THE

ENCYCLOPÆDIA BRITANNICA

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THE
ENCYCLOPÆDIA BRITANNICA

A DICTIONARY OF ARTS,
SCIENCES, LITERATURE
& GENERAL INFORMATION

THIRTEENTH EDITION

Being Volumes One to Twenty-eight of the Latest Standard Edition with the Three New Volumes covering Recent Years and the Index Volume

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VOLUME 29
THE THREE NEW VOLUMES
I
AALAND ISLANDS *to* EYE

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TO

THE TWO HEADS OF THE ENGLISH-SPEAKING PEOPLES

HIS MAJESTY GEORGE THE FIFTH
KING OF GREAT BRITAIN AND IRELAND
AND OF THE BRITISH DOMINIONS BEYOND THE SEAS
EMPEROR OF INDIA

AND

CALVIN COOLIDGE
PRESIDENT OF THE UNITED STATES OF AMERICA

PREFATORY NOTE

THE present Supplementary Volumes of *The Encyclopædia Britannica* are an entirely new survey of the march of events, the progress of knowledge and the innumerable changes of the world's aspects, thoughts, activities, in the years from 1910 to 1926. There have been no more momentous and transforming years in the experience of mankind. Formerly that space of a decade and a half would have been called at best a period. We may justly term it an epoch. It crowds into itself more historic drama and social significance, more economic energy and moral ferment, more destructive force, yet more constructive effort and idealism in every sphere, than have been known in most centuries. In wide regions the former political structure and lines of the map have been altered in a manner that would have surpassed all powers of belief if prophesied beforehand. Old Empires and dynasties have vanished; new nations and systems have appeared. With this, science and invention have gone forward with accelerating speed to wonderful results. All industrial life is searched by questioning and full of new developments. In this short epoch the former fundamental conceptions of time, space, matter and energy have been dissolved or modified. Speculation on the possibilities of further scientific discovery and of its practical addition to human power never was more daring. Medicine and surgery have made at least an equal advance in their resources for the defence, repair and prolongation of human life. Civilised taste, fashion and habit present very visibly a thousand interesting contrasts with the former modes. The new generation differs quite radically in many ways from the pre-War notions of its elders. Philosophy, literature and art re-examine with more unsparing scrutiny the mysteries of human being and purpose and the problems of human relations. Wide and signal as have been the changes in the world's external circumstances, still more general and profound have been the changes in the world's thought and feeling. In 15 years, as a result partly of physical conflict unparalleled for scale, violence and intensity; partly of the subsequent mental reactions; partly of the full and manifold working of influences which had begun to appear before the War, there has occurred a universal revolution in human affairs and the human mind.

After the War, when the extent of this revolution began to be seen, *The Encyclopædia Britannica* made a first attempt to supply the new storehouse of needed information. In this enterprise it followed its own great precedent of over 100 years ago, when Archibald Constable began to issue immediately after the long Napoleonic Wars his splendid six volumes. In one way the supplementary three volumes issued after the World War will always keep irreplaceable value as an aid to the future historian and social investigator. They are exhaustive as a record in minute detail of the War itself and every subject connected with it. They reflect the overpowering extent to which people's minds were still possessed and absorbed by the recent convulsion and its more immediate consequences. We may say that, while the tempest was past, the ocean still heaved and surged on all sides and the air was still obscure. There was as yet no clearness, no repose. There was no restoration of ordinary understanding between nations and classes, nor even of civilised community in the sphere of knowledge and scholarship. The international collaboration conspicuous in *The Encyclopædia Britannica* for generations before was not sufficiently available. And, above all, the proportion of matter occupied by the War and related references bulked so mightily as to allow no adequate space for very many other subjects essential to a general survey of recent information.

Every day during the last five years has emphasised the need for that more comprehensive undertaking. The present writer was invited to frame a plan, to devise the proportions of this more extended design, and to supervise the construction. These three latest volumes of *The Encyclopædia Britannica* are the result. While the verdict on the merits of the execution must belong to the reader, several things may be stated with confidence.

First, this Supplement, as was remarked at the beginning, is an entirely fresh survey of the requirements of common knowledge concerning all the important and interesting additions to human experience and thought equipment and ideas, knowledge and speculation, made during the short but tremendous epoch from 1910 to this present day. Second, no pains have been spared, no resource of inquiry has been neglected, in the endeavour to make the range of the subjects as inclusive and the authority of the contributors as conclusive as some 3,000 pages can permit or the efforts of an editor and his colleagues can secure. Third, the subjects of reference are in fact more numerous and offer a wider range of information than has hitherto been achieved in encyclopaedias proper as distinguished from works of a different kind where very many of the references are as brief as dictionary definitions and no more illuminating than the statement that "an archdeacon is one who performs archidiaconal functions." Fourth, the writers in these volumes do, in fact, represent a larger array of celebrated persons of many nations, and of established repute beyond their own nations, than have ever before been assembled as a band of contributors to any composite work of importance. Fifth, the record of information and ideas is more generally and fully brought up to the time of publication than in any other work existing in any language. This is not to say that achievement satisfies ideals; the Editorial Boards in London and New York are too conscious of the opposite. "The ample proposition that hope makes . . . fails in the promised largeness." A perfect encyclopaedia compiled with no regard to the brevity of human existence would extend to at least 100 volumes exclusively written by experts of genius. On the same principle, a Supplement would be better in 10 such volumes than in three. Happily these perfections are unattainable.

Some account of the spirit and method of the present New Volumes must be given. The Editor and his colleagues had to grapple at the outset with those problems of unity and multiplicity which have beset the architects and builders of encyclopaedias from of old. How to construct the "mighty maze" yet keep it to the plan? How to treat main subjects as a whole and yet facilitate reference by dealing with their subdivisions under separate headings? How to provide for an unprecedented diversity of information—life and thought becoming every day more complex—and for an equal diversity of contributors, yet impress some distinctive spirit on the work as a whole? In the first approach to the solution of these questions a series of circles was drawn. The first allocated the proportions of space to be occupied by the chief departments of knowledge as broadly distinguished.

It was agreed in the discussions of the Editorial Board that tradition must be modified in one respect. Tradition demanded excessive space for all those aspects of life and thought which lend themselves to literary description; whereas, every day, science, invention and economics are becoming relatively a larger part of living interests. It was accordingly decided to give a quarter of the 3,000 pages available in the three Supplementary Volumes to science, theoretical and technical, including medicine and surgery—a larger proportion than has hitherto been devoted to this side of knowledge. History and politics, formerly overflowing all reasonable margins and submerging the more modern developments of civilised life and its apparatus, were dyked back; but over half the whole space is still given to history and politics, with their inseparable adjuncts of biography and geography. Main sections of the great circle having been demarcated in this way, the arrangement of related subjects belonging to each main section, and then the necessary subdivision of each compartment—as literature, economics, agriculture and so forth—were similarly plotted out in a long series of subsidiary and more subsidiary circles, until the whole space of some 3,000 pages was allocated methodically on principles of proportion very carefully considered. On the relative claims of different subjects to space, the discussions of the Editorial Board were continually interesting; and as the points arising were well argued, the decisions were well weighed. Then came the far more difficult matter of breaking up each distinctive group of subjects into hundreds of separate encyclopaedic headings while steadily holding to the proportions of the original plan in the broad. Necessarily all the obvious appearances of such a plan disappear amidst the details of the execution. Proportioned design could only be discovered by a very curious and exceptional reader taking as much pains to trace it as the Editorial Board took to form it. None the less, the plan is there; and while all manner of miscellaneous subjects neighbour each other in alphabetical order, as between the large categories—like national histories and literatures; war; post-War controversies and settlements, political and financial; science and mechanism in all their aspects; economics proper and social movements of a more political kind—the distribution of space is controlled by a reasoned though invisible adjustment.

But however assiduously managed, these after all are only the orderly mechanics of encyclopaedic arrangement. To what spirit have they been subordinated? The whole endeavour has been guided by a few definite purposes. The first purpose has been to reveal what has really happened throughout the whole range of the outward life and the inward being of human kind since 1910, during that decade and a half whereafter nothing in the world can ever be the same again. The second purpose has been to escape from the passions and prejudices and shattering discords of the War period—to revive and enhance that intellectual co-operation between distinguished authorities of every nation, that civilised community in the sphere of intellect, which the War temporarily destroyed but which throughout the century before 1914 it was the increasing object of *The Encyclopædia Britannica* to nourish. Vitally the progress of knowledge and that of its application depend upon the free and ceaseless interchange of ideas between each people and every other. International collaboration—though in politics the views of equally sincere writers belonging to different countries exhibit wide disagreements—plays a more remarkable part, and if dispassionately received, a more enlightening part, in these Three Volumes than in any of their predecessors throughout the long history of *The Encyclopædia Britannica*. The third purpose has been to interpret the life of the English-speaking communities to each other. In their common tongue this work is written, and that tongue has become more definitely than ever during the "short but tremendous" epoch with which this supplement is engaged the leading language of mankind. It is now familiarly spoken by at least 200,000,000 of people spread about the whole globe. No good thinker supposes that community of speech implies community of thought and feeling. That assumption is amongst the most superficial and dangerous of fallacies. For instance, the relations between Great Britain and America are of decisive significance for the general future of the world and are well capable of determining either way for all mankind the choice between peace and chaos. But for the sake of the best relations between America and Britain under present conditions, it must never be forgotten that though England is the mother country of the language and law of the United States, all Europe is the mother-region of the racial blood and feeling of the United States—now the strongest society relatively to others that has arisen since the Roman Empire. A good judgment in Anglo-American affairs will always remember this fact, and that Great Britain cannot promote English-speaking solidarity by identifying itself wholly with one or the other side in the controversies between the nations and groups of continental Europe. In that regard, from the standpoint of English-speaking community, the steady policy of Great Britain should be mediating, reconciling and full of understanding of opposite European views. By a settled temper in that sense the preparation of these volumes has been guided.

Some difficulties and the method of dealing with them must be explained. The treatment of the World War itself was one difficulty but perhaps the least. Its more compact handling in these New Volumes, by comparison with the first post-War supplement, excludes a mass of insignificant detail but throws into bolder relief all those essentials with which the good general reader of history is concerned. The Editorial Board believes that the information concerning the Treaty of Versailles and the connected treaties, the birth and working of the League of Nations, the movements of diplomacy before the War, during the War and after the War in all the international questions arising from the disputable principles and arrangements of the Peace, is given with a clearer method and in a more impartial temper than have been hitherto placed at the disposal of the general reader in any comprehensive work of this kind. It must be remembered that since 1921 when the previous Supplement was completed a flood of new light has been thrown upon the origins and conduct of the World War, upon the personal and circumstantial influences which determined the character of the Peace Treaties, and upon the subsequent international struggles and negotiations. From this fullness of new light the present volumes derive advantage.

How to deal rightly with the political history of nations was a knotted doubt. Here the traditions of *The Encyclopædia Britannica* were no guide, because the nature of the problem was without precedent. From the ruin of former Empires many new States have arisen. Each of them defends its antecedents and position. The peoples defeated in the World War repudiate the charge of exclusive guilt, and protest partly that the tragedy sprang from causes beyond the control of any belligerent, partly that the victors were in fact more culpable. This latter view is as egoistical and self-righteous—like too many claims for the Allies—as the former is impressive. Particularly the vanquished nations, with Russia, with a wide extent of neutral judgment, and with a large degree of opinion amongst the victorious peoples themselves, deny the justice of the Peace Treaties and declare that these without revision will be fatal to the future. In this situation, to seek to enforce an editorial judgment on all contested issues would be premature and presumptuous. For instance, no finally impartial view of the Russian revolution can yet be formed when Russians themselves still differ violently or are silently perplexed, drifting with events, shunning convinced opinion. Upon the chaos in China, the narratives and views of two equally intelligent and honest Chinese, one let us say from Peking and the other from Canton, may be found irreconcilable. What thoughtful person can yet draw up the balance-sheet of Fascism in Italy or of Kemalism in Turkey? Who can predict the future of France or of Germany? In these circumstances, it seemed to the Editor almost unquestionably right to depart from the principle of Olympian judgment practised by *The Encyclopædia Britannica* at long leisure in more stable times. The Editorial Board determined instead to interpret all the variations of national opinions and to have each nation's account of its action and motives since 1910 stated, as a rule, by some leading spokesman of its own. When the narratives are compared the contradictions cancel out; and to an intelligent user of these volumes this method is far more illuminating than would have been any attempt by the Editor to "tune the pulpits" and make them sing one song. To know what are the differences of national views, whether justified or not, is a vital matter of political information.

This edition adds to the *The Encyclopædia Britannica* an entirely new feature—a chronology of the world showing the dates of important events of all kinds since 1910. The universal usefulness of this addition needs no emphasis.

The thanks of the Editor and his colleagues are due to friends and helpers so numerous on both sides of the Atlantic that it is impossible to mention them all. To a still larger extent than in connection with any former edition or supplement, nearly all existing Governments have aided in amassing material, and it must be put on record especially that various embassies and legations in London have taken infinite trouble to assist. Particular acknowledgment must be made in the first case to statesmen and other national leaders who have furnished authoritative contributions—to President Masaryk of Czechoslovakia; to Count Bethlen, Prime Minister of Hungary; to two other Prime Ministers, Sir James Craig of Northern Ireland and the Hon. J. G. Coates of New Zealand; to three Ministers for Foreign Affairs, Dr. Stresemann (Berlin), Dr. Benesh (Prague) and M. Emile Vandervelde, who was still in office when this preface was written; to Mr. Andrew W. Mellon, U.S. Secretary of the Treasury; to Mr. Dwight F. Davis, U.S. Secretary of War; to Mr. C. D. Wilbur, U.S. Secretary of the Navy; to Mr. William M. Jardine, U.S. Secretary of Agriculture; to Mr. James J. Davis, U.S. Secretary of Labor; to Viscount Cecil and the Duchess of Atholl, members of Mr. Baldwin's present administration in Great Britain; while Commissary Trotsky himself has been persuaded to write the biography of Lenin, whose career, whatever else may be thought, has been one of the astonishing features of modern history. We must add Sir Arthur Salter, Director of the Economic and Finance Section of the League of Nations, and Monsieur Albert Thomas, head of the International Labour Office.

Amongst contributors who have held high office or position are Dr. Gustav Ador, ex-President of the Swiss Republic; three former Prime Ministers, of Britain, Canada and France respectively—Mr. Ramsay MacDonald, Sir Robert Borden and Monsieur Edouard Herriot; Mr. Elihu Root, Secretary of State in the administration of President Roosevelt; Mr. Bernard M. Baruch, who was Chairman of the U.S. War Industries Board; Monsieur Joseph Caillaux and Monsieur Louis Loucheur, French ex-Ministers of Finance. Colonel House must be included with these, for his semi-official position under President Wilson was not less powerful though less formal.

But amongst these, two must be singled out for repeated thanks. Lord Haldane and Sir Arthur Salter have been more than contributors. Above all others they have given in various ways generous and invaluable assistance.

Marshal Foch, Adml. von Scheer, Sir Frederick Maurice, Air-Vice-Marshal Sir Sefton Brancker, British Director of Civil Aviation, and Gen. Sir Ian Hamilton are amongst men who held command in the world-changing struggle which fills so many of the ensuing pages; and they write on various aspects of war and arms.

On technical subjects distinguished authorities have given assistance and advice here gladly recognised—in economics Sir Josiah Stamp, Sir William Beveridge of the London School of Economics, and his colleagues Dr. T. E. Gregory and Mr. C. M. Lloyd; in political history and matters entering into its making, Lord Meston, Sir George Aston, Sir William Goode, Mr. H. W. V. Temperley, M. Auguste Gauvain of the *Journal des Débats*, Dr. F. Silberstein of the *Allgemeine Zeitung*, Mr. H. B. Butler of the International Labour Office and Monsieur Henri Davray; in agriculture Sir A. D. Hall; in different sciences Sir J. J. Thomson, Sir W. Bragg, Professor J. T. Hewitt, Professor C. H. Lees, Professor E. N. da C. Andrade, Dr. Reginald Clay, Sir Charles Sherrington, Dr. Hartridge and Dr. C. S. Myers; in medicine and surgery Sir Humphrey Rolleston, Dr. W. Broughton-Alcock, Dr. W. S. Lazarus-Barlow and Colonel MacArthur; in engineering Sir Alexander Gibb and Sir Richard Glazebrook especially, and also Professor J. A. Fleming, Sir Charles Parsons and Sir John Denison-Pender; while in anthropology and archaeology this work owes much to the staff of the British Museum, Dr. H. R. Hall, Mr. T. A. Joyce, Mr. E. J. Forsdyke and Mr. R. K. Granville, and equally to Sir Flinders Petrie, Mr. Miles Burkitt, Dr. A. C. Haddon, Mr. A. J. B. Wace and Dr. R. M. Wenley.

In various other fields the following are amongst those who have read over articles and furnished suggestions: Sir Maurice Hankey, Mr. Lionel Curtis, Professor A. J. Toynbee, Colonel H. Carslake, Lord Morris and Sir Archibald Montgomery. In settling the spelling of place-names good assistance was received from Lord Edward Gleichen and Mr. J. H. Reynolds, respectively Chairman and Secretary of the Royal Geographical Society's Permanent Committee on this subject. We owe assistance likewise to the Royal Statistical Society and the British Institute of International Affairs. In some matters of biography and literature we have been aided also by Mrs. W. L. Courtney, Mr. G. H. Johnstone of *The Times* office in Paris, Baron George de Ottlik of *The Pester Lloyd* and Hussein Bey of Robert College, and by Madame Vengerova in Russian details.

As to the services of the Editor's principal colleagues, no tribute can be too high. No work known is more arduous and exacting than that of making an encyclopaedia—a task demanding constant resource in dealing with contributions and contributors, as well as minute supervision of innumerable details. Mr. A. W. Holland has been at the head of the daily administration; Miss Margaret Bryant and Colonel T. C. Hodson, in charge of different groups of articles, have organised the larger part of the Three Volumes; Mrs. D. Harwood has been responsible for other groups, and Mr. J. R. Thompson for art; while Miss Hollowell, as secretary of the Editorial Board, has shown ceaseless efficiency in aiding every part of the work. Closely associated with the Board itself have been Capt. B. H. Liddell Hart on military questions, Capt. A. C. Dewar on naval; Mr. C. W. Guillebaud on economics; Mr. George Glasgow on foreign politics; while Capt. F. A. M. Webster has helped in arranging the extended treatment of sports and games.

But, above all, it must be recorded here that without the collaboration of Mr. Franklin H. Hooper, the American Editor, in an inseparable partnership with the Editor-in-Chief, the making of these volumes as they stand would have been impossible. Amongst those connected with *The Encyclopædia Britannica* Mr. Hooper is by far the most experienced. He has been its mainstay for many years. In the present undertaking, he has not only brought to the work an endless suggestive fertility and vigour of execution, but has been personally responsible for the array of American contributors. These include four of five living Americans who have received Nobel prizes; the Secretaries of the Treasury, War, the Navy, Agriculture and Labor in the Cabinet of President Coolidge; men of like authority through the whole range of the arts and the sciences; and men dominant in industry and business, as the heads of the Ford industries, the American Telephone and Telegraph Company, the Eastman Kodak Company, the General Electric Company, and the National City Bank of New York—a group of distinguished Americans such as hitherto no enterprise of peace has assembled. To all these Mr. Hooper expresses his thanks and in particular to his assistants in the New York office, Mr. John W. Taylor and Mr. C. F. Ansley.

To the Editor-in-Chief this particular example of co-operation and friendship between America and Britain has been by far the most attractive part of his task. A century and a half after the political severance of the two great English-speaking peoples, *The Encyclopædia Britannica* remains what it was then, and more than ever, a common institution. Once more, by express permission, its volumes are dedicated jointly to His Reigning Majesty King George and to the President of the United States, Mr. Calvin Coolidge. May the day never come when that symbol of kinship and friendship will disappear.

J. L. GARVIN.

LONDON,
September 1, 1926.

ABBREVIATIONS USED IN THESE VOLUMES

A

A.A. =	anti-aircraft; Army Act; Automobile Association.
A.A.G. =	Assistant Adjutant-General.
A.B.C. =	Argentina, Brazil, Chile.
ac. =	acre; acres.
A.C.I. =	Army Council Instruction.
A.C. of S. =	Assistant Chief-of-Staff.
A.D. =	*Anno Domini* = in the year of our Lord (Latin).
Adml. =	Admiral.
A.E.F. =	American Expeditionary Force.
A.F. =	Air Force (British).
A.F.C. =	Air Force Cross.
A.F.M. =	Air Force Medal.
A.F. of L. =	American Federation of Labor.
A.G. =	Adjutant-General.
A.I.D. =	Aircraft Inspection Department.
A.I.F. =	Australian Imperial Force.
Ala. =	Alabama.
Alta. =	Alberta.
amp. =	ampère; ampères.
A.M.S. =	Army Medical Service.
ANZAC. =	Australian and New Zealand Army Corps.
A.P. =	armour piercing (shells).
A.P.D. =	Army Pay Department.
A.P.M. =	Assistant Provost Marshal.
Ariz. =	Arizona.
Ark. =	Arkansas.
A.S.E. =	Amalgamated Society of Engineers.
A.V.S. =	Army Veterinary Service.

B

b. =	born.
bar. =	barrel; barrels.
B.C. =	before Christ; British Columbia.
Bde. =	Brigade.
Bde-Maj. =	Brigade-Major.
Beds. =	Bedfordshire.
B.E.F. =	British Expeditionary Force (in particular in France and Belgium).
Berks. =	Berkshire.
B.E.S.A. =	British Engineering Standards Association.
B.G.G.S. =	Brigadier-General, General Staff.
b.h.p. =	brake horse-power.
B.L. =	breech-loading (artillery; as distinct from Q.F.).
B.M.A. =	British Medical Association.
Bn. =	Battalion.
b.p. =	between perpendiculars.
Brig.-Gen. =	Brigadier-General.
Bs. =	Bolivianos.
B.T.U. =	British thermal unit.
Bty. =	Battery.
bu. =	bushel; bushels.
Bucks. =	Buckinghamshire.

C

c. =	*circa* = round about (Latin).
Cal. =	California.
Cambs. =	Cambridgeshire.
Capt. =	Captain.
Cav. =	Cavalry.
C.B.E. =	Commander of the Order of the British Empire.
c.c. =	cubic centimetre.
C.F. =	Chaplain to the Forces.
cf. =	*confer* = compare (Latin).
C.G.E.A. =	*Compagnie Générale d'Entreprises Aéronautiques* = General Company for Aeronautical Services.
C.G.S. =	Chief of the General Staff.
C.H. =	Companion of Honour.
C.I.D. =	Criminal Investigation Department.
C.I.D.N.A. =	*Compagnie Internationale de Navigation Aérienne* = International Aerial Navigation Co.
C.I.G.S. =	Chief of the Imperial General Staff.
C.-in-C. =	Commander-in-Chief.
cm. =	centimetre; centimetres.
C.O. =	Commanding Officer.
Co. =	Company.
co. =	county.
C. of S. =	Chief of Staff.
Col. =	Colonel.
Colo. =	Colorado.
Comm. =	Commander.
Conn. =	Connecticut.
C.O.S. =	Charity Organisation Society (British).
C.P. =	common pointed (shell).
c.p. =	candle power.
C.R.A. =	*Commission Régulatrice Automobile* = Motor Regulation Staff (French).
cu. ft. =	cubic feet.
C.W.S. =	Co-operative Wholesale Society.
cwt. =	hundredweight.
cyl. =	cylinder.

D

D. =	Director (*e.g.*, D.M.O. = Director of Military Operations); as prefix of office-abbreviations = Deputy (*e.g.*, D.D.M.I. = Deputy Director of Military Intelligence).
d. =	died; penny; pence.
D.A. =	direct action (fuse).
D.A.I. =	direct action impact (fuse).
D.A.Q.M.G. =	Deputy Assistant Quartermaster-General.
D.B.E. =	Dame of the Order of the British Empire.
D.C. =	District of Columbia.
D.C.M. =	Distinguished Conduct Medal.
deg. =	degrees.
Del. =	Delaware.
dept. =	department.
D.F. =	direction finding.
D.F.C. =	Distinguished Flying Cross.
D.F.M. =	Distinguished Flying Medal.
D.G. =	Director-General (*e.g.*, D.G. A.M.S. = Director-General Army Medical Service).
Div. =	Division.
D.O.R.A. =	Defence of the Realm Act.
D.Q.M.G. =	Deputy Quartermaster-General.
D.R. =	dead reckoning.
D.R.F. =	depression range-finder.
D.S.C. =	Distinguished Service Cross.
D.S.M. =	Distinguished Service Medal.
D.S.O. =	Distinguished Service Order.

E

E. =	east.
ed. =	editor; edition.
E.E.F. =	Egyptian Expeditionary Force.
e.g. =	*exempli gratia* = for example.
E.M.F. =	electromotive force.
et seq. =	*et sequentia* = and the following (Latin).

F

fig. =	figure (illustration); figures.
Fla. =	Florida.
F.M. =	Field Marshal.
f.o.b. =	free on board.
fr. =	franc; francs.
F.R.S. =	Fellow of the Royal Society.
fs. =	foot seconds.
F.S.R. =	Field Service Regulations (British).
ft. =	foot; feet.
ft.^{2} =	square feet.
ft.^{3} =	cubic feet.
fur. =	furlong or furlongs.
F.W.D. =	four-wheel drive.

G

Ga. =	Georgia.
gal. =	gallon; gallons.
G.A.R. =	Grand Army of the Republic.
G.B.E. =	Grand Cross of the Order of the British Empire.
Gen. =	General.
G.H.Q. =	General Headquarters.
Glos. =	Gloucestershire.
G.M.T. =	Greenwich mean time.
G.O.C. =	General Officer Commanding.
Gov. =	Governor.
gr. =	gramme or grammes.
G.S. =	General Staff; General Service (British).
G.S.G.S. =	Geographical Section, General Staff.

H

H.A. =	Heavy Artillery; less frequently, Horse Artillery; high-angle (gun).
Hants. =	Hampshire.
H.E. =	high explosive.

Herts. = Hertfordshire.
hhd. = hogshead; hogsheads.
H.M.S. = His Majesty's Ship.
H.P. = high pressure.
h.p. = horsepower.
H.Q. = Headquarters.
Hunts. = Huntingdonshire.
H.V. = high velocity (gun).

I

I. = Island.
I.A. = Indian Army.
Ia. = Iowa.
ib. *or* **ibid.** = *ibidem* = in the same place (Latin).
Ida. = Idaho.
i.e. = *id est* = that is (Latin).
i.h.p. = indicated horsepower.
Ill. = Illinois.
I.L.P. = Independent Labour party.
in. = inch; inches.
in.^{2} = square inches.
in.^{3} = cubic inches.
Ind. = Indiana.
Inf. = Infantry.
I.O.C. = International Oxygen Company (Electrochemistry).
Is. = Islands.
I.W.W. = Industrial Workers of the World.

J

J.C.A. = Jewish Colonisation Association.
J.I.C. = Joint Industrial Council.
jun. = junior.

K

Kan. = Kansas.
K.B.E. = Knight Commander of the Order of the British Empire.
kc. = kilocycle; kilocycles.
kgm. = kilogramme; kilogrammes.
km. = kilometre; kilometres.
K.R. = King's Regulations.
kv. = kilovolts.
kva. = kilovolt ampères.
kw. = kilowatt; kilowatts.
Ky. = Kentucky.

L

La. = Louisiana.
Lancs. = Lancashire.
lb. = pound; pounds.
L.C.C. = London County Council.
Leics. = Leicestershire.
Lincs. = Lincolnshire.
L. of C. = Line of Communications.
L.P. = low pressure.
L.R.C. = Labour Representation Committee (British).
Lt. = Lieutenant.
Lt.-Comm. = Lieutenant-Commander.
Lt.-Gen. = Lieutenant-General.

M

m. = mile; miles.
Maj. = Major.
Maj.-Gen. = Major-General.
Man. = Manitoba.
Mass. = Massachusetts.
M.B.E. = Member of the Order of the British Empire.
M.C. = Military Cross.
Md. = Maryland.
Mdx. = Middlesex.
Me. = Maine.
M.E.F. = Mediterranean Expeditionary Force (British, 1915-7).
M.F.N. = most favoured nation.
M.G.C. = Machine-gun Corps.
M.G.G.S. = Major-General, General Staff of an Army.
M.G.O. = Master-General of the Ordnance.
M.I. = Mounted Infantry (British).
Mich. = Michigan.
min. = minute; minutes.
Minn. = Minnesota.
Miss. = Mississippi.
Mk.I,II,etc. = Mark (artillery, ammunition, etc.).
M.L. = muzzle-loading.
M.M. = Military Medal (British).
mm. = millimetre.
Mo. = Missouri.
Mon. = Monmouthshire.
Mon. = Montana.
m.p.h. = miles per hour.
M.S. = Military Secretary.
M.T. = Mechanical Transport.
Mt. = Mount.
M.V. = muzzle velocity.

N

N. = north.
N.A.C.B. = Navy and Army Canteen Board.
N.B. = New Brunswick.
N.C. = North Carolina; nitro-cellulose.
N.C.O. = Non-commissioned Officer.
N.C.T. = nitro-cellulose, tubular.
N.D. = North Dakota.
Neb. = Nebraska.
Nev. = Nevada.
N.H. = New Hampshire.
N.H.P. = nominal horsepower.
N.J. = New Jersey.
N.M. = New Mexico.
n.m. = nautical miles.
Northants. = Northamptonshire.
Northumb. = Northumberland.
N.O.T. = Netherlands Overseas Trust.
Notts. = Nottinghamshire.
N.S. = Gregorian, or new style, calendar (*see* 4.994); Nova Scotia.
N.U.R. = National Union of Railwaymen (British).
N.U.W.S.S. = National Union of Women's Suffrage Societies.
N.U.W.W. = National Union of Women Workers.
N.W.T. = North-West Territories.
N.Y. = New York.

O

O. = Ohio.
O.B.E. = Officer of the Order of the British Empire.
O.C. = Officer Commanding.
Okla. = Oklahoma.
Ont. = Ontario.
Ore. = Oregon.
O.S. = Ordnance Survey; Julian, or old style, calendar.
O.T.C. = Officers Training Corps.
Oxon. = Oxfordshire.
oz. = ounce; ounces.

P

P. = percussion (fuse).
Pa. = Pennsylvania.
p.a. = per annum.
pdr. = pounder (gun designation).
P.E.I. = Prince Edward Island.
P.O. = Post Office.
pop. = population.
Pres. = President.
Prof. = Professor.
pt. = pint; pints; part.

Q

Q.A.I.M.N.S. Queen Alexandra's Imperial Military Nursing Service.
Q.A.M.F.N.S. Queen Alexandra's Military Families Nursing Service.
Q.A.R.N.N.S. Queen Alexandra's Royal Naval Nursing Service.
Q.F. = quick firing (artillery).
Q.M.A.A.C. = Queen Mary's Army Auxiliary Corps (W.A.A.C.).
Q.M.G. = Quartermaster-General.
qr. = quarter; quarters.
qt. = quart; quarts.
Que. = Quebec.
q.v. = *quod vide* = which see (Latin), for reference.

R

R.A. = Royal Artillery.
R.A.C. = Royal Automobile Club.
R.A.E. = Royal Air Force Establishment.
R.A.F. = Royal Air Force.
R.A.M.C. = Royal Army Medical Corps.
R.A.O.C. = Royal Army Ordnance Corps.
R.A.P.C. = Royal Army Pay Corps.
R.A.S.C. = Royal Army Service Corps.
R.A.V.C. = Royal Army Veterinary Corps.
R.C.S. = Royal Corps of Signals (since 1919).
R.E. = Royal Engineers.
Regt. = Regiment.
Res. = Reserve.
rev. = revolution.
R.F.A. = Royal Field Artillery.
R.F.C. = Royal Flying Corps.
R.G.A. = Royal Garrison Artillery.
R.H.A. = Royal Horse Artillery.
R.I. = Rhode Island.
R.I.B.A. = Royal Institute of British Architects.
R.I.C. = Royal Irish Constabulary.
R.M. = Royal Marines.
R.M.A. = Royal Military Academy (Woolwich); Royal Marine Artillery.
R.M.C. = Royal Military College (Sandhurst).
R.M.L.I. = Royal Marine Light Infantry.
R.N. = Royal Navy.
R.N.A.F. = Royal Naval Air Force.
R.N.A.S. = Royal Naval Air Service.
R.N.R. = Royal Naval Reserve.
R.N.V.R. = Royal Naval Volunteer Reserve.
r.p.m. = revolutions per minute.
Rs. = rupees.
R.S.F.S.R. = Russian Soviet Federal Socialist Republic (Russian).
R.T.O. = Railway Transport Officer (British and U.S.A.).

S

S. = south.
s. = shilling; shillings.
S.A.E. = Society of Automobile Engineers.
Salop. = Shropshire.
Sask. = Saskatchewan.
S.B. = simultaneous broadcast (wireless).
S.C. = South Carolina.
S.D. = South Dakota.
sec. = seconds.
seq. = *sequens, sequentia* = the following (Latin).
sen. = senior.
s.h.p. = shaft horsepower.
S.M.O. = Senior Medical Officer of a formation or station.
S.M.T.O. = Senior Mechanical Transport Officer of a formation.
Som. = Somerset.
S.O.S. = wireless call for life-saving at sea.
S.P.R. = Society for Psychical Research.
S.P.V.D. = Society for the Prevention of Venereal Disease.
sq.ft. = square feet.
Sqn. = Squadron.
s.s. = steamship.
S.S.F.A. = Soldiers' and Sailors' Families Association.
Staffs. = Staffordshire.

T

T. = Territorial (British Army).
T. = time (fuse).
T.A. = Territorial Army.
T.B.D. = torpedo-boat destroyer.
T.D. = Territorial Officers' Decoration.
Tenn. = Tennessee.
Tex. = Texas.
T.F. = Territorial Force.
T.M. = trench mortar.
T.N.T = trinitrotoluene (high explosive).
T.T. = torpedo tubes.
T.U.C. = Trades Union Congress (British).

U

U.S. = United States.
U.S.A. = United States of America.
U.S.S. = United States Ship.
U.S.S.R. = Union of Soviet Socialist Republics (Russian).

V

Va. = Virginia.
V.A.D. = Voluntary Aid Detachment; nursing service, Territorial Force.
V.C. = Victoria Cross.
V.D. = Volunteer Officers' Decoration.
Visct. = Viscount.
viz. = videlicet = namely.
v/m. = volts per metre.
Vt. = Vermont.
V.T.C. = Volunteer Training Corps.

W

W. = west.
W.A.A.C. = Women's Army Auxiliary Corps (Q.M.A.A.C.).
W.A.F.F. = West Africa Frontier Force.
Wash. = Washington.
W.D. = War Department.
Wilts. = Wiltshire.
Wis. = Wisconsin.
W.O. = War Office.
Worcs. = Worcestershire.
W.R.A.F. = Women's Royal Air Force.
W.R.N.S. = Women's Royal Naval Service.
W.S.P.U. = Women's Social and Political Union.
W.T. = Wireless Telegraphy.
W.U.S.L. = Women's United Service League.
W.Va. = West Virginia.
Wyo. = Wyoming.

Y

yd. = yard; yards.
Y.M.C.A. = Young Men's Christian Association.
Yorks. = Yorkshire.
Y.W.C.A. = Young Women's Christian Association.

INITIALS USED IN THIS VOLUME TO IDENTIFY CONTRIBUTORS, WITH THE HEADINGS OF THE ARTICLES TO WHICH THESE INITIALS ARE SIGNED

A. Ab.	A. Abbott. Formerly Assistant Secretary, Department of Scientific and Industrial Research, South Kensington, London.	**Continuation Schools** (*in part*).
A. B. K.	Arthur Berriedale Keith, D.C.L., D.Litt. Regius Professor of Sanskrit and Comparative Philology, Edinburgh University. Secretary to the Crown Agents for the Colonies, 1903–5. Author of *The Belgian Congo and the Berlin Act*; *Dominion Home Rule in Practice*; *War Government of the British Dominions*; etc.	**Belgian Congo;** **British Empire:** *History.*
A. C.	Albert Calmès. Professor at the University of Luxembourg. Member of the League of Nations Commission of Inquiry into Albanian Affairs.	**Albania.**
A. C. B.	Lieutenant-Commander Archibald Colquhoun Bell, R.N. Naval Assistant to the Official Historian of Naval Operations during the World War. Formerly Editor of *The Journal of the Royal United Service Institution.*	**Blockade.**
A. C. D.	Alfred C. Dewar, R.N. (ret.), B. Litt. Gold Medallist, Royal United Service Institution. Late of the Historical Section, Naval Staff, Admiralty, London.	**Admiralty, Board of;** **Coronel, Battle of;** **Dogger Bank, Battle of the**
A. C. I.	Andrew Conway Ivy, Ph.D., M.D. Nathan Smith Davis Professor of Physiology and Head of the Division of Physiology and Pharmacology, Northwestern University Medical School, Illinois.	**Anaemia.**
A. C. T.	A. C. Thaysen, Ph.D. Member of the Staff of the Bacteriological Laboratory. Royal Naval Cordite Factory, Holton Heath, Wareham, Dorset.	**Bacteriology** (*in part*).
A. Cu.	General Sir Arthur William Currie, G.C.M.G., K.C.B., LL.D. Principal of McGill University, Montreal. Formerly General Officer commanding the Canadian Corps in France.	**Canada:** *Defence and Education.*
A. D. H.	Sir A. Daniel Hall, K.C.B., F.R.S. Chief Scientific Adviser and Director General of the Intelligence Department, Ministry of Agriculture and Fisheries, London. Author of *The Soil*; *Fertilisers and Manures*; *A Pilgrimage of British Farming*; *Agriculture after the War*; etc.	**Agriculture:** *General Survey.*
A. D. L.	Alexander Dunlop Lindsay. Master of Balliol College, Oxford. Professor of Moral Philosophy, Glasgow University, 1922–4. Author of *The Philosophy of Bergson*; etc.	**Adult Education:** *Great Britain.*
A. Du.	Albert Dubarry. Editor of *La Volonté* (Paris).	**Caillaux, Joseph.**
A. E. A.	Algernon Edward Aspinall, C.M.G., C.B.E. Secretary to the West India Committee and to the Imperial College of Tropical Agriculture. Author of *The British West Indies*; *The West Indies and Guiana*; etc.	**Bahamas.**
A. E. M. F.	Alfred Edye Manning Foster. Late Proprietor and Editor of *The Country Gentleman*, and *Land and Water Illustrated.* Author of *Auction Bridge Made Clear*; *Auction Bridge and Variations*; etc.	**Bridge, Auction** (*in part*).
A. E. Mo.	Arthur E. Morgan. President of Antioch College. Formerly Chief Engineer of the Miami Conservancy. Author of *Education—The Mastery of the Arts of Life*; *New Light on the Boyhood of Lincoln*; *The Human Goal of Education.*	**Antioch College.**

A. E. T.*	A. E. Twentyman. Formerly Librarian and Information Officer, Board of Education, London.	Education: *Literature.*
A. Fl.	Alexander Fleming, M.B., F.R.C.S. Director of the Department of Systematic Bacteriology, St. Mary's Hospital, London.	Antiseptics.
A. F. P.	Albert Frederick Pollard, M.A. Professor of English History and Chairman of the Institute of Historical Research, University of London. Fellow of All Souls College, Oxford. Assistant editor, *Dictionary of Natural Biography* 1893–1901. President of Historical Association 1912–5. Author of *The Reign of Henry VII. from Contemporary Sources*; *A Short History of the Great War*; *The Evolution of Parliament*; etc.	English History.
A. F. Pr.	Alfred Francis Pribram, Ph.D. Professor of Modern History in the University of Vienna.	Europe (*in part*); etc.
A. F. S.	Alexander Faulkner Shand. Author of *The Foundation of Character.*	Character.
A. F. W.	Arthur F. Woodward. Editor of *The Produce Markets Review* (London).	Canning (*in part*).
A. Fy.	Alexander Findlay, D.Sc., F.I.C. Professor of Chemistry, University of Aberdeen. Formerly Professor of Chemistry, University College of Wales, Aberystwyth. Author of *The Phase Rule and its Applications*; *Practical Physical Chemistry*; etc.	Colloids.
A. G. L.	Alfred Goodman Levy, M.D., M.R.C.P., M.R.C.S. Physician to the City of London Hospital for Diseases of the Chest. Late Anaesthetist, Guy's Hospital, London.	Anaesthetics.
A. G. P.	Arthur George Perkin, F.R.S., F.R.S. (Edin.), F.I.C. Professor of Colour Chemistry and Dyeing and Dean of the Faculty of Technology, University of Leeds. Davy Medallist of the Royal Society, London, 1925. Joint Author of *The Natural Organic Colouring Matters.*	Dyeing (*in part*).
A. Ha.	Arthur Harden, D.Sc., Ph.D., F.R.S. Professor of Bio-Chemistry and Head of the Bio-Chemical Department, Lister Institute, University of London. Author of *Alcoholic Fermentation*; *Inorganic Chemistry for Advanced Students*; etc.	Bacteriology (*in part*).
A. H. B.*	Alfred H. Brooks, B.S., D.S. Formerly Geologist with the U.S. Geological Survey, in Charge of Geologic and Topographic Surveys and Investigations of Mineral Resources in Alaska. Vice-Chairman of the First Alaska Railroad Commission.	Alaska (*in part*).
A. H. P.*	Arthur Joseph Hungerford Pollen. Director, Birmingham Small Arms Co. and other companies. Pioneer of naval fire control and writer on naval matters.	Beatty, Earl.
A. J. B. W.	Alan John Bayard Wace, M.A. Deputy Keeper Victoria and Albert Museum, London. Late Director, British School of Archaeology at Athens, and Norton Lecturer, American Archaeological Institute. Author of *A Catalogue of the Sparta Museum*; *Prehistoric Thessaly*; *The Nomads of the Balkans.*	Archaeology: *Greece and Eastern Mediterranean*; Athens.
A. J. Gl.	Arthur James Glazebrook. Lecturer on Finance, University of Toronto.	Canada: *Finance.*
A. J. T.	Arnold Joseph Toynbee. Professor of International History, University of London. Member of Middle Eastern Section, British Delegation to the Peace Conference at Paris. Koraes Professor of Byzantine and Modern Greek Language, Literature and History at the University of London, 1919–24. Author of *Nationality and the War*; *A Survey of International Affairs, 1920–24*; etc.	Aaland Is.; Asia Minor; Dardanelles; etc.
A. L. Bo.	Arthur Lyon Bowley, Sc.D., F.B.A. Professor of Statistics at the London School of Economics. Formerly Professor of Mathematics and Economics, University College, Reading. Author of *Elements of Statistics*; *An Elementary Manual of Statistics*; *Measurement of Social Phenomena*; etc.	Cost of Living.
A. L. D.	Arthur L. Dakyns, M.A. Barrister-at-law.	Companies and Corporations; Co-Partnership.
A. Le.	André Levinson. Lecturer on Art at the Louvre and the Sorbonne, Paris.	Bakst, Léon.
A. Lo.*	Adolf Lorenz. Professor of Orthopaedic Surgery, University of Vienna. Formerly Director of the Clinic for Orthopaedic Surgery, Vienna. Inventor of the German plaster bed. Author of *A New Method of Treatment of Irreducible Acquired or Congenital Hip Dislocations*; etc.	Bloodless Surgery.
A. Ly.	A. Loveday. Member of the Economic and Financial Section, League of Nations, Geneva.	Balance of Payments.

A. No.*	Arne Novak. Literary Historian Critic. Professor of Czechoslovakian Literature at the Masaryk University of Brno (Brünn). Part author of *A History of Czechoslovakian Literature.*	**Czech Literature.**
A. P. R.	A. P. Rowe. Scientific Officer, Air Ministry, London. Lecturer in Air Navigation and Instruments, Imperial College of Science, London.	**Aerial Navigation.**
A. P. W.	Colonel Archibald Percival Wavell, C.M.G., M.C. General Staff Officer, War Office, London. British Military Attaché on the Caucasus Front, Nov. 1916–June 1917. General Staff Officer with Egyptian Expeditionary Force, July 1917–March 1918. Brigadier General, General Staff, with Egyptian Expeditionary Force, April 1918–20.	**Brest-Litovsk, Battles of; Carpathians, Battles of the; Caucasus, Campaign in the; Dunajec-San, Battle of the; Eastern Front Campaigns.**
A. R.	Arthur Ransome. Author and Journalist, Contributor to *The Manchester Guardian*; *The English Review*; *The Fortnightly Review*; etc. Author of *Six Weeks in Russia*; *The Crisis in Russia*; etc.	**Brest-Litovsk, Treaty of.**
A. Sa.	A. Safrastian. Formerly British Vice-Consul at Bitlis, Kurdistan.	**Armenia.**
A. S. D.	Augustus Seiss Downing, M.A., L.H.D., LL.D. Assistant Commissioner for Higher Education and Director of Professional Education, University of the State of New York, Albany.	**Education:** *United States (in part).*
A. S. E.	Arthur Stanley Eddington, D.Sc., F.R.S. Plumian Professor of Astronomy, Cambridge University. Director of the Observatory, Cambridge. Fellow of Trinity College. Senior Wrangler, 1904 and Smith's Prizeman, 1907. President of the Royal Astronomical Society, London, 1921–3. Author of *Stellar Movements and the Structure of the Universe*; etc.	**Astronomy.**
A. Sr.	Sir James Arthur Salter, K.C.B. Director of the Economic and Finance section of the League of Nations. General Secretary to the Reparation Commission, 1920–2. Secretary of the British Department of the Supreme Economic Council, 1919. Secretary of the Allied Maritime Transport Council and Chairman of the Allied Maritime Transport Executive, 1918. Author of *Allied Shipping Control; an Experiment in International Administration.*	**Control, Inter-Allied.**
A. Th.	Albert Thibaudet. Professor of the History of French Literature in the University of Geneva. Literary Critic of *La nouvelle revue française.* Contributor to *The London Mercury.* Author of *La Poésie de Stéphane Mallarmé, Trente ans de vie française*; etc.	**Barrès, Maurice; Bergson, H.**
A. Th.*	Albert Thomas. Director of the International Labour Office, Geneva. Minister of Munitions in the French Government, 1916. Assistant Editor of *L'Humanité*, 1904. Author of *Le Syndicalisme allemand*; *Histoire anecdotique du Travail.*	**Co-operation.**
A. V.	Auguste Vermeylen. Professor of Modern Philology at the University of Ghent, Belgium. Member of the Belgian Senate.	**Belgian Literature:** *Flemish*; **Belgium:** *Flemish Movement.*
A. V. K.	A. V. Kerrison, R.A. Instructor in Gunnery and Mathematics, Artillery College, Woolwich, London.	**Ballistics.**
A. V. Le C.	Albert von Le Coq. Director, Asiatic Section of the Ethnological Museum, Berlin.	**Archaeology:** *Central Asia and Eastern Asia.*
A. W. A.	Lieut.-Col. Alfred William Alcock, C.I.E., M.B., LL.D., F.R.S. Indian Medical Service (Ret). Formerly Professor of Medical Zoology at the London School of Tropical Medicine. Author of *A Naturalist in Indian Seas*; *Entomology for Medical Officers*; etc.	**Entomology, Medical.**
A. W. H.*	Arthur William Holland Managing Editor (London office) of *The Encyclopædia Britannica*, 13th edition; member of the staff of the 11th edition, 1905–11.	**Betting Tax.**
A.W.H.E.W.	Wing-Commander A. W. H. E. Wynn, O.B.E. Member of the staff of the Intelligence Department of the British Air Ministry, 1916–22.	**Air Forces:** *Great Britain*; **Air Ministry:** *Great Britain.*
B. B.	Bruce Bairnsfather. Author and Journalist. Author of *Fragments from France*; *The Better 'Ole*; etc.	**Cartoon.**
B. B. L.	Benjamin Barr Lindsey. Judge of the Juvenile Court of Denver, Colorado. Author of *Problems of the Children*; *The Doughboy's Religion*; etc.	**Children's Courts** (*in part*).
B. C. S.	Bernard Christian Steiner, M.A., Ph.D., Litt.D. Librarian, Enoch Pratt Free Library, Baltimore; Dean and Professor of Law, Baltimore Law School, 1900–4. Author of *Education in Maryland*; *Institutions and Civil Government of Maryland*; etc.	**Baltimore.**

B. E. P.	Barthelémy Edmond Palat. Formerly General of Brigade in the French Army. Commanded a Division, 1915–6. Author of *La Grande Guerre sur le Front Occidental*; *Les Batailles d'Arras et de Champagne*; and, under the pseudonym "Pierre Lebaütcourt," of *La Défense Nationale, 1870–1.*	**Champagne, Battles in** (*in part*).
B. H. L. H.	Captain B. H. Liddell Hart, F.R. Hist. S. Military Correspondent of *The Daily Telegraph* (London). Inventor of the Battle Drill and various tactical methods adopted by the British Army. Joint Author of the official manual *Infantry Training* and editor of *Small Arms Training*. Author of *The Somme Offensive*; *Science of Infantry Tactics* (transl. for Bulgarian Army, 1925); *Paris, or the Future of War*; etc.	**Allenby, Viscount;** **Cambrai, Battle of; etc.**
B. L.	John Gilbert Bohun Lynch Author and Caricaturist. Author of *Max Beerbohm in Perspective*; etc.	**Caricature**
B. Ma.	Bronislaw Malinowski, Ph.D., D.Sc. Reader in Social Anthropology, London School of Economics, University of London. Author of *The Problem of Meaning in Primitive Languages*; etc.	**Anthropology.**
B. M. J.	B. Melvill Jones, A.F.C. Mond Professor of Aeronautical Engineering, Cambridge University. Fellow of Emmanuel College, Cambridge.	**Aerodynamics.**
B. R. C.	B. R. Coad. In charge of Delta Laboratory, Bureau of Entomology, United States Department of Entomology.	**Boll Weevil.**
B. W. D.	Brian Westerdale Downs, M.A. Fellow and Lecturer in Mediaeval and Modern Languages and English, Christ's College, Cambridge.	**Cambridge.**
B. Wi.	Arthur Frederic Basil Williams, O.B.E. Professor of History, Edinburgh University; formerly Professor of History, McGill University, Montreal. Author of Vol. IV. of *The Times History of the South African War*; *Cecil Rhodes*; etc.	**Botha, Louis.**
C. A. B. C.	Charles Austin Bunworth Campion, O.B.E. Formerly Manager of the Commonwealth Bank of Australia in London. Member of the Economic Committee of the League of Nations.	**Australia:** *Banking and Finance.*
C. A. D.	Clyde Augustus Duniway, Ph.D., LL.D. Professor of History in Carleton College. Formerly President of Colorado College. Author of *Handbook of Graduate Courses*; *Freedom of the Press in Massachusetts.*	**Colorado.**
C. A. M.	Carlile Aylmer Macartney. Passport Control Officer for Austria 1922–5. Author of *The Social Revolution in Austria.*	**Austria-Hungary;** **Burgenland; etc.**
C. Bre.	Cloudesley Brereton, M.A., L-ès.-L. Divisional Inspector (Modern Languages) to the London County Council. Corresponding Member of the National Educational Association (America). Author of *The Organisation of Modern Language Teaching*; *Studies in Foreign Education*; etc.	**Classical Education** (*in part*); **Commercial Education** (*in part*).
C. Ch.	Charles Chree, Sc.D., LL.D., F.R.S. Formerly Assistant Director of the Meteorological Office and Superintendent of the Observatory at Kew, London.	**Atmospheric Electricity.**
C. Ch.*	Cecil Chisholm. Chairman of Business Publications Ltd.; Editorial Director of *The Advertiser's Weekly*; Editor of *System.* Author of *Marketing and Merchandising.*	**Advertising** (*in part*).
C. D. C.	Lieutenant-Colonel C. D. Crozier, R.A. (ret.). Director of Inspection of High Explosives, Ministry of Munitions, 1915–9.	**Explosives, Military.**
C. De B.	Cecil Delisle Burns, M.A., Litt. D. Lecturer in Logic and Philosophy, Birkbeck College, University of London. Author of *Government and Industry*; *Industry and Civilisation*; etc.	**Civil Service.**
C. Du.	Charles St. L. Duff. Barrister-at-law. On the staff of the Foreign Office, London. Author of "The Panama-Costa Rica Boundary Dispute" in *The Fortnightly Review* (Oct. 1921); etc.	**Brazil** (*in part*); **Central American Union;** **Chile** (*in part*).
C. D. W.	William Cecil Dampier Whetham, M.A., F.R.S. Chairman of the Home Office Committee on Factory Lighting. Fellow of Trinity College, Cambridge. Author of *The Theory of Experimental Electricity*; *Back to the Land, a Medley*; etc.	**Agriculture:** *Electric Power.*
C. E. C.	Major-General Sir Charles Edward Callwell, K.C.B. Director of Military Operations at the War Office, London, 1914–6. Author of *Small Wars*; *The Dardanelles*; etc.	**Army:** *General*; **Balkan Wars;** **Dardanelles Campaign.**
C. E. Ch.	Charles Edward Chapman, A.M., Ph.D. Associate Professor of History, University of California. Author of *The Founding of Spanish California*; *A Californian in South America*; *A History of Spain*; *Catalogue of Materials in the Archivo General de Indias for the History of the Pacific Coast and the American Southwest*; *A History of California*; *History of the Cuban Republic.*	**Cuba.**

C. E. F.	Charles Ernest Fayle. Author of *Seaborne Trade*; *The New Patriotism*; *The Great Settlement*; etc.	Convoy.
C. E. I.	Charles Edward Inglis, O.B.E., M.I.C.E. Professor of Mechanism and Applied Mechanics, University of Cambridge. Fellow of King's College, Cambridge.	Bridges.
C. F. C.	Charles Frederick Cross, F.C.S. Analytical and Consulting Chemist. Member of the firm of Cross and Bevan. Joint-author (with E. J. Bevan) of *Researches on Cellulose*; *Text-book of Paper-making*.	Artificial Silk; Cellulose.
C. F. Re.	Charles Fernand Rey. Commander of the Star of Ethiopia. Formerly Assistant Secretary, Ministry of Labour, London. Author of *Unconquered Abyssinia as it is To-day*; etc.	Abyssinia.
C. G. B.*	Brig.-Gen. Hon. Charles Granville Bruce, C.B., M.V.O. Leader of the Mount Everest Expedition. Author of *The Assault on Mount Everest*; etc.	Everest.
C. G. D.*	Claude Gordon Douglas, M.B., Ch.B., C.M.G., F.R.S. Fellow and Tutor in Natural Science, St. John's College, Oxford. Temp. Lieut.-Col., R.A.M.C., 1918. Author of papers on respiration and kindred physiological subjects in scientific journals.	Chemical Warfare (*in part*).
C. G. S.	Charles Gabriel Seligman, M.D., F.R.C.P., F.R.S. Professor of Ethnology, London School of Economics, University of London. Formerly President of the Royal Anthropological Institute. Author of *The Melanesians of British New Guinea*; *The Veddas* (jointly with B. Z. Seligman).	Archaeology: *South and Central Africa*; Anthropology, Applied.
C. H. B.	C. H. Best. Attached to National Medical Research Institute, London.	Diabetes.
C. H. J.	Charles Hubbard Judd, Ph.D., LL.D. Director of the School of Education and Chairman of the Department of Psychology, University of Chicago. Author of *Psychology, General Introduction*; *Psychology of High School Subjects*; etc. Editor of *The Supplementary School Journal*; *The School Review*; etc.	Co-education; Commercial Education: *United States*; Elementary Education: *United States*.
C. H. K. E.	Wing-Commander Charles H. K. Edmonds, O.B.E., D.S.O. Served through the European War. Cuxhaven Raid, Dec. 1914 (Despatches), Gallipoli 1915 (Despatches).	Air Warfare.
C. K. H.	Charles Kenneth Hobson. Author of *The Export of Capital*, etc.	Capital, Export of.
C. K. O.	C. K. Ogden, M.A. Editor of *The Cambridge Magazine*; *The International Library of Psychology*; *The History of Civilisation*. Author of *The Meaning of Meaning* (with I. A. Richards); *The Foundations of Aesthetics*; etc.	Aesthetics.
C. L. C.	Charles Lyon Chandler. Curator of South American History and Literature in the Harvard College Library. Manager of the Foreign Commercial Department of the Corn Exchange National Bank of Philadelphia.	Buenos Aires.
C. Ll. M.	Conwy Lloyd Morgan, D.Sc., LL.D., F.R.S. Emeritus Professor of Zoology and Geology in the University of Bristol. Formerly Professor of Zoology and Geology in University College, Bristol. Principal of the College, 1887–1909. Author of *Introduction to Comparative Psychology*; *Habit and Instinct*; *Instinct and Experience*; *Emergent Evolution*.	Evolution (*in part*).
C. L. T. B.	C. L. T. Beeching. Secretary, Institute of Certified Grocers, London.	Cocoa; Coffee.
C. M. E. M.	Charles Marie Emmanuel Mangin, K.C.B. General Commanding the French V., VI. and X. Armies, 1916–8, and the French forces in the Rhineland, 1918–9. Formerly member of the Supreme War Council and Inspector-General of Colonial Forces.	Champagne, Battles in (*in part*).
C. P. S.	Clifford P. Smith. Member of the Committee on Publication of the First Church of Christ, Scientist, Boston.	Christian Science; Mrs. Eddy.
C. Ri.	C. Richardson. Formerly Hunting and Turf editor of *Land and Water* and *The Field* (London). Part author of *Racing at Home and Abroad*.	Coaching.
C. Ro.	Rev. Camille Roy, D.Ph., L-ès-L., F.R.S. (Can.). Professor of French Literature and Rector of Laval University, Canada. Author of *Essais sur la littèrature canadienne*, etc.	Canadian Literature, *French*.
C. Ro.*	Carl Roos, Ph.D. Chief Librarian of the Royal Library, Copenhagen.	Danish Literature.
C. R. W.	Clinton Rogers Woodruff, LL.B. Attorney-at-law. Hon. Secretary, National Municipal League. Vice-President, American Civic Association. President, Civil Service Commission of Philadelphia.	City Government (*in part*).

C. Sey.	Charles Seymour, M.A., Ph.D., Litt.D. Sterling Professor of History in Yale University. Technical Delegate at the Paris Peace Conference, 1919. Author of *The Diplomatic Background of the War; Woodrow Wilson and the World War*; etc.	**Coolidge, Calvin.**
C. T. B.	Charles Thomas Brues, B.S., M.S. Assistant Professor of Economic Entomology, Harvard University. Author of *Insects and Human Welfare.* Editor of *Psyche* (journal of entomology).	**Entomology, Economic.**
C. T. G.	Charles Theodore Greve, A.B., LL.B. Referee-in-bankruptcy, U.S. District Court, Southern District of Ohio. Secretary to the Trustees of the Sinking Fund of Cincinnati, Ohio. Author of *The Centennial History of Cincinnati.*	**Cincinnati.**
C. T. R.	Charles Tate Regan, M.A., F.R.S. Keeper of Zoology, Natural History Museum, London. Member of Freshwater Fish Committee, 1917–20. Author of *British Freshwater Fishes*; *Animal Life and Human Progress*; etc.	**Colours of Animals;** **Distribution of Animals.**
C. V. D.	Carl van Doren, Ph.D. Literary Editor of *The Century Magazine*, New York. Associate Professor in English, Columbia University, New York. Formerly Literary Editor of *The Nation*, New York. Author of *The American Novel*; *The Raving Critic*; *Many Minds*; *Contemporary American Novelists*; etc.	**American Literature:** *Fiction.*
C. W. C. O.	Sir Charles William Chadwick Oman, K.B.E., F.B.A., M.P. M.P. for Oxford University, Chichele Professor of Modern History, Oxford, and Fellow of New College. President, Royal Historical Society, London, 1917–21, and Royal Numismatic Society, London, 1919.	**Coinage.**
C. W. F.	Major C. W. Ford, R.A. Senior Instructor in Ammunition, Artillery College, Woolwich.	**Ammunition.**
C. W. J. O.	Charles William James Orr, C.M.G. Colonial Secretary, Gibraltar. Formerly Chief Secretary and Acting High Commissioner, Cyprus. Author of *Cyprus under British Rule.*	**Cyprus.**
D.	The Right Hon. Lord Desborough (William Henry Grenfell), G.C.V.O. Chairman of the Thames Conservancy Board. Past President, Oxford University Boat Club. President of the British Imperial Council of Commerce. Late President, London Chamber of Commerce.	**Easter, Fixed.**
D. A. MacG.	D. A. MacGibbon, Ph.D. Professor of Political Economy at the University of Alberta, Canada. Author of *Railway Rates and the Canadian Railway Commission.*	**Alberta; British Columbia.**
D. D.	Dwight Filley Davis, LL.B. United States Secretary of War.	**Army:** *United States.*
D. D. S.	Dorothy D. Steel. Winner of the Open Championship and Ladies Championship at Croquet, 1925.	**Croquet.**
D. M. S. W.	David Meredith Seares Watson, M.Sc., F.R.S. Jodrell Professor of Zoology and Comparative Anatomy, University College, University of London. Author of many papers on Vertebrate Palaeontology and connected subjects in *Proc. Zool. Soc.*; *Journal of Anatomy*; etc.	**Evolution** (*in part*).
D. R. P.	D. R. Pye, M.A. Lecturer in Mechancial Science and Fellow of Trinity College, Cambridge.	**Aero Engines.**
D. S. Mi.	Prince D. S. Mirsky. Lecturer in Russian Literature, King's College, London University. Author of *Modern Russian Literature*; *Pushkin*; *Russian Literature, 1875–1925.*	**Chekhov, Anton P.**
D. Sn.	David Snedden. Professor of Education, Columbia University, New York. Author of *Vocational Education* (1920); etc.	**Continuation Schools** (*in part*).
D. St.	Daniel Starch, M.A., Ph.D. Associate Professor of Business Psychology, Harvard University. Director of the Department of Research, American Association of Advertising Agencies. Author of *Advertising: Its Principles, Practice and Technique.*	**Advertising** (*in part*).
D. T.	Dorothy Todd. Editor of *Vogue*, London.	**Costume.**
D. Y. T.	David Yancey Thomas, M.A., Ph.D. Professor of History and Political Science in the University of Arkansas. Author of *A History of Military Government in Newly Acquired Territory of the United States*; *One Hundred Years of the Monroe Doctrine*; *Arkansas in War and Reconstruction.* Associate editor of *The Southwestern Political Science Quarterly.*	**Arkansas.**
E. B. A.	Major-General Edward Bailey Ashmore, C.B., C.M.G. General Officer Commanding Territorial Air Defence Brigades. Formerly G.O.C. Air Defences of London.	**Air Raids.**
E. B. O.	E. B. Osborn. Literary Editor of *The Morning Post* (London). Author of *The New Elizabethans*; etc.	**Boxing.**

E. Ca.*	Emile Cammaerts. Professor of French Literature at Queen's College, London. Author of *Belgian Poems*; *New Belgian Poems*; *The Treasure House of Belgium*; *Belgium* (The Story of the Nations); etc.	**Belgian Literature:** *French.*
E. C. K.	Edward Cameron Kirk, D.D.S., Sc.D., LL.D. State Dean and Emeritus Professor of Dental Pathology and Therapeutics, Dental School, University of Pennsylvania. Editor of *The Dental Cosmos.*	**Dentistry.**
E. Co.	Einar Cohn. Department of Statistics, Copenhagen.	**Denmark:** *Financial and Economic History.*
E. E. A.*	Edward E. Allen. Director of Perkins School for the Blind, Watertown, Massachusetts. Lecturer on the Education of the Blind, Graduate School of Education, Harvard University.	**Blind, Training of the** (*in part*).
E. F. B. G.	Ellinor F. B. Grogan (Lady Grogan). Author of articles on Balkan subjects in *The Nineteenth Century*; *New Europe*; etc.	**Bulgaria:** *Political History.*
E. F. C.	Edgar Frederick Carritt, M.A. Fellow and Praelector in Philosophy, University College, Oxford. Author of *The Theory of Beauty.*	**Ethics.**
E. F. S.	Lieut.-Col. Edward Fairbrother Strange, C.B.E. Late Keeper of Woodwork, Victoria and Albert Museum, London. Author of *Alphabets, A Handbook of Lettering*; *Japanese Illustration*; *The Colour Prints of Japan*; *Flowers and Plants for Designers and Schools*; etc.	**Decorative Art** (*in part*).
E. He.*	Ernst Hertzfeld. Professor of Oriental Archaeology, University of Berlin. Author of *Erster vorläufiger Bericht über die Ausgrabungen von Samarra.*	**Archaeology:** *Persia.*
E. H. P.*	E. H. Platt. Secretary of the Royal Toxophilite Society, England.	**Archery.**
E. J. Di.	Emile Joseph Dillon. Foreign Correspondent of *The Daily Telegraph* (London). Author of *Russian Characteristics*; *Maxim Gorky*; *From the Triple to the Quadruple Alliance*; *The Eclipse of Russia*; etc.	**Alfonso XIII., King of Spain, etc.**
E. J. F.	Edgar John Forsdyke, M.A., F.S.A. Assistant Keeper of Greek and Roman Antiquities in the British Museum. Editor of *The Journal of Hellenic Studies.*	**Archaeology:** *North Africa and Crete.*
E. J. G.	Edgar Johnson Goodspeed, Ph.D. Professor of Biblical and Patristic Greek and Chairman of the New Testament Department, University of Chicago. Author of *The Story of the New Testament*; *Things Seen and Heard.*	**Chicago, University of.**
E. J. R.	Sir Edward John Russell, D.Sc., F.R.S. Director of the Rothamsted Experimental Station, Harpenden, Hertfordshire. Author of *The Fertility of the Soil*; *Soil Conditions and Plant Growth*; *Farm Soil and Its Improvements*; etc.	**Agriculture:** *Scientific Developments* (*in part*).
E. J. S.	Edward James Salisbury, D.Sc., F.L.S. Reader in Plant Ecology and Fellow of University College, University of London. Hon. Secretary, British Ecological Society. Author of *An Introduction to the Study of Plants*; etc.	**Ecology.**
E. K. R.	Eric Keightley Rideal, D.Sc., Ph.D., F.I.C. Owen Jones Lecturer in Physical Chemistry and Fellow of Trinity Hall, Cambridge. Author of *Electrometallurgy*; *Catalysis in Theory and Practice* (in part); *Water Supplies*; etc.	**Catalysts;** **Conduction, Electric** (*in part*).
E. L.	Edward Laaman. Chief Editor of *Waba Maa* (Estonian newspaper). Director of the Press Bureau at the Estonian Ministry for Foreign Affairs, 1920–4. Secretary to the Estonian Peace Delegation in Paris and London, 1918–20.	**Estonia:** *Political History.*
E. Le.	Emil Lederer, Ph.D. Professor in the Faculty of Philosophy, University of Heidelberg. Editor of *Archiv für Sozialwissenschaft und Sozialpolitik.*	**Communism.**
E. M. D.	Sir Ernest MacLeod Dowson, K.B.E. Surveyor-General of Egypt, 1909–19. Under-Secretary of State for Finance, Egypt, 1919–21. Financial Adviser to the Egyptian Government, 1920–3	**Egypt:** *Financial and Economic.*
E. M. E.	Edward Mead Earle. Assistant Professor of History, Barnard College, Columbia University, New York. Author of *Turkey, The Great Powers, and the Baghdad Railway.*	**Baghdad Railway.**
E. Mo.	E. Moresco. Professor of Colonial Politics at the School of Commerce, Rotterdam.	**East Indies, Netherlands.**
E. N. S.	Colonel Ernest Norman Stockley, R.E., D.S.O. Chief Engineer of the Western Command, England. Chief Engineer, XIX. Corps, 1918, and VI. Corps, 1919.	**Bridging, Military.**
Er. A.	Erik Arup, Ph.D. Professor of Danish History at the University of Copenhagen.	**Denmark:** *Political History* (*in part*).

E. R.-B.	Sir Evelyn J. Ruggles-Brise, K.C.B. Chairman, Prison Commission, England and Wales, 1895–1921. Late President, International Prison Commission. Author of *The English Prison System*; *Prison Reform at Home and Abroad*.	**Borstal System.**
E. Sc.	Ernest Scott. Professor of History in the University of Melbourne.	**Australian Literature.**
E. T. D'E.	Sir Eustace Henry William Tennyson-D'Eyncourt, K.C.B., F.R.S. Managing Director, Armstrong Whitworth and Co., Ltd. Director of Naval Construction at the Admiralty, 1912–24.	**Aircraft Carrier;** **Dreadnought.**
E. Va.	Emile Vandervelde. Minister for Foreign Affairs in the Belgian Government. Formerly Minister of Justice. Represented Belgium at the Paris Peace Conference, 1919. Chairman of the Socialist Group in the Belgian Parliament. Author of *Three Aspects of the Russian Revolution*; *Le parti ouvrier belge*; etc,	**Belgium:** *Economic History*.
E. V. P.	Ernest Vincent Pannell. Electrical Engineer. Technical adviser of the British Aluminium Company, New York. Author of *High Tension Line Practice*.	**Aluminium;** **Electricity, Transmission of.**
E. W. Be.	Edward Wentworth Beatty, K.C., LL.D. President of the Canadian Pacific Railway. Chancellor of McGill University, Montreal.	**Canada:** *Communications*.
E. Wi.	E. Wilson, M.A. Contributor of Acrostics and Crosswords to *The News of the World* (London).	**Acrostics; Crosswords.**
E. W. MacB.	Ernest William MacBride, M.A., D.Sc., LL.D., F.R.S. Professor of Zoology, Imperial College of Science, South Kensington, London. Formerly Strathcona Professor of Zoology at McGill University, Montreal. Author of *A Text Book of Zoology*; etc.	**Cytology;** **Embryology;** **Evolution** (*in part*).
E. W. P. N.	Major E. W. Polson Newman. Correspondent of *The Daily Mail* in Jerusalem. War Correspondent in Syria 1925–6.	**Damascus.**
F. A. Cl.	Frederick Albert Cleveland, Ph.B., Ph.D., LL.D. Formerly Professor of United States Citizenship, Maxwell Foundation, Boston University. Author of *Organized Democracy*; *First Lessons in Finance*; etc.	**Boston.**
F. A. L.	Frederick Alexander Lindemann, Ph.D., F.R.S. Professor of Experimental Philosophy, Oxford University.	**Einstein, Albert.**
F. A. M. W.	Captain F. A. M. Webster. Joint Editor of *The Blue Magazine*, London, and writer on Athletics.	**Athletics.**
F. Ba.	Fernand Baudhuin. Professor of Commerce in the University of Louvain.	**Belgium:** *Finance*.
F. C. B.*	F. C. Bartlett, M.A. University Reader in Experimental Psychology and Director of the Psychological Laboratory, Cambridge.	**Culture Contact, Psychology of.**
F. C. L.	F. C. Lane. Editor of *Baseball*.	**Baseball.**
F. D.	F. Debenham, O.B.E. Lecturer on Geography and Fellow of Gonville and Caius College, Cambridge.	**Antarctica.**
F. G. B.	Frank George Barnes. Superintendent, Homerton Residential School for the Deaf, London, N.E. Formerly Editor of *The Teacher of the Deaf*.	**Deaf and Dumb:** *Great Britain*.
F. H. B.*	Frank Herbert Brown, C.I.E. Member of the staff of *The Times* (London). London correspondent of *The Times of India*. Formerly Editor of *The Indian Daily Telegraph*.	**Das, C. R., etc.**
F. Ho.	Frederick Webb Hodge. Ethnologist with Museum of the American Indian, Heye Foundation, New York. Ethnologist-in-charge, Bureau of American Ethnology, Smithsonian Institution, 1910-8. Founder and ex-President of American Anthropological Association. Editor of *Handbook of American Indians North of Mexico*; and sometime Editor of *The American Anthropologist*.	**Archaeology:** *North America*.
F. H. S.	Major-General Sir Frederick Hugh Sykes, G.B.E., C.M.G. M.P. for the Hallam division of Sheffield. Brigadier-General, General Staff, Supreme War Council, Versailles, 1917-8. Deputy Director, War Office, London, 1917. Chief of the Air Staff, 1918-9. Chief of British Air Section of the Peace Conference, Paris. Controller-General of Civil Aviation, 1919-22. Author of *Aviation in Peace and War*.	**Air Power.**
F. I.	Florence Irwin. Author of *The Complete Auction Player*; *Master Auction*; etc.	**Bridge, Auction** (*in part*).
F. J. C. W.	Major F. J. C. Wyatt, O.B.E., M.C. Organizer and Controller of Camouflage, British Expeditionary Force, France, 1916-8.	**Camouflage** (*in part*).

F. L. En.	F. L. ENGELDOW. On the staff of the Plant Breeding Institute, Cambridge, England.	**Agriculture:** *Scientific Developments (in part).*
F. L. M.	FRANK LIDGETT MCDOUGALL, C.M.G. Australian Representative on the Imperial Economic Committee, London. Author of *Sheltered Markets*; etc.	**Australia:** *Production, Industry and Trade.* **British Empire:** *Trade and Commerce.*
F. L. N.	SIR FREDERIC LEWIS NATHAN, R.A., K.B.E. Director of Alcohol Section, Fuel Research Board, London. Works Manager of the Ardeer Works of Nobel's Explosives Co., 1909-14.	**Alcohol** *(in part).*
F. M. R.	FLIGHT-LIEUTENANT FREDERICK MICHAEL ROPE, R.A.F. Member of Staff, Royal Airship Works, Cardington, Bedford, England.	**Airship** *(in part).*
F. O. B.	FREDERICK ORPEN BOWER, F.R.S. Emeritus Professor of Botany, University of Glasgow. Twice President of the Botanical section of the British Association and ex-President of the Royal Society of Edinburgh. Author of *The Origin of a Land Flora*; *Plant Life on Land*; *Plants and Man*; etc.	**Botany.**
F. Pe.*	FRANKLIN G. R. S. PETERSEN. Member of the editorial staff of *The Times* (London).	**Australia:** *Political History*; etc.
F. R. C.	FRANK RICHARDSON CANA, F.R.G.S. Editorial staff of *The Times* (London). Author of *South Africa from the Great Trek to the Union*; etc. Member of the editorial staff of the *Encyclopædia Britannica* (11th edition).	**Africa** *(in part)*; **Basutoland; Bechuanaland; Cameroons; Eritrea; etc.**
F. R. M. de P.	F. R. M. DE PAULA, O.B.E., F.C.A. Reader in Accounting and Business Organisation at the London School of Economics, University of London. Author of *The Principles of Auditing.*	**Bookkeeping.**
F. W. A.	FRANCIS WILLIAM ASTON, Sc.D., F.R.S. Fellow of Trinity College, Cambridge; Nobel Prizeman for Chemistry. Author of *Isotopes.*	**Atomic Energy.**
F. W. E.-G.	FREDERICK WILLIAM EDRIDGE-GREEN, C.B.E., M.D., F.R.C.S. Special Examiner and Adviser to the Board of Trade, London, on Colour Vision and Eyesight. Author of *The Physiology of Vision.* Inventor of the Colour Perception Spectrometer and Colour Perception Lantern—used as the official test of the British Navy.	**Colour Vision and Colour Blindness.**
F. W. Ha.*	F. W. HACK. Of Neufeldt and Kuhnke.	**Diving.**
G. Ab.	GRACE ABBOTT, M.A. Chief of the Children's Bureau, U.S. Department of Labor. Author of *The Immigrant and the Community.*	**Child Labour and Child Welfare** *(in part).*
G. A. O.	GEORGE ALEXANDER ORROK. Consulting Engineer. Formerly on staff of the New York Edison Company. Author of *Power Engineering.*	**Boilers.**
G. A. Y.	LIEUTENANT-COLONEL GILBERT A. YOUNGBERG, D.S.O. Corps of Engineers, U.S. District Engineer, Jacksonville, Florida. Formerly Assistant to the Chief of Engineers, U.S. Army.	**Engineers, Military:** *United States.*
G. Bo.	GEORGE BONCESCU. Rumanian correspondent of *The Times* (London).	**Bessarabia; Bratianu, Jon; Bukowina; Dobruja; etc.**
G. C.	GUSTAV CASSEL. Professor of Economics at the University of Stockholm. Author of *The World's Monetary Problems*; *Money and Foreign Exchange after 1914*; *The Theory of Social Economy*; etc.	**Exchanges, Foreign.**
G. C. D.	G. C. DIXON. Literary Editor, *The Daily Mail* (London). Author of *From Melbourne to Moscow.*	**Bruce, Stanley M.; etc.**
G. E. B.	GEORGE EARLE BUCKLE, M.A., LL.D. Editor of *The Times* (London), 1884–1912. Formerly Fellow of All Souls College, Oxford. Author of *Life of Disraeli* (vols. III., IV., V. and VI). Editor of *The Letters of Queen Victoria.*	**Balfour, Earl of; Bryce, Viscount; Carson, Lord; Curzon, Marquess; etc.**
G. F. N. C.	GEORGE FELIX N. CLAY, F.R.I.B.A. Author of *Modern School Buildings.*	**Education:** *Architecture.*
G. F. St.	GEORGE FREDERIC STILL, M.A., M.D., F.R.C.P. Professor of Diseases of Children, King's College, University of London. Physician to the Hospital for Sick Children, Great Ormond Street, London. Physician for Diseases of Children, King's College Hospital. Author of *Text Book on Diseases of Children*; etc.	**Children, Diseases of.**
G. G. A.	MAJOR-GENERAL SIR GEORGE GREY ASTON, K.C.B. Lecturer on Military History, University College, University of London. Formerly Professor of Fortification at the Royal Naval College, Greenwich. Author of *Sea, Land and Air Strategy*; *Memories of a Marine*; etc.	**British Empire:** *Defence.*
G. Gl.	GEORGE GLASGOW. Author and Publicist. Author of *The Minoans*; *Ronald Burrows: a Memoir*; etc.	**Beneš, E.; etc.**

G. H. R.	George H. Ryden, M.A. Associate Professor of History and Political Science, University of Delaware. Director of the American Red Cross in South Russia, 1919-20.	Delaware.
G. H. T.	George Herbert Thring. Solicitor. Secretary of the Incorporated Society of Authors, Playwrights and Composers, London.	Copyright.
G. K. A. B.	Very Reverend George Kennedy Allen Bell, D.D. Dean of Canterbury. Formerly resident chaplain to the Archbishop of Canterbury. Author of *The Meaning of the Creed*; etc.	Anglicanism; Davidson, Randall T.
G. L.*	Gonzalez Lodge. Professor of Latin and Greek at Teachers College, Columbia University, New York. Editor-in-chief of *The Classical Weekly*, 1907-13.	Classical Education: *United States.*
G. le G. N.	G. le G. Norgate, B.A. Contributor to *The Dictionary of National Biography*.	Chelmsford, Viscount; etc.
G. le Q. M.	Major G. le Q. Martel, D.S.O., M.C. Deputy Assistant Director of Fortification and Works, Ordnance Department, War Office, London. General Staff Officer, Tank Corps Headquarters, B.E.F., France, 1916-8. Inventor of the One-man Tank.	Armoured Car.
G. L. K.	Geoffrey Langdon Keynes, M.A., M.D., F.R.C.S. Hunterian Professor, Royal College of Surgeons, London. Author of *Blood Transfusion*; etc.	Blood Transfusion.
G. M. W.	George Mackinnon Wrong, M.A., LL.D., F.R.S.(Can.). Professor of History, University of Toronto. Author of *The Fall of Canada*; *The Conquest of New France*; etc.	Canada: *Political History.*
G. O. M.	George O. May. President of the American branch of the firm of Price, Waterhouse and Co., Accountants.	Cost Accounting.
G. S. Du.	Rev. George Simpson Duncan, M.A., B.D. Professor of Biblical Criticism in St. Mary's College, University of St. Andrews.	Biblical Criticism.
G. T.*	Major Edward Geoffrey Toye. Conductor for Sir Thomas Beecham's Opera Companies and other societies. Author of *Experance Morris Dance Book No. 2.*	Dancing.
G. T. B.	George Thomas Burrows. Editor of *The Live Stock Journal* and agricultural correspondent of *The Daily Telegraph* (London).	Bowls.
G. W. G.	G. W. Giles, F.R.H.S. Secretary, Allotments Organisation and Small Holders Society Ltd., London.	Allotments.
G. W. K.*	George Washington Kirchwey, LL.D. Head of the Department of Criminology, New York School of Social Work. Formerly Warden of Sing Sing Prison. Author of *Readings in the Law of Real Property*; etc.	Criminology.
H.*	Right Hon. Viscount Haldane (Richard Burdon Haldane), K.T., O.M., LL.D., F.R.S. Lord High Chancellor of England, 1912–5 and 1924. Secretary of State for War, 1905–12. Chancellor of the University of Bristol. Gray Scholar and Ferguson Scholar in Philosophy of the four Scottish universities, 1876. Author of *Education and Empire*; *The Philosophy of Humanism*; etc. Joint author of *Essays in Philosophical Criticism*.	Education: *General.*
H. A. B.	Brig.-Gen. Henry Arthur Bethell, C.M.G., R.A. Author of *Modern Guns and Gunnery*; *Modern Artillery in the Field.*	Artillery.
H. A. H.	Howard Archibald Hubbard, M.A. Professor of History and Head of the Department of History and Political Science in the University of Arizona.	Arizona.
H. A. T.	H. Avray Tipping, M.A., F.S.A.	Chequers.
H. B. H.	Brig.-Gen. Harold Brewer Hartley, M.C. Fellow and Tutor of Balliol College, Oxford. Controller of the Chemical Warfare Department, Ministry of Munitions, London, 1918–9. Formerly Assistant Director of Gas Services, G.H.Q., France.	Chemical Warfare (*in part*).
H. Bi.*	Henri Bidou. Member of the staff of *Le Journal des Débats* (Paris). Chevalier of the Legion of Honour.	Alsace-Lorraine.
H. Br.*	Henri Brenier. Director-General of the Chamber of Commerce, Marseilles. General Secretary to the National Colonial Exhibition at Marseilles, 1922, and to the Colonial Organisation Congress, 1922.	Algeria.
H. C. Ha.	Henry C. Harwood. Literary Critic, *The London Mercury*; *The Outlook* (London). Author of *Judgment Eve*; etc.	Bennett, Arnold; Ellis, H. Havelock.

H. Co.	Henry Cousens. Late member of the Archaeological Survey of India. Author of *Architectural Antiquities of Western Asia.*	**Archaeology:** *India.*
H. C. W.	Henry C. Watts, D.Sc., A.M. Inst.C.E. Fellow of the Royal Aeronautical Society, England.	**Airscrew.**
H. C. Wo.	Henry Charles Woods. Special correspondent of *The Times* (London) in the Balkans, 1911, and of *The Evening News* (London) during the Balkan Wars, 1912–3. Military and Diplomatic Correspondent for *The Evening News*, 1914–5. Author of *War and Diplomacy in the Balkans*; etc.	**Constantine, ex-King of the Hellenes.**
H. D.*	Harold Dore. Political correspondent of *The Manchester Guardian*.	**Daylight Saving.**
H. E. A.	Henry Edward Armstrong, Ph.D., LL.D., D.Sc., F.R.S. Emeritus Professor of Chemistry at the City and Guilds College, South Kensington, London.	**Chemistry.**
H. E. B.	Henry Eldridge Bourne, L.H.D. Professor of History in Western Reserve University, Cleveland, Ohio. Author of *The Revolutionary Period in Europe*; *History of the United States*; etc.	**Cleveland.**
H. E. Ba.	Harry Everett Barnard, Ph.D. Director of the American Institute of Baking. Formerly Food and Drug Inspection Chemist, U.S. Department of Agriculture.	**Bread Making** (*in part*).
H. Fi.	Herman Finer, D.Sc. Lecturer in Public Administration, London School of Economics. Author of *Foreign Governments at Work*; *The Case Against Proportional Representation*; etc.	**Electoral Laws.**
H. F. O.	Henry Fairfield Osborn, D.Sc., LL.D., Ph.D. Honorary Curator of the Department of Vertebrate Palaeontology of the American Museum of Natural History. Senior Geologist, United States Geological Survey. Research Professor of Zoology, Columbia University, New York. Author of *Age of Mammals*; *Men of the Old Stone Age*; *Origin and Evolution of Life*; etc.	**Evolution** (*in part*).
H. G. C.	Harold G. Colman, D.Sc., Ph.D., F.I.C. Analytical and Consulting Chemist.	**Coal Tar Products.**
H. G. J.	Herman Gerlach James, M.A., Ph.D. Dean of the College of Arts and Sciences and Professor of Political Science in the University of Nebraska. Author of *Principles of Prussian Administration*; *Applied City Government*; *A Handbook of Civic Improvements*; *Local Government in the United States*; *The Constitutional System of Brazil.*	**Chile** (*in part*).
H. G. T.	H. G. Thornton. Head of the Bacteriology Department, Rothamsted Experimental Station, Harpenden, Hertfordshire.	**Bacteriology** (*in part*).
H. Gu.	Hugh Gunn, M.A. Director of Education and Member of the Legislative Council, Orange River Colony, 1902–10. Editor of *The British Empire.*	**Beyers, C. F.**
H. H. J.	Sir Harry Hamilton Johnston, G.C.M.G., K.C.B., Sc.D., F.R.G.S. Commissioner and Consul-General in British Central Africa, 1891. Consul-General in the Regency of Tunis 1897–9. Special Commissioner, Commander-in-Chief and Consul-General for the Uganda Protectorate, 1899–1901. Author of *British Central Africa*; *The Uganda Protectorate*; *The Nile Quest*; *Liberia*; etc.	**Africa** (*in part*).
H. Ho.	Harry Houdini. Professional Magician. Author of *Handcuff Secrets*; *The Unmasking of Robert Houdin*; *A Magician Among the Spirits*; etc.	**Conjuring.**
H. I. P.	Herbert Ingram Priestley, M.A., Ph.D. Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *The Mexican Nation*; etc.	**Costa Rica.**
H. J. Br.	H. J. Braunholtz, M.A. Assistant Keeper of Ceramics and Ethnography, British Museum, London.	**Archaeology:** *Oceania and Easter Island.*
H. J. F.	Herbert John Fleure, D.Sc. Professor of Geography and Anthropology, University College of Wales, Aberystwyth. Hon. Secretary, Geographical Association; and Hon. Editor of *The Geographical Teacher.* Author of *Human Geography in Western Europe*; etc.	**Exploration.**
H. J. T.	H. J. Temple. Political Representative in England of the European Association of Ceylon.	**Ceylon.**
H. Le.*	Harper Leech, M.A. Financial writer with *The Chicago Tribune.* Formerly managing editor, Memphis *Press*, and editor, Denver *Express.*	**Chicago.**
H. L. M.	Henry Louis Mencken. Editor of *The American Mercury.* Contributing editor of *The Nation* (New York). Formerly editor (with George Jean Nathan) of *The Smart Set.* Author of *In Defense of Women*; *The American Language*; *Prejudices*; etc.	**Americanism.**

H. L. T.	Henry Letheby Tidy, M.A., M.D., F.R.C.P. Assistant Physician to St. Thomas's Hospital, and Physician to the Great Northern Hospital, London. Hon. Secretary, Royal Society of Medicine. Formerly Demonstrator of Clinical Pathology to the London Hospital. Author of *Synopsis of Medicine*; etc.	**Encephalitis Lethargica.**
H. Lu.	H. Lund.	**Denmark:** ***Political History (in part).***
H. M. H.*	Henry Metcalf Hobart, B.S. Consulting Engineer of the General Electric Company, Schenectady, N.Y. Author of *Electric Motors*; *Continuous Current Dynamo Design*; *Design of Static Transformers*; etc.	**Dynamo-Electric Machines.**
H. Mi.	J. Hamish Miles. Literary Critic of *The New Statesman* and *The Outlook* (London). Author (with R. Mortimer) of *The Oxford Circus.*	**Beerbohm, Max;** **Doughty, C. M.**
H. Ni.	Hon. Harold Nicolson, C.M.G. First Secretary, British Legation, Teheran. Served on British Delegation to the Peace Conference, 1919. Author of *Paul Verlaine*; etc.	**Diplomacy.**
H. P.	Henri Pirenne. Professor of Mediaeval History, University of Ghent. Member of the Royal Academy of Belgium and the Institute of France. Author of *Histoire de Belgique;* etc.	**Albert I., King of the Belgians;** **Belgium** *(in part).*
H. P. W.	Henry Parker Willis, Ph.D. Professor of Banking in Columbia University, New York. Formerly Director of Research, Federal Reserve Board. Editor-in-chief, *The Journal of Commerce* (New York). Author of *American Banking*; *The Federal Reserve System*; *Federal Reserve Banking Practice*; etc.	**Banking,** ***United States.***
H. R. H.	Harry Reginald Holland Hall, F.B.A., Litt. D., F.S.A. Keeper of Egyptian and Assyrian Antiquities, British Museum, London. Author of *Egypt and Western Asia in the Light of Recent Discoveries*; *Aegean Archaeology*; etc.	**Archaeology:** ***Western Asia and Mesopotamia.***
H. Ro.	Sir Humphry Davy Rolleston, Bart., K.C.B., M.D., D.Sc., D.C.L. Regius Professor of Physic, Cambridge University. Physician in Ordinary to His Majesty King George V. President of the Royal College of Physicians of London. Author of *Diseases of the Liver*; etc.	**Diagnosis.**
H. Sc.	Harold Lorain Scott. Associate Professor of History, Robert College, Constantinople.	**Constantinople.**
H. S. C.	Henry Seidel Canby, Ph.D. Professor of English, Yale University. Editor of *The Saturday Review of Literature.* Author of *The Short Story*; *English Composition in Theory and Practice*; *Everyday Americans*; etc.	**American Literature** *(in part).*
H. Si.	Herbert Sidebotham. Contributor to *The Daily Chronicle*; *The Daily Graphic*; *The Sunday Times* (London). For many years on the editorial staff of *The Manchester Guardian* and known as "Student of War" and "Student of Politics." Author of *Pillars of the State;* etc.	**Churchill, Winston L.**
H. Sp.*	Herbert Joseph Spinden, A.M., Ph.D. Curator of Mexican Archaeology and Ethnology, Peabody Museum, Harvard University. Author of *Ancient Civilizations of Mexico and Central America*; *Civilization and the Wet Tropics*; etc.	**Archaeology:** ***Mexico and Central America.***
H. St. J. B. P.	Harry St. John Bridger Philby, C.I.E. Chief British Representative in Transjordan, 1921–4. Formerly Adviser to the Ministry of the Interior, Mesopotamia. Commanded the British Political Mission to Central Arabia, 1917–8. Author of *The Heart of Arabia.*	**Arabia** *(in part).*
H. T.*	Brigadier-General Harry Taylor, D.S.M. Chief of Engineers, United States War Department. Chief Engineer, American Expeditionary Force, in France 1917–8.	**Colorado River.**
H. Ti.*	Herbert Tilley, B.S., F.R.C.S. Surgeon, Ear, Nose and Throat Department, University College Hospital, London. Laryngologist to the Radium Institute. Ex-president of the Sections of Laryngology and Otology, Royal Society of Medicine. Author of *Diseases of the Nose and Throat*; etc.	**Ear, Nose and Throat, Diseases of.**
H. T. S.	Hugh Tempest Sheringham. Angling Editor of *The Field* (London). Author of *An Angler's Hours*; *Elements of Angling*; *Trout Fishing: Memories and Morals*; etc.	**Angling.**
H. V. S. C.	Lieutenant-Colonel Harold V.S. Charrington, M.C. General Staff Officer, 2nd Grade, at the Staff College, Camberley, England.	**Cavalry.**
H. Wa.	Herbert Ward, M.A., C.B.E. Formerly Chief Inspector for the Training of Teachers, Board of Education, London.	**Education, Experiments in:** *Great Britain.*
H. W. Ba.	H. W. Bartleet. Writer on Motoring and Cycling topics.	**Cycling.**

H. W. C.	HARVEY WILEY CORBETT, F.R.I.B.A., F.A.I.A. Lecturer in Architecture, Columbia University. Past President, Architectural League of New York; member Fine Arts Commission, State of New York. Member of the firm of Helmle & Corbett, New York. Architect of Bush Terminal Office Building (New York); Bush House (London); Springfield Municipal Group (Mass.); George Washington Masonic National Memorial (Alexandria, Va.); etc.	**Architecture.**
H. W. M.	HENRY WILLIAM MARDON. Formerly Lecturer in Geography and Education in the Tewfikieh and Dar el Ulum colleges, Cairo. Author of *A Geography of Egypt and the Anglo-Egyptian Sudan*; etc.	**Aden; Arabia** (*in part*).
H. W. V. T.	HAROLD WILLIAM VAZEILLE TEMPERLEY, M.A., LITT.D., O.B.E. University Reader in Modern History and Fellow of Peterhouse, Cambridge. British Representative on the Albanian Frontiers Commission, 1921. Military Adviser at the Peace Conference, Paris, 1919. Editor of *A History of the Peace Conference of Paris*. Contributor to *The Cambridge Modern History* and *The Cambridge History of Foreign Policy*.	**Ambassadors, Conference of; Eupen and Malmedy; etc.**
I. A. E. E.	LIEUT.-COL. IVO ARTHUR EXLEY EDWARDS, C.M.G. Staff Officer, British Air Ministry, 1918–9. Sometime Deputy Director Air Transport Department of Civil Aviation, Air Ministry, London.	**Aerodrome.**
I. F.	IRVING FISHER, PH.D. Professor of Political Economy at Yale University. Author of *The Nature of Capital and Income*; *The Purchasing Power of Money*; *The Rate of Interest*; *Stabilizing the Dollar*; etc.	**Dollar Stabilisation.**
I. F. D. M.	IAN F. D. MORROW. Formerly Senior Moderator, Trinity College, Dublin.	**Capitulations;** **Europe** (*in part*).
I. W. S	I. W. SHKLOVSKY. Formerly regular contributor to the Russian periodicals *Russko Bogatsvo* and *Russkia Viedomosti*. Author of *Literary Characteristics*; etc.	**Andreyev, L. N.**
J. A. A.	J. A. ARKWRIGHT, M.D., F.R.C.P., F.R.S. Bacteriologist at the Lister Institute, London.	**Bacteriology** (*in part*).
J. A. F.	JOHN AMBROSE FLEMING, M.A., D.SC., F.R.S. Formerly Professor of Electrical Engineering, University College, London. Fellow of University College. Inventor of the thermionic valve which made wireless telephony possible. Hughes Gold Medallist of the Royal Society. Author of *The Wonders of Wireless Telegraphy*; *Fifty Years of Electricity*; etc.	**Electricity**: *Nature and Uses*.
J. A. Fi.	J. ALFRED FISHER. Member of the Grand Council of the Federation of British Industries.	**Asbestos.**
J. A. R. M.	SIR JOHN ARTHUR RANSOME MARRIOTT. M.P. for Oxford City, 1917–22; M.P. for York since 1923. Chairman of the House of Commons Select Committee on Estimates, 1924 and 1925. Secretary to the Oxford University Extension Delegacy, 1895–1920. Author of *English Political Institutions*; *The Eastern Question: a Study in European Diplomacy*; *England under the Tudors*; etc.	**Baldwin, Stanley; Conservative Party.**
J. A. S.*	JOHN ALEXANDER SMITH, M.A. Waynflete Professor of Moral and Metaphysical Philosophy, Oxford. Fellow of Magdalen College, Oxford.	**Croce, Benedetto.**
J. A. T.	JOHN ARTHUR THOMSON, M.A., LL.D. Regius Professor of Natural History in the University of Aberdeen. Gifford Lecturer, St. Andrew's, 1915. Terry Lecturer, Yale University, 1924. Author of *The Study of Animal Life*; *Outlines of Zoology*; *Heredity*; *Darwinism and Human Life*; *What is Man?*; *Concerning Evolution*. Joint Author (with Professor Patrick Geddes) of *Evolution*; *Sex*; *Biology*.	**Biology.**
J. B. C.	JOHN BRIAN CHRISTOPHERSON, M.D., F.R.C.P., F.R.C.S. Physician for Tropical Diseases, Freemasons Hospital and Nursing Home, Chelsea, London. Consultant to the Tropical Diseases Clinic, Ministry of Pensions. Author of *Antimonium Tartratum, a Specific Cure for Bilharziosis*; etc.	**Bilharziosis.**
J. B. C. K.	JOHN BAKER CANNINGTON KERSHAW, F.I.C., F.S.S. Consulting Chemist and Chemical Engineer. Author of *The Electric Furnace in Iron and Steel Production*; *Electrometallurgy*; *Electrothermal Methods of Iron and Steel Production*.	**Electrochemistry;** **Electrometallurgy.**
J. B. F.	JOHN B. FIRTH. Editorial Staff of *The Daily Telegraph* (London). Author of *Augustus Caesar*; *Constantine The Great*; etc.	**Burnham, 1st Viscount;** **Burnham, 1st Baron;** **Chamberlain, Sir J. Austen.**
J. Bro.	JOHN BROWNLEE, D.SC., M.D., D.P.H. Director of Statistics, National Institute for Medical Research, London.	**Epidemiology** (*in part*).
J. B. W.	JOHN B. WATSON, PH.D. Editor of *The Psychological Review*. Late Professor of Psychology, Johns Hopkins University. Author of *Behaviour—An Introduction to Comparative Psychology* (1914); *Psychology from the Standpoint of the Behaviourist* (1919); *Behaviourism* (1925).	**Behaviourism.**

J. C. D.	Jack Cecil Drummond, D.Sc., F.I.C. Professor of Biochemistry, University College, University of London.	**Biochemistry.**
J. C. G. L.	John Charles Grant Ledingham, C.M.G., M.B., F.R.C.P., D.Sc., F.R.S. Professor of Bacteriology and Chief Bacteriologist, Lister Institute, University of London; formerly in charge of Bacteriological Department, King George Hospital, London. Consulting Bacteriologist in Mesopotamia, 1917. Joint-author of *The Carrier Problem in Infectious Diseases.*	**Bacteriology** (*in part*).
J. Ci.	Jaroslav Cisar, Ph.D. Secretary on Special Mission, Czechoslovakian Legation, London. Author of *The Czecho-Slovak Republic.*	**Czechoslovakia** (*in part*).
J. C. M.*	Colonel J. C. Matheson. Assistant Director of Fortification and Works at the War Office, London.	**Coast Defence.**
J. C. Sq.	John Collings Squire, M.A. Editor of *The London Mercury.* Chairman of the English Association. Chairman of the Architecture Club. Author of *Tricks of the Trade*; *Essays on Poetry*; *Grub Street Nights*; *The Comic Muse*; etc.	**English Literature.**
J. C. W. R.	J. C. W. Reith. Managing Director of The British Broadcasting Co. Ltd.	**Broadcasting** (*in part*).
J. Dv.	Jan Dvorocek. Foreign Minister of Czechoslovakia; Head of the Economic Section, Economic Committee of the League of Nations.	**Czechoslovakia** (*in part*).
J. E. C.	Janet Elizabeth Courtney (Mrs. W. L. Courtney), O.B.E., J.P. Author of *Free Thinkers of the Nineteenth Century*; *Recollected in Tranquillity.* Joint-author of *Pillars of Empire.* Joint-author of Index to the 11th edition of *The Encyclopædia Britannica.*	**Alexandra, Queen;** **Chisholm, Hugh.**
J. E. W.	James Edward West, LL.M. Executive Officer of the Boy Scouts of America, 1911; later, Chief Scout Executive.	**Boy Scouts:** *United States.*
J. F. C. F.	Colonel John Frederic Charles Fuller, D.S.O. Military Assistant to the Chief of the Imperial General Staff. Chief General Staff Officer, Tank Corps, 1917-8. Formerly Chief Instructor, Staff College, Camberley. Author of *Tanks in the Great War*; *The Reformation of War*; *Sir John Moore's System of Training*; etc.	**Arras, Battle of.**
J. F. Da.	John Ford Darling, C.B.E. Director Midland Bank Ltd. Formerly General Manager, London Joint Stock Bank Ltd.	**British Commonwealth:** *Finance.*
J. G. H.	Joseph G. Horner, A.M.I.Mech.E. Author of *Plating and Boiler Making*; *Practical Metal Turning*, etc.	**Automatic Machinery.**
J. Gr.	James Greig, R.B.A. Art Critic of *The Morning Post* (London). Author of *Sir H. Raeburn, His Life and Works*; *Life of Thomas Gainsborough*; etc.	**Art Sales.**
J. Gr.*	Josef Gruntzel, Ph.D. Professor of Economics in the School of Economics, University of Vienna. Author of *Handelspolitik*; etc.	**Commercial Treaties.**
J. H. T.	Right Hon. James Henry Thomas. M.P. for Derby General Secretary of the National Union of Railwaymen, England. Formerly Secretary of State for the Colonies. Acting Chairman of Executive Council, British Empire Exhibition, 1924-5. Author of *When Labour Rules.*	**Exhibition, British Empire.**
J. H. van A.	J. H. Van Alstyne. President of the Otis Elevator Co., New York.	**Elevators and Escalators.**
J. J. C.	Brig.-Gen. John J. Collyer, C.B., C.M.G., D.S.O. Late Chief of the General Staff, Union of South Africa.	**Cameroons, Operations in;** **East Africa, Operations in.**
J. K. H.	Joseph Kinmont Hart, Ph.D. Lecturer in Education at the New School for Social Research, New York City. Formerly Associate Editor of *The Survey.* Formerly Professor of Education, Reed College, Portland, and Director of the Pennsylvania School for Social Service. Author of *Community Organization*; *Discovery of Intelligence*; etc.	**Adult Education:** *United States.*
J. Kn.	Joseph Knox, D.Sc. Lecturer in Chemistry in the University of Glasgow.	**Cyanamides.**
J. L. Co.	John L. Cope. Member of the staff of *The Encyclopædia Britannica* (13th edition).	**British Legion.**
J. L. G.	James Louis Garvin, Litt.D. Editor-in-chief of *The Encyclopædia Britannica.* Editor of *The Observer* (London). Formerly editor of *The Pall Mall Gazette.* Author of *The Economic Foundations of Peace*; etc.	**Capitalism.**
J. L. M.	John Linton Myres, M.A., D.Sc., F.B.A., F.S.A., O.B.E. Wykeham Professor of Ancient History and Fellow of New College, Oxford. Vice-President, Anthropological Institute of Great Britain and Ireland, 1921. Author of *The Dawn of History*; etc.	**Archaeology:** *General Survey.*

J. Ma.*	Sir James Marchant, K.B.E., F.R.S. (Edin.). Director of the British National Council for the Promotion of Race Regeneration. Secretary of the National Birth Rate Commission and Editor of its *Reports*. Author of *Birth Rate and Empire*; etc.	Birth Control.
J. Mat.	Julius Mattfeld. Organist in Fordham Lutheran Church, New York; music librarian of the New York Public Library and Radio Broadcasting Station WEAF. Author of *The Folk Music of the Western Hemisphere*; etc. Associate American editor of Hull's *Dictionary of Modern Music and Musicians*.	Choral Singing (*United States*).
J. M. H. McL.	John McLeod Hendrie McLeod, M.D., F.R.C.P. Lecturer on Skin Diseases, London School of Tropical Medicine. Physician for Diseases of the Skin, Charing Cross Hospital. Late Editor of *The British Journal of Dermatology*. Author of *Textbook on the Diseases of the Skin*.	Burns and Scalds.
J. M. M.	John Malcolm Mitchell, M.C., F.S.A. (Scot.). Secretary, Carnegie United Kingdom Trust. Vice-President, Library Association. Author of *The Public Library System of Great Britain and Ireland*. Editor of *The Rural Libraries Handbook* (1922).	Carnegie Trusts.
J. M. M.*	J. Merritt Matthews. Head of the Department of Chemistry and Dyeing, Philadelphia Textile School, 1898-1907. Editor of *The Colour Trade Journal*, 1917-25.	Dyeing (*in part*).
J. M. R.*	Colonel John Markham Rose, D.S.O. Royal Marine Artillery. Commanded Heavy Artillery in South West Africa, 1914-5. Raised and commanded South African Heavy Artillery for service in France, 1915–6.	Bombs.
J. M. Ri.	J. M. Ritchie, M.A. Superintendent and Secretary, London Society for Teaching and Training the Blind.	Blind, Training of the (*in part*).
J. M. Sp.	J. M. Spaight, O.B.E. Member of British Delegation, Commission of Jurists on the Laws of War, The Hague, 1922-3. Author of *Aircraft in War*; *Aircraft in Peace and the Law*; *Air Power and War Rights*; etc.	Aerial Law (*in part*).
J. Mt.*	Jean Martet. Private Secretary to M. Clemenceau.	Clemenceau, Georges.
J. N. F.	John Nicol Farquhar, Litt.D., D.D. Professor of Comparative Religion, University of Manchester. Author of *An Outline of the Religious Literature of India*; etc.	Buddhism.
J. O. S.	John Obed Smith. Formerly Chief Officer, Canadian Government Emigration Department. Dominion Immigration Commissioner for Western Canada, 1901.	Canada: *Immigration and Settlement*.
J. P. A.	James Pryer Allen. Secretary, National Association of Amateur Billiard Players (U.S.A.).	Billiards (*in part*).
J. Re.	Josef Redlich. Lecturer in Public Law and Administration at the University of Vienna.	Austria: *Political History*.
J. R. Fi.	Joseph R. Fisher. Barrister-at-law. Member of Irish Boundary Commission, 1924–5. Formerly Editor and Managing Director of *The Northern Whig* (Belfast). Author of *The Last Irish Parliament*; *Ulster in Irish History*; etc.	Craig, Sir James.
J. R. R.	Right Hon. Sir James Rennell Rodd, G.C.B., G.C.M.G., G.C.V.O. Formerly British Ambassador to the Court of Italy. Member of Lord Milner's Mission to Egypt, 1920. British Delegate to League of Nations, 1921 and 1923. Author of *Social and Diplomatic Memoirs*; etc.	Egypt: *Political History*.
J. Sh.	John Shapley. Morse Professor of the Literature of the Arts of Design, New York University. President of the College Art Association of America. Editor of *The Art Bulletin*. Associate Editor of *The American Journal of Archaeology*.	Art Treasures.
J. S. H.	Julian Sorell Huxley, M.A. Professor of Zoology at King's College, London. Formerly Fellow of New College and Senior Demonstrator in Zoology, Oxford University. Author of *The Individual in the Animal Kingdom*; *Essays of a Biologist*; etc.	Evolution: *Introduction*.
J. S. M. W.	John Sebastian Marlow Ward, M.A., F.S.S., F.R. Anthrop. S. Head of the Intelligence Department of the Federation of British Industries. Author of *Textile Fibres and Yarns of the British Empire*; *An Outline History of Freemasonry*; etc.	Dyeing (*in part*).
J. Sn.	Sir John F. C. Snell, G.B.E., M. Inst. C.E. Chairman of H. M. Electricity Commission; Chairman, Water Power Resources Committee, Board of Trade, London. Formerly President of the Institution of Electrical Engineers. Chairman, Committee on Electroculture, Ministry of Agriculture and Fisheries, London. Author of *Distribution of Electric Energy*; *Power House Design*; etc.	Electric Power, Generation of.

J. St.	Sir Josiah Charles Stamp, G.B.E., F.B.A., D.Sc. President of the Executive, London, Midland and Scottish Railway. Vice-President, Joint Hon. Secretary and Editor, Royal Statistical Society, London. Member of the British Royal Commission on Income Tax, 1919; of the Committee on Taxation and National Debt, 1924. British Representative on the Reparation Commission's Committee on German Currency and Finance, 1924. Author of *Wealth and Income of the Chief Powers*; *Wealth and Taxable Capacity*; etc.	**Capital Levy.**
J. St.*	J. Stewart. Author of *Bread and Breadmaking.*	**Bread Making** *(in part).*
J. St. L. S.	John St. Loe Strachey. Formerly Editor and Proprietor of *The Spectator* (London). Editor of *The Cornhill Magazine* (London), 1896–7. Author of *Problems and Perils of Socialism*; *The Adventure of Living*; *Economics of the Hour*; etc.	**English Speaking Peoples, Relations of.**
J. Th.	Jocelyn Field Thorpe, D.Sc., F.I.C., F.C.S. Professor of Organic Chemistry, Imperial College of Science and Technology. Member of Councils of the Royal Society and the Institute of Chemistry and of the Dyestuffs Development Committee of the Board of Trade. Author of *The Synthetic Dyestuffs*; *Vat Colours*; etc.	**Colour.**
J. T. H.	John Theodore Hewitt, M.A., D.Sc., Ph.D., F.R.S. Formerly Professor of Chemistry, East London College, University of London. Author of *Synthetic Colouring Matters*; etc.	**Ammonia;** **Carbon, Syntheses of.**
J. Wa.*	J. Walch. Lecturer on Drama, University of Leyden, Holland.	**Dutch Literature, etc.**
J. W. G.	John Walter Gregory, D.Sc., F.R.S. Professor of Geology in the University of Glasgow. Author of *The Great Rift Valley*; *The Dead Heart of Australia*; *The Menace of Colour*; etc.	**Colour and Race, Problems of.**
J. W. Go.	James Winder Good. Assistant Editor, *The Irish Statesman.* Irish Correspondent of *The New Statesman* and *The Manchester Guardian.* Author of *Ulster and Ireland*; *Irish Unionism.*	**Dublin.**
J. W. H.-M.	James Wycliffe Headlam-Morley, C.B.E., M.A. Historical Adviser to the Foreign Office, London. Late Fellow of King's College, Cambridge; Assistant Director, Political Intelligence Department of the Foreign Office, 1918–20. Member of the Political Section of the British Delegation to the Peace Conference at Paris, 1919. Author of *The History of Twelve Days*; *The Issue*; *The German Chancellor and the Outbreak of War*; etc.	**Europe** *(in part).*
J. W. Hy.	John William Hinchley, F.I.C., M.I. Chem.E. Assistant Professor of Chemical Engineering, Imperial College of Science and Technology, University of London. Author of *Chemical Engineering*; etc.	**Chemical Engineering.**
J. Wi.	James Williamson, M.I.C.E. Member of the firm of Sir Alexander Gibb and Partners.	**Aqueducts; Dams.**
J. W. O.	Rev. John Wood Oman, D.D. Principal and Professor of Systematic Theology, Westminster College, Cambridge. Formerly University Lecturer on the Philosophy of Religion. Author of *The Church and the Divine Order*; etc.	**Christianity.**
J. W. S. S.	Colonel J. W. S. Sewell, C.M.G. Assistant Director of Fortifications and Works, War Office, London.	**Engineers, Military** *(in part).*
K. K. D.	Karl K. Darrow, Ph.D. Member of Research Staff of the Bell Telephone Laboratories, New York City.	**Conduction, Electric** *(in part).*
K. M. A.	Her Grace The Duchess of Atholl, D.B.E. M.P. for Kinross and West Perthshire and Parliamentary Secretary to the Board of Education. Formerly Vice-President of the Association of Education Authorities in Scotland.	**Elementary Education:** ***Great Britain.***
K. S.*	Karel Šedivý. Czech Publicist. Pen name of Josef Chmelar. Editor of *The Zahranicni Politika* (Prague).	**Czechoslovakia** *(in part).*
K. S. L.	Kenneth Scott Latourette, M.A., Ph.D., D.D. Professor of Missions, Yale University. Formerly Professor of History, Denison University, Granville, Ohio. Author of *Development of China*; *History of Early Relations Between the United States and China, 1784–1844*; etc.	**China;** **Chinese Eastern Railway.**
L. C. A.	Brig.-Gen. Lincoln Clark Andrews. Assistant Secretary of the Treasury, in charge of U.S. Customs Service, U.S. Coast Guard and the Prohibition Unit, charged with enforcing the Volstead Act. Deputy Provost Marshal General at G.H.Q., France, after the Armistice. Author of *Fundamentals of Military Service*; etc.	**Bootlegging and Smuggling**
L. E. H.	Leonard Erskine Hill, F.R.S. Director of the Department of Applied Physiology, National Institute of Medical Research, Hampstead, London. Formerly Professor of Physiology, London Hospital. Author of *Manual of Physiology*; etc.	**Aerotherapeutics.**
L. F. B.	Lewellys Franklin Barker, M.D., LL.D. Emeritus Professor of Medicine in Johns Hopkins University, Baltimore. Author of *Endocrinology and Metabolism*; etc.	**Endocrinology.**

L. H. B.*	L. H. Bakeland, Sc.D., Ch.D. Hon. Professor of Chemical Engineering, Columbia University. Past President, American Chemical Society, American Institute of Chemical Engineers, American Electrochemical Society; Inventor of Bakelite and President of the General Bakelite Co.	**Bakelite.**
L. H. D. B.	L. H. Dudley Buxton, M.A. Lecturer on Physical Anthropology, University of Oxford. Author of *Peoples of Asia.*	**Archaeology:** *China and Southeastern Asia.*
L. Hs.	Lewis Hodous, D.D. Head of the Chinese Department of the Kennedy School of Missions, Hartford Seminary Foundation, Hartford, Conn. Formerly President of Foochow Theological Seminary.	**Confucianism.**
L. J. B.	Lawrence Johnston Burpee, F.R.S.(Can.). Secretary, Canadian Section, International Joint Commission. Formerly Librarian of the Ottawa Public Library. Author of *Bibliography of Canadian Fiction*; *Canadian Humour*; etc.	**Canadian Literature:** *English.*
L. J. S	Leonard James Spencer, Sc.D., F.R.S. Assistant Keeper, Mineral Department, Natural History Museum, London. Editor of *The Mineralogical Magazine.* Author of *The World's Minerals.*	**Crystallography.**
Ll. J.	Lloyd Jackson. Senior Fellow, Mellon Institute for Industrial Research, Pittsburgh.	**Dry Cleaning.**
L. Ma.	Leonard Warburton Matters. Editor of *The Review of South America*; formerly managing editor *The Buenos Aires Herald.*	**Argentina** (*in part*); **Bolivia** (*in part*); **Colombia** (*in part*).
L. M. E.	Leon Moyer Estabrook. Director of World Agricultural Census, International Institute of Agriculture, Rome. Formerly Chief of Bureau of Crop Estimates, Associate Chief of Bureau of Agricultural Economics, and Agricultural Commissioner, U.S. Department of Agriculture.	**Agriculture, Census of.**
L. M. S.	Lucy Maynard Salmon, A.M., L.H.D. Professor of History, Vassar College, Poughkeepsie, New York. Author of *The Newspaper and the Historian*; *The Newspaper and Authority*; etc.	**Censorship:** *United States.*
L. Ro.	Sir Leonard Rogers, C.I.E., M.D., F.R.S., F.R.C.P., F.R.C.S. Member of Medical Board, India Office, London. Physician and Lecturer, London School of Tropical Medicine. Late Professor of Pathology, Medical College, Calcutta.	**Cholera.**
L. R. W.	L. R. Wentholt. Chief Engineer of the *Water-staat* of the Kingdom of the Netherlands.	**Coast Protection** (*in part*).
L. S. C.	Lee S. Crandall. Curator, Department of Birds, New York Zoological Park. Member of collecting expeditions to British Guiana and Costa Rica. Author of *Pets and How to Care for Them.*	**Birds, Migration of:** *United States.*
L. U.	Louis Untermeyer. Author, and occasional lecturer at the universities of Yale, Princeton, etc. Author of *Challenge*; *The New Adam*; *American Poetry since 1900*; etc.	**American Literature:** *Poetry.*
L. V.*	Luigi Villari. Member of the Staff of the League of Nations, 1920–3. Subsequently attached to the Emigration Department of the Italian Foreign Office. Commendatore of the Crown of Italy. Author of *Italian Life in Town and Country*; *The Awakening of Italy*; etc.	**D'Annunzio, Gabriele;** etc.
L. van V.	L. van Vleit. Chess Correspondent of *The Sunday Times* (London).	**Chess.**
L. Wa.	Lina Waterfield. Italian Correspondent of *The Observer* (London). Author of *The Story of Assisi*; *The Story of Rome*; etc.	**Duse, Eleanora.**
M. A. C.	Maurice Arthur Canney, M.A. Professor of Semitic Languages and Literature, University of Manchester. Author of *An Encyclopaedia of Religion*; etc.	**Arabic Literature.**
M. B. B.	Mabel B. Brooks.	**Alaska** (*in part*).
M. Bo.*	Moritz Julius Bonn. Professor of Economics at the School of Commerce, Berlin. Author of *Die englische Kolonisation in Irland; Amerika als Feind*; etc.	**Ebert, Friedrich;** **Erzberger, Matthias.**
M. C. B.	Miles C. Burkitt, M.A., F.S.A. Lecturer for the Board of Archaeological and Anthropological Studies, Cambridge University. Author of *Prehistory.*	**Archaeology:** *Continental Europe and Great Britain.*
M. C. S.*	Malcolm Charles Salaman. Formerly dramatic and art critic of *The Sunday Times* (London). Author of *Old English Colour-Prints*; *The Charm of the Etcher's Art*; *Modern Masters of Etching*; etc.	**Etching.**

M. C. W.*	Milton C. Whitaker. Vice-President of the Industrial Alcohol Co.; Professor of Chemical Engineering, Columbia University, 1911-7.	**Alcohol** (*in part*).
M. G.*	Major Greenwood, F.R.C.P., M.R.C.S. Medical Officer (Medical Statistics), Ministry of Health, London. Reader in Medical Statistics, University of London.	**Epidemiology** (*in part*).
M. H. Co.	Montagu H. Cox. Clerk of the London County Council.	**City Government** (*in part*).
M. H. S.*	Marshall Howard Saville. Professor of American Archaeology, Columbia University, and Member of the Staff of the Museum of the American Indian, Heye Foundation. Formerly honorary curator of Mexican and Central American Archaeology, American Museum of Natural History, New York.	**Archaeology:** *South America*.
M. L.	Matthew Luckiesh, M.S. Director of Applied Science, Nela Research Laboratories, National Lamp Works of the General Electric Company. Author of *The Language of Colour*; *Artificial Light*; *Ultra Violet Radiation*.	**Electric Lighting.**
M. L. S.	M. L. Shepherd. Official Secretary in London of the Commonwealth of Australia.	**Australia** (*in part*).
M. M. W.	Merton M. Wilner. Editorial Writer on *The Buffalo Express*.	**Buffalo.**
M. R. T.	Mrs. M. R. Tragett. Winner, with Miss Hogarth, of the Badminton Ladies' Doubles Championship, 1925.	**Badminton.**
M. S. M.	Colonel Mervyn Sorley Macdonell. Formerly High Commissioner, League of Nations, at Danzig. Governor of the Western Desert Province, Egypt, 1920-3.	**Danzig.**
M. W.	Maurice H. Woods. Member of staff of *The Daily Express* (London).	**Beaverbrook, Lord;** **Birkenhead, Earl of.**
M. W. D.	M. Willson Disher. Dramatic critic. Author of *Clowns and Pantomimes*.	**Circus.**
N. A.	Henrietta (Nettie) Adler, J.P. Late member of the London County Council. Member of the London Advisory Council for Juvenile Employment.	**Children's Courts:** *European.*
N. Bo.	Niels Henrik Bohr. Head of the Institute for Theoretical Physics at Copenhagen. Nobel Prizeman for Physics, 1922.	**Atom.**
N. G. G.	Lieut.-Col. Nicholas George Gedye, O.B.E., B.Sc., M.Inst.C.E. Consulting Engineer to the Ministry of Agriculture and Fisheries and the Development Commission. Formerly Chief Engineer, Tyne Improvement Commission; Acting Director, Civil Engineer-in-Chief's department, Admiralty; responsible for reconstruction of Belgian ports after the War; Chief Civil Engineer for Docks, Harbours and Inland Waterways, Ministry of Transport.	**Coast Protection** (*in part*).
N. M. B.	Nicholas Murray Butler, Ph.D., LL.D. President of Columbia University. Author of *True and False Democracy Education in the United States*; *Philosophy*; *The Faith of a Liberal*; etc.	**Columbia University;** **Education:** *United States* (*in part*).
N. Mu.	Neil Munro, LL.D. Author and journalist. Author of *The Lost Pibroch*; *Gilian, the Dreamer*; *The Shoes of Fortune*; *The Clyde*; *Ayrshire Idylls*; etc.	**Conrad, Joseph.**
N. Mu.*	Nadejda Stancioff, Lady Muir. Daughter of the former Bulgarian Minister in London, M. Stancioff, and formerly member of Bulgarian Diplomatic Service.	**Bulgarian Literature.**
N. R. C.	Norman Robert Campbell, Sc.D. Physicist on the Research Staff of the General Electric Co., Watford, Hertfordshire. Author of *Modern Electrical Theory*; *Principles of Electricity*; etc.	**Electric Radiation.**
N. W.	Norman Wilkinson, O.B.E., R.N.V.R. Marine Painter and Etcher. Originator of Dazzle Painting (Naval Camouflage) as used by the Allied Powers in the World War. Author of *The Dardanelles*; *Colour Sketches from Gallipoli*.	**Camouflage** (*in part*).
O. C. C.	Owen C. Coy, M.A., Ph.D. Director of California State Historical Association. Associate Professor in University of Southern California. Author of *Guide to the County Archives of California*. Editor of *Pictorial History of California*.	**California.**
O. D.	Ozora Stearns Davis, Ph.D., D.D., LL.D. President of the Chicago Theological Seminary. Author of *John Robinson, the Pilgrim Pastor*; *International Aspects of Christianity*; etc.	**Congregationalism** (*in part*).
O. D. Y.	Owen D. Young, LL.D., D.H.L. Chairman of the Board, General Electric Co.; Chairman of the Board, Radio Corporation of America; Chairman, American Section, International Chamber of Commerce; Member of the Dawes Committee.	**Dawes, Charles G.**

O. G. S. C.	O. G. S. CRAWFORD, F.S.A. Archaeology Officer of the British Ordnance Survey. Author of *Man and His Past*.	**Archaeology:** *Air Survey.*
O. H. L.	O. H. LARSEN. Professor in General Agriculture and Agricultural Costings at the Royal Veterinary and Agricultural College, Copenhagen. Director of the Bureau of Agricultural Costings.	**Denmark:** *Agriculture.*
O. J.	OWEN JONES. Continental Manager and formerly Textile Editor of *The Manchester Guardian Commercial Supplement*.	**Cotton.**
O. J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, O.B.E., M.A. Secretary of the British Association. Member of the Geographical Section, Naval Intelligence Department; London, 1915–9. Author of *Commercial Geography of the World*. Joint-editor of *The Oxford Survey of the British Empire*.	**Birmingham; Bombay; Brussels; Delhi; etc.**
O. L.	SIR OLIVER JOSEPH LODGE, D.SC., F.R.S. Principal, University of Birmingham, 1909–19. Professor of Physics, University College, Liverpool, 1881–1900. President of the Physical Society of London, 1899–1900. President of the British Association, 1913–4. Awarded the Albert Medal of the Royal Society of Arts, London, for pioneer work in Wireless Telegraphy, 1919. Author of *The Ether of Space*; *Ether and Reality*; *Electrical Precipitation*; etc.	**Ether.**
O. R.*	MAJOR OWEN RUTTER, F.R.G.S., F.R.A.I. Formerly Magistrate and District Officer in the British North Borneo Civil Service. Author of *British North Borneo;* etc.	**Borneo.**
P. A.*	LESLIE PATRICK ABERCROMBIE, M.A., F.R.I.B.A. Professor of Civic Design, University of Liverpool. Editor of *The Town Planning Review*.	**City Planning.**
P. B.	PIERRE FRANCIS BERNUS. Foreign editor of the *Journal des Débats*. Paris correspondent of the *Journal de Genève*. Chevalier of the Legion of Honour.	**Briand, Aristide.**
P. B. I.	PERCY B. INGHAM. Director of the London School of Dalcroze Eurhythmics.	**Eurhythmics.**
P. C. Mo.	P. C. MORGAN. Secretary, Brewers' Society, London.	**Beer.**
P. Di.	PAUL DIEUDONNÉ. Editor on the staff of the International Institute of Agriculture, Rome.	**Dairying.**
P. E. L.	P. EVANS LEWIN, M.B.E., F.R. HIST.S. Librarian of the Royal Colonial Institute, London. Author of *The Germans in Africa*; *A Geography of Africa*.	**Ashanti.**
P. F. W.	PELHAM FRANCIS WARNER, M.B.E. Barrister-at-law. Formerly Captain of the Middlesex Cricket Eleven. Captained M.C.C. Team in Australia and South Africa. Editor of *The Cricketer*; cricket correspondent of *The Morning Post*. Author of *The Book of Cricket*; *Cricket Reminiscences*; *My Cricketing Life*.	**Cricket.**
P. Hu.	PERCY A. HURD. M.P. for the Frome division, 1918–23. M.P. for the Devizes division since 1924. London editor of *The Montreal Star*. Author of *Canada, Past, Present and Future;* etc.	**Canada:** *Industry and Trade.*
P. J.*	P. JACOBSSEN. Member of Economic and Financial Section, League of Nations. Geneva.	**Budget, National.**
P. J. B.	PHILIP J. NOEL BAKER, M.A. Sir Ernest Cassel Professor of International Relations, London School of Economics; late Fellow of King's College, Cambridge. Author of *The Geneva Protocol*.	**Disarmament.**
P. J. H.	SIR PHILIP JOSEPH HARTOG, C.I.E., M.A., B.SC., L-ÈS-L. Late Vice-Chancellor of the University of Dacca, Bengal, and Academic Registrar of the University of London. Author of *Examinations in their Bearing on National Efficiency*.	**Calcutta, University of; Examinations** (*in part*).
P. L.	PAUL LAMBOTTE. Director of Fine Arts for Belgium. Government Commissioner for Fine Art Exhibitions. Author of two volumes in the *Collection des artistes belges contemporains*.	**Claus, Emile.**
P. Ln.	PAUL LÉON. Director of Fine Arts, Paris. Officer of the Legion of Honour.	**Decorative Art** (*in part*); **Exhibition.**
P. Q.	PIERRE QUESNAY. French representative on the Austrian Reconstruction Commission, 1919–20. Director of Economic Studies, Reparations Commission, Vienna, 1920–2. Assistant to the General Commissioner of the League of Nations in Austria, 1922–5.	**Austria:** *Financial and Economic History.*

R. Bo.	Ralph Bown. Vice-president of the Institute of Radio Engineers. Member of the Department of Development and Research, American Telegraph and Telephone Company.	**Broadcasting** (*in part*).
R. B.-P.	Lieut.-Gen. Sir Robert Stephenson Smyth Baden-Powell, Bart. Chief Scout. Founder of the Boy Scout and Girl Guide Movements. Author of *Scouting for Boys*; *Girl Guiding*; *Aids to Scouting*; etc.	**Boy Scouts.**
R. C. B.	Robert Clarkson Brooks, Ph.D. Professor of Political Science, Swarthmore College, Pennsylvania. Author of *Corruption in American Politics and Life*; *Political Parties and Electoral Problems*; etc.	**Baker, Newton Diehl, etc.**
R. C. F.	R. C. Farmer, O.B.E., D.Sc., Ph.D., F.I.C. Late Chief Chemist, Explosives Department, Ministry of Munitions. Author of *Manufacture and Uses of Explosives*; *Industrial and Power Alcohol*; various scientific papers on explosives and general chemical subjects.	**Explosives.**
R. Cr.	Dame Rachel Eleanor Crowdy, D.B.E. Chief of Social Questions and Opium Traffic Section, Secretariat, League of Nations. Principal Commandant of V.A.D.'s in France and Belgium, 1914–9.	**Child Labour and Child Welfare** (*in part*).
R. de C. W.	Robert de Courcy Ward, A.M. Professor of Climatology, Harvard University. Author of *Climate Considered Especially in Relation to Man.*	**Climate and Climatology.**
R. D. O.	Richard Dixon Oldham, F.R.S. Formerly President of the Geological Society, London. Author of various papers on Geology and kindred subjects.	**Earthquakes.**
R. E.	Ralph Enfield. Ministry of Agriculture and Fisheries, London.	**Agriculture:** *Economics*; **Co-operation, Agricultural.**
R. F. A.	Robert Franz Arnold, Ph.D. Professor of German Literature in the University of Vienna.	**Austrian Literature.**
R. F. B.	Richard F. Bach. Associate in Industrial Arts, Metropolitan Museum of Art. Extension Secretary of The American Federation of Arts.	**Decorative Art** (*in part*).
R. G. H.	R. G. Hawtrey. Assistant Secretary to the Treasury, London. Author of *Currency and Credit.*	**Currency.**
R. G. P. H.	Major R. G. P. Hunter, O.B.E. Royal Engineers. Deputy Assistant Director of Fortification and Works, War Office, London.	**Barracks.**
R. Ha.	Robert Haas. Member of the Communications and Transport Section of the League of Nations, Geneva.	**Aerial Law** (*in part*).
R. H. Co.	Robert Hamilton Coats. Chief of the Bureau of Statistics, Canada. Author of *The Labour Movement in Canada.*	**Canada:** *Area and Population.*
R. H. Cr.	Sir Reginald Henry Craddock, G.C.I.E., K.C.S.I. Lieutenant-Governor of Burma, 1917–22. Member of the Royal Commission on the Civil Services of India, 1923–4.	**Burma.**
R. H. G.	Ralph Henry Gabriel, Ph.D. Associate Professor of History, Yale University. Author of *The Evolution of Long Island.*	**Connecticut.**
R. Hu.	Robert Hutchison, M.D., F.R.C.P. Physician to the London Hospital and to the Children's Hospital, London. Author of *Food and the Principles of Dietetics.*	**Alimentary System, Diseases of the.**
Ri.	The Right Hon. Lord Riddell. Chairman, Periodical, Trade Press and Weekly Newspaper Proprietors' Association. Director, News of the World, Ltd.; George Newnes, Ltd.; C. Arthur Pearson, Ltd.; Newnes and Pearson Printing Co., Ltd.; Country Life Ltd.; Western Mail Ltd.; Represented British Press at Peace Conferences, 1919–22, and at Washington Conference on Disarmament, 1921. Author of *Some Things that Matter*; *More Things that Matter*; etc.	**Censorship:** *Great Britain.*
R. J. S.	R. J. Stopford. Intelligence Department of the British Overseas Bank, London.	**Debts, Inter-Allied.**
R. L. B.	Right Hon. Sir Robert Laird Borden, G.C.M.G., K.C. Prime Minister of Canada, 1911–20. Representative of Canada at the Imperial War Cabinet and at the Imperial War Conference, 1917 and 1918. Author of *Canadian Constitutional Studies.*	**Canada:** *Constitution.*
R. L. H.*	Robert Lockhart Hobson. Keeper of Department of Ceramics and Ethnography, British Museum. Author of *Worcester Porcelain*; *Chinese Pottery and Porcelain*; *The Later Ceramic Wares of China.*	**Ceramics.**
R. Ln.	Robert Liefmann. Professor of Economics and Finance, University of Freiburg, Germany. Author of *Kartell und Trusts.*	**Cartel.**

R. Lo.	Robert Morss Lovett. Member of the editorial board of *The New Republic.* Formerly Professor of English in the University of Chicago. Author of *A History of English Literature* (with W. V. Moody).	**American Literature** (*in part*).
R. Ly.	Robert Lynd. Literary Editor of *The Daily News* (London). Contributor to *The New Statesman.* Author of *The Art of Letters*; *Books and Authors*; etc.	**Barrie, Sir J. M.**
R. N. R. B.	R. N. Rudmose Brown, D.Sc. Lecturer in Geography, University of Sheffield. Member of the Scottish National Antarctic Expedition, 1902–4, and of the Scottish Arctic Expeditions, 1909, 1912 and 1914. Author of *Spitzbergen.*	**Arctic Regions** (*in part*).
R. Pe.	Raymond Pearl, Ph.D., Sc.D., LL.D. Director, Institute for Biological Research, and Professor of Biology, Medical School, Johns Hopkins University. Formerly Professor of Biometry and Vital Statistics, Johns Hopkins University. Author of *Modes of Research in Genetics*; *The Biology of Death*; *Studies in Human Biology*; *The Biology of Population Growth*; etc.	**Death: Why and Wherefore.**
R. Pi.	Rudolf Pintner. Professor of Education, Teachers College, Columbia University, New York. Author of *Intelligence Testing.*	**Examinations** (*in part*).
R. P. R.	Robert Pugh Rowlands, O.B.E., M.S., F.R.C.S. Joint-author of *The Operations of Surgery*, and contributor of articles on surgery to *The British Medical Journal*, etc.	**Appendicitis.**
R. R.*	Sir Robert Robertson, K.B.E., D.Sc., LL.D., F.R.S. Government Chemist, Government Laboratory, London. Director of Explosives Research, Research Department, Royal Arsenal, Woolwich.	**Alcohol** (*in part*).
R. Re.	Sir Richard A. S. Redmayne, K.C.B., M.I.M.E., etc. Consulting Mining Engineer. H.M. Chief Inspector of Mines, 1908–20. Late President of the Institute of Mining and Metallurgy, London, and member of the Fuel Research Board, Coal Conservation Commission and other bodies. Author of *Coal, Its Occurrence, Value and Method.*	**Coal.**
R. R. L.	Russell R. Larmon. Executive Assistant to the President, Dartmouth College, New Hampshire.	**Dartmouth College.**
R. Rn.	R. Romein. Member of Transit Section, League of Nations, Geneva.	**Danube; Elbe.**
R. T. G.	Sir Richard Tetley Glazebrook, K.C.B., D.Sc., F.R.S. Chairman of the Aeronautical Research Committee, London. Zaharoff Professor of Aviation and Director of the Department of Aeronautics at the Imperial College of Science and Technology, London, 1920–3. Fellow of Trinity College, Cambridge.	**Aeronautics.**
R. Van O.	Major R. Van Overstraeten, D.S.O. Member of the Order of Leopold and the Legion of Honour. Aide-de-Camp to His Majesty the King of the Belgians. Graduate of the Belgian Staff College.	**Antwerp, Siege of;** **Belgium, Invasion of.**
R. V. L. H.	R. V. L. Hartley. Of the Bell Telephone Laboratories, New York.	**Amplifier.**
R. W. Re.	Robert William Reid, M.D., F.R.C.S. Emeritus Professor of Anatomy, University of Aberdeen. Member of the Council of Royal Anthropological Institute of Great Britain and Ireland.	**Anatomy.**
R. W. S.-W.	Robert William Seton-Watson, Litt. D. Masaryk Professor of Central European History at King's College, University of London. Founder and Joint-editor of *The New Europe*, 1916–20. Joint-editor of *The Slavonic Review.* Author of *The Rise of Nationality in the Balkans*; *The New Slovakia*; *Sarajevo*; etc.	**Alexander I., King of Serbia;** **Dalmatia; etc.**
S. A. M.	S. A. Mussabini. Author of *A Billiard Player in the Making.*	**Billiards** (*in part*).
S. B.	Stephen Bonsal. Newspaper correspondent. Author of *The Real Condition of Cuba*; *The Fight for Santiago*; *The American Mediterranean*; etc.	**Caribbean, The.**
S. G.	Stephen Lucius Gwynn. Irish Correspondent of *The Observer* (London). Member of the Irish Convention, 1917–8. Author of *Irish Books and Irish People*; *The Irish Situation*; *The History of Ireland*; etc.	**Collins, Michael;** **Cosgrave, W. T.**
S. H.*	Sigfrid Hansson. Member of the Swedish Parliament. Editor of *Fackförenings rörelsen* (Trades Union Movement). Has edited a series of works on the history of Trade-Unionism including *Den Svenska fackförenings rörelsen* (The Swedish Trades Union Movement).	**Branting, Hjalmar.**
S. L.*	John Randolph Shane Leslie. Editor of *The Dublin Review.* Author of *Life of Cardinal Manning*; *Life of Sir Mark Sykes*; *The End of a Chapter*; *The Oppidan*; etc.	**Bourne, Francis (Cardinal);** **Cardinals, College of.**

S. M.	Shailer Mathews, A.M., D.D. Dean of the Divinity School and Professor of History and Comparative Theology, University of Chicago. Author of *The Spiritual Interpretation of History*; etc.	**Baptists** (*in part*).
S. P. C.	Samuel Paul Capen, A.M., Ph.D., LL.D. Chancellor of the University of Buffalo. Vice-President in America of the British Society for Experiment and Research in Education. Formerly Editor of *The Educational Record*. Author of *Resources and Standards of the Colleges of Arts and Science.*	**Education, Experiments in** (*in part*).
St. J. E.	St. John Greer Ervine. Dramatist and Novelist. Dramatic Critic of *The Observer* (London). Author of *The Magnanimous Lover*; *Mixed Marriage*; *Jane Clegg*; and other plays.	**Drama.**
T. Ba.	Sir Thomas Barclay. Member of the Institute of International Law. Vice-President of the International Law Association. Author of *International Law and Practice*; *Law and Usage of War*; *New Methods for Adjustment of International Disputes*; etc.	**Arbitration, International.**
T. B. W.	Thomas Barlow Wood, C.B.E., F.I.C., F.R.S. Drapers' Professor of Agriculture, Cambridge University. Monro Fellow of Gonville and Caius College, Cambridge. Joint-editor of *The Journal of Agricultural Science.* Author of *The Chemistry of Crop Production*; *Animal Nutrition*; etc.	**Agriculture:** *Scientific Developments* (*in part*).
T. C. McC.	Thomas Chalmers McCorvey, LL.D. Professor of History and Political Science, University of Alabama. Author of *The Government of the People of the State of Alabama.*	**Alabama.**
T. E.	Thomas Ewan, M.Sc., Ph.D., F.I.C. Chief Chemist to the Cassel Cyanide Co. Ltd., Glasgow.	**Cyanides.**
T. E. G.	T. E. Gregory, D.Sc. Cassel Reader in Banking and Currency, London School of Economics. Author of *Tariffs: a Study in Method*, etc.	**Banking; Canada:** *Banking*.
T. E. L.	Thomas East Lones, M.A., LL.D. Formerly Senior Examiner in H.M. Patent Office, London. Author of *Aristotle's Researches in Natural Science*; *Zinc and Its Alloys.*	**Calculating Machines;** **Casein;** **Celluloid; etc.**
T. E. P.	Thomas Eric Peet, M.A. Brunner Professor of Egyptology, University of Liverpool, Author of *The Mayer Papyri*; *Egypt and the Old Testament*; etc.	**Akhenaten;** **Archaeology:** *Egypt.*
T. Fr.	Tenney Frank. Professor of Latin, Johns Hopkins University, Baltimore, U.S.A. Author of *Roman Imperialism*; *A History of Rome*; etc.	**Archaeology:** *Italy and the Western Mediterranean.*
T. G. M.	Thomas Garrigue Masaryk. President of the Republic of Czechoslovakia. Principal organiser of the Czechoslovak movement for independence. Author of *The Problem of Small Nations in the European Crisis*; *The New Europe*; *The World Revolution*; etc.	**Czechoslovakia:** *Political History* (*in part*).
T. H. M.	Thomas Hunt Morgan, M.S., Ph.D., LL.D. Professor of Experimental Zoology, Columbia University, New York. Formerly Professor of Biology, Bryn Mawr College, Pennsylvania. Author of *Evolution and Adaptation*; *Heredity and Sex*; *Mechanism of Mendelian Heredity*; *Critique of the Theory of Evolution*; *The Physical Bases of Heredity*; etc.	**Evolution** (*in part*).
T. K.*	Théodore Komisarjevsky. Theatrical Producer. Formerly Producer and Art Director of the Moscow State and Imperial Theatre.	**Acting.**
T. S. A.	Thomas Sewall Adams, Ph.D. Professor of Political Economy in Yale University. Adviser on Taxation, U.S. Treasury Department. Author of *Taxation in Maryland*; etc.	**Excess Profits Duty** (*in part*).
T. W. A.*	Sir Thomas Walker Arnold, C.I.E., Litt.D., F.B.A. Professor of Arabic, University of London. Formerly Professor of Philosophy, Government College, Lahore. Educational Adviser to the Secretary of State for India, 1917-20. Author of *The Preaching of Islam*; *The Caliphate*; etc	**Caliphate, The.**
T. W. R.	Theodore William Richards, Ph.D., LL.D., Chem.D., M.D. Professor of Chemistry and Director of the Wolcott Gibbs Memorial Laboratory, Harvard University. Nobel Prize for Chemistry, 1914.	**Atomic Weights.**
V. B.*	Václan Brdlik, Ph.D. Professor at the Czech Polytechnic, Prague.	**Czechoslovakia** (*in part*).
V. B. C.	Velico B. Christoff. Member of the Bulgarian Society of Economics. Official of the National Bank of Bulgaria.	**Bulgaria:** *Financial and Economic History.*
V. C. R.	Lieutenant-Colonel V. C. Richmond, O.B.E. Head of the Design and Research Section, Royal Airship Works, Cardington, Bedford	**Airship** (*in part*).

V. P.*	VILEM POSPIŠIL, PH.D. Governor of the Czechoslovakian National Bank.	**Czechoslovakia** (*in part*).
V. S.	VILHJALMUR STEFANSSON, A.M., LL.D. Commander of the Canadian Arctic Expedition, 1913-9; of the Arctic Expedition under the auspices of the American Museum of Natural History and the Geological Survey of Canada, 1908-12; and of several other expeditions to Arctic regions. Author of *My Life with the Eskimo*; *The Friendly Arctic*; *The Northward Course of Empire*; etc.	**Arctic Regions:** *Climate and Resources.*
W. A. Ho.	HON. WILLIAM ARTHUR HOLMAN, K.C. Premier of New South Wales, 1913–20. Treasurer of New South Wales, 1914–6.	**Australia:** *Constitution.*
W. A. M.	REAR-ADMIRAL WILLIAM ADGER MOFFETT. Chief of the U.S. Bureau of Aeronautics. Formerly Commandant, U.S. Naval Training Station, Great Lakes, Illinois, and Commandant, 9th, 10th and 11th Naval Districts.	**Air Forces:** *United States*; **Air Ministry:** *United States.*
W. A. P.*	W. A. PROPERT. Author of *The Russian Ballet in Western Europe.*	**Ballet.**
W. A. R.	WILLIAM ALFRED REID, LL.M. Foreign Trade Adviser of the Pan American Union. Lecturer on Latin American Commerce at the School of Foreign Service, Georgetown University; Lecturer on International Commerce at the School of Diplomacy, American University, Washington, D.C.	**Amazon; Bahiâ; etc.**
W. B.-A.	W. BROUGHTON-ALCOCK, M.D. Director of the Central Laboratory, Ministry of Pensions, London.	**Dysentery.**
W. B. H.	WALTER B. HARRIS. F.S.A., Moroccan Correspondent of *The Times* (London). Author of *The Land of an African Sultan*; *Travels in Morocco, 1888-9*; *Morocco that Was*; etc.	**Abdel-Krim.**
W. B. Se.	REV. WILLIAM BOOTHBY SELBIE, M.A., D.D. Principal of Mansfield College, Oxford. Editor of *The British Congregationalist*, 1899–1909. Chairman of the Congregational Union, 1914–5. President of the National Free Church Council, 1917. Author of *The Life and Teaching of Jesus Christ*; *Nonconformity*; etc.	**Congregationalism** (*in part*).
W. Cl.	SIR WILLIAM HENRY CLARK, K.C.S.I., C.M.G. Comptroller-General of the Department of Overseas Trade, London. Member for Commerce and Industry of the Council of the Viceroy of India, 1910–6. Comptroller-General of the Commercial Intelligence Department of the Board of Trade, London, 1916–7.	**Export Credits.**
W. D. B.	WILLARD DELL BIGELOW. Director of the Research Laboratory, National Canners' Association. Formerly Chief of the Division of Foods, U.S. Department of Agriculture.	**Canning:** *United States.*
W. E. B.*	CAPTAIN WILLIAM EDMUND BARBER. Formerly Editor of *The Political Review* and *The Economic Review* (London) and Literary Editor of *The Morning Post* (London).	**Censorship:** *General.*
W. E. B. DuB.	WILLIAM EDWARD BURCHARDT DUBOIS, Ph.D. Director of Publications and Research of the National Association for the Advancement of Coloured People. Editor of *The Crisis.* Author of *The Souls of Black Folk*; *The Negro*; *Dark Water*; etc.	**American Literature** (*in part*).
W. E. C.	WILLIAM ERNEST CASTLE, A.M., Ph.D., Sc.D., LL.D. Professor of Zoology, Harvard University, and Research Associate of the Carnegie Institution of Washington. Author of *Heredity in Relation to Evolution and Animal Breeding*; *Genetics and Eugenics.*	**Eugenics.**
W. Go.*	SIR WILLIAM A. M. GOODE, K.B.E. Unofficial Adviser to the Hungarian Government. President of, and British Representative on, the Austrian Section of the Reparation Commission, Vienna, 1920–1. Author of *Economic Conditions in Central Europe*; etc.	**Bethlen, Count.**
W. Gr.*	W. GRAHAM. Of the Board of Trade, London.	**Dyeing** (*in part*).
W. G. W.	WILLIAM GILLIES WHITTAKER, D.MUS., F.R.C.O. Reader in Music and Conductor of Choral and Orchestral Societies, Armstrong College, Newcastle-on-Tyne.	**Choral Singing** (*in part*).
W. Ha.*	W. HASTINGS, M.B., B.Ch. Former Deputy Director, Public Health Administration of Egypt.	**Egypt:** *Public Health.*
W. H. C.	W. H. COATES, LL.B. Secretary of Nobel Industries, Ltd. (London).	**Excess Profits Duty** (*in part*).
W. H. D. R.	WILLIAM HENRY DENHAM ROUSE, Litt.D. Headmaster, Perse Grammar School, Cambridge. Author of *Latin on the Direct Method*, and editor of numerous works on the Classics.	**Classical Education** (*in part*).
W. H. L.-W.	W. H. LOWE-WATSON, D.S.O., D.C.M. Employment and Insurance Department, Ministry of Labour, London.	**Apprenticeship.**

W. H. Wi.	W. H. Willson (London). Member of staff of *The Encyclopædia Britannica* (13th edition).	**Argentina** (*in part*); **Channel Islands; etc.**
W. K. McC.	William Kidston McClure, C.B.E. Formerly Correspondent of *The Times* (London) in Rome. War Correspondent of *The Times* on the Italian Front, 1915–7. Author of *Italy's Part in the War*; *Italy in North Africa*; etc.	**Asiago, Battle of;** **Cadorna, General;** **Caporetto, Battle of; etc.**
W. L. M.	Lieut.-Col. W. Lockwood Marsh, A.F.R.Ae.S. Head of Equipment Branch, Admiralty Airship Department, 1918. Formerly Editor of *The Aeronautical Weekly*; Secretary Royal Aeronautical Society, 1920; General Secretary and Sole Organiser of International Air Congress, 1922. Joint Author of *The History of Aeronautics*.	**Air, War in the.**
W. L. R.	Rear-Admiral William Ledyard Rodgers. Commander-in-Chief of the U.S. Asiatic Fleet, 1918–9.	**Battleship.**
Wm. A.	Sir William James Ashley, Ph.D., M.A., M.Com. Formerly Vice-Principal and Professor of Commerce in the University of Birmingham. Member of numerous British committees on economic questions. Author of *Introduction to English Economic History and Theory*; *The Rise in Prices*; *The Economic Organisation of England*; etc.	**Economics.**
W. M. H.	Walter Morris Hart, Ph.D. Dean of the University of California. Author of *Ballad and Epic: A Study in the Development of the Narrative Art*.	**California, University of.**
W. Mi.	William Miller. Correspondent of *The Morning Post* (London) in Athens and Rome. Author of *The Latins in the Levant*; *The Ottoman Empire and Its Successors*; *A History of the Greek People (1821–1921)*; etc.	**Adriatic Sea;** **Corfù;** **Dodecanese; etc.**
W. Pa.	Woodford Patterson. Secretary of Cornell University.	**Cornell University.**
W. P. Py.	W. P. Pycraft. Assistant Keeper of Zoology, Natural History Museum, London. Author of *A History of Birds*; *Story of Bird Life*: *A Book of Birds*; etc.	**Birds, Migration of** (*in part*).
W. R. I.	Walter Renton Ingalls. Consulting Mining and Metallurgical Engineer, New York City. Author of *Metallurgy of Zinc and Cadmium*.	**Copper.**
W. S. F.	William Scott Farren, M.B.E., M.A. Consultant in Aeroplane Design. Lecturer in the Engineering Department, Cambridge University, and at the Royal College of Science, London.	**Aeroplane.**
W. S. L.-B.	Walter Sydney Lazarus-Barlow, M.D., F.R.C.P. Member of Cancer Committee, Ministry of Health, London. Late Professor of Experimental Pathology and Director of Cancer Research Laboratories, Middlesex Hospital, London. Author of *A Manual of General Pathology*.	**Cancer Research.**
W. S. Ro.	William Spence Robertson, Ph.D. Professor of History in the University of Illinois. Author of *Francisco de Miranda and the Revolutionising of Spanish America*; *Rise of the Spanish American Republics*; etc.	**Bolivia** (*in part*); **Colombia** (*in part*); **Ecuador.**
W. S. S.	W. Stanley Sykes, M.B., B.Ch., D.P.H. Anaesthetist to the General Infirmary, Leeds, and to the Leeds Dental Hospital.	**Acetylene;** **Ethyl Chloride; etc.**
W. St.	William Stocking, M.A. Historian and Statistician, Detroit Board of Commerce, 1903–21. Author of *Under the Oaks*; *History of the Republican Party*; etc.	**Detroit.**
W. T.	Walter John Turrell, M.D., B.Ch. Consulting Physician, Oxford County Asylum. Electro-Therapeutic Physician, Radcliffe Infirmary, Oxford. Author of *The Principles of Electro-Therapy*.	**Electrotherapy.**
W. T. S.	William T. Shanahan, M.D. Medical Superintendent of Craig Colony, Sonyea, N. Y.	**Epilepsy.**
W. T. St.	W. Tetley Stephenson. Cassel Reader in Transport, London School of Economics, University of London.	**British Empire:** *Communications.*
W. T. W.	Rev. William Thomas Whitley, LL.D. Hon. Secretary and Editor, Baptist Historical Society. Recording Secretary, Baptist World Alliance. Author of *History of British Baptists*.	**Baptists** (*in part*).
W. v. B.	Wilhelm von Blume, D. Juris. Professor of Law, Tübingen University, Germany. Co-operated in the drafting of the constitution of Württemberg, 1919.	**Baden; Bavaria.**

THE
ENCYCLOPÆDIA BRITANNICA

THE FIRST OF THE THREE NEW VOLUMES

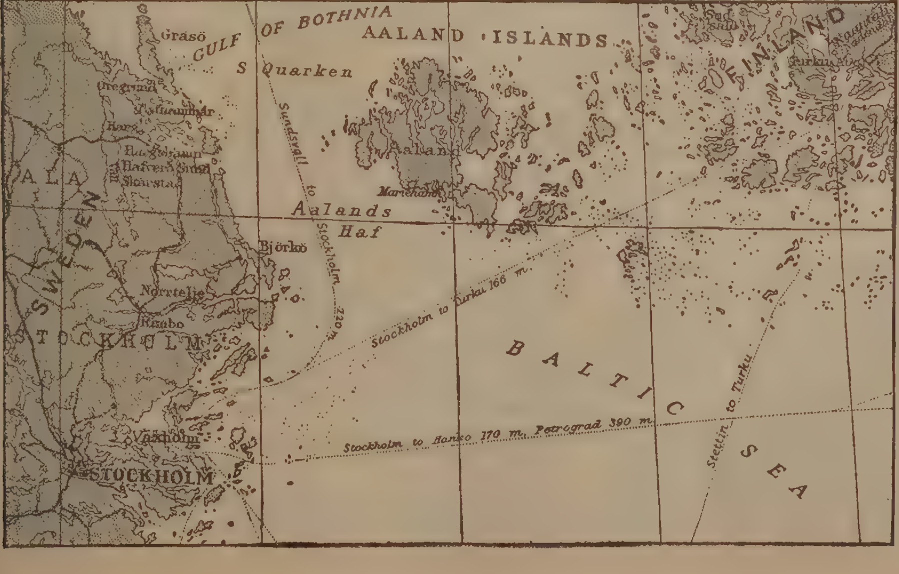
AALAND ISLANDS TO EYE

AALAND ISLANDS (*see* 1.469).—An archipelago in the Baltic Sea, including about 300 islands, forming a bridge across the mouth of the Gulf of Bothnia, between Sweden and Finland. Population 26,000. The islands are nearer to the Finnish shore, and in winter are joined to it by an ice-sheet. Their position gives them some strategical importance. The population, 27,123 in 1922, is Swedish in language and national feeling.

After belonging to the Swedish Crown since the Middle Ages, the islands were ceded to Russia, together with Finland, on Sept. 17 1809. Under the Tsardom they were united with Finland until the latter country declared her independence in 1917. In Dec. of that year the Aaland Islanders claimed the right of self-determination on their own account, and unofficial plebiscites showed a vote in favour of reunion with Sweden. Finland granted the islands autonomy on May 7 1920 but refused to contemplate their secession. In June the leaders of the secession movement were arrested for high treason, and Finnish troops were sent to the island. As this situation was producing a state of serious tension between Finland and Sweden, Great Britain, with the aim of ending it, drew the attention of the Council of the League of Nations to the movement on June 19 1920.

With the consent of the two interested governments, the council consulted a special commission of jurists as to whether the question was international or was the exclusive concern of Finland. This commission declared the question international, whereupon the council dispatched a special commission of inquiry to the spot. This commission reported against the claim of the islanders to secede from Finland, but declared that the islanders formed a distinct group within the Finnish body politic, and suggested that the maintenance of Finnish sovereignty ought to be made conditional upon the incorporation in the autonomy law of May 7 1920 of five specific guarantees. The commission also reported in favour of a new convention, to be signed by all the Baltic powers, for the neutralisation and demilitarisation of the Aaland Islands, to replace the earlier international convention of March 30 1856.

This report was accepted by the council and the two interested governments. An agreed text of the five guarantees was subsequently inserted in the Finnish law, and was placed under the supervision of the council of the league. The new neutralisation convention was negotiated at a conference held at Geneva from Oct. 10–20 1921, and it came into force on April 6 1922.



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ABBAS II. (1874–1923), Khedive of Egypt (*see* 1.9), died at Vienna on April 4 1923.

ABBE, CLEVELAND (1838–1916), American meteorologist and astronomer, was born in New York Dec. 3 1838. His training as astronomer under B. A. Gould, Brünnow and Struve (Pulkova, 1865–6) and work at the U.S. Naval Observatory developed his interest in weather changes. As director of the Cincinnati Observatory, 1869–73, he demonstrated the practicability of weather forecasts based on daily telegraphic synoptic charts, and in 1870 joined the U.S. Signal Corps to organise and direct its weather forecasts. When this greatly expanded service was transferred to the Department of Agriculture in 1891, he went as senior professor of meteorology. Abbe was often and justly called the "Father of the Weather Bureau." *The Monthly Weather Review*, which he edited, and the introduction of the system of Standard Time, were both due to his initiative.

Among his works are: *Report on Standard Time* (1879); *Mechanics of the Earth's Atmosphere* (1892–1910); *Preparatory Studies for Deductive Methods* (1890); *Relation between Climate and Crops* (1901); *Physical Basis of Long-range Forecasting* (1902).

ABBEY, EDWIN AUSTIN (1852–1911), American painter (*see* 1.11). The last years of his life were devoted to mural paintings for the Capitol at Harrisburg, Pa., his native state. Of these he completed three, one for the House of Representatives, another for the Senate Chamber and the third for the ceiling of the dome. In 1910 there was completed under his supervision the decoration of the Peers' corridor of the Houses of Parliament at Westminster. He left bequests of his work to the Metropolitan Museum of Art in New York, the Boston Museum of Fine Arts and the National Gallery, London. He died in London Aug. 1 1911.

ABBOTT, GRACE (1878–), American social worker, was born Nov. 17 1878 at Grand Island, Nebraska. She graduated from Grand Island College in 1898, and, after teaching for nine years, became in 1908 director of the Immigrants' Protective League and a resident of Hull House, Chicago. She received the degree of M.A. from the University of Chicago in 1909. From 1917 to 1920 she was director of the child labour division of the Children's Bureau at Washington, D.C., and subsequently executive secretary of the Illinois Immigrants' Commission, returning to Washington in 1922 as chief of the Children's Bureau. She served in 1923 as unofficial representative of the United States on the advisory committee of the League of Nations on traffic in women and children, and also as president of the National Conference of Social Workers. She wrote *The Immigrant and the Community* (1917) and *Federal Aid for the Protection of Maternity and Infancy* (1923).

ABBOTT, LYMAN (1835–1922), American divine and author (*see* 1.26), continued after 1910 to take an active part in the discussion of public questions. On the sinking of the "Lusitania" in 1915 he urged that the United States should break off diplomatic relations with Germany. He died in New York City Oct. 22 1922. He was the author of *The Spirit of Democracy* (1910); *America in the Making* (1911, Yale lectures on the responsibilities of citizenship); and *Reminiscences* (1915).

ABDEL-KRIM.—Mohomed ben Abdel-Krim el-Khatabe, a Moroccan chieftain, was the son of a kaid of the Beni Uriaghel tribe inhabiting the mountainous country that extends inland from Alhucemas Bay on the Rif coast of Morocco. His father was a person of no particular importance or family, but, being a man of progressive ideas and in contact with the Spaniards at Melilla, he gave his two sons an education to which few of the Rifi tribesmen aspire. While Mohomed, the future Rifi leader, was taught Spanish and a smattering of European knowledge, his brother, Muhammed, was sent to Spain and educated as a mining engineer. Mohomed was employed in the office of native affairs at Melilla, while his brother worked in the interests of certain mining groups.

In 1919 a quarrel between Mohomed and Gen. Silvestre, of the Spanish Army, led to the former's flight from Melilla. He took to the mountains of his tribe, where his brother joined him. Both swore revenge and instituted a fierce resistance to the occupation of the Rif by the Spaniards. In 1921 Mohomed ben Abdel-Krim avenged himself of the slight he had received from Silvestre. With only a few hundred tribesmen he attacked the Spanish advanced post of Anual and captured it. Silvestre was killed, or committed suicide. The fall of Anual spread panic through the Spanish army of 19,000 men. The Spanish posts were deserted and the troops fled in disorderly retreat. Before the fighting was over 16,000 men out of the 19,000 had been massacred. The remainder mostly crossed into the French zone. The Rifi tribesmen were guilty of every kind of treachery and atrocity, but it was their revenge for acts of which they accuse the Spaniards, more especially that of forcible interference with their women, an unpardonable offence in their eyes. The Rifis reached the walls of Melilla, and had they chosen they could have captured the town and massacred its population of 50,000 civilians. But glutted with bloodshed and loaded with loot they desisted.

This signal defeat of the Spaniards vastly increased Abdel-Krim's reputation amongst the tribes. The Jabala, inhabiting the western portion of the Spanish zone, joined his cause and in 1924 the Spaniards were obliged to abandon all their inland positions and retreat on Tetuan and the sea, suffering heavy losses in the retirement. By the end of that year Abdel-Krim, having rid himself by capture of his only rival, Raisuli, was master of the situation and set to work to prepare a fresh campaign against the Spaniards. But a new danger threatened him from the south. The French, gradually occupying the zone to which they laid claim under existing treaties, were advancing northward, and Abdel-Krim was forced to go to the aid of the threatened tribes. His army and the revolted tribesmen invaded the French Protectorate and by June 1925 threatened Fez.

French reinforcements were hurriedly despatched from France and Algeria and by Oct. the French Protectorate territory was clear of the enemy, and a French army of 160,000 men, under Marshal Pétain, was on the borders of the Rif. In September the Spaniards had successfully disembarked a force in Alhucemas Bay and Ajdir had been taken. By Nov. 1 1925 the French and Spanish armies had been obliged by the weather to abandon an active campaign and were digging themselves into winter quarters, but Abdel-Krim, though weakened and threatened, was by no means beaten. This man of great ability and astounding energy fortified his mountain fastnesses and collected new forces to continue his campaign against two European armies, but in vain. He surrendered to France in May 1926. (*See* MOROCCO, CAMPAIGNS IN.) (W. B. H.)

ʽABDULAZIZ IBN SAʽUD, King of Hejaz and Sultan of Nejd, was born at Riyadh about 1880, the eldest son of ʽAbdul Rahman, who was the youngest of the four sons of Faisal Ibn Turki Ibn Saʽud, the Wahhabi Amir of Nejd during the middle of the 19th century. Consequent upon the civil war which prevailed on the latter's death, the early years of ʽAbdulaziz were passed in exile at Bahrei and Kuwait. At the latter place ʽAbdul Rahman and his sons were hospitably received by the ruling Sheikh, Mubarak Ibn Subah, and it was to this astute statesman that ʽAbdulaziz owed his political training. Mubarak, apart from a feud with Ibn Rashid who had usurped the amirate of Nejd, was always in difficulties with the Turks, and in self-defence developed the most cordial relations with Great Britain—a factor which accounts for the confidence in the British which has always marked the reign of Ibn Saʽud. By his father, a sincere and austere Wahhabi, Ibn Saʽud was instructed in the principles of a simple creed, and never allowed to forget his duty to avenge his family. By 1900 he was ready for action and led a band of 200 devoted followers into the desert. With 15 of these he entered Riyadh secretly by night. Next morning he slew the Rashidian governor and was master of the city. And the rest of his life story is the history of Arabia (*q.v.*), culminating in his proclamation as King of Hejaz in Jan. 1926. A man of uxorious temperament, Ibn Saʽud is believed to have married 125 wives.

ABDUL HAMID II. (1842–1918), ex-Sultan of Turkey (*see* 1.35), died Feb. 10 1918. On his deposition in April 1909 he was sent to Salonika as a state prisoner, but when that town capitulated to the Greeks during the Balkan War (1912) he was brought back to Constantinople. In 1915 it was judged prudent to exile him from Turkey in Europe and consequently he was removed to Magnesia, near Smyrna.

ABERCORN, JAMES HAMILTON 2ND DUKE OF (1838–1913) British politician (*see* 1.43), died in London Jan. 3 1913. He was succeeded as 3rd duke by his eldest son, JAMES ALBERT EDWARD HAMILTON, born Nov. 30 1869. The latter was made Governor of Northern Ireland in 1923.

ABERDEEN, Scotland (*see* 1.47), had a population in 1921 of 158,963, a decrease of some 5,000 on the 1911 figure. In 1924, however, the population was estimated at 159,900. The city continues to extend, particularly to the west and northwest. In 1910 a Masonic temple, a grey, granite building in Renaissance style, was erected in Crown street, and new operating theatres, etc., were installed in the Royal Infirmary. In the same year a Roman Catholic church was built at Torry, a fishing village now within the city boundaries, and in 1911 the John Knox Parish Church in Spital was rebuilt. After the War an orthopaedic hospital was installed in the city. In Sept. 1925 King George V. opened the city's War Memorial. This consists of a domed court, or Hall of Remembrance, attached to the art gallery and museum. Other extensions opened at the same time include Cowdray Hall, used for lectures, with the Cowdray Museum of Applied Arts beneath it. New rooms were also provided for the pictures.

ABERDEEN, UNIVERSITY OF (*see* 1.48).—Great progress has been made in every direction since 1909 when the Very Rev. Sir George Adam Smith became principal. Seven chairs and eleven lectureships have been founded. Handsome new buildings have been erected and equipped. The flow of private munificence has been steadily maintained by gifts for the institution of chairs in political economy, geology and engineering, and for library purposes and research. An important addition to the resources of the university was the foundation, in 1913, of the Rowett Institute for Research in animal nutrition. Donations have been received for scholarships and bursaries, and the Carnegie Trust has made generous grants for building purposes. Students are increasing in number. The principal benefactors during the period were Sir Thomas Jaffrey, Dr. Alex. Kilgour, Dr. William Dey, Miss A. H. Cruikshank's Trustees, William Jackson and Mrs. Jackson. Information about the progress of the university will be found in the annual publication *The Universities Year Book.*

ABRAHAM, WILLIAM (1842–1922), British Labour politician, was born in the Afon Valley. He was better known by the name of Mabon, a name originally adopted by him in Eisteddfod competitions. Educated at a national school in Carnarvonshire, he was earning his living as a pit boy at the age of 9 and worked underground till he was 30. In 1871 he became a miners' agent, and rose to be president of the South Wales Miners' Federation. Up to the 1911 strikes he was a power in South Wales—a trade-union leader of the old type; but with the rise of the new trade unionism his influence declined, though he remained a respected figure to the end. Elected to Parliament in 1885 as a Liberal-Labour M.P. for the Rhondda division, he kept this seat till 1918; after the 1918 redistribution he was returned for Rhondda, West, retiring in 1920. Made a privy councillor in 1911, he died on May 14 1922.

ABRUZZI, DUKE OF THE (1873–   ), Italian vice-admiral and explorer, son of Amadeo, Duke of Aosta (*see* 1.804), was born at Madrid Jan. 29 1873 and named Luigi Amadeo. Although he had a distinguished naval career he achieved fame also as a traveller and mountaineer. He was the first to ascend Mt. St. Elias in Alaska (1897) and in 1899 he organised a North Pole expedition (*see* 21.952) part of which reached lat. 86° 34′, at that time the record of northern exploration, he himself being forced to remain behind owing to frostbite. In 1906 he was the first to ascend the Ruwenzori in East Africa, reaching the twin summits (16,800 ft.) which he named Margherita and Alexandra, and made the first detailed map of the Ruwenzori. In 1909 he explored the Central Karakoram in the Himalayas and by ascending peak K2 achieved the record for height. During the World War he commanded the naval forces in the Adriatic, but he resigned in 1917 owing to disagreements with Adml. Thaon di Revel, his chief of staff, and retired from the service. Afterward he undertook to carry out an important colonisation scheme in Italian Somaliland.

ABYSSINIA (*see* 1.82).—No change was made in the international status of Abyssinia between 1910 and 1925; but boundary commissions have in part delimited its Sudanese and Somaliland frontiers. The area is about 350,000 sq. m. and the population approximately 10,000,000.

I. POLITICAL HISTORY

In the years under review Abyssinia, owing to misgovernment and civil war, fell from a state of comparative prosperity to a condition bordering on chaos. The Emperor Menelek, who had converted a congeries of semi-independent kingdoms into a powerful state, died in 1913, but for some four or five years before his death he had taken no active part in the government. Although the stricken Emperor had in 1908 nominated his grandson Lej Yasu, born in 1896, as his successor, under the regency of Ras Tessama, a step confirmed 12 months later by the Council of Ministers, no government worthy of the name was possible owing to the constant intrigue and strife between the Empress Taitu, the Regent and other powerful nobles. In 1910 the Empress Taitu was finally driven into retirement, and in 1911 Ras Tessama died.

Lej Yasu then took the reins of government into his own hands, although he was never crowned, and the state of the country became steadily worse. By his misgovernment, his tyrannical and dissolute conduct, and particularly by his inclination to Islam, he mortally affronted his own subjects, intensely proud as they were and are of their 15 centuries of Christian tradition. His support of the "Mad Mullah" of Somaliland, who claimed him as a cousin, and his efforts to build up a federation of Moslem states, anti-ally in its sentiments, also estranged the sympathies of the three great Powers with possessions bordering on Abyssinia. In Sept. 1916, he was excommunicated by the Abouna, the head of the Abyssinian Church. The great Rases, thus relieved of their oath of fealty, formally deposed him, and proclaimed Zauditu, a daughter of the Emperor Menelek, born in 1876, as Empress, and Djazmach Tafari, born July 17 1891, son of Menelek's nephew Ras Makonnen, as Regent of the Empire, Heir to the Throne and Ras of Rases. Heavy fighting followed. Lej Yasu's father, Ras Michael of Wollo Galla, raised large Galla forces to aid his son, but the troops of the deposed ruler were defeated with great slaughter at Sagalle on Oct. 27 1916. Ras Michael was taken prisoner, and Lej Yasu became a wanderer, first of all in the Dankali country and later in Tigre.

New Rulers.—The coronation ceremonies of the new rulers took place in Feb. 1917, but Zauditu and Tafari succeeded to a troubled heritage. Freed from Menelek's iron rule and abandoned to their own devices during Lej Yasu's unfortunate tenure of office, the great Rases and provincial governors had begun to fall back into semi-independence. Sporadic fighting with the followers of Lej Yasu, who was not finally captured until 1921, continued for some years. Law and order were weakened, and the authority of the government hardly existed outside the central provinces. The dual nature of the governing régime, moreover, made it difficult to exercise really strong and effective control, and stimulated intrigue both domestic and foreign; it seemed indeed as though Menelek's impetus to development was spent. Nevertheless, little by little the Regent gathered together the reins of government, and improvements in administration, both central and local, were slowly achieved.

During this difficult period, in which he was criticised by the more reactionary Abyssinians for going too fast, and by European observers for not going fast enough, Ras Tafari exhibited many of the qualities of his father, Ras Makonnen, who had been not merely a fine soldier but a skilful diplomat, having conducted official missions to Paris, London and Rome. Tafari was aided in his task by the completion, in 1918, of the railway from the coast of French Somaliland to the capital, Addis Ababa. This link with the outside world undoubtedly played a considerable part in maintaining and strengthening the Regent's position and in stimulating intercourse with Europe, so much interrupted by the World War as well as by internal events.

Ras Tafari married Waizero Manin, granddaughter of Ras Michael, in 1912, and by her has two sons and three daughters. His position was so far consolidated by 1922 that he was able to leave the country for a short visit to Aden, and in 1924 he visited the principal countries of Europe with an imposing retinue of over 20 Rases and officials, his absence lasting nearly five months. His greatest triumph was the admission of Abyssinia to the League of Nations on Sept. 28, 1923, subject to certain conditions as to the control of slavery and of the arms traffic. Progress, though slow according to European ideas, has since been made; the Regent opened a school at Addis Ababa into which he introduced European teachers, and a number of young Abyssinians were sent to America, England, and France for their education to be completed. A large American hospital has been erected and many roads have been made in and around Addis Ababa. European enterprise is beginning to take an interest in the country, and the infiltration of European ideas, though very slow and gradual, is real.

Much yet remains to be done. The illiteracy of the people, very few of whom can read or write, the existence of slavery, the authority and bigotry of the priesthood, and most of all the power of the great provincial chief, are obstacles to progress; the financial and general administration and also that of justice leave much to be desired, while the general condition of the peasantry, especially in those parts inhabited by conquered races, is far from satisfactory. But the guarantee of independence involved by admission to the League of Nations should tend to set at rest internal fears of foreign international rivalries and aspirations, and thus facilitate domestic reform.

II. ECONOMIC CONDITIONS AND TRADE

The small progress in the economic and commercial development of Abyssinia during the years 1910–25 may in part be attributed to the disturbed political condition of the country, and in part to the World War and the trade depression which followed it. Other causes which have retarded development are lack of communications, bad methods of taxation, suspicion of foreign enterprise and currency difficulties.

The principal industries are agriculture and cattle-raising, but in spite of the fertility of the soil (in places three crops a year are raised) and the vast herds of cattle, estimated at from 10,000,000 to 15,000,000 head, production is only sufficient to feed the population and provide a few thousand tons of coffee and hides for export. Manufacture and industrial enterprise are almost non-existent. Some European commercial enterprises have been started, and there are indications that the Govt. will be able to give more sympathetic attention in the future to this aspect of the country's welfare. A Belgian company has acquired the alcohol monopoly, a Franco-Belgian company has been formed for cotton cultivation, two Belgian companies are developing coffee plantations on a large scale, and an English company commenced trading operations in 1925.

The total trade of the country approximates £2,500,000 in value annually. The chief exports are coffee and hides, and the principal imports salt, cotton fabrics, and hardware. The main channel of trade is the Franco-Ethiopian Railway, from Addis Ababa to the port of Jibuti in French Somaliland. The principal trade routes with the Sudan are via Gambela, Gallabat, and Roseires: the total annual value of the trade along these routes increased from about £50,000 in 1910 to £372,000 in 1924. Other trade routes are through the Italian colony of Eritrea to Massawa, and through Harar to Berbera in British Somaliland.

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See also articles by A. Hodson, Major L. F. I. Athill, C. F. Rey, *Geog. Jour.* (Feb., 1919; Nov., 1920; Sept., 1922); C. F. Rey, *Jour. of African Soc.* (July and Oct., 1922; Jan., 1923); G. E. Underhill, *Quarterly Rev.* (Jan., 1922); M. de Coppet, *La Géographie* (Nov., 1923); C. F. Rey, *Jour. of African Soc.* (Jan., 1924). (C. F. RE.)

ACCOUNTANCY: *see* BOOKKEEPING; COST ACCOUNTING.

ACETYLENE, IN MEDICINE.—Acetylene, which when pure loses its usual offensive smell, is an anaesthetic when inhaled and was first used as such in 1924. Like ethylene (*q.v.*) it is in the experimental stage at present. Its efficiency is between that of gas-oxygen and ether. Ether may be used with it to deepen the anaesthesia. It has the advantage that far greater amounts of oxygen can be given with it, up to about 50%, than with ethylene or nitrous oxide. *See* ANAESTHETICS. (W. S. S.)

ACHENBACH, ANDREAS (1815–1910), German painter (*see* 1.142), died March 31 1910.

ACHESON, EDWARD GOODRICH (1856–), American inventor, was born at Washington, Pa., March 9 1856. He was compelled to earn his living at an early age, but devoted his leisure to mechanical invention and experiment. Becoming interested in electricity, he entered the employ of Thomas A. Edison. In 1881 he assisted in the preparation of the Edison Exhibit at the Paris International Exposition and later, for the Edison interests, installed the first electric lights in Italy, Belgium and Holland. On returning to the United States, he resumed his experiments. He discovered a new abrasive substance of great cutting power, which he named carborundum. Inventing a method of producing a remarkably pure synthetic graphite, he organised in 1899 the Acheson Graphite Co. to handle the patent therefor. This company met with great success. His numerous patents cover methods of producing metallic silicon cheaply; the lubricants known as oildag, aquadag and gredag; the treatment of clay to increase plasticity (Egyptianised clay).

ACOUSTICS: *see* SOUND.

ACROSTIC (*see* 1.156).—A 20th-century development of the acrostic is the quadruple acrostic. The following, taken from R. A. Knox's *Book of Acrostics*, is a good example.

Uprights: Since there's no A, B, let us C and D.
Lights: 1. Reverse the name a schoolboy might apply, for briefness, to his weekly subsidy.
2. A lady thus (but with an S)
In Southern lands you might address.
3. Initials seen on many a truck.
4. To cattle breeders brings bad luck.

SOLUTION

Uprights: "Since there's no help, come, let us kiss and part."
Lights: 1. HsaCteKcoP (Reverse of Pocket Cash).
2. (s) En Or It A.
3. L.M.S.R.
4. P E S T.

Acrostics may be very simple and also very intricate. The modern acrostic seems to hit the happy medium and, whilst giving the reader plenty of food for thought, sends him occasionally to his Cruden, his Classical Dictionary, or his Encyclopædia.

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ACTING.—In the course of the period 1910–26, several new and different theories of acting have appeared. Different schools, academies of acting and theatres, mostly repertory, have done a great deal towards improving the standard of acting and team work or ensemble acting, on the stage. Of such are, in England, the Repertory Theatre in Birmingham, and the Liverpool Repertory Theatre; in Ireland, the Abbey Theatre, Dublin. Such English producers as Gordon Craig, Granville Barker, J. B. Fagan, Lewis Casson, Nigel Playfair and others, have done very important work in improving the quality of acting, and creating stage ensembles, not only directly by their stage work, but also by their writings on the subject. In the United States, David Belasco, the Theatre Guild of New York, the Washington Square Players, the Provincetown Playhouse and such producers as Hopkins, R. E. Jones, the Reichens and others contributed to this improvement. Moreover, the Little Theatre movement in America must not be overlooked.

In reviewing the general style of acting during this period, it will be noticed that everywhere on the stages of the theatres where there is no leading producer who has a definite theory or system of acting, and who trains his company without having a definite system or theory, there is a mixture, not only of modern, but of very many different styles of acting. In the so-called commercial theatre, with star actors, the typical style of acting is generally, not an art of creation of imaginary characters, but a kind of repetition of themselves by the actors in every part and in every play. These stars are not really acting, but merely showing themselves off to the public, using their personality and certain peculiarities of that personality, and trying to please and to obtain the sympathy of the audience.

Producers such as Max Reinhardt in Germany and Firmin Gémier in Paris use, for the most part, the methods of acting created by the naturalists, André Antoine in France, and Kronig, the producer of the Meininger, in Germany, and developed by Otto Brahm in Germany and Stanislavsky in Moscow. Sometimes these producers introduce, in this naturalistic acting, ideas of the formalists, Georg Fuchs in Germany, Meyerhold and Tairof in Russia, Gordon Craig in England and others. Sometimes they introduce touches of the synthetic theories of acting advocated by Komisarjevsky since 1910. The majority of the French actors trained in the Conservatoire in Paris remain still under the influence, not only of the old romantic school, but also of the pseudo-classical school of acting of the 18th century. The most complete example of that mixture of romanticism with its false "theatrical," effective pathos and the conventional, cold, learned and refined technique of the pseudo classicism, was seen in the acting of Mounet Sully at the Comédie française.

Naturalism.—The best known of all the new theories of acting which have appeared since 1910 is the system of Stanislavsky, the leading producer and director of the Moscow Art Theatre. His system is founded on the principle that an actor, having to be natural and sincere on the stage, could be so only by means of reproducing emotions experienced at some time or other in his life. That form of "psychical naturalism" became part of Stanislavsky's system as a result of "outer naturalism," which he advocated before he turned to psychology in the endeavour to find out a scientific system of acting.

The "inner naturalism" in acting is not a new feature in Stanislavsky's theory. Some French theatrical theorists had already, in the 18th century, founded their systems of acting on the same ideas. They held that an actor can represent himself on the stage only if it is desired that he should be sincere (Batteux, *Les Beaux Arts réduits à un même principe*, Paris, 1746). Remond de Sainte Albini in his book *Le Comédien* (Paris, 1747) wrote that, "love scenes are much better played by actors who are in love in real life." In a similar manner to that of the followers of Racine, Stanislavsky believes that contemporary actors living in their own time, and each one in his special atmosphere are unable to produce other emotions than those that are applicable to the time and to the surroundings in which they lead their everyday life. To be sincere, they must place, beneath the lines and stage directions of the author, their own emotions already experienced in real life. Nemirovitch-Danchenko, another producer of the Moscow Art Theatre, and the collaborator of Stanislavsky, wrote: "An actor must live on the stage only with emotions, and not with words. The meaning which the dramatist wishes to convey is not in the lines of the characters."

It is quite clear that this type of acting destroys the form created by the author of the play and the rhythm of his lines, which express the inner content and the inner movements of the play. The actor who acts by the power of his imagination passes from the form and the rhythm of the play to the inner content of it. The idealistic and emotional content of the play, which he obtains through the form and rhythm of the play, exists in his imagination and produces the necessary working of his intellect to create a stage character with all its peculiarities. The pupil of Stanislavsky neglects the form and rhythm of the play and substitutes his own remembered, intellectual states in place of those of the author.

The Formalists.—Another system, opposite to Stanislavsky's ideas, was advocated during the last years of symbolists, the formalists and the expressionists. Here we have a complete negation of sincerity and lifelikeness; the less the acting is sincere and lifelike the better. Here the actor must not try to create any definite characters; he must represent abstract ideas and convey these through his speeches delivered in a formal way, and through his movements and gestures, again produced in a formal, unlifelike and "picturesque" or marionette-like style. The Russian formalists, for instance Meyerhold and Tairof, during the last years of the revolution, became very much interested in acrobatics and circus business; the movement of the actors in their productions became something akin to a *perpetuum mobile*, dominating both the psychology of the play and the meaning of the lines. Thus the acting on their stages resembled very much a mixture of circus and cubistic ballet performance. Later, Meyerhold, in his manner of making his actors act, came back to the more or less naturalistic style. The German expressionists, such as Jessner, use the formal methods, interspersed with psychological touches. More or less in the same way the actors work on the French *avant-garde* stages, for instance at the Atelier, directed by Dulain, in the productions of Pitoef and Jouvet. In the closed Vieux Colombier they used the same methods of acting. Copeau, the director of the above theatre, must be considered as a pioneer in France in the fight against naturalism and the old fashioned Conservatoire acting. He definitely introduced such new methods of acting as the psychological and the formal on the French stage.

Views of Diderot.—There are, and always have been, very many discussions around the question as to whether an actor should really "feel" or, as some theatrical writers say, "live through" his part. This question was first raised by the French encyclopaedist, Denis Diderot (*Paradox sur le Comédien*). Diderot thought "the possibilities of a good actor lie in the complete absence of sensibility," and recommended to the actor that he should watch himself during the performance, that he listen to his voice and give only "recollections of his emotions." That kind of acting he called *singerie sublime*. It is proved now that an actor cannot move the audience, or be in any way creative on the stage, if he watches himself acting. Instead of being concentrated on the images he has to create, on his inner self, he becomes concentrated on his outer self, becomes self-conscious, and loses the power of imagination.

On the other hand it seems that it is impossible for an actor to get excited by the dramatic situation, and not to lose control of himself. Dr. Johnson said that an actor who, even for a moment, could work himself up to feel like a murderer should be executed after the play was over. It is certainly necessary to be able to feel a passion in order to be capable of depicting it successfully, but as Sir Henry Irving once said, "the actor must keep the passion in hand," or according to the words of the great French tragedian Talma "Il faut que chez les acteurs l'intelligence soit toujours en éveil, agissant de concert avec sa sensibilité pour enrégler les mouvements et les efforts." (*Mémoires de Talma*, A. Dumas.)

What does it mean, that an actor should keep the passions and emotions in hand? How can the reason walk hand in hand with the emotions and not kill these emotions? The way is to act only with the help of the imagination; to create, and not to imitate or reproduce one's own life experiences. An imaginative actor is in no danger of being overcome by his emotions and of being controlled by them. He is controlling these emotions because he has created them according to a plan which he has himself devised. He does not need to give, according to the advice of Diderot, "recollections of his emotions" instead of real emotions for fear of killing his partner, or breaking his own neck on the stage. The "imagination" or "phantasy" unites in itself all the different sides of our psychical life. And when the actor playing a part is living in a world of images created by his own phantasy, he cannot and need not watch and control himself. The images created by the actor's phantasy, and obedient to his will, control, guide and direct his emotions and actions during the performance. (*See* DRAMA; STAGE.)

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ADAM, PAUL (1862–1920), French novelist (*see* 1.172), published in his later years various novels, including *Le Trust* (1910), *Stéphanie* (1913), and shortly before his death *Reims dévastée and Le Lion d'Arras*. He died in Paris Jan. 2 1920.

ADAMS, HENRY (1838–1918), American historian (*see* 1.175), died in Washington, D.C., May 27 1918. In 1910 his *Letter to American Teachers of History* appeared, and in 1911 his *Life of George Cabot Lodge*. In 1913 his *Mont Saint Michel and Chartres* (privately printed in 1904) was published by authority of the American Institute of Architects. In 1918 his autobiographical work, *The Education of Henry Adams* (privately printed in 1906) was issued for the public. No book of its decade evoked more discussion in America. In 1919 *The Degradation of the Democratic Dogma*, consisting of several essays previously published together with one hitherto unpublished, was issued, with an introduction by his brother, Brooks Adams.

His brother, CHARLES FRANCIS ADAMS (*see* 1.175), died in Washington, D.C., March 20 1915. In 1911 he published *Studies Military and Diplomatic* 1775–1865 and in 1913 *Trans-Atlantic Historical Solidarity* (lectures delivered at Oxford). In 1916 Worthington C. Ford edited *Charles Francis Adams; an Autobiography*, from papers deposited in 1913 with the Massachusetts Historical Society.

ADAMS, HENRY CARTER (1852–1921), American economist (*see* 1.175), died Aug. 11 1921. His later books include *Description of Industry* (1918) and *American Railway Accounting* (1918).

ADAMS, MAUDE (1872–), American actress, was born in Salt Lake City, Utah, Nov. 11 1872. The family name was Kiskadden, but she adopted the maiden name, Adams, of her mother, an actress. From an early age she played juvenile parts, and at the age of 16 went to New York. From her appearance in Hoyt's *A Midnight Bell*, in 1889, her popularity grew steadily. In 1897 Charles Frohman gave her her first leading part as Lady Babbie in *The Little Minister:* and in *Peter Pan* she achieved a great success. She introduced Rostand to the American stage, taking the title-rôle in *L'Aiglon* in 1901, and in *Chantecler* in 1911. Other plays in her repertory were *Romeo and Juliet*, *The Pretty Sister of José*, *The Jesters*, and *As You Like It*.

ADAMSEN, AMANDUS HEINRICH (1855–), Estonian sculptor, was born in Port Baltic, Estonia, on Nov. 13 1855, his father being a sea-captain. While still at school Adamsen managed to earn a livelihood by producing carved work of considerable artistic value. In recognition of his talents, and on the recommendation of Count Lütke, president of the St. Petersburg Academy of Sciences, he was admitted as a student to the Academy of Art. He finished his studies at that academy in 1879, when he was awarded the silver medal. He received many commissions from leading members of St. Petersburg society. In 1887 he produced a portrait in relief of Tsar Alexander III.; he then went to Paris where he lived for several years. In 1891 he returned to his native land and lived alternately in Port Baltic and St. Petersburg.

Adamsen's technique in marble and wood has been moulded on classical lines. His small wood carvings are incomparable; and he executed a series of war memorials erected in memory of those who fell in the Estonian War of Independence. His most important works are an allegory, shown at the Paris Exhibition in 1889, entitled "Liebe, Tod und Wissenschaft"; "Die Welle" and "Hunger"; also "Befreiter Genius" and "Sieg der Arbeit" which were executed for the Nijni-Novgorod Exhibition. Mention should likewise be made of "Tod des Hyakinthes," "Leukothea," "Meeresrauschen," etc.

ADDAMS, JANE (1860–), American sociologist (*see* 1.183), became an ardent supporter of the cause of women's suffrage. She was chairman of the International Congress of Women held at The Hague in 1915. A permanent organisation was then established, the Women's International League for Peace and Freedom, of which she became president. Her later books include *Twenty Years at Hull House* (1910); *A New Conscience and an Ancient Evil* (1912); *The Long Road of Woman's Memory* (1916); *Peace and Bread in Time of War* (1922).

ADDING MACHINE: *see* OFFICE APPLIANCES.

ADDRESSING MACHINE: *see* OFFICE APPLIANCES.

ADE, GEORGE (1866–), American author, was born at Kentland, Ind., Feb. 9 1866. After graduating from Purdue University, he took up newspaper work, serving on the Chicago *Record* from 1890 to 1900, after which he devoted himself to writing. He belongs to the school of American vernacular philosophers and humorists, which includes Artemus Ward, Mark Twain and Mr. Dooley, his best-known work being *Fables in Slang* (1899). Ade also wrote a number of musical comedy librettos, motion-picture scenarios, including *Back Home and Broke* (1922), and plays, the best known of which are *The County Chairman* (1903), *The College Widow* (1904) and *Father and the Boys* (1908).

ADELAIDE, South Australia (*see* 1.188), had in 1923 a population, including its suburbs, of 278,856. Electric tramways were started in 1909, and by 1923 71½ m. were open. A building was erected at the back of the Town Hall for city offices in 1915, when a new wing was added to the Natural History Museum. The water supply has been augmented by the construction of a large new reservoir at Milbrook, opened in 1925. A War Memorial has been erected in Lower North Adelaide. An all-Australian exhibition, the largest ever held in Australia, was opened there in March 1925. The inner harbour at Port Adelaide has 4 m. of wharfage, and the outer 2,400 feet. The building of dry docks was contemplated in 1925. The chief magistrate was made a lord mayor in 1919.

ADEN (*see* 1.190).—The frontier of the protectorate was demarcated in 1902–4, and in 1905 a convention was signed by the British and Ottoman commissioners determining the boundary from Sheikh Murad on the Red Sea coast to the Bana river, and thence in a north-easterly direction into the desert. By an Anglo-Turkish Convention of 1914 the boundary was prolonged to a point on the shores of the Persian Gulf opposite Bahrein Island. During the World War, the Turkish forces encroached on Aden territory and approached to within a short distance of the town; they occupied Lahej and Sheikh Othman, but at no time was the safety of Aden itself very seriously threatened. In 1917 the defensive line of Aden described an arc of about 11 m. radius and continued so until the Armistice. At the end of the War the Turks withdrew from the Yemen. The neighbouring territories of the Iman of San'ā conform, theoretically, with the 1905 line, though encroachments had been made at some points which, in 1925, were the subject of dispute.

For administrative purposes Aden is under the control of the Govt. of Bombay and, ultimately, of the Govt. of India. The political relations of Aden with the rest of Arabia and relations with the tribes of the protectorate were taken charge of during the War by the High Commissioner of Egypt. In 1920 political control was transferred to the Political Resident, who was directly responsible to the British Foreign Office. In 1921 this responsibility was taken over by the Colonial Office. For military purposes, the General Officer Commanding is subordinate to the C.-in-C. in India, but the British War Office also exercises a certain measure of control.

The total population in 1921 of the settlement and Perim I. was 54,923 (including some 500 Europeans), as compared with 46,165 in 1911. The trade of Aden is largely a transhipment trade. In 1923–4, the total value of imports was Rs. 7,87,68,225; of which Rs. 31,81,845 was land-borne; and of exports Rs. 6,90,60,316, of which Rs. 45,12,725 was land-borne. In 1924–5 imports totalled Rs. 9,00,36,458 in value and exports Rs. 7,73,49,165, exclusive of government stores and treasure, as compared with imports valued at Rs. 6,56,62,230 and exports at Rs. 6,62,36,935 in 1913–4. The total tonnage of merchant vessels of over 200 tons entering the port in 1924–5 was 4,223,633 tons. During the World War a metre-gauge railway was constructed for military purposes from Aden to Lahej, 26 miles. Later it was extended to Habil, a further eight miles. The National Bank of India has a branch in Aden.

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ADENOIDS: *see* EAR, NOSE AND THROAT, DISEASES OF.

ADLER, FRIEDRICH (1879–), Austrian politician, was born in Vienna, July 9 1879, the son of Viktor Adler (*q.v.*). From 1907 to 1911 he was lecturer in physics at the University of Zurich, but he was soon immersed in politics. From 1911 to 1916 he was secretary of the Austrian Social Democratic party and editor of the monthly *Kampf*. During the World War he was in close sympathy with the Socialists of the Left. In despair over the break-up of the International, he shot the Austrian Prime Minister, Count Stürgkh, on Oct. 21 1916, hoping that the deed would be a signal for the rising of the proletariat against the War. On May 19 1917 he was condemned to death by a special tribunal, a sentence later commuted to 18 years' imprisonment. He was, however, amnestied on Nov. 1 1918. In 1919 he was elected to the National Assembly, and became vice-president of the committee of the Social Democratic party and of the Union of the Social Democratic deputies. He became secretary of the International Labour Assn. of Socialist Parties which he had helped to found.

Adler's chief works are: *Die Erneuerung der Internationale* (1918); *Ernst Mach's Ueberwindung des mechanischen Materialismus* (1918); *Ortszeit, Systemszeit, Zonenzeit und das ausgezeichnete Bezugssystem der Electrodynamik, eine Untersuchung über die Lorentzische und die Einsteinsche Kinematik* (1920).

See *Friedrich Adler vor dem Ausnahmegericht* (1919).

ADLER, VIKTOR (1852–1918), Austrian politician, was born at Prague, June 24 1852. He began to occupy himself early with political and social questions. In 1883 he went to study in Switzerland and in London, where he came into close touch with Engels. On his return to Vienna, however, he turned entirely to politics. The Workmen's party had sunk into political insignificance, so Adler undertook to restore unity in the ranks of labour. In 1886 appeared his paper *Gleichheit*, eventually succeeded by *Die Arbeiterzeitung.*, the principal organ of the Social Democratic party, which Adler continued to conduct till his death. In July 1889 he appeared at the first congress of the Second International, of which he became an official, as the representative of the united Austrian Labour party and was from that time the acknowledged leader of the party.

Adler regarded it as his first task to secure for the workmen representation in Parliament, but it was not until 1907 that he was able to secure universal and equal suffrage. The Social Democratic party increased their representation from 11 deputies to 87. Adler himself entered the Diet of Lower Austria in 1902, and in 1905 was elected to the Reichsrat, where, until his death, he played an important part.

In the congresses and in the secretariat of the International, Adler, with Jaurès and Bebel, played the most prominent part, whether as leader, adviser, or mediator. After the collapse of Austria in 1918, at the constituent session of the provisional German-Austrian National Assembly, he read the declaration of the Social Democrats, in which they expressed their willingness, in association with the other German-Austrian parties, to build the new state on the basis of democracy and self-determination, without prejudice to a possible association with the German Empire. He held for a few days the office of Foreign Minister, but he broke down and died Nov. 12 1918, the day on which the state council had decided to proclaim German Austria a democratic republic, and an integral part of the German Reich.

His works include articles scattered in various newspapers, in the *Neue Zeit; Kampf; Deutsche Worte* (Vienna), in addition to those in the *Arbeiterzeitung;* pamphlets, among which are *Die Fabrikinspektion, insbesondere in England und der Schweiz* (1884); *Die Arbeiterkammern und die Arbeiter* (1886); *Die Gleichheit vor dem Ausnahmegericht* (1889); *Das allgemeine, gleiche und direkte Wahlrecht und das Wahlunrecht in Oesterreich* (1893); *Schwurgerichtsprozess gegen Doktor Viktor Adler wegen Verbrechens der Störung der öffentlichen Ruhe* (1894); *Alcoholismus und Gewerkschaft* (many editions) (1907).

ADMIRALTY, BOARD OF (*see* 1.195).—The history of the British Admiralty since 1909 is the history of a steady increase in departments growing out of the vast multiplication and development of technical and applied sciences, and the problem of admiralty administration is to co-ordinate these multifarious activities into a single whole. This is peculiarly difficult in a war service where one is constantly preparing for one's work without actually performing it. The solution must be sought in freeing those responsible for larger questions from the crushing load of merely administrative business by imposing a clear distinction between fighting and supply, between the science of using the weapon and science of maintaining it in efficiency.

Up to 1909 the Intelligence Dept. was the thinking department of the Admiralty. Both Lord Fisher and Sir Arthur Wilson were opposed to a staff, and the idea found little favour at sea. In 1910 the Intelligence Dept. split into the two departments of Intelligence and Mobilisation of which the latter gradually became immersed in details of manning and mobilisation. The First Sea Lords of the time had no use for a staff; the navy was wedded to methods of centralisation, and there was a tendency to regard the conduct of a war as a simple business, which each flag officer must perform in his own way.

This happy faith received a rude shock at the Agadir crisis in the summer of 1911 when Sir Arthur Wilson was unable to produce any clear plans for war. Opposed to the idea of a staff, he resigned, and it was left to Mr. Churchill, in his memorandum of Jan. 1912, to institute the beginnings of a staff system. The new War Staff, as it was called, consisted of three divisions: Operations, Intelligence, and Mobilisation. Its deficiencies were serious. The Chief of the War Staff was not a member of the board and could not act with the authority of the board. When in 1914 war broke out, the work of the staff fell largely into the hands of a small group of admirals, senior to the Chief of the Staff and working independently of him.

War Period.—The Admiralty Board at this time, under a patent of Dec. 1 1913, consisted of the First Lord, Mr. Winston Churchill (from Oct. 24 1911); the First Sea Lord, Adm. Prince Louis of Battenberg (since Dec. 9 1912); the Second Sea Lord, Vice-Adm. Sir Frederick Hamilton (succeeded Vice-Adm. Jellicoe, July 30 1914); Third Sea Lord, Rear-Adm. Archibald Moore (since May 29 1913); Fourth Sea Lord, Capt. Cecil Lambert (since Dec. 1 1913); Civil Lord, Mr. George Lambert (since Dec. 21 1905); Parliamentary and Financial Secretary, Sir Francis Hopwood, afterwards Lord Southborough (since Jan. 18 1912); and the Permanent Secretary, Sir W. Graham Greene. Rear-Adm. Sir Doveton Sturdee was Chief of the War Staff, but there were at least two flag officers senior to him, Sir Arthur Wilson and Sir Henry Jackson, also acting in an advisory capacity to the board.

Although the Admiralty achieved a master stroke in the battle of the Falkland Is., the deficiencies of the system, which were felt at Coronel, became gravely manifest in 1915; Lord Fisher was then First Sea Lord, having succeeded Prince Louis of Battenberg (afterward Marquis of Milford Haven) on Oct. 30 1914, when Rear-Adm. Sir Henry Oliver became Chief of the War Staff. Lord Fisher was immersed in a plan for a great landing in the Baltic. The First Lord, in the case of the Dardanelles, over-estimated the power of the "Queen Elizabeth's" 15-in. guns and the War Staff could neither supply an element of strong independent criticism, nor grip the problem and transform it into a practicable proposition. Lord Fisher pulled down his blinds and left the Admiralty without a word on May 15. Mr. Churchill ceased to be First Lord some days later when the Govt. was reconstructed. These two were succeeded by Adm. Sir Henry Jackson and Mr. Arthur Balfour (May 28 1915).

At the end of 1916, Adm. Sir John Jellicoe came from the Grand Fleet to succeed Sir Henry Jackson (Dec. 4 1916); Sir

Edward Carson succeeded Mr. Arthur Balfour (Dec. 12) and an anti-submarine division was instituted; then on Jan. 31 1917 the Chief of the Royal Naval Air Service, Com. Godfrey Paine, was added to the board as Fifth Sea Lord, but it was not till May 1917 that the staff was thoroughly re-organised to meet the pressing danger of the German submarine campaign. (Order in Council May 19 1917.)

The office of Chief of the Naval Staff was then merged in that of First Sea Lord, while the appointment of a Deputy Chief (Vice-Adm. Sir Henry Oliver) and Assistant Chief (Rear-Adm. Alex. Duff), both with seats on the board, gave the Naval Staff a predominant weight of board authority. Sir Eric Geddes at the same time became Controller, and all questions of supply were concentrated in his hands till he succeeded Sir Edward Carson as First Lord (July 20).

On Sept. 6 Adm. Sir Rosslyn Wemyss was appointed Deputy First Sea Lord to deal with questions of foreign policy and operations abroad. Finally, in Oct. 1917, the development was carried a step further when two committees were formed in the board, one of Operations, the other of Supply, both under the chairmanship of the First Lord, and by an important Order in Council of Oct. 23 1917, the Chief of the Naval Staff was authorised to issue all orders relating to operations and movements of the fleet, signing them in his own name. Three new divisions of the staff had been formed, viz: Plans (Rear-Adm. Roger Keyes), Minesweeping (Capt. Lionel Preston), and Mercantile Movements (Capt. Whitehead), the latter having evolved from the convoy section.

In Dec. 1917 Rear-Adm. Roger Keyes went to Dover to put in force a new and drastic plan of closing the Straits to submarines and under the pressure of events some sweeping changes took place. Acting Adm. Sir Rosslyn Wemyss succeeded Adm. Sir John Jellicoe as First Sea Lord (Jan. 10 1918), and Rear-Adm. Sydney Fremantle took Vice-Adm. Sir Henry Oliver's place as Deputy Chief of the Naval Staff. When peace was declared Adm. Sir Rosslyn Wemyss, afterward Lord Wester Wemyss, was still in the post which four admirals had held in turn and was succeeded by Earl Beatty on Nov. 3 1919.

Organisation in 1925.—The board as constituted in 1925 consisted of ten members, viz: First Lord, First Sea Lord, and Chief of the Naval Staff (policy and war), Second Sea Lord (personnel), Third Sea Lord (material), Fourth Sea Lord (supplies and transport), Deputy Chief of the Naval Staff (operations and intelligence), Assistant Chief of the Naval Staff (design and development of material), Civil Lord, Financial Secretary, and Permanent Secretary.

The Admiralty office may be classified under the heads of:

I. Secretary's Dept., five branches, viz: M. (Military) dealing with political and diplomatic questions; C.W. (Commissions and Warrants) personnel of officers; N. (Navy) personnel of men; C.E. (Civil Establishment); N.L. (Naval Law); Discipline and King's Regulations; Library and Record Office.

II. Naval Staff, seven divisions, viz: Operations, Intelligence, Plans, Trade, Training, Gunnery, and Torpedo.

III. Personnel departments, seven, viz: Mobilisation, Recruiting, Medical, Physical Training, Paymaster, Chaplain of Fleet, Royal Marines.

IV. Technical, viz: Hydrography and Navigation, Naval Construction, Naval Engineering, Electrical Engineering, Naval Ordnance, Torpedoes and Mining, Naval Equipment, Compass, Dockyards, Civil Engineering, Signal, and Scientific Research.

V. Supply, viz: Victualling, Stores, Sea Transport.

VI. Finance, viz: Dockyards' Accounts, Contract and Purchase, Accountant General.

(A. C. D.)

ADOR, GUSTAVE (1845–), Swiss statesman, was born at Geneva, Dec. 23 1845, of a Vaudois family established there in 1814. He studied law at the Academy and in 1868 became an advocate. In 1871 he started his political career as member of the communal council of Cologny and was elected mayor in 1878 and 1883. In 1878–9 he represented Geneva in the Swiss National Council and became a member of the executive of the canton of Geneva, being in charge of the Dept. of Justice and Police. He resigned, however, in 1880, after an unfavourable election, but returned to this post in 1885 and was president of the cantonal executive in 1892 and 1896. From 1889 to 1917 he was a member of the Swiss National Council, of which he was president in 1901.

Ador gained an international reputation for the hard and disinterested work he did for the International Red Cross. He had become president of the committee four years before the World War, and when it broke out he founded an association at Geneva for facilitating communications between prisoners of war and their families and for alleviating their condition. This other achievement included the establishment of the central agency for forwarding parcels and letters.

In June 1917, after the enforced resignation of Arthur Hoffmann, Ador became a member of the executive of the Swiss Federation with the portfolio of Foreign Affairs. Toward the end of 1918 he was elected President of the Swiss Federation; he retired at the end of his year of office. He headed the Swiss delegation which visited Paris and London in January–February 1920 to secure a reservation of the principle of the neutrality of Switzerland when she joined the League of Nations. He did important work for the league itself, first as president of the Brussels Conference of 1920 and then as president of the Economic and Financial Commission.

ADRIANOPLE or Edirneh (*see* 1.217), now again a Turkish city, has changed hands several times in the succession of military operations since 1912. The population in 1924 was given as only 56,347, as compared with about 80,000 in 1905 and 65,454 in 1911. This diminution is due to the emigration of the population, with the exception of the Jews, after the successive occupations of the city. The south-western portion of the city, burnt down in 1905, was rebuilt with comparatively broad streets. The railway station across the Maritza at Karagatch, which stands among ruins, is being rebuilt.

In 1912, during the first Balkan War, Adrianople was invested by the Bulgars and it was taken from the Turks, with Serbian assistance, in 1913, after a siege of 155 days. During the second Balkan War, in June of the latter year, the Turks retook the town and, by the Treaty of Constantinople, signed on Sept. 29 1913, it was ceded, together with Karagatch, to Turkey by Bulgaria. After the World War, the Greek Army, having been commissioned to restore order in Thrace in May 1920, entered Adrianople in July, and it was ceded to them, on Aug. 10 1920, by the Treaty of Sèvres. During the Greco-Turkish War of 1923 the Greeks occupied the suburb of Karagatch, the railway station of which is very important for the traffic to Dedeagatch and had therefore been abandoned by Turkey to Bulgaria in 1915. On leaving it they destroyed many buildings and removed the machinery from the mills. After the War Adrianople was again restored to Turkey by the Mudania Convention of Oct. 1922 and its restoration was confirmed by the Treaty of Lausanne of July 24 1923. A protocol attached to the treaty subjected the Greek inhabitants of Karagatch to the exchange of populations, and compelled them "to emigrate six months after the re-establishment of peace."

Bibliography.—*British and Foreign State Papers* (1914), Part I, vol. 107, p. 706; (1920), vol. 113, p. 652 (London, 1917–23); *Treaty Series*, No. 16 (1923).

ADRIATIC SEA (*see* 1.218), the arm of the Mediterranean lying between Italy and the Balkan Peninsula. Before the World War the Adriatic littoral belonged to four states—Italy, Austria-Hungary, Montenegro and Albania and in practice to the two first. The object of the Italian Govt. in negotiating the "secret" Treaty of London of April 26 1915, was to secure, in return for Italy's entrance into the War on the side of the Allies, the conversion of the Adriatic into an Italian lake—*il nostro mare*.

Article 4 of that treaty provided that "all Istria up to the Quarnero and comprising Volosca, just beyond Abbazia and the Istrian islands of Cherso, Lussin . . . and the adjoining islets" with Castua and Mattuglie, the station for Abbazia, should become Italian. Article 5 declared that Italy "shall equally receive the province of Dalmatia . . . comprising Lisarica and Tribanj in the north" to a line as far south as Cape Planca (Ploče), between Sebenico and Traù (Trogir), on the mainland, with "all the islands . . . from Premuda, Selve (Silba) and Pago in the north to Meleda in the south, comprising

Lissa, Lesina, Curzola, Lagosta (Lastovo) and Pelagosa, with the solitary exception of Great Zirona (Voli Drvenik) and Small Zirona (Mali Drvenik), Bua (Ciovo), Solta and Brazza." The whole coast from Cape Planca to the "southern root" of the peninsula of Sabbioncello and from a point 10 km. to the south of Ragusa Vecchia (Cavtat) to the river Viosa (north of Valona), except Montenegro, and all the non-Italian islands were to be neutralised. The rest of the Dalmatian coast, besides Fiume and the islands of Veglia and Arbe in the north, were to go to Croatia, Serbia and Montenegro, besides the Albanian roadstead of San Giovanni di Medua (the landing-place for Scutari); but Durazzo was to be Albanian.

Article 6 further conferred upon Italy "the entire sovereignty over Valona, the island of Saseno and a territory sufficiently extended to assure the defence of those points (from the Viosa . . . approximately to the northern frontier of the district of Chimara). Article 7 neutralised the coast south of the above as far as Cape Stylos opposite Corfu. This treaty violated every principle of nationality; it assigned to Italy provinces overwhelmingly Slav (for the Italian population of Dalmatia was only 3·5%), it dismembered Albania and would have created a new Irredentism far more powerful than that which Italy had fought to cure. The entrance of the United States into the War made the treaty a dead letter, although Baron Sonnino, then Italian Minister of Foreign Affairs, still clung to it, for President Wilson refused to be bound by it, and even some Italians, notably Bissolati and Prof. Salvenum, disapproved of it.

Thus began the wearisome "Adriatic question," which at times threatened war between Italy and the Yugoslavs, and attempts were made by British publicists, notably Messrs. Steed and Seton-Watson, to bring about an agreement, the "Pact of Rome," between the two races. The departure of Sig. Orlando, then the Italian Premier, and Baron Sonnino from the Paris Conference was due to this question, which was not regulated till the Treaty of Rapallo between the Italians and the Yugoslavs on Nov. 12 1920, largely the work of Sig. Giolitti and Count Sforza, who had meanwhile become Premier and Minister of Foreign Affairs. In Dalmatia, Italy obtained only Zara—the one overwhelmingly Italian town—with an enclave which included the Albanian settlement of Borgo Erizzo and the island of Lagosta. Italy kept the whole of Istria (despite its large Slav minority) with the islands of Cherso and Lussin and that of Pelagosa. "All the other islands which belonged to the former Austro-Hungarian Monarchy" were "recognised as forming part of the Kingdom of the Serbs, Croats and Slovenes."

By article 4, both States recognised the full liberty and independence of the State of Fiume (*q.v.*), consisting of the *corpus separatum* (the city) and a corridor south of Castua (which became Yugoslav) connecting it with Volosca and Abbazia. Sig. Giolitti evacuated Albania, where Italy retains only the island of Saseno. Sig. Mussolini observed the Rapallo Treaty and settled the question of Fiume, though his wilder followers have proclaimed their intention of annexing Dalmatia.

Zara's Italian patriotism has cost her dear. In Austrian days the capital of Dalmatia and the seat of the local Diet, where numerous officials resided, she is now a small provincial town, the population of which is dwindling, with only one industry—the manufacture of Maraschino—with no railway communication, and much in the same isolated position of Calais or Boulogne when they were English.

Yugoslavia has already the nucleus of a navy in the Adriatic, which is described at Belgrade, no less than in Rome, as "our sea," and the Dalmatian Slavs are famous seamen. Still, the keys of the mouth of the Adriatic, Brindisi and Saseno are in Italian hands. But Saseno is waterless and dominated by the Acroceraunian Mountains.

BIBLIOGRAPHY.—R. W. Seton-Watson, *The Balkans, Italy, and the Adriatic* (1915); *British and Foreign State Papers*, vol. 112, p. 973 (1919), vol. 113, p. 1087 (1920); G. Salvemini, *La questione dell' Adriatico* (Rome, 1919); Adriaticus, *La question Adriatique;* Recueil de documents officiels (Paris, 1920); *See* also "The Problem of Dalmatia" by "Antenor" in *History*, April 1919; E. J. and C. G. Woodhouse, *Italy and the Jugoslavs* (Boston, 1920). (W. MI.)

ADULT EDUCATION.—Since 1910 adult education has, especially in England, acquired a new meaning. The phrase originally meant education of adults who have not been properly educated as children. As the educational system improved, the need for such education diminished, but as democratic government developed, it brought with it the need, felt by everyone, for education in citizenship. Adult education in this sense has been described as "an inseparable aspect of citizenship" and the new movement which dates from the beginning of this century, has extended to democratic countries all over the world, including such countries as Germany and the United States, which, because they had early possessed a comprehensive system of elementary and secondary education, have not felt the need for adult education in its original sense.

Variety of Type.—The new movement has taken many forms and is carried on by many different organisations. These are divided between such as definitely adhere to a particular school of thought or political party and those, of which the Workers' Educational Assn. in Britain and the Danish People's High Schools are conspicuous examples, which aim at giving an education which is not subservient to any political programme. The latter aim sharply distinguishes education from propaganda. There is a great variation also in the extent to which these various organisations use the help of the public educational system of the country.

Workers' Educational Association.—Behind the difference of aim, however, there is very substantial identity in the problems and methods of recent adult education, and a short account of the new movement, inaugurated in England by the foundation of the Workers' Educational Assn. by Mr. Albert Mansbridge in 1903, will bring these out. That association aimed at bringing together working-class organisations to provide for an education, designed not to take men out of their class or trade, but to equip them, whatever their occupation in life should be, for the work of citizenship. It was to be a highway and not a ladder. The education it desired to bring into being was to be broad, impartial and scholarly, was to aim at a higher university standard and was to enlist the aid of the universities and of public authorities.

The association from the first insisted that the distinctive feature of adult education is that it must be controlled by the students, as the education of the young cannot be. The universities were asked to help in maintaining the standard of education, but the choice of subjects and of tutors were to be with the students. It was recognised from the first that adult students bring an experience of life and an understanding of practical problems which are, in their way, as important a contribution as the more theoretical knowledge of the teachers, and that therefore adult education requires a technique and organisation of its own in which both students and university trained teachers have their part to play.

Tutorial Classes.—In 1907 the University of Oxford organised the first tutorial class, the characteristic educational instrument of the new movement. These classes were small, between 20 and 30 persons, meeting once a week in the winter over a period of three years. Each class consisted of an hour's lecture and an hour's discussion, the students undertaking from the start to attend for the full period of three years and to do written work. The classes were under the control of a joint committee consisting of equal numbers of representatives of the university and of working class organisations. The quality of work done in these classes was often of a good university honours standard. All the other universities of England and Wales followed, and in 1925 there were over 500 tutorial classes with 12,000 students.

The total amount of education of this kind now given in democratic countries is very considerable and is rapidly increasing. The movement is still young and its future organisation is still uncertain. Its great strength in the past was that it has been run by voluntary associations and has in a real sense been a university controlled in the main by its students. It suffers, however, from the weakness of administration and the fluctuating enthusiasm characteristic of all voluntary organisations. Its success in the future will depend on how far it can be connected more closely with public educational institutions on the one hand and organised labour on the other, without losing its voluntary character.

See *Final Report* of the Adult Education Committee (Cmd. 321, 1919). (A. D. L.)

United States.—The term adult education has been used in the United States since about 1916, although there is a lack of agreement as to what the term should include. Some think of it as work for illiterates, or for immigrants; others employ it to mean the making up of deficiency in the earlier education of mature men and women; still others use it in the broader sense of the means by which adult men and women shall be released from the thrall of custom and tradition and prepared for intelligent participation in the current of the world's life.

This vagueness of meaning reflects the various origins of the movement, which include the lyceums, workmen's institutes and " literary societies " of the previous century; the "Chautauqua Movement," dating from 1873; social settlements in cities, dating from about 1890; university extension, which has carried college classes into every corner of the land; people's institutes; open forums, church forums and summer forums for educational purposes; women's clubs and parents' congresses; young people's organisations, of many sorts; " moonlight schools " for illiterate Kentucky mountaineers, who after the work of the day, gather in groups on moonlight nights to learn to read; " Americanisation work," promoted by many types of agency since the World War; and the growing efforts of public libraries to diffuse knowledge and promote intelligence. Mention should be made also of evening schools and other forms of educational extension, in which nearly a million and a half young people between the ages of 14 and 25 were enrolled in 1926. Most of this work points definitely to vocational interests and uses. " Correspondence schools " have an enrolment of some 2,500,000 students, with about 1,500,000 new enrolments each year. Not more than 10 % of these students, however, finish the courses for which they register and pay. Since 1918, the term " workers' education " has come into use, workers' universities having been established in many cities from Boston to Seattle; a Workers' Education Bureau was established in New York City to promote the movement. In aim it wavers between the objectives of producing *better workers* and *better human beings*—a defect common to most American educational thinking.

The first important step toward the co-ordination of the various movements for adult education in the United States was taken under the initiative of the Carnegie Corp., in Oct. 1925, when an American Assn. for Adult Education was organised, at Cleveland, Ohio. The purpose of this national association is stated, in part, as follows: " To promote the development and improvement of adult education in the United States and to co-operate with similar associations in all parts of the world." At its first meeting it took steps to make available information regarding the various types of adult education, arranging also for future regional conferences and for a national conference on adult education to be held annually. (J. K. H.)

ADULTERATION: *see* FOOD, PURE.

ADVERTISING (*see* 1.235).—Advertising as we know it is a development substantially of 75 years, beginning about the middle of the 19th century. However, advertising has existed in one form or another as far back as there has been any method of recording ideas by means of visual symbols.

I. A HISTORICAL SKETCH

Speaking broadly, the development of advertising may be traced through four stages of growth: (1) Pre-printing period prior to 1450. (2) Early printing period from 1450 to about 1850. (3) Modern period of expansion from 1850 to 1911. (4) The period of development of standards of practice and the introduction of research methods from 1911 to the present.

Pre-Printing Stage.—Some form of advertising has probably existed since the time when men lived in communities and competed with one another for the necessities of life. Advertising on a large scale was of course impossible without a convenient, rapid method of reproducing visual symbols such as was made possible by the invention of the printing press. Prior to that time there were forms of handwritten and inscribed announcements corresponding to advertisements. There were inscriptions on walls and announcements on sheets of papyrus. Perhaps the oldest known advertisement of this type is in the British Museum, and was written on a sheet of papyrus found in the ruins of ancient Thebes, in Egypt. This announcement offered a reward for a runaway slave. It was written possibly about 5000 B.C.

In Rome, during the time of the Caesars, there were similar bulletins written by slaves and displayed on the boards erected for that purpose about the city. In both Greece and Rome advertisements of gladiatorial exhibitions were posted, giving an appearance probably not unlike that of a modern town when it is filled with circus posters. There was an early interest in the development of trade-marks but only in a very limited manner. These trade-marks were put on vases, pieces of crockery and the like. One form of attracting attention, in some respects a forerunner of advertising, was that employed by the Carthaginians, who, when they arrived with a cargo of goods on the Phoenician shores, built a fire to attract the attention of the inhabitants, who then gathered to examine and purchase the goods.

At first the merchant cried his wares on the streets, carrying them with him as he did so. Later, when shops were established, the professional town-crier appeared on the scene. There were during the pre-printing period many town-criers in the various larger cities of Europe. While their method of announcing or selling was oral, it was nevertheless a forerunner of present-day advertising in the sense of mass selling. It is stated that in 1641 there were 400 town-criers in Paris.

The Early Printing Stage.—The second stage arose when modern methods of printing were invented. This made possible the rapid and unlimited duplication of writing by means of print which is the necessary medium of advertising. With this development there came about the publication of newspapers and periodicals corresponding to our modern magazines. It is said that the first newspaper was published in Strasbourg in 1609. In America, the first newspaper was entitled *Publick Occurrences both Foreign and Domestick,* published in Boston in 1690. This was succeeded in 1704 by *The Boston News Letter,* a weekly publication. The first issue of *The Boston News Letter,* published April 26 1704, contained advertisements. It was 40 years before this publication reached a circulation of 300 copies per issue. The early history of advertising, together with numerous sample advertisements of this early period, is well presented in Sampson's *History of Advertising.*

The Modern Period.—This period may be dated from 1850 to 1911. The reason for putting the dividing point between the second and third periods at 1850 is the rapid appearance of newspapers and magazines, which made possible the development of modern advertising on a large scale. Advertising was impossible until printing developed and until people generally learned to read. One reason for the rapid increase in the number and distribution of advertising media at this time is probably to be found in the development of transportation systems—railways and waterways. Prior to that time railway lines were limited to restricted areas. There was no national transportation system. To illustrate the difficulties of transportation before that time, and even up to 1870 or 1875, we may quote the following announcement of the Kenosha (Wisconsin) *Telegraph* in Rowell's Directory in 1869:—

> The town is renowned for the manufacture of wagons, which find a market all the way to the Rocky Mountains, and even to Oregon, being shipped by way of New York.

This shows how difficult it was to distribute goods generally over the country. It is obvious, then, that without the possibility of transporting goods there was no need of advertising media of wide circulation, and furthermore media could not develop a wide circulation because they could not be distributed conveniently or rapidly. During the middle and latter part of the 19th century the development of a national transportation system made possible the ready distribution of goods and publications. Another reason for placing the dividing point between the second and third periods at 1850 is that about this time advertising agencies arose whose primary purpose was to serve as brokers of advertising space. They were rather different in this respect from the present advertising agency, which, in addition to contracting for space, is, in its best form, an organisation giving expert counsel and service regarding marketing and advertising plans and methods.

During this period the number of magazines and newspapers grew very rapidly, so that in 1861 there were 5,203 magazines, papers and periodicals of all kinds in the United States. Yet advertising was relatively limited as compared with the present day. *Harper's Magazine* had its first advertisement in 1864; *Scribner's* in 1872. Magazine advertising on a large scale did not begin until about 1860 to 1870. It was stated in 1926 that *Harper's Magazine* had approximately as many pages of advertising in one year as it had in its first 24 years. At first it was used chiefly as a medium for advertising the Harper publications. Advertising rates at that time began to assume real proportions. *Harper's Weekly* was receiving $35 an inch for its back page in the 'sixties.

The first advertising agency was established in Philadelphia in 1840 by Volney B. Palmer. Later, offices were established in Boston and New York. Rates and contracts were unstandardised at that time. The agent contracted for a certain amount of space with a publication and then sold it for whatever he could, receiving sometimes as high as 50% of the cost of the space as his commission. Among the better known early advertising agents were V. B. Palmer, S. M. Pettingill and George P. Rowell. In 1926 the United States had about 1,200 advertising agencies. Some 140, including most of the larger ones, were members of the American Association of Advertising Agencies.

Development of Higher Standards and Practices.—The fourth period in the development of advertising may be said to have begun in 1911. Since that time advertising has developed most rapidly as a standardised business. The date 1911 is chosen because it was in that year that definite organised steps were taken to forward the movement of truth in advertising. In 1911 counsel for *Printers' Ink*, a leading advertising journal in the United States, formulated what has become known as "The Printers' Ink Model Statute," which has been adopted in a large number of states. This statute makes dishonest advertising a misdemeanour.

It (*a*) places the responsibility for deception upon the advertiser, (*b*) deals with questions of facts about goods rather than opinions and (*c*) designates the making of untruthful, deceptive or misleading statements a misdemeanour. Up to Nov. 1921 this statute had been adopted in 22 states in substantially the form in which it was originally prepared by counsel for *Printers' Ink*, and in 15 states in modified form.

In these 15 states the modification which was made in the statute consisted for the most part of the insertion of the words "knowingly" or "with fraudulent intent." It is obvious that this change very considerably weakens the forcefulness of the statute. Nevertheless, the adoption of this statute has been a powerful force in bringing deception, misrepresentation and dishonesty in advertising under legal control. The Associated Advertising Clubs of the World, the national and local advertising clubs and other organisations have been active in pushing the adoption of this or similar legislation, which has been a powerful influence toward the remedying of objectionable practices. In addition to state legislation a number of larger cities have ordinances intended to check certain undesirable advertising practices.

About 1912, the Associated Advertising Clubs of the World at their annual convention adopted the motto "truth in advertising," and established a National Vigilance Committee, now called the National Better Business Commission, with the purpose of forwarding higher standards of honesty and reliability in advertising. This committee organised, in connection with the various local clubs throughout the United States, local vigilance committees or Better Business Commissions to eliminate objectionable, untruthful advertising. The purpose of these commissions has been to carry on locally in each city active efforts, similar to those of the National Commission, toward the elimination of dishonest and objectionable advertising and related business methods. Up to 1925, such commissions had been established in over 40 cities, including Boston, St. Louis, Cleveland, Indianapolis, Kansas City, Des Moines, Minneapolis, St. Paul, Spokane, Portland, Ore., and New York City.

About this same time the Associated Advertising Clubs of the World undertook definite educational activity in outlining courses of study and discussions to be conducted by the various local clubs, for the purpose of studying advertising methods and of improving them. A distinct service has been rendered in this connection by the several educational activities of the different local organisations. Colleges and universities began to give serious attention to the study of advertising by establishing well-defined courses of instruction.

Facts About Circulations.—In 1914 there was organised the Audit Bureau of Circulations. This has become the leading agency for securing reliable information about the circulation and distribution of publications. The work of this bureau came about as the result of several organisations which were interested in the endeavour to develop a generally acceptable means of obtaining reliable, standardised statements of circulation. It was felt that the time was ripe for devising such means, and that the advertiser had a right to know what he was buying when he bought space in publications. It was desirable to know not only the total circulation but also something about the various aspects of this circulation, facts which are as important as the statement of the total amount of the circulation.

About 1870 the only facts generally available regarding circulation were the statements in George P. Rowell's *Directory;* and after that time the Ayer *Directory* was the chief source of information. In order to bring about a somewhat more reliable statement of circulations at that time, Mr. Rowell added a gold mark to the name of the publication if the publisher made an affidavit concerning his circulation. This was accompanied by an offer of $100 to anyone who could disprove the claim made. In general, the A B C reports attempt to answer three main questions: (*a*) How large is the circulation? (*b*) Where does it go? and (*c*) How was it obtained? The bureau operates by requiring from its publisher members a so-called publisher's statement every six months. The bureau itself makes an audited report once a year.

The Audit Bureau of Circulation became of great value to advertising, because it made available reliable statements of circulation covering many different phases. In case of error, either intentional or unintentional, the bureau established certain rules. In case of error, a publisher or advertiser member of the bureau could ask for a re-audit of any publication, if he so desired. If the re-audit proved that the publisher had misrepresented the facts the expense was to be borne by the publisher. This fact being then bulletined to the other members of the bureau, the publisher became subject to suspension and expulsion from the bureau. Up to Jan. 1926, 184 general magazines and periodicals were members of the bureau, 72 farm publications, 240 business publications and 925 newspapers. In addition to publications, 137 national advertisers, 120 local advertisers and 181 advertising agencies were members.

About 1913 there was organised in the United States the Association of National Advertisers, another important influence in the study and development of advertising practices. Likewise, during that period publishers developed a distinct consciousness of censorship of advertising. A considerable number of publishers took a definite stand with regard to the advertising which they would or would not accept. The announced or stated policy might not be fully lived up to in practice in all instances but the best evidence of actual progress made in this regard lies in a comparison of the present issues of leading magazines and newspapers with issues of the early years of the century. The improvement is marked. In addition to the elimination of objectionable and doubtful advertising, a considerable number of media went a step further by guaranteeing their advertising in the sense that they would either themselves make good on any misrepresentation or deception which appeared in connection with an advertisement, or would see that the advertiser in question made good. With most of the high-grade media a policy of guaranteeing is substantially implied, and is almost unnecessary in view of the commendable care which is exercised in rejecting questionable commodities or irresponsible business houses.

In 1917 the American Association of Advertising Agencies was organised. It contributed materially toward the establishment of standards of practices and uniform methods of procedure. In 1925 it inaugurated a department of research for studying fundamental problems of advertising and marketing. Finally, and perhaps most important, an increasing use of research methods developed. At least here and there these methods appear to be thoroughgoing in finding the facts on which marketing and advertising plans may be based, scientific research and planning taking the place of guesswork.

II. DEVELOPMENTS SINCE 1850

Considering the last two periods together the chief developments, in addition to those mentioned, may be designated as follows:—

Growth in Quantity.—There has been a tremendous growth in the number of firms employing advertising in one form or another. In 1926 there were about 10,000 firms doing more or less national advertising. The report entitled *Leading Advertisers*, prepared each year by the Curtis Publishing Co., mentions 1,302 firms, which spent $10,000 in 1921 in 36 leading national magazines. In this list there were 50 firms which spent $264,500 or more in 36 leading national publications in 1921. There has been likewise an enormous growth in the number of media. In 1830, it is estimated that there were approximately 800 magazines and newspapers in the United States, of which some 50 were daily publications. Their combined annual circulation was estimated at about 60,000,000 copies, or a circulation of approximately 950,000 copies per issue. In 1830 the total population of the United States was 23,500,000.

In 1861 there were 5,203 papers and magazines for a population of approximately 30,000,000. In 1922 there were 22,353 magazines and newspapers in the United States for a population of about 106,000,000. In other words, there has been an increase of magazines and newspapers since 1861 of approximately 5 times, whereas the population during the same period of time has increased approximately 3½ times. Since 1830 the population has increased approximately 4½ times; the number of magazines and newspapers has increased almost 30 times. A more striking increase has taken place in the total combined circulation. The estimated combined circulation per issue of the magazines was (1925) approximately 50,000,000 copies, and the total combined circulation of the newspapers approximately 45,000,000. Thus since 1830 there has been a growth in total combined circulation of all magazines and newspapers from less than 1,000,000 to from 95,000,000 to 100,000,000 per issue. Besides the marked increase in the number of media and in the extent of their circulation, there has been an equally marked increase in the amount of advertising carried in a given issue of a publication. Two representative newspapers in the United States show an increase in advertising space of 5 times and 13 times respectively from 1850 to 1918.

During that period, also, there developed entirely new media of advertising, including street-car cards, posters, direct-mail, motion-picture and radio advertising. Street-car advertising did not come into general use until about 1890, when the change was made from horse-drawn cars to electric cars. The mail-order field developed rapidly. Not only did mail-order houses spring up in large numbers during the period, but also business firms of all kinds developed a very extensive use of direct-mail material in the form of circulars, catalogues, letters and so on. The large mail-order houses commonly sent out twice a year upwards of 4,000,000 large catalogues in addition to numerous smaller departmental catalogues issued. Figures obtained in 1920 estimated the total approximate amount spent in direct-mail advertising to be $300,000,000; in 1926 the amount was greater, probably much greater.

Advance in Quality.—During the periods under consideration there was a distinct improvement in the quality of advertising. Methods of printing, typography, colour printing, art work and the like, greatly improved. Besides the mechanical improvements there were likewise distinct advances in such essential qualities as accuracy of statement and descriptions, reliability and truthfulness.

Increase in Variety of Uses.—A widening of the scope of advertising developed rapidly. There was a marked increase in the variety of advertising used. Perhaps the dominating types of advertising which flourished originally—that is, about the middle and latter half of the 19th century—were patent-medicine advertising and circus bills and in general much unreliable, dishonest and objectionable advertising. As developed there is hardly a business or type of commodity for which the printed word is not used as a means of selling. Banks and financial institutions of high grade turned to advertising, finding it profitable to employ in a dependable manner the methods which had been found profitable by unreliable financial houses. Advertising suffered because of the objectionable features which were so prominent in its earlier development. For this reason, undoubtedly, high-grade financial houses and to some extent other types of business were slow to take advantage of the possibilities which it offered. High-grade financial houses have a distinct responsibility to the community in guiding the savings of the people into the right channels. The unsound and unethical solicitor of investments has taken advantage of the use of the printed word, and has misdirected untold amounts into unsafe channels. High-grade institutions feel that it is perhaps a duty to use all legitimate sales methods equally effectively, thus guiding the investments of the community into proper channels.

Public service institutions use advertising to place themselves before the public in the proper light, to secure the co-operation of the community and to offer their securities to customers and to others. What is termed institutional or good-will advertising is widely used, not only by banking or similar institutions, but by large firms of all kinds, retail stores and manufacturers. Causes of one kind or another—local, national and international—use advertising to secure publicity and to gain adherents. Churches, charitable institutions, schools, educational endowments, public health bureaux, political parties, candidates and even governments find advertising a suitable and dignified means of publicity. In industrial disputes, employers and employees alike use advertising as a means of influencing public opinion, securing sympathy and moral support.

Trade Marks.—The development of trade marks is likewise a conspicuous characteristic of the periods mentioned, particularly of the first quarter of the 20th century. A large proportion of the trade marks known throughout the United States and all over the world developed during this time. Of the somewhat more than 150,300 valid trade marks registered in the U.S. Patent Office up to 1922 practically none were used prior to 1870, and only a small handful go back to 1885 or 1890. The development of national and international business made trade marks virtually a necessity; and advertising became an important means, perhaps the chief means, of making them known to the public.

Volume of Advertising.—Advertising in 1926 played an important rôle in the operation of business. It assumed such large proportions that it is difficult to estimate its magnitude and to calculate its exact place in commercial affairs. We may gain some notion of its immense proportions from the amount of money expended and from the amount of space used each year for printed advertising in the United States. It has been estimated that in the neighbourhood of a billion dollars is spent annually for this purpose. Approximately $500,000 is spent annually for advertising any one of a score or more of well-known commodities, as high as $3,000,000 and $4,000,000 being spent in exceptional cases. Or we may gain a concrete idea of the immensity of advertising from the cost of space for single advertisements in some of the leading media. Thus, for example, a page in a well-known monthly magazine in a single issue may cost $350, and the back outside cover $800. A page in a well-known weekly publication would run to $7,000, and the back outside cover $12,000. A page in the large metropolitan newspapers cost as high as $1,400 to $1,500. From still another angle the immensity of advertising is indicated by the fact that from two-thirds to three-fourths of the cost of maintaining a newspaper or a magazine comes from its advertising space.

The outsider naturally wonders whether advertising with such high rates for space can really be a profitable aid in selling; or whether it may not be an expensive luxury indulged in by large business concerns. The extent to which advertising plays a justifiable rôle in the distribution of goods is an important and intricate problem which must be dealt with in any important consideration of the subject.

III. ADVERTISING IN BUSINESS

There often occurs in the mind of the layman the thought: Is not advertising an economic waste? Two common opinions with regard to advertising, which are held by a considerable number of people, are that enormously large sums of money are expended for it, and that much of this expenditure must be an economic waste. Rumours are spread about that a page in this magazine or in that newspaper costs so many hundreds or thousands of dollars for a single issue. Or it is learned that the manufacturer of a certain breakfast food spends so many thousands or perhaps so many millions of dollars for advertising in one year. The inference at once is that the consumer must pay for it in the form of a considerably higher price than the breakfast food or the soap or the suit of clothing would otherwise cost. These impressions usually do not get at the fundamental functions which efficient advertising performs in the distribution of goods.

There are wastes in advertising, but there are wastes everywhere in production, in distribution, in personal selling. Economy in the distribution side of business has lagged behind, but distinct advances have been made. Probably the chief sources of waste in advertising are:—

(1) The lack of proper co-ordination between advertising and the other phases of a business—lack of co-ordination with distribution, personal sales, plans and production—advertising where there is no distribution, and the like.

(2) The use of inefficient methods—weak, unconvincing and ineffective appeals, poor presentation, ineffective technique, the use of too large space or too small space due to guessing instead of finding the facts on which to build and plan. It has been estimated that if every piece of advertising material were made 10% more effective it would mean a saving of $100,000,000 to the business interests of the United States.

(3) The use of advertising for commodities in circumstances in which returns are highly uncertain or for business ventures which are too hazardous.

(4) The excessive use of advertising in over-keen competition.

(5) The failure to make all advertising literally truthful and dependable. Even if 96% or 97% of advertising were in the main trustworthy and meritorious, the remaining 3% or 4% would weaken the effectiveness of the rest.

(6) The use of advertising for illegitimate business, highly speculative investments, financial frauds or for commodities of doubtful value or actually injurious to mankind.

Improvements are proceeding in all these directions. Fundamentally, these sources of waste are not peculiar to advertising, but due to the waste and inefficiency in business as a whole. The same sources of waste exist in oral selling—making plans on guesses instead of on facts, not being literally truthful and dependable in every instance, a lack of proper co-ordination with other phases of a business, the waste of time on the part of salesmen and excessive personal expenditure. Preliminary time studies show that the average salesman uses only about 15% to 50% of his working time in actual selling. Fundamentally these wastes in oral as well as in printed selling are not to be laid upon these two aspects of business, but are due to conditions in business as a whole, to mistaken judgment, to ignorance and moral weakness.

The Case against Advertising.—The actual total amount of money spent on advertising is large. The probable amount spent in the United States in one year is in the neighbourhood of one billion dollars. The question is, Who pays for it, and how much different would the price of commodities be if this expenditure were absolutely and entirely eliminated, and in what way would the methods of distribution and the cost of distribution be different? The critic assumes that this money is an economic waste and that prices are higher because of it.

A second argument is that advertising has considerably increased the demand for, and the purchase of, luxuries and semi-luxuries, such as cameras, beverages, automobiles, pianos, phonographs, vacuum cleaners and so on.

A third argument is that advertising has been responsible to a considerable extent for the increasing and widespread use of packages, cartons, wrappers and labels for a large variety of products. Advertising has been responsible to a very large extent for the development of standardised brands and trade-marked articles. These wrappers and containers cost money which supposedly is not a part of the price paid for commodities bought in bulk. The argument is that all of this expenditure is added to the price of the product.

Relative Cost.—It is found that the amount actually spent for advertising specific commodities differs widely from the amount which the average person thinks is spent for advertising specific products. Almost every person who makes a general statement that the prices of commodities are higher because of the advertising, or that the money expended for advertising is wasted, knows little about the actual facts of the relative amount of money expended for advertising a specific commodity. People quite generally have a greatly exaggerated notion of the amount of money spent for printed advertising. An investigation was made to determine the amount which people think is spent for advertising certain commodities. The results of the investigation showed that people generally over-estimate from four to five times the amount spent for advertising specific products. For example, the amount spent for advertising a package of breakfast food retailing at 15 cents was estimated by this representative group of persons as two cents, whereas the actual amount spent by the manufacturer of this food for advertising a single package was three-tenths of a cent, an over-estimation of about eight times. The average person believes that approximately five times as much money is expended for this purpose as is actually the case.

Averages of expenditures for advertising by a considerable number of firms in various lines of business show that actual figures are relatively small. Figures obtained by the Harvard Bureau of Business Research, and based on a considerable number of stores in each case, give the percentages of net sales expended for advertising for the years 1919 and 1920 in several lines of business. The accompanying table furnishes the percentages.

Percentages of Net Sales Expended for Advertising, 1919 and 1920, in Retail Stores

		Common Figure[1] %
	General stores	0·2
	Retail groceries	0·2
187	Retail drug stores (1919)	0·7
130	Retail shoe stores (1919)	1·3
397	Retail shoe stores (1920)	1·9
182	Retail jewellery stores (1920)	2·0
190	Retail jewellery stores (1921)	2·5
266	Department stores (1920)	2·0
301	Department stores (1921)	2·4

The average expenditure for advertising on the part of retailers is approximately 2% or less. Certain types of stores, in particular department stores, expend over that amount, and, on the other hand, a very considerable proportion of retailers spend under that amount. Figures supplied by reliable sources show that the amount spent by manufacturers for advertising is from 2% to 3%, and that therefore the expenditure for advertising as a whole is probably not over 4% to 5%. It is therefore evident that while the total expenditure for advertising runs into large figures, the relative expenditure in proportion to the cost of a commodity is small. In other words, if advertising played no part whatever in stimulating the sale of commodities, and if the cost of advertising were therefore directly added to the price of a commodity to the consumer, the price of an article would be almost inappreciably higher than it now is. An article selling at $1.00 would have to be sold at $1.04 or $1.05 if advertising were purely a dead expenditure of money. Although the actual expenditure for advertising is relatively small—probably not over 4% to 5% in the aggregate—even this expenditure would be a serious waste if it produced no economic or social value. The 1% to 2% spent by retailers, or the 2% to 3% spent by manufacturers, would in many instances serve to make the difference between success and failure.

Effects of Advertisement.—In 1925 a National Distribution Conference was held in Washington under the auspices of the Chamber of Commerce of the United States. The report of the committee appointed to investigate "Market Analysis—Advertising and Advertising Mediums," gives some information with regard to the point just brought up. The investigation consisted of a survey of articles which had appeared in publications, giving specific data about the effects of advertising on costs and prices to the ultimate consumer; and in addition of a questionnaire which was sent out to a group of national advertisers, requesting specific data showing the effects of their advertising on their costs and prices. The results were tabulated and summarised in part as follows:—

> From the data available it is hardly possible to make a non-disputative demonstration. Nevertheless, we believe that it can safely be said that the use of effective advertising by national distributors as a general rule produces one or more of the following results:—
>
> (1) Decreases the cost of selling.
> (2) Lowers the cost of production on account of increased volume.
> (3) Lowers prices to the consumer and thereby raises the standard of living.
> (4) As a by-product, aids in the education of the general public.
>
> Data have been obtained from a number of national advertisers to show the effects advertising has had upon the cost of production and the cost of selling, and prices to the consumer. It is realised that changes in business conditions during the past few years and changes in distribution policies within the individual companies make it very difficult to eliminate the variable factors and to prove the effects of advertising. The data which have been collected, however, seemed to indicate conclusively that the first three results named above are brought about by advertising. . . .
>
> In addition to the four results obtained by advertising which have been mentioned above, advertising often has the following beneficial effects for the manufacturer, dealer or consumer:—
>
> (1) Advertising aids in stabilising production.
> (2) Advertising aids in standardisation and quality.
> (3) Advertising aids in the simplification of products. (Elimination of unnecessary items in the line.)
> (4) Advertising helps to prevent fluctuation in prices.

Summary of Advantages.—A beneficial effect of advertising has been the reduction of seasonal fluctuation in the volume of business. In certain fields of business, the seasonable fluctuation, if not entirely eliminated, has been greatly reduced. The two seasons of buying men's clothing have been greatly extended, and the sale of toys, formerly largely confined to the holiday season, is more evenly distributed throughout the entire year. The same is true of fountain pens, millinery, arms and ammunition, oranges and lemons and other products. The result has been a reduction in the cost of doing business.

Advertising has aided materially in the standardisation of products and quality of goods. This has been brought about through the establishment of brand names and trade-marks, which have become associated with uniform quantities and qualities in the mind of the public, until the recollection of a brand name of any number of specific products calls up the picture of a certain definite quantity and a certain recognised standard of quality, which the public has been educated to receive when it calls for a product by a specific trade-name. Although the establishment of standard packages has probably added to the cost of commodities to some extent, it has had certain other advantages. It has facilitated retailing, requiring less time on the part of assistants in the preparation of products for delivery to the consumer, and it has secured a more hygienic handling of goods, particularly foods.

The noteworthy advances made in the general level of living, in public taste, in personal and domestic conveniences, in the general use of cultural agencies, must be attributed in part to the use of the printed word in the form of advertising. Such products as phonographs and radios and the development in musical taste generally, vacuum cleaners, better-fitting clothes, better-constructed and designed houses, better-painted houses, evidence the advance made in the level of living, due in a considerable measure to the insistent and continuous force of advertising. There is no doubt that we should very likely have most if not all of these improvements and conveniences without advertising, but probably not so many people would have had them so soon. Printed publicity has no doubt helped to educate people to want more and better things in food, clothing, housing, personal comfort and enjoyment.

The almost universal reading of magazines and newspapers has been made possible largely, if not solely, through advertising, since approximately three-fourths of the income of a periodical is derived from its advertising space. In this sense, the newspaper or magazine is practically a by-product of advertising. The trifling sum which is now charged for a newspaper or magazine—in comparison with the large sum which such magazine or newspaper would cost if it were not for the advertising which it carries—has made some form of reading matter available to even the poorest classes of persons. Advertising revenue has made possible the large-scale production of newspapers, magazines and periodicals of all kinds the social and educational value of which is beyond estimate.

It seems to have been found from experience that some products may be sold most economically primarily through personal salesmanship, that some products may be sold to certain classes of people most economically primarily through printed salesmanship, but that probably the great majority of products may be distributed most economically by varied proportions of personal and printed selling. So long as competition is believed to be a desirable factor in human welfare, just so long will competitive means be used. Critics of advertising perhaps may neglect the fact that if advertising were eliminated or abolished other competitive methods would necessarily be substituted for it. If the use of advertising were eliminated, it is quite likely that its place would be taken in most instances by some form of personal selling, with its accompanying expense. The fact that numerous firms which have consistently and continuously used printed salesmanship over a long period of years have survived from early periods of business activity may be taken as some indication that advertising has been found to be a fairly effective agency of business progress. (D. St.)

IV. BRITISH AND EUROPEAN ADVERTISING

The conditions under which advertising is conducted in Great Britain and other European countries differ in many directions from those prevalent in the United States. For this reason British practice diverges in certain important respects from American practice. Both advertising as such, and the newspaper, appeared slightly earlier in Great Britain than in the United States. The first advertisements published were handbills for the sale of goods, printed by Caxton late in the 15th century.

The first daily newspaper printed was *The London Gazette*, founded in 1665, which is still published. But Nathaniel Butter had produced his historic *Weekly Newes* in 1622. Probably the first trade advertisement to appear in a newspaper was one advertising tea, published in *Mercurius Politicus* in 1658. The great national newspaper, *The Times*, was first published in 1678 as *The Daily Universal Register*. Quite a number of existing provincial newspapers, including *The Nottingham Journal*, *The Bristol Times and Mirror*, and *The Hereford Journal*, were founded between 1710 and 1713.

Fifty years later, Dr. Johnson was complaining that advertisements were "so numerous that they are negligently perused: it is therefore becoming necessary to gain attention by magnificence of promises and by eloquence, sometimes sublime and sometimes pathetick." So early as 1712 a duty was placed on advertising. For many decades it yielded the Exchequer little revenue. In the 19th century, however, it had become a valuable source of income. The tax amounted at first to 1/- on each advertisement. In 1815 it was raised to 3/6, and in 1833 it was reduced to 1/6. In June 1853, the advertisements carried in *The Times* averaged 1,500 each day; and in one day in June there were 2,250 inserted—the greatest number that had ever appeared in one paper. The duty on advertising was finally repealed in 1853.

Generally speaking, advertising did not make any great headway in Great Britain until about the year 1850. Modern advertising came into existence about 1890, while the organisation of advertising entered its national phase only in the year 1920. The introduction of research methods dates from about the same year. At every stage of development Great Britain has tended to follow 10 to 20 years behind America, while other European countries tend to lag behind British development and practice by an even wider margin. Between 1920 and 1926 British advertising entered on a period of intensified activity. In these years standards of practice were improved enormously. The national organisation of advertising was not merely initiated but developed with remarkable energy.

Expansion of British Advertising.—Some idea of the expansion of advertising in Great Britain may be gathered from a few figures based on extensive researches. There were in 1926, 2,150 individual newspapers published in Great Britain, and roughly 1,500 journals and magazines. Whereas in 1900 there were scarcely 100 advertising agencies existing in Great Britain, no fewer than 500 agencies were in active business in 1926. In the same year 340 national and regional bill-posting contractors were at work; 67 firms engaged in outdoor publicity of other types; 168 firms in sign writing and in window dressing; and almost 400 in the making of cartons and containers. There are over 50 commercial art studios in London and the provinces; 39 commercial photographers; and several hundred free-lance commercial artists. All these concerns and individuals give service to the advertiser. At the same time, seven concerns and individuals devote their energies to market research—a service which had scarcely been heard of in this country prior to 1920. Expansion has been no less remarkable in the colonies.

Influence of Conditions on Practice.—The divergence between American and British advertising methods may be seen clearly by considering a factor which influences marketing practice in every country, viz., transport. Transport finally determines the distribution of the various advertising media. In the United States the distribution and influence of the newspaper is purely local. In Great Britain the distribution of the London newspaper is national. This makes it possible for the advertiser to broadcast his message from one end of the country to another in 24 hours. Since distances in Great Britain are comparatively short, and since several of the great London newspapers print simultaneously in London and a northern city (Manchester or Leeds), complete national distribution of a paper printed on Monday evening is secured by Tuesday morning. Circulations and advertising rates must be correspondingly high.

Circulation.—The circulation of the best American daily newspapers was in 1926 roughly 200,000 to 600,000; the price of a page advertisement usually ranged from £200 to £300. In the same year the circulation of *The Daily Mail*, on the other hand, was over 1,700,000, and the price of the front page £1,400. *The Times* achieved the remarkable revenue of £5,000 per day. One popular Sunday newspaper actually exceeded all American circulations. *The News of the World* was bought weekly by over 3,000,000 readers, the page rate being normally £2,200. The magazines of Great Britain do not represent, therefore, as American magazines do, the sole means of securing national circulation, nor have they so large a population to tap. Yet the unique humorous journal *Punch* with a circulation of over 200,000 copies, carried over £8,000 worth of advertising every week. *Good Housekeeping*, a successful associate of the American journal of that name had an average monthly revenue of over £12,000, while its Christmas numbers carried over £18,000 in advertisements.

Mail Order Business.—Owing to the compactness of the country and the transport facilities available a second variation occurs. The British public is much less susceptible to mail-order advertising than the American. The spread of motor-bus services to the remotest hamlets may have had much to do with this. The shop window has been brought within reach of the secluded rural populations. The United States Post Office made it easy for the mail order advertiser by collecting the amount of the purchase through its postmen. On the other hand the mail order advertiser in Great Britain, had until 1926, to bear the expense of collection by post, as it was not until March of that year that cash on delivery was introduced. Further, facilities for securing lists of prospective buyers, graded as to income or trade, did not exist in English cities. It was impossible to buy what are known in America as lists of tested and guaranteed names. Nor did the postal authorities assist by charging low rates for the carrying of sales literature.

Scarcity of Statistics.—Two further factors tended to make all advertising in Great Britain or in other European countries more of a "hit or miss" business than in the United States. The first of these was the absence of statistical data on which to assess the market available for any goods either in terms of what competitors are doing or of the consuming public concerned. The British Board of Trade, in particular, reduced its statistical records to the barest minimum. The taking of a new census of production, which must be the basis of all sound market estimates, was delayed by the World War and had had its potential value considerably reduced by the disinclination of manufacturers to give certain essential facts concerning their output.

The United States Govt., on the other hand, made advertising more scientific by presenting to the advertiser the finest statistical material available in any country. When the report by the Bureau of Efficiency on the statistical work of the United States Govt. was completed in 1922 it ran to more than 400 pages. A condensed report, published later, gave no fewer than 700 subjects on which that government compiled statistics, with details as to where and how to secure the facts.

Unless statistics of production are made available annually or bi-annually; unless sales records are obtained from every considerable industry; unless exhaustive researches into the consumer habits are made in every area, it is not possible for the British advertiser to approach the scientific accuracy or the technical skill of the American. Finally, the British public, being homogeneous and speaking one tongue, is less accessible to the magic of the printed word. In other words, it is more sophisticated. Added to this sophistication is a keener buying sense, particularly on the part of women, due chiefly to the possession of a shorter purse.

The resulting influence of all these factors is remarkable. It must mean too often that an advertising campaign successful in America fails completely in Great Britain. A reconsideration of the marketing and advertising channels available is necessary, along with a modification of copy, illustrations and methods generally, if advertising is to achieve its purpose in Great Britain or in any other part of Europe.

Law.—Up to 1926 no act had been passed in Great Britain corresponding to the Printers' Ink model statute formed in 1911 by *Printers' Ink* and passed in a large number of American states. On the other hand, no such general statute seemed necessary, since many of the interests of the advertiser and of the reader of advertisements were already protected in English law by existing statutes; while a body of case law was being built up by test cases in the King's Bench and Chancery divisions of the High Court of Justice. The Indecent Advertisements Act (1889) made it a punishable offence to exhibit or deliver advertisements of an indecent nature. Later rulings confirmed the fact that, under the Advertising Station (Rating) Act (1899), ground used for advertising is rateable.

Legislation was certainly required to define the extent to which the statements in an advertisement may be binding on the advertiser. In an important case (Carlill *v.* the Carbolic Smoke

Ball Co.) a preventive against influenza was advertised, and the makers stated in print that if anybody using the carbolic smoke ball as directed caught influenza within a certain number of days they would pay him £100. The plaintiff used the remedy, and contracted influenza, winning the sum of £100 as the result of his suit. Under English law any statement of a specific fact as to the quality or nature of an article in an advertisement amounts to a warranty, the breach of which gives rise to a right of action. As evidence of this we may take the case of a gunsmith who advertised a gun of first-class quality capable of reasonable wear and tear for several years. When the gun was first used it burst and injured the plaintiff, who successfully brought an action against the vendor for fraud in inaccurately describing the gun.

The position of the advertiser under the Copyright Act (1911) was, in 1926, still the subject of litigation. Perhaps the most important ruling on the subject was that of Lord Romilly:—

> Copyright exists in published books, periodicals, pamphlets, prints and designs. If you copy the advertisement of another you do him no wrong, unless in so doing you lead the public to believe that you sell the articles of the person, whose advertisements you copy. Wherever the letterpress bears the traces of original composition it is entitled to protection, but not where it simply describes the contents of a warehouse, the exertion of the proprietor or the common mode of using familiar articles.

In general it may be said that the plaintiff must prove damage in a British court of law in order to prove that a competitor has transgressed the law by imitating an advertisement or design.

Organisations.—The organisation of British advertising on a national scale was first actively undertaken in the year 1920. The stimulus to action probably lay in the great advertising exhibition held at the White City, London, in that year, which first brought all the advertising interests together for common action. Soon after the holding of this exhibition British advertising men began to attend the annual conventions of the Associated Advertising Clubs of the World in America. As the result of these visits, it was decided to hold the convention of 1924 in London. About this time most of the chief advertising bodies in Great Britain became members of District 14 of the Associated Advertising Clubs of the World.

In Jan. 1926, District 14 of the Associated Advertising Clubs of the World became the Advertising Association of Great Britain. This body had on its committees representatives from all the advertising interests in the country. Under its auspices annual advertising conventions are held. As a result of these conventions, an impulse has been given to every phase of advertising in Great Britain. In particular the club movement has grown up throughout the provincial cities. In 1926 there were over 20 advertising publicity clubs affiliated to the Advertising Association. These clubs decided to meet together frequently for discussion on technical subjects connected with advertising; they undertake arrangements for the local delegates attending the annual convention of the Advertising Association, and do much work of an educational character both within their own ranks and among the outside public.

Probably the advertising club movement in Great Britain is the most remarkable instance of craft interest shown by any industry or profession. The clubs included the Women's Advertising Club of London, whose membership was to be confined to women in executive positions. It is to the clubs that the success of the annual advertising conventions is largely due. In 1920 there came into being the Incorporated Society of British Advertisers. This body was designed to safeguard the interests of the advertiser, its general objects being to increase sales at reduced costs of selling; to make advertising a more profitable proposition; to make collective expression and action possible to advertisers.

The association corresponded exactly with the Association of National Advertisers of America. Following two conferences with representatives of the latter body, it was definitely decided in 1924 that the Incorporated Society of British Advertisers should make its organisation as nearly as possible an exact counterpart of the Association of National Advertisers of America. The association represented directly nearly 300 national advertisers, and, through the affiliation of trade organisations, over 2,000 firms which advertise. The association had on file all procurable information regarding upwards of 6,000 publications of interest to national advertisers. It campaigned consistently for the institution in Great Britain of an audit bureau of circulation, but hitherto without immediate success.

Advertising Agencies.—Advertising agents were represented by the Association of British Advertising Agents, of which nearly all the leading agencies in Great Britain became members. It was registered as an Incorporated Company in 1917. The definition of an "advertising agent" laid down by the association is as follows: "Accredited advertising agents are independent persons, firms or companies of good repute and training, engaged solely in the advertising agency business and possessing the equipment and organisation necessary for the carrying on and development of advertising."

Advertising agents are usually remunerated by a commission on the appropriation, ranging up to 15% according to the size of the appropriation and the amount of work entailed. This commission is usually provided by the special agency commission allowed to recognised advertising agents by newspapers and periodicals. Important papers and groups of papers have lists of recognised agents, and do not allow advertising agents' commission to firms who have not first been placed on their list. The policy of the Association of British Advertising Agents was directed to encourage its members to improve the service which they were able to offer to their clients and to make the minimum agency remuneration 10%, below which figure the association did not consider it possible for an advertising agency to render adequate service to its clients.

The Scapa Society.—Possibly the most characteristically British movement associated with advertising was one to restrain its activities. This was the Scapa Society, formed in 1893 as "the society for checking the abuses of public advertising." The association was concerned with advertising only where the display injuriously affected the amenities of outdoor life. In 1907 the society secured the passage of the Advertisements Regulation Act, and in 1925 of a supplementary Act. The original Act authorised local authorities to make bylaws for the control of hoarding over 12 ft. high, and for the regulation or prohibition of advertisements affecting the amenities of a public park, pleasure promenade or landscape. The extended powers included some for the protection of the view of rural scenery from a railway or highway, the amenities of any village within the district of a rural district council, and those of any historic or public building or monument.

A remarkable evidence of a fine spirit on the part of the advertising profession was the way in which great advertisements were withdrawn by mutual agreement between the Scapa and those concerned. The association virtually abolished the sky sign. In 1923 three great oil and tyre concerns removed their roadside advertisements in deference to the desires of Scapa. The fraudulent advertiser is dealt with by a National Vigilance Committee, under the auspices of the Advertising Association.

(C. Ch.*)

ADY, ENDRE (1877–1919), Hungarian poet, was born Nov. 21 1877 at Ermindszent, Transylvania. He was a leader of the modern school and one of the greatest lyrical poets of Hungary. During his youth he lived in the country and became intimate with the publicists and politicians of the Radical and Socialist parties. When he settled down in Budapest, he turned his attention toward revolutionary politics and contributed to several Radical papers. He also made prolonged visits to Paris and the Riviera but returned finally to Hungary owing to ill-health, and lived there quietly until his death on Jan. 27 1919. During the World War he adopted a pacificist attitude and prophesied the Karolyi revolution of 1918. During his lifetime he published about 20 books, poems, novels and essays, but this number was increased year by year by the publication of posthumous works.

Bibliography.—Jean Horvath, *Ady* (Budapest, 1910); Paul Gulyas, *Ady* (Budapest, 1925); L. Hatvany, *Das verwundete Land* (Zürich, 1921); articles in the *Revue de Genève* (1922 and 1924).

AE: *see* RUSSELL, G. W.

AEHRENTHAL, ALOYS LEXA VON, COUNT (1854–1912), Austro-Hungarian statesman, was born Sept. 27 1854 at Gross-Skal, Bohemia. In 1899 he became ambassador in St. Petersburg, where he remained until his appointment as Foreign Minister in October 1906. Determined to preserve the interests of Austria-Hungary in the Balkans, he also showed himself willing to meet the Russian wishes on the Dardanelles question. After the outbreak of the Young Turk revolution in 1908, he negotiated, in accordance with his previously conceived policy, with Isvolski, an agreement for the annexation of Bosnia and Hercegovina to Austria-Hungary and for the opening of the Dardanelles to Russian warships.

Isvolski's proposals were, however, wrecked by the opposition of Great Britain, and he protested against the annexation of Bosnia and Hercegovina; Aehrenthal, therefore, abandoned the idea of a friendly accommodation with the Russian Government. He held, however, with tenacious energy to his purpose with the result that the annexation was acknowledged by the Powers; an agreement was reached with Turkey; Serbia, after long hesitation, was obliged to submit. For this achievement Aehrenthal was rewarded by the rank of Count (Aug. 18 1909). He held fast by the Triple Alliance, as the surest bulwark of peace, and sought to form the most intimate relations with the German Empire although he insisted on the independence of the Habsburg Monarchy and energetically repulsed all efforts on the part of the German chancellery to set limits to that independence.

One of his most difficult tasks was to adjust the ever-recurring conflicts with Italy, who, while officially supporting the political action of the Triple Alliance, often embarked on courses directly opposed to the interests of Austria-Hungary. A succession of agreements which he concluded with the Italian Foreign Minister, Tittoni, justified his efforts, and enabled him to maintain correct relations with the Italian Government. Yet, by the maintenance of his peace policy, which had the full approval of Francis Joseph, he came into serious conflict with the party led by the chief of the general staff, Conrad von Hötzendorf, which championed an energetic, warlike policy. The battle, carried on with tenacious endurance on both sides, ended in 1911 with the victory of Aehrenthal and the resignation of Hötzendorf. Aehrenthal died Feb. 17 1912 in Vienna.

See B. Molden, *Alois, Graf Aehrenthal: Sechs Jahre auswärtiger Politik Oesterreich-Ungarns* (1917); The article "Aehrenthal" in the *Deutsche Nekrologer* (vol. 18, 1917, pp. 230 *et seq.*); A. F. Pribram, "Der Konflikt Conrad–Aehrenthal" *Oesterreichische Rundschau* (August 1920). (A. F. PR.)

AERIAL LAW.—Aerial law must be considered under its two headings, international (subdivided into peace and war) and national The international law of the air in peace is to be found in the (multilateral) Air Navigation Convention of Oct. 13 1919, and in the (bilateral) agreements which certain states have concluded as between themselves. The international law for war is not the subject of any general convention; the few references to air warfare in the conventions and declarations of The Hague of 1899 and 1907 are now obsolete. The national or municipal law of the air is to be found in the statutes, decrees and regulations of the various states.

The Convention of 1919.—The Air Navigation Convention, 1919, the present parties to which are the British Empire, Belgium, Bulgaria, Czechoslovakia, France, Greece, Italy, Japan, Persia, Poland, Portugal, Rumania, the Serb-Croat-Slovene State, Siam and Uruguay, begins by affirming the sovereignty of each state over the air above its territory. This principle affirmed, the convention goes on to provide for freedom of innocent air passage over the territory of the contracting states for each party to the convention, provided the conditions laid down in it are observed. Such freedom of passage does not apply to "prohibited areas" which states may desire for military reasons to close to all private aircraft, including those in their own territory.

The "nationality" of an aircraft is made to depend upon the country in which it is registered; to be registered in a particular state the aircraft must belong to a national of that state or to a company of which the chairman and two-thirds of the directors possess that nationality. Double registration is prohibited. Every aircraft engaged in international navigation must possess a certificate of airworthiness issued or rendered valid by its state of nationality, and the pilot and other members of the crew must be provided with certificates of competency and licences similarly issued or validated. The documents (certificates, licences, log-books, passenger lists, manifests) which aircraft must be provided with are laid down.

Foreign aircraft may be required to land at aerodromes fixed by the state whose territory they enter; and each state has the right to reserve in favour of its national aircraft the carriage of persons and goods for hire between any two points in its territory. Provision is made for the rendering of assistance to aircraft in landing or in distress, for the application, to aircraft wrecked at sea, of the principles of the maritime law of salvage, for the use of aerodromes at a common tariff of charges, and for certain other matters. The convention is not applicable to military aircraft nor to state non-military aircraft employed on customs and police service; other state aircraft, *e.g.*, postal, are subject to its provisions. A military aircraft is defined as one commanded by a person in military service detailed for the purpose, and such an aircraft may fly over another contracting state's territory only in virtue of a special authorisation.

Rules in regard to the marking of aircraft (to show nationality and identity), certificates of airworthiness, log-books, lights and signals, "rules of the road," licensing of personnel, aeronautical maps and ground markings, the collection and dissemination of meteorological information, and customs procedure, are contained in annexes to the convention.

International Commission.—A permanent International Commission for Air Navigation, composed of representatives of the contracting states, is established and charged with certain powers, including the amendment of the annexes, the receipt or initiation of proposals to amend the convention itself and the inter-communication of information affecting air navigation, etc. The office of the secretary-general of the commission is at 20, Avenue Kléber, Paris. The convention may be denounced by one year's notice. States which did not take part in the World War may adhere to it at any time; those which took part in the War may adhere under certain specified conditions.

Other Arrangements.—A number of important Powers, it will be seen, are not as yet parties to the convention, and international air traffic is regulated, so far as they are concerned, by a series of special agreements between themselves and with other states. The terms of these agreements are in general conformity with those of the convention. The obstacle to a more general acceptance of the convention has been, first, the provision therein forbidding contracting states to permit, except by special and temporary authorisation, the flight above their territory of the aircraft of non-contracting states; secondly, the "weighted" vote which was allowed to the British Empire, France, Italy and Japan. Protocols of amendment of both these provisions have been signed but, not having been ratified by all the parties, are not yet in force.

The convention of 1919 does not bind the contracting parties as belligerents or neutrals (though it would continue to apply in war as between two neutrals), and an attempt to frame a corresponding code for war was made at The Hague in 1923. A commission of jurists, representing the United States, Great Britain, France, Italy, Japan and The Netherlands, under the chairmanship of Judge Bassett Moore, drew up rules which, though they have not been embodied in a convention, are a valuable indication of international opinion, as it stood in 1926, upon the law of air warfare.

The municipal legislation which has been passed to regulate internal flying and to give effect to the international obligations of each country under the convention of 1919, or the separate bipartite agreements, is contained in laws, decrees, ordinances and regulations of many different kinds. It is of great volume and any full survey of it would be impossible here. An indication of its general scope and one or two of its more important features is all that can be attempted.

National or Municipal Legislation.—One usually finds in such legislation (*lato sensu*) provisions for ensuring the safety of air navigation as affecting both air travellers and the general public; provisions, that is to say, for registration and certification of aircraft, licensing of personnel, inspections and tests precedent to such certification and licensing, maintenance and overhaul and renewal of certificates and licences, inspection, licensing and use of aerodromes, carriage of explosives and arms, dropping of articles in flight, jettison of cargo, minimum height of flight over populated areas, investigation of accidents and so on. For defence reasons "prohibited areas" are usually defined, and in many cases corridors of entry for foreign aircraft are prescribed, as well as the general conditions in which such entry is allowed; and the carriage of radio apparatus and cameras is usually restricted. Conditions for the grant of concessions for the operation of commercial air lines and the establishment of international airways are occasionally included. Penalties (fine, imprisonment, suspension of licence) for the infringement of the rules are invariably laid down.

Liability for Damage.—The important question of liability for damage occasioned by aircraft to persons or property on the ground is legislated for in many of the codes. In the absence of special provision the liability of the owner or pilot would be dependent ordinarily on proof of actual negligence or intention. Proof would often be very difficult to obtain and hence it has generally been considered equitable to impose upon the owner or pilot an absolute liability to pay compensation for all such damage, save in so far as he can show that the person damnified was himself to blame. It is also sometimes provided that the owner of an aircraft, or the organisers of an air navigation company must cover themselves by insurance against possible claims for compensation or else must deposit security that will be sufficient to cover their liability.

Occasionally it is provided that legal relations between parties on board a foreign aircraft in the air are governed by the law of the aircraft's nationality, *i.e.*, the country in which it is registered. The French law qualifies such a provision by adding that a crime or misdemeanour committed on board a foreign aircraft is within the competence of the French courts, if the guilty party is a French national, or if the aircraft lands in France after the occurrence of the offence. (J. M. Sp.)

Conference of 1925.—The International Commission for Air Navigation, like other specialised organisations of the League of Nations in their several spheres, by its debates and by its labours will be able to give form to the new principles of air traffic regulation and to evolve the international aerial law of the future, all the more surely when all the states concerned participate in this work.

In Oct. 1925, after only a few years actual experience of international air traffic, at a conference in Paris of the European and certain other governments, a draft convention was framed regarding the responsibility of carriers by air which is the counterpart, so far as concerns air traffic, to the Berne Convention of 1890 on transport by rail. An international committee of experts is to continue the work of this first conference, and to study a series of questions, connected with unification of private law, of the very greatest practical importance for the development of air traffic, such as damage caused by aircraft to property and persons on the ground, compulsory insurance, establishment of air registers, rights of property and ownership, mortgages in respect of traffic by air, etc. Air law is already grappling with the practical problems which arise owing to the advance of technical science and commercial organisation.

There are in existence permanent international bodies to coordinate the efforts of the governments concerned and at the same time to keep in touch with the requirements of those engaged in the traffic. A system of law will thus develop progressively by the solution of individual questions, perhaps, without being guided by preconceived principles. The true principles will be embodied in specific regulations which, many years hence, when air traffic has acquired a stable economic régime, will appear as the fruit of long and patient international co-operation in air matters—a co-operation as yet in its infancy. (R. Ha.)

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AERIAL NAVIGATION.—The practical development of the art of flying has reached the stage at which flights of several hundred miles, without landing, are of frequent occurrence. The Trans-Atlantic crossing made in 1919 with a Vickers-Vimy aeroplane, involved, in fact, a non-stop flight of 1,900 m. entirely over sea. In order that such long-distance flights may be made practically independent of meteorological conditions and devoid of the fortuitous element associated with pioneer effort, it has been considered important to enquire how far the existing methods and instruments used for maritime navigation may be applied to navigation in the air, and, where necessary, to devise new methods and instruments for aeronautical purposes.

The most elementary method of navigation is the recognition, either from maps or from previous experience, of the country over which the aircraft is flying; for this purpose, maps have been made which give prominence to railways, rivers and other objects conspicuous from aircraft. Maps are naturally of no assistance when the craft is flying over sea, desert or uncharted country; moreover, their use necessitates visibility of the ground over at least a considerable proportion of the air route.

Dead Reckoning Navigation.—The basic method of navigating an aircraft is known as dead reckoning (D.R.); other methods, such as the use of wireless beacons or the determination of the altitude of heavenly bodies, serve only to check the D.R. position. Dead reckoning necessitates that a record shall be kept of the speed of the aircraft over the ground and the "track," the latter being the actual direction along which the aircraft is passing over the ground. These values may be obtained from a knowledge of (*a*) the speed and direction of the wind, derived either by observation from the aircraft or from meteorological reports; (*b*) the true speed through the air, obtained by correcting the air-speed indicator for height; and (*c*) the compass course.

If a vector triangle be drawn such that one side represents (*a*) above, and another side represents (*b*) and (*c*), then the length of the third side represents the ground speed and its direction represents the track of the aircraft over the ground. Sometimes the third side of the triangle is found by taking observations of the ground, without first determining the wind speed and direction, but the latter values are always recorded, since, if they remain constant, the ground speed and the track may be found for any values of the air speed and compass course, without making further observations of ground objects. The ground speed may be determined by noting the time taken for a ground object, viewed through a "sight" set at the appropriate position on a vertical bar calibrated in terms of height, to appear to traverse the distance between two timing beads fixed on a horizontal wire which is set along the track of the aircraft. The distance between the two timing beads is made to represent a certain distance on the ground (usually ½ m.) over which the aircraft passes in the observed time.

The angle between the fore and aft line of the aircraft and the track is called the drift angle; it may be determined by observing the direction in which an object on the ground appears to move with reference to the fore and aft axis of the aircraft. If the aircraft were flying directly up or down wind, the drift angle would be zero. The true air speed being known, the wind speed and direction may be found, without timing a ground object, by observing the drift angle on two different compass courses, preferably separated by a fairly large angle.

Graphical construction cannot conveniently be employed in the limited accommodation afforded by an aeroplane cockpit and it is much preferable to solve the vector triangle by instrumental means. Moreover, it is but natural that, where possible, the means for observing ground speed and drift, and the mechanism for solving the vector triangle should be incorporated in one instrument.

INSTRUMENTS AND METHODS

The following are the most important of the instruments used for D.R. navigation. Each enables the ground speed to be determined in the manner described above, and incorporates means whereby the vector triangle may be solved on the instrument itself. They differ somewhat, however, in the method by which the drift is determined.

The Aero Bearing Plate.—In this instrument the drift angle is determined by sighting on a ground object ahead of the aircraft and turning a horizontal drift bar so that the ground object appears to move along the bar.

The Wind Gauge Bearing Plate.—This instrument enables the drift angle to be determined by taking tail bearings of objects over which the aeroplane passed some minutes previously. These observations cannot conveniently be taken by the pilot and a navigator must be carried.

The Course-Setting Sight.—In this instrument the drift angle is determined by sighting ahead. The incorporation of a compass and a link mechanism renders the operation of the instrument to some extent automatic.

Altimeters.—The most convenient method of determining the height of an aircraft above the ground is by the use of a form of aneroid barometer, known as an altimeter, which is calibrated in terms of height. The pressure on the earth's surface, due to the weight of the atmosphere above it, is well known to be less on a mountain than it is at sea-level. If, at any particular height above sea-level, the atmospheric pressure was invariable, its measurement would be an ideal means of determining height. The variation of the atmospheric pressure at ground level is, however, a matter of common observation; moreover, the decrease of pressure with increase of height is governed by the temperature distribution of the atmosphere. All altimeters are, therefore, set at zero when the aircraft leaves the ground, and, in future, are to be calibrated in accordance with a standard atmosphere, which has been adopted internationally. The standard atmosphere assumes that, at sea-level, the temperature is 15° C. and that the barometric height, reduced to 0° C., is 760 mm. of mercury. The decrease of temperature with increase of height is assumed to be 6·5° C. per kilometre. The altimeter, thus graduated, is sufficiently accurate for most purposes, and other possible methods, such as the timing of a sound wave emitted from an aircraft and reflected from the ground, have not yet shown that the greatly increased complexity of the apparatus and its use, is justified by additional accuracy, except, perhaps, at very low altitudes.

Speed Indicator.—The speed of the aircraft through the air, at any height, is deduced from the reading of an air speed indicator. This instrument has a diaphragm, the movement of which is controlled by the difference of pressure in two tubes, which are set parallel to the fore and aft axis of the aircraft, and as far as possible from the effect of irregularities of airflow due to the aircraft structure. One of the tubes registers the static pressure of the atmosphere by means of a series of small holes drilled circumferentially in the tube, whilst the other has an open end facing the direction of motion of the aircraft and registers the sum of the static pressure and the pressure due to the motion of the aircraft. The movement of the diaphragm is, therefore, due only to the kinetic effect of the movement of the aircraft relative to the air, and is a function of the product of the air density and the square of the speed through the air. Since, however, the air density decreases with increase of height, the reading of the air speed indicator must be multiplied by a factor depending upon the height in order to determine the true speed through the air. This is most conveniently performed by the use of a circular calculator fitted circumferentially round the dial of the air speed indicator.

The Aircraft Compass.—The desiderata of any type of compass are (*a*) that there shall be a datum line indicating a known direction; (*b*) that a restoring force shall be set up if the direction of this line is altered by some agency external to the system; and (*c*) that the oscillations natural to the system after a disturbance shall be damped. The magnetic compass is particularly suitable for aircraft, since these requirements can be provided without prejudicing lightness and simplicity. When first adopted for aeronautical purposes, however, it proved far from satisfactory, owing to the considerable oscillation of the needle in approximately straight flight and its apparently erratic behaviour on turns from north and south.

Northerly Turning Error.—The explanation of the latter phenomenon, known as the Northerly Turning Error, was given by Keith Lucas at the Royal Aircraft Factory. Except near the equator, a compass needle will not lie horizontally if pivoted at its centre of gravity and, in the latitude of London, a small weight must be added to the south end of the needle in order to balance the tendency of the vertical component of the earth's magnetic field to make the north end dip. If an aeroplane commences to turn from a northerly course, the effect of the centrifugal force on the unbalanced weight is to rotate the compass card in the same sense as that in which the lubber line of the compass is rotating in azimuth. If the angular velocity of the card is greater than the rate at which the aeroplane is changing course, the compass will indicate a turn in the opposite direction to that actually occurring. The unbalanced weight may be dispensed with by double-pivoting the compass needle so that it is horizontal when the aeroplane is level, but the Northerly Turning Error will still be present on a banked turn, since the vertical component of the earth's magnetic field will be unbalanced and the north end of the needle will dip unless the aeroplane is on an even keel. The error can be reduced by choosing a long period and a high degree of damping for the magnetic system; since, however, both these factors increase the time of settling down to the true reading after a displacement, there is a limit to the extent to which they can be employed as correctives.

The oscillations of the compass card, when the aeroplane is executing a series of small banked turns in approximately straight flight, is also due to the presence of the unbalanced weight. If the damping coefficient is low, and the periodic time of the compass is approximately equal to the period of the aeroplane oscillation, the amplitude of the compass card oscillation may be very large; but it has been found that if the damping exceeds 60% of that corresponding to a periodicity, the oscillations are small, whatever value the period of the aeroplane oscillation may have. Provided that its exact reading is disregarded during and shortly after a turn, and that it is not installed in close proximity to magnetic material, the magnetic compass is now sufficiently reliable for use in aircraft.

Effect of Steel.—The increasing use of steel in aeroplane structure and equipment would, however, appear to render inevitable either the installation of the magnetic compass in the tail of the aircraft or its substitution for another type, though probably not for all types of aeroplane. For one particular magnetic condition of the aircraft a simple and sufficient deviation correction may be made (*see* 6.805). If, however, any moving component is constructed of steel, or if, owing to vibration or other cause, the magnetic condition of the steel parts varies during a long flight, the reading of the compass may be quite unreliable. Installation of the compass in the tail of the aircraft would necessitate means for communicating the reading to an instrument fitted on the dashboard. One such device is the Selenium compass, which records whether the pilot is maintaining a predetermined course but cannot conveniently be used for taking bearings.

Earth Inductor Compass.—Another instrument, the earth inductor compass, developed in America, depends upon the measurement of the electromotive force induced by the earth's magnetic field in a coil rotating about a vertical axis. One development of the principle utilises an armature rotated by a cup anemometer, the current being collected by four brushes so connected to a galvanometer on the dashboard that a null reading is given when the pilot is flying on a predetermined course. An advantage of this instrument consists in its having practically no "memory," *i.e.*, the compass behaves normally almost immediately after a turn. It weighs much more than the magnetic compass, however, and suffers from lack of sensitivity.

The Gyro Compass.—Another possible alternative to the magnetic compass is the gyro compass (*see* GYROSCOPE), which is now being used for the navigation of large ships. It is improbable, however, that the type suitable for maritime navigation will ever be employed on aeroplanes. An alternative type, which may well prove suitable for aeronautical purposes, has been made by S. G. Brown. In this instrument no means are employed whereby a restoring force is set up if the direction of the axle of the gyro, relative to the earth, is displaced, and its efficacy is dependent upon the extent to which disturbing forces, such as friction, can be eliminated.

Position Finding.—The utility of dead reckoning navigation is limited by the need of at least occasional observation of the ground, and, unless it is possible definitely to recognise some landmark from time to time, the method is subject to accumulative error. In fog, or when an airman is flying above cloud, the ground is not visible and alternative means of navigation must be provided. One such means, direction finding by wireless, (*see* WIRELESS) is still the subject of experiment; while another, navigation by astronomical observation, has been used at sea since the 16th century.

Wireless Direction Finding.—All methods of direction finding by wireless have one underlying principle. If a rectangular coil, capable of symmetrical rotation about a vertical axis, be so placed that the plane of the coil is at right angles to the direction from which the wireless waves are transmitted, no current is set up in the coil; in any other position an oscillating current flows having a maximum value when the coil is set "edge on," *i.e.*, when the two vertical sides and the sending station are in the same straight line. If, therefore, the coil be rotated until the current is observed to be a maximum or minimum, the bearing of the sending station can be determined. In practice, telephonic detection is employed and the position of the minimum or zero signal is preferred to that of maximum strength owing to the much greater sensitivity obtainable. For ground reception the Bellini-Tosi system is usually employed; this consists of two small fixed coils, mutually at right angles, each being connected to an aerial loop, and a rotatable search coil symmetrically arranged with respect to the two fixed coils.

Ground Station D.F.—This is the only method at present regularly employed on commercial air routes. The aeroplane carries a transmitting set, and, by wireless telephony, calls for its position. Two or more ground stations observe the bearing of the aircraft, and one of them plots the position on a chart and communicates the information to the aeroplane. This method is fairly satisfactory for day use, but reception by a ground station at night is subject to inaccuracies known as "night-effects." Moreover, it is for many reasons desirable that the position should be determined by the aircraft itself and not by a ground station. For this purpose it is sufficient if the ground station transmits signals and the aircraft carries a receiving set, together with means for detecting the direction of the wireless waves. The following are various modifications of this system; each has been the subject of experiment but none is yet in regular use.

Wing Coil D.F.—This method has undergone successful air tests and can be operated by the pilot. Two sets of coils mutually at right angles are fitted in the aeroplane wings and connected to a receiver. One set, the main coils, is directed fore and aft, and the other, the auxiliary coils, is athwartships. When the aircraft is headed toward the sending station the auxiliary coil receives no current but the main coil receives maximum energy. Under these conditions reversal of the auxiliary coil has no effect upon the signals received by virtue of the current set up in the main coil. If now the aircraft be turned so that its fore and aft axis is no longer toward the station, a current is set up in the auxiliary coil, and alternate reversals of the auxiliary coil will, under these conditions, result in unequal strengths of signals; the aircraft must then be turned until equality of signal strength is obtained. The disadvantage of the method is that it is convenient only when the sending station is the objective or lies on the desired track of the aircraft; moreover, the time taken to fly to the sending station when navigating by wing coils will not, in general, be the shortest possible time, though this is not a very serious objection. The method cannot conveniently be employed to determine position; "homing" by wing coils merely ensures that the aircraft will eventually reach the sending station.

Fuselage Coil D.F.—An alternative method is to use two coils mounted on frames suitable for fitting in the fuselage of the aircraft; these coils are mutually at right angles and may be rotated about a vertical axis. With this arrangement the bearing of a sending station may be obtained, without change of course, by the method described for wing coils. Two or more such bearings on different sending stations, of known positions, would enable the position of the aircraft to be determined. This method necessitates special apparatus and requires the attention of a skilled observer.

Directional Transmission.—In this method the ground station apparatus consists of a fairly large loop which rotates at a speed of about one revolution per minute. No energy is radiated in a direction at right angles to the plane of the coil, and by "tuning in" to the station and observing the time between two consecutive points of silence, the exact speed of rotation can be estimated. Further, if the station emits a distinctive signal when the loop is directed, say, due north, the bearing of the sending station can be calculated by observing the time interval between the distinctive signal and the next zero signal. In practice it would be necessary to use two distinctive signals, preferably 90 degrees apart.

When fully developed, position finding on the aircraft itself will probably be more satisfactory than the existing system of ground reception, particularly for night use. It seems fairly well established that errors due to "night-effects" are confined chiefly to ground reception and are quite small when the aeroplane itself is used for reception.

Navigation by Astronomical Observation.—The determination of the position of an aeroplane by astronomical observation is attended by many difficulties and is hardly likely to be employed on a developed air route along which it is convenient to erect wireless beacons. For long distance pioneer flights over undeveloped country, or, for example, for Trans-Atlantic flights, astronomical observation remains the only method of checking the D.R. position. The principles employed are essentially those used for maritime navigation (*see* NAVIGATION), but both the accuracy needed and the accuracy attainable are considerably less on aeroplanes. Determination of the altitude of a heavenly body necessitates either that the horizon shall be visible, or that the true horizontal or vertical be otherwise known. The horizon is often indefinite from an aircraft, and this fact has led to the development at the Royal Aircraft Establishment, Farnborough, of an ingenious instrument known as the Bubble Sextant.

The R.A.E. Bubble Sextant.—The image of a bubble, contained in a chamber having a spherical glass cover, is observed by reflection from a pentagonal prism and subsequent transmission through a collimating lens and an index glass. The optical distance of the bubble from the lens and the radius of curvature of the glass cover are both chosen to be equal to the focal length of the lens. This arrangement provides that if an image of the sun, obtained by reflection from the index mirror, is brought into coincidence with the bubble image and the instrument is rocked in the hand, the bubble remains in focus, and bubble and sun appear to move together. When measuring the altitude of a star it is more convenient to observe the bubble image by reflection from the under-side of the index mirror and the star by direct transmission through the mirror. The bubble is, of course, subject to displacement if the aircraft experiences an acceleration which is not truly vertical and, in practice, an average of 10 readings is taken. The degree of accuracy essential for maritime navigation is greater than that required for air navigation and it has been found convenient to substitute reduction of observations by logarithmic tables for more rapid methods, the most important being a compact cylindrical slide rule, devised by L. C. Bygrave, which is capable of giving an accuracy of at least two minutes of arc. For airship navigation the conditions approximate more to those appertaining to maritime navigation and there is no reason to suppose that navigation by astronomical observation will not generally be employed on airship routes.

Navigation in Fogs and at Night

Flying in Fog.—The safety of an aeroplane flying near the ground depends largely upon the pilot's ability to maintain, within certain limits, an even keel. Moreover, for navigational purposes it is desirable that a straight course should be maintained. Under normal conditions this presents little difficulty, but in fog, when visual connection with terrestrial and celestial objects is not possible, means should be provided to enable a pilot instantly to recognise any involuntary change of course. It is not at first obvious why the natural gravitational force is not a sufficient indication of the vertical. Imagine an aeroplane to be at rest on the ground, with its wings horizontal, and an ordinary spirit level to be mounted laterally, so that the bubble is in the centre of the tube. If now the aircraft be tilted so that one wing is higher than the other, the displacement of the bubble from the centre of the tube will indicate the nature of the tilt of the aircraft. Change of course of aircraft in flight is normally associated with a lateral tilting of the wings, and, if a bubble level indicated the tilt, or bank, as it does on the ground, departure from straight flight would be shown by a displacement of the bubble.

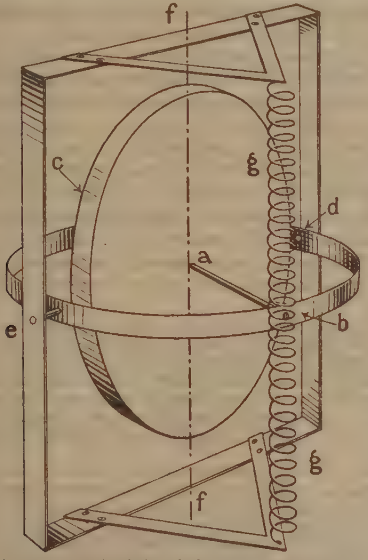

Fig. 1.—Principle of the Turn Indicator.

When an aircraft is turning, however, it is flying on a curved path and the centrifugal acceleration, which acts at right angles to the direction of flight, needs to be considered. It is naturally not possible for a bubble level to distinguish acceleration due to one cause from that due to any other, and the liquid in the level is acted upon, not by the earth's gravitational force alone, but by the resultant of the centrifugal force and the earth's gravitational force. This resultant acts at right angles to the "floor" of the aircraft and the bubble consequently seeks, not the true vertical, defined by gravity, but the apparent vertical, defined by the direction of the resultant of the accelerations. If, therefore, the aircraft executes a banked turn in flight, the bubble remains in the centre of the level and does not indicate a change of course. In fog or cloud a pilot may be unaware that his craft is turning and the magnetic compass affords him little aid, since, as already explained, it is unreliable under these conditions. The need for an instrument which will indicate that the aircraft is changing course has led to the development of the Gyro Turn Indicator.

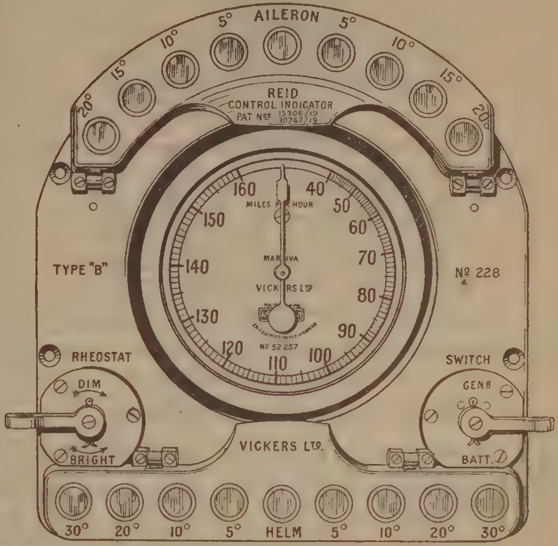

Fig. 2.—The "Reid" Turn Indicator.

The Gyro Turn Indicator.—The gyro turn indicator provides a pilot with a continuous indication either of the maintenance of straight flight or, if the aircraft is turning, of the direction and approximate rate of the change of course. The action of the instrument may be understood by referring to fig. 1. A gyro wheel, a, rotates about an axis, b c, which is horizontal in level flight, and is usually arranged to be athwartships on the aircraft. The frame carrying the wheel and its axle is free to rotate about another horizontal axle, d e, at right angles to b c (*i.e.*, in the fore and aft line of the aircraft). The axle, d e, supports the wheel and the inner frame in an outer frame which is fixed to the aircraft. If the aircraft changes course, the whole system is rotated about a vertical axis, f f, and, in accordance with the laws governing the behaviour of a gyroscopic system (*see* 12.769) the wheel and the axle, b c, commence to rotate about d e.

This rotation, which is known as precession, is controlled by springs, g g, so that the deflection of b c is a measure of the rate of change of course and so that the axle, b c, may return to a horizontal position when the aircraft is again flying on a straight course. The deflection of b c may be indicated to the pilot by any suitable means. The instrument has proved of the greatest use for flying in fog or cloud; it has been developed in a number of countries, but all types depend upon the principle outlined above and differ chiefly in the methods of indicating the turn and driving the gyro wheel. One type, the Reid turn indicator, is shown in fig 2. This instrument employs two rows of electric lamps, each row consisting of four red and four green lamps on each side of a central white lamp. The upper row is controlled by the position of mercury in a U-tube and indicates whether the aircraft is correctly banked. The lower row is controlled by the gyro and indicates the rate of turn. To maintain straight flight the pilot must fly so that no coloured lights are visible.

The Gyro Rudder Control.—Another device, making use of the gyrostatic principle, is the gyro rudder control developed at the Royal Aircraft Establishment, Farnborough. The primary object of this instrument is to relieve a pilot from the strain consequent upon the maintenance of a straight course for a long period of time. The principle is shown in fig. 3. The gyroscopic system consists of a rotor, a, mounted in an inner gymbal ring, b, which is pivoted about a horizontal axis to the outer gymbal ring, c. The latter carries a pin, d, and rotates about a vertical axis, thus operating a valve by means of the lever, e. The system is mounted on a vertical pivot, f, and two ratio arms, one attached to the false rudder bar and one to the gyro box, engage at g. If the aircraft turns, for example, to starboard, air is admitted to the port cylinder, shown in fig. 3, and the starboard cylinder is put into communication with the atmosphere. The pistons consequently move and operate the false rudder bar pivoted at h, which in turn operates the pilot's rudder. Movement of the false rudder bar, however, causes a rotation of the gyro box on its pivot, f; the valve then closes and the rudder bar returns to its neutral position. This instrument has proved very satisfactory during air tests and is likely to reduce considerably the strain of piloting an aircraft over a long distance.

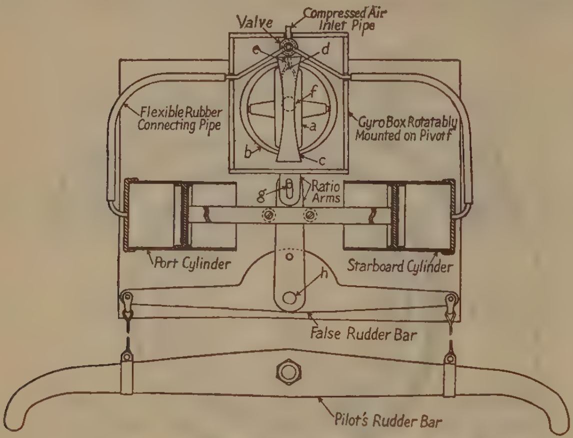
Valve
Compressed Air Inlet Pipe
e
d
f
Flexible Rubber Connecting Pipe
a
Gyro Box Rotatably Mounted on Pivot
b
c
g
Ratio Arms
Port Cylinder
Starboard Cylinder
h
False Rudder Bar
Pilot's Rudder Bar

FIG. 3.—R.A.E. Gyro Rudder Control.

Landing in Fog.—The problem of effecting an aeroplane landing in fog is still the subject of research and experiment. Apart from the necessity of navigating and controlling the aircraft, connection with the ground must be established in such a manner that a landing can be effected. One promising method, which, however, has not yet reached the stage of full scale experiment, is the use of a cable, laid just beneath the ground, excited by alternating current. This cable forms a closed circuit on the aerodrome, and a convenient size and shape would be two parallel sides of about $\frac{3}{4}$ m., joined at the ends by two semi-circles of $\frac{1}{4}$-m. radius. The magnetic field above the cable will consist of circular magnetic lines of intensity varying approximately inversely as the height above the cable. Vertically over the cable the lines will be horizontal, and if instruments are carried enabling this condition to be detected, the pilot will be able continuously to fly vertically over the cable and by gradually decreasing his height to effect a landing.

The instruments carried on the aircraft may consist of two search coils oriented in such a manner that when the aircraft is vertically over the cable the resultant electromotive force induced in them is zero, but if the aircraft departs from the desired course, the E.M.F. induced in one coil will be greater than that induced in the other and the instrument will indicate this condition. The height can be determined by a suitable calibration of an instrument which measures the intensity of the magnetic force. Here is no reason to suppose that this method, when fully developed, will not be largely adopted for the landing of aeroplanes in fog, but the system is, of course, limited to prepared aerodromes. Another promising method is the employment of "lanes" of neon lamps laid on the aerodrome; under conditions of low visibility neon lamps have been found, by experiment, to have a greater visibility range than any other form of illumination.

Flying and Landing at Night.—Navigation at night presents far less difficulty than do flying and landing in fog. There will usually be no difficulty in navigating by D.R. methods, and the problem of night landing is mainly one of supplying sufficient and suitably placed illumination at aerodromes. It is probable that a night-operated air route will have a number of light beacons at suitable distances apart and, unless visibility is very poor, the pilot's task will be merely to fly from beacon to beacon.

The United States has a lighted airway of 1,900 m. from New York to Rock Springs, consisting of a number of terminal aerodromes about 250 m. apart, each having two electric arc beacons of 500,000,000 candle-power each, one circling the horizon every 20 seconds and the other providing flood lighting for landing purposes. In addition there are emergency fields about 15–30 m. apart, each provided with a light beacon; acetylene gas beacons have been installed every three miles over a considerable proportion of the route. A thousand million candle-power beacon near Dijon, France, having a normal range of about 300 m. has been built mainly to assist aircraft flying at night between Paris and Algiers.

An interesting method of facilitating night landing, known as the Hoenig circles, originated in Germany. The installation consists of two vertical lighted circles of different sizes, placed one behind the other, mounted on a trolley and so arranged that the common axis of the circles indicates the direction of landing. The pilot manoeuvres his craft until he observes two concentric circles; by preserving this orientation of the circles a correct landing can be effected.

Navigation of Airships.—Whilst the principles underlying the navigation of aeroplanes apply also to the navigation of airships, the foregoing description of navigational methods and of the peculiar advantages and disadvantages associated therewith, applies chiefly to heavier-than-air craft.

An airship is much steadier than an aeroplane, and instruments, particularly the magnetic compass, are more reliable. Under suitable conditions, astronomical observation can be taken and reduced without difficulty and the accommodation for wireless equipment is greater than in an aeroplane. It will be seen that the conditions obtainable for airship navigation are substantially those employed in maritime navigation. It is important to note, however, that the navigation of airships over long distances will render the availability of accurate meteorological information of primary importance, since an airship, unlike an aeroplane, can land only at prepared aerodomes.

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(A. P. R.)

AERODROME (Gr. *aēr*, air; *dromos*, a course).—At the conclusion of the War 1914–8 the International Commission for Air Navigation, which was a sub-commission of the Peace Conference and is now a part of the organisation of the League of Nations, was appointed, and drafted regulations, which are known as "The Convention Relating to International Air Navigation."

Provisions of the Convention.—By virtue of this Convention, each contracting state undertakes, in time of peace, to provide aerodromes equipped with ground organisation, to include customs posts where required for the operation of international air transport. Every aircraft engaged in international transport must, before proceeding to a foreign country, be cleared for customs, and therefore depart either from a customs aerodrome in the first place or land at a customs aerodrome before leaving the country; similarly, aircraft arriving from abroad must make their first landing at a customs aerodrome. Although it is not definitely stated in the regulations that hangar accommodation, etc., should be provided, the custom has been universally adopted that each state shall erect, at its own expense, aerodromes fully equipped in every respect. Details as to the greater part of this equipment are laid down in the regulations so as to obtain as nearly as possible international uniformity.

National Regulations.—The majority of contracting states have issued their own regulations. In the British regulations, which are laid down in the Air Navigation Order, 1922, and the Air Navigation (Consolidation) Order, 1923, an aerodrome is defined as follows:—

> An aerodrome means any definite and limited ground or water area intended to be used either wholly or in part for the landings and departures of aircraft.

Aircraft in this connection include all balloons, whether fixed or free, kites, airships or flying machines.

All aerodromes in Great Britain and Northern Ireland, which are used as regular places of landing or departure by aircraft carrying passengers for hire or reward, must be licensed for the purpose by the Secretary of State for Air, and, further, every aerodrome which is licensed for public use, or which is open to such use by British aircraft upon payment of charges, shall to the same extent and on the same conditions be open to use by aircraft possessing the nationality of a contracting state to the Convention for the Regulation of Aerial Navigation. Other countries have regulations with regard to the aerodromes which exist in their territory.

Definition.—Although the origin of the word aerodrome only refers to the area to be used for the purposes of alighting and taking-off and is supported in this by the definitions in the regulations, in general practice the word aerodrome is used to include, not only the ground or water, but also the buildings and installations required for the proper operation of air traffic.

Provision of Aerodromes.—On a recognised air route for the operation of land machines, such, for example, as that from London to the Continent, a series of aerodromes is provided at an average distance apart of 25 m. and these are classified, according to the purpose which they serve, as terminal aerodromes, aerodromes, landing grounds and emergency landing grounds. These are situated at Croydon (terminal aerodrome), Penshurst (landing ground), Marden (emergency landing ground), Lympne (aerodrome) and Littlestone (emergency landing ground). Lympne and Littlestone are approximately 5 m. apart and the reason for the existence of the latter, which is sited about sea-level near the coast, is that the former, being on high ground formed by the cliffs overlooking Hythe, is liable to be obscured by low clouds which drift in from the sea. It is essential that aircraft flying over the Channel shall have a landing ground near the coast for use in case of emergency; hence the provision of alternate grounds, one at high and the other at low level, both of which are unlikely to be obscured by cloud or fog at the same time. Of the above, both Croydon and Lympne are provided with customs facilities and in consequence are further classified as "customs aerodromes."

Equipment.—A terminal aerodrome normally is equipped with hangars for the housing of aircraft, workshops, bonded and technical stores, administrative and booking-offices for the companies operating services from the stations, as well as for travel and transport agencies, petrol and oil companies, etc. In addition facilities normally exist for dealing with customs and for carrying out inspection by the immigration authorities. Such aerodromes are further provided with wireless and meteorological facilities, together with government personnel to operate them. Various types of illuminating beacons for the assistance of aircraft flying by night, in addition to some form of device for indicating the direction of the wind both by day and by night, are installed. Accommodation is provided for an official belonging to the Aeronautical Inspection Dept., whose duty it is to ensure that aircraft are being properly maintained, for traffic hands who carry out porterage duties and assist in handling machines on the ground, and for the officials appointed by the govt. for controlling air traffic, the aerodrome and the government personnel employed there.

Landing Grounds.—Landing grounds may, or may not, be equipped with hangar accommodation, but are normally provided with beacons for indicating their position by night and wind indicators to show the direction of the wind both by day and night. Telephones are generally installed, but no personnel other than a caretaker will be found there. Emergency landing grounds are rarely equipped with any form of hangar accommodation and may, or may not, have any form of installation for indicating their position by night or the direction of the wind. Each of the above-named stations, with the exception of Marden, has its name in large capital letters marked on the surface of the aerodrome in chalk and the good landing area is outlined with automatic red flashing lamps which operate day and night.

Sea Traffic Aerodromes.—Aerodromes for the use of sea-going aircraft, such as flying boats or seaplanes, differ from those already alluded to mainly in having an open-water site from which to depart and on which to alight, and slipways leading from this water site to the hangar accommodation and to the prepared passenger departure and arrival platforms. For aircraft of this nature emergency landing grounds are unnecessary since the whole of a water route is itself an emergency landing ground.

Airship Aerodromes.—Aerodromes for the use of airships will in general be provided with all the facilities outlined above as requisite for the operation of land aircraft, but in addition will be equipped with a mast at which an airship can be moored, known as a "mooring mast," and a gas plant for the production of the gas required for inflating the ship. Under normal conditions an airship will only be berthed in a hangar for purposes of overhaul or repair in the same way as a ship goes into dry dock; at other times it will invariably be moored at a mast. The modern mooring mast consists of a steel girder structure rising to the height of approximately 195 feet. The head of the mast is fitted with a receiving arm into which a cone on the bow of the airship engages; this allows free movement in any direction. The mast is supplied with lifts for the use of the crew, passengers, goods, etc., and with pipes for the supply of fuel and water. A passenger mounting in this lift will, on emerging from it, find himself in a small compartment from which a covered way leads into the nose of the airship and thence down the passenger accommodation. This covered way may be likened to the connection between two railway coaches on a corridor train.

Aerodrome Conditions.—Leaving out of consideration emergency landing grounds, which require as a minimum two landing runs at right angles to each other of not less than 400 yd. long by 200 yd. wide, an aerodrome for the use of aeroplanes should normally consist of an area not less than 800 by 800 yards. The surroundings should be as free as possible from all obstructions, such as high buildings, trees, chimneys, wireless masts, etc. The surface should be level and the soil not liable to become boggy or marshy after heavy rain. In Europe aerodromes are invariably grass-covered; in tropical climates, however, they frequently consist of hard sandy surfaces or bare earth.

In the choice of a site for an aerodrome several factors must be considered, but as it is rarely found possible to combine all the desirable qualities in one place the final selection is generally largely a matter of compromise. Accessibility to the centre which an aerodrome serves is of primary importance, but in the neighbourhood of a populous area such as, for example, London, a large open space of the size required can normally only be obtained on the outskirts of the city. Under these circumstances, it is highly desirable that rapid and easy means of communication shall exist connecting the aerodrome with the city. A consideration of paramount importance, in the present stage of development of air transport, is that an aerodrome designed for its use should be sited in such a position as to be as free as possible from fog, town smoke or local mist. For preference the country surrounding an aerodrome should be as open as possible. Two examples of main terminal aerodromes may be quoted:

London Terminal Aerodrome.—The London terminal aerodrome which is situated at Croydon, a distance of approximately 13 m. from Hyde Park Corner. The distance to the centre of London is far too great, there is no direct thoroughfare which leads from the centre of London to the aerodrome, and it is not fed with direct rail or bus communication. On the other hand it is freer from fog and mist conditions than almost any other locality in the immediate neighbourhood of London. Before Croydon was finally decided upon, exhaustive investigation was made into many other sites. An aerodrome in the north of London, unless having overwhelming attractions, was undesirable owing to the fact that aircraft proceeding overseas would find it necessary, either to fly over London or else make a circuit of it, in either case adding appreciably to the distance of the journey and rendering machines liable in foggy weather to be unable to reach their destination, owing to having to traverse the smoky and prevalent fog area extending east and west following the general line of the run of the Thames. In other districts investigated, in some cases it was found to be impossible to obtain sufficiently large areas, in others fog was prevalent, while in others the nature of the ground did not permit of their being satisfactorily converted into an aerodrome.

Berlin Terminal Aerodrome.—The terminal aerodrome at Berlin is situated at Tempelhoferfeld and is probably one of the most perfectly sited aerodromes in the world. This city had the advantage of possessing an enormous parade and review ground which is on high ground, is free from fogs, is almost perfectly flat, is fairly clear of obstructions surrounding it, is on a main road, along which trams pass, and is within ten minutes drive of the heart of the city, a perfect siting for the main terminal aerodrome of the country. (I. A. E. E.)

AERODYNAMICS.—The word aerodynamics refers to those branches of dynamics which form the foundation of the study of aeronautics; it thus applies to two distinct branches of this subject, which relate respectively to the reactions between air and solid bodies moving through it and to the movements of bodies under those reactions and the force of gravity. The former is a development of a mathematical study which has generally been known as "Hydrodynamics," because, although it applies equally to all fluids, it was developed originally with the object of throwing light upon the movements of water; the latter is a branch of "rigid dynamics," the study of the movements of rigid bodies of appreciable size under the action of external forces.

In no single instance has the reaction between a fluid such as air and a body moving through it been deduced directly from the laws of motion. The equations of motion can be formulated, but they have not yet been solved precisely. Aeronautics therefore relies primarily upon direct measurement of these reactions, but unfortunately their precise measurement upon the full scale requires, in general, experiments in free flight, which are difficult, costly, and sometimes hazardous to carry out.

For these reasons nearly all the detailed data available for the study of aeronautics have been obtained from small models of the parts concerned, suspended in artificially induced currents of air, which may either flow down large pipes, called wind tunnels, or take the form of a spout of air directed through the experimental chamber. The technique of the measurement of reactions upon models in a current of air has reached a high development in many countries, and the world's output of data relating to such experiments is now very large. The main function of the theoretical study of fluid dynamics in its relation to aeronautics has been therefore to indicate the extent to which such experimental data can be applied with confidence to the full scale, and to extend the range of phenomena over which a single experiment can be made to give useful information.

Principles of Dynamical Similarity.—These considerations lead at once to the study of similarity in fluid motion. To what extent will the flow round a large body moving fast through air possibly of low density, such as is found at great heights, be similar to that about a small model of that body moving at a slower speed through air of greater density, such as is found near the ground? Experiment has led to the conclusion that the motion of a fluid past a body of given form, moving through it at a given speed, is dependent only upon three physical properties of the fluid: density, viscosity and compressibility. No other property of the fluid is known to have any appreciable influence upon the motions with which aeronautics is concerned, nor does it appear to matter whether the fluid is a liquid or a gas. These perhaps surprising conclusions have results of immense importance, for from them can be deduced the laws governing the application of model data to full scale problems, and it becomes possible to carry out model experiments in any fluid which may be most convenient; moreover, the accumulated knowledge of "hydrodynamics" becomes directly applicable to aeronautics. The precise statement of the laws of similarity, which can be deduced from these premises, is as follows:—

Let l be some length defining the size of the body, V the velocity of the body through the fluid, and ρ, μ and E, the density, viscosity and bulk elasticity of the fluid.

Then strictly similar motions can occur round two bodies of the same shape moving similarly, only when the two quantities $\rho\frac{Vl}{\mu}$ and $\frac{E}{\rho V^2}$ are the same for both motions.[1] Quantities of this nature, which must not change if dynamical similarity is to be possible, are called "criteria of similarity"; they are always non-dimensional, and hence have the same numerical value, no matter in what system of units they are expressed, provided that the system is dynamically consistent.[2]

The criterion $\frac{E}{\rho V^2}$ constant, expresses the fact that in similar motions the volume strains in the fluid at similarly situated points must be the same. It may be re-written $\frac{V}{a}$ constant, where a is the velocity of sound in the fluid, for a^2 is proportional to $\frac{E}{\rho}$. In general, such strains are small, unless the velocity of some of the bodies concerned rises above about $\frac{a}{2}$, which in air is about 550 ft. per sec.; it is therefore usual in practical aeronautics to treat air as incompressible, unless velocities exceeding about 500 ft. per sec. are present. Such velocities have hitherto occurred in aeronautics only near the tips of high speed air-screws, hence it is in this connection only that the criterion, $\frac{V}{a}$ constant, has had any practical significance.[3] When this criterion is of importance it leads to the conclusion that model experiments in air should be carried out at the same speed as the full scale motion represented, but that, so far as compressibility is concerned, the size of the model is immaterial.

The magnitude of the criterion $\rho\frac{Vl}{\mu}$—called the "Reynolds Number"—determines the part played by viscosity in the motion. If two motions about similar bodies have the same Reynolds number the effect of viscosity in the two motions will be the same. If the Reynolds numbers are not the same, viscosity will play a more important part in that motion for which the number is the smaller. Thus the effect upon a motion of increasing either the density, the velocity or the scale, is the same as that of decreasing the viscosity. A fluid which appears relatively viscous to the slow passage of small bodies, may therefore appear to be very inviscid to the rapid passage of large bodies. Air, from the point of view of a gnat, is a somewhat viscous fluid; to an aeroplane it is much more mobile, whilst in relation to the general movements of the winds over the earth it is extremely inviscid.

The aeronautical engineer may be more interested in the forces generated by air motions than in the form of the motions themselves, but when a series of motions are known to be similar, the laws governing the variations of force from motion to motion are easily deduced from the fact that all quantities, or combinations of quantities, having the same dimensions, vary in the same way. Forces upon similar areas will thus vary in proportion to $\rho v^2 l^2$, or to $\mu V l$, or to $\mu^2 \rho$, because all these combinations of the independent variables have the dimensions of force. If, as in most aeronautical problems, the Reynolds number $\rho\frac{Vl}{\mu}$ is the only criterion of similarity which need be considered, and if it has the same value for a series of motions of fluids past bodies of the same shape, then these motions will be strictly similar, and the forces acting upon similar areas will vary as above. If, however, the criterion varies from motion to motion, strict similarity is impossible, because viscosity will play a more important part in one motion than in the other; nothing can then be ascertained as to the mode of variation of the forces, except by detailed calculation or experiment.

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[1] These conclusions can be reached solely from Newton's laws of motion and from considerations of the meaning of similarity.

[2] A dynamically consistent system of units is one in which Newton's law—force proportional to mass acceleration—can be expressed as an equality.

[3] For experiment on air-screws with tips moving above the speed of sound see *Reports Aeronautical Research Committee*, No. 884, 1903–4, vol. 1, p. 345.

This condition can be expressed[1] by the equation $F = \rho V^2 l^2 f\left[\rho\frac{Vl}{\mu}\right]$ where F is the force under consideration and $f\left[\rho\frac{Vl}{\mu}\right]$ stands for any function the form of which can be determined either by detailed calculation or by experiment upon the effect of altering any one of the four variables concerned. The effects of a change in any one of the four independent variables can thus be ascertained by experiment upon the effects of varying any other of the variables,[2] always provided that there is, as is generally true in aeronautics, no other criterion of similarity than the Reynolds number to be taken into account.

For such values of ρ, V, l and μ, as occur in practical work with man-carrying aircraft, $f\left[\frac{\rho Vl}{\mu}\right]$ is very insensitive, even to considerable changes in the value of the Reynolds number, and calculations relating to free flight are generally made on the assumption that this function may be treated as a constant, so that we have $F = k\rho V^2 l^2$ where k is dependent only on the shape and mode of motion of the body through the air. When, however, deductions have to be made from small scale model experiments, this assumption is not always sufficiently accurate. With values of l and V which are practicable in wind tunnels, small though appreciable variation in k with change of Reynolds number are the rule rather than the exception, and the experimental data are then said to be subject to "scale effects." The Reynolds number of a motion on the full scale is generally very much larger than that of the corresponding model experiment, even in the largest and most powerful wind tunnels available,[3] and some uncertainty in the prediction of the behaviour of aircraft from wind tunnels data thus occurs; for there is, as we have seen, no known method of predicting the changes in k consequent upon a change of the Reynolds number. A long series of carefully selected experiments, carried out in free flight upon the full scale, has shown that much of the data of importance in aeronautics is not subject to serious "scale effects" between the highest Reynolds numbers conveniently obtained in ordinary wind tunnels and the full scale; those types of data which are subject to serious scale effects are becoming more and more clearly defined as research proceeds.

The coefficient k above, is called a non-dimensional coefficient[4] of force, and the force to which it refers is indicated by a suffix. Thus $k_F = \frac{F}{\rho V^2 l^2}$.[5] Non-dimensional coefficients of other quantities, such as pressure per unit area (ρ), and moment about an axis (M) are formed in a similar manner.

Thus:—

$$K_\rho = \frac{p}{\rho V^2} \qquad k_m = \frac{M}{\rho V^2 l^3}$$

All such coefficients are constant for strictly similar motions, and being non-dimensional their value is not affected by changing from one consistent system of units to another. They are therefore much used in theoretical calculation, and for recording the results of experiments.

Air Reactions in Relation to the Theory of Inviscid Fluids.—Let us consider the motions which occur when bodies of various shapes move through otherwise undisturbed air. Bodies not specially shaped for low resistance generally drag behind them a quantity of air which, relative to themselves, is nearly motionless. This is called "dead air"; the boundaries of the region which it occupies are well defined near the body, but become ill-defined at some distance behind where the dead air gradually merges into a turbulent wake of irregular eddies. The pressure in this "dead" region is always lower than that of the surrounding atmosphere. Such bodies experience a high resistance to motion and are therefore avoided in the design of aircraft.

Certain shapes called "streamline" shapes, do not drag dead air behind them, and experience much less resistance to motion than those which do so; these shapes are therefore much used in aeronautics. The fish, the modern airship hull and the wing are typical examples of streamline shapes. The air-flow around moving bodies cannot yet be calculated from first principles, hence our precise knowledge of the air reactions upon these streamline shapes is drawn from direct experiment; but much light has been thrown upon their action by the theoretical study of the movement of a hypothetical fluid having absolutely no viscosity. The mathematics of this hypothetical fluid, unlike that of the real slightly viscous fluid air, is in many instances within the powers of modern mathematicians; and had been brought to a high state of development before aeronautics began to attract attention.

When a streamline body has been moving steadily through air for some time, the motion of the air relative to it becomes steady and substantially obeys the laws appropriate to inviscid fluids, except in regions containing air which has passed very near to the surface of the body. Very near this surface the motion is powerfully affected by viscosity, the velocity falling off as the surface is approached until, according to best authorities,[6] it reaches zero at its surface. The layer of fluid appreciably influenced by viscosity appears to decrease in thickness with decrease of viscosity until, in the conditions of interest in aeronautics, it becomes very thin indeed. The viscous layer is responsible for the tangential drag or "skin friction" upon the surface of the body, which constitutes the major part of the resistance of the best streamline shapes, and is, in some as yet unknown way, associated with the development of dead air behind bodies which are not of good streamline shape. The study of the dynamics of this region influenced by viscosity is proceeding vigorously in most of the aerodynamic laboratories of the world.

Returning to a consideration of the region in which viscous forces are negligible, which in most aeronautical problems includes by far the greater part of the whole region in which the fluid is appreciably disturbed by the body, Bernoulli's well-known theorem, relating to the steady motion of an inviscid incompressible fluid, indicates that if the motion is such that the velocity at all points far from the body is uniform, then the pressure (p) and the velocity relative to the body (q) at any point in the fluid, are connected by the relation $p + \frac{1}{2}\rho q^2 = \text{constant}$. If P and V be the uniform pressure and velocity far from the body, this leads to $p - P = \frac{1}{2}\rho V^2\left[1 - \left(\frac{9}{V}\right)^2\right]$; from which the pressure at any point can be deduced from the velocity, or vice versa. The maximum pressure rise is seen to be $\frac{1}{2}\rho V^2$ and to occur when q is zero.

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[1] This condition might equally well have been expressed by either of the equations $F = \mu V l \phi\left(\rho\frac{Vl}{\mu}\right)$ or $F = \frac{\mu^2}{\rho}\psi\left(\rho\frac{Vl}{\mu}\right)$ where ϕ and ψ represent other functions; each of these forms is useful in certain circumstances, but that given in the text is generally used in aeronautics, for a reason which appears below.

[2] For example, should it be found that $F \propto V^n$ then $f\left[\frac{\rho Vl}{\mu}\right] = \left(\frac{\rho Vl}{\mu}\right)^{n-2}$ and $F \propto \frac{\rho^{n-1} V^n l^n}{\mu^{n-1}}$.

[3] In America a wind tunnel has been made which works in compressed air for which $\frac{\rho}{\mu}$ is many times greater than in air at atmospheric pressure. This allows a Reynolds number equal to that on the full scale to be obtained in many instances. At the time of writing the accuracy with which this tunnel faithfully represents full scale conditions in free flight in still air, is under discussion.

[4] Also called an "Absolute coefficient."

[5] The symbol l^2 may be replaced by any other quantity which defines the size of the body and is of the dimensions of area, thus $\frac{F}{\rho V^2 S}$, where S is the wing area, is used in relation to aeroplanes and $\frac{F}{\rho V^2 A^{\frac{2}{3}}}$, where A is the total volume, is used in relation to airships.

[6] Report of Aeronautical Research Committee No. 720 (Stanton) Proceedings of the First International Congress for Applied Mechanics (Delf). (Von Karwan and Burgers), p. 98, et. seq.

There are certain definite ways only in which an absolutely inviscid fluid can flow past a given body, with the restriction that the motion is to be uniform at all points far from the body. One of these flows only can be generated from rest; the others, if generated by some agency not contemplated in the theory and then left to themselves, will continue indefinitely without change. The flow which alone can be generated from rest has the property that, whatever the shape of the body, the pressures generated upon its surface exactly balance, so that no resultant force is exerted. Certain streamline shapes—for example, the airship hull moving axially and the wing moving in its attitude of no lift[1]—develop close approximations to these flows; hence the pressures upon their surfaces, being in close agreement with theory, approximately balance. The resistance to motion is then very low, being due merely to skin friction and to a very slight imperfection of balance of the pressures.

When the attitude of a streamline body in a current of air changes from that which gives rise to the unique flow which alone can be generated from rest, the flow changes progressively to a new form, which may be a close approximation to one of those flows which are appropriate to an inviscid fluid, but could not be generated in it. The precise analysis of these flows in the hypothetical inviscid fluid, is particularly tractable to modern mathematics when the motion is two-dimensional,[2] and a general analysis then leads to the conclusion that the resultant force upon the body is exactly perpendicular to the direction of motion of the undisturbed fluid, and is larger the further the flow departs from that one which can alone be generated from rest. In the corresponding real two-dimensional flow the reaction is *nearly* perpendicular to the direction of motion, but has a small component opposing the motion. If the magnitude of this reaction can be measured, it is easy to identify the particular theoretical flow to which the real flow approximates; the details of this theoretical flow can then be calculated, and are generally found to agree well with the results of detailed experiment.

In the absence of some such measurement of force, no precise method has yet been devised for deciding to which of the possible theoretical flows the real flow will approximate, but Joukowski, observing that for a wing of conventional shape there is only one of the theoretical flows which will not give rise to very large velocities at the trailing edge, advanced the hypothesis that this particular flow will occur. Applied with discrimination, this hypothesis gives results closely in accordance with experience.

Joukowski has, in addition, developed very beautiful methods for obtaining wing sections from mathematical formulae which lend themselves well to analysis of the type under discussion, and since wings with these sections are found by experiment to give results at least as good as any that have been obtained from arbitrarily designed wings, it is becoming common practice to use Joukowski profiles, as they may be called, in actual design. A feature of many of these profiles is that their centre line forms a segment of a circle; if γ be the camber[3] of this segment, C its chord, α the incidence[4] of the chord and $t{\cdot}c$ the maximum thickness of the profile, Joukowski's analysis leads to the following remarkably simple approximations to the lift per unit length (L) of the cylindrical wing.[5]

$$L/\rho V^2 c = (1 + \cdot 8t)\pi \sin(\alpha + 2\gamma) \qquad M/\rho V^2 c^2 = \tfrac{1}{2}\pi\gamma$$

Where M is the moment exerted by the lift about a point on the chord distant $c/4$ from the leading edge, ρ is the density of the air and V the velocity relative to undisturbed air. These formulae agree fairly well with the results of experiment upon two-dimensional wings, but are liable to give the lift slightly too high; a small component force opposing motion, called "profile drag," has also to be added. This profile drag has, as yet, to be determined experimentally; it may in favourable circumstances be less than $\frac{1}{20}$ of the lift.

The two-dimensional aerofoil in free space must be supposed to extend to infinity in two directions perpendicular to the direction of motion, but the span of a real wing is not infinite, hence the flow about it cannot be strictly two-dimensional. No exact method of calculating the flow around a finite wing has yet been devised, but Lanchester suggested that, provided the aspect ratio[6] is large, as in real wings, the effect of changing from an infinite to a finite aspect ratio might be represented by supposing the finite aerofoil to be working in a down current superimposed upon the motion appropriate to two-dimensional conditions. Prandtl has developed this idea into an approximate quantitative theorem, and has shown that if the distribution of lift over the span of the finite wing is elliptic, this superimposed down current will, to a first approximation, be uniform across the span and will be equal to $\frac{2}{\pi}\frac{Kc}{A}V$. A is the aspect ratio and the average lift coefficient over the whole wing.[7] He arrives at the conclusion that the finite wing will generate the same lift as the two-dimensional wing when its incidence relative to the undisturbed air stream is increased by $\frac{2}{\pi}\frac{K_L}{A}$ radians, and that the resistance will be increased by an amount appropriate to a rotation of the resultant force through this angle. The distribution of lift over the span of a real wing, which is generally nearly rectangular in plan form, is not exactly elliptical, but is approximately so, and in practice the Prandtl formulae for conversion from a two-dimensional wing to a finite wing, namely:—

$$A^{a} = \infty a + \frac{2}{\pi}\;\frac{K_L}{A} \quad {}^{8}$$

$$A^{k}D = \infty^{k}D + \frac{2}{\pi}\;\frac{kL^2}{A}$$

give results which are sufficiently accurate for most practical purposes. By further extensions of these methods, estimates can be made of the mutual interference of a number of wings—as in a biplane or triplane—of the effect of placing the wings in a wind channel or near a plane surface, and of the mutual interference of the various blades of an airscrew.

By combining the hypotheses of Joukowski and Prandtl, it is possible to make a fair estimate of the performance of most practicable wings or airscrews, whilst subject to many types of interference from external bodies, the only special experiment required being that to determine the "profile drag" of the section or sections from which the wings or airscrew are built up. So many approximations and hypotheses are, however, involved in these calculations, that they can only be applied safely in circumstances for which direct experiment has shown them to be applicable. If, for example, the wing incidence is too great, or the wing is not of a good streamline shape, "dead air" may form, and the motions cease to approximate even roughly to any flow which has yet yielded to analysis. The wing is then said to be "stalled," and on account of its high resistance becomes an unsatisfactory organ of flight. Little or nothing is known about the causes which make a wing stall and the stalling angle has still to be determined by direct experiment. Various methods of delaying the stall have, however, been found empirically; these are discussed in the section dealing with design.

Free Flight of Heavier-than-Air Craft.—The motions of aeroplanes under the influence of air reactions and gravity have been extensively studied. An aeroplane is a body upon which the air can be made to exert a large force nearly perpendicular to the direction of motion.

The magnitude of this force (R) can be represented by the equation $R = k_R \rho V^2 S$ where S is the wing area. k_r is here a function of the shape and attitude of the aeroplane[9]; it has a maximum value occurring at incidences in the neighbourhood of 18°.[10] When flying at a given speed in air of given density, the pilot, who has control over incidence, can thus call into play reactions up to a definite limiting value, but no greater; if he increases his incidence beyond that which gives the maximum reaction his aeroplane is said to be stalled. The principal use of the reaction R is to balance the weight of the aeroplane in steady straight flight, but it is also used to generate the large accelerations which are required in a rapid turn at high speeds.

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[1] Lift is defined as the component of the air reaction perpendicular to the relative motion of the body and the undisturbed fluid.

[2] By two-dimensional motion is meant motion in which all velocities are parallel to a given plane and in which the flows in all planes parallel to the given plane are the same. For such a motion to be possible the solid body must be in the form of a cylinder, which may, however, have any desired cross section.

[3] $\gamma{\cdot}c$ = maximum distance of segment from chord.

[4] Incidence is the angle made by the chord with the direction of the undisturbed air stream.

[5] These formulae are first approximations, considering t and γ as small quantities.

[6] Ratio of span to chord.

[7] $k_L L$ is here defined as $\frac{L}{\rho V^2 S}$ where S is the wing area.

[8] A^{α} is the incidence of a wing of aspect ratio A required to give the same lift coefficient (K_L) as a two-dimensional wing at incidence ∞A^1, AKo is the drag coefficient of the finite wing and ∞Ko is the drag coefficient of the two-dimensional wing, when the lift coefficient is K.

[9] Variations of k_r with change of Reynolds number are here neglected.

[10] It is at this incidence that "dead air" forms behind the wing, as described in the previous paragraph.

If the speed falls so low that the maximum value of R is less than the weight of the aeroplane, steady flight becomes impossible, so that there is a minimum speed of steady flight for a given aeroplane in air of given density; this is called the stalling speed and is equal to $\frac{w}{v}kr(\text{max.})$ where w is the loading of the wings per unit area.

In the absence of any propulsive force, such as that provided by an engine and airscrew, the reaction (R) is always inclined backwards, through some angle γ, from a plane perpendicular to the direction of motion, hence steady horizontal flight is impossible without the expenditure of power, and in the absence of such power the aeroplane must descend along a path inclined below the horizontal through an angle equal to γ.

When the aeroplane flies in a curved path, the reaction (R) is required both to provide the necessary accelerations and to balance the attraction of gravity. The magnitude and direction of the reaction may now be expressed in the form mg', where m is the mass of the aeroplane and g' is the vectorial sum of the gravitational field and the inverse of the accelerations of the centre of gravity.[1] g' is described as the "apparent gravitational field," because the sensations of the pilot are those which he would experience in a field of this magnitude and direction. It is usual to adjust the aeroplane so that its symmetrical plane is parallel to g', when it is said to be correctly "banked"; the stresses in its main structure are then approximately g'/g times those in straight flight. The magnitude of g'/g has been measured in many manoeuvres, a value 3 is common in violent manoeuvres, values greater than 7[2] have been recorded for very short periods, but values in excess of 4·5, continued for more than a few seconds, have been found by independent investigators to cause temporary loss of sight and other faculties. When g' is greater than g the aeroplane will stall at a higher *speed* than in straight flight, though at the same angle of incidence.

If the aeroplane is to be in equilibrium, the reaction (R) must pass through its centre of gravity. If it does not do so, angular accelerations will occur. The moments of inertia of the aeroplane about axes through the centre of gravity are in general so small that these angular accelerations may be very large, so that rapid rotations would be quickly generated were it not that so soon as appreciable angular *velocities* occur, additional moments are generated which tend to stop them. The limiting rate at which an aeroplane can be rotated is thus determined by equating the moments which can be brought to bear about the centre of gravity, to the opposing moments generated by the rates of rotation. The three control systems, by which moments about three axes through the centre of gravity can be generated, are described in the article AEROPLANE.

When an aeroplane is disturbed from an attitude of balance, moments will be generated even when the "controls" are not moved; it is important to determine whether or not these will be of a kind to restore the equilibrium attitude. If the aeroplane be imagined suspended in an air current, so that it can rotate about a fixed axis through its centre of gravity, then it is said to be "statically stable" about that axis if any small rotation results in a moment which opposes the rotation. To achieve "static" stability in conventional aeroplanes, it is usual to fasten certain fixed areas, called the tail plane and the fin,[3] to the end of the body, at some distance behind the centre of gravity; these act in the same manner as the feathers of an arrow. "Static" stability can be increased either by enlarging these areas, by increasing their distance behind the centre of gravity, or by moving the centre of gravity forward, in relation to the wings.

Stability.—In free flight an aeroplane is said to be *completely* stable when, however it may be disturbed, it will eventually settle down to steady straight flight on an even keel. It is possible to make an aeroplane which will do this, but complete stability does not necessarily follow from the possession of "static" stability. A statically stable aeroplane, if disturbed from steady straight flight on an even keel by a motion in the vertical plane containing the direction of flight, will generally execute an oscillation of long period—20 sec. or more—about the equilibrium path, and this oscillation may increase or decrease in magnitude in accordance with factors which may be independent of the static stability. In the majority of aeroplanes such oscillations decrease, but occasionally, particularly in models, an increasing oscillation is observed. The principal factor which causes an increasing oscillation is a large longitudinal moment of inertia. Again a statically stable aeroplane, disturbed laterally from steady straight flight, may execute a slowly increasing banked turn, requiring however many seconds for the increase to be serious. This form of instability is *intensified* by high directional static stability, but can be eliminated by a sufficiently large dihedral angle.[4] The study of the complete stability of an aeroplane for small disturbances from steady flight has been taken up by Bryan, Bairstow and others, who have reduced the mathematics to a tractable form.

It is not essential for successful flight that an aeroplane should be completely stable, nor even statically stable; unstable aeroplanes have been very successful, particularly as fighters. Much misconception has existed in the past as to the relation between stability and safety. The danger of flying, apart from breakage or fire in the air, is almost entirely associated with the manoeuvres of getting off and landing, when the desirable quality is controllability rather than stability. Provided that static instabilities are not too great, the disturbances to which they give rise in normal flight are slow enough for the pilot to deal with them instinctively and without serious strain, and the question has been much debated amongst experienced pilots, whether or not an unstable aeroplane is easier and safer to bring to earth than a stable one.[5]

An advantage of complete stability is that the pilot, in a long straight flight, can remove his attention from control, and either rest himself or attend temporarily to other duties, but this advantage has been largely offset in the past by the fact that it is hard to balance an aeroplane so accurately that it will not then fly on a slightly curved path. This difficulty can now be overcome by the use of a gyroscopic control on the rudder, which keeps the aeroplane on a given course; with the help of this device a stable aeroplane can be made to fly for many miles on a straight course without any attention whatever from the pilot. Even should the power to fly without human control be unimportant, the designer should, however, know the degrees of static stability which his aeroplane will have, for its characteristic behaviour in the hands of the pilot depends upon this factor. It is becoming the practice to design aeroplanes to have a small measure of static stability both longitudinally and directionally, but over-stability may be as bad a fault as instability.

Control Problems.—The control of the aeroplane by the pilot involves problems of great complication. Apart from the needs of war, powerful control is required mainly for the purpose of manoeuvring for a landing in a restricted area; these manoeuvres are generally carried out at the slowest practicable speed, when the aeroplane is as near the stalling point as the pilot thinks safe, and since the pilot may accidentally stall his aeroplane in these circumstances it is of great importance to give him adequate control when flying at incidences both less and greater than the stalling incidence. Unfortunately certain violent forms of instability may occur when flying above the stalling incidence, and considerable difficulty is experienced in providing means whereby these can be controlled. This whole matter has been studied extensively during the last few years and some progress has been made towards an understanding of the problems and the elimination of the dangers involved.

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[1] This procedure may be expressed by the statement that the resultant force upon the aeroplane is obtained by combining the weight mg with the centrifugal force $\frac{mv}{r}$, where v is the velocity and r the radius of curvature of the path of the aeroplane. With this notation $g' \doteq vg^2+\left(\frac{v^2}{r}\right)^2$.

[2] N.A.C.A. 203.

[3] *See* AEROPLANE.

[4] *See* AEROPLANE.

[5] These remarks do not apply to stalled flying in which violent unstable motions may occur, which are definitely dangerous.

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AERO ENGINES.—All aero engines in use up to the present time work upon the four-stroke constant-volume-ignition cycle and the thermodynamic theory of them is similar in all essentials to that of any other petrol engine. (*See* INTERNAL COMBUSTION ENGINE.)

I. ELEMENTS OF THE PROBLEM

The great problem with which the designer of aero engines is faced is reduction of the ratio weight to horsepower, or as it is customarily expressed the "pounds per horsepower," to the smallest possible value consistent with reliability. But pounds per horsepower in the air cannot be taken simply as a figure obtained on the test-bed; an aeroplane must carry its own fuel, so that economy of fuel consumption is also of primary importance. If we take, in order to fix our ideas, the example of a 450 H.P. engine which weighs itself, say, 900 lb. then the weight of fuel used per hour would be of the order of 225 lb., depending of course at what height the flight was made.

If we consider, not the weight of the engine alone, which is 2 lb. per H.P., but the weight per H.P. of the "power unit (engine and fuel) for a four hours' flight," then the value of this when the aircraft leaves the ground will be not 2 but 4, and it becomes at once clear that the effective weight to power ratio of an engine in flight will be materially affected by its fuel economy. In 1915 there was no water-cooled engine which weighed, complete with water and radiator, less than about 4 lb. per H.P., and no air-cooled engine of less than 3 lb. per horsepower. In the decade 1915–25, these figures have been reduced to the neighbourhood of 2 and 1·6 respectively. The greater net weight of the water-cooled type is discounted, especially for long flights, by better fuel economy.

Tendency of Design.—For an engine of given size (bore and stroke) both the power and economy are increased by an increase of the compression ratio. The tendency of design has therefore been toward the use of higher and higher ratios of compression: from the figure 4·5 of the average motor-car the compression in aero engines has been pushed up to 6 to 1 and higher. The limit to which it can be raised depends largely on the physico-chemical properties of the fuel available. With some fuels, such as Benzol, an engine of 7 to 1 compression ratio will run quite smoothly. With others which differ only in chemical analysis and not at all in appearance, volatility or specific gravity, it would be impossible to run the engine at all. Owing to the high degree of compression of the combustible gas, the ignition, when the spark is passed at the sparking plug, would take place with such violence as to cause "detonation" or "knocking" in the cylinders. In order that the compression ratio may be pressed to the highest possible point, therefore, the supply of suitable fuels for aero engines is a matter of great importance.

The Factor of Head Resistance.—The aero engine designer must also bear constantly in mind the factor of "head resistance." When an aeroplane is flying level, the whole available power of the engine is used up in overcoming the "drag" on body and wings as the machine tears forward through the air. In practically all machines nowadays the engines are at the front of the body or fixed between the wings, and if the drag is to be kept down, the area presented by the engine and accessories, when viewed from the front, must be as small as possible. A most important accessory, in this connection, is the radiator necessary with water-cooled engines.

II. EVOLUTION IN DESIGN

Bearing in mind the four considerations of power, weight, fuel economy and head resistance, their effect upon aero-engine design will now be traced. The designer must be a master of compromise. Compactness, rigidity, revolutions, inertia forces, piston speed and area, bearing loads, valve area, effective cooling and the rest . . . each member of this complex company must be harmonised with all the others and at the same time consideration of each must be pressed to the farthest limit in the service of the two great aims of power and lightness. It is appropriate in the first place to point out the main sub-division into water-cooled and air-cooled types.

Arrangement of Cylinders.—With our primary concern for weight to power ratio the advantages of the air-cooled type are not far to seek; there is the clear gain in weight of all the circulating water, besides the elimination of the weight and drag of the radiator. But the air-cooled engine designer cannot have it all his own way. For minimum head resistance of the engine itself a design of the "cylinders-in-line" type with the crankshaft fore-and-aft will clearly have the advantage; but if for cooling we rely wholly upon a high velocity airstream it is imperative that no cylinder should be seriously more screened from this airstream than any other.

Hence, although a few air-cooled engines of the cylinders-in-line type have been built, the two types which have been widely successful have been those in which the cylinders are arranged radially in one plane, or sometimes in two parallel planes, perpendicular to the axis of the machine; so that all cylinders share equally in the cooling air. Such engines, whether of the "rotary" or "static radial" types, present a large frontal area and offer very serious head resistance.

WATER-COOLED ENGINES

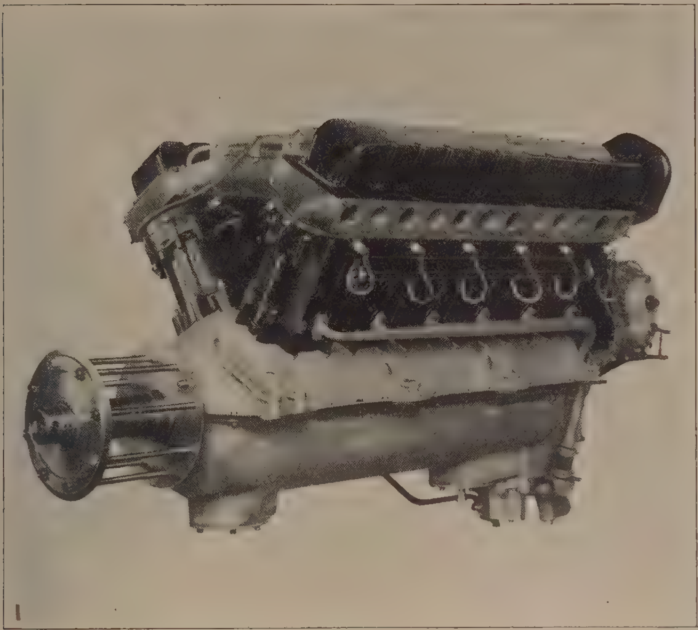
The power developed by an engine depends upon the mean piston speed, the total piston area and the mean-effective pressure in the cylinders. As to the first two the question at once arises: "Shall the requisite piston speed and area be achieved with a few large or many small cylinders, and what in each case are the limiting factors in regard to speed?"

Cylinder Design.—The answer given by designers has been "many and small"; largely on account of the resulting compactness and of the rigidity obtainable with light construction. A long stroke means a heavy crankshaft and a cylinder reaching out a long way from the shaft centre-line and upsetting the slip stream from the propeller. For getting adequate piston speed, therefore, the tendency is toward a short stroke and high revolutions. Large-bore cylinders in line, again, would lead to a long crankshaft, involving both weight in itself and in the resulting crankcase; besides the danger of non-rigidity in a big engine of light crankcase construction. A further advantage of small cylinders is the reduced danger of distortion due to uneven heating while in service.

With many small cylinders in line we get less piston area to the same length of crankshaft, but it is possible to make two or more cylinders operate on one crank and so the balance is redressed. Considerations of this kind have led to the development of the "Vee" and "Broad-arrow" types of engine with two and three banks of cylinders. Fig. 1 on plate shows one of the most successful modern water-cooled engines of the Vee type, the Curtiss D.12 which develops 400 B.H.P. at a total weight of 724 pounds. This engine has a crank throw of only 3 in. and the compactness of the resulting design is evident.

A short stroke means high revolutions to get adequate piston speed, and this in turn involves big inertia forces (since they increase as the square of the revolutions) which become most serious in their effect on the bearing loads at the crankpins. The limit to the closeness of spacing of the cylinder centre lines, with these high-speed engines, is largely a matter of the provision of adequate lengths for the main bearings and for those between connecting-rods and crankpins.

Valve Problems.—The combination of high piston speed with good volumetric efficiency involves ample valve area and the freest possible form of induction system. This, combined with the need for a compact and symmetrical combustion chamber to diminish detonation, has resulted in the almost universal



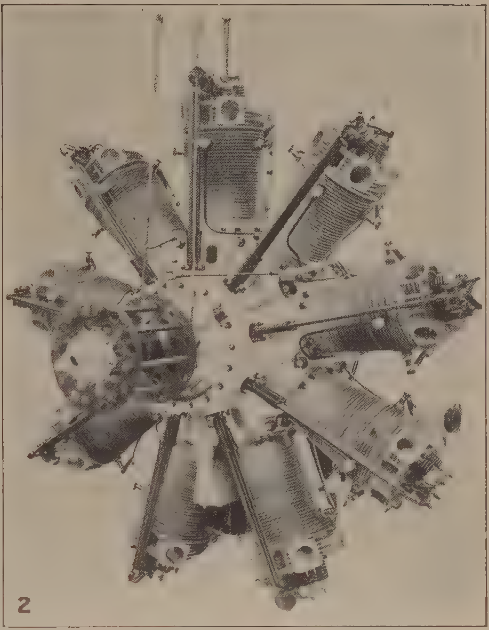


FIG. 1. Curtiss D-12 engine, of 400 B.H.P., weight 724 lb. FIG. 2. Jupiter air-cooled radial engine, 450 H.P., weight 730 lb.
(Fig. 1. Courtesy of "Aero Digest")

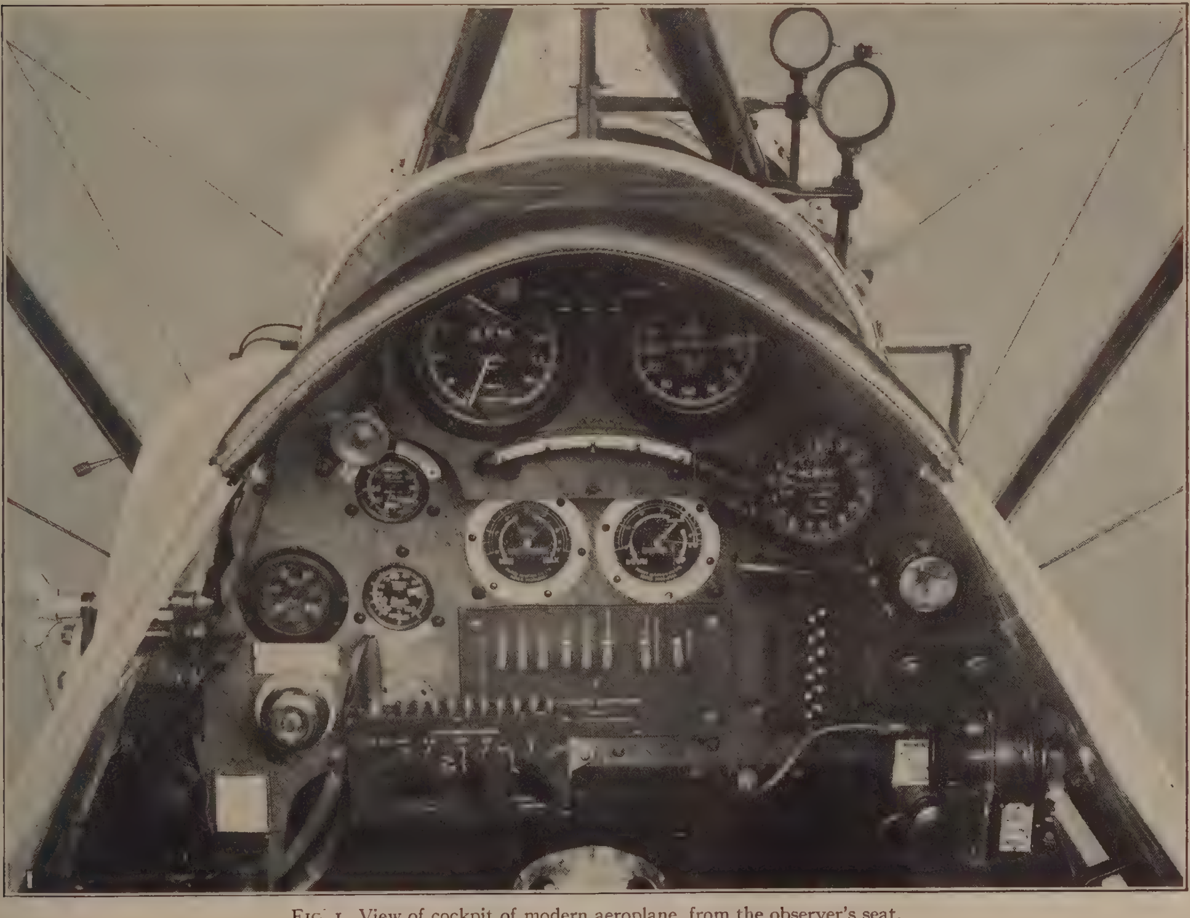


FIG. 1. View of cockpit of modern aeroplane, from the observer's seat.
(Royal Air Force photograph. Crown copyright.)

adoption of four valves in the cylinder head, two inlet and two exhaust, the inlet being rather larger than the exhaust. By this arrangement an effective inlet valve area is obtained equal to about 20% of the piston area. The maximum permissible gas velocity through the valve is about 170 ft. per sec. if good volumetric efficiency is to be maintained, and this therefore, with the valve area available, limits the mean piston speed to about 2,000 ft. per minute.

Next to the big-end bearing loads, valve operation is most critically affected by high revolutions. To get sufficiently rapid opening and closing of a poppet valve for an engine speed of 2,500 r.p.m. the accelerations involve very heavy springs and terribly severe stresses in the cams and in the valve spindles. This difficulty of high-speed poppet valve operation makes the sleeve valve so attractive a possibility.

Fuel Distribution.—With a number of cylinders in line the equal distribution of the fuel between them is a difficulty. Two or more carburetters must be used and the cylinders drawing from each carburetter must be arranged, so far as possible, to do so at equal time intervals. No one arrangement has been standardised as the best: on most 12-cyl. Vee engines one carburetter serves one whole bank of cylinders, but another arrangement divides the engine into two groups of the front six and rear six cylinders, and each group is served by one carburetter. In at least one design some weight is sacrificed for the sake of good distribution in the provision of a carburetter to every two cylinders.

Air-Cooled Engines

The two main classes of air-cooled engines are the Rotary and the Static Radial types. In each the cylinders are arranged radially in one or two planes round the circumference of a circular crankcase. Thus all cylinders are satisfactorily exposed to the cooling airstream, but at the cost of presenting a large frontal area. The rotary engine, in which the cylinders and crankcase rotate with the airscrew, besides the fore and aft airstream, gets the extra cooling due to the rotational speed of the cylinders, but at the expense of considerable waste of power in air friction.

Kinematically the two types are identical. In each there are two parallel axes: viz., that of the main shaft, round which the cylinders are symmetrically arranged, and that of the crankpin, to which the connecting rods are attached. In a rotary engine the crankpin axis is fixed and the cylinders rotate with the propeller, while in the static radial type the cylinders and crankcase are fixed and the crankpin axis rotates round the main shaft in the usual manner.

The speed, and therefore the power, of the rotary engine is limited to about 1,200 r.p.m. by the enormous centrifugal forces on the rotating cylinders, and in consequence recent development of air-cooled engines has been wholly along the line of the static radial.

One of the chief attractions of this type is the possibility of a very compact and rigid crankcase construction. This takes the form, very roughly, of a drum, with cylinders fixed radially round its circumference. Only one crank is employed for all the cylinders which lie in one plane; one piston having a connecting rod with a "big-end" as ordinarily understood, while all the other pistons have "articulated" connecting rods, which are attached by pin joints around the circumference of the big-end of the one master-rod. The loading on the one crankpin is very severe and special designs of big-end bearing are necessary to stand up to it. One of the most successful is the "floating bush" type in which a light bronze sleeve, free to rotate, is interposed between the crankpin and big-end bearing surfaces. A bearing of this kind, of course, is only possible with a crank of the "built-up" type.

Valve Design.—Valve opening is contrived by push-rods and rocker-arms which are carried on the cylinder heads; the rods being operated from a cam ring which is driven at the speed appropriate to the number of cylinders by an epicyclic gear on the main shaft. Since the cylinders of a large, air-cooled, radial engine may undergo an expansion while running of as much as 70/1000ths of an inch, which is not shared by the push-rods, very careful design and proportioning of the rocker-arms are necessary if valve operation is not to be upset.

Fig. 2 on plate is an illustration of the Jupiter engine, one of the most successful of the air-cooled radials. Its nine cylinders, 5$\frac{3}{4}$x7$\frac{1}{2}$ in. bore and stroke, are arranged in one plane and the engine develops 450 H.P. at its normal speed of 1,700 r.p.m. and at a weight complete of 730 pounds.

III. MATERIALS

With the cutting down of weight and the ever more severe conditions as regards temperature and compression ratio the problem of design is bound up with that of materials.

Aluminium Alloys.—The introduction of the light alloys of aluminium was the first great advance in regard to materials. It is now possible to make extremely complex castings and drop forgings for a complete crankcase in this material, and, even before this had been successfully achieved, the introduction of the aluminium piston had largely reduced the mass of reciprocating parts and so brought relief in crankpin bearing loads due to inertia. The high conductivity, too, of aluminium as compared with cast iron has made for cooler pistons and less tendency to carbonisation of the lubricating oil. The same property has led to extensive use of aluminium for making the cylinder heads of air-cooled engines, and, in combination with a steel liner, for complete cylinder construction of water-cooled types. It has even been tried to run a steel or iron piston direct in an aluminium cylinder. The two critical points in regard to high temperatures in a high-duty engine are the centre of the piston, and the exhaust valve, if this is of the poppet type.

Exhaust Valve Materials.—Exhaust valves are called upon to run continuously at a bright red heat and to resist scaling or burning under these severe conditions. The only steels which can successfully do this are certain of the nickel and chromium alloys and these in their turn introduce new problems: they are much more troublesome to machine than carbon steels and also they develop what is known as "temper-brittleness," a condition brought about by the high temperatures at which they are used, and their subsequent slow cooling after use. Alloys of magnesium with copper and zinc are both lighter and stronger than the aluminium alloys. They cast well and machine easily and have been used to some extent for crank-cases with a saving of weight of about 35%. Their disadvantages are a cost of about double that of aluminium and excessive liability to corrosion.

IV. THE SPECIAL PROBLEM: ALTITUDE

Effect on Engine and Airscrew.—Under comparable conditions the pressure developed in the cylinder of an internal combustion engine will be proportional to the weight, and therefore to the density, of the combustible mixture drawn in. At heights above ground level the atmospheric pressure falls off at a rate of roughly 1 in. of mercury per 1,000 feet. At the same time the average temperature of the air becomes lower at a rate and in a manner which varies from day to day. The density of the air will therefore fall off less rapidly with height than the pressure, and the relation between density and height may be very variable.

It is now possible to measure the indicated power of an engine in flight, and experiments on these lines have shown that the indicated power is very nearly proportional to atmospheric density, provided a proper air-fuel ratio is maintained. This, however, is a matter of some difficulty. The "depression" produced in the choke tube of a carburetter and hence the quantity of fuel normally supplied through the jets will, for the same engine speed, be proportional to the square root of the air density. The weight of fuel supplied by a carburetter will therefore fall off less rapidly, as an aircraft rises, than the weight of air drawn in, and the mixture will become too rich. To compensate for this an "altitude control" must be fitted which usually consists of a connection between the float chamber and a point of low pressure in the choke tube. By the gradual opening of this passage the flow of petrol is reduced and the correct mixture maintained.

Engine and Screw.—The useful performance of an aircraft engine cannot be considered apart from its airscrew. These two must be regarded together as the power unit, for the power and efficiency of an engine may be largely thrown away if combined with an inefficient airscrew. Moreover, the efficiency of the airscrew is affected by the revolutions maintained by the engine. Since both indicated engine power and airscrew resistance are proportional to air density, at constant speed, it follows that they both fall off at the same rate as the aircraft climbs. The B.H.P. of the engine, friction losses being approximately constant, will fall slightly more rapidly; but the difference is not large, except at great heights, and since airscrew resistance is also proportional to the square of the revolutions the difference between available engine torque and airscrew resistance will produce only a slight drop in the speed of rotation. A fixed bladed airscrew, therefore, combined with a normal engine will, as the machine climbs, continue to work at nearly constant revolutions and efficiency.

Variation of B.H.P. with Altitude.—Although the indicated power falls off, the mechanical losses in the engine as a whole will not vary much as a machine rises, so that B.H.P. may be expected to fall off more rapidly than indicated horsepower and air density. To determine by direct observation just how fast the B.H.P. falls off with increasing altitude in any given case would be a research of the highest interest. Its accurate determination would involve the two measurements of the speed, and the torque actually delivered to the airscrew. Several attempts have been made to design a torque meter for use in the air, but the mechanical difficulties are so great that so far these attempts at direct measurement have been only partially successful.

The alternative is to deduce how the B.H.P. varies from observations of the performance of the aircraft. This again is a difficult calculation to make with certainty from figures for speed and rate of climb, since the necessary reduction from actual observations must rest upon an answer to the question we are asking: how the altitude has affected engine B.H.P. and airscrew efficiency. It is probably impossible, by tests in the air, to arrive at any satisfactory general law for diminution of engine B.H.P. with height, applicable to all engines, for the simple reason that the mechanical efficiency, which must always vary from engine to engine, and may even vary from day to day with the same engine, has so large an effect on an aircraft's performance as to produce very discordant results. Take for example an engine giving 500 I.H.P. on the ground, and assume that the I.H.P. will fall off in proportion to air density and the friction losses remain nearly constant. If we calculate the B.H.P. at 20,000 ft. where the I.H.P. is halved, this will be 200 or 175, a difference of 12½%, according to whether the mechanical efficiency is 90% or 85% on the ground. Even 1% variation of mechanical efficiency would have an appreciable effect on performance.

The position may be summed up by saying that although such direct observations as have been made indicate that the B.H.P. falls off nearly in proportion to the reduced pressure, irrespective of temperature variation, nevertheless the assumption made above is sufficiently close to justify its use in the prediction of aircraft performances considering the inevitable uncertainties of individual tests. This assumption makes the B.H.P. depend upon the density (and therefore temperature), diminishing in a linear manner with it, but more rapidly than the density itself.

Maintenance of Ground Power at Altitude.—Since the power delivered by an engine will be roughly halved at a height of 20,000 ft., any plan for counteracting this effect of reduced air pressure holds out great opportunities for improved performance. But here the airscrew problem comes in. If the ground power of the engine should be delivered with the airscrew in low density air, then the engine will race away and burst, for unless the inclination of the airscrew blades can be altered the resistance to rotation must fall off with the air density. The usefulness of maintaining ground power at altitude is therefore entirely dependent upon our being able so to vary the pitch of the airscrew blades as to prevent excessive engine speed and at the same time retain a good airscrew efficiency. This problem of providing a variable pitch airscrew is one which is at present occupying our designers and cannot be said yet to have been satisfactorily solved.

Supercharging for Maintaining Ground Power.—To maintain ground power, combustible mixture must be compressed so as to be delivered to the cylinders always at normal atmospheric density whatever the height. This would mean, at 25,000 ft., compressing in the ratio of 2·7 to 1 and then cooling through about 60° C. The necessary cooler involves additional head resistance and, if a piston compressor is used, the displacement will have to be about three times that of the main engine. All this means considerable additional weight, and every added pound is a dead loss at low altitudes and a serious handicap in getting off the ground. For this reason very high-speed rotary blowers offer the best chance of success. Such a blower might either be gear-driven from the engine shaft, or some of the energy of the exhaust gases might be used through the medium of an exhaust-gas turbine. The difficulty attending a blower, if gear-driven from the main shaft, is that, with the exceedingly high gear ratio necessary, about 10 to 1, the inertia of the blower rotor is enormous, and unless some slipping clutch device is provided the gears will be stripped on the very sudden starting up of the engine.

The exhaust turbine drive is very attractive, for, whereas with a gear-driven blower the entire horsepower needed for compressing the air has to be supplied by the main engine, this type makes use of what would otherwise be largely wasted energy. The difficulties are chiefly those of providing turbine rotor blades which will stand the constant exposure to the hot exhaust gases and at these temperatures will retain a strength adequate for a speed of rotation of 2,500–3,000 revolutions per minute. Scarcely less serious is the problem of a shaft-bearing at these speeds when the high temperature makes oil lubrication impossible.

V. MINOR PROBLEMS

Wireless Interference.—While the engine designer has been improving the power and efficiency of his magneto and ignition system to suit high-compression engines, great strides have been made by the wireless branch in short wave-length instruments which can do without the trailing aerial. The magneto and high-tension leads produce waves which upset the sensitive wireless sets, and methods must be devised of so screening off the effects of the ignition system as to allow advantage to be taken of the improvements in signalling apparatus. The high-tension leads are therefore enclosed throughout their whole length in a woven metal sheath which is " earthed " to the engine body and at the same time the plug-heads and contact-breaker are enclosed in small metal cowls which are likewise earthed. But the hard-won improvement in ignition efficiency is cut down by the added electrical capacity introduced by the new screening arrangements, the effect of which, and the additional weight involved, are a dead loss to the engine designer.

Oil Temperature Control.—The functioning of a system of forced lubrication, in which oil is delivered by a pump to all parts of the engine, is very greatly affected by the viscosity of the lubricant. Since the viscosity of the lubricating oil will fall to about 1/10th of its value for a rise in temperature from 40° C. to 100° C., some control of oil temperature is necessary. During the cold period at starting, excessive pressures will be developed by the pump; and although these can be dealt with by relief valves, the flow to the bearings will be very small, and a long period of warming up is necessary until the flow is sufficient to allow full loading to be imposed on the bearings. When flying at low altitudes and in warm climates, and more especially with airship engines which are usually not open to any cooling air-stream, it is necessary to provide for cooling of the oil after it has left the engine and before it is redelivered by the pump.

The problem is a peculiar one, for although the amount of heat to be abstracted is comparatively small, the rapid rise of viscosity as the oil is cooled has the effect of producing a thick coating of viscous oil on any surface where cooling is effective. The conductivity of this viscous layer being very bad, the remainder of the hot oil passes on out of the cooler with a very inadequate reduction of its temperature. The problem is to prevent the oil, as soon as it is cooled, from remaining in contact with the cooling surfaces and so preventing the cooling of that which comes after. The problem will not be solved until a cooler has been designed which is light, which cools effectively and can deal with the high pressures developed while the oil is cold.

Water Recovery.—A problem peculiar to airships is that of compensating for the weight of fuel used during a long flight. In flying to Egypt a large ship would burn some 25 tons of fuel oil, and unless this weight can be made up in some way an equivalent quantity of hydrogen will have to be allowed to escape. An alternative is, while drawing liquid fuel from the tanks, to use less of this and to make up the balance of fuel required by drawing from the gas bags the corresponding weight of hydrogen necessary to maintain balance in regard to buoyancy. Research upon the use as fuel in an engine of a mixture of oil and hydrogen has yielded most promising results and this may prove the most workable solution of the problem.

The alternative of maintaining the dead load on the airship by condensing and storing the water in the exhaust gas from the engines is a matter of considerable difficulty, but it should not prove insuperable. In the combustion of a hydrocarbon fuel the water formed is 9 times the weight of the contained hydrogen. Now an oil fuel contains about 14% by weight of hydrogen, so that in addition to any moisture carried into the engines with the air there will be $9 \times \cdot 14 (= 1 \cdot 26)$ lb. of water for every pound of fuel burnt. This is by no means all recoverable, but with a water recovery apparatus capable of cooling the exhaust gas to within 10° C. of whatever may be the surrounding atmospheric temperature and of collecting all the water formed, the possible recovery should be from 0·9 to 1·0 times the weight of fuel burnt.

VI. FUTURE DEVELOPMENTS

Increase of Size v. Increase of Gas Pressures.—Apart from piston area and piston speed the only way of increasing the power of an engine is to increase the mean effective pressure. This can be done either by raising the pressure or lowering the temperature of the combustible mixture drawn in. The latter alternative has obviously only limited possibilities, but within these limits the use of fuels with high latent heat of evaporation, which therefore give more cooling of the charge, has been successfully applied in racing motor-car practice and may be also in aircraft engines. To raise the pressure of the mixture drawn in means the provision of a blower, not only to maintain ground pressure at altitude but to raise this pressure throughout above atmospheric. Under such conditions an engine of the same bore and stroke would have to have a heavier crankshaft, connecting rods, pistons, etc., to stand up to the larger gas forces developed, the necessary blower and driving gear will be larger and heavier, the air coolers will be heavier and give more drag, so that it might be suggested that the extra power could be got at once by means of a bigger engine (*i.e.*, by more piston area), while leaving the gas pressures the same. Only the detailed calculation of weights and estimates of drag in the two cases can settle the question of which plan will produce the most effective engine, but the small engine with high gas pressure starts with an initial advantage so far as its own head resistance is concerned.

The Two-Stroke Cycle.—To design for a working stroke every revolution is not the easy way toward reducing weight per H.P. which at first sight it appears. The getting of the charge into the cylinder with only the limited area available for inlet valves is, at high speeds, one of the limiting conditions even when the time of half a revolution is available. If it has to be accomplished in one-third of the time, or less, the problem is proportionately greater. Any lowering of engine speed, if combined with all the extra weight of the necessary compressors for scavenging and delivering the fresh charge, may very soon bring down the extra horsepower per pound from a two-stroke cycle to a very narrow margin. It is unlikely, moreover, that the same thermal efficiencies will be achieved as with the four-stroke cycle. Nevertheless the two-stroke cycle is a possible line of advance, more especially with the greater perfection of compressors for supercharging and in combination with the Diesel type of fuel injection.

Sleeve Valves.—One of the most difficult aero engine problems is the satisfactory operation of poppet valves at high speeds and high temperatures. The drawback to the use of sleeve valves has been in the past a tendency toward gas leakage, excessive oil consumption and large mechanical loss due to friction; but with the single-sleeve valve it is possible, by skilled design to minimise these troubles, and this type of valve holds out extremely attractive possibilities. The absence of all springs in the first place and of the excessive accelerations which are so detrimental to cams, would at once eliminate a constant source of trouble. Moreover the sleeve would necessarily be cool, so that tendency to detonation would be reduced; further, it would be possible to provide ample and unobstructed port area so that volumetric efficiency could be maintained at high speed, for apart from the absence of obstruction due to poppet-valve stems in the port, with sleeve valves we are no longer limited to the cylinder end in providing valve port area.

The Compound Engine.—Forty per cent or more of the heat energy of the fuel is at present thrown away in the exhaust of a high-duty engine; where weight is no consideration some of this can be used for raising steam, as in the Still engine designs, but such methods of improving efficiency are probably out of the question for aircraft. The question remains, "Can some of this waste heat be saved by expanding the hot gases much further in a low-pressure cylinder?" The difficulty lies in the transfer of the hot gases at 1,000° C. or more from the high- to the low-pressure cylinder. So long as this has to be controlled by poppet valves the difficulties are probably insuperable; no valves could be expected to stand up to such treatment, when it is remembered that they would need to be operated from outside, and that therefore there would be continuous leakage of hot gas down the valve stems where they slide in the guides. The only hope for the compound engine seems to be through the development of the sleeve valve. It is a possibility, but much research will be required before the difficulties inherent in such a scheme can be met or their magnitude even satisfactorily settled.

The Diesel Engine.—The use of this engine is hardly more than a pious aspiration so far as aircraft are concerned, in spite of its manifest advantages. Not only would it give a very high fuel economy on account of its high compression ratio of 12 or 14 to 1 instead of 5 or 6; but it would burn a fuel of one-third of the price of petrol to-day, and all the weight and complication of magnetos and sparking-plugs would be swept away. There is no fundamental reason why the advantages of compression ignition should not ultimately be achieved without excessive weight; but since present-day aero engines can be built at a weight of less than 2 lb. per H.P. and the corresponding figure for a Marine Diesel engine is of the order of 30 lb. per H.P., it is clear that a long road of patient research has to be traversed before a Diesel type engine can be seriously considered for heavier-than-air machines.

Jet Propulsion.—More than one proposal has been made that the force for propelling an aircraft forward should be obtained by shooting out a jet of air behind on the principle of the rocket. To obtain efficiency, however, when using this principle, it would be necessary that the forward speed of the aircraft should be of the same order as that of the jet backwards, while at the same time the drag due to air resistance has to be overcome by the reaction between the aircraft and the jet. The two conditions are incompatible. But even under the best conditions an air-screw which is rotated by jets at the blade tips and eliminates other driving mechanism could never hope to achieve more than a very poor fuel economy when compared with a present-day heat engine. (D. R. P.)

AERONAUTICS (*see* 1.260).—From the early experiments of S. P. Langley and the Wright Bros. until the beginning of the World War the progress in aeronautics was not marked. Through the efforts of Lord Haldane, which resulted in the establishment of the Advisory Committee for Aeronautics in 1909, research had made a start in England at the National Physical Laboratory and at Farnborough, while in Germany the Pöttingen School had been founded and the importance of a study of fundamental principles was being recognised.

Aircraft, as we know them, were a creation of the War, and military requirements dominated design and practice; the importance of civil aviation was barely recognised; the history of aeronautics, as the reader of Sir W. Raleigh's *War in the Air* realises, formed no small part of the history of the War. The five years (1920–5) have shown a rapid advance in many directions; the theory of the aerodynamic action between a flying-machine and the medium in which it flies has been put on a new basis which has already, as the subsequent pages will show, borne good fruit, which promises to be still more fruitful in the future.

Aircraft are now being designed for the definite purposes for which they are required; that to some extent was true in the earlier period, but the purposes were military, not civil, and the knowledge at the designer's disposal was far less than he now possesses, thanks to investigation and research. Now, as then, to combine strength and lightness is the problem which confronts the designer; metallurgists have realised this and are giving him new materials to work with and in this way they are raising new problems in design.

The internal combustion engine, without which aviation could not exist, is being studied from every point of view with the object of increasing efficiency, of discovering methods to make it as effective at 20,000 ft. as at sea-level, of lessening the number of failures in the air and rendering it as immune from accident as a locomotive or marine turbine.

Methods of navigation are being devised to render air transport safe and certain; wireless has been enlisted in the effort; the Neon beacon and the leader cable illustrate the manner in which aviation, in its desire to put safety first, calls other sciences to its aid. The meteorologist is asked for frequent weather forecasts and is told that there is an urgent need for information as to the nature of gusts in the wind, their intensity, and the rapidity with which they change both in direction and amount. In all directions aeronautics rests on investigation and research.

AERODYNAMICS

Since a sound theory is the basis of good practice, we commence the detailed study of our subject with aerodynamics, dealing with the laws which regulate the flow of air and the motion of bodies through the air. Here the advances have been marked; not that the practice of flight has lagged behind, as will be clear when we come to treat of the design and structure of aircraft, their navigation and their use as a means of transport ever growing in importance. But in England and indeed throughout the world, theory and practice have gone hand in hand, pilots have appreciated the work done in laboratories and, by the aid of wind tunnels, have been ready to test the conclusions of the theorist, and have dared unhesitatingly to carry out the manoeuvres required for the verification of his theories.

Aerodynamics is a branch of the larger subject of hydrodynamics, which deals with the motion of fluids in general, but as its name indicates has been concerned with the properties of the all-pervading fluid, water, or rather with those of a simplified water, identical in some of its main properties with water, but still differing from it sufficiently to allow the mathematician to solve his otherwise intractable equations.

The main difference is the assumed absence of any action of a frictional nature either between the particles of the fluid themselves or between those particles and the surface of any solid which may be moving through the fluid; the fluid is said to have no viscosity.

Now one of the results of this assumption is that if a solid, of which the surface is free from sharp edges or entering angles, be moved uniformly through such a fluid it will experience no resistance, unless the velocity exceeds a certain limit depending on the shape of the solid; the fluid moves smoothly round the surfaces of the solid and the lines of flow, the streamlines, unite where they meet and pass off together; the resultant pressures balance and there is no force on the solid. But if the velocity be too great, or if the body have a sharp edge, theory shows that the pressure at some point of the surface becomes negative; now a fluid cannot support a tension or negative pressure, the motion therefore breaks down. Streamlines leave the body at different points enclosing a mass of dead water which is dragged along by the solid; the surface pressures no longer balance and the solid experiences resistance. A streamline shape, *e.g.*, an airship hull or a fish's body, is a shape in which this failure to maintain streamline motion and to avoid the dead water does not occur at the velocities at which the body is required to move and which therefore would experience no resistance.

Viscosity, etc., of Air.—But real air and water differ from the hydrodynamical fluid in that they have viscosity; air, moreover, can become pressed into a smaller volume, though this property does not greatly modify the motions with which we are concerned; the viscosity, however, is all important and the enquiry as to its effect on the conclusions just drawn is vital. It is here that aerodynamics has made some of its most marked advances during the period since the World War.

In a narrow band close to the surface of the body which we are considering (*e.g.*, an aeroplane wing) moving at right angles to its edge, the motion is modified greatly by viscosity; the layer of air adjacent to the surface sticks to it and is drawn forward with it, and the motion thus caused is communicated to the adjacent layers and superposes on the streamline motion a circulation round the wing opposite to the direction of motion above the wing, and with it below. The velocity above the wing is thus increased, and the pressure reduced relative to the streamline flow, while below the wing the reverse is the case; thus the circulation which we may regard as a vortex or whirl round the wing causes an upward forced lift on the wing.

Friction Factor.—Again, the friction between the layers of air adjacent to the surface shows itself as a drag on the wing, while eddies are set up in the boundary of the dead water, due in part to the friction between it and the rapidly moving streams by which it is surrounded, and these add to the drag. If we consider the case of a wing the span of which is very long (infinite in a mathematical sense) in comparison with its chord, the motion will all take place in planes at right angles to the front edge, and will be the same in any such plane; the loading on the wing will also be uniform. In this case expressions have been found for the lift and drag.

We owe to Lanchester the original conception of this vortex motion round the length of the wing, and to Prandtl and his school the original development of the mathematics, while the problem has been carried further by other workers, notably Glauert at the R.A.E. and Monk in America.

The fact that the wing is finite in length modifies the conditions near the ends; in consequence the simple expressions for the lift and drag need corrections and these have been evolved by making an assumption as to the manner in which the loading falls off as the wing tips are approached. Experiments at the National Physical Laboratory and elsewhere have shown a good agreement with the theory which thus constitutes one of the most notable advances of the past few years. But many more are described in some detail in the section on Aerodynamics and the rest of the articles; among these we may pick out as vital the growth of our knowledge in the means of controlling an aeroplane in flight, especially when at or above the stalling incidence, or when performing difficult manoeuvres, such as spinning.

Spin Factors.—The spin is a method developed during the War for causing an aeroplane to lose height rapidly; its nose is pointed downward and as it descends it spins about an axis approximately vertical. At the same time a method of bringing the machine out of the spin was devised. But in some cases the method failed. Why? This question has led to a whole series of investigations, in part theoretical or on models in the wind tunnels, in part, full-scale, involving daring flights by skilled pilots, aimed in both cases at the measurement of the forces on an aeroplane when spinning and the discovery of the laws which govern that motion; as a result we know now far more about the dynamics of a spin.

Or again accidents occur most frequently as a result of forced landings. As the speed drops there comes a point at which the controls cease to act; the machine is said to be stalled. How does its condition differ from that of a machine in ordinary flight, what are the peculiarities of the motion of the air about the machine which lead to this disastrous result? It is a problem on which many keen minds have been exercised in the near past, both from the theoretical and practical side, and, though a complete solution has not been reached and there is much to learn, work resulting in a larger rudder and a combination of wing-slots and ailerons has shown that experimental machines can be controlled with safety at speeds considerably below the stall.

The Langley Field Wind Tunnel.—In concluding this description of the more purely theoretical advances reference must be made to the high pressure wind tunnel at Langley Field, Virginia, U.S.A. The meaning of the term Reynolds number is explained in the article AERODYNAMICS and the necessity, if model experiments are to be compared with those of full scale, that they should be concluded either at the same Reynolds number or under conditions where the effect due to a change in the number is not marked. This result the high pressure tunnel has enabled us to reach and the detailed conclusions of the work carried out by the able staff employed at Langley Field were eagerly awaited in 1926.

DESIGN AND STRUCTURE

And so we pass on to matters concerning design and structure. Here we notice at once a marked difference between air and land transport. The railway wagon or the motor-lorry rests on the ground; their weights are carried thus. Ships and aircraft are supported by the medium through which they travel and in the case of aircraft heavier than air the motor must provide not only the means of propulsion but also support. This it does as a consequence of the speed at which the aeroplane travels, but it follows that light-weight construction is essential. Strength too is needed and the problem of the designer is to combine strength and lightness in a form which will experience small resistance to rapid motion. In this his problem differs from that of the bridge-builder or the engineer; they, it is true, do not wish to waste material but at the same time a reduction of the weight of the structure they are designing by a few pounds is rarely important; to the aero engineer it is essential. Thus a host of new problems arise. Five years ago an aeroplane almost without exception was built of wood and wire and canvas; while wood is still the rule, all-metal aircraft exist and promise to replace the wood. Metal construction renders desirable new designs and methods of construction and the demand for a light but strong metal calls for difficult and accurate research into metallurgical problems (*see* ELECTROMETALLURGY; METALLURGY).

Lift and Drag.—Again, the lift and drag depend on the speed of the aeroplane, varying as the square of the speed; so that if with a given wing we increase the speed to obtain a greater lift we are met also with a greater drag. But the proportion the lift bears to the drag depends on the shape of the wing; thus we are confronted by the problem of selecting a form of wing which has a high ratio of lift to drag and is free from such other disadvantages as a large displacement of the centre of pressure (the point through which the resultant lift acts), the variations in the angle which the wing makes with the direction of motion.

Safety First.—Once more safety is of the first importance and thus the aircraft must be controllable, completely under the command of the pilot, but it must also be stable within limits, *i.e.*, it must, if for any reason it is caused to deviate from its desired course, tend to return to that course and not require the unison between the eye and hand of an ever-watchful pilot in order to prevent disaster.

In early days the attainment of many of these desiderata was a matter of chance; now the designer sets before himself a definite aim and usually reaches it in his completed machine.

Special Purposes and Design.—And that aim includes the special purpose for which the machine is to be used; in years past a machine which could fly could be utilised for many diverse purposes, *e.g.*, bomb-throwing or passenger transport; now specifications are drawn giving in minute detail all that is required. In this connection an extract from the first Report of Imperial Airways—the company working the traffic from England to the Continent—which has been published is of great interest to all concerned.

After referring to the difficulties and to the high maintenance costs involved in the use of machines not specially designed, the report continues:—

> There is a prospect that the modern machines now coming along will be simpler in construction, require less expenditure of man-hours on maintenance, spend more of their time in the air earning, and being of more advanced design will not become so quickly out of date.

Airscrew and Engine.—We come now to the method of propulsion, the airscrew and the engine which drives it. The airscrew is used exclusively for this purpose and probably will continue to be so employed; it is of interest to notice the difference in this respect between a bird and an aeroplane; the wings of a bird both support and propel it; an aeroplane has wings to carry its weight, but an airscrew in rotatory motion is needed to give it speed. Nature has not fashioned an organ which can be maintained in continuous rotation about an axis.

The Airscrew and its Problems.—The airscrew of to-day is made of metal more often than in the past, but its shape and its efficiency, which is very high, have not been greatly modified. Much more, however, is now known of the theory of an airscrew and the mechanism of the air motions by which the rotational energy driving the screw is transformed into the translational energy which propels the aircraft. It is now fully realised that the blade of a propeller is an aerofoil or aeroplane wing in rapid circular motion about one end. An aeroplane wing is ordinarily driven forward in a straight line in a direction at right angles to its length, and lift and drag forces result; the one acting at right angles to the wing and lifting it, thrusting it upward in a direction perpendicular to that of its motion, the other dragging it back and requiring the action of an external force to maintain the motion.

If now the wing be spun about an axis perpendicular both to its chord and its span and passing through one tip, similar results follow; each section is moving forward, though with a speed which varies as its distance from the axis; each section experiences a lift and a drag, varying of course from section to section, but the lifts combine to form a force thrusting the wing parallel to the axis, while the resultant of the drags is a torque or twisting force about the axis which requires to be balanced by an impressed torque if the motion is to continue.

Thus the torque about the axis, produced by the engine, becomes a thrust parallel to the axis driving the wing in that direction. An airscrew has two or four such blades placed symmetrically round the axis and shaped suitably to produce, for a given speed of revolution, the maximum thrust.

The great advance of the last few years has consisted in the fuller appreciation of this similarity and the realisation of the fact that the methods of calculation outlined above as applicable to the wings of an aeroplane, the circulation theory of the lift, apply also to the action of the airscrew. Vortices are formed around the blades of the screw and it is to these vortices that the thrust is due.

Engine Problems.—But power must be supplied to the airscrew if the machine is to fly, and it was the advent of the internal combustion engine that made flying possible. And here again weight is the essence of the problem; weight includes not only that of the engine itself but that of the fuel it burns and of the oil which makes its motions possible. A comparison of the data as to engines given in any of the earlier text books with those printed in the present article shows what the advance has been, an advance due to many causes. Metallurgical research has given strong metals capable of standing the high temperatures requisite, while at the same time it has provided us with lighter metals of strength sufficient for the purpose with improved thermal conductivity and other advantages. Thermodynamic reasoning points out the need for a high compression ratio in the cylinder and experiments of great delicacy are guiding us to understand more clearly the nature of the combustion which takes place there, the meaning of detonation and some of the means of avoiding it. The valve mechanism has its own difficulties and some of these may perhaps be overcome by the use of a sleeve valve type of construction; in all directions there has been advance, and some engines are far superior for their purpose to those left us by the World War.

Navigation Problems.—And now, having described the machine, its structure and its methods of propulsion, we come to the consideration of its navigation through the air, the difficulty of knowing the vertical when flying out of sight of land, the mysterious behaviour of the compass under certain conditions, first unravelled at Farnborough by Keith Lucas, the new compasses much improved by recent work, the problem of straight flying in a fog, turn indicators, gyro controls and the like, wireless direction-finding and the methods devised for night landing at an aerodrome. In all these directions advances of no small amount have been made, and while there is much to learn the progress has been great.

Commercial Aviation.—Commercial aviation is almost a new idea since the War and embraces a wide field of enquiry. Air transport began under serious difficulties, but from the day when, in 1919, the Air Transport and Aviation Co. dispatched its first aeroplane to fly on a regular commercial service to the present time the progress on the whole has been one of marked advance—advance accompanied by setbacks due to ignorance of the problems to be solved and want of experience as to the methods of meeting the difficulties (*see* FLYING).

Airships (*q.v.*) are described in a separate article drawing attention to two important assets distinguishing airships from aeroplanes. The one is the advantage derived from increase of size, the other the ability to remain aloft without use of power. A clear account of the principles which must guide airship development follows and then we have details of construction of a modern sized ship with particulars of its possible performance and carrying capacity. The advantages which follow from mast-mooring are fully pointed out. The article on SEAPLANES (*q.v.*) deals with flying boats and seaplanes. The problems calling for solution when seacraft are in the air do not differ essentially from those which have to be solved for land-craft. Rising from and alighting upon water, however, involve fresh considerations. The boats and floats are so constructed that when, after starting from rest on the water, a certain speed is attained—the tramp speed it is called—the craft rises in and planes or skims over the water. Up to this point the resistance has increased with increasing speed; as the "tramp speed" is passed there is a marked drop in resistance, for the same expenditure of power the craft begins to move more rapidly, attaining finally its flying speed when it rises in the air. The determination of the "tramp speed," and the proper adjustment of airscrew and engine to attain a full efficiency at this speed, constitute a difficult problem for the designer. Again the impact caused by landing on the water sets up serious stresses in the hull calling for most careful design to combine the necessary strength and lightness. (R. T. G.)

AEROPLANE.—The main problem that confronts the designer of any means of transport is to find a working compromise between the various demands of those who maintain and use the service. There is no conflict between the interests of the operator and those of the user. Their common requirements are safety, speed, comfort and adherence to a published time-table. These all influence the cost of the service, but the measure of each which will enable a service to pay its way can be found only after more experience than is yet available in air transport. The way in which the need for safety reacts on the design of aeroplanes[1] is referred to below, and for information on what has been achieved the article FLYING should be consulted.

Adherence to a time-table involves, from the point of view of design, a general robustness of details and attention to the facility with which minor replacements can be made. Comfort requires a certain minimum space and weight of equipment for each passenger, and an improvement in general means simply a fall in the paying load per aeroplane and hence a rise in fares.

The main advantages which air transit has to offer as a compensation for a reduced measure of safety, comfort and reliability, are speed and freedom from interruption. The air is the only medium of transport which connects, without interruption, all places on the globe, and it may be anticipated that the consequent possibility of transit free from "changes" may prove to be nearly as valuable as the speed which can be maintained.

Stalling Speed.—For reasons which are explained in the article AERODYNAMICS a normal aeroplane, such as those illustrating the article FLYING, cannot be maintained in flight below a certain minimum stalling speed, which, for a modern commercial aeroplane, with fixed wings,[2] varies between 50 and 65 m. per hour. On the other hand, it is possible to give it an engine powerful enough to drive it at between 90 and 120 m.p.h. while leaving a margin of some 25% of its total weight for passengers or goods.

The impossibility of steady flight *below* the stalling speed constitutes the chief danger of air travel. Many attempts have been made to avoid this source of danger by devising an aeroplane which would be capable, as a whole, of remaining stationary in the air. Such machines have generally employed either flapping or rotating wings, the so-called ornithopters and helicopters. The former have shared the legendary fate of Icarus. Of the latter there is at the moment only one example which offers a prospect of success. This, the de la Cierva Autogiro, is, however, fundamentally similar to an aeroplane with fixed wings, in that the rotation of its wings depends on a forward movement of the whole machine through the air, which in turn is attained by means of an ordinary engine and propeller, or airscrew, with horizontal axis. Hence the machine cannot "hover," but its minimum speed is much lower than that of any existing aeroplane. On the other hand, it seems to be inherently less economical of power than an ordinary aeroplane. It appears therefore that its application will be rather to circumstances where the very low minimum speed which at the moment of touching the ground may be as low as 10 m.p.h. and consequent ability to land safely in emergency in confined spaces are of special value, than to normal commercial aviation.

Minimum Speed of Flight.—There is no fundamental obstacle to reducing the minimum speed of a normal aeroplane to some 25 m.p.h., instead of the 50 to 65 m.p.h. quoted above as typical of modern practice. In fact the earliest flying machine had minimum speeds of this order. But the general proportions of such a machine would be uneconomical from every other point of view. In particular almost the whole of the available weight would be absorbed by the structure and power plant, leaving no margin for paying load.

The relation between the total weight (W lb.), the area[3] of the wing (S sq. ft.) and the aerodynamic coefficient (k_L) which determines their lift at any given speed (V ft./sec.) (*see* AERODYNAMICS) is

$$W = k_L \rho S V^2,$$

ρ being the density of the air.

This may be put in the form[4]

$$V = 14\sqrt{\frac{W}{k_L}} \text{ miles per hour}$$

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[1] This article deals only with aircraft which are "heavier than air."

[2] The movable flaps or ailerons at the tips of the wings of such an aeroplane are control surfaces and are referred to below.

[3] The area of the wings of an aeroplane is the sum of the areas of each separate plane (if there are more than one). The area of each plane is the area of its projection on a plane (in the strict sense of the word) through its front and rear edges.

[4] For standard ground level density.

where w = W/S and is called the wing loading, in pounds per square foot. Fig. 1 shows the possible combinations of w and k_L which will give any selected speed. Fig. 2 shows the cross section by a vertical plane parallel to the direction of flight of some modern wing sections. For these the maximum value of k_L (which in virtue of the above relation corresponds to the minimum flying speed) is between 0·55 and 0·65, represented by the shaded band in fig. 1. Modern commercial aircraft using such wings have loadings between 9 and 14 lb. per square foot. A reduction in the stalling speed can be made only by reducing the wing loading or by using a shape of wing section which will give a higher maximum value of k_L. The former course leads to a reduction in the paying load. Much attention has therefore been devoted to the latter method.

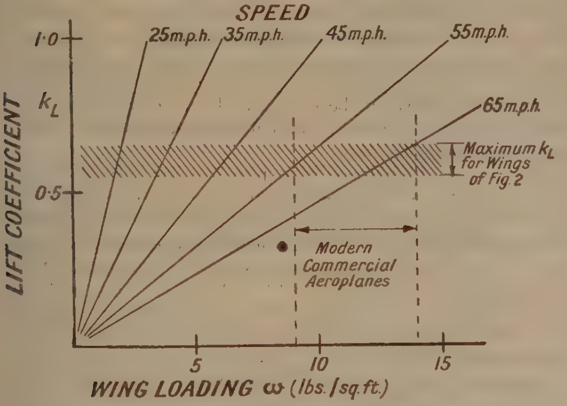

FIG. 1.—Diagram showing the possible combinations of wing loading and lift coefficient which will give any selected speed.

The most effective of the high lift wing sections which have been devised as yet is the slotted wing of F. Handley Page (fig. 3). With this the maximum lift coefficient can be increased some 50% or more. The action of the device is, broadly speaking, to cause the flow characteristic of stalling (*see* AERODYNAMICS) to occur at a larger angle of incidence.[1] The increase in lift is dependent on the relative position of the main and auxiliary wings, *i.e.*, on the size and shape of the slot between them, which can be varied in flight. With the slot closed the characteristics are nearly the same as those of a normal wing. In this respect form, a, (fig. 3) is superior to form, b, but in practice there are, with both, constructional difficulties in the way of ensuring a smooth and unbroken surface when the slot is closed.

Another method which has been widely used, is to vary the curvature, or camber, of the wing (fig. 4). In general, the greater the curvature of a wing section the higher is the maximum lift, but the lower the efficiency at high speeds. This device attempts to secure both high lift and high efficiency by enabling the pilot to alter the curvature to suit the conditions of flight. The increase of lift attainable in this way is much less than can be achieved with a slot, the maximum being about 10%. An automatic form of this device has also been used, the trailing flap being held down by elastic cord and therefore rising as the air pressure increases, *i.e.*, as the speed increases. By combining both these methods very high maximum lifts have been obtained, and it is probable that such a combination will be used on civil aircraft in the near future.

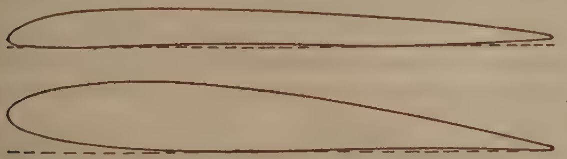

FIG. 2.—Cross sections of modern "wing sections."

The chief obstacles to the use of these variable wings in commercial aircraft are, first, the increase in weight involved, not only in the devices themselves, but also in the larger control surfaces which they require; second, the lack of a clear demand on the part of those who travel by air for a reduction in stalling speed. The increase in weight is not as great as the increase in lift (at the same speed), but the whole aeroplane is appreciably more costly, and in the absence of adequate credit for the benefits derived it is natural that designers should hesitate to adopt such devices.

POWER REQUIRED FOR FLIGHT

When an aeroplane of conventional design and normal proportions is flying horizontally[2] the power of the engine is disposed of in the following ways:—

(*a*) About 25% is lost owing to the inefficiency of the airscrew.

(*b*) From 30% to 45% is used in overcoming the resistance of the air to the passage of the body, including the engine itself, the undercarriage and the exposed part of the wing structure, etc. (*c*) From 45% to 30% is similarly absorbed by the resistance of the wings.

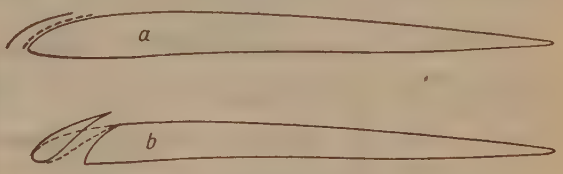

FIG. 3.—Handley-Page "slotted wing."

The choice between the alternative figures in (*b*) and (*c*) depends on the speed of flight, the former corresponding to low, and the latter to high speeds. The resistance of the parts included in (*a*) varies practically as the square of the speed of flight, and the corresponding power therefore as the cube. The resistance of the wings (*c*) may be further subdivided as follows:—

(*c*)1. From a third to three-quarters is due to the equivalent of friction of the air on the surface of the wings. (See the profile drag.) This varies as the square of the speed, and the power as the cube. If the area of the wing is changed, the profile drag changes in proportion. Each wing section has a typical coefficient of profile drag; and, apart from maximum lift, this is in fact nearly all that distinguishes one section from another.

(*c*)2. From two-thirds to a quarter is due directly to the action of the wings as generators of a lifting force, the induced drag of Prandtl (*see* AERODYNAMICS). This varies inversely as the square of the speed, and the power therefore inversely as the speed. It does not depend on the shape of the wing section, or on the area of the wings, but (for a given lifting force, *i.e.*, weight) only on their overall width or span, being inversely proportional to the square of the span. This induced resistance is the essential feature in which transport by aircraft heavier-than-air differs from all other methods, for in no other form is it necessary to expend energy in order to sustain the vehicle. About 8% of the fuel used by a normal aeroplane is used in this way (fig. 5).

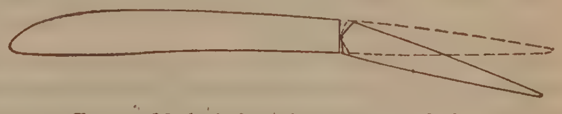

FIG. 4.—Method of varying curvature of wing.

This division of the resistance of the wings into two parts, one of which increases with the speed of flight, while the other decreases, the former dependent (broadly speaking) only on the section and shape of the wings, the latter independent of these factors and governed by the extent to which the span of the wings allows the aeroplane to "grip" the air (*see* AIRSCREW), was originally suggested by F. W. Lanchester. It lay dormant for some years, largely because there was not forthcoming any adequate theory by means of which it would be given quantitative expression in terms of the dimension of the wings. This expression has been rendered possible by the work of L. Prandtl of Göttingen and his collaborators, with great advantage to the technique of aeroplane design. Its chief merit is that it enables a designer to examine the economics of wing proportions without continual resort to model experiments. It has been abundantly verified by comparison with experiments, both in Great Britain and elsewhere, and its applications have been extended by workers in Great Britain, in particular H. Glauert.

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[1] Angle of the chord to the direction of flight. The chord of the wing sections in fig. 2 is indicated by a broken line.

[2] In air of a given density.

The experiments made have not enabled its fundamental ideas to be verified directly, but have shown that it adequately accounts for very varied observations. Many engineering theories stand on a similar footing.

In normal flying conditions, as opposed to the special conditions characteristic of arising from and alighting on the ground, the speed of an aeroplane may vary from 1·2 to 2·0 times its stalling speed. The upper nine of these two figures can be raised by the provision of more power, that given corresponding to a machine having about 60 B.H.P. for each 1,000 lb. of total weight, which is a normal figure for a commercial aeroplane. At its top speed the engine is working at its full power, which is not an economical condition from the point of view, either of the life of the engine or of fuel consumed per ton-mile. The most economical speed, taking into consideration all the various factors, is about 1·5 times the minimum speed. The diagrams in fig. 5 show the way in which the power required for flight depends on the speed, and incorporate the figures given above relating to the distribution of the power among the various parts. The maximum B.H.P. of the engine has been taken to be 100 and the minimum speed 50 m. per hour.

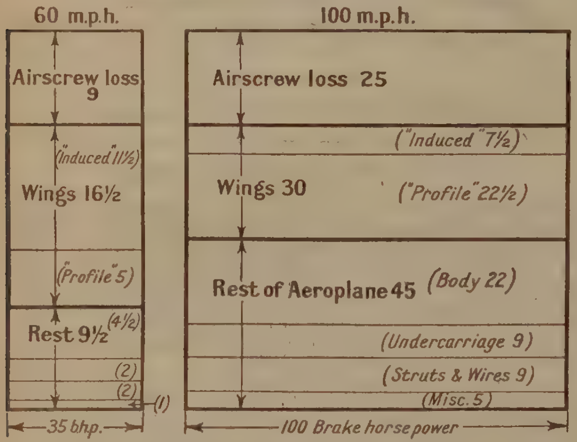

Fig. 5.—Diagram showing how the power required for flight depends on the speed.

These diagrams illustrate the rapid rise of power required with the speed of flight. For such an aeroplane the most economical speed would be about 75 m.p.h., requiring about 50 brake horsepower. If the engine throttle is fully opened at the lower of the two speeds considered above, the aeroplane will climb. The angle of climb for modern commercial aeroplanes is from 1 in 10 to 1 in 15. For high-powered war machines it may rise to 1 in 6, or more.

When the engine is cut off, the aeroplane will lose height, its path being inclined downwards at a corresponding angle, and the necessary power will be supplied by gravity. The angle of descent for a modern aeroplane is from 1 in 6 to 1 in 8. Thus a passenger in an aeroplane will not in general be subjected to greater changes of inclination of the direction of motion than one who travels by road.

Improvement of Performance

The above proportions apply without material change to most modern commercial aeroplanes. The main directions in which improvements in the efficiency of the machines are being sought are as follows:

Airscrew Efficiency.—A loss of between a quarter and a third of the power of the engine in the transmission gear would hardly be tolerated in road or rail transport. Transport by water, however, is burdened by a loss identical in character and of similar amount. It arises from the fact that the propulsive force is obtained by driving a fluid backwards. (*See* Airscrew.)

Resistance of the Body.—The majority of aeroplanes have in the nose of the body either an air-cooled engine, or a water-cooled engine with a radiator. With this arrangement the resistance of the body cannot be separated from that which is incurred in cooling the engine. This latter is equivalent to a reduction in the power of the engine of from 15% to 25% at the cruising speed of a normal commercial aeroplane. At higher speeds the loss is greater.

It is natural to endeavour to recover some of this by placing as much as possible of the load carried (fuel, crew, passengers) behind the radiating surfaces. But a large part of the loss remains, because such parts as these could, at least in principle, be placed in a stream-line body of very low resistance. Such bodies would, however, be heavy, and the conventional tractor aeroplane is by no means a bad compromise, especially when an air-cooled engine is used.

When a very high speed is required, as for example in racing aeroplanes, the cooling resistance can be completely eliminated by using a water-cooled engine in combination with a radiator whose cooling surface is part of the smooth surface of the wings. Such a radiator is heavy and is exposed to damage, reasons which prevented the development of the scheme during the War. It has, however, been used in the United States, by the Curtiss Co., and the success of their aeroplanes in the recent speed contests is largely due to the use of the equivalent of about one-third of the wing surface of a normal aeroplane as a radiator. But the consensus of the opinion of designers in Great Britain appears to be that it is as yet unsuitable for employment in commercial aeroplanes.

Resistance of the Undercarriage.—The undercarriage of an aeroplane has a high resistance, mainly due to the wheels. If the wheels could be withdrawn into the body in flight an appreciable gain would result. Mechanical difficulties are involved owing to their large bulk, but the problem is worthy of attention.

Resistance of the Bracing of the Wings.—There has been a tendency, more noticeable in American, Dutch, French and German than in British designs, to eliminate external wing bracing entirely. There is little doubt but that this results in a heavier structure and a relatively less economical aeroplane than one in which a less extreme construction is adopted—an example of a general principle of all engineering design that extremes are seldom economical. The matter is dealt with below. But it may be remarked that there has been apparent for some time a tendency to reduce the amount of exposed bracing, of all kinds, without entirely eliminating it.

Distribution of Weight

Fig. 6 illustrates the relative proportions of the total weight taken up by the various sections into which it is convenient to divide the component parts. The figures apply to an average commercial aeroplane of moderate size. The distribution of weight varies little from one machine to another, even over a considerable range of size, provided the minimum speed, the cruising speed and the duration of flight are kept fixed.

Structure.—The "structure" includes a great deal which is not part of the essential structure of the aeroplane. A change in the specified strength affects about 60 to 70% only of the nominal structure weight.

Weights.—The weight of the power plant depends mainly on the desired maximum speed of the aeroplane, and on the weight of the engine and its equipment per brake horsepower. There is generally a notable reduction in this item if an air-cooled engine is used instead of a water-cooled engine. The weight of fuel and tanks is dependent on the speed and duration of flight specified, and on the standard of fuel economy reached by the engine. The latter factor varies little for modern engines, both air- and water-cooled engines now giving one B.H.P. hour for about ½ lb. of petrol. The crew and equipment tend naturally to absorb a progressively smaller proportion of the total weight as the size of the aeroplane increases; this is an important advantage possessed by the large aeroplane.

Paying Load.—The paying load, being the balance after the above items have been accounted for, is from 20 to 30% of the gross loaded weight of the aeroplane. Compared with other means of transport this is a high proportion. For example, a modern motor-car of medium power, weighing some 2,500 lb. empty, will carry four passengers and a driver, equivalent to a paying load of some 650 lb. or 20% of the whole. Both a railway train and a ship carry a much smaller percentage of paying load. That all these means of transport are able to offer lower fares than aircraft is due partly to the high running costs of an aeroplane per passenger mile, but mainly to the fact that the majority of travellers are not yet convinced that air transport is safe, and therefore do not use it.

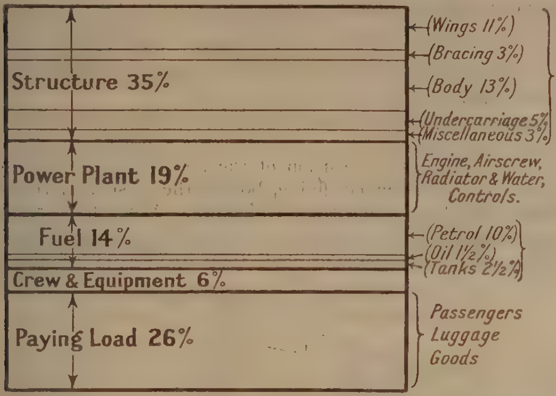

FIG. 6.—Distribution of weight in average commercial aeroplane.

The essential need for economy of weight in aircraft is due, not to the fact that only one-quarter of its weight is available for paying load, but to the high cost of carrying this load by air, as compared with other ways. A saving in the weight of some part of the aeroplane of 1% of the whole allows a reduction of the cost of transport by 4%.

EXTERNAL FORM OF AEROPLANES

There is a striking lack of variation in the appearance as seen in plan of all modern aeroplanes. The main wings have a large span (fig. 7) in relation to their chord, the average ratio of span to chord being about seven. This is a direct consequence of the fact that the resistance due to the generation of lift varies inversely as the square of the span. In some aeroplanes the chord diminishes towards the tip of each wing (fig. 7b) and occasionally the wings, although of uniform chord, are "swept back" (fig. 7c). Neither of these modifications affects the aerodynamic efficiency appreciably.

Ailerons.—Near the tip of each wing is an aileron or wing flap hinged about axes 1·1 (fig. 7a) and interconnected so that an upward movement of one is accompanied by a downward movement of the other. They are operated by a sideways movement of the pilot's control column, and are the means by which the wings are kept level in straight flight, or banked for a turn, as may be required.

Tail Plane.—At a distance of some three chords behind the leading edge of the wings is the tail plane, in area about one-ninth that of the wings. In steady flight its function is to balance or trim the aeroplane, *i.e.*, to ensure that the resultant of all the air forces on the aeroplane passes through the centre of gravity. (*See* AERODYNAMICS.) It is generally in two parts. The front part, some 60% of the whole, is normally fixed, though means are provided by which the pilot can alter its angle of incidence by rotating it about an axis such as 2·2 (fig. 7a), thus enabling the aeroplane to be trimmed for flying at various speeds. This operation is analogous to trimming the sails of a ship so that it carries no weather or lee helm. In a modern aeroplane a movable tail plane is generally considered indispensable.

The Elevator.—The rear part of the tail, or elevator, is hinged on an axis such as 3·3 (fig. 7a), and connected to the control column in such a way that a forward movement of the pilot's hand depresses the trailing edge of the elevator and causes the machine to dive, and vice versa. The elevator is the primary control organ of an aeroplane, since by it the pilot alters the angle of incidence of the wings and hence controls the speed. Fig. 8 shows these and other control organs in more detail, and the forms which they take in more modern machines will be seen in the plate with the article on FLYING.

The appearance of aeroplanes in front and side elevation is more varied than that in plan, owing mainly to the use of one or more planes. As many as four planes have been used on comparatively modern aeroplanes, but the great majority of existing machines have either one or two planes.

Monoplanes and Biplanes.—An analysis of the aeroplanes described in Jane's *All the World's Aircraft* for 1925 shows that, out of a total of nearly 400 types, 32% are monoplanes and 68% biplanes, with two triplanes and no quadruplanes. A similar analysis for 1922 gives, for rather more than half the number of aeroplanes, 22% monoplanes, 74% biplanes, with eight triplanes and one quadruplane. These figures show that the biplane is still the preponderating type, but that the proportion of monoplanes is increasing. The increase during the three years covered is divided between biplanes and monoplanes in the ratio of 9 to 7 approximately. This trend is due partly to the development of wing sections of great depth in relation to their chord, and partly to a desire to eliminate external wing bracing. It is much more conspicuous in foreign than in British design, as will be seen from fig. 9, in which separate analyses are shown diagrammatically for aeroplanes produced in Great Britain, France, Germany, the United States and other countries. It should be noted that the figures given above refer to types and include

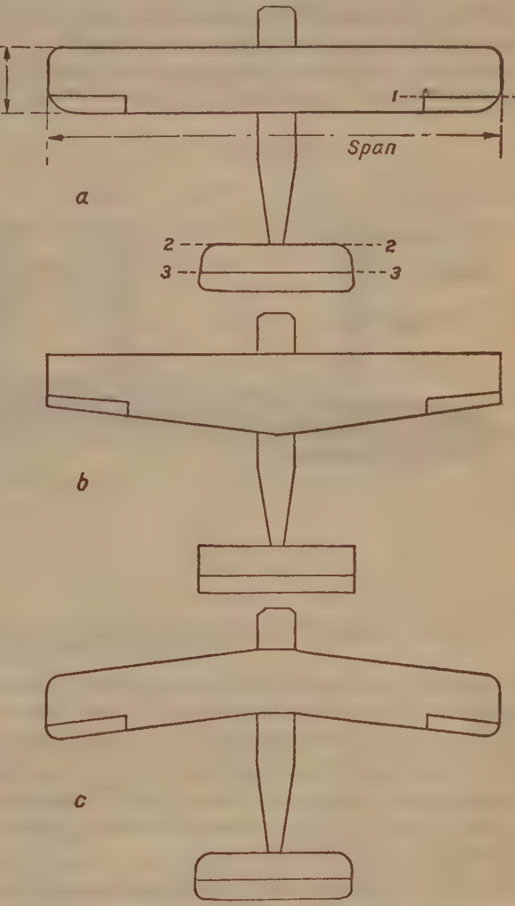

FIG. 7.—Comparison of plans of modern aeroplanes.

both commercial and war aeroplanes and seaplanes. Some of these naturally exist only in small numbers, and some may be confined even to one experimental machine, but there is evidence that all have actually been made and flown. There is no room for doubt that had the above analyses dealt with numbers of aeroplanes, instead of types, the preponderance of the biplane would have been much greater.

The Monoplane.—Confining attention to monoplanes and biplanes, the chief variations in front elevation are shown in fig. 10. The parasol monoplane (a) is used mainly where it is desired to have some of the advantages of external bracing. The monoplane with body above the wing (b) has rather less resistance and is less liable to damage by wind when on the ground, an important advantage. The former type is the more numerous, and the ratio about 3 to 1, but the latter is favoured by the German firm of Junkers which has supplied a large proportion of the machines used on German air lines.

The Biplane.—The biplane with wings of equal span (c) is the most common form of aeroplane, but wings of unequal span (d) (sometimes called sesquiplane, *i.e.*, $1\frac{1}{2}$ plane) have many advantages. The proportion between types (c) and (d) is about 3 to 1. Fig. 10 (e) shows a large biplane with two or more engines.

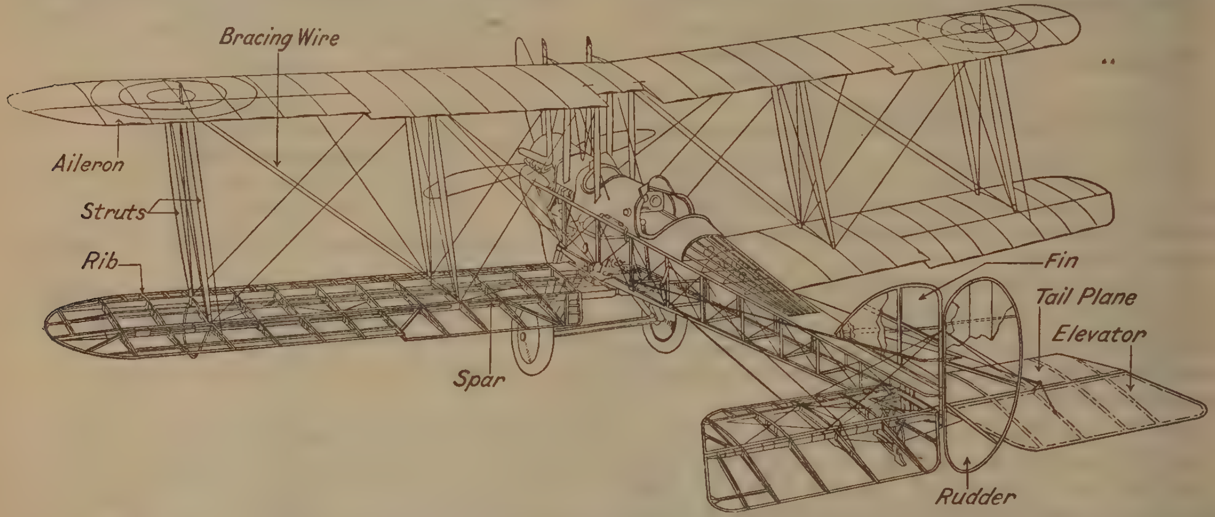

FIG. 8.—Tractor biplane of typical composite (wood and steel) construction. (Part of the covering of the wings, body and control surfaces is removed to show the internal construction.)

In all these the right and left hand wings are not in line, but form a very flat upward Vee. This dihedral angle (which is generally given as the angle between either wing and the horizontal, and varies from 0° to 5°) is introduced in order to improve the lateral stability of the machine.

The corresponding side elevations of these aeroplanes are given in fig. 11. In a biplane the relative position of the planes as seen in this view varies as shown in (c), (d) and (e). In (c) and (d) the planes are staggered, *i.e.*, the line joining the leading edge of the upper and lower planes is not perpendicular to their chords. The angle of stagger is generally between 0° and 30° and a variation over this range has little if any effect on the efficiency of the wings. In (d) the chord of the lower wing is smaller than that of the upper wing, a common variant, especially when the spans are also unequal (fig. 10). In (e) the wings have equal chords and no stagger. The tail plane is here shown as a biplane, in which form its weight can be made low for a considerable area.

Set of the Wings.—The angle at which the chord of the wings is set in relation to the centre line of the body is generally about 5 degrees. Though often termed the angle of incidence, it has no connection with the accepted sense of that word. Its magnitude is the result of a compromise between a number of conflicting requirements, a not unimportant one being the comfort of the passengers. The true angle of incidence being determined by the speed of flight, it is desirable that the relative position of wings and body shall be such that in horizontal flight at cruising speed the body may be nearly horizontal. But the attitude of the body in relation to the wings has no effect whatever on their angle of incidence relative to the direction of flight. Failure to realise this has been responsible for many fruitless inventions of wings whose angular position on the body can be varied. The vertical stabilising and controlling surfaces, a fixed fin and a movable rudder, connected to a rudder bar on which the pilot's feet rest, are situated near the tail plane. They perform practically the same function as the rudder of a boat and can be seen in more detail in fig. 8.

Position of Airscrews and Engines.—In the above sketches the airscrews indicate the position of the engines. In modern aeroplanes the pusher position of the airscrew is seldom used except in single-engined flying boats, the vast majority of modern aeroplanes using tractor airscrews. When two or more engines are used, it is customary to distribute them along the wings, as the transmission of their power by means of shafts and gearing from a central engine-room to airscrews in suitable positions involves a prohibitive weight, which is generally not less than $1\frac{1}{2}$ lb. per H. P. transmitted, or about half the weight of the engine itself. As seen in front elevation the arrangements shown in fig. 12 have been used.

Considerations of rudder control in the event of the failure of one engine make it desirable to place the engines as near to one another as the airscrews permit. Overlapping airscrews have been used, but have generally given rise to troublesome vibrations. It is also desirable that the axes of the airscrews should be, as far as possible, on the same horizontal level as the centre of gravity, in order to avoid giving rise to couples tending to make the aeroplane rotate in a vertical plane when the throttles are altered.

STABILITY AND CONTROL

The general principles of stability and control are dealt with in the article AERODYNAMICS and the stabilising and controlling surfaces have been referred to above. The necessary disposition and dimensions of these surfaces are decided in practice chiefly by direct comparison with previous designs. Since, however, aeroplanes are not merely scale copies of one type, some rational means of using the accumulated experience of previous work is essential, and it is this that research into the fundamentals of stability and control is able to supply. Needless to say, even these methods break down when the aeroplane in question is not broadly similar to those from which the data are derived, and then nothing short of a thorough investigation, assisted by model experiments, will suffice. Very often, even with the best that can be done in this way, uncertainties remain, and the designer is forced, as in other branches of engineering design, to rely upon his ability to draw conclusions from insufficient premises.

Stability.—Stability, the property of returning to a steady state of motion when deliberately or accidentally disturbed, implies as a necessary preliminary the existence of equilibrium of trim in that state. An aeroplane is trimmed for a stated steady condition of flight by an adjustment of its tail plane, the elevators being left free. The degree of stability generally considered desirable for a commercial aeroplane can be attained by arranging the size of tail plane and the fore and aft position of the centre of gravity within certain limits. The further back the centre of gravity, the larger is the necessary tail area. The fore and aft position of the centre of gravity in relation to the wing is defined by its distance from a plane passing through the leading edge of the wing perpendicular to the chord for a monoplane; for a biplane an equivalent monoplane wing is substituted. In normal aeroplanes this distance is usually about one-third the chord, though it has varied between one-quarter and one-half. The height of the centre of gravity of an aeroplane in relation to the wings has a secondary effect on its stability. In particular a low position of the centre of gravity is not necessary for stability. With the first position stability will be secured providing the product of the ratios

$$\frac{\text{area of tail plane[1]}}{\text{area of wings}} \text{ and } \frac{\text{distance of tail plane from centre of gravity}}{\text{chord of wings}}$$

is greater than about 0·35. The latter ratio is usually about 3, and the former one-eighth.

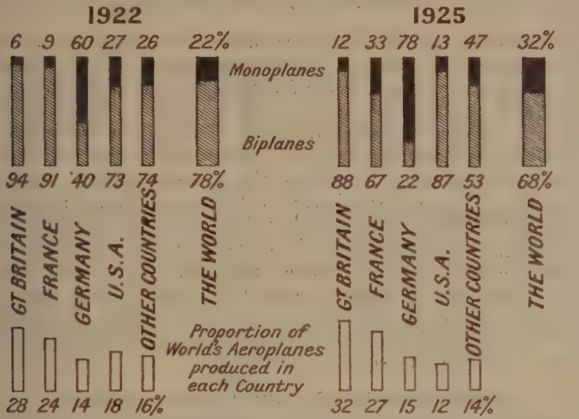

FIG. 9.—Diagram illustrating world production of aeroplanes. (N.B. The analysis refers to *types* of aeroplanes, not numbers of machines.)

The fore and aft control required can generally be obtained if the ratio $\frac{\text{area of elevator}}{\text{area of fixed tail plane}}$ is about two-fifths.

Lateral stability depends mainly on the provision of an adequate fin and dihedral angle. While desirable for the comfort of the pilot, lateral stability is of minor importance compared with lateral control.

Aileron Control.—Ailerons of an area between $^1/_{12}$ and $^1/_8$ of that of the wings are usually provided, and give adequate control at all normal flying speeds. At low speeds, however (more accurately, at angles of incidence of the wings in the neighbourhood of stalling), not only are normal ailerons ineffective, but they may actually be a source of danger, their use aggravating an inherent tendency of the stalled wings to force the aeroplane into a spiral dive or spin. This has undoubtedly been a prolific cause of accidents, of a type which generally involves the deaths of all on board. As the result of research carried out in Great Britain under the auspices of the Aeronautical Research Committee means of curing this vice are now available. The most successful device so far developed involves the principle of the Handley Page slotted wing (see fig. 3).

Rudder Control.—An effective rudder is as essential for safety at low speeds as effective ailerons. The efficiency of any given rudder depends on its being arranged so that the body does not shield it, but it is generally found that when the product of the ratios

$$\frac{\text{area of rudder and fin}}{\text{area of wings}} \text{ and } \frac{\text{distance of rudder from centre of gravity}}{\text{semi-span of wings}}$$

is above 1/20, a satisfactory control is obtained. The latter ratio is usually about 1, so that the former should not be less than one-twentieth. The area of the rudder is generally about $^2/_3$ that of the rudder and fin combined.

Origin of Aerodynamic Data of Design

The designer bases his calculations on data derived from four main sources:

(1) Theoretical investigations, such as the Lanchester-Prandtl theory of the action of wings. (2) Experiments on models in wind tunnels. (3) Experiments on full scale aeroplanes in flight. (4) Analysis of the measured performance of aeroplanes. References to the first of these divisions will be found in the article on AERODYNAMICS, where also the principles underlying experiments on models are dealt with.

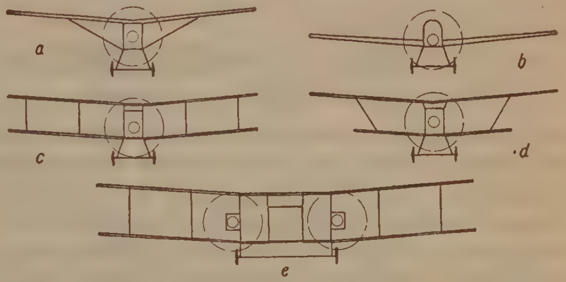

FIG. 10.—Variation in front elevation of monoplanes and biplanes.

The Wind Tunnel.—The wind tunnel has played a great part in the development of aeronautics. Many manufacturing firms possess their own tunnels, used mainly for measurements of the resistance of aeroplane bodies, etc., with a view to improving performance. National wind tunnels exist in many countries, generally reserved in principle for research on problems of wide interest and application. In Great Britain such tunnels exist at the National Physical Laboratory and the Royal Aircraft Establishment, while, as part of the equipment of university institutions where the scientific problems of aeronautics are investigated, wind tunnels were constructed as at East London College in 1910.

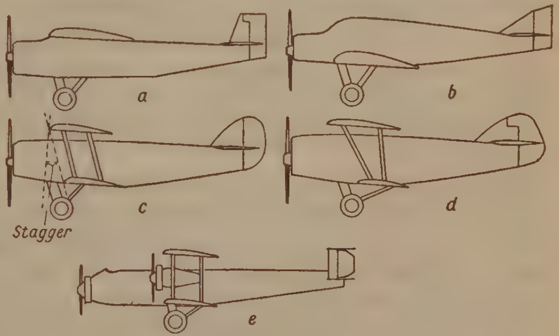

FIG. 11.—Side elevations of aeroplanes shown in Fig. 10.

The main advantage of model experiments is the ease with which the experimenter can control the conditions. They enable suggestions for improvements to be developed to the stage at which a trial on the full scale is possible.

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[1] Including that of the elevator.

Most of the leading aircraft-producing countries carry out full scale experiments. In Great Britain they are made at the Royal Aircraft Establishment under the control of the Director of Scientific Research at the Air Ministry. Owing to the expense involved, private firms can do little work of this kind, but there is active co-operation between them and the Air Ministry, with great benefit to aeronautics. The results of such work will be found in the annual Technical Reports of the Aeronautical Research Committee.

The measurements of speed and climb which are made during the acceptance tests of all aeroplanes are a valuable source of information for the designer. Their analysis enables an overall comparison between various types to be made on a rational basis, but necessarily lacks something in precision. For each type differs from the others in many features, so that, for example, an observed difference in speed cannot safely be ascribed to any one peculiarity. But with suitable precautions reliable information can be obtained in a convenient form. It is found that the factors which have the greatest influence on the speed and climb of an aeroplane are the horsepower per unit of total weight and the total weight carried per unit of wing surface. For further details of the method, and its limitations, references given should be consulted.

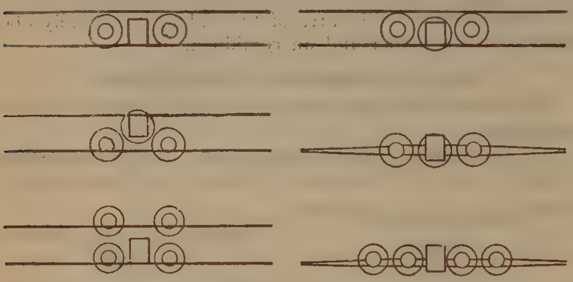

FIG. 12.—Arrangements of two or more engines.

SAFETY OF AIR TRAVEL

The risks to which those who travel by air are exposed are probably the chief influence which hinders the development of air transport. These risks are associated with the following causes: (1) physical failure of the pilot, (2) fire when in flight, (3) collision when in flight, (4) breakage of the structure, (5) forced landing. Dangers of the first four types are not peculiar to aircraft and the precautions they involve are common to transport by road, rail and sea. The measures adopted in air transport have practically eliminated them. It is mainly the dangers which may arise when an aeroplane is forced to land that loom large in the minds of those who might otherwise travel by air. While it cannot be said that these fears are unwarranted, yet in so far as the design of aircraft is involved the position was rapidly improving in 1926.

Forced Landings.—The need for a forced landing arises primarily from failure of the power plant, generally due to a defect developing in some minor part and not to a breakage in the engine itself. Deprived of its power an aeroplane must eventually descend. In practice, from the height at which most civil flying takes place (about 3,000 ft.), about three minutes are available in which the pilot may choose a landing place. If the failure occurs before the aeroplane has reached its working height, the time, and the corresponding area of ground in which this landing place is to be found are reduced in proportion. These considerations unfortunately result in the pilot having to execute somewhat sharp turns in order to place the aeroplane correctly, and it is during these that the control ability of the machine is most severely tested. The ultimate danger lies in the fact that the speed of horizontal travel at the moment of landing cannot possibly be less than the stalling speed. In practice with a typical commercial aeroplane it will be between 65 and 75 m.p.h. The pilot, therefore, endeavours to make the most of what space is available. This consideration, combined with the psychological effect of the apparent increase in the aeroplane's speed as the ground is approached,[1] lead him to carry out the manoeuvres at a low speed, where the inherent characteristics of the aeroplane are least favourable and the controls least powerful (see above).

The dangers associated with a forced landing may be reduced in three ways:

(1) The probability of complete failure of the power plant may be reduced by subdivision. Machines with three engines (see above) are now coming into favour, capable of maintaining their height with any two engines and of greatly prolonging the time of descent with one engine only working. (2) The controls may be so arranged that they give the pilot complete command over the attitude of the aeroplane right down to the stalling speed (see above). (3) The stalling speed may be reduced (see above), so that the space required for landing, and the consequent need for sharp turns, etc., are also reduced.

Reference has been made to what is now possible in the arrangement of controls. But even with controls as normally arranged, there is little room for doubt but that a limitation of the stalling speed of civil aircraft to some 45 m.p.h. would greatly reduce the principal danger of flying. A reduction in stalling speed reduces the space required for landing and therefore increases the proportion of the accessible ground which is suitable. It reduces the danger in the event of over-running the selected landing ground, and it reduces the psychological effect on the pilot of the approach of the ground, in the opinion of some by no means the least valuable advantage. Such a limitation would probably involve for a time an increase in fares, since the aeroplanes would be more costly. This might temporarily retard the development of flying, but in the end the gain in safety could react only to its advantage.

STRUCTURAL DESIGN: THE GENERAL PROBLEM

The aeroplane shown in fig. 8 was designed about 1914, but in its general aerodynamic and structural design it is not fundamentally different from the majority of modern aeroplanes. Regarded as a problem in structural design, a normal aeroplane wing, such as that shown in fig. 8, is a double cantilever, *i.e.*, two similar cantilevers joined at their roots, carrying a load distributed approximately uniformly over its span. The intensity of the loading begins to diminish appreciably at about one chord from the tip, but is still ⅔ of its value at the centre, at a distance of ⅕ chord from the tip. The wing itself is essentially a lamina, the wing sections most commonly used (see fig. 2) having a greatest depth of from 1/14 to ⅛ chord. The resultant loading is nearly perpendicular to the chord, but its line of action (as seen in side elevation) intersects the chord at a point (the so-called "centre of pressure") whose distance from the leading edge of the wing varies from ⅓ to ½ chord in normal flight, but may travel much further to the rear, even beyond the trailing edge—in special conditions. As a whole, therefore, the wing structure must be capable of taking torsion.

From general principles it would appear that the lightest way of bracing such a lamina would be to stiffen it internally by longitudinal and transverse beams, spars and ribs, and to support these by external bracing. The arrangement of two planes, one above the other, connected by struts and wires to form a braced tubular girder, suggested itself to the earliest experimenters in flight. Such a solution is seen in fig. 8 and is typical of the majority of modern aeroplanes.

Alternatively, by tapering the wing in plan (fig. 7b) and thus both reducing the intensity of loading outwards from the centre, though not, it appears, in proportion to the reduction of the chord, and increasing the available depth at the root, the whole of the necessary structure could be contained inside the covering. This is the principle of the internally braced wing characteristic of many foreign designers. It has the advantage of avoiding the resistance of the exposed bracing which is characteristic of the first solution.

Comparison of Monoplane and Biplane.—Many variants of these two main schemes have been used, but in general there is a clear division between them. The first undoubtedly produces a lighter structure and a more compact aeroplane. For, with the same total weight and wing area, the biplane has a smaller span and chord and requires a shorter body and smaller tail.

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[1] To a passenger in an aeroplane 1,000 or 2,000 ft. up, there is generally no sensation of speed relative to the ground.

With the aid of the Prandtl theory it is possible to arrive at comparative overall dimensions for a normal biplane and a monoplane of otherwise similar characteristics. Such a comparison is shown in fig. 13. The span of the monoplane, (full lines) is about 10% larger than that of the biplane (broken lines), and its chord 65% larger. The length of the body and the tail area required are each increased about 28%. Each type has other advantages and disadvantages, but the mere existence of many examples of each indicates that technical opinion is divided on their merits, and to a great extent experience in the design and manufacture of one or the other is a dominating factor in the choice between them.

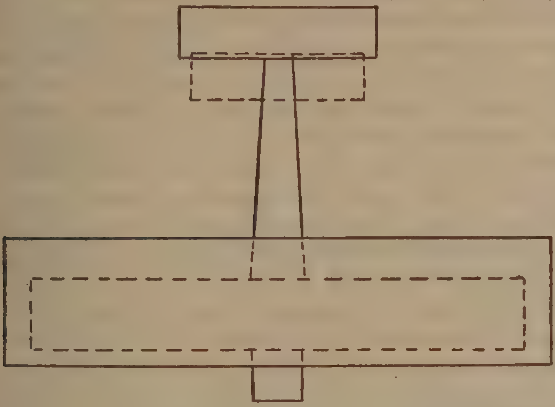

FIG. 13.—Comparison of plans of normal monoplane and biplane.

Refinement in Details.—The details of the structural design depend largely on the materials used (see below). But the main problems are not essentially different from those of the design of ordinary engineering structures, except in one particular. The importance of saving weight in every item of an aeroplane makes it economically possible to carry refinement in design to a point not usually attempted in any other structure. For the same reason elaborate calculations are made during the design, and the effect of every minor strengthening is carefully considered. All aeroplane structures are highly redundant and initial stresses are imposed on the members by tightening the bracing wires, in order to increase the stiffness of the structure. The design of modern aeroplane structures takes account of these features as far as it is possible to do so, in contrast to the general tendency of modern bridge design, for example, which tends to avoid them as sources of uncertainty (*see* BRIDGES). Where saving of weight is a prime consideration such a course is not possible.

Strength of Aeroplane Structures.—Since an aeroplane must be able to manoeuvre rapidly, many systems of air pressure, differing both in distribution and in intensity, must be taken into account. How rapidly it should manoeuvre depends on its class, *e.g.*, a small war machine must be able to execute safely any manoeuvre of which an aeroplane is capable, whereas less exacting conditions suffice for a large commercial machine. Spins, rolls, loops have all to be considered and experiments have been made in order to ascertain the distribution of the air pressure in such manoeuvres. The fundamental manoeuvre is, however, that of rapid recovery from a steep dive at a high speed, and here the combined effect of centrifugal force and gravity produces an equivalent gravity (*see* AERODYNAMICS) several times the normal. It can be shown that, given the necessary control power and indifference to his own safety, the pilot of an aeroplane could impose in this way forces up to 10 or 12 times those which the structure has to bear in the normal flight. As much as seven times normal gravity has been recorded in experiments under war conditions.

This number, the ratio between the effective and the normal value of gravity, is termed the load factor for the whole machine under the stated conditions. A normal commercial aeroplane need never experience a load factor of as much as 2 in flight. In practice it is designed to bear a factor of from 4 to 6, dependent on its size and class. (See R and M 673, the report of the Load Factors sub-committee of the Aeronautical Research Committee.) This is the basis of the specified strength of modern commercial aeroplanes. The ratio between the maximum load factor considered in the design, for any stated form of distribution of air pressure, and the factor in any actual condition of flight appropriate to that distribution, is the nearest approach to the factor of safety commonly used in engineering.

For a commercial aeroplane the factor of safety, as thus defined, seldom falls below 3. In normal level flight it is of the order of 5. For a war aeroplane it may fall to 1½, so that the most highly stressed member is loaded to two-thirds of its breaking load, or even less, but only in extremely rapid manoeuvres.

A commercial aeroplane has a true factor of safety, a margin of strength not called upon under the worst conditions which it normally experiences. The load factors corresponding to irregularities in the air are very small. So long as it is in the air, an aeroplane is exposed to much smaller risk of the failure of its structure by stress of weather than is a ship at sea. Any commercial aeroplane which conforms to the official criterion of strength, and has thereby secured an air-worthiness certificate without which it may not carry passengers, is capable of performing many manoeuvres such as looping and spinning with complete safety.

MATERIALS USED IN CONSTRUCTION

Composite Structures.—The materials which have been most commonly used hitherto for the main structural members of aeroplanes are wood and steel, with a fabric covering for the wings. The wood used is chiefly spruce of the highest grade, and in many aeroplanes the whole of the main structure, with the exception of ties and joints, is of this material. Ties and the joints or fittings by which they are attached to the other members are generally of steel. Steel tubes are used in some parts, either, as in the undercarriage, on account of their robustness, or, as in the control mechanism, because of their efficiency in transmitting torsion.

The general arrangement of the members of a conventional aeroplane structure of this composite character will be seen in fig. 8. The cross section of the wing spars has the I section commonly used in general structural engineering, though the thickness of the web and flanges is much larger in proportion to the overall dimensions of the section than is usual in steel I girders.

The wings of the aeroplane shown in fig. 8 are in biplane form with external bracing. Composite construction has also been applied to wings with no external bracing, generally, but not invariably, monoplanes. The Dutch firm of Fokker is the chief European exponent of such methods. Their wing structures are built mainly of wood, the spars being box girders. The covering of the wings is of three-ply wood, which also enters largely into the ribs and spars.

In aeroplane construction the primary requirement is lightness, and a modern composite aeroplane structure is on the whole nearly as light as one of any other type of construction so far developed, for the same strength. At present it is also very much cheaper. Nevertheless, in so far as it embodies wood it suffers from the following disadvantages:—

(1) Wood of a suitable grade cannot be freely obtained. (2) When exposed to the atmosphere, particularly to large changes in temperature and humidity, wood deteriorates more rapidly than steel or other metals. (3) Wood is not a reliable material. Its external appearance is often misleading as an indication of its internal condition. (4) In aeroplane structures glue and woodscrews cannot be entirely avoided. Both are sources of weakness and uncertainty. (5) When a wooden structure is involved in an accident, many of its members break completely, and splinter and the structure disintegrates, whereas metal members often merely bend, and an all-metal structure generally preserves much of its original shape. The

passengers in a wooden aeroplane are thus exposed to greater danger in case of an accident. (6) Wood has no inherent resistance to fire and cannot be rendered fire resisting.

These disadvantages of wood have been the chief incentive to the development of all-metal construction for aeroplanes.

All-Metal Structures.—The development of all-metal structures by British designers has been mainly confined to replacing each of the wooden members of the composite structure described above by a metal member, using either steel or duralumin. In such a structure the load to be borne by each member is of a fairly simple character and can be estimated fairly closely. Hence a comparison of the merits of a composite and an all-metal structure on these lines can be reduced to a comparison of typical members.

On the other hand European and American designers have used all-metal construction chiefly for monoplanes with no external bracing. The most prominent example is the German firm of Junkers.[1] A wing of this kind cannot readily be considered in detail. In fact it is definitely regarded by its designer as a structural whole. Its structure is highly redundant in character and the corrugated metal covering combines the function of the ribs and fabric found in most other aeroplanes, and in addition contributes largely to the torsional stiffness of the whole wing, a function which in a biplane is performed mainly by the wire bracing. The relative advantages and disadvantages of these two distinct types of aeroplanes are concerned more with their general characteristics than with the materials of their structures.

Relative Cost of Wood and Metal.—The world's present demand for aeroplanes is uneconomical in character. The total volume of the demand is small and it is spread over a large number of types. This reacts to the disadvantage of all-metal aeroplanes in particular. Wood is an economical material when small quantities of many types of articles have to be manufactured. The same raw material is required, and it can readily be shaped to efficient sections by the same simple tools and equipment. With metal, the raw material must be prepared by special plant into the necessary forms (tubes, strip, wire, etc.) and these processes are economical only when large quantities of one form are required. But given the demand for a standard article, metal is cheaper than wood.

Many of the metal details of aeroplanes have been standardised since early in the War, and nearly all the raw materials are now the subject of specifications issued by the British Engineering Standards Association. But there is nothing as yet to correspond with the standard sizes of steel beams (I, angle, channel, etc.) which are essential to economy in general structural engineering, though design is now approaching the stage when such a step will be possible. Against the high first cost, however, must be offset the longer life and greater reliability of metal, and it cannot be doubted that wood as a material for the construction of aircraft is rapidly becoming obsolete.

Physical Properties of Materials.—The disadvantages of wood as a material for the structure of an aeroplane, outlined above, give an idea of what should be the characteristics of a satisfactory material. There is the usual difficulty, common to most problems of engineering design, of assessing the relative importance of each of these characteristics. In fact, their relative positions in the scale change with time and circumstances. But, owing to the low weight of the composite structures characteristic of modern aeroplanes, the technical problem is simplified into that of finding means of making, at the worst equally light, and preferably lighter structures from materials that do not share with wood the disadvantages mentioned. In Table I. are given the strength and specific gravity of various materials which have been, or are likely to be, used for the main structural members of aircraft. They fall into three classes: wood, steel and light non-ferrous metals. The comparatively short life of wood has been quoted as one of its main disadvantages. Both steel and aluminium alloys need protection against corrosion (probably the most promising metal from this point of view being stainless steel). Although it would be misleading to suggest that all the problems of protection of metal structures have been solved, the experience gained suggests that effective protection can be given against all the ordinary causes of corrosion.

It is customary to regard the single figure obtained by dividing the strength by the specific gravity as a figure of merit on which the material can be judged. Such figures are not given in Table I. as they are not, in fact, a reliable criterion for all types of structural members.

Struts and Beams of Thin Metal.—The types of members responsible for the larger part of the weight of the structure of an aeroplane are two, struts and beams, the latter very often having to serve also as struts. Such members have essentially a variation of stress over their cross section, so that when the most heavily stressed point reaches the limiting stress of the material (this may be taken to mark the failure of the member as a whole), the majority of the material is under a lower stress. Hence the density of the material divided by its limiting stress is not in general proportional to the weight of the member.

In general, for a given area of cross section and a given limiting stress, the more the material can be spread out, *e.g.*, in the

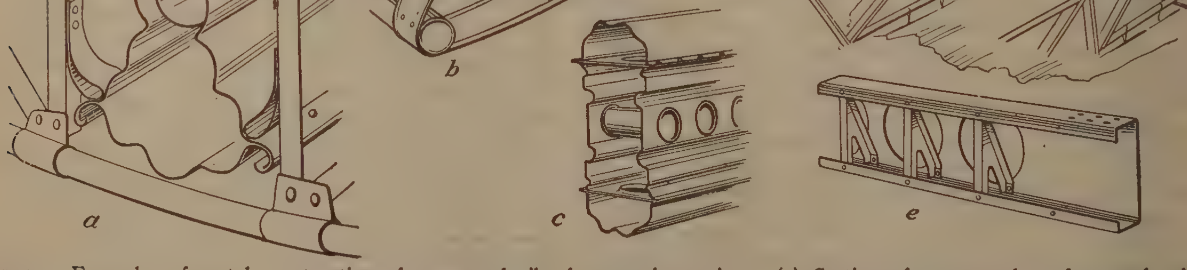

FIG. 14.—Examples of metal construction of spars and ribs for aeroplane wings. (a) Section of corrugated steel spar, showing method of attaching rib by means of spring steel clips rivetted to struts, pressing into corrugations in the spar. (b) Inner end of wing in steel, showing wide rib and attachment of wing to aeroplane. (c) Corrugated steel spar, using transverse tubes to stiffen webs, and duralumin strips to stiffen flanges. (d) Internal construction of wing in duralumin. Spar built up from sheet and angles. Ribs made from tube and channels. (e) Simplified wing spar in duralumin. (N.B. The greatest depth of each of the spars shown is about 5 inches.)

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[1] See H. Junkers, *Journal of Royal Aeronautical Society* (Sept. 1923).

TABLE I.

Material	Specific Gravity	Ultimate Tensile Strength (tons/sq. in.)	Effective Strength in Compression (tons/sq. in.)
Wood			
Spruce	0·45	about 3	2
Steel			
Mild (soft)	7·8	26	15
Plain carbon steel bar for ties (cold-rolled)	7·8	70	. .
Plain carbon steel strip (cold-rolled and blued)	7·8	60	50
$3\frac{1}{2}\%$ nickel steel strip (hardened and tempered)	7·8	90	60
Light Metals			
Aluminium (cold-rolled)	2·6	10	8
Duralumin	2·85	27	17

form of a circle, the greater will be the strength of the strut or beam, but the thinner will the material become. It appears, however, that a limit is reached for steel when the thickness is about 1/50 the radius beyond which an increase in the radius causes a decrease in strength. The member will then fail owing to local buckling of the material, at a load which corresponds to a maximum stress in the material, as calculated in the conventional way, which is below the limiting stress. The design of metal structures for aircraft hinges round the discovery of shapes of cross section which will enable the limiting stress of the material to be reached, and will be convenient for manufacture. The members must also be robust enough to ensure that ordinary handling does not damage them, a serious problem with thin sheets or tubes.

Limiting Stress.—The limiting stress in question is probably what is termed the yield point in compression, the stress at which plastic strain begins, for materials such as mild steel. For high tensile steel and light alloys, in practice the aluminium alloy known as duralumin is the only one used, there is no definite yield point and the limiting stress is accordingly somewhat uncertain. Shapes for members (see fig. 14) have been devised in which the greatest stress at failure is some 60 to 70% of the ultimate tensile strength of the materials (see Table I., column headed "Effective Strength in Compression") and there is reason to suppose that this is not far from the best that can be achieved. Some improvement may be anticipated from an extension of these results to still higher grades of steel, or from the development of a light alloy stronger than duralumin, but at the present time attention is concentrated mainly on the improvement of manufacturing methods.

The ruling principle in the shapes of cross section which have achieved these results with steel is corrugation of the thin sheet material used. The theory of the collapse of corrugated material awaits development, design being at present largely empirical. But the general nature of the strengthening effect of corrugation is well understood. A flat sheet of thin metal buckles readily under compressive stresses. Corrugation, in any direction which does not make too great an angle with the direction of the stress, stiffens it against such buckling. Moreover, it greatly reduces the influence of the inevitable local irregularities in actual materials, and gives robustness to what would otherwise be a very easily damaged member. It has been found essential in struts and beams of thin metal, to corrugate *longitudinally*. Transverse corrugations have proved ineffective.

Steel strip of thickness as low as 1/100 in. has been used in aeroplane spars. The material is either cold-rolled medium carbon steel, whose essential properties have been improved by a process known as blueing (heating to some 350° C.), but is otherwise not heat treated, or a nickel chromium alloy steel, hardened and tempered. Hitherto the strip has been formed into the final shape cold and without any subsequent treatment. This restricts the sections which can be produced and the materials which can be used owing to the need for ductility in order to avoid cracks. Progress has been made in the direction of forming the shapes while the material is in an annealed state and heat treating subsequently. This method will probably supersede "hard" drawing and rolling.

For spars of the size shown in fig. 14, it has been found that the low specific gravity of duralumin makes it possible to use material of such a thickness that corrugation is not always necessary. The resulting shapes (fig. 14) resemble those used in bridge construction, though the lattice girder seen in fig. 14d is found in practice to be heavier than the simpler shape in e. It is probable that, for the size of spar required in the largest present-day aeroplanes of the type under discussion, it is more economical of weight to use a spar composed of a few parts (such as a, c and e) than to build it up from many pieces. On the other hand for larger beams, such as are used in airships, a lattice construction is lighter. Probably the lightest all-metal construction for a wing structure using spars and ribs, etc., combines both steel and duralumin, the former for the main members (spars and struts) and the latter for the subsidiary ribs and edges. With the methods outlined above it is now possible to make an all-metal aeroplane certainly as light as, and sometimes lighter than, the corresponding composite machine.

(W. S. F.)

AEROTHERAPEUTICS.—(*see* 1.270).—In addition to the general use of open air and sunshine, there are several particular ways of using air for therapeutic purposes. Thus oxygen enriched air is used for those made ill through breathing irritant gases such as were used in warfare. These gases evoke oedema of the lungs and danger of suffocation through want of oxygen. So, too, in cases of pneumonia, shock and failing circulation, oxygen inhalation is useful. It is administered either by a mask or in a special chamber in which the patient is put. In the latter case great precaution must be taken against the danger of fire.

Oxygen containing 5% of carbon dioxide provokes deep breathing, and is useful in cases when the lungs require expanding, as after operations for empyema, when hypostatic congestion of the lungs threatens, and in cases of poisoning by carbon monoxide, as in ordinary coal-gas poisoning, etc. This mixture is particularly useful for breathing during induction of and after anaesthesia with ether, the deep respiration inducing on the one hand anaesthesia quickly, and washing the ether out of the body on the other hand at the end of the anaesthetic period (*see* ANAESTHETICS).

Compressed Air.—The breathing of compressed air in a special chamber has been used but this probably has no other action than that of increasing the concentration of oxygen in the air breathed. The breathing of nitrous oxide and oxygen in a compressed air chamber at half an atmosphere extra pressure gives deep and safe anaesthesia; an operating theatre constructed as such a chamber would be valuable.

Air Contamination.—The contamination of the air with certain dusts is important in those affected with hay fever and asthma, *e.g.*, the pollen of plants, spores of aspergillus mould, dandruff of horses, cats, dogs, feathers, to one or other of which dusts certain people have a sensitivity similar to that in anaphylaxis. It has been found possible to relieve such patients by sending them to the high Alps, to sea or by having them sleep in a special dust-proof chamber. Some may be relieved by vaccination with the specific exciting substance (*see* THERAPEUTICS).

Air may be cooled so as to resemble alpine air, but such a method is difficult and of little utility in the sick-room compared with the advantages of natural breathing of open air. Warming and drying air for respiration is of no advantage, but steaming the air is useful in cases of bronchitis.

In a mercurial or sulphur bath, the patient, enveloped in a sheet, sits on a chair beneath which a lamp is placed both to volatilise the drug and produce a steamy atmosphere. The vapour is absorbed by the skin. This treatment is used for syphilis and also for scabies and other affections of the skin.

Rarefied Air.—Rarefied air is used locally for cupping and thus producing local congestion, the blood being drawn into the part to which the cupping apparatus is applied at the expense of other organs. A similar result is got by local application of heat, poultices, etc. In operations where the chest cavity is opened air is blown into the lungs through a tube introduced through the larynx in order to keep the lungs distended.

Ozonised Air.—Ozonised air has been used in treatment of phthisis and wounds. Ozone is an irritant to the lungs and can be used safely only in very weak concentrations, *e.g.*, in a concentration just perceptible to the smell. It takes away the power to smell bad odours, but otherwise has no valuable properties which have been proven. Its chief use, then, is for deodorising offensive smells. (L. E. H.)

AESTHETICS (*see* 1.277).—The chief advances in aesthetics since Prof. Sully's survey—which remains the best statement in the English language—was published in the *Encyclopædia Britannica* (1911) have been applications of psychological discoveries. Though there is still "nothing answering to the German conception of a system of aesthetics in literature," Sully's central postulate (derived through Kant from Hume, who declared that "beauty is no quality in things themselves; it exists merely in the mind which contemplates them") now finds few dissentients.

But the primary task of aesthetics is to describe and analyse the states of mind which give rise to ascriptions of aesthetic qualities, rather than to correlate these states with characters of the physical objects said to be beautiful, ugly, pretty, pleasant and so forth. The latter inquiry can rarely be carried to a useful conclusion, owing to the too great complexity of the factors involved. None the less, great efforts continue to be made to arrive at formulae and measurements which would explain the effect that different kinds of art have on us. But, as Edmund Gurney in *The Power of Sound* showed so conclusively for music, there is no likelihood that we shall ever discover a sufficiently wide formula for what is effective which does not also cover the ineffective. Such researches as those which claim that there are certain fundamental proportions in Greek architecture (J. Hambidge) may, like the printer's standard proportions for book margins, provide rules of thumb for the avoidance of certain crudely displeasing effects.

But the goal of aesthetics, regarded by Sully as the study of certain assignable characteristics by means of which an object "is fitted to affect us in a certain way," must now be recognised to lie rather in the evaluation of the different ways in which we are found to be affected. Very little can be done towards correlating aesthetic experiences with simple characters of their objects, in spite of the mass of material as to the improvised preferences of laboratory-subjects which have been accumulating since 1900, but a good deal can be said about the experiences themselves, and also about their value; *i.e.*, our considered preferences for one rather than another.

Opposing Theories.—Another fundamental assumption made by Sully is, however, being challenged, namely the existence of a distinctive aesthetic state, mood, or attitude, whether regarded as a unique effect of beauty, or as a necessary condition for its perception. Beautiful objects, it was held, either caused this state, or were only perceived to be beautiful when approached with an attitude opposed to that of the practical man, the scientist, or the moralist. This view has been attacked from two sides. In the first place, the so-called aesthetic state is really not one state but a number of superficially similar states, actually very different in origin and nature. Compare, for example, the "detachment" due to the fact that it is a picture we are looking at, and not a tree, with the "detachment" of the contemplation which is part of the final goal of tragedy. And, on the other hand, states similar to these often occur under conditions with which aesthetics would not seem to be concerned; for example, in the nitrous-oxide trance and in incipient stages of dissociation.

This re-orientation is largely due to a heightened sense of the verbal ambiguities involved. It has been customary to assume a common property in things called by the same name, and this tendency has been misleading here, for stricter psychological analysis has made it clear that different states are in question on different occasions.

Further experimental work bearing on this question makes such a result on the whole more probable, though the positive outcome is as yet slight. Some tempting minor theories have been disproved, such as the view that the pleasurableness of certain visual forms is derived from the relative ease of the eye movements by which we perceive them. It has been shown by Stratton and by Judd that the eye does not "follow lines"; it jumps about and its movements do not correspond to the course of the line. Perhaps the most interesting general result has been the demonstration of the great range of difference between individuals, both as to their preferences, for example among colours, and as to the motives which govern such choices.

The experiments of Bullough with colours[1] and of Myers and Valentine with tones[2] would seem to show that individuals fall into four distinct types with regard to their dominant attitude towards such objects: (1) the objective, by whom the colour is liked, *e.g.*, because it is "pure"; (2) the intra-subjective, by whom it is liked, *e.g.*, because it is "warming"; (3) the associative, by whom it is liked, *e.g.*, because it is the colour of wine; (4) the character type, who judge the colour to be "bold," "timid," etc. Further experiments are needed, however, before these types can be accepted as established, and they lend themselves, in any case, to a variety of interpretations.

Value of Experiences.—Another re-orientation concerns the value of the experiences studied by aesthetics. The most obvious point about them is their value, and any theory which leaves this unexplained must be defective. A theory of value in general is therefore necessary for aesthetics, and a thorough attempt to formulate and apply such a theory has been made by Richards,[3] with special reference to literature; an endeavour which represents a return to Socrates no less than to Tolstoi (*see* 1.285).

Aesthetics considers experiences with a view to their valuation; but aestheticians have tended to single out as the distinctive "aesthetic mood" that particular kind of experience in which they were most interested, and, since Kant, attention has been focused chiefly on the mood of detached and impersonal contemplation.

This state of contemplation has, however, often been misdescribed, probably through the influence of the now abandoned "faculty" psychology, as well as through the confusions noticed above. Every experience, no matter how detached or serene, arises only through the play of desires and activities. It is the peculiar direction of desire and will, not their absence, which marks off the contemplative state. They are directed, in fact, towards the maintenance and development *of the state itself*, in all its aspects, not towards the development of one special aspect (as in thinking), nor towards a change in the situation (as in practical activity). But there is nothing dreamlike or indifferent about this state.

Sully looked forward to a deeper inspection of the contemplative mood, and its further analysis has since yielded interesting results. Thus W. M. Urban (*Valuation*, p. 219), based in part on the theories of Meinong and Baldwin, sums up much useful analysis, by French aestheticians such as Paulhan and art historians such as Hirn, in "the concept of the widened ground of diffused stimulation, the *balance* of impulses." E. D. Puffer in 1907 (*Psychology of Beauty*, p. 50), developing one aspect of Schiller's view, had already described the calm or repose of contemplation as a tension, equilibrium or balance of forces; and according to Urban, who remarks that in primitive dances the object of desire, whether martial, erotic or religious, is "distanced," it is this equilibrium of impulses which "prevents the fundamental tendency from breaking forth into overt action."

One of the most interesting results of such an analysis has been to dispose of the theory of pure or aesthetic value which so easily springs from the assumption of the "aesthetic state." Another erroneous corollary has made the contemplative state a rare occurrence, unknown to savages, children and the uneducated. This has given rise to "aestheticism" with the implication that art is a monopoly of the leisured dilettante. A return to Tolstoi, who defined art as the communication of valuable experiences from one mind to another, has therefore been inevitable. It must be recognised, moreover, that very much which seems to be purely aesthetic criticism is in reality comment upon a lack of social opportunity (particularly the absence of an expensive education) and upon acquired mannerisms; the parallel case in which a man is judged by his dress is obvious.

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[1] *British Journal of Psychology*, 2 (1906–8), 3 (1908–10).

[2] *Ibid.*, 7 (1917).

[3] *Principles of Literary Criticism* (1925), especially chap. 5, pp. 35–38. See also C. K. Ogden and I. A. Richards, *The Meaning of Meaning* (1923), in which the verbal ambiguities involved in all discussions of art and beauty are dealt with in relation to the general psychology of language and symbolism.

An important influence leading in the same direction has been that of psycho-analysis (*see* PSYCHO-ANALYSIS) with its fresh light on the growth and development of preferences. Though at present easily misapplied in criticism, its consequences, especially for the study of creative imagination, are likely to be fundamental.[1] The work of the Gestalt school with its stress upon the unity of psychic processes, especially in the study of the perception of form, is also[2] promising, since this unity is certainly an essential consideration both in creation and in appreciation. A more specific problem which awaits development is that raised by the systematic analogical analysis of the emotional effects of sounds and colours.[3]

Philosophy of Aesthetics.—In addition to the endeavors of science to elucidate aesthetic experiences mention must be made of recent developments on the philosophical side. English writers, among whom Bosanquet, Wildon Carr, Carritt, and Collingwood may be cited, have been chiefly influenced by the work of the Italian idealist Benedetto Croce (*q.v.*). In discussing Croce's views it must always be remembered that his aesthetic doctrine forms an inseparable part of his general system of subjective idealism, which includes the denial of the reality of the physical world. It can only be accepted by those who are satisfied with that position, and the attempt to use his formulae by those who do not subscribe to the whole of which they form parts has led to much confusion. In brief, Croce identifies art with intuition, or imagination, the formulative activity of the mind which is prior to thinking in its narrower sense.

At the same time he sharply distinguishes it from the practical activity of the mind. Intuition he again identifies with expression, thereby bringing out the necessity for the formation activity to give form to what it is handling. The work of art, he holds, exists complete in the mind of the artist, the technical work of writing the poem or painting the picture being but a secondary practical activity of "extrinsication." Ugliness is thus regarded as incomplete, or partial beauty, the result of a failure to intuit or imagine with the necessary thoroughness. A psychologist who dissents from this philosophy will remark that the psychology of perception and imagination which Croce's formulae suggest to him seems to be mistaken. But to this the school of Croce have a ready answer, by which the objection is "surpassed." They reply that the methods and results of psychology are either illegitimate or have no bearing upon their position. So the matter must be left until the rival claims to authority of philosophy (in this sense) and of science (in the generally accepted sense) are adjudicated upon.

A new tendency of the past two decades has been the attention received by non-professional theorists. Recent violent revolutions in the arts left professional aestheticians temporarily at a loss, and, especially in England, the younger generation naturally turned to the critics and the artists themselves for guidance. Clive Bell's *Art* (1914) endeavoured to combine the theory of a specific aesthetic emotion with the then prevalent Cambridge Realism, but on closer examination the doctrine of "significant form" was seen to be baseless. The not dissimilar views of Roger Fry also enjoyed a wide vogue, and the more stimulating reflections of Kandinsky, Corbusier and Wyndham Lewis are still deservedly attracting attention. In the literary field, too, the critic has occasionally led the way, and such a work as T. S. Eliot's *The Sacred Wood* (1920) is a worthy successor to A. C. Bradley's *Oxford Lectures on Poetry* (1909). In different fields, also, the Futurist manifestoes of Marinetti, Vernon Lee's Studies in Empathy, the contemplative Hedonism of Santayana and the reported aphorisms of Cézanne have influenced contemporary aesthetic enquiry.

Conclusions.—We have first two views of objective beauty: (1) that there is a simple quality of beauty; (2) that beauty is a complex quality, namely the possession of aesthetic form. The improbability of the second of these has been commented on above; the progress of psychology has rendered the first obsolete. (3) That beauty consists in the imitation of nature. (4) That it is due to the successful technical exploitation of the artist's materials; this view has its relevance in connection with the applied arts. (5) That beauty is the product of "genius"; often an alternative formulation of other views. (6) That beauty is the revelation of (*a*) truth (in some sense), (*b*) the ideal, (*c*) the universal, (*d*) the typical. (7) That beauty consists in the creation of illusion; this has relevance in connection with hypnosis and suggestion theories of art, and in relation to the use of art as a drug (novel reading). (8) That beauty is to be judged in terms of desirable social effects. (9) That the beautiful is the expressive. The rise of the Expressionist school, particularly in Germany, has brought this theory back into prominence. The last seven views may be contrasted as a group with the remaining seven, which are all psychological in a narrower sense. (10) The beautiful is the pleasant. A subsidiary science, which might be termed hedonics, is required to deal with the special problems raised by "pleasure." (11) Beauty is what excites emotion; (12) promotes a specific emotion (*e.g.*, "aesthetic" emotion); (13) involves the processes of empathy; (14) heightens vitality; (15) brings us into touch with exceptional personalities; (16) conduces to an equilibrium of impulses.

BIBLIOGRAPHY.—There is still no comprehensive treatment of aesthetics in English. I. A. Richards' *Principles of Literary Criticism* (1925) provides the best orientation. E. Meumann in his *Ästhetik der Gegenwart* (1919) and his *System der Ästhetik* (1919) has compiled a useful introduction, and R. Müller-Freienfels' *Psychologie der Kunst* (1912) covers a good deal of ground from the psychological angle. A condensed survey, with illustrations, of the 16 main types of theory will be found in C. K. Ogden, I. A. Richards and J. Wood, *The Foundations of Aesthetics* (1922).

The writings of V. Basch, "Le maître-problème de l'esthétique," *Revue Philosophique* (July–Aug. 1921), of C. Lalo, *L'Art et la Vie Sociale* (1921), *L'Art et la Morale* (1922), *La Beauté et l'Instinct Sexuel* (1922), *Esthétique* (1925); and of Fr. Paulhan, *L'Esthétique du Paysage* (1913), will give a good idea of French points of view. B. Croce's *Aesthetic* (Eng. trans., 2nd ed., 1922), and his *Essence of Aesthetic* (*Breviario di Estetica*, 1924) are now available in English; the former contains an extensive historical survey. English followers of Croce are B. Bosanquet, *Three Lectures on Aesthetics* (1915), E. F. Carritt, *The Theory of Beauty* (1923), and R. G. Collingwood, *Speculum Mentis* (1924), *Outlines of a Philosophy of Art* (1925). Criticism of Croce's system will be found in Albert Cock, *Proc. Arist. Soc.* (1914), and H. R. Marshall, *The Beautiful* (1924), chap. 14, the latter being an informative treatment from the hedonistic standpoint, which is also well represented, with a difference, by G. Santayana's *The Sense of Beauty* (1918).

Since vol. iii. of J. Volkelt's *System der Ästhetik* (1924), Theodor Ziehen's *Vorlesungen über Ästhetik* (1925) is the most formidable continental attempt to construct a system. In addition to the experimental work already cited, C. W. Valentine, *An Introduction to the Experimental Psychology of Beauty* (1913) may be mentioned. Max Eastman, *The Enjoyment of Poetry* (1913) and *The Sense of Humor* (1921), J. C. Gregory, *The Nature of Laughter* (1924) and F. A. Beaumont, *The Hero: a Theory of Tragedy* (1925), deal with the literary aspects of Aesthetics. Lucien Bourguès, *La Musique et la Vie Intérieure* (1921), G. Révész, *Erwin Nyiregeházi* (Eng. trans., *The Psychology of a Musical Prodigy*, 1925) and H. J. Watt, *The Foundations of Music* (1920), serve to indicate the material accumulating in one province alone, since the earlier work of Helmholtz, Moos and Hanslik on music; while M. Dessoir's *Zeitschrift für Ästhetik und allgemeine Kunstwissenschaft* (vol. v., 1910, *et seq.*) covers the whole field of reference. (C. K. O.)

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[1] See A. Adler's essay on Dostoevsky in chap. 23 of his *Individual Psychology* (1924); C. G. Jung's many contributions are often suggestive, though S. Freud's studies in this field (cf. *Der Wahn und die Träume;* Eng. trans., *Delusion and Dream*, 1917) have perhaps not the outstanding merits of his other work.

[2] The columns of *Psychologische Forschung* (see for example, the contributions of von Allesch in vol. vi., 1924–5) contain the best work of the Gestalt theorists. K. Koffka's remarks on melody in his *Growth of the Mind* (1924) also merit attention. *Cf.* C. Fox, *Educational Psychology* (1925), chap. 10.

[3] Cf. *Psyche*, vol. ii., Jan 1922, for an outline of the Tudor-Hart theory of the analogy.

AFFORESTATION: *see* FORESTRY.

AFGHANISTAN (*see* 1.306), an independent state in Central Asia. The portion of the frontier between Afghanistan and India to the west of the Khyber was demarcated in 1919 and 1921. The full sovereign rights of Afghanistan were recognised by Great Britain in the Treaty of Peace between the two countries signed on Nov. 22 1921. Estimated area, 245,000 square miles. Population about 10,000,000.

The War Period.—Until the outbreak of the World War, Amir Habibulla had to face only one serious crisis—the Khost rebellion of 1912, which was caused by the rapacity and exactions of the local governor. After considerable trouble the rebellion was put down on terms unexpectedly favourable to the rebellious Ghilzais and Mangals. Amir Habibulla's clemency was prompted both by a desire to conciliate the Ghilzais, the hereditary enemies of the Durrani dynasty, and by the knowledge that his acceptance of Western ideas and encouragement of modern technical improvements had undermined his own popularity. Among the many mixed blessings of modern civilisation which he had introduced in a conservative and unappreciative country were motor-cars, telephones, newspapers, a hydro-electric scheme and a superior high school, the Habibia College in Kabul, staffed chiefly by teachers from India.

With the protraction of the World War, Amir Habibulla's position grew increasingly difficult. At its outset he had declared his intention to abide by his engagement with the British Govt. and keep his country out of the turmoil. But the entry of Turkey, the protagonist of Islam and the holder of the Caliphate, into the War on the side of the Central Powers gave strength to the anti-British party in Afghanistan and paved the way for the dispatch of a Turco-German mission to Kabul in 1915–6. An interesting account of the mission is given—unfortunately for the historian, with admirable discretion—by W. O. von Hentig, its German head, in a book published during the War. The mission had a paper success which did not deceive even von Hentig, who was chiefly responsible for it; and Amir Habibulla had the satisfaction of seeing the War close with his promise to Great Britain fulfilled. There was much speculation, not confined to India or Afghanistan, over the nature of the War reward he was likely to receive, and belief was general that it would take a political as well as a financial form.

Third Afghan War.—All expectations, however, were upset, first, by his assassination on Feb. 20 1919, and then by the Third Afghan War,[1] which was thrust upon India in the following May by his second son, Amanulla, who had ousted his uncle Nasrullah from the throne after a six-day Amirate. The concentration of the British forces was hardly completed when peace overtures, precipitated by the appearance of the first aeroplane over Kabul, were received from the young Amir. The negotiations that followed ended in a Treaty of Peace, signed at Rawal Pindi on Aug. 8 1919, which proclaimed the resumption of peaceful relations, the annulment of the annual subsidy which the Amir had been granted from 1879 onwards, and (more or less as a corollary and for this reason perhaps in a separate letter) Afghanistan's release from Great Britain's control of her foreign relations. This was followed by a Conference at Mussoorie in 1920 at which outstanding differences between the Indian and Afghan governments were freely discussed and the ground cleared for a treaty of neighbourly relations signed at Kabul on Nov. 22 1921 (British White Paper Cmd. 1,786 of 1922).

Independent Afghanistan.—Afghanistan lost no time in making good her foothold within the circle of fully independent nations. Treaties or agreements were made with several of the leading Powers; ministers were sent to Moscow, Berlin, Paris, Rome, Teheran, Angora, and later to London; and as many foreign legations were set up in Kabul. The establishment of a British legation in Kabul put the final seal on Afghanistan's emergence from her old hermit condition. In view of the fate of the British Residency in 1879 it was not entered upon lightly. It was perhaps the most notable feature in the Anglo-Afghan Treaty of Nov. 22 1921, which was only concluded after 10 months of patient negotiation between Sir Henry Dobbs, then Foreign Secretary to the Govt. of India, on the part of Great Britain, and Sardar-i-Ala Mahmud Tarzi, the Amir's father-in-law and Foreign Minister, on the part of Afghanistan. Chief among the difficulties responsible for drawing out the negotiations was a clause in the Russo-Afghan Treaty of Feb. 28 1921,[2] under which Russia had acquired the right to establish consulates at Ghazni and Kandahar—localities admittedly remote from all prospect of Russian trade, and useful to Russia only as jumping-off grounds for intrigue on the Indian frontier. Indeed, Great Britain from the outset declined to negotiate a treaty unless Afghanistan found a way out of a commitment so manifestly hostile in design. Afghanistan's success in doing so was noted in the European Press at the time as a sign that she was not entering the comity of civilised nations altogether unequipped with the weapons of modern diplomacy. And in the next three years there were at least two international crises that attracted attention in the world's Press, from which, after what were apparently false steps at the beginning, she extricated herself with a diplomatic skill and a robust common sense that commanded general respect. The first arose in 1923–4 out of the murder of two British officers by two Afghan subjects within a mile or so of the Afghan border, which was closely followed by the flight into Afghanistan of some ruffians who had murdered an English officer's wife and abducted her young daughter. The second and in some ways even more sensational crisis (for it all but ended in a rupture with Italy) arose out of the shooting of an Afghan policeman by an Italian named Piparno in Afghan Government employ. The procedure adopted in the trial was according to Western ideas highly prejudicial to the accused, and even ran counter to one school, at any rate, of Moslem jurisprudence, in that it ignored the prior settlement of the case with the cognisance of the state by blood-money paid to the relatives. After a protracted incarceration Piparno was summarily executed, and feeling in Italy at once grew tense. In both crises the young Amir took charge of affairs himself when the crisis was at its height, and proved that the Amirate had lost little if anything in strength with Afghanistan's political development, and that when his country's honour was at stake Amir Abdur Rahman's grandson had an ample share of that political sagacity which had been among his grandfather's most marked characteristics.

Modern Development.—In other spheres Amir Amanulla has broken away from his great ancestor's policy, notably in his determination to open up his country to Western civilisation. Here and there indeed he seems to have been dangerously in advance of his time, as in his schemes for the emancipation of women through female education—schemes which were apparently the cause or chief among the causes (under the agitation of the Mullas) of the dangerous rebellion that broke out in Khost in the spring of 1924 and was only suppressed in the following spring after the Afghan Govt. had organised considerable forces to cope with it.

But even clerical conservatism seems unlikely to be able to obstruct the more material of Amir Amanulla's schemes for the development of his country, such as much-needed improvements in communications. In addition to a wireless station at Kabul which is in regular communication with Peshawar and Tashkent, Kabul and the more important localities in its neighbourhood are linked up with the Indian telegraph system, and a project has been on foot ever since the Russo-Afghan Treaty of 1921 for linking up Kabul with the Russian system through Kandahar and Herat. Road communications have improved very greatly during the period 1910–25, for the introduction of motor-cars has necessitated the reconstruction of the principal roads, especially in the neighbourhood of the capital itself. The prospect of a really well-aligned motor-road from Kabul to the Khyber, and from Kabul to Kandahar and thence to Chaman, is not, perhaps, far distant, and when realised must have a profound effect on the economic and political development of the country. Trade between India and Afghanistan, especially by the Quetta route, has increased considerably of late years, and cannot fail to be greatly enhanced by the construction of roads fit for motor transport. The barrier of the Hindu Kush range, with its steep ascents and numerous passes, effectively blocks communication by mechanical transport between Kabul and the north for the present.

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[1] For this campaign see *Papers regarding hostilities with Afghanistan*, 1919 (Cmd. 324 of 1919) and a despatch from Gen. Sir C. C. Monro printed in *The London Gazette*, March 12 1920.

[2] Translation of the text in *L'Europe Nouvelle*, May 28 1921.

Against the Amir's extensive employment of Europeans on technical, educational and other work, there are some murmurings. And whether clerical conservatism or politicians of the Abdur Rahman school will continue to acquiesce in the Russification of some of the essential services and in particular of the tiny air force that Afghanistan is trying to build up, seems very doubtful.

Trade with India.—The foreign trade of Afghanistan is mainly with India. The construction of motor-roads and the completion in 1925 of the Khyber Railway from Janrud to the head of the pass are of great importance to the trans-frontier trade between Afghanistan and India. The only figures available for the trade of Afghanistan are those issued by the Govt. of India and by the governments of the provinces bordering the Afghan frontier. The following table gives the value in rupees of the trans-frontier trade for the average pre-War year and for 1921–2 and 1922–3:—

	Exports to India	Imports from India
Pre-War average	1.07.00.000	1.53.00.000
1921–2	81.00.000	1.35.00.000
1922–3	1.61.00.000	1.58.00.000

The chief exports to India are raw wool, manufactured woollen piece goods, shawls, fruit, nuts, vegetables, ghi, asafoetida and hides. The principal imports from India are cotton piece goods, twist and yarn, indigo, manufactured leather, wheat, sugar, tea and liquors. A trade convention signed at Kabul on June 5 1923 provided for three transit routes across British India for the forwarding of goods to and from Indian posts.

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AFRICA (*see* 1.320).—The period 1910–25 witnessed many important developments in Africa. Territorial changes were numerous and had a marked effect upon political, social and economic conditions. Many pages were added to the history of discovery, while the newly gained knowledge of the continent has greatly affected past conceptions of the development of the higher forms of vertebrate life, especially of the mammals of the Old World from Morocco to China, and even across the Atlantic to South America. South America and the West Indies, it is now clear, were once united with West Africa by a broad belt, across which vertebrates from the Old World in the Eocene, Oligocene and early Miocene formations poured westward and gradually peopled cis-Andine South America.

I. EXPLORATION

The largest unknown area of Africa in 1910 was in the Sahara, including the Libyan desert. Only the central part of the Sahara had been adequately explored, while the greatest gaps on the map were in the Libyan desert. This region may be considered first. Here in 1920 Hassanein Bey (Ahmad Muhammad Bey Hassanein), an Egyptian officer, made a somewhat remarkable journey from the confines of Cyrenaica to the Kufara oasis, the headquarters of the Senussi sect. He was accompanied on this journey by an English woman, Rosita Forbes, who has since made further adventurous journeys in the northern part of Morocco, Abyssinia and the lands east of the Nile. Hassanein Bey in 1923 accomplished a still more remarkable penetration of the unknown, making a journey through the Libyan desert, during which he examined two "lost" oases, into Darfur and Kordofan.

Work of the French.—Previous explorations by the French (1912–7) had greatly increased knowledge of the eastern limits of the Chad basin, and had definitely proved the distinction and disconnection of the Chad-Niger basin and the western basin of the Nile. In this region the name of Col. Jean Tilho remained predominant owing to the greatness of his discoveries, though the spelling assigned by his and other expeditions in the Tibesti and Ennedi mountains requires careful revision. Col. Tilho's expeditions had revealed altitudes in Tibesti of 11,200 ft. and the height of Mt. Tuside as 10,700 ft.; lesser altitudes of 9,800 ft. were determined at Jebal Marra, in Darfur, and of 4,000 to 5,000 ft. on the western borders of the Sudan, while there are other indications of high land on the northwestern edge of the great Nile basin. Further to the south in the Nilotic Sudan, to the east of the main Nile, altitudes of 10,000 ft. were discovered in 1911–2 by Col. H. D. Pearson. Maj. Cuthbert Christy made an interesting journey in 1916 along the southwestern limits of the Nile basin, which in places traversed the ironstone region wherein waters within sight of the explorer flowed either southwards into the Mbomu and its affluents (Congo basin), or northeast into the Nile basin.

French officers, among whom may be named Gen. Laperrine, Capt. Martin, Capt. Mougin and notably Capt. Augiéras, had begun as early as 1904 to continue, in an energetic and scientific manner, the survey of the western Sahara, from the southern confines of Morocco to the basin of the Senegal river and the northern and northwestern Niger. The great depression (the bed of a dried-up sea), known as the Juf, remained unexplored up to 1922; but since then its northeastern fringe has been made a little more known by the adventurous journeys of the Citroën cars across the desert from the latitudes of Insalah and Ahaggar in southern Algeria. A little has been added to the knowledge of the mysterious area, traversed by many great rivers, of Portuguese Guinea, and since 1921 the vast southern part of the Niger basin, and the Black and White branches of the mighty Volta river, which flows into the sea in the British Colony of the Gold Coast, have become better known in detail and in general features. At the same time, northern Togoland, Dahomey, Southern Nigeria and the basin of the great Benue river were mapped in detail.

East and Central Africa.—Much good work was done in East and Central Africa. Mr. I. N. Dracopoli in 1912–3 explored part of southern Jubaland; he reached the Lorian swamp, which receives the waters of the Uaso Nyiro, and solved the problem of its outflow, showing that its waters eventually reach the Juba river. In April 1912, Mr. (later Sir) G. F. Archer completed, after over two years' work, surveys connecting the triangulation of British East Africa with Maj. Gwynn's Abyssinian boundary survey. In East Central Africa a survey by Capt. E. M. Jack, in 1911, of the region northeast of Lake Kivu and west of Lake Victoria added to the knowledge of the Mufumbiro range of active volcanoes; Karisimbi was found to be 14,780 ft. high. In Dec. 1912, Sir A. Sharpe and Mr. M. Elphinstone witnessed the formation of a new volcano, named Katarusi, which, following an earthquake, rose out of an old grass-covered lava field, sending into the northeast corner of Lake Kivu a river of lava which filled up a large bay. Since that time the Mufumbiro region and western Uganda have been surveyed in considerable detail.

The first survey along its whole length of the Congo-Zambezi watershed was made in 1911–4 by Anglo-Belgian and Anglo-Portuguese boundary commissions. As in the Congo-Nile watershed, it was found that many rivers ran for considerable distances parallel to the divide, which is largely bush-covered. Maj. Reginald Walker, one of the British commissioners, discovered that the Luapula, the main eastern headstream of the Congo, did not, as was believed, issue from Lake Bangweulu, but was a continuation of the Chambezi, which passes through the great swamp south of Bangweulu.

Results of the War.—During the World War, exigencies of campaigning led to many additions to the knowledge of the topography of tropical Africa, partly through the use of aircraft for survey purposes. Thus very useful maps, showing routes unsuspected from the ground, were made by airmen of the northern part of Portuguese East Africa. In 1920 Dr. P. Chalmers Mitchell, who passed over the Nile basin in an aeroplane, proved the value of air reconnaissance to geology by the discovery in the Bayuda desert, north of Khartoum, of the volcanic character of a range of hills. A little later the French began to use aeroplanes for survey purposes in the Sahara.

After South-West Africa was taken over under mandate by the Union of South Africa much attention was given to Ovamboland (Amboland), that very interesting northern part of the territory. The strenuous efforts, made for over 10 years, of E. H. L. Schwarz, professor of geology, Rhodes University College, Grahamstown, have led to a more persistent and scientific attempt, during which in 1925 air surveys were made, to explore the western part of the region lying between the Kunene river, Lake Ngami and the southern part of Bechuanaland. The urgent need of saving the country between the basin of the Orange river in the south and the western Kunene on the north from complete desiccation impelled Schwarz to recommend the diversion of the Kunene river from its present route to the sea to its former connection with the half-dry Lake Etosha (Etosha Pan). He hopes, by reuniting all these waters in the northwest of Bechuanaland, to reopen communication both with the Orange river in the south and with the Zambezi in the east.

II. COMMUNICATIONS

The first railway and steamer route across Africa was completed by the opening, in March 1915, of a railway from Kabalo on the Lualaba river (Upper Congo) to Albertville on the west shores of Lake Tanganyika. The year before (1914) the German railway from Dar-es-Salaam had reached Kigoma, on the east shores of Lake Tanganyika. A part of this trans-African route is by the Congo, the navigable stretches of the river being linked up by railway. An all-rail east-west route across South Africa had also been completed. In 1915 a line was built from Prieska to Kalkfontein, connecting the system of the Union of South Africa with that of South-West Africa, and in the same year a short line of 21 m. was constructed joining Walvis Bay with the South-West African system. By this means Walvis Bay and Delagoa Bay were linked by railway. A second east-west all-rail route across Africa will be provided by the railway from Lobito Bay, on the coast of Angola, to Katanga, where it will join the lines to Beira and other east coast ports, as well as to Cape Town. In 1925 some 500 m. of this line remained to be completed, but the whole route had been surveyed, and its construction, after many delays, had been resumed.

While the Cape-to-Cairo scheme still exercised men's imaginations, it was increasingly recognised that the true function of cross-Africa routes was to bring the produce of Central Africa direct to the nearest seaport. The railway from Cape Town via Bulawayo and the Victoria Falls, which had reached the Belgian Congo frontier in 1909, was, however, continued northwards across Katanga to Bukama on the Lualaba river; the line was completed in May 1918, an addition of 442 m. in 10 years, making a through service from the Cape, on the same gauge (3 ft. 6 in.), of 2,598 miles. In order to compete for the copper output of Katanga, the Belgians, in 1922, began the building of a railway from Bukama to Ilebo on the Kasai river, this being a modification of a scheme for a through railway from Bukama to the lower Congo.

East and West Africa.—In East Africa, an extension of the Uganda Railway was begun in Dec. 1921. A line was constructed from Nakuru to Eldoret, and in 1923 loans were raised to carry the line to Mbulamuti on the Busoga Railway, running from Jinja to Namasagali, which is on the first navigable stretch of the Nile. The new line opened up rich cotton growing regions. In Tanganyika Territory a branch line from Tabora, on the Dar-es-Salaam–Kigoma line, with its ultimate terminus at Mwanza on the southern shores of Lake Victoria, was under construction in 1925, the section to Kahama having been completed. In the same year the British Govt. announced its approval of a proposal to raise loans up to £10,000,000 for the further extension of railways and the improvement of harbours in British East Africa.

In West Africa the French drew up plans to connect the middle Niger with the Guinea Coast by railway. The principal line, from Thies, on the Dakar–St. Louis Railway, to Kayes on the Senegal river in the French Sudan—whence a railway already ran to Bamako and Kulikoro on the Niger river—was begun in 1907, but was not completed till 1923. It is 682 m. long. In British West Africa a railway from Accra in the Gold Coast Colony to Kumasi in Ashanti was completed in 1923. In Nigeria the bridging of the Niger river at Jebba, completed in 1914, gave the railway from Lagos to Kano, 704½ m. long, an uninterrupted service.

In 1913 a railway was begun from Port Harcourt, at the mouth of the Bonny river; it was completed to the Udi coal-fields, a distance of 151 m., by May 1916. From Zaria, on the Lagos-Kano Railway, a branch line, 143 m. long, built across the tin-field area to Bukuru, was completed in Dec. 1914. The extension of the Port Harcourt–Udi line northward, via Makurdi on the Benue river, to Kaduna, on the Lagos–Kano line, was begun in 1921 and was nearing completion at the end of 1925. This extension is some 450 m. in length.

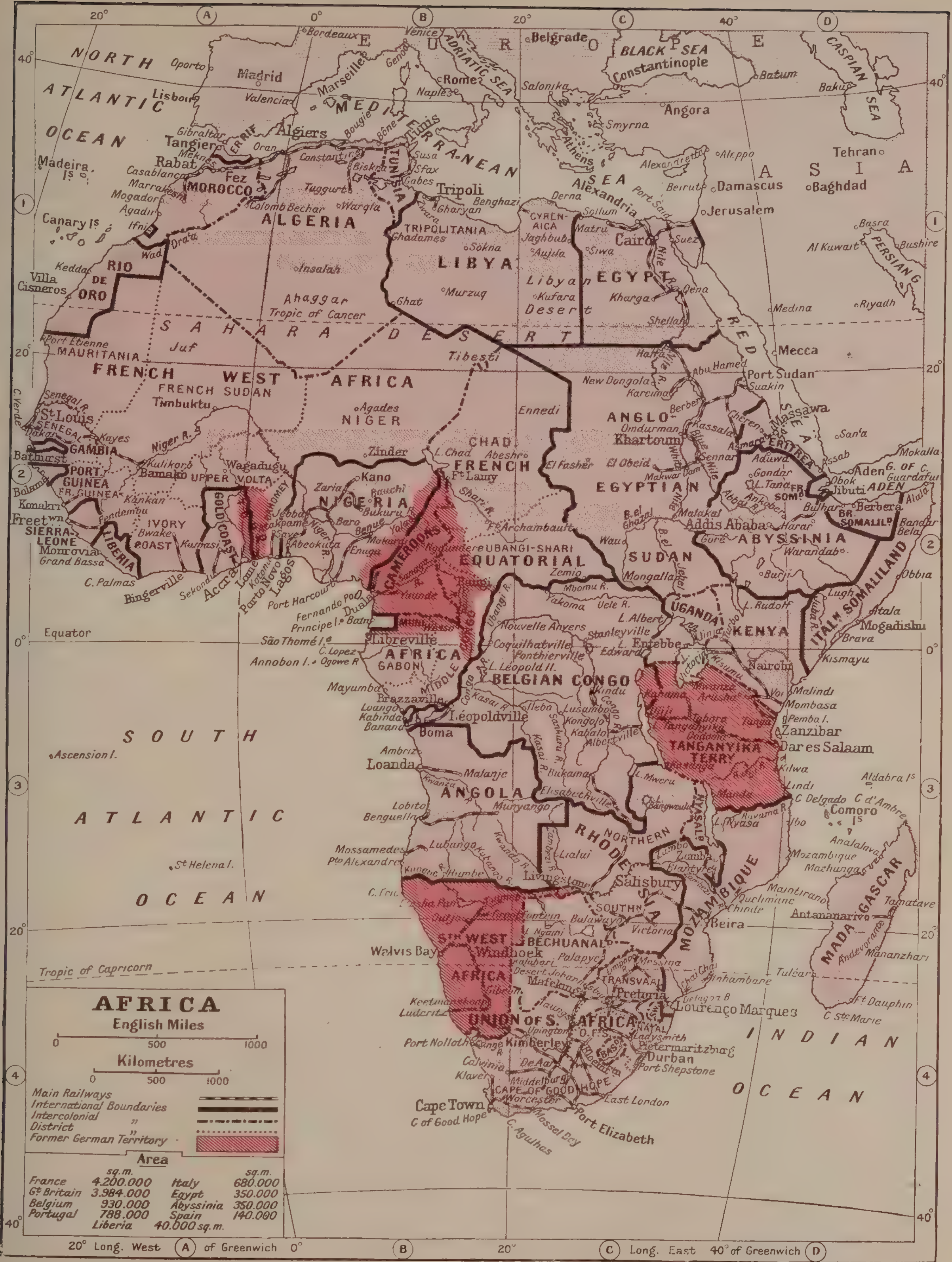
During the 16 years 1910–26 the railway mileage in South Africa was greatly increased. The new railways were mainly of local interest, but a line from Beira to the Zambezi, completed in 1922, gave Nyasaland direct access to the ocean, save that the Zambezi remained to be bridged.

Trans-Saharan railway schemes had not, up to 1926, got beyond the stage of preliminary survey, unless the extension of the railway from Biskra to Tuggurt, opened in 1914, be taken as the first section of such a route. The surveys had shown, however, that there were no serious engineering difficulties to be overcome. Political interest in Morocco led the French Govt. to build lines traversing that country from Casablanca, on the Atlantic Ocean, via Fez and Taza to Ujda, where a junction is made with the Algerian railways. The rising against the French and Spanish governments in Northern Morocco had, however, up to 1926, paralysed any efforts to connect Tangier and Tetuan with the French railway system, though there was then hope that such work might soon be undertaken. In the Suez Canal zone a railway from El Qantara, on the Canal, to Gaza, in Palestine, was constructed in 1916–8 by the British for military purposes, thus giving railway connection with the systems of Palestine, Syria and Asia Minor.

Roads and Air Routes.—Road building, ancillary to, or in substitution for, railways, made great progress, notably in West Africa, the Belgian Congo and Uganda. Since 1910 powerful wireless telegraph stations have been established at many ports and inland centres, while motor-cars and aeroplanes have achieved a conquest of blank and unmapped Africa with a degree of rapidity which would have been deemed marvellous at the beginning of the 20th century. The first flight from Cairo to Cape Town was made in 1920; in 1925 the continent was first traversed from end to end (Algeria—Sahara—Belgian Congo—Uganda—Tanganyika—Cape Town) by motor-car.

III. ETHNOLOGICAL DISCOVERIES

One direction in which Africa has greatly increased its importance and interest in the eyes of reflective persons lies in the past history of the human and sub-human species within its domain. We are gradually coming to understand that, subsequent to the complete severance of West Africa from Brazil, which took place, we may guess, somewhere early in the Miocene epoch and, at a later date, of East Africa from Madagascar and the broken sub-continent of which Mauritius, Réunion, the Amirante Is. and the Seychelles are now the only remains, some further changes took place during the Miocene and Pliocene epochs in the western Sahara and in the Libyan desert between the Tibesti heights and the Nile.


AFRICA
English Miles
0 500 1000
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Main Railways
International Boundaries
Intercolonial "
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20° Long. West A of Greenwich 0° B 20° C Long. East 40° of Greenwich D
NORTH ATLANTIC OCEAN
SOUTH ATLANTIC OCEAN
INDIAN OCEAN
MEDITERRANEAN
BLACK SEA
CASPIAN SEA
RED SEA
PERSIAN G.
EUROPE
ASIA
Tropic of Cancer
Equator
Tropic of Capricorn
MOROCCO
ALGERIA
TUNISIA
TRIPOLITANIA
CYRENAICA
LIBYA
Libyan Desert
EGYPT
RIO DE ORO
SAHARA DESERT
MAURITANIA
FRENCH WEST AFRICA
FRENCH SUDAN
NIGER
CHAD
FRENCH EQUATORIAL AFRICA
UBANGI-SHARI
GABON
MIDDLE CONGO
SENEGAL
GAMBIA
PORT. GUINEA
FR. GUINEA
SIERRA LEONE
LIBERIA
IVORY COAST
GOLD COAST
TOGO
DAHOMEY
UPPER VOLTA
NIGERIA
CAMEROONS
ANGLO-EGYPTIAN SUDAN
ABYSSINIA
ERITREA
FR. SOM.
BR. SOMALILD.
ITALN. SOMALILAND
UGANDA
KENYA
TANGANYIKA TERRY.
BELGIAN CONGO
ANGOLA
NORTHERN RHODESIA
SOUTHERN RHODESIA
NYASALAND
MOZAMBIQUE
MADAGASCAR
STH. WEST AFRICA
BECHUANALD.
TRANSVAAL
O.F.S.
NATAL
BASUTO.
UNION OF S. AFRICA
CAPE OF GOOD HOPE
Madeira Is.
Canary Is.
Ascension I.
St. Helena I.
Comoro Is.
Zanzibar
Algiers
Tunis
Tripoli
Cairo
Alexandria
Khartoum
Addis Ababa
Timbuktu
Dakar
Lagos
Accra
Libreville
Léopoldville
Nairobi
Mombasa
Dar es Salaam
Loanda
Windhoek
Salisbury
Pretoria
Lourenço Marques
Durban
Kimberley
Cape Town
Port Elizabeth
East London
Antananarivo
Madrid
Rome
Constantinople
Jerusalem
Damascus
Baghdad
Tehran
Mecca
Area

	sq.m.		sq.m.
France	4.200.000	Italy	680.000
Gt. Britain	3.984.000	Egypt	350.000
Belgium	930.000	Abyssinia	350.000
Portugal	788.000	Spain	140.000
Liberia	40.000 sq.m.		

The Congo basin, like Lake Chad, had become a great shallow inland sea, and before the advent of man these western portions of the continent contained vast areas covered with shallow water. In any case, from the evidence offered by the prehistoric and historic distribution of mammals and birds, a striking dissimilarity has been shown between the prehistoric mammalian fauna of the north of Africa, Egypt, Abyssinia, the Nilotic Sudan, and east, south-central, southwest and southernmost Africa on the one hand, and the western portions of the continent on the other. Over an increasingly narrow belt, which stretches westward from the Nilotic Sudan to the Cameroons, there still continues a certain affinity in beasts and birds; this affinity extends to the southern part of Senegambia, though even here, and in Nigeria and the Congo basin north of the main Congo, there still exists a strange dissimilarity in the distribution of the mammalian fauna. In the same way South Africa exhibits a wealth of mammalian life which, so far as present discoveries go, is absent from West Africa.

Evidences of Early Man.—The most remarkable development in African discovery has taken place since 1922. Before that date no discovery, of an unchallengeable character, showing the existence there of any human race earlier than the negro, the term negro including Bushman and Hottentot, had been made in Africa. There were faint evidences in the rocks and caves of southernmost Africa of the co-existence there at a relatively remote period—though there was little in the remains which assigned the date with tolerable precision—of some Bushman-like race with mammals now extinct, such as a lingering type of mastodon. But all the human remains of any antiquity in East, North or South Africa seemed to be of negro type, and therefore within the range of close kinship with *Homo sapiens.*

But in 1921 a fine specimen of a male skull, which has been subsequently named *Homo rhodesiensis,* was discovered in the Broken Hill mine, in the central part of Northern Rhodesia. There were also traces of accompanying bones of the limbs. This type bore suggestive resemblances to *Homo neanderthalensis*, whose former existence in North Africa had been suspected for some 30 years, though until then it had left unquestionable remains only at Gibraltar and in Palestine.

At the beginning of 1925 a further discovery was made at Taungs in Bechuanaland, in what is now an almost desert region. Here, embedded in the rocks of the surface, the bones of a young individual, perhaps 10 years old, were brought to sight, so clearly significant as to be unmistakable. Hitherto, though the negro sub-species offers, like the Australoid, indications of ape-like features lost by the white man and the Mongol, it was difficult to extrude either negro or Australoid from specific kinship with the rest of existing humanity. But the human remains found in south-central Africa near the Kafue river, and this truly remarkable man-ape from the heart of Bechuanaland, show that at some period of uncertain remoteness there lingered an ape-like human being with close affinities to the man of Neanderthal, and also, in an upward direction, to the Australoid sub-species of *Homo sapiens;* and further, that the chimpanzees had penetrated to South Africa, and there had left behind, perhaps 500,000 years ago, under altogether different climatic conditions, an ape-like form very near to the human family.

IV. POLITICAL HISTORY

The political map of Africa changed very considerably between 1910 and 1925. In 1910 the British self-governing colonies of the Cape, Natal, Transvaal and Orange Free State were formed into the Union of South Africa, with a single government and one Legislature. In 1911 a considerable area of French Equatorial Africa was transferred to German Cameroons and in return Germany acknowledged a French protectorate over the greater part of Morocco. In Nov. 1912 a Franco-Spanish treaty defined the Spanish zones in Morocco. In 1912, also, Italy annexed the Turkish vilayets of Tripoli and Benghazi (Cyrenaica) to which the common name of Libya was given. In Dec. 1914 a British protectorate over Egypt was proclaimed, but by a declaration of Feb. 1922 Great Britain acknowledged the independence of Egypt. The status of the Anglo-Egyptian Sudan remained unchanged.

In June 1919, by the Treaty of Versailles, Germany renounced possession of all her oversea protectorates in favour of the principal Allied and Associated Powers. These territories, which had all been conquered by the Allies during the World War, were placed under mandatories. The Union of South Africa became mandatory for German South-West Africa; Togoland was divided between France and Great Britain; and France became mandatory for Cameroons, except for a small portion which was placed under the administration of British Nigeria. Britain became mandatory for German East Africa, renamed the Tanganyika Territory, but by subsequent Anglo-Belgian agreements Belgium became mandatory for the provinces of Ruanda and Urundi. In 1920–5 Italy gained additions to Tripoli and Cyrenaica by arrangements with France and Egypt and to Italian Somaliland by arrangement with Great Britain.

As a result of these changes Africa was divided among the following Powers. The territories governed under mandate are reckoned in the possession of the Power named:—

	Sq. m.
France	4,200,000
Great Britain	3,984,000[1]
Belgium	930,000
Portugal	788,000
Italy	680,000
Egypt	350,000
Abyssinia	350,000
Spain	140,000[2]
Liberia	40,000

These figures give a total of 11,462,000 sq.m. as the area of Africa. In the absence of definite surveys of large areas of the continent this may be regarded as a close approximation to accuracy.

German Policy.—The extinction of Turkish rule in North Africa had long been foreseen and was no matter for regret. It ended a connection which had lasted five centuries and had been almost wholly evil in its effects. German sovereignty in Africa had only dated from 1884 and had been rapidly enlarged. Endeavours to extend it further had been a prominent factor in German policy for a decade before the World War. Germany desired a footing on the African coast of the Mediterranean and a port on the Atlantic coast of Morocco. These desires conflicted with Italian and French ambitions, and in 1911 the issue on both points was decided against Germany. As to Morocco, the Franco-German convention of Feb. 9 1909 had recognised the privileged position of France in Morocco, but not a French protectorate over that country, and the sending of the German gunboat, "Panther," to Agadir, in July 1911, was a protest against what Germany considered an unwarranted extension of French influence in Morocco, and an intimation that if German treaty rights in Morocco were to be renounced, France must make compensation. The intervention of Great Britain on the side of France put an end to a dangerous situation; Germany, by a convention concluded Nov. 4 1911, accepted compensation in Central Africa and withdrew opposition to the establishment of a French protectorate in Morocco.

While the Franco-German negotiations were in progress, Italy abruptly declared war on Turkey and invaded, and held, Cyrenaica and Tripoli. Thus Germany, who had designed to exploit those vilayets through the medium of an Austro-Hungarian chartered company, was deprived of her last opportunity—short of war—of gaining a foothold in the Mediterranean. She turned her attention to the development of a *Mittel Afrika* policy. This policy aimed at securing Germany's supremacy, primarily economic and ultimately political, in central equatorial Africa. The aim was to reserve the Belgian Congo, Angola and Mozambique, north of the Zambezi, as a German sphere, and thus to link up Cameroons with the South-West and East Africa protectorates. German industries had need of the raw material tropical Africa produces, and, moreover, southern Angola was a good field for European settlement.

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[1] Including Anglo-Egyptian Sudan.

[2] Including the Spanish zones in Morocco.

British statesmen were not unfavourable to German expansion in equatorial Africa, so long as it was confined to the economic sphere. In 1898 an agreement, signed by Mr. A. J. Balfour and Count Hatzfeldt, had divided Angola and Mozambique into spheres in which Great Britain and Germany respectively were to give financial and economic help to the Portuguese. This was followed in 1899 by the Treaty of Windsor, the object being to reassure Portugal that the Balfour-Hatzfeldt agreement was not in derogation of her sovereign rights in Africa. Neither the agreement with Germany, nor the treaty with Portugal was published.

After the settlement of the Morocco crisis, Germany reopened negotiations with Great Britain in respect of Portugal's African colonies, and Prince Lichnowsky (the German Ambassador) and Sir Edward Grey reached a new agreement, which was ready for signature in 1913. Nearly all Angola was recognised as a German economic sphere, as well as the northern part of Mozambique. The rest of Mozambique, including Delagoa Bay and the Zambezi valley, was to be a British economic sphere. Sir Edward Grey made it a condition of signing that the 1898 and 1899 documents should be published. The German Foreign Office raised objections, Herr von Jagow (then Foreign Minister) stating that the German Press would regard the terms of the Treaty of Windsor and the Lichnowsky agreement as contradictory. By July 1914, however, German consent to publication had been given, but before the new agreement could be signed the World War had broken out.

The World War.—During the progress of the campaigns in Africa the whole of the continent, except Abyssinia and the Spanish protectorates, became involved in the struggle. The conquest of the German colonies was foreseen in the negotiation which preceded Italy's entry into the War, and Article 13 of the agreement signed in London on April 26 1915, between France, Russia, Great Britain and Italy, laid down that:—

> In the event of France and Britain increasing their colonial territories in Africa at the expense of Germany, those two Powers agree in principle that Italy may claim some equitable compensation, particularly as regards the settlement in her favour of the questions relative to the frontiers of the Italian colonies of Eritrea, Somaliland and Libya, and the neighbouring colonies belonging to France and Great Britain.

Italian Ambitions.—Italian ambitions had gone beyond the readjustment of frontiers; in particular Italy wished to acquire Jibuti, the port of French Somaliland and the starting place of a railway to Abyssinia. As Jibuti was the only French port on the Suez Canal route to the East and to Madagascar, as well as the only approach to Abyssinia that France possessed, she declined to entertain proposals for its surrender. Italy, however, obtained from France a welcome rectification of the Tripoli-Tunisia frontier, as well as valuable railway and commercial concessions in Tunisia.

In regard to the Cyrenaica-Egyptian frontier, the British Govt., in 1919, offered Italy a readjustment of territory in the Libyan desert. The negotiations had not been concluded when Egypt was granted independence and after that time they were conducted directly between Italy and Egypt. They turned largely on the possession of the oasis of Jaghbub, a place of some strategic importance, where is also the tomb-mosque of the founder of the Senussi sect. On Dec. 6 1925, an Italo-Egyptian agreement was signed, by which Jaghbub was included in Cyrenaica. The wells to the west of El Sollum were included in Egyptian territory, thus giving El Sollum a needed water supply. South of Siwa the frontier was drawn along longitude 25° E. to the boundary of the Anglo-Egyptian Sudan in latitude 22° North. In 1925 the Anglo-Egyptian Sudan was verging on the position of a clearly defined British protectorate; the tributary sultanate of Darfur had been conquered in 1915, and in 1922–3 the frontier separating it from French Equatorial Africa, which had been in question since 1899, had been delimited on the spot.

France and Spain.—In the same year (1912) that France obtained her protectorate in Morocco, she concluded an arrangement with Spain whereby a Spanish protectorate was set up in the northern part of the sultanate, the port of Tangier and a small area around it being made however an international zone. In the French protectorate Marshal Lyautey, the Resident-General, adopted a bold and conciliatory policy and won the confidence and respect of the Moors. In their zone the Spaniards met with determined opposition, largely owing to the uprise of a Moor, styled Abdel-Krim. In the territory known, somewhat vaguely, as Er-Rif, there seems to have been, as in the coastward portions of Algeria and Tunisia, a much more marked Iberian element in the population than there is in the south of Morocco, and this part of northern Morocco had shown a great hatred of European interference. The Spaniards suffered a severe reverse in 1921 and there was again heavy fighting in 1924 and 1925. In the last-named year the Rifs invaded the French zone, but were defeated and driven back, while the Spanish forces gained some successes in the northeastern area.

Recent Developments.—Abyssinia under Ras Tafari has been making strenuous efforts to attain the position of a civilised power and has joined the League of Nations, but evidence is still needed to show that she possesses in her yellow, brown and black people the elements of real and lasting progress without extraneous European support. In Southern Rhodesia the growth of a vigorous white community led to that country being made, in 1923, a self-governing colony of the British Empire, and with the assumption of direct Imperial control of Northern Rhodesia in 1924 chartered-company rule in British Africa came to an end. In East Africa another vigorous and local white community made its influence felt, namely the settlers in the British East Africa Protectorate, which protectorate was annexed to the British Crown in 1920 and renamed Kenya Colony.

A subject which raised large issues was the position of Indians in South and East Africa, but it was of less importance than the growth of race consciousness among the negroes. Increase of education and of Christianity, the employment of large numbers of Africans in industries and the lessons taught by the World War, were among the factors which intensified the feeling of racial unity and led to manifestations of a new anti-white movement. This movement was different to the simple objection to interference by Europeans, or Arabs, previously displayed, and had a consciousness of the need of self-development and progress. Not all the ferment among the negroes was anti-white, however, and an encouraging feature was the growing recognition, in South Africa as in the tropical regions of the continent, of the duty of the white man to help the negro in his efforts to attain a higher status. For further information, see the articles on the various countries of Africa, *e.g.*, ABYSSINIA; BELGIAN CONGO; CAMEROONS; EGYPT; KENYA; MOZAMBIQUE; SOUTH AFRICA. *See* also MANDATE; NILE.

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The officials of the British Museum Natural History Dept. have published some very interesting works on Africa since 1904. Prominent among them is Dr. C. W. Andrews, *A Descriptive Catalogue of the Tertiary Vertebrata of the Fayum, Egypt* (1906). P. L. Sclater, Oldfield Thomas and others, *The Book of Antelopes*, in 4 vol. (1894–1900); Dr. Rudolf Marloth, *The Flora of South Africa* (1913–5).

Similarly a good deal of light is thrown on the palaeontology of Africa in the works and the pamphlets issued by Dr. Peringuey and Dr. Robert Broom in South Africa, and in the United States by Henry Fairfield Osborn. For current affairs consult *The Geographical Journal*, *The Journal of the African Society* and *L'Afrique Française* (Paris, monthly). See also the bibliographies under SOUTH AFRICA, EGYPT, etc. (H. H. J., F. R. C.)

AGA KHAN (1877–), Indian Moslem leader (*see* 1.363). During 1910–21 his influence both on Indian and international affairs was shown in various directions. He was president of the All-India Moslem League and initiated the fund for raising the Mahommedan college at Aligarh to university status, which was effected in 1920. During the World War he endeavoured to secure the support of the Moslems of the Empire for the British cause. In 1918 he published *India in Transition* which was not without considerable effect in the final shaping of reforms under the India Act of 1919. At the Peace Conference in 1919 and subsequently in 1921 before the Treaty of Sèvres, and in 1923 before the Treaty of Lausanne he advocated a less stringent attitude towards Turkey. His manifold services to the cause of international peace led the council of state in India to recommend, Feb. 5, 1924, that he be awarded the Nobel Peace Prize.

AGLIARDI, ANTONIO (1832–1915), Italian cardinal and diplomatist (*see* 1.377), died in Rome March 19 1915.

AGRAM: *see* ZAGREB.

AGRICULTURE (*see* 1.388a).—This article is divided into four main sections: I. a general sketch of the progress of agriculture from 1910; II. an account of the scientific developments; III. the economics of agriculture, discussed under the three headings of credit, insurance and prices; IV. the use of electric power for agricultural operations.

I. GENERAL SURVEY

The last quarter of the 19th century witnessed an unprecedented fall in the prices of all agricultural produce, especially of wheat and meat. This was due to the opening up of new areas, particularly in America; in the United States alone 300,000,000 acres of land were brought under cultivation between 1870 and 1900, an area greater than that which was being farmed in Europe during the same period.

It was Great Britain with its open markets, with its great emporium trade, with its increasing population already far out of proportion to the productive capacity of its land, that experienced the full brunt of the competition; other European countries protected their farmers by tariffs; one country alone—Denmark—seized the opportunity to expand her agriculture. To the Danish farmer, educated and adaptable, cheap corn and feeding stuffs afforded a means of producing butter, bacon and eggs for the ever-growing English market, and of making a profit on the conversion. The opportunity was equally open to the British farmer, but he did not display the same adaptability in taking advantage of it. With industries near at hand competing for men and capital, the English farmers and their men were not prepared to give the high level of ability and labour for the possible returns that contented the Danish small farmers; moreover, the latter had worked out a system of co-operative marketing which for the first time enabled the agricultural community to hold its own in international commerce. The growth of agricultural co-operation in the last quarter of the 19th century may be regarded as the other great discovery of that epoch, which will rank with fertilisers and machinery in recasting the agriculture of the future.

Prices.—Despite the inroads the farmers of America and of the other new countries were making upon the welfare of European agriculture, it cannot be said that this period of expansion was one of particular prosperity for them. They lived and multiplied exceedingly, but it has been stated that in the aggregate the only profit they made came from the rising values of their land as the community grew round them. On the whole wheat and the other staple crops were being sold at below the cost of production measured in terms of labour, which is the only ultimate standard.

The later period down to the outbreak of war in 1914 saw a gradual rise of prices and the restoration of mild prosperity to British farmers, though any general confidence in the future of agriculture was slow of growth. They had modified their methods to meet the conditions, they were paying more attention to education and scientific developments, they were adapting themselves to the special market at their doors and though all too large a proportion were contenting themselves with an unenlightened routine of cutting expenditure to the bone so as to take a profit out of what the land itself would give, the ever difficult situation was being met. Then followed the World War with a few years of exalted prices and undreamt of profits for all farmers with a well-ordered business. The reaction was equally sudden, and the pit into which agriculture fell was deeper than the peak to which it had temporarily ascended. The War had caused a great stimulus to wheat production, in particular in the Americas (22,000,000 ac. in the United States, 13,000,000 ac. in Canada, 2,000,000 ac. in South America). Markets began to be temporarily overstocked, and if the great break in prices in 1921 was mainly financial in origin, to the farmer it was accentuated by an existing surplus.

Moreover, the War had forced up wages to double or treble their former level, to one more nearly comparable to that prevailing in the industries, while the standard of work rendered had fallen. If to these causes we add a succession of bad seasons from 1921 to 1925, seasons that would have hit the arable farmer hard under the most normal of price conditions, it is small wonder that British agriculture is still staggering under the blow and doubtful which way to take for safety. American farmers have been little less severely hit. In the Agriculture Yearbook for 1923 it is reported that in 15 corn and wheat producing states in 1922 8·5% of owner farmers lost their farms with or without legal proceedings, and the percentage of tenants who lost their property ran materially higher. The bankruptcy cases among farmers rose to 14% of the total as compared with about 5%, which was the figure for pre-War years.

But American agriculture is chiefly suffering from the disparity of reward that it offers as compared with the industries; no single-handed farmer working even a well-established 160-ac. farm can hope for the cash returns that a bricklayer can earn, after all allowance has been made for board and lodging. Prices of agricultural produce are high as judged by old standards, but the farmers' outgoings have risen in a much greater proportion. Particularly where there is a surplus of production above home requirements, a surplus that has to be sold in European markets, the price at home is forced down by competition to a parity with this European level, one which is below the average cost of production.

In European countries, where as a rule peasant farming and protection tariffs prevail, the agricultural community is comparatively speaking prosperous; the farmers' expenditure on raw materials or equipment is small, he and his family supply the labour, so that he reaps almost the full advantage of the higher prices and the depreciated currencies.

Live Stock.—Two types of livestock production exist: grazing on ranges of natural pasture, and more intensive production under artificial feeding. As regards cattle the two systems intermingle; the cattle may be raised on the pastures and sold thence to other districts for finishing. For example, much of the beef produced in Great Britain begins as store cattle raised in the west or north or imported from Ireland or Canada, and then fattened on the rich pastures of the Midlands or the coast, or in the yards of the arable farmers. Similarly feeder cattle from the ranges in the United States travel to the middle west in order to be fattened.

The tendency throughout the world is for ranging to be exchanged for cultivation, consequently the number of range cattle tends to diminish, and this tendency is not compensated for by corresponding increase in cattle raised on the mixed farming that succeeds the ranging. Milch cattle always then begin to grow at the expense of beef cattle. In Australasia an increase in cattle production is still possible, chiefly in Queensland, but there is no great unstocked area available as there was 50 years ago. South Africa is still an undeveloped country as far as the international meat trade goes; a few live cattle are being exported to Great Britain for slaughter, but ranging in South Africa is subject to much greater risks from disease than in America or Australasia. So far, no freezing works have been put up to develop a trade, and until this is done and communications are improved, the capabilities of South Africa and of the highlands of Central Africa to add to the beef supply of the world will remain obscure.

Beef.—Nor is it quite clear to what extent the demand for beef from European countries will persist, stimulated as it has been by the supplies poured in from America in 1918 and 1919. Prior to the War, European countries other than Great Britain were not great consumers of beef but rather of pork and dairy products, their agriculture being founded upon milk and pork production. When cheap grazing is not available the production of beef requires a larger consumption of food than that of pork; in consequence the agriculture of arable countries like Germany tends toward the more economical production of milk and veal, or of pork. The beef consumed is cow or ox beef rather than that of steers or heifers deliberately fattened for the purpose; in fact the purely beef breeds of cattle are little known in Europe. Thus beef is somewhat of a luxury article of consumption compared with pork. If the dietaries of Germany and the United States before the War are compared, with an equal supply of energy the American obtained 39·6% from animal foods, of which 5·3% was beef, whereas the German obtained only 32·4% from animal products, of which 3·2% was provided by beef. Thus the supply of beef in the world may be expected to decline with the diminution of range conditions, while the price must rise to meet the more expensive methods of production.

Sheep.—Specially marked, however, has been the reduction in the number of sheep that took place during the War and since. The following table shows a comparison for some of the chief sheep-producing countries between 1913 and the most recent year for which statistics are available.

Sheep

	1913	1924 (or latest available)	Percentage change
Germany	4,987,000	5,717,000	+15
Spain	16,441,000	18,460,000	+12
France	16,176,000	10,172,000	−37
Great Britain	24,279,000	22,239,000	− 8
United States of America	51,482,000	38,300,000	−26
Argentina	43,225,000	36,209,000	−16
Uruguay	26,286,000	14,514,000	−45
Union of South Africa	35,808,000	31,224,000	−13
Australia	85,057,000	80,110,000	− 6
New Zealand	24,182,000	23,776,000	− 2
	327,923,000	280,721,000	−14

The reduction has been in part due to encroachment on the pastures for cultivation when corn prices were so high, and in Australasia to the lack of a market when transport was no longer available. Great Britain lost 4,542,000 sheep between 1914 and 1920, a loss which has only been repaired since to the extent of 3,350,000. The decline in Britain took place in great measure in those districts where arable sheep farming prevailed, where the sheep are kept for the greater part of the year in folds on turnips and green crops. During the War the arable land was wanted for corn, and both then and since the heavy labour costs incurred both in growing the green crops and in working the folding have made this form of intensive sheep farming unprofitable. It is only in England that this form of sheep raising is general; in all other countries sheep are grazing animals generally reserved for the poorer and drier lands. For this reason sheep farming does not bulk large in the farming of any other European country, except in Spain where there are great tracts of poor and mountain pasture, not utilisable otherwise. Sheep indeed rarely play any considerable part in peasant farming on cultivated land, even under the most intensive system of folding upon green crops.

The finest wool is that provided by the Merino sheep, which originated in Spain but had become widely diffused toward the close of the 18th century. It was with these sheep that the new countries—South Africa, South America, Australia, New Zealand—were at first populated, because wool was the only product exportable, but since the introduction of refrigerated transport they have to some extent given place to Lincolns, Romney Marsh, Leicesters and some of the short-woolled breeds because of their better carcasses. For the really dry countries with rainfalls of 10 in. and less Merinos still hold their own, though a new race, the Corriedales, evolved from crosses between Merino and Lincoln, is coming into favour.

On land suitable for cultivation sheep will always give place to more intensive forms of farming, but nothing can well take their place in the hill country, especially where the rainfall is low. Their numbers are not, therefore, likely to grow in the more settled countries, and there does not as yet appear to be any area available for ranching unless it be some of the high land of Central Africa.

Pigs.—If sheep are associated with the pastoralist and the open spaces, pigs are presumably the live stock of the arable farmer, and are especially valuable to the dairy farmer turning his milk into butter or cheese. Pigs are the great converters of the maize of the Middle Western states into a more salable form of produce, and the bacon industry of Denmark has been built up on the by-products of the dairy and cheaply purchased cereals. Danish farmers have indeed given a lesson to the whole world in the skill with which they have standardised the production of a type of pig suited to the bacon trade. American pigs are in the main of the wrong conformation for bacon, and run too readily to fat, especially upon the predominating feeding with maize; English pigkeepers are perplexed by an unnecessary multiplication of breeds, often with conflicting ideals. The value of the Danish breeding has lain in the elimination of all other considerations than the requirements of the bacon factory. The great exporting countries of pig products are therefore the United States and to an increasing extent the Argentine, and, in Europe, Denmark, Holland and Sweden. The higher-priced Danish and Swedish bacon goes chiefly to Great Britain, which with Germany takes also large quantities of the considerable American produce.

POPULATION AND FOOD SUPPLY

At the present time live stock production is the most profitable side of farming. There is still abundant grazing land to produce meat cheaply with a minimum of labour, and cereals are still relatively cheap for the dairy-farmer and pig-feeder, whose business consists of converting these materials into milk and meat. If food supplies begin to grow short the scarcity will first be felt with regard to meat, indeed many observers consider that a definite shortage of meat supplies is already within sight. With a diminishing herd of cattle and sheep flock the time is not far off when the United States will be a competitor for the meat output of Argentina and New Zealand instead of the largest exporter of meat and animal products.

Everything, therefore, points to rising prices for meat, so that increased attention to live stock production is likely to be the most profitable line of business for the British farmer. As civilisation proceeds and the populations grow, meat will become more and more a luxury, because the open grazings on which alone cheap meat production is possible will become settled. Moreover, a community that is outgrowing its food supplies must become more and more vegetarian. As scarcity approaches, the land must be given up increasingly to the production of direct human food. That day is of course remote, but the indications would point to a gradual tightening of meat supplies and therefore in a country like Britain, accustomed to a high standard of living, to increasing opportunities to the farmer who specialises in live stock production.

The growth of population during the 19th century, unprecedented in the world's history, was rendered possible by the opening up of new lands of America, North and South, of Australia, New Zealand and South Africa. If we exclude from consideration the East (India, China, Japan), where the available land was already utilised to the full and the density of population was already excessive, excluding also tropical countries, we find that the area of land cultivated for the white peoples expanded from about 440,000,000 ac. to over 880,000,000 acres. Now upon the present basis of agriculture something more than two acres of land has to be cultivated in order to maintain one unit of population, man, woman or child, the amount being lower for intensively cultivated countries like Holland, Denmark or Belgium, or Great Britain. Of course maintenance includes other necessary agricultural produce besides food. For example a portion of the cultivated area is given up to fibre crops; and wool and hides are by-products of the livestock industry. Other instances could easily be given.

Areas Still for Cultivation.—Working upon this basis alone that about two acres of cultivated land are necessary for the maintenance of one person, it is evident that in the temperate regions of the world there is no longer land available for the feeding of any large increase of the present population. In Europe there are still great areas of forest, swamp and heath that might be brought into cultivation, but the process would involve an expenditure both of initial capital and continuing labour out of proportion to the returns. Either the prices to be received for produce must rise greatly, or the cultivators must be content with a lower standard of remuneration, before there is much addition to the European area under cultivation. In fact the present tendency is in the other direction; only Italy with its great pressure of population increase is adding to its farming land and reclaiming wastes. All over the poorer land of Great Britain abandoned holdings and crofts may be traced, abandoned for economic reasons alone, because men would no longer live and work so near to the starvation level. Nothing but the direst need or a new scale of prices whereby agriculture becomes relatively the most paying industry will ever bring such land back into cultivation. Other European countries to a less degree show the same tendency at work.

In the United States there are still great areas of potential farming land; for example O. C. Baker (*Economic Geography*, 1925) estimates a possible increase of the wheat area in the United States of America from the present 80,000to 130,000 square miles. But little of this, however, is the natural easily farmed land the settler looks for; the efforts to make good the arid lands by dry farming and irrigation show that the good land has mostly been taken up. What remains is land on which capital outlay is required, land on which production will always be more costly than on the great fertile plains of the Middle West. As in Great Britain, the recent tendency in the United States has been to abandon the cultivation of some of the poorer lands and let them fall back to grazing. Canada still presents enormous potentialities for settlement, though the vast areas the map reveals are severely restricted by increasing aridity toward the West and by cold northwards; Baker considers an increase of the wheat area from 25,000 to 120,000 sq. m. as physically possible. But similarly on most of this land the wheat will have to be more dearly bought, by labour, fertilisers and skill, than on the land now being farmed. The potentialities of South America are less easy of estimate, but in this region there is still a great area of rich plain country unsettled, and it is not too much to expect that another 40,000,000 ac. of land are available for farming under present conditions.

The potentialities of non-tropical Africa and of Australia are small; in the latter country the arid zone lies so near to the coast that the additional area available for normal cultivation is negligible in considering the world's need of food. The great unknown factor in this survey is Western Siberia, a natural wheat area, and Manchuria. All that can be said is that the physical possibilities are great, perhaps as high as 300,000,000 ac., but no one can guess when that will be realisable, dependent as it is upon the establishment of a stable and ordered government. Moreover, on the flank of these regions hang the vast unsatisfied populations of China and Japan, ever ready to expand as the means of sustenance permit, and on this account the expectation of food from this area for the Western peoples can be but small. The data are too approximate for an exact estimate, but it is at least clear that the good land still available for settlement in the temperate regions of the world will never permit of an expansion of population such as took place in the 19th century and indeed is inadequate to meet the present rate of increase.

As potential sources of food there still remain the tropical countries, in particular Brazil and Central Africa, where abundant rainfalls and high temperatures render feasible a very high level of production from the soil. The last 50 years have witnessed remarkable examples of organised production of tropical crops under Western direction and management. The growth of sugar in Java, Cuba and Hawaii, of rubber in Ceylon and the Straits, of tea in Ceylon and Assam, afford examples of the possibilities of organised agriculture, employing the resources of science, the labour-saving power of machinery, the criticism of cost book-keeping, such as can rarely be paralleled in the farming proper of the temperate regions. The same organisation is being extended to the coconut, which, converted into margarine, is becoming one of the chief edible fats of the world. Without doubt the tropics present enormous potentialities of food production for the world, mainly in the direction of oil seeds and edible beans. It must, however, long remain uncertain to what extent the cheap native labour upon which these tropical exploitations are dependent will continue to be available. It does not appear to be possible to maintain a white population itself engaged in the cultivation of the soil in contact and competition with native labour, and Queensland is the only tropical country where agricultural development is being attempted with white labour only.

In this brief survey it is only possible to indicate the broad grounds for supposing that the food production of the world as at present organised is on the point of becoming inadequate for the demands of the growing population. The enormous growth of the 19th century was rendered possible in part by the discovery of fertilisers, but in the main by the opening up of the new lands, particularly in the United States and Canada. The United States is already beginning to call for imports, and will soon require all the food she produces and no longer have an exportable margin for over-populated Europe.

Under a system that calls for two cultivated acres to support a unit of population there is not sufficient land in sight capable of settlement to provide for much further growth of population. The continual rise of food prices since the beginning of the century—and it would appear that the trend is being resumed after the violent fluctuations caused by the War—is further evidence that the process is at work.

The process is being accentuated by the growing disinclination of the civilised peoples to engage in agriculture, because of its small and uncertain returns as compared with other occupations. It appears to be a general experience that wherever by the extension of communications industries or commerce come close to agriculture the latter declines and begins to lose its best brains, its capital and its men. The lure of the cities is proverbial, but the fundamental factor is economic; unorganised agriculture cannot pay the wages obtainable in the organised industries. The decline in the agricultural population of Great Britain and the United States is the most marked, but it is significant that in France, where of all countries the farmer is most protected and prices have been maintained, the peasants are leaving the land for the growing industries, their places being taken in the south at least by Italian immigrants.[1]

Intensive Production.—If the land area for cultivation cannot be expanded the production from the existing area can be intensified, and it is evident from the most cursory examination of the yields of wheat in different countries that a great intensification of yield is easily possible. The select areas of Holland, Belgium, Denmark and Scotland average 40 bu. to the ac.; England produces 32, the world's average is in the order of 12. Turning to potatoes the British average yield is $6\frac{1}{4}$ tons per ac., though good potato growers expect 10, the average in many of the large producing countries, *e.g.*, France and the United States, is less than 3 tons per acre. Intensification of production involves, however, increased cost of production per unit unless in some way the system of farming can be changed. The much disputed law of diminishing returns comes into play, which states that if any factor of production be considered separately, *e.g.*, cultivation, fertiliser or water supply, successive increments of the factor give rise to increases of crop that successively diminish. In other words it is the last bushel of corn that costs the most fertiliser to produce, the last hundred pounds of increase in a bullock that involves the largest consumption of food. This expression of the law of diminishing returns is perhaps not literally correct, but of its general truth in relation to agriculture there can be no doubt. The best illustration of its validity on a large scale may be derived from the course of English farming after

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[1] France:—

1846	Total population 35,400,000	Rural population 26,700,000
1911	Total population 39,600,000	Rural population 22,100,000
1921	Total population 39,200,000	Rural population 18,200,000

the great break in prices that began about 1875. At that time the English level of production as indicated by the yield of wheat, 32 bu. to the ac., was the highest in the world, but the English farmer could not meet the falling prices by increasing his yield. Instead he lowered his standard of cultivation and cheapened his costs. The average yields obtained remained about the same, 32 bu. per ac., because the acreage under wheat was contracted by more than one-half by the withdrawal of the poorer lands from the plough. To take another illustration, the cheap wheat which was forcing the English farmer out of wheat growing was not the production of heavier crops than he could raise; it was North and South American wheat from lands giving an average yield of about 12 bu. per acre. As Lawes put it " high farming is no remedy for low prices."

If then intensification of production on the existing farming land of the world is necessary, it cannot be obtained by merely tuning up farming as it is carried on at present, by employing more fertiliser or more labour, unless there is a general rise in the price of produce to justify the expenditure. There may be adjustments in the system of farming, there may be scientific discoveries or an all-round increase of skill, whereby an increased production is obtainable without increased cost, in which case the law of diminishing returns does not come into play or is disguised. But the probability is that such changes will come slowly; farmers all the world over are naturally conservative and disinclined to alter their proved methods, and under present conditions it would appear that a sharp rise in prices is a necessary antecedent to a wholesale movement in the direction of intensified production.

The introduction of artificial fertilisers and imported feeding stuffs enabled the British farmer between 1840 and 1870 to raise the level of his production by something like one-half; what further advances may be expected from science in the direction of intensification?

Conservation of Fertility.—Doubts have been expressed as to conservation of the fertility of the soil, but that fear may be dismissed. The introduction of leguminous crops into the rotation suffices to maintain a stock of nitrogen sufficient for the present average level of production, and from this source alone the soil of the old settled countries has maintained its power of production over many centuries. The latest extension of this principle has been the growth of lupins over the sandy soils of the northern European plain to be ploughed in as a preparation for the rotation of grain and fodder crops, with, as a result, a definite increase in the fertility of German and Polish soils. An intensive agriculture requires more available nitrogen than can be thus obtained, but this is assured by the many processes that have now been worked out for the fixation of atmospheric nitrogen. Concentrated nitrogenous fertilisers are becoming cheaper and more abundant, and the supply can be made to keep pace with almost any demand conceivable. Phosphates cannot be manufactured, but great deposits have already been revealed, and more will doubtless be discovered.

Most soils under cultivation, however, still remain comparatively deficient in phosphates, and, as Hopkins of Illinois so strenuously preached, if this deficiency be made up and leguminous crops are grown, the production of the Middle West soils can be maintained indefinitely even above its present level. On most soils the needs for potash are less, but the deposits of Stassfurt and Alsace, with the potential supplies from the undeveloped fields of Spain and elsewhere, are so vast as to assure a supply for the most intensified agriculture for a long time to come. The only obstacle to an all-round increase of crops by a greater use of fertilisers is the question of cost; as yet the grain raised on the new lands, cropped extensively at a low level of production without fertilisers is cheaper than that obtained from yields with fertilisers; hence progress depends upon the power of the industrialist to cheapen fertilisers rather than upon the farmer. Nor can much change be anticipated in the allied région of feeding stuffs, since they also are the product of cultivation.

Economics in Conversion.—Great economies are possible in the conversion of feeding stuffs into meat; a calculation made in war time showed that the amount of meat, milk and other animal products realised in Great Britain during the five pre-War years was only about $\frac{1}{5}$ of what might possibly have been obtained from the fodders consumed. But improvement in this respect will be the outcome of exact individual management rather than of any sweeping change of method, and the whole field is influenced by the economic consideration that it is often more profitable to let animals grow carelessly and wastefully on wide pastures rather than to spend labour on husbanding their resources to the full. Still the progress that has been made in America, the Scandinavian countries and Great Britain in the exact rationing of milch cows in proportion to their yield indicates the economies that could be effected.

The aim of the agriculture of the future will be to economise man-power as the expensive item in cost of production, and the value of machinery lies in its power of reducing the labour fraction in the cost per unit of the article turned out.

Breeding.—Genetics, the science of systematised breeding, has a great part to play. Even amongst crops like wheat and barley, which have been worked at by so many generations of the old empiric breeders and which are therefore less susceptible to improvement, great advances have been made within the last half century, not so much perhaps in gross yield as in adaptability to climatic conditions and disease resistance. The breeding of Marquis wheat has enabled the wheat belt to be pushed miles to the northward and added millions of acres to the potential wheat area, solely in virtue of its power of ripening a week earlier without loss or quality.

The enhancement of the percentage of sugar in sugar beet from something in the order of 10 to 18–20% is another example of the breeder's art, and similar improvements may be expected in other fodder crops which are often only the outcome of chance discoveries and accidental crossings. Many of the tropical crops, like the coconut, have never been subjected to selection and are still as nature made them. The immediate task before the breeders is to reduce the old sound doctrine of " pedigree" to terms of useful performance only, to eliminate " fancy " points and to standardise our breeds for production only.

But there is nothing basic, nothing immediately revolutionary in these measures; the key to progress lies in the general adoption of more exact measures and in the education of the farmer to be ready to take advantage step by step of the small but cumulative discoveries of the investigators. Assuming that the progress of science is capable of bringing about great enhancement of production by methods that do not immediately bring into play the law of diminishing returns, we may next inquire whether the organisation of agriculture is adequate to the demands made upon it.

Small or Large Holdings.—By far the greatest part of the farming of the world is carried on by peasant holders, using that term to denote men who cultivate their farms mainly by their own labour and that of their families.

If we ignore the social and political considerations that commend peasant farming to the statesman, to what extent can it be expected to meet the growing demands of the world for food? It may be agreed that the division of a large farm into small holdings is generally attended by increased production, but that is because it involves a change from an extensive to an intensive system of farming, a change which was equally open to the large holder. The efficiency of the peasant is not as a producer but as a competitor who can undersell the large farmer because he is content to give a great output of labour, that of his wife and family as well as his own, in return for a somewhat bare living. But the large farm can be the more efficient if efficiency is measured in terms of production for the labour expended. On the large farm alone can machinery and other labour-saving devices have full scope, and with the staple crops like wheat or potatoes the economy of large-scale working is obvious. Even allowing for the detailed handling involved in stock feeding, milk production, truck and fruit farming, a higher level can be reached by the organisation and skilled supervision of a team than by single-handed working. Large-scale operations for the amelioration of the land by drainage and kindred operations are as a rule only applicable to large estates, unless the state exercises a paternal and often uneconomic control over the land. It may be doubted, too, whether peasant communities are going to be as receptive of the advances of science and new developments as large farmers working for profit.

However, the physical advantages of the larger farmer are very generally offset by his inability to get out of his men a day's labour comparable either in quality or quantity to that given by the peasant. Science and the art of management have not so far advanced as to drive the peasant worker to the wall; indeed, by his labour alone he is still able to undercut the large farmer and make him lose confidence in the power of organisation and machinery. It is in agriculture as it was in the textile industry a century ago, the hand loom weavers can still live alongside the power-mill and even break it by their competition. It is indeed one of life's ironies that just at the time when the advances of science are putting new powers at the disposal of the entrepreneurs of land, labour should be acquiring a new class-consciousness which renders it reluctant to co-operate in any experiment in large-scale farming. Yet it is only by developments of this kind that agriculture would be enabled to pay industrial rates of wages. At present the vicious circle is complete; low prices and the wage threat hold off the capitalist from any adventure into agriculture, while the same low prices prevent the present-day farmer from paying any higher wages.

In despair a solution is being sought in a reversion to peasant farming whereby the land is put into the hands of men who have, hitherto at any rate, been willing to give an ample day's work for an uneconomic return as measured by modern standards. It is often maintained that a peasant community can be united into an efficient agency of large-scale production by means of co-operative organisations, which ensure not only a proper market but also that degree of control of the individual producer that is desirable for his commercial welfare.

Co-operation.—A firmly established co-operative society can buy for the farmer the best type of seed and can almost insist on his growing it; it can enforce upon the farmer standards of cleanliness and quality in the milk produced, it can set out the particular type of pig it is prepared to market and say in what way it should be fed. And the Co-operative Society can exercise this wholesome pressure without hurting the independence of the farmer. Co-operative organisation by binding the farmers into efficient commercial units and by exercising pressure and persuasion in the direction of better technique may outweigh the mechanical disadvantages of the small farm, because it preserves individual initiative and the willingness to work characteristic of the peasant.

Some organisation of marketing is essential to the farming of the future, otherwise even the large farmer is powerless against the growing combinations developed by international commerce, powerless also to meet the fluctuations of production that are inevitable in agriculture. Since the farmer cannot regulate his production because he has to make his preparations long before the market is declared, since he has to adopt a routine susceptible of change only at considerable intervals of time, combination in marketing alone can save him from the damaging effects of seasonal over-production. It may seem idle to take precautions against over-production when the whole world is calling for supplies and a possible scarcity of food has to be contemplated. But it is just these over-productions, temporary, seasonal and local as they may be, that destroy confidence in farming and hinder its orderly expansion. Combination there must be, whether of small farmers moved by the spirit of co-operation or of great agricultural enterprises actuated by business intelligence. Control too may be predicted, whether it is control exercised by farmers themselves from within or by some external authority, for the present haphazard system with its destructive competition between individuals and between nations only results in keeping agriculture at a low level while people want food.

See also CO-OPERATION; FARM ORGANISATION; FARMERS' ORGANISATIONS; FOOD SUPPLY; GRAIN; LAND TENURE, etc.

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(A. D. H.)

II. SCIENTIFIC DEVELOPMENTS

The period 1910–26 saw unprecedented advances in agricultural science. Until 1910 the United States and Canada were the only countries possessing adequate organisation for agricultural research. Germany had a number of experiment stations staffed by enthusiastic workers making the most of their means, but Great Britain and France were both badly equipped. In 1909 the British Parliament set up the Development Fund at the instance of Mr. Lloyd George, then Chancellor of the Exchequer, and assigned a capital sum of £2,900,000 for rural development, including agricultural education and research. Under the advice first of Sir A. D. Hall and afterwards of Sir T. H. Middleton, the Development Commission made grants out of this fund to certain institutions each responsible for one or more sections of agriculture.

In France, the Conseil d'Administration of the Ministry of Agriculture, under the Presidency of M. Roux, is projecting a National Experiment Station. In the British Empire, Canada has admirable agricultural colleges and experimental farms; India has the great experiment station at Pusa, founded in 1903 with the aid of a generous gift by Mr. Phipps, an American; Australia, besides its older Universities and agricultural colleges, has the Waite Research Institute at Adelaide, founded in 1923; New Zealand has the Cawthron Research Institute at Nelson, founded in 1915; Trinidad has the Imperial College of Tropical Agriculture, founded in 1924; while throughout British Africa, notably in the Union of South Africa and the Sudan, there are important laboratories and research stations. The tropical research station founded by the Germans at Amani has now passed into British hands. In the United States, agricultural research, already strong, has been considerably strengthened by increased appropriations, the estimates for the Dept. of Agriculture in 1924 amounting to no less than $42,000,000.

Side by side with these scientific activities, there have been marked developments in implements, including tractors, cultivating and draining machinery, milking machines, harvesting implements which not only cut, but thresh the grain as they travel, throwing out the sacks of grain on the field; and many other appliances. These implements are not as efficient as good workmen in the performance of individual operations, but they achieve more work in a given time. The results appear rather in the reduction in the hours of labour necessary to secure a given crop, than in any increased production per acre. A few crops show increased yields, *e.g.*, in Great Britain potatoes and wheat, but most do not. The human labour has, however, been greatly reduced without sacrifice of crop. Further, the losses through adverse seasons are diminished; there are now no catastrophes like that of 1879. Insect and fungus pests are distributed all over the world by modern transport, but their activities are being controlled.

CROP PRODUCTION

The main advances in crop production are due to: (1) a better knowledge of the properties of soils; (2) greater supplies and greater knowledge of fertilisers and other methods of increasing plant growth; and (3) the introduction of varieties of crops better suited to the local conditions.

The Soil Factors.[1]—The soil provides water and nutrients, but it must also allow liberal access of air to the roots, and be free from any harmful substance or obstruction limiting full root development. The quantity of water needed by the plant is considerable, usually exceeding 300 times the weight of the dry matter, or 30 times the weight of green crops (grass, cabbages, mangolds, etc.), while the amount of nutrients is less than 1/100 part of their dry weight. Indeed over a great part of the cultivated land of the world deficient water supply is the principal factor limiting crop production. Air supply is equally important; successful root development depends on an easy interchange of gases between the atmosphere and the soil through the pore spaces which form 30 to 50% of its total volume. But these spaces also contain water, and in a wet soil air movement is much restricted; carbon dioxide then accumulates, and injures the crop when its quantity rises much above the normal (0·2 to 0·5% by volume of soil air). Freedom of root development necessitates an easy passage of the growing rootlets through the soil. This is secured in practice by bringing the soil into the friable, crumbly condition known as a good tilth. These three factors, favourable water and air relationships and a good tilth are closely linked; the connection has now been traced to the soil colloids.

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[1] For further information see Sir E. J. Russell, *Soil Conditions and Plant Growth* (1926).

Soil Colloids.—Soil consists mainly of mineral particles ranging from 1 mm. diameter to ·001 mm. or less; a fraction, usually about 10% or less, has colloidal properties. Part of this fraction is organic, part inorganic.

The organic part is *humus* derived from decaying plant residues, principally from the lignin by oxidation. Part of this is an acid, humic acid; much of the remainder is akin to an anhydride, for it is transformed into the acid by hot alkali; the acid appears to be tetrabasic and to contain carboxyl groups but no nitrogen (Odén). In the soil it is closely associated with a complex nitrogen compound, probably protein.

The inorganic colloid is the ultra clay or colloidal clay isolated by the Sharples or other super-centrifuge. No sharp line divides this from the clay and fine silt of the older mechanical analysis; usually 0·001 mm. ($=1\mu$) is taken as the conventional upper limit. R. Bradfield (Missouri Experiment Station) shows that the clay is a salt of a complex alumino-silicic acid. In normal soils the base is calcium; the clay is then readily flocculated and conducive to a satisfactory tilth. But the calcium can be replaced by hydrogen forming an acid clay not conducive to good tilth, and having the undesirable property of combining with, and therefore taking from the plant, bases needed for plant nutrition. The calcium is replaced by sodium when sea water floods the land; or, in dry districts, where the irrigation water contains sodium salts (as it commonly does); or in ordinary practice where sodium nitrate is used too intensively on heavy soils.

These base exchanges had long been known but not understood; they were discovered by the English chemist, Way, in 1850, and studied in recent years by Gedroiz at Petrograd and Hissink at Groningen; but the reactive substances were not isolated from the soil. Whether the colloidal clay is the only reactive body is not known.

The colloidal clay has the properties of an electronegative colloid. It can be flocculated by acids or by salts, but is dispersed or deflocculated by the negatively charged hydroxyl anions (*e.g.*, alkalis). The phenomena are complex. The sodium clay is the most easily and the calcium the least easily dispersed of all the clays.

Calcium clay is the normal clay. In the course of their evolution plants have become adapted to it, and it is therefore the most fertile of all clays, conferring on soils the desirable water relationships. Sodium clays, on the other hand, are the least suited to plants. Their easy deflocculation causes resistance to plant roots and filling of the pore spaces of the soil with water. Worst of all, they readily hydrolise in the presence of carbonic acid and water to form sodium carbonate, a dreaded plant poison, the black alkali of irrigated soils. The remedy for these evils, adopted by the California experts, is to convert the sodium into a calcium clay by treatment with calcium sulphate (gypsum); the sodium carbonate and sodium sulphate simultaneously formed is then washed away. The treatment is ineffective, however, unless sodium salts are withheld from the soil.

The colloids, both organic and inorganic, are distributed throughout the soil as a jelly-like coating on the surface of larger particles, or coalescing into smaller particles; their great power of absorbing water is the main factor in determining the water-holding capacity of soils.

These discoveries have found practical application. Dryness in soil, a frequent source of infertility, is associated with lack of colloidal material and is remedied by adding more plant residues, either farmyard manure or green manure, the alternative of adding more clay being usually impracticable. In irrigation schemes care is taken to exclude sodium salts, not always an easy operation, because sodium chloride and sulphate occur widely in the dry regions of the world, no doubt as the residue of former seas. Irrigation is combined with drainage to wash out sodium salts and facilitate re-formation of the calcium clay should the sodium clay arise.

Acidity or "sourness" in soil is now traced to the humic and clay acids; its quantity is measured by a "lime requirement" method based on the power of the soil to absorb calcium from a solution of calcium oxide or bicarbonate; and its intensity by determinations of the hydrogen ion concentration in the soil. Comparison between the two methods is complicated by the fact that the colloidal or other substances in the soil have a considerable "buffer" effect, but an expert analyst can form a fair estimate of the quantity of lime or of calcium carbonate needed to bring about a given degree of improvement.

The organic matter of the soil is more than a source of colloids. Being the remains of previous generations of plants it contains all substances necessary to the life of the plant, and, in addition, material synthesised by the plant during its life and still containing energy fixed by chlorophyl from the sun's rays. In the soil this energy material supports a multitude of micro-organisms: bacteria, fungi, algae, also protozoa feeding on the bacteria, and numerous insects feeding on the organic matter or preying on each other. In obtaining food and energy these organisms decompose the complex organic matter and liberate the energy stored therein, the final products being CO_2, water, simple compounds of potassium, calcium, etc., phosphates and nitrates, all essential plant nutrients. Thus the remains of one generation of plants afford food for a later generation; the transforming agents are the soil organisms which live on the energy and nutrients still remaining in the residues.

The production of plant nutrients, while the usual result of the activities of the soil organisms, is not an essential consequence of their existence. In their search for food and energy they may leave nothing for the plant, or even take up some of the plant nutrients already in the soil. Protein contains more nitrogen than the organisms need even after multiplying as much as the energy content allows; ammonia is therefore left for the plant. Carbohydrates and cellulose on the other hand contain no nitrogen, and the organisms, in multiplying up to their energy content, absorb nitrates from the soil; the plant therefore suffers. This explains why addition of sugar to the soil lowers crop yields, and why straw, in spite of its fertilising constituents, does not increase, but may diminish crop yields. The realisation that the organisms do not always or necessarily produce ammonia has caused the abandonment of the old division of soil bacteria into ammonifiers and non-ammonifiers.

While most, if not all, of the soil organisms can effect alternative reactions for obtaining food and energy, certain reactions can be brought about only by a few specific organisms, among them the oxidation of ammonia to nitrate, which provides energy for the organisms, and the fixation of atmospheric nitrogen and its conversion into protein by Azotobacter and Clostridium, though these organisms, by preference, assimilate nitrate if they have the chance. Other nitrogen fixing organisms live in the nodules on the roots of leguminous plants; the association is mutually beneficial because the plant receives nitrogen compounds from the organism and the organism receives carbohydrates from the plant. The number of organisms in the soil varies continuously.

There are great seasonal changes, the numbers being high in spring and autumn, low in winter and summer, as happens also for plankton in the sea and in fresh-water lakes and for algae in a pond. There are also great daily fluctuations. D. W. Cutler and L. M. Crump have shown that these are determined by fluctuations in the numbers of amoebae, thus confirming Russell and Hutchinson's discovery of the importance of protozoa in the soil economy. The meaning of these changes is not clear.

Three applications of soil microbiology are made in agricultural practice. Simplification of the population by partial sterilisation results in a greater production of nitrate and consequently greater productiveness; the soil can simultaneously be rid of some insect or other pest. In glass-house practice soil may be heated by steam or treated with poisons such as cresol, carbondisulphide, chlorpicrin, etc. These do not long remain in the soil, but are attacked by certain soil organisms and oxidised, presumably for the sake of the energy liberated. None of these methods is applicable to field conditions, but examples of the action are found in hot countries.

A second application of soil microbiology is the inoculation of the seed of a leguminous crop with the organisms associated with it so as to ensure more vigorous or greater growth. This was attempted as far back as 1890, but without success. Subsequent laboratory investigations showed that the organism passes through several stages in the soil, only one of which is motile. For maximum effectiveness it is necessary to ensure motility; this is done by adding milk and phosphates to the cultures. Difficulties of storage and transport of the organisms, which caused many of the best cultures to die before they reached the farm, have been overcome by storing the organisms in sterilised soil and transporting them on agar. The technical details have been worked out by Bartel of Stockholm, Christensen of Copenhagen and Thornton of Rothamsted. Inoculation of lucerne is now a recognised practice in Scandinavia, and is spreading in Great Britain, the empire and the United States.

The third application of microbiology is in the rotting of plant residues to produce a humus manure. The heap is soaked with water and mixed with an ammonium salt and calcium carbonate; the organisms are invariably present, and need only the added nitrogen to set them working vigorously. A fertiliser resembling farmyard manure is thus produced from otherwise waste substances.

THE USE OF FERTILISERS

Where water supply is not a limiting factor, crop yields can be considerably increased by the proper use of fertilisers. The problem of fertiliser supply, formerly urgent, has been profoundly altered by the World War, one of the chief agents with which it was fought—combined nitrogen—being also an important fertiliser. Prior to the War Chile was the main source of nitrate and coal of ammonia; synthetic nitrogen fertilisers were obtainable, the industry having been founded as the result of Sir William Crookes' impressive address at the British Association in 1898, but they played only an insignificant part in farm practice. During the War extensive factories for the preparation of ammonia from atmospheric nitrogen were erected in central Europe and, since the War, in other countries also. Three processes are used: the arc process, yielding calcium nitrate, almost limited to Norway where water power is abundant; the cyanamide process, used in Switzerland and other countries near a source of coal; and a catalytic process now becoming the most popular, usually a modification of Haber's, yielding ammonia which can be converted into the chloride by combining the process with the manufacture of soda, or into the sulphate by reaction with gypsum, or into nitric acid by oxidation.

The effect of post-War developments is seen in the following estimates of the world's production of nitrogen compounds:—

Compounds in Tons (2,240 lb.) of Pure Nitrogen

	1924–5	1912	1903
Chile Nitrate	363,000	401,000	221,000
Sulphate of Ammonia By-product	290,000	247,000	108,000
Fixation Industry:—			
Arc Process (Nitrate of Lime)	25,000	10,000	Nil
Cyanamide	115,000	19,000	Nil
Catalytic Sulphate of Ammonia	255,000	Nil	Nil
Other Nitrogen Compounds	60,000	Nil	Nil
	1,108,000	677,000	329,000

The productive capacity is considerably higher than this; hence all fears as to supplies of nitrogenous manures have been banished. Some of the nitrogen is used for industrial purposes and explosives, but agriculture took about 595,000 tons in 1913, of which 290,000 tons was supplied by Chile nitrate, while it took 983,100 in 1924–5. Germany uses more nitrogenous manure than any other country in the world, her consumption in 1924–5 being estimated at 335,000 tons of pure nitrogen, almost all of which was for agriculture; this is greatly in excess of her pre-War consumption (225,000 tons[1]) and is more than one-third of the whole world's consumption. New methods of manuring crops are being tried (see below, under *Sulphate of ammonia*), in order to secure the maximum agricultural output as a rapid means of increasing wealth.

Nitrate of Soda.—The fears once entertained of an early exhaustion of the Chile nitrate deposits (1921 had been mentioned as a final date) have been dispersed by improved methods of extraction; in 1925 the prospects were so good that Messrs. Guggenheim, of New York, purchased large nitrate grounds and began erecting a plant for the operation of a new process not yet published. Most companies still employ the old Shank's system; some use the more modern processes of Gibbs or Butler,[2] with what success, however, is not known. The price still remains above pre-War levels, while that of sulphate of ammonia has fallen; in consequence the consumption in Great Britain and Ireland, which before the War was 80,000 tons per annum, has now fallen to 40,000 tons.

Nitrate of Lime.—The Norwegian product is entirely satisfactory; its calcium is useful on many soils and its solubility quickens its action. It usually contains 13 % of nitrogen, and is thus somewhat less concentrated than nitrate of soda, which contains 15·5 %. In the pure state it is hygroscopic, but this difficulty is now overcome.

Ammonium Nitrate.—This has the advantage of concentration, containing as a rule 34·8 % nitrogen. Its deliquescence was overcome by crystallising in a special way. But it suffers from the insuperable disadvantage of being highly explosive when detonated, so that it is not likely to become popular as a manure.

Sulphate of Ammonia.—This is now made neutral and is drier, more friable, less sticky and more easily drilled than the old, which contained 0·03 to 0·05 % acid; it is also slightly more concentrated, containing 21·1 % nitrogen or 25½ % ammonia against 20·8 % nitrogen or 25¼ % ammonia. In the export trade it tends to cake, a disadvantage that can now apparently be overcome. New methods of using it on grass land are being studied at Hohenheim; large dressings are given to force an early growth of grass, which is first grazed, then cut for hay and finally grazed again. The system necessitates increased dressings of potassic and phosphatic fertilisers and also of lime. It is being tested at the Dairy Research Institute, Reading.

Great Britain is the chief exporting country and the United States comes second; Spain, Japan, Java and France are the chief importers, using it for oranges in Spain, rice in Japan and sugar in Java. Consumption in Great Britain has risen from 40,000 and 50,000 tons in 1913 and 1914 to 153,000 tons in 1924. The price is now nearly at pre-War level and may fall lower. Cyanamide is inconvenient and uncertain as a direct fertiliser; it is therefore usually converted into ammonia though attempts to overcome its disadvantages are still being made.

Urea is the richest fertiliser in nitrogen (46·7 %), a great advantage for export. It is also neutral, and unlike sulphate of ammonia, leaves no acid residue in the soil. As a fertiliser it is slightly inferior to nitrate of soda but not to sulphate of ammonia; it is better applied with the seed than used as a top dressing.

Superphosphate of Lime.—One ton of sulphuric acid reacts with approximately one ton of mineral phosphate to give superphosphate. The enormous consumption of sulphuric acid during the War caused a great expansion in productive capacity, which it was hoped would bring down the cost of the acid and therefore of superphosphate after the War. This hope has not been fulfilled; acid prices are still 50 to 100 % higher than the pre-War level. The process of manufacture has become greatly improved by the instalment of labour-saving devices and of fans to remove the fumes.

Basic slag has greatly altered since the War because of the displacement of the Bessemer converter by the open-hearth process which yields a slag containing little more than half the phosphate formerly present. Further, the fluorspar used in making much of the slag reacts with the phosphate—yielding a fluorapatite, thus lowering its solubility and fertilising value.

Mineral Phosphates.—Ground mineral phosphate was generally unsuccessful as manure before the War. The failure is now explained; the grinding was not sufficiently fine. Good results are now obtained both on arable and on grass land with phosphate passing through a sieve having 120 apertures to the linear inch, instead of the old one with 100 apertures only. Even so, however, the mineral phosphate appears to be inferior to superphosphate on arable land and to high soluble basic slag on grass land.

Potassic Fertilisers.—Prior to the War potassic fertilisers were obtained only from Stassfurt. Three salts were worked: the sulphate, the chloride or muriate and kainit, a mixed salt containing potassium and sodium chlorides and magnesium sulphate standardised to contain potassium equivalent to 12·5 % of K_2O. During the War the cutting off of German supplies led to exploitation of alternative sources, some of which were good. Since the War Stassfurt no longer monopolises the world markets, the French having opened up the mines of Alsace. These deposits differ from those at Stassfurt in containing neither potassium sulphate nor magnesium salts; hence they supply only the muriate or chloride of potassium and "French kainit," a mixed salt of potassium and sodium chlorides; Stassfurt still therefore has the monopoly of the sulphate and of magnesium salts. The sulphate and the chloride of potassium are on the whole equally effective in promoting plant growth (though in certain circumstances one is more effective than the other), but the sulphate is rather better for improving quality of potatoes, one of the most important crops for which potassic fertilisers are used. The consumption of potassic fertilisers has greatly increased since the War.

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[1] On the pre-War territory with 35,000,000 hectares of arable land: the post-War territory contains only 30,000,000 hectares arable land.

[2] See J. B. Hobsbaum and J. L. Grigioni. *Jour. Chem. Ind.* (Jan. 1917).

Other Suggested Fertilisers.—Magnesium sulphate has on occasion increased the yield of crops, but the conditions are not sufficiently well known to justify recommending its use by farmers. Silicates have been tried as fertilisers, especially in Germany, where it was hoped that they might partially replace phosphates and so reduce the need of importation, Germany having no phosphate deposits; but these hopes have not yet materialised. Manganese and boron are both essential to the growth of certain plants, but neither can yet be used by farmers.

Quality in Crops.—While quality is easily recognised by experts, it cannot yet for any crop except sugar beet be expressed in chemical terms. Quality is mainly determined by varietal factors, some varieties possessing it in greater degrees than others, but it is considerably influenced by temperature, water supply and soil type. Increasing efforts are made by experts to improve quality. In sugar beet, the percentage of sugar has been steadily increased by using as seed producers only those roots found by analysis to possess unusually high sugar content. In 1871 the average percentage was 10; now it varies about 18 or 19. The roots can be sampled without impairing their value for seed production. In potatoes, cooking quality cannot yet be explained in chemical terms, but it is associated with variety and with soil conditions, the black fen soils giving high yields but not high quality, while the silts of the Eastern counties and of the Lothians give both high yields and high quality. In barley, malting value also is not expressible in chemical terms but is associated with variety, with seasonal factors and with soil conditions. Milling value of wheat seems to be mainly varietal; for long it was confined to the hard spring wheats of continental regions (*e.g.*, Red Fife in Canada), but it has now been bred into autumn wheat by Biffen in his "Yeoman."

The effect of fertilisers on the quality of crops is less than was at one time supposed; nevertheless, fertilisers influence the character of the growth, and this reacts on the quality. More important effects are acceleration or retardation of ripening, tendency to strengthen or weaken the straw, and certain changes in the composition of leaf or seed.

Plant Diseases and Pests

Striking advances have been made in our knowledge of plant diseases and pests, and of measures by which they may be controlled. Three general methods are adopted:—

Varieties of plants are sought which are immune or highly resistant to the disease; if, as usually happens, these varieties lack some necessary or desirable character, they are crossed on Mendelian lines with others possessing it. This method is being adopted in the campaign against rust in wheat, one of the worst pests of this crop. It is also used against wart disease in potatoes, a fungus pest (*Synchytrium Endobioticum*) which threatened terrible damage to the crop but has been rendered almost harmless by the introduction of immune varieties.

The second method is to modify the conditions of growth so as to give the plant more vigour to overcome the disease. This has been successful in glasshouse practice in dealing with diseases of the cucumber and the tomato.[1]

The third method is to attempt a cure. Fungi are commonly controlled by spraying with finely powdered sulphur, polysulphides or Bordeaux mixture (copper sulphate and lime), the sulphur or polysulphides being used for the various mildews, and the Bordeaux mixture for other fungi, *e.g.*, potato blight caused by *Phytophthera infestans*, and "leaf curls" on peach, almond and other trees caused by *Exoascus deformans*. Insects are controlled by various sprays, the composition of which is determined by the nature of the insects and the state of the tree, *i.e.*, whether carrying tender foliage or in its winter resistant state. Eggs and sucking insects, *e.g.*, aphids, are killed by "contact" insecticides: alkali washes and coal-tar fractions or synthetic products in winter, nicotine and the various tropical plants used by natives as fish poisons (*Derris*, *Tephrosia*, etc.) in summer. Biting insects, *e.g.*, caterpillars, are killed by spraying lead arsenate on to the leaves; this treatment should never be used after the fruit has begun to form, especially in dry conditions, as nothing more readily causes a scare than the discovery of arsenic on fruit exposed for sale.

Systematic studies of insecticides at Rothamsted and elsewhere are bringing out effective organic compounds producible on the large scale. Other methods of control are to find weak points in the life history of the pest, the destruction of alternative hosts, and the search for hyperparasites which will greatly weaken the pest; this last is attractive but not yet successful except to a limited extent in certain islands, *e.g.*, Hawaii.

Much trouble is threatened by mosaic and other diseases caused by unknown agents and therefore vaguely attributed to a virus. Mosaic is transmissible by injecting a very small quantity of the juice of a diseased plant into a healthy one, and possibly by aphids in their passage from plant to plant.

Weed Control.—The growing cost of labour has compelled farmers to omit some of the cultivations by which in past days weeds were kept down. Four methods of control are adopted:—

(1) Certain free-seeding objectionable weeds are proscribed by law; farmers can be prosecuted for having them on their land.

(2) Threshing and seed-cleaning machinery have been greatly improved, so that seeds are now obtainable of a high degree of purity and entirely free from specified weed seeds.

(3) Effective machinery has been devised on the model of the horse-hoe for uprooting weed seedlings.

(4) Where the crop is already up and the weeds cannot be hoed except with difficulty, the whole field can be sprayed, at the rate of 50 gal. per ac., with a solution of either copper sulphate (3 to 5%), iron sulphate (10 to 15%), more popular on the continent of Europe than in Britain, or ammonium sulphate (30%), not yet commonly used; 5% sulphuric acid has eradicated bracken. These sprays need water, which is not always easily obtainable on the farm; dry sprays are therefore being used, especially finely powdered kainit (4 to 8 cwt. per ac.).

For yellow rattle (*Rhinanthus crista-galli*) in grass land, 6 cwt. powdered salt is applied per acre, and for daisies on lawns a mixture of dry sulphate of ammonia and sand (1:1 or 1:2) is sprinkled over the plants.[2] Once the land is free from weeds it can be kept clean by growing dense crops such as mixtures of oats with vetches, etc., which smother any weed seedlings and can be cut for hay or made into silage.

Other Methods of Improving Crop Production.—A high tension electric charge has been found to add about 25% to the crop yields, but the process is not yet practicable on the large scale. Radioactive fertilisers on this land are ineffective.

Suitable Varieties of Crops.—Modern agriculture is becoming more and more a study in adaptation. Instead of attempting by costly and laborious artifices to alter the soil or mitigate the effects of climate, farmers now seek out new crops or new varieties of old ones better adapted to their conditions than the old ones. This search for new varieties occupies much of the time of the research stations.

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(E. J. R.)

Plant Breeding

This ancient art, which by the end of the 18th century embraced systematic cross-breeding, received a great impulse from the rediscovery of Mendel's laws in 1900. In the past 20 years few agricultural areas have remained entirely unaffected by its exponents. Three broad procedures are now recognised: introduction of crop varieties from other lands, which still bears fruit in newly developing areas; selection or the search for individual plants of especial merit in field crops, which has brought notable advances; and artificial hybridisation or cross-breeding, which stands first in importance. Higher yield, better quality and resistance to disease have been the foci of effort. Only time can establish the merits of new forms. Official figures of acreage rarely discriminate between varieties, so that it is impossible here to mention more than the few more important but well proved advances.

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[1] *See* W. F. Bewley, *Diseases of Glasshouse Plants* (1923).

[2] For further particulars see W. E. Brenchley *Weeds of Farm Land* (1920).

Wheat.—Wheat improvements take first rank, and among them the Marquis wheat of Canada is pre-eminent in point of acreage. In 1892, Dr. William Saunders crossed Hard Red Calcutta, a commercial grade rather than a variety, and Red Fife, then the standard wheat of western Canada. Subsequently his son, Dr. Charles E. Saunders, selected one type from the progeny. This became commercially established in Canada in 1911 under the name of Marquis. In 1917 it constituted 80% of the wheat of the prairie provinces. Imported into the United States in 1913 it had, by 1919, a spread of 11,900,000 acres. Only one wheat is now more wide-spread in America; this is Turkey, which, with twice the area of Marquis, is a striking example of introduction, for it was brought from Russia by Mennonite immigrants. Earlier maturity, the primary distinction between Marquis and the Red Fife and other wheats it has displaced, makes for immunity from rust, drought and frost.

India, with great environmental diversity and characteristic impurity of native varieties, has proved a fine field for the breeder. Under Dr. A. Howard, the Pusa Institute has established selected wheats which are ousting the older forms. Pusa 12 and Pusa 4 have an area of 500,000 acres in the United Provinces, while Punjab 11 is grown in the canalised parts of the Punjab on nearly twice this scale. Helped by the provision of good seed, these new products are estimated to represent an annual gain to the cultivators of £1,000,000.

Something of romance attaches to the introduction into Argentina of a wheat from the Sze-chuan province of China. It has proved highly resistant to *Puccinia triticina*, the rust which more than anything else threatened to suppress the great promise of wheat-growing in South America. The introducer, Mr. W. O. Backhouse, has now raised hybrids which, both rust resistant and generally superior, are fast becoming the standard forms.

From the Swedish station, Svalöf, have come a number of new wheats, barleys, oats and peas; Swedish Iron wheat has added to its laurels by gaining a hold in England. English millers, however, dislike the thick skin and quality of its grain. New wheats continue to be produced in England, despite the many years of improvement already passed. The Little Joss and Yeoman wheats bred by Prof. Sir R. H. Biffen and introduced in 1912 and 1917, are shown by an official return to occupy one-tenth and one-fifth respectively of the whole wheat area of the 14 principal producing counties. Little Joss, a hybrid from Ghirka (Russian), and Square Head's Master, is the only form grown in England with a definite resistance to yellow rust (*Puccinia glumarum*). It has marked standing capacity and a curiously wide soil adaptation. Yeoman is also a product of premeditated synthetic breeding. The parents were Browick (English) and Red Fife—the world's best bread-making wheat. Heavy yield and great standing power are merits it shares with the best of the older forms, but its quality or bread-making capacity has set a standard formerly believed impossible in English wheats. None of the older wheats can be used for bread save in admixture with stronger overseas kinds. Inland millers pay heavy freights in bringing strong imported wheats from the docks to their mills. The all-English loaf is now being made commercially from Yeoman flour, and by partial displacement of imported wheats from the inland millers' blend is effecting a valuable economy.

Barley.—Barley is of peculiar interest because the quality of beer-making kinds is nearly as important as the yield. At the end of the 19th century Chevalier and Standwell were the prevailing forms in Ireland. Archer barley was introduced from England in 1900, and Irish Archer, a selection made by Dr. H. Hunter, soon displaced the older varieties. An even more marked success attended his hybrid Spratt-Archer. Spratt is an old form specially adapted to peaty soils: distinguished by high yield, exceptional standing power and superior quality, it now occupies almost 90% of the barley area of Ireland. It is estimated that £40,000 spent on breeding and testing in Ireland during the period 1905–25 has brought an increase equivalent to £250,000 per annum. Contemporaneously the selections, Archer and Plumage, introduced by Dr. E. S. Beaven of Warminster, have contributed to the prosperity of English growers. The former includes the specially valuable character of short-necked straw by which the loss of ears in tempestuous weather, once very serious, has been much reduced. More recently, Dr. Beaven's hybrid Plumage-Archer has come into cultivation. Its improved quality and increased yield have given it an unquestioned pre-eminence on the heavier barley soils of England and Scotland.

Roots.—Roots, such as potatoes which flower uncertainly and mangolds whose varieties freely intercross in the field, are difficult subjects. But mangolds and swedes have yielded to that systematic patience which has done so much in Danish agriculture. Helweg, in Denmark, first made clear that the only sound basis of estimation for mangolds was yield of solid matter per ac. and not mere wet bulk. Next he demonstrated that different forms or strains within any one variety might be widely divergent in gross yield and percentage of solid matter. Indeed, two strains of the same variety might correspond to a difference of £6–£8 in value of feeding material from one acre. The best strains were picked out, and by persistent teaching all bad strains were forced out of cultivation; good seed was ensured, and roots came to have a greater feeding value per ac. than corn. In England the area under roots is diminishing. In Denmark it has steadily grown, and when the World War stopped the importation of feeding-stuffs it was roots that saved Denmark. There was a time when wart disease (*Synchytrium endobioticum*) appeared to threaten wholesale destruction of English potato crops. But steady production of immune varieties, reinforced by appropriate legislation, may now be said to have brought security to the one great crop in which that country is still self-supporting.

Other Staple Crops.—Rice in Malaya and South India, the millets in India, the Fulghum oat of Texas and Kansas, the hybrid round-tipped tobacco of Connecticut, Svalöf's Victory oat, which has proved the best oat for England since Abundance was introduced, and Dr. C. A. Barber's new sugar-canes in India are among many other valuable new products of the last decade. Some of these forms may soon be displaced by better. Some may, in effect, suffer deterioration—a practical man's belief which the scientist no longer entirely scorns. Improvement is in certain instances largely attributable to general betterment of husbandry and the provision of good seed. But that all these new forms have advantaged the cultivator is beyond doubt.

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(F. L. EN.)

ANIMAL BREEDING

It must be frankly admitted that the expectations raised by the rediscovery of Mendel's laws have not been fulfilled. Nevertheless the conception that a stock animal should be judged by its progeny rather than by its ancestry or by its individual characters, a conception which owes its origin to experimental breeders or statisticians who have worked on Mendelian lines, has given at least three results of first-class economic importance: cows of improved milking capacity, hens which lay more eggs and pigs which reach factory size in less time. It must be added, however, that improved methods of management in feeding, milk recording, trap nesting and egg recording have contributed largely to these achievements.[1]

Vitamines.—The discovery of vitamines has not fulfilled expectations for animal husbandry. It is true that vitamine enthusiasts have brought to light many cases in which methods of feeding commonly used by owners of livestock result in producing symptoms of malnutrition, and more cases in which they do not yield results as good as the feeder ought to secure. Impartial examination, however, shows (*a*) that farm animals are much less affected by vitamine deficiency than are the rats, guinea pigs and pigeons, which were the subjects of the classical vitamine investigations, and (*b*) that farm feeding stuffs are seldom or never really deficient in vitamines. In short, vitamines are not a burning question in the nutrition of farm animals.

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[1] R. C. Punnett, *Heredity in Poultry* (1923); F. H. A. Marshall and J. Hammond, *Physiology of Animal Breeding*, Ministry of Agriculture (1925).

Mineral Requirements.—The many instances of rations in common use failing to produce the expected result or even causing symptoms of malnutrition, and the failure of the vitamine hypothesis to explain the facts, have focused attention on the much neglected subject of mineral requirements. Close examination of this question, more especially by Orr and his colleagues at the Rowett Institute, Aberdeen, has shown that most cases can be explained as being caused by a deficient or ill-balanced supply of ash constituents. There is no doubt that the modern deep-milking cow, the 150- or 200-egg hen and the quick-growing pig which reaches 200 lb. in six months, are excessively sensitive to ash deficiencies. There seems to be no doubt that the good results obtained by the use of fish meal for young pigs and laying hens are due in large measure to its high content of ash. In defining a balanced ration to-day, it is necessary to state not only the proteins, fats and carbohydrates, but also the ash constituents, and it must not be forgotten that even such elements as iodine and iron play their parts.[1]

Nutritive Value.—About 1885 Kellner showed that the real nutritive value of a feeding stuff was not the sum of the digestible nutrients which it contained. Experimenting with about a dozen typical foods, he was able to measure their net nutritive value, which he expressed as the number of lb. of starch equivalent to 100 lb. of the food. Assuming that the difference between the gross and net nutritive value was due to the work done by the digestive organs in disentangling the nutrients from the fibre, he devised a formula, based on digestible nutrients discounted for fibre content, for calculating starch equivalents of feeding stuffs. His starch equivalents thus calculated have received fairly general acceptance, and in fact are still the accepted basis for modern rationing.

Armsby and his colleagues, using quite a different method, have more recently measured net nutritive values, expressing their results in what they call calories of net energy. On theoretical grounds it has been shown that one lb. of Kellner's starch equivalent is equal to 1,070 calories of Armsby's net energy. When converted by this factor into the same terms, Kellner's starch equivalents and Armsby's net energy for the same feeding stuffs agree in most cases. This is very reassuring, since it confirms the accuracy of both figures. Cases in which there is significant disagreement are practically confined to coarse fodders such as hay and straw, and there is no doubt that Kellner's figures are too low for such materials. Armsby has shown that the difference between gross and net nutritive value is mainly due to the large outflow of heat following a meal—Rubner's specific dynamic action—which results from the stimulus given to the animal's metabolism by the absorption of the products by digestion. This being so, Kellner discounted the gross nutritive value too heavily for the presence of fibre, and his starch equivalents of fibrous foods are in consequence too low. It seems to be necessary to raise the starch equivalent of good hay from Kellner's figure of 30 to at least 40, which is Armsby's figure, and probably to raise other fibrous foods in like proportion.

Growth.—Comparative slaughter and balance experiments recently carried out have made it possible to calculate the composition of the increase in live weight of sheep, cattle and pigs at various shapes of growth and fatness.[2] It is quite easy to convert composition into calories, and since one lb. of starch equivalent can produce 1,070 calories in the body, it is possible to set out a table giving the weight of starch equivalent required to produce one lb. of live weight increase in any animal at any stage of growth or fatness. Such a table forms a logical basis for computing rations, provided of course the maintenance ration of the animal can be ascertained. The idea is the same as that underlying the modern method of milk rationing by computing the ration on the basis of maintenance plus so much per gallon of milk yielded. This method, the scientific basis of which was a paper by Kellner in 1911, is now widely used by progressive milk producers, and is perhaps the most valuable and practical outcome of modern nutritive studies.[3]

There is only one reason why rationing on the basis of maintenance plus so much per lb. of increase should not come into equally general use, and that is the lack of accurate knowledge of the maintenance requirement of young animals. Existing tables of maintenance requirements have been calculated by Rubner's surface law from the results of experiments on adult animals. That they may be as much as 50 or even 100% too low in some cases is indicated by du Bois' publications on the maintenance requirements of the human child and Deighton's measurements of the basal metabolism of the growing pig. From Deighton's curve for basal metabolism it is possible to estimate the maintenance requirement of the young pig from weaning to factory size. This information and the caloric value of the increase provide a logical basis for rationing.[4] No similar measurements of basal metabolism or maintenance requirements are available for growing calves, lambs or foals. (T. B. W.)

III. AGRICULTURAL ECONOMICS

This important part of the article on agriculture is divided into three sections, dealing respectively with credit, insurance and prices.

AGRICULTURAL CREDIT

Systems of agricultural credit may be broadly distinguished according to whether they are based upon a co-operative principle or not. Co-operative credit has been successfully applied in Europe (with the marked exception of Great Britain) and in India. In most of the newer countries the co-operative system has been relatively unsuccessful, and other means of financing agriculture have had to be found. The history of co-operative credit in the last 15 years records, almost without exception, an expansion of this system in countries where it had previously been firmly established; the number of rural societies has increased, and improvement and consolidation of central credit institutions have been effected.

Germany.—Even in Germany (the pioneer country in co-operative credit) which has suffered severely from the monetary disturbance due to the War, considerable expansion has taken place. Out of the 38,000 agricultural co-operative societies registered in 1924, 19,529 were rural banks, as compared with approximately 17,000 in 1912. The difficulties of the post-War period were, however, very considerable. Up to 1922, while prices were rising relatively slowly, the deposit of savings with the rural banks continued. But with the rapid collapse of the paper mark after that date the whole system became disorganised; confidence was destroyed and depositors ceased to make the necessary investments. The shortage of capital thus brought about caused acute difficulty in the joint purchase of agricultural requisites, and many co-operative societies were compelled to abandon it. Plans were attempted to obtain working capital; membership was increased, and endeavours were made to attract capital with high rates of interest.

None of these efforts, however, kept pace with the fall in values. Ultimately, attempts were made to stabilise the system by abandoning the basis of the paper mark and placing the business of the co-operative societies on a rye, wheat or gold mark foundation. Stability was ultimately introduced by the establishment of the Renten-mark, but the result was to disclose a shortage of credit in German agriculture, which led to serious difficulties in the sale of agricultural produce and the purchase of agricultural requirements. Since then efforts have been concentrated upon the restoration of the confidence of the rural investor, upon whom the system ultimately depends. Shortage of money and high rates of interest have continued to be one of the chief difficulties of German agriculture, as also is the case with other countries of central and southeastern Europe.

France.—The conspicuous feature of agricultural credit in France is the state subsidy which it carries with it. Under the

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[1] See Dr. J. B. Orr, *The Mineral Elements in Animal Nutrition*, Presidential Address Section M. British Assn. Report 1925.

[2] H. P. Armsby and C. R. Moulton, *The Animal as a Converter of Matter and Energy* (1925).

[3] *Report of Departmental Committee on Rationing of Dairy Cows*, Ministry of Agriculture (1925).

[4] T. B. Wood, *Animal Nutrition* (1924).

Méline Act of 1894 all or part of the members of one agricultural "syndicat" or more (*see* Co-operation, Agricultural) could constitute a credit society, whose capital was obtained by subscription of members. The credit society became a "filiale" of the syndicat. A considerable growth of these societies took place with the assistance of a voluntary organisation which prepared model rules. In 1897 it was made a condition of the renewal of the charter of the Bank of France that it would place at the disposal of the state without interest 40,000,000 francs together with an annual share in the profits of the bank, for the assistance of agricultural credit. In 1899 regional banks were created, the members of which were the local credit societies, and the above subsidy enabled the regional banks to reduce their rate of interest to the credit societies and consequently to provide cheap credit to farmers. The number of regional banks in 1921 was 69, with nearly 5,000 credit societies affiliated to them. The extension of the system to the provision of long-term credit was made under Acts of 1910 and 1920, which now permit a maximum loan of 40,000 francs to individuals to facilitate the acquisition and management of rural properties. These loans are for a maximum period of 25 years with interest at 2% (or 1% in the case of military pensioners or civil victims of the War).

Great Britain.—Great Britain has no standard machinery of agricultural credit, the ordinary joint stock banks and tradespeople providing the bulk of credit to farmers. In 1923 the Agricultural Credits Act was passed with the objects (1) of enabling persons who had bought their holdings during the currency of the Corn Production Acts—April 5 1917 to June 27 1921, when prices were exceptionally high—to obtain mortgage loans from the state, repayable within a maximum period of 60 years, and (2) of establishing co-operative credit societies empowered to borrow from the state. The latter are based on limited liability, each member being entitled to hold an unlimited number of £1 shares upon which 5s. is paid up. The societies are empowered to borrow from the state £1 for each share so held. The Act has not, however, been a success.

As regards long-term credit for the acquisition or improvement of agricultural land, the principle widely adopted in European countries is one under which credit institutions lend money upon first mortgages on farm lands and buildings, and raise money for the purpose by the issue of bonds to the public secured on these mortgages. Institutions of this character are to be found in Germany (Landschaften and mortgage credit banks), Austria, Hungary, Czechoslovakia, Italy, Denmark, etc. In many cases these are of early origin, but since the War, particularly in the countries of central Europe, they have suffered severely from shortage of money, and the high rates of interest have been a serious handicap to agriculture. In a few cases efforts have been made to sell land bonds in foreign countries.

United States.—Agricultural credit in the United States has undergone extensive reform as a result of important legislation passed during the period 1910–25. Under the Federal Reserve Act, Federal Reserve Banks (of which there are 12) are empowered to discount "eligible paper" as defined by the Act for "member" banks in their district. Farmers or other individuals must apply to their local banks which, if they are members of the Federal Reserve System, may rediscount with the Federal Reserve banks the notes, drafts and bills of exchange acquired from their customers. Under the Federal Reserve Act, the term of discount for paper drawn for agricultural purposes was six months as against a three months limit on commercial paper. The former was extended by amendment of the Act to a period of nine months. The Agricultural Credits Act of 1923 also extended the definition of agricultural paper, particularly as regards co-operative marketing associations.

The Act of 1923 extended the facilities for "intermediate" credit by establishing 12 intermediate credit banks, the primary function of which is to discount for or purchase from banks, trust companies, livestock companies and other bodies, notes, drafts and bills of exchange, the proceeds of which are to be used for agricultural purposes. They may also make loans direct to co-operative associations. These intermediate loans have maturities between six months and three years. In order to increase their loanable funds, these banks are empowered to issue collateral trust debentures which are exempt from taxation, up to 10 times their capital and surplus. Lastly, as regards long-term credit, the Federal Farm Loan Act (*see* Federal Farm Loan System) passed in 1916, established a system bearing some resemblance to the German Landschaften.

Twelve Federal Land Banks, each operating in a separate district, are empowered to make long-period loans based on farm mortgages, and to issue bonds to the public, which are tax exempt, up to 20 times their capital and surplus. The borrower must join a Farm Loan Assn. through which he obtains the loan. The Farm Loan Assn. is essentially co-operative in form—each association guaranteeing its own mortgages. Each Federal Land Bank also guarantees the bonds of the others. In addition to these, legislation has provided for the formation of "Joint Stock Land Banks" which are empowered to make loans direct to individuals based on specific farm mortgages and to raise money for the purpose by the issue of tax exempt bonds in the same manner as the Federal Land Banks. A certain amount of credit is also furnished through co-operative channels, 19 states having passed legislation providing for the organisation of credit unions. These unions have some resemblance to the co-operative credit societies in Europe, and raise money for making small loans by the sale of shares and by receiving deposits. The organisation of credit unions as separate agricultural institutions has, however, made only a limited progress up to the present.

Canada.—In Canada credit unions have been more successful, and over 150 with a membership of more than 66,000 have been organised since 1906, mainly in Quebec and neighbouring provinces. By a number of Acts the provinces of Canada have also sought to extend the facilities for short-term credit to farmers. These include the Livestock Encouragement Act, 1917, of Alberta, under which persons may form an association and jointly apply to the Livestock Commissioners for a loan; the Livestock Purchase and Sale Act, 1913, of Saskatchewan; the Rural Credits Act, 1917, of Manitoba, and a similar Act in Alberta, both designed to promote co-operative credit. Mention should also be made of the Ontario Farm Loan Act, the Agricultural Development Act and the Agricultural Development Finance Act, all passed by the Ontario Legislature in 1921—designed both to assist land settlement and to provide short-term loans. As regards long-term credit, legislation has been enacted by the separate provinces. Manitoba passed the Manitoba Farm Loan Act, which became effective in 1917, and was subsequently amended in 1919 and 1921. The Act established the Manitoba Farm Loans Assn., which serves as the lending agency between the provincial government and the farmers, and is governed by a board of five members including a Commissioner of Farm Loans. Loans are secured upon first mortgages on farm lands and are repayable by annual instalment in 30 years. Saskatchewan has passed legislation on similar lines (the Saskatchewan Farm Loan Act, 1917), and Alberta has followed the general lines of the Farm Loan Act in the United States.

Australasia.—The development of agricultural credit has received, and is still receiving, a considerable amount of attention in Australia and New Zealand. Mention should be made of the Agricultural Banks Act, 1923 (Queensland), the object of which was to make provision for state advances to co-operative companies and associations and to farmers and others; the Co-operative, Community Settlement and Credit Act, 1923 (New South Wales), which amended the law in regard to co-operation and made provision for the formation and management of co-operative societies, including rural credit societies, and the Rural Credit Associations Act, 1922 (New Zealand). More comprehensive legislation is contemplated.

India.—The development of agricultural credit in India has mainly followed the European model, and has made consistently steady progress. The first Act legalising co-operative credit societies was passed in 1904. This Act was replaced by an Act in 1912 which closely followed the English Friendly Societies Act and permitted other forms of co-operation. The number of rural credit societies under this Act exceeds 40,000 and these are mainly modelled on the Raiffeisen plan.

Agricultural Insurance

The risks against which farmers are mainly concerned to provide are those incurred in growing, harvesting and storing crops, animal diseases, condemnation of carcasses in slaughter-houses and those risks commonly covered by ordinary life, accident and property insurance. The nature of the risks to which farming is exposed vary between one country and another according to its situation and climate. Thus losses from windstorms are more common in North America than in many countries of Europe (it has been stated that between 1916 and 1923, 752 tornadoes occurred in the United States—an average of 94 annually); in Great Britain animal diseases, and in Scandinavia forest fires, are more important risks, while in Canada damage by hail causes heavy losses to farmers.

Insurance against these risks may be carried out either through ordinary joint-stock insurance companies, or through farmers' mutual insurance societies. Both methods are used, but the latter is held to have certain advantages. Many agricultural risks are, however, of a kind which differ from the risks of fire and accidents, in that the loss of a relatively large amount of property may occur at the same time. This is the case with windstorms which may affect a large area, with hail and with animal diseases which often take the form of epidemics, causing the loss of a large number of livestock within a short period. For this reason local mutual insurance societies operating in a small area frequently cover the risk by re-insurance.

Crop Insurance.—The insurance of crops after harvest is a relatively simple matter, and the risk—mainly a fire risk—is often covered by ordinary joint-stock insurance companies. The insurance of growing crops is a more specialised business. Under this head the most successful development is that in respect of hail insurance. In the United States 43 joint-stock fire insurance companies, 41 mutual companies and four state insurance departments carried hail risks estimated in 1919 at $560,000,000. In Canada the Hail Insurance District of Alberta was formed under the Municipal Hail Insurance Act of 1918, having in 1919 67 municipal districts. Hail taxes are paid by ratepayers to the municipal districts which in turn pay to the municipal board. The total risk borne by the Hail Insurance Board for the four years 1919–22 amounted to $72,000,000. In Saskatchewan the Municipal Hail Insurance Assn. carried an insurance of about $25,000,000 in 1921 and 1922.

Hail insurance in Europe has been developed to a less degree, but organisations to cover this risk are to be found in Germany, Austria, Denmark, Switzerland, France, Spain, Italy and elsewhere. In France 29 mutual societies existed for this purpose in 1921, and Italy had 51 societies in 1922. A certain amount of hail insurance was effected in England in the counties of Bedfordshire and Huntingdonshire after severe storms in 1906, but since then the matter has been allowed to decline. While hail insurance is the outstanding example of successful crop insurance, some progress has been made, particularly in the United States, in the provision of frost insurance. But more hope is attached to the development of comprehensive crop insurance policies, covering all the principal hazards. Several attempts have been made by joint-stock fire insurance companies and others in the United States to develop a system of comprehensive crop insurance, but it is still in an experimental stage. There appears at present to be little development in this direction in Europe.

Livestock Insurance.—Farmers in aggregate have large sums invested in livestock which is liable to suffer loss by disease and other causes. Insurance against these risks through mutual insurance societies or otherwise has made greater progress in certain European countries than elsewhere, although the United States has some 30 mutual livestock insurance companies. France provides perhaps the leading example of European livestock insurance; its development has depended partly on state subsidies. Out of the 14,896 subsidised co-operative insurance and re-insurance societies in France in 1921, over 10,000 were societies for the livestock insurance, and 78 for reinsurance. The annual premiums are fixed by rules of the societies at not less than 1% of the value of the animals in the case of societies which insure cattle only, 1·5% for societies insuring horses, mules, etc., 1·25% for societies insuring cattle and horses, 3·5% for societies insuring pigs. The amount of compensation varies between 50% and 80% of the net loss—*i.e.*, the value of the animals affected after deducting the value of the carcasses. In certain circumstances other methods of calculating the compensation are allowed.

The re-insurance societies cover certain defined areas, and may either contribute to the settlement of all losses falling upon the affiliated societies, or limit their contribution to such local societies as have had to pay compensation up to a sum in excess of a given rate. The affiliated societies contribute a certain proportion of the premiums to the re-insurance societies. Local societies may obtain from the Ministry of Agriculture grants of two kinds (1) establishment grants, made to societies in the course of formation, and (2) grants for losses incurred, made to societies in full working order which have suffered unusual losses. Similar grants may be made to re-insurance societies.

Co-operative insurance in Germany has not made progress comparable with that of other forms of agricultural co-operation. Only a small fraction of the livestock in the country is covered by insurance. In certain states, notably Baden and Bavaria, cattle insurance has received state assistance, and insurance of carcasses against condemnation by the sanitary authorities has also been adopted on a small scale.

In Great Britain certain joint-stock companies specialise in livestock insurance in addition to covering ordinary accidents and fire risks, while there are also a number of mutual societies for the insurance of livestock. There appears, however, little inclination on the part of British farmers to take advantage of these facilities except in the case of pedigree cattle or other valuable stock, the number of mutual societies registered and the membership having declined since 1913. There are, however, a considerably larger number of unregistered societies, such as pig clubs and cow clubs for the insurance of their members' livestock. It should be mentioned that under the Diseases of Animals Act, 1894, compensation is payable by the state to the owner of cattle slaughtered under the Act, in cases of foot-and-mouth disease, swine fever and other diseases.

Fire Insurance.—This is almost universally undertaken by the ordinary joint-stock companies but in some countries, notably the United States, it has also been largely developed on a co-operative basis. Indeed mutual fire insurance is one of the most successful as well as one of the oldest co-operative services which has grown up in that country. In 1924 there were about 2,000 farmers' mutual fire insurance companies carrying risks amounting to over $8,000,000,000. These societies operate largely on an unlimited liability basis, a relatively small number only limit the liability of members to a fixed sum per annum. The first mutual fire insurance companies in the United States were formed more than a century ago.

An interesting branch of agricultural insurance is that connected with forest fires in Scandinavia. Organisations for covering this risk have been formed in Sweden, Norway, Denmark and Finland. The Norwegian Society for Mutual Insurance against Forest Fires formed in 1911, covered risks in 1923 amounting to 335,000,000 crowns, while a similar society in Finland issued policies up to 653,000,000 crowns.

AGRICULTURAL PRICES

The outstanding event in regard to prices of agricultural commodities during the years under review is the upheaval due to the War. In practically every agricultural country, the prices of farm produce rose rapidly from 1914, during the War, and up to 1920, and fell—even more rapidly—between the spring of 1920 and the end of 1922. Although other factors entered into it, the primary cause of this movement is widely recognised to have been monetary, that is to say, it was due to the almost universal monetary inflation which took place between 1914 and 1920, and to the monetary deflation which followed it. This is illustrated by the fact that the prices of agricultural produce, as measured by index numbers, have moved over the whole period in close harmony with prices of general commodities.

The following table shows for the years 1914–22 inclusive, the percentage rise and fall of British agricultural prices (Ministry of Agriculture and Fisheries index number) and the percentage rise and fall of general wholesale commodities (the *Statist's* index number) in each case based on the average of 1911–3 as zero:—

Year	Agricultural Produce	Wholesale Commodities	Year	Agricultural Produce	Wholesale Commodities
1914	1	2	1919	158	147
1915	27	30	1920	192	201
1916	60	63	1921	119	86
1917	101	110	1922	69	57
1918	132	130			

After 1922 prices have remained relatively steady.

The general form of the price movement illustrated in this table is to be found in the case of most other civilised countries. The exceptions are Germany, Russia, Poland and some of the minor European countries, where the general price level continued to rise after 1920 in consequence of the continuance of monetary inflation. In Russia there was a great disparity between the two price levels owing to special considerations, the level of wholesale prices rising out of all proportion to the prices of agricultural produce. But elsewhere the gradual rise of prices, including those of agricultural commodities, from 1914, reaching a peak during 1920, followed by a rapid decline ending in most cases in 1922, was the common experience of each of the following countries: the United Kingdom, France, Sweden, Norway, Denmark, Switzerland, Holland, Spain, Italy, the United States, Canada, India, Egypt, Japan, South Africa, Australia and New Zealand. Although this was the form of the price movement, its extent and also the rapidity with which prices rose and fell differed between one country and another; the agricultural consequences of the price movement have therefore also differed.

The upward price movement was accompanied by general agricultural prosperity; in the United States of America it was a prosperity without parallel in its history. The downward movement was accompanied by serious and in some cases disastrous depression. In Canada, the United States and certain other countries, however, agricultural prices fell during 1920 and

1921 more rapidly than the prices of general commodities; in Great Britain they fell less rapidly. This meant that in addition to suffering the disabilities inseparable from a falling price level, agriculture in the former countries experienced a further difficulty by reason of the decline in the purchasing power of agricultural produce—the amount of other commodities which could be exchanged for a given amount of agricultural commodities. For example, in 1919 prices of farm produce in America stood at 131% above the level of 1913, while prices of all commodities were 106% above 1913. In 1922 the former figure had fallen to 33 and the latter to 49. The fall in the purchasing power of the "farmer's dollar," was therefore a potent factor in the agricultural crisis which developed in America after the spring of 1920.[1]

The curve in the general price movement of 1914–22 was partly due to the fact that the rise and fall of the prices of goods and services which the farmer had to buy—land (rent), labour, transport, seeds, fertilisers, feeding stuffs, etc.— lagged behind those of farm products, and secondly, that in agriculture the period of turnover is long. Thus in the case of Great Britain, in 1919 the prices of agricultural produce were 158% above the pre-War (1911–3) level. In the same year agricultural wages were 96%, fertilisers approximately 100%, feeding stuffs 157% above pre-War level, while the cost of rent and of rail transport had hardly begun to advance. In 1922 when agricultural prices were 69% above pre-War, wages were 74%, fertilisers approximately 52%, feeding stuffs 49%, railway transport about 75% above pre-War, while rents had advanced roughly by about 15%. In addition to this many of these costs of production were incurred many months before the produce was sold, and the effect of this was to increase the margin of profit in the upward movement and to decrease it in the downward. In actual fact these conditions led to a very large volume of agricultural produce being produced during 1920–2 at a loss, not only in Great Britain but in many countries overseas.

This was the primary cause of the almost world-wide depression of agriculture which began in the spring of 1920. But other factors contributed. The stimulus of high prices and increased profits during and immediately after the War, reinforced by the failure of Russia and Danubian countries, led to a rapid extension of the area under arable crops in certain countries. Taking the principal wheat exporting countries—the United States, Canada, the Argentine, Australia and India—the total area under wheat in 1918–9 had increased by nearly 33,000,000 ac. above the average figures for 1909–13; in 1923 they were about 28,000,000 ac. above this average. During the general decline of prices, there was both a falling off in consumption and recovery in European production. In addition to this the world's harvest of 1923–4, particularly in Canada, was an exceptionally good one. The result was that supply exceeded demand, and the general depression of prices consequent upon monetary deflation in 1920–2 was succeeded by a further depression of wheat prices due to increased production. The same applied in a greater or less degree to the other corn crops. As a consequence, a very acute situation developed amongst farmers of arable towards the end of 1923; in the wheat belt of the United States the crisis reached alarming proportions, and many of the banks concerned with financing farmers in this area, being unable to stand the strain, failed to meet their liabilities.

The general level of agricultural prices in Great Britain remained fairly steady in 1924, the chief event being the upward movement of grain prices towards the end of the year. The world's wheat area in 1924 showed a slight decline over that of the previous year, but the world's crop was substantially smaller, the average yield being only 88% of the 1923 crop. The result was to correct the abnormally low level of grain prices in 1923 and to bring the price of wheat approximately to the level of other agricultural commodities. This improvement in prices brought considerable relief to the great wheat-growing countries, particularly the United States, notwithstanding the fact that the purchasing power of farm produce as a whole still remained below its pre-War value.

In regard to the countries which continued monetary inflation after the War, the course of prices was entirely different, and the crisis of 1920–3 was not experienced. But a situation of a different kind developed later in consequence of the degree to which the value of the monetary units ultimately fell. Germany may be quoted as an example. The rise in prices continued comparatively steadily up to 1922, but after that the movement gained enormous momentum. The paper mark sank to a mere fraction of its pre-War value and with it invested savings often disappeared. This is what happened in the case of the rural credit banks, and when stability was ultimately restored by the introduction of the Renten-mark, agriculture was found to be seriously short of working capital. Farmers, in order to raise money for future operations, began to throw large quantities of produce on the market, with the result that prices fell. This in turn brought about a wide discrepancy between the prices of things the farmer had to sell and the prices of those he had to buy. In Jan. 1924, the prices of potatoes were 96%, rye 89%, fattened stock 73% of pre-War value, while superphosphates were 183%, machinery 164%, potash 105% and ammonia 96% of pre-War prices.

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IV. ELECTRIC POWER IN AGRICULTURE

The domestic and industrial uses of electric light and power have developed greatly in towns. There has been less progress in the country, owing chiefly to the high relative cost of distribution where the demand is small and scattered over a wide area.

Use of Electric Power.—Electric light and power have been found very useful on farm premises where current is available. Good light is as beneficial in a farmhouse as in an urban dwelling, in a cowstall as in a factory. The electric motor is simple, robust and easy to start; it gives a steady pull, and, with the usual charge ranging from 1½d. to 3d. an electric unit for power, it is cheap to work.

Barn Machinery.—Farmers rely on an oil-engine which is used (roughly in proportion to the acreage of the farm) to drive what is called barn machinery, *i.e.*, chaff-cutters, root-pulpers, cake and oat crushers, etc. These machines absorb from 1 to 5 H.P. according to size. On a grass farm, the engine, perhaps 1½ to 3 H.P., may work only for two or three hours a week in winter and be hardly used in summer when all the stock is out on the pastures. The annual consumption may be something like 1 H.P. hour per acre of land or, say, 600 H.P. hours per square mile of country, equivalent to 450 electric units of kilowatt hours. On an arable farm, where there is much preparation of food, including perhaps the grinding of barley-meal, an engine of 5 to 8 H.P. may work several hours a day, and the annual consumption amount to about 12 H.P. hours per ac., that is, about 7,000 H.P. hours or 5,000 electric units per square mile.

Cultivation.—The greatest consumption of power in agriculture is in field cultivators such as ploughing. On most farms, this work is still done by horses. The only places where they have been replaced successfully by mechanical power are in flat areas with large arable fields. There ploughing can be done more economically by tractors on light land and by steam tackle on the heavier clay. On a farm where three quarters of the area is arable land, the annual consumption of energy in ploughing may amount to 15,000 to 20,000 H.P. hours per sq. m., and half as much again may be used for other cultivations, a total of 22,000 to 30,000 H.P. hours per square mile. Thus, on arable farms the energy needed for field work is considerably greater than that required to drive barn machinery.

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[1] The subject is discussed in *The Agricultural Situation* by Warren & Pearson, Ch. 8, Wiley & Sons, New York, and in *Report of the Joint Commission of Agricultural Enquiry*, Part I.

Electric Ploughing.—Electric ploughing is being tried in France, Germany, Italy and elsewhere, and is generally carried out by contractors. The most usual method is to haul the plough backwards and forwards by means of a wire rope pulled by a motor mounted on a wagon at each side of the field, just as in steam ploughing. In a modification of this method, a single motor only is used, the wire rope passing round four anchored pulleys, two of which are moved as the plough proceeds. Experiments have also been made in which the motor is placed on a carriage attached to the plough, and current supplied to it through an insulated, flexible cable, which is unwound as the carriage and plough move one way across the field and wound up again as they move back in the other direction.

Costs.—It is difficult to get comparable figures of costs. A committee of the Institution of Electrical Engineers (Aug. 1925) quotes the prices of French contractors as 66 to 127 fr. per ac. for ploughing to depths of 6 to 14 inches. This, at a time when the external value of the franc was about 80 to the pound sterling, seems to be equivalent to 16s. to 32s. per ac., but internal and external values of a currency are different in times of rapidly varying exchanges. The quotations of East Anglian contractors for steam ploughing range from 17s. to 25s. per ac. according to depth (say 8 to 14 in.) and soil. The cost to a farmer of ploughing with horses is generally reckoned at about 15s. for light and 28s. for heavy land per ac. but, if this too were done by contractors, something must be added for profit.

Both steam and oil engines have the great advantage of being self-mobile; they can move about the roads and on to the field under their own power. With electric ploughing, the need of taking wires to each field, the great weight of the motors and carriage, and the cost of hauling them about with horses or tractors, together with the rapid depreciation of some of the machinery, militate against its success. It seems likely that, unless some new method or improvement is applied, electric ploughing will make no headway, and that the use of electric power in agriculture will be restricted to the driving of stationary machinery.

Special Machinery.—Besides the ordinary barn machines, less common implements must be brought under review. For threshing corn, smaller farms mostly rely on travelling threshing machines worked by steam traction engines. Some larger arable farms, however, have their own threshing plants. Where current is available, the machine can well be driven electrically with a motor of from 12 to 15 H.P. according to size. It is stated that, owing to the steadier pull of the electric motor, better threshing is done than with a steam-engine. On certain farms, power is used in other special ways. For instance, where a tower silo is installed, power is wanted to cut up the fodder and to lift it into the silo. Ensilage is sweet or sour chiefly according as it is made above or below a temperature of 47° C., and German experiments show that it may possibly be worth while to heat the fodder artificially by passing an electric current through the silo.

Artificial Drying.—Experiments have been made with some success, chiefly at Oxford, on the artificial drying of crops by blowing hot air through them. The process is not yet fully under control, but if it becomes common, it will consume power. This can perhaps be supplied more conveniently by oil-engines, but in special cases electric motors may be used to drive the fans which blow the heated air through the stacks of corn or hay.

Special Advantage.—One advantage of electric current is that power need only be used to the amount actually required. Motors of quite small size are made which will drive light dairy machinery, horse-clippers, fans for incubators, and other implements which absorb too little power to make it worth while to start an oil-engine to run them. The number of such implements is sure to increase as electric supply becomes more common. As regards dairies, milking-machines and also separators, clarifiers and butter churns are very suitable for electric drive. Dairymen, and perhaps fruit-growers, may find it profitable as time goes on to install refrigerating machinery. This may give another demand for power on certain specialised farms.

Poultry.—To turn on electric light in poultry houses on winter evenings and give the birds an extra feed is found to increase the number of eggs then laid. The rise in the total number laid throughout the year is insignificant, but, since eggs are worth more in winter, the redistribution more than pays for the cost of light, food and extra labour. Incubators can more conveniently be heated electrically than in other ways; by passing heated air through the apparatus by means of an electrically driven fan, uniform temperature and efficient ventilation can be secured.

Plant Growth.—Experiments indicate that plant growth is stimulated by a high voltage current of some milliampère per ac. passing as a discharge to the crop from a network of overhead wires, which are kept at 20,000 to 60,000 volts above the earth. Application for six hours a day for one month early in the growth of the crop seems quite as effective as a longer treatment. With certain cereals, an increase in yield of 20% has been obtained, but the results are not always assured, and the matter is still in an early experimental stage. Other experiments, carried out in America and elsewhere, show that electric light, both arc and incandescent, in greenhouses, has an effect in accelerating the germination of seeds and hastening the growth of certain vegetables, the effect depending somewhat on the colour of the light.

Electric Supply.—In the neighbourhood of towns, and in industrial and mining areas, farms can be and often are supplied with current from central power stations. Most of these stations now produce three-phase alternating current, and the corresponding squirrel-cage type of motor is very suitable for farm use. Further developments of this kind may be expected, but the purely agricultural demand is not enough to carry a network of mains over the countryside. Experience shows that the demand for light and power combined varies from 1,000 to 6,000 electric units per sq. m. in good agreement with the estimate for power alone from oil-engines, as given above. In towns, the consumption may be a thousand times more. Again, for long distances, in order to economise copper, high voltages must be used; these are dangerous, and must be transformed to lower pressures for domestic or industrial purposes. Transformers are expensive, and no ordinary sized farm consumes enough power to carry the cost of a high voltage transformer. Hence arises the apparent absurdity that a farm with high voltage mains running through it may be unable to get power. But, where a chain of villages creates a considerable demand along a definite line, or where pumping or irrigation needs a steady supply of power, the distribution of central station current in rural areas may become possible, especially if produced by cheap water power.

Village Supplies.—Where current from a large power station is not available, a village supply may be feasible; a considerable number have been successfully installed in England, some worked by small waterfalls, others by oil-engines. If water be plentiful, turbines and dynamos may run day and night, and a very cheap supply be obtained; but in other cases the energy must be stored in batteries of accumulator cells, which are costly and short lived. Whenever cells are to be charged, alternating current is, of course, inapplicable, and direct or continuous current must be used.

Private Installations.—When no public supply can be obtained, there remains the question of a private installation. If occasional power to drive barn machines alone is wanted, it is obviously better to drive directly from a small oil-engine. But, if good light be wanted, and use can be found for motors of fractional horse power in dairy or house, a private electric plant may be worth consideration. The dynamo is generally driven by a water turbine or oil-engine, but the use of windmills seems now becoming possible. (*See* also FARM MACHINERY AND TRACTORS.)

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(C. D. W.)

AGRICULTURE, CENSUS OF.—The need for an international agricultural census has been recognised by everyone who has occasion to try to estimate world production, consumption or stocks of any agricultural, livestock or forest product that enters into international trade. Many countries have never taken a census, others have taken censuses only at long and irregular intervals, and there is great diversity and lack of comparability in dates, in methods, in data and in form of publication in different countries. In a total of 201 countries, 140 have never taken a complete agricultural census. The date of the last census in Great Britain was 1908; in Germany 1913; in Austria 1910; in Italy 1918; in Argentine 1914; in Rumania 1905; in Cuba 1899; and in France 1892. Lack of uniformity exists in methods of collecting data, in data collected in censuses of different countries, and sometimes even in different censuses taken in the same country.

The International Institute of Statistics, at its meeting at Brussels in Sept. 1923, approved an exhaustive report by a group of experts nominated by the League of Nations with Professor Umberto Ricci as chairman, advocating the taking of periodical censuses and the improvement of annual statistics in all countries. The Pan-American Union, representing all American governments, which met at Santiago, Chili, in the spring of 1923, and the International Congress of Social Economy, that met in Buenos Aires in 1924, adopted similar resolutions. Each of these international bodies recognised the International Institute of Agriculture as the organisation best situated to promote improvement in national statistical services and the taking of periodical agricultural censuses in all countries.

In response to this expressed need the General Assembly of the International Institute of Agriculture, in May 1924, adopted a resolution confirming the great utility that would result from a general agricultural census in all the states in 1930–1 under a uniform plan. It also called the attention of the Permanent Committee of the Institute to the importance of inducing the adhering governments to agree to take such a census, and of preparing a draft basis programme to be submitted in 1926 to a meeting of specialists to be designated by the respective governments, the agreed programme to be transmitted to the various governments. The General Assembly authorised a small allotment of Institute funds for the expenses of the preliminary work, which was supplemented by funds supplied by the International Education Board and by the United States Department of Agriculture.

Work of the Institute.—The Institute then communicated the resolution to the adhering governments and favourable replies were received from the majority. In May 1925 a director of the preliminary work was appointed, a small office organised and a programme of procedure prepared. This programme contemplates:—

1. The preparation of standard forms of census schedules.
2. The preparation of a glossary of well-defined terms used in the census.
3. The compilation of data on the taking of agricultural censuses, on production and international trade in agricultural, live stock and forest products in all countries.
4. Revision of the preliminary draft of questionnaire forms by statisticians of adhering governments.
5. Discussion and final revision of the census forms by a committee of agricultural statisticians in connection with the General Assembly meeting at Rome in April 1926.
6. Explanation and promotion of the census project in all countries through correspondence, publicity and personal visits of the Director and his assistants.

International statistics of agriculture are important in promoting and facilitating international commerce, and constitute a potent factor in the determination of prices of agricultural, forest and live stock products, and of food, clothing and raw materials in every country, because of the universal operation of the law of supply and demand, and of modern facilities for rapid communication and transportation. But to be of real value international statistics must be comparable, and the only way to secure comparability is through international agreement to take censuses the same year and according to a uniform plan.

Other important results of the universal agricultural census will be its influence in bringing about improvement in the annual statistics of agriculture in many countries, and the probability that the census of 1930–1 will serve as a precedent for future world-wide censuses at regular decennial periods. (L. M. E.)

AICARD, JEAN FRANÇOIS VICTOR (1848–1921), French poet and dramatist (*see* 1.434), died in Paris May 13 1921.

AIRCRAFT CARRIER.—Although, previous to the outbreak of the World War, various trials had been carried out with launching devices for flying seaplanes from off the decks of a battleship, the progress made was slow and it was not until just prior to the outbreak of war in 1914 that a vessel was taken in hand for conversion to an aircraft carrier. The British Govt. then took over a tramp steamer which was subsequently named the "Ark Royal" and fitted her with a flying-off deck forward and two cranes for lifting the seaplane inboard after returning from a flight. This vessel was completed at the end of 1914 and proceeded to the eastern Mediterranean where she proved useful as an aircraft depôt ship.

"*Campania.*"—Further seaplane carriers being needed, several cross-channel steamers and passenger vessels were taken over and converted into seaplane carriers. The largest of these, the "Campania," was taken up in 1915 and a large flying-off deck fitted forward for the purpose of flying seaplanes off wheel trollies. These alterations were completed early in 1916 and the vessel proved of such service that a demand arose for further similar vessels to accompany the British fleet at sea.

"*Conte Rosso.*"—The next vessel taken over was the Italian passenger and cargo ship "Conte Rosso," renamed "Argus" which was building in 1916 at the works of Messrs. Beardmore & Company. A complete flying deck was fitted fore and aft with a hangar for stowing the machines under this deck. The funnels were carried up to the level of the hangar roof and then turned back to run horizontally beneath the flying deck to the stern so as to discharge all funnel gases abaft the stern of the vessel, fans being fitted to cause a good draught through these funnel ducts. For transporting purposes lifts were fitted from the hangar to the flying deck and cranes to lift the machines from the water. To enable machines to be carried on the deck in addition, wind-breaking palisades were fitted which could be raised simultaneously to a height of 14 ft. above the level of the flying deck.

"*Furious.*"—Whilst the first trials of this vessel were proceeding early in 1917 it was decided to appropriate the "Furious," then completing at Messrs. Armstrong's naval yard for aircraft-carrying purposes. This ship was originally designed as a large light cruiser to carry two 18-in. guns in single turrets, one forward and one aft. The first stage of conversion was to remove the forward turret and fit a flying-off deck and hangar, and from this deck seaplanes and aeroplanes could be flown off successfully. Attempts were later made to land machines on this forward deck, but these were not successful and so later the stern 18 in. gun was removed and a big flying-on deck fitted, the two flying decks forward and aft being joined by a walking way around the mast and funnel.

Owing to disturbances set up by funnel gases and eddies around the funnel structure, this flying-on deck was not a great success and the ship was further re-constructed, being finally completed in 1925. This vessel was fitted like the "Argus" with a clear fore and aft flying deck, the funnel gases being led out over the stern.

"*Hermes.*"—About the same time as the appropriation of the "Furious" for conversion, designs were prepared for a carrier named the "Hermes" and this was the first vessel primarily designed as an aircraft carrier. Some six months after, the Chilian battleship "Almirante Cochrane," building at Messrs. Armstrong's works, was taken over for conversion and renamed the "Eagle."

In both these vessels a departure was made in the construction of the flying deck since a completely clear fore and aft deck was not fitted, as in the "Argus" and "Furious." The funnels and navigating positions were incorporated in an "island" arranged on the starboard side, thus giving a clear deck of a width slightly less in way of the island than just forward or aft of it. Neither of these vessels was completed until 1924, and in the meantime vessels of this type received consideration at the Washington Conference, being defined as follows:—

An aircraft carrier is a vessel of war with a displacement in excess of 10,000 tons (10,160 metric tons) standard displacement, designed for the specific and exclusive purpose of carrying aircraft. It must be so constructed that aircraft can be launched therefrom and landed thereon, and not designed and constructed for carrying a more powerful armament than that allowed to it under Article 9 or Article 10 as the case may be.

Articles 9 and 10 are as follows:—

Article 9. No aircraft carrier exceeding 27,000 tons (27,432 metric tons) standard displacement shall be acquired by, or constructed by, for or within the jurisdiction of, any of the contracting Powers.

Aircraft Carriers (1925)

Country and Vessel	Date of Launch	Date of Completion	Length between Perps.	Breadth	Draught	Displacement	Speed	Horse-power	Armament
BRITISH EMPIRE			ft. in.	ft. in.	ft. in.	tons	knots		
Argus	1917	1918	535—0	68—8	21—0	14,450	20½	20,000	2–4 in., 4–4 in. A.A. 20 aeroplanes
Hermes	1919	1924	548—0	70—3	18—7	10,950	25	40,000	7–5·5 in., 4–4 in. A.A.
Eagle	1918	1924	625—0	105—2	21—11	22,790	24	50,000	9–6 in., 5–4 in. A.A.
Furious	1916	1925	735—0	88—0	21—6	19,100	31	90,000	10–5·5 in., 6–4 in. A.A.
Courageous	1916	Being reconstructed	735—0	81—0	22—3	18,600	31	90,000	....
Glorious	1916		735—0	81—0	22—3	18,600	31	90,000	....
UNITED STATES									
Langley (converted)	1912	1922	520—0	65—0	19—0	12,700	14½	7,160	4–5 in. 30 aeroplanes
Lexington	1919	Bldg.	874—0 Extreme	104—0	30—0	33,000	34	180,000	8–8 in., 12–5 in. A.A. 72 aeroplanes carries a catapult
Saratoga	1925	Bldg.	874—0 Extreme	104—0	30—0	33,000	34	180,000	
JAPAN									
Hosho	1921	1922	510—0	62—0	20—3	9,500	25	30,000	4–5·5 in., 2–12 in. A.A. 26 aeroplanes.
Akagi	1925	Bldg.	820—0 Extreme	103—0	30—0	33,000	33	170,000	Reported stowage for 50–70 aeroplanes.
Kaga	1921	Bldg.	700—0	100—0	28—0	27,000	27	60,000	
FRANCE									
Bèarn	1920	Bldg.	560—0	89—0	29—0	24,800	21	35,000	

However, any of the contracting Powers may, provided that its total tonnage allowance of aircraft carriers is not thereby exceeded, build not more than two aircraft carriers, each of a tonnage of not more than 33,000 tons (33,528 metric tons) standard displacement, and in order to effect economy any of the contracting Powers may use for this purpose any two of their ships, whether constructed or in course of construction which would otherwise be scrapped under the provisions of Article 2. The armament of any aircraft carriers exceeding 27,000 tons (27,432 metric tons) standard displacement shall be in accordance with the requirements of Article 10, except that the total number of guns to be carried in case any of such guns be of a calibre exceeding 6 in., except anti-aircraft guns and guns not exceeding 5 in., shall not exceed eight.

Article 10. No aircraft carrier of any of the contracting Powers shall carry a gun in excess of 8 inches. Without prejudice to the provisions of Article 9, if the armament carried includes guns exceeding 6 in. in calibre the total number of guns carried, except anti-aircraft guns and guns not exceeding 5 in., shall not exceed 10. If alternatively the armament contains no guns exceeding 6 in. in calibre, the number of guns is not limited. In either case the number of anti-aircraft guns and of guns not exceeding 5 in. is not limited.

The aircraft carrier was thus recognised as a definite and essential unit in a modern fleet by the Washington Conference at the end of 1921, although the first practical vessels of the type had not been commenced until 1916, those previous to this being experimental and at the best only floating aerodromes with repair facilities. The other naval Powers followed the British lead in the building of this type of war vessel, and the aircraft carriers in service and building in 1925 for all Powers are shown in the table above. This table is restricted to aircraft carriers proper, the earlier smaller vessels, which are really aircraft tenders or depôt ships, being excluded. (E. T. D'E.)

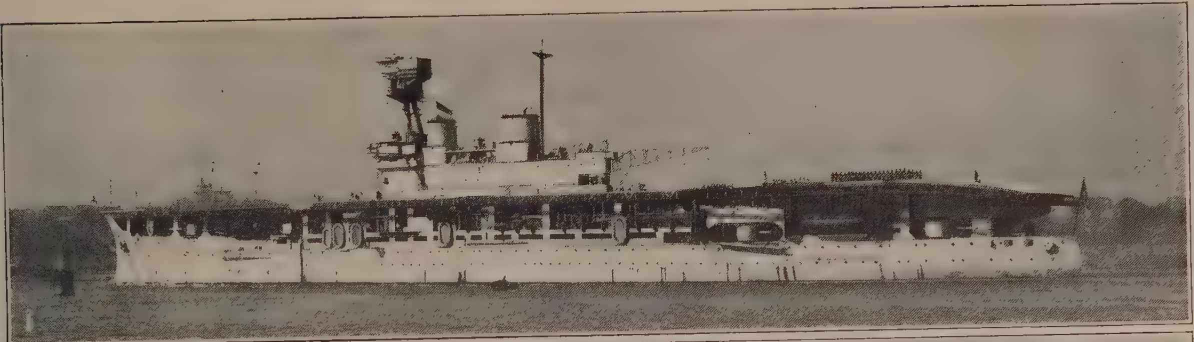
AIR FORCES.—The World War provided a powerful stimulus to all branches of war flying, and great advances were made in technical equipment and experience. This intensive development led to constant changes not only in the practice but in the application of flying, so that when peace came it was expected that progress would be as rapid as in wartime. This led to a hesitancy on the part of most nations to commit themselves definitely to a rigid line of policy in aviation matters. The tendency was to wait and see what the future disclosed rather than to base programmes of development entirely upon past experience.

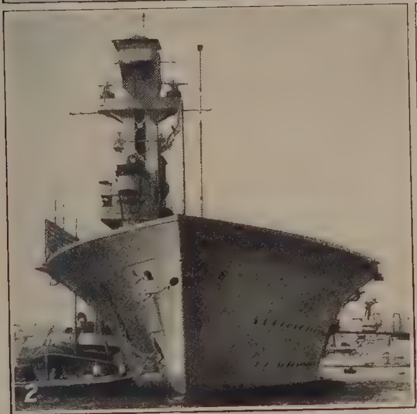
The nations therefore shaped their aeronautical policies with an open mind regarding the future, and in most cases refrained from radical adjustments and expedients which progress to date might have suggested as desirable. What may in externals appear stagnation is not necessarily so in fact. Every forward step is preceded by much research and experiment before it is presented to the world as a concrete achievement. Even by the beginning of 1926 many war experiences had not been fully digested, nor their lessons properly formulated.

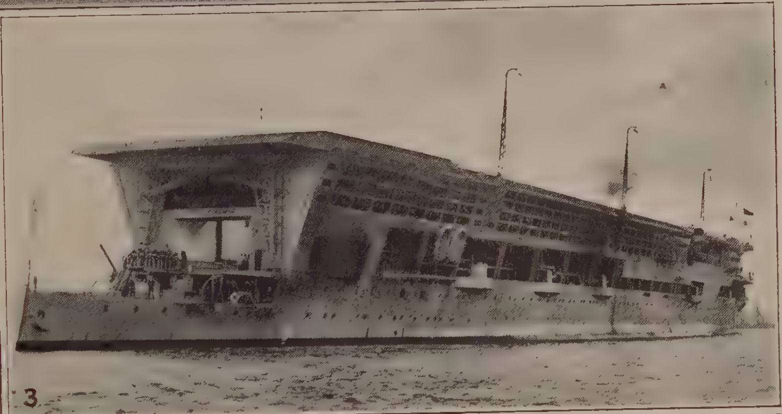
Analysis of available data, research and experiment, although less apparent, equals in importance the more tangible evidence of aeronautical progress. Unlike armies and navies, air forces cannot be judged solely by what is visible to the eye. A policy readily adjustable to whatever changes the future may bring; an elastic organisation that lends itself readily to expansion; adequate provision for research and experiment; training facilities; a husbanding of the resources, industries and trades that subserve the needs of aviation, and the national attitude towards flying give a truer perspective of potential air power than mere numbers of machines. Nor is novelty of type much to go by, since a machine that is ahead one day may be surpassed by others in a little while. Policy and organisation are the most important criteria.

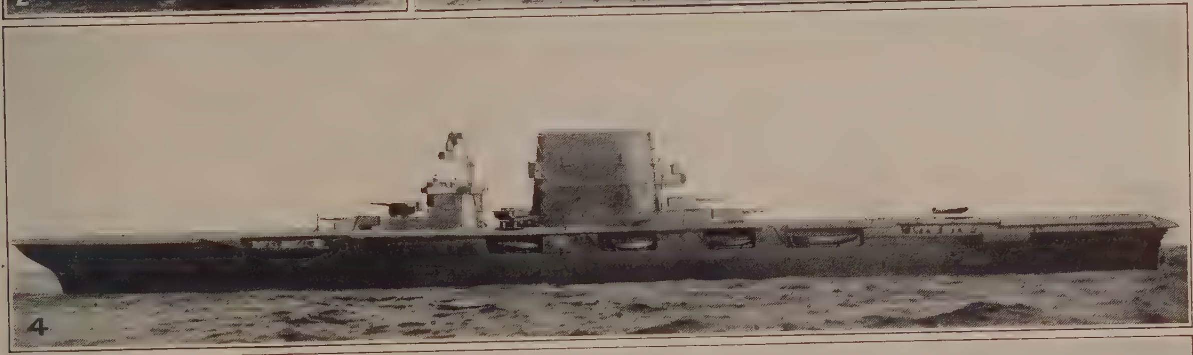
Two Theories of Control.—Two different schools of thought exist in regard to the general principle that should govern the organisation, administration and development of air forces. One school regards flying as a science that can best be applied to war uses by entrusting armies and navies with its adaptation to their own respective needs. Aviation is, accordingly, constituted a component of these services, and its application in war is governed by naval and military considerations. Although this system has certain advantages, in that it grafts a novel instrument of war upon an existing stem and so avoids the disadvantage of setting up an entirely new organisation, there is no doubt that it exerts a limiting influence. The soldier and the sailor naturally approach aviation from the angle of their own profession, and view its possibilities in their bearing upon naval or military warfare.

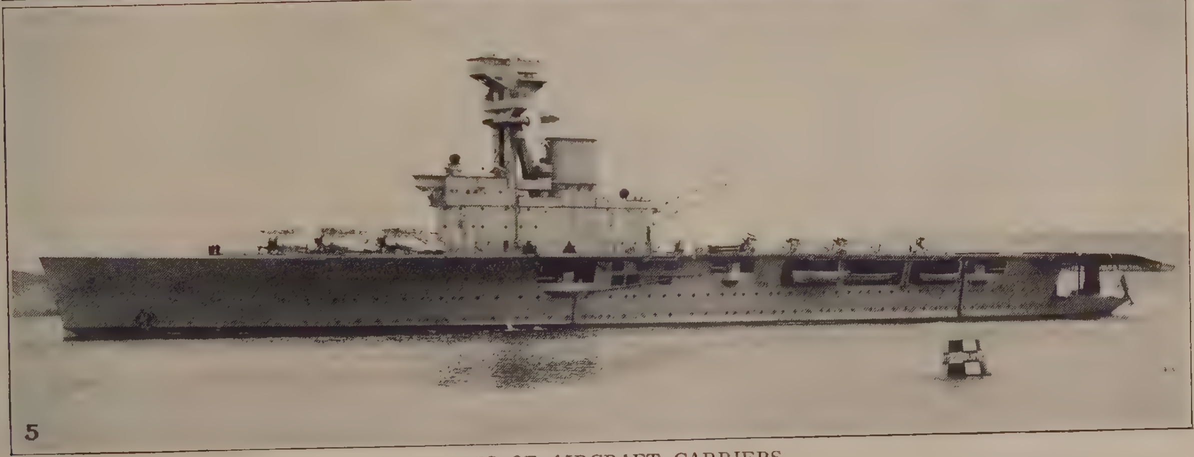
Such advances as are made are likely to follow divergent courses. An apparently inevitable spirit of competition between armies and navies also leads to duplication and tends to deprive effort of its full measure of results. The other school considers that the air merits a profession of its own, and that untrammelled











TYPES OF AIRCRAFT CARRIERS

Fig. 1. H.M.S. "Eagle," port quarter view, showing flight deck. Fig. 2. H.M.S. "Hermes," bow view. Fig. 3. H.M.S. "Furious," latest British aircraft carrier. Fig. 4. Model of U.S. aircraft carrier, of the "Saratoga" type. Fig. 5. H.M.S. "Hermes," showing aeroplanes parked on flight deck.

(Figs. 1, 2, 3 and 5. Photos by Abrahams, Devonport. Fig. 4. Courtesy of U.S. Navy Dept.)

devotion to the science and art of flying is necessary to do full justice to possibilities, not only in relation to war but as a factor in modern life. It accordingly seeks to concentrate all aeronautical effort into one main channel, with branches to the various departments which flying can serve. Duplication can thus be avoided and the fruits of experience can be adequately considered and properly collated.

I. GREAT BRITAIN

Great Britain was the first to gather together the threads of aeronautical activity and place them in the hands of a central authority; and at the beginning of 1918 the air branches of the Admiralty and War Office departments were amalgamated into the Air Ministry (*q.v.*). In April 1918, the flying branches of the navy and army were merged into the Royal Air Force. The idea was not a new one, and, although the impulse of war made obstacles easier to overcome, it was not in war that the conception had its origin. The sub-committee of the Committee of Imperial Defence, charged in 1911 with the study of aviation in its relation to defence, mentioned in its report that such a step might be desirable when flying was more advanced. The germ of the idea is also to be found in the constitution of the Royal Flying Corps, formed in 1912, with its naval and military wings. In this instance, however, the measure was too far in advance of the time to survive inter-service jealousies, and shortly before the outbreak of the World War the Royal Naval Air Service was formed, the Royal Flying Corps becoming part of the army.

As air warfare grew in volume and importance, the defects of the dual system under war conditions became more and more apparent. Full use of the nation's resources was prejudiced, and civilian ministers were not only denied unanimous advice on air matters, but were sometimes forced to choose between discordant views and to settle vital differences of opinion. The drawbacks of this competitive system were particularly glaring in the matter of technical supply. Improvement was sought in the principle of joint naval and military Air Boards to co-ordinate supply for the two air services. These boards had, however, no executive control over policy, and achieved but little. Finally the Air Ministry was brought into being as the only apparent alternative to the existing evils.

Although a war measure, the Air Ministry survived the peace, and administers not only the Air Force but controls civil aviation as well. It has, however, not been allowed to continue its existence as a Department of State without considerable hostility and adverse criticism. Its chief opponents were the navy and army. With their establishments reduced to a minimum, and their budget grants diminishing every year, the older fighting services viewed with misgiving the allotment of funds to the newcomer. They argued that the main use of aircraft in war is to assist directly or indirectly the army and the navy, and that accordingly these services should have entire control of their respective air arms. The reply to this objection is that the conquest of the air has disclosed possibilities which transcend the scope of land and sea warfare; that to narrow the view-point to naval or military problems is to bring their possibilities into a false perspective; and although that aerial assistance to the forces that fight upon the sea and on land is necessary, this need by no means marks the limit that should be set to aerial operations. Moreover, to regard the air merely as an auxiliary to the sea and the land is a dangerous doctrine, since circumstances may render naval and military operations secondary to those carried out by air forces. Another criticism was that a separate air force is extravagant, since it involves additional overhead expenditure. The reply is that this is offset by the economy achieved in having a single authority dealing with air matters.

One result of recognising aviation as a profession in its own right has been a breakaway from traditional practice in policing the British mandates in the East. Security in these territories is the responsibility of the Royal Air Force; aeroplanes are recognised as the chief instruments for the support of law and order, and military forces are used as auxiliaries. The measure has been justified by the great economy achieved. The development of this conception and its successful application would not have been possible without an Air Staff. Another result is a reversal of principle governing the air *vis-à-vis* the land and sea forces in the defence of Great Britain against air attack. Instead of dividing the air into two portions, one above the land and the other above the sea, and making the army and navy responsible for their respective spheres, the air is regarded for purposes of national defence as a single field of activity. The Air Force is accordingly responsible for guarding against air attack, and such ancillary ground forces as may be necessary conform to air defence measures and it carries out its work under the orders of the air commander.

Aviation in Peace and War.—Since it is sometimes claimed that a true appreciation of a nation's air strength cannot be reached without taking into consideration the civil aspect of flying, it is desirable to note the relationship existing between the peace and war sides of aviation. Air strength is represented by air forces maintained in peace, ready to function the moment war breaks out. Heavy losses in life and equipment are, however, to be expected in air warfare, especially if the belligerents are at all equally matched. Air power will, therefore, depend ultimately upon the means available for rapidly making good these losses—that is to say, upon a reserve of flying personnel and on a healthy aircraft industry. It is in respect of these two important factors that civil aviation must make its contribution to a nation's air strength. Hence the practice of granting government subsidies to commercial air transport enterprises. It may, however, be a long time before civil aviation will occupy, in relation to air strength, a position analogous to that occupied by the mercantile marine in relation to British naval strength.

The requirements of civil and war flying differ considerably. For commerce, economy in running and maintenance and paying load are the factors that count most. For war, speed, climbing power, the carriage and use of armament, and fighting qualities in general are the chief factors that control design. Consequently apart from the fact that they connote an aircraft industry and the existence of a potential reserve of pilots, aeroplanes used for civil purposes do not contribute directly to a nation's strength in the air.

The Royal Air Force

The officers of the general duties or military branch of the Royal Air Force are divided into two categories. About 50% of the total are those for whom the Air Force provides a permanent career. Practically all officers in this category must pass through the R.A.F. Cadet College at Cranwell. The remainder consists of officers serving temporarily in the Royal Air Force; either those from civil life who engage for a period of five years on the active list followed by four in the reserve, or those seconded for a period of four years from the army or navy. The other ranks are filled either by boys who go through an apprenticeship in a trade at one of the boys' training establishments, passing into the ranks on reaching the age of 18, or by men enlisted direct from civil life. The normal period of service is seven years with the Colours and five with the reserve. In addition to the general duties branch of the Royal Air Force, there are the stores, accounting, medical, dental and chaplain's branches.

Units are divided into the following types:—

TABLE I.

Type of unit	Equipment
Fighter squadrons . . .	12 single-seater fighting aeroplanes.
Bombing squadrons . .	12 single-engine bombers, or 10 multiple-engine bombers.
Army co-operation squadrons	12 Army co-operation aeroplanes.
Navy co-operation flights	6 aeroplanes, seaplanes or flying boats.
Fleet air arm . . .	6 aeroplane flights in aircraft carrying ships.

Directly under the Air Ministry are a number of commands embracing air force activities both at home and overseas. The following table indicates the various areas in question, and the composition of the different commands:—

TABLE II.

	Inland Area
	2 Fighter squadrons (directly under area headquarters).
Group 1	2 Bombing squadrons; Army co-operation squadron; armament and gunnery school; men's schools of technical training.
Group 3	6 bombing squadrons; 2 flying training schools; experimental establishments.
Group 6	8 fighter squadrons.
Group 7	1 fighter squadron; 2 bombing squadrons; flying training school; central flying school; electrical and wireless school; 3 army co-operation squadrons; school of army co-operation.
	Coastal Area
Headquarters	4 fleet fighter flights; 2 reconnaissance flights; marine aircraft experimental establishment; flying boat development flight; R. A. F. units in H.M.S. "Argus" (aircraft carrier), and H.M.S. "Pegasus" (seaplane carrier).
Group 10	Coastal reconnaissance flight; 3 fleet spotter flights; 2 fleet torpedo flights; air pilotage school; seaplane training flight; school of naval co-operation.
	Overseas Commands
Middle East	2 bombing squadrons; army co-operation squadron; aircraft depôt; engine repair depôt; flying training school; Aden flight.
'Iraq	Fighter squadron; 6 bombing squadrons; army co-operation squadron; 3 armoured car companies; 4 infantry battalions.
India	4 army co-operation squadrons; 2 bombing squadrons.
Mediterranean	1 coastal reconnaissance flight; 2 fleet fighter flights; fleet spotter flight; 2 fleet reconnaissance flights; fleet torpedo flight; R. A. F. units in H.M.S. "Hermes" and "Eagle," aircraft carriers.
Palestine	1 Army co-operation squadron; 1 armoured car company.

In addition to the above the organisation includes a cadet college at Cranwell, Lincolnshire; a school of technical training for boys at Halton, Buckinghamshire; the staff college at Andover, Hampshire; and the Royal Aircraft Establishment at South Farnborough, Hampshire.

The following table gives figures relating to the three chief air forces in Europe:—

TABLE III.

Country	Personnel		Available for independent air action		For army co-operation	For naval co-operation	Total machines
	Officers	Other ranks	Fighters	Bombers	Machines	Machines	
Great Britain	3,000	33,000	144	266	132	118	660
France	960	19,778	180	256	Obs. 536 Fighters 160 Total 696	60	1,192
Italy[1]	2,640	29,226	702		513	315	1,530

[1] According to 1926 development programme.

Although all general duty officers are on a single list and are, with the exception of those in the fleet air arm, available for any form of work, the varied functions performed by the air force result in the division of its units into types, such as the fighter squadrons, fleet air arm, bombing squadrons, etc., according to the duties they perform and the aeroplanes with which they are equipped. Officers, accordingly, become identified with the type of unit in which they have had the most experience, although rigid specialisation is discouraged as a general principle. (A. W. H. E. W.)

II. UNITED STATES

When the United States entered the World War, the aviation personnel consisted of 65 officers and 1,120 men of the army and 35 officers and 163 men of the navy. When the Armistice was signed, the Army Air Service had reached a total of 20,000 officers, 600 cadets, and 164,000 men, while naval aviation had a strength of 6,716 officers and 30,692 men. At the declaration of war, the United States possessed about 300 training planes, of which many were of inferior types. At the time of the Armistice, about 8,500 training planes had been delivered. The Army Air Service had, in addition to these, about 3,300 service type aeroplanes, De Havilland 4's and Handley-Page bombers, while the navy had about 1,600 anti-submarine flying boats. Up to the Armistice, 15,700 training engines and 13,396 Liberty engines had been produced. The Liberty engine development, in point of rapidity, cost and quality, was one of the most strikingly successful projects of the War.

Post-War Problems.—At the commencement of the War, army aviation was under the Signal Corps, but during the War the U.S. Army air service was organised to concentrate the administration of aviation personnel and equipment. In March 1918, the control of naval aviation was centralised in the Office of Operations under the Director of Naval Aviation, where it remained until the organisation of the Bureau of Aeronautics in 1922. The close of the World War found the United States with a large number of aircraft on hand. These were primarily military and naval aircraft unsuited for commercial purposes. Furthermore, in accordance with the war policy laid down, the types of aircraft built by the United States were limited to army observation planes, navy coastal patrol planes and training planes for both the army and the navy. The close of the War found the country therefore with a vast problem of developing and building military aircraft of many other types to meet the special needs of the army and the navy and also the growing demands of commercial aviation.

In the meantime it was necessary, not only from the standpoint of economy but also from that of training, to utilise to best advantage the aircraft on hand. Since the personnel of war-time aviation was recruited largely from civil life and demobilisation deprived the army and navy of the services of this personnel, it likewise became necessary to recruit and train replacement personnel. The Government had the choice of operating the types remaining at the close of the War and building more of the same types, or of operating war types to a limited degree and spending most of the available funds in the development of new types. Since no war was threatened the latter procedure was followed. Development work progressed to the point where in 1926, in so far as quality was concerned, the United States was not exceeded by other countries, and where superior types might be built in quantities in relatively short periods of time.

General Principles.—Military and naval aviation have two primary aspects, which may be characterised as Air Service and Air Force. By air service is meant that portion of the aviation activity which is auxiliary to the military and the naval establishments, such as reconnaissance and the control of gunfire. By air force is meant that branch which contemplates offensive air measures, co-ordinated, of course, with the military and naval establishments. The U.S. national policy requires that naval aviation be maintained in the same degree of readiness as the fleet and in the same proportion of strength, and this is the theory on which the Government has been working. It is a fundamental principle that the best defence is a strong offence, and this implies that naval aviation must be prepared to take the offensive with the fleet. The country is open to invasion from the northwest, the northeast and from the southeast by overseas countries.

In so far as aircraft are concerned, bases would be required for such an offensive. With the fleet at sea fully equipped with its surface vessels, submarines and aircraft, no enemy could establish such bases. Again, with the fleet at sea with its own aircraft, the air force could establish its own bases and carry out its own offensive; but this offensive, in so far as aircraft are concerned, must be based primarily on the decks of the carriers of the fleet. In other words, aviation is an integral and important component part of both the military and naval establishments, and its best effort must be directed in conjunction with the army and the navy, and not independently. Strategic considerations based on the present capability of aircraft require that the United States air force should be the naval air force, not a separate air force based on shore or on ships. On the basis of these fundamental conceptions, development has gone ahead with rapidity.

The air forces of other countries (*e.g., see* FRANCE; ITALY) are discussed in the articles thereon under the sub-heading "Defence." For commercial aviation *see* FLYING.

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AIR MINISTRY.—The British Army and Navy at the beginning of the World War in Aug. 1914 had separate administrative organisations for their air services which were the Royal Flying Corps and the Royal Naval Air Service respectively. These were amalgamated early in 1918 and the Air Ministry was formed. It is a state department and the Secretary of State for Air is the responsible Cabinet Minister. He is also president of the Air Council, whose functions are analogous to those of the Board of Admiralty and the War Council.

The Air Council.—In addition to the president, the Air Council is composed of the Under Secretary of State for Air, who must be a member of either House of Parliament, four service members (the Chief of the Air Staff, the Air Member for Personnel, the Air Member for Supply and Research and the Deputy Chief of the Air Staff) and the secretary, a civil servant. The Air Ministry provides the administrative machinery for giving effect to the Air Council's decisions and it consists of various main departments. The directorate of civil aviation deals with all matters connected with the regulation of civil flying. It comprises an accident branch, which investigates the causes of accidents, whether to service or to civil aircraft; an air transport branch, and a licensing branch. The department of the secretary is charged with the internal administration of the Ministry and is responsible for the general routine. Included in the department are the directorates of accounts, contracts and lands and the meteorological office.

The department of the chief of the air staff includes the directorate of operations and intelligence and the directorate of staff duties and organisation, which, in addition to the functions implied by its designation, controls the signalling branch. This branch deals with questions of wireless communication for both the Royal Air Force and civil aviation. The directorate of works and buildings is also under the chief of the air staff. The department of the air member for personnel deals with the recruitment, discipline, general welfare and training of officers and other ranks of the Royal Air Force. The directorate of medical services forms part of this department.

The department of the air member for supply and research includes the following directorates: (1) the directorate of scientific research and technical development, divided into branches which deal respectively with design, armament, instruments and scientific research; (2) the directorate of airship development; (3) the directorate of aeronautical inspection, which is responsible for the inspection of all materials used in the construction of aircraft and engines; (4) the directorate of equipment, which is responsible for the supply, storage and issue of all equipment for the Royal Air Force. (A. W. H. E. W.)

THE UNITED STATES

In the United States there is no department of the Government corresponding to an Air Ministry as it exists in Great Britain. Instead of endeavouring to administer all aeronautic activities through one central organisation, the Government has divided the administration into three main departments. Military aviation is handled by the War Department through the United States Army Air Service. Naval aviation is administered by the Navy Department through the Bureau of Aeronautics. The only extensive commercial aviation activity is the United States Air Mail, administered by the Post Office Department. This department announced a policy of transferring the operation of some of the air mail lines to private contract. Proposed legislation in Congress in 1926 contemplated the establishment within the Department of Commerce, of a bureau whose purpose it would be to foster commercial aviation.

The geographic position of the United States largely dictated this general policy. As the country is not within close striking distance by air of any major overseas force, it has been the policy to develop air service and air force within the army and the navy rather than a separate air force with subsidiary branches in the army and the navy. Since the types of aircraft required by the army and the navy must be specially designed to meet the requirements of each of these services, and since commercial aircraft have entirely different characteristics, this policy would appear sound. The aeronautic activities of the different departments have been co-ordinated through joint boards and through the National Advisory Committee for Aeronautics.

There are, then, two policies in the matter of administering aeronautics: the one, the British in which military, naval and commercial aeronautics and the separate air force are all controlled by an Air Ministry; the other, the American, in which military, naval and commercial activities have the initiative in development, each along its own special line, co-ordinating their efforts through co-operation, rather than as dictated by a single organisation. These two different policies are in accord with the methods of government of the two countries and are largely dictated by geography and by policy. (W. A. M.)

AIR POWER.—The uses to which ability to fly have been put are threefold: tactical military employment, strategical military employment and social use. All of these may be expected to increase.

Prior to the World War, flying was almost entirely self-educational; its military uses were largely experimental and its commercial value non-existent. Nevertheless, the reconnaissance work carried out by the Royal Flying Corps of Great Britain in 1914 enabled Sir John French, in his own words, "to make speedy dispositions to avert danger and disaster." But visual reconnaissance was only the first of the new tactical utilities; subsequent developments included aerial photography, artillery observation assisted by wireless telegraphy, attack on ground targets by bomb and, later, by machine-gun from low-flying armoured machines. Air attack upon and protection of these services brought about air battles involving up to 100 specialised craft. Special British night-flying fighting squadrons were organised, which, controlling from the air a conjunctive force of guns and searchlights, sustained an effective defence against enemy bombing formations. In the naval sphere both aeroplane and airship were successfully employed in submarine spotting and destruction and in the convoying of mercantile surface vessels. Torpedo attack on ships was developed; and reconnaissance for the contesting fleets had a marked influence in the conduct of the naval campaign in European waters.

Yet the million hours flying on the Western Front did not give the fullest opportunity for tactical air employment. This is exemplified by the operations in Palestine in 1918 when air superiority protected and concealed a British independent cavalry turning movement, and an air attack on retreating columns caused the abandonment of all enemy transport and a complete dislocation of the Turkish plans of retirement. In short, tactical air units developed from an assistance to a vital adjunct to land and sea forces. Even so their possibilities are only partially explored and will undoubtedly increase in the future, prominent amongst the inevitable extensions being the use of troop-carrying aircraft to increase the mobility of armies.

Air Strategy.—In strategy, however, the air war demonstrated in greatest degree the possibility of revolution in military science. Long-range bombing attacks on the industrial centres aimed at the morale of the enemy were first carried out by the Germans; and, though counter-measures put a stop to these raids, their possibility necessitated the retention of considerable defensive forces in Great Britain until a late period of the War. And the effects of subsequent British strategic air power, though it was not systematically organised until the last year of the War, and though the Armistice put a stop to its development, showed both military and political authorities alike that direct attack on the morale of enemy civilian population must be an inevitable accompaniment of any future war and that nations must prepare accordingly for this eventuality.

Air strength can be easily, cheaply and secretly prepared; its radius of action at the close of 1925 was approaching 1,000 m. at 150 m. per hour, and these figures will increase. It opens a new phase and sphere in warlike operations and entails a radical rearrangement of the fighting services and the alteration of the composition of armies by forcing them to take mechanical forms. In addition to being a vital adjunct to the senior arms it is likely to play an increasingly important strategic rôle. An air offensive which is encountered in the air will compel the removal of seats of government and of defence bases beyond its radius of action. With an increased range of aircraft this zone of ineffectivity will extend. Power in the air will dislocate all forms of communication and, if it does not actually cut off the supply of food and raw material, it will render their transit precarious.

Air navigation may go far to assist the avoidance of conflicts, but in time of war, in combination with chemistry, its possibilities will only be countered by superiority in the air. The defence of the British Empire in particular is growing more complicated. Great Britain no longer depends for its security on the sea. On the contrary, its geographical position and extent open it to military attack, and air power is essential to its security (*see* BRITISH EMPIRE: DEFENCE).

Two Principles.—For the full future development of military air power two principles assert themselves; the radical revolution it occasions in the training for and practice of war and the necessity of advancing air power by forwarding the power of flight. Success in military air forces does not depend on numerical superiority alone. Air efficiency, like naval efficiency, depends on the national aptitude and ordinary use in peace. The best airmen are those who are accustomed as a normal routine to flying in all weathers, and decisive success in air battles can only come from long training in the air. Air-going services, both military and mercantile, are the source of air strength, and power of expansion must rest on a widespread civil aerial activity.

Progress and Limitations.—A constantly increasing number of long-distance demonstration flights since 1918, including a flight round the world in 1924, have shown the technical possibilities of aircraft as a means of commercial communication. More practical demonstration is provided by the 30,000 m. of air routes in regular operation in Europe in 1925, extending from London to Nijni Novgorod and from Helsingfors to Malaga, and thence to Dakar, and by the 1,000,000 m. flown by British commercial air services for every fatal accident.

The limitations to the use of this social power at the end of 1925 appeared to be three in number. First, though the risk of accident was small, safety comparable with that of other means of transport had not been obtained. The remedy is further technical progress, particularly in securing by mechanical means much for which the human factor is still responsible. Second, strict regularity of service, an essential in successful transport endeavour, was absent. Conditions of bad visibility still dislocated air services. Allied to this defect was the inability to fly by night, with a consequent loss over long distances of a large proportion of the time saved by travel by day. These limitations are not applicable where fog is of rare occurrence, or where the competition of a highly developed ground transport does not operate. But, with few exceptions, such areas offer no traffic for which speed is essential and its cost economic. The remedy for these disabilities is again technical development which will allow for safe flight in conditions of bad visibility.

The final limitation is economic. The cost of air transport in 1925 may be taken as some 5s. per ton mile and 5d. a passenger mile. On very few routes is there a regular commercial traffic for which such a rate is economic. The remedy is to attract increased traffic by a more efficient service and to reduce costs of operation. Technical progress is the source of both.

Of transport by airship nothing could be said with certainty at the close of 1925. For uninterrupted flights of 2,000 m. or more the airship suggests a means of high-speed economic operation. Such experience as exists shows a series of mishaps, in each of which an attributable and avoidable cause was present; and an unremitting caution in every detail of experimental operation is essential to progress. The military values of air power are demonstrated, but not yet fully developed. Its social value has yet to be proved; but it must be remembered that civilisation has been spread by the extension and development of means of communication, and there is no authentic record of improvement in speed of communication being found and abandoned. (F. H. S.)

See W. Mitchell, *Winged Defence.* 1926.

AIR RAIDS.—Directly Great Britain came into the World War, the German High Command began to encourage their public with prophecies of the havoc the Zeppelins were about to work in England, but it soon became evident that for airships to fly in daylight over enemy territory was to invite disaster. Hence, although reconnaissances over the North Sea towards England were begun by airships, the first actual attacks were made by aeroplanes.

Raids in 1914–5.—In Dec. 1914 a couple of bombs were dropped in the sea off Dover, and three days later, on Dec. 24, the first German projectile hit English soil. A few half-hearted attacks by aeroplanes and seaplanes, made during 1915, were ineffective, and it was left to the lighter-than-air machines to cause the first serious damage. In the evening of Jan. 19 1915 two naval airships approached the coast between Yarmouth and Cromer. They separated and dropped bombs on both towns. Four people were killed.

On April 14, Mathy, boldest of all German air commanders, commanding L9, made a considerable tour over the northern counties. On this occasion he was not particularly successful, most of the bombs falling harmlessly in open country, but the following night L9 caused some damage in Suffolk. The next four raids were similar. Capt. Linnarz, very active about this time in command of one of the military airships, succeeded in bringing his ship over the metropolis on the night of May 31 1915. There was on this night only one raider, armed with an inefficient type of bomb, but there were 41 fires while five people were killed and 14 injured.

Further raids in Yorkshire and Kent on June 4 had little result, but two nights later Mathy again attacked the north. He found Hull, and killed 24 people, besides wrecking some 40 houses. Another airship, LZ37, that attempted to raid on the same night, was destroyed by Lt. R. A. J. Warneford, R.N., while returning home near Ghent. The first serious military damage in England was done by a single ship that raided the north on June 15.

A series of nine raids took place in the latter part of 1915. It opened inauspiciously for the Germans, a Zeppelin engaged in bombing Dover being hit by a 3-in. gun that had just been mounted there. She struggled across the Channel, and was finished off by bombing aeroplanes.

London was reached on four nights during this period. On Sept. 8 Mathy bombed the city deliberately; the damage done amounted to more than £500,000. Mathy also took part in the raid of Oct. 13, when his ship bombed Woolwich. On this occasion the casualties were 33 killed and 77 wounded. Two buildings were destroyed, 20 seriously damaged, and there were 13 fires, the total damage being estimated at £50,250.

Raids of 1916.—The defences could do no better in the early raids of 1916. Nine Zeppelins manoeuvred over the midland counties on the last night of Jan., one getting nearly to Shrewsbury, and 59 people were killed. Out of 16 British aeroplanes that went up in pursuit, 8 crashed on landing. A month later two airships were able to sit over Hull and bomb it from a low height, without any interference from the defence. From this time, however, the defences improved. L15, one of the five ships that attacked on March 31 1916, was hit by the gun at Purfleet; it was then attacked in the air by Lt. A. de B. Brandon, of the Royal Flying Corps, eventually falling into the sea off the coast of Essex. Fifteen airship flights were made over England and Scotland during this April. The British losses were 84 killed during the series.

Further raids at the end of April were organised in conjunction with the naval bombardment of Lowestoft and Yarmouth. A large number of airships took part, but the result was small. London was saved from bombing by its defences on April 25. One Zeppelin was eventually destroyed on the coast of Norway.

An abortive raid on Harwich was followed on Aug. 24 by an attack on London by Mathy. A determined attempt on London was carried out by 14 ships on Sept. 2. The metropolis was undoubtedly saved by Lt. W. L. Robinson of the R.F.C., who attacked the military airship SL11. She fell, a burning mass, near Cuffley, Middlesex. On Sept. 23 1916 11 airships left Germany and the main attack was directed on London by three of the newest super-Zeppelins.

Having crossed the Essex coast shortly before 11 P.M., L33 was over east London ten minutes after midnight. Here she dropped 20 bombs. London, however, was no longer the helpless mass of former days. The searchlights continually lit up the hull of the airship; she was badly holed by the guns, one of her engines was damaged and she began to lose gas and fly clumsily. To add to her miseries, Brandon now brought his machine close up to her. For 20 minutes he stuck to her, pumping bullets into the fabric. As she laboured back towards the North Sea, the crew threw out everything on which they could lay their hands. Her commander crossed the coast at Mersea I., going out due east. But the certainty that his ship would fall into the sea was too much for him; he turned her about and came to earth three miles inland near Colchester.

Mathy meanwhile brought his ship L31, in company with L32, up the English Channel and, turning in over the Kent coast, passed straight over the centre of London. South London and the extreme north of the metropolis suffered severely; but, for some reason, Mathy threw no bombs in the central districts. The handling of the companion ship, L32, was not of nearly so bold a character. Her commander spent an hour circling about Romney Marshes. As he crossed the Thames near Dartford he was picked up by lights and attacked by guns. Lt. Frederick Sowrey succeeded in setting the ship on fire in several places; she fell at Billericay. The British casualties on this night were 40 killed.

On the night of Sept. 25, seven ships raided the north. Mathy, on this occasion, took his ship on an entirely new line; he flew up the Channel as far as the Isle of Wight, where he turned north and went over Portsmouth. He dropped no bombs on the fortress or dockyard.

Yet another serious attempt to bomb London was made on the night of Oct. 1. Eleven ships started from Germany. Mathy, in L31, came in over Lowestoft about 8 P.M. and as usual steered an excellent course on London. Soon after passing Chelmsford, however, he found that the outer defences on that side of the capital were ready for him. He therefore turned and steered northeast. Turning again he flew southwest, in order to get into position for his favourite dash down wind over the city. After drifting a few moments towards Ware, he set his engines going and started for north London at full speed. Suddenly a heavy gunfire was opened on him and he decided to abandon his attempt. Sec.-Lt. W. J. Tempest came up to the ship at 12,700 ft. and brought her down in flames at Potter's Bar. During the whole of this great raid the only British loss was one man killed. The defence of London had now definitely got the better of the lighter-than-air attack; after this period no German airship ever flew intentionally over the metropolis.

Deterred by the victory of the London defences, the Germans turned their attention to the north for the final effort of 1916. They met with no better success. Of the 10 ships that left Germany in the course of Nov. 27, 8 came over land. One was destroyed on the coast near Hartlepool before midnight by Capt. J. V. Pyott of the R.F.C. Another raider, L21, after a remarkable journey right across England to Cheshire, was caught in the early morning, when she was leaving the coast at Yarmouth. She fell into the sea from 8,000 ft. and sank at once. During 1916, 18 raids were made on England by aeroplanes and seaplanes.

The first aeroplane attack on London itself was made on Nov. 28 1916 by a single machine; the only intimation was the fall of six small bombs between Brompton Road and Victoria station.

Raids of 1917.—Before the end of 1916 it had become evident to the German command that, if effective bombing was to be kept up on targets that were worth attacking, it would be necessary to try new methods. Early in 1917, therefore, they began equipping a squadron with special machines suitable for bombing England systematically.

The first attempt came on May 25 1917. The 3rd Bombing Squadron, 16 machines strong, left Belgium early in the afternoon and made the coast about 5 P.M. There were thick banks of cloud over Essex. The task of navigating to London was found too difficult and the leader had to give up the attempt. He therefore turned south. Bombs were dropped on the Canadian camp at Shorncliffe, where there were 100 casualties. The worst effect was produced in Folkestone itself. One bomb fell in a crowded street and killed 33 people, mostly women. The second unsuccessful attempt was made on June 5; 18 machines bombed Sheerness with some effect. The guns at Sheerness succeeded in hitting one of the raiders, which fell into the river off Barton's Point.

London Seriously Damaged.—The third attempt on London was more successful. The whole of the 3rd Squadron started in the morning of June 13; London was reached a little before noon. A few bombs were dropped in the East End and near the Royal Albert Docks; then, at a signal from the leader, the formation loosed 72 bombs over a small area having Liverpool Street station as its centre. The station itself was hit by three bombs. The casualties were severe, 104 killed and 423 injured.

The next raid on London on July 7 was also successful. Twenty-four machines started. The main body of 22 machines came to London. The city received 76 bombs, one of them starting a fire in the General Post Office; 46 persons were killed and 123 injured, 22 buildings were destroyed, and 87 seriously damaged, the total damage being estimated at over £200,000. The anti-aircraft guns fired a large number of rounds, but produced no effect.

The failure of the defensive arrangements caused considerable agitation, and the British Govt. ordered a complete reorganisation. The London Air Defences were formed as a separate command to include all the means of defence, both from the ground and in the air. Gen. E. B. Ashmore was brought from France to take charge of the new arrangements.

The new arrangements were soon tested; on Aug. 12 a party of nine Gothas made the land near Harwich. After following the coast to the Blackwater, they turned inland for London. The communication system of the defence control worked well, and the squadrons immediately defending London were at the required height in time to meet the enemy formation. The German commander turned his formation about before reaching the outer line of guns. A number of bombs were unloaded on

Southend as the enemy made off, and 32 people were killed. An attempt on Aug. 18 was frustrated by bad weather.

An abortive attack on the Midlands by 8 airships on the night of Aug. 21 was followed by the last day attack on England on Aug. 22, when Capt. Kleine, commander of the 3rd Squadron, started out with 13 Gothas to bomb Sheerness and Dover. A number of naval machines turned the Sheerness bombers from their objective, and the German formation, harassed by the British pilots, wheeled south by Ramsgate. Here the anti-aircraft guns, working with great accuracy, shot down two of the raiders. A third was shot down off Dover.

Night Attacks Begin.—The first group of night attacks came in the beginning of Sept. 1917 and one of these reached London itself. On the night Sept. 3–4, about 10:30, hostile aeroplanes were reported near the North Foreland, and warnings were sent out by the central control a few minutes later when it was clear that they were coming up the Thames. Unfortunately there was serious telephone delay in getting the warning out at Chatham, and before cover could be taken a bomb had fallen on a drill hall in which a large number of naval ratings were asleep. No fewer than 107 were killed and 86 wounded.

Although on this night the defence was ineffective, certain points gave hope for the future. Three pilots went up in fast scout machines, and found that it was by no means impossible to handle them at night. The idea also was evolved of barrage fire, a curtain of bursting shell put up in the path of the raiders.

The last raid of this moon period, on Sept. 4, reached London. The barrage fire, organised since the previous night, turned back some of the pilots, but 10 raiders reached the metropolitan area. Considering the magnitude of the raid, the damage caused was small, and the total casualties for the night included only 14 killed and 48 injured.

Favourable weather produced a sustained series of raids, opening on the night of Sept. 24 with an attack on London by aeroplanes, in conjunction with an airship raid on Hull and the north. Nine at least of the pilots attempted to attack London itself, but considerable improvement had by this time been effected in putting up barrage fire, which was successful in turning back all but three of the attackers. Although 27 English machines went up they failed to find any of the enemy; the gunfire brought down one of the Gothas, which fell in the river near Sheerness.

The attack on the north was carried out by 10 airships under Capt. Peter Strasser. Although Hull was found, the raid had very little success. On the following night, Sept. 25, 10 aeroplanes attacked, and 9 people were killed. The attacks were continued on the 28th, when some 20 machines came over; the night was cloudy and a few only approached London; they were all kept off by the barrage fire.

The barrage was again effective on the following night, Sept. 29. Out of the 18 or 19 machines that came over only 4 penetrated far enough to bomb London. The Dover guns did well, bringing one of the enemy down in flames. On the next night, Sept. 30, five German pilots got over London and bombed places as far apart as Highgate, Edmonton and Woolwich: 14 people were injured and two killed. The last raid of the series, on Oct. 1, was made by about 18 machines.

During these raids a large proportion of the attackers had been turned before reaching their target, but the defences were still far from complete. The barrage fire was expensive in ammunition and there was a doubt if the supply could be kept up. The defending squadrons had not reached the necessary efficiency in machines or pilots.

The "Aprons," a new defence devised after the raid of Sept. 5, were only beginning to be installed. The central control as organised in Sept. 1917 could give no information to pilots when once they had been sent on their patrols, but schemes to rectify this had already been initiated.

The airship raid of the night Oct. 19–20 1917, which became known in London as the "silent raid," has points of special interest. Eleven airships met on the evening of the 19th off the Yorkshire coast for an attack on the industrial centres of the Midlands. While over England, the ships flew well over 16,000 feet At this altitude the efficiency of the crews was much impaire by height sickness and the intense cold. Another and fatal con dition was produced by the weather. Near the ground the ai was misty and there was very little wind, but at the height of th airships a strong gale was blowing from the north, and in this th Zeppelins drifted blindly south. One airship passed over Londo without recognising it and dropped a few explosive bombs; on of 50 kgm. fell in Piccadilly near the Circus and caused som casualties.

Realising that, on account of the ground mists, searchlight would have no chance of lighting up a high Zeppelin, the defenc ordered them to remain covered unless an airship could be hear London was saved from a combined attack and the raid ende in disaster to the attackers. One airship only returned t Germany in the usual way; six got back after flying over Hollan or across the Allied lines. The remaining four were destroye during the following day on French territory.

Aeroplane raiding was resumed during the moon period at th end of October. An attempt on the 31st was carried out by 2 machines. Considering that a good many of them got ove London, the effect of the bombs was small, 8 persons bein killed and 21 injured.

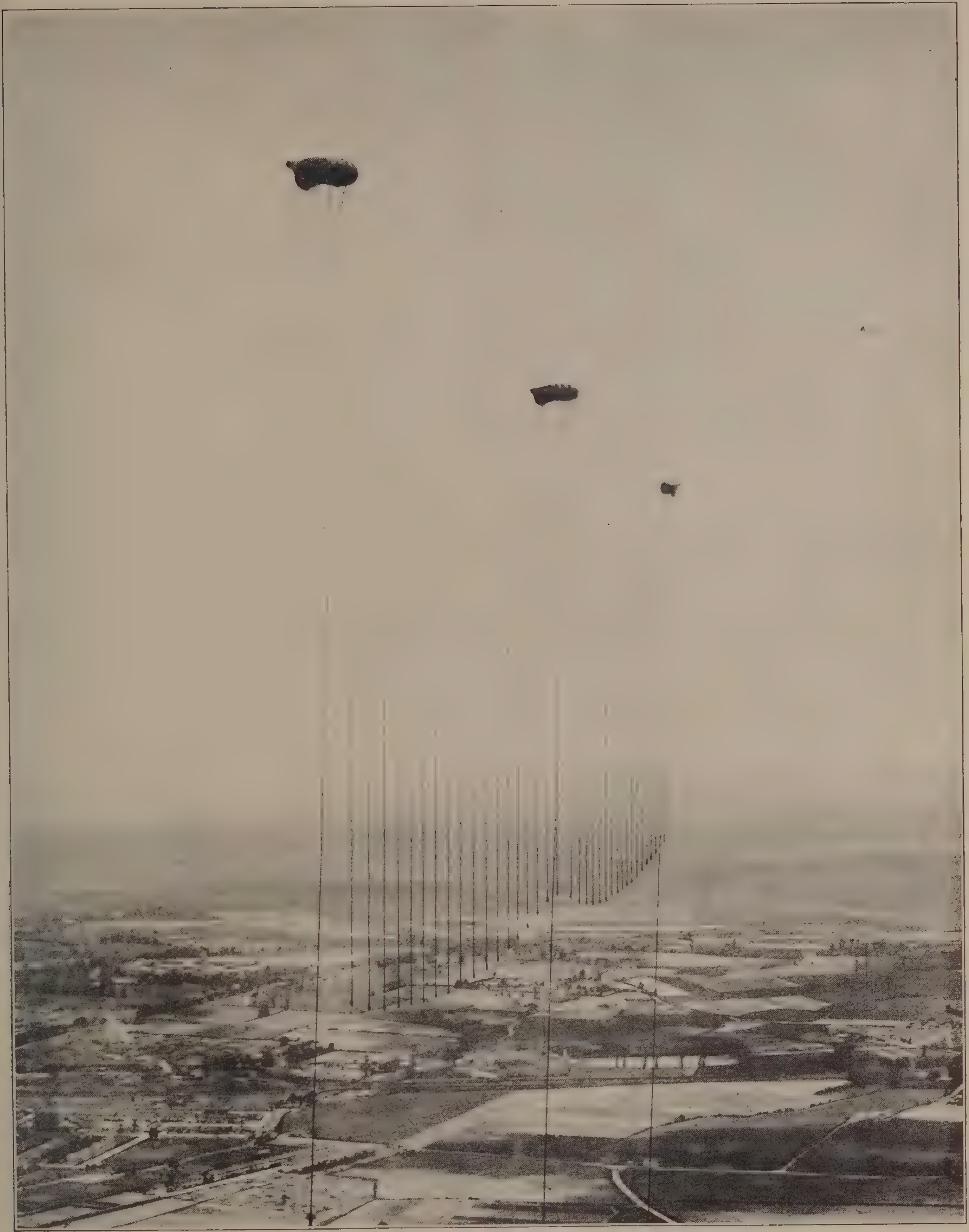
The weather in Dec. 1917 was unfavourable and only thre attempts were made on London. The defences showed stead improvement. Two Gothas were brought down by anti aircraft gunfire during a raid in the early morning of Dec. 6. O the night of the 18th one Gotha was so damaged that it fell int the sea off Folkestone and was destroyed. On this night the ne Giant aeroplane dropped one 300-kgm. bomb near Eaton Squar making a large crater but doing little serious damage. Th whole raid, however, cost London more than £225,000, 42 build ings being seriously damaged and 9 destroyed, while there wer 13 fires. On Dec. 22 the last raid of the year was frustrated b unfavourable weather; one Gotha was forced by engine troubl to descend near Margate, where it was destroyed by the crew.

Raids of 1918.—In the five aeroplane raids of the first quarte of 1918 there was a tendency to replace the smaller Goth machines by the new Giants. A Gotha was destroyed by defending aeroplane on Jan. 28. During this raid a bom dropped by a Giant fell on a building in Long Acre that was bein used as an air-raid shelter, and 41 people were killed. Thre Giants attacked on Feb. 16; the only one that penetrated t London demolished a house in Chelsea Hospital with a 300-kgm bomb. The raid of March 7 1918 was remarkable as being th only occasion on which aeroplanes attacked London in th absence of any moonlight. Warrington Crescent was terribl wrecked.

To turn to the airships, raiding was not resumed until th nights of March 12 and 13 1918. Both these raids were made a an immense height, and the damage did not amount to much Five airships of the newest and largest type attacked the Mid lands on the night of April 12. The end of the airship raidin came on Aug. 5–6 1918. Five ships came up to the coast o Norfolk, no bombs were dropped on land, but L70, the lates word in airship construction, was destroyed.

In the great aeroplane raid of May 19 1918, the German made their maximum effort in this form of attack; between 3 and 40 Gothas of the 3rd Bombing Squadron took part, with a least two Giant machines. Thirteen of the raiders managed t get over London. The casualties included 34 killed and 9 injured, and £130,000 worth of damage was done in the Londo area alone. But the defence had by now made very real progress The Germans lost 7 machines, 3 shot down in air combat, destroyed by gunfire, and one from engine failure. This succes of the defence was final, and the London area was saved fron further bombing.

In addition to casualties (1,413 killed, 3,407 injured) and dam age, the German raids on England produced actual results by n means negligible. A night raid stopped munition work over large area. In order to establish a defence, men and materia were kept back from France. Two hundred aeroplanes of th



AIR RAID DEFENCE

One of the Balloon Aprons covering the approaches to London in 1917–18. The effect of these Aprons was to limit the German bombers to certain heights, and to make it easier for the defending patrols to obtain contact.

best performance and 200 highly trained pilots were available about London at a time when they would have been of the utmost value on the Western Front. (E. B. A.)

European Air Raids.—Apart from raids that formed part of the ordinary operations on the various battle fronts, there were raids on towns of France, Germany and elsewhere, similar in intention to those on Great Britain. On Sept. 27 1914 the first bombs were dropped on Paris by a German aeroplane. On March 18 1915 bombs were dropped on Calais, killing 7 French refugees and injuring twelve. On Sept. 22 1915 French aeroplanes dropped bombs on Stuttgart as a reprisal for the bombardment of open towns by the Germans. In Dec. there were air raids on Calais, and Salonika was bombed by the Germans.

In 1916 on Jan. 29 a Zeppelin flew over Paris, dropping bombs which killed and wounded over 50 persons. In Feb. and March 1917 the Germans raided Salonika, and in April 1917 a large squadron of British and French aeroplanes bombarded Freiburg as a reprisal for attacks on British hospital ships. During the autumn of 1917 the British and French repeatedly carried out raids on the towns of western Germany, and in particular on Saarbrücken and Kaiserslautern. On Dec. 24 1917 a British squadron dropped a ton of bombs on Mannheim-on-the-Rhine.

Early in 1918 the British and French Flying Corps carried out raids against the towns of western Germany. One of the most successful of these was on Jan. 14 by the British upon Karlsruhe, when the main railway station was heavily bombarded and many buildings set on fire. On March 11 1918 hostile aeroplanes raided Paris. On March 29 1918 Good Friday, a shell from "Big Bertha" hit the church of St. Gervais, killing and injuring many of the worshippers. In May of the same year British airmen dropped 33 bombs on Cologne in daylight and also bombed the port of Durazzo in Albania and sank an Austrian torpedo boat. On July 19 1918 British seaplanes bombed the Zeppelin sheds at Tondern (Schleswig) and did much damage.

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AIRSCREW.—The purpose of the airscrew (popularly known as the propeller) in an aeroplane is to transform the power of the engine into a thrust giving a velocity to the aircraft. It consists, usually of two, but sometimes of three or four, blades which have a length about five or six times their width and cross sections of aerofoil shape. One end of each blade is fitted to, or is integral with, a central boss, which fits on and revolves with a shaft of the engine. The blades are equally spaced round the boss.

The motion of any point in the blade is made up of two motions, the first (represented by a b, fig. 1) in a circle around the axis of the engine shaft, and the second the forward speed (b c) of the aircraft which the screw is propelling. This second motion is at right angles to the first. The resultant direction of motion is thus a c at an angle to the plane in which the screw rotates. Since the forward motion b c is the same for all points in the blade whilst the circular motion varies from zero at the centre to a maximum at the tip of the blade, this angle varies with the radius.

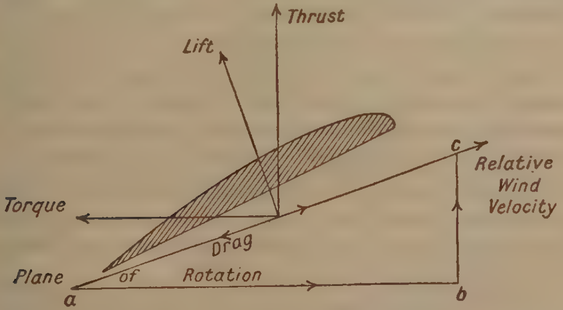

FIG. 1.—Blade of an Airscrew (see Text).

Each portion of the blade is set at a small angle to its resultant direction of motion. Hence the blade is a portion of an approximately helical surface, the pitch of which is known as the geometrical pitch of the screw.

Each portion of the blade is exactly similar to a portion of an aeroplane wing. Like the latter it experiences a "lift" tending to push the blade at right angles to the resultant direction of motion and a "drag" against that direction. The difference between the components of these forces in the direction of travel of the aircraft is the thrust, and the sum of the components in the plane of rotation of the screw is the torque against which the engine drives. In general the thrust is greatest when there is no forward motion of the aircraft. As the speed of the aircraft increases, the thrust falls until at a certain speed it becomes zero. Further increase of speed would result in a resistance instead of a thrust. The distance travelled forward during one complete revolution of the screw when the thrust is zero is known as the *experimental mean pitch.*

If T is the thrust, Q the torque, n the rate of rotation in revolutions per unit time, D the diameter, ρ the density of the air in units of mass, then it can be shown that for geometrically similar airscrews

$$T = \rho\, k_t\, D^4 n^2$$
$$Q = \rho\, k_q\, D^5 n^2$$

k_t and k_q are numerical coefficients whose values depend on the ratio of the speed of translation and the peripheral speed of the tips of the airscrew. These coefficients can be experimentally determined on models of airscrews running in wind tunnels or they may be estimated.

The methods by which such estimates are made and the theories on which they are based form the subject matter of much mathematical and experimental research, of which the following is necessarily a very brief outline. The bibliographical addenda gives references to the more important contributions.

The Momentum.—Airscrew theory has developed along two independent lines. The first is the momentum theory and is associated with the names of Froude and Rankine. According to this theory the airscrew is assumed to be a disc moving at velocity V and imparting a steady change of pressure to the column of air through which it moves. The thrust or change of pressure is necessarily associated with a backward velocity of the column of air which at some distance behind the disc will have acquired a velocity v which velocity is termed the "outflow." A part of this velocity λ v is acquired in front of the disc and this part is termed the "inflow" and the factor λ is called the inflow factor.

The velocity of air passing through the disc is thus $V+\lambda v$ and the mass of air is $A\rho(V+\lambda v)$ where A is the area of the disc and ρ the density of the air in mass units. The thrust is estimated from the rate of change of momentum thus generated and is equal, therefore, to $A\rho v(V+\lambda v)$.

In the further development of the theory it is shown that the inflow is one-half the outflow velocity, *i.e.*, $\lambda = 0{\cdot}5$, and thus $T = A\rho v\,(V+\tfrac{1}{2}v)$, and also that the efficiency is $V/(V+v/2)$. The velocity v is assumed as a purely axial outflow. In the actual airscrew the creation of a thrust is accomplished by the blade exerting a torque, which sets up a rotation in the outflow, and in a complete solution it is therefore necessary to consider a rotational inflow and outflow.

Blade Element Theory.—The second line of development was proposed by Froude and developed by Drzewiecki and Lanchester. In this—the Blade Element Theory—the blade elements are regarded as aerofoils. The velocity of the air relative to the blade element is determined. From this the angle of incidence and the lift and drag forces follow. From these the thrust and torque of the elements are deduced and integration over the length of the blade gives the total thrust and torque. In the simple theory as developed by Drzewiecki no account was taken of the inflow and in its application by designers the lift and drag forces of the elementary aerofoils were taken from wind tunnel tests of rectangular aerofoils having a ratio of length to width of about 6. It was further assumed that the elementary lengths behaved as if independent of neighbouring aerofoils, an assumption shown by recent work to correspond closely with fact.

Both these two theories are incomplete. The momentum theory takes no account of the turbulent and rotational effects implicit in the blade element theory, which in most airscrews account for a very large proportion of the wasted energy. The second takes no account of the inflow shown by the momentum theory.

Modified Theories.—Efforts are therefore made, notably by Fage, Bothezat, Riach and Bairstow, to combine the two theories. Bothezat and Riach develop closely similar lines of argument. Both take account of axial and rotational inflow and show theoretically that both are one-half of the additional velocity in the ultimate slipstream. It is not clear what aerofoil characteristics are to be used. If characteristics taken from wind tunnel experiments are used, the theories appear inapplicable for practical design, since the angles of incidence quoted in such experiments are not the angles to the relative air at the aerofoil but to the air unaffected by its action.

Fage avoids this ambiguity by using an inflow factor which is frankly empirical and is chosen to obtain agreement between the observed and calculated characteristics of the airscrew. A good exposition of the application of the inflow and blade element theories to design is given by Bairstow who uses an inflow factor of 0·35.

Glauert's Theory.—Probably the most complete and successful airscrew theory has recently been proposed by H. Glauert in *An Aerodynamic Theory of the Airscrew*. Glauert has reviewed the whole basis of airscrew theory in the light of the circulation and vortex theory of aerofoils developed by Prandtl and other writers. The theory is based in part on the conception of the slipstream as a cylinder of vorticity, and the relationship between the interference flow at the airscrew and the slipstream velocity is established in a manner more rigorous than that used by other authors.

It is shown that it is not strictly correct to equate the thrust to the rate of change of momentum but that the difference is of no practical importance. When this point is neglected the solution given is identical in form with that given by Bairstow and in current use by designers. The essential feature of this theory in which it differs from or amplifies earlier theories is that the aerofoil characteristics used should be those of an aerofoil having infinite length compared with its width.

These characteristics can be deduced from those measured on aerofoils having a finite length to width ratio. The form of the correction follows from Prandtl's work and is given in a simple and suitable form by Glauert. With such aerofoil characteristics the theoretical inflow factor of one half is used.

This relatively new point of view avoids the empiricism of Fage and Bairstow and the uncertainties expressed as regards Bothezat and Riach and brings theory and experiment into close agreement. The theory does not attempt to take into account the effect of the periodicity of flow inherent in an airscrew which usually has two, and rarely more than four, blades. The author justifies his omission on the grounds of the good agreement shown between observed results and those calculated from his theory but it is this omission which leaves his solution still incomplete and which may therefore give rise to further developments.

Airscrew Windmills.—The term airscrew has so far been used as applying to the only type of propeller used on aircraft. The term applies also to what is popularly known as a windmill. The function and working conditions of the airscrew windmill are in general the reverse of those of the airscrew propeller. The latter receives its power as a rotating torque and transforms it into a moving thrust. The former receives power by means of a thrust due to a forced translational velocity through the air and transforms it into a rotating torque. The propeller accelerates and the windmill retards the air passing through the disc of rotation.

The various airscrew theories are as valid for windmills as for propellers, the windmill being regarded as an airscrew propeller with a negative velocity of advance.

Between the two states, however, there is a range of working, including that referred to by Bothezat as the vortex ring state, for which the usual equations are inapplicable.

There is room, therefore, for development in airscrew theory to cover this gap and to give a complete solution for the thrust and torque of an airscrew under all possible conditions. Work in this direction is proceeding in Great Britain.

Variable Pitch Airscrews.—When the normal aircraft engine is fitted with an airscrew of fixed pitch designed to allow it to run at normal rate of rotation at maximum flying speed, then at any less speed, the rate of rotation will fall until when stationary on the ground the rate of rotation is, according to circumstances, from 80–90% of the normal. Thus it is not possible when taking off or climbing to utilise the full power of the engine.

The speed of the engine also falls with increasing altitude, but only due to the decreasing speed of the aircraft, carburation, and frictional losses in the engine. Apart from the effect of the last two points, it is correct to say that at any given aircraft speed the rate of rotation is independent of the altitude of flight, since both the resistance of the airscrew to rotation and the power available to rotate it vary with the density of the air.

If the engine is supercharged partially or fully to maintain its power independent of altitude, then this balance is destroyed and such an engine fitted with an airscrew of fixed pitch designed, say, to run at normal rate of rotation at a high altitude, would run much slower at lower altitudes thus preventing the utilisation of the full power of the engine under all conditions.

In order to control the rate of rotation under all conditions of speed and altitude and to utilise the maximum power in the most efficient manner, it would be necessary to vary both the pitch and the diameter of the airscrew. The design of such a screw presents almost insurmountable difficulties and has not been seriously considered.

Although it does not give the most efficient screw for all conditions, an airscrew of which the pitch only can be varied is considered a practical compromise. Even this presents difficulties and at the time of writing a completely satisfactory solution of the problem has not appeared. In most countries promising designs are under experiment and the problem may be said to be well on its way to solution. A variable pitch propeller is essential to the full success of the supercharged engine, but its advantages for the ordinary engine are very limited.

The Helicopter.—The helicopter is a particular use of an airscrew. It has frequently been proposed and many attempts have been made to build an aircraft in which the direct lift is supplied by the thrust of an airscrew mounted in a more or less horizontal plane, this airscrew replacing the conventional wings and airscrew. The advantages claimed are a vertical ascent and descent. It is generally believed that the difficulties to be overcome are considerably greater than those presented in the conventional aeroplane and that the resulting performance would be distinctly inferior. The theoretical considerations have been dealt with by Von Kármán and Riach.

The Autogiro.—Whilst a successful solution of the helicopter is still wanting, a type of aeroplane bearing some resemblance to a helicopter has been developed in Spain by Señor Juan de la Cierva and deserves mention as being the first and only successful fundamental departure from the conventional type of aeroplane, and also as giving rise to new aspects of airscrew theory. This aircraft to which has been given the name "Autogiro" is an ordinary aeroplane with its wings replaced by four wings or blades rotating about a vertical shaft fixed at the centre of gravity of the machine. These four wings constitute in effect an airscrew of large diameter. Instead of this airscrew being driven by a power unit as in the helicopter, it is free to rotate and does so under the natural air reactions experienced by the blades when the airscrew moves through the air. It is in fact a windmill driven by a wind at small angles to the plane of rotation. The individual blades are hinged at their inner ends, so that they set themselves in a position in which the resultant of the lift and the centrifugal force passes through the axis of the hinge. The blades therefore rise and fall as they pass up wind and down wind respectively in one revolution. The effective angle of incidence to the relative wind varies therefore throughout a revolution. The net result is that the lift is concentrated at the centre of gravity of the machine without causing the rolling movement involved with a rigid airscrew. This particular and interesting application of the airscrew-windmill gives rise to new problems which are being closely investigated in Great Britain.

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A bibliography of modern theory and research will be found at the end of A. Fage's text-book.

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(H. C. W.)

AIRSHIP (*see* 1.260).—Three generally accepted types of airship—non-rigid, semi-rigid and rigid—have been evolved. Each in its own particular way aims at providing a container or envelope which will meet all the conditions described below, and hitherto each type has had its structural limitation which has prevented the choice of an absolutely ideal shape. In the non-rigid and semi-rigid types, the variation of gas volume is dealt with by providing internal ballonets which are inflated with air, from a blower or scoop or valve in the nose of the ship. They swell up or deflate within the gas space, thus maintaining in the main envelope which contains the gas a constant but very small excess of pressure above that of the atmosphere. This small excess pressure with the aid of the tensile strength of the fabric serves to preserve the form of the flexible envelope against the distorting forces due to various conditions of static and dynamic loading.

Non-Rigid Type.—The non-rigid type has an envelope of rubber-proofed fabric from which one or more cars are slung by wire rigging while the stabilising and controlling planes are supported on skids directly attached to the envelope. The chief classes of non-rigid airships are:—

(1) Those with a plain envelope of circular cross section, from which the cars, etc., are suspended from special patches on the envelope. This class is exemplified in the British S.S. and small American ships.

(2) The German Parsival type, in which an envelope of circular cross section is reinforced against bending under the rigging tension by special trajectory bands disposed along lines of greatest tension in the surface of the envelope and terminating in a girdle to which the car is rigged.

(3) The French Astra Torres type, trilobe in section, with riggings led inside the envelope and divided into fans secured to points along the two top ridges. This type was developed in England during the War, and is represented in the N.S. class.

The non-rigid type was developed most successfully in Germany and France before the War, in England during the War, and latterly in the United States. It has the merit of great simplicity, and has been most successful in small sizes, say from 1,000 to 10,000 cu. metres capacity, or from 1 to 10 tons gross lift. The application of these small airships is for such purposes as coastal patrol, where ability to fly for long periods at moderate speeds is required, or for patrol or inspection at low altitudes over tracts of country unsuitable for aeroplane landing grounds. They have been successfully operated from temporary bases constituted merely by a clearing in a wood with a narrow avenue leading to open ground, this shelter proving sufficient in winds of 60 m. per hour.

Semi-Rigid Type.—The semi-rigid type has been developed chiefly in Italy. A fabric envelope divided into compartments is employed, stiffened longitudinally by a framework, usually of steel tubular construction, running along the bottom and rigidly connected to the stabilising fins at the after end. It is claimed that a given weight of metal can be more economically disposed in the form of a frame of fewer members carrying greater loads than in the form of an exceedingly slender frame completely outlining the hull such as is involved in a small rigid airship. On the other hand, particularly when mast mooring is contemplated, there is a tendency in the larger ships to extend the structure at nose and tail, and to widen the keel structure, so that the distinction between the types becomes less marked.

The range of size for which the semi-rigid type is appropriate, and particularly its upper limit, can, as yet, only be a matter of personal opinion. A ship of about 50 tons gross lift is at present being built in Italy, and will be the largest yet built of the type. The best existing semi-rigid airship is probably the Italian "N1," particulars of the performance of which are given in the table. In these two ships the arrangement of accommodation, power cars, fuel storage, etc., is similar to that of modern rigid airships. The "N1" and the Zeppelin rigid "Bodensee" are of similar size and similar in performance. These two ships are good representatives of their respective types for this particular size.

Rigid Type.—It is, however, in the large, rigid type that the unique possibilities of the airship are fully realised. Development of the rigid airship is largely the outcome of persistent effort, aided by the state, by the Zeppelin and Schütte-Lanz companies in Germany. Their results have been carefully studied by other nations, active interest being taken principally by Great Britain and the United States. Great Britain built one rigid airship in 1909, and in this and others built during the early part of the World War achieved a measure of success independent of Germany and with little knowledge of her methods. In the latter part of the War details of German design became available, and full advantage of this was taken in British ships built subsequently.

There are two assets of the airship which distinguish it essentially from heavier-than-air craft, and may be expected to ensure its continued development. For the first, fundamental principles indicate that as size is progressively increased, range and/or speed will also steadily increase, while they do not indicate any well-defined limit to such increase in size with known materials. Consequently, larger airships than have yet been built will undoubtedly give greater ranges and speeds than those hitherto realised, quite apart from improvement to be expected in design and metallurgical science. The second is the ability to remain aloft independent of motive power.

Developments.—Although the development of the airship commenced many years before that of the aeroplane, it has never been pursued with anything approaching the intensity applied to the latter. Consistent development over extended periods has taken place in only two countries, Germany and Italy. More recently Great Britain, and, to a smaller extent, the United States have contributed substantially to the sum total of progress. France took a leading part at first, but has done little in the last decade.

The small share of aeronautical effort devoted to the airship as compared with the aeroplane, is no doubt largely attributable to the relative size of individual craft of the two classes, which greatly affects the relative cost of each step in development although having no direct bearing on the cost of operation of serviceable craft. The aeroplane, promising so much, has provided since its advent an almost sufficient scope for available talent. In consequence, the airship has not hitherto realised expectations based upon current engineering knowledge to the same degree as craft heavier than air.

Lifting Power.—An airship derives its static lifting power from the fact that its gross weight is less than the weight of the effective volume of air which it displaces. A large envelope or container, to have a gross weight less than that of this volume of air, must be filled with some very light gas, or its internal space must be vacuous. The latter alternative has not been found possible, since the weight of the walls of the container would have to be very heavy to resist the large difference of pressure which would exist between the outside and the inside. The only suitable gases which exist for the inflation of an airship, in order to give it a reasonable amount of lift, are hydrogen and helium.

The gross lifting force of an airship is equal to the product of the volume occupied by the gas, and the difference between the densities of the surrounding air and of the gas. The density of pure hydrogen is 7% of that of air at the same temperature and pressure. Similarly the density of helium is 14% of that of air. Consequently, some 7% of the gross lift obtainable with hydrogen is lost by exchanging hydrogen for helium. In recent airships filled with hydrogen, about 40% of the gross lift has been available for paying load and fuel together, and as the loss of lift on substituting helium must be borne by these two items, it can be represented as a reduction of each by $\left(7 \times \frac{100}{40}\right)\%$, that is, by $17\frac{1}{2}\%$.

Neither gas can be obtained or maintained quite free from air in practice, and there is a loss of available lift on this account.

The large size and necessarily light weight of the structure not only put the idea of a vacuous container out of court, but actually require that the pressure of the contained gas shall be practically equal to that of the surrounding atmosphere at all times. The temperature of the gas may, however, differ appreciably from that of the surrounding air under conditions referred to below.

Regulation of Volume.—Since the volume of a given mass of gas when the pressure and temperature vary is proportional to the ratio of its absolute temperature to its pressure, provision must be made for change in volume of the gas within the envelope when these factors vary, notably with change of altitude.

The gas does not fill the whole volume within the envelope and the required adjustment is invariably effected by admitting air to occupy the varying difference between the volume required by the gas, and the total volume of the external envelope. Mixture of this air with the gas is prevented by flexible separating surfaces whose arrangement varies with individual design. A sufficient increase of altitude must clearly result in expansion of the gas beyond the bulk of the external envelope. Gas is then irrecoverably discharged through safety valves, leaving the envelope just full of gas when the ascent ceases. During any variations of height below this limit the mass of contained gas remains constant. Its pressure is always equal to that of the surrounding air, and its temperature approximately so. Consequently, under these conditions the mass of displaced air and the lifting force also remain approximately constant, the only variation being due to difference between the temperatures of the gas and surrounding atmosphere, and a small correction for humidity. The height at which the gas would just fill the envelope is known as the "pressure height." An airship may alter its altitude below this limit substantially without change of lift; but must lose gas, and consequently lifting force, if it exceeds that height, and in this event will have, of course, a new "pressure height." These considerations are essential for an appreciation of the conditions governing the flight of an airship, yet have been seriously misstated in more than one comparatively recent work, purporting to deal authoritatively with airships.

Temperature Variations.—A difference in temperature between the gas and surrounding air often results from solar radiation, which heats up the gas just as the air in a greenhouse becomes heated. Such a difference is known as superheating. The same or the reverse effect may also be produced, at least temporarily, when flying through atmosphere of varying temperature. Again, when altitude is changed rapidly, so that the gas expands or contracts nearly adiabatically, its temperature may vary more rapidly than the usual atmospheric temperature gradient. The maximum lift obtainable at ground level by filling the ship full of gas, thus rendering the "pressure height" zero, is governed by the density of the air at ground level, and therefore varies with barometric pressure and air temperature prevailing there.

An airship commences a long flight full, or nearly full, of gas, thus realising its maximum lift. The pressure height is small in consequence. As the flight proceeds, fuel is consumed and the ship acquires excess buoyancy. To maintain static equilibrium gas is deliberately discharged. It is not, however, necessary to preserve correct static equilibrium at every moment throughout flight, since a certain departure from static equilibrium is already countered aerodynamically, as explained below.

The envelope will be subjected to the lifting forces due to the displacement of air by gas and the gravity forces due to the weight of structure, gas-bags, gondolas, machinery, fuel, etc. The aim in design is to balance these forces at every point along the ship, as nearly as possible. It will be obvious that this idea cannot be realised for every condition of loading, hence the envelope will be subjected to bending and shearing forces in a vertical plane due to what may be described as static causes.

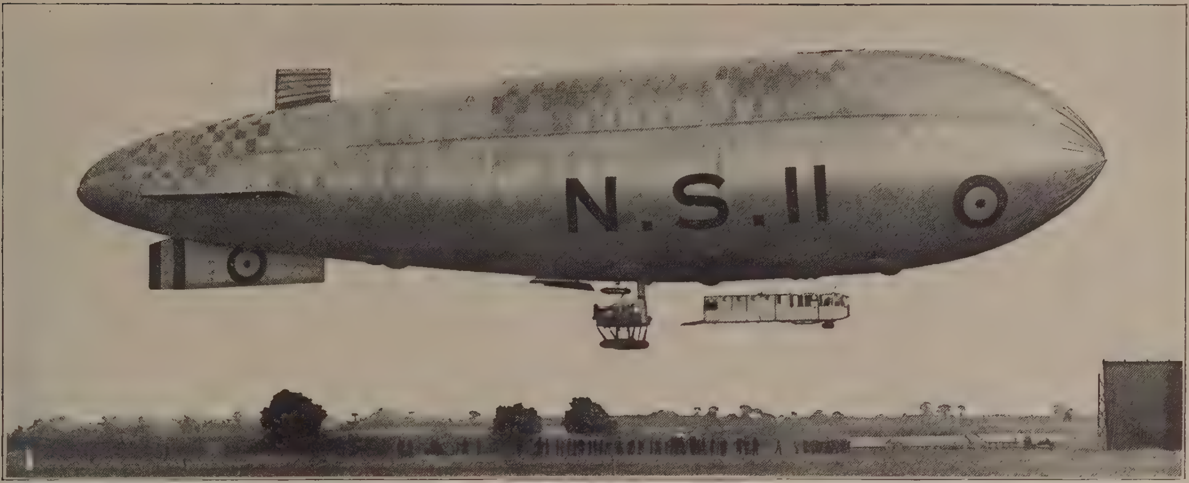
The Envelope.—The envelope must be provided with stabilising surfaces or fins which, in all modern airships, are attached to the stern. To these fins are attached hinged flaps. Those on the horizontal fins serve to incline the axis of the ship to the horizontal plane. When thus inclined the envelope acts somewhat in the same manner as the wing of an aeroplane, and in its passage through the air experiences an aerodynamic force urging it up or down, according to the direction of inclination. This is the normal method employed for alteration of altitude during flight. Moreover, if there is any lack of static balance which it may be undesirable to correct by discharge of gas or ballast, then the ship may be flown with its axis inclined, and kept on a horizontal path by means of the aerodynamic up-thrust, or down thrust. (This force may be quite large. In the case of R33, which has a gross lift of about 60 tons, the maximum possible dynamic lift is about 5 tons, *i.e.*, 8%.) This inclination, of course, reduces the forward speed.

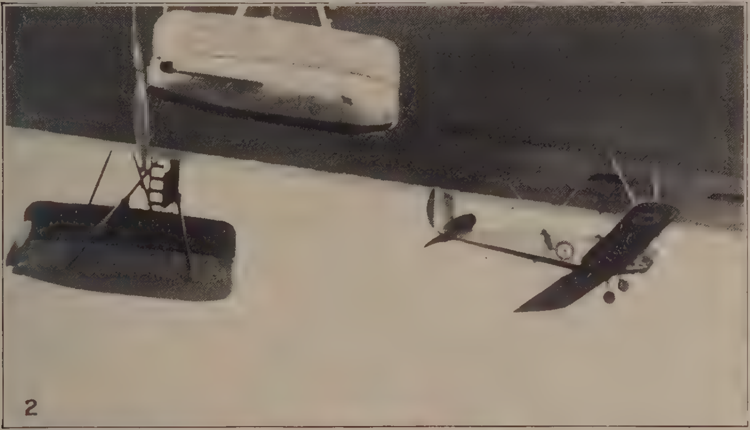
When the nose of the ship is inclined upwards, the general character of the distribution of the aerodynamic up-thrust is that of an upward force on the nose and tail of the ship, and a lesser downward force near the centre. It thus subjects the envelope to additional shearing and bending forces in the vertical plane. In a similar manner the flaps or rudders attached to the vertical fins serve for steering the airship, *i.e.*, turning her in a horizontal plane. In such a manoeuvre, the centrifugal force on the airship, acting outwards from the centre of the turning circle is balanced by a large aerodynamic force acting inwards on the forward portion, a similar one acting inwards on the tail and fins, and a small one acting outwards about the centre. The envelope is thus subjected to bending and shearing forces in the horizontal plane also.

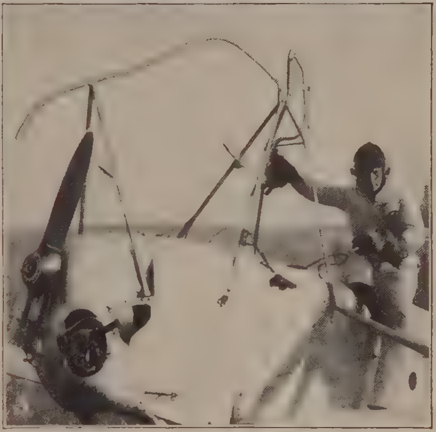
The shape of the envelope should be such as to give the least possible resistance for its volume. The ideal appears to be a bluff nose with a curvature which decreases progressively toward the tail. The shape of the hull in early rigid airships was cylindrical, with more or less pointed ends and a ratio of length to diameter of 10 to 1, or even greater. Research on models in the wind tunnel has shown that a very much reduced resistance to motion for a given volume is offered by a fair shape conforming to certain general principles and from about four to six diameters in length. This has been borne out in practice. The cylindrical portion was progressively reduced and died hard on account of its cheaper construction, but it has disappeared completely in recent designs. The specific resistance does not vary much over the range of "fineness ratio" mentioned, and choice may be determined by considerations other than those of head resistance. At a value of seven, however, the resistance may be expected to show an appreciable increase.

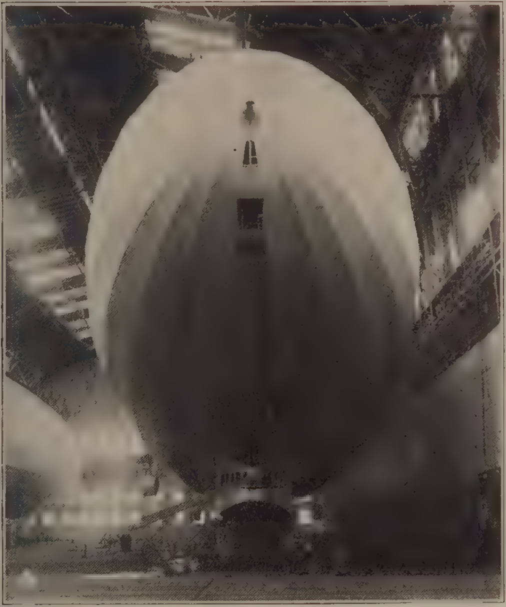
Insufficient appreciation of the forces exerted by the air on the hull during various manoeuvres was reflected in the historic disaster to R38, a British-built airship which broke into two parts in the air in 1921. This accident emphasized the need for more exact determination of the loads imposed on the structure under all conditions of flight, as also of the internal stresses resulting from these loads, and led to the carrying out in England of research to fill the more important gaps in the fund of data necessary for precise design.

The present airship programme of the British Govt. includes extensive research into the distribution of aerodynamic forces and methods of determining internal stress distribution in structures such as that of rigid airship hulls.









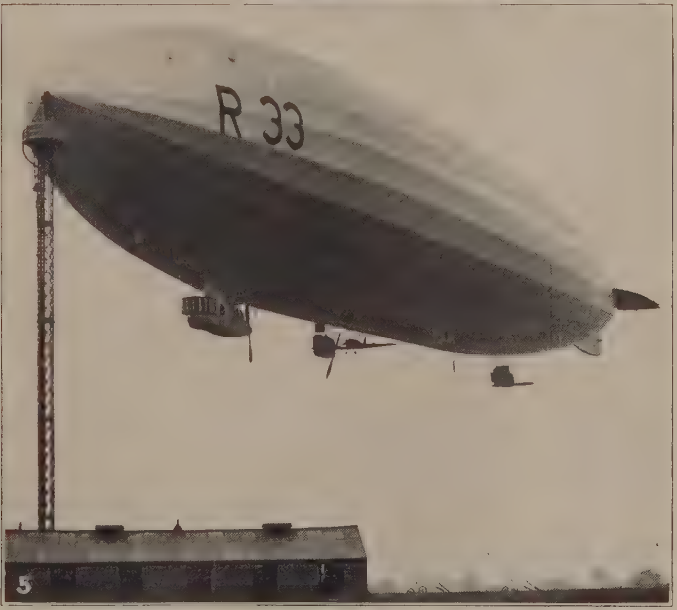


FIG. 1. British naval airship N.S.11. FIG. 2. British airship R.33 with D.H.53 light monoplane attached. FIG. 3. View of monoplane showing attaching mechanism. FIG. 4. U.S. airship "Los Angeles" in her shed at Lakehurst, N.J. FIG. 5. R.33 at mooring mast.

(Figs. 2 and 5. "Central News." Fig. 3. "Topical Press.")

The Hull.—The hull of a modern rigid airship is a stiff framework completely covered with fabric to provide a smooth exterior and it contains a number of fabric gas-bags, each free to expand or contract within the limits of its allotted space, within a wire network closing the panels in the structure, and transverse bulkheads, also of wire, which prevent axial movement when the ship is inclined. The atmosphere has free access to the interior of the hull through suitable openings in the outer cover to accommodate change of volume of the gas in the bags. Some four, five or six propulsive units are attached below the hull, each consisting of a car containing an engine driving an airscrew, to which it is coupled either directly or through reduction gearing. The several cars are so disposed that the slipstream from the propeller of each does not interfere with that of any other.

There is normally a mechanic on watch in each car, and minor repairs are possible during flight. Fuel tanks are disposed within the lower portion of the hull, where accommodation for personnel is also provided. The ship is navigated from a car which normally has the form of an excrescence on the under side of the hull. Access to the exterior of the hull at the top and at the stern is usually provided.

Zeppelin Hull.—The Zeppelin hull comprises a shell framework of duralumin lattice girders and steel wire bracing. The girders are built up of rolled sections and stamped lattice pieces, riveted together. Main longitudinal girders run from bow to stern, with polygonal transverse frames at equal intervals. The latter are normally of two types, main and intermediate, placed alternately. Of these, only the main frames are braced in their own plane by wires traversing the hull and constituting the bulkheads which locate the gas-bags axially. Other builders have followed Zeppelin practice latterly, but a departure is to be anticipated in future designs since types of girder more economical in weight are now known, and because increased sizes and loads will favour alternative arrangements of hull members.

The Gas-Bags.—The gas-bags are of light cotton fabric, lined with gold-beater's skin, for which a synthetic substitute sufficiently gas tight and of similar weight has not yet been found, although it is an object of research, and there is little doubt that one or more will be found.

The Engines.—Petrol-burning engines are used; yet conditions of service differ sufficiently from those for which aeroplane engines have been developed to render the latter in general unsuited for airship use. In a large airship, the total engine power installed is comparatively small in relation to the gross weight; whilst the initial weight of fuel per horsepower installed, or, in other words, the number of hours flown at a stretch, is relatively great. An engine is therefore required which gives high fuel economy at a power output which it can develop for many hours continuously and consistently.

A relatively heavier engine is justified to achieve this. The German Maybach is the only notable example of an engine developed for airship use. Reduction of hull resistance by improved design involves either reduced number or dimensions of propellers for equal results, or increased propeller efficiency for the same dimensions, irrespective of the power applied. These processes are mutually reactive, because the resistance and weight of the power units and propellers is such a large proportion of the whole. As a result, very great improvement in aerodynamic efficiency has been achieved with progress in design. Incidentally the power installed has increased vastly, and direct coupling of engines to airscrews, which was at first out of the question, is now practicable with the advantage of simplicity.

Performance.—Of the two chief assets of the airship cited earlier, the small airship can claim only the second. But this gives a sufficient advantage over other types of aircraft for some purposes, and although the performance is relatively low, one factor may be made good at the expense of another. That is to say, if speed is not required, the craft may remain in the air for a long time, and cover a reasonable distance when employed for purposes such as those already mentioned with reference to non-rigid airships.

The large airship has demonstrated its capacity for fast long-distance travel. ZR3 flew without stop 5,000 m. at an effective speed of 60 knots with no paying load and little margin of fuel. This implies that a distance of the order of 2,000 m. would be economically well suited to this ship, allowing for roughly equal division of available lifting capacity between fuel and paying load (to give maximum ton-mileage) after providing a reserve of fuel for emergency. It may be remarked that the same argument as to relation between extreme range possible and a commercially advantageous range applies equally to any power-driven aircraft.

ZR3 is of 2,500,000 cu. ft. capacity, or about 75 tons gross lift. The construction of airships of twice this size has now been embarked upon, and correspondingly enhanced performance is anticipated. The table gives some data for several types and sizes of ships.

Airship	Length, feet	Diameter, feet	Gas capacity, million cub. ft.	Gross lift, tons	Total disposable lift, tons	Useful lift, tons	Engines			Max. speed, knots	Extreme range in still air with *no* paying load at speeds specified	
							No.	H.P.	Total H.P.		Nautical miles	Knots
Non-Rigid												
S.S.Z. British, 1916	143	30·7	0·07	2·15	0·7	0·43	1	80	80	43	750 1,000	at 43 “ 35
N.S. ditto	262	54	0·37	11·4	4·3	3·2	2	275	550	50	1,200 1,800	“ 50 “ 35
Semi-Rigid												
N.1. Italian, 1924	348	60	0·67	20·3	8	5·5	3	245	735	59	1,850 3,600	“ 59 “ 40
Mr. ditto	105	24	0·035	1·07	0·5	..	1	40	40	39	1,000	“ 30
Rigid												
"Bodensee," German (modified), 1919	430	61·5	0·8	24·3	10	7	4	240	960	65	1,900 4,500	“ 65 “ 40
R33, British, 1918	640	79	1·96	60	24	15	5	250	1,250	52½	3,000 4,200	“ 52 “ 40
ZR3, German, 1924	656	90·5	2·48	75	42	30	5	400	2,000	68	4,300 11,000	“ 68 “ 40

If useful lift be divided equally between paying load and fuel, and one-third of the fuel be set aside for head winds and reserve for contingencies, ranges are reduced to one-third of the figures in the table.

The performance of an airship is adaptable to requirements. Useful lift is defined (in England) as the total available for fuel and paying (or military) load together. It may be divided between the two in any desired proportion. For reconnaissance of patrol, the whole of the useful lift is available for fuel. For commercial work, an equal division between fuel and paying load gives maximum ton-miles, and represents an ideal to be kept in view in choosing routes and intermediate stopping places. Strength and rigidity of the structure in a particular design limit the horse-power which can be safely installed. If relatively low speeds only are required, useful lift may be increased by reducing the weight of machinery.

Altitude, at the commencement of a flight, is obtainable only by sacrificing useful lift, since the maximum lift will be determined by the gas which can be contained at the desired pressure height, and is correspondingly less than that of the ship full of gas at ground level. High altitude may be a military requirement. At 20,000 ft. the gross lift has roughly half the value available at sea-level. The actual power necessary to obtain a given speed, and the aerodynamic loads which may be applied to the structure at that speed, are similarly reduced. If, therefore, full speed is only required at great height it is permissible to reduce the strength and weight of the hull, and advantageous to use a super-compressed, or better, a super-charged engine which will give the required power at the working altitude with reduced machinery weight. For commercial purposes, however, great heights are not sought. It is desirable to fly above the disturbed and " bumpy " air overland in daytime. More advantageous winds may sometimes be found by changing altitude. A reasonable height under good conditions is 2,000 feet. At the latter height the maximum lift is, in an average atmosphere, about 6% less than that available at ground level with a ship quite full of gas.

As a first approximation, the range corresponding to a given quantity of fuel is inversely proportional to the square of the speed. That is to say, the range at half speed should be four times that at full speed. This relationship is modified by the following factors, in order of importance:—

(1) Winds have relatively less effect as speed is increased.

(2) Temporary departure from static equilibrium, compensated by inclined flight, causes relatively less increase in resistance at high speeds.

(3) The overall efficiency of the propulsive machinery and airscrews falls off somewhat with decrease in speed. This effect depends considerably on design.

Economical Speed.—Were none of these factors operative, fabulous ranges would be obtained at very low speeds. All these factors, however, tend to increase the economical speed, or speed at which the range is a maximum for a given quantity of fuel, and either 1 or 2 may provide a definite lower limit to the speed. In passenger carrying it is essential to make such an average speed over the whole journey as will offer sufficient advantage over alternative means of transport, and unless the economic speed is of the same order it cannot be considered.

Generally speaking, the economical speed for a large modern airship under average conditions will lie between 25 and 40 knots, relative to the air, while a speed of the order of 60 knots is probably required for passenger service in competition with other conveyance. For reconnaissance and patrol, however, 25 to 40 knots may be very suitable, and, owing to the enormous corresponding ranges, may make the airship a very useful craft for these duties.

In estimating the fuel required for a certain journey with a particular airship it is clearly necessary to take into account:—

(1) The average wind to be expected.

(2) The speed at which it is intended to fly.

(3) The degree of uncertainty as to the average wind, and the existence or otherwise of emergency bases as determining the reserve of fuel necessary as a margin beyond estimated requirements.

These considerations show that statements of range, carrying capacity and speed of airships, as of other aircraft, can be very misleading unless relevant conditions are specified and appreciated.

Piloting and Navigation.—The distance flown in one stage by a large modern airship is such that widely differing alternative routes can be taken without material increase of mileage. This permits prevailing winds to be avoided or taken advantage of to a valuable extent and similarly enables temporary adverse winds such as those accompanying cyclonic depressions to be wholly or partially avoided, when the affected area is advised by a meteorological service or appreciated from observations on board. The careful selection of routes both before and during flight is of great importance in reducing the reserve of fuel necessary, and thereby increasing the useful load, as well as enhancing the regularity with which a time schedule may be worked to. Good meteorological information is essential to successful commercial airship operation. It is now available, and its scope is increasing apace. Flight by night presents no difficulties, but rather the reverse, owing to the absence of superheating. A striking demonstration of this, and of the safety of airship travel, is the fact that it is not unusual to make the first trial flight of a new airship by night.

Safety in flight depends upon the ability and judgment of the captain and the ability of the navigator rather than on manipulative skill. In determination of geographical position, all the usual methods are available, including astronomical observation and radio direction-finding. The restrictions as to space, position of instruments and general convenience of the navigator, which necessarily obtain in present heavier-than-air craft, do not apply to the airship.

Changes in Buoyancy.—As has already been explained, changes in buoyancy occur during flight from various causes. That due to consumption of fuel is met by discharging gas. Temporary changes of temperature either of the atmosphere or of the gas are constantly occurring during the daytime. Fortunately, the vertical aerodynamic force available by flying in a slightly inclined attitude is sufficient to deal with these temporary variations of buoyancy. The amount of inclination required, and with it the relative increase in drag due to this inclination, vary inversely as the speed. This always tends to increase the economical speed of flight.

Air Currents and Storms.—Moderate vertical air currents are experienced, usually in conjunction with changes of air temperature and particularly at moderate altitudes in hot countries. These are met in flight by inclining the ship and present no difficulty except when landing at noon or afternoon in places where such currents are prevalent. It is remarkable that such districts commonly provide particularly easy landing conditions at other times. Vertical currents of a more serious kind occur in thunderstorms and " line squalls." These can usually be avoided by the aid of visual or communicated warning. Their vertical velocity may be greater than that which an airship could counter by inclination to maintain her altitude. Also such currents may have sharply defined boundaries so that a ship would be involved and carried up or down before she could incline by means of the elevators. Again the first action of the current or gust tends to incline the ship in a sense the reverse of that desired. It is therefore important that an airship should be able to sustain without damage a rapidly impressed change of height, and hence of atmospheric pressure, which may in extreme circumstances be unavoidable. That implies chiefly—adequate openings for air entering or leaving the hull, and adequate gas safety valves in case the ship should be driven above her pressure height. The provision of these is practicable. The conditions also provide one of the most severe cases of aerodynamic loading to be taken into account in designing the hull structure.

Fire Risks.—Careful metallic bonding of every part of an airship is adopted, and has been proved to be necessary and effective in eliminating the danger of ignition of hydrogen by electric spark. This bonding prevents difference of static electric potential arising between various parts. Cases of airships having been struck by lightning without harm are on record, a necessary precaution in these circumstances being to avoid discharge of gas.

Handling on Ground and Mooring.—A large airship cannot be taken into or out of a shed in more than a moderate wind if the wind direction be across the entrance. Since there are comparatively few favoured regions where light winds are the rule throughout the year, such a limitation on airship operation could not be accepted. A revolving shed has been built in Germany, which could always be swung round into line with the wind, but this could not be considered a satisfactory solution owing to its high cost.

The Mooring Mast.—These facts have led to the development of the mooring mast, to which the bow of a ship may be directly connected by a universally jointed coupling. Having been the subject of isolated and inconclusive experiments at various times, including trials with the first British rigid airship in 1909, the mooring mast was proved as thoroughly practicable for large rigid airships by extensive trials made in England in 1920 with R33. It was then shown that an airship can remain at a mast in strong winds, and can moor in a wind of over 30 m. per hour. These figures do not represent limits, but the maxima that were attempted. The same airship, brought again into use in 1925 after several years of inactivity, broke away from the mast in a gale. Loads are imposed on the forward portion of the hull by mast mooring, different from those which may occur in flight. R33 had not been designed for mast mooring, being an old ship impressed for the experiments of 1920, and had been equipped for these tests with a special bow cap. In the light of more recent knowledge it appears that the factor of safety conferred on the forward portion of the hull by this modification, was inadequate to deal with the lateral loads imposed on a moored airship by rapid change of velocity and direction of the wind such as may occur in stormy weather. The subsequent flight for 30 hours and eventual safe landing with an extensively damaged bow are famous, and provide evidence of the ability of an airship to proceed under control at reduced speed when seriously damaged.

The mooring mast achieves much more than the ability to land and leave in other than fair weather. It enables this to be done with about 10 men in place of a landing party of several hundred. It removes the necessity of going into the shed except as a sea-going ship goes into dry dock, since fuel and gas are piped up the mast and running repairs can be effected there. All this was demonstrated during the trials referred to, when R33 was continuously operated from the mast for several months without entering her shed. Consequently, intermediate bases on a long route need a mast alone, the cost of sheds being saved.

Landing.—An airship landing to a mast drops a length of cable from her bow which is then coupled to a cable led out through the mast-head, enabling the ship to be hauled in by a power-driven winch. The chief technical difficulty which had to be overcome in developing the method was that of rendering the final stage of hauling-in, steady. The system devised for the 1920 trials with R33 has been adopted in America and used extensively for the airship "Shenandoah." This airship was also successfully operated from a mooring mast erected on the steamship "Patoka."

Small, non-rigid airships have also been adapted for mast mooring. One of the more successful experiments in this direction took the form of a mast having a rotatable horseshoe head, to which the ship was attached at a point on each side of the envelope a little aft of the bow. The need for mast mooring is, however, not so well established in the case of small, non-rigid airships, for which other methods, such as the natural shelter, referred to earlier, are available.

Aeroplane Carrying.—The idea of an aeroplane being carried by an airship, flying from and returning to the latter at will, has long been in view as a means of combining the extreme mobility of the one craft with the long range of the other. Launching an aeroplane from an airship in flight has been achieved successfully on a number of occasions in the course of experiments conducted in several countries. In some tests in America an aeroplane made "contact" with an airship in such a way as to show that re-attachment was probably feasible although it was not actually performed. Recently in England the complete process has been carried out, a light aeroplane leaving the airship R33 in flight, being subsequently re-attached by its pilot, and properly made fast again to the airship. In this experiment the aeroplane returning to the ship attached itself to a trapeze suspended some distance below the airship. This was subsequently hauled up and the pilot of the aeroplane was able to leave his machine and enter the hull of the airship.

Future Development.—The design and construction of two airships of 5,000,000 cu. ft. capacity, or about 150 tons gross lift, has been sanctioned by the British Government. These ships are to be tried in operation between England and India via Egypt, in an endeavour to carry the development of the large airship rapidly to a stage at which it can be shouldered by commercial enterprise. In connection with the scheme, a suitable shed is being erected in England and another in India with a mooring mast in proximity to each, and an intermediate mooring mast in Egypt, which will divide the journey into two stages and enable the ship to take supplies of fuel and gas.

The risk of fire in airships, apart from military incendiary action, has always been on account of petrol rather than hydrogen, and the precaution now taken in bonding of all parts for electrical conductivity has practically eliminated the hydrogen risk, with the reservation as to military action, while the petrol danger has remained. For the two airships now being laid down, petrol has been abandoned as a fuel in favour of crude oil and kerosene, which are to be tried in the two craft respectively, the design of special engines being involved.

It is further intended to test two methods of effecting economy over the normal system of discharging gas during flight equivalent in lift to the weight of fuel consumed. One of these is the recovery of water condensed from the exhaust gases of the engines equal or nearly equal in weight to the fuel consumed. This would render the discharge of gas unnecessary. The other is the use of hydrogen as a subsidiary fuel in such proportion to kerosene as to maintain the ship in equilibrium as regards buoyancy. By thus reducing the consumption of the primary fuel, an increased paying load may be carried. Both methods have already been demonstrated to be possible. Water recovery was regularly performed on the United States airship, "Shenandoah," although with corresponding disadvantages in weight and head-resistance of apparatus, which further improvement should remove. The use of hydrogen as an auxiliary fuel has been proved on ground tests, and has been tried in the air in small airships, but not to conclusion. (*See* AERONAUTICS; FLYING.)

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AIR, THE WAR IN THE.—Airships and aeroplanes, as distinct from captive balloons, were first used in warfare by the Italian Army during the campaign against the Turkish forces in Tripoli in 1911 and 1912. With the exception of aerial combat, there being no enemy aircraft to encounter, most of the features of modern air warfare were introduced by the Italian airmen. Both aeroplanes and airships were used extensively for reconnaissance work; the Turkish positions were frequently bombed by both types of aircraft, which in some cases received damage from rifle fire and from guns trained vertically by the simple expedient of placing them on the slopes of hillsides; and enemy troops were subjected to fire from aeroplanes armed with rifles and revolvers. Extensive photographic reconnaissance flights were made by airships and the photographs obtained formed into a mosaic from which a revised general staff map of the Tripolitan area was prepared.

The World War.—In the World War the first squadrons of the British Royal Flying Corps flew from Dover to France on Aug. 13 1914. Squadrons 2 and 4 were homogeneously equipped with

B.E.2 type aeroplanes, but Squadron 3 had both Bleriot monoplanes and Henri Farman biplanes, while 5 used Farman and Avro biplanes. Though the Lewis gun had been tested in an aeroplane in 1913, the adoption of machine-guns had not been general, and indeed no provision was made for the arming of these early machines, bomb sights and bomb racks being also lacking. This was partly because their primary duty was held to be visual reconnaissance, and partly because of the narrow margin of lift available, which prohibited any addition to the load beyond the weight of the pilot and of petrol. The same consideration prevented the carrying of cameras, but valuable work was done by the early reconnaissance flights, the first of which was made on Aug. 19. On Aug. 23 the reports of the massing of German troops led directly to Gen. French's order for the retirement which saved the British Army, and timely warning was given on Sept. 4 of the commencement of Von Kluck's attempted enveloping movement against the French left, which led to the battle of the Marne.

The first approach to a fight in the air occurred on Aug. 22 1914, when a German Albatross machine appeared over the aerodrome at Maubeuge and was chased by several British machines. Two days later the first German machine to be brought down was forced to land by machines of Squadron 2. It was considered at that time that the most suitable type for aerial combats was the slow two-seater Henri Farman with propeller in the rear giving a free field of fire for the observer armed with a rifle. Before the end of 1914 it was, however, beginning to be recognised that the greater speed and manoeuvrability of the single-seater gave it advantages over the slower type. The French tried to get over the difficulty of firing forward in the tractor type, with propeller in front, by fitting metal plates on the airscrew blades to deflect the bullets, but this was found to have an adverse effect on the efficiency of the aeroplane. When the Lewis gun was adopted, the British fitted it on the top plane to fire either over, or at the side of, the tips of the airscrew blades, the trigger being operated by Bowden wire from the pilot's seat. The selection of the single-seater machine for fighting purposes necessitated the adoption of the principle, already familiar in the submarine service, of training the whole machine at the enemy aircraft with a fixed gun, in place of the free rifle of earlier days, or the swivelling gun of the two-seater.

The cessation of movement and settling down into trenches and a war of positions led to the development of aerial photography, in order that changes in the positions or sizes of enemy railheads, ammunition dumps and camps might be recorded. Early attempts at co-operation with the artillery also began, generally with the aid of coloured signal lights fired by the aeroplane to indicate the fall of shell; but as early as Sept. 15 1914 an experiment in the use of wireless telegraphy on active service was made, and on Sept. 27 the R.F.C. headquarters wireless section was formed.

Air Fighting Develops.—Air fighting and organised bombing raids developed in 1915. Early in Jan. the Germans made several raids on Dunkirk with a number of machines flying together, in place of the isolated attacks by individual machines which had hitherto been the practice. On Jan. 22, for instance, 13 machines appeared and dropped bombs on the docks. During the battle of Neuve Chapelle in March 1915, in addition to the routine work of reconnaissance and artillery co-operation, the Royal Flying Corps interfered with the enemy's movements by attacking such important points on his lines of communication as Menin, Courtrai and Douai. During the battle of Loos on Sept. 25, co-operation with the artillery was considerably improved and a system of " zone " calls introduced, by which the guns could be rapidly put on to " fleeting " targets.

The co-ordination of aeroplane bombing attacks with army operations was also further developed during this battle and attacks were made on railway lines, trains and important junctions. Early in March the R.F.C. had received the first batch of a newly designed aerial camera, from which greatly improved photographs resulted. In May the Germans produced the Fokker monoplane equipped with an interrupter gear which enabled the machine-gun to be fired through the revolving tractor screw blades, a device which took by surprise the Allied air services, which for some time to come were to continue to rely mainly upon " pusher " machines for fighting. At the beginning of 1916 the uses to which British aeroplanes were being put were reconnaissance, artillery observation and bombing with B.E.2 machines; and aerial fighting with Vickers and F.E. two-seaters, and with D.H.2 single-seater " pusher " machines and the new Bristol Scout single-seater tractor biplane with a machine-gun firing over the airscrew. The universal adoption of the tractor type for fighting was still awaiting the synchronised gear operated by the engine for firing through the airscrew, which appeared on the curiously named Sopwith " Pup," a high performance scout, in the summer of 1916. Squadrons for the definite purpose of fighting in the air were organised and a regular patrol was kept up by each squadron over its own sector of the trenches to engage and drive back the enemy's long-range reconnaissance and bombing machines.

Verdun and the Somme.—During the battle of Verdun, which opened on Feb. 21 1916, the French introduced a new and successful form of air fighting in sending their own machines into German territory to seek out the enemy machines before they reached the lines. This to a large extent enabled their own reconnaissance and artillery machines to do their work undisturbed. The Germans replied to this by developing the " circus " system, never copied by the Allies, of giving a recognised star pilot, or " ace " as the French called him, command of a special fighting squadron for which he chose his own pilots. The originator of this system was the German pilot Boelcke; another famous leader being Von Richthofen, whose " circus " would move to different parts of the line, where the needs of the moment called for it, in an effort to obtain local air supremacy. The opening of the battle of the Somme on July 1 1916 was signalised by intensive British reconnaissance and bombing flights, as well as by attacks with small 20-lb. bombs and machine-guns on the front line troops, in the trenches and billets and on transport immediately behind the lines. The same battle was also the occasion of the introduction of " contact patrol " work in an organised manner and on a large scale. This consisted in locating units of Allied forces, and keeping headquarters informed of the progress from hour to hour; reporting on the positions of the enemy, and in particular on movements of his reserves; transmitting messages signalled by the infantry from the ground to headquarters; and dropping ammunition and supplies to isolated bodies of troops.

The year 1917, and indeed the remainder of the war period, was chiefly occupied in developing and bringing to perfection the different operations in which aeroplanes had already been engaged. Fighting in formation was developed until it became a highly scientific operation in which whole squadrons and even larger formations were frequently engaged. Bombing raids were also carried out in formation on a large scale, both by " day bombers " operating from behind the lines upon reserve ammunition dumps, railheads, concentration camps and similar objectives and by twin-engined " night bombers " working from bases on the coast and far in the rear of the front line upon munition works and industrial centres in the heart of the enemy country itself. Raids of this nature had been carried out by the Germans from 1915 onwards, but it was not until 1917 that the appearance of the large Handley Page machine made retaliation possible; a development which led to the formation of the Independent Air Force on June 6 1918, for the definite purpose of bombing German munition centres. (*See* Air Raids.)

In dealing with the use of aircraft with the military forces during the World War, attention has been confined to operations on the Western Front, because the work in other scenes of war was mainly on the same lines, except for such spectacular performances as the wiping out of the whole of the Turkish VII. Army on Sept. 16 1918, when it was caught in a ravine and bombed to extinction by relays of British aeroplanes. Nothing has, however, been said of the growth of the kite balloon service, which developed from two naval sections that arrived in France in

May 1915, until at the end of the War there was a row of them along the whole line of trenches co-operating with the artillery, for which work they possessed the advantage of rendering possible direct communication by telephone between the observer and the battery.

Operations by Naval Airmen.—The first naval flying operation of the World War was a patrol by Parseval Airship IV. during the night Aug. 5–6 of the approaches to the mouth of the Thames. Airships and aeroplanes patrolled the English Channel during the crossing of the Expeditionary Force to France. For the remainder of 1914 the Naval Air Service was chiefly engaged upon bombing operations with land machines from aerodromes on the coast of France upon the Zeppelin sheds at Cologne, Düsseldorf, Friedrichshafen and other points. The navy introduced the kite balloon to the British services and in March 1915 the first kite balloon section left for the Dardanelles in the "Manica," from which ship the balloon was used to good effect in spotting for the "Queen Elizabeth" and other battleships engaging the Turkish batteries and ships.

About the same time a programme of "S.S." (submarine scout) airships, for use in patrolling the Channel and approaches to the Irish Sea, was laid down. By the end of 1914 three seaplane carriers were in commission in home waters, and shortly after the New Year the "Ark Royal," soon followed by the "Ben-My-Chree," left for the Dardanelles. From the "Ben-My-Chree" were launched the seaplanes which made history in attacking and sinking surface vessels by torpedoes dropped from the air. All these vessels carried the seaplanes in their holds and hoisted them out over the side by derricks to start from the water. In July 1915, seaplanes were used on the east coast of Africa in spotting for the monitors engaged upon destroying the German light cruiser "Königsberg." On Nov. 3 1915 a Bristol scout aeroplane rose from the foredeck of the "Vindex" and thus became the forerunner of the ship aeroplanes which were subsequently developed.

The autumn of 1915 saw the production of the first "Coastal" two-engined type airship, for anti-submarine operations from stations on the east coast. During 1916 aeroplanes of the Naval Air Service were still employed in bombing aerodromes, coastal batteries, docks and also points of military importance, while in the Mediterranean regular anti-submarine and reconnaissance patrols by seaplanes and airships were instituted. In 1917 the navy introduced the Handley Page bombing machine which made it possible to extend the range of bombing attacks. In home waters a more powerful airship, in the "North Sea" class, was produced and still further increased the length of anti-submarine patrols, while airships and, to a less extent, seaplanes began to accompany for prolonged periods the convoys of merchantmen which were organised by the Admiralty. Progress was made in the development of large flying boats operating from Yarmouth and Felixstowe, which patrolled the southern part of the North Sea for submarines and Zeppelins. The principle of carrying aeroplanes in ordinary ships of the navy and flying them from platforms revolving with the gun turrets was introduced, while the torpedo-carrying seaplane was also very considerably developed during this period.

Aircraft versus Submarine.—In 1918 the German submarine campaign reached its height and anti-submarine operations were intensified. Airships accompanied the Scandinavian convoy on the greater part of its journey, while a practically constant supervision was exercised by seaplanes, aeroplanes and airships over the "east coast lane," a narrow belt of water close to the shore to which merchant ships were required to keep for their own protection in their passage up the coast. All the American convoys, both of transports and merchant ships, were regularly met at a distance of some 150 m. from the coast and escorted to port. Aircraft were, perhaps, the most potent factor in combating the submarine menace in convoy work as in reconnaissance, in co-operation with surface vessels and direct attack. Kite balloons were also installed on monitors, patrol boats and even battleships as an aid to the location of submarines.

Towards the end of the War the "Furious" appeared in its converted form as a seaplane carrier with a long flying deck on which aeroplanes could land as well as take off. An instance of the production of a special device for a specific purpose may be mentioned in the mounting of a Sopwith "camel" aeroplane on a lighter, towed behind a destroyer, for the purpose of making a surprise attack on a patrolling Zeppelin airship. At the date of the Armistice the British airship service was on the point of producing rigid airships capable of accompanying the Grand Fleet to sea as advance scouts, but the German Navy employed Zeppelins for this purpose on many occasions and throughout the War maintained a patrol of the North Sea which enabled them to receive early warning of the movements of the British Fleet. (*See* CONVOY.)

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(W. L. M.)

AIR WARFARE.—This article, after an historical introduction, deals with the strategy and tactics of air warfare.

I. HISTORICAL SKETCH

Reconnaissance was, probably, the only clearly defined duty of the British Flying Corps, during the retreat from Mons, and on Sept. 13 when artillery observation by wireless telegraphy and photography from the air were carried out on the Aisne. At the battle of Festubert in May 1915 there took place the first definite attempt at contact patrol with the infantry; machines were allotted for artillery observation; bombing attacks were made on enemy railways and headquarters; and patrols were organised to prevent enemy air reconnaissance. At the battle of Loos, Sept. 25 1915, the co-operation with artillery was extended to counter battery work, and long distance reconnaissance was done as well as tactical reconnaissance.

The next development was due to the appearance of the German *Fokker*. This was a type of aeroplane specially designed for fighting, which seriously interfered with British artillery observation machines; and the practice began of allotting a fighter to an artillery machine for its protection. Later a definite offensive policy was adopted, and specialised fighting squadrons were organised.

Aircraft on the Somme.—The next milestone was the battle of the Somme in July 1916. Aerial activity on this occasion included attacks on hostile balloons, railways and infantry in trenches; artillery observation and contact patrols with the infantry were carried out. In subsequent battles, as at Arras, Messines and the third battle of Ypres, offensive patrols worked far over the German lines and even waited over their aerodromes, their object being to ensure for the attacking infantry freedom from observation and for the artillery observation machines freedom from aerial attack. There was considerable bombing of railheads, trains, dumps and living quarters, both by day and night, and the use of photography was greatly extended.

The battle that began on March 21 1918 marked an important change in air strategy. The normal search for information and the normal fighting for the maintenance of air superiority were completely abandoned in favour of intervention in the ground fighting. Throughout the Allied advance in the second half of 1918 the fighting in the upper air and the attacking of enemy aerodromes with bomb and machine-gun were resumed, as were also reconnaissance and artillery co-operation. Further, there was a great increase in the attacks on troops on the ground, on bridges and on railway stations.

Co-operation with the Navy.—The development of naval co-operation can most conveniently be considered under the headings of work with the battle fleet, commerce protection and the support of military expeditions overseas, respectively.

On the outbreak of the War several cross-Channel steamers were bought and fitted up as seaplane carriers, to work with the Harwich Force; and a Cunard liner was similarly used in the Grand Fleet. The next step in the evolution of the aircraft-carrier was the provision of ships with a flying deck forward whence aeroplanes could fly off, though they were forced to alight in the sea on their return. It was also found practicable to fly an aeroplane off a ship's turret. Finally, as the possibility of an aeroplane alighting on a deck became evident, aircraft-carriers were provided with a deck both for alighting and flying off.

At the time of the Armistice there were two large aeroplane-carriers, "Furious" and "Argus," the former carrying reconnaissance machines and the latter torpedo machines. In most light cruisers a single-seater fighter was carried, whose primary function was to attack Zeppelins. Each capital ship carried two aeroplanes either single-seater fighters or two-seaters, the former to obtain local air superiority, the latter to spot for gunfire. During the last two years of the War long reconnaissance flights, of about 400 m., were made by flying boats from Killingholme, Yarmouth and Felixstowe, over the southern part of the North Sea. The Germans made no attempt to develop aeroplanes or seaplanes for fleet work, but relied on their long range airships, which accompanied the German Fleet on nearly all its important operations, and also maintained throughout the War a very effective patrol of the Heligoland Bight.

In commerce protection aircraft played an important part. A bombing force was used to attack the submarine bases in Belgium, and a limited amount of bombing of the submarine base at Cattaro was done in the spring of 1917, but the most effective rôle of aircraft in anti-submarine warfare was convoy work. Air stations were built up first of all in the English Channel and on the east coast, and later they were extended to the Irish Sea, Mediterranean, French Coast, Newfoundland and the Gulf of St. Lawrence. Airships, flying boats, seaplanes, aeroplanes and kite balloons were all used.

In connection with the navy's function of supporting military expeditions overseas, the Dunkirk aircraft kept a very close watch on the enemy's Belgian ports, to prevent his making, by surprise, a raid in force on the cross-Channel communications of the British Army. At the Dardanelles aircraft co-operated with the ships, working both from carriers and shore bases. It was here that the first successful attacks by torpedo planes were made in Aug. 1915. Air co-operation was also provided for by the navy in East Africa in 1915, in the Red Sea in 1916, in North Russia and on the Caspian in 1919. Since the Armistice considerable progress has been made in fleet co-operation, spotting for gunfire, reconnaissance and torpedo plane work, while the development of flying boats has proceeded so that they are now capable of making cruises lasting several days.

II. STRATEGY AND TACTICS

The principles governing the strategy and tactics of air warfare can now be reviewed, and when possible, suggestions can be made how such warfare may in future develop.

Armies of the Air Force.—If small wars are fought by the air force alone, the objective is to make the enemy's life so burdensome—by material loss, by the interruption to normal life, by the moral effect—that he will sue for peace. This method of war is advantageous in that it can be used very quickly, and that provided the air base is secure, there is no line of communication to guard. Moreover, the force can be kept centralised, which is both safe and economical. However, it is often necessary to employ troops also and in this case, the first duties of the air forces may consist of direct action before the troops are in contact; then, normal co-operation with ground columns as they advance. In addition, there will be the work of watching the long line of communication, and of supplementing it by using aircraft for carrying men and supplies, and for intercommunication. Before ever force is resorted to, aeroplanes may, by demonstration or dropping propaganda over disaffected areas, prevent the spread of trouble and render further action unnecessary. So successful and economical have these methods proved, that it is likely they will be considerably used in future for the control of semi-civilised areas.

In a war to be won primarily by air action, the objective will be the same as in the small war, viz., to interrupt an enemy's national life to such an extent that he prefers to make peace. An air force differs from a fleet or an army in that it cannot adopt temporarily the defensive, and then assume the offensive at its selected time, the reason being that it is impracticable to provide an air force with an impregnable base wherein to shelter during its defensive. Therefore an air force must always be on the offensive, even if it is co-operating with a navy or an army which is temporarily on the defensive. Air fighting is subject to the same principle. On the defensive it is difficult to avoid surprise, because attack may come from any direction or angle in three dimensions. The effect of the offensive on morale is probably even more marked in air fighting than in sea or land fighting. One of the most important parts of any home defence organisation will be its offensive bombing squadrons.

Tactics of Air Fighting.—In a fighting machine the offensive is generally pursued by means of surprise. In the case of one single-seater attacking another, surprise is obtained by attacking from above and behind, since the attacked pilot does not see in this direction. But where a two-seater is attacked, other methods must be used. For instance, attack may be made from behind clouds or from such a direction that the pilot and observer attacked cannot avoid looking towards the sun; or the enemy may be induced to attack a decoy aeroplane, whereupon he himself becomes attacked from above. Fighting machines at first worked singly, later, the formations of fighters were adopted, the most usual being a V echeloned in height.

In the latter stages of the World War it became the practice for a fighter squadron to fly in three V's, the leading V being the lowest, and the rearmost V the highest. Thus the rear of a lower formation was guarded by the formation above it; in the same way that the rear of a single-seater fighter in a formation is guarded by the machine above and behind it. The attacks by fighters led to bombers in the World War flying in formation for mutual protection. A V formation was generally used. Owing to the difficulty of attacking a well handled formation of bombers, the practice of sending fighters as a close escort to bombers is to be deprecated as wasteful. Moreover, fighters which are tied to a bombing formation necessarily lose much of their greatest asset, mobility.

Naval War.—If a naval battle is fought outside the radius of action of shore-based aircraft the first air objective should be to obtain local air superiority, either by incapacitating the enemy's carriers before their aircraft have taken off, or by air fighting. If a fleet were to pass within the range of a powerful, shore-based enemy air force it would lose all power to effect surprise. Another problem is the ability of an air force to drive an enemy fleet to sea in order that it may there be defeated. If the enemy's fleet is based outside the range of shore-based aircraft, the limited effect of air raids by the machines from carriers would not suffice to do this, but if it is based within such range a reasonable measure of air superiority can be obtained, then by continuous air bombardment the fleet's base could be made untenable. Similarly, a smaller air force, though unable to maintain an offensive strong enough to drive out the fleet, could watch the base so closely that if the fleet did come out, the fact would be quickly reported.

For the defence of trade outside the radius of shore-based aircraft, each ship would have to carry an aeroplane, if the trade were dispersed. A catapult or flying-off deck would be necessary and some device to enable the aeroplane to alight on the ship. If the trade were in convoy, it might be desirable to have an aircraft-carrier with the convoy. Within the radius of shore-based aircraft, trade could be assisted and protected by patrols from coastal stations, as in the World War, but to a greater degree in view of the increasing efficiency of aircraft. In attacking trade, aircraft could be most effective if directed against enemy ports, where trade would be concentrated, and the loading and unloading of ships would suffer interruption. At sea aircraft, outside the radius of shore-based aircraft, could be carried in and used as auxiliaries by surface raiders or submarines. Within the radius of shore-based aircraft, merchant shipping could be attacked easily and effectively.

As all arms now use aircraft for tactical co-operation, it is to be expected that simpler methods of inter-communication will be evolved. Again, as aircraft grow more powerful, the blows that are dealt from the air to the ground by bombing and shooting will become heavier. Bombing will become more accurate, and the increased range of aircraft will naturally give them greater scope. Finally, the appreciation of the offensive power of air forces will probably lead to a greater use of air power at critical times, as, for instance, to fight a rearguard action or, conversely, to turn an enemy's retreat into a rout.

Defence Against Overseas Invasion.—In these operations air power appears to be of the greatest importance. Surprise for a sea-borne land attack would be almost impossible to obtain in the face of aerial coast patrols. The patrols would give warning and the defenders would concentrate their sea, land and air forces at the point on which the attack was seen to be directed. One is led to expect an extension of this method of defence, which is obviously more economical than fixed defences distributed along a coast line. An adequate air patrol is essential. The great power of the defender's aircraft to delay or stop an attack by damaging transports, by attacking troops going ashore or by preventing supplies being sent ashore after the troops are also to be considered. Air power seems likely to favour the defender much more than the attacker.

Imperial Defence.—As regards the future use of air forces for Empire defence it should be assumed that an air striking force is normally stationed in some central position, whence air routes radiate to different parts of the Empire, and that every outlying part of the Empire that is liable to attack has a small garrison capable of holding out until the air striking force arrives. The arrival of the striking force would mean that the attacker would be unable to get that measure of air superiority which is essential nowadays for the success of any war by sea, land or air. One advantage of this strategy would be that the air striking force would arrive in a few days, whereas in the past, relief forces have taken weeks or months to reach their destination. Another advantage would be its comparative cheapness, for the striking force would be centralised, which always makes for economy, and the air routes would be maintained by commercial aviation. The underlying strategic principle is that full use is made of the mobility of air forces to bring about a rapid concentration at the decisive point. (*See* BRITISH EMPIRE: DEFENCE.)

(C. H. K. E.)

AKHENATEN.—Akhenaten, the son of his predecessor Amenophis III. and his wife Ty, came to the throne of Egypt about 1375 B.C. Not later than his sixth year the new king transferred his capital from Thebes to Tell el-Amarnah, where he built a new city called Akhetaten "Horizon of the Disk." Thither he retired with his court and gave himself up to the worship of the Aten or Disk of the Sun. This deity had already attained to the dignity of a temple in Thebes under Amenophis III., but Akhenaten raised him to still greater prominence by suppressing the worship of the old state god Amenrēʻ-Horus-of-the-Horizon and probably, though less vigorously that of the other Egyptian deities. The result was a monotheism, though probably not a strict one, showing an undoubted tendency to compromise with the old sun-cult of Heliopolis. Fragments of hymns to the Disk, perhaps composed by the king himself, have been found; these do not differ in any essential respect from hymns to other Egyptian gods, more particularly Amenrēʻ, though as literary productions they stand possibly a little higher. The religion of the Disk as we see it was a contemplative worship with little or no trace of ethical content, and hardly justifies the encomiums passed upon it by some modern historians.

Akhenaten reigned at least 17 years. His wife was a woman called Nefertete, of whose origin nothing is known, but who apparently fell into disgrace toward the end of the reign. The couple had at least seven daughters, of whom the eldest died young, while two others married respectively Sakerēʻ and Tutankhaten (later Tutankhamun), who in turn succeeded their father-in-law on the throne. Akhenaten's new religion barely survived his death, but his neglect of home and foreign affairs had cost Egypt her empire in Syria-Palestine and reduced her internally to a state bordering on chaos.

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AKRON, Ohio, U.S.A. (*see* 1.458), had a phenomenal growth in the decade beginning 1910, due chiefly to the demand for tires and other rubber products incidental to the expansion of the automobile industry. Its area was doubled, and the population tripled, reaching 208,435 in 1920, of whom 5,580 were negroes and 38,021 foreign born. The aggregate value of manufactured products rose from $73,158,000 in 1909 to $558,962,000 in 1919; the average number of wage-earners in the factories, from 15,831 to 65,054. This development was arrested by the general depression of 1920–1, but by 1925 it was estimated that the population had again reached the figures of 1920. The output of the factories in 1923 was valued at $406,836,922; their employees numbered 44,903.

Expenditures for health and sanitation increased from $53,231 in 1910 to $402,459 in 1923; for education, from $277,454 to $2,640,833. A new water system, begun in 1915, represented by 1924 an investment of $11,000,000. Elimination of grade crossings was begun in 1924. A new charter, which came into operation Jan. 1 1920, set up the office of city manager, but four years later his duties were transferred to a mayor elected at large. The City Planning Commission, created by the charter of 1920, secured the adoption of a zoning ordinance in 1922. The municipal University of Akron was created in 1913 by the action of the City Council in accepting the plant and endowment of Buchtel College as a nucleus, the original institution retaining its identity as Buchtel College of Liberal Arts in the university. In 1924–5 the total net enrolment reached 2,151.

ALABAMA (*see* 1.459).—In 1920 the population was 2,348,174, as against 2,138,093 in 1910, an increase of 210,081, or 9·8%. Although the proportion of urban population was greater than in 1910, yet, in spite of the marked development of mining and manufacturing interests, more than three-fourths of the inhabitants were still rural and chiefly agricultural. The urban population (inhabitants of cities of 2,500 or more) was 509,317, the rural 1,838,857. The distribution of population by race was as follows: whites, 1,447,032; negroes, 900,652.

During the decade 1910–20 the white population increased 17·8%, while the negro population decreased 0·8% due to male negro migration to northern industrial centres. The U.S. Census Bureau estimated the population of Birmingham, the leading city of the state on July 1 1925, at 205,670—an increase for the five-year period of 27,400. Other bureau estimates of the same date are: Mobile 65,955, Montgomery 46,481, Bessemer 21,975, Anniston 20,531, Gadsden 17,104 and Selma 16,987. There were 256,099 farms in 1920, against 262,901 in 1910, a decrease due to the negro migration noted above; but there was a marked increase in total production.

Industries and Transport.—Three new lines of material progress are notable: (1) the use of hydroelectric power; (2) the utilisation of the canalised rivers Warrior and Tombigby from the heart of the inland mineral district to the important port of Mobile; and (3) the building of docks, owned and controlled by the state, at Mobile. A private corporation completed two great dams across the Coosa river, and in 1925 a third was in progress. The company supplies electricity for lighting and power to the chief centres of population and industry throughout the state; and in 1925 it had undertaken the construction of a system of dams on the Tallapoosa river at Cherokee Bluffs.

The U.S. Govt. has completed the Wilson dam on the Tennessee river at Mussel Shoals.

During the closing months of 1920 the first vessel of a fleet of government-owned and operated, self-propelling barges made its way down the Mississippi river to New Orleans and into the Gulf, then to Mobile and up the rivers to Birmingham and Cordova in the heart of the Warrior coal-fields. A balanced tonnage, up and down stream, is steadily being developed by the transhipment at Mobile of manganese ore from Brazil, for use in making high-grade steel in the Birmingham district, and by the establishment of an all-water freight rate from New York and other eastern points, via Mobile, to the various river ports.

An amendment to the state constitution having authorised the use of the credit of the state for the construction of a great system of docks at Mobile, an Act of the Legislature at its session of 1923–4 authorised the issue of $10,000,000 of bonds for that purpose and a commission was put in charge of the work. The commission thereupon acquired for the state approximately 400 ac. of land, with a water frontage of two miles on the northern outskirts of the city.

The greater part of the pig-iron produced in Alabama and not used in the manufacture of steel is made into cast-iron pipe, mostly in the Birmingham district. Since 1910 there has been a remarkable development of the cement industry, due to the presence of practically inexhaustible deposits of limestone in the heart of rich coal-fields, side by side with extensive areas of shale and clay, in a territory served by adequate hydroelectric power. Alabama furnished 60% of the domestic graphite used in the World War.

Education.—The Legislature passed an Act, approved Feb. 6 1919, creating a commission of five members, appointed by the governor, to make a study of the educational system of the state with the object of determining its efficiency. The commission in turn invited the U.S. Bureau of Education to accept the task. The result was a series of Acts passed by the Legislature in 1919, constituting the school code of Alabama. Among the most important of these Acts was one providing for a state council of education to co-ordinate the efforts of the University of Alabama at Tuscaloosa, the Alabama Polytechnic Institute at Auburn and the Alabama Technical Institute and College for Women at Montevallo, by assigning to each special fields for higher education.

Taxation and Finance.—Alabama has neither state income nor state inheritance taxes, while its constitution of 1901 limits the state property tax to 0·65% upon assessed values. Under the revenue laws in force at the end of 1925 both real and personal property valuation for taxing purposes was placed at 60% of a reasonable cash value. Under an amendment to the constitution, the Legislature provided for a $25,000,000 bond issue, to be matched by a like amount from the Federal Govt. to be used in constructing highways connecting the several county seats.

History.—During the period 1916–25 the government of Alabama remained in the control of the Democratic party, with only nominal opposition by the Republican party, the educational, property and other qualifications for voters under the state constitution of 1901 having eliminated the bulk of the negro Republican voters. Only in the presidential election of 1920 were there indications of the development of a white Republican party in the state. In that election that party polled 31·9% of the vote cast, thus securing the privilege of a primary for the nomination of candidates in the next election at the expense of the state government.

Before this time factional differences in the Democratic party were fought out in the primary elections under state supervision and the general elections were merely formal ratifications of the choices made in the primaries. It was not easy to distinguish clearly between the two leading factions that developed in the dominant party, but perhaps the terms conservative and progressive sufficiently indicate the line of cleavage. The former insisted on the fullest protection to vested financial interests, and before the adoption of the Eighteenth (prohibition) Amendment to the Constitution of the United States, on a liberal policy of local option in the manufacture and sale of alcoholic beverages. The latter stood generally for strict control, by the state, of corporate capital, especially in the matter of railway rate regulation and for prohibition of the liquor traffic.

Several amendments to the state constitution of 1901 were adopted during this period, most of them dealing with matters of local interest to counties and cities. Two, however, were general in their scope: one providing for local option by counties and school districts as to increased taxation in the interest of public schools; the other authorising the issue of state bonds to the amount of $25,000,000 for the construction of a complete system of highways, thus enabling the state to secure the national appropriations in aid of that policy. At its regular session in 1919 the state Legislature refused to ratify the Nineteenth Amendment to the Constitution of the United States providing for woman suffrage; but as soon as the requisite number of states had made it a part of the Constitution, a special session of the Legislature was called (1920) which promptly passed an Act providing for the registration of women voters and for otherwise carrying into effect the provisions of the amendment.

Governors after 1910 were Braxton B. Comer (Dem.), 1907–11; Emmet O'Neal (Dem.), 1911–5; Charles Henderson (Dem.), 1915–9; Thomas E. Kilby (Dem.), 1919–22; and William W. Brandon (Dem.), 1922– (T. C. McC.)

ALAND ISLANDS: *see* AALAND ISLANDS.

ALASKA (*see* 1.472).—A territory of the United States in the northwest of North America. Area 586,400 square miles. The most important events in the history of Alaska subsequent to 1910 were: (1) the extension of surveys and investigations of resources over more than half of the total area; (2) the change in the public land policy, which no longer prohibited the utilisation of Alaska's coal, petroleum and water powers; (3) the granting of a measure of home rule to the people of Alaska; (4) the improvement of transport by the construction of a government railway from an open port on the Pacific to the navigable waters of the Tanana river, by the construction of many wagon roads, and by the installation of many lights and other aids to navigation; and (5) the great advance of the copper and salmon fishing industries and of gold mining previous to 1916. Alaska's normal development, interrupted by the World War, suffered from a period of post-War stagnation. In 1925 the country was just emerging from this depression.

Public Land Policy.—The political history of Alaska has largely centred in a struggle for more liberal land laws. In early days it had been considered best to transfer the lands to private ownership as quickly as possible, without too close a scrutiny of the means employed. This policy was completely reversed as a result of the conservation movement inaugurated under President Roosevelt. The original aim of the movement was to prevent waste of natural resources, but as this proved unpopular it gradually veered to a protest against corporate control of lands and resources. An important result of the conservation movement was the increase of reservations in Alaska, some 40,000 sq. m. being set aside for various purposes, exclusive of mineral or forest withdrawals. For many years, however, the conservation issue remained unsettled and industries languished. With an abundant supply of fuel close at hand, Alaska was forced to import coal and petroleum at great cost; her pulp wood was rotting in the forest, her water powers were undeveloped. Only gold and copper mining and salmon fishing increased. Finally, during the Wilson administration, a leasing policy for coal and oil lands and water powers was established by law. At about the same time the shortage of paper had a liberalising influence on the regulations relating to the sale of timber from the national forest.

Government.—The struggle of Alaska to attain representation in Washington, lasting nearly 40 years, resulted in 1906 in the authorisation of an elected delegate to Congress. At each biennial election which followed, home rule was the only important issue, until in 1912 an Act was passed granting a territorial government; the post of Governor remained a Presidential appointment, and provision was made for a two-chambered Legislature. The upper chamber, or Senate, consisted of two senators from each of the four judicial districts, serving four years. Sixteen representatives formed the lower chamber, or House of Representatives, four elected for two years from each judicial district. This equal representation gave the less-populated areas of the interior an unjust preponderance in the Legislature, and in many instances worked against the best interests of the Territory as a whole.

Under the Constitutional Act, Congress expressly retained the right of repealing all laws enacted by the Alaska Legislature. Furthermore, the Territory was denied the right to enact laws relating to the excise, to game, fish, fur-bearing animals or to the existing Federal licence tax. It was provided that the capital should be at Juneau.

The first session of the Territorial Legislature was convened on March 3 1913, and the first law passed gave the franchise to women. Since that date the most important legislation has related to mining, hours of labour, workmen's compensation, banking and education. Heavy taxes were also imposed on the salmon fishing industry, and from these the Territory derived a large part of its income. In 1916 the Legislature authorised a plebiscite on the prohibition of the sale, transport and manufacture of all alcoholic beverages. The vote was in the affirmative by 7,958 to 4,431; as the Legislature had no power to change the excise law, a petition was submitted to Congress, which passed a dry law for Alaska in 1917.

Education.—The white schools are under territorial management. The Agricultural College and School of Mines at Fairbanks was opened in 1922. In 1924 there were 77 schools for whites. The education of Alaskan Indians and Eskimos was in the hands of Federal agencies, and in 1924 there were 76 Indian schools, too few, however, to accommodate the children of the natives. In addition to the government schools, there were about 36 sectarian missions for the natives.

Population.—In 1920 the population was 55,036, a decrease of 14·5% from 64,356 in 1910. The whites numbered 29,000, the Indians and Eskimos 25,000; the balance represented Mongolian and other races. Juneau, the capital and an important mining centre, was the largest town, with a population of 3,058 in 1920. The white population of Alaska steadily increased until 1915, when it exceeded 40,000. Subsequent losses were due to: (1) enrolment in military service of about 3,500 men, few of whom returned; (2) high wages in the United States; and (3) the decrease in the gold mining industry. The upward curve in population was not restored until 1924. In that year the number of people arriving in the Territory exceeded the number departing by 577. In addition to the permanent residents of Alaska, between 25,000 and 30,000 men annually visit the Territory to find employment in fishing and mining.

Mountaineering.—The mountain ranges include a number of the highest peaks on the continent. Mt. St. Elias (18,024 ft.) was ascended by the Duke of the Abruzzi in 1897. Several attempts were made to climb Mt. McKinley, the highest peak in North America, before William Taylor and Peter Anderson, prospectors, reached the summit of the north peak (20,000 ft.) in 1910, and Hudson Stuck and Harry P. Karstens the summit of the south peak (20,300 ft.) in 1912. Katmai Volcano on the Alaskan Peninsula, on the margin of the Valley of Ten Thousand Smokes, though dormant for more than a century previous, in 1912 gave forth one of the greatest eruptions in historic times.

Railways.—At the close of 1910 there were 371 m. of railway in Alaska. This mileage included 20 m. of the White Pass Railroad (narrow gauge) which ran inland from Skagway across the international boundary to White Horse in the Canadian Yukon (110 miles). While primarily serving Canadian territory, this line gave access during the open season of navigation to the settlements on the lower Yukon. The Copper River & Northwestern Railroad (standard gauge), extending from Cordova on the coast to the Chitina copper belt (196 m.), was completed in 1910. In 1912 Congress authorised a special commission to report upon the Alaska railway situation. The commission recommended the construction of two lines: one from Cordova to Fairbanks, the other from Seward to the navigable waters of the Kuskokwim. The estimated cost, $35,000,000, was appropriated by Congress in 1914, but in the following year the administration announced the selection of a railway route from Seward to Fairbanks, a far more expensive undertaking. Construction on the Alaska Railroad was begun in 1916 and finished in June 1923, at a total cost of $56,000,000.

Commerce.—In 1924 minerals, furs, fish, etc., were exported to the value of $61,015,062; and the value of imports was $32,580,057. During that year 2,802 vessels entered Alaskan ports and 2,675 vessels were cleared. Coastal Alaska was served by three regular passenger and freight steamship lines which during 1924 operated 12 steamers. A boat service was furnished on the Tanana and Yukon rivers by the Alaska Railroad.

Mining.—From its small beginning at Juneau in 1880 up to the close of 1924, Alaska mining yielded a total value of $535,000,000. Of this 98% represented gold and copper, but the mines also produced silver, platinum, palladium, tin, lead, antimony, tungsten, chromite, coal, petroleum, marble, gypsum, graphite, barite and sulphur; development work was done on deposits containing nickel, iron and molybdenite. Gold production up to the end of 1924 was worth $347,800,000, of which $234,000,000 worth was yielded by placers. After 1916 gold mining steadily declined until 1923 as a result of economic conditions attendant upon the World War. Following the completion of the Alaskan Railroad and the introduction of improved mining methods, the year 1924 showed a slight increase in production. The United States Geological Survey estimated the value of the placer gold reserves to be at least $360,000,000, in addition to the vein deposits whose value could not be estimated. Auriferous lodes have been found in many localities, but the only large lode mines are in southeastern Alaska. Copper mining began in 1901, and up to the close of 1924 had produced 456,000 tons of metallic copper valued at $167,500,000; this was largely the output of the Kennecott mines in the Chitina district. Copper ores are widely distributed, but most of the deposits are as yet inaccessible. Coal, both bituminous and anthracite, occurs in the Bering river and Matanuska fields, the latter within reach of the government railway; the territory contains an abundant supply of sub-bituminous and lignitic coals, which are very widely distributed. All Alaskan coal lands were withdrawn from entry in 1906; no development of the industry was possible, therefore, until a coal leasing law was enacted in 1913. The production up to 1925 was about 670,000 tons.

Important oil seepages have been found at five places on the Pacific seaboard, and at two places in the Naval Petroleum Reserve No. 4 on the North Arctic coast. The withdrawal of all oil lands from entry in 1911 stopped development until 1919, when an oil leasing law was passed and operations began in several localities; up to 1925 the production of petroleum had been confined to the Katalla field. About 12,700,000 oz. of silver and 7,000 tons of lead have been produced. Almost all the tin output of North America comes from Alaska, chiefly from the York district in the Seward peninsula; over 1,000 tons had been mined between 1900, when operations began, and 1925. The mining of platinum and related minerals began in 1916, and about 1,600 oz. had been produced by 1925. Quicksilver mining has been carried on in a small way for many years. In southeastern Alaska extensive deposits of high-grade marble have been quarried on a large scale.

Fisheries.—The product of this industry is greater than the sum-total of all other Alaskan products. The total value of fish marketed between 1867 and 1924 was nearly $600,000,000. In 1924 the fisheries brought in over $39,000,000, of which about $35,000,000 was for salmon. During the World War the salmon catch assumed such proportions that there was grave danger to the industry, but in 1924 Congress authorised the Secretary of Commerce to impose suitable restrictions. The halibut fisheries were also being rapidly depleted, but in 1924 Congress ratified a treaty with Canada and Great Britain for the preservation of the halibut fishery of the Northern Pacific: the value of the Alaskan catch in 1924 was $1,619,443. The number of cod on the Alaska cod banks is enormous, but as yet they have been but little exploited. Herring are found in great abundance as far north as Bering Strait. Whale fishing, once a very important industry, has decayed.

Forest Products.—The commercial timber of Alaska is contained in the two great national forests, the Tongass in southeastern Alaska and the Chugach on Prince William Sound. These have a total area of 21,000,000 ac., and are estimated to contain 79,000,000,000 ft. (B.M.) of timber. Extensive use is now made in local industry of this supply. Sitka spruce, which is very tough, has been exported for use in aeroplane construction. In 1925 a pulp-wood industry was being developed under the encouragement of the Forest Service.

Agriculture.—In 1924 the best developed farming area was in the neighbourhood of Fairbanks, where hardy varieties of wheat were matured and a small flour-mill operated. There is an abundance of good grazing land in the interior, but the period of winter feeding is about eight months. The Matanuska Valley has proved particularly adapted for breeding dairy cattle. The domesticated reindeer herds in 1924 numbered 350,000, valued at $8,750,000. This was the natural increase from the original 1,200 imported by the Government between 1892 and 1902. About 70% of the herd was owned by the Eskimos, for whose support the animals were first imported. After the opening of the Alaskan Railroad the export of reindeer meat became of importance.

Fur Industry.—Between 1867 and 1924 Alaska produced furs to the value of $104,000,000, of which $57,000,000 represented seal skins taken on the Pribilof Islands. Up to 1910 the Government leased the seal-catching privileges on these islands to private corporations, which killed 2,320,028 seals and paid the Government $9,474,000 in royalties. The land killing of seal was restricted, but pelagic sealing, which was becoming very destructive, could not be controlled by the American Government; a treaty was therefore signed in 1911 between the United States, Great Britain, Russia and Japan, abolishing it and providing that the United States was to pay to both Great Britain and Japan 15% of the value of the catch made on the islands. Since 1910 killing has been prohibited on the Pribilof Islands, except by Federal agents. Thanks to these provisions the seal herd increased from 215,000 in 1912 to 697,158 in 1924. The annual production of fur, other than seal, was valued at approximately $2,000,000 in 1924. Most of this was due to the rapid increase of fox-farming, more than 200 fur farms being in operation. Two companies were engaged in sheep-grazing in the Aleutian Islands.

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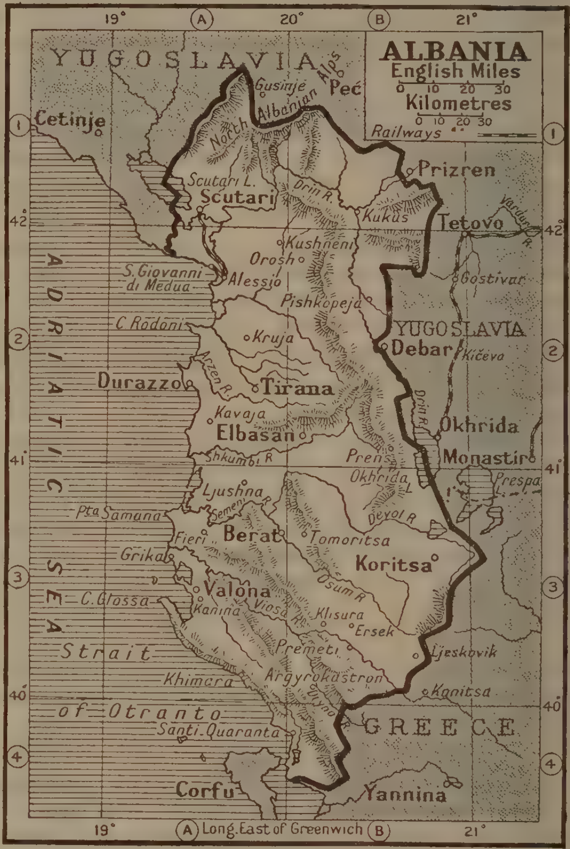
ALBANIA or SHQIPËRI (*see* 1.481), an independent republic on the Adriatic coast of the Balkan Peninsula, and a member of the League of Nations. Its area is 10,757 sq. m. and its population was 816,900 in 1923.

I. POLITICAL HISTORY

The Albanians, distributed in the region between the Vardar and the Adriatic Sea and between Thessaly and Montenegro, with the former Turkish vilayets of Scutari and Yannina as their ethnographic centre, formed part of the Ottoman Empire from the 15th century onwards. That domination, however, was never anything but nominal, the Albanians having had their own administration and never having paid taxes. In 1911 the Maltsori, or tribes of part of Northern Albania, revolted against Turkey, and obtained recognition of their administrative autonomy. But, in the course of the Balkan Wars, the Serbs having invaded Northern Albania and the Greeks Southern Albania, the Albanians claimed their independence at Valona on Nov. 28 1912, and the Conference of Ambassadors, meeting in London, recognised on Dec. 20 1912 the independence of Albania, the crown being offered to the Prince of Wied in Feb. 1914. On Sept. 3 1914 the Prince, besieged in his capital, Durazzo, by the insurgents, had to leave Albania.

Albania during the World War.—At the very beginning of the World War, the Greeks occupied Southern Albania and the Italians the port of Valona. In 1915 the retreating Serbian Army passed through Albania towards the Adriatic coast, and in the spring of 1916 the Austrian Army penetrated Northern Albania as far as Berat, while the Italian troops, after Italy's entry into the War, pushed back the Greeks and took possession of Southern Albania, effecting their junction with the French Army coming from Salonika. Albania had become a battlefield.



The Country after the War.—After the Armistice, Albania was practically occupied by the Italian Army, but in Jan. 1920 a national Albanian Congress assembled at Lushna in Central Albania and nominated a provisional government, which aroused the country against the Italian occupation. Under the Treaty of Tirana, Aug. 3 1920, Italy recognised the Albanian Govt. and evacuated Albania, with the exception of the waterless island of Saseno (originally a part of the Ionian Is. ceded to Greece in 1864, and by Veniselos to Albania) commanding the roadstead of Valona. Albania was admitted a member of the League of Nations on Dec. 17 1920.

The frontiers of the new state were still in doubt. The Treaty of London (May 17 1913) between Turkey and the Balkan States had left delimitation to the Great Powers, but the Northern Epirotes refused to become Southern Albanians and proclaimed an "autonomous" government in 1914. The Corfu Conference (*see* CORFU) decided that question, but only the Albano-Greek frontier had been determined when the World War broke out. There was incessant trouble in 1920 on the Yugoslav frontier, and Yugoslav troops remained in occupation of part of the territory claimed by Albania. Both Greeks and Yugoslavs contended that the decisions of 1913 were irrelevant to post-War conditions. The proclamation of an independent "Mirdite" republic in Northern Albania in 1921 was declared by the Albanians to be the fruit of intrigues conducted from Belgrade. Albania brought up the frontier question to the Assembly of the League of Nations, which decided (Oct. 2 1921) on sending a mission of inquiry. Incursions by Yugoslav troops led to a situation so dangerous that the British Govt. took prompt action (Nov. 7 1921) asking for an immediate meeting of the Council of the League.

Before the meeting took place (Nov. 16) the Yugoslav troops were, however, withdrawn, and in the short interval the Council of Ambassadors had adopted a decision fixing the main outlines of the Albanian boundaries, and leaving the detail to a delimitation commission working on the spot. In its special session (Nov. 18) the Council of the League confirmed this proposal, with the acquiescence of Yugoslavia. The work of the commission was difficult and prolonged, and led indirectly to a serious international incident when the Italian Gen. Tellini, engaged in delimiting the Greco-Albanian frontier, was murdered on Greek territory (Aug. 27 1923). But friendly relations were established with Belgrade and eventually with Athens and Angora. In 1923, however, the Council of the League of Nations had again to intervene between Greece and Albania over a dispute arising on the protection of Albanians during the Turco-Greek exchange of populations. No less than 20,000 Albanian Moslems were said to be affected.

Internal Politics.—The first Albanian Parliament met on March 8 1921. The internal situation of Albania was excessively disturbed throughout 1921 and 1922. Governments succeeded each other in rapid succession, and on March 8 1922 Elez Yusuf, at the head of a band of rebels, established himself in Tirana, and civil war was only prevented by the friendly mediation of Sir Harry Eyres, the British minister. A period of comparative tranquillity followed, in which Ahmed Zogu maintained power almost uninterruptedly. But he was shot at and wounded in the corridors of the Parliament House on Feb. 23 1924 and a new Govt. was formed. In June, Southern Albania revolted, and Ahmed Zogu and his friends fled to Belgrade and Corfu.

The leader of the Democratic and Liberal party, Bishop Fan Noli, said to be a Greek from near Adrianople, declared that the revolution was directed against the corruptness of the late administration and the retention of feudal privileges. The Chamber was dissolved, but no new elections were held. But before the year was out an insurrection, instigated by Ahmed Zogu, broke out in Northeastern Albania. Ahmed Zogu once more entered Albania, reaching Tirana on Dec. 24. Fan Noli and his supporters fled to Italy. He declared that the Yugoslav Govt. had supported Ahmed Zogu, an accusation emphatically denied from Belgrade. Ahmed Zogu declared for a republic (Albania had been nominally under a Council of Regency) and sought the "moral assistance" of the Italian Govt. in establishing a political stability. The Constituent Assembly elected him president of the new republic for a period of seven years in Feb. 1925. The new Govt. was not at first acknowledged by Italy, but nevertheless a group of Italian financiers provided the capital for the new National Bank of Albania. On Oct. 14 the Albanian Congress ratified the delimitation of the boundary with Yugoslavia.

II. SOCIAL AND ECONOMIC CONDITIONS

According to whether they live north or south of the river Shkumbi, the Albanians are called Gegs and Tosks, the latter having attained a more advanced state of civilisation. The social organisation of Albania, with its clans and tribes, recalls that of feudal Europe. The cohesion of the Albanian family is very remarkable.

Albania is divided into nine prefectures, called after the principal centres of population:—Argyrokastron, Berat, Dibra, Durazzo, Elbasan, Koritsa (Korça), Kosovo, Scutari (Shkodra), Valona. In 1923, 562,010 of the population were Moslems; 169,000 Orthodox Greek; and 85,600 Catholic. The Moslems, who represent 69 % of the population, are in the majority in all prefectures, except in that of Argyrokastron, where the majority is Orthodox, and in that of Scutari, where Catholicism is predominant. Orthodox Christians are numerous in the regions of Koritsa, Berat and Valona, while the prefectures of Dibra, Durazzo, Elbasan and Kosovo are almost entirely Moslem.

The principal towns, in order of importance, are: Koritsa, 25,598 inhabitants; Scutari, 21,580; Argyrokastron, 12,400; Tirana, the capital, 10,845; Elbasan, 10,400; Berat, 8,000; Kavaja, 6,307; Valona, 5,942; and Durazzo, 4,785.

Religion.—The Albanians are extremely tolerant in religious matters. In 1923, the Moslem Congress at Tirana broke with the Caliphate, and proclaimed the religious autonomy of Albanian Moslems. After the Congress of Berat in 1922, the Albanian Orthodox Church constituted itself an independent church, with the consent of the Patriarch of Constantinople. This church has four metropolitans, at Durazzo, Berat, Argyrokastron and Koritsa. At Scutari the Catholics have an apostolic delegate and an archbishop. The country is divided into five Catholic bishoprics.

Education.—Under the Turkish domination, which prohibited teaching in the Albanian language, the Albanians remained in ignorance. The new state has succeeded in creating public instruction of all degrees. There are now in Albania 440 primary schools; 14 continuation schools; a teachers' training college at Elbasan; a school of agriculture at Lushna; a technical school at Tirana; an Albanian college at Scutari; and a French college at Koritsa.

Finance.—Albania is economically a backward country, and the state revenues, about 20,000,000 gold francs a year, are hardly sufficient to meet the cost of administration and the still rudimentary organisation of public services. Its economic development will only be possible with the aid of foreign capital. Albania has practically no external debt.

Production.—Albania is a primitive country. Almost the whole population is engaged in agriculture and cattle-raising. Each household attempts to produce all the necessaries of life for its own purposes, including flax, wool and leather, for clothing.

Albania is a mountainous country, a great part of its area being over 3,000 ft. above sea-level, the north and south offering vast districts unfit for cultivation. But the central region, the littoral, the shores of the great lakes, together with many wide valleys and high plateaus in the mountain districts, can be cultivated. The coast region is indeed very fertile, but it is for the greater part uncultivated, and indeed uninhabited, on account of the marsh-fever arising from the undrained marshes. In Northern and Central Albania, only about one-tenth of the arable land is under crops. In the northern mountains, land is held in common by families, the pastures being the collective property of the tribes. In the centre are found the large estates of the Albanian beys. The state moreover possesses a vast stretch of land in this region. South Albania is the best cultivated region.

Albania possesses vast forests of oak, walnut, chestnut, elm and plane trees; and in the high regions forests of beech, pine and fir. These forests are almost exclusively owned by the communes and by the state. The Germans began a timber industry in the forest of Mamuras, north of Durazzo.

Mines.—The mineral wealth of Albania, thought to be considerable, is not yet exactly known, no geological survey having yet been made. The results of the investigations made by the Austrians during the War have not been published. Almost the whole strip of coastline, about 40 m. wide, shows indications of the presence of hydro-carbons. Asphalt and bitumen are worked at Selenitsa, near Valona, by a French company. During the War, the Italians used a petroleum well in the same region. Petroleum concessions were granted to the Anglo-Persian Oil Co. and to the Italian railway lines connected with the Standard Oil Company. Coal seams exist in the regions of Tepeleni, Koritsa and Tirana; and there is iron in the basin of the Fani, near Scutari, and in the Tepeleni district.

Communications.—The ports of San Giovanni di Medua, Durazzo and Valona are good natural harbours, but they have not been developed. With the exception of the Bojana, which is the outlet of the lake of Scutari to the Adriatic, there are no navigable rivers. Since the recovery of her independence Albania has begun to construct much needed roads. In 1925 there were about 720 m. available for motor traffic. There are no railways of normal gauge, though during the War the Austrians constructed "Decauville" lines from Scutari to Durazzo, Lushna and Berat, with branches to Tirana, Elbasan and Fieri. These lines still exist for the most part, but need repair. The line from Durazzo to Tirana is used for the carriage of materials needed for the repair of that route. Early in 1925 a German-owned aeroplane service was started between Scutari, Tirana, Koritsa and Valona.

Trade.—In 1924, Albania imported textiles, cereals, sugar and coffee to the value of 20,489,000 gold francs, three-fourths of which came from Italy. Exports amounted to the value of 12,379,000 gold francs, consisting principally of olives, olive oil, skins, cheese, eggs and bitumen. The greater part of this export trade went to Italy (4,900,000 gold francs). The maritime communications consist of two Italian steamship lines.

Currency.—Albania has neither metallic nor paper money of her own. The unit is the gold franc, but payments are made in napoleons (20-franc gold pieces and 8-florin Austrian gold pieces) and in crowns (silver Austrian money). In Sept. 1925 there was formed the National Bank of Albania, with a capital of 12,500,000 gold francs, of which 51 % was subscribed by an Italian group. This bank has the right to issue bank notes. (*See* LEAGUE OF NATIONS.)

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(A. C.)

ALBANY, N.Y., U.S.A. (*see* 1.489), had a population of 113,344 in 1920, of whom 17,695 were foreign-born. Of the native-born an exceptionally high proportion (91·8%) were natives of the state. The population in 1925 was 117,820, according to the state census. The varied output of Albany's factories rose in value from $22,826,000 in 1909 to $45,455,000 in 1919, and, after a slight recession in 1921, to $53,026,337 in 1923. The deepening of the Hudson river authorised in 1925 will give a 27 ft. channel from Albany to New York City and Albany will become virtually a seaport. The railway yards under construction (1925) by the New York Central Railroad in the "capital district" at an expenditure of about $20,000,000 will be the largest in the world. The Quentin Roosevelt Memorial Aviation Field, maintained by the Chamber of Commerce on Westerlo I., is accessible to hydroplanes as well as to aeroplanes. A tract west of the state Capitol was added to the parks of the city in 1921 and was opened in 1924. A zoning ordinance was adopted in 1924. In June 1924 Albany celebrated its tercentenary in a three-day festival.

ALBERT I., King of the Belgians (1875–), was born at Brussels, April 8 1875, the younger son of Philip, Count of Flanders (1837–1905), who was a brother of Leopold II., and Princess Marie of Hohenzollern. The other children of this marriage were Baldwin (b. 1869), Henriette, afterwards Duchess of Vendôme (b. 1870), a daughter who died in infancy, and Josephine, afterwards Princess Charles of Hohenzollern (b. 1872).

The premature death of Prince Leopold, only son of Leopold II., on June 22 1869, made Prince Baldwin heir presumptive to the Belgian crown, but on his death on Jan. 23 1891, Prince Albert became next in the line of succession. He was carefully educated, and showed a marked taste for engineering and mechanics, studying both naval and aerial construction. He received his training in military matters at the École Militaire under Gen. Jungblut, and also became a thorough sportsman, taking much interest in mountaineering and later in aviation. He served as an officer in the Grenadier regiment. On Oct. 2 1900 he was married at Munich to Elisabeth (b. July 25 1876), second daughter of Duke Charles Theodore of Bavaria. Three children were born of this marriage, Leopold, duke of Brabant (b. Nov. 3 1901), Charles, count of Flanders (b. Oct. 10 1903) and Marie José (b. Aug. 4 1906).

Prince Albert also travelled widely, paying a visit to America in 1898, and in 1908 visiting England in order to study naval construction. In April 1909 he went to the Belgian Congo. This visit was of great educational value. Starting from the Cape, he visited the Cape province and the Transvaal, going from there to Elisabethville. Thence he traversed the Katanga mineral region and followed the course of the Congo to its mouth. He returned to Belgium in Aug. and three months later King Leopold died.

Albert as King.—On Dec. 1 1909 Prince Albert took the oath of fidelity to the Belgian constitution and became king under the name of Albert I. Before his accession he had evinced a genuine interest in the welfare of his people and on his own initiative had founded a training institute for fishermen and pilots. By this means he sought to develop that class of seamen indispensable to the merchant fleet which he desired his country to possess. In his speech from the throne the King emphasised his care for the people's welfare in the words: "Our prosperity depends upon the prosperity of the masses." He occupied himself more especially with the organisation of the army and in May 1913 gave his assent to the law which was designed to secure for Belgium an army of 350,000 men. He also interested himself in various social and legal reforms, while his scientific tastes did not prevent him from becoming a friend of art and literature. The economist Waxweiler, the poet Verhaeren and the painter Laermans, were on friendly terms with the royal family, the latter receiving personal attention from the Queen when he was threatened with the loss of his sight.

Albert was anxious to preserve friendly relations with neighbouring states and after 1910 paid official visits both to Berlin and Paris. On Nov. 5 and 6 1913 the King, who had been appointed honorary colonel of the regiment of Hanover Dragoons, visited Germany for the second time. At a reception in Potsdam, the Emperor William II. and Gen. von Moltke informed him that they considered war with France imminent. The King gave warning of this to the French ambassador in Berlin through his own Minister Plenipotentiary, Baron Beyens. On July 31 1914, when the European crisis came to a head, the King wrote a personal letter to the German Emperor, reminding him of the respect due to Belgian neutrality. Germany replied by the ultimatum of Aug. 2, which in turn was answered by a *fin de non recevoir* and hostilities began.

The King in the Field.—The King took command of the troops and established his headquarters first at Louvain and afterwards at Antwerp. He directed in person the first advance from Antwerp towards Louvain which was intended to relieve the French and British armies engaged with the forces of Kluck and Bulow. After the fall of Antwerp, the King and Queen sent their children to England, while they themselves accompanied the retreating army; when it came to a halt on the Yser they took up their residence at Furnes. From Oct. 17 to 24 the Belgian Army, under the King's command, withstood the German invasion without any Allied assistance. During the whole of the War he remained with the troops, having his headquarters at La Panne, where he was exposed to the risk of enemy bombardments. He made continual visits to the front-line trenches, and even surveyed the enemy's lines from an aeroplane. The Queen remained with him, acting as a nurse in the Hôpital de l'Océan at La Panne. She also interested herself deeply in the welfare of the soldiers in the trenches, and superintended the establishment of canteens and aid posts. Prince Leopold, King Albert's elder son, lived, by his father's wish, the life of a simple soldier in the 12th Regiment. The sovereigns never left Belgian territory except to visit the French troops entrenched in Champagne and the British troops before Ypres. It was only after the War had ended that the King, accompanied by the Queen, crossed the Channel in an aeroplane to visit the King and Queen of England.

When the general offensive of Oct. 1918 was undertaken, Albert was appointed commander of the northern army groups, consisting of both Belgians and French, which captured the forest of Houthulst, "the Flandernstellung," Thourout, Ostend and Bruges, and forced the passage of the Lys. On Nov. 11 1918 the King and Queen made their entry into Ghent, and on Nov. 22 into Brussels, being received with enormous enthusiasm. Even before the signing of the Armistice the King had summoned at Lophem a number of politicians, and arranged a new government containing representatives of the three more important Belgian political parties. After a triumphant reception by

Parliament, the King made a speech from the throne, in which he appealed that all parties should work together for national reconstruction, while, addressing himself to the Allies, he asked for the abolition of Belgian neutrality and of the treaties of 1839 which had left Belgium open to invasion. After the Armistice King Albert declined the augmentation of his civil list. He occupied himself actively with the improvement of conditions in his country, visiting the devastated areas, and contributing considerable sums to "King Albert's Fund," which was devoted to providing temporary shelter for sufferers from the War. He also undertook journeys to Brazil, Spain, France, the United States and England, with the object of studying trade conditions and finding new outlets for Belgian commerce. The popularity of the King and Queen, great even before the War, steadily increased, even the Socialist party taking many opportunities of expressing feelings of respect towards the royal family. In 1923 the Queen visited Morocco and in the following year Egypt. In 1925 the sovereigns took a long voyage to India. During this trip occurred the celebration of their silver wedding and on their return to Brussels large crowds assembled to give them a most enthusiastic reception.

In the matter of his children's education, the King sought to preserve the links of friendship between Belgium and her former allies. Princess Marie José was sent to Florence for the completion of her education, Prince Charles became a midshipman in the British Navy, while a French tutor was appointed to Prince Leopold, the heir to the throne. Particular care was bestowed upon Prince Leopold's education. He studied French and Flemish literature, history, law, economics and philosophy under professors chosen by the King, while Cardinal Mercier directed his studies in metaphysics and moral science. Like his father, the Prince entered the Military Academy and after two years of study was promoted sub-lieutenant of Grenadiers. He then took a year's course at the faculty of philosophy in the University of Ghent, where his studies in history came under the supervision of Prof. Pirenne. At the same time he made a regular study of foreign policy with M. Jaspar, Minister for Foreign Affairs. In 1925 the King arranged for him to make an educational tour to the Congo.

The King did not cease to interest himself in Belgian expansion and colonisation. He expressed a desire to preside in person at the Colonial Congresses of 1920 and 1926 and made important speeches on those occasions. He was actively interested in the development of the Belgian mercantile marine. As before the War, he continued to support the intellectual development of his country. After the War he made official visits to the state universities of Ghent and Liége. In Jan. 1926 King Albert, who had been given honorary degrees by many universities, was elected a member of the *Institut de France.* His solicitude for the welfare of his people was unfailing and, during the floods which ravaged Belgium in Dec. 1925, he and his Queen lost no time in succouring the distressed inhabitants of the inundated districts. (*See* BELGIUM.)

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(H. P.)

ALBERTA (*see* 1.499).—The population of the Canadian province of Alberta in 1921 was 588,454, an increase of 57·22% over 1911. The rural population amounted to 365,550 and the urban to 222,904. The principal groups were English, 180,478; Scotch, 96,062; Irish, 68,246; Scandinavian, 44,038; German, 35,333; French, 30,913; Ukrainian, 15,251; Russian, 21,212; Austrian, 19,430; Indians, 14,557. The Legislative Assembly consists of 60 members, with an executive council chosen from the Legislature. The province is represented at Ottawa by 16 Members of the House of Commons and six Senators.

Agriculture.—Agriculture is the predominant industry in the province. Southern Alberta is of true prairie character. Northern Alberta is to a large extent wooded and enjoys a greater rainfall. Land in the foothill country continues to be devoted to ranching. The wheat yield in Alberta for 1923 was 144,834,000 bu.; oats, 114,977,000; barley, 14,774,000 and rye, 7,640,000 bu. Figures for farm live stock for the same year were horses, 829,143; cattle, 1,520,924; sheep, 239,174; swine, 706,681; poultry, 6,630,163. The production of creamery butter amounted to 17,868,853 lb. The farmers of Alberta are strongly organised and have developed powerful co-operative organisations and pools to market their products.

Mining.—The coalfields of Alberta are the most extensive and valuable in Canada. Anthracite and semi-anthracite appear in relatively small deposits, but every other grade, from the best bituminous to ordinary brown coal or lignite, is found. In 1923, 6,854, 397 tons were mined. Natural gas is found at many points and is extensively used for power, fuel and light. A widespread search has been conducted for oil and the outlook is considered excellent. The tar sands of northern Alberta are a striking feature in the geological resources of the province. There are also large deposits of salt in the north.

The principal manufacturing industries are flour-milling and those associated with slaughtering and meat production and lumbering. Fur trading is still an important industry in the northern part of the province. The province is well served with railways. In recent years large shipments of grain have been made to Europe via Pacific ports and the Panama Canal. Alberta was the first province in Canada to own and operate a telephone system of its own. (*See* CANADA.) (D. A. McG.)

ALBERTINI, LUIGI (1871–), Italian journalist and politician, was born at Ancona, Oct. 19 1871, and after graduating in law took to journalism. In 1896 he joined the staff of the Milan newspaper, *Il Corriere della Sera,* and, in 1909, became editor and chief proprietor. Under his guidance *Il Corriere* became the foremost journal in Italy. In 1914 Albertini was nominated Senator and showed himself a convinced interventionist. After the War *Il Corriere* was steadily anti-Socialist, and Albertini at first sympathised with Fascismo but when the movement began to aspire to seize power by violence he opposed it. When the Black Shirt *squadre* occupied Milan they forced *Il Corriere* to suspend publication, but Mussolini afterwards revoked the suspension. In Parliament Albertini made several important speeches against the Govt. and, after the Matteotti affair, against Mussolini in particular. His paper was frequently confiscated under a decree restricting the liberty of the Press. In Nov. 1920, owing to the difficult position of *Il Corriere,* the company was dissolved, Albertini bought out and a new director appointed.

ALCOHOL (*see* 1.525).—The manufacture of alcohol for industrial purposes and as a source of power has developed greatly on both sides of the Atlantic since 1910.

I. INDUSTRIAL ALCOHOL

Large quantities of duty-free alcohol are used in Great Britain in trade under conditions laid down by statute and administered by the Commissioners of Customs and Excise. The policy of that department enables alcohol to be used in industry with the minimum of restriction, while the revenue is safeguarded against loss from the use of alcohol for drinking or making perfumes by the addition of denaturants such as crude wood naphtha, whose main constituent, methyl alcohol, is difficult to remove from ethyl alcohol even by distillation, and can be detected by several very delicate tests. In more recent times other nauseating ingredients, such as pyridine, have been added for the same purpose.

Apart from its consumption as a beverage, the largest usage in Great Britain is for domestic and industrial purposes, for which, as the circumstances warrant, the alcohol is denatured according to certain general and special formulae, or it may be pure. At present 6,000,000 bulk gallons are used for these purposes. These natures of alcohol are free from duty, but must not be employed in the preparation of an article capable of use as a beverage or internally as a medicine. In many countries it is the custom to publish a large number of formulae for denaturing alcohol to be used for various purposes. In Great Britain, however, the published formulae are few in number, but to meet the requirements of specific industries the Board of Customs and Excise can prescribe denaturants other than the usual ones, many of these being ingredients or intermediate products connected with the process in question.

Grades Used.—The following are the specified grades of alcohol used for industrial purposes:—

Mineralised methylated spirits (1) (2) (4) (9) (11) consist of a mixture of 90 parts by volume of ethyl alcohol, $9\frac{1}{2}$ parts of wood naphtha, and one half part of crude pyridine, together with $\frac{3}{8}$ths of 1 gallon of mineral naphtha or petroleum oil and $^1/_{40}$th of an ounce of methyl violet dye in each 100 gallons of the mixture.

Power methylated spirits (8) (9) (10) prepared in accordance with the following formula: 92 parts of alcohol, 5 parts of benzol, one half part of crude pyridine, and $2\frac{1}{2}$ parts of wood naphtha, together with $^1/_{40}$th of an ounce of Spirit Red III. dye, in each 100 gallons of the mixture, are sold free of duty and restriction when mixed with 25% of petrol, benzol, denatured ether or some other substance approved by the Commissioners of Customs and Excise.

Industrial methylated spirits (1) (2) (4) (9) (11) consisting of 95 parts by volume of alcohol and 5 parts of wood naphtha, can be obtained for the arts and manufactures under the authority of the Board of Customs and Excise, under bond and certain not very onerous restrictions.

Industrial methylated spirits (Pyridinised) (11) have the same composition as industrial methylated spirits, together with one half of one part of crude pyridine.

To none of these varieties of spirits may essential oils or flavouring matters be added without the express sanction of the Commissioners.

INDUSTRIAL USES OF ALCOHOL

Mineralised Methylated Spirits.—Mineralised methylated spirits, which are largely used for burning in lamps and for cleaning purposes, are sold under licence but otherwise unrestricted and duty-free. The quantity used in a year is about 1,500,000 bulk gallons.

Power Methylated Spirits.—This is intended for use in admixture with petrol benzol or denatured ether and is issued for use by the public only when so mixed. Up to the present time a comparatively small quantity of this grade of alcohol has been used for motor traction.

Industrial Methylated Spirits.—The uses to which industrial methylated spirits are put are very varied; over 60, many of them under general headings, being quoted in the Report of the Commissioners (14). Out of a total of nearly 4,000,000 bulk gallons in 1925 (an increase of 25% over that of 1913), 2,500,000 went for varnishes, " finish, " stains and paints. By Regulations which came into force on Feb. 1 1926, " finish," having between three and sixteen ounces of gum resin in actual solution in each gallon, when offered for sale, must be made with industrial methylated spirits (Pyridinised).

Of industrial methylated spirits 250,000 bulk gallons were used in the linoleum industry, nearly 200,000 gallons for the manufacture of ether, over 130,000 for the manufacture of celluloid and collodion, 140,000 in the manufacture of soap and 120,000 for liniments and hair washes.

Smaller quantities are employed in the following manufactures: fine chemicals (81,000); dyes (68,000); medicinal extracts (53,000); photographic plates and papers (41,000); inks and printing (32,000); disinfectants and insecticides (17,000); surgical dressings (15,000); rubber (12,000); and for the following purposes: for use in hospitals (82,000); in dyeing and cleaning and in dye-works (35,000); in chemical laboratories (13,000); in arsenals and dockyards (9,000); in colleges and schools (7,000); and for preserving museum specimens (5,000).

By the regulation of Feb. 1 1926 (11) a pharmaceutical chemist may be authorised to obtain industrial methylated spirits for sale as such or as a constituent of a lotion for external use, not capable of being used as a beverage, for medical and surgical uses other than internal, and for veterinary purposes, under certain defined conditions, involving prescriptions from qualified persons, labelling bottles for external use and limitation as to quantity. Application to use industrial methylated spirits must be made through the local surveyor to the Commissioners of Customs and Excise, who consider each case on its merits. Pure, that is, undenatured alcohol, may also be permitted duty-free by the Commissioners under the Finance Act of 1902 (3) for use in the arts and manufactures, when methylated spirits are unsuitable or detrimental.

Pure alcohol is allowed to colleges and public institutions for teaching and research purposes without any onerous conditions beyond the keeping of a stock account.

Methyl Alcohol.—Methyl alcohol when pure is liable to duty, but is permitted by the Board of Customs and Excise to be used duty-free in arts and manufactures under regulations similar to those for industrial methylated spirits, and is largely used in the manufacture of formaldehyde, of methyl derivatives among dyestuffs and fine chemicals, and for the purpose of crystallisation.

Specially denatured alcohol, also free from duty, is allowed to manufacturers under restrictions compatible with the safety of the revenue, a very wide choice of denaturants being permitted. When, as frequently happens, a suitable denaturant is found in some intermediate product, or acid used or produced during the manufacturing operations, or when the alcohol is a constituent of some mixed solvent, permission is the more readily granted for its use. Thus, the Board of Customs and Excise allow the use of pure ethyl alcohol, denatured with 2% of pure methyl alcohol, in the production of insulin, without onerous excise restrictions.

Under the Finance Act of 1921 (8) an allowance of 5d. per proof gallon, equivalent to about 8d. per bulk gallon, is made on spirits used for preparing industrial methylated spirits and power

Spirits for Non-potable Uses (bulk gallons)
United Kingdom

	1913–4	1921–2	1922–3[1]	1923–4[1]	1924–5[1]
Mineralised methylated spirits	1,754,514	1,167,344	1,273,572	1,345,144	1,402,582
Industrial methylated spirits	3,253,061	2,620,779	3,120,634	3,426,344	3,865,994
Power methylated spirits	..	14,506	87,244	171,219	108,738
Other non-dutiable:—					
For arts and manufactures	434,045	236,703	352,628	401,992	411,643
For arts and manufactures (methyl alcohol)	37,869	39,214	146,353	209,111	268,738
For scientific purposes	4,538	6,407	7,420	7,260	7,424
For scientific purposes (methyl alcohol)	190	194	436	400	381
Total	5,484,217	4,085,147	4,988,287	5,561,470	6,065,500

[1] Great Britain and Northern Ireland only.

France

	1922	1923	1924
Alcohol submitted to denaturation	12,067,946	14,843,290	17,150,012

Germany

	1919–20	1920–1	1921–2	1922–3
Delivered for industrial and other purposes	18,105,450	14,837,548	28,042,454	16,910,564

methylated spirits, or on spirits received for use in the arts and manufactures.

A rebate under the Finance Act of 1920 (5) (6) (7) (12) (13) amounting to 80% of the present duty is made in the case of duty-paid spirits used for medical purposes, such as the preparation of tinctures, etc., and for scientific purposes in chemical laboratories.

References.—Laws. Spirits Act 1880, 43 & 44 Vict. Ch. 24, S.S. 116 to 132; Customs & Inland Revenue Act 1890, 53 & 54 Vict. Ch. 8, S. 32–34; Finance Act 1902, 2 Edw., VII., Ch. 7, S. 8; Revenue Act 1906, 6 Edw. VII., Ch. 20, S. 1 & 2; Finance Act 1915, 5 & 6 Geo. V., Ch. 62, S. 2; Finance Act 1918, 8 & 9 Geo. V., Ch. 15, S. 4; Finance Act 1920, 10 & 11 Geo. V., Ch. 18, S. 4; Finance Act 1921, 11 & 12 Geo. V., Ch. 32, S. 15–16; Finance Act 1924, 14 & 15 Geo. V., Ch. 21, S. 13; *Regulations*—The Power Methylated Spirits Regulations, 1921; Spirits (Medical Purposes) Regulations, 1924; Spirits (Scientific Purposes) Regulations, 1924; The Methylated Spirits (other than Power Methylated Spirits) Regulations, 1925; Annual Reports of Commissioners of Customs & Excise. (R. R.*)

Industrial Alcohol in the United States

An alcohol, from a chemical standpoint, belongs to a class of substances containing, in their molecular structure, one or more replaceable hydroxyl (OH) groups; thus, methanol (wood alcohol), butanol (butyl alcohol), glycerine, phenol (carbolic acid), etc., are all alcohols. Commercially, the term "alcohol" refers to the well-known ethyl (grain) alcohol, produced by the fermentation of the sugar or starch content of vegetable substances such as molasses, grain, cane, potatoes, fruit juices, etc.

Ethyl alcohol, next to water, is the most important and generally used solvent in industry, and is a basic material for the manufacture of a wide variety of products essential to daily life, such as artificial silk and leather, flavouring extracts, varnishes, photographic films and over 300 other products in 4,759 factories in America.

Legislation.—The principle of taxing and regulating alcoholic beverages is fundamental in all civilised countries, and this principle is applied to alcohol itself until industrial needs achieve special legislation, granting tax-free alcohol for industrial purposes. The laws and regulations of the U.S. Govt. providing for tax-free alcohol for industrial purposes were first effective in 1907. The policy of protecting these industries was further confirmed with the advent of national prohibition in the law of 1919, entitled "An Act to prohibit intoxicating beverages, and to regulate the manufacture, production, use and sale of high-proof spirits (alcohol) for other than beverage purposes, and to ensure an ample supply of alcohol and promote its use in scientific research and in the development of fuel, dye and other lawful industries."

Special Exemptions.—The United States laws exempt from tax pure alcohol used by the Federal, State and municipal governments, by educational institutions, hospitals and in scientific research. Alcohol for public distribution and for industrial uses is also tax-free when legally denatured, *i.e.*, when mixed, under Government supervision, with specified materials which shall render the alcohol, or any compound in which it is authorised to be used, unfit for use as an intoxicating beverage.

Denaturation.—Completely denatured alcohol, intended for unrestricted sale and distribution, is effected by the addition of a small quantity of such a material as wood alcohol or kerosene. Six different formulae for completely denatured alcohol are now in public use. Specially denatured alcohol, on the other hand, is designed for distribution to approved manufacturers, under regulations, protected by a bond to guarantee the faithful performance of the conditions stipulated by the Government. In such alcohol only those denaturants are used which will not materially interfere with the special manufacturing use to which the alcohol is to be put. Seventy-four formulae for specially denatured alcohol have been authorised by the Government for over 300 different uses.

The development of the great group of chemical industries based upon an abundant and cheap supply of industrial alcohol may be directly measured by the growth of the production of industrial alcohol. Since tax-free denatured alcohol for industrial uses was first made available in the United States in 1907, the steady growth of this industry, and by comparison those industries using industrial alcohol, may be illustrated by the table in first column from official sources.

Fiscal Years	Denaturing Plants	Completely Denatured	Specially Denatured
		Wine Gallons	Wine Gallons
1910 . .	12	3,076,924·55	3,002,102·55
1915 . .	23	5,386,646·96	8,599,821·81
1920 . .	52	13,528,402·99	15,307,947·18
1921 . .	67	12,392,595·02	9,996,229·90
1922 . .	77	16,193,523·60	17,152,224·31
1923 . .	76	27,128,229·54	30,436,913·14
1924 . .	83	34,602,003·72	33,085,292·04
1925 . .	91	46,983,969·88	34,824,303·28

The saccharine and starch materials used for the manufacture of industrial alcohol in the United States, and the relative proportions of each for the year ended June 30 1925, are as follows: rice, 682,690 lb.; starch, sugar and syrup, 8,107,258 lb.; miscellaneous materials, 145,071 bu.; molasses, 203,270,135 gal.; corn (maize), 7,200,818 bu.; rye, 96,793 bu.; raisins, 96,170,629 lb.

The greater portion of the molasses used in America as the raw material for industrial alcohol is imported in tank steamers from the West Indies. (M. C. W.*)

II. FUEL ALCOHOL

Whilst alcohol is applied in motor-engines in a similar manner to petrol, its vapour mixed with a proper proportion of air being drawn into the cylinder where it is compressed and ignited, it cannot be used with maximum efficiency by itself in engines such as are fitted to modern motors because it requires a higher degree of compression than petrol engines are usually designed to stand, and also because, unless special arrangements are made, a motor-engine will not start readily from the cold with alcohol alone. For these reasons alcohol has not been used to any extent in petrol motors. Mixing with benzol or petrol, or with ether in varying proportions, enables it, however, to be employed successfully in them, until such time as engines specially designed for its use are available. In the event of its production being a commercial possibility it should, therefore, form a valuable addition to the liquid-fuel resources of the world.

Miscibility.—Alcohol of the strength usually employed as a liquid fuel, viz.: 95% by volume, will mix with ether in all proportions and motor fuels consisting of alcohol and ether are in use, *e.g.*, Natalite. Alcohol will not, however, form a stable mixture with benzol or petrol under all conditions of temperature. Increased miscibility at low temperature can be obtained by the addition of a third substance, and higher alcohols, of which butyl and amyl alcohol are the best, and many other liquids, have been patented for the purpose and of these extended trials have been made.

Absolute Alcohol.—If, however, anhydrous or absolute alcohol is employed, then miscibility with petrol is obtained under all practical conditions of use. The production of absolute alcohol has been considerably developed since 1921, and several processes, for the most part using either solid or liquid dehydrating substances, have been invented and some of them have been applied on a technical scale. As a solvent it is more valuable than the ordinary industrial alcohol of 95% strength, and it is especially suitable for the manufacture of nitro-cellulose varnishes. In the years that followed the World War this was coming into use on a considerable scale.

Production Processes.—Alcohol is produced by fermentation from vegetable substances containing starch or sugar, from fermentable sugars produced by the hydrolysis of cellulosic bodies, and synthetically from calcium carbide and from the ethylene contained in coal and coke-oven gases. The vegetable substances may be divided into foodstuffs and non-foodstuffs. If foodstuffs are to be employed it must be possible to grow them in excess of food requirements, and at a cost low enough to ensure that the price of the alcohol shall be about the same as that of other liquid fuels.

Alcohol is produced from molasses in British Guiana, Canada, India, Natal, Queensland, Guatemala, the Hawaiian Is., from potatoes in Germany and Czechoslovakia, from the Mahua flower (*Bassia latifolia*) in India, from maize in Natal, and in New Zealand from waste potatoes, grain, fruit and various shrubs and roots. In Queensland cassava, sweet potatoes, arrowroot and other starch-bearing plants are used.

Research Work.—In a memorandum issued in 1925 by the Fuel Research Board of the Dept. of Scientific and Industrial Research, a British official body, the possibilities of using potatoes, mangolds and Jerusalem artichokes as raw materials for the production of alcohol for power purposes in Great Britain were discussed. Of the three materials, the Jerusalem artichoke was considered to be the most likely, since by treatment of the stalks, a pure, resistant cellulose could be obtained suitable for certain purposes.

Research work is in progress to discover a process that can be worked on a commercial basis in those regions where non-foodstuffs, or cellulosic materials, such as grasses, reeds, straws, peat, waste wood, sawdust, etc., exist in sufficient abundance.

Recent experiments on the hydrolysis of the cellulosic materials have indicated that a soaking of the material in dilute acid can be substituted for an acid hydrolysis under pressure, thus obviating the necessity of using acid-resisting autoclaves and therefore removing some of the difficulties attending the commercial application of the process. The fermentable sugars (pentosans) produced in this way, when fermented, give an alcohol-acetone liquid in the proportion of about 90% alcohol to 10% acetone, a more efficient motor fuel than alcohol alone. The yield of this liquid varies from 15 gal. to 20 gal. per ton, according to the raw material. The production of power alcohol from waste materials, which can be collected and treated at low cost, offers probably the best chance of the solution of the problem of the supply of an alternative liquid fuel for internal combustion engines.

Its manufacture from carbide is only possible where very cheap power is available, and its conversion from the quantities of ethylene removable from coal and coke-oven gas, even should a cheap process be worked out, is not likely to add very materially to the world's liquid-fuel supplies.

Foreign Countries.—Argentina has a *Carburante Nacional* composed of 50% of 98·4% alcohol, and 50% petrol by volumes. Czechoslovakia produces a composite fuel known as *Dynalcol*, a mixture of approximately 3 parts of alcohol to 4 parts of benzol, the latter obtained from the coke and gas industries. In 1923 the production of alcohol in Denmark was 4,980,000 litres; in 1924 it was 6,420,000 litres. In Feb. 1923 a law was passed in France prescribing a "Carburant National." It requires all importers of petrol, benzol, benzene, toluene and coal distillation products, either alone or mixed, in order to obtain importation licences, to purchase from the state a quantity of absolute alcohol corresponding to a minimum of 10% on the quantity of petrol, etc., imported during the preceding month. The alcohol is to be used exclusively in motor fuels. By a decree of May 31 1923, the composition of alcohol-petrol mixtures for sale must consist of not less than 95 and not more than 105 parts by volume of absolute alcohol to 100 parts by volume of hydrocarbons. The law has, however, become inoperative because users of the *Carburant National* are not satisfied with it, and it entails a considerable loss to the state.

Recovery in the alcohol industry in Germany awaits a restoration of the potato production to something like pre-War standards, when about 75% of the alcohol made was distilled from potatoes, of which 2,500,000 tons, unsuitable for other purposes, were utilised, producing an average of 77,000,000 gal. annually. The price which alcohol manufacturers may offer for potatoes is limited by the Government in the interest of conserving the potato crop for human and animal consumption. Meanwhile, the available potatoes are being supplemented by the importation of Indian corn. The national liquid fuel in Germany *Reichskraftstoff* is composed of 25% alcohol, 50% motor benzol and 25% tetralin (Tetrahydronaphthalene). In Greece industrial alcohol is made in large quantities from currants. It is used for domestic illuminating, heating and cooking, for street lighting, etc. In the Hawaiian Islands the surplus of molasses is used to some extent for the production of alcohol for domestic purposes and for use in internal-combustion engines.

In Japan there are one or two motor fuels of which alcohol is an ingredient to about 50%. There are three plants in the Philippines for the manufacture of alcohol, and two liquid fuels are produced from it. One is a mixture of alcohol and ether, the other a mixture of alcohol and petrol. The introduction of absolute alcohol will facilitate its use with petrol as in the case of the "Carburant National" in France. In Sweden a mixture of 25 parts of alcohol, obtained from sulphite lyes, and 70 parts of benzol is being sold under the name of "Bentyl" for use in motors. (F. L. N.)

ALDANOV, MARK ALEXANDROVICH (1889–), Russian novelist and publicist, also known as Landau-Aldanov, was born in Kiev Oct 26 1889. He joined the Socialists and, after the Bolsheviks, in 1917, overthrew the Kerensky Govt., left Russia for Paris, where by his writings, both in French and Russian, he soon won a reputation. His most considerable work is a trilogy, *The Thinker*, of which in 1926 less than half had appeared, and in which the French Revolution is treated with learning, understanding and philosophy. He also discusses in *Armageddon* (1915) the World War, but here shows himself more elegant than precise. Studies of Tolstoi and Lenin are more thoroughly executed. Although Aldanov lacks the grand epical imagination of a Tolstoi and the wide sympathy of a Dostoievsky, he is not unworthy to be ranked as their successor. He avoids the sheer morbidity of the later Russians; he has something to say and says it well. Moreover, he brings to his treatment of the French Revolution the personal experience of a disappointed "Girondin."

ALDRICH, NELSON WILMARTH (1841–1915), American politician (*see* 1.536), died in New York April 16 1915.

ALEPPO (*see* 1.541) has an estimated population of 140,000. There is a European colony there, and the native industries, except that of carpet-making, have given place to European manufactures. The silk trade is important and the exports are mainly raw products. Railways were opened shortly before the World War to Aleppo, which is now connected with Nisibin toward Mosul and with Adana and Mersina in the west, besides the older line connecting with the one between Beirut and Damascus. Aleppo is in Syria (*q.v.*) under the French mandate (*q.v.*).

ALEXANDER (1893–1920), King of the Hellenes, second son of King Constantine and Queen Sophia, was born Aug. 1 1893 and ascended the throne of Greece on the dethronement of his father, June 14 1917. The Govt. itself was for the time in the hands of Venizelos, who had the confidence of the Allies. But the defeat of Germany, and Venizelos's diplomatic triumphs at the Peace Conference, seemed to breathe a new spirit into the young King. From the day of his triumphal entry into Adrianople, he took an active personal interest in the prospect of being the ruler of Greater Greece until his sudden death on Oct. 25 1920, by blood poisoning from the bite of a pet monkey, put a sudden end to all such expectations. In Nov. 1919 King Alexander made a morganatic marriage with an Athenian lady, Aspasia Manos; and after his death a daughter was born to her in Paris on March 25 1921. On Oct. 12 1922 the marriage was declared valid by royal decree, so that Alexander's daughter became her father's legal heir, though she did not thereby acquire any rights in respect of the throne.

ALEXANDER I., King of the Serbs, Croats and Slovenes (1888–), was born at Cetinje on Dec. 4 1888, the second son of Prince Peter Karagjorgjević, later King of Serbia, and of Zorka, third daughter of Prince Nicholas of Montenegro. His mother died in 1890, and during his early years he shared the exile of his father at Geneva. In 1899 he was sent to Leningrad (St. Petersburg), to be educated, and in 1904 entered the *corps des pages* at the Tsar's court. It was not till 1909, nearly six years after his father's election to the Serbian throne, that the young prince came to reside permanently in Serbia. Soon after his return his elder brother, Prince George, was obliged to renounce the succession (March 1909), owing to his unbalanced temperament, and various incidents that occurred during the Bosnian crisis; and Alexander was thereupon formally recognised as crown prince. On the outbreak of the Balkan War (1912) he assumed nominal command of the I. Army and won his spurs at the battle of Kumanovo, subsequently serving with distinction in the campaigns against Turkey and Bulgaria.

On June 24 1914 King Peter, whose health had completely broken down, appointed him prince regent, and he thus held the position of commander-in-chief when the World War broke out. He remained permanently at army headquarters, and shared with his soldiers all the privations of the retreat through Albania. On reaching the coast he fell ill and underwent a serious operation, but when already convalescent resolutely declined the proffered assistance of an Italian destroyer which had been sent to convey him across the Adriatic; he remained till all the refugees had been transported into safety, and eventually found his way on foot to Durazzo. After the exiled Serbian Govt. had established itself at Corfu, Prince Alexander and M. Pašić paid visits to Paris and London, where the prince was received with warm ovations. On April 5 1916, on receiving an important deputation of British sympathisers (led by the Archbishop of Canterbury, the Lord Mayor, Lord Milner and Sir Edward Carson), he publicly identified the dynasty with the cause of unity, expressing his conviction that in the final victory "our Yugoslav people, united in a single state, will have their part."

During the rest of the War he remained at Serbian headquarters and shared his army's victorious advance in Oct. 1918. On Dec. 1 delegates of the Yugoslav National Council in Zagreb formally recognised him as regent in all the Yugoslav provinces of the former dual monarchy, and he assumed the title of "Prince-Regent of the Serbs, Croats and Slovenes." The attempt made upon his life on June 29 1921, after he had taken the oath the previous day to the new Yugoslav constitution, was the outcome, not of any personal unpopularity, but of the subversive aims of the Communists and other revolutionary groups, who hoped to create confusion in the new state, owing to the lack of a direct heir to the throne. On Aug. 16 1921 Prince Alexander succeeded his father as King of Yugoslavia. On June 8 1922 he married Marie, second daughter of King Ferdinand of Rumania, and on Sept. 6 1923 an heir was born, who received the name of Peter.

King Alexander inherited from his father a respect for constitutional and parliamentary traditions, which was conspicuously lacking in his predecessors of the Obrenović dynasty; and his influence has been repeatedly exercised behind the scenes to smoothe down the acerbities of party strife. It was very largely due to his insistence that a reconciliation was achieved between the Serbian Radicals under M. Pašić and the Croat Peasant party under M. Radić in the summer of 1925—an event which contributed greatly towards the political consolidation of Yugoslavia. (R. W. S.-W.)

ALEXANDER, SIR GEORGE (1858–1918), British actor (*see* 1.564), died at Chorley Wood, Herts, March 16 1918. He was knighted in 1911.

ALEXANDER, JOHN WHITE (1856–1915), American painter (*see* 1.564), died in New York June 1 1915. He had been president of the National Academy of Design since 1909.

ALEXANDER, WILLIAM (1824–1911), Irish prelate (*see* 1.565), died at Torquay, Eng., Sept. 12 1911.

ALEXANDRA (1844–1925), Queen Consort of Edward VII., King of Great Britain and Ireland, eldest daughter of Prince Christian of Glücksburg, afterward King Christian IX. of Denmark, and Louise, daughter of the Landgrave William of Hesse, was born at Copenhagen Dec. 1 1844, her full name being Alexandra Caroline Maria Charlotte Louisa Julia. One of her sisters married the Czar of Russia and became the mother of the Czar Nicholas II. As a child Alexandra was brought up with simplicity and early evinced a love of music and of fairy tales, being encouraged in both by her parents' friendship with Hans Andersen. She was married to Albert Edward, Prince of Wales, afterward Edward VII., March 10 1863, and was crowned with him in Westminster Abbey, Aug. 9 1902.

Her singular beauty and charm, first celebrated in Tennyson's *A Welcome to Alexandra* (1863) when she came to England as a bride, and preserved even into old age, won her immense popularity, and her progress through the streets of London on Alexandra Day, or Rose Day, a yearly event inaugurated by her in 1912 for raising funds for the London hospitals by the selling of roses in the streets, attracted annual crowds. She had earlier shown her great interest in the care of the sick by giving her name to the Queen Alexandra's Imperial Nursing Service, organised in 1902 to supply nurses for naval and military hospitals, as well as by the gift to the London Hospital in 1899 of the first Finsen lamp for light treatment of skin diseases. Her love of country life, and especially of horses and dogs, endeared her to a nation, like herself, lovers of animals. Though she took her full share in all public ceremonials, she was happiest in her country home at Sandringham. There in Dec. 1924 she kept her 80th birthday, surrounded by her children and grandchildren, and there she died Nov. 20 1925. She is buried with King Edward in St. George's Chapel, Windsor.

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ALEXANDRIA, Egypt (*see* 1.568).—The population at the 1917 census was 444,617; in 1925 it was estimated at about 480,000, including some 100,000 foreigners, of whom Greeks, Italians, Syrians and Jews were the most numerous. Between 1910 and 1925 the amenities of the city were considerably increased, largely through the activity of the municipality. A town-planning scheme was put into operation and in 1925 Lake Hadra was drained preparatory to the creation of a garden suburb. The public gardens at Nuzha, on the Mahmudieh Canal were enlarged. Harbour accommodation was increased and a breakwater to protect the quays of the eastern harbour completed in 1916. Schemes for the further increase of harbour facilities were under consideration in 1925. Some 90% of the total external trade of Egypt passes through Alexandria, including the whole of the cotton exports. A considerable share of the former passenger traffic of the port has been taken by Port Said. The main roads have been greatly improved and a service of public motor-omnibuses established in the district.

ALEXEYEV, MIKHAIL (1857–1918). Russian soldier, was born Nov. 3 1857. Entering the army in 1876, he became a general in 1904. At the outbreak of the World War he was appointed chief of the staff on the southwestern front, and in that capacity was largely responsible for the Russian victory in Galicia in 1914. In March 1915 he took over command of the armies on the northwestern front and by his energy and ability saved them from complete destruction. Appointed chief of the general staff in Aug. 1915, he had to give up this office in Nov. 1916 on account of ill-health. From March to May 1917 he commanded the army; recalled in September by Kerenski, he attempted to mediate between Kerenski and Kornilov. Failing in this, he went to south Russia and there organised the "Volunteer" army. On the death of Kornilov in March 1918, the military command of the army was taken over by Denikin and Alexeyev became leader of the Government. On Sept. 25 1918 he died of heart disease at Ekaterinodar.

ALFONSO XIII. (1886–), King of Spain (*see* 1.736), was born in Madrid May 17 1886, the posthumous son of Alfonso XII. Belonging to the House of Bourbon-Habsburg, he was baptised as Leon Fernando Maria Isidro Pascual Antonio. Born a king he was proclaimed at birth sovereign under the regency of his mother. Great care was taken to remedy the delicacy of his physique, with the result that in his sixteenth year he was hale and vigorous. His education was not neglected. He mastered thoroughly English, French, and German and acquired a fair knowledge of history and the elements of agriculture.

On coming of age in 1902 Alfonso XIII. endeavoured to get into touch with his subjects in various provinces of his realm, entered into personal relations with the representatives of science, art, and labour and sought everywhere to awaken enterprise and encourage effort. In 1905 he visited Austria, Germany, England and France. One day while driving in Paris, with the President of the French Republic, he narrowly escaped death from the bomb of an unknown criminal.

On May 31 1906 Alfonso married Ena Victoria, daughter of Princess Henry of Battenberg. On the same day a bomb was thrown at their carriage by Mateo Morral, but happily neither of the sovereigns was injured. After the birth of his eldest son Alfonso (May 10 1907), who was proclaimed Prince of the Asturias, the King renewed his travels in Spain, France and England, and at the close of the undecided African campaign of 1909 visited Melilla, where he familiarised himself with the scenes of the fighting. At the funeral of his murdered Premier, Canalejas, Alfonso XIII. fearlessly followed the coffin on foot amid a great concourse of people. In April 1913, when returning from the ceremony of the oath to the national flag in Madrid, the King was fired at three times and again he escaped unhurt. His coolness and dignified behaviour on this occasion won for him enthusiastic ovations, and the generosity that prompted him to commute the death sentence on his would-be assassin intensified his popularity without diminishing the dangers that encompassed him.

In the early days Alfonso had been singled out as the innocent symbol of an odious régime, but later he was charged with being the fomentor of a shameful system of favouritism. The Melilla campaign brought home the evils of bad government alike to the listless masses, who furnished the blood and money to carry it on, and to the officers' corps, who complained that rewards and promotion were lavished on drones while those who bore the brunt of the struggle were systematically ignored; and the monarch's popularity began to decline. By way of lessening the causes of dissatisfaction the King, after a visit to President Poincaré, announced Spain's adherence to the Franco-Anglo-Russian Entente respecting Morocco (1913) and in the same year he strove to settle the Catalonian difficulty by adopting decentralisation and bestowing a large measure of autonomy on various provinces for administrative purposes. But the Morocco problem is perennial and the concession of home rule failed to satisfy the extremists in Catalonia, who forthwith clamoured for a degree of political independence incompatible with Spanish unity and destructive of their own economic prosperity.

Then it was that Antonio Maura (*q.v.*), having outgrown parties and factions, emerged as one of the few genuine statesmen produced by Spain in modern times. His measures of reform were root-reaching; but he was thwarted by the machinations of his adversaries, the perfidy of his partisans, and his own lack of peremptory energy and was therefore unable to enforce the restraints prescribed by the constitution. With the failure of Maura's experiment the last flicker of hope for Spain seemed extinguished. The position of the King became increasingly difficult, despite his efforts to better it. At the outbreak of the Portuguese revolution his official attitude, despite his dream of an Iberian union and the temptation to realise it, was irreproachable, and during the World War, when Spain's position was superlatively difficult, the King scrupulously discharged his manifold duties as a neutral and rendered immense services to the cause of humanity. At home he was less fortunate. The War, by depriving the Rif tribes of arms and ammunitions, had placed them at the mercy of Spain, but the parliamentarians allowed the opportunity to slip and the Moors to bleed the nation white (*see* MOROCCO, CAMPAIGN IN). He was held partly responsible for this disaster and also for the serious abuses prevalent throughout the Army and the Government.

Education was almost non-existent, the army was inefficient, the navy a fiction, justice itself was a sham and a snare, and the nation was but a shuttlecock in the hands of two parties tossed between hopeless ineptitude and insatiable greed. Discerning no hope of redress, the officers' corps, which was the only organ of remedial action in the Peninsula, drafted a reform programme and through the intermediary of the Infantry Union summoned the Govt. in June 1917 to accept it without restriction or delay. The arrest of the spokesmen only served to reveal the solidarity of the Army and the impotence of the Cabinet, and the triumph of the officers dealt a blow to parliamentary government from which it only began to recover in 1925. But before its final collapse the rulers allowed a tidal wave of syndicalist terrorism to invade Catalonia and render normal existence impossible there.

At this conjuncture Gen. Primo de Rivera (*q.v.*), aided by a group of resolute comrades and trusting in the King's official acquiescence in an accomplished fact, seized the reins of power, dismissed the Cabinet, proclaimed the Directorate, suspended the constitution, introduced censorship, and suppressed for the time syndicalism, separatism, and wholesale assassination. After two years' tenure of office he lost the support of some of his partisans and aroused the active hostility of many passive adversaries, while conspiracies were hatched in Paris, Barcelona, and Madrid, some for the purpose of assassinating the King, in June 1925, others with the object of overturning the Directorate in Nov. 1925. The King's family consists of four sons and two daughters. (E. J. Di.)

ALGERIA (*see* 1.642).—French colony in Northern Africa. Its area is 230,000 sq. m. and the population is 5,802,464.

I. POLITICAL HISTORY

Algeria during the War.—One of the first incidents of the World War was the bombardment of Bône and Philippeville by the "Goeben" and the "Breslau" (Aug. 4 1914). The Berbers of Kabylie were perhaps thought to be ready for insurrection as in 1871, and the attack was probably intended more to impress the natives than to hamper the transportation of troops from Algeria to France. German influence had been growing before the War. About 70% of the annual tourists were of German origin, and many of the large hotels were in their hands, as well as an important portion of the coal trade in Algiers. When the Turks entered the War, the propaganda against France and the Allies took more precise shape, especially in the southeast in the neighbourhood of the Senussi and also in the southwest along the Moroccan frontier, owing to the complicity of the unsubdued Atlas tribes. Tracts were distributed and anti-French songs circulated, in which the name of "El Hadj Guilioun" often recurred, but the country as a whole remained remarkably loyal.

The only notable incidents were a promptly suppressed agitation amongst a segregated tribe, the Beni-Chougran in the region of Mascara (Oct. 14), isolated outbursts of banditism on the Tunisian border and an attack by the Touareg Azdjer on the distant post of Djanet, in the neighbourhood of Rhat (April 16). The least trustworthy elements in the population were certain families of Turkish origin in the townships of Eastern Algeria (Constantine, Bougie, Djidjelli, Tebessa); and, at the other political extreme, the "Young Algerians," newly fledged modernists educated in the modernised *medresas* (religious schools) and in the lycées and universities, the North African replicas of the "Young Turks," "Young Egyptians" and their older cousins, the Indian Babus.

The mass of the natives proved to be more loyal; 30,000 of them were already enrolled in the Tirailleurs and the Spahis at the beginning of the War. Before the end 155,000 more had joined the colours, 75,000 by free enlistment and 80,000 by conscription. The total number killed was 19,000. In addition, 110,000 Algerians, largely recruited from the Kabyles, served as non-combatants in France in factories or on the land. In all, about 300,000 Algerian natives, about 6% of the population, assisted in the War. The French population in Algeria (of French stock and naturalised), which stood at 570,000 souls in 1914, provided 155,000 soldiers, of whom 18,500 paid the great price.

The colony did not give men only; it supplied food, especially wheat, sheep and wine. With the exception of 1917 the years of the War were, luckily for France, years of good crops. The season of 1918–9 even proved exceptional; it gave 13,500,000 cwt. of wheat, 13,000,000 cwt. of barley, 3,500,000 cwt. of oats, or 30,000,000 cwt. of cereals all told. From 800,000 to 900,000 sheep were bought every year for the army, which also took Algerian wool. Although certain industries, notably the iron industry and the export of early vegetables and fruit, suffered from the lack of labour and transport, the prosperity of the natives was on the whole increased. Salaries rose, produce fetched high prices, and the allowances paid to the families of enlisted natives were on the same scale as those paid to French families. Moreover, the moral ties between France and her subjects were strengthened.[1]

Political and Administrative Situation.—The only relatively important change in the administrative machinery of Algeria since 1911 has been a re-adjustment of the southern military territories which now are four in number; Ain-Sefra, Ouargla (Saharian Oases), Ghardaia (chief centre, Laghouat) and Touggourt (chief centre, Biskra). Each has at its head a military commander who has under his orders, under the authority of the Governor General, both the civil and military services. Their budget is distinct from that of Algeria proper.

No steps have been taken to create in Paris a Consultative Council, similar to the India Council in London. The tendency is, on the contrary, towards greater decentralisation; though the question of a "Ministry of Northern Africa" (Tunisia, Algeria, Morocco) is still sometimes agitated in political circles in France.

Political Rights of Natives.—The native population of Algeria was in 1921 4,971,424, of a total of 5,802,464 inhabitants, as against 4,740,000 in 1911. The Berber-speaking population is over 1,000,000, though the Berber language, of Hamitic origin, is losing ground before Arabic. But the fundamental ethnologic stock is certainly Berber. The descendants of the Arab invaders have the prestige of a literary language and of the Mahommedan religion; and the Arab "maraboutic" families, who wield great religious influence, have a Berber following. The enrichment of the Berbers, especially of the Kabyles, hard working peasants with traditions and customs of their own and a deep sense of equality, may have in time its political reaction. A race which includes a Terentius Afer, or, by his mother at least, a St. Augustine, and certain great caliphs in Spain, deserves its opportunity.

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[1] See, for instance, in the *Revue du Monde Musulman*, vol. 29, Dec. 1914, the addresses, etc., of the leading Algerian Moslems.

In the meantime a fundamental law passed by the French Parliament on Feb. 4 1919 regulates the political rights of the natives. French citizenship may be acquired by the native who makes application for it under certain conditions. The applicant must be 25 years of age, a monogamist or a bachelor; he must not have been convicted in court, must have resided for two consecutive years in the same township, and must, in addition, have one or other of a list of special qualifications, which are: having served in the French Army or Navy; reading and writing French; being landowner or farmer or proprietor of an urban building or paying the tax on traders (*patentes*); being invested with a public function or a Government pension; possessor of a French decoration or a public testimonial; being the son, of at least 21 years of age, of a naturalised native. The wife can also claim French citizenship. The fees for naturalisation are not very heavy, but the papers are complicated, and in five years the total demands were only 419, of which three-fourths were accepted by the authorities.

The reason for the small number of applications is that the Algerian native, even before the law of 1919, enjoyed, as a French subject without citizenship, a civil and political status with which, he had every reason to be satisfied. Moslem law applies fully or for the greater part according as he lives in the civil or military territories or in Kabylie. The native has representation, by different modes of votation, regulated by decrees, on all public bodies: Financial Delegations, where they make up a special Delegation, who vote the annual general budget; the Superior Government Council; *Conseils généraux*, one for each of the three *Départements;* municipal councils; municipal commissions; *djemaas*, native assemblies; the *douars*, geographical or tribal and administrative units, whether connected with the full townships (*communes de plein exercice*), or the " mixed " townships (*communes mixtes*), but independent in the Southern territories. The native members of those different public bodies have the same rights as the French members. They vote for the presidents, mayors or aldermen (*adjoints*). The special " Arab taxes " have been suppressed. The European colonists no longer enjoy any privilege, and the fiscal law is the same for all.

French Colonisation.—But the great question for France in Algeria, as in Tunis and Morocco, remains the question of French colonisation in Northern Africa. Naturalisation of the natives has played little part in this, as it is still, as we have seen, almost negligible. Twenty-five years ago there were 364,000 Frenchmen, of authentic French origin, in Algeria and the birth rate among French Algerians was high until recently. The 1921 census showed a total white population of 814,520, of whom 633,149 were French and the remainder of other European races, chiefly Spanish, Italian and Maltese. It is indisputable that the other Latin races in Algeria, more especially the people of Spanish blood in the province of Oran, have accepted without difficulty their new French nationality. Their conduct during the War was admirable. In any case it is worth noting that some of the objectors to the French naturalisation laws in North Africa themselves hold the *jus soli* as opposed to the *jus sanguinis*.

Frenchmen in Algeria are not, as some suppose, chiefly civil servants. A census taken before the War gave the number of French agriculturists, without their families, as 149,000. They were landowners, farmers, *métayers* and agricultural labourers. Foreign agriculturists numbered 74,000 only. The surface cultivated by European colonists, principally French, as we have just seen, amounted just before the War to 2,660,000 acres; the area under native cultivation was 6,257,000 acres; the total land owned by Europeans was 5,793,000 acres, on a total of about 38,000,000 acres appropriated lands in the three departments of Northern Algeria[1] under civil administration.

Appropriation of the Land.—A difficult problem in Algeria is precisely that of the appropriation of the land. The Government spent, from 1904 to 1920, 50,000,000 fr. for the creation of " centres of colonisation," which now number 1,000 in Northern Algeria. The land conceded, under prescribed conditions, on gratuity amounted to 132,000 acres, and the land sold to 320,000 acres. Fifty new villages were built and provided with roads, water, drainage, etc., and 140 already existing centres of French colonisation were increased. The legislation of 1902 on domanial land is on the eve of being amended. For a short time just after the War, especially in 1919 and 1920, the enriched natives were buying back the land from the French colonists, but this movement is distinctly on the wane. The natives seem to desire a simplification of the present procedure for private appropriation of the tribal lands still held in common and inalienable (*terres " arch*," according to the native term; from 9 to 10,000,000 acres still available) but this change presents many difficulties.

Defence.—The military forces stationed in Algeria constitute the XIX. Army Corps (Metropolitan French Army). At its head is a General commanding a division who has also under his command the troops in Tunisia. A division is stationed in each of the departments of Algiers, Constantine and Oran, comprising, each, two infantry brigades and one cavalry brigade. Each infantry brigade consists of two regiments, one of natives (*Tirailleurs*) and one of Algerian Frenchmen (*Zouaves*); each cavalry brigade, also of two regiments, the *Spahis* (natives) and the *Chasseurs d'Afrique* (Frenchmen). There exist also divisional groups of artillery, of the Flying Corps (6 squadrons) and the medical, transport and commissariat services, technical sections of artillery (*ouvriers d'Artillerie*), Engineers, the *Gendarmes* (Military Police), etc. In the Southern territories, there are three special Camel Companies (*Méharistes*) stationed at Beni-Abbès, Timmimoun and In-Salah.

Algerian troops being constantly called upon to serve in France, on the Rhine or in other colonies (Morocco), it is impossible to give the exact number of troops present in the colony.

A vice-admiral, commander in chief of the maritime frontiers of Northern Africa, resides in Algiers, with the naval forces in Tunisia also under him, including the Bizerta Arsenal. There are five naval defence " sectors ": Oran, Algiers, Bône, Bizerta and Sfax.

Conclusion.—The taxes have increased, but so has the national wealth. The native, except for the small, though doubtless increasing, nucleus of " Young Algerians," is peaceful and contented. Communist propaganda is limited to a few towns and is being taken in hand by the new governor, M. Viollette.

M. Viollette succeeded in 1925 to M. Theodor Steeg, who had been Governor General for four years. His immediate predecessors were M. Charles Lutaud (1911–8) and M. Abel (1919–21), with a short interim in 1918–9 when M. Jonnart, who held the post with great distinction from 1903 to 1911, acted as Governor. The policy of M. Viollette appears to be directed especially to the development of Algerian agriculture and of the medical and health services of the colonists and the natives, notably in the provision of a body of native midwives.

II. ECONOMIC HISTORY

Finance.—The special Algerian budget, which exists since 1900, is prepared by the Governor General under the control of the French Minister of the Interior. It is discussed and voted by the Financial Delegations—a tripartite body consisting of: (1) colonists; (2) taxpayers other than colonists, *i.e.*, the liberal professions, public servants, etc.; (3) natives, *i.e.*, Arabs and Kabyles—in plenary session, and afterwards by the *Conseil Supérieur*, a public body consisting of 23 high *fonctionnaires;* 16 delegates elected by the Financial Delegations; 15 members elected by the *conseils généraux;* three native *notables* and four public officers designated by the Governor-General, who, besides, can alone propose expenses for the *personnel.* The budget is approved by a decree of the President of the French Republic. The French Parliament authorises the taxes, but does not discuss the budget itself.

Just prior to the War (1913) the Algerian Revenue amounted to 252,000,000 fr., or £6,300,000. The " ordinary " receipts of the budget for 1924 were 394,894,000 fr., the " extraordinary," 141,051,000 fr., *i.e.*, a total of 535,946,000 fr., or, taking the mean exchange of 85 fr. = £6,305,253, but the transformation into sterling is deceptive. The Algerian debt amounts to 860,000,000 fr., and the charges for interest and amortisation to about 13% of the budget. The budget before the War regularly showed an excess of income over expenditure. The War deficit amounted to 372,000,000 fr., which was covered, by a law of March 30 1922, to the extent of 330,000,000, by a special loan.

Production.—The year 1924 was a bad one except for the vintage. Wheat did not give more than 494,000 metric tons, barley 450,000

[1] Total surface, Northern Algeria—52,000,000 acres. Total Algeria with the military territories and the Algerian Sahara, 141,000,000 acres.

tons, oats 115,000. Research is being made in the Government Agricultural Institute at Maison Carrée, near Algiers, and in different experimental farms on selected or new species of wheat. The average production on the colonists' farms is about double that on a native farm. The 1924 output was of 9,782,000 hectolitres or about one-tenth of the output in France itself. The quality improves steadily. Early vegetables and fruit growing have, as already mentioned, become an important factor, especially in the suburbs of Oran and Algiers, thanks to French, Italian, Spanish and Maltese growers. Much suitable land for both the above crops is available near the coast. The principal early vegetables are artichokes, tomatoes, French beans, green peas, early potatoes, etc. The pre-War figure was 45,000 tons. The best olive trees and nearly all the orange, citron and mandarine trees in the Blidah, Bonfarik and other districts are in the hands of French colonists, who have started of late the plantation of cotton, producing 18,000 cwt. in 1924, and the area is being increased.

French companies have undertaken well boring and the plantation of date palms to the south of Biskra. The exploitation of cork forests of the environs of Bougie and Philippeville is also in their hands. The export of alfa (esparto grass), principally in the hands of British concerns, is slowly returning to its 1913 level (109,000 tons in 1923), and there are large natural alfa tracts left on the high tablelands. The export of iron ore has begun again on a large scale, 1,775,000 tons in 1924. The splendid Ouenza deposits are at last being worked, and England remains the principal buyer. The export of lead, 45,000 tons, and that of phosphate of lime, 456,000 tons, as against 370,000 in 1913, is also increasing.

Industry.—Algerian industry is growing, already employing about 30,000 hands. Among the principal factories are flour mills, cement plants, sandal and esparto goods factories and tobacco factories. About one-half of the output of manufactured tobacco is exported. There is a rising industry in carpets, small but interesting, because it gives occupation to women.

Commerce.—Account being taken of the fall of the franc, it is interesting to note that the estimated value of Algeria's general commerce reached 5,085,000,000 fr. in 1923 (imports, 2,912,000,000; exports, 2,173,000,000).[1] The amount of the special trade, *i.e.*, goods consumed in Algeria and exports of Algerian products proper, was 4,402,000,000 fr. (imports, 2,545,000,000, exports, 1,857,000,000 in which France accounts for 2,039,000,000 fr. as seller and 1,329,000,000 fr. as buyer. The part of foreign countries is 506,000,000 fr. in the imports and 528,000,000 in the exports. In 1913, Algeria's total special commerce was of a value of 1,168,400,000 francs.

The tonnage weight of goods exported by sea amounted, in 1923, to 4,678,000 metric tons; imported, 2,235,000 tons; total, 6,913,000 tons. The ships' tonnage reached 13,285,000 tons (measurement) for all Algerian ports, Algiers heading the list and occupying the fourth place among all French ports.

Banking.—An estimate made in 1922,[2] ascribed a value of 2,547,000,000 fr. to the French North African stocks and bonds, to which Algeria brings by far the greatest contribution, though part is subscribed in France. The Banque d'Algérie (bank of issue) has a capital of 25,000,000 fr., the Compagnie Algérienne, 100,000,000, the Crédit Foncier d'Algérie et de Tunisie (mortgage bank) ,125,000,000.

Railways.—Algerian railways measured 3,715 km. in 1921; 1,820 km. are under construction or projected; 6,651,000 passengers and 4,155,000 tons of goods were transported. More than 5,000 km. of fine national roads are in working order. Thousands of foreign tourists travel over them, some in special motor cars, during the winter months, and up-to-date hotels have been built for the tourist traffic. To these roads can be added more than 30,000 km. of byroads. Important irrigation dams are being raised in the valley of the Chelif and others are planned.

The Department of Algiers has an area of 54,540 sq. km. with 1,788,857 inhabitants; that of Constantine, 87,302 sq. km. with 2,162,512; Oran and three small "Territoires de commandement," 65,897 sq. km. with 1,305,051, and the Southern Territories (Military), 367,550 sq. km. with 546,044 inhabitants. The principal towns are Algiers, 206,595 inhabitants; Oran, 147,105; Constantine, 78,220; Bône, 45,171; Themcen, 37,000; Blidah, 35,800; Philippeville, 33,300; Bougie, 19,400; Setif, 18,500. The population in each case is for the urban district of that name and figures are those of the census of 1921.

III. EDUCATION AND CULTURE

The university at Algiers specialises more and more in Mahommedan problems, linguistic, ethnological and geographical; in Berber folklore and customs; in Mussulman law and its adaptation to modern North African conditions. The field is immense. In 1924 there were 59 native students; 23 students of law, 22 of literature and only 14 for medicine and science. The proportion is unfortunate, as there are already too many native lawyers and journalists. The Arab record of scholarship in medicine and science in the Middle Ages might well be invoked to reverse the present fashion in studies.

Primary education, which includes the teaching of French, is still in its infancy, but the number of school places is being increased as the budget permits. The total number of primary scholars in 1924 was 150,052, more than one-third of whom were natives. French and native children are allowed to attend the same schools. In the towns the proportion of French to native children is nearly 10 to 1; in certain country schools the proportion is the other way and French children form a small minority. The number of native girls attending the primary schools is increasing, as also the total number of natives in those schools since the War (gain: 14,400 since 1914). Technical instruction is provided for the natives, but more requires to be done, especially in agriculture. In the lycées and colleges there are 545 boys and 60 girls belonging to the Mahommedan population, out of a total roll of 9,391.

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ALIEN: *see* NATURALIZATION.

ALIMENTARY SYSTEM, DISEASES OF THE (*see* 1.663).—The advance in our knowledge of these diseases during the period 1910–26 may be attributed chiefly to three factors: (1) the opportunities of observation afforded by the performance of surgical operations on the abdomen—the study, as it has been termed, of "the pathology of the living"; (2) an improved X-ray technique; (3) the introduction of biochemical tests for estimating the "physiological efficiency" of important organs such as the stomach, pancreas, and liver. The information gained by these methods has rendered diagnosis of diseases of the alimentary system more precise (*see* DIAGNOSIS), but has not proportionately advanced their treatment except by surgical operation.

The Oesophagus.—In no section of the alimentary canal have the X-rays (*see* RÖNTGEN RAYS) proved of more value in diagnosis than in the oesophagus, and the indications they afford have been rendered more precise by the direct inspection of the interior of the gullet by the oesophagoscope. The commonest symptom of disease of the oesophagus is difficulty in swallowing (*dysphagia*) which results from its obstruction. This is most frequently due to cancer, which chiefly occurs in men and is generally situated at the lower end of the tube where it joins the stomach, though it may also occur at the entrance or at an intermediate point opposite the bifurcation of the trachea. Functional obstruction is much rarer and occurs at the lower end, being due either to a spasm of the muscular sphincter at the entrance to the stomach, or to a failure of the muscular ring to relax as the food passes on (so-called "*achalasia*"). However brought about, the obstruction leads eventually to "idiopathic dilatation" of the oesophagus (*oesophagectasia*). This variety of obstruction occurs in women perhaps oftener than in men and is compatible with comparatively good health. It is treated by dilatation with bougies passed through the mouth or, sometimes, by stretching the lower end of the oesophagus by means of instruments introduced through an incision in the stomach. *Diverticula* or pouches are a still rarer cause of obstruction which can be recognised by X-ray examination.

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[1] The average exchange of 1923 was 75 fr. to the pound. The sterling values are not given, as they cannot be usefully compared with pre-War statistics.

[2] See Henry Blondel, *L'Intérêt de la France dans les placements coloniaux.*

The Stomach.—Cancer still remains the most serious disease of the stomach (*see* CANCER) and has increased rather than diminished in frequency in the last few years. It is commonest in men in the fifth and sixth decades of life and may be situated at the pylorus, which is the most frequent site, at the cardiac orifice (rarest), or in the body of the organ. Its early diagnosis, in time to afford a chance of cure by operation, is still a matter of difficulty, but improved X-ray technique is helping to solve the problem. The so-called "leather-bottle stomach" (*linitis plastica*) is now known to be generally due to diffuse cancerous infiltration.

Our knowledge of the next most serious disease of the stomach (gastric ulcer) has been rendered much more precise in recent years mainly by the work of the surgeons. Ulcer occurs in two forms, the acute and the chronic. Acute ulcers are usually multiple and may appear in the course of any septic infection, but when developing "idiopathically" they are most often met with in young women; chronic ulcers, on the other hand, are commoner in men of middle age, and are nearly always solitary. Acute ulcers are apt to perforate and may also cause profuse haemorrhage; chronic ulcers rarely perforate; but they, too, often bleed. The older statistics according to which "gastric ulcer" was chiefly a disease of women, were the result of including all the "acute" cases; the term as now usually employed refers to the chronic ulcer, chiefly a disease of men. The acute ulcer of young women is less often met with in recent years than it was formerly. The chief symptoms of the acute variety of ulcer are pain immediately after taking food, vomiting and, not uncommonly, haematemesis, with comparatively little disturbance of the general health. The chronic ulcer causes pain which occurs very punctually from one to two hours after meals whilst vomiting and haematemesis are less often met with. Some degrees of weakness, wasting, and anaemia are apt to be present. The symptoms of the chronic ulcer recur in bouts or attacks lasting a few weeks with long periods of more or less complete freedom from discomfort between. When the chronic ulcer is situated at the pylorus it leads to gradual occlusion of the latter with consequent dilatation of the stomach; when situated in the body of the organ it may bring about an "hour-glass" constriction. The most serious change which a chronic ulcer can undergo, however, is its conversion into a cancer. The frequency with which such a transformation occurs is disputed, but that there is a real risk of it, all surgeons are now agreed, and its possibility is one of the chief arguments for the surgical treatment of all cases of chronic ulcer. On the other hand there is no place for surgery in the treatment of the acute ulcer unless perforation has taken place. Haemorrhage from an acute ulcer is rarely fatal and is now never treated by operation; the question of operation in bleeding from a chronic ulcer is still *sub judice*, but opinion is moving in favour of it, transfusion being performed first if necessary.

Chronic ulcer of the duodenum is closely akin to chronic gastric ulcer. Over 80% of the cases are in males. As in gastric ulcer the symptoms occur in attacks lasting a few weeks and often separated by long intervals of complete freedom. Pain is the chief symptom and tends to come on when the stomach is empty and to be relieved by taking more food—hence the term "hunger pain" applied to it. Vomiting is very rare and the chief complications are perforation, which is much commoner than in chronic gastric ulcer, and haemorrhage which may lead both to vomiting of blood and its passage from the bowel (*melaena*). The ulcer is usually situated on the anterior wall of the first part of the duodenum and is apt, after it has been present for a long time, to lead to narrowing of the outlet of the stomach. On the other hand chronic duodenal ulcers—unlike gastric—never become malignant.

Gastric and duodenal ulcers are sometimes spoken of together as "peptic ulcers," and our knowledge of the pathogenesis of the peptic ulcer has advanced considerably, as the result of the work of Bolton in Great Britain and of Rosenow in America. The first stage in the development of an ulcer is the formation of a small area of necrosis in the mucosa in consequence of the lodgment in it of pathogenic streptococci. These organisms appear to reach the stomach or duodenum by the blood stream, either being swallowed or entering the blood from a focus of sepsis in the teeth, tonsils, appendix, gall-bladder, or some other source. According to Rosenow, the ulcer-forming organisms exhibit an "elective" affinity for the gastric mucous membrane whilst others may show a similar affinity for, say, the gall-bladder. Be this as it may, the result of the formation of an area of necrosis in the mucous membrane is that auto-digestion of the dead tissue takes place and a small acute ulcer forms. Most of these heal quickly, but in certain circumstances—for example abnormally high gastric acidity—one of them fails to heal, gradually enlarges, and becomes a chronic ulcer. The remaining organic affection of the stomach (*gastritis*) is now of less frequent occurrence than was formerly supposed.

The functional disorders of the stomach which are responsible for a great deal of what is commonly called "dyspepsia" are still but ill-understood although, by means of X-ray examinations and the use of "fractional" test meals, light is gradually being thrown upon them. Two chief types of functional disorder occur, secretory and motor, and each of these may be affected in the direction either of excess or defect.

Secretory Disorders.—It is now known that the gastric juice as secreted has an acidity of about 0·5%, but that this is reduced to the optimum acidity for digestion (0·2%) by dilution and neutralisation in the stomach, and that the most powerful factor in neutralisation is the regurgitation of duodenal contents through the pylorus. An excessive acidity of the stomach contents therefore ("*acid dyspepsia*," *hyperchlorhydria*) may be due either to over-production of gastric juice or to deficiency of neutralisation, or to both, and can no longer be regarded as a definite "clinical entity." Deficient acidity on the other hand (*hypochlorhydria*, *achylia*) may be due either to defective secretion or to excessive neutralisation. The secretion of gastric juice is controlled partly by the vagus nerve and partly by chemical hormones, and may therefore be affected either by variations in the excitability of the nervous system or by the quality of the food. Excess of secretion is perhaps commoner in men, defect is more often found in women, but over-acidity is more prone to cause symptoms than under-acidity.

Motor Disorders.—These are of greater importance as a cause of dyspepsia than disorders of secretion. The stomach has two motor functions (*peristalsis* and "tone") and these may be disordered independently. Both are much under nervous influence, the vagus increasing tone and peristalsis, whilst the sympathetic has an opposite effect. Diminution of tone (*hypo-motility*, *atony*) is a commoner cause of symptoms than excess and is specially apt to occur in women. Emotional disturbances are prone to bring it about. Excess of tone and peristalsis are often associated with over-acidity, whereas deficiency of tone and acidity often, though by no means always, coincide.

The symptoms of the functional disorders of the stomach differ notably from those of the more serious organic diseases. Pain, vomiting, and wasting are absent, and the patient's chief complaints are of discomfort, flatulence, acidity, and so forth. As disorder of function is largely nervous in origin, treatment must be directed in great measure to the central nervous system, but acidity can be corrected by antacids, atony by strychnine, and so on. The diet of the patient must also be adapted to the weakened organ.

The Colon.—The investigation of diseases of the colon has been facilitated by the introduction of the methods of examination by the X-rays after an opaque enema and by the sigmoidoscope. Cancer is still the most serious affection, the sigmoid and pelvic colon being its commonest sites. Treatment is by operation and, if undertaken early enough, is often successful. Ulceration of the colon is now divided into (*a*) dysenteric and (*b*) non-dysenteric. Dysenteric ulceration (*see* DYSENTERY) may be caused either by the amoeba histolytica or by dysenteric bacilli of the Shiga or Flexner type. The distinction between these different forms can be made by a bacteriological examination of the stools and by the serum agglutination test. Non-dysenteric ulceration (*ulcerative colitis*) is not very uncommon as a primary disease in Great Britain. Its symptoms are the same as those of the dysenteric variety (diarrhoea with the passage of blood and mucus, some fever, pain and tenesmus) and it can be recognised by the use of the sigmoidoscope. Nothing is yet definitely known of its bacteriology. Antidysenteric serum is a powerful aid in the treatment of acute bacillary dysentery whilst emetine is a specific for the amoebic form. Non-dysenteric ulceration is treated by lavage and, in severe cases, by the operation of appendicostomy.

The frequent occurrence of little pouches (*diverticula*) in the wall of the colon has been established by modern methods of investigation. Sometimes these become inflamed when the condition termed " diverticulitis " arises. It is not without danger. Much attention has been devoted in recent years to the alleged stagnation of the contents of the large bowel (colon stasis) with consequent absorption of poisons into the blood (auto-intoxication). Such stagnation is believed to be promoted by dropping or displacement of the colon or by the undue mobility of sections of it, and extensive operations have been undertaken for the correction of these conditions. Whilst, however, auto-intoxication may sometimes take place, it is beginning to be realised that it is not nearly so frequent as was supposed and that operation for it is rarely necessary or advisable.

The Pancreas.—The pancreas is still very largely the *terra incognita* of the abdomen, mainly on account of its inaccessible position. The introduction of tests for "pancreatic efficiency," however, has helped to make the diagnosis of its diseases easier. Amongst these tests are Loewi's adrenalin mydriasis reaction, the urinary diastase test, and the estimation of the unsplit fat in the stools. Glycosuria, also, is often an indication of the failure of the internal secretion (insulin).

New-growth (cancer) is the most serious disease of the pancreas and one of the commonest. It specially affects the head of the organ and usually shows its presence by the production of obstructive jaundice.

Acute pancreatitis (haemorrhagic necrosis of the pancreas) is one of the conditions which produce what is termed an " abdominal catastrophe." It is difficult of diagnosis and is only curable by laparotomy.

Chronic pancreatitis, an interstitial inflammation or fibrosis of the organ, may result from partial obstruction of the duct, *e.g.*, by gall-stones, or from an ascending infection of it. The symptoms are very much the same as those produced by cancer.

The Liver.—Recent work has thrown a good deal of light on the nature of jaundice. It is now known that bile pigment is not produced in the liver cells but is derived from the breaking down of red blood corpuscles in the " reticulo-endothelial system "—a network of cells widely diffused in the body but especially in the spleen. The pigment so produced is picked out of the blood by the hepatic cells and transferred to the bile. Two chief varieties of jaundice are recognised: (*a*) obstructive, (*b*) non-obstructive. The former is due to any gross obstruction in the bile ducts such as may be caused by cancers or other tumours pressing upon or involving the ducts, impacted gall-stone and so forth. It is characterised by the complete absence of bile from the stools and its presence in the urine.

Non-obstructive jaundice, as it is usually called, is of two varieties—the haemolytic and the toxic. The former is due to increased destruction of red blood corpuscles and occurs to some extent in Addisonian (pernicious) anaemia and also in the rare disease known as " family jaundice "; toxic jaundice on the other hand is brought about by severe damage to the liver cells rendering them incapable of transferring bile pigment from the blood to the bile. Many poisons act on the cells in this way, such as arsenic and phosphorus, as well as the toxins of certain organisms, *e.g.*, those of yellow fever and some septic infections; poisons of " endogenous " origin may act similarly, as in acute yellow atrophy of the liver and the toxic jaundice of pregnancy. In all forms of non-obstructive jaundice bile is present in the stools but it may or may not be present in the urine. So-called " catarrhal jaundice," formerly believed to be obstructive, is now, largely as a result of the van den Bergh test, known to be due, in part at least, to direct damage of the liver cells, although obstruction of the ducts from catarrh also plays a part in its production. Much work has recently been done on the pathology of gall-stone formation. It is generally agreed that infection of the gall-bladder is a predisposing factor, the infection being usually conveyed through the blood stream in the same way as in cases of peptic ulcer. In addition it is possible that an excess of cholesterol in the blood contributes to their formation. Of the other chief diseases of the liver, cancer and cirrhosis, there is nothing new to be said. (R. Hu.)

ALINGTON, CYRIL ARGENTINE (1872–), British educationalist and writer, was born in Ipswich, Oct. 22 1872 and educated at Marlborough College and Trinity College, Oxford. After being elected a fellow of All Souls College, Oxford, and taking Holy Orders, he taught at Marlborough and Eton successively. In 1908 he was appointed headmaster of Shrewsbury School and in 1916 succeeded his brother-in-law, Edward Lytelton, as head master of Eton. Dr. Alington was peculiarly fortunate in commanding the respect and affection of his pupils and, while not hostile to new ideas, sought to maintain rather than modify the public school tradition. His published works include *A Schoolmaster's Apology* (1914), a brief but discursive expression of his educational ideals; two popular novels, *Strained Relations* (1922) and *Mr. Evans* (1922); some humorous verse, and collections of sermons and addresses.

ALLBUTT, SIR THOMAS CLIFFORD (1836–1925), British physician, was born at Dewsbury, Yorks, July 20 1836. Educated at St. Peter's School, York and Caius College, Cambridge, he studied medicine at George's Hospital, London, and afterward in Paris, subsequently practising in London and Leeds. He carried out much valuable work on the pathology of the nervous system, and made important investigations of tetanus and hydrophobia, devoting, in addition, considerable time, to ophthalmoscopy and inventing the short clinical thermometer. He was consulting physician to many institutions and from 1889 to 1892 was a commissioner in lunacy. He was elected F.R.S. in 1880, and later became a member of many other British and foreign scientific societies, and received many honorary degrees and other awards. In 1892 he became regius professor of physic at Cambridge, in 1907 was created K.C.B. and in 1920 a privy councillor. Sir Clifford Allbutt was a member of many government committees, including the Home Office inquiry into trade diseases. He died at Cambridge Feb. 22 1925.

Allbutt's published works include *The Use of the Ophthalmoscope in Medicine* (1871); *On Scrofulous Neck* (1885); *Diseases of the Heart* (Lane Lectures, 1896); *Historical Relations of Medicine and Surgery* (1905); *Greek Medicine in Rome* (Fitzpatrick lectures, 1909–10); *Diseases of the Arteries and Angina Pectoris* (1915); *Science in the School* (1917) and *Notes on the Composition of Scientific Papers* (3rd ed., 1923). He also edited *A System of Medicine* and *A System of Gynaecology* (1896, 1899, 1907).

ALLEN, SIR JAMES (1855–), New Zealand politician, was born in South Australia on Feb. 10 1855, his parents settling in New Zealand a year later. He was educated in England at Clifton and St. John's College, Cambridge, and afterward studied at the Royal School of Mines, in London. Returning to New Zealand he was, in 1887, elected a member of the House of Representatives. He was Minister for Finance, Defence and Education from 1912–5, and, in 1915, when a separate Ministry of Defence was formed, he took charge of it, retaining the post until 1920. It was largely due to his efforts that, in 1914, the New Zealand Force was one of the most effective of the British Dominion armies. During the absence of Mr. Massey in England during and after the War he acted as Prime Minister for two years. He was made a K.C.B. in 1917 and was appointed High Commissioner for New Zealand in London in 1920. His long, practical experience as a Dominion administrator and his sympathetic understanding of the needs of the Empire rendered his presence in London especially valuable both to the Dominion and the Empire. He is the author of *New Zealand and Federation. The Financial Aspect* (1890), a pamphlet issued by *The Press*, Christchurch and *New Zealand's Possessions in the South Seas* (1903).

ALLEN, JAMES LANE (1849–1925), American novelist (*see* 1.691), died Feb. 18 1925. His latest books include *The Doctor's Christmas Eve* (1910), *The Lost Christmas Tree* (1914), *Sword of Youth* (1915), *A Cathedral Singer* (1916), *A Kentucky Warbler* (1918), *Emblem of Fidelity* (1919) and *The Alabaster Box* (1923).

ALLENBY, EDMUND HENRY HYNMAN, 1ST VISCOUNT (1861–), British field-marshal, was born April 23 1861, and joined the Inniskilling Dragoons in 1882. He saw active service early in the Bechuanaland expedition of 1884–5 and in Zululand 1888, and later passed through the Staff College. During the South African War (1899–1902) he took part in the cavalry operations leading to the relief of Kimberley, in the battle of Paardeberg, and in the advance to Pretoria. During the later stages of the war he won distinction as a column commander, and his command of the 5th Lancers from 1902–5 spread his reputation throughout the army. Then, after command of a cavalry brigade, he became inspector of cavalry in 1910 and in 1914 went out to France in command of the cavalry division.

The work of his troops, mounted, during the retreat from Mons and advance to the Aisne, and, dismounted, in holding the line south of Ypres during the critical weeks of Oct., won high praise in Sir John French's dispatches. When a second cavalry division arrived, Allenby was given command of the Cavalry Corps then formed, and in Oct. 1915 he succeeded Sir Charles Monro as commander of the III. Army. Throughout 1916 his army front was relatively quiet, but in the spring of 1917 it played a foremost rôle in the battle of Arras.

In June Allenby left France to succeed Sir Archibald Murray in charge of the forces in Egypt and Palestine. His first three months on the borders of Palestine, the season being still unsuitable for operations, were devoted to intensive preparations for an autumn offensive, reorganising the command, greatly developing the communications, and moving his own G.H.Q. from Cairo to the front at Rafa. Complete secrecy and many ruses misled the Turks as to the main point of attack. The strong defences of Gaza were bombarded from Oct. 26 onwards and serious attacks followed, on Nov. 1, to fix the enemy's attention and draw in his reserves.

Meanwhile, as a necessary preliminary to the real blow, the outlying bastion of Beersheba, 35 m. east of Gaza, was gained by a convergent manoeuvre on Oct. 31, a prelude to the decisive attack on Nov. 6 which broke through the enemy's weakened centre and into the plain of Philistia. This compelled a general retreat of the Turks, and the pursuit was pressed so relentlessly that by Nov. 14 the port of Jaffa had been seized, the Turkish armies driven apart in two divergent masses, and Allenby was able to wheel his forces to the right for an advance inland on Jerusalem. The British troops kept too closely on the heels of the Turks for the latter to block the narrow mountain passes, and, despite a stout Turkish resistance almost at the gates of Jerusalem the objective was gained with the surrender of the city on Dec. 9. By the time the winter rains set in the position of the British had been improved and their hold on Jaffa and Jerusalem had been made thoroughly secure.

The further advance initiated in the spring was interrupted by the crisis on the western front, which forced the dispatch to France of most of Allenby's British troops. The depletion was made up by reinforcements from India and Mesopotamia, and the summer of 1918 was devoted to reorganisation and the training of these new units. Finally, in mid-Sept., the carefully planned and prepared offensive was launched. Feinting towards the east bank of the Jordan, to distract the enemy's attention, Allenby secretly concentrated, on the Mediterranean flank, the mass of the infantry and behind them the cavalry. In this way he changed a two to one superiority on the general front into a four to one superiority at the decisive point of attack. On the night Sept. 18–19 the forces in the hilly centre had attacked to fix the enemy's attention, and at dawn on the 19th the western mass struck; the result was to roll the Turks back northeast, like a door on its hinges.

Through the open doorway the cavalry passed, riding straight up the coastal corridor for 30 m. before swinging east to cut the Turkish communications, and close all exits of retreat. Completely trapped, the main Turkish armies were rounded up, while the British cavalry exploited the victory of Megiddo by a swift and sustained pursuit, which gained first Damascus and finally Aleppo. The capitulation of Turkey rang down the curtain on this brief and dazzling campaign. Making all allowances for the British superiority in strength, it must rank as one of the masterpieces of military history, as perfect in execution as in design. For his services the victor was promoted field-marshal and raised to the peerage as Viscount Allenby of Megiddo and Felixstowe, receiving also a grant of £50,000.

Though his campaign had been waged beyond the borders of Egypt, Allenby had been throughout responsible for the protection and internal order of the Nile delta, where the military situation and the changed status of Egypt had led to considerable unrest. In 1919 he was appointed British High Commissioner in Egypt, and held the post until 1925, through the long sequence of political trouble and disturbances arising out of the agitation for independence. In such conditions criticism of the administration was inevitable, but it is a testimony to Allenby's impartiality and sympathy that it was rather of the velvet glove than of the iron hand. If the ultimate verdict rests with history, it can at least be recognised now that the prestige of his name was a unique asset, and indeed made him the only possible choice for the post at such a critical period. *See* PALESTINE, CAMPAIGNS IN. (B. H. L. H.)

ALLENSTEIN-MARIENWERDER, a region composed of districts of the former Prussian provinces of East and West Prussia.

Article 94–98 of the Treaty of Versailles provided that the East Prussian Circles (Kreise) of Allenstein, Ortelesburg, Osterode, Sensburg, Johannisburg, Lotzen, Lyck and Neidenburg, in so far as they had not already been ceded to Poland, and further the West Prussian Circles of Marienwerder (east of the Vistula), Stuhm, Rosenburg and the section of the Circle Marienburg situated east of the Nogat, should declare by a plebiscite whether they desired to belong to Germany or Poland. Until the plebiscite should take place the administration of these Circles was taken over by inter-Allied commissions for East and West Prussia respectively, supported by Allied garrisons.

The whole territory has an area of about 15,900 sq. miles. According to the German census of 1910, the East Prussian area had a population of 556,000 of which 288,000 were Germans; the West Prussian area, 24,000 Poles, 114,000 Germans. In East Prussia 172,000 were Masurians, who are Slavs, but Protestants. The plebiscite held on July 11 1920 was preceded by much agitation and band warfare. In the East Prussian region 98% of the population voted for Germany, in the West Prussian 92%. Both districts were assigned to Germany on the basis of the vote; but, in accordance with the terms of the treaty of Versailles, a zone 50 m. broad and some 30 m. long on the east bank of the Vistula near Marienwerder and four villages with the harbour of Kurzebrack on the same river were assigned to Poland in order to secure for the Polish state, at this point, the sovereignty over the course of the Vistula accorded to it by the treaty. The inhabitants of the adjacent East Prussian territory are at all times to have access for themselves and their boats to the Vistula. Three frontier communes in the southwest of East Prussia were also assigned to Poland. On Aug. 16 both the inter-Allied commissions left the plebiscitary areas.

ALLOTMENTS (*see* 1.699).—An allotment, in Great Britain, is any parcel of land above ¼ ac., but not exceeding five ac. in extent, which is cultivated as a farm or garden, or partly as a farm and partly as a garden. In other words, it is a small agricultural holding, subject to the same terms relating to notice to quit and compensation. Such allotments are almost exclusively confined to rural districts and are to be found principally in the fen district and where the soil is suitable for market gardening.

The word allotment, as popularly used, means something entirely different, and really refers to an allotment-garden. This is defined as an allotment not exceeding 40 poles in extent, which is wholly, or mainly, cultivated by the occupier for the production of vegetables and fruit crops for consumption by himself or his family. The overwhelming number of allotments are of this kind, and in this article the term allotments must be taken generally in this sense.

The Small Holdings & Allotments Act, 1908, was followed by a great increase in the number of allotments. On Dec. 31 1909 there were 58,648 allotments covering an area of 17,529 ac., increased on Dec. 31 1914 to 130,526 allotments and 33,523 acres. During this period, land-renting associations were formed in all parts of the country with the object of procuring and managing land for their members.

The War Period.—The World War changed the whole aspect of the problem. The provision of allotments had been, hitherto, largely a rural question, but the food shortage which developed as the War went on transferred the problem from the countryside to the towns and cities. Home food production on a larger scale became an imperative necessity. To ensure this, emergency legislation under the Defence of the Realm Regulations was passed in 1916–7 and 1918 (since withdrawn), the effect of which was to give local authorities powers for the compulsory acquisition of land for allotments. The powers granted were at first confined to the appropriation of vacant land, *i.e.*, undeveloped building sites, but were afterwards extended so that practically any land could be acquired. Hitherto, the statutory right to an allotment was confined to the "labouring population," but this limitation was withdrawn. The result was that patriotic persons, of both sexes and from all classes of society, were to be found cultivating allotments, until, on Dec. 31 1920, there were 1,330,000 allotments, embracing 185,000 acres. Even then there remained 44,736 unsatisfied applicants waiting for land to cultivate.

The cultivation of allotments during the War created a new and absorbing interest for thousands of British citizens, so much so that, when the temporary allotments which had been used were taken for purposes of greater public utility, a widespread demand for alternative land on a more permanent tenure was made. This desire may be traced in a series of Acts of Parliament: The Land Settlement (Facilities) Act, 1919; the Agriculture Act, 1920; the Allotments Act, 1922; the Agricultural Rates Act, 1923; and the Allotments Act, 1925. This legislation has entitled the allotment holder, under normal circumstances, to a six months' minimum notice to quit; compensation for crops and manures when less notice is received; concessions in local rates; and representation on the statutory allotments committees of local authorities. The 1925 Act enables associations to borrow from the Public Works Loan Commissioners up to two-thirds of the value of land purchased, repayment being spread over a maximum period of 35 years. Local authorities providing allotments are also empowered, if necessary, to incur a loss not exceeding a 1d. rate when action is taken under the Allotments Acts. They may also obtain allotments in advance of the demand, as well as make provision for them in all schemes of town planning.

The great problem which confronts the allotment movement is insecurity of tenure. Allotment associations are helping to solve it themselves by the purchase of land where practicable, but this is impossible in congested areas where land is scarce and very expensive. Large allotment areas still exist where the tenancies may be determined by short notices to quit. An increasing number of temporary allotments have been surrendered for building purposes and the decrease in the number reported at the end of 1924 was due almost entirely to this cause.

Some Figures.—The Ministry of Agriculture gave the figures at the end of 1923 as 1,190,000 allotments and, at the end of 1924, 1,170,000, a decrease of about 1·5%, but they add: "It would be a mistake to conclude from these figures that interest in the allotment movement is waning." There were 15,000 registered applicants waiting for allotments at the end of 1924.

Allotments produce 700,000 tons of foodstuffs each year, worth, approximately, £7,000,000, and this produce not only increases the national wealth but makes a valuable contribution to the family budgets of over 1,000,000 families. From a small allotment-garden of 10 rods (just over 300 sq. yd.) it is estimated that £10 worth of vegetables are obtained during the season.

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ALMA-TADEMA, SIR LAURENCE (1836–1912), British painter (*see* 1.712), died at Wiesbaden June 25 1912. An exhibition of his works was held in London in 1913.

ALSACE, EARLY OPERATIONS IN: *see* FRONTIERS, BATTLES OF THE.

ALSACE-LORRAINE (*see* 1.756), two provinces of France, restored to her by Germany under the Treaty of Versailles. The area is: Bas Rhin, 1,848 sq. m.; Haut Rhin, 1,354 sq. m.; Moselle, 2,019 sq. m.; and the population Bas Rhin, 651,686; Haut Rhin, 468,943; Moselle, 589,120.

I. GERMAN ADMINISTRATION 1910–8

Under the constitution of July 4 1879, Alsace-Lorraine (das Reichsland) was administered by (1) a minister for Alsace-Lorraine, assisted by under-secretaries of state, acting for and on behalf of the chancellor; (2) a provincial delegation (Landesausschuss), possessing the legislative initiative, and the right of receiving and discussing petitions; (3) a statthalter, representing the emperor.

A new constitution was passed by the Reichstag on May 26 1911. The emperor, as direct sovereign of the Reichsland, continued to be represented in Strasbourg by a statthalter, who governed with the assistance of a secretary of state, responsible to the emperor alone. The *Landesausschuss* was replaced by a *Landtag*, consisting of an upper chamber composed one-half of ex-officio members, one-half of members nominated by the emperor; and a second chamber composed of 60 members elected directly by universal suffrage. The elections for the second chamber (Oct. 22 and 29 1911) returned 26 members of the Centre (Catholic party), 10 of the Lorraine Group, 11 Socialists, 9 Liberal Democrats and 4 Independents.

The Landtag and the Ministry came into conflict on April 29 1912, when the Govt. on the strength of secret reports from Berlin, demanded the dismissal of the director of the Grafenstaden locomotives works, on the ground of French intrigues, and threatened to withdraw their orders from the works. The second chamber passed an unanimous vote of censure on the ministers for failing to defend the accused. A second vote of censure was passed when the *Souvenir alsacien-lorrain* which tended the graves of 1870, was suppressed in 1913, and it was known that the Ministry was preparing further measures against the French Press and associations.

Far more serious was the incident of Saverne (Zabern). In Oct. 1913 the news spread that a young officer of the 79th Infantry, Lieut. von Forstner, had, on parade, addressed the Alsatian recruits as "Wackes" (street arabs), and promised 10 marks to every soldier who would bring in the skin of one of these "Wackes." Alsatian soldiers were obliged to parade before the Lieutenant, saying "I am a Wacke." In addition, Forstner had grossly insulted the French flag.

The *Elsaesser* and a Saverne newspaper protested. Public opinion was aroused. Forstner was pursued by lads in the streets, and had to go about under guard. The affair threatened a collision between the civil power and the military authorities. On the night of Nov. 9–10, Forstner had been besieged in his quarters by a mob. The sub-prefect and the mayor consented to summon the fire-brigade. But without awaiting orders, Col. von Reutter, who was in command of the garrison, had on his own initiative sent out military patrols and held machine-guns in readiness. The sub-prefect referred the matter to the Minister of the Interior, Mandel; the colonel referred it to Gen. von Deimling. As it happened, Mandel and Von Deimling were dining at Strasbourg in the same house, and the discussion between them was a stormy one.

On Nov. 28, when Forstner was being pursued in the street as usual, Lieut. Schadt ordered out the guard, and Col. von

Reutter had 29 persons arrested at random. The soldiers searched houses, and the procureur and several civil magistrates were shut up in the barracks. On Dec. 2 Forstner caused the arrest at Dettwiller of a shoemaker's boy, and struck him on the head with his sabre. The affair became daily more serious, and deep feeling was aroused. In the Reichstag on Dec. 4 1913, all parties, with the exception of the Conservatives, passed a vote of censure on Bethmann-Hollweg by 293 votes against 54, with four abstentions. In Alsace the second chamber violently attacked the Ministry in the sittings of Jan. 13 and 15 1914; even in the first chamber the vote of censure was unanimous but for the votes of two generals and a professor of public law, named Labaud, and two abstentions.

The military party accepted the challenge. Forstner, at first sentenced to 43 days arrest, was acquitted on appeal by the War Council, together with Reutter and Schadt. In Berlin the prefect of police, Herr von Jagow. published in the *Kreuzzeitung* a letter in which he declared that the officers garrisoned in the annexed provinces were serving in a practically enemy country. Finally the emperor, exasperated by the attacks against the military caste caused by this notorious case, accused in turn the statthalter and his ministers of weakness. Count von Wedel was replaced by Baron von Dallwitz and Herr Zorn von Bulach by Count von Roedern as minister of state. All parties of the Second Chamber formed a "league for the defence of Alsace-Lorraine" to repel the attacks and suspicion directed against the country.

During the War the German authorities took severe measures in Alsace-Lorraine. During the first months about 1,000 well-known persons were imprisoned or sent into Germany to be kept under police supervision. The sale of French newspapers was forbidden in Alsace-Lorraine, and the use of the French language in the streets. In 1918, according to official statistics, 1,640 persons were under preventative arrest and 1,900 exiled. Young persons and women were obliged to work for the army in bad and dangerous conditions. By 1917, 18,426 natives of Alsace-Lorraine had deserted from the German Army; 23,000 served as volunteers in the French Army during the War.

At the end of July 1918, conviction of the impending defeat of Germany became general in Alsace. The new chancellor, Prince Max of Baden, replaced the statthalter and the secretary of state by two Alsatians, M. Schwander, Mayor of Strasbourg, and M. Hauss, the leader of the Centre party. M. Schwander could not form a ministry, and in the beginning of Nov. the Chamber compelled his resignation, and itself formed a ministry, in which a Nationalist Alsatian, M. Pfleger, was Minister of the Interior. This was the constitutional position at the date of the Armistice of Nov. 11. But at the same time marines from Kiel arrived at Strasbourg and Metz, where they organised councils of workmen and soldiers. French flags, which had already been hoisted, were replaced by red flags. Finally, thanks to the mediation of the Socialist leaders Imbs and Peirotes, the two governments—of the Chamber and of the Soviets—reached an agreement. To put an end to the anarchy caused by the retreating German troops delegations begged the French generals to hasten their entry.

On Nov. 12 the Abbé Delsor proposed in the Alsatian Chamber an address of allegiance to France, which was unanimously agreed. Gen. Pétain entered Metz, Gen. Gouraud Strasbourg, Gen. de Castelnau Colmar, and were received with acclamations. The Treaty of Versailles returned Alsace-Lorraine to France as from Nov. 11 1918.

II. FRENCH ADMINISTRATION 1918–26

Alsace-Lorraine had constituted an artificial union under Germany. The French re-occupation avoided sudden changes of administration. "It was thought preferable," writes M. Delahache, "to limit as far as seemed possible immediate and absolute changes. It was not desired to reject, on principle and without discrimination, institutions and usages which had been established in Alsace after 1870. The Chamber of Trade, limited companies, the Land Register, social insurance—all of them novelties for the rest of France, but familiar in Alsace, were worth conserving, and doubtless worth extension. It ought to be possible to profit by experience gained, to find useful models, to try new combinations."

The framework created by Germany was therefore maintained. A high commissioner, M. Georges Maringer, held office until March 21 1919, when M. Millerand was appointed with the title of commissioner-general. He was succeeded by M. Alapetite on Feb. 11 1920.

The three German departments became those of Haut-Rhin, Bas-Rhin and Meurthe et Moselle, each of them administered by a commissioner. The French Govt. promised to allow the population to retain German institutions, municipal government, civil law, education system, workmen's law, social insurance and confessional schools. It also retained the Concordat. The former offices of the Minister of the Interior of Alsace-Lorraine continued to function up to April 1919. There was then constituted a Department of the Interior, which grouped under its authority health, religion and prison services. Public assistance, which under the German régime was not a state administration, was organised as in other departments and attached to the Ministry of the Interior. The Ministry of the Interior had to create a system of sub-prefects, to form an elective regional council (bill of Dec. 24 1919), and to draw up elective lists on the principle of French electoral law, under the decree of May 6 1919.

Finance.—A decree of the Prime Minister's of Nov. 26 1918, made the circulation of the mark illegal from Dec. 19. It was conceded that for Alsatians, for Lorrainers, the Allies and neutrals domiciled in Alsace or Lorraine before the War, marks would be exchanged at the rate of 1·25 francs to the mark. In Dec. about 900,000 marks were exchanged. The customs frontier was moved back from the Vosges to the Rhine, and the French tariff was put in force on Jan. 30 1919. The general adjustment of indirect taxation to French practice was completed on Aug. 1 1919. Direct taxation (income tax) was introduced by the Chamber of Deputies on the initiative of the deputies of Alsace-Lorraine, to come into force in 1920. The state monopoly on tobacco growing was extended to Alsace-Lorraine by the decree of May 27 1920; the monopoly has not been extended to manufacture and sale.

Justice.—The decree of Nov. 30 1918, displaced all the magistrates of Alsace and Lorraine; the creation of a new personnel occupied 10 months. Commissions of five members were created to study the introduction of French law. Penal law and the law with regard to criminal investigation were introduced on Nov. 25 1919, Patents and copyrights law on Feb. 10 1920.

Education.—The new service was installed in place of the German system on Nov. 29 1918. The officials were removed and replaced as opportunity offered; the new organisation was only really established in April 1919. The professors left Strasbourg University; it was therefore closed on Dec. 8 1918; but reopened on Jan. 19 1919. In secondary and primary education, the change was made slowly, the teaching of French was enforced and that of German reduced; thus the readaptation of Alsace-Lorraine to French life has been gradual. Serious difficulties have not arisen, nor will they unless the central Govt. attempt to touch linguistic and religious liberties. In 1924 the proposal of the Herriot Ministry to suppress the confessional schools provoked lively opposition.

Administrative Changes in 1925.—On Sept. 9 1920, a consultative committee was added to the commissariat-general. These institutions are necessarily provisional. As early as Dec. 1921, a Socialist deputy, M. Uhry, asked in the Chamber for the abolition of the commissariat-general and the end of the transitional régime—a programme which was adopted from that date by the extreme Left. M. Uhry returned to the charge in Dec. 1922, when the Alsace-Lorraine budget was under discussion. The Chamber of Deputies refused to make the change, by an enormous majority. In the summer of 1923, the Govt. declared their intention of abolishing the commissariat-general on July 1 1924. M. Alapetite resigned in the course of that month; M. Cacaud, secretary-general of the commissariat, undertook his official duties on July 21 for the time being. On Nov. 8 a meeting of the Alsace-Lorraine deputies was held under the chairmanship of M. Herriot, then Prime Minister. It was decided that the commissariat-general should be abolished from Jan. 1 1925. The temporary council at Strasbourg was to be replaced by a council sitting in Paris. This council was definitely authorised by a decree of Nov. 14, and M. Painlevé, in a speech delivered on June 1 1925, at Strasbourg, promised that it would be promptly formed. An under-secretary of state—the first to hold the office was M. Georges Bonnet—was charged with matters specially concerning Alsace-Lorraine. (For the importance of Alsace and Lorraine in the general economy of France *see* FRANCE.)

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ALTMAN, BENJAMIN (1840–1913), American merchant and art collector, was born July 12 1840 in New York City, and died there Oct. 7 1913. As a young man he became interested in early European and Oriental art. His collections of Chinese porcelains and Oriental rugs were remarkable. Of the works of Rembrandt he possessed probably the largest private collection ever assembled. He bequeathed his collections, including works by Velazquez, Van Dyck, Cuyp and Ruysdael, to the Metropolitan Museum of Art, New York City. Shortly before his death he secured the incorporation of the Altman Foundation, established for the welfare of the employees of the department store of B. Altman and Co., of which he was the head.

ALUMINIUM (*see* 1.767).—During the period 1911 to 1925 the annual production of aluminium showed a steady increase of from 45,000 to approximately 200,000 tons from all sources. The increase of 440% in the aluminium production is therefore a remarkable epitome of the wide uses which have been found for the metal. Of the foregoing productions the United States and Canada contribute about one half, whilst the remainder is made up by the European industry represented by independent interests in Great Britain, France, Switzerland and, latterly, Germany. Virtually all the producing interests are engaged on a policy of expansion.

No significant changes have been made in the methods of production, bauxite ore still forms the basic material from which aluminium is reduced and it is commercially mined in the South of France, Italy, Yugoslavia and Hungary, also in British and Dutch Guiana, while in the United States the ore is mined in Arkansas, Georgia and Alabama. Many other prospective deposits exist in other parts of the world, but have not yet been commercially exploited. Experiments to reduce aluminium from alunite (aluminium-potassium silicate) and kaolin (aluminium silicate) have been technically but not commercially successful. The average purity of metal now shipped by the leading European producers is 99%, a somewhat lower commercial grade being employed for castings and higher purity for conversion into sheet, wire and special alloys. The only significant impurities in high-grade aluminium consist of silicon and iron.

Uses of Aluminium.—The principal use for aluminium is in the form of castings, for which purpose the metal is usually alloyed with zinc or copper or both, the aluminium being from 85% to 95% of the content. Such alloys form the basis of motor car crank-case castings, transmission housings and a great multitude of other parts produced in sand moulds according to regular brass foundry practice. Wheels for motor omnibuses, rear axles and brake drums are among the important examples of commercial aluminium castings in regular production. These have been made possible by the development of high endurance alloys resistant to fatigue and shock. In the production of still larger and more difficult castings considerable use has been made of an alloy of 87% aluminium and 13% silicon. By melting this alloy under prescribed conditions it is possible to attain a tensile strength of 27,000 lb. per sq. in. and an elongation of 8% on two inches, together with a very dense structure, low shrinkage and absence of porosity. Individual castings have been made in this alloy up to a weight of 2,500 pounds.

Many aluminium castings are now produced in hot iron moulds and afterwards heat treated to bring out the best properties of the metal. An important alloy for this work is generally known as "Y" alloy and was developed at the National Physical Laboratory, Teddington, Middlesex. It contains 92% aluminium, 4% copper and the remainder nickel and magnesium, and will give a tensile strength of 44,000 lb. with $5\frac{1}{2}$% elongation. Unlike many other alloys it is exceedingly strong when hot and is therefore widely used for pistons and cylinders of internal combustion engines (*see* Internal Combustion Engine; Metallurgy).

The development of new alloys has also expanded the field for aluminium sheet and forgings. Although pure aluminium sheet is extensively used for motor car bodies and for cooking utensils, certain uses demand alloys of particularly high strength.

This is so in the case of aircraft construction, in which the greater part of the machine is built of duralumin (*see* Aeroplane). This alloy has been progressively developed and used since its invention by Wilm in Germany in 1910. Its average composition is 95% aluminium, $3\frac{1}{2}$% copper and the remainder magnesium and manganese. The metal is hot rolled, forged and otherwise fabricated, heat treated and quenched with a resulting tensile strength of 60,000 lb. per sq. in. and an elongation of 20% on two inches. Not only is it comparable with steel on the basis of strength, but it has the merit of light weight attaching to aluminium alloys in general and its tensile strength per ton is practically $2\frac{3}{4}$ times greater than 40 tons of steel.

A considerable tonnage of high-grade aluminium is hot rolled, drawn into wire and stranded into a cable for electrical transmission (*see* Electricity, Transmission of). For a given conductivity aluminium is actually some 50% lighter than copper and generally more economical. At the present time (1926) it is estimated that there are not less than 200,000 m. of aluminium wire in use for overhead transmission lines, the bulk of which consists of a composite cable having a steel core around which the aluminium wires are stranded.

As now commercially produced, the summarised properties of aluminium are as follows (British Aluminium Company, Ltd.):—

Atomic weight . . . . = 27·1
Melting point ° C. . . . = 658·7
  ° F. . . . = 1217·7
Specific heat . . . . = 0·214
Thermal conductivity (cal. per 1° C. per cm. per sec.) . = 0·504
Expansion coefficient ° C. . = 0·00002268
  ° F. . = 0·0000126
Density . . . . . = 2·705
Tensile strength, wire, hard . = 28,000 lb. per sq. in.
Tensile strength, wire, soft . = 14,000 lb. per sq. in.
Modulus of elasticity . = 9,600,000 lb. per sq. in.
Resistivity of aluminium at 20° C.
  Standard annealed aluminium
    Ohms per metre gramme = 0·0763
    Microhms per in. cube . = 1·1102
    Microhms per cm. cube . = 2·82
  Standard hard drawn aluminium
    Ohms per metre gramme = 0·0774
    Microhms per in. cube . = 1·1260
    Microhms per cm. cube . = 2·86

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ALVEAR, MARCELO TORCUATO DE (1868–), Argentine politician, was born at Buenos Aires Oct. 4 1868, the son of Torcuato de Alvear, several times mayor of Buenos Aires, and grandson of General Carlos de Alvear, the first Argentine Minister to the United States. After graduating from the University of Buenos Aires he affiliated himself with the Radical party, and in 1912, after some years of study and travel in Europe, he was elected to the Lower House of the Argentine Congress, first from the city, and then from the province, of Buenos Aires. As a Congressman he promoted social-service legislation, notably for the improvement of housing and Civil Service conditions. He served as Argentine Minister to France from 1916 until his election as President of Argentina in 1922, when he received a large majority over his opponent, Dr. Lisandro de la Torre. On the whole he continued the policies of his predecessor, Hipólito Irigoyen, though his long residence in Europe enabled him to take a somewhat broader view of foreign affairs. As his term as president continued, he gradually became more influential in the affairs of the Radical party, in whose councils he assumed an outstanding position.

ALVERSTONE, RICHARD EVERARD WEBSTER, 1st Baron (1842–1915), British lawyer (*see* 1.775), died at Cranleigh, Surrey, Dec. 15 1915.

AMANULLA KHÁN (1892–), Amir of Afghanistan, was born June 1 1892, being the third son of Habibulla Khán by his principal wife, Ulya Hazrat. On Feb. 20 1919 Habibulla Khán was assassinated, whereupon his brother, Nasrulla Khán, seized the reins of government. Six days later, however, Amanulla Khán declared himself Amir. In Aug. 1919, following fighting between British troops and Afghans, the new Amir successfully negotiated a treaty of peace by the terms of which Afghanistan was left officially free and independent. From this time onward the Amir consistently adopted a policy of westernisation. He even went so far as to advocate the emancipation of women by female education, which roused the opposition of the Mullas and was one of the causes of the rebellion which broke out in Khost in 1924. (*See* AFGHANISTAN).

AMAZON (*see* 1.783).—The economic vicissitudes through which the Amazon basin passed in the period 1910–26 are traceable largely to changes in the rubber industry. Although crude rubber was sent from the Amazon as early as 1827, several decades passed before the annual exportation attained commercial importance. With the remarkable increase in the demand for rubber, prices rose, and gatherers in the forests were sent further afield.

About 1910–1 prices reached their highest point, yearly exportations amounted to thousands of tons and numerous river craft plied on the Amazon and its tributaries. The inhabitants of the valley were almost exclusively engaged in rubber exploitation. The growing of foods was largely abandoned, even necessary commodities being imported. About this period, however, plantation rubber trees of the East Indies were coming into bearing and the result was a collapse by 1915 of the one great industry of the region. At this juncture the World War reduced shipping available for trade in the Amazon; the scarcity of imported foodstuffs necessitated a rapid change in the occupation of the inhabitants, who reverted to fishing and the growing of such crops as sugar-cane, manioc, corn, tobacco, cotton and nuts.

Expeditions.—During the period 1910–26 there were numerous expeditions, exploratory and scientific, into regions watered by the Amazon and its tributaries. The most notable was that made by Roosevelt and Rondon (1913–4) down the Rio Duvida (River of Doubt), most of which had never been visited. The journey lasted two months and covered a distance of 470 miles. The river proved to be a branch of the Madeira, 940 m. in length, joining the main stream in lat. 5° 21′ South. Other expeditions were the Fleming expedition (1919), which studied the industrial possibilities of the region; and the Rice expedition (1924), which made valuable scientific observations, taking many aerial photographs. The Carnegie Museum also sent an expedition for the study of fishes; the Ellsworth, the Farabee, the Fawcett and other parties obtained geographic, geological and ethnological data. The Rusby party and other specialists investigated flora. Probably the most important commercial investigations in Amazonia were those undertaken in 1923–4 by the American Rubber Mission financed by the U.S. Government. Its leader, Dr. W. L. Schurz, was assisted by specialists from the Depts. of Commerce and Agriculture, and from the business world, and by experts from Brazil, Bolivia and Peru. This party investigated the regions of the rivers Tocantins, Xingu, Tapajoz, Madeira, Mamoré, Beni, Madre de Dios, Acré, Purus, Ucayali, Huallaga, Negro and Branco, conducting a survey along a total of 37 watercourses. Special parties penetrated inland and examined soils and agricultural possibilities, particularly with a view to the production of rubber and sugar-cane.

Trading Spheres.—Exporters and importers recognise three trading spheres; the regions, respectively, of Pará (or Belém), Manaos and Iquitos. Numerous European and American steamships call at Pará; some proceed to Manaos, while others go up the river to Iquitos. Motor-cars are numerous in Pará and Manaos, and are being introduced into regions such as Cobija in Bolivia and other primitive settlements. Electric-light plants are in operation in larger cities and in Obidos, Porto Velho, Riberalta, Cobija, Alemquer, etc. River steamers are also thus equipped. The Mamoré-Madeira Railroad, 220 m. around Madeira Falls, opened in 1912, provides access to additional virgin territory. Land telegraph and radio services operate between the several cities of the region and many smaller places, thereby lessening their isolation.

Estimates place the population of the Amazon basin at about 1,500,000, all but 200,000 being credited to Brazil. The city of Pará has 180,000; Manaos, 40,000; Iquitos, 8,000; Santarem, 5,000; Obidos, 3,000. It is estimated that in the Amazon basin about 30,000 labourers might be recruited for agricultural or other purposes. Considerable quantities of rubber, Brazil nuts, fish and other products were being exported in 1925. The region's imports were on the increase. (W. A. R.)

AMBASSADORS, CONFERENCE OF.—The term has been used in times past to denote the sessions or reunions of ambassadors at a certain centre, generally for the period of the execution of a treaty. The best example of this is the Ambassadors' Conference which sat at Paris and Vienna from 1815–22. It consisted of the ambassadors at Paris of Great Britain, Russia, Prussia and Austria. It was concerned with the execution of the Treaty of Vienna and cognate instruments, but naturally tended to interfere with other matters as well. But a strict limitation of its function to the Treaty of Vienna was insisted upon by Wellington as Allied Commander-in-Chief in France and by Castlereagh, the British Foreign Minister. On Canning's accession to power (Sept. 1822), this principle was so strictly observed as practically to withdraw England from the conferences altogether. The whole arrangement came to an end in 1826, after a period of eleven years.

Somewhat similar has been the experience of the Ambassadors' Conference between the years 1920 and 1925. With the coming into force of the Treaty of Versailles (Jan. 10 1920), the Ambassadors' Conference at Paris became one of the organs concerned with the execution of the Treaty. Another permanent one was the League of Nations (*q.v.*). A third, which was not permanent, but frequently superseded the Ambassadors' Conference, was the Supreme Council. None the less the Conference had considerable powers. It met every week at Paris and discussed the execution, first of the Versailles Treaty, and then of all the others. It consisted of the representatives of Great Britain, France, Italy and Japan, with the American Ambassador attending in the capacity of a spectator after 1921. Many of the technical decisions under the treaties were actually taken by the ambassadors, and in a large number of cases important interpretations were given. On the whole the Ambassadors' Conference tended to the advantage of France, for the full technical staff of her Foreign Office was available for every question, while the other Powers were generally represented only by their ordinary embassy staffs.

It is difficult to give details of their activities when so much mystery obtained concerning them. On the larger aspects of Reparations they were not influential. The German aspects were always withdrawn from them while Mr. Lloyd George was Prime Minister, and, after his fall, the same policy was continued by his two successors. Similarly the settlement of Austrian and Hungarian Reparations, though discussed in the Ambassadors' Conference, was decided by the League of Nations. On the other hand their decisions were sometimes final on questions of frontiers. In the case of Albania, a frontiers commission was appointed at Paris, and had thrashed out the question before the matter was transferred in Sept. 1921 to the League, which finally settled it in Nov. of that year. But, except in the case of Memel and the plebiscite areas, the complicated frontiers of Poland, left unsettled by the Peace Conference, were decided by the ambassadors. They also reorganised the frontiers established between Poland and Russia by the agreement of Riga.

The most important function performed by the Ambassadors' Conference was undoubtedly in Oct. 1921, when the ex-Emperor Karl for the second time returned to Hungary with the view of regaining his crown. The "Little Entente" (Czechoslovakia, Yugoslavia and Rumania) threatened very strong measures against Hungary. But, largely as a result of the ambassadors' intervention, Karl was arrested (Oct. 24), and a law was passed by the Hungarian Parliament which abrogated his sovereign rights (Nov. 3). The Ambassadors' Conference thus averted a dangerous crisis, and was held to have proved its value.

Its action in 1923, in connection with the Corfu incident, brought the Conference into some discredit, and produced considerable discussion as to the desirability of limiting its powers. Shortly after he became Prime Minister, Mr. Ramsay MacDonald announced that its powers would be limited to the execution of the Versailles Treaty, and this policy seems in effect to have been continued. Much of its executive work has ceased since disarmament has been achieved in all ex-enemy countries, and since practically all financial matters have been transferred to other authorities.

The greater weight in the authority of the Council of the League, marked by the presence of British and French Prime Ministers in 1924, and of Great Britain's Foreign Minister and France's Premier in 1925, would appear to be a sign of the decline of the Ambassadors' Conference. It is significant that the Greco-Bulgar frontier dispute, which arose in Oct. 1925, was referred not to the Ambassadors' Conference, but to the Council of the League, at Paris. (*See* SUPREME COUNCIL.)

BIBLIOGRAPHY.—H. W. V. Temperley, *History of Peace Conference* (1924); A. J. Toynbee, *Survey of International Affairs, 1920–23* (1925). (H. W. V. T.)

AMENDOLA, GIOVANNI (1882–1926), Italian politician and journalist, was born at Naples April 15 1882. He entered journalism at the age of 18, and eventually became Rome correspondent of the Milan *Corriere della Sera*, which he left in 1921 to found a paper of his own, *Il Mondo*. In 1919 he was elected deputy for Sarno in the province of Salerno and re-elected in 1921 and 1924. After the War he devoted himself entirely to politics as a Democratic Liberal and a supporter of Nitti. On Nitti's fall, June 9 1920, he joined the opposition to Giolitti, and became Minister for the Colonies, first under Bonomi, then under Facta. He opposed Fascism from the first, and after Mussolini's advent to power he became in some sense the leader of the heterogeneous opposition groups. After the Matteotti crime he was the leader of those who withdrew from the Chamber to the Aventine (*see* ITALY). His devotion to constitutional principles led him during the election campaign of 1924 to declare the electoral law enacted by the Fascist Govt. to be unconstitutional and therefore null and void. Though generally respected for his honesty, he did not show the qualities necessary for a great political leader. His two publications *Una battaglia liberale* (1924) and *La Democrazia dopo il 16 Aprile 1924* (1924) made known his political faith. His death in hospital at Cannes April 6 1926, was thought to be the result of the two attacks on his life on Dec. 26 1923 in Rome, and in Aug. 1925, while on holiday at Montecatini.

AMERICANISM, a term first used by John Witherspoon, president of Princeton University, in 1781, designates (*a*) any word or combination of words which taken into the English language in the United States, has not gained acceptance in England, or, if accepted, has retained its sense of foreignness; and (*b*) any word or combination of words which, becoming archaic in England, has continued in good usage in the United States. The first class is the larger and has the longer history. The earliest settlers in Virginia and New England, confronted by plants and animals that were unfamiliar to them, either borrowed the Indian names or invented names of their own.

Examples are afforded by *raccoon* (1608), *chinkapin* (1608), *opossum* (1610) and *squash* (1642) among Indian words and by *bull-frog, canvas-back, cat-bird* and *live-oak* among inventions. The former tended to take anglicised forms. Thus the Indian *isquontersquash* (at least, that is how the early chroniclers recorded it) became *squantersquash* and was then reduced to *squash*, and *otchock* became *woodchuck*. Many other words came in as the pioneers gained familiarity with the Indian life. Such words as *hominy, moccasin, pone, tapioca* and *succotash* remain everyday Americanisms.

The archaisms, of course, showed themselves more slowly. They had to go out of use in England before their survival in America was noticeable. But by the beginning of the 18th century there was already a considerable body of them, and all through that century they increased. The English language in Great Britain, chiefly under the influence of pedantry in the age of Anne, was changing rapidly, but in America it was holding to its old forms. There was very little fresh emigration to the colonies, and their own people seldom visited England. Thus by the end of the century "*I guess*" was already an Americanism, though it had been in almost universal use in England in Shakespeare's day. So, too, with many other verbs: *to wilt, to whittle, to fellowship* and *to approbate*. And with not a few adjectives: *burly, catty-cornered, likely* and *clever* (in the sense of amiable). And with multitudes of nouns: *cesspool, greenhorn, cordwood, jeans, flap-jack, bay-window, swingle-tree, muss* (in the sense of a row), *stock* (for cattle) and *fall* (for autumn).

Meanwhile, American English had begun to borrow words, chiefly nouns, from the non-English settlers, and to develop many new words of its own. To the former class the Dutch contributed *cruller, cold-slaw, cockey, scow, boss, smearcase* and *Santa Claus*, and the French contributed *gopher, prairie, chowder, carry-all* and *bureau* (a chest of drawers). Other contributions came from the Germans of Pennsylvania, the Spaniards of the southwest, and negro slaves. The native coinages were large in number, and full of boldness and novelty. To this period belong, for example, *backwoods, hoe-cake, pop-corn, land-slide, shell-road, half-breed, hired-girl, spelling-bee, moss-back, crazy-quilt, stamping-ground* and *cat-boat*. These words were all made of the common materials of English, but there was something in them that was redolent of a pioneer people and a new world. In their coinage the elegances were disdained; the thing aimed at was simply vividness. At the same time, verbs were made out of nouns, nouns out of verbs and adjectives out of both.

In 1789 Benjamin Franklin, who had lived in England, denounced *to advocate, to progress* and *to oppose* as barbarisms, but all of them are good American to-day, and even good English. Noah Webster, the lexicographer, gave his imprimatur to *to appreciate* (in value); *to eventuate* was popularised by Gouverneur Morris; and no less a hero than Washington is said to have launched *to derange*. Many inventions of that daring era have succumbed to pedagogical criticism, *e.g., to happify, to compromit* and *to homologise*. But others equally harsh have gradually gained acceptance, *e.g., to placate* and *to deputise*. And with them have come in a vast number of characteristic American nouns, *e.g., breadstuffs, mileage, balance* (in the sense of remainder) and *elevator* (a place for storing grain).

Divergent Meanings of Words.—It was during the same period that a number of important words, in daily use, began to show different meanings in England and America. Some familiar examples are *store, rock, lumber* and *corn*. What Englishmen call a *shop* was called a *store* by Americans as early as 1770, and long before that time *corn*, in American, had come to signify, not grains in general, but only maize. The use of *rock* to designate any stone, however small, goes back still further, and so does the use of *lumber* for *timber*. Many of these differences were produced by changes in English usage. Thus *cracker*, in England, once meant precisely what it now means in the United States. When the English abandoned it for *biscuit* the Americans stuck to *cracker*, and used *biscuit* to designate something else. How *shoe* came to be substituted in America for the English *boot* has yet to be determined. There is indeed much that remains obscure in the early history of such Americanisms. Until very lately, American philologians kept aloof from the subject, which they apparently regarded as low. Until George P. Krapp, of Columbia University, took it up, there was not even any serious investigation of the history of American pronunciation.

Thus the American dialect of English was firmly established by the time the Republic was well started, and in the half-century following it departed more and more from standard English. The settlement of the West, by taking large numbers of young men beyond the pale of urbane society, made for grotesque looseness in speech. Neologisms of the most extravagant sorts arose by the thousand, and many of them worked their way back to the East. During the two decades before the Civil War everyday American became almost unintelligible to an Englishman; every English visitor marked and denounced its vagaries. It was bold and lawless in its vocabulary, careless of grammatical niceties, and further disfigured by a drawling manner of speech. The congressional debates of the time were full of its phrases; soon they were to show themselves in the national literature.

Policing the Language.—After the Civil War there was an increase of national self-consciousness, and efforts were made to police the language. Free schools multiplied in the land, and the schoolmarm revealed all her immemorial preciosity. A clan of professional grammarians arose, led by Richard Grant White; it got help from certain of the literati, including Lowell. The campaign went to great lengths. "*It is me*" was banned as barbarous, though it is perfectly sound historically; *eye-ther* was substituted in polite usage for *ee-ther*, though the latter is correct and the former is on the part of an American an absurd affectation.

But the spirit of the language, and of the American people no less, was against such reforms. They were attacked on philological grounds by such iconoclasts as Thomas R. Lounsbury; they were reduced to vanity by the unconquerable speech habits of the folk. Under the very noses of the purists a new and vigorous American slang came into being, and simultaneously the common speech began to run amok. That common speech is to-day almost lawless. As Ring Lardner reports it—and he reports it very accurately—it seems destined in a few generations to dispose altogether of the few inflections that remain in English. "Me and her woulda went" will never, perhaps, force its way into the grammar-books, but it is used daily, or something like it, by a large part of the people of the United States, and the rest know precisely what it means.

On higher levels the language of the Americans is more decorous, but even there it is a genuinely living speech, taking in loan-words with vast hospitality and incessantly manufacturing neologisms of its own. The argot of sport enriches it almost daily. It runs to brilliantly vivid tropes. It is disdainful of grammatical pruderies. In the face of a new situation the American shows a far greater linguistic resourcefulness and daring than the Englishman. *Movie* is obviously better than *cinema*, just as *cow-catcher* is better than *plough* and *job-holder* is better than *public-servant*. The English seldom devise anything as pungent as *rubber-neck*, *ticket-scalper*, *lame-duck*, *pork-barrel*, *boot-legger* or *steam-roller* (in its political sense). Such exhilarating novelties are produced in the United States every day, and large numbers of them come into universal use, and gradually take on literary dignity. They are opposed violently, but they prevail. The visiting Englishman finds them very difficult. They puzzle him even more than do American peculiarities of pronunciation.

Of late the increase of travel and other inter-communication between England and America has tended to halt the differentiation of the two dialects. It was more marked, perhaps, before the World War than since. But if it ever vanishes altogether the fact will mark a victory for American. The American cinema floods England (and the rest of the English-speaking world) with American neologisms, but there is very little movement in the other direction. Thus the tail begins to wag the dog. How far the change has gone may be observed in Australia. There a cockneyfied pronunciation holds out, but the American vocabulary is increasingly triumphant. In Canada it long ago overcame the last vestiges of opposition.

BIBLIOGRAPHY.—There is no satisfactory dictionary of Americanisms. The best is Richard H. Thornton's *American Glossary* (1912), but it is based wholly on written records and is thus incomplete. George Philip Krapp's *The English Language in America* (1925) is valuable to the student of American pronunciation, and contains much miscellaneous matter of interest, but there are gaps in it, and the author opposes his own evidence by arguing that English and American show few important differences. An extensive bibliography is in H. L. Mencken's *The American Language*, 3rd ed. (1923). In 1925 Dr. Louise Pound, of the University of Nebraska, began the publication of a monthly, *American Speech* (Baltimore).

(H. L. M.)

AMERICAN LEGION.—An organisation of World War veterans who served honourably in the armed forces of the United States or who, as American citizens, entered the armed forces of a government associated with the United States in the War. Organisation was effected at a series of meetings held at Paris, France, March 15–7 1919; at St. Louis, Mo., May 8–10 1919; and at Minneapolis, Minn., Nov. 10–12 1919. A national charter was granted by Act of Congress, Sept. 16 1919.

The membership attained its maximum (759,799) in 1921, standing at 609,407 in 1925. The legion maintains a national headquarters at Indianapolis, Ind., and publishes *The American Legion Weekly*, its official organ. Its activities have been directed effectively toward the passage of the National Defence Act (1920), the creation of the U.S. Veterans' Bureau (1921), the appropriation of government funds for the care of disabled veterans (total 1920–4, $2,944,944,169), and the passage of bonus bills both by the Federal and state governments in favour of those who served in the World War. A programme for the aid of war orphans was devised in 1923; and in 1925, with the aid of the public, a fund of about $5,000,000 was raised to endow permanently the legion's child welfare and rehabilitation work. The legion also initiated the preparation of a code of national flag etiquette.

See Annual Reports to Congress; M. James, *A History of the American Legion* (1923); E. Putnam, "The American Legion—A Brief Outline of Its History and Accomplishments" (1923) and "The American Legion," in *Annual Report of the American Historical Association*, vol. 2; *ibid.*, vol. 1, p. 199 *seq.*

AMERICAN LITERATURE (*see* 1.831).—The years 1910 and 1911 were dates of real significance for literature in English. They marked with approximate accuracy the end of a period. It was then, and not later, when the turmoil of the World War had confused men's minds, that three literary movements lost their momentum, and a fourth became dominant. The brilliant but short-lived aestheticism of the 'nineties, with its wit and its vivid play upon sensation, died for lack of roots. The cult of force and moral manliness, which in Kipling's staccato style had captured the popular imagination on both sides of the Atlantic, lost its validity because it ceased to represent either the facts or the emotions of an era both more democratic and more sceptical. And finally, the premature romanticism which had swept America particularly into a sentimental enthusiasm for its own supposed past and made the presses reel with "best sellers," encountered the passion for reality which science had bred, and sank underground into that instinctive world where the interests of the demi-literate are forever fed by raw imaginings that have little place in literature.

It was, indeed, about 1910 that the scientists, the satirists, the philosophers in fiction, who since the 'eighties in Europe had been attacking the conventions upon which 19th-century literature rested, won their victory and scattered not merely the feeble remnant of Victorianism, but overthrew the Kiplings, the Stevensons, the sentimentalists and the aesthetes. Bernard Shaw and H. G. Wells were their protagonists in English, with the influence of the great Russians behind. About that time, both in Great Britain and in America, the prevailing interests of the literary changed. In prose and poetry, in fiction and on the stage, the attempt to escape from the conventional, to make literature square with new facts, to seek a fresher reality, is obvious. There is a break with the past which the World War only accentuated and the younger writers of the second and third decades accepted as their duty and heritage. The idea became more important than the form in fiction; the stage drifted toward satire; poetry, after a long dormancy, revived in realistic moods in which much that had been regarded as unpoetical was better expressed than beauty in its conventional aspects.

I. INTRODUCTION

At the beginning of the new epoch American literature was popular, diffuse and feeble, and Americans were far more influenced than influential; yet once the movement was under way it developed great energy and wrought wide changes in the literature of the United States. American writers who, except for Whitman and Mark Twain, had been of little world significance since the days of the great New Englanders, became again important, with definite achievements and still more definite promise. The effect of the War upon European literature was shattering. The story is different for America. That craving for a new reality which America had shared with Europe was reinforced and directed by the violent emergence of the United

States out of relative isolation into the current of world ideas. A new nationalism was born in American literature, due to a new perspective of America as a nation among nations.

This new nationalism was, from 1914 to 1920, in externals a new internationalism, engendered by a flood of European ideas (many of them wrapped round propaganda) which reached far beyond the bounds of literature and scholarship and led not only to a new knowledge of European thought, but, with more importance, to a vivid consciousness of ideas as a determinant of national beliefs and action.

The novels of Theodore Dreiser in the first decade of the century had expressed in powerful crudity the American attempt to get at the reality of American life; but in the *Spoon River Anthology* of Edgar Lee Masters in 1915, and in Sinclair Lewis' *Main Street* in 1920; a new spirit of self-criticism appears, which is quite as much due to a quickened national sense as to a search for truth.

In a romantic age the entry of America into the War might have led to a violent reaction from European ideas into a narrow and optimistic patriotism. In spite of victory and a vast prosperity afterwards, what happened was the reverse. The literature of the United States has become more critical, more realistic, more sophisticated. And although the American theme has been exalted as not before for many generations, what has been written is not " local colour " but studies of America as a part of world civilisation. The result has been a rapid increase of energy and effectiveness in American writing, due to the wealth of new subjects and the opportunity for experiment, with a much more uneven advance in the artistic value of the product. The years 1910–26 have been not so much an age of youth as an opportunity for all new talents, whether young or old. In poetry, the peak of energy was apparently reached in the second decade of the century, and the writers who established themselves then—such as Robert Frost, Amy Lowell, Edwin Arlington Robinson, Vachel Lindsay, Edgar Lee Masters and Carl Sandburg—have had no such virile successors; nor, with the exception of Frost, has their own later work been of sustained importance. American fiction, however, did not reveal its full power until 1920, and is still expanding in fertile experiment, and this is true also of drama and criticism.

The realism of this new American literature is thoroughly national in character. The work of Willa Cather, Booth Tarkington, Sherwood Anderson, Sinclair Lewis, Eugene O'Neill, Vachel Lindsay, for example, shows in effect the entrance into American literature, both as author and as subject, of the American democracy—not as Whitman conceived it, a band of equalitarian brothers, but as a bourgeoisie of everyday people, not class conscious, the product of industrialism and uplift. As industrialism tends more and more throughout the world to produce men and women of the American habit of life, this gives an importance to the new American fiction that is quite independent of its absolute artistic merit. In the American moving picture this social importance has often parted from aesthetic and critical values altogether. Sinclair Lewis' *Main Street* (1920) and *Babbitt* (1922), however, have a symbolic value comparable in kind, if not in degree, to *Hamlet* and *Anna Karenina.*

Still more closely related to the tendencies and influences noted above, is the striking drift toward satire, especially since 1920 and the disillusionment which followed the War. The inevitable comparison with European society arising from America's international experience resulted not so much in admiration of the foreigner as in criticism of home-made civilisation. Americans saw themselves in perspective as no earlier American writers had done—not even Mark Twain, whose satire was directed against humanity rather than America. Sinclair Lewis was the bannerbearer in this; but a surprising number of novels, plays and poems in the period can best be judged as satire, and a new criticism—literary, historical and social—has developed with either satire or analysis of the American mind as its chief motive. American literature has become fully self-conscious.

With self-criticism has come the sudden and almost complete sophistication of the advancing edge of American writing, both journalistic and literary, and especially of American dramatic writing. Naïveté has gone, except for the naïve assumption that comfort, wealth and triumphant love win happiness forever after, which is still current in broadcast magazine literature. American literary art has become critical, detached and often cynical to a marked degree. It is significant that this is least true in the American magazines of wide circulation which are a purely native product, and most marked upon the New York stage, which has been strongly influenced by European modes and ideas. There has also been a wide extension of the area in which experience is sought for art. The interest in the lower and middle levels of consciousness, so apparent in all of the stronger American writers, is of course common to all modern literatures, but in the United States it has been especially fruitful because it has led poets, dramatists and novelists to break through the standardisation of American experience to the incongruous emotions astir beneath. The uneven work of Sherwood Anderson, the sensational plays of Eugene O'Neill, the quiet penetration of Robert Frost, the fantasies of Christopher Morley, all are indicative of this new power. Inevitably the new area of investigation has spread to those questions of sex which psychology had revealed as of high importance, and the controversy as to the relations between art and decency has been an important part of contemporary criticism.

A direct result of these new extensions of interest has been a marked development of technique and a more uneven advance in literary craftsmanship. The novel and the drama have been especially fertile in experiment, and although the foreign influence of Proust, Dorothy M. Richardson, James Joyce and the German expressionists has been strong, the symbolism of Cabell, the realistic fantasy of Christopher Morley, the dramatic devices of O'Neill, the slow broodings of Anderson have been highly original in their application to the American theme. Craftsmanship, always the weak point in American literature, has notably advanced in the hands of such skilful workmen as Hergesheimer, Cabell, Frost, Elinor Wylie and Mrs. Edith Wharton, until crudity can no longer be regarded as a concomitant of strength in American writing. On the stage this sense of artistic fitness has been most notably displayed in the remarkable development of background and direction, where again the inspiration is European but the result often highly original.

The only " schools " of literary expression which may be said to have come into existence in the United States since 1910 are symptomatic of the tendencies at work. Free verse, of which the imagists, led by the late Amy Lowell, were champions, was essentially an attempt to get new vigour and new scope for American poetry. It was used and overused by writers whose interest in the American scene led them to desire, like Whitman, new rhythms to express perceptions not hitherto felt to be poetical. Having accomplished its main purpose, free verse as such has become again of minor importance. The curious outburst in American fiction of what the French many decades earlier had called naturalism, was largely a result of the new interest in American life. The novel of the Middle West, usually of farm experience, which became a familiar type in this period, was written in the closest possible imitation of the actual appearance of life, and was made vigorous, if not always interesting, by the sudden discontent of its authors with the monotony and narrowness of American rural existence. Here, as in free verse and in the handling of sex, honesty frequently outran art.

Outside of belles lettres, such work in biography and history as could properly be called literature was strongly influenced by the conditions of the era. The scientific, impersonal study of facts which had its great impetus in the 19th century became the foundation for more critical, more personal, and more imaginative books, which did not so much revert to the older methods of narrative as substitute criticism, philosophy and analysis for an unrelieved structure of uninterpreted fact. The new international interests brought by the War and the sudden discovery of the importance of the American frontier were stimulating factors. Such books as *The Education of Henry Adams* (1918) and such a series as the *Chronicles of America*, ed. Allen Johnson

(1920), reflected in the one case the more human note, and in the other the breadth of the new interest in the American past, which every year since their publication has seen increase. Such notable memoirs as the *Letters of Walter H. Page* (1922, 1925) and of *William and Henry James* (1920) have helped to increase the interest of Americans in themselves.

The history of the period 1910–26 in American literature is a story of new fundamental conceptions entering the American mind, which have conditioned all writing not strictly utilitarian or entirely superficial in its nature. The new premises upon which a part of American thinking and observation have been conducted, the sense of new values in beauty and the emotions generally, have combined with the influence of the innumerable translations and reprints from abroad to encourage technique, increase sophistication, lift the general level of literary accomplishment and sharpen and clarify the interest in the American scene. There are perhaps few great names in this period, although purely aesthetic criticism has had as yet little time or inclination to operate; but the violence of the attack by representatives of an older culture upon the typical books of the time is evidence of the energy inspiring change. Contemporary American literature is clearly both pioneer and transitional, and bears every mark of the beginnings of a new age. (H. S. C.)

II. POETRY

What has been called "the new era in American poetry" may be said to date from 1914. In that year various unformed tendencies suddenly crystallised into a set of movements, and the poets who were to become the leaders of the renaissance issued their first challenging volumes. Within 12 months there appeared Vachel Lindsay's *General Booth Enters into Heaven*, Amy Lowell's *Sword Blades and Poppy Seed*, James Oppenheim's *Songs for the New Age*, Robert Frost's *North of Boston*, and the first anthology of *The Imagists*, which, under the aegis of Amy Lowell, introduced the work of John Gould Fletcher and "H. D." A year later readers became familiar with four new names, through the immediate popularity of Edgar Lee Masters' *Spoon River Anthology* (1915), Sara Teasdale's *Rivers to the Sea* (1915), Edwin Arlington Robinson's *The Man against the Sky* (1916), and Carl Sandburg's *Chicago Poems* (1916). Edna St. Vincent Millay's *Renascence* had been acclaimed as early as 1912, and in 1917 these poignant verses, written by the poet at 19, became the title-poem of her most famous collection.

Her sonnets took rank among the best ever written in America, and her concise lyrics in *Second April* (1921), recalling influences as unlike as Catullus and Emily Dickinson, gave rise to a small army of imitators. Sara Teasdale won almost as many followers. Her *Rivers to the Sea* (1915) and *Flame and Shadow* (1920) contain love songs worthy of Christina Rossetti, poems which are as inevitable and artless as folk-songs.

Though some of the poets attained eminence in more than one *genre*, the tendencies of the period were so pronounced that much of the poetry fell naturally into certain divisions. The outstanding group—the one to interpret life from the realistic standpoint—included Edwin Arlington Robinson, Robert Frost, Edgar Lee Masters and Carl Sandburg. Each of these achieved an attitude and an idiom which, while strongly differentiated, were always indigenous. Robinson was the first to revolt from the rhetorical exaggeration and the "poetic diction" of the preceding period. Even his first volume, *Children of the Night* (1897), anticipated the later innovators by using a speech that was not the language of the poetasters but of the people. His *Collected Poems* (1921) and the subsequent *Dionysus in Doubt* (1925) revealed a precise and curiously astringent voice, a tone that, in its very clipped syllables, declared its New England origins. The dryness of his utterance was deceptive; beneath the congealed phrases there ran a warm flood of sympathy, particularly with those who, from a worldly point of view, were failures. His most highly coloured canvases are those of such defeated dreamers as "Miniver Cheevy" and "Captain Craig," mediocrities like the son in "The Gift of God" and battered derelicts like "Bewick Finzer." Robinson's spiritual godfather is undoubtedly Browning. More surprising than the tremendous extent of his gamut is the certainty of the smallest notes he strikes within it. He is as successful with a long philosophic monologue (*vide* the panoramic "Ben Jonson entertains a Man from Stratford") as with a concentrated sonnet; he is equally at home in a ballad, in dialogue and in the blank verse novel, "The Man who Died Twice" (1924), which won him the Pulitzer Prize for the second time. His brilliant condensations, his objectiveness, his very inability to surrender to the emotions, establish his individuality as well as his backgrounds.

Robert Frost, fully as representative, was even more obviously "native." His *North of Boston* (1914), *Mountain Interval* (1916) and *New Hampshire* (1923), constitute a New England trilogy. Here are the gaunt hillsides, the thinning homesteads, the physical and spiritual isolation of a people struggling among rocky pastures and dried-up brooks. In delineating his subjects, Frost showed himself, first of all, a lover of the fact. But Frost was no mere despondent statistician; he wore his rue and realism with a difference. If he was a farmer, he was also a philosopher, he was more concerned with the soul than with the soil. Nor was he a grim naturalist. His gravest narratives were pronounced with something akin to fantasy; a sly pucker was never absent from so straightforward a disclosure as "Mending Wall"; even that sombre masterpiece, "The Death of the Hired Man," was not without intellectual raillery. It was the "tone of voice" which characterised not only Frost's major efforts but the later lyrics which, though less known, bid fair to rank as high as his larger designs. Here—and this feature has already become an "influence"—was a natural speech so arranged that the accents of the speaker rose from the printed page.

The work of Edgar Lee Masters divided itself into two parts: *Spoon River Anthology* (1915) and the volumes which preceded and followed it. *Spoon River Anthology* was possibly most important as a document; there can be no doubt concerning its powerful translation of local drama, village gossip and universal passions. As art its value was less certain, but its concise epitaphs were far more arresting than the pedestrian blank verse which prevented the excellent thought in *Towards the Gulf* (1918) and *Domesday Book* (1920) from attaining literary distinction.

The realism of Carl Sandburg frequently approached mysticism. Sandburg had been termed "the laureate of industrial America"; and the appellation seems apt enough, for all his volumes, particularly *Chicago Poems* (1916), *Cornhuskers* (1918) and *Smoke and Steel* (1923), vibrated with the throbbing of immense machines. What Frost and Robinson did for New England, Sandburg did for the mid-west. His poetry, like his setting, was full of ferment; his irregular lines, exploring the borderland between poetry and prose, captured a dynamic energy which employed slang with gusto and, occasionally, with beauty. In spite of a frequent excess of violence in his utterance, the mystical element continually loomed above the brutal. If Sandburg gave voice to some of the most raucous declamations of his day, he also breathed some of its quietest phrases.

The aesthetic attitude, though limited in appeal, was responsible for three years of bitter controversy. The literary conflict started quietly enough with the publication of the first volume of *Some Imagist Poets* (1915), grew violent with Amy Lowell's belligerent championship, and finally developed into a prolonged battle over free verse. The Imagists themselves—Amy Lowell, John Gould Fletcher and "H. D." were the American contributors, although Ezra Pound was the first organiser of the group—placed their emphasis on a visual poetry ("the presentation of an image"), on "absolute freedom in the choice of subject," on "the language of common speech," on the "use of the *exact* word, not the merely decorative word." Though much of their work was the product of a programme rather than the result of a creative compulsion, their influence was that of a healthy corrective. The late Amy Lowell was the most tireless fighter against facile platitudes and the clichés of the period; her volumes are a series of brilliant protests, though she herself scorned propaganda in poetry. Even her two-volume biography *John Keats* (1925) caused almost as much discussion as her controversial criticism. *Men, Women and Ghosts* (1916) and *Pictures of the*

Floating World (1919) reveal an enamelled world whose glittering contours are as " hard and clear " as any artisan could desire. The group disintegrated; Amy Lowell turned to larger and more orthodox patterns; John Gould Fletcher and " H. D." amplified their *vers libre* with rhyme and an almost formal construction, the latter's *Collected Poems* (1925) proving to be one of the chief accomplishments of this movement.

Of the rhapsodists, the two most important were Vachel Lindsay and James Oppenheim. Where Lindsay used a drum-beat rhythm and percussive rhymes, Oppenheim employed a semi-Whitmanic, semi-Biblical free verse, but a broadly rhapsodic spirit dominated the work of both. Lindsay was essentially a populariser, capturing in his chants the syncopated sounds of modern American life. Although he disdained the appellation, he was called " the poet who united ragtime and religion," and an examination of his *General Booth enters into Heaven* (1913), *The Congo and other Poems* (1914) and *The Golden Whales of California* (1920) disclosed the influence of half-savage dance tunes, minstrel shows and the hurly-burly of " jubilee " camp-meetings. But Lindsay was as much the missionary as the minstrel, a street-corner evangelist pausing in the midst of his preaching to perform on the saxophone. Oppenheim achieved his effects by recalling the sonority of the Psalms. *The Sea* (1924), a collection of his previous volumes, was both prophetic and analytical; its key was major and its theme was " We are flesh on the way to godhood." Another poet influenced by Whitman though not imitative of him was Robinson Jeffers. Jeffers' *Roan Stallion* (1926), a sensational blend of beauty and violence, was hailed by even the more academic critics as a communication of almost elemental power.

Many of the critics of the " new " poetry, admitting its vigorous spontaneity and intellectual variety, objected that it lacked the sheer singing quality which had been the chief property of English verse. Nothing could be farther from the fact. Lizette Woodworth Reese was the forerunner of the lyricists who, reacting from the elaborate graces and coy affectations of the love-songs of the preceding period, delighted in a direct speech, sparse imagery and immediacy of contact. Of these singers the majority were women, of whom the best known was Edna St. Vincent Millay.

Adelaide Crapsey, Genevieve Taggard, Léonie Adams, Elizabeth J. Coastworth, Hazel Hall, Jean Starr Untermeyer were possibly the most ingratiating of this group, although a sharper and more cerebral type of lyric was patterned if not perfected by Elinor Wylie and the more impassioned Louise Bogan. Mrs. Wylie's verses, in *Nets to Catch the Wind* (1921) and *Black Armour* (1923), were particularly edged; here was a dazzling technique fitted to an unusually "jewelled brain." Among the more resonant singers, Conrad Aiken fashioned a curiously crepuscular music, which later, in *Punch; The Immortal Liar* (1921) and *Priapus and the Pool* (1925), developed into a dark lyricism of extraordinary plangency.

John Crowe Ransom perfected a subtly modulated accent in *Chills and Fever* (1924); John Hall Wheelock, beginning with the buoyant athleticism of *The Human Phantasy* (1911), ascended to a more controlled ecstasy in *The Black Panther* (1922); William Rose Benét and Stephen Vincent Benét, brothers in blood and balladry, struck their most vigorous chords in the former's *The Burglar of the Zodiac* (1918) and the latter's *Tiger Joy* (1925).

Following Edwin Markham's *The Man with the Hoe* (1899), social protest found voice in the extended *Poet in the Desert* (1915) by Charles E. S. Wood, *Arrows in the Gale* (1914) by Arturo Giovannitti and *Challenge* (1914) by Louis Untermeyer. The last was Untermeyer's most popular volume, although *Roast Leviathan* (1923), displaying a far greater restraint, was a decided advance in tone and technique. As parodist and translator, his performances in *Including Horace* (1919), *Heavens* (1922) and *Poems of Heinrich Heine* (1923) were well received, and his critical collections, *Modern American Poetry* and *Modern British Poetry*, were revised several times subsequent to their publication in 1919.

After America's entrance into the World War a great quantity of militant poetry was produced of which next to nothing remains. The names of only two "War Poets," both of whom were killed in action, have survived, and each of these persists by virtue of a single poem: " Trees " by Joyce Kilmer and " I have a Rendezvous with Death " by Alan Seeger.

As has been implied, Ezra Pound was the leader of the experimentalists. A pioneer in style and an innovator in metrics, he allowed his artistry to become theory-logged and to sink in a welter of erudition. The same is true of much of the work of T. S. Eliot, whose *The Waste Land* (1922) occasioned a fierce controversy.

Nor would the record of energetic experiment be complete without listing the euphuistic ironies of Maxwell Bodenheim, the staccato whimsicalities of Alfred Kreymborg, the abstract elegance of Wallace Stevens, the critical wit of Marianne Moore, the curious combination of typographical trickery and lyric gravity of E. E. Cummings. The traditional note, though less assertive, has not been silenced for lack of expression. Among the more conservative technicians were William Ellery Leonard, whose autobiographical *Two Lives* (1925) proved to be one of the most remarkable sonnet sequences ever produced in America; Arthur Davison Ficke; John G. Neihardt, whose *Song of Three Friends* (1919) is part of an epic series celebrating the winning of the West; and the rhetorical but often eloquent George Sterling. (L. U.)

III. FICTION

The death of Mark Twain in 1910 led to a change of opinion concerning him in the United States, which was symptomatic of a larger change of opinion, already under way, concerning fiction in general. Heretofore he had customarily been valued for his broad humour and his eloquent gusto. Now, however, the publication of *Mark Twain: A Biography* (1912) by Albert Bigelow Paine, *Mark Twain's Letters* (1917) and such posthumous works as *The Mysterious Stranger* (1916) and *What Is Man?* (1917—but privately printed in 1906) called attention to a strain of naturalism, often profound and almost always pessimistic, which had grown upon Mark Twain during his later years. That this strain was noted after his death as it had not been noted before was due only in part to the further evidence which his posthumous books offered. Various other writers as well, since about the time of the war with Spain (1898), had been insisting, both in their theories and in their practice, that realism could no longer be bounded by the discreet and kindly limits set by William Dean Howells but must look more searchingly into various hidden paths and remote fields of human conduct; and there had come into existence a public which was impatient of a certain genteel smugness characteristic of much of the fiction produced at the close of the 19th century and the beginning of the 20th.

Of the predecessors of the movement the first place may be given to Stephen Crane, whose Civil War novel *The Red Badge of Courage* (1895) remains at once the most convincing and the most beautiful fiction commemorating that war. In this and in his other stories dealing with warfare, and in his *Maggie: A Girl of the Streets* (1893; 1896), Crane disregarded the expansive and sentimental moods ordinarily implied or evoked in fiction concerned with such themes, and fixed his eye upon specific facts with the intensity of genius. No one of his followers was quite so intense, but some of them learned from him, or shared with him, the method of concentrating upon individuals rather than upon types or social classes. Harold Frederic's *The Damnation of Theron Ware* (1896), a study of the disintegration of a clergyman under the influence of liberal ideas; Theodore Dreiser's *Sister Carrie* (1900), an account of the rise of a trivial woman to fame as an actress; David Graham Phillips's *Susan Lenox*, 2 vol. (1917), a record of the drab miseries and sober splendours of a courtesan; Hamlin Garland's *A Son of the Middle Border* (1917), an autobiographical chronicle of a pioneer—all these are devoted to exceptional individuals whose stories become more rather than less impressive in their application for the reason that they are so little muffled in generalisations.

This interest in exceptional individuals not infrequently gives to American naturalism a quality which makes it seem more or less romantic as compared to the official realism of Howells and his school, with their primary emphasis upon the normal ways of life. Frank Norris, in the two parts of his uncompleted trilogy, *The Octopus* (1901) and *The Pit* (1903), wrote with touches of epic magnificence about the growing and marketing of wheat. Jack London, in *The Call of the Wild* (1903), *The Sea-Wolf* (1904), *Love of Life and Other Stories* (1907) and in many other volumes of autobiographical and fictive adventure, dealt with animals and men waging a fierce evolutionary struggle against hostile environments, and may be said to have created the demand for " red blood " in fiction which still persists. Upton Sinclair, the chief spokesman in fiction of the American proletariat, made vigorous, if at times sensational, drama out of the warfare between social classes, in *The Jungle* (1906) and *100%* (1920), as well as in other equally characteristic, though not equally successful, books, all occupied with phases of the same conflict.

William Sydney Porter, better known as "O. Henry," brought a kind of vivacious Bohemianism to bear upon the little comedies of existence which he noted among the undistinguished inhabitants of New York City, as in *The Four Million* (1906), and extended the same spirit with the dexterity of an accomplished raconteur to other sections of the country, as in *Heart of the West* (1907).

Strictly speaking, however, American naturalism did not reach its full development until the second decade of the 20th century, when Theodore Dreiser (*q.v.*) published the bulk of his fiction: *Jennie Gerhardt* (1911), *The Financier* (1912), *The Titan* (1914), *The Genius* (1915), *Free and Other Stories* (1918), *Twelve Men* (1919). These, with *An American Tragedy* (1925) and the various autobiographic works, *A Traveler at Forty* (1913), *A Hoosier Holiday* (1916), *A Book About Myself* (1922), *The Color of a Great City* (1923), should have served to make Dreiser's attitude and aims clear. Instead, he has been misunderstood and misrepresented, mispraised and misdefended, with an abundance which falls to the lot of only those writers who, whether deliberately or not, become centres of controversy. The controversy about Dreiser is due simply to his habit of regarding human life with more attention to its personal than to its social aspects. His characters either move in the direction of their desires under the impulse of some primitive will or else drift at the mercy of capricious tides of fortune. Something romantic unquestionably appears in his preoccupation with such primitive elements and in his disposition to forgive whatever seems to be natural in the conduct of men. His brooding pity, however, does not reduce him to mere softness. He has been unwearying in his search for evidence in every case, and has assembled such a mass of rugged documents as no other novelist of his school has furnished. His best work, on the whole, may be found in *Sister Carrie*, *Twelve Men* and *An American Tragedy*.

With the school of naturalism may be associated certain novelists who, while technically not much akin to it, join with it, in effect, in swelling the literature of protest. Robert Herrick in such of his novels as *The Memoirs of an American Citizen* (1905), *Together* (1908) and *Waste* (1924) has bitterly arraigned the conventional American ideas about marriage and about money. Sinclair Lewis in *Main Street* (1920), *Babbitt* (1922) and *Arrowsmith* (1925), has won a hearing for an issue never before made popular in the United States. His heroes and heroines all revolt against the dullness of life and attempt, with varying degrees of success, to escape from it. Brilliant as a satirist, with an alert and decisive intelligence, Lewis has also the gift of rapid and persuasive narrative. He has also the knack of phrase which has enabled him to make "Main Street" synonymous with provincial dullness and "Babbitt" the generic name of any complacent business man. Less witty and clear-cut than Lewis, Sherwood Anderson has been engaged in the same assault upon stupidity. In a sense, *Winesburg, Ohio* (1919), *The Triumph of the Egg* (1921), *Horses and Men* (1923), *A Story Teller's Story* (1924) and *Dark Laughter* (1925), all tell the same story, of how a troubled spirit, bewildered by the complexity and apparent meaninglessness of American industrial life, makes an effort to break away from it toward freedom. The bondage is always obscurely felt and the goal is always dim, but the impulse is keen and irresistible. Anderson, who is a poet at heart, is profoundly devoted to the idea that life to be truly good must be mobile and creative, not fixed and obedient.

The literature of protest, of course, is far from including all the recent varieties of fiction. Booth Tarkington has been content, as in *Penrod* (1914), *Seventeen* (1916), *The Magnificent Ambersons* (1918) and *Alice Adams* (1921), to accept contemporary life on virtually its own terms and to make observant and agreeable fun of its follies. Something of the same impulse guides George Ade, whose work from *Fables in Slang* (1899) to *Hand-Made Fables* (1920) caricatures a generation in an inimitable idiom. The language of illiteracy has been employed with humorous shrewdness by Don Marquis in *The Old Soak and Hail and Farewell* (1921) and *The Old Soak's History of the World* (1924) which create a character in the honourable native line of Artemus Ward and Mr. Dooley, and by Ring W. Lardner in *You Know Me Al: A Busher's Letters* (1916), with its amusing burlesque hero, and with less illiteracy but no less vernacularity in *How to Write Short Stories* (1924), a collection of short narratives of notable veracity.

At the other extreme are the novels and tales by Edith Wharton, who has applied a method inherited from Henry James to the representation of fashionable life chiefly in New York City and in the parts of Europe frequented by cultivated and sophisticated Americans. *The House of Mirth* (1905), *The Custom of the Country* (1913), *Xingu and Other Stories* (1916) and *The Age of Innocence* (1920) are written with subtle irony and with an imaginative grasp of delicate situations. Mrs. Wharton's masterpiece, however, is generally conceded to be *Ethan Frome* (1911), a moving *tour de force* concerned with a tragic stroke of fate in rural New England. Willa Cather, almost as subtle though not so ironical as Mrs. Wharton, surpasses her in sympathy with simple, instinctive persons. The heroines of *O Pioneers!* (1913), *The Song of the Lark* (1915), *My Antonia* (1918) and *A Lost Lady* (1923) are among the most convincing women in the entire range of American fiction. The interpretation goes past all superficial judgments as to the goodness or badness, the intelligence or stupidity of these characters, and reveals an essence which somehow seems to lie deeper than any of their defining traits.

Considerably aloof from all these other tendencies are three novelists who are often put in a single class because they have in common a taste for exquisite decoration. They have little else in common. Elinor Wylie began her career as a poet, but turned aside to write *Jennifer Lorn* (1923) and *The Venetian Glass Nephew* (1925); dainty, exotic romances with plots as irresponsible as those of fairy tales and with the pungent, allusive manner of high comedy. Carl Van Vechten turned from musical criticism to write *Peter Whiffle: His life and works* (1922), *The Blind Bow-Boy* (1923), *The Tattooed Countess* (1924) and *Firecrackers* (1925), which with a witty erudition and some diabolism chronicle the lives of certain groups of emancipated intellectuals, mostly resident in New York City. Joseph Hergesheimer in *Mountain Blood* (1915), *The Three Black Pennys* (1917), *Java Head* (1919), *Linda Condon* (1919) and *Cytherea* (1922), to mention only his most characteristic novels, has set forth various American periods and localities with remarkable pictorial vividness and has also made striking drama out of various profound problems of character.

Most detached of all from contemporary life and from current modes of fiction is James Branch Cabell (*q.v.*) who is as eminent among modern American romancers as Dreiser is among the naturalists. Cabell's work consists of a series of novels, tales and poems, all bound together in a concerted scheme and furnished with a critical prologue and an autobiographical epilogue. The stories are gay, high-hearted and dramatic. The style, while now and then mannered, is uniformly rich and beautiful.

Information respecting most of the writers mentioned above and numerous others who cannot be mentioned for lack of space will be found in George Gordon, *The Men Who Make Our Novels* (1919); Grant Overton, *The Women Who Make Our Novels* (1918); Blanche Colton Williams, *Our Short Story Writers* (1920); Carl Van Doren, *Contemporary American Novelists 1900–1920* (1922). The "Modern American Writers" series includes studies of Dreiser (1925) by Burton Rascoe, *Edith Wharton* (1925) by Robert Morss Lovett, and *James Branch Cabell* (1925) by Carl Van Doren. (C. V. D.)

IV. HISTORY, BIOGRAPHY, ETC.

The effort toward realism characteristic of American literature since 1910 is apparent in history, biography and criticism, as well as in fiction and poetry. In historical writing this spirit of realism has shown itself in the collection and study of documents reflecting the social and economic life of different epochs, and the scientific interpretation of events in their light. The publication of Frederick J. Turner's *The Frontier in American History* (1920) was an important contribution to this movement.

While the continuation of the monumental works on the history of the United States, by James Ford Rhodes and Edward Channing, is to be noted, a more important work is *The Riverside History of the United States* (1915), edited by William E. Dodd, to which Carl L. Becker contributed *Beginnings of American Life;* Allen Johnson, *Union and Democracy;* W. E. Dodd, *Expansion and Conflict*, and F. L. Paxson *The New Nation.* Other members of this school of realistic interpretation are James Truslow Adams in his studies of *Revolutionary New England 1691–1776* (1923), Charles A. Beard in his *Economic Interpretation of the Constitution of the United States* (1913) and *Economic Origins of Jeffersonian Democracy* (1915), Samuel Eliot Morison in his *Maritime History of Massachusetts 1783–1860* (1921) and his *Sources and Documents Illustrating the American Revolution 1714–1788* (1923). The contributions of American writers to European history are necessarily less striking, but at least *The Mediaeval Mind* (1914) by Henry Osborn Taylor and *Mont-Saint-Michel and Chartres* (1913) by Henry Adams should be mentioned. Certain American historians who maintained their scientific detachment were able to render a service of high value in the review of the documents bearing upon the origin of and responsibility for the World War, chief among them Prof. Sidney B. Fay.

In the philosophic interpretation of the forces which have underlain the unfolding of the national life of the country, such as the economic urge of the pioneer and the religious zeal of the Puritan, Herbert Croly's *Promise of American Life* (1909) and *Progressive Democracy* (1914) have exercised most influence on the new school of critics to be mentioned shortly. The founding of *The New Republic* in 1914 under his editorship brought together a group of journalists whose chief aim was the constructive criticism of contemporary politics, among whom Walter Lippmann with his *Preface to Politics* (1913), *Drift and Mastery* (1914) and *Public Opinion* (1922), and Walter E. Weyl with *The New Democracy* (1912) and *Tired Radicals* (1921) were outstanding figures.

The same tendency toward realism in the collection of fact and observation of phenomena shows itself in biography and autobiography. The period under discussion is remarkable for the number of narratives of personal experience which divided with fiction the favour of the reading public. Thus we have the self-revelation of a member of the Puritan aristocracy in *The Education of Henry Adams* (1918), the experience of the pioneer in Hamlin Garland's *A Son of the Middle Border* (1917), and the life-stories of immigrants in Mary Antin's *The Promised Land* (1912), *The Americanization of Edward Bok* (1920) and Ludwig Lewisohn's *Up stream: An American Chronicle* (1922). A rich experience among many of the various strains of our population is recorded in Jane Addams' *Twenty Years at Hull-house* (1910). Light is thrown upon the political life of the time in the *Autobiography* (1913) of Theodore Roosevelt and the *Autobiography: A Personal Narrative of Political Experiences* (1913) of Robert Marion La Follette. Biography during this period felt the impulse toward new and penetrating methods of interpretation afforded by the psychological investigations of the psychoanalysts and behaviourists. Among the more formal biographies, Albert Bigelow Paine's *Mark Twain's Biography* (1912) and Amy Lowell's *John Keats* (1925) are in the front rank. The specific effort to detach characters from conventional appraisal and to interpret them anew in the light of their behaviour and environment and by the aid of analytic psychology is seen in the biographical studies of Van Wyck Brooks, *The Ordeal of Mark Twain* (1920) and *The Pilgrimage of Henry James* (1925), the essays of Gamaliel Bradford, *Damaged Souls* (1923) and *Bare Souls* (1924).

With the possible exception of poetry, the field of most striking development in American literature in the years 1910–26 is criticism. Here we find at the beginning of the period a well-entrenched group of critics carrying on the traditions of Lowell and Whipple, devoted to maintaining the aesthetic standards of classicism, the ethical standards of Puritanism, the social ideals and individual tastes for which President Harding later coined the word "normalcy." In 1910 appeared *The New Laokoön* of Irving Babbitt in which he stated with much ability the case for classicism. During the period Paul Elmer More was continuing his *Shelburne Essays, 1904–10* and W. C. Brownell was adding to his acute studies of style in *American Prose Masters* (1909). Stuart Pratt Sherman began as a militant member of this school, with *Americans* (1922), but has steadily moved leftward with his acceptance of such realists as Sherwood Anderson and Sinclair Lewis. A critic who showed a marked departure from this group was James K. Huneker, who protested that he cared nothing for general ideas, and though possessed of sound technical equipment in the fields of music and literature, gave himself more and more to sheer impressionism. Following Huneker, Henry L. Mencken asserted the creed of creative criticism; but in the main he has devoted himself to attacking the social and aesthetic idols of traditional American culture, and defending realistic, out-of-door writers like Theodore Dreiser and Edgar Lee Masters. His first campaign was in behalf of the robust philosophy of Nietzsche, *Philosophy of Friedrich Nietzsche* (1911). In subsequent years his *Book of Prefaces* (1917) and successive books of *Prejudices: First Series* (1919), *Second Series* (1920), *Third Series* (1922), *Fourth Series* (1924), continued his challenge. With the establishment under his editorship of *The American Mercury* (1924), he became for the moment the greatest critical force in America. Among other critics who have extended the bounds of American appreciation are Ernest Boyd who as a cosmopolitan of the world of letters has brought foreign developments, particularly the awakening in Ireland—*Ireland's Literary Renaissance* (1916)—to notice, and Carl Van Doren, who with Professor Sherman Erskine and Trent edited the *Cambridge History of American Literature* (1917–21), and as literary editor of *The Nation* and later of *The Century* has been the foremost to greet newly arriving poets and novelists. The most original and distinctive summary of American literature is that by John Macy, *The Spirit of American Literature* (1913).

In the years before the War appeared a group of literary critics who joined hands with the new school of political critics to press questions of ultimate significance with reference to the bases of American culture and its relation to original creative art. These writers pointed out the close connection between the Puritan and pioneer origins and the subsequent development of a civilisation based on ideals of luxury and material success. They endeavoured to forward in national culture and creative effort the original and genuine in place of the imported and imitated. The ground was prepared for their effort by the gathering of a group of writers and workers in the arts about the personality of Alfred Stieglitz in his studio in New York. Out of this group sprang *The Seven Arts Magazine*, which had among its contributors James Oppenheim, Van Wyck Brooks and Randolph S. Bourne. The sceptical attitude of these critics toward the past extended itself to the contemporary crusade of America to make the world safe for democracy, and their magazine perished in the War. The attitude and purposes of the school found expression in Van Wyck Brooks' *America's Coming of Age* (1915) and *Letters and Leadership* (1918), Randolph Bourne's *Youth and Life* (1913) and *Untimely Papers*, published posthumously in 1919.

A definite and fundamental relation to these advanced schools of political and cultured thought is held by pragmatic philosophy. William James died in 1910; but his personal influence remained strong, revived by the publication of his *Letters* (1920). The chief formal promulgation of the pragmatic attitude in regard to conduct and education was made by John Dewey in *Human Nature and Conduct* (1922) and *Experience and Nature* (1925). The ablest opponent of the pragmatists was George Santayana in *Winds of Doctrine* (1913) and *Character and Opinion in the United States* (1920). In *Scepticism and Animal Faith* (1923), however, he seems to approach their point of view. Santayana has reached a high place in American letters as a literary and miscellaneous essayist in *Three Philosophic Poets* (1910) and *Soliloquies in England* (1922). Among other essayists, Dr. S. M. Crothers in *Humanly Speaking* (1912) and *The Dame School of Experience* (1920) continues the genial tradition of Dr. Oliver Wendell Holmes; Agnes Repplier, with considerable tartness, defends the conservative point of view in *Counter Currents* (1916) and *Under Dispute* (1924). Another tradition of the American essay, that of Thoreau, is continued in the nature studies of John Burroughs, *Studies in Nature and Literature* (1913) and John Muir, *Boyhood of a Naturalist* (1916). (R. Lo.)

V. NEGRO LITERATURE

The plight of the Africans brought to America during the slave trade and of their descendants is one of the most dramatic in human history. That there should arise a literature written by black Americans touching their own situation depended on many things—their education, their economic condition, their growth in group consciousness. Before 1910, the books written by American Negroes were with some exceptions either a part of the general American literature or individual voices of Americans of Negro descent.

There began, however, about 1910 something that can be called a renaissance. It came because of oppression, because the spread of education made self-expression possible, and because a larger number of these 10,000,000 people were raising themselves above the lowest poverty. The first sign of this renaissance was naturally a continuation of the self-revelations current during the abolition controversy in the slave narratives, of which Frederick Douglass's *Life and Times* (1892) was the most striking and Booker Washington's *Up from Slavery*, published in 1901, the last great example. Since 1910, other autobiographies have followed. In these later stories there is, of course, less of the older spontaneity, little of adventure and more self-consciousness. John R. Lynch published his revealing *Facts of Reconstruction* in 1913. Alexander Walters (a black bishop), R. R. Moton (the successor of Booker Washington) and many others published autobiographies.

A more careful consideration of the Negro's social problems has characterised the period 1910–26. This is perhaps best illustrated by the three or four volumes of essays published by Kelley Miller, the trenchant work of William Pickens, W. E. B. DuBois's *Darkwater* (1920), and J. A. Rogers's *From Superman to Man* (1917), and especially by the files of the growing weekly Negro press. These general considerations have led to a number of scientific studies. Foremost among these are the series of Atlanta University studies covering 13 years and touching such matters as *Efforts for Social Betterment among Negro Americans* (1910); *The College-Bred Negro American* (1911); *The Common School and the Negro American* (1912); *The Negro American Artisan* (1913); *Morals and Manners among Negro Americans* (1915). There came also as a result of the Chicago riot the careful study of *The Negro in Chicago* (Illinois-Chicago Commission on Race Relations, 1922). The Tuskegee *Negro Year Book*, edited by M. N. Work annually since 1915, and the work of Dr. George E. Haynes have been along the same lines.

More striking work, however, begins with the rewriting of American history from the Negro point of view. The doyen of this effort since 1910 has been Carter G. Woodson, whose work has been prolific and painstaking. Beginning with 1916 he has published a considerable number of books, including the *Journal of Negro History*, 10 large volumes filled with documents, essays and research. Next comes Benjamin G. Brawley with his *Short History of the American Negro* (1913 and 1919), *Social History of the American Negro* (1921) and his study of *The Negro in Literature and Art in the United States* (1921). With these may be noted Steward's *The Haitian Revolution, 1791 to 1804* (1914), Emmett J. Scott's *The American Negro in the World War* (1919) and *The Gift of Black Folk: the Negroes in the Making of America* (1924), by W. E. B. DuBois, published by the Knights of Columbus.

But not in propaganda, science nor history has the essence of the renaissance shown itself. Rather the true renaissance has been a matter of the spirit and has shown itself among the poets as well as among the novelists and dramatists. In poetry, there are a dozen or more writers whose output has been small but significant. George McClellan, with his somewhat didactic and conventional verse, forms the link between past and present. Then comes James Weldon Johnson, Claude McKay, Leslie Hill, Joseph Cotter, Jr., Georgia Douglas Johnson, Countée Cullen and Langston Hughes, besides a half-dozen others. It is notable that already several critical anthologies (by James Weldon Johnson, Robert Kerlin, White and Jackson) have appeared. William Stanley Braithwaite has appeared as a widely read critic of poetry. The development in fiction is still newer and includes some earlier attempts like *The Quest of the Silver Fleece* by W. E. B. DuBois (1911) and James Weldon Johnson's *Autobiography of an Ex-Coloured Man* (1912), and newer and more significant work by Rudolph Fisher, Jessie Fauset, Walter White and Jean Toomer. In the drama, Willis Richardson and one or two others have been writing effectively, while in the explanation and collection of Negro music and folk-lore we have J. Rosamond Johnson, T. W. Talley and J. W. Cotter.

Perhaps the extent of this renaissance of Negro literature can be summed up in two works. One is the 15 volumes of *The Crisis* magazine, which began publication in Nov. 1910, and has since been a compendium of occurrences, thoughts and expression among American Negroes. Most of the newer Negro writers found first publication in its pages. The second is the book called *The New Negro*, published in 1925 and edited by Alain Locke, in which some 30 contemporary Negro writers express the spirit of their day. All these things are beginnings rather than fulfilments, but they are significant beginnings. They mean much for the future.

(W. E. B. DuB.)

BIBLIOGRAPHY.—The following is a selection from the numerous works which have been published during the past ten years dealing with recent American literature: Van Wyck Brooks, *America's Coming-of-age* (1915), and *Letters and Leadership* (1918); Amy Lowell, *Tendencies in Modern American Poetry* (1917); Lloyd R. Morris, ed., *The Young Idea*, an anthology of opinion concerning the spirit and aims of contemporary American literature (1917); W. P., Trent, et al., *The Cambridge History of American Literature*, 4 vol. (1917–21); Grant Overton, *The Women Who Make our Novels* (1918); George Gordon, *The Men Who Make our Novels* (1919); Conrad Aiken, *Skepticisms* (1919); H. L. Mencken, *A Book of Prefaces* (1920); T. E. Rankin, *American Writers of the Present Day* (1920); F. Haskett, ed., *On American Books*, a symposium (1920); Blanche Cotton Williams, *Our Short Story Writers* (1920); Marguerite Wilkinson, *New Voices* (1921); J. W. Manly and E. Rickert, *Contemporary American Literature* (1922); F. E. Schelling, *Appraisements and Asperities* (1922); Carl Van Doren, *Contemporary American Novelists 1900–1920* (1922); Bruce Weirick, *From Whitman to Sandburg* (1922); Stuart P. Sherman, *The Genius of America* (1923); Norman Foerster, *Nature in American Literature* (1923); Grant Overton, *American Night's Entertainment* (1923); Carl Van Doren, *The Roving Critic* (1923); C. E. Bechhofer, *The Literary Renaissance in America* (1923); W. L. Phelps, *As I Like It*, 2 vol. (1923–4); L. Untermeyer, *American Poetry since 1900* (1923); E. A. Boyd, *Portraits* (1924); P. H. Boynton, *Some Contemporary Americans; the Personal Equation in Literature* (1924); Grant Overton, *Authors of the Day* (1924) and *Cargoes for Crusoes* (1924); Carl Van Doren, *Many Minds* (1924); J. C. Farrer, ed., *The Literary Spotlight* (1924); Carl Van Doren and Mark Van Doren, *American and British Literature since 1890* (1925). The "Modern American Writers" series includes studies of the more prominent writers of the period.

AMERY, LEOPOLD CHARLES MAURICE STENNETT (1873–) British politician, was born at Gorakhpur, Northwest Provinces, India, Nov. 22 1873, and was educated at Harrow and Balliol College, Oxford. He was elected a fellow of All Souls College in 1897, and, after travelling for a year in the Near East, in 1899 joined the staff of *The Times*, London, and acted as chief correspondent to that paper during the South African War (1899–1902), remaining associated with it till 1909; during this period he edited *The Times History of the South African War*. He began his political career as a strong advocate of tariff reform and, having contested in the Unionist interest seats at Wolverhampton and Bow and Bromley, was elected in 1911 M.P. for the Sparkbrook Division of Birmingham. From 1914 to 1916 he served with the British Army, first in France and later in the Near East, and from 1917 to 1918 was a secretary of the War Cabinet and on the personal staff of the Secretary for War. In Jan. 1919, he became Under-Secretary for the Colonies and in 1921 Parliamentary and Financial Secretary to the Admiralty. From Oct. 1922 to Jan. 1924 he was First Lord of the Admiralty in the Unionist Cabinet. In Nov. 1924, he became Secretary of State for the Colonies.

He has published various works, including *The Problem of the Army* (1903); *Fundamental Fallacies of Free Trade* (1906); *The Great Question* (1909); *Union and Strength* (1912).

AMIENS (*see* 1.855) had a population in 1921 of 92,780. The city is recovering slowly from the ravages caused by the bombardments of 1918, when the cathedral was struck nine times; the roof was pierced and the triforium, two chapels in the ambulatory, and some buttresses and window tracery were hit. The churches of St. Germain and St. Rémy, the Prefecture and the Musée de Picardie were partially ruined and much damage was done in the Rue de Beauvais. The wool and textile industries have regained their pre-War condition.

Amiens fell into German hands on Aug. 30 1914, but after the battle of the Marne it was cleared of the scattered German units who remained, and the front established some 20 m. eastwards, where it remained till 1918. Amiens formed the first concentration point for British troops disembarking at Boulogne in 1914, and the first aircraft park was established here. It remained of high importance owing to its position on the lines of communication, and in March 1918 the Germans made a great effort to break through between the British and French armies at the Amiens salient and "roll them up on either hand." They advanced to within eight miles of the town, which was evacuated by civilians and bombarded daily by heavy guns. But the tide was turned by the opening of the British strategic offensive in Aug., and on Aug. 15 Mass was said in the cathedral as a thanksgiving for the town's deliverance.

AMIENS, BATTLE OF: *see* VICTORY, ADVANCE TO.

AMIR 'ALI, SEYYID (1849–), Indian jurist and Moslem leader, was born April 6 1849, of an Arab family, tracing descent from the Prophet, which migrated from Persia and settled at Mohan in Oudh in the middle of the 18th century. At Hugli College, Calcutta, he graduated in 1867, taking his M.A. in 1868. He came to London and was called to the bar of the Inner

Temple in 1873. He had already published *A Critical Examination of the Life and Teachings of Mahomed*, the first of a series of books of Islamic modernist interpretation and apologetics, which have given him a recognised place in English literature. He was for some years a lecturer on Mahommedan law at the Presidency College, Calcutta, and afterwards president of the faculty of law at the university there. He was also chief presidency magistrate of Calcutta and in 1890 was appointed a judge of the Bengal High Court, being the first Mahommedan to reach the bench in India. He was made a C.I.E. in 1887. In 1904 he retired and settled in England. He was the first Indian to be sworn (Nov. 1909) of the Privy Council and to serve on its Judicial Committee. But his chief ambition in life was the advancement of the Indian Moslems, both morally and materially, along practical and constitutional lines and his activities paved the way for the Morley-Minto and subsequent reforms.

AMMONIA (*see* 1.861).—The production of ammonia and ammonium salts increased during the War period, due to the direct use of ammonium nitrate and, to a lesser extent, perchlorate, as mixtures for shell filling, and to the demand for nitrogenous fertilisers. Attention was also directed to the combustion of ammonia as a source of nitric acid and nitrates, and to the production of urea from ammonia and carbon dioxide.[1]

In obtaining ammonia and its compounds from the ammoniacal liquors of gas works and coke-oven recovery plant, continuous stills are usually worked in such a manner that the preheated ammoniacal liquor passes down a column similar in function to the columns of spirit or benzole stills, in which it meets an upward current of steam. The salts of ammonia with weak volatile acids are thereby dissociated and the ammonia, mixed with carbon dioxide, hydrogen sulphide, etc. usually passes into saturators containing sulphuric acid, where it is converted into ammonium sulphate. The remainder of the ammonium salts, which are not readily dissociated, react with heated milk of lime in a still at the base of the column, the remainder of the ammonia being expelled and subsequently converted for the most part into ammonium sulphate.

Ammonia obtained from gas works or coke-oven recovery plant, or from salts derived from this source, is usually contaminated with small quantities of pyridine bases. It is advisable to use synthetic ammonia when a high degree of purity of the ammonia is essential. In attempting, like Stas, to purify ammonium salts by treatment with oxidising agents, the resistance of the pyridine ring to oxidation should be kept in mind.

Compounds with Acids.—Whilst ammonium salts of weak acids are easily dissociated on heating in aqueous solution, the salts with strong acids are more stable but nevertheless lose some of their ammonia on boiling. Veley (1905) measured the degree of hydrolysis by boiling a definite volume of a salt solution containing a known amount of the salt for a definite time and determining the loss of ammonia. E. G. Hill (*Jour. Chem. Soc.*, 1906, vol. 89, p. 1273), by further experiments with greater refinement, showed that for monobasic acids the hydrolytic dissociation is inversely proportional to the "strength" of the acid.

Ammonium Perchlorate.—This salt may be obtained from an alkaline perchlorate, obtained electrolytically, and an ammonium salt. Its use in high explosive shell is limited owing to the liability to detonation by mechanical shock.

Ammonium Thiocyanate.—This can be obtained from ammonia and carbon disulphide, $CS_2+4NH_3=NH_4CNS+(NH_2)_2S$. In addition to other uses, its isomerisation to thiocarbamide, $CS(NH_2)_2$, has become of interest in relation to the rubber industry.

Solutions of ammonia in water apparently contain ammonium hydroxide, NH_4OH, in very small amount. An equilibrium exists in the solution which may be expressed by the combined equation

$$NH_3+H_2O \quad \rightleftarrows \quad NH_4\,OH \quad \rightleftarrows \quad NH_4^{\cdot}+OH'$$

which is not intended to exclude the formation of complexes $(NH_3)_m(H_2O)_n$. Accepting Bredig's value for the velocity of the ammonium ion (70·4 at 25°) and assuming that $NH_4^{\cdot}$ and OH' are the only ions existing in the aqueous solution, it appears that of the total ammonia approximately the following amounts are ionised: N/100, 4%; N/10, rather over 1%; N/1, about 0·3–0·4%. Information as to the form in which ammonia exists in aqueous solution is given by Hantzsch and Sebaldt, and T. S. Moore.

The definite, though small, electric conductivity of liquefied ammonia points to the existence of ions which may be NH_2', NH'', N''' and $NH_4^{\cdot}$, the latter from the union of ammonia with hydrion.

The dielectric constant of ammonia is 21 to 23, many salts dissolve in liquefied ammonia giving electrically conducting solutions. The conductivity is far inferior to that of the corresponding aqueous solutions, thus 1 mol of potassium iodide is ionised to the extent of 90% if dissolved in 20 litres of water but requires 2,000 litres of ammonia for an equal degree of ionic dissociation. The limiting value of ionisation of a salt is usually reached at 1,000 to 5,000 litres in the case of water and at 25,000 to 50,000 litres in the case of ammonia.

Constitution of Ammonium Salts.—The former view was that when ammonia combined with an acid, the tervalent nitrogen atom became quinquevalent. Werner thought that subsidiary valencies are called into play, representing, *e.g.*, ammonium chloride in the following manner:—

$$(H_3N \;.\;.\;.\;.\; H)^{\cdot}Cl'$$

But ammonia also combines with the alkyl esters of strong acids, thus the first product of the action of ethyl chloride on ammonia is ethylammonium chloride, $N(C_2H_5)H_3C_2$. Since alkalies liberate ethylamine, $N(C_2H_5)H_2$, from this salt, the assumption has to be made that the additional ammonium salt undergoes intramolecular change in its kation

$$(H_3N \;.\;.\;.\;.\; R)^{\cdot}\rightarrow(H_2NR \;.\;.\;.\;.\; H)^{\cdot}.$$

The formation of di-, tri-, and tetra-alkyl ammonium salts by successive replacement of hydrogen by alkyl is explained similarly.

Whilst the ionisable acid radicle can be readily accepted as standing outside the rest (kationic portion) of the molecule, non-equivalence of the four valencies binding alkyl groups is difficult to imagine. A quaternary ammonium salt, in which all four alkyl groups are different, does not exhibit isomerism if the groups are introduced in different order. Moreover, if a salt or hydroxide be decomposed by heat, the alkyl group which escapes with acid radicle or hydroxyl depends on the nature of the group and not on the order in which it has been introduced into the molecule.

The firm attachment of the alkyl groups to the nitrogen atom is attested by the fact that quaternary ammonium bases are only liberated from their salts by the action of bases which form insoluble salts with the kations; *e.g.*, moist silver oxide in the case of the halides, barium hydroxide in the case of the sulphates.

The stability of the quaternary ammonium grouping is illustrated by the amalgam obtained when an absolute alcoholic solution of tetramethylammonium chloride is electrolysed with a mercury kathode (McCoy and Moore, *Jour. Amer. Chem. Soc.*, 1911, vol. 33, p. 273). The amalgam has a crystalline fracture and differs from ammonium amalgam in not becoming inflated below 10° C. In contact with air it becomes coated with an alkaline crust, it decomposes water with evolution of hydrogen and formation of colloidal mercury and tetramethylammonium hydroxide.

When all four alkyl groups of a quaternary ammonium salt are different, the compound can be resolved into optical isomerides, Pope and Peachey (*Jour. Chem. Soc.*, 1899, vol. 75, p. 1127) definitely resolved benzylphenylallylmethylammonium salts into dextro- and laevo-rotatory forms, experiments by Le Bel (*Compt. rend.*, 1891, vol. 112, p. 724) had not been conclusive. The probability that the four alkyl groups are arranged at the corners of a tetrahedron with the nitrogen atom at the centre has been made certain by the resolution of 4-phenyl-4^1 carbethoxypiperidinium-1:1^1-spiran bromide into its enantiomerides (Mills and Warren, *Jour. Chem. Soc.*, 1925, vol. 127, p. 2507). On the electronic theory, it is probable that the ammonium ion, $NH_4^{\cdot}$, and the methane molecule, CH_4, have corresponding configurations since each complex is composed of a positive nucleus, four hydrogen nuclei, and ten electrons, this is confirmed by the experimental stereochemical evidence.

Ammonia and Metallic Salts.—Ammonia reacts with metallic salts in different ways. Either hydrogen in the metallic salt is replaced by metal or addition takes place. Besides the amides (or nitrides) of the alkali and alkaline earth metals, *e.g.*, sodamide, $NaNH_2$, obtained by the direct action of sodium on ammonia with liberation of hydrogen, compounds are known which may be regarded as ammonium salts in which hydrogen has been replaced by metal. Thus "infusible white precipitate" may be mercuriammonium chloride, NH_2HgCl, though possibly it is mercuric amide chloride, $Hg(NH_2)Cl$. The latter structure may be compared with that of zinc diamide, $Zn(NH_2)_2$, a stable compound obtained by the action of ammonia on ethereal solution of zinc ethide (Frankland, 1858). An amide-halide structure, NH_2-Mg-I, seems to be necessary for the substance produced with liberation of ethane by the action of ammonia on an ethereal solution of ethylmagnesium iodide (Oddo and Calderaro).

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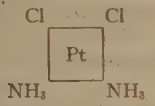
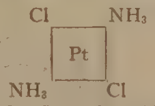
[1] The synthetical production of ammonia is dealt with under NITROGEN, FIXATION OF.

Co-ordination Compounds.—When ammonia is directly attached to a metallic salt, it is convenient to introduce Werner's idea of co-ordination. This may be illustrated by reference to quadrivalent platinum, whose chloride, $PtCl_4$, is a non-electrolyte. With two molecules of potassium chloride, we have potassium platinichloride, K_2PtCl_6. In hexammine-platinic chloride, $PtCl_4,6NH_3$, all four chlorine atoms are ionisable, the complex $[Pt,6NH_3]$ forming a quadrivalent kation. Compounds with intermediate proportions of ammonia are known, but in every case the sum of the atoms and ammonia molecules intimately associated with the platinum atom is six, the co-ordination number. Other atoms belonging to the molecule are ionisable as seen in the following list:—

$[PtCl_6]K_2$, gives the ions $[PtCl_6]^{\cdot\cdot}$ and $2K^{\cdot}$
$[PtCl_5,NH_3]K$, gives the ions $[PtCl_5,NH_3]^{\cdot}$ and $K^{\cdot}$
$[PtCl_4,2NH_3]$, is a non-electrolyte
$[PtCl_3,3NH_3]Cl$, gives the ions $[PtCl_3,3NH_2]^{\cdot}$ and Cl'
$[PtCl_2,4NH_3]Cl_2$, gives the ions $[PtCl_2,4NH_3]^{\cdot\cdot}$ and $2Cl'$
$[Pt,6NH_3]Cl_4$, gives the ions $[Pt,6NH_3]^{\cdot\cdot\cdot\cdot}$ . . . . and $4Cl'$

Many complex compounds of chromium, iron, nickel and cobalt are known in which the metal exhibits the co-ordination number 6, but in the case of divalent platinum and copper, the co-ordination number is four. Thus two non-ionisable compounds of the formula $Pt(NH_3)_2Cl_2$ are known, their isomerism may be explained if we suppose the platinum atom to be situated at the centre of a square of which the corners represent the positions occupied by chlorine or ammonia.





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AMMUNITION (*see* 1.864).—The normal modern shell, whether monobloc or made in parts and assembled, has the general form of a cylindrical steel body, hollow to receive the filling, with the base flat and the head pointed.

I. AMMUNITION FOR ORDNANCE

In designing projectiles for ordnance, it is necessary to consider the function of the shell at the objective, the capacity of the shell to withstand the forces of projection, the ballistic qualities of the projectile in flight and the suitability of the design for manufacture and supply. The design of a shell must therefore be considered as a compromise between these conflicting qualities, as it is obvious that a projectile designed solely for purposes of flight might prove incapable of sustaining the pressure developed in the gun.

It is necessary, however, to give due consideration to all the essential properties of a shell. The head was normally of true ogival shape, with the centres of the circular arcs in or near the plane of the front end of the body and with a radius varying from about 1½ to 2½ calibres. The driving band was pressed into a groove near the rear end of the shell to cause rotation of the projectile, to prevent undue escape of gas around the projectile when the gun is fired, and to provide a seating for the projectile. A fuse hole was prepared either in the nose or base of the shell.

Range and Accuracy.—Many experiments have been made since 1900 to improve the shape of projectiles with a view to obtaining longer ranges and greater accuracy, with the ultimate result that modern projectiles have generally long, tapering points which correspond to an ogive of from 6 to 10 calibres. Although, theoretically, there appears to be no limit to the length of the head, in practice, a head longer than that due to an ogive of 8 calibres radius has certain disadvantages affecting the accuracy of flight. As an alternative to increasing the length of the shell itself, a device known as a false ogive, or ballistic cap, has been much employed, particularly by the Germans; this consists of a light, hollow cap screwed on to the body of the shell proper, thereby improving the general shape and not substantially affecting the accuracy.

Attempts have also been made to obtain still greater ranges by stream-lining or boat tailing the base in varying degrees. A certain increase of range may thus be obtained, under certain conditions, but frequently a loss of accuracy results. The results obtained by varying the shape of projectiles depend, to a great extent, on the velocity of projection, and the effect on range and accuracy of any shape of head is influenced by the shape of the base of the same shell and vice versa. It may be stated that modern high velocity projectiles have long, tapering heads, sharp points and parallel bases. Projectiles fired at velocities lower than 2,000 ft. per sec. (f.p.s.) may also have stream-lined bases, but when the velocity falls to below 1,200 f.p.s., the head shape tends to bluntness but more attention is devoted to the shape of the base. These remarks are intended to apply merely to projectiles actually in use at present, and are not intended to define the optimum design.

Driving Bands.—The material generally used for driving bands is copper, in the form of rings, and no other substance appears completely satisfactory for this purpose. The chief disadvantage of copper is that it gives rise to metallic fouling in the gun, called coppering, which can be removed by chemical or mechanical processes, with special apparatus, but decoppering is difficult to carry out in the battery position in the field. Attempts have been made to incorporate in the cartridge or attach to the shell some material which will remove the copper from the bore of the gun during firing. A shell normally has one driving band, but two or three may also be used. The Germans, in large shell, normally used three bands.

Weight, Length and Diameter.—Other factors affecting design are the weight, length and diameter of the shell and, to a great extent, these factors are interdependent. In practice, a certain maximum weight of shell is found suitable for a definite gun, mounting and charge. The diameter is fixed, and the length therefore depends on the type of shell under consideration. There is a certain limit to the length of the shell, which is governed by stability. Approximately the weight of a shell in pounds suitable for a given gun is half the cube of the calibre in inches. The diameter of the shell body is slightly less than that of the bore across the bands, to ensure a free passage for the projectile up the bore. The modern practice is to keep this clearance as small as possible and in some cases it is as small as 0.01 inch.

Material.—With modern ordnance, the projectiles are practically all made of cast or forged steel. During the World War, cast iron was largely employed to assist in overcoming shell shortage in various countries, but its use is now generally discarded, except for projectiles used for practice and special purposes. The steel employed may be either straight carbon or alloy steel and in certain cases may be subjected to heat treatment. Normally, modern shell are manufactured by forging from steel ingot or bar, though in certain cases shell may be cast to the required shape.

Types of Projectiles.—Projectiles for ordnance may be divided into two main classes, shot and shell. The only shot now found in modern armaments are proof shot, practice shot, paper shot and case shot. Proof shot are solid shot used for proving ordnance and charges. Practice shot are solid shot used for practice purposes. Paper shot are used to test gun mountings which cannot fire service projectiles in peace time, owing to their siting. They are made mainly of paper or pulp, and their weight is calculated to exert the same stress on the mounting as a service round, but they break up in the bore when fired. Case shot generally consist of three or more long steel segments held in position inside a thin, tinned canister, the whole being filled with bullets. The top and bottom are formed of steel plates and, in larger natures, the shot is stiffened by a central bolt. It is not much used in modern equipments.

The natures of shell now used are: common pointed or C.P. shell; high explosive or H.E. shell; shrapnel shell; armour piercing or A.P. shell; and special shell, of kinds such as smoke, star (illuminating) and incendiary.

C.P. Shell.—Little development has taken place in C.P. shell, as such, in modern types of ammunition. Filled with powder, they are still to be met with in certain countries and used with or without soft steel caps they fulfil certain functions usefully. For many purposes they have been superseded by H.E. shell. They have not been utilised in British service with H.E. fillings but have been developed as H.E. shell in the German naval service, in which case they have been filled with TNT, the method of filling agreeing with the usual German practice for H.E. shell.

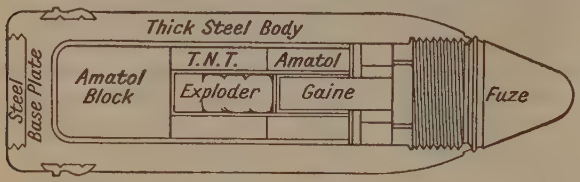

Thick Steel Body
T.N.T.
Amatol
Amatol Block
Exploder
Gaine
Fuze
Steel Base Plate

FIG. 1.—Modern British H.E. Shell.

H.E. Shell.—Modern British H.E. shell are normally of forged steel with solid bases, a special steel base plate being fitted in a recess in the base to give added strength and prevent any possibility of ingress of gases. The walls may be comparatively thin, which gives good effect against material, or, alternatively, the walls may be thick enough to give good effect against personnel. The nose of the shell is prepared to take a fuse. In other countries solid bases are not considered essential in these shell.

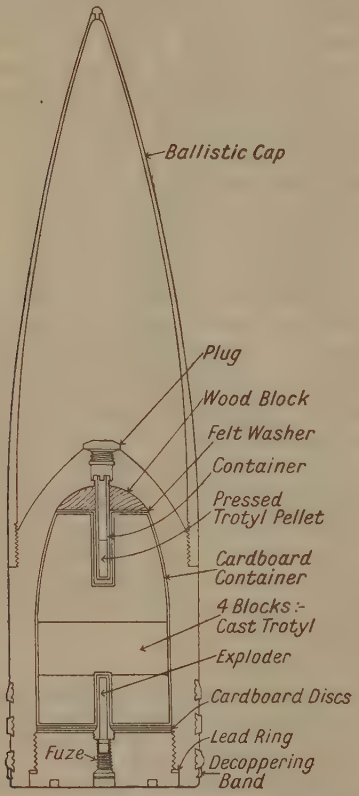

Ballistic Cap
Plug
Wood Block
Felt Washer
Container
Pressed Trotyl Pellet
Cardboard Container
4 Blocks:- Cast Trotyl
Exploder
Cardboard Discs
Lead Ring
Decoppering Band
Fuze

FIG. 2.—Modern German H.E. Shell.

Explosives used as shell fillings are ordinarily, picric acid, TNT (tri-nitro-toluene), and amatol, which is a mixture of TNT and ammonium nitrate. Other substances used are dinitrobenzene, trinitroanisol and guncotton, and, during the World War, many other substances were tried. The explosives are generally inert and not easily detonated, and hence an exploder system is ordinarily found between the fuse and the filling itself. In some cases, where detonation gives little or no smoke, some smoke-producing mixture is included in filled shell to assist observation. A typical modern British H.E. shell is illustrated in fig. 1. The steel body is stout, giving good fragmentation. The filling is amatol, with a proportion of TNT to facilitate detonation. The exploder system in this particular case is represented by a gaine and an exploder. Fig. 2 illustrates a modern German H.E. shell evolved during the War. The filling calls for little comment. There are several points of interest in comparison with earlier shell. The base is closed by an adapter, which is contrary to British practice. Three driving bands are employed and a decoppering ring is fitted. Two fuse holes are provided, which permit of either nose or base fusing, or even the use of two fuses at the same time. This shell also provides a good example of the ballistic cap or false ogive.

Shrapnel.—Modern shrapnel do not differ in principle from the earlier types. The walls are made as thin as is consistent with ability to stand the stresses on firing and in flight. The bullets are ordinarily of lead antimony alloy, 41 to the lb. for light shrapnel, increasing in weight for heavier shell and for special purposes. They are kept in position by resin. The body may be closed either by a fuse socket or by a separate head, the part in either case being so secured to the body of the shell that its removal is easily effected by the small bursting charge of fine grain powder. The central tube may or may not be provided with powder pellets.

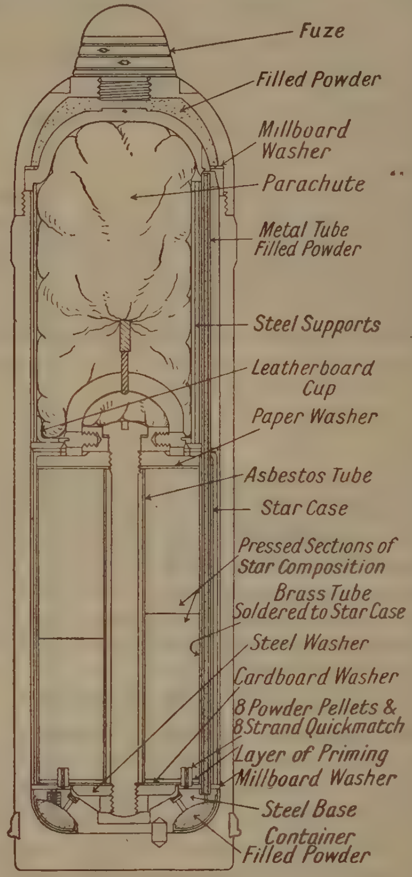

Fuze
Filled Powder
Millboard Washer
Parachute
Metal Tube Filled Powder
Steel Supports
Leatherboard Cup
Paper Washer
Asbestos Tube
Star Case
Pressed Sections of Star Composition
Brass Tube Soldered to Star Case
Steel Washer
Cardboard Washer
8 Powder Pellets & 8 Strand Quickmatch
Layer of Priming
Millboard Washer
Steel Base
Container Filled Powder

FIG. 3.—Section of German 15 cm. Star Shell.

A.P. Shell.—Little change is to be seen in modern A.P. shell. An improvement in shape, by altering the shape of the cap, and the introduction of H.E. as filling instead of gunpowder are the only important changes in recent years.

Special Shell.—Gas shell were introduced by the Germans during the World War, and were developed by them into weapons of great offensive power. Ordinarily shell bodies of H.E. design were utilised and filled with a liquid or solid substance which volatilised on exposure to the air giving a concentration of gas sufficiently strong to disable an unprotected man. The shell were usually opened by a small charge of explosive, the fuse employed being of the instantaneous type. In later patterns of shell, the chemical ingredient was enclosed in a bottle which was buried in an ordinary H.E. filling. The shell functioned as an ordinary H.E. shell with the additional deleterious effect due to the chemical.

Smoke shell are really another product of the World War. In design they resemble gas shell and are filled with composition intended to give smoke clouds for purposes of concealment. They are actuated by instantaneous fuses and contain small H.E. opening charges. Incendiary shell, also introduced by the Germans, contain incendiary substances and are used with either time or percussion fuses. They call for no further comment. The star shell has many advantages. The latest type of illuminating shell may be considered as well represented by that illustrated in fig. 3. There is a time fuse which can be set for any time up to 33 seconds. When the fuse functions, the flash from the magazine ignites the powder in the dome of the shell and blows off the head of the shell. The flash from the powder passes down a side channel to the powder charge in a small magazine in the base of the shell; the powder explodes and ejects the star and parachute from the body, and at the same time the star composition in its case, by means of quick match strands and powder pellets embedded in the composition, is ignited. After ejection, the parachute itself opens and supports the star until it burns out.

Cartridges and Ignition.—Cartridges for ordnance are divided into two main classes called technically breech-loading or B.L. and quick-firing or Q.F. and each class is subdivided into gun and howitzer cartridges. All modern ordnance is breech-loading and the terms B.L. and Q.F. merely indicate the system of obturation, or gas sealing, employed with the gun. Of recent years no radical changes have taken place in the make-up of cartridges and means of ignition, and, in principle, these stores have not varied since 1911. The World War imposed on the belligerents certain drastic changes in equipment owing to the lack of raw material, and these changes affected cartridges to a certain extent. For the main part such changes were inferior substitutions, which have disappeared.

Propellants.—Generally speaking, the propellants employed in modern cartridges are of the nitroglycerine or nitrocellulose type; the former class containing both nitroglycerine and nitrocellulose, whereas, in the latter, nitroglycerine is absent. All these propellants, generally described as smokeless powders, are somewhat difficult to ignite, and hence an igniter is a feature of cartridges, which may be found in the form of a separate store called an igniter, or be embodied in the primer or igniting medium. The igniter is ordinarily composed of fine grained gunpowder. The propellant is usually manufactured in cords, sticks or tubes, which shapes are known commonly as stick forms. It is, however, also prepared in flakes, discs and other small shapes which, for want of a better name are called granular forms. Well-known stick forms are cordite and Röhrenpulver. Well-known granular forms are NCT, Ballistite, Ringpulver and Würfelpulver. During the World War the Germans and Austrians were compelled to use inferior propellants owing to the scarcity of nitric acid. An example of this type of propellant is ammonpulver (*see* EXPLOSIVES).

B.L. Cartridges.—B.L. gun cartridges are built up of bundles of propellants of stick form cut to the required length, tied with silk and inserted into cylindrical silk bags of which the ends are closed by silk discs. An igniter is stitched on to one or both ends of the cartridge. This type of igniter consists of fine grain powder enclosed in a circular bag of shalloon and covers the ends of the cartridge in order to intercept the flash from the igniting medium, tube or other flash initiator. The exterior of the cartridge may be laced with silk cloth tape so as to form a stiff cartridge. The charges for heavy guns may be made up in separate portions, for convenience in handling and to permit the use of a reduced charge. In large cartridges a silk cloth becket runs up the centre and has a loop at the top for handling (*see* 1.872). Granular form propellant has been used for certain cartridges and, in principle, the method of making up is similar to that employed with the stick form, with slight modifications to compensate for the lack of rigidity of the cartridge. B.L. howitzer cartridges are similar generally to the earlier type (*see* 1.873). In modern practice, bundles attached to the core by tape may be used instead of rings.

Q.F. Cartridges.—In these cartridges, the propellant charge is contained in a brass case which effects the obturation of the gun. This class of ammunition is of two types, fixed ammunition and separate. The use of the brass case influences rapidity of fire, in that it obviates the operation of sponging out smouldering débris; it allows of the cartridge carrying its own means of ignition, thus saving one loading operation, and it also offers great safety against accidental ignition. On the other hand, the brass case is expensive in itself, and any defect in it may cause serious damage to the gun, the gas having to escape through a constricted channel; it adds to the weight of the cartridge, entailing increase in transport, and finally, where large output is required, the supply of raw material becomes a serious proposition. During the World War, the Germans were compelled to use steel as a material for Q.F. cases owing to the shortage of brass. The use of such cases was limited to ordnance of small calibre or ordnance with low velocities.

Means of Ignition.—B.L. cartridges are ignited by means of electrical or percussion tubes. Q.F. cartridges carry their own means of ignition, which may be caps, primers or tubes, the latter being fitted with adapters. A typical modern percussion primer is illustrated in fig. 4. The body is of brass, with a tapered flange to ensure a good fit in the cartridge case, and is suitably screwthreaded. A brass cap, filled with cap composition, is seated in the body and a brass anvil plug with central hole screws down on to the cap. The upper portion of the primer forms a magazine which is filled with fine grain powder, and the primer is closed with a linen disc and brass washer, secured by the end of the body being turned over. The primer functions when the striker of the breech mechanism impinges on point A of the primer, the cap fires, the powder in the magazine is ignited and the subsequent flame ignites the propellant.

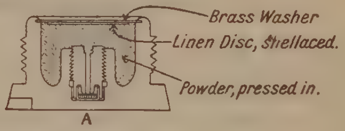


FIG. 4.—Percussion Primer.

Fuses.—A fuse is employed to initiate the bursting, explosion or detonation of a shell at the required place or time. The mechanism of a fuse must fulfil two conditions: it must operate at the required time or place and it must not operate prematurely. The latter condition is fulfilled by embodying external or internal safety devices in the design. External devices are employed when it is impracticable to provide sufficient protection by internal means. These may consist of pressure plates, safety caps or pins and similar devices intended to prevent the fuse from arming or firing before loading, during transport or storage and preliminary handling, including accidental dropping. Caps and pins are removed before loading. Internal devices, while performing similar functions to the external devices, also give safety during acceleration in the bore and during the period of flight, and comprise such means as safety shutters, tapes, centrifugal bolts, ferrules, collars, pillars, detents and springs. Normally, they prevent premature collision between detonators and needles, or may prevent ignition of the bursting charge in the event of accidental firing of the detonator. The use of safety devices will be considered in connection with individual fuses described below.

Fuses may be classified as follows:

(1) Percussion fuses { (a) Direct action (D.A.).
(b) Graze action, nose or base.
(2) Time, or time and percussion fuses { (a) Composition or burning.
(b) Mechanical or clockwork.

1. (a) Direct action fuses function as a result of a direct blow on the nose, a hammer or needle being forced on to a detonator. A later pattern of D.A. fuse is the British fuse No. 106 illustrated in fig. 5, from which its general construction will be understood. It is protected before loading by a safety cap, which is removed by hand. A split steel collar is interposed between the underside of the hammer head and the top face of the fuse body and round this collar the safety tape is wound. On firing, the tape weight is gripped between the hammer head and body. When acceleration ceases, that is, when the shell leaves the bore, the weight is released, flies off, unwinds and carries the tape with it, tearing away the split collar. The hammer is then supported only by a thin shearing wire. On impact, the hammer is

driven in, shearing the copper wire, the detonator is fired, and in turn fires the magazine. A safety shutter is provided, which only opens after the shell leaves the bore of the gun. Fuse No. 106 may be taken as typical of a class of D.A. fuse which is rather more sensitive than an ordinary D.A. fuse, and is known sometimes as an instantaneous, or, in German, *empfindliche* fuse.

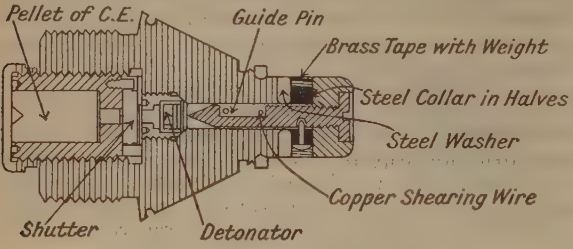
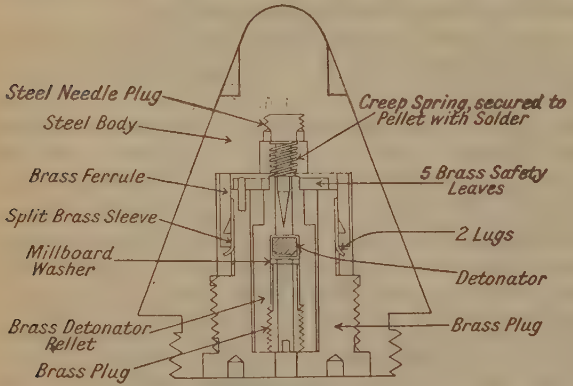

Pellet of C.E.
Guide Pin
Brass Tape with Weight
Steel Collar in Halves
Steel Washer
Copper Shearing Wire
Shutter
Detonator

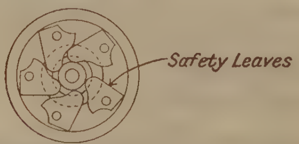
FIG. 5.—Percussion Direct Action Fuse.

Another type of D.A. fuse, somewhat less sensitive than the ordinary type, is the direct action impact type (D.A.I.). Such fuses merely differ from ordinary D.A. type, in that the suspension of the needle is very much stronger and hence the fuse requires a stronger blow on the nose in order to make it function.

(b). Graze fuses or check action fuses function as a result of the forward movement of a graze pellet relatively to the main body of the fuse. When the shell receives a check in velocity a pellet carrying a detonator moves forward onto a fixed needle or alternatively a needle pellet moves on to a detonator. A typical nose graze fuse is illustrated in fig. 6. The illustration represents the German fuse Kz. f. Spgr. m. K. and shows its general construction. Before firing, the detonator pellet is kept away from the needle by five interlocking brass leaves held in position by a brass ferrule supported on a split brass sleeve. On acceleration, the ferrule sets back clear of the safety leaves and rebound is prevented by two lugs on the sleeve. When acceleration ceases, the brass leaves open out one by one under the influence of centrifugal force, leaving the fuse in a sensitive condition or "armed." Creep action of the detonator pellet during flight is prevented by the so-called creep spring. On graze, the pellet flies forward on to the needle and the detonator fires, the flash passing through a hole in the pellet to the exploder in the shell.


Steel Needle Plug
Steel Body
Brass Ferrule
Split Brass Sleeve
Millboard Washer
Brass Detonator Pellet
Brass Plug
Creep Spring, secured to Pellet with Solder
5 Brass Safety Leaves
2 Lugs
Detonator
Brass Plug

SECTION


Safety Leaves

PLAN SHOWING ARRANGEMENT OF LEAVES

FIG. 6.—Percussion Graze Fuse.

A practice common in German design is to arrange a combination of direct and graze action effects in one fuse. In this type the detonator is housed in a movable pellet which functions in the usual way. The needle is formed on the inner end of a rod, the outer end of which projects from the top of the fuse. On impact, the detonator pellet moves forward on to the needle as in an ordinary graze fuse but in addition to this action the needle is also forced on to the detonator by direct action.

2. A time fuse is one which can be set to burst a shell at a certain predetermined time after firing. A time and percussion fuse, commonly known as a T and P fuse embodies, in addition to the time mechanism, a graze percussion mechanism which will function independently should the shell strike any object in flight or on impact with a target. Time fuses are divided into two main classes, (*a*) burning or composition and (*b*) mechanical or clockwork. The modern composition fuse is exemplified by the British T and P No. 80 (*see* 1.870).

Very little change has occurred of recent years in the design of these fuses. Attempts have been made to lengthen the time of burning by increasing the number of rings and by altering the composition in the rings but, fundamentally, the design remains unaltered. In the T and P No. 80 fuse, the escape of gas from the burning composition is facilitated by radial gas escape holes. In some foreign designs, gas escape through the nose is arranged, but the radial method is more general. The movable ring type of fuse is almost universal but a notable exception is noted in the French type of T and P fuse No. 23–31, which is set by punching a hole at the appropriate point in a composition-filled lead tube by means of a machine called a *débouchoir*. The simple time fuse is rarely found in the modern armaments, a percussion mechanism being almost invariably embodied in the design. Should a time fuse only be required, as in the case of anti-aircraft projectiles and star shell, an ordinary T and P fuse may be employed with its percussion mechanism removed. Nevertheless, fuses which are time fuses only may be found in use with various equipments.

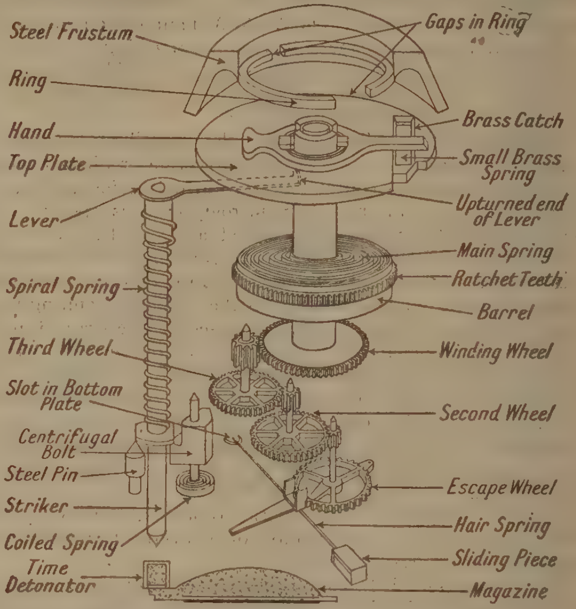

Steel Frustum
Gaps in Ring
Ring
Brass Catch
Hand
Top Plate
Small Brass Spring
Lever
Upturned end of Lever
Main Spring
Spiral Spring
Ratchet Teeth
Barrel
Third Wheel
Winding Wheel
Slot in Bottom Plate
Second Wheel
Centrifugal Bolt
Steel Pin
Escape Wheel
Striker
Hair Spring
Coiled Spring
Sliding Piece
Time Detonator
Magazine

FIG. 7.—Diagram illustrating action of Mechanical Time Fuse.

The use of burning composition in time fuses is by no means ideal, and for many years experiments have been carried out with a view to obtaining a clockwork or mechanical apparatus. Various patterns were tried, but none were satisfactory until 1916 when the Germans brought into use a clockwork fuse *Doppelzünder 16* (T and P fuse 1916 pattern) which may be considered as typical of this class. This fuse is illustrated in figs. 7 and 8, the latter illustration being merely diagrammatic and the description which follows is of principle and arrangement only. The clock train is driven, as in a watch, by a coiled spring in a barrel, but the escapement is original and peculiar. A straight steel spring takes the place of the hair-spring, which would be rendered useless by the effect of rotation and shock of discharge, and as the length of the straight spring is adjustable, the movement of the pallet of the balance, and therefore that of the escapement wheel and the clock train, is controlled and regulated. A horizontal hand, the position of which depends on the setting of the fuse, has, on its under surface, a notch, into which fits the upturned end of the lever at the top of the striker.

When the clock train is started, the hand moves round with it, but is prevented from rising and releasing the lever by a ring attached to the conical housing of the fuse. This ring is provided with two slots into which the hand can fit; thus, when the clock is working, the rotation brings the hand into coincidence with the slots, and when forced up by the action of a small spring, it releases the upturned end on the lever. The striker, previous to firing, has been held in the safe position by a collar on it, which rests on a shoulder of the centrifugal bolt, but when this bolt is moved away by the rotation of the shell, the outer end of this shoulder still rests on a steel pin. When the upturned end of the lever is freed from the notch in the lower side of the hand, as previously described, it flies out and rotates the striker, so that the collar clears the steel pin and allows the striker to fall and fire the detonator. The setting of the fuse and the hand is accomplished by turning the housing with a suitable key, this housing being free to move before firing. On discharge it is very ingeniously clamped to the body of the fuse by means of steel pins in a ring in its under surface. This ring sets back and the pins are driven through the flange of the clock case, a groove being turned on its under side to thin the metal, and thus to allow of easy penetration. The clock train, wound up like a watch, is started at the moment of firing by the setting back of a detent.

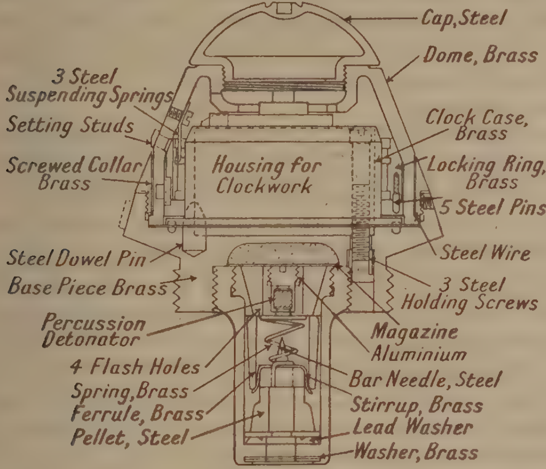


FIG. 8.—Typical Time and Percussion Mechanical Clockwork Fuse.

II. AMMUNITION FOR OTHER WEAPONS

Since 1910 rapid strides have been made in the development of new designs of ammunition for rifles and machine guns.

The Cartridge Case.—The general manufacture of the case has not altered except in detail, but special attention has been given to the hardening, so that, whilst the front end is left sufficiently soft to expand against the walls for gas sealing, the rear half of the case is left hard to stand up against the force of extraction.

Means of Ignition.—No change has been made in the cap or primer, but it has been realised that the composition may deteriorate, especially in conditions of warm, damp storage, or in contact with moist powders. This leads to missfires or hangfires, and slow or incomplete ignition is found to exercise a most deleterious effect on accuracy. The tendency is, therefore, rather to overcharge with fulminate composition in manufacture, so that the efficiency of the ignition shall not be destroyed, even though some deterioration may have taken place in the composition.

Charge.—It is still a debatable point whether purely nitrocellulose powders are preferable to ones containing a proportion of nitro-glycerine. Nitro-glycerine has the advantage of making the powder more powerful, bulk for bulk and also of improving the gelatinisation, making the powder damp proof and better able to withstand adverse conditions of storage. On the other hand, pure nitro-cellulose powders give the same velocities with a lower maximum pressure than nitro-glycerine powders, and are claimed by some to give more accurate shooting. In the result, Britain has held to cordite, but other nations, particularly the United States of America, have adopted N.C. powder as their normal load.

Bullets.—Greater changes have been made in the bullet of the small arm cartridge than in any other component part. Not only has the form of the earlier bullet been materially changed, but several entirely new types have been evolved, such as the tracer and armour-piercing bullet and the normal, or service, bullet. During the last century the use of small arms at distances greater than 1,000 yards was never seriously considered, though it was realised that the actual range of these weapons was well in excess of that figure. With the gradual improvement of machine-guns and the increased care taken in teaching musketry to the infantry soldier after the Boer War, it was found that massed fire could be brought to bear on large targets with great effect at long ranges. The problem of increasing the range by improving the contour of the bullet at once came to the fore, and by 1914 most countries had discarded the round-nosed bullet in favour of a pointed one, the contour of the point being struck by a circle whose radius was about 8 times the calibre. Further improvement in range can be obtained by stream-lining or boattailing the base of the projectile, but as this involves certain difficulties in making the bullet take the rifling, the practice has not been universally adopted. As regards the make-up of service bullets the lead core with special envelope remains the standard practice, but efforts have been made to improve the material of the envelope so as to obviate fouling the bore with the metallic deposit left by cupro-nickel. In America a 90% copper envelope with 8% zinc and 2% tin has been found successful as an anti-fouler.

Tracer Bullets.—The value of a bullet which left a visible wake either of smoke or of flame, was recognised in the early days of air fighting during the World War. This led to the introduction of a bullet stemmed with burning composition, usually a mixture of barium salts and magnesium, in the base, which was ignited by the propellant gases on firing the rifle. The difficulty with a tracer bullet is to make it range identically with the service bullet, and the only solution so far found is to bring the two together at an optimum range, say 500 yards.

Armour Piercing Bullets.—The need for combating armoured cars, aircraft, tanks and snipers' plates with a missile having a better penetration than the service bullet, led to specially designed armour-piercing bullets for such purposes. These consist of jacketed bullets, having envelopes harder than those normally used, to withstand the increased charges which are needed to give penetration. Sometimes soft steel is used for this purpose. The core consists of a specially treated tool steel, and a lead surround is provided, since without this device the bullet would be too hard to take the rifling. The lead surround has the further function of supporting the point of the core at the moment of impact, thus preventing fracture of the hardened point which might otherwise occur.

Armour much over 0·25 in. cannot be penetrated by a 0·303-in. calibre bullet. On the other hand it takes a 1-in. plate to keep out a well-designed 0·5-in. calibre bullet, and this thickness of armour is nearing the limit of weight that any land or air vehicle can profitably carry. For this reason every first class nation has introduced or is contemplating the introduction of a 0·5-in.

calibre weapon with A.P. bullet for such purposes. For normal use by the infantry soldier, however, the weight that can be carried by the individual is the limiting factor, and any increase in calibre would materially reduce the number of rounds that could be taken into action.

Machine Gun Ammunition.—Progress in machine gun ammunition has run on strictly parallel lines to rifle ammunition and in most cases ammunition is mutually interchangeable between the two weapons. The problems are the same and may be summarised as the attainment of a high standard of accuracy, a minimum of erosion, wear and metallic fouling and elimination of flash. The adoption of large calibre ammunition (0·5 in. and upwards) will affect machine guns more than rifles, since for the former the question of transport is not so formidable.

Pistol Ammunition.—In the British Army the 0·455-in. calibre revolver with its heavy, unjacketed lead antimony bullet has remained unchanged for 30 years. As a man-stopping projectile at point blank range it remains unbeaten, but its weight and poor accuracy at longer ranges limit its value. Most nations have adopted automatic pistols for their subsidiary weapon, and for these, jacketed bullets, either of copper or cupro-nickel, are employed. The various nations differ as to optimum calibre for pistol ammunition, but the tendency appears to be away from the light comparatively high-velocity bullet such as the German 0·300 Mauser which was sighted up to 1,000 yd., thus holding the pistol to its true rôle, namely that of a man-stopping weapon at short range.

AEROPLANE BOMBS

Aeroplane bombs have their inception in the indiscriminate throwing of trench grenades from the rather crude flying-machines which were in existence during the early stages of the World War. Gradually bombs and bombing methods were improved till, before peace was concluded, the aeroplane bomb held an important place as an offensive weapon. The main difference between aeroplane bombs and gun projectiles is one of strength. The latter may have to attain a muzzle velocity of about 2,000 f.p.s. in the length of the piece, and this entails pressures running up to 20 tons to the square inch. The former is merely dropped, so that the stresses on it when falling are very little greater than those encountered in normal handling and transport, and it is only when penetration of concrete buildings or armoured decks is sought that anything more than a thin steel case is required to contain the H.E. filling. As regards shape, the terminal velocity of an aeroplane bomb is never above 1,100 f.p.s., hence the stream-lining of the tail is just as important as the contouring of the head. Most bombs are therefore pear-shaped with vanes attached to the cone of the tail to ensure that the bomb drops nose first.

Method of Detonation.—To detonate the H.E. filling on impact with the target, fuses or pistols are used. These are usually simple mechanisms depending for their arming on the unscrewing of vanes by the air stream whilst falling. The Germans gave a rotary flight to some of their bombs by twisting the vanes so that a safety device, worked by centrifugal action, could be incorporated, but this tends to slow down the flight of the bomb. In general a safety pin, which is only withdrawn from the fuse when the airman drops the bomb, is used as an additional safety precaution. The building up of the detonation wave is accomplished by a central exploder which may run the whole length of the bomb or, as in gun shell, only a few inches into the H.E. filling.

MAGAZINES AND SHELL STORES

A magazine is a building with passages leading thereto, in which are stored explosives in bulk which must be under special magazine conditions with regard to precautions against fire or explosion. An explosive store is a building, standing apart from others, used for storage of explosives which are not necessarily kept under magazine conditions. A shell store is a store in which filled shell are kept.

Although in England the Explosives Act, 1875, expressly exempts government magazines from its provisions, the conditions imposed by the Act apply generally to them. *Magazine Regulations, 1922*, lays down in detail the principles governing the arrangement for a magazine in Great Britain as regards site, construction and working conditions. For explosive stores the regulations for magazines are modified as regards the necessity for special clothing and certain minor conditions, but otherwise magazine regulations should generally be strictly enforced.

For the purpose of storage and transport all service explosives are classified in *Magazine Regulations, 1922*, into groups, and the regulations specify the class of store in which each group is kept. The principles on which this classification is made are based on the stability of the explosive, its liability to decomposition, the ease with which it ignites or explodes and similar properties. For example, explosives liable to decomposition and bearing an explosion risk must be kept in a magazine. In fortresses and defensive works magazines and stores require special protection from enemy fire, which is ordinarily provided by heavy traverses. Magazine safety regulations are rigidly enforced, but certain variations in storage are permitted under special conditions.

Arrangements for War.—In a theatre of war arrangements must be improvised to conform as far as possible to magazine regulations as regards the provision of buildings or shelters, but safety regulations should be invariably observed. Wooden huts, with corrugated iron roofs, can be employed in connection with storage of explosives and ammunition; a height of 8 to 10 ft. from floor to eaves would be suitable, and such huts can be made splinter-proof by layers of sandbags. A large storage hut may occupy a space 30 ft. wide by 300 ft. long, and would be divided into compartments or bays by traverses made of double walls of galvanised iron sheeting. A floor of road metal, rammed hard, would suffice. When a building is not available, a raised floor with tarpaulin supported on a framework so as to allow of ventilation, is readily improvised. All explosives should be kept in substantial cases or receptacles where possible. All ammunition necessarily kept in the open should be stored on battens and covered with tarpaulins, which covering should be removed whenever conditions are favourable, in order to permit of ventilation and to prevent sweating. When shells are piled in the open they should never be exposed to the direct rays of the sun.

At base depôts and advanced depôts arrangements for storage of ammunition can be made on more or less semi-permanent lines. From these depôts, the ammunition passes to ammunition parks and columns where the arrangements have to be improvised as local conditions permit. With mobile warfare the movements of parks and columns would prevent any arrangements for storage, separate from the vehicles, of more than a temporary character, as the principal object would be to deliver, as rapidly as possible, ammunition from the depôts to the particular batteries where it might be most urgently required.

For trench warfare, the system of dumps was employed to facilitate ready supply of large quantities of munitions. These dumps would be classified according to the nature of the ammunition and might be mere stacks in the open, separated by traverses of sandbags. Convenience of transport and local conditions would be the main factors in determining the position and extent of these dumps. (C. W. F.)

AMPLIFIER: *see* BROADCASTING; MICROPHONE; TELEGRAPH; TELEPHONE; WIRELESS TELEGRAPHY.—Amplifiers are used generally either in connection with systems of electrical communication or for rendering sounds and other vibrational waves perceptible that would otherwise be too faint to be heard. The essential features of an amplifier are a source of energy, such as a battery, and means whereby the flow of energy from this source may be so controlled by the wave to be amplified that the variations of the original wave are reproduced upon an enlarged scale in the wave set up by this flow.

Practically all of the amplifiers in use up to 1910 depended upon variations in the electrical resistance of a mass of granular carbon which result from variations in mechanical pressure, as in the telephone transmitter. Here the power associated with the electric wave may be as much as 1,000 times that of the sound wave. For amplifying weak alternating electric currents of voice frequency, a combination of telephone receiver and transmitter having a common diaphragm was used. This so-called "mechanical repeater" was used on telephone lines. Various other devices based on changes in resistance with mechanical motion were developed to meet particular needs, notably those of submarine cable telegraphy.

Types in Use.—With the beginning of the period 1910–26, the amplifying possibilities of electric discharge devices were coming to be recognised. Amplifiers of this kind fall into two classes—the so-called negative resistance devices, which have only two terminals; and those having separate input and output terminals corresponding to those of the mechanical repeater. The former include discharge devices such as arcs, in which the voltage between the electrodes decreases with increasing current. Owing to their extreme instability, very little practical application has been found for them.

Of the second class by far the most important is the three-electrode thermionic discharge type variously known as audion, valve, triode, vacuum tube and pliotron. In this type the path of the current from the battery includes a discharge between two electrodes in an evacuated vessel. The discharge is made possible by the emission of electrons from a hot cathode, usually a filament through which an auxiliary heating current is passed. The anode may be either a plate or a cylinder concentric with the filament. The flow of current is controlled by the potential of a third electrode, or grid, situated between the anode and the cathode. The discharge passes through openings in this electrode. The source of the wave to be amplified is connected, usually through a voltage step-up transformer, with the grid and the filament, so that the potential of the grid relative to the filament varies in accordance with the wave to be amplified. The output circuit, which includes the path between the plate and the filament together with a load circuit, has set up in it an amplified copy of the impressed wave.

The carbon amplifier, besides its use as a telephone transmitter, has been applied to submarine and subterranean signalling and to the detection or location of airplanes, submarines, mining operations and gunfire. Thermionic amplifiers are widely used in wire telephone and loud-speaker systems, in submarine cable telegraphy, and in high-frequency telephony and telegraphy by wire and by radio for amplifying both high- and low-frequency currents. They make possible more refined electric and other measurements, and have a variety of miscellaneous applications in special fields such as in aiding the deaf to hear and in making heart sounds more readily audible. (R. V. L. H.)

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AMRITSAR (*see* 1.895), the wealthiest town after Delhi in the Punjab, had in 1921 a population of 160,218, mostly Moslem and Hindu. There are about 200 looms engaged in the carpet-making industry, and the town has some commercial importance, as apart from the entrepôt trade in piece goods, a large business in skins and hides is carried on. The two yearly fairs are the most widely attended in the province. The foundation stone of a new hospital was laid in 1917.

As a result of the intense feeling aroused by the Rowlatt Act, banks and other buildings were pillaged and burnt and Europeans murdered in the town in 1919, and the civil authorities called for military assistance. On April 13 the so-called tragedy of Amritsar occurred, when Gen. Dyer found it necessary to disperse an unlawful gathering in the Jallianwala Dagh, and as a result nearly 400 natives were killed by gunfire, and probably three times that number wounded. This, and the administration of martial law proclaimed the following day aroused bitter indignation, which was not allayed by the appointment later of the Hunter Committee to enquire into the disturbance. Owing to this incident many moderate Indian politicians were alienated from British rule, but among the British community in India and elsewhere General Dyer found many sympathisers in the difficulty in which he had been placed. *See* INDIA.

AMSTERDAM (*see* 1.896) had in 1923 a population of 706,194. The city suffered considerably during the World War from the loss of a great part of the former extensive financial business. The Stock Exchange was closed in Aug. 1914, but reopened on Feb. 9 1915. There followed a stagnant period, with little international business. Immediately after the War a very difficult period set in; but the sound tactics pursued by Amsterdam bankers resulted in the florin reaching par before the end of 1924; shipping on the Rhine increased after the German mark had been stabilised and conditions in the Ruhr had improved.

The total goods traffic of the port increased 50% between 1913 and 1924. The Coen harbour, on the south side of the Y, with 3,112 ft. of quays for seagoing ships and 2,000 ft. for river craft, was opened in 1924, and plans were prepared for a new lock 1,292 ft. long at the entrance to the North Sea Canal at Ymuiden. The canal itself was dredged to a depth of 33 ft., and a new canal to improve the connection between Amsterdam and the Rhine was recommended, which would accommodate the largest barges in use on the Rhine, connect with the existing canal at Utrecht and be carried across the Dutch Rhine to Tiel. The railway line between Amsterdam and The Hague was being electrified in 1926.

AMUNDSEN, ROALD (1872–), Norwegian explorer, was born July 16 1872, in Borge, a country district near Sarpsborg in southeastern Norway. Educated at Christiania (now Oslo) he took his B.A. degree in 1890 and began to study medicine, but gave it up and went to sea in 1894. During the following nine years, Amundsen, with the tenacity of purpose which was one of his chief characteristics, prepared himself for his future career as an explorer, and in 1903–6 he led an expedition consisting of himself and six companions through the North West Passage, on board the "Gjöa," a little sloop of 47 tons. Simultaneously he succeeded in fixing the position of the magnetic North Pole. His next expedition, on board the "Fram," originally intended as a North Polar expedition, by a dramatic surprise, became a South Polar expedition (1910–2), and was the first actually to reach the South Pole. After his return in 1913 he resumed his preparations for a North Polar expedition but was stopped by the outbreak of the World War. He remained inactive until 1918 when he left Norway on board the "Maud," a new vessel, with the aim of drifting from the North Siberian Is. across the Polar basin. Baffled in this undertaking owing to the fact that the Polar stream did not prove to be constant, he decided to force the Polar basin in an aeroplane. On his fourth attempt he succeeded, using the semi-rigid dirigible "Norge," built in Italy. Starting with the American Ellsworth, from Spitsbergen, May 11 1926, he flew to the pole, which he circled twice, thence across the unexplored Arctic basin to Point Barrow, Alaska, and finally landed May 14 at Teller on Behring Sea. The total distance traversed was 2,700 m., the time occupied in the flight being only 71 hours. *See* POLAR EXPLORATION.

ANAEMIA.—A generic term for various forms of disease characterised by a defective constitution of the blood, or more specifically, by a reduction in the oxygen-carrying power of the blood. This reduction is due, either to a decrease in the number of red blood corpuscles, or to a decrease in the amount of haemoglobin they contain, haemoglobin being that constituent of the red corpuscles which makes it possible for them to carry oxygen to the tissues and to play an important rôle in the transfer of carbon dioxide from the tissues to the lungs. The amount of haemoglobin that each red corpuscle contains is represented by a term known as the colour index, which is derived by dividing the percentage of haemoglobin by the percentage of red corpuscles.

Types of Anaemia.—The existence of several kinds of anaemia is recognised. A satisfactory classification is impossible because of the incompleteness of our knowledge. The customary division is as follows: (*a*) the primary, those in which the cause is yet unknown; and (*b*) the secondary, those due to some known cause. Chlorosis and pernicious anaemia are primary anaemias. The anaemia caused by haemorrhage, malaria, chronic poisoning by known chemical and biological agents, parasites, malnutrition, malignant disease, etc., is secondary. As our knowledge increases, all the different anaemias in the course of time will probably become secondary.

Symptoms.—Since the chief derangement in all anaemias is a reduction of the total amount of haemoglobin in the blood, the symptoms and pathological anatomy are quite similar in the different kinds of anaemia. Pallor of the skin and mucous membranes, shortness of the breath, palpitation, faintness, weakness, languor, headache, and usually gastro-intestinal disturbances, are the general symptoms. A special tendency to haemorrhage is frequently present. The physician frequently finds the heart to be dilated and hears systolic murmurs in the heart on auscultation. Anatomically the internal organs are pale, sometimes smaller than normal and atrophic, and their cells contain an excessive amount of fat. The spleen is enlarged in some anaemias and is usually of denser consistency than normal. The red bone-marrow, which forms the red corpuscles and haemoglobin, is increased in amount except in rare cases. The diagnosis depends on the clinical picture, the examination of the blood, and a number of other findings.

Causative Factors.—Obviously anaemia must be due to either one or a combination of the following factors: loss of blood, increased destruction of red corpuscles, or a disturbance of the red bone-marrow (erythroblastic tissue), leading to a decrease in the normal supply of red corpuscles or to a decrease in the amount of haemoglobin they contain. The red bone-marrow in health continually supplies the blood with red corpuscles which contain a constant amount of haemoglobin to take the place of those destroyed in the liver, spleen and other tissues; so that the number of red corpuscles and the total amount of haemoglobin in the blood remain quite constant.

If blood is lost, or if there is an increase in the destruction of red corpuscles, the red bone-marrow compensates by producing red corpuscles at a more rapid rate than normal. In such a case, especially if the loss, or destruction, is great, the red corpuscles so produced are frequently small, contain a subnormal amount of haemoglobin and may even contain a nucleus, which denotes that the cell is young. In the course of time these abnormal cells are replaced by normal cells and the red bone-marrow returns to a normal rate of production. But if the loss or destruction is continuous or intermittent, as in chronic anaemias, the blood contains more and more abnormal red corpuscles. The erythroblastic tissue further attempts to compensate for this continuous demand for red cells by invading and replacing the yellow marrow which does not form red corpuscles. If the demand is in excess of the capacity of the erythroblastic tissue to respond, the condition of the blood seen in the chronic anaemias develops, namely, a decrease in the number of red corpuscles, the presence of abnormal types of corpuscles, and a diminution of the total amount of haemoglobin in the blood.

In some of the anaemias it is possible to state definitely which of the above factors are concerned; in others opinion can be based only upon an interpretation of the known facts. In the anaemia that follows repeated haemorrhage, as occurs in ulcers of the gastro-intestinal tract, the obvious factor is the loss of blood. In the anaemias caused by haemolytic toxins, the destruction of red corpuscles is the chief factor concerned, although these toxins may also act on the erythroblasts or embryonic red corpuscles in the bone-marrow. In the anaemia secondary to malignant disease, *e.g.*, gastric cancer, the anaemia is due to a combination of several factors: the loss of blood from haemorrhage; an increase in the destruction of red corpuscles in some cases; a disturbance of nutrition leading to a lack of proper food supply for the erythroblastic tissue; and the possible action of the autolytic products of the cancer cells which may inhibit the activity of the bone-marrow. The evidence of increased red corpuscle destruction can sometimes be obtained by examination of the spleen and liver, their cells containing a larger quantity of iron than normal, by examination of secretions or excretions, such as the bile and urine (haemoglobinuria), and by determining the fragility of the red corpuscles. The fragility of the red corpuscles is ascertained by determining their ability to withstand a hypotonic solution of sodium chloride without disintegrating, normal red corpuscles being able to resist a 0·4% solution, whereas "fragile corpuscles" will discharge their haemoglobin in a 0·5% solution. The evidence of disturbance of the red bone-marrow is obtained by detailed examination of the blood, the cellular constituents being markedly altered. In the chronic anaemias regeneration and destruction, or loss, occur simultaneously, so that the blood picture gives an idea more of the capacity of the erythroblastic tissue to respond than of the amount of destruction that is occurring. In aplastic anaemia, a rare condition, the red bone-marrow does not respond, and as a result the anaemia runs a rapid and progressive course without remissions, contrary to the usual course of the chronic anaemias.

Chlorosis.—Chlorosis and pernicious anaemia are primary anaemias that deserve special discussion because of their common occurrence. Chlorosis occurs almost exclusively in females between the ages of 14 and 25, the most frequent ages of onset being 14 and 15. This disease is characterised by a pronounced haemoglobin deficiency without a proportional decrease in red corpuscles. It is rarely directly fatal and is fortunately very amenable to treatment with iron preparations, blood transfusions being required only in advanced and stubborn cases. The administration by mouth of bone-marrow and spleen is also beneficial. Recurrences of the disease are quite common. The cause of chlorosis is unknown. All evidence shows that a haemolytic agent is probably not responsible. The erythroblastic tissue is at fault, particularly in the formation of haemoglobin. The fact that iron is so beneficial suggests that iron starvation is in some way related to the primary cause, which is also related in some way to the age of puberty and the function of menstruation. Because of this latter factor, some believe that the glands of internal secretion, especially the ovary, are at fault; but no conclusive evidence is as yet available. An improper diet, overwork, worry and lack of fresh air are predisposing factors. Chlorosis does not occur frequently in country-bred girls, which is probably due to the greater exposure to sunshine and "outdoor life," which these girls enjoy. The symptoms of chlorosis are in general those of anaemia.

Pernicious Anaemia.—Pernicious anaemia is a common disease but is less frequent in occurrence than chlorosis. It is a disease of middle life and is twice as common in males as in females. It is characterised by a progressive anaemia interrupted by periods of temporary improvement, and by a fatal termination almost without exception in from two to five years, the body being rarely emaciated. The onset of this disease is slow and insidious. The skin is pale and later takes on a lemon tint. Languor, weakness and breathlessness are not marked at first, but later become extreme. The heart palpitates readily. The mucous membrane of the mouth is glossy and appears bloodless; the tongue is sore. The appetite fails and quite early in the disease acid disappears from the gastric secretion. Attacks of diarrhoea and abdominal pain frequently occur. There is a tendency to bleed into the skin and serous surfaces. Some patients experience sensations of numbness and tingling and complain of neuritic pains.

The blood picture is very abnormal, the red corpuscles being markedly reduced in number and very abnormal in shape and size, as well as in other respects. The red corpuscles contain an abundance of haemoglobin, the colour index being greater than 1·0. The white blood corpuscles are generally normal or diminished in number, but frequently abnormal forms are present. On post-mortem examination the bone-marrow is red and hyperplastic, except in cases of aplastic anaemia; lesions of the spinal cord are found; the gastric mucosa is frequently atrophic; the internal organs show fatty degeneration; the lymph glands may be deepened in colour (haemo-lymph glands), and there is much iron pigment in the kidneys, liver and spleen.

In contrast to chlorosis, there appears to be no serious difficulty in the formation of haemoglobin in pernicious anaemia. Many evidences of excessive blood destruction are present, particularly the increased iron content of the organs, free haemoglobin in the blood serum and urine, the frequent occurrence of jaundice, and the increased fragility of the red corpuscles. A condition simulating pernicious anaemia occurs on continued poisoning with toluylendiamine and ricin and in patients infected with bothriocephalus, an intestinal parasite that produces an haemolytic agent.

Haemolytic substances are said to be present in the intestine of anaemic patients that have chronic intestinal disorders, and recently a condition similar to pernicious anaemia has been observed to occur following intestinal stasis. B. aërogenes capsulatus, which frequently inhabits the intestine of man, produces an haemolytic agent, and it is reported that they occur in increased numbers in the intestine of patients that have pernicious anaemia and that their number decreases during the remissions. The feeding of this bacterium in large numbers, or the intravenous injection of their products, produces in animals a condition quite like pernicious anaemia in man. Buckman and Horrall report that an haemolytic substance is present in the serum of pernicious anaemia patients.

Some observers believe that the stomach is in some way related to the cause because of the high incidence of absence of acid in the stomach (achlorhydria) of patients suffering with this disease and because this disease sometimes occurs after total removal of the stomach. The absence of the acid in the stomach is said to favour the growth of bacteria that produce haemolytic poisons. After total gastrectomy in dogs a grave anaemia is found, which, however, has been controlled by the administration of iron and cod-liver oil. It is impossible to state at this time whether the change in the stomach is primary or secondary. Although the more recent evidence seems to show that it is primary, it is commonly held to be secondary, as are the changes in the bone-marrow and nervous system, to the action of a toxin, irrespective of its source.

All treatments at present can be said to be only palliative. The source of the toxaemia should be looked for. Nutritious and readily digestible foods should be ingested, and plenty of fresh air, sunlight and cod-liver oil are indicated. Dilute hydrochloric acid by mouth improves digestion. Removal of the spleen has been tried extensively, but without definite benefit. It is of great benefit, however, in splenic anaemia. Repeated blood transfusion quite probably offers more for pernicious anaemia than any other form of treatment.

Other Forms of Anaemia.—There are other diseases of the blood and blood-forming organs, such as lymphosarcoma, Hodgkin's disease, chloroma, leucaemia and anaemia pseudoleucaemia of children, in which anaemia occurs. In these diseases the disturbance chiefly involves the white corpuscles, or leucocytes, and hence these diseases are not to be considered in a general discussion of anaemia.

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ANAESTHETICS (*see* 1.907).—The agents for producing general surgical anaesthesia which were the first to be introduced, that is, nitrous oxide gas, ether and chloroform, not only remain in general use, but actually provide in greater part for the requirements of modern surgery. Local anaesthesia, which has in part supplanted general anaesthesia, has still only a very limited application.

Nitrous Oxide.—The War showed that persons suffering from severe shock and loss of blood from wounds did not progress favourably following operations under chloroform or ether, but that the prospects of recovery were distinctly improved when performed under the continuous inhalation of nitrous oxide gas. The reasons for this cannot be stated precisely, but it may be said in general terms that nitrous oxide is less depressing, and further that owing to its exceedingly rapid excretion, consciousness and normal bodily conditions are quickly restored after completion of the operation.

Nitrous oxide or "laughing gas," as it was formerly termed, is familiar as an agent for producing brief periods of narcosis, as for the extraction of teeth. When administered thus in a pure state it excludes the admission of air to the lungs and if continued would cause complete asphyxia. The problem of continuous administration is therefore the admission of sufficient oxygen to the lungs to satisfy the needs of the body. Air contains about one-fifth of its volume of oxygen, but if nitrous oxide were diluted to this extent its partial pressure would be reduced to about 80%, which is too weak for the convenient production of its full anaesthetic effect, at least in the early stages of its administration. Oxygen may in fact be reduced to a proportion of one-tenth of an atmosphere without causing discomfort to the patient or even under ordinary circumstances causing the discolouration of the face known as cyanosis. It may even be reduced lower than one-tenth and yet be capable of sustaining life. The continuous administration of nitrous oxide mixed with oxygen requires a sufficiently delicate mechanism to regulate and indicate the relative proportions of the gases, but it is not a method which is adapted for all classes of cases; the relaxation of the body muscles is not sufficient for the convenient performance of certain operations; the narcosis is not always sufficiently deep and it may have to be supplemented by an admixture of ether vapour; nor is it absolutely free from danger. Its advantages in the cases of profound shock referred to appear to be undoubted, but it can not be classed for precision of action with the routine anaesthetics, chloroform and ether.

Ether.—The use of ether as an anaesthetic has received considerable stimulus from the introduction of the "open" method of administration. In order to induce anaesthesia in a muscular person, or "to get him under" in ordinary phraseology, a strong vapour may be required, this being as strong as 25% to 30% in some cases.

In the "open" ether method the breathing is noiseless, effortless, and only slightly exaggerated, so that delicate abdominal operations can be performed with comfort. The flow of saliva is considerably less than in the closed method, probably from the absence of asphyxia, and this can be entirely abolished by the subcutaneous injection of a minute dose of atropine previous to the administration. There is no sign of cyanosis, and the patient's face remains a healthy colour throughout; the only restriction of oxygen is by reason of the displacement of air by ether vapour which at a maximum will be less than one-third its volume, and as in the later stages of an administration much less vapour is required, the restriction becomes entirely negligible. The after-effects of ether, such as vomiting and malaise, are considerably less pronounced than those that follow a "close" administration.

The application of the "open" method to ether inhalation has been brought about by an exceedingly simple adaptation. The liquid ether is applied to a pad of open-wove fabric, such as "stockinette" or a number of layers of absorbent gauze stretched over a framework mask of which the margin is roughly adapted to the contours of the face; the mask rests lightly upon the face, a soft pad being interposed between its edges and the skin to prevent the entrance of air in this direction. In this way the inhaled air passes through the meshes of the fabric and in doing so every portion of it comes in close contact with the ether and takes up a greater proportion of vapour than it would if it merely passed over the surface of the fabric.

The induction of anaesthesia by the " open " method is liable to be somewhat prolonged, an undoubted disadvantage, but once full anaesthesia has been produced it is maintained without difficulty and the results attained are in general more satisfactory than those of any other form of inhalation anaesthesia.

The " intratracheal " method of etherisation is conducted by passing a narrow tube through the larynx into the trachea almost to the level of its bifurcation. Through this tube a continuous current of air and ether vapour is forced into the lungs at a pressure which keeps the lungs moderately distended, but not so much as to abolish the natural respiratory movements. The air returns through the chink of the vocal cords by the side of the tube and this continuous return blast blows away any solid or fluid particles, blood or pieces of tissue, in the neighbourhood, and prevents their entering the trachea, an accident which may possibly occur in ordinary inhalation methods. The advantage of intratracheal ether in operations involving the respiratory passages is therefore obvious; it is likewise a convenient arrangement for operations upon the face, which is left entirely uncovered, and in operations upon the interior of the thorax a proper aeration of the lungs can be thus ensured.

Chloroform.—The form of sudden death which is occasionally encountered under chloroform anaesthesia has acted as a deterrent to its more extended employment in spite of its manifest conveniences.

It is now becoming realised that the typical sudden chloroform fatality is not conditioned by an overdose as formerly supposed. It has long been known that the majority of deaths occur in the very early stages of anaesthesia before the patient is fully narcotised, and further examination of reports of fatalities shows that there is generally some evidence of light anaesthesia preceding death, or else that overdosage can be ruled out of question. There is a further point brought out by these reports, which was in fact fully appreciated by John Snow in the middle of the last century: whereas in overdose the respiration is paralysed before the circulation, in the typical chloroform death the outstanding feature is an absolutely sudden failure of the circulation, and the failure of the respiration is a secondary result.

Dr. A. G. Levy, in 1911, reported certain cases of sudden cardiac failure that he had observed in animals obviously in a light stage of chloroform anaesthesia, and he succeeded in reproducing this death by the intravenous injection of small doses of adrenalin in lightly chloroformed animals, but the experiment failed under full chloroform narcosis. This at once accounted for those cases of syncope and death, a number of which had been recorded, following the injection of adrenalin into the mucous membrane of the nose for the purposes of certain nasal operations which were always conducted under light anaesthesia, the form of this syncope being the same as in an ordinary chloroform fatality.

By following up this line of research it was shown that sudden cardiac failure could be induced likewise by various procedures—excitation of the cardiac accelerator nerves either directly or through a reflex mechanism, stimulating the excretion of the adrenal glands, by intermitting the administration of chloroform, or by withholding the chloroform during excitement and struggling; the event never occurred during deep narcosis. The underlying condition of the cardiac syncope was shown to be that of fibrillation of the ventricles, in which the ventricles are entirely deprived of their power of propelling the blood through the arteries.

On this theory death under chloroform can be prevented by simple precautions, by making the induction of anaesthesia continuous and expeditious and thereafter continuously maintaining a full degree of narcosis. Chloroform should never be employed if the conditions of the operation forbid the observance of these rules and especially in those special cases in which a light degree of anaesthesia is required. (*See* ETHYL CHLORIDE; ETHYLENE.)

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(A. G. L.)

ANATOLIA: *see* ASIA MINOR; TURKEY.

ANATOMY (*see* 1.920).—While during the period 1910–25 the policy of appealing to the legal custodians of unclaimed bodies to hand them over for anatomical examination followed the course previously pursued by licensed teachers of anatomy, the government authorities not only supervised the administration of the Act, but also helped the schools to obtain an adequate supply of material to meet their needs. The immediate result has been an extension of sources of supply so as to improve considerably the state of affairs which prevailed in Great Britain in 1910.

In recent years there has been much confusion with regard to the nomenclature used in the science of anatomy. This arose from an attempt to revise and improve the terminology which had previously been in common use. At present either the original or the new " Basle " terminology or a combination of both are employed, but it is very desirable that a unanimous understanding should be arrived at by anatomists for the good of the science in general, and for its application to medicine and surgery in particular.

While advances in the science of anatomy since 1911 have been important, but of a highly technical nature, many contributions have been made largely in association with cognate subjects such as comparative anatomy, physical anthropology, embryology, physiology, pathology, medicine and surgery.

There has been much elaboration and improvement in apparatus designed for the examination in the living person of the organs of sense, alimentary canal, respiratory and genito-urinary systems. The technique of preparing the tissues of the body for microscopic examination has also advanced.[1] Perhaps the most important step forward in recent years has been the application of X-rays in the study of macroscopic anatomy particularly of the living body—an advance which has proved of immense importance in the practice of medicine and surgery.

Osteology.—Advances in connection with the skeleton have been largely concerned with its development. The controversy regarding osteogenesis has continued and new views have been expressed as regards the origin, growth and fate of osteoblasts and osteoclasts. Important contributions have been made dealing with the human clavicle, ribs and bones of the face. With regard to the descriptive aspect of osteology an interesting account has been given of the human sinus maxillaris at all ages. Sexual differences in the human skull and sexual and racial characters of the human ilium have been recorded. Important papers have also appeared upon the morphology of mammalian teeth and sternum.

Muscular System.—The World War, with its immense train of injuries to muscle and nerve, was directly responsible for renewed intensive study of these systems. The investigations of Prof. Kulchitsky upon the innervation of muscle fibres, the consequent and subsequent suggestions by Prof. Hunter that muscle fibres are of two kinds with separate nerve supplies from the central and autonomic systems, and the actual designing of surgical measures for amelioration of muscle spasm based upon these ideas, have not yet been sufficiently confirmed. The morphological aspect of the muscular system has also received its due measure of attention.

Nervous System.—C. W. Ariens Kappers has demonstrated that control is exercised upon the grouping of brain cells by forces, probably of a bio-electric character, emanating from the nerve tracts with which these are functionally associated.

Much attention has been given to the comparison of particular areas of the central nervous system in a series of vertebrates with a view to elucidating the evolutionary significance of these areas in man. Considerable work has been directed to the relative

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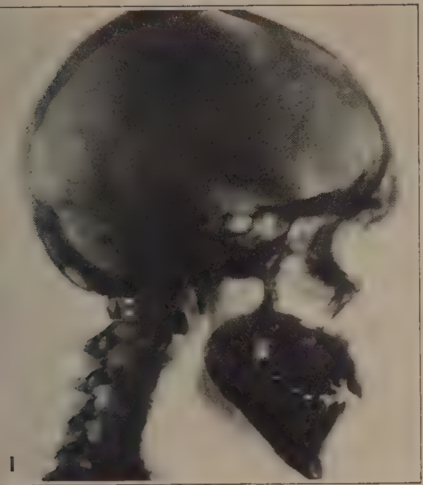
[1] A. B. Lee, *The Microtomist's Vade-Mecum*, eighth edition by J. Bronte Galenby (1921).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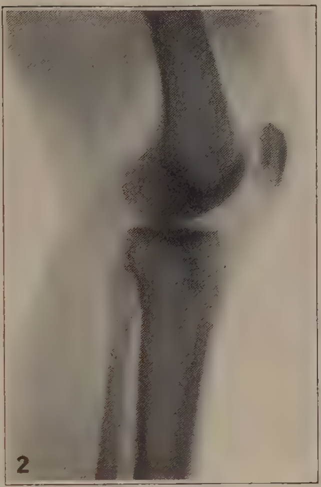
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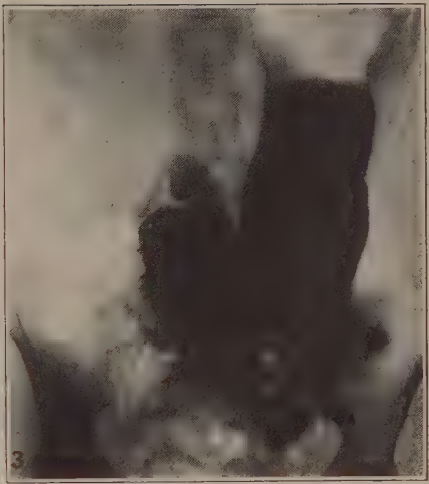
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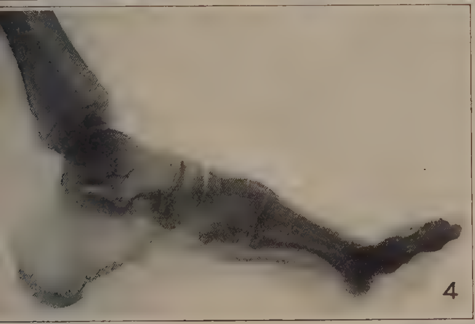
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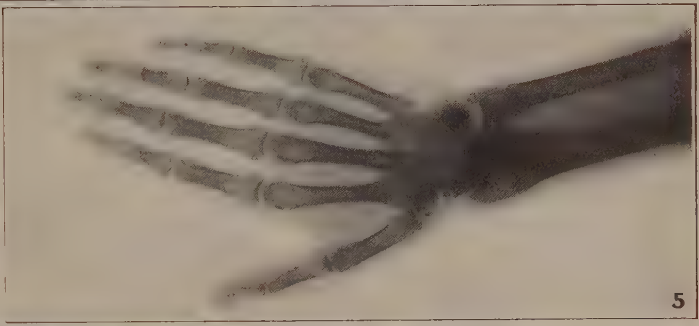
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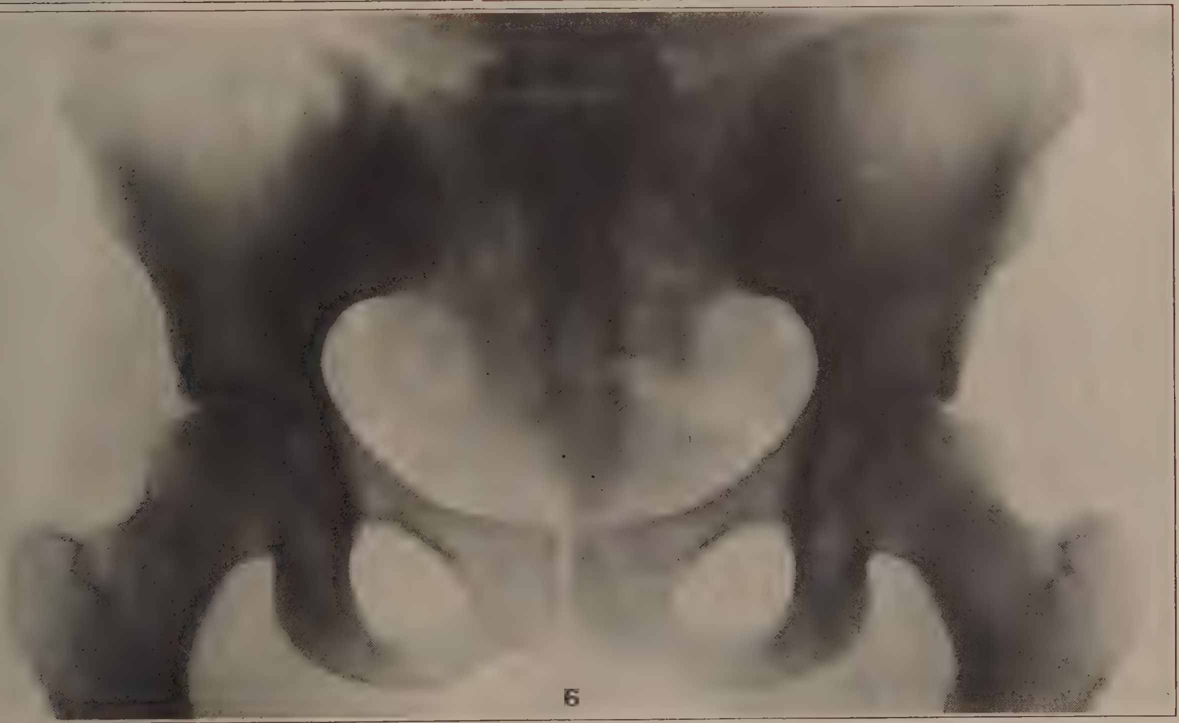
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RADIOGRAPHY AS APPLIED TO ANATOMY

FIG. 1. Lateral view of Head. FIG. 2. Side view of Knee. FIG. 3. Normal Stomach and first part of Duodenum immediately after ingestion of barium meal. FIG. 4. The Ankle and Foot. FIG. 5. Lower part of Forearm and Hand. FIG. 6. Pelvis and Hip-Joint.

(Photographs by courtesy of Dr. Levack, Aberdeen; Dr. Spriggs, Ruthin Castle, N. Wales; and Dr. Salmond, Univ. Coll. Hospital, London.)

anatomy of the origin, course and distribution of the motor and sensory nerves, with the acquisition of knowledge, highly detailed, but of great practical importance.

Organs of Sense.—Very important and extensive investigations have been carried out by Karl Pearson, E. Nettleship and C. H. Usher on the subject of albinism in man, showing that eyes, hair and skin may alone show perfect albinism, and that perfect albinism in eyes may be accompanied by imperfect or wholly absent albinism in hair. Anatomical science is indebted to S. Ernest Whitnall for an exhaustive account of the anatomy of the human orbit and accessory organs of vision, and to Sir Frederick Smith for anatomical notes on the accessory organs of the eye of the horse. As regards the ear much attention has been given to the study of the structures concerned in the mechanism of hearing, and attention may be directed to comprehensive accounts of the anatomy of the ear in man and animals by Albert Gray, Glasgow.

Vascular System.—During the years 1910–25 additions to the knowledge of the vascular system have been chiefly in relation to function. Recent advances in connection with structure have been with regard to the blood supply of the valves, the muscular architecture and the development of the human heart. Further information has also been gained with respect to the arterial supply of the pons, medulla, and fore-brain, and the development and comparative anatomy of the arteries of the extremities.

Digestive System.—The chief advances in the anatomical knowledge of the digestive system have been along the lines of development and morphology. Particular attention has been paid to the teeth, the shape and size of the tonsils at different ages, the minute structure of the oesophagus in mammalia, the form and immediate relations of the abdominal viscera with special reference to their peritoneal attachments, their blood and nerve supply and lymphatic connections.

Respiratory System.—Numerous papers of importance have been written upon the human and comparative anatomy and development of this system with special reference to the lobes of the lungs and the nerve supply of the larynx. Recent knowledge, which has been acquired by means of X-rays regarding the position of the diaphragm and thoracic viscera, will be found in the paragraph below, *Radiography as Applied to Anatomy.*

Genito-Urinary System.—The problem of the descent of the testis has attracted renewed investigation and given rise to new opinion. Comparative anatomy, development and clinical methods have been studied for light upon the various parts of this system, and the most valuable additions have been made to our knowledge of the appearance of the urethra, bladder and ureter by the cystoscope and of the kidney by radiography.

Ductless Glands.—Much attention has in recent years been focused on the function of these glands and a renewed interest has been taken in their morphology and microscopic anatomy.

RADIOGRAPHY AS APPLIED TO ANATOMY

Human anatomy has been greatly advanced by the application of radiography to the study of the body especially in its living state. In recent years the apparatus in connection with radiography has been enormously improved (*see* RÖNTGEN RAYS). Advances have been made in the preparation of the human body, prior to its exposure to the X-rays, by the employment of substances to which the rays are highly impervious.

In order to interpret the photographs obtained by radiography it is essential that the person who takes the photograph and the person who interprets it should be one and the same, as it is of primary importance that the interpreter of the photograph should have first-hand knowledge of the exact relation between the source of the rays, the object to be examined and the photographic plate.

The Skull.—An instructive radiogram of the skull is obtained by placing the tube generating the rays on one side of the head and by laying the photographic plate flat against the other. Fig. 1 on plate shows a lateral view of the head resting upon the upper part of the spinal column. On detailed examination a good view is obtained of the extent of the cavity which contains the brain. The orbital and nasal chambers with their accessory air sinuses (antrum of Highmore and sphenoidal air sinus) are well seen. Particularly there is noticeable, immediately behind the sphenoidal sinus, the saddle-shaped sella turcica for the lodgment of the pituitary gland which is chiefly concerned in the growth and metabolism of the body.

Shoulder.—A front view of the shoulder and neighbouring part of the chest when the arm hangs by the side of the body, discloses the relative position of the bones of that region. The ribs pursue an obliquely downward course in order to allow of their movements in respiration.

The clavicle passes outwards and slightly upwards toward the acromion process of the scapula, with it to form a bony arch overhanging the shoulder joint and thus helping to prevent upward displacement of the humerus at that joint. The body of the scapula rests on the ribs thickening at its axillary border and upper and outer angle where it expands to form the glenoid fossa for the reception of the head of the humerus. The coracoid process which is swung by fibrous tissue to the clavicle in the recent state is very evident.

The ball and socket character of the shoulder joint is so arranged as to allow of extensive movement of the arm at the joint, the socket (glenoid cavity) being small as compared with large articulating surface of the ball. The upper extremity of the humerus with its articular surface and tuberosities are well seen.

Elbow.—A good picture of this region is obtained by taking a radiograph from its inner side with the elbow joint slightly bent and the forearm in such a position that the palm of the hand is directed toward the median plane of the body. The lower end of the humerus shows the internal condyle with a ridge running upward from it and a groove behind it for the passage of the ulnar nerve (funny bone) from the arm into the forearm. The upper end of the ulna shows the deep concavity by which it articulates with the pulley-shaped surface of the humerus and its helmet-shaped upward extension (olecranon process) for the attachment of the triceps muscle—the great extensor of the forearm. The head of the radius supported upon its conical neck articulates with the humerus above and the ulna at the side. The whole picture emphasises the hinge-like character of the elbow joint and the pivot character of the joint between the bones of the forearm at the elbow.

Wrist and Hand.—Fig. 5 on plate shows the lower part of the forearm and hand viewed from the palmar aspect. The radius and ulna, the carpal, metacarpal and phalangeal bones form distinct shadows. The outline of the wrist joint shows that the hand is supported mainly by the expanded lower end of the radius, the head of the ulna being separated from the carpus by an interval which in the recent state is filled up by a fibro-cartilaginous pad.

The outlines of all the eight bones of the carpus can clearly be made out forming a group consisting of two rows of bones with an ∽-shaped joint between them. The os magnum is the largest bone of the group and lies with its long axis in line with the middle finger, the semi-lunar and the radius. Its rounded head fits into a cup formed by the scaphoid and semi-lunar; its body is flanked by the trapezoid and unciform, and its base supports the third and to a lesser degree the second and fourth metacarpal bones. The pisiform is rather indefinitely seen immediately below the ulna and in front of the cuneiform. The trapezium partially hides the trapezoid.

The four inner metacarpal bones lie close to one another, while the first or that of the thumb is separated from the second by a wide interval. A small sesamoid bone is seen lying upon the inside of its head.

The phalanges of the fingers and thumb are shown very distinctly and the ball and socket character of the metacarpa-phalangeal and the hinge-like nature of the inter-phalangeal joints are also manifest. The whole radiogram affords a striking illustration of the adaptation of the hand for prehensile purposes as compared with the foot which is constructed essentially for supporting the weight of the body and for locomotion.

Pelvis and Hip-joint.—The architecture of the bony framework of the pelvis which transmits the weight of the trunk and upper extremities allowing at the same time room for viscera is well seen in fig. 6 on plate.

The relation of the wedge-shaped sacrum with its coccygeal appendage to the rest of the body girdle is apparent. The sacrum is seen to be interlocked between the ilia of the innominate bones so as to form with them an arch transmitting the superincumbent weight either to the lower extremity in the erect posture or to the ischial tuberosity in the sitting position. The tendency towards the spreading of the arch is prevented by the front portions of the pelvic girdle acting as tie beams and there are three "buffers" which break shocks; one at the symphysis pubis in the middle of the front part of the girdle and the other two at joints between the sacrum and ilia. The foramina for the exit of nerves from the spinal cord to supply the lower extremities and soft parts of pelvis are apparent. The general character of the female as compared with the male pelvis is well exemplified in fig. 6, *e.g.*, the widely spreading ilia, the great width of cavity below the ilia and the wide sub-pubic angle.

To get a good radiogram of the region of the hip-joint is a somewhat difficult matter. One taken from the front shows the thigh occupying its position in the erect posture, revealing the socket or acetabulum, the head of the femur with its pit for the round ligament, the oblique neck, and the upper part of the shaft with the great and small trochanters. The arrangement of the cancellous bone tissue is such as to bear the superincumbent weight in the best possible way. Unlike the shoulder-joint which is constructed essentially for prehension, the hip-joint is formed for support and locomotion.

Knee.—Many radiograms of this region show that the bones which form its foundation come near the surface of the limb especially in front and that they are consequently liable to mechanical injuries and to the effects of other adverse influences from without.

A good general idea of the region is obtained by taking a radiogram from the side (fig. 2 on plate). It shows the lower part of the femur with its condyles, upper part of the tibia with its spine, tuberosities and tubercle, and the upper part of the fibula with its head.

There is seen to be but little interlocking between the femur, tibia and patella which enter into the formation of the knee joint. The tibia articulates by a relatively small surface with the relatively large articular surface of the femur, the joint so formed being an example of a hinge joint with the pin of the hinge a movable one. The spine of the tibia is seen projecting upward between the condyles of the femur acting like the flange of a wheel and so helping to prevent lateral displacement of the tibia from the femur at the joint. The knee-cap, to which are attached the great extensor muscles of the leg, moves upward and downward on the femur only. The fibula is seen articulating with the tibia, the joint surface being oblique in direction in order to break shocks between the two bones.

Ankle and Foot.—In fig. 4 on plate a view of the skeleton of the lower part of the leg and of the foot is given from the inside. The tibia and fibula of the leg, and the tarsal and metatarsal and some of the phalangeal bones are shown.

The tibia articulates with the astragalus at the ankle joint, and on close inspection the relative positions of the malleoli of both the tibia and fibula to the astragalus can be made out, the bones of the leg and the astragalus forming a hinge joint. The tip of the outer malleolus which forms part of the fibula reaches to a lower level than the tip of the inner malleolus which belongs to the tibia. The foot as in the case of the hand is seen to consist of a number of bones by virtue of which its mobility and elasticity are increased, while the chances of fracture or dislocation are lessened.

The antero-posterior and to a less extent the transverse arch of the foot are shown, the pillars of the former consisting of the great tuberosity of the os calcis behind and of the heads of the metatarsal bones in front. The astragalus forms the keystone of the arch, and transmits the weight of the body from the tibia to the astragalus and os calcis behind and to the scaphoid, cuboid, cuneiform and metatarsal bones in front. The spicules of the cancellous tissue in these bones are arranged so as to bear the weight of the body transmitted through them. The so-called tunnel of the tarsus and the mediotarsal joint across the foot between the astragalus and os calcis behind and the scaphoid and cuboid in front are very apparent, showing at the same time that the articulation between the os calcis and cuboid forms a separate joint. The front of the middle cuneiform is indicated by a narrow vertical shadow situated a little behind the shadow indicating the anterior border of the internal cuneiform.

The radiogram illustrates vividly the essential difference between the hand and the foot, in that the big toe is seen to be closely applied to the second toe and not opposable to the rest of the foot as the thumb is to the rest of the hand.

Ossification.—Ossification begins in each bone of the skeleton at one or more spots called "primary centres of ossification." Each appears before birth and by their spreading they form the main part of the bone. After birth "secondary centres of ossification" begin to show themselves independently of the main mass, form what are known as "epiphyses" and join it at various periods after birth to make the adult bone. Radiography, when applied to the living body, affords very valuable information as to the forms, times of first appearance and times of junction of the epiphyses with the main parts of bones to which they belong. It has shown that there is very great variability in the times of appearance and of fusion of epiphyses in different individuals, a fact which is of great importance in the practice of surgery.

Thorax and its Contents.—Apart from revealing the skeleton of the thorax, radiography permits inspection of the position and contour of the heart and great vessels, the lungs and mediastinum.

Abdomen and its Contents.—Subsequent to the introduction of matter opaque to X-rays such as barium or bismuth salts into certain organs, radiography has played a very important part in elucidating the anatomy of the alimentary canal and the urinary tract.

Fig. 3 on plate shows a normal stomach and first part of the duodenum immediately after the ingestion of a barium meal. The clear area at the upper part indicates the air-containing portion of the cavity in the neighbourhood of the entrance of the oesophagus.

The writer of this article is indebted to Dr. Levack, Radiologist, Royal Infirmary, Aberdeen, Dr. Spriggs, Duff House, Ruthin Castle, North Wales and Dr. Salmond, Radiologist, University College Hospital, London, for the radiograms that are reproduced in figs. 1 to 6.

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(R. W. RE.)

ANDERSEN, HANS NIELS (1852–   ), Danish shipowner and merchant, was born at Nakskov in poor circumstances. He went to sea and in 1884, having gained experience by trading with the

East, he founded the business of Andersen & Co., at Bangkok, opening in 1894 a branch house in Copenhagen. In 1897 he established at Copenhagen Det Östasiatiske Kompagni (The East Asiatic Company) which soon became the largest commercial enterprise in Denmark and one of the few Danish undertakings of world-wide renown. In 1912 at Copenhagen, the company launched the first large motor-ship. Owing to his powers of administration and his extensive connections throughout the world he rendered important services to his country during the World War. He received the Order of the Elephant, the highest Danish order, in 1919. He is the author of *Tilbageblik* (1920).

See A. Fraenkel, *Verden med dansk Maal eller Danmark med Verdensmaal* (1916).

ANDERSON, ELIZABETH GARRETT (1836–1917), British medical practitioner (*see* 1.959), died at Aldeburgh, Suffolk, Dec. 17 1917.

ANDERSON, SHERWOOD (1876–), American author, was born in Camden, O., Sept. 13 1876. After trying various occupations, he entered the advertising business and eventually left his native state for Chicago. His first literary work was a story, *Sister*, which appeared in the *Little Review* (1915). His first novel was *Windy Macpherson's Son* (1916). In 1921 his novel, *Many Marriages*, was awarded the *Dial* prize of $2,000. Among his other works are *Marching Men* (1917); *Mid-American Chants* (1918); *Winesburg, Ohio* (1919); *Poor White* (1920); *The Triumph of the Egg* (1921); *Dark Laughter* (1925) and the autobiographical *A Story Teller's Story* (1925). Mr. Anderson's fiction is mainly psychological in interest, and pessimistic in tone. The frankness with which he treats the relations of the sexes has frequently provoked criticism.

ANDORRA (*see* 1.965).—This little country has a population of 5,231 and an area of 191 square miles. The poorness of communication remains the principal hindrance to the country's development. A motor road from the French side runs as far as Soldeu; and from the Spanish side a road from Seo de Urgel reaches Encamp, 5½ m. beyond Andorra la Vella, the capital. A motor omnibus service is in operation between Seo de Urgel and Andorra la Vella. From Soldeu to Encamp, a distance of 8 m., there is only a mule track. The track passes between high cliffs containing valuable deposits of iron ore and occasional small veins of silver and lead. For the exploitation of these minerals a good road is essential; the construction of such a road has become Andorra's chief political issue, but at the end of 1925 the question remained unsettled. The tobacco crop is the main source of the wealth of the country.

ANDRÁSSY, JULIUS, Count (1860–), Hungarian statesman, was born June 30 1860, the son of Count Julius Andrássy (*see* 1.967). He was elected deputy in 1885, and in 1906 became Minister of the Interior, in the so-called Coalition Cabinet (*see* 13.921). At the collapse of this Ministry in 1910, he refused to join the Khuen-Héderváry Govt. but declared that he would not actively oppose it, and dissolved the constitutional party, of which he was leader. In 1913 he delivered three speeches in the Hungarian Delegation against the conduct of foreign affairs, advocating a policy of European *détente*, and in Parliament he opposed the plan for the centralisation of the internal administration of Hungary. At the outbreak of the World War he supported the Tisza Ministry, but opposed Burian on the Polish and Italian questions. In 1915 he pleaded for peace, and urged a wide extension of the franchise. Upon the resignation of Burian in Oct. 1918, he became Foreign Minister in Vienna and, in a note to President Wilson, made a last attempt to conclude a separate peace. He then retired from office, but in Jan. 1920 was returned for Miskolcz to the Hungarian National Assembly and later became leader of the Christian National party. In Oct. 1921, at King Charles's second attempt to regain his throne, he was taken prisoner with the King and was imprisoned for several months. In 1922 he was returned to the Nationalist Assembly as a Legitimist deputy.

His works include—*Ungarns Ausgleich mit Österreich vom Jahre 1867* (1897); *Die Ursachen des Bestandes des Ungarischen Staates und dessen verfassungsmässiger Freiheit* (3 vols., Budapest, 1901–11); *The Development of Hungarian Constitutional Liberty* (1908); *Wer hat den Krieg verbrochen?* (Leipzig, 1915, Eng. trans. by E. J. Euphrat, New York, 1915); *Interessensolidarität des Deutschtums und Ungartums* (Munich, 1916); *Diplomatie und Weltkrieg* (1920, Eng. trans. by J. H. Reece, 1921), and *The Antecedents of the World War*, vol. 1, Hungarian (1925).

ANDREE, RICHARD (1835–1912), German geographer (*see* 1.971), died at Leipzig Feb. 22 1912.

ANDREWS, ROY CHAPMAN (1884–), American naturalist and explorer, was born at Beloit, Wis., Jan 26 1884. After his graduation from Beloit College in 1906, he went to Alaska on his first exploring trip. In 1909–10, he accompanied, as a naturalist, the "Albatross" on its voyage to the Dutch East Indies, Borneo and Celebes; in 1911–2 he explored northern Korea; and in 1913 was with the Borden Alaska expedition. From that date he devoted himself to the exploration of the lesser known portions of Central Asia, China and Borneo. The fruits of his expeditions in 1921 and 1925 into Central Asia included the discovery of new geological formations, large fossil fields, dinosaur eggs and the skull and other parts of the baluchitherium—the largest known land mammal. Evidence was discovered also pointing to Central Asia as a place of origin and centre of distribution for much of the reptile and animal life of the world. Mr. Andrews became chief of the division of Asiatic exploration of the American Museum of Natural History and wrote: *Whale Hunting with Gun and Camera* (1916); *Camps and Trails in China*, with Yvette Borup Andrews (1918); *Across Mongolian Plains* (1921) and numerous scientific bulletins of the American Museum of Natural History.

ANDREYEV, LEONID NICOLAIEVICH (1871–1919), Russian novelist, was born in Orel June 18 1871. Educated at the government school, in 1896 he received the diploma of the University of Moscow. Poverty and an unhappy heredity drove him in 1894 to an attempt on his own life, as a result of which he suffered from a weak heart which ultimately caused his death. For a long time Andreyev was unable to find a place in literature, and he became a reporter on the paper *The Courier*. In 1899, his story *They Lived* appeared in the monthly *Zhizn* (Life) and attracted universal attention. It is the only one of Andreyev's stories in which a happy love-story is told in an attractive manner.

In 1901, when the first series of his stories appeared in a separate edition, N. K. Michailovsky, the most influential critic of the time, paid a high tribute to the genius of the young author. This series included the stories *The Grand Slam*, *The Tocsin*, *The Wall*, in which Andreyev's creative genius and its characteristics were clearly visible. His subsequent works: *The Story of Serguey Petrovitch*, *Thought*, *In the Mist*, *The Life of Father Vassili Fiveisky*, *Ghosts*, etc., are similar to his first work in spirit and philosophical outlook.

His works are permeated by a horror of life, which appeared to Andreyev, as to James Thomson, a "City of Dreadful Night." His manner is original and he follows the great precept that "In literary works, there should be little room for words and large space for ideas." The same terror of life is expressed in Andreyev's plays *The Life of Man* (1907), *King Hunger*, *Anathema* (1909). He was not a morbid pessimist who derided the misery of mankind, but a mournful humanist. He pities the sufferers and is filled with scorn for those who add nightmare to nightmare. Andreyev's best known works reflect this attitude: his protest against war, *The Red Laugh* (tr. 1905); against capital punishment, *The Seven that were Hanged* (tr. 1909), which appeared during the reign of the White Terror in 1909; and the passionate *S.O.S.* (1919), directed against the Red Terror.

Andreyev refused to follow Gorki's example and to recognise the Bolshevik régime, declined the honours offered by the Bolsheviks and fled to Finland. He thus lost the fortune he had accumulated by his writings, and during the last years of his life he once again experienced poverty and even want. *S.O.S.*, one of the most remarkable works of Russian literature and Andreyev's swan song, was published in Finland. He died in Helsingfors Sept. 12 1919. (I. W. S.)

ANGELL, JAMES ROWLAND (1869–), American educationalist, was born at Burlington, Vt., May 8 1869. He was a son of James Burrill Angell (d.1916), first president of the University of Vermont and fourth president of the University of Michigan (1871–1901). He was educated at the Universities of Michigan (A.B., 1890; A.M., 1891) and Harvard (A.M., 1892), and spent a year in Europe, chiefly at Berlin and Halle. In 1893 he was appointed instructor in philosophy at the University of Minnesota. In 1894 he was called to the University of Chicago as assistant professor of psychology and, after 1905, was professor and head of the department. He was dean of the university faculties after 1911, and acting president during 1918–9. In 1906 he was elected president of the American Psychological Assn., in 1914 exchange professor at the Sorbonne, and in 1915 special lecturer on psychology at Columbia. In 1921, on the resignation of Arthur T. Hadley (*see* 12.798), he was elected president of Yale University.

He was the author of *Psychology* (1904; 4th ed., revised, 1908); *Chapters from Modern Psychology* (1912); and *An Introduction to Psychology* (1918).

ANGLICANISM.—The years 1910–26 constituted a period of extraordinary interest and importance for the Anglican Communion, especially for the Church of England. It is probable that future historians will register as the most important fact from the point of view of general church history the great advance in the prestige of this communion in relation to Christendom as a whole. This was largely due to the circumstances of the World War and the post-War years and to the personal influence of the Archbishop of Canterbury.

Ethos and External Relations.—But a still deeper cause may well be the peculiar ethos of the Church of England itself—the riches of which are the more clearly shown the more that church comes into contact with other and especially foreign churches. Most notable has been the growth in cordiality and understanding between the Anglican Communion and the Orthodox Eastern Church. From 1918 onwards appeals have come to the Archbishop of Canterbury from the leaders of the persecuted Russian Church, and there is no doubt that the strong moral support consistently given by the archbishop and others in the Church of England proved of great value and encouragement to Christians in Russia, besides having a decisive influence in the saving of the life of the Patriarch of Moscow (Tikhon).

Similarly the Church of England was regarded by the Greek Orthodox Church and the Eastern Churches generally as their principal spiritual stay in face of the Turkish attacks on Armenians, Assyrians and Greek Christians; and the archbishop's public appeal on behalf of the Patriarch of Constantinople during the Treaty discussions at Lausanne is generally held to have secured the promise then given that Constantinople should continue to be the spiritual centre of the Oecumenical Patriarchate. In a different field, it was during this period that the Patriarchate of Constantinople was officially represented for discussion on Anglican-Orthodox relations in connection with the Lambeth Conference of 1920. Again, in 1922, the Patriarch and Holy Synod of Constantinople formally acknowledged the validity of Anglican ordinations, an acknowledgment subsequently endorsed by the churches of Jerusalem and Cyprus. In 1922, in pursuance of a resolution of the Lambeth Conference, the Eastern Churches' Committee was constituted by the Archbishop of Canterbury for maintaining regular relations with these churches under his supervision.

Christian Unity.—It is perhaps even more remarkable, and an outcome of the "Appeal to all Christian People" on Christian Unity issued by the Lambeth Conference in 1920, that certain Anglican divines, including Bishop Gore and the Bishop of Truro (Dr. Frere) from time to time since 1921 have held conversations with Roman Catholic divines at Malines under the presidency of the late Cardinal Mercier, for the purpose of elucidation of difficulties, and a better understanding of each other's position. These conversations, from the second in 1923, were held with the "cognisance" of the Archbishop of Canterbury and Pope Pius XI.; but were in no sense negotiations, and in fact left the fundamental difficulties, spiritual and juridical, practically unsolved.

Other illustrations of the widening range of the Anglican communion are the recognition of Anglican ordinations by the Old Catholics of Holland in 1925; the establishment of occasional intercommunion with the Church of Sweden in 1920; the participation of two Anglican bishops in the consecration of two Swedish bishops the same year; the liaison work carried on by the Protestant Episcopal Church in the United States of America with European churches and their "colonists" in America; as well as the prominent part played by Anglican bishops, clergy and laity in the World Conference on Faith and Order which first proposed in 1910, was to hold its first meeting in 1927, and in the Universal Christian Conference on Life and Work held at Stockholm in 1925.

The Lambeth Conference.—The Lambeth Conference of 1920, the sixth of the series of decennial conferences of Anglican bishops, provided a further evidence of the general mind of the Anglican communion, and its report aroused wide-spread interest. The date of meeting, a year after the signing of the Treaty of Versailles, and the importance of the subjects treated, gave force to the discussions and freshness to the 80 resolutions adopted. In particular the "Appeal to all Christian People" created a profound impression throughout Christendom; while the conference itself did much to strengthen the fellowship between the different Anglican provinces.

The subject of Reunion is treated elsewhere (*see* Reunion); but it is essential to an appreciation of Anglicanism to emphasise clearly the great part played in the reconciliation of the churches by the Anglican communion, especially as a result of the Lambeth Conference. The breadth of the Lambeth Appeal is the more remarkable in view of the stir caused by the Kikuyu controversy of 1913–4, when Dr. Weston, Bishop of Zanzibar, formally appealed to the Archbishop of Canterbury against a measure of intercommunion with Protestant churches in East Africa proposed by the bishops of Uganda and Mombasa. The archbishop had replied to the appeal that full intercommunion was for the present impossible; but that members of non-episcopal churches, isolated from their own, would be welcomed at Holy Communion in Anglican churches. Special attention should be directed to the joint conferences on the appeal held between Anglican and Free Church representatives under the Archbishop of York's presidency at Lambeth Palace in 1921 and 1925, and to the changed spirit shown in such instances as the addresses given by both archbishops at annual assemblies of different Free Churches, and the occasional preaching of sermons in cathedrals and churches by Free Church ministers with episcopal sanction and in conformity with resolutions adopted by both convocations.

Modernism.—One grave issue, hardly if at all touched in the Lambeth Conference of 1920, which the Anglican communion, like other churches, has been compelled to face since 1910 may be briefly but loosely described as Modernism. The problem has been before the Church for many years, largely in relation to Biblical criticism. A good deal of interest was aroused by the publication of *Foundations* in 1912, a volume of liberal (but hardly radical) essays by seven Oxford theologians, edited by Rev. B. H. Streeter, whose article on the historic Christ formed the principal target of criticism.

But greater anxiety was caused a few months later, partly by the Bishop of Zanzibar's letter to the Bishop of St. Albans on questions of faith and order, partly by Dr. Latimer Jackson's Hulsean lectures on The Eschatology of Jesus. A critical debate took place in the Upper House of Canterbury Convocation in April 1914, and the discussion closed with a resolution affirming "that the denial of any of the historical facts stated in the Creeds goes beyond the limits of legitimate interpretation, and gravely imperils that sincerity of profession which is plainly incumbent on the ministers of the Word and Sacraments"; and "at the same time" in view of "new problems raised by historical criticism" emphasising "the need of considerateness in dealing with that which is tentative and provisional in the thought and work of earnest and reverent students."

Here the matter rested for a while. But in 1917 a serious crisis was caused by the nomination by Mr. Lloyd George, as Prime Minister, of Dr. Hensley Henson to the bishopric of Hereford. The Archbishop of Canterbury was urged to refuse consecration, on the ground of heresy, but after explaining the reasons of his disagreement with the objectors in a letter to the Bishop of Oxford, Dr. Gore (who later withdrew his objection), the archbishop consecrated Dr. Henson in Feb. 1918.

A further crisis was provoked in 1921 by certain addresses delivered at the Conference of Modern Churchmen held at Cambridge, but both Canterbury and York convocations dealt with the situation with a reassuring effect. Other provinces in the Anglican communion have had similar problems, notably the Protestant Episcopal Church in the United States of America, where special attention should be called to Bishop Lawrence's autobiographical (modernist) sketch *Fifty Years* as well as to the Bishops' Pastoral Letter (anti-modernist) both appearing in 1923. On the whole it may be said that while particular dioceses or societies have had unusual difficulties, the Anglican communion as a whole has handled the problem with a considerable measure of success.

The Services of the Church.—Questions of public worship have also aroused wide interest. The Royal Commission on Ecclesiastical Discipline reported in 1906. The principal step taken as a result of the report was the issue of Royal Letters of Business to the convocations of Canterbury and York. From 1906 to 1920 the two convocations prepared their replies, which involved a general revision of the Prayer Book (*see* PRAYER BOOK, REVISION OF). The revision thus proposed was then brought before the Church Assembly and amended by the House of Clergy and the House of Laity; and in 1926 the House of Bishops submitted a final revision to the Church Assembly for acceptance or rejection *en bloc*. A new lectionary had already received legal sanction (1922) and is now in use as an alternative.

The leading motive for revision at first, no doubt, was the need of introducing order into churches where illegal practices were alleged to prevail. But the work done has covered the whole field of Divine Service. The War gave a new impetus to devotional practice and experiments of all kinds, and many interesting suggestions have been made with a view to greater freedom and variety by different groups, *e.g.*, by the authors of *A New Prayer Book*. The chief experimenters in devotional practice have been the party known as Anglo-Catholic. Many of their experiments have been of value.

But keen controversy has arisen, especially with regard to Reservation and "Devotions" connected with the consecrated elements. The bishops in 1917 passed a resolution which, while recognising the need of Reservation in certain circumstances, laid down the principle "that the Reserved Sacrament is to be used for the communion of the sick and for no other purpose whatsoever." It may be said that the two chief issues in Prayer Book revision are Reservation, much the more acute, and the question of providing an alternative Order of Holy Communion. The earlier problems, such as the ornaments rubric, the use of the Athanasian Creed and Prayers for the Dead, can no longer be considered central or, indeed, critically difficult. The results of the revision are eagerly awaited by various provinces of the Anglican communion. Canada has already issued a revised Prayer Book and the Protestant Episcopal Church in the United States hopes to complete a similar revision in 1928.

Spiritual Progress.—The spiritual work of the Church has naturally been much affected by the War. In the Church of England 3,060 clergy were commissioned as naval or military chaplains, and 100 laid down their lives. Many others served with the Church Army and the Young Men's Christian Association. They learnt much of the religion of the ordinary Englishman, and the results of an inquiry initiated by the Young Men's Christian Association were published in a volume *The Army and Religion* (1919). Special attention was called to the widespread ignorance of ordinary religious truths and to the need of dealing afresh with the whole method of religious education. In 1916 a National Mission of Repentance and Hope was organised in the Church of England to deepen religious life at home, and a number of useful reports on evangelistic work, Christianity and industrial problems, etc., were published.

Increasing interest has been taken in social questions. Crusades, in which labour plays a part, have been held, and the last Sunday of April is observed in many churches as industrial Sunday. The War has had a severe effect on the supply of ordination candidates, though the numbers had been declining since the beginning of the 20th century. Over 1,500 "Service" candidates have been ordained in the Church of England since the War, but the total shortage for the years 1915–24, as compared with the preceding 10 years, was about 2,850. Proposals for reviving the sub-diaconate as a means of relieving the shortage are under consideration.

Women in the Church.—The ministry of women has made a distinct advance. Boards of Women's Work are being formed. Women messengers and pilgrims are increasingly used. Proposals for admitting women to the priesthood were made in certain quarters, but received very little support. The most important step taken was the resolution of the Lambeth Conference in 1920, recommending that "the Diaconate of Women should be restored formally and canonically, and should be recognised throughout the Anglican communion." This recognition has been accorded in the Church of England, and a form of ordination of deaconesses approved.

Missionary Work.—The missionary work of the Church has gone steadily forward. There has been an increased recognition of the world call to the Church. The Church Assembly now has a missionary council. Further there is an increasing desire that the Church itself should act as a missionary body. There has been a steady growth in indigenous churches, and for the first time native priests have been consecrated as bishops in India, China and Japan. India has been the scene of very large mass movements. Co-operation with other churches in the mission field has been a marked feature of modern Anglican mission work, the result in part of the World Missionary Conference at Edinburgh, 1910. The value of such co-operation is especially proved in education and in dealing with governments.

Church and State.—Important changes in the relation of Church and State have taken place or are in contemplation in several provinces. Thus, in Australia the General Synod is steadily considering the difficult question of the *nexus* between the Church of England in Australia and the home church. The Indian Church Measure seeks to give a definite autonomy to the Church in India. The disestablishment of the Welsh Church was effected in 1920, and the Bishop of St. Asaph (Dr. Edwards) was enthroned as Archbishop of Wales. Two new dioceses have been added to the former four since disestablishment.

In England a special committee on Church and State was appointed by the two archbishops at the request of the Representative Church Council in 1913, and its report, published in 1916, led to the passing of the Church of England Assembly (Powers) Act in 1919, a great deal of popular support having been previously gained by the Life and Liberty Movement and the bill being strongly pressed by the Archbishop of Canterbury. This Act gives power to the Church Assembly, consisting of the House of Bishops, the House of Clergy and the House of Laity (Men and Women), to pass measures "relating to any matter concerning the Church of England"; such measures to have the force and effect of an Act of Parliament after the passing of resolutions in both Houses approving the measure and the receiving of the royal assent. Up to date (1925) 15 measures have received the royal assent including measures dealing with the union of benefices, the sale of advowsons, ecclesiastical dilapidations and the formation of five additional bishoprics.

Church Reform.—The two Convocations have reformed their Lower Houses. Parochial church councils are required to be established in every parish, and have powers relating to property and finance. The total number of qualified electors in 1924 was 3,537,020. The Church Assembly, regarded as an instrument for Church legislation, has done a great deal of necessary work which would not have been possible without it, and is steadily overtaking the arrears that have been long outstanding.

There has been a general overhauling of machinery throughout the Church of England. A Central and Diocesan Boards of Finance have been created. Five new dioceses (Chelmsford, St. Edmundsbury and Ipswich, Sheffield, Coventry and Bradford) were formed between 1913 and 1919. A commission on the Property and Revenues of the Church of England reported in 1924, and its recommendations are being considered by the Church Assembly. It is hoped that these recommendations will in some measure deal with the pressing problem of clerical poverty. A similar commission is now engaged on the cathedrals. The Ecclesiastical Commissioners have agreed to augment benefices in public patronage to a minimum income of £300 (for parishes with a population of over 300 and under 1,000), £350 (under 4,000), £400 (over 4,000). In 1925 a Tithe Act was passed securing the complete redemption of ecclesiastical tithe in a period of 85 years, the tithe rent charge being fixed at £105, of which clerical tithe owners receive £100 free of rates.

Authorities.—*Official Year Book of the Church of England; Proceedings of the Church Assembly; Report of the Archbishops' Committee on Church and State; Report of Lambeth Conference* (1920); Archbishop R. T. Davidson, *Character and Call of the Church of England* (1912). (G. K. A. B.)

ANGLING (*see* 2.21).—Since 1910 there has been little change in either the practice or theory of angling as a sport, though there has been some progress in knowledge, and a considerable widening of scope due to the discovery of possibilities in remote seas and rivers, made chiefly by anglers of the United States and of the British Empire. There has also been further development of the resources of acclimatisation, the most interesting result, perhaps, being the ultimate success of the efforts, which began so long ago as 1868 and had been given up as hopeless, to introduce salmon to New Zealand. In 1919 a genuine *Salmo salar* from the Waiau river was sent to England in a block of ice. Since then the establishment of the species in New Zealand has been confirmed. The country, therefore, now possesses Atlantic and Pacific salmon, as well as brown and rainbow trout.

In regard to the salmon, reference should be made to the new light on its history shed by what is known as scale-reading. The fact that the markings on fish scales gave a clue to the age and growth of the fish was suggested about the end of the 17th century by the Dutch naturalist, Leeuwenhoeck. The idea was applied to salmon by H. W. Johnston in *The Field* of Oct. 29 1904, and has since been followed up with great zeal by various investigators. The result, summed up in the briefest form, is a general conclusion that the salmon usually spends one year or two in fresh water as a parr, and then feeds in the sea for two or three years before returning to spawn. The old notion of yearly spawning has been greatly modified, and it is now considered exceptional for a salmon to spawn more than twice in its life. Scale-reading has had another result for it has led to the conclusion that the sea trout is not essentially different from the river trout except in habit.

Salmon Fishing.—The only changes of note in methods of angling for the salmonidae have been: (*a*) increased popularity of the light-rod idea and its application to salmon fishing, together with the extended use of the dry fly for salmon, especially in North America; (*b*) the restoration of the wet fly to typical dry-fly waters in the method known as nymph-fishing. For other forms of freshwater angling in the British Is. there is nothing new to record, the most notable event, perhaps, being the authentication of a pike of 53 lb., caught on Lough Conn in 1920. Before, 50 pounders, though possible, were legendary.

Legislation.—A Fishery Act for England and Wales, passed in 1923, improves and consolidates previous legislation. The pollution of rivers has inspired a new movement of co-operation between industrial and fishing interests. The British Govt. set up a pollution committee, which has been at work for several years, and from its labours some good results are apparent. A new source of danger is the dressing of roads made necessary by increased motor traffic. It has been established that tar, very largely used at first, may have disastrous effects when road washings get into streams. The trouble is in some cases being removed by the use of bitumen instead, and experiment is being carried on by the pollution committee in regard to other safeguards.

Big game fishing with species running to several hundred pounds is established now in many seas, America, Africa, Asia and Australasia all offering great opportunities. Several important freshwater species have also become a regular part of angling enterprise, notably the dorado of South American rivers, the "Euphrates salmon" of the Euphrates watershed, a fish resembling the mahseer in character but reaching much greater weights, and the Nile perch and tiger fish of the big African rivers.

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ANGLO-JAPANESE ALLIANCE.—On Jan. 30 1902, owing to the threat of Russian aggression in the Far East, Great Britain and Japan concluded an alliance of a defensive character which provided for mutual assistance in the safeguarding of British interests in China and Japanese interests in China and Korea. The agreement was a valuable asset to Japan in the war with Russia, which broke out in 1904; but it did not involve Great Britain in active hostilities.

In 1905 the agreement was revised; its scope was extended to India and eastern Asia generally (*see* 15.241), and Japan's paramount position in Korea was more definitely emphasised. The general changes of situation in the Orient after the Russo-Japanese War, notably the annexation of Korea to the Japanese Empire in 1910, led to a further revision. The negotiations in London between Sir Edward (Viscount) Grey and Baron (Viscount) Kato ended in the renewal of the alliance on July 13 1911. An important feature of the new agreement was the inclusion of an article exempting either high contracting party from the obligation to come to the armed assistance of the other in case of war against a Power with whom either party had concluded a general arbitration treaty (Article 4). At that particular time a treaty of such a description was under negotiation between the British and the United States governments, and it was with the particular object of excluding the United States from the possible application of the alliance that this article was inserted. The proposed general arbitration treaty, however, failed to obtain the consent of the United States Senate to its ratification, but the British and Japanese governments made it unmistakably clear that the spirit in which the article was conceived had not on that account been altered in the least; and the British Govt. have held that the Peace Commission Treaty with the United States, signed in 1914, constituted a general arbitration treaty within the meaning of Article 4. The Alliance of 1911 was to last for ten years, and in the absence of a year's notice from either contracting party to terminate the agreement it would automatically continue in existence, even after July, 1921, until such denouncement was made.

The Treaty and the World War.—The World War, into which Japan readily entered on account of the Anglo-Japanese Alliance, ended with the Treaty of Versailles, which brought forth the League of Nations. The question was then mooted, though more academically than politically, whether the military clauses of the Anglo-Japanese Alliance would not be in contravention with the letter of the Covenant of the League (Article 20) and on July 8 1920 the two high contracting parties addressed a joint note to the secretary-general of the league to the purport that the agreement would, in case of its renewal, take a form which would not be inconsistent with the Covenant. The renewal of the alliance was discussed at the British Imperial Conference in London in June 1921; and it was then announced that, under the terms of the treaty, it could continue without definite renewal. At the same time a second note was addressed to the League of Nations (July 7 1921) stating that the Covenant should prevail over the agreement on points where there might be inconsistency between them. But, apart from doubts as to whether the alliance was not inconsistent with the obligations of the Covenant, both Great Britain and Japan were becoming aware that it was increasingly unpopular in the United States and in China. So, at the Washington Conference (*q.v.*) in Dec. 1921, the agreement made for a four-Power Pacific treaty (United States, France, British Empire, Japan) provided for the Anglo-Japanese Alliance being brought to an end. The alliance, therefore, ceased to exist on the deposition of the ratifications of the above treaty on Aug. 17 1923. For 21 years it had been the most stable influence in the Far Eastern position, and a cardinal factor in British and Japanese policy. (*See* JAPAN: HISTORY.)

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ANGOLA (*see* 2.38), the name commonly given to the Portuguese possessions on the west coast of Africa south of the equator. Although large areas of southern Angola have proved to be suitable for European colonisation and for stock-raising, the progress of the colony has been very slow. The population (1925) was approximately 4,000,000 natives and 10,000 Europeans. Loanda (São Paulo de Loanda), the capital, had about 18,000 inhabitants.

Production.—Up to 1911 the manufacture of rum was the leading industry. In that year the Govt. closed the factories, compensating the owners and the planters who grew sugar and sweet potatoes for the production of alcohol. Coffee, rubber, maize and sugar became the chief exports, followed by palm oil and palm kernels, wax and dried fish. In 1916 diamonds, usually small, but of good quality, were discovered in the extreme northeast of Angola near the Belgian Congo frontier, and 161,000 carats had been mined by the end of 1920. In 1921 the production was over 100,000 carats; in 1925 it had risen to 150,000. Imports are mostly cotton and hardware goods and foodstuffs. In consequence of a highly protective tariff, trade is chiefly with Portugal and in Portuguese ships. From 1920, however, Germany took an increasing share of the trade. Of the tonnage of vessels entering Loanda in 1923, a total of 465,000, Portugal's share was 261,000 and Germany's 121,000. The average annual value of the external trade in 1910–24 was from £3,000,000 to £4,000,000. The value of exports had reached £1,210,000 by 1913; in 1923 it was £1,237,000, exclusive of diamonds worth £730,000.

Improvements and Reforms.—A measure granting Angola a degree of autonomy was passed by the Portuguese Parliament in 1914, followed in 1920 by a more liberal measure. In 1920, also, Senhor Norton de Mattos, a former governor, returned to Angola as High Commissioner with an ambitious programme of development and colonisation. Chief attention was to be paid to harbour improvements and railways, the deficiency of means of communication being a leading cause of the backward state of the country. For two years there was much activity, but then a crisis arose, due in part to the lack of sufficient produce for export to pay for the imports of the Govt. and the trading community, and in part to the inability of Angola to raise more than about a sixth of the authorised loan of 60,000 gold contos (about £13,300,000). The crisis was acute throughout 1924. In 1925 the Portuguese Govt. voted 9,000 gold contos (£2,000,000) to enable the colony to carry out the most needed public works. These included the reconstruction of the Loanda Railway, which had been bought by the state in 1918 and serves valuable coffee areas. Apart from the cost of development works, public expenditure frequently exceeded revenue. Between 1910 and 1925 the revenue increased from about £500,000 a year to over £1,000,000. The 1924–5 budget showed revenue £1,080,000 and expenditure £1,580,000. The public debt was approximately £4,500,000.

A Native Affairs Dept. was created in 1913 and it effected various reforms, but the principle of compulsory labour was maintained. From 1918 to 1921 the authorities took an active part in the recruitment of labour for private enterprise. The system led to abuses and was abolished in 1921. Continual complaints that labour was not procurable resulted, however, in 1925 in a partial return to the old system, chiefs being required to produce the men and both chiefs and officials receiving payment per head for the labour obtained.

The Benguella Railway, which starts at Lobito Bay, was intended primarily to serve the copper fields of Katanga, Belgian Congo, but in crossing the plateau of southern Angola it opened up the territory best suited to European settlement. By 1914 the railway had reached Chingwari, 323 m. from Lobito. Construction then stopped till 1922–3, when the line was extended another 60 m. to Silva Porto (Bihé), while in 1925 additional funds were forthcoming. The company owning the railway then entered into an agreement with Portugal to complete the line to the Congo frontier by the end of 1928. The railway, upon which over £7,000,000 has been spent, is a British enterprise.

Germany, whose colony of Southwest Africa adjoined Angola on the south, had for many years looked upon Angola as a field for economic, and ultimately for political, exploitation. A treaty with Great Britain recognising German economic interests as supreme in the greater part of Angola was negotiated in 1913–4 and would have been signed but for the outbreak of the World War (*see* AFRICA).

The loss of Southwest Africa, conquered in 1915, deprived Germany of a base for penetration; nevertheless after the War German influence and trade within the colony steadily grew, so that by 1925 Germans exceeded in number all other European residents combined with the exception of the Portuguese. British capital in the Benguella Railway represents about 90% of the whole, and unsuccessful efforts to buy this stock were made by the Germans both before and after the War.

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ANGORA (*see* 2.40) the capital of the Turkish Republic had an estimated population in 1924 of about 35,000. The Turkish Nationalist Movement, which was organised by Mustafa Kemal in 1919, led to the setting up of a Nationalist Govt. at Angora in April 1920, the city being chosen owing to the fact that, while it was far enough from the coast to be reasonably safe from attack by the Greeks, or the principal Allied Powers, it was in touch with other parts of the interior of Anatolia, and was the railhead of the northeastern branch of the Anatolian Railway. The ability of the surrounding area to supply the food requirements of the population and the raw materials needed by local industry was also of importance. On Oct. 13 1923, by a decision of the Great National Assembly, Angora was declared the capital of Turkey.

The city is connected by the Anatolian Railway with Constantinople, and a line to Sivas was nearing completion at the end of 1925. In view of its increased importance and growing population, Angora was badly equipped as regards accommodation for its population and for the Govt., and as regards sanitary arrangements, etc. During 1925, however, considerable progress was made by the municipality in house building, road construction and sanitation. A beginning was made with the drainage of the swampy fields between the station and the town, a breeding ground for the malarial mosquito, and with the construction of a public park; modern systems of drainage and of water supply were commenced. A new Parliament House and buildings for the Ministry of Finance, Courts of Justice, General Post Office, etc., were approaching completion at the end of the year, and a modern hotel was being built. The industrial development of the city was being actively encouraged, and German engineers were called in to erect factories and workshops for the production of tiles, cotton and flax goods, etc. The installation of a power station capable of furnishing electric light throughout the city was completed, sawmills constructed, and a flourmill equipped with modern machinery. The Government decided in 1925 to install a telephone exchange and erect a powerful wireless station. By the end of 1925 certain foreign legations had moved their headquarters from Constantinople to Angora, and the others were represented by secretaries.

ANIMALS, DISTRIBUTION OF: *see* DISTRIBUTION OF ANIMALS.

ANKYLOSTOMIASIS: *see* HOOK WORM.

ANSON, SIR WILLIAM REYNELL (1843–1914), British jurist (*see* 2.84), died at Oxford June 4 1914.

ANTARCTICA (*see* 21.960).—The Antarctic regions may be generally defined as that portion of the globe which lies within the 60th parallel of south latitude, and for purposes of reference it is now customary to divide it into four quadrants of 90° which, reckoning eastwards from the meridian of Greenwich, are named the Enderby, Victoria, Ross and Weddell Quadrants. A less precise division into sectors referred to the contiguous continents is perhaps more useful to the general reader; and the African, Australian and American sectors denote the portion of the regions to the south of those continents respectively.

The 60th parallel passes through no land whatever, but it does in fact roughly coincide with the northern limit of a belt of floating ice which surrounds the regions and forms an efficient barrier to a ship's progress except in the late summer and autumn. It therefore includes nothing which does not share in the general characteristics of these polar regions, though it does exclude the south Georgia and south Sandwich groups of islands in the southern Atlantic which are definitely Antarctic in character.

Contrast between Northern and Southern Regions.—In considering this parallel as a boundary we are at once impressed with a marked contrast between the amenities of the northern and southern polar regions. Within the area poleward of 60° north latitude live more than 1,000,000 human inhabitants and countless land animals. Some of the largest and most valuable timber forests are north of 60°, and not a few industries connected with lumber, mining and fishing flourish. In the similar area in the southern hemisphere, there is not a single permanent human inhabitant, nor a single land animal larger than an insect. There are no trees and very few plants of any kind at all. The sole industry which can be said to exist in the Antarctic regions is that of whaling, which is now carried on during a few months in each year in the American and Australian sectors. The reasons for this contrast naturally depends largely upon temperature.

The explorations of the 20th century have shown us that the south polar region, again in complete contrast to the north, is largely occupied by a continent of more than 5,000,000 sq. m. in extent, that is to say, equivalent in size to Australia and Europe without Russia. The South Pole is placed centrally in this continent, which, though far from being symmetrical, may for general purposes be considered as bounded by the 70th parallel.

Characteristics of Antarctica.—The most noticeable feature about the continent is its unique isolation. It is possible to traverse all the other continents without crossing more than about 60 m. of shallow sea, but to reach the Antarctic continent one must voyage over at least 600 m. of practically oceanic depths and that across the roughest seas and fiercest winds in the world.

Between 55° and 65° south latitude there is no land to interfere with the west to east circulation of sea and air, and that zone is therefore the home of the permanent west winds, the westerly drift and the wandering albatross, all of which encircle the Antarctic continent ceaselessly. There are, in short, none of the interchanges of warm and cold air and water between temperate and polar regions which in the northern hemisphere lead to such curious anomalies as an almost ice free Spitsbergen in 79° N. and an almost icebound Labrador coast 20° farther south.

In this fact, therefore, we have an almost complete explanation of the strange contrasts in climate, and consequently in habitability, between the opposite polar regions, and the remainder of the explanation is forthcoming when we consider the relief of this vast deserted continent. The South Pole itself is situated on a plateau nearly 10,000 ft. in height, and there is every reason to suspect that the greater part of the continent is continuous plateau. Allowing for the incomplete nature of the data we can with some fairness compute the average height of the continent as of the order of 6,000 ft., which is just twice as high as Asia, the next in order of magnitude.

When we add to this conception of a high and isolated continent the fact that, of its 5,000,000 sq. m. probably less than 100 sq. m. is free from a permanent covering of ice we can well understand that here there is no attraction for man or beast or plant. We have further to conceive of a climate in which, south of 70°, it never rains and rarely thaws, except in the neighbourhood of exposed rocks, where in fact any land animal would have to lead the life led by the two or three minute insects so far discovered, consisting of an active life of some few days in the height of summer followed by some 360 days of hibernation, frozen solidly in the rock pool or clump of moss which is its home. The continent is thus in the grip of an ice age, more rigorous than that which has left its marks upon Europe and North America, and naturally the study of such a region resolves itself largely into a study of its manifold ice forms.

Of these the least known and the most impressive is the ice-cap, whose lateral dimensions are those of the continent itself and which supplies the myriad glaciers which everywhere fringe the coast, sometimes in ice-worn valleys, but more often as a continuous glacier-front running down into the sea for hundreds of miles along the coasts. The thickness of the inland ice is probably not so great as its extent would suggest. No direct measurements have been made, but from an examination of the outlet glaciers it appears unlikely that the sheet is ever more than 2,000 ft. thick except in basins, and in general is much thinner, a conclusion which is confirmed by the fact that many hundreds of miles inland from the coast the ice sheet appears to follow closely the form of the underlying ground.

The Barrier.—The general features of the Antarctic ice-cap are reproduced on a smaller scale in Greenland, but the floating ice sheets which are to some extent derivatives of the ice-cap are met with nowhere else in the world. When Ross in 1841 first penetrated the pack ice into the ice-free Ross Sea he sailed due south until he was brought up in about 77° south by an ice wall from 50 to 200 ft. high, barring his way to the south. He sailed along the greater part of its 400 m. seaward face. He called it the barrier and the name has remained though it is sometimes replaced by the name shelf-ice. The Ross barrier, as it is now called, is the greatest of these floating ice sheets, but is typical of many others to be met with in the Antarctic. It is roughly the size of France and consists of a sheet of ice varying from 500 to 1,500 ft. in thickness, the outer end being open to the ocean and the inner end held fast to the continent by the glaciers which act as feeders and by being aground close to the actual coast. Its surface is smooth, and it forms the easiest approach to the Pole itself, since it reaches to within 30 m. of that spot.

It is formed by the snow of countless ages collecting, it may be, upon an originally thin crust of sea ice, and it moves at a rapid rate, up to 1,500 yd. in a year, as a result of its own tendency to spread. There is reason to suppose that in some places it also increases by freezing from below. The tabular icebergs so typical of the southern hemisphere, with their flat tops and stratified appearance are obviously derived from this and similar barriers, and their immense size, up to 30 m. in length of side, is only natural considering the size of the parent masses. Each summer, when the break up of the winter sea ice has allowed the full force of the ocean swell to reach the face of the barriers, large fragments are broken off, or "calved," and these float away to the northward until they reach warmer and stormier waters where they disintegrate into low but massive pieces known as "growlers," which are the terror of the ship-master sailing those latitudes in the winter.

Sea Ice.—The sea ice itself is comparatively temporary. It begins to form in sheltered bays as early as the end of Jan. and by the beginning of March any ship is liable to be frozen in unless its harbour is a windy one. There are probably large variations from year to year in the area of sea solidly frozen over, since a strong wind, and such are very frequent, will prevent sea ice forming, or will blow out any which is not of considerable thickness, but in sheltered bays the ice will continue to increase in thickness until Oct. or Nov., by which time it will be anything up to seven feet through. This will begin to break up and float northward from the beginning of Dec. onwards, but the innermost bays may not lose their ice until late in Feb., or occasionally not at all for two years in succession. The belt of drifting pack ice which rings the continent is made up of the ice from this summer break-up and it is least dense in autumn after the summer heat has caused a great deal of it to melt.

The Continent.—The continent, thus hidden or protected, is formed for the most part of old rocks amongst which the most prominent are of Permo-Carboniferous age and bear coal, which is found in the Australian sector up to within 300 m. of the Pole. In this sector the rocks have been above sea level since Palaeozoic times, except where the Ross Sea area has broken and sunk below it, giving rise to a series of volcanic centres, of which the largest, the Ross Island group, still has an active volcano, Mount Erebus, 13,000 ft. high. On the South American side, however, there has been no wholesale sinking of the crust, but the rocks have been folded into mountains similar in origin to the Andean chain. The coal which has been found is of doubtful quality, and on account of the small area of bare rock to be seen it is exceedingly improbable that any other minerals of value will ever be discovered.

Products of the Continent.—Since there are no land animals or plants the resources of the region are limited to the products of the sea. Of these the most striking are the various species of penguins, which inhabit all zones of the region. Fortunately for the preservation of such harmless and delightful birds their blubber coated skins do not possess a marketable value. The seals also, not being of the fur bearing kind, are more or less immune from human exploitation. There remain the whales, which in large numbers frequent Antarctic seas to feed on the minute animals there to be found which in their turn ultimately depend for their food upon diatoms, the typical marine plants of the region, microscopic in size but so countless in number as to colour the sea ice. The rorqual, the humpback and the huge blue whale are now all hunted in these seas by modern methods and the annual value of the products obtained exceeds £2,000,000 sterling. (*See* WHALES.)

Until the rise of the whaling industry the Antarctic can be said to have had no political significance whatever, but since the beginning of the century the territorial waters of the continent, if not the land itself, have acquired a value and, as will be seen from the map, two sectors are now portions of the British Empire and are known as the Ross Dependency, administered by New Zealand, and the Falkland Islands Dependency administered by the Govt. of the Falkland Islands. (*See* also POLAR EXPLORATION.)

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ANTHROPOLOGY (*see* 2.108).—*See* also ARCHAEOLOGY; COLOUR AND RACE PROBLEMS; FOLKLORE; HUMAN GEOGRAPHY; MAN, EVOLUTION OF; PHILOLOGY; RACES OF MANKIND; SOCIAL ANTHROPOLOGY.

The Problem Stated

Anthropology is the science of man and of his culture at various levels of development. It includes the study of the human frame, of racial distinctions, of civilisation, of social structure and of man's mental reactions to his environment. We confine our attention to the science of culture, and, since the study of living peoples uses methods and controls sources of information entirely different from those at the disposal of archaeology and pre-history, we restrict our scope to the study of the modern living representatives of primitive mankind.

Toward the end of the 19th century there was an increasing realisation of the specific nature of cultural process and of the complexity of culture. The vastness of the problems, the human interest and the dramatic beauty of anthropological facts were brought home to scholars and laymen alike by the monumental works of Sir James Frazer. At the same time, important scientific movements were developing on the Continent (Durkheim and Wundt), and, most important of all, the man of science began to go out into the field himself and to study native races personally by direct observation.[1]

The Events of 1910

Thus was gradually prepared the last period. At or about that date, a number of important anthropological events occurred.

In 1910 Sir James Frazer published his treatise on *Totemism and Exogamy*, by which a lively and voluminous discussion of both subjects was started anew. In the same year Prof. Seligman's *Melanesians of British New Guinea* appeared—an admirable record of specialised scientific fieldwork, followed in 1911 by the monograph on *The Veddas*, which embodies the joint research of himself and Mrs. Brenda Z. Seligman. From the African field, Joyce and Torday produced *Les Bushongo* (1910, Eng. trans. 1925). On the continent of Europe, Van Gennep issued *La Formation des Légendes*, followed on his *Rites de Passage* of a year earlier. Lévy-Bruhl launched an interesting controversy regarding the mentality of primitive man. The same subject was discussed by Prof. Boas a year later. In 1911, Dr. Rivers, at the Portsmouth meeting of the British Assn., started in this country the conflict between Diffusionism and Evolutionism. Ankermann and Graebner had already opened a similar controversy among German anthropologists in 1905. In America a discussion of methods and aims was inaugurated as far back as 1896 by Professor F. Boas ("The Limitations of the Comparative Method in Anthropology," *Science*, N.S. iv.).

About 1910, again, the results of one of the most important achievements in fieldwork were brought out in the works of Prof. Thurnwald. In 1912 Prof. Durkheim issued his book on *Elementary Forms of the Religious Life* (Eng. trans. 1915), and in 1914 there appeared the two volumes of the *History of Melanesian Society* by Dr. Rivers, Prof. Westermarck published his *Marriage Ceremonies in Morocco* and Sir Baldwin Spencer his *Native Tribes of the Northern Territory of Australia* completing the triad of excellent monographs by Spencer and Gillen. Two important anthropological events close this period. In 1925 Prof. R. Thurnwald began to publish the *Zeitschrift fur Völkerpsychologie und Soziologie*, a journal which sets out to give a comprehensive survey of anthropological facts and relevant socialogical theory. In the same year M. Marcel Mauss reissued *L'Année Sociologique*, which for 12 years (1900–12) had been one of the most important and valuable contributions to science, with its comprehensive interest in human culture and its attempt at unifying humanistic disciplines on the basis of anthropology.

Progress Since 1910

In spite of much fuller knowledge of primitive cultures, modern anthropological theory presents great diversity, and the subject is dominated by a number of one-sided and incompatible tendencies.

Psychological Interpretation of Culture.—Continuing the direct tradition of German folk-psychologists, as well as of the British classical school, Wundt, Vierkandt, Krueger and their collaborators attempt to explain systematically the phenomena of language, custom, belief and social organisation by reference to psychological processes. Quite as exclusively psychological are the contributions of the psycho-analysts, who account for totemism, taboo, initiation ceremonies, in fact for the whole field of primitive cultures, by unconscious mental mechanisms. Psychological interest is also predominant in the works of Frazer, Van Gennep, Crawley and Westermarck. All these writers belong on the whole to the evolutionist school.

The extreme representative of the diffusionist school, Graebner, maintains that all the regularities of cultural process are "laws of mental life" and that "their scientific and methodical study is possible only from the psychological point of view" (Graebner, p. 582, 1923), while Pater Schmidt, Wissler, Lowie and Rivers constantly use psychological interpretations. Thus, no anthropologist nowadays wishes completely to eliminate the study of mental processes, but both those who apply psychological explanations from the outset and those who want to use them after culture has been " historically analysed " forget that interpretation of culture in terms of individual psychology is as fruitless as mere historical analysis; and that to dissociate the studies of mind, of society and of culture, is to foredoom the results.

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[1] Cambridge Expedition (A. C. Haddon); Spencer and Gillen; Jesup Expedition (F. Boas); the work organised by the German Colonial Office and the Dutch Govt, by the Bureau of American Ethnology, and the excellent museums and other institutions of North America.

The Distribution, Contact and Diffusion of Culture.—As influential and one-sided as the psychological trend is the interpretation of similarities and analogies of culture by the principle of mechanical transmission. First vigorously propounded by Ratzel as the main problem of ethnology, the study of distribution and diffusion has been followed up by Frobenius, Ankermann, Graebner, Pater W. Schmidt, Pater Koppers and subsequently by the late Dr. Rivers.

Whether the doctrines recently propounded by Prof. Elliot Smith and Mr. Perry about the universal spread of culture from Egypt will have to be classed with other discarded hypotheses or whether they contain a permanent contribution to the history of culture remains to be seen. Their use of anthropological data is unsatisfactory[1] and their argument really belongs to archaeology, in which field their views have met with adverse criticism.[2] One or two competent anthropologists, however, have given these theories their vigorous support (Rivers, C. E. Fox).

The merit of the moderate anthropological diffusionism lies in its geographical rather than in its historical contributions. As a survey of facts correlated to their geographical substratum, it is a valuable method of bringing out the influence of physical habitat as well as the possibilities of cultural transmission. The distributions mapped out for America by Boas, Spinden, Lowie, Wissler, Kroeber, Rivet and Nordenskiöld; the survey of Melanesian cultures given by Graebner; of Australian provinces given by W. Schmidt; of Africa prepared by Ankermann, will possess lasting value.

The historical hypotheses of Frobenius, Rivers, Schmidt and Graebner, the sweeping identifications of " culture complexes " all over the globe, will not so easily pass muster. They suffer from a lifeless and inorganic view of culture and treat it as a thing which can be preserved in cold storage for centuries, transported across oceans and continents, mechanically taken to pieces and recompounded. Historical reconstructions within limited areas, such as have been done upon American material for instance, in so far as they are based on definite records or on archaeological evidence, give results which can be empirically verified, hence can be of scientific value. Dr. B. Laufer's study on the potter's wheel and certain contributions to the history of American culture (T. A. Joyce, A. V. Kidder, N. C. Nelson, H. J. Spinden, L. Spier) are methodologically acceptable, though they belong to archaeology rather than to the science of living races and cultures. Such sound works must be clearly distinguished from the productions in which a conjectural history is invented *ad hoc* in order to account for actual and observable fact, in which therefore the known and empirical is " explained " by the imaginary and unknowable.

Sociological Theories of Culture.—Robertson Smith is undoubtedly the spiritual father of this movement. He was the first to see that religion must be accounted for quite as much by its social nature, by what it does for tribal cohesion, as by its meaning and value for the individual. The great American anthropologists, Powell and Morgan, also contributed toward our understanding of clan solidarity in savage societies. Durkheim, inspired by their work as well as that by Bachofen, Wilken and Sir James Frazer, developed a sociological theory of early culture. Kohler and the school of comparative jurisprudence in Germany, Steinmetz in Holland and later, Rivers in England, also studied primitive society from the sociological point of view, over-emphasising perhaps the solidarity and the lack of differentiation within the early horde and clan. The doctrine of primitive legal cohesion and of social structure by direct solidarity given by Durkheim, Steinmetz and Kohler; the subtle and stimulating interpretation of primitive magic, sacrifice and religion by Durkheim, Hubert and Mauss; the recent analysis of contract and gift by Mauss and Davy, show an enormous advance upon any previous work in the greater precision of concepts, in the consistent application of the sociological method side by side with psychological interpretation, in the conscious attempt at following native classification, nomenclature and perspective. It is impossible to adopt these views unreservedly because they tend to lapse into metaphysical vagueness. In order to avoid the explanation of culture in terms of individual mental processes, yet fully aware that psychology cannot be excluded, these anthropologists compromise by introducing the conception of collective consciousness, which sociologists and anthropologists alike (Ginsberg, MacIver, Radin) have shown to be untenable. The sociological school exaggerated the social nature of primitive man, the importance of the clan and the solidarity of kinship. They neglected the rôle of individual initiative and variation, the part played by self-interest and the institution of the individual family.

Theories of Specific Difference of Primitive Mentality.—Grown on the soil of the sociological school, but laying more stress on the purely psychological side, other theories seek to account for savage belief and custom by the alleged specific character of mental structure in primitive man. Basing their conclusions on a number of interesting but probably exaggerated and distorted statements by such observers as Cushing and Dennett, and on a mass of obviously immature and superficial accounts by missionaries and other amateurs, the writers of this school aver that the savage is prelogical and mystical, impervious to experience living in a world of " dim participations " (Crawley, Lévy-Bruhl, Vierkandt, Danzel, H. Werner, Graebner). These views have but limited currency among the theoretical anthropologists, whose position has been well expounded by Carveth Read. Modern field-workers, equally competent to speak about the savage from first-hand knowledge and to deal with problems of comparative psychology and epistemology through training, have one and all criticised adversely these points of view (Boas, Rivers, Radin, Kroeber). None the less, by posing the problem of primitive knowledge and mentality, by stirring up opinion and forcing anthropologists to make up their minds, the writers of this school, above all M. Lévy-Bruhl, have made a serious and valuable contribution to Science.

The Functional Analysis of Culture.—This type of theory aims at the explanation of anthropological facts at all levels of development by their function, by the part which they play within the integral system of culture, by the manner in which they are related to each other within the system, and by the manner in which this system is related to the physical surroundings. It aims at the understanding of the nature of culture, rather than at conjectural reconstructions of its evolution or of past historical events.

Two factors contribute toward the development of the functional point of view. The modern specialist field-worker soon recognises that in order to *see* the facts of savage life, it is necessary to understand the nature of the cultural process. Description cannot be separated from explanation, since in the words of a great physicist, " explanation is nothing but condensed description." Every observer should ruthlessly banish from his work conjecture, preconceived assumptions and hypothetical schemes, but not theory.

Modern field work thus regards a theory purely empirical, never going beyond inductive evidence, serving only to gain an insight into the mechanism of culture in its various phases: social organisation, belief and material outfit. The field-worker who lives among savages soon discards the antiquarian outlook. He ees every implement constantly used; every custom backed up y strong feeling and cogent ideas; every detail of social organiation active and effective. He perceives that culture, above ll, provides primitive man with the means of satisfying his ants, and of mastering his surroundings. The functional view f culture insists therefore upon the principle that in every type f civilisation, every custom, material object, idea and belief ulfils some vital function, has some task to accomplish, repreents an indispensable part within a working whole.

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[1] A. A. Goldenweiser, *Early Civilization*, p. 311; R. H. Lowie, *Amer. Anthrop.*, pp. 86–90 (1924); B. Malinowski, *Nature* (March 11 1924).

[2] O. G. S. Crawford, *Edinburgh Review*, pp. 101–116 (1924); T. D. Kendrick, *Axe Age*, p. 64 *et seq.* (1925); J. L. Myres, *Geographical Teacher*, No. 71, pp. 3–38 (1925); Presidential Address, *Folk-Lore*, xxxvi, 1925, p. 15; Flinders Petrie, *Ancient Egypt*, pp. 78–84 (1923); T. E. Peet, *Journal of Egyptian Archaeology*, vol. 10, p. 63 (1924); A. M. Blackman, *ibid.*, pp. 201–209.

It keeps always in mind the biological basis of human ivilisation, the correlation of culture to human wants, hence o human instincts and emotional dispositions. Instincts, motions and ideas cannot, however, be treated by biology lone but must be approached through the study of mental rocess. Psychology, therefore, is indispensable for due underanding of culture.

At the same time the functional view teaches that man in the ery fact of culture transcends his biological outfit. In his impleents, weapons, clothes and ornaments he extends his anatomial endowment, whether to protect his life, to charm his feloweings or to procure his nourishment. Knowledge supplies man ith responses which go far beyond anything implied in instinct. n dogmatic belief we have a new type of mental attitude not bserved in animals. Biology is therefore not enough to explain uman adjustments through culture. Psychology again is not ufficient, for man does all important business in common, while very individual contribution has to be translated into cultural ct, imprinted upon material objects and linked with social rganisation. The other approach to the functional method is om the evolutionary point of view, nowadays generally disredited and discarded, yet fundamentally sound when correctly t forth. The development of culture consists in the gradual rystallisation of well-defined institutions out of mixed and nonpecialised behaviour. The essential features of each institution emain permanent while the less relevant ones change conderably. In order to understand, however, what is essential nd what is not, it is necessary to define each institution and ustom by its function. Again since the essence of evolution nsists not in a sequence of different forms changing one into nother, but in a better adaptation of an institution to its funcon, the more precise way of posing the evolutionary problem ads inevitably to the functional point of view.

The functional view of culture can be traced back to the inhoate but stimulating writings of A. Bastian, to the suggestions f Lazarus and Steinthal, to the work of E. B. Tylor and W. obertson Smith. It is implied in the best achievements of odern field-work (notably of the American anthropologists, . Boas; J. W. Fewkes; C. Wissler; A. Fletcher and La Flèche; . E. Jenks; A. L. Kroeber; Elsie C. Parsons; J. R. Swanton; . E. Goddard; J. O. and G. A. Dorsey; R. H. Lowie; F. C. Cole; . Radin; E. Sapir; Ruth Benedict). It has been active in the ork of the French school, where it is constantly gaining ground compare the latest publications of MM. Davy, Fauconnet, ranet, Mauss and Rivet). Functional interpretations will be ound predominant among the soundest theories of the comarative school (Brinton; H. Schurtz; W. Wundt; J. G. Frazer; I. Webster; E. A. Crawley; Westermarck; Van Gennep; Mart). The comparative school however has allowed the evoluonary view to overshadow the functional method, while most merican anthropologists have failed to disentangle the empirial interpretation of culture in terms of function from reconstrucon in terms of conjectural history. They have thus lapsed into type of explanation which at its best belongs to archaeology, nd thus have greatly sterilised their otherwise splendid fieldork and stimulating theory.

Recently, however, and among a small number of anthroologists only, the functional method has been applied systemtically and exclusively in field-work and theory (W. Hoernlé; . Malinowski; A. Radcliffe-Brown; Richard Thurnwald).

The functional method, by showing what culture does for a rimitive community, establishes its value and thus utters a arning against too hasty interference with native belief and institution and too wasteful an exploitation of native labour and resources. By demonstrating how primitive custom and law work, it furnishes the administrator with practical hints of how to frame and administer native regulations. By inquiring into savage economic organisation, the functional method can teach how to manage indigenous labour and how to trade with the natives. By a sympathetic study of early belief and ritual, it can instruct the missionary how to graft a new creed upon the old one without destroying what is good and sound in it.

The functional method, concerned as it is with the actual working and mechanism of primitive culture, supplies the right theoretical foundation for the practical application of anthropology (*see* Anthropology, Applied), for which mere antiquarian reconstructions, whether historical or evolutionary, are irrelevant.

The following analysis of concrete problems is carried out from a functional point of view.

The Cultural Function of Marriage and Family

This is perhaps the most debated and the most instructive of all anthropological problems.

The Institutions of Marriage and Family.—Careful inductive comparison reveals one important indication: marriage and family are almost universal, and can be traced through all types and levels of culture. Their universality can be accounted for by the functional analysis of these institutions. Two functions of paramount importance are fulfilled by any institution which regulates mating and propagation; the maintenance of racial quality and the maintenance of the continuity of culture. Sociological considerations prove that the individual family based on monogamous marriage provides the best opportunities for effective sexual selection. It also supplies the best training for the future cultural work and sociological orientation of the young individual (Lowie, Kroeber, E. C. Parsons). The importance of the family as the early social and cultural pattern for later life has been independently established by anthropology and psychoanalysis (A. Radcliffe-Brown, J. C. Flügel). The family is the link between instinctive endowment and the acquisition of cultural inheritance, in that it permits the biological bonds between parent and infant gradually to ripen into social ties. It also eliminates a number of dangers due to the disruptive factors of the sexual instinct.

Regulated Licence.—This phenomenon does not allow of a simple and satisfactory solution. As culture advances and larger numbers of men and women come into contact, the experimental component of the sexual instinct drives people to indiscriminate mating. Freedom in pre-nuptial intercourse, festive licence, religious prostitution, lewd marriage ceremonies are the rule in savage and barbarous communities, with the exception perhaps of those on the lowest level (Schmidt and Koppers). Again, in some tribes the institution of marriage suffers temporary obliteration in the form of wife-lending or exchange, *jus primae noctis*, sexual over-rights of chiefs and magicians and similar relaxations of the matrimonial type. These customs have been explained as "survivals of primitive promiscuity." That such an explanation is untenable has been convincingly shown by Westermarck. There are two ways of regulating the intercourse between the sexes: either by suppressing all irregular mating, or by allowing a well-defined and limited licence. Biology and psycho-analytic theory teach that stern repression and rigid sex morals are not a complete solution of the problems here involved. Anthropology, moreover, shows that this problem is especially present at low levels of culture. According to some authorities, a regulated and limited licence should be considered as an imperfect but effective way of dealing with the disruptive forces of sex. Such regulation, moreover, is in no savage tribe found to be subversive to the fundamental institutions of marriage and the family which exist in spite of it everywhere.

At the same time, there is not one single tribe where sexual licence is found untrammelled, where anything approaching promiscuity obtains. Two forms of regulation are found everywhere:

the strict prohibition of the wife's adultery safeguards the bonds of marriage and is only now and then over-ruled by exceptional customs; the prohibition of incest within the household safeguards the integrity of the family. This is very often extended to exogamy which embraces the whole clan.

The Clan.—The clan and the classificatory principle of kinship appear on a closer sociological analysis not to be substitutes for the family and household, but the outcome of more extended co-operation in matters other than sexual mating and the rearing of children (A. Radcliffe-Brown, A. L. Kroeber, Thurnwald). The clan functions principally in economic, legal, and above all, in ceremonial matters. It is also closely connected with age-grades, secret societies and men's clubs wherever these exist; with the ceremonial distributions of wealth (the *kula*, the *potlatch* or the *hakari*), with magical specialisation and co-operation. Thus, in its functional definition, the clan represents the non-sexual and non-genetic extension of the kinship principle beyond the household and above the natural function of the family. Exogamy again appears as an additional bond of solidarity—a natural extension of the principle of incest running side by side with the extension of the kinship principle. As the link between the individual family and the wider groupings of local and political type, the clan is of special importance.

The clan is always due to the over-emphasis of one side of kinship—an over-emphasis necessary to eliminate any ambiguity in the transmissions of heredity rights and obligations. This has been aptly summed up by Dr. Lowie in his terminology of bilateral and unilateral kinship. The clan appears therefore as the natural result of the two influences which come into the foreground as culture advances: the continuity of tradition on the one hand and the extension of co-operation on the other. The clan allows of the establishment of greater cohesion within each generation and across succeeding generations. The explanation here given accounts for the institution, neither by an accident nor by specific ideas, nor by a hypothetical primitive communism in sexual matters, but by reference to certain deep-seated influences of cultural progress working before our very eyes. With all this, although the clan is of great benefit for society and culture, it never becomes an absolute necessity like the family. It is rather a symptom of advancing social differentiation than its inevitable effect. Thus, although the family and marriage are found to be universal, there exist tribes without any subdivisions into clans, moieties or matrimonial classes. Further, since the clan is associated with the general scheme of development, it cannot be regarded as a fortuitous index of this or that culture.

Mother-right and Father-right.—The correlated phenomenon of unilateral kinship also plays a very important part in diffusionist schemes. Mother-right and father-right respectively have been taken by Ankermann, Graebner, Rivers, W. Schmidt and Koppers as principal indices in their classification of cultures. But the question arises, is either mother-right or father-right an independent element, or are they both always correlated? It seems, however, that mother-right and father-right are never found in isolation, but always co-exist—one of them emphasised by the tribal law and the economic arrangements, the other, though subordinate, never completely absent. Until the problem thus raised has been solved, until the proof is given that mother-right and father-right can exist as exclusive, sharply defined stages or sociological principles, their use as indices of culture, and evidence of its spread must remain meaningless. Here again, functional analysis of the methods of reckoning descent leads to a clear definition of such concepts, indispensable for their use in any speculative constructions.

Problem of Sex.—Thus the family, the clan, sexual restrictions, as well as sexual liberties, are not the stages of a transformation nor fortuitous indices of cultural type or cultural stratum, but correlated, component parts of one big institution: the institution which controls the mating of sexes, the procreation of offspring and the education of the young, and fulfils the integral function of racial and cultural continuity. The nature of its component elements is explained by the part which they play within this integral scheme. The functional method might also be extended to all the other aspects of organisation—territorial, political, legal and economic. Each is related to an essential need of human society and culture, distribution over its locality, defence, maintenance of order, and the production of necessaries and values.

Economic Organisation

Until the researches of anthropologists in Melanesia, in New Zealand, in North-West America, in Africa, and in Micronesia revealed a wealth of material, and theoretical students laid stress on the cultural importance of primitive economics, there reigned in anthropology the simple, occupational view of primitive husbandry. Schemes of occupational stages or types, the collecting of food, hunting, fishing, the tending of herds, the raising of crops and industrial production were set forward as the only subject matter of descriptive or analytical economics, as it is called.

In all such views, primitive man is regarded as having but simple elementary needs, and proceeding reasonably and naturally to satisfy them. The little spare time he has left over he devotes to the casual production of superfluities, and to the satisfaction of his hobbies, which latter activities, however, are usually placed outside the domain of economics. Thus we read in an authoritative work, *Notes and Queries in Anthropology:* "The first essential of maintenance is a supply of food; and in many simple communities the actual food quest and operations arising from it . . . . occupy by far the greater part of the people's time and energy, leaving little opportunity for the satisfaction of any lesser needs." And again, we are told by another writer (Buxton) that generally the savage "has no means to acquire more wealth than he can carry about on his person or on the persons of his family." The main questions cut short by such *a priori* assumptions are those of the incentives to production, of the organisation of labour and of the primitive forms of the apportionment of wealth.

The Economic Motive.—Is it true then that primitives work only to satisfy their primary needs? In the lowest stages of culture people are ready to endure thirst and hunger, but bent upon stimulants or narcotics. We know of tribes without clothing, but of none without ornaments. There are natives without fixed habitations, yet keen on the display of such wealth as they possess. At higher levels, under more favourable conditions, certain commodities are actually produced far in excess of actual needs. And this is not done "in exchange for food or for the means of obtaining it," as runs the usual opinion (*Notes and Queries*).

Nor is it carried out through economic foresight. Large quantities of accumulated food and wealth are employed instead for festive display, for ceremonial yet useless donations, sometimes even for mere destruction, often on a gigantic scale. All such customs serve merely for the manifestation of the wealth of the owner, of his generosity, of his economic power. In the South Seas, the accumulated food is employed for the production of objects of value by the feeding of artisans, who devote themselves to the polishing of axe-blades, to carving, to the making of shell ornaments or of mats (Thurnwald, Müller-Wissmar). Some of these early forms of valuable tokens of wealth have a distinctly religious character, serve in ritual ceremonies, are associated with belief and possess elaborate mythical pedigrees (Mauss). Finally, there is one very important fact which contradicts the merely utilitarian view of primitive economic incentives: the products of savage industries in general, far from being made with the minimum of effort required for their utility, show a lavishness of artistic detail, of decoration and pedantic finish, which often put to shame any civilised artisan. The joy in the work, the satisfaction of perfect craftsmanship, the artistic passion for the general appearance of the finished product dominate savage industries and enterprise.

It is clear from this evidence that the "first essentials of maintenance," the primary needs and the requirements of practical utility, do not exclusively control the economic effort of primitive man. Nor is their aim always to achieve the utilitarian maximum of effect by the minimum of effort. To understand the lriving forces of early production, it is, therefore, not sufficient o make reference to man's animal needs. It is necessary to realse also the native ideas of value: their pleasure in the integral ffect of their work in which artistic, sporting, social and even eligious motives are mixed with those of pure utility.

The Character of Early Production.—The well-known scheme f K. Buecher, who would place the whole range of primitive usbandry within the limits of the "individual search for food" nd of "closed household economy" is the clearest expression f the view that primitive man works for himself and his family lone, and that he knows no production on a wider, a communal r tribal scale.

A fuller insight into the nature of primitive labour reveals the xistence of organisation. Even in the lowest cultures there are asks which transcend the forces of one individual or of one famy—the felling of trees, drive-hunting, the very collecting of food. t higher stages, such pursuits as communal hunting and fishing, he making of gardens, the construction of houses and canoes equire some type of organised labour. This points to a definite pecialisation, distribution and synchronisation in time, a division f functions, an integration of the individual contributions to the ommon end. If we enquire what are the elements of the ecoomic organisation, it soon becomes clear that we must distinuish between moral or persuasive, and social or coercive factors. . Buecher in a later work (*Arbeit und Rhythmus*) has drawn ttention to the great importance of rhythm for successful work. any other stimulants and incentives could be mentioned, the nost efficient of which is unquestionably work in company. Conersation, jokes, mutual assistance and interest relieve the edium of solitary labour, while emulation, example and the atisfaction of pride are under primitive conditions possible only n communal work. The best worker is always recognised as uch among savages, and his leadership is followed. Much more nportant, however, is the moral prestige enjoyed by supernatural xpert knowledge which, in the form of magic, always controls ital and difficult economic pursuits. Marking the dates, inauguating the successive stages, imposing periods of rest and setting he time limits, it acts as an organising, co-ordinating influence.

Social coercion is the other important force of economic rganisation. As soon as distinctions of rank and power arise hey are used as means of extorting labour, while, on the other and, economic inequalities function as indices of social status.

Primitive Ownership.—This economic problem has been disussed with some detail by anthropology. But while, on the ne hand, the writers, who, like Buecher, assume an atomised conomic production, admit only of individual or personal ownrship, those following Morgan, and influenced by a strong socialstic bent, Engels, Bebel, Cunow, make the savage into a comnunist. As a matter of fact, property, which is but one form of egal relationship, is neither purely individualistic nor communal, ut always mixed (*cf. Nature*, Supplement, Feb. 1926, on Law and Order").

The misuse of such conceptions as "communism," associated vith an incorrect application of the concept of "money" may e exemplified on a scheme recently put forward by the late Dr. ivers. Dr. Rivers designates certain forms of valuables found n Melanesia, such as mats, arrows, pigs' jawbones and, above ll, shell discs, as "money," following the usage of white traders, nissioners and planters. Dr. Rivers, to justify the use of this vord, insists that these objects "are used for no other purpose" nd "have a very definite scale of value," but he gives in other ontexts a definite and concrete account of several ways in which hese objects are used "for other purposes," and thus stultifies is first criterion. The second criterion is obviously insufficient or identifying a commodity as "money." All objects have in ur economy "a very definite scale of value," yet we do not pply the word money to a pair of slippers, a motor-car or a icture by Raphael, nor use these things as such.

Now the taking of terminological liberties with well-defined oncepts has its dangers. "Money" has no sooner been introuced into the argument than communism crops up and the wo are related by a remarkable piece of reasoning:

> The subject of communism in property is closely connected with that of money. A thoroughly communistic people can have no use for money among themselves. If they possess anything which can be regarded as currency, it can only be used in transactions with other peoples. The use of money should therefore be associated with the disappearance of communism; if it can be shown that Melanesian money is due to immigrant influence, and especially to that of the Kava people, we shall have gone far to establish the conclusions already suggested. (*History of Melanesian Society*, vol. 2, p. 385.)

And again:

> A thoroughly communistic people would have no need for money, and any explanation of the communism of Polynesia will therefore furnish also the explanation of the absence of money (p. 392).

And as an "historical explanation" of these facts:

> The explanation of the absence of money in Polynesia and of the communism of its people is to be found in the special mode of settlement of the Kava people (p. 393).

These passages furnish a conspicuous example of how ill-defined concepts lead to far-fetched schemes and unsound constructions.

Summary.—To sum up briefly, it is incorrect to assume that man for a long time has lived in a semi-natural primitive stage of individual acquisition of food and primary utilities. Equally untrue is the correlated assumption that he lifted himself out of this condition by the gradual application of the economic principle of maximum of effect for the minimum of effort. Instead, from the outset, artificial, cultural, non-instinctive aims have been indispensable to him and his culture. Early types of value and symbols of wealth have spurred him from the outset to economic effort. This effort is organised and standardised by tradition. The real problem, therefore, consists in gaining insight into the primitive forms of condensed wealth, into the mixture of motives and impulses which drive man; and in studying the manner in which these primitive incentives control organised effective effort. All the conclusions arrived at show that for the discussion of economic problems it is necessary to consider the relation of early wealth to religion and to magic as well as its function in primitive social structure.

The borderland questions—the influence of economics on social structure; the problem of wealth as the foundation of rank, power and status; the rule of give-and-take in social obligations; ceremonial distribution of goods and its economic importance—are gradually coming into the forefront of anthropological interest, and open up entirely new horizons in theory and observances. They bring it into close contact with the disciplines of economics, history and sociology (Bücher, Schwiedland, M. Weber, K. Lamprecht).

The relation between the various larger aspects of culture opens a new type of problem. Social organisation is largely dependent upon economic foundations, while economics cannot be studied without a knowledge of the various groups within the tribe. Religion and magic are not independent, but are intimately associated with economic pursuits, with power and prestige, with domestic life and everyday necessities.

The Supernatural

Here the functional view is put to its acid test. What can be the function of primitive belief and superstition, of animism considered as valueless, crude and mistaken, of magic, regarded as a spurious and fallacious pseudo-science, of totemism, of barbarous burial ceremonies and of cruel initiation rites? And yet the method here set forth stands and falls with the possibility of defining the whole of the supernatural. It is bound to show in what way belief and ritual work for social integration, technical and economic efficiency, for culture as a whole—indirectly therefore for the biological and mental welfare of each individual member.

The Current Theories.—Most modern theories in fact come near to the posing of this problem and to its solution. It is implied in the whole structure of Frazer's *Golden Bough*, in the contributions of Westermarck to the moral side of religion, in Durkheim's analysis of the integrative function of public ceremonial, in the additions of Hubert and Mauss to his theories, in Marett's analysis of magic, in Crawley's vitalistic view of religion, above all, in the analysis of Andaman belief and ceremonial by A. Radcliffe-Brown. But too often the functional view is still smothered by evolutionary or historical discussions—as to whether magic preceded religion, as to what was the primitive form of religion, and so on.

Magic.—The great number of modern theories dealing with magic range between two apparently opposed views, which label magic as primitive science or primitive stupidity (*Urdummheit*) respectively. We must reject the implication of the first theory, that magic preceded science, and that it once did fulfil that function. It must be placed to the credit of this theory, however, that it does full justice to the practical context of magic. The second theory emphasising the central conception of impersonal ubiquitous force—*mana, orenda, wakan* rightly appreciates the difference between belief and knowledge; and brings out the mystical character of magic (Marett, Hubert and Mauss, Preuss).

The functional theory reconciles both points of view. Let us start from the close association of magic with practical activities. First, every practical pursuit amongst savages is always primarily based upon knowledge and is never exclusively controlled by magic. There are in all savage cultures certain activities in which technical ability, guided by knowledge, completely suffices. In others, the help of magic is also invoked. What are the respective contributions of knowledge and of magic to such a mixed activity? In its essentials the division of function between the two is very simple: as far as his knowledge goes, as far as he can safely rely on experience, reason and technical ability, the native—whether in his gardening or fishing, in the building of craft, in warfare or sailing—does not use magic. No savage has ever been observed to select the tree for his dug-out by divination, to bring forth seedlings by formulae without having planted them. Only where, in spite of knowledge and effort, the results still turn unaccountably against him, only when forces completely beyond his mental grasp and practical control baffle him—in dealing with garden pests, with the supply of fish and animals, in securing wind or weather, in preventing disaster at sea or in war, above all, in dealing with bodily decay, disease or personal accidents—does the savage resort to supernatural means of filling the lacunae in his practical power.

The type of belief met in magic is always an affirmation of man's power to deal with the situation by a rite or spell. This belief simply repeats in a standardised manner, what hope all the time has whispered within the individual's own mind. Again, the rite repeats in a fixed, definite form what the natural expression of emotions already contains, only, as a rite, it is carried out with a purpose and with the conviction that it is a means to an end.

When we compare the forms of the fixed magical ritual, they are remarkably akin to the response of upset equilibrium occurring under similar conditions. Black magic, which corresponds to the sentiment of hate, and which replaces the outbursts of impotent rage, contains in its most typical ritual of stabbing, pointing the bone, mimic destruction, in the text of its formulae, a reproduction of the various gestures, words and types of behaviour, which we can watch in the natural vent of the emotions. Exorcism of evil powers repeats in word and deed the reactions of fear.

In all practical activities, the successful ends, which hope vividly brings before the mental vision at moments of uncertainty and suspense, are connected in such ritual, which bridges over the fateful moments. Sir J. Frazer's apposite term of "imitative magic" and his exhaustive illustrations of his point of view illustrate also the present theory. Here it is only suggested that the association of "ideas," designated by Frazer as the cause of "imitative magic," can only be accounted for by our theory of imperfect biological adjustment induced by culture. Baffled instinct arouses emotional tension as well as a conflict of ideas and an impasse in conduct. Through magic, culture prescribes the adequate ideas, standardises the valuable emotional tone and establishes a line of conduct which carries man over the dangerous moment.

This new type of explanation, based on the functional method, shows how cultural behaviour, in the very act of bestowing immense benefits and advantages on man, also opens up new problems and creates new needs. To satisfy these a new type of behaviour, ritual practices and a new mental adjustment, faith or mystical outlook, come into being, thus providing an answer to the question which is always essential: What actual benefit does magic confer upon man, what is its positive contribution to culture? It is a remedy for specific maladjustments and mental conflicts, which culture creates in allowing man to transcend his biological equipment.

Social Consequences.—In its traditional aspect, magic leads to important social consequences. It is the essence of magical lore that every word of a formula must be spoken correctly without omission or alteration, every detail of the rite performed. Since magical knowledge can live only in man's memory, the correct transmission, the legitimate filiation of magic are essential to man's confidence in its efficiency. The inheritance of magic is always one of the most important problems of descent and of the modes of reckoning kinship. As a rule, magic is handed on within the family circle.

In this connection it is important to stress that *all* forms of magic usually perform an important social rôle. No magic can be regarded as anti-social in the sense in which Durkheim and his school attempt to define it. Even sorcery or black magic functions as a legitimate though dangerous weapon, of which one of the main uses is in the enforcing of an established power and the biddings of law. The actual manner in which magic is connected with practical activities makes it, as we have seen, into the very skeleton of economic organisation. It supplies most of the co-ordinating and driving forces of labour, it develops the qualities of forethought, of order, of steadiness and punctuality, which are essential to all successful enterprise. Thus magic fulfils an indispensable function within culture. It satisfies a definite need which cannot be satisfied by any other factor of primitive civilisation.

Totemism.—Totemism is a belief which affirms an intimate bond between a group of men and an animal or vegetable species, sometimes a class of objects. It raises therefore two problems, the first as to the nature of the belief, the second as to the social organisation with which it is linked.

Most theories saw its origin in some small or accidental detail of social organisation or belief, as in nicknames, guardian spirits, transmigration of souls and, recently, in the Freudian theory of parricide. To the functional theory the real problem, however, is: what is the function of a type of belief which affirms the affinity between man and animal, is correlated with clan organisation and leads to moral and ritual rules associated with the multiplication, killing and eating of animals?

Man's interest in his surroundings is primarily practical. He has to collect food, construct his dwelling, roam about his district to hunt or fish. In the forefront of importance are the animals in his territory—those which feed him, those whose skins clothe him, whose feathers, teeth and claws supply him with ornaments and those which threaten his safety or comfort. Hence the whole of animal life has an intense interest and significance for him.

Now in dealing with the animal kingdom, in obtaining the useful species to eat, in defending himself against the dangerous or repulsive ones, primitive man, where his natural means fail him, has recourse to supernatural ones. The magical claims over any aspect of nature lead always to an assertion of a sort of affinity or kinship between the magician and the object controlled. Indeed most magic implies mythological descent from animals or affiliation to them. Thus we see that the native's practical interest in the animal or vegetable kingdom leads through magic directly to the assertion of a mutual bond.

Magic has a tendency to become specialised and departmental, exclusive and hereditary in a kinship group or clan. The subdivision of the tribe into totemic clans seems to be best explained, therefore, by the hypothesis that such clans were originally magical bodies engaged in controlling, through spell and rite, certain animal or vegetable species for the welfare of the tribe.

Thus is assigned to totemism a definite cultural function. Selective interest in vitally relevant factors of the environment, man's capacity to control it, are embodied in a system of beliefs which standardise, enhance and sacralise these culturally valuable mental states. By endorsing man's confidence and his hopes of effective control, by making these tendencies substantial in an explicit mythological dogma, totemism contributes to individual happiness, to social cohesion and to the general efficiency of culture.

Summary.—In recent work (Frazer, Crawley, Van Gennep, Miss Jane Harrison) much stress has been laid upon the association of religion with the crises of life. In fact in most religions, savage or civilised, the main phases of human life history—conception and pregnancy, birth and puberty, marriage and death—are associated with belief, ritual and mythological stories. Religion therefore fulfils at vital crises an indispensable function in he scheme of human culture.

Culture entails a transformation of direct instinctive response nto a mode of behaviour governed by purposive ends, that s, by cultural values. The super-instinctive type of behaviour leads man into impasses and difficulties out of which he an be extricated only by rules of thought and of behaviour which also have to be supplied by culture. In practical pursuits magic helps man over the difficulties. The rôle of Religion consists in the establishment of spiritual ends, dogmatic ealities and moral rules of conduct. In totemism, which sacralises important factors of the environment; in the belief in immortality and in the associated ideas about communion with spirits nd their influence on human fate; in the consecration of food and f indispensable elements of culture, such as fire, standard implements, tokens of wealth; in surrounding tribal tradition and rder by the halo of sanctity, religion is the source of social and ultural values.

Primitive Knowledge

Reason, the capacity to know, to invent and to evolve theories, has been regarded as the distinctive mark of man, dividing Iomo sapiens from other living beings. Perhaps over-confident xaggeration of this has led to the recent reaction which denies the primitive mind any power of reasoning and of observation.

But had primitive technique been studied not as a self-contained object, but in its functional dependence upon knowledge on the one hand and magic on the other, the theory of a rimitive mystical and prelogical mentality could never have een erected. Primitive man shows a rational behaviour, an unimpeachable logic and a definite power of empirical observation, not only in his technology, but also in his major economic ursuits and in his sociological behaviour.

Language.—This subject has been so far but imperfectly tudied by anthropologists, and its cultural theory is as yet ardly outlined. The study of dead languages by grammarians nd philologists has caused speech to be regarded as a self-contained phenomenon governed by special laws of its own. It as a considerable step forward when, some time ago, the study f language was taken up by psychologists, who began to treat in correlation with thought and other phenomena (Lazarus, teinthal, Wundt). The structural features of language were xplained as an adequate expression of reasoning, of emotional ates, of aesthetic needs and of the characteristics of the human ill. Even this, however, is not sufficient.

Recent developments in linguistics, as well as in the philosophy f language, have set forth the view that language cannot at ny stage of development be regarded as an adequate expression logical, metaphysical, aesthetic or scientific categories (J. ewey, Jespersen, Ogden and Richards). Language, in all ocieties and at all stages of development, is an essential part human action (Dewey). Communication by spoken word is indispensable for any concerted activity and enters into all aspects of culture as a working element. (*See* Philology.)

From the functional point of view, a word which designates n implement is as much an essential manner of using that implement as is any type of bodily skill required to handle it. The master of a craft, however primitive, must be able to give his orders in case of emergency in a technically adequate and theoretically correct manner, and the bodily reactions of his vocal apparatus are as essential to the practical issue as the manual dexterity of his crew. Language plays a similar part in warfare, in economic pursuits, in ceremonial activities. In religious and magical ritual, the spoken word is conceived and felt by man to be a creative act which produces a definite practical effect.

But if speech, in its primitive forms, is an indispensable instrument of cultural behaviour, its structure must be correlated to pragmatic needs and to the requirements of action rather than to logical, reflective or oratorical necessities. Hence the categories of primitive speech must be a compromise between logical and rational conditions, sociological and practical needs, and certain limitations imposed by material culture.

The problem of meaning cannot be treated by the study of language, torn out of its cultural context. The classical philologist has already summoned the archaeologist to his assistance. The study of living languages of the primitive type, helped out by the study of living cultures, would, no doubt, reveal to us infinitely more than can be reached by the study of dead speech. A word is as sterile without the knowledge of how it is used in live context, as behaviour remains mysterious without its accompanying flow of speech. Life is neither mere verbiage nor a pantomime. Speech has been given man for action, and as mere loquacity it is a disease of culture. (*See* Philology.)

Mythology as Primitive Science.—In order to vindicate the autonomy of knowledge within primitive culture, it is still necessary to deal with the view that, at low levels of culture, myth is a substitute for science. We read in an authoritative handbook:—

> Myths are stories which, however marvellous and improbable to us, are nevertheless related in all good faith, because they are intended, or believed by the teller, to explain by means of something concrete and intelligible, an abstract idea, or such vague and difficult conceptions as creation, death, distinctions of race or animal species, the different occupations of men and women; the origins of rites and customs, or striking natural objects or prehistoric monuments; the meaning of the names of persons or places. Such stories are sometimes described as *aetiological*, because their purpose is to explain why something exists or happens (*Notes and Queries*, pp. 210 and 211).

We are thus told that primitive man evolves stories and believes in them, in order to explain abstract ideas. As a matter of fact myth is not a form of primitive science, but an aspect of religion, magic and morality; its function is not to explain queries nor to illuminate abstract or obscure points, but to strengthen belief, to substantiate morals and to enhance tradition, in short to bring home to primitive man all that has to be believed, obeyed and accepted.

To establish our point, we have to place myth within the scheme of primitive culture and to show its pragmatic function. Myth is a part of folklore in the narrower sense of the word, that is, of oral tradition. Man in all ages and all climes possesses a body of concrete stories which can readily be divided into several classes.

Of these, the first serves predominantly for amusement and recreation. Stories of this class describe more or less dramatic or funny adventures of men and animals, ogres and hobgoblins, all of which are not regarded as real. Such tales, when studied within their cultural context and regarded from the native point of view are found to play an important part in native life, in that they enhance sociability, fill out seasons of enforced idleness or make up the substance of amicable gatherings.

Another class of stories, taken more seriously, refer to important exploits and heroic deeds of past generations and are considered to be true. The sociological function of such stories is that they develop family pride, knit the kinship bonds and serve to increase communal or tribal solidarity.

There are finally stories which are regarded as sacred and connected in a specific manner with magical and religious cult, with social organisation and with the body of tribal custom and moral rules. These and these only could be regarded as " explanatory " stories, in that, among other subjects, they account for the origins of the world, give the reasons for death, furnish revelations of future existence, and promise immortality, narrate the beginnings of magic, and so on. The explanatory character, however, is prominent only as long as the story is considered without its cultural context. In all cases where the associated ideas and feelings have been observed; where we know the conditions under which the myth is recited or enacted; above all where the practical influence of the myth has been studied—we are able to assign a definite cultural function to it. Thus, in connection with magic, we find stories which are not intended to *explain* the ritual or the phenomenon governed by magic, but are meant to substantiate the belief in magical efficiency. All such stories give us an account of an extremely successful, miraculous precedent. Around the various religious rites and ceremonies, there cluster stories which vouch for the efficiency of the religious acts in obtaining the desired effect.

Again, we have a class of myths which confirm the existence of privileges, give the antecedents of rank and power, or enforce duties and which, in general, strengthen traditional law and order. Wherever myth, that is a sacred story, has been studied in connection with the sources of its sanctity as well as with its sacralising results, it can be shown that it has served to strengthen faith by reference to an original Golden Age, to miraculous precedents in the dim past. The study of myth in conjunction with ritual and institution has been carried out only in limited areas, for instance in the Andaman Is. (A. Radcliffe-Brown), in Central Australia (Spencer and Gillen), in Melanesia (B. Malinowski), in Northwestern America (Boas and others), in Polynesia (Elsdon Best). All the facts we know, however, prove that myth is in no way comparable to primitive science, but that instead it functions as a religious warrant, vouching for the truth of belief, the efficacy of ritual, and the fitness and justice of moral or social duty.

THE IDENTIFICATION OF CULTURE

The functional method seems at first sight to be of especially easy application to artifacts, to material objects fashioned by man for his cultural uses. Food stuffs ready for consumption, man's equipment in protective shelter and clothing, his tools and his weapons, are all obviously means to an end.

The Place of Artifacts in Culture.—But this very facility has its dangers. The purposive character of most artifacts has made the *implement* into the typical representative of material objects: hence, all these have generally been regarded as representing the *technique* of culture. It is deemed sufficient to state how these objects are *made* and how they are *handled*. In *Notes and Queries* one-third of the space is devoted to "technology," the description of manual production and of the handling of artifacts. In the *Handbook of Folklore*, this study is defined as an anthropology with technological considerations cut out. All this is incorrect, since "material culture" is not an autonomous, self-contained province of culture, such as religion, law or economics, each of which fulfils a specific function. Material culture is an indispensable accessory of every single aspect, every pursuit and institution and thus fulfils a general function.

On the other hand, the bald technological treatment is not sufficient to do justice to any class of artifacts. The objects of immediate consumption or use, as well as tools and implements, are essentially correlated to economics and must be studied within its context. The same applies to a weapon, the proper analysis of which immediately leads to the description of the manner in which it is wielded, thus to the methods of warfare and war magic and, finally, to the political organisation of the tribe.

There is no single type of human activity without its material accessories. There is not one artifact, however practical or simple, which could be properly understood without its context of living culture, including belief as well as technique, social organisation and traditional knowledge.

Any general theories of culture or of progress which ascribe all driving power to either the material or the moral aspect of culture alone are guilty of one-sided exaggerations. Philosophy of history without a scientific basis is of little value. Functional anthropology on the other hand finds great help in the conception of culture as a form of biological adaptation on a gigantic scale, which empirically analyses the concepts of progress and of cultural reality and seeks to place the study of culture within the scheme of other sciences. Modern empirical philosophy has also been in turn greatly influenced by anthropological work, above all, by the theories about primitive knowledge, its relation to faith and to practical activities (W. Wundt, L. T. Hobhouse, K. Lamprecht, M. Weber; above all, J. Dewey and the Columbia School of Culture Philosophy).

The Criteria of Cultural Identity.—The other danger which the study of material culture harbours for the anthropologist is the fallacy of *fixed form*. The strict determination of shape imposed upon many artifacts, especially tools, by their use, has made many objects appear perfectly defined by their form. An axe-blade, a knife, a bow and arrow, a spoon, a walking stick, "will be, as a rule, recognised at once as such" (Graebner, p. 56). Again we are told that the concepts and means of identification "are so much matters of everyday use to the ethnologist that the activity of the intellect, as it compares the objects, remains below the threshold of consciousness" (p. 57). These statements contain a very serious fallacy, obvious when it is remembered that nothing of any scientific value can be achieved by the study of isolated aspects, or, worse still, of isolated objects. And any definition by form treats an object as a self-contained isolated entity. As soon as an object is defined by relation and by function it has to be considered as a part of a larger whole, and it is the form of the whole which becomes the relevant factor in our definition.

The criteria of form and of quantity, as defined by Ratzel, Graebner, Schmidt and others constitute the foundation of the historical method. When studying the problem of the identification of cultural objects and the complexes of such objects, writers of this school seek to show to what extent similarities and ideas found in different parts of the world can be explained by diffusion, by the hypothesis that they "have been developed at a single culture centre in the far distant past and have been disseminated thence over the whole world" (Kroeber, *Anthropology*, p. 200). They have thus not only to prove the identity of two objects, but to prove it so that their genealogical kinship, their identical birth in a parent culture, is established.

In order to do that, the "infallible and objective criteria" of form and quantity have been elaborated. We are told that two things belonging to two different cultures can be regarded as the same, "when identities appear, which are not founded in the essence of the object or, speaking of material goods, in its material" (Graebner, p. 98; *ibid.*, p. 108; Schmidt and Koppers, p. 68; Kroeber, p. 199). A classical example is the identification of West African and Melanesian bows, made by Ratzel on account of the similarity of their section, means of attachment of the cord and the material (lawyer cane) of which the cord is made. Not one of these features, we are told, can be explained by its function or by the limitations imposed through material or purpose.

On this example, we may also observe the second criterion, that of quantity. The bow in the two regions shows not one, but a number of features apparently not related to each other.

> If a trait is composed of several elements which stand in no necessary relation to each other, and these several elements recur among distinct or remote peoples in the same combination . . . one can be reasonably sure of the real identity of common origin of the complex trait,

says Kroeber summarising the diffusionist point of view (*Anthropology*, pp. 199–200).

The "quantity" criterion applies not only to details found on one object, but to objects, customs and institutions, provided these are not related to one another. Such an *ensemble* is then usually called "a cultural complex," such as the cultural complex consisting of the bow already mentioned as well as shields, houses, masks, drums and clothing. This, Frobenius believes, forms a really identical stratum of culture both in West Africa and Melanesia.

When the two criteria are carefully examined, the functional anthropologist perceives that the assumption of wide occurrence of meaningless and irrelevant objects and unrelated complexes rests primarily upon a mere deficiency of knowledge. An object, or a detail of it, appears to us "inessential," "arbitrary,"

“ devoid of function ” only as long as we do not understand the unction of that detailed feature or object. Since the study at irst hand of savage races has been conducted mostly in an amaeurish manner, and our collections are crammed with unlabelled, undefined, misunderstood specimens, the argument from rrelevance, *i.e.*, from our ignorance, has no value in anthropology. The fact is that the more we know about the culture of a egion, the fewer features appear to us “ extrinsic ” or “ arbirary,” the more all is revealed correlated, determined, provided vith a function. And this brings us to the crux of the argument: orm without function is an empty concept in the science of ulture.

A pointed stick can be used as a spear in war or in the hunt, s a digging or punting pole, as a ceremonial staff or magical vand, as well as for many other purposes. The details of its orm are adapted to the function and defined by it. And this olds good with regard to every item of material culture.

Once we begin to define form by function, both criteria, that f *meaningless form* and of *fortuitous coincidence*, break down ompletely. An object can be defined and identified only by its se, the study of use leads us again to connect the object with he pursuit, the institution, the aspect. The real identities of ulture appear to lie in the organic connection of its parts, in he function which a detail fulfils within its scheme, in the relaion between the scheme, the environment and the human needs. Meaningless details disappear, shape becomes alive with meaning and with function, and a testimony of irrelevant form falls way as worthless. The method of formal treatment breaks own even more completely in the study of primitive sociology, conomics and supernaturalism than in that of material culture.

And this entails a partial qualification of the criticism of he historical method. First of all, many students in mapping ut distributions apply functional identifications of culture intead of formal ones (especially Wissler, Kroeber and Lowie). n the second, it is always possible to profess a bad method nd to use a good one. The coincidence of details in an object r simultaneous appearance of objects is an important fact, whether we try to find out its organic relations or rest satisfied with denying them. The distribution of such objects or omplexes does raise a problem. The objection is that in the pinion of the upholders of the historical doctrine, the problem s solved. For to them a distribution of such similar traits or omplexes is a proof of common origin, a proof just because they ffirm the absence of any inner relation or function. To the unctional school, on the other hand, who cannot rest satisfied vith dogmatically abiding by a gap in our knowledge, distribuion raises a series of problems. In the first place how far we can egard the complex as an organic unity; secondly, what is the unction of this coherent whole; thirdly, in view of this function, ave we to assume independent development along similar lines, onvergence along dissimilar lines or mechanical transmission? The real explanation, however, underlying any of these hypothees, lies in the discovery of correlations and of permanence hrough function.

Summary.—The outer framework of material culture is corelated in a clear and direct manner to the satisfaction of man’s iological needs. It constitutes the *milieu* which man evolves o interpose between himself and the rigours, dangers and insuffiiencies of his physical surroundings. But this material apparatus as to be operated by men collectively, organised and controlled y the body of tradition, scientific as well as religious and magial. Thus indirectly most elements of social cohesion as well as ertain beliefs and ideas can be correlated with man’s primary eeds, and explained by the biological function which they fulfil nd the survival value which they possess. But this is not suffiient, and here an extremely important addition has to be made: he facts of social organisation impose certain conditions upon uman behaviour, imply restrictions and create new wants, hich again call forth specific cultural arrangements. Thus, igher forms of organised labour need some compulsion, supplied y political inequalities, and some moral framework, supplied y certain forms of magic.

Mental development running side by side with higher technical ability brings about fear, thought and reflection which make man anticipate his destiny and probe into the past and future of his world. The beliefs of primitive man about future life, the beginnings of the world and spiritual powers have to be correlated with his increasing mental outlook as well as with the widening social horizon and the development of cultural values. Social cohesion requires some means of enforcing the various rules imposed upon the individual for the common good, and this brings about the sanctions and inducements, which constitute the essence of primitive law. In all this the functional view avoids the error of attributing any priority to one or the other aspect of culture. Material objects, social grouping, traditional and moral values, as well as knowledge, are all welded into a functional system. To explain any item of culture, material or moral, means to indicate its functional place within an institution, which has to be thus explained with reference to its aspect and this again has to be placed within the system of culture.

Finally, anthropology hopes, with the help of her sister sciences, to state the place of culture in the scheme of organic evolution; to show how it is correlated to the instinctive animal equipment of the human species; to demonstrate how it has allowed man to rise above the brute level, to control his surroundings, to develop his knowledge, his faith and his conscience.

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ANTHROPOLOGY, APPLIED.—Public recognition of the advantages to be gained by the practical application of anthropological knowledge had scarcely begun before the War, and naturally suffered a severe setback from which it only slowly recovered. There were administrators who recognised the native point of view, and were even prepared to study the sociology of their charges, and in a few cases, recorded the results of their observations; yet nowhere was there any general official recognition that the acquisition of such knowledge should be part of an administrative officer's duties, and adequacy in native affairs was not generally regarded as necessary for promotion. Nevertheless a healthy spirit is abroad even if performance at times lags behind the demands of both theory and common sense.

Divisions.—Applied Anthropology has two main aspects:—(1) Cultural (or in the broader sense psychological). (2) Physical, embracing especially the great problems of racial characters both physical and mental, miscegenation, immunity and so forth.

Both aspects are of the greatest importance to humanity as a whole, for both are compact of the basic factors which must be considered in the solution of some of the most urgent world problems of the present day. Here no general consideration of the philosophical or ethical questions concerned is possible, but a reasonably kindly attitude of the dominant race toward the weaker peoples, and a desire to preserve and serve them, will be taken for granted, as well as the fact that the development of a territory involves the exploitation of its native inhabitants to a greater or less degree. There will also be assumed the determination on the part of the governing races to modify and if necessary to terminate the anti-social practices of their less desirable members, even where this directly or indirectly limits the exploitation of the "natives." Further, while every people presents its special problem, all these are but different aspects of the greater problem of adaptation, which must be worked out afresh in many instances if the widest range of physical and cultural types are to be given their best chance of survival and development within the conditions besetting them.

Hunting Peoples.—First, there is no possible future for the few scattered remains of the hunting peoples that still exist; only in certain instances is the white man responsible for their disappearance, and at the time of the European colonisation of the tropics superior "native" cultures were, in a number of instances, destroying these humbler groups with the same certainty as our own.

Agricultural Peoples.—With regard to the agricultural peoples but recently in the Stone Age, it is yet too early to speak with confidence, for although the natives of the smaller islands of the Pacific have been blotted out or exist only as degenerate remains, it is permissible to hope that under considered efforts those of the larger islands (such as New Guinea) may not only survive but even enjoy a measure of happiness.

Methods.—As to method, there is little to guide us in the past, for though culture contact (*see* Culture Contact, Psychology of) is no new thing in history, the economic needs of today present entirely new conditions. Moral ideas have also changed, and it is no longer possible to enslave or exterminate all peoples unable or unready to adopt or adapt a higher civilisation. Yet in spite of these apparently favourable factors there has been nothing before comparable with the persistence and energy with which the higher race is imposing itself on the backward peoples.

For practical purposes, then, we can only be guided by the knowledge gained during comparatively few years, backed by the experience of our more successful administrators, the whole tempered by a quality of prevision and a capacity to "think black" which experience has not shown to be unduly common. Yet there is this encouraging feature: those who have for some years been associated with the teaching of anthropology to African civil servants from the practical standpoint have been struck both by the quickness and avidity with which many of these men—some fresh from college, with no experience of natives—have assimilated the basic elements of native thought and custom, and in a number of instances by the definitely successful results of the methods set forth in the classroom when wittingly applied abroad.

Use of Existing Knowledge.—What then are the means by which the store of knowledge we already possess may be used, and how far is a practical rather than theoretic interest in native peoples likely to introduce new methods of acquiring knowledge, or eliminate methods known to be of scientific value? Nothing suggests that the practical or applied outlook makes, or should make any change in the method of the field worker. For if it be urged that attention to any particular theory is likely to distract the observer from a fair all-round study of facts, the reply is obvious that theory can only stimulate the field worker to fresh observations, which should neither limit his area of outlook nor discourage him from seeking the fullest knowledge of the folk he is investigating in their present and past environment. The more complete the apparatus of the observer, whether government official, missionary or professional anthropologist, the more likely is he to form a complete picture of a people in which due weight is given to the activities both mental and physical of its members, enabling the administrator to foresee their behaviour as individuals, as members of a family or of a larger social group.

Unity and Complexity of Social Life in the Lower Cultures.—Ethnic and historical connections naturally are important, but stress must be laid from the practical point of view on the interaction of existing ideas and customs. It is impossible to understand the ideas regulating inheritance and bride price—two most important matters with which the administrator is concerned—without at the same time inquiring into the religion, sociology and economics of his people. Unforeseen and undesired ends have resulted from arbitrary interference with native custom. The native has a point of view of his own, and before sweeping away seemingly objectionable customs, the white man with knowledge of anthropology should seek to preserve the driving force which runs through native life, while changing those features which are anti-social according to civilised ideas, though in those cultures in which they occur they instigate much praiseworthy social activity.

Head Hunting.—One of the best examples that can be cited is offered by head-hunting, a widespread habit which white civilisation cannot tolerate. Yet its suppression was regarded by W. H. R. Rivers as one of the main factors in the depopulation of Melanesia.

> No one could be long in Eddystone without recognising how great is the people's lack of interest in life, and to what an extent the zest has gone out of their lives. This lack of interest is largely due to the abolition of head-hunting by the British Government. This practice formed the centre of a social and religious institution which took an all-pervading part in the lives of the people. The heads sought in the head-hunting expeditions were needed in order to propitiate the ancestral ghosts on such occasions as building a new house for a chief or making a new canoe, while they were also offered in sacrifice at the funeral of a chief.
>
> Moreover, head-hunting was not only necessary for the due performance of the religious rites of the people, but it stood in the closest relation to pursuits of an economic kind. The actual head-hunting expedition only lasted a few weeks, and the actual fighting often only a few hours, but this was only the culminating point of a process lasting over years. It was the rule that new canoes should be made for an expedition to obtain heads, and the manufacture of these meant work of an interesting kind lasting certainly for many months, probably for years. The process of canoe building was accompanied

throughout by rites and feasts which not only excited the liveliest nterest but also acted as stimuli to various activities of horticulture and pig breeding. As the date fixed for the expedition approached, other rites and feasts were held, and these were still more frequent and on a larger scale after the return of a successful expedition. In stopping the practice of head-hunting, the rulers from an alien culture were abolishing an institution which had its roots in the religion of the people and spread its branches throughout nearly every aspect of their culture, and by this action they deprived the people of the greater part of their interest in life, while at the same time they undermined the religion of the people without any attempt to put another in its place.[1]

This example is valuable from two standpoints. It demonstrates the interlocking of departmental activities, as a white man might be tempted to call them, in native life, and it furnishes the very type of practice which no white administration can permit. The *impasse* seems absolute, yet in Sarawak, where almost the same necessity for head-hunting exists, the difficulty has been overcome by sympathetic officials who have themselves taken charge of some of the old skull trophies of the people, and thereafter when the demand for the ceremonial use of a skull arose one of the old skulls was lent to the community, the whole transaction being put on a business footing by the careful recording of skulls "in" and "out." Again, in an nland district of Papua, where no man could hope to marry unless he had taken a skull, the officer in charge was able to persuade the tribe that the killing of a wild boar offered at least as good a test of pluck and skill, and so was able to substitute the taking of a boar's head for that of a man (often a woman or child). The Kula, the great trading expedition of the Trobriand Islanders, described by B. Malinowski,[2] is another excellent example of the interlocking of native activities. From the administrator's point of view there are no anti-social features in this complicated system of ceremonial exchange, yet so sympathetic a governor as Sir Hubert Murray states that it will surely be superseded by modern methods—no government, "however sympathetic, can keep it alive." True, modern methods must eventually supersede the Kula, but what attempts are being made to keep it in being, and if it is doomed what ingenuity is being exhibited in the attempt to keep up interest in the competitive garden making and canoe building and racing which play such an mportant part?

Importance of Ceremonial.—No one doubts the close relaionship between social organisation, ceremony, morals, economics and even ethics among ourselves; everyone recognises the psychological value of display, ceremonial and sport; yet in the administration of the backward races this common knowledge is oo frequently ignored. What government at home would preume to stop royal processions, the Oxford and Cambridge boatace or public football matches? Yet the corresponding expressions reproduced by natives in dances, initiation ceremonies and public feasts are frequently suppressed, by the influence either of the administrator or the missionary, long before it is understood whether they are harmful or not. Active teaching s needed, now as much as ever, that the interests of people cannot be cut off with impunity, and the substitution of harmless or anti-social features in savage ritual and institutions is sound ocial psychotherapy.

Positive Interference.—Frequently new regulations are introduced which undermine the native social structure of which the Europeans had remained entirely in ignorance.

There are tribes in Africa in which chieftainship is unimportant but age classes are well developed. The Govt. found difficulty in dealing with people among whom appeared no vested authority, and administrators appointed "chiefs." The position of these men was anomalous, they had no native prestige, and appeared to be government servants. Later researches brought to light the fact that an efficient form of government had been all but destroyed by the foreign appointment of chiefs. The age grade system, with its elaborate initiation ceremonies, had provided a sound basis for both civil and military organisation: the younger men formed one class, while civil administration was vested in an older grade. The elders complained that they no longer had any authority in the villages, the young men did as they chose, no longer respecting the age-class regulations and taboos, some so obviously useful, as that prohibiting the use of intoxicating liquors to the younger grades. Later in places the system was resuscitated, but much harm had been done; for the authority of the elders had been undermined, the younger generation had lost respect for the elders, and the steady rise in social importance that the age-class system provides had gone.

Kingship.—In other instances trouble has been caused by gnorance of the fact that a chief may belong to that exalted class of beings called by Frazer "Divine Kings," or if not actually of this order be at least of semi-divine nature, and responsible for rain and generally for the prosperity of the land. Here it may be wise to recognise frankly the hierarchical superiority of the priest-king, and to appoint under him an administrative government chief; indeed, besides the priest-king there are often one or more men recognised by the tribe as executive officers in everyday affairs.

Magic.—The administrator cannot ignore magic and sorcery, and it is useless for him to affirm that the British Govt. cannot countenance a belief in sorcery; magic may be a fiction, but the belief in it is a potent reality in all the ruder cultures, and is not extinct in higher cultures. Cases of death alleged to be caused by magic or by poison—the two often being synonymous—are continually brought before administrators, yet rarely is evidence produced against the magician which on the white man's laws of evidence can lead to conviction. In parts of Melanesia it is doubtful whether there is any authentic evidence for the use of poisons by a sorcerer; yet folk undoubtedly die as the result of his machinations; they die from no other ostensible cause, and their death is ascribed to magic. The sorcerer is not convicted, but if the people take the law into their own hands and kill him the Govt. steps in and punishes the slayers, who according to the ideas of their peers have courageously performed a public duty.

Another factor which greatly adds to the difficulty of dealing reasonably and justly with sorcery and witchcraft is that generally speaking the darker races are far more suggestible than ourselves; unfortunately, space is lacking to elaborate this statement or to set out a tithe of the evidence on which it is based.[3] It is small wonder then that many natives believe that the Govt. encourages sorcery; indeed, the relative immunity of the sorcerer from all vengeance in certain instances may actually produce this result.

But as a general plan of treatment, probably an ordinance of the kind in force in Papua is useful, in which it is stated that though there is really no such thing as sorcery yet the practice is so harmful that it is treated as criminal. At any rate, the administrator is not the only person in a dilemma; witness the plaint of one Tata Ko, a well-known sorcerer, to Capt. Barton, then Governor of Papua: "If a man falls sick his family come to me and ask me to make him well. If I don't do something for him they say, 'Tata Ko, the sorcerer, desires to kill our brother,' and they are angry and will perhaps try to kill me. If I do give them something they insist on paying me well for it; should I refuse to take their presents they would not understand it and they would think I was trying to kill their friend, but when I do take what they give me, you arrest me on a charge of sorcery blackmail."[4]

Magicians not Charlatans.—In most instances magicians are not charlatans; though they may impose upon the credulity of their clients they do believe in their own power; they have inherited the gift and perfected their craft by means of hard training. Though legislation may be useful, magic cannot be disposed of by law, for every death except perhaps of the very old is attributed to magic, and it is only when a man has some appreciation of the natural causes of death and the benefits of medicine that he relies less upon magic. Missionaries have long been aware that their best weapon is the hospital; administrators should start clinics shortly after administrative posts, as in the case of the splendidly fitted hospital ship, with its medical officer and orderlies, placed by the Sudan Govt. in 1922 for service on the White Nile and its tributaries.

Social Side of Magic.—Yet, however perfect administration, magic cannot die a sudden death; and this has its advantages, for magic has its social as well as its anti-social side.

White magic will persist, and in Melanesia, for instance, its benefits are well seen in connection with the Kula. In the Trobriand Is. the specialists in magic are experts in the various crafts, in gardening and canoe building, etc., and it is under their auspices that the good traditions of gardening and building are maintained. Though no canoe could sail unless the appropriate magic had been performed at each stage of its construction, good magic would never be used to counteract the effects of bad material or bad workmanship. Thus, the continual magical observances guarantee a careful selection and tests of material, and are an incentive to good work. A successful trading expedition is the result of good magic, and, just as magic is the most important regulator of the Kula, so is it of prime importance in garden work. The islanders, like most natives, are notoriously unthrifty, and it is doubtful if any native would cultivate sufficiently for his needs if left to individual responsibility. For man does not live by bread alone, and a garden which will make a fine display and be much talked of appeals to the mass of the population more than the knowledge of a supply against famine.

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[1] *Essays on the Depopulation of Melanesia*, p. 106 (1922).

[2] *Argonauts of the Western Pacific* (1922).

[3] C. G. Seligman, *Anthropology and Psychology, J.R.A.I.* (1924).

[4] C. G. Seligman, *Melanesians of British New Guinea* (1910).

African Cases.—Again in Africa, where the evil side of magic is so prominent, it also has its beneficial side. Many events bring a curse or *thahu*. The consequences of the *thahu* are severe. Many of the breaches of custom producing *thahu* may seem to us ridiculous or hampering, yet Mr. C. W. Hobley notes that in about one-third of the instances the *thahu* is brought upon the offender, or brought upon a third party, by the intentional act of the offender, who "goes about with the burden of the misdeed on his conscience, and this worries him so much that he gradually gets thin and ill. . . . It therefore ends by his confessing to the elders and begging them to free him from the curse."[1]

Practical Suggestions.—In order to save the backward races from extinction and enable them to adapt to new circumstances two courses seem advisable: (*a*) that all government servants, and others—especially missionaries—coming into direct contact with natives should take as part of their preparatory studies a course in anthropology; (*b*) that every government should appoint trained anthropologists, in order to make detailed investigations and to act, when needed, as advisers to the administration. Each of these plans has its definite sphere of usefulness, and calls for further consideration.

Training–Anthropology.—Apart from a degree in anthropology, which as matters stand at present it is idle to expect more than a small minority to possess, the preparatory course in anthropology may be of two kinds: a six to twelve months' course at one of the universities—actually three academic terms—in which, besides the social anthropology which is of prime importance from the administrative standpoint, a certain amount of technology and physical anthropology will also be taught. If three terms be taken the course will in fact be, or approximate to, that required for a diploma in anthropology. Such a course, if more stress than is sometimes the case be laid upon practical difficulties and details, is no doubt excellent in those few instances in which a man has already a strong, almost a "natural" interest in anthropology; but this plan yields disappointing results when applied as hitherto to men who have had no foreign experience.

Better results appear to be obtained by the plan applied to the preliminary training in native modes of thought of the men selected by the Colonial Office as African civil servants. A course, known as the Tropical African Services Course, gives an intensive training for two six-weekly periods, with a short holiday between them, in law, accounts, tropical products, tropical hygiene and sanitation, ethnology and the principles of African languages. Less than a dozen lectures are given in ethnology, but these have been carefully thought out to show the special characteristics of savage—especially African—thought, and the practical difficulties which the beginner will have to face, the actual syllabus being roughly as follows:—

Some fundamental conceptions; Definitions; Race and Language; Methods; The Classificatory System and Clan Organisation; Awe; *Mana; Taboo;* Magic; The Cult of the Dead, its simple and more complex manifestations; Developments in the Higher Religions; Heroes; Divine Kings and Gods; Animism; Polytheism; Persistence of both beliefs in the higher cultures, and their importance in the more advanced religions; The relation existing between man and animals; Totemism; Animal Cults; The part played by occupation and environment in the expression of religions; Migrations and cultural contacts; The fusion of peoples and the formation of subraces; Some social and religious complexes.

Experience shows that a certain small number of men will be sufficiently interested to study the tribes they live among and to record their habits and customs, or at least to keep in touch with their teachers.

A further development is for the Colonial Govt. to pay the expenses (fees and sustenance allowance) of men with administrative experience who are keen enough to spend two to four months' leave working intensively at anthropology at one of the universities. Few have so far availed themselves of this plan, yet such are their knowledge and keenness that this scheme is likely to prove of the utmost value both administratively and scientifically, one feature of special importance being that such students have a knowledge of at least some native language, and so are in a position to apply the technical knowledge they have gained directly on their return to Africa.

In France, the *Institut d'Ethnologie* and the *Facultés et Établissements Publics d'Enseignement Supérieur* of the University of Paris provide instruction in the various branches of ethnography and linguistics, having special regard to the French colonies. Instruction is given in the languages of the native populations of the French possessions, Arabic, Berber, the Sudanese languages, Malagasy, as well as the more important languages of the Far East, Siamese, Annamese and Cambodian. The social, family and religious organisation of Islam and the social habits and religious beliefs of the natives of the French colonies are described and compared by a band of experts of European reputation. In Austria, instruction in languages and, to a lesser degree, in ethnology, is given to missionaries at the Missionary College of St. Gabriel, near Vienna.

Professional Anthropologists.—The appointment of professional anthropologists stands on a different footing. No arguments need be employed in favour of their administrative and scientific value. The ordinary official has neither the leisure nor the training, even if he has the desire, to make intensive investigations, and as time goes on and means of communication improve, and his journeys take place increasingly by car, he will have less and less opportunity of meeting his people unofficially and studying them at first hand. A further difficulty that stands in the way of the administrative official is that the native knows that his attitude to many customs such as human sacrifice, cannibalism and black magic must be hostile, and however sympathetic he may be he is still regarded as the man in authority. The anthropologist stays at native villages remote from government headquarters, and, once he has been able to gain the confidence of the people and let them know that his only object is to learn, one of the chief obstacles to obtaining reliable information will be removed. Anthropology as a profession presents a vicious circle. There are few men ready to become government anthropologists, though the machinery for training them exists at our universities. Men are not trained because there are no prospects; and then, when opportunities offer, there are insufficient candidates available. Should it be possible to anticipate a regular demand the men would soon be forthcoming.

Encouragement to anthropological research has been given by the Sudan Govt.; the Gold Coast and Nigeria have appointed as anthropologists officers who had qualified by taking courses in anthropology. There is a trained government anthropologist in Papua, and chairs in Anthropology have been founded in the Union of South Africa and at Sydney, where special training is provided for administrative officers in Papua. Such action shows the trend of enlightened opinion, but the advantages that anthropological knowledge offers are appreciated only in minute proportion in comparison with needs and opportunities. All governments have their experts in geology, botany, agriculture and zoology in its many branches: it is a strange paradox that so often man alone should be unstudied.

Physical Problems.—Turning to the physical side, it may be useful to recall the old saying, "God made the white man, God made the black man, but the devil made the mulatto," if only to consider how far this proverb embodies a truth, and, if it does, how the facts are to be faced in practice. There are broadly two types of racial combination. In the first, the races coming together are so far apart as to make hybridisation a real breaking down of the inherent characters of each, while in the second the fewer differences present offer only a moderate variability as a basis for recombination and selection which may be quite desirable. The latter, socially constituting the "melting pot," is perhaps best represented in history, and can best be appreciated anthropologically by a study of the *Völkerwanderungen*, with the broad result that an outburst of vigour and capacity is found to follow the mixture of peoples belonging to the same great racial groups. From the political standpoint this form of miscegenation has become of increased importance since the opening of the 20th century.

Mixed Marriages.—The proverb is intended to apply to moral values, and before accepting it it is necessary to remember that such children are almost invariably relegated to the inferior race (in practice, the mother's) for their upbringing, and so are ocially and morally at a grave disadvantage, except where a ufficient number of mixed unions occur, when a hybrid community, with its own social habits and values, is established, llowing a fair estimate to be formed of the physical and mental ualities of its members.

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[1] C. W. Hobley, *Bantu Beliefs and Magic*, p. 142 (1922).

The Reheboth Community.—The only all-round study of such community is that of Prof. Eugen Fischer of the Reheboth ommunity of southwest Africa.[1] This consists of the descendnts, some 150 in number, through five or more generations, of he hybrid offspring of a group of trek Boers and Hottentot women, and includes the offspring of a number of unions with members of the parent races. The genealogies are not always asy to follow, but the Reheboth bastards show extreme variability, and are divided into " European," "Hottentot " and " Inermediate " groups. They are a strong, healthy and fruitful people, taller than either parent race, *i. e.*, they show a common ndication of hybrid vigour. There is no predominance of heritage from either race, but the inheritance of facial characters and colour is described as alternate, and in spite of the three groups there is no special tendency for the inheritance of groups of characters the unit elements of which are combined in either parent race.

Psychologically the most important observation is that the Hottentot mentality predominates; there is neither European energy nor steadfastness of will. Further, though several subects show a fairly high degree of intelligence, the Bastards live entirely in the present; they are typically *Augenblickmenschen*, while this character is not compensated by any special power of imagination or in the arts and crafts, in which they are distinctly weak.

Other Groups.—As instances of other hybrid groups, with their own adequate social organisation, certain Arab tribes of the Sudan carrying much black blood, the mixed European-Chinese population of the Straits Settlements, and the negro-Amerind hybrid population of Guiana may be added. Owing to lack of precise knowledge of the building up of these groups little of importance can be said on the physical side, for terms having no precise connotation are used; *e.g.*, it is obvious that there is a vast difference genetically and socially between the tall dolichocephalic Dinka and the short mesaticephals of the Bahr-el-Ghazal, though both would be classed as " negroes " by Arabs and Europeans; while with regard to the Arab stocks there can be no certainty whether any particular strain carries Armenoid blood. All that can be said at present is that the members of these tribes appear to have adapted themselves admirably to their mode of life, which is predominantly Arab, socially, economically and religiously, and that the majority of individuals appear to present an intermediate type with regard to two of the most easily observed characters, namely skin colour and breadth of nose, though striking individual variations occur, *e.g.*, a " black " skin may be associated with a face and nose almost typically Caucasian. Further, darkness of skin tends to be predominant, and there are certain families in which this tendency is so marked that it would perhaps be fair to speak of these as exhibiting dominance in the true Mendelian sense. Mentally and morally these tribes are Arab, not negro; thus socially and morally the inferior stock may be said to have been improved by the mixture. How far the Arab has suffered must remain an open question, and whether the improvement may not be in part due to the direct influence of Islam. It is at least worth noting that the reconquest of the Sudan demonstrated the truth of an observation made years before in Arabia by Robertson Smith, namely that not the pure Arab but the mixed Arab-negro population exhibits the quality of religious fanaticism.

In both the other two examples quoted, whatever the physical differences between the races concerned, they stand on equal or more nearly equal level. The mental and physical alertness of the mixed Chinese-White population of Singapore is striking, and they form a definite social class furnishing many highly efficient civil servants and clerks. Generally, Mongolian traits of feature predominated, and it appeared that the Mongolian eye, at least in the F.1. generation, was dominant, as it was in Malay-Melanesian matings observed in New Guinea. It may indeed be found that Mongolian-White matings give particularly interesting, and perhaps desirable, combinations. In one Japanese-White marriage the children (all female) exhibited a high degree of hybrid vigour, considerable artistic ability, and in type approximated to Polynesian; unfortunately, they passed out of observation before maturity, and it can be stated as a matter of experience that five other children, the result of two Japanese-White matings, did not reproduce this type.

With regard to the negro-Amerind mixture of Guiana, there seems no doubt that a definite type has been produced which has largely taken to a special mode of life as boatmen on the rivers, for which it is well fitted, and that this hybrid population exhibits much of the physical efficiency of the negro without his laziness and excitability. For books on the subject see the Bibliography to the article ANTHROPOLOGY and the works quoted in the text. (C. G. S.)

ANTIMONY (*see* 2.127).—Normally, the world's consumption of this metal is not large, and in pre-War years was almost entirely met by the production of a few countries, principally Borneo, France, Austria-Hungary, Asia Minor and, since 1900, China. By the terms of the Peace Treaty of 1919, the larger part of the Austro-Hungarian ore-producing areas was included within the territory of Czechoslovakia, which in 1921 attained an output of 1,573 tons. During the War, belligerent governments became large buyers of the metal for ammunition purposes, principally for the manufacture of shrapnel bullets. The greatest production was reached in 1916, since when there has been a steady decline. The following table compares the production of antimony ore in the principal countries during the years 1913, 1918 and 1923.

Metric Tons

	1913	1918	1923
British Empire			
Australia	1,270	779	518
Other parts	26	55	..
Other Countries			
Austria-Hungary	1,878	..	78
France	4,472	1,650	543
Italy	360	404	660
Asia Minor	240	400	400
China	13,032	18,112	16,383
Mexico	2,340	3,269	482

BIBLIOGRAPHY.—A. W. G. Wilson, *Mining of Antimony Ores in Canada*, Mines Branch, Canada, Summ. Rept., No. 421 (1915); A. M. Sén, *Notes on the Occurrence of Lead, Zinc, and Antimony Ores in Mysore*, Dept. Mines & Geol., Mysore State (1917); A. Gibb Maitland, *The Antimony Deposits of Western Australia*, Mining Handbook, Geol. Surv. (1919); W. Versfeld, *The Base Metal Resources of the Union of South Africa*, Dept. Mines and Ind., Union of South Africa (1919).

ANTIOCH COLLEGE.—Antioch College, an institution of higher education at Yellow Springs, Ohio, is governed by a board of 20 trustees, the president of the college being *ex officio* president of the board. As reorganised in 1921, with Arthur E. Morgan as president, Antioch entered upon a distinctive career that has attracted widespread attention both on the part of the general public and of educationalists. The enrolment is limited to about 600. The course for undergraduates commonly requires five or six years, and leads to the B. S. or A. B. degree. In choosing students, consideration is given to reports on required physical examinations, secondary school records, intelligence tests, life sketches by the applicants and reports of references. The traditional dominant purpose of the American College is the " stimulation and development of those gifts of intellect with which nature has endowed the student." Antioch has endeavoured to restate the proper purpose of the college. According to its philosophy, that purpose is nothing less than the integration of life and its symmetrical development.

In America the college, including the technical school, is becoming recognised as the chief and almost the only ordered means for preparing intelligent young people for life. Students should be concerned, not with scholarship or technical skill alone, but with learning what life means, and how to make the most of it. Antioch holds that there is no single faculty, not even intelligence, which is the chief element of human excellence, or which chiefly needs systematic development. Excellence lies in symmetry, in the development of every part of personality in proper relation and proportion to every other part. Every element necessary to a well-proportioned life should have recognition in a college programme; not simply those which traditionally have been associated with formal education. Specialisation must take its due place as a normal concern of education, but not as the chief concern. Antioch undertakes to make an appraisal of personality and of life, and to determine what programmes will best stimulate and develop all the gifts of personality, always being controlled by a sense of relative values.

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[1] *Die Reheboth Bastards und das Bastardierungsproblem beim Menschen* (Jena, 1913).

The work of the college falls under four main heads; required physical education, a required liberal curriculum, technical or professional training, and part-time practical economic work. Physical education includes periodic physical examinations, necessary corrective exercises, athletics for everyone and a course in personal and social hygiene. Required liberal studies aim to introduce students to all major fields of human interest, rather than to a few special interests, and to be the medium by which significant gains of human knowledge and outlook become the common property of educated men and women. These required courses include two years of English and literature; five years of history, economics and government; one year each of mathematics, chemistry, physics, biology, earth science (a combination of physiography, geology and astronomy); psychology; and a study of scientific method. A year of philosophy is required; and a year of " applied aesthetics," this last an effort to stimulate a sense of beauty, and to direct its application to everyday affairs. " Personal Finance " teaches the rudiments of personal financial management.

These subjects require about half the total classroom time for six years. Elective courses provide advanced work for qualified students. "Autonomous courses," similar to undergraduate seminars, are open to students of proved ability, who pursue advanced work with minimum supervision. There are no required courses in religion. The temper of the institution as a whole reflects the controlling desire to understand the significance of life and to guide conduct by that understanding. Free, critical inquiry is encouraged. All students must take the liberal courses.

Technical and professional courses prepare for business, engineering, scientific research, education, journalism and home and institutional management. They aim at mastery of fundamental principles rather than specialised application. Nearly all occupational programmes include courses in administration and management. The first two years are exploratory, the required liberal work dominating, while the students consider possible vocations. Gradually the occupational lines are defined, first in general, and then in specific callings.

To develop traits not easily reached by classroom work, such as initiative, self-reliance, responsibility, courage and adaptability, and to help practical adjustment to life, both men and women students spend half their time at college and half in practical economic occupations, in alternate five-week shifts. Each working position is continuously filled, one student working while his or her alternate studies. These "co-operative " students work over a radius of 1,000 m., with 150 employers, in a wide variety of callings; the positions being chosen because of their educational value to the particular students. Self-support is incidental, but the students to a large degree themselves meet college expenses. The work develops stamina, helps students recognise and prepare for appropriate callings, acquaints them with practical life, and helps them appreciate professional studies. The alternation allows more intense application to college work, since the students do not grow stale from unrelieved application to books. The " personnel department " furnishes vocational counsel, locates positions, visits students at work, and helps them realise its educational value. Credit toward the degree is given for suitable practical accomplishment. (A. E. Mo.)

ANTISEPTICS (*see* 2.146).—During recent years the study of antiseptics has gone mainly along two lines—to produce more efficient antiseptics for use in the ordinary way by external application, and to elaborate chemical substances which can be injected into the circulation and destroy the infecting microbes. At the same time many studies have been made on the natural antiseptics by which the body rids itself of infection.

Natural Antiseptics.—These exist in greater or less degree in almost every cell of the human body, as well as in most of the secretions. Metchnikoff showed that some cells (phagocytes), and especially the white corpuscles of the blood, could ingest and digest microbes, and Wright discovered that this ingestion or phagocytosis only took place after the microbes had been acted on by the blood fluids. The blood fluids also have a considerable power of destroying or restraining the growth of many pathogenic bacteria (*see* IMMUNITY). Fleming showed in 1922 that the cells and secretions of the human body have a remarkable antiseptic power toward certain microbes by virtue of their containing a ferment which has been called " Lysozyme." Of all the secretions the tears are the richest in this ferment, and it has been shown that human tears, even when diluted six million times, have a markedly destructive action on some of the microbes found in the air—obviously a natural means of protection against infection.

Chemical Antiseptics.—Research has been directed to the action of these on the natural defences of the body, and the body cells are, in general, found to be much more susceptible to the action of these chemicals than are bacteria. If an ordinary chemical antiseptic, *e.g.*, carbolic acid is added to blood infected with staphylococci or streptococci (the ordinary microbes of suppuration), the blood itself has such a power of killing these microbes that with a moderate implantation some 95 to 99% are destroyed; but when the concentration of carbolic acid in the blood reaches 1 in 600 the whole of the natural antiseptic power of the blood is lost and every microbe implanted survives and multiplies. Of course, more concentrated solutions of the chemical will, in addition to killing the blood cells, inhibit or destroy the bacteria and so exert an antiseptic action, but this is only manifest after the natural defences against infection have been destroyed.

Chemotherapy.—The ideal method of using an antiseptic for the treatment of a bacterial infection is to introduce it into the circulation so that it reaches every portion of the infected focus and destroys the microbes. For ordinary bacterial infections this ideal has not yet been attained, but remarkable advances have been made in this direction in certain infections. In 1910 Ehrlich prepared an organic arsenical product which when injected into the body, rapidly destroyed the microbe of syphilis, and this product, salvarsan, together with the more recently introduced substances of similar constitution, has revolutionised the treatment of this disease (*see* VENEREAL DISEASES). Following Ehrlich, Morgenroth prepared a quinine derivative (Optochin) which had a remarkable affinity for the pneumococcus (the microbe which causes pneumonia), while it had little action on other microbes; but unfortunately this substance had certain toxic qualities which rendered it unsuitable in practice. In some other infections, also, drugs have been found which can destroy the infecting agent without exercising any serious toxic action on the human body; notable among these are Emetine in amoebic dysentery (*see* DYSENTERY), and " Bayer 205 " in sleeping sickness. The fact that drugs can be prepared which have a very specific action on one microbe offers some hope that in the near future there will be produced chemicals which will destroy the ordinary disease-producing bacteria without damaging the tissues, and so furnish an easy and certain remedy for the common infections.

Chemical Antiseptics and Wounds.—Prior to the World War the use of antiseptics in surgery had been largely discarded in favour of aseptic methods which aimed at preventing the access of microbes to the wound. During the War, however, it was found that all the wounds were infected with septic microbes, and many antiseptic methods were employed in the hope of destroying these microbes. Briefly, the results obtained were these: none of the antiseptics was able rapidly to sterilise a wound; most of them were without any evident effect on the bacterial infection; those which have appeared to have some influence on the course of the infection had, in addition to their " antiseptic " action on the bacteria, a stimulant effect on the infected tissues, and this probably contributed largely to their success. The popular pre-War antiseptics, such as carbolic acid, iodine and the salts of mercury, were found to be without effect on the progress of an infection, although outside the body, these are powerful bactericidal agents.

Chlorine derivatives obtained great popularity in the form of eusol (hypochlorous acid), sodium hypochlorite (Dakin's fluid) or chloramine-T, a more complicated organic derivative, and this type of antiseptic is still in common use under various trade names. Some of the aniline dyes also are used as antiseptics, and outside the body these are probably the most powerful of all the chemical bactericidal agents. Gentian violet, brilliant green and acriflavine have been largely used, but in all these cases the action on the bacteria is slow and the dyes are rapidly absorbed by the tissues and dressings of the wound. Acriflavine differs from almost all other antiseptics in that it has a more powerful action in blood serum than it has in water, and it was hoped from this that it would prove very effective in killing bacteria embedded in the tissues; this hope, however, has not been fulfilled, although the dye still obtains some popularity in the treatment of certain infections.

Another method of using an antiseptic is to fill the wound with an almost insoluble substance which slowly gives off an antiseptic substance. A good example of this is iodoform, and although this in itself has no power of killing microbes it slowly breaks down in contact with the body fluids and liberates small quantities of iodine, to which the antiseptic action of the iodoform is attributed. This substance, iodoform, used to be very popular in the treatment of septic infections, but it possesses a very penetrating odour and has been largely given up on this account. In addition to its direct antiseptic action, it possesses, in common with some of the chlorine antiseptics, the power of inducing a large flow of lymph from the wound and so aiding the natural defensive mechanism of the body.

Sterilisation.—While antiseptics have not been very successful in killing bacteria in infected tissues in the body, they are invaluable in sterilising apparatus, instruments and infected matter of many kinds outside the body. An infected water supply can be efficiently and economically sterilised by the use of a small quantity of chlorine (*see* WATER, PURIFICATION OF); the infective excreta from cases of typhoid fever and similar diseases can be rendered harmless by treating them with carbolic acid or other similar antiseptic; catgut for use in surgical operations can only be sterilised by the use of chemical antiseptics, and there are innumerable other ways in which these chemicals fulfil their function of destroying bacteria.

BIBLIOGRAPHY.—Medical Research Council, *London, Special Report No. 57. Studies in Wound Infections* (1921). (A. FL.)

ANTWERP (*see* 2.155) had an estimated population in 1923 of 300,000. The decision taken in 1878 to change it from a fortress to a fortified position by the construction of an outer line of forts at a distance of from 5 to 11 m. from the city had been to a great extent carried out by Aug. 1914, though no one of the 17 forts involved in the scheme had been completed. The Belgian Govt. left Brussels for Antwerp on Aug. 17 1914; and three days later the Belgian Army, retiring before Von Beseler's forces, took up a position behind the fortified lines. The bombardment began on Sept. 28 and on Oct. 9 the city surrendered. By that date only about a tenth of the population remained in the city. The damage included the destruction of some 300 houses, mostly in the Marché-aux-Souliers, the Avenue d'Amérique and the suburbs near the forts. On Nov. 19 1918 the King and Queen of the Belgians entered the city in state.

Restoration Work.—After the German evacuation in 1918 the restoration of the city proceeded rapidly. The Zoological Gardens were restocked, various new streets were laid out, a large railway station was built and at the end of 1925 work was begun on a great boulevard to Brussels. More important, however, are the extensions and improvements in the harbour works undertaken after the World War. They include the construction of a canal dock over three miles long which stretches from the old wet dock No. 3 to the bend of the Scheldt at Kruisschans, where it ends in a maritime lock approximately 886 ft. long and 115 ft. wide, with a depth ranging from 33 to 48 ft. The dock itself is maintained at a constant depth of about 39 ft., and is connected with the other docks in the harbour by a channel about 440 yd. long and 110 yd. wide. It was estimated that the lock would be completed by the end of 1926. Further schemes of extension included the construction of wet docks adjoining the canal dock and in 1925 the building of two wet and three dry docks was undertaken. The complete plan was designed to give the port a total dock water area of 1,334 ac. and a quayage length of 28 miles. The necessary railway extensions bring the length of the port railway system up to 500 miles.

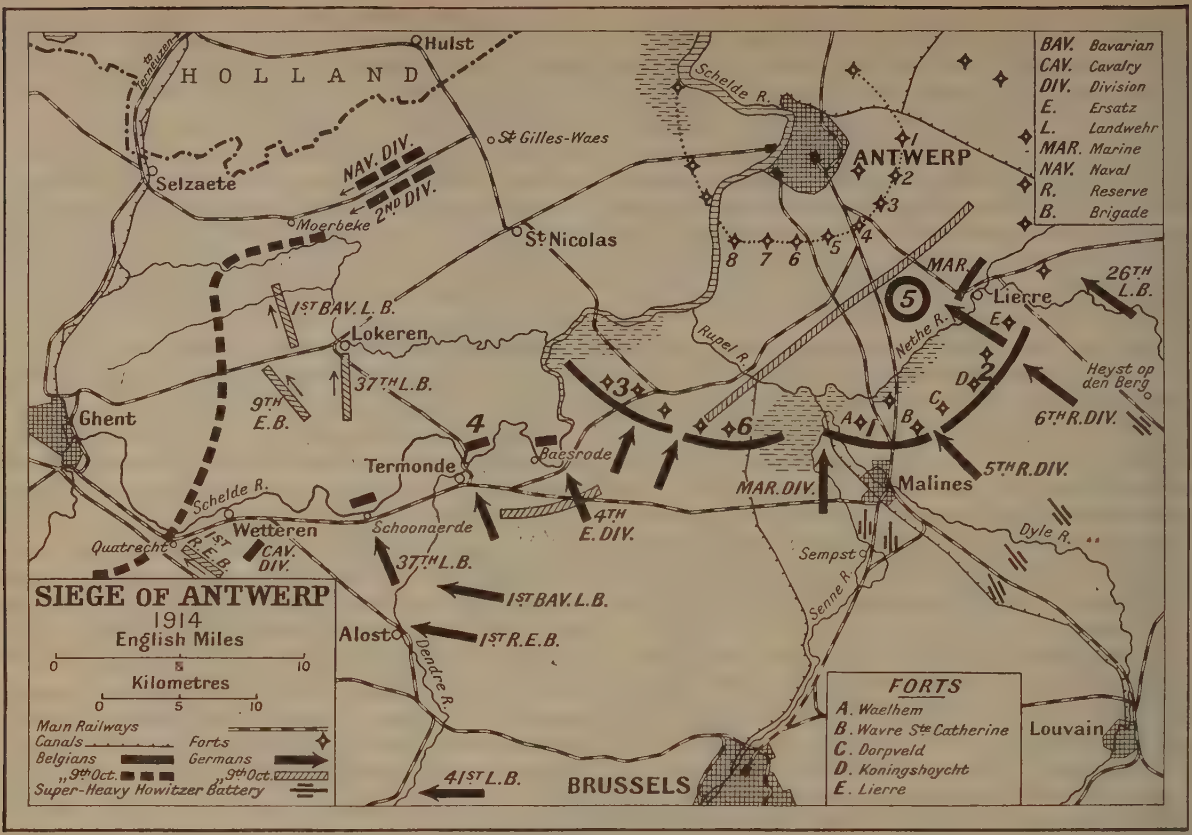
During the German occupation Antwerp remained to all intents and purposes a dead city. From the close of 1918 onwards its trade and industry showed a steady revival, and in 1924 the tonnage of shipping using the port was 17,496,900. The construction of river boats for export to Africa was resumed after the War, and this industry rapidly returned to something approaching its former importance. Shipbuilding proper showed little sign of prosperity, although a good deal of ship repairing was attracted to the port.

ANTWERP, SIEGE OF.—After the Meuse the natural line of defence for the Belgian Army against an adversary from the east is the Schelde and the entrenched camp of Antwerp. As a commercial metropolis Antwerp was an obvious centre for arsenals, hospitals and stores of munitions and provisions, and it became the army's base of operations. By reason of its situation the fortress was also a refuge, if only a temporary one; it was also an excellent flank position for use against the lines of communication of the German Armies operating in the north of France. Through Ostend and Zeebrugge, Antwerp had easy means of communication with England. Under the shelter of Antwerp and the Schelde, British troops could safely land in Flanders, operate in liaison with the Belgian Army, protect the Pas-de-Calais coast with its sea traffic, vital to England, and prevent the Allied left wing from being turned and enveloped.

The Defences Described.—The entrenched camp of Antwerp, as it was in 1914, was the result of two distinct undertakings, (1) those carried out between 1859 and 1870 under the direction of Brialmont, and comprising a line of detached forts placed at about a distance of two to three miles from the agglomeration of buildings and built both in masonry and in earth, and a polygonal enceinte on the outskirts of the city; and (2) those undertaken after 1906, which provided a principal line of defence, composed of 17 forts about 3 m. apart, with permanent redoubts in the intervals. The forts were placed at a distance of 5 to 11 m. from the city proper and were armed with one or two cupolas for twin 15-cm. guns, two cupolas for single 12-cm. howitzers and four or six cupolas for single 7·5-cm. guns. The redoubts had only one 7·5-cm. cupola. Forts and redoubts were constructed entirely of ordinary concrete, with vaults 2·50 metres thick at the crown and surrounded by wet ditches, 33 ft. wide. The old fort line was about to be transformed into an *enceinte de sûreté*, the forts being organised for small weapons and connected by concrete redoubts and a grille.

These extensive works had necessarily to be spread over several years and on the outbreak of hostilities in 1914, not one of the forts planned in 1906 was completed. Some lacked cupolas; others had cupolas without concrete aprons, and these had to be improvised by pouring gravel, iron rods and cement, in some cases sacks of cement soaked with water, or even simple sandbags, round the cupolas. Communications and drainage were not established either inside or outside the forts, neither was the machinery in place. No equipment for fire observation and no observation posts existed and the necessary survey work for firing by the map was incomplete. The substructures and the armouring, constructed to resist the 21-cm. mortar, were not calculated to face 30·5- or 42-cm. projectiles. The total perimeter was 60 m. of which 6 m. were protected by inundations. The defence force numbered only 40,000 men, most of whom had seen no military service for 10 years. The staff was entirely inadequate for the duties.

Operations Begin.—The retreat of the Belgian Army behind the Nethe on Aug. 20 was only temporary. When the German I. Army wheeled through and past Brussels on its way to France, it dropped the III. Res. Corps under Von Beseler, and three Landwehr brigades, to face northward as a flankguard against the Belgian Field Army in Antwerp. Von Beseler took up his position on the line Grimberghen-over-de-Vaert-Aerschot. On


SIEGE OF ANTWERP
1914
English Miles
0 5 10
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Main Railways
Canals
Forts
Belgians
Germans
„9th Oct.
„9th Oct.
Super-Heavy Howitzer Battery
BAV. Bavarian
CAV. Cavalry
DIV. Division
E. Ersatz
L. Landwehr
MAR. Marine
NAV. Naval
R. Reserve
B. Brigade
FORTS
A. Waelhem
B. Wavre Ste Catherine
C. Dorpveld
D. Koningshoycht
E. Lierre
HOLLAND
Hulst
to Terneuzen
Selzaete
St Gilles-Waes
NAV. DIV.
2ND DIV.
Moerbeke
St Nicolas
Schelde R.
ANTWERP
1
2
3
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MAR.
26TH L.B.
Lierre
Nethe R.
Rupel R.
Heyst op den Berg
6TH R.DIV.
5TH R.DIV.
1ST BAV. L.B.
Lokeren
37TH L.B.
9TH E.B.
Ghent
4
3
6
Baesrode
Termonde
MAR. DIV.
Malines
Scheldt R.
Wetteren
Quatrecht
1ST R.E.B.
CAV. DIV.
Schoonaerde
4TH E. DIV.
Sempst
Dyle R.
Senne R.
37TH L.B.
1ST BAV. L.B.
Alost
1ST R.E.B.
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Aug. 25 and again on Sept. 9 the Belgians, in co-operation with the Allied attacks on the frontiers and the Marne, made sorties from Antwerp and attacked his lines. On the second of these occasions his situation was at one time critical. A third sortie was being prepared toward Sept. 20, when reports began to come in of important German movements and of a quantity of very heavy artillery on the roads in the region north of Brussels. Falkenhayn, acting as chief of the general staff, had given the order to carry the fortress and the powerful *matériel*, which had laid in ruins the forts of Liège, Namur and Maubeuge, was being established in position between the Senne and the Grande Nethe, from Sempst to Heyst. The total artillery strength of the Germans before Antwerp was 186 pieces of field artillery, 48 long guns of 10, 13 and 15 cm., 120 howitzers of 15 and 21 cm. and 13 super-heavy howitzers of 30·5 and 42 cm.

Von Beseler's army group comprised at that time the 37th Landwehr Bde. between Alost and Termonde, where it had served in flank guard since Sept. 14; the 4th Res. Div. between Termonde and the Willebroeck Canal; the Marine Div. between this canal and the Dyle about Malines; the III. Res. Corps from the Dyle to the Antwerp-Aerschot railway and the 26th Landwehr Bde. north of Aerschot, with a group furnished by the III. Res. Corps further to the right front at Westerloo.

On Sept. 27 the Belgian Field Army was distributed as follows: The 1st and 2nd Divs., between the Senne and the Nethe, from Willebroeck to Lierre, with the 5th Div. in reserve north of the Nethe; the 6th and 3rd Divs. between the Senne and the Schelde; the 4th Div. at Termonde and the Cavalry Div. about Alost–Wetteren to cover the communications between Antwerp and the sea.

The German Bombardment.—On the morning of the 28th the German bombardment was let loose along the whole front between Termonde and Lierre. It at once became clear that the attack was being concentrated on the south front of the fortress. Von Beseler had not the necessary forces to prosecute a siege on another side while still covering the communications through Brussels against a sortie. Trusting in the proved powers of his weapons of attack which, installed beyond the range of the Belgian gun, could fire as deliberately as on an experimental range, he decided to spare his infantry, to destroy the forts and throw into confusion the lines of defence by gunfire, controlled by aircraft. The results attained, he proposed cautiously to advance his infantry and gain a footing in the shattered forts and pulverised lines of defence.

The bombardment was continued for four days with clocklike regularity. It was directed against four forts (Waelhem, Wavre Ste. Catherine, Koningshoycht and Lierre) and the spaces between them. The concrete was inferior in quality to that of Liège and Namur, and galleries were pierced, men's quarters destroyed, cupolas destroyed, jammed or made inaccessible; powder magazines blew up, fires broke out and the air in the shelters became unbreathable. Forts and trenches had been reduced to rubbish heaps by the time that the enemy, on Oct. 1 at 5 P.M., delivered his assault. Resistance was offered everywhere except at Wavre Ste. Catherine, where the garrison had been driven away by the flames.

The bombardment recommenced on Oct. 2, increasing in precision, and the inevitable happened. The Dorpveld redoubt and Fort Waelhem, which had been reduced to the last extremity, now surrendered. The Tallaert redoubt blew up; the Koningshoycht and Lierre forts, which had been ruined, were evacuated. On the night of Oct. 2–3, and on Oct. 4, all the defence troops were transferred to the north of the Nethe from Waelhem to Lierre. The Belgian troops now began to be seriously disheartened. For a fortnight past the race to the sea had been in progress in France, the battle front had reached Arras and Béthune and fresh German masses were traversing Belgium in a westerly direction. The question was, would the Allies win the race in time to join hands with the Belgians on the Schelde? This junction was essential, even if it entailed the abandonment of the fortress. The King was strongly in favour of holding the fortress until the last extremity, in order to keep occupied the German troops and material now concentrated before it, and also to gain time for the formation of a Franco-British-Belgian front on the Dendre or on the Schelde, leaning on the Dutch frontier.

Assistance from Britain.—Mr. Winston Churchill, at that time First Lord of the Admiralty, fully realised the rôle of the fortress as the bulwark of the Pas-de-Calais. When he heard that the Belgian Govt. was to leave the city he came to take stock of the situation. The King informed him personally of the task he proposed for the Belgian Army on the extreme left of the Allies. Entirely in agreement, Mr. Churchill returned to London to push forward the dispatch of English and French reinforcements to Antwerp and, above all, to Ghent.

The immediate result of Mr. Churchill's intervention was the arrival at Antwerp on the evening of Oct. 3 of a brigade of 2,000 men of the British Royal Naval Division. The appearance of these, the first Allies the Belgian soldiers had set eyes on during the two months of the War, roused enthusiasm, but unfortunately this assistance could be no more than a moral stimulus. Meantime, Von Beseler was bringing up his heavy batteries to crush Fort Kessel, while his infantry was making its way slowly into Lierre, being held up on the northern boundary of that town by the fire of the marine brigade on the fifth. To the south of the town four German battalions crossed the Nethe under cover of the bombardment and on the night of Oct. 5–6 the 5th Belgian Div. attempted to push them back into the river.

This counter-attack, with bayonets fixed and unloaded rifles, reached the Nethe at one point and caused the enemy serious alarm for a moment, but the fatigue of the attacking troops and the superiority of the German artillery rendered any permanent success impossible. In the course of the day (Oct. 6) the remainder of the 1st, 2nd and 5th Divs. and the British Marine Bde. fell back to the line Contich–Bouchot. Meantime, along the Schelde, the enemy was becoming more and more agressive at Baesrode, Termonde and Schoonaerde, where the 6,000 men of the 4th Div. lay extended on a front of 18 miles. In the region of Lille the enemy's right wing was only 30 m. from the sea, whereas the distance from the Nethe to Nieuport was 85 miles. It was essential to save the Belgian Army from being surrounded, and the King decided that the field troops should cross the Schelde on the night of Oct. 6–7 and march to join the British 7th and 3rd Cavalry Divs. then landing at Zeebrugge and Ostend, which were to move to Ghent in conjunction with a brigade of French marines. The decision came just in time, for on Oct. 7 the Germans forced the Schelde at Schoonaerde and pushed on toward Lokeren.

The City Abandoned.—The continuation of the defence was entrusted to Gen. Deguise with the garrison troops, the 2nd Div. and the British Naval Div. which had been brought up to 10,000 men. The general placed these two divisions on the line of forts 1 to 8, where throughout the days of the 7th and 8th they stoically endured the usual bombardment. An attempt to intimidate the governor by the bombardment of the city had no effect. The departure of the field army, on the other hand, did affect the morale of the population and the fortress troops. The British Admiralty did not want the Naval Div. to be surrounded and telephoned for it to be withdrawn, whereupon Deguise decided to withdraw the 2nd Div. also, to abandon the city and to continue the defence on the left bank. But the fortress troops had now reached the limit of their endurance and the general, knowing the Germans to be near Lokeren, authorised officers and units to leave the fortress and rejoin the field army. Meanwhile the civil authorities, seeing the city empty of troops and threatened with destruction by the fires which had been started by the bombardment, sent a deputation to Von Beseler to save the city from a disaster which could have no military advantage. The fortress was empty, the works out of action; on Oct. 10 the governor signed the capitulation. (*See* BELGIUM, INVASION OF.)

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(R. VAN O.)

AOSTA, EMANUELE FILIBERTO, DUKE OF (1869–), Italian general, was born Jan. 13 1869, the eldest son of Prince Amedeo of Savoy, Duke of Aosta (*see* 1.804), and thus a cousin of Victor Emmanuel III. He adopted a military career, but this was interrupted by a serious illness and when the World War broke out he was on the retired list. Later, however, he was appointed to the command of the III. Army. After the War the rumour of the possibility of his being proclaimed king in place of Victor Emmanuel III., owing to the latter's reluctance to adopt Fascism in its entirety, gained a certain amount of credence in foreign circles.

APARTMENTS: *see* ARCHITECTURE.

APPENDICITIS (*see* 2.217).—Experience during the period 1910–26 has shown quite definitely the extent to which inflammation of the appendix is prevalent.

Many valuable lives are needlessly lost from appendicitis every year, chiefly due to ignorance and delay in diagnosis and treatment. The significance of abdominal pain, especially in children, is not sufficiently recognised by the public. Time is wasted on purgatives and sedatives, both of which do much harm, for the former precipitate perforation and hasten the spread of the disease; and the latter, by relieving pain, mask the symptoms and often lead to fatal delay in treatment. No one can tell whether an attack is going to subside under medical treatment or proceed with great rapidity to a fatal issue. The risk of immediate operation is practically negligible, whereas that of waiting is great and uncertain. The experience of surgeons all over the world shows that there is practically no mortality from operations for appendicitis undertaken within 12 or even 24 hours of the onset of the attack, whereas the death-rate for operations delayed until the third or fourth day is about 10%.

When the inflammation is limited to the appendix there is little risk in operation, but the complications of the disease are very grave. Fortunately they take time to develop and therefore can be avoided by operating sufficiently early. There are many different degrees of appendicitis such as: (1) *appendical colic*, due to intermittent obstruction of the appendix and usually associated with no signs of inflammation, such as fever: (2) *acute appendicitis*, which varies in degree from the mildest inflammation to gangrene or mortification with perforation of the appendix, causing local or generalised peritonitis: (3) *chronic appendicitis* or "*appendix dyspepsia*." Here chronic inflammation of the appendix leads to irregular spasm and flatulent distension of the stomach and intestine with nausea and vomiting, a condition often mistaken for gastric or duodenal ulcer.

Symptoms.—The most important symptom of acute appendicitis is the sudden onset of severe pain in the middle of the abdomen, settling later in the right flank, above the groin. Here a medical man, who should be called at once, will find superficial and deep tenderness and rigidity and fixation of the abdominal wall, the significance of which is unmistakable. When the appendix is misplaced, so are the local signs. The pulse and temperature usually rise, but unfortunately they may sometimes remain normal, or suddenly fall below it, in grave cases. A falling temperature and a rising pulse are of the greatest significance. Other symptoms are nausea and vomiting, a flushed face and furred tongue; a rigor is not uncommon. Instead of constipation there may be diarrhoea and irritability of the bladder from spread of the inflammation. Either local or general swelling of the abdomen is usual in late cases and sometimes an abscess may point and even discharge on the skin or into the bowel.

Diagnosis.—This depends chiefly upon the detection of local tenderness and rigidity in the right flank and the presence of fever and a quickening pulse; indiscretions of diet, although they may cause vomiting, do not give rise to these signs.

Palliative Treatment.—When symptoms suggestive of acute appendicitis develop it is of vital importance to put the patient to bed and give him nothing but water until the diagnosis has been made and an operation can be performed. When, for some reason, an operation cannot be performed, complete rest and careful diet must be continued until the attack has subsided.

Only liquids are given by the mouth, and purgatives and sedatives are entirely avoided; but local sedatives, such as moderate heat, may be applied to the abdomen.

Operation.—It is a common mistake that the patient needs elaborate preparation for an operation for appendicitis, but fortunately this is not the case, and the rapid progress of an acute attack will not allow of it.

A valvular incision, which should leave no weakness of the abdominal wall, is made over the site of the appendix; the latter is removed and the wound completely closed except in late cases, when abscess or peritonitis has developed, in which temporary drainage may be necessary. In very late grave cases with abscess formation, the surgeon has sometimes to be content with mere drainage, deferring the removal of the appendix to a later date. Appendicitis usually recurs with increasing frequency and severity, therefore it is generally agreed that when an attack has subsided it is wise to remove the appendix soon, in a quiet interval, in order to prevent the recurrence of a grave or fatal attack. It is, however, a foolish policy to defer operation when an opportunity offers of having it performed early in an attack, for under medical treatment or deferred surgical treatment the mortality is about 10%, whereas the risk of early operation is certainly under 0·5%.

See W. H. Battle and E. N. Corner, *The Surgery of the Diseases of the Vermiform Appendix* (1911). (R. P. R.)

APPONYI, ALBERT, Count (1846–), Hungarian statesman (*see* 2.226), was from 1906–10 Minister of Education in the Wekerle Cabinet. He succeeded Kossuth as president of the party of Hungarian Independence, and advocated universal suffrage. At the outbreak of the World War he adopted the standpoint of a "truce of God" with regard to all internal dissensions. He retired into private life after the outbreak of the revolution of Oct. 1918. In 1919 he was elected as a non-party deputy to the National Assembly and was head of the Hungarian peace delegation in Paris. He became a member of the League of Nations Union and in 1924 and 1925 represented Hungary at the Assemblies of the League of Nations. He stands above rather than outside party politics, and his authority as the "Grand Old Man" of the nation carries unusual moral weight.

His published works include *Recollections of a Statesman* (1912); "Die rechtliche Natur der Beziehungen zwischen Österreich und Ungarn" in the *Osterreichische Rundschau* (vol. 28); in Hungarian: *My Memoirs: 50 years*, vol. 1; *Youth, 25 years in Opposition* (1922). Two volumes of parliamentary speeches have also been published relating to the 25 years' activity mentioned in the first volume of the Memoirs.

APPRENTICESHIP (*see* 2.228).—In Great Britain the gradual decline of apprenticeship, which had become apparent in the early part of the century and was due mainly to the increasing use of automatic and semi-automatic machinery, was accelerated during the War. All available boy and girl labour was employed on the mass production of munitions of war, and in many of the skilled occupations the recruitment of boys and girls as apprentices practically ceased, while the training of boys who had become apprentices was cut short by military service or prejudiced by the fact that skilled journeymen, working under great pressure, had no time to instruct.

Reconstruction Scheme.—The consequent shortage of apprentices might have been accentuated by the loss of those apprentices whose training had been interrupted by military service had it not been for the interrupted apprenticeships scheme, under which the Ministry of Labour paid to the employer a grant of one-third of the journeyman's weekly rate to enable the apprentice to receive, during a reduced period of renewed apprenticeship, approximately the wage which he would have been earning if he had been continuously employed. The co-operation of organisations of employers and workpeople was secured and appropriate schemes were issued for each industry. Thus some 45,000 apprentices, who might otherwise have drifted into unskilled or semi-skilled employment or have remained unemployed, completed their training and qualified as journeymen, while it is estimated that an equal number of apprentices was re-absorbed under schemes similar to the government scheme but not assisted by a government grant.

Post-War Difficulties.—Since the War the recruitment of apprentices has been handicapped by trade depression. Many employers have been reluctant to engage apprentices when it has not been certain that there would be work on which to train them or when for economic reasons it was essential that the whole time of the skilled worker should be spent on productive work. On the other hand, boys have been deterred from binding themselves as apprentices by the marked rise of wages of the "sheltered" semi-skilled or unskilled worker, who might be receiving as much or more than the unsheltered skilled worker; by the high rate of unemployment in certain of the skilled trades; by the inability of his parents to support him on the low wages usually paid during the early years of apprenticeship; or by the urgent need in the home for the high immediate wage which can frequently be obtained in comparatively unskilled occupations which offer no "prospects."

Industrial Organisations.—The possibility of a shortage of skilled workers due to a decline in the number of apprentices has not been overlooked by employers' and workers' organisations and such joint industrial bodies as Joint Industrial Councils. Certain of the more important industries are taking steps to augment the supply of apprentices, while special schemes for the training and employment of apprentices have been prepared by a number of joint industrial bodies. A definite attempt to increase the number of apprentices in the building industry in connection with housing schemes has been made by the National Building Industry Committee, a joint body which works in co-operation with the Ministry of Health.

New Conditions and Problems.—It is difficult to forecast the future of apprenticeship in Great Britain. The increasing use of "mass production" methods of manufacture will, no doubt, reduce the proportion of skilled men required, but the skilled men who are employed when such methods are used must be highly trained, and in most industries the view is held that this training can best be given under a system of apprenticeship.

There is a tendency in certain industries, however, to provide for the recruitment of skilled workers by a carefully regulated system of "up-grading" selected semi-skilled workers instead of by a system of apprenticeship. Possibly in the future the two systems will be found side by side. But the following important industries still look to apprenticeship to supply most of their future skilled workers:—Printing and bookbinding, engineering and ironfounding, shipbuilding, building, furniture, electrical contracting, vehicle building, gold, silver and jewelry manufacture, hand-sewn boot and shoe making and repairing, surgical and optical instrument making, heating and domestic engineering, dress and mantle making, millinery and the manufacture of women's dress generally.

Change of Status.—During the last generation a change has taken place in apprenticeship itself. The apprentice who lived with his employer's family had largely disappeared in the latter half of the 19th century and his place had been taken by the "indentured" apprentice who was bound by written articles. In his turn the indentured apprentice is slowly disappearing. Many of the so-called apprentices in Great Britain to-day are not indentured; they may be employed under written agreements other than indentures or merely in accordance with a "verbal understanding." A boy may work with journeymen and may be recognised by them and possibly by the trade union as an "apprentice," but the employer may not be under any definite obligation to the boy. Broadly speaking, a young worker is regarded in Great Britain to-day as an "apprentice," if, during the early years of his employment, he receives wages which are definitely less in amount than the worth of his services and concurrently obtains from the employer such training as will enable him to qualify as a journeyman.

Attitude of Employers.—Since 1910 the number of employers in Great Britain who take definite steps to encourage the technical training of apprentices has steadily increased and at the present time (1926) there are believed to be in England and

Vales alone at least 70,000 learners and apprentices who are ided or encouraged by their employers to pursue courses of nstruction. The methods used vary from industry to industry nd from firm to firm. The "sandwich" system may be adopted nder which the apprentice or learner spends alternate periods in ne works and in the technical school or university faculty of ngineering: young workers may be released for one or two alf-days a week in order that they may attend classes; appren- ces may be permitted to leave work early in order that they nay attend technical schools: classes may be established in the orks by the employer with or without the assistance of the ocal education authority: or an apprentice supervisor may be ppointed to ensure that apprentices receive proper instruction. Iany joint industrial councils have education committees or pprenticeship committees which concern themselves with the ndustrial training of apprentices, while some trade boards have repared schemes for the training of their young workers.

GOVERNMENT POLICY

Great Britain.—The policy of successive British governments nce the conclusion of the War has been to leave each industry determine questions of apprenticeship in accordance with its wn needs but to encourage consideration of the subject by rganisations of employers and workers and by joint industrial rganisations.

Other Countries.—In other countries there has been a tendency n the part of the state to intervene and a disinclination to leave uch an important matter as the recruitment and training of otential skilled workers to be settled by the industries them- elves. In New Zealand and in certain of the Australian states tatutory awards are made, closely regulating the conditions nder which apprentices may be engaged and employed. A bill present under consideration in New Zealand enlarges the owers of the state and lays emphasis on the need for relating pprenticeship and technical training, whilst similar proposals re being considered in South Africa. In Germany the Industrial ode regulates generally the employment of apprentices and cludes a provision determining the number of apprentices that ay be employed by an individual employer, but detailed regu- tions are left to industrial organisations. In France and in ost other European states apprenticeship is regulated to a reater or less extent by legislation, which has regard primarily the importance of technical training. Legislation proposed in rance in effect compels employers who do not make reasonable rovision for the training of their apprentices to contribute to a nd for the support of technical training provided by the state. n Sweden comprehensive legislation regulating apprenticeship under discussion.

In the United States, however, apprenticeship as understood Europe has largely decayed; questions of apprenticeship are etermined by the custom of the trade or in accordance with the ews of individual employers having regard to the internal rganisation of the industry from the point of view of methods production; increasing emphasis is being laid on the need for aining young workers in the quickest and most efficient manner ossible, and rapid strides have been made in the provision of chnical instruction, inside or outside the workshop, for appren- ces and other young workers. (*See* TECHNICAL EDUCATION.)

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AQUEDUCTS (*see* 2.240).—In the domain of pressure conduits r water supplies, cast-iron pipe continues to be most in favour Great Britain on account of its durability, but the trend of ecent development is towards the substitution of riveted or elded steel for cast iron especially for medium and large sizes, nd for situations where settlement of the ground is expected. he advantages of steel are its lightness, reliability, water- ghtness and security from cracking, and experience now shows hat well-coated steel pipe when buried in normal soil will endure r many years. Examples exist of pipes about $\frac{3}{16}$ in. thick hich are still in use after 40 years service.

Pipe Linings.—Efforts have been directed for some time by manufacturers towards the application to steel and iron pipes of an interior lining which will permanently adhere and prevent rusting, pitting and incrustation. The bases of two such linings, which are put on by a process of centrifugal spinning, are Portland cement and bitumen, and experience is now being accumulated as to their endurance under various conditions.

The new pipe-line[1] from Lake Tansa for the Bombay Water Supply is a good example of riveted steel construction for pipes of 57 in. to 72 in. diameter under moderate head. The pipe is formed of single plate rings $\frac{3}{8}$ in. thick and 7 ft. 4 in. long, alternately in and out, with the longitudinal joints double riveted and circumferential joints single riveted.

Hydroelectric Aqueducts (*see* HYDROELECTRIC ENGINEERING).—The greatest developments in aqueduct construction in recent years have taken place in connection with hydroelectric power supply schemes. Almost every class and size of conduit is concerned, from enormous open canals, lined and unlined, to tunnels and great pipes of steel, wood or concrete for moderate pressures and smaller pipes of steel for high heads up to over 5,000 feet.

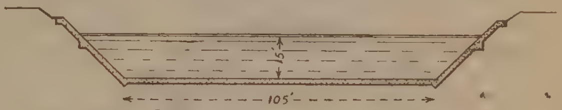

Fig. 1. *Basse Isère Canal*

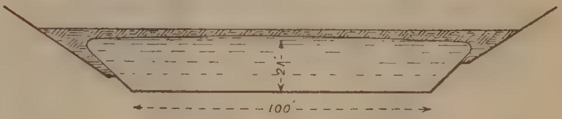

Fig. 2. *Humber Arm Canal*

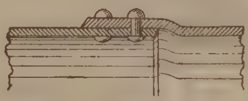

Fig. 3.
Spigot & Socket Riveted Joint

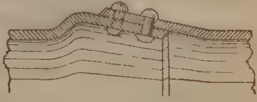

Fig. 4.
"Bump" Joint

Canals.—A concrete-lined canal for conveying water to the low head power station at Beaumont Monteaux on the Basse Isère, France (fig. 1), is 105 ft. wide on the bottom with 15 ft. maximum depth of water, side slopes of 1 to 1 and cement concrete lining 12 in. thick on floor and sides, finished with a surface rendering of cement mortar $1\frac{1}{4}$ in. thick. The lining is laid in sections with a transverse expansion joint every 23 feet. The maximum flow is 10,000 cusecs and maximum average velocity $6\frac{1}{2}$ ft. per second. The fall is 1 in 6,400.

At the Humber Arm Hydro-electric Works of the Newfoundland Power and Paper Co. there is a large unlined canal in conjunction with seven large wood-stave and steel pipe-lines for a maximum head of 250 feet. The canal has a base width of 100 ft. and water depth of 21 ft. for a minimum winter flow of 5,000 cusecs. A typical cross-section is shown in fig. 2, which also indicates the restriction of water area expected in winter from the formation of thick ice. The lessened water area and increased wetted surface together give rise to serious reduction of capacity which must be allowed for in regions such as this, which are subject to severe and prolonged frost. The gradient is 1 in 7,450 and the maximum velocity of flow is about 3 ft. per second. The dimensions of this unlined canal should be compared with those of the lined canal at Beaumont Monteux designed for a flow twice as great.

Wood Stave and Riveted Steel Pipes.—Each of the seven pressure pipe-lines is formed of an upper part in wood-stave construction and a lower part of steel riveted construction. The wood-stave portion is used up to a maximum head of 167 ft. and is 9 ft. 6 in. diameter with machined staves $3\frac{1}{4}$ in. thick in widths of $5\frac{1}{2}$ in., and having mild steel bands $\frac{3}{4}$ in., $\frac{7}{8}$ in. and 1 in.

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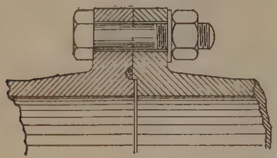
[1] *Engineering*, Oct. 7 1924.

diameter at spacings varying from $2\frac{1}{4}$ in. to 8 in. It is carried on piled foundations at intervals of 12 ft. 6 in., the direct support being on curved cradles of reinforced concrete formed over the piles (fig. 8).

The riveted steel portion has diameters of 9 ft. 6 in. and 8 ft. 6 in. and thickness from $\frac{9}{16}$ in. to $\frac{13}{16}$ inch. The maximum flow and velocity are 550 cusecs and 9.7 ft. per sec. respectively. The pipe is formed in rings 8 ft. long alternately in and out, each ring being made with two plates and having two longitudinal lap joints. The pipe-lines are protected with a bituminous coating and surrounded with earth as protection against freezing.



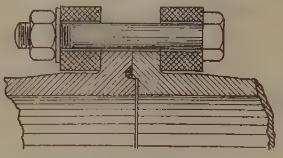


Fig. 5. *Flanged & Bolted Joints.* Fig. 6.

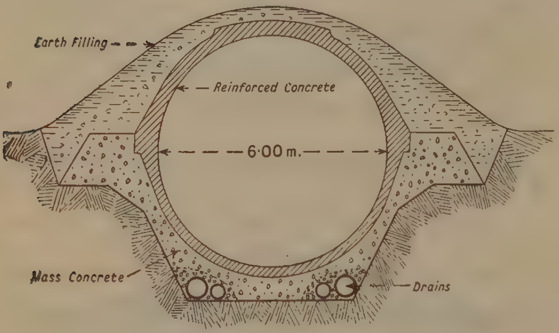


Fig. 7. *Drac-Romanche Conduit.*

Covered Conduits and Tunnels.—Free-flowing contour conduits, where practicable on steep hillsides, are usually made rectangular in concrete or reinforced concrete and covered over as protection against slides and rock falls. Tunnelling is, however, often preferred on the score of shorter distance with less loss of head, less risk of accident and smaller cost of maintenance. Free-flowing tunnels are commonly lined with concrete on bottom and sides, but not on the roof if the rock is sufficiently sound.

Low-pressure Tunnels.—Low-pressure tunnels are now largely used in mountainous districts to convey the water from the reservoir or intake to the top of the high-pressure pipe-line while conserving the maximum possible head. In hard, sound unfissured rock they may be unlined, but lining of rich concrete, in conjunction with sealing of fissured places by injection of cement through drill holes, is generally desirable. The hydraulic flow conditions in unlined tunnels are very uncertain and smooth concrete lining is often used on this account alone. Kutter's coefficients may be taken as ·012 to ·014 for concrete lining, and provisionally as ·024 to ·032 for unlined tunnels. Where the weight of rock cover over the tunnel is not sufficient to balance the water pressure, the lining may have to be reinforced to withstand the pressure, and the possibility of water under pressure finding its way into extensive fissures must be guarded against.

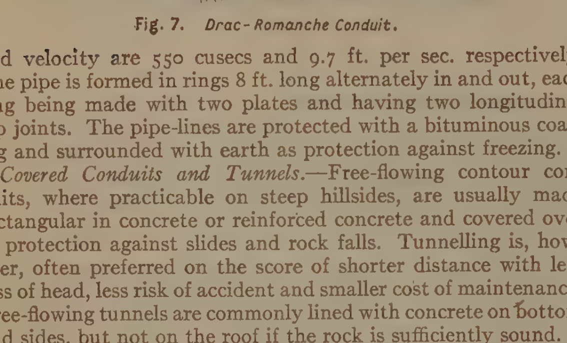


Fig. 8.—Pipe constructed of wooden staves and steel hoops.

High-pressure Welded Pipes.—High pressure portions of pipelines are now almost exclusively made of hammered lap-welded mild steel in lengths up to a maximum determined by the rolls available for bending the plates to circular form, lengths of 20 to 26 ft. being common. With suitable welding apparatus having long reach, two or three such lengths can be joined together by circumferential welded joints to make single smooth-bore pipes of 40 to 60 ft. in length. Such pipes have less weight, offer less resistance to flow and require less field work for installation as compared with riveted pipes. The steel used requires to be of extra mild, ductile and weldable quality for which, when allowance of about 90% efficiency for the welded joint is made, a working tensile stress of about 5 tons per sq. in. is appropriate. A hydraulic test to at least 50% but preferably to 100% above the working pressure should be made on each pipe at the maker's works. The joints form a vital part of a high-pressure pipe and the trend of development is to make them strong and rigid, and avoid the use of bolted, packed and expansion joints wherever possible. Welded pipe with riveted end joints represents, for medium and large-size pipes, the best modern practice, the riveting being single, double or treble, according to the pressure which may be applied.

Two forms of riveted joint are shown in figs. 3 and 4. Fig. 3 shows a spigot and socket form turned and bored to slight taper to ensure perfect fit and water tightness. Fig. 4 shows the so-called "bump" joint with coned and swelled ends, arranged so that the rivet heads do not project within the skin of the pipe. For the smaller sizes, where the room inside is too cramped to permit proper riveting, flanged and bolted joints of various types are used, generally with a packing ring to ensure watertightness. Two broad classes of joint may be noted: (1) flanges rigidly fixed to the pipe by riveting, welding or screwing; (2) a pair of loose flanges bolted together so as to grip the swelled or slightly flanged ends of adjacent pipes. Typical forms of the two classes are shown in figs. 5 and 6.

Welded pipe, and especially bends and junction pieces, are manufactured with great difficulty when the thickness exceeds $1\frac{1}{4}$ inches. Usually the thickness can be kept within necessary limits by sub-division of the flow, but for exceptional cases welded pipe, with weldless steel bands shrunk on at intervals, has been used. The thickness of the tube is then fixed from considerations of manufacture and the additional strength required to resist bursting is furnished by the bands. The tube must be of extra mild, weldable steel; the rings may be of ordinary or high tensile steel.

Security Measures.—High-pressure pipe-lines and precipitous and difficult locations usually go together. Security of installation is of the utmost importance in view of the serious damage that may follow the release of great uncontrolled power due to failure. The principal forces to be dealt with are the weight of the pipe and contents, and the inclined components thereof which cumulatively may be very large, the outward thrust at bends arising from the water pressure, and the large, longitudinal forces of tension and compression produced by changes of temperature. The latter forces can only be modified by the introduction of expansion joints, they cannot be eliminated.

Two contrasting methods of installation are in use, which may be designated the Swiss and the French method respectively. In the Swiss method a heavy concrete anchorage surrounding the pipe is provided at every bend, horizontal or vertical, the pipe-line being thus divided into a series of straight lengths, each of which is provided with an expansion joint near its upper end. The anchorages are designed to resist the maximum forces transmitted by the section of pipe-line attached thereto. In the French method main anchorages are provided at top and bottom only, there are no expansion joints, subsidiary intermediate anchorages are provided to hold the pipe in position and take care of the stresses produced by local variations of temperature and generally bends and elbows are left free to spring somewhat under extremes of temperature.

There are numerous successful examples of each method, one of the latter class worthy of mention being the pressure pipeline of the Eget Station in the Pyrenees. The fall is about 2,470 ft. and there are seven parallel pipes of 22 in. diameter serving seven Pelton wheels, each of 5,000 horsepower. There are no expansion joints, and the final joining up was done at medium temperature to limit the range of dilatation and contraction stresses. Pipes were used in lengths of about 40 ft. with heavily bolted flanges of the type shown in fig. 6. The pipes rest on inclined metal saddles which are bolted to the tops of concrete or masonry piers about 3 ft. thick.

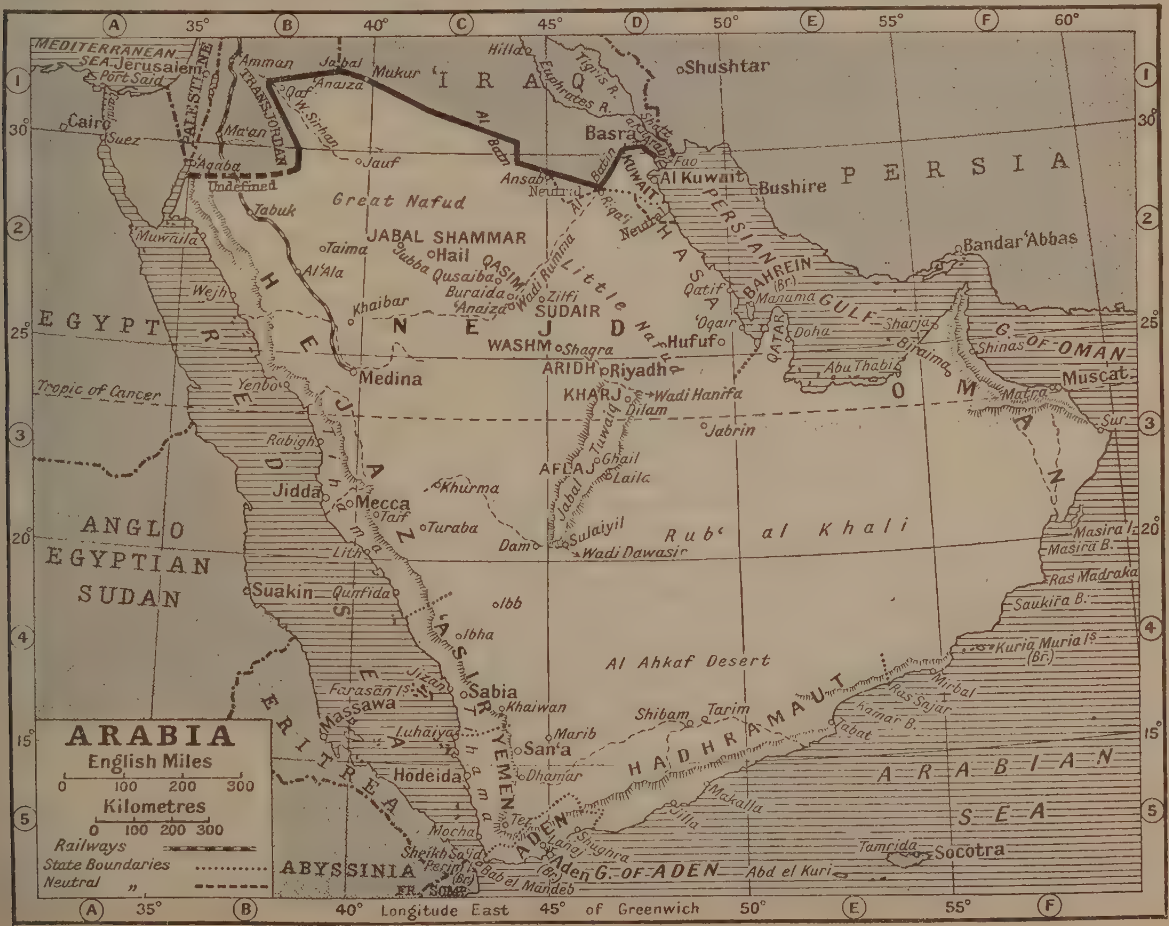
Reinforced Concrete Pressure Conduits.—Reinforced concrete is finding increasing use for low-pressure pipes and conduits, there being definite advantages on the score of maintenance and security against collapse from partial vacuum together with, in suitable cases, a saving in first cost. Essential requirements to success are fine, well-graded aggregate and sand, with a rich admixture of cement, and careful and thorough mixing and working into place, all combined with careful designing and proper disposition of reinforcement to take account of principal and secondary stresses in both the circumferential and longitudinal directions. For moderate diameters and pressures, precast, reinforced concrete pipe with joints of the "lock joint" or other special type and in lengths up to 12 ft. has found considerable use. The site must be accessible as the weights are heavy.

For large diameters the conduit is manufactured "in situ." Probably the largest reinforced pressure conduit yet constructed is that of the Drac-Romanche Hydroelectric Development at Pont de Claix near Grenoble, France. The diameter is 19·7 ft. and the section is as shown in fig. 7. The outer mould for the lower half of the reinforced tube is formed of mass concrete, steel shuttering being used for the rest of the construction. The fine concrete for the tube was mixed in the approximate proportions of 500 kgm. cement; .400 cu. metres sand; .800 cu. metres aggregate, say by volume 1:1·1:2·2. The maximum head is about 50 ft., maximum flow and velocity 2,800 cusecs and 9·2 ft. per sec. respectively and loss of head about 1 metre in 1,500 metres. A covering of earth serves to minimise temperature variations. (J. Wi.)

ARABIA (*see* 2.254).—By the end of 1925 considerable progress had been made toward determining the political boundary of Arabia on the north. In 1921 the boundary between Nejd and Kuwait was fixed by agreement between Ibn Saʽud and the high commissioner for ʽIraq. In the same year the boundary between Nejd and ʽIraq was fixed at the Conference of Mohammerah. In Oct. 1925 a British Mission under Gen. Sir Gilbert Clayton visited Ibn Saʽud in the Hejaz to fix the boundaries between Nejd and Transjordan.

The northern boundary resulting from these arrangements is as follows: Starting near Haql on the Gulf of ʽAqaba it runs eastwards, south of Mudawara station on the Hejaz railway, to the 38th meridian. Thence from lat. 30° it strikes northwest to ʽAmari wells leaving all Wadi Sirhan to Nejd. Thence it runs east to Jabal ʽAnaiza leaving a corridor of British mandated territory between Nejd and Syria. And thence it follows the ʽIraq-Nejd boundary in a southeast direction through the Batu depression and the wells of Ansab to Riqaʽi in the Batin valley, whence it circles round the Kuwait principality to the Persian Gulf coast.

In the southwest corner of Arabia the boundary between the Aden protectorate and Yemen was delimited by an Anglo-Turkish com-


ARABIA
English Miles
0 100 200 300
Kilometres
0 100 200 300
Railways
State Boundaries
Neutral
A B C D E F
35° 40° 45° 50° 55° 60°
1 2 3 4 5
30° 25° 20° 15°
Longitude East of Greenwich
MEDITERRANEAN SEA
Jerusalem
Port Said
Cairo
Suez
PALESTINE
Amman
TRANSJORDAN
Jabal Anaiza
Qaf
W. Sirhan
Ma'an
'Aqaba
Undefined
Jauf
Mukur
IRAQ
Hillah
Tigris R.
Euphrates R.
Shushtar
Basra
Shatt al Arab
Al Batin
Fao
Al Kuwait
KUWAIT
Neutral
Ansab
Bushire
PERSIA
Great Nafud
Tabuk
JABAL SHAMMAR
Taima
Hail
Qusaiba
QASIM
Buraida
'Anaiza
Zilfi
Wadi Rumma
SUDAIR
Little Nafud
Muwaila
Al 'Ala
Wejh
Khaibar
NEJD
HASA
Qatif
BAHREIN (Br.)
Manama
'Oqair
Hufuf
QATAR
Doha
Sharja
Abu Thabi
Buraimi
Bandar 'Abbas
G. OF OMAN
Shinas
Muscat
Matra
Sur
OMAN
EGYPT
HEJAZ
Medina
WASHM
Shaqra
ARIDH
Riyadh
KHARJ
Wadi Hanifa
Dilam
Jabrin
Tropic of Cancer
Yenbo
Rabigh
AFLAJ
Ghail
Laila
Jabal Tuwaiq
Jidda
Mecca
Taif
Khurma
Turaba
Dam
Sulaiyil
Wadi Dawasir
Rub' al Khali
ANGLO EGYPTIAN SUDAN
Lith
Suakin
Qunfida
'ASIR
Ibb
Ibha
Masira I.
Masira B.
Ras Madraka
Saukira B.
Kuria Muria Is. (Br.)
Al Ahkaf Desert
Farasan Is.
Jizan
Sabia
Massawa
Khaiwan
ERITREA
Luhaiya
Marib
San'a
YEMEN
Hodeida
Dhamar
Shibam
Tarim
HADHRAMAUT
Mirbat
Ras Sajar
Kamar B.
Tabat
Makalla
ARABIAN SEA
Mocha
Tez
Lahej
Shughra
ADEN
Sheikh Said
Perim I. (Br.)
Bab el Mandeb
Aden
G. OF ADEN
Abd el Kuri
Tamrida
Socotra
ABYSSINIA
FR. SOMA.

mission in 1902–4, and runs from a point opposite Perim island in a roughly northeast direction to Qa'taba beyond which a due northeast line continues it into the virgin desert. Apart from these frontiers the land boundaries of the various Arabian states are indeterminate. (H. St. J. B. P.)

I. EXPLORATION AND TOPOGRAPHY

In 1904 Dr. D. G. Hogarth in *The Penetration of Arabia* gave a full history of the exploration of the peninsula up to that date. Since then considerable progress has been made in the exploration and mapping of the country and the results of this are described below.

Central Arabia.—In 1917, when on a mission to the Emir of Nejd, H. St. J. B. Philby crossed the peninsula from sea to sea, a feat previously accomplished by only one other European—Capt. Sadlier, in 1819—his line being from 'Oqair ('Ojair) on the Persian Gulf to Jidda, by way of Hufuf, Riyadh and Taif. He attributes the exceptional fertility of the Hufuf group of oases to the re-appearance at the surface there of the rainfall of a very large area. Beyond Riyadh, Philby was the first European to follow, for most of the way, the great central pilgrim route to Mecca. He passed Ghat Ghat, a centre of the Wahhabist revival. After 80 m. of limestone desert alternating with belts of dahana, his route lay across the highlands of Nejd, a granitic tract 150 m. in breadth, where he found altitudes up to 3,100 ft.; this tract forms part of the great divide between the northeast and southeast slopes of Arabia in which, in about lat. 23½° N. and long. 43½° E. lie the head-waters of W. Sahaba. For no less than 200 m. between the small settlement of Qusuriya, long. 44° 30′ E. and Khurma, lat. 22° N., long. 42° E. —a village of mud huts on the confines of the Hejaz and a point of conflict between the King of the Hejaz and the Emir of Nejd—he found no settled habitation, but encountered vast herds of gazelle. After crossing the Rakba plain he reached Taif and, following down the gorge of W. Fatima, reached Jidda.

In a subsequent journey, May–June 1918, Philby explored southern Nejd, going 300 m. southward from Riyadh to Dam and back. He determined astronomically the positions of a number of places, including Riyadh (lat. 24° 37′ N. long. 46° 41′ E.), Abu Jifan (lat. 24° 29′ N.), Hair (lat. 24° 21′ N.), Sulaiyil (lat. 20° 25′ N., long. 45° 29′ E.) and Dam (long. 44° 40′ E.), and ascertained various heights by aneroid readings. As a result of the journey, the hydrography of the Tuwaiq plateau, the backbone of central Arabia, is now as well known as any part before the World War. Philby's estimate of the population of Riyadh is 12–15,000, and its most conspicuous buildings are the palace of the Emir and the great Wahhabi mosque. The oases of Nejd were found to comprise, usually, a nucleus town with scattered hamlets, with not more than a few square miles of cultivated land around in each case, and populations never exceeding 10,000. In Aflaj and Kharj he made a notable discovery of ruin fields of considerable area, which suggest burial mounds of an early era.

In both districts, the peculiar system of irrigation from natural reservoirs or deep well pits by means of subterranean channels, or *karez*, was unexpectedly found to prevail. At Umm al Jabal, just south of Laila, is a lake ¾ m. by ¼ m., possibly the largest sheet of permanent water in Arabia, and also a number of reservoirs of unusual size, one measuring 500 by 600 yards. In the Makran depression, south of Badia (lat. 22° N.), are other perennial pools of water surrounded by woods of well-grown trees. The oasis of Dam locally known as "the wadi," consists of some 20 separate settlements with a total population of 9,000, mostly of negro origin or of the Dawasir tribe. It was found that the Nejd oases are not tropical paradises; that there is no chain of oases linking Nejd with either 'Asir or Yemen; and that there is no region of fertility between southern Nejd and Oman, nor any settled spot between it and either Oman or Hadhramaut.

Northern Arabia.—As a result of two journeys in Arabia in 1910 and 1912 Lt.-Col. G. E. Leachman drew attention to W. Khar, an important affluent of the Euphrates, and discovered its possibilities as a line of communication between Syria and 'Iraq via the oasis of Jauf, noting that water is obtainable at regular intervals along it. He was first among Europeans to visit the wells at Leina, of which there are several hundreds, spread over an area of 5–6 sq. m.; and he is the only European who has made any record of a journey from J. Shammar to Suq'ash Shuyukh. His travels were equally important politically, for he laid the foundations of a good understanding between Britain and the Emir of Nejd; he was treacherously shot, Aug. 1920, in Mesopotamia.

In 1913–4, Miss Gertrude Bell travelled alone, except for native guides, from Damascus to the neighbourhood of Taima. Thence she passed eastwards over new ground along the southern margin of the Nafud to J. Shammar and visited Hail; then northwards by Loqa to Najaf and Baghdad, adding considerably to knowledge of a region hitherto traversed only by Wallin in 1848. Miss Bell was at that time the only woman traveller in Arabia, with the exception of Lady Anne Blunt, and one of the few women who can lay just claim to the title "explorer," for she surveyed her route by prismatic compass from start to finish.

Capt. Shakespear, British political agent at Kuwait, who became political officer in Nejd in 1914, and was killed in action in 1915, crossed the peninsula in 1913–4 from Kuwait to Suez by way of Riyadh, Buraida, Haiyaniya and Jauf al 'Amir, following an entirely new course beyond the last-named place. Other expeditions—by Douglas Carruthers in 1909, by Alois Musil in 1908–9 and 1910 and by Barclay Raunkiaer in 1912,—yielded valuable results.

The Hejaz.—The Arabian section of the Hejaz railway was so ill-known before the World War that even the stations could not be enumerated correctly. Determination, in 1917, of the lat. and long. of Ma'an and the observation of the long. of a few stations to the south enabled valuable adjustments to be made in the trace of the line. A belt of the Hejaz slope, some 300 m. in length between Wejh and Rabigh and a smaller tract immediately south of 'Aqaba were explored as a result of War operations, and a Turkish staff map of the country within a 30-m. radius of Medina added further useful data, so that a great part of the Hejaz can now be mapped with fair accuracy. The Billi tribe who people the rolling country between Wejh and the railway were found to be pure nomads without a single settlement in their district except one small garden at Al Kurr; the Juheina and Harb to the south of them are less nomadic.

'Asir and Yemen.—Toward the end of 1918, in the course of Idrisi's final campaign against the Turks, British officers met tribesmen from the least known parts of the interior, and gained much topographical, social and political knowledge, especially on the composition and distribution of the chief tribes of 'Asir and Yemen. The position of Ibha (formerly Menadhir), the headquarters of the Turks, was ascertained, though no European got there even when they surrendered. Sabia, Idrisi's capital, about 23 m. east-southeast of Jizan, was visited by an Indian medical officer. In Yemen, in 1909, a considerable amount of survey work was done by M. A. Beneyton, a French engineer, for a proposed railway from Hodeida to San'a and 'Amran and much unexplored territory was mapped on a scale of 1:250,000. G. Wyman Bury went from Hodeida to Sa'na in 1912 and has thrown light on the topography and economic conditions of Yemen. A. J. Wavell visited San'a in 1911 and gave the best description of the city since Manzoni, 1884. He found the population reduced to 18,000 as compared with Harris' computation of 50,000 in 1891. The decline in population and the commercial depression prevalent in Yemen may be attributed largely to the lawlessness of the intractable Zaranik and Qahtan tribes who occupy the country between the highlands and Hodeida.

Aden Protectorate and Hadhramaut.—Bury, in 1911, described his penetration of the Kaur watershed (alt. 7–9,000 ft.), north of the Yafa'I Fadhli country. He visited Yeshbum (population 4,000), the capital of the Upper 'Aulaqi, situated in a plain producing cotton and indigo and carrying on an industry in cotton fabrics, and got as far as Beihan, 110 m. inland of Shughra and almost in touch with Marib.

The Red Sea Coast.—The naval patrol during the World War explored the intricate coastline from 'Aqba to Aden. The triple coral reef fringing it had kept this coast almost inviolate, but the very numerous openings through the reefs are now known and have been charted.

The desert north of lat. 30° N. may be considered as well known, thanks largely to the activities of the Royal Air Force, which has maintained a regular fortnightly mail across it from Cairo to Baghdad, and to the enterprise of the British Nairn Motor Transport Co. (Beirut to Baghdad *via* Damascus) and of a Syrian motor company (Damascus to Baghdad *via* Palmyra). Various schemes have also been under consideration to connect Baghdad with Haifa by a trans-desert railway and preliminary surveys have been made in this connection, notably by Maj. A. L. Holt of the 'Iraq Railways. South of latitude 30° there has been little exploration since 1921, but a notable exception is an expedition made in the winter of 1923–4 by Maj. R. E. Cheesman to the hitherto unvisited oasis of Jabrin on the fringe of the Great South Desert. A British commercial syndicate has also been engaged in prospecting for oil in the province of Hasa, and similar work was begun in Oman late in 1925.

A notable addition to the maps of Arabia is Sheet No. 32, Persian Gulf (Scale 1:4,000,000) published by the War Office in 1924 and including the whole peninsula above latitude 20 degrees. This sheet is based on all the latest available information and is certainly the best map ever published of Arabia. The million-scale map of Arabia now covers the whole peninsula north of lat. 24° N. and a sheet (Laila), issued in 1923, covers the central area south of that line down to lat. 20° North. Million-scale maps, issued by the Survey of India, cover the southwest, south and eastern extremities of Arabia but have not been brought up to date. (H. W. M.)

II. POLITICAL HISTORY

The political situation in Arabia has undergone a remarkable change since 1911. At that time the Ottoman Govt. was able to maintain authority over the Red Sea provinces of Hejaz, 'Asir, Yemen and the Persian Gulf province of Hasa. In Central Arabia supremacy was divided between the Emirates of Jabal Shammar and Nejd; while the principalities of Kuwait, Bahrein, Qatar, Trucial Oman and Muscat, the territories of Hadhramaut and the Aden hinterland were in varying degrees under effective British protection.

In 1912 Amir ʽAbdul ʽAziz ibn Saʽud—who, as a youth of 20, had in 1900 rescued the territories of his ancestors from the rule of the Ibn Rashid dynasty of Hail and had since then effectively established his own rule throughout Nejd from Qusaiba in the north to Wadi Dawasir in the south—planted at Artawiya, a desert watering east of Zilfi, the first of the many Ikhwan colonies which have since formed the very basis of his power. (*See* WAHIBI MOVEMENT.) By doing so he formally revived in its most puritanical and fanatical form the long-dormant Wahibi movement, which had a century before made one of his ancestors for a short time undisputed master of all Arabia. His plan was to make the centrifugal elements of nomad society serve his own political ambitions under the banner of a great religious revival, for the furtherance of which he established these colonies—their number is reputed now to be about 50—as depots or rallying points for the Bedouin. He provided the funds necessary for the building of mosques therein and arms and ammunition for the use of each colony, which thus formed a contingent of what was in effect a conscript army. For five years the essential character and immense possibilities of this movement were not appreciated outside the limits of Nejd itself.

During the winter of 1913–4 Ibn Saʽud suddenly descended upon the Hasa province with quite a small force. The citadel of Hufuf was captured by a night attack almost without resistance on the part of the Turkish garrison, which took refuge in the fort-like precincts of the Ibrahim Pasha mosque, but surrendered almost immediately. The Turkish troops were escorted to the coast and with the garrisons of Qatif and ʽOqair, which also surrendered, were allowed to depart in peace by sea.

The World War.—Before the Turks had had time to avenge this blow, they were involved in the World War, as the result of which they lost the whole of their Arabian Empire. Early in the War, Captain W. H. I. Shakespear of the Indian Political Service was appointed British representative at the court of Ibn Saʽud, and the latter immediately began hostilities against Jabal Shammar, whose ruler Saʽud ibn Rashid, who had succeeded to the Emirate in 1908, stood by the Turks to the end. Captain Shakespear was unfortunately killed in the first and only battle of the campaign at Jarrab in Jan. 1915 and, the battle having proved indecisive, Ibn Saʽud became inactive till the summer of 1918, when he again advanced against Ibn Rashid but had gained no substantial success before the end of the World War. The only event of importance affecting Nejd during this period was the signing of a treaty of friendship between Great Britain and Ibn Saʽud in Dec. 1916.

Meanwhile the centre of Arabian gravity shifted to the Hejaz, where Husain ibn ʽAli, Emir of Mecca, raised the standard of revolt against the Turks. Husain's assumption of the title of "King of the Arab Countries" was not viewed with favour by Ibn Saʽud and created between the two rulers an ever-growing coolness, which was prevented from breaking out in open hostilities only by the constant efforts of the British Government. At the end of 1917 a further cause of estrangement arose out of a dispute over the oasis of Khurma on the Hejaz-Nejd border. The people of the oasis, being of the Wahibi persuasion, and their chief, Sharif Khalid ibn Luwai, declared for and demanded protection of Ibn Saʽud. The latter accepted their allegiance, and a serious crisis arose in the summer of 1918, when King Husain made two vigorous but unsuccessful efforts to capture the "rebel" oasis. His failure made it unnecessary for Ibn Saʽud to take action and at the end of the War Khurma still formed part of Nejd.

War with Ibn Saʽud.—King Husain, unwilling to accept such a situation, appealed for British intervention and in March 1919, a committee presided over by Lord Curzon decided in his favour. He was authorised to occupy the oasis, and Ibn Saʽud was warned to relinquish it on pain of incurring the displeasure of the British Govt. and of losing his subsidy of £60,000 a year. The Hejaz forces under the King's second son ʽAbdullah, advanced to Turaba, 80 m. from Khurma in May, and Ibn Saʽud, disregarding the British Govt.'s warning, sent a force to meet him. In the dead of night the Wahibis surprised ʽAbdullah's sleeping camp, and annihilated the whole of his army, some 4,000 strong. ʽAbdullah and a small following escaped, and the town of Taif was evacuated by its inhabitants in fear of a Wahibi advance. Even Mecca and Jidda were thrown into a state of consternation. But Ibn Saʽud, content with the capture of Turaba, withdrew to Riyadh. His first objective was naturally the Emirate of Jabal Shammar but, apart from occasional raids, he was unable during 1919 and 1920 to gain any substantial success. Meanwhile he sent an expedition against ʽAsir, the mountainous country south of Hejaz, and captured its capital, Ibha, in the summer of 1920. Having consolidated his position there and among the neighbouring tribes down to Wadi Bisha, he again turned to Hail where an accident now favoured him, Saʽud ibn Rashid being shot dead by a relative during a picnic. The vacant Emirate passed to ʽAbdullah ibn Mitʽab, who was unable to cope with the heavy task thus thrust upon him and, fearing treachery, took refuge with Ibn Saʽud during the summer of 1921. Muhammed ibn Talal, his successor, fared no better and in Aug. 1921 Hail surrendered to Ibn Saʽud.

In July 1922, the Wahibis occupied Jauf, which had long owed allegiance alternately to Ibn Rashid and to the Ruwalla chief, Nuri ibn Shaʽlan, and extended their activities up Wadi Sirhan. They even raided Transjordan in Aug., but were driven back by the Royal Air Force detachment at ʽAmman. About the same time they occupied Khaibar and Taima on the Hejaz border and the Red Sea (Hejaz) port of Qunfida. By the summer of 1923 Ibn Saʽud seemed to have reached the zenith of his power, and in Nov. the British Govt. invited him and the various Sharifian states (Hejaz, ʽIraq and Transjordan) to a conference at Kuwait, which dragged on till April 1924 without result. Meanwhile the Ikhwan (particularly during the winter of 1923–4) had carried out a number of raids on the tribes of the ʽIraq frontier, and the failure of the Kuwait conference resulted in a second raid (in Aug. 1924) on several villages near ʽAmman. This was repulsed by the Royal Air Force, but resulted in the extension of Wahibi influence to the "Salt Villages" of Wadi Sirhan. The Wahibi monarch (who had been recognised by Great Britain in 1921 as Sultan of Nejd, and had ceased to enjoy a British subsidy as from March 1924) now played his trump card with results which far exceeded his expectations. A Wahibi army launched against Hejaz captured Taif without opposition in Sept. 1924, and, owing to the absence of its commander, committed excesses which were immediately disowned by Ibn Saʽud. After a battle at Hadda in the Taif mountains, Mecca was occupied in Oct. and by the end of 1925 the whole of the Hejaz was in Ibn Saʽud's possession.

III. DIVISIONS OF ARABIA

Oman.—This roughly comprises the extensive and mountainous promontory which forms the eastern extremity of Arabia, extending from Ras Musandam on the Gulf of Oman to the eastern limits of Hadhramaut at Ras Sajar (lat. 16° 8′ N.) on the Indian Ocean. Its capital, Muscat (*see* 20.99 and 19.43), was before the War an important centre of the traffic in arms, which was in 1912 subjected to control by the establishment of a warehouse at the instance of the British Government. The present Sultan of Muscat, Saiyid Taimur, who succeeded his father, Saiyid Faisal ibn Turki, in 1913, enjoys a nominal authority over the whole of Oman, but his rule is effective only on the coast. The tribes of the interior are practically independent under the loose control of an Imam of the ʽIbadi sect, whose centre is at Rustaq.

A rising of the ʽIbadis in 1913–4 against the Sultan resulted in the occupation of Bait al Falj near Muscat by a British Indian force, which remained there throughout the War, defeating the rebels in 1915. Since the War the Sultan's administration has given rise to much dissatisfaction and in 1920–1 the British Govt. intervened to patch up an understanding between him and the ʿIbadi Imam. Shortly afterwards the Sultan had to agree to the creation of a sort of Council of Regency for the administration of the state and since then he has taken no active part in the government of his dominions, residing partly in India and partly on his personal estates. For all practical purposes the administration is controlled by the government of India.

Kuwait (*see* 15.956).—Of the various states along the Arabian coast of the Persian Gulf, Kuwait alone has had its frontier with Nejd defined. Its chief, Mubarak Ibn Subah, always a staunch friend of Great Britain, died in 1916, and was succeeded by his son, Jabir, who died the following year, to be succeeded by his brother, Salim, an inveterate foe of Ibn Saʿud. Salim died in 1921 and was succeeded by Jabir's son, Ahmad, who still rules. The importance of Kuwait lay in the fact that before the War it was the chief *entrepôt* of Central Arabian trade, but recently owing to a dispute regarding the Sheikh's right to collect customs dues on goods in transit, Ibn Saʿud has developed the three Hasa ports of Jubail, Qatif and ʿOqair and deflected trade in that direction. Kuwait trade has consequently to some extent declined.

Qatar.—The small peninsular state of Qatar has since 1914, when it ceased to be under Turkish rule, maintained a sort of independence under its Sheikh, ʿAbdullah ibn Thani, whose authority does not extend beyond a few settlements on the coast and who is on good terms with his powerful neighbour, the Wahhabi Sultan.

Trucial Oman.—Between Qatar and Oman proper lie the petty states of Abu Thabi, Dibai, Sharja, ʿAjman and Umm al Qaiwan, each under its own semi-independent Sheikh and all controlled and protected by Great Britain, whose representative resides at Sharja, in virtue of an agreement made in 1892. The authority of these states is confined to the sea-coast and their boundaries with Nejd have not been defined.

Hadhramaut.—This comprises a considerable and prosperous territory marching with Oman on the east and the Aden protectorate on the west. Its boundaries northward towards the Great Desert are undefined. The greater part of this territory is ruled by Sultan Ghalib ibn ʿAwadh of the Qaʿaiti dynasty, which is closely linked with the Indian state of Haidarabad. His capital is at Makalla on the coast and the actual work of administration is carried on in the Sultan's name by a Wazir, Saiyid Husain ibn Mihdar. Apart from Makalla, Shihr on the coast and Shibam inland are the main centres of the Qaʿaiti allegiance, while Tarim and Saiyun (both inland) are the headquarters of two co-equal Sultans of Kathiri stock, whose affinities are with Java and the East Indies. These Sultans are Mansur and Muhsin, both sons of Ghalib ibn Ahmad, and the effective government of their dependencies is in the hands of a Wazir, Salim ibn ʿAbud. During the War the Qaʿaiti influence was exercised on the side of Great Britain, while the Kathiris were intensely anti-British and were suspected of supplying the Turks in Yemen with goods imported via Shihr and Shibam. The Qaʿaiti-Kathiri feud was temporarily composed in 1918 by a treaty, but the prosperity of the Hadhramaut and the development of its great agricultural resources—it is an important tobacco-growing centre—can only be secured by the elimination of the Kathiri element whose rule is as oppressive as that of the Qaʿaiti dynasty is mild. The whole area falls within the sphere of British influence and protection.

Yemen and ʿAsir.—These form geographically a single unit extending northward between the Red Sea and the western (undefined) border of the Great Desert from the frontier of the Aden protectorate to a line running northeast from Hali point to Wadi Bisha. Before the War this area formed the Turkish provinces of Yemen (south) and ʿAsir (north), and during the War they were held to the end by Turkish troops whose hold on ʿAsir was always somewhat precarious. Here the authority of Turkey had since 1910 been disputed by Saiyid Muhammed at Idrisi, who maintained his independence in the coastal lowlands (Tihama) with his capital at Sabia and in the ports of Maidi and Jizan. A Turkish expedition against him proved ineffective, and with Italian assistance in 1911–2 he consolidated his position. In 1915 he entered into an agreement with the British Resident at Aden, but was unable to assist the Allied cause in any substantial manner. After the Armistice he continued hostile to the Imam of Yemen, and cultivated friendly relations with King Husain. In 1921 he occupied Hodeida, relying on his treaty with Great Britain. Meanwhile in 1920 Ibn Saʿud had occupied the uplands of ʿAsir and their chief town, Ibha, and in 1922 the Idrisi himself died. His son and successor Saiyid ʿAli, maintained his position somewhat precariously till 1925 when the Imam Yahya of Yemen occupied Hodeida. Since then the Idrisi, confined to Sabia and the ports of Jizan and Maidi, has practically ceased to count as an Arabian potentate.

The Imam Yahya ibn Muhammad, religious head of the Zaidi sect and temporal ruler of the Yemen, has on the other hand greatly consolidated his position. Coming into power in 1904 he was soon involved in a serious rising against the Turks which was with difficulty subdued in 1905 (*see* 2.270). An arrangement was then arrived at, but was broken in 1910, when the Imam besieged Sanʿa. The city was relieved, and in 1913, by an imperial farman, a mediatised status was conferred on the Yemen, the Imam being recognised as the religious and social chief of the Zaidi elements. At the outbreak of the World War he declined to negotiate with Aden, and sided with the Turks, using his influence to stir up strife against the British among the tribes of the Hadhramaut and the Aden protectorate. The Turks left the Yemen at the end of 1918 and a British garrison occupied Hodeida. In Aug. 1919 a British mission under Col. H. F. Jacob proceeded inland from Hodeida to visit the Imam, but was captured by Quhra tribesmen and detained at Bajil till December. In the early part of 1921 the Imam's troops, commanded by the former Turkish Wali, Mahmud Nadhim Pasha, became active in the Tihama around Hodeida but were anticipated by the Idrisi who occupied that port in February. Since then the Imam has from time to time threatened and actually violated the Aden protectorate frontier and eventually ejected the Idrisi from Hodeida (see above). At the end of 1925 he was in a stronger position than ever before, and ranked second only to Ibn Saʿud among the rulers of Arabia. The World War seriously affected the prosperity of Hodeida and other Yemen ports, but during 1925 Italian commercial enterprise seemed to be actively engaged in restoring their pre-War importance, while late in the same year a British mission set out to visit the Imam.

IV. TRADE AND COMMUNICATIONS

Communications.—At the beginning of 1926 the Hejaz line from Maʿan to Medina was the only railway within Arabian territory. Motor transport was still in a backward stage—a few cars have used the Jidda-Mecca, Rabigh-Mecca and ʿOqair-Hufuf route for some years past—but there is likely soon to be a great expansion in this direction. There are no made roads except the one from Hodeida to Sanʿa but, except in the mountainous and drift-sand regions, communications are easy by camel and the tracks are generally possible for motor traffic. The Hejaz has a telegraph line from Mecca to Jidda which is connected by cable with Port Sudan. The Hejaz has also some nine wireless stations and there are similar installations at Ibha Hodeida and Sanʿa. Both the Red Sea and Persian Gulf ports and Makalla have adequate regular steamer services. Generally speaking the last few years have witnessed a considerable improvement in communications and the near future should see this improvement greatly extended.

Imports.—Arabia is essentially an importing country and imports piece-goods and foodstuffs (rice, flour, sugar, tea and spices), which it pays for by a considerable sale of camels (to Egypt, Syria, etc.), by a modest export of hides, dates, coffee, pearls, etc., and by supplies of all kinds to the annual pilgrims to the Hejaz (averaging 100,000). The chief ports are Jidda, Hodeida, Yenboʿ, Wejh, Rabigh and Mocha on the Red Sea, Makalla and Shihr on the Indian Ocean, and Muscat, Bahrein, ʿOqair, Qatif, Jubail and Kuwait on the Persian Gulf. Customs duty at Jidda is said to amount to £500,000 (at a general rate of

10% with exceptions in the case of silk, tobacco, etc.) in an ordinary year, but it is impossible to give an estimate of the total value of the export and import trade of all Arabia.

Production.—Camel-, sheep- and horse-breeding are carried on on a considerable scale by the Bedouin but the market for Arab horses is no longer what it was before the War, while the conditions of modern civilisation have made horses a luxury for the rich rather than a necessity for all. The Persian Gulf has a flourishing pearling industry, and in the Red Sea pearls are found in small quantities and there is a flourishing trade in black-coral (made into rosaries for pilgrims). The fishing (and salting of fish) industry has a great future but needs proper organisation. At Salif and other places there is good rock salt, while the west coast of Arabia is suspected, but not proved, to be rich in minerals. In the Hasa *abas* (cloaks) of good quality are made and in the Yemen there is a small industry of decorative gold and silver work (scabbards, sheaths, etc.). (*See* HEJAZ.)

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ARABIC LITERATURE (*see* 2.271).—A vast number of writings have appeared since 1910 in various parts of the East—*e.g.*, Egypt, North Africa, India. Among recent publications, a book written by Sheikh Ali Abdel Razek of Cairo on *Islam and the Bases of Government* (1925) is particularly noteworthy for its political and cultural significance. The author, who has been punished for heretical teaching by deprivation of his judgeship, as well as his professorship in El-Azhar University, Cairo, seeks to prove that in the Koran and in the Traditions (*Hadith*) about Mahomet there is nothing to indicate that the Prophet cherished ambitions of earthly kingship, or that he proclaimed anything concerning matters other than those affecting faith and practice. It would follow from this that there is nothing to prevent Mahommedans from learning from unbelievers, or from keeping pace with modern European progress.

Great progress has been made in the work of editing and translating classical or standard Arabic texts. Rhuvon Guest has edited and published (1912) the Arabic text of the work on *The Governors and Judges of Egypt* by El Kindi (897–961 A.D.; 283–350 A.H.). C. H. H. Macartney has done the same (1919) for *The Dîwân of Ghailân ibn ʿUqbah, known as Dhu'r-Rummah.* Verses by Dhu'r-Rummah are quoted frequently in the works of lexicographers, but before the publication of the Dîwân only one of his longer poems had been made easily accessible. D. S. Margoliouth has made available, by publishing the text with a translation, a work which has been pronounced to be the best on life in the palaces of the Caliphs and generally one of the most instructive in the Arabic language, the *Experiences of Nations* (*Tajärib al-Uman*) by Ahmad ben Mohammed Miskawaihi[1] (d. 1030 A.D.; ?330–421 A.H.). A continuation of the *Experiences of Nations* was written by Abu Shuja ʿRudhrawari (d. 1095 A.D.; 488 A.H.). It appears to be in the main an abridgment of the Chronicle of Hilal ben Muhassin ben Ibrahim (359–448 A.H.). This text also has been published, with a translation, by Margoliouth.[2]

Chemistry came to Europe by way of the Moslems of Spain; but of the vast chemical literature in Arabic very little has been made accessible to European students. Some importance attaches, therefore, to the publication, from three manuscripts, of the text, with a translation, of the *Book of Knowledge acquired concerning the Cultivation of Gold* by Abuʿl-Qāsim Muḥammad ibn Ahmad al-ʿIrāqī, who seems to have flourished in the 13th century A.D. (7th century A.H.).[3]

In 1921 Sir Charles J. Lyall published a complete text, with translation, of the *Mufaḍḍalīyāt*,[4] the famous anthology put together by al-Mufaḍḍal, who was head of the school of al-Kūfah. Al-Kūfah and al-Baṣrah had become the headquarters of schools of grammatical and linguistic research which drew upon the national stores of poetry preserved in the memory of the tribal traditionists or Rāwīs. Lyall holds that the anthology is a collection of genuine pre-Islamic poems. D. S. Margoliouth, on the other hand, maintains that the ostensibly pre-Islamic poetry is suspect on both external and internal grounds.[5]

In 1914 Dr. Alphonse Mingana published some leaves from three ancient Korâns.[6] The manuscript from which these leaves were taken is a palimpsest, the upper script being a series of closely written homilies in Arabic by early Christian Fathers, such as Theodosius, Chrysostom, and Mar Jacob. The traditional view is that the text of the Korân, as it now stands, was fixed by command of the Caliph ʿOthmân; but these leaves seem to belong to a time before the text was fixed. That the traditional view may not be correct is suggested by the contents of a manuscript brought from the East by Dr. Mingana and published in 1925.[7] The manuscript incorporates a discourse (chap. 25–30) which consists entirely of quotations of the Korân translated into Syriac. These quotations seem often to represent a version which is not always in harmony with the *textus receptus* of the Korân, but exhibits whole verses which are not found in it at all. There are grounds for thinking that the version made its appearance some time between 684 and 704 A.D. This supports a suggestion made by Mingana in 1916, that the text of the Korân was standardised, not under the Caliph ʿOthmān, but under the much later Umayyad Caliph ʿAbd al-Malik b. Marwān.[8]

In 1922 A. Mingana published a translation of *The Book of Religion and Empire*, a semi-official Defence and Exposition of Islam written by order at the court and with the assistance of the Caliph Mutawakkil (847–61 A.D.), by ʿAli Ṭabari, who seems to have died about 854 A.D. This is the first work by ʿAli Ṭabari to be published. More recently Mingana has published a charter granted by the early Caliph Muktafi II. (1136–60 A.D.) to the Nestorian Patriarch, Abdisho III. (1138–47 A.D.). This charter has survived only as a model of good Arabic composition in an Arabic anthology. It is written in rhymed prose and in a very florid style. It shows that the early caliphs treated their subjects with great toleration.

BIBLIOGRAPHY.—In addition to the works mentioned in the body of the article, see M. H. Shayk, ʿAbd al-Raziq, "Arabic Literature since the Beginning of the Nineteenth Century," *Bulletin of the School of Oriental Studies*, London Institution. Vol. ii., pt. 2 (1922) and pt. 4 (1923). (M. A. C.)

ARABI PASHA (*c.* 1839–1911), Egyptian soldier and revolutionary leader (*see* 2.283), died at Cairo Sept. 21 1911.

ARBER, EDWARD (1836–1912), British man of letters (*see* 2.323), was killed in a taxicab accident in London Nov. 23 1912.

ARBITRATION, INDUSTRIAL: *see* INDUSTRIAL RELATIONS.

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[1] *The Eclipse of the ʿAbbasid Caliphate, Original Chronicles of the Fourth Islamic Century* (1920–1).

[2] Included in the work mentioned above.

[3] The Arabic Text edited with a Translation and Introduction by E. J. Holmyard, M.A. (1923).

[4] *The Mufaḍḍalīyāt.* An Anthology of Ancient Arabian Odes compiled by al-Mufaḍḍal, son of Muhammad, according to the recension and with the commentary of Abū Muḥammad al-Qāsim ibn Muḥammad al-Anbārī. Edited for the first time by Sir Chas. James Lyall. Two volumes (1921), volume 3 (1924). The dates of Mufaḍḍal's birth and death are uncertain. The years mentioned for his death vary from 164 to 168 and 170.

[5] "The Origins of Arabic Poetry" in *The Journal of the Royal Asiatic Society* (July 1925), pp. 417–49.

[6] *Leaves from three Ancient Qurâns, Possibly Pre-ʿOthmanic*, edited by Alphonse Mingana and Agnes Smith Lewis (1914).

[7] *An Ancient Syriac Translation of the Kurʿān exhibiting New Verses and Variants* (1925).

[8] *Journal of the Manchester Egyptian and Oriental Society* (1916), see further Hastings *Encyclopaedia of Religion and Ethics* (1918).

ARBITRATION, INTERNATIONAL (*see* 2.327).—Until 1911 progress in arbitration had been confined within certain limits, questions involving national honour or vital interests being excluded from its operation. In 1911, however, an effort was made to widen its scope. The credit for the innovation is probably due to the United States, as the new idea was first embodied in treaties between that Power and France and Great Britain respectively. The change consisted in an attempt to include within the scope of arbitration treaties all cases of international difficulty or dispute, without exception, a procedure being provided which varied according to the gravity of the matter at issue. The two treaties specifically referred to above have never been submitted to the test of an actual case and it is perhaps idle to speculate on their merits.

Arbitration Treaties before the War.—As between other Powers, various arbitration treaties embodying to a greater or less extent the idea of an all-embracing agreement were made; and it is regrettable to record that those which were put to a severe test failed entirely to prevent a resort to force of arms, thus apparently demonstrating the truth of the argument that arbitration on questions involving national honour or vital interest was foredoomed to failure. In July 1914, arbitration on the disputed points in Austria-Hungary's ultimatum was proposed by Serbia, and Britain proposed mediation. But this conciliatory procedure was unsuccessful.

In the Italo-Turkish War no time was given for any possible pacific intervention, and in the Austro-Hungarian conflict with Serbia the same method of excluding pacific intervention was adopted. In the Italian conflict with Greece over the Albania murders it was the same again, in spite of the parties being pledged to arbitration. These instances showed that arbitration must be of immediate and automatic application if it is to prevent a disaster.

Some account of the leading provisions of the arbitration treaties of 1911 between Great Britain and the United States and between France and the United States must be given. Apart from the provision that the treaties were to embrace all manner of disputes and differences, various preliminary stages of procedure were provided, which may be summarised as follows:—

1. Request by either party to submit any difference between them to a joint high commission of inquiry.
2. Power to either party to postpone the reference to the high commission for one year from the date of the request, in order to afford an opportunity for diplomatic discussion and adjustment of the questions in controversy.
3. Appointment by each party of three of their nationals, these to form the joint high commission.
4. Holding of the inquiry by the joint high commission, the inquiry to be followed by a report upon the particular question or matters referred to it, for the purpose of facilitating the solution of the disputes by elucidating the facts and defining the issues, the report to include also such recommendations and conclusions as may be appropriate.
5. If the difference persist, the case becomes the subject of an agreement to refer the matter to arbitration, such agreement to provide for the organisation of the tribunal, which will arbitrate, and to determine the question or questions at issue. The object of the treaties, however, was not only to provide automatic application, but also to divert attention from the issue to the method of settlement, and thus to enable diplomacy to gain time, while providing the means of obtaining a calm examinations of the points involved.

Arbitration under the Covenant.—Since the World War a new era for arbitration has begun. Arbitration had been regarded as having attained a sufficiently high status in international relations in being promoted by permanent treaties to the position of a recognised adjunct of diplomacy. The Covenant of the League of Nations gave it a much higher rank, and the activities with which it was sought to invest the League would practically displace diplomacy in its present representative form. Arbitration tended to replace direct negotations between the ministers whose departments were concerned, suppressing, or at any rate relegating to a secondary position, the employment of the diplomatic channel.

Under the Covenant the members of the League agree that if there should arise between them any dispute likely to lead to a rupture, they will submit the matter either to arbitration or to inquiry by the Council of the League, and they bind themselves in no case to resort to war until three months after the award by the arbitrators or the report by the Council.

> The members of the League agree that whenever any dispute shall arise between them which they recognise to be suitable for submission to arbitration and which cannot be satisfactorily settled by diplomacy, they will submit the whole subject-matter to arbitration.
>
> The members of the League also agree that they will carry out in full good faith any award that may be rendered and that they will not resort to war against a member of the League which complies therewith. In the event of any failure to carry out such an award, the Council shall propose what steps should be taken to give effect thereto.

It is seen that these provisions do not pretend to include all difficulties, but are confined to such matters as all parties may regard as arbitrable. Another clause, however, provides that "disputes as to the interpretation of a treaty, as to any question of international law, as to the existence of any fact which if established would constitute a breach of any international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among those which are generally suitable for submission to arbitration."

The attitude of the British Govt. in respect of these provisions of the Covenant was expressed in a speech made by Lord Balfour on July 6 1925, in which he stated:—

> Arbitration is the thing; there is no question which can arise which will not be submitted to arbitration. If arbitration be really observed, war will be impossible. If either party to a dispute refuses to arbitrate or to carry out a decision of arbitration, our obligation and that of the other parties would be to throw in our whole strength to defend the aggrieved party.

On the continent of Europe this confidence in the future of arbitration is equally strong. Before the World War, arbitration was regarded as a permissive method and though the term "compulsion" was used, it was merely in the sense that contracting parties had bound themselves to submit the cases specified in their engagement to arbitration. Under the Covenant, as Lord Balfour interprets it, compulsion is given a much more effective sense.

Geneva Protocol.—To secure further the inclusion of all differences between nations, and to apply compulsory arbitration as a substitute for war, the Geneva Protocol, adopted on Oct. 2 1924, but never ratified by the Powers, provided a systematic procedure of conciliation, arbitration, and forced compliance with the League's decisions, for the prevention of war. This took the form of an exhaustive amplification of the above-cited articles of the Covenant.

Its provisions were as follows:—

> 1. If the dispute submitted to the Council is not settled by it, . . . the Council shall endeavour to persuade the parties to submit the dispute to judicial settlement by arbitration.
>
> 2. (*a*) If the parties cannot agree to do so, there shall, at the request of at least one of the parties, be constituted a committee of arbitrators. The committee shall so far as possible be constituted by agreement between the parties.
>
> (*b*) If within the period fixed by the Council, the parties have failed to agree, in whole or in part, upon the number, the names, and the powers of the arbitrators and upon the procedure, the Council shall settle the points remaining in suspense. It shall, with the utmost possible despatch, in consultation with the parties, select arbitrators and their president from among persons who, by their nationality, their personal character, and their experience, appear to it to furnish the highest guarantees of competence and impartiality.
>
> (*c*) After the claims of the parties have been formulated, the committee of arbitrators, on the request of any party, shall through the medium of the Council request an advisory opinion upon any points of law in dispute from the Permanent Court of International Justice (*q.v.*), which in such case shall meet with the utmost possible despatch.
>
> 3. If none of the parties asks for arbitration the Council shall again take the dispute under consideration. If the Council reaches a report which is unanimously agreed to by the members thereof, other than the representatives of any of the parties to the dispute, the signatory states agree to comply with the recommendations therein.

The Protocol unfortunately amplified also the coercive clauses, military and economic, in case either party to a dispute failed to comply with the pacific solution proposed or arrived at by the League. Owing more particularly to these coercive provisions Great Britain repudiated the Protocol. The United States, which had been foremost in promoting arbitration, has never adopted the Covenant owing mainly to these very coercive provisions which the Protocol made the mistake of amplifying. Great Britain's repudiation of the Protocol has prevented for the time being its general application. It is nevertheless important, as showing the length to which European statesmen are prepared to go in the enforcement of arbitration awards.

As regards economic coercion against a power which declines to accept arbitration, it is not a principle much more feasible than coercion by force. Suspension of trade between any two industrial countries may be as much a loss to the one as to the other. Feeling in Great Britain and the United States seems practically unanimous in distrusting the application of any coercive method whether or not a domestic interest is involved. Until some new method is found of accentuating moral force which will not have the defects of the sanctions provided by the Covenant, the moral force of universal public opinion seems destined to be the only guarantee of respect for arbitration and its award.

Meanwhile Germany, Sweden, Finland and Switzerland have concluded treaties of arbitration. In these a new element has been added to the system of compulsory treaties, in the form of a standing committee of competent persons appointed by the two contracting states, to which all difficulties can be referred for examination and counsel. Considered in relation to the treaties of 1911, this development seems to constitute another step toward the solution of the problem of extending the scope of arbitration treaties so as to include questions of national honour and vital interest.

At the sixth meeting of the Assembly of the League of Nations the failure of the Protocol of 1924 was dealt with in a report containing the following paragraph:—

> At the moment when the declarations of certain governments have shown that an early entry into force of the Protocol for the pacific settlement of international disputes is not to be expected, several delegations have been anxious to affirm the fidelity and unanimity with which the members of the League remain attached to the triple object underlying that draft treaty, namely, arbitration, security, and disarmament, and to indicate methods or measures by which an approach might be made to this object, pending the achievement of a general settlement which many consider indispensable.

The government most particularly concerned in the wrecking of the Protocol was that of Great Britain. Its attitude produced among the other members of the League of Nations the impression that Great Britain, in spite of her active championship of arbitration, was not prepared to accept the obligations resulting from strict compliance with the provisions of the Covenant. This impression was shared by many Englishmen, but Lord Balfour's statement made it clear that it was erroneous; and it was not surprising that, later on, the Foreign Secretary, Sir Austen Chamberlain, should take the lead in calling a special conference to deal with the problems existing in Central Europe, under the auspices of the Covenant itself. Great Britain thus showed that while observing her traditional attitude of distrust towards international generalities, she was genuinely attached to the principle of arbitration and was ready to give it the widest feasible scope.

Locarno Pact.—The result of the conference called by the British Govt. at Locarno in Oct. 1925 was a pact under which the Powers, between whom difficulties are most likely to arise, undertake in no circumstances whatever to resort to war. They pledge themselves to submit disputes of every kind to some form of peaceful procedure. This agreement must be taken in conjunction with Article 16 of the Covenant, which provides that disputes as to the interpretation of a treaty, as to any question of international law, as to the existence of any fact which, if established, would constitute a breach of international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among those generally suitable for submission to arbitration or judicial settlement.

Both the Geneva Protocol and the Pact of Locarno adopted the same principle as that which underlay the abortive Anglo-American Treaty of 1897; though that treaty was called a treaty of arbitration it was at the same time a treaty of conciliation. It is interesting to note that Lord Salisbury, who acted, it is believed, on the advice of the late Lord Chief Justice, Lord Alverstone, initiated the negotiations for the treaty in question in a draft, the first proposition of which was as follows:

> Her Britannic Majesty and the President of the United States, shall each appoint two or more permanent judicial officers for the purposes of this treaty and on the appearance of any difference between the two Powers which, in the judgment of either of them, cannot be settled by negotiation, each of them shall designate one of the said officers as arbitrator; and the two arbitrators shall hear and determine any matter referred to them in accordance with this treaty.

This principle, though it was not adopted in the treaty of 1897, has been adopted in practically all the new treaties of arbitration entered into since the conclusion of the World War.

The important object of International Arbitration is further dealt with in a number of articles of which the following may be mentioned: Europe: History; League of Nations; Locarno, Pact of; Sanctions and Guarantees; Tacna-Arica; World Court.

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(T. Ba.)

ARCH, JOSEPH (1826–1919), British labour leader (*see* 2.342), died at Barford, Warwickshire, Feb. 12 1919.

ARCHAEOLOGY (*see* 2.344).—The articles which follow summarise the main features of the remarkable advance made since 1910 in the scientific knowledge of ancient life. As the handmaid of history, archaeology establishes correlations with the record of the climatic variations since the main outline of the world was shaped in the early Pliocene age. The antiquity of man has been proved for Europe to the lowest limits of the Pleistocene age.

I. INTRODUCTION

Evidence is accumulating to warrant the belief that eoliths mark the existence of a tool-using, tool-selecting, intelligent species which can be none other than the forerunner of *Homo sapiens* in the upper Pliocene, if not of *Homo sapiens* himself. Great stresses, shakings, compressions and earth movements have taken place since then, so that the wonder is that we have any evidence of this nature left. Only stone could survive these processes. Stone was the prime material from which permanent tools were fashioned, and is still employed for that purpose by the Australian aborigines, who use at the present day a practically complete series of stone implements, representing all the various stages of culture known in prehistoric Europe. It persisted long in Africa, in Oceania and in America. Communities like the Andamanese can exist without stone implements by fashioning all they need from shells and from the products of the jungle. Of the culture of such groups but little proof would survive.

Continuity of Settlement.—The science of archaeology discloses a feature of significance, the continuity of settlement. Localities have definite site-values which persist from age to age. Cities are built, are destroyed, are rebuilt in turn to perish, but the site-values ensure continuity of occupation. It is, therefore, possible to examine the sequence of strata, of deposits, to test this stratification and to lay down a chronological order by the sequence method of dating, based primarily on pottery. The tale it tells, in spite of its fragility, is of incalculable importance to the student of civilisation, because the use of pottery indicates a permanency of settlement, and historical variations in the population of localities are indicated by the introduction of new designs (*Cambridge Ancient History*, vol. i., p. 71). We can thus form, as never before, an estimate of life in ancient days and realise how full it was, how vivid, how touched with the problems of life and death, of love and hate, of war with man, with beast and with nature. These records yield proof of the influence of religion on the arts and crafts, of the potency of magic to stimulate and provide sanction for the economic activities. They show how law and order have grown up, how peace and stabilised conditions must be postulated for the development of the high specialisation, which produces the wonderful flint work of the Badarian culture, or the jewellery of the new Indo-Sumerian civilisation, or the statuary of the later dynasties of the older kingdom in Egypt. The great empires of Babylonia, Sumeria, Egypt, Crete extend their influence, each deriving somewhat from the other.

The change from savagery to civilisation comes, as it were, suddenly. Agriculture is the necessary basis of all settled civilisations, but the time and place of its origin are not yet clear. Knowledge there was in abundance of the processes of nature; how far that knowledge was checked and controlled by experiment, how far it was sustained and conserved by the traditional forces of magic and religion, we cannot yet know.

All ideas are changing, not least the belief that maritime activity is of recent origin. How much early Egypt owed to maritime contacts is not known, but the development of maritime intercourse in the Mediterranean, focused on the Cyclades and on Crete, has certainly been a potent factor at a later period in disseminating culture east and west, tying up the lore of Chaldea with Crete. On the other side, the Persian Gulf and the Red Sea have certainly served as links with India and, at a later date in the 4th century B.C., intercourse was active from India, both from the north up to Patna on the Ganges, the capital of the Mauryan Empire, and from the south, the home of that great, mysterious Dravidian civilisation, to the still more mysterious East, even perhaps to China. Indian maritime activities may have to be correlated in due time with the culture developed in Oceania, where in distant New Zealand traditions survive of a migration from Hawaiki, identified with India, where there are still current modes of speech related to the Austric family of which Polynesia is a member.

From East and West comes evidence of the rise and fall of empires. From China, where early man is now known to have existed, comes a glimpse of early greatness. In the north of India there was certainly established a vast commercialised kingdom with cities almost modern in their architecture, planning and sanitation, and traces of this culture can be found, as we now know, in Baluchistan, as the sign-posts on the road to—or is it from?—Sumeria. Here at one stroke is revealed the secret of the change which transformed the simple society of the pastoral nomad, depicted in the Vedas, into the organised, stabilised, hierarchically ordered society of the period of the Brahmanas. Aryandom is seen to be coloured throughout by elements derived from this prehistoric culture. We now realise that the splendour of the Periclean age in Greece has a long past behind it, that Egypt was then, as Herodotus learnt, old Egypt, that art had flourished on independent lines elsewhere before.

Science is concerned with the measurement of time and in the establishment in Egypt of the Sothic cycle (*Cambridge Ancient History*, vol. i., p. 248) and in the astronomical lore of Babylon is evidence of observation, record and knowledge, profound and valuable. There must have been record and observation over long periods to permit the formulation of these systems of calendars: so too with the Maya systems, based on the vigesimal system and on stellar as well as solar and lunar observations. The independent invention by the Mayas of the Zero is notable in itself and as a mathematical device of first-rate importance and value almost comparable in scientific utility to the invention of fire, and it is due, so far as western civilisation is concerned, to India.

There are yet vast tracts unexplored; there is still need for extensive survey to form the framework of our picture, the details of which can only be corrected by and compiled from intensive studies. New scripts are discovered and, like the Minoan and Easter I. scripts, remain as yet undeciphered; other scripts give up their secrets and disclose sometimes new languages, sometimes variants of familiar stocks of speech. Ample as is the material, it is still lacking in many respects. It is still inadequate for the testing of extensive theories, but Homer has been vindicated, Herodotus no longer labours under the stigma of credulity and, as Tylor bade us remember, " What the poet relates may be fiction, what he mentions is apt to be history."

The old meets the new in many ways and in strange matters. We use steel and concrete as permanent constructional materials, and we seek, as man has always sought, to relieve the severity imposed by our materials by ornament and decoration. It is modern practice now to use solid plaster moulds into which figures may be cast for decorative purposes. This device was used in Central Asia and to it we owe the survival of Hellenistic types in Asiatic art so long as the moulds were available for use, till replaced by the ideals of Chinese art.

Though the methods and discipline of modern anthropology differ necessarily from those essential to archaeology, the two sciences are complementary to one another and, while archaeology helps us in some degree to realise the setting of ancient life, it is to anthropology that we look for the revival of the spirit by which alone we can picture the fullness of life as it was in the ancient world. There are left to us traces of religious rites for the safety and welfare of the dead, for which modern anthropology finds many analogies in current practice.

If we dare assume a continuity and persistence in belief, such that the mentalities of the lower culture of to-day represent in large measure the spiritual conditions of the ancient world, we can recreate much of the stirring past. We know that they distinguished the successful hunter on his death by special rites, we have evidence of the use of magical means to ensure success in the chase, for the promotion of fertility, for the welfare of the community, and of the utilisation of means identical with those employed by ruder folk to-day. Thus, these surveys of archaeological progress throughout the world permit in varying degree a realisation of the conditions in which civilisation, law and order, the arts of life and the beginnings of science made their appearance in the history of the world. (X)

II. A GENERAL SURVEY

The word " archaeology " is commonly used in several senses. To some, it is the general study of antiquity as a whole; of life, that is, *as it was*, within selected limits of time, in a selected region. In this sense, we speak, for example, of Greek or Roman or mediaeval European archaeology. But in this wide significance it is not easy to distinguish archaeology from history, or at all events from that wide and vague penumbra of political history, which is concerned with the background, circumstances and accessories of those " great events " which preoccupy the political school of historians.

To others, interpreting archaeology more strictly, it is the study of the material remains of antiquity, as technology is the study of the material achievements of the present day, and the processes by which they are brought into being; of the ways, that is, in which man satisfies material needs by material means. In this sense, archaeology is the comparative study and interpretation of craftsmanship in bygone times.

But this conception of archaeology as " technology in the past tense, " though fundamentally justified, concentrates attention on materials and processes, to the neglect of the needs which they subserve, and the satisfaction which they are devised to ensure. In particular, current usage accepts, as an integral and important aspect of archaeology, the study of the ways in which man has in the past satisfied his aesthetic and other ideal needs by some material device such as sculpture or painting, either as self-sufficient arts or as enhancements of some other aspect of the craftsman's work than its sheer utility—as means to a material end.

Distribution of Interest.—In this aspect, archaeology is, or at least includes, the " past tense " of art-criticism; and this aesthetic consideration has in fact determined the distribution of archaeological interest and enquiry among periods and regions of culture. To apply a crude practical test, it is usually easy to raise funds for archaeological research, when there is prospect of recovering ancient works of art; usually difficult, on the other hand, when the questions to be answered are primarily technological, or even historical. Examples are the relative popularity of Egyptian and of Babylonian archaeology; of the Minoan and mature Hellenic periods in comparison with the austere and almost artless Early Iron Age which separates them in Greek lands.

Such study of bygone schools of representative or even decorative art is obviously concerned not only with descriptions of the objects themselves, and their manufacture, but with the interpretation of them as expressions of aesthetic ideals, and also as aids to the comprehension of religious or political conceptions which stimulated or dominated the creative imagination of their makers; the symbolic art of Egypt, India and Mexico, the ideal types of Greek deities and Christian iconography, the great schools of portraiture, athletic sculpture and genre painting, with their political and social implications, are illustrations of this.

Relations with Epigraphy, etc.—Very special cases of such ulterior significance are the archaeological study of documentary objects, inscribed monuments, papyri and other classes of written records, and (in their historical aspect) of coins and medals. In so far as they are concerned with the materials, craftsmanship, circumstances of preservation and discovery, as evidence for date and significance, epigraphy, palaeography and numismatics are to be reckoned as archaeological studies, however closely the application of the facts which they reveal, is related to the work of the historian. When a writer like Rostovtzeff[1] speaks of "writing history with the aid of archaeology," he has however in mind, not documentary evidence acquired through archaeological research, but historical conclusions circumstantially established by archaeological considerations; the distribution, sequence and characteristics of certain kinds of human handiwork.

Relations with the "Humanities."—Apart from curio-hunting the formation of decorative "galleries" of old masterpieces, and such occasional freaks of zeal as the excavations of Assurbanipal or Nabonidus, archaeology is a recent offshot of the humanities. Though the Renaissance scholars were no less interested in ancient art (and especially architecture) than in literature, material relics were rarer and less manageable than texts; the first systematic publication of antiquities in J. Gruter's *Thesaurus* dates only from 1603; and J. Selden's *Marmora Oxoniensia* from 1628. Deliberate travel in search of such relics begins with the mission of the Marquis de Nointel to the Grand Turk in 1673 and the travels of Spon and Wheler in Greece in 1676; organisation of scholars for such research with the foundation of the Society of Dilettanti in 1733 and the travels of Stuart and Revett (1751–3), Pococke (1751) and Chandler (1764–6); and in France, of Choiseul-Gouffier and Pouqueville.

Other landmarks are the *Doctrina numorum veterum* of J. H. v. Eckhel (1792–8) and A. F. Mionnet's *Description de Medailles antiques* (1806–13) which laid the foundation for the scientific study of coins; Leake's pioneer work in Greek topography from his arrival in Constantinople in 1793; and above all, the scientific work of Napoleon's Egyptian expedition in the same year, of which the best known incident is the discovery of the "Rosetta Stone" which gave Champollion the clue for the decipherment of hieroglyphic texts. Tomb-robbing had been habitual in the Near East, as in Italy, especially in Etruria and Campania, since ancient times, but the notion of recording the finds as they were made hardly goes back beyond the days of Sir Richard Colt Hoare (1812–9). Systematic excavation of an ancient site was first attempted on a large scale at Herculaneum in 1738 and at Pompeii in 1763; but these were essentially sites of a single period and layer of deposit, and gave no scope for stratigraphical research, even if the historical perspective of the excavators had been sufficiently developed to allow this.

Type Sequences.—For another century, indeed, and more, the sole available method of investigation was the comparison of types and styles, with occasional aids to a fixed chronology from inscriptions on monuments and coins. Consequently it was long before archaeology could be regarded as more than an illustrative "handmaid to history." In certain departments of fine art, and especially in painting, the comparison of dated examples of successive phases of style made generalisations possible as to certain characteristics of "primitive" or "archaic," "mature" and "decadent" work within the same school; and in the early 19th century the same method gave brilliant results in the study of what had hitherto been merely "Gothic" architecture.

It was not until some progress had been made in the kindred subject of geological "fossils," with the aid of the "systematic" zoology of Linnaeus and Cuvier, and the evolutionary conceptions of Lamarck, that a beginning was made by C. J. Thomsen in the morphological classification of the prehistoric antiquities of the National Museum founded in Copenhagen by Nyrup in 1806. Thomsen, forming continuous series of implements, of less and more specialised types, and observing the resemblance (for example) of the most mature types made from stone, to the least-developed types in bronze, had established before 1830 the sequence of distinct "ages" of stone-, bronze- and iron-using culture within the same region. The same conclusion was reached independently by F. Lisch in the ducal museum of Mecklenburg-Schwerin in 1836; and Thomsen's pupil, J. J. A. Worsaae clinched these results by the discovery that in Danish peat-bogs, stone implements were found mainly in the lowest layers, characterised by the presence of remains of Scotch firs; bronze mainly in layers above these, with oak; and iron in the uppermost layers, where beech alone occurred: thus proving not only sequence of the three "ages," but periods of sufficient duration to allow considerable changes of climate. Keller's demonstration of similar superposition of types on the floors of Swiss lakes, in 1854, attracted even wider attention—the word *Kultur-schicht* for such layers of remains of handiwork, first occurring in 1855; and in 1859 the same stratigraphical argument, in the hands of Prestwich and Evans, confirmed the brilliant anticipation of Boucher de Perthes, of the glacial antiquity of the "palaeoliths" in the terrace-gravels of the Somme.

Thomsen's morphological argument, reformulated on a wider basis, and applied to human handiwork generally by G. Klemm,[2] was interpreted afresh on the new Darwinian principle of "survival of the fittest" by Sir J. Lubbock, *Prehistoric Times* (1865), and A. H. L-F Pitt Rivers, "Principles of Classification," *Jour. Anth. Inst.*, vol. 4 (1874); E. Kapp's *Grundlinien einer Philosophie der Technik* (1877), G. Semper's *Der Stil* (1878), and M. Hoernes, *Urgeschichte des Menschen* (1892), marking important extensions and refinements. And meanwhile the work of Keller and Troyon among the Swiss "lake dwellings" stimulated the copious well-directed explorations of Gastaldi (1860), Ströbel (1861), Pigorini (1863), Chierici (1864) and their pupils, in the far more accessible *terramare* settlements of Lombardy. It was indeed in this exceptionally favourable material that the technique of scientific excavation was mainly developed; to be applied, less than 10 years later, by Schliemann, on the traditional site of the Homeric Troy, to the first dissection of an exclusively dry-land site, on which the deposits had been accumulated in the open, without water-action.

Use of Photography.—By this time, the new art of photography had immensely increased the rapidity and accuracy with which discoveries could be recorded; H. Schliemann's *Atlas Trojanischer Alterthümer* (1874) is the first important use of it for purposes of publication. By way of contrast, the epoch-making tomb-records of von Sacken and Ramsauer, in the great early-iron-age cemetery at Hallstatt (1862) remained almost unutilised for a generation, because they consisted only of a single set of water-colour-drawings.

Photography had indeed been employed rather earlier to record architectural monuments, as in the Roman excavations of J. H. Parker, published in 1874; but for field work it was not till gelatine began to supersede collodion as the sensitised film, about 1875, that modern photographic registration became possible. Even the *British Barrows* of W. Greenwell and G. Rolleston

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[1] *Iranians and Greeks in South Russia.* Preface.

[2] *Allgemeine Kulturgeschichte der Menschheit* (1843–52).

(1877), a model of scientific research and description, is but scantily illustrated by wood-blocks of single objects.

Organised Excavations.—With experience gained in Schliemann's Trojan excavations, in the Roman Forum, and on less important sites elsewhere, the new Imperial Govt. of Germany initiated at Olympia in 1874 the first large-scale excavation of an untouched classical site. The far earlier excavations of Newton (1856–66) at Halicarnassus and Cnidus, and those of Wood at Ephesus (1863–74) had at best surveyed and despoiled important sites which the barbarous Ottoman administration made it impossible to conserve. At Olympia and similarly later on the Acropolis of Athens, in the French excavations of Delphi and Delos and elsewhere, a civilised government undertook in advance to protect and maintain what was found, either on the spot, or in national collections, even more effectually than had been assured by the French inspectorate of antiquities in Egypt organised by Mariette in 1858. Obviously it is only on some such guarantee for the conservation of results that it is justifiable to leave exposed the foundations and other immovable monuments which excavation exposes to the risk of vandalism.

Preservation of Monuments.—Such public guardianship of ancient monuments other than buildings in habitual use, begins with a French statute of 1810, the official inspectorate of French monuments in 1830, and Guizot's *Commission des Monuments Historiques* in 1837; and with the farsighted legislation of the newly founded Greek Kingdom in 1834. The first British "Ancient Monuments Act" comes much later, in 1882, with the Hungarian Act of 1881 and the Turkish Antiquity Law of 1884, which was the first to provide for equitable division of portable objects between the state, the landowner and the excavator. Public custody of ancient monuments appears in the Greek, Italian and most of the continental enactments compulsorily; in the British Act of 1882, only in the event of voluntary transfer of a monument by its owner to the public Commission of Works. In addition the "National Trust for Places of Historic Interest or Natural Beauty" was recognised by the second British Act as a legal custodian, and has rendered many valuable services in this way. Systematic registration, somewhat on the French model, is contemplated under the Historical Monuments Commission of 1908, and some degree of conservation at public expense by the Irish Act of 1892 and the third British Act of 1913.

Records and Surveys.—Monuments, if sufficiently conspicuous or notable, have at all times found record in ordinary topographical maps; but the notion of a deliberately archaeological survey is comparatively modern. The first large scale map of the antiquities and ancient sites of a district is the magnificent *Karten von Attika* of F. Curtius and J. A. Kaupert (1884); rather earlier, but necessarily on a smaller scale, is the *Survey of Western Palestine*, with seven volumes of memoirs, executed for the Palestine Exploration Fund and published in 1881. A fine later example of such work is the *Archaeological Survey of Nubia*, necessitated by the imminent submergence of large numbers of sites and monuments by irrigation works. Local archaeological surveys in Britain, for the most part organised by private enterprise since 1890, are now supplemented and co-ordinated by the appointment of an archaeological officer to the Ordnance Survey. Outside Europe and Egypt an Archaeological Survey of India, revived and developed during Lord Curzon's vice-royalty, is the only attempt to plot the antiquities of a considerable region on a coherent plan, though the French *Mémoires de la Délégation Archaeologique en Perse* contain valuable pioneer surveys and also records of excavation.

Air Survey.—The employment of aircraft as an aid to archaeological discovery hardly occurs before the World War and is still rare and experimental. Remarkable results, however, have already been obtained in Great Britain, by the co-operation of training-units of the British R.A.F. with the archaeological department of the Ordnance Survey, and elsewhere, by British, French and Italian airmen in regions such as North Africa, Syria and Mesopotamia, where distances are great, surface travel arduous and exposure and visibility on the other hand unusually good. The peculiar value of such air-surveys results from the revelation (under favourable conditions of light, at dawn or sun set) of surface features due to denuded earthworks, hut-circles and other disturbances of the natural soil, of which the actual elevation is too slight and gradual to be plotted or even detected by an observer on the ground level (*see* section XIX. AIR SURVEY).

Value of Maps.—In a quite different direction, the employment of mapping as a means of interpreting the significance, not only of sites and monuments, but even of casual finds, is only recently becoming appreciated, now that a sufficient quantity of data have been accumulated and classified, and the significance of the mere find-spot of an object is more clearly appreciated. Such distribution-maps represent the analysis of the miscellaneous information incorporated in the regional survey, into appropriate categories, and the correlation of these with one another, and with natural features or resources cognate to their production or use.

Distribution of Amber.—For example, the distribution of objects of amber (the sources of which are known to be geographically limited) is already sufficiently well known to give valuable information as to the routes along which it was transmitted toward the most distant find-spots; and seeing that a commodity so widely prized was also highly valued, the distributions of other commodities, sometimes of unknown origins, along the same routes, throws fresh light on each other, as elements in a return-traffic, and on the significance of other resemblances between the cultures of the regions which these trade-routes interconnect.

Similarly, the growth and spread either of this or that type of culture as a whole, such as the Hallstatt or La Tène civilisation of the Early Iron Age in Europe, or of particular devices or practices such as the safety-pin or the leaf-shaped sword, or zoomorphic ornament or the custom of cremation, are demonstrated by comparing the distributions of early and of late phases of each type of object concerned; or conversely, the place of an anomalous variant in the series of development may be shown by the relative geographical extent of its distribution. Instructive examples of recent research in these directions are the work of Åberg on the Frankish types of brooches, of Peake on the leaf-shaped sword, and of Rostovtzeff on the polychrome jewellery and schools of animal-decoration in late classical and early medieval times.

Sequence-Dating.—Though archaeology is seldom concerned, as history usually is, with individual (and, to that extent, unique) events, and consequently reckons far more often in terms of relative antiquity than of precise chronological data, some advance has been made—especially by Sir W. Flinders Petrie, working on the very large masses of cognate material derived from the predynastic cemeteries of the Nile Valley, and by Sir Arthur Evans on the copious contents of the palace-sites at Knossos, and other deposits of the Aegean bronze age—toward a method of "sequence-dating" capable of considerable refinement, especially wherever the series of development in different classes of craftsmanship support each other's indications. Unitary modifications in the general complexion of a culture, or of a single art or craft in it, appear under such circumstances to be closely related to the careers of individual craftsmen, leading to a rough reckoning by human generations.

Synchronisms.—Occasionally, such "sequence-datings" and the approximate coincidence of corresponding phases in distinct regions are even found to be confirmed and correlated with the "absolute" chronology of a country such as Egypt, of which there is documentary evidence for its history, by the occurrence of what are known as "datemarks."

The argument from such "datemarks," formulated first in essentials by Flinders Petrie and generally accepted as valid about 1890, is as follows. An object belonging to a particular phase (*c*) of a changing culture (*A*), and found in the same layer of deposit—a rubbish heap, ruined house or tomb—with a particular phase (*d*) of another culture (*B*) in the region of that culture, cannot be of later date than the objects with which it is found, while it may (obviously) have been itself more or less old already when it became associated with them. With such unilateral association only, no further conclusion may be drawn. If, however, with objects of phase (*c*) in the region of culture (*A*), there be found even a single object belonging to phase (*d*) of culture (*B*), then it follows similarly that the intruded object (*d*), though it may have been older, cannot be of later date than the objects (*c*) with which it is found. But it has been already established that phase (*c*) cannot be later than phase (*d*); and phases, neither of which can be later than the other, are necessarily contemporary.

In this way it has been possible, for example, to synchronise phases of the Early Minoan culture of the south Aegean with the V. and VI. Dynasties of Egypt; phases of the Middle Minoan, with the XII.; and the Palace-Style of the Second Late Minoan period with the middle reigns of the XVIII. Dynasty.

Such synchronisms are rare as yet; but they become more numerous as the material becomes more copious and is more accurately recorded; and they illustrate the stages by which the purely morphological comparisons of the archaeology of the early 19th century are re-interpreted in the light of stratigraphical exploration into a closely reasoned construction which is difficult to distinguish from historical knowledge. (J. L. M.)

III. CONTINENTAL EUROPE AND GREAT BRITAIN

Eoliths.—The existence of tertiary man or of a tool-making animal, first mooted in 1867 at the congress of Paris, was only recently proved near Ipswich, thanks to Mr. Reid Moir's researches. Tertiary deposits in East Anglia were laid down, for the most part, in a shallow sea, and must have formed low sandbanks, sometimes carrying a sparse vegetation, not unsuitable to the existence of primitive man living mainly on shellfish. The argument for the existence of a tool-making animal is that certain flints have been found, chipped in several directions in a manner practically inconceivable had natural forces been the only agency at work. Further in the case of some of the East Anglian finds, it is difficult to see what natural forces could be involved.

At Thorington Hall, near Ipswich, a bi-valve shell was found in the gravels with the hinge still intact, thus indicating no differential movements in the gravels which could have set up shearing actions. Nor could the flints have been naturally chipped elsewhere and introduced later into the deposits, because tiny chips as well as larger chipped implements are found in definite layers associated together. This would not be the case if the objects had been washed in from a distance. Naturally the chipped flints are exceedingly primitive, the usual types being scrapers and beak-shaped tools. In the light of these new East Anglian discoveries a number of classical tertiary sites are being reconsidered, such as Boncelles (Belgium) and Puy de Courny (Auvergne, France).

PALAEOLITHIC CULTURES[1]

A considerable advance has been made in our knowledge of Palaeolithic man. Work has been done on the Archaeological Sequence both relative and absolute, though the exact correlation of the various cultures with the geological record still remains rather obscure. The French sequence of cultures has become standardised as follows, the names being taken from typical find-stations:—

Upper Palaeolithic	Magdalenian from La Madeleine, Tursac, Dordogne. Solutrean from Solutré, Seine et Loire. Aurignacian from Aurignac, Hte. Garonne.
Middle Palaeolithic	Mousterian from Le Moustier, Dordogne.
Lower Palaeolithic	Acheulean from St. Acheul (Amiens), Somme. Chellean from Chelles, Seine et Marne. Pre-Chellean.

These cultures have been separated on stratigraphical grounds supplemented by a typological study of the tools. Layers containing definite industries (*i.e.*, assemblages of contemporary artifacts) are often found in super-position one above the other in cave deposits. These typical industries are exclusively made of stone in Lower and Middle Palaeolithic times, but also of bone, horn, ivory and antler in Upper Palaeolithic times. Doubtless wooden tools were always manufactured, but this material of course readily disappears. It has been possible further to subdivide each culture, according to its special tool or series of tools. Thus, the Magdalenian shows no less than six sub-divisions, Sclutrean three, Aurignaçian five, Mousterian three, Acheulean three and the Chellean two. Naturally these sub-divisions are of less general importance, but none the less they can be recognised over large parts of Western Europe.

It has been increasingly realised that the French sequence is not of universal application and that in other districts outside the immediate influence of Prehistoric France, conditions were not exactly similar; thus in Moravia, second only to France in importance from a Palaeolithic point of view, nothing earlier than Mousterian is found, while Upper Palaeolithic cultures, starting apparently from a similar Aurignacian stock develop on their own, only slightly influenced from other areas. The Prehistorian, even in these early times, has to deal with areas of cultural development in Europe, connected with, and influenced by, each other to a greater or less extent, but by no means necessarily similar.

Chronology.—The correlation of the archaeological and geological records remains a thorny question. On Penck's hypothesis Quaternary times, coinciding with the great Ice Age, can be sub-divided into four Glacial Maxima with warm inter-Glacial periods between. These are called from earliest to latest: Günz, Mindel, Riss and Würm, after four tributaries to the Danube basin from the German Alps, the inter-Glacial periods being called respectively Günz-Mindel, Mindel-Riss and Riss-Würm. Connected with the Glacial Maxima was the laying down over large parts of Europe of wind-borne deposits of loess, due to the cold, dry Steppe-like conditions prevailing. The early loesses and much of the evidence for earlier glaciations have been necessarily destroyed by the later ice advances, but the Würmian glaciation being of less intensity than the Riss, its terminal moraine has not reached out as far into the plains as that of its predecessor, which has thus been preserved. Other investigators have denied a fourfold glaciation system, and consider there were only three or even two Glacial Maxima. Correlation between the archaeological and geological record is obtained by finding industries typical of a culture in or on a datable deposit such as a loess, river terrace or known moraine. An absolute chronology in time is a very difficult matter. Attempts have been made to determine when the retreat of the Würmian ice began, but these have not been very successful. However, 20,000 years ago as an approximate date for the dawn of the Upper Palaeolithic has the support of many authorities and is probably not far wrong.

Home Art and Cave Art.—This consists of sculptured and engraved (rarely painted) objects found in home sites associated with datable tools. Lately a number of important examples including two good human figures, an ivory one from the Pyrenees (see fig. 7 on plate), and a dried clay one from Moravia have been found, as well as other statuettes and engravings of horse, mammoth, bear, etc. The Solutrean folk, except under the immediate influence of Magdalenians nearby, were not an artistic people, but there is both an Aurignacian and a Magdalenian art.

The old theory that sculpture necessarily preceded silhouette, which in turn preceded line engraving, no longer holds good. We find line engraving from the earliest times and sculpture of course continues to the end. It is true, however, that the proportion of engraving to sculpture increases with the development of the art.

Although the "Venuses" are Aurignacian, the Magdalenian art is by far the richest and comprises naturalistic figures of animals, patterns and conventionalisations, these latter increasing towards the end of the period. Some of the patterns seem to correspond with our fashions of to-day, having a very limited existence in time, but a wide distribution in space, *e.g.*, a broken zigzag pattern is found at the same period in such widely separated areas as Cantabria and the Jura, while certain early Magdalenian motives are found as far east as Moravia. Attempts are being made to classify the Magdalenian home art of France according to technique and types of designs into six sub-divisions corresponding to those made with regard to the tools.

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[1] A culture is perhaps definable as the sum of the activities of a people as shown by their industries and other deducible characteristics.

Cave art consists of paintings and engravings on the walls of caves and rock-shelters; they seem generally to have been made for ceremonial purposes. Two distinct groups are known of which the first, of Upper Palaeolithic date, occurs in the caves of the limestone districts of Dordogne, Lot, the Pyrenees and Cantabria and includes two anomalous areas, in southwest Spain and the heel of Italy (one cave only). Figures of contemporary animals, many of them now extinct, such as the mammoth, cave bear and woolly rhinoceros (see fig. 6 on plate), are wonderfully portrayed. The materials used were natural oxides and carbonates of iron, oxide of manganese and charcoal; these were ground up and mixed with fat, the colours obtained being light red, dark red, chocolate or light yellow, orange, blue black or coal black.

The authenticity of this art can be shown from the fact (*a*) that certain engravings have been found covered by undisturbed Palaeolithic deposits, which must therefore be later in date than the engravings themselves; (*b*) that figures of extinct animals occur sometimes covered with layers of stalactite. The drawings, with rare exceptions, bear no relationship to one another and are made one upon another. From such palimpsests studied in conjunction with the different techniques present here and in the home art, it has been possible to determine four distinct chronological phases, characterised by certain styles or techniques. Thus phase 1 is Aurignacian, phase 2 early Magdalenian, phase 3 middle Magdalenian and phase 4 late Magdalenian. The engravings of phase 1 show a deep, continuous line; both they and the paintings have no idea of perspective till right at the end of the period, and generally only two legs are indicated. A number of representations of the human hand occur as well as series of engraved parallel wavy lines. Phase 2 shows a very considerable advance. The engravings are no longer made with one continuous line, and sculptures in high and low relief have been found. Natural bosses of rock or stalactite somewhat resembling an animal are often utilised and improved, and the paintings show stump drawing or fine punctuated outlines. This perhaps was the most vigorous moment in the career of palaeolithic art.

In phase 3 the engravings become finer, but the paintings show considerable falling off. Their vigour is lost, the stump drawing becomes flat wash and the fine, punctuated lines degenerate into coarse, continuous ones. In phase 4 the engravings become exceedingly fine—mere scratchings—but are beautifully made. In one or two cases something of the nature of impressionism is present. For example, a little hairy mammoth is represented with his feet appearing from under his woolly coat, but on careful observation it will be seen that the feet have no linear connection with the body, yet the general appearance is perfect. The paintings regain somewhat the vigour of phase 2 by the use of polychrome, but although the beauty and skill of the later frescoes on the ceiling at Altamira (Spain) is astounding, the pristine freshness and vigour of the art of early Magdalenian times is perhaps somewhat lacking.

Magic.—Possible motives for this art involve the concept of sympathetic magic. Decoration or desire for expression are not explanations that satisfy the circumstances. They were certainly made for magic purposes connected with a desire for food. The fact that the phases change at the same time over wide areas indicates a continuity of intercourse between the artists-medicinemen-priests, involving something like schools of tradition. At the Trois Frères cave near St. Girons (Ariège, France) there is a little chamber at the end of a long cave, the walls of which are covered with beautiful engravings, the whole being dominated by the figure of a man masked, with antlers, as a stag and with a long tail (see fig. 1). Close by this figure and equally dominating the chamber below, is a sort of natural pulpit accessible from behind, whence no doubt the sorcerer himself officiated. The darkness and the weird silence of the cave must have been very conducive to a readily influenced state of mind, and among a hunting people an induced self-confidence is half the battle for success.

The second group occurs in rock shelters in eastern Spain and comprises paintings (and in one instance an engraving) in a totally different style from those in the caves. Scenes are common and, unlike the first group, so are representations of the human form. From the fact that a number of animals no longer living in Spain are painted, such as the rhinoceros, elk and bison, a late Palaeolithic age for this group is considered probable. Motives are unknown, but since they are quite clearly unconnected with "homes" they may possibly have been decorations at some sacred place.

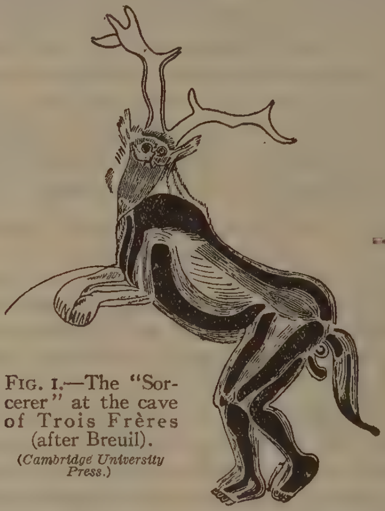


FIG. 1.—The "Sorcerer" at the cave of Trois Frères (after Breuil).
(*Cambridge University Press.*)

MESOLITHIC CULTURES

At the end of Palaeolithic times, the climate rapidly changed to a more genial one (why is still uncertain) and the old arctic fauna disappeared. New cultures appear, some doubtless evolved from late Palaeolithic originals. Of these so-called "transitional" cultures, four main ones have been recognised: (1) Azilian named after Mas d'Azil, Ariège, France. (2) Tardenoisean named after Tardenois, Aisne, France. (3) Asturiense or Asturian named after Asturias, Spain. (4) Maglemosean named after the Maglemose or Great Bog, Zealand, Denmark.

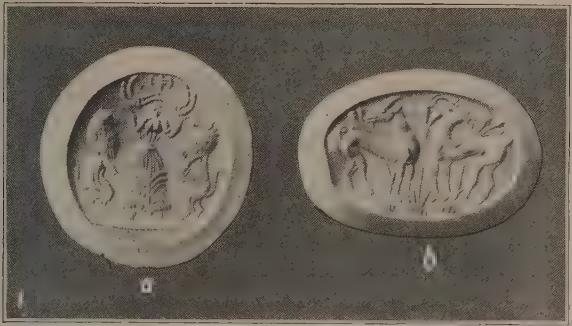
The Azilian seems to have been a comparatively small culture, mainly focused round south France. It is found, however, in north Spain, east France and, in one instance, in Belgium; and anomalous finds have been discovered in western Yorkshire and in Scotland at Oban. No domestic animals with the exception, once, of the dog, occur. The industry shows tremendous falling off from the Magdalenian standard, though a new type of bone harpoon and painted pebbles (river pebbles with red dots, lines, circles, etc., on them) appear. Art disappears.

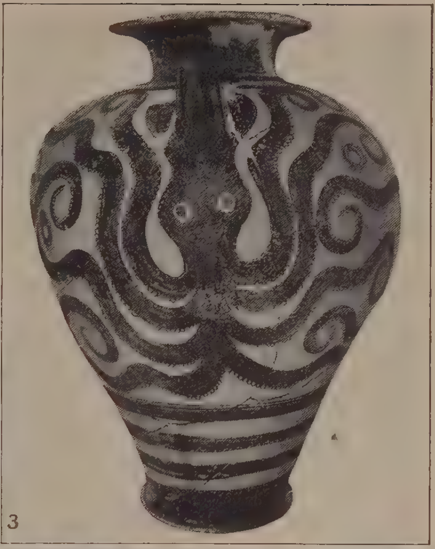
The Tardenoisean culture is mainly characterised by pygmy industries, these little tools being doubtless hafted as knives, teeth for saws, etc. Pygmy industries indicate the idea of a composite tool, and this idea could quite well develop at different times and in different parts of the world, so that the existence of pygmy industries in various continents does not indicate connection with European Tardenoisean cultures. The Asturian is a small culture found in Asturias (Spain) stratigraphically post-Azilian, but without domestic animals or pottery. Its origin and distribution are not yet fully known.

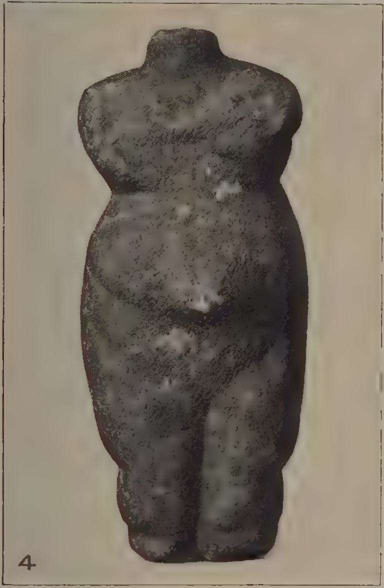
The Maglemosean culture with its flint and stag-antler industry, is centered round the Baltic where it is the first post-Glacial arrival, unless we are to separate some rare finds made of reindeer antler. It has been recognised as far south as Boulogne and as far west as eastern England. The typical tool is a special kind of harpoon.

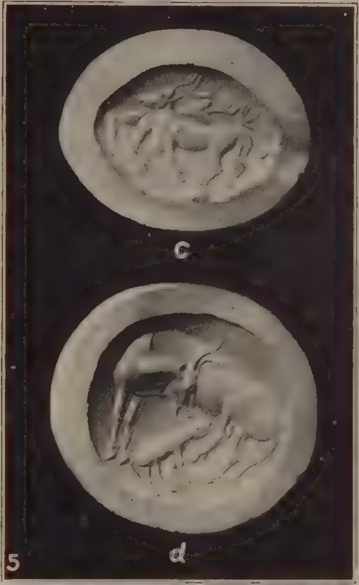
ARCHAEOLOGY

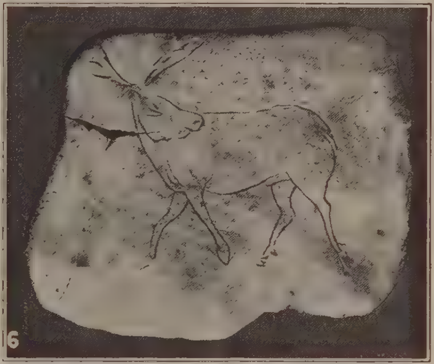
PLATE I.

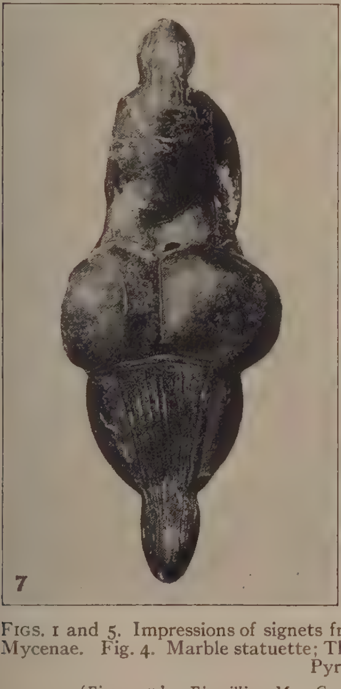


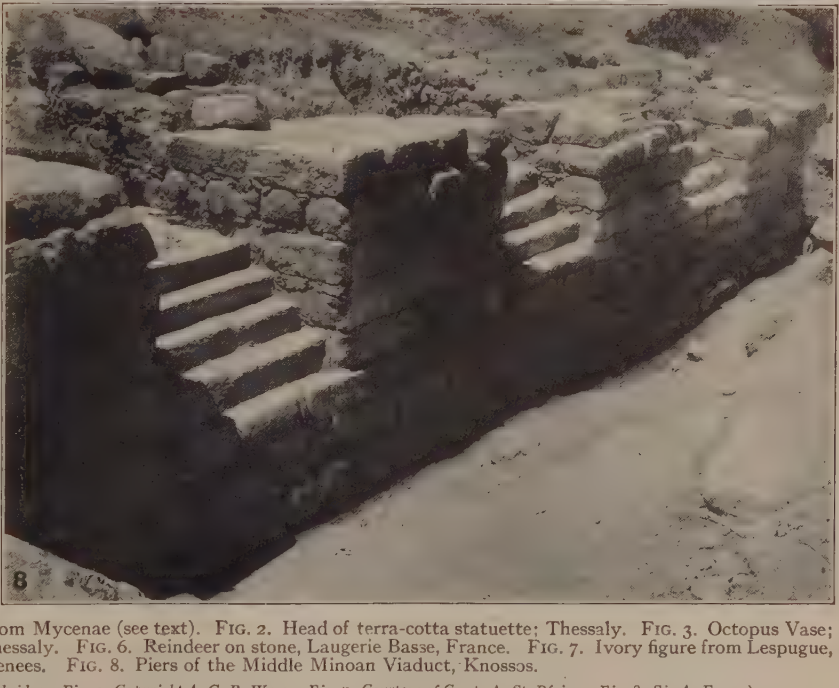












FIGS. 1 and 5. Impressions of signets from Mycenae (see text). FIG. 2. Head of terra-cotta statuette; Thessaly. FIG. 3. Octopus Vase; Mycenae. Fig. 4. Marble statuette; Thessaly. FIG. 6. Reindeer on stone, Laugerie Basse, France. FIG. 7. Ivory figure from Lespugue, Pyrenees. FIG. 8. Piers of the Middle Minoan Viaduct, Knossos.

(Figs. 2 and 4. Fitzwilliam Mus, Cambridge. Fig. 3. Copyright A. G. B. Wace. Fig. 7. Courtesy of Comte A. St. Périer. Fig. 8. Sir A. Evans.)

NEOLITHIC CIVILISATION

The Neolithic civilisation first introduced (*a*) agriculture, (*b*) domestic animals, (*c*) the making of pottery and (*d*) the making of stone tools by grinding and polishing. The effect of these four discoveries on human progress was enormous; (*a*) and (*b*) permitted a great increase of population, and also concentrated this population into definite communities. Specialisation was thus possible and practical knowledge increased; (*c*) refined the home and provided an excellent medium to be decorated for its own sake; (*d*) could produce an edge on stone thereby tough as well as sharp) a great addition to the sharp but brittle chipped flint edge. This was especially useful for carpentry. Where these new developments had their sources is uncertain but (*a*) and (*b*) were probably introduced from central Asia.

The Neolithic civilisation in Europe can be divided into three areas or circles, an eastern, a northern and a western, and in each circle there is possible a chronological sequence, generally threefold. Until the end of Neolithic times, the whole of central Europe was occupied by a primeval forest and, except for the loess lands which were free from trees, there was little intercourse between the various circles. In late Neolithic times, however, a dryness set in, the forest disappeared, the three circles coalesced and there developed a bewildering series of hybrids, closely followed by the introduction of the use of metal, the dawn of the Copper age, and then that of the early Bronze age.

Eastern Circle.—The early Neolithic folk of eastern Europe seem to have arrived from central Asia, probably driven thence westwards by increasing dryness due to the slow disappearance of the great sea area of late Quaternary times, that had made all those regions so suitable for human development. The culture is at first characterised by the so-called band pottery decorated with spirals, meanders and the like. This early linear pottery is succeeded by decoration by means of punctuated lines (*Stich Band*). A little later, an anomalous group of painted pottery appears as well, but the exact relationships of this latter are not clearly known. Its distribution extends from south Russia to Moravia and southwards as far as northern Thessaly.

The Western Circle.—In the Western Circle which extends from south Holland round to Italy, occur the well-known polished stone axes, and in lakes throughout the lower slopes of the Alps, pile dwellings. Megalithic buildings abound comprising dolmens, passage graves, stone kists, etc. The exact cradle of this Megalithic Tomb cult is still uncertain. In south Spain where they are especially varied, they coincide with a flourishing Copper age, early developed in that country, owing to the abundance of suitable ores.

The Northern Circle.—The Northern Circle includes Scandinavia and the Baltic area. Here is seen development from the Maglemose culture (see *ante*) to that of the Kitchen Middens where pottery occurs, although domestic animals, with the exception of the dog, are absent. This, in turn, influenced by the Megalithic culture from the southwest, gives rise to the well-known Megalithic cultures of Scandinavia. The earlier industries continue, however, to exist in the hinterland under the name of Arctic culture. But the Northern Circle suffered further influences from outside, for the so-called comb pottery culture coming from northern Asia seems to have arrived here at an early period, and rather later the introducers of the "single grave" and "battle axe" arrived from the east, originally probably cradled in south Russia.

The hybrids which developed at the end of Neolithic times cannot here be described; sufficient to say that strong northern influences are observable as far south as southern Germany, while the pile dwelling culture spread along the Alps till we find it in Slovenia. Finally the so-called Beaker folk, who were cradled in south Spain, arrived with their characteristic bell-shaped pottery vessels in central Europe, possibly via Belfort, and spread as far east as Budapest, reaching our own coasts by way of the Rhine valley. They had some knowledge of copper and it seems to be they who first introduced this metal into Great Britain.

Neolithic Art.—A very conventionalised art in rock-shelters in Spain of late Neolithic or Copper age is known; also a semi-naturalistic art engraved on rocks in western Norway which must be referred to the Arctic culture. Late figurines occur in the Eastern Circle but otherwise, with the exception of a good engraving of a fish on a cork float from Lake Wauwil and decorated pottery, home art is rare.

England.—Except from the point of view of chronology and its tertiary deposits, England is not specially important from the prehistorian's point of view. It lies far to the north and was long under the influence of the great Scandinavian ice-field. Rich Lower Palaeolithic deposits occur, specially in the basins of the Ouse and Thames. Mousterian industries, both with warm and cold fauna, have been found in the Thames basin and presumed Mousterian industries occur in caves in the southwest as well as in Derbyshire. Upper Palaeolithic industries are rare, some being found in a few caves. These show Aurignacian development with only a little influence from the Solutrean and Magdalenian cultures farther south. Pygmy industries are being discovered, specially round Sheffield, and include the pygmy Burin typical of Tardenoisean times. In northern England, an Azilian harpoon has been found to the west of the Pennines, Tardenoisean industries on the hills themselves and a Maglemosean harpoon to the east.[1] Little progress has been made in systematising the British Neolithic industries, although much has been done in docketing the Megalithic constructions, and Neolithic home sites with pottery, etc., have been excavated near Peterborough. Distribution maps for eastern England show that the forest lands were not peopled by Neolithic folk, who preferred the dry, sandy areas of Norfolk and Suffolk overlooking the Fens, with an open hinterland behind for their small flocks and herds. The absence of sickles points to but little agriculture. The Fen islands were only occupied at the end of the time, probably on account of pressure from the oncoming Beaker folk.

THE BRONZE AGE

The outstanding Bronze age discoveries since 1910 are, of course, those of Crete, the Aegean and Mesopotamia. Elsewhere systematic work has continued following largely typological grounds. One of the earliest sites seems to be Aunjetitz in Bohemia, but exactly how metal was introduced into northern Europe is still a moot point; certain it is, however, that the Beaker folk knew of the use of copper.

THE EARLY IRON AGE

Similar systematic work and excavation continue in Early Iron age sites. The dryness of late Neolithic and Bronze age times was replaced by increasing dampness, and possibly the big folk-movements of the early Iron age were due to deteriorating climatic conditions. The main discovery in England of importance, is the find of this "Hallstadt" culture, hitherto believed absent. Typical pottery was first recognised near Devizes and is now probable from a number of sites in East Anglia and elsewhere.

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IV. ITALY AND THE WESTERN MEDITERRANEAN

Italy.—Despite wars and the resulting poverty in Italy, excavations continue. Archaeological reports since 1910 in the standard publications (the *Notizie degli Scavi*, the *Monumenti Antichi* and the two *Bulletini*) cover more than 20,000 packed pages. In the prehistoric field the harvest is still of great importance. The Picene region has yielded hundreds of well-stored inhumation tombs which form a series of links between the neolithic and historic times. The finds are well placed in the Ancona Museum (Dall' Osso, *Museo di Ancona*). They explain fully why the rich Adriatic littoral was not disturbed by the Terramara invaders: the neolithic folk lived on in Picenum and barred the way. Unfortunately, some recent archaeologists, obsessed by the new "Picene hypothesis," have forgotten linguistic evidence to the point of substituting the word *Picene* for *Sabellic* throughout eastern Italy.

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[1] It is possible that some of the small industries found on the surface in East Anglia may belong to this latter culture.

North of the Po, at and near Este in the Euganian region, valuable excavations have been carried on for over 10 years (*Bull. Paletn. Ital.* 1911; *Not. d. Sc.*, 1916–22). The "Atestines" were evidently a strong and wealthy people from the 8th till the 5th century, with a civilisation akin to that of the Villanova folk and in their later days strongly influenced by the Etruscans. From the great Terramara people we have had but little fresh material. The Golaseccans of the Italian Lake region are still a riddle. A few new discoveries seem to indicate that they were a tribe distinct from the Terramaricoli, and some scholars incline to the view that they represent the first Celtic invaders of Italy, though a very early group. Nothing decisive has been found in the Ligurian country. The few cremation tombs recently unearthed there may possibly belong to a wedge of Terramara folk. They certainly do not prove the Ligurians Indo-European.

Villanova sites throughout Etruria and neighbouring regions are still yielding rich rewards that confirm previous discoveries. Randall-MacIver's[1] assignment of the early Iron Age settlements of Rome and the Alban Hills to this people will probably carry conviction. The most fruitful discoveries have been made near Bologna, at Vulci, Veii (still unpublished), the Faliscan region (Holland, *The Faliscans in Prehistoric Times*), Terni (*Not. d. Sc.*, 1914, p. 3), the Alban Hills (*Bull. Paletn. Ital.*, 1924) and Antium (9th century cremation tombs found on landing the Italo-American cable in 1925). Clearly the Sabellic tribes brought inhumation into the eastern border towns of the Villanovans (from Falerii to Latium) a century or more before the Etruscans reached those places. For the excavations of many important nuraghi in Sardinia one may consult Taramelli's new catalogue of the museum of Cagliari. For the whole field of prehistoric archaeology in Italy down to the 7th century we have now a nearly complete *corpus* of the material in F. von Duhn's *Italische Gräberkunde* (1924), a book of profound erudition.

Of Etruscan sites, Caere has yielded exceedingly fine Greek vases besides valuable funerary objects and inscriptions, which will aid in restoring the history of Etruscan culture from the earliest day till Roman times. Unfortunately very few of these tombs have been published. Veii has proved unexpectedly fruitful. The foundations of a three-cella temple were found, and near it considerable fragments of a 6th-century terra-cotta group representing a contest between Apollo and Hercules, probably an acroterion of the temple. The Apollo, now in the Villa Giulia, is a masterpiece of its century (*Not. d. Sc.*, 1919). Many of the terra-cotta antefixes (*Not. d. Sc.*, 1922, 206) are also of rare beauty. On the acropolis of the city have been found parts of the old city wall, foundations of several Etruscan dwellings and two public buildings, and a large elliptical basement, which is supposed to be the foundation for a straw-thatched town hall of very early date. Farther north were discovered the stone walls of a 7th-century dwelling-house of five rooms—the oldest structure of its kind in Italy (*Not. d. Sc.*, 1913 and 1922, 206–380). The tombs have proved that Veii was once a Villanova city which fell into the hands of Etruscan rulers sometime before Rome's foundation.

Populonia, which prospered on the manufacture of the iron-ore of Elba, has yielded many important finds. During the recent War numerous shiploads of iron slag from the ancient Etruscan furnaces were removed for re-smelting, and in the process an old cemetery was uncovered. These graves and others near by were found to be well-stored with urns, arms and ornaments which A. Minto has recently published in a volume entitled *Populonia* (Firenze, 1922). A similar series on excavations at Marsiliana has also been published by the same scholar. At Orvieto a 4th-century Etruscan temple with excellent pedimental terra-cottas has been found, important especially because of the tendencies of contemporary Greek art which they reflect. Good illustrations of these finds have just been published in *Dedalo* (1925, p. 136). Vignanello has yielded good Greek vases as well as much Etruscan ware. A grave at Todi has been found to contain numerous red-figured vases and some good Etruscan armour. Finally, at Rome, on Monte Mario behind the Vatican, casual building operations revealed a very interesting 7th-century Etruscan village built over the site of an early Bronze-Age settlement. The *corpus* of Etruscan inscriptions has also advanced by several fascicles with many new inscriptions, but no real advance has yet been made toward their interpretation. A convenient summary of Etruscan art in Rome is to be found in R. A. L. Fell, *Etruria and Rome* (1924).[2]

Rome.—The city of Rome still yields a constant stream of ancient works of art. The terms of the recent treaty restored the whole of the Capitoline hill to Italy, and the government with characteristic zeal at once ordered the excavation of the site of Rome's chief temple. The massive foundations of Tarquin's structure were laid bare and found to agree with the dimensions recorded by ancient authorities (*Not. d. Sc.*, vol. 18, 1921). Unfortunately none of the decorative terra-cottas of the old temple have as yet come to light. In the Forum little has been done because of the long illness of Senator Boni, whose recent death ended a remarkable career as an excavator. On the Palatine the rear of the Imperial palace was cleared in 1915 and some excellent wall paintings and mosaics of the Claudian and Neronian periods brought to light in abandoned rooms beneath. In similar rooms found under the front of the palace were discovered wall decorations of great historical interest dating from the Ciceronian period. These are briefly described in G. Lugli's recent guide to the *Zona Archeologica di Roma* (1924). The most valuable treasure yielded by the Palatine in recent years is the exquisite but still unpublished Nike, which will probably find a worthy position in the National Museum.

The city government has excavated a large part of the Augustan Forum. The numerous architectural fragments found from the Temple of Mars Ultor, the portico near by and the marble covering of the enclosing wall are of great beauty and precision, and several inscriptions of historical importance have also come to light.

Several rooms of Nero's "Golden House" were cleared. The debris had been searched long ago for works of art, but the walls, protected by the superimposition of Hadrian's buildings, were found to be decorated in a style resembling that of the "Claudian" rooms of the Palatine. The small and richly coloured panels set in embroidered stucco are excellently executed but overloaded in design, as are the Renaissance loggia arabesques which they inspired. In many places on the walls were found the signatures of Renaissance artists who had crawled over the debris to study the ceiling decorations (partial report in *Jahrb. des Kaiser-Deutschen. Arch. Inst.*, 1913, p. 217). Among statues recently found, there should be mentioned, besides the Nike, an excellent portrait of Augustus (*Not. d. Sc.*, 1910, 223), an "Artemis" from Aricia (*Jahrb. des Kaiser-Deutschen. Arch. Inst.* 1922, 112), an excellent bronze representing a youth of the Julio-Claudian house, now in New York (*Am. Jour. Arch.*, 1915). Furthermore, some forgotten fragments of great importance, which have long been lying and awaiting study in the basement of the Vatican, include a fine head from a Parthenon metope and a good copy of one of the "Tyrannicides" (unpubl.).

In 1917 there was discovered under the railway outside of Porta Maggiore a mysterious underground "Basilica" in almost perfect preservation, probably of the 1st century A.D. It had been built by sinking shafts in which the concrete walls and the piers of the nave were moulded. After a concrete vault had been cast over the walls, the enclosed earth had been removed and the walls and ceiling plastered and very richly stuccoed in low relief with mythological and genre scenes. It is, perhaps, the best preserved monumental structure of the Roman world, and the lavish stucco work, though not quite as delicate as that of the Farnesina, shows an ease and freedom of execution which gives it high rank. Whether the themes were merely decorative or were meant to be symbolic, is not known. Indeed, the purpose of the structure is still under discussion. Scholars incline to the belief that it was the meeting-place of a group devoted to some mystical cult (Mrs. E. Strong, *Jour. Hellenic Stud.*, Part I, 1924). The tomb of the Aurelii found on the Viale Manzoni (*Mon. Ant.*, 1922) has awakened much comment because of its excellent figures in fresco and the Christian symbolism that some of the paintings seem to contain. There is a seated figure before a flock that seems to symbolise Christ as Judge. Eleven excellent standing figures have with less certainty been identified with the Apostles. The new excavations of Imperial Rome constantly disclose the evidence of oriental cults. Another tomb well decorated with interesting wall paintings is that of Octavia north of the Vatican (*Not. d. Sc.*, 1922). The two largest Mithraea known have also come to light in this period, one under S. Clemente, the other under the baths of Caracalla (*Not. d. Sc.*, 1912).

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[1] *Villanovans and Early Etruscans* (Oxford, 1925), a reliable survey and a penetrating analysis of the material.

[2] See also Randall-MacIver, and von Duhn, *op. cit.*, who will both treat Etruscan archaeology more fully in their forthcoming volumes.

Under the church of San Sebastian were found a number of columbaria of the 1st century made for pagan cremation and decorated with excellent paintings and stucco which in the 2nd century were converted into burial places. The area was then levelled off and a room for funeral banquets constructed. The walls of this room contained a great number of invocations to Peter and Paul rudely scratched. These finds will have an important place in early Christian history (*Not. d. Sc.*, 1923). Recent restorations of the churches of Santa Sabina, S. Quattro Coronati and S. Giorgio in Velabro have also revealed earlier structures of value to church history. In the rapid expansion of Rome since 1918 a very large number of tombs with sarcophagi, hundreds of important inscriptions, and three new series of catacombs have been found. These have been reported with commendable speed in the *Notizie degli Scavi*.

In the vicinity of Rome the more important excavations have disclosed Horace's villa on his Sabine farm (soon to be published in *Not. d. Sc.*), details of Domitian's palace at Albano, of Hadrian's villa near Tivoli, a splendid and very old temple with fine terra-cottas at Lanuvio (*Mon. Ant.*, vol. 27, 1921), valuable fragments of a pre-Julian calendar at Anzio (*Not. d. Sc.*, vol. 18, 1921), and a very important part of the seaport town of Ostia. At Ostia the finds are so numerous that a mere enumeration would require pages. The walls and gates of the oldest settlement (4th cent.?), which Virgil seems to describe in his seventh book, have been disclosed; the more extensive wall of the 1st century B.C. has been traced throughout and two of its excellently constructed gates cleared; the Forum of the late republic has been excavated, a temple of Rome and Augustus found at one end, and beneath the pavement of the Forum a series of barrack-rooms and offices of the oldest town. Many new temples, the offices of the city guard, the offices of the foreign shippers, the large cistern of the city, numerous state granaries, the foundations of what seems to be the earliest Temple of Jupiter, the municipal Senate house, a very interesting safety storage house, and much else can now be studied. Of particular interest in revealing the plan of city dwellings are the extensive ruins of the "Casa di Diana" which, rising to three or four storeys, contained many suites of independent apartments which received their light through windows opening to the streets. This rather than the Pompeian type of dwelling we must now assume for the city of Rome.[1]

The excavations at Pompeii in 1925 yielded a magnificent Greek bronze Ephebus, perhaps the best work of art that the buried city has disclosed. It is now in the Naples Museum. (See *Bull. d Arté*, 1926, p. 341.) The work of clearing the western part of the city has progressed uninterruptedly. A large number of houses of moderate size with fair wall paintings have been found, among them several of religious import—a Cybele group, a Pompeian Venus, a group of the twelve gods. Of particular interest are several with picturesque balconies, and an office decorated with representations of armour, supposed by some to be the headquarters of the *juvenes*, the ancient "boy scouts." The newly found structures have been carefully restored and the paintings well protected from weathering and decay, but publication has not kept pace with the excavations.

Finally, very important excavations have been diligently and carefully conducted on the Greek sites of lower Italy and Sicily. E. Gabrici published in two sumptuous volumes the discoveries made before the War at Cumae (*Mon. Ant.*, vol. 22). Since Cumae was for centuries the Greek tutor of Italian barbarians these volumes are indispensable to students of Greek and Italian studies. Unfortunately the excavations of the Temple of Apollo, the home of the sibyl whose oracles brought so many Greek rites to Rome, were stopped by the War and left incomplete. In southern Italy P. Orsi has excavated Locri, Caulonia, Medma and other sites, with striking finds of Greek vases, remarkably fine architectural decorations in terra-cotta, early Greek entablatures of great beauty, and large numbers of terra-cotta votive figures of no mean artistic value. ("Caulonia," *Mon. Ant.*, vol. 23 [1914–6]; W. A. Oldfather, "Locri" in Pauly-Wissowa; *Not. d. Sc.*, 1917 for Medma.) At Ciro in Calabria he has found a remarkable head of an acrolithic Apollo of about 460 B.C. (*Atene e Roma*, 1925). He has also published the finds from an important archaic Temple of Megara Hyblaea in *Mon. Ant.*, p. 110, (1921). But the most important work of the kind has been Orsi's extensive excavations in Syracuse, especially of the site and ruins of the great Temple of Athena. Here were found a rich store of objects from pre-Greek huts, of early Greek edifices and especially many exquisitely executed fragments of the 5th-century temple (*Not. d. Sc.*, 1910, and *Mon. Ant.*, 1918, pp. 354–762). The state has also begun a thorough-going archaeological survey of Italy, the first fascicle of which has been published by Prof. Lugli.

Spain.—Spanish archaeologists have in recent years done their most vigorous and fruitful work in the Palaeolithic sites, where discoveries of capital importance have been made. It is now clear that Spanish culture of the late Lower and the Upper Palaeolithic periods is closely connected with the Capsian art of Tunis. Because of a greater readiness to use human figures in their paintings, in hunting, ritualistic and battle scenes, than the contemporary Aurignacian-Magdalenian art of southern France has revealed, this art of Spain promises especially to attract the students of early anthropology. Obermaier has made a careful summary of results in his *Fossil Man in Spain* (1924).[2]

For the beginnings of Protohistoric art we have many valuable bronze objects from a sunken cargo of about the 10th century B.C., found outside of Huelva, apparently destined for, or coming from, the then important city of Tartessus (*C. R. Acad. Insc.*, 1923, p. 203). The city itself is being searched for near the mouth of the Guadalquivir by A. Schulten (*Arch. Anzeiger*, 1924). Of the numerous minor objects found in Carthaginian and Iberian sites a full account may be read in Bosch-Gimpera's recent report (*Arch. Anzeiger*, 1924, col. 172). The Greek colony of Emporion has yielded little but walls and an Aesculapius statue which, though heavy in execution, is pronounced by Carpenter a 5th-century Athenian work (*The Greeks in Spain* [1925]; P. Paris, *Promenades Arch. en Espagne*, 1921). Carpenter (*ibid.*) seems also to have discovered the site of the important Greek city of Hemeroskopeion. On Roman sites excavations are continuing at Mérida, especially in the imposing theatre constructed by Agrippa, where a good seated Ceres was found; at Italica, the first Roman colony of Spain; and at the Roman camps around

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[1] Prof. Calza, the director of excavations at Ostia, has issued a convenient guidebook with references to the publication of the various finds (Calza, *Guida di Ostia*, 1925).

[2] The detailed reports of the more striking of recent finds are: for northwestern Spain: H. Breuil, *La Pasiega* (1913); H. Obermaier, *Com. Inv. Pal. Pre* (1918); E. Hernández-Pacheco, *ibid.* (1919); for the east and south: H. Obermaier, *Com. Inv. Pal. Pre.* (1919); H. Breuil, *L'Anthr.* (1912, 1920, 1921); and *La Pileta* (Monaco, 1915). G. G. MacCurdy, *Human Origins* (1924), records the most important finds.

Numantia constructed during the famous siege of that Celt-Iberic city (*cf.* P. Paris, *Prom. Arch. en Espagne*, 1921; J. R. Mélida, *El teatro romano de Mérida*, 1915; A. Schulten, *Numantia*, 1905; Bosch-Gimpera in *Arch. Anzeiger*, 1924).

France.—Here also the striking discoveries have been made in the caves of the Palaeolithic period. In 1923 Casteret found in the caverns of Montespan over a score of animal figures modelled in clay, in relief and in the round (*Rev. Anthr.*, 1923). Many of the bodies were significantly covered with dart thrusts. Of almost equal importance is the "Cavern of David" with its many paintings and especially its engraved figures of men and women, relatively few of which have hitherto come to light north of the Pyrenees (*Illust. Lond. News*, 1923, Oct. 20). Other important discoveries of the period are reported from Dordogne (G. Lalanne, *L'Anthr.*, 1912; Dr. L. Capitan, *C. R. Acad.*, 1913) and from Ariège (Comte H. Begouen, *Congr. Int. Anthr. Geneva*, 1912, and *C. R. Acad*, 1920, p. 303). Many scattered finds of the Halstatt and La Tène periods have been recorded in French reports, but none of striking importance. For the Roman period excavations have cleared large areas at and about Alesia, disclosing, particularly, parts of the fortifications of Caesar and Vercingetorix (*C. R. Acad.*, 1912 and 1924), at the Roman citadel of Lyons (*Ibid.*, 1925) and at the sites of the public buildings of Vienne and Orange (*Rev. Arch.*, 1924). (T. Fr.)

V. NORTH AFRICA

Cyrene.—The outstanding archaeological event of the period under review in North Africa is the exploration of Cyrene. Since the expedition of Lieut. Murdock Smith, R. E., and Comm. Porcher, R.N., in 1860, this important site had not been approached until a party from an American yacht reached it in 1904. As a result of their visit, a permit to excavate was obtained from the Turkish Govt. and an expedition under the late Richard Norton was sent out by the Archaeological Institute of America in 1910.

Work was at first impeded by the fears and ignorance of local Arabs, and, when these obstacles had been overcome, one member of the staff was shot by assassins. But the excavators were not deterred, and considerable results were obtained in the first season (*Bulletin of the Arch. Inst. of America*, vol. 2, 1910–1). A beginning was made in the clearance of buildings on the Acropolis, cultivated land near the Fountain of Apollo was tested, and some of the conspicuous chamber-tombs were examined. Several pieces of sculpture were found, the best being a head of Athena. From the cultivated land thousands of terra-cotta votive statuettes of archaic Greek style were recovered. All the tombs had been robbed in antiquity. In 1911 Tripoli and Cyrenaica were occupied by Italian military forces, and the American expedition was not allowed to resume its work. The excavation was continued in the following years by the Italian Colonial Service of Antiquities. Several buildings were cleared and identified, and extensive finds of marble sculpture were made.

The most highly appreciated piece is a headless statue of a nude Aphrodite, thought to be Greek work of the 4th century B.C. This was taken to Rome where it is now exhibited in the Museo delle Terme. The rest of the material from Cyrene has been placed in the museum of Benghazi. The Aphrodite was brought to light by the collapse of a wall supporting the platform of the Temple of Apollo. Excavation in this place laid bare the Baths from which 20 Hellenistic or Greco-Roman statues were recovered. The central niche in the Great Hall was occupied by a colossal portrait-statue of Alexander the Great. A colossal figure of Zeus *Aigiochos* was found in a temple, in front of a large inscribed base, which may have supported cult-statues of the Capitoline triad. Besides the official publication of these finds in the *Notiziario Archeologico* of the Italian Colonial office, many of the statues have been illustrated and discussed elsewhere.[1] More recent excavations have cleared the Temple of Zeus (or the Capitoline deities) and the *Tabularium*, and have revealed an earlier Greek structure beneath the Temple of Apollo. Two marble torsos of archaic *korai* and votive terra-cotta statuettes are the only material known that belongs to the time of the city's greatness. The early cemetery has not been located. An account of the work done at Cyrene from 1919 to 1922, was published in *Aegyptus*, 1923.

Tripolitania.—Much has been done on other sites in Tripolitania, and in the archaeological organisation of the new province. Museums have been established at Tripoli, Benghazi and Homs: the last is the repository for finds made in the excavation of Leptis Magna.[2] This particularly splendid Roman city has been found marvellously well preserved beneath sand dunes.[3] The triumphal arch of Marcus Aurelius at Tripoli has been cleared. A torso of Apollo, discovered in the demolition of the fortifications, is said to be the finest piece of Greek sculpture in marble yet found in Africa, and a Roman villa at Zliten contained the finest mosaics.[4]

Another prolific source of Hellenistic sculpture, which alone would have brought North Africa to the first place among classical lands, is a sunken ship which was located off Mahedia, near Thapsus in 1907.[5,6] A valuable document in the history of art is a bronze herm inscribed with the name of its sculptor, Boëthos of Chalchedon. Later salvage includes small decorative bronzes belonging to furniture, parts of large marble vases and candelabra in Neo-Attic style, and a painted Campanian plate of the 2nd century B.C. The ship has been closely examined. Its hold was divided into three compartments, in which the statuary was stowed, and it carried a deck-load of 65 unfluted marble columns. It seems to have brought its last cargo from Athens. The surviving pieces are in the Museum of the Bardo (Musée Alaoui) at Tunis. Two large bronze statuettes of the same kind, a standing boy and a seated girl, came from the harbour of Hippo Regius in 1912, and another of earlier style, perhaps a Greek original of the 5th century, representing a young horseman, was found at Volubilis in 1918.[7]

Morocco.—The excavation of Volubilis (Qsar-Farun), the centre of Roman domination in Morocco, was begun by direction of Marshal Lyautey in 1915, the labour being supplied by German prisoners of war. A triumphal arch and the ruins of a basilica were the visible monuments of the site. The excavations, which are still in progress, have revealed the general plan of the city, the forum with its tribune, baths and other public buildings, shops and private houses. In the latter are some good mosaics, one showing a rider sitting backwards on his horse and holding out a cup, presumably a winning jockey with his prize. Numerous inscriptions throw light on the date and status of the city; curiosities among them are dedications to Mithras and Commodus by one Aurelius Nectorega, a centurion in command of British cavalry stationed there.

Tunisia.—New cities added to the imposing series of Tunisia are Bulla Regia and Thuburbo Majus; Sufetula has been further excavated, and the three temples of the capitol, the gate of the forum, the triumphal arch and other monuments have been repaired with their original stones. This is one of the finest Roman cities of North Africa.[8] A complete set of bronze cult-vessels was found in a vault of the Capitolium at Pupput.

Algeria.—No new work of importance has been begun in Algeria, but in this province, as in Tunisia, the clearance and reconstitution of cities such as Timgad and Lambaesis goes on with constant accumulation of new material. Thubursicum can show a particularly well-preserved theatre, and Madaurus has baths with latrines. Inscriptions and mosaics are the peculiar riches of North Africa. Among the latter there is now a portrait of Xenophon at Sufetula to match the Virgil of Hadrumetum; favourite subjects are ships, buildings, landscapes and animals. The mosaic floor of a tomb at Lambiridi bears extraordinary figures which are said to illustrate hermetism.[1]

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[1] Bullettino d'Arte, *Cronaca* (June, 1914; Nov. 1915; May to Aug. 1918); *Journal of Hellenic Studies* (1920, 1921).

[2] *Notizario Arch.* 3 (1922).

[3] *Dedalo* (April 1925).

[4] *Dedalo* (Nov. 1923).

[5] *Comptes Rendus, Académie des Inscriptions* (1908–11, 1913).

[6] The finest of the bronzes recovered up to 1910 were published in *Monuments et Mémoires: Fondation Piot*, 17, 18 (1909–10), and the marbles in *Rev. Arch.* 18 (1911).

[7] *C. R. Acad. des Ins.* (1919); *Gazette des Beaux Arts* (Jan. 1921).

[8] A. Merlin in *Notes et Documents*, Tunis, Direction des Antiquités et Arts 5 (1912).

Carthage.—New interest has recently been shown in the site of Carthage, although it is too late to save much of it from damage done by building-contractors and irresponsible excavators. In 1924–5 an American university expedition has begun operations there. Dr. L. Carton has done valuable work on the topography of the Punic city, identifying the commercial and war-harbours, the admiralty island, lines of sea-walls and quays and other features.[2] Three cemeteries, covering in succession the period from the 7th to the 3rd century B.C., have been located, and a sanctuary of Tanit has been explored. The latter was full of votive offerings, each consisting of a monumental stone or altar and a buried jar which contained the relics of burnt sacrifice, charred wood and bones of infants. Punic graves have also been explored in the neighbourhood of Thapsus.

Libyan Elements.—Beside the intrusive Semitic, Greek and Latin cultures, the native Libyan elements are being more closely studied. Remains of the ancient language have been connected with modern Berber dialects, prehistoric rock-paintings have been compared with those of French and Spanish caves, and a special study has been made of dolmens and megalithic structures in the district south of Constantine. Other Iberian connections are indicated in Libyan place-names, and on the eastern side of the Mediterranean region research has detected strong Libyan influence in the Minoan civilisation of prehistoric Greece.

BIBLIOGRAPHY.—Académie des Inscriptions et Belles Lettres, *Inventaire des Mosaïques de la Gaule et de l'Afrique* (1910–); O. Bates, *The Eastern Libyans* (1914); R. Cagnet, *L'Armée romaine d'Afrique et l'Occupation militaire de l'Afrique sous les Empereurs* (ed. 2, 1913–); Cagnat, Merlin and Chatelain, *Inscriptions latines d'Afrique, Tripolitaine, Tunisie, Maroc* (1923–); S. Gsell, *Atlas archéologique de l'Algérie* (1911), *Inscriptions latines de l'Algérie* (1922–), and *Histoire ancienne de l'Afrique du nord* (1913–).

(E. J. F.)

VI. SOUTH AND CENTRAL AFRICA

The boundary between Africa and Egypt and the northern and northwestern portions of the continent must be both conventional and provisional. The explorations during the last 20 years of Reisner at Kerma in Nubia (between the 3rd and 4th cataracts) and of Garstang at Meroe, have carried Egyptian influence so far south in the Nile Valley that these sites, although inhabited by peoples of mixed culture, must from the archaeological standpoint be referred rather to Egypt than to the Sudan.

No such line of division exists in the west between the North African cultures and those of negro-land; indeed Gautier[3] has shown that there is good reason to suppose that the latter has advanced perhaps as much as 1,000 km. at the expense of the former, during the last two or three thousand years. Moreover, Meroe itself does not accurately represent the southern limits of the mixed civilisation to which it has given its name; some 12 m. south of Khartum on the right bank of the Blue Nile are the remains of Soba, a Meroitic site, later the capital of the Christian kingdom of ʻAlwa (the Alut of the hieroglyphs) while, as will be seen later, Meroitic remains have been recently discovered 200 m. south of Khartum.

Yet Meroe, which lies in the neighbourhood of the 17th parallel of north latitude, and which as far as our present knowledge goes was the most southern city of importance in classical times, may well stand as the main southern bastion of Egyptian influence, and the area with which this article will deal is that part of Africa lying south of 16° north, which will be divided into three provinces, eastern, western and southern.

The Nile-Congo watershed, a natural feature of geographical and ethnic importance, constitutes part of the dividing line between the eastern and western areas, which continues northwards along the broad ridge of relatively high land that roughly divides the territories of the Anglo-Egyptian Sudan from those administered by France. Thus the boundary line somewhat closely follows the western confines of Darfur, while south of the Nile-Congo watershed it coincides with the boundary between the Belgian Congo and British territories to the east, both eastern and western provinces being limited to the south by a line roughly following the 10th parallel of south latitude.

THE EASTERN PROVINCE

Palaeolithic Artifacts.—Here discoveries have so far been limited to the Sudan, Uganda, Somaliland, Kenya Colony and Abyssinia, while surprisingly little is yet known of the early prehistory of even these territories. Except possibly in the extreme north, within a few miles of Halfa, no implement of River-drift type is known to have been found in the Sudan. This fact may be due to incomplete exploration, but is of some significance considering the abundance of specimens which have been found on the surface in Egypt and Libya, in Somaliland (where Mr. H. W. Seton-Karr has collected countless specimens of River-drift and Mousterian types), South Africa, and recently, in deposits, by Mr. Wayland in Uganda, though the majority of the implements he discovered are perhaps to be associated with the Le Moustier *facies* rather than that of the River-drift. Be this as it may, Mr. Wayland has collected Chellean hand-axes in gravels, considered of pleistocene date, capping quartzite hill tops some 300 ft. above the present level of the lake, and also implements of a well-developed Mousterian type, including "points, side-scrapers, flake knives, tortoise cores and tortoise points," as well as two typical side-scrapers in a cave under some five ft. of cave earth.[4]

No typical Mousterian specimens have yet been found in the Sudan; certain specimens were collected from two sites, namely, Jebel Katul in northwest Kordofan, and Jebel Gule in Dar Fung. At the former site were found near the foot of the hill, a number of roughly worked stones, considered by the Abbé Breuil to belong to the Mousterian period, to which he also referred a number of thick fluted and engrailed scrapers from Jebel Gule, which somewhat closely resemble palaeolithic discs from Suffolk and other localities, while one implement was regarded as a true but much worn coup-de-poing of Mousterian age. So far as is known no implements attributable to the latter part of the Old Stone Age have been found anywhere in the Eastern Province, certain pygmy implements which will be mentioned later being regarded as neolithic.[5]

Neolithic Age.—Evidence concerning the New Stone Age is furnished by a number of finds made on widely scattered sites in the Sudan, Uganda and Kenya Colony, but there are hints that in parts of negro-Africa, which nowhere had a Copper or Bronze Age, stone implements may have persisted to within the last few centuries and the use of iron be quite recent.

Stone Axes.—The distribution of the most typical of neolithic implements, the ground stone axe, makes it necessary to refer to the conditions prevailing north of latitude 16 degrees. Unknown in predynastic Egypt polished axe heads are common in Nubia, where a number have been found in predynastic and early dynastic tombs. Many examples have come from Meroe, and specimens probably occur on every site of neolithic date in the Sudan; they have been found, *e.g.*, at Jebel Geili, 90 m. east of Khartum, at Jebel Gule, between the White and Blue Niles, and at Faragab in Northern Kordofan; moreover, the grooves in the rock faces on which they were ground exist both at Jebel Gule and Jebel Geili, while stone axes of a peculiar type have been found in western Darfur by Mr. D. Newbold. These facts all seem to support the idea put forward (*Rep. Brit. Assn.*, Pres. Address, Section H. 1915) that the ground stone axes of the Nile Valley are of negro origin, a view consistent with their occurrence in the Congo, and, in relatively enormous numbers, in the Gold Coast. Perforated disks or rings, and hollow conical and spherical stones, all ground in the usual neolithic style, have been found at Meroe, on Jebel Haraza (Kordofan) and at Jebel Geili, where stone disks and axe heads can be definitely associated together and with Meroitic potsherds.

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[1] *Rev. Arch.* (May to June 1922).

[2] *C. R. Acad. des Ins.* (1912; 1918–20); *Rev. Arch.* (Sept. to Oct. 1911; May to June 1919; May to June 1923).

[3] Gautier, E. F., "Études d'ethnographie saharienne," *L'Anthropologie* (1907).

[4] A. A. Smith and E. J. Wayland, *Some Primitive Stone Implements from Uganda* (Uganda Protectorate, Geological Survey Dept., 1923), and verbal information.

[5] For an account of the Jebel Gule site and the different types of implements found, see C. G. Seligman, "A Neolithic Site in the Anglo-Egyptian Sudan," *Jour. Roy. Anth. Inst.*, vol. 40 (1910).

Besides the types already alluded to, Jebel Gule yielded a large number of pygmy implements of quartz, carnelian and hornstone (similar to those found in South Africa and attributed to Bushmen), and there is reason to believe that this industry also existed at Faragab, where these "points" were used to bore the innumerable disk heads of ostrich egg-shell which cover the ground. Of these pygmy implements from Gule one was a well-marked lunate of Tardenoisian form, and this specimen may lead to the consideration of the distribution of the Tardenoisian type in the eastern Province. The British Museum has a number of beautifully worked *dos abattu* specimens of obsidian from the neighbourhood of Njoro in Kenya Colony; typical lunates, of jasper and of carnelian respectively, have been found in Uganda (Wayland), while to pass northwards of latitude 16°, Dr. G. A. Reisner (*Sudan Notes and Records*, vol. 2, No. 4, 1919) has found in tombs dating to the Egyptian XXV. Dynasty in Upper Nubia, perfect lunates of carnelian, in such numbers that there can be no question of their inclusion in the tombs being accidental. The handiwork of man is evident.

This may close the account of stone implements which may be assigned to the Stone Age cultures, so long as it is realised that the Neolithic certainly comes down to a period vastly more recent than the Neolithic of even northern Europe, and that in the Sudan, at least, it is overlapped by the Meroitic civilisation, numerous outliers of which have been found, including those of Jebel Geili, another in the neighbourhood of the Makwardam on the Blue Nile, notable for its Greco-Roman bronze vessels, and at Abu Sofian in western Kordofan. Although there is no evidence to show that they are Meroitic it will be convenient here to refer to the discoveries made by Mr. H. S. Wellcome at Jebel Moya near the Blue Nile, and by Seligman in the mounds near Faragab, a village of sedentary Arabs some 20 m. east of Bara in northern Kordofan. Though made about 1910 only the most meagre descriptions of the Jebel Moya discoveries have been published, although they are of prime importance to the history of the Sudan.

Besides stone implements, were found beads and amulets, a number of scarabs and small plaques bearing Ethiopian and Egyptian cartouches, ranging from about 700 B.C. or perhaps going back to an even earlier date (*Brit. Assn. Reports*, 1912), while a paper by Prof. D. E. Derry[1] giving anatomical details of skeletons from graves at this site indicates that the inhabitants were tall negroes resembling in height and cephalic index some of the present day negroes of the hills of southern Kordofan.[2] At Faragab the mounds extend over acres and their surface and the areas between them are literally covered with disk beads of ostrich egg, fragments of bone débris and other foreign objects, including fragments of imported rocks. Two types of potsherds are of special interest, one consisting of a fabric bearing the impression of the string mat on which it was made (such mats are still used in the hills of northern Kordofan), and in this resembling the coarser wares found by Garstang in the graves of Meroe, the other oblong-oval in shape and rather shallow, often decorated with geometrical designs and produced at each end into a solid mass (handle?), its general appearance recalling that of many Melanesian wooden food bowls. This type seems to be hitherto unknown anywhere in Africa. The beads are of ivory, dolomite and scolecite; the single dolomite bead is definitely not of a type hitherto regarded as negro, while a single carnelian bead, if Egyptian, as no doubt it is, is regarded by Sir Flinders Petrie as certainly not later than XVIII. Dynasty.[3] The presence of many pieces of worked ivory is noteworthy. Of Meroitic monuments of any size, apart from those found at Soba, *e.g.*, the "lamb" now in the Palace Gardens at Khartum, the rock drawings discovered by Mr. Crowfoot at Jebel Geili, representing a king wearing the uraeus crown worshipping a rayed solar divinity, which may be taken to be of late Meroitic date, is of special interest.

Rock Pictures.—The only other rock pictures described in the Sudan are in Kordofan and Darfur. Generally they are outlined in red or blackish pigment, but examples roughly graved on masses of granite also occur in the Jebel Haraza *massif.* Drawings with pigmented outlines are found on Jebel Haraza and Jebel el 'Afarit, and seem to form two groups. To the first belong rough but spirited sketches of men on horseback, camels and giraffes. The workmanship of the second group is rougher and much less vigorous; it includes representations of camels, men on horseback and men marching or dancing, carrying the small round Hamitic shield. This, together with their general resemblance to the "Libyo-Berber" rock pictures of the southern Sahara, indicates a comparatively recent date. Moreover, MacMichael notes that the work is faint and indeterminate, and that there is no trace of graving; in other words the neolithic tradition has not persisted. Probably they are more recent than the stone disks and hollow conical and spherical stones found on Jebel Haraza, already mentioned.

Megalithic Monuments.—Megalithic stone monuments occur in the Sudan, some of the present day, others certainly recent, a few apparently of some antiquity, though as to these our knowledge is of the slightest. In the northern Sudan the Beja tribes surround the graves of their dead with a circle of upright stones; round some of the older graves individual stones were occasionally taller than a man, and it is probably the persistence of such stones after their smaller neighbours have disappeared that has given rise to monoliths such as that some two metres high, to which the Prophet, according to the accepted tradition, tied his horse, overlooking the Khor Arab near the Sinkat-Erkowit road in the Red Sea Province.

Another monolith of much the same dimensions has been described and figured by J. W. Crowfoot from 'Isa Darheib, inland from 'Aqiq (*Geog. Jour.*, May 1911), and in this instance there seems nothing to suggest its origin in a Beja grave. Further south megalithic monuments have been reported from the Madi, while stone circles are made by the Lotuko-speaking tribes wherever stone is abundant, as squatting places for the men, though in no case could evidence be obtained of stones large enough for this use being carried even a few miles.

Again, although megalithic structures are said to occur among the Bari-speaking tribes of Mongalla Province, it is certain that at least some of these are recent erections over graves. Although megalithic neither in structure nor form there is a type of stone monument some 80 ft. long and about 5 ft. high occurring in some number in the neighbourhood of Erkowit. These (*Jour. Egypt. Archaeology*, vol. 2, 1915) are constructed without any cement or mortar; the face consists of a limiting wall of more or less flat slabs of local rock, while the spaces between the containing walls are filled in with smaller fragments.

Each of these monuments may be considered as consisting of three main elements, viz.: (1) an oblong rectangular portion, (2) two oval masses, to each of which is attached an expansion shaped somewhat like a fish's tail and (3) the curved walls uniting the other elements. Their orientation seems to have been toward the rising sun, while each oval element is interrupted at a constant point in its circumference by the interposition of from two to four upright slabs. There is no chamber or space behind these stones, but from their constant presence and the uniformity of their position it is obvious that they must have had a perfectly definite significance to the builders, indeed they recall the false doors of Egyptian monuments. Mr. J. W. Crowfoot found human bones under the filling of the rectangular portion but no objects with them. They may provisionally be regarded as mediaeval, but as antedating the spread of Mahommedan influence which was becoming dominant towards the middle of the 15th century.

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[1] This will be found in *Proc. 17th Internat. Congress of Medicine*, Sec. 1, Pt. 2 (London, 1913).

[2] For figures of Nuba resembling the Jebel Moya burials see C. G. Seligman, *Jour. Roy. Anth. Inst.*, vol. 40, 1910, especially Plate XXXV., figs. 8 and 9.

[3] C. G. Seligman, "Prehistoric Site in Northern Kordofan," *Annals of Archaeology and Anthropology*, vol. 7 (Liverpool, 1915).

It is as yet too early to estimate the significance of the objects found by Mr. D. Newbold (*Sudan Notes and Records*, vol. 7, 1924) on his recent journey from Bara in Kordofan to the international boundary (long. 24° E.) between the Sudan and French Equatorial Africa. Evidence of former occupation of the country, now desert or the poorest steppe, was abundant, including cairns, pottery (some Meroitic), a small brick pyramid at Abu Sofian (16° N., 28° E.), and five ground axes of glauconite of hitherto unknown type from the Wadi Hawa. Drawings roughly incised on boulders, *e.g.*, at Sobat el Hammad, showed tailed and phallic men, elephants, giraffes, ostriches, oryx, cattle and several other animals which could not be identified. At Umm Tersawen there were also a number of human figures, some tailed, some armed with bows. "At Abu Sofian two groups of pictures, obviously of the same date and 'school,' were within a day's march of one another. Here the drawings were incised on rough boulders, and were very numerous. Camels are shown literally in hundreds; giraffes and ostriches still appear; but the cattle dwindle in numbers, while the elephant is not represented, and the bowmen give place to men armed with spears and carrying shields." The latter armament appears to bring these drawings into the Libyco-Berber class.

Abyssinia.—Discoveries relating to the prehistoric periods are as yet lacking in Abyssinia, where interest centres in the monuments dating from the 4th century A.D. discovered at Aksum by Theodore Bent (*The Sacred City of the Ethiopians*, 1896).

Littman, the leader of the German expedition to Aksum, holds that the carved and decorated monuments generally termed "obelisks" are in fact stelae (of huge dimensions it is true, *e.g.*, from 15 to 33 metres) and therefore each to be regarded as part of a tomb, a point of view rendered the more probable by the presence at their base of stone slabs, often carved, which have every appearance of being altars. All this seems to imply a cult of the dead, but, apart from this, inscriptions dating from the 1st and 4th centuries record the names of the gods of the Semitic conquerors of northern Abyssinia. A Greek inscription of Adulis, no longer in existence but copied in the 6th century by Cosmas Indicopleustes, states that the King of Aksum of the 1st century, who caused this record to be cut, worshipped Zeus, Ares and Poseidon. A later document of King Aizanas (about A.D. 350) is in Greek, Sabaean and old Ethiopic. An analysis by Littman of this inscription, together with one dating from about a century later, indicates that worship was rendered to Heaven, Sea and Earth, together with Mahren "who begat the King," the latter being identified with Ares. Other monuments include rude monoliths, some ornamented with bands, and a most spirited rock-carving of a lioness in low relief.

THE WESTERN PROVINCE

Palaeolithic Remains.—It is only recently that stone implements of River-drift type, and therefore to be regarded provisionally as of palaeolithic age, have been discovered in West Africa. In the British Museum there is a series of massive implements of Chellean type, consisting of quartz porphyry, which on the surface have weathered to the softness of chalk. These come from the alluvial deposits of the Bauchi plateau, as do a smaller number of implements of Mousterian type of the same mineral, and one very steep end-scraper of a more homogeneous stone showing no surface weathering.[1] There is also in the national collection a number of short stumpy implements of Drift type of a reddish quartzite, for the most part with unworked butt, found on the golf links of Accra (Gold Coast). Similar specimens have been found in the local gravels, the actual specimens in the museum having apparently been washed up from the beach.

Neolithic Age.—Polished axe-heads of ordinary neolithic type are by no means uncommon in West Africa and the Congo Valley. They are found in Northern Nigeria, especially in the Bauchi Plateau gravels, where it is said that they overlap to some extent the Drift types. They are, however, of a different stone, for the most part of dolerite. In the Gold Coast Colony they are found in large numbers, as are perforated quartz discs, while a few bossed spheres about two inches in diameter, of anomalous appearance and unknown use, have been recovered. A collection of neolithic implements from Calabar includes stone axes, unusual in that they possess a definite tang for hafting.

Under the title "Tumbakultur" Oswald Menghin (*Anthropos*, 20, 1925) has recently described a culture characterised by series of implements, widespread in the Lower Congo area, which he tends to approximate, though with difficulty, to the Campignian of Europe. Be this as it may, Menghin finds a long series of artifacts passing insensibly from implements of coup-de-poing type, Campignian *pics*, flattened ovates of almost laurel-leaf type, to notched and roughly cruciform spear or arrowheads, some, though larger and coarser, irresistibly recalling the "freak" forms from Breonio in Italy. Apart from these, many ground stone axes have been found in the Congo area.

Megalithic Monuments.—Megalithic monuments are distributed widely in West Africa in the form of stone circles and standing stones. In Gambia both classes of monuments have been carefully described by the late Henry Parker in a paper published after his death (*Jour. Roy. Anth. Inst.*, vol. 53, 1923):—

> The circles themselves are generally found in groups or clusters comprising from two to nine, but single circles are met with. With one possible exception there are no uncompleted circles, except those formed by concentric outer pillars standing round an inner circle. . . . The groups of circles are arranged in single straight lines; in nearly parallel lines consisting of two, three or four circles; or in pairs; but never in triangles or pentagons. Many stones are prostrate and . . . almost invariably these fallen pillars . . . are at least partly buried by the soil. . . . Some have their upper face almost level with the ground, and as a rule the others are half or three-quarters covered by the earth. . . . Superficially considered this is the only indication of the age of these structures, and . . . it would be of great value if we knew the rate of elevation of the soil. Without such knowledge it is only possible to draw the conclusion from this evidence that both the circles and the menhirs must have been erected many centuries ago.
>
> In addition to the concentric outer pillars, there are several instances where the outer pillars are arranged on the eastern side of the circle in a straight line, or even in two parallel lines, in a north and south direction. Such lines are invariably to the east of the circle. . . .

The circles are considered sacred to the Earth Spirit, and ceremonies are performed in them to propitiate the latter, as also for the protection of the crops. It does not, however, appear that Mr. Parker excavated in them, and their date and purpose must be left for future exploration, though in the light of information received on the spot the contents of the circle (human remains, spearheads, copper armlets) dug by Messrs. J. L. Todd and G. B. Wolbach (*Man*, No. 96, 1911) suggest that in recent times these monuments were the sites of sacrifice for success in warfare.

In some of the northern villages of the Cross River Division of Nigeria, *i.e.*, in the villages of the Akayu, Indem and Atam districts (on the left bank of the Aweyong river) there are stone circles, the stones often more or less conical and carved to represent the human body from the waist upwards. These have been described and figured by Mr. C. Partridge (*Cross River Natives*, 1905, pp. 268–599); the navel is specially prominent, and cicatrices seem to be reproduced. At Agba village the circle surrounds an old tree, and the grove of the great chief who erected the circle. The tree is sacred, and of the stones it was said by the ancestors "these stones are your forefathers, your very great chiefs; every year you must sacrifice to them" (p. 271).

Beads.—In the past, claims of high antiquity have been made on behalf of the so-called "aggry" beads that have been found in West Africa. Yet as stated by Sir Hercules Read, with the single exception of the necklace to be discussed immediately, none of these beads show features not to be found in mediaeval or later beads from the factories of Venice. The necklace, presented to the British Museum by Mr. L. P. Davies, was obtained from the grave of "a renowned chief" at Mansu, a town on the route from Elmina to Kumasi. It is described in detail in *Man*, No. 1 (1905–).

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[1] Since this was written the Geological Survey of Nigeria has published an *Occasional Paper* (No. 4), by Mr. H. J. Braunholtz, describing and figuring the implements of the Bauchi plateau.

For present purposes interest centres in some 20 beads of crystalline glass, irregular-facetted, and especially one bead of crystalline glass moulded like a mulberry. Sir Hercules Read writes of these as being in a state of iridescent decay, the surfaces being in many cases deeply pitted and presenting exactly the same appearance as beads of the same kind from the Mediterranean area. He points out that the crystalline glass in this necklace is identical in appearance with those from the tombs at Kameiros in Rhodes, dating from the 6th century, and goes on to suggest, but " without insisting too strongly on this point," that here are " glass beads of classical style found for the first time in West Africa, and presenting features that in point of date may justifiably be associated with the name and time of the Carthaginian Hanno, a name often invoked when objects of indeterminate age are found on the African coast."

Though probably not of any great age, reference must be made to the soap-stone carvings of human heads or figures (occasionally animal figures) found in the ground, sometimes apparently in pits, in certain districts of Sierra Leone, where they are used as agricultural charms. These figures are for the most part roughly carved, the work being well within the scope of present-day Africans, and Joyce, who has figured and described them (*Man*, No. 57, 1905, and No. 40, 1909), points out that there is really no reason to see in them—as has been proposed—evidence of foreign, *i.e.*, Egyptian or Carthaginian influence. The objects described by Frobenius from Old Ife (*The Voice of Africa*, 1913, vol. 1, chap. 14; " The Archaeological Finds "; and *Das Unbekannte Africa*, Munich, 1923), the ancient capital of the Yoruba, are also probably of no great age; there do not seem to be any which the 16th century Benin civilisation might not have produced.

Possibly of about the same date are a number of bronze and silver objects, now on deposit in the British Museum, from a sandy mound (no doubt a grave) at Tumuni in the Sokoto Province of Northern Nigeria. Sir Hercules Read holds that they exhibit features and analogies which are unusual in negro African metal work, pointing to artistic or commercial relationship with the culture of the Mediterranean area, doubtless at a period remote from the date of the manufacture of the relics themselves.

The most important pieces are a bucket with incurved sides and lugs, and a barrel-shaped armlet (?) for wear on the bicepital region. The lines and casting of both, and the geometrical patterns tooled on their surfaces, are good and careful work. While the find, as a tomb-group, may date to 1480 A.D. as suggested by Mr. H. R. Palmer, yet, as stated by Sir Hercules Read, they are of unusual interest from the analogies they present with the early Mediterranean cultures, and we may have here a distant echo of the early art of the Bronze Age. At the same time there is no reason to think that the actual objects are anything but local productions, though they may differ from those of more recent date.

The Southern Province

Palaeolithic Implements.—Artifacts of rude Chellean type, often larger than the corresponding implements of Western Europe, are found over the greater portion of South Africa, nor does there seem to be any reason why these should not be regarded as true palaeoliths of an age comparable to those of Europe. One of the most satisfactory finds of this order is constituted by a considerable number of implements of chalcedony, quartzite, etc., exactly similar to types characteristic of the River-drift Period of Western Europe and Great Britain, associated with and evidently forming part of ancient terrace gravels deposited as drifts by the Zambesi (in the neighbourhood of Victoria Falls) at a remote period. The position of these terrace gravels and surface drifts in regard to the Batoka Gorge indicates their real antiquity, since they must have been deposited by the river when the latter was covering the old valley floor more than 400 ft. above its present level. Here Mr. Henry Balfour excavated several implements from undisturbed gravel deposits at depths varying from 6 in. to 2 ft., some greatly waterworn and heavily patinated. Leaving this particular site, it will be remembered that Peringuèy distinguished an axe or cleaver type of coup-de-poing. Dr. K. M. Barnard has informed the writer that an important find at Montagu (Cape Colony) demonstrates that this " type " is but a stage in the preparation of an ovate.

> A curious point was the total absence of chips. The bouchers occurred in layers of black and white earth, indicating clearly the presence of fires. . . . Three separate occupational layers were found, separated by deposits of sand due to natural causes which may indicate lengthy periods of time. No skeletal remains or bone implements or rubbing stones of any kind were found. The whole deposit was capped by a thin layer containing small chert flakes of the type usually ascribed to the Bushmen.

Implements of Mousterian type, though less common than those of the River Drift certainly occur and are widely distributed. With regard to stone implements of more advanced types than Mousterian, there has been a tendency to describe these as " Solutric " (*e.g.*, in the publications of the late J. P. Johnson), an unfortunate and inaccurate term carrying entirely premature implications. Indeed since the generality of advanced types of South African stone implements should be regarded as Neolithic or later, reference should be made to the typical Tardenoisian lunates of late Nubian tombs, as well as to the admitted use of pygmy points by the Bushmen.[1]

Pottery.—It is not clear that examples of pottery of any considerable age exist. These figured by Peringuèy—provisionally assigned to Bushmen, Strandloopers and Hottentots—are of the rudest type, predominantly ovoid with conical bottoms, sometimes ornamented, the kneading and baking being very poor.

The Bushmen.—No apology seems necessary for considering the " archaeology " of the Bushmen with that of the kindred Strandloopers (no longer to be regarded as a distinct race, the name describing a mode of life and not implying a constant physical difference), for even though the former are not utterly extinct, the few survivors no longer pursue their characteristic arts of painting and graving on rock. It is generally admitted that the Bushmen stock came into South Africa from the north, and Stow was of the opinion that there were two great divisions, each with its characteristic mode of life and art, viz.: (1) cave-dwellers (painters), and (2) kopje-dwellers (sculptors), the latter producing their works by " pecking " the rock face on which they worked. This view does not seem to be generally accepted, perhaps it only emphasises differences in technique due preponderantly to environment.

The paintings of the Bushmen, naturalistic polychrome studies of high artistic merit, for the most part record the animals which they hunted and upon which they subsisted. But paintings of the carnivora are not absent, and cattle raids, dances and magico-religious (?) scenes are also portrayed. Belonging no doubt to the latter class are the fairly numerous examples of animal-headed human figures, not to be confused with the wearing of animal skins as a hunting ruse to admit approach to the game, as in the famous picture in the Hershel district of Cape Colony of a Bushman wearing an ostrich skin while stalking a flock of these birds.

The character of Bushman paintings has been well summed up by Mr. Henry Balfour:—

> They are " remarkable not only for the realism exhibited by so many, but also for a freedom from the limitation to delineation in profile which characterises for the most part the drawings of primitive peoples, especially where animals are concerned. Attitudes of a kind difficult to render were ventured upon without hesitation, and appreciation even of the rudiments of perspective is occasionally to be noted, though only in a crude and uncertain form. The practice of endeavouring to represent more than could be seen at one time . . . is far less noticeable in Bushmen art than might have been expected from the rudimentary general culture of these peoples, and one does not see instances of *both* eyes being indicated upon a profile face, or a mouth in profile on a full face. . . . The colours were usually laid on uniformly over the surface which they

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[1] For figures of typical Tardenoisian lunates, as well as many other stone implements of unusual form or special interest, a paper by Mr. John Hewitt, printed in *The South African Journal of Science*, vol. 18 (1922), should be consulted.

individually covered, but a shading off is sometimes exhibited." (*Bushmen Paintings*, 1909, p. 9.)[1]

Dr. K. M. Barnard points out that examples similar in execution to those described by L. Péringuey (*Trans. S. Afr. Philos. Soc.*, 16, 1906, and 18, 1909) have been discovered at various places in Southwest Africa, the farthest north being in the Grootfontein district. In addition to the usual animals there are representations of the human foot, and the spoor of various bucks, while from the position in which these latter occur the explanation that they are "sign-posts" to water cannot be maintained.

Quite recently Maj. F. J. Bagshawe (*Man*, No. 92, 123) has discovered in Tanganyika Territory rock-paintings of Bushmen type of so high an artistic quality that their origin can only be referred to this race, an extension northwards which goes well with the distribution of the Bushmen *kwe* (digging-stick weight), of which specimens, known in Tanganyika, have been discovered in Uganda (Wayland) and even among the Bari of the Southern Sudan (Seligman). The Tanganyika rock-paintings include an eland, cow, ostriches, giraffe and antelope.

Strandloopers.—The Strandloopers are a people of whom, apart from their skeletal characters, we know little, though concerning these there is a fair volume of reliable if not always consistent data. Their cultural attainments may be judged, *e.g.*, from the remains found in the caves and rock-shelters of T'zitzikama cliffs, about 100 m. to the west of Port Elizabeth. One of these shelters explored by Mr. F. W. Fitzsimons (described by Sir Arthur Keith, *The Antiquity of Man*, I, 1925), contained deposits some 30 ft. deep. The lower 5 ft. and the upper 6 ft. were sterile; below this latter layer was a stratum some 7 in thickness in which numerous Strandlooper burials were encountered amidst remains of fireplaces, broken pottery, implements and ornaments in stone and bone.

Then came the third stratum, over 6 ft. in thickness. While removing this stratum and working at a depth of 15 ft. below the original floor of the shelter, Mr. Fitzsimons found graves containing remains which differed from those he had met with in the stratum above. Unfortunately the bones in the lower stratum were imperfectly preserved. The graves had been partly protected by slabs of stone some of which had been rudely engraved with human figures. There were lumps of red ochre, necklaces of shell and bone and tools of stone and bone. In a still deeper stratum, also about 6 ft. in thickness, there were traces of burials and hearths, the human remains being fragmentary, but considered to belong to individuals of the Boskop types. As to the Zimbabwe and similar ruins in Rhodesia, the conclusions of D. Randall-MacIver (*Mediaeval Rhodesia*, 1906) (*see* 28.980) have not proved generally acceptable in South Africa. While there is no inherent improbability in the early Semitic origin of these ruins, it seems unnecessary to seek a foreign colonisation where the facts in no way contradict a local origin. No authentic inscriptions have been found, and no objects discovered in the Great Zimbabwe, around which the controversy has chiefly centred, need be more than a few centuries old, while those that are not foreign imports (porcelain, etc.) are of African type. Moreover a re-examination of the evidence, including unpublished material in the library at Lisbon, has led Father Schebesta (*Mitt. der Anthrop. Ges. in Wien*, 1922–3) to the conclusion that not only is the Zimbabwe a product of the indigenous Kingdom of Monomotapa described by the Portuguese, but that its builders culturally resembled the Baganda, and probably certain other of the more advanced peoples of Central Africa. For bibliography, see the references in the text. (C. G. S.)

VII. EGYPT

Since 1910 excavation in Egypt has progressed, if we except the four years of war, at a much faster rate than ever before. The methods of excavators have improved, and there has arisen a tendency to undertake specific pieces of work designed to clear up definite archaeological problems. A chronological arrangement will best show the contributions of the more important excavations of the period under review toward the pure archaeology of each successive period.

The Predynastic Period

In predynastic archaeology the outstanding discoveries are those made near Badari, 30 km. southeast of Asyut, and in the Faiyum. The full reports of these excavations have not yet been made public, but it would seem from what has already transpired that the finds take back our knowledge of the predynastic Egyptian stage beyond what was previously considered to be the beginning of the predynastic period, namely, the moment known in Petrie's Sequence Dating as S.D. 30. At Badari itself a stratified settlement has been found, the upper layers of which contain material of the usual predynastic kind. The lower strata, however, yield finds of a type hitherto unknown in Egypt. Among these are very finely worked flints (see fig. 2), including arrowheads of two shapes, and pottery which would seem to be the precursor of the predynastic red-polished and black-topped wares; this pottery, like some of later date already known from Nubia is frequently ripple-marked on the surface. In the lower strata, along with this ware, rough pottery of a type quite new to Egypt makes its appearance. Remains of huts were also found.

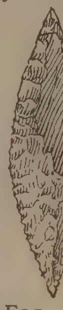

Fig. 2.—Flint implement from the Faiyum.

If the evidence of the stratification is sound—and there seems no reason whatever to doubt it—these finds take us a stage back beyond the earliest predynastic previously found in Egypt. Any attempt to put a date either to the beginning or to the end of the period would, on present knowledge, be folly. Not far from the settlement was found a cemetery whose contents show it to be contemporary with the lower levels of the settlement. Many tombs yielded glazed beads, and two contained objects of copper, in one case beads of copper ribbon and in the other a borer. The new civilisation, to which the name Badarian has been given, must therefore be considered not as purely neolithic but as belonging in part at least to the copper age.

Probably quite distinct from this culture is that revealed by recent discoveries in the Faiyum. Flints picked up on the surface in this area have long been known, and settlements in which the makers of these flints lived have now been found. A few rough pottery vases were recovered, but in such poor condition that it is difficult to appraise their original appearance and technique. Numbers of polished stone axes, bone borers and harpoons were picked up, and there is evidence, though not as yet quite conclusive, that they too belong to the settlements.

The archaeological position and date of this Faiyum culture remained undecided in 1925, and all that can be said pending further excavations is that it must in no way be confused with that of Badari.

Predynastic Civilisation.—The predynastic civilisation in the old sense of the word continues to receive illustration from every part of Upper Egypt, though we are still without evidence for its existence in the Delta. At Abydos were excavated two settlements, the main lesson of which is that in a settlement there will always be found types of rough flint and

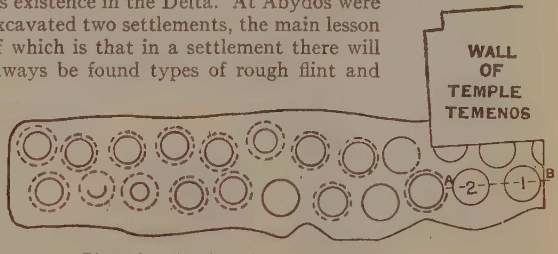

Fig. 3.—Plan of grain kiln, showing two lines of jars, and roughly rectangular form of kiln.

(*From Cemeteries of Abydos. T. E. Peet.*)

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[1] This is the standard work on Bushmen paintings; for rock-gravings reference should be made to J. V. Želisko, *Felsgravierungen der Südafrikanischen Buschmänner* (Leipzig, 1925), which contains much of the unpublished material collected by Emil Holub in his journeys in the seventies and eighties of last century.

bone objects and pottery destined for every-day use which are virtually unrepresented in the cemeteries of the same period, and which would, at first sight, from their very roughness, be put down as earlier in date than the finer objects of the contemporary tombs. In each of these settlements was found a "grain-kiln" consisting of a group of large jars set in the sand and surrounded by wood fuel enclosed by a brick wall, so as to form a sort of closed kiln with the mouths of the jars free. These structures were undoubtedly used for parching grain, and throw an interesting light on predynastic agricultural science (see figs. 3 and 4).

Discovery of Copper and Iron.—The discovery of copper in Badarian tombs seems to settle in the negative the question whether any part of the predynastic period previously known is rightly to be considered neolithic. The finding of beads of hammered iron in two tombs of the Middle Predynastic period at Maidum takes back the knowledge of this metal in Egypt to a much earlier date than had been imagined, though the stringing of these beads along with others of gold seems to show that iron was a great rarity. There is still no evidence for the general use of iron in Egypt before about 1200 B.C.

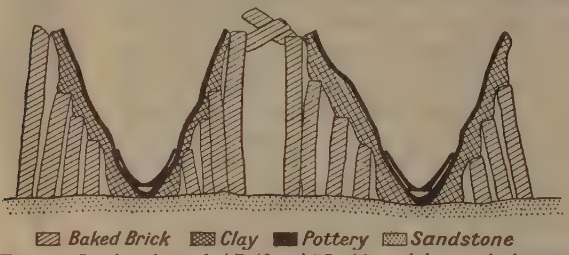


FIG. 4.—Section through AB (fig. 3). Inside each jar, at the bottom, is a small basin of rough clay, intended perhaps to prevent grain from lodging in the pointed bottom of the jar. Each jar is heavily coated with clay on the outside and supported by four rows of fire-bricks of different sizes; the fuel was placed among and between these.

(From "Cemeteries of Abydos"—T. E. Peet.)

Gebel-el-ʿAraq Knife.—The most striking single predynastic find during the 10 years 1915–25 is undoubtedly the flint knife with carved ivory handle from Gebel-el-ʿAraq. The delicacy of the work in the battle and hunting scenes on this handle is such as to give us a much higher idea than we had before of the skill of the predynastic craftsman. Some see Elamite affinities in the work and therefore postulate a period when Egyptians and Elamites were subject to the same cultural influences. It may be said here that this and some suggestions on similar lines are the only contributions made of late years to the problem of the origin of the early Egyptians, which, so far at least as archaeological evidence is concerned, remains very much where it was 10 or even 20 years ago.

THE ARCHAIC PERIOD AND OLD KINGDOM

The archaeology of the I. Dynasty has been very considerably illustrated by excavations of that period at Tarkhan and Tura. At both sites it is noticeable that the passage from the predynastic to the dynastic period is marked by no violent change visible in the cemeteries. At Tarkhan the main novelty is the custom of burial on beds, of much the same structure as in later Egypt, with wooden legs and side-posts, and leather straps on rush matting stretched across. In several tombs were found planks which had evidently been derived from portable houses formed of boards fastened together by rope or twisted gut, holes for which still remained. These houses probably served the same purpose as the maize-stalk huts of to-day, in which the peasants often dwell in their own fields during the busy agricultural season.

Physical Anthropology.—In some respects, however, the most important results of the excavation of Tarkhan are the measurements taken of the long bones of the skeletons, which, according to the discoverer, indicate the gradual infiltration of a new people into Egypt just before and during the I. Dynasty. In the lack of similar material from other sites it is perhaps too soon to say whether these figures prove all that is claimed for them.

Early Architecture.—The early history of architecture in Egypt seems likely to be revolutionised by recent discoveries at Saqqara. Against the north side of the Step Pyramid of King Zoser of the III. Dynasty has been found the shrine containing the royal statue. It is a small and simple but very finished construction in limestone, and the statue, in the same material, painted, which was visible from outside through two small "squint holes," while recalling the still earlier figure of Khasekhem, anticipates in the moulding of its features the fine style of the IV. and V. Dynasties.

Mastabas.—Two mastabas within the boundary wall of the pyramid have been excavated. In each case the south façade shows fine limestone masonry of a type only equalled at this early date by that of the north face of the boundary wall of the Step Pyramid. Each façade was decorated by four engaged fluted columns terminated by fluted leaf capitals. The dimensions of the column drums suggest that the façade was two-storied and that the whole building in its original state represented a house or palace with a forecourt. The side walls of the court which lay in front of the façade were ornamented with smaller engaged columns each exactly imitating a single papyrus stem and flower.

In the centre of each façade a door surmounted by a *kheker*-frieze leads to a small L-shaped offering-place containing no fewer than five niches. The roof of this chamber is formed of limestone slabs set on edge in such a way as to imitate the rafters of a wooden roof.

The pit of one of the mastabas yielded a vase inscribed with an unknown king-name Nubnefer.

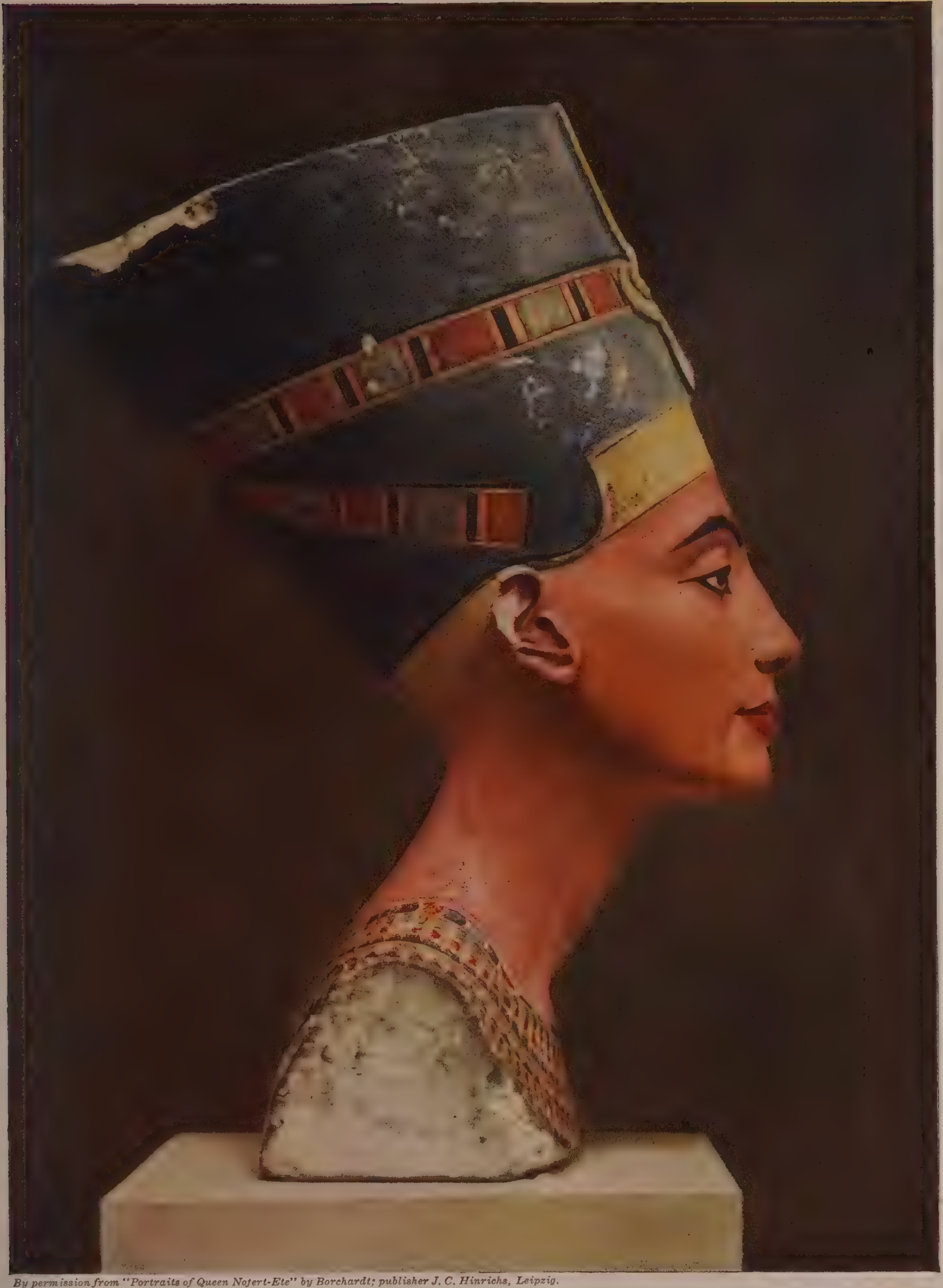
The significance of these finds is clear. Here, as the excavators themselves state, we have at a very early date a type of architecture in stone which is not only quite new to us but which represents the final development of a style the earlier stages of which are totally lost.

Pyramid Architecture.—One of the chief contributions to our knowledge of Egyptian architecture has been the clearing up of the structure and lay-out of the pyramid. The pyramid of Chephren at Giza shows the following features. Against its east side lay the temple which formed the offering-place for the king buried under the pyramid. This temple was approached by a covered inclined way from a smaller introductory or "valley" temple which lay down on the edge of the cultivated land, the pyramid itself being on the plateau. The introductory temple of the Chephren pyramid is that long known as the Sphinx Temple, and the Sphinx itself forms a part of the pyramid-complex and is therefore a portrait of King Chephren.

Similar arrangements can be observed in the case of all pyramids which are not too badly destroyed. They have been worked out both for the Mycerinus pyramid at Giza and for those of the V. Dynasty Kings at Abu Sir. The vexed question whether the pyramid grew out of the mastaba form by the addition of a series of coats of stone and an apex may be said to be still in dispute.

The mastaba cemeteries of the royal families and nobles which adjoin the pyramids are found to have been regularly laid out, forming veritable cities of the dead. The substitution of a mere limestone head or heads for the funerary statues usual in the tombs is a not rare feature of this period. The deep and as yet, unexcavated shaft-tomb, containing objects bearing the name of Sneferu should add largely to our knowledge of the tomb and perhaps house-furniture of the Old Kingdom, which is at present very small.

Temple Architecture.—The excavations at Abu Sir have also revealed much that is new in connection with the temple-architecture of the Old Kingdom. The sun-temple built by King Neuserrēʿ resembles in its general design a pyramid, having a valley-temple and inclined approach. The temple itself has been restored by its finders as resting against the east wall of a truncated pyramid surmounted by a huge obelisk. In the offering-court was found an alabaster altar with a slightly raised circular



By permission from "Portraits of Queen Nofert-Ete" by Borchardt; publisher J. C. Hinrichs, Leipzig.

QUEEN NEFERTETE ("The beautiful one has come"), WIFE OF "THE HERETIC KING"

From the bust recently excavated, and now in the Neues Museum, Berlin.

centre surrounded by four blocks each in the form of a *hotep*-sign, thus taking back to the Old Kingdom a form previously known only from the New Empire. South of the temple was a brick structure in the form of a boat, doubtless representing the barque of the "Morning Sun." Similar boats have been found in connection with other pyramids.

THE EARLIER INTERMEDIATE PERIOD

The lacuna between the end of the Old Kingdom and the beginning of the Middle has been largely filled up on the literary and historical side by the publication of the two new Petrograd papyri. Archaeologically the results indicated by these have been borne out by excavation, more particularly at Qau el Kebîr and at Sidmant. It is now clear, for instance, that the button-seals with their rather crude geometric and naturalistic designs are to be attributed to the end of the VI. Dynasty and just later, and they are regarded by some authorities as a product of the Syrian peoples who invaded the Delta at this moment. The Herakleopolitan Period, IX. and X. Dynasties, represented by cemeteries at Sidmant, has yielded material which completes the link between the Old and the Middle Kingdoms (see fig. 5).

Scarabs.—In the Sidmant tombs simple scarabs are found which determine the types for this period, and the scarab can now be traced back almost, if not actually, into the VI. Dynasty. The supposed examples of the IV. and V. Dynasties are still highly suspect. The Sidmant cemeteries also show the development of the wooden models of servants, cattle, granaries, etc., which reached their highest perfection under the XI. Dynasty.

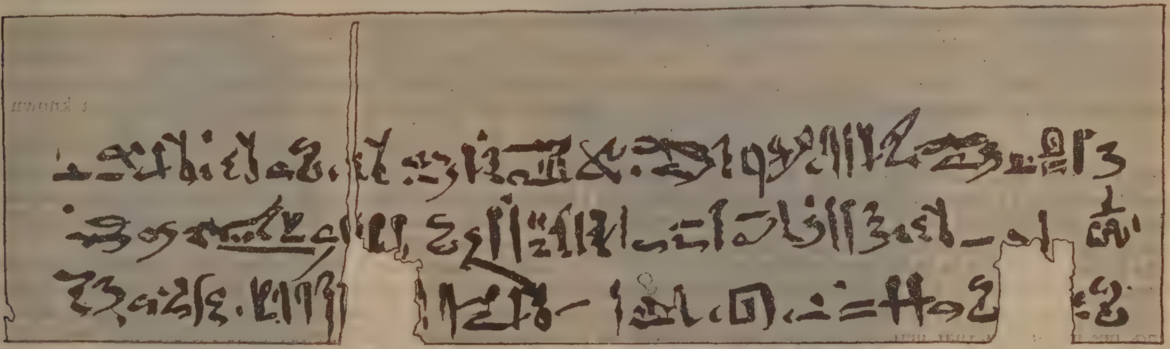


FIG. 5.—Fragment of Hieratic Papyrus. From the advice of King (Kheti) to his son King Merikerēc. (Gol. Pap. Hierat. Pl. XI. 1116A. recto. 11.70–72.) "(Egypt fights) 70 in the necropolis. Injure not the tombs with deeds of injury (?); for even so I did and even so it did occur, even as should be (??) done to 71 one who has transgressed in this way (?) with (?) the God. Deal not evilly with the Southern land, for thou knowest the prophecy of the Residence concerning it. 72 That (?) shall (?) happen even as this did happen. They did not transgress, according as they said . . . . I speak of (?) Thinis . . . . . . 73." (Translation by Dr. Alan Gardiner in *Journal of Egyptian Archaeology*, I, 22 ff.)

Models in Tombs.—To this later date belongs the wonderful find of such models made in the tomb of Mehenkwetrē in the hill behind Sheikh ʿAbd el Qurna at Thebes. They include gardens with pools, scenes of cattle-inspection, slaughter-houses, carpenters' shops, breweries, bakeries and weavers' yards. They infinitely surpass in delicacy of technique and attention to detail—as well as in preservation—any of the models hitherto known to us, and will be of real service in reconstructing the methods of Egyptian craftsmen, more particularly spinners and weavers.

THE MIDDLE KINGDOM

The XII. Dynasty continues, in the matter of large monuments, to maintain its reputation for secrecy, and we are still without a single even tolerably preserved temple of ordinary type, though the design of the pyramid offering-temple, a normal development of that of the Old Kingdom, is now known from Lisht and Dahshur. In respect to smaller antiquities a great increase in our knowledge has taken place. In connection with the XII. Dynasty tomb of Senebtisi at Lisht it has been shown that much of the tomb-furniture previously held to be of this dynasty, notably the brightly painted coffins with texts inscribed within, and the wooden models of servants, farm scenes, etc., is earlier, and must be pushed back into the XI. Dynasty, if not in some cases even farther. To the XI. probably belong, for example, the pit-graves which lie in front of the great rock-tombs at Beni Hasan. The typical XII. Dynasty coffin is almost plain, often with a single band of inscription down the centre, and the more elaborately painted examples, though they do in some parts of Egypt survive into this dynasty, are perhaps to be associated with the hegemony of Herakleopolis in the IX. and X. Dynasties, a hegemony which, historically as well as archaeologically, is just beginning to come to its own.

Jewellery.—Among the smaller archaeological material of the Middle Kingdom none has received of late more ample illustration than jewellery. In the shaft and chamber tomb of a princess Sithathoriunut, near the pyramid of Senusret II. at El Lahun, was found a mass of jewellery which can be only compared for quantity and quality with the early finds from Dahshur. The finest pieces are a superb gold diadem, and two pectorals of the Dahshur type. All three pieces are inlaid with semi-precious stones, lapis lazuli, turquoise, carhelian and garnet. Similar work was found in jewels from a tomb at Riqa, and we may now take it that this form of *cloisonnée* work was a product of the Egyptian jewellers of the Middle Kingdom, if not earlier; at any rate there is no longer any reason for seeking its origin abroad. The two ebony caskets with inlay of ivory and other material in which the El Lahun jewels had originally lain take back this type of box, now so well known from the tombs of Yuia and Tuyu and Tutankhamun, into the XII. Dynasty.

THE LATER INTERMEDIATE PERIOD

New discoveries affecting this dark epoch have chiefly been made in two types of tomb, both of which are in a sense exotic, the so-called "pan-graves" and the Hyksos tombs. Many years ago shallow tombs scooped in the desert sand were found at Hu which contained crouched burials accompanied partly by normal Egyptian objects typical of the end of the XII. Dynasty and later, partly by black-topped vases not unlike those of predynastic date, skulls of animals, often painted with black and red spots, and bracelets made of rectangular slips of mother-of-pearl. Similar tombs are now known from Rifaʿs Balabish and elsewhere. The contents of these tombs show close affinities with those of the later period of the C-group in Nubia (see below) though at the same time there are disturbing points of difference These latter are not, however, so serious as to invalidate the conclusion that at about the end of the Middle Kingdom there was a considerable infiltration of people from Nubia into Upper Egypt. One grave at Rifaʿa contains a scarab of the Hyksos king Sheshy, but the "pan-grave" civilisation would appear to have died out in Egypt at or before the rise of the New Kingdom.

Type of Grave.—In this same connection must be noticed a type of grave occurring not in groups but only sporadically in Egypt (*e.g.*, El Qurna, Abydos) at about the same period. These tombs all contain specimens of the very thin beautiful red polished pottery with black top of which the most frequent shape is the cup or bowl with flared rim found in such quantities at Kerma in Nubia and clearly typical of some southern civilisation, allied to but not identical with the Nubian C-group and the Egyptian pan-graves (see below). Such burials must be those of isolated immigrants from the south.

The other type of burial typical in Egypt of the dark age which followed the Middle Kingdom is that of which examples were found at Tell el Yahudiya. Here there exists an enormous fort with earthen walls, which is doubtless rightly assigned to the Hyksos invaders, and beside it lies the cemetery of its inhabitants. The bodies are crouched, and the more remarkable finds in the tombs, which contain a certain amount of normal Egyptian material, are scarabs with names of Hyksos kings, and a type of black pottery, mostly tall jugs with handles, with white-filled incisions. The home of this pottery, which occurs sporadically in tombs throughout Egypt and even as far south as the Sudan, is still uncertain, though many place it in Syria. A clever attempt to assign a Nubian origin to this ware has lately been made, but has not yet met with general acceptance.

Cretan Pottery.—With regard to foreign pottery in general it may be recorded here that most of the foreign painted ware found many years ago at El Lahun is now recognised as being Cretan of Middle Minoan date. An almost complete vase of this style was found in a tomb at Abydos together with cylinder-seals of Amenemhet III. and Senusret III.

The New Empire

Our archaeological knowledge of the New Empire (XVIII. Dynasty onward) has been increased mainly by three facts, the systematic excavation of Tell el ʽAmarna, the discovery of the tomb of Tutankhamun and the clearance of the royal cemeteries of the Ethiopian Period in the district of Napata.

Domestic Architecture.—The importance of the Tell el ʽAmarna excavations, apart from the artistic value of many of the objects found, lies in the fact that here for the first time we learn the details of Egyptian town-planning and domestic architecture. A considerable portion of the city of Akhet̆aten built by King Akhen̆aten about 1375 B.C. has now been laid bare. The design of the town is simple and regular. Two main streets, one of them more than 50 yd. broad in places, traverse it from north to south, but both are completely unpaved. The houses were all built of mud brick, occasionally with details, such as door-posts, lintels and column bases, in limestone. The nucleus of each house was the central hall, the walls of which were carried up higher than those of the surrounding rooms and provided with windows towards the top. This hall was roofed with wood and mud-plaster supported on wooden columns from one to four in number. Round it were grouped two long rooms, one on the north and the other on the west, both perhaps partly open to the weather on the outer side, bedrooms, workrooms, bathroom with limestone bath and lavatory. A staircase led up from the central hall on to the roof. In one instance at least there seems to be evidence for the existence of a second storey. The walls of the rooms were in many cases painted with bright designs in colours on the plain mud-plaster background. The larger houses were enclosed in a garden with trees, flower-beds and possibly in some cases an artificial pond. In a part of the enclosure were granaries, kitchen, a well and servants' quarters (see fig. 6).

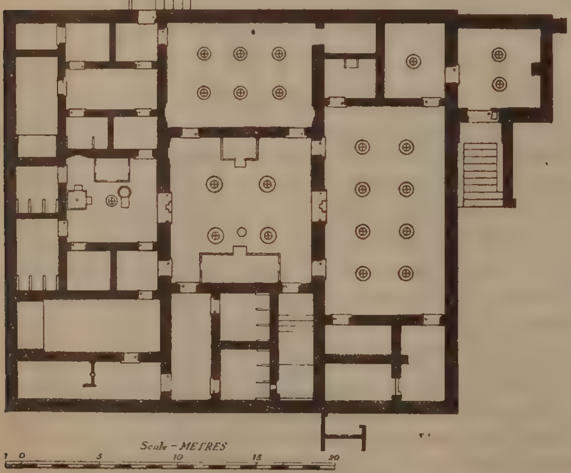


Fig. 6.—Plan of the house of the Vizier Nekht.
(*From City of Akhenaton, Peel and Woolley.*)

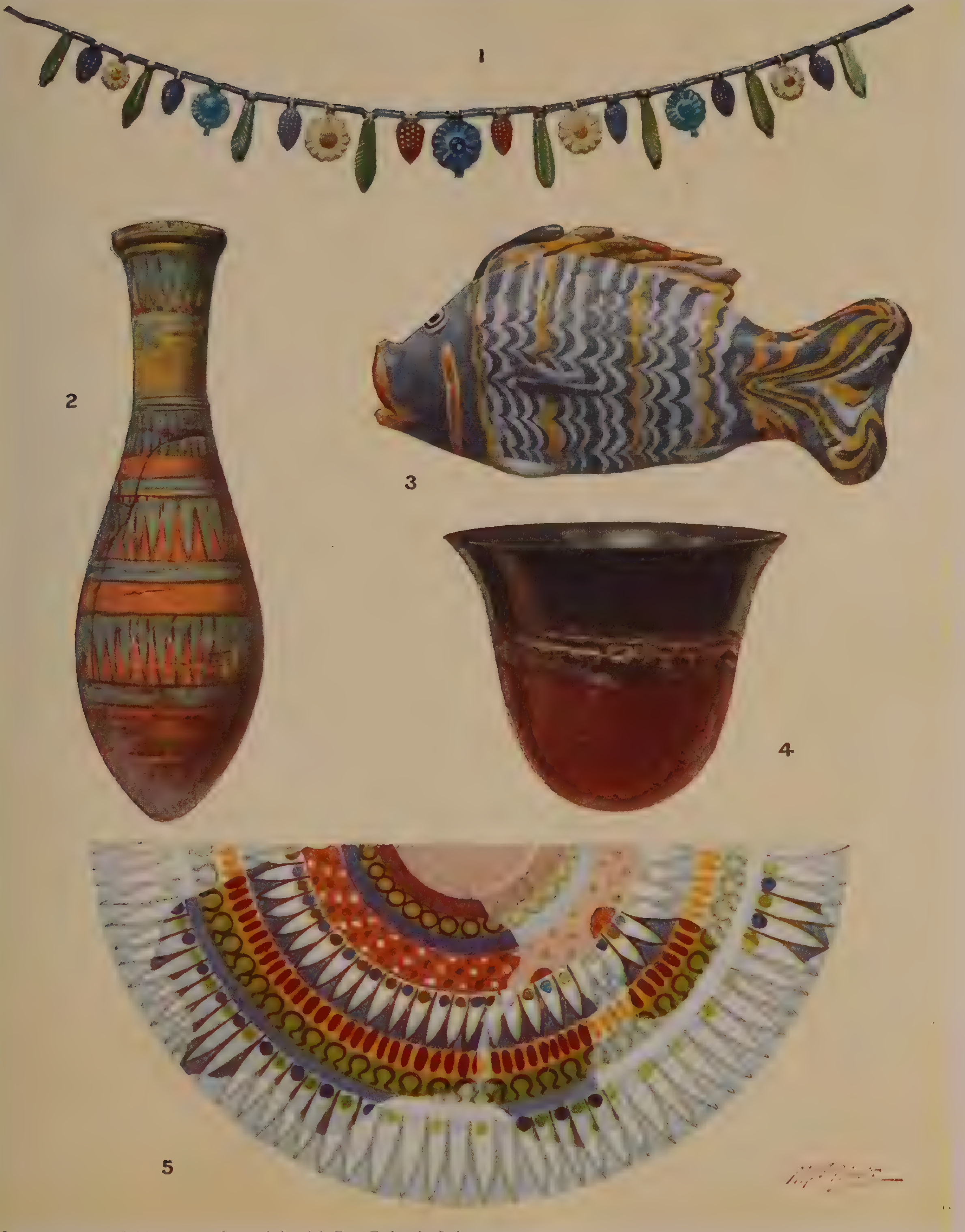
Palaces.—In addition to houses two other buildings have been excavated. The one, called Maruaten, seems to be a combination of a palace with religious buildings, the other, the North Palace, may have served a purely secular purpose. Both are destroyed almost to floor level, but in our nearly complete lack of information with regard to such buildings, they are of high value. With them may be included the palace of Amenophis III. on the west side of Thebes and that of Merenptah recently excavated at Memphis. All testify to the extensive use of fresco paintings both for the walls and the pavements of buildings of this period (see fig. 5 on plate).

Religious Architecture.—In the matter of religious architecture there is little new to record save the clearance of the so-called Osireion, at Abydos, behind the Seti temple. This is unique insomuch as it is the only subterranean building as yet known in Egypt. Its massive columns and roof-blocks, necessary to support 30 ft. of superincumbent sand, are a new feature in Egyptian architecture. It was finished as a cenotaph of Merenptah, though the burial-chamber itself was inscribed with funerary texts in the name of Seti I. The identification with Strabo's Well seems very probable.

King Tutankhamun's Tomb.—From the archaeological point of view the main value of the discovery of the tomb of King Tutankhamun lies in the almost numberless specimens which it has produced and is still producing of the arts and crafts of the Egyptians at this period. It will be many years before all its contents can be thoroughly studied and the skill of their makers properly appraised. In the meantime it may be said that, though the artistic value of the objects is somewhat variable, their technique is uniformly good. Taking the finds of this tomb in connection with those from the tomb of Yuia and Tuyu it will be possible to write a detailed treatise on Egyptian furniture of this period: the forms of beds, couches, chairs, stools and cabinets seem to have been very definitely fixed by tradition, but there is infinite variety in the manner in which decoration of carving, inlay, *appliqué* and painting on stucco was applied to them. From these same tombs and that of Tuthmosis IV. we have now evidence which enables us to reconstruct in its smallest detail the Egyptian war-chariot, with its broad stout axle and flimsy body, usually of leather framed in wood.

The Jewellery.—Tutankhamun's jewellery bids fair to rival in quantity all that previously found in Egypt; it is not as yet published, but it shows us the logical continuation and development in the New Empire of the openwork, the granular and the inlaid techniques of the Middle Kingdom. Specimens of garments seem to show true needlework embroidery as contrasted with the embroidered tapestry hitherto known on Egyptian materials: the use of applied golden sequins as a decoration is a new feature. A great contribution is made to the much discussed question of Egyptian lighting by the discovery of wicks of twisted linen suspended in oil cups. In connection with this same subject it may be added that De Garis Davies has recognised in certain tomb-pictures representations of candles consisting of large conical masses of fat consumed by means of a small wick at the apex.

The Shrines.—From the funerary point of view the chief addition so far made to our knowledge by the tomb is the verification of the purpose and arrangement of the so-called shrines of wood



1-4 by permission of the British Museum; 5 by permission of the Egypt Exploration Society

SPECIMENS OF EGYPTIAN ART

1. String of beads and pendants in glazed faience (modern stringing)—from Tell el-'Amarnah. c. 1370 B.C. 2. Painted pottery vase of rare design—from Tell el-'Amarnah. c. 1370 B.C. 3. Variegated glass vessel in shape of a fish—from Tell el-'Amarnah. c. 1370 B.C. 4. Cup of XII Dynasty Black-top ware—from Nubia. c. 2000 B.C. 5. Fragment of wall fresco (with restoration) from a house at Tell el-'Amarnah.

with gilt decoration which, one within another, conceal and protect the coffins. Such a canopy was found in fragments in the tomb of Queen Tyi, and the use then conjectured for it is fully confirmed by the finding of Tutankhamun's canopies in position.

Egyptian Archaeology in Nubia and Syria

No account of Egyptian archaeology can afford to omit the discoveries of the period 1910–25 in Nubia. In the predynastic period the civilisation of Egypt and Nubia was one and the same. From the I. Dynasty onward Nubia fell behind and produced for many centuries mere modifications of this early culture. These are known as the A-group, parallel to the Early Dynastic in Egypt, the B-group, parallel to the Old Kingdon, and the C-group, roughly parallel to the Middle Kingdom. During the Middle Kingdom the Egyptian governors of Nubia lived at Kerma, near the Third Cataract, where a curious new civilisation seems to have been built up by Egyptian craftsmen on the C-group basis. The most remarkable product of this culture is the beautiful thin red-polished pottery with black top referred to above (*see* fig. 4 on plate). The Egyptian governors at Kerma were buried on their beds surrounded by large numbers of native victims slaughtered at their funeral, apparently in imitation of a local custom observed, though less fully, in the tombs of contemporary Nubian chiefs. The New Kingdom brought the whole flood of Egyptian civilisation into Nubia, and the local industries hardly survived this inruption except for certain of the old types of pottery.

Revival of Nubian Culture.—Some centuries later this Nubian culture underwent an astonishing revival, the centre of which lay farther south in the Sudan, where Dr. Reisner has laid open an entirely new field of research. Historically he would divide his finds into two periods, the Napatan Kingdom of Ethiopia, about 900 to 300 B.C. and a Meroitic Kingdom of Ethiopia from 300 B.C. to 500 A.D. The archaeological importance of his work lies in the fact that he has discovered the tombs of the whole of the rulers of the Ethiopian Kingdoms throughout these periods, together with objects typical of the civilisation which they enjoyed. The earliest tombs of the Napatan kingdom at El-Kurru are mere mounds or tumuli, but with Piankhi, the conqueror of Egypt and founder of the XXV. Egyptian Dynasty, the pyramid once again becomes the correct form for a royal tomb, after a lapse of about 1,000 years. The finds in the tumuli include numerous arrow-points of flint and chalcedony of Libyan forms, and these, combined with certain inscriptional evidence, indicate that the ancestors of Piankhi were not Ethiopians but immigrants from Libya. Graves of horses were in some cases found close beside those of their royal owners. The finds in general show that Ethiopia formed a stronghold of Egyptian arts and crafts during the period of decadence in Egypt itself, and possibly prepared the way for the renaissance of the XXVI. Dynasty.

The Meroitic Kingdom.—The Meroitic Kingdom is almost without interest archaeologically. The local pottery seems, however, to make one last effort, and side by side with a survival of the ancient Nubian black and brown ware with white-filled incision, produces an elegant thin yellow ware painted with geometrical—more rarely naturalistic—designs or ornamented in the barbotine style. All else is decadent Egyptian or still more decadent Graeco-Roman.

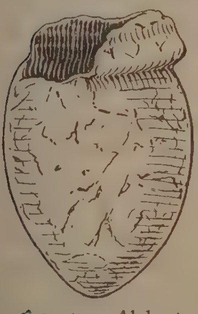


Fig. 7.—Alabaster vase from Byblos. V. or VI. Dynasty. (British Museum.)

Relations with Syria and Palestine.—In conclusion a short reference is necessary to the new field of Egyptian archaeology which appears to be opening up in Syria-Palestine. The interest of the discoveries of Beisan (the biblical Beth-Shan) are in the main historical, but the excavation of a XIX. Dynasty Egyptian fortress and of an Egyptian temple of Ashtaroth of similar date, with still earlier temple beneath it, is a matter of very new archaeological interest. At Byblos, too, where the Egyptians from very early times, appear to have made offerings in a temple, among which are vases inscribed with names of V. and VI. Dynasty kings and a cylinder which can hardly be later than the Thinite period (I. and II. Dynasties), there appears a likelihood that important archaeological material from a remote period but poorly represented in Egypt itself may be recovered. The occurrence in the tombs of certain chieftains of Byblos of Egyptian objects of XII. Dynasty date, in conjunction with local pottery and silver vases possibly of Aegean origin, is also noteworthy (*see* section X., Western Asia).

(T. E. P.)

VIII. CRETE

Later archaeological discovery has hardly altered any of the results stated by Sir Arthur Evans, the most experienced and most active of Cretan explorers, in 1910, but the very considerable accumulation of new material confirmed and extended his conclusions. It is only at Knossos that architectural novelties have since come to light, but two more palaces have been found, at Tylissos and Mallia, and several towns, some containing large and almost palatial houses, have been partially or completely cleared in the islands of Pseira and Mokhlos, at Nirou Khani on the north coast of Crete, and at Arkhanes and Plati in the interior.

Further work in the great palaces revealed new details of their plan and structure, and at Knossos much has also been done toward replacing the upper floors. The sanctuary cave of Kamares has been re-examined, and other mountain shrines were investigated at Arkalokhori and on Juktas. The most extensive finds, however, are sepulchral. Few cemeteries were known before 1910, and they belonged mostly to the end of the Late Minoan age (Zapher Papoura, Liliana, Kourtes); since then the earlier periods are represented on numerous sites, the most notable of which are in the Mesara plain (beehive-tombs), in Mokhlos, near Gournia (Sphoungaras and Pakhyammos), and again at Knossos (Isopata). The latest transitional phase was illustrated by remarkable finds at Vrokastro. Several works of sculpture of great distinction appeared during the period under review, having been found in some instances in their proper context by scientific excavation, and duly received into the Museum of Candia; in other instances accidentally or illicitly unearthed, and passed through the hands of dealers into foreign collections.

The first volume of Sir Arthur Evans' book, *The Palace of Minos at Knossos*, includes all the significant material that had been found on every Cretan site up to the time of its publication (1921). The varieties of hieroglyphic and linear scripts find their latest discussion in its pages, and an isolated document so remote from Knossos as the Phaistos Disk is fully examined there. No further progress had been made toward the determination of the Minoan language, but Sir Arthur Evans stated that the painted inscriptions on certain Mycenean vases found at Thebes in Boeotia agree both in form and grouping with the script in use at Knossos in the latest Palace period (L.M.II.), a coincidence which argues identity of language as of religion and general culture in the mainland (Mycenean) in the Phaistos Disk and Cretan (Minoan) civilisations. He is inclined to recognise in the Phaistos Disk a section of a pictographic metrical composition celebrating a sea-raid, a religious song of victory, conveyed to Crete from a Lycian or kindred Anatolian country. The book includes the results of supplementary excavations in Knossos undertaken in 1912 for the purpose of clearing up some obscure points in the plan and history of the palace. An instructive but difficult feature was the existence of superimposed pavements and floor levels, which showed successive chronological phases often involving complete change of function and design. It became evident in the course of these probings that the site was still productive, and excavation was accordingly resumed in 1922 and continued in the following years.[1]

At the southeast angle of the palace several huge blocks of masonry were found 20 ft. out of place, having been hurled to that distance by an earthquake shock, and having demolished a house in their fall. The pottery and other objects abandoned in the house give an accurate date for the catastrophe at the end of the Middle Minoan period (1600 B.C.). It seems that the widespread destruction and the general set-back which was long observed at the end of this period must now find its explanation in this physical cause. Some parts of the palace structure were not rebuilt after their collapse, and this house and another that shared its ruin were methodically filled in after a religious sacrifice had been performed on the spot, presumably to propitiate the earth-shaking power. Relics of the rite were found in two skulls of long-horned bulls and fragments of portable tripod altars. Rich stores of polychrome pottery of the finest (M. M. II.) style, were recovered from structures underlying these houses. A subsidence at this angle of the palace wall was shown by further exploration to have been a subterranean quarry with vaults and galleries from which potters and plasterers of the Early Minoan epoch had derived a certain kind of red earth.

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[1] A. J. (Oct. 1922), J. H. S.. Part II. (1924).

In regard to the structure of the palace particular attention was given to the entrances. By the north gate the foundations of an outer bastion were traced, and the discovery of an early magazine for oil-jars points to its use as a depôt for stores arriving by the sea-gate from the harbour town of Knossos. The state entrance of the palace was the west porch. Here the removal of large fallen blocks revealed for the first time its true inner lines. Opening out of a reception area there was found a warder's lodge, a feature which recurs elsewhere in Cretan palaces. The processional corridor leading south from this entrance turned left to a Southern propylon which, in its original form, contained a large sacristy cist. From this propylon a broad flight of steps led through a spacious upper porch to the principal hall of the West Wing. Beyond this, unexpected evidence come to light of a staircase leading from the stepped porch on the Central Court to an upper storey. These structures have been replaced in their original positions and the Great Hall and its approaches covered with floors of reinforced concrete supporting the original column bases and door joints. This makes at once a monumental feature of the site, a protection for the lower rooms, and a permanent conservation of the existing elements.

But the most remarkable discoveries were made in connection with the south gate, where excavation revealed a monumental portico with inclined steps climbing up the slope. In connection with this on the farther bank of the stream that fed the Kairatos, there came to light, beneath an indurated natural deposit of gypsum, the most colossal piece of Minoan architecture that has been found in Crete, the piers of a massive viaduct by which the southern road was led across the torrent (see fig. 8 on plate). The stepped intervals between the piers, through which the flood-waters were released, are precisely like the spillways of a modern dam. Further sections of the road were traced at intervals across the island, over the low watershed of the central sea. Its track is visible in the ancient cuttings, in some surviving sections of its heavily built retaining walls, and in guard-houses, residences and shrines along its route. Its terminal port was at Komo near Phaistos and H. Triada, which it also linked with the dominating power at Knossos, but it doubtless served as the general line of traffic to Knossos from the Libyan sea and Egypt.

At the Knossian road-head, in front of the viaduct, Evans found a caravanserai of unique character. Its remains show a front yard backed with stone stables and storerooms, which served as the basement of upper storeys, partly brick-built. There was a refectory in the form of a stepped pavilion, adorned with a painted frieze of partridges and hoopoes. Attached to the pavilion is a smaller porch containing a sunk basin for foot-washing, and fragments of clay bath-tubs in an adjoining room indicate that more extensive ablutions were performed in greater privacy. There are even traces of a piped hot-water system. A small spring chamber was heavily choked with gypsum incrustation; but when this was hewn away the water at once rose in its ancient place, and the system here and elsewhere is now in working order. After the choking of the spring at the end of the Palace period, the well house was used as a shrine, and was filled with votive offerings belonging to the latest Mycenean and the earliest Geometric periods, which show the same continuity of culture on an inhabited site as is seen in graves at Vrokastro and elsewhere. The lowest date that can be provisionally assigned to the Proto-Geometric material is 1000 B.C. The date of the main structure of the inn, as of the great viaduct and portico beyond it, is L. M. I.*a* (1550 B.C.), to which period the painted frieze belongs. The viaduct in its original form and the stepped portico belonged to M. M. I.*a* and were therefore contemporary with the original foundation of the palace.

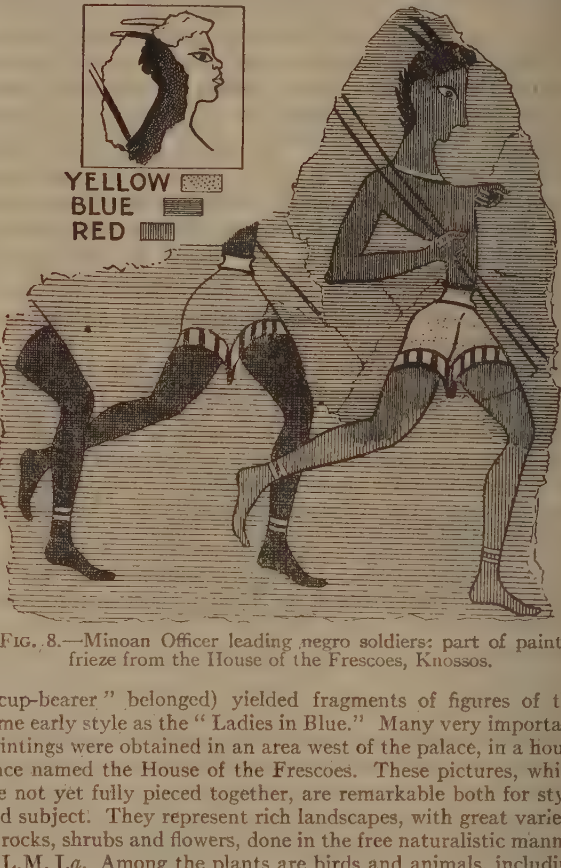

FIG. 8.—Minoan Officer leading negro soldiers: part of painted frieze from the House of the Frescoes, Knossos.

Some other frescoes came to light in the palace itself, where a lower level of the processional corridor (to which the well-known "cup-bearer" belonged) yielded fragments of figures of the same early style as the "Ladies in Blue." Many very important paintings were obtained in an area west of the palace, in a house since named the House of the Frescoes. These pictures, which are not yet fully pieced together, are remarkable both for style and subject. They represent rich landscapes, with great variety of rocks, shrubs and flowers, done in the free naturalistic manner of L.M. I.*a*. Among the plants are birds and animals, including a monkey that can be identified as a Sudanese species. One piece shows a jet of water rising from an artificial fountain. Another bears the figure of a *Minoan officer accompanied by two negro soldiers* (see fig. 8). The intimate African relations which are illustrated by these paintings became increasingly apparent in Minoan remains. One of the late discoveries at Knossos may throw light upon the beginning of this influence. In the south-west part of the central court, where paving slabs had been removed, wall foundations were discovered, and were thoroughly investigated in 1923 and 1924. Two main strata could be distinguished, though both belonged to the concluding phase of the Upper Neolithic, and in these the ground-plans of two rectangular houses were made out. The accompanying pottery showed some anticipations of E.M. I. forms, such as stemmed goblets, which seem to have had metallic prototypes.

A find was a copper axe on a house floor in a pure neolithic context, probably imported, like the models for the vase-shapes, from protodynastic Egypt. In the same house was the base of a mottled limestone cylindrical pot of late predynastic type, and other fragments show that the local fabric of variegated stone vessels, which culminated in the magnificent specimens of Mokhlos, had already begun before the end of the Stone Age. The house-plans are an agglomeration of rooms like the later palace itself, but an entirely new and unexpected feature in them is the fixed hearth, of which two examples were discovered. These are the only instances in Crete before the latest Minoan period, when the fixed hearth reappears in conjunction with the Mycenean *megaron* as an importation from the Greek mainland. The fact that throughout the long interval of the Minoan age only portable tripod hearths and chafing-pans are found must be referred to an influence coming from the milder climate of North Africa. The fixed hearth must now be regarded as part of the original Anatolian inheritance of Crete, which persisted until the end of the Stone Age, and was then displaced by a new movement.

The African influence, which had previously been noted in many physical and personal characteristics of the Minoan race, has had further confirmation on the sepulchral side. Between 1904 and 1917 a series of beehive tombs (*tholoi*) were located in the Mesara, and their contents proved to be objects of the same early class as the H. Onuphrios deposit, the Egyptian and possibly Libyan affinities of which were pointed out by Sir Arthur Evans in 1895. Two of the present series were found at H. Triada; most of the remainder were published by their excavator, the Cretan Ephor, S. Xanthoudides, in 1924. The vaults have megalithic doorways and in some cases rectangular antechambers. They were used for communal burial during the whole of the Early Minoan age, and some contained remains of several hundred interments. The associated material consisted mostly of pottery, notably of rare E.M. types, stone vessels, carved ivory seals, copper and silver weapons. One of the most significant foreign elements is a Babylonian cylinder of about 2000 B.C. (=M.M. I.) The beehive vault and the square entrance enclosure occur, as Sir Arthur Evans has pointed out, in certain tombs of North Africa, where an origin for the form is indicated n the huts of Libyan nomads. On the other side these early Cretan *tholoi* may supply the ancestry of the stately Mycenean tombs, which first appeared in mainland Greece after the Cretan occupation at the end of M.M. III. During the Middle Minoan age such vaults seem to have gone out of use for sepulchral purposes in Crete, but their design and method of building are exemplified in a circular well-house discovered by Evans at Arkhanes near Knossos in 1922, which is contemporary with the earliest mainland tombs.

The strange variety in Minoan methods of burial has been amply demonstrated by recent work. Besides the *tholoi*, which may have been peculiar to Mesara with its close Libyan outlook, Early Minoan communal interments have been found in a cave at Pyrgos[1] and in rectangular enclosures or rock-shelters at Mokhlos. Cist graves of the same period have been found at Mokhlos, Pseira and Sphoungaras. This Cycladic mode of burial was practised also in the Middle Minoan age, but burial in jars then came nto use beside it, and is represented on the same three sites and at Pakhyammos. Jar-burial was usual in L.M. I., when the great square chamber tombs began (Isopata); the latter persisted with beehive tombs as the typical Late Minoan and Mycenean method. Shaft-graves and pit-caves were frequent in L.M. II. and after (Zapher Papoura), and in L.M. III. the custom arose of using clay chests and bathtubs for coffins, the unearthing of which in classical times doubtless gave rise to the stories that Minos and Agamemnon had been killed in their baths. Rich finds of coloured stone vases and unique gold jewels came from the E.M. tombs of Mokhlos. The same cemetery and those of Sphoungaras and Pakhyammos produced fine examples of painted burial jars, particularly of L.M. I. date. The Knossian chamber tombs opened in 1910 belong to a group situated on the plateau of Isopata.[2] Their earliest elements go back to the end of M.M. III. The Tomb of the Polychrome Vases (L.M. I.) contained two goblets brightly painted in unfixed colours which llustrate the survival of an obsolete technique for sepulchral use. The cult of the dead is more impressively displayed in the neighbouring Tomb of the Double-Axes (L.M. II.), the singular form of which, with central buttress bearing a carved half-column, is a symbolical reproduction of a Minoan columnar sanctuary with its supporting pillar-crypt. There are benches along the walls as in a living-room, and a cist grave cut in a platform on the stone floor has the plan of a double-axe. The tomb, like most of its kind, had been rifled in antiquity, but among the few pieces of jewellery remaining were some amber beads and disks, and several fine specimens of Palace style vases were made up from fragments. Smaller vases were a bull's-head "filler" and a jar of the same shape as the ritual polychrome vases, and there were two bronze double-axes.

Similar cult objects were found in the large house west of the palace known as the Little Palace, which is connected by a paved way with the theatral area. In this building a room with sunken balustraded floor approached by steps (such as were once thought to be baths, and are now recognised as sacred chambers) was already known. Further exploration revealed other architectural features which seem universally to have been connected with the Minoan cult. These are basements with heavy square pillars supporting the roof at points where columns above carried the ceiling of an upper hall. Between the pillars in this instance were vats for receiving libations; in other Knossian houses cups have been found holding remains of offerings and the stepped socket of a double-axe. Here, in the well of a staircase giving access to one of the columnar upper rooms, were found a similar axe-socket, clay vases in the shape of a bull's head, and other ritual forms, and a magnificent bull's-head vase carved in black steatite, half natural size. Its nostrils were inlaid with white shell, its eyes painted behind crystal inlay, and the horns were gilt wood.[3] Very curious finds of cult objects were also made in a large house at Nirou Khani by Xanthoudides in 1919.[4] In one room were four colossal double-axe blades of bronze, of which the biggest was nearly 4 ft. long and more than 2 ft. wide. In two other rooms 40 or 50 tripod-altars made of unbaked clay had been stacked in rows along the walls. It must be supposed that these sacred implements were manufactured here, and that one of the privileges of the priest-kings who lived in the palaces was the sale of such furniture to their subjects. The pottery from this building is mostly of L.M. I. style.

Another palatial house of the same date was excavated by J. Khatzidakis, at Tylissos.[5] It had been destroyed by fire about the same time as the palace of Knossos. Remarkable objects were found: four gigantic basins, from 4½ ft. to 2½ ft. in diameter, an obsidian libation-vase ("filler") 9 in. high, fragments of painted plaster, one with a picture of a large ceremonial fan, and a bronze statuette of a praying man. This last figure was the means of identifying a very fine example of the type which had lain in the British Museum for many years.[6] Another bronze statuette, perhaps representing a flute-player, which is said to have been found near Phaistos, was acquired by the Rijksmuseum of Leyden.[7] A quite extraordinary piece of Minoan sculpture is a small bronze group representing a man somersaulting backwards over a charging bull. This belongs to an English collector.[8] Sculpture in ivory is also illustrated by two exquisite pieces. One, which is now in the Museum of Fine Arts at Boston, is a figure of the Minoan goddess or her votary wearing a flounced robe enriched with gold and holding two golden snakes.[9] The other,[10] obtained by Sir Arthur Evans, represents a boy with arms upraised in adoration, and was apparently the companion figure of the Boston ivory in a group of the goddess and her son-consort. A marble statuette bought by the Fitzwilliam Museum at Cambridge (1926) represents the goddess holding her breasts. It reproduces in detail the costume of the Snake Goddess of Knossos.

Another palace has been located at Mallia, on the north coast of Crete, and is now being excavated by the French school at Athens. It was destroyed at the very beginning of the Middle Minoan age, and consequently supplies much valuable chronological information, as, for instance, that the hieroglyphic script of Knossos was fully developed in M.M. I.*a*. To the same early period belongs the largest bronze sword that has been found in Europe, a splendid weapon with inlaid hilt and faceted crystal pommel. It comes from what may have been a royal tomb on this site. The excavation of the palaces of Phaistos and H. Triada is regarded by the Italian Mission as finished. A final plan and description of Phaistos were published by L. Pernier in 1914.[1] A street of houses, described as an *agora*, of the Late Minoan period was uncovered at H. Triada in 1910, and in 1912 an L.M. III. shrine was found there, containing the customary stacks of cups for offerings. Such domestic shrines or the more intimate pillar-cult of houses are represented in every considerable Minoan building. Public places of worship are less common and of different kind. A built sanctuary was found by Sir A. Evans on Mount Juktas,[2] but other mountain-shrines, sacred to the powers of nature, seem to have been left in their natural state. The Kamares Cave, situated on Mount Ida, in which the first finds of M.M. polychrome pottery ("Kamares ware") were made about 1894, was fully explored by the British school at Athens in 1913. This cave is a great hollow in the limestone, nearly 6,000 ft. above the sea, running about 100 yards into the mountain at a downward slope of 30 degrees. At its bottom is a smaller cave with a very narrow entrance. No trace of habitation was found. The place was evidently a sanctuary dominating Phaistos and the Mesara, and the offerings found in it were made "by people coming as far down into the cave as they could, or perhaps as far as they dared, and laying their vases among the great boulders."[3] Little was found besides pottery, and that belonged almost exclusively to M.M. I. and II. Most of it was plain ware, but painted shards were numerous, and among the recovered vases are some of the most decorative in Minoan art. The absence of the kinds of votive offerings, particularly bronzes, which have been found in other Cretan sanctuaries, must probably be explained as a fashion of the time. In the same year Khatzidakis cleared a very small cave which was nowhere more than three feet high or six feet wide, at Arkalokhori near Lyttos. The predominant offerings were copper dagger-blades and double-axes of Early Minoan date. The first examples of E.M. I. stemmed goblets in black pottery with burnished patterns were also found here.[4]

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[1] Ἀρχ. Δελτ. (1918).

[2] A. J. Evans, "Tomb of the Double-Axes," etc., *Archaeologia* (1914).

[3] *Ibid.*

[4] Ἀρχ. Ἐφ (1922).

[5] Ἀρχ. Ἐφ (1912).

[6] *J.H.S.* (1921).

[7] Jahrb. d. deutsch. arch. Inst. (1915).

[8] *J.H.S.* (1921).

[9] *A.J.A.* (1915).

[10] This will be published in vol. 2 of *The Palace of Minos at Knossos.*

The end of the Minoan age is still obscure in detail. Universal destruction is apparent at the close of L.M. II., and in the island towns of Pseira and Mokhlos there was no subsequent recovery. The Cretan sites, however, were reoccupied at once, and although the palaces were not fully rebuilt their partial inhabitation and the continuous use of towns and cemeteries indicate no cultural or racial change in the last period (L.M. III.). But Late Mycenean (Myc. III.) elements were brought from the mainland at this time to Crete, as they were carried to Cyprus, Rhodes and elsewhere in the Aegean, and the last phase of prehellenic culture in Crete seems to have been the same as in the rest of Greece. The following age of transition, which was represented by the offerings in the well-house at Knossos, is best seen at Vrokastro. There, on a series of high hills and ridges near Gournia, has been found an extensive settlement with attached cemeteries of the latest Bronze and earliest Iron Ages. Two distinct funeral rites are recorded: inhumation in chamber tombs, and cremation in the same tombs or in bone enclosures. The style of the pottery in the chamber tombs is Sub-Mycenean or Proto-Geometric; that in the bone enclosures is early and mature Geometric. The pottery in the town is of the latest Mycenean class (Myc. III.*b*). Different types of fibulae were associated with the three kinds of pottery, iron weapons were found with both kinds of burial, and in one chamber tomb there was a bronze tripod of the kind that had been previously found with Transitional material at Knossos, in Cyprus, at Athens, and most recently at Tiryns. Six Egyptian faïence seals were found with the tripod, which had not been precisely dated. But it is clear that the Vrokastro finds cover the period between 1200 and 800 B.C., and display the stages by which Hellenic (Geometric) art displaced Minoan, without, however, offering an historical explanation of that phenomenon. Crete evidently felt the full activity of these momentous changes. Discoveries made by an Italian Mission at Afrati, the ancient Arcadia, in 1924[5] revealed a remarkable series of vases in the early Orientalising style, which tend to show that the island was prominently concerned with the revival of art in the Archaic Greek period, partly by maintaining the Minoan tradition, partly by resuming its old position of intermediary between Europe and the Middle East.

The period was also marked by the publication of many important books. Some of these are final records of excavations made before 1910, but previously known only from provisional reports in periodical publications: such are the late Richard Seager's accounts of his valuable explorations in Pseira and Mokhlos, the first part of the publication of objects found by the British school of Athens at Palaikastro, and the first volume of Sir Arthur Evans' great work. Books reviewing the Cretan material in its Aegean or wider Mediterranean relations were written by Dussaud, Fimmer, Glotz, Hall and Mosso; and two useful pictorial surveys were produced by Maraghiannis and Bossert.

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(E. J. F.)

IX. GREECE AND EASTERN MEDITERRANEAN

Greece.—In Greece since 1910 the increase in our archaeological knowledge has been great in spite of the cessation of work during the War. It is best to divide the field into two sections—the prehistoric and the historic. The gain to knowledge seems greater in the former than in the latter, because practically every discovery in the prehistoric sphere, where we know so little, adds considerably to our knowledge. On the other hand the historic period is already so well explored that only important discoveries make really serious additions.

THE PREHISTORIC PERIOD

The Greek and British researches in Phocis and Thessaly in 1912 and 1910 show that a Neolithic and Bronze Age culture flourished all over Northern Greece between 3000 B.C. and the close of the Mycenaean period about 1150 B.C. Its development shows four periods, of which the first and second are Neolithic. The culture of the first is well advanced and indicates that man had progressed far beyond the palaeolithic stage. The second has connections with similar cultures that centre in the upper Balkans round the Carpathians. The third period is the early Bronze Age and it also is related to the early cultures of Macedonia and Serbia. The fourth period is the Later Bronze Age and a time of decline until in the 15th century B.C. Mycenaean civilisation invaded the country. Recent American researches in Corinthia, Argolis and Arcadia have shown that in Neolithic times a similar culture covered Southern Greece. In both north and south brightly painted hand-made and polished pottery is characteristic of the Neolithic periods, and as it is technically good, is in strong contrast to the coarse, incised Neolithic pottery of Crete and the islands. This suggests a racial difference between the islands and the mainland at that time, and since the polychrome pottery of the second period is related to that of the Carpathian area, this might point to the coming of people from East Central Europe into the Peloponnese before the close of the third millennium. During this second Neolithic period a bronze-using folk akin to the population of the islands and Crete entered Southern Greece, and overran the Peloponnese and all Central Greece, as far north as Mount Othrys. This probably occurred about the middle of the third millennium.

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[1] *Ann. Scuola Ital.*, i. (1914).
[2] *Palace of Minos*, i., p. 154.
[3] R. M. Dawkins in *B.S.A.*, 19 (1912–3).
[4] *B.S.A.*, 19 (1912–3).
[5] *J.H.S.* (1924).

The Bronze Age.—The remains of the Early Bronze Age in Southern Greece (Early Helladic Period) are well illustrated by the American excavations in Corinthia and by the Swedish at Asine, by the German at Tiryns, by the Greek in Boeotia and Euboea and by the British at Mycenae. The same series of excavations with more recent work by the Americans in Boeotia and the discovery of the "House of Cadmus" at Thebes by the Greeks have immeasurably increased our knowledge of the Middle Bronze Age and Late Bronze Age (Middle and Late Helladic Periods) in continental Greece. The Middle Bronze Age is marked by the intrusion of people characterised by the use of pottery known as Minyan Ware. The origin of this is not yet known and though it is common on the Greek mainland and occurs also in the islands, none had been found in Crete up to 1925. It would appear that in the Middle Bronze Age, owing to this intrusion, relations between Crete and the mainland were broken. Before the beginning of the Late Bronze Age about 1650 B.C., the Cretan civilisation established itself on the mainland partly by trade and partly by colonisation. The receptivity of the people of the mainland for the more advanced civilisation is exemplified by the rapid rise of places such as Thebes or Mycenae to first-class importance. Then with the Late Bronze Age begins the Mycenaean Age *par excellence* and the history of this has been completely rewritten as a result of the excavations just referred to at Mycenae, Tiryns and Thebes. During the 16th and 15th centuries B.C. Crete was culturally dominant on the mainland and was possibly politically dominant as well. But before the close of the 15th century B.C. the character of the mainland asserted itself so strongly that when, about the beginning of the 14th century B.C., the Palace of Knossos was destroyed Mycenae succeeded to the artistic and political inheritance of Crete.

Mycenaean Culture.—Mycenae in the 16th century B.C. was ruled by a dynasty of kings who were buried in the Shaft Graves discovered by Schliemann. They were succeeded by a second dynasty about 1500 B.C. and the monarchs of this were buried in the nine beehive tombs which are one of the marvels of Mycenae. Brilliant remains have also been found of the frescoes which decorated the palaces of Tiryns and Thebes. About 1400 B.C. when Mycenae took the place of Knossos as the centre of power and culture, there arose a great king who extended and refortified its citadel, built the Lion Gate and the Grave Circle, and reconstructed the palace on the summit of the acropolis. To him may also be assigned the Treasury of Atreus which dates from the same period. To the same century belong the citadel and palace of Tiryns and the latest phase of the "House of Cadmus" at Thebes. At both sites a quantity of vases bearing painted inscriptions in the still undeciphered Minoan script have been discovered. Well-furnished tombs excavated at Mycenae, Thebes, Chalcis and Asine have yielded a rich series of objects illustrating the art, customs and religion of the people. The latest Bronze Age stratum at Mycenae seems to indicate that, although Mycenae itself perished by fire during the 12th century B.C., there was no sudden break in civilisation at the beginning of the Iron Age. The seals, *a*, *b*, *c*, *d*, (see figs. 1 and 5 on plate) are of the 15th, 14th, 13th and 12th centuries B.C., respectively.

THE HISTORIC PERIOD

Excavations by the Americans at Vrokastro in Crete and on Mount Hymettus, by the British at Halos, by the Swedes at Asine and by the French at Delos have thrown further light on the early Iron Age and it is becoming clearer that its culture, from which classical Greek art is descended directly, was an age of transition when the art of the Bronze Age absorbed new elements and so commenced a fresh evolutionary process. The finds on Hymettus hint that the employment of the Greek alphabet may perhaps have to be put back even earlier than the 7th century B.C. This need cause no surprise, for the comparatively high stage of development which it had reached in the 6th century B.C. indicates that it had been used for some time, and we know the art of writing was well known in the Bronze Age.

The evidence concerning the rise of archaic art has been enriched by the German and Greek work at Corfu and Thermos in Aetolia. The important discovery of a pedimental group in high relief at Corfu has much enlarged our knowledge of early temple sculptures. In the centre is a great Gorgon being slain by a small Perseus and on either side of her is a large lion. Other small figures occupy the interspaces and the angles. The primitive composition of this group shows that early temple sculpture followed the types of the heraldic groups of the Bronze Age like the Lion Gate of Mycenae. A similar composition of a goddess between two lions has been reconstructed from fragments found in the Artemision at Delos. The French researches in the Heraion at Delos, the Greek in the temple of Zeus Thaulios at Pherae, the Italian at Arcadia in Crete, by their richness in pottery and other small objects, well illustrate the gradual development of Greek art from the geometric to the late archaic period.

Classical Period.—In the classical period the principal progress that has been made lies in the attempts to read the early history of famous buildings such as the Parthenon, the Olympieion and the Nike Temple at Athens, the Heraion at Olympia and the Temple of Apollo at Thermos. When these temples were first excavated they were regarded as units of one period only. Now the early altar of Nike has been found; also two earlier temples below the Heraion and at least one earlier temple below the Parthenon and below the Olympieion. The first temple at Thermos was surrounded by a colonnade curved at one end and probably dates as far back as the 8th if not the 9th century B.C. It is thus the earliest Greek temple.

On the sites of great cities such as Argos, Elis and Corinth work has been continued by the Dutch, Austrians and Americans, but in proportion to the expense involved and the fame of the cities the results are disappointing except for some interesting classical inscriptions from Argos and a few imperial statues of the 1st century A.D. from Corinth. Similarly the new British excavations at Sparta, apart from one good archaic marble statue, a few small bronzes and a crop of Hadrianic inscriptions, have not been encouraging. On the other hand experimental work by the Americans on the smaller sites of Phlious and Nemea has proved very promising. Fresh work has been undertaken by the French at Delphi which has revealed a shrine of Hermes to the west of the sanctuary. Buildings previously excavated, such as the Athenian and Sicyonian Treasuries and the Temple of Athena Pronoia have been re-examined with valuable results as to their history, plans and decoration. In Delos the Sanctuary of the Foreign Gods was found and cleared and other work done in and around the sanctuaries of Apollo and Artemis and in particular the position of the tombs of the Hyperborean maidens mentioned by Herodotus is believed to have been identified. A Greek excavation has found a sanctuary of Herakles on Mount Oeta where, according to legend, was the hero's funeral pyre. At Koroneia interesting inscriptions of Roman date have been found which refer to the maintenance of the dikes of Lake Kopais.

Study of the Hellenistic remains of Asine and of Mycenae by the Swedes and the British has provided interesting information about the life of small townships. The Greeks have begun work on the important Byzantine ruins at Nicopolis.

Balkan Area.—In Balkan lands, owing to the disturbances of war, not so much has been done as might have been hoped

Albania and southern Serbia are still more or less virgin fields, though the Byzantine monuments of the latter region have been carefully studied by the French. Still, the results achieved are worthy of enumeration.

Macedonia.—A distinct advance has been made in Greek Macedonia, where French and British explorers have been at work on the prehistoric mounds. The results are only provisional, but we can estimate the character and connections of its culture in the Bronze Age. Though, as might be expected, there was contact with Serbia to the north, with Thessaly in the south and with Thrace in the east, Macedonia had distinct individuality. Finally in the period just before the beginning of the Iron Age it was subjected to fairly strong Mycenaean influence, especially along the littoral. The Greek and French have begun at Pella, Dium, Thessalonica and Philippi the exploration of the remains of the succeeding Hellenic and Roman periods. At Thessalonica it has been shown that the Arch of Galerius was originally double and built in connection with the round domed building later converted into the church of St. George. At Philippi the shrines of Silvanus and of the Egyptian gods have been identified, and illustrate the variety of cults practised in a city of Greek Macedonia in Roman times.

Aegean Islands.—In the Aegean Is. much work has been done. A sign of the times is the beginning of operations in Samothrace by a Czechoslovak expedition. The Greeks have started the exploration of Mitylene and Chios. The French have been at work in Thasos since 1910 though with several intervals due to the War. The city walls, which have been almost completely traced, have several gates marked by the presence of interesting reliefs of the early 5th century B.C. Many other sculptures have been found, including an archaic Apollo Kriophoros over 10 ft. high and the remains of a group of statues representing Dionysus with Comedy, Tragedy and other figures. The foundations of a temple nearly as large as the Parthenon have been cleared, the market place and surrounding buildings explored and the theatre carefully studied. The crop of inscriptions has been large and apart from the art treasures found it is to be hoped that the correlation of the results will provide us with new material for the history of Greek culture in the Thracian archipelago. In Samos the Germans have completed the excavation of the Temple of Hera. This was a very large temple with a double colonnade all round and had 24 columns on the long sides with eight at one end and nine at the other. The existing ruins are those of a temple which was begun in the first half of the 5th century B.C., but was never finished. To a considerable extent it imitated a still earlier building which was destroyed by the Persians when they raided Samos about 517 B.C. after the death of Polycrates. Near the altar a statue base with the name of Cicero has been found and others erected in honour of the Julio-Claudian imperial family for their help to the temple after it had suffered in the piratical war of the time.

The Dodecanese.—The Italians have begun a survey of the Dodecanese and a Museum has been established in Rhodes. Excavations have taken place at several sites, mostly in Rhodes, where perhaps the most interesting results have been obtained at Ialysus. Here many more tombs were opened in the cemetery whence came the Mycenaean vases now in the British Museum. In Cyprus a Swedish expedition has done valuable work. Hitherto most of the evidence for the early history of the island was provided by tombs, too often carelessly excavated. The Swedes have been scientifically investigating the stratification of early inhabited sites and have determined a chronological sequence by which the previously excavated tombs can be classified. Thus a satisfactory basis is obtained for the classification of the earlier civilisation of the island, which shows, with native elements, connections with Syria, Egypt, Mycenae and, if the signs are rightly interpreted, with Cilicia. The character of the Mycenaean pottery mentioned from Cyprus, Rhodes and Macedonia reflects the culture of Mycenae and the mainland rather than of Crete. The great expansion of the Aegean civilisation would thus have taken place after the fall of Knossos, when Mycenae was the centre of power. (A. J. B. W.)

X. WESTERN ASIA[1]

Palestine.—In Palestine the most important discoveries of the years 1910–25 have been made in the American excavations at Beisan, the site of the ancient Bethshean or Bethshan. The work has been carried on for the University Museum, Philadelphia, by Mr. Clarence S. Fisher, assisted by various helpers, and is now being continued by Mr. A. Rowe, an Australian archaeologist.[1] Bethshan was an important place as commanding the fords of the Jordan eastward from Galilee into Syria south of Lake Tiberias.

In very early times a route ran past it from the Vale of Esdraelon, which the road from Egypt through Philistia reached at Megiddo, across the Jordan and so northward past the Hauran to the district of Damascus. It was occupied by the invading Scyths in the 7th century B.C., and from them derived its classical name Skythopolis. Seven centuries earlier, under the XVIII.–XIX. Dynasties of Egypt, it was an important Egyptian fortress, with which the Egyptians held central Palestine before the Philistine invasion, and after that event ended the Egyptian control, it was one of the chief fortresses of the Philistines till their defeat by the Israelites.

The hope that important discoveries of Philistine remains would be made during the excavations has not been fulfilled. Instead, however, very important discoveries of the Egyptian period have been made, including two stelae of Seti I. and one of Rameses II., and a locally-made statue of Rameses III., the art of which is very curious. One of the two stelae of Seti I. has been said to mention the Tuirsha (Mediterranean sea-rovers who invaded and took service in Palestine in the 14th and 13th centuries B.C.) and the ʽAperiu or ʽApuri, a people who have often, and probably rightly, been identified with the ʽIbhrīm or Hebrews. The statement that Semitic prisoners are mentioned also on the stela of Rameses II. as working on buildings in the city of Rameses (Pelusium) in the Delta, which has naturally been taken as confirmation of the Biblical tradition of the Hebrews working under the Egyptian taskmasters at "Pithom and Rameses" is now known to be erroneous.[2] Were it correct, it need not have been supposed therefore that his son Meneptah was the Pharaoh of the Exodus, as has often been thought. The Exodus probably took place much earlier than his time, if, as was supposed by Josephus, it is identical with the Expulsion of the Hyksos. In that case Iahmase or Amasis I. will have been the Pharaoh of the Exodus. There may have been, however, a Ramesside oppression, the tradition of which has been transferred to the period before the Exodus, whereas it really refers to three centuries later,[3] so that Rameses II. may have been the Pharaoh of an oppression, though the Pharaoh of the Exodus lived long before then. But no confirmation of this view can be derived from the stelae of Bethshan.

Another important excavation in Palestine has been that of Ophel, the site of the most ancient Jerusalem, for the Palestine Exploration Fund, carried out by Prof. R. A. S. Macalister, assisted and succeeded by the Rev. J. Garrow Duncan.[4] Not much that is interesting in the way of antiquities has been discovered, but the architectural and topographical finds have been notable, including the Jebusite Wall with its additions of Solomonic and Nehemian times, and what Prof. Macalister considers to be the remains of the Millo bastion, with the breach made by David when he stormed the city. The oldest Jerusalem probably did not occupy any part of the present city. It lay on the tongue-like hill spur of Ophel between the Tyropoeion Valley and the Vale of Hinnom, overlooking Siloam and the Virgin's Well immediately south of the Haram or sacred enclosure of the Moslem mosques which occupy the site of the Temple of Zion. The hill has now no buildings, but a house here and there on it. It was here that the ancient city of Urusalim stood which is mentioned in the Tell el-Amarna letters of the 14th century B.C. A tiny place it must have been, according to modern ideas; but very ancient cities occupied very small sites with extraordinarily narrow streets and closely packed houses, as we see from the remains of the contemporary and earlier towns of Gournia and

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[1] The figures appearing throughout the text of this section, "Western Asia," refer to the bibliography at the end of the section.

Pseira in Crete, where the streets often hardly allowed of two persons passing one another. The Palestine Exploration Fund's work lies astride the shoulder of the hill towards the northern end or root. At its southern end or butt, M. Raymond Weill has carried out excavations for Baron Edmond de Rothschild, which have yielded results of interest,[5] such as the Greek inscription recording the building of the synagogue of Theodotos, besides some archaeological evidence with regard to the walls, water-supply, necropoles, etc., of the most ancient Jerusalem on Ophel, and a good deal with regard to the antiquity of the quarrymen of Roman times, who probably destroyed tombs and other evidence as to the earliest epoch which we would give our ears to possess now. Other explorations at Jerusalem have been essayed by Mr. Nathan Slousch.

Petra and Transjordan.—In the south Petra has been investigated again by Sir Alexander Kennedy,[6] and Mr. St. J. Philby has noted archaeological remains in Transjordan, where the Roman ruins at ʿAmman, which had been reported to be in some danger of vandalic interference, are now more carefully supervised. Further north Dr. Hrozný, of Vienna, has been digging near Mzerib,[7] at Sheikh Sa'ud, where he discovered near the inscribed monolith of Rameses II. an interesting Canaanite inscription dating before 1000 B.C., as well as buildings of the Hittite period. In spite of the fact that Angora had given him full permission to do so, he was not permitted by the local Turkish authority to excavate at Kül Tepe, near Kaisariyeh, the spot whence have come the "Cappodocian" tablets of early Semitic immigrants into Anatolia that are in our museums. In the north the most important excavations have been those of M. Montet at Jebeil,[8] the site of the ancient Byblos or Gebal, on the Phoenician coast. It has of late years become increasingly evident that Byblos had a specially close connection with Egypt.

The well-known legend about the stranding of the body of Osiris at Byblos and the journey of Isis to collect his scattered members in a box or coffin has always shown that the foreign town of Byblos had very early a special connection with Egyptian myth and legend. And in ancient texts it is always mentioned as if it has some special importance for Egypt. M. Montet has now shown by his excavations that not only was Byblos quite Egyptianised as early as the time of the XII. Dynasty (*c.* 2000 B.C.), but that even so early as the time of the III.–IV. Dynasties 1,000 years before, in the time of King Sneferu, it possessed a purely Egyptian temple. We are at once reminded of the record that Sneferu sent ships to the Phoenician coast to bring back the great beams of pine and cedar that he needed for his buildings. In fact much earlier than his time in all probability wood was brought by sea from the Lebanon to Egypt, and the legendary connection of Osiris with Byblos, the enclosure of his body in a wooden coffin there, and the fact that his emblem, the *Ded* or *Ṭaṭ* (usually called "the emblem of stability"), is nothing but a conventional representation of a coniferous tree with horizontal branches,[9] probably refer to the fact that the Egyptians very early obtained from Byblos the wood for the making of the coffins of the dead. Byblos was a holy place in connection with Khentamenti and Osiris, the gods of the dead (afterwards united), and before the time of Sneferu became practically an Egyptian colony, as we see from M. Montet's results. From them too we see the effect of the Egyptian connection on the local culture, especially under the XII. Dynasty, when the dead Phoenician princes were buried in sarcophagi of half-Egyptian form, with many of the ordinary Egyptian accompaniments of the dead at the time, in the shape of stone vases, etc., imported from Egypt.

We see too how it was that Egyptian influence was always so strong in Phoenicia, from the earliest to the latest times; how it was that under the XVIII. Dynasty the conquering Pharaohs so easily established their rule there after the expulsion of the Hyksos, and that the native princes continued faithful to Egypt, even when deserted by the pacificist King Akhenaten and abandoned to the attacks of the Amorites and Hittites; how it was that under the XXVI. Dynasty Egypt could always find some support against Babylon in Phoenicia; and how it was that even to the end Phoenician art always exhibited a strong Egyptian impress, stronger than that of the rival art of Mesopotamia. A very important discovery made by M. Montet is that of an Aramaic or rather Phoenician inscription of the time of Rameses II. (*c.* 1250 B.C.), the epitaph of a local prince, Ahiram, of that time. This shows that the Phoenician or Aramaic alphabet already existed as early as the 13th century B.C., whereas previously it had not been supposed that it dated very much earlier than the 9th to which the famous inscription of the Moabite Stone belongs.[10] In the north M. Contenau has continued his excavation at Sidon.[11] Other articles on Syrian and Palestinian archaeology which need not be specified here have appeared in *Syria* and in the *Quarterly Statement* of the Palestine Exploration Fund, such as the exploration of Tell Nebi Minduh (Kadesh on the Orontes) by M. Pézard (*Syria*, 1922), for instance, as well as articles on Philistine pottery by Saussey, and so on.

An important find was made in the Beirut Museum by Mr. C. L. Woolley in 1921 of sub-Mycenaean pottery that had been found in burials in North Syria.[12] It can hardly be doubted that these are remains of the Philistine invading horde that made its way about 1200 B.C. from southeast Asia Minor through Anatolia, overthrowing the Hittites, so that "no land stood before them," into Central Syria (Amor), where the horde abode for some time, before continuing its advance through Palestine to the borders of Egypt. There it was defeated by Rameses III., afterwards settling down in the Shephelah as the historic people of the Philistines, to whom we must ascribe the sub-Mycenaean ceramic from various excavations in Palestine. They themselves, though not properly speaking Minoan or Mycenaean Aegeans had been very closely affected by Mycenaean culture, as were no doubt all other "Peoples of the Sea."

Speculations as to the influence of Minoan culture on that of Phoenicia, such as those of Woolley, who would ascribe the Phoenician seafaring possibly to the influence of Aegean dynasts in the Phoenician cities,[13] are hardly borne out by the facts, as we have no proof of any such foreign princes having ever existed, and in the Amarna letters all the names of Phoenician princes are Semitic. Still less probable is the fantastic hypothesis of Autran,[14] who would establish Minoan culture on the Phoenician coast, a theory for which there is no archaeological warrant whatever, as Woolley himself shows.

Anatolia.—In Anatolia the revived Turkish régime has not been favourable to archaeological exploration until very recently, when the veteran Prof. Ramsay and certain American scholars have once more got to work on the antiquities of the classical period. Hrozný was not allowed to dig at Kül Tepe, as has been mentioned above. As regards the earlier period, work has been confined to the further elucidation of the Hittite documents found at Boghàz-Kyöi, work which has been carried out chiefly by Drs. Hrozný, Forrer and Sommer. Forrer[15] has identified eight different languages as spoken in Bronze-Age Anatolia, of which the royal or official Hattic or Hittite ("Kanisian") of the Boghàz Kyöi tablets is, he agrees with Hrozný, Indo-European: while "Protohattic," the original language of the Hittites, is Asianic, and non-Aryan, as are also other Asia Minor languages. "Luvian," according to Forrer, was a more distant relation of the original speech of the "Wiros" (as Dr. Peter Giles and others call the original Indo-Europeans) than "Kanisian" Hittite, and has occasional resemblances to Greek, which in the case of Greek are to be assigned to the Aryan Greeks borrowing from their "Luvian" predecessors in Greece. For Forrer, apparently, the Aegeans, and so probably the Minoan Cretans, talked Luvian. (Here is an opening for would-be decipherers of the Minoan script.)

But whether this be so or not, the only epigraphic relics that we possess of Eteokretan appear to be entirely non-Aryan, like "Protohattic" or Lycian. Forrer has followed up his discovery of these different tongues in cuneiform, a discovery which is beyond cavil by a supposed discovery to which serious objections may provisionally be taken.[16] He thinks he has found in Hittite documents actual mention of Achaian princes of the 14th and 13th centuries B.C., and these specifically the Andreus and Eteokles mentioned by Pausanias as early rulers of the Boeotian

Orchomenos and (no less) the famous Atreus of Mycenae. Nobody doubts, of course, nowadays that the heroic princes of Greek legend had their originals in fact, and Atreus may very well have been an historic personage. But when we find him and others discovered so " pat " in Hittite documents we may well pause. It is like discovering a mention of King Arthur in a Saxon chronicle, and about as probable. The ultimate authority for the identifications rests on the correctness of Dr. Forrer's identifications of place-names. Now the *Ahhiawa* which he so confidently identifies as Achaia is identified by Prof. Garstang, a rival identifier of Hittite place-names, as the classical Anchiale, the Ingirā of the Assyrians, in Cilicia.[17] And so on. We are not on firm ground yet. As for the names themselves, *Antaravas* might do quite well for Andreus—it is just how a Cyprian would have translated ʽΑνδρευς into his syllabic script—but though *Attarissiyas* is an interesting equivalent for Atreus (=A-tresyas, " untrembling "?) it has yet to be shown to be a probable one philologically: it is by no means certain that Atreus does=†A-tresyas, and mean " untrembling." *Tavagalavas*=Eteokles (ʽΕτεοκλεης) is open to grave suspicion.

However, in the cuneiform equivalents of Greek names, in the list of Cypriote princes who submitted to Sargon of Assyria in 673 B.C., Eteandros (ʽΕτεϝανδρος) is reproduced as *Ituwandar*. The digamma is given its full force. We should have expected to have seen Eteokles reproduced as " Ituvukalavas." Where is the initial? There are archaeological difficulties in the way of acceptance of the theory too. Forrer does not take sufficient account of them, and until further discovery has confirmed his identifications it would be as well to be chary of accepting them at their face value. Dr. Kretschmer has identified Alakshandu, another prince mentioned in these tablets as king of Uilusa, as an Alexandros, of the Pamphylian coast, who, since there were Κιλικες in the Troad as well as in Cilicia, was the original of Alexandros of Ilios, otherwise Paris himself![18] His memory had merely migrated from Pamphylia to the Troad. All this seems rather wild. Uilusa has also been identified with Ialysos in Rhodes by Prof. Garstang.[19] Dr. Forrer will implicitly have none of all this: for him Uilusa was Elaioussa in Cilicia and Alakshandu was a Cilician. It must be said against Dr. Kretschmer's view that we should expect to find Alexandros transliterated in cuneiform by Alakshandar, not Alakshandu, as Eteandros was by Ituwandar, and as in fact the name of Alexander the Great *was* actually transliterated into cuneiform in the 4th century B.C. The ρ was an indispensable element in the word. Generally speaking, all these attempts of identifications of names,[20] whether of persons or places, in the Hittite tablets, do not yet seem to have yielded much positive knowledge.[21] But that is not to say that they will not do so in the future.

We cannot make more than a passing reference here to the very interesting discovery at Es-Salahiye (Bithnanaia) on the Euphrates, in what is now French mandated territory, by British officers in 1920 of frescoes of late-Roman time which have been published by Prof. J. H. Breasted and M. Franz Cumont,[22] as they are later in date than most of the archaeological discoveries with which we deal.

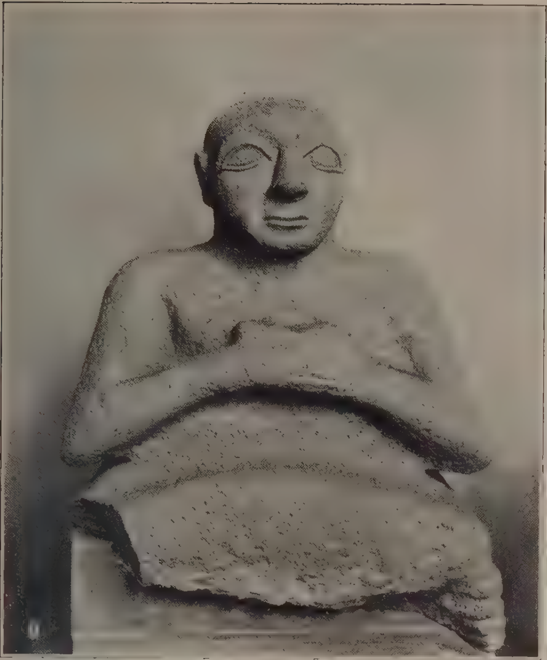
Mesopotamia.—In Mesopotamia, active archaeological work is in progress. The pre-War work of the Germans at Qala ʽa Shargat (Asshur) and Babylon has not been resumed, but that of the French (de Genouillac) at Tell Oheimir, the site of the ancient Kish, has been taken up by a joint expedition of the University of Oxford and the Field Museum, Chicago, largely financed by a British Maecenas, Mr. Weld, and directed by Prof. Stephen Langdon, with the assistance of Mr. Philip Mackay in the field. Very interesting results have been obtained in the first two years' investigation of this vast site, including one of the oldest monuments of Babylonian writing, a stone tablet with incised inscriptions in linear hieroglyphics, the original signs from which later on the cuneiform script was developed. This can hardly date any later than 3500 B.C., and is probably older. Fragments of figures of men in mother-of-pearl inlay were found, that are also among the most ancient relics of Sumerian art, and probably belong to the same period. They are of extremely curious type and archaic aspect, giving the impression of being distinctly older than the oldest relics of historic art from Ur and Lagash. The first volume recording this work has already been published by Prof. Langdon.[23]

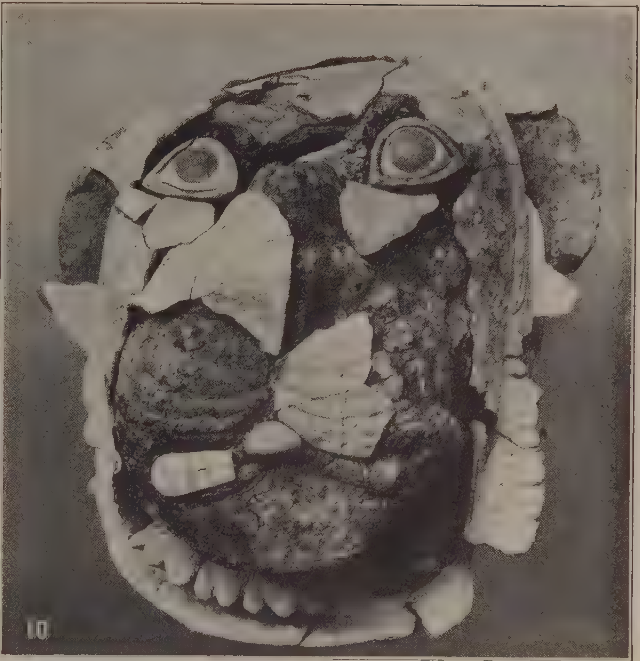
At Kish, however, hardly any relics of older prehistoric age have as yet been discovered than have come to light at Tell el ʽObeid and Abu Shahrein, and to a less extent at Ur. These relics in the shape of painted pottery and flint implements, etc., were first found by Mr. Campbell Thompson at Abu Shahrein (the ancient Eridu)[24] and by Mr. H. R. Hall at Tell el ʽObeid and Ur,[25] both excavating for the British Museum in 1918–9. In 1922–3 this work was taken up again by a joint expedition of the British Museum and the University Museum, Philadelphia, under the direction of Mr. C. L. Woolley, accompanied by the late Mr. F. G. Newton as architect, Mr. Sidney Smith of the British Museum and Mr. A. W. Laurence in the first year, in 1923–4 by Mr. F. G. Newton and by Mr. C. J. Gadd of the British Museum and Mr. Fitzgerald; and in 1924–5 by the Rev. L. Legrain and Mr. Linnell.[26] Continuing the work begun by Mr. Hall at Ur, Mr. Woolley has there discovered and planned with the help of Mr. Newton a most interesting series of temple-buildings and has traced the temenos-wall of the temple of the moon-god. The ziggurat or temple-tower has also been cleared by him and planned by Mr. Newton. He has also completed the work begun by Mr. Hall at Tell el ʽObeid, and has found there more relics of the sculpture and toreutic art of the early Sumerian period, first discovered by Hall. The copper Lion's head (*see* fig. 10 on plate) is now published for the first time.

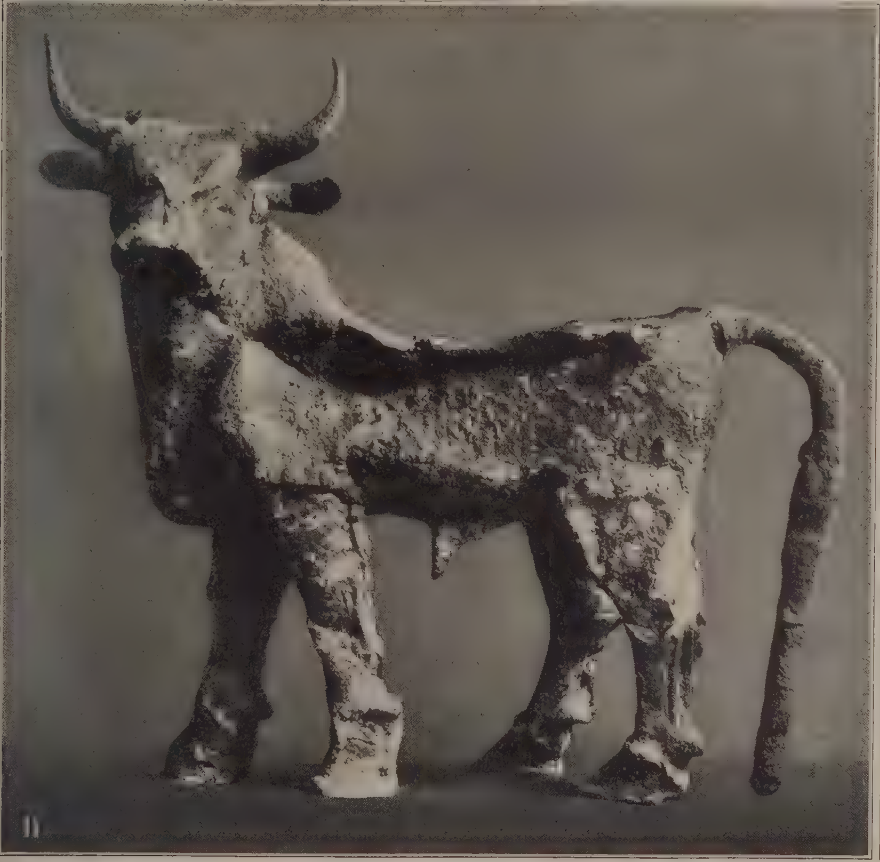
The newly found antiquities include an inscribed tablet of the very early king A-annipadda, of the I. Dynasty of Ur, who is to be dated about 3200 B.C., shortly before the time of Ur-Ninâ of Lagash, whose sculptured tablets, etc., were formerly the most ancient known relics of Sumerian art. A very fine example of the same art of copper plating over a bitumen or clay ore, or an *âme* of wood covered with bitumen or clay, as exemplified in Mr. Hall's Lions, is the bull discovered by Mr. Woolley (*see* fig. 11 on plate) in the British Museum. Mr. Woolley has discovered and explored the prehistoric necropolis from which came the painted pottery and stone implements found on the surface by Hall, and so has added to our knowledge of this earlier culture, which was probably Sumerian, and is certainly now to be dated well before 3500 B.C. It was apparently chalcolithic in character, and so the introduction of metal into Babylonia is probably to be placed before 4000 B.C., perhaps roughly contemporaneously with its introduction into Egypt in the pre-Dynastic period, which also was largely chalcolithic. The question whether Egypt or Babylonia was first in the field with copper is still unsolved, but the possibility that both countries received it from the north at about the same time seems increasingly probable.

The prehistoric Sumerian pottery is paralleled by a somewhat similar ware found at Samarra, north of Baghdad, by Sarre and Herzfeld,[27] before the War, and by the identical ware discovered by Pézard at Bandar Bushir.[28] All these wares present analogies to those found by the French expedition of de Morgan some years ago at Susa and at Tepe Musyan in Persia, as also to that found by Pumpelly at Anau in Turkistan. And further connections eastward with the neolithic ware from Muhammedabad in Eastern Persia have been adumbrated,[29] while wares have been discovered in China that have been compared with the Mesopotamian and with that of Tripolje in Bosnia.[30] Whether this is going too far or not remains to be seen. The whole question of the interrelationships of these primitive wares of Asia is treated by Mr. H. Frankfort, in an occasional paper published by the Anthropological Institute of Great Britain, No. 6.[31] Mr. Frankfort finds that the Babylonian pottery is most closely connected with the oldest ware of Susa I., which probably dates from *c.* 4000 B.C. or perhaps somewhat later. The late M. de Morgan also contributed an article on the neolithic age in the Near East to *Syria*[32] before his regretted death.

Connections with India.—A very interesting parallel with Sumerian art has recently been discovered by Sir John Marshall in excavations at Mohenjo Daro in Sindh and at Harappa in the







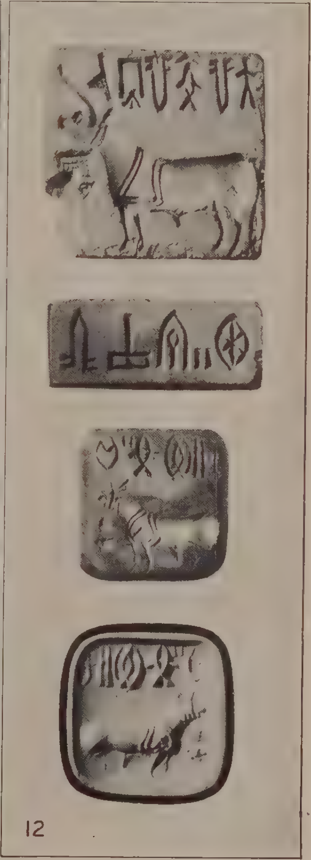


FIG. 9. Figure of Priest or Official; early Sumerian: c. 3200 B.C. From Tell el 'Obeid. FIG. 10. Lion's head, of bitumen covered with copper. From Tell el 'Obeid. FIG. 11. Copper bull; early Sumerian: c. 3200 B.C. From Tell el 'Obeid. FIG. 12. Steatite seals from Harappa, Punjab (British Museum).

(Fig. 9 and Fig. 10. Brit. Mus. Excavations, 1919. Fig. 11. Joint excavations of Brit. Mus. & Univ. of Pa. Mus., Philadelphia.)

Punjab, in the shape of seals (*see* fig. 12 on plate) with intagli of bulls in, as Prof. Sayce and Messrs. Sidney Smith and Gadd have pointed out, distinctly Sumerian style, and with signs somewhat resembling the oldest forms of Sumerian writing.[33] They certainly seem to show some art-connection between Babylonia and India in the early third millennium B.C., but whether they are to be taken as confirmation of the hypothesis of racial connection between Sumerians and Dravidians, bringing the Sumerians from India, put forward by Hall in 1913,[34] or are rather to be taken as proof of connection the other way, the Indians having borrowed elements of art from Babylonia, remains to be seen. The connection is rendered the more certain by the discovery at Kish in 1925 of a seal identical in character with those of Mohenjo Daro and Harappa,[35] a find of phenomenal importance. (*See* Section XIII. INDIA.) Since then two other seals of the same type from Babylonia have been identified; one is in the Louvre. An impression of a similar seal has recently been published by Père Scheil.[35a]

In 1923 two distinguished French Assyriologists, M. Thureau-Dangin and the Rev. Père Dhorme, carried out excavations for a short time in the Tell of Asharah on the Euphrates, which yielded interesting results.[36]

Recent Publications.—One of the most important recent publications of cuneiform inscriptions has been that by Mr. C. J. Gadd, of the British Museum, of a tablet containing Babylonian annals relating to the period of the final attack on Nineveh by the Medes and Babylonians, which fixes the date of the Fall of Nineveh as 612 B.C., whereas hitherto 606 has generally been regarded as the date.[37] There is no doubt however now that 612 is the correct year. Many new and unexpected details of the final war are given, showing that for a year or two after the catastrophe an Assyrian king named Ashur-uballit maintained himself at Harran, and that the Egyptians, then ruled by Psammetichus I., so far from being inimical to Assyria, as had previously been supposed, in reality supported her, and that in 616 Psammetichus had sent an army to Mesopotamia to her help.[38] Pharaoh Necho also apparently marched to Carchemish in order to help Ashur-uballit in the first place, but after the fall of Harran attempted to hold Assyria's western provinces as his own share of the spoil, till he was defeated and expelled by Nabepolassar.[39] Mr. Sidney Smith has pursued his publication of the Cappadocian tablets in the British Museum, and has published new material dating from of the time of the Persians and the Diadochi.[40]

Chronology.—A great deal has been written on Babylonian chronology in the light of new discoveries of king-lists by Legrain, Gadd, Leroy Waterman, Langdon, Weidner, Schroeder, Lehmann-Haupt, Albright, del Negro, Schnabel, Fotheringham and E. Meyer;[41] but certainty cannot be said to have been reached in the matter except the fact of the uselessness of the lists (as in Egypt) for definite chronological purposes. The volumes of the *Cambridge Ancient History* hitherto published have contained interesting contributions by Prof. S. Langdon and Dr. R. C. Thompson on early Babylonian history, and a new American history of Assyria has been published by Prof. A. T. Olmstead,[42] with the help of new material deciphered from ancient Assyrian letters by Dr. Leroy Waterman. M. Delaporte has brought out an English edition of his book on Mesopotamia in the "Evolution de l'Humanité" series,[43] and Dr. Meissner an illustrated work in two volumes on "Babylonien und Assyrien" in the *Kulturgeschichtliche Bibliotek.*[44] Finally Sir Ernest Budge has lately published a new edition of his *Babylonian Life and History*,[45] which contains summaries of the most recent discoveries and a work largely devoted to making clear the overwhelmingly British character of Assyriological science which it has maintained since the days of Rawlinson and Hincks, entitled *The Rise and Progress of Assyriology.*[46]

In Western Persia the French Mission has continued its work at Susa, and some recent results have been published by M. Mecquenem in the *Revue Assyriologique.*[47] A word of homage is due to the memory of the great French archaeologist, M. Clermont-Ganneau, who passed away, full of years and honours, in 1923, of M. Jacques de Morgan and of Mr. F. G. Newton, the architect who assisted Mr. Woolley at Ur, and with the plans and restoration of the temple-tower.[48]

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XI. CENTRAL ASIA

In Eastern Iran, *i.e.*, Soghdiana, Bactria (including Gandhāra, or the northwest corner of the Punjab), in Chorasmia, Merev and Seistan, lie the keys to the problems of early Iranian culture and its influence on the culture of India and China. Again, southern Siberia, in its *qurghans* or *tumuli*, preserves antiquities, which will, undoubtedly, reveal some day the still obscure relations between its nomad "Scythian" inhabitants, the Pontus and China. But excepting the work done in Gandhāra, the only scientific excavations on a larger scale have been made in Eastern or Chinese Turkistan, a bowl-shaped depression hemmed in on all sides except the east by enormous mountain-chains with difficult passes, and in the east approached through the Gobi Desert. The only safe trade routes between China and the Hellenistic Orient passed through the rich oases along the northern and the southern margin of the bowl. By them the silks of China reached the West and the products of the Hellenistic Orient, of Iran, of India and the Buddhist religion, the most powerful propagator of Indian religious thought and of modified Hellenistic art, reached China and the Far East.

These routes were of the highest importance to China, and whenever a vigorous dynasty ruled that country, they were regularly protected by military garrisons.

But, while the Eastern Iranian sites contain relics possibly dating back to early Iranian history, the ruined cities and monasteries of Eastern Turkistan (and of Gandhāra, which is culturally indissolubly connected with Eastern Turkistan) offer only remains of the period between the last century before Christ, in the West, and the 10th to 11th centuries of our era.

However, the archaeological work done in these comparatively late sites, by Russian, English, German, French and Japanese explorers, has proved that the ultimate basis of Buddhist art in China, as in all other eastern Buddhist lands, is the Hellenistic Antique as developed in Gandhāra.

The Tokharians.—The name Eastern Turkistan does not apply to this area in the early period, for until the Uighur Turks began their conquest, from the northeast, in the 8th century, the many oasis-states were occupied by Iranians (Sacae and Soghdians) in the west, southwest and north, and by Indians in the extreme southwest. From the oasis of Kucha in the north, to that of Turfan in the northeast, the ruling race appears to have been a tribe speaking a language of the European (*centum*) group. They are called Tokharians in the Middle Turkish texts dug out from temple ruins near Turfan, and the energetic heads, on the wall-paintings from these temples, of blue-eyed, red-haired men with European features, differing entirely in everything but dress from pictures of Iranian or Eastern Asiatic donors, may well be portraits of men of this remarkable race.

MSS. Discoveries.—The numerous MSS. finds are written on wood, leather, palm-leaf, birch-bark and paper in Tokharian (till then unknown), the lost languages of the Sacae and Soghdians, in Sanscrit, Pehlevi and at least two Iranian dialects, Middle-Turkish in two dialects, Tangutan, Tibetan, Syriac, a few lines of Greek, in Chinese and Mongol, with yet undeciphered MSS. fragments of the lost language of the Hephthalites or White Huns, and small fragments in two other unknown alphabets. All this literature is strictly religious, excepting fragments of a Middle-Turkish translation of the fables of Aesopus and remains of two MSS. of the legend of Barlaam and Josaphat, also in Turkish, found in the Turfan oasis, close to the borders of China proper.

The religions represented are Buddhism, Christianity, Zoroastrianism (one fragmentary leaf) and Manichaeism, which, introduced by way of China and accepted by the Uighur kings in the 8th century, is represented by many MSS., sometimes beautifully illuminated, in the Soghdian, Middle-Persian and Middle-Turkish languages. These remains are written in no fewer than 24 scripts. Islam is not associated with this culture. When this religion began to encroach upon it in the 10th century, the decline of the mainly Buddhist states of East Turkistan had begun.

Art Problems.—In sculpture and painting the basis of all this art is the Hellenistic Antique, as developed in Gandhāra and in Bactria under Indian and Iranian influences. The Buddhist religion, and with it the modified Graeco-Buddhist art of Gandhāra, entered Central-Asia by the Royal Road through the the Khyber Pass and Bactria, through Udyana and, later by the trade-routes through Kashmir.

Architecture.—The architecture is purely ecclesiastical—domestic buildings probably did not differ materially from similar erections in the present day. Iranian or Indian models are strictly followed. All traces of Chinese influence are absent and, of antique elements, only the beautiful *caisson* ceilings occur occasionally. Two groups are found, (*a*) rock-cut temples and cells, (*b*) temples, *stūpas*, and monasteries built with sun-dried bricks (*adobe*).

Cave Temples.—The cave-temple settlements follow Bactrian rather than Indian prototypes in their general plan. They are mostly crowded together, often in hundreds, on the perpendicular faces of steep cliffs, in glens of difficult access, near running water and in wild and romantic scenery. The cells of the monks are simple, small, vaulted rooms, with a fire-place, and often a bench cut out of the stone. The walls are plain white-washed, without any ornament. There are very few such cells in even extensive temple groups.

Settlements.—The cave-buildings in the older settlements were connected by extensive stone-cut galleries, provided with few windows for the admission of air. Light in the temples and cells must have been mainly artificial, as proved by great masses of remains of wicker-lanterns.

The commonest type of cave-temple is of Indian origin. It consists of a square, vaulted anteroom, opening on a cella of the same description. The back-wall of the cella has a recess, in which the cult-statue was placed. To the right and left of the statue, two short, low, vaulted corridors were cut into the rock opening into a third corridor, at right angles to them, and parallel to the back-wall of the cella.

The square or rectangular block of stone thus resulting often contained, in a hidden receptacle, relics, manuscripts, coins and other valuables. These receptacles had always been opened and despoiled. This block stands for the *stūpa*. The corridors were used for processional circumambulation. On the walls of the cella were painted the effigies of the donors, the life-story of the Buddha in a number of pictures separated by decorative borders, or rows of paintings representing certain Buddhist legends.

The vaulted roof is decorated with tiers of conventionalised representations of mountain landscapes, each containing some birth-story (*jātaka*). The middle line between the two topmost tiers contained representations of flights of ducks, constellations, the sun and the moon, wind goddesses and the effigies of the sun- and moon-gods in their chariots, most of these representations following Hellenistic prototypes. In later temples (after 700 A.D.) the mountains are replaced by rows of Buddhas.

Iranian Types.—Two other common types are Iranian. The first consists of a square room covered by a cupola rising from profiled mouldings at the upper edge of the walls. The second is similar but covered by a *lantern roof;* such as exists to this day in wooden houses from Armenia through Bactria to Kashmir and Western Tibet, as described by Moorcroft.[1] In later cave-temples further east (Turfan), this roof was often painted only on the vaulted temple roof. These two Iranian types are used by the Chinese and Koreans as models in their cave-temples (*e.g.*, Tunhwang). Another type is a long, narrow, tun-vaulted apartment, with, or without, a socle for the cult-figure.

Brick Temples.—The temples built with sun-dried bricks are erected on the same lines as the cave-temples. The "lantern-roof," however, never occurs in these buildings, as this construction is impossible with bricks, but the middle of the ceiling vault in the eastern oases (7th–9th centuries) often bore a painted representation of such a roof. These painted lantern-roofs were commonly used to decorate ceilings in Chinese cave-temples.

The Stūpa.—The *stūpa* is either (1) a (massive) building of pyramidal shape, plain on the outside, with a receptacle for relics, coins, MSS., etc., or (2) a dome-shaped erection on a quadrangular base, or (3) in the eastern oases, a pyramid with rows of niches for Buddha-statues, or (4) as a remarkable quadrangular building in several tiers, diminishing in size upwards, like a gigantic staircase. A number of large, vaulted niches for Buddha-statues are carved on the four faces of each tier. These erections are often of great size, one face having as much as 20 metres length. Another rarer Indian type, of much smaller size generally, is a beautifully proportioned building of polygonal cross-section.

Monasteries.—The monastery is usually a square or rectangle surrounded by a strong wall with towers; with one or more temples and rows of cells arranged along the inner course of the walls, built of sunburnt bricks of most excellent quality, evidently made on the spot in the required shape and size.

Paintings.—In most temples the walls and vaulted ceilings of the rooms were richly decorated with mural paintings in tempera-colours. The colours vary in the different settlements, the most ancient ones being distinguished by a lavish use of true ultramarine. In some temples the floor was of stucco, often with most artistic paintings in *al fresco.*

The walls were found in all stages of preparation. Some were simply roughened, awaiting the application of a layer of smoothed stamped clay, in others this finish had been applied, after which the smooth surface was covered with a very thin layer of stucco. On this smoothened surface the painters drew a "net" of rectangles, one within the other, into which the patterns for the pictures were fitted.

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[1] M. Trebeck, *Travels in the Himalayan Provinces, etc.* (London, 1841, vol. 2, 390) who found it in cave-temples at Bāmiān; "the roof was carved so as to represent tiers of beams crossing each other at angles and diminishing their distance as they ascended, until they left an octangular space of about 20 inches only, imitating the roof of a log-house in Tibet and Kashmir."

Designs.—These patterns were larger or smaller pieces of paper, on which the artist drew his pictures with India ink. The lines were then perforated, the pattern fixed to the wall and beaten with a bag containing powdered charcoal. The contours thus obtained were then traced in India ink and the colours filled in. Sometimes, in young settlements, an ancient pattern may have been used, so that critical analysis of style, in paintings and still more in sculpture, is not a safe guide to the age of the work.

Art Influence and Sources.—All paintings are intensely influenced by late-antique schools of painting, originating in Gandhāra, the Punjab and Bactria. According to the province whence the painters came, or drew their inspiration, the paintings of Turkistan show Hellenistic elements modified in an Indian, or in an Iranian sense. Purely antique and purely Sassanian elements also occur, especially in friezes.

Chinese elements are wanting absolutely in the older, western oases. But China accepted the syncretistic art, painting and sculpture produced in these regions, and, misunderstanding and modifying the forms received from the West in a Chinese sense, created the splendid art of Thang times on the basis of modified Hellenistic Buddhist art.

After Buddhism declined in India, China became the leading Buddhist power, and this new syncretistic Chinese art gained influence only in the eastern settlements (Turfan), and never farther west than the oasis of Kutchā.

Main Styles.—Five principal well-marked styles of painting, were first observed by A. Grünwedel. (1) Several styles, directly containing late antique elements, such as are found in the Gandhāra-Sculptures; are united under the name Gandhāra. In certain temples antique elements preponderate, while others show these elements modified in Iranian or Indian sense (presumably 5th–6th century A.D.). (2) The style of the "Knights with the long swords" (Tokharians), is presumably a local continuation of Style No. 1 (probably 6th–7th century A.D.). (3) The Older Turkish style, has a pronounced syncretistic character; the forms of style 1 and 2 are incorporated, but Chinese elements begin to occur. The decorative borders of the wall-paintings and the ceilings show a remarkable and charming flower-ornamentation. The costume of the donors differs completely from that of the donors in the older styles. The inscriptions are in Chinese and Central-Asian Brāhmī (presumably 7th–9th century A.D.). (4) The Younger Turkish Style, more properly the Uighur style, shows a further syncretistic development of style 3 in a Chinese sense—it is only found in the Turfan oasis and is the final development of the older elements into Chinese forms (8th–11th century A.D.). (5) The Lamaistic Style has evident relations to Tibetan art.

Sculpture.—All sculpture in Eastern Turkistan derives from the late antique school of Gandhāra and pure Hellenistic types appear even in late times in the Eastern settlements, where the paintings had assumed an essentially Chinese character.

Use of Moulds.—The perseverance, in sculpture, of Hellenistic forms is simply explained by the fact that, Turkistan being a loess-country, without stone fit for the sculptor, the art-craftsmen were forced to use stucco-moulds, of which quantities were found, mostly for the production of half-relievo figures. The larger kinds were moulded in pieces and afterwards put together, often very roughly, with straw-ropes, twigs, coarse pegs, etc. The statue was prepared in the rough, its surface was remodelled, finished off with a fine layer of stucco and richly painted and gilded.

In the older western oases the material for the statues was often stucco; in the later (eastern) settlements the common clay of the country, mixed with chopped straw, vegetable fibres and animal hair. In spite of the crudeness of this material, the effect resulting is frequently imposing.

The moulds were probably imported from Gandhāra and replaced, when broken, by exact duplicates, produced, mechanically, from their own former products. Thus antique forms persisted long after paintings had begun to undergo Eastern-Asiatic modifications. When the Sassanians cut the road to the West, no new Western influences could penetrate, while communications with China continued to be easy and frequent.

Change of Type.—In consequence, the ideal type of beauty began to change and gradually the craftsmen deliberately changed their moulds to suit the Eastern-Asiatic type of beauty. The nose became shorter, the brows were made slanting, the eyes more prominent, etc., while the late antique hairdresses, utterly incomprehensible to the Easterns, were changed according to their own notions and taste.

Thus the evolution of a late antique head can be followed, through many stages, until a typically Chinese head results.

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XII. PERSIA

Pre-Achaemenian Period.—Rock-sculptures of remote antiquity have been discovered or more accurately studied. They prove that the influence of the higher developed civilisations of Elam and Babylonia stretched much farther into the interior than was supposed. A gold treasure discovered in the Asterābād region (frontier of Russian Turkistān) is Sumerian in character (3000–2500 B.C.); engraved shells of proto-Elamite type are found at Isfahān; and an elaborate early Sumerian rock-sculpture was discovered near Talaspid in Fars. The conclusions drawn from those single objects are supported by the main archaeological material: pottery. The rich harvest of proto-Elamite pottery at Susa belongs to *c* 3000 B.C. Very similar pottery has been found all over Iran.

At this remote period, relations with India are attested:—among the fresh discoveries of prehistoric remains at Harappa and Mohenjo Daro are typical seals, which may all be derived from types preceding the later cylindrical shape and in common use in Elam and Sumer during the fourth millennium B.C.

The second millennium marks a period of cultural depression in Iran. Painted pottery continued in the whole of Iran down to the Achaemenian and Seleucid periods, *i.e.*, to the beginning of our era, and a great number of bronzes belong to a group known from Asia Minor, which cannot be dated exactly. A great change happened suddenly: a new population, the Arians, who later founded the Median and the Achaemenian empires, settled in Iran. In harmony with the historical indications in the Assyrian annals, we find the first monuments of this population in north-west Iran, around the lake Urmia and Hamadan-Ekbatana, a region belonging at that time to the Khaldian or Urartaean empire of Van. There remains a group of large tombs, cut into rock, in the shape of the Median house which survives in west Iran to the present day. All the tombs are found in ancient Media, and architectural features and religious emblems prove them to be pre-Achaemenian, hence Median. But whether the inhabitants were already Zoroastrians or followers of a pre-Zoroastrian faith, remains unanswered.

Achaemenian Period.—The discovery of another royal tomb in Khak-i-Rustam, Mamassani region in Fars, connects the Median tombs with those of the Achaemenians at Persepolis and Naqsh-i-Rustam. It must be attributed to a predecessor of Cyrus, one of the kings of Anshan, his ancestors. It has columns with proto-Ionic capitals. Hence, Achaemenian architecture derives its origin from the Median type, of which the rock-cut tombs are the only remains as yet discovered. The art of Arian Iran was at first created in northwest Persia, influenced by the art of the Khaldian or Urartaean empire of Van, itself depending upon the older, Hittite, art of Asia Minor. From Media this art spread into south Iran. Rock-cutting freestone masonry, wooden columns and a highly developed metallurgy are its characteristics.

The similarity to the early Ionic architecture of the west coast of Asia Minor is explained, not by Greek co-operation, but by the fact that both are the extreme branches of a style of architecture that once spread over Asia Minor, Armenia and west Iran. On the other hand, during the whole reign of the Achaemenids, three provinces of India, called Hindu, Gandhara and Thatagu, formed integral parts of their empire. The first surviving monuments of India, although post-Achaemenian, show evidence of Iranian influence in architecture and sculpture—columns, capitals, ornaments. The plan of the palace of Pataliputra is believed to be made in imitation of Persepolis. The transition to rock-sculpture, freestone masonry, stone sculpture from older woodwork, is due to immediate Iranian influence. China adopted the same methods, as proved by the oldest Chinese monuments discovered in Szechwan.

Post-Achaemenian Period.—The least known period of Iranian history is the Parthian, which is of special importance for the development of the Zoroastrian religion and the national epics. The most promising sites are a Greek temple (of Dionysos?) at Khurheh in Mahallat, the capital Hecatompylos near Damghan, and the huge temple of Anâhît at Kangāvar. During the Arsacid period, the great empire of the Saka or Indo-Scythians, extending from the modern province of Seistān in Persia to Muttra and Bombay in India, was connected, more or less loosely, with Iran. Among its rulers, known from their coins, appear some members of the Sûrên family, one of the highest feudal houses of Parthia. When the Arsacid Dynasty was replaced by the Sasanians, the reconquest or the extension of their rule over those eastern parts of Iran was among their first accomplishments. According to Pahlavi inscriptions and Bactrian coins, from 230–350 A.D., ancient Soghd and Bactria, *i.e.*, Samarqand and Balkh, were ruled by Sasanian prince-governors, and, in the same way, at least from 280–350 A.D., the entire former Scythian empire was an integral part of their realm. These new facts, proved by inscriptions and coins, explain the Iranian influence exercised during this period on the civilisation of India.

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(E. HE.*)

XIII. INDIA

Archaeological exploration was first started officially in northern India in 1862 and was strengthened by Lord Curzon, when Viceroy. India was divided into circles, each with its own superintendent and staff. Epigraphists were appointed, and, later, an archaeological chemist was added to the department. Annual progress reports are published, and an Imperial Series of Monographs and Memoirs on particular subjects is maintained. Epigraphical results are chiefly published in the *Epigraphia Indica*, the *Epigraphia Moslemica* and the *Epigraphia Birmanica*. In addition to the exploration of architectural monuments above ground, and the excavation of those below, a great deal of work has been accomplished in the conservation and repair of these. Antiquarian museums have been established all over the country, and several of the native states have taken up archaeological work within their own areas.

Prehistoric Antiquities.—" Eoliths " have been found in India which, as elsewhere, are provisionally accepted as artifacts. Palaeolithic implements of the Chellean type are widely spread in India. Neolithic implements exhibit a remarkable variety and in general conform to similar objects from western Asia and Europe. The most noteworthy exception is the chisel-shaped, high shouldered celt found in Burma, Assam and Chotā Nāgpur, as in Indo-China and the Malay Peninsula.

Pottery.—Pottery, both plain and decorated, is found in association with neolithic sites. The plain forms are either rough, smooth, polished or painted while the decorated forms are impressed or moulded or, less commonly, incised. Some of the geometrical painted designs are considered to recall the typical features of Anau and Elam pottery. In southern India incised designs and cognate marks have been described as owners' marks, potters' marks, hieroglyphics, some being regarded as resembling Minoan script.

Cave Drawings.—In caves in the offshoots of the Vindhyas, associated with pygmy flints, are found rude drawings in ruddle or haematite, which have been ascribed to neolithic culture, though possibly the product of relatively recent inhabitants. At Singanpur the cave paintings of hunting scenes, groups of figures, picture writing and drawings of animals, reptiles, etc., have been thought to show the same methods as were used at Cogul in Spain—an Aurignacian product. The argument is far from convincing and the theory of an Australian connection cannot be regarded as proved.

Megaliths, etc.—Special problems are raised by the megalithic monuments found in many parts of India. Examination of cairns in Hyderābād state and southern India has yielded pottery of an interesting type: lapis lazuli beads which, being foreign to India, indicate commercial intercourse, possibly with Kashmīr or Persia; some gold, silver and copper and iron, due perhaps to an early use of iron for local purposes. It is suggested that resemblances to Egyptian material indicate contact with a common source.

Recent Excavations.—The results of the survey of the rock-cut temples of India carried out before Lord Curzon's time have been published. Much miscellaneous work has also been accomplished amongst the structural temples. Ampler funds have enabled the department to take up excavation work on a more extensive scale, and some of the more ancient sites, especially in the north of India, have been opened up. Amongst these are the mounds covering the ruins of the old city of Taxila in the Punjab—a place mentioned by early Greek and Chinese historians as a great centre of trade and learning centuries before the Christian era. Much of the three sites that the city occupied as it passed successively under the domination of Persia in the 5th century B.C., the Greeks, the Mauryas, the Bactrian Greeks, the Scythians in the 1st century B.C. and the Kushans, has been laid bare and has revealed much of its story. The walls of the houses, monasteries, chapels, *stupas*, and the palace of the kings have been unearthed. One of the *stupas*, containing a portion of the relics of the Buddha, yielded with it a very interesting inscribed silver scroll. Besides much semi-classical sculpture, the ruins have given up a great abundance of minor antiquities in pottery, stone, copper, bronze, silver and gold together with quantities of coins—the accumulation of centuries. Prof. Herzfeld has lately discovered inscriptions in Persia which, he considers, go to prove that the Punjab was under Persian rule in the 3rd century A.D. In the 5th century the White Huns overran the country leaving ruin in their wake (*see* Section XII. PERSIA).

Buddhist Relics.—The great *stupa* built by the Kushan king, Kanishka, over a relic of the Buddha, which had been mentioned by the Chinese pilgrims, has been identified and opened. The mound lay at a short distance to the west of Peshāwar. It yielded the relics and the reliquary, the latter bearing the name and an effigy of the king. The *stupa* appears to have been the argest and most magnificent monument of its kind known in India. The recovered relics were presented, with great ceremony, to the Burmese Buddhists in 1910. Other relics of the Master, rom the Piprahwa *stupa*, had been previously presented to the King of Siam, and, later, others from Taxila were conveyed to he Buddhists of Ceylon, who had in 1882 received those from the *tupa* opened up at Supara (? Ophir) near Bombay.

The Maurya Palace at Patna.—On the site of the old Maurya captal of Pataliputra (Patna) remains of the palace of the emperors have been brought to light, once a vast pillared hall of about the 3rd century B.C., containing eight rows of monolithic columns, of 10 columns each, of polished sandstone. It presents, in many espects, a marked likeness to the Hall of a Hundred Columns at Persepolis, indicating a close intercourse between Persia and India. The rest of the building, which appears to have been burnt, was probably of wood.

From the remains of the old Buddhist monasteries at Nalanda, once famous as a Buddhist seat of learning, four miles from Rajagriha, a large number of antiquities was collected.

Greco-Buddhist Art.—Greco-Buddhist sculptures, of the best period of Gandhāra art, have been reclaimed at Takht-i-Bahi, and investigations have been carried out along the Peshāwar-Swat border. From Sahri-Bahlol excavation has yielded quantiies of sculptures in stone and stucco. At Mathurā (Muttra) nscribed images of the emperor Kanishka and other Kushan princes have been found; and at Isapur, near by, an inscribed acrificial pillar whose inscription was considered the earliest in pure Sanskrit then found. Further excavations were carried out t Kasia (Kusinagara) the place where the Buddha died. At Basarh and Bhita excavations were continued which produced reat numbers of seals at the former place.

Buddhist Monuments.—Buddhism, following the valley of the ndus, advanced through the Punjab into Sind leaving a trail f Buddhist monuments in its wake. The remains of several *tupas* have been uncovered especially that at Mirpur-Khas which ontained its relics. The great site of Brahmanabad has been xamined, and in the light of the recent Sumerian-like finds at Mohen-jo-dharo, it requires further and deeper excavation.

In central India, extensive clearances were made around the Great *Stupa* at Sanchi, and the fragments of the old railing which dorned the berm and the top being found, the latter was retored, together with the crowning umbrella, while the basements f monasteries and chapels were reclaimed from the debris and ungle. Near by, at Besnagar, the site of Vidisa, a flourishing ity when the Greek kings were ruling at Taxila, the base of a Garuda pillar was cleared revealing an inscription recording its rection by a Greek, Heliodorus, an ambassador from the Taxilan ourt.

Excavations were continued at Sarnath, near Benares, where bjects of the Gupta and mediaeval periods and Kushan coins were recovered; other places visited and explored included Surtgadh (Bīkaner), Salihundam in south India, the Jamalgarhi *tupa*, the caves of Bagh with their interesting frescoes, Maheth nd Saheth the site of Sravasti, and many other spots in south ndia and Burma.

Sumerian Discoveries.—The most startling and unexpected iscovery made in the archaeological field is that of the presence, n the Punjab and in Sind, of objects which bear a striking likeess to Sumerian remains of 3000 B.C., and the character of the ew letters found upon some of these distinctly points to a common rigin. In Sir John Marshall's view "this Indus civilisation exended over an immense area including Sind, much of the Punjab, Baluchistān and probably Rājputāna and countries even further o the east. The existence of roomy and well-built houses and he relatively high degree of luxury as well as the character of many of the smaller antiquities (seals, gold jewellery, copper vessels) betoken a social condition much in advance of what was then prevailing in Mesopotamia or Egypt."[1]

Kashmir.—Remarkable buildings and richly moulded reliefs were discovered at Harwan in Kashmir by the state Archaeological Dept. comprising the triple basement of a *stupa;* a set of chapels; two smaller *stupas*, and a large apsidal temple, in the courtyard of which is a curious tile pavement, on which are Kharoshthi numerals which indicate a date of 400 to 500 A.D. at the latest. Amongst the moulded decorations occurs a representation of a cock fight which recalls to mind one of a bull fight in the oldest of the Bhaja caves, surrounded with Persepolitan details.

Ajanta Cave Paintings.—The famous wall paintings at the Ajanta Caves, of about the 7th century A.D., which were in a very bad state, and were peeling from the walls in places, were taken in hand by an expert from Italy, who has put them into a more permanent state of preservation.

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INDONESIA

Sumatra.—Sumatra still awaits investigation. It may be surmised that it escaped colonisation from India because the maritime movements of that country from the East started from points in India and under conditions which made Java rather than Sumatra their main objective. The set of local currents and the weather conditions played a decisive part in determining the lines of early navigation, especially in this difficult region.

Java.—The settlement of Indian colonists in Java dates from the 5th century A.D. and was mainly influenced by the south, whence radiated the main forces of colonisation, although in the 4th century B.C. commercial enterprise from Bengal was active. No detailed description of the monuments at Borobodur is necessary, but the presence of Saivaite elements, as well as of Buddhistic material, afford clues to the admixture of religious motives in the decoration of what is justly termed the Ninth Wonder of the World. Modern analysis of the reliefs of the great temple is held to reveal ignorance of Indian structure. The employment of Javanese conventions indicates that the fundamental elements must be looked for in local architectural principles, the inspiration being afforded by Hindu rulers and priests who were devoid of technical knowledge. Java marks the limit of Hindu influence which still indeed persists there.

Other Islands.—In the remainder of the islands which compose Indonesia two strains of influence may be discerned—Chinese and Malay—which have both combined and also been influenced by contact with Islamic culture of Arabian origin. In Celebes Stone Age culture persisted till recent times; in Borneo only the coastal fringe shows any traces of contact with superior cultures, the interior, which is largely unexplored, being occupied by peoples of a low stage of culture, including pygmy groups. In the Philippines, however, three distinct zones of cultural settlements may be discerned, *i.e.*, the coastal, the plain and the mountainous, the rudest being that associated with the mountainous area. Much that is essential in the culture of the sub-tropical areas is perishable in the humidity and temperature conditions which there prevail. It is possible, however, that in the future systematic investigation may disclose evidence of the extension, both of early Chinese and early Indian influence over a greater zone in Indonesia than is at present suspected.

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[1] *Illustrated London News*, Feb. 27 1926, p. 346.

XIV. CHINA AND SOUTHEASTERN ASIA

Although the progress which has been made in the study of the prehistoric archaeology of the Far East has been very great, it is not possible at present to put forward a sequence dating which can in any way compare with that of Europe. The precise significance of many of the finds is at present imperfectly understood, but material is being collected, which should in the near future enable the archaeologist to trace the prehistory of much of this vast area.

Palaeolithic Remains.—Up to the present no true palaeolithic implements have been discovered, either in China proper or in southeastern Asia. Matsumoto believes that a human sacrum found in the province of Honan in central China must be considered to belong to Neanderthal man, but precise data are lacking and the definite association of the bone with those of elephants is uncertain; nor can the early implements from Indo-China be considered definitely palaeolithic because, although of rude form, they are associated with a modern fauna. Numerous surface finds in China, which have sometimes been considered to be palaeolithic, are equally doubtful. North of the Great Wall in the region, however, where the Hwang Ho penetrates Gobi with a great northerly bend usually known as the "Ordos bend," Teilhard and Licent found definite palaeolithic remains in at least five localities. The types from one site (Ning Hsia) in the northerly part of Kansu, the province which separates Mongolia from Tibet, are said to be Mousterian. The second site, a fluviatile deposit, at Sjara Osso Gol, contemporary with the loess of central China, contained similar implements associated with quaternary deposits containing forms similar to Elephas primigenius and Rhinoceros tichorhinus of Europe. Deposits at a third site in the same region contained implements which are probably older. Implementiferous deposits were also found elsewhere in loess gravels and in the desert region close to the Hwang Ho itself. The sites extend over a long belt of country nearly 600 m. long enclosed by the great bend of the Hwang Ho. While most of the implements appear to be Mousterian, some are closer to the Aurignacian type, but all are small, possibly, as the explorers suggest, owing to paucity of material. The forms are not quite identical with those from Europe, and until the gaps are filled, exact comparison is impossible.

Neolithic Remains.—The neolithic deposits, essentially a vague term in this region, are widespread over the Far East and at least two separate culture areas exist, though further investigation may either link up the two or discover new areas. Provisionally these may be termed the northern and southern areas.

Northern Area.—The northern includes much of Mongolia, northeastern China, Manchuria and certain parts of Japan. Its relation to the Siberian early cultures has not yet been fully explored. Much of this area is extremely rich in remains. In certain regions on the Mongolian plateau this culture has been established stratigraphically, and is nearly always found in a bed of black sands superimposed on the quaternary sands, which in Mongolia replace the loess of the Chinese plain. The neolithic succeeds the palaeolithic without any transition, as far as is known at present. One of the most important sites is at Linn Hsi north of Sira Mouren Gol (116° east and 44° north). Most of the implements discovered are somewhat rude and might at first sight be considered to be palaeolithic, but other delicate instruments occur, including triangular arrow-heads. They are associated with rude pottery, which is made without a wheel.

The most important implements which have been found both on the plateau and within the Wall at Kalgan, north of Peking, are comparatively fragile laurel-leaf-shaped implements slightly polished. Both Andersson and Teilhard are unanimous in thinking these implements to be ploughshares. Their importance lies in the fact that similar implements are associated with the neolithic culture of North America, and there is every reason to associate the two. At present the authors of this culture are not clearly known. The kitchen middens of Japan show a similar culture, which can there be divided into periods stratigraphically. In Japan human skeletons have been discovered in association with the pottery. The types are similar to those of the present day Ainu (*see* Races of Mankind) but it is difficult to associate the two groups of peoples, as the Ainu have no indigenous pottery. Numerous rude stone monuments have been found in Manchuria and Korea, which probably belong to this culture but they have not as yet been adequately studied.

Pottery.—The rude pottery of this culture survived through the succeeding periods, and indeed is in use to-day, which makes some of the dating difficult. It forms an integral part of the finds in the succeeding culture, which has been carefully studied by Andersson in various parts of China, including the most westerly and the central provinces and Manchuria. This culture is definitely of a chalcolithic type; with it are associated not only the coarse ware already noted but polished celts and fine painted ware, which can be divided into brick-red small, thin-walled monochrome vessels and others which are painted. Wheel-made vessels occur, but most are hand-made. The polychrome vessels are mostly bowls and are often beautifully worked. This type of pottery belongs to the same class of painted ware which has been found at Anau near 'Ashqābād in Russian Turkistān and Tripolje and has a wide distribution in western Asia (*see* Section X. Western Asia, note 30). There are also some local forms, notably the tripod pot, which has developed into the *li* of ancient and modern China. This culture, with its close parallels with the west and indigenous forms, has a very wide distribution over northern China, and is associated with the bones of people who do not differ essentially from the modern Chinese. No traces of metal have been discovered in spite of careful and extensive excavations, but apart from the introduction of metal and the substitution of metal for ceramic or lithic material, many of the forms associated with this culture survive in China to-day, with the exception of the remarkable polychrome ware. Up to the present this culture does not appear to have been reported from Japan.

No exact dating can be given; probably in Manchuria the culture was at its height about 1500 B.C., but as it extended over a vast area its floruit was probably very different in different localities. Pig, the typical domestic animal of China since Chinese culture began, was found in immense quantities, but in some places Andersson found remains of recent animals now locally extinct. Considerable surface changes have taken place in some sites since their deposition. In a loess country, however, denudation sometimes takes place at a rapid rate.

Southern Area.—The southern extent of both this culture and the preceding one is not yet known, and the rude neolithic is not at present clearly established in central China. Southeastern Asia seems to constitute a separate archaeological province, separate certainly from the Mediterranean region and on the whole from the countries to the immediate west. Although the brothers Sarasin seem to have linked up the archaeology of Ceylon both with that of India and some parts of the Malay Archipelago, suggesting a culture which in Europe would be considered late palaeolithic, elsewhere such evidence is lacking. In the Malay Peninsula numerous polished stone implements have been discovered and there is evidence to suggest that at least some were in use contemporaneously with metals, some authorities suggesting both bronze and iron. Earlier or stratified deposits, which probably exist, remain as yet to be discovered. Special attention has been directed to this region, owing to the discovery of pithecanthropus erectus and other primitive skulls in Java, but in spite of considerable researches in that island the history of palaeolithic culture in that region has yet to be written.

Indo-China.—Indo-China has been more thoroughly explored. A careful examination of a number of caves has not led to the discovery of any ancient animal remains comparable either to those of Mongolia, India or Europe. The fauna of the caves is essentially recent, terrestrial molluscs being especially prominent, all belonging to species which still survive in the same region. The industry associated with the early caves is of rude technique, although pottery is found. The implements have not the finish which is characteristic of some of those belonging to the earlier neolithic of Manchuria, and have been considered by some to be actually palaeolithic. The fauna, however, contradicts this and they must be definitely considered to be neolithic. Certain cranial fragments have been discovered associated with the industry, and their reconstruction has revealed a type of man akin to the modern Melanesians (*see* RACES OF MANKIND). This industry closes very abruptly and there is no transitional period between this and the succeeding or "classical neolithic" period of Indo-China. This culture has a wide distribution and extends as far as and probably beyond the southern frontiers of modern China and westwards into India. But its full extension has not yet been explored and it is not possible to express its exact limits. It is certainly a recent neolithic, but the attempts which have been made to date it, especially by estimating the effects of annual increase of fluviatile deposits, by which means a date several centuries anterior to our era has been arrived at, have not received any general acceptance.

We have a well-marked culture which is characteristic of an archaeological province, which must be, in the present state of our knowledge, considered entirely separate from the other cultures so far considered. The technique shows a very considerable experience in the art of stone working, especially in the form of the axes which have a characteristic shape. They are rectangular in form and in many specimens are worked with a shoulder, the part farthest from the blade thus forming a tongue for hafting. The bracelets made of shell also show considerable skill in the handling of materials.

The origin of this highly developed culture is at present unknown. Recent workers are inclined to regard it as not being indigenous to the area in which it is at present known, but as being introduced suddenly by some great ethnic movement which drove out the former Melanesian makers of the rude earlier neolithic culture. The local transition is too great, as at present explored, to permit any suggestion of the peaceful penetration of an alien culture, but further excavations in neighbouring regions may throw light on the transition. It does not seem possible at present to link up the various neolithic periods of south-eastern Asia with those of the northern part of the continent, but it would appear that there must be a line of contact between the chalcolithic of northern and central China and the neolithic of Indo-China somewhere in southern China. Sites have, however, at present not been reported. (*See* MONGOLIA.)

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(L. H. D. B.)

XV. OCEANIA AND EASTER ISLAND

Introduction and General.—In the latter part of the 18th century permanent contact with European settlers was established and induced a rapid transition from the stone to the steel age. Previously writing was unknown in the area, if we except the pictographic "script," as yet imperfectly explained, of Easter I., and in spite of the astonishingly high development of oral tradition in Polynesia and of the occasional accounts of earlier European navigators from the 16th century onward, the pre-European period must be regarded as, in the main, prehistoric.

Imperfection of Record.—Although it is improbable that any of the more important monuments have entirely escaped observation and record, the greater part of the area has never been properly surveyed in an archaeological sense, and the published records available for many islands are meagre and of too unequal value to allow of any final correlation. The only islands of which detailed surveys have been published are Easter, the Australs, the Marquesas, Hawaii (some islands), the Carolines (Ponape and Kusaie) and, in part, New Zealand and the Chathams. Surveys of Tonga, Rapa-iti and some smaller islands (Fanning, Malden, Christmas, etc.) are now (1926) in preparation by the Bishop Museum, Honolulu.

Absence of Palaeolithic Culture.—Owing to the character of the climate, and the complete absence of pottery in Polynesia, the materials for archaeological study are practically limited to stone tools and monuments. No evidence of a palaeolithic culture has been found in any part of Oceania. The prevailing tools are everywhere axes or adzes of stone (occasionally also shell), polished wholly or in part, although flaked obsidian was also used in certain islands where it occurred (*e.g.*, Easter, New Zealand, New Britain), and roughly flaked quarrying tools bearing a superficial resemblance to palaeolithic hand-axes are found in Easter Island. Judged by its tools, the prehistoric culture of the area belongs entirely to the neolithic period.

Divisions.—The ethnographical division into Melanesia and Polynesia holds good, in the main, for archaeology. In the former region adzes are of the "celt" type and rounded or sublenticular in section; in the latter they are predominantly straight-edged and angular in section, and further subdivided into a tanged and tangless type, characteristic of east and west Polynesia respectively. The distribution of monuments is in substantial agreement with that of the tools, and the elaborate structures of masonry characteristic of Polynesia scarcely occur west of Fiji, where rude heterogeneous megaliths are the rule. Exceptions in the Solomon and Banks Is. may be regarded as relics of Polynesian migrations eastwards, or as due to later reflex movements.

Absence of Stratified Sites.—No stratified sites showing culture sequence, except in a minor degree in New Zealand, have been found. The habit of making permanent funerary offerings seems to have been little developed, and grave-goods, where discovered, do not differ markedly from artifacts of recent date. Only in parts of Melanesia has the occurrence of deposits distinct in character from the products of the historic inhabitants been observed.

POLYNESIA

In Polynesia there is little evidence of a succession of cultures; monuments and implements represent at most an earlier and higher phase of the culture that continued into historic times. Exceptions do occur, however; adzes of distinctively Melanesian type, found in Tahiti and Easter I., and the carvings of bird-headed men in the latter, suggest the possibility of a pre-Polynesian occupation of parts of eastern Oceania by the negroid race. The presence of a strong negroid strain in the inhabitants of eastern Polynesia is doubtful evidence in the same direction, since it may quite probably be due to racial intermixture during the Polynesian migrations through Melanesia and not to fusion in the islands in which it is found.

Eastern Polynesia.—In all the island groups east of Tonga and Samoa, without a single important exception, occur the remains, now more or less ruined, of megalithic structures, the sacred places or *marae* of the Polynesians. These consist typically of paved rectangular enclosures, surrounded by stone walls, and containing one or more rectangular stone platforms, sometimes, as in Tahiti, of stepped pyramidal form. These elements were variously combined and differ in details of construction, contour and size. Thus in the Marquesas the walls are low or absent, in the Australs the platforms are generally lacking, while in Tahiti and Hawaii all features are generally present. The platforms were faced with large boulders or hewn blocks of stone or coral, sometimes weighing many tons, and often neatly fitted in regular courses, although mortar was never employed. The core consisted of earth or rubble, and sometimes contained burial pits or vaults. Platforms served also as substructures for sacred houses of perishable material, for the exposure of the dead, as sacrificial altars, etc. Many of them were originally surmounted by large figures of wood or stone in conventionalised human form. The stone figures, some still *in situ*, are found in Hawaii (Necker), Easter I., Pitcairn, Tahiti, the Australs (Raivavai) and in the Marquesas, where they exactly resemble those carved in wood.

In the Marquesas, platforms, which always had vertical sides, were also much used for secular purposes, both in public assembly places (*tohua*) as seats for the spectators of dances, and as foundations for the ordinary dwelling-houses. The extreme development of terraces and platforms in the latter islands is undoubtedly due to the scarcity of level ground in the steep and narrow valleys and to the abundance of suitable boulders and easily worked volcanic stone. The largest recorded platform, that of Oborea, in Tahiti, now almost destroyed, measured 90 x 24 yd. at the base, and rose in 10 or 11 steps to a height of about 50 ft.; but in general these structures did not exceed 12 ft. in height. The antiquity of particular structures cannot be determined from internal evidence, but they were presumably built by ancestors of the historical Polynesians, who on traditional evidence did not reach the area earlier than the 7th century A.D. The fact that they occur in similar form in all groups, including Tahiti and Hawaii, which remained without intercommunication after the great voyages of the 13th and 14th centuries, as well as on intermediate islands, afterwards uninhabited, like Malden and Fanning, shows that the type must have been fully developed by the time of these voyages. Many were still in use when discovered, and some were even constructed in the historic period.

Easter Island.—In Easter I., where large trees were absent, stone construction attained its maximum development. The coast is almost surrounded by stone terraces (*ahu*), associated with burial vaults, the largest being some 300 ft. long and 15 ft. high; on these platforms, and scattered about the island, stood hundreds of monolithic statues, now overthrown, ranging from 6 to upwards of 30 ft. in height, and crowned originally with "hats" of red tuff. Some of these were still standing and apparently worshipped when discovered in 1722. Stone houses with partially corbelled roofs are found here only in Oceania, and the numerous carvings of bird-headed men on rocks and statues are unique in Polynesia. The *maraes* and stone figures of Pitcairn, uninhabited when found, bear some resemblance to those of Easter Island. Pitcairn I. has traces of a former Polynesian settlement in *maraes* and figures somewhat resembling those of Easter Island. Large stone axes of exceptional type have been dug up in the soil. Other small islands, found uninhabited, but bearing evidence of former Polynesian settlement, include Palmerston, Flint, Malden, Christmas, Fanning, Necker (Hawaii).

Samoa and Tonga.—In Samoa and Tonga typical walled *maraes* are not found, but the occurrence of stone temple and burial platforms in the former, and sepulchral mounds containing stone cists in the latter have been recorded. In the mountainous interior of Upolu (Samoa) is a group of upright basalt slabs on a paved floor (*O Le Fale-o-le-Fe 'e*), evidently the supports of a former house or temple, while in Savaii there are remains of roads and raised causeways elaborately engineered, but long disused and partly destroyed by an overflow of lava.

The most striking examples of true megaliths are the two trilithons on Tongatábu (Tonga), 15 and 30 ft. high respectively, the lintel stone being mortised into the two uprights in one case, and surmounted by a stone bowl in the other. A tradition ascribes the erection of the former to a chief of the 14th century in connection with a kava feast. Equally remarkable are the terraced "tombs of the kings" (*langi*), which are faced with hewn coral blocks measuring up to 22 ft. in length.

Stone Fortifications and Petroglyphs.—Stone fortifications occur on many islands, and reach their highest development in the terraced entrenchments and solid stone towers on the mountains of Rapaiti. Of the petroglyphs, representing conventional human and animal figures, concentric circles, etc., which are found abundantly in Hawaii and the Marquesas, some by their situation seem to have had religious significance, while others are "travellers' marks"; but many are of recent date.

New Zealand.—The final settlement of New Zealand by Polynesian immigrants from Rarotonga in the 14th century was preceded by an earlier branch of the same race, possibly also by people of Melanesian affinities. Archaeology throws little light on this question. The earthwork and stone fortifications belong for the most part to Maori culture, as do probably the pit dwellings and terraces of the Pelorus and Auckland districts and the artificial caves and figures carved in the soft tuff of Rotorua. Excavations in Otago have shown that the culture of the early moa hunters, which includes flake implements of quartzite and obsidian and rock paintings, did not differ essentially from that of the historical Maori. Curious figures incised in a sandstone pit in Auckland and rock-carvings in the Kaingaroa plains representing canoes of Maori type are among the more interesting recent discoveries. The stone implements of the extinct Moriori resemble Maori types, with the exception of tanged obsidian blades; tree-carvings and much weathered bird figures incised on cliffs have been reported.

Micronesia

The most important monuments of Micronesia are found in the Caroline Is., where both on Ponape and Kusaie extensive groups of buildings intersected by canals were constructed on artificially enlarged reefs protected by sea walls. They take the form of rectangular paved courtyards, frequently in contiguous clusters, surrounded by massive walls, constructed by laying long columnar blocks of basalt lengthwise and crosswise in alternate layers. These walls rise in places to a height of more than 20 ft., but were not roofed. The enclosures formerly contained houses of perishable material, traces of which remain; also platforms, terraced or pyramidal, in which were sepulchral vaults roofed with coral or basalt slabs. The most striking and best preserved of these structures is the royal cemetery of Nan Tauach at Matolenim (Ponape), which stands in a double enclosure and contains four burial chambers. Enclosed burial platforms of a somewhat similar type occur farther west in Yap and the Bunaj Islands. They have certain points in common with the *marae* of Polynesia, to which they are possibly related. Although the date at which these "sacred cities" of the Carolines were begun is not clear, they were still inhabited at the time of their discovery, and the tradition of how they were constructed by means of inclined planes of tree trunks survives. The stone pounders, and shell and other objects found in the tombs, do not suggest a high antiquity.

In the Marianne Is. occur groups of conical pillars, built of cemented coral slabs, and surmounted by hemispherical capitals. These are always arranged in two parallel rows, and presumably served as house supports; a burial has, however, been reported in one of the capitals. The largest, in Tinian, are 15 ft. in height with capitals six or seven ft. in diameter.

Melanesia

In various parts of Melanesia are found relics of a prehistoric culture or cultures, which it is as yet impossible to date or correlate satisfactorily. An important region covers the east end of New Guinea, New Britain and the adjacent archipelago, where the remains found include ornamented pottery (somewhat similar to that of prehistoric Japan), engraved shells, obsidian implements and stone pestles and mortars, some of which occur at a considerable depth in river gravels and all of which are quite distinct from the products of recent inhabitants. In the same region, but within a more limited area, are low stone circles, lines and heaps of stones, now used as squatting places and, in part at least, of recent origin. Rock paintings and engravings are numerous in the district behind Port Moresby, some of them coated with a film of calcium carbonate, indicating a certain antiquity. Megaliths are widely distributed and irrigation terraces are found throughout Melanesia. In the Solomon Is. (Bougainville and San Cristoval) upright stones occur singly and in groups; in San Cristoval some villages are bordered with stone walls or platforms, and numerous stone-faced and earth mounds—containing shafts leading to burial chambers, and sometimes surmounted by stone statues, small dolmens, or upright stones—are still in use. They may be related to Polynesian burial platforms. Their form and the mortuary customs associated with them have led to a comparison with early Egyptian mastabas; but the supposed resemblance of the pig-tail figures to Egyptian royal statues seems too remote to justify the emphasis laid upon it. In the New Hebrides the antiquities include menhirs, stone sacrificial "tables" or dolmens, walls and high platforms, and an obsolete type of pottery. There is an exceptional development of stone walls and buildings in the Banks Is., but some of these are of recent construction. In New Caledonia stone statues (in caves in Lifu) and a few "dolmens or trilithons" have been reported. Petroglyphs are common to all these groups, and particularly numerous in New Caledonia, where they take the form of human and animal figures, spirals and other patterns. Some of the better structures may be attributed to reflex Polynesian influence which has affected many of these islands in comparatively recent times; the *nanga* of Fiji so closely resemble Polynesian *marae* as to leave no doubt of their common origin.

Migrations—Negrito and negroid races were undoubtedly the first to arrive in the Pacific and occupy the Melanesian area, and may possibly have spread as far as Easter Island.

Oral traditions, supported by botanical and linguistic evidence, indicate that the ancestors of the mixed Polynesian race set out from the Asiatic continent (probably India) in the latter part of the 1st millenium B.C., and after a period of settlement in the Indonesian archipelago proceeded in at least two main streams of migration by way of Melanesia or Micronesia to Fiji, which they reached in about the 5th century A.D. Thence eastern Polynesia and New Zealand were settled in successive voyages during the 7th to 14th centuries. Hawaii seems to have been reached first by a direct migration from Indonesia, and subsequently by a branch of the main wave from southeastern Polynesia; this conclusion is supported by archaeological study which recognises two distinct types of *heiau* (*marae*), the later of which corresponds with the Taendi Purgu type.

Hypotheses—The hypothesis that Oceania served as a highway for the diffusion of an "archaic civilisation," originating in Egypt in the 3rd millenium B.C., and including the practices of sun worship, mummification and the building of megalithic structures; and that the stone monuments of Oceania are attributable to the bearers of this culture complex, has been a subject of considerable controversy. If tradition is right in asserting that Polynesian migrations did not reach the eastern Pacific before the 6th or 7th centuries A.D., and if, as appears probable, these people were the builders of the monuments in that area, it is apparent that they cannot have reached America in time to introduce civilisation to that continent. On the other hand, since they were in contact with Asia till a late period, they can hardly have escaped the influence of old-world culture or have failed to carry some of its elements with them into the Pacific. The absence of pottery has been used by others as an argument for the very early isolation of the Polynesians; but this art might easily have been lost as a result of prolonged wanderings among coral islands, where the material with which to practice it was not available. The view that Oceania was peopled by migration from America finds little support at the present time.

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XVI. NORTH AMERICA

Pueblo Area.—The greatest activity in archaeological research in northern America has been in Arizona, New Mexico, Colorado, Utah and Nevada—the territory of the ancient Pueblos—partly because its ceramic remains afford an exceptional basis for determining the succession of cultures. The excavations by A. V. Kidder of Phillips Academy at Pecos, by Neil M. Judd of the National Geographic Society, at Pueblo Bonito and Pueblo del Arroyo, and by F. W. Hodge, of the Museum of the American Indian, Heye Foundation, at Hawikuh, each of whom has devoted six years to these researches in New Mexico, had for their chief purpose a determination by stratigraphic studies of the sequences of the pottery types found at those sites.

Other studies of a generally similar nature were conducted by N. C. Nelson for the American Museum of Natural History in ruins of the Tewa, Tano and Keres Indians of the Rio Grande drainage in New Mexico, especially in Galisteo valley, which have been productive of much information on the stages of pottery development from the earliest period until the Pueblo rebellion of 1680; and by Earl H. Morris during several seasons at the great ruin near Aztec, New Mexico, the site of which has been purchased and presented to the Government as a National monument. During three years in Cañon del Muerto, Arizona, Morris recovered a remarkable series of sandals and other textiles. There has been work by Erich Schmidt at an ancient pueblo site near Miami, southern Arizona; by Fewkes in various important Pueblo culture centres, such as the Mesa Verde National Park and the Hovenweep region of Colorado, the Mimbres valley of New Mexico, the Navaho National monument and the Black Falls ruins in Arizona.

Excavations by E. L. Hewett of the School of American Research at Chettro Kettle in Chaco Cañon and elsewhere in New Mexico; by Hodge and Lothrop at Kechipauan, near Zuñi in the same state; by J. A. Jeançon and F. H. H. Roberts in southern Colorado; by Jeançon in Taos valley and the ancient Tewa country of northern New Mexico; by Wesley Bradfield of the School of American Research near the Santa Rita mines in southern New Mexico; by the Cosgroves for two years in Mimbres valley for the Peabody Museum of Harvard University; the joint researches conducted by the Bureau of American Ethnology and the School of American Research, under Hodge and Hewett respectively, in the Rito de los Frijoles, the Pajarito Park, and the Jemez valley, New Mexico (the Southwest Museum of Los Angeles joining in the Jemez work a year later), and the discoveries by Dr. Wilson for the Commercial Museum of Philadelphia in Tewa ruins of the Pajarito have all added to the sum of knowledge respecting this important archaeological field, while the systematic work by Kidder and Guernsey for Phillips Academy and the Peabody Museum of Harvard University, respectively, in caves, cliff-dwellings and other habitation sites and burial places, during several seasons, have resulted in defining the four earliest periods of southwestern culture.

Byron Cummings of the University of Utah and the University of Arizona, Judd of the National Museum, and J. L. Nusbaum of the Museum of the American Indian, have worked at the archaeology of northern Arizona and southern Utah. Walter Hough of the National Museum has explored pit-dwellings near Luna, New Mexico. Of a more or less kindred character were the observations on ancient remains near Flagstaff and in the Grand Cañon, Arizona, by S. A. Barrett and G. A. West of the Milwaukee Public Museum. The reputed finding in the Grand Cañon of ancient pictographs representing mammoths, seriously exploited by a local museum in California, has not been accepted. In 1924–6 M. R. Harrington, for the Museum of the American Indian, conducted excavations at a series of early Pueblo ruins known as Pueblo Grande de Nevada, in southeastern Nevada, of great archaeological importance because the remains pertain to the most westerly extension of the Pueblo culture area yet discovered.

Southern States.—Perhaps less spectacular in results, but of equal importance, have been the excavations conducted in the southern states by several institutions, and notably by Mr. Clarence B. Moore, whose researches in conjunction with the Academy of Natural Sciences of Philadelphia have been characterised as the most important of their kind ever undertaken by private means within the United States. Mr. Moore devoted each field season during many years to the excavation of hundreds of mounds along the streams and the Florida coast, the results of his observations being published as the units of work were finished. The Bureau of American Ethnology also explored mounds in Alabama and Tennessee and at Weeden I. near St. Petersburg, Florida, where culture stratification was observed by Fewkes. A season was spent in a study of the historic Nacoochee mound of the Cherokee by Heye, Hodge and Pepper, in Georgia, in 1915, under the joint auspices of the Bureau of American Ethnology and the Museum of the American Indian. Of great importance to the elucidation of the culture history of the Cherokee are the results of excavations by M. R. Harrington in Tennessee for the Museum of the American Indian, which have been published, as likewise has his memoir on some important Caddo sites in Arkansas, explored under the same auspices. Of special interest to archaeologists, by reason of its great size, is the Etowah mound in Georgia, the systematic excavation of which, commenced by Moorehead for Phillips Academy, promises noteworthy results. The same institution has explored mounds also in Mississippi with a view to determining relations.

Since its establishment in 1909, the Alabama Anthropological Society has located more than 200 aboriginal sites within the State and has explored about a fourth of these. On the Alabama and Coosa rivers evidences of an advanced culture, identical with that revealed by Moore at Moundville, have been uncovered, and certain artifacts suggest Mexican influence in this area. Of more or less related interest, by reason of cultural contact with the adjacent mainland in prehistoric times, are the researches carried on in the West Indies by Fewkes for the Bureau of American Ethnology and the Museum of the American Indian, by de Booy and Huckerby for the latter museum, and especially by M. R. Harrington for the same institution in Cuba, with results of outstanding importance. Until 1918 Texas had been almost neglected as a field of archaeological research, but the Bureau of American Ethnology and the University of Texas, represented by J. E. Pearce, have done much to elucidate the problems of the early inhabitants of that state. Everywhere over the limestone region are found numerous and extensive kitchen middens which show evidence of a hunter culture only. In the timbered region of eastern Texas are evidences of an early mound-builder culture and of the relatively settled village culture of the historic period. Along the streams of central Texas are many old camp sites which reveal evidences of a culture superior to that of the kitchen middens. In the trans-Pecos region a low form of Pueblo culture has been revealed, with evidences of cave life here and there, and in the Panhandle traces of a crude form of stone buildings have been found by Moorehead, who regards them of Pueblo origin.

Cave Work.—Special efforts have long been made to trace the remains of very early man in the United States; and although various reports of such occurrence in association with fossil remains have been made from time to time, no indubitable evidence had, up to 1926, been adduced. With a view to obtaining scientific data on the subject, much cave work has been done, notably in the Ozark mountains of Arkansas-Missouri, by the Bureau of American Ethnology, by Nelson for the American Museum of Natural History, and by M. R. Harrington for the Museum of the American Indian, and also by Nelson in Kentucky caves. Loud, of the University of California, and Harrington have also conducted important excavations in an anciently inhabited cave near Lovelock, Nevada. But in none of these investigations has anything been found to indicate the former presence of people not readily identifiable as American Indians. The Delaware valley near Trenton, New Jersey, has long been the scene of researches looking to the establishment of evidence of early man in the vicinity, the latest studies there being those of Leslie Spier and Alanson Skinner for the American Museum of Natural History, who found a pre-pottery argillite culture underlying the later culture of the historic Delaware Indians, and demonstrated that arrowheads and natural pebbles were impartially deposited in sand by a stream which was probably not much later than the Glacial retreat. Anthropologists demand incontrovertible evidence of the existence of very early man in America, however; and Holmes and Hrdlička of the National Museum have been especially active in combating all suggestions of such, based on casual or superficial observation or on fortuitous associations.

Mound Region.—The Peabody Museum of Harvard University in 1911 finished the exploration of the extensive aboriginal cemetery at Madisonville, Ohio, and a new survey of the great Serpent mound in that State was made. In co-operation with the University of Illinois, Moorehead of Phillips Academy conducted investigations of the Cahokia mound group in Illinois, the largest in the United States, whose larger earthworks are now preserved as a State park. For twenty-five years the Ohio State Archaeological and Historical Society, under W. C. Mills, has conducted intensive excavations throughout the State, special attention being devoted since 1910 to the Harness mound, the Seip group and Tremper mound in the lower Scioto valley, all belonging to the Hopewell culture; the Feurt mounds and village-sites of the Fort Ancient culture; the Westenhaven mound, probably of early Hopewell culture; the Mound City group, and the celebrated Hopewell group, which in 1925 revealed, among other remarkable objects, artificial copper noses on two skeletons and a necklace of 320 pearls. Various sites in Butler county and along the Scioto were investigated, and Flint Ridge, the source of material for making arrow- and spear-points and knives, was examined.

The Milwaukee Public Museum has been remarkably active in archaeological work in Wisconsin under the guidance of S. A. Barrett. The Kratz Creek mound group in Marquette county was investigated and 53 mounds opened, with important results; the extensive old site at Aztalan was uncovered, revealing influence from the coast of the Gulf of Mexico; and mound groups in Shawano, Oconto, Green, Lake and Marquette counties, and at Shorewood, a Milwaukee suburb, were likewise explored. Investigations of old Kansa and other sites in Nebraska, and still other sites in Iowa, were carried on by the Peabody Museum of Harvard University. In South Dakota, W. W. Stirling, for the National Museum, explored four of ten village sites on the Missouri river, three of which were Arikara and one the historic village visited by Lewis and Clark in 1804. The Wisconsin Archaeological Society has located, since 1911, nearly 5,000 mounds in 21 counties, in addition to large numbers of village, camp and workshop sites, planting grounds, cemeteries, flint and pipestone quarries, lead diggings, sacred springs, petroglyphs, etc., and a number of single mounds, mound groups, burial places and other aboriginal remains have been explored. Additional mounds and mound groups have been preserved for public use and marked with tablets at various places, and a large part of the ancient Indian enclosure of Aztalan has been acquired by the society and is now the Aztalan Mound Park under State control.

Pacific Coast.—The efforts of the University of California have been devoted mainly to the archaeology of its own State. A beginning has been made on the systematic recording of the localised private collections and on the methodical comparison of all this material by areas. Actual excavating has been done in strategic points in the upper San Joaquin valley, on San Francisco bay, in the Stockton-Lodi region and on Humboldt bay. Looking toward the establishment of connections, excavation has also been conducted in the Willamette valley at Albany, and on the Columbia river, principally at Sauvies I. and The Dalles, in Oregon, and in western Nevada; and reconnaissance trips have been made into the Imperial valley, California, and into Lower California. Excavation of a site at Santa Barbara by J. P. Harrington for the Bureau of American Ethnology and the Museum of the American Indian revealed typical Chumash artifacts, together with skeletal remains which at first were thought to be of extreme age, but more deliberate scientific study shows them to have no features not characteristic of late Pacific coast Indians.

New York and New England.—On behalf of the New York State Museum, Arthur C. Parker investigated many sites. One of the late historical period at Port Jervis revealed characteristic articles of European provenience. A pre-colonial site at Richmond Mills, Ontario county, examined with the co-operation of the L. H. Morgan Chapter of the State Archaeological Society, proved to be Seneca. A site of similar culture near Factory Hollow, in the same county, probably had been occupied by the Richmond Mills people in early colonial times. A pre-colonial site near the outlet of Owasco lake had belonged to an Algonkian tribe. A site in Brant, on the Cattaraugus reservation, had been occupied by the Seneca at the beginning of the colonial period. Other sites investigated were the Seneca village of Gannagaro, near the town of Victor, which was destroyed by the French in 1687, an Algonkian fishing village at Green Point near Catskill, a site near Vine Valley, on Canandaigua lake, with remains similar to the Ohio mound region, a quarry site and workshop south of Coxsackie, covering a hill a mile long, an Algonkian site near Four Mile Point, on Hudson river, which exhibited contact with New England. Several years were devoted to an archaeological survey of the State and the charting of sites, and much light has been shed on the chronological sequence of the early aboriginal occupancy. In 1925 the Rochester Municipal Museum, under Mr. Parker's direction, conducted an expedition on Lamoka lake, Schuyler county, where an early, pre-pottery Algonkian fishing village site was uncovered. Considerable activity was manifested by the Museum of the American Indian in archaeological researches especially in and about New York City—at Throgs Neck, Clason Point and Inwood (where Skinner conducted important excavations), on Long Island and Staten Island, and at Croton Point, as well as at several up-State localities, notably on Frontenac island, in Cayuga lake, where D. A. Cadzow uncovered a prehistoric Algonkian site.

In New England, Phillips Academy, under Moorehead, conducted many expeditions during 12 seasons, mapping upward of 1,000 shell-heaps and village sites and 50 cemeteries. About 50 sites were explored. Reports on the archaeology of Maine and other areas were published, and a correlation of cultures by means of a study of type specimens is in progress. The Peabody Museum of Harvard University has surveyed an interesting old earthwork in the Sudbury valley, Massachusetts, an Indian burial-place was explored at Dartmouth in the same State, and excavation has been conducted at old sites in Charles river valley and on Martha's Vineyard. The Peabody Museum of Natural History in Yale University has done considerable field-work in Connecticut, under the immediate direction of G. G. MacCurdy, and in 1925 Carroll G. Alton, assistant, dug out a camp-site on Thames river near Norwich, which dates from the early contact with whites.

Canada.—Although the exigencies of the World War retarded progress in archaeological research, the Victoria Memorial Museum at Ottawa has done much in field reconnaissance and in recording and publishing results since 1911. Following the first extensive exploration, conducted in 1912 at an Iroquoian site near Roebuck, Ontario, by W. J. Wintemberg, archaeological reconnaissances have been made in Manitoba by W. B. Nickerson; in Ontario by Wintemberg; in Nova Scotia, New Brunswick, Alberta, Saskatchewan, British Columbia (including Queen Charlotte Is.) by Harlan I. Smith, and on Barter I., Alaska, by D. Jenness.

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XVII. MEXICO AND CENTRAL AMERICA

Important advances have been made in our knowledge of the archaeology of Mexico and the adjacent Central America since 1910 as the result of first, the discovery of a stratification of archaeological remains in the valley of Mexico; second, the decipherment of dates inscribed on Mayan monuments in Yucatan and adjacent parts of Mexico, Guatemala and Honduras, and the reduction of these dates into days of the Gregorian calendar and years of the Christian era; third, reclassifications in language introducing new data on the origin of various tribes; fourth, demonstrations in the field of technology and art establishing time levels in industry and disclosing the extent of ancient commerce; fifth, reinterpretations in myths and legends now believed to deal in part with historical characters. The facts presented in the explanations of Tyler and Lehmann must now be posed in historical succession covering 5,000 or 6,000 years.[1]

Stratification of Remains.—The stratification was first observed at Atzcapotzalco, near Mexico City, in 1910, and later was investigated by the International School of Archaeology at Colhuacan and near-by sites. In the top soil were found objects of Aztec manufacture, and under these, to the depth of several feet, were the much finer products of the Toltecs. Finally in a deep stratum of water-worn gravels were found little clay figurines of men and women, made in a peculiar style, together with pottery strikingly different in shape and design from that of the upper layers. Similar figurines were also found on the tops of denuded hills about Lake Tezcuco and were recognised as belonging to an archaeological type called Tarascan, which has been re-named Archaic.

The discovery yielded three major horizons: Archaic, Toltec (with obvious affiliations to the Mayan of the Central American lowlands), and finally Aztec or Chichimec, corresponding to the civilisation found by Cortes. The Archaic remains belonged to a village-dwelling population acquainted with agriculture and weaving as well as with pottery-making, and it therefore became necessary to postulate a still earlier culture of pre-agricultural type, that of the first immigrants into the New World. These are believed to have entered America via the Siberia-Alaska bridge in lower Neolithic times. Remains of these first nomads are rare in Mexico and Central America, but are found elsewhere.

ARCHAIC CULTURE

The Archaic culture was the outgrowth of the domestication of maize, beans, squashes and other plants indigenous to the arid lands of the American tropics. The little figurines of men and women have been interpreted as expressions of a primitive religion in which the little men stood for success in war and the chase and the much more common statuettes of women were fetishes of the fertility of mother earth. These little figurines can be traced through slight variations in style from Mexico into Colombia, thence eastward across Venezuela as well as southward to Peru. Archaic art underlies the higher expressions of civilisation in all tropical America, and the plants domesticated at this time furnish the economic explanation of growth in population and increasing complexity of social organisation. The ultimate economic values of this nuclear civilisation of ancient America are incalculably vast.

The Archaic culture lasted for several thousand years, the indications of age being, first, the thickness of deposits; second, the high degree of domestication in plants, which are carried further from their wild state than the domesticated plants of the Old World. Some botanists have insisted that American agriculture is older than that of Asia, but the archaeological evidences hardly support this conclusion. The first independent domestication of plants may be on nearly the same historical plane in the two hemispheres. New indications of age for the Archaic culture are found in sites near Mexico City, where ancient lava flows have covered villages of this period.

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[1] *See* ARCHAEOLOGY (5.677) and MEXICO (18.329).

Mayan Chronology

The Mayas (*see* 17.931) may have established themselves in the wet lowlands of eastern Central America as early as 1000 B.C. The archaeological evidence indicates, however, that their beginnings were in the piedmontal zone adjacent to the dry region of the Archaic civilisation. In this zone transitional types of pottery are found which are lacking in the heart of the Mayan territory. The early Mayas modified the important food plants of the Archaic civilisation till these plants would grow under conditions of heavy rainfall, and they succeeded in domesticating a number of new plants, such as cacao.

The sources of Mayan history are several brief chronicles preserved in Spanish writing by educated Indians together with abundant inscriptions on early monuments. The chronicles reach back to 176 A.D. in a count of time periods called Katuns, which are really periods of 7,200 days, corresponding to the basic value of the fourth position in the place-value notation of numbers used by the Mayas. This numerical system is vigesimal instead of decimal except that in the third place we find 360 instead of 400 and the katun is 20 times 360. On the ancient monuments the dates are the number of days from a beginning day, and the terminal days of katuns are emphasised.

The German school of Americanist science led by Seler paid marked attention to Aztec sources and interpreted Mayan archaeology in the light of their Mexican studies. The American school undertook the study of Mayan sources on their own merits under the leadership of Brinton, Goodman, Bowditch and Thomas. In 1910 Morley suggested a correlation of the katuns of the chronicles with the katuns of the ancient inscriptions on the evidence of an inscription at Chichen Itza. At the same time Spinden showed that when monuments at Copan were arranged in stylistic order, the dates fell in similar order, indicating that these dates probably declared the chronological positions. The early correlation of the katuns proved to be slightly in error since the katuns had been counted as current rather than elapsed units of time. Nevertheless, the arrangement made possible relative accuracy in chronology, while the demonstration of artistic sequence permitted the placing of many abbreviated dates.

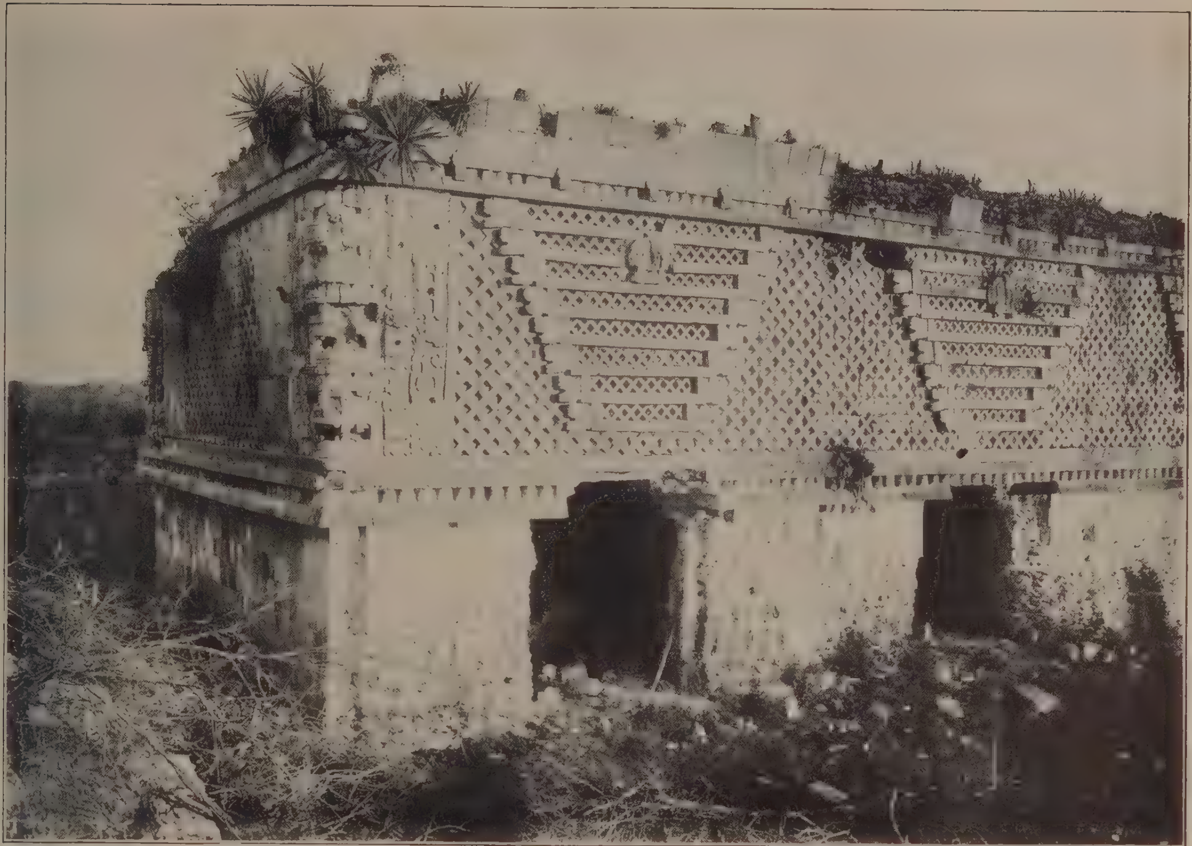
Early attempts at correlating the Mayan calendar with European time counts failed to pass all tests. In 1919 Spinden published a day-for-day correlation of Mexican and Mayan chronology with that of Europe, and in 1924 presented astronomical proof of the correctness of the arrangement and showed that many Mayan calculations deal with fixed points of the tropical year such as the solstices and equinoxes and especially with two arbitrary stations in a farmer's year of the ancient Mayas, namely, April 9 and Sept. 2, reached by sunset readings along an astronomical base line at Copan. This base line consists of two monuments set up on opposite sides of the valley and about four miles apart. An observer standing at the eastern monument sees the sun go down directly behind the western one on the two dates given above, which are also recorded on several monuments in the ancient city. It appears that an astronomical congress was held in Copan to decide formally upon these stations. References to this congress are found in the Mayan chronicles as well as in traditions of the Mexicans.

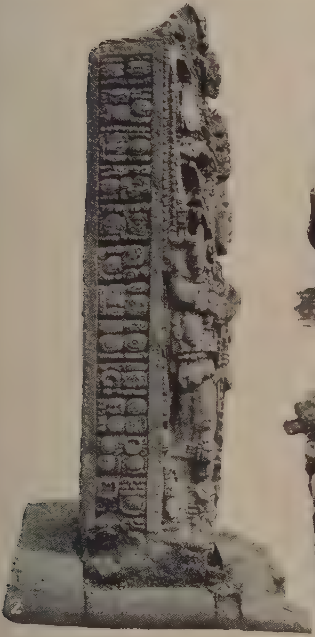
An unknown scientist, possibly deified as the god called Itzamna, seems to have invented the Mayan calendar after making a daily record of observations beginning on Aug. 6 613 B.C. This date is the real zero of Mayan history, although the perfected Mayan calendar was not inaugurated till 580 B.C. (according to inscriptions at Palenque and Copan) when the new year's day of the Mayan civil year stood exactly at the winter solstice. The unknown scientist reduced a calendar of moons to a calendar of numbers. A 365-day year was constructed of 18 months of 20 days each plus 5 days. The days were counted in numerical succession from a mundane era reached by counting seven baktuns, or units of the fifth numerical position, back into the past from Aug. 6 613 B.C. In this manner the epoch of the mundane e was established on Oct. 14 3373 B.C.

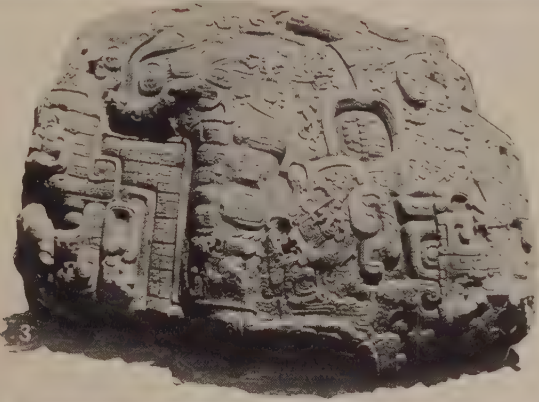
The writing out of the number of days in the Mayan calend involved place-value numeration 1,000 years before this impo tant arithmetical device was known to the Old World and t Mayan eral count of days preceded by 300 years the first er count of years in the Old World (the era of the Seleucidae, Oct. 312 B.C.). The unknown Mayan scientist likewise invented system of designating the days by a permutation of 13 numbe and 20 names, making a round of 260 days called the tzolki When this permutation of days is combined with the 365 pos tions in the year the result is 52×365=18,980 days, called t calendar round. The mundane era is zero, 4 Ahau 8 Cumhu, b the zero is written 13–0–0–0–0, as we transcribe Mayan numbe in this case and the historical era is 7–0–0–0–0, 10 Ahau 18 Za The 4 Ahau and 10 Ahau are designations of days in the perm tation and they are declared to occupy, respectively, the 8 place in the month Cumhu and the 18th place in the month Za The Mayas had a system of hieroglyphs with pictographic, ide graphic and phonetic elements by which days, months and ma other things could be recorded. For numerals they general used bars and dots, with the dot counting as one and the bar five. Numbers with bar-and-dot numerals in several places we commonly written in columns with the lowest place-value at t bottom.

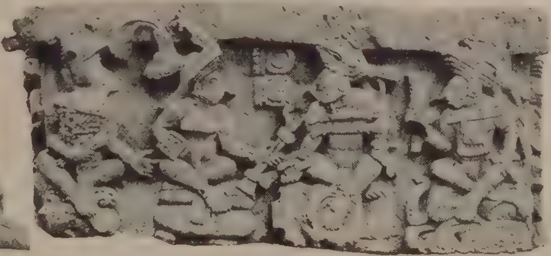
The decipherment of Mayan dates discloses a remarkab astronomical science. This ancient people had obtained by o servation practically the modern values for the length of t tropical year, for intervals between possible eclipses and for t average periods of revolutions of several planets. They acco plished these results because they did not invalidate their cale dar by making leap-year corrections, but permitted the mont to revolve slowly around the natural year. The proper corre tions were accurately known but were not interpolated. T etymologies of month names and the symbolism of month hier glyphs are in agreement with the seasons when we put the fir day of the month Pop at the winter solstice, a condition whi obtained about 580 B.C. At almost the same time the Ven calendar started flush with the actual heliacal risings or fir appearances of the planet as morning star. The Mayas observe that in every period of 8 calendar years there were 5 appearanc of Venus as morning star, at intervals which averaged 584 day When the 260-day tzolkin was brought into the reckoning, grand Venus permutation of 37,960 days, or 104 calendar year was obtained. During this time the actual positions of Ven moved a little more than 5 days out of agreement with the Maya civil calendar and about 30 days out of agreement with the se sons. The Mayas observed the calendarial positions of Ven and they also observed the actual positions. Moreover, they he as sacred to Venus certain special days in the tropical year, o being April 12, which could be occupied by heliacal rising Venus once in 243 or 251 years. On Stela C at Copan, this pri cipal date is the actual one of Venus' emergence out of the su light, and there is a marvellous calculation covering 4,617 yea which involves the moon as well as Venus.

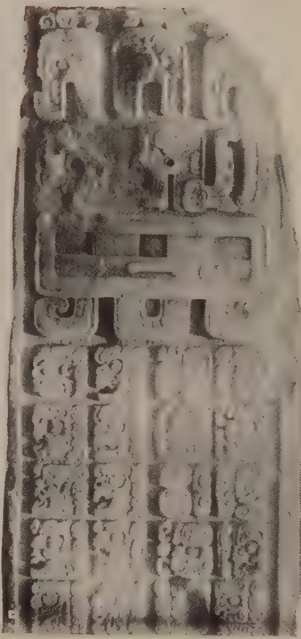
The first Mayan monuments with contemporary dates fa about 100 B.C. The most brilliant period of the First Empi began about 400 A.D., and ended suddenly shortly after 600 A. At this time all the great cities, such as Copan, Tikal and Pa enque, were abandoned to the enveloping forest. The sudden brea down has been variously attributed to yellow fever, civil wa social decay, exhaustion of the soil and even climatic change. T Mayas, greatly reduced, moved into the region back of Campech Several fine buildings and a few dates are known from this inte mediate period. The Second Empire began with the re-esta lishment of Chichen Itza about 960 A.D. There was a brillia renaissance in which Uxmal, Izamal, Kabah and Labna flou ished. Then a large part of northern Yucatan was subdued the Toltecs from the highlands of Mexico. Dates are now know for some of the finest buildings of the Second Empire. A seco abandonment of stone-built cities took place about 100 yea before the coming of the Spaniards.











(© "*Wide World.*")

FIG. 1. Eastern Building of the Nunnery, Uxmal, Yucatan. FIG. 2. Stela A, Copan, Honduras. FIG. 3. The great turtle sculpture, Quirigua, Guatemala. FIG. 4. Altar with inscription, Copan, Honduras. FIG. 5. Mayan inscription at Quirigua, Guatemala, in which the upper line is an introduction to two horizontal columns of faces of gods, with a final date corresponding to June 12 496 A.D.

The Toltecs

The Toltecs (*see* 26.1062) were one of several nations outside the Mayan area who enjoyed the fruits of the First Empire. Others were the Chorotegas to the south in Honduras, Nicaragua and Costa Rica, and the Ulmecs, Zapotecs, Mixtecs and Totonecs to the west and northwest in Mexico. The height of individualised culture for these secondary civilisations was between 1000 and 1200 A.D. At the end they were mostly consolidated into the extensive but short-lived Toltec Empire under Huetzin, Ihuitimal and Quetzalcoatl. The original capital of the Toltecs was Tula, doubtless to be identified with Teotihuacan. From here they extended their rule toward the northwest as far as the present states of Zacatecas and Durango and toward the southeast as far as Salvador and perhaps Nicaragua. They became a power in northern Yucatan with Chichen Itza, Mayapan and Uxmal as the chief cities under their control.

Little is known about the first two rulers mentioned above. Ihuitimal was also called Totepeuh, and is mentioned under both names in Guatemalan chronicles. The third was the great Quetzalcoatl, also called Topiltzin, "Our Prince." In the Mayan chronicles Quetzalcoatl appears as Kukulcan, "Plumed Serpent"; and as Hunac Ceel, "Great Fear." Quetzalcoatl is one of the great characters of history, a compound of warrior, priest, administrator and scientist. He seems to have received his early training in Yucatan, endearing himself to the Mayas by several scientific achievements, of which three can be recovered. He founded the Toltec era which served for later Mexican chronology and which began with a day called 1 Tecpatl, or Flint, in the first position of the Mexican month Toxcatl. This was Aug. 6 168 A.D., in exact correspondence with the first historical day of the Mayas, but 1,781 years later. He also established the era of the Sacred Fire on the day 7 Acatl in the year 2 Acatl in coincidence with the sacred fire ceremony of the Mayas. The zero day of this era was Feb. 16 1196 A.D. Finally, Quetzalcoatl was made God of the Morning Star because he predicted the appearance of Venus as morning star in the year 1 Acatl when it rose on April 12 1208 A.D., in conformity with a famous date for this planet treated in old Mayan books and on monuments at Copan.

As regards his political activities we know that Quetzalcoatl put down a rebellion of the Mayas in 1191, subduing Chichen Itza and making it the Toltec capital of Yucatan. He created orders of nobility and elaborated the coronation ceremony used in later times by most Mexican and Central American nations. Quetzalcoatl introduced into Mexico a mild religious cult of the Mayas without human sacrifice but with fasting and penance, in which the worship centred around a serpentine deity connected with the annual rains. In later times Quetzalcoatl was identified with the Mexican counterpart of this serpentine deity as Ehecatl, "God of the Storm Winds." The new religion of Quetzalcoatl brought on civil war among the Toltecs, which ultimately destroyed their power about 1220, although some of the arts and ceremonies were maintained at Cholula, Colhuacan and Atzcapotzalco.

The Age of Metals

The establishment of Mayan and Toltec chronology fixes, within relatively narrow limits, the beginning of the metal age in Central America and Mexico. No specimen of metal, not even a copper stain, was observed during excavations at Copan, Quirigua and other Mayan cities of the First Empire. Las Quebradas in Guatemala was actually built upon a placer mine, yet in the sluicing operations which have almost destroyed the site, no specimen of worked gold has been found. Nor are any ornaments of metal, such as gorgets and bells, pictured on the early monuments. We therefore conclude that the metal age did not begin till after 600 A.D., yet by 1200 A.D. metal work was highly developed in gold, silver, copper and various alloys. Many specimens found at Chichen Itza in northern Yucatan are of Costa Rican and Colombian origin, and the technique of metal-working is the same from southern Colombia to Central Mexico. The art was apparently introduced from South America about 1000 A.D., and underwent a rapid growth in the 500 years before the Spanish Conquest. Recent analyses have shown that the Mexicans were not ignorant of bronze and that they made many alloys, some containing lead. They were acquainted with the lost wax process of hollow casting and with a false filigree really moulded from a model of wax wire.

Recent publications by Saville and Rivet cover Mexican gold work, and the former has published papers on wood carving and turquoise mosaic work, the latter probably a Toltec invention. The fine ceramics of Mexico and Central America deserve greater attention for beauty of shape, design and colour. One kind of pottery is semi-glazed due to a suffusion of lead flux. Another kind resembles cloisonné but is made with heavy pigments rather than enamel. Also there is fresco pottery, moulded and carved pottery, and still another kind in which the designs are put on by a negative wax process resembling that of Javanese batiks.

The Chichimecan Period.—The Chichimecan period begins with the abandonment of the Toltec cities about 1220 A.D. and extends to the Spanish Conquest. The Chichimecs were tribes of rather low culture, speaking dialects of the Mexican language. During the civil wars that marked the end of the Toltec Empire the Chichimecs pressed into the valley of Mexico and established themselves in small groups among the Toltec survivors. Afterwards the Chichimecs boasted that they had begun their career of empire as pure nomads, but these claims need not be taken too seriously.

The best document dealing with this period, the Codex Xolotl, makes Xolotl, the founder of the dynasty of Tezcuco, enter the abandoned territory around Teotihuacan in 1224. He is pictured as a mountain brigand collecting tribute from farmers. The Acolhuas, as Xolotl's Chichimecs were called, became sedentary under Techotlala, who founded Texcuco about the same time that the Aztecs, another division of Chichimecs, founded Tenochtitlan. His son, Ixtlilxochitl, was murdered by the famous tyrant Tezozomoc of Atzcapotzalco, but Nezahualcoyotl recovered the power in 1431. Regnal years of the dynasty of Tezcuco follow:—

Xolotl	1225–1284	Ixtlilxochitl	1409–1418
Nopal	1284–1315	Interregnum	1418–1431
Tlotzin	1315–1324	Nezahualcoyotl	1431–1472
Quinatzin	1324–1357	Nezahualpilli	1472–1515
Techotlala	1357–1409	Cacama	1515–1520

The Aztecs have an unbelievable tale of a peregrination with many stops. It begins at the Toltec era, on the year 1 Tecpatl, corresponding to 1168. In 1325 the Aztecs reached the shores of Lake Tezcuco, where they lived undisturbed until 1351, when they were defeated in a sanguinary battle among the reeds by the combined forces of Colhucan, Xaltocan and Altzcapotzalco. They then became vassals of Cozcoz of Colhuacan and in 1364 moved to several small islands to construct Tenochtitlan as their capital. After the accession of Acamapichtli in 1376 the history of the Aztecs is one of conquest upon conquest and of horrible excesses in human sacrifice. Yet Montezuma held in 1519 only a small part of the territory that Quetzalcoatl had controlled in 1200 nor had the Chichimecan arts yet reached the high standard set by the Toltecs.

Linguistic Reclassifications.—The science of linguistics may give the historian his oldest facts because the demonstration of kindred speech in sundered tribes is proof presumptive of ancient contact. The number of distinct stocks of language in the New World has been greatly reduced in recent years (*see* Philology). The Shoshoni and Pima languages are connected with the Nahuan or Mexican languages. This stock stretches from Idaho to Costa Rica and embraces tribes that by test of culture run from lowly nomadic to highly civilised—witness the "Digger" Indians of Nevada and the Aztecs of Mexico. The drift has plainly been toward the south, yet it is strongly indicated that some tribes of this group have been in Mexico for several thousand years. The Otomi languages in Central Mexico are joined with the Chiapanecan group, mostly located in Nicaragua and Costa Rica, indicating a southern movement of the latter, but there is evidence that the Otomi moved northward instead. The incursion of wild South

American tribes into the Isthmus of Panama exerted a pressure which depopulated most of the Chorotegan culture area. Lehmann also joined the Subtiaba language of Nicaragua with the Yopi of southern Mexico. The Yopi, like the Otomi, were much given to the terrible cult of Xife, God of the Flayed, which likewise flourished in Nicaragua. The Subtiaba have been put into the Hokan stock, which mostly comprises the very primitive tribes of California and northern Mexico, while some North American Indian languages are possibly connected with the languages of eastern Asia. Such linguistic affiliations obviously go back long before the dawn of history.

The arguments against influences of the Old World upon the New in the matter of high civilisation are very strong. The economic bases in domesticated plants are distinct, the New World makes no use of the wheel at all and the really wonderful scientific achievements of the Mayas find no counterpart in the Eastern Hemisphere.

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XVIII. SOUTH AMERICA

The archaeology of the great continent of South America is, as yet, imperfectly known, and great areas still remain to be investigated. It follows that the northwestern part of the country must have been the first region settled, and the archaeology of Colombia and Ecuador, in the mountain region and the coast, appears to indicate two perhaps independent movements of people from middle America, profoundly influenced by the widely different environment.

It is highly probable that the vast region of Brazil and eastern Argentina was not occupied for so long a time as the Pacific coast and the inter-Andean valleys; indeed, it is reasonable to conjecture that the southern Brazilian area and portions of Argentina were the latest parts of the continent to be permanently settled, if it is considered that the logical route of early migration southward from Central America was probably along the Pacific coast, or through the Andean valleys, or both. There seems to have been, at the time of the earliest aboriginal invasion of South America, a movement eastward from Panama, along the northern coast of the continent, through Colombia, Venezuela and the Guianas, which reached the mouth of the Amazon and ascended that stream; and there may also have been a contemporaneous filtration of people southward by way of the numerous waterways which drain into the Caribbean Sea. This movement of people would naturally have taken a much longer time, considering the physical difficulties of the route, than by the less obstructed highway on the Pacific side of the continent.

Considerable archaeological work has been carried on in Ecuador, Peru and Argentina; to a lesser degree in Colombia and Chile, while the rest of the continent still remains almost virgin field for the investigator. Specifically, the great Republic of Brazil, somewhat larger in area than the United States, exclusive of Alaska, is as yet almost *terra incognita*, so far as its antiquities are concerned.

Ecuador.—Our knowledge of the archaeology of Ecuador has been greatly advanced by the researches of Saville, Jijon y Camano, Rivet and Uhle, and it is now possible to determine something of the ancient culture of this part of South America. In this country there are three great zones, not climatic but cultural, for every variety of climate prevails. These culture zones are those of (1) the inter-Andean valleys, (2) the Pacific coast and (3) the Oriente of the Amazon basin. The antiquities from the Pacific coast indicate the former existence of two cultures differing widely from those represented by the artifacts from the highlands, where at least three major cultures may be distinguished, especially in the types of pottery found in the Andean valleys. The northern coast culture merges into the culture of the south Colombian coast region, and throughout the Ecuadorian coast there are distinct traces of influence exerted from Central America, chiefly from the field of Mayan culture (*see* Section XVII.) Some of the human effigy vessels and figures are unquestionably of Central American style, and might have been made within the area of Mayan culture. In the countless human heads and faces of pottery are found all styles of treatment, from the archaic of Mexico to the most advanced and accurate modelling. Many of the pieces are so closely allied to Mayan artifacts as to be almost indistinguishable. At the same time, these coast cultures possessed individual characteristics indicating an intense local development.

In the interior of Ecuador investigations in the province of Chimborazo have revealed stratified culture sequence (not as yet discovered on the coast), where six epochs appear to be present, before the comparatively late invasion of the Inca northward from Peru. Much remains to be done in this important field; most of the region of Colombia, especially where the continent approaches the Isthmus of Panama, still awaits examination.

Peru.—On the coast of Peru, are conditions not found elsewhere in ancient America. The entire stretch of coast, except for the narrow strips watered by streams, is a parched and rainless region, where there are numberless ancient cemeteries. In these are preserved, to a degree not found in any other part of the Western Hemisphere, everything that was buried in the graves hollowed in the nitrous sands. Owing to these unusual natural conditions little relating to the material culture of the ancient inhabitants of the Peruvian coast has been lost, and we possess greater knowledge of their arts and crafts than of any other aboriginal American people. The Inca, or more properly the Quichua, were not the originators of the complex of cultures, nor did they form the mass of the coast population. They came down from the mountains in comparatively recent times, and were the heirs of at least four cultures, or succeeding epochs or periods of civilisation, which had developed in sequence on the coast and in the great Andean valleys. Although the Inca dominated the region along the coast when the Spaniards arrived, they had made little impress on the arts and crafts of the coast people. That man has existed for a considerable period on the Peruvian coast has been demonstrated amply by the archaeological researches of Uhle, in the Chincha valley, at Ica, Pachacamac, Ancon, Moche and other places, and we now know with a degree of certainty something of the character of the different pre-Inca culture epochs.

Quipus.—Unlike the great Nahuan and Mayan civilisations of middle America, the civilised people of South America never developed a system of hieroglyphic "writing," but they invented a device of an exceedingly ingenious nature for recording numerical records. The quipu or knot record was a simple but clever primitive method of tying knots on a string. Locke has established the numerical value of the knots on the pendent strands of the quipu. A number was arranged in decimal notation, with the units or ones at the lower end of the strand. The tens were tied above the ones, and the highest order appears nearest the main or parent strand. The number in each order above the ones is usually a group of single knots, not exceeding nine, while the ones, or lowest order, is represented by a long knot. When the items listed were in groups it was customary to group the strands on the main strand, and frequently a top strand served to sum up the numbers in the pendent strands to which it was attached. A colour scheme was in use with certain colours for the different kinds of things recorded. Nordenskiöld has now followed up this discovery by calculations based on a number of quipus, and indicates that many of them appear to have been of a calendarial nature in connection with calculations concerning the length of the year based on observations of both solar and lunar years, for astrological and divinatory purposes. If the studies of Nordenskiöld are proved to be sound, it will be possible to place the ancient Peruvians on the same intellectual plane as the ancient Mayans of Yucatan and Central America.

Chile.—To the south of Peru, it has been established that in northern Chile, there were in early times several cultures chronologically considered, the so-called Atacameno standing out as the leading people of this part of South America. This culture flourished in the desert of Atacama, reaching from the Chilean coast eastward to high altitudes, and into northwestern Argentina and southern Bolivia. It appears to have been related to the Diaguite or Calchaqui culture of Argentina. Late researches in the coastal area have revealed undoubted stratified deposits which have attracted the attention of students, and promise ultimately to yield much information pertaining to the early history of this interesting region.

Argentina.—Knowledge of the archaeology of Argentina is confined chiefly to its northwestern provinces. Here the climatic conditions are similar to those of the desert regions of Peru and Chile; hence perishable materials have been preserved to a remarkable degree. The country has been extensively explored in recent years by Argentine archaeologists, whose researches have revealed certain striking similarities in types of artifacts with those of southwestern United States. There seems to have been more than one culture in this great region, but the most generally recognised has been called Calchaqui, now more usually known as Diaguite. Of the language and affiliations of the Diaguite people nothing is known, but there is evidence of an invasion from the Andean region of Peru and Bolivia that profoundly influenced this culture, probably in relatively modern times.

(M. H. S.*)

XIX. AIR SURVEY

Long before aeroplanes were invented it was confidently hoped that vertical photographs would some day be taken, and it was felt certain that, if so, they would greatly assist archaeology. Maj. Elsdale was the pioneer of air-photography in the British Army. Between about 1880 and 1887 he carried out many experiments from free balloons; but ballooning was not much in favour then and, although some progress was made, he received little or no official support in his experiments

During several years immediately preceding the War, Mr. Henry S. Wellcome successfully used large box-kites, with specially devised automatic control cameras, for photographing his archaeological sites and excavations in the Upper Nile regions of the Anglo-Egyptian Sudan.

During the War, when aeroplane photographs first became common, it was expected that archaeological features would be observed; but in the British sector in France none were seen. The photographs were often taken at a great height, over country which is archaeologically barren, or which was too rankly overgrown to show results. Only on other fronts was time found for archaeology in the air. Colonel Beazeley observed and photographed in 'Iraq in 1917, cities whose ruins were unintelligible on the ground. On an air-photograph these ruins were seen as an orderly arrangement of streets and houses. This definitely proved that air-photography could add to knowledge, and that it would be an invaluable aid to excavation. To Col. Beazeley, therefore, is due the credit for the first actual application of aeroplane photography to archaeology.

The birth of the new study in England, however, dates from 1922 when Air Comm. Clark Hall observed certain curious marks on R.A.F. air-photos taken in Hampshire. With him must be mentioned Flight-Lieut. Haslam, who took a number of photographs near Winchester showing what turned out to be prehistoric fields. Air Comm. Clark Hall showed these photographs to Dr. Williams-Freeman and Mr. O. G. S. Crawford, Archaeology Officer of the Ordnance Survey, who saw that their expectations were fulfilled, and even surpassed, by what was revealed. It was possible from these photographs to make a map of the prehistoric field-system near Winchester.

Popular interest was first aroused by Mr. O. G. S. Crawford's discovery and publication of negatives showing, for the first time, the complete course of the Stonehenge avenue (eastern branch). The photographs were taken in the dry year of 1921 by the Old Sarum squadron; but their archaeological importance was not recognised until two years later, in 1923.

The most important archaeological air-photographs obtained are those taken during 1924 by Mr. O. G. S. Crawford and Mr. Alexander Keiller. An aeroplane was specially hired, and about 300 photographs of archaeological sites were taken.

Outside England little has been done except in 'Iraq, Palestine and Egypt. In Palestine many sites have been photographed by the Royal Air Force, at the suggestion of the Dept. of Antiquities. A photograph of Masada on the Dead Sea is to be described and published shortly in the *Journal of Roman Studies*. In Egypt valuable archaeological results were secured as a by-product of the 3rd Nile Aerial Survey (1922). Oblique photographs have been taken of Numantia in Spain but obliques are always inferior in archaeological value to verticals.

It is usually imagined that the camera, when fixed in an aeroplane, records marks on the ground which are invisible to the eye of an observer. That is not so. The observer can see these marks more plainly than the camera records them, for he sees them in colour. The most remarkable discoveries that have been made are due to plants, which are sensitive to slight differences of soil and moisture. For example, if a ditch has been dug on a chalk down and the down has afterwards been ploughed flat and sown with corn, for ever afterwards the subsoil filling (or silt) of that ditch differs from the adjacent never-disturbed soil. Nothing can ever restore chalk once dug to its former state. Archaeologists have long know this, for one of the principal needs in excavation is to distinguish between disturbed and undisturbed soil. But one cannot dig up a whole field or several fields to find a ditch which, after all, may not exist. Here it is that a vertical view helps; for the effect of this moister and more fertile silt upon a crop of corn is to promote its growth and deepen its colour. Thus from above one sees, and can photograph, a belt of darker green corn following the line of the vanished ditch. These lines are sometimes visible on the ground, from across a valley, or even at closer quarters. Sometimes (as in parts of the Stonehenge Avenue) they are quite invisible. But always, when more than a single ditch is concerned, the distant view is necessary to convert chaos into order. The reason for this necessity can best be explained by means of a comparison. If one looks through a magnifying-glass at a half-tone illustration made through a coarse screen, it ceases to be seen as a picture and becomes a meaningless maze of blurred dots. If one holds it some distance off and looks at it with the naked eye it becomes a picture again. The observer on the ground is like the user of the magnifying-glass; the observer (or camera) in the air resembles him who looks at the picture from a distance. (*See* Surveying)

The majority of prehistoric sites, and many later ones, were a maze of ditches and pits, dug for drainage, storage, habitation, defence or boundary purposes. Many still exist on the downs, undisturbed and turf covered; many more have been flattened by cultivation. All of the latter can be re-discovered by air-photography, provided only that the arable has not been allowed to revert to grass. Even then traces of the ditches are sometimes visible, especially on poor soils and in dry summers, by a belt of darker green. Air observation, however, is most fruitful when young crops are growing; then discovery is easy and rapid, and every flight is productive. Such sites may afterwards be seen to exist by an observer on the ground; but few of them could ever have been discovered except from the air. Chalk is not the only soil that produces these streak-sites; they have been observed on oolitic limestone near Bath and plateau gravel near Exbury.

Other factors enable air-photography to record ancient sites. Prehistoric cultivation-banks are revealed because they either throw slight shadows or because when ploughed they appear as belts of lighter soil, from the chalk grains mixed with them (see plate). From photographs the prehistoric field-system of a district can be accurately mapped. Again, rabbits work in the looser silt of filled-up ditches (as well as in the soil of the lynchets), and if there are many rabbits a white line, or row of white patches, is visible from the air. Daisies and poppies grow from choice above these ditches, and barrows and hill-top camps have thus been revealed by white and scarlet circles.

Lastly, the low shadows at sunrise and sunset etch the slopes of low banks in deep black. That is the time to photograph lynchets. On a June morning before breakfast the greater part of Salisbury Plain is seen to be covered with the banks of abandoned Celtic fields; but afterwards they "fade into the common light of day." The great ramparts of hill-top camps throw a shadow even at mid-day, but are best photographed when the sun is low, for then not only do the ramparts stand out best, but also the banks and pits of the habitations within.

Hambledon Hill, Dorset, England (see fig. 1 on plate), one of the finest hill-top camps, on an isolated hill about 300 ft. above the surrounding country. The entrance of the camp is protected by a hook-like prolongation of an outer rampart; from it led a pathway within the camp, passing between oblong and circular pits, the site of huts. Those, especially in the middle portion of the camp, are very clearly seen, and beside them is a Long Barrow, far older of course than the camp, which was probably made in the Early Iron Age. Across the narrow ridge connecting the hill of the camp with the next hill, was built a formidable double scarp-to-scarp rampart; and beyond this can be seen the faint outline of a probably older camp (only partially included). The hill must have been permanently inhabited.

Note. A scattered flock of sheep in the inner portion of the camp will give some idea of the scale of the photograph.

Oakley Down, Dorset, England (see fig. 2 on plate), between Salisbury and Blandford, on chalk soil, now covered with turf. The principal features are: (1) The raised causeway of the Roman road running diagonally across the picture, (2) a group of round barrows, or burial mounds of the Early Bronze Age, older than the Roman road, through two disk-barrows on either side of it, (3) a network of Celtic fields, particularly noticeable in one corner of the photograph. In the valley below is the remains of a contemporary pond (very large, but now dry), and there are signs of Celtic ploughing on both sides of the Roman road.

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(O. G. S. C.)

ARCHANGEL (*see* 2.356), Capital of the province of Archangel in the Russian Socialist Federal Soviet Republic. In 1925 its population was about 35,000. It is governed by executive committees elected by the local congress of Soviets. The principal industry is sawmilling.

The population practically doubled between 1914 and 1916. Warehouses and other buildings, an electric light and power plant, and a tramway in the main street were built. On the side of the river, where the railway station stands, some miles of wooden houses sprang up. To cope with increased traffic a start was made in 1916 with the conversion to broad gauge and the double tracking of the railway to Vologda, this work being completed in 1919. The railway terminus was enlarged and the road to Leningrad was remade to carry a military motor service. Two of the largest ice-breakers, in addition to the one already in use, and several big floating docks were installed in the port, and numerous jetties and quays were built. But facilities for the handling of guns, munitions, etc., remained inadequate; and added to this difficulty was the fact that after the closing of the Baltic and Black Sea harbours, Archangel was the only available Russian port served by a railway, and was therefore called upon to handle the whole of the wheat exports. Continuous dredging has to be carried on during the summer in the harbour, which is accessible for vessels drawing up to 21 ft., but only those of under 20 ft. draught can cross the bar and shoal in one tide.

History.—After German mine-layers had visited Archangel in 1915, a unit of six British trawlers was sent, but till 1917 they engaged only in mine-sweeping and escort work. A difficul problem arose after the Russian collapse in 1917, when vas quantities of stores and coal were lying in the port. Subsequently British and French cruisers were sent to hold the coast and when the Germans were in Finland in May 1918 troops were sent; these occupied Archangel with little opposition on Aug. 1918, and advanced up the railway in conjunction with a flotilla on the Dvina. In the same year N. Tschaikovsky, a socialist who had been exiled in England, overthrew the rule of the Soviet Commissars and set up a provisional northern government in Archangel and Murmansk with himself as president. The town councils and courts of law were re-established, and in September a conference of northern co-operative associations was held to consider the economic organisation of the district. Tschaikovsky's party joined the British in operations against the Bolsheviks and the campaign was carried on after the World War, the evacuation of Archangel not being completed till Sept. 1919, when the city was again in Bolshevik hands.

ARCHER, WILLIAM (1856–1924), British critic (*see* 2.362), became dramatic critic of *The Tribune* in 1906 and afterwards of *The Nation* and *The Star*. In 1921 his play *The Green Goddess* was produced in the United States and subsequently in London with great success. In 1923 he published *The Old Drama and the New*. An acute, rather than a sympathetic critic, he, nevertheless, must be applauded as not least amid the influences determining the renaissance of the British drama. He died Dec. 27 1924.

ARCHERY (*see* 2.362), a pastime which has recently enjoyed a considerable increase in popularity.

At the beginning of 1914 there were in Great Britain no less than 75 recognised archery societies and, though the standard of shooting, as compared with that of the period 1855–80, had, no doubt, deteriorated, yet slowly but surely interest in the sport was reviving. Then came the World War and archery in common with other sport was dropped or at most indulged in merely to keep the clubs going and afford the War workers some temporary relaxation. The Royal Toxophilite Society, the leading society in the kingdom, held no meetings from 1915 until 1919, and all the public meetings were abandoned.

When the War came to an end, great efforts were made by archers all over the kingdom to revive the sport; new clubs were formed, old clubs were revived and, on the whole, it may be said that there are now more votaries of archery, especially among ladies, than for many years past. Toward the close of the War, the Royal Toxophilite Society had been forced to relinquish its ground in Regent's Park, London, and to accept for a time the hospitality of the Honourable Artillery Company in Finsbury, while endeavouring to obtain a fresh ground in London. After two years, new headquarters were found in the neighbourhood of Hyde Park, the ground was laid out and a small clubhouse obtained near it. The Society was reorganised, ladies being, for the first time, admitted as members. In 1925 the Bowyers' Company once more offered two gold medals for competition among the best shots in the kingdom, on the society's ground. In this year were revived the various championship meetings, namely the Grand National, the Grand Western, the Grand Northern, the Southern Counties, the Leamington and Midland Archery Meeting and the Hereford Round Meeting.

Archery in the United States.—No international meetings have yet been held, though archery has made considerable headway in the United States, as is proved by a comparison of the scores made in the American and English championships in 1924. The American champion of that year, S. Jiles, made 889 on the double York round as against 880 made by the English champion, W. A. Inderwick; while the lady champion of America, Miss D. D. Smith, made 575 on the double national round as against 580 made by the English champion, Mrs. Shillito.

A comparison of some of the best scores, made since 1895, reveals the fact that while H. A. Ford's 1,251 for the double York round is unapproached, yet scores of over 1,000 have been made

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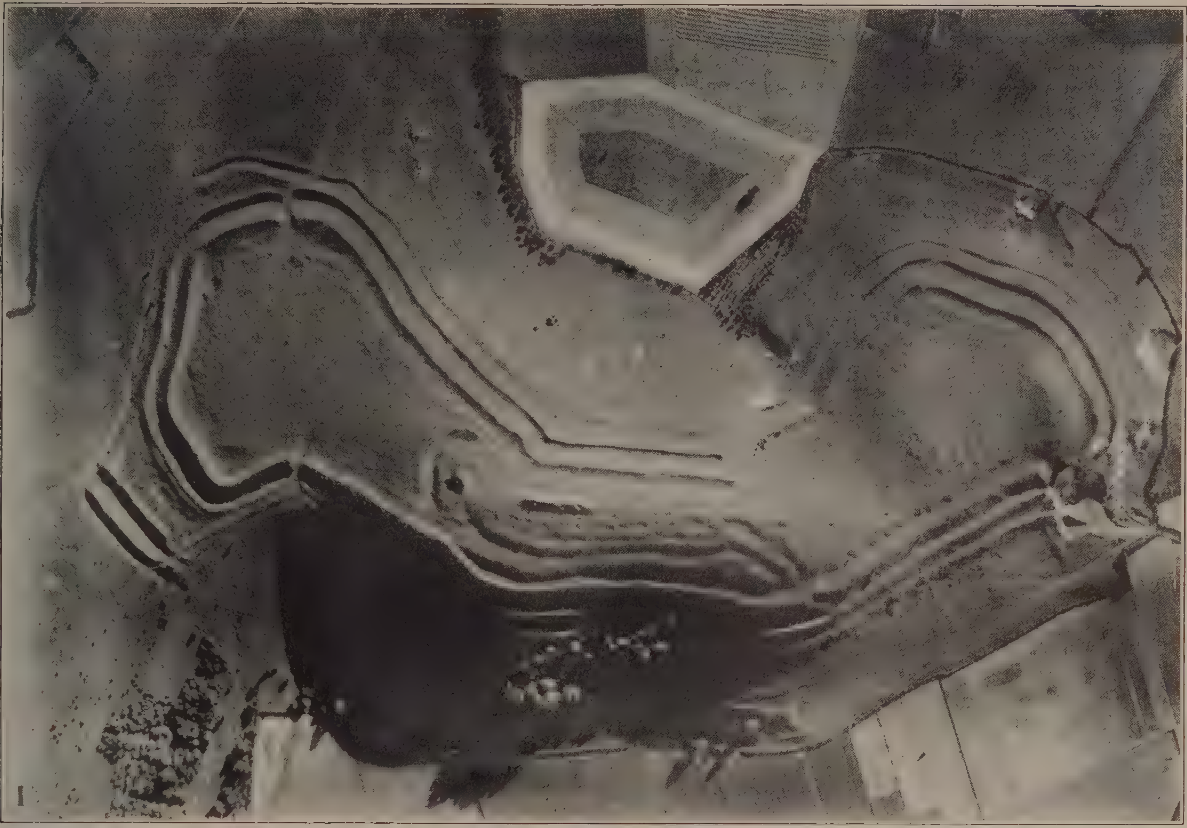

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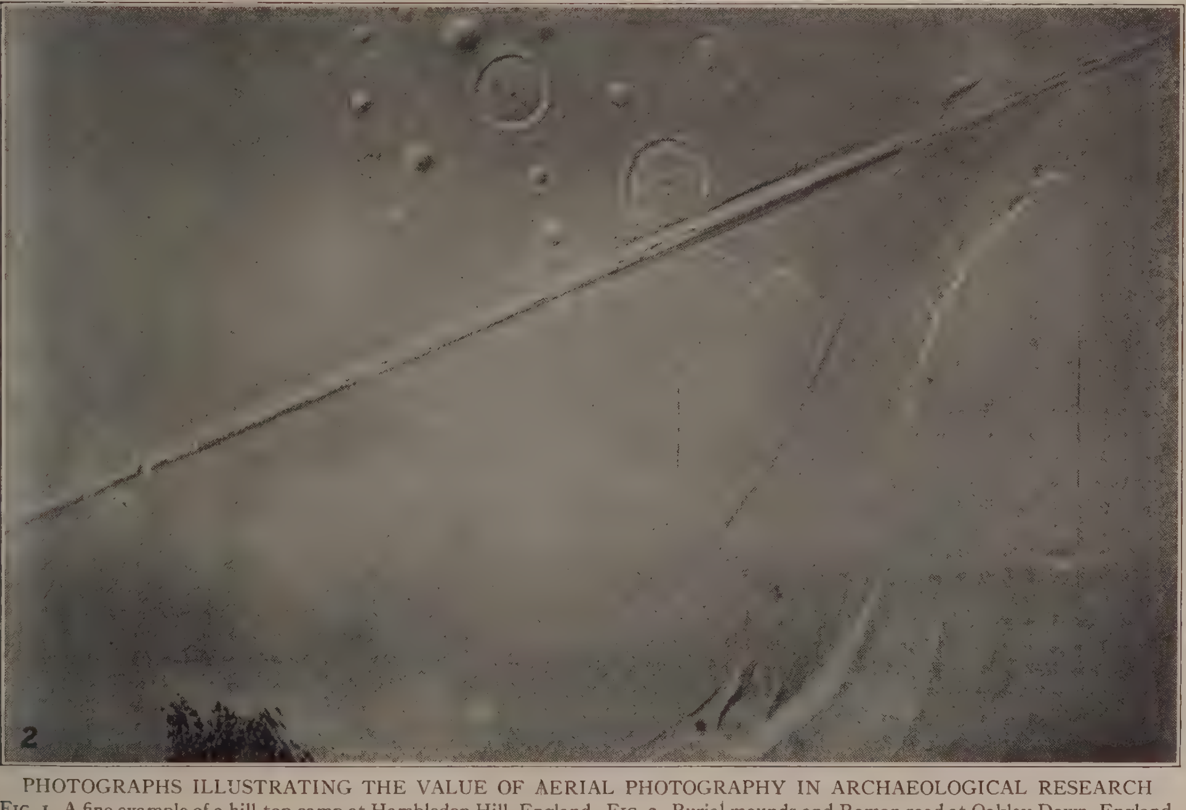


PHOTOGRAPHS ILLUSTRATING THE VALUE OF AERIAL PHOTOGRAPHY IN ARCHAEOLOGICAL RESEARCH

FIG. 1. A fine example of a hill-top camp at Hambledon Hill, England. FIG. 2. Burial mounds and Roman road at Oakley Down, England.

by F. A. Govett (1,004), C. E. Nesham (1,027) and H. P. Nesham (1,067), the last-named in 1912, while in 1913 C. K. Philips made 982. On the single York round an examination of club records shows that some remarkably fine scores have been made since 1910, notably 114 hits totalling 592 by C. K. Philips in Oct. 1913; 112 hits totalling 574 by H. P. Nesham in Nov. 1912; and 100 hits totalling 524 by Spencer Madan in Oct. 1912, besides many other scores of 500 and over. In 1925 the highest recorded club score for the single York round was 497 by E. H. Nelson. (E. H. P.*)

ARCHITECTURE (*see* 2.369).—To review the progress of architecture during the period 1910–26 in the world at large, and more particularly in America, Great Britain and the European continent, we should first understand the influences—social, political, industrial and educational—which lie at the root of an unprecedented construction development during this period. Strictly speaking, architecture is concerned only with those buildings which embody elements of beauty, or which at least vary from strict utilitarian necessities for the sake of better appearance. Undoubtedly the outstanding feature of the period under review has been a growing interest in, and enthusiasm for, the architectural improvement and embellishment of all types of buildings. We are, as a rule, no longer contented with purely utilitarian solutions of our problems. We demand improvement in the appearance of our surroundings, whether it be our homes, our workshops or our playhouses.

I. INTRODUCTION

Sixteen years may seem a very short time for a distinct change or even for any new tendency to develop in the field of architecture. If it took a century to modify a style in the past, how then can a decade and a half manifest any important change? The answer is simply that architectural forms change in direct ratio to the rapidity of building construction and building demolition. In the past, building was a slow, leisurely proceeding, expensive in terms of human energy; to-day power machinery furnishes most of the energy; consequently, changes in style, which are nothing more or less than period changes in the life of the people, occur more rapidly. A building which formerly would have taken five years to complete, can to-day be built in one year or perhaps less.

We can safely assume that five times the amount of building is now being done, and that therefore styles will change five times as rapidly, provided, of course, that there is a sustained demand for such quantities of building. In America this demand is enormous; old buildings give way to new, new buildings seem to rise almost over night; and in Europe, where the tendency is to retain and use what it already has, there is to be noted a marked tendency in the same direction, as, for example, the passing of Regent street and the Kingsway development in London and the Continental cutting of boulevards in Paris and in Rome. Since a nation writes its history in buildings and gives expression to its natural love of beauty through architecture, anything which so enormously increases both the size and the number of buildings must be accounted a potent factor in architectural development of all kinds.

Influence of the World War.—This demand for rapid building construction is largely the result of the influences of the World War. For a period of nearly five years, there was a complete cessation of building operations except for war purposes. The natural reaction was to make up for time lost. France has the tremendous task of reconstructing its devastated areas. In England the housing situation is an all-absorbing problem. In America, with its almost unlimited resources and wealth, better housing is a crying need, greater factories are required to supply the materials and the furnishings for these houses, and more business buildings are needed in which to conduct the commerce and trade resulting from renewed and augmented activity.

Such frenzied building activity has not always followed war. But the World War was singular in this respect: it entailed vast re-organisations of labour for the intensive production of war materials. The result was that labour in construction fields demanded and received wages out of all proportion to the scale formerly paid, and far above the rates paid to workers in other fields. These conditions in turn resulted in an expanding scale of living to which this large portion of the population would have attained under normal peace conditions only after a long period of years. The increased housing demand was a natural corollary of increased wages. The masses, more affluent than ever before, insisted on larger and better homes, more elaborate and expensive furnishings.

Rush to the Cities.—A further cause of building activity is the concentration of population in and near the larger cities. The World War is not alone responsible for this. Since about 1885 the rapidly increasing development of machinery has completely changed social relationships. Men and women who are no longer needed on the farms to produce food for the world have flocked to the cities to produce manufactured articles. The production and use of more and more articles, both necessities and luxuries, require more buildings to make them in, more buildings to sell them from, more buildings in which to transact the business arising from their manufacture and sale, and more homes to house the workers. In the words of a recent writer, "Production has played many parts in history; it has taken various forms. The form which it takes in this, the machine age, is strange and new. 'Consumption' is a new necessity, a new science. Through the centuries, the problem has been, how to produce enough of the things men wanted; the problem now is to make men want and use more things." With the concentration of population have come the corporation, the trust and the super-trust. Great buildings, great at least in bulk and cost, are required to house vast numbers of workers. Formerly a municipal or other government was the only agency which could build large structures; to-day private enterprises, through control of capital in large amounts, builds on a greater scale and more expensively than any government will or can build. This evident and rapid change influences every walk of life and thereby affects every building, no matter what its function. (*See* URBANISATION.)

DIVISIONS OF THE SUBJECT

At first glance, a division of our subject by countries would seem to be a natural one: American architecture, British architecture, French, Japanese, etc. It is a method frequently employed in architectural surveys, but all parts of the world have been brought so closely together, and each nation's knowledge of every other nation's activities is so complete and immediate, that such division would result in unnecessary duplication. One could hardly, for example, describe the modern architecture of Japan and not explain the British and American influence. Means of communication have so reduced time and distance that national styles are no longer mutually exclusive. The possibility that any nation in the future will develop a purely indigenous architecture is remote, for it would mean that the physical, material and spiritual status of its people had not been touched by modern inventions. We shall therefore discuss our subject, not by geographical boundaries, but according to those influences, industrial, commercial, social, educational, political and religious, which are the basic causes of all building development, and common to all nations. We have placed them in the order of their importance, considered in terms of capital investment and number of people involved. If computed in terms of human happiness and well-being, then possibly the order should be reversed.

II. INDUSTRIAL ARCHITECTURE

Under this classification we include all buildings in which commodities are made and stored, from the reception of the raw material to the production of the finished article. This field, while not usually discussed in a review of architecture, has now peculiar significance, because the present period of civilisation is normally neither an age of war nor an age of art, but a scientific and industrial age. Industrial plants, through combination and absorption, have grown far beyond the wildest imaginings of the 'eighties of the last century. Such growth is an accepted condition of our time, and the architect has a definite part in it. His problems in this field are large problems. To be sure, he is given little opportunity for the elaboration of detail, but he has great opportunity for interesting arrangements and impressive masses.

Only in the 20th century have such problems as steel plants, mining hoists, automobile works, etc., been considered in any sense architectural. Generally handled by engineers with practical considerations only in view, the architect had no essential part, but was called in, if at all, to add a bit of "dressing" to a predetermined structure. To-day, however, the large corporations have come to realise more and more that beauty in its broadest sense is a commercial asset.

Importance of the Architect.—The architect, by training and experience, has a more comprehensive sense of arrangement than the engineer or the contractor. A prominent builder in the industrial field says: "There is not much doubt that the very finest industrial buildings which have been built in the years between 1915 and 1925, the finest in general effectiveness as well as in appearance, have been produced under the direction of architects. A certain distinctive appearance, a certain completeness of design, a more perfect interior arrangement and a general suitability seem more likely to prevail when the largest industrial buildings are handled through an architect's office than when an architect is not in the picture." The architect is consulted to advantage from the outset of the problem; choice of site, plan arrangement, types of construction, fire prevention, natural lighting, welfare provisions, plumbing, heating and ventilation, and artificial illumination are all matters of consideration in the design of any building.

Reinforced concrete, a form of construction in increasing use, is peculiarly adapted to industrial plants. In the earlier examples it was used in imitation of other and more customary building materials, with forms of ornamentation such as cornices, architraves, arches, etc., borrowed from older buildings of the masonry type. Later examples show a great improvement in this respect; the concrete is used with the greatest simplicity of form, and all extraneous embellishment omitted. Effects are secured by carefully studied proportion and massing. (*See* FERRO CONCRETE.)

The City Factory.—The factory in cities is beginning to take on city dress. The open labour market commonly causes a large industrial plant, especially in such work as garment-making, to build in the heart of a city. Such a plant should not be a blot among fine buildings, but should be in harmony with its surroundings. (*See* FACTORY DESIGN.)

The plan problem is as varied as the nature of the work carried on, but industrial plants may be divided into three types, depending on the different kinds of enclosed spaces: (1) plants of large area, of only one floor, top lighted; (2) plants of large spaces for great machines, travelling cranes, etc., in conjunction with smaller spaces of the ordinary type; (3) plants of ordinary spaces, many storeyed and dependent on light from the sides. The first type furnishes simply a problem of building over large areas and with "saw tooth" skylight construction; the second involves engineering for broad spaces, but both clerestory and top lighting are possible; the third type does not differ from the ordinary many-storeyed building built for commercial work.

III. COMMERCIAL ARCHITECTURE

Commercial architecture includes all buildings in which the purchase, sale, exchange and transport of commodities is carried on, and in which the financing of business enterprises is negotiated. It covers a wide field. With industrial architecture, to which it is closely allied, it constitutes by far the most important architectural development since 1900, not alone as measured in terms of quantity, but in terms of actual progress as well. The necessities of industry and commerce have developed a striking and significantly new architecture, highly expressive of our own age. The whole trend in the commercial field is toward larger and larger units—larger office buildings, larger department stores, larger banks, larger railway stations.

The increase in the height and mass of commercial buildings (and we shall see later wherein this applies to hotels and apartment houses as well) is perhaps the most phenomenal feature of this development. Many misapprehensions exist as to its cause. One of the most persistent is the belief that in New York, where the so-called sky-scraper has received its chief development, the long, narrow shape of the island forced growth upward. This is far from the truth. There is still plenty of room for lateral expansion on Manhattan Island. The tall buildings form a narrow ridge through the center, following the general course of Broadway. Should all the buildings on the island proper be reduced to an average height, they would probably not exceed seven or eight storeys. This contention is proved by the rapid appearance of groups of tall buildings in many other cities where the special topographical conditions of New York do not exist.

The truth is that increased concentration makes for increased efficiency in commercial operations. It is probable that the tall building originated in the desire of real-estate owners to exploit small and heavily-taxed property holdings. Increased revenue could be obtained from a small area of land by building upward. The sky-scraper has proved invaluable to efficiency in business, for, in the final analysis, all important business affairs are negotiated through personal contact, in spite of telephone, telegraph and other substitutive means of communication.

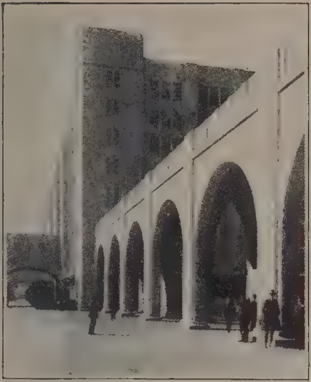
Office Planning.—Since the office building of the sky-scraper type is the most distinctive example of commercial architecture, let us consider it in detail. The usual procedure in most plan studies is to start with the ground floor and build up. But in planning office buildings (and this applies to hotels as well) the architect reverses this process and plans from the top down. That is to say, he develops a typical upper-floor plan first, because the major income is derived from these typical floors, and if some sacrifice is to be made, it can better be made on the ground floor than on the office floors. A typical office unit is first determined upon, a series of such units is arranged along both sides of a corridor, and then the line of vertical circulation (lifts or elevators) is fixed at a central point on this corridor so that no tenant is obliged to walk more than 100 ft. from his office door to an elevator. Utility spaces—toilets, cleaners' closets, vent shafts, flues, etc.—are then added and the plan is completed.

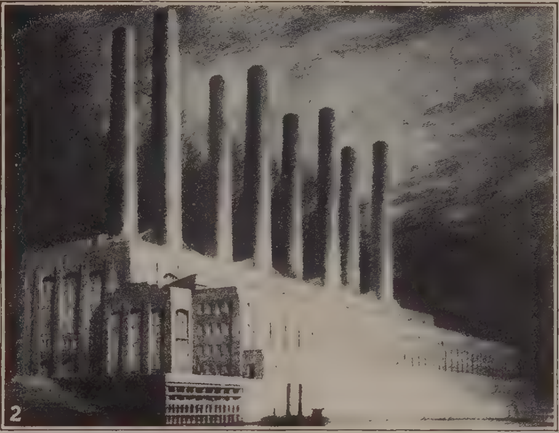
Authorities differ as to what constitutes the ideal office unit; they agree, however, that it is better to have less space (less capital investment) permanently rented at a high figure than much space partially rented at a low figure. Lighting is the important factor here. The depth, *i.e.*, distance from windows to corridor, of a well-lighted office is never more than twice the clear ceiling height. Twenty feet is better than twenty-five. The width of the unit varies with the distance between steel columns, which economical engineering consideration places at not less than 15 or more than 22 feet. The diagram shows a typical office unit with internal divisions, each of which can be subdivided into smaller rooms in a single large office unit. Although a 4-ft. corridor might serve all practical purposes, the width should increase with the length for the sake of beauty of proportion. Corridors should also increase in size as they approach the elevators.

The building lot at the architect's disposal determines, of course, the arrangement of offices. The plot plan diagram given herewith shows possible dispositions on three standard lots. It will be noted that "dark" spots, such as always occur where a wing joins the main buildings, are used as far as possible for the necessary utilities, such as elevators, stairways and smoke towers. Toilets can be artificially ventilated and lighted, but it seems better to place them on small back courts, which furnish inferior office space at best, thereby retaining some degree of natural light and full natural ventilation. The British building laws require outside toilets, always; that is, they must always have outside windows, no matter how much artificial ventilation may be provided.

Staircases and Elevators.—In American office buildings, stairways are little more than fire-escapes. As the law requires them to be entirely enclosed with fire-resisting walls and doors, they are never conspicuous and are rarely visible. In England,

ARCHITECTURE (Industrial and Commercial)





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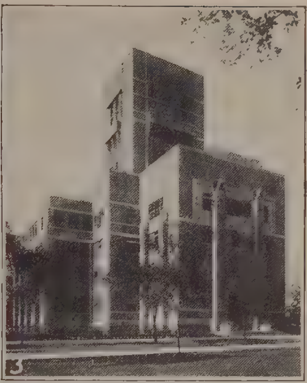

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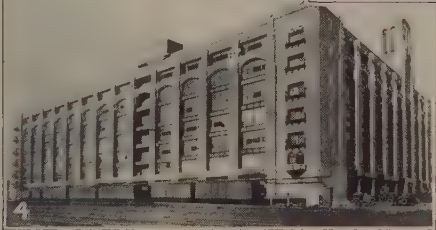

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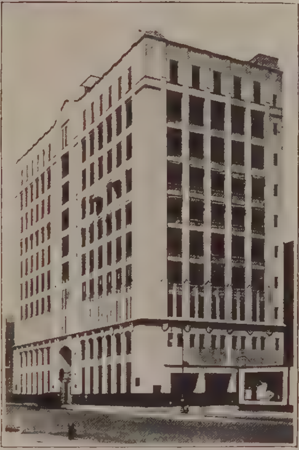

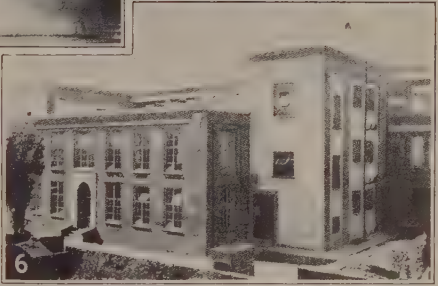

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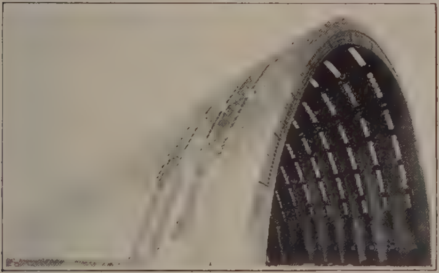

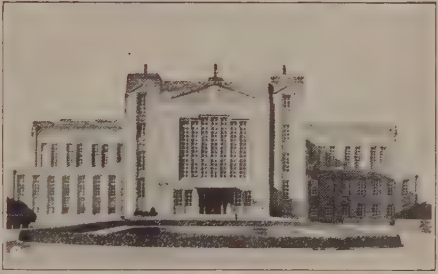

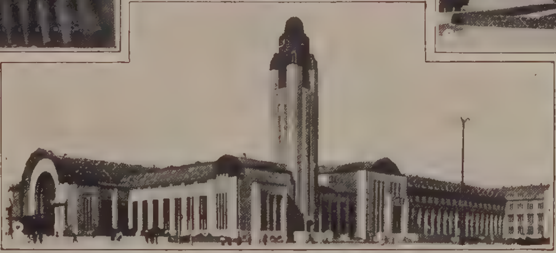

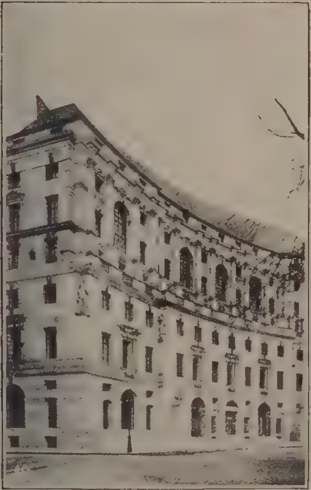

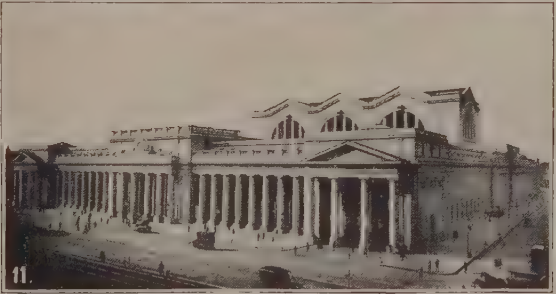

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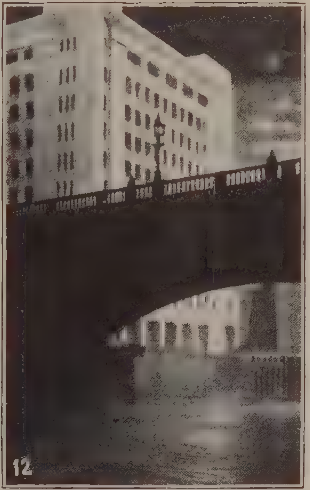

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FIG. 1. Army Supply Base, Brooklyn, N. Y., Cass Gilbert, Architect. A simple but effective use of concrete.

FIG. 2. Cahokia Power Station, Illinois, U. S. A., Moran, Russell and Crowell, Architects. Study in mass, using great stacks as dominant feature.

FIG. 3. Bunte Bros. Factory, Chicago, Illinois, U. S. A., Schmidt, Garden & Martin, Architects. Effective use of brick and stone simply treated but with interest at final points.

FIG. 4. R. R. Donnelley & Sons Co. Printing Plant, Chicago, Howard Shaw, Architect. Practical conditions solved for mass interest and yet delicate detail.

FIG. 5. Fletcher Bldg., N. Y. City, Helmle & Corbett, Architects. City factory in concrete, using the structural recessing of wall as it rises, as basis of architectural treatment.

FIG. 6. Shoe Factory, Norwich, England, A. T. Scott & Sons, Architects. A good example of pleasing masses simply treated.

FIG. 7. Dirigible Hangar, Orly (S. et O.), France. Freyssinet, Engineer. Reinforced concrete in pure harmony of form and function.

FIG. 8. Railway Station, Helsingfors, Finland, Eliel Saarinen, Architect. Effective composition without use of conventional classic forms.

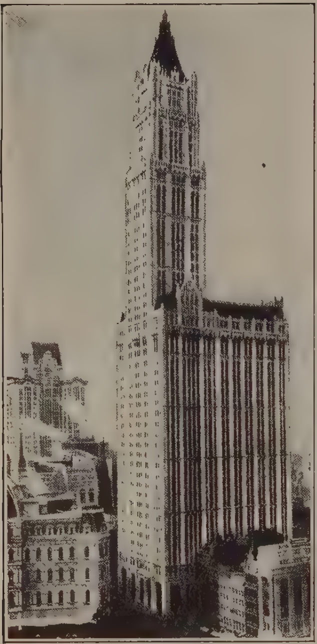
FIG. 9. Wireless Station, Nauen, Germany, H. Malthesias, Architect. Interesting composition in brick depending solely on mass and proportions.

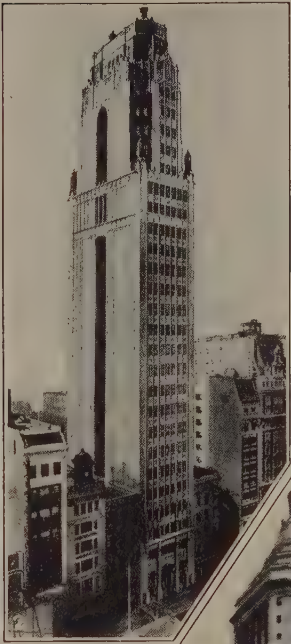
FIG. 10. Britannic House, London, Sir Edwin Lutyens, Architect. A variety of different openings charmingly harmonised by careful sense of scale.

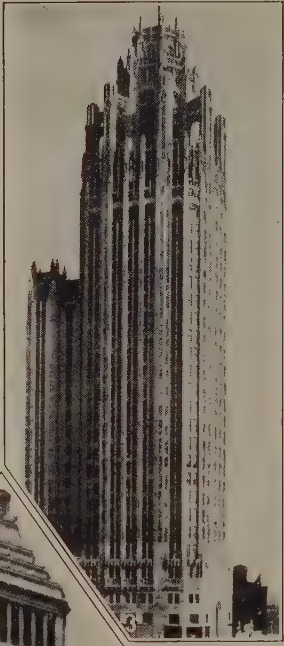
FIG. 11. Pennsylvania Station, N. Y. City, McKim, Mead & White, Architects. Classic architecture used most impressively.

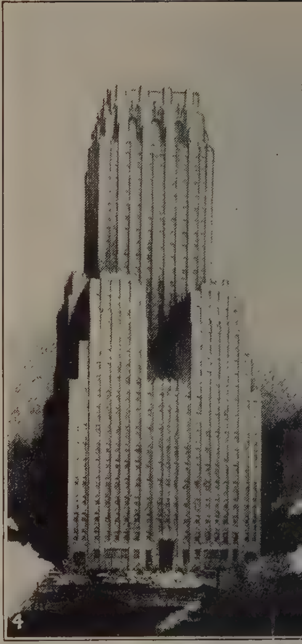
FIG. 12. Adelaide House, London, Sir John Burnet & Partners, Architects. Extreme simplicity within a well defined frame.

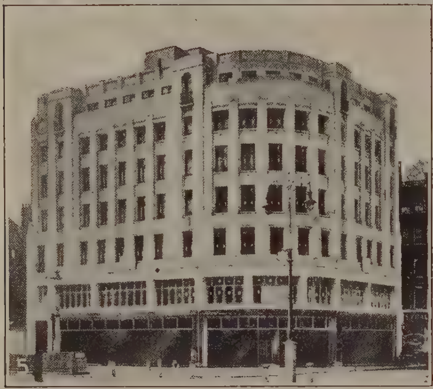
ARCHITECTURE (Commercial)

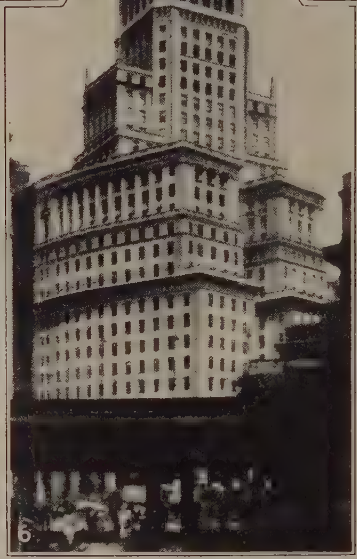


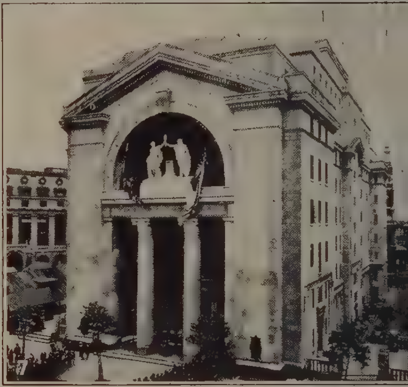


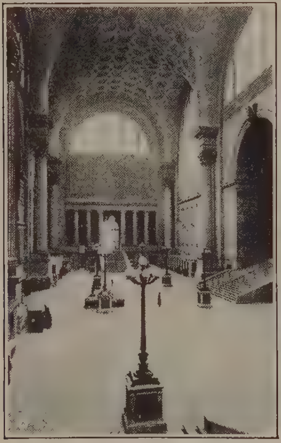


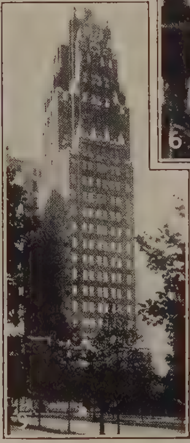


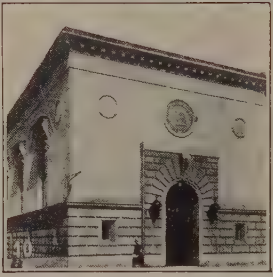


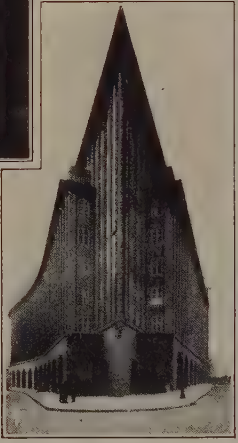


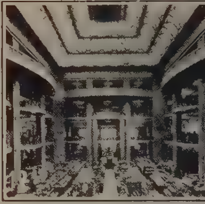












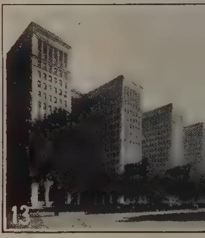


FIG. 1. Woolworth Building, N. Y. City, Cass Gilbert, Architect. Highest building. Vertical composition on a vertical mass.

FIG 2. Bush Building, N. Y. City, Helmle & Corbett, Architects. Building on a narrow lot, but architecturally treated on all sides.

FIG. 3. Tribune Tower, Chicago, Howells & Hood, Architects. Height accentuated by flying buttresses carried above height restriction for usable floors

FIG. 4. Telephone Bldg., N. Y. City, McKenzie, Voorhees & Gmelin, Architects. Striking example of the effect of height restriction with tower.

FIG. 5. Strand and Wellington Street, London, Trehearne & Norman, Architects. New simplicity in business building.

FIG. 6. Standard Oil Building, N. Y. City, Carrère & Hastings, Shreve & Lamb, Architects. Height restriction interpreted with classic feeling.

FIG. 7. Bush House, London, Helmle & Corbett, Architects. Architecturally treated with respect for importance of location at end of Kingsway.

FIG. 8. Pennsylvania Station Interior. McKim, Mead & White, Architect Impressive space inspired by ancient Roman baths.

FIG. 9. American Radiator Building. Raymond Hood, Architect. An inte esting experiment in black brick with gold trimmings.

FIG. 10. Philadelphia Savings Fund, Mellor, Meigs & Howe, Architects. simple bank expressive of security and wealth.

FIG. 11. Chile House, Hamburg, F. Hoger, Architect. Extreme modernis of questionable beauty.

FIG. 12. Bon Marché, Paris, L. H. Boileau, Architect. Interior of a large sto with skylight court and balconies, example of modern French.

FIG. 13. General Motors Company, Detroit, Mich., Albert Kahn, Architec Head Office of a very modern Trust.

where the height of buildings is limited to nine or at the most 10 storeys, there is one conspicuous open stairway and there are one or two sets of enclosed stairs.

Elevators are often the key to the plan scheme and are usually grouped together for greater service efficiency. Even small buildings have at least two (because of possible breakdown), and if more are needed on account of greater floor area or greater number of storeys, they are so placed that a tenant waiting for a car may be able to step easily to the first one that flashes a signal. A battery of six elevators, three facing three, is the ideal arrangement. Eight, four facing four, are possible. More than eight in one battery is not practical, because in such case the passenger might not reach the car before it had passed. If more than one system is installed, the systems must be separated enough for each to serve effectively an entirely new area, and the plan problem simply repeats itself, *i.e.*, two buildings side by side, but with connecting corridors.

Inasmuch as 100 ft. each way from the elevator line is the convenient limit one may go horizontally, 15 storeys is about the limit of effective service for a single battery. As the building with ground area for one group of elevators increases in height, it may require a battery of more than eight, in which case the problem becomes two buildings, one placed on top of the other, with the vertical circulation of the upper structure running through the lower as an "express" service. This general formula, however, is only partially applicable to buildings which diminish in floor area as they rise.

Lighting.—Window spacing and height is an important consideration. The usual bay between steel columns is from 15 to 20 feet. Experience seems to dictate the use of two windows in this bay. One window to a bay gives too much wall space and too little light; three windows give too little wall space and too much light. An even field of equally spaced windows is more elastic for interior division into offices. The amount of natural light is not as important as the quality of light. Windows located with regard to exterior architectural effect rather than to interior comfort and convenience sometimes extend nearly to the floor, while above is left a dark void of wall space and ceiling. Many windows of average size are preferable to a few large openings, just as several well-distributed ceiling lights in a room give better illumination than one powerful centre light. Too much glass surface causes economic waste and physical discomfort.

No general principles can be formulated for the planning of ground floors, basements and sub-basements, because conditions vary widely according to the local problem. The number of floors below the street level depends upon the height, and to some extent the location, of the building. Some very high buildings have as many as five floors below the pavement. Boilers and mechanical equipment are located on various of these lower floors according to the needs of the problem.

Zoning.—Building regulations naturally have a direct effect on city architecture. Early in the 18th century the building-height restriction in Paris produced the Mansard roof, which became such a fashion that it was widely adopted in cities and countries where no height limitation existed. Similarly, the London Building Act gave that city a distinctive character which has been preserved even in newer districts. And now the recently enacted zoning laws in New York, although their primary purpose is utilitarian, are creating a distinctly new style of architecture, one which bids fair not only to become a pattern throughout the United States, but also to influence European forms.

The ordinary sky-scraper, which was simply an elongation of the five- or six-storey commercial building made possible by the lack of height limitation, was in no sense a new form. Rather, it was a distortion of an old form. The new zoning law in New York does not prohibit the erection of sky-scrapers, but it considerably modifies their appearance. Its chief aim is to relieve street congestion, for, other things being equal, it is obvious that such congestion is directly proportionate to the bulk of the buildings flanking the street. The Paris law limits the straight vertical height to 20 metres; above that, additional storeys must remain within the arc of a circle of fixed radius. The London regulations permit of 80 ft. vertical height and two supplementary storeys which must remain behind a sloping line of 75 deg. from the horizontal.

In New York the vertical height is now determined by the width of the street, but varies according to the "zone" or district in which the given property is situated. These districts are classified as follows: "One-time" districts "one-and-one-half-time" districts, "two-time" districts and "two-and-one-half-time" districts. That is to say, the straight vertical height may be equal to the width of the street in residence zones; it may be one-and-one-half times the width of the street in certain residence and business zones; twice the width in the principal business centres and two-and-one-half times in the Wall Street financial section. For the purpose of the law, no street is considered less than 50 ft. or more than 100 ft. wide. Additional storeys above the vertical height must remain back of a line drawn from the centre of the street through a point on the top front of the vertical height.

The salient feature of New York is its towers, and it was considered wise, in framing the new zoning law, to permit the erection of a tower, which may rise to an indefinite height (limited only by structural possibilities and economic conditions), upon 25% of the total lot area. This has resulted in a very surprising and interesting form of architecture which is rapidly changing the aspect of the city, despite the fact that the law has been in force but seven years.

In Paris certain buildings of a monumental nature, either religious or governmental, may exceed the height limit. In London, towers purely for architectural embellishment but not for human occupancy, may pass the legal height. In New York, however, no restriction is made as to occupancy of the tower provided that the building remains within the given "envelope." Furthermore, the so-called "dormer" permit allows certain portions of the front of each building to rise slightly in excess of the maximum vertical height to give variety of outline. Above this the buildings are usually stepped back, forming a pyramidal series of terraces which vie with the storeyed magnificence of the hanging gardens of Babylon. The law has produced two other interesting results: first, the virtual elimination of interior light courts, these being cut in the side in order to preserve a base for the central tower; second, the tendency to assemble larger and larger plottage so that the 25% tower will be large enough to warrant construction of a great number of tower storeys.

Bank Buildings.—The plan problem of banks and financial institutions has changed little except in the space involved. Many mechanical improvements which affect lighting, ventilation and control have developed, and new inter-communicating devices to facilitate the rapid transaction of business are employed. Due in large part to exhaustive experiments made by the Federal Reserve banking system, established by Act of Dec. 23 1913, vault construction has made notable advances, certain types of vault being virtually impregnable to burglar and even mob attack. Although these practical matters are part of the architect's work, they do not materially affect the aesthetic problem. One tendency, however, which does concern the purely architectural aspect, may be noted. The main banking room, where the major part of the public transacts business, is becoming more and more the architectural feature of the interior. Even the officers of the bank, from the president down, are quartered in this space, and the various partitions necessary to separate bank employees and public take the form of screens, counters, rails, etc., which thereby become a kind of furniture rather than an architectural separation. Some of these great banking rooms are the most magnificent and richly treated spaces in modern architecture, comparable to the interior of government buildings, or even to palaces of the Old World.

Stores.—Following the trend of all commercial and industrial construction, stores are being concentrated in larger units. The small shop on the street level continues to exist, but it has produced nothing particularly new in design. On the contrary, many of the most distinctive have attained refreshing charm and simplicity by reverting to designs of a century ago. The great department store is the principal modern solution of the retailing problem. The building often covers an entire city block (sometimes even two), and is sometimes many storeys in height. By means of quantity purchase and elaborately developed service and delivery systems, the department store supplies the public with every kind of commodity so competing with the speciality shops.

In Paris and Berlin the centrally lighted " well " type of store, with its surrounding galleries, is still the rule and gives an impressive interior which is both airy and attractive. But in London and New York every inch of floor-space is utilised, and artificial illumination takes the place of the natural light proceeding from the skylight over the central well. In fact, American building laws in most cities do not permit the open well form of store because of fire hazard. In addition to the usual lifts, the movement of shoppers is facilitated by means of mechanical devices such as escalators and ramps and lifts. Intercommunicating belt conveyers, etc., are usually installed to speed the movement of merchandise.

Transportation.—Although architecture relating to transportation is here listed in the commercial category, transportation affects every branch of human endeavour more or less directly and might well be discussed under any or all subdivisions of the subject. The railway terminus is the most important problem the architect has to deal with in this group, bridges and viaducts being considered still in the light of engineering problems not susceptible of architectural treatment.

These mammoth stations are becoming an impressive feature of the modern city and offer fine opportunities for the display of architectural genius. There are two reasons for this: the tendency to combine the termini of several railways in a central or union depot, and the increasing realisation that railway stations are the real gateways to the modern city. First impressions are likely to be lasting ones, and no better point could be chosen at which to make an effective display. Even in many small towns and villages, stations are being erected in keeping with the local environment and designed with an eye to artistic fitness.

Generally speaking, two classes of people make use of a station; those travelling daily to adjacent suburbs, who know precisely where and how to go, and desire to reach their trains with the least possible inconvenience; and strangers who must make inquiries at every turn. The architectural problem is therefore to provide an entrance of generous proportions leading directly to a central hall where information booths, booking-offices, luggage-rooms, parcel deposits, news stands, etc., are convenient, and from which gates to trains, conspicuously marked, are readily accessible. Furthermore the movement of trains, luggage and freight involves engineering complications of no mean order. These exacting requirements have been met with notable success in several imposing structures since 1910. The Pennsylvania and Grand Central Terminals in New York, the Union station in Washington, D.C., and the new Union station in Chicago are some of the most impressive examples (*see* RAILWAY STATIONS).

IV. SOCIAL ARCHITECTURE

Under this heading we shall include all buildings for human residence, recreation, entertainment and health. Not many generations ago, all these activities were provided for in the home, where our forbears lived, entertained, played and cared for the sick and the infirm. To-day all these social activities are more highly specialised, and are more and more being taken care of in specially designed buildings. The theatre, picture house, public garden, amusement park, stadium, ball park, athletic field, etc., provide for recreation. The sick and dependent are ministered to in public and private hospitals, nursing homes, orphanages and homes for the aged, infirm, feeble-minded, etc.

Present-day dwellings are of five distinct classes: (1) the free-standing country home, which is becoming less usual; (2) the more compact city house, also fast disappearing; (3) the still more compact flat, or, as it is more usually termed in America, apartment; (4) the apartment hotel, a development of quite
cent years; and (5) the hotel itself.

Private Dwellings.—Before the World War, the building
country homes proceeded at a more or less normal pace. Ma
fine examples of very elaborate and distinctive architectu
appeared, with gardens, parks, terraces, fountains and inforn
and rustic settings. But since the War, the construction
homes by individual owners has diminished steadily. This l
been due not only to the burdens laid upon wealth, but to t
difficulty of obtaining competent domestic servants. The la
house is peculiarly dependent on this class of worker. B
drawn away from their usual pursuits by the War, the serva
class was at its close unwilling to return to domestic duti
Even small dwellings, in which the housework was formerly do
by members of the family, are now being brought into grou
and much of the domestic drudgery is provided for co-ope
tively. This tendency has been a fairly steady growth since 18
The factory has usurped more and more of the work of the hon
food is supplied in ready-cooked form; clothes are washed
quantity; heat and light are automatically provided. With l
and less of this kind of work to do, the modern home-dwel
finds that he or she wants none at all.

The War also gave great impetus to housing schemes. Pre
ing necessity forced governments, both national and local, a
corporations, both large and small, to provide habitations on
extensive scale. Town-planners studied the problem, overca
the difficulties, and incidentally proved that better homes, w
infinitely more healthful surroundings and better sanitary c
ditions, could be provided through paternalistic or benevol
direction than was possible through individual initiative.

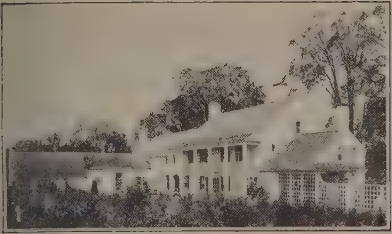
Apartment House or Flat.—Together with these housing
velopments, the modern apartment or flat building is the m
striking feature of social architecture. Apartments, especia
in America, are not confined to cities and towns where the c
centration of population might furnish an excuse; they ha
an increasing vogue even in the small villages.

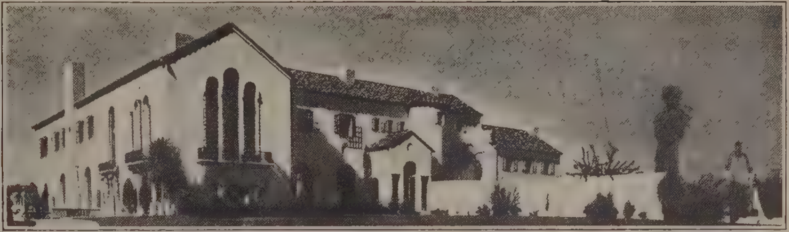
The apartment building is simply a combination of comp
homes one above the other. For many years Paris used t
type of dwelling extensively, and examples exist in many ot
large European cities. Recent apartment houses, notably
America, exhibit many new and architecturally interest
features. The plan problem consists of making a series of co
pact home units, each comprising a living-room, dining-roo
kitchen and one or more bedrooms and baths. These are
essentials, although a foyer or entrance hall, library and stu
may be added to the living-room; a breakfast-room, pantry a
servants' hall may be added to the kitchen and dining-roo
and a nursery and servants' rooms to the bedrooms. The
however, are merely supplementary to the basic unit.

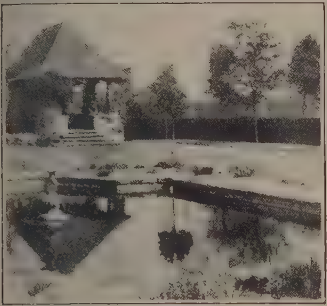
Apartment buildings are of two distinct types: the walk-
and the elevator or lift type. Any building over five or six store
requires a lift, and to be of practical value the lift must alwa
work. Since no mechanical device is ever perfect, good planni
practice requires that when lifts are installed there be a batte
of at least two in order to ensure constant operation in case o
breakdown. It might seem that the lift would change the pla
ning problem only in so far as it made more storeys possible.
course when there are only one or two apartments to a flo
either the lift or the stairway occupies a central location, and t
apartments are planned around this line of vertical circulati
as a starting point. But as the number of apartments per fl
in the walk-up type increases, additional separate lines of sta
ways must be added where needed. Lifts, however, being p
pendicular shafts, are kept together, thereby forming a ce
tral distributing point on each floor to a much larger number
apartments. This requires special planning.

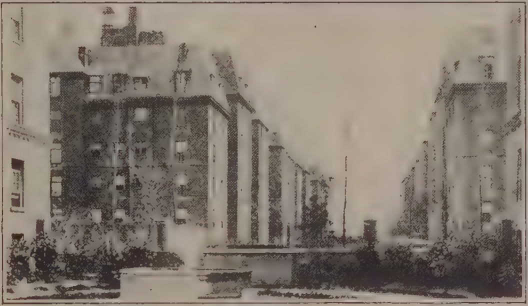
In arrangement the apartment unit is not essentially differe
from the old-fashioned home, except that in the apartme
which is the outgrowth of a desire to reduce the cares of hou
keeping, the several rooms must be placed with a view to co
venient intercommunication, and must be reduced in size to t
minimum. The living-room or parlour is the largest room, a

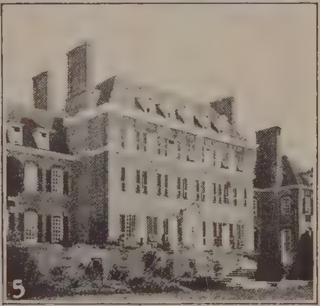
ARCHITECTURE (Social)











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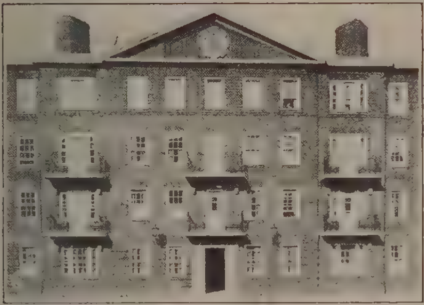

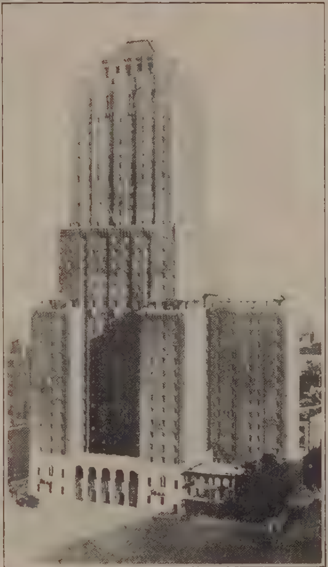

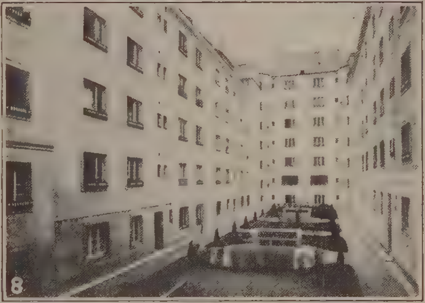

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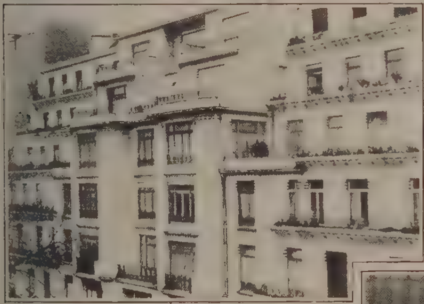

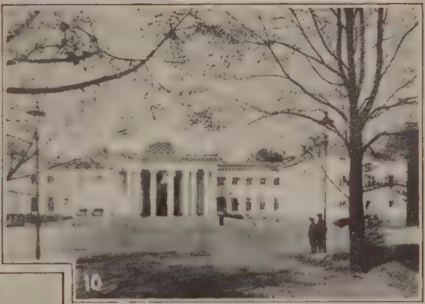

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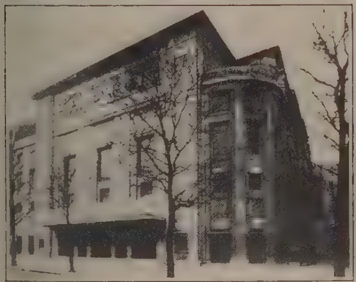

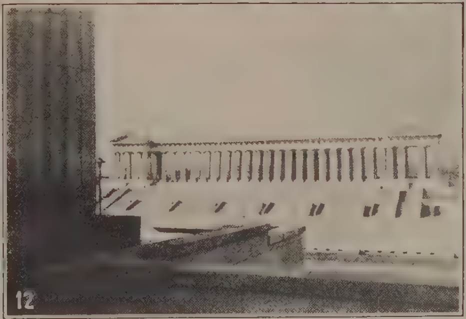

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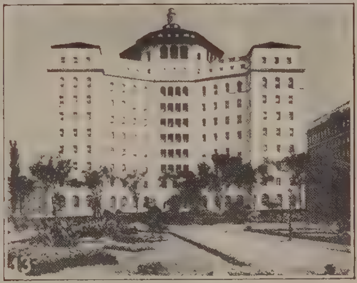

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FIG. 1. House, New Canaan, Conn., U. S. A., Calvin Kiessling, Architect. Wood architecture, early American Colonial style.

FIG. 2. House, Los Angeles, Calif., Harwood Hewitt, Architect. Spanish Mission style suitable to warm climate.

FIG. 3. Garden, Burdocks, Gloucestershire, England, E. Guy Dawber, Architect. Charming combination of formal and informal.

FIG. 4. Flats, Jackson Heights, L. I., A. J. Thomas, Architect. Example of concentrated housing with generous garden space.

FIG. 5. Great Maythern, Kent, Sir Edwin Lutyens, Architect. (Fine restoration.)

FIG. 6. Hortensia House, Chelsea, London, Percy Tubbs, Son & Duncan, Architects. "Walk Up" apartments simply treated.

FIG. 7. Shelton Hotel, N. Y. City, Arthur Loomis Harmon, Architect. Skyscraper apartment hotel.

FIG. 8. Apartment House (Wehrhausgruppe), Karl Ehn, Architect. Vienna Garden court view.

FIG. 9. Apartment House, Paris, Sauvage & Sarrazin, Architects. Interesting use of recessed upper storeys.

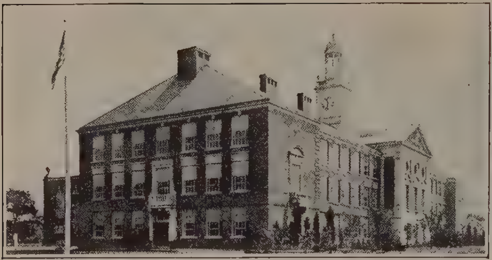
FIG. 10. Residence, Leningrad, I. Fomin, Architect. Classic influence.

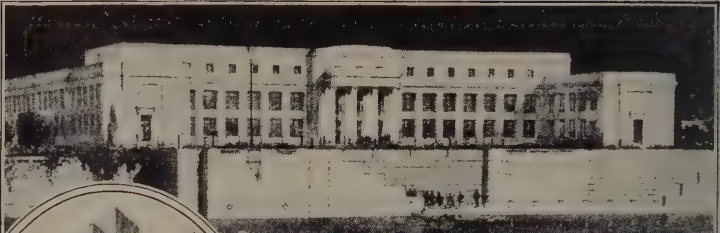
FIG. 11. Théâtre des Champs Elysées, Paris, A. & G. Perret, Architects. Modern solution of theatre façade.

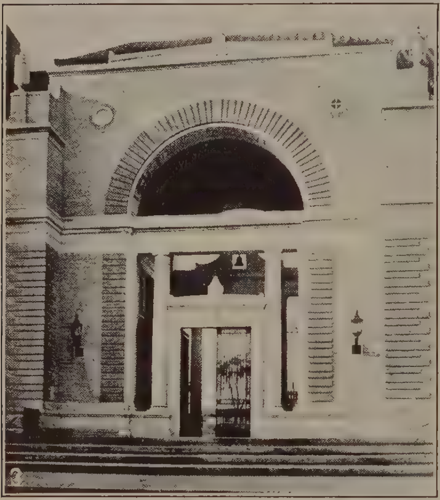
FIG. 12. Grant Park Stadium, Chicago; Holabird & Roche, Architects. Example of impressive civic provision for outdoor entertainment.

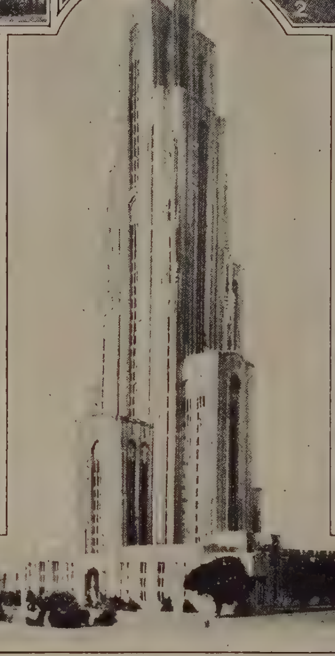
FIG. 13. Fifth Avenue Hospital, York & Sawyer, Architects. A city hospital planned for maximum light and air.

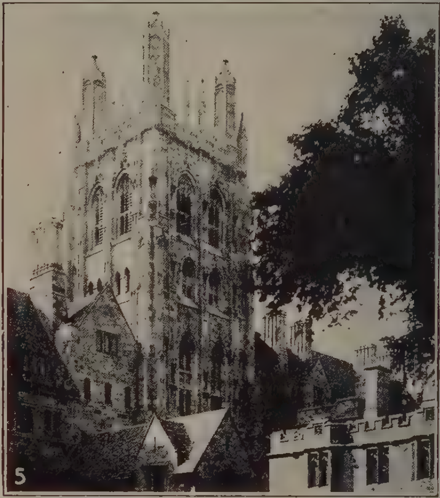
ARCHITECTURE (Educational)

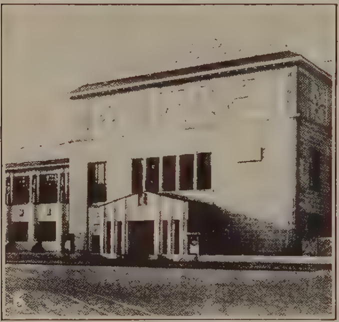


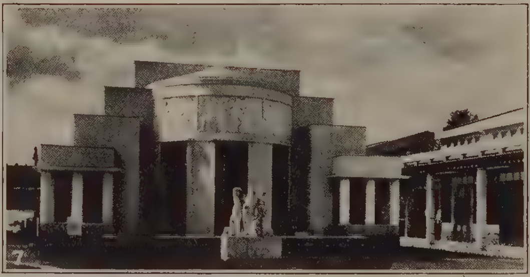


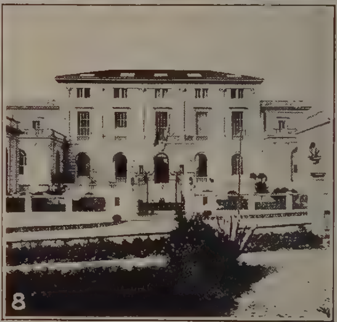


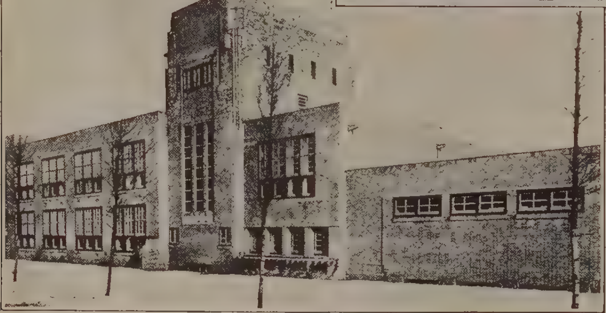












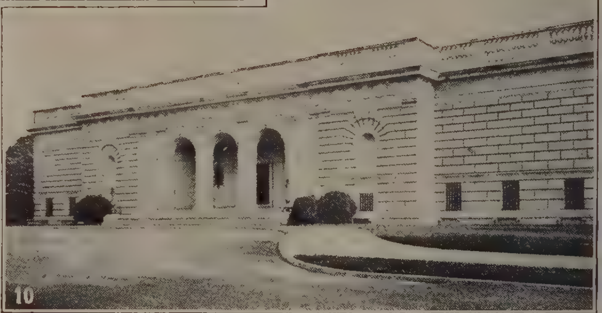


FIG. 1. High School, Rockville Center, L. I., U. S. A., H. T. Blanchard, Architect. Fairly typical of American schools.

FIG. 2. High School, Columbus, Ohio, W. B. Ittner, Architect. Impressive massing in classic manner.

FIG. 3. Clare College, Cambridge, Eng., Sir Giles Scott, Architect. Memorial architecture in spirit of school building.

FIG. 4. Projected building of the University of Pittsburgh, U. S. A., Day and Klauder, Architects. Most modern combination of school and skyscraper.

FIG. 5. Harkness Hall, Yale University, U. S. A., J. G. Rogers, Architect. Example of old-world architecture brought to modern university.

FIG. 6. Art Gallery, Zurich, Switzerland, Prof. Karl Moser, Architect. Modern architectural motifs interestingly used.

FIG. 7. Pavillon du Collectionneur, Paris, 1925, Exposition, Pierre Patout, Architect. Extreme modern exposition architecture very well done.

FIG. 8. American Academy in Rome, McKim, Mead & White, Architects. Important school of architecture and allied arts.

FIG. 9. School Building, Hilversum, Holland, Dudok, Architect. Effects secured by mass, rather than detail.

FIG. 10. Freer Art Gallery, Washington, D. C., Chas. A. Platt, Architect. Interesting handling of walls with few openings.

opening off this, usually with wide doors which permit the occasional use of the two spaces as one, is the dining-room. Adjacent to the dining-room are the pantry, if one is included in the plan, and the kitchen. Bedrooms and baths are preferably arranged in a wing of the building, so that they may be separated to some extent from the other quarters.

Modern bathrooms are small and very compactly arranged, one to each bedroom when possible. Service facilities for the kitchen are important. When the building does not exceed nine or ten floors, a hand-operated dumb-waiter is installed, running from the basement to each kitchen, by means of which the janitor of the building distributes food supplies to the various tenants. Garbage is collected by the same device, although incinerators are also widely employed. The flues of the incinerator open into all the kitchens, and garbage and waste are emptied directly into them and reduced to ashes, which can be removed from time to time at the base. This disposal system keeps the dumb-waiter car and shaft clean. A gas-stove, an all-metal kitchen cabinet, a combination porcelain sink and laundry tub, an ice-box, and in recent years an electric ice-machine are generally installed when the building is erected. In America the use of an ice-box is almost universal, not only for cooling purposes during the summer heat, but because it helps to preserve food in a safe and sanitary condition throughout the year. The dining-room has one or more electric outlets convenient for toasters and electric grills on the dining-room table. The living-room often has a practicable fireplace, not for heating but as a social amenity. (*See* HOUSEHOLD APPLIANCES.)

A central heating plant for each building or group of buildings provides the necessary warmth during the winter months, the system usually employed being steam with exposed radiators in all rooms. When the apartment building exceeds ten storeys, the hand-operated dumb-waiter is hardly practical. Electrically driven "fool-proof" dumb-waiters are sometimes used, but the initial cost is large and the upkeep expensive. In the most modern practice, an additional service lift is installed. This is preferably located near the kitchen wing, or at the rear of the apartment house, to bring in food supplies, to remove garbage and waste, and for the use of the servants.

In the beginning, the particular appeal of the "flat" was the elimination of stairs. In the old-fashioned city house, built like a narrow slab in a block of similar houses, the overburdened housewife found the stairs very tiring, especially when it meant six or seven flights from basement to attic. This advantage in the flat, however, was largely offset by the difficulty of separating living from sleeping quarters. The so-called "duplex" apartment was the first solution of this annoying problem. Here the entire apartment unit occupies two floors, the sleeping quarters above and the living-rooms below, with a small interior stair for communication.

In the effort to reduce space, since part of the care of a home is its size, a low ceiling was adopted. The New York building law at present specifies a clear height of no less than eight feet; formerly it was nine. Consequently builders anxious to get the maximum return from a given piece of property build to this minimum. The larger rooms, particularly the living-room, seemed proportionately low, and were consequently depressing. Even the largest and most expensive apartments seldom exceeded 9½ ft., on account of the great waste of cubic contents in the minor rooms. This has resulted in the evolution of still another type of apartment, in which, by a combination of alternating "duplex" and "simplex" floors, the living-rooms are given an extra ceiling height, bringing them back again to the proportions of the old-fashioned city home, two storeys of living-rooms being placed adjacent to three storeys of minor rooms. This arrangement has the double advantage of retaining something of the atmosphere of the old-fashioned home in at least one important room, and yet economising space, while providing the advantage of modern convenience in other parts of the apartment.

Apartment Hotels.—The apartment hotel, a type of building which is becoming more and more popular, is simply an apartment house in which the kitchens and the servants' sections of all the apartments are concentrated in one place and conducted under hotel management. Meals are privately served in each apartment, as simply or as elaborately as desired, and maid service is furnished by the management. Public dining-rooms are also provided. Architecturally, the apartment hotel may be characterised as an apartment house without kitchens, or as a hotel made up of permanent private suites.

Hotels.—In the hotel proper, improvement in mechanical arrangements is more manifest than any change in basic planning principle. As in most other types of building, the tendency is toward increased size. A prominent hotel authority states that the heavy overhead expense of a modern hotel, giving as it does complete service of every kind, makes it difficult to operate successfully with less than 1,000 rooms. Some recent examples in America exceed 2,000 rooms. This means large ground area or great height, or both. Twenty storeys are now customary, and a 40-storey hotel is projected for New York. The plan problem of an hotel starts with a typical bedroom floor, which is repeated many times and is the basis of income for the hotel. Steel skeleton construction, the accepted form of building in nearly all countries, makes possible a more economical bedroom floor arrangement than the older types of wall-bearing construction, with which, of course, there was also a definite limit to the possible number of storeys. The lower floors, the least in demand as bedrooms (for the public seems to have lost its fear of fire in modern structures and prefers to be high for light, air and freedom from noise), are used for the essential hotel offices, lounging spaces, parlours, dining-rooms, banquet-halls, restaurants, cafeterias, etc.

Specialised Buildings.—In the field of indoor entertainment, progress in theatre design is very marked, while the advent of the picture house adds a new problem. In the old theatres, stage and auditorium formed two nearly balancing elements. Improved mechanical equipment has somewhat reduced the size of the stage, and the different seating arrangements of the auditorium have increased proportionately the ground area of this part. The cinema requires almost no stage, and in many cases the auditorium has been enlarged beyond the reach of the human voice. In both types the cross section shows the use of but one balcony, and shows no supporting posts to interrupt the view. Architecturally most theatres of both types are problems in interior design. Being commercial enterprises, and requiring no natural light, they occupy spaces away from the street and have at most only a small street frontage. Of course the government-owned and municipal theatres are generally free standing, and have an architectural treatment in keeping with their location.

For open-air entertainment, the most significant structure that has appeared is the great stadium, rivalling in size, and in some cases in architectural embellishment, the colosseums of old. These are of three general classes: those completely elliptical in form and built on banked-up earth; those built up from the level of the ground as was the Colosseum of Rome, but open at one end; and those built only at one side of the play-field.

Care of the sick has been given particular attention. The experience of the World War gave both medicine and surgery opportunities for study and experiment that brought about great strides in both these fields, and evolved many new features in hospital design. The temporary War hospitals showed new arrangements and new dispositions in all the various activities in modern hospitals, and these new ideas became incorporated in the post-War permanent buildings. Two types of plans may be noted—the open scheme with few storeys where ample space is available, and the compact many-storeyed type required in cities. The open plans show a more orderly arrangement of building units, central administration, kitchen facilities and power plants; general orientation is a very important factor, and lines of communication unite the various elements in a direct and simple plan-scheme.

V. EDUCATIONAL ARCHITECTURE

Under this heading we shall include all buildings in which knowledge is imparted and acquired, either directly, by contact between teacher and pupil, as in schools, colleges and universities; or indirectly, as in museums, libraries and exposition buildings. Compulsory education, especially in the elementary branches, prevails in most civilised countries, and government-directed institutions are on the increase. Schools are erected to fit many and diverse lines of study. The one-time high-school group that represented merely the finishing touches of an English education has become subdivided into many different forms. The modern development of education, that prepares the pupil for a later status in life, has resulted in vocational schools, in which the pupil may be trained in a vocation which his inclination, guided by the influence of his teachers, leads him to select, and which launches him successfully upon a career.

School Architecture.—The development of architecture in school building has been one of the most remarkable phases of architectural progress during the present century. (*See* Education.) The architect who specialises in schoolhouse construction not only must be a student of educational methods, but he must also know how to conserve the physical wellbeing of the pupil during school hours by surrounding him with every element of safety that will safeguard his health, his eyesight and his general physical condition. Specialists in various lines of schoolhouse construction have developed these matters to a point of exact science: and in the plan of the building, the arrangement of the classroom, the width of the corridors, and the heating and ventilation systems, methods have been evolved that make the schoolhouse the most perfectly functioning building that we have at present developed.

The tendency towards larger and larger units, which runs through commerce and industry, manifests itself again in educational buildings. This is deplored by many educators on the ground that it standardises educational methods and robs the student of individual attention, but the fact remains that the large institution is the only adequate means of meeting the demand for instruction.

There is, however, a definite limit to the number of students a single teacher can handle. Much study and experiment on the part of experts in this field have evolved a classroom of fairly definite size and shape. The school plan revolves around this unit classroom, just as the plan of an office building is based upon the office unit. Unilateral lighting is preferred when possible. Wide corridors adjoin all rooms, leading to the building exits, stairways, assembly hall, gymnasium and other special spaces. Ceiling heights are ample for ventilation purposes, and when there is 15 feet or more from floor to floor above, stairways can be doubled, thus securing two separate stair exits in the space formerly occupied by one.

Universities.—The most interesting feature of the newer colleges and universities is the comprehensive plan lay-out upon which they are being built, permitting of future expansion. The older universities of Europe grew through the centuries by successive accretions, and they possess, of course, the charm and interest of historical background and precedent. Certain modern universities, notably in America, have endeavoured to recapture this atmosphere by imitating the semi-monastic architecture of those older institutions—Harkness Memorial Hall at Yale and the Graduate School at Princeton, to mention only two. On the other hand, there is a growing tendency to accept frankly the changed conditions of the time and build in the modern idiom. The University of Pittsburgh plans to build its halls of learning in the form of a modern 60-storey sky-scraper.

Libraries.—Libraries are keeping step with the general increase in public education. Many large cities have a central building, extensive in scope and impressive in design, and one or more branches at convenient points in the populous districts. The general plan consists of a central public room, where books are loaned and returned, where card catalogues are convenient for consultation, and where information is given. Together with the stock rooms, this forms the hub of the plan, around which are disposed other special spaces, such as children's room, periodical rooms, reference rooms, special exhibits, etc., as the scope of the work demands.

Museums.—Public museums constantly take a more importa
place in modern life as a means of indirect education. The ad
tion of many commercial, industrial, mechanical, horticultu
and other museums to the traditional art museum is proof
this. Here the plan is comparatively simple, consisting of la
well-lighted spaces through which visitors pass from room
room. Good modern practice provides one entrance with c
trol, and a disposition of rooms which permits of any given sp
being temporarily closed for rearrangement or installation
exhibits without shutting off other rooms from public acce
The growing tendency of the modern museum to combine edu
tional courses open to the public with its more traditional act
ities frequently calls for the addition of lecture-rooms, referen
rooms and even auditoriums to the usual plan.

Expositions.—Expositions are generally housed in tempora
buildings constructed for the purpose. The plan problem is
especial interest to the architect, because it gives him an opp
tunity to make experiments on a large scale which he might
care to risk in more permanent buildings designed for spec
purposes. The Columbian Exposition in Chicago in 1893 chan
the whole tendency of architecture in America, creating a v
table renaissance of classic styles. The Paris Exposition Univ
selle in 1900 experimented with the flowing line and naturalis
ornament, but with no permanent effect upon architecture
general. The Wembley Exhibition near London revealed cert
possibilities in the use of permanent concrete construction,
lost much effectiveness through lack of distinction in setting a
approach. The French, on the other hand, made the most
their Exposition des Arts Décoratifs in Paris in 1925, and ma
of the temporary buildings displayed architectural forms
unusual interest: the straight line, the post and lintel, sculpt
in low relief panels, strong contrasting colours; classical mou
ings, capitals and cornices were conspicuous by their absen
The influence of the Paris Exposition can be seen in certain co
mercial buildings in America, and will doubtless have a last
effect, because the style so readily adapts itself to modern for
of machine-made construction.

VI. STATE AND CITY ARCHITECTURE

When the War broke out many municipalities in England w
erecting new and imposing buildings to house local administ
tions. State governments in the United States had undertak
new capitols; and new, modernised post-offices, customs-hous
town-halls, etc., were partially built in many quarters. The W
temporarily checked such activity, but much of the work
been completed since.

The plan problem of modern administrative buildings is so
what similar to that of the commercial office building except
two special features. In the first place, the inclusion in the p
of certain large and specially designed rooms or spaces for
assembly of boards, councils, delegates or gatherings of rep
sentatives, which become the dominant features, surrounded
offices for government workers and permanent staffs; and s
ondly, the more extravagant architectural treatment of both
exterior and the interior, with liberal provisions for landsca
settings, all very properly done to impress the community w
the power and authority of the state.

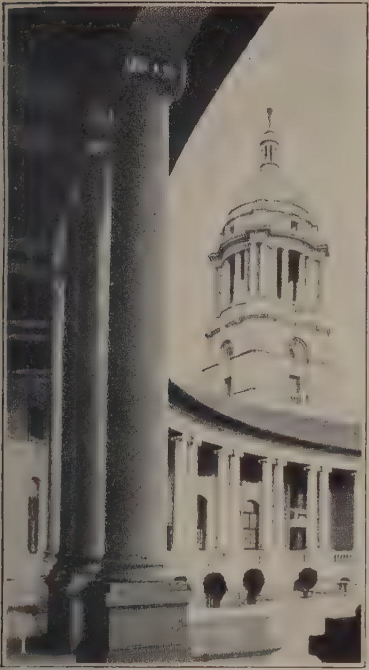
The architectural problem is new only in so far as the tende
for the state to assume ownership of certain public utilities
considerably increased the space needed for government wo
The London County Council Hall, near the Houses of Par
ment, the fine building of the Port of London Authority,
Town Hall of Stockholm and the state Capitol of Nebra
in the United States are conspicuous examples. The politi
changes resulting from the War will undoubtedly find express
in new governmental buildings in the countries most affect
although as yet nothing of note has appeared.

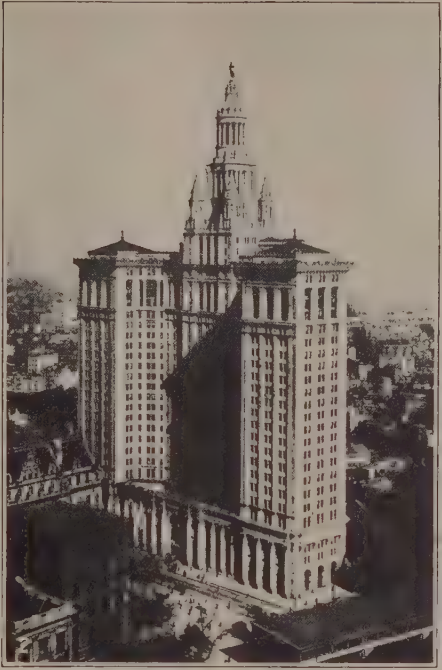
VII. ECCLESIASTICAL ARCHITECTURE

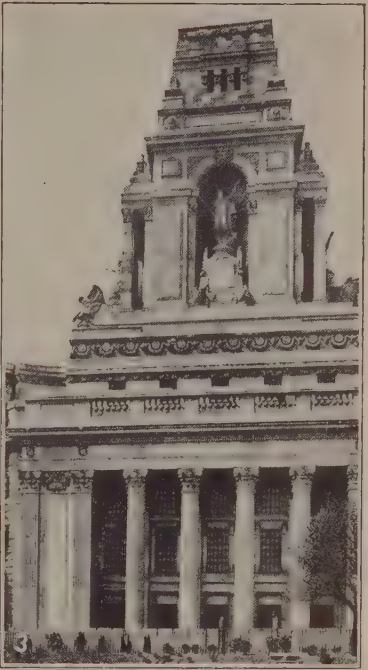
Religious architecture, which includes all buildings erec
for spiritual or commemorative purposes, appears to be i
transitional stage. In the endeavour to adapt itself to chang

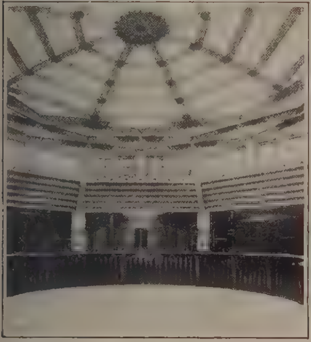
ARCHITECTURE (Political)

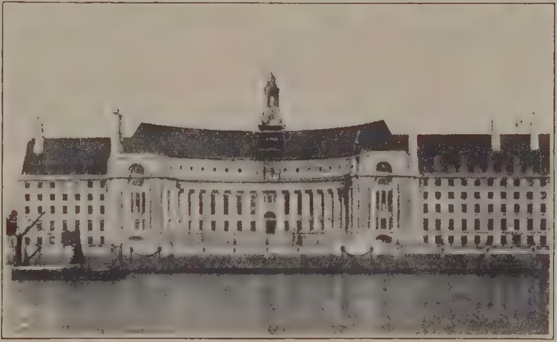
PLATE V.

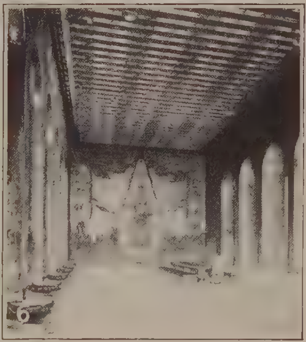


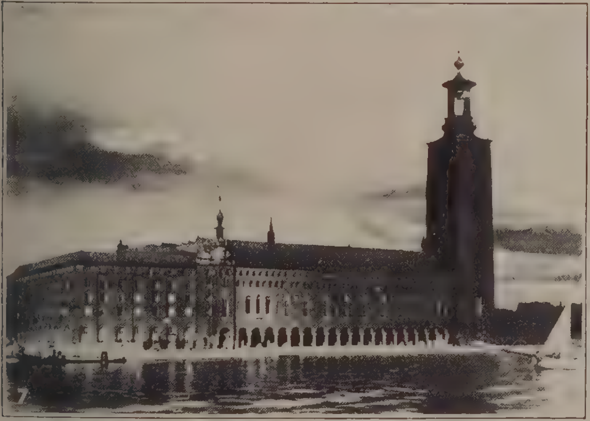












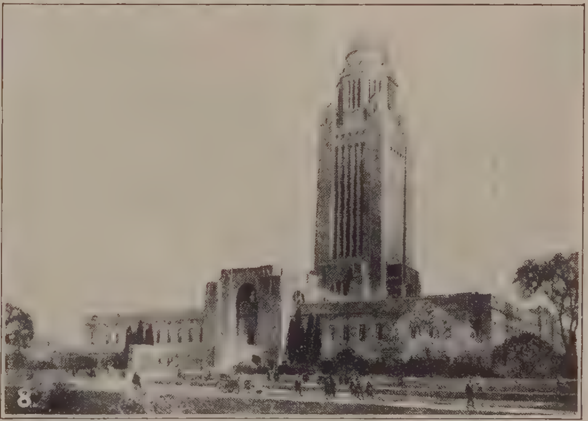


FIG. 1. Western Tower, Union Building, Pretoria, South Africa, Sir Herbert Baker, Architect. An example of dignified government architecture.

FIG. 2. New York Municipal Building, McKim, Mead & White, Architects. A city's business office in a skyscraper. A street passes through the central arch of the monumental colonnade.

FIG. 3. Port of London Authority, Sir T. E. Cooper, Architect. The extreme of monumental character.

FIG. 4. Bureau des Postes, Paris, Le Cœur. Modern interior architecture of a new kind.

FIG. 5. County Hall, London, Ralph Knott, Architect. An imposing elevation making the most of the frontage on the Thames.

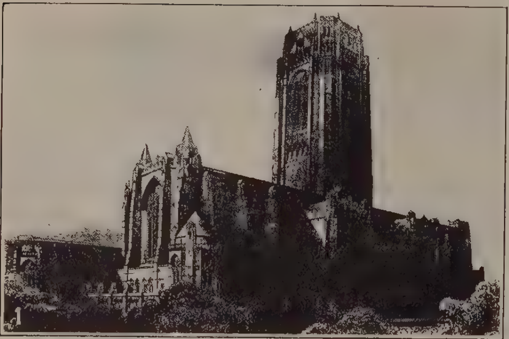
FIG. 6. Town Hall, Stockholm, Sweden, R. Ostberg, Architect. Interior: impressive scale and unusual combination of old forms with new detail.

FIG. 7. Town Hall, Stockholm, Sweden, R. Ostberg, Architect. A new and northern variation on the theme of the Doge's Palace and Campanile at Venice.

FIG. 8. Nebraska State Capitol, Lincoln, Nebraska, U. S. A., Bertram G. Goodhue, Architect. A new and inspiring solution of the State Government Building.

PLATE VI.

ARCHITECTURE (Religious)



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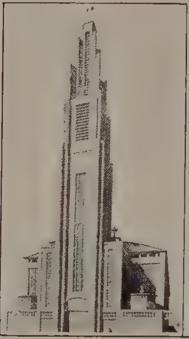

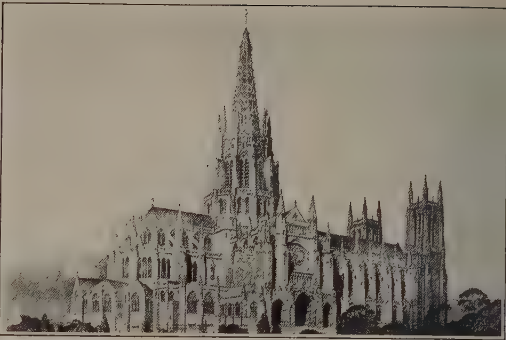

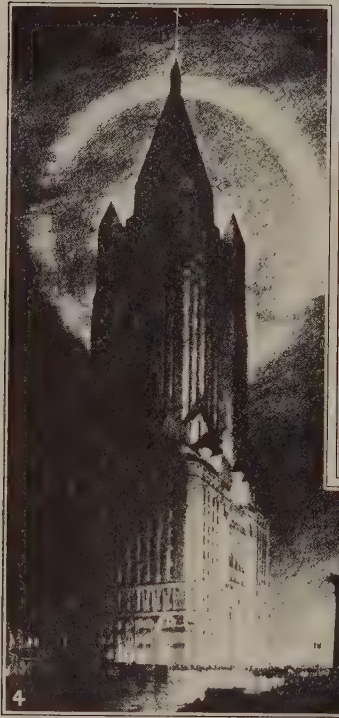

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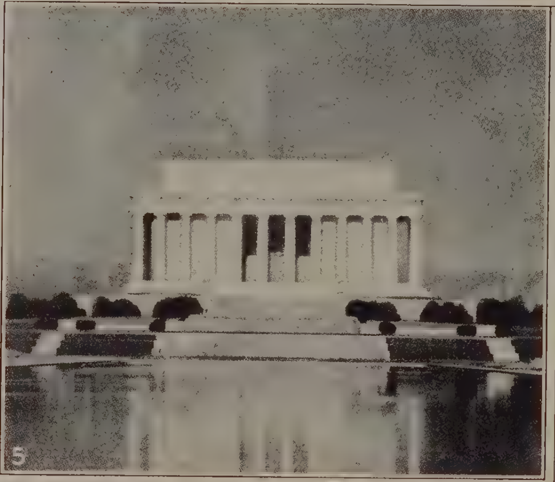

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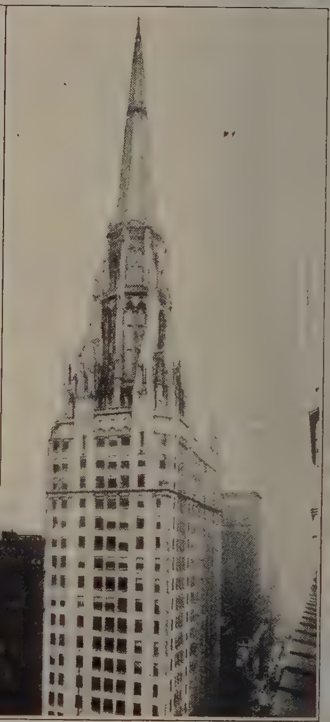

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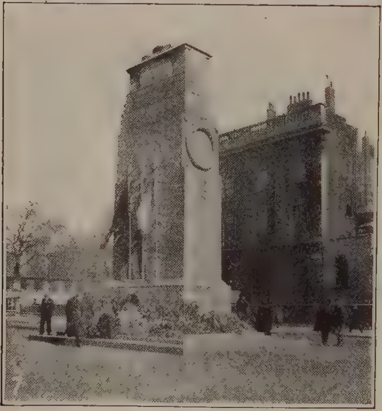

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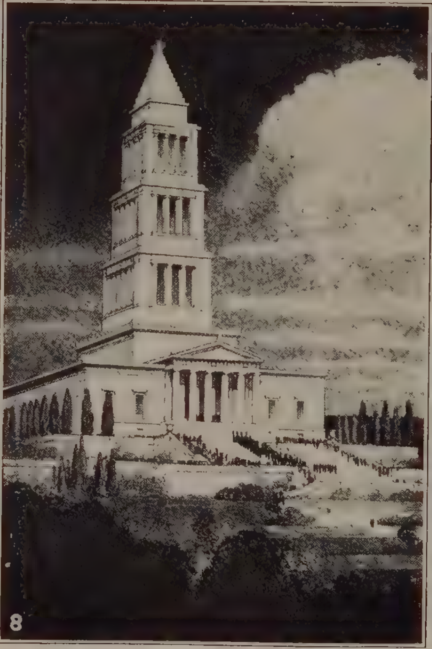

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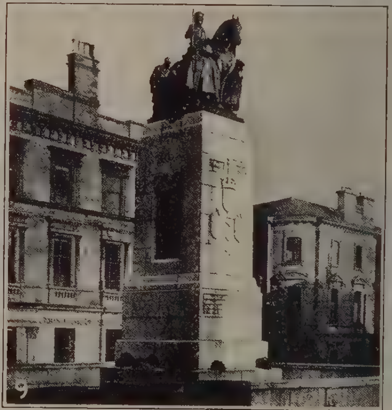

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FIG. 1. Liverpool Cathedral, England, Sir Giles Scott, Architect. A great building with all the inspiration of the middle ages and yet thoroughly modern.

FIG. 2. Nôtre Dame de Rainey, Perret, Architect. Concrete in its new form. Note the external wind braces on the spire.

FIG. 3. St. John the Divine, N. Y. City, Heins & LaFarge, Architects, R. A. Cram succeeding. Extremely reminiscent of the old world.

FIG. 4. Broadway Temple, N. Y. City, Donn Barber, Architect. Most striking example of the combination of church and business.

FIG. 5. Lincoln Memorial, Washington, D. C., Henry Bacon, Architect. Most impressive example of classic dignity, in a perfect setting.

FIG. 6. Chicago Temple, Holabird & Roche, Architects. Another example of church and business.

FIG. 7. Cenotaph, Whitehall, London, Sir Edwin Lutyens, Architect. Most impressive of war memorials. Photo. W. S. Campbell, Press Studio, London.

FIG. 8. Washington Masonic Memorial, Alexandria, Va., U. S. A., Helmle & Corbett, Architects. A tower in steps inspired by the ziggurat of old, in a carefully landscaped setting.

FIG. 9. War Memorial, Paisley, Scotland, Sir Robert Lorimer, Architect, and Mrs. Meredith Williams, Sculptor. Sculpture and architecture combined in a dignified ensemble.

conditions, the Church finds itself faced on the one hand with the necessity of broadening its activities, and on the other with the problem of effecting a physical compromise with other forms of building. Architecturally this involves two distinct problems: (1) enlarging or modifying the Church to house new activities; (2) combining it with commercial structures, a course adopted to some extent in the United States.

In the past, the Church was a refuge for the poor and afflicted, a seat of learning and a centre of social life. One after another these functions began to be assumed by independent agencies. Education, except in the spiritual sense, fell chiefly under secular supervision; separate institutions began to care for the sick and the poor; the increased number of social diversions weakened this phase of the Church's hold on the people. There seems to be, however, a tendency to reassume some of these functions in the form of welfare work and community service. This has added to the necessary equipment of the Church proper such spaces as small auditoriums, Sunday-school rooms, gymnasia, committee-rooms, restaurants, etc. The modern church, excepting the ritualistic type, which has not materially changed in plan arrangement or source of design, tends more and more to assume the form of an auditorium in which the important consideration is to see and hear adequately.

The enormous growth of large cities has left many churches stranded in business or financial sections, miles from their parishes, so that their very existence as buildings is jeopardised. In both London and New York there are many such churches which are preserved only for their architectural interest or historic associations. It is not mere speculation that, with a few exceptions, these will eventually have to give way. Even in newly developed residential communities, the smaller church finds it difficult to retain a fixed or stable congregation. Localities are no longer local. The automobile, the railway, the telephone and the radio have all conspired to diffuse and diversify public attention.

New Churches.—The most startling and essentially modern feature of religious architecture is the "sky-scraper church." In order to retain a position in the crowded, highly taxed business centres, certain churches in America have combined with office buildings. This enables them to carry on their social and community service without depending entirely on voluntary contributions for maintenance. The architectural problem here is a commercial sky-scraper with an auditorium on the ground floor; two buildings of quite different character are superimposed one on the other.

Churches, from the simple village type to the great cathedral, are being built, for instance the cathedral at Washington, the great cathedral in Liverpool and the Cathedral of Saint John the Divine in New York. France tried a novel experiment in building the Church of Notre Dame at le Raincy. This structure, built of reinforced concrete, is of rigidly simple modernistic design but of dubious aesthetic value.

VIII. IN MEMORIAM ARCHITECTURE

Memorials, a form of architecture antedating any remaining evidence of permanent human habitation, have greatly increased in number and importance since the War. As a problem, memorials have a peculiar fascination for the architect, because they are usually untrammelled by the practical restrictions of ordinary buildings, and frequently offer the best opportunity for combination with the allied arts of sculpture and painting. The difficulties of the problem lie principally in this very lack of limitations, the freedom of choice making selection of the appropriate mode of expression more difficult.

War memorials, which abound in every country engaged in the conflict, frequently employ war implements and costumes as a basis of design. The most successful, however, stress abstract conceptions such as bravery rather than the paraphernalia of war. An indication of the universal trend toward democracy is apparent in numerous memorials to the Unknown Soldier. War memorials range from simple wall tablets to buildings of impressive proportions. The latter sometimes take the form of memorial hospitals, soldiers' homes, assembly halls, etc., in which case their inclusion under memorial architecture is merely nominal. Public interest in war memorials brought about a recrudescence of other commemorative monuments. The Lincoln Memorial in Washington, D.C., is one of the most impressive ever erected to one man. The George Washington Masonic National Memorial at Alexandria, Va., overlooking the Potomac river, is another example on an impressive scale.

IX. CONCLUSION

Several general matters bearing upon the development of architecture, which could not appropriately be considered in any of the foregoing categories, deserve discussion here. Architectural education, because of a change from the apprenticeship method to the school method, has made phenomenal progress. In France, of course, where the École des Beaux Arts has provided systematic instruction for over two centuries, there has never been a lack of trained men. Even after America began to establish architectural courses (at first in connection with engineering schools), England still retained the apprenticeship system. But when students of both nations began to attend the Beaux Arts in Paris the situation gradually changed. The United States is organised through the medium of the Beaux Arts Institute of Design in one vast school of architecture, with a hundred or more teachers and over a thousand students. In England, the University of Liverpool, the University of London and other well-established schools of architecture conduct their courses along lines similar to the Beaux Arts *atelier* system

The essential features of this system are as follows: Students work in groups, called *ateliers* or studios. The students of each group receive a programme of conditions for a building (or part of a building, depending upon their degree of advancement), and, after several hours of study, prepare an *esquisse* (sketch) which combines in one drawing their general solution of the problem. With this sketch as a basis, they proceed to develop a *projet*, or plan, in complete detail. The work is carried on under the supervision of a *patron*, who in most cases is a practising architect as well as a teacher. Discussion and mutual help among the students of each studio are invaluable factors in the progress of the student, the older pupils helping the younger with ideas and the technique of drafting, the younger helping the older with the mechanical work of repetition and details. Of course no student's work is complete until he has had ample office practice. The great advantage of the *atelier* method lies in the acquisition of broad ideas of plan-composition and design at a time of life when the imaginative faculties are susceptible of development and before the student has become hedged in and cramped by the endless details of actual practice.

The effect of this system upon the design of modern buildings is marked. Formerly a single genius, such as Wren or the Brothers Adam in England, or Richardson or McKim in America, could change the style of architecture of an entire nation, for it has always been true in the arts that the quantity producer. provided his work had quality as well, exerted the greatest influence upon other workers in the same field. The *atelier* method, by inculcating sound principles and directing thousands of students along definite lines, improves the standard of architecture the world over. No architect's training is now considered complete until he has had a good school and college education, a sound cultural background, a complete university course in his particular subject, and travel and study abroad. Familiarity with architectural forms in general, knowledge of modern engineering practice, and thorough sympathy with the practical building requirements of the time are the basic reasons why buildings are constantly improving both in style and in quality of workmanship, and why architects as a professional group are less and less influenced by the genius of a single master, no matter how great his skill or how large the quantity of his work.

Russian Architecture.—The plan of this survey of world architecture cannot be strictly followed in considering Russian architecture because of the fact that during the larger part of the period in question political conditions practically excluded Russia from participation in the common cultural life of the other nations. The years that immediately preceded the World War may, however, be discussed, as they formed the most creative period in all Russian history. After the first abortive revolution of 1905 a great number of wealthy landowners began for safety's sake to move to the cities, selling their estates and investing money in industrial and commercial enterprises. A revival of building activity in the cities followed, while the increasing influence of the nobility in Russian city life left its mark on the style of the architecture, “ Classicism,” which reminded the nobility of the period of its political and cultural domination. In both the chief cities of Russia (St. Petersburg and Moscow) there were built palatial private residences, of 30 or 40 rooms each, artistically decorated in a “ classical ” style. Whole blocks were covered with newly built apartment houses, with spacious halls and picturesque interior courts decorated by fountains and statues.

The years which immediately preceded the War were characterised by the last attempt of the nobility to affirm its predominance as the governing class of Russia. At the same time it was the period of an acute struggle between the nobility and the industrial class of Russia, which at that moment had become already sufficiently strong and independent and, in its best and most progressive representatives, had attained a level of spiritual culture and artistic taste not inferior to that of the nobility. We witnessed, therefore, a similar revival of industrial buildings, on a very large scale, concrete and concrete-steel being widely used. Entire factory settlements were built anew, the largest of which are found in the rubber industry (The “ Treugolnik ” Co.—about 7,000,000 sq. ft.), textile industry, shipbuilding, railroad stations, warehouses, grain elevators and war industries.

The years 1914–23 were a period of stagnation for Russian architecture. Only purely theoretical and experimental work was being done in the studios of architects, bringing about the formation of two distinct artistic schools. One, represented mostly by the younger generation of revolutionary tendencies, is based on abstract philosophical theories, contrary to technical possibilities and the requirements of life itself. This is the so-called “ cubism.” The other school, headed by architects of mature artistic judgment and large practical experience, remains true to classical principles, but tries to simplify the classical forms and to use construction as a decorative element. In 1923 an All-Russian Agricultural Exposition building (more than 52,000,000 cu. ft.) was constructed in Moscow by the architects Shchussev and Oltargevsky. In this undertaking both of the above-mentioned schools were represented, as some parts of the building were constructed by architects of “ cubistic ” tendencies.

BIBLIOGRAPHY.—The principal sources of information on modern architecture are the best architectural periodicals of the various countries: *The Architect; The American Architect; The Architectural Forum; The Architectural Record* (New York); *The Architectural Review; The Architects' Journal* (London); *Moderne Bauformen* (Stuttgart); *L'Architecte* (Paris); and *Architettura e Arti Decorative* (Rome).

(H. W. C.)

ARCTIC REGIONS. (*see* 21.938).—This article deals with the sovereignty, climate and resources of the area known as the polar regions. For the story of its exploration since 1910 *see* the article POLAR REGIONS.

Sovereignty Questions.—Most Arctic lands are now under the sovereignty of one or other state. The treaty transferring the Danish West Indies to the United States (1917) contained a clause recognising Denmark's right to extend her economic and political sphere over the whole of Greenland. Norway disputed this right on the ground that only Norwegian sealers and trawlers made any use of the east coast. An agreement between the two states was signed in 1924, giving Norwegians unhindered access to that shore, but leaving undecided the question of Danish sovereignty, which Norway does not admit, maintaining that Eastern Greenland is a *terra nullius*. In 1916 Russia reiterated her claim to all the Arctic islands lying north of Asia, including Wrangel Island. Attempts on the part of V. Stefansson in 1921–4 to establish a British claim to Wrangel Island met with no official support in Britain or Canada, and in Aug. 1924 Russia officiall hoisted her flag on the island and reasserted her claim. Fran Josef Land is not included among Russian claims, and may b regarded as a *terra nullius*. By a treaty signed in Paris, Feb. 1920, the principal European Powers and the United States an Japan recognised Norway's sovereignty of Spitsbergen and Bea Island. Canada claims all islands of the American Arctic Arch pelago between the meridian of 60° and 142° west of Greenwich Greenland excepted. This carries British sovereignty to th Pole. (R. N. R. B.)

I. CLIMATIC CONDITIONS

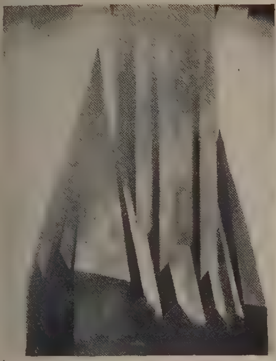
It is a commonplace of modern geography that there are tw main kinds of climate, continental and insular, with the sea coasts of continents partaking somewhat of the insular qualities In continental climates, there are greater extremes of heat an cold than on islands. It follows that the most intense cold in th Arctic is nowhere near either the mathematical centre, called th North Pole, or the sea-ice centre, called the Pole of Inaccessibility (84° N. Lat., 160° W. Long.). In arctic Alaska, the coldest weather is, so far as we know, in the Yukon basin; in Canada it is in Yukon Territory; and in Siberia it is in the province o Yakutsk. All these places have been inhabited for a quarter o a century or more by Europeans who are not known to have bee materially discouraged in their work by the mere disagreeableness of the climate, although they have been handicapped b the frozen ground and in other things that result directly fron the cold.

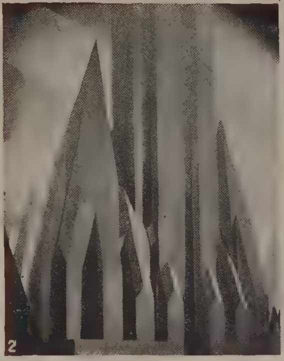
The Coldest Region.—The coldest known region of the norther hemisphere is the province of Yakutsk, in the vicinity of th arctic circle, where temperatures colder than 90° F. below zer have been reliably recorded—and that on the edge of cerea farming, for the great Russian atlas published just before th War indicates that wheat, barley, oats and rye are cultivated if not at the very cold pole of the Northern Hemisphere, at leas within a comparatively short distance from it, where the temperature frequently drops lower than 80° below zero. This i colder than any known region in arctic Alaska or arctic Canada We may conclude, then, that winter cold does not frighten awa Europeans through its mere disagreeableness nor render it impossible for them to make a living.

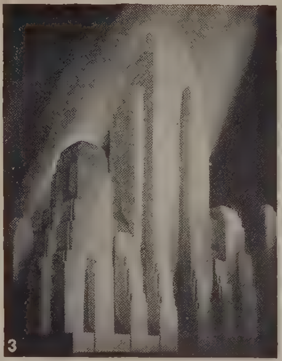
No records apparently authentic of temperatures colder than 60° F. below zero are available from any of the arctic islands and it is almost certain that they do not occur. The coldes spells that do occur are when the wind blows from the interior of the islands. It seems unlikely, therefore, that the temperature ever drops as low as 55° below zero at the North Pole the Pole of Inaccessibility, or, indeed, at any point on the arctic sea.

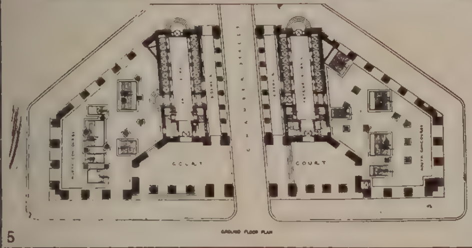
Summer Temperatures.—There is probably no spot on a low land in the continental Arctic, whether in Asia or America, tha does not occasionally have a summer temperature warmer than 80° F. in the shade. Or, if there is such a place, it must be on a peninsula, or on a narrow coastal strip between ice-covered mountains and the sea. Many places in the continental Arcti have occasional temperatures above 85° in the shade, and a least one arctic weather bureau station, that of the United State Govt. at Fort Yukon, Alaska, has a record of 100° in the shade The slowness of the public to realise that there is such grea summer heat in the Arctic is due partly to the prevalence of th ancient view that all the Arctic is always cold, and partly to th reports of travellers whose entire arctic experience has been o the ocean or on a seacoast.

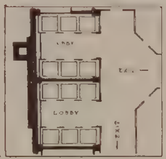
The reason for the great mid-summer heat on arctic lowland is, of course, that the sun delivers an adequate number of hea units per day to account for it. The ordinarily accepted figure are three or four per cent more at the North Pole than at th equator for the top of the atmosphere and three or four per cen less for sea-level. This means that you would have “ tropical ” heat at any place in the Arctic where the sun's rays strike a dar surface and where there is no local reservoir of “ cold ” to neutralise it. The places, therefore, that do show a “ tropical ” hea are on lowlands that are sheltered from ocean breezes and from

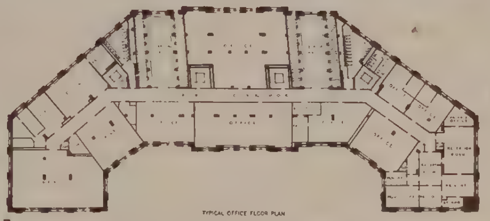


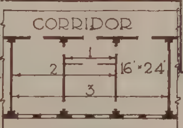




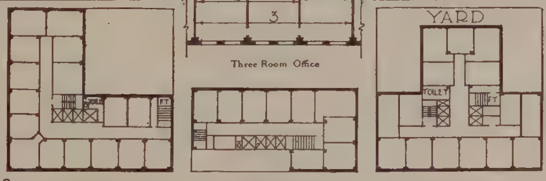

COURT
COURT
GROUND FLOOR PLAN
5


LOBBY
LOBBY
EXIT
6

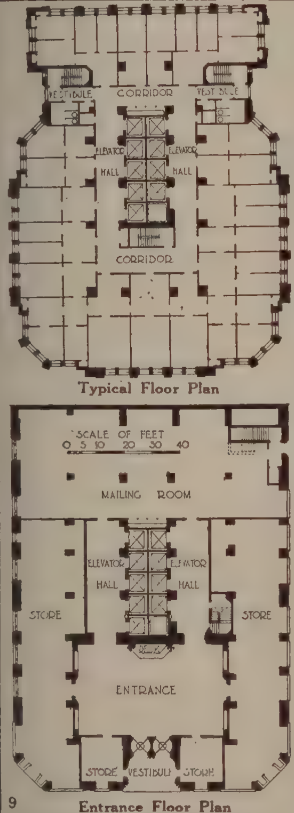

OFFICE
TYPICAL OFFICE FLOOR PLAN
7


CORRIDOR
2
16'×24'
3

Three Room Office

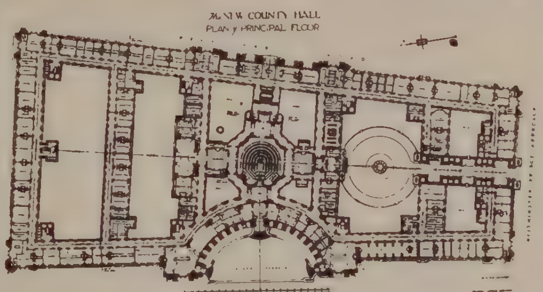

YARD
TOILET
FT
8

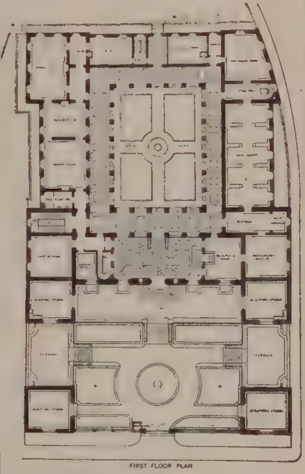
Corner Lot, 100x100 Corner Lot, 50x100 Interior Lot, 100x100

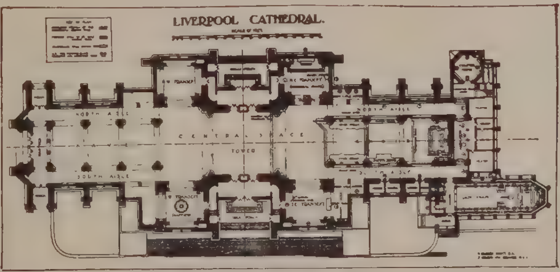

VESTIBULE
CORRIDOR
VESTIBULE
ELEVATOR
ELEVATOR
HALL
HALL
CORRIDOR
SCALE OF FEET
0 5 10 20 30 40
MAILING ROOM
ELEVATOR
ELEVATOR
HALL
HALL
STORE
STORE
ENTRANCE
STORE
VESTIBULE
STORE
9

Typical Floor Plan

Entrance Floor Plan


The NEW COUNTY HALL
PLAN of PRINCIPAL FLOOR
10


FIRST FLOOR PLAN
11


LIVERPOOL CATHEDRAL.
NORTH AISLE
CENTRAL SPACE
TOWER
SOUTH AISLE
12

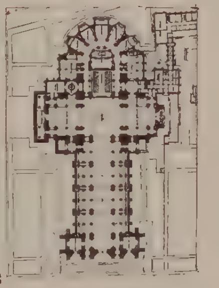


FIG. 1.—Zoning Envelope (building laws of New York City) showing the mass of building which would occur if carried to extreme limits permitted by law over square 800 x 200 ft. On 25 % of a lot area, a tower may rise to any height.

FIG. 2.—Same as 1, showing courts cut in to provide natural light in building.

FIG. 3.—Sloping surfaces changed to vertical, ready for windows—the tower reduced to a structural possibility—*i.e*, height of 1,000 ft. and offsets adjusted to steel supports.

FIG. 4.—The finished building, windows in place, architecturally embellished and ready for occupancy. These diagrams show the cause of the "style" of architecture which is becoming prevalent in America.

FIG. 5.—Plan of ground floor, Municipal Building, New York City: McKim, Mead and White, Architects. A street passes through the centre.

FIG. 6.—Economical layout for elevators in an office building.

FIG. 7.—Plan of typical office floor, Municipal Building, New York City: McKim, Mead and White, Architects. Note elevator layout.

FIG. 8.—Typical office plans on rectangular lots.

FIG. 9.—Ground floor and typical floor, Tribune Building, Chicago: Howells and Hood, Architects.

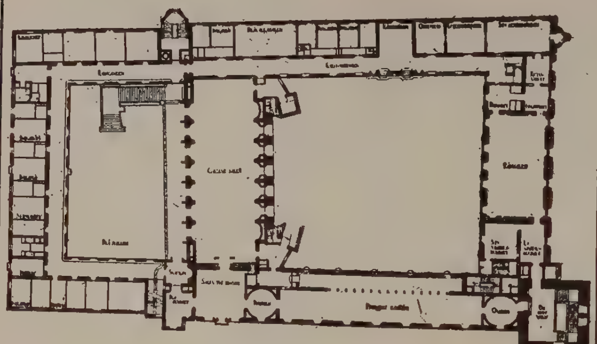
FIG. 10.—Plan of the new County Hall, London: Ralph Knott, Architect. Elements well composed, with clear circulation.

FIG. 11.—Plan of American Academy in Rome: McKim, Mead and White.

FIG. 12.—Plan of Liverpool Cathedral: Sir Giles Scott, Architect. Developed under one guiding hand.

FIG. 13—Plan of Cathedral of St. John the Divine, New York City: Heins and La Farge, Architects; R. A. Cram, succeeding. Developed under different hands, as were the old cathedrals, which were long in building.

ARCHITECTURE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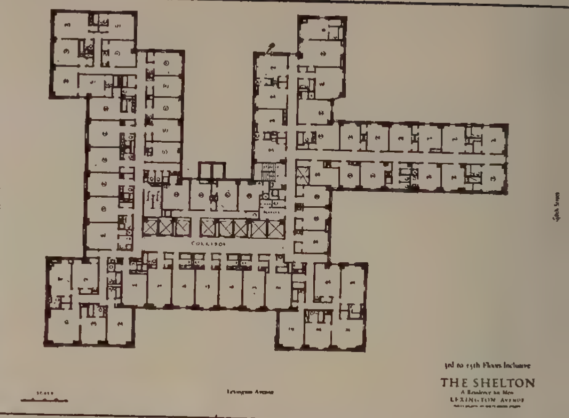
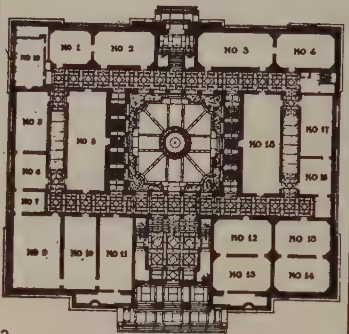

CORRIDOR
3rd to 15th Floors Inclusive
THE SHELTON
LEXINGTON AVENUE
2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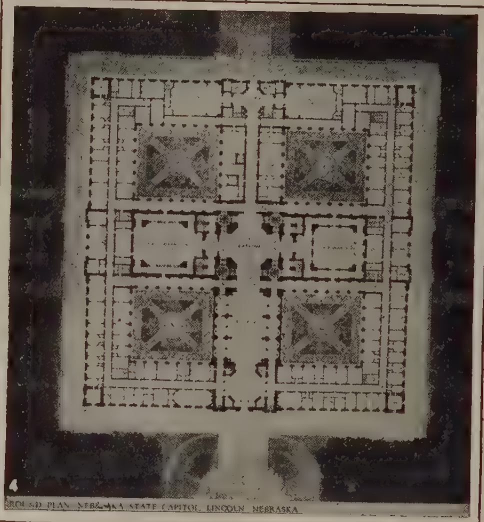
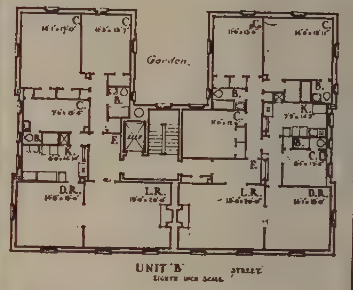
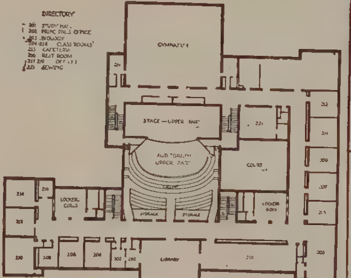
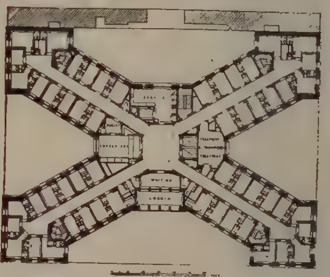

4
GROUND PLAN NEBRASKA STATE CAPITOL LINCOLN NEBRASKA


Garden
D.R.
L.R.
L.R.
D.R.
UNIT 'B'
EIGHTH INCH SCALE
STREET
5


DIRECTORY
GYMNASIUM
STAGE—UPPER PART
AUD'TORIUM UPPER PART
COURT
LIBRARY
6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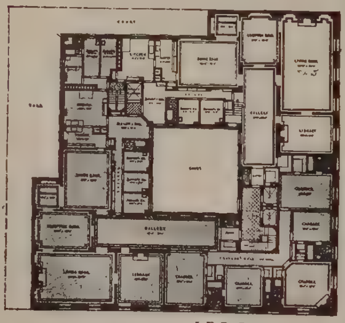
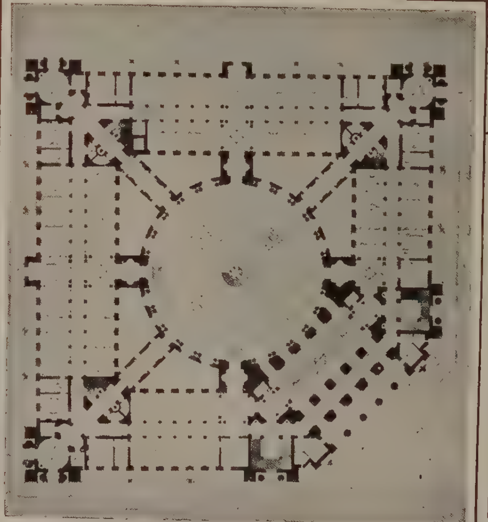

J. E. R. Carpenter, Architect.

8



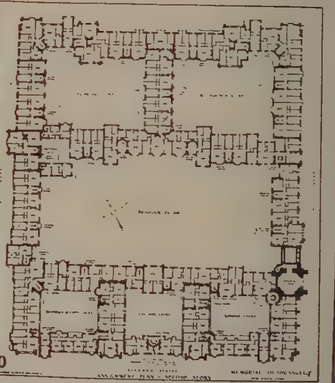

10

FIG. 1.—Plan of Town Hall, Stockholm, Sweden: R. Ostberg, Architect. Modern building reminiscent of old forms.

FIG. 2.—Typical upper floor plan of Shelton Hotel, New York City: A. L. Harmon, Architect. Modern skyscraper hotel.

FIG. 3.—Plan of Freer Art Gallery, Washington: Charles Platt, Architect. Well arranged display spaces.

FIG. 4.—Plan of Nebraska State Capitol: B. G. Goodhue, Architect. A new note in state capitol planning.

FIG. 5.—A typical plan of small suburban apartment, Jackson Heights, New York City: A. J. Thomas, Architect. The better type of modern housing practice.

Fig. 6.—Fairly typical American high school plan, Rockville Center, N. Y.: H. T. Blanchard, Architect.

Fig. 7.—Typical upper floor plan, Fifth Avenue Hospital, New York City: York and Sawyer, Architects. An unusual plan for the limited space available in a city.

FIG. 8.—Example of plan of large apartments, New York City: J. E. R. Carpenter, Architect.

FIG. 9.—Plan of Port of London Authority Building. Very clear and well organised. Sir T. E. Cooper, Architect.

FIG. 10.—Plan of Memorial Quadrangle, Yale University, New Haven, Conn. A reminiscence of the Old World. J. R. Rogers, Architect.

winds that come from ice-covered mountains. If the length of summer is measured by the season during which streams flow unfrozen and during which certain insects are alive and more or less active, the arctic summer would range from a maximum of about five and a half months in such places as the north shore of Great Bear Lake, to perhaps two months in places like Borden Island.

But an important thing to remember is that there is a direct dependence of animals on plant life and that plants measure their summer not by the calendar but by the number of hours of sunlight. At Fort Yukon, Alaska, for instance, on a day that varies from, let us say, 65° at the coldest to 95° at the warmest (in the shade), there would be approximately as much growing time as in two ordinary days in the humid tropics. This is why some plants grow so much more rapidly in certain parts of the Arctic than the same plants do in any part of the tropics or temperate zone. An interesting, and to most botanists an unexpected, corollary is that some plants also grow to far greater size in the Arctic than in the temperate zone or tropics, as cabbages, for instance. This may possibly be because they lose speed in the temperate zone where they have to stop and start again to conform with alternation of day and night, but can maintain a continuous and fairly uniform rate of growth in the Arctic where the daylight is continuous.

Arctic Weather.—Dr. Fridtjof Nansen announced as one of the outstanding conclusions of his great scientific expedition of 1893–6, that the Arctic is, on the average, one of the least stormy large regions of the world. Stefansson's observations as a result of 11 years spent north of the arctic circle and the studies of other observers have tended to confirm Nansen. In many parts violent gales are quite absent, or at least have not yet been observed by scientific men. Gales are common only where an open ocean is faced by high mountains or a plateau.

Snowfall.—It is difficult to measure arctic snowfall because the snow is usually very dry and fluffy and is driven about a great deal by even the lightest winds. There is no doubt that, however, on the average, arctic precipitation is very light. It is estimated that, if the snow of winter be added to the rain of summer, the result would be about eight inches of water, certainly not more than ten, on most parts of the arctic lowlands of Canada and Alaska. The Siberian lowlands may be even drier. We have, therefore, the apparent paradox that the average snowfall of the Arctic is much less than that of Scotland or of Illinois, for instance.

Glaciers.—It is now well established that there is no permanent snow or ice on any land in the Arctic unless it be mountainous. The required height of mountains varies roughly with the varying precipitation. The highest mountains of Melville I., for instance, are probably not more than 4,000 feet. This is not enough for the formation of any real glaciers. Mr. E. de K. Leffingwell, in his studies of arctic Alaska, found that in the first coast range south of Flaxman I., the altitude of 6,000 ft. was not enough for the formation of glaciers. But in the second range, a little farther south, which runs up towards 10,000 ft., there were some glaciers. So far as we yet know, there is no evidence of ancient glaciation on the great low plains of arctic Alaska. This must have been because they were then as now a region of very light snowfall.

Fogs.—Since fogs are caused by the meeting of air currents of differing humidity and temperature, it is obvious that the insular Arctic and the coast lands must be regions of frequent fogs. In summer, for instance, with a lowland steaming under a sun that creates an 80° temperature in the shade, and just in front of it an ocean the surface of which is around 30° F., any breeze blowing from the land would be suddenly cooled, producing a sea fog. Similarly, any breeze coming from the ocean would produce a fog over the superheated land. Such fogs would be thickest and most frequent where the sea and land meet. We gradually work out of the land fogs when we travel inland and out of the sea fogs when we steam away from land. From the flying point of view, it is important that these fogs have been found by experience to be very low on the average. They are often thick on the decks of whaling ships, but so thin at the masthead that the captains in the crow's-nests can see each other plainly while the men on the decks have no visual evidence that other ships are near.

Summing up, the arctic winters are longer than those of most extremely cold places now inhabited by prosperous and contented Europeans, such as Dakota and Manitoba, for instance. They are also a little colder. But they are, on the other hand, less stormy and with a lighter snowfall. The summers, although shorter, are in some places almost or quite as hot. It would seem, then, that the same sort of people might be willing to live in the Arctic who are willing to live in Dakota and Manitoba.

It will undoubtedly be difficult to get people to colonise the Arctic, but in the opinion of many this will not be any special arctic problem but rather a general frontier one. For the tendency which brings American farmers to the cities, increasing the percentage of urban population, makes it as difficult to induce Londoners who are out of work to migrate to sub-tropical Australia as to sub-arctic Canada. The weakening or dying out of the frontier spirit is one of the conspicuous social phenomena of our time.

II. NATURAL RESOURCES

Since the climate, as such, will not prevent arctic colonisation, the ascertained resources may be enumerated.

Coal.—It is now known that coal is almost, if not quite as likely to be found in the Arctic as in tropical or temperate lands. It is not surprising, therefore, that seams of coal, of varying quality, of course, have been reported by most arctic explorers. Stefansson, for instance, found coal in all but two of the islands north of Western Canada. In these, Victoria Island and Meighen Island, further exploration may show coal.

Coal of quality said to be equal to the best Welsh has been mined for several decades in Spitsbergen, some five or six hundred miles north of the arctic circle, and these mines should eventually supply a great part of northern Scandinavia and of northern Russia. In Alaska, a coal mine at Cape Lisburne, well north of the arctic circle, was worked to supply the whaling fleet even before 1885, and fell into disuse only with the abandonment of the whaling industry. The natives of the north coast of Alaska mine coal at Wainwright for their own use and to sell locally to missionaries, government schools, traders, etc. The members of Stefansson's expedition, living by hunting on Melville I., maintained two winter camps, one in Liddon Gulf and the other on the north coast near Cape Grassy. They burned bituminous shale in the southern camp, but in the northern they burned lignite of good quality, some of it saturated with oil.

Oil.—Indications of oil have been found in many parts of the Arctic. The Imperial Oil Co. of Canada, a branch of the American Standard Oil, has flowing wells on the Mackenzie river just south of the arctic circle, and the same oil-fields are known to extend beyond the circle. About 500 m. north from these wells and, therefore, about 500 m. north of the arctic circle, Stefansson found oil on northern Melville Island. The U.S. Navy has recently set aside a vast oil reserve in arctic Alaska, and both private prospectors and representatives of large oil companies have staked claims east of the government reserve. These claims are near Cape Simpson which, but for Barrow, is the most northerly cape in Alaska.

Iron and Copper.—Hardly less fundamental than oil and coal are iron and copper. No large arctic deposits of iron ore are known. There are iron "prospects," however, in many places. But the copper fields that lie between Bear Lake and the centre of Victoria I. in a district roughly 200 m. sq., give great promise, —if the world's need of copper increases, or if the spread of settlements to that country make mining more feasible. There are copper prospects in other parts of the Arctic, and gold, silver, platinum and tin have been found.

Vegetation.—A more fundamental resource than even the oil and coal is the vegetation of the Arctic that makes food-production possible. The coniferous forest extends beyond the arctic circle, in Canada in certain river valleys as much as 150 m., and even farther in Siberia. Trees 100 ft. high are found 100 m. north of the arctic circle. They make the Arctic more homelike to those who are used to forests, and they are doubtless valuable. But many consider that the same land would be more immediately valuable if the trees were absent, for then it would be covered with grass, like most of the rest of the Arctic, whether continental or insular.

It is one of the exploded beliefs that arctic vegetation is mainly mosses and lichens. Some 20 years ago, Sir Clements Markham published the statement that the Arctic possesses 28 species of ferns, 250 lichens, 332 mosses and 762 flowering plants. Many species have been discovered since then, and many others will be discovered hereafter. There will probably be little disagreement with the estimate that we have in the Arctic at least 10 times as many tons of flowering plants as of non-flowering. There are a few small portions of the Arctic where cereals can be profitably cultivated, and still others where garden vegetables will be of some value. But, so far as can be seen at present, the chief thing to do with the arctic soil is to permit that vegetation to continue growing which grows there already and to make an economic use of it by converting it into meat, hides and other animal products.

Reindeer.—There is one suitable animal, the reindeer, domestic in the Old World since prehistoric times. No one knows how many of these there may be in arctic Siberia, where single owners often have from 5,000 to 10,000 head. But there are definite figures for the entire period of reindeer domestication in Alaska. The American Govt. commenced by importing 16 head from Siberia in 1892. Up to 1902, when importation ceased because of an embargo imposed by the Tsar's Govt., 1,280 animals were brought from Siberia. These have never failed to double every three years since importation, so that by the spring of 1926 there were 500,000 head.

The U.S. Department of Agriculture estimates that the grazing resources of arctic and sub-arctic Alaska will be adequate for 3,000,000 to 4,000,000. Since the climate and vegetation of arctic Canada are, for reindeer purposes, the same as those of arctic Alaska, with an area 10 times greater, we can say, roughly, that Canada will support from 30,000,000 to 40,000,000 head. Undoubtedly the reindeer area in Asia and northern Europe is twice as large as the Alaskan and Canadian put together, which would make total world figures between 100,000,000 and 125,000,000. This estimate is probably low.

No animal now domestic can be profitable in the Arctic except the reindeer. Cattle, sheep, horses and goats can, of course, be raised in many parts, but, under present costs and prices, they would not pay. The reindeer pays handsomely because it needs no barn for shelter, no hay for feed, nor any protection from wind or weather.

Domestication of Ovibos.—There was a project under discussion in 1926 of domesticating the ovibos (musk ox) because it eats certain arctic vegetation that reindeer do not eat and because the reindeer produces only meat and hides while the ovibos produces wool in addition. Ovibos beef is indistinguishable from ordinary domestic beef in colour, flavour, taste and odour. The wool, as determined by the Textiles department of the University of Leeds (Prof. Aldred F. Barker), has good heat retaining and wearing qualities, is easy to bleach and dye, is softer than cashmere, and will not shrink—in other words, is one of the finest of known wools.

With the ovibos domesticated, the potentialities of the Arctic will be greater. But with only the reindeer, there is no doubt that the arctic grasslands (which means all lands in the Arctic not so high and mountainous as to be snow-covered) will be colonised unless, indeed, the world movement of population from the country to the cities stops further colonisation entirely. In most cases mining will develop after the ranchmen have occupied the grazing lands. But in some cases, notably with oil, the mining will precede colonisation. That gold mining will precede colonisation seems for the moment unlikely, although that is the one kind of mining that has hitherto taken people to the Arctic. But the rise in the cost of living is only another expression for a drop in the value of gold, so that the gold deposits, which paid fabulously in Alaska 20 years ago, are not paying now even where production remains uniform.

Site-value.—Finally we must point out a resource of the Arctic that has nothing to do with climate, minerals or the like, but is due entirely to position. The history of civilisation as we know it is essentially the history of the Northern Hemisphere. Generally speaking, civilisation seems to have started in the subtropics—Yucatan for the New World; Egypt, Asia Minor, etc., for the Old World. As civilisation has been spreading northward during historic time, it has really been spreading toward the centre of a circle. That centre is the Arctic.

It was an Elizabethan ideal to find a sea-way north from Europe to the Indies. No practical route was ever found, because of the floating ice in the arctic sea. So, perforce, we have gone roundabout. But now ships of the air are opening up the roads of the air which lie straight in any desired direction. As the Elizabethans knew, China is north of Europe. But Peking is also north of New York, and the wheat-fields that are spreading over central Siberia are north of the growing wheat-fields of central Canada. The cities springing up in those wheat lands will be far from each other east and west, but not half so far north and south.

Air Routes.—The world is developing an increasing speed mania, both for messages and for passengers. The flying conditions of the Arctic are probably, on the average, as good as those of any other equally large area of the world. It follows, therefore, that the centre of the circle of civilisation, which is the Arctic, will be the flying crossroads of the world. This will necessitate the establishment of way stations here and there. Of itself, that will to a small extent require colonisation. It will have a vastly greater indirect effect by spreading accurate knowledge of the Arctic throughout the world. Thereupon will follow such colonisation as the real climate and actual resources justify.

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ARDENNES, BATTLE OF THE: *see* FRONTIERS, BATTLES OF THE.

ARGENTINA (*see* 2.460).—A republic in South America, having an area of 1,153,119 sq. m., and a population, Jan. 1 1924, of 9,293,797.

I. POLITICAL HISTORY

During the period 1910–25 Argentina enjoyed an external and domestic peace such as she had never known throughout a period of similar duration in her history. She was enabled to consolidate and bring nearer perfection the institutions of the country; give effect to the democratic ideals of her statesmen; and put an end to abuses and systems which, for nearly a century, had disturbed her peace and retarded her progress. In 1910 the republic celebrated the centenary of her first bid for independence, commemorating with a successful international exhibition the events of May 25 1810, when the residents of Buenos Aires ejected from office the Spanish-controlled municipal council and deposed the viceroy Cisneros. By 1910, after 100 years of recurrent political disturbance, a new era for Argentina had opened. There was peace within her frontiers and all difficulties with her neighbours had been overcome. Boundary disputes with Brazil, Chile and Bolivia had been amicably settled, either by the arbitrament of foreign powers—as in the case of the very serious difference with Chile—or by direct negotiation.

The Pre-War Years.—Dr. Roque Sáenz Peña was installed in office as President in Oct. 1910. He gave the closest attention to reforms designed to foster and strengthen public respect for and confidence in the institutions of the country. Much of the trouble during the 20 years prior to 1910 had been due to corrupt practices possible under the old system of open voting at elections, and the methods of trickery and force employed throughout the country by powerful "caudillos," or political "bosses." President Peña reformed the electoral law and instituted the secret ballot. This was the outstanding and most valuable of his official actions, and incidentally it is worth noting that the first effect of the reform, at the next presidential elections in 1916, was the defeat of the Conservative party to which the author of the new law belonged, and which had enjoyed political control of the country for over a quarter of a century. There was a good deal of industrial trouble in the years 1910–4, due, not to any political unrest, but to economic conditions following the collapse of the land and cattle boom of 1910. Early in 1914 Dr. Peña was too ill to fulfil his duties, and the presidential mandate was assumed by the vice-president, Dr. Victorino de la Plaza.

The War Period.—President Peña died in 1914. With conspicuous ability Dr. de la Plaza was directing the affairs of the nation through a difficult period when the outbreak of the World War occurred. In a country with such a cosmopolitan population the sudden disruption of international relations necessarily had an immediate repercussion. All important contracts involving shipping, the exportation of grain and meat and the importation of manufactures, were cancelled and something like a business panic was imminent. It was only averted by the declaration of a moratorium. The banks closed their doors for a week, and time was given for an examination of the general situation. The strict neutrality of Argentina was proclaimed. It was recognised early that the republic would play an important part in the provisioning of Europe, and out of a moment of threatened panic the country emerged in a spirit of confidence that at least it could not be adversely affected by the War.

The general outlook of the Argentine people on the causes of the War and its subsequent conduct was one largely of indifference until the events of early 1918. There was a fairly pronounced sympathy with the Allies, and particularly with Belgium and France, but Germany's preliminary successes rather impressed the people, and the vigour with which she entered upon propaganda in Argentina had its effect. A German newspaper in the Spanish language was established in Buenos Aires and was widely circulated gratis throughout the country. The Allies were very slow in countering this propaganda, and Argentine public opinion at first held that the Central Empires would prove successful. This opinion was strengthened by the news of the annihilation of Admiral Cradock's squadron off Coronel, Chile, by the German squadron commanded by Admiral von Spee, but its effect was quickly overcome by the more convincing destruction of the German fleet in the battle of the Falklands. Meanwhile Buenos Aires had had its first glimpse of the War, by the arrival of the German steamer "Elenore Woermann," bringing the survivors of the "Cap Trafalgar" and the cruiser "Ebor," the former of which—well known in the Plate trade—had been sunk by the British armed liner "Carmania." The great newspaper *La Nación* was strongly pro-Ally, and prominent poets and other writers pronounced themselves vigourously in condemnation of Germany. Officially, however, the country remained strictly neutral, though its whole resources were exclusively at the disposal of the Allied powers.

President Irigoyen's Régime.—The presidential elections in 1916 withdrew all attention from the War to domestic politics. For the first time the elections were to be "free" under the secret voting system introduced by President Peña. The Conservatives confidently nominated Señor Rojas-Seru. The Radicals who had, to use a local expression, "been in the wilderness" for 30 years, put forward Dr. Hipólito Irigoyen, and the result was a sensational victory for the latter. Dr. Irigoyen was comparatively unknown to the new generation, and came from relative obscurity to the presidency. Twenty-five years earlier he had been one of the most vigorous "caudillos" in the country, and had suffered exile for his association with Leandro N. Alem in the revolution of 1893. Buenos Aires knew little of him, but his power and prestige with his party and in the country must have been very great throughout the period when he was quietly working for a restoration to power of the Radicals. On attaining office in Oct. 1916 he followed the custom of transferring to his partisans every office and position that could possibly be given. It was widely believed that, while the neutrality of Argentina in the War would be strictly adhered to, the President was privately rather pro-German. This popular belief received no confirmation by any official act, and it is much more probable that Dr. Irigoyen entertained no feeling one way or the other, his policy being one of intense nationalism.

When in the early part of 1917 the United States entered the War and President Wilson appealed to the Latin American States to follow her lead, strong influences were brought to bear to change the official attitude of Argentina. Brazil and other countries declared war on Germany; Uruguay broke off diplomatic relations, but President Irigoyen permitted no departure from the country's proclaimed neutrality. A more severe test came when, in pursuance of her unrestricted submarine campaign, Germany sank several ships flying the Argentine flag. National feeling ran high. It was intensified by the disclosure that the German Minister in Buenos Aires, using Swedish diplomatic channels for the purpose, had advised his government in dealing with Argentine ships, either to spare them or "sink without a trace." Wild riots ensued in Buenos Aires. The German Club was sacked, and other property damaged. A clamour for war arose, but the President refused to give way. The government contented itself with demanding explanations and obtaining compensation, which was given by Germany by way of the transfer to the Argentine national transport fleet of certain ships that had lain in port since the outbreak of the War.

Post-War Years.—The conclusion of the War was as entirely unexpected in Argentina as its outbreak. The country was enjoying great prosperity, only suffering to a limited extent from shortages of coal and certain manufactures. Immediately the Armistice was signed there was some confusion, especially as regards the condition of the primary industries under war contracts, now to be cancelled. Industries that had sprung into being during the War also felt "panicky" in face of an expected early resumption of trade with Europe in manufactured goods. Trade unionism had developed strongly, particularly among the marine and dockside workers. President Irigoyen was reputed to be intensely sympathetic toward the "proletariat," and much of the energies of his cabinet had been devoted to legislation designed to ameliorate the conditions of the labouring masses. At this period strikes were rather frequent. Early in 1919 occurred the "tragic week," of which practically no report reached Europe. A prolonged strike at the works of the Argentine Iron and Steel Company culminated in a demonstration of the strikers. The police were sent for, and came into conflict with the rioting strikers, several of whom were killed. At the funeral of the victims, which was attended by thousands of workers, further shooting took place. The trouble spread throughout the city of Buenos Aires, and finally the military took charge of the situation and promptly restored order. Actually the affair had no deep political significance, though subversive elements of the cosmopolitan population certainly intruded themselves into it. Industrial troubles endured until after the end of Dr. Irigoyen's term of office. Shipping and the transport systems were most involved, and the business of handling the country's imports and exports suffered severely. In 1922 the port of Buenos Aires was completely at a standstill for over three months. From the beginning of 1923 the position began to improve, coincident with the country's return to normal conditions of industry, trade and commerce.

Argentina and the League.—The republic was one of the first of the Latin American States to give its adhesion to the League of Nations, which it joined on July 16 1919. The Foreign Minister (Dr. Honorio Pueyrredon) and a delegation attended the first Assembly in 1920, when the minister delivered a striking address and presented a formula for the inclusion of Germany and all sovereign states within the League on a basis of absolute equality, and for submitting disputes to an international judicial court. On the rejection by the Assembly of this formula, the delegation withdrew. Up to the end of 1925 the republic had taken no active part in the deliberations of the League. For a time no dues were paid, but in 1925 Congress approved of the nation meeting its obligations in this respect.

President Alvear's Régime.—Dr. Irigoyen's term of office expired in Oct. 1922. He was succeeded as president by Dr. Marcelo T. de Alvear, whose candidature was supported by the retiring president as head of the Radical party. At the elections the people again gave the Radicals their confidence, the Conservatives and Socialists being easily defeated. In the Federal capital the Socialist party had come into prominence since 1910. In the 1922 presidential elections, the following votes in the Electoral College were secured: Union Civica Radical, 335; Concentration National (Conservative), 60; Socialist, 22; Democrata Progresista, 10. Under the Alvear régime substantial progress was made, particularly in the direction of financial reform. The floating debt was greatly reduced, economy in administration effected, the big overdraft in excess of legal authorisation at the Banco de la Nación wiped out, and a more rigid control exercised over the affairs of the nation. A more businesslike attention was paid to the exploitation of the State-owned petroleum industry and the administration of the National railways.

In 1925 President Alvear had to reorganise his Cabinet, following the resignations of the Ministers of the Interior and of Agriculture. During the first few months of his administration the President and his Cabinet were faced with rather difficult economic conditions owing to the heavy fall of cattle values, upon which so much of the prosperity of the country depends. The foreign freezing companies fixed prices according to the demand ruling in European markets, and intense dissatisfaction prevailed amongst the influential cattle breeders. It was proposed at one time to nationalise the meat export industry, or alternatively to compel the exporters to pay minimum prices. Before any of the varied schemes for rectifying the situation came to fruition, however, values for cattle began to rise, and in 1925 they reached the highest point ever recorded. Agricultural and other primary industries were in a flourishing condition in 1925, high prices ruling for most lines of produce.

Social Legislation.—The period 1910–25 was remarkable for the volume of legislation of a social character, most of it passed during the Irigoyen régime. The principal Acts passed related to employers' liability; compensation for injured workers and those incapacitated by disease contracted at their work; the early closing of shops and business establishments; restriction of Sunday labour; official control of sweated industries carried on in the home for an outside employer, and the provision of cheap homes for workers, and pensions. A National Department of Labour was established, with very wide control over every phase of employment and industry. In the immediate post-War years, a Rent Restriction Act was in operation, but it became inoperative in 1924 when the Supreme Court declared it unconstitutional. In 1925 the attempt to enforce a general Pensions Law, framed somewhat on the lines of the British legislation, proved futile owing to the opposition of both employers and employees, who refused to make the required contributions. This law practically lapsed, though it was not repealed.

British Royal Visit.—A notable event in Argentine history was the first official visit ever paid to the country by a member of the British Royal Family, the Prince of Wales journeying in H.M.S. "Repulse" to Buenos Aires at the invitation of the president and nation. The Prince reached the Federal capital on Aug. 18 1925, and received an enthusiastic welcome. After a round of ceremonies he toured the country, and crossed the Andes to Chile. On his return to Argentina he was again shown the greatest hospitality, and spent some days as the personal guest of President Alvear. In recognition of the magnificent reception given to the Prince, King George V. bestowed the Grand Cross of the Order of the Bath upon the President, and conferred high honours upon members of his cabinet and prominent officials. (L. Ma.)

Defence.—The army of the Republic is a national militia, and service is compulsory for all male citizens from the age of 20 to 45 years; naturalised citizens are exempt for a period of 10 years. For the first 10 years men belong to the permanent forces, *i.e.*, the first line, for the next 10 years to the National Guard, and for the last five to the Territorial Guard: the period with the permanent forces includes one year's continuous service. The Army Regulations of Jan. 1916 laid down the establishment for 1924 as 1,501 officers, 3,160 non-commissioned officers, 1,820 volunteers and 20,000 conscripts. There is a trained reserve of 300,000 men, half in the first line and half in the special reserve, and a territorial reserve of 100,000 men. A military aviation school has been established at El Palomar: in Dec. 1924 the Air Force consisted of a fighting flight, a bombing flight, and an observation flight. The navy consists of two battleships, the "Moreno" and "Rivadavia," four armoured cruisers, one light cruiser, one cruiser, seven destroyers, five torpedo boats, two coast defence vessels and a few training and miscellaneous craft. The battleships, launched in 1917, have a displacement of 27,940 tons and a nominal speed of 22·5 knots: their principal armament consists of twelve 12-in. and twelve 6-in. guns. Under a programme introduced in 1924 for the reconditioning of the battleships and four cruisers, the "Rivadavia" and "Moreno" were brought up to the post-War standard of their class in the early part of 1926. The personnel of the navy includes 337 officers, 130 engineers, 27 electrical engineers and 9,100 men (including 5,000 conscripts); the men have to serve for two years. A corps of coast artillery of some 450 men, a naval school and schools for mechanics, artillery and torpedo practice have been established. Before 1914 the army was trained and armed on the German pattern; a certain number of Argentine officers were sent each year for 18 months' training with the German Army, and German instructors were provided for the Argentine Army. Since 1914, however, certain features of the British, French and United States systems of training have been adopted.

II. ECONOMIC AND FINANCIAL HISTORY

The area of the Republic is 1,153,119 sq. m., divided into one Federal district, 14 provinces and 10 territories. The total population on Jan. 1 1924 was 9,293,797, an increase of 17·9% over the population in 1914, which was 7,885,237. The increase is well distributed over the whole of the area. The population of the Federal capital, Buenos Aires, increased from 1,575,814 in 1914 to 1,811,745 in 1924. From 1910 to 1913 inclusive the increase in the population of the country was largely due to immigration, the excess of immigrants over emigrants during the four years being 625,016. From 1914 to 1918, owing to war conditions, immigration almost ceased and emigrants exceeded immigrants. After the end of the World War the flow of emigrants recommenced: during the years 1922–4, inclusive, the net annual increase, *i.e.*, of immigrants over emigrants, averaged 114,000. In 1925 this average was not maintained, the excess of arrivals over departures dropping to 75,525. Argentina is not a suitable country for Anglo-Saxon immigrants of the labouring classes, the conditions being more favourable to Italians, Spaniards and other people of southern Europe. Limited opportunities in farming, dairying, and similar agricultural pursuits, are presented to Anglo-Saxons with a capital of from £500 to £1,000; a larger capital is required for stock-raising. Labour troubles were prevalent during the War and immediate post-War period, but later the relations between capital and labour improved.

National Finance.—The financial position of the Argentine nation at the end of 1925 was quite sound, though in one or two instances among the provinces the situation could not be considered satisfactory. During 1925 the Federal authority worked with marked success to rectify the national finances and put an end to a drift that had threatened to become serious. There had been an accumulation of budget deficits since 1913, with the exception of 1920, the total of these deficits amounting at the beginning of 1925 to about $1,000,000,000 paper. By the end of 1925, however, the Minister of Finance announced a prospective surplus for the year ended March 31 1926 of $50,000,000 paper. In 1923 the total indebtedness of Argentina, including national, provincial and municipal obligations, amounted to nearly $3,000,000,000 paper (about £261,000,000 at par of exchange). To a

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[1] The Argentine dollar is also known as the peso, the two being convertible terms.

large extent this debt was incurred for essential public works, generally of a reproductive character, and on projects necessary for the development of the country.

The level of the public securities of Argentina is high in the financial world, owing to the regular payment of interest, and the 1% annual amortisation always carried by the nation's foreign loans. One or two of the provinces have not been so regular in their debt services. The floating debt of the nation stood at $746,812,099 on Jan. 1 1925. By the end of that year the debt had been decreased to $485,197,108 paper. The consolidated debt was $1,523,581,900 paper on Jan. 1 1925. By June 30 of the same year it had risen, largely as the result of the adjustment of the floating debt, to $1,673,647,300 paper. If the gross national debt of Argentina be taken as approximately (on June 30 1925) $2,275,000,000 paper, and accepting an estimated population on the same date of 9,500,000, the per capita indebtedness was $239.47, or nearly £21. Such a debt is lower than that of the great majority of nations of similar economic capacity. The budget for 1926 foreshadowed a national expenditure of $674,983,500 and a cash revenue of $695,000,000. Provision was also made for special expenditure, mainly on public works, of an additional $138,996,000 against which it was proposed to issue internal bonds for $150,000,000.

Production.—Argentina is essentially an agricultural and pastoral country. During the first quarter of the 20th century she rose from a position of comparative obscurity among the nations of the world to one of considerable importance as a source of cereals and animal products. Between 1909 and 1918 the value of her national production more than doubled, while the total area under cultivation increased by over 20%. The climatic conditions, together with the fertile soil, are almost ideal for the production of wheat, maize, oats, barley, linseed and lucerne. The wonderful lucerne crops provide unequalled feed for cattle, which, added to the climatic conditions, makes Argentina the finest cattle-raising country in the world. By 1910 she occupied the leading place among the countries of the world as an exporter of beef; on Jan. 1 1914 there were 25,866,763 cattle and 43,225,452 sheep in the country. In 1910 the republic experienced a "boom" in cattle and land. Excessive speculation led to a collapse, and from the beginning of 1912 until the outbreak of the World War a severe depression prevailed.

The World War greatly influenced the development of Argentina. While on the one hand she suffered by the cessation of developmental works that depended upon the provision of foreign capital and material, by the sudden stoppage of emigration from southern Europe, and by a dearth of the manufactured goods she required, she gained immensely by the increased demand, at higher prices than had hitherto been known, for her primary products. So far as the shortage of manufactured goods was concerned Argentina found a substantial source of supply in the United States. The national wealth increased substantially during the War, the high prices obtained for foodstuffs more than compensating for any loss the country suffered by the adverse effect of the War in retarding the normal development programme. The production of most cereals was enormously increased, and the pastoral industry became more prosperous than ever it had been before.

The wheat crop was of great importance to Great Britain and other wheat-importing countries. Good crops were obtained in 1915 and 1916, but that of 1917 was poor. Towards the end of 1917 the Allied governments entered into negotiations for the purchase of Argentine cereals. An agreement was concluded in Jan. 1918 whereby the British and French governments agreed to buy the surplus of wheat and other cereals to an approximate amount of 2,500,000 tons, at a minimum price of $12.50 (paper) for every 100 kilos of wheat, $7 (paper) for every 100 kilos of oats and $15 (paper) for every 100 kilos of linseed, f.o.b. The Argentine Government agreed to open credits in favour of both the British and French governments up to $100,000,000 (gold or equivalent in paper), the amounts drawn under these credits to carry interest at 5%.

The linseed crop was adversely affected by War conditions, due to the loss of markets and the difficulty of obtaining cargo space. In 1914–5 the crop amounted to 11,432,000 quintals, but in 1916–7 it only totalled 1,015,000 quintals. The scarcity prevented adequate marketing, and growers had great difficulty in disposing of their produce. Attempts were made to establish factories for crushing the seed in Argentina, in order to export the oil, which took up less cargo space than the seed. These attempts were not very successful, however, largely owing to the difficulty of obtaining the necessary machinery. The production of linseed was necessarily curtailed and normal production could not be resumed until the conclusion of peace. During the period 1919–25 Argentina has contributed over 50% of the world's supply of linseed.

Other important agricultural products are lucerne (alfalfa), cotton, rice, rye, barley, sugar cane, tobacco, potatoes, peanuts, grapes and olives. The development in cotton cultivation since 1909 has been very considerable, production increasing from 1,390 tons in 1909–10 to 10,000 tons in 1919–20 and to some 45,000 tons in 1924–5. The general trend in cultivation, particularly of cereals, is for more intensive methods to be adopted. The yield per hectare is rising, and since 1922 great progress, under the direction of the Ministry of Agriculture, has been made in scientific seed selection and in improved methods of cultivation.

The following table gives the production, in quintals, of wheat, maize, oats and linseed for each of the War years, and the average crop for the immediate pre-War and post-War periods:

Period	Wheat	Maize	Oats	Linseed
Average for 1909–10 to 1913–4	40,023,358	48,694,000	7,874,980	7,904,062
1914–5 . .	46,040,000	87,320,303	7,170,000	11,432,000
1915–6 . .	46,000,000	40,930,000	10,927,000	8,951,000
1916–7 . .	21,804,010	14,946,000	4,613,000	1,015,000
1917–8 . .	59,730,000	43,350,000	9,962,450	4,975,780
1918–9 . .	46,702,880	56,961,500	4,900,560	7,817,400
Average for 1919–20 to 1924–5 .	54,381,113	55,224,161	7,207,985	12,557,003

Pastoral Products.—The chief feature of the period 1910–25 was the development of the canned, frozen and chilled meat traffic. The transition from the trade in live animals to this traffic was greatly accelerated during the War period, and has been of immense advantage to the country. Important meat refrigerating and packing industries have sprung up and a large trade has developed in valuable by-products such as hides, hair, wool, bones, manures, tallow and fat. The export of canned meat increased from 13,590 tons in 1913 to 102,153 tons in 1917. The post-War slump resulted in a great depression in the industry, but by 1925 conditions had largely improved under the influence of increased demand and higher prices. The livestock census of Dec. 31 1922 gave the number of cattle as 37,064,850 and of sheep as 36,208, 981: these figures, when compared with those for 1914, show an increase of 11,198,087 cattle, but a decrease of 7,021,471 sheep. During 1924, 3,812,890 cattle and 4,421,010 sheep were killed in the slaughtering yards of the large "frigorificos" or meat refrigerating and exporting companies; over 1,000,000 tons of meat were exported during the year. Dairying and cheese-making are increasing in importance.

Manufactures and Fuel.—Owing to the lack of home supplies of coal and iron, Argentina has made but little progress as a manufacturing country. The reduction during the War period in foreign supplies of manufactured goods resulted in the development of home industry. Factories for the production of textiles, paper, chemicals, electrical machinery, etc., were established, but progress was not very rapid owing to the shortage of coal, iron and machine tools. These infant industries were protected by high duties on imports of manufactured goods. Their future, however, depends largely upon the development of the oil and water-power resources of the country. Petroleum was first discovered in the Comodoro Rivadavia area in 1907, and in 1913 about 20,000 tons were obtained; production increased to 200,000 tons in 1918 and to 750,000 tons in 1924. Government reserves have been established at Comodoro Rivadavia and at the smaller field of Plaza Huincul, near Neuquen; the greater part of the output is from these reserves.

Trade.—Although the War period resulted in a great development in the export of meat and cereals, it partly checked the normal development of the resources of the country, and it is possible that progress would have been greater if the World War had not occurred. One very beneficial effect of the War, however, was that the country was thrown upon its own resources, instead of depending upon foreign assistance, thus compelling increased production and more economic methods of production and finance. The result was that Argentina was in a much better position in 1919 than she had been in 1913.

The visible balance of trade from 1913 to 1920 inclusive was favourable each year, the value of exports considerably exceeding the value of imports. In 1921, however, owing mainly to the fall in world prices, an adverse balance was recorded; in 1922 and 1923, also, imports exceeded exports, but in 1924 and 1925 a favourable balance was recorded. The following table gives the values of exports and imports, in gold pesos, for 1913, 1918 and from 1920 to 1925:—

	Imports	Exports		Imports	Exports
1913	496,000,000	519,156,000	1922	689,645,000	676,008,000
1918	500,603,000	801,466,000	1923	868,430,000	771,861,000
1920	934,968,000	1,044,085,000	1924	828,710,000	1,011,395,000
1921	749,534,000	671,129,000	1925[1]	880,000,000	930,000,000

[1] Estimated.

The visible adverse balance of trade for 1921–3 was further increased by invisible imports, estimated at an annual value of about 200,000,000 gold pesos: the largest items in these imports are interest payments on foreign capital invested in the country and on foreign loans, and payments for shipping and financial services.

The outstanding results of the outbreak of War in 1914 were the great falling-off in imports from the United Kingdom, the complete cessation of trade with Germany, and the great increase in trade with the United States. After 1918, however, trade largely returned to pre-War channels. The following table shows the distribution of the import trade with the principal countries concerned for 1913 and 1923:—

Country of Origin	Values in mill. of gold		Percentage of total	
	1913	1923	1913	1923
United Kingdom	154	207	31	23·8
United States	73	181	14·7	20·9
Germany	84	118	16·9	13·6
Italy	41	68	8·3	7·8
France	45	59	9·0	6·7
Belgium	26	45	5·2	5·2
Brazil	11	46	2·2	5·3
Mexico	2	15	·3	1·8
Spain	15	30	2·9	3·5

Communications.—Between the completion of the Transandine railway in 1909 and the year 1925 the railway system of Argentina was greatly extended. Construction was particularly rapid between 1909 and 1913, the total length of line in the latter year being about 20,000 miles. During the War period, owing largely to the lack of capital, very little progress was made. After 1918 a policy of state railway construction largely replaced the former policy of private enterprise, and a programme, at an estimated cost of £40,000,000, was drawn up. The line linking the system of Argentina with that of Bolivia was completed, two other Transandine lines were commenced, and the system was extended in the southern areas. By 1925 the total mileage reached 22,220, of which about 65% was British owned, 20% state owned and the remainder controlled by French interests.

Few good roads exist, the total length of roadway in 1925 being only about 10,000 m., less than one-half the railway mileage. A high power wireless station has been erected at Monte Grande in the province of Buenos Aires and submarine cable connection with Montevideo established. During the early years of war several naval transports were used in the coastal carrying trade, and formed the nucleus of a national freight fleet. Ships handed over by the Germans as compensation for the sinking of Argentine vessels were added to the fleet, which was still in being at the end of 1925.

Banking and Currency.—The monetary unit is the gold peso, or dollar, value at par, 47·58 pence. This coin is not in circulation, however, the unit of circulating currency being the paper peso, worth ·44 of the gold peso. Banking facilities have greatly increased during the period 1910–25. The central bank, the Banco de la Nacion Argentina, had over 210 branches and agencies throughout the country on Jan. 1 1925. Private banks are divided into native and foreign banks. In 10 important institutions the capital is wholly Argentine: the others, some 20 in all, are either branches of foreign banks or banks founded with foreign capital. A Government Postal Savings Bank was established in 1915.

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(W. H. Wi.)

ARGETOIANU, CONSTANTIN (1871–), Rumanian statesman, was born at Craiova. He studied law and medicine in Paris and was in the diplomatic service from 1907 to 1913. In 1914 he was elected a Senator and became Minister of Justice in Gen. Averescu's Cabinet in 1918. Together with Averescu and Cantacuzene he formed the People's League, which became the People's party in 1920. Later on, owing to dissensions, he left the party with a number of followers and joined the Nationalist-Democratic party under the presidency of Prof. Jorga. This group having coalesced with the Transylvanian party under Jules Maniu, Argetoianu became a prominent member of the new formation, which is called the National Rumanian party.

ARGONNE: *see* VICTORY, ADVANCE TO.

ARIZONA (*see* 2.544).—The population in the 1920 census was 334,162 consisting of: Whites, 291,449; negroes, 8,005; Indians, 32,989; Chinese, 1,137; Japanese, 550; all others, 32. As compared with the census of 1910 this represented an increase of 129,808, or 63·5%. The rural population constituted 64·8% of the whole in 1920 as against 69% in 1910. The population of the capital, Phoenix, was 11,134 in 1910 and 28,053 in 1920.

History.—In connection with the entrance of Arizona into the Union a question of national interest was raised. As provided by the Enabling Act signed by President Taft, June 30 1910, a convention met at Phoenix from Oct. 10 to Dec. 9 1910 to frame a constitution. The constitution then adopted provided that one-fourth of the electors of a judicial district might, by petition, demand the recall of a judge. If he did not then resign, a special election could be held to determine whether he should be recalled. In Aug. 1911 the House of Representatives passed a joint resolution providing for the admission of Arizona on condition that the constitutional provision for recall be submitted to a vote of the people. President Taft had already informed Congress that he would not sign the bill, and in a message to that body took the position that he must veto the measure or assume responsibility for the recall of the judges. Later in Aug. he approved a resolution granting statehood on condition that the provision for recall be struck out. This was done, and on Feb. 14 1912 President Taft signed the proclamation admitting Arizona.

After the state was admitted the people amended the constitution, inserting the original clause providing for the recall of judges. A second issue of national interest was the Alien Labour law enacted by the voters of the state in 1914. The Act provided that when any corporation, company, partnership or individual employed more than five workers, 80% of them should be qualified electors or native-born citizens. The ambassadors of Great Britain and Italy averred that the law violated existing treaties. The United States District Court declared the law unconstitutional as conflicting with the Fourteenth Amendment. On appeal the United States Supreme Court upheld the decision, Nov. 1 1915. The final decision was that it had already been established that aliens were entitled to equal protection under the laws of the United States.

The election of Nov. 1916 resulted in a situation that aroused high party feeling. Previously Gov. Hunt, supported by a Democratic Assembly, had been elected for two terms. In 1916 he ran for the third time. On the face of the returns, Mr. Campbell, the Republican candidate was elected; but both candidates came to Phoenix in Jan. to be inaugurated, and Mr. Hunt refused to leave the executive office. Later he was compelled to surrender the office to Mr. Campbell, but resumed it again in Dec. 1917, after the State Supreme Court had declared him the legally elected governor. The bitter political struggle reflected a tense industrial situation that culminated in a number of strikes, the most important of which was the one at Clifton and Morenci beginning in Sept. 1915. The Bisbee deportation incident in July 1917, when over 1,100 members of the organisation called the Independent Workers of the World were deported to Columbus, New Mexico, produced an even more critical situation. President Wilson at once warned the governor of the danger of such a precedent and appointed a committee to investigate and adjust the dispute. The committee found that any adjustment between employers and labour organisations was impossible, and recommended a law making future deportations a Federal offence.

Irrigation.—In 1919 Arizona adopted a comprehensive code of water laws providing for the adjudication and control of water rights, and creating a State Water Commissioner. After 1920 especial attention centred in the Colorado river problem. (*See* COLORADO.) The utilisation of this river presents many difficulties, involving international as well as interstate interests in the water supply, and rouses controversy, not only as to the location of a dam or dams, but also as to whether the construction shall be by the Federal Govt. or by private corporations. The estimates for dam construction vary from $13,000,000 to $55,000,000, according to the location. The Colorado River Compact, formed Nov. 1922, in accordance with the provisions of an Act passed by Congress in the previous year, attempted to secure a division of the water among the seven states in the Colorado basin. The Compact was rejected by the Arizona Legislature in 1923. Two years later it was accepted with reservations by the Arizona Legislature, but vetoed by the governor. The objection to the Compact is that, if accepted, Arizona surrenders present rights to water and power. A conference of the states of the "lower basin" met on Aug. 17 1925 to discuss the possibility of agreement as to the division of water among these states, but it broke up immediately because of the uncompromising attitude of the states interested.

Education.—In 1916 a high school of the state was for the first time admitted to the North Central Association of Colleges and Secondary Schools. In 1925, 27 of the 52 high schools of the states were in the association. The growth of the normal schools at Tempe and Flagstaff kept pace in enrolment and equipment with the growth of the public schools, and in 1925 they were created into state teachers' colleges with four-year courses leading to the Bachelor degree. In 1910 a state school for the deaf was organised, at first affiliated with the university and under its direction, but later separated, with its own organisation. The University of Arizona increased from an enrolment of 84 regular college students in 1910–1 to one of 1,416 in 1923–4. The institution in 1925 was composed of five colleges on the campus at Tucson—College of Agriculture, College of Education, College of Law, College of Letters, Arts and Sciences, College of Mines and Engineering. The Agricultural Experiment Station, the Stewart Observatory, the Arizona Bureau of Mines, the State Pure Food Laboratory and the State Museum were also on the campus. In 1916 the University of Arizona was admitted to the North Central Assn.; in 1919 it became a member of the Assn. of American Colleges, and in Nov. 1924 the Assn. of American Universities voted that it should be added to the list of approved institutions.

Agriculture.—During the decade ending in 1920 the number of acres irrigated increased from 320,051 in 1910 to 467,565 in 1920, a gain of 46·1%. Almost a third of this gain was in Yuma co. as a result of the construction of the Laguna dam; the greater portion of the remainder was irrigated by pumping. The World War produced great changes in dairy-farming and cotton-growing. In 1916 the dairy industry reached its height when the number of dairy cattle in the Salt River Valley was estimated at 60,000. This number was reduced to about 8,000 at the end of 1920, when the high price of long staple cotton led to the increased production of that commodity. Later the fall in the price of long staple cotton caused the dairy industry to develop, and the dairy cattle in the valley in 1925 numbered about 24,000. The number of acres under cotton rose from 13,300 ac. in 1914 to 180,000 ac. in 1920. The low price of long staple in 1921 turned the farmers to the production of short staple, but the rise in price of long staple in 1924 again tended to increase the production of that variety. Horticulture greatly developed, and the production of orchard and subtropical fruits increased. The most important of the latter are grapefruit, oranges and dates.

Minerals.—In 1910 the production of copper was 297,250,538 pounds. This rose to 615,493,561 lb. in 1923, representing 42·89% of the total in the United States. The tendency during 1910–25 was toward the development of low-grade deposits, but the older companies were still working high-grade deposits in 1925. The stripping of Sacramento Hill, near Bisbee, was practically completed in 1920. The plant for handling this huge low-grade deposit began operations April 2 1923, and by the end of the year had treated 615,177 tons of ore, averaging 1·83% copper. Gold production in the state increased from 152,350 oz. in 1910 to 296,437 oz. in 1923, and silver from 2,566,528 oz. in 1910 to 7,376,832 oz. in 1923.

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(H. A. H.)

ARKANSAS (*see* 2.551).—In 1920 the population was 1,752,204, an increase of 177,755, or 11·3% over that of 1910. It was divided 72·2% white, 27% coloured. Only 13,975 were foreign-born. The estimated population in 1925 was 1,907,000. The population was decidedly rural, only 290,497 being classified as urban in 1920. The density was 33·4 per sq. mile. Little Rock was the largest city, with a population of 65,142 in 1920, and estimated at 72,566 in 1925. Other leading cities were Fort Smith, Pine Bluff and Hot Springs. Since 1920 two small towns have enjoyed a remarkable growth, due to the discovery of oil—El Dorado, estimated at 25,000; Smackover, at 20,000, in 1925.

Agriculture.—Agriculture was still the leading industry and cotton the leading crop. The output for 1924 was 1,100,000 bales, valued at $125,400,000; for 1925, 1,349,184 bales. The seed crop in 1924 was 541,800 bu. valued at $17,338,000. The Arkansas cotton is of a high quality. The corn crop in 1924 was 36,300,000 bu. valued at $38,841,000. The development of the rice industry has been rapid. Introduced in 1904, the production was 2,400,000 bu. in 1910, 7,780,000 in 1920, 7,431,671 in 1925. In the amount produced per acre Texas alone exceeds Arkansas by about half a bushel. The state ranks well in the production of apples, both as to quantity and quality. Strawberries bring in about $1,500,000. In 1920 the state ranked fourth in the acreage devoted to vineyards, and many more have been set out since then. More and more attention is given to the raising of pure-bred live stock. The dairy industry also flourishes. The total value of agricultural crops in 1924 was $230,128,200, plus $58,832,400 for live stock. Since 1920 many counties have shown a decrease in the number of farms operated by owners and an increase in the number operated by tenants.

Manufactures.—Lumber and timber products still hold first place. The annual cut is about one and a half billion board ft., exclusive of firewood. Car and general construction and repairs have pushed ahead of cottonseed oil for second place, while furniture, made mainly at Fort Smith, is a valuable product.

Banks and Finance.—In 1925 there were 396 state and private banks and trust companies and 86 national banks with capital and surplus amounting to $24,759,000 and resources amounting to $270,252,000. Individual deposits amounted to $92,927,000, besides $22,413,000 on savings accounts. The increase in the ratio of the banking resources of the state to those of the nation was exceeded in 1909–19 only by those of Oklahoma and Nevada. The state budget for 1925–6 amounted to $16,460,034. The total recognised debt was $2,597,166, of which $1,447,166 was considered permanent.

The school population in 1924 was 668,690, of whom 501,758 attended school. The state university is supported by taxation. The Legislature in 1925 changed the state normal school and the four agricultural high schools into colleges.

Transport.—In 1922 the state had 5,085 m. of steam railway and 126 m. of electric railway. The number of motor-cars, trucks and tractors had risen to 185,242 in 1925. There were 4,200 m. of hard-surfaced roads, some of them concrete, and in addition about 5,000 m. of improved highways. Most of the roads were built by improvement districts, but are maintained by the state. The Legislature in 1925 appropriated $6,500,000 for construction, maintenance and retirement of district bonds. The Federal subvention for 1925 amounted to $1,250,000.

Minerals and Mining.—Petroleum, first discovered in paying quantities in 1921, was in 1925 the leading mineral industry. The industry centres around El Dorado and Smackover. The production in 1925 amounted to 74,749,000 barrels, giving the state fourth place. The output of coal rose rapidly until 1913, since when there has been a decline, due in part to labour troubles. The bauxite industry reached its zenith in 1918 with a production of 532,000 tons. In 1924 the output was 442,451 tons. The first strong well of gas was opened in Crawford county in 1915 and one near El Dorado in 1921. In 1925 wells were in operation in Crawford, Sebastian, Nevada, Ouachita and Union counties. The state ranks first in the production of whetstones. The clay found in Saline county is used for the making of pottery of a very artistic type, called Niloak. Building stone and granite of a high type are found near Batesville. The only known diamond field in North America is in Arkansas.

History.—The state has continued under the control of the Democratic party since 1874. Down to 1924 only 10 out of 39 proposed amendments to the constitution of 1874 had been adopted. This was largely due to a ruling of the Supreme Court that, even after the adoption of the new initiative and referendum measure in 1910, a majority of the total vote was necessary for adoption. In 1920 a new initiative and referendum measure, which declared that only a majority of the votes cast on a measure was necessary for its adoption, forbade all local legislation by the Legislature, and provided for the initiative and referendum in counties and municipalities, received a majority of the votes cast on it, but not a majority of the total vote. Submitted again in 1922, it failed to receive a majority of the votes cast on it.

In 1924 three amendments received a majority of the votes cast, but not a majority of the total vote. A writ of mandamus was sought against the Speaker to compel him to declare the second of these adopted. As all the amendments were in the same class, the Supreme Court judges declared themselves disqualified because one of these measures affected their salaries. The governor accordingly appointed a special supreme court, which reversed the earlier decision and declared that only a majority of the votes cast on a measure was necessary for its adoption. This was made retroactive and brought to life the new initiative and referendum measure which had been declared not adopted in 1920.

Important legislation after 1910 included provision for a state farm for convicts, industrial schools for delinquent women and children, a minimum wage law, since declared unconstitutional by the U.S. District Court, a compulsory education law, and measures giving women the right to hold office, requiring teachers to present certificates of freedom from tuberculosis, legalising co-operative marketing associations, and creating a warehouse and marketing bureau. All efforts to reform the general property tax have failed, but more revenue has been secured by new taxes. The governors since 1909 have been: George W. Donaghey (1909–13); Joseph T. Robinson (Jan. 8—March 1913); W. K. Oldham (acting) (March 8–23); J. M. Futrell (acting) (March 23—Aug. 6); G. W. Hayes (Aug. 6 1913–7); C. H. Brough (1917–21); J. T. McRae (1921–5); Tom J. Terral (1925–). (D. Y. T.)

ARMAMENTS: *see* AIR FORCES; ARMY; BATTLESHIP; NAVY, etc.

ARMENIA (*see* 1.564).—The Soviet Socialist Republic of Armenia is a component part of the Federation of the S.S. Republics of Transcaucasia, itself a unit of the Russian Soviet Union (U.S.S.R.). The area of the republic is about 27,000 sq. km., and its population, 1,000,000, 86% of which is Armenian. It consists of the provinces of Erivan and Alexandropol, and lies between the Araxes and the Kura rivers. There are about 600,000 Armenians in Georgia and Azerbaijan, and another 500,000 in Northern Caucasus and in other parts of the Union of Russian Soviet Republics.

Under Turkish Rule.—In 1911 the Young Turk administration had produced noticeable improvement in the conditions of Armenian life in the Ottoman Empire. Although there were occasional disorders and acts of injustice, the general security prevailing in the vilayets bestowed economic and social benefits on the people. Freedom of movement and travel gave great impetus to agriculture, cattle-breeding and commerce. Tens of thousands of Armenian exiles had returned home and recovered their lands and properties. Military service by Armenian youth in the Ottoman Army and the presence of Armenian Deputies in the Chamber gave the nation a new status in the empire.

Armenians under Tsarist Rule.—The Armenian people in Transcaucasia were in a not less favourable condition. As a counterpoise to the restoration of their lands to the Armenian peasants in Turkey, the Russian Imperial Duma voted a credit to enable Armenian and Tatar peasants in Transcaucasia to repurchase their lands and become independent proprietors. The comparatively impartial administration of Count Vorontsov Dashkov, the Viceroy of the Caucasus from 1905 to 1915, had given opportunities for national and economic development. Yet at this period even the Armenian leaders of Transcaucasia looked across the frontiers to progressive Turkey as the rallying ground for the Armenian race.

"Reform Programme" of 1913.—After the overthrow of the balance of power in the Balkans by the Balkan Wars of 1912–3, Russia,[1] supported by Great Britain and France and reluctantly followed by the Central Powers and Italy, took the initiative in drawing up a scheme of "reforms" for the Armenian vilayets, Trebizond being added to the other six vilayets defined as Armenian in the Treaty of Berlin, 1878. No Armenian then asked for reforms. Fearing, however, that the European negotiations might compromise his people, the Catholicos of Ejmiadzin persuaded Boghos Nubar Pasha to visit Petrograd as his delegate in May 1913.

The diplomatic representatives of six European Powers met on the Bosporus in the summer of 1913 to discuss the Russian draft. A scheme emerged in the autumn, according to which the seven vilayets of Erzerum, Van, Bitlis, Diarbekr, Trebizond, Kharput and Sivas were to be divided into two sectors over each of which a European inspector was to supervise the carrying out of reforms. At the time when the scheme was imposed on a defeated Turkey, in 1914, the Armenian people on both sides of the frontier had never been more compact and prosperous. Between the watersheds of the Euphrates and the Kura, about 3,000,000 Armenians constituted a strong and healthy nationality.

Armenians in the World War.—When the Turks mobilised in Aug. 1914, Armenian recruits responded to the call. The Armenian ecclesiastical authorities and the party leaders assured the Turks of their loyalty, but could not vouch for their compatriots in Transcaucasia. The declaration of war between the Allied Powers and Turkey (Nov. 1914) immediately turned the thickly populated Armenian-Kurdish frontier districts into a battlefield. The harshness of Turkish requisitions and ill-treatment of Armenian troops in the Turkish Army increased the number of deserters, and caused racial friction. Among the Russian forces operating on the Caucasian front were various volunteer units, as well as some Armenian regiments consisting mostly of Armenians from Russia, but including Armenian political refugees from Turkey encouraged by the repeated declarations of Allied war aims to follow a doubtful course. The Turks confounded Armenian resistance to injustice with sympathy for the Allies. The successful defence of the Armenians in Van strengthened Turkish suspicions. Armenian peasants in the war area were forcibly driven from their homes in April 1915 and many of them were murdered. Simultaneously with one of the worst defeats of Tsarist Russia in Galicia and the utter failure of the British naval attack on the Dardanelles, the three Entente Powers issued in the third week of May a joint threat to the Turkish Govt. to the effect that they would hold them individually and severally responsible for any further Armenian "atrocities." The Turks translated this official threat into the language they were accustomed to understand by past experiences, and drew their own conclusion therefrom.

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[1] See *Orange Book* of Russian Foreign Office, Feb. 1915.

The Committee of Union and Progress, which had been wavering in April and May in their Armenian programme, resolved at the end of May on the murder, deportation and spoliation of the entire Armenian people in Turkey (see J. Lepsius, *Deutschland und Armenien*, 1919, page 19). Telegraphic instructions were issued by the Turkish Govt. to provincial authorities to "evacuate" all Armenians from the military zones, where they represented "danger" to Turkish defence and deport them to the deserts of Mesopotamia and Syria. This scheme was carried out in June–July 1915, with unparalleled barbarity; men, women and children were murdered indiscriminately and the remainder driven to the desert to fend for themselves.

This "evacuation" of the Armenians produced a fundamental change in the attitude of Entente Powers toward the Armenian question. The Grand Duke Nicholas, who had replaced the former Viceroy, occupied Erzerum, Trebizond and the upper valleys of Euphrates and Tigris. This achievement enabled the Grand Duke to proclaim in the summer of 1916 "the liberation of Armenia from the Turkish yoke." He tried, however, to bar the native surviving Armenians from returning to settle in the occupied region, because Tsarist Russia had planned to plant Cossack settlements in the Araxes and Euphrates valleys on Armenian-Kurdish fertile lands.

This "Euphrates Cossack" idea had its repercussion in Great Britain. In spite of the secret treaties concluded by the Allied Powers for the partition of Turkey, the British Prime Minister declared in his Guildhall speech in 1916 "that H.M. Govt. was resolved to secure the liberation of this ancient (Armenian) people."

Soviet Russia and Armenia.—The Russian Revolution of 1917 eventually resulted in the secession of Transcaucasia from Russia after the dispersal of the Russian armies. On his accession to power, Lenin proclaimed the unity of Armenian lands and sent Shahumian to organise it. By the Brest-Litovsk Treaty of March 1918, however, Soviet Russia was compelled to cede the Batum, Kars and Ardahan districts to Turkey. The Federated Republic of Georgians, Armenians and Tatars, which was formed in consequence of Bolshevik Revolution, attempted to resist the Turkish advance. But misunderstanding broke out among the three peoples, and the Turks occupied the three ceded districts. Under the auspices of German military leaders then in Transcaucasia and with the help of Turkey, the Armenians in Transcaucasia proclaimed their independence on May 28 1918, with their capital at Erivan.

After the Armistice the victorious Allied Powers again promised to reconstitute Armenian nationality. Some efforts were made to concentrate the surviving Armenians in Turkey in Cilicia, then occupied by British troops, presumably with the idea of making that area the home of the Ottoman Armenians; whereas in Transcaucasia the British military authorities in occupation were indifferent to Armenian legitimate rights. A small war between Georgia and Armenia was stopped by them.

Armenian Delegates at the Paris Conferences.—At the Peace Conference in Paris the Armenian Delegation were induced to demand a "great Armenia" extending from sea to sea. President Wilson was being urged to accept a mandate for this "great Armenia." Consequently the two Armenian delegates, Boghos Nubar Pasha and M. Aharonian, presented a memorandum to the Supreme Council in Feb. 1919. The demand was conditional on the acceptance of a mandate by the United States, which the American Senate did not want. While the negotiations for peace with Turkey were dragging on, the Armenian delegates concluded an Agreement with Sherif Pasha, the Kurdish delegate to the Peace Conference, in Oct. 1919. In the Conference held in London in March 1920, the Armenian delegates again pleaded their case. In April at the San Remo Conference the Supreme Council offered the mandate for Armenia to the League of Nations. The arrangements made with regard to oil at San Remo, however, hastened the reappearance of Russia at Baku. This approach of Soviet Russia had its immediate effect in Armenia and Georgia, both of which negotiated peace treaties with her in May. The Armenian delegates in Moscow were offered assistance if the Armenian Govt. allowed the transport of Russian troops over the railway line of Alexandropol-Kars-Erzerum to go to the rescue of the Turks, who, hard pressed by the Greeks in the west, were willing to make any concession. The Armenian Govt., after consultation with the British representatives, rejected the Russian offer. In the summer of 1920 the Turkish Nationalist Govt. at Angora repeatedly invited Erivan to negotiate a separate peace, but the delegate of the Armenian Republic signed the Treaty of Sèvres on Aug. 10, which provided a *de jure* recognition of the independent Armenian state.

Two months after the signature of the Treaty of Sèvres the Turks attacked Armenia. Abandoned by the Allied Powers and badly equipped, the Armenian Army put up little resistance to the Turks, who by the end of Nov. had occupied Kars and Alexandropol. After the Armenian Govt. had signed a treaty of peace, Soviet Russia rushed troops, led by Armenian Bolsheviks, to Erivan, and by an open telegram invited the Turks instantly to stop the operation.

S.S. Republic of Armenia.—A Soviet Armenian Govt. was established in Erivan in Dec. 1920 amid circumstances of famine and disruption. Since that time the Armenian Communist party, about 1,000 strong, has been governing the country. With the financial support of Soviet Russia and the Federated republics of Georgia and Azerbaijan, the Armenian Soviet Govt. has established peace and a measure of prosperity. Barren land and marshes have been reclaimed by a scientific system of irrigation, and considerable encouragement is given to cotton and tobacco growing. Copper mines at Allahverdi and Ghatar are in process of exploitation, and schemes of generating electric power are in progress.

Armenians Abroad.—The position of Armenians of Turkey stands to-day as follows: there are about 100,000 Armenians in Constantinople. When the French evacuated Cilicia in 1921, about 80,000 Armenians migrated from that district to Syria under deplorable circumstances. There they still remain, insecure and helpless. The Greek rout at Smyrna in 1922 drove about 100,000 Armenians to Greece and the Balkans, where they remain since in uncertainty. There are large or small communities of Armenians in the United States of America, Persia, France, Egypt and smaller groups in various European and Asiatic countries.

Nansen Settlement Scheme.—After five years of discussion, the League of Nations at last sent a commission in 1925 to Armenia headed by Dr. Nansen to report upon the possibilities of settling refugees within the frontier of the republic. Dr. Nansen recommended a loan of £900,000 to the Armenian Govt. for this object, and the Council of the League has set up a commission to arrange the loan.

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(A. SA.)

ARMOUR, JONATHAN OGDEN (1863–), American merchant, was born in Milwaukee, Wis., Nov. 11 1863, the son of Philip D. Armour (*see* 2.578). He entered Yale in 1881, but did not finish his course, as in 1883 he joined the business of Armour & Co. Made a partner the following year, he became general manager and head of the company after the death of his father in 1901. Under his guidance the business became one of the largest in the United States, branching out into the preparation of by-products. In 1920 the company was forced by the action of the U.S. Govt. to restrict its operations to a wholesale business in meat, poultry, eggs, butter and cheese.

ARMOURED CAR, a motor-car or lorry provided with protective armour and adapted as a fighting machine. The main characteristic of an armoured car is great mobility. An objective which is situated as far as 200 m. from the main body of an army can be attacked by an armoured car within 10 hours under suitable conditions. The early types of armoured car consisted of motor-cars or lorries with iron plating fastened on the sides. The design developed rapidly into cars that were completely protected by armour plate and provided with one or two turrets with all-round fire.

On the outbreak of the World War in 1914, the possibility of using armoured cars was at once apparent; but, owing to the numerous requirements for motor transport in other directions, it was not found possible to supply them in any numbers while the mobile warfare on the Western Front lasted, though the armoured cars of the Royal Naval Air Service rendered valuable service on the Belgian coast a few weeks before the trench deadlock became established. Later, when the armies settled down to trench warfare, the roads were blocked and armoured cars could not be used. They were, however, employed with considerable success on several occasions during the last few months of the War when the mobility of the armies was partially restored. Although armoured cars are confined to roads in most parts of Europe, they can traverse large tracts of desert in countries such as Egypt. During the War, British armoured cars were successfully used in Egypt, Mesopotamia, east and south-west Africa, Rumania and south Russia.

Attempts have been made to give armoured cars some means of leaving the roads and traversing ordinary country when required. These attempts have taken the form of replacing the rear wheels by short endless belts of the tractor type, or of arranging that the wheels can, when desired, be removed and the weight taken by a pair of steel or rubber tracks. These experiments have so far resulted in machines that have a reduced mobility compared with an armoured car and less fighting power than the tank. Wheels have therefore been retained for armoured cars, and cross-country work is confined in most countries to tanks. (*See* TANKS.)

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(G. LE Q. M.)

ARMOURED TRAINS.—In the earliest days of the application of railways to war uses, the idea presented itself of utilising the weight-carrying capacity of the railway and the pulling power of the locomotive for tactical as well as for strategic purposes. "Railroad batteries" figured in the American Civil War and in the war of 1870–1 and armoured trains have appeared thereafter sporadically in most wars. Their utility, though it was confined within rather narrow limits, was unquestionable until the development of mechanical road transport.

Nowadays, however, in countries where the rail system is sufficiently developed to give such trains real freedom of movement there exists an even fuller system of main roads on which armoured cars can operate, and in the World-War period the fighting train only figured in such theatres as those of the Russian civil wars, in which roads fit for heavy traffic are as a rule rarer than railways. As against the armoured car working on good roads the train must always suffer from being limited to certain tracks which are very easily interrupted by raids, air bombing, or artillery fire, and in the future, as cars of the four-wheel drive or caterpillar types improve, the freedom of movement of the armoured car cannot but increase even in theatres of war in which roads are few.

On the other hand, the old railroad battery, considered as a form of gun-mounting, possesses many advantages over other forms of mounting heavy ordnance for field warfare. In the well-laid bed of a railway track, organised to distribute heavy strains equably, such mountings have their firing platform ready made, and the power of the locomotive gives heavy artillery a mobility that otherwise it would lack. In this form, then, the train represents the battery vehicles of horsed or motor artillery. The central member is the heavy truck carrying the gun, and the others are arranged for ammunition and for the accommodation of the gun personnel. Light armour is frequently used for the protection of the vehicles against shrapnel bullets, and in some cases the gun itself is provided with a shield. (*See* ORDNANCE.)

ARMSTRONG, HENRY EDWARD, British chemist, became, in 1874, professor of chemistry in the London Institution. In 1876 he was elected F. R. S. and served on the council of the Royal Society 1888–90, 1900–2 and was vice-president in 1901–2. He achieved considerable success in his researches on organic and general chemistry, particularly in his work on the terpenes, the naphthalene and benzene series, and on physical chemistry. He was professor of chemistry in the City and Guilds College, South Kensington, and took a prominent part in the advancement of his science.

ARMY (*see* 2.592).—The following article constitutes an account of the outstanding changes which have taken place since 1910 in the general principles governing the organisation and maintenance of armies. The first section of the article may be taken as applying to the military forces of all the Great Powers. There follow more particular discussions of the armies of the British Empire and the United States. For details concerning the armies of the other Great Powers (France, Germany, Russia, Italy, etc.), the reader should consult the articles on those countries.

I. GENERAL

As was only to be expected in view of the vast scale on which the World War was fought, of its protracted character, and of the impetus which was given during its progress to scientific investigation for military purposes, certain modifications were brought about during its course in the organisation of the armies that participated in the struggle.

Aviation.—One very important fresh factor had been brought into play even before hostilities commenced in Aug. 1914, although it was then still almost in the embryo stage. This was the discovery between 1909 and 1911 that aviation was a practicable undertaking, and the immediate recognition by soldiers that this new art could be turned to good account in the furtherance of military operations on land. The consequence was that flying corps were introduced into several of the European armies between the years 1911 and 1913, and that, by the summer of 1914, each one of the major countries to become involved in the conflict could lay claim to possessing a number of efficient air units, fully equipped and ready to take the field. Military authorities in general were, however, at that time disposed to take the view that the main purpose which aviators would be able to fulfil satisfactorily in face of the enemy was the carrying out of reconnaissance work, in some measure taking the place of cavalry in the performance of this important duty.

But at a very early stage of the hostilities it became apparent that aeronautical units could and should fulfil other functions as well (*see* AIR WARFARE). The experience gained between 1914 and 1918 has caused all the more important European States, other than the United Kingdom, Italy and Germany, to include in their armies aviation corps which are in all cases organised on a considerably more ambitious scale than were the aviation corps which they possessed in 1914. The United Kingdom and Italy have elected to divorce their flying corps entirely from their armies. Germany is precluded by treaty from maintaining one.

Weapons.—The most notable changes in this category are the increase in the proportion of machine guns and the number, calibre and mobility of heavy guns and howitzers; and the introduction of an entirely new weapon, namely the tank (*q.v.*).

As regards machine guns, it should be mentioned that the Germans took the field in 1914 with a far larger proportion of them than did any other belligerent. It was one cause of their early successes. Their opponents speedily realised the importance of the question, and they made desperate efforts to multiply their stock; this proved to be but a slow process, seeing that machine-guns take a particularly long time to manufacture. The lesson has, however, been learnt, and most armies to-day are adequately supplied with these weapons.

Although the Germans were better fitted out at the outset of the struggle with mobile heavy howitzers than were the other belligerents, the full value of these and of mobile heavy guns in modern warfare only came to be recognised gradually even by them. The paramount importance that these forms of artillery acquired on the Western Front as the conflict proceeded, was to some extent due to the form of sedentary trench warfare which the operations assumed after the first three months. But during the progress of the struggle in various theatres it became apparent that the "caterpillar" form of mechanical traction could be so developed as to make howitzers of great weight reasonably mobile and howitzers of medium weight highly mobile, and that such relatively ponderous forms of artillery were in consequence capable of being employed to good purpose even in campaigns of movement. The result of these experiences is to be seen in the numbers of batteries armed with such weapons maintained as an item in most armies of the present day (*see* ARTILLERY).

Tanks first appeared in the field in the summer of 1916 during the British offensive in the Somme region, their manufacture and their presence with the troops having been kept a secret. Their potentialities in trench warfare were recognised at once, but the United Kingdom enjoyed a great advantage in having the start. The French immediately embarked on manufacture, and the Germans followed suit after capturing a few tanks. Many improvements on the original pattern were devised before the close of hostilities, and further improvements have been carried out since that date, with the result that tanks, which were in the first instance introduced merely for the special purpose of attacking elaborate lines of trenches, are now capable also of playing a prominent rôle in the most mobile military operations. Their design, moreover, is continuously undergoing elaboration and development.

Transport.—Just as in civil life mechanical traction is tending to oust horse traction, so also in the military world lorries and the lighter forms of motor vehicle are more and more replacing the old horse-drawn wagons and carts and ambulances which used to trail behind the troops. But in the case of armies, the caterpillar type necessarily assumes a far greater importance than it does in civil life in countries that are provided with roads. Although certain developments in respect of the employment of mechanical traction took place during the World War (quite apart from the question of tanks or of heavy artillery), the tendency of the day is to carry this considerably further. The idea is to make armies entirely independent of roads.

Cavalry.—The relative value of cavalry in normal conditions of warfare, as compared with that of the other two main arms—infantry and artillery—has been tending to decrease steadily, as the power of fire-arms in all forms has grown. The experiences of the World War have, on the whole, had the effect of thrusting mounted troops still more into the back-ground, partly owing to the development of aviation, and partly because cavalry can be of little assistance when trench warfare prevails. Nevertheless, it was shown in Palestine and also in Mesopotamia that there was still plenty of scope for mounted troops and, even if most countries have been showing a disposition to reduce the strength of the mounted troops they maintain, the day of the mounted combatant is by no means over.

In the course of the World War permanent troops, troops of the militia type and new formations all underwent exhaustive trial under varied circumstances, and each of the three categories gave evidence of its worth under at least certain conditions. Of regular troops nothing need be said. It has never been suggested even by the most enthusiastic believers in forces such as the British Territorial Army, that they come up to the high standard of efficiency expected of standing armies.

Territorials and Reserves.—In regard to semi-permanent troops, it has to be acknowledged that the German Reserve divisions, the French Territorial divisions and the British Territorial divisions, when first pitted against regular troops, were considerably below the standard of efficiency which they afterwards attained. They required time, coupled with a form of operations not calling for a high standard of training. And they were granted both. The first British Territorial units to be placed in the field crossed the Channel in Sept. 1914; the last took the field some 17 months later; these troops were thus actually fighting from 2¾ years to four years, and they were bound to learn their work before the War ended. The Germans put most of their Reserve divisions into the field at once, as did the French in the case of their Territorial divisions, and neither German nor French non-permanent troops compared with permanent troops during their early months in face of the enemy.

New Armies.—As regards troops only created at the outbreak of War, the British new armies set on foot by Lord Kitchener afforded a shining example in the World War. Speaking generally, these troops did well quite early, always provided that, after reaching the theatre of operations to which they were sent, they had been broken in to their duties by slow degrees. Trench warfare generally admitted of this important principle being carried out. If tried severely at the start—as at the Dardanelles—they were apt to fail. The first new army division crossed the Channel to France in May 1915, nine months after the units composing it had been created; the last one took the field a year later. They performed magnificent service in all the later stages of the War; but they had all by that time met with ample opportunities for learning their work, and nearly all of them, moreover, had spent many months in sedentary warfare before they were put to higher tests. Opinion at British G.H.Q. in France was at first disposed to ridicule the creation of these new armies. If that was partly because the magnitude of the struggle was not realised, nor its duration forseen, it was also a result of mistaken notions as to the time required before newly created troops can be made fit to fight. It was generally assumed that a recruit must undergo several months of training before he was fit to be drafted to a regiment serving in the field, but experience in the later years of the War proved that a few weeks' training is quite sufficient for drafting purposes. There were men in the corps which broke the Hindenburg line at the end of Sept. 1918 who four months before had not yet put uniform on.

War Wastage.—Military ideas upon the subject of war wastage have perforce undergone a transformation since 1914 as a result of bitter experience. Not one of the belligerent states taking part in the World War was prepared for the rate at which this wastage was to occur. It proved to be incomparably higher than it had been in any previous contest, in spite of the fact that, thanks to improved medical arrangements and more efficient surgery, wastage from disease (except in unhealthy theatres like Macedonia and East Africa) was relatively small and the proportion of wounded men who speedily recovered was relatively very high. The premises upon which calculations as to strength of reserves required to keep a force of given strength in the field had been based proved to be valueless at a very early stage of the contest. The Dardanelles campaign, for instance, lasted only 8½ months; but, although the maximum strength of the British Army in the field was only 128,000, the casualties amounted to 112,000, including 39,000 killed or missing. An army to be properly organised for great operations of war must possess far greater reserves in some form or other than had been supposed to be necessary in the summer of 1914.

Chemical Warfare.—Chemical warfare played an important rôle in some of the theatres of operations during the World War, and is not unlikely to play a still more important one in wars of the future. But its introduction as an element in warfare is rather a question of tactics, equipment and research than of army organisation. The same holds good with respect to the employment of hand grenades, of trench mortars and other devices especially applicable to trench fighting (*see* CHEMICAL WARFARE).

II. THE BRITISH EMPIRE

The British Army, in respect to organisation, stands very much where it did in 1914. Its system of command and of administration has undergone little alteration. The system of recruiting, alike for the regular forces and for the territorial forces, remains practically as it was. Its order of battle, supposing it to be brought to a war footing, has only changed in points of detail. Its powers of expansion in an emergency have been increased neither in principle nor in practice, in spite of all that has occurred since the year 1911. At the beginning of Aug. 1914 the military forces of the United Kingdom, comprising the regular army, the special reserve and the territorial force, were designed in case of a grave national emergency to place an expeditionary force of six divisions and a cavalry division in the field oversea, with an additional division to follow, and to retain 14 territorial divisions in the British Isles for the purpose of home defence. The regular army also provided garrisons for a number of localities oversea.

Expansion in 1914–5.—No plan for the expansion of the British regular forces at home beyond the requirements of the expeditionary force, with its additional division, existed when the World War broke out, apart from the automatic embodiment of the special reserve, which provided units for home defence, and could be utilised for draft-producing purposes to replace wastage in the expeditionary force after the army reserve had been used up. Lord Kitchener, however, immediately called home the bulk of the regulars from India and from the other oversea garrisons, and by this means four further divisions were provided as an addition to the seven already contemplated. He, moreover, took immediate steps to duplicate the 14 territorial divisions and one of these newly improvised divisions, besides two of the old ones, had left England for India before the end of Oct. to replace regulars brought home. But the greatest expansion of all took place in the form of the so-called "New Army." Its first six divisions were created in Sept., the next twelve were created in Oct., the next six in Nov. and the last six in Jan. 1915.

There was also a certain expansion of mounted troops, but not on a large scale. Actually, 55 divisions, recruited in the United Kingdom, took part in the War, and there were also the three territorial divisions sent out to India in the autumn of 1914. When war was declared it had only been hoped to send abroad a force of 160,000 men, to be followed soon afterwards by another 20,000; but during the later stages of the contest the United Kingdom had a field army of nearly a million and a half fighting in various theatres, besides the forces supplied by the Dominions and Colonies and India.

In July 1914 the strength of the regulars, army reserve, special reserve and territorial forces was approximately 670,000; 4,970,000 men were recruited during the following 4¼ years within the United Kingdom. Recruiting remained voluntary up till March 1916, when compulsory service was introduced, in the first place for unmarried men, and subsequently for married men, between the ages of 18 and 41, unless exempted for medical or other special reasons. In the spring of 1918 an Act was passed raising the age limit to 50 and cancelling various exemptions previously in operation.

Dominions and Colonies.—At the beginning of the War the Dominions and Colonies had no more than some relatively small forces of permanent troops; they nevertheless placed large fighting forces in the field, the troops being in almost all cases freshly recruited and specially organised for the purpose. Canada produced four divisions which took the field, besides another which was used for drafting purposes. Australia produced five divisions, and New Zealand one. Australia and New Zealand, between them, also placed two divisions of mounted troops in the field. The troops raised in South Africa were almost entirely employed in Africa. Table I. shows the numbers enlisted and sent oversea.

TABLE I.

Dominion	Total in arms	Sent oversea
Canada	628,964	418,035
Australia and Tasmania	416,809	330,000
New Zealand	220,099	100,471
South Africa	136,070	74,196
Newfoundland	11,922	10,610

India.—The Indian Army at the outbreak of the War was organised in nine divisions, together with an incomplete division in Burma. This organisation was, however, to some extent thrown out of gear by the recall of the greater part of the British troops to Europe to fight on the Western Front; the territorial divisions sent out to replace these troops were not, at all events for the first few months, sufficiently trained to take the field, and they were to a large extent broken up and at first used for garrison purposes. India, nevertheless, contributed 10 divisions for work in field armies, besides finding the force which originally embarked on the campaign in East Africa. Of the divisions that took the field, only three were divisions that had existed before hostilities broke out; three more were organised during the early months of the contest. Then, after the disasters in Mesopotamia early in 1916, five entirely new divisions were created, of which four took the field before the end of the War, all of them proceeding to Mesopotamia. Of the divisions actually employed in various theatres, one was captured at Kut and three were broken up during the conflict; so that at the time of the Armistice there were actually only six in the field. The total number of natives of India enlisted during the progress of the War amounted to 1,524,187. The number of casualties suffered by the Indian Army during the course of the contest was approximately 160,000, chiefly in Mesopotamia, Egypt and Palestine.

The Army Since the War.—The reduction of the military forces recruited in the United Kingdom to their peace footing necessarily occupied considerable time; and even after the Armistice they had to be kept more or less on war establishment for many months. Not until 1921 could it be said that the army had got back to pre-War conditions, and its strength still greatly exceeded that of 1913, in spite of the Air Force having been detached. The army estimates in 1922–3 amounted to £62,000,000, as compared with the figure £28,220,000 for the year 1913–4. The Geddes Committee, however, took the matter in hand, and the equivalent of five cavalry regiments, 24 infantry battalions and a number of artillery units were reduced, saving £10,000,000.

One important change carried out since the War has been the disappearance of the special reserve; there is, however, an intention to restore the Militia in course of time, and its battalions appear in the Army List as skeletons. A supplementary reserve of officers and men was set on foot in 1924, the rank-and-file being mainly technical and arranged in two categories, trained and untrained. Moreover, the territorial army is now asked to accept liability for service oversea in time of war, subject to sanction of Parliament, instead of being intended purely for home defence as it was before 1914. The three branches of the Royal Artillery were re-amalgamated as regards officers in 1921, as a consequence of war experiences. Two entirely new corps have been constituted—the Royal Corps of Signallers and the Royal Tank Corps. The former is an expansion of the arrangement under which signalling was mainly in the hands of the Royal Engineers, the latter a consequence of the introduction of the tank for war purposes in 1916. Table II. shows the establishments of the home forces provided for in Army Estimates in 1911 and 1926, and the establishments of the different branches of the regular army in those two years.

The Indian Army since the War.—The demobilisation of the Indian Army was carried out more rapidly on the conclusion of hostilities after 1918 than was the case with the home troops, although the Afghan War to some extent delayed the process. Moreover, soon after demobilisation was complete, a reorganisation took place, the result of which was to reduce the strength of both the British and the Native portions of the army to below the pre-War figure. Some other changes of importance have also taken place. In 1921, the forces as a whole were divided into four army commands—Northern, Eastern, Southern and Western. In that year a territorial army was started, as also an Indian army reserve of officers in two classes. The auxiliary forces were

TABLE II.

Category	1911	1926
Regular Forces	168,233	142,432
Army Reserve	138,000	96,000
Special Reserve	86,539	..
Supplementary Reserve	..	23,151
Militia Reserve	700	..
Militia Channel Islands	3,163	1,325
Malta and Bermuda Militia	2,894	1,437
Territorial Forces	315,408[1]	186,093
Officers' Training Corps	823	1,245
Total	715,760	451,683

Branch	1911	1926
Cavalry	14,762	9,680
Artillery	32,881	24,233
Engineers	9,610	6,623
Corps of Signallers	..	5,013
Infantry	96,182	77,457
Tank Corps	..	3,294
A.S.C.	6,696	6,303
R.A.M.C.	4,637	4,163
Other Departmental Corps and Establishments	3,465	5,666

[1] 267,500 effective

also reorganised and rendered more efficient. It was decided that the field army should consist of four divisions and five cavalry brigades.

The following table shows the numbers of combatant British regular units maintained in India in the years 1911 and 1926 respectively:—

	1911	1926
British:		
Cavalry Regiments	9	5
Batteries	66	64
Infantry Battalions	52	46

The establishments of various units making up the British military forces in India in 1926 made an approximate total of 61,550.

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III. THE UNITED STATES

On Feb. 27 1911 Congress added 200 line officers to the regular army in order to meet the demands of the National Guard for instructors; increased the Corps of Engineers by 60 officers; gave 60 dental surgeons to the service, and rectified relative rank for those adversely affected by regimental promotion. On Aug. 24 1912 an Act, commonly known as the "Manchu law," required line officers to serve two years out of every six with troops. On April 27 1914 Congress gave $250,000 for aircraft, and on July 18 1914 it authorised an aviation section of the Signal Corps, totalling 60 officers and 260 enlisted men.

On June 3 1916 came the National Defence Act, which increased the regular army from a war maximum of 128,653 to one of 287,846; organised the army of the United States into the regular army, volunteer army, officers reserve corps, enlisted reserve corps and the National Guard while in the service of the United States; provided for the aforesaid increase in five annual increments, unless the President desired in an emergency to call out the whole force; limited the number of enlisted men of the line to 175,000; proportioned the regular army into 65 regiments of infantry, 25 of cavalry, 21 of field artillery, seven of engineers, a coast artillery corps, two battalions of mounted engineers and other corps, and bureaux of the War Dept.; established the organisation of a division into three brigades of three regiments each, with auxiliary troops; made the term of enlistment seven years, three with the colours and four with the reserve; inaugurated vocational training and federalised the National Guard by causing each member thereof to take a new oath, which bound him to the will of the President as well as to State authority. On Aug. 29 1916 another Act created a Council of National Defence, composed of the secretaries of War, the Navy, the Interior, Agriculture, Commerce and Labour, for the "co-ordination of industries and resources for the national security and welfare."

Mexico.—On March 9 1916 the Mexican bandit, Pancho Villa, with about 1,500 men, having attacked Columbus, N.M., and having killed 18 Americans and wounded many others, units of the regular army and National Guard were concentrated along the border, and Brig.-Gen. J. J. Pershing was sent into Mexico at the head of a provisional division of regulars (two brigades of cavalry and one of infantry with auxiliary troops). After about 12 minor engagements the expedition was called home and the National Guard organisations were ordered to their respective states (Feb. 1917). For the great conflict about to ensue this Mexican campaign gave extra training to the National Guard and demonstrated to the War Dept. a deficiency in means of transportation for all troops.

The World War.—On April 6 1917, when the United States came into the World War, the regular army had received only its first increment from the Act of 1916, and the National Guard was undergoing combined demobilisation and reorganisation. The strength of the United States forces on April 1 1917 was 199,705 officers and enlisted men, of whom 127,588 were regular army, 5,523 Philippine Scouts and 66,594 National Guard in the Federal service. In addition, there were some 4,000 in the enlisted reserve corps and some 117,500 national guardsmen not in the Federal service. The regular army was distributed as follows: United States (especially on the Mexican frontier), 88,798; Philippines, 17,951; China, 1,383; Hawaii, 9,900; Panama Canal zone, 7,300; Porto Rico, 1,484; Alaska, 772. As to officers, there were 5,960 in the regular army, some 3,000 in the officers' reserve corps and 3,199 national guardsmen in the Federal service, making a total of over 12,000. In addition, there were some 5,000 National Guard officers in state service.

Mobilisation.—The three great problems which confronted the general staff in obtaining a proper army were: first, the lack of any legalised system for raising a sufficient number of men in an equitable and efficient way; second, the great dearth of officers as instructors and trainers; and third, the immediate demand for sufficient shelter and supplies for the large numbers of men necessary for the work in hand.

The first problem was met by the Selective Service Act, May 18 1917, which in substance brought the regular army to full war strength and provided for drafting all members of the National Guard and its reserves, for raising by voluntary enlistment only four infantry divisions, and for conscripting a force of 1,000,000 men. As a result, on June 5 1917, there registered for the draft 9,925,751 men; and on July 3 1917 the President called into service the entire National Guard, with a resulting total of 379,323 by Aug. 5 1917. The calling of the first draft to the colours was delayed by lack of shelter and supplies, especially woollen clothing, until Sept. 5 1917, between which time and the spring of 1918 some 687,000 reported. On Dec. 15 1917 all registrants were placed in five classes, according to personal conditions and national needs. Out of some 3,700,000 men in the army at the end of the War, about 2,800,000 came from the draft, which had made possible a uniform supply of recruits and replacements for American arms.

The second problem was met principally by three sets of reserve officers' training camps. The first series of 16 camps, beginning May 15 1917 at 13 army posts in the United States, enrolled approximately 38,000 qualified applicants. On Aug. 11 1917, at the conclusion of the course, commissions in various grades up to colonel were awarded 27,341 graduates. The second series of eight camps, beginning Aug. 27 1917, enrolled over 20,000 candidates. On Nov. 27 1917 commissions as in the first series were awarded to 17,237 graduates. These two series were composed largely of college men. Since no coloured candidates had been admitted to these camps, a special school for them at Fort Des Moines, Ia., beginning June 18 1917 and ending Oct.

18 1917, graduated 639 captains and lieutenants. In Porto Rico three camps, covering the period from Aug. 27 1917 to Nov. 6 1918, graduated 711 captains and lieutenants.

The third series of 27 training camps, beginning Jan. 5 1918, were more in the nature of schools; and 90% of the applicants were former enlisted men. From this series, on April 19 1918, three were graduated and listed as eligible for appointment as second lieutenants 11,659 men. At this time, the total output of the camps was over 57,000 graduates. After May 15 1918 officers' training schools, established throughout the United States and its possessions, replaced the camps until the end of the War.

The Supply Question.—The third problem was not so speedily solved, principally because of the lack of preparation for undertakings of such kind and magnitude. It was necessary at once to mobilise resources and industry, to organise adequate transportation, to obtain storage, distribution, and ports in the United States and France and to construct cantonments for training the vast numbers of recruits soon to come. The Council of National Defence by its sub-committees and dollar-a-year men[1] gained immediate contact with commerce and industry and was the father of the powerful War Industries Board, created formally on March 4 1918, with Mr. Bernard M. Baruch as its chairman. The new board co-ordinated and controlled resources, industry and transportation so as to produce an adequate flow of supply to the army and navy, without impeding unnecessarily commercial activity in the United States. Operating within the army, much as the board was acting for the country, were the operations and the purchase, storage and traffic divisions of the general staff.

By an interlocking organisation of these various co-operating agencies, tedious, duplicating and extravagant systems of supply were gradually eliminated. The flow of materials through the United States to the Western Front is shown by the fact that by the date of the Armistice the embarkation service had sent about 9,000,000 tons of cargo over a line of communication 3,500 m. long. Within a few weeks after the inauguration of the system of control made by the inland traffic service, the freight congestion in the United States was removed, and from May 1917 to the Armistice the railways had transported 8,714,582 men. Shortly after war was declared the construction division was called upon to build in 90 days 16 national army cantonments with an aggregate capacity of 640,000 men. In addition, housing for 16 officers' training camps and for 16 National Guard cantonments had to be expeditiously procured. By Nov. 1 1918 the construction division, with 130,000 employees, was engaged on 448 projects involving $756,000,000.

American Expeditionary Forces.—On May 26 1917 the Secretary of War, in a letter to Maj.-Gen. J. J. Pershing, directed him to command the land forces of the United States operating in continental Europe; to proceed there with his staff and establish, after consultation with the French War Office, bases, lines of communication and depôts for active participation at the front; to co-operate with the troops of the other countries employed against the enemy and in so doing to preserve the identity of the forces of the United States.

Pershing sailed immediately with a small staff, and one month after the date of the above letter Maj.-Gen. Sibert, with the 16th, 18th, 26th and 28th Infantry of the regular army and the 5th Marines, arrived in France as the first contingent of Pershing's command. The next to begin to arrive was the 2nd Div. in Aug. 1917, and by March 1918 four complete combat divisions, the 1st, 2nd, 26th and 42nd, were in Europe. Pershing's "organisation project of July 10 1917" contemplated a shipment overseas during 1917 and 1918 of 30 divisions. By July 1918, under his "schedule of priority shipments," there were transported 996,000 men. A subsequent programme of Gen. P. C. March, Chief of Staff, July 18 1918, proposed the landing of 80 divisions by the middle of 1919, or a force of 3,360,000. Under the latter scheme, by Aug. 1918 the number sent overseas increased to 1,576,000, and by the time of the Armistice rose to 2,085,000, or to 41 American divisions and a part of another.

The 1st Div. entered the trenches for instruction on Oct. 20 1917, and took over a division sector on Jan. 19 1918, north of Toul. On March 28 1918 Pershing placed all the American forces, four trained and two untrained divisions,[2] at the disposal of the Allied Commander-in-Chief. On May 28 1918 the 1st Div., fighting as a unit, made a successful attack on Cantigny; at the same time 16 American divisions (six trained) were placed at the disposal of the Allies. During July 15–18 the 3rd, 28th, 42nd and parts of the 92nd Divs. aided in the defeat of the last German offensive on the Champagne-Marne front.

Meanwhile, the organisations of divisions into higher units was proceeding with difficulty. Although the I., II., III. and IV. Corps headquarters were organised between Jan. and June, it was not until July 4 that the I. Corps, consisting of the 26th American and 167th French Divs., was assigned a tactical command at the point of the Marne salient west of Château-Thierry. From July 18 to Aug. 6 the 1st, 2nd, 3rd, 4th, 26th, 28th, 32nd and 42nd Divs. (mainly comprehended in the I. and III. Corps) formed 30% of the Allied strength in the Aisne-Marne offensive. The American I. Army, under the command of Gen. Pershing, was organised in the Château-Thierry region and began to function on Aug. 10, but upon stabilisation of the Aisne-Marne offensive along the Vesle river shifted its operations eastward.

From Sept. 12–16 the I. Army, containing the I., IV. and V. Corps with a total of 11 American and four French divisions, reduced the St. Mihiel salient. This army, beginning its attack on Sept. 26 in the Meuse-Argonne operation with the III., V. and I. Corps, employed in this offensive 25 American divisions and one French cavalry division. By Oct. 12 the American II. Army had completed its organisation, and with the IV. and VI. Corps went into line generally west of the Moselle. In addition to these operations two American divisions served with the British on the Ypres-Lys and three in the Somme offensive; three participated with the French in the Oise-Aisne operation, two with the French IV. Army in Champagne, and two with the French and the Belgians in Flanders. By the date of the Armistice, 29 American divisions had been engaged in active fighting and American forces were holding 134 km. or 22% of the entire Western Front, having captured some 63,000 prisoners, 1,378 cannon and 9,650 machine-guns. Their casualties were: killed in action, 36,780; died of wounds, 13,466; died of disease and other causes, 27,293; total overseas dead, 77,539; total wounded, 234,852; prisoners, 4,416.

The supply of the American expeditionary forces was handled in France by the line of communications, which in Feb. 1918 was changed to the services of supply or S.O.S. This vast organisation in rear of the combat zone was charged with immense projects involving roads, docks, railways and buildings; the transportation of men, animals and munitions by sea, rail and inland waterways; the operation of telephone and telegraph systems; the control of replacements; the hospitalisation necessary for an army of 2,000,000 men; the reclassification of officers and men; the establishment of leave areas and of welfare and entertainment projects; the liquidation of American affairs in France; and the embarkation of troops for home. In addition to the materials sent from the United States, these services purchased 10,000,000 tons abroad; the communication system covered 215,500 km. of telephone and telegraph lines; the engineers produced 200,000,000 feet of lumber; the transportation corps put 20,000 American cars and 1,500 American locomotives on French railways; and the medical units on Nov. 12 1918 were caring for 193,026 patients in hospitals. By the time of the Armistice the strength of the S.O.S. was 668,312 men.

Other Fronts.—In Sept. 1918 an expeditionary force of some 10,000 men was sent to Siberia. At other times some 5,000 men went to north Russia and one regiment served in Italy.

Demobilisation.—The Armistice necessitated the demobilisation of some 3,700,000 in service oversea and in the United States, the termination of contracts with due regard to the interests of industry and the government, the co-ordination with labour over the employment situation and the prevention of congestion of ex-soldiers in the larger cities.

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[1] People who carried out public duties for a purely nominal remuneration.

[2] An American division was practically twice the size of a British, French or German division.

On the morning of Nov. 11 1918 Gen. March issued orders for the immediate discontinuance of all mobilisation; on Nov. 16 he gave specific instructions for the discharge of certain temporary forces in the United States; on Nov. 22 he issued instructions to Pershing covering procedure which would facilitate discharge in the United States of the oversea forces, but left to the commander-in-chief of the American expeditionary forces the order of return of units. The demobilisation of personnel involved intricate problems of the care and habilitation of sick and wounded, the location of demobilisation camps, the discharge of special classes for relief of distress and the needs of industry, the avoidance of congestion of labour, the economy to be exercised in transporting discharged soldiers and the procedure at demobilisation camps involving physical examinations and disinfection of discharged soldiers.

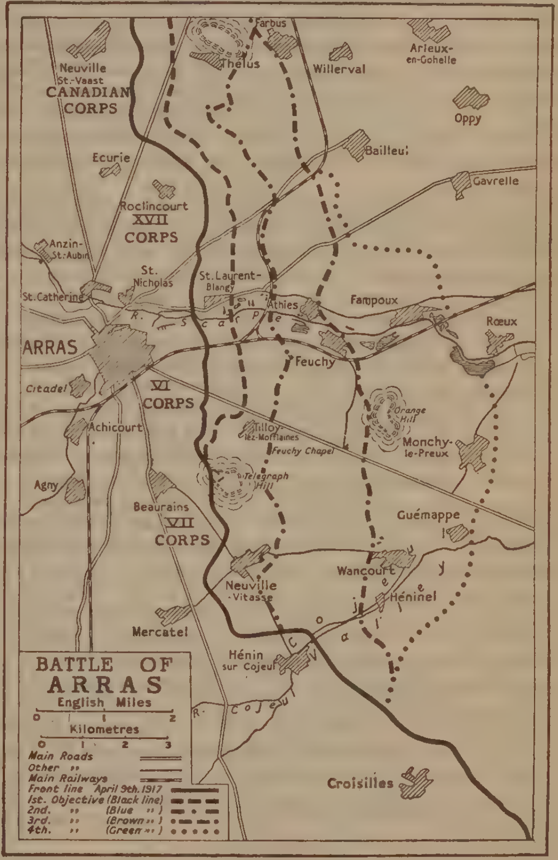
It was necessary to retain in the service, in addition to the regular army, a large number who were indispensable to the care of billions of dollars' worth of property, and to the work connected with debarkation, demobilisation and convalescent centres, hospitals, domestic guard duty, fire protection and border police. By Jan. 4 1919 there were discharged 732,766 men; by Feb. 1 the number had increased to 1,026,664; by May 1, to 1,936,011; and by July 1, to 2,736,654. By April 1 1920 demobilisation of enlisted men was practically completed. In addition to the demobilisation of personnel, the army was called upon to cause industry to return speedily to its peacetime course, after labour, capital and manufacture had been occupied for a year and a half in preparing materials for war. The problems confronting the War Dept. during the transition included the disposal of war supplies, the appropriate rate of curtailment of war production so as not to create widespread unemployment and economic disturbance, the settlement of claims and contracts, the adjustment of real estate connected with war activities, the liquidation of international obligations and of sales abroad.

On Nov. 11 1918 the equipment branch of the operations division, general staff, made a study of existing supplies, which resulted in the classification of materials and the retention of a war reserve. During Jan. 1919 there was established a Claims Board, which by the middle of the year had adjusted 25,196 contracts, besides those allowed to run. By Sept. 1 1919 property in the United States costing about $700,000,000 had been sold for about $530,000,000 or 77% of its cost. Surplus property in France estimated to have cost $1,250,000,000 was sold for about $500,000,000. Out of an estimated value of $3,276,349,533 worth of surplus property on hand at the Armistice, there remained in Jan. 1926 only $9,278,269 worth, the materials represented by the difference having been sold at an average of 36% of their cost.

Phases since the War.—In order to overcome the waste and confusion incident to unpreparedness, Congress passed on June 4 1920 the National Defence Act, which established the army of the United States in the approximate proportions of one-half organised reserves, one-third National Guard when called into service, and one-sixth regular army, the last factor being limited to 280,000 officers and men. For training and tactical control, the country and its possessions were divided into corps areas, all three components of the army within each area being potentially organised for prompt mobilisation. The regular army, the component engaged primarily in military training, was to be responsible for the instruction and proficiency of the other two components. The President could change the strength of the different arms to suit varying demands of national defence and the developments of the new services, such as air, chemical warfare and tank corps. Within the regular army a single promotion list for officers throughout all branches, except the Medical Corps, equalised advancement by seniority. Provision was made for reserve officers' training corps in colleges and for training camps during summer months. Altogether, the legislation was viewed generally as the first sound military policy of the United States. Accordingly, in 1921, the army spent its efforts upon training and recruiting qualified personnel. On June 30 1922 Congress reduced the regular army to a maximum of 175,000 officers and men, and later in the year made the maximum for officers 12,000, so that it was necessary to separate from the service over 100,000 officers and men, many of whom had recently enlisted or been commissioned. By Dec. 1 1925 the strength of the army of the United States was: organised reserves, 98,585 officers and 5,600 enlisted men; National Guard, 11,673 officers and 166,080 enlisted men; regular army, 11,957 officers and 124,249 enlisted men, 38,714 of the regular force being stationed abroad. See *The War with Germany: A Statistical Summary* (U.S.A. War Office, 1919). (D. D.)

ARRAS, BATTLE OF.—The great battles which opened the campaign of the Allies in 1917 on the Western Front were the direct outcome of two main causes, the first was the strategical position resulting from the battle of the Aisne in 1914, and the second the tactical position resulting from the battle of the Somme in 1916.

The former placed the bulk of the German forces in the West in the huge salient Nieuport-Noyon-Verdun, and the second a considerable portion of these forces in the smaller salient Arras-Gommecourt-Morval. The first offered considerable possibilities for the Allies to get in a right and left hand blow on Valenciennes and Mézières, the main centres of the German lateral communications, and the second of similar blows in the direction of Quéant against the northern and southern flanks of the German VI. and I. Armies. If it had been possible to bring off this last operation successfully, such a debacle of the German forces would have resulted that not only would the advance of the British armies seriously threaten Valenciennes, but the rush of



German reserves to stop the gap would have withdrawn pressure from before the French about Reims, and would probably have enabled them to advance on Mézières.

Alternative Plans.—In June 1916 a plan, known as the Blaireville project, was prepared, the object of which was to strike at the Germans between Monchy-au-Bois and Beaurains during the later stages of the battle of the Somme, but on account of the casualties sustained during the early stages of this battle, this project was abandoned. In Oct. the project was revived and its scope extended. A simultaneous offensive on all fronts was suggested, in which, whilst the main attack was to be made by the British, a subsidiary attack was to be carried out by the French in the neighbourhood of Reims. In Oct. the British plan included the following operations. At the earliest date possible (about March 15 1917) the IV. and V. Armies were to reassume the offensive and the III. to strike between Beaurains and Arras, occupy Monchy-le-Preux, and by pushing southeast, deny to the Germans the Cojeul Valley as a line of retreat, and, if possible, that of the Sensée also. Meanwhile the I. Army was to attack north of the Scarpe and form a defensive flank.

In Dec. Gen. Nivelle, who had recently been appointed to the chief command of the French Armies, objected to the subsidiary part to be played by the French, and put forward a plan in which the decisive blow was to be delivered from the Aisne. The task of the British, according to this plan, was to deliver an offensive in Artois which would draw in large forces of the enemy, and so reduce opposition on the French front. Further, to assist in the French concentration, as a preliminary measure, Gen. Nivelle insisted that the British should relieve the French forces as far south as the Amiens-Roye road, and that this relief should be completed by March 1, the offensive to open on April 1.

From Oct. onwards vast preparations, which were impossible to disguise, were put in hand. Railways and roads were extended, dumps formed, gun emplacements built, aerodromes levelled and the greater portion of the underground quarries of Arras, St. Sauveur and Ronville opened up and made ready in every detail to accommodate two divisions which were to reinforce the attack by passing underground. This sudden and unexpected reinforcing of the front was to be the surprise of the battle.

Preliminaries.—Meanwhile a hostile operation was begun which bid fair to filch from the British the tactical advantage won during the preceding summer. Towards the end of Feb. it became apparent that the Germans intended to evacuate the Gommecourt salient, and the recent construction of the Hindenburg line suggested a rounding off of the right angle between Arras and Craonne. If this could be successfully accomplished, not only could the tactical blow against the Gommecourt salient be avoided, but the strategical blows against Valenciennes and Mézières be impeded or delayed. The problem which now faced the Allies was a threefold one, namely, whether to hit at once, or recast their plan, or finish their preparations and carry it out as originally intended. As weather impeded the first and want of time the second, the third was adopted with the following modifications. The III. Army was now to play the leading part, and by attacking north and south of the river Scarpe with three corps, whilst holding one corps and the Cavalry Corps in reserve, was to penetrate the German defences and by advancing on Cambrai turn the Hindenburg line from Heninel and Marcoing. The I. and V. Armies were to operate on the left and right flanks of the III. Army.

The battle front, some 15 m. in width, extended from just north of Croisilles to a little south of Givenchy-en-Gohelle, at the northern foot of the Vimy ridge. This ridge which rises to a height of 475 ft. above sea level dominated the whole battlefield from the north. From its summit overlooking Lens the ground falls away to the river Scarpe, between which and the Cojeul river it is in nature undulating. In the forward zone of defence the Germans had dug three lines of trenches, each of which was heavily wired. Then four to five miles east of this system was dug the Drocourt-Quéant line, which at the date of the battle was still unfinished and but lightly wired.

At the beginning of April the German reserves numbered some 600,000 men, and consequently the success of the battle depended on the time it would take to penetrate the Drocourt-Quéant line. If this line could be broken within 48 hours of the initial attack, the intervention of these reserves might be avoided and so large a gap created that eventually great numbers would be drawn towards it and away from the French offensive in the south, where the main blow was to fall. This time could only have been gained by the employment of a considerable number of tanks, or by a preliminary bombardment of not more than 24 hours duration. After denuding the training grounds of both France and England, only 60 tanks could be assembled, therefore the only alternative was a hurricane bombardment, and though the III. Army for long suggested such an operation, G.H.Q. insisted on three weeks systematic wire cutting culminating in a general bombardment of several days' duration. During this period 2,700,000 shells were fired, and though the wire was destroyed all chance of surprise vanished.

Plan of Attack.—The final plan of attack was as follows:—

(*a*) III. Army (Gen. Sir E. H. H. Allenby). The VI. and VII. Corps were to attack south of the Scarpe between Arras and Mercatel. Their objective ran from a point 2,000 yd. southeast of Hénin sur Cojeul northwards to Guémappe, thence east of Monchy-le-Preux to the Scarpe. This objective contained two formidable lines of defence, namely, the Cojeul-Neuville Vitasse-Telegraph Hill-Tilloy-lez-Mofflaines line, and the Feuchy Chapel-Feuchy line. South of these were some 3,000 yd. of the Hindenburg line, and east the strong position of Monchy-le-Preux which dominates the whole of the surrounding country. The XVII. Corps was to continue the front of attack north of the Scarpe.

(*b*) I. Army (Gen. Sir H. S. Horne). The Canadian Corps and the 13th Bde. of the 5th British Div. were to attack the Vimy heights, Thélus and the hill north of Thélus, a position considered one of the strongest in France.

(*c*) V. Army (Gen. Sir H. Gough). The Australian Corps and the V. Corps were to operate between Lagnicourt and the right of the III. Army northwards towards Vis-en-Artois. The position of this Army was a most difficult one, as the destruction of the roads and the bad weather had rendered it impossible to move forward much artillery, a *sine qua non* of the battles of this period.

(*d*) The whole of the above operations was to be considered as a preliminary step to the advance of the Cavalry Corps and the XVIII. Corps south of the Scarpe. These corps were to break through at Monchy-le-Preux and advance eastwards through the Drocourt-Quéant line.

Opening of the Attack.—On April 9, at 5.30 A.M., the general attack was launched under cover of a magnificently timed creeping barrage, and within 40 minutes the whole of the German first line system, except a small portion of the Vimy ridge, was captured. About Tilloy-lez-Mafflaines and Telegraph Hill tanks accounted for a good many of the enemy and then proceeded eastwards to assist in the reduction of the Blue line and such parts of the Brown line as they were able to reach during daylight. By noon the greater part of the second objective had fallen and a number of hostile batteries were captured. By the close of the day practically the whole of the objectives north of the Scarpe had been taken, but south of this river the third objective had only been penetrated in places, and the fourth objective remained untouched.

During the night of the 9th–10th, the 37th Div., which had been held in reserve, advanced to the northern slopes of Orange Hill; and during the morning of the 10th this advance was followed by a general attack on the Brown line which enabled the 37th Div. to reach the outskirts of Monchy-le-Preux, which on the morning of the 11th was captured by this division assisted by tanks. Whilst these operations were in progress the Germans strongly reinforced their front, and so stubborn had become the opposition that to relieve the pressure on the VII. and VI. Corps fronts the V. Army was ordered to attack on the morning of the 11th from the direction of Bullecourt northwards. At 4.30 A.M. 11 tanks, followed by the 62nd Div. on the left and the 4th Australian Div. on the right, stormed the Hindenburg line, but on account of the width of the trenches and inadequate artillery support only two tanks, co-operating with the Australians, were able to cross this line. These led the attack as far as Riencourt-lez-Cagnicourt when a strong German counter-attack drove the Australians back; meanwhile the attack of the 62nd Div. had been completely held up on the southern outskirts of the village of Bullecourt.

On the 12th, Heninel and Wancourt were captured by the 21st and 56th Div., and minor operations were carried out on the 13th and 14th when the main offensive of the III. and V. Armies terminated, 13,000 prisoners and 200 guns having been captured. Pressure, however, was not altogether relaxed, as on the 16th the French launched their grand offensive on the Aisne, and to assist in this operation it was considered necessary to hold the enemy. Though this attack proved a complete fiasco, pressure was maintained on the Arras Front, and the line pushed forward to include the villages of Guémappe, Gavrelle and Arleux-en-Gohelle. On May 5 the battle of Arras was brought to a close. Since April 14 6,000 additional prisoners and some 50 guns were taken, but British casualties had been severe, totalling, between April 9 and May 5, no less than 132,000 officers and men killed, wounded and missing.

Results of the Battle.—The failure of the Allied spring offensive may be traced to various causes, the most important being: The exhaustion of the French due to the battles of Verdun and the Somme in 1916, the total lack of surprise on both the British and French fronts; the distance apart of the two battlefields, and the comparative narrowness of the fronts attacked when compared with the strength of the German reserves. The results of this failure and their influence on future operations were clearly brought out by Sir Douglas Haig at a conference of army commanders held at Noyelle-Vion on April 30. On this occasion he said:—

> As regards the French, their losses had been heavy and they could not continue to operate by similar methods to those which they had employed since their main offensive launched on the 16th April. There was a possibility of changes in the French higher command. This contingency would doubtless alter the military policy of the French, which would then probably be of a defensive nature with a tendency to avoid losses. Although the French War Minister and Prime Minister had given an assurance that offensive operations would be carried on, it was doubtful whether it was possible for the French Army to prosecute these on a large scale . . . he continued that it was his intention to move steadily forward up to a good defensive line. . . . Once this line has been reached it will be possible to decide further action. It may then be necessary to continue on our present front, to attack on the Havrincourt front, or to shift the centre of gravity up to the Second Army. In the meantime it is necessary to hold the enemy and make him think that we are undertaking a methodical offensive similar to our operations last year on the Somme.

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(J. F. C. F.)

ARRHENIUS, SVANTE AUGUST (1859–) Swedish chemist (*see* 2.648), was born at Wijk, near Uppsala, Sweden, on Feb. 19 1859. He was educated at the Cathedral School and the University of Uppsala. In 1895 he was appointed professor of physics in the University of Stockholm, and in 1905 became director of the physico-chemical department of the Nobel Institute. He devoted himself especially to the study of electrolysis and evolved the theory of electrolytic dissociation. In 1903 he was awarded the Nobel Prize for chemistry, and received, among numerous other foreign distinctions, the Davy and Faraday Medals of the Royal Society.

Among his works are *Immunochemistry* (1907); *Theories of Chemistry* (1907); *Worlds in the Making* (1908); *Quantitative Laws in Biological Chemistry* (1915), all written in Swedish and translated.

ARRIAGA BRUN DA SILVEIRA E PEYRELONGUE, MANOEL JOSÉ D' (1839–1917), Portuguese politician, was born in Horta, in the Azores, July 8 1839. Educated at the University of Coimbra, he graduated in law in 1866. Arriaga early showed signs of his Republican sympathies, with the result that his father, an ardent Royalist, disinherited him; and as a student he was obliged to support himself by coaching his juniors. He had a distinguished scholastic career, among his appointments being the rectorship of the University of Coimbra and a professorship at the Lyceum in Lisbon. His political career opened in 1882, when he was elected Republican deputy for Funchal. From 1890 to 1892 he represented Lisbon. During the revolution of 1910 (*see* PORTUGAL) he was a prominent figure on the Republican side; and on Aug. 24 1911 he was elected first constitutional President of the Portuguese Republic. The Royalist risings of 1911 and 1912 taxed the strength of the president; and in 1915, feeling no longer able to cope with the difficulties of the situation particularly in face of the coup d'état of May 14, he resigned on May 27. Arriaga died March 5 1917.

ART: *see* AESTHETICS; DECORATIVE ART; PAINTING, ETC.

ARTIFICIAL SILK, or RAYON.—Any plastic form of cellulose or derivative can be extended or drawn in continuous length. The plastic form is conditioned by associated solvents, which, in the case of fluid solutions, are in multiple proportion by weight of the cellulose or derivative. The drawing to thread, filament or film can be taken to a limit of attenuation dependent upon the structural qualities of the colloidal matter present in its 7 to 12% solution.

The silkworm elaborates, from its vegetable diet, a nitrogenous, colloidal complex, very different from cellulose in constitution and properties, in the form of a hydrated, plastic mass, which it spins, or rather draws to a thread; the thread is laid into the symmetrical form of cocoon, incidentally passing, by chemical changes of internal and external reaction, to insoluble forms. Thus the insect labours, and man enters into the fruit of its labours, largely forgetful of the wonderful worm. The artificial silk industry owes its obvious debt to the worm, and is prevented from forgetting it by the difficulty of coining an autobasic descriptive term. If in the course of this article we use the alternative "Lustra Cellulose," it is only as an expedient.

Rise of the Industry.—Industrial artificial silk is a wonder even of the 20th century. Its development may be briefly set out under the dates of the various stages:—

1883. Hilaire de Chardonnet described the invention of producing thread by drawing solution of nitrocellulose through fine orifices.

1890–1900. The industrial process including regeneration of cellulose from the nitrate thread perfected. Formation of the Société d'Exploitation "Soie Artificielle Chardonnet" and production of artificial silk at Besançon.

1892. Cross and Bevan patented the viscose process of dissolving cellulose, and

1895. Formed the Viscose Spinning Syndicate and applied the process to the production of thread in association with C. H. Stearn and C. Topham. The latter invented the centrifugal spinning box and process in substitution of the method of parallel drawing, and afterwards twisting the fibres to the textile compound thread.

1900–1902. Société Française de la Viscose was formed and reached industrial production of viscose silk at Arques la Bataille.

1902–1907. British-American developments organised by S. Courtauld & Co. (H. G. Tetley & T. Latham).

In these earlier stages a third process played a leading part in competition with the Chardonnet. This was the Cuprammonium process of dissolving the cellulose and drawing it to thread by coagulation to hydrated colloid in either acid or alkaline medium. This was based on the pioneer labours of Pauly, Frémery, Urbain and Bronnert, and the silk known as Glanzstoff constituted a considerable proportion of the 8,000 to 9,000 tons which was the average annual production of the new textile material in the period 1910–2. To complete the story of increase and ever-widening production, and of the survival under competition of the three systems, we give the aggregate figures for the several producing countries of 1924.

Estimate of Production of Artificial Silk, 1924

	Metric Tons		Metric Tons
United States . . .	16,245	Austria . . .	1,200
England . . .	10,885	Poland . . .	700
Germany . . .	10,760	Czechoslovakia . .	588
Italy . . .	8,400	Japan . . .	545
France . . .	5,606	Hungary . .	280
Belgium . . .	4,034	Spain . . .	84
Switzerland . . .	1,820	Sweden . . .	80
Holland . . .	1,530	Russia . . .	40

This amount of 62,797 tons was produced by 79 firms, operating 95 factories, and includes 4,900 tons of Chardonnet silk, 900 tons of Cuprammonium silk and 54,197 tons of Viscose silk. These figures are compiled from the statistical records of Courtaulds, Ltd. The output of the three cellulose silks mentioned above is less than the aggregate of the preceding table by 2,800 tons. This is attributable to the introduction of celanese, which is produced mainly by the British company of that name. The antecedent British Cellulose Co. with works at Spondon, Derbyshire, undertook the manufacture of the acetate in Great Britain as the colloidal basis of the varnish or dope applied to aeroplane wings. As a war service the enterprise was in part financed by the British Government. In the last year of the World War the production of the dope reached the figure of 5,000,000 gal., which at 1 lb. of acetate per gal. would account for the production of 8 tons a day at Spondon. At the conclusion of the War the demand for the dope fell to fractional proportions, and the technical staff of the company developed commercially the potentialities of the acetate in the production of silk thread, non-inflammable photographic film, and solid celluloid substitute.

As for the uses to which the material is put it has been estimated that, as regards the United States, which is the largest market for it in the world, 28% is made into hosiery, 26% is mixed with cotton and 16% with silk. About 13% is used in the manufacture of underwear and the balance is put to a variety of uses, which are increasing almost every day. The potentialities of the yarn appear therefore to be tremendous both in the old and the new world.

Processes.—In considering various qualifying factors we have to revert to the process itself, and to the technical principles involved in drawing the solution of cellulose to thread. The unit thread is coarse or fine in terms of its diameter; in exact terms it is the ratio of weight to length. In the silk counts the unit is the denier. For the present purpose the denier is the metric denier of 1 milligram per 10 metres; natural silk is a thread of 1 to 2 deniers. Artificial silk, in the early years of production, was a unit of 6 to 7 deniers, but it was evident to the inventors that finer dimensions were attainable; in the case of the anhydro ester silks by merely reducing the diameter of the "spinning" orifice, and in the case of aqueous solutions, by "drawing down" the thread in the fixing bath. This process of stretch drawing is a refinement of the earlier processes of direct "spinning," in which the thread of cellulose-hydrate (cellulose 17%, hydration water 83%) is formed in the first few cm. of contact of the cellulose solution with the fixing solution of the setting bath. It has been especially developed under the Thiele patents and in connection with the cuprammonium solution of cellulose. The present industrial specialisation in yarns of fine counts is that of the Brysilka Co. (Apperley Bridge, Yorkshire), and of certain firms on the Continent of Europe. The process involves drawing under vacuum through a column of fixing solution contained in a funnel, and exact control of all the auxiliary conditions.

The viscose reactions of decomposition with ultimate regeneration of cellulose (hydrate) are by contrast intrinsic and accompanied by interior effects of reaggregation; there are therefore a number of "fixing" reagents which condition a graduated action of the "setting" bath, which allows the drawing tension on the thread to take effect in attenuation. Viscose threads of 1 to 3 deniers can therefore be "spun" by the direct process and by various of the more obvious alternatives. But on the trend of the market during 1924 toward yarns of the heavier deniers, the viscose companies have not found it advantageous to compete with their rivals in concentrating on fine production. This question of range of yarn counts was introduced in connection with the statistics of production, so that the figures for weight may require revision in terms of yarn grades and corresponding values.

Competition with Natural Silk.—Up to the present the new cellulose product has made its own developments rather than entered into direct competition with silk. But competition has necessarily arisen, and there is in fact a recognised displacement in certain directions, and further progress must be estimated in terms of the capabilities of artificial silk, that is, of fundamental qualities. Obviously the most important is the ratio of weight to length. With this quality are directly associated the covering power of the yarn as a weaving and optical effect, and, indirectly, the effects of softness and lustre. The present stage of development has been mainly realised on the basis of a unit thread of 5 to 7 deniers, which is a multiple of the "size" of the natural silk. It is now established that the cellulose can be drawn to these dimensions and incidentally produced as yarn. The next fundamental point is that of specific weight, which is an ultimate characteristic of the respective substances; silk-serin has the density 1·23 and cellulose 1·53.

The earlier spinning methods applied to viscose produced a cylindrical thread in close imitation of the natural fibre. Important technical progress resulted from study of the cellulose fibre in regard to form and contour as revealed by cross sections. With changes of the setting bath there were differentiations toward ovoid and kidney-shaped forms; by further correlating the stages of "ripening" of the viscose with the conditions of the setting bath, it was found possible to exaggerate an irregular contour to one having deep indentation, the effect of which was to increase the perimeter by 50% above that of the regular cylinder of equal denier. The effect of this is the increase of apparent bulk of the thread, and of the covering power of the twisted multiple thread or yarn. The new element of technical control is a point of manifest superiority of the artificial process, since the added qualities of the thread and yarn compensate for the major defect due to greater density of substance. Next in order are the mechanical and chemical qualities or properties which (1) are expressed as strength (tenacity) and elasticity, and (2) which condition resistance to the inevitable water-oxygen environment.

Tenacity and Elasticity.—The earlier forms of lustra cellulose showed a specific tenacity of 1·0 to 1·4 grammes per denier, reduced to about 30% on wetting. Technical progress has realised a substantial increase on these figures and especially in respect of "wet strength" which reaches 60% of that of the original dry thread. The statistical records of Courtaulds, Ltd., show a breaking strain in grammes per denier of 1·2 to 2·2 dry and 0·5 to 1·1 wet. The variations are those conditioned by methods of manufacture together with the deniers of the unit thread. The present averages for the production of this firm are deniers 6 to 7, but with the range 3 to 11; the breaking strain is 1·5 dry and 0·7 wet, in grammes per denier.

In practice the true elasticity comes little into reckoning; the extensibility, or stretch, reaches 16 to 20%, which is of the order of the elongations of the natural silks under breaking strain. The results obtained from the observation kept over cellulose substance yarns produced in the period 1895–1900 fully confirm the *a priori* assumptions of permanence of material, based on the actual chemical constitution of cellulose and the experience of its utilisation in various forms.

It has been necessary to set out in some detail the fundamental qualities of the material as the primary conditioning factors. Two others of scarcely less importance are self evident. The viscose process and products have the advantage in respect of costs of production and adaptability, representing a wide range of controlled variations in correlation with the wide and varying requirements of the textile industry. Lastly, the new material was launched into a world of already highly developed technical and competitive activity, ready to exploit the potentialities of the new product in the confection of the new fabrics, plain and mixtures, and in the auxiliary effects of decorative design and colouring.

Production.—The long-deferred realisation of the acetate "silk" is a postponement due to a number of interferences, in a sense accidental, amongst which was the World War; for the realisation was foreseen by the viscose pioneers and others, who recognised *a priori* a basis of first principles as the promise of achievement. Thus the production of the acetate involves the simplest of factors; cellulose, carbon (coal), chalk and electrical energy. The product, as an ester, represents an increase of yield of 50% matter added by synthesis to the original cellulose; it has the relatively low specific gravity of 1·34; its combining relationships with dyestuffs are specific. *A posteriori* the celanese product proves to have a special form, divergent from the cylindrical, and realising a high covering power. These, with other advantages, must be recognised as assuring industrial developments. On the other hand the process of spinning is elaborate, and requires a special cellulose raw material (cotton) specially prepared, and generally a higher scale of capitalisation and factory costs. These disadvantages have been increased under the present conditions of altered industrial values, and, moreover, the product has now to compete with its viscose rival, which is firmly established, and protected by the goodwill of routine consumption and the progressive development of textile quality and novel effects.

Waste Products.—It will be obvious that there are incidental waste products of the "silk" process as there are of the cocoon silks. The latter are in a form which can only be treated for mechanical separation of the fibres reduced to short length. These are graded and spun or twisted to the yarns known as schappe or spun silk. The fibrous wastes of the artificial silk process can be similarly treated. The results have led to a direct production, especially of the viscose silk, in short length, by reeling the thread as formed on bobbins of suitable diameter, and cutting through the mass of filaments which are liberated in calculated short length or staple. The fibre is known as "staple fibre," "vistra," "fibro," "artificial wool." It is spun usually in admixture by the methods required for discontinuous or ultimate fibre, *e.g.*, wool, cotton.

The silks, natural and artificial, are solid; in the production of the latter the viscous solutions are carefully prepared to be free from bubbles. The presence of bubbles leads to curious deformations of the thread and defective yarns; on the other hand a study of these defects has led to the industrial production of the air-filled fibre—in the case of the viscose process by charging the viscose to its maximum with bubbles of air, and increasing the effect in the setting bath by the addition of compounds reacting with liberation of gas (*see* CELLULOSE). (C. F. C.)

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ARTILLERY (*see* 2.685). The Old French word *artiller*, to equip with engines of war, is from the Low Latin *artillare*, to make machines. The English word *artillery* dates from the early 17th century. It is now used to mean firearms of greater power than those carried by hand, and also the personnel who use them. The present article deals with the contemporary state of the artillery arm in land warfare.

I. TYPES OF ARTILLERY

The function of land artillery is to kill troops at a range beyond that of a hand weapon, and to destroy material, obstacles, and defences. Various natures of artillery have been developed, suitable to the tasks to be fulfilled. These are:—

Field artillery.
Medium artillery.
Heavy artillery.
Super-heavy artillery.
Anti-aircraft artillery.
Trench artillery.

Field Artillery.—This is capable of accompanying the advanced fighting line of an army. It consists of light guns and howitzers able to move at 10 m. an hour on the road, and able to keep pace with infantry, or cavalry, in the case of the horse artillery, across country. It can come into action without previous preparation of the ground, and, like all other natures of artillery, it can engage a target either from a position in the open by direct vision over the sights, or from a concealed position by means of angles of direction and elevation signalled from an advanced observing position or from an aeroplane. It consists of light guns and light howitzers.

The field gun is, in all armies, a piece throwing a shell of from 15 to 18 lb. to a distance of at least 10,000 yd., and weighing less than 30 cwt. in action. Before the introduction of mechanical traction the weight was limited to 24 cwt. and the range to 6,000 yards. The present limit of 30 cwt. is due principally to the fact that this weight is as much as a gun-detachment of 6 men can manhandle. All modern field guns are quick-firing; that is, the gun recoils on the carriage and returns to the firing position, while the carriage remains steady. This saves the delay due to running up and relaying the gun after each shot, and increases the rate of fire from 2 rounds a minute to 25. It also enables the gun-detachment to remain behind the gun-shield, instead of having to stand clear of it during the recoil of the carriage.

The field howitzer differs from the field gun in that it throws its shell high into the air, so as to descend at an angle of about 45°. This enables it to reach targets, such as men in deep trenches, protected from the direct fire of guns. Since this high-angle fire requires less effort than direct fire, the field howitzer is able to fire a shell double the weight of that of the field gun, without exceeding the same weight of equipment. Howitzer fire, from its nature, is local in effect, and at targets of considerable depth from front to rear, such as advancing infantry, it is far inferior to the flat-trajectory fire of guns. In most armies one-fourth of the field artillery consists of howitzers, and three-fourths of guns.

Special natures of field artillery are:—

Horse artillery, which can keep pace with cavalry across country. Usually, for simplicity of ammunition supply, the gun is the same as that of the ordinary field artillery, but the weight behind the team is reduced by mounting the gunners on horses, instead of carrying them on the limbers and ammunition wagons.

Mountain or pack artillery is divided into separate loads which can be carried on pack animals or transported for short distances by hand. It is used in country impassable to wheeled carriages, and is sometimes employed as artillery of accompaniment. The gun itself is divided into two pieces, forming mule loads not exceeding 320 lb., including 65 lb. of saddle and equipment. The old "screw-gun" used by the British mountain artillery was divided half-way down the bore, but the modern tendency is to divide the gun behind the base of the cartridge, so that the chase forms one load and the breech another. The carriage of a mountain gun has a cranked axletree, which is turned upward when firing at high elevations, so as to afford room for recoil without the breech striking the ground. In other respects the mountain gun is a smaller edition of the field gun, and fires a shell of 12 to 15 lb. to a distance of about 5,000 yards. Mountain howitzers, firing a shell of about 22 lb., are also used.

Artillery of Accompaniment.—The provision of a special light gun to accompany the infantry firing line is now a subject of controversy.

A good specimen of the modern field gun is the U.S. 75-mm. gun, model 1921 on 1924 carriage (see fig. 1 on plate). This gun weighs 30 cwt. in action, and fires a 15-lb. shell ranging, with super-charge, 15,000 yards. With the normal charge the range is about 11,000 yd.; the super-charge, with stream-lined shell, is not used for ordinary fire, on account of the excessive wear which it causes to the gun. For the same reason it is probable that a reduced charge for ranges below 6,000 yd. will be introduced. Flashless powder is used, and the shrapnel has a clockwork fuse. The carriage has hydropneumatic recoil gear of the St. Chamond pattern, and a split trail, which permits of rapid traverse through a wide angle for the purpose of firing at tanks moving across the front. It allows of the gun being elevated to a high angle for firing at aircraft.

Although a field gun is not a fully effective anti-aircraft gun, it is desirable that it shall be capable of engaging low-flying aeroplanes when these attack the troops with machine-guns. The wheels of the American field gun have rubber tires, to obviate, or at least to reduce, the damage to the equipment caused by tractor draught at a speed of 10 m. an hour. The French 75-mm. field gun is a Schneider model similar in essentials to the American gun. In England, Armstrongs have a

1925 pattern 3-in. field gun rather more powerful than the American gun. Vickers have a 3·3-in. 18-pdr. M.V. 2,100 fs., ranging 12,700 yd. with stream-lined shell and super-charge and weighing 30 cwt. in action. (*See* fig. 1).

Medium Artillery.—This consists of guns and howitzers of greater range and shell-power than field artillery, yet sufficiently mobile to accompany the infantry advance. The usual types are a 4·7-in. gun firing a 50-lb. shell to a range of 15,000 yd. and a 6-in. howitzer firing a 100-lb. shell to a range of 12,000 yards. The 4·7-in. gun is designed to fire upon distant road crossings, railway junctions and other important points which have to be engaged without delay, before the heavy artillery can come up. The 6-in. howitzer fires a powerful shell capable of demolishing buildings and of destroying entrenchments, other than those of a semi-permanent nature. It is the principal weapon used in trench warfare. Both pieces are available for counter-battery work, that is, for attacking entrenched guns which have been located by aircraft or by sound-ranging.

The medium gun is an enlarged edition of the field gun. The 6-in. howitzer was formerly a short, handy piece, but owing to the increased range now required of it the length of the modern type is as much as 25 calibres. Fig. 2 on plate shows a short Krupp 6-in. gun used as a howitzer by the Germans. This would now be mounted on a carriage with split trail. The girdles on the wheels prevent them from sinking into the ground.

Heavy Artillery.—This term is applied to pieces heavier than medium artillery, including guns up to 8-in. calibre and howitzers up to 9·2-in. calibre. In modern war it is necessary to attack objectives at least 10 m. behind the fighting front, and accordingly road-mobile heavy artillery, which can engage targets beyond the range of medium artillery, has been introduced.

The principal gun of this type is the 6-in. gun, the latest pattern of which ranges 15 m. with 100-lb. shell. It can be fired from the ground, without the delay entailed by building a platform; wire mats or similar appliances are used to prevent the wheels from sinking. Modern 6-in. guns have split-trail carriages to enable them to be traversed quickly.

A howitzer heavier than the 6-in. is required for destroying bridges and semi-permanent entrenchments. The 8-in. howitzer fires a 200-lb. shell and ranges 18,000 yards; the British 9·2-in. howitzer, known in the War as "Mother," fires a 290-lb. shell ranging 12,700 yd.; and the new American 240-mm. (9·45-in.) howitzer fires a 356-lb. shell to a range of 25,000 yards. The latter piece is accepted as the typical modern heavy howitzer, and is about the largest piece likely to be transported by road in future warfare, as it is considered that heavier natures are better transported by rail. Fig. 3 on plate shows a French Schneider 6-in. gun, 1925 pattern, with rubber-tyre wheels, intended for tractor draught. A platform would be built for it if it were intended to remain long in the same position.

Super-heavy Artillery.—As the size of a shell is increased, the effect increases in a higher ratio. Much of the destructive effect of a 1,000-lb. shell is due to the blast, not to the local destruction caused by the high-explosive charge. The effect of the blast is to bring down walls as much as 50 yd. from the point of burst, to cause roofs to fall in, and generally to wreck a great building such as a railway station or factory. A single hit from a 12-in. shell might destroy a bridge altogether, whereas ten hits from 6-in. shells, equal to the same weight of ammunition, would only cause easily reparable damage.

A further advantage gained by the use of very heavy guns is the greatly increased range. Thus the British 9·2-in. gun throws a 380-lb. shell 14 m., while the new U.S. 14-in. gun ranges 22 m. with 1,560-lb. armour-piercing shell, and nearly 30 m. with a somewhat lighter stream-lined shell. These considerations have led to the extensive employment of super-heavy pieces in land warfare.

Gun versus Howitzer.—Formerly a howitzer was a low-velocity weapon fired at a high angle of elevation, while a gun was a high-velocity piece with a flat trajectory. The howitzer conveyed the shell to the target with a much smaller propelling charge than the gun, and consequently lasted much longer than the gun before it was worn out. At present all guns are mounted so as to fire at high angles of elevation, in order to attain their extreme range, and use reduced charges as well as full charges and super-charges in order to save wear. On the other hand, the range required of howitzers is now greatly increased, so that the 1914 pattern, 12 calibres long, has been superseded by howitzers of 25 calibres and over, firing much heavier charges.

The distinction between gun and howitzer is therefore tending to disappear. It may be said, generally, that where a high striking velocity is required, as in the case of an attack on armour, a 50-calibre flat-trajectory gun is used; where the object is to convey a mine shell to the target, a 25-calibre howitzer, with a powder-charge only sufficient to carry the distance at 45 degrees of elevation, is preferred. Thus, in the World War, the French had a 520-mm. (20½-in.) howitzer throwing a shell weighing 1 ton 8 cwt. to a range of 12 m.; the Germans had a 380-mm. (15-in.) gun which threw an 8-cwt. shell 28 miles. The comparatively short range required of the 20½-in. howitzer is an instance of economy of force; it was built to fire from a railway mount, and the French reckoned that it could thus be brought within 12 m. of its prospective targets. The German 15-in. gun was transported by rail and fired from a permanent platform; its long range of 28 m. was necessary in order to bombard Dunkirk from the German lines. For the same reason, its shell weighed only 8 cwt., whereas a typical 15-in. gun fires a shell of 17 cwt. to a proportionately shorter range.

Super-heavy pieces are usually fired from railway mountings, or at least are transported by rail. But an invader may find

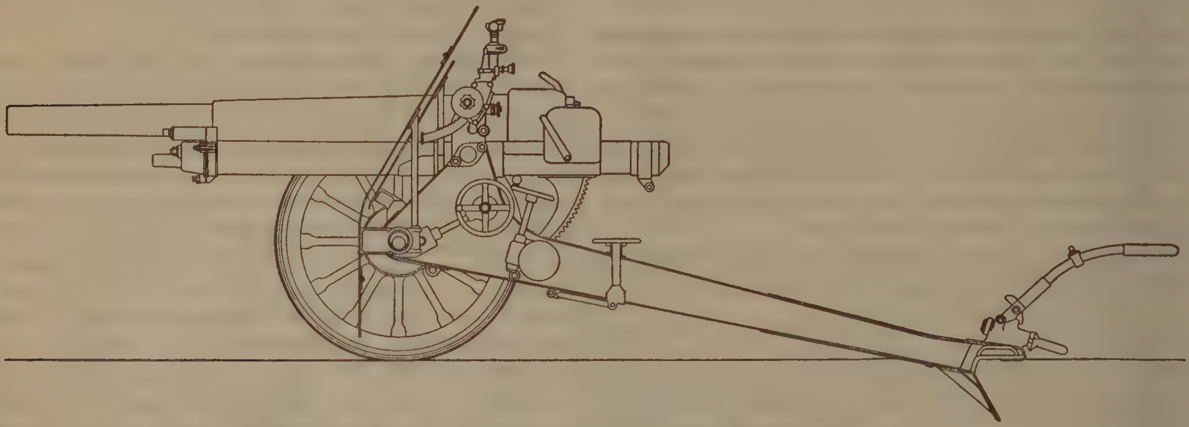
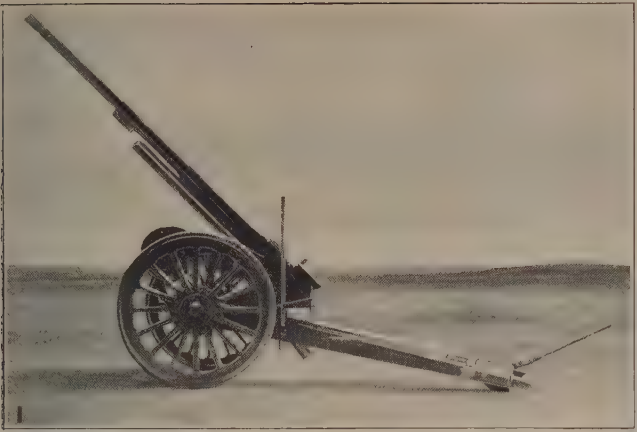
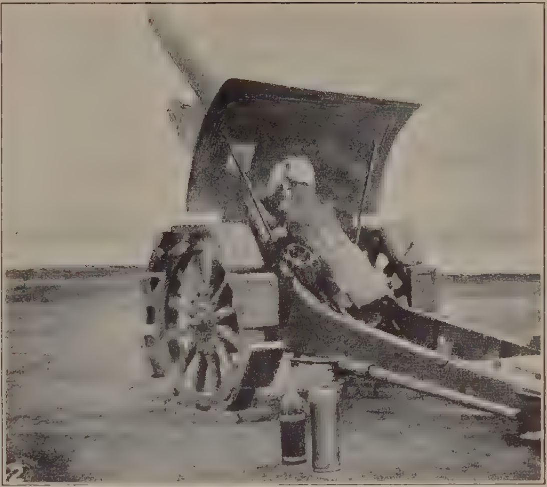
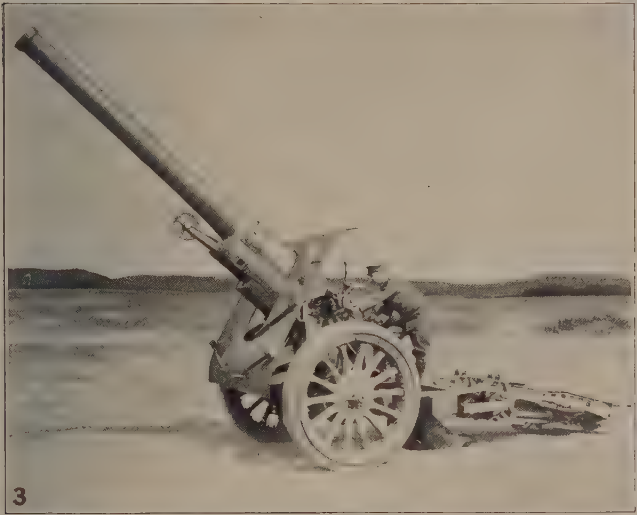
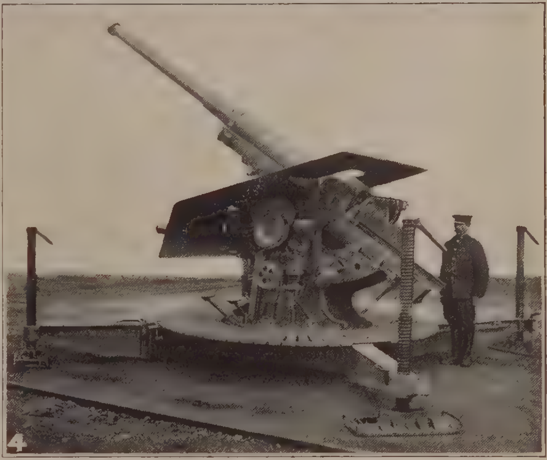


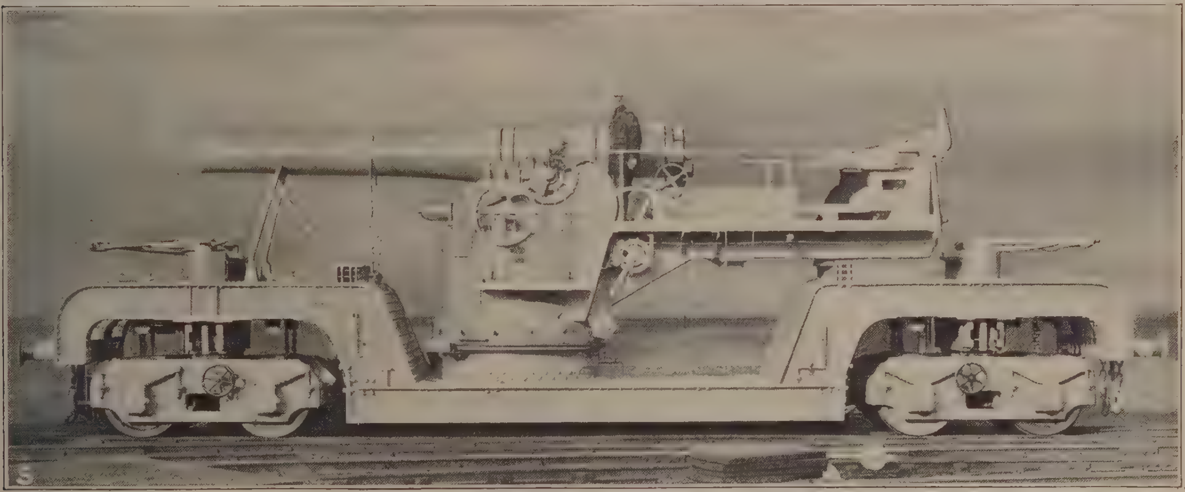
FIG. 1.—Vickers 3·3-in., High Velocity, 18-pdr. Field Gun (1925).











REPRESENTATIVE TYPES OF MODERN ARTILLERY

FIG. 1. American 75-mm. Field Gun (1921). FIG. 2. German Krupp 6-in. Howitzer. FIG. 3. French Schneider 6-in. Gun (1925). FIG. 4. French Schneider 4·2-in. Anti-Aircraft Gun. FIG. 5. British Armstrong 12-in. Howitzer, on railway mounting.

(Fig. 1. Courtesy of U.S. Ordnance Dept.)

it necessary to bring up large howitzers, for the reduction of fortresses near the frontier, before the captured railways can be made available. The difficulty in the way of transporting these pieces by road is the limit of the weight which bridges can carry. Even on the great main roads of western Europe this weight is not more than 30 tons, and on country roads it may be as little as 5 tons. This implies a special type of howitzer, comparatively short and light, capable of throwing a heavy shell to a short range. The German 42-cm. (16·5-in.) howitzer brought up for the siege of Antwerp was only 12 calibres long, and weighed 21½ tons, or about 29 tons on its special wagon. It threw a shell of 15·7 cwt. to a range of 10,300 yards. It was drawn by 3 traction engines, with a fourth in reserve for hills. The recoil gear, carriage, platform (in 2 parts), and gear for mounting the howitzer formed separate loads, and the piece required 13 traction engines altogether.

The French have a 370-mm. (14·6-in.) howitzer, only 8 calibres long, throwing an 8-cwt. shell 11,500 yards. It is rendered road-mobile by being carried on 2 road-trucks, one following the other, with an arched girder between them from which the piece is suspended. The United States has a 9·45-in. howitzer on a caterpillar mounting, driven by electricity from a separate vehicle which carries the 150-H.P. power unit. The total weight of the vehicle carrying the howitzer is 13 tons.

Long-Range Guns.—During the World War the Germans bombarded Paris from a distance of 76 m. with specially built long-range guns, throwing 265-lb. shells. This long range was obtained by using a velocity of 5,000 fs. and firing at an elevation of 55 degrees, so that the shell passed through the layer of dense air nearest to the earth, and reached the comparatively thin air at a height of 10 m. which opposed little resistance to its flight. In this case the greatest height of the trajectory was 24 miles. Guns of this type cannot fire more than about 30 rounds before they are worn out. Owing to uncertain weather conditions, the accuracy is poor; while the gun is new the shells may be expected to fall within a space of 2 m. long by ¾ m. wide, but as the gun becomes worn these limits are soon exceeded. It is now considered that aeroplanes are more efficient than guns for this kind of bombardment, as an aeroplane can now carry a 2,000-lb. bomb and can drop it with far greater accuracy than the gun.

Anti-aircraft Artillery.—The problem of hitting a target moving in three dimensions is a difficult one and the additional complication due to a curved trajectory has to be eliminated as far as possible. All A.A. guns are therefore flat-trajectory weapons, with muzzle velocities of the order of 2,000 fs. for light guns up to 3,000 fs. for medium guns. Ordinary field guns mounted on lorries, as employed in the World War, are of little use. However, modern field gun carriages are built to allow of high angles of elevation, to fire upon low-flying aeroplanes when these attack the troops with machine-guns. Regular A.A. guns are mounted on substantial pivots, with hydro-pneumatic gear to check the severe recoil. Mobile guns, used in the fighting line, are usually on low, wheeled platforms, which can be drawn behind a lorry.

On coming into action, the platform is lowered to the ground, and levelled by screw-jacks at each corner, so as to bring the pivot exactly vertical. Semi-mobile guns, used in sedentary warfare, are on heavier platforms which are carried in sections and put together before firing; and non-mobile guns, for the defence of fortresses and cities, are on solid concrete or caisson platforms. Mobile A.A. guns are usually 12-pdrs.; the greatest height of the trajectory is over 20,000 ft. and, up to 5,000 ft., the height at which reconnoitering aeroplanes usually fly, the trajectory is very flat. Semi-mobile and non-mobile guns are usually 40-pdrs. of about 105 mm. (4·2-in.) calibre. This calibre is used principally to obtain a flat trajectory up to 10,000 ft.; the additional weight of shell does not materially increase the effect.

The ammunition used with A.A. guns is shrapnel or high-explosive shell; a proportion of the shells are fitted with tracers. A tracer is a small firework in the base of the shell, which leaves a trail of smoke to mark its flight. This is necessary, since an ordinary shell fired into the air disappears until it bursts, and there is nothing to show whether it has passed close to the target or otherwise. The shell is fused so as to burst close to the target. If the fuse fails to act at this height, it explodes the shell at the highest point of the trajectory, so as to avoid endangering one's own troops by the shell falling among them.

Fire at aeroplanes is entirely by prediction; the course and speed of the target are measured by optical instruments, and the gun is fired at the point where the aeroplane is expected to be, making due allowance for the time of flight of the shell. If the first shot or salvo misses, the plane will at once begin to dodge, and it is useless to fire at it until it has again settled down to a regular course.

A good instance of the semi-mobile type of anti-aircraft gun is the French Schneider gun shown in fig. 4 on plate. This is a 4·2-in. gun firing a 37-lb. shell with a muzzle velocity of 2,300 feet per second. The pivot mounting is fixed on a steel platform, transported on wheels: the extensions carrying the screw-jacks are folded inward for travelling. The total weight is 8·8 tons. The overhead shield serves principally to conceal the movements of the detachment from above.

The special feature of this gun is the control apparatus. This is an instrument which is set up at a suitable observing position affording a clear all-round view; it is electrically connected to the gun, and may be half a mile distant from it. Six gunners tend the instrument, and observe the aeroplane with a short-base rangefinder and telescopes attached to the instrument, thus determining its range, height, speed and course. The instrument translates these data into simple elements of elevation and training of the gun. These are transmitted to the gun by electric connections which actuate dials on the gun-mounting. The gun-detachment have only to follow up the reading of these dials with the elevating and traversing hand-wheels; they need not see the target at all. When the course of the aeroplane has been determined, the officer at the observing position makes a "prediction" of the point which it should reach, say 30 sec. later, and directs his telescope on this point; the dials at the gun move forward accordingly. If the aeroplane duly appears on the cross-wires of the telescope, the officer fires the gun electrically; if it has changed its course in the meantime, a fresh prediction is made.

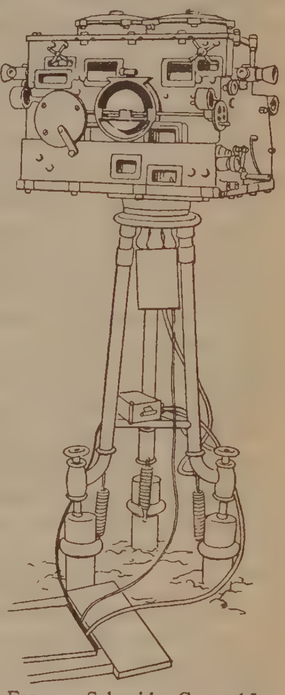


FIG. 2.—Schneider Control Instrument for Anti-aircraft Fire.

Trench Artillery.—When two opposing forces are entrenched, they tend to press forward till their advanced works are within 100 yd., or less, of each other. The same thing occurs in siege warfare, when the besieger extends his front trench till it is close to the fortress. The need then arises for a weapon capable of throwing a heavy bomb to a short distance, yet which is so small and light that it can be carried up through the trenches. The original piece of this type is the Coehorn mortar used in the sieges of the 18th century. The modern type was introduced by the Germans at the beginning of the World War.

The Krupp Minenwerfer is a light gun of 2-in. calibre mounted on a short plank. The 50-lb. spherical bomb rests on the muzzle, and has a tubular steel "stick" which extends down the bore of the gun. The piece is fired at an angle of 45 to 75 degrees of elevation, and its extreme range is about 450 yards. The 50-lb. bomb, with its high-explosive charge, is capable of wrecking a "dug-out" or blowing in the walls of a trench so as to block it.

As the weight of the 50-lb. bomb rendered ammunition supply, in the front trenches, a laborious proceeding, the British introduced the light Stokes trench mortar, firing a 10-lb. bomb. This is a weapon of a different type. It is a light steel tube of 3-in. calibre, with a spike projecting into the breech end of the bore. The cylindrical bomb has a small cartridge and percussion cap fixed to its base; it is dropped into the muzzle, and slides down till the percussion cap strikes the spike, when the cartridge is ignited and the bomb blown out. The extreme range is about 1,200 yd.; this enables it to be used from a point well back in the trench system, where it is safer and less likely to draw fire than in the advanced works of the outpost zone. A 25-lb. Stokes mortar was afterwards introduced, and was used principally for firing smoke shell. Later on, the bombs were fitted with air-vanes to increase their accuracy. The 3-in. Stokes proved such a handy weapon that it was used in mobile warfare as an infantry gun, for the reduction of "strong points" encountered in the infantry advance. Being a high-angle weapon, it was useless against moving tanks.

The French used the Dumezil trench mortar, which is on the same principle as the Krupp Minenwerfer, but heavier. It throws stick-bombs of various weights, from 35 to 99 lb.; with the former it ranges over 700 yards. They tried a compressed air mortar, in which the range was determined by varying the pressure in an air-chamber; this was an efficient weapon, but was considered too complicated to manufacture in large numbers.

The Germans had a 9-lb. trench mortar, ranging 1,400 yards, and in 1918 they adapted it so that it could be used as a mobile infantry gun, for direct as well as for high-angle fire. This is a miniature field howitzer, fired from a bedplate in the trenches and mounted on a small wheeled carriage for work in the open.

Heavy Trench Mortars.—Owing to the difficulty of supplying heavy ordnance in sufficient quantities, trench mortars were introduced, in 1915, capable of throwing a 200-lb. shell about 1,200 yards. The principal piece of this type was the Batignolles 240-mm. (9·45-in.) mortar. This is in two pieces screwed together, and is fired from a mounting fixed on a bed of wooden balks. It is intended to be carried into the trenches on special iron barrows. The total weight is about a ton, and it is divisible into five barrow-loads. The Allies used this weapon for firing from positions towards the rear of the trench system, where it could be turned on the front trenches in case the enemy invaded them. The Germans used, for the same purpose, a rifled 170-mm. (6·69-in.) trench mortar, firing a shell of 110 lb. to a range of 1,250 yards.

II. AMMUNITION AND TRANSPORT

All modern guns fire smokeless powder consisting of guncotton and nitro-glycerine in varying proportions. This powder makes a broad white flash at the muzzle of the gun, which enables the enemy to locate it, especially at night, unless the gun is behind cover extending at least 10 ft. above the muzzle. Therefore field guns and other guns which have to be in action within 5,000 yd. of the enemy are now provided with flashless powder, which makes only a dull red glow. The flashless quality is secured by adding certain ingredients to the smokeless powder.

Projectiles.—The most effective man-killing projectile against troops in the open is shrapnel shell, which is a steel case containing bullets and a small propelling charge. A time fuse, in which time is measured by a column of burning composition, or by clockwork, is set to ignite the charge behind the bullets when the shell arrives at a point about 50 yards from the enemy. The head of the shell is then blown off and the bullets released from the case which falls to the ground, the bullets going forward with the velocity of the shell at the moment of burst.

However in the World War, in view of the enormous requirements of ammunition and the predominance of trench warfare, it was decided that the proportion of shrapnel should be considerably reduced. Even field artillery, which, at the outset, carried at least 80% of shrapnel, were reduced to 5%, the remainder being common shell. The common or high-explosive shell is merely a hollow projectile containing high explosive, detonated on impact by a simple percussion fuse. It may be either thick-walled, producing effect by its splinters, or thin-walled ("mine") shell, containing a large burster for the demolition of earthworks, etc. The former has an "instantaneous" fuse which bursts the shell before it has time to penetrate into the ground, the latter has a "delay action" fuse which allows the shell to penetrate some 6 ft. before exploding.

Special natures of shell are star shell for illuminating, smoke shell to conceal troop movements by obscuring the enemy's view, incendiary shell, armour-piercing shell and chemical or gas shell, containing lethal or disabling gas. Although the latter were used in the World War, their employment was condemned by the Treaty of Versailles, 1919, and by the Washington Conference, 1922. Whether they will be used in future wars is a question beyond the scope of this article, but it may be said that all nations are taking measures for defence against chemical warfare.

Explosives are used for the bursting charges of shells. The substance principally used is picric acid, otherwise known as lyddite, melinite, shimosé, etc. Various substitutes, such as trinitrotoluene (trotyl) and ammonal are used on account of difficulties of supply (*see* EXPLOSIVES, MILITARY).

EFFECT OF SHELLFIRE

The field artillery shrapnel shell discharges about 300 bullets, spread over a space of 150 to 300 yd. (according to the angle of descent of the projectile) from front to rear, and about 25 yd. wide. Fire at troops is therefore so controlled that the lines of fire of the guns are 25 yd. apart and so that a shrapnel shell can be burst once a minute at least in front of each 25-yd. unit of target. This is the normal rate of field artillery fire, and the rates of barrage fire are based on this. The rate may be reduced for fire of interdiction, or doubled or quadrupled at decisive moments. Or the lines of fire may be concentrated, so that the fire of several guns converges on one target, when attacking a single gun or group of machine-guns. Common shell, when used with instantaneous fuses against troops in the open, is less effective than shrapnel, but its moral effect is greater.

Bombardment.—Effect on earthworks depends on the minepower of the individual shell, as measured by the size of the crater which it produces. For instance, a 6-in. howitzer mine shell, containing some 13 lb. of explosive, produces a cylindrical crater about four yards across and 10 ft. deep, partly filled up by earth falling back into it. Therefore to breach a 12-ft. parapet it must be struck by one such shell per 4 yards. If the diameter of the crater is less than the thickness of the parapet, great waste of ammunition ensues; for this reason field gun and field howitzer shell are practically ineffective against entrenchments. At guns in the open, a modern field gun takes 15 rounds of shell at 3,000 yd., or 25 rounds at 3,500 yd., to make a disabling hit.

Wire Cutting.—Defensive belts of barbed wire are a leading feature of modern defences, and it is of great importance to provide means of cutting lanes in them for attacking troops to pass through. In 1915 this was done by the precise and deliberate fire of shrapnel, and had to be carried out on the day previous to the attack, thus forfeiting the advantage of surprise. The introduction of the instantaneous fuse for common shell has enabled wire-cutting to be done quickly, but a large expenditure of ammunition is still required. The French found in 1918 that 600 rounds of field common shell were required to cut a lane 25 metres wide through a belt of strong wire 25 metres deep at ranges of 2,000 to 4,000 metres. The time taken was 15 min., after ranging had been completed.

Fire at Tanks.—Any gun, down to a 6-pdr., is capable of disabling a tank with a direct hit at ranges up to 2,000 yards. At longer ranges, field and mountain guns have to be provided with armour-piercing shell to attack armoured tanks. The 18-pdr. field gun will penetrate about 2½ in. of armour at 1,000 yd. and 1½ in. at 4,000 yards.

Fire at Armoured Forts.—The Belgian forts destroyed by the German super-heavy artillery in 1914 were not attacked by firing at the armour, but by undermining the armoured turrets with mine shell which exploded in the earth under them. It has been proposed to obviate this by covering the ground in front of the turret, to a distance of 50 metres, with an apron of cast-iron blocks one metre cube, which will burst the "undermining" shell harmlessly on the surface.

Armoured forts are very vulnerable to gas attack and to heavy bombs dropped from aeroplanes, and it is probable that, in future land defences, they will be replaced by entrenchments.

Supply of Ammunition

Modern methods of warfare developed in the World War necessitated the employment of enormous quantities of artillery ammunition. Thus in Aug. 1918 the Germans had over 30,000,000 shells in their ammunition columns and depôts in France. In 1914 it was considered that 1,500 rounds per field gun should be in hand at the beginning of a campaign; of these, on the average, 300 were carried with the battery, 100 in a light ammunition column capable of moving across country, and 100 in a heavy ammunition column. The remaining 1,000 were kept ready in arsenals. It was soon found that this allowance was insufficient. It was found necessary, for a great attack, to put in one field gun per 10 yd. of a 50-m. front, and in view of the fact that each gun might have to fire 500 rounds in a day, the old methods had to be revised. The solution was to bring the daily output of the arsenals as close as possible to the fighting front, by using ordinary railways, light railways and specially-laid trench railways.

The ammunition columns, which now consist entirely of motor lorries, are no longer looked upon as reserves of ammunition, but as carriers between the advanced ammunition depôts, called dumps, at the various railheads and the guns. They formed advanced dumps by the roadside as near as possible to the gun positions, and the battery ammunition wagons took the ammunition up to the guns. The view of those who base their ideas on the World War experience, is that before an action each gun should have 300 rounds beside it, in addition to the number carried in the battery wagons. The railhead dump is usually at least 5 m. behind the guns, to secure comparative immunity from fire, and the motor ammunition columns are expected to make 4 double trips a day, covering 40 to 50 m., besides the additional ground covered in an advance.

Special artillery vehicles are no longer used in ammunition columns; these consist mainly of civilian motor vehicles, either lorries or stripped chassis fitted with platforms. In principle, all transport has to be "general service," capable of carrying ammunition, stores or troops, as required.

At the gun itself, a shielded ammunition wagon, containing about 100 rounds, is run up beside the gun, forming a protection for the gunners employed in setting fuses and in passing shells to the loading number.

Transport of Artillery

At the present time the draught horse is in process of being replaced by mechanical transport for all artillery. This change is necessarily a gradual one, and its nature and progress in different countries are partly determined by the extent to which the mechanical transport which has replaced the horse in civil life can be rendered available for military purposes.

Artillery may be mechanicalised in several ways. The automobile gun-carriage has the gun-mounting built into it, and is preferably of the "caterpillar" type. The artillery tractor pulls the gun behind it, and carries the detachment and first supply of ammunition, and the artillery carrier carries the gun on a platform from which it is dismounted, by a ramp, for firing. From the tactical point of view, the automobile gun-carriage is at the moment not satisfactory, as it is too vulnerable and too large for concealment, and requires an undue amount of labour to entrench. The motor is useless while the gun is in action, when, if it were separable from the gun, it would be most useful in bringing up ammunition.

Tractors.—The artillery tractor may be a caterpillar or a vehicle of the lorry type. Both forms are open to the objection that the complicated mechanism of a Q.F. gun is damaged by rapid travelling on the road, even if the wheels be provided with rubber tires. The caterpillar tractor is good across country, but cuts up the roads; the least unsatisfactory in this respect is the tractor of the French Kégresse type, with rubber caterpillar bands, which are said to last as long as linked steel bands. On the other hand, the rubber bands do not grip so well as steel ones on slippery ground. Various attempts have been made to construct tractors and carriers having both road wheels and caterpillar tracks. The American Christie tractor travels normally on road wheels, and has a caterpillar band which is put on round the wheels for cross country work; the French St. Chamond carrier-tractor is a complete caterpillar vehicle, with an extra pair of road wheels on extensions of the chassis at each end, which can be raised well clear of the ground, allowing the vehicle to rest on the caterpillar tracks.

Another vehicle, of a different type, is the "4-wheel drive" lorry, in which the wheels are driven independently. This is excellent on the road, and is capable of moving over easy country. But, owing to the extra complication and expense, the civil demand for it as a vehicle is very small. The Pavesi agricultural tractor is a small, 4-wheeled vehicle with a flexible connection between the fore and hind carriages, which enables it to adjust itself to irregularities of the surface of the ground. Its 4 wheels are driven independently, and have removable "spuds" which are put on for cross-country work. It has a 16-H.P. engine burning paraffin or petrol. The road speed is about 5 miles an hour, and the machine is therefore unsuited for the rapid transport of reserve field artillery. It has, however, been adopted for the Italian divisional artillery, and it is under consideration as the tractor for the French artillery of accompaniment.

The artillery carrier saves the gun from road strains, but entails delay in lowering the gun on to the ground when it comes into action, and in hoisting it up again with a ramp and winch. Many tractors, such as those of the American Holt type, can be fitted with platforms and used as carriers. It is not practically possible to fire the gun from the carrier, as this would entail a considerable increase of weight and complication. Any commercial lorry can be readily adapted as an artillery carrier, for travel on the road only, by the addition of a winch. As regards the difficulty of combining a road vehicle and a cross-country vehicle, the carrier is subject to the same disadvantages as the tractor.

French and Italian Practice.—The French, in 1920, proposed to introduce an agricultural tractor, encouraged by a government subsidy, which should be available for the transport of artillery. But it was found that owing to the small size of fields in France there was little demand for the tractor, and no immediate prospect of its superseding the horse. On the other hand, the use of motor-lorries is extending rapidly. The French have now decided to carry the army field artillery, which is required to be highly mobile, on lorries, thus accepting the principle of the carrier, not the tractor. These lorries cannot move off the road, except on favourable ground; therefore each battery carries a pair of draught horses per gun on its lorries, to take the guns into position. The French had 83 of these *batteries portées* at the end of the War. The French gun of accompaniment, at the rate of 2 per battalion in the fighting line, is to be drawn by a small agricultural tractor of the Pavesi type standing about one metre high.

The Italians have arrived at a somewhat different solution. No draught horses are bred in Italy; they have to be imported from Germany. It has therefore been decided that the divisional field guns are to be drawn by the Pavesi agricultural tractors already described. The Italian army field artillery, which is required to be highly mobile, will be carried on low platforms, which have springs and rubber-tired wheels, pulled by fast lorries. When the guns have to leave the road, they will be taken into position by the divisional Pavesi tractors.

The Americans have finally condemned the automobile gun-carriage, and favour the caterpillar tractor. They consider it possible to produce a pattern of caterpillar band which will not cut up the road unduly. Other nations are still experimenting. Medium guns are usually tractor-drawn, the gun being shifted to a "travelling" position in which the weight is divided between the gun wheels and limber wheels. Heavy guns are transported on special wagons, drawn by tractors, which carry the piece itself, while the empty carriage is drawn by a second tractor.

Super-heavy artillery is transported almost entirely by rail, though in 1914 the Germans brought up their siege howitzers, divided into separate loads, on special road-wagons. The railway mounting consists of a massive platform supported by bogies, on which the gun mounting is built (see fig. 5 on plate). In the English Elswick type the gun is fired while the mounting is "alive" on its wheels; in other types the central platform is lowered on to the rails before firing. All-round fire from the truck, without special preparation, is only possible with medium guns; for heavier natures the gun is laid for direction by running the truck up or back along a curved siding. Or, in some railway mountings, the gun-truck is supported laterally by heavy "outriggers" sunk in the ground.

For the heaviest natures the railway is used for transport only, and the gun is lowered on to a previously built platform. Permanent concrete platforms were used in 1914, but these were superseded by "caisson" platforms consisting of iron boxes bolted together and filled with earth, surmounted by a steel platform plate which carried the mounting. Recent American platforms dispense with the caissons, and consist of the platform plate only; this is divided into sectors for transport, bolted together on the spot, and pegged down with a number of steel stakes. These platforms can be laid in a few hours, this being a great addition to the value in the field.

Railway mountings can be used for the transport of artillery on light railways, and even on trench railways. Additional narrow-gauge wheels are fitted to the gun-truck for this purpose. In this case a platform must be used for firing. The limit of the height and width of a railway mounting is the loading gauge of the railways on which it may have to be used; this depends principally on the size of the tunnels. Practically there is no limit to the length or weight.

III. TECHNIQUE AND ORGANISATION

In modern war, guns are quickly silenced if they come into action in full view of the observing posts of artillery already in position. Except in special cases, as that of guns of accompaniment, artillery always use the concealed position behind a ridge or other cover from view, in which the elevation and direction necessary to hit the target are signalled by an advanced observer. An aeroplane may be used, when available, to correct the fire; modern developments of wireless telephony enable the airman both to send and to receive messages. Advanced observers on the ground now use "ground wireless" instruments. It is now considered that with wireless telegraphy, which is more reliable than wireless telephony, it is possible to use one instrument per 500 metres of front without interference.

Ranging.—This process serves to determine the elevation at which a gun will hit the target, or, more correctly, the elevation at which the mean point of impact of the shells will coincide with the target. This elevation is not necessarily that due to the map range, as it is affected by the temperature, height of barometer, strength of the powder, degree of wear of the gun and other factors which together constitute the "error of the day."

When a number of shells are fired from a gun which is pointed at a given elevation above the target, they do not fall in the same place, but are distributed over a space which, at medium ranges, may be 100 yd. in depth. Together they form a "sheaf of fire." The first step in ranging is to determine, by observation of the fall of the shells, 2 elevations, at the higher of which the sheaf of fire will fall beyond the target, and at the lower of which it will fall short. These 2 elevations must be such that the sheaves of fire do not overlap, as otherwise they would afford no definite information. The 2 elevations constitute the "long bracket," within the limits of which the true elevation must lie. The usual long bracket is one of 300 yards. This bracket is then "split" by firing at the 2 intermediate hundreds of yards, and observing the results, thus obtaining a closer approximation to the elevation required. Finally, corrections of 25 yd. are made till an equal proportion of rounds are observed to burst over and short. Ranging for line, that is, for lateral direction, is carried out in the same way.

Map Ranging.—It is of great importance to be able to open effective fire by surprise, without preliminary ranging. It is possible to do this if the exact map range, and the factors constituting the error of the day, are known beforehand. In position warfare the ground is accurately surveyed, and the emplacement of each gun is marked on the survey. Guns are carefully "calibrated," a process which consists in determining the error due to wear by firing at a known range. The error of the powder is measured in the same way. A special section in each army corps, known as "Meteor," keeps the batteries informed as to the atmospheric conditions. By this method it is possible to open effective fire without ranging, even on unseen targets, with sufficient accuracy for purposes of bombardment. Map ranging is hardly applicable to mobile warfare.

Another method of ranging, much used in trench warfare, is the employment of a "witness point." This is an easily observed point in the enemy's lines, such that its range can be measured exactly; it should be in the general direction of the prospective target, and within about 500 yd. of it. By firing a few preliminary rounds at the witness point, and observing the result, the data necessary to hit the target can be obtained.

Sound Ranging.—This is effected by observing the moment at which the report of an enemy gun, or the burst of a shell fired at it, reaches each of a chain of recording instruments. It has recently been improved so as to give very accurate results under suitable weather conditions, from a set of instruments occupying as little as 2,500 yd. of front. Setting up the instruments takes the rather lengthy time of from 24 to 48 hr., which limits the employment of this method in mobile warfare. (*See* SOUND RANGING.)

The proportion of field artillery to infantry in an army was for long fixed at about 6 guns to 1,000 rifles, and infantry divisions were formerly organised on this scale. It was found, however, that this proportion of guns was excessive for sedentary warfare, and utterly insufficient for active warfare. A modern division has therefore only 4 guns per 1,000 rifles, the 2 additional field guns being formed into mobile "army" brigades to be put in as reinforcements where required. A division has one battery of medium guns for long-range work: heavy guns and howitzers, which can fire over a front exceeding that of a division, are allotted to army corps; and super-heavy guns are under army command.

The proportion of artillery of all natures arrived at by the end of the World War was 10 guns and howitzers per 1,000 rifles, roughly 6 field, 2 medium, 1½ heavy, and ½ super-heavy. This did not include the trench mortars, at the rate of one per 100 yd. of front, used in trench warfare.

The usual field artillery fire unit is the battery of 4 guns, which is capable of firing 100 rounds a minute on emergency. Six-gun batteries are sometimes used for the sake of economy, as they require proportionately fewer officers and battery staffs. Field batteries are organised in brigades (French *groupes*, German *Abteilungen*) usually of 3 gun batteries and one howitzer battery. Medium artillery work in single batteries of 4 guns, heavier natures work singly.

Prior to 1914 the highest artillery command was that of the divisional artillery, but when the artillery of a given front had to be increased to treble its normal strength, for attack or defence, it was found that a higher artillery command was required. The G.O.C. the artillery of an army corps of 3 divisions (sometimes 4), now commands the 3 divisional artilleries (reinforced if necessary by army field artillery); the corps artillery (also reinforced); and any super-heavy artillery allotted to him for the operation.

IV. TACTICS OF ARTILLERY

In modern war it is found that infantry units opposed to each other are driven to seek cover, and immobilised, as soon as they get within the zone of each other's aimed fire. Their only means of arriving at a tactical decision is to enlist the aid of an arm which is capable of keeping down the fire of troops opposed to them while itself keeping beyond the range of effective rifle fire, or which is capable of withstanding rifle fire, as in the case of shielded guns and tanks.[1] The assistance afforded to the infantry by the artillery during the World War was so effective that the artillery came to be regarded, at least until 1918, as the most important arm, although it is incapable of achieving victory by its own efforts.

Before 1914 it was held that infantry and artillery should work in intimate co-operation (*liaison*) so that when an infantry unit was checked it could at once communicate with the artillery behind it, and inform them as to the exact points which the infantry required to be shelled. The first battles of the World War showed this ideal to be impracticable, as communications broke down at once. Neither telephoning, visual signalling nor communication by orderly, were possible under heavy fire. In addition to this not even the infantry themselves were capable of locating the enemy which was causing them casualties. When troops were in permanent trench systems, telephonic communication, by deeply laid cables, was maintained; but the moment the infantry advanced or retreated from their trenches they lost touch with the guns.

Barrage.—This led to the introduction of the barrage, which is a screen of bursting shell across the whole front of the infantry advance. The smoke and the dust thrown up conceal the infantry and protect them from aimed fire. The "creeping" barrage is advanced according to a time-table, by "bounds" of perhaps 100 yd.; it is "halted" on each successive objective to "pound" it before the infantry assault it, and when the final objective is attained it becomes a "standing" barrage to screen the infantry while they consolidate the position. The infantry follow the creeping barrage closely, keeping just behind the zone of bursting shells. It is intended that the barrage shall destroy all opposition, but however dense and however deep the zone of bursting shells is made, this is almost impossible to attain, as infantry and machine-gunners take refuge in deep trenches while the barrage passes over them, and then re-appear.

The objections to the barrage are serious. It cannot be put down without considerable delay and once started, it cannot be controlled. Moreover, since it has to be fired by a large number of dispersed batteries, it is impossible to communicate with them all, through a "chain of command," in time to check it if the infantry are unable to keep up with it. Since the whole area of the advance has to be covered progressively with bursting shells, the greater part of these are ineffective, except as contributing to the smoke screen. It requires elaborate preparation and a very heavy expenditure of ammunition. The modern tendency is therefore to restrict the barrage, and the number of guns detailed to fire it, to the minimum required for safety; that is, to form a protective rather than a destructive barrage, and to employ as many guns as can be rendered available in accurate fire at important targets in and behind the enemy's line. It is obvious therefore that when a situation demands a barrage, the fight has temporarily become of a stationary nature.

The creeping barrage is also used to screen retreating troops; a "flank" barrage screens the flank of troops halted or on the move, and a "standing" barrage is used for many purposes, such as to prevent the enemy from reinforcing the portion of his line which is being attacked. The barrage, with all its defects, is necessitated by the impossibility, under present conditions, of communication between units on the battle-field. Should wireless telephony be so developed as to be directive, selective and proof against interference, the crude method of barrage may disappear.

MOBILE WARFARE

The creeping barrage may not be sufficient to overcome all opposition to the advance, and the infantry are liable to be held up by machine-guns and troops protected by overhead cover. It is necessary that they shall be accompanied by artillery, following the firing line so closely that they can see what is going on, and can open fire on machine-gun nests, etc., without the delay caused by signalling messages.

Guns of Accompaniment.—So much is generally admitted; but the nature, command and organisation of the accompanying artillery are matters on which opinions differ. Moreover, the infantry are not satisfied with guns of accompaniment, but demand a weapon of their own in the actual firing line to deal with sudden attacks by tanks and machine-guns. It is impossible to go into the whole controversy in this article. The opinion of the French, which carries great weight, is as follows:—

> The artillery of accompaniment must have a fully efficient shrapnel weapon; miniature guns are of little use; the gun will be the service 75 mm. field gun on a low carriage, and will be taken into action by a small tractor standing less than one metre high. It may have a special light shell to facilitate ammunition supply. The artillery will be tactically under infantry command, but will be free to choose its own technical methods.

Other nations are introducing pack guns, or special light guns or howitzers which can be drawn as far forward as possible by small tractors, and can then be divided into loads and carried up by hand. The British gun of accompaniment is at present the 3.7-in. pack howitzer, but it is generally considered that its 20-lb. shell is so heavy as to present serious difficulties in ammunition supply.

The infantry gun, as distinguished from the artillery of accompaniment, will probably be a small piece firing a shell of about 1½ lb. capable of stopping tanks up to 1,000 yd. range, and of destroying machine-guns. It will be on a low sleigh mounting. This is in effect a development of the elephant rifle issued to the German infantry as a tank-stopper. The recoil of this rifle was too severe for firing from the shoulder, and it was in process of withdrawal and re-issue as a machine-gun at the end of the War. Fig. 3 represents a Schneider one-inch machine-gun firing armour-piercing shells, intended especially for stopping tanks.

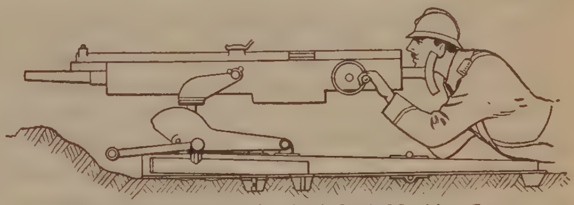


FIG. 3.—Schneider 1-in. Anti-Tank Machine-Gun.

PHASES OF THE WORLD WAR

The World War was divided into four phases: the invader's dash into enemy country, a long period of trench warfare, the breaking of the line, and the retreat of the invader. It is of the utmost importance to the invader to make his initial dash so rapid and effective as to finish the war at once; similarly the defender hopes to drive back the invader without entering on an exhausting period of sedentary defence. Therefore both sides must be able to dispose of highly-mobile troops and the light and medium artillery must be able to keep pace with an advance at the rate of 50–100 m. per day.

Salients and Re-entrants.—The tactical method will be, as heretofore, the rapid deployment of a superior force of infantry and artillery wherever opposition is encountered. The length of the battle-front will be measured in hundreds of miles. The battle-front will naturally assume an indented shape, with salients where slight opposition is encountered, separated by re-entrants where the resistance is obstinate; these salients will be fed by reserves so as to spread out laterally and to encircle and pinch out the re-entrants between them. In this warfare the light artillery is relied upon to form the salients, while the heavy and superheavy artillery, the latter ranging about 30 m., bombards the re-entrants and renders them untenable.

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[1] Gas warfare is not here considered.

The attacking force is preceded by a screen of motor-cyclist infantry supported by light artillery. This force moves about 20 m. in advance of the main body; its function is to conceal the movements of the main body, to overcome slight resistance, and to locate the positions taken up by the defending army. The object of including artillery in this force is to overcome resistance with which the combat troops (*e.g.*, mechanicalised infantry or tank infantry) cannot cope; thus a machine-gun in a house commanding a bridge or defile might hold up infantry for hours, whereas a field gun would wreck the house in a few minutes. It is necessary that the artillery accompanying this force shall be highly mobile, in order that it may be brought to any point where resistance is experienced with the least possible delay. Some authorities consider that it is worth while to introduce an automobile gun for this purpose alone, in spite of the objections to it already mentioned. In any case it must be a piece capable of a higher degree of mobility than that required of the divisional artillery.

Deployment.—Wherever a defensive position is located by the advanced screen, and the aeroplanes which accompany it, the long columns in rear deploy as quickly as possible. The attacker cannot tell how serious the resistance will be, but if he underestimates the strength of the defence, and delivers an attack with insufficient artillery support, he exposes himself to a severe check. His safest course is to prepare for an attack *en règle*, preceded by an artillery bombardment, led by tanks, and protected by a barrage.[1] This entails bringing up a large supply of ammunition, since each field gun should have 300 rounds "dumped" beside it, in addition to the supply that is carried with the battery.

Further, it entails reinforcing the artillery on that particular front to "attack strength" of one gun per 10 yd. of front, by bringing up artillery from the reserve and from neighbouring columns. This is because one field gun can only barrage 30 yd. of front effectively, and because only one-third of the guns are available for barrage purposes, as will be seen. The deployment and formation of artillery dumps will take at least 24 hr., and the attack will take another day, from dawn to dusk; after all this preparation and delay the attacker may find that he has deployed against a sham position, and wasted time and ammunition. He is therefore tempted to endeavour to rush the position with his advanced guard, a proceeding which affords great opportunities to an alert defender.

Supporting Artillery.—As regards the action of the supporting artillery, that of the guns of accompaniment has already been referred to. Of the remainder, one-third of the guns will bombard and afterwards barrage; the other two-thirds, including all the medium and heavy guns available, will bombard the position and will afterwards concentrate on important points in the defender's line and on objectives such as cross roads and railway stations in rear of it. The French regulations of 1912 advised deploying only a sufficient number of guns for the immediate purpose in view. But it is now generally considered that the German method is preferable; this consists of getting all the batteries into position, ready to open fire if required, as quickly as possible. One reason for this preference is that a battery in action in a concealed position is much safer from fire than if it remains in column on the road, where it can be located by aeroplanes.

Defensive Positions.—The local conduct of the attack consists in forming salients wherever the infantry or other combat troops can get forward, feeding the salients with reserves so as to form offensive features, and surrounding and "pinching out" the re-entrants between them. A modern defensive position is not a well-marked continuous line, which would be untenable under artillery fire; it is a chain of small centres of resistance, or localities organised for defence, each as inconspicuous as possible, held by detachments varying from a platoon to a company with machine-guns. These defended localities and the posts comprising them flank and support each other by their fire; they are protected as far as possible by obstacles, but they cannot be provided with barbed wire and overhead cover as in a regular system of entrenchments.

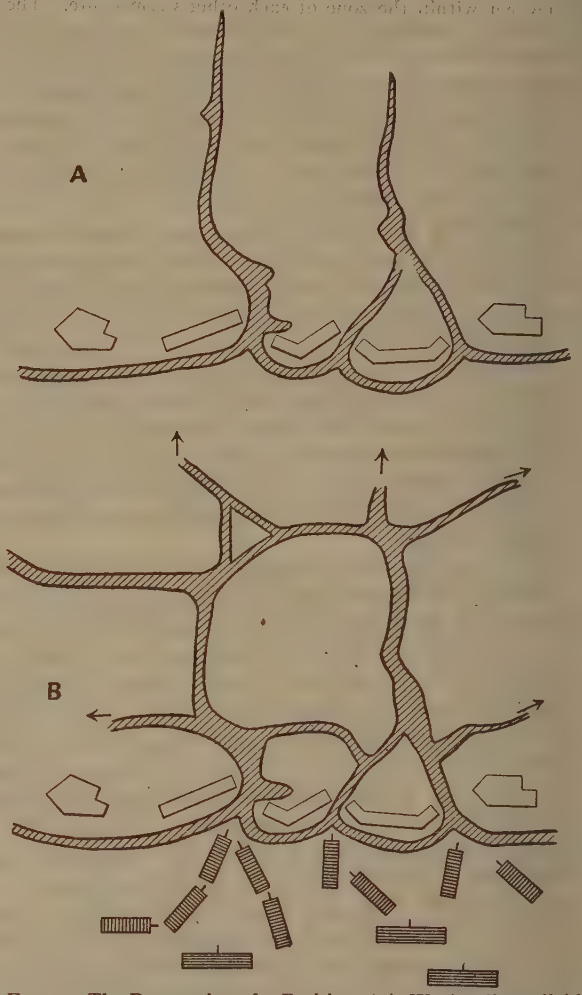

FIG. 4.—The Penetration of a Position. *A*, Weak salients liable to be cut off; *B*, Salients fed by reserves, and pinching out re-entrants.

Each of these centres of resistance has to be taken, or enveloped and cut off, by the attackers, and for this they require the assistance of the guns of accompaniment. For the fighting is too confused and complicated for the divisional artillery in the rear to afford much help to their infantry at this stage, especially as the enemy posts, being carefully concealed, often remain undiscovered till the infantry are close upon them. However, the divisional artillery must press forward as their infantry gain ground, keeping in touch with them as closely as possible. Aeroplanes, dropping messages, will assist in keeping up communication between the infantry and the guns. If the infantry are seriously checked, and have to await reinforcements, the divisional artillery must be prepared to put down a barrage in front of them. Medium and heavy guns gain little by advancing to a shorter range, and their fire is interrupted while they are moving; consequently they do not usually advance till several miles of ground have been gained.

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[1] This and most of the subsequent detail is inevitably based on the conditions of the World War and is thus liable to be radically modified by the mechanical evolution which is taking place in all armies. Further it visualises a scale of artillery support which is beyond the means of the British Army, at least under its post-War organisation.

A fully-organised defensive position may be 4 or 5 m. in depth, consisting of several successive chains of defended localities. As each of these is taken by the attack, the bombardment, which has been "lifted" at the moment of assault, is shifted to the next line of defences; these have hitherto been invisible to the artillery of the attack, but are now in view of the advanced artillery observing officers, who press forward to the first-line positions as soon as they are taken. The infantry advance is resumed (usually by fresh troops); a fresh barrage is started, and the attack pushes on till success is achieved, or till the attacker's forces are exhausted.

In modern warfare there is no question of keeping any of the attacker's guns in reserve to cover a possible retreat; it is considered preferable to use all the available gun-power to strengthen the offensive.

Pursuit of the Enemy.—After a position is captured, it is most important to keep up pressure on the retreating enemy, in order to convert his retreat into a rout. Horse-drawn artillery is usually too exhausted to pursue, but motor artillery can go on as long as its petrol lasts. The pursuit is one of the few occasions when artillery should fire at night; even if accurate fire is impossible, a few shells taking effect on the men and transport of a crowded column will do a great deal to lower the enemy's morale.

The strategy of the defender consists mainly in keeping the attacker in ignorance of the real defensive position; he is thus induced to deploy prematurely against sham positions lightly held by mobile troops and guns, so that the defender can counter-attack his weak, extended line with a strong, concentrated force. Here, again, a high degree of mobility is required in order to assemble the field artillery quickly enough to take advantage of any momentary weakness in the attacker's line. The same principle applies to the tactics of mobile defence. The attacker's communications are impeded by long-range shell fire, which hinders him in bringing up his reserves and heavy artillery, and his advancing infantry are weakened by shrapnel fire. Wherever the defender can secure a superiority of force he delivers a counter-attack, protected by an artillery barrage and supported by accompanying and divisional artillery.

Similarly, in the defence of the real position, the defender endeavours to conceal his trenches and defended posts, and thus save them from concentrated artillery fire, till the attacking infantry arrive within short rifle range of them, and are mowed down by machine-guns which have hitherto been kept silent. The defending artillery have the advantage of knowing the ground and the precise range of every point in their defences, and must do their utmost to keep up communication with their infantry, in spite of the damage to telephone lines caused by the bombardment. (The "ground wireless" instruments already referred to may here be most useful.) Therefore they should be able to deliver sudden bursts of fire on the attacking infantry at critical moments, and to afford efficient support to local and general counter-attacks.

ARTILLERY IN TRENCH WARFARE

As the invader advances into the enemy's country, the hastily mobilised defending forces will grow stronger, and the resistance will become stiffer. If the defender succeeds in assembling a force nearly equal to that of the invader, and in establishing it in a strong, entrenched line, before the invader reaches the capital or other vital point, there will then ensue a period of trench warfare.

A modern entrenched line consists of a forward or covering zone some 2 m. deep, consisting of small detached works lightly held, intended to delay the enemy, to break up his line, and to mask the defences in rear; a main zone of strong detached works capable of all-round fire, connected with each other by a chain of short lengths of trench and with the troops in rear by communication trenches; and a reserve zone or second line, which must be far enough in rear to compel an enemy who has penetrated the main zone to form up for a fresh attack.

When both sides are comparatively inactive, the field artillery defending the line is kept at its minimum defensive strength of one gun per 30 yd. of front, of which one-third is in the main zone for the defence of the covering zone, and two-thirds in positions in rear for the defence of the main zone. Heavier natures are still further in rear, in positions where their long range enables them to cover a wide front.

The work of artillery in routine trench warfare is to exhaust the enemy's strength by inflicting constant losses on him, and to take part in the daily minor engagements between the covering zones. These daily combats are necessary to prevent the defence from degenerating into mere passive resistance, to keep the enemy on the alert, and to prevent him from withdrawing troops in order to strengthen his offensive on other fronts. Counter-battery work is constantly carried on, the enemy batteries being located by flash-spotting, sound ranging and by observation from aeroplanes and captive balloons. Since any battery which has been located will be shelled out when the line is bombarded, as many batteries as possible are kept in "silent positions," from which they are not allowed to fire; the daily work of harassing the enemy is carried out by a comparatively small number of guns.

BREAKING THE LINE

It is useless to break through on a narrow front, where the troops who penetrated the line would be exposed to artillery fire from both flanks. The Germans, in April 1918, attacked on a front of 50 m., and for this attack they assembled about 9,500 guns and howitzers of all calibres, mostly field guns, or rather more than one gun to every 10 yd. of front. Their attack was pressed home only on alternate sections of about 3,000 yd., so that the fire of one gun per 5 yd. was concentrated on the real fronts of attack. Instead of a week's bombardment, as in previous battles, the opening bombardment was compressed into 6 hours of rapid fire, gas shell being used against the front trenches, and high-explosive shell against important points up to 10 m. in rear. Wherever the infantry penetrated the front line they were accompanied and closely followed up by field artillery. The leading features of this attack were the "surprise" bombardment and the bold use of accompanying and supporting field artillery. The former was due to the development of "map" firing, which enabled preliminary ranging to be dispensed with. In future battles an even shorter bombardment may be used, especially if tanks are available to break through the barbed-wire defences.

The main difficulty in the operation of breaking the line is that of assembling a sufficient force of infantry and artillery on the front of attack without the enemy's knowledge, or so quickly that he has not time to collect an equal force to oppose it. The normal artillery strength of the front has to be trebled. Positions for the reinforcing batteries have to be prepared, telephone cables laid and buried and ranges measured, so that a fully effective bombardment can be opened suddenly, without warning, on the day of attack. The assault may have to be driven home to a depth of 50 m. before the defender's line is broken so that troops can pour through the gap, and this implies that preparations must be made to push forward guns and ammunition over the battle-field (which is probably a mass of shell-holes, with all roads and bridges destroyed) so as to maintain an unremitting pressure on the defender and prevent him from disengaging his troops and forming them up for a fresh stand. It was the difficulty of bringing up men, guns and ammunition over the battle-field that brought most of the attacks in the World War to a standstill.

Tactics of Attack.—The tactics of the attack on an entrenched position are much the same as those of the attack on a position in mobile warfare. The points of difference are: (*a*) the details of the defences are definitely known from aerial photos; (*b*) the obstacles, such as barbed wire, are more formidable; (*c*) the defenders will have plenty of deep "dug-outs," so that the barrage and bombardment will be less effective. The first point implies that the bombardment can be concentrated on definite points, instead of being more or less spread over the country; the second requires that field guns and, if possible, tanks, must be pushed forward to cut the wire; the third is simply a matter of plenty of heavy howitzers.

Generally speaking, the result of an attack on the grand scale is a matter of strategy rather than tactics, and depends on the relative strength of the forces (especially artillery and tanks) which the combatants are able to assemble on the front attacked. If the defender is able to reply to the bombardment with an equally effective bombardment, and to the barrage with a counter-barrage, no decisive result can be obtained—by infantry at least. Failing this, the defender must give ground without allowing his line to be broken, remembering that every mile of advance increases the difficulties of the attacker, till the impetus of the attack is exhausted.

Gas Warfare.—Though all civilised nations have condemned the use of poison gas in warfare, it is considered necessary to take measures for defence against it. The chemical composition of poison gases is described under Chemical Warfare; we are here concerned with their tactical employment.

Poison gas may be lethal or disabling; phosgene is an instance of the deadly kind, while mustard gas and lachrymatory gas are not fatal. Chlorine is disabling and ultimately fatal. Further, these gases may be so volatile as to disappear in a few minutes, or they may impregnate the ground so that the effect lasts for weeks. These are known as non-persistent and persistent forms of gas.

Troops may be protected from breathing gas by gas-masks and respirators, but these cannot be worn indefinitely; men must remove them to eat and sleep. It is impossible to protect them from mustard gas, which causes painful burns on the hands and legs. Mustard gas is persistent; a wood or a village impregnated with it will remain impossible to enter for weeks. Phosgene is comparatively volatile, and a light breeze is sufficient to dissipate it; chlorine is a heavy gas, and may remain in trenches and hollows for many hours if there is no wind.

Poison gas may be discharged from cylinders, and carried by the wind towards the enemy, or it may be discharged by gas projectors, which are special mortars throwing a 60-lb. drum containing gas-generating liquid; or gas shells may be fired by ordinary artillery, usually light and medium howitzers.

Gas shells require a special range table, as they are lighter than ordinary shell. They are fired either entirely by map, or after preliminary ranging with ordinary shell, as their impact cannot be observed. Hot sunshine causes volatile gas to disperse quickly, and a strong wind blows it away; gas is therefore most effective on a cloudy, still day. The shells are pitched to windward of the target so that the breeze will carry the gas in the required direction. In this respect guns are more efficient than gas cylinders, as they are not obliged to await the coming of a favourable wind.

Gas bombardments are used for various purposes. Thus a piece of ground soaked with persistent gas is denied to the enemy; batteries of artillery, especially when sited in hollows or woods, may be neutralised; trenches which are being attacked may be bombarded with non-persistent gas, which will have cleared away by the time the attacking infantry reach them. Enclosed spaces, such as houses and dug-outs, are readily made untenable. Troops wearing masks lose much of their fighting efficiency and even a small number of gas shells may induce the enemy to put on their gas-masks, and so reduce their fire-effect.

The number of gas shells required for an effective bombardment varies according to the weather, the calibre of the piece, and the nature of the gas used. With the light field howitzer of 105-mm. (4·2-in.) calibre, in fairly still weather, it is reckoned that one round per metre of front is required with non-persistent gas, or two rounds with persistent gas. These figures include only the shells which pitch in the target or within 50 metres to windward of it. *See* Ammunition; Ballistics; Explosives; Ordnance; for naval guns *see* Gunnery, Naval.

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ART SALES (*see* 2.699).—The public and private art sales in Great Britain from 1911 form in the main a sad record of the depletion of national treasures, and show an extraordinary revision in values. Many of the finest works of art formerly in Britain have gone to America, and the exodus is bound to continue. There are still collectors of taste and judgment in the country, but transatlantic competition makes it impossible for most of them to purchase early works of the highest importance. But this inability to buy Old Masters should induce collectors of limited means to patronise the art of modern men, and keep an eye particularly on the work of promising youngsters. Again and again in the past has this foresight been richly rewarded.

The Sargent sale in 1925 may be mentioned, although the prices paid were the result of sentiment rather than artistic appreciation. Works which he himself may have regarded merely as studio "property" fetched extravagant sums: for example, a copy by him of "Prince Batasar Carlos" by Velasquez, measuring 21½ in. by 17¾ in. realised £6,300, a small watercolour made £4,830, an oil painting of "San Vigilio" £7,350, and the total for 163 lots on the first day reached £145,984. Rembrandt etchings also grow in favour. In 1924 the Rudge collection, which was unknown to the experts, established a new maximum in realising £34,000, and the £3,780 given for a first state of "Dr. Arnoldus Tholinx" broke all records for any etching or engraving, the nearest to that figure being the £3,045 paid two years earlier for Valentine Green's mezzotint translation of "The Ladies Waldegrave" by Reynolds.

As already said, many famous pictures have passed from Britain to America in the period under review, but the greatest excitement was caused by the private sale of the Duke of Westminster's pictures, "The Blue Boy," by Gainsborough, and "Mrs. Siddons as the Tragic Muse," by Reynolds, for £200,000 in 1921. Previously, it will be recalled, the Reynolds was withdrawn at Christie's at £52,500 and it was said that £150,000 had been refused for "The Blue Boy" which, as Farington records, was purchased by John Hoppner for 65 guineas in 1803, after having been sold for 35 guineas in 1796. The highest auction price for a Gainsborough was the £20,160 realised for "The Market Cart" in 1913, while the Reynolds maximum stands at £15,520 in 1919 for the portrait of "Mrs. Freeman." That year was one of the most memorable in the annals of art sales. For the first time in history each of 100 pictures realised not less than 1,400 guineas in British auction rooms. The Hamilton Palace sale on Nov. 6 1919 fetched £168,957, the highest sum ever obtained in one day at Christie's, beating the £150,000 record for a two-days dispersal, amassed earlier in the year by the Drummond collection. Three other records were made in that sale: the £6,500 for Turner's drawing of "Zürich," a similar sum for Guardi's "Fête on the Grand Canal," which cost Sir George Drummond £800, and £26,775 for a portrait of "Joseph Coymans" by Franz Hals which, however, was exceeded by the £27,400 paid in America for the same artist's "Old Lady" that figured in the Yerkes collection.

Notable Sales.—Nor were these the only records for 1919. In the Hamilton Palace sale the £54,600 paid for Romney's group of "The Beckford Children" was the highest price given in the public market for any picture. The artist received £105 for the painting of the two girls. A picture of "St. Eustace" ascribed to Carpaccio brought £33,600 in the Vernon-Wentworth sale, "The Spendthrift" by Jan Steen, £17,010, the former record was the £3,412 10s. for "The Sick Lady" in 1910, and Ruysdael's "Landscape," £12,600. James Ward's portrait of "Miss Georgiana Musgrave" made £7,140 against £1,680 in 1905, which was then the maximum for this artist's works. The remarkable events of 1919 may be compared with the auction doings in 1913, when, by the middle of June, the turnover at Christie's alone reached more than £1,000,000. Romney's "Anne, Lady de la Pole" fetched £41,370; Gainsborough's "Market Cart"

£20,160, as against £4,750 10s. in 1894; Hobbema's "Woody Landscape" £15,750 as against £3,460 in 1890; a Hals "Portrait of a Gentleman" £9,000 as against a price of £5 5s. with a still-life subject into the bargain in 1884.

The two abundant years before the World War had filled the warehouses of the dealers with stock, and that fact, combined with financial depression, brought about the result that when on Friday, July 24 1914, Christie's season ended, there were few notable things to report. Only 38 pictures, compared with 85 in 1913, realised 1,400 guineas or over. Two of these works were "A Man with a Red Cap," attributed to Titian, which made £13,650 and Peter de Hooch's "Interior with Figures," which was sold for £8,610 at Robinson and Fisher's, four days before War was declared.

The War Period.—The years between that date and 1919 were memorable for the sales conducted free of charge by Messrs. Christie on behalf of the Red Cross Fund. The great success of these charitable sales helped to restore confidence in the art markets, which also were affected by the Duveen purchase of portions of the Pierpont Morgan collections costing £1,000,000. One of the tragedies of the War was the loss of Sir Hugh Lane in the "Lusitania." In 1916 Christie's celebrated the 150th anniversary of the firm's existence.

Raeburn's art was long in winning favour in the sale-room. In 1877, 49 of his pictures fetched only £6,000. Since then, however, very high prices have been realised for his portraits; for example, "Mrs. Robertson Williamson" brought £23,415 (1911) and "The McNab" £25,410 (1917). These two works remained in England. Gainsborough's charming sketch of his daughters, which fetched £3,045 (1923), went to the National Gallery, London, and Hoppner's fine "Portrait of William Pitt" was purchased for a British peer at £7,350. It came from the Baroness Burdett-Coutts' collection (1922), as did Raeburn's "Portrait of Sir Walter Scott," which made £9,660 and went to America.

In the following year the Brownlow Van Dyck "Portrait of Anton Triest" fetched £29,400. Mention should be made of the futile sale of Sir John Robinson's pictures on July 7 1923. The nominal total for the 114 works by Old Masters was £205,741 10s, but in most cases the excessive reserves were not reached, so that in no previous sale in England had such a large percentage of lots been bought in, in spite of the fact that most of those actually sold showed a profit, and that many of the withdrawn pictures were knocked down at larger prices than those originally given for them by Sir John. In the autumn of 1923 it became known that 10 of the finest pictures in Lord Glenconner's collection of British master-pieces had been acquired by Messrs. Knoedler, and shipped to the United States.

Reference has been made solely to the disposal of pictures, but numerous other works of art have been sold privately and in the open market at prices not less sensational than those obtained for paintings.

On the continent of Europe, too, competition has been acute, with the result that prices were abnormally high in 1911, 1912 and 1913, as they were in Great Britain. In Paris in 1911, the Maurice Kann collection, consisting of 85 lots, realised £108,850, to which must be added the tax of 10% paid then by purchasers. With a few exceptions the profits were enormous. So, too, with the collection of his brother Rodolphe Kann, which cost him about £200,000 and fetched about £1,200,000. Rembrandts, which were bought by him for £1,600 and £2,000, brought £20,000 to £30,000 and a Vermeer of Delft, for which he gave £48, sold for £2,000.

Paris and New York Sales.—In 1912 there were five great Paris sales, the Roussel, Dollfus, Carcano, Doucet and Rouart, which together realised over £1,250,000. A few individual prices may be given. In the Doucet sale a pastel portrait of "Duval de l'Epinoy" by Quentin de la Tour made £26,400, which was eight times the previous maximum for a pastel; John Russell's "Mrs. Elizabeth Curie" sold in Paris for £3,200; H. Regnault's "Salomé," £19,000; "The Countess of Wilton" by Sir Thomas Lawrence, £19,104; "Les Danseuses à la Barre" by Degas, £19,400 (the artist sold it for £20); Chardin's "Les Bulles de Savon," £12,000, and in the following year (1913), Rembrandt's "Bathsheba," £44,000.

Mantegna's "Madonna and Child" in the Weber sale, Berlin (1912), fetched £31,000 against £4,000 paid for it in 1902. In Amsterdam 32 Rembrandt drawings from the J. P. Heseltine collection totalled over £25,000, the highest individual price being £2,508 paid for "The Farm." In the same city (Nov. 1925) the Castiglione collection realised £150,000. Of that sum, a signed and dated (1635) Rembrandt "Portrait of a Syndic of Amsterdam" brought £17,833, Nicholas Froment's "Resurrection of Lazarus," £12,833 and Correggio's "Mystic Marriage of Saint Catharine," £10,666.

The two greatest sales ever held in America were the Yerkes in 1910, which, at £400,000, established a record in New York, and the William Salomon in 1923 which realised £258,569 for 764 lots. Before the latter sale took place, Sir Joseph Duveen purchased privately 15 of the more important pictures at an estimated cost of £200,000. In the Yerkes sale, Franz Hals' "Portrait of a Woman" fetched £27,400, Troyon's "Going to the Market," £12,000 and Turner's "Rockets and Blue Lights," £25,800.

It should be mentioned that the transference in 1925 of a portion of Lord Leverhulme's collection from his Hampstead residence for sale in America caused some excitement, as that transaction was thought to be the beginning of an attempt to make New York the centre of the world's art sales instead of London.

(J. Gr.)

ART TREASURES.—The flow of art treasures from the old to the New World is no novelty. From the days of colonisation onward Americans have naturally desired to possess European heirlooms. Nor has the drain been on Europe alone. The merchantmen of the days of sailing ships bringing back to Salem and other ports their cargoes of tea and spices inaugurated that importation of souvenirs from across the Pacific which, continuing with increasing volume, has resulted in the great American collections of the art of the Far East.

I. THE TRANSFER FROM EUROPE TO AMERICA

Public Interest in European Art.—It has been, however, the importation of European art in recent years that has attracted widespread attention to the transfer of art treasures to America. There are various reasons for the growth of public interest in this transfer. In the first place, values are well known in European art. The relative merit or even the identity of Chinese and Japanese painters is in the main obscure to the uninitiated, but the mention of a picture by Hobbema or Botticelli means something to the merest novice. Moreover, the European picture or other art object has commonly a recorded history, with frequently an ascending series of preceding sale prices to attest its steady appreciation; if not, it can be compared with a pedigreed object. Secondly, in the case of European art the limit of the market supply is known more or less exactly. Thus a picture by Vermeer is considered as a certain fraction of the total work of Vermeer which might come on the market. If it passes into the inalienable ownership of a public gallery the next Vermeer to come on the market is by so much a larger fraction. Thirdly, competition in collecting European art has become very keen. When the Jarves collection came to America two generations ago it attracted less attention than a single picture of that collection might attract now. The solidity of art values has been made conspicuous by the economic and monetary crises of recent years, and, as a result, the art collection has come to be looked upon as a form of investment. Finally, art objects, however owned, are apt to be regarded as semi-public in nature, and their vicissitudes are therefore a matter of public interest. This is particularly true in the case of large collections.

Private Collections.—Of the large collections which have come to America since 1910 the most important is that of the late Mr. J. Pierpont Morgan, most of which is now in the Metropolitan Museum of Art and the J. Pierpont Morgan Library, New York. The objects brought in 1912 to the Metropolitan Museum came partly from the Victoria and Albert Museum and other European museums, to which they had previously been lent. Paintings which may be mentioned are the Colonna Raphael, the "Virgin and Child with Saints," the "Portrait of a Genoese Lady and Child" by Van Dyck; the "Holford Landscape" by Hobbema; three panels by Filippo Lippi; three saints and donors, mentioned by Vasari; portraits by La Tour, Reynolds, Hoppner, etc. The Fragonard room imported by Mr. Morgan subsequently found its way to the Henry Clay Frick collection. The Metropolitan Museum is indebted to the Morgans for the sculptures from the Château de Biron, many others from the Hoentschel collection, and objects of applied arts of all kinds. It is particularly rich in ivories and possesses, in the Swenigorodski collection of Byzantine enamels, the Cyprus treasure, the Albanian treasure, and the collection of Germanic—largely Merovingian—antiquities, assembled by Baron and by Queckenberg, ample evidence of Mr. Morgan's wide interests and of his forehandedness in acquiring material of a sort not likely to appear often on the market.

Another collection which was brought from public exhibition in a European museum to America is the Goloubew collection of Persian and Indian paintings. For some years prior to its purchase in 1914 by the Museum of Fine Arts, Boston, it had been exhibited in the Musée des Arts Décoratifs, Paris. The Boston Museum has since added Persian miniatures and a collection of Indian art rich in examples of painting, so that it is now able to illustrate to a degree unattained elsewhere the history of Mahommedan painting from the 12th century onward.

The Riggs collection of arms and armour came from Paris also. But it had been formed by an American living there. In 1913, when it left Paris to come to the Metropolitan Museum, it was unrivalled among private collections of armour; its addition to the Metropolitan Museum has been followed by further gifts from the same donor and others, until the museum's collection of armour has become one of the most important.

Museums.—Most of the collections that have come into the possession of American museums in recent years have not been transferred entire from Europe but have been formed gradually, largely through the agency of dealers, by collectors in America. Characteristic examples, to take a single museum, the Metropolitan Museum of Art, are the collections bearing the following names: Altman, 1913 (paintings by Fra Angelico, Botticelli, Mantegna, Dürer, Vermeer and others, a much-discussed group of Rembrandts, sculptures, furniture, an exceptional collection of Chinese porcelains); Jesup, 1915 (71 pictures, 24 of the British, 23 of the French school, the rest of miscellaneous schools); Fletcher, 1917 (251 objects, including good Gothic sculpture and David's portrait of Mlle. Charlotte du Val-d'Ognes); Vanderbilt, 1920 (paintings and furniture); Dreicer, 1921 (largely paintings and sculpture); Ballard, 1922 (rugs); Barnard, 1925 (medieval sculpture, including the unfinished cloisters from St. Michel-de-Cuxa and extensive fragments from the cloisters of St. Guilhem-le-Désert); Huntington, 1925 (188 objects, including paintings by Vermeer, Rembrandt, etc.). The background of every large American museum is a group of men who form collections that they eventually give to it. The size and number of such collections are much more significant for the transfer of art objects to America than are the occasional, widely heralded, but commonly second-rate, European collections that are brought over entire to be sold in American auction rooms.

Fashions in American Collecting.—There have been fashions in American collecting, but so diverse are the interests of different communities and social groups that few considerable fields have been slighted. Certainly, Sienese painting has been greatly favoured, but that has not prevented collectors from acquiring pictures of the other Italian schools. A nation that enjoyed nearly a century ago the bituminous painting of Germany—particularly of the Düsseldorf and Munich schools—then furnished the chief foreign market for the murky and sentimental Dutch of Israels' type, could hardly be free from the contemporary adulation of anything even remotely Rembrandtesque. The rediscovery of the art of Spain, which began with the obvious later masters and has gradually worked backward through the primitives to the Middle Ages, was beginning about 1925 to arouse great interest in America. Americans have taken an active part in exploration and excavation, especially in Egypt; as a result the collections of Egyptian art that have recently been forming in the museums of Boston, New York and Chicago are surprising both in size and quality, the more so the better one knows the great collections at London, Paris, Berlin, Turin and Cairo.

German art, except prints, has not emigrated extensively to America any more than it has to neighbouring European countries. Scandinavian art, apart from the works of a few modern painters, has stayed at home and so has in general the medieval and modern art of eastern Europe except smaller portable objects of the Byzantine period. This is the more remarkable in view of the eager assemblage of objects from most parts of Asia and the recent enthusiasm for the art of the African negroes and the American aborigines. In the case of modern art there is a wide discrepancy in the distribution of the work of various countries. French art is, of course, collected everywhere. But while the painters of Spain find a good market in America, the modern painters of Italy, despite their prominence in the Venice expositions and the flood of American tourists to Italy, are little known in the United States, though some of their works have gone to South America.

II. CHARACTER OF THE TRANSFER

The character of the transfer of art objects to America can be illustrated by a selection of representative examples, chosen mainly from those which have found their way into public collections and each standing for many of its kind.

Egyptian.—The Boston Museum has been steadily receiving a portion of the discoveries made by Dr. Reisner. In this way it has acquired a very rich collection of the art of the Old Kingdom. The sculpture from the pyramid of Mycerinus includes an unrivalled series of portraits. The Metropolitan Museum, New York, on the other hand, has acquired more by purchase than it has from its own excavations in Egypt. Thus the tomb of Perneb, from Sakkara, though of secondary artistic importance, the most imposing monument that has come to any museum from Egypt, was purchased on behalf of the museum from the Egyptian Govt. in 1913. Another important purchase was that of a large part of the treasure of Lahun, discovered by Flinders Petrie in 1914. This jewellery was found in almost perfect condition in the tomb of the Princess Sat-hathor-iunut, probably the daughter of Senusert II of the 12th Dynasty. The same dynasty, which is the most important for our knowledge of the Middle Kingdom, is represented also by the Metropolitan Museum's acquisition, in 1919, of the large sphinx of Senusert III.

Another of Flinders Petrie's discoveries which has come to America is the sphinx of Rameses II found in the temple of Ptah at Memphis in 1912 and now in the University Museum, Philadelphia. This brings us to the New Empire, in the art of which the Metropolitan Museum has become particularly rich. A striking acquisition of the sculpture of this period was that of seven colossal seated statues of the lioness-headed goddess Sekhmet in diorite. These came from the temple of Mut at Karnak, were taken to England about 1830, and had been in the possession of Lord Amherst before they were bought by the Metropolitan Museum in 1919. The same museum has an extensive and growing collection of Coptic art, particularly textiles; in 1910 it bought 116 stone fragments, including inscriptions, sculpture and architectural decoration. About three-quarters of these were sold by the Egyptian Govt. and came chiefly from the monastery of St. Jeremias at Sakkara, excavated by Quibbell.

Classical.—The Museum of Fine Arts, Boston, acquired in 1914 a gold and ivory statuette of the Minoan Snake Goddess. Though the type is not unfamiliar, the materials and quality make the statuette unique. Another important acquisition of the same museum was the head of a Greek goddess from Chios, which came to the museum from England in 1910. This head is said to have been discovered in 1853. It was seen on Chios by Studniczka in 1887 and his mention of it in an article the following year led to its removal to England. There it was exhibited at the Burlington Fine Arts Club in 1904. It is of Parian marble and is regarded as Praxitelean. From England, too, came the fragments of the largest known grave stele of the Greek archaic period, since 1911 in the Metropolitan Museum. The total height is 13 ft. 5⅛ inches. It is incomplete, and a head and hand from it are in Berlin. The Metropolitan Museum has secured a number of fine bronzes, including a life-size head of Agrippa, 1914; a statue of a boy 4½ ft. high, probably of the first century B.C., 1914; a statuette of an athlete, 1921; and, most prized of all, a statuette of a horse dating about 470 B.C., 1923. The magnificent bronze statue of Eros in the Morgan Library should be remembered in this connection. It was found at Boscoreale. The late Mr. Morgan lent it for a time to the South Kensington Museum and then in 1910 to the Metropolitan Museum, where it used to form the centre-piece in the museum's frescoed room from a villa at Boscoreale. There is a steady flow of Roman sculpture in stone to America, chiefly portrait heads, sarcophagi reliefs and architectural carvings.

Italian.—There has been more general interest in America in Italian art than in any other. As a result, nearly all the older private, or originally private, collections (*e.g.*, Frick, Gardner, Ryerson, Walters, Widener) are well stocked with Italian pictures. This makes the museum collections, except those of Harvard and Yale, seem proportionately meagre. The Metropolitan Museum secured at Paris in 1914 a ceiling by Pinturicchio, which would not appear extraordinary in Italy but has considerable illustrative value in America. It consists of 22 panels, in fresco now transferred to canvas, from the Palazzo del Magnifico at Siena; these are now used for the ceiling of one of the museum rooms. A ceiling by Tiepolo from the Palazzo Barbaro, Venice, acquired by the museum in 1923, is used for another room. One of the most important pictures purchased by the Metropolitan Museum in recent years is the "Meditation on the Passion" by Carpaccio, from the Abdy sale in London, 1911. Another important Carpaccio is the "Knight in Armour," sold at Christie's in 1919 and now in the Kahn collection, New York. The landscape of the former picture shows points of analogy with the large landscape of "St. Francis Receiving the Stigmata," by Giovanni Bellini, in the Frick collection and it has been suggested that Bellini might have finished the design for Carpaccio's picture. From the Abdy sale came the "Three Miracles of St. Zenobius" by Botticelli, now in the Metropolitan Museum. They are part of a well-documented series of which others are in the National Gallery, London, and the Dresden Gallery.

Of the half-dozen greatest names of the High Renaissance America must, in the nature of the case, have a very limited representation. Raphael's portrait of Giuliano de Medici came from Germany in 1925. Various portraits by Titian have come, including a well-known one from the Giovanelli Palace. Tintoretto too is variously represented in recent importations. A "Doge in Prayer before the Redeemer," acquired by the Metropolitan Museum in 1910, is of interest because it was bought in 1852 by Ruskin. More important as a picture is the "Miracle of Loaves and Fishes," a large picture acquired in 1913 from an English collection. Of Correggio two pictures may be mentioned; a large painting of "Four Saints," bought by the Metropolitan Museum in 1912 and formerly in the Ashburton collection, and a "Mystic Marriage of St. Catherine" bought by the Detroit Museum at the Castiglione sale in Amsterdam, 1925. Of the *Quattrocento* painters Fra Angelico is a favourite among American collectors, possibly because he is somewhat like the Sienese in spirit. The jewel-like little octagonal "Madonna and Child with Angels, Saints and a Donor" which was formerly in the Aynard collection, Lyons, and has been in the Boston Museum since 1914, overshadows the "Nativity" which came to the Metropolitan Museum in 1924. Because of its large size, brilliance and fine preservation, the "Annunciation" by Fra Angelico's contemporary, Masolino, in the Goldman collection since 1916, demands notice.

There is less Italian sculpture of good quality on the market than there is painting. Most of it that comes to America goes into the private collections (*e.g.*, Mackay and Widener). Outstanding exceptions are the "Angel Annunciate" by Matteo Civitale and the "Nativity" by Antonio Rossellino, both in painted terracotta and acquired by the Metropolitan Museum in 1911. The same museum secured in 1910 and 1921 fragments, formerly in Ruskin's possession, that are thought to be from Giovanni Pisano's pulpit for the cathedral of Pisa, two trumpeting angels and an angel with ox and lion.

Spanish.—The most remarkable work of Spanish art which has been brought to America is the mural decoration of the apse of S. Maria de Mur, in Catalonia. This came in 1921 and was purchased by the Museum of Fine Arts, Boston. As set up in a special room built for it with the intention of giving a setting like its original one, it transports the museum visitor effectively into the Spanish Middle Ages. Works attributed to El Greco or to Velasquez are to be found in most of the larger collections, but the greatest migration of Spanish paintings to America has consisted of the works of contemporaries. The various exhibitions of Zuloaga have tended to domesticate him in America, and Sorolla is extensively represented, particularly by the decorations of the Sorolla room opened in 1925 at the Hispanic Society of America. This institution is for the United States the focus of interest in things Spanish.

French.—The enthusiasm at the end of the 19th century for French painting has not been entirely sustained. The increasing interest in primitives has rather less to feed upon in France than in Italy or Spain. One of the private collections, the Friedsam collection, has made a speciality of early French works. In this field the museums have mainly contented themselves with small portraits of the general style of Corneille de Lyon. Examples were added to the Boston Museum in 1919 and 1924. Two kinds of French sculpture have been eagerly sought by American collectors—Gothic fragments and works of Rodin and his followers. Of the former, good examples are the "Virgin and Child" of the Amiens School, bought by the Metropolitan Museum in 1918; the 14th century great altarpiece from Pau, bought by the Boston Museum in 1924; and the five very early Gothic statues given to Yale University (1925). These last are transitional and are sometimes described as late Romanesque. Of the Romanesque proper, the series of capitals in the Fogg Museum at Harvard University is an important acquisition. Although private collectors, such as Mr. Pitcairn, are interested in medieval sculpture, America is considerably behind Europe in this branch of collecting. Of Rodin and his school, nearly every American museum has something to show, and there seems to be no decrease of interest, for the followers of Rodin continue year after year to have successful New York exhibitions.

Dutch and Flemish.—Almost none of the contemporary paintings of Belgium and Holland find an American market. On the other hand, the works of the 17th century and earlier are as popular here as elsewhere. A writer in 1921 was able to list eight examples of Gerard David in America. Others, for example the "Entombment," lent to the Art Institute of Chicago in 1913, can now be added to the list. Bosch, Patinir and the Antwerp School of about 1525 are likewise well represented in recent importations. But it is primarily the great figure painters of the 17th century—Rembrandt, Hals, etc.—whose names are attached with varying plausibility to pictures arriving in the American market.

British.—The traditions of the Homeland are strong enough in the United States to give the portrait painters of Great Britain a special prestige. This extends even to painters, like Holbein and Van Dyck, who are not British but have social position in Great Britain. Thus, while the German school is not popular in America, a number of paintings by Holbein have recently come into American collections. These include a portrait identified as "Jean de Dinteville," in the Goldman collection; a miniature portrait of "Thomas Cromwell," in the Morgan collection; and another portrait of "Thomas Cromwell," in the Frick collection. Before 1915, when it came into the Frick collection, the last-named picture was at Tyttenhanger Park. Mr. Goldman's picture, which is usually regarded as the finest of the three, came from the collection of Sir John Ramsden, of Bulstrode Park, Buckinghamshire.

The greatest publicity has been given to the purchase for Henry E. Huntington of the "Blue Boy," by Gainsborough, and "Mrs. Siddons as the Tragic Muse," by Reynolds, pictures formerly belonging to the Duke of Westminster. But the recently published catalogue of paintings of the British School in Mr. Huntington's collection shows 32 other pictures of almost equal importance. The Taft collection at Cincinnati has likewise been enriched at the expense of English country houses. In contrast, the American museums have not, in view of the great competition, acquired many important works of the British School.

Restitution of Art Treasures.—Although this article is chiefly concerned with the transfer of art treasures to America, it should not be forgotten that there have been, especially since the World War, important transfers elsewhere. Among other restitutions to Belgium are the panels of the Ghent altarpiece which have been returned from the Kaiser Friedrich Museum. One hundred and eighty pictures, which had been removed from Italy to Austria between 1808 and 1866, were returned to Italy, likewise as a result of the War. Most of these had historic associations as decorations of the halls of the ducal palace, the offices of the old republic, the churches and the confraternities of Venice. Besides pictures restored to Venice, nine magnificent Raphaelesque tapestries were returned to the ducal palace at Mantua. In general, however, Germany and Austria have not lost any considerable amount of their artistic treasures as a result of the War. The cession of Alsace-Lorraine meant of course the loss of works in those provinces, including one altarpiece very dear to the Germans, the Isenheim altarpiece by Matthias Grünewald at Colmar. The financial crisis in these countries did not lead to extensive exportation of works of art. During the War, however, one truly famous picture left Germany, "The Legend of St. Eligius," by Petrus Christus, now in the Lehman collection in New York.

Bibliography.—For the transfer of art objects, the current periodicals give fairly complete information. The bulletins which are published by practically all the American museums note briefly current accessions. The accounts in the newspapers are necessarily incomplete and untrustworthy. A few books such as *Venetian Paintings in America*, by Bernhard Berenson, and *Greek and Roman Sculpture in American Collections*, by George H. Chase, are useful. (J. Sh.)

ASBESTOS (*see* 2.714).—An incombustible, fibrous material usually found in serpentine formation in many parts of the world, with numerous varieties which are known or described as mountain flax, leather or cork, amianthus, tremolite, crocidolite, and by other names.

Deposits in Italy.—The asbestos from the Val Malenco or Val Tellina in northern Italy, occasionally found in the form of thread from 3 to 20 ft. in length, is strong, tough, saponaceous, incombustible and free from objectionable impurities, and was first used commercially in 1871, when an asbestos factory was established in Glasgow. A few years later another factory was established in Turin.

Canada.—Meanwhile other deposits of asbestos were discovered in the province of Quebec. While the chemical properties of this Canadian, or "chrysotile," variety are similar to those of the Italian fibre, there is a marked difference in their physical characteristics; the Canadian material, having a finer texture and being easier to obtain and to manipulate by machinery, came rapidly into extensive demand, although for some purposes Italian asbestos was, and is still, considered more suitable; on analysis it is shown to contain:—

	Per Cent
Lime and Magnesia	37·84
Silica	41·69
Oxide of Iron	3·01
Potash	0·85
Soda	1·41
Alumina	2·57
Moisture evaporated at 100° C.	3·04
Loss on heating to white heat, water of hydration and organic matter	9·59
	100·00

Other Sources.—Three other principal sources of supply were afterwards discovered and developed (*a*) in South Africa, blue in colour and containing, when compared with Italian and Canadian asbestos, a much larger percentage (from 30 to 40%) of oxide of iron and a correspondingly smaller percentage of magnesia; (*b*) in the Ural Mountains, similar to the Canadian but a little darker in colour and slightly less pliable; and (*c*) in Rhodesia. As this latter variety satisfactorily meets the requirements of manufacturers, its use is fast increasing.

Asbestos is now manufactured in England, in the United States, France, Germany, Austria, Russia, Italy, Spain, Belgium, Canada and Australia. The production of the raw material has sprung from about 200 tons (Italian) about 1868 to a total from all sources of over 250,000 tons in 1924. The United States are the largest consumers, and it is believed that the asbestos factories there absorb over 70% of the output of the raw material from the Canadian mines.

Uses.—Asbestos is now made into a great variety of articles, used in practically every branch of trade, and in laboratories, surgical, medical and hospital equipment, no department of industry or scientific research to-day being complete without asbestos in one form or another. Probably the most important development in the use of asbestos in recent years has been in connection with building operations. Tiles for roofs, flat sheets for partitions, ceilings, etc., corrugated sheets for factory and other buildings, in which asbestos in combination with Portland cement, and marketed in Great Britain and abroad under various trade names such as "Poilite," "Everite," "T.T.," "Eternit," etc., has come into large and rapidly increasing demand in nearly all parts of the world.

As the economic value of asbestos depends, not only on its power to withstand high temperatures, but also on its low thermal conductivity, and its partial resistance to the attacks of acids, its field of usefulness is practically unlimited.

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ASHANTI (*see* 2.724), a dependency of the Gold Coast Colony, is divided into two provinces, the Eastern with headquarters at Kumasi, the capital, and the Western with headquarters at Sunyani. Its area is 24,560 sq. m. and its population 406,594. King Prempeh, who in 1896 resisted the establishment of a British Resident at Kumasi and was sent as a political prisoner to the Seychelles, was allowed to return to Ashanti at the end of 1924, although without special powers. The golden stool on which he was crowned was hidden in Ashanti, and was only rediscovered in 1921.

Ashanti is administered by a chief commissioner, assisted by provincial and district commissioners. Although it is constitutionally separate and distinct from the Gold Coast Colony and the Northern Territories, all three are treated, so far as finance is concerned, as a single unit. No satisfactory estimate can be made, therefore, as to the revenue and expenditure, except those for purely local purposes. Similarly it is impossible to state the actual trade statistics and the only satisfactory test is supplied by the tonnage figures of the railway, which show that 61,176 tons of cocoa, 2,983 tons of kola and 4,085 tons of other produce were railed to the ports in the year 1923–4.

As in the Gold Coast Colony proper, cocoa forms the principal item of commerce, and is the foundation of the peace and prosperity of the country; practically all the plantations are owned and managed by natives. Agricultural stations have been established at Kumasi, Juaso and Ejura, and special efforts were made during 1923–5 to encourage the planting of oil palms and the cultivation of coffee. Gold-mining is of importance, although only two mines were producing in 1924. Excellent motor roads, 721½ m. in length, have been constructed, including one between Sunyani and Kumasi; the Great North Road from Kumasi to Ejura is the finest and carries a heavy traffic to and from the north. A second railway from the Gold Coast to Ashanti, linking up Accra and Kumasi, was completed in Aug. 1923. The Govt. maintains a fleet of motor vehicles at Kumasi.

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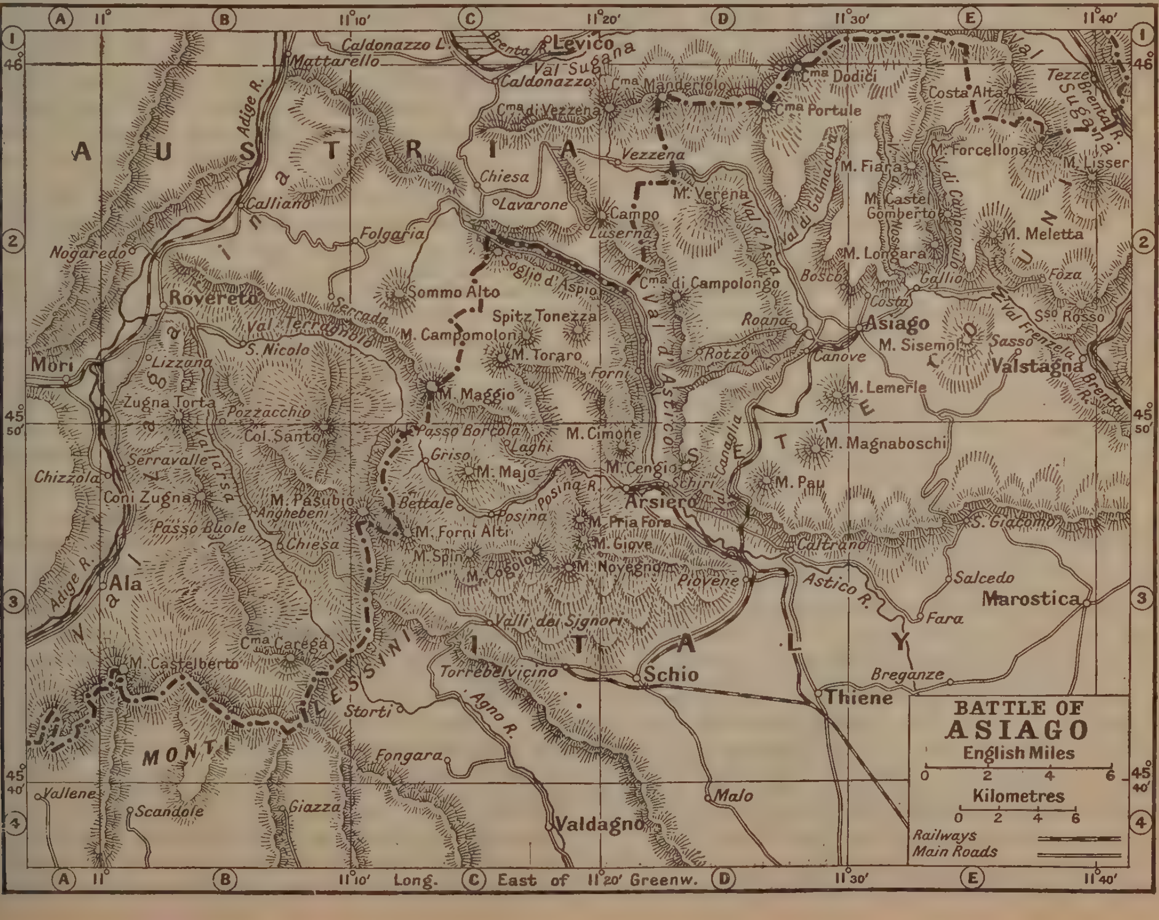
(P. E. L.)

ASHFIELD, ALBERT HENRY STANLEY, 1st Baron (1874–), British business man, was born at Derby Nov. 8 1874. He spent his early years in the United States, and was educated at American technical schools and colleges. He entered the service of the Detroit City Street Railways and had a successful business career, becoming general manager of the company and subsequently of the Public Service Corporation of New Jersey. In 1907 he returned to England, and took up the position of general manager of the Metropolitan District Railway and soon after became managing director of the traffic combine which included the London Underground Electric Railway Companies and the London General Omnibus Company. In 1914 he was knighted. On the formation of Mr. Lloyd George's Govt. in 1916 Sir Albert Stanley was elected to Parliament as a Coalition Unionist for Ashton-under-Lyne, being included in the Cabinet as President of the Board of Trade. He was a notable instance of a minister selected as a "business man" and not for any of the usual political considerations. He resigned from his office in May 1919, and in Jan. 1920 was raised to the peerage.

ASIAGO, BATTLE OF, 1916.—The Asiago plateau was the scene of various battles on the Italian front during the World War (*see* Italian Campaigns); but the name of the battle of Asiago was given to the fighting which took place on the Trentino front during the Austrian offensive of 1916.

An attack from the Trentino with the object of cutting the Italian communications with the Julian front, and so bottling Cadorna's main force in what Krauss (in his book *Die Ursachen unserer Niederlage*) calls "the Venetian sack," was an operation which could not but commend itself to the Austrian general staff. Even Falkenhayn, who refused his co-operation to the proposal made by Conrad von Hötzendorff in Dec. 1915, admits that "it was very inviting." He did not, however, agree with Conrad and with Krauss, then chief of the staff to the Archduke Eugene, that a completely successful attack would have a decisive effect. He doubted the possibility of collecting the force he considered necessary for the enterprise (25 divisions), and did not think that the railway communications were adequate to supply such a force. He was, moreover, anxious about the Russian front. Conrad's plan was to attack through the Asiago and Arsiero uplands, in the direction of Vicenza and Bassano, and when he failed to convince Falkenhayn that the effort should be a joint one, he determined to attack independently.

Cadorna's Plans.—Cadorna's line of argument, when rumours of attack began to arrive, resembled that of Falkenhayn. He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Val Sugana
Brenta R.
Cma di Vezzena
Vezzena
M. Forcellona
M. Lisser
AUSTRIA
Adige R.
Chiesa
Lavarone
M. Fiara
M. Verena
Val di Galmarara
Val d'Assa
M. Castel Gomberto
Calliano
Campo
Luserna
M. Meletta
Nogaredo
Folgaria
M. Longara
Bosco
Gallio
Foza
Soglio d'Aspio
Cma di Campolongo
Sommo Alto
Rovereto
Serrada
Spitz Tonezza
Roana
Costa
Asiago
Sso Rosso
M. Campomolon
Val Terragnolo
S. Nicolo
Mori
Lizzana
M. Toraro
Rotzo
Canove
M. Sisemol
Sasso
Valstagna
Val Frenzela
Forni
M. Lemerle
M. Maggio
Zugna Torta
Pozzacchio
Passo Borcola
Laghi
M. Cimone
M. Magnaboschi
Col Santo
Griso
M. Majo
M. Cengio
SETTE COMUNI
Chizzola
Serravalle
Coni Zugna
M. Pasubio
Anghebeni
Bettale
Posina R.
Posina
Arsiero
M. Pau
Passo Buole
Chiesa
M. Forni Alti
M. Pria Fora
M. Giove
M. Spin
M. Cogolo
M. Novegno
Caltrano
S. Giacomo
Piovene
Ala
Adige R.
Astico R.
Salcedo
Marostica
Fara
Valli dei Signori
ITALY
Cma Carega
M. Castelberto
Torrebelvicino
Schio
Breganze
Thiene
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Storti
Agno R.
Fongara
Vallene
Scandole
Giazza
Malo
Valdagno
BATTLE OF ASIAGO
English Miles
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did not think that Conrad could spare troops for an offensive on the grand scale, and he was of opinion that the railway communications in the Trentino were insufficient for such an offensive. He concluded that the reported movements in the Trentino signified a limited attack, to be undertaken with the object of hampering his own offensive action towards the east. He had continually urged upon Brusati, who commanded the I. Army, that his rôle was strictly defensive, now that his first duty, that of reducing the length of the Trentino front and occupying strong defensive positions previously selected, had been successfully performed. On various occasions Cadorna had emphasised the necessity of strengthening the positions chosen by him for defence, but his instructions had been insufficiently regarded.

When Cadorna went to visit the lines in person, at the end of April, he found that while the front lines, in many cases unsuitable for prolonged resistance, had been elaborately fortified, in various sectors the reserve lines which he had indicated as the "battle positions" were almost untouched. Cadorna ordered the positions to be modified, and the work of preparation was hastened on; but the enemy attack seemed imminent, and it was impossible to set about a complete re-organisation under the immediate threat. On May 8 Brusati was replaced by Gen. Pecori-Giraldi, the commander of the VII. Corps (III. Army), and within a week the Austrian offensive was launched.

Disposition of the Forces.—The Austrian attacking force was arranged in two armies, one behind the other, Dankl's XI. Army in front with 9 divisions, Koevess's III. Army in support, with 5 divisions. The troops in the Val Lagarina and Val Sugana were not included in this force, which was to make its offensive between the two valleys, where only supporting attacks were to be carried out. Krauss, as chief of the staff to the Archduke Eugene, was opposed to the disposition of the two armies and to the limitation of the attack to the hill country. He urged that the front of attack should from the outset be divided between Dankl and Koevess, and pressed for the concentration of attacking masses in the valleys, especially in the Val Sugana. But the original plan, prepared in all its details by Conrad and his staff, was not modified; it would seem that the Archduke and his chief of the staff had little freedom of action. The tactical direction of the attack was entrusted to Dankl, who had at his disposal some 180 battalions.

To meet the attack, Pecori-Giraldi had in line and immediate reserve, between Lake Garda and the Val Cismon (north of the Val Sugana), 130 regular battalions, 7 battalions of Customs Guards and 45 battalions of Territorial Militia, the latter at very low strength and of small fighting value. But his centre was weak, for 28 battalions of regular troops were in the Val Sugana sector, and on the actual front of attack he had only 90 regular battalions. Another division was concentrating at Desenzano, and 5 more were on the Tagliamento ready to be sent in support in case of need. The artillery strength consisted of 851 guns, of which 348 were of heavy or medium calibre and 259 were light guns of position. Dankl had, initially, a big superiority in infantry, but his great advantage lay in his preponderance of artillery strength. Between the Val Lagarina and the Val Sugana were concentrated some 2,000 guns, of which nearly half were of heavy or medium calibre, including 40 305-mm. howitzers, four 380's and two or three German 420's.

The Austrian Attack.—The offensive opened on May 14 with a very heavy bombardment along the whole line from the Val Lagarina to the Val Sugana, but the concentration of fire was most intense between the Vallarsa and the Upper Astico, and against this sector, the following day, the main infantry attack was launched. The plan was to attack first with the right wing of the XI. Army, commanded by the Archduke Charles, supported not only by its own artillery, but by flanking fire from the massed guns on the Lavarone plateau. When the right wing had made sufficient ground the left wing was to come into action against the Italian line north of the Upper Astico.

For a time everything went well with the attack. The Italians were driven back from their ill-chosen front lines, losing many prisoners and guns, and by May 19 their position was very grave all along the line from the Vallarsa to the Astico. The retiring troops had failed to make a prolonged stand on the insufficiently prepared battle positions. On the left Monte Pasubio, the key position, was only lightly held by reserves, which had been hurried up in the nick of time, and in the centre the Austrians had driven the defenders off the main line of defence, which ran from Monte Maggio by Campomolon to Spitz Tonezza. The 37th Div., which had held this line, had been forced back beyond the Posina and the Astico, and there were gaps both to right and left of it. The Austrian right was pressing hard on the Italian main positions west of the Vallarsa (Coni Zugna and Passo Buole), and was collecting forces to attack Pasubio. There was breathing space for a moment in the centre, but the Austrian left now came into action, Krautwald von Annan's III. (Graz) Corps being launched against the Italian 34th Division. Ample Italian reserves were now on the move, but it was a race. Krauss blames the Archduke Charles for waiting with his XX. Corps until the guns could be brought up to support a new attack, instead of driving through at once to Arsiero with all available troops. The risk was not taken, and the short respite gave time to close the door in the face of the invader.

The course of the battle, with the necessity of bringing up reserve divisions, led to a reorganisation of the attacking forces, Koevess taking command of the left wing and Dankl of the right. In the Vallarsa and Pasubio sector the attack developed strongly, but without success. Farther north the Archduke Charles was waiting for his guns and reserves, and between his left and the III. Corps, Kirchbach's I. Corps was coming into action. The III. Corps was hammering against the Italian 34th Div., which was not to resist for long.

The situation in the centre was critical, and Cadorna considered that if the Austrians were able to concentrate on the weak spot and keep up the impetus of their attack they might succeed in breaking through to the plain. On May 20 he went to Udine, and after consultation with the Duke of Aosta and Frugoni gave orders for the concentration of a reserve army in the Venetian plain. The first four corps of this reserve army (the V.), which were made up of units drawn from the II. and III. Armies, were ready on June 2.

Meanwhile the Austrians were continuing their advance in the centre, but they could gain no ground against the Italian left. By May 22 Bertotti's 44th Div., sent up from Desenzano, was in solid possession of both sides of the Vallarsa road and of Pasubio, and in touch with Ricci-Armani's 37th Div. on his left. It was in this sector that the Austrian offensive met its fate. Owing to the steadfast resistance of the troops under Ricci-Armani and Bertotti, Dankl could never secure a sufficient width of front for his advance. If the Zugna ridge had fallen, the effect upon the Pasubio position, already a salient, would have been more than serious, and upon the holding of the Pasubio lines depended the maintenance of the positions to the eastward. If Pasubio went, the line south of the Posina was turned, and the Austrians had a new route to the plain by the Valli dei Signori, as well as the opening they were now making for, by the Lower Astico. Till May 30 the attacks on the Zugna ridge were continuous, but no progress was made. The attempts upon Pasubio were as incessant, and lasted longer. The Austrian infantry advanced along the great ridge from Col Santo; they came up from Anghebeni and Chiesa in the Vallarsa and from the Val Terragnolo by the Borcola Pass. All efforts were in vain.

Northeast of Pasubio, along all the rest of the mountain front to the rim of the Val Sugana, the Austrians gained notable successes. Koevess drove back the Italians across the Val d'Assa, and thence still farther east, across the parallel valleys of Nos and Campomolon. To the southwest Dankl's left crossed the Astico, and after heavy fighting pushed the Italians back across the Val Canaglia, while his centre gained ground across the Posina, south of Arsiero. At the end of May the Italian position still seemed critical, and Cadorna gave orders for the withdrawal of stores and heavy guns from the Isonzo front to beyond the Sile, south of Treviso. He believed he had the measure of the Austrians, but he omitted no precautions. His confidence, in fact, was justified. The impetus of the Austrian attack was dwindling. Losses had been very heavy; the attacking divisions were beginning to lose their offensive value, and the reserves were insufficient. Already on May 27 Conrad had been compelled to ask Falkenhayn to send a division of the Austrian XII. Corps, which belonged to Prince Leopold's Army Group. And Cadorna's V. Army was practically ready in the plain.

On June 4 Brusilov broke through at Leeck. The first news of the Russian attack did not perturb Austrian headquarters, for Conrad thought that his line in the east was firmly held. In a few days the situation was changed altogether. But even before the news of the disaster had reached Bozen it was clear that the offensive against Italy had failed. Koevess was to gain a little more ground. By June 8 the Austrians were only three miles from Valstagna, low down in the Brenta Valley, but they had shot their bolt. South of Asiago and south of the Posina the attack was continued for 10 more days. Here were the shortest routes to the plain and here the Austrians had been able to bring up their guns in sufficient numbers. Kirchbach made a great effort against the Monte Lemerle-Monte Magnaboschi line, while the Archduke Charles strove hard to win room south of Arsiero by incessant attacks in the Novegno sector. No further ground was gained.

Retreat of the Austrians.—By the middle of the month Cadorna had begun the first move of a counter-attack, but the Austrians were now getting ready to go out of the salient and back to a strong line which they had already selected. Attacking on May 25, all along the line, the Italians found the invaders in retreat. It was too late to develop the counter-offensive which was to have been directed against the two sides of the Austrian salient, and Cadorna relinquished the idea of a big attack as soon as he found a resistance which could only be overcome by long preparation and the use of artillery in mass.

Casualties on both sides were very heavy, and indicate the severity of the fighting. The Austrian losses were estimated at over 100,000; the Italian figures, up to the end of the counter-movement, were 35,000 killed and 75,000 wounded, with 45,000 prisoners, many of whom should be reckoned among the wounded. The Austrian attempt to break through ended in definite failure but the attack was well planned and conducted with skill and determination. Failure was due to the fact that Conrad met with a resistance which went beyond his calculation. Falkenhayn and Cadorna had summed up the situation rightly.

BIBLIOGRAPHY.—*La Guerra Italiana nel 1916* (1917), from official documents; T. N. Page, *Italy and the World War* (1921); L. Cadorna, *La Guerra alla Fronte Italiana* (1921). (W. K. McC.)

ASIA MINOR (*see* 2.757), a geographical term used both in a wider and a narrower sense. In the wider usage it covers Asiatic Turkey within the pre-War frontiers, excluding the Arabian Peninsula. In its narrower sense it means the Anatolian Peninsula, together with a vague zone extending eastwards along the roots of the peninsula into Armenia and Kurdistan.

As a result of the World War, Asia Minor in the wider sense has been broken up politically into the Turkish Republic and the three territories of Syria, Palestine and 'Iraq, under "A" mandates, the first being mandated to France, and the two others to Great Britain. Asia Minor in the narrower sense has still been left entirely inside the Turkish frontiers by the Treaty of Lausanne. On the other hand, the abortive Treaty of Sèvres provided for the partitioning of the narrower area also. A district round Smyrna was to be placed under Greek administration, while the remainder of the southern half of the region was divided between a French and an Italian zone of special influence, under an Anglo-Franco-Italian convention, signed simultaneously with the treaty. Owing to the decisive Turkish victory in the Greco-Turkish War of 1919–22, all these arrangements fell to the ground, so that the present area of Turkey in Asia practically coincides with Asia Minor in the narrower sense. (*See* 'IRAQ; LAUSANNE, TREATY OF; MOSUL; PALESTINE; SÈVRES TREATY OF; SYRIA; TURKEY.) (A. J. T.)

ASQUITH, HERBERT HENRY: *see* OXFORD AND ASQUITH, EARL OF.

ASTHMA: *see* RESPIRATORY SYSTEM, DISEASES OF THE.

ASTON, FRANCIS WILLIAM (1877–), British scientist, was born at Harborne, Birmingham, Sept. 1 1877, and educated at Malvern College and the universities of Birmingham and Cambridge. He was elected to a fellowship at Trinity College, Cambridge, and was made assistant lecturer in physics at Birmingham University in 1909. In 1920 he received the Mackenzie Davidson Medal of the Röntgen Society, and in 1922 the Hughes Medal of the Royal Society. He received the Nobel Prize for chemistry in 1922 for his work in connection with isotopes and also the John Scott Medal, Philadelphia, and the Paterno Medal, Rome, both in 1923. He has written *Isotopes* (1922) and numerous papers in scientific periodicals on electric discharge in gases, mass-spectra, isotopes, etc.

ASTOR, JOHN JACOB (1886–), younger son of the 1st Viscount Astor, was born May 20 1886. Educated at Eton and New College, Oxford, in 1906 he joined the 1st Life Guards, and, from 1911 to 1914, was A.D.C. to the Viceroy of India. In 1916 Major Astor married Lady Violet Mary, daughter of the 4th Earl of Minto and widow of Lord Charles Mercer-Nairne. On the outbreak of the World War he went to France with the Household Cavalry and served there four years. He was wounded at the first battle of Ypres and again severely in Sept. 1918. In 1922, Major Astor purchased the holding of the late Viscount Northcliffe in *The Times* Publishing Co., and became chairman of it and chief proprietor of *The Times*. Shortly afterwards he caused to be established a body of trustees consisting of the holders of certain important non-political offices, whose consent he made necessary to any future transfer of the control of that journal. He was elected Conservative member for the Dover Division of Kent in Nov. 1922 and re-elected in 1923 and 1925. In 1925, as treasurer of the Empire Press Union, he attended the Press Conference in Australia.

ASTOR, NANCY WITCHER, VISCOUNTESS (1879–), daughter of Chiswell Dabney Langhorne, was born May 19 1879 in Virginia. She married in 1897 Robert Gould Shaw of Boston, from whom she obtained a divorce in 1903, and in 1906 she married Waldorf Astor. When her husband succeeded to the viscountcy, Lady Astor, who had shown much interest in the affairs of his constituency at Plymouth, was adopted as Conservative candidate, and was elected by a substantial majority on Nov. 28 1919, thus becoming the first woman to sit in the British House of Commons.[1] She was re-elected at the General Elections of 1922, 1923 and 1924. She spoke frequently in debate and was specially active in the cause of temperance, bringing forward a bill to prohibit the serving of liquor to young persons under 18 except at meal-times, which became law in 1923.

ASTOR, WALDORF ASTOR, 2nd VISCOUNT, British politician, was born in New York May 19 1879, and educated at Eton and New College, Oxford. He represented Plymouth as a Unionist 1910–8, and the Sutton Division of Plymouth 1918–9, when he vacated his seat on succeeding to his father's peerage. He was chairman of the Government Committee on Tuberculosis and of the State Medical Research Committee. During the World War, he was inspector of quartermaster-general services, and in 1918 became private secretary to the Prime Minister, Mr. Lloyd George. He acted as Parliamentary Secretary to the Ministry of Food, 1918–9, and to the Local Government Board in 1919, retaining the same position on the formation of the Ministry of Health up to 1921. Since 1915 he has been the proprietor of *The Observer* and active on behalf of many causes of social progress, especially temperance reform. At the same time he was one of the leading British owners and breeders of race horses.

His father, WILLIAM WALDORF ASTOR (*see* 2.794), became a naturalised British subject, and was created a peer in 1916, assuming the title of Baron Astor of Hever Castle. He was made a viscount in 1917, and died in England Oct. 18 1919.

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[1] In 1918 Countess Markieviecz had been elected by an Irish Constituency in the Sinn Fein interest, but she did not take her seat.

ASTRONOMY[1] (*see* 2.800).—In the present century the centre of interest in astronomy has shifted from the solar system to the vaster domain of the stars and nebulae, and most of the progress in the years 1910–26 to be recorded relates to the stars. Knowledge of the sun as a particular star has also advanced.

The article STAR (*see* 25.784) was written at a time when statistical methods of research were in their zenith. Accumulated data as to proper motions, magnitudes, types, etc., for large numbers of stars were analysed and conclusions drawn as to the scale and structure of the stellar universe. After some further years of fruitful activity, this kind of study seems to have given place to more intensive study of individual stars. A feature of recent work is the application of modern atomic physics and the quantum theory of radiation to stellar problems; and the study of the stars has become closely linked with the study of the atom. It is now realised that the light despatched to us by the stars and nebulae contains elaborate messages in a code to which atomic physics provides the key, and not only the condition of the radiating layers but the internal mechanism of the star can be inferred with some confidence. We divide the article into (1) The solar system; (2) the stars; (3) clusters and nebulae.

I. THE SOLAR SYSTEM

The Sun (*see* 26.85).—By means of the spectroheliograph it is possible to obtain photographs of the sun in light of a single wave-length; we thus obtain a picture of the distribution of the matter which emits this wave-length or a negative of the matter which absorbs it. In practice either calcium or hydrogen light is used, since these elements furnish spectral lines sufficiently isolated to give good results. The emission of a particular spectral line depends on favourable conditions of temperature and density, and these will vary with the level in the sun's atmosphere. Thus the function of the spectroheliograph is not so much to separate particular elements as to isolate different *levels* in the sun's atmosphere and provide separate photographs of what is occurring at each level.

The highest level is given by photographs in the red light of hydrogen Hα, and examples of the remarkable structure revealed by the spectroheliograph at the Mt. Wilson Observatory are shown in the plate (figs. 5 and 7). In fig. 7 we see clearly the vortices whirling round the dark sun spots which occupy their troughs, and we can make out that the direction of whirl is opposite in the large spot and in the smaller spot to the left of it. If the whirling matter is electrically charged it should act like a solenoid and produce a field of magnetic force; and this idea led G. E. Hale (1) to test whether a magnetic field could be detected in sun spots. By the Zeeman effect a spectral line absorbed or emitted in a magnetic field is broken up into two or more components; in particular for light travelling along the axis of the solenoid the line becomes a doublet with its two components circularly polarised in opposite directions. Applying the optical test for circular polarisation clear evidence of the magnetic field in sun spots was obtained, the strength being generally of the order 2,000 to 3,000 gausses. A large proportion of the sun-spot lines are observed to be slightly broadened, and the Zeeman effect is at least partly responsible for this.

It was pointed out many years ago by Carrington that sun spots very frequently occur in pairs, the line joining them being approximately parallel to the sun's equator. In these pairs the two spots are found to have opposite polarity, that is to say, if the magnetic field is upwards in the leading spot it is downwards in the following spot. Even when the spot group is more complex a similar bipolarity is observed; Hale estimates that in 90% of the spot groups the disturbed area shows this bipolar structure. The polarity follows a regular law. With rare exceptions the preceding spots in the Northern Hemisphere all have magnetic fields of one sign, and those in the Southern Hemisphere all have the opposite sign; after a sun spot minimum the signs in the two hemispheres are interchanged. This last reversal has been observed through two minima in 1912 and 1923 (2).

Strangely enough there is no regular relation between the polarity of the spot and the direction of the whirl above it, and the vortices shown in the hydrogen photographs obey no such uniform laws as regards Northern and Southern hemispheres. This leads us to think that the origin of the sun spot and its magnetic field is down below. The spot may be caused by a vortex—formed by currents circulating in the interior of the sun—which rises to the surface and has a free end there. It is suggested by Bjerknes that this internal vortex joins the following spot of one group to the leader of the next group, so that a spot group corresponds to a break in a permanent vortex in the form of a circle round the sun's axis. This vortex travels from high to low latitude during the sun-spot cycle, and the sun spots follow it (as observation shows); it then descends into the interior of the sun and at the same time a second permanent vortex of opposite rotation rises to the surface in high latitude and a new sun-spot cycle begins. The theory, though speculative and crudely developed at present, seems to have much to commend it. In any case it would seem that we have to do with a lower vortex —a whirl*pool*—formed according to uniform laws, and an upper vortex—a whirl*wind*—sucked in by it.

Hale has also found a general magnetic field of the sun, *i.e.*, not associated with exceptionally disturbed regions such as sun spots, which is roughly equivalent to the field of a uniformly magnetised sphere and analogous to the earth's magnetism (3). It is found that the magnetic axis of the sun deviates from the rotation axis, though not so widely as happens on the earth, the inclination being 6 degrees. The synodic period of rotation of the magnetic axis is 31·44 days. If we could assume that the source of this field is the permanent magnetisation of the interior material this would give the real period of rotation of the sun—a quantity otherwise unknown. Our knowledge of the sun's rotation has hitherto been based entirely on surface markings which revolve at different rates according to their latitude. The magnetic period of 31·5 days agrees with that of surface markings in latitude 55 degrees. The strength of this general magnetic field is of order 20 gauss and the whole observation is one of exceptional difficulty, so that perhaps the foregoing determinations of the axis and period should not be accepted too hastily.

The accepted value of the constant of solar radiation is that determined by C. G. Abbot, viz.: the amount of solar energy passing across 1 sq. cm. outside the earth's atmosphere is 1·93 gram-calories per minute. This is the same as if the sun were a "black body" with a temperature 5,740° C. (absolute), which is accordingly defined to be the effective temperature of the photosphere. The sun's total radiation is $3{\cdot}8\times10^{33}$ ergs per second. There appears to be satisfactory evidence that the sun's radiation varies a little according to the stage of the sun-spot cycle, being least when the sun's surface is quiescent. Abbot also claims that irregular changes varying according to the state of the surface have been established. Since the same changes were measured simultaneously at two widely separated stations, terrestrial causes seemed to be ruled out (4). His earlier estimates of these irregular variations were undoubtedly excessive, and according to the more recent results they are restricted to very small range. Another method of testing the variability of the sun has been carried out by Guthnick and Prager by photoelectric measurements of the brightness of Saturn; the planet, being illuminated by the sun, would reflect any changes in the intensity of the sun's light. The measures showed that the light is nearly steady, and excluded the large fluctuations originally suspected. Looking at the problem theoretically, there is no special difficulty in admitting a small regular change in the rate of radiation according to the phase of the sun-spot cycle, but an irregular holding up and release of considerable quantities of radiant energy seems unlikely.

The photosphere is the name given to the region from which most of the sun's light comes. Although no definite limits can be assigned to it, its thickness may be taken to be of the order 100 km. or perhaps less. The whole of this region is rarefied gas of density about $\frac{1}{10,000}$ of that of our own atmosphere; but the coefficient of viscosity in these conditions is probably high, and hydrodynamically it may be compared to a slightly sticky

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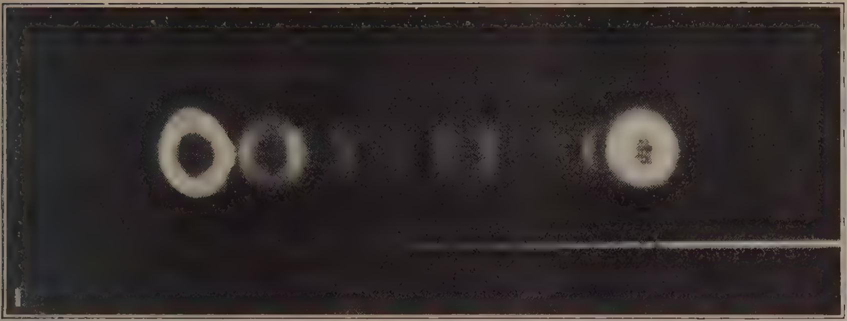
[1] The figures in parentheses appearing throughout the text of this article, refer to the references at the end.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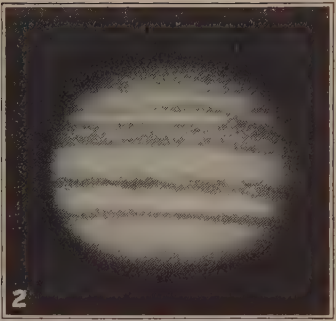
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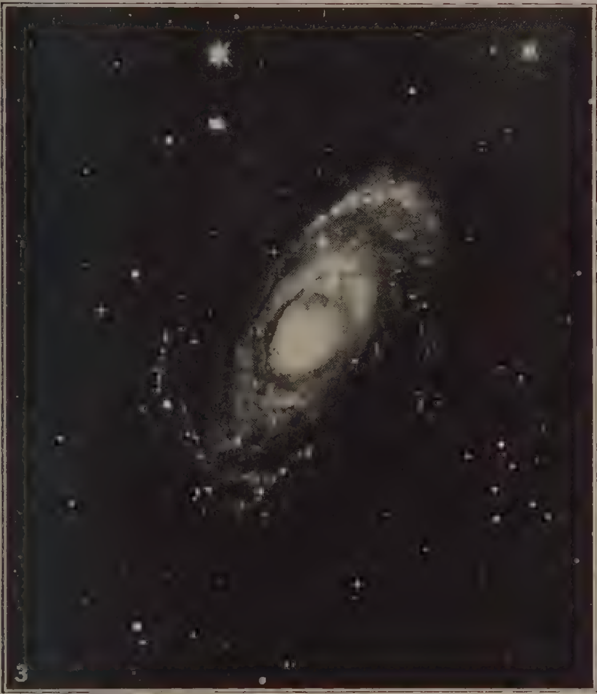
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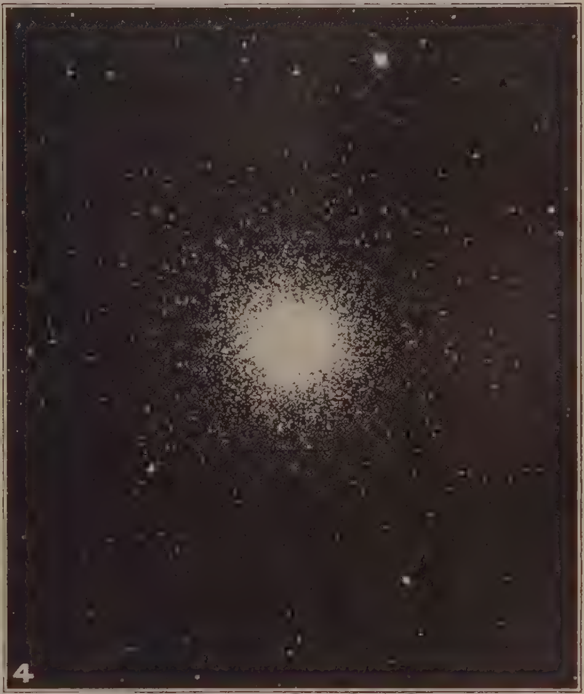
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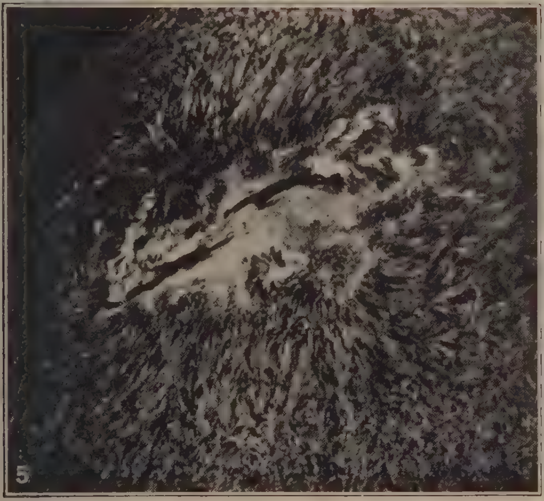
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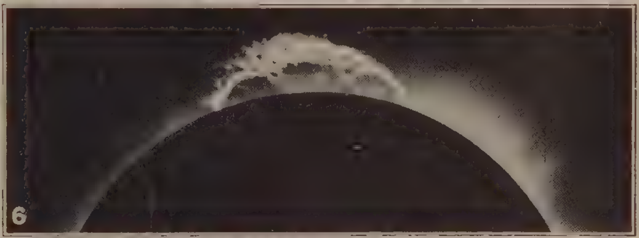
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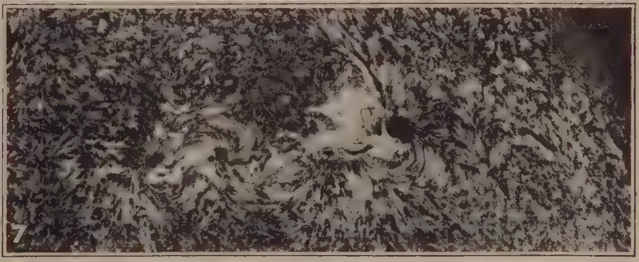
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FIG. 1. Monochromatic Images of Ring Nebula. FIG. 2. Jupiter (Dec. 19 1917). FIG. 3. Spiral Nebula, M. 81 (Ursa Major). FIG. 4. Globular Cluster, M. 3 (Canes Venatici). FIG. 5. Spectroheliogram (Hα light). FIG. 6. Solar Prominence (May 29 1919). FIG. 7. Sunspot vortices.

liquid. The temperature ranges from not less than 4,650°C. at the top to about 7,000°C. at the bottom.

The upper part of this region is called the reversing layer; this is where the great majority of the Fraunhofer lines of the sun's spectrum are imprinted on the light. The pressure here is about 0·0001 atmospheres. Above this rises the chromosphere, extending to a height of over 10,000 km., which, it is now believed, is supported by radiation-pressure. General radiation-pressure is not very powerful on the sun, and the chromosphere is composed of a few elements (notably calcium) which by reason of strong line-absorption in the most intense part of the solar spectrum gain more momentum than the others. A detailed theory of the equilibrium of the calcium chromosphere due to E. A. Milne (⁵) has proved remarkably successful. Not only does it account satisfactorily for the height of the distribution, but it gives a purely astrophysical determination of an atomic constant of calcium—the life of an excited ca+ atom—which there is every reason to regard as correct. By special eruptions matter can be carried to much greater height; fig. 6 (on plate) shows a prominence 100,000 m. high photographed by the British Eclipse expedition at Principe on May 29 1919.

Mars (*see* 17.761).—We shall review the problem of the physical and climatic conditions of this planet in the light of recent investigations, including those made at the favourable opposition of 1924 (⁶). Few astronomers have the opportunity of examining for themselves the phenomena reported to be observed at specially favourable stations, since Mars is never well placed for observation in England and similar northern latitudes. Consequently there is much doubt as to what should or should not be accepted as trustworthy; but recent great advances in the photography of the planet, especially at the Lowell Observatory, have removed scepticism on some points. The geometrical network of narrow rectilinear "canals" supposed by Lowell and some other visual observers to cover the surface is still regarded with suspicion; most authorities explain it away as a mistaken impression of faint markings—of curious form perhaps, but not distinctively artificial. On the other hand some of the broader canals are shown on the photographs; and although the appearance does not particularly suggest artificial regularity, they are unlike any natural features on our own planet.

Seasonal changes of the surface markings are now conclusively established; a regular cycle of change with the Martian season is repeated at each opposition. The dark markings appear in regular succession, deepen in intensity and increase in area as the spring and summer advance, the polar snow melting meanwhile. It is difficult to resist the impression that we are viewing the annual growth of areas of vegetation on red desert soil. It is rash to accept so speculative a conclusion without more direct confirmation, but there seems to be no alternative explanation of the seasonal changes that is equally plausible. If life of any kind is admitted, can we restrict it to the vegetable kingdom? But that line of thought leads to guesses for which the astronomer accepts no responsibility.

There is now strong evidence that Mars has an efficient atmosphere, though it is considerably more rarefied than our own. Photographs occasionally show clouds which blot out the surface features for a time and pass away. There is usually a white fog over the polar region turned away from the sun, very different in appearance from the sharply outlined white snow cap covering the summer pole. A general haziness of the Martian atmosphere is evidenced in a manner pointed out by W. H. Wright. A terrestrial landscape can be photographed by infra-red light through a mist so thick that nothing can be seen visually; the longer the wave-length, the less is the scattering and consequent blurring of the picture. Photographs of Mars in light of different wave-lengths behave just as though the surface-detail were being seen through a hazy atmosphere; ordinary photographic light of short wave-length gives little more than a general blur, photographs in yellow visual light show more detail and those in infra-red light are the sharpest of all.

Determinations of the surface temperature of Mars by radiometric measurement of the heat coming to us from various parts of the surface have been made by Coblentz and Lampland and by Pettit and Nicholson. The former obtained an average temperature of +15° C. and the latter −13° C. (Other estimates arrived at on various assumptions are also given by the authors, but we prefer the foregoing based on Stefan's Law.) Evidently we are still left in considerable uncertainty as to the climatic conditions, but even the lower estimate is not inordinately cold when we remember that the polar snow cap is included in the average; the higher estimate makes the day temperature quite genial. According to Coblentz the dark regions (indicating vegetation or moisture?) are warmer than the red desert regions.

Other Planets (*see* 25.357).—A ninth satellite of Jupiter was discovered by S. B. Nicholson at the Lick Observatory in 1914. Like the eighth satellite it revolves round the planet in the opposite direction to the other seven. The periods of satellites 8 and 9 are about 739 and 745 days respectively, and the two bodies are revolving in almost equal interlocked orbits in planes inclined at about 10 degrees. Satellites 6 and 7 form a somewhat similar interlocked pair, their periods being 251 and 260 days respectively; but their motions are in the "direct" sense. The photograph of Jupiter (taken at the Lowell Observatory) shown on the plate (fig. 2), illustrates the great advance in planetary photography in recent years.

Much interest has been taken in the Trojan group of minor planets. These illustrate a special case of the problem of three bodies discussed by Lagrange, viz.: that in which the three bodies are situated at the vertices of an equilateral triangle. The Trojan planets have the same mean distance and revolution period as Jupiter, and the equilateral condition is roughly fulfilled. The problem of the small librations of such a planet about the triangular point of equilibrium has been discussed by E. W. Brown; the condition of stability is that the mass of Jupiter must be less than ·0385 times that of the sun—a condition which is easily satisfied—and the period of the libration is about 140 years. Actually the Trojan planets are at some considerable distance from the triangular points, and the problem of determining the finite librations (as opposed to infinitely small librations) has provided much exercise for mathematicians (⁷). Six members of the group are now known, Nos. 588 Achilles, 617 Patroclus, 624 Hector, 659 Nestor, 884 Priam and 911 Agamemnon; of these Patroclus and Priam are near the triangular point 60° behind Jupiter, and the others 60° ahead of Jupiter.

The period of rotation of Uranus round its axis has been determined by V. M. Slipher from measures of the line of sight velocity of the advancing and receding limbs. The result is $10^h 50^m$ and the direction of rotation agrees with that of revolution of the satellites. Leon Campbell subsequently found that the light of the planet is variable with the same period, presumably owing to unequal brightness of different parts of the surface. The rotation period of Venus still remains a mystery; and there are advocates of the long period of 224 days as well as various estimates of a short period (one to three days).

Latitude Variation (*see* 16.267).—The study of the small periodic motion of the earth's axis of rotation (relatively to the earth) which gives rise to "variation of latitude" has been continued at the six international stations (reduced in number during and after the World War). The effect is made up of (*a*) the free precession of a spheroid rotating about an axis which does not coincide with its axis of figure; the period of this precession determined from the observations is 432¼ days; (*b*) an annual term, which is a forced oscillation due to meteorological and seasonal causes. Owing to interference of these two terms, there is an effect analogous to "beats" in sound waves, the amplitude of the motion alternately rising to a maximum of about $0''\cdot3$ (30 ft.) and dying out in about six years' period. The annual term appears to be nearly circular and of amplitude $0''\cdot085$; the possible causes contributory to this, such as seasonal circulation of the atmosphere and ocean, snowfall and vegetation have been investigated by H. Jeffreys, who finds a fair agreement between predicted and observed values. A mysterious Kimura or *z* term, which appears in these international results, would, if interpreted literally, indicate an annual approach to the pole and recession by all stations on the same latitude simultaneously—or a shifting of the earth's centre of gravity to and fro along its axis. It is, however, now believed that the term arises from a small systematic error in the observations; independent observations made at Greenwich and Pulkovo (not belonging to the international chain) show either a reduced or zero Kimura term.

Gravitation.—The epoch-making theory of gravitation, put forward by Einstein in 1915, is described in the article RELATIVITY (*q.v.*). We refer to it here because the new law of gravitation, required by his theory, removes the most outstanding divergence between theory and observation in the solar system—viz., the progression of the perihelion of Mercury. There is still some discrepancy between theory and observation for the motion of the node of Venus; but this is a much smaller residual, and may perhaps even be attributable to accidental errors. Einstein's predicted deflection of light by the sun's gravitational field was verified by the British Eclipse expeditions in 1919 and further confirmed by the Lick expedition in 1922. His third crucial test—a general displacement of spectral lines to the red in the sun as compared with terrestrial sources—was for some years a subject of controversy, as it is difficult to eliminate other causes of shift of the lines; but it now seems to be generally agreed among investigators that the effect is confirmed.

E. W. Brown's lunar theory, developed according to the methods of G. W. Hill, was completed by the publication in 1920 of full *Tables of the Moon's Motion.* It seems safe to say that no term of appreciable significance has been omitted; nevertheless the moon deviates unmistakably from its theoretical place in an irregular manner. An investigation by H. Glauert (8) seems to show that the irregularities are at least partly due to variations in the rate of our standard timekeeper, viz., the earth's rotation; for the longitudes of the sun, Mercury and Venus exhibit similar irregularities, and the curves closely resemble one another. Besides these irregular changes, there is a general secular acceleration of the moon, which, being cumulative, leads to large changes in the circumstances of ancient eclipses. The historical evidence of all kinds has been rediscussed by J. K. Fotheringham (9) who arrives finally at the values $10''\cdot5$ for the moon's secular acceleration[1] and $1''\cdot0$ for the sun's secular acceleration. These quantities are presumably attributable to tidal friction, which causes a direct acceleration of the moon's orbital motion, as well as a spurious acceleration through the increase in the length of the standard of time.

It is now believed that the bodily tides in the earth have little effect and that the most effective retardation is due to tides in land-locked and shallow seas. According to G. I. Taylor the Irish Sea alone contributes $^1/_{50}$ of the total dissipation of energy.

II. THE STARS

Progress in our knowledge must depend largely on the patient accumulation of accurate statistics as to the parallaxes, motions, magnitudes, spectra, etc., of large numbers of stars; we therefore review the great advance in these data that has taken place in recent years.

The first photographic determinations of stellar parallaxes reaching a modern standard of accuracy were made by H. N. Russell and A. R. Hinks at Cambridge and F. Schlesinger at Yerkes in 1903–7; earlier results are now superseded except for a few of the best heliometer measures made chiefly by Gill. Extensive programmes have since been carried out with large telescopes, and the latest compilation (1924) by the parallax committee of the International Astronomical Union contains results for about 1,870 stars. Although the probable error is generally below $\pm 0''\cdot01$, this unfortunately does not give us the distances of 1,870 stars, for many of the parallaxes are inappreciable. Very few of the stars are near enough for the trigonometrical method to give a close measure of their distance, and a large proportion of the measures can only be of interest in statistical discussions of distribution. We cannot resist the impression that stellar parallax determination is reaching its limit with present instruments; and perhaps for that reason special interest is attached to a new method of finding the distances of stars described below under "Spectroscopic Parallaxes."

Lewis Boss's *Preliminary General Catalogue of 6,188 Stars* published in 1910 has been an invaluable aid to research with regard to proper motions. It comprises all the brighter stars and the proper motions constitute a great improvement on data previously available. The first really extensive lists of radial velocities were published by the Lick Observatory in 1911. Over 2,000 had been determined by 1921 when a catalogue was formed by J. Voûte. Progress would have been more rapid but for the large proportion of spectroscopic binaries which makes it necessary to repeat the measures at suitable intervals in order to discriminate between orbital motion and the steady secular motion which is looked for. The latest compilation (10) records 1,054 spectroscopic binaries, of which 248 have well-determined orbits.

The apparent magnitudes of stars range from $-1^{m}\cdot5$ for Sirius to 20^{m} and upwards for stars photographed with the largest telescopes. The corresponding light ratio is more than 100,000,000 to 1, and it is no easy matter to subdivide this range accurately. For this purpose a sequence of standard stars has been chosen near the North Pole; their magnitudes stretch at short intervals from the first to the twenty-first magnitudes, and by the co-operative effort of a number of observatories definitive magnitudes on an absolute scale have been found (11). It is usual to determine magnitudes of other stars by differential comparison with these. Separate standards are needed for visual and photographic magnitudes; the relation of the two scales has been fixed by international convention so that they coincide for stars of spectral type AO between $5^{m}\cdot5$ and $6^{m}\cdot5$. Since the photographic plate is most sensitive to blue light and the eye to yellow light, the difference photographic *minus* visual magnitude gives a measure of the colour of the star. This is called the "colour-index." The colour-index ranges from about $-0^{m}\cdot5$ for the bluest (type B) stars to $+1^{m}\cdot9$ for the reddest (type M) stars. The sequence of colour-index corresponds closely to the sequence of temperature, and the spectral type can usually be inferred correctly from the colour-index or *vice versa.* This affords a useful method of classifying stars too faint for spectroscopic examination. Some progress has been made with direct measurement of the heat received from the stars and the corresponding "bolometric" magnitudes have been determined; considerable corrections are necessary on account of selective absorption of heat in passing through our atmosphere, and the method has been chiefly confined to the study of special stars. The bolometric magnitude is more usually inferred from the visual magnitude by applying a theoretical correction depending on the effective temperature (or spectral type) of the star.

The Draper classification of stellar spectra is now employed almost exclusively. The stages from the hottest to the coolest are denoted by the letters O, B, A, F, G, K, M; intermediate stages are estimated in tenths, *e.g.*, G5 means half-way between GO and KO. Typical stars are B, Rigel; A, Sirius; F, Procyon; G, the Sun; K, Arcturus; M, Antares. Types N and S seem to contain low temperature stars in conditions alternative to M, type M being characterised especially by the spectrum of titanium oxide, S by zirconium oxide and N by carbon compounds. A catalogue of the spectral types of 230,000 stars classified by Miss A. J. Cannon has been published by the Harvard Observatory and forms a monumental work of reference.

The absolute magnitudes of stars cover nearly as wide a range as the apparent magnitudes. The sun's absolute magnitude is 4·9, that is to say, it would have this magnitude if seen from the standard distance of 10 parsecs (parallax $0''\cdot1$). The most luminous stars have absolute magnitude about -5^{m} or 10,000 times brighter than the sun. The following are the four faintest stars known with their absolute visual magnitudes:—Proxima Centauri $15^{m}\cdot4$, Barnard star $13^{m}\cdot3$, Groombridge 34 *comes* 13^{m}, Pi 2^{h} 123 *comes* $12^{m}\cdot3$. These are all red stars possessing a low surface temperature.

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[1] The moon goes ahead by the amount $10''\cdot5T^2$, where T is the time in centuries. This is the conventional definition of "secular acceleration" in this connection.

Masses of Stars.—In a double star the two components revolve round one another under their mutual attraction; it is possible to measure the gravitational force exerted by one component on the other and so determine the mass. There are not very many systems for which our knowledge is sufficiently accurate to give trustworthy masses; among the best determinations are Sirius 2·45 and 0·8, Capella 4·2 and 3·3, α Centauri 1·1 and 1·6. The mass of the sun, viz.: 1·98. 10^{33} gm., is here taken as unit. In spectroscopic binaries with known orbits of both components we can usually determine only a lower limit to the masses, because one element of the orbit, namely its inclination to the line of sight, is lacking. These give evidence that very much larger masses occasionally occur. It has been shown by J. S. Plaskett that the O-type star 6° 1,309 has components with masses not less than 86 and 72 times the sun's mass. Masses not less than 260 and 50 are attributed to the components of υ Sagitarii, but the evidence is less certain. V Puppis consists of two equal stars of mass 19; in this case the star is an eclipsing variable, and the phenomenon of eclipsis tells us that the line of sight must be nearly in the plane of the orbit. At the other end of the scale masses from ¼ to ½ the sun's mass are common; the smallest known mass is that of the fainter component of Krueger 60, which is probably about one-sixth.

According to the theory of stellar radiation to be described presently, the absolute brightness of a star affords a close indication of its mass. This theory is fairly well checked by the direct determinations of mass; and, if it is accepted, we can apply it to find the masses of the numerous stars for which no other determination exists. It appears that the stars are for the most part closely similar in mass; a range from ⅓ to 3 would include at least 90% of the stars. The larger masses mentioned above are quite exceptional; we tend to discover exceptional rather than normal masses because it is especially the brightest stars which attract attention.

Advantage is taken of this uniformity of stellar mass to determine the "dynamical parallaxes" of double stars. If a is the semi-axis of the orbit in astronomical units, P the period in years, and m_1+m_2 the mass of the system in terms of the sun, we have by the law of gravitation

$$m_1+m_2=a^3/P^2$$

Thus a can be found if m_1+m_2 is known or guessed. We may assume with fair probability that $m_1+m_2=2$, the probable deviation being comparatively unimportant because a is proportional to the *cube root* of m_1+m_2. But the value of a in angular measure is found from the apparent orbit in the sky; comparing the angular measure with the linear measure given by the above calculation, we at once find the distance or parallax of the star.

It is possible to modify the procedure so that it can be used when a small arc of the orbit has been observed insufficient for a complete determination of the orbital elements. Dynamical parallaxes of 556 double stars have been published by J. Jackson and H. H. Furner (12); from these the absolute magnitudes and linear velocities (transverse to the line of sight) were calculated. The linear velocities were combined to give a determination of the sun's motion through the stellar system, the result being a velocity of 19·1 km. per sec. towards the Apex R.A. 273°, Dec.+34 degrees. This agrees remarkably well with the values generally accepted; and in particular the accordance of the speed with the value 19·5 km. per sec., obtained from the discussion of spectroscopic radial velocities, shows that the assumed mass 2·0 × sun must be almost exactly the average mass of a double star system.

Densities of Stars.—The sun has an average density greater than water, viz.: 1·41. This is fairly typical of a majority of the stars; but in recent years we have learnt that there exist numerous stars of a much lower density. We have to enlarge our ideas to include "giant" balloon-like objects with density so rarefied as to be comparable with air or even with a moderately high vacuum. These giant stars are especially conspicuous because, being swollen to great bulk, they have great light-power. Except for this high luminosity there is nothing very obvious about the appearance of the rarefied stars to distinguish them; the ordinary spectral classification is no guide. For instance the three eclipsing variables W Crucis, RZ Ophiuchi, SX Cassiopeiae have densities less than ·001, but they are classed in type G along with the sun. It is now known that there are certain telltale features in the spectrum which can be used to distinguish them; but these are only found by minute inspection and were not noticed until after the giant stars had been found and studied by other methods. Some information as to stellar densities can be obtained from eclipsing variables; it happens that a study of the eclipses gives sufficient data as to the relative dimensions of the two components and their orbit to solve the problem. But the most useful and universal clue is the absolute magnitude. The three stars above mentioned show practically the same spectrum as the sun, and it seems fair therefore to conclude that their surfaces are in the same radiating condition and will give the same amount of light per unit area within reasonable approximation. Thus if a star of the same spectral type as the sun gives 100 times as much light (5 magnitudes brighter) its surface must be 100 times greater; its radius is accordingly 10 times greater and its volume 1,000 times greater. The inference can be extended to other spectral types, accepting the principle that if the quality of the radiation as shown by its spectral distribution corresponds to a particular temperature the *quantity* of radiation must also correspond to that temperature at least to a rough approximation. Whenever we know the absolute magnitude and spectral type of a star we can give a good estimate of its size.

Until recently this was our only means of determining the size of the stars (except for some meagre information from eclipsing variables), because the stars are so distant that no appreciable disk can be seen even in the largest telescopes. But in Dec. 1920 the interferometer method developed by Michelson was successfully applied to the problem; although the star disk could not be seen, yet its angular diameter could be measured by observing the disappearance of a system of interference fringes (13). Pease and Anderson working with a 20-ft. interferometer at Mt. Wilson Observatory measured the angular diameter of Betelgeuse, the result being 0″·045. The parallax of this star is too small to be determined with much accuracy, and the conversion from angular to linear measure is a little uncertain; but it turns out that Betelgeuse is certainly large enough for the whole of the earth's orbit to be fitted inside it. A few other stars have since been measured, but most star disks are far too small to be within reach even of this powerful method. Whilst it is valuable to have a proof by actual measurement that some stars have diameters 200 times greater than the sun, the importance of these interferometer results is that they confirm closely the diameters already deduced from the absolute magnitude and spectral type.

As already explained there is not a great deal of range in the masses of the stars, and the huge bulk of Betelgeuse and similar stars indicates low density rather than great quantity of material. We have, of course, no actual measurement of the mass of Betelgeuse, but we infer from analogy with other stars or from the theory of stellar radiation that it is not more than 50 times the mass of the sun. In any case it is certain that its density must be very low, because Einstein's theory shows that a star of the bulk of Betelgeuse and density comparable to that of the sun would have extraordinary properties; in particular there would be a great shift to the red of the whole spectrum. According to the usual view the stars are formed by aggregation of primordial nebula, and it is therefore not surprising that we should find some stars in an early stage of low density.

Giant and Dwarf Stars.—Arranged in order of temperature from the hottest to the coolest, the spectral types fall into the sequence O,B,A,F,G,K,M. Until about 1913 it was generally assumed that this represented the course of evolution of a star, which started (presumably catastrophically) at high temperature and gradually cooled. We have, however, just seen that Betelgeuse and some similar stars which are cool red stars of type M are in an extremely diffuse state, and therefore represent the earliest stage in the condensation of a star from a nebula, We must not jump to the conclusion that all type M stars are to be placed in the earliest stage of evolution. Closer examination shows that type M is heterogeneous, and contains two quite distinct groups, the one consisting of giant diffuse objects and the other of small dense stars (red dwarfs) apparently in the last stage before extinction. This and other features of the spectra, luminosities and densities of the stars are brought into order by the giant and dwarf theory of evolution put forward independently by E. Hertzsprung and H. N. Russell, which has dominated research in stellar astronomy from 1914 to 1924. There is now strong reason to think that the theory cannot be sustained in its present form; but since it undoubtedly contains a great deal of truth and the necessary reconstruction has not as yet made much progress we shall give the usual form of the theory and later point out where it fails.

We must go back to Homer Lane's theory of the evolution of gaseous masses (*see* 25.788). Starting with a very diffuse globe of gas held together by its own gravitational contraction, the conditions of mechanical equilibrium require that its temperature must rise as it contracts. This rise of temperature continues so long as the material is rare enough to behave as a perfect gas. The gases with which we are familiar cease to follow the laws of a perfect gas when the density approaches that of the liquid state; it may therefore be anticipated that in the sun (density 1·4) the material is behaving more like a liquid and the star is cooling in the ordinary way. Accordingly the idea is that a star starts as a cool diffuse mass of perfect gas; it condenses and rises in temperature until the deviations from the gas laws check the rise of temperature; it then cools like a liquid and finally becomes extinct. It follows that a star passes through any particular temperature and spectral type twice, once ascending as a diffuse giant and once descending as a condensed dwarf. In any spectral class we shall have two groups of stars alike in surface temperature but wide apart in all other respects; in particular the two groups differ in density and in stage of evolution. The most conspicuous outward characteristic is the great difference of luminosity due to the larger surface area in the giant stage.

Instead of having a single evolutionary sequence of spectral types, the star must start as a giant of type M, ascend toward type B and then descend as a dwarf to type M again. It depends on its mass how far up the series it climbs, and probably a star must be three or four times as massive as the sun in order to reach the high temperature of type B. Smaller stars will turn at A, F or even lower. As Russell has put it, a star of small mass is a poor self-heating affair. The division of giants and dwarfs is most conspicuous for the lowest temperatures K and M since the corresponding stages are then at opposite ends of the evolutionary sequence; for types F and A the two groups begin to merge into one another and the division is less easy to recognise.

The observational confirmation drawn from many sources is now extremely favourable. For stars of known parallax the absolute luminosity can be calculated directly; and when these are grouped according to spectral type the bifurcation of the luminosities is evident. The luminosities of the giant stars depend very little on the spectral type since the rising temperature compensates for the decreasing surface area; their absolute magnitudes cluster closely about a mean value $+1^{m}\cdot 0$. For the dwarfs the decreasing temperature and decreasing surface co-operate to give a rapid fall of brightness through successive types, and the absolute magnitude fades to about $+10^{m}\cdot 0$ at type M. By the spectroscopic method of determining absolute brightness, Adams and Joy have been able to give striking statistics; of 58 stars of type M examined, they found that 48 were giants with magnitudes between $-1^{m}\cdot 0$ and $+3^{m}\cdot 4$, and 10 were dwarfs between $+9^{m}\cdot 8$ and $+10^{m}\cdot 7$; there was thus a gap of six magnitudes separating the groups. (It is possible that the sharpness of the separation is exaggerated by the circumstances of selection of the stars for examination, but we do not think the influence of selection is so great as to make the result misleading.) Ascending to types K and G the groups draw closer together and begin to commingle, but even in type F the frequency curve shows the two maxima. The bifurcation into giants and dwarfs is also well shown in Shapley's investigation of the densities of eclipsing variables and in Jackson and Furner's study of dynamical parallaxes.

Before leaving the observational evidence we must refer to a point which becomes especially significant now that Russell and Hertzsprung's theory of evolution is under suspicion. The giants apparently do not link on continuously to the dwarfs at type A. We trace the regular giant series from type M to G, and then there seems to be a gap with scarcely any normal giants of type F—as though this stage were rushed through rapidly. Such giants as do occur in type F are of higher luminosity and mass. We are now more inclined to divide the stars into a "Main Series" running down in temperature continuously from intensely luminous stars of type O to faint stars of type M, together with a side group of giants chiefly limited to types G, K and M. The latter is presumably a temporary halt in the early stages of evolution; when the halt is over the star proceeds rapidly to join the main series at a point depending on its mass.

The shock to the giant and dwarf theory comes from a result reached in 1924. Both from astronomical observation and purely physical theory it seems that stellar matter will continue to behave as a perfect gas up to densities exceeding that of platinum. Thus there is no explanation of the turning point from the giant to the dwarf series, and the descent along the dwarf series (if it occurs at all) must be due to some entirely different cause.

Radiative Equilibrium of the Stars.—The discovery that many of the stars are of very low density has given a stimulus to investigations of their internal conditions of equilibrium; for the material, being practically a perfect gas, will obey comparatively simple and definite laws. The distribution of temperature and density in a sphere of gas in equilibrium under its own gravitational attraction is a classical problem studied by Lane, Ritter, Kelvin, Emden and others. For the most part the mathematical analysis developed in these earlier researches is used in the modern theory, but three new features have been introduced:—

(*a*) It used to be supposed that the equilibrium was adiabatic—that is to say, the material was kept stirred by convection currents, hot gases ascending to replace the continually cooling material at the surface. But it is now clear that the heat passes to the surface not by material transfer but by radiation, and the condition of equilibrium is that each region will settle down to the temperature at which it radiates an amount of heat equal to that which it absorbs from the radiant heat flowing through it. This was first suggested as probable by R. A. Sampson in 1894, and the theory of radiative equilibrium was developed by K. Schwarzschild in 1906 for the atmosphere of the sun. It was taken by the writer as the basis of the theory of the stellar interior in 1916. One simplification resulting from this change is that a physical constant of stellar material, viz., the ratio of specific heats, which was difficult to estimate, is no longer required to be known.

(*b*) The pressure of radiation is sufficient to have an important effect on the condition of equilibrium especially in the more massive stars, and is taken into account in the new theory.

(*c*) It is recognised that at the high temperature in the stellar interior the atoms will be strongly ionised. Most of the electrons which circulate round the nucleus of an atom will have broken loose; and these, moving freely and exerting their own partial pressure, must count as separate "molecules" in determining the average molecular weight. All numerical results depend on the adopted value of the molecular weight; and it is essential that this should be known rather accurately since it is raised to a high power in several of the most important formulae. Owing to the ionisation we adopt a much smaller molecular weight than in the earlier investigations. Moreover we are no longer seriously troubled by uncertainty as to the chemical composition of the stellar interior, because *whatever the chemical composition* (provided only that there is not an excessive proportion of hydrogen) the molecular weight will be close to two. This is a consequence of the fact that the number of electrons surrounding the nucleus of an atom is approximately half the atomic weight, so that when all have broken loose there will be one free particle for every two units of weight. In stellar conditions the stripping of the atom is not quite complete, but the modification of the molecular weight can be calculated and allowed for.

Since it is believed that the star's heat is maintained by liberation of subatomic energy, another unknown condition enters into the problem, viz.: the relative distribution of the subatomic source through the interior. This, however, has no very important effect on the results, and the margin of uncertainty due to our ignorance of the distribution has been calculated by considering the extreme cases of a source entirely concentrated at the centre and a source fairly evenly distributed through the star. All the difficulties and uncertainties attending the calculation of the internal temperatures of the stars seem to have eliminated themselves, and it is believed that we have trustworthy knowledge for all stars in the condition of a perfect gas.

The effective temperatures of a few thousand degrees represent only the marginal heat of the stellar furnaces, and the greater part of the material of a star is at a temperature of several million degrees. In a typical giant star Capella the central temperature is 10,000,000° and the average temperature is about $\frac{2}{3}$ of this. In the sun the central temperature is about 40,000,000°. (We shall see later that the theory applies to the sun in spite of its high density.) All stars on the main series have nearly the same internal temperature as the sun. It should be realised that from the standpoint of the expert in atomic physics these temperatures are not at all high. Temperature is a measure of the average speed of the molecules. At 40,000,000° the speed of the free electrons is still low compared with that ordinarily imparted to them in electrical experiments, and far less than that of the β particles shot out in radioactive disintegration. We cannot anticipate any disintegration of the nucleus, such as Rutherford has found in the laboratory by employing incomparably more powerful agency. The difference is that, whereas qualitatively the atomic processes in a star are by no means out of the ordinary, the intensity or rapid succession of the individual processes is not reproducible in laboratory experiments. It helps us a great deal that in studying the stellar interior we have not to envisage unfamiliar atomic processes but to calculate the cumulative effect of a great multiplication of familiar processes.

The temperature-gradient in the interior tends to cause a flow of radiation outwards, which is hindered by the opacity of the stellar material, the opacity being a measure of the amount of obstruction offered by a substance to the flow of light or other radiation through it. Thus the total outflow of heat from the star depends on the internal temperature distribution (calculated by the theory already discussed) and on the opacity. If L is the radiation of the star (ergs per sec.), we find

$$L=4\pi cGM(1-\beta)/k$$

where c is the velocity of light, G the constant of gravitation, M the mass of the star (in grammes), k the coefficient of opacity, and $1-\beta$ the ratio of radiation pressure to the whole pressure found by solving the quartic equation

$$1-\beta=0{\cdot}0031\ M^2\ \mu^4\ \beta^4$$

where M is now expressed in terms of the sun's mass and μ is the average molecular weight. Knowing L and M for any star we can now calculate k; for instance in Capella we find $k=120$ C.G.S. units; this means that radiation passing through a screen of stellar material containing 1/120 grammes per sq. cm. (equivalent to about 6 cm. of air) would be reduced to one-third (strictly $1/e$) of its original intensity. This is a very high opacity. We see that the old difficulty as to how heat is brought up from the interior of a star to replace that radiated by the surface material has vanished; there is no need for convection currents; our problem is rather to explain how the material offers so much obstruction and dams back the internal heat, allowing it to escape no faster than it does. The high opacity is not so surprising when we realise that the radiation in the interior of a star consists of X-rays chiefly of wave-length 1 to 10 Ångstrom units, and the opacity determined astronomically is of the same order as the opacity of ordinary material to these X-rays as measured in the laboratory. The stellar opacity is in fact less than the terrestrial opacity because the high ionisation of the material throws a great part of the absorbing mechanism out of order.

The Mass Luminosity Relation.—Application of the modern physical theories of X-ray absorption to stellar conditions indicates that the coefficient of opacity will be directly proportional to the density and inversely proportional approximately to the $\frac{7}{2}$ power of the temperature ($k \propto T^{\frac{7}{2}}$). By the use of this law we eliminate k and obtain a relation between L and M. The density of the star nearly disappears from the relation; so that the total radiation or absolute bolometric magnitude of a star is a function of the mass, subject only to a trifling correction depending on its stage of evolution as indicated by density or by spectral type—provided always that the star is sufficiently diffuse to behave as a perfect gas. We call this predicted relation the mass-luminosity relation. So far as it can be tested with the not too abundant observational data available it appears to be strongly confirmed. The physical theory has not been so successful in predicting the absolute scale of luminosity of the stars; at present the position is that whilst the stars agree among themselves, they are all apparently about $2\frac{1}{2}$ magnitudes too faint. The cause of this discrepancy remains a mystery; but so long as we confine attention to differential comparisons it does not trouble us.

The startling result appears that not only do the giant stars confirm the mass-luminosity relation but the dense dwarf stars also agree with it, and the sun, for example, falls into line on the mass-luminosity curve (14). Taken at face value this unlooked-for agreement indicates that the material of the sun must be behaving as a perfect gas. This would be quite opposed to the giant and dwarf theory of evolution which attributes the low luminosity of the sun at its present stage (compared with that of the diffuse stars) to the deviation from a perfect gas. Nevertheless we seem bound to accept the new conclusion not only on account of the argument by which it was first reached, but because consideration of the physical conditions of material at a temperature of some millons of degrees clearly shows that it will remain a nearly perfect gas up to extremely high densities. Terrestrial material ceases to behave as a perfect gas at densities approaching that of water, because the atoms, which behave as rigid spheres with radii of the order 10^{-8} cm., are becoming jammed together. But in the stars atoms of this description do not exist; there are only the small fragments of atoms (ions) with radii of order 10^{-10} cm., and these do not jam until a density some thousands of times higher is reached. Our expectation that there would be a change in stellar conditions at a density between say 0·1 and 1 rests on a false analogy, which proves to be baseless as soon as attention is called to it.

Detailed investigation, taking account of the electrical forces between the ions, shows that there will be no appreciable failure of the gas-laws in any ordinary stars—except that in stars of small mass the material will be *superperfect* gas causing these stars to be about $\frac{1}{2}$ a magnitude brighter than at first predicted. There is some slight observational confirmation of this excess. The theory becomes extended to include all ordinary stars (*i.e.*, excluding " white dwarfs ") and differences of absolute brightness are now attributed almost entirely to differences of mass. This fundamental change of view was only reached in 1924, and there has scarcely been time fully to reconstruct our ideas of stellar evolution in accordance with it.

The Companion of Sirius.—If matter at the density of platinum is still behaving as a perfect gas the limit of compressibility must be at far greater density. Thus it is possible that stellar matter may exist having a high density transcending terrestrial experience. Conversely if definite evidence of such matter can be found it will be the strongest possible confirmation of the views to which we have been led. It happens that there already existed evidence of the existence of stars of extravagantly high density—evidence which would probably have been accepted as fairly convincing if the conclusion had not been thought too absurd to be taken seriously. These stars are called *white dwarfs.* Only three are definitely known; but they are probably rather numerous in space because as a rule they are not detected unless they are close to us. The most famous is the companion of Sirius which has $\frac{4}{5}$ the mass of the sun but gives only 1/360th of the sun's light. This would not surprise us if it were a red star of feeble surface luminosity, but it was shown by W. S. Adams in 1919 that it was a white star of spectrum F and therefore should have a surface-luminosity greater than that of the sun. The radius calculated in the ordinary way from the luminosity and type is 19,000 km.—not so large as Uranus—and the corresponding mean density is 60,000 grammes per cubic centimetre. When it was realised that these results were not necessarily nonsensical, a further test was applied by means of Einstein's theory.

The red-shift of the spectral lines—the third Einstein effect—is proportional to the mass divided by the radius and according to the above figures would be 30 times as great on the companion of Sirius as on the sun. It would be equivalent to a Doppler effect of 20 km. per second. (The true Doppler effect can be separated from the Einstein effect because the motion in the line of sight is known from observation of Sirius itself.) Although the observation was difficult on account of the faintness of the object and its proximity to Sirius, Adams was able to show in 1925 that an Einstein effect of 21 km. per sec. existed, agreeing with the prediction (15). The companion of Sirius has been famous in the history of astronomy as a body whose existence was known and accepted unreservedly 18 years before it was first discovered with a telescope, Bessel having shown in 1844 that Sirius was revolving under the attraction of an unseen mass; it now comes into prominence again as revealing that stellar matter can be compressed to a density of a ton to the cubic inch. There is no reason to think that this matter consists of other than the familiar elements; it is simply a case of tighter packing of the smashed atoms.

Radiation Pressure.—At any point in a star gas-pressure and radiation-pressure together support the weight of the material above. The proportion supported by radiation-pressure $(1-\beta)$ is to a first approximation the same in all parts of the star and, if the molecular weight is given, depends only on the mass. We might expect something significant in the range of mass for which radiation-pressure increases from minor to major importance, say $1-\beta$ increases from 0·1 to 0·5. The masses corresponding to these limits are 1·6 to 11·5 times the sun's mass (for molecular weight 2·1). This seems to give a clue to the remarkable phenomenon that the masses of the stars are so nearly uniform. Apparently the matter of the universe has aggregated primarily into lumps whose size is determined by this critical range of radiation-pressure. We know that a gaseous mass without radiation-pressure is stable unless it is in extremely rapid rotation; we do not know the conditions of stability of a mass subject to radiation-pressure. It is a plausible hypothesis that high radiation-pressure endangers the stability of a star; in that case the aggregation of matter to form stars will be put a stop to at limits of mass generally in the range indicated. In considering how accurate this coincidence is we must notice that there is now a wide-spread belief that the star radiates a considerable part of its mass during its lifetime. If so we must take for comparison the original masses, or the masses of stars observed in the most diffuse state. The range 1·6 to 11·5 agrees excellently with the known range of mass of the K and M giants.

Saha's Theory of Stellar Spectra.—After the first use of spectroscopy to identify the chemical elements in the atmosphere of a star, the most important advance was the discrimination of "enhanced lines," *i.e.*, lines strengthened in the spark spectrum as compared with the arc. This gives a criterion as to the physical condition of the star's reversing layer, because it depends on the temperature and density whether the arc or the spark spectrum predominates. Much of the earlier progress in this development is due to Sir J. N. Lockyer and A. Fowler. In general the arc lines are absorbed by the neutral atom and the spark lines by the atom with one electron missing (singly ionised atoms). Sometimes the distinction can be carried further; and for example, Fowler has identified the separate spectra of singly, doubly and trebly ionised silicon in the laboratory and in the stars. The modern thermodynamical theory of ionisation was brought to bear on the astronomical observations by M. N. Saha in 1920 and his method of interpretation of spectra has dominated all recent progress (16). Consider the element calcium. In a red star the temperature of the reversing layer is low and the atoms will not be ionised, so that only the arc lines appear. At somewhat higher temperature ionisation begins, and the H and K lines of ionised calcium are shown. In the sun both spectra are prominent. Passing to higher temperatures the arc lines disappear since no atoms are left in the neutral state; and in the hottest stars the atoms become doubly ionised so that the H and K spectrum fades out.

If the pressure in the reversing layer is known we can calculate by theory how the state of ionisation progresses with temperature and so determine the temperatures corresponding to the spectral types in which the various spectra are observed to appear, disappear or reach maximum intensity. Lines absorbed by *excited* atoms (ionised or not) are especially useful, since the abundance of excitation is sensitive to small changes of temperature. By connecting together the data for different elements and controlling the results by reference to the best determinations of stellar temperature by other methods, a fairly consistent temperature-scale for the various types has been found. It appears that the pressure in the reversing layer is between 10^{-3} and 10^{-4} atmospheres—much lower than used to be supposed. A few lines are found to correspond to a still lower pressure; these are probably chromospheric lines absorbed by ions which experience strong selective radiation pressure which maintains them at a high level above the ordinary reversing layer. A number of the improvements in the detailed applications of the theory are due to R. H. Fowler and E. A. Milne.

Spectroscopic Parallaxes.—Although giant and dwarf stars of the same temperature have, broadly speaking, the same spectrum, a detailed examination of particular lines reveals distinctive differences. It was early shown by E. Hertzsprung that those spectra marked by Miss Maury as having "*c*-characteristic" belonged exclusively to giant stars. More precise criteria were found by W. S. Adams and A. Kohlschütter in 1914; and the method has been developed by Adams into a means not only of distinguishing the two classes but of determining quantitatively the absolute luminosities of stars. For example, the "enhanced lines" of strontium 4,077 and 4,215 are relatively strong in stars of high luminosity and weak in those of low luminosity; whereas the "furnace lines" of strontium 4,607 and calcium 4,455 behave in the reverse manner. Thus measures of the relative intensities of these lines give an indication of the luminosity of the star.

At present the procedure is purely empirical; the curve connecting absolute magnitude with differential intensity of the selected lines is deduced from and tested by stars of known trigonometrical parallax; it is then applied to deduce the luminosities and hence the parallaxes of other stars. Parallaxes determined by this method for 1,650 stars have been announced (17). The existence of this criterion of absolute magnitude is explained in a general way by Saha's theory. The state of the outer layers of a star, and hence the spectrum, is controlled by two factors, viz.: the value of gravity at the surface and the intensity of the stream of radiation poured through them from below; the latter factor is equivalent to the effective temperature. Take two stars of high and low luminosity respectively, *e.g.*, a giant and dwarf of the same effective temperature; the former being a diffuse star has a much lower value of gravity, and this has the consequence that the reversing layer occupies a level of lower pressure. With lower pressure the same stages of ionisation occur at reduced temperature; and it is in fact confirmed that the same spectral type corresponds to lower temperature in a giant than in a dwarf. But a change of pressure does not simply shift the temperature scale for the whole spectrum; actually the shift is different for each element and each phase of the atom—normal, ionised or excited—so that differential comparisons of particular lines betray the alteration of pressure.

Variable Stars.—The three leading classes of variable stars are (*a*) eclipsing variables, (*b*) Cepheid variables, (*c*) long-period variables. Rather more than 200 eclipsing variables are known; in these one component wholly or partly hides the other during part of the revolution so that there is a decrease of brightness. Intensive study of the light-curves of particular stars gives important information as to the radii of the components, densities, surface brightness, etc. In a number of systems a "reflection effect" has been observed and measured; that is to say the two hemispheres of the faint component are of unequal brightness, and the star goes through phases like the moon owing to illumination by the bright component. It has been shown theoretically that a star must be a perfect reflector of heat (heat–albedo = 1); but since our actual measurements are not in heat units but in light units this cannot be immediately checked by observation. In some systems the two components are so close that they distort one another, and the prolate form of the stars gives rise to observable features in the light-curve. It would seem that eclipsing variables will afford a quite exceptional opportunity of studying details of stellar constitution, but progress at present is difficult.

The explanation of the Cepheid variables is more uncertain. The first question is: Is the Cepheid a binary star? The spectroscope *apparently* answers in the affirmative for it shows a radial velocity increasing and decreasing in the period of the light variation, as though the star were revolving round an unseen body. But the change of light is not due to eclipses because the minimum brightness occurs when the star is receding most rapidly—at a time when the other component could not be between us and it. There must be an actual variation in the rate of radiation by the star, and this has been confirmed by H. Shapley who showed that the spectral type and therefore the surface conditions change during the period. For example, δ Cephei changes from type F0 at maximum to G2 at minimum. This periodic heating and cooling is the main cause of the change of brightness.

One suggested explanation is that the orbital motion occurs in a resisting medium, so that the front side of the star is brighter than the rear side on account of the impact of the medium; this would explain why minimum brightness always occurs when the star is retreating. But opinion is now tending towards a pulsatory theory proposed by H. Shapley (18) which rejects the binary hypothesis altogether. The fact is that there is literally no room for the supposed second component required by the binary hypothesis. The Cepheids are giant stars filling a large volume, and the "orbit" is always small compared with the dimensions of the star itself. When we calculate the size of the orbit of the supposed companion (which we can do, knowing the period and approximate mass of the system) we find that it would graze or even lie inside the principal star—a *reductio ad absurdum* of the binary hypothesis. Further, a relation has been found between period and density in these stars, which points to the period being determined by intrinsic conditions; such a relation is quite unintelligible if the period is provoked by an external cause, viz.: the revolution of a companion. Accordingly Shapley suggests that the variable is a *single star which dilates and contracts with a regular pulsation;* and the observed motion of approach and recession refers, not to the star as a whole, but to the upheaval and subsidence of the part of the surface presented towards us.

The radius of δ Cephei may be taken as about 20,000,000 km.; the semi-amplitude of the oscillation, according to the observed radial velocities is 1,270,000 km. or about 6% of the radius. For 15 other fully observed Cepheids the semi-amplitude of the pulsation ranges from 3 to 8% of the radius; this seems an amount of compression and expansion suitable to produce the rather large changes of temperature required. Within narrow limits the period is inversely proportional to the square root of the star's mean density, a relation which seems significant in view of the fact that the pulsations of a gravitating sphere follow this law. Moreover the constant of proportionality is of the order of magnitude predicted by theory: we can calculate that a globe of gas having the mass and density of δ Cephei will vibrate in a period between 4 and 10 days (varying between these limits according to the adiabatic constant of the material of which it is composed); the observed period is 5·37 days. (19) The most serious objection urged against the pulsation theory of Cepheids is that it requires a broadening of the spectral lines at minimum and maximum, because all parts of the disk would not be moving with the same speed in the line of sight; this has not yet been observed. It is to be hoped that this crucial but rather difficult effect will be thoroughly sought for in the near future.

A question arises as to how the pulsations are maintained. There is very little dissipation of energy from viscosity and the main cause of decay of the pulsations would be the leakage of heat between different parts of the star. We have in any case to admit that a supply of energy (sub-atomic energy) is continually being released in the stars, and if certain thermodynamical conditions are satisfied this may supply the mechanical energy required to maintain the pulsations. The simplest theory is that this energy is released more rapidly when the star is compressed and at maximum temperature; the star then receives excess heat at high temperature which it radiates at low temperature and so acts as the working substance of a heat-engine. This explanation is perhaps too powerful, as it makes it difficult to understand why every star is not set in pulsation. An alternative theory is that the heat supply is constant but the varying opacity (acting like the valves of an engine) governs its flow in such a way that mechanical work is performed.

It now seems probable that the long-period variables link on continuously to the Cepheid variables, the differences being only skin-deep. It is, however, the skin which we observe, and in the long-period variables, which are stars of very low density and low photospheric temperature, a great surface eruption occurs at a certain stage of the pulsation. At the height of the eruption the star is usually at least 100 times as bright as at minimum; but it has recently been discovered that the increase of heat radiation is not nearly so great. By direct radiometric measurements, the variation of heat is found to be about 1 magnitude—just as in the Cepheids. The theoretical relation between period and density obeyed by the Cepheids is found to apply also to these low density stars, and the fact that the long-period variables are all of type M (or the other red types N and S) agrees with the rule found for the Cepheids that the type becomes redder with increasing period.

Novae.—Two "new stars" of unusual brilliance have appeared in recent years. Nova Aquilae III. was discovered independently by a great many observers on June 8 1918 when it was already a first-magnitude star. Its earlier history has been supplied from an examination of photographic records of the sky. From 1888 onwards it remained steady at $10^{\mathrm{m}}\cdot5$ and a photograph taken by Max Wolf three days before discovery showed that it was still normal. Incidentally we may note that it cannot have been a red star (types K or M) or it would have appeared in visual catalogues. On June 7 it had reached $6^{\mathrm{m}}\cdot$ according to a Harvard photograph. The next day (when it was discovered) it had brightened to $0^{\mathrm{m}}\cdot8$; and on June 9 it was only slightly inferior to Sirius. Then followed the usual slow decline with occasional fluctuations; and it had faded to $5^{\mathrm{m}}\cdot5$ by the end of October. W. F. Denning discovered a Nova in Cygnus on Aug. 20 1920 which reached the second magnitude. Its earlier history is unknown, but it must have been fainter than $15^{\mathrm{m}}\cdot$ in 1908.

Broadly speaking each Nova reproduces the same sequence of phenomena with remarkable faithfulness. If caught early enough before maximum brightness is reached, the spectrum is that of an A or B type star with the absorption lines displaced to the violet. This appears to indicate that the outer layers of the star are being propelled upwards; the velocity varies from day to day. A few days later bright emission lines appear on the red side of the corresponding absorption lines. The absorption lines become doubled and trebled as though there were several jets of uprushing gas with different speeds. The bright lines broaden into bands and show complicated structure. The light is now declining owing to the continuous spectrum fading away, and the spectrum becomes mainly an emission spectrum. About a fortnight after maximum bright nebular lines (*i.e.*, lines of unidentified origin but characteristic of gaseous nebulae) appear. The great speed of upward rush of the absorbing gases is very remarkable, velocities of the order 2,000 km. per sec. being observed; there is no reason to doubt that these velocities are genuine for the star does actually expand and in the later stages shows a nebulous disk visible in large telescopes. The observed rate of spreading appears to agree with the speeds indicated by the shift of the absorption lines. After the outbreak has subsided the star becomes of spectral type O surrounded by a nebulous disk—like a planetary nebula. For this reason it is sometimes thought that the ordinary planetary nebulae originate from novae; but this seems unlikely, because, so far as can be ascertained, there is a big difference in scale of the two kinds of objects.

Of the many theories advanced to account for the outbreak, a collision of two stars seems unlikely on account of its statistical improbability; and moreover the regular sequence of changes could scarcely be started by a haphazard impact. An eruption from within, whether occurring spontaneously at a certain stage of evolution or precipitated by the entry of a star into a nebula, may be more likely; but this theory also presents difficulties. J. H. Moore has shown that the extended nebulous disk shows differential motions of rotation in different parts. In any case, it seems likely from the very rapid sequence of changes that the main outbreak is only skin-deep. Novae always occur within the limits of the Milky Way (or in spiral nebulae); but this may perhaps be due to the greater depth of the stellar universe in this direction. So far as can be judged the Nova before the outbreak is a dwarf star; and at least in the case of Nova Aquilae it cannot have been a very red star. (The long-period variables, whose violent outbreaks are rather suggestive of the explosion of a Nova, are giant red stars.) We may meditate on the fact that the stars subject to these catastrophes are probably in about the same stage of evolution as that through which the sun is now passing.

Motions of the Stars.—Many researches have confirmed Kapteyn's discovery that the stars (or at least those near enough for investigation) move preferentially in two favoured directions. Since the article STAR (*see* 25.784) was written, the spectroscopic radial velocities have become available for testing the theory and they confirm it decisively. Relatively to the sun the favoured directions are inclined at about 120° (the apices being at R.A. 96° Dec.+8°, and R.A. 290°, Dec.−54°); but referred to the mean of the stars they are necessarily two opposite directions along a straight line. The extremities of this axis of preferential motion are called the *vertices*. The following appear to be the most accurate determinations of the vertex by the two independent methods (20):—

From proper motions (Boss's catalogue) R.A. 94°·2, Dec.+11°·9.
From radial velocities (Lick catalogues) R.A. 94°·6, Dec.+12°·5.

We should rather expect this star streaming to be a local phenomenon in the stellar universe, but up to the present no sensible change in the velocities or relative abundance of the two streams has been found in the region surveyed. Photographic determinations of the direction of motion of faint stars of small proper motion made a Cambridge Observatory show that the phenomenon occurs without detectable alteration up to distances of 500 parsecs from the sun. It is significant that the line of preferential motion lies in the galactic plane. The phenomenon may be due to two star clouds passing through one another; or it may represent some dynamical property of a single system. The latter view has often been favoured owing to the very elegant mathematical specification of the corresponding velocity distribution given by K. Schwarzschild's ellipsoidal theory (21).

The more detailed study of the systematic motions of the stars leads to results of great complexity. We have to recognise a third drift, pointed out by J. Halm, which is nearly at rest relative to the mean of the stars. The type B stars appear to belong to this third drift and show no sign of the preferential motion towards Kapteyn's vertices; but the drift also comprises stars of other types. Another important phenomenon is the asymmetry of the motions of high velocity stars. We shall here follow the conclusions of J. Oort (22) with regard to this phenomenon; G. Strömberg, who has also investigated it, holds somewhat different views. According to Oort stars with velocities above a certain limit (probably about 60–80 km. per sec.) are moving almost exclusively towards one hemisphere of the sky. This is an additional effect, apparently having nothing to do with the two main star-streams. Tentatively we suppose that these high velocity stars are intruders into our local star cloud, having come into it from another cluster situated on one side. Regarding our star cloud as a semi-permanent system, there will be a certain velocity of escape. Stars with velocities below this limit are permanent members of the system describing orbits under its attraction, and there cannot well be one-sided asymmetry in the distribution of such orbital motions; but stars with speeds greater than the velocity of escape must be intruders which pass through the system once only, and preserve more or less the direction of motion with which they entered. Whatever the true explanation, these high velocity stars all moving one way affect considerably the various statistical discussions of the relation of stellar motions to other characteristics such as type and luminosity, because the asymmetric stream appears to include a larger proportion of stars of low luminosity and reddish type.

In 1910 J. C. Kapteyn and W. W. Campbell announced independently that (after allowing for the solar motion) the average speeds of the stars increase continuously from type B to type M. According to Campbell the average radial speeds are—type B, 6·5; A, 10·9; F, 14·4; G, 15·0; K, 16·8; M, 17·1 km. per second. In this investigation the K and M stars were almost all giants; but it has been found that the dwarf K and M stars have still higher speeds averaging about 40 km. per sec. for one component. There is also a general progression of velocity with brightness, the faintest stars having the highest average speed; and this is very much mixed up with the above dependence of speed on spectral type. To add to the confusion it has been found by Plaskett that stars of type O instead of having still smaller speeds than type B have moderately high speeds; and this is confirmed by the high speeds of planetary nebulae which usually contain a type O star as nucleus.

It seems likely that the correlation of speed both with spectral type and luminosity results from a more fundamental dependence of speed on mass—the smaller the mass, the higher the velocity. It is tempting to suppose that there is equipartition of energy as among the molecules of a gas, the average value of $\frac{1}{2} mv^2$ being the same for all classes of stars. Although the observations confirm this to a certain extent, it is difficult to suppose that there is any theoretical basis for such a law. The mutual perturbations of the stars tend to bring about equipartition, but the process is too slow to be effective within the lifetime of the stars concerned. Moreover, the empirical connection of mass and speed must not be pressed too far, because the O type stars which have very large masses have rather high speeds. The whole problem of stellar velocities is very mysterious. There must, we think, be a number of causes involved, and it seems clear that the stellar system has not yet reached anything like a steady and permanent distribution.

Moving Clusters.—Many years ago R. A. Proctor pointed out a group of stars in the neighbourhood of the Hyades with practically equal proper motions; the researches of L. Boss (23) have thrown new light on the nature of this association. He recognised as belonging to the group 39 stars spread over an area 15° square; the motions appear to converge towards a certain point in the sky—a perspective effect which would naturally occur if the actual motions in three dimensions are parallel; the direction of the convergent point gives the direction of the common motion of the group relative to the sun.

Knowing the spectroscopic radial velocity of one or more members, we can by an easy geometrical construction find the whole linear velocity and also locate each star separately in space. We thus obtain exceptionally full and exact information as to the distances and luminosities of this group of stars. The cluster is roughly spherical with a diameter of 10 parsecs; there must be many non-associated stars—accidental interlopers in so large a region—and perhaps the most significant conclusion is that the casual attractions of these stars have not been able during the lifetime of the cluster to disturb appreciably the parallelism of the motions and so scatter the cluster. Another remarkable "moving cluster" is formed of five stars of the Plough together with stars widely separated in the sky, including Sirius, α Coronae and β Eridani. Similar associations are specially frequent among the stars of the B type of spectrum, one of the most distinct being a chain of stars crossing the constellation Perseus.

Number and Distribution of Stars.—Important statistics of the number of stars down to various limits of magnitude have been obtained by Chapman and Melotte and by P. J. Van Rhijn. We give some results of the latter investigation which is the more recent (24).

The total number of stars down to photographic magnitude $16^{m}\cdot 0$ is 33,000,000; by a somewhat risky extrapolation it is estimated that the total number of stars in the system is between three and four thousand millions, and to reach half this number it would be necessary to go as far as magnitude $25^{m}\cdot 5$. (Exactly what is meant by the "system" in the foregoing sentence is somewhat difficult to define; there may, of course, be exterior galaxies or extensions which are not reckoned in these counts.) An important point is the well-known flattened distribution of the stars; up to magnitude 16^{m} the stars are distributed in the galactic plane $5\frac{1}{2}$ times as thickly as at the galactic poles. This is an increase compared with the concentration of the brighter stars; up to magnitude 5^{m}, the corresponding ratio is $2\frac{1}{2}$. We can easily understand this greater concentration of the faint stars, since on the average they carry us to greater distances, at which the oblate shape of the stellar system has more pronounced effect.

Taking a lower limit of luminosity 1/200 × sun, it is estimated that there are 30 stars within a sphere of five parsecs radius round the sun; about 20 of these have actually been identified. If this star density persisted, a sphere of 1,500 parsecs radius would contain 800,000,000 stars, besides an unknown but probably rather large number of extinct stars and of stars giving less than 1/200th of the sun's light. This gives some idea of the possible extent of the star cloud to which we belong; there can be little doubt that the density must fall off very considerably within a distance of 1,500 parsecs, more especially in the directions of the galactic poles.

The following table based on an investigation by Kapteyn, Van Rhijn and Weersma shows the average parallax of stars of different magnitudes:—

Mag.	Mean Parallax	Mag.	Mean Parallax
$1^{m}\cdot 0$	·060″	$7^{m}\cdot 0$	·0090″
$2^{m}\cdot 0$	·044″	$8^{m}\cdot 0$	·0065″
$3^{m}\cdot 0$	·032″	$9^{m}\cdot 0$	·0047″
$4^{m}\cdot 0$	·023″	$10^{m}\cdot 0$	·0034″
$5^{m}\cdot 0$	·017″	$11^{m}\cdot 0$	·0025″
$6^{m}\cdot 0$	·012″	$12^{m}\cdot 0$	·0018″

It is an even chance that a particular star has a parallax between 0·83 and 1·13 times the average parallax for its magnitude.

Evolution of Rotating Masses.—The figures of equilibrium and the final disruption of rotating fluid masses have been studied in great detail by J. H. Jeans. In agreement with Liapounoff he has found that the so-called "pear-shaped" figure of equilibrium, which succeeds the Jacobi ellipsoidal form, is unstable. For a full account of his conclusions as to the evolution of double stars, spiral nebulae and clusters reference must be made to his book *Problems of Cosmogony and Stellar Dynamics* (1919). With regard to the solar system, he finds himself unable to account for the formation of the planets by rotation alone; and he attributes them to a tidal disruption of the sun having occurred at some distant epoch in the past. If this view is correct the system of the planets is a "freak of nature," owing its existence to a chance encounter of some larger star (which approached within less than the sun's diameter from its surface). Comparatively few other systems of this kind would be formed; and the common view that the stars in general are attended each by a system of planets may be entirely mistaken.

Age of the Stars.—According to the Helmholtz-Kelvin theory, which supposes that a star's heat is supplied by gravitational energy converted owing to contraction of the star, the age of the sun is not more than 30,000,000 years. Physical, geological and biological arguments all agree that this time is far too short. An astronomical argument against the contraction theory is derived from the Cepheid variables. Like other giant stars δ Cephei would need to condense very rapidly if the heat which it squanders were derived from contraction; the increase of density must in fact amount to 1% in 40 years. Since the period of the light variation is intrinsic, this must also change as the density changes; calculation shows that the period should decrease 40 seconds annually. Now δ Cephei has been under careful observation since 1785 and the decrease of period is only just detectable—about 0·08 seconds per annum. Thus in the present stage evolution is proceeding at no more than $^{1}/_{500}$ of the rate required by the contraction hypothesis. In casting about for some other source of stellar energy, it is necessary to realise that no source is of any avail unless it liberates heat in the deep interior of a star. The temperature gradient between the centre and the surface has to be maintained (otherwise the star would collapse to the white dwarf state) and it is impossible to maintain a temperature gradient by supplying heat at the bottom end. This seems to rule out all suggestions that a star picks up its energy from outside.

Granting then that the energy required for future radiation must be already within the star, we can at once set an upper limit to the amount. All kinds of energy possess mass, and the mass of the sun is equivalent to $1\cdot 8\cdot 10^{54}$ ergs of energy. This is the total store, and at the present rate of radiation it is sufficient for $15\cdot 10^{12}$ years; actually it would last considerably longer since the rate of radiation would decrease as the sun's mass decreased. To put the argument in another form, the mass of the sun's radiation amounts to 130 million million tons per year; and the sun cannot go on losing this mass for more than the period stated because by that time there would be no mass left. With insignificant exception the store consists of energy of constitution of atomic nuclei and electrons, *i.e., subatomic energy;* the whole amount can only be released if there is some process of annihilation of the electrons and protons which constitute matter. A less radical suggestion is that only transmutation of the elements occurs. In that case not more than $^{1}/_{100}$ of the mass can be released as free energy; and to obtain even that much the mass must consist initially of hydrogen, since the main release of energy occurs when hydrogen is transmuted into helium as a first step towards the synthesis of higher elements. The energy emitted in ordinary radio-active changes is insignificant from the cosmical standpoint.

Although the theory of annihilation of matter presents grave difficulties, it is attractive (1) because it is doubtful if the less radical hypothesis can give an adequate time-scale, (2) because stars observed in the earliest diffuse stage have on the average masses two or three times greater than the average mass of the more condensed stars, (3) because if a star does not change mass considerably all previous ideas of evolution of faint stars from bright stars collapse. A star might also change mass by picking up or losing matter from its surface, but calculations indicate that this effect must be small compared with the loss of mass by radiation. The sun's chromosphere would have to move outwards at 500 km. per sec. continually in order to carry off as much mass as is lost by radiation.

One difficulty is the co-existence of giant and dwarf stars in clusters. The larger the mass the faster is the rate of loss of mass; and however big the stars may be to start with, at the end of a million million years there can be no more than twice the sun's mass left. In moving clusters such as the Taurus cluster and Praesepe we find stars of more than twice the sun's mass (judging from their luminosity) and therefore conclude that the age of these groups cannot be more than 10^{12} years. But the loss of mass of a dwarf star in that time is almost negligible, so that the dwarf stars in these clusters must have been born with practically their present masses. If we have to admit that the cluster dwarfs have undergone no evolution of mass, is there any point in assuming that dwarfs in general have been evolved from more massive stars? On the other hand, it may be significant that these clusters appear not to have their full quota of dwarfs, there being few if any below absolute magnitude about 7^{m}.

Very little progress has been made in unravelling the dependence of the rate of liberation of subatomic energy on temperature and density; but it seems to be established that the rate must increase with temperature or with density or both, since otherwise the stars would be unstable. It is also clear that there must be exhaustion effects, the older stars having used up their more prolific supplies. Thus the sun liberates only 1·9 ergs per gr. per sec. as compared with 58 by Capella, in spite of the fact that the sun is hotter and denser. A remarkable feature pointed out by H. N. Russell is that stars on the Main Series have nearly the same internal temperature. Thus V Puppis which requires a supply of 700 ergs per gr. per sec., and Krueger 60 which requires 0·08, both have to rise to a central temperature of about 40,000,000° to obtain their requirements. It looks as though 40,000,000° is a critical temperature at which subatomic energy becomes available practically *ad libitum;* but this is scarcely credible as a physical hypothesis.

According to Kohlhörster and Millikan an extremely penetrating radiation found in our upper atmosphere comes to us from outside the earth. If their experimental results are accepted there can be little doubt that this radiation originates in the nebulae or in the diffuse matter pervading space, and the great penetrating power points to subatomic processes as the cause of it. This indicates an evolution of the elements prior to the condensation of matter into stars; and indeed astronomical evidence of the presence of complex elements in the most diffuse stars seems to require such an advance. But it baffles imagination to conceive how the four protons and two electrons required to form a helium atom can be brought together in a diffuse nebula.

The whole problem of stellar evolution is now in a most chaotic state because it has become involved with questions of the laws of liberation of subatomic energy which as yet have proved to be too difficult for us. It should be understood that these attempts to form a theory of the subatomic generation of energy from astronomical studies, although unsuccessful, are not speculative in the ordinary sense of the term. When once it is admitted that the stars' radiation is provided by subatomic energy, it follows that the measurement of the liberation of this energy is one of the commonest astronomical observations; the attempt to co-ordinate the results of these measurements, and to discover the laws connecting the rate of liberation with the physical conditions and age of the material is not airy speculation but a pressing problem of practical research.

III. CLUSTERS AND NEBULAE

Globular Clusters.—About 70 globular clusters are known. (*See* 19.332.) They are distinguishable from the loose irregular clusters by their symmetrical and condensed appearance. A typical example, Messier 3 (Canes Venatici), is shown in the plate, fig. 4, from a photograph taken at Mt. Wilson.

The Cepheid variables contained in some of these clusters have been used by H. Shapley (25) to gauge their distances, relying on the fact that the absolute magnitude of a Cepheid of given period is a known constant. In Messier 3 the mean magnitude of 110 Cepheids is $15^{m}\cdot 50$, the individual stars deviating as a rule no more than $0^{m}\cdot 1$ from this mean. In the cluster ω Centauri 76 Cepheids concentrate with similar closeness about a mean magnitude $13^{m}\cdot 57$. It is clear that the difference $1^{m}\cdot 93$ must correspond to the greater distance of Messier 3; and it is easily deduced that the ratio of the distances is 2·43, this ratio being very accurately determined provided that absorption of light in interstellar space is negligible.

We are not quite so certain of the absolute distances of the two clusters; but the evidence seems to indicate that the absolute magnitude of Cepheids with periods less than a day is $-0^{m}\cdot 2$, which gives the following distances—ω Centauri, 5,800 parsecs; Messier 3, 14,000 parsecs. When it is recalled that the usual trigonometrical method can scarcely be applied to determining distances greater than 50 parsecs, the extraordinary power of this method of plumbing space will be realised. The method was first used by E. Hertzsprung to determine the distance of the Lesser Magellanic Cloud.

By this method, and by supplementary devices, Shapley has been able to plot the distribution of the globular clusters in space and to form an idea of the extent of the system which they outline. Even in this vaster system the galactic plane is still a plane of symmetry and of flattening, though the clusters extend to great distances above and below, the average distance from the plane being eight kiloparsecs. In plan the system is elongated with its axis in galactic longitude 325°—nearly the direction of star streaming; the greatest diameter is at least 60 kiloparsecs, and the sun is near one end of it, so that practically all the globular clusters are found in one hemisphere of the sky. The most remote cluster known is distant 67 kiloparsecs or 200,000 light years. We have to recognise that the "stellar system," dealt with in the researches described previously, is but a small star cloud in this greater galactic system. Roughly speaking those researches may be considered to relate to a domain of about 800 parsecs radius; the sun seems to be fairly centrally placed in the local star cloud (about 90 parsecs from the centre according to Charlier), but this is on the outskirts of a greater system whose centre is 20,000 parsecs away.

Spiral Nebulae.—The idea that there may exist "island universes" independent of and co-equal with our own galactic system of stars has appealed to many astronomers from time to time. If any known celestial objects deserve this name it must be the spiral nebulae, and after many vicissitudes this theory of their nature is now most favoured. It is natural to suppose that our flattened system of stars with the clusters and obscuring clouds of the Milky Way coiled round, would if seen from a distant point, look rather like a spiral nebula such as that shown in the plate, fig. 3 (M. 81, Ursa Major). The spiral nebulae show no tendency to crowd towards the galactic plane. Most of them have very large velocities of recession of the order 1,000 km. per sec., which seems to argue a lack of dynamical association with the galactic system. The great difficulty has been to know how far away we must place them. Rude estimates of distance based on the brightness of the novae which have sometimes been discovered in them suggested that they were extremely remote. On the other hand A. van Maanen believed he had measured comparatively large proper motions of points of the nebulae, which showed that they were not so remote as the globular clusters; but it was impossible to reconcile these results with any consistent scheme of mass and dimensions of the nebulae, and moreover the rotation shown by the supposed proper motions was in the opposite direction to that shown by the radial velocities. In 1924 E. P. Hubble discovered and observed a number of Cepheid variables in the great Andromeda nebula, and using these as a gauge, he deduced a distance of 300,000 parsecs (a million light years). Presumably the smaller spirals are still more remote. This seems to settle the question of distance and size of these nebulae. Accepting Hubble's result, the Andromeda nebula is still inferior in size to the galactic system of stars and globular clusters, but it is at any rate an object of comparable class, and is fairly entitled to be regarded as an island universe.

The theory of relativity suggests an explanation of the observed high receding velocities of the spirals. According to De Sitter's theory of a curved space-time remote objects would be expected to show a displacement of their spectral lines to the red, partly owing to a "slowing down of natural processes" in remote regions and partly owing to genuine receding velocities acquired under the cosmical repulsion which exists in a world of De Sitter's type. This explanation is, however, very much weakened by the fact that we know of two spirals (the Andromeda nebula being one of them) *approaching* with speeds of 300 and 260 km. per second.

Gaseous Nebulae.—Other classes of nebulae are comparatively near objects within the ordinary limits of the stellar system. The diffuse nebulae are of gaseous constitution or possibly a mixture of gaseous and meteoric matter. Since they occupy great tracts of space their densities must be extremely low, otherwise they would have large masses which would have conspicuous effect upon the distribution of stellar velocities. Besides the bright diffuse nebulae we recognise dark nebulae or obscuring patches, which cut off the light of the stars behind and cause apparently void regions in the sky. It is not always possible to tell whether a void region is due to one of these patches or is a genuine lacuna in stellar distribution, but there are many cases where the existence of dark nebulosity is undoubted. It is believed that bright and dark nebulae are of the same nature, the luminescence of the former being due to stimulation by the radiation from the stars present in them. Thus the Orion nebula is caused to shine by the numerous hot B type stars in that constellation; a similar nebulosity in Taurus is dark because there are no B type stars present. The connection of nebular light with stellar stimulation is well seen in Hubble's variable nebula; here there is one principal star which is a variable, and the nebula also varies. Owing to the low density and the effect of ultra-violet radiation from the stars the material of the bright nebulae is rather highly ionised; this probably accounts for the fact that most of the lines of the nebular spectrum are unidentified, the conditions being difficult to reproduce in the laboratory. Of the identified lines, hydrogen, helium, ionised helium and probably carbon are found.

Planetary nebulae are disk- or ring-shaped clouds which surround a single central star. The star is always found to be extremely rich in ultra-violet light, and is probably to be classed as type O. It is sometimes thought that this aureole consists of atoms expelled and sustained by radiation pressure; but on closer examination we find it difficult to see how radiation pressure can have much to do with the phenomenon. These nebulae are found by spectroscopic observation to be rotating, and there can be little doubt that rotation plays a fundamental part in the equilibrium. Fig. 1 on plate, due to W. H. Wright, shows a photograph of the Ring nebula in Lyra taken through a prism, so that monochromatic images are shown for each of the chief emission lines. It will be seen that the different wave-lengths give rings of different sizes, and the great difference of distribution is well shown by the bright images on the extreme left and right (both corresponding to unidentified spectral lines). This may be due either to actual differences in distribution of the gases giving these lines, or more probably to differences in the conditions of ionisation.

Calcium Cloud in Space.—In certain spectroscopic double stars the phenomenon of "fixed calcium lines" is observed. Whereas the other spectral lines shift to and fro as the star approaches and recedes in its orbit, the H and K lines of ionised calcium remain stationary. It is clear that somewhere between us and the star's photosphere there must be an absorbing cloud of calcium vapour which does not follow the star in its orbit. The phenomenon was first pointed out by Hartmann in 1994 for the star δ Orionis. Later Miss Heger discovered that the D lines of sodium also remain fixed in δ Orionis. The same behaviour has now been observed in a large number of stars, but no other "fixed" spectral lines have been found. The important question to decide is whether the cloud belongs to the double star or whether it is a continuous cloud filling interstellar space. J.S. Plaskett (26) has shown that the latter alternative is correct; the motion of the calcium cloud is often different from that of the centre of mass of the star. After removing the solar motion the velocity of the cloud relative to the mean of the stars is found to be small. Just as there are lines in the solar spectrum which do not share in the sun's rotation and are accordingly to be attributed to absorption during the passage of the light through the earth's atmosphere, so we have fixed lines of calcium and sodium which do not share in the orbital or individual motion of the star and are to be attributed to absorption in an interstellar "atmosphere." The fixed lines only appear in the spectra of the hottest stars, but that is perhaps due to the fact that cooler stars have strong H and K lines of their own, masking the lines of the cloud. It has been suggested that the presence of the hot star is necessary in order to ionise the calcium vapour and render it capable of absorbing H and K light, so that although the absorption is performed by the interstellar cloud only the parts of the cloud stimulated by the star are effective. But this explanation would not hold good for the D lines of sodium which are absorbed by un-ionised unexcited atoms. There can be little doubt that the absorption occurs equally along the whole track of the light through space, and the intensity of the lines should be an indication of the length of track, that is the distance of the star.

In order to avoid a huge mass of the stellar system inconsistent with the observed velocities of the stars, it must be postulated that this interstellar cloud is of very low density. About one atom per cubic centimetre is the maximum that can be allowed. It is calculated that matter so diffuse as this would take up a high temperature not much lower than the photospheric temperatures of the stars; although a black body in interstellar space would sink to a temperature of 3° absolute. The density is too small to give any appreciable scattering or absorption of light in space other than the special line-absorption of calcium and sodium.

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(A. S. E.)

ATHENS (*see* 2.831).—In spite of continual war between 1912 and 1922, Athens has progressed in every way since 1910. As the seat of government, it is also the focus of society, politics and trade. Its port, Piraeus, the best equipped and principal harbour of Greece, is the terminus of the railway and steamship lines, and the mart for all imports and exports. As new quarters have been laid out to accommodate the rapid growth of population, and the refugees from Asia Minor, Athens now extends all round the base of Mount Lycabettus. Outlying parts, such as Patēsia and Pangrati, have enormously increased, and suburbs such as Kēphisia, Marousi, Phalēron and Kallithea have much expanded.

New Discoveries.—Its museums make Athens an art centre of the first rank, and its monuments always provide fresh material for our knowledge of Hellenic culture. The constant study, which scholars of all nations devote to the Acropolis, takes practical shape in such work as the re-erection of fallen portions of the Erechtheum, Propylaea and Parthenon. Recent discoveries show that the Odeum of Pericles was a rectangular hypostyle building and not circular, as formerly supposed, and that the seats of the Theatre of Dionysus in its earliest form were in straight lines. An accident revealed two archaic sculptured bases built into a later wall, perhaps that of Themistocles, not far from the Dipylon. These, which still retain some of their original colouring, are sculptured with chariot groups and athletic scenes. In their freshness and simplicity they are charming examples of archaic Attic art.

So the excavation of the Agora, now planned by the Americans, may well lead to most important results. The area to be cleared, which is bounded on the west by the Temple of Hephaestus, on the east by the Horologium of Andronicus, and on the north by the Stoa of Attalus and the Library of Hadrian, is now covered by narrow streets and small houses, many of which date from Turkish times. When Greece became free, Ross, the first head of the Department of Antiquities, proposed that this should be reserved, and, when excavated, become a public park. Round the Agora were colonnades, the Stoa Basileios and the Painted Stoa which had frescoes of the battle of Marathon, the Temple of the Mother of the Gods and other shrines.

Public buildings here were the Bouleuterion, or Senate House, the Prytaneion, the centre of state hospitality, and the Tholos, or round building. Monuments and statues of all kinds, commemorating distinguished citizens or foreigners and great events, were erected among them, and also inscriptions with official records and accounts. The discovery of one of these buildings, with its art treasures and original documents, for Greek history would be an event of first-rate importance.

(A. J. B. W.)

ATHLETICS (*see* 2.846).—The London Olympiad of 1908 may well be regarded as marking the commencement of a fresh athletic era throughout the world. It is worthy of note that the United States, in pursuit of a progressive policy, has always at once included in the Amateur Athletic Union and Inter-Collegiate championship programmes any new event which might be added to the Olympic syllabus. The English Amateur Athletic Assn. (A.A.A.), on the other hand, for many years ignored such events as Throwing the Javelin, Discus and 56 lb. Weight and the Hop, Step and Jump, and allowed to fall into disuse, through lack of encouragement and competition, such excellent exercises as Pole Vaulting, Shot Putting and Hammer Throwing, and gave but little more attention to High and Long Jumping and Hurdling.

In 1910 the English Amateur Field Events Assn. (A.F.E.A.) was formed and authorised by the A.A.A. to hold championships. By 1914 the purpose of the A.F.E.A. had been fulfilled, for in that year the A.A.A. incorporated in its championship programme the Javelin, Discus, Hop, Step and Jump and the 440 Yards Low Hurdles, but even then these events were not taken as seriously as the others.

Fifth Olympiad.—Meanwhile the holding of the Fifth Olympiad (1912) had been allotted to Stockholm and the Swedes had recalled from America that great athletic coach, Ernie Hjertberg, to make ready a national team. Finland, also, had produced a great distance runner in Hannes Kolehmainen, and a set of magnificent heavy weight field events men, such as Saaristo, Taipale and Niklander, while France had come into prominence with Jean Bouin, a world's record holder, who was, however, beaten by Kolehmainen in both the 5,000 and 10,000 Metres races. Germany, too, gained prominence with Rau, the sprinter, and Braun, the middle distance runner.

It is significant that at the Stockholm Olympiad the United States finished first with a total of 85 points, Finland second with 29 points, Sweden third with 27 points and Great Britain fourth with 15 points. American athletes were again in the ascendant, but with their supremacy challenged by Finland and Sweden. Finland, Sweden, Norway and Denmark had now become definitely athletic countries, while France, Germany and the lesser European nations, such as Italy, Belgium and Holland, were all showing steady progress toward national athletic efficiency.

More International Matches.—About this time, too, the custom of holding international athletic matches became popular. Most notable of all these, perhaps, is the Scandinavian Landskamp, in which Norway, Sweden and Denmark meet annually at Oslo, Copenhagen and Stockholm in rotation. France, too, entered the international arena with matches with Sweden and Belgium, and Great Britain began to hold a triangular international in which England, Ireland and Scotland met annually. The other European nations in meeting each other contest practically the whole of the Olympic programme, whereas from England's match with France are excluded such important events as Javelin Throwing, Pole Vaulting and the Low Hurdles, and in the case of the British triangular international the Discus is also omitted. In any comparison of international prowess in field events it is only fair to note that neither Discus nor Javelin Throwing is practised at Oxford and Cambridge, and the Hammer Throwing event has been abandoned, while these events are regular features at all American and foreign schools, colleges and universities.

The War Period.—After Stockholm came the World War, which prevented the Sixth Olympiad, although a vast stadium had been built to house it at the Grunewald, Berlin. Many doubtless thought that in those strenuous years all sport must come to an end. This was not to be. Alva Kranzlein, the American sprinter-hurdler-jumper, had returned to Germany, the land of his forefathers, to make ready the German Olympic team, and in Germany or Holland he stayed throughout the War, laying the foundations of a great athletic future for those nations. He was probably the first person to discover, in the internment camp at Gravenhaag, Holland, the potentialities of H. F. V. Edward, the West Indian, who won so many A.A.A. championship titles.

In England championships were abandoned from 1914 to 1919. Athletic meetings of a sort continued to be held under an unofficial general amnesty, which allowed pure amateurs and those soldiers who had forfeited their amateur status to compete together. In Great Britain the London Athletic Club contrived to carry on the Public Schools Sports Meeting right through the War, thus assuring for Great Britain the nucleus of a fine supply of athletes of international standing when the days of war should be ended.

Education of Athletes.—Here, one may pause to draw attention to the splendid movement now in progress all over the world for the better athletic education of boys at school. In the United States the universities and colleges, as well as every school of any standing, have their properly qualified athletic coach. Inter-university, inter-collegiate and inter-school athletic meets are exceptionally popular, and the same may be said of the Scandinavian and many other European nations. France, in particular, has established a Ministry of Sport. In Scotland inter-scholastic championships have long been in vogue. In England the Public Schools Sports Meeting and also the Public Schools Relay Meeting, the latter under the auspices of the Achilles Club, are both established fixtures, and there is now an Inter-Schools Athletic Assn., which, for the first time, held championships in 1925. The Public School Athletic League of New York, organised in 1906, annually has between 7 and 8 thousand boys compete in its championships, all on one day. It is a usual thing to have between 2,500 and 3,000 boys compete in the indoor elementary championships each year. But in no country, save possibly the United States, is there to be found anything approaching the Swedish Schoolboys Athletic Week, held annually in Stockholm, to which city school teams journey from every part of Sweden.

The War Period Again.—To revert, however, to the War period. The United States, unaffected by the struggle in its early stages, and Sweden, Norway and Denmark, which countries maintained their neutrality throughout this time of strife, forged rapidly ahead. In 1915 at Cambridge, Mass., Norman S. Taber placed upon the books a new amateur mile world's record of 4 min. 12⅗ sec., which, at last, eclipsed the professional mile time of W. G. George, who, in 1866, covered the distance, in his match with W. Cummings at Lilly Bridge, in 4 min. 12¾ seconds. Taber's race was the forerunner of a great many record-breaking performances.

In 1916 at Evanston, U.S.A., R. I. Simpson brought the 120 Yards High Hurdles record down to 14⅗ sec., owing to certain modifications he made in the, then, accredited style of hurdling, and in 1920 a young Canadian, Earl Thomson, who had served in the Royal Air Force, still further reduced the record time to 14⅖ seconds. Two of the most noteworthy achievements of the War period were the performances accomplished in 1916 by J. E. Meredith (U.S.A.), who set up new world's records for the Quarter Mile, which he ran in 47⅖ sec., and the Half Mile run in 1 min. 52⅕ seconds. At Magdeburg in 1913, incidentally, A. R. Taipale (Finland) threw the Discus 158 ft. 11 inches. This performance is duly recognised in Scandinavia, but has never been passed by the International Amateur Athletic Federation; otherwise it would stand as the world's record.

Shortly after the signing of the Armistice a great Inter-Allied Military Athletic Meeting took place in the Pershing Stadium at Paris. Of signal importance at this time was the step taken by the authorities of the British services, who decided that the pre-War custom of rewarding athletic proficiency among soldiers and sailors by money prizes must forthwith cease. An inter-services meeting was held in 1919, at which some of Great Britain's Dominion soldiers, not yet demobilised, proved clearly that the Dominions themselves would hold a strong hand at the next celebration of the Olympic Games. It is interesting to note that even after the United States had entered the World War, the National A.A.U. championships were not abandoned, whereas, in Great Britain, no championship meetings took place between 1914 and 1919.

Peace Conditions Return.—In the year of the restoration of the A.A.A. championships the governing body again elected to omit certain of the field events from the programme; nor have they since insisted upon the inclusion of these events, which score, equally with the track events at the Olympic Games, in such important contests as the triangular international between England, Scotland and Ireland, the annual match between England and France, and the inter-county championships. The governing body in 1925 decided to abandon the English National Championships, after they had been held for only three years, and were just beginning to produce a really satisfactory crop of fine young English exponents of these field events. The A.A.A. championships are open to the whole world and hitherto Great Britain has always been outclassed at the A.A.A. championships proper in the majority of field events

In Great Britain the sterling post-War work of the Oxonians, A. N. S. Jackson and B. G. D. Rudd, coupled with the exertions of the Cambridge men, P. J. Baker, G. M. Butler, R. S. Woods and W. R. Seagrove, was responsible for inducing university athletes to take a healthy interest in open competitions generally, and championship meetings in particular, outside the limited scope of their own university Sports.

In 1919 the Inter-University Athletic Board of Great Britain and Ireland was constituted, comprising the universities and university colleges of Aberystwith, Bangor, Birmingham, Bristol, Cardiff, Durham, Leeds, Liverpool, Manchester, Nottingham and Sheffield; other universities have since joined the movement. At these provincial universities the whole of the Olympic events are practised, and year by year the records, especially in the field events, improve.

Seventh Olympiad.—It was decided to hold the Seventh Olympiad at Antwerp in 1920, partly as a tribute to the Belgian people for the part they had played in the War, but principally in order that the true Olympic cycle might not be interrupted. There was a great outcry that the war-worn nations were not yet sufficiently recovered to participate in such a festival. P. J. Baker, Cambridge University, was appointed captain of Great Britain's athletic team; the whole Olympic side came under the control of Brig.-Gen. R. J. Kentish, C.M.G., D.S.O., and the British team won golden opinions in Antwerp. Great Britain did better in actual competition at this Olympiad than she had ever done at any previous celebration of the Games. Notable victories were gained by A. G. Hill in the 800 and 1,500 Metres, by B. G. D. Rudd, the Oxonian, representing South Africa, who won the 400 Metres, and by Percy Hodge, who broke the world's record in the 3,000 Metres Steeplechase. The British team succeeded also on this occasion in winning the 1,600 Metres Relay Race.

At the conclusion of the Antwerp Games the United States was first, Finland second, Sweden third and the British Isles fourth, the same order as appertained at the conclusion of the Stockholm Games, but in the other positions there was a marked difference. France, for example, eighth at Stockholm, was now fifth, while Italy had moved up from the eleventh to the sixth place. America's strength lay in the sprints, hurdles, relay races and jumps. Finland gained honours across country, in the middle distance races and the throwing events. Sweden scored heavily through the magnificent team work of her men, and Italy came into prominence by the fine walking of Ugo Frigerio.

Further proof of the taste which the public was acquiring for international competition was exemplified immediately after the Games by the match between France, Sweden and the United States, which took place in Paris, and that even greater match at Queen's Club, London, between the United States and the British Empire. This match has evidently come to stay, since it was repeated in London in 1924, after the celebration of the Eighth Olympiad at Paris. In 1921 the International Amateur Athletic Federation held an important congress at Geneva. New rules for international competitions were passed and the Olympic programme at last standardised. The years that followed the Antwerp Olympiad were years of wonderful progress. This is conclusively proved by the existing world's records

Running.—In 1906 the 100 Yards record of 9⅗ sec. was established. This record was equalled in 1922 by the Canadian, C. Coaffee, while C. W. Paddock, U.S.A., has also, upon several occasions, covered the distance in that time. Paddock has also, in 1921 and 1924, run 220 yards in 20⅘ sec., thereby establishing himself as the greatest sprinter the world has ever seen. Taber's mile record, to which reference has already been made, was, in 1923, quite eclipsed by the Finnish phenomenon, P. Nurmi, who, in a race at Stockholm, beat the great Swede, Edvin Wide, in a mile race run in 4 min. 10⅖ seconds. From one mile up to 10 miles the records are about evenly divided between Nurmi and Alfred Shrubb. Earl Thomson still holds the palm among high hurdlers, but the 220 Yards Low Hurdles record of 23⅕ sec. was made by C. E. Brookins (U.S.A.) in 1923, and that of 53⅘ sec. for the 440 Yards Low Hurdles by F. H. Taylor in 1925.

Jumping.—In jumping the most marvellous improvements have been made. Old-time sportsmen still remember the amazement that was felt when, in 1876, M. J. Brooks of Oxford University accomplished a high jump of 6 ft. 2½ in., and again in 1893 when that other great Oxonian, C. B. Fry, created a world's long jump record of 23 ft. 6½ inches. The latter performance was totally eclipsed by the Irishman, P. J. O'Connor, who, in 1901, cleared 24 ft. 11¾ inches.

Credit for the subsequent improvement in jumping belongs to America. Taking the High Jump first, it must be remembered that in 1895 M. J. Sweeney (U.S.A.) cleared 6 ft. 5⅝ in., and that by 1921 an Englishman, B. Howard Baker, had cleared 6 ft. 5 inches. In the meantime, however, George Horine, a young undergraduate of Leland Stanford University, California, had evolved an entirely new method of jumping, styled the "western roll," by which, in 1912, he cleared the height of 6 ft. 7 inches. In 1914, however, Edward Beeson, another American, reached 6 ft. 7$\frac{5}{16}$ in., and even this has been exceeded by yet another American, H. M. Osborne, who, in 1925, jumped 6 ft. 8¼ in.; this was no fluke performance, for he has, time and again, gone within an ace of beating even this stupendous record.

From the beginning of the present century, when O'Connor set the world's Long Jump record at a quarter of an inch short of 25 ft., it was a fruitful source of discussion as to whether such a jump could be made again and even 25 ft. possibly be beaten. At Stockholm in 1912 Albert Gutterson (U.S.A.) only just failed to reach O'Connor's mark, his actual jump measuring 24 ft. 11⅕ inches. Early in 1920 the United States began to produce a crop of most amazing negro jumpers. Sol Butler is said to have beaten 25 ft., but the record never went on the books. In 1921, however, E. O. Gourdin, Harvard University, actually jumped 25 ft. 3 inches. Shortly after this, yet another negro, de Hart Hubbard, repeatedly beat 25 ft. and in exhibitions cleared 25 ft. 4 in.; being exhibitions, however, these jumps did not stand as records. At the Paris Olympiad de Hart Hubbard pulled a muscle and, although winning the competition at 24 ft. 5$\frac{5}{16}$ in., was far below his best form, and it was left to R. Legendre, a white American, who was competing in the Pentathlon, to carry the world's record on to 25 ft. 5⅝ inches. Since then de Hart Hubbard has attained his ambition by clearing 25 ft. 10⅞ inches.

For many years it was believed impossible that a pole vaulter would ever beat 13 feet. At Antwerp in 1920, however, F. Foss (U.S.A.) accomplished 13 ft. 5 in. in a downpour of rain, and in 1922 Charles Hoff, of Norway, at Copenhagen cleared 13 ft. 6 inches. Again at Copenhagen, a year later, the same athlete cleared 13 ft. 9¾ inches. It was confidently anticipated that Hoff would beat 14 ft. at the Paris Games, but just prior to the Olympiad of 1924 he broke his ankle and so could not compete. In 1924 it was reported that R. E. Spearrow (U.S.A.) had, at Tokio, cleared the amazing height of 13 ft. 10½ inches. This record has not yet been accepted, but at Abo in 1925 Hoff, the Norwegian champion, actually cleared 13 ft. $11\frac{13}{16}$ inches.

It is significant that nations that have hitherto been considered non-athletically disposed, such as the South American peoples and the Japanese, are really taking seriously to sport, At the Olympic Games at Paris in 1924, for instance, when A. W. Winter, New Zealand, set up a new world's Hop, Step and Jump record of 50 ft. $11\frac{3}{16}$ in., L. Bruneto, of Argentina, was second at 50 ft. 7¼ in., which easily beat the previous Olympic record, while M. Oda, Japan, was sixth at 46 ft. 9 inches.

Weight Putting.—The world's record for Putting the 16 lb. Shot has stood at 51 ft. to the credit of Ralph Rose (U.S.A.), since 1909, but has since been closely approached, both by other Americans and by Finnish and Swedish men. The record of 189 ft. 6½ in. for Throwing the 16 lb. Hammer was created in 1913 by P. Ryan (U.S.A.) and has never since been seriously challenged. It is interesting to note, however, that the Javelin Throwing record which, in 1908, stood to the credit of E. V. Lemming, Sweden, at 179 ft. 10½ in., was raised to 216 ft. 10⅜ in. by J. Myrra, Finland, in 1919, and again eclipsed, with a throw of 218 ft. 7¼ in., by H. Lindstrom, Sweden, in 1924; this thrower has since done 221 ft., which record has not, however, been accepted by the International Amateur Athletic Federation. Still more interesting is it to note that, in 1924, the British thrower, J. Dalrymple, accomplished 186 ft. 5 in., while a number of Americans have exceeded 200 ft. and the Frenchman, Degland, has beaten 190 feet. From 1912 until 1925, the world's official Discus Throwing record of 156 ft. 1⅜ in. was held by J. Duncan (U.S.A.). In Sept. 1924 Thomas J. Lieb (U.S.A.) broke this record with a throw of 156 ft. 2½ inches. Clarence "Bud" Houser (U.S.A.), the Olympic shot and discus champion, has bettered 158 ft. twice in 1925. This performance was closely approached upon several occasions by the two Finnish throwers, Taipale and Niittymaa, and has been eclipsed by Glenn Hartranft (U.S.A.), who, on May 2 1925, reached 157 ft. 1⅝ inches.

Marathon Running.—Marathon running, at the official distance of 26 m. 385 yd., is an event competed for but once or twice annually in any country, by reason of the strain imposed upon the runners. But here again a great improvement has taken place during the decade 1915–25. In 1908 Dorando Pietri, the little Italian waiter, ran from Windsor to London in 2 hr. 54 min. 46⅖ seconds. At Stockholm in 1912 the course was only about 25 m. and the time taken by the winner, K. K. McArthur, South Africa, was 2 hr. 36 min. 54⅘ seconds. At Antwerp, however, the full course was covered and the race won by H. Kolehmainen, Finland, in 2 hr., 32 min. 35⅘ seconds. In 1924 numerous Olympic trials were held in the United States and one of these was won by Clarence de Mar, in what must be considered world's record time of 2 hr. 29 min. 40⅕ seconds. The actual Paris Marathon was won by A. O. Stenroos of Finland in 2 hr. 41 min. 22⅗ sec., R. Bertini, Italy, being second, and Clarence de Mar, United States, third.

Cross Country—It has been said that the home of cross country running is England and to this form of recreation the country owes the long-continued successes of so many of her men in the middle distances upon the track. Englishmen have, however, to-day found serious rivals in this branch of sport in the French teams that annually visit the country, in the Finns who have always beaten them at the Olympic Games, and also in the United States, where the cult of cross-country running has obtained a firm hold. Switzerland, too, is becoming a recognised force in international competition. At the Paris Olympiad in 1924 J. Imbach for a brief space held a new world's 400 Metres record, while P. Martin, Switzerland, finished second to D. G. A. Lowe, Great Britain, in the 800 Metres, and W. Scharer, Switzerland, was second to P. Nurmi, Finland, in the 1,500 Metres.

Walking.—Walking is a sport which has had a certain vogue in Great Britain, America and Canada, but which is more enthusiastically practised in Italy than elsewhere. The great days of walking in England were those in which G. E. Larner, a Brighton policeman, and G. J. Webb, who had been both sailor and soldier, were completely unbeatable at the 1908 Olympiad, in which they took first places in both the 3,500 Metres and the 10 Miles walking events. Before the Stockholm Olympiad, Larner had retired and it fell to Webb to uphold England's honour at 10,000 Metres, the only walk included in the programme. Webb, however, was beaten by G. H. Goulding of Canada, but finished ahead of E. L. Altimani, of Italy. At Antwerp in 1920 the Britishers were completely outclassed by Ugo Frigerio, who won both the 3,000 and 10,000 Metres events, and also by the two men from the dominions, G. L. Parker (Australia) and C. C. McMaster (South Africa), as well as by the two Americans, R. F. Remer and J. B. Pearman. At Paris, in 1924, England again suffered defeat, Frigerio finishing first in the 10,000 Metres Walk, followed by G. R. Goodwin (Great Britain), C. C. McMaster (South Africa) and his fellow Italian, D. Pavesi. The world's walking records are as follows: G. E. Larner (Great Britain), 2 to 6 Miles and 8 and 9 Miles, and G. H. Goulding (Canada), Half Mile, 1 Mile and 7 Miles. All other records from 11 to 25 m. are held by British walkers.

At the Eighth Olympiad held in Paris in 1924, at which nearly 2,000 athletes representing 45 different nations took part in the track and field events, the United States, in 27 events, scored 12 first places, made 5 of the 9 new world's records and established 2 of the 5 new Olympic records, while one of the two marks, equalling previous Olympic records, was also established by an American. Of the other countries Finland scored 9 first places, Great Britain 3, New Zealand 1 and Italy 1.

Athletics in Great Britain.—In America, Scandinavia, on the European continent and even among the coloured races of the world, athletic progress of an amazing kind is taking place from year to year, but up to 1925 it seemed certain that Great Britain must fall so far behind as to be at last forced to abandon the struggle altogether. The difficulty, however, was overcome when it was realised that hitherto British athletic sport had been too individualistic to appeal to the British sporting spirit. The decentralisation of authority was decided upon and county amateur athletic associations began to come into being throughout the country.

The essence of the county administrative scheme is found in the internal management of the sport by counties within their own areas, inter-county contests being an essential adjunct to the movement. At present Bedfordshire, which county held matches in 1925 with the London Athletic Club and the University of London A.C., has probably achieved the most signal progress. In this connection it may be stated that England has for years past been divided into northern, midland and southern areas for administrative purposes, and that the furtherance of the county scheme lies at present entirely in the hands of the south, a circumstance strongly resented by the northern and midland districts.

In 1925 the first English Inter-County Relay and Team Athletic Championship, for the trophy presented by the Achilles Club, was held at Stamford Bridge, London; and Middlesex proved the winner. The position, however, was an entirely unsatisfactory one. The fatal policy of booming certain events at the expense of others was once again fully in evidence, such events as Hammer, Discus and Javelin Throwing, the Pole Vault, Hop, Step and Jump, and the 440 Yards Low Hurdles being excluded from the programme. The result was that Bedfordshire, exceptionally strong in the field events and hurdles and several other counties refused to take part in championships which were not considered fully representative of English athletic sport. A pronouncement was made subsequently that the championship programme would not be in any way augmented in 1926. Consequently the midland counties, comprising Bedfordshire, Gloucestershire, Leicestershire, Shropshire and Staffordshire, for the time being, abandoned all thought of taking part in the inter-county championships. The north also, although possibly from different motives, refused to have anything to do with the county scheme. In deference to the views of the counties, however, it was finally agreed to include Pole Vault and

Throwing the Discus, but this still leaves Hammer and Javelin Throwing outside the scheme.

The essential fact is that, up to 1906, the Amateur Athletic Assn., which is the governing body of the sport in England, has been unable to establish any liaison with the English Public Schools, which should prove the great recruiting ground for future Olympic Teams. On the other hand, the counties, by reason of their more personal local contact, have in one year begun to till this field, as is witnessed by the number of schoolboys who gained their county athletic colours during 1925, and the far greater number of school authorities who sought the advice and assistance for coaching schools for the annual sports, of old champions and other experts.

Women as Athletes.—One aspect of international athletics still remains. It is the surprising degree of efficiency which women are attaining in this particular phase of sport. Long before the War women's colleges in the United States recognised and practised track and field athletics keenly and also kept records; but it was only during, and to a greater extent since, the War that British, French, Czechoslovakian and Belgian girl athletes took up athletics seriously.

Mrs. Sophie Eliott-Lynn, whose sporting record ranges from big game hunting to aviation, and Mrs. V. Cambridge, have been the prime movers in Great Britain and their efforts have been ably seconded by Messrs. Lyons' Ladies' A.C., the London Olympiades and the Middlesex Ladies' Athletic Club. It may be said, indeed, that the women's athletic movement started in England and has spread outwards. As was natural, the records remained chiefly in the hands of English girls during the first years following upon the inception of the scheme. Championships, international matches and a great international festival, akin to the men's Olympic Games, are now held annually; performances are improving and records being broken week by week. In 1924 a team of Czechoslovakian girls met and was defeated by an English team. In 1925 the interest of this international match was greatly enhanced by the arrival in London of a team of Canadian girls.

Before the triangular international meeting in 1925 between Great Britain, Canada and Czechoslovakia the world's records stood as follows: 100 Yards, Rose Thompson (England) 11⅖ sec.; 250 Metres, E. Edwards (England) 34 sec.; 100 Yards Hurdles, G. Sabie and F. Batson (America) 14⅖ sec.; 440 Yards, V. Palmer (England) 61⅖ sec.; 880 Yards, M. Lines and E. Trickey (England) 2 min. 26⅗ seconds.

Records in the throwing events represent the best right and left hand throws added together and are as follows: Putting the 8 lb. Shot, V. Morris (France) 68 ft. 11 in.; Throwing the Javelin, Mlle. Vidlakova (Czechoslovakia) 161 ft. 2½ in.; Throwing the 3½ lb. Discus (best hand only), V. Morris (France) 98 ft.; High Jump, Phyllis Green (England) 5 ft.; Long Jump, Mlle. Mejzlikova (Czechoslovakia) 17 ft. 4½ inches.

At the women's international held at Stamford Bridge, London, on Aug. 1 1925, Miss E. Trickey (England) set up a new half mile women's world record of 2 min. 24 sec., while Miss V. Palmer, also of the English team, beat the world's record in the 250 Metres, which distance she ran in 33⅘ seconds.

This movement, which was almost purely British in its original conception, is now gaining a true international vogue, and, towards the end of 1925, a team of British girl athletes journeyed to Scandinavia for the purpose of assisting at the inauguration of a Swedish Women's Amateur Athletic Assn. and also took part in an international meeting at Stockholm. (*See* OLYMPIC GAMES.)

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(F. A. M. W.)

ATLANTA, Ga., U.S.A. (*see* 2.853), the commercial capital of the southeast, had a population of 200,616 in 1920, an increase of 29·6% over 1910, of whom 62,796 were negroes and 4,738 foreign born; in 1925 (local estimate) it was 253,783. Its area was increased from 17·3 sq. m. in 1910 to 31·6 sq. m. in 1924. The value of its manufactured products was $33,083,000 in 1909; $113,992,000 in 1919; $122,284,262 in 1923. Leading industries within the corporate limits (1923) were printing and publishing, and the making of confectionery and ice cream, mattresses and bed springs, furniture, lumber and planing-mill products. Cotton-mills, fertiliser plants and numerous other industries were located near the city. Hydro electric power to the amount of 236,936,695 kilowatt hours was used in 1923. A steam heating plant, serving the central part of the business district through underground mains, evaporated 315,000,000 lb. of water in 1924.

Atlanta has easily kept its position as the principal distributing point and financial centre of the southeast. The seat of a Federal Reserve Bank, it ranked 16th in bank clearings in 1924 ($2,895,571,945) and 21st in postal receipts ($3,408,368). In 1925 an average of 400 cars of merchandise and package freight left the city daily. By 1925 large hotels and sky-scraper office buildings gave it a metropolitan appearance. The streets were overcrowded, and projects for widening some of them were under consideration. A city-planning commission, established in 1920, secured the adoption of a zoning ordinance in 1922. In 1921–2 a comprehensive survey of the public-school system was made, and plans were mapped out to meet anticipated needs as far ahead as 1940. Emory University, founded in 1914, and Oglethorpe University, originally located at Midway, but destroyed during the Civil War, and re-opened at Atlanta in 1916, are notable additions to the surrounding circle of educational institutions. On Stone Mountain, 16 m. east of Atlanta, a magnificent memorial to the Southern Confederacy was under construction in 1926. When completed a procession of over 700 gigantic figures carved in the bare granite will sweep across the precipitous mountain side for 1,300 feet. Under the central group will be quarried out a vast memorial hall, to serve as a depositary for records and relics of the Confederacy.

ATLANTIC CITY, N.J., U.S.A. (*see* 2.855).—Growing slowly in permanent population and the normal occupations of an American city, Atlantic City continues to develop its unique position as an all-the-year-round playground for the nation and a favourite meeting-place for conventions. The permanent population in 1920 was 50,707, of whom 10,946 were negroes and 7,009 foreign born; in 1925, according to the estimate of the census bureau, it was 53,287. This is increased to 300,000 in Aug. and it is estimated that there are 15,000,000 visitors in the course of a year. In 1925 there were about 1,000 hotels. The Atlantic City airport, dedicated in May 1919, was the first in the world. During the summer there is an aeroplane passenger service to New York. The Boardwalk, built of steel and concrete with a board flooring, 60 ft. wide in the central portion and extending 8 m. along the ocean front, is connected with six great recreation piers reaching out over the ocean for 1,000–2,500 ft. and lined with sumptuous hotels, shops and places of diversified amusement. The city issued bonds to the amount of $1,734,000 in 1924 for the purchase of a Convention Hall site bordering on the Boardwalk. In 1912 the commission form of government was adopted.

ATMOSPHERIC ELECTRICITY (*see* 2.860).—Our knowledge of atmospheric electricity at the earth's surface depends on data from comparatively few stations. Of the air we have only scanty information from balloon observations. Thus any mean results put forward are exposed to much uncertainty. In the article in vol. ii., page 864, 125 volts per metre was accepted as a mean value $\overline{P}$ of the potential gradient at ground level. This implies the presence on the ground of a negative charge whose surface density Σ in electrostatic units (E.S.*v.*) is given by

$$-4\pi\sigma=\overline{P}=1\cdot25/300=0\cdot0041\dot{6}$$

Taking the earth as a sphere of radius 64×10^7 cm., its entire negative charge is $-0\cdot0041\dot{6} \times 4 \times 10^{17}$ E.S.*v.* or -56×10^4 coulombs. The inference drawn (2.867) from the rapid fall in the potential gradient with increased height above the ground shown in balloon ascents was that an equal positive charge exists in the atmosphere, most of it in the lowest 4 kilometres. The charge at any spot on the earth is undergoing constant change. A vertical air-earth current is continually passing. This has been observed at only a few stations, and at most of them only during fine weather, and at one or two hours of the day.

From these observations it has been inferred that the fine-weather current is directed downward, and averages about 2 10^{-16} amp. per cm^2. Under a uniform current of this magnitude, the earth would receive in one second about 1,030 coulombs of positive electricity, and its entire negative charge, if unreplenished, would disappear in about nine minutes.

A limited area on the earth may experience uninterrupted fine weather for weeks, and if it were an electricity tight unit, we should assume that it also received a liberal allowance of some very penetrating radiation which ordinary instruments do not record. We know, however, that the earth is a conductor. Thus the phenomena might be accounted for if regions experiencing bad weather (during which potential gradient is often negative) received an excess of negative electricity. During bad weather, electricity passes between the air and the earth in at least three ways. There is an air-earth current, carried as in fine weather by ions; there is electricity brought down by rain or snow and there is lightning. Our information as to these supplies will be discussed presently.

Besides the large rapid changes of local earth charge, associated with rain and lightning and the passing overhead of charged clouds, there are slower regular changes depending on the time of day and the season of the year. In Britain, potential gradient is higher in the evening than in the early morning, and higher in winter than in summer. If this held good everywhere, the charge on the earth as a whole might remain invariable (fine weather and bad weather effects balancing out), electricity passing between areas in which it is early morning and areas in which it is evening, and between areas where it is summer and areas where it is winter. But doubts are entertained as to whether the phenomena in the southern and northern hemispheres are complementary, a maximum potential gradient having been observed in summer in some southern stations. The view has also been put forward that the diurnal variation at sea, of which our observational knowledge is very scanty, is mainly dependent on universal, not local time. Again results from some stations have been supposed to show an increase in potential gradient with increasing sun-spot frequency. If these conclusions are correct, the charge on the earth as a whole would seem to have a diurnal, a seasonal and an 11-year period.

A knowledge of the mean value of the potential gradient, therefore, is of fundamental importance, and here a serious difficulty at once presents itself. The earth's surface is not in general, an unbroken level plain. In the hollows or in the immediate neighbourhood of trees, the potential gradient is inevitably lower than elsewhere. The surface charge is not uniformly distributed. There is more of it on ridges than in hollows, and it exists on tree tops rather than on the ground underneath. But over an area of many square miles, under normal conditions, the charge should be at least approximately the same as if the surface were flat. What we really require to know is the potential gradient over a flat area making as close an approach as possible to an infinite plane. Also the potential must be measured in such a way that the presence of apparatus and observer is without effect. A suitable spot is hard to find near many stations, and the factor for reducing observed values to the infinite plane is seldom a quantity wholly above suspicion. In the case of many of the older data, no factor was applied, and the results are only of relative value. A factor is known to have been applied in the case of the following selection of more recent values of potential gradient P:—

TABLE I.—*Mean Potential Gradient for the Year*

Station	Latitude	Period	P (volts per metre)
Eskdalemuir . .	55° N.	1912–22	256
Potsdam . . .	52° N.	1904–23	203
Kew	51° N.	1913–23	333
Davos . . .	47° N.	1909–10	64
Tortosa . . .	41° N.	1911–23	108
Samoa . . .	14° S.	1913–8	115
Cape Evans . .	78° S.	1911–2	87

The above value for Potsdam is lower, and that for Kew higher than the older values given in 2.861 and 862. This is mainly, if not wholly, due to a revision of the reduction factors. The exceptionally low value at Davos, it is suspected, may arise partly from the position of the site of the absolute observations in a narrow valley. But, as a rule, we should expect imperfections in the site or in the method adopted to lead to too low a factor, and so to an underestimate of potential gradient. On the other hand, potential gradient data are mostly from fine weather days. An attempt to estimate the effect of this restriction at Kew was made for 1922. On the average day, means from the whole 24 hours and from the four hours 3h., 9h., 15h. and 21h., are closely alike. The electrograms were measured at these four hours on all days of complete trace, and the means so obtained were as follows: all days 271 volts per metre, occasions free from negative potential 293 volts per metre. The corresponding all day mean from selected fine days was 318 volts per metre.

This suggests a reduction of some 15% if mean annual values at Kew were derived from all days instead of from selected fine days. At Kew during 1923, a fairly normal year, negative potential was recorded on 190 days, but its longest duration on any one day was 12·5 hours, and its total duration for the year only about 350 hours. Potential gradient seldom remains continuously negative for long. During rainfall, alternations of sign often occur, and during thunderstorms they are too large and rapid for the ordinary apparatus to follow accurately. Thus disturbed weather results are affected by considerable uncertainties.

There are other sources of uncertainty. Few observatories are in sparsely peopled areas. Many are in or near large towns, where the atmospheric conditions suffer from by-products of civilisation, which unfortunately influence atmospheric electricity. The breaking up of water, whether by natural or artificial means, leads to a separation of electricity. Condensed steam usually carries a positive charge, and steam trains may exert a considerable influence on potential gradient. But there is another more widely spread influence, atmospheric pollution mainly due to smoke. In a smoky atmosphere (for example in Dublin, where special observations have been taken) light, mobile ions diminish, and heavy, slow-moving ions largely increase in number. The conductivity of the air tends to fall, and the potential gradient to rise. The practice at Kew Observatory is to derive mean values and diurnal inequalities of potential gradient from 10 selected fine weather days a month. The 10 selected days of each month of the two years 1921 and 1922 were divided into a more dirty 5 and a less dirty 5. The mean amount of pollution in the atmosphere, as measured by the Owens pollution recorder, and the mean potential gradient, were calculated from the two groups of days separately, for the year as a whole, summer (May to Aug.) and winter (Nov. to Feb). Table II. gives the results, the pollution being in milligrammes per cubic metre and the potential gradient in volts per metre.

TABLE II.—*Potential Gradient on Days of Greater and Less Atmospheric Pollution*

Class of Days	Year		Summer		Winter	
	Pollut.	Potent.	Pollut.	Potent.	Pollut.	Potent.
More dirty .	0·491	343	0·252	201	0·726	486
Less dirty .	0·254	252	0·139	161	0·331	319
Ideal (clean)	. .	155	. .	112	. .	179

The results for the ideal clean day were calculated on the hypothesis that the increase of potential gradient due to pollution varies directly as the amount measured by the Owens recorder. The atmospheric conditions which promote air pollution at Kew, would possibly lead to enhanced values of potential gradient even if the atmosphere were pure. But it is hardly open to doubt that pollution has a direct effect. In 1921 when a prolonged coal strike led to an exceptionally clear atmosphere in England for several months, the mean value of the potential gradient at Kew was the lowest recorded for many years, being only 281 volts per metre, as against 315 volts per metre in 1920. and 318 volts per metre in 1922.

Sunspot influence, such as is prominent in the diurnal range of the magnetic elements, has been supposed by some to apply to the mean annual value as well as to the diurnal range of the potential gradient. A priori the result is probable enough, in view of the increased conductivity of the upper atmosphere which auroral and magnetic phenomena suggest at sunspot maximum. The normal way of investigating the existence of a sunspot influence on the mean yearly value Q of any quantity, is to apply Wolf's formula

$$Q=a+bS,$$

where S is the sunspot frequency, or area, and a, and b constants, to be determined from the observed values of Q by least squares. a is the value of Q when S vanishes, as it nearly does at sunspot minimum; b is positive or negative according as Q is greatest or least at sunspot maximum. In the average 11-year period the extreme value of S approaches 100; thus 100 b/a is a convenient measure of the importance of the sunspot influence. Any haphazard collection of figures will naturally give a finite value for b. To determine whether the sunspot influence is real or imaginary, we consider the size of the correlation coefficient r (regarded here as an essentially positive quantity, the sign of the correlation being shown by b). For perfect correlation r is unity, and unless r is a substantial fraction the correlation is unlikely to be real. Table III. gives some data obtained for recent periods of years.

The only case in Table III. where r is as large as is usual in the case of the magnetic daily range, is that of the mean yearly value at Eskdalemuir. The values of 100 b/a are all small compared with those encountered in Terrestrial Magnetism, (*q.v.*). On the whole, the results for 1911–21 at the three stations favour a small 11-year variation in the mean annual value of potential gradient, with a maximum at sunspot maximum and a fourth station, Tortosa, not included in Table III. also favours this view. The small values generally obtained for r throw, however, doubt on the reality of the sunspot influence. If it is real and universal, as in the case of magnetism, it is clear from the Potsdam results that it may be masked at individual stations by other causes. The verdict perhaps most in accordance with the facts is "not proven."

2.861 contained a good many data for the annual variation of the potential gradient. Table IV. gives some more recent data in absolute measure. Under W/S is given the ratio bourne by the mean value of the four winter months (Nov. to Feb. in the Northern Hemisphere, May to Aug. in the Southern Hemisphere) to the mean value of the four summer months.

All the five stations in the Northern Hemisphere show the maximum in winter, the minimum in summer. This is equally true of older data from these and a number of other northern stations. But the opposite phenomenon, according to B. Chauveau, has presented itself at one exceptionally high level station in France (Pic du Midi, 2,860 metres); though this is strongly opposed by the results at Davos, the phenomena on mountain summits want further investigation. For the Southern Hemisphere, results are conflicting. Only one year's data are available for Buenos Aires, but unless it was an altogether exceptional year, winter is clearly the period of maximum. At Samoa, earlier data from 1906–8 placed the maximum clearly in winter, but these are now under suspicion. The Samoa data in Table IV. though derived from 6 years, depend really on only 40 months, there being many breaks in the record. The annual variation they suggest is very trifling and uncertain, a result not improbable in itself in view of the low latitude. The observer at Cape Evans, Dr. G. C. Simpson, pointed out that the maximum appears in summer in all the observations taken in high southern latitudes, including Hut Point (78° south), Belgica Station (71° south), Port Charcot (65° south) and Petermann I. (65° south), and expressed the opinion that "the potential gradient in the Antarctic is higher in the summer than in the winter." Some authorities have gone further, claiming that a maximum in summer is characteristic of the whole Southern Hemisphere. This seems, however, to be supported by results from only two stations outside the Antarctic, viz.: Cape Horn and Batavia. The observations at Cape Horn were of very limited duration, and at Batavia results for different periods, from different levels, appear about as conflicting as at Samoa. Older observations at Melbourne agree with those at Buenos Aires in placing the maximum in winter.

The conclusion that the seasons influence the potential gradient in different directions in the two hemispheres, the maximum appearing in both near northern mid-winter, cannot be accepted as proved on existing evidence. It is a question obviously of fundamental importance.

The diurnal variation of potential gradient at a number of stations is considered in detail in recent works by Chauveau and Mathias. The former, who has made a special study of the subject, thinks that the normal type of the diurnal variation makes a close approach to a single 24-hour wave, the maximum appearing in the evening, the minimum in the early morning. The double oscillation generally encountered, with minima in the early morning and early afternoon, he regards as largely the product of local disturbing causes, such as atmospheric pollution, trees, heating of the ground by the sun. The expediency of reserving judgment will appear on considering figs. 1 and 2. Results for Kew (1913–23) and Eskdalemuir (1912–22) appear side by side in fig. 1. Winter includes the four months Nov. to Feb., summer the four months May to August. The heavy horizontal lines answer to the mean values for winter, the whole year and summer. The Eskdalemuir winter curve suggests Chauveau's ideal station. Its afternoon minimum and forenoon maximum are inconspicuous as compared with those at Kew. But the Eskdalemuir summer curve is of quite a different type. The morning minimum is hardly represented, and the afternoon minimum is more prominent even than the Kew one. Eskdalemuir is in an upland valley with pure air and few trees. Fig. 2 illustrates the effects of atmospheric pollution in an actual case. The curves show the diurnal variations for the year as a whole of potential gradient and atmospheric pollution at Kew. They are based on the two groups of more dirty and less dirty days of the two years 1921 and 1922, already described. The unbroken lines refer to the more dirty, the broken lines to the less dirty days. The line oo represents zero potential and zero pollution. The

TABLE III.—*Values of Constants in Wolf's Formula*

Nature of Q	Station	Period	a	b	100 b/a	r
			v/m	v/m		
Mean value of potential gradient	Potsdam	1904–23	211	−0·216	−0·102	·34
	Kew	1904–23	309	+0·303	+0·098	·37
	Eskdalemuir	1911–21	236	+0·440	+0·186	·83
Range diurnal inequality for year	Potsdam	1911–21	205	−0·143	−0·069	·46
	Kew	1911–21	312	+0·444	+0·142	·56
	Eskdalemuir	1912–21	110	+0·115	+0·105	·25
	Kew	1911–21	152	−0·114	−0·075	·23

TABLE IV.—*Annual Variation of the Potential Gradient (volts per metre)*

Station	Period	Jan.	Feb.	Mar.	April	May	June	July	Aug.	Sept.	Oct.	Nov.	Dec.	Mean	W/S.
Eskdalemuir	1912–22	323	338	271	234	200	177	183	199	234	268	328	320	256	1·72
Potsdam	1904–23	278	270	218	186	166	151	151	154	169	190	226	272	203	1·68
Kew	1913–23	482	438	405	354	272	200	196	201	249	321	426	454	333	2·07
Davos	1908–10	93	101	82	71	51	33	42	47	45	49	67	87	64	2·01
Tortosa	1918–23	133	96	112	91	92	80	84	93	92	100	112	116	102	1·31
Samoa	1913–8	118	121	113	106	105	117	118	125	115	103	117	119	115	0·98
Buenos Aires	1911–2	96	57	59	138	154	149	174	153	165	116	147	102	126	1·57
Cape Evans	1911–2	96	89	75	79	67	80	85	78	105	90	88	107	87	0·82

scales were so chosen that the horizontal lines representing the mean values for the more dirty group of days (viz., 343 v/m and 0.490 milligrams/metre ^{3}) come at the same level. The mean values for the less dirty group (252 v/m and 0.252 milligrams/metre ^{3}) are also shewn by horizontal lines. With increased pollution there goes increased potential, and the diurnal variations of the two elements are of very similar type. But while the afternoon maximum and minimum of pollution become relatively less important as pollution diminishes, this is not true of potential gradient.

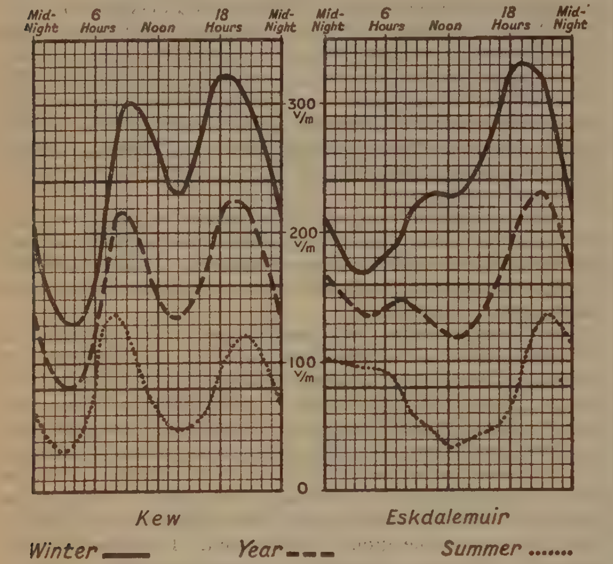


FIG. 1.—Graph comparing the Diurnal Variation of Potential Gradient at Kew and Eskdalemuir.

The electricity brought down by rain or snow has been measured by the following amongst others: G. C. Simpson (Simla 1908–9), K. Kähler (Potsdam 1908), Schindelhauer (Potsdam 1909–11), A. Baldit (Puy-en-Velay 1910–11), McClelland and Nolan (Dublin 1911–2). Simpson obtained a complete record during the rainy seasons of two years. Kähler and Schindelhauer had also continuous records. These three observers measured the results of two-minute falls. Baldit took 15-second falls, but his observations being taken by eye, are in one way less complete, while giving more minute details of individual cases. On some occasions, as observed at Dublin, the charge brought down by rain, especially by fine rain, may be of one sign for a considerable time. But in general, there are frequent changes of sign and continual changes of intensity. Thus even short intervals of time tend to give too low maximum rates. In Table V., A denotes the ratio of the duration of positively charged rain to the duration of negative, B the ratio of the total quantity of rain charged + to the total quantity charged −, C the ratio of the total positive charge brought down by rain to the total negative, D is the excess of positive over negative charge calculated for a total rainfall of 100 centimetres.

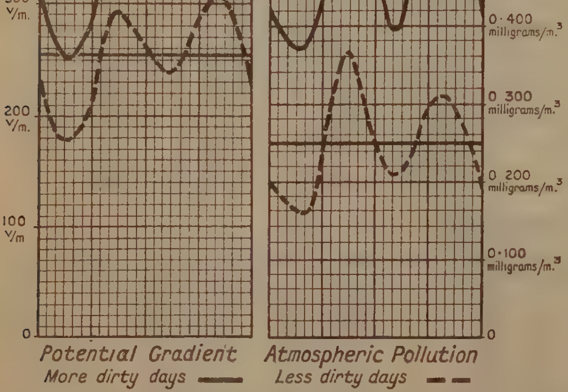


FIG. 2.—Graph illustrating the diurnal variations of potential Gradient and Atmospheric Pollution for a Year, at Kew.

TABLE V.—*Rainfall Electricity Data*

Place	Period	Kind of Rain	A	B	C	D(E. S.U.)
Simla	1908–9	all	2·5	...	3·2	17·5
Potsdam	1908	"	...	..	..	5·6
"	1909–11	"	2·2	..	1·4	2·8
Dublin	1911–12	"	3·1	4·8	..	..
Puy-en-Velay	1911	"	2·9	..	1·4	..
"	1911	ordinary	5·3	4·3	2·3	..
"	1911	storms	1·7	1·5	1·2	..
"	1911	squalls	1·1	1·2	1·1	..

At Dublin, little if any of the rain that fell was accompanied by thunder. The observers at Potsdam and Puy-en-Velay drew a distinction between ordinary rain, with which they found a marked excess of positive charge, and thunderstorm or squall rain for which the excess of positive was trifling. Much of the rain at Simla was storm rain, and it was generally heavier than elsewhere, but it gave as marked an excess of positive as did ordinary rain. All the observers found the charge per cm^3 of rain to be greatest in the lightest rains. In one 15-second fall at Puy-en-Velay, the charge per cm^3 was -43.6 E.S.U. This formed part of a 5-minute fall for which as a whole the charge per cm^3 was -37.7 E.S.U. Negative charges exceeding 40 E.S.U. per cm^3 were observed at Potsdam on one or two occasions. The greatest positive charge per cm^3 observed was $+26.7$ E.S.U. at Puy-en-Velay.

While the charge per cm^3 tended to be greatest in light rains, the quantities of rain then occurring were so trifling that the largest vertical currents due to rain occurred during the heavy storm rain. At Puy-en-Velay, currents were measured of $-1{\cdot}10\times10^{-12}$ and $+1{\cdot}05\times10^{-12}$ amp. /cm^2, and currents nearly, if not quite, as large were also observed at Simla. The figures supplied by Simpson give as the average current in amps. per cm^2 for the positively charged and the negatively charged rain, the respective values $+41\times10^{-15}$ and -31×10^{-15}. The corresponding figures for Puy-en-Velay are $+20\times10^{-15}$ and -42×10^{-15}. No charge was recorded during some 40 per cent of the time of sensible rainfall at Simla. Allowing for this, the average current during sensible rainfall was at least 2×10^{-14} amp./cm^2, or 100 times the ordinary ion-carried current in fine weather. The excess of positive charge observed at Simla was $+15{\cdot}1$ E.S.U. per annum. This is sufficient to maintain the fair weather current, estimated at 2×10^{-16} amp./cm^2, for 290 days. The excesses of positive electricity observed at Potsdam and Puy-en-Velay are much less, and considerable differences were observed at these stations at different seasons of the year. Also, while snow on the few occasions when it was observed at Simla brought with it a considerably larger positive charge than the corresponding amount of rain, the charges accompanying snow at Potsdam appeared to be small and predominatingly negative.

No simple explanation of thunder and lightning can be accepted without reserve. But there appears a general consensus of opinion that the theory proposed by Dr. G. C. Simpson is less open to criticism than any other. It depends essentially on the following facts: 1. The velocity of raindrops falling through still air, increases with the size of the drop only up to a certain diameter. Drops of larger size tend to flatten and break up into smaller drops. 2. The breaking up is accompanied by the separation of electricity. 3. During thunderstorms there are in limited areas rapidly ascending air currents. It is inferred that when a larger drop falling through an ascending air current breaks up, the drops into which it breaks receive a positive charge, the negative going to the air, and are carried up. They may unite and increase in size, fall and get broken up again. In this way a continual separation of charge may go on, until the potential is locally raised to the point at which a lightning stroke becomes possible.

For information as to the changes of potential gradient during thunderstorms, we are indebted mainly to the work of C. T. R. Wilson at Cambridge and H. Norinder at Uppsala. Wilson's method consists essentially in measuring the alterations in the charge on a plate representing part of the earth's surface. Norinder measures the potential difference between two insulated horizontal wires at different heights. Accompanying a flash of lightning there is a very rapid, if not quite instantaneous, change of potential gradient. Out of 864 flashes observed by Wilson 528, or 61%, were accompanied by a rise of potential gradient. Wilson supposes a thundercloud to consist essentially of a lower and an upper part, oppositely charged, the sign of the upper charge being usually positive. Supposing then a charge $+Q_2$ to be concentrated at a height H_2, and a charge $-Q$, at smaller height H, on the same vertical, we can calculate the potential from these charges and the image charges $+Q_2$ and $-Q$, at depths H_2 and H. From this potential, we easily obtain the following expression for the downwardly directed vertical force at ground level

$$2Q_2H_2(H_2^2+L^2)^{-\frac{3}{2}}-2Q_1H_1(H_1^2+L^2)^{-\frac{3}{2}}$$

where L is the horizontal distance of the spot where the force is measured from the vertical line on which the charges are supposed collected. Immediately under the charges L vanishes and the force is given by

$$2(Q_1H_1^{-2}-Q_2H_2^{-2})$$

As H_2 considerably exceeds H_1 this is negative—implying a positive charge on the ground—unless Q_2 is much larger than Q_1. At a distance L, large compared with H_2, the expression for the force becomes approximately

$$2(Q_2H_2-Q_1H_1)L^{-3}$$

This is positive unless Q_1 is considerably larger than Q_2. Thus at a large distance, the sign of the vertical force and the sign of the earth's charge are the opposite of what they are immediately under the cloud. Supposing Q_2 positive, when lightning passes discharging the cloud, potential gradient will suddenly rise under the cloud, while at a large horizontal distance it will fall, the fall varying inversely as the cube of the distance. According to Wilson's observations, the change of potential gradient does follow roughly the law of the inverse cube. Wilson's theory does not give Q directly, but QH, where H is a sort of centre of gravity of the thunder cloud. Assuming H to be 2 km Wilson found Q to be on the average, about 20 coulombs. Supposing the value correct, the initial value of the current recharging the cloud must usually amount to several amperes. For a spark to pass in ordinary air at atmospheric pressure, a voltage of 30,000 v/cm is requisite. This would actually be found at the surface of an isolated sphere of 250 m. radius charged with 20 coulombs.

The presence of the earth and the supposed bi-polarity of the cloud, of course complicate matters. Wilson observed changes of potential gradient of the order 1,000 v/m for flashes at 10 km distance, and inferred they might be of the order 100,000 v/m under the centre of the cloud. Norinder has actually observed changes of potential gradient of 200,000 v/m. Under exceptionally high potential gradients, air tends to become ionised, and the presence of pointed objects like grass and leaves promotes discharge. Thus even when no lightning is passing or rain falling, the air-earth current may be abnormally large under thunderclouds. Recently C. E. P. Brooks, from a summary of thunderstorms at different parts of the earth, has calculated that over the earth as a whole, about 100 lightning strokes occur per second. If these were all of one sign, and each brought 20 coulombs to the earth, this would be equivalent to a vertical current of about 4×10^{-16} amp./cm². Many lightning strokes pass, however, between clouds, and a large minority according to Wilson bring down positive electricity. Thus lightning cannot safely be treated any more than rain as a negligible factor in the problem presented by the earth's negative charge in fine weather.

As to the other atmospheric electricity elements, in addition to the ions caught by the Ebert apparatus which have values of the order 1·5 cm/sec. for their mobilities (*i.e.*, their velocities under a potential gradient of 1 v/cm), there are "heavy" ions. These, having a mobility of only about $\frac{1}{3000}$ of that of the light ions, are practically negligible so far as concerns the conductivity of the air and the air-earth current, unless their numbers much exceed those of the light ions. In or near large towns, judging by the large average number—16,000 per cm³—found in Dublin by McClelland and Kennedy, heavy ions may play an important part. But in country districts, they seem no more numerous than light ions. Thus the ordinary calculations of conductivity based on light ions alone should not be much in error. For the mean numbers n_1 n_2 of light positive and negative ions per cm³, as observed at a number of land stations, Chauveau gives 750 and 630 respectively. For the corresponding figures from sea observations—mostly by the surveying ship of the Carnegie Institution of Washington, Chauveau gives $n_1=730$, $n_2=580$. The areas represented are so comparatively few that we can only say that there is little if any difference between land and sea. If we take the value now accepted for the ionic charge $4{\cdot}8\times10^{-10}$, we obtain from Chauveau's mean land values as the free ionic charges positive and negative per cubic metre.

$$E_1=0{\cdot}36 \text{ E.S.U.} \qquad E_2=0{\cdot}30 \text{ E.S.U.}$$

If k_1 and k_2 are the mobilities, the air-earth current, assuming the air without vertical velocity, is given by

$$i=(k_1\ n_1+k_2\ n_2)\ eP$$

where e is the ionic charge, P the potential gradient per cm. This may be written $i=\lambda P$, where λ the conductivity is given by $\lambda=\lambda_1+\lambda_2$ with $\lambda_1=k_1n_1e_n\lambda_2=k_2n_2e$.

λ_1 and λ_2 the so-called conductivities for positive and negative ions are usually measured separately. If we suppose, as an example, $n_1=n_2=500$, and $k_1=k_2=1{\cdot}5$ v/cm=450 E.S.U., we have $\lambda=\lambda_1+\lambda_2=2\times500\times450\times4{\cdot}8\times10^{-10}=2{\cdot}2\times10^{-4}$ E.S.U. There are only a few stations where regular observations are made of λ, and these are mostly at only one or two hours of the day.

The following mean yearly values have been obtained for λ and i

			λ(E.S.U.)	i(amp/cm²)
Davos:				
Hrly. Obs.	1909–10	1 yr.	2·68	1·71
Potsdam:				
Hrly. Obs.	1910–1	1 yr.	$0{\cdot}95\times10^{-4}$	$2{\cdot}37\times10^{-16}$
Tortosa:				
Obs. near 11 h.	1918–23	6 yrs.	1·80	2·03
Val Joyeux:				
Obs. at 9h., 13h., 17h.	1924	1 yr.	1·43	1·57

Speaking generally, the diurnal and annual variations of λ are in the opposite direction to those of potential gradient. At all the stations mentioned above λ is largest in summer, and at Potsdam and Davos it is largest in the early morning, when P is least. The vertical fine weather current would seem to be a less variable element than the others.

The ionisation of the atmosphere has several possible sources, including γ rays from radium and thorium in the ground, radioactive emanation in the air, photo-electric effects at the ground, ultra-violet light especially at higher levels, and penetrating radiation. The last-mentioned source has been demonstrated by experiments with closed vessels. Near the earth's surface it is less over sea than over land, but still sensible. Over land, as we ascend, it diminishes at first according to the observations of Hess and Kolhorster, but after attaining a minimum at a height of 500 metres or a little over, it increases again, attaining much higher values than near ground level. More recent observations made by R. A. Millikan confirm this increase, though making it considerably less than Kilhorster supposed. Millikan has found the radiation to include rays of different penetrating power, some much more penetrating than the hardest γ rays. The source of this radiation is still problematical.

For references the reader is referred to the treatises by Chauveau and Mathias described below. Chauveau's vol. I is entirely historical. The volume edited by Mathias has an elaborate bibliography at the end of each chapter, as well as a very full name index. L. A. Bauer, *Terrestrial Magnetism*, vol. 29, p. 23, etc.; B. Chauveau, *Electricité Atmosphérique*, in 3 vol.; G. C. Simpson, *British Antarctic Expedition* 1910–3 *Meteorology*, vol. I, p. 312; E. Mathias *Traité d'electricité atmosphérique et tellurique;* G. C. Simpson, *Phil. Trans.* A. vol. 209, p. 405; C. T. R. Wilson, *Phil. Trans.* A. vol. 221, p. 73. (C. Ch.)

ATOM (*see* 2.870), *Structural Units.*—Through the experimental discoveries of the second half of the 19th century it became gradually clear that the atoms of the elements, far from being indivisible entities, had to be thought of as aggregates built up of separate particles. Thus from experiments on electrical discharges in rarified gases and especially from a closer study of the so-called cathode rays, one was led to recognise the existence of small negatively charged particles the mass of which was found to be about 2,000 times as small as the mass of the lightest atom, the hydrogen atom. These small particles, which may be regarded as atoms of negative electricity are now, following Johnstone Stoney, generally called electrons. Through the investigations of J. J. Thomson and others convincing evidence was obtained that these electrons are a constituent of every atom. On this basis a number of the general properties of matter, especially as regards the interaction between matter and radiation, receive a probable explanation.

In fact the assumption that electrons are vibrating around positions of stable equilibrium in the atom offered a simple picture of the origin of spectral lines which allowed the phenomena of selective absorption and dispersion to be accounted for in a natural way. Even the characteristic effect of magnetic fields on spectral lines discovered by Zeeman could, as was shown by Lorentz, be simply understood on this assumption. The origin of the forces which kept the electrons in their positions remained for a time unknown, as well as the way in which the positive electrification was distributed within the atom. From experiments on the passage through matter of the high speed particles expelled from radioactive substances, however, Rutherford was in 1911 led to the so-called nuclear model of the atom. According to this the positive electricity is concentrated within a nucleus of dimensions very small compared with the total space occupied by an atom. This nucleus is also responsible for practically the whole of the atomic mass.

True Properties of the Elements.—The nuclear theory of the atom has afforded a new insight into the origin of the properties of the elements. These properties can be divided into two sharply distinguished classes. To the first class belong most of the ordinary physical and chemical properties. These depend on the constitution of the electron cluster round the nucleus and on the way in which it is influenced by external agencies. This, however, will depend on the attractive force due to the nucleus which keeps the cluster together. On account of the small size of the nucleus compared with the distance apart of the electrons in the cluster, this force will to a high approximation be determined solely by the total electric charge of the nucleus. The mass of the nucleus and the way in which the charges and masses are distributed among the particles making up the nucleus itself will only have an exceedingly small influence on the behaviour of the electronic cluster.

To the second class belong such properties as the radioactivity of the substance. These are determined by the actual internal structure of the nucleus. In the radioactive processes we witness, in fact, explosions of the nucleus in which positive or negative particles, the so-called α and β particles, are expelled with very great velocities. The complete independence of the two classes of properties is most strikingly shown by the existence of substances which are indistinguishable from one another by any of the ordinary physical and chemical tests, but of which the atomic weights are not the same, and whose radioactive properties are completely different. Any group of two or more such substances are called isotopes (*q.v.*), since they occupy the same position in the classification of the elements according to ordinary physical and chemical properties. The first evidence of their existence was found in the work of Soddy and other investigators on the chemical properties of the radioactive elements. It has been shown that isotopes are found not only among the radioactive elements, but that many of the ordinary stable elements consist of isotopes, for a large number of the latter that were previously supposed to consist of atoms all alike have been shown by Aston's investigations to be a mixture of isotopes with different atomic weights. Moreover the atomic weights of these isotopes are whole numbers, and it is because the so-called chemically pure substances are really mixtures of isotopes, that the atomic weights are not integers.

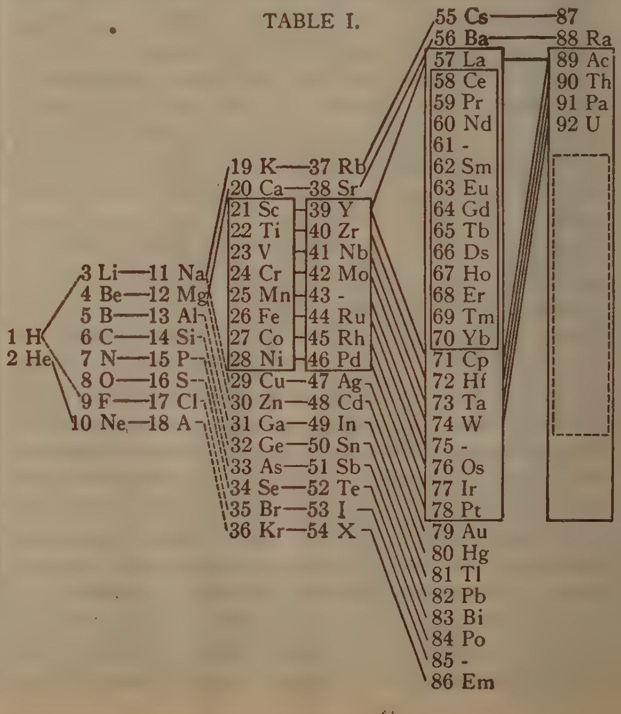
Inner Structure.—The inner structure of the nucleus is still but little understood, although a method of attack is afforded by Rutherford's experiments on the disintegration of atomic nuclei by bombardment with α particles. Indeed, these experiments may be said to have started a new epoch in natural philosophy in that for the first time the artificial transformation of one element into another has been accomplished (*see* TRANSMUTATION OF ELEMENTS). In what follows, however, we shall confine ourselves to a consideration of the ordinary physical and chemical properties of the elements and the attempts which have been made to explain them on the basis of the concepts just outlined.

THE RELATIONSHIPS BETWEEN THE ELEMENTS

Periodicity of Elements.—It was recognised by Mendelejeff that when the elements are arranged in an order which is practically that of their atomic weights, their chemical and physical properties show a pronounced periodicity. A diagrammatic representation of this so-called periodic table is given in Table I., which represents in a slightly modified form an arrangement first proposed by Julius Thomsen. In the table the elements are denoted by their usual chemical symbols, and the different vertical columns indicate the so-called periods. The elements in successive columns which possess homologous chemical and physical properties are connected by lines. The meaning of the square brackets around certain series of elements in the later periods, the properties of which exhibit typical deviations from the simple periodicity in the first periods, will be mentioned below.

Radiation.—The discovery of the relationship between the elements was primarily based on a study of their chemical prop-

TABLE I.



erties. Later it was recognised that this relationship appears also very clearly in the constitution of the radiation which the elements emit or absorb in suitable circumstances. In 1883 Balmer showed that the spectrum of hydrogen, the first element in the table, could be expressed by an extremely simple mathematical law. This so-called Balmer formula states that the frequencies ν of the lines in the spectrum are given to a close approximation by

$$\nu = R\left(\frac{1}{(n'')^2} - \frac{1}{(n')^2}\right) \qquad (1)$$

where R is a constant, and where n' and n'' are whole numbers. If n'' is put equal to 2 and n' is given successively the values 3, 4, . . . the formula gives the frequencies of the series of lines in the visible part of the hydrogen spectrum. If n'' is put equal to 1 and n' equal to 2, 3, 4, . . . a series of ultra-violet lines is obtained which was discovered by Lyman in 1914. To $n''=3$, 4, . . . correspond series of infra-red hydrogen lines which also have been observed.

Rydberg in his famous investigation of line spectra more than 30 years ago was able to analyse in a similar way many spectra of other elements. Just as in the case of hydrogen he found that the frequencies of a line-spectrum (such as that of sodium) could be represented by a formula of the type

$$\nu = T'' - T' \qquad (2)$$

where T″, T′ can be approximately represented by

$$T = \frac{R}{(n - \alpha\kappa)^2} \qquad (3)$$

$\alpha\kappa$ is a constant for any one series, but takes different values a_1, a_2 . . . for the different series, while n takes a set of successive integral values. R is constant throughout for all spectra, and is the same constant as that appearing in (1); it is generally called the "Rydberg number." In many spectra the terms of most series are multiple, *i.e.*, the terms which we consider as forming a series do actually form two, three or more series corresponding to two, three or more slightly different values of $\alpha\kappa$. Rydberg also discovered that the spectra of elements occupying homologous positions in the periodic table were very similar to each other, a similarity which is especially pronounced as regards the multiplicity of the terms.

Moseley's Discovery.—The study of X-ray spectra made possible by the work of Laue and Bragg brought out relations of a still simpler kind between different elements. Thus Moseley (*q.v.*) in 1913 made the fundamental discovery that the X-ray spectra of all elements show a striking similarity in their structure, and that the frequencies of corresponding lines depend in a very simple way on the ordinal number of the element in the periodic table. Moreover the structure of these spectra was very like that of the hydrogen spectrum. The frequency of one of the strongest X-ray lines for the various elements could for instance be given approximately by

$$\nu = N^2 R\left(\frac{1}{1^2} - \frac{1}{2^2}\right) \qquad (4)$$

and that of another line by

$$\nu = N^2 R\left(\frac{1}{2^2} - \frac{1}{3^2}\right) \qquad (5)$$

where R is again the Rydberg constant and N the ordinal number of the element in the periodic table. The extreme simplicity of these formulae enabled Moseley to settle any previous uncertainty as to the order of the elements in the periodic table, and also to state definitely the empty places in the table to be filled up by elements not yet discovered.

Atomic Numbers.—In the nuclear model of the atom, the ordinal number of an element in the periodic table receives an extraordinarily simple interpretation. In fact, if the numerical value of the charge on an electron is taken as unity, this ordinal number, which is often called the "atomic number" (*q.v.*), can simply be identified with the magnitude of the nuclear charge. This law which was foreshadowed by J. J. Thomson's investigations of the number of electrons in the atom as well as by Rutherford's original estimate of the charge on the atomic nucleus, was first suggested by van den Broek. It has since been established by refined measurements of the nuclear charge, and it has proved itself an unerring guide in the study of the relationship between the physical and chemical properties of the elements. This law also offers an immediate explanation of the simple rules governing the changes in the chemical properties of radioactive elements following the expulsion of α or β particles.

THE QUANTUM THEORY

The discovery of the electron and of the nucleus was based on experiments, the interpretation of which rested on applications of the classical laws of electrodynamics. As soon, however, as an attempt is made to apply these laws to the interaction of the particles within the atom, in order to account for the physical and chemical properties of the elements, we are confronted with serious difficulties. Consider the case of an atom containing one electron: it is evident that an electrodynamical system consisting of a positive nucleus and a single electron will not exhibit the peculiar stability of an actual atom. Even if the electron might be assumed to describe an elliptical orbit with the nucleus in one of the foci, there would be nothing to fix the dimensions of the orbit, so that the magnitude of the atom would be an undetermined quantity. Moreover, according to the classical theory the revolving electron would continually radiate energy in the form of electromagnetic waves of changing frequency and the electron would finally fall into the nucleus. In short, all the promising results of the classical electronic theory of matter would seem at first sight to have become illusory. It has nevertheless been possible to develop a coherent atomic theory based on this picture of the atom by the introduction of the concepts which formed the basis of the famous theory of temperature radiation developed by Planck in 1900.

This theory marked a complete departure from the ideas which had hitherto been applied to the explanation of natural phenomena, in that it ascribed to the atomic processes a certain element of discontinuity of a kind quite foreign to the laws of classical physics. One of its outstanding features is the appearance in the formulation of physical laws of a new universal constant, the so-called Planck's constant, which has the dimensions of energy multiplied by time, and which is often called the "elementary quantum of action." We shall not enter upon the form which the quantum theory exhibited in Planck's original investigations, or on the important theories developed by Einstein in 1905, in which the fertility of Planck's ideas in explaining various physical phenomena was shown in an ingenious way. We shall proceed at once to explain the form in which it has been possible to apply the quantum theory to the problem of atomic constitution. This rests upon the following two postulates:—

1. An atomic system is stable only in a certain set of states, the "stationary states," which in general corresponds to a discrete sequence of values of the energy of the atom. Every change in this energy is associated with a complete "transition" of the atom from one stationary state to another.

2. The power of the atom to absorb and emit radiation is governed by the law that the radiation associated with a transition must be monochromatic and of frequency ν such that

$$h\nu = E_1 - E_2 \qquad (6)$$

where h is Planck's constant and E_1 and E_2 are the energies in the two stationary states concerned.

The first of these postulates aims at a definition of the inherent stability of atomic structures, manifested so clearly in a great number of chemical and physical phenomena. The second postulate, which is closely related to Einstein's law of the photo-electric effect, offers a basis for the interpretation of line spectra; it explains directly the fundamental spectral law expressed by relation (2). We see in fact that the spectral terms appearing in this relation can be identified with the energy values of the stationary states divided by h. This view of the origin of spectra has been found to agree with the experimental results obtained in the excitation of radiation. This is shown especially in the discovery of Franck and Hertz relating to impacts between free electrons and atoms. They found that an energy transfer from the electron to the atom can take place only in amounts which correspond with the energy differences of the stationary states as computed from the spectral terms.

The Hydrogen Spectrum.—From the Balmer formula (1) and the quantum theory postulates, it follows that the hydrogen atom has a single sequence of stationary states, the numerical value of the energy in the n^{th} state being Rh/n^2. Applying this result to the nuclear model of the hydrogen atom, we may assume that this expression represents the work necessary to remove the electron from the nth state to an infinite distance from the nucleus. If the interaction of the atomic particles is to be explained upon the laws of classical mechanics, the electron in any one of the stationary states must move in an elliptical orbit about the nucleus as focus, with a major axis whose length is proportional to n^2. The state for which n is equal to 1 may be considered as the normal state of the atom, the energy then being a minimum. For this state the major axis is found to be approximately 10–8 *centimetres*. It is satisfactory that this is of the same order of magnitude as the atomic dimensions derived from experiments of various kinds. It is clear, however, from the nature of the postulates, that such a mechanical picture of the stationary states can have only a symbolic character. This is, perhaps most clearly manifested by the fact that the frequencies of the orbital revolution in these pictures have no direct connection with the frequencies of the radiation emitted by the atom. Nevertheless, the attempts at visualising the stationary states by mechanical pictures have brought to light a far-reaching analogy between the quantum theory and the classical theory. This analogy was traced by examining the radiation processes in the limit where successive stationary states differ comparatively little from each other. Here it was found that the frequencies associated with the transition from any state to the next succeeding one tend to coincide with the frequencies of revolution in these states, if the Rydberg constant appearing in the Balmer formula (1) is given by the following expression:

$$R=\frac{2\pi^2e^4m}{h^3} \qquad (7)$$

where e and m are the charge and mass of the electron and h is Planck's constant. This relation is actually found to be fulfilled within the limits of the experimental errors involved in the measurements of e, m and h, and may be considered to establish a definite relation between the spectrum and the atomic model of hydrogen.

Correspondence Principle.—The considerations just mentioned constitute an example of the application of the so-called "correspondence principle"[1] which has played an important part in the development of the theory. This principle gives expression to the endeavour, in the laws of the atom, to trace the analogy with classical electrodynamics as far as the peculiar character of the quantum theory postulates permits. On this line much work has been done in the last few years, and quite recently in the hands of Heisenberg has resulted in the formulation of a rational quantum kinematics and mechanics. In this theory the concepts of the classical theories are from the outset transcribed in a way appropriate to the fundamental postulates and every direct reference to mechanical pictures is discarded. Heisenberg's theory constitutes a bold departure from the classical way of describing natural phenomena but may count as a merit that it deals only with quantities open to direct observation. This theory has already given rise to various interesting and important results, and it has in particular allowed the Balmer formula to be derived without any arbitrary assumptions as to the nature of the stationary states. However, the methods of quantum mechanics have not yet been applied to the problem of the constitution of atoms containing several electrons, and in what follows we are reduced to a discussion of results which have been derived by using mechanical pictures of the stationary states. Although in this way a rigorous quantitative treatment is not obtainable it has nevertheless been possible, with the guidance of the correspondence principle, to obtain a general insight into the problem of atomic constitution.

THE SPECTRA OF ELEMENTS OF HIGHER ATOMIC NUMBER

The hydrogen spectrum may be considered as evidence of a step-like process in which an electron is captured and bound increasingly strongly in the field surrounding the nucleus, the stages of this process being the stationary states of the atom. Simple arguments lead to the conclusion that the stages corresponding to the binding of an electron by a nucleus of any given charge will be represented by a similar sequence of stationary states and that the energy W_n necessary to remove the electron from the n^{th} state will be given by the expression:

$$W_n=N^2\,\frac{Rh}{n^2} \qquad (8)$$

where N is the atomic number of the elements under consideration. These states may be visualised as mechanical orbits of the electron in which the major axis is N times as small as the major axis in the corresponding orbit in the hydrogen atom. The spectrum associated with the binding process under consideration is represented by the formula:

$$\nu=N^2\,R\left(\frac{1}{(n'')^2}-\frac{1}{(n')^2}\right) \qquad (9)$$

For $N=2$, this formula actually represents the spectrum which is emitted by a singly ionised helium atom, *i.e.*, a helium atom, which has lost one of its electrons. Spectra of this type have not yet been observed for values of N larger than 2, but it will be seen that formula (9) includes the approximate formulae (4) and (5) representing the frequencies of the strongest lines in the X-ray spectra of the elements. This may be understood if we assume that an X-ray spectrum is associated which changes in the state of binding of one of the electrons in the inner region of the atom, where, at least when the atomic number is large, the force on the electron due to the nucleus will far outweigh the forces due to the other electrons, and where consequently the presence of these electrons will have a comparatively small influence on the strength of the binding.

Influence of Electrons.—In general the mutual influence of the electrons is very considerable. Consider the stages by which an electron is captured by an atom of which the nucleus already has s electrons circulating round it. In the initial stages of this process while the orbits may be supposed to have dimensions which are large compared with the orbital dimensions of the electrons previously bound, the repulsive forces from these latter electrons may be assumed to neutralise s units of the nuclear charge, and the resultant force will be approximately the same as when an electron is circulating round a nucleus of atomic number N-S. In the later stages, when the dimensions of the orbit of the new electron are smaller, the other electrons can no longer be considered to act as a single central charge, and their repulsion cannot be easily determined. Thus the conditions become more complicated, and the stationary states can no longer be treated by picturing the motion of the new electron as following a Keplerian ellipse. It has been found, however, that many features of the resulting spectra would be explained by assuming the added electron to move in a plane central orbit consisting of a sequence of quasi-elliptic loops. In contrast to a Keplerian orbit, however, the single loops are not closed but the successive maximum radii will be placed at constant angular intervals on a circle with the nucleus at the centre. For such central orbits it is possible, as was first shown by Sommerfeld, to select from the continuous multitude of possible orbits a set of orbits which may be taken as representing stationary states in the sense of the quantum theory. These states are labelled with two integral numbers; the one, denoted by n, corresponds to the integer appearing in the Balmer formula and is called the principal quantum number. The other, denoted by k, may be called the subordinate quantum number. For any given value of n, the number k can take the values $1, 2, 3 \ldots n$, corresponding to a set of orbits with increasing minimum distance from the nucleus. For a given value of k increasing values of n correspond to orbits which exhibit an increasing maximum distance from the nucleus, but which are similar in size and shape in the region where the electron comes nearest to the nucleus.

For the work necessary to remove an electron in an n_k orbit completely from the nucleus, the theory leads to the following approximate expression

$$W_{n,k}=(N-s)^2\frac{Rh}{(n-\alpha_k)^2} \qquad (10)$$

where α_k depends only on the subordinate quantum number k, and approaches zero for increasing k.

If s is equal to N-1, we see that the $W_{n,k}$ when divided by h coincide exactly with Rydberg's expressions (3) for the spectral terms of the ordinary series spectra of the elements. These spectra may therefore be considered as evidence of processes, representing the last stage in the formation of a neutral atom, in which a nucleus of charge Ne, which holds already N-1 electrons bound in its field, is capturing an Nth electron. In recent years it has been found that many elements under suitable conditions besides their ordinary spectra also emit spectra for which the terms can be represented by

$$T=p^2\frac{R}{(n-\alpha_k)^2} \qquad (11)$$

where p may take the integral values 2, 3, 4. . . . Comparing (11) with formula (10) we see that these spectra must be ascribed to atoms, which after having lost p electrons are rebinding an electron in the field of the remaining atomic ion.

This interpretation of series spectra allows also the rules governing the possible combinations of spectral terms to be explained. In fact, it has been found that only those lines appear in the spectrum for which the k-values of the spectral terms involved differ by one unit. From an investigation of the constitution of the radiation which on classical electrodynamics would be emitted from an electron performing a central motion, this rule can be shown to be a simple consequence of the correspondence principle.

Multiplet Structure.—The multiplet structure exhibited by the terms of most series spectra makes it necessary to assume that the motion of the electron involved in the emission of these spectra is somewhat more complicated than the simple central motion described above. An analysis based on the correspondence principle indicates that this motion may be described as a central motion on which is superposed a uniform precession of the orbital plane round an invariable axis in space. For a time, however, it seemed very difficult to obtain any closer connection between the observed structures and the above hypothesis of the constitution of the atom. In particular the remarkable analogy between the finer structures of the optical spectra the X-ray spectra, which had been brought out by the experiments, was very puzzling. The study of the strange anomalies exhibited by the effect of a magnetic field on the components of the optical multiplets has, however, quite recently led to the view that the electron itself carries besides its electric charge, also a magnetic moment which may be associated with a swift rotation round an axis through its centre. This new assumption allows not only the anomalous Zeeman effect to be accounted for, but affords at the same time a natural explanation for the empirical rules governing the dependency of the widths of the multiplet structures on the atomic number.

ATOMIC CONSTITUTION AND THE PERIODIC TABLE

Soon after the discovery of the electron it was recognised that the relationships between the physical and chemical properties of the elements expressed in the periodic table point towards a group-structure of the electronic distribution in the atom. Fundamental work on these lines was done by J. J. Thomson in 1904. After the discovery of the nucleus and the simple interpretation of the atomic number given above, his work has been followed up with great success especially by Kossel and Lewis.

Valency Properties.—It is suggested that the electrons within the atom possess a tendency to form stable groups, each containing a definite number of electrons, which in the neutral state of the atom surround the centre of the atom like successive shells or layers. An explanation of the simple valency properties holding for the second and third period of the periodic table was for instance obtained by assuming that there was a tendency to form completed shells each containing eight electrons. The single valency of sodium and the double valency of magnesium are ascribed to the facility with which the neutral atoms of these elements can loose one or two electrons respectively, as the atomic ions remaining would then contain completed shells only. On the other hand the double negative valency of sulphur and the single negative valency of chlorine are ascribed to the tendency of their outermost shells to take up two or one additional electron respectively in order to form a complete shell of eight electrons, like that contained in the neutral atom of the inactive gas argon.

Statical Arrangement of Electrons.—Attempts have been made to associate the existence of such groups with statical configurations of electrons possessing a high degree of symmetry. The presence of groups of eight electrons for instance has been explained as an arrangement of electrons at the corners of a cube. However suggestive these ideas have been in affording pictures of the constitution of chemical compounds, they do not allow a direct connection with other properties of the atom to be established; the main difficulty being that stable statical arrangements of the electrons are incompatible with the nuclear theory of the atom. In the meantime, however, it has been possible to connect the group structure of the electronic cluster in the atom with the quantum-theory interpretation of spectra. Thus the constitution of the neutral atom in its normal state can be investigated by imagining a process by which N electrons one after one are captured and bound in the field of force surrounding a nucleus of charge Ne.

To each step there corresponds a multitude of stages, *i.e.*, stationary states, in which the electron is more and more firmly bound to the atom. The final state, in which binding is strongest, corresponds to the normal state of the atomic ion. A definite connection between the spectra and the group structure was now established by assuming that in the normal atom only a limited number of electrons can be bound in states visualised as orbits characterised by definite values of the quantum numbers n and k. The electrons bound in orbits corresponding to a given value of n are said to form an n-quantum group, which in its finally completed stage will contain n subgroups, corresponding to the possible values 1, 2 . . . n which k may take. For a sufficiently large nuclear charge, the strength with which the electrons in the different subgroups belonging to one and the same group are bound will be nearly equal. In the gradual building up of the groups in atoms with increasing nuclear charge, it is, however, to be noted that when an n_k orbit appears for the first time in the neutral atom, the strength of the binding will depend very considerably on the value of k.

This is due to the circumstance that this quantum number fixes the closest distance to which the electron may approach the nucleus. The screening of the nuclear charge by the other electrons in the atom may therefore be very different for orbits corresponding to different values of k, and the effect on the strength of the binding can be so large that an orbit characterised by certain values of n and k may correspond to a stronger binding than an orbit for which n is smaller but k larger. This offers a natural explanation of one feature of the periodic table, namely that the periods grow gradually larger, while there appear sequences of elements which differ comparatively little in their chemical and physical properties. Such a sequence marks a stage in the development of an n-quantum group, which consists in the addition of a subgroup corresponding to a value of k which was previously not yet represented in that group, and which takes place after the building up of a group corresponding to a higher value of n has already begun. In fact, during the addition of the subgroup a temporary standstill will occur in the development of the latter group, the constitution of which will primarily determine the chemical affinity of the atom, since it contains the most loosely bound electrons.

In the accompanying table (Table II.) is given a summary of the structure of the normal state of the neutral atoms of the elements. The figures before the different elements are the

TABLE II.

	1_1	2_1	2_2	3_1	3_2	3_3	4_1	4_2	4_3	4_4	5_1	5_2	5_3	5_4	5_5	6_1	6_2	6_3	6_4	6_5	6_6	7_1	7_2
1 H	1																						
2 He	2																						
3 Li	2	1																					
4 Be	2	2																					
5 B	2	2	1																				
⋮																							
10 Ne	2	2	6																				
11 Na	2	2	6	1																			
12 Mg	2	2	6	2																			
13 Al	2	2	6	2	1																		
⋮																							
18 A	2	2	6	2	6																		
19 K	2	2	6	2	6		1																
20 Ca	2	2	6	2	6		2																
21 Sc	2	2	6	2	6	1	2																
22 Ti	2	2	6	2	6	2	2																
⋮																							
29 Cu	2	2	6	2	6	10	1																
30 Zn	2	2	6	2	6	10	2																
31 Ga	2	2	6	2	6	10	2	1															
⋮																							
36 Kr	2	2	6	2	6	10	2	6															
37 Rb	2	2	6	2	6	10	2	6			1												
38 Sr	2	2	6	2	6	10	2	6			2												
39 Y	2	2	6	2	6	10	2	6	1		2												
40 Zr	2	2	6	2	6	10	2	6	2		2												
47 Ag	2	2	6	2	6	10	2	6	10		1												
48 Cd	2	2	6	2	6	10	2	6	10		2												
49 In	2	2	6	2	6	10	2	6	10		2	1											
⋮																							
54 Xe	2	2	6	2	6	10	2	6	10		2	6											
55 Cs	2	2	6	2	6	10	2	6	10		2	6				1							
56 Ba	2	2	6	2	6	10	2	6	10		2	6				2							
57 La	2	2	6	2	6	10	2	6	10		2	6	1			2							
58 Ce	2	2	6	2	6	10	2	6	10	1	2	6	1			2							
59 Pr	2	2	6	2	6	10	2	6	10	2	2	6	1			2							
⋮																							
71 Gp	2	2	6	2	6	10	2	6	10	14	2	6	1			2							
72 Hf	2	2	6	2	6	10	2	6	10	14	2	6	2			2							
⋮																							
79 Au	2	2	6	2	6	10	2	6	10	14	2	6	10			1							
80 Hg	2	2	6	2	6	10	2	6	10	14	2	6	10			2							
81 Tl	2	2	6	2	6	10	2	6	10	14	2	6	10			2	1						
⋮																							
86 Em	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6						
87 —	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					1	
88 Ra	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					2	
89 Ac	2	2	6	2	6	10	2	6	10	14	2	6	10			2	6					2	1

atomic numbers, which give the total number of electrons in the neutral atom. The figures in the different columns give number of electrons in orbits corresponding to values of the principal and subordinate quantum numbers standing at the top. A comparison with the periodic table (Table I.) will show that those elements, which in chemical respect are homologous will have the same number of electrons in the electronic groups most loosely bound, containing the so-called valence-electrons. The atoms of elements which in Table I. are enclosed in brackets possess electronic configurations in which a subgroup is being added to a group, whose principal number is less than the group containing the typical valence-electrons. An especially conspicuous example of such a completion of an inner group is offered by the elements forming the family of the rare earths. Here we witness the addition of the fourth subgroup to the 4-quantum group, which begins first in Ce (58) while the addition of the third subgroup was already finished in Ag (47).

Table II. is in general agreement not only with the optical spectral evidence but also with that in the region of X-rays. As mentioned earlier, we see in X-ray spectra a change in the binding of an electron in the interior of the atom. This takes place when, for instance, by the impact of a swiftly moving particle on the atom, an electron is removed from one of the electronic groups, and its place is taken by an electron belonging to a group for which the binding energy is smaller. As an example it may be stated that the strong X-ray whose frequency is approximately represented by formula (4) is emitted when an electron has been removed from the 1-quantum group, and one of the 2_2 electrons performs a transition so as to occupy the empty place. The line represented approximately by formula (5) originates from a transition by which a 3_3 electron takes the place left open upon the removal of a 2_2 electron.

The question how many electrons there are in the various groups and subgroups has been subject to much discussion in the last few years. Table II. is the temporary result of this discussion and seems to give an adequate description of the spectral as well as the chemical evidence. It is clear that a full theoretical treatment of the problem cannot be obtained from considerations based only on the simple picture of central orbits. Such a treatment will essentially involve an examination of those features of the binding of the electrons, which appear in the multiplet structure of spectral lines. Indeed it is very probable that the idea that the electron itself has magnetic properties may give the clue to the interpretation of the empirical rules governing the number of electrons in the group structure of the atom.

In this article we have tried to give an idea of the fertility of the use of mechanical pictures visualising stationary states in the analysis of the properties of the elements. Notwithstanding the valuable suggestiveness of such an hypothesis it must once more be emphasised that such pictures do not allow the atomic phenomena to be interpreted quite rationally within the frame of the postulates of the quantum theory. For the adequate description of the properties of atoms it seems impossible to rely directly upon any concept of classical electrodynamics. On the contrary it appears imperative that any such concept should from the outset be transcribed in accordance with the methods of the new quantum mechanics, alluded to above. (*See* also Atomic Weights; Chemistry; Gases, Electrical Properties of; Isotopes; Quantum Theory.)

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ATOMIC ENERGY.—By this expression is generally meant energy associated with the inner nuclei of atoms, in contradistinction to energy of translation or thermal agitation possessed by the atoms moving as units, or chemical energy which is associated with their outer systems of electrons. Soon after the discovery of radioactive elements it was demonstrated that their radiations were entirely unaffected by temperature or chemical combination, and that therefore they must be supplied by a source of energy more deeply seated than any hitherto suspected. On Rutherford's theory of the atom, this source could only be the nucleus itself which in the process of spontaneous disintegration liberated energy in the form of radiations. Measurements showed that one gramme of radium gave out heat at the rate of 100-gramme calories per hour, and would continue to do so at a hardly diminished rate for many centuries.

This radioactive energy was, atom for atom, so vastly greater than that liberated in the most violent chemical reactions that it aroused great interest, and was hailed as the source of the sun's heat. Misled by the idea that radioactivity could be "induced" in otherwise non-radioactive elements, radioactive energy was eagerly seized by speculative writers (see H. G. Wells, *The World Set Free*, 1914) as the energy of the future. Further investigation failed, however, to support these claims. It was calculated that even if the sun were composed entirely of radioactive matter, the energy produced would still be quite inadequate to meet the demands of science. Experiments supposed to prove the existence of "induced" radioactivity were found to bear in reality a different interpretation and the excessive rarity of the radio elements removed any hope of using these as a source of terrestrial energy on a practical scale.

With the coming of Relativity (*see* Relativity) and the discovery of Isotopes (*see* Isotopes) the matter took a new aspect. The whole number rule removed the last obstacle in the way of the electrical theory of matter, that all atoms are composed of protons and electrons, the atoms of positive and negative electricity. According to Rutherford's nucleus atom theory, in the atom of a normal element all the protons and about half the electrons are packed together to form a central positively charged nucleus, which is surrounded by the remaining electrons. It can be shown that if we bring two charges of opposite sign as close together as they are in the nucleus, their fields will affect each other in such a way that the mass of the system will be reduced. This reduction is called the packing effect. In the atom of hydrogen with a nucleus of a single proton there can be no packing effect, so that it will be abnormally heavy. Measurements by means of the mass-spectrograph demonstrate conclusively that the mass of a hydrogen atom, consisting of one proton and one electron, is that accepted by chemists, namely 1·0077, whereas that of the helium atom, consisting of a nucleus of four protons and two electrons and two exterior electrons, is 4·00. Hence, whatever the explanation, it is certain that if it were possible to transmute hydrogen into helium, mass would be lost, and therefore, by the theory of relativity, energy liberated. On the latter theory, mass and energy are interchangeable, and the energy associated with a mass m is mc^2 where c is the velocity of light. For quantities of matter in ordinary experience this quantity of energy is prodigious. Take the case of one gramme atom of hydrogen, that is to say, the quantity of hydrogen in 9 cu.-cm. of water. If this is entirely transformed into helium the energy liberated will be

$$\cdot 0077 \times 9 \times 10^{20} = 6\cdot 93 \times 10^{18} \text{ ergs.}$$

Expressed in terms of heat this is $1\cdot 66 \times 10^{11}$ calories or in terms of work 200,000 kilowatt hours. Within a tumbler of water lies sufficient energy to propel the "Mauretania" across the Atlantic and back at full speed. Here we have a supply equal even to the demands of astronomers. Eddington remarks that if only ten per cent of the hydrogen in the sun were transformed into helium, enough energy would be liberated to maintain its present radiation for a thousand million years. There can be little doubt that the vast energy of the stars is kept up by the loss of an insignificant fraction of their mass. Whether this process is a degradation of hydrogen, or simple annihilation of matter by the coalescence of protons and electrons, is unknown. How long it will be before man can release and control this energy, and to what uses he will put such vast potentialities, are subjects for the philosopher. The first step has already been taken, for Sir Ernest Rutherford has succeeded in causing transmutation in several elements, only, of course, in inconceivably small quantities, by bombardment with swift alpha rays. If scientific knowledge maintains its present rate of progress, the balance of probability is in favour of ultimate success, but this appears so far off that almost any speculation is permissible. It may be that the operation, once started, is uncontrollable and that the new stars which flare out from time to time are but the notification of successful large-scale experiments on far distant worlds. It may be that the highest form of life on our planet will one day discover supreme material power, or cataclysmic annihilation, in the same ocean wherein, we are told, its lowest forms originally evolved.

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ATOMIC WEIGHTS.—Atomic weights have been defined as "the relative weights of the atoms of chemical elements referred to a common standard." This statement still serves as the simplest indication of the fundamental idea involved, although it now needs amplification. The concrete development of the idea was first effected in 1803 by John Dalton, an English chemist, when he converted the vague atomistic theory of the ancient Greeks into a highly valuable scientific asset by means of the concept of atomic weights. The chemical atomic theory thus initiated has been strengthened by modern investigation, and is to-day entrenched in a well-nigh impregnable position.

Practical and Scientific Interest.—Atomic weights are quantities of great practical and theoretical importance. They record the operation of the chemical law of definite combining proportions; hence they are the basis of quantitative chemical analysis, and are in everyday use throughout the world. Because of the parallelism between gravitational effect and inertia, they record also the relative masses of the atoms of the elements. They possess an extraordinary degree of definiteness, since the law of combining proportions is one of the few known precise laws of the universe. Far deeper in meaning than the accidental astronomical "constants," such as the length of the day or the length of the year, the atomic weights of the simple elements and of the individual isotopes (*see* Isotopes) stand out as among the peculiar and basic attributes of those 92 elementary substances of which everything is composed. Their interpretation is closely concerned with our inferences concerning the nature of things.

Dalton's Views.—Simple as the original concept of atomic weights seems to be, it nevertheless presents problems which are rather complex. For example, 22·997 grammes of sodium combine with 126·932 grammes of iodine to form sodium iodide. This ratio of the combining weights of these elements appears to be invariable. As Dalton pointed out, these weights must depend on the relative weights of the respective atoms; no other simple explanation is conceivable. There is in the experimental result, however, nothing which shows whether the sodium and iodine combine atom for atom, or whether one atom of sodium combines (for example) with two of iodine. Dalton himself perceived that this latter happening might in many cases occur; indeed it is the essence of his Law of Multiple Proportions. There is now every reason to believe that in this particular case of sodium and iodine the atoms actually combine one to one, and that the numbers given above represent really the relative weights of the atoms of sodium and iodine; but there are many less simple cases. For instance, 126·932 grammes of iodine combine with 20·035 grammes of calcium; here the latter number represents only half the atomic weight of calcium; because every molecule of calcium iodide is believed on excellent evidence to contain two atoms of iodine for every atom of calcium. Such a decision was beyond the reach of Dalton. It is based chiefly upon three subsequent discoveries to be briefly described.

Avogadro's Hypothesis.—In 1811 Count Amedeo Avogadro di Quaregna advanced the hypothesis, based upon Gay Lussac's Law of Volumes, that equal volumes of gases under like conditions of temperature and pressure contain the same number of molecules, a molecule being defined as consisting usually of two or more atoms. This hypothesis (which has since been so amply confirmed as to become, in many minds, a statement of fact) furnishes the most important means of deciding between the multiples or sub-multiples of the combining proportions which are to be taken as the atomic weights, because it fixes the molecular weights and formulas of volatile elements and compounds (*see* CHEMISTRY).

Dulong and Petit's Constant.—The second important means of deciding between possible multiples and sub-multiples of atomic weights was the discovery of Dulong and Petit (1818) that the atomic weight of an element is about equal to a constant number (6·3) divided by the specific heat. To be sure, this rule is not exact; but its inexactness is not usually great enough to affect it in its office of deciding the multiple or sub-multiple of the chemical combining proportion to be taken as the atomic weight. For example, the specific heat of calcium is about 0·16; therefore its atomic weight is shown to be about 39·4, whereas the exact value found by chemical means is 40·07.

Crystalline Similarity.—A third method of answering the question exists in the similarity of the crystal forms of similar salts of allied elements, discovered by E. Mitscherlich in 1821. If the atomic weight of one element entering into such isomorphous crystals is unknown, that multiple of the combining proportion of this element which corresponds to the formula indicated by the known salt may be taken as the true atomic weight.

The full significance and essential consistency of these three methods of solving Dalton's unsolved problem were not realised until 1858, when a table of atomic weights identical in principle with that used today was published by S. Cannizzaro. Previous doubts concerning the criteria just described had caused many chemists to reject wholly the term "atomic weights," and to call the arbitrarily selected multiples merely by some such name as "proportion numbers" or "chemical equivalents." But the numbers now used (as regards the multiples chosen) inevitably involve the atomic theory, hence the adjective "atomic" is fitting. "Weight" also is fitting, since the values are determined by means of the gravitational balance. The term "atomic mass" applies consistently only when inertia is the basis of measurement. The term "chemical equivalent" is now used to signify the atomic weight divided by the valence.

Standard of Atomic Weights.—The choice of the standard of atomic weights has varied. Dalton chose the smallest atomic weight, that of hydrogen, as his standard. Berzelius temporarily selected Oxygen = 100 as the standard of his system. Later the chemical world returned to Dalton's practice, especially because (according to early work) it was believed that the atomic weight of oxygen is nearly the whole number 16, if hydrogen is taken as 1. Finally, after it had been shown by E. W. Morley and others that the ratio of the atomic weights of oxygen and hydrogen is in fact 15·878 to 1, it was decided, by general consent, in 1905, to abandon the standard H = 1·000, retaining the standard O = 16·000. The decision was based upon convenience. The permanent choice of O = 15·878 would have changed by nearly one per cent almost every other accepted value, and would have caused much confusion in previous quantitative statements. Besides, more atomic weights approach whole numbers when oxygen is taken as exactly 16·000 than when any other usual standard is chosen.

A more weighty reason lay in the fact that most of the values are experimentally determined by relation to oxygen, and are referred to hydrogen only through that element. Hence any subsequent change in the accepted ratio H : O (one of the most difficult to determine of all such ratios) would affect all the atomic weights, if hydrogen were chosen as the standard substance. The present unit of the system of atomic weights is therefore exactly the sixteenth part of the atomic weight of oxygen. The atomic weight of hydrogen thus becomes 1·0077. The choice, on the whole, was a wise one; it has been justified by modern research, and has proved to be peculiarly fortunate, because probably all atoms of oxygen are alike in weight (*see* ISOTOPES).

Atomic Numbers and Actual Weights.—Atomic weights are *numbers;* that is to say, they represent ratios and are therefore devoid of physical dimensions. They are, however, very different from the quantities designated by J. A. R. Newlands and H. G. J. Moseley as "atomic numbers," which record the serial order of the places in the periodic classification of the chemical elements. No immediate knowledge of the actual weights of individual atoms is afforded by "atomic weights," unless the number of atoms in a given gross weight of some elementary substance is known. Various researches have shown that 16 grammes of oxygen contain about 606×10^{21} atoms; hence a single atom of oxygen must weigh 0·000,000,000,000,000,000,000,026,4 gramme. The actual weights of other kinds of atoms must be in due proportion.

Experimental Determination.—The exact values of the chemical combining proportions which form the basis of the table of atomic weights are found only by experimental work. Therefore, before the table is given, the necessary experimental methods may well be briefly described. The first and most generally useful method employed for the purpose has as its object the determination of the precise amount of one element which is necessary exactly to combine with a given amount of some other element of known atomic weight. The experimental technique is that of the most refined quantitative chemical analysis. Early extensive and careful investigations of this kind were conducted by J. Berzelius, C. de Marignac, J. B. A. Dumas, J. S. Stas and many others. Recently most of the work in this direction has been conducted in the United States (E. W. Morley, W. A. Noyes, T. W. Richards, G. P. Baxter and others), although European investigators (especially B. Brauner and O. Hönigschmid) have made important contributions.

Experimental work of this kind naturally involves the observance of a number of essential conditions. Comparatively few compounds of any given element are fit to serve as a means of determining its atomic weight, for the reason that comparatively few substances may be prepared in a perfectly pure state. The choice of the compounds to be employed is in some ways the most crucial part of the whole process, for with some compounds no result worthy of consideration could be obtained, even using the greatest care possible.

Having chosen wisely, the experimenter must prepare the needful substances, whatever they may be, in a state of very great purity. He must never forget that every precipitate carries down with it contaminating impurities absorbed or included by the substance as it separates from the solution. He must remember always that no receptacle necessary to contain the substance is free from the possibility of being attacked or dissolved, thus affecting the result. Moreover, precipitates are never wholly insoluble; and most substances will volatilise if heated to an excessive temperature. These complicating circumstances combine often in unexpected ways to introduce impurity, and the experimenter must not only guard against these dangers, but must prove by adequate tests that no such complication has occurred. Moreover, above all, he must not forget that oxygen, nitrogen and water are almost omnipresent; and continual care must be exercised lest in some way one of these impurities may affect the substance which is serving as the basis of the work.

These difficulties are greatly augmented during the latter part of the work; because after the beginning of the quantitative experiment, not only must the substance be kept in a pure state, but also it must be collected to the last trace and brought on to the balance pan—a stern condition not imposed by the preliminary preparation of material. If any escapes collection, the loss must be estimated by careful experiments, so that its exact amount may be known. All the weights used must be carefully standardised, and correction must be made for the buoyancy of the air on the bodies weighed. For further statement of these and other precautions and for a brief description of apparatus suitable for avoiding many pitfalls, together with the details of an especially instructive complex case, the reader is referred to *Carnegie Institution of Washington, Publication No. 125.* A critical summary by F. W. Clarke of all investigations up to 1920 is to be found in the third Memoir of Volume 16 of the *Memoirs of the National Academy of Sciences* (Washington).

A Typical Experiment.—A simple case may best exemplify the method. In one of many experiments, 7·59712 grammes of ferric oxide (Fe_2O_3) prepared with the greatest care, were found to yield on reduction (by means of hydrogen at a high temperature) 5·31364 grammes of metallic iron. The loss of weight (2·28348 grammes) represents the oxygen present in the oxide. Hence, from the proportion $(2{\cdot}28348) : (5{\cdot}31364) = O_3 : Fe_2 = 3(16{\cdot}000) : 2x$, the atomic weight of iron is found to be 55·848. (G. P. Baxter and C. R. Hoover.) The analysis was repeated many times in order to eliminate accidental errors.

Silver is often used as an intermediary standard of reference, because its chloride, bromide and iodide are particularly susceptible to exact treatment. For example: in 11 concordant experiments an aggregate of 60·6479 grammes of exceedingly pure ferrous bromide ($FeBr_2$) were found to require 60·6731 grammes of the purest silver to precipitate all the bromine present. (Baxter and Thorvaldson.) The accepted atomic weight of silver being 107·88, we have the proportion:—$(60{\cdot}6731) : (60{\cdot}6479) = 2\ Ag : FeBr_2 = (2[107{\cdot}88]) : y$, giving $y = 215{\cdot}670 = FeBr_2$. Since $Br = 79{\cdot}916$ (found by converting a known weight of silver into silver bromide), the atomic weight of iron is thus found to be 55·838, a value only slightly less than that found from the oxide. The rounded average of the two values (55·84) is taken as the true value.

Alternative Method.—Another general method of determining atomic weights (applicable only to gases or vapours) depends upon Avogadro's Rule, and resolves itself into the weighing of like volumes of different gases under like conditions of temperature and pressure. This is the only gravimetric method applicable to the six inert gases (helium, etc.) which do not form chemical compounds. The method determines molecular weights, not atomic weights; but the number of atoms in a molecule may be inferred in other ways, and therefore the atomic weights calculated from the data. The method involves experimental difficulties. The globe containing a gas inevitably weighs much more than the gas itself and is peculiarly subject to changes of buoyancy of the air. The exact measurement of temperature and pressure is not always easy, nor is the perfect purity of the gas to be weighed a condition readily secured. Moreover, Avogadro's Rule holds only for perfect gases; no actual gas fulfils exactly its requirements, because of the bulk occupied by the molecules themselves and their mutual attraction. On the whole, making allowance for these difficulties, the method of determining molecular (and therefore atomic weights) by comparison of the densities of gases agrees remarkably well with the results obtained from chemical analysis (Lord Rayleigh, E. W. Morley, P. A. Guye, A. Leduc, E. Moles, G. P. Baxter).

Third Method.—A third method of determining atomic weights (like the last, a purely physical method) is that which determines the mass (or rather the ratio of mass to electric charge) of rapidly moving charged atoms or molecules by means of their deflection by electric and magnetic fields. It appraises with moderate precision (by means of impressions on a photographic plate of the positions of impact of the deflected particles) the relative atomic masses pertaining to selected groups of atoms. In its original form it furnished the first experimental evidence not only that in some elements the atoms are all alike in weight, but also that in other elements this is not the case (Sir J. J. Thomson, 1912). Different varieties of a single chemical element, similar in every respect except as regards the weights and masses of their atoms, and apparently inseparable by natural agencies when once mixed, are called isotopes (F. Soddy). Under that head will be found a full description of this method of evaluating them, which was greatly improved by F. W. Aston, in his "mass-spectrograph" (*see* ISOTOPES).

Isotopes.—Many but not all of the elementary substances have been found by this third method to be isotopic or "complex." Hence elements may be divided into two classes; simple elements, probably possessing only one variety of atom, and isotopic elements, containing two or more varieties. The relative proportions of the several isotopes in a given elementary substance are shown roughly by the relative intensities of the "photographic" records; they can be shown exactly only by quantitative analysis, and then only when no more than two isotopes are present. Thus ordinary terrestrial chlorine ($Cl = 35{\cdot}46$) must consist of a mixture of about 30 atoms of ($Cl = 37$) to every 100 atoms of ($Cl = 35$).

Although the term "atomic weight" referred originally to the elementary substances (whether simple or isotopic) which actually occur on the earth's surface, it is applicable with even greater fitness to each isotope alone. Of all the isotopic elements only one, namely lead, has had the atomic weight of any individual isotope accurately determined by chemical analysis (Richards, Soddy, Hönigschmid). The individual isotopes of this metal are unique, because, so far as we can tell, they are end-products of the spontaneous disintegration of uranium, and other radioactive elements, in which the atoms of lead were segregated at the moment of their terrestrial birth and confined in the minerals producing them. Their abnormal atomic weights (determined by chemical methods of unquestioned trustworthiness) constitute the most convincing evidence of the existence of isotopes. For the determination of the atomic weights of the isotopes of all the other isotopic elements, some form of "mass-spectrograph" is needed because complete separation of mixed isotopes is at present unattainable in any other way.

Table of Atomic Weights.—The following table of atomic weights of the chemical elementary substances as they exist on the surface of the earth is essentially the table issued in 1925 by the International Committee on Elements and Atomic Weights, but includes the newly discovered element hafnium, as well as two of the individual isotopes of lead which have been experimentally investigated by chemical methods. "Atomic numbers" are also given. Usually, the larger the atomic weight, the larger the atomic number; but all isotopes of a given element have the same atomic number. Except in the case of hydrogen, the atomic number is never more and usually somewhat less than half of the atomic weight.

The following table records quantities of outstanding practical importance; it is the *vade mecum* of the analytical chemist. Its value to theory also is very great.

Redefinition of Term.—The discovery of the spontaneous disintegration of radioactive elements and the finding of isotopes have modified our theoretical interpretation of the atomic weights. Because of these discoveries, two *a priori* premises (of a more or less philosophical nature), namely, first, the assumption that the atoms are indivisible (the elementary substances being absolutely permanent) and, second, the assumption that the atoms of a given chemical element are all alike in weight, must to-day be abandoned, but the premises are seen on close scrutiny to be by no means an essential part of the chemical atomic theory. Nevertheless, the old definition of atomic weights must be altered in order to correspond exactly to modern knowledge.

Table of Atomic Weights of the Chemical Elements

	Symbol	At. No.	At. Wt.
Aluminium	Al	13	26·97
Antimony	Sb	51	121·77
Argon	A	18	39·91
Arsenic	As	33	74·96
Barium	Ba	56	137·37
Beryllium (Glucinum)	Be	4	9·02
Bismuth	Bi	83	209·00
Boron	B	5	10·82
Bromine	Br	35	79·916
Cadmium	Cd	48	112·41
Calcium	Ca	20	40·07
Carbon	C	6	12·000
Cerium	Ce	58	140·25
Cesium (Caesium)	Cs	55	132·81
Chlorine	Cl	17	35·457
Chromium	Cr	24	52·01
Cobalt	Co	27	58·94
Columbium (Niobium)	Cb	41	93·1
Copper	Cu	29	63.57
Dysprosium	Dy	66	162·52
Erbium	Er	68	167·7
Europium	Eu	63	152·0
Fluorine	F	9	19·00
Gadolinium	Gd	64	157·26
Gallium	Ga	31	69·72
Germanium	Ge	32	72·60
Gold	Au	79	197·2
Hafnium (Celtium)	Hf	72	180·
Helium	He	2	4·00
Holmium	Ho	67	163·4
Hydrogen	H	1	1·008
Indium	In	49	114·8
Iodine	I	53	126·932
Iridium	Ir	77	193·1
Iron	Fe	26	55·84
Krypton	Kr	36	82·9
Lanthanum	La	57	138·90
Lead (ordinary)	Pb	82	207·20
" (from U)	"	82	206·06
" (from Th)	"	82	208·
Lithium	Li	3	6·940
Lutecium	Lu	71	175·00
Magnesium	Mg	12	24·32
Manganese	Mn	25	54·93
Mercury	Hg	80	200·61
Molybdenum	Mo	42	96·0
Neodymium	Nd	60	144·27
Neon	Ne	10	20·2
Nickel	Ni	28	58·69
Nitrogen (Azote)	N	7	14·008
Osmium	Os	76	190·8
Oxygen	O	8	16·000
Palladium	Pd	46	106·7
Phosphorus	P	15	31·027
Platinum	Pt	78	195·23
Potassium (Kalium)	K	19	39·096
Praseodymium	Pr	59	140·92
Radium	Ra	88	225·95
Radon (Niton)	Rn	86	222·
Rhodium	Rh	45	102·91
Rubidium	Rb	37	85·44
Ruthenium	Ru	44	101·7
Samarium	Sm	62	150·43
Scandium	Sc	21	45·10
Selenium	Se	34	79·2
Silicon	Si	14	28·06
Silver	Ag	47	107·880
Sodium (Natrium)	Na	11	22·997
Strontium	Sr	38	87·63
Sulphur	S	16	32·064
Tantalum	Ta	73	181·5
Tellurium	Te	52	127·5
Terbium	Tb	65	159·2
Thallium	Tl	81	204·39
Thorium	Th	90	232·15
Thulium	Tm	69	169·4
Tin	Sn	50	118·70
Titanium	Ti	22	48·1
Tungsten (Wolfram)	W	74	184·0
Uranium	U	92	238·17
Vanadium	V	23	50·96
Xenon	Xe	54	130·2
Ytterbium	Yb	70	173·6
Yttrium	Y	39	88·9
Zinc	Zn	30	65·38
Zirconium	Zr	40	91·

A more complete and precise definition may be worded as follows: "Primarily, atomic weights are appropriate simple multiples (decided by theory) of the relative combining proportions or relative gas-densities of elementary substances calculated on a consistent basis. They represent the relative average weights of the atoms of given specimens of elementary substances referred to a common standard." Any such definition involves other definitions. An elementary substance is a substance which is not disintegrated into other elementary substances by ordinary chemical reactions. This definition avoids the implication that such a substance is incapable of disintegration by extra-chemical means. "Element" and "chemical element" are sometimes used synonymously. "Atoms" are postulated as the smallest particles of such a substance under ordinary conditions. They are not necessarily incapable of disintegration under extreme conditions. Hence their name (from ἀ privative and τομός "divided, cut") is not now appropriate, but it will doubtless be retained; the term "chemical atom" would perhaps be better. The qualification involved in the word "average" above is necessary because of the discovery of isotopes. The weighted average of the atomic weights of the isotopes in any particular isotopic or "complex" elementary substance is that which is recorded as its atomic weight.

Constancy of Atomic Weights.—That the atomic weights are constant in different compounds is shown by the analysis of many pure substances containing the same element and also by H. Landolt's experiments (1907), which proved that there is no loss or gain of gravitational effect in ordinary chemical reactions within one part in ten million. Moreover, specimens of various elementary substances (*e.g.*, sodium, calcium, copper, silver, iron, nickel, cobalt, etc.) found in different parts of the earth or even in meteorites, have been found by careful research to have constant atomic weights independent of geographical occurrence. All the samples of terrestrial lead even, except those found in uranium or thorium minerals, show similar uniformity. That each native terrestrial mixture of isotopes is thus unvarying seems to show that each was commingled when the earth was still fluid, or else that some unknown law determines the proportion in which the isotopes are formed. If it were not for the consistency indicated in this paragraph, the table of atomic weights would be much less useful than it is. The atomic weights are precisely consistent also with the electro-chemical equivalents indicated by Faraday's Law (Faraday, Rayleigh, Richards), affording thus further evidence of their fundamental nature.

Hydrogen and Other Elements.—The hypothesis of Prout (1815) that all the elements are aggregates of hydrogen has been greatly strengthened by the discovery of isotopes; for it appears that the fractions in the table above are due chiefly to isotopic mixtures, in which each isotope taken separately has nearly a whole number for its individual atomic weight. The atomic weights of uranium, radium, thorium, the isotopes of lead, and helium furnish an argument in favour of the theory of the atomic disintegration in which they are concerned, and therefore support the postulate maintaining the composite nature of the elements. Nevertheless, all the simple elements and individual isotopes have atomic weights somewhat less than the appropriate multiples of that of hydrogen, as has been shown in the case of oxygen. Many theorists believe that this common deficiency is due to the actual loss of mass during the atomic coalescence of hydrogen nuclei, the expelled mass being transformed into energy. If this is true, the exact values of the simple atomic weights (and those of individual isotopes) even to the third decimal place, possess great theoretical interest, since they must furnish an essential clue to the amount of energy expended. Modern hypotheses concerning the structure of the atom (Sir E. Rutherford, Sir J. J. Thomson, N. Bohr, G. N. Lewis, I. Langmuir) assume that practically all the weight and mass of the atom (fixing, of course, its atomic weight) are concentrated in an exceedingly small nucleus in its centre.

Concord with Atomic Numbers.—For fifty years the atomic weights decided the arrangement of the periodic system of the elements. Recently X-ray spectra have more certainly evaluated the atomic numbers which place the elements in this system (Moseley); but the agreement between the two methods is close enough to indicate a fundamental if sometimes complex relation between them.

Atomic Weights and Cosmogony.—The sun and stars appear spectroscopically to be made largely of the elements existing on earth. It is therefore no mere flight of fancy to infer that the vast gravitational forces which regulate the motions of the heavenly bodies are due to the collective action of countless myriads of atoms, whose individual shares in the process are recorded in the table of atomic weights. The foregoing considerations concerning atomic weights suggest many other cosmological inferences, which are, however, beyond the scope of this article (*see* "Atomic Weights and Isotopes," *Chemical Review, 1*, 1, 1924). It is not too much to say that these unique numbers, the atomic weights, probably bear a very close relation to the unknown fundamental processes which determined the nature and evolution of the universe. (T. W. R.)

AUCKLAND, New Zealand (*see* 2.894), increased largely in area, and the population rose from 82,101 in 1906 to 172,935 in 1924. From 1913 to 1926 seven outlying boroughs were incorporated in the city boundaries, making the area 7,844 acres. Many streets have been paved and the traffic routes widened and improved. The Grafton Bridge was erected in 1910, a town hall in 1911 and a new building for the State Maternity Hospital in 1923. In 1913 the Art Gallery was enlarged, and an Old Colonists Museum, with objects illustrating the history of New Zealand and of Auckland in particular, was installed therein in 1916. A number of parks and reserves have been acquired by the municipality, which now controls 8,000 ac. of open spaces. In the Wakefield Street Reserve is a memorial of the early wars in New Zealand, unveiled in 1920, and the foundation-stone of the World War Memorial was laid in 1925 in Auckland Domain, which has been improved through the use of the profits from the industrial exhibition held there in 1913–4. A winter garden has been built and a statue of Robert Burns was unveiled in the park in 1921. A large dam was constructed at Nikotupu in 1925 to augment the water supply. Before the World War several wharves and a western breakwater were built in the harbour and land was reclaimed in Freeman's Bay. Since 1919 further work has been carried out, and parts of the harbour have been deepened. There are 14,925 ft. of wharfage.

AUCTION BRIDGE: *see* BRIDGE.

AUFFENBERG-KOMAROW, MORITZ, RITTER VON (1852–), Austrian general, was born May 22 1852 at Troppau. A most able soldier, Auffenberg was one of the leaders of the Austrian military party, which centred round the Archduke Franz Ferdinand. Owing to the latter's influence he became Minister of War in Sept. 1911 until Dec. 1912, when he resigned owing to the opposition of the Emperor and the Magyars. In 1914 he commanded the Austrian IV. Army and won a remarkable victory at Komarów, Aug. 26—Sept. 3 1914, but was suspended for alleged irregularities in April 1915. He published an autobiography, *Aus Oesterreichs Höhe und Niedergang* (1921).

AUSTIN, ALFRED (1835–1913), British poet (*see* 2.938), died June 2 1913 at Swinford Old Manor, near Ashford, Kent.

AUSTIN, MARY HUNTER (1868–), American author, was born in Carlinville, Ill., Sept. 9 1868. After graduating from Blackburn University in 1888, she went to California for reasons of health, marrying there Stafford W. Austin of Bakersville, Cal., May 19 1891. For some years she resided at Independence, Cal., and her first book, *The Land of Little Rain* (1903), dealt with outdoor life in California, as did many of her succeeding works. She made a special study of the Indians of the southwest, embodying the results in many articles and addresses. Among her best known works are *The Flock* (1906); *Lost Borders* (1909); *The Arrow Maker*, a play produced at the New Theatre, N.Y., 1911; *The Man Jesus* (1915; revised edition, 1925, entitled *A Small Town Man*); and *The American Rhythm* (1923). She also wrote the chapter on "Aboriginal Literature" in *The Cambridge History of American Literature* (1919).

AUSTRALIA (*see* 2.941).—The area of the Australian Commonwealth is 2,974,581 sq. m., exclusive of its Papuan Territory. Its population at the census of 1921 was 5,435,734.

I. POLITICAL HISTORY

The second decade in the history of the Commonwealth was a period of national development. The first 10 years of the century had seen the birth of the constitution, the gradual evolution of parties and political creeds and the slow education of the people to think in terms of a single Commonwealth rather than of a group of states. In the second 10 years the process of education was completed, and if the lesson was learned in the hard school of war it was all the more deeply engraved on that account. It is very important to note the immediate and far-reaching effect which the World War exercised on the internal politics of the Commonwealth. The growth of national sentiment is difficult to measure, yet each achievement of Australian arms—whether it was the sinking of the "Emden," the landing at Anzac Cove or the advance at Bullecourt—struck another blow, not only for the Allied cause but for Australian unity as well.

The War gave a common aim and a single purpose which the years of peace could never have afforded. The six states forgot their rivalries and their jealousies and, whether it was a case of reinforcements or of Red Cross funds, the national effort was all directed towards the one united purpose. For the time, interstate boundaries disappeared. There was, in addition, the exceedingly practical factor of men from all the states meeting each other and mixing with each other in camps and billets and in the front line itself. From Brisbane to Perth is more than a week's journey by train, and in normal times the Queenslander has few chances of meeting his fellow-Australian from the West. In varying degree the same fact holds good even of intercourse between states that adjoin each other and it is difficult to overestimate the effect of the mutual knowledge and sympathy that was acquired between 1914 and the Armistice.

Although the War was immeasurably the greatest factor in welding the national character of the Commonwealth it was by no means the sole cause. The effort towards unity found expression in a variety of ways, and many signs in Australian political history of the period 1910–25 suggest that war merely hastened what peace would have attained in the end. There was no doubt, for instance, that in 1925 popular interest in Federal politics far transcended interest in the comparatively narrow arena of state affairs, and that that interest was steadily increasing. Again, measures of a distinctively national character, such as the construction of the transcontinental railway, the creation of the Australian Navy and the provision of compulsory military training in time of peace, were all products of the years before the War. Even the attitude towards the erection of a Federal capital at Canberra had changed, and if there was no great enthusiasm for the scheme, at least it did not arouse the mingled feelings of jealousy and derision with which it was greeted when first proposed.

Pre-War Period.—The purely political history of this period was marked by several distinctive features. In the first place, there was the definite commitment of the people to certain political doctrines—notably Protection and the maintenance of the "White Australia" ideal—which may be described as part of the national policy irrespective of party. In the second place, the dividing lines on questions of tariff and taxation, which in the first few years of the Commonwealth Parliament separated the parties, gradually disappeared and were replaced by the far wider cleavage between political Labour and the forces which oppose it. The rise of Labour was the outstanding development in Australian party politics after 1910. In the early days of the Commonwealth the place of Labour in politics was that of a noisy but relatively unimportant section of the opposition. At the end of 1925, not only was it the sole force in opposition to the Federal Govt., but it actually held office in every state except Victoria. It is not easy to account for this ascendancy without embarking on controversial subjects, but the broad lines of the movement may be said to have run along the ever-increasing education of the working classes to political power; the application of the efficient machinery of the great unions towards party ends, and the determination of the Labour leaders that their influence should extend far beyond the industrial—as distinct from the political—life of the community.

The year 1910 saw the end of the third Deakin administration, and in Feb. the House was dissolved. The elections which followed resulted in a substantial victory for the Labour party under Mr. Fisher, who had previously been Prime Minister from Nov. 1908 to June 1909, and who now returned to office with a working majority both in the Senate and in the House of Representatives. But there were clear indications that his victory had been gained not so much because the country approved of his policy as because it was thoroughly tired of coalitions. In May 1911 he submitted to a referendum certain amendments of the Federal Constitution, without which the Government could not carry out its avowed programme. These amendments sought to give to the Commonwealth Parliament:—

(*a*) full power to legislate with respect to trade and commerce instead of the limited power it had under the constitution;

(*b*) full power over all trading corporations;

(*c*) specific power to deal with the wages and conditions of labour and with labour disputes;

(*d*) power to deal with all combinations and monopolies;

(*e*) power to declare that any business was a "monopoly" and following such declaration, to acquire it, paying on just terms for any property used in connection with it.

The Australian people have always been reluctant to alter the Constitution, which was framed after many years of deliberation and controversy, and Mr. Fisher's amendments were defeated by a majority of about 250,000 votes. Thus his Government found itself holding office without the power to carry out its policy.

Nevertheless, Labour carried on for two more years, and actually brought into effect important schemes for national defence. The credit for the inception of these schemes was due to the Deakin administration, which in 1909 had not only brought in a Bill enforcing military training on the young men of the Commonwealth, the first instance of compulsory service in an English-speaking community, but also decided to give practical effect to the sweeping recommendations of the Imperial Defence Committee of the same year. But Labour had offered no serious opposition to these measures, and when it succeeded to office it spared no effort in giving them the fullest possible effect. Among other legislation of this period was the transfer of the Northern Territory from South Australia to the Commonwealth, and the grant of a "maternity bonus" of £5 on the birth of each child.

Australia During the World War.—In May 1913 another General Election was held in the Commonwealth. It had a singularly unsatisfactory result in so far as Mr. Deakin's successor, Mr., afterwards Sir, Joseph Cook, obtained a majority in the House of Representatives but was unsuccessful in the Senate. In these precarious circumstances he managed to survive until July 30 1914 when a dissolution of both Houses was granted. Five days later, war broke out. There was an immediate outcry for the abandonment of the elections, but the writs were already out, and an attempt to arrange an allotment of seats and form a National Govt. signally failed. For nearly two months Mr. Cook and his colleagues conducted Australia's war effort, and it is to them that the credit for the initial organisation of the Australian Imperial Force belongs.

The election came on Sept. 17. Again Mr. Fisher triumphed, and he at once proved that Labour was no less ready and eager than its opponents to put every effort into the war. "The last man and the last shilling" was Mr. Fisher's promise, and the change of government certainly brought no slackening in the Commonwealth's contribution to the Empire's cause. For more than a year Mr. Fisher remained at the head of affairs. Then, in Oct. 1915, he accepted the appointment of High Commissioner in London and was succeeded by the Attorney-General, Mr. W. Morris Hughes.

For the next seven years the political history of the Commonwealth was dominated by the personality of Mr. Hughes. His services to Australia and to the Empire may have been somewhat over-estimated when he was in power, but there is as little doubt that, in the reaction that followed his fall, they came dangerously near to being forgotten altogether. This much is certain: that he proved himself a leader at a time when his country stood most in need of leadership, that he was whole-hearted in the sincerity of his feelings towards the Empire, and that he was gifted to an exceptional degree with the power of infecting others with his own enthusiasm. He spared neither his health nor his frail physique in the incredible amount of work which he performed each day, and the very faults which ultimately helped to bring about his downfall—his impatience of criticism, and his intolerance alike of the feelings of his colleagues and the trammels of constitutional precedent—were not altogether bad qualities in a crisis when prompt action was emphatically the need of the moment.

In 1916 he travelled to Great Britain, and the remarkable success he achieved with his hard-hitting speeches all over the country was reflected in the increased prestige which accrued to him in Australia. But with his return to the Commonwealth there came an anticlimax. The tide of recruiting had begun to fall, the best of Australia's manhood had already left for the front, and the nation waited for Mr. Hughes to declare for the measures of conscription which he had advocated so wholeheartedly abroad. He hesitated, and finally decided to submit the question of conscription to a referendum. Never in the history of the Commonwealth had so bitter a campaign been waged. Arrayed against Mr. Hughes was a public opinion which included all the leaders of advanced Labour, the Industrial Workers of the World, the Bolshevists, the Pacifists and many Irish. The referendum was held and conscription was decisively rejected by the people.

The immediate result was the break-up of the Labour party. A second referendum and a second defeat made it impossible for Mr. Hughes to remain leader of a party which had officially rejected the most vital clause of his policy, and in 1917 he crossed the floor of the House and formed the Australian National War Government. The new Ministry was recruited mainly from the ranks of the former opposition and included only three of the Prime Minister's former colleagues. So came into being the National party which was to hold office for the next eight years and which at the end of 1925 seemed more firmly established than ever. The Armistice came a year after the reshuffle and once again Mr. Hughes visited England. Once again he returned to his own country with an increased reputation, for his vigorous assertion of Australian claims, not only in London but at the Peace Conference at Versailles, had to a great extent re-established his popularity.

The War Effort.—The sacrifices of the nation are shown by the following figures: Australia sent 329,883 troops overseas. The casualties of this force reached the extraordinarily high proportionate total of 314,078, of which 59,302 were deaths from wounds or disease. Other casualties from wounds or gas totalled

166,819, and there were 87,957 cases of sickness. The financial drain of the War on a young nation of less than 6,000,000 inhabitants was appalling. The following table gives the estimated war expenditure between 1914 and 1920:—

1914–5 . .	£15,111,335	1917– 8 . .	£66,958,360
1915–6 . .	41,201,946	1918– 9 . .	83,447,990
1916–7 . .	61,541,566	1919–20 . .	70,137,319

It is estimated that the total war expenditure in which pensions and allowances played a large part, were well over £600,000,000.

Australia has made generous provision for ex-service men. Pensions payable for total disability range from £2 to £3 a week, with extra provision for a wife and all children under 16 years of age. Ex-soldiers and sailors were liberally helped to re-establish themselves in civil life and, co-operating with the state governments, the Commonwealth Government has provided farming lands, grants and loans for houses, working capital, etc. Up to 1924 the Repatriation Commission had spent £13,717,000 in gifts or loans to ex-service men, and £34,145,000 had been advanced on account of ex-soldier settlement on the land. There is also a scheme to provide education for war orphans and the children of incapacitated ex-soldiers.

Post-War Problems.—It was to the solution of the enormous problems following the War that Mr. Hughes applied himself when he returned to Australia after the Peace Conference. But, triumphant as was his return, there is little doubt that his decline in power began at this stage of his career. Labour had been badly beaten at a "khaki" election in 1919, and he was branded as a traitor to the cause by his old associates. The Nationalists themselves were not a happy family, for the "Country party," which, as avowedly representing agricultural interests, had sprung into being at the election, was already disposed towards mild flirtations with the Opposition. There were personal considerations as well, and although Mr. Hughes paid a successful visit to the Imperial Conference of 1921 his success was coldly received by his own countrymen.

The eighth Parliament of the Commonwealth came to an end at the close of 1922. The elections, held in Dec., were marked by the most violent personal bitterness, and although Labour again suffered defeat, it was evident that no alliance of Nationalists and the Country party was possible under the leadership of Mr. Hughes. An acceptable successor was found in Mr. Stanley Melbourne Bruce. His first task was to form a coalition with the strongly reinforced Country party. Dr. Page, its leader, became Treasurer, and the administration was known as the Bruce-Page ministry. But Mr. Bruce was the real leader. He rapidly consolidated his position, and by the time he came to visit London for the Imperial Conference of 1923 his position was firmly established.

The chief business of the Conference was concerned with Imperial Preference. Mutual preference, which promised considerable help to Australia's primary industries, was agreed to between Great Britain and Australia. These arrangements, entered into on behalf of Great Britain by Mr. Baldwin's first government, were not carried out by the succeeding government of Mr. Ramsay MacDonald. The proceedings of the Australian Parliament in 1924 reflected the results of the change of Government in Great Britain: because Mr. MacDonald in the Imperial Parliament refused to accept the agreement for an Imperial naval base at Singapore, the Australian Prime Minister brought forward a new naval programme; and because the new British Government refused to endorse the preference agreement, the Australian Prime Minister proposed a scheme to assist exporters to obtain markets overseas, and also a series of Bounty Bills, designed to help the primary producer. Acts were passed by Parliament providing for export bounties on beef, and on fencing wire, galvanised iron, traction engines and wire netting manufactured in Australia; the bounty on shale oil produced locally was increased. A reciprocal trade treaty with Canada was also sanctioned.

A long series of shipping strikes culminated in the crisis of 1925. Shipping in Australian ports was held up and trade production seriously affected. Many local labour organisations sympathised with the strikers, and the political Labour party was, in the opinion of the Australian Government, responsible for aiding a strike movement which had a strong revolutionary aspect. The Commonwealth Government took measures to deport the strike leaders who were alien to Australia, but political Labour, which was in power in the majority of the state governments, openly resisted this and other measures dealing with the strike situation. Mr. Bruce finally decided to appeal to the country for authority to take measures which he deemed necessary for its safety, and a general election was held in Nov. 1925. The election resulted in the heavy defeat of the Labour party. The Nationalists obtained 38 of the 75 seats in the House of Representatives, the Country party 14 and the Labour party 23. In the Senate there were 22 seats to fill. Labour already held 11 seats in the section not due to retire, and it was therefore necessary for the party to win eight seats in order to have a majority in that House. The electors, however, made a clean sweep of the Labour candidates and returned 22 members of the Nationalist and Country parties. Voting at this election was compulsory under a penalty of £2.

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CONSTITUTIONAL QUESTIONS

Experience has demonstrated the marked rigidity of the Australian Constitution. Between 1908 and 1925 only one amendment was carried in accordance with the procedure outlined in section 128. The situation foreseen by certain critics, in which proposed amendments would be carried by sweeping popular majorities, but lost to an opposition strong enough to control three small states, did not occur, but the submission of proposed alterations to a referendum proved a sufficient barrier. Proposals which obtained the necessary statutory majorities in both Houses of Parliament were generally lost when they were referred to the people.

Proposed Amendments.—In 1910, simultaneously with the general election of April 13, electors were asked to decide on two constitutional amendments. One of these was accepted by a majority; it enlarged the power of the Commonwealth to take over the debts of the states, which by section 105 of the Constitution was limited to debts already existing at the date of the Commonwealth's establishment. By the amendment state public debts incurred later could also be taken over. The other proposal related to the allocation of the customs and excise revenue between the Commonwealth and the states. Under section 87, the Commonwealth's share was limited to one-fourth of its total. This arrangement was to continue for a period of ten years and thereafter until the Commonwealth Parliament otherwise provided. Parliament resolved, however, to diminish the portion left to the states to an amount representing £1.5.0. for each unit of population—and to do so, not by statute, a course which was open under section 87, but by constitutional amendment, in order to give the states a somewhat more stable claim on the proportion left to them. The amending measure was passed in Parliament but was rejected at the referendum of 1910. At a slightly later date, an ordinary statute to the same effect was passed. The effect of this was greatly to enhance the financial importance of the Federal Government, while the corresponding reduction of the states' share in customs and excise revenue, by approximately 50 %, initiated a period of considerable financial stringency in their finances.

A further unsuccessful effort to amend the constitution was initiated in 1910 and submitted to the people in a referendum of April 26 1911. The object of this was to give to the Commonwealth Parliament power to deal with the following matters:—

(*a*) Trade and commerce, without any limitations, instead of "trade and commerce with other countries, and among the states" only.

(*b*) The control and regulation of corporations of all kinds, except those formed not for the acquisition of gain. (Only "foreign corporations and trading and financial corporations formed within the limits of the Commonwealth" came under the jurisdiction of the Federal Parliament.)

(*c*) Labour and employment, including wages and conditions of labour and the settlement of industrial disputes generally, including disputes in relation to employment on state railways. (Conciliation and arbitration by the Commonwealth operate only in the case of any industrial dispute extending beyond the limits of any one state.)

(*d*) Combinations and monopolies in relation to the production, manufacture or supply of goods or services.

This proposal was rejected by a majority and also by a majority in every state except Western Australia. On the same occasion and as an outcome of the same legislation, it was proposed to insert in the constitution the following sub-section:—

> When each House of Parliament, in the same session, has by resolution declared that the industry or business of producing, manufacturing or supplying goods, or of supplying any specified services, is the subject of any monopoly, the Parliament shall have power to make laws for carrying on the industry or business by or under the control of the Commonwealth, and acquiring for that purpose on just terms any property used in connection with the industry or business.

This proposal was also rejected by closely similar voting. In 1913 the same proposed alterations of the constitution, with certain minor changes, were again submitted in the form of six separate amendments. They were again rejected, although on this occasion a majority for them was obtained in Queensland, South Australia and Western Australia, while New South Wales, Victoria and Tasmania were hostile. In 1919 proposals were again submitted to a referendum for extending the legislative powers of the Commonwealth relating to industrial disputes and the nationalisation of monopolies. Both proposals were rejected. On this occasion South Australia was hostile, but Victoria gave a majority for the proposals, as did Queensland and Western Australia.

Decisions of the High Court.—Apart from action of a legislative character directly altering the nature of the constitution, there must be noted, within the period 1900 to 1925 certain constitutional changes due to the activity of the High Court, which, under the terms of the constitution, is made its final interpreter. In a series of early cases the doctrine of immunity had been applied to both Commonwealth and State instrumentalities. Under this doctrine, the officers, institutions and other machinery of the one government are not to be fettered, controlled, hampered or interfered with by the legislation of the other government. The instrumentalities of the Commonwealth are thus immune from any such legislation of the state, which, even if it contains no explicit exceptions in their favour, automatically exempts them. The principle had also been applied conversely, and it had been held that state instrumentalities were similarly exempt from the incidence of Federal legislation. The High Court later enunciated, in connection with cases of overlapping of state and federal powers, what amounted in the circumstances to a new principle, stated by the majority of the Court in the following terms:—

> That section (sec. 109) which says "When a law of a State is inconsistent with a law of the Commonwealth, the latter shall prevail, and the former shall, to the extent of the inconsistency, be invalid," gives supremacy, not to any particular class of Commonwealth Acts, but to every Commonwealth Act, over not merely State Acts passed under concurrent powers but all State Acts, though passed under an exclusive power, if any provisions of the two conflict; as they may. (The *Amal. Soc. of Eng. v. the Adelaide S.S.Co.—28 C.L.R.* 129.)

This important determination has obviously affected the independence and dignity of the states. The total disbursements, *e.g.*, to be made to its railway or other industrial servants by any state, may now depend not on the decision of the taxpayers of the state, but on that of an organ of the Federal Govt. (the Court of Conciliation and Arbitration). This would appear to be a substantial derogation of the states' financial autonomy, which in other portions of the constitution is carefully safeguarded. The high court also decided the true meaning of section 92 of the constitution, the important part of which is as follows:—

> On the uniform duties of customs, trade, commerce and intercourse among the States, whether by means of internal carriage or ocean navigation, shall be absolutely free.

The attempts of various states to maintain control over some commodity whose place of origin was within their territory met with varying degrees of success.

Two Important Points.—In the case of New South Wales the state had, by appropriate legislation, taken over the whole of the wheat in the state, and refused to sell it in other states except upon its own terms. The Court held that this constituted no violation of section 92. The ownership had passed to the King. If his advisers wished to export it to another state they were free to do so. Later a New South Wales statute purported to make public property of pigs. Here, however, the Legislature had provided that the ownership should pass only upon a proclamation, and that in the interim no holder should export except in certain conditions. This additional provision was regarded as infringing the prohibition of section 92 and therefore invalid.

When a similar question arose in Queensland over the position created by statute which had been modelled upon the New South Wales statute, and in which the operative words were equivalent, the Court changed its attitude and, on fuller consideration, came to the conclusion that in the interval preceding the actual transfer of stock, or meat, to the King, an intermediate type of property interest, not previously known to the law, had been created, and that it was within the province of the state Legislatures to create such new forms of property. Confronted later with the somewhat different problem presented by the action of the Queensland Parliament in endeavouring to make it unlawful for the trader to sell commodities within Queensland at anything above an officially proclaimed price, the Court held that so far as it sought to impose this prohibition upon traders of other states this Act was invalid. (McArthur v. Queensland 28 C.L.R. 530.)

This decision also has affected the standing of the constituent states of the Commonwealth, by imposing a definite limitation upon their legislative powers. Whether the same limitation would apply to the legislation of the Commonwealth was, of course, not a matter to be decided. But the majority of the Court indicated clearly that they considered it would not. The net result of the judgment would thus appear to be to exclude a whole field of legislation from the jurisdiction of the states and leave it, subject to any further decision of the High Court, to the Commonwealth.

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DEFENCES OF THE COMMONWEALTH

The Defence Acts of 1909 and 1911 provided for the compulsory enrolment and military training of all males between the ages of 12 and 18 as cadets, and then between 18 and 26 as citizen soldiers. The Acts compel the boy and the young man to attend so many statutory parades each year and to spend several days actually in camp—the number in each case varying according to circumstances. The total number of boys at cadet age at the census of 1921 was approximately 300,000. There were 353,000 men of citizen soldier age. By an Act of 1921 the Australian Army system was reorganised on the model of the Australian Imperial Force in the World War. The organisation is territorial, each area providing a battalion of infantry and a proportion of other troops. After training, the citizen soldier passes into the reserve.

As a result of the Washington Conference on Disarmament it was decided by the Commonwealth in 1922 that the universal training law should be continued, but that its operation should be restricted to the more populous centres and to certain quotas only. As from July 1 1925 senior cadet training was confined to one quota instead of four quotas, beginning on July 1 of the year in which persons liable for service reach the age of 17 years. Citizen force training was confined to three instead of seven quotas, beginning on July 1 of the year in which persons liable reach the age of 18 years, and continuing until June 30 of the year in which they reach the age of 21 years. Notwithstanding these reductions in training, the liability to register at the age of 12 years and to serve for the full period prescribed by the Defence Act remained. The Divisional Organisation of the Field Force is retained in skeleton form, units being maintained at considerably below war strength. The total strength of the permanent military forces in 1925 was approximately 38,889.

An important section of the reserve is formed by the rifle clubs. In 1925 these clubs, which are officially recognised, numbered 1,383 with a membership of over 80,000. The Royal Military College at Duntroon was established in 1911 for the purpose of training officers for the permanent forces. Over 158 staff cadets graduated between that year and 1918 and saw service during the War. The activities of the college suffered as a result of post-war retrenchments.

Naval Policy.—In 1909 Australia, which had previously contributed a subsidy to the British Navy, agreed at an Imperial Defence Conference to a proposal for the building of an independent Australian fleet unit. Under this scheme Australia provided a fleet unit of one battle cruiser, three light cruisers, six destroyers and three submarines, which, placed unreservedly at the disposal of the British Admiralty at the outbreak of the World War, did notable service. Additions to the navy, by purchase and gift, were gradually made, and when peace arrived the fleet consisted of one battle cruiser, six light cruisers, twelve destroyers, six submarines and various auxiliaries, sloops and depôt ships.

The Washington Conference greatly affected Australian naval policy. In acceptance of its decisions the battle cruiser "Australia" was sunk and 19 other ships paid off. In 1925 the number of ships actually in commission was less than in 1914. A vigorous programme of development was begun, including the construction of two new cruisers, the maintenance of ships out of commission and the establishment of submarine bases and oil depôts. Australia has a naval college at Jervis Bay for the education of naval officers; the system closely follows that of naval colleges in England, and all expenses of the cadets are met by the Commonwealth Government. There is also a training ship at Sydney for other ranks.

In 1912 approval was given for the establishment, as part of the army organisation, of a Central Flying School for the training of aeroplane pilots. Training commenced at Point Cook in June 1914 and continued actively throughout the War. An Air Adviser to the Navy Department was appointed in 1918. In 1920 the Australian Air Force was constituted by proclamation as part of the military forces. On March 31 1921 this force became the Royal Australian Air Force. The approved establishment is 71 officers and 300 other ranks; the units are a headquarters at Point Cook, an aircraft depôt and training school and an experimental section. Over 120 aerodromes and landing grounds had been prepared by the end of 1925.

II. ECONOMIC AND FINANCIAL HISTORY

Area and Population.—The following table gives the areas and population of the States and Territories of the Australian Commonwealth:—

State	Area in sq. m.	Population 1921
New South Wales	309,432	2,100,371
Victoria	87,884	1,531,280
Queensland	670,500	755,972
South Australia	380,070	495,160
Western Australia	975,920	332,732
Tasmania	26,215	213,780
Northern Territory	523,620	3,867
Federal Capital	940	2,572
The Commonwealth	2,974,581	5,435,734

In 1909 the Commonwealth and the State of New South Wales entered into an agreement for the surrender to and acceptance by the Commonwealth of an area of 912 sq. m. as the seat of the Government of the Commonwealth. This area was constituted a Federal Territory on Jan. 1 1911. By the Jervis Bay Territory Acceptance Act 1915, an area of 28 sq. m. at Jervis Bay was surrendered by New South Wales and accepted by the Commonwealth as a port for the Federal Territory. On Jan. 1 1911, the Northern Territory was transferred by proclamation from the State of South Australia to the Commonwealth, and constituted a Federal Territory. On July 1 1914 Norfolk Island, a Crown Colony administered by the Government of New South Wales, was taken over by the Federal Parliament as a territory of the Commonwealth. In 1920 the former German possessions of Kaiser Wilhelms Land, the Bismarck Archipelago and the Solomon Islands were entrusted under mandate from the League of Nations to the Government of the Commonwealth of Australia, and administered as the Territory of New Guinea.

The natural increase of births over deaths per 1,000 of the population in the period 1906 to 1910 was 15·93. The population at the census of 1911, exclusive of full-blood aboriginals, was 4,455,005. As a consequence of the World War the rate of increase fell, and for the period 1919 to 1923 the figure was 14·07 per 1,000. At the census of 1921 the population was 5,435,734. The average annual increase for the period 1921 to 1924 was 117,000. Of this number, 68·5% was due to natural increase and 31·5% to immigration. The increase for 1925 was 110,000, of which 65% was natural increase and 35% immigration. At the end of 1925 the total population approximated 6,000,000.

Aboriginal reserves totalling 30,231 sq. m. have been set aside for the native population, and all possible help is given to this primitive people; their number however constantly declines. The 1921 census showed 1,597 in New South Wales, 144 in Victoria, 1,609 in South Australia, and an estimate of 15,587 in Western Australia. The number in the Northern Territory is variously estimated from 20,000 to 50,000, the weight of evidence favouring the former rather than the latter number. In Tasmania the aborigines have been extinct for many years.

Growth of Urban Population.—A feature of Australian social life is the preponderance of the urban over the rural population. In South Australia and Victoria more than one-half of the total population of the states is concentrated in Adelaide and Melbourne respectively, while over 45% of the population is contained within six towns. The following table shows the population of these towns on Dec. 31 1924, both in numbers and as percentages of the populations of the respective states. The total is also given as a percentage of the total population of the Commonwealth.

	Year	Population	%
Sydney (N.S.W.)	31st Dec. 1924	1,012,070	44·89
Melbourne (Vic.)		885,700	53·45
Brisbane (Qld.)		245,015	29·35
Adelaide (S.A.)		289,914	53·84
Perth (W.A.)		176,467	48·46
Hobart (Tas.)		56,507	25·74
Total		2,665,673	45·44

The states and the Commonwealth strive to counterbalance the call of the cities by cheap railway rates for farmers' goods, by increasing as much as possible such of the conveniences of civilisation as are under state control, by encouraging manufactures in country centres and by other means: all effort seems to be in vain, and the proportion of the urban to the total population is growing. The settlement of the great empty spaces of the Northern Territory still presents an apparently insoluble problem, and successive commissions of inquiry have failed to suggest any adequate remedy for what is generally recognised as a national danger.

Immigration.—In regard to immigration, Australian public opinion has undergone a marked change, due chiefly to a fuller appreciation of the danger of a small white population. There was, for many years, a desire on the part of the exceedingly prosperous working-people of Australia to keep out immigrants as much as possible, lest an increase in the population should result in lower wage rates and a fall in the standard of material welfare of the workers. That desire survived in some quarters in 1925 and was still a force to be reckoned with; but it was gradually being recognised that a much larger population was necessary to the safety of the country, and need not affect the individual prosperity of the inhabitants of a continent which has room at a low estimate for 100,000,000 people. In 1906 the policy of state-aided immigration was re-established and, though interrupted by the War, was later revived under Commonwealth direction.

In 1920 an arrangement was made between the Commonwealth and state governments, under which the Commonwealth is responsible for the recruiting of immigrants abroad, whilst the state governments advise the Commonwealth as to the numbers and classes of immigrants they are prepared to receive. The Commonwealth selects the immigrant according to the requirements of the state concerned and brings him to Australia; on his arrival the state takes the responsibility for placing him in employment or on the land. Under an amending Immigration Act (1920) the entry was prohibited:—

(*a*) of any person advocating the overthrow by force or violence of the established Government of the Commonwealth or of any state or of any other civilised country, or of all forms of law, etc.

(*b*) for a period of five years, of any person of German, Austro-German, Bulgarian or Hungarian parentage and nationality, or of Turk or Ottoman race.

By a proclamation issued on Dec. 2 1925, the latter restriction was removed as from that date, except in so far as it affected persons of Turk or Ottoman race. Between 1914 and 1923, 914,436 persons were assisted to migrate to Australia.

British immigration was still far from satisfactory in 1925. The following table gives the figures for the years before the War and the period 1921–4.

	Grand Total	British Immigrants		Grand Total	British Immigrants
1910	94,543	81,457	1921	87,938	73,015
1911	139,020	124,061	1922	93,513	82,028
1912	163,990	146,602	1923	92,859	83,200
1913	140,251	122,443	1924	103,667	86,614

The Empire Settlement Act of 1922, by the terms of which the British Government entered into partnership with the Dominions for the encouragement of assisted immigration, failed to realise the expectations of its sponsors. The hostility of organised labour in Australia, the high standard demanded by the Commonwealth authorities in London, and the fact that Crown Lands are owned by the states, all tended to restrict the flow of immigration from the mother country. In May 1925 an important agreement with the British Government to encourage migration to Australia was announced. The British Government offered to make a loan to the Australian Government of £34,000,006, provided that, within a period of 10 years, 450,000 British emigrants were settled in Australia. The British Government would meet one-half of the interest charges on this loan during the first five years and one-third during the second five years; it also undertook to bear a proportion of the cost of maintenance of training farms in connection with the scheme, and made certain guarantees against loss. This agreement has to be accepted by all the states of the Commonwealth before it can be given practical effect. Up to the end of 1925, only Victoria and Western Australia had accepted. (F. Pe.*)

PRODUCTION, INDUSTRY AND TRADE

During the years 1910–25, the pastoral and agricultural industries have continued to be the most important in Australia, though a considerable growth of manufacturing has taken place. The mining industry has, however, declined both in quantity and in value. In the following table the average annual value of the output of the various classes of production are compared.

Class of Production	Period	
	1911–3	1921–2 to 1923–4
	£	£
[1]Agricultural	43,563,000	83,399,000
[1]Pastoral	53,402,000	87,808,000
Forests and fisheries	6,166,000	11,169,000
Dairy, poultry and bee farming	19,909,000	43,357,000
Mining	24,790,000	20,841,000
Manufactures	59,873,000	131,556,000
Total	207,703,000	378,130,000

[1]Period 1911–2 to 1913–4.

Allowance should be made for the alteration of price levels between 1911 and 1924. It is officially estimated that on 1911 price levels the value of the annual average production for the period 1921–2 to 1923–4 of the agricultural industry was £59,341,000; the pastoral industry, £44,032,000, and the dairying, poultry and bee-keeping industries, £24,479,000.

Pastoral Production.—During the period 1910–3 wool represented 13·3% of the total Australian production and 35·0% of the total exports, and for 1921–2 to 1923–4, 12·9% of the total production and 45·5% of the total exports. Before 1914 Australia annually produced twice as large a quantity of wool as any other country. Her output in 1912–3 amounted to approximately 700,000,000 lb. out of a world total of some 3,157,000,000 lb., *i.e.*, 22·6%. In 1921–2 the world production had sunk to 2,697,000,000 lb., of which total Australia was responsible for 631,000,000 lb. or 23·5%. The breeding of sheep for wool is carried on in every state of the Commonwealth, particularly in New South Wales. Owing to climatic conditions, the sheep population of Australia fluctuates considerably. During the period 1910–25 the lowest number of sheep, 69,000,000, was recorded in 1915 and the highest, 93,000,000, in 1911. In 1923 the number was 80,110,461; a considerable increase occurred in 1924, there being 4,000,000 more in Victoria and Queensland alone.

During the period 1885–1925 careful attention to breeding developed a much more valuable type of sheep. Between 1890 and 1920 the average yield of wool per sheep has risen by about 2 lb. or 40%. In 1913 the average value of merino wool was 10d per pound. In 1915–6, owing to war conditions, wool clips accumulated in Australia. The Imperial Wool Purchase Scheme was then established and the Imperial Government purchased, during the remainder of the War period, the Australian clips on a flat rate basis of 1/3½d per lb. plus one-half share of any profits realised on sales for civilian purposes. By agreement the price of 1/3½d for Australian wool was maintained for the 1919 season, but world prices for wool were rising rapidly. In April 1920 the high water mark was reached, but a heavy slump followed, which was intensified by the termination of the Imperial Wool Purchase Scheme in June 1920, after which the price per lb. fell still further, the lowest point being touched in March 1921. On Jan. 27 1921 the British-Australian Wool Realisation Association, Ltd., was formed to take over the balance of stocks held by the British Government, and it undertook the marketing of the stocks of Australian wool on behalf of the Imperial Government and of the producers. The concluding sale of the B.A.W.R.A. wool took place on May 2 1924.

The total number of cattle in Australia in 1913 was 11,483,882, and in 1923 the number had increased to 13,357,508. In considering the beef industry, from this total must be deducted dairy cattle, numbering 2,035,717 in 1913 and 2,304,644 in 1923. The raising of cattle for beef is the main industry of the northern districts of Western Australia, the Northern Territory and the northwest of Queensland. The War conditions gave a great impetus to the Australian beef industry. The British Government bought the available supplies of Australian beef at fixed prices until 1921, when the price level on the British market was so low that the export of beef from Australia was unprofitable. From 1922 till 1924 the Australian Government was forced to subsidise the export of frozen and canned beef, and of live cattle for slaughter.

The year 1925 saw a rise in price which was sufficient to cover the cost of production and marketing, but which was not sufficient to encourage any large increase in production. Australian beef is at a serious disadvantage in comparison with that of

South America. The best Argentine meat is brought to Great Britain in a chilled state, whereas Australia, being much farther away, has to send her beef in a frozen condition. The further development of the industry is largely dependent on whether scientific research can remove this disadvantage. The importance of the beef industry in Australia is not confined to its own intrinsic value. Cattle, as opposed to sheep, can be travelled large distances and can flourish without elaborate fencing. For these reasons the development of a large portion of Northern Australia is dependent upon cattle.

The production of sheep for mutton and lamb has, in Australia, always been subsidiary to wool production, and for this reason less progress has been made in Australia than in New Zealand in this branch of the pastoral industry. The export trade in mutton and lamb is confined to the southern coastal areas of Victoria, New South Wales and South Australia; the average annual exports for the period 1911–3 amounted to 149,957,686 lb. and for 1921–2 to 1923–4 to 99,710,969 pounds. Australia consumes about four-fifths of her production. Experience in the use of superphosphates and clovers on lands within the heavier rainfall areas in South Australia indicates that very considerable developments of mutton and lamb production will occur in the near future.

Agricultural Products.—Great progress has been made in improvement of the methods of production and in the varieties of wheat grown. These improvements have led to an increased yield per acre which is the more noteworthy when it is realised that the production of wheat has been extending into drier areas. The results which have been obtained in the drier areas make it evident that the area under wheat in 1925 could be trebled without substantially lowering the average yield per acre. The progress made in wheat production in the Commonwealth is indicated in the table given below:—

	Annual Average	
	1911–2 to 1913–4	1921–2 to 1923–4
Area under wheat	8,018,294 ac.	9,674,445 ac.
Total yield	88,987,183 bu.	121,178,973 bu.
Average yield per acre	11·1 bu.	12·53 bu.
Value per acre . . .	£2. 0. 6	£3. 4. 6

The production of cereals other than wheat is developed on a much more limited scale. The oat crop, mainly produced in Victoria, is used for feeding purposes. Maize is grown to a considerable extent in New South Wales and Queensland, and barley growing is concentrated in South Australia. Very large areas in Australia are suitable for the growing of barley and maize, but the production is conditioned by markets for these cereals. If an export market could be found for Australian pig products, a large extension of production of both barley and maize will take place.

Sugar cane is grown in Queensland and New South Wales, Queensland producing over 90% of the total output. The annual average production of cane in the period 1911–2 to 1913–4 was 1,696,000 tons; for 1921–2 to 1923–4 it was 2,309,000 tons, from which an average output of 297,457 tons of sugar were obtained. The "White Australia" policy has led the Commonwealth Government to assist the cane farmers in various ways. In 1915 the Government agreed to purchase the sugar output at the price of £30 6s. 8d. per ton. In 1923 this agreement was terminated, and a competent tribunal was formed which fixed the price at £27 per ton. The embargo on importation was continued until 1925, but special concessions were granted to manufacturers using sugar in goods for export.

Cotton production in Queensland dates from 1919. In that year 72 ac. were planted and 37,238 lb. of unginned cotton produced. In 1923–4, 75,000 ac. of land under cotton in Queensland produced 12,614,000 lb. of unginned cotton. In order to encourage the development of this crop, the Commonwealth Government, in conjunction with the Queensland Government, guaranteed the price of 5d. per lb. to cotton of less than 1¼ in. staple and 5½ per lb. to cotton of a longer staple. The reason for the encouragement from government sources of this experimental development has been the idea that the production of cotton in Australia is particularly suitable for the small farmer, and, if successful, will lead to a rapid extension of land settlement.

Dairying.—Dairying, as shown by the following table, has expanded considerably during the period 1911–24:—

	Annual Average	
	1911–3	1921–2 to 1923–4
Dairy cattle (milking)	1,547,016	1,654,268
Milk produced for all purposes	578,012,226 gal.	704,370,465 gal.
Butter production .	199,508,714 lb.	242,910,734 lb.

The most important product of the dairying industry is butter; 40% of the production was exported during the period 1911–3 and 37% during 1921–2 to 1923–4. The season 1924–5 witnessed a largely increased export, amounting to 145,281,000 lb. or 79,000,000 lb. more than in 1923–4. The co-operative production of butter from milk has made more progress in Australia than any other branch of agricultural production; 70% of the total output is manufactured in co-operatively owned butter factories. The Australian dairying industry has been extensive rather than intensive, but the present tendency is to attach an increasing importance to intensive methods. Attention is being directed towards the improvement of the breeding of dairy cattle and to the progressive improvement of pastures.

Forestry.—A post-War revival of interest in forestry resulted in state encouragement of the educational side. The annual average amount of local timber sawn or hewn in the Commonwealth during the period 1911–3 was 649,110,000 super. ft., and for 1921–2 to 1923–4, 615,986,000 super. feet. The exports of dressed and undressed timbers (hardwood) show a distinct decline between the annual average for 1911–3 and the annual average for 1921–2 to 1923–4 from 134,078,000 super. ft. in the earlier period to 96,866,000 super. ft. in the later period.

Fruit.—Fruit production in Australia may be classified under the five main heads of apples and pears, soft deciduous fruits, dried fruits, citrus fruits and tropical fruits. In 1913, the apple crop amounted to 4,691,836 bu., valued at £1,086,702. The annual average of 1921–2 to 1923–4 shows an increased yield of 2,000,000 bu. over the 1913 figure, the value being £1,962,836. The area under apples amounted in 1923–4 to 81,000 ac., and of this total Tasmania contained 32%. The increase in pear production is not so noticeable, the yield in 1913 being 1,100,114 bu. and the average for 1921–2 to 1923–4, 1,388,713 bu. The export of apples in 1913 was 49,000,000 lb. and in 1923–4 65,000,000 pounds. The production of apricots, peaches and berry fruits is either consumed locally or exported as canned or pulped fruit. The export of canned fruit increased from an annual average value of £15,000 in the period 1911–3 to £471,000 in 1921–2 to 1923–4. Dried fruit production is concentrated mainly in the Murray basin. The progress in this industry has been remarkable. The annual production of dried fruits averaged 243,000 cwt. for the years 1911–3, but during the period 1921–2 to 1923–4 the output averaged 682,000 cwt., currants and raisins accounting for 637,000 hundredweight. Pre-War figures indicate that only 20% of the production was exported, but since the War the export has increased to 80%.

The citrus industry flourishes in the Murray irrigation settlements, New South Wales, Queensland and Western Australia. In 1923–4, 2,820,000 bu. of oranges were produced. The export trade has as yet hardly passed the experimental stage: in 1923–4 approximately 26,560 bu. of oranges were exported to Great Britain. Queensland is the main source of tropical fruits. An expanding production of bananas and pineapples has coincided with ex-soldier settlement in that state. The wine industry is rapidly increasing. The area under vineyards in 1912–3 was 62,388 ac., South Australia and Victoria accounting for 80% of this total. By 1923–4 the acreage had increased to 112,965 acres. The annual production of wine increased from an average of 5,262,948 gal. for the period 1911–3 to 11,551,415 gal. for the period 1921–2 to 1923–4.

Mining.—The following figures indicate the relative importance, as far as value of output is concerned, of the mineral products of Australia:—

	Annual Average	
	1911–3	1921–3
	£	£
Gold	9,936,041	3,571,757
Coal	4,324,004	10,645,710
Silver lead ore and concentrates	3,347,321	1,930,569
Copper ore, ingot and matte	3,025,783	964,639
Zinc and concentrates	1,576,538	950,855
Tin and tin ore	1,323,239	462,071
Lead	328,288	430,771
Iron	154,125	531,970
Silver	309,760	307,973

Hard coal mining activities are concentrated in New South Wales whose output amounts to 83 % of the total. Australia's gold output, 64·5 % of which comes from Western Australia, only represented 5 % of the world production in 1922, in comparison with her 10 % share before 1914. The decadence of mining in Australia may be regarded as of a temporary nature. Large metalliferous areas are reported in Central Australia, but the existing lack of transport facilities renders development too costly to be undertaken.

Manufactures.—The two most important branches of secondary production are the iron and steel and the woolen industries. Large supplies of high-grade iron ore occur in South Australia; these are shipped to the coalfields at Newcastle, New South Wales, where an iron and steel industry has been established. Articles of apparel and boots and shoes are now largely manufactured and there has been a considerable development of engineering activity, especially in the production of railway rolling stock. The average annual value added to products by process of manufacture was £59,873,000 for the period 1911–3 and £131,556,000 for 1921–2 to 1923–4. Of the latter total about £48,682,000 was due to such branches of secondary production as the preparation of foodstuffs for consumption, the provision of heat, light and power and brick and tile production.

Heat, Light and Power.—The supplying of heat, light and power in 1912 cost £4,901,975 and in 1923–4 cost £14,750,000. The development in Tasmania of hydroelectric schemes has led to the establishment in that State of a number of new industries. In Victoria large brown coal deposits occur. The Victorian Electricity Commissioners were set up in 1918 to consider the possibilities of establishing a scheme for electrical generation from the lignite mined at Morwell. The supply of electricity from this source of cheap power is becoming a factor of great importance to the factories in and around Melbourne.

Irrigation.—Irrigation in Australia is concentrated mainly in the Murray valley. The Murray River Agreement, entered into in 1914 by the Commonwealth Government and the Governments of South Australia and Victoria, was brought into operation in 1917. The agreement provides for the construction of the Hume dam on the upper Murray, the Lake Victorian storage schemes, the Burrunjuck dam in New South Wales and the Sugar Loaf dam in Victoria. The work is supervised by the River Murray Commission and it is estimated that when these works are finished, the water impounded will irrigate 1,500,000 acres: 26 locks and weirs are to be constructed on the Murray and Darling rivers which, when completed, will allow of 1,000 m. of navigation on the Murray, 600 m. on the Murrumbidgee and 1,000 m. on the Darling. The special importance of these irrigation works is to be found in the opportunities which they provide for close settlement, which has been found the most satisfactory form of land settlement for British immigrants.

Overseas Trade.—The annual average value of Australian imports for the period 1911–3 was £74,958,000 and for the period 1921–2 to 1923–4, £125,147,000. The domestic exports for these periods had an average annual value of £79,033,000 and £121,734,000 respectively. Australian tariff policy has for many years been governed by two desires: firstly, to protect and encourage home manufactures, and secondly, to assure to the British manufacturer the chief share of the import trade. Under the Tariff Act of 1920 additional protection was afforded to many Australian industries and the average preference on British goods was increased from 5 % to 12 %.

In 1921 the Industries Preservation Act was passed to protect both the Australian and the British manufacturer from the competition of countries with depreciated exchanges. The Tariff Board, composed of a government representative, two business men and a representative of primary producers, was also set up in 1921 to administer the Industries Preservation Act and to investigate the effect of the tariff upon primary production and upon the cost of living. Later tariff measures carried on the two policies of industrial protection and imperial preference. The general trend of Australian overseas trade is shown in the following table:—

Imports

Country of Origin	Annual Average	Per Cent	Annual Average	Per Cent
	1911–3		1921–2 to 1923–4	
	£		£	
United Kingdom	37,661,000	50·3	61,677,000	49·4
United States	10,226,000	13·6	26,076,000	20·8
Germany	6,851,000	9·1	682,000	·5
Other countries	20,220,000	27·0	36,712,000	29·3
Total	74,958,000	100·0	125,147,000	100·0

Exports

Country of Destination	Annual Average	Per Cent	Annual Average	Per Cent
	1911–3		1921–2 to 1923–4	
	£		£	
United Kingdom	33,841,000	43·0	51,741,000	42·6
France	8,628,000	10·9	11,961,000	9·8
Belgium	6,720,000	8·5	5,279,000	4·3
United States	2,046,000	2·6	8,351,000	6·9
Other countries	27,798,000	35·0	44,402,000	36·4
Total	79,033,000	100·0	121,734,000	100·0

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BANKING AND FINANCE

Banking in Australia, linked as it is with the economic development of that continent, presents in its history since 1908 features of exceptional interest. The pre-War period was marked by the continued recovery from the effects of the financial crisis in Australia in 1893, by the realisation of immobile assets, chiefly unproductive or partly productive lands, and the steady conversion of the proceeds into commercial or other similar assets of a more or less liquid form and by the general strengthening and consolidation of the banking position.

Of the 30 banks in existence before 1893, 13 were either absorbed by other institutions or disappeared, while several of the older banks, still struggling in 1908 to carry through their reconstruction obligations of 1893, have successfully met them, and regained positions of undoubted strength. Their recovery in earning power and dividends and the increased market value of their shares are indicative of the general trend towards the more stable and prosperous banking conditions which prevailed throughout Australia in 1925. Evidence of this change is reflected in the net profits of the trading banks, which increased from £908,000 in 1899 to £2,423,000 in 1908, while dividends in the same period went up from £660,000 to £1,378,000. Of the 14 older banks forming the main body of the 19 institutions trading in Australia in 1925, some of them emerged from the crisis of 1893 not only untouched by its effects but with added strength. None of the 14 banks, it may be mentioned, has been in existence for less than 40 years. Five additional banks have been added since 1908 to the number operating in Australia; of these three are foreign institutions each with a single agency, mainly for exchange purposes, and two are locally domiciled, one being the central institution—the Commonwealth Bank of Australia.

State Regulation.—For a number of years two of the aims of the Labour Party in Australia were a State note issue and a State bank: these aims were ultimately achieved, although not precisely on the lines nor with the results contemplated. The Australian banks, from their foundation, had enjoyed the right to issue their own notes. In 1866, the Queensland Govt., in order to facilitate their own financial operations, decided to make an issue of Treasury notes as an auxiliary to the issues of the banks. But the banks, wishing to protect their own circulation, presented for payment every government note as it came into their hands for credit or collection, thus rendering abortive the government scheme, which was withdrawn a couple of years later. After a majority of the banks had suspended payment in 1893, the Queensland Govt., in order to stabilise the currency and provide funds for their own commitments in London, abolished the bank-note issues in Queensland by imposing a prohibitive tax and circulated their own Treasury notes. The latter continued as a monopoly from 1893 until 1911, when all other issues were superseded by the Federal Govt. notes now circulating throughout Australia. The Queensland Govt. circulation averaged £1,500,000 during the 18 years of its existence, against a gold backing of about one-third, the maximum circulation reaching £1,692,506.

Under the Australian Notes Act of 1910 the sole right to issue and re-issue notes became vested in the Commonwealth Government. The private issues of the banks, which had reached a maximum of £3,800,000 in 1910, therefore lapsed and were redeemed on presentation. On Sept. 30 1925 notes were still outstanding to the amount of £202,588, including all lost or destroyed. The Federal issue at close of 1910 was £3,389,476 and in Dec. 1911 reached £10,156,358. It amounted to £56,890,226 in Dec. 1924, falling on June 30 1925 to £53,890,226. The latter comprised £23,930,437 notes held by the public and £29,959,789 by banks, the reserves being £25,841,027 of gold coin and bullion, Australian Govt. securities valued at £27,574,106 and other assets. The management of the issue was handed over to the Commonwealth Bank of Australia when a Note Board was created in 1920. The net profit from the Note Issue Department is paid by the bank direct to the Treasury, the amount for the half year ending June 30 1925 being £578,577.

The Commonwealth Bank.—After much contention in the Australian Parliament, the Commonwealth Bank Act received assent on Dec. 22 1911 and steps were taken to bring the measure into operation without delay. The first governor, Mr. (afterwards Sir) Denison Miller, was appointed on May 14 1912, and to his organising capacity, energy and prudent conduct of the affairs of the bank its success was largely due. Branches were opened in London and throughout Australia in Jan. 1913, and senior officials were selected for the management from other Australian banks. From London a system of agents and correspondents, first in the British Isles and then throughout the world, was arranged, and a bank created to handle in London not only banking in all its phases but the organisation required for the loan flotations in England of the Commonwealth Govt. as well as of several of the state governments and municipal and other bodies. The preliminary expenses of the bank were provided from a loan of £10,000 from the Treasury to the governor; this was quickly repaid, a remunerative business was formed and large profits, aggregating £4,696,608, were made in less than 12 years from its inception. The institution was started without capital, other than the temporary loan of £10,000, but it was backed by the guarantee of the state for all its obligations.

After the death of Sir Denison Miller in 1923, the intention to alter the constitution of the bank by appointing a Board of Control of eight Directors was given effect, and the amending Act was passed on Aug. 20 1924. A capital of £20,000,000 was also provided for the bank, £4,000,000 of which was obtained by transfer from accumulated profits, £6,000,000 is to be granted from government funds, and the balance to be raised by the sale of debentures. Up to Dec. 1925 the £4,000,000 from reserves had been deemed sufficient, and £696,608 from profits still remained at reserve account. A Board of Advice in London of three members was also provided for, but no appointments had been made before the end of 1925.

The War Period.—After the outbreak of the World War the British Govt. entered into contracts through the Australian Govt. for supplies at pre-War prices, and the cost of these was paid from time to time to the Commonwealth Bank in London, for distribution through the other banks to the producers. Wool, wheat, meat, butter, cheese, etc., thus paid for aggregated a value of over £200,000,000. All the primary producing industries were, as a necessity of the War, assisted in their financing and practically controlled by the Commonwealth Govt., their products being taken over in bulk or dealt with in "pools." The total amount thus paid to primary producers under the compulsory and voluntary pooling arrangements exceeded £437,000,000.

In Australia loans for War purposes were floated through the state bank for a total sum of £210,000,000; subscriptions for the 10 local war issues exceeding £250,000,000. The private banks loyally co-operated in all these War measures and shared in the related exchange transactions. The financing of the Australian troops was carried through by the Commonwealth Bank. Branches were opened in army camps throughout Australia and in England, for the purpose of facilitating soldiers' payments, and some millions of transactions were undertaken without charge, including private cable transfers to England, France, Egypt, Palestine, etc. Australian state notes were cashed for Australian soldiers and travellers at the chief centres throughout the world at par of exchange. Bank of England notes, to a large aggregate, were cashed for returned soldiers in Australia free of charge, under an arrangement by which the Commonwealth Bank was periodically reimbursed in London on receipt of advice of the amounts cashed; the notes themselves, owing to submarine activities, were retained in Australia until after the World War.

Post-War Developments.—The course of Australian finance throughout the War and during the post-War period ran without hitch or difficulty. The Commonwealth Bank—which operated in effect if not in name as a central bank from its formation —displayed in its management in Australia and in London a helpful attitude of co-ordination and co-operation towards the private banks. Its strong leadership was willingly followed, and even if the necessity for assistance by way of advances or discounts or otherwise did not materially arise, the fact that the state bank, as the instrument of the government and with its reserves including its note issue and gold holdings, stood behind the whole of the banks, contributed towards dispelling any unrest or uncertainty which might otherwise have arisen. As a special measure after the outbreak of War, the Australian states were assisted temporarily from the Notes Fund to the extent of £20,000,000, but the gold reserve never fell below 40%, although the statutory reserve is 25%. Money in Australia was easy during and after the War, and exchange with London more or less stabilised. This was assisted by the arrangements with the British Govt. for purchase of all wool and wheat, etc. The ease of money, especially in the later post-War period, resulted partly from the bountiful seasons, and partly the good prices realised from wool and wheat. In 1925 the value of the wool shipments from Australia alone reached £55,000,000, as against £25,000,000 in 1914 from Australia and New Zealand together, although the weight of wool despatched abroad had not increased.

Another factor in the monetary ease has been the somewhat liberal expenditure of borrowed money. In addition to the distribution from war loans, the expenditure and the purchase of properties for returned soldiers and their settlement has aggregated £100,000,000, and new loans raised by the various states between 1915 and 1924 totalled £250,000,000. The distribution of these borrowed moneys has stimulated certain classes of employment and trade, and doubtless has re-acted on some forms of land values. From 1915 to 1924 the Commonwealth public debt increased from £37,000,000 to £415,000,000 and the State debts from £348,000,000 to £595,000,000. After deducting debt counted twice the net total public debt in 1924 was £955,579,000. Thrift, as evidenced by the larger deposits in the state governments' and Commonwealth Bank's savings bank departments, has certainly been accelerated, the total balances having grown from £46,147,472 in 1908 to £176,871,147 in 1925. The assets held against the state savings bank deposits of £140,000,000 comprise government stocks £74,000,000, municipal loans £7,000,000, land mortgages and other investments £39,000,000, and cash items £20,000,000.

Land banks, mostly formed since 1918, operate in every state. Through the medium of these institutions, funds for short or long term credits to farmers and other land settlers are readily found. They are all state organisations, variously styled the Rural Bank Department of New South Wales, the State Bank of South Australia, the Agricultural Bank of West Australia, etc. The respective states are responsible for the obligations of these bodies, and the amounts of loans on mortgage granted by them and the state savings banks to settlers aggregated £58,338,995 in 1923. A rural credits department of the Commonwealth Bank, to be kept distinct from its general banking business, was formed under an Act dated Sept. 14 1925, for the purpose of financing the orderly marketing of primary produce by means of loans for periods not exceeding one year. The department may have advances from the Treasury up to £3,000,000 at any time, may issue debentures and shall have allocated to it 25% of the net annual profits of the note issue department until the amount so paid reaches a total of £2,000,000. (The profits of the note issue department exceed £1,000,000 per annum.) The advances of the rural credits department may be made to the banks or co-operative associations or such other bodies as may be specified by proclamation.

Exchange Problems.—Before the return to the gold standard in 1925 the value of the Australian pound since 1914 had been linked throughout with that of the British pound sterling. Subject to ordinary seasonable trade fluctuations, the Australian exchange on London was maintained on a fairly stable basis except on two occasions. One was when, after the end of the War, goods overdue and in anticipation of requirements were rushed out too hurriedly and payment for these shipments exhausted the banks' London funds, which could not be immediately replenished from Australia owing to the embargo on gold shipments. The converse of this position was created in 1924, when, owing to heavy shipments of wool and wheat at high values, the currency available in Australia proved inadequate to finance the purchases, even against credits established by the chief English banks. In the view of the Note Board any increase in the note issue, even against gold offered by the associated banks or against cash ear-marked in London, would have created unjustifiable inflation.

But the new directors of the Commonwealth Bank, when appointed in Oct. 1924, took, under the wise leadership of the Prime Minister, the practical rather than the doctrinaire view, and for the seasonal requirements made notes temporarily available to the associated banks against London cash cover, readjustment to be effected on the marketing of the produce in London. Notes were only applied for to the extent of 25% of what was at first thought necessary; repayment was duly made by the banks, and the exchange impasse, during which premiums of 5% and over were paid for telegraphic remittances for the purchase of wheat, wool and other Australian produce, was removed. Gold was imported to the value of £10,000,000 and the gold standard was soon after adopted in Australia, simultaneously with the return to the gold basis in England, thus placing the exchange position on a permanent and stable basis.

The following statement shows the position of the various cheque-paying banks in Australia:—

Capital, Reserves and Dividends of Australian Banks to June 30 1924 (excluding three foreign banks each with a single exchange agency)

	£
Capital Paid up	30,466,275
Reserved and Undivided Profits	26,496,857
Dividends for year	3,353,356

Assets and Liabilities in Australia for quarter ended Sept. 30 1925. (Sworn averages)

	Liabilities		Assets
	£		£
Notes of Old Issues, unpresented	202,588	Gold and Silver coin and bullion	33,235,455
Bills in circulation	2,727,868	Australian Notes and cash with Commonwealth Bank	37,162,790
Balances due to other banks	7,950,938	Landed Property	7,255,407
Deposits	316,763,543	Notes and Bills of other banks	2,726,341
		Balances due from other banks	5,900,786
		All debts due to the banks	264,790,564
Total liabilities	£327,644,937	Total assets	£351,071,343

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TRANSPORT AND COMMUNICATIONS

Railways.—The great majority of the railways are owned and controlled by the Federal and State Governments. Between 1910 and 1925 the total mileage open for traffic increased from 18,012 m. to 27,644 m. On Oct. 22 1917, the Trans-Australian Railway from Kalgoorlie in Western Australia to Port Augusta in South Australia was opened for traffic; the line is controlled by the Federal Government. With the transfer of the Northern Territory by the South Australian Govt. to the Commonwealth Govt. on Jan. 1 1911, the railways in the Northern Territory from Darwin to Pine Creek, and in South Australia from Port Augusta to Oodnadatta came under Federal control.

The Northern Territory Acceptance Act 1910 provided for a trans-continental line from South Australia to the Northern Territory. The extension of the existing line southwards from Pine Creek to Emungalan was completed in 1917. There are four different gauges in use on the main lines in the various states. A Royal Commission (1921) recommended the conversion of all main trunk interstate lines to a standard gauge of 4 ft. 8½ in. at a cost of £21,600,000. In 1925 the construction of a 4 ft. 8½ in. gauge railway between Grafton, New South Wales and Brisbane, Queensland, was begun. This is the first action taken towards the unification of gauges. The electrification of the Melbourne Suburban Railways (143 m.) was completed in 1923. Work on the construction of the Sydney City and Suburban Electric Railway (11·9 m.) was recommenced in 1924 after being shut down for 4½ years.

Motor traffic in Australia developed considerably between 1910 and 1925. Since 1918 the state governments and local authorities have expended considerable sums, not only in making new roads in newly settled areas, but in improving the existing trunk roads. In 1923 the Commonwealth Govt. passed the Main Roads Development Act, which provided for an annual grant to the state governments of £500,000 for the making of main roads. The grant is conditional on the respective states supplementing it on a pound for pound basis. The grant was increased to £1,000,000 in 1924, and up to the end of 1925 £3,250,000 had been expended under the arrangement.

Shipping.—Both interstate and overseas shipping is controlled by the Commonwealth Govt. under the provisions of the Navigation Act 1912–20. The Act was assented to Oct. 24 1913 and is being brought into operation in sections by proclamation. Various sections were proclaimed between July 1921 and Dec. 1925, including the coastal provisions, which provide that all shipping engaged in interstate trade must conform to the regulations under the Act in regard to wages, manning accommodation, etc. A decision of the High Court, June 23 1925, held that the provisions of the Colonial Laws Validity Act applied to the Commonwealth, and that the provisions of the Commonwealth Navigation Act concerning the engagement and discharge of seamen were invalid, being repugnant to the Imperial Merchant Shipping Act.

In 1916, owing to the scarcity of freightage due to war conditions, Mr. Hughes, then Prime Minister, bought 15 steamers for the Commonwealth, and a programme for the building of 48 vessels in Australia was announced. Owing to certain variations, the programme resulted in the building of 21 steel cargo vessels and two five-masted schooners with auxiliary power. In addition, five steamers of 8,450 tons each were constructed in the United Kingdom, and the Commonwealth Govt. also had 18 ex-enemy steamers and one ex-enemy vessel under its control. Statutory provision for the establishment of the Australian Commonwealth Line of steamers was made in 1923, when the whole right and title to the 50 vessels then owned by the government was vested in a Board of Directors. The line was offered for sale in 1925, but only a few vessels were disposed of.

Wireless.—On March 28 1922 the Commonwealth Govt. entered into an agreement with the Amalgamated Wireless (Australasia) Ltd., whereby the company agreed to establish and maintain direct wireless communication between Australia and the United Kingdom and Canada, and to take over from the Commonwealth Govt. the existing radio stations under its control. The company is required, if desired, to hand over control of all stations to the government in time of war or public danger. Broadcasting stations have been established in all the capital cities. The agreement provided for the erection of high-powered long-distance wireless stations in the United Kingdom and Australia. Owing to refusal of British Govt. to grant licenses for erection and operation of a trunk and other stations in the United Kingdom for communication with Australia, the agreement was amended in Sept. 1924, the company undertaking to erect in Australia a "beam" station capable of providing a commercial wireless service with the United Kingdom and Canada of at least 21,600 words per day for 300 days per year.

Aviation.—An Air Navigation Act was passed in 1920, the Civil Aviation Department formed and a Controller of Civil Aviation appointed. Aerial surveys have been made in all mainland states and in the Northern Territory. Nearly 100 landing grounds have been acquired or leased. Services have been established between Perth and Derby (Western Australia), Adelaide and Cootamundra (N.S.W.) and Charleville and Camooweal (Queensland). The services are subsidised by the Government for the conveyance of mails.

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INDUSTRIAL AND SOCIAL CONDITIONS

The average weekly wage for male adults throughout Australia for all industrial groups was estimated by the Commonwealth statistician at £2 11s. 3d. in 1911, £4 14s. 6d. in 1921 and £4 14s. 3d in 1924. The printing group, with £5 8s. 3d., showed the highest average wage in 1924; the building group was next with £5 5s. 6d. and the agricultural group lowest with £4 5s. 10d. (including board and lodging). For females, the average in 1924 was £2 9s. 7d. per week compared with £1 7s. 2d. in 1914. These rates of wages are the minimum for a full week's work.

The basic weekly wage was first declared in New South Wales in 1914; the rates at March 1925 were £4 2s. for males and £2 1s. 6d. for females. A Royal Commission appointed by the Commonwealth Government in 1919 declared in its findings for a basic wage of £5 16s. per week for a man with wife and three children under 14 years. In 1920 the Commonwealth Government fixed the basic wage for male employees at £4 per week and 5s. for each dependent child. The Board of Industry of South Australia, appointed under the Industrial Code, 1920, was charged with the fixation of the living wage. The first declaration was made in April 1922, the rates for male adults being 12s. 11d. per day; this was increased to 13s. 1d. in Oct. 1923 and to 13s. 8d. in April 1924. In Queensland, the Industrial Arbitration Court declared the basic weekly wage for adult male workers at from £4 5s. to £4 15s., according to the district. These rates were operative in 1925.

A statutory 44-hour week was brought into operation in New South Wales in 1921, the 48-hour week restored in 1922 and the 44-hour week again enacted in 1925. A statutory maximum 44-hour week was brought into operation in Queensland in Oct. 1924. The average working hours for all industries throughout the Commonwealth (excluding shipping and agricultural) in 1924 were 46·66 per week for males and 46·02 for females. The conditions governing apprenticeship are clearly defined in each state.

Trade Unions.—The trade unions range from the small independent associations to the large, interstate organisation, which, in some cases, is a branch of a British or an international union. The number of separate unions and branches in 1924 was 376. The number of male members was 1,175,749, representing 54·5% of estimated total number of employees. The figures for female members were 280,664 or 31·5%. The tendency towards closer organisation is evidenced by the fact that, although membership of trade unions has increased since 1912 by 72%, the number and membership of unions having less than 2,000 members have considerably decreased. In 1924, there were 469 employers' associations, with a membership of 77,930, united for their own protection and for representation in cases before arbitration courts, wages boards and other wage-fixing tribunals. Associations of employers and employees are recognised under the Commonwealth Conciliation and Arbitration Act as well as under several State Acts, and such organisations may be registered.

Unemployment.—According to trade union returns, the average number of unemployed in Australia in 1924, exclusive of persons unemployed through strikes or lock-outs, was 35,507 or 8·9%, as compared with 16,054 or 6·5% in 1913. Very few unions pay unemployment benefit. In 1922 the Queensland Government passed the Unemployed Workers' Insurance Act, which provided for the establishment of an unemployment insurance fund from contributions by workers, employers and State in equal parts and for the payment of unemployed sustenance therefrom at the rates of from 15s. to 20s. per week for single (male or female) workers, and £1 5s. to £1 15s. per week for married workers, with 4s. or 5s. per week for each child under 16 years of age. The Unemployed Council, constituted under the Act, was empowered to order employers to proceed with works that could reasonably be proceeded with, with a view to reducing unemployment. The Act also provided for Government relief work in localities affected by unemployment, and for the establishment of labour farms for unemployables.

Regulation of Wages.—Two systems exist for the regulation of wages and terms of contracts of employment. In Victoria and Tasmania there is the wages board system, and in Western Australia an industrial court. The industrial legislation of New South Wales, Queensland and South Australia embodies both systems. Industrial courts in these states have been exercising the functions of wages boards. The New South Wales Industrial Arbitration (Amendment) Act, 1926, abolished the state court of industrial arbitration and vested its powers in an industrial commission. In Victoria, wages boards' decisions may be reviewed by the Court of Industrial Appeals. There is also the Commonwealth Court of Conciliation and Arbitration which has power to deal only with matters extending beyond the limits of a single state. The Industrial Peace Act, which was passed by the Federal Parliament in 1920, provided for the appointment of special tribunals for the prevention and settlement of industrial disputes extending beyond the limits of any one state. This is supplementary to the Court of Conciliation and Arbitration. The awards or decisions of a tribunal are binding at law and have the same effect as an award of the Arbitration Court.

Health.—Though part of Australia is within the tropics, there is practically no tropical disease. The death-rate from all causes in 1924 was 9·47 per 1,000. The infantile death-rate, which, owing to the hot summers ruling over the greater part of the Commonwealth, is the chief cause of anxiety to the public health authorities, has considerably improved. In 1901 it stood at 103·61 per 1,000, in 1924 it was only 57·08 per 1,000. The Commonwealth Government pays a maternity bonus of £5 for every child born of a white woman resident in Australia, and the states have public health organisations dealing specially with infant welfare. Apart from infant mortality, the chief foes to human life in Australia are tuberculosis, cancer and diseases of the heart. A Commonwealth Department of Health was formed on March 3 1921.

Education.—The most notable advance in the educational life of the Commonwealth between 1910 and 1925 was in the rapid development of the younger universities. In 1925 there was a university in each of the six states, and the tendency was more and more to decentralise university training instead of looking to Sydney, Melbourne and Adelaide as the natural centres. Considerable progress was made in the establishment of state secondary education, in the form of high schools and technical colleges, to continue the valuable work done in the primary institutions which, in most of the states, provide free education for children up to 14 years of age.

Art.—One of the remarkable features of Australian life during the post-War period was the rapid growth of a distinctively national school of art, and the appreciation of its work by the general public. Men like Lambert, Streeton, Heysen, Hilder and Roberts went to the Australian "bush" for their inspiration and gradually their fellow countrymen awoke to the realisation of the beauty that lay at their own doors. At the same time, Norman Lindsay was making a world-wide name for himself with his delicate etchings and his imaginative black and white work and Bertram Mackennal had established himself as a sculptor. An exhibition of Australian art held in London in 1924 attracted considerable attention.

Sport.—The War did not have the same devastating effect on sport as it had in countries nearer the scene of hostilities. The traditional love of games, born of the sunny open air life, remained unchecked, and racing, cricket, football and lawn tennis suffered little as a result of the war years. Events particularly worthy of note are the victories of Australia over England in the post-War series of test matches; the performances of the Western Australian race-horse Eurythmic; the success of Australian crews at Henley for the first time and the consistently good showing of Australian lawn tennis players in the Davis Cup contests.

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(M. L. S.)

AUSTRALIAN LITERATURE.—During the period 1910–25 occurred the death of two writers whose books have permanent value in Australian literature. Rolfe Boldrewood (T. H. Browne), who died 1915, wrote many popular novels, such as *Robbery under Arms* (1888), *The Squatter's Dream* (1890) and *The Miner's Right* (1890), all of which possess no small measure of literary charm. Henry Lawson, who died in Sept. 1922, in his poems and short stories, described the life of the shearer, the small farmer and the swagman. His *Children of the Bush* (1910) was his culminating achievement as a story-writer.

The book which attained the largest degree of public appreciation in Australia during this period was C. J. Dennis's *The Sentimental Bloke.* Written in slang, it was pervaded by warm humour, mingled with fine feeling. Bernard O'Dowd published *The Bush* (1912), as well as an elaborate poetical rhapsody on Venus-worship and a collected edition of his poems.

Mary Gilmour's *The Passionate Heart* (1918) and *Hound of the Road* (1922) contain mature examples of this poetess' genuine art. J. B. O'Hara published *Calypso and other Poems* (1912) and a collection of his best work as a writer of verse. A posthumous book by Victor Daley, *Vine and Roses* (1911), and the *Complete Works* of William Gay (1911) should be noted. Leon Gellert's *Songs of a Campaign* (1918) and *The Isle of the Sun* (1919) fully sustained this author's poetic reputation. Archibald T. Strong published *Sonnets of Empire* (1915) and a volume of translations from Theodore de Banville (1913). Bertram Stevens's *Golden Treasury of Australian Verse* (2nd edition, 1912) and Walter Murdoch's Oxford Book of *Australasian Verse* (1918) are good anthologies. The only critical works which call for mention, published within the period under review, are the *Peradventure* (1912) of A. T. Strong, a collection of essays, and T. G Tucker's critical edition of Shakespeare's *Sonnets* (1924).

Kangaroo (1923), although written by an Englishman, D. H. Lawrence, was the most notable work of fiction dealing with Australia during this period. The best of the humorous books of "Steele Rudd" (Arthur Hoey Davis)—*On our Selection* and its several sequels—were reprinted in a uniform edition in 1913, and continued to command a well-merited popularity. Among present writers of short stories none can compare with Louis Becke and Henry Lawson. Mrs. A. Gunn's *We of the Never-Never* (1912) was a vivid description of life in the interior of the continent, and C. A. Bean's two books, *The Dreadnought of the Darling* and *On the Wool Track* (1916) were pieces of descriptive realism of photographic fidelity. Elsia Masson's *An Untamed Territory* (1915) was a charming account of life in the Northern Territory. R. L. Jack's *Northmost Australia* (1921) was the work of an eminent geologist, while Baldwin Spencer's *Across Australia* (1912) was significant both as a description of travel and as the work of a noted anthropologist. The appeal of Spencer's *Native Tribes of the Northern Territory of Australia* (1914) was more strictly scientific.

Biography and History.—In biography, Walter Murdoch's *Alfred Deakin, a Sketch* (1923) stands prominent. Prof. Ernest Scott's *Life of Captain Matthew Flinders, R.N.* (1914) and his *Life of Lapérouse* (1912) also belong to the biographical section. Miss S. Macarthur Onslow's *Early Records of the Macarthurs of Camden* (1914) was chiefly a collection of family papers. Among autobiographies Sir George Reid's *My Reminiscences* (1917) proved somewhat disappointing, but must be regarded as of some importance historically. Dr. J. M. Creed's *My Recollections of Australia and Elsewhere* (1916) and Bishop Gilbert White's *Thirty Years in Tropical Australia* (1918) may also be mentioned; and two popular books were C. A. W. Monckton's *Some Experiences of a New Guinea Magistrate* (1921) and *Further Reminiscences* (1922).

A series of well-illustrated art books appeared from the office of the attractive periodical *Art in Australia.* The most successful volumes were those devoted to the art of the painters Hilder, Arthur Streeton, Hans Heysen and George Lambert, A.R.A. Two volumes by the Sydney architect, Hardy Wilson, *Old Colonial Architecture in New South Wales and Tasmania* and *The Old Cowpastures Road,* were excellent achievements. A volume of the drawings of Norman Lindsay exhibited many phases of the craftsmanship of this accomplished artist.

Amongst historical works, B. R. Wise's *The Making of the Australian Commonwealth* (1913) is a spirited and valuable record of memorable controversies and momentous decisions. H. G. Turner's *First Decade of the Australian Commonwealth* (1911) is a useful survey. Marion Phillips's *A Colonial Autocracy* deals fully with the governorship of Macquarie in New South Wales. James Collier's *The Pastoral Age in Victoria* (1911) is written from intimate personal knowledge. R. C. Mills's *The Colonisation of Australia* (1915) traces particularly the influence of Edward Gibbon Wakefield. Dr. J. S. Battye's *History of Western Australia* (1924) is a very solid work, based on ample documentary material. J. T. Sutcliffe's *History of Trades Unionism in Australia* (1921) and M. Willard's *History of the White Australia Policy* (1923) deal with two highly important phases of historical politics. Edward Sweetman's two works on the development of responsible government, in Victoria and in Australia generally, brought together a mass of information that had been overlooked by all previous writers.

The History of State Education in Victoria by Sweetman, Long and Smyth, was a good piece of work. S. H. Roberts's *History of Australian Land Settlement* (1924) deals with a subject which is the very core of Australian history. In G. Arnold Wood's *The Discovery of Australia* (1922) many popular misconceptions were shattered. Scott's *Terre Napoléon* (1910) discussed the several French expeditions dispatched to Australian waters during the 18th and early 19th centuries. Ida Lee (Mrs. C. Bruce Marriott) added to her studies in Australian maritime history by publishing *The Log Books of the Lady Nelson* (1915), *Bligh's Second Voyage to the South Sea* (1920) and *Early Explorers in Australia* (1925). Scott's *Short History of Australia* (1916), Fitchett's *The New World of the South* (1913), T. Dundabin's *The Making of Australasia* (1922) and Sir T. A. Coghlan's four volumes on *Labour and Industry in Australia* (1918) were more general works on Australian history. Dr. MacLaurinan's *Post Mortem, Essays Historical and Medical* (1922) attempted to diagnose the maladies of a number of historical characters. The *Historical Records of Australia,* published by the Library Committee of the Commonwealth Parliament under the editorship of Dr. Frederick Watson (1913, *et seq.*) are invaluable, but unfortunately it has been determined to cease publication. For a good presentation of the physical conditions of Australia an extremely valuable book is Griffith Taylor's *Geography of Australia* (1914).

Books on sociological topics include H. L. Wilkinson's *History of the Trust Movement in Australia* (1914) and *State Regulation of Prices in Australia* (1917); C. A. Bernays' *Queensland Politics During Fifty Years* (1916); Duncan Hall's *The Commonwealth of Nations* and the book of essays by various hands edited by Meredith Atkinson under the title *Australia: Economic and Political Studies* (1920). *A New Province for Law and Order* by H. B. Higgins (1922) was an important work on the theory and working of industrial tribunals. Amongst miscellaneous books may be mentioned *14,000 Miles through the Air* (1922) by Sir Ross Smith and *An Australian Bird Book* by Dr. J. A. Leach (1911 and later editions).

Books on the War.—The official history of the part taken by Australia in the World War, edited by C. A. Bean, was planned to fill twelve volumes, one half of which had been issued by 1925. This history will form an adequate record of the achievements of the Australian armies and a worthy literary monument to the brave men whose names are inscribed within the volumes. Sir John Monash, in *The Australian Victories in France in* 1918 (1920), gave a survey of the operations leading up to Aug. 8 1918, and of the great day itself. *The Desert Mounted Corps* by R. M. P. Preston (1921) and *Australia in Palestine* by H. S. Gullett and C. Barrett were devoted chiefly to the work of the splendid cavalry force commanded by Sir Harry Chauvel. A. D. Ellis's *The Story of the Fifth Australian Division* (1920), F. M. Cutlack's *The Australians in their Final Campaign* (1918), R. Bridges's *The Immortal Dawn* (1915), and P. F. S. Schuler's *Australia in Arms* dealt with particular phases.

A few works on Australia by foreign writers should be added to this review. C. H. Northcott's *Australian Social Development* (1918) and C. D. Allin's *History of the Tariff Relations of the Australian Colonies* (1918) were by American authors. Two very interesting French books were *Sous la Croix du Sud* by P. Wenz (1910) and *L'Australie et la Pacifique* by G. M. Crivelli and Pierre Louvet (1924). R. Schachner in *Australien in Politik, Wirtschaft und Kultur* (2 vol., 1910–11) gave a German account of many aspects of Australian life. From Stockholm came G. Anderson's *Australien: Natur och Kultur* (1912). For a brief but penetrating piece of political observation by a Briton there is nothing better than Viscount Bryce's chapters on Australia in his *Modern Democracies* (1921). (E. Sc.)

AUSTRIA, REPUBLIC OF.—This state was formed in Nov. 1918 from a portion of the Austrian lands of the former Austrian Empire. Its area is 32,352 sq.m.; and the population is 6,526,661. (*See* 2.970 and 3.2.)

I. AREA AND POPULATION

The territory included in the republic consists of some of the poorest and most mountainous areas of the former Austrian Empire. Only about one-third is under cultivation; another third is covered with forest, and the remainder is largely mountainous, though well-suited in parts to grazing and dairy farming. The economic situation is completely dominated by the existence of Vienna, a highly organised financial, commercial and industrial centre containing nearly one-third of the total population of the republic in a comparatively poor state, unable to produce, under present conditions, sufficient foodstuffs to meet the needs of its people, and cut off from its former markets and sources of supply. The following table shows the areas and populations of the provinces of the republic:—

Province	Area (sq. m.)	Population
Vienna	107	1,863,783
Lower Austria	7,462	1,478,697
Upper Austria	4,628	873,702
Salzburg	2,763	222,731
Styria	6,327	977,350
Carinthia	3,684	370,432
Tirol	4,790	313,699
Vorarlberg	1,005	139,968
Burgenland	1,586	286,299
	32,352	6,526,661

Defence.—The present Austrian Federal Army (Bundesheer) originates from the "People's Army" (Volkswehr) formed by the Revolutionary Govt. simultaneously with the disbanding of the remainder of the old Imperial Army. The Treaty of St. Germain limited the strength of this army to 30,000 men and officers. At present this limit is not reached by the actual number; budgetary reasons work for a reduction of military expenses. The present force numbers 15,000 men and non-commissioned officers. The Austrian Army is formed by voluntary enlistment for a period of 12 years. All means of mobilisation are forbidden by law. The army consists of six brigades each of two infantry regiments, six squadrons of cavalry, six artillery and six technical units. There is no air force. The men and officers enjoy, during the time they serve, the full rights of citizenship.

II. CONSTITUTIONAL AND POLITICAL HISTORY

The Revolution.—Nov. 12 1918, the day after which the last Emperor of the Habsburg-Lorraine line abdicated in Vienna, is also the day from which the new Austrian Republic formally and legally dates its birth. On Oct 21 the assembly of all the German members of the Lower House (Abgeordnetenhaus) of the former Austrian Parliament had already determined to declare the German-Austrian portion of the Austrian territories, formerly under Habsburg rule, an independent state, and had constituted itself the Provisional National Assembly. The constitution of the former Monarchy afforded a legal foundation for this action, for it was based on the Emperor Charles' manifesto of Oct. 16 inviting the racial entities of the non-Hungarian half of his empire to constitute national states within the framework of the empire.

On Oct. 30 the Provisional National Assembly assumed the supreme independent authority in those Austrian territories claimed by it to be predominantly German, and appointed a State Council as executive under the leadership of the three presidents of the Assembly, who then nominated secretaries of state as heads of the administrative departments simultaneously organised for German-Austria. But the revolutionary movement, which broke out in Vienna at this moment as a consequence of the general military break-down of the Central Powers, led to the declaration of an independent German-Austrian Republic on Nov. 12. This declaration, which was in accordance with the right of self-determination, was the result of revolutionary action, and expressly repudiated any legal descent from the broken-up empire. The Czechoslovak Republic had already come into being on Oct. 28. The law promulgated by the Provisional National Assembly on Nov. 12 1918 explicitly declared in its first Article: "German-Austria is a democratic Republic," and in its second: "German-Austria is a component part of the German Republic." Thus in the proclamation itself of the new state, there was adumbrated its cessation by a future treaty uniting it with the German Reich.

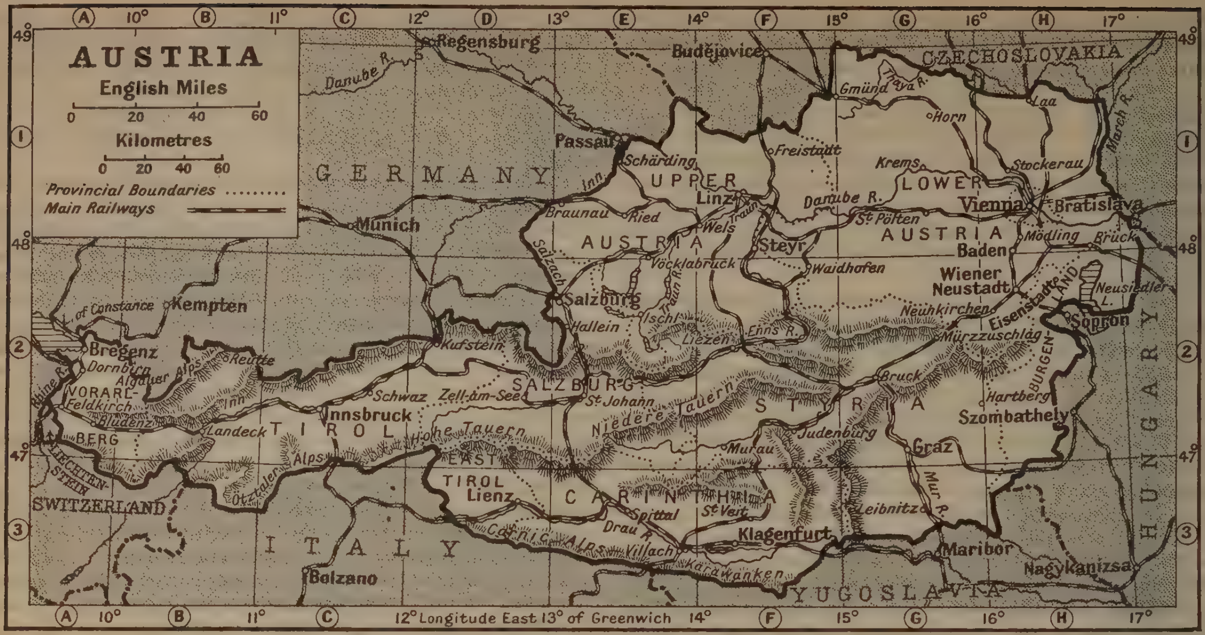
Ten days later, in a special law, on Nov. 22 1918, the National Assembly defined its territory. In addition to the ancient hereditary Austrian lands (Crown Lands), with the exception of districts inhabited by the Yugoslav and Italian races, this law claimed the inclusion in its territory of a large number of predominantly German districts in Moravia and Bohemia. Simultaneously with the constitution of a German-Austrian Republic as a whole, administration was taken over in the separate provinces (the former Crown Lands), of which the republic was composed. The provincial Diets, resolving themselves into provisional assemblies, carried out corresponding changes, the presidents being entrusted with the conduct of the provisional administration and the executive power in their provinces. Thus the autonomous organisation and provincial self-government, established by the constitution of the Austrian Empire of Feb. 26 1861, was perpetuated as a real popular self-government in the separate provinces, this time on a really democratic foundation.

The history of the Austrian Republic as far as its foreign relations are concerned, can be divided into three parts: the period up to the passing of the Treaty of St. Germain, ratified on Oct. 17 1919; the period ending with the conclusion of the Geneva Pact with the League of Nations, Oct. 4 1922; and the period regulated by that agreement.

From the Constitution of the Republic to the Peace

Treaty of St. Germain.—The Treaty of St. Germain finally defined the frontiers and extent of the new republic. Austria was obliged to renounce all claim to the districts occupied by the Czechs in 1919, but inhabited by a German population. In the south, towards Yugoslavia, the frontier in the Klagenfurt district was drawn in accordance with the plebiscite (Oct. 10 1920) ordered by the treaty; in southeast Carinthia it was essentially according to the ancient frontier of that province. The treaty also laid down that the republic was in future not to bear its own chosen name, but that of Austria. The principle already laid down in the Treaty of Versailles, that the Austrian Republic must preserve her independence, and that union with Germany could only take place with the consent of the League of Nations, was also laid down in the dictated peace of St. Germain. But the treaty awarded a large part of the old German-settled territories in West Hungary to Austria; and Hungary was obliged by the Treaty of Trianon to evacuate and transfer them. The execution of these decisions of the Paris treaties was not complete until well on into the year 1921.

Burgenland.—The Austrian occupation of the West Hungarian territory called the Burgenland by the Austrian Govt. met with violent opposition in Hungary from public opinion and from the Government. Troops of free lances, organised under official pat-


AUSTRIA
English Miles
0 20 40 60
Kilometres
0 20 40 60
Provincial Boundaries
Main Railways
A B C D E F G H
10° 11° 12° 13° 14° 15° 16° 17°
49 48 47
1 2 3
Regensburg
Danube R.
Budějovice
CZECHOSLOVAKIA
Gmünd
Horn
Laa
March R.
GERMANY
Passau
Schärding
Freistadt
Krems
Stockerau
UPPER
LOWER
Linz
Danube R.
Vienna
Bratislava
Munich
Braunau
Ried
Wels
St. Pölten
AUSTRIA
AUSTRIA
Steyr
Mödling
Bruck
Baden
Vöcklabrück
Waidhofen
Wiener Neustadt
Neusiedler L.
Salzach
Salzburg
Ischl
Hallein
Liezen
Enns R.
Neunkirchen
Eisenstadt
Mürzzuschlag
Sopron
L. of Constance
Kempten
Bregenz
Dornbirn
Algäuer Alps
Reutte
Kufstein
Inn
SALZBURG
VORARLBERG
Feldkirch
Bludenz
Schwaz
Zell-am-See
St. Johann
Niedere Tauern
STYRIA
BURGENLAND
Bruck
Hartberg
Szombathely
Innsbruck
Landeck
TIROL
Hohe Tauern
Judenburg
Graz
LIECHTENSTEIN
Alps
EAST TIROL
Murau
Mur R.
HUNGARY
SWITZERLAND
Ötztaler Alps
Lienz
CARINTHIA
Spittal
St. Veit
Leibnitz
Drau
Klagenfurt
ITALY
Carnic Alps
Villach
Maribor
Nagykanizsa
Bolzano
Karawanken
YUGOSLAVIA
12° Longitude East 13° of Greenwich

ronage, prevented by force of arms the entry into the country of the Austrian officials and gendarmes to whom the occupation was entrusted, and even threatened the Austrian frontier. An appeal by Austria to the Conference of Ambassadors led to long diplomatic conversations, which culminated in a conference at Venice, Oct. 20 1921, when Italy, as self-constituted arbitrator, forced Austria[1] to accept a plebiscite in Oedenburg (Sopron), the capital of the territory in dispute. This procedure, imposed on Austria in the interests of the Magyars, led to a Magyar majority, and the town of Oedenburg and several communes were left to Hungary. Minor frontier rectifications in favour of Czechoslovakia, in accordance with the peace treaties, were carried out without incident (*see* BURGENLAND).

Difficulties of the New State.—The law of Oct. 1 1919 definitely and finally drew Austria's frontiers in accordance with the treaty. The carrying into effect of the onerous and complicated terms of the treaty became the chief task of Austria's foreign policy, which was prevented from following any independent line by the weak economic condition of the country and the ever-increasing financial difficulties of the state. In the years 1919 and 1920, it was only with the help of credits from the United States, granted largely in kind, that it was possible to maintain the town population, which had been reduced to destitution by the World War and the effects of the blockade. The most important agencies in relieving this extreme misery and suffering were the American Relief organised by Mr. Herbert Hoover, which fed the children, and the work of the Society of Friends for the starving population of Vienna and other towns. Thus at that time the whole political life of the republic was absorbed in the efforts to assure the existence of the republic under the burdens imposed on it by the consequences of the War and by the division of the great and ancient empire into independent economic and political units; in the fulfilment of Austria's obligations; and in the task of maintaining public order in the face of internal and external dangers. The Chancellor, Karl Renner, who had been at the head of the Govt. since the revolution, nevertheless succeeded in 1920 in establishing friendly relations with the Czechoslovak Republic. Numerous problems arising out of the execution of the treaty were harmoniously solved in an agreement concluded with the Prague Govt. at Brno (Brünn) (June 7 1920) and a supplementary agreement at Karlovy Vary (Carlsbad) (Aug. 23 1920).

THE LAW OF THE CONSTITUTION AND INTERNAL POLICY

The Constituent Assembly.—The revolutionary decisions of Nov. and Dec. 1918 had provided for the summoning of a National Constituent Assembly, elected on the broadest democratic franchise and by proportional representation, which met at Vienna on March 4 1919. The result of the elections was again to divide political power between the three parties, which together had carried through the revolution, but in considerably altered proportions. Out of a total of 159 deputies, 69 belonged to the Social Democratic party, 63 to the Christian Socialists and 26 to the Pan-Germans, *i.e.*, to the Nationalists. In accordance with the two laws of March 14 1919, on the franchise and on the Govt., the Constituent Assembly retained for the time being the provisional Constitution of the Republic of 1918, but introduced fundamental changes. The Council of State (Staatsrat) and its three presidents were abolished.

From this date the Ministry, consisting of the State Chancellor, the Vice-Chancellor and the secretaries of state, was entrusted with full executive and administrative powers, and was henceforward to be elected on nomination of the main Committee of the National Assembly, consisting of the president, two vice-presidents and eleven deputies. Several former functions of the Council of State were now transferred to the Ministry; some of its prerogatives, such as the appointment of judges and higher officials, were, however, transferred to the president of the National Assembly acting in agreement with his vice-presidents. He became the representative of the republic abroad and treaties must be ratified by him. He represented the supreme power in the republic, although with strictly limited functions. The Constituent Assembly, elected for two years, was to be in continuous session for this period. The most important alteration in the character of the Parliament was the appointment of the Main Committee to form the permanent link between Legislature and Executive and to regulate the work of Parliament.

Centralised or Federal Government.—It was evident in the early days of the Austrian Republic, that, as in imperial Austria, the relation to the state of the historic provinces presented the great problem, indeed the problem of the political existence of the state. From the very beginning the idea of centralisation had been most strongly emphasised by the Social Democrat leaders. Opposition in the provinces increased. In the laws of March 14 1919 certain provisions were therefore inserted to meet the case of conflicts between the decisions of the provincial assemblies and the Federal laws, the central authority being empowered to challenge such decisions before the newly instituted Constitutional Court.

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[1] The Venice Protocol, approved by the Council of Ambassadors, Oct. 27 1921.

Dr. Renner's Government.—The republic and its Govt. still rested on the coalition of the three parties, which included the whole population. Social Democracy remained politically the strongest factor; on the reconstitution of the Govt. which took place on March 15 1919, by election from the National Assembly, almost all the important posts were filled by Social Democrats: the Ministries of the Interior, of Foreign Affairs and of War. The first Chancellor, Dr. Renner, presided over the new Ministry, and was appointed head of the Peace Delegation to Paris.

The Social Democratic party found its main support in the trade unions and party organisations, which in Vienna and in all industrial districts included almost the whole of the working classes. The revolutionary feeling which had resulted from the downfall of the Monarchy during the War was a strong auxiliary. Part of the official class and of the lower middle class also supported it. But on the other hand, the Christian Socialist party had succeeded in winning over not only all the agricultural class, but also the overwhelming majority of the upper and middle classes in Vienna and the provincial towns. The Social Democrat leaders regarded the coalition, from which the first constitutional Govt. was formed, as a union of workers and peasants, from which a complete democratic republic would emerge through the legislation to be passed by the National Assembly. The party, under the leadership of Dr. Renner, President Seitz and Dr. Otto Bauer (Foreign Minister), was able to preserve its unity by successfully combating those activities of its own Left wing, which had been inspired by the establishment of the Bolshevist Republic in Russia and by the temporary success of Bolshevism in Hungary. They succeeded in subordinating party differences to party unity.

In the spring of 1919, when the Soviet Republic in Hungary under Bela Kun was exercising increasing pressure on Austrian social democracy, the situation became at times highly critical, but the policy and tactics of the Social Democrat leaders directed against Bolshevism were successful in restraining the population of Vienna. Thus there was never serious danger from the isolated attempts by the extremist elements to disturb by violence of any kind the quiet development of Austria's republican democracy.

These attempts were repressed by the armed police. In spite of the deep depression which the dictated peace caused in Austria, and in spite of the increasing difficulties of social and economic conditions, the Coalition Govt. succeeded in preserving public order uninterruptedly. The gradual cooling of revolutionary sentiment in the masses did not therefore lead to any change in Social Democratic policy, which was directed to the maintenance and development of the democratic republic, nor to any reactionary movement against democracy by the Christian Socialists, who represented the Conservative elements in the community. This relative stability, in a community ever more severely threatened from day to day, was further demonstrated by the united opposition from both the great parties in the country to the attempts made by the ex-Emperor Charles, on March 13 and Oct. 26 1921, to restore the dynasty by his return to Hungary. Nevertheless the second coalition, formed on Oct. 17 1919, with Dr. Renner at its head, was felt to be an undesirable hindrance to normal political developments, while the agricultural and urban middle classes, led by the Christian Socialists, began to resist the predominance of socialistic ideas in government and administration. These tendencies emerged most clearly on the question of the new army organisation.

The Proportional Government.—The Coalition was formally dissolved, and a so-called "proportional" Govt. formed, that is an administration containing representatives of the parties in proportion to their numerical strength. This Ministry was to settle the law of the constitution, which had not yet been adopted and to transact business until the elections, which were to take place at an early date. This procedure, which again showed the strong leaning of all Austrian parties to friendly compromise, was successful. The new Federal constitution, after long preparation, was completed on Oct. 1 1920 in the last days of the Constituent Assembly.

Dr. Mayr's Ministry.—The elections which followed (Oct. 17) showed a loss of nearly 200,000 Social Democrat votes, and a corresponding increase of the Christian Socialist vote, and led to the formation (Nov. 20) of the first Ministry, in which Social Democracy was not included, under Chancellor Dr. Mayr. The new National Council consisted of Christian Socialists, 82; Social Democrats, 66; German Nationalists, 20; Peasants' Party, 6; Workers' Party, 1. The German Nationalists supported the majority in most political questions, but the two non-Socialist parties formed no coalition.

The new Federal Constitution had to solve the fundamental problem whether Austria should be organised on a federal or a centralised basis. The provinces demanded the greatest possible extension of their administrative and financial independence, a claim strongly supported by the whole agricultural class and by a part of the urban middle class in the provincial capitals; but the majority of the German Nationalists and Christian Socialists of Vienna demanded the retention of the "Centralist" Constitution. The Social Democratic party directed its efforts to preserving a strong central administration so as to weaken as far as possible the political influence of the Christian Socialists on the provincial bodies.

Status of Vienna.—The main point of the compromise eventually reached was the principle of an eventual administrative reform on federal lines, the execution of which was deferred for future legislation. One consideration which carried great weight was the significant change in Social Democrat policy, which had hitherto been in favour of centralisation. The party demanded, and received, the assurance that the city of Vienna, containing little less than one-third of the total population of the state, in whose City Council Social Democracy had had an overwhelming majority since 1919, should be legally severed from the province of Lower Austria, and be declared an independent province (Bundesland). In accordance with this stipulation the City Council is at the same time the Provincial Diet, and has all the legislative and administrative powers which the constitution gives to the provinces. It became a provincial government, and the burgomaster the governor of a province. This arrangement led the Social Democrats to lose much of their interest in opposing a further federalisation of the republic. Some minor modifications of the principle were conceded to the Christian Socialists.

The Constitution of the Republic.—Austria was given a special head of the state, the Federal President, who is elected by the Federal Assembly for four years. This latter consists of the National Assembly, henceforward called the National Council, elected on the widest franchise for men and women, and of the newly created Federal Council, elected by the provincial Diets, from the inhabitants of their provinces by proportional representation. The Federal Council has a certain share in legislation, as all legislative decisions of the National Council, with the exception of the Budget, are submitted to it, and it may within eight weeks exercise its suspensive veto. In this case the National Council need only pass the legislation concerned a second time, and the veto is annulled.

The Federal President's position is a purely ceremonial one. He concludes foreign treaties, formally appoints a large number of Federal officials and army officers, and has the right to pardon, and to confer honours and distinctions. He has no real political power. All his orders have to be countersigned by the chancellor and by a member of the Federal Government. He is responsible for the constitutionality of his actions, and can be indicted before the Constitutional Court by a majority of the Federal Council. The President may only hold office for two successive periods. He may not practise any profession, but he is awarded a reasonable annual salary to meet the costs of official ceremonies and hospitality. Dr. Michael Hainisch was elected the first Federal President on Dec. 8 1920 and was re-elected on Dec. 9 1924. The Federal Ministry, presided over by the Chancellor, is composed of ministers whose numbers are not fixed by the constitution. and to whom state secretaries may be added. Their powers remain unaltered under the new constitution. The great questions of the allotment of taxes between the central government and the provinces, and of the Federalist demand that the whole internal administration be transferred to the provincial government, received no practical solution.

AUSTRIA'S SERIOUS ECONOMIC POSITION

Austria's internal policy was, from this time onward, dominated by the threatening conditions of the country's economic life, above all by the rapid depreciation of the Austrian exchange in consequence of the continuous inflation of the currency. The ever-growing deficit in the federal budget and the provincial revenue necessitated the continuous output of currency notes. At the same time the yield of the taxes disappeared, and the levy on capital of 1920 remained inoperative. These events embarrassed the Mayr Govt. all the more as they had great pressure put upon them by the popular movement for union with the German Reich. This movement was instigated by the provincial governments, which had been working against Vienna since 1919, led by the Tirol. They were strongly under the influence of Bavaria, where the Conservatives and Nationalists had consolidated themselves. The Govt. under pressure of French intervention opposed the movement when its strength was evidenced in plebiscites.

In the spring of 1921, the chancellor in vain endeavoured to secure financial help in London; both there and in America all efforts were unsuccessful. Industry had begun to revive in the end of 1920, and needed foreign credit and currency to pay for imports of raw materials; the financial administration had immediate and similar needs, and this situation caused a more rapid drop in the value of the Austrian crown abroad.

The Schober Ministry.—The Christian Socialist party thought it advisable under these circumstances not to continue to bear alone the burden of unpopularity and responsibility which the conduct of government must necessarily impose in such difficult circumstances. They decided to join with the German Nationalists in electing a ministry of officials, with the respected police president of Vienna, Schober,[1] as chancellor (June 21 1921). This Ministry also had to struggle with economic and financial difficulties. With the fall in the exchange the cost of living rose terribly, especially in Vienna: between July 1 1920 and July 1 1921 prices were doubled; between Oct. 1921 and Jan. 1922 they were trebled. This and the feverish attempts to secure foreign currency were the clearest indications of the threatened collapse of the exchange. Another result was serious social unrest, which on Dec. 1 1921 led to a working-class demonstration accompanied by looting and shop-wrecking. Chancellor Schober and his Finance Minister, Dr. Gürtler, concentrated their efforts on avoiding financial ruin. A number of new taxes were imposed on the wealthy classes, and preparations were made to withdraw the state subsidies towards the cost of living, which weighed heavily on the Treasury.

Understanding with Czechoslovakia.—At the same time the Govt. endeavoured to put Austria's foreign relations on a firm foundation. The unfortunate ex-Emperor Charles' attempts at restoration had proved the success of the policy of co-operation between the Succession States, a policy developed by Dr. Beneš, the chief minister of the Czechoslovak Republic. Austria, it is true, did not join the "Little Entente," but Chancellor Schober and the Federal president visited President Masaryk, and Schober subsequently concluded at Lany (Lana) a treaty (Dec. 16 1921) with the Govt. of the Czechoslovak Republic, in which both states pledged themselves to carry out the peace treaty loyally, to support each other against all revolutionary movements and to submit all disputes to a court of arbitration. Czechoslovakia granted Austria a credit of 500,000,000 Czech crowns, and promised to support her applications for credit both in London and Paris.

This rapprochement with the Czechoslovak Republic encountered strong opposition from the Pan-Germans, who now refused their support to the Government. Their defection led to the fall of the Schober Ministry at a time when the devaluation of the crown was proceeding at headlong speed. The urgent demand for foreign currency and securities rapidly exhausted an English loan, and a catastrophe in the exchange seemed imminent. Under these circumstances, the Schober Ministry resigned (May 31 1922) and the leader of the Christian Socialist party, Monsignor Seipel, put himself at the head of a coalition Govt. based on an agreement between his party and the German Nationalists (Pan-Germans). So for the first time a united Anti-Socialist front was avowedly formed. Dr. Seipel decided to treat Austria's economic and financial helplessness not merely as her own burden, but as a problem of European policy, and on his diplomatic journeys to Prague, Berlin and Verona, he prepared the chief lines of his policy in dealing with the Western Powers, which aimed at long-date and adequate credits, with the help of which Austria might be entirely restored. The success which attended his efforts is dealt with in the section on Economic and Financial History p. 287.

Political Effects of Geneva Agreement.—The Geneva agreement for the reconstruction of Austria dominated the whole internal situation of Austria in the three years following its conclusion; in spite of the indubitably great success of Dr. Seipel's policy it has not been popular; the dismissal or pensioning off of nearly 100,000 state employees severely affected the lot of many families, and all the more harshly as the economic crisis made new occupations impossible in most cases.

The most severely affected were the middle classes, whose sons were unable to find employment in the liberal professions any more than in the Civil Service. Even the officials in employment and the thousands of pensioned officials and employees complained bitterly of their inadequate salaries and pensions. Here again it was the higher officials and judges who were most severely hit, for under party pressure the new scale of salaries and retiring pensions was so arranged that they were fixed at pre-War level for the lower classes in the service, whereas the middle, and, above all, the higher ranks only received from 60 to 30% of the pre-War salary or pension, and even in these figures no account was taken of the diminished purchasing power of money. The working class on the other hand, supported by its strong trade unions, was able from 1920 to 1923 not only to secure its pre-War wages, but in many cases, to raise them. This favourable position has been maintained, although in the past two years the results of the economic crisis and of unemployment, in which the figures of those receiving relief reached at times 160,000, reacted more and more on wages. The political results of these conditions were that Social Democracy maintained the strength of its position; indeed its majority in the City Council of Vienna has considerably increased.

In spite of the steady opposition of the Socialist minority of the National Council to the "Geneva policy," Dr. Seipel maintained his majority in the elections of 1923, which only made small alterations in the strength of the parties. When Dr. Seipel, whose health was affected by the results of an attempt on his life, resigned in Nov. 1924, the coalition Govt., newly formed under his influence, was able to continue quietly the conduct of the affairs of state.

Dr. Ramek's Ministry.—The new Ministry under the Chancellor, Dr. Ramek, continued Dr. Seipel's policy of scrupulous fulfilment of the Geneva agreements, and it was also able in the session of 1925 to complete the constitution in agreement with the Social Democrats. The essence of the reform lay in a further strengthening of the federal principle of the constitution, as the administrative authorities, formerly under the state and controlled by Federal State departments, were now attached to the provincial governments. The Ramek Ministry maintained and extended the financial reform of 1924 in favour of the provinces and communes.

The chief question in Austria's internal policy in the latter half of 1925 was the speedy removal, promised in the June session of the League of Nations Council, of the control over the finances of the republic, exercised for the past three years by the Finance Committee of the League of Nations and the Commissioner-General. The essential point in question is whether it is possible to maintain a lasting balance of the budget, although income and expenditure have long been considerably higher than was originally contemplated by the Council of the League. Moreover the question of the gradual abolition of the Restriction of Rents Act, which has been in force since the War and has, together with the fall in the value of the crown, almost entirely destroyed the value of house property in favour of the tenant, was a burning question in dispute between the majority and minority in the National Council. Financial problems such as the demands of the Civil Service for higher salaries and pensions continued to form the chief pre-occupation of the Government. Party conflicts were of a mild nature and unaccompanied by social disturbance. The demand for union with the German Reich was strongly supported by Social Democracy. (J. Re.)

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[1] John Schober, born Oct. 14 1874, was appointed, by the last Imperial Govt., police president of Vienna (1918).

Social Democrat Policy.—The Austrian Social Democrat party became the most powerful force in the country in 1918. In the first of the two Coalition Governments it was the predominating, in the second an equal, partner. It thus had nearly two years in which to put its views on government into practice, although always with great reservations owing to the coalition with the Christian Socialists, and the dependence of Austria on foreign countries.

These reservations made it impossible for it to carry through the large programme of nationalisation of factories, banks, mines and large estates, which it formulated in 1919. In fact it accomplished no expropriation at all. The old state military factories were taken over for peace production on socialised or semi-socialised lines. These experiments were based on the lessons of English Guild Socialism and Russian Bolshevism; the control was in the hands of a mixed body of the producers, the consumers and the state, the workmen receiving a share in the profits. In general, these concerns suffered from shortage of capital, and few survived long. The Workmen's Council, elaborately organised parallel to Parliament, proved efficient only in preventing an open breach with the left-wing extremists; the Soldiers' Council succeeded in preventing a military reaction, if one was planned but broke down in the field. The first agrarian programme encountered the hostility of the farmers and the Church, and was never fulfilled at all. The party therefore returned to its old stronghold of the trade unions, which had expanded to embrace practically all manual and lower intellectual labour, fortified by a Soldiers' Union in the army and a very complete system of works councils (*Betriebsräte*), its active experiments on communal lines being confined to the powerful municipality of Vienna.

Social Legislation.—On the other hand the first Ministry of Social Welfare under Hainisch accomplished remarkable work in purely social legislation, including laws establishing the eight-hour day, insurance against accidents, extension of sickness insurance, state assistance for mothers and infants, a subsidy for children and numerous other measures for the protection of particular classes, especially children. Social legislation in Austria is now very complete, though no provision for old-age pensions has been made. The workmen are in a strong position and the Conciliation Boards have greatly reduced the number of strikes and lockouts. The new education laws aroused much opposition owing to their anti-clerical tendency.

At the Party Conference of 1925, Dr. Otto Bauer produced a new agrarian scheme based on the old Austrian *gemain* or common land. Its effect would be to establish a number of village communities of small-holding, dairy and cattle-farming proprietors, each largely dependent on his usufruct of the common land. Afforestation, the common land and, to some extent, even the small-holding private property would be subjected to a large amount of state and communal control. Cereals would become a state monopoly, the cheap credit required by the small holders being supplied by an extension of co-operative societies and banks. (*See* LAND TENURE.)

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III. ECONOMIC AND FINANCIAL HISTORY

In order to follow the development of the economic and financial history of Austria, it is necessary to distinguish two periods. From 1919 to 1922 Austria awaited salvation from without which it thought impossible from within; it was a period of discouragement and financial crisis, when many thought that only the steady provision of credits by foreign states, or union with Germany, could help her. From 1922 to 1925 certain Austrian politicians showed real determination to re-organise the country, and, with the help of the League of Nations, Austria reformed her finances; at the same time she worked at economic reconstruction, a more difficult task, and one of lower achievement.

THE BEGINNING OF THE CRISIS

The day after the proclamation of the republic a first preliminary budget had to be framed for the period Nov. 1 1918—June 30 1919. In theory 41% of the 3½ milliards of normal expenditure was covered by taxation; but neither frontiers, territories, nor sources of revenue were clearly indicated. The Finance Minister tried to raise a loan, and demanded the payment of taxes (old and new) for the whole financial year before the middle of 1919; otherwise, he stated, resort would have to be made to the note printing presses, which would lead to the collapse of the currency. The Austro-Hungarian crown, which before the War was worth 1·05 fr., had fallen on the Zürich exchange to 37·75 centimes on Nov. 11 1918 and to 18 centimes in June 1919. The districts which had formerly furnished cereals and coal to Austria had been detached from the republic and had adopted a new money. The Govt. therefore had to buy in foreign exchange and to import corn and fuel; but to assure the maintenance of order, it decided to furnish them to consumers at a very low price. The difficulties were accentuated by the necessity of employing the large number of German-speaking officials dismissed by the Succession States. The increase in expenditure and the fall in the exchange made it impossible to adhere to the estimates. The tax on capital had, in the spring of 1919, provided funds which enabled the Finance Minister, Dr. J. Schumpeter, to reduce for some weeks the additions to the paper currency; yet the issue of paper money reached 9 milliards in Aug. and 12 milliards at the end of the year. Only 37% of estimated expenditure for 1919–20 (17 milliards) could, according to the budget, be covered by taxation. It was known that expenditure was increasing much more rapidly than revenue, and capital was exported on a large scale in anticipation of a period of inflation. The terms of the Peace of St. Germain, ratified in Oct. 1919, further aggravated the situation; indeterminate financial obligations weighed down the new republic, and a first claim was established on all property to guarantee the payment of reparations. The crown fell to a value of 3 Swiss centimes at the end of 1919.

Financial Catastrophe.—Immediately after the Armistice, foodstuffs were sent into Austria by the Allied Governments, supplies being granted on credit. Private relief centres, notably those of the American Relief Fund and the Society of Friends, were established in Vienna. On March 1 1919 a relief credit of $30,000,000, subsequently increased to $48,000,000, was granted to Austria for the import of food. The credits were furnished in equal amounts by France, Great Britain and Italy, certain specific Austrian public assets being assigned as security. The Austrian Govt., in May 1919, made the repayment of these relief credits a prior charge on all its revenues. The Austrian section of the Reparations Commission, sitting in Vienna under the presidency of Sir William Goode, was concerned in 1920–1 with deciding what, if any, reparations could be paid by Austria. The section decided that Austria was not in a position to pay any reparations and suggested that a loan should be granted her to enable a definite scheme of reconstruction to be carried out.

Meantime the Austrian budget for 1920–1 showed an estimated deficit of 41 milliard crowns at a time (June 1920) when the total circulation was only 17 milliards. The crown continued to depreciate. At the end of 1920 it was worth less than a Swiss centime. The printing of notes continued, from 17 to 30 milliards and then to 175 milliards. At the end of 1921, 14 paper crowns were equivalent to one Swiss centime. At first, speculators in other countries had refused to believe in the finality of such a collapse, and collected depreciated money in the hope of a rise, but Austrians, on the contrary, lost all faith in the currency, and changed it as rapidly as possible for foreign securities or for goods. The policy of subsidising food made it possible to pay very low wages and to produce goods at prices below those of the world markets. This premium on exports only disappeared when producers learned, after cruel experience, not to confound real gains with differences in rates apparent at a time of depreciation.

Proposed International Action.—At the London Conference of the Allies, Feb. 21—March 14 1921, the Austrian Chancellor, Dr. Mayr, submitted a proposal for the application of the Ter Meulen Scheme to Austria, and Great Britain, France, Italy and Japan decided to suspend the mortgages which guaranteed their credits to Austria. Dr. Mayr's proposal was referred to the League of Nations. The Financial Committee met at once, and sent to Vienna (April 15 1921) a delegation consisting of M. J. Avenol, Sir Drummond Fraser and M. Glückstadt, whose recommendations were accepted by the league and forwarded (June 3) to the Supreme Council. But the suspension of all the mortgages encumbering Austrian assets on account of reparations and credits for reconstruction necessitated negotiations with 18 states. While they were proceeding, the situation became worse and the project fell through. The actual situation in Austria went from bad to worse.

Once more the Entente Powers had to come to the help of Austria and consented to advance funds, partly for the formation of a new bank of issue. The British credit of £2,250,000 was used, however, in a vain attempt to support the crown for a few weeks. After it was exhausted the depreciation of the crown was accelerated, accompanied by an immediate rise of prices. The long foreseen collapse seemed inevitable.

The food subsidies, which accounted for half the deficit on the budget, had been suppressed in Dec. 1921 and a budget with revenue to cover 60% of the 348 milliards expenditure had been drawn up for 1922; but the automatic adjustment which it had been necessary to enact between salaries and cost of living led to a rapid increase of expenditure, without any counterpart in increased revenue. In a few months all the estimates were exceeded; prices rose rapidly, and the public felt the burden of reforms more than their necessity. In Aug. 1922 the circulation exceeded 1,000 milliard crowns, and 15,000 crowns were worth one gold crown (140 crowns were equivalent to one centime).

On Aug. 7, Dr. Seipel made a despairing appeal to the Supreme Council, informing it that neither the present Govt. nor any other could continue to administer the state. On Aug. 15 1922 the Austrian question was referred a second time for "examination and report" to the League of Nations, with an indication of the possibility of a plan for making private credits available for Austria, providing such credits would not be wasted like previous ones.

The League of Nations Plan.—In Sept. 1922, thanks to preparatory work and to the atmosphere of the Assembly, of the Council and of the Committee for Austria, presided over by Lord Balfour, invaluable support was obtained, and a plan for the purpose was elaborated.

The Reparations Commission granted an exceptional moratorium, suspended all claims for 20 years, renounced the pledges of its mortgage and announced a similar decision on the part of the states which provided the relief credits, and thus created a basis for credits. The Financial Committee of the League reported that, when all possible economies and reforms had been carried out by the Austrian Govt., a loan of £30,000,000 would be required to put Austria on her feet. They estimated that the charges on the loan could be met, under strict administrative methods, from the proceeds of the customs and the tobacco monopoly. They pointed out that the process of reconstruction entailed that Austria "must endure and support an authority which must endorse reforms entailing harder conditions than those at present prevailing, knowing that in this way alone can the state avoid an even worse fate."

A complete scheme of reconstruction was adopted on Oct. 4 1922, agreed by Great Britain, France, Italy, Czechoslovakia and Austria. It was embodied in three protocols, the first reaffirming Austrian independence and sovereignty; the second stating the conditions of the loan, and the third laying down the functions of the commissioner-general of the League, charged with the administration of the scheme and the reciprocal obligations of the Austrian Government. A delegation of the council, presided over by M. Albert Janssen of the National Bank of Belgium, proceeded on Oct. 17 1922 to Vienna, and remained there until the middle of Dec. when the commissioner-general, Dr. Alfred Zimmermann, took over his duties.

The Geneva protocols put the Govt. under the immediate obligation to take steps to reduce the deficit and to present to Parliament a bill conferring on it full powers to insure within two years the balancing of the budget. The delegation supported the Govt., helped it to organise a bank of issue completely independent of the state and procure necessary financial resources by credit operations. It drew up a programme for budgeting by stages, fixing for each half year the maximum figure for expenditure, and estimated the receipts. The total charges on the state were to fall progressively from 672,000,000 gold crowns to 350,000,000 in the year 1925, so that the deficit to be covered amounted to 520,000,000 gold crowns.

Far-reaching reforms had to be carried out in order to conform with the plan: the provisional delegation and the Govt. had agreed on a scheme of reorganisation providing for the dismissal of 100,000 civil servants, the re-arrangement of departments, the putting of state undertakings on a sound basis, the increase of receipts, and the provision of financial resources for the provinces and communes. This programme was carried out from 1922 to 1925.

THE RECONSTRUCTION LOAN

Inflation was stopped on Nov. 18 1922, and the Govt. aided by the confidence inspired by the new scheme was able to raise short-term loans to meet the immediate needs of the situation. The Committee of Control authorised the negotiation of short-term loans amounting to $10,600,000 in Austria and £3,500,000 raised successfully abroad under the guarantee of the four guaranteeing Powers.

On April 16 1923 the assent of the Committee of Control was given to the raising of the long-term loan, to run for 20 years, redeemable by June 1943. Three trustees, M. Albert Janssen, M. Wallenberg and Mr. Jay, were appointed to watch the interests of the bondholders. The guaranteeing Powers were the four original guarantors, whose guarantee covered 94% of each *tranche*, together with Belgium, Sweden, Holland and Denmark. The following are the details of the issue:—

Market	Total (nominal)	Rate of interest, per cent	Rate of issue, per cent
London	£14,000,000	6	80
New York	$25,000,000	7	90
Stockholm	13,110,000 Swedish crowns	6	80
Amsterdam	3,000,000 guld.	6	80
Brussels	25,000,000 Belgian francs	6	80
Switzerland	25,000,000 Swiss francs	6	80
Austria	$13,000,000	7	93
Paris	170,000,000 French francs	6½	84
Rome	200,000,000 lire	6½	93
Prague	60,000,000 gold crowns	(no public	emission)

The long-term loan yielded the Austrian Govt. 585,000,000 gold crowns, *i.e.*, the sums necessary for the repayment of the obligations incurred to the Allied governments in 1922 and the repayment of the short-term loans plus new money amounting to more than 326,000,000 gold crowns. To this sum should be added a further 20,000,000 gold crowns, lent directly to the Austrian Govt. by the Swiss Govt., and 26,000,000 gold crowns, the yield of the Spanish guarantee. Thus a total sum of 372,000,000 gold crowns of new money was available, sufficient to meet the needs of the Austrian Treasury up to the end of 1924 under the programme of reform.

The New National Bank.—From Jan. 2 1923 the new National Bank of issue, with a capital of 30,000,000 gold crowns, began to function independently of the state, under the presidency of Dr. Reisch. Its cash balance in gold and securities of 93,000,000 gold crowns came in great part from the repatriation of Austrian capital, which had been going on since the initiation of the scheme, the foreign securities held by Austrian nationals being exchanged by them for crowns. The proceeds of the Reconstruction Loan and the speculative influx of capital from abroad, raised the cash balance in 1923 to 300,000,000 gold crowns, that is, to 10 times the value of the bank capital.

The New Currency.—The currency was stabilised at 14,400 paper crowns to one gold crown, this rate being strictly maintained, and the monetary reform of 1924 made the situation still more secure by establishing a new monetary unit, the schilling, on a gold basis, equal to 10,000 crowns, or 0·694 of the gold crown, *i.e.*, containing 0·2117 grammes of fine gold.

Execution of Internal Reforms.—The stipulations of the reform programme in other departments, without being rigorously followed, were carried out courageously. The dismissal of state officials and employees, which proceeded at first at the prescribed rate, became more difficult later on; 25,000 employees had been dismissed between

Oct. 1922 and Jan. 1923, according to plan; at the beginning of July 1924 the figure reached 68,000 instead of 100,000. Up to the close of 1925 the figures reached about 80,000. The high cost of pensions and increases of salary of the personnel employed have prevented the hoped for economies from materialising in full measure; nevertheless the administrative machine has been put on a much more economical footing. The re-arrangement of government departments also disappointed expectations; in April 1923 the number of ministries was reduced from 11 to 7, but the saving effected by concentration and reduction of personnel was outweighed by increases of salary to those who remained. On the other hand, the reorganisation of state undertakings has effected great improvements. Helped by the advice of foreign experts, the Austrian administration has succeeded in making current receipts cover expenses, but owing to the neglect of capital outlay during the period of confusion, the financial needs are still great. The cutting down of expenses went well at first but grew more difficult later; real economies were effected and wasteful expenditure checked, but necessary expenditure on repairs to roads and buildings, and legitimate increases of salary, as well as the service of the new public debt, have counterbalanced the saving.

Budgets of 1923–5.—Austrian experience has shown that it was useless to count on a great reduction of total expenses, but has proved how quickly revenue recovers when the currency is stabilised, and private incomes have adapted themselves to the change. From the moment that the crown was stabilised the fiscal system could work. The state levied direct taxes in the same currency in which the taxpayers received their incomes, and in the case of indirect taxation it profited by the increase in general prosperity and in consumption. Thus the gross revenue from customs and tobacco pledged for the Reconstruction Loan was estimated at 100,000,000 gold crowns a year; but the receipts for 1923 reached 190,000,000, those of 1924, 270,000,000 and those of 1925 are at the rate of more than 300,000,000. The total receipts from taxation have exceeded forecasts, showing that the Austrian state can count permanently on receipts much above 350,000,000 gold crowns per annum. The Council of the League of Nations therefore authorised the Austrian Govt. in Sept. 1924 to budget for a higher amount than that fixed originally. The figure of 495,000,000 plus 50,000,000 for capital expenditure, totalling 545,000,000 gold crowns, has been fixed for 1925. Control will be abolished if these results are maintained, but during the following 10 years it may be re-introduced if the balancing of the budget or the service of the loan should be threatened. The committee of guarantor states will continue to meet periodically until the loan is amortised in 1943.

For three years the commissioner-general has fixed the preliminary monthly budget with the Finance Minister, fixing the figures of expenditure, approving estimated receipts and using the loan to cover the difference. A year after the adoption of the scheme, when the programme estimated a deficit of about 158,000,000 gold crowns per annum, a monthly surplus was recorded. In 1924 and 1925 the total deficit on the budget was less than productive capital expenditure shown by the accounts. Thus a considerable sum remains over from the loan, and the method of its expenditure should be fixed when control will cease, as it seems not to be needed to cover current deficits, as had originally been planned.

The Economic Problem

The re-establishment of a firm financial situation convinced a growing number of Austrians that the Austrian state could carry on an autonomous existence, but hesitation and doubt reappeared with regard to economic conditions. Toward the close of 1923, the adaptation of economic life seemed to take place even more rapidly than the budgetary improvement. Thanks to a restoration of confidence there was a reversal in the movement of capital, which flowed into Austria at the beginning of the reform as quickly as it had flowed out in previous years. The result was that Austrian accounts balanced so easily that the difficulty of the economic problem was lost sight of.

In spite of Press campaigns the National Bank remained faithful to the stabilisation policy inaugurated by Dr. H. Schwarzwald; it absorbed at this time all surplus foreign exchange, buying it from the public and putting it to reserve, without letting the crown appreciate. This policy was the wiser, as the easy balancing of accounts in 1923 was not permanent. Some sources of revenue, such as the repatriation of capital invested abroad, would not recur; others, such as the influx of foreign capital for speculation on the Bourse, were but temporary, and withdrawals would shortly exceed the original investments. This is exactly what happened. Foreign capital, attracted to Austria, did not permanently remain, although the country suffered from lack of capital as a result of the losses due to monetary depreciation.

At the moment when the state realised that with its limited resources it must retrench, financial circles in Austria did not at once realise that, in private business, unhealthy elements should be eliminated. Instead of reserving the exceptional credits at the disposal of the market for productive enterprises, the banks in 1923 were tempted too often to attract foreign capital to all business on the market, whatever its nature. The result was a general speculative rise, rather than an improvement in the conditions of production of promising business.

Industrial Capital.—When the inevitable decline took place in 1924 on the Stock Exchange, the foreigner having then withdrawn his capital, the lack of floating capital was sharply felt in the country. The National Bank, in order to avoid a catastrophe, had to increase its discount business, at the same time that it supplied the foreign exchange necessary for external payments. The rise in the rate of discount, which it was obliged to adopt, stabilised the high rate of interest, to the detriment of production. This rise brought back short-term foreign capital to a certain extent, and thus enabled accounts to be balanced, but it frightened people abroad, who had been disposed to make long-term investments in Austria, by its reaction on the income of business enterprises. Productive business was left with insufficient floating capital. Industrial capital was, in gold values, much less than before the War, for during the depreciation period all reserves had depreciated or had been invested. In the first case they were non-existent; in the second, they had to be converted afresh into floating capital, which could only be done by realising a part, that is, by investing a certain percentage of shares abroad.

Meanwhile, manufacturers had to pay enormous rates to procure funds necessary for the payment of salaries and for raw materials (25 to 28% per annum to the beginning of 1925, then less); net costs and possibilities of sale abroad suffered accordingly, and the conditions of home production made a barrier to export more dangerous than any foreign customs barrier. Under these circumstances, severe unemployment developed; 200,000 unemployed (about a fifth of the working-class population) had to draw relief in the spring of 1925. Building, metal and textile industries and trade were particularly affected, and the effort to reduce costs of production increased unemployment. Owing to lack of outlets, emigration and intensified production were difficult.

The Layton-Rist Report.—This was shown in the report presented to the League of Nations in Sept. 1925 by Mr. W. T. Layton and Prof. Charles Rist. They reported a slow but sure improvement in the economic situation from 1922 to 1925. Austrian economy seemed to them to be suffering from the same evils as the rest of post-War Europe, but more acutely. The increased customs tariffs and the difficulty of commercial relations between states were especially prejudicial to a country like Austria, separated by its new frontiers from its former normal markets. (P. Q.)

Trade and Commercial Policy.—The outstanding feature of the post-War trade of Austria is the large adverse visible balance which is shown in the table below.

	1921	1922	1923	1924
	£	£	£	£
(A) Imports	70,846,000	73,219,000	80,091,500	100,515,000
(B) Exports	37,673,700	44,308,000	47,062,000	57,526,000
Excess of (A) over (B)	33,172,300	28,911,000	33,029,500	42,989,000

The chief imports are fuel, raw materials, cereals and finished goods; exports are mainly iron and magnesite, timber and wooden manufactures, textiles, leather and leather goods, machinery and chemicals.

Tariffs and Commercial Treaties.—The commercial policy of the republic is largely influenced by the situation in Central Europe. The Austrian tariff is mainly designed to provide revenue and give protection to home industries; but it is also intended as a weapon for obtaining commercial concessions from other countries and, with this end in view, the duties on imports were increased in 1925. Commercial treaties were concluded in 1924–5 with Great Britain, Czechoslovakia, Germany, France, the Belgium-Luxemburg Customs Union, Spain, Greece and Norway. These treaties, negotiated by

Dr. R. Schüller, secured appreciable advantages, and the adverse visible balance of trade, which reached 686,000,000 schillings in the first half year of 1924, was only 333,000,000 in the corresponding period of 1925; 73 % of imports were covered by sales abroad. The big commercial deficit alarms the Austrian public, which forgets that many prosperous countries before the War paid with exports for a similarly small proportion of their imports (*see* BALANCE OF PAYMENTS). If, in 1913, an economic zone comprising the regions forming post-War Austria had been detached from the rest of the Austro-Hungarian Empire, it would have been seen that this region could be self-sufficing; although it produced materially much less than it consumed, it bridged the gap by other means.

The Position of Vienna.—Vienna was a great international business and financial centre, and, above all, was a reservoir for capital, which she could invest profitably and which returned with increased interest. Vienna also attracted foreigners, and the profits from services that it rendered enabled it to pay for the products which came from other parts of the empire. To-day, the regions composing new Austria remain organised materially as before the War, but monetary depreciation has destroyed a great part of the capital which assisted the provision of "invisible exports." Austria has become a country which temporarily needs capital, whilst retaining the structure of a country which invests capital, and consequently a debit commercial balance.

It is to be hoped that a general diminution of protective tariffs will allow Austrian exports to increase, but it would be foolish to expect the disappearance of the excess of imports in a country which has always imported more goods than it produced. It is normal for Austria to have a large commercial debit balance, and it would not be possible to change that state of affairs, even by devoting many years to the formation of productive machinery in the centre of Europe, already excessively industrialised. It is not normal for Vienna to lack capital, because it has an organisation which has always successfully handled and directed it. The problem with which Austria is confronted is to secure loans, and to make them yield more than they cost until she has been able, out of her national savings, to provide sufficient working capital of her own; economic stabilisation will then probably be attained by Vienna again becoming a European financial centre.

PRODUCTION AND INDUSTRY

During the years 1914–8, agriculture declined very considerably, and a disturbing feature in the new state is the slow recovery that is being made. The following table gives the yield in tons of the chief crops in 1913, 1919 and 1924:—

Crop	1913	1919	1924
Wheat	289,939	139,171	237,662
Rye	604,057	229,503	407,331
Barley	179,443	83,207	158,921
Oats.	465,804	197,132	331,902
Maize	78,266	53,735	91,856
Potatoes	1,508,320	544,904	1,524,996
Sugar Beet	403,621	74,190	365,214
	3,529,450	1,321,842	3,117,882

These figures refer to the areas included in the Austrian Republic, except that the figures for 1913 and 1919 do not include the crops of the Burgenland, which represent some 10 % of the 1924 yields. Cattle-raising and dairy-farming are suited to the climate and configuration of the republic, and are slowly improving. The following table gives the numbers of livestock in 1910 and 1923:—

Year	Horses	Cattle	Sheep	Goats	Pigs
1910	318,217	2,356,012	301,404	239,340	1,935,536
1923	282,484	2,163,025	597,414	382,204	1,472,821

Mineral deposits are of considerable importance: the chief are iron, magnesite, salt and graphite. The industries of Austria are well organised and equipped, and capable of producing a large surplus for export. The plentiful supplies of iron ore are more than sufficient for the needs of her important metal-working industry, and the forests ensure a constant supply of timber. The lack of coal hampers industrial progress and has resulted in the exploitation of waterpower resources; it is estimated that the total waterpower capable of being harnessed amounts to some 3,500,000 horsepower. The textile, iron, metal-working, electrical, motor vehicle, woodworking and paper-making industries are the most important. Owing, however, to the lack of working capital, the loss of pre-War markets and the post-War financial crisis, conditions in industry are very depressed and a considerable time must elapse before the pre-War prosperity can be regained.

COMMUNICATIONS

The railways of the republic have a total length of over 4,000 m., and link up every part of the country with Vienna, which is an important station on the line from western to southeastern Europe. The railways, over three-quarters of which are state owned, have been reorganised under expert commercial management, independent of the Government. Electrification is rapidly proceeding, and a programme for the electrification of the railways in the western area was laid down in the law of July 23 1920; the first part of this programme was practically completed by the middle of 1925. The river Danube is of great importance, owing to the lack of seaports, as an artery of transport; its value to Austria should greatly increase when the deep water Rhine-Main-Danube canal, under construction, is completed. Vienna has developed into an important centre for aerial services; it is a landing station on the Paris-Constantinople and Prague-Budapest air routes, and a terminus for lines running to Munich and Trieste.

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AUSTRIA-HUNGARY (*see* 3.2), the name given to the Dual Monarchy of Austria-Hungary, dissolved in 1918. Area, 264,062 sq. m.; population, 51,352,429 (1910).

With the annexation of Bosnia and the Hercegovina in Oct. 1908, the Austro-Hungarian Monarchy reached its final form. It consisted of two independent states, whose relations were governed by the Compromise of 1867: the complex in the West which may be termed Austria, consisting of numerous provinces (Kronländer) with local Diets, united by a central Parliament; and the Kingdom of Hungary, a unity affected only by the local independence, under a governor and a Diet, enjoyed by Croatia. The Emperor-King, their common ruler, reserved the unity of control over foreign affairs, the armed forces and certain other matters, in which the people had a voice only in the delegations appointed for the purpose from the respective Parliaments. The annexed provinces were to be absorbed later in the Dualist system, but no agreement could be reached on their destiny. For the moment they were administered by the common finance minister, assisted after 1910 by an elected Diet which was autonomous in internal affairs.

Population.—The last census for the Monarchy as a whole was that of 1910. It gave the total population as 51,352,429 (Austria 28,567,898; Hungary with Transylvania 18,264,533; Croatia and Slavonia 2,621,954; Bosnia and the Hercegovina 1,898,044). No figures for nationality were then given; but figures for the habitual language (Umgangsprache) were given, which must be taken with caution. Apart from the dubious nature of Magyar official statistics, Jews are only reckoned separately in the annexed provinces, while they actually form no mean proportion of the German, Magyar and Polish speakers. Austria puts Serbo-Croat under one heading, Hungary distinguishes Serbs and Croats, but puts Slovene under "other languages."

The approximate racial totals and distribution were: Germans (in the territory of the present republic, the Sudetic lands of Bohemia, Moravia and Silesia, parts of West Hungary, Transylvania and the Banat) 12,050,000; Czechs (Bohemia and Moravia) and Slovaks (north Hungary) 8,500,000; Poles (east Silesia, west Galicia) 5,070,000; Ukrainians (east Galicia, northeast Hungary) 4,000,000; Slovenes (south Styria, southeast Carinthia, Carniola, the Coastland) 1,390,000; Serbs (southeast Croatia, the annexed provinces, parts of the Banat and Bačka in south Hungary) 2,675,000; Croats (Croatia, Dalmatia, the annexed provinces) 3,000,000; Italians and Ladins (south Tirol, Trieste and district, some Dalmatian towns) 800,000; Rumanians (parts of Transylvania and the Banat), 3,250,000; Magyars (central Hungary with Székler settlements in Transylvania) 10,200,000. The official figures were as shown on the next page.

The Balkan Danger.—From the date of the annexation of Bosnia and the Hercegovina (Oct. 1908), the differences which were dividing Europe into two hostile camps centred ever more clearly round the conflict of interests between Austria-Hungary and Serbia. With the Turkish Empire again on the brink of collapse, the Balkans were the field in which any change, however trivial in itself, might develop into a trial of strength involving first Germany and Russia, then all Europe.

Nationalist Movements.—Internal conditions in the Monarchy made a pacific solution of this problem almost impossible. The extension of the franchise in Austria (1907) had not had the desired result of allaying the Nationalist agitation. The Social Democrats, Austria's one international party, emerged indeed from the first elections on the new basis as the strongest parlia-

Racial Distribution in 1910

Language	Austria	Hungary	Crotia and Slavonia	Bosnia and Hercegovina
German	9,950,678	1,903,357	134,078	22,968
Bohemian, Moravian and Slovak	6,435,532	1,946,357	21,163[1]	7,527[2]
Polish	4,965,667	..	..	10,975
Ruthenian (Ukrainian)	3,518,882	464,270	8,317	7,431
Slovene	1,253,148	(3)	(3)	3,108
Serb	783,010[4]	461,516	644,955	825,418
Croat		194,808	1,638,354	385,009[5]
	Mahommedan Serbo-Croats,			612,137
Italian and Ladin	768,592	..	..	2,462
Rumanian	275,088	2,948,186	846	608
Magyar	10,899	9,944,627	105,948	6,443
Other Languages	..	401,412[6]	67,843[7]	13,958

[1] Slovak; Czech is included in "other languages." [2] Czech and Slovak. [3] Included in "other languages." [4] From religious figures one may deduce 110,000 Serbs, 670,000 Croats. [5] Figure arrived at by subtracting the figures for orthodox Serbs and Mahommedan Serbo-Croats from the total of Serbo-Croat language. [6] Described by the Magyar official statistics as "principally Wendisch (Slovene), Bunyewatisch, Gipsy, Czech-Moravian, Polish, Bulgar and Italian." Estimated figures for Hungary with Croatia and Slavonia on the basis of the 1890 census, 115,000 Slovenes; 200,000 Gipsies. Of the remaining contingents the largest are Czech, Polish and Bulgarian. [7] Includes 7,886 Spanish Jews; 5,419 Gipsies.

mentary party; but only to succumb themselves to disintegration, the majority of the Czech members splitting off into a separate and often hostile Nationalist group. The chief gainers from the extended franchise were the more backward Slav races particularly the Ukrainians and Slovenes. Here the change deepened and complicated the Nationalist movement, and brought its democratic character into increasing conflict with the ruling system. The neo-Slav movement gained in strength, and its political character was increasingly evident and increasingly directed against the organisation of the Monarchy. The central figure of the Russophils in Austria was Kramar, leader of the Young Czech party.

The Young Czechs, the Polish National Democrats, the Pan-Russian party among the Ukrainians and the Slovenes, who were now awakening to the sense of brotherhood with the other southern Slav races, were in violent opposition to their government's policy toward Serbia and Russia. The Austrian Slavs were now in close political connection with the Slovaks, and still more with the southern Slavs in Hungary. The dynasty had long used the Croats as a counter to the Magyars, who in turn had played off the Serbs of Hungary and Croatia against the Croats. But since the resolution of Fiume (1905) the political leaders of Serbs and Croats had united, at first to support the Magyars against the dynasty; but when the Magyars left their help unrewarded they allied themselves with Serbia against Vienna and Budapest alike.

The Slavs of the Monarchy could only have been appeased by a complete reorganisation, involving the abandonment of the Dualist system and probably of the German alliance. They were strongly supported by the Social Democrats, who advocated the transformation of the Monarchy into a "second Switzerland," with complete liberty of development for all its nationalities. Even had it been possible to carry this through peacefully in Austria, it would have led to civil war in Hungary, and probably to war with Serbia. The military party, led by Conrad von Hötzendorf, the chief of the general staff, was prepared to face the latter risk; on several occasions Conrad advocated annexing Serbia bodily. The heir to the throne, Francis Ferdinand, was in close touch with the military party, although by no means always in agreement with their views. With time he had assumed practical control over the army, and it was thanks to his influence that the army reforms, which were urgently necessary, were taken in hand seriously from 1908 onwards. But these reforms aroused almost universal opposition; among the Slavs, who feared an aggressive policy against Serbia, and still more among the Magyars. Francis Ferdinand disliked the Magyars personally and politically, and it was known that his first act on accession to the throne—before his coronation in Hungary—would be to break the Magyar supremacy, either by adopting a system of "trialism" which would elevate the southern Slavs to the position of a third partnership in the Monarchy or by some less drastic form of federalism. But while the prospect aroused the Magyars' fear and resentment, and was at the back of most of their agitation for a national army, the Archduke's ideas were too reactionary and clerical to awaken corresponding hopes among the Slavs.

Rule of the Bureaucracy.—Francis Joseph was in any case too old to change. He clung tenaciously to the German alliance and the basic principle of the Dualist system, the twin hegemony of Germans and Magyars. He had never really either understood or sympathised with the Slav national movements, and as his Slav subjects moved further from his ideas, and as constitutional government in Austria became a real impossibility—the weary Nationalist obstruction had made the proceedings of the Reichsrat and the Diets alike into a tragic farce—he restored the real authority to the hands of the old bureaucracy, which in its higher branches was still mainly German and loyal; while political control was concentrated in the hands of the Minister President alone. Beck's Ministry, which had carried through the electoral reform, fell in 1908; both Bienerth who succeeded him (Nov. 1908—June 1911), and Stürgkh, Austria's last peace minister President, from Nov. 1911 (Gautsch's Ministry, June—Oct. 1911, was only a temporary stop-gap) were absolutists at heart; and in March 1914 Stürgkh dismissed the Austrian Parliament altogether. Up till then, necessary government measures were forced through under paragraph 14 of the constitution, or the parties sold their votes for appointments in the bureaucracy—the logical reply to this policy, but one which would have had the effect, in a few years, of disintegrating the bureaucracy and even the army altogether.

Hungarian Dissensions.—In Hungary Francis Joseph had an ally in Count Tisza. The struggle in Hungary, bitter as it had been, had been to some extent unreal. The Magyar gentry and Jewish financiers who monopolised the seats in the Hungarian Parliament and the political and economic influence in the country differed only on the degree of independence which it was safe to claim; their interests were homogeneous, and none of them could afford to face an electoral reform in favour of the poorer classes and the non-Magyars. Thus the monarch's threat to introduce universal suffrage proved effective. The party of Independence split. The old Liberal party reorganised itself as the National Party of Work and entered Parliament in June 1910, with a large majority. Tisza, who became President of the Hungarian Parliament in 1912, and Hungarian Minister President in 1913, was convinced that the Magyar nation could not afford to do without the backing from Germany and Austria afforded by the Dualist system. He therefore carried the army measures in 1912 with a high hand against the Party of Independence. At the same time, he maintained the claims of his nation and his caste most ruthlessly. The electoral law of 1913, with which his name and that of Lukacs were associated, and which became law but was never applied, was a reform only in name.

In 1912 he crushed a workman's demonstration in Budapest with much bloodshed, and Cuvaj, appointed under his influence in that year to be Ban of Croatia with the powers of a Royal Commissary, suspended the Croat Constitution, and surpassed all records of corrupt despotism; the memory of his rule was not wiped out by the milder period which succeeded it. The unity of the army had been saved and a temporary stability restored in Hungary; but at the price of the final estrangement of the southern Slavs of the Monarchy and the passionate hatred of Serbia, whom the Magyar land-owners, intent on their economic interests, denied the most legitimate outlet for her aspirations.

Home and foreign policy thus moved in a vicious circle. The hegemony of the German and Magyar upper classes alone enabled the Monarchy to show a strong face to the world and to reorganise the army. But it put a peaceful solution of the Serb problem out of the question, while the discontent of the Italian and Rumanian minorities in the Monarchy aroused the hostility and ambition of Italy and Rumania, and endangered Austria-Hungary's understandings with these countries.

War Foreseen.—From 1908 the war party was convinced that a conflict was inevitable. Its members urged a drastic solution of the Slav problem, and rapid reform in the army. Conrad was in favour of annexing Serbia in 1909, and in 1911 he advised a "defensive war" against Italy while she was engaged with Turkey in Tripoli. Francis Joseph, however, earnestly desired peace and believed that it could be maintained; partly, no doubt, because only the most optimistic reports were allowed to reach his ears. Aehrenthal also wished and worked for peace, and with some success, once the storm after the annexation had been weakened. He therefore offered Italy a free hand in Tripoli in return for non-interference with Austrian plans in the Balkans. The Allies were drawn together by the common desire to prevent Serbia's access to the Adriatic, and united in their Albanian policy; the Triple Alliance could therefore be renewed as early as Dec. 1912.

The Balkan Wars.—The Balkan wars (*q.v.*), however, put Berchtold, who became Foreign Minister on Aehrenthal's death (Feb. 17 1912), in a most difficult position. An active pro-Turkish policy was impossible in view of the feeling among the Slav populations and the danger of a conflict with Russia. Austria-Hungary remained a spectator, and carried her point as regards Albania, so that Serbia was still denied an outlet to the Adriatic. But she could not prevent Serbia from joining hands with Montenegro across the Sanjak of Novi Pazar, so that these two countries, while remaining her irreconcilable enemies, were now increased in strength. In the Eastern Balkans her prestige diminished. With Rumania allied with Serbia against Bulgaria, to intervene in Bulgaria's favour meant disappointing Rumania; not to intervene meant the loss of a potential ally against Serbia. In fact, Austria-Hungary worked for a compromise; disappointing Bulgaria, whom her efforts could not save from dismemberment, and estranging Rumania, who now showed a marked desire to join the Russian camp, with, presumably, designs on Transylvania. There was a grave danger that all Balkan states would reunite in a new Balkan League under Russian leadership against the Monarchy. To prevent this, one secure ally was necessary, and Austria-Hungary urged that Bulgaria was the most suitable, while Germany believed that Rumania should be made safe, even at the cost of sacrifices. The Viennese policy prevailed. From March 1914 on, the chief aim of the Central Powers was to secure Bulgaria as a firm ally. Meanwhile, Rumania grew more hostile, Irredentism increased in Italy and Serbia's hatred was unbounded. In June 1914 Conrad drew up a memorandum describing conditions in the Balkans as intolerable. Rumania must state her attitude clearly, Bulgaria be induced to sign a definite alliance. Berchtold hoped to unite Rumania, Bulgaria, Greece and Turkey in a new Balkan League against Serbia.

Outbreak of War.—When the news of the murder of Francis Ferdinand at Sarajevo on June 28 reached Vienna, all those in authority, except Tisza, considered the time had come for a reckoning with Serbia, to whom, in spite of the negative report of the investigators, they ascribed the guilt of the murder. It was understood that Germany would support her Ally in a conflict with Serbia; and Conrad reported that the military situation, even in a World War, would be better now than later. On July 23 an ultimatum was despatched to Serbia, containing conditions of which the rejection was inevitable. In fact, Serbia accepted nearly all the conditions, but the die once cast, the advisers of the Monarchy refused to draw back. They rejected all efforts of mediation, and declared war on Serbia on July 28. Within a week the World War had broken out; Austria-Hungary and Germany were pitted against Serbia, Montenegro, Russia, France, Belgium and Great Britain, with her daughter states (*see* EUROPE).

The Monarchy's internal dissensions were little apparent on the outbreak of the War. Among the troops, only the Czechs were partly disaffected. The civilian opposition, both Nationalist and Democratic, declared for the Govt. if without enthusiasm. In Austria, the bureaucracy and military were already in charge, Parliament having been suspended in March, and could carry through mobilisation, militarise the War industry and much of the administration and justice and establish a state of siege, without interference. This dictatorship continued in fact for nearly three years, during which censorship and courts-martial solved the complications of internal politics. In Hungary, Tisza's régime left the "nationalities" and lower classes equally helpless; the Magyar "gentry," however, still met in the Hungarian Parliament and thus, as the only vocal class in the Monarchy, acquired a dominating influence in its politics.

The effects of the nationalist discontents were, however, immediately apparent in the foreign relations of the Monarchy. Although she could conclude alliances with Turkey (Aug. 5 1914) and Bulgaria (Sept. 6 1914), her two former Allies, Italy and Rumania, not only admitted no *casus foederis*, but demanded territorial concessions as a price for their neutrality. Burian, who succeeded Berchtold on Jan. 13 1915, at last consented to surrender some districts in Austria—a step urgently advised by the German and Austrian High Commands—but was never able to concede what the Entente offered. Italy therefore concluded the Treaty of London on April 26 1915, and declared war on May 23. Rumania hesitated longer, but, as Tisza passionately refused to yield an inch of soil in Transylvania, Rumania also declared war on Aug. 27 1916.

The Polish Question.—Meanwhile the fatal difficulties of the Polish question had become acute. Russia was driven out of "Congress" Poland, Warsaw falling on Aug. 5 1916. The Central Powers administered the country provisionally by means of two provincial governments in Warsaw and Lublin respectively. But when Russia refused to take the province back at the price of leaving the Entente, neither Ally would allow the other complete control over Poland, and both were embarrassed by the ambiguous attitude of their own Polish subjects. No settlement of the question could be reached. The Poles of Austria, Germany and Russia worked together very skilfully to get the best out of any possible situation, including the defeat of the Central Powers. In the hope of securing Polish soldiers, a proclamation on Nov. 5 1916 promised the restoration of an independent Poland as an hereditary constitutional monarchy. Galicia was to receive increased autonomy within Austria.

Blockade of Austria.—This proclamation was almost the last act of Francis Joseph, and the concession was sweetened by the news of the military success in Rumania. But it was the beginning of the national concessions in Austria, while Hungary had already struck a blow at the unity of the Monarchy. Early in 1915, Tisza had closed the Hungarian frontier against the export of foodstuffs to Austria. Such small quantities as were later released were bought at the secret price of a further alteration of the "quota" in Hungary's favour. The blockade, the loss of supplies from Hungary and Galicia—ravaged in the first fighting—and the diminution of home production consequent on shortage of human and animal labour made the food situation in Austria already desperate, especially in the towns; the country districts shut themselves off, held up supplies and ran up prices in defiance of the law.

Foreign Nationalist Committees.—The Czechs and southern Slavs had established foreign committees in 1915, while the disaffection in their home provinces was growing rapidly. The latter were still hampered by mutual jealousies and by the commitments of the Entente to Italy. Only a minority favoured the "Great Serb" solution proclaimed by the Serb Govt., the majority inclining to a "Great Croatia" or a Yugoslav Union under the Habsburgs. The Czechs, too, worked still for autonomy within the Monarchy. But their troops were by now quite unreliable, and the protracted trial of the Young Czech leader Kramař proved how very widespread was this anti-Austrian and this pro-Russian feeling.

While the dominant classes of the Germans supported the dictatorship as indispensable and were even considering a new arrangement for the future Austria under which the German hegemony should be established securely, war weariness and discontent were growing among the working classes. But they were too cowed and too lethargic to protest, until Friedrich Adler, the Socialist leader—at the time a solitary figure—did this in startling fashion by shooting Stürgkh dead on Oct. 21 1916, "as a demonstration."

When Francis Joseph died (Nov. 21), his successor Charles, a young man of undoubted good intentions but mediocre ability, thus found a very difficult situation, which he hoped to solve by a change of régime. Conrad von Hötzendorf exchanged the post of chief of the staff for an army command, and there were other important military changes. Count Czernin became (Dec. 22 1916) Foreign Minister and real head of the government.

Peace Proposal of 1917.—The March revolution in Russia gave a great impetus to the Slav national movements and to the Social Democrat agitation, which was more perceptible as the military pressure on the population was now relaxed. Charles and Czernin saw the danger and worked hard for peace. The Emperor opened up secret negotiations with the Entente through Prince Sixtus of Parma, and promised in a letter of March 24 1917 to support the "just claims" of France to Alsace-Lorraine. These negotiations broke down, however, as Italy insisted on the full measure promised her in the Treaty of London. Czernin now turned to the Germans and asked them to offer peace, renouncing Alsace-Lorraine for compensations in Poland. This Germany refused to do, although she would have taken Poland, giving Austria-Hungary compensations in the Balkans. It became clear that Germany would turn her armies on Austria if she abandoned the alliance. Czernin could not face this danger and was obliged to continue the war, and even to consent to Germany's wish for unlimited submarine activity.

Meanwhile, an attempt was made to allay discontent at home. Charles called on Tisza to introduce electoral reform with soldiers' votes in Hungary. Tisza resigned on May 22 1917 and a fresh Hungarian Cabinet was formed to carry through the reform. A general amnesty (July 2 1917) was issued for political offences and the Austrian Parliament summoned on May 31 1917.

Nationalist Claims.—But its first meeting showed how far popular ideas had moved. The Poles demanded an "independent and united Poland," declaring that the Polish question was one for international consideration; the Czechs, that the Monarchy be "transformed into a federal state of free and equal national states"; the Slovenes, that all southern Slavs of the Monarchy be united into one independent democratic state under the Habsburgs; motions which involved the end of the Dualist system. The Austrian Social Democrats supported the claims of the Slavs. Adler's trial (May 18–19 1917), during which he delivered an extraordinary indictment of prevailing methods, gave them courage and a programme.

The Poles were finally alienated a few months later. A separate peace with the leaders of Soviet Russia was signed on March 3 1918 at Brest-Litovsk. During the negotiations a Ukrainian delegation appeared, claiming autonomy. Czernin signed (Feb. 9) a separate peace with them by which he allowed the district of Kholm to be included within the frontiers of the new Ukraine, and Austria's Ukrainian districts, East Galicia and the Bukovina, to be formed into an autonomous Crownland. These concessions infuriated the Poles, who had acquired their independence from Soviet Russia. They turned their backs on Austria, and from now on were practically independent. Meanwhile, the peace with the Ukraine failed to achieve the hoped-for results. It had been dictated by the urgent need to replenish Austria's food stocks, but the armies of occupation could send few supplies into Austria owing to the breakdown of communications, and their requisitionings turned the inhabitants into enemies. The shortage continued to be terrible. It had already led to a strike in Jan. 1918 in the Austrian and Hungarian munitions districts, which almost amounted to a revolution, when the Govt. had had to make terms with the workmen's leaders.

America's entry into the War increased the hopes of the remaining Slavs, especially since the new régime[1] in Hungary proved quite powerless in the face of the opposition of Tisza's party, and the position of the non-Magyars grew no better. It was, however, impossible for the Emperor to negotiate on the basis of the Fourteen Points in face of the attitude of Germany, while the Magyars would have answered any attempt to satisfy southern Slav and Czechoslovak wishes by breaking with Austria and probably joining hands with Germany against her. This fear kept Austria true to the alliance, and temporarily restrained the nationalist and revolutionary movements while Germany was rallying for her great military effort of 1918. At the same time, Clemenceau's revelation (April 1918) of the Sixtus negotiations strained the alliance badly, and irreparably damaged the prestige of the dynasty among its German and Magyar subjects. When the great German and Austrian offensives had shot their bolt, the national movements revived. In the course of the summer the Entente recognised the Czechs as a belligerent power, and all the Slavs began to see that the break-up of Austria would give them more than her continued existence. The Slavs now based their calculations on a break-up, the Austrian Social Democrats had adapted theirs in their party conference of Oct. 1917, and the party in Hungary which demanded complete independence with democratic reforms and immediate peace grew very strong. Desertions at the front and mutinies in the hinterland grew rife; the fleet mutinied on a grand scale and hoisted the red flag (Feb. 1918).

Request for Peace.—On Sept. 15, the Bulgarian front broke. The Armistice of the 29th left Hungary unprotected. The Magyar regiments demanded to be sent home to guard their own frontiers. The Govt. was distracted between the centrifugal demands of the Slavs and the insistence of the Magyars on Hungary's integrity. On Oct. 1, the Minister President of Austria announced that Austria was to be transformed into a "federation of free States." Two days later, Austria-Hungary, with her allies, begged Wilson for an Armistice. Meanwhile, the Poles proclaimed their independence in Warsaw on Oct. 7, the Ukrainians summoned their National Council for the 19th, the Czech Govt. was formed in Paris on the 14th. On the 16th, the Emperor issued a manifesto promising that every nation should form a separate state. But the Magyars had threatened separation unless a clause were inserted that the integrity of Hungary should not be affected thereby; this stultified the whole proclamation. Meanwhile, the Hungarian peace party had the country behind it, and the Slovaks, Serbs and Rumanians of Hungary were at last able to voice their demands. The Germans of Austria prepared to erect their own state, as the Emperor's manifesto had sanctioned. Viktor Adler, speaking for the Social Democrat party, demanded that Austria should become a federal state of the German Reich; the other parties were still Monarchist.

Break-up of the Monarchy.—On the 31st, President Wilson replied that the complete satisfaction of the Slavs was a condition of the Armistice, which was now vital to Austria, since a fresh Italian offensive had commenced. First the Magyar, then the other troops—the Germans excepted—left the front for their own countries. The Austrian fleet handed itself over to the Croats. In the last days of Oct., autonomous governments were formed in Prague, Laibach, Sarajevo, Trieste, Cracow and Lemberg, and a neutral Govt. was set up in Vienna to liquidate the central administration. On Oct. 27 the Foreign Minister accepted Wilson's conditions regarding the rights of the nationalities, "especially of the Czechoslovaks and Yugoslavs." The Dualist system was officially abandoned. On the 30th a national Hungarian Govt. was formed in Budapest; on the 31st Tisza was assassinated. The provisional Govt. in Vienna declared the legislative power to rest with itself, the executive with a National Council to be elected immediately. The Socialists and German Nationalists now demanded a republic. On Nov. 2 the Emperor accepted Italy's conditions for an armistice. The Austrians ceased hostilities on the 3rd, the Italians on the 4th. On the 11th, the Emperor renounced his share in the conduct of government; on the 12th, the German-Austrian Republic was proclaimed last of the Succession States (*see* also EUROPE).

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[1] Count Esterhazy formed a Hungarian Cabinet in June, and was followed two months later by Wekerle.

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AUSTRIAN LITERATURE.—The literature of Austria is so closely connected with that of Germany that in order to get a correct perspective of the subject during the years between 1910 and 1926 one must bear in mind the chief phases through which German literature has passed in the same period. These may be described as (1) naturalism, not the uncompromising aggressiveness of Holz and Schlaf, but of a mitigated and domesticated species; (2) neo-romanticism, which from about 1910 was also made to suit the average public; and finally (3) expressionism, a movement that is opposed to, and yet is linked up with its predecessors.

Although Austrian literature has passed through the same stages, it has preserved its own specific and unmistakable characteristics, due before the World War to the peculiar position of the Alpine and Sudetic Germans within the Habsburg monarchy, and their close, albeit hostile relations, to so many other nations; due after the War to the revolution and other crises. But many distinctive traits of Austrian literature must be explained from causes common to pre-War and post-War conditions: from the history of the country as an autonomous body politic, geographical features, its Roman Catholicism and its various local traditions. Especially the temperament and mentality of the people of Vienna, which is, and always has been, a literary centre, have modified to a certain extent the Austrian development of German tendencies in general. The Viennese have a vivid perception of beauty as well as of sentiment and of fun; they love music, nature and everything spectacular; they are endowed with a subtle taste in art. On the other hand they take life as easily as possible, by avoiding everything unpleasant. They dislike extremes, are always glad to compromise, and usually take little interest in metaphysical phenomena and problems. Since 1914 this mentality has undergone a slight change, but it will be found faithfully expressed in a great part of pre-War and post-War Austrian literature.

Three Periods.—There are three distinct periods in modern Austrian literature. In the first period are to be found those authors (best known abroad), who in the '80s and '90s laid the foundations of the Austrian "Moderne" on the basis of realistic or neo-romantic principles. These men by now have either completed their life-work or at least are not likely to reveal any new features, although their former leader, Hermann Bahr, is a perfect Proteus in versatility. There are secondly, those writers who between 1900 and the World War, represented various aspects or combinations of realism and romanticism; and lastly, the authors of the War and post-War period: most of them, but not all, influenced by expressionism. This division is by no means arbitrary and, if applied without pedantry, it gives an adequate survey of modern Austrian literature.

These three groups are easily distinguishable, if we turn to the field of lyrical poetry. The leadership among the "old moderns," must be awarded to Hugo Hofmannsthal. He is pre-eminent in the school originated by the Rhinelander Stefan George in opposition to the crude naturalism of the early '90s. His style may best be conceived by thinking of him as a reincarnation of Swinburne, to whom he is deeply indebted. There is the same exuberance of language, the same gorgeous imagery, the same quest for subtle beauty and the same interest in complicated or abnormal psychical phenomena; Hofmannsthal's personal characteristic being an elegant weariness, an aristocratic aloofness from everyday matters.

The next group consists of lyric poets, more or less under the influence of Hofmannsthal: Wladimir Hartlieb, Hans Müller, Alfred Grünewald, Stefan Zweig, Otto Hauser, Felix Braun, Paul Wertheimer, Max Mell and the passionate Anton Wildgans. But the third group follows the banner of expressionism, and is characterised by a conscious, nay deliberate disregard of the laws of logic and of metre, and an all-embracing love of the universe and of mankind as a part of it, reminiscent of Walt Whitman and the French unanimists. Albert Ehrenstein, Franz Werfel, Georg Trakl (d. 1914), Karl Schossleitner, Friedrich Schreyvogl, the painter Uriel Birnbaum may be mentioned here; and there is a certain affinity in matter and thought between their poems and those of the powerful satirist, Karl Kraus, and of the labour poet, Alfons Petzold (d. 1923), although in age both belong to an earlier period, as well as Peter Altenberg (d. 1919), equally original in life and art, whose short "prose poems" sometimes possess an irresistible charm and a childlike wisdom.

Independent of these groups are Richard Kralik, Karl F. Ginzkey, Richard Schaukal, the religious poetess Enrica Handel-Mazzetti, Erika Spann-Rheinsch, the Tyrolese poets Arthur Wallpach, Karl Dallago, Heinrich Schullern, all belonging to the school of the old romantics rather than to the new.

Narrative Literature.—In narrative literature also the "moderns" of the '90s hold their own with their younger competitors, and in some cases are ahead of them. In the forefront are Arthur Schnitzler and Jacob Wassermann, the latter an immigrant from the German Reich. Both have mastered the technique of fiction, and have never quite lost touch with naturalism. Both deal especially with the present day and the life of great cities, Schnitzler devoting himself chiefly to personal problems, Wassermann, with no common imaginative power, to social questions too. Among Schnitzler's rivals may be mentioned: Bahr, the founder of the Austrian "Moderne", Raoul Auernheimer, Felix Salten, Hans Müller, Paul Zifferer, Robert Musil and among the younger generation, Ernst Lothar; while Otto Stoessl's measured and thoughtful style is somewhat reminiscent of Wassermann.

The next group which appeared about 1908 adopted an attitude of tacit opposition to the Schnitzler school; the scenes of their novels are laid for the most part, not in Vienna, but in the provinces, and the leader of this "Kailyard" movement is the Styrian, Rudolf Hans Bartsch, an emotional writer with a fervid imagination and a florid, sometimes ecstatic style, a master in the word painting of landscapes. He had numerous followers, who shared his power of giving speech to nature, and his sympathy with the life of the countryside and the provinces. These were Ginzkey, Karl H. Strobl, Franz Nabl, Robert Hohlbaum, Josef F. Perkonig, Hans Sterneder, Hans Hammerstein—and again a separate group of Tyrolese: Hans Hoffensthal (d. 1915), Dallago, Schullern, Albert Trentini.

The historical fiction of Austria, after having been severely boycotted by "thoroughgoing" naturalism, received a fresh impetus before the War from the philosophic writers, Josef Popper-Lynkeus, Erwin G. Kolbenbeyer, Emil Lucka, all excelling in technique, vividness of style and depth of thought. It was also influenced by the devout Handel-Mazzetti and the learned Otto Hauser—and in their wake Alma J. Koenig, Hermann Graedener, Braun and Egmont Colerus have followed. Hohlbaum, endowed with a great wealth of invention, wrote successful novels giving, if considered as a series, the development of the German "Geist." The last generation of novelists, the writers of the War and post-War period, are characterised by weary resignation, by passionate negation or assertion of the life force. Spiritualism, occultism and religion have become fashionable again, and find expression in novels of terror and in Wellsian Utopias. Otto Soyka, Franz Spunda, Paul Busson, (d. 1924) Franz Rebiczek and Rudolf J. Kreutz, a no-more-war novelist, may all be included in this category. The eminent prose work of Kraus, begun as early as 1899, stands apart from the main stream.

Drama.—In the drama of the period under revision the modified naturalism of the Schnitzler school and the new romantic or neo-baroque style of Hofmannsthal have held their own, but the leadership is undoubtedly with the Tyrolese, Karl Schönherr. Society comedy with its graceful discussion of erotic problems continues to be cultivated in the Schnitzler manner, by Bahr, Salten, Wertheimer, Auernheimer, the Shaw apostle Siegfried Trebitsch and Kurt Frieberger; and, quite recently, by Hofmannsthal, too. On the other hand, Mell and Georg Terramare attempted to revive the mediaeval morality play, suggested by Hofmannsthal's arrangement of *Everyman* in 1912. Otherwise the neo-romantic drama shows only a poor harvest (Richard Beer-Hofmann, Braun, Zweig). Next to Schönherr's super-realistic plays are to be mentioned the dramas of Wildgans, whose style indicates clearly the transition from unrelentingly cruel naturalism to ecstatic expressionism. This reaction directed against the mere exact rendering of visual and acoustic phenomena as well as against the academic and somewhat anaemic ideals of the neo-Romantics, was begun in the pre-War Empire and eagerly followed in post-War Austria: it restored and enhanced the poet's ego and liberated the drama from all the conventions hitherto determining form and subject. The young dramatists Arnolt Bronnen, Franz Th. Csokor, Oskar M. Fontana, Hans Kaltneker (d. 1919), Walter Eidlitz, Otto Marbach and Richard Billinger are all followers of this school, but Werfel has shown the greatest creative power among his contemporaries. Hans Müller has tried his hand in diverse styles.

The Vienna Burgtheater, which formerly gave the lead to theatrical and, in some degree, to dramatic art in Germany, had already been deprived of its hegemony before 1900, and now has a dangerous rival in Max Reinhardt's *Theater in der Josefstadt*. The annual summer festivals in Salzburg are also due to Reinhardt's initiative.

See H. Naumann, *Deutsche Dichtung der Gegenwart 1885–1924* (1924); Chr. Touaillon, in *Oesterreich in Wort und Bild*, edited by C. Brockhausen (1925); J. Bab, in *Das deutsche Drama*, edited by R. F. Arnold (1925). (R. F. A.)

AUTOGIRO: *see* AIRSCREW.

AUTOMATIC MACHINERY.—The greatest single advance that has been recently made in the evolution of machine tools has been that of movements which are effected without requiring the direct interposition of the attendant.

Speeding-up.—With the rapid growth of automatic movements, general speeding up has become increasingly necessary in order that inoperative intervals shall not check the rapid sequences of tooling. A notable result has been the growth of time studies, and the functions of the route men in the shops. This also has been vastly quickened by the general substitution of tools of high speed steels for those of carbon steels, the increase in speed being approximately three to one. A consequence is that it now becomes increasingly difficult to prevent the time spent in fixing up work from lagging behind that occupied in actual tooling. A solution is reached partly by the use of fixtures to receive the work, partly by continuous methods of tooling on rotating tables, and by modifications in the details of machines, included in the vast subject of machine design.

The advances that have been made in automatic movements may be broadly classified under three heads—the supply and feeding of the work blanks, the details of tooling, and the multiplication of the tool-holding and of the work-holding equipments. Nearly all recent machine tools have been influenced by these changes in some degree.

The great compelling influence that has galvanised these swift developments has been the production of component parts in large quantities, the adoption of which is now imperative in all highly competitive manufacture. The output is vastly larger now from a modern machine than from its very recent predecessor of less than ten years since. And equally essential and remarkable is the fact that all the parts produced in almost incredibly short periods will interchange without corrections. These results, impossible of attainment in the older practice, are commonplace facts in the new designs and conditions. (*See* MASS PRODUCTION.)

Work Blanks.—The feeding of the work blanks is the first stage in an automatic scheme. It occurs in two forms—one embracing pieces of small diameter that are not rotated on centre points as in a common lathe, but which are fed through the hollow spindle of a headstock and gripped during the tooling with some form of collet chuck at the front; and the other, that of articles too large in diameter to be passed through the spindle, but which are inserted and chucked from the front. In each, intervention on the part of the attendant is frequently dispensed with. In the first, a self-acting toggle mechanism at the tail of the head-stock grips the hinder end of the stock bar and feeds it forward through the spindle immediately a piece has been tooled and severed, and the same movement grips the front end in the spindle by the automatic closing of the collet chuck, when the tooling of the succeeding piece commences.

The duty of the attendant is limited to the insertion of a new bar as often as the previous one has been used up. In the second case, that of articles too large to pass through the hole in the spindle, limited usually to about 4 in., a chuck is screwed to the nose of the spindle. When the volume and the shape of the articles permit, these also are fed automatically by sliding them by gravity down a chute, with a few exceptions the attendant has then to place the work in the chuck. But this is never the older form with gripping screws that are tightened individually on the work. In the greater number of instances this is an "adapter," designed precisely for the shape of the work, and closed instantaneously with the same mechanism that operates the smaller collet chucks used for bar work. A variant on this, the use of which is increasing, is the pneumatic chuck opened and closed with compressed air, all trouble with screw adjustments being eliminated. And where a large volume of repetitive work is in hand, the chucks are designed for that alone, or a standard chuck is adapted by fitting false jaws in iron or steel to suit it.

Grinding.—In the latest method of grinding, the articles are neither mounted between centres, nor fed by the movement of a table, nor is the grinding wheel traversed. The time commonly occupied in drilling centres and in chucking between head and tailstocks is wholly saved, with the result that grinding is accomplished in about one-third of the time that is occupied in the ordinary machines. And being centreless, the allowances left for grinding can be smaller.

The rotation and feeding of the work longitudinally are effected with one wheel, the grinding is done with another, the peripheries of the two facing each other, and revolving in opposite directions. The pieces, which are usually short, are brought through a chute to the wheels, and discharged into a box when finished, so that the cycle of movements is wholly automatic. The principle is simple. The controlling wheel rotates at the relatively slow speed at which work is run, and being in close contact with it, drives it frictionally at the same speed, while the wheel that grinds and is opposed to it, and driven independently, running at the peripheral speed of grinding wheels, from 5,000 to 6,000 ft. surface speed per minute, removes material. The exact amount ground off is controlled by the micrometric radial settings of the two wheels, which also effects the settings for pieces of different diameters within the range of capacity of the machine.

The automatic feeding is effected by the inclination of the axis of the controlling wheel in relation to the axis of the grinding wheel. If the axes were parallel, the work would be merely rotated, but the angular disposition combined with rotation compels the work to move endwise. The rate of feed is determined by the amount of angularity given to the controlling wheel, the range of which is from 0 to 6 degrees. Only in one machine is the feed imparted by giving the angularity to the rest that supports the work between the wheels. These machines work to best advantage on short pieces of moderate diameter, not exceeding about 12 in. long by 4 in. diameter, but this embraces a vast quantity of spindle stud and pin work. The same machines will shoulder small pieces, in which case the longitudinal feed is not used, but only a radial movement.

Tooling.—The details of tooling and of tool equipments are much more highly elaborated than they have been. This work is now allotted to specialists, the tool setters, in the tool room. Arrangements may be very simple, or extensively elaborated. But always the cost of tool making has to be correlated to that of production, the controlling factor of which is the number of pieces to be tooled. If these total to many thousands, the cost of the tool equipment divided among them is negligible. The same relation holds in elaborated work—holding fixtures, and tool-controlling jigs, which now fill so large a place in manufacture. Cost is only relative, the essential being the rapid and uniform production of very large quantities. An immense number of small articles that involve several separate tooling cuts—turning, drilling, boring, threading, within fine limits—are produced in periods that are measured by one or two minutes, and at a cost of a fraction of a penny. These are triumphs of the tool designer, associated with the automatic arrangements of the machines.

All advanced tool arrangements now are based on the principle of multiple cutting. That is, several tools, or tool edges, or points, operate either at the same time, or in very rapid succession. The most familiar example of this kind is the older one afforded by the screw machines and turret lathes, with their polygonal turrets, each carrying its tool or set of tools, on the several faces, and the cross- or cut-off slide with tools supported both at front and rear. After the various tools have been set up, their action is wholly automatic under the operation of cams and stops. Some turret faces may be occupied with simple turning tools, or drills, or taps or dies, but others carry veritable batteries of tools, that perform several distinct operations, or turn several diameters.

Turning.—Invention has taken a more specialised direction, to deal with a large volume of work for which turning and facing alone are employed, and for which the extensive elaboration of the turret lathes would not be economical. For this, the turning-machines built broadly on the lathe model are designed. In these, the work is carried between the centres of head and tailstock, and is turned with batteries of tools clamped to rests supported at front and rear of the lathe bed. The possibilities of so simple a scheme are immense. Within the limits imposed, they far exceed those which the turret lathe affords. Details differ widely in various machines, but the feature common to all is that a large number of simple tools, not forged, but severed from plain rectangular bar and suitably ground, are carried rigidly in holders clamped down to the tool base, and fed automatically, those at the front in a longitudinal direction, those at the rear radially inwards for shouldering. By the aid of suitable forms, tapered or curved outlines can be produced as readily as parallel pieces. As many as ten or a dozen separate tools can be mounted on a single bar, each having minute radial adjustments with a screw.

In addition to the multiplication of tools, there is a feature which increases economy. In many shafts and spindles having several diameters and shoulders, one portion is often much longer than others. Then the tools are set so that the time occupied in cutting this length determines the periods of all the other cuts, so that when the maximum length has been turned all the others are completed. The economy is often carried farther. If one length is very much in excess of the others, two tools are apportioned to deal with that, in tandem, the hinder finishing where the leading one had commenced.

The work of the automatic turning machines is usually limited to pieces that are carried between centres, or, which having been bored elsewhere, are mounted on arbors supported between centres. If this should appear a limited range of functions, it is not so, remembering the immense numbers of short shafts, spindles, shouldered and flanged elements that enter into motor work, and into the gear cases common now on nearly all machine tools. Lengths of pieces are generally limited to about 20 in., and diameters are moderate. But within these limits, given a constant product, they are more economical than any other lathe or turret machine. In some modifications, lengths are extended to take motor crank shafts, and cam shafts, with corresponding increases in the numbers of tools.

Work Holders.—The multiplication of work holders, and of corresponding tool-holding equipments, is an equally striking development. If the turret lathe with a single work spindle has lost ground before the invasion of new machines in one direction, the principle has made headway in others. Given a very large product, the greatest demands for which are now made by the builders of motor vehicles, the single spindle automatic lathe is being surely displaced by lathes that have from three to five work-holding spindles all having their bearings in a rotating head which is locked at each station while all the pieces in all the spindles are being subjected to simultaneous tooling operations from tools mounted on bars aligned with the spindles, and the numbers of which correspond with those of the work-holding spindles. During a single revolution of the head, an article will be completed, or if it is of a simple character, two may be produced. All the movements are automatic.

The multiple spindle automatics fall under two groups, those for bar work, and those for chuck work—the same division that exists in the single spindle automatics and turret lathes. In the first the stock bars are fed through the hollow spindles with toggles, and gripped during the tooling. In the second the work is chucked from the front by an attendant stationed there. The chucks used have jaws suited to the shapes of the work, and give an instant grip.

Continuous automatic work is done on machines with horizontal work tables that rotate constantly. Chief among these are the vertical spindle milling-machines and the grinding-machines of the same class. A circular table, or, as often, a fixture attached to it, or for some light grinding, a magnetic table rotated without intermission, receives large numbers of small parts, as races for ball bearings, levers, etc., which are all tooled in the course of a revolution, removed and replaced by others by an attendant stationed at one locality.

Lubrication.—In all these machines lubrication and cooling are amply provided for. Not infrequently as much as 15 gal. of cooling compound are pumped automatically over the tools and the work per minute. In some machines the supply is automatically cut off the instant that a series of operations is completed.

Gear Cutting.—In the extensive field of gear tooth cutting, automatic provisions have been made as nearly perfect as possible. In all the later machines, indexing is effected without interference by the attendant. In those machines where both sides of a tooth are being cut simultaneously, whether they use a hob, a rack, a pinion cutter or planer arms, movements are automatic from the setting up until the completion of the gear. In these also the indexing is performed after every cut, so that many revolutions of the blank have to be made before the teeth are finished to their correct depth and section. When opposite sides of teeth are cut alternately, risk of local heating is lessened by taking a central gashing cut all round first, using a form cutter, and finishing each side subsequently with lighter cuts.

Recording.—Automatic recording fills an essential place in many mechanisms. By means of it an inspector can read results that are plotted on a sheet of paper without watching the actual recording. It is used on gear tooth testing machines, on pyrometrically equipped furnaces and in a number of other industrial operations.

Automatic movements include services of the machine shops. Feeding chutes are supplied in increasing numbers to supply blanks to machines. Work is brought to, and carried away from machines on moving conveyors, in place of hand carrying, wheel barrows or trucks. Motors are assembled while travelling on conveyors past the workmen, each of whom contributes his little quota to the building up. Work is carried between floors on inclined or spiral conveyors. Automatic conveying systems are adopted in many industries other than those associated with engineering. (J. G. H.)

AUTOMOBILE: *see* MOTOR VEHICLES.

AVEBURY, JOHN LUBBOCK, 1ST BARON (1834–1913), British banker (*see* 3.51), died at Kingsgate Castle, Kent, May 28 1913.

AVERESCU, ALEXANDRE, (1859–), Rumanian general and politician, born March 9 1859 at Ismail (Bessarabia), was a volunteer in the war of independence against Turkey in 1877–8. Promoted officer at the conclusion of peace, he remained in the army and studied at the high military school of Turin (Italy). He was Minister of War in 1907 when he repelled the peasants' revolt. In 1913 he conducted the military operations in the war against Bulgaria as chief of the general staff. As commander of the II. and III. Armies, and later of the armies in the Dobruja, during the 1916 campaign, Gen. Averescu became enormously popular with his soldiers, a popularity which later on helped him considerably in his political career. In March 1918 he was entrusted by the king with the formation of a Cabinet and conducted the peace negotiations with the Central Powers. Afterwards he retired from the army and entered the field of politics He was proclaimed president of the People's League, which later became the People's Party, and thanks to the popularity of Gen. Averescu this organisation was called to power in March 1920 with its president as Prime Minister. After holding this office for a year and ten months he resigned on Dec. 17 1921 but remained president of the party.

AVIATION: *see* AERONAUTICS; AEROPLANE; AIRSHIP; FLYING.

AYUB KHAN (1855–1914), Afghan prince, son of Shere Ali (*see* 3.77), died at Lahore April 6 1914.

AZCÁRATE, GUMERSINDO (1840–1917), Spanish politician, was born at León, Spain, Jan. 13 1840. Educated at the universities of Oviedo and Madrid, in 1868 he was appointed assistant professor of comparative jurisprudence at the latter university and four years later became professor. In 1875 he resigned rather than submit to the famous Orovio decree limiting the liberty of the chair. He was, however, reinstated six years later and became one of the group headed by Francisco Giner, to which Spain owes most of its up-to-date educational institutions. From 1868 he represented, almost continuously, León, in the Cortes, as a moderate Republican. He had learned by painful experience that the attempt to set up a republic in a country where there was no genuine Republican party could only result in anarchy and military dictatorship. He, therefore, expressed his approval of the reformist evolution toward monarchism initiated by Melquiados Álvarez, but, upon his defeat as a deputy, he proved the strength of his principles by refusing a seat as senator for life. After the Barcelona outbreak of 1909 he kept apart from the violent section of his party. His position was less that of a leader than of a man whose personal character gave a certain dignity to the anti-dynastic parties. He died at Madrid Dec. 14 1917.

AZERBAIJAN (*see* 3.80), a Socialist Soviet republic, forming part of the Transcaucasian Federation of Soviet Republics, inhabited principally by Tatars. The capital is Baku and the principal industry is provided by the oil wells there, the production from which in 1926 was improving (*see* TRANSCAUCASIA).

BACCELLI, GUIDO (1830–1916), Italian physician and politician, was born at Rome in 1830. After graduating in medicine at the University of Rome, he became assistant professor of medical jurisprudence in 1856, and some years later professor of clinical medicine. He soon acquired a great reputation as a practising physician, and devoted himself particularly to the study of malaria; his researches proving invaluable for the reclamation of the Roman Campagna. In 1875 he was elected deputy for a division of Rome, which he represented until his death. He was Minister of Education in various Cabinets from 1879–99, and of Agriculture under Zanardelli (1901–3); from 1889 to 1893 he was vice-president of the Chamber. A keen classical scholar, he took an active interest in archaeological matters, although in some of his projects, such as the famous *Passeggiata Archeologica* in Rome, he showed more enthusiasm than judgment. His labours for the isolation of the Pantheon and the creation of the Museum of Ancient Art and of the Modern Art Gallery in Rome deserved and met with more general approval. He died in Rome Jan. 11 1916.

BACON, HENRY (1866–1924), American architect, was born at Watseka, Ill., Nov. 28 1866. In 1884 he entered the University of Illinois to study architecture. From 1888 to 1897 he was with McKim, Meade & White, in New York, excepting the years 1889–91, which he spent in Europe as Rotch Travelling Scholar. From 1897 to 1903 he was a member of the firm of Brite & Bacon, in New York, but after that time he worked independently. Among his important works were the Court of the Four Seasons at the Panama-Pacific Expositions; the Union Square Savings Bank, New York City; the Public Library, Paterson, N.J.; the Waterbury General Hospital, Waterbury, Conn., and the Whittemore Memorial Bridge, Naugatuck, Connecticut. Of numerous monuments, some designed in collaboration with various sculptors, the following should be mentioned: the Lafayette Monument, Brooklyn, N.Y.; the Lincoln Monument, Lincoln, Neb.; the Longfellow Monument, Cambridge, Mass.; the Republic Monument and the Centennial Monument, Chicago, Ill.; the President Harrison Monument, Indianapolis, Ind.; the Civil War Memorial and World War Memorial, Yale University, and the Parnell Monument, Dublin, Ireland. In 1920 the Lincoln Memorial, at Washington, D.C., designed by him, was completed at a cost of more than $2,500,000. He died Feb. 16 1924 in New York City.

BACON, ROBERT (1860–1919), American banker, was born in Boston, Mass., July 5 1860. He graduated from Harvard in 1880, and the following year entered the banking business in Boston. In 1894 he joined the house of J. P. Morgan & Co. in New York. He was assistant Secretary of State, 1905–9, and then for a short time Secretary of State, succeeding Elihu Root on the latter's election to the Senate. Ambassador to France from 1909 to 1912, he was commissioned major in the U.S. Reserves in 1917, being assigned to the staff of Gen. Pershing in France. He returned to America with the rank of colonel in 1918, and died in New York City May 29 1919.

BACTERIOLOGY (*see* 3.156).—In the sections below are described the main features of the remarkable progress made in the science of bacteriology since 1910 and of the important additions to medicine and industry which have accompanied these developments. Reference should also be made to the article on filter passing microbes.

I. BACTERIA OF THE SOIL

The systematic study of the bacteria of the soil has been hampered by two main difficulties. The first of these is the want of a rational scheme for identifying and classifying the apparently limitless number of varieties that can be isolated from soil. Löhnis and Smith claim (1914, 1921) that a large number of bacteria exhibit complicated life-cycles of changing forms. Such cycles have been established and confirmed by other observers in the case of certain organisms, notably *Azotobacter chroococcum* and *Bacillus radicicola* and, if of general occurrence, they may supply a rational basis of classification. The second difficulty has been that of determining which of the bacteria isolated take an active part in the soil population.

H. J. Conn (1917) held that the bacteria most active in the formation of ammonia in soil belonged to types that grow with difficulty in ordinary plate cultures and that the large spore-forming rods so evident in such cultures were present in the soil mainly in a resting condition. Winogradsky (1925), employing a new method for staining micro-organisms in the soil itself, observed that in unmanured soil the bacterial flora consists of colonies of short rods and cocci, usually imbedded in the colloidal matter of the soil. In addition, such soil must contain a great variety of other bacteria in numbers normally too small to be apparent by his technique, for the addition of energy-giving material causes the appearance in preponderating numbers of one or a few types which differ according to the substance added.

Owing to this changing quality of the bacterial flora, misleading inferences are easily made from estimates of total bacterial numbers in soil based on platings of a diluted soil suspension. Such estimates, however, help to indicate the influence of soil conditions on the bacterial flora as a whole and the relations between this flora and other sections of the soil population. The bacterial numbers in a field soil rise and fall at daily and even hourly intervals. The work of Cutler, Crump and Sandon (1923) shows that the daily changes in bacterial numbers are related inversely to those of the active amoebae. There seems therefore to be a fluctuating equilibrium between the bacterial and protozoan sections of the soil population. The heating of the soil to 55° C., or treatment with toluene, at first reduces the bacteria, but eventually causes a marked increase in bacterial numbers, and there is evidence connecting this with the harmful effect of the treatment on the soil protozoa. Thus the existence of an equilibrium between the sections of the soil population complicates the action of physical and chemical conditions on the soil bacteria. In arable soil, therefore, no simple relationship is usually found between the bacterial numbers and the temperature or moisture. Conn (1914) has even observed that the freezing of soil may cause a large increase in the bacteria. The reaction of the soil has a marked influence on certain groups such as *Azotobacter* and the ammonia-oxidising bacteria which are very susceptible to acidity. The action of alkali salts on soil bacteria has been studied in America (Greaves, 1916) where soil alkali is a serious problem. Certain salts such as those of arsenic have been found in low concentrations to stimulate bacterial activities, but the cause of this action is not yet understood.

Activities of Soil Bacteria.—Chemical changes brought about by bacteria in the soil fall naturally into two groups, those that result in a release of energy which the bacteria utilise for their vital processes, and those by which the bacteria build up the material of their cells.

Certain groups of soil bacteria can obtain their energy from inorganic compounds. In addition to the ammonia and nitrite oxidising groups discovered by Winogradsky, and the hydrogen oxidising organisms found by Kaserer (1906), another group of such organisms has recently attracted much attention in America. These bacteria oxidise sulphur and sulphides to sulphuric acid (Waksman and Joffe, 1922), and raise the acidity of their environment to a high degree. This fact has been utilised in the treatment of potato scab disease by composting with sulphur; the scab parasite being intolerant of the acid conditions produced by the sulphur oxidation.

Nearly all the energy material present in soil, however, is derived from plant remains. There is evidence that the simpler carbohydrates are among the first plant constituents to undergo decomposition. The fermentation of pentoses by bacteria has recently been investigated by Fred Peterson and Davenport

(1920), who isolated an organism capable of splitting xylose and arabinose into a mixture of lactic and acetic acid. A large proportion of plant tissues consists of cellulose and its derivatives. It seems improbable that, in normal well-aerated soil, the anaërobic bacteria described by Omeliansky can play a leading part in cellulose decomposition. Macbeth and Scales (1913) isolated a number of aërobic bacteria claimed to be capable of decomposing cellulose, but their experimental evidence has been criticised. A remarkable organism was isolated by Hutchinson and Clayton (1919) and named *Spirochaeta cytophaga*. This organism commonly exists in the shape of flexible, tapering filaments but it possesses a complex life-cycle including a spherical "sporoid" stage. It will rapidly decompose filter paper, but its growth in artificial media is quickly inhibited by more soluble organic compounds such as sugars. More recently Gray and Chalmers (1924) isolated another organism, *Microspira agarliquefaciens*. The destruction of cellulose by this organism has been found to be stimulated by small quantities of xylose and lignin. The determination of the nitrogen and phosphate required for cellulose decomposition has led to the development of a process now in use, by which straw or other plant remains treated with appropriate salts are made to decompose into a mixture having a decomposition and properties closely resembling farmyard manure.

Ammonia-producing Bacteria.—A variety of bacteria can obtain energy by decomposing the nitrogen compounds in the soil with the release of ammonia. The work of Doryland (1916) and others has emphasised the fact that the ammonia is only a by-product in the economy of the bacteria. The common ammonia-producing bacteria can also derive their energy from carbohydrates and, when such compounds are present in excess, they can assimilate the ammonia and nitrate already present in their surroundings. It is for this reason that unrotted straw ploughed into the soil causes a temporary loss of nitrate and consequent lowering of fertility.

Nitrogen-fixing Bacteria.—Where non-nitrogenous sources of energy occur in sufficient excess, the groups of bacteria that assimilate free nitrogen may come into prominence. Thus Winogradsky (1924) found that the addition of mannitol to soil caused the predominance of the nitrogen-fixing bacteria *Azotobacter* or *Clostridium pasteurianum*. A large number of soluble organic substances can be utilised as sources of energy for nitrogen fixation, and the products of the decomposition of cellulose by *Spirochoeta cytophaga* can also be utilised by *Azotobacter* (Hutchinson and Clayton, 1919).

Several new organisms capable of assimilating nitrogen have been described (Bondorff, 1918; Fulmer and Fred, 1917) but there is no evidence that their importance compares with that of *Azotobacter* or *Clostridium pasteurianum*. The relative activity of the latter organism is difficult to estimate. It is a strict anaërobe but there is evidence that it may live in association with aërobic organisms that produce a local deficiency of oxygen around it (Omelianski and Solunskov, 1916). Attention is still directed to the nitrogen-fixing bacteria living in beneficial association with higher plants. The best known case of this is that of the organism inhabiting the root cells of leguminous plants. This organism, *Bacillus radicicola* (Beijerinck) has been shown to possess a complex life-cycle through which it passes in culture (Bewley and Hutchinson, 1920), in the soil (Thornton and Gangulee, 1924), and within the tissues of the host plant (Wallin, 1922). The cycle includes an actively motile stage during which the bacteria migrate through the soil. Infection usually takes place through a root hair and the bacteria induce the multiplication of the cells of the root cortex which they subsequently infect.

In normal plants, vascular strands from the centre of the root grow out into the tissues of the nodules, and it is believed that carbohydrate energy material, necessary for nitrogen fixation, is brought along them to the bacteria. Under abnormal conditions, nodules can be formed, in which these strands are absent or defective, and in such nodules practically no nitrogen is fixed but the bacteria become parasitic on the host cells, deriving their food by attacking the protoplasm (Brenchley and Thornton, 1925). The benefit that leguminous plants normally derive from the presence of *Bacillus radicicola* has led to many attempts at artificial inoculation by treating the seed with a suspension of bacterial culture. It has been shown that physiological varieties of the organism exist, each capable of infecting but a limited group of host plants and also distinguishable by serological methods (Klimmer and Kruger, 1914). The practice of seed inoculation has proved beneficial where a leguminous crop has been introduced into a district in which the soil is deficient in the correct variety of the organism.

Bacteriological Tests of Soil Fertility.—Many attempts have been made to estimate the fertility of a soil by bacteriological tests. No close correlation can be found between estimates of total bacterial numbers and soil productiveness. Attempts to gauge the biological activity of soil flora have usually been made by estimating the amount of ammonia or nitrate or the increase in total nitrogen when the soil is kept under laboratory conditions or added to nutrient solutions. Discordant results have been obtained, probably owing to the unnatural conditions to which the bacterial flora is thus subjected. Biological tests have been used with greater success to reveal definite factors in a soil that limit bacterial activity. Thus Christensen (1915, 1923) has devised bacteriological tests whereby unfavourable acidity and deficiency in available phosphate can be detected.

For references to Soil Bacteriology the following journals should be consulted: *Jour. Agric. Sci.*; *Jour. Agric. Research* (Washington); *Soil Science* (New Brunswick, N.J.); *Proc. Roy. Soc.*, Ser. B.; *Jour. of Bact.* (Baltimore); *Annals Applied Biology* (Cambridge); *Nature*; *Zentralblatt f. Bact. etc.* (Jena); Reports of U.S.A. Agric. Exp. Stations, etc. (H. G. T.)

II. BACTERIOLOGY IN INDUSTRY

Cellulose-decomposing Bacteria.—Light has been thrown on the activity of these organisms in the destruction of cellulose-containing textiles which become exposed to damp. Both cotton, flax, jute, wood pulp, and the textiles made from these fibres have long been known to decay, to become tender when stored under damp conditions. The financial losses thereby involved are very great and for American raw cotton alone have been estimated to amount to many millions of dollars annually. Aërobic cellulose-decomposing bacteria are responsible for a very large percentage of these ravages.

The study of the stages by which the bacterial decomposition of the cellulose molecule proceeds has thrown light on many observations which had hitherto been obscure. Thanks chiefly to Pringsheim's researches it has been established that cellulose (*q.v.*), on being acted upon by the enzymes of certain bacteria, yields cellobiose and glucose as intermediate decomposition products. Both of these sugars can be utilised as food substances, not only by a large number of bacteria which are unable to attack cellulose, but by herbivorous animals and by man. By the aid of these sugars, nitrogen-fixing bacteria, living symbiotically with cellulose-destroying forms, can fix atmospheric nitrogen and render it available for plant growth. The liberation of glucose from cellulose in the animal intestine also enables herbivorous animals to derive the same nutritive value from cellulose, as they would from a corresponding quantity of starch.

The final decomposition products of the bacterial decay of cellulose have been shown to comprise fatty acids, methane, hydrogen and ethyl alcohol. Quite recently efforts have been made to utilise cellulose-decomposing bacteria for the production of alcohol (*q.v.*) for industrial purposes. This work, however, is still in its infancy and it remains to be shown whether the very large quantities of cellulose containing plant débris which accumulate in nature can, in this way, be turned to useful account. The same may be said of the sporadic efforts made to produce methane and hydrogen by the fermentation of cellulose.

Hemicelluloses.—That ethyl alcohol can be produced industrially by the bacterial fermentation of hemicelluloses, another constituent of many plant débris, now appears to be established. The application of this process should be of considerable interest in many localities where liquid fuels are expensive. On the whole the bacterial activities which involve the decomposition of hemicelluloses bid fair to become an important subject. The preparation of silage, for instance, has now definitely been shown to be associated with the bacterial fermentation of hemicelluloses contained in the plant tissues subjected to ensilaging. The same may be claimed to have been finally established during recent years for the spontaneous combustion of hay. Whether the fermentation process which tobacco undergoes during maturing belongs to this category of bacterial activities is likely, but not yet definitely proved.

Pectin.—The bacterial fermentation processes by which yet another constituent of vegetable tissues, their pectin, is decomposed has received much attention during the past decade and several new retting processes for the preparation of fibres such as flax and hemp have been evolved. The most important of these are the Ochmann process, conducted in running water at low temperatures and in the presence of oxygen, the Rossi process, carried out at blood temperature in the presence of oxygen, and the Carbone process, worked at blood temperature in the absence of oxygen.

Starch.—In the study of the bacterial fermentations of starch two lines of research deserve special mention. The first of these, the conversion of starch containing plant tissues into a mixture of butyl alcohol and acetone, derived its impetus from the requirements of the World War. During the period of the War the demand for acetone far exceeded the available supplies, and new sources for the production of this solvent had to be devised. The foresight of the British Govt. made it possible to evolve a fermentation process in which certain types of bacteria, related to the anaërobic retting bacteria, were utilised for the conversion of starch into a mixture of butyl alcohol and acetone. With the ever increasing demand for butyl alcohol this fermentation process is now well established industrially and in the United States more than 200 tons of butyl alcohol is being produced weekly.

The other line of research connected with the bacterial decomposition of starch is that of panary fermentations. It is on the fermentation processes occurring in the dough during rising that successful bread-making depends, and a thorough study of the complicated biological reactions thereby involved is long overdue. Serious efforts are now being made in the United States to throw light on these reactions.

Sugars.—In the study of the microbiological decomposition of sugars the most interesting recent progress is connected with the production of glycerine by the ordinary yeast fermentation of sugars, and with the conversion of sugars into lactic acid through bacterial action, the latter with a view to obtaining the sodium salt of lactic acid. This sodium salt yields very viscous solutions with water which, on account of their low freezing point, are superior to glycerine and lubricating oils for a great number of purposes.

The production of glycerine during the ordinary alcohol fermentation by yeast is based on Neuberger's and Connstein's observation that sodium sulphite, or other alkaline salts, added to a fermenting sugar solution interfere with the normal course of the reaction and cause glycerine and acetaldehyde to be accumulated at the expense of alcohol and carbon dioxide. Working this reaction on a technical scale, as much as 25% of glycerine, calculated on the sugar fermented, may be obtained.

In touching upon the bacterial fermentation of sugars it should be recalled that considerable progress has been made during recent years in the study of the interesting fermentation process to which freshly gathered cacao beans are normally subjected. In the way this process is carried out industrially micro-organisms—both bacteria and yeasts—are responsible for the desired changes occurring in the bean.

Dairying.—Though no startling revelations have been made in the field of dairy bacteriology during the last decade, progress has been steady and important. Attention has been paid to the important problem of securing a more hygienic milk by processes of eliminating the bacteria already present and by preventing their entry into, and their development in, the milk. In the manufacture of butter and cheese, where the presence of certain bacteria is essential, the conditions for the development of the desired forms have been further investigated. The additions o pure cultures of the types responsible for the required changes have gone far to ensure more reliable processes of manufactu as well as more stable products.

See H. Pringsheim, *Die Polysaccharid,* (1923); A. C. Thaysen and H. J. Bunker, *The Microbiology of Cellulose, Hemicelluloses, Pectin and Gums* (Oxford, 1925); *Jour. Instit. of Brewing; Jour. Indust. and Engineer. Chem.* (Easton, Pa.); *Jour. of the Franklin Instit.* (Philadelphia); *Biochem. Zeitsch.*, etc. (A. C. T.)

III. MEDICAL BACTERIOLOGY AND IMMUNOLOGY

Many advances have been made since 1910 in our knowledge of bacteria as causative agents of disease in man and animals and in the science of immunology.

IMPROVEMENTS IN TECHNIQUE

Dark Ground Illumination.—Much use has been made of this method of studying bacteria, whether in the live or fixed state. Its chief practical applications have been in the demonstration of slender objects such as the *Spirochaete pallida* in material from syphilitic sores (*see* VENEREAL DISEASES), the detection of motility and the enumeration of bacteria in emulsions such as vaccines. To obtain the dark ground effect, the microscope requires to be fitted with a special form of condenser, of which there are now many models, and a powerful source of illumination is necessary. The rays from the source of light after reflection at the substage mirror can enter only the peripheral portion of the condenser and, owing to their obliquity, are then either wholly reflected from the upper surface of the cover-glass or, according to the type of condenser, refracted into space beyond the range of the objective lens. Should, however, small objects come in the way, such as bacilli possessing a different refractility from that of the fluid in which they are suspended, the rays are dispersed by them, and are able to enter the objective. Bacilli then appear as white spots on a dark background. With an ordinary condenser a very similar effect is produced by mixing material containing delicate organisms with india ink, or collargol or congo-red, and spreading in a thin film on a slide. Delicate organisms in the material can then be readily picked up from the surrounding dark field. Recently the photography of organisms beyond the range of ordinary microscopic vision has been attempted with the aid of ultraviolet light, but the method is as yet on trial. (*See* MICROSCOPY.)

Enumeration of Bacteria.—Besides the dark ground illumination method used in conjunction with the well-known Thoma-Zeiss ruled slide chamber, in which bacteria can be counted directly, turbidity measurements give very accurate estimations, the turbidity of the bacterial emulsion, suitably diluted, being compared with that of a series of tubes containing varying concentrations of barium sulphate previously standardised to represent a definite bacterial content of the particular organism under investigation.

Isolation and Cultivation of Single Bacterial Cells.—For the cultivation of "pure line" strains of micro-organisms it is essential to start from a single microbe. In Barber's method (1904) a single bacillus in an appropriately diluted emulsion is picked up into an extremely fine capillary pipette working on a special holder under microscopic control. It is really founded on the earlier method of van Schouten (1899), who employed a fine glass loop for the same purpose. Barber's method has been also greatly developed in general cytological studies and it is now possible to perform surgical operations on single cells. In Burri's method, dilutions of the culture are mixed with india ink and drops of these are laid on gelatine or agar plates. Under the microscope these drops are examined, and if one is found containing a single bacillus it is marked and allowed to grow into colony form, or the single organism may be removed directly to a nutrient medium.

A recent method, elaborated by Barnard, depends on the fact that ultraviolet light destroys bacteria. A single bacillus is marked down, and between it and the entering rays a minute droplet of mercury is placed under microscopic control. The bacillus is thus protected, while the surrounding organisms are killed. It can then be dealt with culturally.

Methods of Culture.—Numerous improvements in cultural methods have been introduced of late years, such as the addition of egg to a nutrient basis of agar, or the use of solid, inspissated mixed white and yolk of egg, especially for the growth of tubercle bacilli. A medium composed of broth and serum, covered with liquid paraffin, and containing a piece of sterile, unheated rabbit's kidney was introduced by Noguchi for the growth of spirochaetes, and has been recommended for other organisms of difficult culture. Attention has been directed of late to the importance of making culture medium of exactly the right degree of alkalinity, and the method now used for this purpose is to test and standardise the media at a constant temperature by means of delicate colour indicators, *e.g.*, phenol-sulphone-phthaleine. A hydrogen-ion concentration of 7·6 has been found the most suitable for general bacteriological purposes.

Anaërobiosis.—Anaërobic culture methods have been improved by the introduction of various patterns of jars to contain Petri dishes or test-tubes; the object of these is to facilitate the removal of all, or a part, of the oxygen with an air pump, and replace it with hydrogen or other indifferent gas. The removal of the oxygen is also attained by using the catalytic action of spongy platinum (or palladium) to produce slow combination of oxygen with hydrogen. After removing the greater part of the air with a pump and replacing it with hydrogen, the jar is closed and the catalyst contained in a small wire-gauze cage heated by means of an electric current. The remaining oxygen then combines quietly with hydrogen and this action keeps the platinum hot as long as it is required, *i.e.*, until the oxygen is used up.

FERMENTATIONS PRODUCED BY BACTERIA

Chemical Processes Involved in Fermentation.—Bacteria are in many cases very selective in their chemical action on such substances as the sugars, higher alcohols and hydroxy acids, and produce from them a great variety of products, these reactions being largely used for diagnostic purposes. The trend of modern work on this subject is to show that specific enzymes are probably necessary for the first stage in the attack on substances of different chemical or stereochemical constitution, but that the immediate products of this attack are frequently of the same character. These then become changed under the influence of a system of enzymes which is common to a considerable number of different organisms, yielding final products of a similar nature, but in differing proportions. In some cases additional enzymes are present, which modify the result, yielding special products specific to a particular organism.

Thus, *B. coli* acts both on mannitol and glucose, probably by the aid of two distinct enzymes, but yields the same final products from both substances, in different proportions, corresponding to the difference in composition of the two compounds. On the other hand *B. lactis aerogenes*, which attacks the same two compounds and produces from them all the products yielded by *B. coli*, in addition converts a part of one of the intermediate compounds (probably acetaldehyde) into butylene glycol, which is not produced by *B. coli* and the formation of which is presumably due to the influence of a specific enzyme. The exact way in which the primary products of the first attack on the molecule are worked up may be greatly influenced by the conditions to which the organism is subjected, and, thus, the proportions in which the final products are formed may vary considerably.

Pasteur's dictum that "Fermentation is life without air" still maintains its validity. It is now interpreted in the sense that the changes summed up in the term fermentation proceed with evolution of energy, part of which can be utilised by the organism. In aërobic organisms this replaces the energy which, in aërobic life, is gained by the oxidation of food materials. Many bacteria (facultative anaërobes) can carry out their life cycle anaërobically provided that they are supplied with material which they can decompose with evolution of energy and with the production of an intermediate substance which can be assimilated by the organism (*e.g.*, *B. coli* in presence of glucose). In many cases this can be accomplished by providing a pair of substances, one of which can be oxidised (or reduced) at the expense of the other in the presence of the organism with evolution of energy and the production of an assimilable intermediate compound. Thus *B. coli* cannot grow anaërobically in peptone water in presence of either a lactate or a nitrate, but grows readily when both are present, the nitrate being reduced and the lactate oxidised to some substance (probably pyruvic acid) which is assimilable by the organism. The nitrate can be replaced by fumarate which is reduced to succinate.

Value of Sugar Fermentation Tests in Differential Diagnosis.—A very important, and usually very reliable, method of distinguishing between allied races and species of bacteria is that founded on their fermentative action (production of acid or acid and gas) on various carbohydrates and alcohols. In addition to carbohydrates and alcohols, the salts of the organic acids have been used for a similar purpose (citrates, tartrates, etc.). The sugar reactions are not invariably constant for the same kind, or even for the same strain, of bacteria but they are perhaps as constant as any other set of characters. In the diagnosis of a bacterial species, as in the case of other living things, it is often necessary to consider several characters and not to place reliance on a single characteristic.

VARIATION OF BACTERIA

Under the head of variation of bacteria three kinds of change are understood. (1) Fluctuation which implies the temporary change due to alterations of environment which do not persist when the special circumstances are removed. (2) Persistent variation which is hereditary and, whatever its cause, is not directly dependent for its continuance on the special circumstances, and (3) so-called cyclical variation by which bacteria are supposed to undergo successive changes in cycles, during which they assume very different forms and characters and may even become indistinguishable from the higher fungi presenting apparently sexual forms. The latter kind of change, however, is not generally accepted as occurring in any of the well-known pathogenic bacteria, in spite of the fact that it has been described since the earliest days of bacteriology. Fluctuation may be briefly dismissed by saying that wide variation in form and size are well known to occur in most groups and the physiological and morphological characters may be temporarily suppressed by special conditions.

Hereditary Variation.—True persistent hereditary variation has been only gradually accepted by bacteriologists since the identity of changed forms with the original strain has rightly been challenged till full proof was available. These variations, which have been called mutations, since they are hereditary and often appear with some suddenness, may affect many of the structural and functional characters of bacteria. Within limits, size and shape of the individual bacteria and their colonies are subject to great changes, and variation in regard to fermentation of carbohydrates undoubtedly occurs, though more rarely. Many mutants are best obtained by selecting colonies of different appearance. It not infrequently happens also that colonies which are several days old show, on their surfaces, small projections or papillae, which consist of bacteria which have acquired new properties.

Some of the most remarkable variations affect the agglutinability of the cultures by salt solutions and specific serum. A commonly found mutant in old cultures is one which is spontaneously agglutinable in salt solution (0·85%) while it has at the same time lost some of its agglutinability by the specific serum for the parent strain and also acquired new properties of serum agglutinability. Another variant occurring in the proteus and coli-typhoid group, the *O* form of Weil, has lost its heat-labile agglutinogen, responsible for flocculent agglutination, and at the same time ceased to be actively motile. Loss or change in pigment-forming characters is also well known. An important character which is liable to variation is virulence. The loss and the regaining of virulence may, to some extent, be controlled, and the change may persist in the strain.

Single Cell Variants.—Variants in different directions have been shown to arise from single cell cultures. The hereditary variants may persist indefinitely, especially if care and time are spent in obtaining them pure by repeatedly making plate cultures and selecting isolated colonies. In other cases reversion cannot be avoided.

THE BACTERIOPHAGE

This represents a newly observed phenomenon, first described by F. W. Twort (1915) and F. d'Hérelle (1918). The former observed a lytic change accompanied by translucency of some colonies in certain cultures of *staphylococcus* and found that this lysis could be communicated to other normal colonies by an extract of the affected culture which had been passed through a Berkefeld filter, and was itself free from bacteria. D'Hérelle, starting with a Berkefeld filtrate from the faeces of dysentery convalescents, was able by adding a drop of this to a culture of *B. dysenteriae* (Shiga) to produce lysis of the bacteria. A drop of the resulting solution after filtration could be used to repeat the phenomenon in a fresh culture, and in this way a renewal of the active principle could be brought about indefinitely. This principle d'Hérelle called the bacteriophage (*Bacteriophagum intestinale*), and he maintains that it is an ultra-microscopic, living organism, which is parasitic in the bacteria and reproduces itself. The solution containing the principle is often active in a dilution of 1 in 100 million, and 5 c.c. of broth containing bacteriophage in this dilution, if inoculated with the sensitive culture, will reproduce in 24 hours in the incubator a clear solution containing the bacteriophage in the original strength, which again is still active when similarly diluted.

If a tube of suitable diluted phage, inoculated with *B. dysenteriae*, is incubated for three hours, and a loop of it then inoculated on agar, confluent growth of the bacteria may be obtained with a number of small, round, clear areas where no growth of bacteria has occurred. These spaces d'Hérelle called *tâches vierges* and considered them to represent colonies of the bacteriophage which had devoured the bacteria. Other bacteria are attacked besides *B. dysenteriae*, *e.g.*, *B. typhosus*, *B. paratyphosus* and *B. coli*. Most strains of bacteriophage are specific for certain kinds of bacteria, or even for certain strains of these species. Thus some varieties of bacteriophage will act on "rough" variants of *B. dysenteriae* and on some strains of *B. coli*, but not on the corresponding normal or "smooth" cultures.

After the action of the bacteriophage on a broth culture and the resulting clearing of the original turbidity, it is usual for some bacteria to remain alive which, when cultured on agar, are found to be considerably altered in the appearance of their colonies. Their agglutinability by salts is also changed. These colonies are often resistant to the bacteriophage. There is no doubt that bacteriophage may be present in small quantities in cultures, but remain unnoticed, and it has been suggested that many variations, occurring apparently spontaneously, are in reality brought about by the presence of unrecognised bacteriophage. D'Hérelle has advocated the use of bacteriophage in the prevention and treatment of infective disease, but its value for this purpose is not widely recognised.

The question of the nature of the bacteriophage has stimulated a very large amount of research on account of its theoretical importance. If the more generally accepted view ascribing the properties of the bacteriophage to a non-living enzyme or catalyst were proved, the fact that it appears to infect and multiply in a culture of bacteria might by analogy throw light on some infective diseases associated with ultramicroscopic viruses affecting the higher forms of life. The characteristics which make it less probable that the bacteriophage is a living entity are its ready filtrability through a porcelain filter, its resistance to heat (60° to 65° C.), its resistance to acetone and chloroform and its inability to lyse dead bacteria or to multiply in the absence of a living bacterial culture.

Acute Infectious Jaundice or Weil's Disease.—This disease, which came into some prominence as a War disease, especially on the Western Front, was found by Inada and Ido (1914) to be due to a motile spirochaetal organism *Leptospira icterohaemorrhagiae*. In certain localities it appears to be a parasite in the kidneys of wild rats, and infection of food and water by the urine of such rats is the most likely mode of transmission. A similar organism has recently been found to be the cause of a disease in young dogs called *The Yellows*.

Yellow Fever.—Noguchi since 1919 has brought forward excellent evidence that another *leptospira* (*L. icteroides*) is responsible for yellow fever (*q.v.*), and the employment of therapeutic serum, prepared by immunising horses with this *leptospira*, has very favourably influenced the course of the disease. Also good reports have been received of the use of prophylactic vaccines in lowering the incidence.

Tularaemia.—McCoy (1911) in the course of examining ground squirrels in California for evidence of plague infection discovered another plague-like disease in these rodents which was not due to *B. pestis*. In the following year, he and Chapin isolated the specific organism and it was given the name of *B. tularense* from Tulare co. in California where the epidemic in the ground squirrels was prevalent. During the years preceding the demonstration of the organism, cases of severe lymphangitis in man apparently following insect bites had been observed in the state of Utah. Since the discovery of the parasite quite a number of human cases of infection have occurred in some of the American states. The disease is rarely fatal but a very protracted convalescence is the rule. The mode of infection in the field is almost certainly by the bite of the horse-fly (*Chrysops discalis*) which has fed on infected ground squirrels or jack rabbits. In the laboratory, also, workers engaged on research into this disease have been attacked, *e.g.*, at the Washington Hygiene Laboratories and at the Lister Institute, London. The mode of transmission in the laboratory is as yet unknown, but probably the organism gains entrance by the respiratory tract as in pneumonic plague. Outside the United States of America this disease of rodents has not, so far, been reported.

Melioidosis.—This disease was first described in 1913 by Whitmore as a "glanders-like disease" occurring in Rangoon, and indeed the clinical relationship to glanders, both in man and in horses, is very close. Their morbid anatomy also is very similar. It runs a more acute course, however, than glanders, and is usually fatal. The causative organism *B. whitmori* is primarily a parasite of rodents and as Stanton and Fletcher have found, it possesses a close serological relationship to *B. mallei*, the cause of glanders, but differs from it in its growth on nutrient media and in the fact of its motility.

Rat-bite Fever.—This is a prolonged, febrile disease, of which inflammation of the lymphatics and a well-marked rash on the skin, together with wasting, are prominent symptoms. The course of the disease is very irregular and the fever intermittent. A spirochaete has been described and is generally accepted as the causal micro-organism. The disease occurs in Japan, India and other parts of Asia, and cases have been recorded in Europe, including Great Britain and America.

Gas Gangrene.—During the World War the occurrence of large numbers of infections of wounds led to a close study of the bacteria responsible for them. The anaërobic bacilli in particular were investigated anew, and much confusion in their classification and nomenclature cleared up. To three species especially, *B. perfringens* (*B. welchii*), *Vibrion septique* (*B. oedematis maligni*) and *B. oedematiens*, most of the cases of gas gangrene were found to be due. From these three species, moreover, toxins and antitoxins were prepared which were found to be of service clinically. Unfortunately, these discoveries were not made till too late to be of use in the treatment of the large number of cases prevalent during the first years of the War. (*Rep. Med. Research Committee*, Spec. Rep. No. 39.)

PROGRESS IN IMMUNOLOGY

Antibodies Generally.—The study of the antibodies in the blood serum of animals which have been inoculated with bacterial suspensions or toxins, has proved of great value in many directions. In the case of antitoxin, apart from its great therapeutic value in diseases such as diphtheria (*see* INFECTIOUS

FEVERS), it is now possible to form some estimate of the susceptibility or immunity of an individual by determining the amount of antitoxin in the blood (Schick test in diphtheria). The other well-known antibodies, agglutinins, precipitins, bacteriolysins and opsonins, do not give an accurate measure of immunity. These latter are, however, used as important aids (1) in elucidating the processes concerned in disease and its cure, (2) in making a diagnosis of the presence of a disease, (3) in identifying a given bacterium by the use of a serum evoked in the animal body by inoculation of the particular species of bacterium concerned, or indeed, for differentiating bacteria that are very closely allied.

Agglutination.—The agglutination of bacteria by a specific serum appears to be a process of the same kind as the reaction which occurs when a diluted solution of protein, *e.g.*, serum protein or egg albumin, is added to a serum obtained from an animal which has been injected with this protein. In the case of bacteria, the phenomenon is less simple, since there is no doubt that many bacteria contain more than one substance, perhaps many, capable of exciting the production of agglutinins, and consequently, more than one agglutinin is present in the serum of the inoculated animal.

The extent of the variation, and difference in the composition, of these agglutinogenic substances is not yet fully known, but their existence and diversity are of importance in identifying or differentiating allied bacteria. When a serum has been prepared that will agglutinate a given kind of bacterium it is often found that it will also agglutinate other kinds of bacteria of the same group to a lesser degree. This fact suggests that these different bacteria have some factor that is common to them all in their composition.

One method of comparing antigenically different species of bacteria is to prepare separate agglutinating sera for each kind and to test the degree of agglutination of each emulsion with each serum. A more refined method of analysis is to treat the agglutinating serum with the emulsion, to remove the clumps by the centrifuge after a few hours, and then to test the supernatant fluid with a fresh emulsion to see whether the property of clumping has been removed or diminished for the same and other strains. This method (absorption of agglutinins) has been extensively used in attempts to classify the antigenic constituents of allied bacterial races. By this means many at first sight identical strains have been divided into groups and subgroups, *e.g.*, the *Salmonella* group by Schütze and Bruce White, the *meningococcal* group by Gordon and the *dysentery* group by Andrewes. These groups are sometimes separable by fermentation and other tests and are said to remain quite constant in culture, maintaining their finer differences. Perhaps sufficient time has hardly elapsed, or sufficient study been given, to this very difficult subject to decide to what extent the lesser distinctions are maintained in a state of nature or under varying conditions of culture.

The agglutinogens present in a given culture, which are usually considered, though probably not quite accurately, to be identical with the agglutinable substances, can be differentiated by other means. For example, there are agglutinogens which resist a temperature of 100° C. for 5 to 30 min. and others which can no longer be detected after this treatment. There is some evidence that the heat-labile antigens are, at least in part, associated with the flagella, since non-motile varieties of motile organisms are often deficient in the heat-labile antigen. These two classes of antigen are related to distinct agglutinins in serum. Another means of distinguishing antigens has been brought to light by chemical processes of extraction and purification (by ether, alcohol, etc.) and it has been found that certain partial components of a carbohydrate (*pneumococcus*, Avery and Heidelberger) or lipoid (*B. tuberculosis*, Zinnser) nature, play a part in these reactions, though probably in every case only when united with protein material.

Discordant facts which require harmonising with any accepted system of classification may be mentioned. (1) Some pure strains may lose or gain agglutinability in culture without apparent change in other respects. (2) Some variants may have lost their agglutinability with the serum made from the parent strain, but may agglutinate with serum made from the variant which leaves the parent untouched. (3) Cultures which seem alike culturally and as regards pathogenesis, *e.g.*, *staphylococci*, *meningococci*, *gonococci*, etc., may be readily differentiated by agglutination, and subdivided by absorption technique. (4) Strains which appear identical serologically may differ markedly in pathogenic properties, *e.g.*, *M. melitensis* and *B. abortus*. (5) Strains may change in virulence and in fermentation characters, and yet be unaltered serologically. Para-agglutination and heteroagglutination are similar phenomena which signify the agglutination of diverse strains by serum obtained from an animal which is suffering from an apparently unrelated infection, *e.g.*, the agglutination of *B. proteus X19* by the serum of typhus fever patients (Felix and Weil).

The facts which have emerged during the recent extensive study of agglutination have given rise to the hypothesis that each bacterium contains a mosaic of antigens, some of which are highly specific and peculiar to each subspecies, while some are common to the whole species or group and others appear to be entirely unrelated as regards phylogeny and occur in very diverse bacteria (*e.g.*, Forssmann's nonspecific antigens). It is probable that the identification and classification of bacteria by their antigens have their limits, though the resultant data are extremely valuable in some cases.

Complement Fixation.—This is the name given to another procedure by which the presence of antisubstances to bacteria can be recognised in the blood serum of animals. In principle it rests on the discovery by Bordet and Gengou that when a bacteriolytic serum containing bacteriolysin and a suspension of the corresponding bacteria are allowed to interact in the presence of fresh serum, a constituent of the latter (alexin or complement) joins the combination of bacteria and antisubstance, and remains fixed to it, this union resulting in the death and solution of the bacteria. To render this fixation of complement obvious even where lysis of the bacteria is not visible, another system which also needs complement for its consummation is added to the mixture, and the occurrence or not of the first reaction is determined by the completion or the non-completion of the second reaction.

The most commonly used antigen-antibody system for the second system is a mixture of a suspension in salt solution of the red-blood corpuscles of the sheep and of a serum which is known to be lytic for them but which does not contain active complement. This latter desideratum can be assured by previously heating the haemolytic serum to 56° C. for 30 minutes. If there is free complement at liberty to join the red corpuscles and antiserum, the red cells break up, and the haemoglobin is set free as a clear solution in the surrounding medium. The colour and transparency of the solution is a readily observed indicator of the presence of free complement and, to some extent, of its amount. This by inference allows an estimate to be made of the reagents present in the first system. If no appropriate bacterial substance or no antisubstance is present, then no complement will be fixed in the first reaction, and consequently it will still be available for haemolysis.

It was found by Weil and his colleagues that the complement fixation in the group of bacteria which they especially studied (intestinal Gram negative group) was associated with the heat stable rather than with the heat-labile antigen (agglutinogen) in the bacteria.

Vaccines for Prophylaxis and Therapy.—A bacterial vaccine is a preparation of antigen (bacteria or their products) introduced into an animal to excite active immunity. The use of preventive vaccines is firmly established by animal experiment (*e.g.*, anthrax, plague, dysentery, enteric and paratyphoid fevers, etc.). So far as accurate experiments have been possible, the living bacteria, or bacteria killed at low temperatures, *e.g.*, 52° C., have been found more efficient than emulsions treated at higher temperatures, or by strong chemical agents.

The use of vaccines for treating disease rests on a very different footing, since little or no satisfactory evidence from animal experiments is forthcoming, and the clinical results with human disease have been extremely irregular. The earlier hope that it would be possible to produce clinical improvement by graduated doses, fitted to the varying resistance to the disease as estimated by *in vitro* tests, has been for the most part given up, though new methods are often introduced and require critical examination. The hypothesis that the strain of bacterium (homologous) actually infecting the patient is the most suitable for treatment is unsupported experimentally and is now less regarded by clinicians. Experimental and clinical evidence have also pointed to the beneficial effects in some cases of inoculation with various foreign proteins and unrelated bacterial emulsions. Probably much of the vaccine treatment of the past was of no real value and a large part of the good effects reported have been due to a non-specific element in the inoculum.

National Collection of Type Cultures.—This collection of living cultures from all spheres of bacteriological activity was founded in 1920 at the Lister Institute, London, under the auspices of the Medical Research Council. It has been of great service to microbiologists in all parts of the world, over 2,000 strains being maintained in 1925. The second edition of the catalogue appeared in 1925 and can be procured from H.M. Stationery Office, London.

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BADEN (*see* 3.184).— A free state and territory of the German Reich, has an area of 5,819 sq. m. and a population (1925) of 2,319,581.

Political and Constitutional History.—Until 1918 Baden was a constitutional monarchy under a Grand Duke. The Government was always conducted in a liberal spirit, and although the population was mainly Catholic, Baden enjoyed the reputation of being a model small liberal state. During the World War social disturbances hardly existed here; the Social Democrats were accustomed to entering the Government, placed few difficulties in its path, and did not vote against the budget; while the heir to the throne, Prince Max, who was the last Chancellor of the Reich, worked hard for a peace by understanding and internal reforms. But his dynasty fell naturally with the rest; on Nov. 10 1918, a revolutionary provisional government was formed, containing representatives of the Social Democrats, the two Liberal parties and the Catholic centre. On Nov. 22 the Grand Duke abdicated with the consent of Prince Max.

Baden was the first German state to produce its new constitution (May 21 1919), although this was afterwards considerably curtailed by the Weimar constitution of the Reich. The constitution was republican and democratic, with a single Chamber, which possesses the right of legislation, chooses the Ministry and selects from it the minister president, who also bears the title of president of the state, but is not the head of the state, merely the person presiding over the Ministry. There are provisions for referendums; laws involving an amendment of the constitution must always be submitted to popular referendum. This constitution closely resembles that of the Swiss Confederation, but differs from it in that in Baden the Government is dependent on Parliament, which can at any time dismiss the whole Ministry or individual members of it. In Oct. 1925, after the new elections, the Liberals left the Government, which was carried on by a coalition of the Social Democrats and the Centre. (W. v. B.)

BADENI, KASIMIR, COUNT (1846–1909), Austrian statesman (*see* 3.34d), was born Oct. 14 1846 at Surachovo in Galicia. He studied law and served some years in the Ministry of the Interior and from 1879 at Cracow as lieutenant of the governor of Galicia. He resigned from the government service in 1886, but two years later was appointed Governor (*Statthalter*) of Galicia. In Sept. 1895 he was appointed Austrian Prime Minister and his attitude was at first satisfactory to the German-Austrians. In 1897, however, in order to gain the support of the Czechs for the new *Ausgleich* with Hungary, he made certain important concessions in respect of the use of the Czech language in Bohemia. This was done by ordinance, without parliamentary sanction, and met with violent opposition from the German deputies, some of whom were imprisoned. The storm of indignation aroused among the German-Austrians by this policy led to Badeni's downfall on Nov. 28 1897. He died at Radziechow, near Lemberg, in Austria, July 9 1909.

BADMINTON (*see* 3.189).—The development of this game in Great Britain since 1910 is evidenced by the increase in the number of clubs affiliated with its central organisation, the Badminton Association. In 1910 only 302 clubs were so affiliated, including Scottish clubs, while at the end of 1925 the number totalled 615 in England alone. A further total of 254 clubs belonged to the Irish, Scottish and Welsh Badminton Unions.

The World War necessarily checked the progress of the game, but since 1918 it has steadily gained in popularity, and with the aid of exhibition matches, which for some seasons have been held all over England, a better knowledge of the possibilities of Badminton has been acquired. Another symptom of the game's advance is the increase in the number of county associations, the chief object of which is the promotion of inter-county matches and competitions.

The game is still developing rather slowly on the continent of Europe, but it has advanced rapidly in Canada, and in 1925–6 a team of six British champions visited the Dominion for the purpose of playing exhibition matches. The team, captained by Sir George Thomas, arranged to appear in New York before returning to England.

The list of tournament fixtures in the season 1925–6 was in striking contrast to that of the season 1910–1. At that time only about a dozen open meetings were held, whereas the fixtures for 1925–6 numbered at least 25. International contests between England and Ireland, England and Scotland, and Scotland and Ireland, are now established features of every season. England retained her unbeaten record in 1925, though in 1924 she only escaped defeat at the hands of Ireland by the narrow margin of one match. In 1925 the British Open Championships resulted as follows: Men's Singles, J. F. Devlin. Ladies' Singles, Mrs. A. D. Stocks. Men's Doubles, H. S. Uber and A. K. Jones. Ladies' Doubles, Mrs. Tragett and Miss Hogarth. Mixed Doubles, J. F. Devlin and Miss K. McKane.

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BADOGLIO, PIETRO (1871–), Italian general, was born at Grazzano, Sicily, Sept. 28 1871. During the Italo-Turkish War he served in Tripoli on the staff. During the World War he planned and carried out the successful attack on Monte Sabotino which preceded the fall of Gorizia in Aug. 1916 and commanded the XXVII. Corps at the battle of Caporetto. From Feb. 1918, he acted as sole sub-chief-of-staff under Diaz. He conducted the Armistice preliminaries at Villa Giusti and signed the Armistice on behalf of Italy. In Nov. 1919, he was appointed to the rank of army general and was chief of the general staff in succession to Diaz until Feb. 1921. In 1923 he was appointed ambassador to Brazil, but returned to be chief of the general staff, a post which had been recreated when Sig. Mussolini took charge of the War Ministry.

BAEYER, JOHANN FRIEDRICH WILHELM ADOLF VON (1835–1917), German chemist (*see* 3.192), died at Munich Sept. 5 1917.

BAGHDAD (*see* 3.194).—The population, mostly Arab, was estimated in 1925 as 170,000. During the World War one of the two old gates, which were still fairly well preserved, was blown up by the Turks, who also burnt the famous library of over 20,000 volumes. After the British occupation in 1917 a pontoon bridge was built across the Tigris and named after Gen. Maude; it is reached by a street cut through the city by the Turks for artillery transport. The theological building of the College at Mu'adhdham Al-al-Bait was formally opened by King Feisal on March 15 1924 and the foundation stone of the central block laid. A British Residency has been built near the river, and a palace for King Feisal on the outskirts. Sanitary conditions have been greatly improved and an efficient health service established; medical institutions include the New General Hospital, the Civil Hospital for Women and Children and an isolation hospital. A telephone system and an improved system of water supply have been installed. Schemes for the provision of electric power and a tramway service were submitted to the council of state in 1923. Irrigation schemes have been put into operation in the surrounding areas and flood protection measures carried out.

Developments in communications during and after the War have greatly added to the importance of Baghdad as the trade centre of 'Iraq. By the outbreak of the World War the projected line northwards to Mosul had been completed as far as Samarra. After the capture of the city by the British troops under Gen. Maude in 1917, railway construction was actively undertaken. By 1922 the line to the north had been extended to Sharqat, 185·5 m. from Baghdad, and other lines in operation were southwards to Basra, 356 m. and northwestwards to Khanaqin and the Persian frontier. The city has also developed into an important river port. The produce of the surrounding districts is distributed by rail and river, and a large trade with Persia and Kurdistan has grown up. The chief exports from the city are wool, gum, opium, dates, skins, hides and carpets; imports are cotton goods, coffee, sugar, indigo, pepper, tobacco, etc., which are largely re-exported.

Baghdad is an important air station on the route from Europe to India. A fortnightly air mail service from Cairo was established in 1921. In Oct. 1923 an Overland Mail Motor Service was inaugurated between Baghdad and Haifa, via Damascus, by the Nairn Transport Co., and by 1924 a regular weekly service was maintained. A wireless station, in regular communication with Cairo and Beirut, was brought into operation with effect from Jan. 25 1923; commercial traffic is accepted for Great Britain, Germany, the United States and Syria.

BAGHDAD RAILWAY (*see* 27.439).—The Baghdad Railway was, as originally set on foot, a predominantly German enterprise for the construction of rail communications from the Bosporos to Baghdad. Its military and economic importance to Turkey, its position as the keystone of German policies in the Ottoman Empire, its strategic menace to British and Russian interests in the Near East and its potentialities for undermining French influence in Anatolia and Syria, all combined to make it one of the outstanding problems of world politics in the 20th century.

Handicapped from the start by financial difficulties, the German promoters sought to internationalise the railway. An attempt to interest French and British capital in 1903 was only partly successful. The British Govt. refused to sanction participation in the project; but, in spite of opposition by their government, French bankers subscribed almost 30% of the shares. Subsequently the diplomatic resistance of the Entente Powers returned perennially to plague the Ottoman Govt. and the German concessionaires. On the other hand, the steady progress in construction and the unexpected success of the sections actually placed in operation led British, French and Russian diplomacy to the conclusion that a policy of obstruction would prove barren. In 1908 the respective national policies toward the Baghdad Railway were reconsidered, and an honest effort was made in the convention of June 2 to reconcile the divergent interests involved.

Diplomatic Moves.—Anglo-Turkish negotiations of 1910–1 ran aground on the rocks of loans and increased customs duties. But the heretofore solid front of Entente diplomacy was broken in Nov. 1910, when, by the Potsdam Agreement, Russia agreed to abandon her objections to the Baghdad Railway in return for German recognition of the Russian sphere of interest in Persia. The Ottoman Govt. then prepared the way for an understanding with Great Britain and France by granting several valuable economic concessions in Anatolia and Syria to nationals of those Powers. The Balkan wars interrupted the course of the negotiations, but in Feb. 1914, a secret Franco-German convention settled all outstanding differences between French and German capitalists and between their respective governments.

Most significant of all, however, were the far-reaching agreements of 1913–4 between the British, German and Ottoman Governments. Turkey arranged a revision of the Baghdad Railway concession to conform with existing British economic and strategic interests in Mesopotamia and the Persian Gulf; Great Britain consented to an increase in the Ottoman customs duties. After very extensive negotiations between German and British business men having interests in the Near East, an Anglo-German convention[1] was initialled at the Foreign Office, London, June 15 1914. This document marked a complete rapprochement on a question which had been a sore point in Anglo-German relations for more than a decade. According to its provisions "two English members acceptable to His Britannic Majesty's Government" were to be elected to the Board of Directors of the Baghdad Railway Company; the terminus of the line was to be Basra instead of Kuwait on the Persian Gulf; and a policy of mutual diplomatic helpfulness was to be pursued as concerned the economic development of Mesopotamian resources (including oil-fields). Just before the outbreak of the World War the diplomatic problems connected with the Baghdad Railway had been all but settled.

Control of the Baghdad Railway by Germans was one of the principal factors in enlisting Turkey in the War on the side of the Central Powers. Once in the War the Turks, with German assistance, effectively used the Baghdad line in defence of the Dardanelles and Mesopotamia, as well as in two attempted invasions of Egypt. When the Germans lost and the Ottoman Empire was disintegrated the dream of "Berlin to Baghdad" became but a memory. All German rights in Turkish railways were abrogated by the Treaty of Versailles (1919); the German Govt. expropriated and delivered to the Reparations Commission substantially all the holdings of its nationals in the Baghdad Railway Company. In the unratified Treaty of Sèvres (1920) Turkey was obliged to confirm the confiscation of German railways in the former Ottoman Empire and to agree to any disposition which the Allies might choose to make of them.

But the Turkish Nationalists rejected the Treaty of Sèvres, and the Treaty of Lausanne (1923) did not provide for the liquidation of former German railway concessions. The greater portion of the railway remained in the possession of, and was operated by, the Turkish state. The Mesopotamian and Syrian sections of the line were handed over to the control respectively of the Kingdom of 'Iraq and the French administration at Beirut. To confound confusion, on Sept. 25 1918 the German owners of the Baghdad Railway had granted to the Anatolian Railway Co. an option on all their shares in the former company. Questions of compensation to the shareholders (among whom is the Reparations Commission) had not been decided early in 1926.

Construction.—By the outbreak of the World War the railway reached from Konia to the foot of the Taurus Mountains, and in 'Iraq the section Baghdad to Samarra had been completed. During the War construction was actively pushed forward in the direction of Mosul. The Taurus and Amanus tunnel systems were completed in 1918, and by the end of the War the line was laid from Konia to Nisibin. It connected with the Syrian system at Muslimiya north of Aleppo, a connection completed in time to enable the troops of Lord Allenby to enter Asia Minor in 1918 by rail. By 1924 a temporary bridge had been built across the Euphrates at Jerablus, a branch constructed from Derbesiye to Mardin, and the line was open for traffic as far as Nisibin. In 'Iraq the British had extended the line from Baghdad to Samarra as far as Qal'a Sharqat, and had linked up Baghdad with the port of Basra on the Persian Gulf. In 'Iraq, in 1926, further construction depended largely upon the outcome of the proposal to move the line to the more fertile and higher regions on the other side of the river Tigris. (*See* ASIA MINOR; PERSIAN GULF.)

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[1] See *The Political Science Quarterly*, vol. 38, pp. 24–44 (1923) and the Parliamentary debates reported in Hansard.

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BAHAMAS (*see* 3.207), a British West Indian colony; area, 4,404 sq. m.; population, 54,886 (1924). On Sept. 27 1915 the Legislature voted £5,000 to defray the cost of a war contingent. In 1916 the War Contingent bill was passed for the maintenance at effective strength of a contingent of 200 men for the British West Indies Regiment. The first draft left Nassau on Sept. 9 1915. The colony contributed liberally to the various patriotic war funds. At first the effect of the World War was scarcely felt. Though labourers in Inagua and Long Cay suffered from the cessation of the stevedore trade, the demand for sisal and sponges was enhanced. When, however, the United States entered the War, the tourist business was adversely affected, but during the post-War period it more than recovered lost ground.

In 1913 a contract was entered into with the Peninsular and Occidental Steamship Co. and the Florida East Coast Hotel Co. for mail, passenger and freight steamship communication between Florida and Nassau during the winter, and for the provision of a first-class hotel in Nassau for five years at £5,000 a year. Their steamer "Miami" having run ashore, the contract was cancelled by the Government in 1915. A temporary service between Mayport (Jacksonville) and Nassau was then arranged. In 1914, by Act of the Legislature, a Development Board was established to develop the tourist trade, and in 1921 a contract was signed with the Munson Line for a weekly passenger and freight service from and to New York during the winter, and a fortnightly service during the summer.

Production.—The cultivation of tomatoes, an industry which has greatly developed since 1918, is making considerable progress; in 1924 exports were valued at £37,381. Pineapples are also cultivated and a fair export trade in canned pineapples has grown up. The extensive areas covered with pine forests are only partially exploited. The Board of Agriculture, which ceased to exist in 1910, was re-established in 1912 on broader lines. With the advice of the Marine Products Board the sponge industry is being pursued more scientifically; exports in 1924 were valued at £131,618.

Finance and Trade.—Revenue rose from £84,386 in 1910–1 to the record figure of £852,573 in 1922–3. In 1923–4 it was £553,375. The expenditure in 1910–1 was £85,315; in 1922–3, £377,164 and in 1923–4, £452,044. The reason for the increase in revenue is to be found in the expansion in the imports of spirits resulting indirectly from the 18th Amendment to the Constitution of the United States in 1919. The public debt, on March 31 1924, amounted to £20,219. The value of imports of wines, spirits and liqueurs rose from £7,237 in 1918 to £1,088,000 in 1923. In 1910 imports coming from the United States were valued at £220,621; from the United Kingdom at £81,266; and from Canada at £12,728. In 1924 the figures were: United States, £748,000; Great Britain, £507,000; and Canada, £173,000. The total value of the oversea trade during 1924 was £2,210,000, consisting of imports valued at £1,584,000 and exports at £626,000, domestic exports were worth £274,327.

Canadian Agreement.—The Bahamas, which had not taken part in the Canada-West Indies Conference of 1912, sent a representative to Ottawa in 1920 and were signatories to the Trade Agreement of June 18 of that year, increasing voluntarily the agreed preference from 10 to 25%. Under the Agreement Canada provided a three-weekly steamship service between Canada, the Bahamas, Jamaica and British Honduras, the Bahamas agreeing to contribute 25% with a maximum of £3,000 towards any deficiency in the working (*see* WEST INDIES). The Bahamas were represented again at the Conference of 1925 and were signatories to the Trade Agreement of July 8 of that year. Under this agreement such produce of the Bahamas as is dutiable in Canada receives a preference of 50% of the duties, with a specific preference of one half cent per pound on canned pineapples, while Bahamas sponges of marine production are admitted free of duty, foreign sponges paying an *ad valorem* duty of 17½%. The Government of Canada undertook to provide, within 15 months after ratification, a fortnightly mail, passenger and freight service between St. Lawrence ports in summer and other Canadian ports in winter, calling at Bermuda, the Bahamas and Jamaica fortnightly. The Government of the Bahamas undertook to contribute £2,000 per annum towards such services when established.

Public Works.—The revival of the tourist trade after 1918 resulted in increased attention being paid to public works. In 1923 the main channel and mooring basin of Nassau Harbour were dredged clear of sand by an American company and a Government dredger then commenced work on the remaining rock. In 1925 schemes were under consideration for the construction of a wharf, a new hotel and a new abattoir. Steps were also taken to improve the roads and repair the sea wall. A radio telegraph service, installed by the Anglo-French Wireless Telegraph Co., was completed in 1923. (*See* WEST INDIES.) (A. E. A.)

BAHIA or SÃO SALVADOR (*see* 3.210).—During the years 1900 to 1920 the population of Bahia increased about 38%; since 1920 this increase amounted to 13%. Official estimates place the population (1926) at 320,000. Bahia has made marked progress in extending new streets, in laying miles of new sewerage and in providing sanitation and improved health conditions; a more adequate water supply system is under construction; various civic improvements are announced, while there is unprecedented activity in the construction of residence and business property. The use of automobiles, motor-trucks and tractors in the country is rapidly growing, as mule carts and horse-drawn vehicles are disappearing from the streets.

Port improvements, begun in 1909, have made fair progress, and, when completed, will represent an outlay of about $20,000,000. Ships now dock, instead of anchoring in the bay, and the cargo is transferred in modern ways to and from well-equipped marine warehouses. During the five years, 1920–5, exports of cacao, hides, tobacco, coffee, sugar and hard woods ranged from 100,000 to 150,000 tons annually. Diamonds also were exported. Imports of manufactured goods ranged from 60,000 to 101,000 tons yearly. About 100 industrial plants are engaged in manufacture, but higher class goods and implements are imported. The improved financial condition of the State of Bahia reacts favourably on the city's progress. (W. A. R.)

BAHREIN (*see* 3.212), an archipelago off the Hasa coast, is a British Protectorate which for more than 50 years up to 1922 had been under the rule of Sheikh 'Isa ibn Khalifa. In that year, owing to the extreme old age of the ruling Sheikh and the prevalence of intrigues among his sons, the British authorities induced him to abdicate in favour of his son, 'Abdullah. Outwardly independent, the administration of the islands is, for all practical purposes, controlled by the British political agent stationed at the port of Manama. Bahrein is the centre of the valuable pearling industry of the Persian Gulf, and before the War ranked next to Kuwait as a clearing station for Central Arabian trade. (*See* PERSIAN GULF.)

BAINVILLE, JACQUES (1879–), French historian and journalist, was born at Vincennes, near Paris, Feb. 9 1879. His first literary work was a life of Louis II. of Bavaria (1900), written while travelling in Germany. He then devoted himself to criticism, and published many articles, as yet uncollected. But his path in life was already marked out. He came under the influence of Maurras, joined the Royalist party, and, at the time of the Dreyfus case, became in 1899 one of the original editors of the monthly review, *Action Française*. This review in 1906 became a daily paper, of which Jacques Bainville was appointed foreign editor. From that time he devoted his energies to his short daily articles, which were clear, well-written, intelligent and full of striking phrases that soon became proverbial, such as that on the Treaty of Versailles, "*trop doux pour ce qu'il a de* *dur, trop dur pour ce qu'il a de doux.*" His activities as a political journalist were interrupted by a visit to Russia during the World War, and by the publication of various works, which aroused great interest, not only among his Conservative followers, but also among critics in general.

Jacques Bainville was the first writer in France to deal with the political philosophy of the War. This he did in *L'histoire de deux peuples* (1915), a work in which the influence of Maurras is modified by that of Thiers and Albert Sorel. The struggle between France and Germany is traced back to the far-off racial antagonisms from which it sprang, and one seems to be reading the documents of an endless lawsuit between the two peoples. The book is breathless and a little superficial, but clearly and brilliantly written. After the conclusion of peace he published *Les conséquences politiques de la paix* (1920), a reply to the well-known work of Mr. Maynard Keynes. The title itself of this book reflects the spirit of the *Action Française*, with its motto of "Politics First," and is an indication of how widely Bainville's views differ from those of the Cambridge economist.

Bainville's most celebrated work is his *Histoire de France* in one volume (1923), which is a model of clearness, intelligence and grace of style. The doctrines of the *Action Française* in favour of the monarchical system are prominent, but they are considerably modified, and the dominating theme of the book is the continuity of political tradition in France. The author is not a trained historian, and a certain number of errors have crept in, but they are of minor importance. Jacques Bainville also became editor of *La Revue Universelle*, a fortnightly review with a considerable popularity. (A. Th.)

BAKELITE, the trade name for a new plastic which during the years 1910–25 has found increasing applications for varied purposes, ranging from radio, wireless telegraphy and other electrical devices to gears, grindstones, aeroplane propellers, self-lubricating bearings, jewellery and ornamental articles.

Appearance and Characteristics.—It has the general appearance of the natural resins; yet its extreme hardness, exceptional strength, infusibility, insolubility and general chemical inertness are properties lacking in the natural resins, of which amber, a fossil resin, is one of the hardest. Unmixed with other substances it is very transparent and of an amberlike colour which can be changed by the addition of suitable dyes. It can be produced colourless and transparent.

Uses in Industry.—For important technical uses it is mixed with fibrous materials, thus acquiring an opaque reddish-brown colour which is sometimes changed to black or other colours by means of dyes or pigments. It possesses neither the elasticity nor flexibility of rubber or celluloid but is rather rigid. But this rigidity and its faculty to withstand temperatures at which rubber, celluloid, and natural resins liquefy or are destroyed, together with its adaptability for being moulded rapidly, and with extreme accuracy, to various shapes, have made possible endless applications in industry. In the manufacture of ornamental articles, its greater strength and brilliancy than amber are advantageous. For electrical insulation it withstands increases of temperature which would be fatal to rubber or resinous compounds, even if the latter had as great a tensile strength; hence its numerous uses for wireless telegraphy, radiophones, telephones, electric lampsockets, generators, motors and other electrical equipment. It is used for mechanical devices where strength, resistance to moisture, oil and solvents, or increases of temperature are essential requirements. Paper or woven fabric impregnated with it and then hardened in a hot, hydraulic press gives sheets, rods and tubes which have found extensive uses, *e.g.*, for electrical insulators, silent transmission gears and aeroplane propellers. In both the latter applications its greater strength and resistivity to moisture make it preferable to rawhide gears or wooden propellers. By mixing it with emery or graphite such divergent uses as grinding wheels and self-lubricating bearings have been brought about. Transparent Bakelite laboratory apparatus permits handling hydrofluoric acid.

History.—The creation of a super-resin by chemical synthesis has been the result of efforts extending over half a century. More than 50 years ago Adolph Bayer and others, while engaged in the study of crystalline bodies engendered by the inter-action of aldehydes upon phenols, noticed in some cases the formation of resinous-looking substances. But they were entirely valueless, being no better than the worst of the natural resins and more expensive to produce. Later, Delaire, Blumer, Luft and others made repeated attempts to improve the quality of these synthetic resins (*see* Synthetic Resins). Their main efforts were directed toward the production of resins which could be substituted for shellac, a fusible, soluble resin. Thus originated several shellac substitutes, none of which on account of inferiority supplanted the natural product. Story, by using practically the same raw materials, produced an infusible product, but failed to control the reaction so as to obtain a final product of the required qualities for useful purposes. A rather baffling situation arose from the fact that the same formaldehyde and the same phenols might produce, under apparently the same conditions, the most varying products, ranging from crystalline substances, soluble in water, to fusible and soluble shellac substitutes, or, at times masses which refused to melt or dissolve.

Baekeland's Researches.—Early in 1909 L. H. Baekeland published the results of many years of research work on this subject. He indicated well-defined methods for producing each variety of substances with absolute regularity. He announced the important technical effect of the action of ammonia or other bases in conjunction with phenol and formaldehyde, thus directing the chemical reaction toward the formation of infusible products. He also introduced the simultaneous action of heat and pressure for insuring the same effect.

He thus succeeded in controlling a seemingly erratic chemical reaction, and rendered its technical utilisation possible. The infusible final product of maximum hardness he called "C." But he was able to stop the reaction at an intermediate substance called "A." The latter has all the external properties of a natural resin. It is very brittle, softens and melts when heated, and many of the resin solvents affect it. But it is different from the natural resins in that on the application of a somewhat higher temperature it soon hardens and is transformed into "C." This change is due to a regroupment of the molecules, known as polymerisation (*see* 14.881).

So the whole art of using these resinoids is to work them while they are still in the fusible, soluble "A" condition, which permits them to be dissolved or to be moulded while in the plastic state; then to apply enough heat to cause polymerisation into the final state "C." Chemical investigation indicates that the final product is a complex solid solution of several different chemical individuals. Bakelite is also known as phenol-resin, resinoid, redmanol, condensite, resinit, formite, amberite, sipilite, amberdeen, faturan, etc.

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BAKER, GEORGE FISHER (1840–), American financier, was born at Troy, N.Y., March 27 1840. When he was eight years old his family removed to Brooklyn, N.Y., and later to Williamsburg, New York. Most of his boyhood was spent at Dedham, Massachusetts. After a brief period of schooling at Williamsburg, N.Y., he entered Seward University, Florida, N.Y., from which he graduated at the age of sixteen. From 1858–65 he was a clerk in the State Banking Dept., his services being interrupted for six months at the outbreak of the Civil War, when he acted as secretary to Gov. E. D. Morgan of New York. When the national banking system was created in 1863, Baker interested a friend, Mr. Thompsen, who established the First National Bank of New York City, giving Baker a position as teller and offering him on credit all the stock he wanted. Baker refused, however, to go into debt and bought only 30 shares with his savings.

The bank at first grew slowly, dealing chiefly in government bonds; but when, in 1865, Baker became cashier and active head it began to expand rapidly, being admitted to the Clearing House in 1868. Baker was frequently consulted by the Secretary of the Treasury and in 1877 he became president of the bank, the policy of which he continued to direct with such success as to make it one of the strongest banking institutions in America. In 1882 he acquired the Richmond and Danville Railroad which was the nucleus of a group reorganised as the Southern Railway. Later he obtained control of the Jersey Central and the Delaware, Lackawanna and Western, when these systems were in difficulty. In addition to the presidencies and directorships of numerous powerful corporations, he was president of the Metropolitan Opera House Association. His benefactions included large gifts to the Metropolitan Museum of Art, to the Red Cross and to universities. Conspicuous among the latter was one of $5,000,000 for the Graduate School of Business Administration of Harvard.

BAKER, GEORGE PIERCE (1866–), American educationalist, was born at Providence, R. I., April 4 1866. He graduated from Harvard in 1887 and from 1905 to 1925 was professor of English there. His courses dealing with the theory of the drama were highly successful, and his famous laboratory, known as the "47 Workshop," afforded practical training for his students. In Nov. 1924 he accepted an invitation from Yale University to become head of the new department of dramatic art. His works include: *The Development of Shakespeare as a Dramatist* (1907); *Dramatic Technique* (1910); and *Modern American Plays*, collected and edited with introduction (1920).

BAKER, NEWTON DIEHL (1871–), American lawyer, administrator and party leader, was born at Martinsburg, W. Va., Dec. 3 1871. He was educated at Johns Hopkins (A.B. 1892) and at Washington and Lee (LL.B., 1894). In 1897 he began the practice of law in his native town, removing later to Cleveland, Ohio. Here he soon distinguished himself as a lieutenant of Mayor Johnson in the latter's long struggle for tax reform and three-cent fares. Appointed city solicitor by the mayor in 1902, he held that office by election from 1904 to 1912 and that of mayor from 1912 to 1916. On the floor of the Democratic national convention of 1912 he fought successfully to release the Ohio delegation from the Unit rule, thereby contributing 18 votes toward the nomination of Wilson. As President-elect the latter offered him in 1913 the Secretaryship of the Interior, which he declined in order to push forward municipal reforms in Cleveland. Upon the resignation of Garrison three years later, however, he was appointed Secretary of War. Although an avowed pacifist, immediately after the organisation of the 65th Congress in 1917 he submitted a plan for universal military conscription, and remained at the head of the Department of War throughout the whole period of the World War and to the retirement of Wilson in 1921. Administration policies regarding preparedness, conduct of the War and treatment of conscientious objectors became the subject of severe criticism, much of it for partisan ends. In reply to this, he maintained before the Chamberlain Senate Committee early in 1918 that "no army of similar size in the history of the world has ever been raised, equipped or trained so quickly." After 1921 he resumed the practice of law in Cleveland. In the Democratic convention of 1924 he made a strenuous but losing fight for a strong League of Nations plank. (R. C. B.)

BAKST, LÉON (1866–1924), Russian painter, passed his childhood in St. Petersburg. He attended the Imperial Academy of Arts, but was obliged to leave after painting a too realistic "Pietà." As a member of the Society of Painters in Water Colours and as teacher to the children of the Grand Duke Vladimir, he succeeded both as a Court painter and in the fashionable world. Under the influence of Alexandre Benois, he changed his artistic outlook and joined the group "The World of Art" that was struggling for the recognition of modern art. He became secretary of the review edited by that group. From 1900 onwards he was scenic artist, first at the Hermitage Court Theatre and afterwards at the Imperial Theatres. He designed the scenery and accessories for the tragedies of Sophocles in the spirit of the Greek theatre and in the archaic style of the Aegina sculptures. He made a voyage to Greece and Crete of which he wrote an account, and his famous picture "Terror Antiquus," expresses his vision of mythic Greece.

In 1906 he exhibited in the Russian section of the Salon d'Automne in Paris. Two years afterwards he achieved considerable fame as the chief painter of scenery for the Russian ballets produced by Diaghilev. "Cleopatra," "Scheherazade" (1909) and "Daphnis and Chloe" were among his most notable achievements. He returned to Russia and founded a liberal school of painting. Afterwards he settled in Paris, where he designed the setting of the tragedies of D'Annunzio and of a play of Verhaeren. He painted the scenery and designed the costumes for the "Sleeping Princess," the fairy ballet of Tchaikovsky produced in London in 1921. He also produced several plays at the Paris Opera, among them the "Bewitched Night." Léon Bakst revolutionised the application of the decorative arts of the theatre and thus presented a unity of impression. The influence of his genius may also be seen in the costumes of the time. He died in Paris Dec. 27 1924. See André Levinson, *The Story of Léon Bakst's Life* (London, 1921.) (A. Le.)

BAKU (*see* 3·230).—The population in 1925 was about 250,000. Baku changed hands repeatedly between 1917 and 1920. After the break-up of the federated republics of Transcaucasia, Azerbaijan, Georgia and Armenia, formed in 1917, Azerbaijan constituted itself an independent Mohammedan republic early in 1918, claiming Baku as its capital, but in March the Russians and Armenians ejected the Tatar Moslems.

In July Baku was occupied by a small British force from Mesopotamia, but this was withdrawn in Sept. owing to the exhausted condition of the Armenian population and the arrival of Turkish reinforcements. By the terms of the Armistice in Nov. 1918, however, the Turks agreed to offer no objection to an Allied occupation, and on Nov. 17 a British force from Persia, with Russians and Armenians, reoccupied the town to preserve order. An Azerbaijan Govt. was established, but was wholly inexperienced, and the British military forces were forced to take over most of the work of civil administration. When the British troops were withdrawn in Aug. 1919, the order which they had brought to Baku was rapidly changed to chaos. A Russian force entered the town without opposition in April 1920, and, with the help of a rising of the local Bolsheviks, the Soviet Socialist Republic of Azerbaijan, forming part of the Transcaucasian Socialist Federal Soviet Republic, was proclaimed with Baku as its capital.

The Oil Industry.—In 1920 the oil wells in the Baku area were nationalised by the Soviet Government. The refining machinery was repaired, new wells drilled and new refineries erected. In 1923–4, 191 new wells were being drilled and, in May 1924, 1,929 wells were reported to be active, as against 709 in 1920. In 1913 the yearly output of oil amounted to 9,438,000 tons; in 1923–4 it was 4,241,863 tons, valued at 88,625,000 roubles. The republic has granted large tracts of land for the enlargement of the industry, and a pipe-line to Poti is projected. The town is connected with Batum by a pipe-line, as well as the railway, and with Krasnovodsk, across the Caspian, by steam ferries, and is only one day by steamer from the North Persian ports. The annual trade fair was revived in 1922.

BALAKIREV, MILI ALEXEIVICH (1836–1910), Russian composer (*see* 3.324), died at Petrograd May 28 1910.

BALANCE OF PAYMENTS.—By the term international balance of payments is meant in the first instance the statement of accounts or balance-sheet which could be compiled, were knowledge on this subject complete, referring to all those transactions between one country and others which involve monetary payments or obligations.

But a certain confusion is caused by the fact that the word balance is employed both for the balance-sheet itself and for any difference which may be shown between the total outgoings and the receipts. Actually the two sides of this account must balance, for every transaction which should be included must involve either a receipt, payment, credit or obligation. But the statements are frequently, indeed generally, drawn up in such a way that a positive or negative balance may result. By positive balance is meant an excess of the apparent receipts over the apparent expenditure; by negative, the reverse.

Before the World War writers frequently excluded gold from the items composing the statement of accounts, and presumed that the net balance shown indicated the amount of gold which left or entered, or, but for short term borrowing, would have left or entered the country. Since the War, however, the most approved practice has been to include all monetary transactions, with the exception of the arrangement of banking or other similar commercial floating credits.

If it were possible, therefore, to draw up a complete statement for any country on this principle, the net balance would represent the increase in the country's floating credits or debits. But in practice a large number of items have to be estimated on an inadequate foundation of ascertained fact, so that the difference between the two sides of such an account is really composed of errors in estimation plus or minus changes in floating balances. In Denmark, and more recently in Norway and certain other countries, official statistics of bank balances are published annually, and the estimates can, therefore, be constructed using these statistics as the corner-stone of the whole structure of calculation and argumentation. For these countries, therefore, it is possible to obtain a more accurate estimate of one of the most interesting group of items brought out by the balance-sheet, namely capital movements, than it is for others.

The fact should be emphasised that a statement of the balance accounts of any country relates to monetary transactions only. Gifts in kind and reparations in kind are, therefore, when possible omitted—but money gifts or reparations paid by draft included. In practice it may frequently prove impossible to effect these exclusions. The export of currency notes is equivalent to the opening of a special form of credit.

The Chief Headings.—The types of transaction which may give rise to international monetary obligations are almost infinite; but the main headings may be grouped as follows: Inward or credit movements—exports of (1) merchandise; (2) gold bullion, gold and other specie and currency notes; (3) capital items, including receipts on account of amortisation of loans existing and new domestic securities sold abroad, foreign securities sold abroad, domestic real estate and other capital values sold abroad; (4) interest and dividends from foreign loans and capital invested abroad; (5) shipping freights, charter money and other earnings of national ships from abroad; (6) transport and similar earnings from foreign goods in transit; (7) post, telegraph and telephone receipts from abroad; (8) funds brought in by immigrants and returned emigrants and emigrants' remittances from abroad; (9) receipts from tourists; (10) receipts from foreign, diplomatic, consular and similar services; (11) commissions, insurance policies and premiums, brokerage, etc.; (12) miscellaneous. The reciprocal debit items are obvious and need no capitulation.

The compilation of such a statement in any country would entail special inquiry and a considerable element of conjecture. Thus allowance would have to be made for the possible over- or under-valuation in the trade statistics of the recorded imports and exports, for contraband trade and other omissions. Reliable statistics are seldom available for the so-called invisible items, *i.e.*, all items other than merchandise, coin and bullion. And in each country different measures for estimating the value of each item, dependent on the organisation of business, have to be adopted.

In spite of the practical differences which such estimates involve, the study of this question has received a remarkable amount of attention since the War. Official estimates for the year 1923 or 1924 have been prepared by 15 governments, the most elaborate being those of the United States of America. For this country very detailed statements, official or non-official, have been compiled since 1919. These are summarised in the table in the next column.

The final item represents in part errors and omissions, which in the last three years were estimated at −133, −115 and +4 million dollars. Complete accuracy can never be attained. But the statement renders clear the manner in which the enormous net exports of the earlier years, largely to Europe, were covered by long-term loans and short-term credits, how the floating credits are being gradually liquidated, and how the export surplus itself sank from over $4,000,000,000 in 1919 to $389,000,000 in 1923. The increase of this surplus in 1924 was coincident with the revival of capital export.

United States: Balance of Payments (Millions of Dollars)
(Credits+ Debits−)

	1919	1920	1921	1922	1923	1924
Exports of Merchandise (net)	+4,016	+2,950	+1,976	+734	+389	+970
Exports+ and imports− of silver (net)	+ 152	+ 26	− 11	− 8	− 2	+ 36
Exports+ and imports− of gold (net)	+ 160	− 50	− 667	−238	−294	−258
Export of U.S. currency (net)	+ 91	+ 103	− 100	..	+ 50	− 50
Interest on foreign investments (net)	+ 50	+ 50	+ 80	+351[1]	+417[1]	+464[1]
Ocean freight payments (net)	+ 93	+ 93	+ 33	+ 7	− 8	+ 8
Governmental expenditure abroad	−2,375	− 305	− 50	− 16	− 19	− 5
Immigrants' remittances, charity and tourist expenditure (net)	− 650	− 850	− 700	−700	−760	−855
Foreign Loans paid off	+ 515	+ 571	+ 255	+ 78	+ 23	+45
Sales of securities to foreigners	..	..	+ 48	+216	+412	+319
Repayment of principal of debts to U.S. Govt.	..	..	..	+ 31	+ 91	+ 23
Foreign investment of American capital	− 970	−1,445	−1,092	−963	−417	−909
Excess of credits + and debits − on all transactions	+1,082	+1,143	− 228	−508	−118	−212

[1] Includes interest received by U.S. Govt. from foreign governments.

Although the interest earned by the United States of America on her foreign investments rose from about $50,000,000 in 1919, to over $460,000,000 in 1924, it was still less than 50% of the receipts of the United Kingdom on this account. But, according to the estimates of the Board of Trade the net receipts of the United Kingdom estimated in 1913 at £210,000,000 were despite changes in the purchasing power of money only £220,000,000 in 1924. In 1926 very considerable revisions were made in the more recent estimates of the British balance of payments. The united figures for 1924 and the preliminary estimate for 1925 are as follows:—

United Kingdom: Balance of Payments (in Millions of Pounds)

	1924	1925
Excess of imports of merchandise and bullion	324	386
Excess of government payments made overseas	28	15
Total	352	401
Net income from overseas investments	220	250
Net national shipping income	130	115
Foreign ships disbursements in British ports	10	9
Commissions	40	40
Other services	15	15
Total invisible exports on balance	415	429
Available for investment abroad	63	28
New overseas issues on London market in year	134	88

The relative importance of the visible and invisible items in individual balances of international accounts varies enormously from country to country and from year to year. In the years immediately succeeding the War, most European countries showed a heavy visible negative, and most of the important extra-European countries a large visible positive balance of trade, the differences being accounted for mainly by short-term borrowings. (*See* TRADE, INTERNATIONAL.)

Of the countries for which estimates have been made, the United States, the United Kingdom, France, Austria, the Netherlands, Switzerland and Sweden, all obtained a net income from foreign investments in 1923. Switzerland and Italy earn a very considerable net income from tourists, estimated at somewhat over $27,000,000 for the former in 1924 and $119,000,000 for the latter in 1922. A number of European countries further acquire an important addition to their foreign purchasing power from the remittances sent by emigrants, the largest sums being received by Italy about $126,000,000 in 1923; Greece, about $25,000,000 in 1923 and $40,000,000 in 1924; Poland, $25,000,000–$30,000,000 in both 1923 and 1924; the Irish Free State roughly estimated at about $20,000,000 in 1924. The United States State Dept. reckons that remittances to Germany in 1924 from America alone were in the neighbourhood of $80,000,000.

The greater part of the emigrants' remittances received by Europe, but by no means the whole, is derived from the United States of America, whose outgoings on this account in 1923 and 1924 are given at $350,000,000. The net expenditure of her tourists and travellers is also enormously greater than that of any other country, amounting in 1923 to nearly $300,000,000 or more than half of the foreign earnings of British shipping in that year. (A. LY.)

BALDWIN, JAMES MARK (1861–), American philosopher (*see* 3.247). Leaving Johns Hopkins University in 1909, he occupied a chair at the National University of Mexico until 1913. In 1915–6 he lectured at Oxford University and the French provincial universities. He was made a professor at the École des Hautes Études Sociales, Paris, in 1919. His later writings include *The Individual and Society* (1911), *History of Psychology* (2 vol., 1913), *Genetic Theory of Reality* (1915) and *The Super-State* (1916).

BALDWIN, STANLEY (1867–), British politician, was born at Bewdley Aug. 3 1867, the only son of Alfred Baldwin, chairman of the Great Western Railway and for 16 years M.P. for the Bewdley division of Worcestershire. Descended from a family, long small landowners in Shropshire, Baldwin's great-grandfather, toward the end of the 18th century, migrated into Worcestershire and established at Bewdley an iron foundry which expanded with the passage of time into the great combination of iron and steel manufactories and collieries known as Baldwin's, Ltd. The development of this concern contributed to the making of Stanley Baldwin; for, deeply as he was rooted in the rich soil of the English midlands, his economic and social outlook was the result of close personal experience of the evolution of modern industry.

Besides the territorial and the industrial there was a third strain in Baldwin's character which came to him from his father's and his mother's people. It was that of Puritanism. Both his parents were of Puritan stock; both indeed were brought up as Wesleyan Methodists. His mother, who lived to see her son twice Prime Minister, was Louise, one of the five remarkable daughters of the Rev. G. B. Macdonald, a Wesleyan minister. Of Mrs. Baldwin's sisters, one became the wife of Sir Edward Burne-Jones; a second of Sir Edward Poynter, P.R.A., and a third of J. L. Kipling. Stanley Baldwin is thus a first cousin of Mr. Rudyard Kipling. Mrs. Baldwin was a great favourite with Rossetti and William Morris, and it was in this circle and from his close and constant association with his gifted relations that Baldwin derived an abiding taste for the best things in art and literature. His formal education was that given to young men of his class. In 1881 he went to Harrow and in 1885 to Trinity College, Cambridge, where he took his B.A. in 1888.

After leaving Cambridge Baldwin went into his father's business; and when his father entered Parliament in 1892 Stanley Baldwin became virtually the head of the concern. For nearly 20 years the business was the central interest of his life. He became a county magistrate and a county councillor, and lived the life of a country gentleman, with scholarly tastes and large and expanding business interests. In 1892 he had married Lucy, the eldest daughter of E. L. J. Risdale of Rottingdean, by whom he had two sons and four daughters. In 1906 he served his apprenticeship to politics by unsuccessfully contesting Kidderminster in the Conservative interest. Two years later his father died, and Stanley Baldwin succeeded to the chairmanship of the business, now converted into a joint stock company, to a seat on the board of the Great Western Railway and to the representation of the Bewdley division of Worcestershire.

On March 3 1908, the future Prime Minister took his seat in the House of Commons, and on June 22 made his maiden speech. It was a characteristically modest and sensible contribution to a debate on a subject of which he had intimate knowledge. He spoke in opposition to the Coal Mines (Eight Hours) bill from the point of view of the class which he and his family had represented for four or five generations. In the session of 1909 he had the chance of making a private member's motion. He chose as his theme the investment of British capital abroad, and in the course of his speech revealed himself as an ardent protectionist. But, although the House listened to him respectfully on the several occasions on which he spoke, he gave no special promise of future distinction. For nine years he did his work as a private member, quietly, effectively, simply and modestly.

Official Career.—Lord Edmund Talbot, later Viscount Fitzalan and then Chief Whip, noted Baldwin's ability and advised Bonar Law to make him his parliamentary private secretary. This was done in Dec. 1916, and from that moment Baldwin's advancement was astonishingly rapid. In Jan. 1917, he became a Junior Lord of the Treasury, but instead of going into the whip's office, he was kept busy " on the bench," deputising for the Financial Secretary who had no seat in the House. In June he became Joint Financial Secretary to the Treasury and in that capacity gave valuable assistance in debate to Mr. Bonar Law and Mr. Austen Chamberlain—successively Chancellors of the Exchequer. Accustomed to control the policy of a great business concern, Baldwin was not perhaps well fitted for a subordinate place in the official hierarchy, but his efficient work in Parliament was rewarded by admission to the Privy Council in 1920 and to the Cabinet when, in 1921, he became President of the Board of Trade. It was there that he first gave proof of the stuff that was in him; but in party politics he was still almost an unknown factor.

His chance, however, came in 1922. The Coalition formed by Mr. Lloyd George in Dec. 1916, and cemented by the general election of 1918, was by that time manifestly breaking. Many Liberals, and still more Conservatives, found that the Coalition imposed too great a strain on their political consciences. Mr. Lloyd George and his personal followers were anxious to appeal again to the electors as a Coalition. The majority of the Conservatives were opposed to them. The crisis came in Oct. 1922, when, in fear of a *coup d'état* by the Coalition Ministers, a meeting of the Conservative M.P.s was called at the Carlton Club on Oct. 19. Mr. Austen Chamberlain presided, and his weight, with that of almost all his colleagues in the Cabinet, was thrown into the scale of the Coalition. But they did not prevail with the rank and file of the party, who decided, there and then, by 187 votes to 87 to cut themselves adrift from Mr. Lloyd George and the Liberal wing of the Coalition, and to appeal to the country as Conservatives *sans phrase*. That meeting was the turning point in the history of modern Conservatism; it was the turning point in the career of Stanley Baldwin.

The result was due, apart from the determination of the rank and file, pre-eminently to two men: Bonar Law and Baldwin. The former emerged from retirement, to rescue his party from the Coalition. His action was heroic; the hand of death was already on him, and nothing but a high sense of duty induced him to essay a task manifestly beyond his strength. But Baldwin's was the greater courage. Only recently admitted to Cabinet rank, yet plainly destined to a high place in politics; just approaching the zenith of his powers, physical and intellectual; with everything to lose politically by a false step, he took his courage in both hands and did simply what he believed to be right. His speech was characteristically brief and direct. He went at once to the "root of the whole difficulty—the position of the Prime Minister," and expressed his conviction that if the "present association" were continued, the disintegrating process in the Conservative ranks, already far advanced, would "go on inevitably until the old Conservative party was smashed to atoms and lost in ruins." Accordingly he declared himself "prepared to go into the wilderness if he should be compelled" by the dynamic force of Mr. Lloyd George to "stay with him."

The die was cast. The meeting voted with Bonar Law and Baldwin; Mr. Austen Chamberlain and other Unionist leaders went into the wilderness—temporarily—with Mr. Lloyd George; Bonar Law became Prime Minister—the first Conservative to hold the office in sixteen years; Baldwin became Chancellor of the Exchequer and principal lieutenant in the Commons; Lord Curzon of Kedleston remained Foreign Secretary and leader in the House of Lords.

The electors endorsed the verdict of the Carlton Club meeting; 344 Conservatives were returned, a clear though small majority over all other parties; but the Premier was a stricken man and after a few months in office resigned. Length and distinction of service, no less than intellectual pre-eminence, pointed to Lord Curzon as his successor; but the King was persuaded that, since the Labour Party had become the official Opposition, a peer-premier was no longer practicable. Accordingly Baldwin was invited to form a Ministry, and, assured of the loyal support of his colleagues, consented. The Ministry was easily reformed under the new Premier, but some of the ablest and most experienced Conservatives still remained outside the Ministry and the loss of Bonar Law was severely felt.

Baldwin's first Ministry was short-lived. In Nov. 1923, despite the fact that his parliamentary majority was intact, he decided to ask the electors for a vote of confidence in himself and in the policy which he believed could alone cure trade depression and relieve unemployment—protection for native industries. The country refused its assent. Out of the three parties none commanded an absolute majority in the new Parliament. Consequently the Baldwin Ministry, with 259 supporters, met Parliament. The Liberals, however, coalesced with the Labour men and turned out the Conservatives. Mr. Ramsay MacDonald, thereupon, became the head of a Labour Govt. and remained for nine months in office, until a hostile vote in the House of Commons compelled him to appeal to the country, with the result that Baldwin found himself at the head of a solid phalanx of 414 Conservatives. Commissioned to form a Ministry he not only invited Mr. Austen Chamberlain and other Conservative exiles to rejoin the Cabinet, but entrusted the Chancellorship of the Exchequer to Mr. Winston Churchill. Growing steadily in political stature, having won an electoral victory almost without parallel in recent history, he refused to exploit a party triumph.

Personality and Character.—The career thus outlined is one of the most remarkable in English political history. To what qualities or endowments may Baldwin's meteoric rise to ascribed. Fortune has undoubtedly been kind to him, though in politics fortune rarely smiles except on those whom she suspects to be worthy of her favours. Baldwin has still to win a place in the select company of great statesmen, but fate has given him an opportunity and he himself has given promise that he can take advantage of it. He starts with several initial advantages. The first, and not the least, is that his countrymen know him to be, like Pitt, pecuniarily disinterested. Pitt was a poor man, but his refusal of the Clerkship of the Polls proved that he counted money as dross compared with the public repute. Baldwin, a rich man, proved his public spirit when in June 1919 he presented to the Exchequer for cancellation £150,000 of the new War Loan, a sum representing approximately 20% of his total fortune. He hoped, in this way, to set an example of personal sacrifice. He clearly perceived that the country was in grave danger of "being submerged in a wave of luxury and materialism," and he believed that "a fool's paradise is only the ante-room to a fool's hell."

With the ideals of a patriot Baldwin combines the instincts of a Puritan. He appeals, therefore, if not like Gladstone to the Nonconformist conscience, to the best feelings of all good men, whatever their creed. "I stick all through to what I believe to be right." So Baldwin said at the Carlton Club meeting, and his countrymen instinctively recognized that he spoke with sincerity and simplicity. There is no pose about Baldwin, though his briar pipe comes (thanks to the photographers) perioulsy near one. Simple, sincere, disinterested, he is also shrewd. Brilliant he is not; and indeed all that makes for brilliance he almost ostentatiously disdains. He is slow of speech and a curious working of the face and puckering of the brows gives the impression that his thoughts are, like his speech, laboured. "My mind moves slowly," he wrote of himself.

His speeches reveal a fund of dry and rather caustic humour, but in verbal wit he does not excel, though his judgments on men and things are expressed, especially in private, with pungent force and directness. Rhetoric he profoundly mistrusts; oratory he regards with Froude as "the harlot of the arts." Yet he has a keen appreciation of style in literature, and though he is impatient of the intrusion of the intellectual into politics or industry, few men have a higher sense of the value of real education. Less of the scholar, in the narrower sense, than Gladstone or Peel, he belongs like them to the commercial aristocracy. He loves good art and good literature, but above all he loves nature, and his joy in the sights and sounds and smells of the English countryside is drawn from that quiet worship which is the basis of all true poetry. No one who was not at once patriot and poet could have made the speech which he made on St. George's Day, 1924.[1] (*See* CONSERVATIVE PARTY.) (J. A. R. M.)

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[1] In 1926 he published *On England*, a volume of his best non-political addresses, and by his calm and humane demeanour during the general strike his reputation at home and abroad was raised.

BALFOUR, ARTHUR JAMES BALFOUR, 1ST EARL OF (1848–), British statesman (*see* 3.250). Mr. Balfour (as he then was) was confronted, as Conservative leader, after the General Election of Jan. 1910, with an embarrassing situation. While endeavouring to save the effective authority of a second Chamber and to avert Irish Home Rule, with his supporters still sore over the Tariff Reform controversy, he was faced by a Liberal Ministry dominated once more by a body of 80 Irish Nationalists, who held the balance of power in the House of Commons and insisted on a forward policy. He advocated the reform of the House of Lords as an alternative to the Ministerial Veto Resolutions, which he denounced as irrational.

In the lull in the party fight which followed the death of King Edward, he welcomed the suggestion of a conference between the parties to endeavour to arrange a compromise, and was one of the eight leaders who met on 21 occasions between June and Nov. without coming to an agreement. When the conferences failed and ministers announced another dissolution, he did his best to rouse the country to the dangers which, in his opinion, threatened it. When the second general election of 1910 confirmed the verdict of the first, dissatisfaction with his leadership, which had been long entertained by a considerable section of the Unionists, began to spread. It was pointed out that he had now led the party to three electoral defeats in succession: in 1906, Jan. 1910 and Dec. 1910.

The course of the session of 1911 intensified this dissatisfaction. Mr. Balfour did indeed fight the Parliament bill, in its passage through the House of Commons, with courage, persistency, acuteness and passion. In committee he strove hard, but in vain, to get fundamental laws exempted from its operation. But he shrank from encouraging the House of Lords to persist in opposition, when ministers announced that they had obtained the King's consent to the creation of sufficient peers to make its passage certain. He did indeed move a vote of censure imputing to ministers a gross abuse of the constitution in the advice they had given to the Crown; but he declared that he would stand or fall with Lord Lansdowne in that statesman's recommendation to the Unionist peers to abstain from further resistance as being no longer free agents.

This attitude was passionately resented by a large group of "Diehards," who organised themselves under Lord Halsbury. Mr. Balfour's counsel prevailed, and the bill was allowed to pass; but his authority as leader had been seriously shaken, and in Nov. he decided that the time had come for him to resign. In announcing his decision to a meeting of the Conservative Assn. of the City of London on Nov. 8 he said that he desired to abandon his heavy responsibility before he could be suspected of suffering from a sort of petrifaction in old courses and inability to deal with new problems; and that he felt he had not the vigour, at his time of life, again to conduct a ministry. The announcement, in spite of the signs of discontent, came as a great shock to the party and the country.

Mr. Balfour was then only 63, and his powers as a parliamentarian were really at their height. Although he proceeded to devote more time to his manifold other interests in life—philosophy, science, literature and the fine arts—he still took at intervals a prominent part in debate, giving throughout a loyal support to his successor in the House of Commons, Mr. Bonar Law. The renewed controversy on Home Rule afforded him a great opportunity; and the powerful series of speeches which he delivered, at Westminster and elsewhere, in the course of the next three years, did much to awaken Great Britain to the imminent danger of civil war in Ireland, and to force ministers into the policy of excluding Ulster, in some form or other, from the operation of their bill.

When the World War broke out, he cordially accepted the policy of the Unionist leaders to sink all political differences in support of the national Government. Speaking at the Guildhall, London, on Nov. 11 1914, he said that the Allies were fighting for civilisation and the cause of small States, and, whether the War was short or long, they would triumph. In this spirit he joined the first Coalition Ministry in May 1915, becoming First Lord of the Admiralty under Mr. Asquith. He speedily restored the harmony of the Board of Admiralty, which had been distracted by a quarrel between Mr. Churchill and Lord Fisher. He also reversed Mr. Churchill's policy of differentiating between prisoners from submarines as compared with other German prisoners. Perhaps the best work which he did at the Admiralty was the issue, at intervals, of some cogent papers, mainly for the benefit of the Americans, indicating the great work of the British Navy in the War and exposing the fallacies involved in the captivating phrase, "the freedom of the seas."

The chief naval battle of the conflict, the battle of Jutland, was fought during his term of office; and he incurred widespread criticism by the manner in which the news was officially communicated to the public, the great losses in ships being dwelt on to such an extent as to suggest that, instead of being a victory, if an imperfect one, the action was a defeat. In Nov. 1916 Mr. Balfour brought Sir John Jellicoe into the Admiralty as First Sea Lord, Sir David Beatty becoming naval commander-in-chief. On the King's birthday, June 3 1916, Mr. Balfour's eminence and his patriotic readiness to resume in wartime, in spite of advancing years, official labours in a secondary position, were suitably recognised by the grant of the Order of Merit. When Mr. Lloyd George formed his Coalition Ministry in Dec. 1916, the Foreign Office, on the retirement of Lord Grey of Fallodon, was pressed upon Mr. Balfour, as it was essential to have there a man of experience and weight. He took up his new duties only a few weeks before Germany instituted the unrestricted submarine warfare which brought the United States into the War; and in April 1917, he headed a British mission which visited America in order to arrange for regular co-operation between the two countries.

His attractive personality greatly impressed his hosts, and he received the compliment of being invited to address the House of Representatives on May 5. He proceeded subsequently to Canada, and there addressed the two Houses of Parliament. The concentration of power in the hands of the War Cabinet and the great personal ascendancy which Mr. Lloyd George, as Prime Minister, rapidly acquired, tended to reduce the importance of the Foreign Secretary during Mr. Balfour's tenure of the post. It was, however, he, as Foreign Secretary, who in Nov. 1917 gave a promise on behalf of the British Govt. to provide a "national home" for the Jews in Palestine after the War. He went to the Paris Conference in 1919 as the second British plenipotentiary, and appended his signature to the Treaty of Versailles and to the abortive treaty of guarantee to France against German aggression.

When the Conference was over, Mr. Balfour relinquished the Secretary of State's seals to Lord Curzon, but remained in Mr. Lloyd George's Cabinet as Lord President of the Council. He was appointed chief representative of the British Govt. at the first Assembly of the League of Nations in 1920 and also at the International Conference at Washington, D.C., in the winter of 1921–2. At Washington he was, after the Secretary of State, Mr. Hughes, the leading figure of the Conference; and his prompt and cordial acceptance of Mr. Hughes's proposals for the scrapping of capital ships and their future strict limitation greatly impressed the American public. The Conference not only secured the limitation of navies, but also merged the Anglo-Japanese Alliance into the Four-Power Pacific Treaty, the other two Powers being the United States and France. On his return in 1922 from this mission Mr. Balfour was created, in March, a Knight of the Garter, though still a commoner, and in April, an earl.

During this year the question of Inter-Allied debts was pressingly raised by America, a purely creditor state; and Lord Balfour addressed the so-called Balfour note, on behalf of the British Govt., to the French Ambassador and the representatives of other European Powers. He pointed out that, while Great Britain, though more a lender than a borrower, was in favour of a general cancellation of Inter-Allied debts, she could not agree to the cancellation of European debts due to her, independently of the question of the British debt to the United States.

Lord Balfour had no sympathy with the feeling of hostility which was growing in the Conservative party throughout 1921–2 toward the continuance of a Coalition Ministry, and spoke in that sense at the Carlton Club meeting on Oct. 19 1922, which broke up the Coalition. He resigned office along with the other Unionist Coalition Ministers and did not join either Mr. Bonar Law's or Mr. Baldwin's Conservative Ministry in 1922–3. But he maintained a friendly attitude, and, after the fall of the Govt., he moved, in a party meeting on Feb. 11 1924, a vote of confidence in the ex-Premier which was carried by acclamation.

Lord Balfour was elected in 1919 Chancellor of his old University, Cambridge. In 1923 he published a further philosophical work, *Theism and Thought, a Study in Familiar Beliefs*. He became president of the British Academy, and was constant in his attendance at its meetings. He became president also of the National Institute of Industrial Psychology. Early in 1925 he paid a visit to Palestine, and was received with enthusiasm by the Jewish population which had accepted his invitation of 1917 to establish there a national home. No open Arab hostility was shown to him in Palestine; but in Syria, which he proceeded to visit, it flamed out in immediate menace and the French administration had to escort him hurriedly out of the country. On his return to England he accepted an invitation from Mr. Baldwin, on Lord Curzon's death, to join the Govt. as Lord President of the Council; and he was immediately detailed for the congenial task of presiding over a Civil Research Committee instituted by the Cabinet. (*See* CONSERVATIVE PARTY; ENGLISH HISTORY.) (G. E. B.)

BALINE, ISRAEL (1888–), American song writer, known as Irving Berlin, was born in Russia May 11 1888, and was brought to the United States in 1892. Early poverty curtailed his schooling, and he left home at 14 to earn his living, finding employment as a singing waiter in various Chinatown and Bowery cabarets. There he began to write song lyrics and compose melodies. The increasing popularity of his songs enabled im in 1919 to open a music publishing business. In 1920, in artnership with Sam Harris, he built the Music Box Theatre n New York City, for which he wrote a number of highly sucessful revues. "Alexander's Ragtime Band" (1911), "Everyody's Doin' It" (1911) and several other compositions gave im international popularity as the pioneer of ragtime music. ts subsequent evolution into jazz owes much to his later work, uch as "Pack Up Your Sins" (1922) and "Everybody Step" 1921) characterised by complex rhythms and intricate melody.

See Alexander Woollcott's *The Story of Irving Berlin* (1925). A iscussion of his work will be found in Gilbert Seldes' *The Seven ively Arts* (1924).

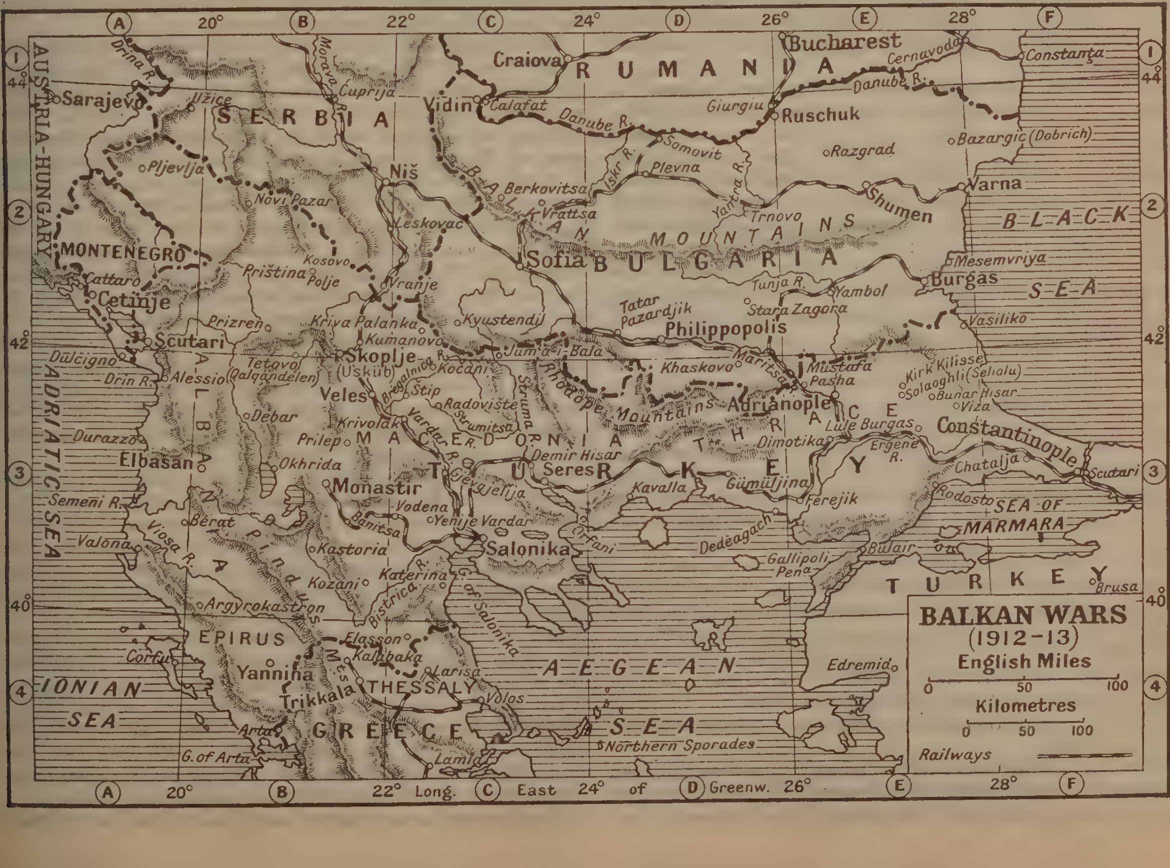
BALKAN WARS, 1912–13.—This article gives an account of he campaigns of Bulgaria, Serbia, Greece and Montenegro, as llies, against Turkey, in 1912 and 1913, and also of the brief truggle that followed between the former allies, with Turkey nd Rumania intervening, in the summer of 1913. When war roke out, all Macedonia, Albania and Epirus still formed part f the Ottoman Empire. This also included much of the hill ountry between Macedonia and Thrace, as well as Kosovo Polje and regions on the borders of Serbia and Montenegro, as he frontiers then existed, together with the tongue of territory orming the sanjak of Novi-Pazar that jutted up to the confines f the Austro-Hungarian Empire.

The Balkan League.—Military alliances, directed against Turkey, had been adjusted between Bulgaria and Serbia, and etween Bulgaria and Greece during the early part of 1912; and he state of Macedonia, under Ottoman rule, served as an excuse or them to order mobilisation on Sept. 30 and Oct. 1. War was leclared as soon as their armies were on their war footing, and ctive operations then at once commenced, Montenegro, which ad no formal agreement with the others, actually starting the ostilities. The Turkish regular forces in Europe at the time omprised 12 divisions of very weak establishment in Thrace, and 2 similar divisions stationed at various points in the extensive Ottoman territories further to the west; organisation of a sort also existed for about doubling the number of divisions on mobilisation; but it would not appear that the actual numbers available during the opening and decisive weeks of the struggle exceeded about 100,000 combatants in Thrace and about 140,000 in the western theatres. Large military forces, it is true, existed in Turkey in Asia; but, owing to the activities of the Greek fleet, these could not be transferred to any part of European Turkey other than Thrace.

Against this, Bulgaria possessed nine very strong regular divisions, numbering about 180,000 combatants, with two strong reserve divisions formed after mobilisation. Serbia promptly placed five somewhat weaker regular divisions in the field, making up a total of about 80,000 combatants, with five well-organised reserve divisions ready to follow. Greece could muster four regular divisions of somewhat weak establishment, the combatants at the start numbering perhaps 50,000, with four reserve divisions to be set up on mobilisation. The Montenegrin Army on the other hand was wholly on a militia basis and was but ill-suited for fighting, except among its own mountains or immediately outside its own frontiers. Thus the allies, at the outset, enjoyed rather the advantage in respect of numbers; and, thanks to their reserve formations being much the better organised, they retained and indeed increased this advantage during the weeks of hostilities that followed.

I. THE THREE THEATRES OF WAR

Owing to the geographical situation, there were bound to be three practically distinct main theatres of war when the struggle began, viz.: on the Turko-Bulgarian frontier of Thrace, on the frontier between Macedonia and the allied Powers, Bulgaria and Serbia, and on the frontier between Greece and Turkey. Under a military understanding between Bulgaria and Serbia, six of the nine Bulgarian regular divisions were to have been allotted to the eastern theatre of war, while the remaining three


BALKAN WARS
(1912–13)
English Miles
0 50 100
Kilometres
0 50 100
Railways
A B C D E F
1 2 3 4
20° 22° 24° 26° 28°
44 42 40
East Long. of Greenw.
AUSTRIA-HUNGARY
SERBIA
RUMANIA
BULGARIA
MONTENEGRO
ALBANIA
MACEDONIA
THRACE
TURKEY
EPIRUS
THESSALY
GREECE
BALKAN MOUNTAINS
Rhodope Mountains
ADRIATIC SEA
IONIAN SEA
AEGEAN SEA
BLACK SEA
SEA OF MARMARA
Bucharest
Craiova
Cernavoda
Constanța
Danube R.
Giurgiu
Ruschuk
Calafat
Vidin
Bazargic (Dobrich)
Razgrad
Somovit
Plevna
Isker R.
Yantra R.
Varna
Shumen
Trnovo
Berkovitsa
Vrattsa
Sofia
Mesemvriya
Burgas
Tunja R.
Yambol
Stara Zagora
Tatar Pazardjik
Philippopolis
Vasiliko
Kirk Kilisse
Solaoghli (Seliolu)
Bunar Hisar
Viza
Mustafa Pasha
Khaskovo
Maritsa R.
Adrianople
Lule Burgas
Ergene R.
Dimotika
Constantinople
Chatalja
Scutari
Rodosto
Gümüljina
Ferejik
Dedeagach
Bulair
Gallipoli Pena.
Brusa
Edremid
Kavalla
Seres
Demir Hisar
Orfani
Salonika
G. of Salonika
Yenije Vardar
Vodena
Gjevjeli
Struma R.
Strumitsa
Radovište
Stip
Kočani
Jum'a-i-Bala
Kyustendil
Kumanovo
Kriva Palanka
Vranje
Leskovac
Niš
Morava R.
Cuprija
Užice
Drina R.
Sarajevo
Pljevlja
Novi Pazar
Kosovo Polje
Priština
Prizren
Skoplje (Usküb)
Tetovo (Qalqandelen)
Veles
Bregalnica R.
Vardar R.
Krivolak
Prilep
Debar
Okhrida
Monastir
Banitsa
Kastoria
Kozani
Katerina
Bistrica R.
Elasson
Kalabaka
Larisa
Volos
Trikkala
Lamia
Yannina
Arta
G. of Arta
Corfu
Argyrokastron
Viosa R.
Berat
Valona
Semeni R.
Elbasan
Durazzo
Alessio
Drin R.
Dulcigno
Scutari
Cetinje
Cattaro
Pindus
Northern Sporades

co-operated with the Serbian Army in operations directed against Macedonia. But Bulgaria altered this arrangement at the last moment, retaining eight divisions for the east and employing only the remaining one in the western theatre, and this, moreover, as it turned out, moved independently toward Salonika. It was, from the purely military point of view, a sound decision, as the Turks could not be reinforced in Macedonia from Anatolia, whereas they could be so reinforced in Thrace; but the action of Bulgaria in the matter tended to cause somewhat strained relations between that kingdom and Serbia at the very start.

Campaign in Thrace.—It will be convenient to take the campaign in Thrace first. The Bulgarian staff organised its eight regular divisions, destined for Thrace, with the two newly formed reserve divisions, as three armies, the II. Army on the right of the Maritsa, prepared to move on Adrianople, the I. Army in the centre more to the east, and the III. Army on the left about Yambol, prepared to move on Kirk Kilisse. On the declaration of war, on Oct. 17, the three armies advanced and they passed the frontier on the 18th and 19th to the northwest and north of Adrianople, and on the 22nd to the northwest and north of Kirk Kilisse.

Adrianople was a great entrenched camp, composed of many forts and works, fairly well armed; Kirk Kilisse was also provided with some works, but they were not of an efficient character. The II. Army advanced against Adrianople and to the west of it, with a view to investment, while the I. Army followed a line more to the east and from the 22nd to the 24th was engaged with the enemy about Seliolu, the battle ending in its complete victory. On that same day the III. Army entered Kirk Kilisse, after some severe fighting, capturing an immense booty. The Turkish field forces had originally been formed up about the Ergene; but they had been ordered north to take the offensive, and had thus brought on the encounter battles at Seliolu and Kirk Kilisse, in which they were heavily defeated. They retreated in confusion to the line Lule Burgas—Bunar Hisar, the victorious Bulgarians, owing to having outrun supplies, losing touch with them and therefore giving them time to reorganise to some extent.

On discovering the direction of their opponents' retreat, the Bulgarian I. and III. Armies found themselves, in the first instance, called upon to make a wheel to the left. Severe fighting took place on the 28th, 29th, and 30th in the country between Lule Burgas and Viza in which both sides suffered heavily and which ended in the Turkish right near Viza becoming seriously endangered; Nazim Pasha, the Ottoman commander-in-chief, thereupon ordered a general retreat, and his troops fell back to the Chatalja Lines, covering Constantinople. The victors were too exhausted to pursue, so that all touch with the defeated army was lost for the moment. In the meantime, the Bulgarian II. Army had invested Adrianople, and some troops were pushed on to Dimotika and to Dedeagach on the Aegean Sea.

After a few days, the I. and III. Bulgarian Armies, being reinforced and having their lines of communications in working order, advanced towards the Chatalja Lines and after a brief pause delivered an assault upon them on Nov. 17. The attack was repulsed at all points with heavy loss, and the Bulgarian command, sobered by this untoward experience, refrained from making a second attempt. The remains of the Ottoman field forces in the country to the west of the lower Maritsa had in the meantime been surrounded and compelled to surrender at Ferejik. Operations in Thrace now came to a standstill for a fortnight, and then, on Dec. 3, an armistice was signed between Bulgaria, Serbia and Montenegro on the one hand, and Turkey on the other, Greece being no party to it for reasons which will appear later. The Bulgarian campaign in Thrace had been brilliantly successful, although Adrianople remained in Ottoman hands; but the operations of the allies in the west had been no less triumphant.

Macedonia and the West.—The Serbian authorities had been very happy in their mobilisation arrangements, and by the time that war was declared, they were already in a position to concentrate their five reserve divisions, as well as their five regular divisions close to the Turkish frontier. Their I. Army, of five divisions, was about Vranje; their III. Army, of four divisions, was further to the west, north of Priština; their II. Army, of one division, with the Bulgarian 7th Div., was about Kyustendil in Bulgaria. The plan was for the I. and III. Armies to advance southward into Kosovo Polje and on Üsküb, while the II. Army came in from the east and from Kyustendil, ready to operate against the right flank of the Turkish forces known to be assembled at Üsküb and to the north of it. The action of the Bulgarian staff in only sending the one division to this theatre, instead of three divisions as previously agreed upon, necessarily weakened the effect of the threat of the II. Army against the Ottoman communications, and the 7th Bulgarian Div. in fact afforded practically no help at all, being bent on an eccentric march on Salonika via the Struma valley.

All three Serbian armies crossed the Ottoman frontier on Oct. 19 and 20 through the mountains, meeting with slight resistance. The Turkish forces were necessarily much dispersed in view of the vast area of the territory to be guarded; but an army of five weak divisions in the Vardar valley had been moving northwards towards the Serbian frontier, and most of it reached Kumanovo on the 22nd. The head of the Serbian I. Army had arrived within a few miles of that place on the same day and had taken up a position, where it was attacked by the Turks on the following day but succeeded in holding its ground. The remainder of the I. Army came up on the 24th and a general action ensued in which the Ottoman troops were signally defeated. They fled southwards, evacuating Üsküb and withdrawing the detachments posted further to the northwest which had been opposing the advance of the III. Serbian Army from about Priština. The victors, however, hardly realised how complete had been their success and, hampered as they were by the difficulties of the country and the delays in bringing up their impedimenta from beyond the frontier, they failed to take full advantage of it. It was not till the 29th that their three armies had joined hands and were prepared for further advance.

The disorganised Turks had for the most part withdrawn partly down the Vardar, and partly from Veles by Prilep towards Monastir; and on becoming aware of this the Serbian staff made an entirely new disposition of available forces. The II. Army was sent off eastwards to aid the Bulgarians before Adrianople; part of the III. Army moved westwards into Albania; the I. Army, reinforced, moved southwards to co-operate with the Greeks in disposing of the Turks known to be gathered about Salonika and Monastir. The sanjak of Novi-Pazar had in the meantime been occupied by Serbian and Montenegrin detachments, and Montenegrin forces had advanced against Scutari, but they had failed to make any impression on its defences. Although some unimportant Ottoman detachments were still to be found in northern Albania, the whole of that portion of Turkey in Europe lying north of a line stretching from about Štip on the east, to just north of Scutari on the west, was by the end of October, for all practical purposes, in the hands of the allies, while the 7th Bulgarian Div. was moving down the Struma valley and approaching Demir Hisar.

Greece and Salonika.—In the meantime, the Greek military forces had not been idle. The main army, under command of Crown Prince Constantine, had been concentrated in northern Thessaly when war was declared. A smaller force was assembling near the Gulf of Arta, destined for offensive operations in Epirus. The Ottoman military authorities had only told off four weak divisions, partly regular and partly reserve, to guard against hostile invasion in this southern theatre of war, and the task of the Greek troops in the region immediately north of Thessaly, at the outset, proved a simple one. The Crown Prince crossed the frontier on Oct. 18, occupied Elasson next day, and on the 23rd routed the Turks a little further to the north, his left occupying Kozani on the 25th. His right advanced at the same time, and on the 28th occupied Katerina on the shores of the Gulf of Salonika, where an advanced maritime base was established.

The Turkish forces defeated near Elasson had for the most part retired on Monastir, where there was a considerable concentration of troops, owing to the army which had been defeated by the Serbs at Kumanovo having for the most part fallen back over the mountains towards this town. But Constantine, aware that the Bulgarians were on the move for Salonika, and determined for political reasons to get to that city first, merely pushed out one division north-westwards to guard his left flank, while with the bulk of his troops he advanced to Vodena. His position there was not wholly comfortable, for the Serbian forces were still a long way from Monastir and a Turkish army of three or four divisions had taken up position at Yenije Vardar so as to cover Salonika against hostile advance from the west. He attacked this position on Nov. 2 and 3, but was repulsed, and his flank guard was at the same time defeated at Banitsa and Kastoria by Ottoman troops that had been pushed south from Monastir. Two days later, however, a fresh attack upon Yenije Vardar proved successful, whereupon the Turks opposed to him there retired into Salonika, which he occupied on Nov. 9, 29,000 of the enemy laying down their arms.

On the following day the Bulgarian 7th Div. arrived and claimed the city for Bulgaria; but an agreement on the subject was patched up and the Crown Prince now divided his army in two, half remaining east of the Vardar, and the remainder moving westwards to co-operate with the Serbian forces in dealing with the enemy forces gathered about Monastir.

II. THE TURKISH COLLAPSE

Part of the Serbian I. Army had advanced to Prilep on Nov. 5 and had then halted for the remainder to come up in line, for Prince Alexander, who was in command, hoped to fight a decisive battle before Monastir with the whole of the troops that could be made available. The Turks had taken up a strong position north of the town and there they proposed to stand their ground. In the circumstances, Prince Alexander, whose impedimenta took time to cross the hills out of the Vardar valley, was not prepared to commit his army to the attack before the 14th. The date was subsequently deferred to the 18th, his plan being to deliver a frontal assault, while at the same time turning both of the enemy's flanks.

As it happened, however, the isolated Serbian division told off to operate against the Ottoman left delivered a premature night attack on the 15th, and had then to resist resolute Turkish counter-attacks during the succeeding two days, unsupported; but it managed to keep the enemy at bay, and when the battle was finally launched on the 18th, the Serbians were completely successful. The Turkish Army broke up. Half of it was killed, wounded, or captured; the other half made its way, in units or small parties, to the only friendly stronghold now left open—Yannina, in Epirus (Scutari was closely invested by this time). The victory of Monastir proved to be decisive, and all that remained for the allies to do in the western theatre of war was to march through Albania to the sea, occupying various points for police purposes, to reduce the two fortresses of Yannina and Scutari, and to take steps to meet the possibility of Austro-Hungarian intervention. Serbia and Montenegro therefore joined in the armistice that was signed on Dec. 3, as already mentioned, between Bulgaria and Turkey.

The Greek Govt., anxious to complete the occupation of Epirus and the capture of Yannina, were not parties to this suspension of hostilities. The operations north of the Gulf of Arta, in difficult country, had made somewhat slow progress at first; but on Nov. 10 Greek troops had arrived near Yannina, and within a few days a loose blockade had been established, which had not, however, prevented some of the Turkish fugitive detachments from entering the place after the battle of Monastir. A great part of the Hellenic field army was brought round by sea from Salonika during the winter, so as to ensure the fall of the fortress as soon as the weather should again become favourable for active operations.

Adrianople.—Negotiations between the belligerents were set on foot in London shortly after the armistice; but these were abruptly terminated on news arriving of a military *coup d'état* having been carried out on Jan. 23 at Constantinople, in which the existing Govt. was overthrown and Nazim Pasha, the commander-in-chief, was murdered. The military Govt. that had been set up denounced the armistice within a few days, and hostilities were resumed on Feb. 3, although Ottoman field armies had ceased to exist in Europe except within the Chatalja Lines and the Gallipoli Peninsula. The story of the second phase of this war is merely the final instalment of the sieges of Adrianople, Yannina, and Scutari. An effort was, it is true, made by the Turkish field forces in Thrace to debouch from the lines of Chatalja and Bulair with a view to relieving Adrianople, and this led to heavy fighting locally; but the Bulgarians held their own on both fronts, so Adrianople was perforce left to its fate by the Ottoman military authorities.

The terms of the armistice had not admitted of the revictualling of this extensive stronghold, which remained blockaded during the truce, and by the time that hostilities came to be resumed the garrison was already finding itself short of certain supplies. The investing forces at this time were composed of the Bulgarian II. Army, which had taken up the duty in the first instance, and of the Serbian II. Army, which had been transferred from the western theatre of war after the victory of Kumanovo. But although it soon became evident from attempts at sorties and increased desertion that the garrison was weakening, lack of transport and of artillery delayed preparations for an assault till the middle of March, and by that time the besiegers had been reinforced by three Bulgarian divisions which it was found possible to transfer from their former position before the Chatalja Lines.

The fortifications around the city of Adrianople consisted of a number of substantial, but very conspicuous, forts, with a girdle of infantry redoubts further out, the whole forming an extensive perimeter; but the only really modern works were a certain number of batteries, distributed in the intervals. The infantry redoubts, moreover, were open at the gorge—a serious source of weakness. The garrison at the time of the assault numbered about 50,000, and the allies chose the eastern side of the fortress for attack. A preliminary intensive bombardment of the works was carried out on March 24, and that night the whole of the advanced line on the eastern side was stormed. On the following night an assault was delivered upon the main position; but this was brought to a standstill by the Turkish wire, except at a point where one of the forts was captured by a single regiment. Although the commander of the regiment found himself at dawn to be isolated, he promptly struck out right and left against the rear of the works on either hand, and he thus cleared the way for unit after unit that had been held up by the frontal wire, so that within a few hours the whole line of eastern defences was in Bulgarian hands. Attacks were also being delivered at other points, and about mid-day on the 26th, the Turkish commandant surrendered unconditionally. The assault had cost the allies about 9,500 casualties.

Scutari.—Yannina had fallen three weeks earlier to a successful general assault delivered by the Greek troops under the Crown Prince. This took place on March 5 and the Turkish garrison, numbering about 30,000 wounded and unwounded, surrendered next day; at the end of March only Scutari remained to be taken. The Turkish commandant of this latter fortress had refused to recognise the armistice because its terms did not provide for his revictualling; but little actual fighting took place during the months of Dec. and Jan. On Feb. 7, however, a determined assault on important defences on the eastern side of the stronghold, which was only partially successful, was made by the Montenegrins; another was delivered next day, which made no progress. But on the 9th, the trenches were carried after a fierce combat, and the besiegers thereby gained a footing within the Ottoman line of defence. They, however, found that they could advance no further at this point.

A Serbian contingent had arrived shortly before this to take part in the siege, and the activities of the allies were now transferred to the south-western side of the fortress—its western side rested on Lake Scutari. Not until March 31 and April 1, however, was an assault attempted in this quarter, and then the undertaking failed. The Serbian general took over the chief command after this rebuff, but jealousies, military and political, speedily arose, and on April 16 he and his forces took their departure. The Montenegrins had now to take over the whole of the besieging line, and the stronghold seemed safe from further assaults in consequence, but it nevertheless suddenly capitulated on April 22. The Great Powers had, however, decided that the place was to belong to the new State of Albania, and, under pressure from them, the victors were obliged on May 6 to evacuate it.

III. THE SECOND BALKAN WAR

Negotiations with a view to bringing the contest to an end had by this time been in progress for some weeks, and peace was signed in London on May 30. Under its terms, Turkey in Europe was, with the exception of the country lying close to Constantinople and to the Gallipoli Peninsula, partitioned between the victors, Bulgaria acquiring the lion's share. But the Balkan League was on the point of explosion, the Great Powers were trying to establish an independent Albania, Rumania in alarm at Bulgaria's aggrandisement was preparing to intervene, and a portion of northern Macedonia and Kosovo Polje remained in dispute between that kingdom and Serbia. Bulgaria also coveted Salonika, and had during April and May transferred her military forces from Thrace to the vicinity of the old Serbian frontier and of the borders of Macedonia, in preparation for making good her claims in the west. A state of tension consequently existed throughout the month of June, and at last, on the 30th, without warning or declaration of war, Bulgaria assumed the offensive against both Serbia and Greece.

The Bulgarian staff had arranged their forces as five armies, the I. Army facing the Serbian frontier between Vidin and Berkovitsa, the V. Army on its left, the III. Army about Kyustendil, the IV. Army about Kočani and Radovište, and the II. Army between Strumitsa and Seres facing the Greeks. The Serbian forces were disposed in three armies, the II. Army guarding the old Serbo-Bulgarian frontier, the I. Army in the centre about Kumanovo and Kriva Palanka, and the III. Army on its right about the Bregalnica; the Greek forces were holding a front between Gjevgjelija on the lower Vardar and the mouth of the river Struma.

The Bulgarian offensive, benefiting by surprise, was in the first instance successful. Their IV. Army broke in between the allies, reached the Vardar at Krivolak, and with the aid of the III. Army thrust back the Serbian front for some distance between that point and Kriva Palanka; their II. Army at the same time drove the Greek advanced troops in all along the front. But the allies were disposed in considerable depth, the Bulgarian soldiery had little heart for fighting once it became apparent that their antagonists meant to resist, by the night of July 1 the offensive had already died down, and it was then the turn for the Serbian and Greek troops to counter-attack.

Pressing forward on July 2, the Serbian I. Army drove a wedge through the Bulgarian line in the direction of Kyustendil, and on the two following days hustled the defenders in a south-easterly direction; the Serbian III. Army was in the meantime effectually checking any further advance on the part of the enemy about the upper Bregalnica. The Greek Army had brought up its reserves, and on the 3rd and 4th it counter-attacked, forced the Bulgarian II. Army back all along the line, and by the 7th had effectually outflanked the enemy's left. The result of these operations in the south was that the Bulgarian II. Army found itself obliged to retreat northwards up the narrow Struma valley, running the risk of being cut off by Serbian forces should these, advancing from Kočani and Kriva Palanka, succeed in occupying Jum'a-i-Bala. So, in view of the critical position of affairs, the Bulgarians made a desperate effort to retrieve the situation by initiating a fresh offensive. Their I. and V. Armies moved forward by several routes to threaten old Serbia, only to be repulsed at all points by the Serbian II. and I. Armies. The Bulgarian III. and IV. Armies at the same time advanced against the Serbian III. Army in the direction of the upper Bregalnica, and this latter effort achieved some measure of success; but it also had been definitely checked by July 10.

A brief pause ensued. Then, on the 15th, both Serbians and Greeks began pressing slowly forward. Bulgaria was by thi time in a sorry plight, for Rumania had declared war and had begun an unopposed march on Sofia, while the Turks had issued from Chatalja and Bulair and had reoccupied Adrianople. By transferring their I. Army from the north to the hills east o Jum'a-i-Bala, and attacking the Greeks in the Struma valley with this and their II. Army, the Bulgarian staff made a fina attempt to stem the pressure. But the venture came to nothing and on July 31 the aggressors in this second campaign, surrounded by hostile columns that were converging on thei capital from every quarter, sued for peace. This was signed a Bucharest on Aug. 10.

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BALL, THOMAS (1819–1911), American sculptor (*see* 3.263) died at Montclair, N.J., Dec. 11 1911.

BALLET (*see* 3.269b).—At the beginning of the 20th century the ballet, as seen in Paris or Milan, the centres of the two classical schools, still lived on in the crystallised form that had been perfected 60 years earlier in the days of Taglioni; while its music scenery and costume still followed traditional ways and were regarded as accessories of minor importance. The supremacy of the old order remained unchallenged till 1906, when a new convention for stage dancing, initiated in America and perfected by an American, Isadora Duncan, appeared in Europe.

In this new form the maillot, the padded shoes and the ballet skirts gave way to bare feet, classic tunic and flowing drapery. There was no dancing *sur les pointes*, but stately movement from one deliberate "Greek" pose to another, to the accompaniment of music always carefully chosen from the works of Chopin Gluck or some equally famous master. It had the air of being easy and natural, but was really the outcome of much thought and long training. Miss Duncan's figure was lithe and supple her sense of rhythm was good, and she had acquired the certainty of balance that marks the first-rate dancer. Neither her dancing nor her theories were taken seriously till she arrived in St. Petersburg in 1907, where the two conventions met, the "classical" and the "classic," each at the highest point of its development. Reacting one upon the other, a new form emerged, the Fokine ballet, which combined the virtues of the two schools and quickly superseded both.

The Ballet in Russia.—The Russian Imperial Ballet was an institution that dated from the days of the Empress Elizabeth (1741–61). It had always enjoyed a full measure of Imperial favour, and had been kept in a state of high efficiency. From 1863 to the early years of this century its destinies had been ruled by Marius Petipa (born in Marseilles, 1819, died 1910), who had moulded it on the strictest lines of the Franco-Italian tradition. It was an age when long ballets were in favour, planned in five or six acts with prologue and epilogue, and lasting between three and four hours. Within the limits of its code the technical standard of the *corps de ballet*, which included almost as many men as women, was exceptionally high, and the virtuosity of its leading dancers was carried to the limits of human endurance. Apart from certain ballets by Tschaikovsky, the musical repertory was uninspired, and the mounting was as gaily irrelevant as anything the West could show.

After the resignation of Petipa and with the appointment of Michel Fokine as his successor several important changes began to appear. Fokine was strongly influenced by the theories of sadora Duncan, and it was in accordance with her teaching hat the best composers and painters were brought in to write nd decorate the new ballets, and that the ballets themselves were cut down to one act of such a length that three or four ould be played in one evening. Though the old technique was by no means abandoned, it was modified by the addition of many of the Duncanesque movements; and the bare feet and Greek tunic began to alternate with the traditional uniform. Within a year of his appointment Fokine managed to sweep away the accumulated traditions of two centuries, and the ballet was at last free to express itself in any form that the dramatic ubject demanded. The Russian Ballet remained practically unknown outside its own country till 1909, when a company rom the Marinsky Theatre of St. Petersburg appeared at the Châtelet Theatre in Paris. This visit had been arranged to ollow up the Exhibition of Russian Painting at the Autumn Salon of 1906 and the opera season of 1908, all three being designed to extend the knowledge of Russian art in the capital of their allies.

Development of the Diaghilev Ballet.—Serge Diaghilev (b. 1872), to whom the management of these three seasons had been entrusted, was known in Russia as one of the younger leaders of the Renaissance of Russian art. In 1894 he had planned and edited the first Russian review of the world's art, *Mir Iskusstvo*. Between 1899 and 1901 he had been attached to the service of the Imperial theatres under Prince Wolkonsky, but had been transferred to another post when it was found that his reforming zeal was displeasing to the official world. He was one of the warmest supporters of Isadora Duncan during her visit to St. Petersburg, and an equally staunch supporter of Michel Fokine when he began to put her theories into practice. For the Paris season he chose three of the new ballets of 1908, the *Pavillon d'Armide*, *Nuits d'Egypte* and *Chopiniana*, with the ballet from the opera *Prince Igor* and the best of the old type, Tschaikovsky's *Le Lac des Cygnes*. The success of the season was so marked that another was arranged for 1910 at the Opera, during which three of the most famous of ballets of his repertory were produced, *Scheherazade*, *Carnaval* and *L'Oiseau de Feu*. In these Diaghilev, now definitely in authority, was able for the first time to express his ideas fully, with choreography unfettered by too close adherence to any one theory, with music finely chosen and finely rendered, and with decorations that showed a judicious splendour in *Scheherazade*, and an equally judicious simplicity in *Carnaval* or *Les Sylphides*.

The company had by now accomplished the mission on which it had been sent, and with the cessation of state support, it became necessary for Diaghilev to take not only the artistic but the financial burden on his own shoulders. So in 1911 the "Diaghilev Ballets Russes" began the career of extended tours through all the capitals of Europe and America that has continued. For his dancers he still drew on Russia, but for all else he came to rely less and less on his own countrymen until it was almost exclusively to western Europe that he turned for his musicians and his painters. That this company, without a fixed home, with varying fortunes and an ever-changing personnel, has lived for so many years and never relaxed its experimental activities is a remarkable tribute to the genius of its creator. It has revived a moribund art and has revolutionised the world of dancing.

Choreography.—Up to the end of 1912 the choreography of all the ballets was the work of Michel Fokine. He was the great eclectic, the master of the composite ballet, who used the methods of Petipa, of Duncan and of the Russian folk dancers each in their proper environment with equal success; and his only comparative failures were in the two Greek ballets *Narcisse* and *Daphnis et Chloë*, when he worked exclusively in one idiom. He was the inventor of the modern ballet, and from his creations practically all the later developments can be traced. As a dancer Fokine was graceful and accomplished, but lacked the genius of his successor.

Vaslav Nijinsky took command for the season of 1913. He was much influenced by Jacques Dalcroze, a Swiss exponent of musical calisthenics, in accordance with whose theories the dancing in Debussy's *Jeux* was made to synchronise exactly with the beat of the music; while in Stravinsky's *Le Sacre du Printemps* the movement became a sort of rhythmic counterpoint in opposition to it. While both efforts had a scholarly interest neither proved satisfactory. In the latter ballet the loyalty of the company was severely tested, for the expression of primitive fear and rejoicing, demanded by the subject and its musical treatment, involved the rejection of all accepted canons of grace and the substitution of deliberate uncouthness. As a dancer, Nijinsky ranks among the greatest in history, and his premature retirement was an irreparable loss to the ballet.

Léonide Massine, who first appeared in 1914 in Strauss's *Légende de Joseph*, produced his first ballets in 1917. His work was a development of the Fokine ballet, sharpened by contact with Andalusian forms, which he studied closely before the production of Da Falla's *Tricorne*. His preference for angular rather than curved movement became more marked as time went on, especially in the ballets he designed for Diaghilev and Charles Cochran in 1924 and 1925. The best example of his inventive power was perhaps seen in *Le Rossignol* (1920), in his use of mass movements as foreshadowed by Nijinsky in *Le Sacre du Printemps*. As a dancer he is alert and certain in his balance, with a marked sense of rhythm.

Bronislava Nijinsky, Nijinsky's sister, designed the dancing in the ballets of 1922–4. Her choreography was vivacious but her sense of group movement a little deficient. Among the dancers, the more notable names are those of Tamara Karsavina, a dancer of perfect technique and compelling grace, who between 1910 and 1914 created most of the principal rôles; Lydia Lopokova who made her début in 1910 but who did not rejoin the company till 1918, when she reappeared in *Les Femmes de Bonne Humeur;* Vera Nemchinova, Lubov Tchernicheva, Olga Spessivtseva and Lydia Sokolova (Hilda Munnings), the only English dancer who could rank with them. Anna Pavlova danced with the company in 1909 and 1911. Among the men, in addition to the three *maîtres de ballet*, have been Adolf Bohm, Léon Woizikovsky and Stanislas Idzikovsky. The stage management remained throughout in the hands of Serge Grigoriev, and the principal teacher was Enrico Cecchetti, who retired in 1921.

Music.—The Diaghilev ballet proved the truth of Isadora Duncan's dictum that, for purposes of dancing, the quality of music is more important than the form in which it is written. Schumann's *Carnaval* and Rimsky Korsakov's symphonic suite *Scheherazade* have shown themselves as suitable for ballets as Tschaikovsky's *Casse-Noisette* or Delibes' *Sylvia*. Of Stravinsky's great ballets only the first, *L'Oiseau de Feu*, was written in detached numbers. His others, like those of Debussy, Ravel, da Falla and the younger French writers, are written in continuous form.

The orchestration of music written for the piano gave rise to adverse criticism in earlier days, but the orchestral versions of Chopin and Schumann were found to be so skilful and sympathetic that opposition was silenced. Tommasini and Respighi later on translated Scarlatti and Rossini as ably as Rimsky Korsakov and his friends had dealt with Chopin and Schumann. Stravinsky's version of Pergolesi in *Pulcinella* was perhaps more open to criticism owing to the very personal idioms he used. Manuel da Falla's *Le Tricorne* was the most successful of the later ballets, while the work of the modern French composers has not been so distinguished.

Decoration.—The outstanding name in this section is that of Léon Bakst (*q.v.*), who between 1910 and 1921 designed 14 ballets. In whatever style he might be working, Egyptian, Greek, Persian or Venetian, everything, while it was archaeologically justified, was impressed with his own rather flamboyant personality. His versatility was great, and his first two ballets, *Scheherazade* and *Carnaval*, came to represent the two main types of all the series of "Ballets Russes." The Western artists who decorated the later ballets, such as Pablo Picasso, André Derain and Georges Bracque, take higher rank as painters, but their work, always excepting Picasso's scenes for *Parade* and *Le*

Tricorne, seems to lack the instinctive and specialised sense of the theatre possessed by the Russian group, Alexandre Benois, Nicholas Roerich and Alexander Golovin. The essential qualities of Russian art were finely expressed by Michel Larionov in *Contes Russes* and Natalia Gontcharova in her setting of the opera ballet *Coq d'or*. Boris Anisfeld and Vladimir Polunin were the painters of most of the scenery; their difficult task was to translate on to 40-ft. canvases the intention of the two-ft. sketches furnished by painters of different nationality and outlook.

As regards the ballet outside the Diaghilev sphere there is little enough to record. In Russia itself the old decorations of Imperial days are used to adorn the old ballets, and as an institution it seems to have fallen under the ban which condemns all survivals of the *ancien régime*. In Paris and in Milan the stars rule the stage; the Pavlova ballet tours the world reaping a golden harvest from the virtuosity of its marvellous leader. The one independent company of higher endeavour, the Swedish Ballet, ended a short career (1919–24) that might have earned enduring fame had the dancing of its members been on the level of its leader's ideals and his powers of stage production.

List of Ballets.—The following is a complete list of the ballets produced by the Diaghilev company between 1909 and 1925.

M indicates the composer of the music, D the designer of the stage setting and costumes, C the choreographer:—

1909 *Le Pavillon d'Armide*, M—Tcherepnin, D—A. Benois, C—M. Fokine; *Prince Igor*, M—A. Borodine, D—N. Roerich, C—M. Fokine; *Le Festin*, M—Rimsky Korsakov, Tschaikovsky, Moussorgsky, Glinka and Glazounov, D—C. Korovin, C—M. Petipa; *Le Lac des Cygnes*, M—Tschaikovsky, D—A. Benois, C—M. Petipa; *Nuits d'Egypte* (*Cléopâtre*), M—Arensky, D—Léon Bakst, C—M. Fokine; *Chopiniana* (*Les Sylphides*), M—Chopin, D—A. Benois, C—M. Fokine.

1910 *Scheherazade*, M—Rimsky Korsakov, D—L. Bakst, C—M. Fokine; *L'Oiseau de Feu*, M—Igor Stravinsky, D—A. Golovin, C—M. Fokine; *Carnaval*, M—Schumann, D—L. Bakst, C—M. Fokine; *Giselle*, M—A. Adam, D—A. Benois, C—M. Petipa.

1911 *Sadko*, M—R. Korsakov, D—B. Anisfeld, C—M. Fokine; *Le Spectre de la Rose*, M—Weber, D—L. Bakst, C—M. Fokine; *Narcisse*, M—Tcherepnin, D—L. Bakst, C—M. Fokine; *Petroushka*, M—Stravinsky, D—A. Benois, C—M. Fokine.

1912 *Le Dieu Bleu*, M—Reynaldo Hahn, D—L. Bakst, C—M. Fokine; *Thamar*, M—Balakirev, D—L. Bakst, C—M. Fokine; *L'après midi d'un Faune*, M—C. Debussy, D—L. Bakst, C—V. Nijinsky; *Daphnis et Chloë*, M—Maurice Ravel, D—L. Bakst, C—M. Fokine.

1913 *Le Sacre du Printemps*, M—Stravinsky, D—N. Roerich, C—V. Nijinsky; *Jeux*, M—Debussy, D—L. Bakst, C—V. Nijinsky; *La Tragédie de Salomé*, M—Florent Schmitt, D—Soudeikine, C—Romanov.

1914 *Papillons*, M—Schumann, D—M. Doboujinski and L. Bakst, C—M. Fokine; *La Légende de Joseph*, M—Richard Strauss. Scenery, J. M. Sert. Dresses, L. Bakst, C—M. Fokine; *Midas*, M—Steinberg, D—D. Doboujinski, C—M. Fokine; *Le Coq d'Or*, Opera Ballet, M—R. Korsakov, D—N. Gontcharova, C—M. Fokine.

1917 *Soleil de Nuit*, M—R. Korsakov, D—M. Larionov, C—Leonide Massine; *Parade*, M—Erik Satie, D—P. Picasso, C—L. Massine; *Contes Russes*, M—Liadov, D—M. Larionov, C—L. Massine; *Les Femmes de Bonne Humeur*, M—Scarlatti, D—L. Bakst, C—L. Massine.

1918 *Les Jardins d'Aranjuez*, M—Fauré, Chabrier and Ravel, D—J. M. Sert, C—L. Massine.

1919 *La Boutique Fantasque*, M—Rossini, D—A. Derain, C—L, Massine; *Le Tricorne*, M—M. da Falla, D—P. Picasso, C—L. Massine.

1920 *Pulcinella*, M—Pergolesi, Stravinsky, D—Picasso, C—L. Massine; *Le Chant du Rossignol*, M—Stravinsky, D—H. Matisse, C—L. Massine; *Le Astuzie Femminili*, Opera Ballet, M—Cimarosa, D—J. M. Sert, C—L. Massine.

1921 *Chout*, M—S. Prokoviev, D—M. Larionov, C—M. Larionov, T. Slavinsky; *La Belle au Bois Dormant*, M—Tschaikovsky, D—L. Bakst, C—M Petipa.

1922 *Renard*, M—Stravinsky, D— and C—M. Larionov.

1923 *Les Noces*, M—Stravinsky, D—N. Gontcharova, C—B. Nijinska.

1924 *Les Biches*, M—F. Poulenc, D—Marie Laurencin, C—B. Nijinska; *Les Fâcheux*, M—G. Auric, D—G. Braque, C—B. Nijinska; *Les Tentations de la Bergère*, M—Monteclair, D—Juan Gris, C—B. Nijinska; *Le Train Bleu*, M—D. Milhaud, D—Chanel and H. Laurens, C—B. Nijinska.

1925 *Les Matelots*, M—G. Auric, D—P. Pruna, C—L. Massine; *Zéphyr et Flore*, M—Dukelsky, D—G. Braque, C—L. Massine; *Barabau*, M—Rieti, D—Maurice Utrillo, C—Balanchin.

See W. A. Propert, *The Russian Ballet in Western Europe* (1921).

(W. A. P.*)

BALLIN, ALBERT (1857–1918), German shipowner, was born in Hamburg Aug. 15 1857. Educated for a mercantile career, his first notable achievement was the organisation of the emigrant traffic on the Carr Line. He then took over the management of the passenger traffic on the Hamburg-Amerika Line, becoming, in 1886, director and shortly afterwards director-general of that enterprise. Under Ballin's leadership the Hamburg-Amerika Line expanded steadily, acquiring numerous other shipping companies and increasing its capital tenfold. By negotiating agreements with other shipping companies, Ballin practically reorganised Germany's shipping trade; and he was the author of the German-American shipping agreement of 1902. He died suddenly in Hamburg Nov. 9 1918.

BALLISTICS (*see* 3.270).—General agreement is to be found in the treatment of exterior ballistics in various countries, but the subject of interior ballistics, which is concerned with the behaviour of the gun, the projectile and the charge while the projectile is in the bore, has led to widely different methods of treatment.

I. INTERIOR BALLISTICS

The complexity of the physical laws involved makes the subject a very difficult one to treat with completeness theoretically, and the aim of most methods is to produce a solution which is in general accord with the theoretical laws as at present known, but which contains undetermined coefficients whose values can be adjusted so as to make the calculated results agree with the observed results in particular cases.

The maximum pressure inside the bore, and the muzzle velocity of the projectile on leaving the bore, are the quantities whose determination is most important—any rational method with two undetermined coefficients can be used to give agreement with observed results for maximum pressure and muzzle velocity in the case of one particular gun, charge and projectile. The soundness of the method employed will determine whether the results for other guns, charges and projectiles can be predicted with reasonable accuracy. In view of the divergencies between published systems, it is convenient here merely to indicate the systems of equations used, and the physical laws involved in any method, and then to give references to detailed accounts of each method.

Laws of Burning of Propellants.—The actual problem of interior ballistics is, of course, that of the mode of expansion of gases under high pressure. The problem is slightly different from those ordinarily met with in the domain of physics in that the mass of the gas is constantly being added to as the propellant burns, so that the first problem to be solved is the rate at which the propellant burns, and the dependence of this rate on the existing conditions of pressure, temperature and density. Modern propellants are for the most part colloids, and charges are composed of a number of grains of definite size and shape. For colloid propellants Piobert's "Law of Burning by Parallel Layers" is well established. This law states that at any instant during the burning of the grain the thickness burnt through in the direction normal to the exposed surface is the same over the whole surface.

The rate of burning of the thickness is a property of the propellant. Most methods assume that this rate of burning is a function of the pressure only and, following Sarrau (1876), use the relation

$$\frac{dy}{dt} = \mathrm{BP}^{\alpha} \qquad (1)$$

where y is the fraction of the normal thickness burnt off at time t, P is the mean pressure at that time, and B and α are constants depending upon the propellant.

The systems in use differ chiefly in the choice of α; some values in use are:—

(1) $\alpha = 1$ (English and American practice; also used by Charbonnier and Sugot—France).

(2) $\alpha = \frac{2}{3}$ (Gossot and Liouville—France).

Function of Form.—Equation (1) yields information as to the rate at which the thickness is burnt away. Obviously the rate at which the volume is being consumed, that is to say the rate at which gas is being produced, will further depend upon the area exposed to burning at any instant. Thus, for a charge of given mass, one composed of small grains would be expected to be burnt more quickly than one composed of large grains. Thus the form of the grain must be taken into account. The different forms employed may be divided into three main groups:—

(1) Those which burn with a continually decreasing surface. To this group belong all solid grains and short cylinders with an axial perforation.

(2) Those which burn with a practically constant surface, such as long thin tubes.

(3) Those which burn with an increasing surface to a certain stage, the grain then breaking up into other forms quite different from the original shape. An example of this type is a cylindrical grain pierced longitudinally by a number of holes.

Since it is the volume of charge burnt that determines the amount of gas present at any instant, it becomes necessary to determine a relation between Z, the fraction of the charge burnt, and y, the fraction of the thickness of the grain burnt.

Charbonnier introduced the idea of a "function of form." Let S_0 be the initial surface of the grain, and S the surface when a fraction Z of the grain is burnt. Then, depending upon the geometry of the grain, it is easy, using the law of burning by parallel layers to deduce a relation of the type

$$S = S_0 \cdot \Phi(Z) \qquad (2)$$

$\Phi(Z)$ is the "function of form."

The combination of equations (1) and (2) leads to an equation

$$\frac{dZ}{dt} = C \cdot P \cdot \Phi(Z) \qquad (3)$$

where C is a constant. This is the required equation giving the rate of consumption of the charge at any instant.

In England and elsewhere a somewhat different practice is adopted. Instead of considering the surface exposed at any instant it is usual to deduce, from the geometry of the grain, an equation of form of the type

$$Z = f(y) \qquad (4)$$

and to use equations (1) and (4) in combination instead of the single equation (3), as in Charbonnier's system.

Characteristic Equation of the Gases-Expansion Equation.—The next step in the solution of the problem is to consider the behaviour of the gases when produced. Most methods take as characteristic equation a modified form of Van der Waal's Equation, namely,

$$P(V-\eta) = RT \qquad (5)$$

with the usual notation, due allowance being made, in calculating V, for the space occupied by the unburnt propellant.

V and η, of course, depend upon the amount of gas produced, that is, upon Z, and V also depends upon x, the distance the projectile has moved at time t, and upon the initial air-space.

Once burning is complete the relation between V and x is

$$dV = A \cdot dx \qquad (6)$$

where A is the area of cross-section of the bore.

Some methods assume that the expansion during burning is isothermal and equation (5) is written

$$P(V-\eta) = \lambda \qquad (7)$$

where λ is a constant.

Others assume that the expansion is adiabatic, or partly adiabatic and partly isothermal, and write

$$P(V-\eta)^K = \lambda \qquad (8)$$

where K is some constant intermediate in value between unity and the ratio of the specific heats of the gases. Whatever assumptions are made, the object is to produce a relation between P, Z and x which shall hold during burning. This relation is the "expansion equation." The motion of the projectile can now be considered in two stages, namely, during burning and after burning.

Motion while the Charge is being Consumed.—It is most convenient to take either Z, or y, as the independent variable during this stage, as each ranges from 0 to 1 during the stage, and supplies definite limits for any necessary integrations.

The variables concerned are P, x, t and Z, if Charbonnier's Function of Form is used. Thus three equations will be necessary in order to complete the system.

Equation (3) between Z and t, and the expansion equation between P, Z and x, are two, and the third is supplied by an equation of motion or energy, which, in its simplest form, can be written

$$m \cdot \frac{d^2x}{dt^2} = A \cdot P \qquad (9)$$

where m is the mass of the projectile.

If equation (4) is used as the equation of form, equations (1) and (4) replace equation (3), and the four equations now provide the complete system for the five variables P, Z, y, x and t. There is no difficulty in the integration of the equations.

Motion after the Charge Is Consumed.—Most methods take this phase as being adiabatic expansion and write

$$P(V-\eta)^{\gamma} = \text{const.} \qquad (10)$$

where γ is the ratio of the specific heats of the products of combustion. This, together with the equation of motion, forms the complete system for this phase. The most convenient independent variable to use is x, the shot travel, or, which is much the same thing, to use V, the volume. Methods differ in the choice of γ, some taking it to be 1·2, others leaving it undetermined, and fixing its value in particular cases by the comparison of calculated values with observed values of the velocity. Most methods agree in taking γ as constant over the range of temperatures occurring in a gun.

Secondary Considerations.—So far nothing has been said concerning the energy expended in (1) Engraving the driving band of the projectile; (2) Friction between the band and the rifling; (3) Rotation of the projectile; (4) Recoil of the gun; (5) Kinetic energy of the gases; (6) Heat losses by conduction through the material of the gun.

It is in allowing for these losses that the difficulty of reconciling calculated results with observed results arises. In general, the heat losses by conduction are considered negligible, and the others are usually compensated for by writing, instead of m, the mass of the projectile, a fictitious mass m', given by the equation

$$m' = i(m+\mu c) \qquad (11)$$

where i is a correction coefficient and is greater than unity, and μc is the mass of the charge.

$$0 < \mu < 1.$$

Another point to be considered is the pressure at which the projectile commences to move, known as the "shot-start" pressure. An obvious simplification is to take this as zero; this assumption is made in many methods in use. Hadcock (*Proc. Roy. Soc.*, A, vol. 94) in his system allows for a definite shot-start pressure.

Thermodynamical Method.—A method differing in principle from most others is that of Henderson and Hassé (*Proc. Roy. Soc.*, A, vol. 100). The authors give first of all an account of the chemistry of the explosion, and finally evolve an expression for the heat-content of the gases as a function of the absolute temperature only. By the use of an equation of form, a rate of burning law, and equating the energy lost by the gases to the kinetic energy of the projectile (allowing for losses by a fictitious mass m'), the system of equations is complete. Full details of the solution are given in the paper cited. This method further differs from others in that no assumption is made as to the constancy of the ratio of the specific heats.

Monomial Formulae.—Sarrau and others have attempted to express the muzzle velocity and maximum pressure by means of monomial formulae obtained empirically. Such formulae have no theoretical foundation, and are of very restricted application, inasmuch as they are the equivalent of the differential coefficients of muzzle velocity and the maximum pressure with respect to the variables involved for one particular set of values of those variables. They can be relied upon to give accurate results only for cases varying very little from the particular one upon which they were based.

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II. EXTERIOR BALLISTICS

Modern developments in artillery material, and more especially the requirements of anti-aircraft gunnery, have rendered essential a knowledge of the elements at all points of a trajectory, and not merely those at the point of fall, as heretofore.

Law of Air Resistance.—The air resistance R, depends upon 1. The velocity, v, of the projectile. 2. The calibre, d, of the projectile. 3. The shape of the projectile. 4. The steadiness in flight. 5. The physical characteristics of the air in which the projectile is moving, namely, the density, viscosity and elasticity.

For a projectile of given shape and steadiness, dimensional considerations lead to the form

$$R \propto \rho d^2 v^2 f\left(\frac{v}{a} \cdot \frac{vd}{\nu}\right) \qquad (1)$$

where ρ = the density of the air,
a = the velocity of sound in air (a measure of the elasticity),
ν = the kinematic viscosity,
f is a function of the two arguments $\frac{v}{a}$ and $\frac{vd}{\nu}$, both of no dimensions,
f is called the *drag coefficient.*

At velocities less than the critical velocity

$$f = A \cdot \frac{\nu}{vd}$$

and the expression (1) reduces to the form

$$R = A \cdot \rho \cdot dv \cdot \nu,$$

the ordinary expression for the resistance of a viscous fluid.

At velocities greater than the critical velocity,

$$f = \mathrm{A}\cdot\frac{\nu}{vd}+\mathrm{B},$$

where B is some constant. As v increases the value of the second term becomes of more and more importance, till at velocities of the order of 600 ft./sec. f is practically constant, and the expression (1) leads to a quadratic law of resistance.

At still higher velocities, the argument $\frac{vd}{\nu}$ has little effect, and in most ballistic work it is assumed that

$$\mathrm{R} \propto \rho\cdot d^2\cdot v^2\cdot f\left(\frac{v}{a}\right). \tag{2}$$

Experiments of Bashforth, and later those of the Gavre Commission, 1888, were all directed to the determination of $v^2\cdot f\left(\frac{v}{a}\right)$ as a function of v only, whereas it appears from the foregoing that the value of a, in other words an elasticity effect, also should be taken into account. Thus the effect of a change of temperature will be twofold—firstly, it will affect the density, ρ, and secondly it will affect the elasticity, and hence a.

Density of the Air.—Since the resistance depends upon the air density, any small arc method will demand a knowledge of the density of the air at each point of the trajectory. As is well known, this density diminishes with height, and it is usual to assume a standard density lapse, given by a formula of the type

$$\rho = \rho_0\cdot c^{-hy} \tag{3}$$

where ρ = density at a height y,
ρ_0 = density at ground level,
and h is a constant.

This may be expressed more generally in the form

$$\rho = \rho_0\cdot\mathrm{H}(y), \tag{4}$$

where $\mathrm{H}(y)$ is some function of the height: $\mathrm{H}(y)$ may be given as a formula or in tabular form.

Trajectories are calculated for this assumed density structure, and any variations from this assumed law are allowed for in differential variations.

Ballistic Coefficient.—From (2) the resistance to a projectile of given shape and steadiness is given by

$$\mathrm{R} \propto \rho\cdot d^2\cdot v^2\cdot f\left(\frac{v}{a}\right).$$

As in 3·271 it is assumed that the shape and steadiness can be allowed for by coefficients κ and σ respectively, and the retardation, r, experienced by a projectile of mass m, and coefficients κ and σ is given by

$$r = \frac{\kappa\cdot\sigma\cdot\rho\cdot d^2\cdot v^2\cdot f\left(\frac{v}{a}\right)}{m}. \tag{5}$$

The quantity $\frac{m}{\kappa\cdot\sigma\cdot\rho\cdot d^2}$ is denoted by C, and is called the *ballistic coefficient.* C, as thus defined, depends upon the density, and therefore upon the height.

With this notation, (5) becomes

$$r = \frac{v^2\cdot f\left(\frac{v}{a}\right)}{\mathrm{C}}. \tag{6}$$

Choice of the Resistance Law.—As has been pointed out, all previous experiments have been directed towards the expression of the drag coefficient as a function of v alone, and not of $\frac{v}{a}$. Further, in the application of these experimental results to the compilation of tables for use in the calculation of trajectories, attempts have been made to give the law of resistance a functional form.

Thus, the results of Shoeburyness experiments of 1906 have been expressed in the form $\mathrm{R} = \mathrm{A}v^n$, where values of A and n were given for different regions of velocity. A and n were so chosen that the aggregate was a continuous function, but the differential coefficients were discontinuous at the points where A and n changed—the "n-junctions" as they are called. This being so, any attempt at checking step-by-step integration by the method of differences will break down at these points.

In France the method has been to utilise the Gavre Commission results; these results have been smoothed, and attempts have been made to express them by a continuous function which also has continuous differential coefficients. One such formula, based on the Gavre results, is that of Le Chef d'Escadron Démogue, and is as follows:—

$$\log f(v) = \log\left[0{\cdot}2550+\frac{\sqrt[4]{1+0{\cdot}0392\left(\frac{v^1}{10}\right)^8}}{27226+494\,v'^2}\cdot \tan^{-1}v'\right] \tag{7}$$

where $\tan^{-1}v'$ is expressed in minutes of arc and $v' = \frac{v-330}{550}$ (where v is in metres per sec.).

All small arc methods used at present depend on a resistance law (or tables of resistance) given as a function of v only. When experimental methods yield a law based on the argument $\frac{v}{a}$, it will be essential to consider the value of a at each point of the trajectory, thereby taking into account the elasticity effect. With this remark, the following work will refer to the resistance law as $\rho.d^2.v^2.f(v)$, since existing tables afford this information only. Equation (6) will thus become

$$r = \frac{v^2\cdot f(v)}{\mathrm{C}}. \tag{8}$$

The Differential Equations of Motion of the Projectile.—Treating the projectile as a heavy article, the equations of motion are of the form

$$x'' = -r\cos\theta \tag{9}$$
$$y'' = -g-r\sin\theta \tag{10}$$
$$x' = v\cos\theta. \tag{11}$$
$$y' = v\sin\theta \tag{12}$$

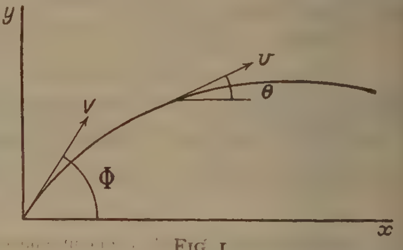

FIG. 1.

x', y', x'', y'', have the usual significance, and θ is the angle that the tangent to the trajectory makes with the horizontal.

From the above equations of motion, the following equation follows immediately

$$g\cdot\frac{d(v\cos\theta)}{d\theta} = r\cdot v. \tag{13}$$

Equation (13) contains only the two variables v and θ (if, for the moment, the dependence of C on y is neglected). It is the differential equation of the hodograph and serves as the starting point for most of the small-arc methods, and for this reason is sometimes referred to as the *principal equation.*

Integration by Small Arcs.—Briefly stated, the problem is: given the elements x, y, v, θ, t and the ballistic coefficient at the beginning of an arc of the trajectory and one element at the end of the arc (this element thus fixing the size of the arc), to determine the other elements at the end of the arc. (See fig. 1.) The methods in use differ chiefly in the element used to fix the arc; this element is usually referred to as the independent variable.

The French method is to use θ as the independent variable, choosing the size of arc so as to have a given total curvature, usually a whole number of degrees. The method used is the *Méthode G.H.M.*[1] In Great Britain and the U.S.A. time is used as the independent variable. Italian methods make use of a generalisation of Siacci's method (Bianchi), in which the chord and its perpendicular are taken as the co-ordinate axes for each arc. According to Cranz, the Germans make use of a purely graphical method of integration.

Integration in Small Arcs—Time as Independent Variable.—The suffix 0 will refer to values at the beginning of the arc, and the suffix 1 to those at the end.

q will be used to denote $v\cos\theta$, the horizontal component of velocity.

Equations (8) and (13) lead to

$$\frac{d(v\cos\theta)}{d\theta} = \frac{v^3f(v)}{\mathrm{C}g} \tag{14}$$

Also from the equations of motion

$$\frac{dt}{d\theta} = -\frac{v}{g\cos\theta}. \tag{15}$$

Hence

$$\frac{dq}{dt} = \frac{d(v\cos\theta)}{dt} = -\frac{v^2f(v)\cos\theta}{\mathrm{C}}. \tag{16}$$

$$\int_{q_0}^{q_1}\frac{1}{q^2}\,dq = -\int_{t_0}^{t_1}\frac{\sec\theta\, f(v)\,dt}{\mathrm{C}} \tag{17}$$

leading to

$$\frac{1}{q_1}-\frac{1}{q_0} = \frac{\sec\bar{\theta}\, f(\bar{v})}{\bar{\mathrm{C}}}(t_1-t_0) \tag{18}$$

where $\bar{\theta}$, v, and $\bar{\mathrm{C}}$ are appropriate mean values estimated from the values for preceding arcs; $f(v)$ is at once obtained from tables.

It follows from (15) that

$$\int_{\theta_0}^{\theta_1}\sec^2\theta\cdot d\theta = -\int_{t_0}^{t_1}\frac{g}{q}\cdot dt \tag{19}$$

integrating

$$\tan\theta_0-\tan\theta_1 = \frac{g}{q}(t_1-t_0). \tag{20}$$

Further

$$x_1-x_0 = \bar{q}(t_1-t_0) \tag{21}$$
$$y_1-y_0 = \tan\bar{\theta}(x_1-x_0) \tag{22}$$

---

[1] Garnier-Haag-Marcus. A full account of it is to be found in Garnier: *Calcul des trajectoires par arcs successifs*—Gauthier-Villars (1919).

Equations (18), (20), (21) and (22) are the working equations. (t_1-t_0) is chosen so that the above equations are true to some predetermined numerical accuracy.

As a first approximation, the following mean values are taken

$$\begin{aligned}\bar{q} &= \tfrac{1}{2}(q_1+q_0)\\ tan\,\bar{\theta} &= \tfrac{1}{2}(tan\,\theta_1+tan\,\theta_0)\\ \bar{y} &= \tfrac{1}{2}(y_1+y_0)\\ \bar{v} &= \bar{q}\sec\bar{\theta}\end{aligned} \qquad (23)$$

The procedure may be summarised as follows:—

(1) From previous arcs estimate $tan\,\bar{\theta}$, $\bar{C}$, and $\bar{v}$ and so, from equation (18) and the known value q_0, calculate q_1.

(2) With this value of q_1, calculate $\bar{q}\sec\bar{\theta}$, which should now be checked against the estimated value of v.

(3) If the two values do not agree, use the calculated value of $\bar{v}$ as a fresh estimate of $\bar{v}$, and repeat the process till no difference (to the degree of accuracy employed) is obtained.

(4) The values of x_1, y_1 and θ_1 are at once obtained from the working equations, and the next arc can now be calculated.

It will be found necessary to use small values of (t_1-t_0), say $\frac{1}{4}$ second, when v is near the velocity of sound in air, as $f(v)$ will be changing rapidly in this region.

The above procedure makes use of estimates from the preceding arcs. In the case of the first few arcs, therefore, the procedure is somewhat different.

From equations (14) and (15)

$$\frac{\delta q}{q}-\frac{vf(v)}{C}\delta t \qquad (24)$$

From the initial conditions, namely, the muzzle velocity, angle of departure, and value of C at the ground level, an estimate of δq and therefore of q for the first arc can be made. Hence, from equations (20) and (22) $(tan\,\theta_1-tan\,\theta_0)$ and (y_1-y_0) are obtained.

These values lead to values of $\bar{C}$, $sec\,\bar{\theta}$, and $\bar{v}$ sufficiently accurate for a first working of the arc. From the results, better estimates are made and the arc is reworked, the process being repeated till the required degree of agreement between estimated and calculated values is obtained.

The second and third arcs are worked on similar lines, except that the results for the first arc facilitate the estimation of δq.

The fourth and succeeding arcs can now be worked by the general process.

Differential Variations.—In the calculation of trajectories a certain set of standard conditions has been assumed, namely: (1) Earth motionless. (2) No wind. (3) Standard density structure. (4) Muzzle velocity, V, and the ballistic coefficient, C, are constant and known. (5) Further, if $\frac{v}{a}$ is admitted as the argument of the drag coefficient, a standard temperature (or elasticity) structure will have to be specified in addition to the density structure.

The effect of small variations in the initial conditions, V, C and ϕ can be found by interpolation between calculated trajectories. For other variations, it has been found desirable to consider variations in the elements of the trajectory as functions of the variations from normal conditions to which they are due, and to solve the differential equations of the variations by an extension of "small-arc" methods. Such a method is that discovered by Professor G. A. Bliss and improved by Dr. T. H. Gronwall.

Effect of Wind.—The effect of a uniform wind throughout the trajectory can be calculated by a simple consideration of the velocity of the shell *relative to the air*, it being borne in mind that this is the velocity for which ballistic tables are calculated.

Wind velocities being small compared with projectile velocities, it will be seen that the uniform wind may be resolved into two components, one in the plane of fire, and affecting the range, but not the line, and the other perpendicular to this plane, and affecting the line only. In general, of course, the direction and speed of the wind will seldom be uniform throughout the trajectory. It being assumed, however, that the wind structure can be determined by observation, the method of correction is exhibited in the following paragraph:—

Weighting Factors: Application to Conditions Varying throughout the Trajectory.—Let there be some condition E (maybe wind, density, elasticity, etc.) which is not that for which the normal trajectories were calculated, and which does not vary by the same amount from normal throughout the trajectory, but whose variation from normal at any particular point is known. The trajectory is divided into a number of zones, generally 10, of equal height. The mean variation from normal of E in each zone is known.

Let ΔR_0 be the range correction for a variation ΔE of E from normal throughout the whole trajectory.

Let ΔR_p be the total range effect produced by a variation ΔE in the p^{th} zone alone, E being considered normal in all the other zones. (This can easily be done by small arc methods.)

Hence $$\Delta R_0 = \sum_{p=1}^{p=10} \Delta R_p.$$

The ratios $\frac{\Delta R_1}{\Delta R_0}, \frac{\Delta R_2}{\Delta R_0}$ are denoted by the quantities w_1, w_2, and are called weighting factors, since they show the weight of the variation ΔE in each zone.

Now let the variation of E from normal be different in each zone, ∴ δE_1 in the 1st zone, δE_2 in the 2nd zone, and so on. Then, the variations possessing the proportional property of 1st order variations,

$$\text{Range effect in 1st zone} = \frac{\delta E_1}{\Delta E}\cdot\Delta R_1 = w_1\delta E_1\cdot\frac{\Delta R_0}{\Delta E}$$

$$\text{Range effect in 2nd zone} = \frac{\delta E_2}{\Delta E}\cdot\Delta R_2 = w_2\delta E_2\cdot\frac{\Delta R_0}{\Delta E}$$

and, by summation,

$$\text{Total range effect, } \Delta R = \frac{\Delta R_0}{\Delta E}\cdot \sum_{1}^{10} w_p\cdot\delta E_p,$$

that is to say $\sum_{1}^{10} w_p\cdot\delta E_p$ is the variation in E which, if uniform throughout the trajectory, would produce the same effect as the given variations in the different zones. Hence, given the weighting factors, and the variations in each zone, the problem is reduced to finding the effect of a uniform variation throughout the trajectory, and this follows from the principal variations already calculated. Weighting factors are calculated and classified according to the height of the trajectory concerned. They can be calculated for range wind, cross wind, density,[1] and elasticity.[2]

The following are typical values of cross wind weighting factors:—

Vertex Height	No. of zone counting upwards from ground									
	1	2	3	4	5	6	7	8	9	10
1,500 ft.	·05	·06	·07	·07	·07	·09	·09	·10	·15	·25
4,000 ft.	·08	·08	·08	·08	·08	·09	·09	·10	·10	·22
12,000 ft.	·05	·06	·06	·07	·07	·08	·08	·10	·13	·30

The above table brings out the greater importance of variations in the top zones compared with those near the ground.

Rotation of Projectiles—Yaw—Drift—Stability.—Thus far the projectile has been considered as a heavy particle, and no account has been taken of the rotation necessary to keep it point foremost, nor of the forces that may be called into play by any oblique presentation of the elongated projectiles. Jump card[3] experiments have shown that the axis of the projectile does not always lie along the tangent to the trajectory. The angle between them is called the angle of yaw. When yaw is developed the line of the resultant air pressure intersects the axis at a point in front of the centre of gravity, and this air pressure exerts a moment about the centre of gravity in such a direction as to increase the yaw. Due to the rotation of the projectile about its axis, precession and nutation of the axis ensues. If the spin is insufficient, this moment may cause the projectile to become unstable.

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BALLOON: *see* AIRSHIP.

BALMONT, CONSTANTINE (1867–), was born June 3 1867 at Gumishche, in the province of Vladimir, on his father's estate. A scholar of Elizabethan drama and of Shelley, he first became known as the translator of the latter and the apostle of his ideas. His extensive travels in South Africa, Mexico, New Zealand and Spain account for the exotic vein in his poetry. He produced his best work during the 'nineties and the early years of the present century. The very titles of the volumes published during this period—*Under the Northern Sky* (1894), *Silence* (1898), *In Boundless Space* (1895), *The Burning Buildings* (1900), *Only Love* (1903), *Let us be like the Sun* (1903)—indicate the stages of his development from pure aestheticism to an aggressive and partly anarchical Nietzschean poetry, which brought him immense popularity and made him the acknowledged head of a younger generation of Russian symbolists. This vogue has long since passed, but he remained one of the finest of modern Russian lyric poets. *The Liturgy of Beauty* (1905), *Evil Charms* (1906), *The Bird of Flame* (1907) are representative of his later work. He has also written several volumes of prose. In 1918, shortly after the outbreak of the Bolshevik revolution, he went to live in Paris.

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[1] In practice, temperature weighting factors (for density effect only) are calculated instead of density weighting factors, as it is easier to measure temperature variations from a standard temperature structure than actually to measure densities.

[2] The application of elasticity weighting factors is in process of development.

[3] A very complete account of jump-card experiments and their analysis, and the conditions of stability, will be found in the "Aerodynamics of a Spinning Shell," by R. H. Fowler, E. G. Gallop, C. N. H. Lock and H. W. Richmond, F.R.S. (*Phil. Trans. Roy. Soc.*, A, vol. 221), and Part II. of a paper on the same subject by R. H. Fowler and C. N. H. Lock (*Phil. Trans. Roy. Soc.*, A, vol. 222).

BALTIMORE (*see* 3.288).—The population of Baltimore, the eighth city of the United States in number of inhabitants, increased in the decade 1910–20 from 558,485 to 733,826, of which number 108,390 in 1920 were negroes, as compared with 84,749 in 1910. The population in 1925 was estimated at 794,000. The taxable basis increased from $915,433,444 in 1918 to $1,543,064,251 in 1925.

Manufactures.—In 1919 the capital invested in manufactures was $434,243,740; the value of their output was $677,878,492, and the wage-earners in manufacturing plants numbered 97,814. In 1923 the wage-earners increased by 4,963 and the manufacturing capital by $15,992,500. This great increase may be attributed to differential freight rate on goods from the west, deep-water manufacturing sites, steamship connections, coastwise and foreign, and abundance of labour. Baltimore is a popular city with labour because in normal times its markets are notably cheap, and the continuance in Maryland of the ground-rent system makes possible the purchase of homes by labouring men on easy terms. In 1923 permits were granted for the construction of 4,203 dwellings, and other building permits increased the total to 20,303. Of 130,000 residences, 62% are owned by the occupants. In 1922 Baltimore handled 4,326,000 tons of foreign merchandise and 1,103 vessels cleared for foreign ports.

Municipal Improvements.—The physical characteristics of Baltimore have been much altered since 1910. By a paving loan of 1906, and by a special paving tax of 1912, funds were provided for the conversion of 210 m. of the cobblestone streets into modern smooth-paved ones at a cost of $9,500,000. Three concrete tubes were constructed in the bed of Jones Falls, which had become an unsightly open sewer, and into these the stream and an additional flow of storm-water sewage were directed and carried through the city for a mile and a half. On top of these tubes a highway was constructed, known as the Fallsway, which relieved the congestion of north and south traffic between the water front and the uptown railway yards. At a cost of $23,500,000 the main work of installing a new sewerage system, begun in 1905, was completed in 1916. A dam at Loch Raven, with a capacity of 2,000,000,000 gal., and a filtration plant at Montebello for impounding and purifying the Gunpowder river water supply were constructed. A boulevard connects several of the parks. A Memorial Hall, commemorating those who died in the World War, was dedicated in April 1925.

Legislation.—One of the most important changes was the passage in 1918 of an Act of the Maryland Assembly by which, to the 32.19 sq. m. of Baltimore territory, were added 51.83 sq.m. of land and 11.30 sq. m. of water, making the total area 95.32 sq. m. and adding about 100,000 persons to the population. At the November election in 1920, the people voted overwhelmingly in favour of four improvement loans, aggregating $51,750,000.

Finance.—Fifty-three Baltimore banks and trust companies, exclusive of private banking firms, showed on Jan. 1 1925 aggregate resources of $601,934,355, and deposits of $500,079,982. In 1924 bank clearings reached a total of $5,025,334,741, a gain of 3·8% over the preceding year and of 121.7% over 1917.

Education.—The Johns Hopkins University established a School of Public Hygiene in 1920, and in 1925 it announced tha it intended to discontinue its collegiate and undergraduat Engineering Dept., confining itself to higher education. Loyol College has opened new buildings in the northern part of the city A number of fine public schools have been built, and several hig schools have either been constructed or are planned. The Enoc Pratt Free Library, constituting the public library system of th city, has a central library building and 26 branches.

The mayors of Baltimore have been: from 1907–11, J. Barr Mahool (Dem.); 1911–9, James H. Preston (Dem.); 1919–23 William F. Broening (Rep.); 1923–7, Howard W. Jackson (Dem.) In 1923 the City Council was reorganised so as to consist of on House instead of two.

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(B. C. S.)

BALUCHISTAN (*see* 3.291), a minor province of British Indi with agencies attached. The area is 134,638 sq. m., the popu lation 799,625 (1921).

Development.—The chief features in the history of Baluchista during the period 1910 to 1925 were her weathering of the storm set up by the World War and the Afghan War that followed o its close, the increase to the railway system in the administere districts and the development of road communications in th vast areas that make up the frontier state of Kalat.

Effect of World and Afghan Wars.—The Sandeman system the essence of which is the administration of frontier tribes a far as may be on tribal lines according to tribal custom throug tribal chiefs and headmen, stood the strain of the World Wa well. The only serious trouble that arose was among the Marr Baluch, a tribe whose depredations were a household word in th plains of Sind before the days of Sandeman, and whose natura unruliness had been encouraged by the weak personality of it last two Chiefs. Affected by pessimistic rumours of Germa victories and British defeats, and strengthened in their pessi mism by a call for recruits for the army, the Marris attacked th Gumbaz post in Feb. 1918. Driven off with the loss of 125 killed they looted and burnt the Kohlu sub-tahsil, and with the hel of the Khetrans sacked Barkhan and Fort Munro, and held u a train between Sibi and Harnai. Retribution was swift. Afte severe chastisement from a punitive column the Marri Chie surrendered with the whole of his tribe early in the followin April.

The Pathan portions of Baluchistan, over which the Worl War passed without rousing much restiveness, were more seri ously troubled by the Afghan War. But this was due to externa causes. The collapse of the militia in the North West Frontie Province, the abandonment—as many believed, needlessly—o the militia posts in the Upper Tochi, the consequently inevitabl abandonment of Wana in south Waziristan and the gallant bu tragic retreat of its garrison through north Baluchistan, set up conflagration throughout the greater part of the lower Zhob In Fort Sandeman and its immediate neighbourhood it was soo brought under control. But it smouldered on for some time i the more inaccessible areas, especially those abutting on th Waziristan border.

Communications.—The World War was responsible for bring ing into being two long-standing railway projects. The first o these was an extension from Khanai on the Sind-Pishin railwa to Hindubagh. Constructed in 1916–7 in order to speed up th transport of the Hindubagh chromite deposits, then in urgen demand for munitions, it is almost bound to prove the first stag of a railway extension to Fort Sandeman, eventually perhaps t link up with the North West Frontier strategic railway system More dramatic was the extension of the Nushki railway alon the Nushki-Seistan trade route (with which the combined genius of Lord Curzon and Colonel Webb Ware had bridged the Chaga desert some 20 years before) first to Dalbandin (118 m.) in Jan 1917, then to Mirjawa (269 m.) on the Perso-Baluch border i

Feb. 1919, and finally to Duzdab (52 m.) in the following April. It is hardly rash to hazard the prophecy that, given the continued control of American financial advisers over the Persian Treasury, under the masterful rule of the new Shah Reza Khan, railhead will not long remain at Duzdab.

Kalat State.—There have also been developments in many branches of the administration of the Kalat State, but none more marked, perhaps none more needed, than in communications; 600 m. of road have been driven through Makran, 500 m. through Jhalawan and 250 m. through the Kachhi. Formerly it took weeks, growing into months, to travel from the capital town of Kalat to the outlying parts of this state which sprawls over more than 73,000 square miles. A motor-car can now cover the distance in as many days, and the effect on the general betterment of the administration has been immediate and great.

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BANAT: *see* RUMANIA.

BANCROFT, HUBERT HOWE (1832–1918), American historian (*see* 3.309), died at Walnut Creek, Cal., March 2 1918. He published in 1909–10 *The Book of Wealth* and in 1912 *Retrospection, Political and Personal*, giving an account of his labours.

BANCROFT, SIR SQUIRE (1841–1926), British actor and manager (*see* 3.309), published in 1925 a further book of reminiscences, *Easy Chairs*, and died in London April 19 1926.

BANDELIER, ADOLPH FRANCIS ALPHONSE (1840–1914), American archaeologist (*see* 3.311), died in Madrid March 19 1914. His last published works were *The Islands of Titicaca and Koati* (1910) and *The Ruins of Tiahuanaco in Bolivia* (1912).

BANERJEA, SIR SURENDRANATH (1848–1925), Indian (Brahmin) politician and journalist, was born Nov. 10 1848 in Calcutta. Passing for the Indian Civil Service at the open competition of 1870, he was retired after two years' service, and then opened a small school in Calcutta which soon expanded into the well-known Ripon College. His work as a political reformer began in 1876 when he founded the Calcutta Indian Association and three years later he became editor of *The Bengalee* newspaper. In subsequent years he became the centre of many stormy episodes. He was one of those who established the Indian National Congress in 1883, and presided over the Poona session of 1895 and again at the meeting at Ahmadābād in 1902.

In 1893 Banerjea was elected to represent the Calcutta corporation on the Bengal Legislative Council, and was twice returned to the central Legislature as member for Bengal. He gave evidence in 1897 before the royal commission on Indian expenditure and frequently visited England in connection with deputations and political missions. Vehemently opposing the administrative partition of Bengal effected by Lord Curzon in 1905, he supported the boycott of foreign goods which arose from the upheaval. He always exhibited, however, a preference for consitutional agitation, and was among the first to welcome the Montagu-Chelmsford reforms. Severing his association with the congress, which had passed under "extremist" control, he formed an "Indian Liberal" organisation, and accepted office as Minister for Local Government and Sanitation in Bengal. A knighthood was conferred upon him in Jan. 1921, and in 1924 he retired into private life. Shortly before his death on Aug. 6 1925 at Barrackpore, he published his autobiography, *A Nation in Making.*

BANFFY, DEZSÖ, BARON (1843–1911), Hungarian statesman (*see* 3.315), died in Budapest May 24 1911.

BANG, HERMANN JOACHIM (1858–1912), Danish author (*see* 3.315), died Jan. 29 1912. In 1910 a volume of his essays appeared, *Masker og Mennesker*, followed in 1911 by a volume of short stories, *En dejlig Dag*. His collected works were published in six volumes in Copenhagen and Oslo (1912). See F. Poppenberg, *Nordische Porträts—Hermann Bang* (1904).

BANG, NINA HENRIETTE WENDELINE (1866–), Danish politician, was born at Copenhagen, where, in 1894, she graduated M.A. She married a politician, Gustav Bang, who died in the year 1915. Devoting herself to economic studies, she was active as a Social Democrat in politics and journalism, and in 1918 became a member of the Landsthing (Upper House). In 1924 she joined the first Danish Social Democratic Government under Theodore Stauning as Minister of Education, thus becoming the first woman Cabinet Minister in the world. With the support of Danish and foreign scientific funds Mrs. Bang commenced, in 1906, the publication of a comprehensive work about the dues on the Sound, *Tables of Shipping and Goods Transport on the Sound, 1497–1660* (1906–22).

BANGKOK (*see* 3.316), Siam.—Since 1910 new roads have been built, and a number of Chinese banks have made the city their headquarters. Trade is flourishing, having doubled since 1907; in 1923–4 the exports were worth £15,741,609 and the imports £12,511,801. Over 85% of the trade of Siam goes through Bangkok, and 1925 was a record year for the export of rice, the chief product and article of export of the country (1,324,363 tons). There are about 80 rice-mills working in the city and neighbourhood. The naval arsenal dock has been reconstructed, and a dry dock built by the Bangkok Dock Company. Vessels of 13 ft. draught can cross the bar. A railway to Penang, which shortens the journey to Europe by three days, was opened in 1918; since 1922 express services have been run to Penang and Singapore. The line to the northeast was being extended to Korat in 1926, and the building of a bridge across the Menam Chao Bhraya river will link the northern and southern railway systems. In 1917 the Chulalongkorn University was opened.

BANKING AND CREDIT (*see* 3.334).—Although pre-War economic literature laid the foundations of modern theories of credit control, it was the disorganisation of the War period and the efforts since made to re-establish currencies on a firm basis which have given the control of credit its present practical and scientific interest. In order to classify the points at issue, it is desirable to start with the most general case, and to make corrections for the specific influences exerted by particular systems of currency standard and by the peculiarities of environment.

I. THE CONTROL OF CREDIT

The theory starts from the assumption that the flow of purchasing power in an economic community is governed, in the last resort, by the activities of the central bank, for the central bank, under all circumstances, is the final source for the supply of media of payment. Even when an economic community has not itself a central bank, its monetary phenomena are affected by the actions of the central banks of other communities, given a world economic order, so that, broadly, the monetary phenomena of the economic universe as a whole are functions of the activities of the central banks. Given a central bank, then, the funds at the disposal of the community are subject to its control. For, if it pursues a policy of stringency it can, directly and indirectly, deprive the outer money market of funds and thus create a universal stringency; if it pursues a policy of expansion, it can add to the resources of the outer money market and thus produce a state of universal fluidity.

Since the theory further postulates that the price-level is a function of the mass of media of payment in circulation, it follows that the price-level is itself dominated by the monetary or credit policy of the central bank; in the last resort, it is governed by the conception of their responsibilities entertained by the leading functionaries of such a bank. It is irrelevant whether the central bank emits purchasing power in the form of book-credits or of cash: first, because an expansion in the former will lead to an expansion in the latter; second, because the bank will govern its grant of credit in the first form by the power which it possesses of expanding the second form. Hence, the generalised theory lays it down that it is not the volume of cash which governs the volume of credit, but the volume of credit which governs the volume of cash in circulation, since, in its most general form, the power of the central bank to emit cash is unlimited.

Given that central banks possess the powers attributed to them by the theory, two groups of questions arise: (1) Through what mechanism does the impulsion to expand or contract credit affect the economic structure? (2) What are the appropriate devices by which these impulses can be regulated?

Varying Views.—Three groups of views may be distinguished, though there are elements common to all these views.

(*a*) One group of writers lays great stress upon the influences exerted directly or indirectly by divergences in the movement of real and nominal interest rates, or by the differences between the money rate of interest and the rate of return on real capital (normal rate of interest), in periods of expansion or contraction. Thus it is argued by Irving Fisher that if at a time when prices are rising, money rates of interest rise less rapidly, the real rate of interest may be falling, though the money rate charged may be rising. Or, as is urged by Wicksell, if the normal equilibrium rate of interest is given, any offer by bankers to lend at less than this rate will discourage lending to bankers and encourage borrowing from bankers; this will itself cause prices to rise, and unless bankers' rates of interest are again equilibrated with real rates of return on capital, a constant pressure in the direction of further expansion will be felt. The converse is of course the case when nominal rates are above real rates or when money rates are above normal rates; both as regards a rise and a fall, divergences tend to be cumulative in their effects.

It is to be noted that Fisher's theorem and Wicksell's are by no means identical. Irving Fisher's "real" rate of interest is based on the relation (in terms of *goods*) between the value of what is borrowed as compared with what is repaid, and is contrasted with the rate per cent on the amount of money borrowed: Wicksell's "normal" rate is the price (in terms of money) which will just equilibrate demand for (real) capital with the supply of it. Whatever the price-level, this rate itself may be undergoing a change which may increase or decrease the divergence between it and the money rate at which loans are being contracted: Fisher's conception essentially rests on changes in the price level not compensated by changes in the money rate of interest.

(*b*) A second view, that of Professor Cassel, places most stress on the discrepancies that can occur between the *real* supply of savings and the *nominal* supply of savings, *i.e.*, the volume of purchasing power. If the supply of purchasing power is so great as to add to the current real savings of the community an artificial supply, leading to additional demands on the available productive powers of the community, prices will inevitably be driven up. Conversely, a fall in the price-level can be produced if the supply of purchasing power reduces the nominal volume of savings below the current real savings.

(*c*) Current British theories have borrowed from the views already mentioned, but lay stress also on the relationship between profit-margins, the supply of purchasing power and the rate of discount. Thus, in Mr. Hawtrey's treatment of the problem, an increase in the volume of purchasing power will be distributed as increased income, will induce traders to give larger orders and will result, since production is not absolutely elastic, in rising prices. The temptation to the trader is in part speculative, since stocks in his hands go up in value, but it arises in part from the relative lowness of interest rates, since this widens the margin between traders' income and traders' cost, in particular the cost of carrying stocks.

The Discount Rate.—Whatever be the angle of approach, it is clear that the dominant theories lay great stress upon the rate of discount, which, as the price which is paid for the current use of purchasing power, appears to all groups alike as the legitimate instrument by which an excess or deficiency in the supply of purchasing power can be prevented. Having thus outlined the dominant theory of credit control, it becomes advisable at this stage to refer to the limiting conditions and the qualifications which, in the opinion of the present writer, it is necessary to introduce.

The Influence of Particular Currency Systems.—The general theory assumes that the central bank completely controls the supply of purchasing power. This is, however, only true in exceptional cases, when the country is not on a metallic standard basis (or if, being on such a basis, the central bank controls the entire output, the state refraining from issuing an independent currency of its own). When a community is on a metallic basis, the price-level is ultimately controlled by the output from the mints, so long as it effectively remains on that standard. For, if the central bank increases the supply of local purchasing power to such an extent as to lose parity with gold or other metal, the community is no longer on a metallic basis. If the central bank is given the power to refuse gold at will and the mints are not obliged to take gold and give coin at the request of other holders, the country is not on a true gold basis. But if the central bank attempts to maintain its local currency at least on a par with gold, and if the bank accepts gold freely, or in default of such acceptance gold can be turned into coin at will at the mint, then the power of the central bank to prevent the value of gold from falling (and with it the local currency) is limited by the degree to which it can withdraw alternative forms of currency from use.

The practical condition is that the liabilities of the bank should remain constant, whilst its earning assets should be replaced by gold as it comes in, *i.e.*, that the gold reserve should increase at the expense of other items on the assets side of the balance sheet. In this way, the effect of increased supplies of gold in influencing the value of currency can be delayed until the gold is equal to 100% of the unaltered liabilities. After that point is reached, the central bank is powerless to prevent the value of the currency from falling. Within this margin, laxity or stringency of credit-administration will still remain important elements, but as soon as a community is on the gold standard, it will be the gold supply which will *ultimately* dominate the situation; laxity, however, will drive the country off the gold standard and stringency—in the form of accumulating large reserves—will prevent a relative upward swing of prices—relative, that is, to other gold-using areas.

The second assumption of the theory is that the central bank only issues credit in response to a commercial demand. But this is certainly not always the case; in particular, it was not the case during the War, when the central banks made part of the machinery of War, issuing vast loans to the governments. To this aspect of the subject we return below. Here it is only necessary to state that, even if the central banks had practised a policy of extreme self-denial and had refused direct assistance to governments, it would not have altered the situation very much; for the governments could have issued currency of their own or, alternatively, have borrowed from the central banks indirectly. Even had the banks attempted to apply business principles to these indirect loans and discounts, it would not have made the slightest difference. The governments would have received the *net* proceeds (minus a further deduction representing commission to the borrower for undergoing the trouble involved), and would have profited from the taxation of the large profits of the central banks, so that loans plus tax would have resulted to the same thing, though loans might have been somewhat smaller and proceeds from the taxation of central banks might have been somewhat larger than was actually the case.

The third assumption of the dominant theory is that it is always possible for the central bank to control the credit situation, *i.e.*, that it is always either actually the lender, or can make itself the lender, whose loans are necessary to satisfy the (marginal) effective demand in the market. This aspect of the theory is the more important in that it raises the whole question of the effectiveness of the discount-rate as the chosen instrument of credit control.

Experience has revealed that both on psychological and technical grounds the efficacy of the discount rate is subject to qualification. It is clear that a given rate can only be effective if borrowing actually takes place at that rate. Even in pre-War days, however, this was not always the case. There developed, therefore, on the part of the Bank of England, the practice of selling securities for cash and their repurchase for account, with the intention of depriving the market of funds and therefore causing a demand for accommodation at the bank, which, of course, meant that the bank rate became "effective." This is one aspect of a truth which can be expressed thus: that a central ank can influence the money market not only by its *discount* olicy, but also by its investment policy, that is to say, that so r as the effects on market rates are concerned, it makes, *quan-tatively*, no difference whether a given volume of funds is added o market resources, or is withdrawn from the market, by means espectively of additional discounts or additional investments, r by reduced discounts or reduced investments. The difference etween the two methods lies in the fact that the discretionary ower of the central bank is greater in the one case than in the ther; when a central bank attempts an exclusive control by eans of variations in discounts, it may find that the willingness f the market to absorb funds may be less than it desires. This in itself a confirmation of the view that the discount rate may ot always be fully efficacious in producing the desired effect, nce there is a limit below which the rate cannot fall. On the ther hand, when the central bank is selling securities and there-re reducing the funds at the disposal of the market, it can *nforce* a given rate. A central bank, then, by expanding its hold-gs of investments may influence the market in the desired di-ection even though a reduction in discount rate has had no, or nsufficient, effect; a reduction in investments need not be accom-anied by a rise in discount rate, though it will obviate the neces-ity for a reduction. The systematic exploitation of these facts onstitutes the so-called " open market " policy of the Federal eserve System, inaugurated on a systematic scale in 1923 and lly set forth in the 10th annual report of the Board.

Discrimination.—Even in pre-War days it was the practice of entral banks to supplement the discount rate by a gradually ncreasing stringency of discrimination in the choice of bills they ould discount, whenever undue demands were being made by he market for accommodation. In post-War days, this embry-nic policy has developed into a fully conscious policy of *ration-ng* on the part of certain central banks in those countries, which ave just emerged—as namely, Austria, Hungary, Germany —from a period of violent change in the value of the monetary tandard. This points in itself to certain defects in the " method f discount rate variations." For, though it may be true that f a given volume of accommodation will be afforded by a central ank, it can make, ultimately, no difference whether this amount s distributed by fixing the quantity and apportioning it on given rinciples, or by fixing the price appropriate to a given quantity nd allowing the market to determine those who will buy that uantity at the price fixed, yet there seem to be certain advan-ages in the method of rationing which cause it to be preferred. he central bank retains the power of *discrimination* between ne borrower and another to a much greater extent in the case f rationing; but, apart altogether from this point, the determina-ion of what *will* be the " equilibrium price " appropriate to a iven quantity is purely experimental and may lie at such un-sual levels as to defy completely calculation or prevision. Thus, even a 98% discount rate proved ineffective in Germany before the cessation of inflation and, if rates of this order of magnitude have to be applied, it may be better to approach the problem of regulation from another angle, *i.e.*, from the angle of pre-deter-mined limits of quantity.

In other words, though there may always be a rate which, if enforced, will be deterrent, it may be more difficult to enforce that rate than to employ an alternative device. The argument that, if borrowers know that a rise in rates will be ruthlessly em-ployed, a considerable rise of rates will in fact be avoided, rests on a psychological premise which is not universally valid and upon economic grounds which are not always applicable. The argu-ment assumes in fact (*a*) that the cost of credit is a sufficiently large item of expense as to make an upward or downward move-ment in the cost of credit an appreciable element in the calcula-tion of profit or loss; (*b*) that, apart from the direct incidence of profit or loss, borrowers believe an alteration of discount rate to be a sufficiently accurate guide to the future conditions of busi-ness as to cause them to anticipate loss if they do not immediately begin to contract their commitments. The extent to which a belief of this sort prevails is not a fixed magnitude: it varies with individuals, times and nations.

Whilst the modern theory of credit control undoubtedly contains elements of permanent scientific value, it cannot be said that unanimity prevails either as regards the logical structure of the theory or the practical value of its results. Its elaboration is in the main the consequence of the currency chaos of the last decade. The reintroduction of the gold standard does not absolve central banks from the task of credit-regulation: the formula that a central bank must watch its reserves is merely a practical maxim which conceals the important scientific truth that the preservation of adequate reserves *involves* at all times supervision of credit conditions. In fact, central banks have always supervised credit conditions, unless diverted from their true object by erroneous theories or by the exigencies of governmental finance. Modern research is likely to influence central bank practice by the provision of sensitive statistical and economic indices, which will throw light upon underlying economic conditions earlier than the movement in the reserve position could do—a development which is being forced upon the Federal Reserve System in the United States, for instance, by the inapplicability of the reserve test under the present conditions of surplus gold reserves.

II. THE CENTRAL BANKS AND THE WAR

At the outbreak of the War the world was upon the gold standard. European countries, the Dutch East Indies, Japan, possessed central banks, generally endowed with the monopoly of note issue: in the United States of America the Federal Reserve System was just beginning to operate. The absence of true central banks elsewhere, particularly within the British Empire, was compensated by the maintenance of cash balances in London and in New York (on the part of Canadian banks); these balances, replenished by the rediscounting facilities available, especially in London, enabled local banking systems to use the older money markets as central banks whenever the necessity for expansion was felt. In this way, the whole world credit structure turned on the gold reserves of the established financial centres.

Gold Reserves.—The central banks maintained gold reserves larger than were absolutely necessary, partly out of conservatism, partly because of the belief that large gold reserves would constitute an element of strength in times of war. These gold reserves they were enabled to accumulate the more easily because (1) the world output of gold was expanding; (2) small notes in certain cases were allowed to circulate in order to divert gold to the central bank; (3) the note issue regulations were designed to prevent a too free expansion of the note issues, whilst the notes were kept at par with gold either by direct conversion into gold on demand or by conversion into assets which were at par with gold.

The note issues were limited either by (1) the requirement of a maximum limit without any specific reserve ratio (France) or (2) by the requirement of a percentual reserve without limit of issue (as in Denmark, Switzerland, Holland); or (3) by a combination of a percentual reserve requirement (usually 33⅓ or 40%) with a fixed " uncovered " issue (Germany, Austria). In certain cases, *e.g.*, the United Kingdom, Russia, Norway, the principle was maintained that *above* a certain limit the entire issue should be fully covered, though this is only a variant of (3) above. The " uncovered " issues had generally to be backed by specified securities, usually commercial bills of exchange with 3 or 2 signatures, thus linking the volume of notes with trade movements and giving elasticity to the whole system.

To avoid the danger of governmental exploitation of the note issue, Treasury Bills could not be included in " eligible " discountable paper, or, alternatively, the amount which the government could borrow was limited. In order to combine elasticity with the maintenance of gold parity, the constitution of certain central banks had instituted the principle of the taxation of excess issues, *i.e.*, the reserve requirements could be temporarily suspended, provided that a tax was paid on the volume of notes in excess (Germany, Sweden, United States). The intention was that the discount rate should be proportionately raised, but this by no means always happened in practice; the central banks refraining from raising the rate in order to avoid burdening industry and commerce with too heavy rates. The profits of the banks were generally divided between the shareholders and the governments, after provision had been made for reserves, and the general relations between the bank and the government usually enabled the latter—following the model of the Bank of France—to appoint the chief executive officials and thus exercise considerable indirect influence.

The War resulted in the central banks of the world being turned into currency manufacturing institutions. The notes of the banks were made inconvertible, or, where this was not the case, the free export of gold was prohibited. Usually, both steps were enforced. The governments financed themselves by discounting Treasury Bills or other obligations; apart from this direct borrowing, indirect inflation was practised by the banks granting loans at lower rates of interest against War Loans or other government securities. Even amongst the neutrals, mobilisation charges and subsidies and other extraordinary expenditure worked in the direction of depriving the central banks of free power of control; in their case also, gold imports from the belligerents produced "gold inflation," and even where, as in the case of the Scandinavian central banks, the right to refuse gold was granted (1916), errors in banking administration were made. It was probably inevitable that the central banks should lend themselves to the financial exigencies of their governments, but apart from this, throughout the War, the central banks were guilty of absurd delusions as to the value of gold reserves at a time when their notes were inconvertible and gold reserves could do nothing to maintain their value. Finally, bank administrations generally inverted cause and effect and attempted to justify their enormous issues of currency by arguing that higher prices required more currency, so adding intellectual confusion to economic disorganisation. To this belief and to the persistent idea that it is safe to lend "so long as the security is good" must be ascribed some of the orgy of inflation which was the part cause of the post-War "boom" of 1919–20, after the worst of the governmental pressure had been removed (*see* CURRENCY).

The net effect in Europe was that between 1913 and 1919 the total gold in banks and in circulation fell from $3,764,000,000 to $3,240,000,000: the neutrals (Scandinavia, Switzerland, Holland and Spain) gaining $720,000,000, the belligerents losing $1,247,000,000. The relative importance of loans to government and on government securities before and after the War to the totality of all productive operations of the chief European central banks is brought out in the following table. The absence of Sweden is due to the transference of government loans from the central to the commercial banks before the end of the inflationist period, *i.e.*, roughly before the end of 1920.

Percentage of Total Earning Assets of Central Banks
(Represented by Claims on Governments and Advances on Government Securities)

	1913	1918	1920		1913	1918	1920
Portugal . .	74	77	74	Netherlands .	6	23	14
France . .	43	86	86	Finland . .	1	53	54
Belgium . .	12	88	87	Japan . .	27	6	14
Bulgaria . .	47	84	81	Switzerland . .	. .	44	51
Serbia . . .	61	53	85	Spain . .	34	31	27
Greece . .	31	17	75	UnitedKingdom	38	49	59
Rumania . .	31	69	86	Italy . . .	23	69	59
Denmark . .	2	34	25	United States .	. .	10	9
Germany . .	21	98	98				

III. CENTRAL BANKING SINCE THE WAR

New Central Banks.—Since the end of the War two main developments are to be noted: firstly, a considerable extension in the number of central banks, and, secondly, a considerable degree of reorganisation in the central banks of certain countries, such as Germany and Russia, already possessing such institutions. Both these developments are to a large extent the common result of a single cause, viz., currency disorganisation, but the extension in the number of central banks is also due to the emergence of new states. Thus the separation of the Baltic States from Russia has led to the creation of the Banks of Estonia (1919), Lithuania (1922) and Latvia (1923): the re-creation of Poland led, first, to the State Loan Office and, after currency chaos, to the Polish National Bank (1924); the splitting up of Austria-Hungary and the liquidation of the old Austro-Hungarian Bank has resulted in the formation of the Banking Office of the Czechoslovakian Republic (though legislation in 1920 and 1925 has prepared the way for a new central bank), in the formation of the Austrian National Bank in 1922 and the National Bank of Hungary in 1924.

Currency disorganisation in Russia led to the new State Bank of the U.S.S.R. in 1921. Currency chaos in Germany led in Oct.–Nov. 1924, first to the creation of the Rentenbank (now in liquidation) and, under the aegis of the Dawes Commissioners, to the reorganisation of the Reichsbank in 1924. Danzig was provided with a central bank in 1924. In South and Central America, the first steps towards a new central bank were taken in Mexico in 1923: Colombia erected a bank in the same year: Peru had founded a reserve bank in 1922 and Chile one in 1925. In the British Empire, the first steps towards central banking in India were taken by the absorption of the three presidency Banks into the Imperial Bank of India in 1920: in Australia the Commonwealth Bank Act of 1924 has reorganised the bank (formerly a purely commercial institution) on the lines of a central bank: in South Africa a reserve bank was created in 1920, and under Canadian legislation of 1923 (supplementing emergency legislation of 1914), the Ministry of Finance has been given certain of the powers of a central bank.

One may envisage this movement under three heads: (1) the general intellectual forces which have shaped it, (2) the agencies which have furthered it, (3) the technical aspects of the new institutions.

(1) *Brussels and Genoa Conferences.*—The underlying theory has already been previously explained, but it was at the two International Conferences of Brussels (1920) and Genoa (1922) that the theory was prominently expounded. At Brussels attention was mainly fixed upon the cessation of inflation, but the Conference called for the establishment of new central banks in countries where they did not already exist. It was at Genoa that a broad programme was laid down. The second commission of the Conference, acting upon the report and draft resolutions of the committee of experts, called for the universal establishment of central banks and the inauguration of the policy "of continuous co-operation among credit banks of issue, or banks regulating credit policy in the several countries." Such "co-operation . . . would provide opportunities of co-ordinating their policy, without hampering the freedom of the several banks." By resolution 12 it was left to the Bank of England "to call a meeting of such banks as soon as possible," in order to elaborate an International Convention regulating the reserve policy of the banks in order to avoid, what was feared might result from the return to the gold standard, "a struggle for gold," and hence considerable fluctuations in the purchasing power of gold.

(2) *Co-operation between Central Banks.*—The International Conference thus proposed has not taken place, but there is nevertheless a considerable degree of informal co-operation at the present time. The Governors of the Bank of England and of the Federal Reserve Bank of New York are in frequent personal touch with one another and the actual policy of certain European central banks has been greatly influenced by the advice which has been tendered to them, as well as by the assistance afforded them, by the Bank of England. Thus the pegging of the Hungarian crown in terms of sterling was made one of the conditions of an advance of £4,000,000 in 1924: the Austrian crisis of 1924 was accompanied by movements in the Austrian bank rate instigated by the bank, whilst the recent credit policy of the National Bank of Belgium has also been influenced by the attitude of the British authorities.

Actual developments have also been powerfully affected by the prestige of the Federal Reserve System and by the influence which the League of Nations has been able to bring to bear. The economic pre-eminence of the U.S.A. has resulted in the

Federal Reserve System becoming the model which has been followed in Latin America and in South Africa (especially as regards the ownership of shares in the reserve bank by outside banks and in the framing of rules governing " eligible " paper) and has also left its mark on Europe, a result which is, of course, due in part to the selection of American economists and experts (notably Prof. Kemmerer, of Princeton) to guide the reorganisation of banking and currency conditions. The Finance Committee of the League of Nations influenced the form taken by the National Bank of Austria and the new National Bank of Hungary. Experience gained in the erection of these banks served as a basis for reform in Germany.

(3) *Technical Aspects of Central Banks.*—So far as the technical aspects of the newer institutions are concerned, the following points may be noted:—

(*a*) The tendency to assimilate sight deposits or demand liabilities and notes in circulation for reserve purposes. Thus demand liabilities have either to be specifically protected, as in the case of Peru, South Africa and the Reichsbank (where a 40% reserve in the shape of immediately available bank balances and short bills must be held), or demand liabilities and notes are added together for the purposes of calculating the reserve ratio, as in Austria, Hungary, Czechoslovakia, Colombia.

(*b*) The tendency for permission to hold part of the "cash" reserve not in actual gold coin or bullion, but in the shape of foreign bank balances and foreign bills. In Germany 25% of the cash reserve may be in foreign exchange assets; in most of the newer bank constitutions no distinction is drawn between actual gold in vault or held in the shape of gold assets. The actual cash ratio also varies considerably—20% in the case of Austria, Hungary and Czechoslovakia (in all these cases provision is made for a progressive rise in the minimum ratio in the course of time); 25% in the case of Russia, 30–33⅓% in the case of Poland, Lithuania and Danzig; 40% in the case of Germany and South Africa; 50% in the case of Peru, Esthonia and Yugoslavia; 60% in the case of Colombia.

(*c*) A third tendency is for the introduction of the principle of the taxation of excess issues, or, as it may also be put, the taxation of deficiency reserves, and to insist that at a time when these rates of taxation are being enforced, the discount rate must be at a given level, so as to cause the borrower to bear the burden. Thus, in the case of the new Reichsbank the bank rate must be at least 5% if the reserve is less than 40% for more than one week, and the discount rate, when an excess tax is being imposed, must be raised not only by the amount of the tax, but by one-third more.

(*d*) A fourth feature is the tendency to limit very closely the borrowing powers of the governments at the central bank. In the case of Austria and Hungary such loans are forbidden altogether; in Czechoslovakia loans are only allowed to the state against customs and tax warrants and the products of state industries (Article 129 of Act of 1920); loans to the German Govt. by the Reichsbank are limited (apart from fixed amounts which may be loaned to the Posts and Railways) to 100,000,000 marks for a maximum period of three months (Article 25 of Bank Act). It must not be overlooked that most of the new European central banks start with vast sums owing them by the state, in consequence of notes issued during the inflation period, and provision for the gradual reduction of these debts, usually out of the share of the profits falling to the state, has had to be made.

So far, in most of the countries where a central banking reorganisation has taken place as part of, or in connection with, currency reform, the central bank has been successful in maintaining the international value of the new currency unit, though Poland is so far an exception. The task of stabilising the values of these currencies in terms of gold was made easier by the fact that they were usually very much undervalued abroad, so that it was possible to peg the foreign exchange value and yet allow of a very considerable degree of internal currency expansion. But the experience of Austria in 1924 and of Germany in 1925 shows that the point must ultimately come when an almost brutal use of restrictive powers must be made in order to safeguard the stabilised currencies from a new decline. Thus the central banks of Europe have so far hardly even considered the problems which the newer theories of credit control have raised, viz., the stabilisation of the whole field of business in the interests of stable price-levels. Some of them, particularly the Bank of France, are still struggling with the problems presented by government finance; but in general it may be said that in the field of central banking in 1926 the worst is definitely over and that a new era has definitely begun.

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IV. BANKING IN THE UNITED STATES

The panic of 1907 and the recovery which followed it formed only a temporary interlude in the general development of the United States banking system; immediately afterwards the country entered upon a period of prosperity which continued practically unbroken until 1914. Lessons learned during the panic, however, convinced the community of the necessity of making some change in the note-issue system. The Aldrich-Vreeland law of 1908, while providing for so-called emergency currency, also established the National Monetary Commission, which was directed to inquire into the general situation of the banking and currency problem with a view to formulating a broader and more comprehensive statute.

This Commission presented in 1910, a general bill covering the whole field of banking reform, but political changes caused delay. The preliminary drafts of a new measure were prepared under the direction of a sub-committee of the Banking and Currency Committee of the House of Representatives, and the Bill so formulated became the Federal Reserve Act, entered in the statutes on Dec. 23 1913. It was undoubtedly the most important measure relating to banking or currency in the United States since the Civil War, and it made possible the important financial services rendered by the United States during the World War, The Federal Reserve System necessarily accepted the existing National Banking System as a basis, building upon a foundation already firmly established in American finance.

The National Banking System (*see* 3.345) had proved inadequate, partly because in time of stress there was no recognised means of relieving hard-pressed banks, and partly because the currency was inelastic, being limited by the amount of bonds available, besides being slow in issue and redemption. Agitation after the panic of 1893 for the issue of emergency currency as a means of checking the development of acute panics ultimately grew into a demand for a currency not purely of emergency nature, but elastic, as required by business needs, and therefore including issues of ordinary bank notes protected by the joint guarantee of the banks. The only practical outcome of the agitation was seen in certain of the sections of the Gold Standard Act of 1900.

The Federal Reserve System.—The Federal Reserve Act was the outgrowth of a gradual movement in the direction of central banking. It sought to provide elastic currency, not by changing existing law but by adding a new type of institution, the Federal Reserve banks, whose membership (stockholders) was to consist of national banks, compulsorily included, while institutions organised under state law (banks and trust companies) might at will also become members. Each member bank was required to contribute to the capital of its local reserve bank a sum equal to 3% of its capital and surplus, and to become liable for an additional 3% in case of necessity. The directing mechanism of the system was the Federal Reserve Board, consisting of five members (later raised to six) chosen by the President of the United States, with the Secretary of the Treasury and the Comptroller of the Currency as *ex officio* members. The essential requirement of the Act was the compulsory transfer of the reserves of member banks to the Federal Reserve banks, the reserve provisions requiring a 6% minimum of vault cash, and a 7% minimum of balances on the books of the reserve banks, while the remaining 5% of the reserve required in central reserve cities might be either in vault or in the reserve bank. This was the so-called divided reserve. Each reserve bank was authorised to issue currency against commercial, industrial or agricultural paper, with a maximum maturity of six months except when of agricultural origin, in which case the maximum maturity was 180 days. Deposits of notes ready for issue were to be made with an officer known as the Federal Reserve Agent, there being one such officer at every Federal Reserve bank. Each Federal Reserve bank was governed by a board of directors, six of whose members (three bankers and three business men) were chosen by constituent member banks voting in three separate groups according to size of capital, while three (including the Federal Reserve agent, who was also the chairman) were chosen by the Federal Reserve Board. The Board was given the function of passing on, and establishing, rates of discount, such rates, however, being originally named by the boards of directors of the several Federal Reserve banks.

In the following table, compiled from reports obtained by the Comptroller of the Currency, the advance in the number of organised banks, including national, state, savings and private banks, loan and trust companies between 1910 and 1925 is shown:—

	Resources in Millions of Dollars						*Liabilities in Millions of Dollars*						
	Number of Banks	Loans and Discounts	Investments	Due from Banks	Cash on Hand	Aggregate Resources	Capital Stock	Surplus Fund	Undivided Profits Less Expenses	Due to Banks	Individual Deposits	United States Deposits	Nationa Bank Circulation
1910	23,095	12,495	4,723	2,393	1,423	22,450	1,879	1,547	404	2,225	15,283	54	675
1913	25,993	14,568	5,407	2,776	1,560	25,712	2,096	1,676	573	2,584	17,475	49	722
1914	26,765	15,288	5,584	2,872	1,639	26,971	2,132	1,714	562	2,705	18,517	66	722
1915	27,062	15,722	5,881	3,233	1,457	27,804	2,162	1,732	639	2,783	19,135	49	722
1920	30,139	31,208	11,387	5,833	1,076	53,079	2,702	2,410	976	3,708	37,315	175	688
1921	30,812	28,932	11,381	4,974	946	49,671	2,903	2,542	910	2,809	34,844	390	704
1922	30,389	27,860	12,547	5,414	829	50,425	2,943	2,697	933	3,244	37,194	128	725
1923	30,178	30,416	13,672	5,597	797	54,034	3,052	2,799	954	3,610	40,034	238	720
1924	29,348	31,427	14,228	6,121	911	57,144	3,114	2,967	971	3,928	42,954	152	729
1925	28,841	33,883	15,400	6,774	951	62,057	3,169	3,173	1,007	4,370	46,763	147	648

While state banks and trust companies included the bulk of the investment institutions of the nation, the commercial banking assets were predominantly held by national banks. On June 30 1925, these numbered 8,072 with deposits totalling $19,909,669,000 and total resources, including rediscounts, reported at $24,350,863,000. Since 1890 there had been a rapid development of trust companies in many parts of the United States, while savings banks had also expanded rapidly both in the number of depositors and in assets; depositors increased from 6,107,083 in 1900 to 13,971,793 in 1924, and deposits from $2,449,547,885 in 1900 to $8,439,855,000 in 1924. The corresponding increase in trust companies was from 1,564 in 1914 to 1,680 in 1925, with a growth in aggregate resources from $5,489,500,000 in 1914 to $11,563,549,000 in the later year.

Effect of the World War.—The sudden advent of war in Europe necessarily subjected the banks to a very severe shock and pushed into the background the immediate questions of competition between different classes of institutions. Specie payment was suspended, and a severe drain of gold out of the country was caused by England's effort to supply herself with funds. There was also some fear that American foreign trade might be wholly or largely cut off. German war vessels, however, were soon driven from the North Atlantic, and the movement of products from the United States to Europe was resumed upon a limited scale. The banks, which had begun the issue of clearing-house certificates on Aug. 3 1914, were able to retire their obligations on Dec. 1 of the same year, although the Stock Exchange (which had been closed on July 31) was not reopened until later. As the requirements of European countries for goods became heavier, and as export shipments from the United States increased, the banks entered upon a period of unusual prosperity. Credit became comparatively safe, not only because of the upward movement of prices but because of the fact that the large purchases of goods made for European account were in most cases practically guaranteed by the European governments. The number of banks increased steadily, and both savings and commercial deposits advanced. There was little need to call upon Federal Reserve banks for rediscount accommodation, and they prac tically remained inactive.

After the United States entered the War a paper basis wa established, and much of the enormous increase in the gold hold ings of the United States was impounded. Congress passed a Act (June 21 1917) changing two fundamental ideas in the Fed eral Reserve Act. The maximum reserve requirement was re duced from 18% to 13% in central reserve cities, with the pro viso that the entire amount should be carried in reserve banks and the issue of notes directly against gold was permitted. Th Act also extended to state institutions more liberal condition for entry into and withdrawal from the system. Membershi increased rapidly from 1917 onward, and by the close of 192 (after some post-War reaction) the total number of membe state institutions was 1,441, the national bank members bein 8,048 in number.

The War effected far-reaching changes in the portfolios o paper holdings of the banks of the country. The public were en couraged to save and to use their savings in the purchase o Liberty Bonds, but large assistance had to be extended to bond buyers to enable them to make their payments. The Govern ment also became a heavy purchaser of all classes of commodities and paid for them largely by issues of Treasury certificates. Thu the investments of the banks and their portfolios of paper cam to consist largely of government obligations or of notes collater alled by such obligations. Many of the states, moreover, had in imitation of the terms of the Reserve Act, modified their loca laws so as to permit state institutions to take on fiduciary func tions previously confined to trust companies. The national bank were also assuming savings-deposits functions. Hence the growt of the so-called department store type of bank, characteristi of the post-War period. While the growth of a discount marke had been restricted by War conditions, the Federal Reserve Ac had laid the foundations of it, particularly through its authorisa tion of the creation of bankers' acceptances and the provision fo foreign branch banks. There was a mushroom growth of foreig branches established by American institutions during the year 1914–20, while acceptance paper also developed, at first tenta tively, but later to an average amount aggregating about $750, 000,000. The effort to introduce the trade acceptance or com mercial bill was not very successful in displacing the single-nam paper made under the open account system, which had becom the staple in American banking.

Working of the Federal Reserve System.—The operations of th Federal Reserve System as such from 1914 to 1925 may b divided into four periods: the first from Nov. 2 1914 to the dec laration of War by the United States, April 6 1917; the secon from the latter date to about Nov. 4 1919; the third from Nov 4 1919 to the beginning of the year 1921; and the fourth fro the latter period until the end of 1925. In the first period th Federal Reserve banks were organised, obtaining the collabora tion of the financial community, and introducing new standard of commercial paper through a system of regulations and th installation of a national and district clearance and collectio system. The Federal Reserve Act had authorised the Board t act as a clearing-house for the several reserve banks, and early in 1915 the so-called gold settlement fund at Washington was created, and eventually a daily system of telegraphic clearing between reserve banks was developed. Supplemented by an inter-district plan which laid the basis for an extensive plan of "par" collection within the several districts, this new enterprise helped to eliminate excessive internal rates of exchange and to establish a uniform condition of remittance throughout the United States. This work had been fairly successfully inaugurated by 1917, and in anticipation of war a large supply of Federal Reserve note currency had been printed.

During the second period the system seconded the Treasury Department in paying for the War and in financing European nations compelled to rely upon American aid. The Armistice found the country with an inflated price level and a somewhat undermined banking situation. It would have been well had the Reserve System set itself at once to reduce inflation, but, as usual, political consideration intervened. The fifth Liberty Loan was not floated until the spring of 1919, and heavy advances aggregating about $2,500,000,000 were made to European nations after the Armistice. The Reserve System found the pressure too strong, and permitted inflation to continue during 1919 and early 1920. Reaction set in during the spring of 1920 and became serious at the end of that year, the close of the year and the beginning of 1921 being a period almost of panic. Rectification had become necessary, and the Reserve System had raised its rate of discount fairly steadily during the year 1920. Deflation had been brought about in some measure through changes of rate, but probably in much larger degree through the efforts of the banks and business men of the country to restore normal conditions. The opening of the fourth period in 1921 found the system working for the first time under approximately normal circumstances. During the years 1921–5, therefore, the operations of the reserve banks were more closely adjusted to the general banking situation, and it was possible to judge the general results of the new law.

Expansion of Reserve Banks.—The great expansion resulting from the fiscal transactions of the Treasury coincided with the upward swing of business taking place soon after the complete establishment of the collection system. Greater efficiency was secured through the opening of new branch offices at strategic points. In all 22 branches were created, certain of them acting primarily as collection agencies, while others added very considerable powers in the rediscounting of paper and the holding of reserves. Early in the War the system entered into agency relationships with the Bank of England, whereby that institution was to hold funds in trust for the Federal Reserve banks jointly, while they in turn were to undertake similar duties for the Bank of England. It was understood at the time that the agency relationship would not, until after the War at least, lead to the performance of functions involving the buying and selling of bills or operations in the discount market. Similar relationships were later concluded with the Bank of France, the Bank of Japan and various other central foreign institutions, but the relationship was on a restricted basis, and did not result in the undertaking of international discount operations.

The position of the Reserve Banks on Oct. 28 1925 was as follows:—

Assets	
Gold with Federal Reserve Agents	$1,377,127,000
Gold redemption fund with U.S. Treasury	47,770,000
Gold held exclusively against Federal Reserve notes	1,424,897,000
Gold settlement fund with Federal Reserve Board	716,589,000
Gold and gold certificates held by banks	641,063,000
Total gold reserves	2,782,549,000
Reserves other than gold	110,511,000
Total reserves	2,893,060,000
Non-reserve cash	52,932,000
Bills discounted:—	
Secured by U.S. Government obligations	293,285,000
Other bills discounted	296,709,000
Total bills discounted	589,994,000
Bills bought in open market	328,717,000
U.S. Government securities:—	
Bonds	56,020,000
Treasury Notes	248,477,000
Certificates of indebtedness	20,260,000
Total U.S. Government securities	324,757,000
Other securities	3,220,000
Foreign loans on gold	3,399,000
Total bills and securities	1,250,087,000
Due from foreign banks	640,000
Uncollected items	684,027,000
Bank premises	61,557,000
All other resources	18,120,000
Total resources	$4,960,423,000
Liabilities	
Federal Reserve notes in actual circulation	$1,694,771,000
Deposits:—	
Member bank—reserve account	2,227,212,000
Government	38,670,000
Foreign bank	12,071,000
Other deposits	19,311,000
Total deposits	2,297,264,000
Deferred availability items	617,350,000
Capital paid in	116,602,000
Surplus	217,837,000
All other liabilities	16,599,000
Total liabilities	$4,960,423,000
Ratio of total reserves to deposit and Federal Reserve note liabilities combined	72·5%
Contingent liability on bills purchased for foreign correspondents	$36,849,000

The experience of American banks after the "silent panic of 1920–1" was somewhat chequered. There was a steady and substantial growth in assets and in turnover, the banks getting back more than they had lost through shrinkages resulting from the panic. But the results of the inflation which had led to the conditions of 1920–1 could not be avoided. In many cases, after the immediate effects of the shrinkage of prices had been overcome, banks found themselves in a weakened and unsatisfactory condition. In the case of not a few of the larger institutions this necessitated compulsory contributions by directors or additional subscriptions to stocks by stockholders, in order to make up the shortage resulting from losses. In other cases, however, there was an inevitable breakdown. As a result the years 1924 and 1925 saw a marked shrinkage in the number of banking institutions in existence, partly due to the constantly increasing number of mergers necessitated in many cases as a means of avoiding failure, and partly to the great number of actual failures, which in 1924 amounted to 777 and in 1925 to a total of 612.

In some measure this unfortunate record was the result of over-speculation during and after the War. In the middle-west and south-west, for example, where the bulk of the failures took place, extraordinary and unreasonable loans had been freely made by the banks upon farm land or live stock or both, while large advances upon inadequate security, oftentimes unsold produce, were common. The oversight of banking had been inadequate and limited; and the general supervision exerted by state banking authorities, in view of the greatly increased number of institutions, grew steadily more and more inadequate. The National Banking System also suffered from insufficient and careless oversight of its members, and had too readily and too hastily granted bank charters in favour of institutions that had but slight hope of success. The banks themselves had been inclined to engage in undesirable operations. Although the Federal Reserve System was expected to diminish the volume of speculation, it had not done so, events both during and after the War showing that the country banks were more inclined than ever to pour their money into the speculative market, while funds were withdrawn from the slow and steady development of legitimate business in the interior of the country. Other factors in post-War banking were a return to almost exclusive interest in domestic operations, and a tendency for the smaller American banks to invest heavily in bonds of long maturity. The general tendency has, therefore, been rather towards a diminution in the degree of liquidity. Meantime there has been a marked growth of branch banking legislation and practice. Under the administrative rulings of the Comptroller of the Currency, many national banks have created branches within their own cities, while state banks and bankers have proceeded along similar lines. In general the states have come to be divided into three groups: one possessing positive laws permitting branch banking; a second having no definite law on the subject, but permitting branches more or less restricted by administrative ruling; and a third carrying on its statute books definite legislation opposed to branch banking. Altogether more than 2,000 branches in all existed at the end of 1925, in the various states, a fair proportion of them being branches of national banks located in the same city as the parent office.

In spite of adverse conditions the Federal Reserve System succeeded in unifying and consolidating the legitimate interests of the banks, and tended to eliminate many of the doubtful and unsatisfactory methods which had prevailed before its organisation. The fact that the system was not successful in accomplishing some of its chief objects did not in any way detract from its successes, especially that of strengthening the condition of the city banks in many very important particulars. It seems fair to conclude that the Federal Reserve System did not function very successfully in the country districts; its chief success was apparently found in connection with city institutional lending and in the initiation of broad general improvements of method, such, for example, as those that relate to the clearance and collection system.

AUTHORITIES.—*Reports* of Secretary of the Treasury, Comptroller of the Currency and Federal Reserve Board, 1914–25, inclusive; Federal Reserve *Bulletins*, 1915–26, inclusive. (H. P. W.)

BANTING, FREDERICK GRANT (1891–), Canadian scientist, was born in Canada and educated at the University of Toronto. He served in the World War and then practised medicine in London, Ontario, until May 1921, when he commenced research on the internal secretion of the pancreas at the University of Toronto. In 1922 it was announced that he, with Prof. Macleod and others, had succeeded in preparing insulin, a specific cure for diabetes. He was appointed professor of medical research at the University of Toronto in 1923 and together with Prof. Macleod received the Nobel Prize for medicine in the same year. *See* INSULIN; THERAPEUTICS.

BAPTISTS (*see* 3.370).—The Baptist World Alliance, formed in 1905, has drawn together the Baptists of all lands, and has facilitated a systematic survey and more systematic work. International congresses have been held in London, Berlin, Stockholm, Philadelphia; another is due at Toronto in 1928. Similar meetings have been held in the Southern Hemisphere. An executive is appointed every five years, whose European office is at 4, Southampton Row, London.

I. IN THE OLD WORLD

The troubles of continental Baptists during the World War called forth abundant sympathy and practical help from their brethren. A conference at London in 1920 resulted in linking each national group on the Continent with one of the stronger groups elsewhere, in fostering theological seminaries within each country, and in the most promising students receiving further training in Germany, Sweden, England and America. A conference in Chicago in 1925 planned for professors from Sweden, England, Canada and the United States to visit certain countries of central Europe for aiding the national seminaries and conducting special short-term schools.

Great Britain.—Britain has seen a great strengthening of the Baptist Union, from whose memory the old distinctions of "general" and "particular" have faded away. Important financial measures are raising the standard of sustentation and superannuation, and linking the churches in closer fellowship. Much attention is given to the training of lay preachers, whose real importance had been somewhat overlooked. The problem of training and settling ministers is being viewed as a whole, and after careful thought two great changes have been adopted. There is a strong tendency to fix a term for the period of service in any one post, often five years, with the possibility of renewal. Then, to facilitate interchanges and to bring the churches into closer relations with the union, a 17th-century office has been revived and modified. General superintendents work in large areas, one for the English-speaking churches in Wales, one for Scotland, one for London and eight for the rest of England. These ministers confer monthly.

Development in Russia.—On the continent of Europe, the most remarkable development has been in Russia, where the increase has been phenomenal. No trustworthy figures have been published by the Soviet Govt. but from many quarters reports are sent of untiring evangelists increasing the membership by 30% a year. Whereas the highest figure mentioned in 1911 was 100,000, the lowest mentioned in 1925 is 1,000,000; one responsible leader claims 2,000,000 in his section, and a prominent statesman speaks of 3,500,000. Growth has outstripped organisation, but two groups are fairly well knit. The older radiated from Tiflis and Kiev, and flourishes among the peasantry; the younger radiated from Petrograd and embraces a large number of more cultured people. These are now re-arranging themselves on geographical lines; already there is a Ukrainian Baptist Union, and careful attempts are being made to evolve one all-Russian Union on lines congenial to the Slavic genius, as also to establish one or more theological seminaries. In South America, the initiative is still largely with missionaries from North America and Europe.

Africa.—In Africa, too, progress depends on the guidance of foreigners. Under the French, Belgian and Portuguese flags work must be conducted in native languages, or French or Portuguese. There is no sign of such wholesale adoption of Christianity as has taken place among Africans in America; these distant relations however recognise their special obligations and discharge them in the west and south.

Developments in Asia.—In Asia the feature of recent years is the growth of strong native missions in India and China, which are grateful for past help from Europe and America but which are taking tentative steps of their own. One conference passed a resolution that it now understands the need of the churches, and will indicate to foreigners the kind of help and helpers desired. Baptists of south China have assumed all responsibility for planning and administering the work in all phases, and their decision is hailed with deep satisfaction by the missionaries and the Foreign Boards. The Christian Literature Society for China has a majority of Chinese as authors, editors and managers. The Christian universities in both lands are still largely influenced by foreigners. (W. T. W.)

II. IN THE NEW WORLD

The Baptists of America were in 1925 organised in 14 national, or approximately national, bodies. Of these, the Northern Baptists Convention had at that date, a membership of 1,419,791; the Southern Baptist Convention 3,574,531; and various negro conventions 3,044,528. After allowance has been made for duplications, the total membership of the Baptist churches in the United States was 8,025,348. The total value in 1925 of church property of American Baptists was $343,540,300, and the amount raised for missions and various other beneficences was $18,493,717 with a total amount of annual contributions of $74,504,611. These large figures indicate a rapid development.

The Northern Baptist Convention.—Prior to 1907 the Baptist churches of the northern states had no central body to which they could send delegates. There existed a number of societies engaged in foreign and home missions and publication, but these were not strictly representative bodies. In 1907 there was a tentative organisation of a Northern Baptist Convention which was subsequently developed into a permanent body, composed of delegates from local churches and 37 affiliating organisations, including state conventions. This body has no authority, but has very great influence. Perhaps its most important operation was its adoption of a five-year programme for the purpose of stimulating the evangelistic and benevolent activities of the churches.

During the World War, the convention co-operated patriotically with national activity, but found that the finances of the societies were in danger of serious deficit. There was, therefore, organised a campaign to raise $100,000,000 during a period of five years. The convention also entered into the Federal Council of the Churches of Christ in America and the Inter-Church World Movement. As a result of the situation in which the nation then was, the Northern Baptists found themselves obligated for large sums to the Inter-Church World Movement at the very time they were engaged in raising the vast sum voted. These obligations were met, but the total amount raised in the campaign was approximately only 60% of the total amount desired. The cost of operating foreign missions rose more rapidly than the income, and there has been a need of some limitation of missionary expansion. In 1925 the Northern Baptists had in the foreign field 805 missionaries; 2,154 churches with 8,321 native workers, 3,645 schools of all grades, with 136,178 pupils; and 84 hospitals and dispensaries. The Northern Baptists at the same time maintained 14 seminaries, three training schools, 23 universities and colleges, five junior colleges and 18 academies. They furnish a large number of leaders in theological thinking and scholarship.

The denomination has suffered considerable inner disturbance because of the efforts of certain conservative elements in the denomination to get control of the convention and adopt a confession or creed for the churches. This move was so thoroughly opposed to the Baptist policy that it was rejected overwhelmingly when finally the vote was taken upon it. At the same time, the agitation has been continued by persons, several of whom are not members of the Northern Baptist Convention, who have founded the Baptist Bible Union for the purpose of maintaining what seems to them to be fundamental Baptist positions.

The Southern Baptist Convention.—This body is vigorously expressing itself in various forms of denominational activity in the South. Southern Baptists have declined to enter the Federal Council of the Churches of Christ in America and the Inter-Church World Movement. In 1919, however, they instituted a drive for $75,000,000 and pledged $90,000,000, which has been approximately 65% successful. The Southern Baptists are organised somewhat differently from their Northern brethren, having boards rather than societies. They have a large number of churches, many of which are in rural districts. Theologically, the Southern Baptists are conservative and especially insistent upon immersion as the mode of baptism. Their development in wealth and prestige, especially noteworthy in Texas, is attested by their support of two theological seminaries, three training schools, 32 universities and colleges and 28 junior colleges. They have established a large number of hospitals, several of which have a large income. They also maintain a number of orphanages. They are making, especially through the faculty of the Southern Baptist Theological Seminary at Louisville, distinguished contributions to theological scholarship.

The Negro Baptists have organised a number of national, or semi-national bodies, the two largest of which are the National Baptist Convention and the National Baptist Convention of America. These bodies maintain various missionary societies and publication societies with costly buildings; they are well organised and efficiently led. They maintain several theological seminaries and are active in educating the youth of their churches.

Foreign-Speaking Baptists.—For a number of years, there has been work carried on by Baptists among foreign-speaking immigrants in the United States, and these efforts have resulted in the establishment of a number of Baptist Conventions and other organisations in the various nationalities. The largest of these bodies are the German and Swedish Conventions, which represent a total membership of something like 65,000. In addition smaller bodies of Danish, Norwegian, Czechoslovak, Polish, Hungarian, Finnish, Italian, French, Portuguese, Rumanian and Russian bodies have also been organised. There are also a large number of unorganised, foreign-speaking Baptists. In fact, it is common for such foreign-speaking citizens of America, who have broken with their state churches, to organise under the simple forms of Baptist denominations. The exact number of all the foreign-speaking Baptist bodies, so far as can be discovered, is approximately 82,000. These foreign-speaking groups have been of very great value in the process of Americanisation, for, as a rule, the second generation either speaks English or joins English-speaking churches. (S. M.)

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BÁRÁNY, ROBERT (1876–), Austrian physician, was born in Vienna April 22 1876, and became a lecturer on diseases of the ear at the university there in 1909. In 1915, when he was a military doctor at Przemysl, he was taken prisoner by the Russians, but after some time he was released as an invalid. In 1917 he was invited to Uppsala University as assistant professor for ear and throat diseases and thus gained the title of professor. In 1914 he won the Nobel Prize for medicine for his investigations in physiology and the methods of diagnosis, of great significance in the development of internal surgery. Bárány also carried out important investigations in the physiology and pathology of the cerebellum, and worked out a method for the objective diagnosis of one-sided deafness. His works include *Physiologie und Pathologie des Bogengang – Apparats beim Menschen* (1907).

BARBADOES: *see* WEST INDIES, BRITISH.

BARBUSSE, HENRI (1874–), French man of letters, was born in Paris May 17 1874. Educated at the Collège Rollin, he became a journalist. In 1910 he was editing the periodical *Je Sais Tout*, but found time to write novels, of which *Les Suppliants* (1903) and, in particular, *L'Enfer* (1908), an intense tragedy tinged with melodrama, won considerable success. He is known chiefly for a brutal piece of realism, *Le Feu* (1916), which won the Prix Goncourt in 1917 and remains one of the most unforgettable pictures of modern war. Later he became a correspondent of the socialist journal *L'Humanité* and devoted his time to preaching against war. Among his other works are *Clarté* (1919); *La lueur dans l'Abîme* (1920); and *Quelques coins du coeur* (1921).

BARCELONA, SPAIN (*see* 3.391), has continued to increase in size and population during recent years. In Dec. 1923 the population was 760,572 and it is now the largest town of Spain. The War brought great prosperity to Barcelona, which supplied large quantities of war materials and manufactured goods, and this is shown in the appearance of the place. Broad avenues have been driven through the old quarter and the slopes of Montjuich converted into a fine park with terraced gardens, an open air theatre and a stadium. At the foot of the hill are the buildings for the exhibition of 1926. The Pedralbes Palace was presented to King Alfonso on the occasion of his visit to Barcelona in May 1924, by loyal Catalonians. The aim of the donors was to improve relations between Castile and Catalonia by providing a home in a pleasant climate which should be visited regularly by royalty. The palace, which was completely furnished by the donors and embellished with much marble, bronze and gilding, stands in the suburb of Sarria on the lower slope of the hills and has fine views; everything in it is said to be of Catalan origin. A tube railway was opened in Dec. 1924 and a line of the Metropolitan Railway, linking up the northwestern suburbs of Gracia and San Gervasio, in Dec. 1925; a new dry dock has been constructed in the harbour.

Barcelona, fulfilling its old reputation as the centre of revolutionary ferments, was in 1916 the headquarters of the system of infantry committees of defence, which led to a conflict, and had serious political effects. In 1921 a conference on communications and transport was held under the auspices of the League of Nations and led to the formation of an international body, the technical and advisory commission on traffic problems. After the War Barcelona suffered, like other places, from the crisis in trade; the Spanish commercial treaties have also been a severe blow to the metal industries. In 1923 there was a general strike, with conflicts between the police and Syndicalists. Under a law promulgated in 1924, many suggestions made by the Barcelona municipality have been adopted. The alcalde or mayor is now elected by popular vote, and the number of electors is much greater. The municipality, in common with others in Catalonia, has been given wider administrative powers. In Sept. 1925 there was a military revolt in Catalonia and martial law was enforced for a short time.

BARCLAY, SIR THOMAS (1853–), English lawyer, was born in Dunfermline, Scotland, and after studying at the universities of London, Paris and Jena, went to Paris as a correspondent of *The Times* in 1876. He was called to the bar (1881) and in 1882 resigned from *The Times* in order to study French law practice. From 1900 onwards he was constant in his advocation of cordial Franco-British relations. In 1903 and 1904 he visited the United States and agitated for an Anglo-American treaty of arbitration and conciliation, and in Feb. 1905 visited Berlin, at the invitation of the Associated Chambers of Germany with a view to promoting improved relations with that country. He was elected to Parliament as Liberal member for Blackburn in 1910. Amongst his numerous publications on international law and relations may be mentioned: *Problems of International Practice and Diplomacy* (1907); *International Law and Practice* (1917); *New Methods for Adjustment of International Disputes* (1918); *Le Président Wilson et l'évolution de la politique étrangère des États-Unis* (1918).

BARING-GOULD, SABINE (1834–1924), British novelist (*see* 3.401), published *The Evangelical Revival* (1920) and *Early Reminiscences* (1923). He died at Lew Trenchard, Cornwall, Jan. 2 1924.

BARKER, SIR HERBERT ATKINSON (1869–), British manipulative surgeon, was born in Southport, Lancs., April 21 1869. Educated with a view to following the legal profession, at an early age he showed an aptitude for manipulative surgery and in 1889 was placed under the tutorship of Mr. J. Atkinson. On the latter's death in 1904, Barker took over the practice and in the following years he acquired a wide international reputation. He specialised particularly in the correction of abnormalities of the joints by manipulation, and the cure of derangements of knee cartilages and flat-foot. Although Sir Herbert performed an extraordinarily large number of successful operations, his methods never met with the formal approval of the medical profession, who steadily refused to admit him officially to their ranks. He was knighted, however, in 1922, as the result of a memorial to the Prime Minister signed by several of the most distinguished surgeons of his day. His written works consist principally of articles in various periodicals urging the medical profession to study more closely his own methods of bloodless surgery. *See* MANIPULATIVE SURGERY.

BARKLA, CHARLES GLOVER (1877–), British scientist, was born June 7 1877, the son of John Martin Barkla, secretary of the Atlas Chemical Co., Widnes, Lancashire. He was educated at Liverpool Institute; University College, Liverpool; and Trinity and King's Colleges, Cambridge. In 1902 he became Oliver Lodge fellow of Liverpool University, and demonstrator and assistant lecturer in physics, 1905. In 1907 he was lecturer in advanced electricity, and from 1909–13 Wheatstone professor of physics in the University of London (King's College). He was then appointed professor of natural philosophy at the University of Edinburgh. He became Bakerian lecturer at the Royal Society 1916, and Hughes medallist of the same society in the following year. In 1917 he was awarded the Nobel Prize for physics. He has written numerous papers on electric waves, X-rays, etc., for various scientific journals.

BARLACH, ERNST (1870–), German artist and poet, was born at Wedel, Holstein, on Jan. 2 1870. After distinguishing himself as a sculptor he attracted public notice with his dramatic works, *Der tote Tag* (1912), *Der arme Vetter* (1918), *Die echten Sedemunds* (1920), *Der Findling* (1922) and *Die Sündflut* (1924). He received the Kleist prize for the last named drama in 1924. He illustrated the majority of his pieces with woodcuts. He is an expressionist and his philosophical dramas represent the mythical struggles of mankind with the powers of darkness. Notwithstanding the massiveness of his forms, his drawing and sculpture reflect a delicate and sensitive understanding.

BARNARD, GEORGE GREY (1863–), American sculptor, (*see* 3.410), completed his two great groups of 31 statues for the Pennsylvania Capitol at Harrisburg in 1912. His bronze statue of Lincoln, heroic in size, was unveiled in Lytle Park, Cincinnati, in 1917. This statue aroused considerable public discussion, prominent art critics denouncing it as devoid of any artistic qualities. On the other hand many admirers of Lincoln, including Miss Tarbell, his biographer, and Theodore Roosevelt warmly praised the work, but his son, Mr. Robert T. Lincoln, objected to placing replicas in London and Paris, and the council of the National Academy of Design issued a formal protest. Among Mr. Barnard's more noticeable later works were "Rising Woman," in marble (1918), and "Adam and Eve," marble group (1923), both purchased by J. D. Rockefeller, Jr.; "A Monument to Democracy" (1920), containing 400 figures in plaster; and "Let There Be Light," a bronze statue of heroic size, for Louisville, Ky. (1925).

BARNARD, J. E. (1870–), British physicist, was born in London and achieved considerable success in the science of microscopy. He carried out very valuable work at the National Institute for Medical Research, Hampstead, London, where he was in charge of the department of applied optics, by co-operating with Dr. Gye in the demonstration in 1925 of the existence of the cancer virus. He held in addition the post of lecturer at King's College, London, and was president and honorary secretary of the Royal Microscopical Society, London. He was elected F.R.S. in 1924.

BARNES, ERNEST WILLIAM (1874–), British divine, was born on April 1 1874 and was educated at King Edward's school, Birmingham and at Trinity College, Cambridge, where he had a brilliant career, being bracketed second wrangler in 1896 and elected in 1898 to a fellowship of his college. Ordained deacon in 1902 and priest in 1903, he held various appointments at Trinity College, Cambridge, becoming tutor in 1908. He wrote many valuable papers on mathematics and in 1909 was elected F.R.S. In 1915 he was appointed Master of the Temple and in 1918 Canon of Westminster. He rapidly acquired a reputation as a vigorous and broad-minded preacher and in his sermons discussed either evolution and science, or the more homely aspects of Christianity, with equal candour and individuality. In 1924 on the recommendation of Mr. Ramsay MacDonald, Canon Barnes was appointed Bishop of Birmingham. In this capacity his "advanced" views, and in particular his refusal to sanction the practice of the reservation of the Sacrament which he considered contrary to the spirit of the Prayer Book and likely to foster superstition, led to sharp controversy with the Anglo-Catholic elements of his diocese and attracted wide public notice in England.

BARNETT, JOHN FRANCIS (1837–1916), British composer (*see* 3.414), died in London Nov. 24 1916.

BARNETT, SAMUEL AUGUSTUS (1844–1913), British divine and social reformer (*see* 3.414, died at Hove, Sussex, June 17 1913. See Henrietta Barnett, *Canon Barnett: His Life, Work and Friends* (1918).

BAROTSELAND (*see* 3.424), the southwest division of Northern Rhodesia and a native reserve. Except for the substitution, in 1924, of direct imperial control for that of the Chartered Company no change was made in the political status of Barotseland. Europeans, other than officials, missionaries and traders approved by the paramount chief, are not allowed to settle in the country. The Barotse have shown keen interest in education, and large numbers profess Christianity. Lewanika (*see* 16.519), who had placed Barotseland under British protection, died in 1916, and was succeeded as paramount chief by his eldest son, Litia, who took the name of Yeta III. The chief is aided by a *ngambella* (prime minister) and a *kotla* (council); he has no jurisdiction over Europeans.

See D. W. Stirke, *Barotseland. Eight Years among the Barotse* (1922).

BARRACKS (*see* 3.427).—This article deals only with the building of barracks by the British Govt., as that is the only authority that is continually building them in various parts of the world. Other countries have built large, solid barracks in military centres and these barracks stand for long periods, whereas the British authorities are constantly reorganising and changing, so that new barracks necessarily follow. As regards the United States, the subject is dealt with under the heading TRAINING CAMPS (*q.v.*).

In Great Britain barrack construction has been in the hands of the Royal Engineers since 1918, as it was before 1904. During the intervening period (1904–18) an architectural branch under civil control existed at the War Office to deal with new barracks and hospitals at home stations, while services of a minor nature at home and all services abroad remained with the Royal Engineers.

Lighter Barracks.—About 1906–7 proposals were made to the Army Council to introduce a lighter form of barrack construction. Previously it had been considered economical to build as solidly as possible, on the ground that the cost of repairs was less than that of a temporary building, while the life of the building was longer. It was pointed out, however, that this was a fallacious argument to apply to buildings which were required for a service that was subject both to frequent changes of policy and to changes of standard imposed by progress in science, and that, moreover, constructional science had reached a point where it was possible to construct buildings which, while suitable to military needs, were less expensive in cost, more rapidly erected, more easily altered, and very little more costly to maintain than the more substantial type hitherto adopted.

Just then an opportunity occurred of making the experiment on a fairly wide scale. An earthquake at Kingston, Jamaica, had destroyed completely the military barracks and all the administrative offices and staff quarters and urgent representations were made for their immediate replacement. Neither labour nor material being available locally, it was decided to build the new barracks with a skeleton steel framework, vertical steel stanchions, braced below by steel horizontal joists, and, above, by a composite steel and wooden truss. The stanchions were bolted to a flat steel plate, set in a concrete block in the ground, and they were calculated to carry the whole weight of floors, walls, roof and other contingent parts, such as windows, doors, shelves, etc. The walls, which carried no weight but were merely screens from the weather, were composed of a double panelling of metal lathing fastened to the steel stanchions and plastered over, the space between the two sets of panels acting as a non-conductor of temperature. The material was prepared in England and erected on arrival in Jamaica by a company of the Royal Engineers. The barracks were quickly erected and proved a great improvement, both in comfort and convenience, over the old ones, while there was a very considerable saving in the cost. Encouraged by the success of the experiment in Jamaica, a similar form of construction was tried in England at Bordon, near Aldershot, where a barrack with some accessory buildings was urgently required for a field company of Royal Engineers.

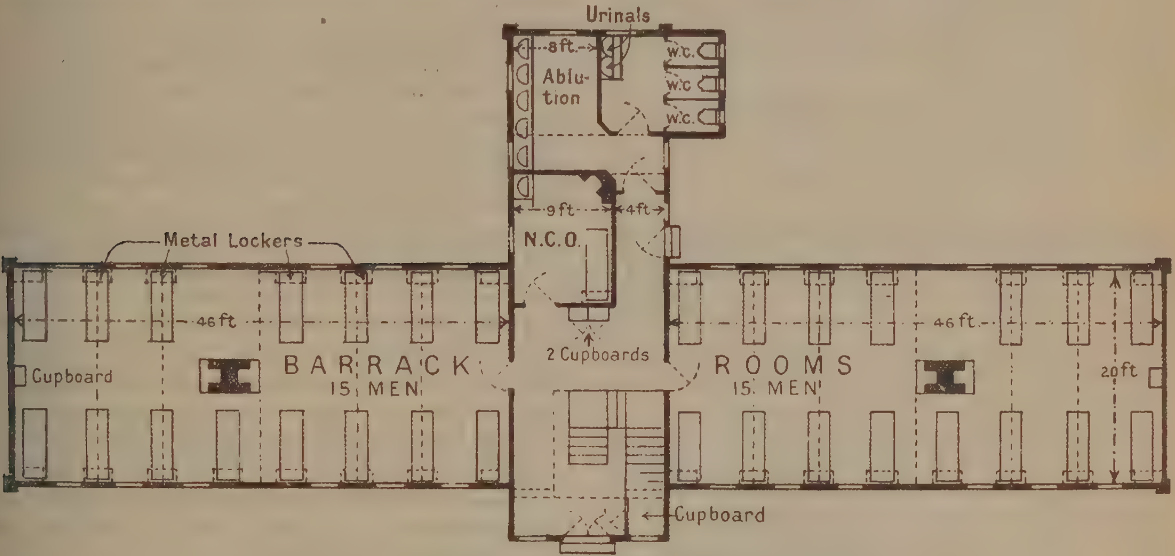

FIG. 1.—Ground floor plan of a small modern double-storeyed barrack.

Figure 1 shows the ground-floor plan of a modern double-storeyed barrack to accommodate two platoons of infantry. The floor above is similar. On each floor are two barrack-rooms, each for 15 men, with an ablution-room and sanitary annex in close proximity and with a room for one N.C.O. between the two barrack-rooms. The walls are built between steel stanchions, of brick $4\frac{1}{2}$ in. thick rendered with ordinary plaster inside and rough-cast outside, the steel stanchions carrying the weight of the roof, floors, etc. The same type of construction has been applied with great success to other buildings.

Hutting during the War.—When the accommodation for the new armies came to be considered in the first few days of the World War, it was decided to adopt a cheap design of hut which could be readily erected, and easily adapted to any form of temporary material and to any reasonably level site. In addition the following points were settled:—

(*a*) Huts to hold one sergeant and 24 men should be constructed giving 48 sq. ft. of floor area per man. (*b*) There should be two principal spans of hut, 20 ft. and 28 ft., and, as far as possible, all the various buildings should be planned to fit one or the other of these. (*c*) There should be a battalion cook-house, with cooking range and boilers for 1,000 men and having on either side of it dining-rooms for 500 men each. Between the cook-house and the dining-rooms there should be sculleries. (*d*) There should be in each battalion a bath-house with a central heating boiler and hot and cold water laid on to the showers, which should be in the proportion of 5 to every 100 men. (*e*) There should be a regimental institute of three rooms, namely supper-room, games-room and corporals' room; the bar and beer cellar to be between the supper-room and corporals' room so that central serving could be arranged. There was also provided a kitchen and scullery in an annex. (*f*) There should be officers' and sergeants' messes planned to accommodate 30 officers and 50 sergeants respectively, and consisting of a mess-room and an ante-room in one block, joined by a short passage with a kitchen block. (*g*) Four drying-rooms, fitted with stoves and bars, should be provided, in which wet clothing could be hung. (*h*) The latrines should be on the dry-earth system and the ablution-rooms and urinals should either lead into soak pits or into sewage filters. (*i*) The lighting should be done by electric lamps.

Considering the urgency of the matter, it would not have been surprising if extensive changes had proved necessary after the camps, so built, came into use. Changes, however, were few, although several details were amended. Thus some of the accessories were afterwards omitted, such as the dining-rooms, on the ground that the men could dine in their sleeping huts if necessary.

As regards material, some of the earlier huts were founded on brick piers. This was a mistake and it would have been better to have had a stout pile of creosoted wood. The brick piers involved bricklayers and bricks and mortar and the provision of these often meant delay. The framework of walls, roofs and floors was mainly red fir of market scantlings. A light steel framework was used in some cases, with expanded metal plastered on one side, and sheet iron painted in the interior of the room, but this was costly compared to timber. For lining, match boarding and 3-ply wood were used. Asbestos sheets were tried at first, but were found very brittle unless the backing of timbers was fairly close, and S.X. boarding and other fibrous matter were also employed but were not found suitable. The floors were, in most cases, of planking.

Hospital Huts.—On the outbreak of war in 1914, the whole question of hospital design came, necessarily, into great prominence and the following types of hospital huts were standardised:

(*a*) A ward hut, 140 ft. long by 20 ft. wide, comprising a 24-bed ward for ordinary cases and a separate small ward for one special case, a nursing sisters' duty-room, a scullery, a linen cupboard, and ablution and bath-rooms; (*b*) a hut, 160 ft. by 28 ft. for the administrative offices, consisting of an out-patient department with a consulting-room, waiting-room and dispensary, the offices of the principal medical officer, his clerks and registrars, the matron's office, a nursing sisters' duty-room, a clinical laboratory, the orderly medical officers' room and the medical board-room; (*c*) an operation hut, 51 ft. by 36 ft., containing the operation-room, X-ray-room, anaesthetic-room, sterilising-rooms, preparation-room, store and photographic developing-room; (*d*) a mortuary hut, 30 ft. by 14 ft. 8 in., containing a post-mortem-room, a body chamber and a viewing-room; and (*e*) a disinfecting hut, into which all foul clothing, bedding, etc., is brought, passed through a disinfector and, after treatment, re-issued.

Other hospital buildings, with certain modifications to meet the varied requirements of a hospital, followed the usual lines for ordinary barrack huts, quarters, etc.

Portable Huts.—There were many types of portable light huts made of wooden framework and canvas, but they were not found satisfactory for prolonged use, affording no better protection against cold and heat than tents, while the edges of the framework caused the parts of the canvas in contact with them to wear rapidly. Portable huts of corrugated steel bent to a circular form, were, however, most useful. Their great advantage was that the materials could be packed up together so as to take up little space; and the one disadvantage was that, at a time when steel was much required for other services, it was difficult to get supplies of these huts in large numbers.

Training Camps.—The first military training camps in the United Kingdom were built respectively at Aldershot, England, and at the Curragh, Ireland, now replaced by the training camp at Catterick, Yorkshire, between 1855 and 1859. When the World War broke out in 1914, a demand arose once more for training centres, and the problem of hutments had again to be dealt with. The types of huts adopted have already been described; it is here proposed to deal very briefly with (*a*) the principles on which sites were selected; (*b*) the system of grouping the typical designs so as to form suitable unit hutments and the grouping together of these unit hutments; (*c*) the accessory services incidental to such groups of hutments.

Selection of Site.—The following principles governed the selection of sites: (1) It was essential that there should be open ground available at all times of the year for manoeuvring and field-works, and suitable positions for rifle ranges, for bombing practice, entrenchments and similar activities; (2) the soil should be, preferably, gravel or chalk; there should be good drainage, and generally healthy surroundings; the water supply should be ample, and either pure or capable of being purified; (3) there must be ample means of communication by rail, or water, or both, and while the site should not be on a main line of railway so as to impede other movements, it should not be far away from existing railways; (4) lastly, from the engineers' point of view, besides traffic facilities, it is desirable that materials should be easily procured, water abundant, labour not unreasonably difficult to obtain and supervise, and, if possible, an established local system of waterworks, drainage works and electrical power in which by agreement the camp might partake.

System of Grouping.—The area required for a hutted camp for an infantry battalion is about 1,100 ft. by 500 ft., out of which the parade ground takes up a space about 430 ft. by 300 feet. Facing one side of the parade ground is the officers' mess with the living huts for officers on either side of it. On the opposite side are the barrack huts, which are grouped on either side of a central line of buildings comprising the sergeants' mess, the shower baths, dining-rooms and cook-house, the drying-room and the regimental institute. Flanking the parade ground are the guard house and offices, the horse shelters, saddle- and harness-rooms and forage stores, the vehicle shed and the mobilisation equipment store. Hutted camps for other units are designed on generally similar lines. In grouping such unit hutments into a divisional camp or cantonment, it is desirable that such buildings as the hospital, post-office, power station, army ordnance store sheds, supply depôt, banks, etc., should be centrally situated. The main training ground should lie on one side of the camp and as near to it as possible.

Accessory Services.—It is only possible here briefly to enumerate the accessory services for a large cantonment. They comprise (1) hospital, (2) roads and railways, (3) water supply, (4) lighting, (5) refuse disposal and sewage. In addition to hutted camps for brigades, divisions, etc., there were similar cantonments for (1) remount depôts, (2) ordnance stores and (3) aerodromes. The broad principles of lay-out and construction are similar. (R. G. P. H.)

BARRAGE: *see* ARTILLERY.

BARRÈS, MAURICE (1862–1923), French writer and politician (*see* 3.434). Maurice Barrès always considered himself a Lorrainer, charged with the interpretation and the vindication of his own people. His schooldays were spent at the Lycée of Nancy, and, immediately after, he made his literary *début* with some ironical pamphlets which successfully displayed his intellectual "dandysme." Renan paid him the compliment of being annoyed by his *Huit jours chez M. Renan* (1888).

He enhanced his reputation by the three volumes of the *Culte du moi*, which appeared from 1888 to 1891. They provoked much ridicule in the Press, but the humour, charm and "prétiosité" with which he developed his theme of the cultivation of the "ego," and thus an harmonious inner life, was hailed with delight by the younger generation. Many of the ideas which permeate his later works may be found in his second work *Un homme libre* (1889), which exercised a considerable influence on his generation. The section dealing with Lorraine was described by Ernest Lavisse as an admirable piece of historical psychology. His third book, *Le jardin de Bérénice* (1891), a novel, showed great delicacy of feeling and subtlety of style, and was inspired by the author's electoral campaign at Nancy as Boulangist candidate. He was only 26 when he was elected to the Chamber, and from that time he led a life divided between literature and politics.

Intelligent, ardent, ambitious, modelling himself now on Benjamin Constant and now on Disraeli, Barrès, during the period between the end of Boulangism and the Dreyfus case, hesitated as to the wisest course to pursue. He stood for one of the Paris divisions as a Socialist patriot, and was defeated. In 1892, he wrote a short novel, *L'ennemi des lois*, the subject of which was anarchy. He travelled in Italy and in Spain. He edited for about six months a paper called *La Cocarde.* Maurras was his colleague in this venture, and together they roughly blocked out the future doctrines of the French Nationalist party.

In 1897, he began the publication of his most important work, *Le roman de l'enérgie nationale.* The generation and *milieu* described are his own. His characters are types rather than living beings, but as a delineation of a period it may be ranked with *Le Rouge et le Noir* and *L'Éducation sentimentale.* The second volume, *L'appel au soldat*, contains a vivid account of the Boulangist movement, and the third, *Leurs figures*, a picture of parliamentary life at the time of the Panama affair, bears comparison with the pages of Saint-Simon.

The Dreyfus case, in which he took an active interest, made him a vehement Nationalist. He now assumed the position of spokesman for Lorraine, and undertook the series entitled *Bastions de l'Est. Au service de l'Allemagne* (1905) describes the year of military service under Germany of a young Alsatian, and *Colette Baudoche* (1909) tells the story of a young girl from Metz. The War brought these books a rather artificial success as propaganda. Meanwhile, Barrès was writing admirable descriptions of travel in France—*Les amitiés françaises* (1903), in Greece—*Le voyage de Sparte* (1906), in Syain—*Greco* (1912). They contain some of his best work, and some of the finest prose in the language.

The War was the apotheosis of his doctrines. He redoubled his activities. His work as a journalist had always been remarkable in quality, it now became remarkable in quantity also. He achieved the feat of writing an article for the *Echo de Paris* every day for four years. These, when they were re-issued in the long series, *L'ame française et la guerre* (1915–9), did not retain their original popularity.

After the War, Barrès carried on his rôle as defender of the French Eastern front by a mediocre work, *Le gênie du Rhin* (1921). He returned to pure literature with his novel *Un jardin sur l'Oronte* (1922), which derives its inspiration from his earlier travels in the East. These he described in *Une enquête aux pays du Levant*, which appeared in 1923 on the very day, Dec. 5, of the author's sudden death in Paris from heart failure. He left much unpublished work, the materials for the autobiography, *Mêmoires*, on which he was engaged, and a large correspondence, which will probably prove to be one of the most interesting of his generation.

He was, when he died, even more than Anatole France, the most significant figure among contemporary French men of letters. The influence of his political thought had worn itself out, but his literary authority still swayed the younger generation. He had the power to charm. The prejudices, the narrowness and the egotism, with which he had been reproached, gradually disappeared. The qualities of sympathy and reverence always commanded his esteem, and his epic of the countryside, *La colline inspirée* (1913), reveals the springs of his religious life. His old age would have been fruitful, and his death deprived us of recollections which might have rivalled *Les Mêmoires d'outre-tombe.* Of all French writers he may best be compared with Chateaubriand. Like Chateaubriand he created but one living figure, himself, but into that figure he breathed the soul of contemporary France, and thereby captured the heart of his generation. (A. Th.)

BARRIE, SIR JAMES MATTHEW (1860–), British novelist and dramatist (*see* 3.435), from 1900 onwards wrote almost exclusively for the theatre. *Peter and Wendy* was published in 1911, and even this was only a kind of pendant or satellite to that shining star of the Christmas theatre, *Peter Pan.* As for the plays written since that time, Sir James became more expert, as he grew older, in keeping the balance between comedy and pathos, and more daring in preaching from the stage a very simple gospel, the gospel that is to be found in his famous rectorial address delivered at St. Andrews University on the subject of Courage.

In that address (1922) he described his business in life as "playing hide and seek with angels," and in most of his later work will be found an underlying appeal to make life, as far as is possible, a game with angels, to become as little children, and to prefer a heavenly failure to a too-worldly success. He was attacked by a newspaper proprietor, at the time of this address, for preaching an "immoral gospel" *virginibus puerisque*, and for popularising a religion of failure; and, indeed, Sir James frankly said in it: "When you reach the evening of your days, you will, I think, see with, I hope, becoming cheerfulness—that we are all failures, at least all the best of us." The theme of the vanity of success recurs, now comically, now mournfully, throughout his later work. It is the dominant theme in *The Will*, a short and sentimental play produced in 1913, where we see the folly of success expounded in terms of commonplace life without the author's usual fantastic elaborations. *The Twelve Pound Look*, which belongs to about the same period, is a more comic treatment of the same theme. The hero, who is described in the stage directions, as "a pleasant rotundity with a thick, red neck" is a successful city man about to be knighted.

Sir James Barrie is, in the general opinion, more infallibly an artist in his comedy than in his pathos, and *The Twelve Pound Look* is, perhaps, the most successful of all his one-act plays. *Pantaloon* and *Rosalind* are two other one-act pieces which are published in the same volume with *The Twelve Pound Look* in the collected edition. They are both plays of mixed comedy and pathos, which take us behind the scenes in the theatre, and show us the puppets escaped out of the limelight into the joys and sorrows of ordinary life—especially perhaps the sorrows. *Rosalind* was written, it is said, for Miss Ellen Terry, and it is a charming dramatisation of the tribute which the author afterwards paid to Miss Terry at St. Andrews: "The loveliest of all young actresses, the dearest of all old ones; it seems only yesterday that all the men of imagination proposed to their beloved in some such frenzied words as these, 'As I can't get Miss Terry, may I have you?'" Another and longer play written during this period was *The Adored One*, which was censured by a number of critics on the ground that it was a joke about murder.

Barrie's War plays are of no permanent importance. *Der Tag*, produced in 1914, is merely a political argument in which, very properly, the Kaiser gets the worst of it. *The New Word*, written about the same time, is a comically moving little piece, about the pride of the elders of a family in the young second lieutenant they have given to the army. *A Kiss for Cinderella* (1916), though in some respects a comedy of the War, does not depend on the War for its chief appeal, but is the fullest expression of the genius of Barrie that playgoers had had since those marvellous years, 1903 and 1904, that produced *Quality Street*, *The Admirable Crichton*, *Little Mary* and *Peter Pan*. *A Kiss for Cinderella* is as sentimental as *Quality Street*, as ingenious as *The Admirable Crichton*, as childishly comical as *Little Mary* and as much a Christmas dream and as popular with infants as *Peter Pan.*

In *A Kiss for Cinderella* we realise how near is the author's genius to that of Hans Andersen, on the one hand, and of Dickens, on the other. Like Hans Andersen he mixes the everyday world with fairyland, and like Dickens he entices us to that borderland of laughter where we suddenly find ourselves in tears. There surely never was a play in which the dramatist played "hide and seek with angels" to better purpose. At one moment we might be reading *The Little Match Girl;* at another we might be behind the curtain at a scene between Dick Swiveller and the Little Marchioness; but there is a special kind of broken-hearted fun that no one from the beginning of the world ever invented before the coming of Sir James Barrie.

In 1917, he produced *Dear Brutus*, a comedy with tragic implications, which takes us into still remoter regions of dreamland than we visit in *A Kiss for Cinderella.* Here, as in others of his plays, we find ourselves wondering whether Sir James Barrie is not, after all, as fundamentally pessimistic as Thomas Hardy. If he takes us into dreamland for an hour, it is to show us the "might-have-beens" of everyday existence, and he leaves us wondering whether everything that happened was not fated, and whether the "black spot" in many of us was not born with us. "What really plays the dickens with us," says Purdie in the play, "is something in ourselves. Something that makes us go on doing the same sort of fool things, however many chances we get."

At the same time, such is the complex nature of men of genius, it would be as absurd to label Sir James Barrie a pessimist as it would be to label him, as some have done, a sentimental optimist. He is in the difficult position of a man who believes that the world can be saved by goodness, but does not see how goodness is possible unless you are born with it—who loves human nature but does not trust human nature to behave as it ought to behave. He sees the world populated by angels and ordinary people, and he is hurt, for all his jokes, that ordinary people should behave like ordinary people. This to him is the enduring doom of life, as we see in *Mary Rose* (1920).

Here, as in *A Kiss for Cinderella* and in *Dear Brutus*, we have an escape into dreamland or into some world of the fourth dimension. In his early work, Sir James had seemed to believe in the final consolation of kindness, but in *Mary Rose* we feel that, though he still believes in the consolation of kindness, he suspects that there is for human beings a tragedy beyond all consolation, and that the terrible thing in life is not only that people we love must die but that we forget them. "Fanny," says Mary Rose's father, congratulating himself years after her disappearance on the Scottish island, "this should be put on my tombstone, 'In spite of some adversity, he remained a lively old blade to the end.'" There you have at once the Barrie comedy and the Barrie tragedy. And then comes the Barrie half-consolation in the aged mother's reply: "What better encouragement to the young than to be able to tell them that happiness keeps breaking through?" It will be seen from all this that Sir James Barrie's comedy is comedy *de profundis*. Written in 1926, his only play since *Mary Rose* has been his one-act enigma, *Shall We Join the Ladies?* (1922).

Barrie received a baronetcy in 1913, and the Order of Merit was conferred on him in 1922. His address to the students of St. Andrews was followed by one or two other speeches, at Dumfries and elsewhere, which have been full of matter of interest to the biographer as well as of characteristic good counsel and jest and playful, mystifying make-believe. His speeches were reported in the popular Press at a length that suggests that he was a national literary figure with no rival on the same high level of popular admiration but Mr. Kipling. He is at once jester and tender-hearted moralist with a rare kind of genius that cannot but be loved by common men and women. "Stuff in that young man," wrote Stevenson of the early Barrie in a letter to Henry James, "but he must see and not be too funny." Stevenson's fear has proved to be quite unfounded. The funnier Barrie has become, the more serious he has become and the more he has given us of the fundamental emotions of pity and of love.

(R. Ly.)

BARRILI, ANTONIO GIULIO (1836–1908), Italian novelist (*see* 3.436), died Aug. 15 1908.

BARROW-IN-FURNESS (*see* 3.443).—The population (63,770 in 1911) was 74,254 in 1921. The area of the borough is 11,002 ac. of land, with 1,311 of water and 10,385 of foreshore. The shipbuilding yards developed greatly during the War period and war vessels of all types, including dreadnoughts and submarines, were constructed.

The Cavendish dock adjoining the Ramsden dock on the east, 146 ac. in extent, has been leased by the Furness Railway Co. to the firm of Vickers, Ltd., for the construction of airship sheds and for the manoeuvring of airships and dirigibles. The airship factory is situated on Walney I., which is connected with the mainland by a bridge with an opening span of 120 ft. for the passage of vessels. Among the public buildings constructed since 1911 are the town hall with a clock tower 170 ft. high, and a workingmen's club and institute, the gift of a former mayor; a Carnegie library was opened in 1922. The N. Lonsdale Hospital and the Infectious Diseases Hospital have been extended. Further electrical power is now obtained by works on the Leven river at Backbarrow near Lake Windermere for Barrow and other towns.

Vickerstown on Walney I. is a rapidly growing township and is becoming more and more a residential suburb of Barrow. The James Dunn park is on the east, and the Biggar Bank, a public recreation ground facing the Irish Sea, on the west side of the island.

BARRY, ALFRED (1826–1910), English prelate (*see* 3.444), died at Windsor April 1 1910.

BARRYMORE, ETHEL (1879–), American actress, was born Aug. 15 1879 in Philadelphia, and was educated at the convent of Notre Dame in that city. She made her *début* in 1896 in the company of her uncle, John Drew. In 1897 she first appeared in England in *Secret Service*, and with Sir Henry Irving's company in *The Bells* and *Peter the Great* (1898). She was first starred by Charles Frohman in *Captain Jenks* in 1900, and subsequently became one of the leading actresses in the United States, appearing in, amongst other plays, *A Doll's House* (1905), *Alice-sit-by-the-Fire* (1906), *Déclassé* (1922), and *The Second Mrs. Tanqueray* (1924).

Her brother, JOHN BARRYMORE (1882–), who first appeared on the stage in *Magda* in 1903, established his position as one of the foremost American actors. He appeared in *Richard III.* in 1920, and in *Hamlet* in 1923. The latter success he repeated at the Haymarket Theatre, London, in 1925. He also achieved success in motion pictures.

Another brother, LIONEL BARRYMORE (1878–), made his first appearance in 1893 in *The Rivals*, his grandmother, Mrs. John Drew, taking the part of Mrs. Malaprop, and had a successful career on both the stage and the screen.

BARTELS, HANS VON (1856–1913), German painter (*see* 3.447), died at Munich Oct. 5 1913.

BARTHOU, JEAN LOUIS (1862–), French politician, was born at Oloron-Sainte-Marie Aug. 25 1862. He practised as a lawyer in Pau and in 1889 was elected deputy. He became Minister of Public Works in the Cabinet of Charles Dupuy, 1894, in which Poincaré also made his début as Finance Minister. Minister of the Interior in the Méline Cabinet of 1896, he returned to the office of Minister of Public Works in 1906, under Sarrien. Successively Keeper of the Seals and Minister of Justice, he combined in 1913 the duties of Premier and Minister of Public Instruction. He was minister without portfolio in Painlevé's Cabinet during the World War, and Minister of War in that of Briand in 1921. He will be principally remembered as the able representative of France at the Genoa Conference, 1922. Barthou was elected Senator in July 1922, and was president of the Reparations Commission in October of the same year. His principal written works are *L'action syndicale* (1904), *Mirabeau* (1913), *Lamartine orateur* (1916) and *Les amours d'un poète* (1919).

BARTLETT, PAUL WAYLAND (1865–1925), American sculptor (*see* 3.450), gave further evidence of his abilities in a number of statues, the most notable of which were the group in the pediment over the House wing of the Capitol, Washington, D.C., the six statues in front of the New York Public Library, a statue of Benjamin Franklin at Waterbury, Conn., and his "Patriotism" in red granite at Duluth, Minnesota. Most of his life was spent in France, where he was made a commander of the Legion of Honour shortly before his death in Paris on Sept. 20 1925.

BARTÓK, BÉLA (1881–), Hungarian composer and pianist. Born March 25 1881 at Nagyszentmiklós, Transylvania, he began composition at the age of nine and studied first under László Erkel and later at the musical academy, Budapest, under Stephen Thoman and John Koessler. In 1903 his symphonic poem "Kossuth" was performed in Manchester under Hans Richter. The strong national movement prevailing in Hungary at this time influenced his work considerably and resulted in his researches into folk music and traditional melodies. The outbreak of the World War put an end to his travels, and he became, of necessity, reserved and isolated. The post-War generation, however, hailed him with enthusiasm. Among his most notable works are "Bluebeard" (1918) and the pantomime, "The Wonderful Mandarin." He has also written chamber music and numerous works for the piano. In 1906 he became a professor at the musical academy, Budapest.

BARTON, CLARA (1821–1912), American philanthropist (*see* 3.452), died at Glen Echo, Md., April 12 1912. She is the only woman whose name has been taken by a post of the Grand Army of the Republic.

See Mrs. Corra Bacon-Foster, *Clara Barton, Humanitarian* (1918).

BARTON, SIR EDMUND (1849–1920), Australian lawyer and statesman, was born in Sydney Jan. 18 1849. Educated at the grammar school and university there, he was called to the bar in 1871, becoming a Q.C. in 1889. He entered politics in 1879, and was elected to the New South Wales Legislature by the University of Sydney. From 1883 to 1887 he was Speaker of the House of Assembly; and in 1889 he became Attorney-General. In 1896 he had succeeded Sir Henry Parkes (*see* 20.831) as leader of the Federation movement; and in 1900 he led the delegation which presented the Commonwealth Constitution bill to the Parliament in London. The following year he became Australia's first Federal Prime Minister. He held office for two years, when he was made senior puisne judge of the High Court of Australia, being succeeded in the Premiership by Alfred Deakin. Sir Edmund was throughout his career an ardent supporter of

Imperial Preference and an advocate of protection. He died suddenly at Medlow Bath, near Sydney, Jan. 6 1920. Known affectionately as the Father of Australia, he inspired throughout his long career as a politician a deep personal devotion.

BARUCH, BERNARD MANNES (1870–), American financier, was born in Camden, S.C., Aug. 19 1870. He graduated from the College of the City of New York in 1889 and for many years was a member of the New York Stock Exchange. In 1916 he was appointed a member of the advisory committee of the Council of National Defence, and subsequently became chairman of the Committee on Raw Materials, Minerals and Metals, and of the War Industries Board. In 1919 he became a member of the Supreme Economic Council of the Peace Conference in Paris, and in the same year was appointed by President Wilson a member of the Industrial Conference in Washington. He wrote *The Making of the Reparation and Economic Sections of the Treaty* (1920) and articles for this *Encyclopædia.*

BASANAVICIUS, JONAS (1851–), Lithuanian statesman, was born in the province of Suwalki in 1851 and educated at Mariampol. He then proceeded to Moscow University, where he studied philology, history and medicine. His name was particularly associated with the famous journal *Ausra* (Dawn), which he issued in East Prussia and smuggled into Lithuania during the last decades of the 19th century. In 1885, however, he was obliged to leave Germany and for many years practised as a doctor in Bulgaria. In 1905, after the Russian Revolution, he was unanimously elected president of the famous Diet of Vilna. Besides being a national leader and a patriot, he was equally famous as a scholar and issued numerous publications in Bulgaria, America and Lithuania. He was especially interested in Lithuanian folklore and his work *From the Life of Ghosts and Devils* deals with this subject. He has been styled the "Patriarch of the Lithuanian Renaissance." He was the founder and president of the Lithuanian Scientific Association.

BASCOM, JOHN (1827–1911), American educationalist (*see* 3.458), died Oct. 3 1911 at Williamstown, Massachusetts.

BASEBALL (*see* 3.458).—In the period 1910 to 1925 the world series games played annually between the winning teams of each of the two major leagues, the American and the National, remained the most popular sporting contests in the United States. Around the two major, which retained their undisputed supremacy, grew up an elaborate system of minor leagues. These leagues were graded A, B, C and D, roughly according to the population of cities represented. Later the three most prominent of the minor leagues assumed a rating, which gave them some privileges formerly claimed exclusively by the majors.

In 1914 there were no fewer than 52 minor leagues in the complicated structure known as organised baseball. In that year the supremacy of the major leagues was threatened by the formation of the Federal League. This league, backed by sport-loving millionaires, fought tenaciously for two disastrous seasons and then collapsed. Several of its magnates, however, were allowed to purchase major league clubs, while others were partially reimbursed for their heavy losses. In 1920 continued dissatisfaction with the national commission culminated in a new national agreement, and the appointment of Judge K. M. Landis as commissioner of organised baseball with the powers of an absolute dictator. The rules, which are under the supervision of the commissioner and his advisory council, became enormously complicated.

Rules of the Game.—Organised baseball possesses an elaborate system of codified laws. Of these the reserve clause, introduced in 1879, is the most extraordinary and misunderstood. In brief, it allows a club a perpetual equity, subject to certain restrictions, in the services of a player who has contracted to enter its employ. This equity may be retained or sold to another club, with or without the player's consent. The player with a minor league club may thus be drafted, at stated intervals, to clubs of higher classification, on the payment of a fixed fee, or his services may be sold to the highest bidder, or he may be traded for another player.

This rule has been bitterly condemned on the assumption that it violates the established laws of the land which prohibit human slavery. In most cases, however, the players, though chafing under its restriction, recognise its necessity. The corner stone of organised baseball, it guarantees to a club the players whom it has obtained or developed and prevents the larger and wealthier clubs from destroying the balance which must be maintained in a well-organised league. Organised baseball decides internal disputes according to its own laws. An aggrieved player or club may appeal to a league executive and eventually to the commissioner. The latter's decision is final.

Spectators and Publicity.—The enormous growth of baseball as a public institution is best illustrated by the mammoth stadiums of steel and concrete which have been erected in every major league city and in many prominent minor league cities. The largest of these is planned to seat more than 60,000 spectators and represents an investment of several million dollars. The world's series games are often attended by the President and many other prominent officials, and while in progress they engross the attention of the entire nation. Hundreds of writers from all parts of the country visit the games. Every newspaper presents graphic accounts, numberless score boards record the progress of the play, and every event that occurs on the field is instantly broadcast by radio.

Baseball has become an enviable profession. There are major league players who derive from the sport an annual income greater than that of the President, and receive perhaps as much publicity. Increasing public interest has called into being a small army of paid writers. Every prominent newspaper has at least one man on its staff, often several, who devote most of their time to baseball. A literature on the subject has grown up, and many baseball terms are recognised additions to the everyday vocabulary. The records of baseball are carefully preserved and numerous statisticians elaborate these for the press.

The players are only baseball's field army. A far larger army of persons is employed in auxiliary operations. Every league has its trained staff of umpires: men who devote years to the mastery of the game and the quick interpretation of its elaborate rules. Every important club maintains scouts who scour the country in search of possible playing talent. The care of the huge grand stands and playing fields requires experienced ground keepers, ticket sellers and office workers. Large manufacturing industries have developed to supply the enormous amount of equipment: bats, gloves, balls, masks, shinguards, windpads, uniforms, shoes and miscellaneous articles.

Baseball in Other Lands.—Baseball is peculiarly American and is often called the national sport, but it has made decided progress as a world sport. In Canada it is played with much enthusiasm, while it has made strides in Mexico and in the West Indies. It has become popular in Japan, and Japanese college teams tour American cities. The Chinese and Koreans are also interested. Ambitious campaigns have been undertaken to introduce baseball to the whole civilised world. Groups of professional players have several times circled the globe.

To the uninformed observer the game appears to lack the elements of good sportsmanship. But without question it fosters a spirit of good fellowship. Rich and poor meet on an equality, and much of the verbal demonstration is a meaningless escape of pent-up emotion. Baseball's influence in America has been far-reaching and, on the whole, decidedly beneficial. It has fostered a rough but friendly spirit of fair play, developed quick thinking, and stimulated that evolution of athletic sport which is so notable a feature of the 20th century.

Bibliography.—See A. G. Spalding, *America's National Game* (1911); C. H. Claudy, *The Battle of Baseball* (1912); W. J. Clarke and F. T. Dawson, *Baseball* (1915). (F. C. L.)

BASKETBALL has become the national indoor game of the United States. It can be played in almost any space, at any time of the year, though adapted more for winter than for summer. It was invented in 1892 by Dr. James Naismith, at the Y.M.C.A. Training School, Springfield, Mass., in an endeavour to evolve an indoor game that would have the same appeal that baseball, football and other outdoor sports had already attained. Its growth in the United States has been phenomenal; and, although played professionally to some extent, it is essentially amateur. The rules are formulated by a joint basketball committee comprising representatives of the National Collegiate Athletic Assn., The Young Men's Christian Assn. and the Amateur Athletic Union of the United States. Slightly adapted, it is also played at practically every woman's college and in every high school. Through the Y.M.C.A. it has been introduced into China, Japan, the Philippines and into the Latin-American countries; also into France and England, where it is much played in girls' schools.

It is played on a rectangular surface, the maximum measurements of which should not exceed 94 ft. in length by 50 in width, and may utilise a space as limited as 60 by 35 feet. There are two goals (the original goals were peach baskets, hence the name) consisting of bottomless nets made of twine suspended from metal rings 18 in. in diameter. The latter are fastened to surfaces 6 by 4 ft., made of wood, painted white, called backboards; these are placed at each end of the court. The height of the ring from the floor is 10 feet. The game is played between two teams of five members each, a round leather-covered inflated ball weighing from 20 to 23 oz., and not less than 30 nor more than 32 in. in circumference being used. The object of the players is to throw the ball into their own basket or goal. Time of play is divided into halves of 20 min. each, with a 10 min. intermission between. These periods may be shortened by agreement. The ball must not be kicked, nor hit with the fist, but may be passed or thrown to another of the player's own side. He may not run with the ball, but it may be dribbled, that is, bounced along the ground. Supervision of play by a referee and an umpire is strict, and fouls are called for any infraction of the rules. The penalty for a foul is a free throw for goal from a point 15 ft. from end of court. The successful completion of this throw scores a point. A goal from the field in active play scores two points.

The rules for women's basketball are supervised by a women's basketball committee of the American Physical Education Assn.—although some girls' teams adopt boys' rules. A team may comprise from six to nine players. The size of the court approximates that of the boys' game, but girls' rules call for two zones when teams are composed of six players, and for three zones for a greater number. Certain players are restricted to these zones. Points count two and one, as in the boys' game.

BIBLIOGRAPHY.—W. E. Meanwell, *The Science of Basketball* (1924); F. C. Allen, *My Basketball Bible* (1924); E. J. Mather and E. D. Mitchell, *Basketball* (1925). See also Helen Frost and C. D. Wardlaw, *Basketball and Indoor Baseball for Women* (1920) and Spalding's *Official Basketball Guides* (men's and women's).

BASLE (*see* 3.462) had a population in 1920 of 135,976. It is a great railway and distributing centre with large electric, metal, and chemical works and a ribbon-making industry. The old town is unspoilt, and its industries are carried on in the rapidly extending suburbs. The Kunsthaus, an unpretentious building in the Heimplatz, was opened in 1910 with exhibitions of pictures, sculpture, etc., and a library, and an interesting example of a nobleman's house close by, the Landolthaus, was arranged as an annex and museum in 1919. The Frau Münster Kirche, near the bridge of the same name, was restored and modernised in 1912, and offices for the *National Zeitung*, with painted façades, were built in the Market Place in 1915. The Baden railway station, one of the largest in Europe, was finished in 1922. A building for the Pestalozzium, which contains an educational exhibition and Pestalozzi's study, has been erected near the Urania bridge.

BASRA (*see* 3.489) has a population estimated at about 50,000. During the World War the port equipment was modernised by the inland water transport branch of the British Royal Engineers, and in 1925 there were 4,000 ft. of wharfage served by railway lines, shipbuilding yards, barge and coal depots, warehouses, etc. The port lies some 75 m. up the Shatt el'Arab, which is deep all the way, but in 1924 only vessels of less than 19 ft. draught could cross the Fao bar. In 1922 the 'Iraq Govt. took over the control of the port from the British Govt. pending transfer to a port trust. In 1924 an agreement was executed with the Anglo-Persian Oil Co. for the dredging of the bar at Fao; the company was to advance the money required and the 'Iraq Govt. undertook, through its port authority, to carry out the work, which was begun in the same year. Considerable progress was effected during the period 1922 to 1925 in the administration of the port.

During the World War Basra was connected by railway with 'Amara on the Tigris, but the lines were afterwards taken up and a line constructed alongside the Euphrates, and connecting the port with Baghdad. In 1922 an automatic telephone system was brought into operation, and in 1923 a wireless station, which is in regular communication with Cairo and Beirut, and accepts traffic for England and Germany, was opened. A short railway line to the Baghdad Gate, under two miles in length, was completed in Jan. 1923. (*See* MESOPOTAMIA, OPERATIONS IN.)

BASTIAN, ADOLF (1826–1905), German ethnologist (*see* 3.500), died Feb. 3 1905.

BASUTOLAND (*see* 3.503), a British territory in South Africa. The increase in population to 498,781 in 1921 and then to about 540,000 in 1925 led to the cultivation of areas, *e.g.*, the Maluti Mts., formerly used only as grazing grounds. Between 60,000 and 80,000 Basuto find employment outside the country, chiefly in the Transvaal mines.

Agriculture and stock-raising are the main occupations. Wool, mohair, wheat, and maize are the chief exports. The value of exports rose from £193,000 in 1908 to £958,000 in 1924. Imports rose from £239,000 in 1908 to £942,000 in 1924. The revenue, £108,000 in 1908–9, was £252,000 in 1923–4; the expenditure, £241,000 in 1923–4, in some years exceeded the revenue, but Basutoland is self-supporting. The accumulated surplus between 1908 and 1921 totalled £159,000, which sum was spent on public works. About 50% of the revenue is derived from a poll tax on adult males, which in 1911 was substituted for a hut tax. A Basuto (properly Masuto) with more than one wife paid additional taxes for the second and third wife, but nothing for wives in excess of three. Fully a fourth of the Basuto (incorrectly Basutos) profess Christianity. Education is mainly in the hands of missionary societies.

Government.—Basutoland is under the control of the British Colonial Office. Ownership of land by Europeans is forbidden, and the Basuto, a virile race of mountaineers, strongly opposed incorporation in the Union of South Africa. Their desire to remain under direct Imperial control was repeatedly expressed, as in 1921 to Prince Arthur of Connaught, then High Commissioner for South Africa, and in 1925 on the occasion of the visit of the Prince of Wales. The system of government which, under a resident commissioner, allows a measure of home rule to the Basuto continues to work well. The *pitso* or national council meets yearly, 95 out of its 100 members being nominated by the chiefs and the other five by the administration. It has advisory powers only, but its advice is often taken. Sir H. C. Sloley, who had been resident commissioner since 1901, was in Dec. 1917 succeeded by Sir E. C. F. Garraway. Letsie II., who had been paramount chief since 1905, died in Jan. 1913 and was succeeded by his brother Griffith. When the World War began Griffith and his people offered to raise regiments for combatant service. The offer was declined, but 1,400 Basuto served with the South African native contingent in France, and many were employed in Southwest and East Africa.

Maseru, the capital, population (1921) 399 Europeans and 1,890 natives, is the largest town. A branch line connecting Maseru with the South African Railway system runs for one mile in Basutoland, and is the only railway in the territory. Some four miles from Maseru is a leper settlement established in 1912.

Annual reports on the Basutoland are published by the Colonial Office, London. See also *The Official Year Book of the Union of South Africa, 1910–24* (Pretoria, 1925). (F. R. C.)

BATAILLE, HENRI (1872–1922), French dramatist, was born April 4 1872 at Nîmes. In early youth he thought of becoming a painter and, in 1890, entered the École des Beaux Arts. His first venture into dramatic work, *La belle au bois dormant* given at the Théâtre de l'Oeuvre in 1894, was a failure; but his reputation was definitely established by a book of verse *La chambre blanche* (1895), and when his Breton drama *La lépreuse* was produced in 1896, he stood revealed as a dramatist of real promise. From that time onwards he developed his gift for writing plays in which passion is shown to sway men's lives more than their beliefs, until he reached maturity with *Maman Colibri* (1904), *La marche nuptiale* (1905) and *Poliche* (1907). Among his other works are *La femme nue* (1908), *La* *vierge folle* (1910), *La divine tragédie*, a book of war poems (1916) and *La chair humaine* (1922). He died March 2 1922 at Rueil, near Paris.

BATEMAN, KATE (1842–1917), American actress, daughter of Hezekiah Linthicum Bateman (*see* 3.508), conducted after 1892 a school of acting, appearing rarely on the stage. Her last appearance was as Kirjipa in *False Gods* at His Majesty's Theatre, London, in 1909. She died in London April 8 1917.

BATESON, WILLIAM (1861–1926), British biologist, was born at Whitby Aug. 8 1861. He was educated at Rugby and St. John's College, Cambridge, and became known for his biological investigations, which included important researches on Mendelism and the determination of sex. In 1894 he published *Materials for the Study of Variation*. In 1907 he gave the Silliman lectures at Yale University, from 1908 to 1909 was professor of biology at Cambridge, and in 1910 was appointed director of the John Innes Horticultural Institution at Merton Park, Surrey. From 1912 to 1914 he was Fullerian professor of physiology at the Royal Institution, and in 1914 was president of the British Association. He received the Darwin Medal of the Royal Society, of which he was a fellow and a Royal Medallist, in 1904, and was also the recipient of other British and foreign awards. His works include *Mendel's Principles of Heredity* (1902) and *Problems of Genetics* (1913), besides many short studies on biological subjects. He died at Merton, Surrey, Eng., Feb. 8 1926.

BATTLESHIP.—The subject of the principles of design of battleships was dealt with fully in the article SHIP (24.891), and probable changes were suggested. Since that article was written the authorities responsible for the defense of their respective countries have not thought it wise to introduce any serious variation from the line of progress then suggested. But everywhere a certain element of public opinion seems to distrust the judgment of responsible authority, and to fear that the new developments in aviation and in submarine service have rendered the accepted type of battleship obsolete.

Moreover, treaties for the limitation of armaments and in regard to the supply of munitions of war have projected the maintenance of navies beyond the limits of strictly domestic affairs. Henceforward, while the treaties run, the design and effectiveness of battleships are an international political matter. This article will offer an explanation of why responsible admiralties were not swerved from their course by the charges of undue conservatism founded on their adherence to the old type of battleship with only moderate changes.

Control of Sea Traffic.—The sea is the great highway of international traffic. Navies have existed and still exist only to protect their seaborne commerce in favour of their own national life and of their military forces overseas, and to use their power in detriment to the traffic of the hostile belligerent. They fight with this purpose as their final objective. A victory at sea is valueless which has no reaction on seaborne traffic.

With the growing specialisation of interrelated industries in far-distant regions, the control of ocean traffic in warfare is becoming more and more important, because national support to combatant forces is more and more dependent on supplies and raw materials drawn across the sea. War on property in transit on the sea is likely to assume even greater importance than it did in the World War.

With the domination of sea communications as the ultimate naval objective of either or both belligerents, shipping used for strictly combatant service hitherto always fell into three broad classes: (*a*) Supply craft for the fleet and overseas armies, for men must eat and arm before they can struggle; (*b*) types of reconnaissance craft depending on high speed for scouting, screening and information, because knowledge is a prerequisite for profitable employment of fighting strength; (*c*) heavy fighting craft whose duty is to beat down opposition after being supplied with munitions and with knowledge by the other two classes.

In all times, this last type, built to give and take the heaviest punishment possible under the general situation of the arts and science of the period, has been the battleship of the day. The battleship is by no means invulnerable; what the hand of man has made it can also destroy. Destruction may take place by administrative failure of duty, by traitorous sabotage, by battle with similar opponents and by attacks coming from the air and from beneath the surface of the sea. Like other combatants, the battleship will survive a battle only by her own hard fighting.

Granting that the control of surface-borne ocean traffic is, and will in the future be, the purpose of all warfare upon the seas, as it has been in the past, we are now asking ourselves where future predominance of type for naval warfare lies. Has the ultimate means of control passed away from the surface of the sea into the air or beneath the sea?

Surface ships of every type have one great advantage over the aeroplane and the submarine. The surface ship floats on the water with a reserve of buoyancy so great that very considerable injury to her structure is necessary to sink her. On the contrary, aeroplanes in the air, and submarines when under the water, have no reserve of buoyancy, and both must seek the surface as soon as injured, and there both are much handicapped. Yet their work, like the work of other combatant craft, is ultimately against surface craft.

Functions of War Vessels.—Combatant surface craft have always been divided into two broad classes, those whose chief military characteristic is fighting strength gained at some expense to mobility, and those whose distinction is speed and mobility gained somewhat at the expense of fighting strength but not altogether excluding it. The speed ships are primarily for scouting, screening and securing information, as well as to attack and defend commerce. The strength ships are to overcome the strongest opposition; yet need the support of the speed ships to guide and aid them in fleet battle. After successful fleet action, the speed ships may disperse to control commerce. But successful fleet battle is the result of co-ordinated effort of all types, and the speed ships, although comparatively weak in combatant strength, have yet a form of battle superiority over the strength ships. This rests on the tactical advantage of surprise which exists on shore as well as afloat. To meet a surprise time is the essential condition.

The Time Element.—Speed and superior mobility as combatant factors bring in the time element. Even if the attack is a weak one only, it may be driven home before the defence wakes up to utilise his strength, and the speedy assailant makes off before the stronger defendant can organise his counter-attack and pursue. This is as true of a cavalry attack as of a torpedo boat attack. The tactical answer to speed now as always is to oppose it by a counter-attack and pursuit no less speedy.

This time element also causes the success of the new weapons of every kind. The enemy does not know how to meet the novelty. When he learns how to do so, the novelty loses much of its effectiveness, for the parry is known. Such was the situation in the World War. Neither side was ready to meet the first hostile use of submarines, tanks, gas warfare and aviation. Now all are less important than they were because the novelty has disappeared. Methods of defence are known and are still developing. Public opinion lags and does not take note of the vital importance of this fact.

An Element of Surprise.—The considerations here summarised lead to the comprehension of a well-balanced fleet as one in which the commander-in-chief has the element of surprise available to him in two different forms. The first form lies in the use of the initiative through a tactical choice of weapons, as for instance the enemy forms for gun action but meets a torpedo attack under a smoke screen. The other form is, through superior mobility, to choose the time and place of attack and to break off action at pleasure, without fear of pursuit.

A wise combination of the activities of the two classes of surface ships—the strength ship and the speed ship—properly proportioned as to numbers, has hitherto constituted a well-balanced fleet. But now the proper balance is altered by the introduction of submarines and aircraft. In time of peace, as novelties, these necessarily excite relatively more public interest than they deserve in comparison with older types. The use of submarines by the Germans to the imperilment of the Allied cause has the romance of crime about it, and that of aircraft has the romance of high adventure; but in any other war they will both be used according to the measure of their serviceability and will lose much of their romantic interest.

Submarines.—Compared with other classes of ships the submarine is weak except for her distinguishing characteristic of submergibility. Thereby she can lie in ambush and surprise the enemy, but she cannot escape surface craft by mobility; she can only hide. If detected she is lost. The reply to the submarine is found in high speed surface craft seeking the submarine by listening devices and then destroying her. The submarine will always be embarrassing to a surface navy, but not necessarily dominant over it. A surface navy with a well-balanced adjustment of types is perfectly competent to deal with the submarine arm. But with a given aggregate strength of the fleet, the proper balance of types to meet a navy using submarines is different from that required to meet an opponent without them.

Aircraft.—As for aircraft, they are not weapons but vehicles; they derive their importance from their ability to rise into the air and so to avoid obstacles; and also, under favourable conditions, altitude may increase their range of vision. Perhaps more of their value comes from the fact that they are the fastest vehicles known. By such mobility they confer upon their riders the choice of time and place of surprise attack. They can be brought under fully effective counter-attack only by equally speedy opponents; that is, by an opposing air force. The chief use of aircraft is where mobility is most important, in scouting, screening and observation information service. In combatant efficiency the aeroplane does not stand high: its defensive structure is weak, and it can deliver an attack effective only through its high speed, which enables it to strike its blow before its own destruction. But the aircraft loaded with weapons (*i.e.*, bombs) moves slowly among its fellows, and is vulnerable to faster aircraft.

As in the case of submarines, here also a well-balanced surface fleet will be one prepared to overcome aircraft. But whereas the slow-moving submarine menace is countered by fast surface submarine chasers, the menace of heavy bombing and torpedo aircraft must be met by more speedy opponents, which in this case can only be faster aircraft. The answer of a surface navy to aircraft attack is to have aircraft of its own in sufficient numbers, just as it must have enough torpedo boats and enough cruisers and other types to make resistance effective against surface enemies.

With regard to further development of aircraft as substitutes for other types of shipping, the responsible heads of all navies are against it. Although useful, aircraft did not decide the World War, and nothing since has shown they will decide any future one. The advocates of greater aeroplane development and reorganisation assert that the air service will replace other types and inherit the future, but since the War they have no new facts or arguments to adduce in support of their assertions. With aircraft opposed to aircraft as one of the elements in the fleet, victory will fall to the best all-round fleet; a few aeroplanes in excess will mean no more than a few more guns. or any other minor difference in material.

Limitation of Armaments.—The final question concerning the future of battleships regards treaty limitations as they affect armaments and the laws of war. The ostensible reasons put forward for such treaties are humanitarian and the reduction of expense. The public supports such treaties in the hope, scarcely a belief, that they tend to prevent wars. But an analysis of the minutes of the assemblies at which such treaties have been concluded shows that, from the first Hague Conference to the most recent, the delegates ever seek to establish their countries in time of peace in situations of strategic advantage for war. Limitation on exportation of arms throws each non-manufacturing nation as a client upon some manufacturing power, and a large manufacturing capacity in readiness to turn out war supplies permits a nation so situated to contemplate international agreements as to formal reductions in armaments or as to limitations upon the export of munitions with more equanimity than another.

The Washington Conference (*q.v.*) of 1922 did away with the threat to British naval supremacy of the growing American battleship fleet, and Britain accepted equality in future battleship and aircraft carrier strength as satisfactory to her, with a limitation on tonnage; but agreement as to limitations of strength in other types could not be reached, although the size and armament of individual battleships and cruisers were fixed.

Proposals to abolish submarines could not be put through, because on this point there was sharp divergence between France and England. For generations England has had the dominant navy, and in consequence has always been conservative. She wants no change; for successful novelties challenge her position. The submarine is the weapon of weaker powers, and if France accepted its abolition her diplomatic weight in a dispute with England might be reduced. On the other hand, the abolition of submarines would confer a measure of diplomatic and belligerent freedom upon Great Britain by freeing her shipping from a serious menace. The humanitarian point of view most affects the public; but admiralties may not take this as an exclusive guide, for it is their duty to be more far-seeing than the public.

As for aircraft, the situation is not altogether the same. Their production belongs to the manufacturing nations, and consequently their necessity in war aids the four great manufacturing Powers to dictate world policies if they can agree upon such. When such an air agreement is lacking, and war threatens, it has not yet been made apparent that war from the air favours one of the four great manufacturing Powers more than another; yet it is a serviceable auxiliary to all. So no Power objects to aerial warfare on national strategic grounds.

As for further treaty limitations:—

(*a*) If limitation or abolishment of present type battleships takes place predominance will tend to pass to modifications of the present authorised 10,000-ton cruisers, which will then embody the age-long idea of the type of ship capable of the greatest endurance against all forms of hostile attack combined with maximum striking power when supported by suitable auxiliary types of combatant craft.

(*b*) Should limitation be placed on the total of all classes of combatant shipping, sea-power and the consequent ability to dominate world commerce in the national interest will tend to pass to the nation possessing the greatest combined combatant and merchant fleet, and a certain proportion of merchant ships would no doubt be fitted for ready conversion to combatant use in war.

(*c*) Should a treaty provide for ratios in each type of shipping, the result would be to favour strategically some one nation whose standard is adopted for distribution of tonnage among types. For any navy whose types are well balanced has made an adjustment between them suitable to her own political and geographical situation, but best suited to herself only. And if other nations accept it they have incurred strategic waste of pre-War effort in order to sign a treaty. The only sound limitation on armaments is one proceeding from voluntary action of nations because they see no occasion for aggression by themselves and feel they offer nothing tempting to aggression by others. That day is distant. Until then battleships of some sort embodying the strength characteristic as discussed above will remain the ultimate reliance of navies.

Under current treaty limitations, it may be assumed without information as to details of design that the British "Nelson" and "Rodney" are such ships. It is probable that they differ not greatly in total power from the Japanese "Mutsu" and the American "Colorado," improvements probably lying along battery arrangements, better compartmentation under water, greater deck protection, perhaps a little more speed and other minor differences at the discretion of the designer, but about which it is impossible to guess.

These ships of three Great Powers are the answer of their responsible admiralties to unsupported assertions that the day of the battleship has passed.

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BAUDRILLART, HENRI MARIE ALFRED (1859–), French ecclesiastic, was born in Paris Jan. 6 1859, the son of Henri Baudrillart. He was educated at the Lycée Louis-le-Grand, the École Bossuet, and the École Normale Supérieure, taking degrees in history, law, literature and theology. He became a priest in 1893, and next occupied the chair of history at the

Catholic Institute of Paris, of which he became rector in 1907. The following year he became vicar-general of Paris, and in 1915 founded the Catholic committee of French propaganda abroad. In 1918 he was made a member of the Académie française, and in 1921 was consecrated titular Bishop of Himeria. In Nov. 1925 he was made a papal count and bishop assistant at the pontifical throne.

Baudrillart's works include: *La politique de Henri IV en Allemagne* (1885); *Philippe V. et la cour de France* (1889–99), (Grand Prix Gobert); *L'église catholique; La renaissance et le protestantisme* (1905); *Quatre cents ans de Concordat* (1905); *La vie catholique dans la France contemporaine* (1918), etc.

BAUER, GUSTAV (1870–), German politician, was born at Darkehmen, East Prussia, Jan. 6 1870. He became connected at an early age with the German trade-union movement, and in 1908 was elected president of the general committee of the trade unions of Germany. In 1912 he entered the Reichstag as a Social Democrat, being appointed in Oct. 1918 Secretary of State for Labour in the Govt. of Prince Max of Baden. Appointed Minister of Labour under the Republic in Feb. 1919, on June 21 of the same year he became president of the Ministry formed to accept the Peace Treaty of Versailles, resuming shortly afterwards the former title of Chancellor. After the Kapp *Putsch* in March 1920, he fled with Ebert, the President of the Reich, to Dresden and later to Stuttgart. On his return he became Minister of the Treasury in Hermann Müller's Cabinet and shortly afterwards Minister of Commerce. From May 1921 until Nov. 1923 he held, conjointly, the offices of Vice-Chancellor and Minister of the Treasury in Wirth's Cabinet.

BAUER, OTTO (1881–), Austrian politician, was born at Vienna. Bauer was one of the founders of the Socialist Educational Movement, "Die Zukunft." He founded with F. Adler, the theoretical Socialist periodical *Der Kampf* and collaborated on Kautsky's journal *Die Neue Zeit*. He became secretary to the Parliamentary Fraction of the Social Democrat party in 1904 and at once proved himself the party's most brilliant theoretician. His first work *Die Nationalitätenfrage und die oesterreichische Sozialdemokratie*, treated the problem of nationality in the Dual Monarchy with deep historical insight and on lines entirely borne out by later developments. As a prisoner of war in Russia he studied Bolshevism at first hand, and on his return to Austria in 1917 became leader of the left wing of his party, which worked for a republic and self-determination for all nationalities. He was appointed under-secretary of state for foreign affairs by Victor Adler and became minister a few days later, on the latter's death (Nov. 12 1918). He retained this post under the Austrian Republic until July 1919. After 1918 it was Bauer's brain which really guided the international and internal policy of his party which he preserved as a non-Bolshevist but advanced Socialist organisation. He launched the few Socialist experiments in Austria (see his pamphlet, *Der Weg zum Sozialismus*, Vienna, 1920) and the Socialist agrarian policy (*Der Kampf um Wald und Weide*, Vienna, 1925; *Das Agrarprogramm der oesterr. S. D. Partei*, Vienna, 1926).

He wrote an important account of his own and his party's activities, *Die oesterreichische Revolution* (Vienna, 1923; English translation, London, 1925). His other chief works are *Bolshevismus oder Sozialdemokratie* (Vienna, 1920); *Der neue Kurs in Sovietrussland* (Vienna, 1921); *Das Weltbild des Kapitalismus* (in *Der lebendige Marxismus*, Jena, 1925).

BAUXITE: *see* ALUMINIUM.

BAVARIA (*see* 3.543), a territory and Free State of Germany, with which Coburg has been united since 1920. Its area, is 29,506 sq. m.; and the population (1925), 7,493,000.

Political History, 1910–8.—The prince regent Luitpold died on Dec. 12 1912. During the last years of his reign the Catholic-Clerical party, which was thenceforward to determine Bavaria's policy (the Bavarian People's Party or Volkspartei, is the new name of this party), had come into power after prolonged political struggles. When Podewil's Ministry, which had been in opposition to the Landtag, and finally dissolved it, was defeated in the elections of Feb. 1912, the prince regent instructed Baron von Hertling, a member of the Centre party in the Reichstag, to form a Ministry. He formed a Cabinet of officials, except for two posts, which he gave to members of his party.

The Ministry decided in Sept. 1913 to confer the royal dignity upon Luitpold's successor, Ludwig III., by making the necessary change in the constitution, but was immediately plunged into sharp conflict by the introduction of the bill for increasing the civil list. The World War brought a truce to party politics, but this was subjected to a heavy strain during the last year of the struggle, when the discontent of the population gradually assumed alarming proportions. Von Hertling became Chancellor of the Reich in Nov. 1917, and was succeeded as Minister-President by Von Dandl, who, in Nov. 1918, found himself confronted with the revolution.

The Revolution.—On the night of Nov. 7–8, before the fall of the Imperial Govt. in Berlin, the revolution broke out in Munich. The Wittelsbach dynasty was deposed, and Kurt Eisner, the Independent Socialist, placed himself at the head of the Revolutionary Government. He at once endeavoured to establish the new republic on a statutory basis by issuing an order for the re-election of the Diet, whose duty it would be to determine the new constitution. A provisional constitution of the Socialist Republic of Bavaria was set up in the interim by the Government. The Diet was to meet on Feb. 21 1919, but on that very day Eisner was shot dead. The result was the outbreak, on April 4, of a new revolution, inspired by the Bolsheviks. In Munich, the Councils Republic (*Räte-Republik*) was proclaimed, but its reign came to an end on May 1, amidst fierce fighting. Once more the Diet was assembled, and on May 5 1919 Hoffmann, the minister-president, laid before it the Government's scheme for the new constitution.

The New Constitution.—The new constitution, which came into being on Aug. 14 1919, was based on the assumption that Bavaria was still a sovereign state, although the Reich had laid claim to many of its former rights. Foreign policy, the army and railways became the concern of the Reich. Bavaria's economic policy also became severely restricted, as the financial legislation of the Reich had requisitioned her principal sources of income. The form of the state is prescribed by the Reich. Bavaria, like the Reich, is a democratic republic with parliamentary government; but it is a state without a president, and thus lacks the organ required to maintain the balance of power against Parliament. The controlling element is the Diet, which has no superior authority except that of the people, which elects its members and can dissolve it by a "popular demand" (*Volksbegehren*), and is also empowered to administer the laws directly by means of a referendum (*Volksentscheidung*).

The Diet is elected, like the Reichstag, by universal suffrage and secret ballot, based on the system of proportional representation. It consists of a single Chamber. There is no Upper House. A minister-president is appointed by the Diet, and the other ministers are selected by him by agreement with the Diet. Ministers and secretaries of state are responsible to the Diet for their administration. The Ministry as a whole, or any single member of it, may be forced to resign by a vote of non-confidence. The Diet is the legislative, its ministers are the executive authority. The necessary ordinances are issued by the Ministry as a whole, but the responsibility for administration rests upon individual ministers. Although the minister-president presides over the whole Ministry he has not the standing of a prime minister.

Direct legislation by the people, by popular vote, may occur in two cases: (1) when the Diet rejects a "popular demand" for the enactment of a law or accepts it only in an amended form, and (2) when the Diet has passed a law from which, within two months, an appeal is made by "popular demand" or a referendum called for by the whole of the Ministry. In so far as the people are able to legislate directly, Bavaria is, like the Reich, a direct democracy, but for the rest her constitution is based upon a system of representative democracy.

Political History under the New Constitution.—The policy of Bavaria since 1919 has been governed by (1) the risk of a conflict with the Reich and (2) the risk of a counter-revolution by Nationalist and Monarchist organisations. Relations with the

Reich were impaired by the view, held by the dominating parties in Bavaria, that the Weimar constitution involved excessive centralisation and uniformity. Bavaria therefore demanded greater independence for the individual states, and wished, not only to restore but to develop still further the Federal system of the old constitution of the Reich. On the question of the particular rights to be retained by Bavaria there were constant battles between the two Governments.

The rise of the Nationalist organisations was due, on the one hand, to a reaction after the temporary rule of Bolshevism in Munich, and, on the other, to the execution of the Versailles Treaty by the Entente. Events, such as the attempted counter-revolution in Berlin, the so-called "Kapp Putsch" (March 1920) could not fail to make their impression on Bavaria, especially as many of the participants found asylum there. Hoffmann's Socialist Ministry was forced to resign, and Kahr's bourgeois (non-Socialist) Cabinet took its place. On June 6 the bourgeois parties obtained a two-thirds majority in the elections, and the "law-and-order party" ("*Ordnungsblock*") began its rule. Herr Escherich founded the *Einwohnerwehr* or "Orgesch" (Organisation Escherich), a voluntary militia, for protection against possible repetitions of a Bolshevik revolution. This organisation was, however, dissolved by order of the Entente Commission, and Von Kahr resigned in consequence on Sept. 12 1921. His successor, Count Lerchenfeld, had an equally good majority but was also obliged to go out of office in the following year on account of a conflict with the Reich Govt. (Oct. 27 1922). Von Knilling's new Ministry leaned still more to the Right and the Democrats left the Government.

Meanwhile, the Nationalist leagues had gained in strength and now began to defy the Government's orders. The most powerful of them were the National Socialists, an extreme militarist, nationalist and, above all, anti-semite body, nominally democratic in tendency, but actually largely used by the rich to break strikes and attack Socialism. This body was raised from obscurity by one Hitler, a good demagogue but no politician, and it wavered between Bavarian separatism and pan-Germanism in a bewildering fashion. It became dangerous in the autumn of 1923, when Ludendorff joined it and gave it the backing of all the secret military leagues which called him leader. But it aroused opposition in Bavaria by setting itself against a restoration of the Wittelsbach dynasty and against the Catholic Church. Herr von Kahr was appointed general state commissioner with full dictatorial powers.

On Nov. 8 1923 the counter-revolution broke out in Munich. It was suppressed with bloodshed, the Reich defence force having remained loyal to the constitution, and Hitler and other leaders were sent to prison or lunatic asylums. Von Kahr's task was now at an end, and on Feb. 18 1924 he retired. The elections for the Diet gave no party a majority; a coalition Ministry was therefore once more formed, consisting of the Bavarian People's party, the German Nationals and the Farmers' League (*Bauernbund*). Held, the leader of the Bavarian People's party, placed himself at the head. This Ministry offered a firm front to the National-Socialist party and strove to reach a settlement with the Reich Government. In the antisocialist and Federal tendency of its policy, it nevertheless follows in the track of its predecessors. The Monarchist (Wittelsbach) movement is still very strong (*see* GERMANY). (W. v. B.)

BEATTY, DAVID BEATTY, 1st Earl (1871–), British admiral, was born Jan. 17 1871, the second son of Capt. David Longfield Beatty, of Co. Wexford, Ireland. In 1884 he entered the training ship, "Britannia," as a naval cadet. From 1896–8 he was with the Naval Brigade in Egypt and the Sudan, and later went to China to assist in the suppression of the Boxer rebellion in 1900. His conduct during these campaigns attracted much attention and explains why he reached the rank of captain before he was 30. He owed nothing to the purely civilian virtues of proficiency in examinations and technical efficiency. His mind was unhampered by non-military preoccupations and traditions, his predominating idea being that the purpose of war was a triumphant peace. He thus commended himself to Winston Churchill, who in 1911 was First Lord of the Admiralty. Beatty served two years at Whitehall as Churchill's secretary, a consultative and not an administrative post. In 1913 he was appointed to command the Battle Cruiser Squadron.

All doubts as to the wisdom of selecting an inexperienced junior for the leadership of a formidable proportion of Britain's naval forces were dissipated before a month of the World War had passed. In a raid into the Heligoland Bight in Aug. 1914, Beatty took his squadrons well within the range at which the German battle-fleet might have been expected to strike, a challenge the enemy did not take, and sank three cruisers and one destroyer without loss. A few months afterwards he intercepted the German ships under Von Hipper in his third attempt on the English coast towns. The Battle Cruiser Fleet was unfortunately reduced in numbers, and early in the engagement, the flagship "Lion" was disabled. Beatty's last signal, to pursue the enemy's capital ships and engage them more closely was regrettably misunderstood, with the result that the action was broken off and the German cruiser, "Blucher," alone was sunk. These two experiences of action bore fruit on May 30 1916 in the battle of Jutland (*q.v.*).

The debate over the German admiral's bold and skilful evasion of the traps set for him, the inability of the Grand Fleet, in conditions of acknowledged difficulty, either to bring and keep the enemy under effective fire till his business was done by daylight, or, on the morning of June 1, to intercept and destroy him in his headlong flight from the battle-field, when crippled and dispirited, does not involve Beatty's share in the action, and the commander-in-chief's despatch of June 15 1916 records a tribute unbesmirched by controversy.

Nevertheless, in the first grief and disappointment that followed on the news that the Germans had escaped, while "Indefatigable," "Queen Mary" and "Invincible" and other ships had been sunk with lamentable loss of life, Beatty did not escape censure. He was blamed for the "rash and impetuous" tactics that had been both costly and fruitless. Later, when it was known that the loss of the lightly armoured capital ships was not caused by exposure to overwhelming fire, but by their magazines being open to the blast of chance shells bursting in the turrets 50 ft. above them, opinion swung to the other extreme, and Beatty, who, like Nelson, missed no opportunity when attack was possible, became a national hero, the personification of aggressive and tenacious daring. If the censure was unmerited, the canonisation was for inadequate reasons. Beatty's record in three engagements, his drastic revision of the Grand Fleet's battle orders after taking command in Dec. 1916, and his no less drastic reorganisation of the guidance and control of the naval service on becoming First Sea Lord in 1919, remain permanent monuments to his clear insight into the essentials of fighting, of his firm grasp of the only principles by which fighting forces can be led and of his capacity to inspire others.

In 1921 he was the British delegate at the Washington Conference on the limitation of armaments. He received the K.C.B. in 1914. In 1919 he was raised to the peerage as Earl Beatty, Viscount Borodale of Borodale, Baron Beatty of the North Sea, and received a grant of £100,000 for his services during the War. He was also awarded the G.C.B. and the O.M. and was the recipient of numerous other British and foreign honours and decorations. In May 1901 he married Ethel, daughter of the late Marshall Field of Chicago, and has two sons. (A. H. P.*)

BEAVERBROOK, WILLIAM MAXWELL AITKEN, 1st Baron (1879–), was born at Newcastle, N.B., May 25 1879, the son of the Rev. William Aitken, a Presbyterian minister who subsequently became minister at Newcastle, where the boy's youth was passed. At an early age he started business in Halifax, Nova Scotia. His abilities attracted the attention of John E. Stair, a local financier, who made him a partner in his business. On the older man's death Aitken, who had made a considerable fortune, removed to the wider field of Montreal, where he continued his business operations and in 1907 acquired a seat on the stock exchange.

In 1910 he was suddenly plunged into a financial struggle of the first magnitude and into national notoriety. He was asked by the Bank of Montreal to investigate the prospects of an amalgamation of three Canadian cement mills. As a consequence of his examination he slipped almost by accident into a scheme for the amalgamation of all the Canadian mills. The question was, Could this be done, and if so at what price should such a combined company be launched on the market? Aitken named the figure, and, though most of his associates disbelieved him absolutely, he proved right, and made at a stroke an immense fortune. Largely owing to his own imprudence, he found himself the object of an organised Press attack, and achieved a considerable unpopularity throughout Canada. Time has proved the finance of the Cement Trust to be sound, and it has always paid a good dividend to its shareholders.

At this point Aitken, having attained his predetermined aim of making £1,000,000, retired from business and entered English politics. He won a sensational victory at Ashton-under-Lyne in Dec. 1910, and in Parliament became private secretary to Bonar Law. His influence with that statesman, who, in 1911, became Leader of the Opposition, was suspect to many Conservative members. He played a part in making his friend leader against the rival claims of Walter Long and Austen Chamberlain, but this was hidden from the public at the time. His skill for political manoeuvre was first generally recognised in 1916, when, by bringing Mr. Bonar Law, Sir Edward Carson and Mr. Lloyd George together, he helped to engineer the overthrow of Mr. Asquith and the substitution of Mr. Lloyd George as a Premier pledged to a more vigorous conduct of the War. For this service he was raised to the peerage in Jan. 1917 as Baron Beaverbrook of Beaverbrook, N.B. and Cherkley, Surrey. He had been knighted in 1911 and created a baronet in 1916.

At the outbreak of the World War he had become Canadian "Eye-Witness" at the front. In 1915 he became a representative of the Canadian Govt. with the Expeditionary Force, taking charge later of the Canadian war records. In Feb. 1918 he joined the Cabinet as Chancellor of the Duchy of Lancaster and Minister of Information in charge of propaganda. Immediately after the Armistice he resigned from the Cabinet and abandoned politics.

For some years before this date Lord Beaverbrook had possessed a financial interest in *The Daily Express*, but had taken no active part in its direction. He now took over entire control and gave the newspaper his whole attention. In a short time he raised it from the somewhat depressed condition in which he found it and turned it into a flourishing and powerful organ. In 1921 he founded *The Sunday Express*, and after a prolonged struggle established it successfully as a popular Sunday journal. Later, when the late Sir Edward Hulton's newspapers were placed on the market, he secured a controlling interest in *The Evening Standard*—thus creating a kind of triple alliance. His published works are the first two volumes of *Canada in Flanders*; *Success*, a study of the ethics of business; and *Politicians and the Press*, (1925). Lord Beaverbrook married in 1906 Gladys Henderson, daughter of Brig.-Gen. C. W. Drury, of Halifax, Nova Scotia. (M. W.)

BEBEL, FERDINAND AUGUST (1840–1913), German socialist (*see* 3.601). During Bebel's last years his views regarding the revision of the Social Democratic programme underwent a considerable change; he ultimately favoured revision in the sense of co-operation with other political parties in democratic reforms. In the Reichstag he continued to oppose Germany's official militarism; while strongly advocating resistance in the case of foreign aggression. His attitude towards imperial and autocratic Russia was throughout uncompromising. It would hardly be too much to say that he would have welcomed a rupture with Russia on almost any ground. His influence in this regard powerfully contributed to foster those sentiments in the Social Democratic party which led it to acclaim the declaration of war against Russia on Aug. 1 1914. One of his last public appearances was at an International Peace Conference at Berne in 1913. He died at a sanatorium at Passugg, in Switzerland, Aug. 13 1913.

BECHUANALAND (*see* 3.604), a native territory in South Africa under the control of the British Colonial Office. The population in 1921 was 152,983, of whom 1,743 were whites, compared with 120,776 in 1904, of whom 1,004 were whites.

The Protectorate is essentially a pastoral country and in 1921 the Bechuana possessed 495,000 cattle and 380,000 sheep and goats. Cattle, hides, and skins are the chief exports. The revenue, raised mainly from customs and a hut tax, first exceeded expenditure in 1915–6, when the figures were: revenue, £70,000; expenditure, £68,000. Previously deficits had been made good by the British exchequer. In 1924–5 the revenue was £99,000 and the expenditure £87,000. During 1922–5 a locust destruction campaign was carried out with marked success, over 37,000 swarms of *voetgangers* being destroyed.

Under the administration of a resident commissioner, the Bechuana tribes possess autonomy. They have made considerable progress and show a keen desire for education. Native and European advisory councils were established in 1920. Bathoen, paramount chief of the Bangwaketse tribe, died in July 1910 and Sebele, paramount chief of the Bakwena, died in Jan. 1911. Montsioa, chief of the Baralong, died in April 1911. All these chiefs were noted men in the early struggles between the Boers and British for the possession of Bechuanaland. A greater figure, Khama, paramount chief of the most important tribe, the Bamangwato, died in Feb. 1923, aged about 93. Khama, who had been converted to Christianity in 1860, had been paramount chief since 1875 and had been consistently friendly to the British. A stern, self-willed man, he was a great advocate of temperance and of education. When in June 1925 the Prince of Wales visited Bechuanaland, he unveiled a memorial to Khama at Serowe, the Bamangwato capital. Linchwe, chief of the Bakgatla, a wise and good ruler, the last surviving chief at the time when the country came under the British flag, had died in Oct. 1924. Sekgoma, Khama's son and successor, died Nov. 15 1925.

Among the white inhabitants, mostly farmers settled along the railway line, which links the Cape Province to Rhodesia, an agitation grew up for admission to the Union of South Africa. In Dec. 1924 Gen. Hertzog, Prime Minister of the Union, informed a deputation that in his opinion the time was ripe for considering the incorporation of the Protectorate, and also the Swaziland Protectorate, in the Union. For geographical reasons that part of Southwest Africa, known as the Caprivi Zipfel, was in 1922 transferred for administrative purposes to the Bechuanaland Protectorate.

Annual reports on the Protectorate are published by the Colonial Office, London. Consult also *The Official Year Book of the Union of South Africa, 1910–24* (Pretoria, 1925). (F. R. C.)

BECKWITH, JAMES CARROLL (1852–1917), American portrait painter (*see* 3.610), exhibited at St. Louis in 1904 "The Nautilus" and a portrait of Mrs. Beckwith. The universities of Yale and Johns Hopkins and West Point Military Academy possess examples of his works, and the New York Public Library has a collection of his crayon and pencil drawings. He died in New York Oct. 24 1917.

BÉDIER, JOSEPH (1864–), French scholar, was born Jan. 28 1864 in Paris and was appointed professor of medieval French language and literature at the Collège de France in 1893. He won the degree of *docteur-ès-lettres* with *Les Fabliaux*, a work on early French poetry which was crowned by the Académie Française. The publication of his *Roman de Tristan et Iseult* (1900) set a European seal on his reputation. In *Les Légendes épiques* (3 vol., 1908) he developed, with a wealth of picturesque detail, his theory that the great cycles of romance grew up along the pilgrim routes of medieval France. He thus supplied an ingenious and romantic interpretation of the Charlemagne, Guillaume, and Quatre Fils Aymon cycles, which directly contradicted the theory of their origin from a primitive common epic material maintained by Gaston Paris and his successors. Bédier's exquisite and lucid style gained him innumerable admirers among scholars and laymen alike. Among his other works are *Les Crimes allemands* (1915) and *La Chanson de Roland* (1921).

BEEBE, CHARLES WILLIAM (1877–), American ornithologist and explorer, was born in Brooklyn, N.Y., July 29 1877. In 1899, after receiving the degree of Bachelor of Science from Columbia University and completing a year of graduate study there, he became honorary curator of ornithology of the New York Zoological Society and was later made director of its Dept. of Scientific Research. He originated the collection of living birds in the New York Zoological Park, and brought it up to the first rank with a census of 900 species and 3,000 specimens. His scientific expeditions took him to Nova Scotia, Florida, Mexico, Venezuela, British Guiana, the Himalayas, Borneo, China, Japan and Galapagos. In an expedition in 1924–5 which he organised to explore the Sargasso Sea, the Humboldt current, and the Galapagos Is., he made many observations of scientific value and secured many rare specimens of marine life. He published a monograph on pheasants in four volumes, the first of which (1918) won him the Elliot Medal of the National Academy of Sciences.

In addition to many scientific papers on birds and evolution and numerous magazine articles, he has written: *Two Bird Lovers in Mexico* (1905), *The Bird* (1906), *Log of the Sun* (1906), *Our Search for a Wilderness* (1910), *Tropical Wild Life* (1917), *Jungle Peace* (1918), *Edge of the Jungle* (1921), *Galapagos: World's End* (1923), *Studies of a Tropical Jungle* (1925), *Jungle Days* (1925) and *The Arcturus Adventure* (1926).

BEECHAM, SIR THOMAS, (1879–), British conductor and impresario, was born April 29 1879, the elder son of Sir Joseph Beecham, 1st Bart. He was educated at Rossall School and Wadham College, Oxford, and gave his first concert with the Queen's Hall Orchestra in London 1905. He founded and afterwards conducted the New Symphony and Beecham Symphony orchestras, and also the Beecham Opera Company. After producing operas by Delius and others at Covent Garden Theatre in 1910, he gave a brilliant season of Russian opera and ballet at Drury Lane in 1913, where Chaliapin took the title-rôle in *Boris*. In 1915 Beecham gave a season of opera in English at the Shaftesbury Theatre, London, followed by others at the Aldwych Theatre. In 1916 he was knighted, and succeeded the same year to the baronetcy. In 1917 and 1918 he produced Russian, German and Italian operas at Drury Lane Theatre, returning in 1919 to Covent Garden, where he gave a first performance of Massenet's *Thérèse*. In 1920 under the Grand Opera Syndicate, Ltd., Sir Thomas produced operas by Bizet, Debussy, Puccini and others. His work in promoting Grand Opera in English has been of great value, and contributed largely to the foundation of the British National Opera Company in 1921.

BEECHING, HENRY CHARLES (1859–1919), British divine and writer (*see* 3.640), was dean of Norwich from 1911 until his death at Norwich Feb. 25 1919.

BEER (*see* 3.642).—The output of the brewing trade of the United Kingdom in the year 1913–4 exceeded 36,000,000 standard barrels. At this time the beer duty was 7s. 9d. per standard barrel, but by 1920 it had been raised to 100 shillings. The yield of the duty at 7s. 9d. had been £13,623,000, and, although a reduction in consumption by 10,000,000 bar. took place, the yield in 1920–1 on 26,730,000 bar. had risen to £123,394,000—practically 4d. per pint. In 1923, by means of a rebate of 20s. per bulk bar., the tax was reduced to about £4 net, but consumption, which had once more fallen, stood in 1925 at little more than 22,000,000 standard bar., or over 26,750,000 bulk barrels. The yield of the duty was £82,000,000. The number of licensed breweries in that year was 1,996 as compared with 5,311 in 1905. The materials used in 1925, excluding Ireland, were about 360,000 cwt. of hops, 12,500,000 cwt. of malt and corn and 1,700,000 cwt. of sugar.

The average retail price and taxation of beer in 1924 in London, compared with other European capitals, was as given in the table in the next column.

	London	Paris	Brussels	Berlin	The Hague	Copenhagen
Price	6d. per pint	0·70–·90 fr. per litre draught; 1·1 fr. per litre bottled	0·95–1·14 fr. per litre	32½ pf. per pint	48 cents per litre	29 öre per 0·35 litre (bottled)
Equivalent price per pint	6d.	1–1¼d. draught, 1½d. bottled	1–1¼d.	4d.	5½d.	4¼d.
Proportion paid as tax	40 %	(1)	(2)	10½ %	7 %	25 %

[1] Beer is subject to a production tax of 1½c. with surtax of 50c. per degree-hectolitre, *i.e.*, per hectolitre of wort and per degree of specific gravity over 100 water at 15° Centigrade.

[2] No tax on beer as such; on malt used in manufacture of beer there is a tax of 20c. per kilogram.

The exports of beer from Great Britain in 1925 amounted to 290,000 standard bar. and the imports of foreign beer to 15,000 standard bar., excluding 1,610,000 from Ireland. In 1925, in order to protect English hop-growers, a customs duty of £4 per cwt. (with one-third preference to British Dominions) was imposed on imported hops for a definite period of four years. The expenditure on alcoholic beverages in Great Britain in 1925, estimated at over £300,000,000, provided the state exchequer with revenue amounting to about £175,000,000. *See* LIQUOR CONTROL.

No figures for the capital invested in brewing alone are available. In May 1918 Government committees reported that state acquisition of the liquor trade, including wholesale and retail licensed premises, but excluding hotels, restaurants, wholesale spirit stores, etc., would require more than £400,000,000 but less than £500,000,000. The number of persons employed in brewing and malting in 1907 was officially returned as 84,969, and probably that number held good in 1925. *The Brewers' Almanack* for 1926 estimates that a minimum of 700,000 persons are wholly engaged in brewing, distilling, bottling, the wholesale and retail sale of alcoholic beverages and in allied trades; that direct dependents on these employees number 440,000, and indirect dependents a further 500,000.

Irish Free State.—Prior to 1914 the production of beer averaged 4,000,000 barrels. The industry was greatly affected by the World War, and at one period production fell to one-third the pre-War figure, mainly owing to the limitations on output imposed by the Government. Up to the end of 1925, as in Great Britain, only a partial recovery had been recorded. In normal years the industry consumes one-half the Irish barley crop. Taxation in 1925 averaged 3½d. per pint and provided one-quarter of the total revenue of the country. In pre-War years about one-third of the output was exported; in 1925 the export figure represented approximately one-half the production, exports mainly being to Great Britain and Northern Ireland.

Czechoslovakia.—The brewing industry attained its maximum output immediately preceding the outbreak of the World War, when there were 666 breweries in operation with an annual production of 13,000,000 hectolitres. During the War period the industry suffered severely from the falling off of supplies of malt, and was in a most critical position when the new republic of Czechoslovakia was established in 1918. A brewers' commission was formed and all necessary steps taken for improving the condition of the industry. Production increased from 1,623,445 hectolitres in 1917–8 to 3,875,520 hectolitres in 1918–9, and by 1924 there were 663 breweries in operation with an annual capacity exceeding 13,000,000 hectolitres. Special attention is paid to the export trade, particularly by the breweries of Bohemia, including the well-known brewery of Pilsen. The industry employs some 20,000 workmen.

Germany.—Brewing production was greatly curtailed owing to war conditions, as is clearly shown by the following figures of the consumption of beer (production plus import minus export) during 1913, 1923 and 1924 in the present German area: 1913, 61,920,000 hectolitres; 1923, 28,590,000; 1924, 34,087,000.

The industry satisfactorily survived the post-War period of inflation, but suffered from the violent price fluctuations. Sales increased during 1924–5, and from Jan. 1 1925 the production of pre-War full strength beer has been permitted. Exports of beer fell from 941,342 hectolitres in 1913 to 413,568 hectolitres in 1923. A small increase was registered in 1924–5. The minimum working week is 48 hours. In June 1925 the average weekly wage for skilled workers in the whole of Germany was 44·45 gold marks. A strong movement towards concentration exists throughout the industry, particularly in the chief centres of Munich, Berlin and Dortmund.

The following table, based on figures given in the *Annuaire Statistique* (1924) of the French Govt., gives the average annual consumption of beer in litres per head in certain countries:—

	1911–3	1920–3
United Kingdom	124·0	83·0[1]
Denmark	86·2	72·0
Norway	21·3	32·0
Sweden	48·9	33·4
Austria	72·0	44·0
Hungary	14·7	7·0
Switzerland	80·0	33·0

[1] 1920–2 only. In 1923 the consumption in Great Britain was 77·5 litres per head; in 1925 it was 79·5 litres.

Germany	104·0	48·0
Holland	28·5	23·5
Belgium	226·0	177·0
France	33·6	25·2
Italy	2·2	3·2
United States	78·0	9·0[2]

[2] In the United States of America the 18th Amendment to the Constitution, ratified in 1919, prohibited the manufacture, sale and import of all "intoxicating liquors," later defined by Act of Congress as any beverages that contain more than 0·5 % of alcohol by volume.

(P. C. Mo.)

BEERBOHM, MAX (1872–), British caricaturist and writer, was born in London Aug. 24 1872, a half-brother of Sir Herbert Beerbohm Tree, the actor. He was educated at Charterhouse and Merton College, Oxford. Before he had left Oxford, Beerbohm had made a reputation as an essayist of wit and polish, *The Yellow Book* offering him a congenial hospitality. This reputation was maintained, when he succeeded G. B. Shaw as dramatic critic to *The Saturday Review*, by the judiciously small amount of work which he published and its almost uniformly high accomplishment, in essays, fiction and parody alike. This includes *The Works of Max Beerbohm* (1896); *The Happy Hypocrite* (1897); *More* (1899); *Zuleika Dobson* (1911); *Seven Men* (1919); *And Even Now* (1920).

As a caricaturist, Beerbohm's fame followed a parallel line, and his skill as a draughtsman certainly increased with the years. Among his volumes of published drawings are *Caricatures of Twenty-five Gentlemen* (1896); *The Poet's Corner* (1904); *Fifty Caricatures* (1913); *A Survey* (1921); *Rossetti and His Circle* (1922), and *Observations* (1925). As a sophisticated commentary on the social and literary life of his time, Beerbohm's economical and often caustic drawings stand alone; his residence in Italy, at Rapallo, after 1910, gave him many advantages for the detached observation of personalities and tendencies, although once or twice it may have endangered his perspective; and he was certainly free from a certain fear of acid comment which has dimmed the art of caricature in England since the early Victorian age. (*See* CARICATURE.) (H. MI.)

BEESLY, EDWARD SPENCER (1831–1915), British positivist (*see* 3.644), died at St. Leonards-on-Sea July 7 1915.

BEGAS, REINHOLD (1831–1911), German sculptor (*see* 3.652), died Aug. 3 1911.

BEHAVIOURISM is a direct outgrowth of studies in animal behaviour during the first decade of the 20th century. C. Lloyd Morgan, the British psychologist, must be looked upon as the founder, virtually, of the American school of animal psychology. His books, *Introduction to Comparative Psychology* (1894) and *Animal Behaviour* (1900), broke away from the traditional anthropomorphic interpretations of animal acts. He first emphasised the necessity of tracing all the steps in any act we see the animal performing before the interpretation of that act becomes possible. His actual experiments upon the learning of animals were few in number but rich in interpretative value. His studies emphasised the trial and error nature of all animal learning. Morgan's work undoubtedly inspired the American animal psychologist, E. L. Thorndike, who first instigated systematic experimentation upon chicks, dogs, cats and monkeys in the United States. There soon followed in that country a host of experimentation upon mammalian learning. We mention in passing the work of Small, Yerkes, Kinnaman, Davis, Allen, Porter, Carr, Franz, Johnson, Ulrich, Richardson, Yoakum, Haggerty and Watson.

The rich results coming from the study of infra-human mammals led to similar studies on man. During this same general period we find man studied for the first time as a member of the animal kingdom. We mention the work of E. J. Swift, W. F. Book, H. A. Ruger and K. S. Lashley. Acquisitions of skilful acts such as keeping three balls in the air, typewriting, solving mechanical puzzles, learning to shoot the English long bow, serve to illustrate the types of problems studied. The results of these human studies emphasised the *essential similarity between human and infra-human learning.*

Emergence of Behaviourism.—Up to the appearance of Watson's two papers, "Psychology as the Behaviourist Views It" (1913) and "Image and Affection in Behaviour" (1913), and his book *Behaviourism—An Introduction to Comparative Psychology* (1914), there was no crystallisation of the behaviouristic trend. None of the workers in the field of animal behaviour made any attempt to escape the implications of consciousness in their interpretation of human or animal acts. In these three publications the terms "behaviourism," "behaviouristic" and "behaviourist" were first used. Washburn's book, *The Animal Mind* (1907), represents very well the tendency of the time. She felt the need of interpreting all animal behaviour in terms of consciousness as defined in the introspective systems of W. Wundt and E. B. Titchener.

Behaviourism when first conceived was based largely upon the rather loose concept of habit formation. The work of Pawlow and his students on the conditioned reflex, while known to the behaviourists, played at first a relatively minor rôle in their formulations. This was due to the fact that his experiments were chiefly concerned with conditioned glandular reflexes, which at that time was a subject hardly touched upon by psychologists. Bechterew's work on the conditioned motor reflex, where human subjects were used, had from the first a very much greater influence upon behaviourism. The work of Lashley in conditioning the human salivary reflex and of Watson and Rayner on conditioning human emotional reaction (fear) showed the great range of application of the conditioned reflex methods to human behaviour. This work has led to an attempt to formulate all habit (organisation) in terms of conditioned glandular and motor reaction. In spite of the fact that behaviourism did not at first utilise to any extent the conditioned reflex methods, Pawlow and Bechterew must be looked upon as furnishing the keystone to its arch. During the period of the general formulation of behaviourism as a system rather than as an approach to psychology, or as a specialised method in psychology, the writings of E. B. Holt, A. P. Weiss and K. S. Lashley are noteworthy.

THE FUNDAMENTAL VIEWPOINT

The behaviourist takes the position at the outset that the total behaviour of man from infancy to death is the subject matter of (human) psychology. Behaviour can be observed like the phenomena of all other natural sciences, *e.g.*, chemistry, physics, physiology or biology. The same general types of methods used in the natural sciences can be used in behaviour psychology So far in his objective study of man no behaviourist has observed anything that he can call consciousness, sensation, perception, imagery or will. Not finding these so-called mental processes in his observations, he has reached the conclusion that all such terms can be dropped out of the description of man's activity.

All behaviouristic observations apparently can be presented in the form of stimulus and response. The simple schema used is S→R. A behaviouristic problem is solved when both the stimulus and the response are known. For a very simple example, substitute in the above formula for S, contact on the cornea, and for R, blinking. The behaviourist's problem is solved when this has been done as a result of verified controlled experimentation. The neurologist has a problem to solve in this same phenomenon, namely, in determining the neural connections involved, their course, their numbers, the timing and spread of the neural impulse, etc. The behaviourist does not encroach upon it. The physical chemist has a problem to solve here also. His problem is not encroached upon either by the behaviourist or by the neurologist.

His problem is the determination of the physical and chemical nature of the neural impulses, the amount of work done in the reaction and the like. In every human reaction there is thus a behaviourist's problem, a neuro-physiological problem and a physico-chemical problem. When the phenomena of behaviour are once accurately formulated in terms of stimulus and response, the behaviourist achieves predictability with reference to his phenomena and control over them—the two essentials every science demands. One might put it in another way. Suppose the behaviourist were given the problem of how to cause a human being to blink, he solves it by touching the cornea with a hair (control). In more complicated reactions, especially those labeled "social", the S→R relationships are not so easy to solve. For example, present the stimulus prohibition (S) to any given nation, what will the response (R) be? It may take years to determine R completely. Many behaviouristic problems have to wait for their solution upon the slow experimentation of science as a whole. Regardless of how complicated the stimulus-response relationships may be, the behaviourist does not admit for a moment that any human reactions cannot be so described.

The general goal of behaviourism, then, is to so amass observations upon human behaviour that in any given case, given the stimulus (or better **situation**), the behaviourist can predict in advance what the response will be; or given the response, he will be able to state what situation is calling out the reaction. Looked at in this broad way, it is easy to see that behaviourism is far away from its goal. But while its problems may be difficult, they are not insuperable. The one thing that makes the approach of the behaviourist difficult is the fact that stimuli not at first calling out any given response can come later to call out a specified type of response. We call this a process of *conditioning* (earlier called habit formation).

THE GENETIC METHOD

This difficulty forces the behaviourist to resort to the genetic method. He takes the infant at birth and surveys his so-called physiological system of reflexes or, better, embryological responses. Having taken this inventory of unconditioned, unlearned responses, he next begins to try to condition them. When this has been done, two striking facts seem to appear. First, the number of complicated unlearned responses appearing at birth or at intervals thereafter is relatively small. *This leads to the rejection of the whole concept of instinct.* Most of the complex responses that the older psychologists called instinctive, such as crawling, climbing, cleanliness, fighting (a long list), are now believed to be built in or conditioned. In other words, the behaviourist no longer finds support for hereditary patterns of behaviour nor for special abilities (musical, art, etc.) which are supposed to run in families. He believes that given the relatively simple list of embryological responses which are fairly uniform in infants, he can build (granting that both internal and external environment can be controlled) any infant along any specified line—into rich man, poor man, beggar man, thief.

How the Building Takes Place.—Suppose one assumes that there are present at birth only 100 unconditioned embryological responses—there are many more of course. These appear in the form of breathing, crying, movements of arms, legs, fingers, toes, trunk, defaecation, urination and the like. If we assume that all of these can be conditioned and integrated according to the law of permutation and combination, the total possible number of built-in responses would be factorial one hundred—many millions more than any adult, even the most versatile one, is ever called upon to make even in the most complex social environment.

These embryological responses do not appear haphazard—they are not "random." Some definite stimulus calls them out. Let us call all such stimuli unconditioned stimuli, (U)S. Let us call all such responses unconditioned responses (U)R. The formula could be expressed thus $\frac{(U)S}{A} \rightarrow \frac{(U)R}{1}$.

After conditioning $\left.\begin{array}{r}B\\C\\D\\E\\Etc.\end{array}\right\} \rightarrow 1$

In the schema A is such an unconditioned stimulus, 1 is such an unconditioned response. Now if the experimenter takes B—and B so far as is known may be any object in the universe—and lets it stimulate the organism simultaneously with A for a certain number of times (sometimes even once is enough) it thereafter will also arouse 1. In the same way one can make C, D, E call out 1; in other words, one can make any object at will call out 1 (stimulus substitution). This shows how the stimulus side of our life gets more and more complicated as life goes on. In a similar way reactions become complicated as soon as a simple stimulus through the process of conditioning comes to call out a chain of reflexes (integration). In this way the behaviourist tries to take the vague concept of habit formation and to give it a new and exact scientific formulation in terms of conditioned responses. On this basis the most complicated of our adult habits are explicable in terms of chains of simple conditioned responses.

The simplification in psychological theory which comes through the application of behaviouristic principles is best seen in the realm of the emotions. Take fear. The works of Watson and Rayner, Moss, Lecky, Jones and others have shown that the fundamental unconditioned stimulus (U)S calling out a fear reaction is a *loud sound* or *loss of support*. Every child with only one exception, of approximately 1,000 infants examined, was found to catch his breath, pucker his lips, cry or, if older, crawl away, when a loud sound was given behind his head or when the blanket on which he was lying was suddenly jerked. Nothing else so far observed will produce the fear response in early infancy. Now it is very easy to make the child fear any other object in the universe. All the experimenter has to do is to show the object and strike the steel bar behind his head and repeat the procedure a few times. The schema of the situation follows:—

(U)S	(U)R
Loud sound Loss of support	"Start," crying, etc. (fear)

After conditioning:—

(C)S	(C)R
Rabbit, dog, furry objects	Fear

Conditioning of the emotions, (fear, rage, love, etc.) takes place very much earlier in the life of the infant than has hitherto been supposed; it is a process that brings complexity in response at a rapid rate. This means that an infant two or three years of age is already shot through with thousands of responses built up by the environment in which it lives.

The Process of Unconditioning.—The experiments of the behaviourists have shown that there is not only a process of conditioning or building taking place constantly from birth to death, but that there is also a process of *unconditioning* taking place as well. A simple experiment of the type described below best illustrates it. A conditioned negative response was set up in a 1½ year old child—that of drawing back from or running away from a bowl containing gold fish. We quote from a recent experiment:—

> The child, the moment he sees the fish bowl, says 'bite.' No matter how rapid his walk, he checks his step the moment he comes within 7 or 8 feet of the fish bowl. If I lift him by force and place him in front of the bowl, he cries and tries to break away and run. No psychoanalyst, no matter how skilful, can remove this fear by analysis. No advocate of reasoning can remove it by telling the child all about beautiful fishes, how they move and live and have their being. As long as the fish is not present, you can by this verbal organisation get the child to say 'Nice fish, fish won't bite'; but show him the fish and the old reaction returns. Try another method. Let his brother, aged 4, who has no fear of fish, come up to the bowl and put his hands in the bowl and catch the fish. No amount of watching a fearless child play with these harmless animals will remove the fear from the toddler. Try shaming him, making a scapegoat of him. Your methods are equally futile. Let us try, however, this simple method. Get a table 10 or 12 feet long. At one end of the table place the child at meal time, move the fish bowl to the extreme other end of the table and cover it. Just as soon as the meal is placed in front of him, remove the cover from the bowl. If disturbance occurs, extend your table and put the bowl still farther away, so far away that no disturbance occurs. Eating takes place normally, nor is digestion interfered with. The next day repeat the procedure but move the bowl a little nearer. In four or five such sessions the bowl can be brought close to the food tray without causing the slightest bit of disturbance.

The behaviourist concludes that by his experiments upon the conditioning and unconditioning of the responses of infants and children he has gotten a clear view of the way human beings are built up by the environment in which they find themselves. Man is a biological unit that can be studied like any other animal.

Does Thinking Offer Any Problem?—Many introspective psychologists agree up to this point with the behaviourist (Bertrand Russell, for example), but the subjectivist claims that there is something new in thinking (and let us include "imagination" under this term). What has the behaviourist to offer on thinking. The behaviourist's formulation runs somewhat as follows:—

The increasing dominance of language habits in the behaviour of the developing child leads naturally over into the behaviourist's conception of thinking. The behaviourist makes no mystery of thinking. He holds that thinking is behaviour, is motor organisation, just like tennis playing or golf or any other form of muscular activity. But what kind of muscular activity? The muscular activity that he uses in talking. Thinking is merely talking, but talking with concealed musculature.

> Take any child when he first begins to talk. Peep through the keyhole and watch him in the early morning. He will sit up in bed with his toys, talk aloud to his toys, talk about them. When a little older, he will plan out his day aloud, say aloud that his nurse is going to take him for a walk, that his daddy is going to bring him a car. In other words, he talks overtly when alone just as naturally as he works overtly with his hands. A social factor comes in. The father gets to the point where his own morning nap is disturbed. He yells out "Keep quiet." The child begins then to mumble to himself—a great many individuals never pass this stage, and they mumble to themselves all through life whenever they try to think. The father does not like the child's mumbling any better than his talking aloud, and so he may slap him on the lips. Finally, the parents get the child to the point where he talks silently to himself. When his lips are closed, it is nobody's business what is going on below. Thus we come to behave as we please if we do not give any external motor sign of it—in other words, our thoughts are our own.

A further question comes up for serious consideration: Do we think only in terms of words?

> The behaviourist takes the position to-day that whenever the individual is thinking, the whole of his bodily organisation is at work (implicitly)—even though the final solution shall be a spoken, written or subvocally expressed verbal formulation. In other words, from the moment the thinking problem is set for the individual (by the situation he is in) activity is aroused that may lead finally to adjustment. Sometimes the activity goes on (*a*) in terms of implicit manual organisation; (*b*) more frequently in terms of implicit verbal organisation; (*c*) sometimes in terms of implicit (or even overt) visceral organisation. If (*a*) or (*c*) dominates, thinking takes place without words.

Words are thus the conditioned (C)S substitutes for the world of objects and acts. Thinking is a device for manipulating the world of objects when those objects are not present to the senses. Thinking more than doubles human efficiency. It enables the individual to carry his day world to bed with him and manipulate it at night or when it is a thousand miles away.

Strict behaviourism is making rapid progress in America. It however has not yet been universally accepted even there. The older subjective psychology is being profoundly modified by it. One sees very little of *introspection* and still less of *imagery* in the writings of the subjectivists.

See J. B. Watson, "Psychology as the Behaviourist Views It." *Psych. Rev.*, XX (1913); *Behaviourism* (1925); the articles by K. S. Lashley in the *Psych. Rev.* in 1925; A. P. Weiss, *A Theoretical Basis of Human Behaviour* (1925); George A. Dorsey, *Why We Behave Like Human Beings* (1925); Bertrand Russell, *Analysis of Mind.* (J. B. W.)

BEILBY, SIR GEORGE THOMAS (1850–1924), British chemist, was born in Edinburgh Nov. 17, 1850 and educated at the university there. He joined the Oakbank Oil Co. in 1869, and later became a director of the Cassel Cyanide Co., the Castner-Kellner Alkali Co. and many other important undertakings. He invented a new process for retorting oil shale, a new synthetic method of manufacturing alkaline cyanides, and also carried out much important work on the economical use of fuel, establishing the Fuel Research Station at East Greenwich shortly before his death. Having served on several commissions and assisted the Govt. in an advisory capacity on many occasions, he was elected F.R.S. in 1906, and was knighted in 1916. He held office in many scientific societies, and was the author of a book on *The Aggregation and Flow of Solids* (1921), and of numerous important papers on chemical and metallurgical subjects. He died at Hampstead, London, on Aug. 1, 1924.

BEIRA (*see* 3.657), a seaport of Portuguese East Africa with a population (1921) of 11,871. Already the chief port for Rhodesia and Katanga, the completion in 1922 of a railway to the Zambezi made Beira also the port for Nyasaland. It has, in addition, a considerable trade in sugar and other produce of the territory administered by the Mozambique Co., of which it is the capital. The maximum depth of water in its harbour is 32 ft., the minimum 12 feet. The depth at the customs wharf varies from 20 ft. to nil. Ships are loaded and unloaded from anchorage by lighters; the wharf and railway piers had in 1925 a cranage power of 3,000 tons a day, but the facilities provided did not keep pace with the needs of shipping. The cargo handled in 1924 exceeded 1,000,000 tons. British ships constitute by far the greater part of the tonnage using the port; Portugal and Germany provide most of the remainder. The Pungwe and Buzi rivers, at the mouth of which Beira is built, are subject to serious floods, causing damage to the railway lines to Rhodesia and Nyasaland.

BEIRUT (*see* 3.658), now the most flourishing town in Syria, is the seat of the French High Commissioner for Syria and of the Government of the autonomous state of Grand Liban (Lebanon). The residence of the High Commissioner is in the Forest of Pines outside the town. A museum in the municipal buildings contains antiquarian remains found by the Service des Antiquités since the French occupation.

The production of silk began to revive in 1920, having fallen after the World War to less than one-tenth of its previous value, and the exports from Beirut were almost doubled in that year. In 1922 the exports of silk, oil, cotton, fruit, etc., were worth 36,392,000 fr., and the imports, largely manufactured goods, were worth 363,025,000 francs. Beirut is the most important port on the seaboard, though Tripoli may offer serious rivalry when its inland communications are improved. The harbour accommodation has been improved under the French régime, and traffic is increasing. There are 3 different anchorages: (*a*) inside the harbour with a depth from 25 to 45 ft., and 13 to 26 ft. along the quays; (*b*) outside the harbour, but sheltered by a breakwater, with a depth from 40 to 100 fathoms; (*c*) outside the harbour with depths of 100 fathoms and upwards, but exposed to the northwest winds.

The population of Beirut, largely Christian, is estimated at 140,000; after the bombardment of Damascus by the French in Nov. 1925 this figure was swelled by the arrival of numerous refugees. The town was bombarded in Feb. 1912, when a Turkish gunboat was sunk by an Italian squadron. After the Turkish collapse during the World War, in 1918, it was taken by the French Navy on Oct. 5, and occupied by British troops on Oct. 7.

BEKHTEREV, VLADIMIR MIKHAILOVICH (1857–), Russian neuropathologist, was born in the province of Viatka. He studied medicine in the medico-surgical academy at St. Petersburg (now Leningrad), graduated in 1878 and devoted himself to the treatment of mental and nerve diseases under Prof. Mergejevsky, a famous specialist of the time. He took the doctor's degree in 1881 and became *privat-docent*. In 1884 he went abroad to do research work under Dubois-Raymond, Wundt and Charcot, and was appointed professor at the University of Kazan, where he started clinical research of mental diseases and promoted the first psycho-physiological laboratory. In 1893 he became professor of the Military Medical Academy in St. Petersburg and was elected director in 1905–6. To foster psycho-physiological research, he founded in 1907 in St. Petersburg a psycho-neurological institute, which existed on private donations up to 1917, when an additional brain institute was formed and both were taken over by the government. He published more than 200 scientific papers on pathology and anatomy of the nervous system and founded a society of neuropathologists and the periodical *Nevrologitcheski Vestnik*. His work on *The Nerve Currents in Brain and Spinal Cord* appeared first in Russia in 1882; the second edition in 1896 has been translated into French and German. *The Functions of the Nervous Centres* appeared in Russia in 1909; his *Psychology, Objectively Demonstrated* was published in 1910; and his *General Diagnosis of the Nervous System Diseases* in 1911.

BÉLA KUN: *see* KUN, BÉLA.

BELASCO, DAVID (1859–), American playwright and theatrical manager, was born at San Francisco, Cal., July 25 1859. After graduating from Lincoln College, Cal., in 1875, and filling the position of stage manager at several theatres in San Francisco, he went to New York in 1880 to take charge of productions at the Madison Square Theatre. In 1885 he joined Daniel Frohman at the Lyceum Theatre in a similar capacity. He subsequently owned and directed the prosperous Belasco Theatre. He wrote or adapted some 200 plays, largely melodramatic, and owing to his mastery of stagecraft he was eminently successful as a producer and stage director. He presented E. H. Sothern in *Lord Chumley* (1887); Mrs. Leslie Carter in *The Heart of Maryland* (1895) and *Du Barry* (1901); Blanche Bates in *Naughty Anthony* (1899) and *The Girl of the Golden West* (1905); Henrietta Crosman in *Sweet Kitty Bellairs* (1903) and David Warfield in *The Music Master* (1904), *The Return of Peter Grimm* (1911) and *The Merchant of Venice* (1922).

Among his numerous other productions may be mentioned: *May Blossom* (1884); *The Charity Ball* (1887, with H. C. De Mille); *Men and Women* (1890); *The Girl I Left Behind Me* (1893, with Franklin Fyles); *Madame Butterfly* (1900); *The Darling of the Gods* (1902, with John Luther Long); *The Governor's Lady* (1912); *The Temperamental Journey* (1913); *The Secret* (1914); *A Celebrated Case* (1915); *The Boomerang* (1915); *Polly with a Past* (1917); *Kiki* (1921); *The Comedian* (1923); *Canary Dutch* and *Salvage* (1925).

BELFAST (*see* 3.664) became the capital of Northern Ireland and the seat of its government in 1921. The first Parliament was opened by the King and Queen on June 22 1921. Since 1918 Belfast has sent nine members to the British House of Commons. The population in 1911 was 387,947, and was estimated in 1923 at 429,000.

During the World War the shipbuilding and repairing yards were very active, and aeroplane engines and sails were made in the city for all the Allies. In 1918 the two shipbuilding firms, Harland & Wolff and Workman & Clark, both extended their yards, which employ normally about 36,000 hands. There were 40,000 power looms and a million spindles in the spinning and weaving industry in 1920. A graving dock, one of the largest in the world, was opened in 1911 in the harbour, and a new deep-water berth has been built. The total area of docks and basins, including part of the river which is practically a dock, is 140 acres. The total tonnage of shipping entering the port in 1924 was 3,164,274, an increase of 147,587 tons on the 1923 figure. The harbour defences and facilities for defending the coast at Belfast Lough were left in British hands when the two Irish states were set up. In 1920 the model farm, Balmoral, an area of 90 ac., and also land at Legoniel, were presented for public use.

The London, Midland & Scottish Railway station has been rebuilt and enlarged. The foundation stone of the Irish Presbyterian Church War Memorial Hospital was laid in 1923. In 1924 large reservoirs in the Silent and Annalong valleys in the Mourne Mts. were in process of construction, and in the same year the Duke and Duchess of York laid the foundation-stone of the new art gallery. An Ideal Home, Housing, Health, and General Trades Exhibition was opened in Feb. 1925. Plans are being prepared for new Parliament buildings.

During the agitations against the Home Rule bill of 1912 several demonstrations and political and religious disturbances took place in Belfast, culminating in the signing of a solemn covenant by 500,000 people. Serious rioting also occurred intermittently for a week in July during the Sinn Fein campaign of 1920.

BELFAST, QUEEN'S UNIVERSITY OF.—This Irish university dates from 1909, before which time it was Queen's College, Belfast, a constituent college of the Royal University of Ireland. The municipal college of technology is connected with it. The university gives degrees in arts, science, including civil engineering, law, medicine, commerce, agriculture and applied science and technology. In the year 1923–4 the trustees of the Rt. Hon. J. C. White gave £60,000 to the university for the endowment of departments of bio-chemistry and bacteriology.

BELGIAN CONGO (*see* CONGO FREE STATE, 6.917), a Belgian colony in Equatorial Africa. Readjustments under conventions with Portugal, Germany, and Great Britain between 1910 and 1915, and the addition of the mandated areas of Ruanda and Urundi in 1919, increased the total area of the colony by some 19,000 sq. m. and added between 2,500,000 and 3,000,000 to its population, bringing the former to about 910,000 sq. m. and the latter to perhaps 10,000,000 in 1925. No accurate figures of native population are available; in 1923 there were 10,037 Europeans, of whom 5,853 were Belgians; 724 Portuguese, and 704 British, the latter mainly in the Katanga.

I. POLITICAL HISTORY

The annexation of Nov. 15 1908 transferred the Congo from the personal rule of the Belgian King to the control of Parliament, through the Colonial Minister. The death of Leopold and the accession of Albert in 1909 led to the removal of the restrictions on freedom of trade, and to reforms in native administration. The former land policy was reversed, recognition being accorded to the customary rights of user enjoyed formerly by the natives, and the principle of freedom in the disposal of their labour was recognised. Native government was reorganised in 1910; the chiefs were restored to their old authority, subject to tribal custom, provided that it did not conflict with public order or laws intended to supersede tribal usage; they were further required to enforce the laws, police their areas, promote public health, and carry out public works, for which purpose they might call upon their subjects for a limited amount of forced labour.

Freedom of trade as required by the Berlin Act was established by 1912; the Govt. withdrew from its close association with commercial companies, and from 1911 the Katanga placed under a vice-governor-general, with wide powers but without an independent budget, was opened to exploitation. A further subdivision soon proved necessary, and in 1914 the whole Belgian Congo was divided into four provinces: Congo-Kasai, Orientale, Equateur, and Katanga, each under a vice-governor-general aided by an advisory council, leaving the governor-general and his council to deal with general questions and finance. The provinces were further subdivided into districts under commissioners, and these into territories under administrators, authorised to supervise the native administration, subject to strict regulations to prevent abuse of power. A more impartial administration of justice was also secured by judicial reform.

The genuineness of the reforms was recognised by Great Britain, and the appreciation of the natives was shown by their loyalty in the World War. Congolese forces aided France in the Cameroons and Britain in Northern Rhodesia. They conquered and held from Sept. 1916 to March 1921 a considerable area of German East Africa. On the German surrender of East Africa under the Treaty of Versailles, and by an agreement with Great Britain in 1919 approved by the League of Nations in 1923, Belgium obtained under mandate the thickly populated cattle-raising areas of Ruanda and Urundi.

By the conventions of Saint-Germain-en-Laye (1919), the principles of the Berlin Act and of the Brussels Act of 1890, regarding freedom of trade and equality of opportunity for trade and industry, were reasserted in favour of members of the League of Nations; concessions might be granted, but differentiation on national grounds was forbidden, and the rule restricting customs duties was waived. Missionary enterprise was encouraged, and the liquor traffic further regulated. In 1920 M. Louis Franck, the Colonial Minister, on visiting the colony, had to contend with a partial strike in the Civil Service and native unrest due to war conditions. Order was gradually restored, and five years later the chief problem which confronted M. Henri Carton on his visit as Colonial Minister was that of transport. In 1925 Ruanda and Urundi were given provincial status, with a distinct budget, in terms of the mandate of the League of Nations.

II. ECONOMIC HISTORY

The abandonment of governmental exploitation of the rubber industry through the compulsory collection of wild rubber by the natives, which up to 1910 had provided 75% in value of the total exports, coincided with lower rubber prices in Europe, and thus furthered the development of other branches of agriculture. The exploitation of the oil palm was commenced, and in 1922 nearly 50,000 tons of palm nuts and over 10,500 tons of palm oil were exported. Successful efforts were made to develop cotton growing, the production of ginned cotton amounting to 1,100 tons in 1922. Cocoa cultivation was not very successful, but coffee increased in importance. The production of rice increased, some 9,000 tons entering into trade annually; in 1922 about 600 tons were exported. A steady export of gum copal was maintained, nearly 14,000 tons being exported in 1922. Stock-raising was established in the north-east, and the tsetse fly was cleared from considerable areas in the Katanga; an increasing export business was developed in skins from Ruanda and Urundi. Some 300 tons of ivory continued to be exported annually.

The exploitation, partly by British capital, of the Katanga copper area is of fundamental importance, the output rising from 97 tons in 1911 to 56,577 tons in 1923; the diamond industry of the Kasai, first worked seriously in 1913, reached an output of 310,367 carats in 1923, while the gold production of Kilo and Moto rose to 3⅛ tons a year. In 1922, 238 tons of uranium mined at Chinkolobwe were exported to Belgium for the extraction of radium; in 1923 the export increased to 478 tons. The dependence of the Katanga on Rhodesian coal was greatly diminished by the exploitation of the Luena coalfield. Iron, tin and cobalt are also worked.

Communications.—Progress was essentially bound up with improved transport. The line from Kabalo to Albertville on Lake Tanganyika, affording connection with Europe via Dar-es-Salaam, was opened in 1915; that from Rhodesia, giving direct communication to Capetown and Beira, reached Elisabethville in 1910 and Bukama in 1918. The Colonial Minister in 1920 brought forward an extensive scheme of public works estimated to cost 638,000,000 fcs., and a law of 1921 approved a loan of 300,000,000 francs. Road construction was begun on a large scale, obstacles to river navigation removed, water, drainage and electric light systems planned for the towns, and the removal of the capital to Kalina Point, between Léopoldville and Kinshasa, decided on.

Harbour improvements were undertaken at Boma, Coquilhatville, Kinshasa and Matadi, and rapid progress made with a railway from Bukama to Ilebo, on the Kasai, to secure the Katanga trade and open up the Kasai area. A railway was begun from Chilongo on the Katanga line to meet the Benguella railway and link the Congo with Europe via Lobito Bay, saving 3,000 m. on the Beira route. A crisis arose in 1924 owing to the inadequacy of the Matadi-Léopoldville line; by great efforts its capacity was doubled by 1925, and plans were adopted to electrify the line and to lengthen the quays at Matadi and construct a port at Ango-Ango. An air service was installed between Kinshasa and Luebo, via Ilebo.

Labour Supply.—The scantiness of the labour supply under the new régime hampered progress. Efforts to combat it were made by ensuring fair terms of recruitment and employment both on private and public work, the code elaborated by the Labour Commission of 1924–5 being widely approved as a model. Great attention was also paid to the campaign to eradicate sleeping sickness and diminish venereal disease.

Trade and Finance.—The War diverted most of the external trade to Great Britain, and though after 1918 Belgium recovered much of her former predominance, imports from Great Britain of foodstuffs, spirits, clothing, machinery, iron sheets, cotton goods, etc., were 17·6 % of a total value of 268,719,988 fcs. in 1922, and exports thither, chiefly copper, palm oil and palm kernels, formed 10·3 % of a total of 294,579,315 francs.

The loss of revenue through the cessation of governmental exploitation led to constant deficits and, despite a considerable increase in customs duties, in 1924 ordinary revenue stood only at 141,603,640 fcs. as against an ordinary expenditure of 167,949,290 fcs.; there was also extraordinary expenditure of 103,000,000 fcs. and only 5,500,000 fcs. extraordinary receipts. But as against a debt of some 500,000,000 fcs. in 1924 the Colonial Minister claimed assets in the shape of the colony's share in the copper, coal, diamond, gold, radium and cotton industries of not less than 655,000,000 francs. At the same time Belgian investments in the Congo were estimated at 5,553,000,000 francs.

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(A. B. K.)

BELGIAN LITERATURE, FLEMISH (*see* 10.495).—Although during the years immediately preceding the World War, Flemish literature was in a very flourishing condition, it continued to maintain the tradition inaugurated in the 'nineties by the review *Van Nu en Straks*. This latter movement had definitely liberated Flemish writers from antiquated traditions and was the beginning of the modern era in Flanders. Thus, apart from Cyriel Buysse (b. 1859), the most notable figures of this period were the poets and prose-writers born in the 'seventies; their only serious rival of the younger generation being Félix Timmermans (b. 1886).

On the whole—although there are certain exceptions, notably Karel van de Woestyne—the literature of this period is distinguished by its emotional intensity and vitality rather than by wealth of ideas, and this is probably the reason why it is still little known abroad. The best works are difficult to translate. None the less, the literature of ideas gained ground; criticism, in particular, was subject to more serious treatment. Moreover, when one takes into consideration the smallness of the country, the literary output is really remarkable. It is impossible in a short article to give every writer his due, and therefore only outstanding figures can be mentioned.

Poetry.—The poetry of René de Clercq (b. 1877) has a fresh and vivid spontaneity; his invocations of nature, his lyrics of pity or anger, with their warm democratic feeling, are full of vitality. His later works, however, show a falling-off; the poetic ideas have not been allowed to mature, and his style is sometimes too loose. The greatest modern Flemish poet is indubitably Karel van de Woestyne (b. 1878) who, from the appearance of his first volume in 1903, preserved a consistently high level of production. It is safe to say that his complex and sibylline personality has struck a new note in European literature. He is the poet of the soul, racked by suffering, torn by conflict and inspired by a passionate longing for the things of the spirit; and in the sublimation of the ego he has transfigured the heart and senses of man and shown the perpetual conflict between mind and matter, between reality and the soul's dream of eternity. Jan van Nÿlen (b. 1879) and Firmin van Hecke (b. 1884) by their rare purity of style, are closer to him than any other contemporary poets.

Prose Writers.—The masters of narrative prose, Cyriel Buysse and Styn Streuvels, are dealt with in separate articles; the former as an objective realist, has delineated most truthfully Flemish popular life; the latter, by his poetical treatment, idealises it. Maurits Sabbe (b. 1873), with his warm sensitive semi-tones, best reproduces the atmosphere of Bruges. Lode Baekelmans (b. 1879), whose humour is broader, brings to life the dock quarter and the picturesque characters of the Antwerp streets. The tales of Fernand Toussaint (b. 1875) are distinguished by a delicate nuance of technique. The novels of Herman Teirlinck (b. 1879) depart from strict realism; they are imbued with an individual fantasy, which delights in exquisite arabesques. In Van de Woestyne, who has also written several volumes of prose on symbolic themes, the creative imagination reigns alone, remote from reality.

New tendencies, however, are visible in the younger writers of the post-War era. Certain poets, as Urbain van de Voorde (b. 1893), remain true to traditional versification, but others such as Wies Moens (b. 1898) completely break with all tradition and proclaim absolute liberty of rhythm and image; while Paul van Ostayen (b. 1896), discarding all logical phrases and even all idea of "subject," endeavours to express himself by sound values alone.

Ernest Claes (b. 1885) may be mentioned amongst the vivid narrators of the present, but the novelist, Félix Timmermans, achieved the greatest popularity, and at the same time won the appreciation of literary critics. His bright, spontaneous style, full of unexpected images which surprise by their very aptness, is combined with delicacy of perception and the true tang of nature. His *Pallieter* (1916) expresses an exuberant joie de vivre, the equal of which would be hard to find. *Het Kindeken Jezus in Vlaanderen* (1918) and *De Pastoor mit den Bloeyenden Wyngaerdt* (1923) are among his most important works. They are essentially Flemish in their mixture of frank sensuality and mystical tenderness.

In the theatre, Gaston Martens (b. 1884) at times relieves the old realism by a picturesque fantasy and produces an almost extravagant effect. Hermann Teirlinck, of the former generation, however, made, in his later years, the most serious attempt toward a dramatic renaissance: drawing his inspiration simultaneously from the medieval moralities and the cinema, he released the drama from the confines of the unities. His characters are types and mainly allegorical, and thus present all the spiritual elements of action moving in visible form. (A. V.)

BELGIAN LITERATURE, FRENCH (*see* 3.680).—Belgian literature which was so flourishing at the beginning of the 20th century, suffered some severe losses during the next two decades. Charles van Lerberghe, the greatest Belgian poet after Verhaeren, whose correspondence with F. Séverin has appeared recently, died prematurely in 1907. The powerful novelist, Camille Lemonnier, succumbed to a grave illness, in 1913; his last works being a tragedy, *Edénie* (1912), and a symbolic story *Au Coeur Frais de la Forêt* (1913). Emile Verhaeren died in 1916. More recently Edmond Picard, a well-known lawyer and critic who exerted a considerable influence on the younger generation, and Ivan Gilkin, one of the founders of *La Jeune Belgique*, were lost to Belgian letters. To these names should be added those of several writers of great talent and promise who were killed fighting for their country. Some of their writings have been collected in *Les Ecrivains belges morts à la guerre*, an anthology that was published in 1912.

War Literature.—The War itself inspired a great amount of literature both inside and outside Belgium. Most of these productions have only an historical interest, others deserve to be considered as contributions to Belgian letters. Among the latter, must of course be included all the writings of Maeterlinck and Verhaeren. A soldier poet, disciple of Verhaeren, Maurice Gauchez came to the fore with *Les Rafales* (1917), and Emile Cammaerts published in London a series of poems, *Belgian Poems* (1915), *New Belgian Poems* (1916) and *Messines and other Poems* (1918), which attracted a great deal of attention.

The most interesting productions of War literature are, however, those which were written during the four years of German occupation (1914–8) or immediately after the deliverance of the country. A. Giraud, and M. Elskamp, published two notable books of poems, *Le Laurier* and *Sous les tentes de l'exil* (1923), and the historian, H. Pirenne, *Souvenirs de captivité en Allemagne.* Among other works of prose let us mention the anonymous *Lettres d'un provincial ou les propos du conseiller Eudoxe*, a satire on German administration after the style of Pascal, *L'oeil sur les Ostrogoths* by E. Verlant, the war memories of M. Lekeux, a Franciscan monk who fought as an officer of artillery, *Mes cloîtres sous la tempête*, and a collection of War impressions by two young writers, Lucien Christophe, *Aux lueurs du brasier*, and R. Vivier, *La plaine étrange.*

While, in former days, literature was practically ignored by the state, several institutions were founded in order to stimulate its activity. In 1920, a Belgian Academy of French language was established by royal decree which published critical studies on Belgian literature and awarded prizes for essays on set questions or for any book of verse or prose worthy of encouragement. Certain endowments were entrusted to it, such as that of the French Société des Auteurs et Compositeurs of a biennial prize for dramatic literature. The Academy passed resolutions which were acted upon by the Govt. and undertook an enquiry into the situation of the French language throughout the world.

Most of the 14 original members of the Academy formerly belonged to the group of *La Jeune Belgique*, and at the end of this period were already looked upon as the writers of the older generation. Among them were: G. Eekhoud, a story writer of Flemish peasant life, and the author of several translations and criticisms on the Elizabethan drama whose work *Perkin Warbeck* appeared in 1914; the Parnassian poet, Albert Giraud, who, besides *Le Laurier* mentioned above, published *Eros et Psyche* in 1920 and *Le concert dans un musée;* F. Séverin, who was particularly successful in his descriptions of Walloon countryside (*La source au fond des bois*); the poet essayist A. Mockel (*La flamme immortelle*, 1924), and two accomplished novelists and story-writers of Walloon extraction: H. Krains (*Mes amis*, 1921) and L. Delattre (*Du côté de l'ombre*, 1924).

The influence of art, so powerful on Belgian literature, reasserted itself in later years owing to the constant interest shown by the Belgian public in modern and ancient painting. Among the poets and playwrights who, more recently, devoted part of their time to art criticism are: G. Le Roy in *James Ensor* (1922) A. Goffin in *L'Art religieux en Belgique* (1924) and G. Vanzype in *L'Art Belge du 19ème siècle* (1923), *Henri de Braekeleer* and *Rubens.*

It has often been noticed that the delight they take in description had somewhat hampered the talent of Belgian novelists. This may account for the fact that, in the writers of this period, as in the former generation, poems and dramatic works were generally above the level reached by novels, though writers of Walloon extraction were less inclined than their Flemish colleagues to mistake their pen for the brush. Among the most distinguished works of the latter since the War, may be mentioned H. Stiernet's *Le roman d'un tonnelier*, H. Davignon's series of novels dealing with Anglo-Belgian relationship, L. Piérard's *Les trois borains*, G. Garnir's *La chanson de la rivière*, E. Glesener's *Les dytiques* and R. Dupierreux's *La certitude amoureuse;* among the former, the most original writers are: H. van Offel (*Les deux ingénus*), F. Hellens (*En écoutant le bruit de mes talons*), and A. t'Serstevens (*Le vagabond sentimental*).

Poetry and the Drama.—It is almost impossible to classify the various tendencies which inspired the work of the modern poets. We find, on one side, a remarkable group of religious poets such as V. Kinon (*L'âme des saisons*), P. Nothomb (*Portes du ciel*), Th. Braun (*Le beau temps*), P. Fierens and G. Raemaekers who illustrate the mystical side of the Belgian temperament; on the other, the group of "La Renaissance d'Occident," headed by M. Gauchez (*Hymne à la vie*) who exalt the joy of life, following the realistic tendencies of Verhaeren. A certain number of poets, like Marie Gevers, (*Missembourg-Antoinette*), and E. Cammaerts, *Poèmes intimes* (1922) insist on the intimacy of homelife, others, like E. Marcuse and L. Kochnitzky, *Elégies bruxelloises*, follow impressionist and humoristic tendencies. R. Verboom, M. Thiry and N. Ruet may be mentioned among the most promising poets of the younger generation.

When considering the drama, we have again to deplore the loss of Verhaeren whose last tragedy *Hélène de Sparte* was given in Paris in 1912. From Maeterlinck, we have had: *The Burgomaster of Stilemonde* (1918), produced in England by Sir Martin Harvey; *The Betrothal* (1918), a sequel to *The Blue Bird* (1910), played in London in 1921; and two plays in modern setting: *The Cloud that Lifted* and *The Power of the Dead* (1923). Maeterlinck's amazing success in Paris, 30 years ago, was almost repeated, in 1920, by a young Belgian playwright, F. Crommelynck, whose semi-grotesque, semi-tragic play, *Le cocu magnifique* (1921), created a sensation at the Théâtre de l'Oeuvre. This author, who seems strongly influenced by the biting humour of Pieter Breughel, published more recently two other plays: *Les amants puérils* and *Tripes d'or.* G. Vanzype, a writer of problem plays who remained steadfastly faithful to his high standard, added three more, *Les semailles*, *Les visages*, *Les autres* to his already lengthy list of works. The dramatic power of Belgian writers can also be clearly detected in the two plays of P. Spaak, *Malgré ceux qui tombent*, and G. Rency, *La dernière victoire*, while such works as H. Soumagne's *L'autre messie* (1924) and P. Demasy's *La tragédie de Faust* and *Jésus de Nazareth* (1924) showed that this power was by no means exhausted among the younger generation. There are few essayists in Belgium, but certain criticisms such as those of J. Destrée, L. Dumont-Wilden, G. Charlier, F. Ansel and C. Bernard are of real and permanent interest. (E. Ca.*)

BELGIUM (*see* 3.668).—The eastern frontier of Belgium was rectified in 1919 and 1920; under the Treaty of Versailles Germany ceded to her neutral Moresnet and part of Prussian Moresnet; cantons of Eupen and Malmédy were provisionally ceded to Belgium by the same treaty, and the decision was confirmed by the League of Nations. The area of Belgium was hereby increased to 11,792 sq. miles. The estimated population (1923) is 7,666,055.

On Dec. 17 1909 King Leopold died at the château of Laeken. In 1908 the Congo, of which the King was the personal sovereign, had been ceded by him to Belgium. The death of the King was followed under the Belgian constitution by a regency, of which M. Schollaert was President. On Dec. 23 1909 the King's nephew, Albert of Belgium, took the oath to the Belgian constitution and became King of the Belgians as Albert I.

I. POLITICAL HISTORY

Belgian political problems before the War arose from the constant increase of the highly industrialised population and the consequent need of economic development. The great urban centres of population were developing with prodigious rapidity, while emigration was practically non-existent. In 1910 the Belgian industrial population amounted to 1,710,161 out of a total population of 7,423,784; 120,000 persons were organised in the trade unions. This enormous importance of industry, as of commerce, largely determined Belgian policy. Belgium throughout maintained practical free trade. In 1900, customs dues only represented 2·3% of the value of imports, in 1913 1·4 per cent. Yet, important as commerce and industry are, agriculture represents an economic wealth not inferior to them. It is highly developed and its products constitute one of the principal branches of export. These two poles of the economic strength of the country, industry and agriculture, also determine the strength of the political parties.

Political Parties.—Industry, with its enormous man power, has furnished recruits for the Socialist party, while the agricultural population forms the basis of the Catholic party, and especially of its democratic wing, the Christian Democratic party. Both the Socialist and the Christian Democratic parties are parties of social organisation. Socialism has created enormous workmen's co-operative organisations, as the *Vooruit* at Ghent, the *Maison du Peuple* at Brussels and the *Travail* of Jolimont; in 1910 the Socialist party had organised 3,000,000 members in its co-operative undertakings, which had a turnover of more than 100,000,000 francs annually. Similarly, the Christian Democratic party created a number of trade unions and social organisations, often directed by the priests. The most important of these are the *Boerenbonden*, peasants' associations for co-operative purchase and sale through societies formed on the Raiffeisen system, which are organised in all the great rural districts in the Flemish districts. This vast federation of peasants' associations has its centre in Louvain, where it has established an important bank. These two groups of democratic organisations, which constitute two powerful and disciplined masses of electors and are backed by great material resources, exercise a decisive influence on politics, the trend of which is towards social and economic control.

The Socialist trade unions were to try their strength in the campaign which they undertook in 1912 in favour of unlimited universal suffrage. This campaign coincided with the violent educational struggle which now opened between the parties of the Left (Liberals and Socialists) and the Catholic parties. The latter, who had a majority in the Chamber, brought forward a bill in 1912 to place the free schools and the public schools on an absolute equality. Education, especially primary education, is largely in the hands of religious establishments, whose schools are recognised and subsidised by the state, and are in many parishes the only ones. For these religious schools the Government proposed a treatment similar to that accorded by the state to public education. The Liberals and Socialists united against the Right. Nevertheless, in the elections of 1912 the Catholic party retained a majority in Parliament. In order to prevent this education bill from becoming law, and to force the introduction of universal suffrage, the Socialist party organised a general strike in April 1913. Several hundred thousand workmen went on strike. The educational law was passed, but the Government agreed to introduce compulsory education as a concession to the Liberal party, and the laws of May 19 and June 15 1914 make attendance at schools compulsory between the ages of six and fourteen.

Important, too, were the linguistic and military questions. Belgium had enjoyed uninterrupted peace since 1830, and had interested herself little in military problems. In 1912, however, the threatening international situation obliged the Prime Minister, M. de Broqueville, to introduce legislation instituting the principle of compulsory military service. In 1913 the army was completely reorganised; the general staff received the most extensive powers, a superior council of national defence was instituted, and schools of artillery, cavalry and engineers were created. The École de Guerre and École Militaire were reorganised, and armament was brought up to date. These reforms were to be complete in five years.

The War, 1914–8.—The international crisis which came to a head in July 1914 found Belgium unprepared for war, in spite of her recent military laws. The neutrality of Belgium, and Luxembourg had been guaranteed by the five Great Powers (Great Britain, France, Prussia, Russia and Austria) in the treaties of 1839, which bound the guaranteeing Powers to intervene if either party to a war violated that neutrality. On July 30, following the precedent in 1870, Sir Edward Grey addressed a message to the French and German governments, drawing their attention to this point and asking for an assurance that Belgian neutrality would be respected. The German Govt. declared itself unable to answer this question; and on Aug. 2 invaded Luxembourg and sent Belgium an ultimatum calling on her to allow the German troops free passage across Belgian territory. If the request was refused, Germany would treat Belgium as an enemy. To this note Belgium, who had mobilised 15 classes of militia on July 31, replied by a formal refusal on Aug. 3. Parliament accepted war unanimously, and the Socialist party assured the Government of its unreserved support. The leaders of the Liberal and Socialist parties, MM. Goblet d'Aviella and Hymans and M. Vandervelde, joined the Government as ministers without portfolio.

THE WAR PERIOD

The Invasion.—In the night of Aug. 3–4 the German Army invaded the country. Liége fell on Aug. 7 and Namur on Aug. 23. The province of Namur was ravaged, the towns of Andenne, Tamise and Dinant were pillaged, and it is estimated that in the province of Namur 1,949 persons were killed and 3,000 houses destroyed. After their entry into Louvain the Germans set fire to the centre of the city, when the cathedral of St. Pierre, the famous library and 1,120 houses were destroyed. Seventy-nine of the inhabitants were shot. The town of Aerschot was almost destroyed. The Germans entered Brussels on Aug. 20. In the course of the occupation of Brabant 594 inhabitants were shot and in the Antwerp and Hainault provinces 665 persons. Antwerp was evacuated by the Belgians on Oct. 6, and with the withdrawal of the Belgian Army to the Yser the whole country, with the exception of the southwestern districts of Flanders, was under German occupation. (*See* WORLD WAR.)

The German Occupation.—Germany sent General von der Goltz, Baron von Bissing, and General von Falkenhausen as successive governors-general. The governor-general, assisted by a central staff, exercised executive power. He legislated by promulgation of orders, except in the two Flanders, Hainault and South Luxembourg, where all power rested with the highest local military authorities. Provinces and districts were administered by German officials, with military commandants of cantons. The powers of the Belgian provincial councils were finally suppressed on July 6 1918. Many Belgian burgomasters were deported. The occupied territories paid a tribute, amounting finally to 60,000,000 fr. per month, for the maintenance of the German Army in Belgium. The legislative measures instituted by the German military tribunals were numerous and repressive (*see Législation et administration allemande en Belgique de 1914 á 1918*, J. Pirenne et M. Vauthier, Carnegie Endowment). Von Bissing also instituted, Feb. 5 1915, a new judicial system, with two courts of instance, that of the provincial governors and of the heads of arrondissements and of commandants. The executive and judicial power were not separated. On April 3 1917 the governors were empowered to pronounce total or partial confiscation of property. The Belgian judicial powers were suppressed by decree of April 7 1918. German *Kaiserliche Bezirksgerichte* replaced the Belgian *tribunaux répressifs*. The family was pronounced responsible for faults committed by a single member of it. A sentence pronounced on an absentee could be served by a third person; general confiscation of all property, forbidden by the Hague Convention and the Belgian constitution, was introduced, as was deportation for refusal to work for the German authorities, or even for simple "undesirability." On April 7 1918 German tribunals of first instance and appeal (in Brussels and Namur) replaced all civil Belgian jurisdiction. The Belgian magistrates, bench of judges and court of appeal made frequent protests. Three presidents of the last-named were deported in 1918 in consequence of a conflict arising out of the arrest of certain "activistes" leaders.

In order to disorganise the country, Germany sought to exploit the linguistic differences between Belgium's northern and southern provinces with the help of the so-called *parti activiste*. From 1916 on, various decrees abolished the French language in the previous bilingual administration of Flanders. On March 21 1917 a decree was issued dividing Belgium into two distinct linguistic regions, with administrative centres at Brussels and Namur. All ministries were doubled, the Flemish remaining in Brussels, the Walloon moving to Namur. French became the only official language in the Walloon district, Flemish in the west. The use of German and Flemish was, however, authorised in Walloon territory. The *activistes* attempted to organise a new independent Flemish State under German protection. On Feb. 11 1918 an enormous demonstration was held in Brussels against separation. German troops dispersed the crowds, but, in face of the unanimous protests of the Belgian authorities, Germany did not dare recognise a legislative authority for the *Raad van Vlaanderen*. With ceaseless energy, however, she continued her efforts to foster linguistic differences, notably by flemicising the University of Ghent.

Industry suffered severely from the occupation. Raw materials were requisitioned, foreign enterprises put under sequester on Feb. 17 1915, together with all industrial concerns which might be useful or dangerous to Germany, especially great metallurgical businesses, quarries, mines, electricity works, etc. In 1915 central offices were set up for the coal, oil and grease, water, gas and electrical industries. The Government thus controlled all the essentials of industry.

The stoppage of overseas exports ruined Belgian industry. Unemployment increased enormously, reaching 650,000 in 1916. Germany desired to recruit these workmen for her own use, but met with obstinate refusals. On Aug. 14 and 15 1915 appeared the first decrees ordering severe penalties for persons who refused to work for Germany. At the same time, commissions were sent from Germany to take out of the Belgian workshops everything which could be used beyond the Rhine, and to destroy systematically all machinery which could not be transported to Germany. By June 30 1918, 167 factories had been completely destroyed, and 161 were on a list of the governor-general's for immediate destruction. Of the 57 blast furnaces, 26 had been rased to the ground, 20 put completely out of action. Only the mines necessary for Germany were spared. When the Germans retired, in 1918, they ordered these mines to be flooded, but the order was not carried out.

The process of destruction was hindered by the protests of the neutral powers, who threatened Germany with economic reprisals. On Feb. 18 and July 21 1917 work was forbidden in all factories and workshops except by special permission; the whole Belgian working population was thus thrown out of work. At this moment Germany ordered the stoppage of all public works undertaken by the provinces and communes for the relief of unemployment. These steps were preliminary to the plan of deporting the Belgian working population. In Nov. the military authorities requisitioned able-bodied men between the ages of 17 and 60 throughout the whole country. Inhabitants on the lines of communication were mostly sent to the Yser or North French fronts, to construct railways, prepare routes and dig trenches, often within the range of artillery. The other workmen were concentrated in great camps in Germany, whence they were dispatched to German factories or labour battalions; 57,718 were transported to Germany, 57,541 to the front; 2,531 died in consequence of ill-treatment.

Foodstuffs began to grow short in Nov. 1914. Immediately on occupation, the German Govt. had repealed all measures taken by the Belgian Govt. to insure rationing. Public authority had now no further power to intervene, and private initiative stepped in. Committees sprang up everywhere. A central committee was founded at Brussels under the title "Comité Central de Secours et d'Alimentation," under M. Ernest Solvay. The Committee desired to import foodstuffs from England, but the British Govt. refused. Finally, Von der Goltz having promised to exempt all imported foodstuffs from requisitioning, the British Govt. consented to allow their import under the supervision of the embassies of Spain and the United States. The "Commission for Relief in Belgium" was set up to organise the supervision (*see* RELIEF). The activity of the Comité Central acquired enormous importance, and extended throughout the country. It then changed its name to "Comité National de Secours et d'Alimentation." By Dec. 31 1918 it had distributed foodstuffs to provincial committees to the value of over 3½ milliard francs (2½ milliards for Belgium, 1 milliard for France). The profit made on the sale of foodstuffs was used to organise charitable works at an expenditure of 1,300,000 francs. After America's entry into the War Mr. Hoover resigned his post as president of the commission for relief in Belgium, and a Spanish-Dutch committee took over the work.

The Belgian Government during the War.—The German occupation forced the Government to retire, first to Antwerp, then to Ostend, then to Havre. At the same time, over 1,000,000 Belgians left the country, 200,000 fleeing to France, 100,000 to England and 700,000 to Holland. The Government in Havre immediately set about reorganising the army, which had never left the front. On March 1 1915, after having reorganised the necessary centres of instruction, the Government called to the colours all Belgians from 18 to 25. Numerous volunteers joined the forces. Thanks to the establishment of officers' schools, centres of instruction, munitions factories, gun foundries and hospitals, the Government managed to maintain an army in the field with a mean effective strength of 150,000.

PEACE AND RECONSTRUCTION

The Peace.—Belgium was represented by MM. Hymans, Vandervelde, and Van den Heuvel at the Peace Conference, but was not admitted to the deliberations of the Council of Ten. At the second plenary session of the Peace Conference the Belgian, Canadian and certain other delegates protested against the control assumed by the "Big Five;" and from that time more scope was given to the representatives of nations other than the Principal Allied and Associated Powers. M. Hymans played an important part in drafting the Covenant and M. Vandervelde in framing the constitution of the International Labour Office. The Treaty of Versailles did not restore to Belgium the Grand Duchy of Luxembourg and Dutch Limburg which had been alienated from her by the treaties of 1839. But at Versailles, she received again her own sovereignty and part of the Prussian Moresnet; while Germany renounced in her favour her rights over the Walloon cantons of Eupen and Malmédy. Belgium was confirmed in the possession of these two cantons by the League of Nations. The Grand Duchy of Luxembourg (*q.v.*), by a plebiscite held in Oct. 1919, voted for a customs union with France by 60,135 votes against 22,242 votes cast for Belgium. In 1920, however, France renounced her claim in favour of Belgium; and on July 25 1921 Luxembourg entered into a customs, railway and consular union with Belgium. In Africa, Belgium received the mandate for the Urundi and the Ruanda, representing part of the territories conquered by the Belgian Army, which was operating with the forces of the British Empire during the War.

After the War the problem of Belgium's international status took on a new form. Belgium was anxious to free herself of the restrictions on her right as a sovereign state to form defensive alliances, especially as the guarantee of neutrality which had been substituted for this right had proved ineffectual. The treaties of Versailles, Saint-Germain and Neuilly accordingly contained the provision that Germany, Austria and Hungary recognised that the treaties of 1839 no longer conformed to the requirements of the situation, consented to their abrogation[1] and accepted in advance whatever arrangements might be made to replace these treaties by the Principal Allied and Associated Powers, or by any of them in concert with the governments of Belgium and of the Netherlands.

The logical consequence of the new position was a military convention concluded in Aug. 1920 between Belgium and France, after full consultation between the respective general staffs. In Nov. 1920 the two governments informed the League of Nations that the military alliance had been concluded, and that it was of purely defensive character, but no details were disclosed. It only comes into force in case of unjustified aggression on the part of Germany; and stipulates formally that each of the signatory governments shall decide finally in each case whether it is to be applied.

Belgium offered to conclude a similar agreement with Great Britain; indeed, her ardent hope was to see a Belgo-Franco-British Entente established. This could not be achieved; but Belgian foreign policy had a clear mission to maintain the traditions of the Entente and to reconcile the British and French points of view. Her representatives at the various international congresses, MM. Paul Hymans, Jaspar, Theunis and Vandervelde, did important work in this direction. Belgium's policy has naturally been mainly influenced by the two problems of security and reparations (*see* the articles under those headings). Under the influence of the latter problem she joined the French in their occupation of the Ruhr (*see* RUHR). On every occasion she has shown herself as conciliatory as possible, while insisting on the necessity of receiving due reparation. In order to arrive at a practicable settlement of the reparations question, Belgium repeatedly sacrificed her rights of priority for the benefit of her Allies (*e.g.*, July 1920, Aug. 1921, July 1922). Belgium became a non-permanent member of the Council of the League of Nations on its formation. M. Paul Hymans was elected the first President of the League.

The Treaty of Versailles guaranteed Belgium priority for the sum of 2,000,000 gold marks on Reparations account. In addition her allies declared themselves ready to transfer Belgium's war debt (5,600,000,000 fr.) to the German reparations account. In 1925 the United States required from Belgium recognition of her war debt, although the remission of this debt had been foreseen by the treaty. An arrangement was concluded with America regarding this debt on Aug. 18 1925 (*see* section on national finance).

The question of the Schelde was not solved by the Treaty of Versailles. Belgium attempted to reach a *modus vivendi* on this subject with Holland; but no arrangement could be reached, as Holland laid claim not only to the sovereignty of the waters of the Schelde, but also to the sovereignty of the Wielingen channel which would have made possible the complete isolation of Belgium from the sea. On April 3 1925 a new treaty was signed settling the relationship between the two countries.

Reconstruction.—After the conclusion of peace the government was chiefly occupied with the problem of feeding the country, which necessitated various measures prohibiting export and authorising the requisitioning of home-grown foodstuffs. In consequence of the destruction of industry, there were 800,000 unemployed in the country and 2,400,000 persons, or one-third of the population, were dependent on public assistance. The state was obliged to create relief works immediately. The number of persons organised in trade unions rose from 200,900 in 1914 to 600,000 in 1919. By the end of 1919 the 2,000 km. of railway which had been destroyed were reconstructed. Thanks to the recovery of the 24,000 Belgian machines brought back from Germany and to the huge orders for material placed in England and America (which were made possible by the credits granted to industry by the banks, these having enlarged their capital considerably for this purpose), industry recovered rapidly.

The economic and social problems were rendered much more complex by reason of the difficulties which faced the Government; the reconstruction of the devastated regions, valued at over 35 milliard francs, called for very great sums; military pensions, indemnities for damage caused by war, unemployment doles swelled the budget disproportionately. In 1919 the public debt had risen from 4 milliard francs before the War to 13 milliards, and passed 30 milliards in 1921. At the same time the fall of the exchange continually increased the cost of living. In 1925 the Belgian francs seemed stabilised at 106 francs to the £ and the index cost of living at 500. This rise of prices naturally necessitated a great increase of salaries and readjustment of wages. At the same time the demand for social legislation increased greatly. On June 1 1919 the working day was reduced to 8½ hours, and on Dec. 1 to eight hours. This great victory of democracy brought a series of industrial crises. To prevent or diminish conflicts, national councils, formed by delegates of the masters and the workmen in equal numbers, with an official as president, were set up after the Armistice. The action, although devoid of any legislative backing, was often successful. Similarly in the mining industry, especially in the basins of the Centre and Borinage, a whole system of arbitration was set up, freely organised by the masters and workmen. The financial measures of the Government were also democratic in tendency, including income tax, super-tax and an increase in succession duties.

The fall of the exchange impoverished the middle classes, holders of state papers and mortgages and small house owners. This was further accentuated by the housing law, permitting tenants to continue to occupy their dwellings, limiting the rent to a sum not exceeding 125% of the pre-War rents, while building costs had increased by 700%. On the other hand, the quick recovery of industry, speculation on the exchange and in shares, and the great orders necessitated by reconstruction contributed to enrich the industrial and commercial classes. The high price of living also improved the conditions of the peasants, who spent enormous sums on acquiring land. Thus the middle classes were in a difficult situation between the rich capitalists on one side and the workmen and peasants on the other. The activity of the banks drained out all the free money in the country, and gave real power to the great financial establishments.

The considerable improvement in the condition of the working classes increased the power of the trades unions. The Socialist party formed the *Banque Belge du Travail*, while the increased wealth of the peasants gave the *Banque des Boerenbonden* very great financial and political power. The political result was the weakening of the Liberal party, which was recruited from the middle classes, an access of strength for the Socialist and Catholic parties, and an increase of the democratic element. The passing of a law which re-established the legal personality of associations not aiming at profits (June 27 1921) also deserves mention. This law met a real demand, and the country is now covered everywhere with charitable, scientific or social associations. The religious establishments are all under this form.

The intellectual life of the country revived. The *Association Internationale des Académies* chose Brussels as the centre of its activity. On Aug. 19 1920 an *Académie de la Langue Française* was formed at Brussels. The status of legal personality benefited the free universities of Louvain and Brussels and the universities of Ghent and Liége. The profits realised by the commission for Relief in Belgium went to constitute a university fund, with a capital of 80,000,000 fr., for the development of the sciences in Belgium. Each university was further endowed with a capital of 20,000,000 francs. A war archives department was established to collect all documents bearing on the history of the War between 1914 and 1918. The period of restoration was blessed with a truce in the political struggle, unlimited universal suffrage from the age of 21 was introduced at the demand of the Socialist party; female suffrage, which was claimed by the Catholic party, was granted for communal elections.

The elections of Nov. 16 1919, under the new franchise, resulted in the Catholic party's losing the majority which it had held since 1884. At first the country was under a " concentration "

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[1] In the Locarno Pact Oct. 16 1925 Germany, Belgium, France, Great Britain and Italy took note of the adoption of the treaties for the neutralisation of Belgium. A treaty signed in Paris May 22 1926, by Great Britain, France and Belgium confirmed the abrogation of these treaties. Germany, Austria, the Netherlands and Soviet Russia were to be asked to give their adhesion.

Government, presided over by M. Delacroix, and later by M. Carton de Wiart; afterwards by a coalition between Catholics and Liberals under M. Theunis; then, after the elections of April 1925, in which Socialists balloted 818,852 votes, Catholics 751,011 and Liberals 305,032, by a democratic Catholic-Socialist coalition under MM. Poullet and Vandervelde. In May 1926 M. Henri Jaspar, as prime minister and minister of the interior, assumed office with the support of all parties in the Chamber and the Senate, except a handful of extremists.

But the most acute political question in Belgium became the language question. Official statistics in 1910 showed that of Belgians over 15 years of age 2,198,296 spoke French only, 2,136,022 Flemish only, while 805,012 were bilingual. From the linguistic point of view the country may be divided into three zones: (*a*) the Walloon districts of Liége, Namur, Luxembourg, Hainault and South Brabant, with a minority in 1910 of 23,531 speaking only Flemish, (*c*) the Flemish districts of East and West Flanders, the province of Antwerp, Limbourg and the northern districts of South Brabant, with a minority in 1910 of 56,232 speaking French only; (*b*) the *arrondissement* of Brussels, situated between the Flemish and Walloon zones, in which the languages are fairly evenly balanced. An inquiry made in the city of Brussels in 1920 gave 15% Flemish-speaking, 33% French-speaking and 50% bilingual inhabitants.

Defence.—According to the Military Law of 1923, the Belgian Army is partly conscript, partly volunteer. Compulsory service with the colours is 12 months in the infantry, fortress artillery and engineers; 13 months in the cavalry, horse field artillery and horse transport corps. Military service lasts for 15 years in the regular army and reserve, 10 years in the territorials. Reserves are only called out in case of danger of war. The strength of the army with the colours in Dec. 1924 was 5,410 officers, 10,849 N.C.O.'s 63,181 men and 6,303 gendarmerie, total 85,743. The field army consists of 4 regular and 2 reserve corps, besides a heavy artillery brigade, air and miscellaneous units at the disposal of the Grand General Staff. The navy is small, consisting of the ex-British sloop "Zinnia," 14 ex-German torpedo boats and 22 motor launches.

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II. THE FLEMISH MOVEMENT

The Flemish movement took clear shape as early as 1830. In the nineties the extension of the suffrage strengthened the movement, and the law of 1898 proclaimed the Flemish language officially on an equality with the French. The progress of democracy, the growing riches of a very fertile literature, the rise of a Flemish upper class side by side with a French-speaking upper class, were destined from now on to multiply the causes of conflict and to necessitate many readjustments.

The census of 1910 established the numerical strength of the linguistic groups: the northern half of Belgium is Flemish; the southern half is Walloon, while the population of Brussels at the present time is mixed. The Flemish minority in the Walloon districts is composed of peasants and unskilled workmen; whilst the French-speaking minority in the Flemish district forms a great part of professional, financial, industrial and commercial circles, and has, therefore, a much higher social coefficient. In the capital, where the population is mixed, French is predominant. The Flemish movement is, therefore, faced with two obstacles: on its own territory, a large fraction of the bourgeoisie, numerically small but socially important; in Parliament, a coalition composed of most of the Walloon deputies, a majority of the Brussels deputies and certain Flemish deputies, this coalition being usually in the majority.

The Flemish point of view is that the extension of culture in Flanders is only possible if the free development of the popular language is assured. A certain number of citizens maintain that it is impossible to carry this process too far without endangering the unity of Belgium. The Walloon case is briefly this: if the Walloon is to know both languages in order to gain a public position in the central administration or a rank in the army, he is at an immediate disadvantage, since the Flemish have a much greater general interest in learning a widespread language, whereas the Walloon finds it difficult to learn Flemish in a practical fashion; besides which the Walloons are disquieted by the fact that the Flemish birth rate is something like three times as high as their own.

In the years before the War, the struggle centred chiefly round the University of Ghent. There are four universities in Belgium:- two state-maintained at Ghent and Liége, and two independent, at Brussels and Louvain. A bill was brought forward in 1911 by representatives of the three great political parties for the progressive Flemicisation of the University of Ghent. The question had not been settled when war broke out. On the other hand, Parliament in 1913 voted a Law demanding from army officers a sufficient knowledge of the two languages; it was unfortunately too late for this arrangement to take effect during the World War. The Education Act of 1914 provided that the language habitually spoken by the child should be the vehicle of instruction. In the course of these years, the Separatist idea began to strike root especially among the Walloons and chiefly for political reasons: annoyance at seeing a Catholic government, which rested mainly on the Flemish rural masses, remaining in power since 1884.

During the War the German authorities tried to exploit the linguistic question to destroy national unity. Their efforts were helped by some Walloons and by larger groups of Flemish "activistes," some of whom believed in a German victory, while others expected a peace by agreement which would leave the measures taken by the occupying authorities untouched in a free Belgium. They had no support from the population, and the recognised leaders of the Flemish movement opposed activism resolutely. In 1916 the Germans Flemicised the University of Ghent; in 1917 they decreed administrative separation. At the same time a Flemish Parliament, or "Raad van Vlaanderen" constituted itself, and proclaimed the autonomy of Flanders in Dec. 1917. Nothing of this survived the armistice.

After the War, the linguistic problem was more urgent than ever. A law of 1921 established equality between the two languages in internal administration. The plan of Flemicising the University of Ghent, first broached in 1911, passed the Chamber of Representatives in 1922 by a very small majority, but was thrown out by the Senate. A compromise was necessary, and in 1923, a fresh bill established a bi-lingual régime in the University of Ghent: one-third of the courses was given in French; one-third in Flemish, and the student might choose for the last third between a Flemish and a French section. This compromise satisfied no one. Pro-Flemish students saw in it the official consecration of a principle which they refused to admit, that is, the equality of the two languages in Flemish districts, and therefore boycotted the Flemish section. Extremist ideas gained much ground; they are represented in the first instance by the "party of the front" which was originally composed of soldiers of the Yser, but which ended by incorporating the whole Flemish nationalist movement. Their aim is autonomy of Flanders under the Federal régime, and they are the most vigorous advocates of the manifesto in favour of the condemned "activistes." The great majority of Flemings, however, remain neutral in the traditional political parties, and refuse to acknowledge any separatist aims, especially in view of Belgium's international situation.

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(A. V.)

III. NATIONAL FINANCE

Pre-War Situation.—The Belgian Budget in the pre-War years presented the following results:—

	Ordinary Receipts Fr.	Ordinary Expenditure Fr.	Balance Fr.	Extraordinary Expenditure Fr.
1910	682,487,000	672,954,000	9,533,000	156,502,000
1911	695,252,000	689,186,000	6,066,000	121,760,000
1912	755,463,000	749,254,000	6,209,000	146,517,000
1913 (provisional)	788,614,000	787,385,000	1,229,000	142,947,000

To appreciate these results, it must be remembered that the receipts and expenditure of the railways are included in the state accounts. Of the extraordinary expenditure which was financed by loans, about one-half was allocated for the railways. The remainder was used for productive purposes.

Public Debt.—The public debt was apparently high (five milliard gold francs on the eve of the War), but it had been largely contracted for railways, telegraphs and telephones. Directly productive state property was worth at least 3½ milliard fr.; it yielded about 120,000,000 fr. in 1912, when the public debt absorbed only 160,000,000 francs. The provision for the public debt moreover included a sinking fund. In 1913, the sum of 20,000,000 fr. was devoted to its reduction.

This provision for the extinction of the debt, together with the surpluses of the Ordinary Budget, compensated for the abuses of the Extraordinary Budget; Belgian finance may therefore be said to have been healthy. Taxpayers were not heavily burdened. The total national income was estimated at 6½ milliard fr., and in 1913 the yield of the taxes amounted to 345,000,000 fr.; that is to say, they only absorbed 5% of the national income, as against 11% in France.

Post-War Situation.—War expenditure was incurred without any legislature control, and no account had been drawn up by the end of 1925. During the occupation, the Germans levied war contributions on Belgium amounting to 2,620,000,000 gold fr.; in addition, they exacted 68,000,000 fr. from the communes. Belgian indebtedness to the Allies amounted to 5,600,000,000 gold marks. This was placed to German account by the Treaty of Versailles, but the United States were not signatories of the treaty. The Treaty of Versailles further allotted to Belgium a priority of 2 milliard gold marks on Reparation account.

Upon the German evacuation, the Belgian Govt. decided to redeem the marks in circulation on the basis of 1·25 fr., as German currency had been imposed on the people. A sum of 7,592,000,000 fr. was required to effect this redemption, and this was the beginning of Belgian inflation. The Government never printed notes to cover the Budget deficit; it even repaid 600,000,000 fr. of the advances received from the National Bank for the exchange of marks. The Allies did not agree to place to German account the cost incurred for the redemption of German marks circulated during the occupation, but Belgium did not lose all hope of, at any rate, a partial indemnification for the losses she had sustained during the struggle.

In 1919 the fiscal system, which had been in force for a century, was recast. The previous direct taxes were replaced by an income-tax modelled on the English income-tax. It comprises three direct taxes—the tax on land, the tax on investments and the tax on salaries and earnings—together with a supertax.

Financial Situation.—The financial situation of Belgium was very serious for years, so serious that the public debt increased by 40 milliard francs. This state of things was due to the German invasion and to the cost of the reconstruction of devastated areas, completed in 1924–5. By June 30 1924 Belgium had advanced on German account 20,719,000,000 fr., excluding the cost of the redemption of the mark. But the crisis was passed in 1923. Compensation for war losses was nearly completed in 1926; after this the payments made under the Dawes Plan could be devoted entirely to the reduction of the public debt, the normal reduction of which still continued. This was calculated to absorb 300,000,000 fr. in 1926.

In view of the incompleteness of the public accounts, the best means of judging Belgian finance since the Armistice is to follow the progress of the public debt, external debt being calculated at the same rate of exchange. The figures for the financial years, beginning in Sept. of each year, are as follows:—

1919–20	Increase of 5·5 milliard fr.
1920–1	Increase of 6·0 milliard fr.
1921–2	Increase of 2·5 milliard fr.
1922–3	Increase of 1·0 milliard fr.
1923–4	Increase of 0·2 milliard fr.
1924–5	Increase of 1·0 milliard fr.

These figures exclude the American debt, reinstated in the Belgian National Debt in accordance with the agreement of 1925. The increase of one milliard registered in 1925 is compensated by balances accumulated at New York to meet the fluctuations of the exchange.

Summary.—Since 1923 the Belgian debt remained stationary, in spite of expenditure in two years of 600,000,000 fr. for railway construction, and still more considerable sums for public works, such as the port of Antwerp and the devastated areas. The budget of 1925, from which the accounts of the state monopolies are excluded, is as follows:—

	Receipts Fr.	Expenditure Fr.
Ordinary	4,268,007,000	4,526,390,000
Extraordinary	115,821,000	611,711,000
Reparations	976,707,000	928,345,000
Total	5,360,535,000	6,066,446,000

The deficit of 706,000,000 fr. is explained by the important works undertaken by the state, and the indemnification for war losses. Ordinary expenditure includes the whole service of the debt, even that incurred in Reparation account. The estimates for 1926 foresaw a deficit of not more than 200,000,000 fr., more than covered by receipts from arrears of taxation and the reduction of debt.

On Sept. 30 1925 the position of the public debt was as follows: Consolidated, 28,770 millions of francs; floating, 16,120 millions of francs; total 44,890 millions of francs. Of this, 13,925,000,000 fr. were external debt, the dollar being reckoned at 22·50 francs.

On Aug. 18 1925 Belgium concluded with the United States an agreement on the debt. This is to be repaid by the year 1987, by means of annuities reaching the sum of $12,700,000 from 1936 onwards. The War debt is not subject to interest, while the debt incurred since the War bears a rate of interest calculated at 1·35% up to 1934, and at 3½% in subsequent years. By an agreement made with Great Britain, Dec. 31 1925, the total debt of Belgium and of the Belgian Congo to that country (£12,600,000) is to be paid within 30 years, the interest being 5%. At the end of 1925, Belgium was preparing a currency reconstruction, on the basis of the stabilisation of the franc at 100 fr. to one pound sterling or slightly more.[1]

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IV. ECONOMIC HISTORY

Belgium is more highly industrialised than any country on the continent of Europe, with the exception of Saxony. In the second half of the 19th century, *i.e.*, between the two great censuses of 1846 and 1900, the industry of the country underwent a fundamental change through the immense increases which took place in the numbers of the working class, and, more especially, in the amount of motive power employed. Leaving the transport industries out of account, the total steam power increased more than tenfold in this period, namely, from 40,000 H.P. to 430,000 H.P.

In the period 1911–25 Belgian industry continued to progress in the same direction, in spite of the World War and the military occupation. Since the War, the amount of available energy has been increased by means of various improvements, so that comparison is difficult; but it is probably not an over-statement to put the increase in the aggregate motive power of industry at not less than 50%, the most noteworthy additions being in the coal mining, metallurgical, glass-making and textile industries, and in the power-producing industries themselves. The increase in the power used in, and produced for certain industries is as follows:—

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[1] For six months (Oct. 1925 to March 1926), the Belgian currency remained steady but a hitch in the foreign loan negotiations and internal difficulties has caused a breakdown. The new three-party Government proposed drastic measures and the stabilisation of the franc at a higher rate.

Industry	Power in kilowatts	
	1910	1923
Coal-mining	208,200	351,929
Metallurgical industries	146,941	158,873
Glass, glassware and plate glass industries	18,225	28,548
Textile	107,196	113,726
Special electricity works	91,815	250,380
	572,377	903,456

Mining.—In the southern coal-fields, which have been worked for a long time, production tends to decrease, as the following figures show:—

Year	Thousands of Tons	Year	Thousands of Tons
1911	23,054	1923	22,115
1913	22,842	1924	22,243
1919	18,343		

The exploitation of the northern coal-field, the Campine district, is, on the contrary, of very recent date, and this area has a great future before it.

In 1872, just after the trial borings in Dutch Limburg, the Belgian geologists, Lambert and André Dumont, asserted the existence of coal in Belgian Limburg. A first partial investigation was undertaken by J. Urban, who made borings at Lanaeken in 1897. His venture was unsuccessful, as was that of A. Dumont at the end of Jan. 1899; but in Aug. 1901 two further attempts by Dumont established the existence of coal in this region. It is now known that the Campine coal-field occupies an area of more than 100,000 hectares, and the coal content is estimated at 8,000 million tons. The beds consist chiefly of excellent gas- and coking-coal, *i.e.*, the very kind which is becoming exhausted in the southern coal-field, and, failing fresh supplies, would eventually have had to be brought in from abroad. The Campine beds lie at a great depth, the distance from the surface varying from 475 to 620 metres for different kinds of coal. The earliest concessions in the area, and the first companies formed to exploit them, date from the first decade of the present century. Up to the end of 1923 the total costs of production in the Campine district had amounted to 550,000,000 francs. Extraction only began in 1917, but in that year 11,640 tons were raised and the subsequent increase has been very rapid; in 1919 the amount had risen to 140,000 tons and in 1924 to 1,116,670 tons.

In all the Belgian mines machinery is being increasingly employed. In 1923, 49·2% of the coal in the southern coal-field was mechanically hewn and 59% in the northern. The yield from the metal mines, which had greatly diminished since the middle of the 19th century, showed in 1926 signs of increasing vitality. Several factors have been responsible for this new development, which, however, is still in the preliminary stage.

Quarrying.—The comparative positions are indicated by the following figures:—

	1911	1923
No. of quarries at work	1,558	891
Value of the production (in gold francs)	64,700,000	83,000,000
Number of workmen employed	35,809	28,427

The output of the industry is mainly in squared porphyry and sandstone, but includes also lime and the raw material of the cement industry, which has considerably increased its equipment since the War.

Iron and steel were greatly injured by the destruction due to the War, but, like many other industries, it is actually in a better position than before, owing to the replacing of the equipment destroyed by new and improved kinds.

	1911	1924
Blast furnaces in operation	49	54
Pig-iron production (thousands of tons)	2,046	2,808
Average No. of workers employed in iron and steel works (blast furnaces, steel works, and rolling mills)	32,935	35,086(1923)
Production of rough steel (thousands of tons)	2,128	2,780
Production of finished steel (thousands of tons)	1,655	2,379

Similarly, in the metal construction and machinery industries —although here, again, precise statistics are lacking—it is evident that resources have been considerably developed, and various kinds of work are now done in Belgium for which recourse had formerly to be had to foreign countries. The development of the electro-technical industry is especially remarkable.

Zinc and Lead.—New mineral industries have arisen, namely, tin, cobalt, electrolytic copper and radium production. These are all comparatively new in Belgium; the raw materials are obtained from Belgian Congo, the mineral wealth of which led English consul to say that Katanga would prove another Rand, as far as copper was concerned; the supply of uranium discovered in the same province of Katanga has given Belgium a decisive preponderance in radium production. The drop in prices which followed the opening of the Oolen works (Campine district), which deal with the Katanga minerals, has led to the closing of a number of foreign undertakings of a similar kind.

Glass Making—The use of mechanical methods is being rapidly developed, the processes employed being those invented respectively by the Americans, Libby and Owens and the Belgian Fourcault. The present production of glass is over 41,000,000 sq. metres, or very nearly that of the pre-War period; 26% of this is made by machinery which the industry formerly did not possess. Owing to especially favourable conditions the plate glass industry has been exceedingly prosperous since the War. Plant has been greatly extended and many foreign factories are now under Belgian control (in Germany, Czechoslovakia and Poland).

Textile Industries.—In this group the number of working-class factories grew very greatly after 1910. The “ Filatures et Tissages ” of the celebrated co-operative organisation “ Vooruit ” is the largest business of the kind in Belgium.

The cotton industry possessed 1,492,000 spindles in 1914, and 1,764,500 at the beginning of 1925. The pre-War production of yarn was 51,000 tons; in 1924 the production was 49,264 tons, classified according to the place of origin of the raw material. The amounts of raw cotton consumed are: America, 25,213 tons; East Indies, 22,065 tons; Egypt, 1,220 tons; miscellaneous, 766 tons. Here again, efforts are being made by Belgian industry in conjunction with certain colonial undertakings, the colonial Government, and Belgian financial interests to secure that as much of the raw material as possible is drawn from Belgian Congo.

The linen industry, which drew its supplies very largely from the Baltic provinces of Russia, suffered in an especial degree from the scarcity of raw material. These difficulties are now less acute; the industry has been able to establish relations with Latvia and Esthonia and is making a rapid recovery. Belgium's artificial silk industry was the most important in the world before the War. It has now been outdistanced by those of the United States, England, Italy and Germany, but still occupies an important place in the world's markets. The industrial equipment has increased by approximately 75%. Moreover, Belgium, through her factories at home and abroad (in the United States, Poland and Hungary), has a practical monopoly of the Chardonnet process (collodion silk).

Diamond Cutting.—The specifically Belgian industry of diamond-cutting is carried on in Antwerp, which in 1926 was the leading city of the world in this respect, having outstripped Amsterdam and the German, French and American centres of the industry. Antwerp handles a very large part of the output of the diamond mines of the Congo and of Portuguese Angola.

Summary.—To sum up, the chief features in the development of Belgian industry, regarded as a whole, are as follows:—

1. Concentration and integration, especially in the iron and steel, machine construction, quarrying, cement, ceramic (tile-making), chemical, sugar and cotton industries;
2. Development of mechanical processes in the coal, iron and steel, ceramic and glass industries;
3. The Belgianisation of certain undertakings—iron and steel, zinc, metallurgy and chemical products—through the liquidation of the foreign, and especially the German, interests;
4. The introduction of new kinds of manufacture machinery, chemical products, artificial silk (acetate process), radium, etc.;
5. A considerable increase in the interest of the Banque Belge in the national industries, and, as a result of its influence, a tendency towards concentration and combination, both vertical and horizontal;
6. An extended use of electrical motive power.

Electricity Supply.—The following table indicates the advance made in the supply of electricity by private undertakings in

Belgium (communal undertakings are not included), as shown by the generating capacity of the central station, the capital employed, the number of units sold and the development of main and secondary systems.

	1911	1922
Population served	1,476,000	4,146,000[1]
Generating capacity (kilowatts)	79,325	388,749
Capital invested (thousands of fr.)	71,117	410,089
K.W. hr. sold (thousands)	85,170	389,401
Secondary systems (kilometres)	1,938	7,876
Main systems (kilometres)	500	4,681

[1] More than 6,100,000, if the large public undertakings are included.

Various schemes are in existence for the electrification of Belgian railways, but the immense amount of capital required and political considerations have deferred them.

Labour.—Before the World War, Belgium was essentially the land of low wages. After the War the standard of living of the working classes changed very greatly. The eight-hour day became the general rule, in spite of various legalised exceptions and modifications. Wages rose, owing to the power now possessed by the trade unions. Albert Thomas, director of the International Labour Office, stated in 1925 that Belgium was probably the country where working-class status had been most conspicuously raised since the War. The result of this is that the owners of industrial undertakings can no longer make up for inferior equipment by low wages; and this is one of the most important factors of the technical progress indicated by the facts and figures set out in this article. See the monthly *Bulletin* of Belgian Chamber of Commerce in London, continued as *The Anglo-Belgian Trade Journal.* (E. Va.)

BELGIUM, INVASION OF.—The military rôle of Belgium in 1914 was determined by two considerations of fundamental importance: the geographical situation of the country, which, seated astride the direct road from Berlin to Paris and Calais, had become the cockpit of Europe, and her international political situation as defined by the guarantee of perpetual neutrality.

The Strategical Situation

In Article 7 of the treaty with Holland of 1839 it is laid down that "Belgium, within its territorial limits, shall form an independent and permanently neutral state, and is required to observe this same neutrality with regard to all other states." Of this treaty "all articles are drawn up under the guarantee of Austria, France, Great Britain, Prussia and Russia." This neutrality clearly implied that Belgium was under an obligation to use her military forces, not to repulse an aggressor at all costs—a task beyond her means and one for which there could be no justification—but in such a manner as to prevent that aggressor from obtaining any anticipated advantage in his operations against a third party, *i.e.*, to suspend for an adequate period free passage along the great international strategic highway of which the axis is defined by the Meuse, the Sambre and the Oise. The mission of the Belgian Army was essentially to gain time for itself and cause the enemy delay.

To this end the foremost and best position to occupy, supposing the enemy to come from the east, was the Meuse, its steep scarped slopes and its two road and railway junctions, Namur and Liége. These two towns had been encircled by a ring of armoured and concreted forts by Brialmont in Leopold II.'s reign. The forts lay beyond the firing range of the area built over, and acted both as bridgeheads and as "points d'appui" of fortified positions, from which, with the support of their guns, the field army could easily hold up enemy forces of equal strength. It might be that the enemy would bring up very superior forces in front of the Meuse. In this case the Belgian Army would avoid being engaged in a battle which it was foredoomed to lose. It would retire fighting, step by step, on Antwerp—its base of operations and the national citadel—holding itself in readiness to move out again for the counter-offensive in co-operation with any relief force the Powers guaranteeing Belgium's neutrality should send to its assistance.

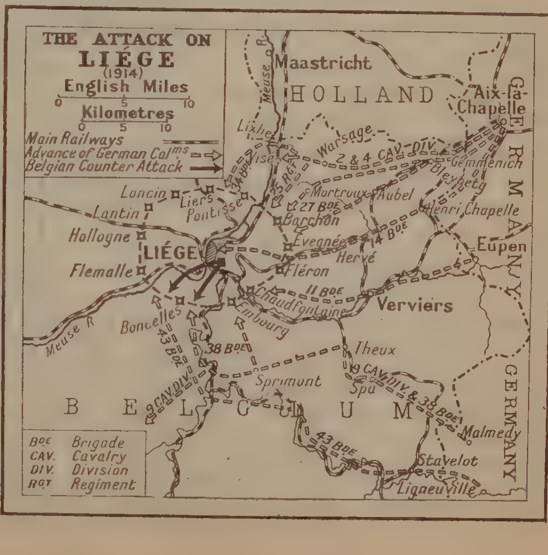
Such was the plan of campaign drawn up by King Albert; but unfortunately Belgium was in the throes of military reorganisation when the World War broke out. The country had been slow in realising that the rivalry between its powerful neighbours constituted a menace to itself. In 1913 Parliament had voted a compulsory military service system which was to produce 340,000 men in 10 years' time. Actually, on mobilisation, only 117,000 men were available for the field army and 60,000 for the fortress troops. The field army, grouped in six army divisions and one cavalry division, was without any reserve drafts whatever; the fortress troops, composed of men aged 28–35 years, were weak in cadres and poor in quality. The plan of concentration had been revised, but there had not been time to make out the time-table for rail transport.

Belgian Preparations.—On the evening of July 31 mobilisation was ordered. On Aug. 2 it became known that the Germans had invaded the Grand Duchy of Luxembourg, and at 7 P.M. the ultimatum was presented to the Belgian Minister of Foreign Affairs by the German ambassador in Brussels: "If Belgium behaves in a hostile manner to German troops, and particularly if she impedes their march forward by resistance on the part of the Meuse fortifications, or by the destruction of roads, railways, tunnels or other works, then Germany will be compelled to regard Belgium as an enemy." Belgium's reply to this injunction was the categorical refusal which her sense of honour and of her duties toward Europe demanded.

Since it was definitely from the east that danger threatened, and since France had officially declared that she would respect the integrity of Belgian soil, the place of concentration indicated for the army was on the Meuse between Maastricht and Namur. But, as has been said, transport arrangements were still incomplete and a modification had to be adopted. The King ordered that the 3rd and 4th Divs., mobilised at Liége and Namur, should remain in those fortresses with instructions to defend them to the last man. The remaining four divisions and the cavalry division were to make their way—the former by rail, the latter by road—toward the zone Tirlemont-Perwez-Louvain, whence they were to proceed together toward the Meuse with all possible speed.

The Attack on Liége

As already stated, Liége and Namur were not designed to withstand a regular siege, but consisted of a ring of forts (12 at Liége, 9 at Namur) which controlled the free use of the Meuse bridges and marked a favourable line of battle. Constructed about 1890, these forts, of triangular or rectangular design, had vaulted casemates of 2 m. 50-cm. concrete and were armed with two 15-cm. guns in cupolas, two 12-cm. guns and two 21-cm. howitzers, besides some pompoms in "éclipse" cupolas.



Strength of Liége.—With the help of the 3rd Div. the Liége garrison was brought up to about 30,000 men. Gen. Leman was in command. While he hastened to have trenches dug between the forts, his main concern after Aug. 3 was to blow up the railway tunnels and barricade the roads leading from Germany. It was well that he did so, for on the 4th, at 8 A.M., six German columns crossed the frontier on the line Aix-la-Chapelle-St. Vith, and at noon gun and rifle fire were heard at Visé.

The importance of the fortress lay in the fact that it controlled the lines of march of the German I. and II. Armies. Now the success of the plan of campaign conceived by the general staff in Berlin depended upon the rapid crossing of the Belgian plains by these armies, and Gen. von Moltke, to avoid being held up in any way by Liége, had planned to carry the position during the concentration period (while troops were being carried up by rail) with a special army composed of six brigades at peace strength and the three divisions of Gen. von der Marwitz's cavalry corps. Accordingly, Gen. von Emmich, with his "Army of the Meuse" (consisting of 25,000 riflemen, 10,000 cavalrymen and 124 guns) was ordered to carry the place by a handstroke. The forts were to be masked by a few companies and their artillery neutralised by his batteries while six brigade columns would penetrate the intervals. This assault was to take place by night, and the columns were to make their way independently toward the town and storm this at daybreak. The aim of the whole enterprise was to secure the bridges before they could be destroyed. As regards the temerity of this scheme, it is only fair to say that Von Moltke expected to find merely the normal garrison of 6,000 men in Liége.

German Advance.—On the morning of Aug. 4 the 4th Div., followed by cyclists and chasseurs conveyed by motors, made its way rapidly along the Dutch frontiers to Visé. The roads had been barricaded with felled trees and it was noon before the cavalry reached the Meuse, only to find the bridge submerged and the opposite bank lined with riflemen. On Aug. 5 a *coup de main* aimed at Fort Barchon was severely punished by the short-range fire from the fortress guns. At 10 P.M. the various brigades, having completed their reconnaissances and the installation of their batteries, proceeded concentrically to the attack.

The onset of the battle was marked by great tension on either side and heavy thunder showers accompanied it. Of the five brigades which attacked on the right bank, four were completely repulsed. In the south the 38th and 43rd in particular suffered severe losses round about Sart Tilman; they retreated over five miles the next day. The 34th Bde., which attacked alone on the left bank after crossing the Meuse near to the Dutch frontier, was held up for several hours on the outskirts of Herstal by street fighting and left 400 prisoners in the hands of the Belgians, as well as a colour of the 87th Mecklenburg Regiment.

By a strange chance a half-company of Jägers, detached as a flank guard, made their way quite unopposed into the town, reaching the Rue Sainte Foi about 7 A.M., where the garrison headquarters were situated. An aide-de-camp of Leman and the captain of the company killed each other on the spot, and the escort, snatching up their rifles, put the Jägers to flight. This extraordinary incident led the commander of the defence to believe that the enemy had brought over considerable forces to the left bank. Fearing that the troops defending the right bank might be cut off, he at once sent them an order to recross the river, a decision by which the last of the German brigades was to benefit considerably. This brigade, the 14th, marching from east to west, was entrusted with the attack between Forts Fléron and Evégnee, but had been stopped short by rifle and gun fire in the intervening village, its advanced guard being decimated, its general and one colonel killed. It would probably have come to a definite standstill but for the arrival at this critical moment, by another stroke of fortune, of Gen. Ludendorff, who was watching the operations on behalf of the German II. Army and was the very author of the plan of attack.

Attack under Ludendorff.—Taking over the command he ordered a renewal of the attack and, as Leman had sent all his reserves to Sart Tilman, succeeded in pushing back the three weak battalions opposed to him in an all-night street battle. Toward 10 A. M. he arrived on the heights over Liége with his brigade reduced by half and almost without munitions, uneasy rather than proud of his success, for there was no sign of the other attacking troops. A few small columns were visible in the distance turning westward; these were the victorious Belgian troops, recalled to the other bank by the order to retreat. They were, however, so exhausted that once they had left the trenches they were incapable of engaging in a fresh battle. Leman, acting on belief that the whole of the German VII. and X. Corps were against him, gave orders to the 3rd Div. to rejoin the field army. He himself would continue to hold off the enemy with forts alone.

Thus Ludendorff was able to enter the town of Liége without further opposition on the morning of Aug. 8. Most of the bridges had been destroyed. The forts, all of which were still intact, kept watching roads and railways, their guns making the use of either impossible. Urged by Ludendorff's energetic representations, the German general staff now formed a new siege army, under Gen. von Einem, which comprised, in addition to Von Emmich's group, all the troops of the VII., IX. and X. Corps—taken as they detrained—and some powerful heavy artillery, including several battalions of 21-cm. mortars and four 42-cm. howitzers. A new mode of attack was tried. One by one the forts were isolated, closely invested and bombarded with concentrated fire, which blew them to pieces and at the same time threatened to asphyxiate the garrisons.

Fall of the Forts.—The defenders came through their ordeal with honour, and would certainly have held out longer but for the irresistible effect of the 42-cm. shells. Pontisse, Fléron and Chaudfontaine only gave in when they had reached the limit of human endurance. On Aug. 15, at 5 P.M., the fort of Loncin sprang into the air, lifted by the explosion of a powder magazine, hit by a 42-cm. shell, 350 men being buried under the débris. By a stroke of luck Leman was picked up, unconscious, on the rim of this enormous crater by the Germans, who were themselves horrified by the spectacle. The last of the forts surrendered on the 16th, leaving the way clear, at last, for the Germans to whom the passage meant so much.

While these events were taking place at Liége the 1st, 2nd, 3rd and 6th Divs. and the Cav. Div. were assembling in the region Tirlemont-Perwez-Louvain. The plan of marching towards the Meuse was perforce abandoned on the information that the Liége position was broken and the 3rd Div. in retreat.

CONSEQUENCES OF THE FALL OF LIEGE

Belgian Position Outlined.—On the morning of Aug. 4, when the crossing of the frontier by German troops had become an established fact, King Albert had sent a note to the British, French and Russian governments announcing the violation of Belgian neutrality, and proposing "a concerted and common action by the guaranteeing powers in order to resist Germany." In reply Gen. Joffre sent one of his staff officers to say that the French troops, amounting to four army corps, could not reach the region of Namur before about the 15th. Help from England would necessarily take still longer to come. Under these conditions the King decided that the army should remain in its positions, which were: (1) the forts of Liége, acting as isolated works, under Leman; (2) the fortress of Namur, reinforced by the 4th Div; (3) the entrenched camp of Antwerp, guarded by about 40,000 fortress troops; and (4) the field army, 90,000 strong, entrenched behind the river Gette, forming a link between Antwerp and Namur, covering Brussels and excellent railway lines which could be used by any French or British troops that came to the rescue.

Unfortunately, the Allies were not to profit by these arrangements. The French would not think of anything except their attack in Lorraine and the Ardennes; the British did not arrive at Mons before Aug. 22. As fast as the Liége forts fell to the superguns the Germans commenced to push their troops across the Meuse without intermittence. As early as Aug. 10 Marwitz's cavalry corps had thrown itself on the Belgian front at Tirlemont. On the 12th he tried to turn that front through

Haelen near Diest. Here he met the small Belgian cavalry division, supported by four battalions and was completely routed, leaving 500 killed and wounded and 1,000 horses on the field. On the evening of Aug. 17, the German I. and II. Armies having reached the front Hasselt—St. Trond-Huy, the Kaiser ordered the general advance. The next day, at 9 o'clock, Gen. von Kluck attacked the Belgians on the Gette between Tirlemont and Diest with seven divisions of the IX., IV., III. and II. Corps, while one division of the II. Corps and the 2nd Cav. Div. turned the left flank on the north to cut off the retreat on Antwerp.

Retreat to Antwerp.—This attack was no surprise to the King. For several days reports had been coming through that greatly superior forces of at least 200,000 men were approaching. Gen. Lanrezac's French troops had got only as far as Philippeville and the British Expeditionary Force as far as Le Cateau. To avoid useless and complete destruction, the Belgian Army began to retire slowly on Antwerp, fighting rearguard actions at Tirlemont on the 18th and at Aerschot on the 19th, and taking up its position on the line of the Antwerp forts on the 20th. On this day, the Germans entered Brussels.

THE SIEGE OF NAMUR

The Belgium 4th Div. remained at Namur. The moment it lost touch with the bulk of the Belgian Army, it became part of the fighting system of the Franco-British forces.

German Plan of Attack.—On the morning of Aug. 18 Joffre issued a succession of orders in which it was laid down that the French III. and IV. Armies should advance into the Ardennes and the French V. Army and the British Expeditionary Corps take the offensive west of the Meuse in the direction of Gembloux-Nivelles. The two last-named armies were not in a position to execute this order; it was not until Aug. 23 that they assembled on the line Mons-Charleroi-Namur. Meanwhile, the Germans having discovered—through the reconnaissances of their airmen—the French columns marching northwards between Maubeuge and Dinant, gave Von Bülow—already in command of the I. and II. Armies—authority over the III. Army, which was to strike the Meuse between Namur and Givet, and made up their mind to overwhelm the Allied left by a converging attack delivered by 15 corps. It was essential to the scheme that the fortress of Namur should be carried with the least possible delay.

The task was entrusted to a special army detachment under von Gallwitz. It included the Guards Res. Corps, the XI. Corps, three pioneer regiments, five battalions of 21-cm. howitzers, two battalions of heavy guns, one battery of 42-cm. howitzers and four of 30·5 Austrian howitzers. These troops came into position northeast of the fortress. To complete the investment the III. Army detached the 24th Res. Div. north of Dinant and the II. Army the 14th Res. Div. south of Gembloux. Thus during the two days of the battle of Charleroi the 30,000 men of the Namur garrison drew upon themselves six enemy divisions and 500 guns.

Bombardment of Namur.—The attack on Namur was quite different from that on Liége. There was no longer any question of a surprise. Von Gallwitz, who in peace time was inspector-general of artillery, aimed at an artillery preparation so devastating as to render the defence incapable of resistance to the assault. All his batteries concentrated their fire upon three forts, Maizeret, Marchovelette and Cognelée, and on the interval between the two last named, where he intended to make a breach. The bombardment commenced at 10 A.M. on Aug. 21, continued throughout the night and the whole of the following day, and reached its height on the morning of the 23rd. The trenches and the wire—at that time very slight—had disappeared. The forts were reduced to shapeless ruins; all their cupolas were put out of action.

Surrender of Namur.—Three French battalions had arrived in the fortress. A counter-attack, half Belgian, half French, attempted to repulse the enemy artillery, but failed. The defending troops suffered steady extermination without being able to fire a shot. Finally, at 11 A.M. the German infantry masses made a sudden onrush—three divisions of them to a front of 4½ km., held by what remained of nine battalions of 700 men. The defenders were swept off their feet. At many points, although enveloped, they put up a desperate resistance; and as a result it was not until evening that the assailant reached the outskirts of the town.

Gen. Michel, commanding the fortress, had disposed a brigade facing northwest to co-operate in the French offensive which he was impatiently expecting. At about 1.30 P.M. he heard, however, on the one hand that the French on his left had been driven back southward instead of advancing to the north; on the other that the Germans, far behind his right, had crossed the Meuse between Namur and Dinant. With their front broken the garrison ran the risk of being enveloped and surrounded. Michel therefore expedited the order for an immediate retreat toward the southeast.

By dint of 48 hours of forced marches—coming after a three days' battle—the greater part of the garrison succeeded in rejoining the French troops and a fortnight later in reinforcing the Belgian army at Antwerp. Five or six thousand men of the rearguard were trapped between the flank corps of the German II. and III. Armies, and after several skirmishes were forced to surrender. The six forts which were still active at Namur were able to hold up Von Gallwitz's forces two days longer. Suarlée and Andoy only surrendered on the evening of Aug. 25 after having offered a memorable resistance to the enemy's mortars, which bombarded them simultaneously from all sides. *See* also ANTWERP, SIEGE OF; FRONTIERS, BATTLES OF THE.

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(R. VAN O.)

BELGRADE (*see* 3.681d) had a population of 111,740 in 1921. The town is rapidly losing what remains of its Oriental appearance, though the side streets are still cobbled and muddy, with small single-story dwellings and shops, as the Serbs are building extensively to cope with the acute shortage of houses. The tropical diseases research laboratory has been amassing data as to the danger threatened by malaria in the district. The National Bank was enlarged in 1925, and a new high road completed to Cattaro. The city is connected by rail with the Adriatic ports of Spalato and Sebenico.

Belgrade suffered two severe bombardments and changed hands four times early in the War. The World War began with the bombardment of Belgrade by the Austrians on July 29 1914. In 1914 it was taken by the Austro-Germans, but the Serbs made a brilliant return, and in Dec. King Peter made a triumphant entry into his capital. Large numbers of prisoners were taken, but both they and their captors fell victims to a terrible plague of typhus. In Sept. 1915 a general attack was made by Austrians and Germans on the river frontier. Continuous bombardment for more than a fortnight made Belgrade untenable and it was partly evacuated by the Serbs. There was bitter fighting in the streets, but on Oct. 9 the town fell. It remained in the enemy's hands until the end of the War, and when the Serbs returned to Belgrade, the Austrian Empire had fallen and the Kingdom of Yugoslavia was already in existence.

BELL, ALEXANDER GRAHAM (1847–1922), American inventor (*see* 3.684), died Aug. 2 1922 at his summer home near Baddeck, Nova Scotia.

BELL, CHARLES FREDERICK MOBERLY (1847–1911), British journalist, was born in Alexandria, Egypt, April 2 1847. Educated privately in England, he returned to Egypt in 1865, and there took up journalistic work, becoming *The Times* correspondent and founding *The Egyptian Gazette*. In 1890 he returned to London as assistant manager of *The Times* and to the end his great energies were devoted to the service of that paper. Although in some ways rather out of touch with technical developments, his strong will, indomitable courage and tremendous industry were instrumental in keeping *The Times* alive during some very difficult years. This was the time when he was associated with Mr. H. E. Hooper in publishing and selling *The Encyclopædia Britannica* and founding the Times Book

Club. This dominating personality again asserted itself in 1908, when, in spite of much opposition, he brought about the sale of *The Times* to Lord Northcliffe. He then became managing editor, a post he retained until his death in his office chair on April 5 1911. While in Egypt, Bell wrote several books, including *Khedives and Pashas* (1884); *Egyptian Finance* (1887); *From Pharaoh to Fellah* (1889).

See F. Harcourt Kitchen, *Moberly Bell and his Times* (1925).

BELLEAU WOODS, a tract of forest land, in area less than a sq. m., 5 m. northwest of Château-Thierry, and 42 m. east of Paris, where a fiercely contested battle took place between the United States and German forces in June and July 1918. When the third German offensive was launched on the Aisne front, the 2nd Div. of the American Expeditionary Force under Gen. Bundy was rushed to the assistance of the VI. French Army and deployed across the Paris-Château-Thierry road west of the latter town. On its front lay Belleau Woods and the villages of Torcy, Bouresches and Vaux, all occupied by the enemy. The Germans had been halted at Château-Thierry but were consolidating themselves at Vaux and in Belleau Woods in preparation for a renewed advance west of Château-Thierry. The task of dislodging them was entrusted to the marine corps brigade under Gen. Harbord.

The attack was made on June 6, and the woods were penetrated but could not be held. The ground was extremely difficult, almost impenetrable underbrush covering a rugged outcrop of rock. Three days later the attack was renewed. The fighting was bitter, but, after a struggle lasting over a fortnight, the woods were finally taken by the marines; Bouresches and Vaux were also captured and the German advance was effectively blocked. In this engagement the Germans lost 24 guns and 1,654 prisoners, but the United States losses were severe, amounting to 285 officers and 7,585 men killed, wounded and missing. The battleground was in 1923 dedicated as a permanent memorial to the United States officers and men who lost their lives there, and the French Govt. ordered the name to be changed to that of Bois de la Brigade de Marine. (*See* GERMAN OFFENSIVE.)

BELLOC, JOSEPH HILAIRE PIERRE (1870–), British author, was born at La Celle, St. Cloud, France, July 27 1870, the son of a French barrister, Louis Swanton Belloc. His mother, Bessie Rayner Parkes (1829–1925), was prominent in the early days of the woman suffrage movement. Belloc was educated at the Oratory School, Edgbaston, then, as a French citizen, served with the artillery at Toul, afterwards entering Balliol College, Oxford, in 1893. He was naturalised in 1902. He was elected M.P. for Salford from 1906 to 1910, first as a Liberal then as an Independent.

Verses and Sonnets (1896) launched Belloc on a varied, not to say tempestuous, literary voyage. Historical studies of *Danton* (1899) and *Robespierre* (1901) first proved his lively historical sense and compelling prose style. His independence of mind in politics showed itself at Oxford, later as a staunch "pro-Boer," and again in the circumstances of his retirement from parliamentary politics; it was shown too, in his association with Cecil Chesterton in conducting *The Eye Witness*, and in writing *The Party System* (1911), and *The Servile State* (1912). Books of nonsense rhymes, such as *The Bad Child's Book of Beasts* (1896); *The Path to Rome* (1902); satires such as *Mr. Clutterbuck's Election* (1908) and *The Mercy of Allah* (1922); numerous volumes of essays and travel sketches; collected poems (1924); military and topographical studies; and *The Cruise of the Nona* (1925)—these are samples of a great versatility of talent. As an upholder of nationalism and the Catholic tradition, Belloc has summed up his attitude best in two of his works, *The Jews* (1922), and *Europe and the Faith* (1920).

BELLOWS, GEORGE WESLEY (1882–1925), American artist, was born in Columbus, O., Aug. 12 1882. Educated at Ohio State University, he moved in 1904 to New York, where he studied art under Robert Henri. In 1910, 1918 and 1919 he was an instructor at the Art Students' League in New York City, and in 1919 taught also at the Chicago Art Institute. His work is distinguished by dignity of composition, vitality and intense interest in life. His drawings and lithographs include many notable illustrations of sporting subjects, and his painting showed at first a preference for sable shades. Later, however, he added to the distinction of his drawing a rich, vibrant use of colour. Among his paintings may be mentioned "Jean and Anna," in the Albright Art Gallery, Buffalo, N. Y.; "Emma and Her Children," in the Boston Museum of Fine Arts; "Portrait of my Mother," in the Chicago Art Institute; "Polo Game," in the Columbus Gallery of Fine Arts; "Stag at Sharkeys," in the Cleveland Museum; "Men of the Docks," owned by Randolph Macon Woman's College, Lynchburg, Va.; "Up the Hudson," in the Metropolitan Museum, New York City; and "North River," in the Pennsylvania Academy of Fine Arts, Philadelphia. He died in New York City Jan. 8 1925.

BELMONT, AUGUST (1853–1924), American banker and financier (*see* 3.710), died in New York City Dec. 10 1924.

BENAVENTE Y MARTÍNEZ, JACINTO (1866–), Spanish playwright and critic, was born in Madrid Aug. 12 1866, the son of a physician. He entered the law faculty of the university there, but, preferring literature, left without taking a degree. His first critical work was *Letters of Women* (1893) which he followed up with the comedy *El Nido Ajeno* (1894). He came under the influence of the French theatre for a brief time but soon distinguished himself by originality, imagination and classic purity of style. His light and elegant comedies were at first criticised as deficient in action, merely satirical dialogues aimed against society and its most sacred traditions. But he soon received encouragement from both the public and the critics and his various experiments in theatrical production never once resulted in serious failure. When his first comedy was produced the Spanish stage was monopolised by the Basque, José Echegaray (*see* 8.870), but Benavente soon proved his superiority and took his place. His dialogue is always brilliant, his characters true to life and the action never flags.

Several of Benavente's plays have been translated into various foreign languages and produced in remote parts of the world. He himself travelled through the United States and Spanish America superintending the execution of his plays by a company formed under his own eye. In 1922 he received the Nobel Prize for literature.

Among his most notable plays are *Invested Interests* (1907), *Saturday Night* (1903), *Brute Force* (1908), *The Vulgar* (1901), *The Mistress of the House* (1901) and *The Rose of Autumn* (1905).

BENCKENDORFF, ALEXANDER, COUNT (1849–1917), Russian diplomat, was born in 1849. He entered the diplomatic service in 1869 and began his career as an attaché in Florence, proceeding thence to Rome. In 1897 he was appointed minister in Copenhagen, and remained there until 1903. The Copenhagen post gave him an exceptional opportunity for watching the principal moving powers of European politics from a point of vantage, as the matrimonial alliances of the Danish Royal Family occasionally brought together in a friendly family circle the widow of Alexander III., Nicholas II. and the Prince of Wales, who was to become King Edward VII. In this way Count Benckendorff received his initiation into the spirit of an Anglo-Russian *rapprochement* even before it actually resulted in an Entente. When he was promoted, in 1903, ambassador to the Court of St. James, the atmosphere seemed anything but favourable to an Anglo-Russian *rapprochement.* The rivalry of the two Powers in the East was growing more and more acute. But when the storm had discharged itself in the Japanese War, Count Benckendorff had an important share in bringing about a change for the better. On the conclusion of the secret convention at Björkö (1905) between Wilhelm II. and Nicholas II., which was likely to disrupt the Franco-Russian Alliance and so involve Russia in a continental league against England, Count Benckendorff was invited to Copenhagen and served as a confidential intermediary between Russia and Great Britain. The Björkö intrigue evaporated without leaving any tangible result, and the historic *rapprochement* between Great Britain, France and Russia took its course. Benckendorff made his home in London where he died Jan. 11 1917.

BENEDICT XV. (1854–1922), Pope, was born at Pegli, in the diocese of Genoa, Nov. 21 1854, his name being Giacomo della Chiesa. In contrast to his immediate predecessor Pius X., who was of humble origin and whose ministerial experience was mainly pastoral, Benedict XV. was descended from one of the oldest families of Italy, and his work had been chiefly in the official or diplomatic service of the Holy See. His ancestors in the Middle Ages were enrolled in the patricians of Genoa, while other branches of his family followed the popes to Avignon in the 14th century.

Giacomo della Chiesa was educated in the seminary and at the University of Genoa, where he took his degree as doctor of law in 1875. Afterwards he went to Rome and studied for the priesthood in the Collegio Capranica, from which he passed to the Accademia dei Nobili Ecclesiastici, the usual training school for those who devote themselves to the *carriera*, or diplomatic service, of the Vatican. Here he became the friend of Cardinal Rampolla, who, on being sent in 1883 as papal nuncio, to Madrid, took Chiesa with him as his private secretary. He remained in Spain four years, and in 1887, when Leo XIII. recalled Rampolla to make him his Secretary of State, Chiesa also returned to Rome and was made minutante in his department. His work was the summarising and inditing of the official letters and dispatches of the Holy See, combined with the functions of confidential secretary. As he discharged these duties for 13 years, he was able to acquire a unique knowledge of the international relations of the Church throughout the world.

In 1903, when Cardinal Merry del Val succeeded Rampolla as Secretary of State, Chiesa was retained in his post. On Dec. 16 1907 Pius X. appointed him Archbishop of Bologna, and on May 25 1914 raised him to the dignity of cardinal. The outbreak of the World War in Aug. of that year, and the death of Pius X. a few weeks later, found him in the midst of the pastoral duties of his great diocese. At this time, as Cardinal-Archbishop of Bologna, he delivered a remarkable address on the attitude and duty of the Church during the War, and strongly emphasised the paramount importance of the Holy See observing strict neutrality, while leaving nothing undone to restore peace and goodwill and to mitigate suffering. The address caused a deep impression, and was no doubt much in the minds of the cardinals when they assembled in conclave for the election of a new pope on Aug. 31 1914. On Sept. 3, after 10 scrutinies, or votings, Cardinal della Chiesa was elected by a large majority, and was proclaimed from the balcony of St. Peter's as Benedict XV.

During the War he preserved an attitude of strict neutrality, and made several attempts to effect peace. Official relations between France and the Vatican were resumed, and a British representative was accredited to the Papal Court for the first time since the 17th century. He died Jan. 22 1922. *See* PAPACY.

BENEŠ, EDWARD (1884–   ), Czechoslovak statesman, was born May 28 1884 in the village of Kožlany, Czechoslovakia. His parents were poor peasants, but the boy was educated in the faculty of philosophy at Prague University, where fees are small and are wholly remitted in the case of poor students. He continued his education at the Sorbonne and the École de Science Politique in Paris, then at Dijon, where he graduated as doctor of laws (1908). In 1909 he was appointed professor of economics at the Prague Academy of Commerce; in 1912 lecturer, and in 1922 professor in sociology at the University of Prague. When the World War broke out he was still a young man of 30, but was already one of the leaders of the Czechoslovak nationalist movement, and soon became Dr. Masaryk's right-hand man in the work of intensive nationalist propaganda which was precipitated by the World War. In 1915 he went to Paris to work as a journalist and diplomat in the cause of Czechoslovak liberation from the Habsburg yoke. There he collaborated with Dr. T. G. Masaryk and Gen. Stefanik in support of the Allied cause. In that same year he was made general secretary in the Czechoslovak National Council, the executive body of the national movement, which in 1918 was recognised by the Allies as the Czechoslovak Provisional Government.

Place in European Politics.—Dr. Beneš became Foreign Minister in the newly formed government, and himself formed one government (1921–2). He was the head of the Czechoslovak Delegation to the Paris Peace Conference (1919–20), and a signatory of the Peace Treaties. He was appointed Czechoslovak representative at the League of Nations in 1920; was elected a member of the League Council in 1923, and re-elected in 1925. He was co-founder of the Little Entente in Aug. 1920, part-author and keen advocate of the Geneva Protocol of 1924, and represented Czechoslovakia at the many diplomatic conferences to which she was a party after the War. On behalf of his country he initialled the Locarno Treaties on Oct. 16 1925, and signed them in London, on Dec. 1 1925.

The outstanding personality of Beneš in the post-War years was, not unnaturally, the cause of controversy among students of affairs in western Europe, especially in Great Britain. British opinion of the Left criticised him on the occasion of several Franco-British diplomatic crises between 1920 and 1924, especially those created by the Genoa Conference and the Geneva Protocol, on the ground that his orientation was toward Paris rather than toward London. Others criticised him on the alleged ground of " interference " between Paris and London; and yet again, that his policy was that of an opportunist. The view, however, that is supported by the evidence of Dr. Beneš' public statements and by his record of action, appears to be that he regarded Czechoslovak political independence, in the first instance, as due largely to the Franco-British Entente and was therefore anxious to preserve the continuance of that Entente. Franco-British diplomatic quarrels caused him anxiety, both for the particular interests of Czechoslovak security and for the general interests of European stability. At the same time, he showed himself to be an unsentimental realist, holding the view that a negative attitude in diplomacy was a blunder, irrespective of the merits of the case.

His object was the political and economic consolidation of Czechoslovakia, to be effected through the regional method of the Little Entente and through a general European stabilisation. He adopted a most progressive policy toward Russia, Czechoslovakia being the first country in Europe to restart trade with that country. In common with the statesmen of most of the small nations in Europe, Dr. Beneš wished to see the principle of universal compulsory arbitration enshrined in international law. He partly evolved and subsequently advocated the Geneva Protocol of 1924. To Dr. Beneš the main attraction of the protocol was that it would, in his view, safeguard the interests of the small states, and best serve the interests of Europe.

It was not till the eve of the Locarno Conference in 1925, that he abandoned his public appeals on behalf of the principles of the protocol (even though the protocol itself was a dead letter by then); and he made it clear, when the Locarno Treaties were initialled, that he regarded them as an instalment of the protocol idea. Dr. Beneš never concealed that in his view and in that of his Yugoslav and Rumanian colleagues it was an important function of the Little Entente to prevent any Hungarian or Habsburg coup against the 1919 settlement. It was largely due to his influence that the two attempts of April and Oct. 1921, to restore the Habsburg régime at Budapest, failed. Dr. Beneš has shown himself to be progressive in policy, and exceptionally well informed. His unbroken period of office, his work for the League of Nations and the close touch he has maintained with European affairs during seven years make him one of the most influential of post-War statesmen in Europe. After the Locarno Treaties were negotiated he at once began laying the diplomatic foundations for a " Locarno " treaty for the east of Europe, to which Hungary should be a party on the analogy of Germany's participation in the western pact. He is the author of some 12 vol. on political and sociological subjects. His published works are mainly concerned with political economy and social conditions in Central Europe (*see* LITTLE ENTENTE).

BIBLIOGRAPHY.—Periodic pamphlets, reproducing his public statements, issued by Orbis (Prague, 1920–5); E. Beneš, *Five Years of Czechoslovak Foreign Policy* (1924).

(G. GL.)

BENN, WILLIAM WEDGWOOD (1877–), British politician, was born May 10 1877 in London. He entered Parliament in 1906 as Liberal member for St. George's, Tower Hamlets, which he represented until 1918. He was a Lord of the Treasury from 1910 to 1915, being an efficient and popular junior whip, and was acting chairman of the National Insurance Commission. A promoter of the National Relief Fund, he was chairman of the executive committee when it was reorganised in 1914. He volunteered for service in the World War and had a distinguished record, receiving the D.S.O. for his services in the R.N.A.S. His liaison work with the French and Italian forces earned him the Croix de Guerre and the Italian Bronze Valour Medal and War Cross. After the War, Capt. Benn returned to politics, being elected for Leith as an Independent Liberal in 1918 and re-elected at subsequent elections. He was one of the small Radical group formed within the Liberal party after the general election of 1924 and, as such, was an extremely active member of the Opposition.

BENNETT, CHARLES EDWIN (1858–1921), American classical scholar (*see* 3.740), died May 2 1921 at Ithaca, New York. His later publications include *Syntax of Early Latin*, 2 vol. (1910, 1914); *New Latin Composition* (1912) and an English translation of Horace's *Odes and Epodes* (1914) in the Loeb Classical Library.

BENNETT, ENOCH ARNOLD (1867–), British author, was born in the district of Shelton, northeast of Hanley, one of the "Five Towns" in Staffordshire, May 27 1867, was educated there, and entered the offices of a local solicitor. In 1893 he abandoned law, and came to London, where he successfully practised journalism. His first novel of any distinction was *Anna of the Five Towns* (1902). By *The Old Wives' Tale* (1908) he definitely established his reputation as the French realists' most eminent and faithful disciple who, moreover, could draw on rich memories of the manners of the middle classes in the English Midlands and who could exercise an inimitable humour.

Meanwhile this humour found other vents than through his more ambitious work. *Anna of the Five Towns* is contemporary with the wild extravaganza, *The Grand Babylon Hotel*, and he interrupted the composition of *The Old Wives' Tale* to write *Buried Alive*, a gay trifle not properly appreciated until it was dramatised. If *The Card* (1911), followed by *The Regent* (1913), devoted to the career of the adventurous Denry, best illustrated Mr. Bennett's humour, it is in the *Clayhanger* series that his imagination reaches the highest point. *Clayhanger* itself was published in 1910, and its sequel *Hilda Lessways* in 1911. In these novels Mr. Bennett not only created characters of unusual vitality and implicated them in an absorbing plot, but he also interpreted to the world the life of the Pottery towns, the 19th century to the 20th. A well-known cartoon by Max Beerbohm expresses the impatience of the public at the delay in the appearance of the third volume of the trilogy. But *These Twain* (1916) was disappointing.

Thereafter it seemed that the novelist, having exhausted his memories of the Five Towns, had also exhausted his talents. Such books as *The Pretty Lady* (1918), and *Mr. Prohack* (1922) are vivid, expert, but seem intended rather to express the vulgar delight of a provincial in metropolitan luxury than to reflect the genius of a great artist. But *Riceyman Steps* (1923), the study of a miser and his loyal servant, although the scene is set in London and not in the Five Towns, again displays the psychological subtlety, the grim humour and the honest pathos of the earlier Bennett.

As a playwright Mr. Bennett has been content to exercise his lighter talents. *Milestones* (1912), in which he collaborated with Edward Knoblock, remains his most notable work, though *What the Public Wants* (1909), a comedy of the modern newspaper, *The Great Adventure* (1913), the dramatic version of *Buried Alive*, and *The Title* (1918) have been deservedly praised. His sense of the theatre has proved too strong to enable him to put forward there original ideas, or to confuse the audience by new devices.

Similarly, in the short story, Mr. Bennett seems primarily to have ensued technical efficiency. The volume of stories called *The Grim Smile of the Five Towns* (1907) belongs to the best period of Mr. Bennett's earlier manner, but contains nothing of enduring merit, and *Elsie and the Child* (1924), apart from its title story, a sequel to *Riceyman Steps*, is little more than good journalism. Mention must also be made of the works of popular philosophy. In them common sense is more conspicuous than profundity of thought or literary elegance. Nor should the descriptive sketches, of which *Paris Nights* is an early example, be forgotten. Rough and at times garrulous, they nevertheless show gusto.

In a fantasy of Mr. Wells, the following notes from an undelivered address appear: "Arnold Bennett as an aborted Great Man, would have made a great Victorian and had a crowd of satellite helpers. Now no one will treasure his old hats and pipes." If indeed Mr. Bennett's hats and pipes are not collected by posterity, the spirit of the times will be principally to blame. Like Dickens, Mr. Bennett is an unsophisticated and occasionally exasperating novelist, but like Dickens he has learnt how to command at once the applause of the few and the favour of the many. The few find in his serious work the fruits of a memory and observation even more precious than an exuberant fancy, a sanity and humaneness eminent in contemporary fiction, and a striking intelligence. (H. C. Ha.)

BENNETT, JAMES GORDON (1841–1918), American newspaper proprietor (*see* 3.740), died May 14 1918 in Paris, whence he had long directed the policies of *The New York Herald*. In his will he provided for the establishment of the James Gordon Bennett Memorial Home for New York Journalists in memory of his father, the founder of *The New York Herald*.

BENSON, ARTHUR CHRISTOPHER (1862–1925), British man of letters (*see* 3.745), died at Cambridge June 17 1925. After 1910 he published several books, mostly essays and sketches of people he had known; and in 1926 a posthumous novel, *The Canon*, appeared. His best work, however, was probably done in biography, but the true force of his personality was never fully preserved in his writings; it was given to Eton, his college, and his friends.

His brother, Robert Hugh Benson (1871–1914), died at Salford, Lancs., Oct. 19 1914.

BENSON, FRANK WESTON (1862–), American artist (*see* 3.745), in addition to his reputation as a painter, achieved marked success with his etchings and wash drawings of wild fowl, a field in which his talent is especially spontaneous and happy. As in his painting, his work combines manliness and delicacy and is pervaded with a sense of gaiety. He has few equals in the reproduction of flying birds and waterfowl.

BENSON, WILLIAM SHEPHERD (1855–), American naval officer, was born at Macon, Ga., Sept. 25 1855. He graduated from the U.S. Naval Academy in 1877, and after various promotions became captain in 1909 and rear-admiral in 1915. He had been commandant of the Philadelphia Navy Yard for two years when, in 1915, he was appointed chief of naval operations. He was a member of the commission appointed to confer with the Allied Powers in 1917, and was appointed naval representative for preparing the terms of the Armistice (1918), and naval adviser to the American Peace Commission. He was retired automatically in 1919 with the rank of rear-admiral. In 1920 he was appointed chairman of the U.S. Shipping Board and was made a permanent admiral for life.

BENZ, KARL (1844–), German engineer, was born at Karlsruhe Nov. 26 1844. He studied under Redtenbacher and Grashof at the Karlsruhe Polytechnic and after working in various workshops on locomotive and bridge construction set up independently at Mannheim in 1871. From his earliest youth he had aimed at "putting the locomotive on the street," having no knowledge of the English and French road locomotives of the 1820's and 1830's. His interest in gas engines was awakened by Lenoir's gas machine. He constructed a two-stroke engine model of his own, and founded an engine factory. As, however, the group financing him would only deal with fixed engines, he left it. He founded the firm Benz and Co., Rheinische Gasmotorenfabrik, and began to construct fixed engines; then developed a light high speed four-stroke engine (250 revolutions, 2/3 H.P.)

He discovered the differential, special electrical battery ignition with spark induction, surface carburetter. He completed his first car in 1885, speed 10–16 km. per hour, and took out the patent in 1886 (D.R.P. 37435). He sold the first car to the Frenchman, Roger, and then joined the firm of Panhard and Levassor. In England he encountered difficulties owing to the Locomotives Act (not abolished till 1896); and in 1893 he took out a patent for steering gear with triple axle and steering rods tangential to the wheels. Later, he took up his residence in Mannheim.

BERCHTOLD VON UND ZU UNGARSCHITZ, LEOPOLD, Count (1863–), Austro-Hungarian statesman, was born April 18 1863, and entered the Austro-Hungarian Foreign Office in 1893. In 1903 he went as councillor of legation to Petrograd and in Dec. 1906 was appointed ambassador there. With the Russian court and the aristocratic society of Petrograd he maintained the best relations, but failed entirely in his efforts to accommodate the obviously increasing differences between Russian and Austro-Hungarian policy. He took a leading part in the negotiations preceding the crisis caused by the annexation of Bosnia-Hercegovina, which aimed at securing common action of the two Powers in the Balkan question. It was at his château of Buchlov, in Moravia, that the fateful conference took place between Izvolsky and Aehrenthal (Sept. 15 1908). In March 1911 Count Berchtold was recalled from Russia, and on Feb. 17 1912 he was, against his own will, appointed Aehrenthal's successor as Foreign Minister.

His efforts were directed toward securing the position of Austria-Hungary in the Balkan Peninsula. At this time he considered possible a peaceful solution of the Balkan question by agreement with Russia and the Western Powers. But the obvious efforts of Russian statesmen to weaken the influence of Austria-Hungary in the Balkans, the aggressive activities of the Serbs and the ambiguous behaviour of Bulgaria forced him to change his attitude, especially as he failed to receive from the Western Powers the support which he had sought.

During the three Balkan wars, Oct. 1912 to Aug. 1913, Berchtold's attitude was characterised by weakness and indecision. He repeatedly took steps toward active intervention, but drew back when the Entente Powers used threats, and the other members of the Triple Alliance intervened with counsels of moderation in Vienna. His efforts at the close of the third Balkan War to secure a revision of the Treaty of Bucharest (Aug. 10 1913), which was unfavourable to Bulgaria, were as unsuccessful as his attempt to secure an accommodation between Bulgaria and her rivals by way of direct negotiation. The prestige of Austria-Hungary in the Balkans noticeably declined. Serbia's endeavours to extend her power to the Adriatic and to win recruits for the ideal of Great Serbia among the kindred Slav races of Austria-Hungary became more and more evident. For these reasons, at the conferences at the Ballplatz which followed the murder of the heir to the throne, the Archduke Francis Ferdinand, on June 28 1914, Berchtold maintained the view that a definitive settlement with Serbia was essential, even at the risk of war with Russia and France.

After the outbreak of the World War he directed his efforts to inducing Italy and Rumania to carry out their obligations and to securing new allies for the Central Powers. These efforts were, for the most part, unsuccessful. Turkey alone joined the Central Powers. Rumania and Italy declared their neutrality; even Bulgaria dragged out the negotiations, though Berchtold offered great concessions in return for her active intervention on the side of Austria-Hungary and Germany. Italy's demands for compensation were acknowledged in principle by Berchtold, under pressure from Germany, but he embarked on the negotiations with hesitation, and to the day of his resignation (Jan. 13 1915) he refused to listen to any proposal for the cession of Austrian territory. In March 1916 Berchtold was appointed Obersthofmeister (lord high steward) to the heir to the throne, Charles Francis Joseph, whom he subsequently served as Oberstkämmerer (lord high chamberlain). After the fall of the dynasty he took no further part in politics. (*See* Austria.) (A. F. Pr.)

BÉRENGER, RENÉ (1830–1915), French politician (*see* 3.769), died Aug. 29 1915.

BERESFORD, CHARLES WILLIAM DE LA POER BERESFORD, 1st Baron (1846–1919), British sailor (*see* 3.770), long known as Lord Charles Beresford, was made a peer in 1916 and died Sept. 6 1919, when the title became extinct.

BERGEN, Norway (*see* 3.772), had a population in 1920 of 91,443. The central part of the town was burnt down in 1916, but is being carefully replanned and rebuilt. A new road has been made from the old German quay to the street above, and the old warehouses, with their dark courts and alleys, are disappearing. A garden suburb has been laid out at Finbergaasen by the municipality. The public library was removed to new buildings in 1917, and a post-office built behind the Exchange. The Rasmus Meyer collection of Norwegian paintings, old interiors and furniture, presented to the town, has been placed in the Art Gallery. The port has extensive quays and three large, and several smaller, engineering works, with shipbuilding yards attached. There are six patent slips and three dry docks.

BERGIUS, FRIEDRICH (1884–), German chemist, was born Nov. 11 1884 at Goldschmieden near Breslau. He studied at the universities of Breslau, Leipzig and Berlin and at the technical schools in Karlsruhe and Hanover. Later he founded a private technical research laboratory in Hanover, and devoted himself chiefly to the study of the influence of high pressure on chemical actions. This is described in his book *The Use of High Pressure in Chemical Actions* (1913). These studies led up to his work in connection with the conversion of coal into liquid products. Through the action of hydrogen under high pressure and at high temperature, he succeeded in converting a high percentage of coal-dust into oil, direct, without first obtaining intermediate products. The oil is equivalent in value to crude mineral oil. An experimental plant was erected at Rheinau near Mannheim.

BERGSON, HENRI (1859–), French philosopher, was born Oct. 18 1859 in Paris, of Anglo-Jewish parents. After a brilliant career at the Lycée Condorcet, he hesitated for some time between literature and science, being equally gifted in both directions, and then decided for the former. He became naturalised as a Frenchman, and entered the École Normale Supérieur where he was the contemporary of Jaurès. He taught philosophy first at the Lycées of Angers and Clermont, and then in Paris at the Lycée Henri IV., the École Normale Supérieur and the Collège de France. In 1918, he succeeded Émile Ollivier at the Académie Française. From that time he gave up teaching and devoted himself to politics and to international affairs, as head of a mission to America, and after the World War, as president of the committee of intellectual co-operation.

Bergson's Philosophy.—This account of the appointments held by him is, however, of small importance as compared with the history of the development of his mind, revealed in the books which have gained him a world reputation. He is the most highly esteemed of contemporary students of philosophy. Bergson the philosopher is not, like Hegel, Schopenhauer and Spencer, the creator of a great system, conceived as a whole in youth, and gradually expressed in later life. There is, nevertheless, in his philosophy one outstanding idea which is said to have come to him during a walk at Clermont-Ferrand, when he was 25 years old. Since Plato, philosophy had consisted in eliminating duration, in regarding time as an illusion, and finite being and eternity as one, and Bergson asked himself whether, on the contrary, the being, of which the philosopher took cognisance by reflection, might not be one which endured, might not be time itself. For the phrase of Descartes, "Je suis une chose qui pense," he substituted "Je suis une chose qui dure," and for the *sub specie aeterni* of Spinoza, a *sub specie durationis.* Just as he substituted durational for non-temporal values, so for static values, he substituted values of motion and change. This was the true Bergsonian revolution, which may be related to the German and English historical and evolutional philosophies characteristic of the 19th century.

All Bergson's work is thus concerned with duration and movement. He does not proceed by general speculation. Each of his books is a study of one particular question, and this illustrates his second characteristic, originality of method. In his opinion, philosophy, like science, can only progress by disregarding general theories and universal systems, and devoting attention to particular problems, each of which demands its own point of view. The solution of any one of these does not necessarily involve an analogous solution of the others. Bergsonism implies continued striving after a precise adaptation to reality. The aim of each of his works is the elucidation of a detailed problem, though each is also part of a general philosophy, the philosophy of duration and change. Those who discover in Bergsonism an apotheosis of intuition and of mystical values and a depreciation of intelligence are mistaken as to the true substance of his theories.

The *Essai sur les données immédiates de la conscience* (1889), which was Bergson's thesis for the doctorate, is primarily an attempt to establish durational values, where the necessary illusions of the mind situate the appearances of space, and thence to proceed towards an original solution of the problem of free-will which was at that time the principal occupation of French philosophers. *Matière et mémoire* (1896) contains a detailed consideration of the problem of aphasia leading to a profound study of the means, namely the memory, by which existence is made continuous. In *L'évolution créatrice* (1907), he attacks the whole problem of existence. Whilst Spencer merely supported evolution by evidence derived from fragments of the evolved, Bergson takes as his material the essential motion of the being changing, or rather of the being which is itself both change and movement. This is his most famous and influential work, and that which has most fully expressed his ideas as to the secret of the universe.

An important part of Bergson's philosophy is to be found in his minor works, such as the essay *Le rire* (1900), his lectures at Oxford entitled *La perception du changement* (1911) and the volume *Durée et simultanéité* (1922), in which he discusses Einstein's theories. Except for the articles which have been collected under the title *L'énergie spirituelle* (1919), he has published nothing of late years, though he has been engaged in the study of moral and religious problems.

We must, in conclusion, refer to his position as a teacher and a writer. His lectures at the Collège de France were models of clearness and grace of expression and enjoyed great popularity. It was, however, probably as a master at the Lycée Henri IV. that his influence was most strongly felt. His style is modelled on that of the great philosophers, restrained and concise, like that of Condillac and at the same time full of colour and imagery, like that of Plato and Bacon. (*See* PHILOSOPHY.) (A. TH.)

BERI-BERI: *see* VITAMINES; also 3.774.

BERLAGE, HENDRIK PETRUS (1856–), Dutch architect, received his technical training at Amsterdam and Zürich and eventually settled at The Hague. As his career progressed he broke away from the Renaissance and Gothic styles which he had originally followed and finally succeeded in expressing the conception of beauty prevailing in his own time. Under the influence of these new ideas architecture in Holland reached an important stage of development. The chief characteristics of Berlage's style are simplicity of form, severity of line and a preference for brick as a material. In later years he was actively concerned with urban extension, and in this connection became architectural adviser to Amsterdam, The Hague and Rotterdam.

BERLIN (*see* 3.785) is the capital of the German Reich. The population of Greater Berlin (area 332 sq. m.) was 3,803,770 in 1919. The birth-rate in 1921 was 14·6 per 1,000, and the death-rate 12·8, making an excess of births over deaths of 1·8. It is now the second largest city in Europe, the population being estimated at 4,042,000 in May 1925. The birth-rate in 1925 was 11·6 per 1,000 and the death-rate 11·2, making an excess of births over deaths of 0·4 per 1,000.

Berlin has undergone a very considerable development in respect of the form of its municipal organisation. The rapid growth of the suburbs, which were independent communities, necessitated the adoption of certain main lines of procedure, applicable both to them and to Berlin, in order to prevent conflicting action on the part of the authorities on one side and the other. This led, in 1911, to the creation of Greater Berlin, as, in the first instance, an association of the city with the more important outlying districts for special objects. It embraced the city of Berlin and the towns of Charlottenburg, Schöneberg, Neukölln, Wilmersdorf, Lichtenberg and the administrative circles of Teltow and Niederbarnim. Its objects were to institute a common control of streets, roadways and the elevated railway, also of building and street alignment plans, the uniform co-ordination of police regulations and the acquisition of large tracts of forest and of land for building. This special union came into force on April 1 1912. It soon became manifest, however, that beyond co-operation for special purposes, a further co-ordination of the administrations of these places was requisite. It was only in the year 1920 that it was possible, after long negotiations, to form a new municipality of Berlin, embracing all the suburbs under a single united administration. A law to this effect was carried through the Prussian Constituent Assembly on April 27 1920, and was put into force on Oct. 1 of the same year. This law effected the centralisation of Berlin and all its suburbs into one uniform municipal region (*Stadtbezirk*), but nevertheless left large powers of local self-administration to the individual communes (*Gemeinden*).

Varied Developments.—On May 15 1912 the former secretary of state for the treasury, Wermuth, was elected chief burgomaster of Berlin in place of Kirschner, who had resigned. Under his administration, which lasted till Nov. 25 1920, the city experienced notable developments. The first municipal crematorium was opened in 1912. In June 1914 the ship canal uniting Berlin with Stettin was inaugurated. In the same year the city acquired the estate of Lanke, thus securing extremely valuable land for settlement purposes. In Oct. 1915 the city purchased the Berlin Electrical Works. The years of the World War necessitated the vigorous intervention of the municipal administration in order to keep the population supplied with food and other necessaries of life. A special commission for food supplies was appointed as early as 1914. In 1915 the supply of meat, vegetables, milk, etc., by the municipality was instituted. The management of all these supplies necessitated the appointment of a host of officials. The establishment of the war departments of the Empire and of Prussia as well as of the city thus entailed an accession of population which by 1917 had caused a great dearth of house accommodation, a scarcity which constantly increased up to 1921, so that special offices for enabling the public to obtain dwellings had to be established under municipal supervision. Even in 1921 it was almost impossible to find a flat. The general necessities arising out of the World War demanded vast expenditure on the part of the city.

The Revolution.—The city of Berlin suffered severely from the effects of the revolution of Nov. 9 1918. The revolution itself was practically bloodless, so far as Berlin was concerned, although the stormy sittings of the Workmen's and Soldiers' Councils, held in the Reichstag building, occasionally led to minor collisions. It was not till Christmas 1918 that serious fighting took place, when the Independent Socialist party, supported by the Sailors' Division, tried to seize power. After several days of sanguinary combats in the neighbourhood of the castle and the royal stables, where the sailors had established themselves, the division was ultimately compelled to surrender. Early in March 1919 the Spartacist insurrection broke out; it began in the suburb of Lichtenberg and spread over the whole centre of the city. The number of those who were killed in the street fighting was 1,175. The last victims of the revolution met their death on Jan. 13 1920 when a mass of people, incited by Spartacist propaganda in connection with the parliamentary debates on the Industrial Councils bill (*Betriebsrätegesetz*), attempted to storm the Reichstag building. There were 42 killed and 105 wounded. The Kapp *Putsch* in March of the same year was likewise attended by some casualties, but the decisive episode was a general strike imposed by the Socialist parties and the working-class leaders in order to put an end to Kapp's usurpation of power.

Since the revolution of 1918 the police force has been recruited from the army, housed in barracks and clothed in military uniform, in spite of many protests from the Allies. It reverts to a military footing at once in times of disorder, as when a fresh communist outbreak was feared owing to the inflation collapse and the high cost of living in 1923, when a minor state of siege was put into force. During 1921–3 there were frequent strikes in the municipal services, with demands for higher wages, and food riots, with looting of shops. The population were nervous and exasperated, but the prevalent discontent was allayed with the fall of the government and the coming into power of Stresemann.

The Prussian State Library, opposite the palace of the Emperor William I., was finished in 1914, and two north wings of the Frederick Wilhelm University, in Kaiser Franz-Josef Platz, were built between 1913 and 1919. In the latter year a new branch of the National Gallery was installed, with a collection of modern pictures, in the Palace of the Crown Prince in the Zeughaus Platz, and a portrait gallery in the Academy of Architecture in the Schinkel Platz. The Schloss Museum was opened in the Schloss in 1921 with exhibits of pottery, silver, furniture, etc. The important Pergamon sculptures are housed in the Neues Museum, but a new museum is being built to the west of it to take the Pergamon antiquities and those from Western Asia, and as a German museum. The Hohenzollern Museum, containing personal possessions of the Prussian rulers, in Schloss Montbijou, is at present (1926) closed. A second large exhibition hall was built on the Kaiserdamm for the motor show of 1924, to obviate the overcrowding which previously existed.

The North-South (N.S.) tube, begun before the World War, was opened in Jan. 1923, and a new harbour, called the "West Harbour," in Sept. 1923. It is situated in the northwest of Berlin, between the Ring stations of Putlitzstrasse and Brusselstrasse. For some distance it is contiguous with the permanent way of the Hamburg-Lehrter Railway. The northern basin of the harbour is 655 metres long, 55 metres wide; the southern basin is 448 metres long and 55 metres wide. The two basins together have quays about 2,500 metres long, at which 68 large Elbe ships of 600 tons can be dumped down and loaded simultaneously. The harbour has the most modern arrangements for loading and unloading.

BERLIN, IRVING: *see* BALINE, ISRAEL.

BERNHARDI, FRIEDRICH VON (1849–), German soldier and writer, was born in Petrograd Nov. 22 1849, and he entered the German Army in time to take part in the Franco-Prussian War. From 1891 to 1894 he was German military attaché at Berne and later he took charge of the military history department of the General Staff in Berlin. In 1907 he was given command of the VII. Army Corps, but he retired in 1909 and turned his whole attention to writing on military subjects. Following Treitschke, Bernhardi held that war must come, that Germany must conquer or fall and that she is entitled therefore to secure victory at any cost. His gospel of force, thus proclaimed outside his own country, was a factor (possibly exaggerated at the time) in creating a belief that Germany was in an aggressive mood. His chief book was *Deutschland und der nächste Krieg* (1912), the translation of which into English caused a great sensation. In 1914, Bernhardi commanded an army on the western front.

BERNHARDT, SARA (1845–1923), French actress (*see* 3.801), in 1909 played Jeanne d'Arc in Paris. In 1910 she toured in America. In 1913 she was given the Cross of the Legion of Honour. Though lame as the result of an operation, she appeared in Nov. 1920 in Paris in a new play, *Daniel*, by Louis Verneuil, and repeated this performance in London in April 1921. She died March 26 1923.

BERNSTEIN, EDUARD (1850–), German politician and writer, was born in Berlin Jan. 6 1850. In 1872 he joined the Social Democrats and from 1881–90 edited, with Bebel the *Sozialdemokrat* in Zurich and later in London, where he lived in exile until 1901. It was during this latter period that he became intimate with Friedrich Engels and Karl Marx. In 1902 he entered the Reichstag as deputy for Breslau. He led the revisionist or right wing section of the Social Democrat party, but when the split in the party occurred in March 1916, his pacificist convictions forced him to associate with the Independents or extreme left wing. He rejoined the Majority Socialists, however, in 1919. Bernstein is, however, better known as a writer than as an active politician. His works include: *Die Voraussetzungen des Sozialismus und die Aufgaben der Sozialdemokratie* (first pub. 1899, latest ed., 1920); *Zur Geschichte und Theorie des Sozialismus* (1901, 1904); *Sozialismus und Demokratie in den grossen Englischen Revolution* (1922); *Erinnerungen eines Sozialisten* (1918); *Die deutsche Revolution, ihre Entstehung, ihr Verlauf und ihr Werk* (1921).

BERNSTORFF, JOHANN HEINRICH, COUNT VON (1862–), German diplomatist, was born in London Nov. 14 1862, the son of the Prussian diplomatist, Count Albrecht von Bernstorff, who was Prussian minister and German ambassador in London, 1854–61 and 1862–73. He entered the diplomatic service in 1899, was secretary of legation successively at Belgrade, Dresden, St. Petersburg and Munich, and (1902–6) councillor of the embassy in London. He then went as consul-general to Cairo, whence he proceeded as German ambassador in 1908 to Washington, and remained there until America's declaration of war against Germany, in April 1917. He made great efforts to facilitate mediation by President Wilson, but he did not receive the support he expected from authoritative quarters in Berlin. On the American declaration of war he returned to Germany and was sent as ambassador to Constantinople, where he was employed until 1918.

In various publications and in his reminiscences on his term of office as ambassador in Washington, he endeavoured to prove that Germany, if she had followed the proper policy, could have avoided war with America. This statement of his views excited much controversy in his own country. When the revolution broke out in 1918 Bernstorff left the diplomatic service, but later took an active part in parliamentary politics as a member of the Democratic party in the Reichstag, and also maintained a close connection with the international Press, and with pacific post-War propaganda, especially with League of Nation matters and as chairman of the German League of Nations Union.

BERTHELOT, PHILIPPE (1866–), French diplomat, son of the eminent chemist, Marcellin Berthelot (*see* 3.811), was born Oct. 9 1866 at Sèvres. Entering the diplomatic service in 1889, he went, in 1904, to the Foreign Office, where he remained throughout his career. In 1913 he became assistant in the political and commercial department. In this position, during the absence of his chief, who had accompanied MM. Poincaré and Viviani to St. Petersburg, he did much useful work during the early days of the international crisis of July 1914. Head of the political department in 1919, he became, in 1920, Secretary to the Ministry of Foreign Affairs with the rank of ambassador. In 1922, on the advent to power of M. Poincaré, he was suspended because of his intervention in favour of the Industrial Bank of China, controlled by his brother. In 1925 he was restored to the secretaryship. Exceptionally cultured, experienced and possessing a most retentive memory, M. Berthelot has played a most important part in the direction of French foreign affairs, particularly during the War, the Peace Conference and ensuing years.

BERTILLON, ALPHONSE (1853–1914), French anthropometrist (*see* 3.812), died in Paris Feb. 13 1914.

BERTOLINI, PIETRO (1859–1920), Italian politician, was born at Montebelluna July 24 1859. He began his career as a barrister and entered Parliament in 1891 as member for his native town, eventually becoming under-secretary at the Ministry of the Interior in the Pelloux Cabinet (1898–1900). Later, after the fall of Gen. Pelloux he went over to Giolitti, who appointed him Minister of Public Works in the Cabinet of 1907, and he proved a capable administrator. In the autumn of 1912 Sig. Giolitti, who had returned to power in 1911, entrusted him with the new Ministry of the Colonies. He was *rapporteur* for the extended suffrage bill which came into force in 1913 and must be given credit for the ingenious machinery which he devised for enabling illiterates to vote and for avoiding electoral corruption. Throughout the World War he remained in retirement as a confirmed neutralist. Sig. Nitti appointed him senator and president of the Italian delegation on the Reparations Commission. He died at Turin Nov. 28 1920.

BERZEVICZY, ALBERT DE (1853–), Hungarian politician and writer, was born June 7 1853. After studying law and politics at Budapest University, he travelled extensively in Europe. He was professor of law in the University of Eperjes and in 1881 was returned to the Hungarian Parliament by the same town. He became Minister of Education in 1903, having held various posts in the department since 1884. From 1910–2 he was president of the House of Deputies. He is chiefly known for his works on history, art and politics. Berzeviczy published numerous historical and other works, among which may be mentioned *Absolutism in Hungary*, vol. 1 (1925); *Landscape Painting in the 17th Century* (1910). In 1904 he was elected a member and in 1905 president of the Hungarian Academy of Sciences, over whose centenary celebrations he presided in 1925.

BESANT, ANNIE (1847–), British theosophist, was born in London Oct. 1 1847, the daughter of William Page Wood. She married in 1867 the Rev. Frank Besant (d. 1917), afterwards vicar of Sibsey, Lincs., but obtained a separation from her husband in 1873. She had become an ardent freethinker, and from 1874 to 1888 she worked in close association with Charles Bradlaugh, both in politics and in freethought propaganda, as a lecturer and a writer of pamphlets over the signature of "Ajax." Her increasing tendency towards socialism of the more revolutionary type occasioned a divergence between them after 1885, which was completed in 1889 by her adhesion to the Theosophical Society. She became a devoted pupil of Mme. Blavatsky (*see* 4.48), and threw in her lot very largely with India. She founded the Central Hindu College at Benares, and was elected president of the Theosophical Society in 1907; she established the Indian Home Rule League, and became its president in 1916, and in 1917 she was president of the Indian National Congress, but later dissociated herself from the extreme wing of the Nationalist party. It was her marked gifts of oratory and organisation which carried her to the position, unique for an Englishwoman, of leader in a Hindu political movement. In addition to her numerous freethought pamphlets and works on theosophy, she published an *Autobiography* (1893); and *The Religious Problem in India* (1902).

BESSARABIA (*see* 3.821), a province of Rumania lying between the Prut, the Dniester and the Black Sea. Its area is 17,350 sq. m. and the population in 1919 was 2,625,000.

Political History.—In 1912 Russia celebrated the completion of a century since her annexation of Bessarabia. The loss of that province, however, had always remained a sore point with Rumanians, and the Russian celebrations served to arouse Rumanian national sentiment. Meetings held in Bucharest were attended by representatives of all the Rumanian cultural societies and of Bessarabian emigrants settled in Rumania. Among the most vehement critics who denounced the imperialistic tendencies of the Tsarist Govt. was Dr. G. C. Rakovsky, who at that time was a Rumanian subject and the leader of the Rumanian Socialist party.

In spite of the radical measures adopted by the Russian Govt. for the denationalisation of the Moldavian (Rumanian) element in Bessarabia, such as the suppression of the Rumanian language in schools and churches, etc., the province had not become Russified nor altogether submissive to the rule of the Tsar, and certain liberal-minded elements there, as in other parts of the empire, gravitated toward the democratic *zemstvos*. To these popular organisations may be traced the origins of a powerful liberal movement amongst the Rumanian population which set in at the outbreak of the Russian revolution in 1905. This movement, however, was ruthlessly suppressed.

When in 1917 the Russian revolution proclaimed the right of peoples to decide their own fate, Bessarabia declared herself autonomous (on Nov. 3 1917) and a National Council (*Sfatul Tsarei*) was elected. On Dec. 2 1917 the "Sfatul Tsarei" proclaimed Bessarabia a "Moldavian Democratic Republic," forming part of the Federation of Soviet Republics, equal rights and liberties being granted to all its citizens.

On the collapse of the Russian front, the Sfatul Tsarei made an appeal to the Rumanian Govt. at Jassy for Rumanian army detachments to guard the railways and keep order in the province. On Jan. 24 1918 Bessarabia, following the example of the Ukraine, declared herself the "Independent Moldavian National Republic," thus detaching herself from the Federation of Soviet Republics, and on March 27 of the same year the Sfatul Tsarei formally and unconditionally voted for political union with Rumania subject to certain conditions for local autonomy, and the proposal was accepted by the Rumanian Government. The union of Bessarabia with Rumania was not acknowledged by Russia, nor at that period even by the Allied Powers. On Nov. 27 1918 the Sfatul Tsarei accepted a new motion under which Bessarabia was incorporated unconditionally in Rumania. In the following year elections on the basis of universal suffrage were held, and for the first time Bessarabia sent representatives to the Parliament in Bucharest.

The union of Bessarabia with Rumania was recognised by the Supreme Council of the Allies on March 3 1920, and formally and explicitly by the Treaty of Paris (Oct. 28 1920) signed by England, France, Italy and Japan. England and France ratified the treaty, but Italy and Japan delayed its ratification. The United States stood aside from the treaty signed at Paris on the ground that there was at that time no Russian Govt. to state the Russian side of the case. Rumanian treaties with Yugoslavia and Czechoslovakia do not involve these countries in the defence of Bessarabia, but the treaty between Poland and Rumania signed at Bucharest on March 3 1921 declares that the two states should come to one another's assistance in the event of an unprovoked attack on their eastern frontier. The union is still a matter of controversy between Russia and Rumania, and the negotiations between Russian and Rumanian delegates which took place at Genoa in 1922 and at Vienna in 1924 led to no settlement.

Administration.—On assuming the charge of the administration of Bessarabia the Rumanian Govt. took steps to ensure public order which had been disturbed by armed bands of Bolshevists. Pickets of troops were posted all along the Dniester in order to exclude Red bands and Bolshevist agents. By the agrarian reform law passed by the Parliament in Bucharest all private estates over 100 hectares were expropriated and turned over to the peasants. Thus, more than 340,000 peasant families became the owners of over 1,000,000 hectares of land. The administrative system of the province was changed by replacing the *zemstvos* (district councils) and *volosti* (sub-district councils) by prefects and sub-prefects appointed from Bucharest. For administrative purposes Bessarabia was divided into nine districts, each district being in charge of a prefect.

Population.—In 1919 the population was estimated at 2,625,000 inhabitants, of which the Rumanians numbered 1,585,000, the rest being composed of Russians (45,000), Ukrainians (225,000), Jews (138,000), Germans (72,000), etc. Owing to Bolshevist agitation and a large influx of refugees and Bolshevist agents who continuously try to cross into Bessarabia, the province has been in a state of siege ever since the War. The commander of the army corps at Chisinau (Kishinev) is virtually the military governor of Bessarabia.

Economic Development.—The disorganisation of the ways of communication, which even in normal times were very restricted in the province, the parcelling out of large estates and the adoption of a new currency have hindered the normal economic development of Bessarabia. Rumania being herself an agricultural country, she cannot provide a market for the products of Bessarabia (cereals, fruit and wine). Under the Russian rule Odessa was her natural outlet, and her fruit and wine found a ready market in Russia. The export trade of Bessarabia can only develop when her railways have been reorganised as part of the Rumanian system and converge toward the Rumanian ports of Galatz and Braila. (*See* RUMANIA.)

See *British White Paper Cmd. 1747 of 1922; Les quatre Décrets du gouvernement roumain en Bessarabie* (Paris, 1919); *The Roumanian Occupation in Bessarabia*, Documents (Paris, 1919). (G. Bo.)

BETHLEN, STEPHEN BETHLEN DE, COUNT (1874–), Hungarian statesman, was born on Oct. 8 1874 at Corneşti (Gernyeszeg), Transylvania. His father, Count Stephen Bethlen, was a member of the famous family that gave Gabriel Bethlen, Prince of Transylvania, to Hungarian history. His mother was Countess Helen Teleki. The son went to school at the Theresianium in Vienna, then studied law at the University of Budapest and also obtained the diploma of the academy of agriculture at Magyaróvár. After finishing his studies he travelled in Europe and the United States. On his return home he took charge of the management of his large estates—estates which were sequestrated after the Treaty of Peace by the Rumanian Government.

He soon began to take an active interest in domestic politics, and in 1901 was elected to Parliament as a member of the Liberal Opposition. His speeches always attracted attention and particularly impressed that famous statesman Count Tisza, who, when in power prior to the World War, offered Count Bethlen a portfolio in the Cabinet, an honour which Count Bethlen declined. The Emperor Francis Joseph appointed him a privy councillor and this, with the exception of the degree of doctor of laws conferred, in 1922 by the University of Cluj (Kolozsvár), now removed to Szeged, was the only distinction Count Bethlen ever accepted. Until he became Prime Minister in 1921 he had never held office. By the end of 1925 he had been longer continuously in power than any other European Prime Minister of that day.

The 20 years that elapsed between the day Count Bethlen entered political life and the day he became Prime Minister although not marked by Cabinet responsibility, were full of activity in relation to domestic affairs and of service to the state. After the Hungarian revolution of Nov. 1918, and during the ensuing régime of Count Michael Károlyi, Count Bethlen took a leading part in creating the counter-revolutionary organisation which, when the Bolshevists came into power, took shape as the emergency Govt. of Szeged. (*See* HUNGARY.) As the chief representative in Vienna of this anti-Communist Govt. Count Bethlen did much to keep up the courage and the hopes of his fellow-countrymen and to create throughout the rest of Europe the determination to end the excesses of Soviet rule as enforced in Budapest by Bela Kun.

When the Hungarian Peace Delegation went to Paris Count Bethlen was one of the principal delegates, and it was under his personal direction that the Hungarian memorandum in relation to Transylvania was drafted. Ten months after the Treaty of Trianon had been signed, and a few days after King Charles had made his first fruitless effort to regain the throne of Hungary, Count Bethlen accepted the invitation of the Regent, Admiral Horthy, to form a Cabinet in consequence of the resignation of Count Paul Teleki.

As Prime Minister.—On April 14 1921 Count Bethlen became Prime Minister. Few men in the political history of Europe had so often and for so long refused high office: few had ever taken it under such thankless and discouraging conditions. The Succession States, with overwhelming armies, threatened the occupation of Hungary on the ground that the recent attempt of King Charles to regain the throne endangered the Peace Settlement. The great Allied Powers were in much the same mood. On the other hand the Hungarian people were seething with indignation over what they considered to be the injustice and humiliation of the dictated Treaty of Peace. In this crisis, with no Cabinet experience, relatively ignorant of official procedure, bitterly opposed both by Royalist and Socialist extremists, Count Bethlen dared to lead his country. He succeeded at home because of his unquestioned patriotism, moderate views and political sagacity: abroad his powers of reasoning, fairness and flair for negotiation received quick recognition.

By Oct. of his first year as Prime Minister he had achieved a notable diplomatic success in concluding at the Conference of Venice an amicable agreement with the Austrian Chancellor regarding western Hungary (Burgenland). For months Austria and Hungary had been on the verge of hostilities over the ownership of this territory which under the Peace Treaty had been allotted to Austria. In consequence of the Venice conference the important town of Sopron and its environs, after a plebiscite, were ceded back to Hungary. In the same month—Oct. 1921—Count Bethlen had to face another national crisis when King Charles for the second time, but on this occasion with armed forces, endeavoured to regain his throne. The firmness shown by Count Bethlen in concert with the Regent, after all avenues of negotiation with Charles had been exhausted, undoubtedly saved Hungary from national extinction.

The elections rendered necessary by the expiration of the mandates of the existing Parliament returned Count Bethlen to power in June 1922. This enabled him to substitute for his previous coalition Govt. a new Cabinet supported by a united "Government party." This second Govt. of Count Bethlen can scarcely fail to be one of the most important, if not the most important, in Hungarian history. By the end of 1925 it had completed the scheme of land reform, created a new basis of suffrage, approved radically new standing orders for Parliament, ratified agreements settling outstanding political and economic difficulties with neighbouring states and last but most important of all had achieved the financial and economic salvation of Hungary. The courage of Count Bethlen in accepting office in his country's darkest days had been rewarded. There were several occasions between 1921 and 1925 when it appeared impossible for him to weather the political storm and when his defeat seemed only a matter of days or even hours. That he survived, and not only succeeded, but obtained ascendancy was due to his unswerving devotion to the principle of national consolidation and his skilful policy of the "golden mean."

The economic salvation and reconstruction of Hungary became possible almost solely owing to Count Bethlen's personality and to his individual efforts. In the spring of 1923 he appealed in Paris to the Reparation Commission so to suspend the Reparation sword of Damocles as to permit Hungary to remain alive. At that time the state was faced with bankruptcy and the people with ruin. Count Bethlen took his political fortune in his hand and pledged his proud countrymen to accept the financial control of the League of Nations. Most of his opponents and many of his supporters thought that would be his political death. The Reparation Commission, by the casting vote of France, refused Count Bethlen's request. He went on a desperate pilgrimage to London, Paris and Rome to get that decision reconsidered. He was a stranger to practically all the Allied Ministers, yet thanks to his transparent integrity and reasonableness he succeeded. Within 18 months the Reparation Commission had suspended the Reparation charges, the League of Nations had arranged all the intricate details of a plan of reconstruction, the Hungarian Parliament had agreed to all the league's demands of control, and a loan of about £11,000,000 was floated successfully on the money markets of the world—principally in London and mainly through British support. That would never have been achieved if Count Bethlen had been a man of less patience or less determination.

By the end of 1925, thanks to the self-sacrifice of the Hungarian people and their willingness to follow the lead of their Prime Minister, the reconstruction scheme was assured of a success far beyond the anticipation of the league or of the outside world. The Hungarian budget showed a surplus instead of a deficit, the currency was stabilised, and instead of £11,000,000 only £3,000,000 had been required to meet deficits in the earlier stages. It was not surprising that the chairman of the financial committee of the league said that body were "glad to convey their very sincere congratulations to you, Count Bethlen, who have directed the fortunes of your country through so many difficult years and are still guiding it through the present effort of reconstruction."

Count Bethlen married Countess Margit Bethlen, a talented poetess. He belongs, like his ancestors who raised armies for Calvinism, to the Reformed (Calvinist) Church. (W. Go.*)

BETHMANN HOLLWEG, THEOBALD VON (1856–1921), German statesman, was born Nov. 29 1856 at Hohenfinow, near Berlin (*see* 11.898). He was descended from the Frankfort banking family of Bethmann, which attained great prosperity in the 18th century, and a branch of which was founded by his great-grandfather Johann Jakob Hollweg, who had married a daughter of the house.

Having risen through the regular legal and official stages of promotion, in 1905 he was appointed Prussian Minister of the Interior and in 1907 Secretary of State for the Imperial Home

Office and vice-president of the Prussian Ministry. At the time of Bethmann Hollweg's appointment to the chancellorship in 1909, internal affairs, under his predecessor, Prince Bülow, had reached a deadlock in the Reichstag owing to the revolt of a section of the Liberal-Conservative *bloc* against the proposal to establish death duties as part of the reform of the finances of the empire. It was not until the general elections of 1912 had transformed the situation by bringing a great accession to the strength of the moderate National Liberals and the Left, especially the Social Democrats, that the Government was able to reckon upon a more amenable majority.

In the interval Bethmann Hollweg endeavoured to conciliate the Catholic Centre by a policy of compromise in matters which had threatened to lead to a renewal of the *Kulturkampf*, such as the denunciation of the Reformation in the Papal Encyclical of 1910 and the Catholic demand for the modification of the Jesuit law. He secured the final abrogation of this law under stress of war conditions in April 1917. Bethmann Hollweg was likewise the sponsor of the new constitution for Alsace-Lorraine (*q.v.*) which in 1911 established the government of that territory of the empire upon the basis of popular representation in a territorial assembly and admission, though without full state rights, to the Federal Council. He was less successful with the vexed question of the Prussian franchise, which, in 1910, he attempted to solve by proposing a direct system of election while retaining in a modified form the local division of the electorate according to income-tax assessment into three classes. His bill was ultimately rejected by the reactionary Chamber of Deputies.

He was equally unsuccessful in dealing with an outbreak of militarism in Nov. 1913 at Zabern in Alsace where the population, exasperated by the truculence of a young officer, was subjected to the arbitrary exercise of martial law by the colonel in command of the garrison. Bethmann Hollweg's treatment of the incident satisfied neither the reactionaries nor the advanced parties, and, for the first time in the history of the Reichstag, a vote of censure was passed upon the Chancellor.

In 1914 Bethmann Hollweg became famous by his remark to Sir Edward Goschen, British ambassador in Berlin, that the Belgian guarantee was " a scrap of paper." Over unrestricted submarine warfare he divested himself of responsibility, having declared in Jan. 1917, " I can give Your Majesty neither my assent to the unrestricted submarine warfare nor my refusal."

By the middle of July 1917, Bethmann Hollweg had lost all support in the Reichstag. The Conservatives and National Liberals were alienated by his Prussian franchise policy and his conflicts with the higher command. The Left and the Catholic Centre in which Erzberger with his so-called Peace Resolution (adopted by the Reichstag on July 19) had acquired the upper hand were convinced that the Allied and Associated Powers would place no confidence in the overtures of men with the past of Bethmann Hollweg and Zimmermann. Finally, on the morrow of the publication of the second Prussian Franchise Edict, on July 14 1917, Hindenburg and Ludendorff came to Berlin in order to hold conferences with the chiefs of political parties regarding the terms of the " Peace Resolution." The Chancellor could not tolerate this military interference with his own department, and the Emperor, confronted with an ultimatum from his two indispensable military leaders, accepted the Chancellor's resignation. Bethmann Hollweg retired to Hohenfinow and took no further part in politics beyond writing his *Reflections on the World War* (vol. 1, 1919). He died at Hohenfinow on Jan. 1 1921, after a brief illness.

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BETTING TAX.—In some countries revenue is raised by a tax on betting. This is so in the six states of Australia, in Ontario, the Union of South Africa and New Zealand, as far as the British Empire is concerned, and in France, Germany, Italy, Austria and Belgium. The method adopted is to put an *ad valorem* tax on the amount staked. To collect the money machines known as the totalizator and the pari mutuel are used. The totalizator is a machine operated by electric power, which, working on almost the same principle as a cash register, registers every bet made with it and shows publicly the amount of money staked on each horse in the particular race and the total amount staked on all the horses in the race. The pari mutuel system, used in France and elsewhere, is practically the same as the totalizator, but is worked in the main by human instead of mechanical agency.

In 1923, in view of the demand that betting should be taxed in Great Britain, the House of Commons appointed a committee to report upon the subject. A majority of the committee reported in favour of such a tax and made various suggestions for levying and collecting it. Bookmakers and their premises were to be licensed or registered and betting in the street was to be made illegal. The duty proposed was 2½% on the amount staked and it was estimated that from it, £5,000,000 would be obtained each year. For small bets books of tickets would be issued to bookmakers, whose books would be examined by the officials of the Board of Customs and Excise. In the Budget of 1926, the Chancellor of the Exchequer (Mr. Winston Churchill), proposed to impose a tax on all legalised betting and suggested that this should be at the rate of 5% of the amount staked. In the same year a tax on betting was imposed by the Irish Free State. (A. W. H.*)

BEYERS, CHRISTIAN FREDERICK (1869–1914), South African soldier, was born in the Cape Colony, but went in early life to the Transvaal. He took a prominent part in the South African War, reaching the rank of general. On the grant of responsible government to the Transvaal in 1906, Beyers was elected Speaker of the House of Assembly, and commended himself to the Opposition by his tolerance and impartial conduct in the chair. On the establishment of Union, in 1910, he was appointed commandant-general of the South African Defence Force and in that capacity visited England in 1912. On the outbreak of the World War, he showed determined opposition to the loyal policy of Botha and Smuts, especially in regard to the campaign in German Southwest Africa. His ultra-patriotic views and strong religious feelings gave him much influence with the backveld Boers and helped to foment the rebellion. After conducting an acrimonious correspondence with Smuts, he resigned his post and shortly afterwards went openly into revolt. After various vicissitudes his forces were harried and broken, and Beyers himself, in trying to escape across the Vaal river, was drowned Dec. 8 1914. At first some doubts were entertained as to the manner of his death, but on Dec. 10 these were dispelled by the finding of his body. (H. Gu.)

BHOPAL, BEGUM OF.—Nawab Sultan Jahan (1858–) was the fourth woman in succession to rule Bhopal, a state of about 7,000 sq. m. in Central India. Sprung from an ancient stock of Afghan invaders, she was married in 1874 to a member of her own family, and had three sons. She succeeded her mother in 1901. Of an energetic, warm-hearted and industrious disposition, she also was renowned among the Indian princes as a just and progressive ruler and as a sage and scholarly personality. She took particular interest in the education and medical care of the women of her State, and encouraged agricultural improvement and industrial development. She visited Europe in 1911, and again in 1925 went to London where she secured the nomination of her son as her successor. She maintained a regiment of Imperial Service Cavalry, and was entitled to a salute of 21 guns within, and 19 outside, her own territory. On May 18 1926 it was announced that the Viceroy had approved her decision to abdicate in favour of her son.

BIBLICAL CRITICISM.—During the period 1910–25 biblical criticism has made notable advances marked by new orientations and the reopening of many subjects believed to be closed.

Historical Background.—A generation ago little could be said with security regarding human history before 1600 B.C.; now we have in *The Cambridge Ancient History*, vol. 1 (1923), 600 packed pages of detailed information, while another such volume is required to carry on the record to 1000 B.C. Thus the dark story of Hebrew origins is read to-day not merely by the aid of analogies from ancient Arabia, but in the new light shed by the advanced contemporary civilisations of Babylonia, Egypt, Crete and the Hittites (*see* ARCHAEOLOGY); and whatever influence that civilisation may have had on the characteristic religious ideas of the Hebrews, it drives us to consider afresh our views on the possible antiquity of their history and their documents. An obscure period in later Jewish life (5th century B.C.) has been illumined by the discovery of the Elephantine Papyri (ed. A. E. Cowley, 1923).

As regards the New Testament, instead of construing Christianity merely in contradistinction to a legalistic Judaism or a bankrupt paganism we now recognise the various strands of thought and aspiration to be traced in pre-Christian Judaism and the eager gropings after life and light expressed in the heathen mystery-cults, while by the help of innumerable ostraka, papyri and inscriptions the terminology of the New Testament is studied in relation to the " common Greek " of the time. " New Light " may bewilder as well as illumine; but as useful correctives we may note the increasing attention paid (*a*) to religious psychology: a passionate faith, whether in communities or in individuals, is something far subtler than a synthesis of derived religious ideas, and allowance must be made for the influence of a dominating and original personality like Moses, Jesus or Paul; (*b*) to the Jewish background of the New Testament; it is folly to trace to heathen sources anything that can be equally well explained from Jewish antecedents.

I. THE OLD TESTAMENT

The Hexateuch.—Despite reactionary tendencies (*cf.* M. Kegel's *Away from Wellhausen*, Eng. Trans., 1924) the general critical position regarding the literary sources J E D P[1] of the Hexateuch has been consolidated. The line of advance depends upon our reconstruction of Israel's religious history. Stressing the influence of the prophets, S. A. Cook (*Camb. Anc. Hist.*, vol. 3, 1925) dates even J and E, as well as D, in the 6th century B.C., whereas Sellin carries back J and (in its primary form) E to the time of David and Solomon, and traces the Book of the Covenant (Exodus xx. 23–xxiii. 19) and even, in a simple form, the Decalogue, to Moses himself. As regards D, R. H. Kenneth (*Deuteronomy and the Decalogue*, 1920) and G. Hölscher see in it a purely idealistic reconstruction dating from the Exile, while A. Welch (*The Code of Deuteronomy*, 1924) denying that it demands a centralised worship, and stressing the primitive character of many of its enactments, dates it near the rise of the monarchy. We may doubt if either of these suggestive theories will displace the established view connecting Deuteronomy with the book found in the Temple (2. Kings xxii. 8) in 621 B.C. P was probably never a continuous document, and much of its material may be pre-exilic in origin.

The Prophets.—While the criticism of a generation ago rediscovered the sublime figures of the Old Testament prophets, we must not forget that they were seers rather than teachers; they had links with the earlier nebi'im, and their function in part was to discern *in advance* Yahweh's forthcoming judgments, even though their essential value lay, not in their predictions, often falsified by events, but in their spiritual insight into eternal principles. Did they too, like the nebi'im, receive their message mainly in ecstasy? G. Hölscher and T. H. Robinson assert this even of the greatest prophets, but in many of their " visions " some part was surely played by deep sober reflection on the facts of experience. We may, however, with advocates of the ecstatic theory, agree that the prophetical books consist not of long coherent harangues but of short unconnected utterances (there seem to be five such in Isaiah i.) set side by side with indifferent editorial skill. Perhaps in the case of most of the prophets much anonymous matter has been mixed up with their genuine utterances, which become more fully intelligible when it is removed.

A vital problem is the interpretation of their thought in relation to the religious history of the nation. Many critics regard their vigorous denunciations of sacrifice as denying any valid place whatsoever to it in the true worship of Yahweh. In his sublime conception of " the Suffering Servant " (chs. liii., etc.) has the " Great Unknown " whom we call Deutero-Isaiah been influenced by the sufferings of Jeremiah, perhaps even (as Sellin thinks) by the tradition of the martyrdom of Moses in Shittim?

The " Writings," and the Apocrypha and Pseudepigrapha.—Recent work on the later books of the Old Testament and on the Wisdom and Apocalyptic literature of the period between the Testaments has made possible a more credible account of the rise both of Talmudic Judaism and of Christianity. We see how conceptions such as predestination and free will, and the suffering of the righteous, begin to find expression as dogmas.

II. THE NEW TESTAMENT

Text.—As regards the text, much more value is now attached than by Hort to the so-called " Western " authorities. The text of Von Soden's monumental edition appeared in 1913, but his critical theories, like his notation, have not commanded acceptance. B. H. Streeter has advanced considerably the work of regrouping texts according to local centres. Of special interest among new discoveries are a " Western " Gospel book (Codex W, ed. by H. A. Sanders, 1912), of date not later than the 5th century; and a Coptic version of St. John's Gospel (*c.* 400 A.D., see *Expositor*, 1924, p. 203). The discovery of the Gallio inscription (see A. Deissmann, *St. Paul*, Eng. Trans. 1912, appendix 1) enables us to date Paul's arrival in Corinth in 50 or 51 A.D.

The Synoptic Gospels.—The Gospels are primarily collections of reminiscences current in the Christian communities because of their value for edification, missionary-preaching and apologetic, and arranged on a plan which is not wholly chronological. Luke's framework has been shown by Streeter to be a special source (edited by Luke himself?) into which excerpts from Mark are interpolated. One of Matthew's sources was a collection of anti-Jewish proof-texts (" testimonia ") from the Old Testament, traces of which are found throughout the New Testament and frequently in early Christian literature (see J. Rendel Harris, *Testimonies* 1916 and 1920).

The Johannine Literature.—C. F. Burney's arresting work on *The Aramaic Origin of the Fourth Gospel* (1922), the attempt to link up the Logos-doctrine with the Memra of the Jewish Targums (so now even Ed. Meyer), or with the Wisdom literature (so J. Rendel Harris, *The Origin of the Prologue to St. John's Gospel*, 1917), the recognition of affinities with Jewish apocryphal literature, the greatly increased value placed (notably by Jewish scholars) on the historical value of much both in the narratives and in the discourses, all point to the conclusion that the background of the Fourth Gospel is Jewish, and probably Palestinian, rather than Hellenic. The question of authorship is secondary to that of atmosphere, and dogmatism here is folly. Behind the Gospel looms the figure of a Jerusalemite of priestly stock, whom some would identify with the son of Zebedee, a few (including Burney) with the seer of the Apocalypse, though the weight of critical opinion, distinguishing him from both of these, connects him with " John the Presbyter," possibly a disciple of John the Apostle.

The Epistles.—Working to-day in a freer atmosphere, criticism is questioning many of the accepted views regarding the origin of the New Testament Epistles. Dictation to a (shorthand?) scribe may explain some of their peculiarities of vocabulary and style (*cf.* G. Milligan, *New Testament Documents*, 1913). Before the Epistles were formally collected, fragments of genuine correspondence may easily have been combined into one letter—is this true of 2 Corinthians, of Romans (as regards ch. xvi.), of Philippians? Galatians, now generally accepted (though Lietzmann demurs), as addressed to the South Galatian churches, is dated by many (as it was by Calvin) before the Jerusalem Council—the earliest of Paul's letters. Romans may in that case have been originally composed as a treatise in the same controversial period, and adapted later to serve as a circular letter.

[1] J, the earliest source, is marked *inter alia* by the almost exclusive use of the name *Jahveh*, preferably written *Yahweh* (Jehovah); in E, the second source, we find the name *Elohim;* D is the basis of our Deuteronomy; and P stands for a priestly source compiled after the destruction of the Temple. The Pentateuch in its present form may be taken as the work of Ezra and his associates.

The arresting thesis that some, if not all, of the Ephesians-Colossians-Philemon-Philippians group were written during one or more imprisonments at Ephesus not recorded in Acts xix. (date *c.*52–5) is supported by A. Deissmann (see his contribution, with bibliography, to *Anatolian Studies* presented to Sir W. M. Ramsay, 1923). As regards the letters to Timothy and Titus, P. N. Harrison's argument (*The Text of the Pauline Epistles*, 1921) that their vocabulary is un-Pauline and has close affinities with that of second-century writers, will appear to many conclusive; but undoubtedly genuine Pauline fragments are embedded in them, and on any view of their authorship difficulties of historical setting would be greatly relieved if 2 Tim. iv. 9-20 were transferred to 1 Tim. (of Acts xx.). Hebrews has generally been interpreted as an appeal to Jewish-Christian reactionaries, but its significance is greatly enhanced if with many recent editors (*e.g.*, H. Windisch, J. Moffatt; *cf.* E. F. Scott, *The Epistle to the Hebrews*, 1922) we discount its title as a misnomer and read it as demonstrating the finality of a religion that knows neither Jew nor Gentile.

Acts of the Apostles.—The main critical battle of the future is to range round Acts. Loisy argues that about the year 130 Luke's careful narrative was falsified beyond recognition in the interest of church theory, but with him the apologetic colouring of history is almost an obsession. In chapters i.–xv. the atmosphere is largely that of the primitive community; C. C. Torrey (*Harvard Theological Studies*, i, 1916) has made a good case for their close, even literal, dependence on an Aramaic document. The date of Acts is generally placed after 75; but there is force in the contention (accepted by A. Harnack, *The Acts of the Apostles*, 1911), that the book's abrupt conclusion implies a date before the issue of Paul's trial (*c.*62), and Plooij holds that Luke's purpose in writing was to assist Paul's defence by showing the claim of Christianity to be a *religio licita* within the empire. This date if accepted *simpliciter* would imply a still earlier date for the Gospels of Mark and Luke.

Two Main Issues

The two main problems (and they are ultimately one) to which all New Testament criticism leads are the personality of Jesus, and the rise and development of the Church.

The Personality of Jesus.—It is now recognised that the Gospels are in no sense "lives" of Jesus, and do not provide the material for a "life." There is material, however, for a portrait; and even the Rationalist Press (F. C. Conybeare, *The Historical Christ*, 1914) has ably refuted the fantastic attempts of A. Drews, P. Jensen, J. M. Robertson and W. B. Smith to deny that Jesus ever lived. (*Cf.* M. Goguel, *Jésus de Nazareth, Mythe ou Histoire?*, 1925.) But that portrait is not to be obtained merely by adding psychological finishing-touches to Mark's bare outline, and the Fourth Gospel must be drawn on for many important features. Instead of interpreting Jesus as pre-eminently a teacher with a "sane and well-poised mind" criticism now tends to believe that He shared in some measure the apocalyptic conceptions of His time, seeing the present age in the light of an imminent new world-order which it was His divine mission to inaugurate; but the validity of His religious and ethical message is independent of the apocalyptic form in which it is expressed, securely based as it is on the Son's revelation of the Father.

Beginnings of the Church.—The centre of gravity in criticism is shifting from the Gospel-story to the origin and development of the Christian Society. Liberal critics, recognising the chasm that separates their so-called "historical Jesus" from the "Son of God" of the early faith, have interpreted Paul as a daring innovator who, indifferent to the truth about the Galilean prophet (so Wrede), adulterated the simple gospel of Divine Fatherhood with Jewish Messianic conceptions and rites and doctrines of the mystery-cults. But a more intimate study of the soul of Paul shows rather that he loyally adhered to the traditions of the faith, that in countless ways he reflects as in a mirror the mind and spirit of his Master, and that his doctrine of the Church, far from being a conscious transference to Christianity of the conception of a cult-fellowship based on magical rites, follows naturally from his essentially religious conception of the relation of the Son of God to the individual believer and to the fellowship which he founded, and may even go back to a mystical strain in the teaching of Jesus Himself.

Studies like W. Scott's *Hermetica* (1924, 1925) remind us further how slender are many of the alleged affinities between Christianity and the heathen cults. Thus more and more the storm-centre of criticism is found in the religion of the primitive communities. While there is truth in the contention that even the Gospels are evidence primarily for the Church's conception of Jesus and only secondarily for the historical truth about Him, the converse is no less true, that conceptions and practices which criticism reveals as essential elements of the primitive faith (*e.g.*, the Lord's Supper, and the recognition of Jesus as *Kyrios*, Lord) are most likely to have their roots in the life and teaching of Jesus Himself.

The War robbed Biblical study of many of its foremost representatives on both sides of the conflict, but stirred many others to appreciate as never before that surging religious life of which the Scriptures are the literary deposit. "When I personally," A. Deissmann has written (*Review of the Churches*, Jan. 1925), "compare my understanding of the Gospel to-day with the understanding of it I thought I had ten years ago, I can only speak of a real inner growth. The task of the present generation is to add to all the latest philological and historical investigation a truer and deeper spiritual appreciation of the vital forces of the New Testament."

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BIGELOW, JOHN (1817–1911), American diplomatist and journalist (*see* 3.922), died in New York Dec. 19 1911. In 1909 he published three volumes of *Retrospections of an Active Life*, covering his career to 1866. Two additional volumes, ending with 1879, were issued by his son (1913).

BIKANER, SIR GANGA SINGH, MAHARAJA OF (1880–), Indian soldier and statesman, was born Oct. 3 1880, and succeeded by adoption his elder brother, Dungar Singh, in 1887 as 21st ruler of the state, being invested with full powers in 1898. The first of his many visits to England was made in 1902, when he attended King Edward's coronation, and became A.D.C. to the Prince of Wales, an appointment continued by King George. In the World War the Maharaja served in France as a staff officer and in 1915 he took part in the fighting to withstand the Turkish invasion of Egypt. In 1917 he was made a member of the Imperial War Conference and assisted the Secretary for India at the Imperial War Cabinet. He represented the Indian states at the Peace Conference, 1919, and the Indian princes at the League of Nations Assembly, Geneva, 1924. It was largely due to his personal influence that the constitution of the Chamber of Princes, as a deliberative, consultative and advisory body, was secured under Royal Proclamation in 1921. His appointment as Chancellor was indicative of the intellectual prominence he had acquired in the deliberations of the rulers. (F. H. B.*)

BILHARZIASIS or SCHISTOSOMIASIS.—A disease caused by the fluke parasite schistosoma.

Distribution.—One of the widest spread endemic diseases of the world, schistosomiasis is endemic throughout Africa, has spread to South America and the West Indies, China, Japan, the Philippines, Formosa and Burma. One European country only, south Portugal, is known to be infected by schistosomiasis (1925). Indigenous cases have been reported in India and Western Australia. Cases have been recorded of persons infected in England; and there is probably there a species of mollusc capable of serving as intermediary host if climatic conditions and the hygienic standard of Great Britain were less rigorous.

History.—The disease is one of great antiquity. Armand Ruffer found calcified bilharzia ova in mummies of the 20th dynasty (1250–1000 B.C.). It is probably of equal antiquity in China. In 1799–1801 many cases were noted in Napoleon's army in Egypt—and in more recent times expeditionary armies have suffered considerably from "Egyptian Haematuria."

Causation.—Schistosomiasis is caused by certain metazoal parasites of the family Schistosomidae Looss-1899 (type genus Schistosoma Weinland 1858) belonging to the trematode class of the phylum Platy-helminthes. In the schistosomidae the sexes are separate, and the alimentary canal is united posteriorly into a single tube. In the known human species the egg is furnished with a characteristic spine (point) or knob. A ventral (gynaecological) canal for carrying the cylindrical female worm is formed by the infolding lateral margins of the leaf-shaped male.

There are three known human species: *Schistosoma haematobium*, the chief African species and the most commonly known, infects principally the bladder. *Schistosoma mansoni*, also found in Africa, the only species infecting the New World, affects the large intestine. *Schistosoma japonicum*, the Asiatic species, affects the large intestine and liver and spleen.

The adult worms inhabit the portal venous system, reach maturity in the liver and pass in the portal tributaries to the pelvic veins in the bladder and large intestine to lay their eggs, which reach the exterior world in the urine and faeces.

In fresh water with favourable conditions of climate and environment, the ovum hatches the ciliated embryo (miracidium) which escapes. If during its short active life it approaches an appropriate water-snail, it is attracted to it, penetrates and bores its way to the pancreatico-hepatic gland and encysts. The gland is tunnelled and converted into a mass of ramifications. Bifid larvae (cercariae) develop within the daughter cysts and escape when the snail ruptures. The parasite again becomes free swimming.

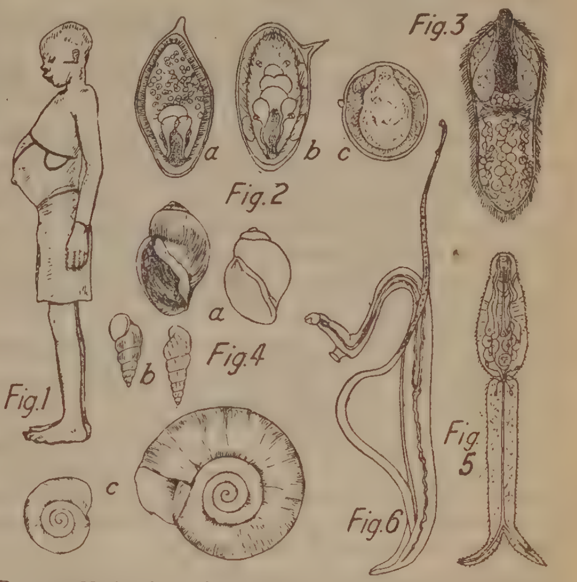

FIG. 1.—Native boy of Nyasaland, with (intestinal) Bilharzia. (*After photo, W. H. Dye.*)

FIG. 2.—Ova of human Bilharzia: (*a*) with terminal spine (vesical); (*b*) with lateral spine (intestinal); (*c*) smaller than (*a*) or (*b*), with blunt lateral nob (Asiatic).

FIG. 3.—Free swimming miracidium hatched from the ovum (*after Looss*).

FIG. 4.—Intermediate hosts of Bilharzia: (*a*) Isidora (Bullinus) genus; (*b*) Oncomelania genus; (*c*) Planorbis genus.

FIG. 5.—Cercaria from snail; free swimming ciliated larva, which, piercing the skin, passes to the liver and becomes the adult worm.

FIG. 6.—Mature male and female worm of Schist. Japonica (*after Faust and Meleney*).

Cercariae survive not longer than 36 hours. They are attracted by and penetrate human skin and mucous membranes immersed in the water. They discard the tail and are carried by the blood and lymph to the lungs and from thence to the liver where they mature.

Definite symptoms of schistosomiasis may be expected two months or later from the time of contact with infected water.

In 1851 Theodor Bilharz discovered the worm in the portal vein. In 1913 Miyairi and Suzuki in Japan traced the life cycle of Schistosoma japonicum through the snail Katayama nosophora. In 1915 R. T. Leiper discovered the intermediate host of the two Egyptian species and proved their separate entities.

Treatment.—In 1917 J. B. Christopherson in Khartoum found that antimony tartrate administered intravenously was an infallible parasiticide for both species of Egyptian schistosomiasis, and worked out the method of treatment by antimony which has since been adopted. Later Cawston, Tootell, Faust and others found that antimony tartrate was an equally trustworthy parasiticide for Asiatic schistosomiasis.

The potential longevity of schistosoma haematobium in the human body is longer than 28 years (Christopherson). Schistosoma mansoni has a recorded duration of 15 years in man. The longevity of schistosoma japonicum is unknown.

Clinical Notes.—Clinically schistosomiasis is divided into three stages:—

(1) The period during which the parasite reaches maturity in the body.

(2) The period when symptoms are due to the deposition of the eggs in the organs (bladder and intestine).

(3) The period of structural change and permanent damage of the tissues.

Recovery is the rule provided re-infection is obviated. Death takes place from toxaemia due to a heavy infection, from intercurrent disease, from impairment of liver function, from complications caused by the damaged organs and cancer.

Preventive Measures.—Theoretically schistosomiasis can be stamped out of a locality by:—

(1) Curing all the cases. (2) Killing the intermediary hosts (water snails). (3) Preventing the mollusc infecting man, and man the mollusc.

This is effected by the intravenous injection of antimony tartrate (Pot. or Sod.) daily for five days, afterwards three times a week until the necessary total (adult) amount—25-30 grains—is reached. Antimony is contraindicated in cardiac and renal disease and when the liver is extensively disorganised. Emetin is given when antimony tartrate is not tolerated.

Extermination of the snails is accomplished by chemicals which kill the mollusc but are beneficial to or do not interfere with the fertility of the soil, as

slaked lime (CaO), calcium cyanamide ($CaN, CH.$). calcium phosphate ($Ca_3 (PO_4)_2$ and ammonium sulphate ($(NH_4) 2SO_4$.

Chlorinated lime ($CaCl OCl$) and copper sulphate ($Cu SO_4$) though efficacious are detrimental to the crops.

Sulphate of copper $\frac{1}{5000000}$ dilution kills cercariae.

In Egypt, where irrigation is under government control, Leiper recommended the periodical drying up in rotation of irrigation canals for 15 days. The natural enemies of the snail (ducks) are to be encouraged. Water contaminated by bilharzia, if kept for two days, is innocuous for domestic purposes.

Educational measures (lectures, cinematograph demonstrations and systematic instruction in schools) are of the greatest importance.

The prophylaxis of schistosomiasis is largely a matter of national character and social conditions which vary according to racial and political history in each infected area.

Education in hygiene and mass (universal) treatment by antimony tartrate are the best general means of eliminating schistosomiasis. *See* PARASITOLOGY.

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(J. B. C.)

BILLIARDS (*see* 3.934).—During the first four years of the period 1910–25 the Australian prodigy, George Gray, revealed the possibilities attaching to the in-off strokes, played in series from hand. His array of four-figure breaks, headed by a memorable effort of 2,196 (unfinished), gave rise to much controversy as to the leniency of the rules in permitting an unlimited chain of these red ball losing hazards. Attention was called to the restrictions imposed upon the remaining "key" shots, the close cannons and the almost completely effaced spot-stroke play. But no legislative action was taken and the radius of Gray's activities, like that of his copyists, was widened. The desire not to place obstacles in the path of the ordinary amateur player accounts in great measure for the decision of the authorities to leave the rule relating to red ball in-offs untouched.

Gray's displays so caught the public fancy that he was considered invincible and a wave of surprise greeted the publication of his name among the list of entrants for the 1914 championship. There were those, however, who realised what a difficult task the newcomer to championship contests had undertaken; he would now have to play with the ivory ball, the standard match ball, and not with the composition one which he knew so intimately. Gray was beaten quite easily in his opening heat. The ivory ball, with its minute subtleties, its inner life and powers of expansion and contraction, reduced the master of composition balls to comparative ineffectiveness.

Greatest of all championships in the interest it evoked, the 1914 competition not only burst the bubble created by George Gray, but brought about a change in the established order. For a decade H. W. Stevenson had borne out all the high predictions made for him by John Roberts, and become the accepted master of the billiard cue. In 1914, however, this brilliant exponent was unexpectedly defeated in the second round of the championship, after having apparently gained a winning advantage. Stevenson made way for another and not quite so spectacular a performer, although certainly a more doggedly insistent one, Melbourne Inman.

The Game During the War.—The World War brought about a tremendous increase in the popularity of billiards. Every Y.M.C.A. hostel, every sanatorium, every military mess, called for billiard tables. Thousands of young men became intimate with a game of which many of them had only vaguely heard. A leading form of entertainment for soldiers home on leave was the displays at Thurston's Hall, Leicester Square, London, W.C. Many of the professionals, and a good proportion of the leading amateurs continued to play during the War period, and the Annual Amateur Championship, competed for by veterans, was regularly decided during those years.

Changes in the Laws.—Very few changes have taken place in the laws since 1910. An amendment to the Rimington-Wilson code of rules, which have worked so smoothly since their innovation, was adopted. This gives the non-striker, whose opponent has committed a technical foul or breach of the rules, a double option, instead of the single one which did not fairly meet the offence. Now the non-offending player may either have the balls set up in their spotted positions, according to rule, or play at the balls where they rest upon the table. After many years of vexatious double control, with two differing sets of rules, an amalgamation of the older Billiards Assn. with the more recent Billiards Control Club has brought the government of the game under one body, known as the Billiards Assn. and Control Club. Following this amalgamation came the decision to use composition balls for the 1926 championship.

CHAMPIONSHIPS, 1910–25

Professional Champion		Amateur Champion	
1910	H. W. Stevenson	1910	H. A. O. Lonsdale
1911	H. W. Stevenson	1911	H. C. Virr
1912	M. Inman	1912	H. C. Virr
1913	M. Inman	1913	H. C. Virr
1914	M. Inman	1914	H. C. Virr
1915	No contest	1915	A. W. T. Good
1916	No contest	1916	S. H. Fry
1917	No contest	1917	J. Graham Symes
1918	No contest	1918	J. Graham Symes
1919	M. Inman	1919	S. H. Fry
1920	W. Smith	1920	S. H. Fry
1921	T. Newman	1921	S. H. Fry
1922	T. Newman	1922	J. Graham Symes
1923	W. Smith	1923	W. P. McLeod
1924	T. Newman	1924	W. P. McLeod
1925	T. Newman	1925	S. H. Fry

T. Newman holds the record break of 1,274 points with ivory balls. The Australian, W. Lindrum, has scored a break of 1,879 with composition balls. These are the two highest breaks scored under the present code of rules. J. Davis, of Chesterfield, holds the snooker pool break record of 95.

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(S. A. M.)

United States.—William F. Hoppe dominated the balkline game in the United States from 1910 to 1925. The death of Schaefer, the elder, in March 1908, opened the way for Hoppe in tournament and match. The championship tournaments were of international character, Horemans (Belgium), Conti (France), Hagenlacher (Germany), Yamada (Japan) and others unsuccessfully competing. Toward the close of the period Schaefer, the younger, son of the old champion, upheld the family tradition, threatening Hoppe and twice lowering his colours owing to the brilliance of his play.

Horemans came to the United States at the close of the War. The Belgian developed a new balkline system largely employing the masseé. Other professionals copied it, producing amazing runs such as Schaefer's 400 unfinished from spot in the 1925 tournament, and a match record average of $51\frac{1}{7}$ for 4,000 points. In a special contest he counted a run of 436. In a professional exhibition W. W. Spink counted the high figure of 1,009 in a single inning. A Junior Championship was established in the United States in 1923 and won by Tado Suganuma (Japan). In turn A. Cutler, K. Suzuki and A. Bos held the title.

The National Assn. of Amateur Billiard Players maintained an unbroken line of championship contests. Like the professional records, their performances improved, J. A. Clinton, Jr., of Pittsburgh, creating the American record of 154 for high run, high average of $37\frac{4}{8}$, and grand average of 18·33 in the 1923 tournament.

Champions 18·2 Balkline

Professional	Amateur
1910 W. F. Hoppe	1910 E. W. Gardner
1911 W. F. Hoppe	1911 E. W. Gardner
1912 W. F. Hoppe	1912 M. D. Brown
1913 W. F. Hoppe	1913 J. Mayer
1914 W. F. Hoppe	1914 E. W. Gardner
1915 W. F. Hoppe	1915 J. Mayer
1916 W. F. Hoppe	1916 E. W. Gardner
1917 W. F. Hoppe	1917 N. Hall
1918 W. F. Hoppe	1918 C. Huston
1919 W. F. Hoppe	1919 D. McAndless
1920 W. F. Hoppe	1920 P. N. Collins
1921 J. Schaefer	1921 C. H. Heddon
1922 W. F. Hoppe	1922 E. T. Appleby
1923 W. F. Hoppe	1923 P. N. Collins
1924 W. F. Hoppe	1924 E. T. Appleby
1925 J. Schaefer	1925 F. S. Appleby

Amateur international championship contests were held, C. F. Conklin winning in 1910; J. F. Poggenburgh, 1912; E. T. Appleby, 1922.

Professional and amateur national championships were decided at pocket billiards and at the increasingly popular three cushion caroms. Ralph Greenleaf was outstanding at the pocket game among professionals, and J. Howard Shoemaker among amateurs. At three cushions De Oro, Layton and Cannefax proved masters among professionals, and F. I. Fleming the best amateur.

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(J. P. A.)

BILLING MACHINE: *see* OFFICE APPLIANCES.

BINGHAM, HIRAM (1875–), American explorer and Senator, was born at Honolulu, Hawaiian Is., Nov. 19 1875, and educated at the universities of Yale, California and Harvard. He became professor of South American geography and history at Yale in 1915, where he had previously been teaching those subjects, and devoted much of his time to exploration. His expeditions took him over the Spanish trade route from Buenos Aires to Lima in 1908–9, and, in 1911, 1912 and 1914–5, to Peru. In April 1917 he organised the U.S. Schools of Military Aeronautics, and was commissioned lieutenant-colonel in the Air Service. He was later chief of the Air Personnel Division at Washington and also in France from March to Aug. 1918. From August to December he commanded the Allies' flying school at Issoudun. In 1924 he was elected Governor of Connecticut, and, having resigned from Yale, was inaugurated Jan. 7 1925. The following day he resigned to become U.S. Senator, having been chosen at a special election to fill the unexpired term of Senator Frank B. Brandegee. He has published *Journal of an Expedition Across Venezuela and Colombia* (1909); *Across South America* (1911); *Vitcos, the Last Inca Capital* (1912); *In the Wonderland of Peru* (1913); *An Explorer in the Air Service* (1920), and *Inca Land* (1922).

BIOCHEMISTRY.—Biochemistry may be defined as the study of the chemical or physico-chemical processes which play a part in the life phenomena of plants and animals. The subdivision of the mother science of chemistry into a number of special branches, physical, inorganic, organic, biological, etc., has been the natural consequence of the rapid advances in knowledge which have been made since about 1870. Although the study of the chemical aspect of the physiology of living organisms has only been generally termed biochemistry for some 20 years, it is actually one of the oldest branches of chemical science.

Lavoisier.—Disregarding events which occurred before the birth of modern chemistry at the end of the 18th century, we find that Lavoisier, the creator of the new science, himself spent no small portion of his time in prosecuting biochemical research. He showed clearly for the first time that the life-processes of the animal body can be investigated by chemical means, for he proved by quantitative methods that the body temperature is maintained by the combustion of foodstuffs just as the heat generated in the burning of wood or a candle is produced by the oxidation of organic matter. The first half of the next century produced three outstanding figures, whose united labour extended widely the foundations on which the modern study of biochemistry is based. In the first place Liebig, carrying back with him from Paris to Germany the inspiration gained by contact with those who had been students or colleagues of the great Lavoisier, not only established the study of organic chemistry, on which biochemistry is dependent, but actually opened up wide avenues of research on problems of plant and animal chemistry.

Liebig.—In 1837, at the request of the British Association for the Advancement of Science, he undertook to prepare a report on the state of knowledge in organic chemistry. This led to the publication in 1840 of his memorable work *Die Chemie in ihrer Anwendung auf Agrikultur und Physiologie*, followed in 1842 by *Die Thierchemie, oder die organische Chemie in ihrer Anwendung auf Physiologie und Pathologie.* These two classics mark quite clearly the point at which the study of plant and agricultural chemistry on the one hand, and that of animal chemistry on the other, first attracted wide interest amongst scientists in general and chemists in particular. Hofmann speaking of this great man said, "In the study of biology, vegetal and animal, Liebig was the first to disentangle intricacies that had before seemed problems beyond the grasp of human intellect to solve; and it was one of the grandest results of his philosophical and experimental investigations that he traced amidst the multitudinous and apparently ever-varying manifestations of life, in its countless modifications of kind and degree, the operation of a few simple laws, physical and chemical, affording, by their determinate combination, the precise and proved conditions of vital development, nutrition, growth and perpetuation from generation to generation, in unaltered individuality."

Claude Bernard and Pasteur.—At this time progress in this field of thought was still hampered by the persistence of ideas regarding the existence of a *vital force.* The first blow to shatter these theories was dealt by Wohler in 1828 when he announced the synthesis from inorganic materials of urea, a typical animal product for the formation of which some influence exerted by the vitality of the organism had, until then, been considered essential. The belief in a *vital force* or *vital principle* would have died slowly had it not been for the brilliant series of researches in experimental physiology that have made the work of Claude Bernard immortal. The third figure is the illustrious Pasteur, whose researches on fermentation, putrefaction and disease revealed not only the organisms that gave rise to these conditions, but also, in many cases, the chemical or physico-chemical changes that occurred.

During the second half of the 19th century researches in plant and animal chemistry were prosecuted with increasing vigour. Unfortunately, however, there was a tendency for the studies in each field to be kept apart from the other, and there were comparatively few investigators of that period who were sufficiently broad in their outlook to attempt to view the problems from the standpoint of the cell rather than from that of the animal or plant. Much progress was made in both animal chemistry or, as it was usually termed, physiological chemistry, and in plant and agricultural chemistry, but there were few attempts at correlation.

The Twentieth Century.—The more general appreciation of the need of a wider outlook seems to have become apparent at the opening of the 20th century, when the term biological chemistry or biochemistry began to displace the older terms. In Great Britain the Biochemical Club, now the Biochemical Society, was founded in 1905 and published the first volume of *The Biochemical Journal* in 1906. The corresponding scientific journals in the United States and Germany, namely, *The Journal of Biological Chemistry* and *Biochemische Zeitschrift*, also appeared for the first time in that year. The rapid advance of the new branch of chemistry can be illustrated by the growth of *The Biochemical Journal*, of which the first volume (1906) contained 32 papers, amounting in all to 495 pages of printed matter, whereas the volume for 1924 contained 188 papers and a total of 1,428 pages.

Chemical Processes in the Cell.—The study of the chemical processes occurring in living cells or brought about in the external medium by their action has all along been dependent to a very large extent on the rate of advance in our knowledge of organic and physical chemistry. The contents of the cell, known generally as protoplasm, represent to the chemist a mixture of such complexity that despair of ever gaining any clear conception of its actual composition might well be pardoned. Not only is the task one of great difficulty by reason of the wide variety of substances which are to be found present in cells, but also because a large proportion of those compounds exist in the cell in the condition known as the colloidal state (*see* COLLOIDS).

Conditions of Progress.—Progress in biochemistry has, therefore, been dependent to a large extent on the rate of advance of knowledge in the neighbouring fields of organic and physical chemistry. One example may make this clear. A large proportion of the solid material of cellular contents is composed of complex nitrogenous substances termed collectively the proteins. No satisfactory theory regarding their significance in living cells could be advanced until information concerning both the molecular structure of the proteins and their physical properties as colloids had been obtained. The former was provided by the classic researches of the great German chemist Emil Fischer, who revealed, by his analytical studies, that the proteins are large, complex molecules formed by the intercombination of a number of amino-acids by virtue of their basic and acidic groupings. Although it is still uncertain whether the only form of linkage between the constituent amino-acids in the protein molecule is that described by Fischer, it is apparent that it is by far the most common and a very important one. His work has given us a general picture of the internal structure of the protein molecule that is in agreement with the vast majority of known facts concerning their chemical properties.

Parallel with these researches in the field of organic chemistry on the constitution of the proteins, extensive investigations were being made in many quarters on the colloidal properties of these remarkable substances. As a result of this work it has at last been possible to attack with reasonable chances of success the major question concerning the rôle of the proteins in the living cell, a most remarkable achievement.

In general it can be seen that advance in biochemistry has followed much the same path that can be traced in the growth of other branches of experimental science. Broadly speaking, its development can be divided into two phases, the descriptive phase and the quantitative phase. In the former period the efforts of investigators were devoted mainly to the isolation of the substances present in living tissues and to the investigation of their nature and properties, whilst in the later phase attention has gradually become diverted towards elucidating their significance in the organisms and to the quantitative examination of the dynamics of the reactions in which they are concerned.

The study of biochemistry may be regarded as having very definitely entered the second phase about 1910, for in almost any journal devoted to this branch of science the great proportion of the papers published at the present time are devoted to the study of the dynamics of cellular reactions. The importance of pursuing this line of study must be apparent when it is borne in mind that it is particularly by reason of the extraordinary complexity and variety of the energy exchanges that occur in even the simplest cell that one differentiates living from non-living matter.

Definition of Life.—From the earliest time philosophers have attempted to define life, without one wholly satisfactory definition having been advanced. To-day the difficulties of their task can be appreciated because it becomes increasingly evident that there is no clear line of demarcation between the living and the non-living. Nevertheless, as Claude Bernard indicated in his striking essay on the "Phenomena of Life," there are a number of properties of living matter which, taken collectively, serve as a rough and ready means of differentiating it from systems relatively inert. These outstanding phenomena are: (1) Assimilation and respiration. (2) Reproduction. (3) Growth and development. (4) Movement. (5) Secretion and excretion.

Considered singly it is obvious that no one of these is in itself characteristic of living matter alone, but as yet no system that could be considered in the light of present opinion a non-living one has been found to exhibit all together. It may serve to show the scope of modern biochemistry if examples be given of the application of the new branch of science to the study of the chemical aspect of these phenomena of life.

Assimilation Processes.—The biochemical study of assimilation has somewhat naturally fallen into two sections, depending upon whether plants or animals are being considered. The power possessed by green plants to synthesise complex organic substances from carbon dioxide, water and simple inorganic salts, such as nitrates, sulphates and phosphates, places them in a class apart from other beings and calls for particular study (*see* PHOTOSYNTHESIS). The essential difference is, of course, that for the synthesis of organic matter from carbon dioxide a supply of energy is necessary—the reaction being an endothermic one. Comparatively long ago it was recognised that the source of this supply of energy is the sun, but only recently has the knowledge of the nature of the pigments in the leaf, of the absorption of energy in the form of light by these pigments, of the mechanism of absorption of carbon dioxide by the leaf and of the nature of the substances formed during assimilation, enabled biochemists to construct reasonable theories as to the process of photosynthesis in green plants. In this field much remains to be done. In spite of many strong indications that the first step in carbon assimilation is the photochemical reduction of carbon dioxide to formaldehyde, precise confirmation is lacking. The efficiency of the process is also undetermined. Early investigators believed it to be of the order of 3–5%, but Warburg has recently recorded values as high as 80%.

Chlorophyll.—There is also the question of the origin of the chlorophyll pigments in relation to their rôle as energy absorbers and transformers. Obviously so complex a molecule as Willstätter's researches revealed chlorophyll to be must have an exceedingly long evolutionary history. From what type of substance is it descended? At a very early period in the history of living organisms it is probable that supplies of energy for assimilation of carbon dioxide and formation of organic substances were derived not from the absorption of solar radiation by suitable pigments, but from simple exothermic chemical reactions of the type exhibited by the existing species of autotrophic bacteria (*see* BACTERIOLOGY). These remarkable organisms, amongst which are grouped certain of the sulphur bacteria, the nitrite bacteria, and the hydrogen bacteria, possess the power to carry out simple reactions, such as the oxidation of sulphur to sulphates, ammonia to nitrites and hydrogen to water, and to use the energy liberated by these reactions to effect the conversion of carbon dioxide into organic matter. It is also interesting to note that certain of the sulphur bacteria contain a pigment, bacteriopurpurin, which appears to function somewhat in the manner of chlorophyll in higher plants, when the bacteria are exposed to the light, whereas in the dark these organisms satisfy their energy requirements by the oxidations referred to above. Possibly these species represent the transitional forms that ultimately led to the evolution of the assimilatory system of the green plant.

Plant Synthesis of Carbon.—Little as is our knowledge regarding the synthesis of the compounds of carbon in the green plants, it is profound when compared with that concerning the formation of substances containing other elements; in particular nitrogen. We are, to all intents and purposes, entirely ignorant of the mode of formation in the plant of the great groups of substances, the proteins, alkaloids and plant bases.

Animal Assimilation.—The outstanding fact that the animal organism is essentially analytic and not synthetic as is the green plant, has, of course, been recognised for many years. The study of assimilation by the animal becomes, therefore, to a large extent, the study of the breakdown, or metabolism, as it is termed, of the foodstuffs that are ingested by the organism to supply, on the one hand, the energy for heat production or work and, on the other, the molecular units required to construct or keep in repair its tissues.

Biochemical investigations of assimilation in the animal world have made rather more rapid progress than corresponding efforts in the field of plant chemistry. To a large degree this is due to the fact that, in the higher animals at least, it is to some extent possible to follow the fate of substances by examining the body fluids, the individual organs, or, more particularly, the excretions.

Food Metabolism and Enzymes.—The study of the metabolism of foodstuffs in the animal body represents a large and important branch of biological chemistry. It entails in the first place an examination of the mode of action of the remarkable catalytic agents possessed by the living cell and termed enzymes, by means of which the complex molecules of the proteins, polysaccharides and fats are broken down so that the simpler molecules of amino-acids and sugars can pass through the absorbing membranes of the alimentary canal.

Mechanism of Absorption.—The actual mechanism of absorption of substances into the tissue fluids must then be studied, after which we must enquire into the fate of the molecules that have been assimilated. Some of these go to form tissues that are being constructed, especially during the period of growth; of the others, the great majority are in due course oxidised so that the energy liberated by their oxidative degradation may be available for maintaining body temperature, or for the performance of work. A whole field of biochemistry is concerned with the mechanisms by which organic molecules are oxidised in the living cell to carbon dioxide and water, for a large proportion of the substances that are rapidly and fully oxidised in the tissues at temperatures below 40° C. are only oxidised by drastic treatment with chemical reagents and by the employment of high temperatures when subjected to experiment in the test tube.

Respiration Processes.—It was discovered by the researches of Mayou, Priestley and Lavoisier that living creatures support life by the process of respiration, in which oxygen is taken into the system, and the product of oxidation of organic matter, carbon dioxide, is given off. To-day it is recognised that respiration is in no way peculiar to living tissues, for many non-living systems can be constructed that will absorb oxygen and eliminate carbon dioxide under conditions more or less comparable with those under which the living cells respire. The very striking experiment described in recent years by the distinguished German chemist Otto Warburg may be taken as an illustration. The oxidation of certain substances which are oxidised in the body, *e.g.*, certain amino-acids, will take place along apparently similar paths, at any rate leading to the formation of carbon dioxide and ammonia, when their aqueous solutions are shaken with carefully prepared charcoal in a fine state of division. A measure of the oxygen absorbed and of the carbon dioxide evolved in such cases is as truly a measure of the respiration of the charcoal as a determination of the respiratory quotient is an indication of the oxidative activity of a living tissue. The parallel becomes even more remarkable when it is learnt that the respiration of the charcoal particles can be depressed by the addition of narcotics or poisons in a manner absolutely comparable with the influence of these substances on the respiration of living yeast cells, red blood corpuscles or muscle tissue.

Origin of Circulatory System.—The biochemical study of respiration is, however, a problem presenting many aspects. Primarily it is necessary to investigate the means by which the oxygen is brought to the cells, a task that widens on every hand and takes us into many fields. The cells of the simpler forms of life draw their supplies of oxygen direct from solution in the surrounding fluid, but for more complex organisms this would not suffice, and methods of distributing the oxygen to tissues more remote from the external medium have evolved. Thus arose the circulatory system of animals. Simple air-breathing species dependent on the diffusion into the tissue spaces of oxygen from a more or less complicated system of tracheal tubes, gave rise to more complex organisms leading to the evolution of the lung with its enormous diffusion surface. Even this would have been insufficient to supply the oxygen requirements of the majority of animals if oxygen carriers of the type of haemoglobin had not been evolved to enable the circulating fluid to carry round to the tissues ample oxygen for their needs.

Haemoglobin.—The evolution of haemoglobin and other so-called respiratory pigments, their functions as oxygen carriers are widely studied problems of the biochemist, but his interest cannot stop with the study of the mechanisms by which oxygen is brought to the cells, he must enquire how the oxygen is made available in the cell for oxidations.

Action of Oxygen.—Atmospheric oxygen, whether obtained direct from solution in the surrounding medium, or by the dissociation of oxyhaemoglobin is relatively inert as an oxidising agent. Of the foodstuffs oxidised in living cells only very few are appreciably attacked by oxygen in the molecular form O_2; the unsaturated fatty acids present in such oils as cod liver oil and linseed oil are examples of compounds that take up molecular oxygen, but the extent to which they are oxidised is very small when compared with the complete degradation to carbon dioxide and water that occurs with such ease in the animal body. Early in the 19th century Schönbein in his studies of ozone pointed out that oxygen must in some manner be activated before it is able to effect the majority of oxidations, and this view, in one form or another, has formed the basis of the many theories of oxidation that have been advanced since his time. We are still without clear ideas regarding the mechanism of activation of molecular oxygen which the living cell possesses, but the studies of Warburg on tissues and on the charcoal model to which reference has been made suggest that the presence of iron plays an important part in the process.

Oxidative Mechanisms.—This brings us in a natural sequence to refer to the oxidative mechanisms which the living organism possesses. In the first place there are the oxidising enzymes, the oxidases, a group of catalysts, many of them of a highly specific character, capable of oxidising with great rapidity under suitable conditions a wide variety of substances. The biochemical examination of the oxidases has been extensive, and has, particularly in recent years, given us considerable information how molecules such as those of tyrosine, xanthine and uric acid are oxidised. According to the recent work of Thunberg and Baltelli and Stern the cell possesses, in addition to the recognised type of oxidase, other types of oxidative catalysts of a thermolabile nature. It would appear, however, from the results of the researches of Sir Gowland Hopkins and of Meyerhof that there are also present in the cells of plants and animals oxidative-reductive systems which are thermostable. The remarkable substance glutathione, discovered a year or two ago by Hopkins, probably plays an important part in these last-mentioned systems. In no field of research in biochemistry at the present time are activities so vigorous as in that devoted to the study of oxidations in living tissues.

Reproduction.—Turning now to the second characteristic of life in our list, namely, reproduction, we find we are considering a phenomenon which might well, at first sight, appear to be outside the scope of experimental attack by biochemists. Surely, in the processes underlying reproduction, if anywhere in the realm of biology, might be traced the "vital force" or "entelechy" that would at almost every turn frustrate our efforts. The clear demonstration that such is not the case, and that the problems of fertilisation and reproduction are no less open to experimental biochemical investigation than those of digestion or respiration, we owe to the remarkable work of the great experimental biologist Jacques Loeb. His investigations on the influence of the composition of the surrounding medium on the reproductive cells of certain marine animals dispel any doubt that many of the problems of fertilisation, of specificity and of inheritance will in time be solved, and to a large extent by biochemical methods (*see* CYTOLOGY; EMBRYOLOGY).

Control Experiments.—Can this be doubted when we recall that the migration of the sperm to the egg has been shown to be directed by the physico-chemical action of certain substances derived from the latter; that the penetration of the ovum by the sperm can be controlled by altering the composition of the surrounding fluid, even to the extent of permitting the admission of a sperm cell foreign to the egg; that the mechanical act of penetration performed by the sperm, and resulting in the almost explosive outburst of oxidative activity that marks the initiation of fertilisation, can be reproduced by perforation with needles so successfully that numbers of male frogs have been reared to adult size from eggs so fertilised? Considering these striking facts, and at the same time bearing in mind the mass of evidence that is accumulating on every side to show how the development of the reproductive cells is under chemical control in the body and how these tissues themselves exert by chemical means a far-reaching control on the development and functions of other tissues, no reasonable doubt can be entertained that the phenomena associated with reproduction are open to biochemical investigation.

Genetic Problems.—Many of the closely associated problems of genetics are also well within the biochemist's purview, as can readily be judged by giving one or two examples. The inheritance of colours, whether we are thinking of the blue, red or purple colours of flowers or the black and brown markings of animals, has been shown to depend on the inheritance of a physico-chemical system capable, under ordinary conditions, of producing the colour. Some of these systems and the mechanism of their action are fairly well understood. The systems may be more or less complex in character, but unless they are complete the mechanism for the production of the colour cannot function normally. Thus, for example, two white flowers from different plants of the same species may lack colour because one component of the colour-producing system is absent. If the missing factor is the same in both cases, crossing will not result in the production of coloured flowers, but if, on the other hand, their deficiences are complementary, a proportion of the seeds produced on cross fertilisation will yield plants with coloured flowers. The mechanisms concerned in the production of both animal and plant colours have been extensively studied *in vitro*, and they are to some extent understood.

Growth and Development.—The biochemical study of growth and development has been followed along many paths. The influence of the composition of the soil on plant growth has attracted wide attention ever since the classic researches of Liebig were published. To-day the agricultural biochemist not only studies the significance of the more obviously essential constituents of the soil, such as nitrates, phosphates, etc., but is concerned to no little extent with the influence which apparently insignificant amounts of other substances may have. The curious fact that the broad-bean plant will not grow to full maturity without a minute amount of the element boron being present in the soil is an example of what has already resulted from investigation in this direction.

Chemical Control.—The biochemical study of the growth and development of animals provides many examples of both these aspects of the chemical control of growth. On the one hand the energy requirements of animals during the period of growth have been investigated in great detail, whilst on the other, it has been ascertained that a normal development is dependent on the satisfaction of a number of more or less clearly defined requirements.

A small but definite amount of the amino-acid tryptophane, a constituent of some, but not all, proteins, is necessary for growth of young animals, and the provision of any amount of a protein deficient in that particular building stone will fail to induce growth unless the missing unit is provided from some other source. Many biochemists at the present time are engaged in investigating the remarkable influence which the substances known as the vitamins have on the growth and nutrition of animals. The number of these substances that are generally accepted as being clearly differentiated is already five, and probably more exist as yet undiscovered. Their chemical nature remains unknown in spite of considerable study, and we are also regrettably ignorant as to the actual part they play in the economy of the organism. (*See* VITAMINES.)

Growth Factors.—Lastly, there is a chemical aspect of growth in the investigation of the influence of inorganic elements on animal development. Problems such as the rôle of traces of iodine in inducing normal development of the thyroid gland, and the manner in which lime salts are deposited in growing bone illustrate the type of question in this field that calls for an answer from biochemists.

Movements.—Study of the chemical or physico-chemical factors inducing the movements of plants and animals covers a wide field of experimental research, ranging from control of the movements of free-swimming unicellular organisms to the unravelling of the complex series of events that occur during a muscle twitch in higher animals.

Regeneration.—Little is yet known of the factors determining the growth movements of plants beyond Loeb having shown by his researches on regeneration in Bryophyllum that chemical factors probably play a part in the directional growth of shoots and roots. The movements of many forms of simple animals can be to a certain extent controlled by making alterations in the composition of the medium in which they exist, as, for example, when the water flea, Daphnia, which normally swims away from the light moves in the reverse direction when carbon dioxide is bubbled through the water. Another remarkable example also described by Loeb, is that of the larvae of Porthesia which in the starving condition are attracted toward light and climb high up the stems of the plant on which they customarily feed, but which, having fed on the leaves, become negatively heliotropic and at once descend again to the darker regions. By starving them or by feeding on the leaves of the plant they can in the laboratory be made at will to move toward or away from a source of light.

Mechanism of Muscular Movement.—Turning to what we may regard as the other corner of this field, namely, the biochemical investigation of the mechanism of muscular movement in animals we find one of the most complete chapters of modern biochemistry. The long series of researches of outstanding merit by Hopkins and Fletcher, Meyerhof and A. V. Hill have taught us how the glycogen of muscle is broken down to sugar; how the sugar, passing through the intermediate stage of being combined with phosphoric acid, gives rise to the lactic acid that initiates the contraction, and how these anaerobic changes are followed by an oxidative phase of recovery during which part of the lactic acid passes back into its precursor, whilst the remainder is oxidised to carbon dioxide and water. These changes have been followed with such precision by chemical and physical methods that the heat production of the muscle during the whole cycle has been accounted for with considerable exactitude by a knowledge of the heat exchanges of the chemical reactions which are believed to occur. In spite of these carefully compiled results we are as yet ignorant of the actual processes involved when the muscle fibre shortens in contraction. Without doubt it is a physico-chemical mechanism of which the nature will soon be revealed by future research.

Hormones.—The processes of secretion and excretion have been the subject of extensive biochemical research, although mainly on animal tissues. The discovery by Starling and Bayliss of the agents known as hormones indicated for the first time how important a part such chemical messengers play in the co-ordinating mechanisms of the higher animals. Their discovery of secretin, the substance of, as yet, undetermined nature which is produced in the mucosa of the upper part of the small intestine under the stimulus of the entry of acid food material from the stomach, and which, passing into the blood stream, invokes, in a very short space of time, the secretion of the digestive juice of the pancreas, has paved the way for the discovery by Banting and Best of the internal secretion of the pancreas itself, and more recently of that of the internal secretion of the parathyroid gland by Collip. Viewed as a whole, the regulatory action (*see* ENDOCRINOLOGY) exerted by the secretions of the various glands and tissues of the higher animals is seen to be one of the most delicately balanced nature, but it is one that is quite definitely open to chemical investigation.

Excretory Processes.—The processes of excretion by which living organisms rid their tissues of waste products have, as yet, been scarcely investigated at all in plants. In animals, more particularly in the mammals, they have been extensively examined from the biochemical standpoint. The secretion of urine, the work done by the kidney in this process, the chemical and physico-chemical principles underlying the concentrations of waste products that appear in the excreted fluid, all these have been the subject of prolonged and fruitful investigation during the period under review.

Secretory Processes.—Of no less interest are problems concerning the secretion by living cells, such as the gastric mucosa of animals, of fluids containing appreciable concentrations of free mineral acids. These questions are intimately bound up with the very general one concerning the mechanisms by which the reaction of the body fluids is maintained within narrow limits. The study of the system of amphoteric colloids and simple electrolytes that constitute the tissue fluids of animal or plant tissues has, from the standpoint of physical chemistry, been almost exhaustive, and the analysis, step by step, of the influence of the many factors playing a rôle in the cycle of changes that occurs in blood during its circulation in the bodies of animals stands as one of the most impressive tributes to the application of the rigid, quantitative methods of modern physical chemistry to problems of outstanding biological importance. Many other spheres of extensive biochemical work might be mentioned, but it will be sufficient if brief reference be made to the chemical investigations of fermentation and bacterial changes on account of their enormous economic importance.

Fermentation Processes.—To-day, as a result of the researches of Harden and Young in Great Britain, of Fernbach in Paris, and of C. Neuberg in Germany, we are in possession of a reasonably clear idea of the stages by which the sugar molecule is broken down to yield alcohol and carbon dioxide when fermented by yeast. Most of the intermediate products have actually been isolated and their part in the process proven beyond question. Of particular interest is the fact that the most recent work on the fermentation of sugar by yeast and on its degradation in the cells of the animal body points to the essential steps in the breakdown of the carbohydrate molecule being the same in both cases.

Probably in no other field of research in biochemistry have so many striking examples been found as in that of fermentation chemistry, of the course of a reaction being changed by alterations in the conditions of the experiment. Certain of these diversions of the normal course of events have proved of considerable economic value as, for example, when, during the World War, German scientists were able to prepare considerable quantities of glycerol from sugar by causing inhibition of the fermentation at a certain stage in its progress by the addition of sulphites.

Apart from the alcoholic fermentations there are numerous other processes, many of them of considerable technical importance, in which the action of the bacteria (*see* BACTERIOLOGY) or other forms of micro-organisms are the subjects of biological research.

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BIOLOGY (*see* 3.954) is the general science of organisms, plants and animals alike. It includes botany and zoology, and the study of man as organism; but it is at once more and less than the sum of these: more, because it is the science of organisms in their general aspects as living individualities; less, because it has not to do with the detailed descriptions given by the zoologist and the botanist, except in so far as these may throw light on the problems of the nature and continuance and evolution of life. In other words, biology is a general science, including the special sciences of botany and zoology, protozoology and bacteriology, anatomy and physiology.

Divisions of Biology.—There are various general questions that may be, and must be, asked in regard to organisms: and the answers to these are the biological sub-sciences. First, there is analysis of structure, both macroscopic and microscopic; that is to say, histological as well as anatomical; and this inquiry leads towards an understanding of what may be called the principles of organic architecture. This is the sub-science of morphology. Second, there is analysis of function or activity; how does the organism "work" and keep going? This is the sub-science of physiology. As in morphology, so in physiology, the analysis may be at different levels, passing from the intact creature to its organs, its tissues, its cells and its living matter or protoplasm. Historically, as a matter of fact, these two complementary sub-sciences—morphology and physiology—have developed *pari passu* and logically along the lines of this gradually deepening analysis. The organism, which is always an individuality, may also be regarded as a correlation of organs, a woven fabric of tissues, a vast city of cells and an integrate of protoplasmic whirlpools, to use Huxley's metaphor.

The third biological sub-science is embryology (*q.v.*) which inquires into the development of the individual organism; not merely describing the successive stages of "ontogeny," but investigating the factors that are operative in the process of individual becoming. Thus, besides descriptive embryography, there is physiological embryology, often nowadays experimental. To give an example, it is a characteristic modern inquiry to trace the influence that the hormones of various ductless or endocrinal glands (*see* ENDOCRINOLOGY) exert on the developing embryo of which they form a part. As embryology deals with the individual organism in its time relations, it is obviously difficult to draw a hard and fast line indicating where it should stop. It must obviously include larvae as well as embryos; yet why not adolescents as well as larvae? This is a familiar difficulty that has many illustrations, and it means that these sub-sciences merely represent the diverse ways of looking at organisms. It is common sense, however, to keep the term embryology for the study of the developing organism, before it assumes in great measure the character of its adult.

The fourth sub-science is palaeontology (*q.v.*), which inquires into the past history of the race to which a type belongs. It relies on the fossilised remains, the history written in the rocks, and it aims at working out pedigrees. How did the modern type of horse arise, or what was the ancestry of flowering plants? No doubt a fossil may be anatomised as regards its hard parts; and there cannot be any strict separation between dissecting an animal recently alive and one that lived a million years ago. Part of morphology has to do with fossils, but the specific inquiry of palaeontology is historical. The anatomy of the fossil is utilised in the reconstruction of extinct organisms. But with this there must also go a reconstruction of the environment in past ages, so that the organisms of long ago may be seen as players on a definite stage, as Kowalevsky showed almost picturesquely in his classic studies of fossil Ungulates.

Ecology.—But just as palaeontology is distinctively concerned with the races of organisms, and embryology with the becoming of the individual, so physiology must rise beyond the functions of the single organism to a study of the activities of the pair, the family, the herd, and so on, not only in themselves, but also in their inter-relations with their environment, animate as well as inanimate. This is what Semper called "the physiology of organisms" or general physiology; it is now called ecology or bionomics, and is largely concerned with the behaviour and inter-relations of organisms. It is in great part the old-fashioned "Natural History."

Taxonomy.—Similarly, we may pass from the morphology of the single individual to its place in the general scheme of classification. That is to say, we may study the grouping of plants and animals in species, genera, families, orders, classes and phyla; and this in a word is taxonomy, which is to morphology what ecology is to physiology.

Aetiology.—But there is another great question which looms behind all the others: How have these organisms come to be as they are, both as regards themselves and as regards their inter-relations? This is what Huxley called aetiology, an inquiry into the causes or factors that have been operative in the great process of organic evolution. This inquiry concerns not only the past and the present, but the possible, the variations and the siftings of to-day as well as those in the distant past, to which we argue back partly from the data of palaeontology and partly by analogy from what is of present occurrence. When palaeontology rises to the height of its calling and becomes causal as well as palaeontographical, it passes into phylogenetic aetiology. And similarly when embryography becomes physiological and experimental embryology, it passes into what may be called ontogenetic aetiology. This implies more than the physiology of the embryo at different stages of its ontogeny, it is an inquiry into the behaviour of the germ-cells and the embryonic cells in so far as this throws light on the historic process of phylogeny. Thus everyone will grant that such a fact as the early segregation of germ-cells from body-cells (*see* CYTOLOGY), or, to take another example, the reducing division in the maturation of the germ-cells, has a very important bearing on the general theory of organic evolution. While it is impossible to separate biology into self-contained sub-sciences which can be profitably studied and advanced in isolation from one another, there is convenience and stimulus in a map which indicates the eight possible approaches.

PALAEONTOLOGRAPHY (Race)	TAXONOMY (Groups)	ECOLOGY (Groups)	PHYLOGENETIC AETIOLOGY
EMBRYOGRAPHY (Individuals)	MORPHOLOGY (Individuals)	PHYSIOLOGY (Individuals)	ONTOGENETIC AETIOLOGY

The stiff abstractness of this map may be counteracted by keeping in mind the obvious fact that biology is not a departmental elaboration of knowledge, but itself a growing organism, correlated through and through.

Position of Biology among the Sciences.—In a survey of the world without there is much to be said for recognising three main orders of facts—the inorganic, the organic, and the social; or, in other words, the domain of things, from dew-drops to stars; the realm of organisms, from microbe to mammal; and the kingdom of man, with its many societary forms. Thus, if the terms are permissible, we may recognise the cosmosphere, the biosphere and the sociosphere, which overlap and intersect in interesting ways. When coral-polyps build a reef, or beavers construct a dam, they are including part of the cosmosphere into the biosphere, just as a man brings the earth into his sociosphere when he makes a great dam or breakwater, or when he transforms organisms into his service by domestication or cultivation. For each of these three great spheres there is a distinct mode of evolution, for the genesis of a solar system and the history of a social institution are *very* different from one another, and *very* different from the process of organic evolution among plants and animals.

Sociology.—A further reason for thinking of three great orders of facts is that it has become practically impossible to separate chemistry and physics, and it is becoming, in the judgment of many, increasingly impossible to separate biology and psychology (*q.v.*). The science of the nature and origin and activity of societary forms stands by itself as sociology (*q.v.*). The question is whether there are three or more great orders of facts which require distinctive concepts for their formulation. Chemistry and physics are concerned with matter and energy; biology faces the peculiar kind of activity that we call life; sociology has to do with human integrates that act in some measure as unities. It is much more than a problem of convenience; the question is how many large departments of knowledge can be regarded as autonomous.

Psychology.—But there is also much to recommend the retention of the familiar Spencerian grouping of five great concrete sciences—chemistry, physics, biology, psychology and sociology. One advantage of this scheme is that it gives emphasis to the central position of biology. Since organisms are material systems specially adapted for the transformation of energy, biology must rest on a foundation of chemistry and physics. One needs only to think of the step of progress that was made when Lavoisier brought the oxidations of the living creature into line with the combustion of fuel in air. Or, looking in the other direction, the linkage of mental activity with bodily, of psychosis with neurosis, is so intimate that psychology without physiology is unthinkable. And some would reverse the statement, and say: *Nemo physiologus nisi psychologus.* Similarly, it is evident that sociology requires all the help that it can get from the psychologists and the biologists. Classifications of the sciences are means, not ends; and while a recognition of three great orders of facts is useful for some purposes, there are also advantages in recognising five. Thus when psychology is thought of mainly as the positive science of mental processes, its separateness from biology stands out; yet it joins hand with biology when it is regarded as the science of behaviour.

Legitimate and Illegitimate Materialisms.—The contributions of chemistry and physics to an understanding of the organism are fundamental, for organic activity is bound up with the reactions of complex chemical substances in a colloidal state. The metabolism of the body is a concerted chemical routine, and if fermentation is a chemists' business there is plenty of it in the organism. The organism may be more than an engine, to our thinking much more, yet an engine it is, and it cannot be understood apart from the properties of colloids, the phenomena associated with surfaces, and many other physical facts. This is what Comte called a "legitimate materialism," using the concepts of a lower science to elucidate the phenomena which occur in the subject-matter of a higher. That laws of chemistry and physics apply in some measure to the life of organisms, is proved up to the hilt by the history of biology.

Biological Categories.—The question is whether there will be any biology left when chemistry and physics have said all they have to say? Will bio-chemistry and bio-physics swallow up biology? The negative answer given by many biologists, who believe in the autonomy of their science, may be supported in various ways, but the strongest position is probably that the chemical-physical formulations do not actually describe what we see and know. If complete, they would afford a ledger of all the chemical and physical transactions that go on in the body, but that would not describe the organism's apparently unique qualities as an integrated living individuality, such as its power of enregistering its experience within itself so that subsequent behaviour is influenced. As science is at present, it is necessary to use special biological categories describing the life of the organism—notably its growing, reproducing, developing, varying, endeavouring. For isolated transactions in corners of the body, the chemico-physical descriptions may suffice, but not at present for anything like behaviour. Much has been discovered in regard to the movement of muscle, *e.g.*, the contraction of the living threads in presence of lactic acid, but it cannot be said that we can as yet give a chemico-physical account of the twinkling of an eye. As everyone allows, there is a chemistry and a physics of the organism, absolutely indispensable and full of promise, but when they are added up they do not give biology. Perhaps they will change, but at present the chemico-physical formulae are inadequate for the complete description of distinctively vital activities; and, from the nature of the case, they must still more egregiously fail to grip when " mind " is an appreciable factor. But without saying that it is " mind " that makes all the difference, the position of the psychological vitalists, and without postulating any " vital force " or " entelechy "—the position of other positive vitalists, we are content to state the case for " methodological vitalism," that the organism, compared with a non-living material system, is a new synthesis or emergence, requiring distinctive concepts for its description (*see* EVOLUTION).

Illustrations of Modern Biological Methods and Results.—(1) A great simplification was effected when it was shown by Hardy and by Fischer that the cytoplasm of the cell has no visible structure. For the reticular, fibrillar and other appearances, described in so much detail in the later years of the 19th century, are artefacts due to the fixing and staining. They may be mimicked in homogeneous white of egg, and the same kind of cell will show a different structure according to the way in which it is treated. Yet the typical cell remains a microcosm, with its mitochondria and chromidia, its Golgi apparatus and its centrosomes, and there is almost certainly an interpenetration of the cytoplasm with an ultra-microscopic filming which separates off different areas in the colloidal substance. Many different kinds of particles and immiscible droplets quiver in suspension in the fluid medium, and in the centre there is the nucleus surrounded by a semi-permeable membrane, through which a regulated exchange is effected between the nucleoplasm and the general cytoplasm. But the nucleus is itself a little world. When it is active it shows a definite number of readily stainable rodlets, the chromosomes, bathed in a complex nuclear sap or karyolymph. In some cases a chromosome appears as a linear series of minuter units, " microscomes," fixed on ribbon of " linin," and in indirect ways it is becoming possible to discern the topography of a germ-cell chromosome. Thus it is said that the hereditary " factors " or " genes " for vermilion eye and rudimentary wing lie together in a certain stretch of the first of the four chromosomes of a particular race of the fruit-fly, drosophila.

Chromosomes.—Increasing attention is being given, especially from the botanical side, to the number of chromosomes in particular organisms, and a discovery has been made which appears to be full of promise. It is a familiar fact that every kind of embodied organism has a definite number of chromosomes, which is in most cases rigidly adhered to, except that the ripe sex-cells have half the normal number, and that the number in the female may be one more accessory than that in the male. Thus one form of the threadworm (*Ascaris megalocephala*) common in the food-canal of the horse has two chromosomes, a very small number, while the horse itself has 66, which is a very large number. Man's number is 48, and that of the mouse 24, but it will be clearly understood that it is not the number itself that is of primary importance, since the same may occur in quite unrelated types. Thus man's number, 48, occurs in some snails and bananas. What is of chief interest is the constancy of the number, and that it bears some relation to the groups of linked hereditary characters.

Specific Characters.—In the genus Rosa the fundamental number is 7, and a series of species can be arranged which have in their body-cells 14, 21, 28, 35, 42 and 56 chromosomes. It is clear that the evolution of rose species has been associated with a multiplication of the chromosomes in septets or sets of 7. Prof. R. Ruggles Gates has been one of the most successful demonstrators of the correlation between chromosome peculiarities and specific characters; and chromosome-series have been demonstrated in a considerable number of plant genera. It has been supposed that a rose species with, say, 28 chromosomes (tetraploid) was the outcome of a duplication of the chromosomes of a species with 14 (diploid); and similarly in other cases. But Dr. C. C. Hurst finds that the tetraploid (28) species of rose shows the combined characters of 2 distinct diploid (14) species. Similarly, the hexaploid species (42) shows the combined characters of 3 distinct diploid (14) species; the octoploid (56) shows the combined characters of 4 distinct diploid (14) species. Thus it appears that the increase in the number of septets means in these roses something more than a mere duplication and reduplication of chromosomes; it means different combinations of the different septets which are known to occur in the various diploid species of Rosa, of which 5 are known. Given 5 diploid (14) species with differential septets of chromosomes and of characters, numerous new species, say, with the tetraploid, hexaploid or octoploid numbers, may arise, and have arisen, by diverse combinations. This is an important biological discovery with far-reaching applications.

Biochemical Data.—(2) One of the great milestones in modern biochemistry was the discovery of glutathione by Prof. Sir F. Gowland Hopkins in 1921. This organic substance, widely distributed in plant and animal cells, acts as an " oxygen transporter," an intermediary between the oxygen of the air and the food-materials of the tissues. It is a chemical fact that glutathione is a compound of two amino-acids (glutaminic acid and cystein), and that it alternates between an oxidised form (acting as a hydrogen-acceptor) and a reduced form, but we are here concerned with the biological fact, which is of fundamental importance, that this transporter and liberator of oxygen accounts for the energy-yielding combustions that take place at a low temperature within the living cell. It explains how the cell burns and yet is not consumed. In this connection should be noticed Dr. D. Keilin's discovery of a widely distributed uncoloured cell-pigment, which he calls " cytochrome " which seems to have something important to do with the control of oxygen within the cell. It contains the chemical nucleus " haem," that forms the coloured portion of the red-pigment (haemoglobin) of the blood of many kinds of animals.

Cell-culture.—(3) Another very interesting method, particularly associated with the names of Ross G. Harrison and Alexis Carrel, is the isolation and culture of single cells or groups of cells. A single nerve-cell can be watched for many days under the microscope, and the amoeboid nature of the tip of its growing fibre can be demonstrated. A few cells from the heart of an embryo chick can be kept alive for days in an artificial medium, and by their spontaneous rhythmical contraction they corroborate the conclusion that the heart muscle of a higher animal contracts of itself by reason of an ingrained rhythm, apart from stimuli from the central nervous system. If care is taken to give the isolated fragment appropriate food, a supply of oxygen, a suitable temperature, and aseptic conditions, there seems little in the way of limit to the life of a piece of tissue in a glass tube, or on a glass plate, or in some other such arrangement. The life of isolated fragments of tissue from a chick embryo has been prolonged for 10 years—a longevity not less than that of the hen into which the embryo might have grown. By this culture method it is possible to study the behaviour of tissues under various conditions, and to distinguish between intrinsic potentialities and reactions to extrinsic stimulants, such as hormones or extracts of other tissues. By it investigators can detect or delimit the factors that inhibit or stimulate the growth of tissues; and this may assist, not only in the transformation of embryography into embryology, but in the control of pathological changes.

Micro-dissections.—Here should be recognised the great promise of the ingenious micro-dissection methods which have been recently elaborated, by Prof. Robert Chambers in particular. The object to be micro-dissected, such as an egg-cell or a protozoon, is included in a "hanging-drop" suspended from the under-side of a cover-glass firmly fastened on the stage of the microscope and forming, as it were, the roof of a moist chamber that has no floor. Into this space there protrude the exquisitely fine tips, straight or curved, of glass needles which are fixed in holders attached to an ingenious system of screws fastened to right and left on the under-side of the stage of the microscope. The object cannot be seen with the naked eye, but it is quite clear in the centre of the field of the high-power microscope, and the needles can be manipulated through the screws so that their very delicate tips meet where desired. By working the screws it is possible to move the needles in a vertical as well as in a horizontal plane; thus one tip may be used to press the object against the cover-glass while the other is used to cut a piece off, or to remove a nucleus or even to effect an intra-cellular injection. The method has been found fruitful in studying the physical properties of protoplasm, in separating particular portions of a cell, and in isolating a single micro-organism, so that an absolutely pure culture or "pure line" can be secured. In connection with new biological methods, prominence must be given to the use of the ultra-microscope, and to the micro-analytic methods invented by Prof. Pregl of Graz for dealing with extremely minute quantities of a particular substance. With only a fiftieth of what has usually been regarded as a minimum, he is able to effect analysis more rapidly and not less accurately than before.

Photosynthesis.—(4) To take another instance of a very different nature, there seems to be great biological interest in Prof. Baly's discovery of artificial photosynthesis (*see* PHOTOSYNTHESIS). The most important organic process in the world is obviously that on which all life depends, the building up of carbon compounds in the green leaf. This is what Prof. Baly and his collaborators have been able to mimic. Using the light of a mercury-vapour lamp, which has a very short wave-length, Prof. Baly was able to build up formaldehyde from water and carbon-dioxide, which is precisely what the green leaf does. Light of a somewhat longer wave-length caused the molecules of formaldehyde to unite to form simple sugars. The experimenters also succeeded in bringing about a union of nitrites and formaldehyde in a test-tube subjected to the light of a quartz-mercury lamp. Here it may be noted that a discharge of lightning through the air might lead in Nature to a fixation of nitrogen, which man now achieves with his powerful electric arcs (*see* NITROGEN, FIXATION OF). Rain might bring the fixed nitrogen to earth in the form of nitrite of ammonia or the like. In other words, the materials Prof. Baly used are such as might be readily available on the surface of the earth, and this consideration makes the possible origin of the living from the not-living more plausible. In any case, all theory apart, the ingenious chemist has been able to build up formaldehyde, sugars and nitrogenous organic substances from very simple inorganic materials with only light to help him. In some later experiments Prof. Baly was able to bring about the reactions referred to by using ordinary sunlight in the presence of certain "photo-catalysts" which probably play a part comparable to that of chlorophyll in the plant.

Luminescence.—(5) Considerable progress has been made toward an understanding of organic luminescence. Some luminous organs, as in certain cuttlefishes, seem to owe their photogenic power to colonies of "phosphorescent" symbiotic bacteria. This might be called extrinsic animal luminescence in contrast to intrinsic animal luminescence, where the light is due to the metabolism of the animal itself. In his treatise on *Animal Light* (1919) Prof. Newton Harvey distinguishes among intrinsically luminescent animals (*a*) those in which the photogenic material is oxidised within the cells where it is formed, as in fire-flies; and (*b*) those in which the material is secreted to the exterior and oxidised outside the cell. Of the latter a clear example has recently been discovered (1925) by Mr. C. F. Hickling in a Macrurid fish (*Malacocephalus laevis*) which emits an abundant luminous secretion into the water. In all other luminous fishes as yet recorded, the luminescence is produced within the living cells. Dubois and Harvey have produced strong evidence in support of the conclusion that in the fire-flies, the small crustacean Cypridina and the piddock or Pholas a photogenic substance luciferin is oxidised to oxyluciferin in the presence of a ferment luciferase, the result being cold light, *i.e.*, without any heat-rays. But while the physiological aspect of bio-luminescence has been elucidated, there remains a paucity of facts in regard to its significance in the everyday life of the animal, *e.g.*, whether it serves as a lure or as a scare, a lantern or a sex signal, or for kin-recognition in darkness. It is probable that an unimportant side-track in metabolism has been utilised in different ways in different types, and may sometimes have no use at all.

Symbiosis.—(6) In illustration of recent ecology reference may be made to the great extension of our knowledge of internal partnership or symbiosis. Additions have been made to the list, long since begun, of unicellular algae (Zoöchlorella and others) living in mutually beneficial partnership within the cells of Radiolarians, freshwater sponges, hydra, various Alcyonarians and sea-anemones, and, most vividly of all, in the little Turbellarian worm Convoluta. But the researches of Buchner and others have proved the frequency of yeast-like organisms in the food-canal of insects like cockroaches, which live on very dry food, or in the larva of the death-watch which thrives on the fine sawdust it eats out of the wainscot. It seems that the symbiotic yeast-plants and other micro-organisms are intermediaries between the unpromising food-material and the insect's alimentary tract, and that they are able, in some cases at least, to set up very useful fermentations.

Termite Symbionts.—Very convincingly worked out by L. R. Cleveland of Baltimore is the partnership between wood-eating termites, *e.g.*, Reticulitermes and certain remarkable Infusorians (*e.g.*, Trichonympha) which live in the intestine, and serve as the middle-men between the dry-as-dust food and the intestinal epithelium. By incubating the termites for 24 hours at 36° C., it is easy to kill the Infusorians without hurting the termites, and it is found that the defaunated individuals die in 10–20 days though copiously fed with their normal diet of wood. But if they are re-infected with their partner Infusorians they live on indefinitely. A colony of termites well provided with symbiotic Infusorians can thrive for many weeks on an exclusive diet of filter-paper.

Orchids and Fungi.—Or, again, many, perhaps all, orchids have a partner root-fungus or mycorhiza which penetrates the superficial layers and contributes greatly to the success of the plant. In some of the root-cells the fungoid threads seem to feed; in other cells, less superficial, the threads and their products are digested. It is a mutually beneficial partnership. The French botanist, Noel Bernard, showed that the germination of the orchid seeds is closely dependent on the presence of the partner fungus. The orchid seeds are small and the embryos are slow of developing, but even if they get a start they cannot go far unless infection from the soil takes place, and in some cases the infection is specific. Only one kind of fungus will serve. How the fungus promotes development is not quite clear, but there is no doubt as to its being a "benign disease." Orchid-growers are now able to provide the suitable fungus, and thus secure the germination of seeds that baffled them before. In some parts of the world with unready moorland soil, the most outstanding biological fact is the exuberant success of the heather; but this depends on its being interpenetrated, even to leaf and flower, with a partner or symbiotic fungus.

Pigmy Parasites.—Very remarkable on another ecological line is Mr. Tate Regan's account of pigmy parasitic males in three Cerativid Angler-fishes which frequent the "mid-waters" of the ocean between 250 and 500 fathoms. In the Arctic *Ceratias holbolli* a female about eight inches in length carried on her ventral surface two males of two-and-a-half inches. The snout and chin region of the dwarf male was permanently attached to a papilla of the female's skin, and the blood-vessels of the two were confluent. The male is without teeth and without the luminescent "lure" borne by the female; the mouth is useless; the food-canal is degenerate. In *Photocorynus spiniceps* from the Gulf of Panama, the female about two-and-a-half inches in length bore a male under half an inch long on the top of her head in front of her right eye. In *Edriolychnus schmidti* from the western Atlantic, the dimensions were about the same as in the last case, and the female carried the pygmy male fixed upside down on the inner surface of her gill-cover. Pygmy males are well known among some invertebrates as in Bonellia, some barnacles, some parasitic crustaceans and some of the Myzostomes that live attached to crinoids. But Mr. Tate Regan's cases are unique among vertebrates. The Cerativid anglers seem to be of sparse occurrence, hence perhaps the survival value of these remarkable arrangements which secure the fertilisation of the eggs when they are shed into the sea. It may be by hormones that the presumedly synchronous liberation of the germ-cells in the two sexes is secured. We cite this case as a good instance of the progressive study of inter-relations.

Flowers and Birds.—Yet another line may be illustrated by the work of Otto Porsch on the pollination of flowers by birds. He finds evidence of over 1,600 tropical and sub-tropical flower-birds which habitually visit flowers, carry pollen on their head feathers, and more or less depend on the nectar of flowers for their food and drink. They tend to be small in size, as in humming-birds and honey-birds, and strong in wing, able to flutter before or poise themselves on the blossoms. They usually have a fine-pointed bill, sometimes elongated, and a long slender tongue, which sometimes bears processes like a brush. The habit has been acquired in no fewer than 31 different families. The "ornithophilous" flowers are usually conspicuous in their colouration (including white) and usually scentless. They produce large quantities of watery nectar and many of them have special capillary arrangements around the mouth of the nectar-receptacle which tend to prevent wasteful overflow. Good examples are to be found among fuchsias, mallows, aloes, tropaeolums, verbenas, honeysuckles, gardenias, cactuses, cannas and irises. They must be so built that the stamens dust the bird's head with pollen, and that the stigma of another blossom is in turn dusted. If the birds are effective pollinators, they will be, for several reasons, better than such insects as bees, *e.g.*, in having a longer year and a longer life; and it is significant that over 16% of the families of flowering plants in Java have bird-flower representatives. Fully 50 genera have species that are pollinated by birds, belonging to 22 different species. Ornithophily is not a new thing, but we cite Porsch's work as an instance of the kind of biological progress that is rewarding more intensive investigation.

Artificial Parthenogenesis.—(7) Very striking, again, on another line, was the discovery of the possibility of artificial parthenogenesis by Prof. Yves Delage of the Sorbonne and Prof. Jacques Loeb of New York, who were experimental biologists of great achievement. In several starfishes and sea-urchins, some worms and molluscs, and even as high up in the scale as the frog, it has been found that various modes of treatment, which alter the chemical and physical character of the water, will bring about artificial parthenogenesis. That is to say, an egg-cell which normally requires to be fertilised by a sperm-cell may be launched on aspermic development. In the case of the frog, Bataillon's quaint method is to prick the eggs with a fine needle of glass or platinum and then wash them with blood. The development, as in the other cases, is quite normal, and several fatherless frogs—of both sexes—have been successfully reared. These experiments are not only of high interest in themselves, they have led to a theory of fertilisation, which is full of promise, though still somewhat incipient. (*See* EMBRYOLOGY.)

Sex Studies.—(8) Another article will deal with the general subject of *sex;* what is admissible here is merely an illustration of modern biological methods, Baltzer's study of Bonellia viridis, a green worm not uncommon in the Mediterranean and occasionally occurring in the North Sea. The female has a body about the size of a prune, bearing a string-like, terminally bifid, very contractile proboscis which may be two feet long and is used in probing about in search of food. But the male is microscopic and lives in what may be called the reproductive duct (modified nephridium) of the female. It has no mouth and depends on what it absorbs parasitically through its ciliated surface. In 1914 Baltzer discovered that when the free-swimming larvae that emerge from the eggs settle down on the substratum they develop into females, while those that settle on the proboscis of the adult, begin to absorb from the skin, suffer an arrest of development, and become the pigmy males. Sometimes Baltzer shook off the young males before they had been long on the proboscis, and in this way he obtained inter-sex forms, intermediate between males and females. At a certain stage the males leave the proboscis and enter the mouth of their bearer and undergo a final change. After this they emerge and enter the reproductive duct, where they remain for the rest of their life, fertilising the eggs before these are set free. In his last paper (1925) Baltzer has shown by intra-vitam staining that the young males absorb nutritive material from the skin of the proboscis, and an extract of that skin is found to have a poisoning effect on small animals, such as slipper-animalcules, threadworms, water-fleas and tadpoles, as well as on the male larvae themselves. As an extract from the wall of the reproductive duct is not injurious, it becomes practically certain that the arrest of development exhibited by the larvae on the proboscis is due to the absorption of some specific substance from the female skin.

Endocrine Glands.—(9) No biological outlook at the end of the first quarter of the 20th century can fail to take notice of the discovery of the rôle of the ductless or endocrinal glands, such as thyroid, supra-renals and pituitary in the body of vertebrates. (*See* ENDOCRINOLOGY; PHYSIOLOGY.) As shown by Bayliss, Starling, Shafer and others, these endocrine glands produce stimulating hormones and soothing chalones which are distributed throughout the body by the blood and exert specific influences on particular parts, now activating and again inhibiting. These chemical messengers are like keys that open certain doors and close others, and they exert a regulative action on many of the functions of the body, securing their orchestration or correlation. To nervous and other forms of integration has now to be added this chemical integration, and it is hardly too much to say that the discovery has changed the whole face of physiology. Biologically regarded, the hormones, such as adrenalin and thyroxin, enable the biologist to understand not only everyday events such as the cat's hair standing on end before the intruding dog, but the changes that come about in adolescence when hormones from the reproductive organs saturate throughout the body, and activate the growth of the stag's antlers, the swelling of the frog's first finger, and scores of other adolescent novelties.

Of fundamental importance also is the part that hormones play in the processes of development, in quickening and slowing rates of growth, and in securing the proportions of different parts. Unhealthy dwarfs and giants are expressions of disturbance in the normal activity of the endocrine glands. The discovery of hormones among backboneless animals and in plants has begun. Thus there is a hormone in the leech, and it seems to have been satisfactorily proved that diffusing hormones are operative in the striking movements of the Sensitive Plant. In reference to man there is no doubt as to the pervasive influence of the endocrine glands on the health of the mind and body, but there has been a tendency to exaggerate this. In pathological cases, no doubt, a disturbance of hormone-production, in a plus or minus direction, may be disastrous, but the inborn variations in the majority of cases are within relatively narrow limits, and can be in some measure counteracted by nurture. It must be kept in mind that there are other not less important factors in the normal inheritance—the nimble brain, the strong heart, the active liver, not to speak of goodwill and power of control. Biologically, as well as psychologically, it seems to be an unwarranted exaggeration to speak of the ductless glands dominating and determining the personality, except, as we have said, in extreme pathological cases.

Pigmentation.—(10) Some important work has been done of recent years on rapid colour-change in animals (*see* COLOUR OF ANIMALS), and a convenient balance-sheet of investigation is to be found in Dr. L. T. Hogben's *Pigmentary Effector System* (1924). The contraction or expansion of the chromatophores in a frog's skin used to be referred to the control exercised by the fine branches of the sympathetic nervous system, but the researches of Hogben and Winton have shown that the control is due to a hormone secreted by the pituitary body in fluctuating quantities. In reptiles like the chameleon and the Phrynosome, most of the colour-change is due to the up-and-down movement of the dark pigment granules in the branched melanophores, and this is mainly under the control of the adrenalin hormone secreted by the supra-renal bodies. In flat-fishes, such as plaice and flounder, where the colour-change is very rapid, the control is effected by branches of the sympathetic nervous system. There is sometimes an enveloping of the pigment-cell with fine terminal branches of nerve-fibres, an innervation which has never been demonstrated in amphibians. It is striking, then, that in three classes of vertebrates, the predominant control of the colour-change is effected in three different ways, though the possibility is not excluded that there are auxiliary controls besides. The impression of variety would be increased if invertebrate types, such as crustaceans and cuttlefishes, were also considered, and no one can doubt that this is a very promising line of biological research with far-reaching implications.

Metabolic Gradients.—(11) One of the most suggestive of new biological ideas is Prof. C. M. Child's hypothesis of "metabolic gradients," but in brief compass it is not easy to do more than give a glimpse of it. In the simple planarian worms that are common in brooks, creeping on stones and water-weed, there is a frequent asexual multiplication by transverse fission. At a certain distance behind the head a transverse constriction appears, but there is no structural peculiarity to mark the place. Eventually the tail-end is separated off and grows a new head; the original head-end develops a new tail; and after a period of growth the process repeats itself. In his profound study of the planarian worm, Prof. Child found that its maximum rate of chemical change or metabolism, measured for instance by the output of carbon dioxide, occurs in the head-region; it gradually falls off posteriorly; but the curve rises again to a lower peak far down the body and then falls again to the tip of the tail. Now the site of the second, smaller peak is the place where the transverse constriction will occur, and where the future head-end of the coming offspring will be formed. The head-end seems to exert a graduated sway or control over the body and when this wanes to a minimum, a hitherto somewhat suppressed individuality may assert itself. In a similar way the growing point of a shoot exerts a control on the buds beneath it, which are not activated until the apex has been carried by growth to a certain distance. The structure of the body is the equipoised result of many controls, both quickening and restraining.

Biology and Psychology.—Many will disagree, but psychology may be conveniently described as primarily the study of the subjective aspects of the organism. As some of these are correlated objectively with behaviour and, in man's case, with conduct as well, a contact with biology is obvious. For the ecologist is also concerned with animal behaviour, though in a synthetic rather than in an analytic way. He is not so much interested in the inner activity of the animal as in the objective outcome (*e.g.*, in courtship, nesting, nurture, co-operating, competing) and its rôle in securing the continuance and advancement of life. But the ecologist is bound to join hands with the comparative psychologist.

Another contact between the two sciences is implied in the unity of the organism. Whatever view be taken of the relation of "mind" and "body," there is no doubt that these two abstract terms refer to aspects of the organism which are equally real and cannot be studied in complete isolation from one another. There may be mental processes which can be adequately described in psychological terms without any reference to the body, and there may be bodily processes which can be adequately described in physiological terms without any reference to the mind, but between these two limits or extremes there is a large stretch of behaviour which requires dual treatment. In dealing with the activities of plants the botanist does not find any need to postulate a subjective aspect, though he might not be bold enough to deny its possibility; but many naturalists who study the ways of birds find an apsychic description quite inadequate.

The Inclined Plane of Animal Behaviour.—Among unicellular animals there are numerous reactions to stimuli, and some of these are hereditary like Paramecium's reversal of cilia, retreat, change of direction, and re-advance; a simple concatenation that often enables the creature to circumvent some obstruction or injurious stimulus. In Stentor and other forms there is clear evidence of a "trial and error" procedure of a simple sort. To a microscopic shower of dust the animal responded by reversing its cilia, by bending to one side, by contracting into its sheath, and finally by loosening itself and swimming away. In Prof. H. S. Jennings' case of an amoeba pursuing a smaller amoeba, capturing it, losing it, recapturing it after change of direction, and finally losing it again, there seems to be evidence of purposive behaviour at a low level. Some of Heron Allen's cases of foraminifera that build up beautiful and effective extrinsic encasements, of sponge spicules and the like, are, to say the least, very suggestive of mentality.

In regard to multicellular animals the facts are more abundant. There are many simple reflex actions which depend on inborn linkages of certain nerve-cells and certain muscle-cells, usually involving four links:—(1) sensory neurons, (2) adjustor or associative neurons, (3) motor neurons, and (4) the effector muscle-cells. But even here there is an inclined plane, for in sponges there is neuro-muscular reaction, although there are no nerve cells; in hydra there are nerve-cells at once sensory and motor; in the earth-worm and even in man there may be simple reflexes that do not involve more than sensory and motor neurons; and then in the opposite direction there is an evolution of compound reflexes, as when nestlings react to the parent-bird bringing them food.

Experimental Behaviour.—On a different line is what may be called tentative or experimental behaviour—the search for food, the exploring of a corner, the behaviour of a brainless starfish in attacking and disarming an equally brainless, but very formidable, sea-urchin. This is far below the level of intelligent behaviour in the ordinary sense. In the early life of many animals, especially birds and mammals, there is a period of association-forming, as when a chick learns to connect a particular maternal cluck with a rapid seeking for shelter, a linkage that is inborn or instinctive in some other creatures. The forming of useful associations leads on to more difficult achievements in the way of non-intelligent learning. Thus even a frog will "learn" to find its way out of a maze and a rat may become very expert after a short course of lessons. There is certainly a profiting by experience, though it seems too generous to credit the animals with judgment.

Tropisms.—Of great importance and of widespread occurrence are "tropisms," which are engrained constitutional obligations to adjust the body so that the two sides—it may be the two eyes, ears, or nostrils—are equally stimulated. In this way a physiological equilibrium is automatically secured. Thus the young eel or elver goes straight up-stream, the male mosquito finds the buzzing female, and the moth flies into the unnatural stimulus of the candle. Somewhat higher is the persistent way in which newly hatched loggerhead turtles make for the more open horizon, as Prof. G. H. Parker has shown, which usually and happily means finding the sea.

Instinctive Behaviour.—On the same line of hereditarily pre-established reflexes are the various grades of instinctive behaviour, the purest expression being found in ants, bees and wasps. Physiologically regarded, they are concatenations of reflex actions, but in many cases, at least, it seems necessary to suppose that they are suffused with awareness and backed by endeavour. To say that this endeavour is nothing more than the physiological urge of hunger or of sex seems inadequate when the subtler instances of instinctive behaviour are kept in view.

The Hive-bee.—A glimpse of the subtlety of animal behaviour in its lower reaches is afforded by Prof. K. von Frisch's careful studies of hive-bees in connection with their discovery of nectar. It is well known that when a bee discovers a rich treasure of nectariferous blossom and returns laden to the hive, the flowers are soon afterwards visited by considerable numbers of bees whose comings and goings continue until the supply is exhausted. The old theory was that the original bee-discoverer guides her comrades to the feast. But this is not what happens. Frisch found that when a bee (carefully marked) returns full of nectar to the hive, she executes a peculiar " round dance " on the comb. This excites the resting bystanders who issue forth to search for themselves. But they are not without a clue, for they have sampled the floral fragrance lingering on the discoverer's body, and they search for flowers with that particular scent. If the nectariferous flower has no scent, a clue is afforded by the body-scent which the discoverer-bee leaves on the blossom. Bees have on their posterior body a protrusible glandular organ which secretes a scent recognisable even by man, and when an exploring bee finds a very profitable flower she excitedly protrudes the scent-organ, and thus sprays the petals with a scent which gives the other searching bees a clue. When supplies are exhausted, the returning bees execute no dance, and no fresh explorers issue forth. All this has been worked out with convincing care, and it is also shown that when the bees are collecting pollen, with a specific fragrance which helps in the search, there is again a dance on the comb that tells the tale, though it is quite different from the nectar-dance.

Intelligent Behaviour.—In sharp contrast to instinctive behaviour, in the view of many biologists, is intelligent behaviour, where there is some learning, some profiting by experience, some understanding of a situation, some appreciation of relations so that a slight change of circumstances does not lead to bewilderment, as in instinct, but is met by a fresh adjustment. To use Romanes' terminology, intelligent behaviour is psychologically dependent on a " perceptual inference." Thus, to take some recent instances, a chimpanzee will piece together two bamboo rods so that they make a double stick long enough to reach a fruit outside the bars of the cage; or an orang having discovered how to use a wooden lever will proceed to make and use others of different sizes and strengths, and will even use its trapeze bar to enlarge the space between the first upright of its cage and the iron partition wall so that the opening becomes large enough to allow of the gratification of a long-cherished desire to look into the next compartment. The recent studies on chimpanzees by Dr. Yerkes and Mrs. Learned, and even more those by Prof. Köhler, show conclusively that the intelligence of apes (*see* Intelligence, Animal) though strikingly limited in certain directions, has been hitherto underestimated. When the doings of these predominantly intelligent animals are compared with the highest achievements of ants and bees, the contrast corroborates Sir Ray Lankester's view that " the little brain type " rich in instincts and far from educable, is on a line of evolution quite different from " the big brain type," with few instincts in the strict sense, but eminently educable. In many cases, however, as in birds, there may be an intricate mingling of intelligent and instinctive behaviour in varying proportions.

Development of the Brain.—Of great biological interest is the cerebral series worked out by Prof. Elliot Smith showing the graduated improvement in the anterior region of the fore-brain in jumping shrew, tree-shrew, spectral tarsier, marmoset, monkey, ape and man. The demands of arboreal life favoured cerebral variations in the direction of controlled agility, the seeing eye and the understanding ear. There was a reduction of the snout, a bringing forward of the eyes, an enlargement of the brain case. In particular there came about a great reduction of the olfactory region of the fore-brain and a progressive increase of the centres for sight, touch, hearing, and dexterous movements. Soon there was added the power of stereoscopic vision, and the outgrowth of a pre-frontal or neo-pallial lobe of the cerebrum that made delicate eye-movements possible and a focusing of attention as well as vision. There is anatomical evidence of an evolutionary trend which gave increased scope to the centres for vision, hearing, touch and skilled movements. It has been part of the tactics of evolution among the highest mammals to reward improved visualisation (*see* Man, Evolution of).

The Inclined Plane.—Much has to be done in analysing the various grades of behaviour, but biology has contributed to comparative psychology a wealth of observational data which suggest the idea of a long inclined plane, on which there are diverse evolutionary lines variously ramified, rather than any linear succession. But another general conclusion may be drawn, that there are two main modes of behaviour: (*a*) the expression of enregistered capacities for effective response, as in reflexes, tropisms, constitutional rhythms, instincts and habituations; and (*b*) the expression of a capacity for initiative, tentatives and experimenting, as in " trial and error " procedure, non-intelligent new departures, experiential and associative " learning," and clear-cut intelligence. Of reason in the strict sense, involving what Romanes called " conceptual inference," and of conduct, involving the control of behaviour in the light of general ideas, the only convincing illustrations are human.

Definition of Instinct.—The largest contribution that biology has to make to psychology is this disclosure of the inclined plane of animal behaviour, which implies, of course, applications to man, who has his reflexes and urges, his intelligent experiments and his habituations. It is to be regretted, however, that many psychologists used the terms " instinct " and " instinctive " very vaguely when discussing human behaviour and conduct. The term " instinctive " has been defined in a thoroughly clear way by Prof. Lloyd Morgan and most modern zoologists use it in his sense. Confusion has arisen through the psychologists' loose application of the term to a medley of promptings—urges, appetites, inborn reaction-tendencies, racial pre-dispositions, and so forth. Here it may be said that biological studies on what Galton called " ancestral inheritance " have thrown a useful light on the racial enregistrations which form part of the " Primary " (as distinguished from the " Freudian ") Unconscious.

Dominance of Mind.—The study of animal behaviour in its many gradations brings into prominence two great facts, (1) the increasing emergence of the mental aspect of organisms in the course of the age-long process of Becoming (*see* Evolution), and (2) the increasing importance of the mental factor as a *vera causa* in organic evolution (see E. S. Russell, *The Study of Living Things*, 1924). Indeed one of the largest results of Biology is the evidence it has brought forward of the increasing dominance of the mind in evolution. Through many grades of animal individuality there has been an advance towards human personality.

Biology and Sociology.—The three sides of the biologist's prism are Organism, Function, and Environment, and they are obviously the same as the sociologist's Folk, Work, Place—Le Play's Famille, Travail, Lieu. In scientific discussion and in practical endeavours there is often a loss of time and energy because the three complementary aspects are not kept equally in view. As the unit in sociology is not the individual, but some societary integrate, the old misleading analogy between the animal organism and the " social organism " should be abandoned. The true analogy is between animal societies and human societies, and this has been utilised far too little. In the ant-hill, the bee-hive, the termitary, the rookery, the beaver-village, the herd of antelopes, and so on, there are valuable hints for the sociologist; and Dr. W. Trotter's *Instincts of the Herd* (1919) requires a sequel. That may be found indeed in *Tier-Soziologie* (Leipzig, 1925) by Prof. F. Alverdes.

Tradition and Human Society.—In this incipient, comparative sociology, the interesting parallelisms must not be allowed to weaken the emphasis on the differentia between Wild Nature and Man. For in human societies there is not only the uniqueness implied in man's reason and language, there is the maintenance of an extra-organismal heritage which may be as supreme as the germ-plasmic or Natural Inheritance is fundamental. In traditions and customs, institutions and laws, literature and art, permanent products and external registrations, there is a persistent social heritage, or, from another point of view, environment, which is only adumbrated in the ant-hill and the beaver village. Moreover, there is great apartness implied in man's consciousness of his own history and in his occasional but characteristic endeavours to control the future in the light of general ideas. It is mistaken to suppose that animals may not actively share in their own evolution, but it is obvious that they cannot do so with man's clear purpose.

Biological Applications.—Just as chemistry and physics have their applications in biology, so has biology its application in sociology, as is plain when we think of such facts as health and disease, variation and heredity, fertility and length of life. But it is unscientific to try to force social phenomena into biological frames, and to make things that are very different appear, by analogous terminology, as if they were the same. Thus there arises a biological section of sociology concerned with such problems as the relation of individuation and reproduction (see Spencer's *Principles of Biology*, 1895), the import of inbreeding and outbreeding (see East and Jones), the transmissibility of acquired characteristics and the complementariness of hereditary "Nature" and environmental "Nurture" (see Galton and Pearson). More distinctively sociological, and yet with its hand on biology, is an inquiry into the differential significance of a societary unit, for instance in allowing the survival of individual variations and modifications which could not persist without some such shield. What, in other words, is meant by social variations, social heredity, social selection and the like. Just as it is an illegitimate "materialism" to force the facts of organismal life into the frames of chemistry and physics, so it is an illegitimate "biologism" to force the facts of human social life into the frames of pure biology.

Biotechnics.—This term, proposed by Prof. Patrick Geddes, may be usefully applied to man's control of organisms for his own ends. Thus the domestication of animals and the cultivation of plants are pre-historic instances, and though few important additions have been made to either list within recent times, there has been much progress in breeding, especially since the Mendelian clue was discovered. The production of astonishing egg-layers among poultry or of the Marquis or Garnet wheat among cereals may be cited as two examples out of a hundred. This art of breeding may aim at establishing subtle qualities, such as wheat immune to the disease of "rust," or collie-dogs that are almost rational in their handling of sheep.

Applications of Biotechnics.—What is sought after is often a more economical or more permanent exploitation of the resources of nature, as in the fishing industry and in farming, as well as in minor matters such as bee-keeping and ostrich rearing. Some of the improvements of most promise rest on a biological understanding of the facts of the case. To the interesting problems of forestry (*see* FORESTRY), which are of so much importance from the occupational as well as from the economic side, the methods of genetics and ecology are beginning to be applied. On a similar line one may refer to what Prof. Oliver and others have done towards the utilisation of waste places, like sandy heaths, pit-heads and salt marshes; or to Prof. Bottomley's experiments on the utilisation of peat; or to Prof. Scott Elliot's study of the ways of checking the spread of bracken, which is annually encroaching very seriously on pasture land.

The Balance of Nature.—Man's struggle with his animal enemies, which was doubtless of incalculable importance, in the early days of his ascent, has succeeded so far that in regard to the larger forms the danger now is that he push his victory too far. Even in regard to snakes, which still bite man's heel, there is a tax to pay for their elimination, namely the increased multiplication of rats and mice and other small rodents. There is reason to hope that a clearer realisation of Darwin's central ecological idea of the web of life (the multiplicity of vital interrelations in Animate Nature) is lending greater subtlety to man's attempts to check those organisms that are prejudicial to his interests and to foster those that are in his favour. Thus golden eagles are no longer shot at sight as they once were, and, apart from aesthetic and other reasons, birds are being spared because of the beneficent part that many of them play in keeping down injurious insects, the unchecked increase of which would in a few years bring everything to destruction. A respect for the Balance of Nature rests on the soundest biological foundations.

Preventive Medicine.—A recognition of bionomical linkages has reaped a rich reward in connection with human parasites (*see* MALARIA; PARASITOLOGY). Thus the conquest of malaria in many places has depended on pouring a little petrol on the stagnant pools where the larval mosquitoes live. The film of oil makes it impossible for the larvae to hold on to the surface by their posterior respiratory tube, and they drown. But the distribution of the malaria organism (Plasmodium) depends on the vagaries of the adult mosquito, and thus the petrol method works wonders. When account is taken of the importance of malaria in human history, the value of biotechnics receives signal confirmation. The same holds in regard to many other diseases.

Further Examples.—One would not seek to put to the credit of applied biology what clearly belongs to preventive medicine, yet in many cases the latter has been effectively supplemented by the former. Thus while it is a medical discovery that carbon tetrachloride is extraordinarily potent in expelling from man's food-canal the small threadworms (ankylostomum and necator) which cause one of the commonest and most serious diseases of tropical countries (*see* HOOKWORM), it is a question for natural history how the larvae of the hookworms behave in the soil, and how the natives become cutaneously infected by walking with bare feet on ground that has become hopelessly contaminated. Now these hookworms, which suck blood from the wall of the intestine, are responsible for widespread weakness, depression and despair, forming, according to some authorities, the heaviest pathological cloud that has ever rested on the human race. The campaigns undertaken by the Rockefeller Institute have shown conclusively that this cloud may be dissipated in a relatively short time, and health secured as long as simple sanitary precautions are respected. Part of this triumph may be fairly placed to the credit of biotechnics.

The same may be said in regard to our knowledge of the part that many insects and some Acarines (mites and ticks) play as the carriers of microbic diseases. Thus in addition to the case of mosquitoes and malaria already referred to, one may recall the tsetse flies which carry the micro-organisms (Trypanosomes) of sleeping sickness, and the fleas that spread the bacterium of Bubonic Plague from rat to man. Many of these knots in the web of life are of great importance, a signal instance being the part a minute mite plays, according to Rennie and White, in bringing about "Isle of Wight" disease in bees.

Eugenics, Eutechnics and Eutopias.—There is a growing inclination to bring biological facts and ideas to bear on three of the great *objective* human problems, the betterment of the stock (*see* EUGENICS), the amelioration of occupational conditions (Eutechnics), (*see* INDUSTRIAL PSYCHOLOGY; INDUSTRIAL WELFARE) and the improvement of the environment (Eutopias). Even the conviction that these three aspects must be correlated is a biological commonplace of the first magnitude. Much that is being done to lessen occupational diseases (many of them already conquered) is frankly to the credit of medicine, but the biological note is sounded in the investigation of industrial fatigue and in the study of economy of movement. It may be said that modern dietetics has passed from a basis of experience to a basis of experiment, and has become subtly biological. Or again, while the value of exercise in the open air and sunlight has been recognised, as a pious opinion at least, for ages, it has now acquired a quite new biological authorisation (*see* HELIOTHERAPY; PUBLIC HEALTH). Similarly, very much that is being done to make surroundings more wholesome and more beautiful is not directly actuated by biological considerations, yet there is no doubt that endeavours in this direction are being invigourated by what is biologically known in regard to the influence of the environment on the individual organism especially in its early life. The Proteus newt of the Dalmatian caves has a pigmentless skin in its native haunts, but it soon becomes dark when brought into the well-lighted laboratory. In the caves it is blind, and the arrested eye never comes to the surface; but the young ones reared in the light may receive their sight.

Eugenics.—Eugenics was defined by Sir Francis Galton as "the study of agencies under social control that may improve or impair the racial qualities of future generations, either physically or mentally." The theoretical soundness of the study is obvious. The difficulty is in regard to practicable eugenics. Thus, whether sound or unsound biologically, it is socially impracticable to return to "the purgation of the state" which Sparta to some extent practised and Plato approved. It might be a kindness that weakly infants, whose life must be more or less miserable, should be allowed a euthanasia, but it has to be admitted that many weaklings have been makers and shakers of the world, that eliminative methods are apt to outrun our present secure knowledge, that their operation would in some instances remove the results of evil without touching the causes, and that we cannot at present go far in social surgery without outraging social sentiment.

As regards positive eugenics, it may be suggested that greater enthusiasm for health and a heightened biological patriotism will lead (1) to more careful selection of partners in life, (2) to well-considered forms of social selection that will favour the increase of the fitter types and the decrease of the undesirables, (3) to a more conscientious "criticism of consumption" which will favour occupations that are wholesome and handicap the reverse, and (4) to an enlightened and moralised practice of medically authorised methods of birth control (*q.v.*) that will probably tend to raise the health-rate. The probability is that a diffusion of biological education will steadily work towards the eugenic ideal, which is, after all, one of the oldest man has cherished.

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(J. A. T.)

BIPLANE: *see* AEROPLANE.

BIRDS, MIGRATION OF.—No longer do dwellers in Great Britain believe that the cuckoo spends the winter with them in the guise of a hawk, and that the swallow tribe seek refuge in horse ponds, or holes in sand pits and cliffs, till the winter is past and the summer is at hand. It is now a matter of common knowledge that they leave, when the summer is spent, for the more congenial climes of Africa and return in the spring.

But the movement embraces a large number of species unrecognised by the world at large, and there is an autumn movement which is unsuspected by the uninitiated. With the spring come the cuckoo, the swallows, the swifts, the warbler tribe, wagtails and wheatears, the red-backed shrike and many others. In the autumn, as these leave, come the redwing, fieldfare, snow-bunting, shore-lark, woodcock, shorteared owls and yet others. They leave with the advent of spring.

Results of Observation.—To explain these seasonal changes many theories have been advanced. For the most part they rest on a postulated instinct, engendered by conditions imposed by the glacial period, ages ago. When observation is substituted for mere guesswork some pertinent facts present themselves. In the first place migration is possible only to such species as can find food wherever they go. The hornbill and the toucan, the bird-of-paradise and the peacock cannot migrate, because they have become adjusted to a food supply having a relatively restricted distribution. Should famine overtake them they must as certainly die if they fare forth in search of food as if they stayed in the stricken area. Hence, such species are relatively limited in regard to their individual numbers. Chimney-swallows and sedge-warblers vastly outnumber hornbills or birds-of-paradise, for example.

Since the insectivorous and carnivorous species can count on an almost universal source of food, the impression is gained that migration is purely a matter of food supply; that the cuckoo, the swallows and the warblers must, perforce, leave in the autumn because flies and caterpillars are hard to come by in the winter.

This simple explanation, however, is demonstrably untenable. We are misled by concentrating too much on the insectivorous species. Every autumn the home-bred thrushes and woodcocks leave Britain and their places are presently filled by other thrushes—redwings and fieldfares—and woodcock, which come from more northern regions to escape the rigours of their native land. Evidently, then, our thrushes do not leave because the British Islands are no place for thrushes in the winter.

Again, if these movements were simply conditioned by the food supply why should the swallows, warblers and other spring migrants leave the genial climes of Africa to pass the summer in Britain? The journey is full of perils, many fall by the way and many perish on arrival from a sudden return of wintry weather. Further, as the native-bred birds are returning, those that came in the autumn leave for their breeding grounds in Northern Europe; they leave, in short, just when food is growing more plentiful.

The Real Reason.—A careful survey of the phenomena of bird migration seems to show that the primary cause of these movements is not the need of finding food so much as an optimum temperature for the offspring. That this is the key to the problem seems to be shown by the fact that during any spell of really hot weather the native birds, whether incubating in a sun-baked hedgerow, a shadeless heath or a ledge of rock 200 ft. above the sea, all alike show signs of evident distress, sitting with open mouths apparently panting for breath. With the advent of the young the same distress is seen; the fledglings sometimes hang over the edge of the nest exhausted by the heat.

Such facts show that had these birds remained in their African winter quarters they would have reared no young. And similarly, if the redwing and fieldfare had not left in the spring, they too would have met with a like disaster. These birds, in short, have each and all become tempered, or adjusted, by natural selection to certain more or less definite ranges of temperature, a general average of heat and cold, beyond which they cannot range with impunity. If this interpretation is correct, then it would seem that these migrants must, at some remote past, have been forced out from an area where they were resident the year round, as are so many native birds.

Need for Migration.—The necessity for migration came about as these species, increasing in numbers beyond the limits of their food supply, were forced, in each succeeding generation, farther and farther from the ancestral centre. Let us suppose this to have been true of the swallows, originally of African origin. There came a time when those which had been forced northward found themselves in a temperate climate, where the winter was uncongenial. They would be driven back towards their ancient centre of dispersal; but now they could no longer stand the summer temperature of their winter quarters, and as a consequence would be forced to return to the land of their birth. Since it is the custom, for obvious reasons, for the adults to drive their young away as soon as they can fend for themselves, the birds hatched last year, returning to their birth-place, will find their prospective breeding sites occupied by their parents. Hence they would be forced still farther northward. Thus is the range of a species gradually extended. Thus it has come about that the migratory species are vastly more numerous in individuals than resident species.

Migratory species become as much "local-races" as the resident species. The pair of swallows which reared their broods in a barn in Ripley, Surrey, in 1925, will, if both survive, return to that village, and to that nest for the same purpose. But for this wonderful homing instinct, disaster would overtake the species. As the migrating hosts set out on their migration to their native land, which is their birth place, they spread, as it were, fanwise, each to his appointed place. Thus they spread evenly. But for this, vast hordes might elect to stay in one small area, anywhere on their route, when disaster would inevitably follow. The males, as a rule, are the first to arrive for on them falls the necessity of seizing upon a breeding territory, which is held at all costs against rivals, perhaps their own offspring. The females follow about a week later, and pair up as they meet with the successful males.

The Sense of Direction.—Finally, there is one aspect of migration for which no satisfactory interpretation is yet forthcoming. With some species, as with the common cuckoo, the adults leave for their winter quarters some considerable time in advance of their young. How then do these find their way? We can only postulate some subtle sense of direction, inherited from their parents, which, earlier in the year, made their way unaided from Africa, that land of plenty and genial warmth, whither they had gone to escape the rigours of the winter months in the north. So long as it was assumed that migration was merely a matter of food supply, the appeal to "inherited habit," forced on the migrating hosts by the severities of the last glacial epoch, had a certain superficial plausibility. But since this glacial grip of the land lasted several thousands of years, it becomes untenable as a serious solution of this problem.

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(W. P. Py.)

United States.—During recent years, the migrations of North American birds have been the subject of much intensive study. Spring and autumn routes, as well as the territory in which the winter is spent, are now well known for most species, the principal lanes of flight following the valleys of the great rivers, such as the Mississippi and the Hudson, as well as the sea coasts.

There are three main routes by which birds pass from the United States into the countries to the south. The most obvious one leads through the mainland of Mexico, directly into Central America. The second uses northwestern Florida as a jumping-off place, followed by a flight directly across the Gulf of Mexico to Yucatan. The third takes the travellers down through the peninsula of Florida, thence across the Caribbean Sea to South America, with resting places in Cuba, Jamaica and other islands of the West Indies. Closely related species, probably because of inherited habit, may use widely different routes, and a few, such as the redstart, use all of them. In most cases, however, the line is closely restricted.

In general, the direction followed in the southward and autumnal flight is used for the return in spring. However, there are some striking exceptions, which serve to increase our wonder at the ability of the birds to find their way. The much-quoted case of the golden plover will serve as an example. Those that nest near the Arctic Ocean, gather in Labrador in July. Here they acquire a considerable reserve of fat and finally cross to Nova Scotia. Thence, they strike out over the sea, directly for the northern coast of South America, more than 2,000 m. away. If fair weather prevails, they seem to make no stop until the goal is reached, though fogs or head winds may drive them ashore. The winter is passed in Argentina. On the return journey to their northern nesting grounds, some 8,000 m. distant, the birds follow an entirely different course, through Central America and up the Mississippi Valley. The problem of the origin of migration routes is a difficult one at best, and such cases as this have so far baffled solution.

Probably the most important recent contribution to the study of migration, is the development of bird banding. Light aluminium rings, bearing a serial number and a return address, are placed on the legs of young birds in the nest, or on those of adults, which are trapped and released. This work, at first carried on by scattered individuals, has now been taken over by the Bureau of Biological Survey, at Washington. With the help of interested naturalists, in all sections of the country, some thousands of birds are marked yearly. Out of this total, many returns are made to the central office, and from the mass of data gathered in this manner, much valuable information concerning migration routes is being obtained. (L. S. C.)

BIRDWOOD, SIR GEORGE CHRISTOPHER MOLESWORTH (1832–1917), Anglo-Indian writer (*see* 3.979), died at Ealing, London, June 28 1917.

BIRDWOOD, SIR WILLIAM RIDDELL (1865–), British general, was born Sept. 13 1865. He joined the 12th Lancers in 1885 and was in the following year transferred to the Indian Staff Corps, joining the cavalry. After service in several frontier expeditions, and in the South African War (1899–1902), he was closely associated for several years with Lord Kitchener in India, acting as his military secretary. Lord Kitchener, in Dec. 1914, selected him for the command of the Australasian forces which were being assembled in Egypt, and in the following April he commanded this army corps in the memorable landing at Anzac. He was in charge of the troops clinging to this patch of the Gallipoli Peninsula until Aug., and his personality won the confidence and regard of these Australasian troops in a unique degree. Birdwood carried out the masterly withdrawal of the Dardanelles forces from their dangerous positions in the following December and January. After a short period in Egypt he took his Australasian troops to the Western Front, where they played an important part in the last phases of the British advance in the autumn. For his services he was made a baronet, besides receiving a grant of £10,000. He paid a visit to the Antipodes a year after the War. In 1920 he took up command of the northern army in India, and in 1925 was promoted field-marshal and appointed commander-in-chief in India.

BIRKENHEAD, England (*see* 3.982), with an area of 3,909 ac. and a population of 145,952 in 1921, is a thriving city, which has increased largely in importance during and since the World War. It has now a great trade in cattle, coal and grain, and numbers of warehouses and works have been built. Birkenhead is one of the chief meat markets of the empire, and (with Wallasey) the largest milling centre in Europe. The biggest cattle market in Great Britain is held at the Mersey Cattle Wharf, and there is a special landing stage for cattle. A clock tower, a memorial to King Edward VII., was unveiled in 1912, and a war memorial cenotaph in Hamilton Square in 1925. An art gallery and museum was opened in 1912.

In 1923 the docks covered an area of 170 ac., and improvements were being considered. A new deepwater entrance has been built and a passage made to Bidston Moor, so that this undeveloped land may be made a manufacturing centre. Birkenhead is also a large shipbuilding centre; the yards, which cover over 100 ac., had a very large output during the World War. A water undertaking, begun in 1911 and involving the construction of a reservoir three miles long at Alwen in Wales, was completed in 1921; the corporation became the sole water authority for the borough in 1925.

BIRKENHEAD, FREDERICK EDWIN SMITH, 1ST EARL OF (1872–), British politician and lawyer, was born at Birkenhead July 12 1872. Educated at Birkenhead Grammar School and Wadham College, Oxford, where he was a scholar, he took a first-class degree and in 1894 was President of the Union. As an undergraduate he impressed his contemporaries by his force of character, oratorical power and mordant wit. He won the Vinerian law scholarship in 1896, and secured a fellowship at Merton College. He lectured both at Merton and Oriel, and became a university extension lecturer in modern history.

Choosing the law as a career, Mr. Smith was called to the bar at Gray's Inn in 1899. Skilfully gathering round him his old connections in the north of England, he attached himself to the local bar at Liverpool, where his natural abilities swiftly gained him a considerable practice. Audacious intrepidity was his main characteristic as a youthful pleader. Following his Oxford tradition as a Conservative, he was adopted as candidate for the Walton Division of Liverpool and made a speech at a public meeting which greatly impressed Joseph Chamberlain. Elected M.P. for Walton in 1906, he held that seat until raised to the Lord Chancellorship in 1919. He signalised his entry into the House of Commons by delivering, from the broken ranks of the Opposition, a maiden speech of brilliant mockery which made his reputation.

A rapidly growing practice at the London bar, where he took silk in 1908, hindered him from pursuing the regular routine of Parliamentary opposition. The achievement that brought him prominently before the public as a barrister was his success in an action brought in 1908 by Lever Bros. against *The Daily Mail* for describing that company as a "Soap Trust." He also appeared for Miss Le Neve in the Crippen case and against Lord Alfred Douglas in a case arising from the disputes about Oscar Wilde. His forensic style differed from his method of public oratory. He inclined to be quiet, dispassionate and deadly in cross-examination. A tremendous worker at the bar, he undertook tasks which would have overwhelmed most men in combining his legal and political careers.

His chief political strength lay in captivating and mastering mass audiences. After the retirement of Chamberlain popular Conservatism found in him its most telling exponent, and in the art of the platform even Lloyd George had to reckon with him. The qualities which won his early success also made him enemies, not always in the rival political fold. He brushed opposition or prejudice brusquely aside, and he never restrained his wit from playing over any object it fancied. At the same time he was much loved by his intimate friends and subordinates, to whose feelings and interests he always gave marked consideration.

Mr. Smith took a prominent part in the struggle over the Parliament bill. He moved its rejection on the third reading, May 1911, and threw in his lot with the Die-hards, who desired the peers to reject the measure. His growing position was recognised by a Privy Councillorship in 1911 and he became an accepted member of the Conservative "shadow" Cabinet. The Irish question was now becoming acute and Mr. Smith was Sir Edward Carson's principal lieutenant in the resistance organised in Ulster.

The War of 1914–8 closed the original Irish controversy. He accepted the task of controlling the Press Bureau, went to France as eye-witness with the Indian corps, and did valuable work in the administration of army law. He was recalled from France to become solicitor-general in the first Coalition of 1915, and succeeded Sir Edward Carson as attorney-general in Nov. of that year. In this year he was knighted. The Defence of the Realm Act threw on the law officers of the Crown a great burden of anxious work including the prosecution of Sir Roger Casement for high treason. As attorney-general Sir F. E. Smith's most important success was the case in which he succeeded in getting the rights to the unoccupied land of Rhodesia reserved to the Crown instead of passing to the British South African Company.

When Lloyd George reconstructed his Ministry after the election of 1918, the attorney-general was offered the Lord Chancellorship, and was raised to the peerage as Viscount Birkenhead in 1919. The appointment, though quite in the normal order of promotion, was subjected to considerable criticism, partly owing to the new Chancellor's comparative youth, but chiefly to his vehement partisanship in earlier years. His chief legislative achievement during his term of office was the Law of Property Act of 1922. This reform, long overdue but perpetually held up by the inertia of the various legal authorities and interests, revolutionised the whole system of holding landed property. Among Lord Birkenhead's most notable judgments were (1) Director of Public Prosecutions *v.* Board, dealing with drunkenness as an excuse for crime; (2) Wakeford *v.* The Bishop of London; (3) The Rhondda Peerage case before the Committee of Privileges, laying down that women could not sit in the Upper House by right of peerage; (4) Admiralty *v.* S.S. "Volute"—a judgment on the law of negligence in collision cases. Of this fourth deliverance Lord Finlay said "I regard the judgment to which I have just listened as a great and permanent contribution to the law on the subject of contributory negligence, and to the science of jurisprudence."

The fall of the Coalition Government of 1922 was brought about by the desire of the rank and file of the Conservative party to regain its independence. Lord Birkenhead and some other Conservative ministers opposed this movement in vain at the Carlton Club meeting. As a consequence he was not included either in the administration of Mr. Bonar Law or in that of Mr. Baldwin, and he assumed an attitude of marked independence. On vacating the Lord Chancellorship he had been made an earl. Mr. Baldwin prudently healed the breach in the Conservative ranks on assuming office again in 1924, and Lord Birkenhead became Secretary of State for India.

Lord Birkenhead, as an Oxford scholar, had a natural taste for letters and his libraries were filled with carefully selected volumes. He himself writes well and profusely. His work on International Law has gone through several editions. He published a collection of Essays on Unionist Policy in 1913, the story of his American visit during the War in 1918, and two volumes of Collected Essays in 1922. The Essay on Lord Salisbury, originally published in *The Times*, is his best historical work and the short sketches of his young friends who died in the War reveal the human side which he always shows to youth. He married in 1901 Margaret Eleanor, daughter of the Rev. Henry Furneaux of Oxford, the editor of *Tacitus*. They have one son (Viscount Furneaux) and two daughters, the ladies Eleanor and Pamela Smith. (M. W.)

BIRMINGHAM, Ala., U.S.A. (*see* 3.983), diversified its industries until, in 1924, its factories were producing 1,640 kinds of articles. Pig-iron and steel remained the basic products. Others of importance were cast iron and clay pipe; wire, nails, steel cars, car wheels, rails, stoves, cotton gins; sugar-mill, coal washing and mining machinery; cement, brick, lumber, cotton-seed oil and meal and fibre; corn meal, meat, cotton goods and chemicals. By 1920 the old beehive coke-ovens had given way to by-product ovens with an annual capacity of 4,500,000 tons of coke, yielding also vast amounts of coal-tar and 17,000,000 ft. daily of by-product gas, which supplied the city mains. Hydroelectric power in ample quantities was already available, and the Muscle Shoals (*q.v.*) development is well within the limits of economical transmission. On Jan. 1 1910 the city's boundaries were extended, incorporating several suburbs, including Ensley, and increasing the area to 49 square miles. The population in 1920 was 178,806, of whom 70,230 were negroes and 6,410 foreign born; in 1925 (census bureau estimate) 205,670. Bessemer, Fairfield (a model industrial city), and other suburbs, which, though politically independent, are an integral part of the economic unit, would increase the population by 60 or 65%.

The commission form of government was adopted in 1911. Transportation facilities were augmented by the construction of the Birmingham Belt, encircling the city and connecting with all of the nine trunk lines; and by the opening (1920) of a terminal at Birmingport, on a branch of the Warrior river, 17 m. from the switching limits of the city, giving access by water to Mobile and other Gulf ports. In 1922 the Board of Education undertook a thorough examination of the school plant and mapped out building programmes to relieve the worst conditions immediately, make adequate provision by 1930, and, after that, provide for the anticipated normal growth of the population up to 1940. By 1924 six new buildings had been completed and four more were under construction. A municipal market house was completed in 1923; a municipal auditorium, seating 6,000, in 1924. The cost of living in Birmingham is relatively high (110·9% of the average for 31 American cities, Dec. 1924). Birmingham-Southern College, created in 1918 by the consolidation of Birmingham College, founded in 1898, and Southern University, founded at Greensboro, Ala., 1859, had a total enrolment for 1925–6 of 2,086, of whom 876 were in the college proper.

BIRMINGHAM, ENGLAND (*see* 3.983), has increased largely in size since 1910. The primary cause of its growth in area was the extension of the municipal boundaries by an Act of Parliament, though manufacturing developments and industrial enterprise before the World War, as well as the influx of munition workers in 1914–8, contributed materially to the increase in population, which had reached 919,444 in 1921, making Birmingham the third largest city in Great Britain. Twelve members have been returned to Parliament since 1918.

The Greater Birmingham scheme became an accomplished fact in 1911, when Aston Manor, Erdington and Handsworth, almost the whole of Norton and Northfield, and the rural district of Yardley were added to the city. King's Norton and Northfield, as parts of Birmingham, ceased to be portions of Worcestershire from the geographical as well as the administrative aspect, and came nominally within the boundary of Warwickshire, as did Handsworth from Staffordshire. The area of the city was increased to 43,537 ac., or about 68 sq. m., and the membership of the city council to 30 aldermen and 90 councillors.

Housing.—In 1918 a policy for dealing with the housing question was formulated, and by 1921 the corporation was in possession of about 1,930 ac. of land for housing purposes. In 1925, 8,279 houses had been built, and provision made for a total number of 21,873. Birmingham was the first large town in England to prepare a comprehensive scheme of town planning. No definite steps to carry it out were possible until the extension of the city in 1911, when 24,000 ac. of undeveloped land in the suburbs were brought under the control of the council. The first scheme authorised referred to Harborne and Quinton, to the west of the city; no factories were provided for in this area, but considerable space was reserved for them in the East Birmingham scheme, where the greater part of the property is already industrial. These schemes were approved in 1913, those for North Yardley and South Birmingham in 1916, and that for Southwest Birmingham after the War. Much work has been done on the widening of roads, and the construction of new arterial routes. A scheme was under consideration in 1926 for improving the canal system between Birmingham and the Mersey, to make it navigable for barges of 100 tons, instead of for those of 30 tons, as at present.

A large number of parks and open spaces have been acquired by gift or purchase. Among the largest are Perry Reservoir, of 95 ac. (1919); Selly Park, of 20 ac. (1910–4); Barr Beacon, of 148 ac. (1919); Pype Hayes Park, Erdington, of 76 ac. (1920); Swanshurst Park, Sparkhill, of 44 ac. (1917–23); King's Norton site, of 25 ac. (1920); Rose Hill, Rednal, of 129 ac. (1920); Staple Hall Farm, Northfield, of 90 ac. (part of which is to be used for housing). An Elizabethan house called the "Golden Lion," was moved from Deritend and re-erected in Cannon Hill Park in 1911. The total area of parks, recreation grounds and open spaces was 2,645 ac. in 1925. The village and estate of Bournville are now managed by a body of trustees.

Improvements.—Considerable improvements were in progress in the central part of the city in 1926, especially in New street and Bull street. An area was being cleared in the neighbourhood of the "Hall of Memory," the Birmingham War Memorial, a circular temple off Broad street, which it is hoped to make the civic centre of the city; a War Memorial Masonic temple is to be built here, and it is hoped in the future to erect further municipal buildings, in addition to those finished on the Colmore estate in 1912, to house the different departments which are still scattered about Birmingham. Picture galleries and a museum of casts were built over the new municipal buildings and connected with the old art gallery by a bridge over Edmund street. The natural history museum was established at the same time. In 1925 it was also decided to reconstruct the interior of the town hall to provide further accommodation.

Ambitious schemes for road widening and improvements of traffic conditions are in hand, notably one for the construction of a north-south road, 80 ft. wide, which will be carried over New street station on a viaduct. New churches include St. Benedict's, Bordesley (1910); St. Basil's, Deritend (1911); St. Germain's, Edgbaston (1917); and a Roman Catholic church in Sparkhill. Birmingham became the seat of a Roman Catholic archbishop in 1911. In 1914–6 a new parcel post-office was built on the site of the old inland revenue office in Paradise street, and the inland revenue transferred to Empire House, Great Charles street. The Repertory Theatre in Station street was built in 1913. "Highbury," Moor Green, formerly the residence of Mr. Joseph Chamberlain, and the adjoining house, the home of Mr. Richard Cadbury, used as orthopaedic hospitals during the War, afterwards reverted to the corporation as gifts. The old children's hospital in Broad street, used for government purposes during the War, was moved to larger premises in Ladywood Road. The Princess Mary Centre for Disabled Soldiers is at Rednal, and a hospital for nervous diseases has been opened at Edgbaston.

After the War the chamber of commerce entered into possession of the Colonnade hotel in New street. The enormous structure erected by the Government on the corporation playing fields at Castle Bromwich, for use in connection with the aerodrome established there during the War, provided in 1921 accommodation for the Birmingham section of the British Industries Fair. Other large buildings erected during the War facilitated the development of local industries. Fort Dunlop is a new suburb, occupied by the makers of rubber goods. The output of shells, fuses, etc., during the War was very large; although the output of shells produced in Birmingham was not a record, the number and variety of articles manufactured for the use of the army, navy and air force was greater than in any other part of the country. The city is now second only to Coventry in the manufacture of motor-cars. (O. J. R. H.)

BIRMINGHAM, UNIVERSITY OF (*see* 3.986).—The wise modern policy of insisting that universities, such as this, should aim at the highest standard in every department has been followed with conspicuous success. The problems of industry are admittedly dependent upon the application of scientific principles and the institution in 1922 of a Dept. of Petroleum Engineering is significant of the importance of this subject. Contact with the active life of commerce and industry is maintained very closely. The Coal Owners' Mining Research Laboratory is now associated with the university. The Asylums Committee of the city is associated with the university on the Joint Board for Research in Mental Diseases. A chair in town planning gives evidence of the interest in important social problems, while the establishment of a Dept. of Legal Studies brings the university into close relationship with the needs of this important profession. Honour schools, including that in geography, have been instituted; new, ampler and more adequate accommodation is being provided; extramural activities are being developed and the interests of the working classes are carefully provided for.

In response to an appeal issued in 1920, over £250,000 was raised, of which approximately half was ear-marked for special purposes. The Treasury grant has been increased and local support augmented. In addition there have been a number of benefactions for various purposes—scholarships, research funds, memorials, for the endowment of chairs, such as that in Italian, in law, in finance, and for special purposes, such as the development of the Dept. of Oil Engineering and the erection of new buildings for the Biological departments. A donation of £100,000 was made by Sir Charles Hyde without restriction.

The number of students at the university is stabilised at about 1,400 to 1,500 for full-time degrees. Economic conditions affect the entry considerably, and with an improvement of trade in the Midland area the entries should increase. It is notable that women out-number men considerably in the faculty of arts.

A much higher proportion of the students have come through ultimately from public elementary schools, particularly those who are in the pure science departments. Sir Oliver Lodge, the distinguished scientist, was principal of the university till 1919, being succeeded by C. Grant Robertson, C.V.O., who came from Oxford.

BIRRELL, AUGUSTINE (1850–), British writer and politician (*see* 3.989), continued to be Chief Secretary for Ireland till the Dublin rebellion of Easter 1916, a period of over nine years. The cattle-driving agitation died down, and Irish politics, save for labour troubles, were comparatively quiet, till the two general elections of 1910 had once again made retention of office by the Liberal leaders dependent on the Irish vote. A third Home Rule bill was now inevitable, and Mr. Birrell spent much of the autumn of 1911 in preparing it. The main conduct of the measure was, however, taken out of his hands in the sessions of 1912, 1913 and 1914, by Mr. Asquith, the Prime Minister.

When resistance was organised in Ulster, when volunteers were enlisted and drilled in the province, and a provincial government constituted, Mr. Birrell adopted the *laissez-faire* attitude which had throughout been the mark of his Irish administration; and he applied the same treatment to the Irish volunteers who were raised in the Sinn Fein and Nationalist interest. With the outbreak of the World War the Home Rule controversy was left in abeyance; and the danger with which Mr. Birrell had to cope came from extremists of the Sinn Fein, Irish-American and Irish Labour parties of whom Casement and Larkin were the apparent leaders. They promoted a strong and largely successful propaganda against enlistment in Ireland, which culminated suddenly in open rebellion at Easter 1916. Immediately after the suppression of the rising, Mr. Birrell resigned; and he left Parliament and political life in 1918. Resuming his literary work, he published in 1920 a life of his father-in-law, the poet Frederick Locker-Lampson; in 1922, *Collected Essays* in 3 vol.; and in 1924 *More Obiter Dicta*. His originality, satire and ripeness put him at the head of English men of letters on the critical side.

BIRTH CONTROL.—Birth control is the popular name for control of conception, the deliberate restriction of births by chemical and mechanical means, instead of by abstention from intercourse. The term was first used by Mrs. Margaret Sanger in *The Woman Rebel* (April 1914).

The use on a large scale of contraceptives is a modern phenomenon. The prosecution in 1877 of Charles Bradlaugh and Annie Besant, for selling, in order to establish freedom of publication, a pamphlet by Dr. Charles Knowlton entitled *The Fruits of Philosophy*, gave enormous publicity to birth control methods, and a Malthusian League, with Dr. Drysdale as president, was immediately established to continue the propaganda in favour of small families. The League started a periodical, and Dr. Drysdale and his wife, Dr. Alice Vickery, devoted their lives to writing and lecturing on the need of spreading the knowledge of contraception, especially among the poorest classes.

They maintained that the two fundamental needs of food and love could be satisfied only through contraception, and that poverty, sex starvation, and promiscuity could only be avoided by early marriage and small families. In 1881, by their assistance, a Dutch Neo-Malthusian League was established followed by similar leagues in Belgium, France, and Germany. In 1921 the League opened a clinic in South London, where a doctor instructs poor mothers in the Mensinga method. In 1922 it held in London the Fifth International Neo-Malthusian Conference. In 1925 it distributed over 500,000 leaflets proposing that the Ministry of Health should allow the welfare centres to give contraceptive instruction if they wished to do so.

Decline in the Birth-Rate.—The results of these and similar efforts, of course in addition to other causes, quickly showed themselves in a declining birth-rate. Before the 18th century there was nearly a population equilibrium. Between 1750 and 1800 the population of England and Wales rose from 6,500,000 to 9,000,000. In the 19th century, influenced by great national prosperity and the development of preventive medicine, the population rose from 9,000,000 to over 32,500,000. This amazing advance reached its height in 1876. Thereafter a decline in the birth-rate set in which still continues. That decline is exhibited in the census returns particularly in the report on the "Fertility of Marriage," vol. 13, 1911. One example may be given: Table 44, which relates only to wives over 45 years of age at the census date, shows that, when necessary allowances are made, children born to 100 couples fell from 738 for marriages entered into between 1851–61, to 632 for those of 1881–6, the latest date to which this particular investigation was made. This shows a decline of over 14%. Later returns show a much greater decline. In 1881, in round figures, 883,600 children were born to 26,000,000 persons, but in 1924 only 729,900 children were born to 38,746,000 persons. Table 42 in the 1911 report also shows the changes in the fertility of each social class from 1851–61 to 1906–11. The effect of the differential decline there recorded is shown as follows:—

	England and Wales, 1911 *Social Class*	*Legitimate Birth-rates in Social Classes per 1,000 married males*
I.	Upper and Middle	119
II.	Intermediate Class (exc. scholars) . .	132
III.	Skilled Workmen	153
IV.	Intermediate Class	158
V.	Unskilled Workmen	213
VI.	Total Population	162

This effect may be illustrated in another way from the upper classes. "Taking Burke's Peerage," says Professor Whetham, "and considering only those families which have held an hereditary title for at least three generations, we exclude the more modern middle-class commercial element in the present peerage, and get more homogeneous material. Marriages which took place during the 10 years ending in 1840 gave an average of 7·1 births to each fertile couple. For the next 10 years the average sank to 6·1, at which figure it remained constant till after 1860. From 1871 to 1880 the average was 4·36, while from 1881 to 1890 the corresponding number was 3·13."

These data, said the report of the National Birth-rate Commission, amount to a complete statistical demonstration that fertility is closely correlated with social status, the more prosperous the social class the lower is the fertility. This initial difference is not removed by subsequent differential mortality upon the offspring in favour of the more wealthy classes.

Every rise in the condition of the artisan tends at present to lower the birth-rate in his class. Whenever political and social conditions bring a man into a position in which he hopes to rise or fears to fall, the family will be restricted. That kind of motive which we may blame as love of comfort, snobbishness, timorousness, or praise as proper pride, desire for self-improvement, and prudence, is the most potent cause of family restriction.

America and Australia, like Europe, have the same problem to face, and there is evidence that the same phenomenon can be observed in India. No doubt, special causes play a part in each case. In France the provisions of the Code Napoléon, which insist on the division of property, make in the same direction. Social difficulties connected with religion operate in India.

Thus a differential birth-rate has arisen as a consequence of the practice of restriction by the higher social classes. For a population to maintain its numbers unaltered it is necessary, Professor Whetham estimated, that families should consist of "not less than four children." A nation which produces three children to the fertile marriage has, therefore, a birth-rate of three-quarters of that necessary on this basis to maintain its position. Whetham says:—

> If the death-rate be taken at 15 in 1,000 per annum, the birth-rate will be $\frac{3}{4}$x15, or about 11; that is, about four less than the 15 needed to replace the dead. At the end of a year the 1,000 will have become 996, while at the end of a century, 687, and in two centuries 472 of their descendants will alone be left. The birth-rate of other sections of the people is still about 33, or 13 more than their higher death-rate of about 20. In a year each 1,000 will become 1,013; in a century, 3,600; and in two centuries, about 13,000. Thus the less prolific stock, if originally equal in number to the other, would be but one in six at the end of 100 years, and in 200 years it would be but 1 in 30 of the population. It would be lost in the descendants of the stocks of predominant fertility.

A Public Enquiry.—In 1916 the National Council of Public Morals established the National Birth Rate Commission (some of whose findings have already been quoted), with the recognition of the British Govt. which allowed Dr. T. C. Stevenson, the superintendent of statistics, and Sir Arthur Newsholme, its principal medical officer, to serve as members.

The Commission, which consisted of 43 members representing medicine, science, economics, statistical, educative and religious interests, issued its first report in 1916, entitled *The Declining Birth Rate: its Causes and Effects.* A second appeared in 1920, on *Problems of Population and Parenthood;* a third in 1921, on *The Prevention of Venereal Disease;* and a fourth in 1923, entitled *Youth and the Race.* The commission heard over 70 expert witnesses on all aspects of these problems and published for the first time the views of the Roman Church, the Church of England, and the Free Churches on the ethical aspects of birth control. The Commission's enquiry was made in four directions: (1) the extent and character of the decline; (2) the alleged causes; (3) the effects; (4) the economic and national aspects. These reports were presented to the various departments concerned, the Ministry of Health and the Board of Education; and extensively circulated and reviewed throughout the British Empire and America. Dr. Sidney Webb described the report thus:

> The Commission has produced the most candid, the most outspoken, and the most impartial statement that this country has yet had as to the extent, the nature, and the ethical character of the voluntary regulation of the married state which now prevails over the greater part of the civilised world.

> In dealing with the wider problem of birth control, the Commission said that when we look beyond our own shores the possibility of an increase along with improvement of the population becomes manifest. There are vast territories in Canada and Australia which are very sparsely peopled, and are not yielding in food for human sustenance and raw material for human industry what they might. The rise of prices throughout the world can be met only by a much fuller development of the incalculable natural resources of such lands, a development which is waiting an increase of population. Can we resist the pressure of Asiatic immigration without provoking antagonism, if not worse, while we are not making full use of the lands which we are resolved to keep "white"? If we value our national type should we not desire its diffusion, for the sake even of the backward types, that they may be advanced by our influence to a better standard of life and thought? Britain must, in view of these considerations, regard with gravest concern her falling birth rate, and take such practical steps as may be within her power to arrest the decline, and, if possible, restore the rate to a higher figure. That an increase in quantity is desired is clear, but it must be an increase in quality as well. The crux of the problem is to increase the supply from good stocks, precisely the stocks which possess the important qualities of foresight and control. It cannot be supposed that the Dominions will accept emigrants from feeble stocks, which there, as here, become a burden on the industrious. Their statesmen are anxious to avoid that catastrophic condition in which—
>
> By filching all the substance of the fit
> We make the rotten multiply on it.
>
> The Commission concluded that there is no evidence that the world's population is outrunning the natural resources: but on the contrary the presumption is that for their fuller utilisation a larger population is necessary, and thereby could be maintained with a higher standard of living.

Propaganda.—Birth-control propaganda received another impetus from the enormous sale of the writings of Dr. Marie Stopes and from her libel action against Dr. Halliday Sutherland. A Society for Constructive Birth Control, with the mother's clinic for birth control, was established by Dr. Stopes and her husband. In 1923, Dr. Stopes published an exhaustive treatise on birth control entitled *Contraception, its Theory, History and Practice: A Manual for the Medical and Legal Professions and All Social Workers*, which has been largely used by doctors and medical students.

In 1924, The National Birth Rate Commission established a special committee, consisting of representatives of medicine, public health, education, sociology, and religion, under the presidency of the Bishop of Winchester to investigate further the ethical aspects of birth control. This report was published in May 1925, together with the evidence taken. Four of the conclusions of the committee may be quoted:—

> (1) The use of contraceptives is a symptom of the artificial character of our civilisation whereby for large numbers of people a simple, healthy, normal married life is difficult, and in some cases all but impossible. (2) There are numerous cases in which control of conception, considered in itself and apart from the question of the methods employed, is medically necessary and economically advisable, but in every such case all the circumstances should be weighed in the light of the best available scientific and ethical counsel. (3) The ideal method of birth control is self-control. Such self-control must be agreed upon by husband and wife and be carried out in a spirit of service and sacrifice. Therefore, so far from giving any general approval to the use of contraceptives, the line of real advance lies in a deeper reverence, a return to greater simplicity of life and, not least, a drastic reformation of our social and economic conditions. (4) The weightiest argument for birth control is found in the economic circumstances (wages, grossly inadequate housing, and the like) of many persons. While in many instances birth control by contraceptives may be the lesser of two evils, the ultimate remedy lies in the amelioration of those conditions.

The report has been widely circulated and reviewed and is now being followed up by a strictly medical and economic enquiry promoted by the same body.

The American Birth Control League was organised in 1921 under the presidency of Mrs. Sanger. Due to her efforts similar leagues have since been organised in Japan, China, and India. The main activity of the American League is directed toward the removal of federal and state statutes prohibiting instruction in contraception under the direction of duly licensed physicians, and aims at the eventual establishment of clinics for scientific and hygienic instruction of parents. It has also established a Research Department for the scientific investigation of contraceptive methods.

Under the auspices of the American Birth Control League, Inc., the Sixth International Neo-Malthusian and Birth Control Conference was held in New York City, March 1925. Delegates from fifteen countries including China, Japan, and India as well as the leading nations of the Occident presented reports concerning the status of birth control propaganda and practice throughout the world. The whole question was treated in its ethical, psychological and medical aspects as well as in its relation to economic and international politics. *See* POPULATION.

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BIRTH RATE: *see* POPULATION.

BISON (*see* 4.11).—During the period 1910–26 there was a rapid and continuous increase in the number of bison on the North American continent. This is shown by the census taken by M. S. Garretson, secretary of the American Bison Society. As on Jan. 1 1924 this gave a total of 14,369 head for all North America. Of captive buffalo there were 4,167 in the United States and 8,877 in Canada. In addition there was a herd of 100 head running wild in the Yellowstone National Park, U.S.A., and another of over 1,000 near Great Slave Lake in Northern Canada, these latter being known as wood bison. The greatest herd of bison in the world in 1926 was the Canadian national herd at Wainwright, Alberta, numbering, in 1924, 7,489 head. About 1,200 head of young animals from Wainwright were turned loose south of the wood bison region and the two species are now mingling. Experiments have been made both in the United States and Canada in crossing the bison with domestic cattle, with the object of introducing into range cattle a hardy strain of bison blood. A cross-breed, known as "cattalo," was produced, but practical difficulties developed, resulting in the abandonment of further efforts.

BISSELL, GEORGE EDWIN (1839–1920), American sculptor (*see* 4.12), died Aug. 30 1920 at Mount Vernon, N.Y.

BISSOLATI-BERGAMASCHI, LEONIDA (1857–1920), Italian politician, was born at Cremona Feb. 20 1857. The son of Demetrio Bergamaschi, he was adopted by, and took the name of his stepfather, Prof. Bissolati, the philosopher. He was an active member of the Italian Socialist party from its foundation in 1892, and he exercised considerable influence as a journalist, editing the official organ of the party, *L'Avanti*. In 1897 he entered Parliament as member for Pescarolo, and was afterwards elected for the second division of Rome (1908) which he represented until his death. Although a confirmed Socialist, Bissolati became dissatisfied with certain aspects of the policy of the party, notably with its anti-patriotic attitude at the time of the Libyan War. In 1912 he seceded from the party and founded the Reformist Socialist group. At the outbreak of the World War Bissolati declared himself an interventionist, whereas the "official" Socialist party was frankly neutralist. In June 1916 he was minister without portfolio in the Boselli national Cabinet. He resigned in Dec. 1918, owing to disagreements with Sig. Orlando's Govt. over the Treaty of London. He opposed the annexation of the Alto Adige because of its German population, and of north Dalmatia with its Slav majority; but he advocated the annexation of Fiume as a purely Italian town. His attitude on the Alto Adige and Dalmatian questions lost him much of his former popularity, but his undoubted honesty and patriotism caused wide regret for his death, which occurred at Rome on May 6 1920.

BITTER, KARL THEODORE FRANCIS (1867–1915), American sculptor (*see* 4.13), died in New York April 10 1915. In 1911 he finished a model designed for the Henry Hudson monument. He was director of sculpture at the San Francisco Exposition (1912–5), and at the time of his death was president of the National Sculpture Society.

BJERKNES, VILHELM (1862–), Norwegian physicist, a son of Carl Anton Bjerknés, professor of mathematics in the University of Christiania (Oslo), was educated at the university of that city. At an early age he gave an experimental confirmation of his father's prediction, on theoretical grounds, of the remarkable apparent actions at a distance between pulsating and oscillating bodies in a fluid, and their analogy with electric and magnetic actions at a distance. From 1890–1 he studied electric waves at Hertz's Laboratory at Bonn in Germany, and in 1895, after carrying out much valuable work at Oslo (Christiania) and at Stockholm, where he was appointed lecturer in the university in 1893 and professor of mechanics and mathematical physics in 1895, he gave a complete theory of the phenomenon of electric resonance which has contributed much to the development of wireless telegraphy.

Bjerknes subsequently returned to hydrodynamics and particularly the problems of meteorology, in which he was supported by the Carnegie Institute of Washington. Two introductory volumes of a larger work, *Dynamic Meteorology and Hydrography*, were published in 1910–1, under the auspices of this Institution. In 1917 he went to Bergen, where, as professor of physics, in the new Geophysic Institute there, he was the originator of an improved and more scientific weather service, afterwards controlled by his son and collaborator, Jakob Bjerknes (b. 1897), which occasioned a new view of cyclones and anticyclones. His papers on electric oscillations were published in *Annalen der Physik* (1891–5). In his *Vorlesungen über Hydrodynamische Fernkräfte nach C. A. Bjerknes' Theorie* (1900–2) he gave the first complete exposition of his father's discoveries, and in a later book *Die Kraftfelder* (1909), he stated the same theory in a generalised form according to methods of his own.

BLACHE, VIDAL DE LA (1845–1918), French geographer, was born at Pézénas, Hérault, Jan. 22 1845. He was educated at the École Normale Supérieure in Paris, and entered upon the study of geography by way of that of history. The relations between geographical causes and historical effects were with him the subject of a life-study, the results of which are seen in one of his best-known works, the *Tableau Général de la Géographie de France* prefixed to Lavisse's *Histoire de France* (1903) and later republished separately; but he always refrained from pressing the theory of geographical "control" to an extreme. He joined the French school at Athens in 1867, and was thus enabled to travel extensively in Mediterranean lands. From 1872 to 1877 he was in charge, latterly as professor, of the department of history and geography at Nancy; from 1877 to 1898 he taught geography in the higher grades at the École Normale Supérieure, and from 1898 to 1909 he held the chair of geography in the Faculté des Lettres at Paris. He lectured widely and among his publications is the monumental *Atlas Général: Histoire et Géographie*, first published in 1894; he founded in 1891, and edited until his death, the periodical *Annales de Géographie*, and contributed constantly to its pages. He died at Tamaris-sur-Mer (Var) on April 5 1918.

BLACKBURN (*see* 4.20) had a population of 126,630 in 1921. It was estimated at 129,000 in 1923 and the area of the borough is 7,420 acres. It is proposed to make it a diocese, taken from that of Manchester, as soon as the necessary funds are raised. An electrical generating station was opened in 1921; and in 1924, 27 of the large textile mills had adopted electric power and others were on a waiting list. The Town Hall has been extended and all municipal departments were transferred there in 1915. The county court was enlarged in 1912. An annex to the Blackburn and East Lancashire Royal Infirmary was finished in 1915, and a large war memorial block was in course of construction in 1924. Three public halls were opened in 1921. St. Jude's church was built and its parish formed from that of St. Thomas in 1914; St. Silas, Preston New Road, was finished in the same year, and the Church of the Saviour, Longshaw road, was given a separate parish in 1922.

BLACKPOOL, England (*see* 4.24), has increased largely in population, the figure in 1911 being 60,746 and that in 1921 99,640. It was made a parliamentary borough in 1918, and in the same year the urban district of Bispham with Norbreck and part of the civil parish of Carleton were incorporated. The Princess Parade, extending from the North Pier to Cocker street, was opened in 1912. A considerable amount of building has been done, particularly on the north shore, rising toward Fleetwood. In 1911 a central free library and reading rooms were erected in Queen street, and in 1912 a large opera house in connection with the winter gardens was built. In 1922, 274 ac. of undeveloped land behind the town were bought for a park, and an ambitious scheme of development, including a "social centre," a restaurant, a lake, a county cricket ground, a golf course, etc., was prepared. The Indian Pavilion on the North Pier, burnt down in 1921, was rebuilt in 1923 to seat 1,750 people.

BLACK SEA (*see* 4.25).—The political changes which have taken place on the shores of the Black Sea since 1911 have not been great, and result chiefly from the enlargement of Rumania. After the Balkan Wars in 1912–3 that state obtained territory in the Dobruja region at the expense of Bulgaria. The reason assigned for this rectification of the frontier was that the old line, which ran from Silistra on the Danube to the coast, exposed the railway from Bucharest to the port of Constantsa to attack. The value of the territory thus transferred is small, but the change which was confirmed after the World War meant the loss to Bulgaria of the two small ports of Balčik and Cavarna and brings the present frontier very close to the important Bulgarian port of Varna.

The War itself gave to Rumania the province of Bessarabia, that is, extended its Black Sea frontier from the Chilia mouth of the Danube to the right bank of the Dniester. The only port on this strip is Cetatea-Albă (Akkerman), of little value save for local traffic. Soviet Russia, it may be noted, does not recognise the transference of Bessarabia.

The other political changes are nominal rather than real. A part of the northwest coast, with the port of Odessa, is now included in the Ukraine; most of the rest of the northern shore belongs to the Russian Socialist Federal Soviet Republic, while the remainder of what was formerly the Russian coast belongs to Georgia, all of which states are included in Soviet Russia. Ukraine includes the most productive of the grain lands of European Russia, and Odessa was the most important Black Sea port of imperial Russia. On the Georgian coast the two ports of Batum and Poti are the main outlets of the Caspian oil-fields.

In Rumania and Russia the export trade from Black Sea ports has shown changes alike in amount and in character. Before the War Rumania was, after Russia, the most important wheat-exporting country in Europe, wheat forming on the average more than two-fifths by value of her total exports. The War period led inevitably to the total collapse of this trade. *See* DARDANELLES.

BLAKE, EDWARD (1833–1912), Canadian politician (*see* 4.35), died at Toronto March 1 1912.

BLAKELOCK, RALPH ALBERT (1847–1919), American painter (*see* 4.38), died near Elizabethtown, N.Y., in the Adirondacks, Aug. 9 1919. Owing to insanity he was kept under restraint during the last 18 years of his life. In 1913 he was made an associate of the National Academy of Design and in 1915 a full member. In 1916 the Toledo Art Museum paid $20,000 for his "Brook by Moonlight."

BLAND-SUTTON, SIR JOHN (1855–), British surgeon, was born at Enfield Highway, Middlesex, in 1855. He studied medicine and surgery at Middlesex Hospital from 1878 onwards, and from 1881–6 made systematic examinations of animals dying in the gardens of the Zoological Society, London. This work formed the substance of a series of lectures delivered at the Royal College of Surgeons 1886–91. He subsequently carried out much valuable work on hysterectomy and the diseases of women. He was president of the Medical Society of London in 1914, of the Royal Society of Medicine 1921–2, of the Royal College of Surgeons in 1923, and was also consulting surgeon to Middlesex Hospital. He was the recipient of many British honours, being knighted in 1912 and made a baronet in 1925.

His published works include *Evolution and Disease* (1890); *Ligaments, their Nature and Morphology* (1887); *Surgical Diseases of the Ovaries, etc.* (1891); *Tumours, Innocent and Malignant* (1893); *Diseases of Women* (1897); *Surgery of Pregnancy and Labour, complicated with Tumours* (1901); *Gall Stones and Diseases of the Bile Ducts* (1907); *Man and Beast in Eastern Ethiopia* (1911); *Fibroids of the Uterus* (1913); *Selected Lectures and Essays* (1920); *Orations and Addresses* (1924).

BLASCO-IBANEZ: *see* IBANEZ, VICENTE BLASCO.

BLASHFIELD, EDWIN HOWLAND (1848–), American artist (*see* 4.43), executed, among other works, mural decorations for the chancel of St. Saviour's, Philadelphia; the state Capitol at Madison, Wis.; the courthouse at Youngstown, O.; and the state Capitol of South Dakota. For these two last works he received the gold medal of the Architectural League (1911). He has published *Mural Painting in America* (1913).

BLASTING: *see* MINING.

BLIND, TRAINING AND WELFARE OF THE.—In April 1925 the total number of blind persons known to the registering authorities in Great Britain was 48,472. On the same date (April 1925) the number of employed blind in Great Britain was 10,274. Nearly 2,000 were employed in basket-making and nearly 1,000 each as piano-tuners and in the knitting industry. Brush and mat-making employed together about 1,100.

The number of cases of blindness from disease and accident is on the decrease, and more care is taken by local authorities in the prevention and treatment of infantile ophthalmia and better precautions against accident are insisted upon in textile, metal and other factories. Additional power was given by the Public Health Act, 1925, to local authorities in England and Wales to make, with the consent of the Minister of Health, such arrangements as they may think desirable for assisting in the prevention of blindness, and in particular for the treatment of persons ordinarily resident within their areas suffering from any disease of, or injury to, the eyes.

Educating the Blind.—For many years the work of the elementary schools for the blind has progressed steadily. In 1907 the English schools were transferred to the jurisdiction of the Medical Branch of the Board of Education. This was carried out from motives of administrative convenience, and the transfer, although undesirable on purely educational grounds, may have contributed something to freedom and individuality. Excellent progress was made till 1921 when, for reasons of economy, teaching staffs were reduced and the number of children in a class increased with a resultant decrease of efficiency. In 1908 the College and in 1912 the Association of Teachers of the Blind were founded, and after doing much good work independently were amalgamated in 1924. By their efforts the general level of teaching and the qualifications of teachers in schools for the blind were raised and a corporate spirit was introduced into this branch of the teaching profession.

Suggested Reforms.—In 1910 the industrial affairs of the blind world were in an interesting condition. An organisation of blind workers, mainly workshop employees, called the National League of the Blind, had begun to direct public opinion to the need for a more systematic solution of the problem than could be secured by the piecemeal action and insufficient resources of the voluntary institutions. The institutions had been in the main opposed to the idea of government assistance for the adult blind. The alternative plan, proposed by the workshop authorities, was to secure government contracts, and orders for brushes and baskets were obtained from the Post Office and the War Office. Unfortunately the work could not be executed except at a loss, so that the institutions were no better off than before. Because of the failure of this line of approach the institutions swung round completely in favour of state assistance.

The number of blind men and women employed in British workshops was only 2,300. About 200 young persons were completing their technical training annually, and for these practically no provision was being made. At the same time the wages paid were inadequate and, owing to lack of funds in most of the institutions, very little could be added thereto. As far back as the days of the Royal Commission on the Blind of 1886 the blind workers had stood united in favour of a state subsidy of wages in one form or another, but their petitions had gone unheeded. Now the matter came again to the front and, along with the demand for municipal workshops, a measure before Parliament stipulated for an adequate wage. The institutions were thus driven to produce a measure of their own. This was the state of affairs in 1910 and in December of that year the first attempt was made to bring the two competing measures, the league's bill and the institution's bill, into line. An agreed bill was at last put forward with the united support of the blind world and secured its first reading in May 1914, but it got no further, probably because of the outbreak of war.

Administrative Action.—The forward step, however, came by another route. Mr. Wardle, Labour M.P. for Stockport, initiated, in March 1914, a useful debate on the conditions of the blind. The Govt. were friendly and on May 7 set up a departmental committee "to consider the present condition of the blind in the United Kingdom and the means available for (*a*) their industrial or professional training and (*b*) their assistance, and to make recommendations." The committee's report was published in August 1917 and contained, among much that was negligible, one suggestion of far-reaching consequences. This was that a central authority should be set up "in the Ministry of Health, whenever such a Ministry should be created, and in the meantime in the Local Government Board, for the general care and supervision of the blind." This central authority was to have at its disposal funds provided by the Exchequer. It was to be responsible to Parliament for its actions and to be guided as to policy by an advisory committee.

By the establishment in the following year of this department and of a similar department in the Scottish Board of Health, a new era was begun. Since that date the advance in all branches of work for adult blind has been unprecedented. New services have been instituted and old services developed out of recognition. In Aug. 1919 regulations were issued explaining the services in respect of which grants would be paid. The following table details these services with the grants paid in England and Wales during the years 1921–2 and 1924–5.

Act of 1920.—In 1920 the Blind Persons Act, which had been in suspense during the War period, was passed. Its provisions may be summarised as follows:—

	1921–2	1924–5
	£	£
Counties' Assns.	6,844	7,292
Workshops	31,476	39,365
Home Workers	6,117	15,013
Homes and Hostels	7,412	8,650
Home Teaching	12,978	19,035
Book Production	4,912	4,683
Capital Expenditure	..	577
Tools and Miscellaneous	147	355
	69,886	94,970

Section 1 provides for a grant of pensions to blind persons on attaining the age of 50 at the same rates and on the same conditions as old-age pensions.

Section 2 places a duty on local authorities to promote the welfare of blind persons ordinarily resident in their area, and for this purpose enables them to provide and maintain or contribute toward the provision and maintenance of workshops, hostels, homes and other places for the reception of blind persons, or to do any other thing approved by the Ministry or the Scottish Board of Health for promoting the welfare of the blind. Local authorities were required to prepare and submit to the Ministry or Board a scheme for the exercise of that duty.

Section 3 applies the provisions of the War Charities Act, 1916, with certain modifications, to all agencies making public appeals for subscriptions on behalf of the blind.

The Local Authorities have gradually increased their interest in, and contributions toward, this service since the Act came into force on Sept. 10 1920. The amount of their contribution was under £15,000 in 1921–2, and the estimated figure for 1925–6 was over £127,000. Most of this subsidy has gone to the voluntary institutions and agencies to supplement and expand their work. In 1925 nearly 13,000 blind men and women in England and Wales between the ages of 50 and 70 were in receipt of an old-age pension at a cost to the community of about £320,000. The figures for Great Britain and Northern Ireland were over 16,000 pensioners at a cost of about £413,000. In Great Britain, therefore, public money, in one form or another, is spent, either directly upon, or in the interests of, blind people to the extent of over £600,000 a year. This figure is more than equalled by the amount received by institutions and agencies by way of voluntary contributions from the charitable public. During the year which ended March 31 1924, these institutions, other than the endowed pension societies, received in this way no less than £662,000.

The War and the Blind.—The war years of 1914–8 brought about a great addition to the numbers of the sightless. In all probability more than 10,000 soldiers and sailors lost their sight on active service. To this appalling total the British Commonwealth contributed nearly 2,000 and Germany 3,000. In Britain these blinded men were cared for in special institutions, St. Dunstan's in London and Newington House in Edinburgh. There they were given fresh hope and inspiration, were taught an occupation such as mat-making, boot-repairing, massage or telephony, and, for the most part, established in their own homes. In Germany, a laudable effort was made to find occupation for those blinded in the War in particular sections of factory production. Messrs. Siemens led the way in this endeavour, and about 450 were so employed at the close of 1925. (J. M. Ri.)

THE UNITED STATES

Activity and progress have been marked in work for the blind in the United States since 1910. The following paragraphs summarise briefly the independent actions of the various states.

The Young Blind.—Seven residential schools have been rebuilt in suburban locations, most of them adopting the cottage plan. In 1913, certain low-vision children began attending day centres opened for them in common schools, and by 1925, 15 states had collectively 205 of these sight-saving classes. There is as yet no systematic provision for the blind who are feeble-minded. Deaf-blind pupils now mostly attend schools for the deaf. While little demand exists for specially prepared teachers of the blind, a movement for them has begun. In 1917 the country adopted Braille as its uniform type, and in 1919 the Govt. increased from $10,000 to $50,000 its yearly subsidy for embossed books for the schools.

The Adult Blind.—New legislation to reduce industrial accidents has lessened the cases of blindness due to this cause. Since the World War, practically every state conducts a rehabilitation bureau which will assist blind persons not served by other agencies. Ten states have set up permanent commissions for the blind, making 19 in all. These employ the usual instrumentalities, the latest means to employment being the placing of the fit in industry alongside the seeing. Suitable occupations are the assembling of parts in factories and typing. The Federal compensation in 1925 to those (477) blinded during the World War is from $150 to $200 a month. Moreover, money was abundantly spent in efforts to re-educate these young men and to place them back in industry. Congress in 1924 authorised the Veterans Bureau to expend not exceeding $100,000 in obtaining embossed books for them, which, with the general hand-copying of stories begun during the War, adds materially to the books available for finger readers.

The Blind, by Harry Best, Ph.D. (1919), is the most notable American monograph on this subject. There was launched in 1922 the American Foundation for the Blind, with offices in New York City. Its slogan, "nation-wide service to the blind," indicates its purpose. (E. E. A.*)

BLINDNESS: *see* OPHTHALMOLOGY.

BLISS, CORNELIUS NEWTON (1833–1911), American merchant and politician (*see* 4.72), died in New York Oct. 9 1911. Although prominent in the Republican party, and for a long period the treasurer of its national committee, he refused to accept public office. His lack of sympathy with Theodore Roosevelt's growing influence led him to retire from politics.

BLISS, TASKER HOWARD (1853–), American soldier, was born at Lewisburg, Pa., Dec. 31 1853. He graduated from West Point Military Academy in 1875, and from 1885 to 1888 was professor of military science at the Naval War College. In 1897 he went to Madrid and was military attaché at the American legation. He served through the Porto Rican campaign during the Spanish-American War and from 1898 to 1902 was in charge of Cuban customs and collector for the port of Havana. In 1903 he became commandant of the Army War College. From 1903 to 1905 he was a member of the Joint Army and Navy Board and also of the general staff. From 1905 to 1909 he held various commands in the Philippines. During the latter half of 1909 he was president of the Army War College, afterwards becoming assistant chief of the staff, to which post he returned in 1915 after four years' service in command of military departments. In 1917 he was made chief of the staff and promoted to the rank of general, but he retired later in the year, having reached the age limit. He was a member of the Allied Conference (1917), of the Supreme War Council (1918) and of the International Peace Conference (1918–9).

BLISTER: *see* BURNS AND SCALDS.

BLOCKADE.—Several years before the World War began, the British Admiralty had realised that there could be no thought of stationing a squadron off the German coasts and declaring a blockade of Germany. The development of minor attack by means of mines, light torpedo craft and submarines had given naval states a means of keeping enemy forces away from their coast-lines; apart from which the German battle-fleet was sufficiently powerful to destroy or drive off any line of cruisers which attempted a blockade.

The British Admiralty was bound to make its naval dispositions accordingly. On the outbreak of war two cruiser squadrons were given the duty of watching the enemy's trade and stopping it as far as they could. The first was stationed at the western mouth of the English Channel. The second, called Cruiser Force B or the Northern Patrol Force—was not given any definite station; but was intended to watch the northern exits from the North Sea, between the north of Scotland and Norway. Neither of these cruiser squadrons was a blockading force; their duties were to arrest all enemy ships and to stop cargoes of contraband.

The cruisers at the mouth of the Channel were soon withdrawn, and their duties transferred to a boarding flotilla in the

Straits of Dover. The history of Cruiser Force B was different. During the autumn and winter of 1914, the commander-in-chief treated it as part of the Grand Fleet cruiser squadrons; and attempted to use all his light forces to intercept and inspect trade. To do this, he divided the northern part of the North Sea into patrol areas which covered the line between Buchan Ness and the Norwegian coast, and allotted a squadron to each. The loss of "Hawke" to a German submarine showed that the watching line must be withdrawn to the north and west, and the steady increase in the escort and reconnaissance work of the Grand Fleet cruiser squadrons made it necessary to give one single squadron the specialised duty of watching and inspecting the trade routes to northern Europe. The squadron of old cruisers, which had hitherto made up Cruiser Force B, was paid off, and its place was taken by a force of armed merchant cruisers called the 10th Cruiser Squadron.

The line along which these ships patrolled varied continuously but it was found that the bulk of the east and westbound European traffic ran through the rough rectangle bounded by the Faeroes, the Faeroe Bank, the Hebrides and the Shetlands, and the lines of patrol were so arranged that they ran across it. Another line of watching cruisers was maintained between the Faeroes and Iceland and, during the summer months, a small patrol was kept in the strait between Iceland and Greenland. These may be called the stabilised dispositions of the 10th Cruiser Squadron; they were subsequently altered in points of detail only. About the same time it was announced that, owing to the enemy's reckless mine-laying policy, the North Sea was henceforward to be looked upon as a military area, and that any neutral ship which passed through it did so at her own risk, unless she called at Kirkwall and received the Admiralty's instructions. These two measures gave final shape to the naval arrangements for putting all neutral commerce to northern Europe under observation.

The Central Organisation.—The British Admiralty's dispositions when the War began made provision for intercepting enemy ships and contraband; but the Govt. had realised for long that the mechanism of modern sea-borne commerce is too intricate to be controlled by naval means alone. But although the point had been grasped, little provision had been made for setting up an adequate organisation, and the central staff, known later as the Ministry of Blockade, was built up during 1915.

The Ministry of Blockade, in its final shape, consisted of various departments and branches. The chief of these and the nucleus round which the whole organisation was formed, was the Contraband Dept. of the Foreign Office, created in Aug. 1914. The Contraband Committee was formed in Oct. 1914. In Jan. 1915 were created the War Trade Intelligence and the War Trade departments and the Licensing Committee. In the same year were established the Enemy Exports Committee (March), War Trade Statistical Dept. (April), War Trade Advisory Committee (September), and the General Black List Committee (October). In 1916 were added to the Ministry the Foreign Trade Dept. of the Foreign Office (January), Finance Dept. (January), and the Restriction of Enemy Supplies Dept. (August). Finally in Jan. 1917 the Insurance Intelligence Dept. and the Blockade Committee were set up.

Contraband.—As there was no thought, when war began, of blockading Germany, or of stopping all her import and export trade, and as the British Govt. could only order the seizure and arrest of enemy ships and contraband cargoes, it was a matter of great importance to state the rule of law on which they would act in the matter of contraband. The Declaration of London was not binding on the Govt., in that it had not been ratified; it was, none the less, in substance, a summary of the rules of maritime law established by custom, and had all the weight, though possibly not the binding force, of an international convention. It so happened, however, that the rules of the Declaration of London which referred to contraband gave great advantage to neutral traders who intended to traffic in it surreptitiously.

Contraband was divided into two classes. Absolute contraband, defined in a list of military stores, could be stopped if its ostensible destination were a neutral port, and its final destination an enemy country; conditional contraband, in which were included foodstuffs and fodder, could only be arrested if destined for the armed forces or an official department of an enemy state. Free commodities, which included several articles of great importance in munition factories, could not be stopped in any circumstances. The British Govt. was not bound by these rules, and indeed, could not be expected to observe them. It was, none the less, most important that the Govt. should observe rules of warfare which were justifiable by custom.

Orders in Council.—Various orders in council were issued during the War. (1) The order of Aug. 20 1914 laid down that the rule of continuous voyage should be applied to conditional as well as to absolute contraband. It also reaffirmed the Government's intention, previously expressed in the royal proclamation of Aug. 4, to place articles on the contraband list by its own authority, without obtaining the consent of neutrals. Jurists have quarrelled with this procedure; but it is too well established in practice to be seriously contested. The order also stated that the ultimate destination of contraband might be established by any *sufficient evidence.* In all previous wars most of the evidence against a cargo had been taken from the ships' papers and the letters in the captains' possession at the time of seizure. This order empowered the naval authorities to stop all cargoes of conditional contraband which were being sent to Germany through the Netherlands, Denmark, Sweden and Norway.

By the order of Oct. 29 1914, issued in reply to American pressure, the Govt. resigned some of the rights it had claimed under the previous one. "Notwithstanding the provisions of Art. 35 of the said Declaration," ran the order, "conditional contraband shall be liable to capture on board a vessel bound to a neutral port, if the goods are consigned 'to order' or if the ship's papers do not show who is the consignee of the goods . . . ." This obviously gave neutral shippers of contraband exceptional facilities, as it is quite easy under modern conditions of commerce to disguise the ultimate destination of a cargo without consigning the goods "to order." The order, none the less, reserved to the British Govt. the right to treat neutral countries as bases of enemy supply, if statistics showed that they were so; but this clause was never applied.

The order of March 11 1915, commonly, though not officially, styled the reprisals order and issued in answer to the German declaration of submarine war against merchantmen, was the basis of the blockade of Germany. In it the British Govt. stated that its naval forces would thenceforth stop all ships and cargoes with a German origin or destination; contraband would be condemned; non-contraband would either be requisitioned or returned to the owner. The orders in council of Oct. 29 1915 and March 30 1916 amended the order of Oct. 29 1914. The order of July 7 1916 rescinded the Declaration of London, and stated that thenceforward the British Govt. would act in accordance with the customary law of nations. A statement of the rules of law which they intended to follow in the matter of contraband was added to the order. The order of Jan. 10 1917 amended the reprisals order of March 1915.

The order of Feb. 16 1917, issued in answer to the German declaration of unrestricted submarine warfare, was complementary to the reprisals order of March 1915. It declared that a vessel, met at sea, whilst on its way to a neutral port giving access to enemy territory, without previously calling at a British port for examination, would be deemed to be carrying goods of enemy destination or origin. Goods of this character would be liable to condemnation in prize, instead of being requisitioned or returned.

A Stronger Blockade.—It can be seen from the foregoing that the blockade of Germany began with the order in council of March 1915, which was a measure to prevent goods of any kind from entering or leaving Germany. The difficulty was that, at the time, the British Govt. did not possess the means of giving full effect to its intentions. Two cordons of cruisers, one watching the Heligoland Bight from the Danish frontier to the Ems, and another patrolling the Baltic between the Great Belt and the

Russian frontier, might have stopped all Germany's seaborne supplies. The 10th Cruiser Squadron, holding a patrol line between Scotland and Iceland, obviously could not do so. It could have blockaded all the states of northern Europe together; but had no power to isolate any one of them. The duty before the Govt. was, therefore, to make this order in council effective in two ways: (1) by distinguishing between goods intended for consumption in neutral countries and goods intended for re-export to the enemy, (2) by seeing that no British or Allied goods found their way to the enemy, or released similar goods, produced in neutral countries, for re-export to Germany. These two schedules of duties had best be treated separately.

The original policy of the British Govt. had been to persuade neutral governments, contiguous to Germany, to prohibit the export of all goods which were declared contraband in London; but this proved unworkable. Neutral governments could not always be persuaded; and when traders were prosecuted for disobeying such prohibitions as existed, the penalties imposed were not deterrent. A little experience showed that the British Govt. would have to deal direct with neutral traders and neutral shipping companies and leave their governments alone. The new policy took time and it was not until the end of 1915 that it was working properly. The leading commercial and industrial magnates in the Netherlands, Denmark and Switzerland were induced to form themselves into trusts, and were made the sole consignees of all goods that the British Govt. desired to stop from going into Germany. These trusts signed agreements with the British Govt., in which they gave guarantees that no goods consigned to them would be re-exported.

Arrangements with Neutral Shippers.—The first of these guilds to be formed was the Nederlandsche Overzee Maatschappij; in Denmark, the guild was called the Industrieraadet, and in Switzerland the Société de Surveillance Suisse. No general trust of the kind could be formed in Sweden, owing to the opposition of the Swedish Govt., but in Sweden, Norway and the United States the policy of dealing direct with trading associations was pursued successfully. During 1915 American cotton was stopped from going into Germany by separate agreements with the cotton industries in the United States and Sweden, and American meat supplies were dealt with by a far-reaching agreement with the American Meat Packers' Association. Norway differed from other Scandinavian countries in that, owing to her geographical position, she was not so likely to become an intermediate dumping station for German goods. In her case the problem consisted mainly in finding some means of stopping Norwegian fish oils and in seeing that Norwegian shipping, a great carrier of foreign goods, was not used for indirect German trade. This was done by negotiations and agreements with a special body called De Norske Fabriker (Denofa).

Although this could not have been done by naval means alone, neither could it have been done without predominance at sea. The 10th Cruiser Squadron, controlling all the sea approaches to northern Europe, was the source and origin of the British Government's power of bargaining. Neutral traders knew that Great Britain could stop all the sea-borne traffic to northern Europe if she wished, and they realised that if they were to carry on their ordinary business they must come to terms with her.

Development of the Policy.—By creating these great consignee trusts in neutral countries and by dealing direct with neutral traders, the British Govt. found a method of solving the problem of cutting off enemy supplies, and it only remained to perfect the existing machinery. At the beginning of 1916 statistics and information showed that the Germans were certainly beginning to feel the effects of the economic warfare, but that supplies were still going through from neutral countries and that considerable stocks had been laid in during the first months of the War, as well as during the period when Great Britain's general policy was in the process of formation. During 1916 the gaps and defects in the system were to a large extent made good by (1) the rationing system, (2) the issuing of Letters of Assurance or "navicerts," (3) blacklisting, (4) bunker control.

The rationing system was, as its name implies, the placing of an embargo upon all neutral goods in excess of a certain figure which was arrived at by examining the statistics of the country's trade. At first sight it seems incredible that neutrals should have allowed their imports to be regulated by a foreign Power. The new system eased friction between Great Britain and neutrals very considerably for the following reason. The trade agreements signed during 1915 had dealt with some, but not all, of the important imports of northern neutrals. They could not be made to cover all the articles of the country's import list, because there were certain commodities for which the trade guilds refused to be responsible. The consequence was that cargoes of these unguaranteed goods were often held up, to see if evidence could be collected against them; and the delays and uncertainties had caused a great deal of irritation. The rationing system lacked a legal basis, but it gave neutral traders the certainty and security which they sought.

Letters of Assurance was a name given to a system of control which applied only to shipments from the United States to Scandinavia. American traders submitted to the British embassy at Washington a complete list of the goods they wished to ship, and of their quantities and applied for permission to pass these through the patrols. Thanks to an elaborate organisation, formed solely for the purpose of making the necessary investigations as rapidly as possible, a permit or a refusal was generally telegraphed within 48 hours. If further investigation was necessary the applicant was informed. This system was a development of the general policy of easing friction by allowing the neutral merchant to know where he stood. It was extremely successful; over 40,000 applications were made between March 1916 and April 1917 and 30,000 were granted.

The blacklisting system grew out of the postal and telegraph censorship. The inspection of all mails and wires which passed through the country gave the blockade authorities an immense amount of information about the organisation of German import and export trade. It disclosed the firms in America and Scandinavia which were most concerned in it, the dummy consignees which were being used to disguise the dealings, and it also gave details of a great number of particular transactions. The blacklisting system was elaborated to ensure that all the firms known to have an interest in enemy trade should be absolutely denied the use of British shipping or British insurance. In addition, all neutral shipping lines were called upon to give undertakings that they would not carry the goods of blacklisted firms on pain of being refused British bunker coal. Both a general and a statutory blacklist were kept by the blacklisting committee.

Bunker control, already mentioned as a means of enforcing blacklist regulations, was a formidable economic weapon. The principle of the system was that neutral shipping lines were only allowed to take in British bunker coal if they visited a British port for examination, and if they gave guarantees that they would not handle goods which were prohibited. The control which this gave Britain over neutral shipping companies was very great. In 1917, the 10th Cruiser Squadron was actually withdrawn, and yet all the shipping to northern Europe continued to call voluntarily at British ports of examination.

Control of Domestic Resources.—Before the War began a subcommittee of the Committee of Imperial Defence had examined the question of trading with Germany in time of war; they had decided that there were many branches of trade between Germany and Britain which might be continued with advantage to Great Britain; but that a policy of non-intercourse was, on the whole, the best. As a result a draft Trading with the Enemy Act was ready for presentation to Parliament when War was declared. It forbade all commercial and financial intercourse with enemy countries, but not with men of enemy nationality domiciled abroad. It fell to the Trading with the Enemy Committee, a body constituted by the Treasury on Aug. 4 1914, to give effect to the proclamation. Its business consisted mainly in advising the Privy Council to grant or refuse licences for export trade, and in making recommendations with regard to export prohibitions. The control of the insurance market, the sequestration of enemy property, the liquidations of enemy businesses and enemy banks were carried out by specially appointed committees.

The United States declared war against Germany in April 1917 and soon passed measures for stopping all German trade and for making it absolutely impossible for adjacent neutrals to re-export to the Central Powers. As the 10th Cruiser Squadron was withdrawn during the year the American Govt. was not asked to assist in the naval side of the blockade, but in all else—blacklisting, export embargoes, postal and telegraphic censorship—the American Govt. acted far more drastically and severely than the British.

Effects of the Blockade.—Information received from Germany shows that, although Germany was not completely deprived of foreign supplies until the autumn of 1917, the country was, none the less, reduced to terrible distress in the winter of 1916, and that it was only the conquest of Rumania and the occupation of the Ukraine which saved a breakdown. One of the most decisive factors was the complete loss of all artificial fertilisers at a very early period of the War. The soil of Germany cannot produce its normal harvest of grain, fodder and potatoes without these fertilisers. It was thus impossible to make good the increasing shortage of sea-borne supplies by intensive cultivation, or even to prevent the harvests from falling below their average yield. All this was accentuated by the demands of the military, the loss of productive man-power and the inevitable waste of foodstuffs sent and distributed to armies in the field. The loss of oils and fats was severely felt at a comparatively early date, and had effects which nobody could have foreseen. The damage to the population was great, but that was not all. The lack of lubricants lowered the transporting capacity of the railways.

The meat imported from adjacent neutrals during 1915 and 1916 was never enough to fill the deficit created by the British agreement with the American Meat Packers Assn.; the cattle killed at home in any year could not be replaced in the next, owing to lack of fodder for raising the young kine. The suffering and demoralisation caused by this progressive lack of most of the necessaries of life was most severely felt in the industrial districts of the west and centre.

Austria felt the blockade even more than Germany. When the Armistice was signed the population of Vienna was in little better plight than the population of Paris in 1871. In the autumn of 1919 Prof. E. H. Starling, after making a dispassionate and scientific study of the conditions of life in Germany, reported officially to the British Govt. that "the nation of Germany is broken both in body and spirit." (White Paper Cmd. 280.)

The blockade of Germany proved that modern states are interdependent to a degree which nobody had conceived before the War began. An industrial country cannot be isolated from the outer world and continue to produce machinery and food supplies at the same time; an agricultural country severed from its neighbours may possibly feed itself, but it will never keep its armies supplied with arms and material. Even after the coalition of the Central Powers covered half Europe with its conquests and occupations, its lack of sea-borne supplies created wants and deficits which, in their turn, created others, and in the end the entire population of Germany, Austria, Bulgaria and Turkey broke down under the strain created by these progressive discomforts and sufferings.

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(A. C. B.)

BLOEMFONTEIN (*see* 4.74), the capital of the Orange Free State and the seat of the Court of Appeal of the Union of South Africa has a population (1921) of 36,491. The white inhabitants increased from 14,720 in 1911 to 17,711 in 1921. Owing to its central position, its excellent climate, and its railway facilities, Bloemfontein became increasingly used for conferences—political, educational and agricultural—of delegates from all the provinces of the Union. It is noted for its annual agricultural show, and has the most important live-stock market in South Africa. Since 1916 Grey University College has been a constituent college of the University of South Africa. Law Courts, in the classical style, have been built; government buildings replace those burnt down in 1908, and a State Museum has been erected. The Raadzaal of republican days became the meeting place of the provincial council; Government House was turned into a Girls' High School. The foundation stone of an Archives Building was laid in Oct. 1925, the first building in South Africa designed solely for the preservation of historical documents. Bloemfontein returns two members to the Union Parliament.

BLOK, ALEXANDER (1880–1921), Russian poet, was born in Leningrad (then St. Petersburg) in 1880. His father was professor of mathematics at Warsaw. In 1903 he married the daughter of the Russian scientist, Mendeleev. His first book of poems, *Songs to the Belle Dame* (1904), show the influence of the mystic poet and philosopher, V. Soloviev. Later his romantic style was changed to one of bitter irony and sarcasm and his works show deep disillusionment conflicting with a national idealistic inspiration. "The Scythians" is representative of this latter phase. All these alternating motives, expressing the eternal contrast between the real and the ideal form the vast scope of Blok's greatest poetry. The Bolshevik revolution inspired him to write his famous poem "The Twelve"—English translations by C. E. Bechhofer (1920), and B. Deutch and A. Yarmolinsky, New York (1920). The poem is an apologia for the revolution. He is the finest lyric poet of modern Russia, and ranks with the great masters of the past. His outstanding qualities are the great depth of feeling manifested in his poetry, the rich melody of his verse, his extremely varied rhythm, and the blending of an exquisite lyrical style with the raciness of speech of the masses together with an extremely skilful use of the vulgarisms and slang of the street. He died in Leningrad Aug. 7 1921.

Blok's principal poems, besides those already mentioned, are "The Unexpected Joy" (1907), the lyric drama, *The Fair Booth*, "The Earth under Snow," "Hours of the Night," "The Hoary Morning" and the romantic drama, *The Rose and the Cross.*

BLOK, PETRUS JOHANNES (1855–   ), Dutch historian, was born Jan. 10 1855 at Helder, Holland. After holding a professorship in Gröningen University, he became, in 1894, professor of Dutch history in the University of Leyden, a position which he retained until 1925. From 1894 to 1897 he was history tutor to Queen Wilhelmina. In 1904 he founded the Netherlands Historical Institute in Rome. His most important work is *Geschiedenis van het Nederlandsche Volk* (*History of the Dutch People*) (1892). Among his other historical books are *Een Hollandsche Stad in de Middeleeuwen* (*A Dutch Town in the Middle Ages*) (1882); *Willem de Eerste Prins Van Oranje* (*Prince William the first*) (1919).

BLOODLESS SURGERY.—In a sense this method is an accidental and indirect outcome of Listerism. Its originator, Lorenz of Vienna, was an early follower of Lister and suffered so severely from carbolic acid intoxication that surgery by antiseptic methods of all kinds became impossible for him. Still impressed, however, with the cardinal aim of Lister's teaching, namely, the avoidance of introduction of bacteria into a wound from without, he concluded that he would make no wound at all unless absolutely necessary. The method is employed in orthopaedics and, strictly speaking, is not bloodless for the bruising that may result is evidence of ruptured blood-vessels; a better term would be woundless or subcutaneous surgery.

Stretching Procedure.—The contrast between surgery and bloodless surgery in correction of an orthopaedic deformity is as follows:—Orthosurgery, by cutting or excising, adapts the bones to the shortened soft parts; bloodless surgery lengthens the shortened soft parts by stretching until they correspond to the length of the bones. This lengthening is effected by repeated (many hundred) small stretching procedures (the modelling correction of the Germans) and not by a single forcible procedure (the forcible correction of the French), which introduces undesirable damage, such as fracture or injury to nerves. Modelling and forcible correction differ further in that the former gradually annihilates the natural elasticity of the shortened soft parts so that they fail to retract when the modelling tension ceases, and can be fixed, passively, in any desired position by a suitable appliance. This gradual process is unaccompanied by the pain that characterises forcible correction.

Modelling Correction.—Modelling correction is not without danger, even if cautiously performed. The soft parts, when subjected to tension and extension, are of different tolerance. Muscles and ligaments are much less liable to damage. In case of absolute resistance to stretching, the tendons are severed with a thin, sharp needle (tenotome), although in this case the character of the bloodless operation is blurred to a certain extent. Fortunately the blood-vessels, being elastic, are less sensitive to stretching. In spite of this, the circulation can be greatly impaired if excessive stretching of the vessels cause their inner walls to come in contact, thus stopping the flow of blood. Therefore the circulation must be watched closely.

Nerve Stretching.—Of all soft parts the nerves are the most sensitive to stretching. "Pins and needles" is a familiar example of the fact. Should pressure on the nerve last a comparatively short time—say some hours—paralysis may ensue, the nerve remaining anatomically uninjured. Such a paralysis persists for many months.

Reactive Swelling.—Another danger of modelling correction is reactive swelling of the soft parts after the procedure. The plaster cast, maintaining the limb in the corrected position, must therefore be very accurately upholstered and even split appropriately, in order to provide room for the swelling, which is always to be expected, or gangrene may develop in the parts enclosed within the bandage.

Nature of Deformity.—The aim of modelling procedure is correction of deformity. The question arises: What is a deformity in the orthopaedic? The answer is likely to be: Deformity means any alteration of the normal form. But this would cover the conception in part only. A knee bent to a right angle may be a very severe deformity, or no deformity according as the joint is fixed or movable. It does not matter whether the bones forming the knee-joint be normal in shape or not. As soon as there is fixation, there is deformity. A straight knee-joint represents no deformity in the common sense, yet is a severe one, if the joint is fixed in the straight position. Club-foot, knock-knee, bow-legs are obvious deformities, in which alterations of the shape of the bones concur with immobility of the parts.

Deformity and Function.—The essential character of deformity s impairment of function, with or without obvious alteration in shape of the bones of which a joint is composed. Most of the deformities are represented by fixed joints. The angle, in which a joint is fixed, is of no importance. We differentiate the deformties of the joints, not by this angle, but by firmness of the given position. Thus, a joint is "contracted" if there is still ome mobility between the bones of the joint, or "ankylosed" f no mobility is left, because the bones of the joint have become united by bony tissue as a sequel to the underlying disease.

It is evident that ankylosis is beyond the reach of bloodless urgery. If an ankylosed knee is not straight, it cannot be made p by the modelling correction, but solely by the chisel. Contracted joints, however, with even the slightest trace of mobility, epresent the most important objects of bloodless treatment. ut even here the field of bloodless surgery is limited by the ature of the underlying disease.

Contractures.—To make evident the necessity of such further mitation, contractures must be classified according to their rigin. The most important causes of contractures are tubercuous disease of the joints, rickets and similar softenings of the bones and infantile paralysis. Congenital deformities, though ss frequent, are, in many cases, the cause of contractures. In ddition there are contractures caused by accident (fractures of bones, luxations of joints), by rheumatic joint diseases, by luetic, cerebral affections, etc.

Tuberculous Contractures.—On the whole the army of cripples can be divided in two groups, viz., diseased cripples and healthy cripples. Among the first are those whose contractures are due to tuberculosis. The treatment of tuberculous bone and joint diseases exclusively belongs to bloodless surgery. Resections of tuberculous joints in children in the course of time often result in deformities more severe than those occurring naturally. Open-air life, plentiful food and sunshine, combined with bloodless mechanical treatment, bring about results which contrast favourably with those due to the knife.

It is not yet possible to cure tuberculosis by direct specific medication. We must reach the aim by a roundabout way, viz., by improvement in the general health of the patient, and since a rather severe operation does not improve general health, osteoplastic operations in cases of tuberculous disease of the spine in children (Pott's Disease) are contra-indicated.

Spinal Disease.—This operation of German-American origin, consists in inserting a bony peg from the tibia between the split spinous processes of the vertebrae. By bony union of the transplanted bone-peg with the spinous processes disintegration of the vertebrae should be lessened, if not prevented. This operation might be necessary if cure could not be brought about without it. Fortunately this is not the case. On the contrary, it is proved by every day experience, that even the worst cases of their kind can be cured without any operation, while the resulting deformity (gibbosity) is no worse, and the duration of the treatment is no longer than in cases which had been operated upon. It is in tuberculosis of the spine that mechanical bloodless treatment can be proud of the result it has obtained. It is essential in the treatment of tuberculous diseases of the spine as well as of other tuberculous joints to secure immobilisation, for in this way the efforts of nature in producing bony union of the diseased parts are most effectively assisted.

The Plaster Bed.—The apparently difficult problem of immobilising the spinal column has been solved in a most satisfactory way by Lorenz's plaster bed, which is a well-upholstered plaster model of the trunk. Though pain has been severe, especially during the night, the patient in his plaster bed is exempt to such a degree that he bears perambulator exercise with equanimity. Thus he is neither confined to his bed nor to his room, he can enjoy open air, sunshine, undisturbed sleep, his appetite increases and he gets well without any operation. The developing gibbosity can be lessened, and sometimes even prevented, by adjustable cushions placed underneath the prominent parts. A similar plaster bed has been employed with benefit for spinal war injuries.

Other Joint Diseases.—In the same way immobilisation is essential in the treatment of all other tuberculous diseases of the joints (hip-disease, white swelling of the knee, etc.). Immobilisation by plaster casts is superior to extension, though this latter method is also useful as a means of fixation. By far the greater number of cases of tuberculous joint diseases, develop contractures, whatsoever method of treatment they may have gone through. Should the contracture not be evident at the time when the treatment has come to an end, it will develop later on, when the patient is left to himself.

The usual contraction of the knee-joint is flexion, of the hip-joint is flexion and abduction. It might be thought that if the treatment of tuberculous diseases of the joints is the exclusive field of mechanical bloodless treatment, it should be the same with the resulting final contractures. Although Lorenz advocates bloodless surgery in the treatment of the acute stage of tuberculous joint diseases, he warns strongly against treatment of the resulting contractures by modelling correction. The healed tuberculous joint is comparable to a bone scar and should not be torn asunder, lest the tuberculous process be stirred up anew. Such contractures call for the chisel, and correction is done not in, but near, the joint (pararticular osteotomy).

Rickets.—To the diseased cripples also belong patients suffering from rickets. During the acute stage of the disease, correction of deformities belongs to bloodless procedures. In reality, also patients with lateral deviation of the spine belong to the class of diseased cripples, because their deformity is due to a pathological softening of the bones of the spine. The treatment of scoliosis is the task of bloodless surgery. Besides measures to improve the general health of such patients, gymnastics, massage, corsets, etc., are of great importance in treatment, in which also the plaster bed plays a great part.

Healthy Cripples.—Finally reference must be made to the class of healthy cripples. Leaving on one side deformities due to accident where recourse may be had to bloodless surgery, mention must be restricted to deformities consequent on infantile paralysis, the most terrible scourge of childhood. It can well be asserted that all contractures caused by paralysis can be straightened out by the bloodless method. When the normal shape of the limbs is restored, a very simple brace is sufficient to make walking possible. It must be admitted that conditions can be improved by successful transplantation of tendons. But this operation is not absolutely necessary. Many cases do without it—for instance, cases of paralytic flexure-contraction of the knee-joint. Instead of transplanting the active flexors of the knee-joint to the paralysed extensor (quadriceps), Lorenz substitutes the lost power of this latter muscle by the weight of the body. This is done by a slight overstretching of the contracted knee, by which the line of weight is thrown in front of the axis of the knee-joint.

Arthrodesis, or artificial stiffening of joints by an operation on the cartilage and on the bone, gives poor results, except in the shoulder joint. Lorenz also strongly objects to extirpating bones in paralytic deformities of the foot. At first the result may seem to be good enough, but very often in the course of years consecutive deformities develop, which are worse than the original ones. To the healthy cripples belong further such congenital deformities as congenital wry-neck, congenital club-foot, and—most important of all, because most frequent—congenital dislocation of the hip-joint.

Advantages of Modelling Correction.—In all these cases bloodless treatment obtains better results than operative procedures. Modelling correction, assisted by preliminary tenotomy in case of absolute necessity, can overcome the severest deformities of this kind. Extirpation of bones, resection of wedge-shaped pieces of bones is superfluous in ninety-nine cases out of a hundred. Instead of resecting bones, the modelling correction restores the normal position of the deformed bones to each other and maintains this position by mechanical means. The bandaged foot, being compelled to support the weight of the body, is subject to the formative power of physiological function. By acting in their normal function the deformed bones, in the course of time, assume the normal shape. In this way the function, viz., to bear the weight of the body is forced to serve the purpose of the orthopaedic treatment. Similar benefit may often be derived from the treatment in cases of flat-foot.

Luxation of the Hip-joint.—Congenital luxation of the hip-joint, the most frequent of all congenital deformities, can be entirely cured by bloodless surgery without open operation. This achievement is one of its greatest successes. Reposition of the displaced head of the femur into the acetabulum is brought about by manoeuvres which are entirely consistent with those of modelling correction. By repeated stretching of the soft parts the head of the femur is forced into the acetabulum. This is the first, and often a very difficult part of the procedure.

Far more difficult is the second part of the treatment, *i.e.*, retention of the head of the bone in the socket, the latter being too small and too shallow to retain it within its defective borders. To accomplish this, the thigh has to be fixed in certain extreme positions, by which the head is prevented from slipping out of the socket. Owing to forced pressure of the head into the socket, the latter develops according to the size and shape of the head of the femur, while without it the socket would get smaller and smaller. Contractures and shortening of certain soft parts caused by the extreme position of the thigh help to retain the head in its normal place. It takes about a year before the socket is developed so far as to guarantee retention of the head.

The third part of the treatment consists in gradual reduction of the extreme abducted position of the thigh into the normal one. The difficulty of simultaneous treatment of bilateral hip luxation can be imagined from what has been said about unilateral luxation. Children with unilateral luxation are allowed to move about during the greater part of the treatment's duration and bear fairly well the impediment caused by the fixing bandage.

Described thus shortly the plan of treatment seems to be simple enough, but its actual achievement is by no means so simple. Experience has proved, that within certain limits of age (up to 5 or 6 years) the cure of the children can be a perfect one, while in older cases at least great improvement can be obtained. This is so much the more remarkable, as surgeons of all times regarded the deformity in question as absolutely incurable. When all mechanical experiments had failed, some surgeons opened the hip-joint with a knife, in order to deepen the shallow acetabulum with sharp spoons and to replace the luxated head of the femur into it. The results were fairly good in young children, but in older ones frequently resulted in a stiff and contracted joint. But this was not the worst, for opening the hip-joint and artificially deepening the socket proved to be an operation much more dangerous than laparotomy. Some operators had up to 10% mortality.

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BLOOD TRANSFUSION, the term used in medical literature for the process of transferring the blood from the circulation of one living animal to that of another. The first authentic record of it was not made until the middle of the 17th century. A Florentine physician, Francesco Folli, claimed to have transfused blood from one animal to another on Aug. 13 1654. Subsequently many experiments bearing on the subject were made by Dr. (later Sir Christopher) Wren, Richard Lower, Edmund King, and Thomas Cox, their experiences being recorded in the *Philosophical Transactions* published by the Royal Society about 1666. Some of these experiments were witnessed by Samuel Pepys, who referred to them in his *Diary*. In spite of this activity in England the credit for first performing a blood transfusion upon a human being must be given to Jean Denys of Montpellier. An account of his experiment done upon a boy aged 15, was published in *The Philosophical Transactions* for July 22 1667.

On this occasion, and indeed throughout the 17th century, the blood for transfusion was taken from a lamb or a calf, and, although good therapeutic results were claimed at first, the operation soon fell into disrepute and was almost entirely abandoned. Little or nothing was heard of it during the 18th century and it was not until 1818 that attention was again focused upon its possibilities. This was due to the writings of James Blundell, lecturer at St. Thomas's and Guy's Hospitals, who invented a syringe for receiving the donor's blood and for pumping it into the recipient. His first experiments were performed upon dogs and in 1824 he described the transfusion of patients with human blood. From this time onwards many different observers recorded their experiences and several methods of performing the operation were described. The coagulation of the blood outside the body was always the prime difficulty. One way of overcoming this was to remove the fibrin which forms the basis of the clot, and from 1835 onwards this defibrinated blood was used by various operators.

Transfusion did not, however, come into general use as a therapeutic measure during the 19th century, and after the year 1875 was largely neglected. This was probably due to the increased number of disasters which had attended the operation as soon as it began to come into fashion. An improvement in technique was initiated in America through advances in the surgery of the blood vessels, and this culminated in the work of Crile, who about 1907 described in detail an efficient method of performing *direct* transfusion by means of an anastomosis between an artery of the donor and a vein of the recipient. Coagulation of the blood was thereby prevented and it was possible, at any rate in theory, to transfer as much blood from one person to another as might be desired, though it was difficult to ascertain, even approximately, how much blood had passed.

Meanwhile discoveries were being made which tended to eliminate the chief factor responsible for the fatal results of some of the earlier transfusions. It had long been known that the bloods of different species of animals were incompatible, that is to say, the blood of a calf introduced into the circulation of a man was inevitably and rapidly destroyed, this process being attended by more or less serious symptoms, or even by death, according to the amount of blood introduced. In 1907 it was shown by Jansky in Scandinavia that an analogous incompatibility existed in all races of man between the bloods of different individuals, so that a given recipient might safely receive the blood of certain selected donors only. Hitherto no such selection had been practised. Jansky's work was repeated by Moss in America in 1910, and human beings have since that time been classified into four definite groups, the blood of only one of these being suitable for more or less indiscriminate injection into all recipients. This group (No. 4 of Moss's classification) includes over 40% of the individuals of western peoples and its members have been called "universal donors." Further research has shown that this term must not be interpreted too literally, but it may be regarded as a close approximation to the truth. The blood of any individual can readily be assigned to its correct group for clinical purposes, and the test is now never omitted before transfusion except in cases of great urgency.

A further advance was made in 1914 when Agôte of Buenos Aires first used sodium citrate as an anti-coagulant for the donor's blood. This substance, when mixed with the blood as it issues from the donor's vein, combines with, and renders inert, the calcium which is present in the blood in small quantity and is an essential factor in the coagulation reaction. The blood then remains fluid for an indefinite time, and the small amount of citrate which it contains is usually harmless to the recipient. Direct transfusion by Crile's method was technically difficult to perform, and it was soon abandoned in favour of citrated blood. This method was introduced opportunely for use in the treatment of the wounded during the World War, 1914–8, though it was largely employed only after the entry of the American surgeons into the hospitals in France, transfusion being more widely known in their country than elsewhere. Some surgeons, however, believed, and still believe, that citrate is responsible for the reactions, usually mild in degree, which follow a certain percentage of all transfusions, however carefully the bloods of donor and of recipient may have been tested. In spite of much controversy the supposed harmful effect of citrate has not yet been proved, and this method, which has many advantages, is more often used than any other. If whole, or untreated, blood be preferred, coagulation may be retarded by receiving the blood into a glass vessel coated on the inside with paraffin; it must then be transferred to the recipient as rapidly as possible. Several forms of apparatus have also been invented depending on the use of a syringe, which is alternately filled from the donor and at once emptied into the recipient. The use of such an instrument demands that donor and recipient should be ying side by side, and this may be a disadvantage.

In 1923 a return was made by Storer to the older method of using defibrinated blood to which no foreign substance has been added, and it is possible that this may prove to be the method f choice in the future. Storer's ground for eliminating the anti-oagulant was the belief that its presence impaired the anti-acterial properties of the donor's leucocytes, but his contention till has to be substantiated in practice, and could only be of weight in treating patients with bacterial infections.

Blood transfusion has been found to have its greatest clinical alue in the treatment of acute anaemia (*see* ANAEMIA) due to oss of blood following injury, or in conditions such as bleeding rom a gastric ulcer or *post-partum* haemorrhage. The picture of depletion of the patient's circulating fluid is here presented in its simplest form, and replacement of the blood which has been lost is the obvious and most satisfactory remedy. Transfusion is also of value in combating the shock following severe surgical operations or injury, which may or may not have been accompanied by much loss of blood, and in the treatment of several diseased conditions in which, for one reason or another, the patient's blood is deficient in its power of coagulation. Thus, in the hereditary disease known as haemophilia, the patient may be rendered temporarily normal by transfusion of blood, and persistent bleeding will cease. Transfusion has been used in the treatment of a very large number of patients suffering from pernicious anaemia, some having received as many as thirty injections of blood over a period of several years; but, although a temporary remission of the disease may be obtained by this means and the patient's life be prolonged, the disease cannot thereby be cured. Transfusion has a distinct value in the treatment of many conditions in which the patient has become exhausted by prolonged illness, particularly those due to chronic bacterial infection, but here again improvement rather than cure is to be expected. The limitations of transfusion as a therapeutic measure, are, therefore, fairly well defined. It is still used more widely in America than in other countries, but it is coming to be employed more frequently everywhere.

Transfusion may also be considered from the point of view of the donor. Here the chief point of interest is the amount of blood which he can afford to lose without danger. It has been found that a healthy young man can part with any amount up to a litre of blood without experiencing anything more than a transient faintness. Usually he is not called upon to give more than 500 to 750 cu. cm. for one transfusion.

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(G. L. K.)

BLUE SKY LAWS.—This name is popularly applied in the United States to those statutes enacted in many states to protect purchasers of stocks and bonds from fraud. The first Blue Sky law was passed in Kansas in 1911, requiring investment companies among other things to file with the Secretary of State a full description of their business and forbidding them to sell securities until authorised by the bank commissioner. Within two years no fewer than 18 other states had enacted similar legislation, and in 1926 some form of Blue Sky law was to be found in 45 states. Requirements vary in the different states, but in every case information must be filed with a designated official or commission and licence obtained.

In 1914 there developed considerable opposition to Blue Sky legislation. Its constitutionality was attacked on the ground that it violated the commerce clause of the Federal Constitution; that it delegated legislative and judicial power to an executive official; that it deprived citizens of liberty and property without due process of law. In Michigan, Iowa and Ohio these contentions were upheld by the lower courts; but in 1917 the U.S. Supreme Court decided that such laws were constitutional on the ground that "prevention of deception is within the competency of government."

BLUM, LEON (1872–), French politician, was born April 9 1872 in Paris, a member of an Alsatian Jewish family. In 1890 he entered the "École Normale Supérieure," taking his degree in philosophy. He also studied law, and in 1895 entered the Conseil d'État. In 1919, however, he was elected to the Chamber. Whilst still engaged in law he became prominent as a brilliant literary and dramatic critic. His first book, *Nouvelles conversations de Goethe avec Eckermann*, was published anonymously in 1902. He took part in the Dreyfus campaign (*see* 10.882) with Jaurès whom he loved and admired.

From 1905–14 he was dramatic critic on *Comoedia* and *Le Matin.* He joined the Socialist party in 1899, but it was only during the World War and after, that he became an active member. In 1919 he was returned for the Seine to the Chamber of Deputies and strenuously opposed Poincaré's policy concerning the occupation of the Ruhr. He played a leading rôle in the International Socialist Congresses of Hamburg in 1923 and Marseilles in 1925. Although opposed to the participation of Socialists in the government, he favoured a policy of "Support" to such governments as Herriot's and the Painlevé second ministry in 1925.

BLUNT, WILFRID SCAWEN (1840–1922), British writer (*see* 4.93), died at Crabbett Park, Sussex, Sept. 10 1922. He published a complete edition of his poetical works in 1914 and two volumes of *My Diaries* (1919 and 1920). His wife, LADY ANNE BLUNT, became Baroness Wentworth on the death of her niece, daughter of the 2nd Earl of Lovelace, in 1917. She died Dec. 25 1917, and the barony of Wentworth descended to her daughter, the wife of the Hon. Neville Lytton.

BOEHM VON BAWERK, EUGEN (1851–1914), Austrian economist (*see* 4.112), died Aug. 28 1914.

BOHEMIA: *see* CZECHOSLOVAKIA.

BOHR, NIELS HENRIK DAVID (1885–), Danish physicist, was born at Copenhagen, and graduated as a doctor in 1911. From 1911–2 he studied at Cambridge and Manchester under J. J. Thomson and Ernest Rutherford. In 1913 he became a lecturer at the University of Copenhagen, and from 1914–6 was reader in mathematical physics at the University of Manchester. In 1916 he was appointed professor of practical physics at the University of Copenhagen, and in 1921 head of the institute for theoretical physics, Copenhagen. In 1922 Bohr was awarded the Nobel Prize for Physics, and in 1923 received the honorary degree of doctor of science from the universities of Cambridge and Liverpool.

The most important of Bohr's researches are those concerned with the application of the Quantum Theory to the problems of the structure of atoms and molecules, the interpretation of their spectra and the interchange of energy between matter and radiation. His pioneer work in this field, on the mechanics and the spectrum of the hydrogen atom, was set forth in two papers in *The Philosophical Magazine* for 1913–4. Later developments include the extension of the theory to the structure and the optical and X-ray spectra of more complicated atoms, and the explanation of the regularities in the properties of different elements which are expressed by the periodic table. (*See* ATOM.)

BOILERS (*see* 4.141).—The principal developments and improvements in boiler design, construction and operation since 1910 may be summarised as larger units, additional application of heat-saving devices, increasing pressures, powdered coal firing and greatly improved automatic stokers, combustion control systems, deconcentrators, de-aerators and the experimental use of alloy steels in forged, cast and welded material.

Size of Units.—In 1910 the largest units in one setting were the Stirling boilers at the Delray station at Detroit, Mich., with 24,000 sq. ft. of surface. Many boilers of this general design are now in use in sizes varying from 15,000 sq. ft. to 30,000 square feet. Most of these installations are in the north-central United States. Flanagan (Proc. Iron and Steel Elec. Eng.) claims that the design is particularly advantageous where the feed water is bad. The Delauney-Belleville Co. in France has installed a number of similar boilers under the Ladd patents, while in America this type is best represented by the Ford plant, River Rouge, Michigan.

The horizontal tube type has increased in size from 7,000 sq. ft. in 1910, best represented by the 14 tubes high, 21 tubes wide, tube bank, with three 42 in. drums of the Babcock & Wilcox Co., to sizes containing 14,000 to 24,000 sq. ft. of heating surface, 24 tubes high, 54 tubes wide, with but one 60 in. cross-drum. Maximum furnace widths of 13 ft. in 1910 have been increased to 30 ft. in 1925, while the tube length—which was standard in 1910 as 18 ft.—has been increased in some instances to 24 feet. Steel-cased air-tight settings, the general use of superheaters and economisers, and greatly increased furnace volumes, the reappearance of air preheaters in stationary practice and the increasing use of water-tube sectional designs are notable developments.

European Practice.—In Europe, boilers of the Garbe type have been increasingly popular, although the Stirling, Babcock & Wilcox, Yarrow, Spearing, Steinmuller and other types have made progress. The largest sizes have been of Stirling type, although the double Babcock & Wilcox boilers at Barton, Manchester, are nearly as large.

Fuel Consumption.—Perhaps the best indicator of progress is the amount of coal burned per front foot of furnace. In 1910 this did not exceed 400 lb. per hour when good efficiency was obtained. This figure has been increased until 1,400 lb. per front foot has been burned in regular work at good efficiency with 1,700 to 1,900 lb. per hour during peak periods at reduced efficiency. The modern large boiler with 30 ft. furnace will burn 20 tons of coal per hour at better than 70% efficiency, evaporating 200 tons of water per hour from and at 212° Fahrenheit.

Steam Pressures.—Maximum steam temperatures still remain at about 750° F., although oil stills are being worked at 1,000° F. to 1,100° Fahrenheit. Steam pressures have steadily risen from 200 lb. gauge to 600 lb. for the majority of the installations completed in 1925, while one large boiler of 1,200 lb. pressure is in service at Weymouth, Mass., and several smaller ones in Germany and Sweden. The Swedish installations are of the Blomquist type, where the boiler consists of 10-in. tubes revolving in the furnace with the water held to their inside surface by centrifugal force (*see* fig. 2). Most of the German boilers are of the Schmidt type.

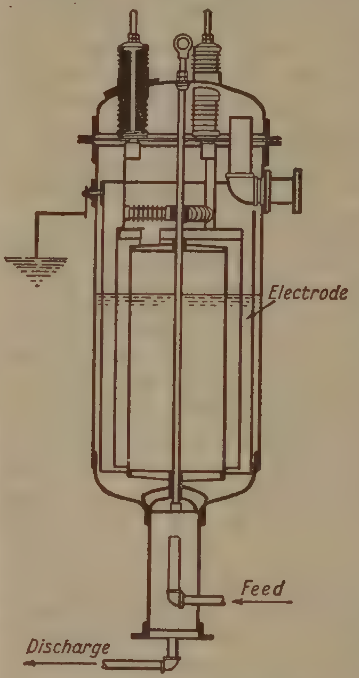

FIG. 1.—Kaelin Electric Steam Generator—three phase—single unit system.

Superheaters.—The use of superheaters has become general, and most of the newer installations are using maximum temperatures around 700° F., which was true of only a few plants in 1910. Radiant heat superheaters of a number of types are in use but have not become standard. Steel tube economisers have nearly replaced the cast-iron tube variety for high pressure work. Many designs of both tubular and plate air heaters are also in use, but this apparatus has not been in use long enough to be standardised.

Electric Boilers.—Where there is a surplus of hydroelectric power, the electric boiler, first manufactured by Sulzer Bros., has been largely used. The greatest use of this boiler is in Canada, where it has been brought to a high degree of perfection. The hydroelectric power must be very cheap or else coal or other fuel excessively dear, to make the use of these boilers economical. The internal combustion boiler, where the fuel is burned inside of the boiler in contact with the water, has been used for some years in chemical works, for gas turbines, and in torpedo service. Little real work has been done, and commercially the last two types may be neglected.

Construction.—Most of the rules for boiler construction before 1910 were drawn from the rules of such classification societies as Lloyd's, Bureau Veritas, A.B.C. or from such associations as the Manchester Steam Users' Assn. or the Swiss Boilermakers' and

Users' Association. In 1915, the American Society of Mechanical Engineers bringing together the designers, manufacturers, insurance societies and users, adopted the report of the boiler code committee. This code is now standard in the United States, having been adopted by 19 states and 15 cities. Most of the German states have similar construction laws, and the tendency toward a uniform construction law is well marked.

Tubes.—Both iron and steel boiler tubes are in use, but by far the most extensively used are the hot finished and seamless cold-drawn steel tubes made from pierced billets. Sectional headers are made from cast steel, from welded forged steel, and swaged up from seamless drawn steel tubes. Boiler drums are made from plates riveted in the usual way, but welded shells are in use as well as seamless forged shells. Alloy steels have been introduced for all purposes and are finding a place in high-pressure work, the drum for the 1,200-lb. Weymouth boiler being a hollow forging with swaged ends 24 in. in internal diameter and 4 in. thick. Staybolt manufacture has been greatly improved, and the control of riveting pressures in order to secure perfect filling of the hole without overworking the metal has been studied with great advantage.

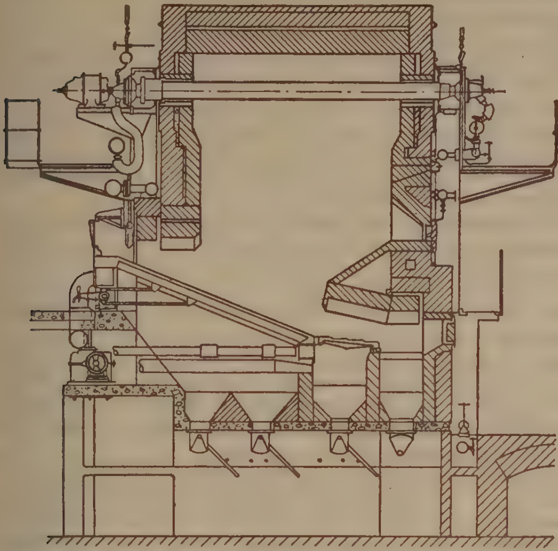

FIG. 2.—Blomquist High Pressure Boiler, 1,500 lb. per square inch.

Operating Practice.—In general, the improvement of practice has been the securing of greatly increased capacity while maintaining a better efficiency. This was not possible with hand firing or with the short and inefficient stokers in vogue in 1910. The longer underfeed stokers put in at Conner's Creek, Detroit, in 1912, gave that station a maintained boiler efficiency over a year of 78%, which was excellent work. Efficiencies over a year of 88% for boiler, superheater and economiser are now reported from Lakeside (Milwaukee) and other stations. The forced draft chain grate stoker has been most successfully used, and is built in very large sizes, while the underfeed type has been much lengthened and improved.

Capacities.—Capacities have been greatly increased. The evaporation of 4 to 6 lb. of water per sq. ft. of surface was considered good practice in 1910, and a maintained efficiency of 78% at this rating was difficult. Evaporations of 10 to 12 lb. at the same efficiency are now possible, and some late guarantees will run as high as 17 lb. equivalent evaporation per sq. ft. of surface at an efficiency of over 90%.

These improvements are due to better stoker design, to better utilisation of radiant heat, to the use of pure feed water and to automatic combustion control. Ash grinders, properly located, allow practically all of the combustible to be burned out of the fuel and most of the sensible heat of the ash to be absorbed by the air for combustion. Soot blowers, installed in most new installations since 1910, enable tubes to be kept clean. Deaerators for eliminating oxygen and other gases from the feed water prevent corrosion and assist in keeping the surfaces clean. Much more care is taken with the feed water, and water-softening plants are in universal use. Deconcentrators, working continuously, take water from the circulation system, filter it and return clean water to the boiler. Automatic combustion control systems, where the air and coal are automatically proportioned to the load, help in securing perfect combustion and maintaining a high efficiency. Furnace design has progressed until a 30 ft. by 20 ft. setting with walls 40 ft. high is possible. Greatly improved refractories are obtainable and the air-cooled firebrick furnaces gave little trouble. Water-cooled furnace walls of the fin type, cast-steel box or refractory types, are in successful use, the water used being part of the circulatory system of the boiler.

Powdered Coal.—The most striking departure, however, is the expansion of powdered coal firing, which has extended the range of good efficiency and enabled the operator to use different qualities of coal in the same apparatus with equal efficiency. The systems lends itself to the maintenance of high combustion temperatures and high CO_2, and the losses of combustible in ash and clinker are much less than where a fire bed is used. The cost of pulverising the fuel is not large, and many of the later installations have adopted this method of firing. The system necessitates large furnace volumes, about one cu. ft. of space being required for each 1·5 lb. of coal for best efficiency. The bin and feeder system, with a central pulverising plant is most successful at present, but the many unit systems are promising and much used for small installations.

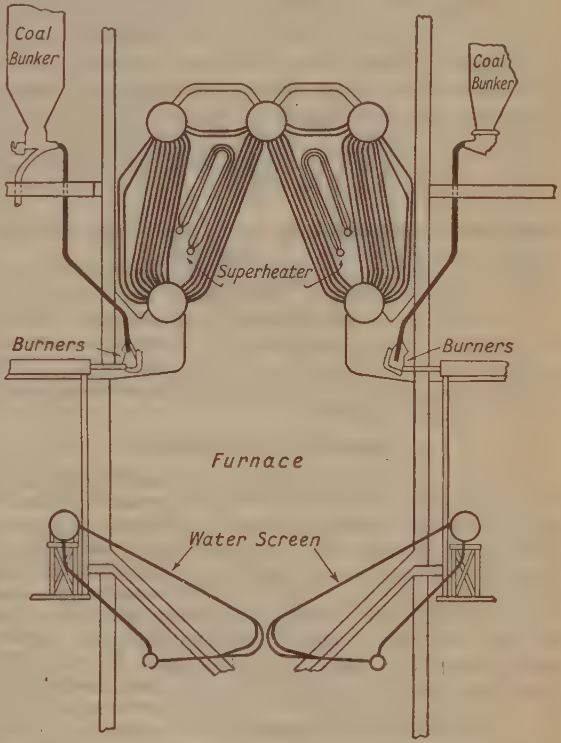

FIG. 3.—Section through Boiler House, Trenton Channel, Mich., showing great height of settings. Stirling boiler.

Oil Firing.—Since 1910, the mechanical atomising of oil fuel has been introduced with marked success, as much as 3,000 lb. of oil per hour being handled by a single burner. When the oil is heated to the right viscosity (that is, between 3°–4° Engler) atomisation is nearly molecular and the results are good. The power and heat used is usually less than ·5% of the steam output of the boiler in contrast to ·75% to 1·5% consumed when steam atomisation is used. *See* F. J. Drover, *Oil and Oil-fired Boilers*, 1924. (G. A. O.)

BOITO, ARRIGO (1842–1918), Italian composer (*see* 4.155), died June 10 1918.

BOK, EDWARD WILLIAM (1863–), American editor and author, was born at Helder, Holland, Oct. 9 1863, and brought to the United States when six years old. Educated in the Brooklyn public schools, he became an office boy with the Western Union Telegraph Company. Continuing his education at a night school, he entered the employ of Henry Holt & Co., publishers, in 1882, and two years later became associated with Charles Scribner's Sons, publishers, eventually becoming advertising manager. He acted as editor of *The Brooklyn Magazine* from 1882 to 1884. In 1886 he founded *The Bok Syndicate Press*, the success of which led to the offer of the editorship of *The Ladies' Home Journal* in 1889; under his management this magazine became one of the most successful publications in America. After 30 years as editor he retired in 1919. A year later he published *The Americanization of Edward Bok*, which won the year's award of the Joseph Pulitzer Prize for the best biography, and the gold medal of the Academy of Political and Social Science. In 1923 he created the American Peace Award, providing $100,000 for the best practicable plan by which the United States might co-operate with other nations to achieve and preserve the peace of the world, one half to be paid upon the acceptance of the plan by a selected jury and the balance upon its acceptance by the Senate. The plan submitted by Dr. C. A. Livermore, of the New York Peace Society, won the award.

In addition to his autobiography Mr. Bok published, among other works: *Successward* (1895), *The Young Man in Business* (1900), *Her Brother's Letters* (anonymous, 1906), *Why I believe in Poverty* (1915), *Two Persons* (1922), *A Man from Maine* (1923), *Twice Thirty* (1925), *Dollars only* (1926), *You; A Personal Message* (1926) and *America, Give Me a Chance* (1926).

BOKHARA or **BUKHARA** (*see* 4.156), a province of the Uzbek Socialist Soviet Republic (*see* TURKESTAN).

BOLIVIA (*see* 4.166), a republic in South America and a member of the League of Nations. Estimates of the area vary, the boundary dispute with Paraguay being still unsettled. The official estimate is 708,195 square miles. No exact census of the population has been taken. In 1925 it was estimated at 2,820,119, but it is probable that, allowing for aboriginal tribes, Bolivia has about 3,200,000 inhabitants.

I. POLITICAL HISTORY

On Aug. 6 1909 President Montes was succeeded by Senor Eliodoro Villazón. From this moment the progress of Bolivia was most marked, and during the period to the end of 1925 conditions in the Republic were much more stable, both economically and politically, than ever before. General Montes assumed office for a second term on Aug. 6 1913, and remained President until 1917. The World War had a considerable influence upon the trade of Bolivia: imports decreased, while her exports, mainly minerals, increased very considerably in value. The country proclaimed its neutrality in 1914, but departed from this attitude in consequence of Germany's submarine policy. Diplomatic relations with Germany were severed on April 13 1917, the reason for this action being that a German submarine had torpedoed in neutral waters a ship with the Bolivian Minister to Berlin on board. The Republic took no direct part in the War on the side of the Allies, but all her resources in metals were at their disposal.

Montes relinquished office on Aug. 6 1917, and was succeeded by his former Minister of Finance, Señor José Gutiérrez Guerra. Shortly after this the agitation for an outlet to the Pacific reached an acute stage. The policy of President Guerra was apparently aimed at a *rapprochement* with Chile over the long-standing grievance resulting from the loss of Bolivia's coastal territories. Popular indignation against this attitude led to demonstrations: Guerra was forced to resign, and was escorted out of the country to Arica. Meanwhile the World War had ended. Bolivia was represented at the Versailles Conference, and signed the Peace Treaty of 1919. As a signatory of the treaty, she became an original member of the League of Nations.

Relations with Chile.—Following the deposition in July 1920 of President Guerra, the Provisional Govt. of Bolivia prosecuted the popular demand for a revision of the situation in regard to her lost territory. Invoking Article 19 of the Covenant of the League of Nations, the Bolivian delegates to the First Assembly of the League presented a request on Nov. 1 1920 for the modification of the Treaty of 1904, whereby hostilities with Chile, nominally maintained since the termination of the war of 1879, were formally concluded. It was contended that the treaty had been imposed on Bolivia by force; that Chile had not fulfilled certain of its clauses; and that the resulting situation constituted a constant menace to peace: while Bolivia suffered a wrong, contrary to the rights of nations, because, under the pact she had "become a country completely enclosed and deprived of access to the sea."

The Assembly of the League decided that it could not properly entertain this request for the alteration of a treaty, and that ordinarily an international compact could only be modified by the contracting parties. Bolivia then attempted to become a party to the negotiations between Chile and Peru for the settlement of the controversy over the disputed territory of Tacna-Arica. Chile declined to admit Bolivia's claim to participation in the negotiations, declaring that it had accepted the invitation of the United States to a conference at Washington to consider the unfulfilled clauses of the Treaty of Ancon, and that those clauses related only to Chile and Peru.

Saavedra's Presidency.—In view of Chile's refusal to recognise Bolivia in the Tacna-Arica negotiations, President Bautista Saavedra, who had been elected President in 1920 and had entered office on Jan. 29 1921, appealed early in 1922 to President Harding of the United States, explaining Bolivia's case and urging that she be admitted as a third party at the approaching conference. Dr. Saavedra emphasised that the negotiations affected Bolivia as a victim of the War in which she had been associated with Peru against Chile, and that the question of the disputed territory could not be adjusted unless his nation's loss of an outlet to the sea were repaired. Further he argued that Bolivia's consent to the Treaty of 1904, by which she recognised Chile's sovereignty over the Department of Atacamá, was obtained under duress. In his reply President Harding took the view that he could not ask Bolivia to be a party to the negotiations: the inclusion of Bolivia in the discussions, he stated, was a matter for the sole consideration of Chile and Peru. Thus Bolivia was excluded from the conferences at Washington, which resulted in an agreement by Chile and Peru to submit their dispute over the unfulfilled clauses of the Treaty of Ancon to the arbitration of the President of the United States.

The presidency of Dr. Saavedra was productive of a greater efficiency in administration, and in marked economic progress. Nevertheless some measure of political unrest was experienced both in 1924 and 1925. A revolutionary movement took place in July 1924 and was promptly suppressed by the Government. Ostensibly the object was to promote the secession of the province of Santa Cruz to the neighbouring republic of Brazil, but active opposition to the policy of the Saavedra Govt. was really the purpose of the disturbance. In Jan. 1925 Dr. José C. Villanueva, a physician who had been serving as Minister of Public Instruction and Agriculture, and Abdon Saavedra, a brother of the President, were nominated as Republican candidates for President and Vice-president. The Liberal party nominated Dr. Salamanca for the presidency. After a vigorous electoral campaign the Republican candidates were elected on May 2 by an overwhelming majority. The successful candidate for the presidency should have taken office on Aug. 6, but Congress refused to ratify his election on the ground that it was invalid because Dr. Villanueva had not resigned public office, as required by the Constitution, at least six months before election. Meanwhile Saavedra continued in office.

At this moment the centenary of Bolivian Independence was being celebrated by an International Exposition at La Paz, and a good deal of political excitement developed. On Sept. 1, Congress formally declared the election of May 2 null and void. President Saavedra transferred his office to Dr. Felipe Guzmán, President of the Senate, to administer the government provisionally, pending a new election. A Cabinet was appointed to deal with the political unrest resulting from the unseating of Dr. Villanueva. To some extent the army was affected, and on Sept. 18 martial law was proclaimed in three provinces. Dr. Villanueva and his partizans were accused of tampering with the army and the unseated President was instructed to leave the country. Conditions then improved. In Dec. the new election was held and Dr. Hernando Siles, a Republican, was elected. He was installed in office in Jan. 1926.

The Constitution adopted in 1880 was still in force in 1926. Sucre remained officially the capital of the Republic, but actually La Paz had become the political and commercial capital. The National Congress meets in La Paz every year; the Presidential Palace and most of the Government offices are maintained there, and Sucre is merely the seat of the Supreme Court. (W. S. Ro.)

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The annual revenue of the Republic rose from 12,583,232 bolivianos (Bs.) in 1910 to Bs. 43,063,489 in 1924: expenditure increased in proportion, the figure for 1924 being Bs. 41,494,949. Surpluses of Bs. 816,667 and Bs. 1,368,540 were realised in 1918 and 1924 respectively, but in the 10 years 1915–24 the net deficits amounted to Bs. 39,512,416. On Jan. 1 1925 the national debt amounted to Bs. 127,834,844: it consisted of external debt, Bs. 92,970,000, internal debt, Bs. 20,647,355 and floating debt, Bs. 14,217,489. Under a contract with the Equitable Trust Co. of New York, dated May 31 1922, Bolivia arranged for a loan of $33,000,000 at 8% with a currency of 25 years, of which sum $29,000,000 had been issued in 1925, part being used to redeem a French loan for railway construction, and the balance for further railway and road building.

Production and Industry.—Mineral deposits remained the principal source of wealth in Bolivia during the period 1910–25. Throughout the World War intense activity prevailed in mining owing to the increased demand at high prices for such metals as tin, lead, copper and wolfram. In 1925 Bolivia stood second among countries in the world in the production of tin. Of her total exports in 1924, valued at Bs. 115,191,500, metals were represented by tin, Bs. 84,200,000; lead, Bs. 9,080,000; silver, Bs. 8,800,000; copper, Bs. 4,587,000; bismuth, Bs. 2,387,000; antimony, Bs. 410,000, and zinc, Bs. 86,000. The exploitation of the vast mineral wealth of the country depends largely upon the development of transport facilities and the utilisation of the immense water-power resources of the country. There has been a distinct advance in agricultural production, but methods were still primitive in 1925 and only a comparatively small area was systematically cultivated. Rubber production particularly is proving a valuable industry, exports in 1924 being valued at Bs. 2,930,000. Stock-raising was still in a backward condition in 1925, but to this branch of industry and to agriculture the Government is giving serious attention.

Trade.—Developments in mineral production resulted in a great increase in exports. The balance of trade between 1910 and 1925 was consistently in favour of Bolivia, particularly during the war years when the prices of metals rose to phenomenal heights. The course of trade is shown by the following table:—

	Imports Bs.	Exports Bs.
1910	48,802,394	75,622,146
1913	54,762,833	93,721,513
1918	34,999,886	182,612,850
1923	62,914,000	107,693,000
1924	62,570,000	115,191,500

The countries furnishing the largest amounts of imports were the United States, Chile, Great Britain and Argentina. In 1924 the main items of imports, and their values, were: manufactures, Bs. 40,057,864; foodstuffs, etc., Bs. 15,833,005; raw materials, Bs. 5,649,248; live animals, Bs. 1,028,345. Exports to the United Kingdom were valued at Bs. 81,909,611; to the United States, Bs. 25,521,144; to Argentina, Bs. 3,228,041; and to Chile, Bs. 463,119.

Communications.—As a country without a seaboard Bolivia is dependent on railways passing through the territories of her neighbours for her communication with the outer world. Traffic rights over these railways are guaranteed by treaties. There are three distinct connections with the Pacific coast. One outlet is by way of the La Paz-Guaqui Railway, thence by the Southern Railway through Peru to the port of Mollendo. Further south Bolivia can be reached from the Chilean port of Arica by a railway that runs practically straight through to La Paz, the distance between the two places being only 279 m., as against the journey of 529 m. between Mollendo and La Paz. Still further south there is the railway from Antofagasta, in Chile, which joins the main Bolivian trunk line at Uyuni. A great improvement in the communications with Bolivia was the completion in 1925 of the section of the trunk line between Atocha and Tupiza, thus giving the republic through connection, by way of La Quiaca, with Buenos Aires and the Atlantic seaboard. On the east the country can be reached via the Amazon and Madeira rivers. Most of the rubber and other tropical produce of the Beni and Colonias regions is shipped this way, with the Mamore-Madeira railway acting as a link with the river communications. In 1925 Bolivia had about 1,300 m. of railways. A further 200 m. were under construction, while projects were being considered for about 1,000 miles. In association with colonisation schemes it was proposed also to create ports along the Paraguay river—constituting part of the eastern frontier of Bolivia—so that steamers could approach the republic by way of the River Plate.

Money and Banking.—By a law of Dec. 31 1908 Bolivia virtually adopted the gold standard. The monetary unit is the silver boliviano, given a value under the above law of Bs. 12·50 to English and Peruvian pounds, both of which are legal tender. In 1920 United States gold coins were also declared legal tender, the boliviano having a par value to the dollar of $0·3893. After 1914 practically all the silver coins were exported from Bolivia, and in 1925 the currency consisted of nickel coins and paper money. On Dec. 31 1924 the stock of gold held by the three principal banks of the country amounted to Bs. 21,067,855 against a total note circulation on the same date of Bs. 34,754,848. During the war period the exchange value of the boliviano fluctuated considerably. Efforts were made by the Government to steady the exchange by means of a moratorium, the prohibition of gold exports, the suspension of banking conversion and the fixing of an official rate of exchange, but none of these expediencies sufficed to maintain the boliviano at par.

A national law of Jan. 7 1911 gave Bolivia a semi-state bank known as the Banco de la Nación Boliviano. Its original capital was Bs. 15,937,500, of which half was subscribed by the Government from proceeds of a loan raised in Paris. This bank absorbed the Banco de Bolivia y Londres, the Banco Agricola and the Banco Industrial. All national banks operating in Bolivia must subscribe 20% of their capital to the Banco de la Nación, though foreign banks may place this quota in national bonds. The paid-up capital of the Banco de la Nación on Dec. 31 1924 was Bs. 22,000,000, and the Republic then held 114,738 of the total of 176,000 shares. A German bank, the Banco Alemán Transatlántico, is the only foreign institution in Bolivia, though banking operations are also conducted through special departments of several large foreign mercantile concerns. There are two nationally constituted mortgage banks, the Crédito Hipotecario de Bolivia and the Banco Hipotecario Nacional. In Nov. 1914 a law was passed confining the right to issue paper currency to the Banco de la Nación, though permitting till Dec. 31 1924 the circulation of notes to the approximate value of Bs. 3,000,000 already issued by the Banco Nacional and the Banco Mercantil. All such notes were required to be cancelled by the end of 1929.

III. EDUCATION AND DEFENCE

Education.—After 1910 substantial progress was made in education, and the degree of illiteracy greatly reduced. It stood as high as 84% in 1900, but was reduced to about 60% in 1925. This was due not only to the big increase in the number of schools, but to the education of the army conscripts from the remote districts, who help to impart a knowledge of reading and writing to Indians who previously did not know Spanish. The amount spent on education in Bolivia rose from Bs. 1,497,643 in 1910 to Bs. 3,650,203 in 1924. Schools are maintained either by the National Govt. or by the municipalities. The number of national schools rose from 187 in 1910 to 450 in 1918, and in 1925 was well over 500. The attendance at these schools was 58,766 in 1918, and in 1925 was estimated to be over 80,000. In addition to the elementary schools, there are the high schools, or *colegios nacionales*, as well as private academies. The supply of teachers is met by training colleges established throughout the country, with a Superior Normal Institute in La Paz. A remarkable impetus has been given of recent years to practical or vocational training. Schools of arts and crafts are now found in the principal cities, and an Institute of Applied Arts at La Paz has an enrolment of about 250 trainees. The University of La Paz furnishes instruction in law, medicine, obstetrics, pharmacy, dentistry and theology. Each Department in the Republic also has its own university, with the exception of Beni, but in these institutions only one course, that of law, is generally given. A national School of Mines exists at Oruro, and the Government also maintains a School of Agriculture and Animal Husbandry, a School of Commerce, an Institute of Bacteriology, an allied School of Agronomy and Veterinary Science, a Conservatory of Music and various model farms.

Defence.—Universal military service is theoretically the basis of Bolivia's defence system, all males between the ages of 19 and 50 being liable. Actually only a limited number of the available conscripts are taken into the army, lots being drawn to fill the annual quota for training. A law of Dec. 15 1915 provided for a permanent force of 3,577 men, and the ordinary peace strength of the army is about that number, with an immediate reserve of 15,000 men, though in 1925 there were also available for defence about 200,000 men who had undergone some training. There are four regiments of infantry, a regiment of cavalry, a regiment of field artillery, equipped with Schneider-Creusot guns, a regiment of mountain artillery and a machine gun corps of 150 men. The amount actually spent on defence during 1924 was Bs. 7,878,170.

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(L. MA.)

BOLL WEEVIL, COTTON.—The first home of the cotton boll weevil was undoubtedly in the plateau region of Mexico or Central America. Before 1892 the insect had spread throughout the larger portion of Mexico. It occurs southward to Guatemala and Costa Rica, and in the eastern half of Cuba. About 1892 it crossed the Rio Grande near Brownsville, Tex., and entered U.S. territory. It may have flown across, or it is possible that it was carried over in seed cotton. By 1894 it had spread to half a dozen counties in southern Texas. Since 1894 it has extended its range annually from 40 to 160 m., although in several instances the winter conditions have caused a decrease in the areas that are infested.

At the end of the year 1922, 87% of the American cotton belt had become infested by the weevil. This infested area produces most of the cotton crop of the United States, comprising almost all of the important cotton-producing sections. Practically the only territory remaining uninfested is the semi-arid zone along the western margin of the cotton belt. Some of this territory has been invaded in seasons of favourable weather, but the weevils have been driven back in periods of adverse weather. Whether the weevil will ever become seriously injurious in that territory is problematical, but it has shown marked ability to adapt itself to unfavourable conditions. The losses caused by the boll weevil are both direct and indirect and extend throughout practically the entire cotton belt. The Bureau of Crop Estimates of the U.S. Dept. of Agriculture reported the potential production of cotton prevented by weevils in the year 1921 as 6,277,000 bales.

The adult boll weevil is about one-fourth of an inch long, varying from one-eighth to one-third of an inch, with a breadth about one-third of its length. This measurement includes the snout, which is approximately half the length of the body. Variation in size is due to the amount of food the insect has obtained in the larva stage. Individuals from bolls (unripe pods containing lint and seed) are therefore nearly always larger than those from squares (fruit buds). The recently emerged individuals are light yellowish in colour, but this changes to a grey or nearly black shade in a few weeks' time. In the field the most conspicuous indication of the presence of the boll weevil is the flaring and falling of numbers of squares or buds. Unfavourable climatic conditions and careless cultivation, however, frequently cause great shedding of the fruit, which is often mistaken for weevil damage. If excessive shedding be noted and the squares upon being cut open show a white, curved grub that has fed upon the contents, there is little doubt that the boll weevil is the insect causing the damage.

The boll weevil passes the winter as an adult or beetle. With the advent of autumn weather the adult boll weevils in cotton fields begin to seek protection against the winter. They fly from the fields in every direction, although their movements are governed partially by the prevailing winds. They may fly into hedges, woods, cornfields, haystacks, farm buildings or other places. A number of weevils also obtain hibernating quarters without leaving the cotton fields. These may crawl into cracks in the ground, under grass, weeds or other trash, and into the burrs from which the cotton has been picked. During the winter the weevils take no food, and remain practically dormant; on warm days they may move about to a certain extent. Emergence from hibernation depends primarily upon temperature and rainfall in the spring, although some minor factors are concerned. In the southern portions of the cotton belt emergence usually begins from the first to the middle of March, but farther north it is somewhat later. Emergence from hibernation has been prolonged from the middle of March to June 28, and in more extreme cases from the middle of Feb. to about the first of July.

In the spring and throughout the fruiting season of cotton the eggs are deposited by the female weevils in cavities formed by eating into the fruit of the plant. An egg hatches under normal conditions in about 3 days, and the grub immediately begins to feed. In from 7 to 12 days the larva or grub passes into its pupal stage, corresponding to the cocoon of butterflies and moths. This stage lasts from 3 to 5 days. Then the adult issues, and in about 5 days begins to breed. Climatic conditions cause considerable variation in the duration of the stages, but on an average it requires from 2 to 3 weeks for the weevil to develop from the egg to the adult. The males feed upon the squares and bolls without moving until the food begins to deteriorate. The females refrain, throughout most of the season, from depositing eggs in squares visited by other females, but late in the autumn, when all of the fruit has become infested, several eggs may be placed in a single square or boll. As many as 15 larvae have been found in a boll. The squares are greatly preferred as food and as places for depositing eggs. As long as a large supply of squares is present the bolls are not generally damaged to any serious extent. The bolls, therefore, have a fair chance to develop as long as squares are being formed. The weevil, so far as at present known, breeds in no plants other than cotton and a wild plant related to cotton and found in the mountains of Arizona.

In spite of the many complexities involved in the problem of weevil control, efficient methods (*see* COTTON) have been developed for reducing its damage, which are of practical use to growers. These are described in *Farmers' Bulletin No. 1329*, procurable on request from the U.S. Dept. of Agriculture, Washington, D.C. (B. R. C.)

BOLSHEVISM is the name given, first to the theories and later to the practice of a section of the Russian Social Democrats. Since 1917, when the Bolsheviks came into power in Russia, the word has become currently accepted as synonymous with communism. The Russian Social Democrat party was formed under the Tsarist régime to work for the replacement of the state structure by a dictatorship of the organised proletariat according to the theories of Marx. At its second convention in London (1903) the committee of this party divided into the Bolsheviks (meaning majority) with 26 members and the Mensheviks (= minority) with 25. After 1910 the two groups no longer sat in one committee; and in 1912 the Bolsheviks, under Lenin, deposed the old central committee at the Conference of Prague, declaring "we are the party."

The Bolsheviks, as opposed to the Mensheviks, aimed at the immediate establishment of the soviet system, rejecting an intermediate form of democracy. All power was to be concentrated in the hands of one centralised bureaucracy, a professional revolutionary class which required blind obedience from the mass of the proletariat, ignoring all other classes of society completely. The Mensheviks demanded a democratic republic, in which the proletariat should co-operate with the peasants and the intelligentsia.

In the abortive revolution of 1905 revolutionary Workers' Councils first made their appearance in the factories and achieved a certain amount of success. The revolutionary activity of the Bolsheviks was maintained unremittingly up to and during the World War. Discontent was sedulously sown in the army and the factories, and the method of penetration by communist "cells" was widely adopted. The Tsarist Govt. fell in 1917; after a short interregnum of the Kerensky régime, the Bolsheviks seized the supreme power and built up a new form of government based on the soviet or council system. (*See* COMMUNISM; RUSSIA.)

BOLTON (*see* 4.180) had a population of 180,851 in 1911, and of 178,678 in 1921. In 1923 it was estimated at 182,200. The area of the parish and municipal borough is 15,279 ac. of land, and 371 of water. Leverhulme Park, 98½ ac., the gift of the 1st Lord Leverhulme, was opened in 1919, and the White Bank estate of 27 ac., with a house which is used as a central school, was presented by the descendants of John Haslam in 1920. The churches of St. Barnabas and St. Margaret, Halliwell, were consecrated in 1913, and the parish of St. Chad was formed out of several others in 1912. A Presbyterian Church and the Claremont Baptist Institute were erected in 1910. Minerva Hall, the headquarters of the Lancashire and Cheshire Miners' Federation, was opened in 1914 in Bridgeman street.

BOMBAY, India (*see* 4.183b), population (1921) 1,175,914, has undergone considerable development recently owing to the activities of the development directorate appointed in 1920. Large schemes were put in hand, destined eventually to house 250,000 of the poorer inhabitants, and so relieve the existent overcrowding, and to add 2 sq. m. to the area of the city by reclamation of land in Back Bay and East Colaba. The cost seriously exceeded the estimates, on account of the unsuitable nature of the material dredged, and it was proposed in 1926 to complete only a part of the reclamation and to dispose of the dredging plant. South Salsette Island, between Bombay and the mainland, is being developed, industrial and residential colonies have been established outside the city, and several new arterial thoroughfares opened.

The Mahim scheme is complete, and comprises two main avenues and cross roads, with a road 60 ft. wide from Worli. The reclamation scheme between Mazagon and Sewri is also finished, and the cotton, grain and oil depôts have been moved from Colaba. Previously raw cotton was carried on carts from the goods yards to the Cotton Green at Colaba, but now the Bombay Port Trust has provided railway communication between the railway station, the docks and the depôt at Sewri, which has sheds to hold 3,000,000 bales of cotton.

In 1921 the Bank of Bombay united with those of Bengal and Madras, forming the Imperial Bank of India, with local headquarters in Bombay. A new General Post Office has been built near the Victoria station, the old one being now used for the fort area only, and in 1911, the foundation stone was laid of buildings for the Royal Institute of Science on Mayo and Esplanade Roads, containing a library, public hall, examination rooms, etc. A Pasteur Institute, where research in tropical medicine is carried on and plague vaccine prepared, has been established in old Government House, and a large Sanitary Institute was opened in Princess street in 1915.

Harbour Improvements.—In the harbour a deep water pier has been built at Trombay for discharge of bulk petrol, with a pipe connection to Sewri, and the seawall of the Alexandra dock is extended for 1,500 ft. to form the new Ballard pier, with a passenger station where passengers embark and disembark. A floating caisson for Merewether dry dock was ordered in July 1924, and the harbour defences have been remodelled and supplied with the heaviest guns. Docks are to be built on a large area of reclaimed land to the north of the present docks. Other recent activities of the Bombay Port Trust include the building of a line to connect with the Great Indian Peninsula and Bombay, Baroda and Central railways at a point 6 m. from the city, to take over traffic and convey it direct to the docks and depôts as required. Part was opened in 1915, and the main system finished in 1924. The total length with sidings is over 100 miles.

Electric Power.—The remarkable electric power works of the Tata hydroelectric scheme were opened in 1915. The monsoon rainfall on the Ghats is impounded in three lakes at Lonavla, and falls to a general station where 40,000 H.P. is generated by five turbines; more power will be available as the scheme develops. It is conveyed 42 m. to a receiving station on Bombay Island by aerial transmission cables, whence it is distributed to mills and other customers. Further hydroelectric developments are in progress near the present lakes where the Andhra river has been dammed to form a lake 12 m. long. The company, connected with the Tata Supply Company, was formed in 1916, and the supply of power began in 1922.

A memorial of the landing of the King and Queen in Dec. 1911 has been erected on the Apollo Bunder, replacing the temporary pavilion erected for the occasion. Previously the Apollo Bunder was used for embarking and disembarking passengers in fine weather with an iron shelter only. The memorial building of Indian design is of yellow basalt, and consists of three halls. The large centre one is flanked by arched entrances, and the smaller ones seat 600 people in each.

Trade Commerce.—Bombay suffered to a smaller extent than any other Indian port from the World War, though shipping was seriously affected by mines; 1920–1 was a record year, for though there were prolonged strikes in 1919 and in Jan. 1924, there was a strike in the mills which eventually affected 150,000 hands owing to the non-payment of a yearly bonus during a period of depression. There were disorders, and attempts, which were frustrated by the police, were made to burn down mills. There was much distress among the strikers, who returned to work in March, but in Sept. 1925 trouble again arose. In that month only five mills were at work.

Bombay remains the chief distributing centre in western India for imported cotton goods, and there are 82 cotton spinning and weaving mills in the city and environs. The preponderating share of trade is in Indian hands, and most of the mills have Indian managers. In 1922–3 the total imports and exports were worth £217,017,000 (exports £93,572,000; imports £123,445,000), as compared with £142,394,000 in 1912–3. (O. J. R. H.)

BOMBAY, UNIVERSITY OF.—In 1913 a start was made with the provision of lectures for post-graduate students in history, economics, philosophy, Sanskrit and Persian. In 1919, schools of sociology and economics were established for research, and buildings costing over 8 lakhs of rupees completed in 1923. The university is still mainly concerned with examinations and has affiliated to it a number of institutions in Ahmadabad, Baroda, Bombay, Dharwar, Junagarh, Karachi, Poona, Sangli and Surat. Ten lakhs of rupees have been given by Sir Cunimbhoy Ebrahim for scholarships by way of repayable advances to Mahommedan students going to other countries for higher studies.

BOMBS (*see* 4.181).—Under this head are dealt with solely the mechanical instruments which were evolved in 1915–6, as opposed to those used with an explosive propellent, which are described under the heading ARTILLERY.

When contrary to all preparations the combatants on the Western Front settled down to trench warfare in 1914, a demand arose for short-range engines which could throw bombs to a greater distance than was possible by hand. Eventually this need was met by trench mortars and trench guns, but the first inventions were merely improvements on the ancient idea of the catapult, and relied for their propulsive effort on the energy of springs.

Types of Bomb.—The first British weapon of this kind used in France was the *Leach*, nothing more nor less than a heavy catapult worked in a strong forked wooden frame, in which powerful rubbers were pulled back to tension by a winding handle. When the bomb was in position in the pouch a trigger broke the connection and the release of the rubbers propelled the bomb. The Leach catapult with new rubbers was capable of throwing a 1½ lb. grenade 200 yards. It possessed the advantage over trench mortars of silence in action, but its ranging power was unnecessarily great for grenade work, and not powerful enough for the work done eventually by the trench mortar. The catapult of the French Army, known as the *Sauterelle*, was smaller and more portable, but correspondingly less powerful than the Leach. This catapult was a magnified crossbow, acting by the reassertion of springs bent in cocking. The *West* spring gun, used by the British in 1915, was a very powerful weapon using an ingenious combination of springs, but was too cumbrous. It had 28 springs, and a variation in range was obtained by the number employed for each shot; using 24 springs it threw a 2-lb. bomb some 240 yards. It was an efficient weapon, but was soon rendered obsolete for reasons already explained, as were many other ingenious types.

A type, which differs in principle from a gun, did remain. It used an explosive more on the rocket principle. The grenade had a sleeve tail, and the thrower consisted essentially of a peg over which this sleeve fitted, the propellent charge being loaded into the sleeve. The most enduring example of this principle was the German Granatwerfer, used in large numbers up to 1918. It consisted of a thrower and base plate on which it could be trained for direction on the same principle as a gun, and could similarly be clamped for elevation against a graduated arc. When the sleeve of the grenade, with its propellent cartridge, was placed on the peg and the safety-pin of its fuse withdrawn, the trigger lanyard was pulled, the sear freed the striker rod which was impelled forward by a spring and fired the cartridge as in a rifle.

Until 1918 this weapon used only simple high-explosive bombs. In that year a second type of bomb was introduced in which a small repellent charge in the head of the bomb was fired on impact with the ground, causing it to rebound and so to burst in the air instead of burying itself. The ordinary (1915) grenades weighed about 4 lb. and had a range of some 300 yards. The bouncing bomb was heavier (5¼ lb.) and ranged only to 275 yards.

In the British service this heavy class of bomb was entirely supplanted by the trench mortars, howitzers, Stokes gun, etc., and by the light bomb thrown by hand. A bombing section of one N.C.O. and 30 men was attached to each battalion, and bomb-throwing became a part of every infantryman's training. There were inventions by which a bomb could be projected from the ordinary rifle. (*See* GRENADE.) (J. M. R.*)

BONDFIELD, MARGARET (1873–), British politician, was born March 17 1873 at Chard, Somerset. Her father was a lace designer and both parents were ardent Radicals. At an early age she became an assistant in a draper's shop at Brighton, but soon she moved to London, and in 1898 became assistant secretary of the Shop Assistants' Union. At the Trade Union Congress in 1899 she was the only woman delegate. She was a member of the administrative council of the Independent Labour party from 1913–21, and an active propagandist for trade boards, the minimum wage, adult suffrage, and peace. During the War she worked in the closest association with Mary Macarthur and on the latter's death, in 1921, succeeded her as secretary of the National Federation of Women Workers. This body was incorporated the same year in the National Union of General Workers, of which organisation she was the chief woman officer. She was made chairman of the Trade Union Congress in 1923 and in Nov. of that year was elected M.P. for Northampton. In the Labour Govt. of 1923–4 she was Parliamentary Secretary to the Ministry of Labour, but she was defeated at the general election of 1924. See M. A. Hamilton, *Margaret Bondfield* (1924).

BONESETTING: *see* MANIPULATIVE SURGERY.

BONI, GIACOMO (1859–1925), Italian archaeologist, was born in Venice April 25 1859. He entered the Venice Academy of Fine Arts, where he graduated as an architect, after which he studied practical mechanics in England. On returning to Venice he became assistant in the work of restoring the Ducal Palace, and in 1888 he was appointed Inspector of Fine Arts in Rome. Ten years later he was given charge of the office for the preservation of ancient monuments in the Lazio, and it was then that he undertook the excavations in the Forum and the Palatine with which his name is chiefly associated (*see* 23.591). He also erected the Museo Forense in the church of Santa Francisca Romana. In 1914 he undertook excavations on the Palatine, to which he thenceforth dedicated all his activity. Besides being an eminent archaeologist he was a keen classical scholar. Boni was made Senator in 1923 by Sig. Mussolini. Although he published no monumental work, he was the author of a large number of essays, pamphlets and articles on archaeological and kindred subjects and also on botany. He died in Rome July 7 1925.

BONNAT, LEON JOSEPH FLORENTIN (1833–1922), French painter (*see* 4.210a), died at the Château de Monchy, Oise, Sept. 7 1922.

BONNEY, THOMAS GEORGE (1833–1923), British geologist, (*see* 4.212c), died at Cambridge, Eng., Dec. 9 1923.

BOOK: *see* PUBLISHING.

BOOKKEEPING (*see* 4.225).—In the commercial world to-day an essential part of the organisation of a modern business is a strong and efficient accounts department organised upon modern and scientific lines far in advance of the methods adopted in the past. The modern business man realises that in order to manage and control his business operations he requires far more information than was the case in the past. With the increase in the cost of living the cost of clerical staff has risen, and for this reason and with a view to reducing overhead charges, new methods have been adopted in connection with bookkeeping systems in order to reduce the amount of clerical work involved.

Modern Devices.—In the modern business, the use of loose leaf and card ledgers in place of the old bound ledger has greatly increased, and a material saving in time is effected. In order to accelerate the balancing of the account books, the sectional balancing system is widely used, and each ledger is balanced at short intervals, often monthly. By this organisation a greater control is effected and the whole of the bookkeeping work is speeded up. The balances upon the total accounts afford valuable information for statistical purposes and enable the total book debts and the total creditors of the concern to be arrived at monthly, without extracting all the balances upon the personal ledgers. The clerical work that is done upon the books is materially reduced and accelerated by the use of adding and calculating machines, and if there is sufficient work to keep the machines occupied, the cost of the machine is soon recouped in the saving of clerical salaries.

Ledger posting can now be effected by machinery (*see* OFFICE APPLIANCES). One operation posts to a ledger account, adds up and works out the balance on the particular account, makes out the monthly statement and, at the same time, records the total of all the items posted so that this total can be agreed with the totals of the book from which the ledger is being posted. In this way the ledger postings are agreed daily and the work in connection with the balancing of the books is accelerated.

In modern systems every effort is made to reduce the number of operations in recording and handling transactions. For example, in the despatch and recording of sales, five operations—the detailed advice to the packer, the case contents note, the advice note to the customer, the invoice and the entry in the sales day book—may be effected at one typing by means of the typewriter, specially prepared forms and carbon leaves. The carbon copies of the original invoices are bound into books and thus form the sales day book. By such methods a considerable saving of time is effected and the opportunities for error are reduced.

Analysis Books.—A material amount of time can be saved in many businesses by analysis books, by which the number of items to be posted can be reduced to monthly totals. In large concerns, where a considerable amount of analysis work has to be done, machines are used, by which a great volume of transactions can be recorded and analysed accurately with incredible speed. The use of such machinery is the most marked development which has taken place in recent years, and as the result of practical experience, office machinery is firmly established as a valuable part of the modern accounting organisation.

Statistical Records.—The use of statistical records is as yet in an early stage of development. In the account books of a business a mass of detail information is recorded covering every phase of all the transactions of the concern. The bookkeeping records result in the annual profit and loss account and balance sheet of the business, but the modern business man is realising that important changes and movements can take place during a year and that it is vitally necessary that such movements should be detected immediately they develop, in order that steps may be taken at once with a view to overcoming any adverse factors.

With this end in view, it is a comparatively simple matter to organise a statistical system built up from the existing records by means of which the information available for the management is greatly expanded and every change is recorded from week to week. Many modern businesses have developed this type of organisation to a high degree of perfection, and have proved by practical experience the great value of this information in the management and control of business operations. Many concerns prepare approximate profit and loss accounts and balance sheets monthly, so that the whole position can be watched closely and in addition have detail statistical records of every important factor.

Diagrams are of great value, as in many cases a movement is revealed far more clearly by a well-drawn diagram than by a statement of figures, and a diagram often reveals factors which may be entirely overlooked upon a close study of a series of figures.

The Double Account System.—This system was first provided for in the Regulations of Railways Acts, 1868, and its use has been extended to gas, water, electric light and canal companies. It therefore applies compulsorily only to these classes of companies which are formed under special Acts of Parliament and which are required to present their accounts upon a uniform basis.

There is no difference in principle as between the ordinary method and the double account system—the difference is merely that under the latter system the balance-sheet is split into a capital account and a general balance-sheet. The capital account shows on the one hand the share and loan capital raised, and on the other the expenditure to date upon the acquisition of the fixed assets of the undertaking. The credit balance upon the capital account, which represents the working capital of the concern, is carried to the general balance-sheet, which, in addition, includes on the one side all the floating assets, such as cash, investments, stock-in-trade, book debts, etc., and on the other, trade creditors, temporary loans, reserves and the balance upon the profit and loss account.

With the ordinary company, the information contained in the capital account and general balance-sheet, as described above, is consolidated into one account—*i.e.*, the balance-sheet. The objects of the double account system are to show the share and loan capital which has been raised, the expenditure upon fixed assets and the balance of working capital which remains.

Under the regulations governing these statutory companies, their fixed assets must be maintained out of revenue. When, therefore, a fixed asset is replaced, the cost of the renewal must be charged direct to revenue account, but these companies are not bound to provide in advance for the cost of replacement, that is to say, during the life of the asset. The whole of the cost of replacement therefore falls upon the revenue account of the year during which such replacement takes place.

This system inevitably leads to very fluctuating charges to revenue account for replacements, but these fluctuations can be overcome by the creation out of revenue of replacement reserves. Such provisions, however, are not legally necessary and are therefore quite voluntary.

Under the regulations it is not clearly laid down as to what the procedure should be in cases where, owing to increased prices, the cost of replacement exceeds the original cost. For example, the cost of replacement of a fixed asset might be £30,000, whereas the original cost was £20,000. In this connection practice differs and some companies charge the actual cost of the replacement to revenue, and others the original cost. It is generally held that the sound policy is to charge the whole of the increased cost to revenue, as the earning capacity has not been increased, the extra cost being caused merely by an increase in price levels.

In the case of a fixed asset which is abandoned and is not replaced, the regulations do not provide that the cost of the discarded asset shall be written off to revenue. The working of the system in practice, as regards the replacement of fixed assets and as regards discarded assets, is open to criticism, but these are difficulties which may be overcome by the creation of reserves out of revenue. (*See* COST ACCOUNTING.)

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(F. R. M. DE P.)

BOOKKEEPING MACHINE: *see* OFFICE APPLIANCES.

BOOTH, CHARLES (1840–1916), British sociologist (*see* 4.238), died at Gracedieu Manor, Leicestershire, Nov. 23 1916.

BOOTH, WILLIAM (1829–1912), founder of the Salvation Army (*see* 4.239), died in London Aug. 20 1912. In 1909 Gen. Booth lost the sight of one eye and, three months before his death, of the other also. His last public appearance was at the Albert Hall, London, on May 9 1912. He was buried at Abney Park Cemetery, London, after lying in state at Olympia, West Kensington, London.

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BOOTH, WILLIAM BRAMWELL (1856–), general of the Salvation Army, and eldest son of General William Booth, its founder, was born at Halifax, Yorkshire, in 1856. He became an officer in the Salvation Army in 1874, and was appointed chief of the staff in 1880, a position which he held until his father's death in 1912, when he became general. Mr. Bramwell Booth organised the first social relief operations of the army, of which he had charge from the time when it began to extend its activities abroad. As general he travelled extensively on behalf of the Salvation Army in Europe, the United States, Canada, India, Australia and New Zealand. He originated a training system for officers in the organisation, and did much to develop foreign missions. Mr. Booth was prominent in the campaign against the "white slave" traffic. In 1885, as a result of his part in a social purity agitation, he was indicted with the late W. T. Stead and others on a technical charge and was subsequently acquitted. The action proved to a sceptical public that young girls could be bought and sold under the most degrading circumstances, and it was largely due to this agitation that the Criminal Law Amendment Act, 1885, was passed. He was ably assisted in his work by his wife, Florence, herself a Salvation Army officer, whom he married in 1882.

BOOTLEGGING AND SMUGGLING.—National prohibition (*q.v.*) in the United States has brought about a revival of the lost art of bootlegging and of the once rather popular profession of smuggling. The pioneers of early colonial days found it expedient to outlaw the sale of liquor to the Indians who, unaccustomed to its use, drank to excess and under its influence often became dangerous. But unscrupulous citizens, caring more for financial profit than for community welfare, engaged in the forbidden traffic and often concealed in the legs of their boots the liquor they carried for sale. This gave the name "bootlegger" to the illicit liquor trafficker. The name has now been revived and applied to the various phases of the intricate outlaw business of supplying liquor to the market in the complex modern world.

Smuggling.—Smuggling was a lucrative and more or less accepted occupation in colonial times, there being no centralised government interested in customs revenues. After the central government was formed, it established a Federal control of customs revenue and, through the Federal agencies of customs revenue and service and coast guard, it soon made smuggling unprofitable and unpopular, and the practice almost disappeared. The boundary line between the United States and Mexico has been the one exception. This frontier is for each nation the furthest removed from its seat of government and constitutes for each its least populous region. Except at a few widely separated points it consists of more or less barren deserts and mountains. These conditions are ideal for smuggling, and both nations have suffered financially from its continued practice. In May 1925 the representatives of both nations met in El Paso, Tex., and formulated a treaty that was designed to stop smuggling along the boundary line.

Introduction of Prohibition.—While the early settlers found it expedient to forbid the sale of liquor to a certain class, it was only by slow stages that society in the United States became willing to forbid the use of liquor to all its members. Laws to this end first appeared in small communities; and here always someone was ready to import liquor for profit in violation of the law. The need was thus always felt for wider and wider control, until ultimately the Constitution of the United States was amended to forbid the manufacture, transportation or sale of intoxicating beverages anywhere within the nation. In its laws making this amendment effective, Congress defined intoxicating beverages to be those containing one-half of 1% of alcohol by volume.

The Illicit Markets.—Individuals who continued to drink created a demand for intoxicating beverages in violation of the law, and, as always, there were unscrupulous individuals willing to supply this illicit market. There was thus rapidly built up the outlaw business of obtaining supplies of liquor and of distributing them to the market—a business involving the bribery of government and other agents and the corruption of traffic in alcohol and liquors for legitimate purposes. The Govt. easily controlled all the known supplies of liquor, and ultimately concentrated them in government-controlled warehouses from which they were withdrawn for legitimate purposes by government permit. Those people still determined to drink turned at first to home manufacture. But the bootleg business developed rapidly, and liquor soon became available at such prices as made home manufacture unnecessary, as it always had been inconvenient and unsatisfactory.

Revival of Smuggling.—The first bootleg supply was liquor withdrawn from government warehouses through the use of fraudulent permits, etc. This was soon prevented by the Govt. and the bootlegger then turned to importation from abroad. Smuggling, on an increasingly large scale, sprang into existence. Ships under the protection of foreign flags, laden with contraband liquor, hovered just without the territorial waters, within easy communication of the shore, and there established an unfailing source of supply to the bootlegger.

Coast Guard Measures.—The U.S. Coast Guard, long since relieved of its duty to prevent smuggling, and for generations engaged in the happier duty of bringing relief to those in distress at sea, was ill prepared to break up this traffic. By 1924 as many as 336 rum ships were known to be engaged in bootlegging. All along the coasts, specially equipped high-power motor-boats, often armed and armoured, and innumerable fishing and other coastwise craft, were engaged in running liquor from these ships to countless inlets and landing places. Congress increased the personnel and equipment of the coast guard to meet this situation; and the Govt. made treaties with foreign powers which, for this purpose, extended the U.S. territorial waters from 3 m. to 12 miles. By June 1 1925 the coast guard was sufficiently augmented to make a serious effort to eliminate this smuggling business off the Atlantic coast between Boston and Atlantic City. The method employed was to picket each rum ship with small patrol boats which rendered contact with the shore impracticable. This resulted in reducing the rum fleet along this front to negligible proportions and in keeping at much greater distances the few ships which did appear.

Home Manufacture.—As bootlegging found increasing difficulty in importing its supplies from abroad, it turned to home manufacture and rapidly acquired facility in imitating every foreign and domestic brand that the market demanded. Labels and containers were imitated with sufficient perfection to defy detection on the part of the purchaser. The alcohol for this manufacture was obtained by the diversion of alcohol, and particularly of denatured alcohol, from its legitimate avenues in industry. This rapidly became the chief, practically the only, source of supply. The percentage of unadulterated genuine whisky found among the total of the whisky confiscated runs between 1 and 2%.

Industrial Uses.—Alcohol (*q.v.*) is one of the articles essential to industry. Its uses are so numerous in manufacture, and the quantities used legitimately by industry are so large, that its control introduces the most serious problems for the Govt. in the enforcement of the prohibition laws. To these problems the Govt. was in 1926 giving the most serious attention, with the purpose of encouraging and protecting the legitimate use of alcohol and of eliminating its illegitimate use. This involved issuing annually over 40,000 permits and supervising the operations of the permittees.

Bootleggers and Industry.—The bootleg industry in turn invaded practically every field of business and secured permits for the use of alcohol, transacting just enough legitimate business to secure the permits, while diverting to the liquor traffic the rest of the alcohol secured. To do this successfully they sold to legitimate customers at greatly reduced prices in order to get enough business to justify their existence. They thus menaced the stability of many legitimate business enterprises and almost forced them to participate in the illegitimate profits derived from the bootleg industry. The Govt. undertook to control this situation in its earlier developments by denaturing alcohol for industrial use, to make it unfit for beverage use. But the bootlegger, indifferent to considerations of public health, soon established the practice of "boiling," or redistilling—but indifferently well. A later expedient was the introduction of chemicals to counteract the denaturant, liquors containing a double dose of chemicals thus reaching the market.

Administrative Organisation.—Early in 1925, the U.S. Coast Guard, the customs service, and the prohibition activities, all more or less directly concerned with the enforcement of the prohibition laws, were concentrated under the control of one assistant secretary in the Treasury Department. The prohibition unit was reorganised and regulations and policies were revised so as to strengthen materially the hand of the Govt. and enable it more successfully to cope with the organised and demoralising liquor traffic.

Narcotics.—While the conspicuous revival of smuggling involves liquors primarily, it is only natural that the practice, once established, should have come to include other articles. Smuggling was in 1926 practically the only source of supply for the illicit trade in narcotics. Because this trade offers tremendous profits, and because narcotics are moved in such small packages, the Govt. finds it difficult to control this smuggling. All manner of expedients are resorted to by the smugglers, and their detection requires constant vigilance on the part of highly trained agents. Real progress was, however, being made and, while there were still many addicts in the United States, it was believed that their number was continually decreasing.

It is impossible to state with even approximate accuracy the amount of liquor smuggled into the United States or illicitly manufactured during the period covered by the National Prohibition law. The very fact that the business is unlawful renders it impossible to obtain reliable figures. The table that follows gives some statistical data of the operation of the Federal prohibition officers since the effective date of the 18th Amendment. The table shows only the legal transactions uncovered by prohibition officers and permits no estimate of the undiscovered unlawful transactions.

Report of Arrests, Seizures, etc., Made by Federal Prohibition Officers

	Fiscal Year ending June 30		
	1923	1924	1925
Illicit distilleries seized	12,219	10,392	12,023
Illicit stills seized	14,000	15,853	17,854
Illicit still worms seized	7,512	8,211	7,850
Illicit fermenters seized	124,401	124,720	134,810
Gal. of distilled spirits seized	457,365	1,672,743	1,102,787
Gal. of malt liquor seized	4,803,872	5,379,528	7,040,537
Gal. of wine, cider, mash and pomace seized	9,085,411	8,774,916	10,572,933
Number of boats and launches seized	134	236	182
Total appraised value of property seized	$11,478,277	$10,843,881	$11,199,664
Number of agents injured	45	28	39
Number of agents killed	11	2	7
Number of persons arrested	66,936	68,161	62,747

(L. C. A.)

BORAH, WILLIAM EDGAR (1865–), American politician, was born at Fairfield, Ill., June 29 1865. He studied at the Enfield Academy, Ill., and entered the University of Kansas with the class of 1889, but did not finish his course. He was admitted to the bar in 1889, practised at Lyons, Kan., 1890–1, and thereafter at Boise, Idaho. He was an unsuccessful candidate for the U.S. Senate in 1902, but was elected in 1906 and re-elected in 1912, 1918 and 1924. At the time of the split in the Republican party in 1912 he opposed the nomination of President Taft, but refused to follow Roosevelt, although in sympathy with his policy. In 1913 he introduced an unsuccessful bill for raising the income tax exemption to $4,000. He had long favoured a Federal levy on incomes, but thought that with the then existing system of indirect taxation the additional burden should fall upon the well-to-do. He favoured woman suffrage and independence of the Philippines, but was opposed to the League to Enforce Peace on the ground that it tended toward internationalism. He strongly opposed many of the measures of President Wilson's Administration, and in particular the League of Nations, of which he was always an active opponent.

Always a strenuous advocate of disarmament Borah proposed a resolution in the Senate in favour of opening negotiations with Great Britain and Japan for a mutual reduction in the naval programmes of the three Powers. Though rejected at first, it was ultimately adopted by Congress as an amendment to the Naval Appropriation bill of 1921. He suggested also a world economic conference to consider disarmament, and it was in part owing to his efforts in this direction that the Washington Conference on the limitation of armaments (Nov. 1921) was held. He endeavoured unsuccessfully to persuade the Senate to recognise the Soviet Govt. of Russia. At the time of the coal strike of 1922 he favoured the operation of the mines by the Federal Government. He was opposed to the World Court, on the ground that it was an adjunct of the League of Nations. Opposed as he was to the United States joining the League of Nations, he prepared an alternative plan to "outlaw" war, which he placed before the Senate Feb. 13 1923. His sympathy with the insurgent group within the Republican party was reflected in a movement to nominate him as a candidate at the next presidential election; but at Spokane, Wash., June 23 1923, he declared that he would neither lead a third party nor be a candidate.

At the Republican National Convention held at Cleveland, O., June 12 1924, he was nominated for the office of vice-president, but refused to permit his name to go before the convention. Both on the platform and in the Senate he continued to take an active independent interest in foreign affairs as they affected the United States, freely criticising the policy of the Government. He constantly urged that pressure be brought to bear upon the Allied nations in connection with the repayment of the loans made to them by the United States. On the death of Senator Henry Cabot Lodge he became chairman of the Committee on Foreign Relations, Dec. 3 1924. In the final vote in the Senate Jan. 27 1926, he was one of the 17 who voted against the participation of the United States in the Permanent Court of International Justice. Although one of the most influential men in American public life during the period 1915–26, Borah adopted, in general, a critical rather than constructive attitude toward specific measures and his name is associated with the enactment of few important or progressive laws.

BORDEAUX (*see* 4.244) became the seat of the French Govt. when Paris was threatened by the Germans in Aug. 1914. Its population (1921) was 267,409. During the World War the town and port were exceedingly active. The factories were engaged in munition work and great quantities of stores and troops passed through the harbour, which was the chief disembarkation point for the American forces. After the War it was the seat of an American embarkation camp. In 1920 the Grand Theatre, where the National Assembly met in 1871, was burned down. An annual international fair, with a strong colonial tendency, was started in 1916, and has been held each year since, except in 1918. The wireless station at Croix d' Hins, begun during the War by the American authorities and completed afterwards, at the time the most powerful in the world, was handed over to the French Govt. in 1920.

During the War practically a new outer port was constructed at Bassens, below Bordeaux, largely by the American authorities, with docks, sheds to accommodate 40,000 tons of stores, a grain silo with a capacity of 60,000 quintals, etc. The river channel has a depth of 26 ft. to Pauillac and of 23 to 26 ft. from there to Bordeaux. A dry dock is to be built. In 1923 the establishment of an outer, or deep-water, port at Le Verdon, at the mouth of the Gironde, was sanctioned and work was started in 1924.

BORDEN, SIR FREDERICK WILLIAM (1847–1917), Canadian politician (*see* 4.245), retired from politics in 1911. Created K.C.M.G. in 1902, he died at Toronto Jan. 6 1917.

BORDEN, SIR ROBERT LAIRD (1854–), Canadian statesman (*see* 4.245), in Oct. 1911 formed a new administration to succeed that of Sir Wilfrid Laurier and on Jan. 1 1912 took office as president of the Privy Council of Canada, or Prime Minister. He was created G.C.M.G. in 1914 and during the World War spent some time in England as a member of the Imperial War Cabinet. In Oct. 1917, with a view to the better fulfilment of Canada's part in the War, Borden formed a Government comprising members of both the Liberal and Conservative parties. In this Government, which was returned to power at the election of Dec. 1917, he took office as premier and secretary for external affairs. During the War period he rendered notable service to the Allied cause, for instance in bringing about the proper utilisation by the Allies of the resources of the British Empire, such as lumber, minerals, and food; at the same time he was a strict but courteous upholder of the Canadian point of view. In 1919 he retired from the premiership and in 1922 published *Canadian Constitutional Studies.* (*See* CANADA.)

BORDET, JULES (1870–), Belgian physiologist, was born at Soignies June 13 1870. In 1892 he graduated as doctor of medicine at the University of Brussels. From 1894 to 1901 he worked at the Pasteur Institute at Paris whence he was recalled to Brussels to found a "Pasteur Institute" for the province of Brabant of which he was made director. He was also appointed professor at the University of Brussels and in 1919 received the Nobel Prize for medicine and physiology.

His early studies showed that antimicrobic sera include two active substances, one existing there before immunisation, and known as alexine; the other a specific anti-body created by vaccination. He introduced the method of diagnosing microbes by sera; and his discovery of the fixation of alexine (in the first instance for cholera) inaugurated a general method of diagnosis for infectious fevers, now universally employed for the identification of typhoid fever, plague, tuberculosis, etc. He discovered haemolytic sera in 1898; that is, the immunisation gained by every animal when inoculated by the blood of another species, against the latter, by the production of substances which destroy the red corpuscles of the same species as those which have been injected. In this manner the various species of animals can be distinguished by the chemical constitution of their specific albuminoids. He also showed that haemolytic sera act on foreign blood by a mechanism strictly comparable with that by which an antimicrobic serum acts on microbes and, further, that the reactions of all these sera are colloidal in nature.

More recently he discovered the microbe of whooping cough determining its action and the method of immunising convalescents from that disease. He devoted much time to the study of the coagulation of the blood and has thrown light on the process of the formation of coagulin showing that it includes two elements; the first, albuminoidal and peculiar to the liquid blood and the other, lipoidal in nature, originating in the cells of the blood or tissues. He further studied the formation of anaphylactic poisons and, in the sphere of microbic biology, the autolysis of microbic transmissibility. In addition to many works on various subjects, he is the author of *Traité de l'Immunité dans les maladies infectieuses*, published in 1920.

BORENIUS, TANCRED (1885–), Finnish art historian, was born July 14 1885 at Wiborg, Finland, son of Carl Borenius. He began his studies at the University of Helsingfors and went therefrom to Italy, where he laid the foundations of his profound knowledge of Italian painting. In 1914 he was appointed lecturer on the history of art, and in 1922 professor at University College, London. When Finland became independent, he acted as secretary to the Diplomatic Mission (1918), notifying the event to Great Britain, France, Belgium, etc., and the next year he was the temporary diplomatic representative of Finland in London. His works include *The Painters of Vicenza* (1909); a new edition of Crowe and Cavalcaselle, *History of Painting in North Italy* (1912); *Catalogue* of the Collections of Sir Frederick

Cook, vol. 1, "Italian Schools" (1913); *Catalogue* of Viscount Lee of Fareham's Collection (1923); *Four Early Italian Engravers* (1923); *English Primitives* (1924).

BORGLUM, GUTZON (1867–), American sculptor, was born in Idaho March 25 1867. He was educated at St. Mary's College, Kan., studied art at the school of the San Francisco Art Assn. and during 1890–3 attended the Académie Julien and the École des Beaux Arts in Paris. He then returned to America, but in 1896 went to London, and exhibited much sculpture and painting there and in Paris. In 1902 he moved his studio to New York. He was a disciple of Rodin. The huge scale of many of his conceptions can be compared only with that of antique oriental monuments. For example, he proposed a Confederate memorial on Stone Mt. near Atlanta, Ga., to be cut in relief along the face of that granite mountain as a frieze representing an army on the march, conspicuous from a great distance. The Stone Mountain Confederate Monumental Assn. was formed in order to carry out the suggestion and Borglum prepared a design. The work, however, was interrupted owing to difficulties arising between him and the association. A new design by Augustus Lukeman was adopted Aug. 27 1925 in place of that of Mr. Borglum. In 1919 he exhibited a head of Lincoln cut from a block weighing six tons. The same year he was chosen to design a monument for Warsaw, commemorating the rebirth of Poland. Among his colossal figures are the Twelve Apostles for the Cathedral of St. John the Divine, in New York, and another head of Lincoln in the rotunda of the Capitol at Washington. Other works include the Sheridan Monument in Washington; "Mares of Diomedes" and "Ruskin" in the Metropolitan Museum of Art, New York; a statue of Lincoln, Newark, N.J.; and a statue of Henry Ward Beecher at Brooklyn.

BORGLUM, SOLON HANNIBAL (1868–1922), American sculptor (*see* 4.250), brother of Gutzon Borglum (see above), completed many important statues after 1910, including "God's Command to Retreat" in 1911, representing Napoleon on horseback in a snowdrift, in bronze; "Jacob Leisler," heroic figure in bronze at New Rochelle, N.Y.; "Reverie of a Pioneer," colossal equestrian for the Court of Honour, San Francisco Exposition; "Backin' 'Em Up" (1919), four dismounted cavalrymen, with horses; "The Little Lady of the Dew," unveiled 1920 in the churchyard of St. Mark's in the Bowery, New York City; "Inspiration" and "Aspiration" (1920), two statues of Indians, in stone, both at St. Mark's in the Bowery. He was Y.M.C.A. secretary with the French Army in 1918, won the Croix de Guerre and later was engaged in work with the American Expeditionary Force in France. He died Jan. 31 1922.

BORIS III. (1894–), King of the Bulgarians, was born at Sofia Jan. 30 1894. The eldest son of Ferdinand I. who abdicated in his favour, and of Princess Marie Louise of Bourbon-Parma, who died in 1899, he received at birth the title of Prince of Tirnovo. Though born into the Roman Catholic religion, Boris III. joined the orthodox religion for political reasons in 1896. The Prince was educated at the military academy of Sofia, and in 1911 and 1912 travelled extensively with his tutors for educational purposes in Asia Minor, along the Mediterranean coast, in North Africa and the Canary Islands. His official journeys as heir-apparent included a visit to his godfather Nicolas II., at St. Petersburg (Leningrad) in 1897, visits to Brussels and Paris in 1910 and to London for the coronation of King George, 1911. He served as major in the Balkan War of 1912. During the World War, Prince Boris was attached to his father's staff, under the strict control of Ferdinand, who was well aware of his son's opposition to the Central Powers. Following the abdication of Ferdinand, Boris III., was proclaimed King of the Bulgarians, Oct. 4 1918. After his accession he lived the life of a constitutional monarch, residing at the palaces of Sofia, Vrania Euxinograde and Sitnyakovo. His education made him fluent in Bulgarian, French, Italian and German, and gave him an acquaintance with English, Albanian, Russian and Turkish. The possessor of wit, courage and individuality, he displayed great charm of manner. A great naturalist and especially fond of botany, he was also a born engineer.

BORNEO (*see* 4.256), an island in the East Indies. Its area is 289,846 sq. m. and the population is estimated at 2,500,000.

During the period 1910–25 the four political entities into which the island of Borneo is divided were free to work out their own development. The War affected them only economically. Among the natives of the far interior there were occasional disturbances, of which the Rundum rebellion in North Borneo in 1915 was the most serious, but these were suppressed by the forces at the disposal of the Governments concerned. The native tribes now live at peace; the whole island, except possibly for certain parts of Dutch Borneo, is under effective control, and apart from one or two outbreaks in the remoter districts, headhunting may be regarded as a thing of the past.

Area and Population.—The total population of the island in 1925 was estimated at about 2,500,000. The total white population was about 5,000. The Chinese were about 250,000. The following table gives the areas and population of the four political sections into which the island is divided:—

	Area (sq. m.)	Population
Dutch Borneo	212,740	1,626,001[1]
North Borneo	31,106	257,804[2]
Sarawak	42,000	600,000[3]
Brunei	4,000	25,451[2]
	289,846	2,509,256

[1] Census of 1920.
[2] Census of 1921.
[3] Estimated.

Production.—The rubber boom of 1909–10 led to large areas of land being taken up for planting, and so brought increased prosperity to the island. The boom came at a time particularly fortunate for North Borneo, which was then passing through a critical period. Brunei, and to some extent Sarawak, also benefited. Rubber companies in Borneo suffered severe depression in the years that followed the War, but the tide turned in 1925, plantations in Dutch Borneo (where tapping was not restricted) making particularly large profits (*see* RUBBER). Increased interest has been shown in coconut planting throughout the Island, but the tobacco industry, which is confined to North Borneo, experienced serious reverses. The financial assistance of the Chartered Co. enabled the three companies still operating in 1925 to survive. The stands of commercial timber in the island are almost inexhaustible and are being exploited with European capital in Dutch and North Borneo. In 1920 a modern sawmill was established in Sandakan, but owing to the political chaos in China, the nearest and most important market, the timber industry in North Borneo had not by 1925 realised expectations.

Minerals.—Dutch Borneo, the most developed part of the Island, owes its prosperity mainly to its mineral wealth. The most extensive oil-fields are at Balik Papan, but there are several others of importance, and fresh oil is continually being struck. Gold and diamonds are also worked, the richest diamond field being at Martapura, where Cape diamonds are sent for polishing and then returned to the Cape. The workings are entirely in Malay and Chinese hands. The discovery at Miri of a rich oil-field of great extent improved the fortunes of Sarawak at a time when the gold was being worked out; the annual production is over 600,000 tons, which brings the state £100,000 in royalties. Up to the end of 1925 no oil in paying quantities had been found in North Borneo, where the only mineral worked commercially was coal, mined by a British Co. at Silimpopon. Coal is mined also in Dutch Borneo and Sarawak, but the mines at Labuan have been abandoned owing to the seams running under the sea.

Trade.—The internal trade of the island is almost wholly in the hands of the Chinese. The chief imports are rice, cloth, ironware, tinned provisions, kerosene oil and matches. These are common to all the territories, but the exports vary and show the different lines on which each area is developing. In order of importance, the six chief exports of Dutch Borneo are timber, oil, coal, diamonds, gutta-percha and copra, with rubber becoming more important every year; of North Borneo, plantation rubber, timber, tobacco leaf, copra, coal and cutch; of Sarawak, oil, sago, plantation rubber, jelutong, pepper and cutch. Sarawak has also a considerable trade in rattans and illippi nuts.

Communications.—The development of the island has been hindered by lack of good communications. At the end of 1925 there were 125 m. of railway in North Borneo and 20 m. in Sarawak. Good roads, beyond those in the south of Dutch Borneo, are few. After the War an extensive scheme for opening up North Borneo by means of roads was introduced, but the need for economy caused a revision of this policy; a metalled road of 20 m. between Jesselton and Tuaran was completed, however, and also a few miles in the neighbourhood of Sandakan. Elsewhere bridle paths take the place of roads, while rivers and native tracks remain the only highways through the forests of the far interior. Towns and Government stations are linked up by telephone and telegraph, Sandakan having an automatic telephone service, and there are wireless stations in Dutch and North Borneo and Sarawak. The ports are connected by coasting steamers. Steamship companies also maintain communication between Dutch Borneo and Surabaya and Singapore; between North Borneo and Singapore, via Labuan, the Philippine ports, Hongkong and Australia. A British Co. has replaced the German line which served the territory before the War, while another line runs from Singapore to Sarawak.

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BORSTAL SYSTEM.—In the domain of criminal law, the notable change in public attitude and opinion with regard to the treatment of juvenile crime, finds expression, as far as Great Britain is concerned, in the two Acts of Parliament of 1908, viz.: The Prevention of Crime (Borstal) Act, and the Children Act.

In the middle of the 19th century, strong protests were made against a penal system, under which young persons and even children were subject to the harsh penalties of imprisonment, and penal servitude and transportation were commonly inflicted on young and old alike. Effort was then concentrated on the attempt to substitute for such penalties a system of industrial and reformatory treatment; and in 1854 the principle was established that at least up to the age of 16 this method should, in suitable cases, be adopted. In 1894 two public inquiries into the administration of prisons and of Home Office schools arrived, almost simultaneously, at the same emphatic conclusion, viz: "that the age 16–21 was the dangerous age; that we must concentrate on that; on the incipient criminal" or, as he was officially christened, the juvenile adult. At this time, about 20,000 young criminals of this age, 16–21, were coming every year to prison. They constituted a veritable recruiting ground or nursery for the dangerous professional criminal of later years. To find a remedy for this was the purpose of what has now become known as the Borstal System.

Under the Acts above quoted, the following principles were established:—

1. The age of criminal "majority" was extended to 21, with power to raise to 23.
2. In lieu of the ordinary sentence of imprisonment, a special form of detention was devised, under special rules, of which the purpose was to develop mentally and physically and morally all inmates (not prisoners). The duration to be for not less than one year nor more than three.
3. Except in very special cases, no sentence of imprisonment could be passed on any person under 16.

The new system took its name from the village of Borstal, Kent, where the early experiments on boys between the ages of 16 and 21 were carried out in an old convict prison, prior to the passing of the Act.

The Act gives power to the Court to order detention in any case, 16–21, "where it shall appear to the court that by reason of criminal habit or tendency it is expedient that the offender shall be subject to such instruction and discipline as appears most conducive to his reformation and to the repression of crime."

Aims and Results.—The rules and regulations are based on the principle that up to a certain age, every offender may be regarded as potentially a good citizen; that his lapse into crime may be due either to physical degeneracy or bad social environment; that it is the duty of the state at least to try to effect a cure, and not to class the offender offhand and without experiment with the adult professional criminal. The Act of 1908 further provided for the establishment of an association, whose special duty would be to provide for the after-care of all persons of both sexes discharged from Borstal Institutions. This association, known as The Borstal Association, is a highly organised method of care and supervision. Without this supplementary work of patronage the Borstal System could not have attained the conspicuous success which can be claimed for it, because, of the 6,000 lads released after training in Borstal establishments since the Act came into operation, only about 35% have again come into conflict with the law. Broadly, about two out of every three Borstal lads are reclaimed.

This result is achieved by the "personality" of the superintending staff, from the Borstal commissioner himself to, in a descending scale, governor, house master, and a carefully selected instructing staff, each with a strong optimism and belief that by an appeal to what is best in each individual—his honour, corporate spirit, pride in his house, love of sport, and rivalry in games and competitions, by all these subtle weapons, wisely and steadily employed, it is possible, though not easy, to recreate young natures and dispositions not yet thoroughly depraved.

When the day of freedom comes, gained after long and patient trial and test, in the form of a conditional licence to the care of the Borstal Association, which is only granted when "there is a reasonable probability that the offender will abstain from crime," the licencee faces life again with a changed outlook. The Borstal System ranks as a work well done, justifying the ideals of its founder:—

> He determined to save the young and careless from a wasted life of crime. Through his vision and persistence a system of repression has been gradually replaced by one of leadership and training. We shall remember him as one who believed in his fellowmen. (*See* Criminology.)

Bibliography.—The reader should consult the quarterly review published by the Borstal Institution, Rochester. From July 1923 to Oct. 1924 it appeared as *The Borstalian;* and from Jan. 1925 onwards as *The Phoenix.* (E. R.-B.)

BOSE, SIR JAGADIS CHANDRA (1858–), Indian physicist, was born Nov. 30 1858. After graduating from St. Xavier's College, Calcutta, he entered Christ's College, Cambridge, gaining high honours in 1884. In 1885 he joined the Bengal educational service as professor of physical science at the Presidency College, Calcutta. His first appearance before the British Assn. at Liverpool in 1896 was to demonstrate an apparatus for studying the properties of electric waves almost identical with the coherers subsequently used in all systems of wireless communication. He also invented an instrument for verifying the laws of refraction, reflection and polarisation of electric waves. His discovery of a parallelism in the behaviour of the receiver to the living muscle led him to a systematic study of the response of inorganic matter as well as animal tissues and plants to various kinds of stimulus. After laborious researches he proved that the life mechanism of the plant is identical with that of the animal. His crescograph is a recorder of plant growth capable of magnifying a small movement as much as ten million times. He was the first Indian to become F.R.S. (1920) for scientific, as distinct from mathematical achievement. In 1915 he became professor emeritus of the Presidency College and thereupon devoted himself to founding the Research Institute in Calcutta which bears his name. He was knighted in 1917.

See Patrick Geddes, *The Life and Work of Sir Jagadis C. Bose* (London, 1920) and *Sir J. C. Bose: His Life and Speeches* (Madras, 1920).

BOSNIA AND HERCEGOVINA (*see* 4.279), since 1918 provinces of Yugoslavia. Its area is 20,429 sq. m., and the population (1921) 1,889,929.

Austro-Hungarian Rule.—The winter of 1908–9 marked a decisive era in the history of Bosnia and Hercegovina, whose population found itself for six months the pivot of an acute international crisis. Despite the recent grant by the Austrian Govt. of a certain measure of church autonomy, the Serbian Orthodox element remained keenly dissatisfied, and looked more and more towards Serbia; the Moslems were nervous and reserved, realising that the steady ebb of Turkish influence in Europe was bound to increase their isolation; only the Croats, forming at most a quarter of the population, looked for help to Vienna, and they too were increasingly alienated by the trend of events in Croatia. One of the main arguments employed by Aehrenthal to justify annexation of Bosnia and Hercegovina was that the Young Turkish Revolution had forced Austria-Hungary to clear up the constitutional status of the two provinces, since otherwise the malcontent elements would have been entitled to representation in the new Parliament at Constantinople, and would thus have acquired a powerful instrument for anti-Austrian agitation.

Having made use of this argument, Vienna had no course save to grant some measure of representative Government to Bosnia and Hercegovina, and as neither Austria nor Hungary would consent to its being attached to the one rather than to the other, or to its partition between them, a hybrid form of constitution was devised, by which the territory received a Diet of its own and special laws of association and assembly, but was not represented in the two central Parliments and Delegations and thus had no say in foreign affairs. The new constitution, proclaimed on Feb. 17 1910, had the capital defect of stereotyping sectarian and social differences by dividing the electorate into three "Curiae" (or electoral colleges) and by assigning in each of these a fixed number of seats to the Orthodox, Moslem and Catholic elements, that is, 32·24 and 16 respectively, out of 72. The Diet was expressly excluded from any control of the executive, which remained as before under the Governor (Landeschef), his deputy (Ziviladlatus), the administrative head of departments in Sarajevo and the Joint Ministry of Finance in Vienna as supreme instance.

These carefully hedged concessions were very badly received. The Emperor's visit to Bosnia in the summer of 1910 was intended to symbolise to the outside world the permanence of Austro-Hungarian rule. Baron Burián, as Joint Finance Minister of the Dual Monarchy and administrator of Bosnia, tried to win the Serbian element for co-operation with the Government, and openly described them as the most progressive element in the country. Burián, himself a Magyar, was influenced by the fact that the Croats of Bosnia (with whom the Moslems were allied for tactical reasons) were strongly clerical in sentiment and were in close touch with their fellow clericals in Croatia, whose programme of Yugoslav unity inside the Habsburg Monarchy involved them in acute conflict with Budapest. The situation in Croatia reacted more and more upon Bosnia, and rendered Burián's half-measures ineffectual, while strengthening the self-confidence of the Serbs. In Feb. 1912 he was succeeded by Ritter von Bilinski, a prominent Polish Conservative who enjoyed the confidence of Francis Joseph; but any hope which he may have entertained of clearing up the internal situation was frustated by Hungary's establishment of a dictatorship in Croatia (April 1912) and by the victories of Serbia in the Balkan War (Oct.–Nov.)—events which roused the whole Yugoslav population of Austria-Hungary to a state of feverish excitement.

The Bosnian group was specially active among the Yugoslav students, who began to found organs of their own in Prague, Vienna and Zagreb as well as Sarajevo. The younger generation devoted their efforts to inculcating revolutionary ideas among university and middle school youth in Bosnia and the neighbouring provinces. They were completely successful. The confidential memoranda prepared by high officials in Sarajevo and Vienna on the very eve of the War show them to have been altogether at a loss as to what policy to adopt.

The Bosnian situation was rendered all the more difficult by the increasing jealousy between the provincial Government in Sarajevo and its nominal superior the Finance Ministry in Vienna, or to translate this into personal terms, between the military Governor, Potiorek, representing the views of the general staff and of the Archduke Francis Ferdinand, and the civilian Minister Bilinski as the confidant of the Emperor. In May 1913 Potiorek, despite Bilinski's disapproval, had closed the Bosnian Diet and dissolved various Serbian societies and the headquarters of the Serb Radicals. He continually urged the adoption of still more stringent measures, and tended more and more to act without consulting Bilinski. The most notorious instance of this was the decision, reached between Potiorek and Francis Ferdinand, that the latter should attend the military manoevures to be held in Bosnia in June 1914. Bilinski was not consulted or even notified, and the entire arrangements remained in military hands. To this circumstance must be ascribed a large share of the blame for the assassination of the Archduke Francis Ferdinand and his consort, the Duchess of Hohenberg, during their short but memorable visit to Sarajevo on June 28 1914.

This outrage was the work of Bosnian revolutionary students (*see* EUROPE; SERBIA).[1] The Governor, Potiorek, so far from being blamed for his lack of precautions, remained in high favour, was placed in command of the Austro-Hungarian forces invading Serbia and was mainly responsible for their severe defeat at Rudnik in Dec. 1914. He was replaced as governor by General Sarkotitch, who upheld all measures of repression against the Serb population. After the murder the mob of Sarajevo had, with police connivance, sacked many Serbian houses and institutions, and destroyed the Serbian printing presses and newspaper offices. During the following winter a whole series of treason trials were instituted against the youth of Bosnia—65 from the gymnasia of Sarajevo and Trebinje, 22 from Banjaluka, 9 from Mostar and 38 from Tuzla—thus demonstrating the widespread nature of the movement. Most notorious of all was the Banjaluka Treason Trial (Nov. 1915–April 1916) in which 98 out of the 151 prisoners were condemned to sentences varying from 20 years to 2 months, and 16 to death (afterwards reprieved). During the spring of 1915 the official organ at Sarajevo published list after list of Bosnian-Serb families who were thus declared to have forfeited their citizenship: and many thousands of women and children were driven across the Montenegrin frontier, often with only the clothes in which they stood.

Union with Yugoslàvia.—During the War all political life ceased in Bosnia and Hercegovina. Almost all the Serbian schools were closed. When Austria's Balkan front collapsed in Oct. 1918, a national committee was formed in Sarajevo, which acted in close accord with the Yugoslav National Council at Zagreb. Since the formal recognition of union with Serbia by deputation from the Council, the fate of Bosnia has been bound up with that of the new Yugoslav State. But though centralising tendencies gained the upper hand in the seven years following the War, many vital problems of local concern still survive. The very difficult Bosnian land question, which Austria-Hungary failed to solve in her 40 years' rule, was solved all too drastically and on party lines. The state promised the big Moslem landlords compensation, but did not fulfil its pledge, once more for party reasons; but though the large estates were split up, a new agricultural and urban proletariat was created. Sarajevo and other towns lost much of their prosperity, owing to the ultra-centralist tendencies of Belgrade (*see* YUGOSLAVIA).

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[1] For a full discussion of these events and the question of responsibility, see *Sarajevo*, by R. W. Seton-Watson (1926).

BOSTON, United States (*see* 4.290).—The population of the area incorporated as the city of Boston was, in 1920, 748,060, an increase of 77,475, or 11·6% over that of 1910, being by far the smallest percentage of increase in the history of the city, and the smallest numerical increase since 1875. But the two figures are not precisely comparable, as the municipal area was enlarged from 43 to 48 sq. m. in 1912 by the inclusion of Hyde Park, which in 1910 had a population of 15,507. During the five years 1915–20 the increase of population was less than one per cent. The official estimate for 1925 was 781,529.

The metropolitan area, constituted by the Legislature of Massachusetts for certain purposes of common action, includes, in addition to municipal Boston, 39 adjacent cities and towns, with an area of 409½ sq. m., and had in 1920 a population of 1,658,936, and in 1910 of 1,423,429. The percentage of population in the city, as compared with that of the metropolitan area, thus decreased from 47·8% in 1910 to 45·5% in 1920.

Commerce.—Boston's coastwise trade is important, the tonnage being much larger than that of its trans-Atlantic commerce. It is second only to New York in export of meat and dairy products, and is the largest leather, wool and fish market in the world. The port's foreign commerce is shown in the following tables:—

Vessels in Foreign Trade

	Entered		Cleared	
	Number	Net Tonnage	Number	Net Tonnage
1910 . . .	1,355	2,714,382	1,136	1,828,887
1915 . . .	1,488	2,463,651	1,161	1,659,802
1920 . . .	1,089	2,021,152	850	1,293,681
1923 . . .	1,695	4,303,563	1,036	2,229,408

Imports and Exports of Boston District[1]

	Imports	Exports
1910	$129,006,184	$ 70,516,789
1915	152,653,791	107,475,677
1920	456,246,322	281,614,919
1923	307,322,274	552,158,108

[1] Since 1919 known as the Massachusetts district, including Boston and eight minor ports.

Manufactures.—The following table shows the value of products and materials and the amount paid in wages in the years 1909, 1914, 1918, and 1923:

Manufactures of Metropolitan Boston

Year	Value of Products	Value of Materials Used	Wages Paid
1909	$ 510,583,337	$284,354,062	$ 93,125,349
1914	584,115,582	323,455,579	107,139,932
1918	1,240,496,193	737,506,555	210,781,794
1923	1,232,206,787	620,031,648	245,640,825

First in importance among manufactures is outer footwear, $172,879,356. Next in importance are slaughtering, $45,261,202; machinery and foundry products, including electrical machinery, $113,150,576; printing and publishing, $88,918,414; men's and women's clothing, $61,713,941; confectionery, $44,690,008. The increase in the value of manufactured products during the years of the World War (1914–8) was rapid, but was due largely to the increase in prices. The total increase in the number of persons thus employed from 1913, before the World War, to 1919, the period of highest production under war pressure, was 44,354. Then followed a period in which a large number of employees were out of work. With the immigration of foreign workers and the relatively static industrial demand, increasing numbers of native-born persons moved away from Boston and the actual increases in population were largely in the ranks of the immigrant peoples. In 1920, 32% of the inhabitants of municipal Boston were foreign-born. Of these, in percentages 24 were Irish, 16 Russian, 16 Italian, 5 English, 3 German and 36 all other nationalities; 64% of the municipal population was wholly or in part of foreign parentage.

Railways.—During the 15 years 1910–25 the subway system was enlarged. The Boylston addition from Arlington to Kenmore street (1911–4) and the extension under the Common over the Charles river basin and underground in Cambridge to Harvard Square (1914–8) developed a system 9 m. long. New subways with the elevated system gave central clearance and ease of transfer throughout the district. In the cities and towns several interurban lines were abandoned, but the motor transport service by private initiative was greatly increased. The second transportation requirement—the need for equipment to keep in touch with outside markets—has not been met. Boston has failed to provide adequate terminal and storage facilities; and it is constricted in its railway service. There are three railway systems that look to Boston for clearance and outlet: the Boston & Maine, the Boston & Albany, and the New York, New Haven & Hartford. But the lack of facilities for transfer from one system to another makes Boston virtually three ports instead of one—competitors with each other instead of with outside ports. The cities to the north (*e.g.*, Lowell, Lawrence, etc.) often find it of advantage to ship via New York. The same is true for freight originating on each of the three systems.

Education.—The public-school system is under state guidance and patronage (*see* MASSACHUSETTS). The trend of higher education has been toward increasing opportunity for the masses. This is shown not only by the increasing number of full-time college students, but also by the rapid growth in the number taking part-time university extension courses.

Buildings, Libraries and Museums.—In 1910 the Museum of Fine Arts was demolished, and on the site was erected the Copley Plaza Hotel, built at a cost of $3,800,000 and opened in 1911. The new building of the Museum of Fine Arts, erected on Huntington avenue, was opened Nov. 15 1909, and a second section opened Feb. 3 1915. The Boston Opera House was erected on Huntington avenue in 1909. To the State House east and west wings were added during 1914–9 at a cost approximating $3,000,000. John Sargent's series of panels in the public library was practically completed in 1916, when he added a third sequence, "The Theme of the Madonna." In Feb. 1924 the public library contained 1,308,041 volumes and had the large free circulation of 2,922,861 books for 1924. The New England Conservatory of Music remained the largest in the United States, having, in 1924, 3,374 students. In 1925 the Metropolitan Theatre was completed at a cost of $8,000,000; the Keith-Albee Theatre at a cost of $3,000,000.

History and Finance.—Boston, as a metropolitan district, has retained much of the institutional structure of the old towns which have grown together and become consolidated for certain purposes by legislation. Several things happened between 1909 and 1925 which indicate a drift toward political unification. What was known as the Boston 1915 movement resulted in better business leadership, in more ample support given to the Chamber of Commerce and other trade bodies and legislation toward a unified harbour. A charter adopted in 1909 gave to the city a small council of nine members elected at large. In 1920 a first effort was made to consolidate the several independent cities and towns under a Greater Boston charter, and in 1925 the holding of primaries (primary elections) was discontinued. In many ways the whole metropolitan district has developed the habit of acting together.

Boston's *per capita* expenses continued to be the largest of any American city; but the average yearly expenditure for the five years ending in 1923 was $48,504,028, excluding payments on funded and floating debts. The city debt in 1924 was $85,502,173 (gross debt, $128,627,401); this included the debt of Suffolk county, which in 1923 was $1,435,335. The Metropolitan Water Board System has a capacity of 80,000,000,000 gallons. The city's tax valuation in 1923 was $1,714,104,300, of which only $160,146,800 represented personalty. (F. A. Cl.)

BOTANY (*see* 4.299).—In treating generally of the progress and development of a science during a stated period attention may be either centred on specific events of importance which have marked that period, or directed to those gradual changes which occur without any startling innovation, but still influence opinion or alter practice. We shall consider the progress of botany from both aspects.

Discovery of a New Class of Plants.—It is not often that so short a time as 15 years is stamped by any discovery of the first rank. But the foundation of a new class of plants justifies such a claim. The discovery of the *Psilophytales* in the Rhynie Chert, of early Devonian age, is an event not merely notable as introducing in full detail a type of vegetation barely hinted at before, but also because the early land-plants so disclosed present material of the highest importance for comparison. The positive illumination which they bring in the region of morphology may be compared with that shed by the observations of Hofmeister in 1857. The publication of the Memoirs, in which they are fully illustrated, may be held as the most striking botanical event in these 15 years.

This series of memoirs on Old Red Sandstone plants from the Rhynie Chert Bed (Kidston and Lang, *Trans. Roy. Soc. Edin.*, 1917–21) embodies detailed descriptions of four species belonging to three distinct genera of land-plants; three of them are complete from end to end as they might be of any modern types. Though vascular plants, they are rootless, and there is no differentiation of stem and leaf. The relations of these plants to the living *Psilophytales* are clearly recognised, though it was found necessary to establish a distinct class to receive them, associated as they now are with the old Devonian fossil, *Psilophyton.* The reticence which the authors show is one of the most remarkable features of these monographs. They stand as statements of objective fact, and will always have to be taken into account when the foundations of the morphology of the sporophyte are discussed. In particular these plants present a new aspect of the problem as to the origin of the main categories of members in vascular plants.

The Algae.—Almost coincidentally with their publication there appeared a series of memoirs by Dr. Church of Oxford, the most notable of which was an elaborate essay entitled "Thalassiophyta." They deal with the origin of the larger algae, and suggest views as to their relation to a land flora through some early but direct transition from marine to terrestrial life. But no details of the actual transitory forms are supplied. In contrast with the memoirs on the Rhynie Chert these writings convey little in the nature of new fact. They are original but highly speculative, while the Rhynie Memoirs provide material for new inductions with the minimum of theoretical conclusion. Time will surely show which of the two methods is the more fruitful and scientific.

Generations in Plants.—The old controversy on the antithetic as against the homologous origin of alternation of generations in plants had lost its intensity in 1910, in face of the obvious deficiency of facts which could lead to a final conclusion. Moreover the cytological detail in the development of the zygote in *Coleochaete* did not support the suggestion that the mass of cells produced represents a rudimentary sporophyte (Allen, *Ber. d. D. Bot. Ges.*, 1905, p. 285). Further, the product of germination of the zygote of *Oedogonium* was regarded by some merely as a sporetetrad. Little aid could be derived from the life histories of the desmids and diatoms, for they show inconstant suggestions of alternation in the making, but with the same cytological cycle at the back of all. The brown algae also tell an inconstant tale; for on one side we see a cycle of balanced alternation of haploid and diploid phases, such as was demonstrated for dictyota by Lloyd-Williams: on the other is the lop-sided cycle of *Fucus*, where there is no independent haploid generation at all beyond the gametangia themselves, and the substantive plant is diploid. The period under discussion has happily shed light on this difficulty by the demonstration, through various hands, of a minute but independent gametophyte in *Laminaria.* Those who will, may see in it some elucidation of the state of *Fucus*, and hold the view that there has been a progressive elimination of the independent gametophyte along lines roughly parallel to those of angiospermic plants, the final result appearing in the simple cycle of *Fucus* itself.

Meanwhile a serious attack has been made at a more promising point by the study of the cytological history of one of the simpler brown algae. Miss Knight (*Trans. Roy. Soc. Edin.*, vol. 53, 1923) has shown that the cycle of *Pylaiella* may be traced from diploid plants bearing unilocular sporangia and haploid spores, to haploid plants producing haploid gametes whose fusion results in the re-establishment of the diploid condition. But the completion of this cycle may be indefinitely postponed by a long succession of haploid and diploid individuals, while there appears to be no obligate relationship between the cytological states of the somatic nuclei and the kind of sporangium developed on a given thallus. In fact, in *Pylaiella* the cytological state cannot be viewed as determining the nature of the reproductive cells. This instability suggests that we see here a form of alternation nascent rather than complete; and it stimulates interest in a continued cytological study of other simple algae.

Cytology of the Red Seaweeds.—The complicated life histories of the Red Seaweeds have, during the period under review, been reduced to a common cytological scheme, through the investigations of Yamanouchi, Kylin, Svedelius and others. In the simpler types the reduction takes place on the first division of the egg (Scinaia), so that the egg only is diploid and the rest of the cycle haploid, reproducing vegetatively by monospores: this state is not unlike that of *Oedogonium.* But in others three distinct generations may occur in the life history, the reduction taking place in the *Tetrasporangium.* The germination of a tetraspore gives a haploid gametophyte; on syngamy the result may be a diploid carposporophyte, which is dependent upon the sexual plant and produces carpospores. These again on germination produce diploid tetrasporophytes, bearing after reduction haploid tetraspores; and these again germinate to form gametophytes that may be dioecious. Notwithstanding the variability and the apparent complication of these life histories, as first described by Bornet and Thuret, they prove to be based upon a simple cytological cycle, essentially similar to that which Strasburger demonstrated in 1894 underlying the alternation of the Archegoniatae, as first described by Hofmeister.

Cytology of the Algae.—There is in point of fact a high degree of variety in the way in which the cytological cycle fits upon the succession of formal changes in the algae. These plants may be regarded as showing an instability of "generations" that is not dominated or corrected by environment, since the conditions under which the cycle is executed are as a rule relatively uniform. It is different with the landliving archegoniatae. Here the nuclear cycle (though still open to occasional exceptions) is more definitely stabilised in relation to successive "generations," so that the sporophyte is normally, though not invariably, diploid, while the gametophyte is normally, though not invariably, haploid. It may be suggested rather than fully substantiated that this stabilisation has in descent been related to the land-habit and to that amphibious life which it imposed upon the earlier denizens of the land. This greater stability certainly accompanies the existence of the archegonium, an organ which is plainly a means of encapsulating the defenceless ovum in plants exposed to the air. Some such general view of the archegonium, first suggested by Schenck and by Lang, formed the background of many of the arguments advanced in the discussion on alternation at the Linnaean Society in 1909 (*New Phyt.*, vol. 8, p. 104).

If the archegoniate type of alternation be thus regarded as stabilised in accordance with an amphibious habit, though possibly initiated in some less stable ancestral cycle, the old controversy between antithetic and homologous alternation may be held as drawn. The field has been appreciably widened from the restricted source of comparison with green algae. The problem of the future in this relation will be not so much the origin of the gametophyte and sporophyte respectively, as that of the correspondence of the diploid and haploid states with somatic phases characterised by differences of external form. For the nuclear cycle appears to be a more constant thing than the formal phases of the soma upon which it is imposed. One feature, however, appears to be general, viz., that a diploid nuclear state habitually underlies the most complex structure that the soma has attained. What is specially required as a foundation for a settled opinion on alternation is a wider knowledge of the nuclear cycle in the simpler forms of algae. But even when such facts come to hand, it may still be a question whether the archegoniatae are related phyletically to any known algae, or yet whether they all sprang from one common source.

Morphology and Physiology.—The relations between morphology and physiology have been changing during the years under review (1910–26). The old formal morphology, which dealt with conformation in the abstract and submitted the data to stiff objective comparison, has now given place more fully than ever before to that treatment which is best described under the title of organography. Not only is the method of Schleiden adopted, which ordained that development is the foundation of all insight into morphology, but that development is now studied from the point of view of the conditions under which it proceeds. The results are consciously and intentionally related to the impress of those conditions upon the individual life. This aspect of form is presented in a work which will probably be held as, more than any other, representative of the period, viz., the second edition of the *Organographie der Pflanzen* (1913–23), by Professor Karl von Goebel. In its 2,000 pages there is embodied a great mass of fact, methodically stated and treated comparatively. But the work suffers from a want of close co-ordination of the rich material, and from the absence of any apparent attempt to draw the isolated threads together into any general conclusion that can be held as phyletic. Moreover the material, magnificent as it actually is, is singularly deficient in two essential features, viz., in comparison of the internal structure of the adult plant, particularly of the characteristics of the vascular system, and in the comparison of related fossils with the data from living vegetation. In the absence of these aspects, so essential as they now are for any balanced comparative conclusion, the deficiency of positive phyletic results is readily intelligible. Probably such results lay entirely outside the scheme of the distinguished author. His object may have been the study of Organography in the abstract, in which case he has fully achieved his end.

Scheme of Descent.—During the period under review opinion has been gradually assuming some more definite form as to a general scheme of descent of the vegetable kingdom. It has been influenced by the new and positive data of palaeontology which have emerged (*see* PALAEOBOTANY). The data may not appear greatly to aid the construction of any "evolutionary tree." They tend rather to induce a negative opinion, that, though signs of convergence downwards may sometimes be recognised, if any connection of the several lines existed at all it must needs be sought in periods of time prior to those of which we have any exact knowledge at present. Such a view is supported by the early existence of wood of coniferous type, such as that of Hugh Miller's "cone-bearing tree," from the Old Red Sandstone of Cromarty.

Importance of Palaeontological Records.—The investigation of eospermatopteris,[1] presumably a pteridosperm from the Devonian of New York State, appears to support the view, already beginning to be entertained, that the filicales and the pteridosperms were more distinct from one another in descent than had been previously believed; perhaps that they represent separate lines of evolution from some such a type of vegetation as is seen in the Rhynie fossils. A still more separate origin must be sought for the lycopodiales, equisetales and sphenophyllales, and for the bryophyta. On the other hand the palaeontological evidence has become more and more explicit in showing the priority of Eusporangiate as against Leptosporangiate ferns. It is even doubtful whether any typical Leptosporangiatae were existent in palaeozoic time. With such a basis already secured for a phyletic scheme within the class of the filicales, it is becoming possible to lay out the several families of ferns with some degree of certainty as to their evolutionary relations, their progressive features being constantly subject to check according to their remarkably consistent palaeontological record from the carboniferous period onwards.

Such results for the pteridophytes depend upon a wide range of comparison, combined with a consecutive palaeontological record. This is shared in some degree by the gymnosperms, and remarkable progress has been made in their study both in the living and the fossil states, especially in America (*see* PALAEOBOTANY) and compare the writings of Coulter and Chamberlain, of Jeffrey, of Wieland and of Lawson of Sydney, Australia. But the angiosperms present a problem hitherto well-nigh insoluble, notwithstanding much intensive examination of their fossil remains. No doubt the system of Engler was an advance upon its predecessors. No one will feel confident satisfaction in its results. What is required is some great extension of the criteria of comparison by which the higher plants may be seriated, together with more ample palaeontological data according to which the results of those comparisons may be checked. Without such added means the end, viz., a naturally phyletic grouping of angiospermic plants, seems not yet to be within sight.

Tentative efforts have been made from time to time, but the success has been slight or partial. Perhaps complete success may never be attained, for on the one hand essential features of the propagative organs of Angiosperms are highly standardised: as witness the constancy of the embryo-sac and its contents; of the pollen-sac and pollen grains; and of the embryogeny. On the other hand, the vegetative system is very directly subject to modification according to circumstances. Thus the most valuable ground for their seriation is cut away from under the feet of the phyletic systematist of the angiosperms. Probably the best means of advancing this difficult branch will be to begin from the distal end, by the specific and generic study of some carefully selected families. As such results become cumulative it may become increasingly possible, with the help of palaeontological data, to probe downwards towards the earlier sources. But in practice this method is still in its infancy.

Cytology.—In cytology (*q.v.*) and its allied branch of heredity (*q.v.*), the general tendency has been toward a less implicit confidence in the exclusive importance of the chromosome. But on the other hand a beginning has been made in the critical review of older classifications of the algae and fungi on the basis of cytological characters in a broader sense. As regards the chromosomes themselves the position as stated by Bateson appears still to hold, that all the evidence points to the conclusion "that we are about to find among the chromosomes one more illustration of the paradoxical incidence of specific difference, not the fundamental phenomenon on which that difference depends" (Mendel's *Principles of Heredity*, 1909, p. 270). As regards heredity the fundamental importance of the establishment by Johannsen of the pure-line principle has become ever more evident, and it is now embodied in the practice of plant breeding stations. But this need not by any means exclude the possibility of change of features in the pure lines themselves, in which in any case rare mutations are known to occur: in particular such changes as may result from the impress of environment extended over periods of secular time.

Evolution in Plants.—The years under review have witnessed changes in opinion on evolutionary questions, but these have not yet consolidated into any general agreement respecting the methods of evolution in plants. The eager pursuit of the chromosome, stimulated as it was by the coming of Mendelism (*q.v.*) has not provided any completely satisfactory solution. It is now realised more clearly than before that Mendelian segregation is at best a distributing agency; it is not a means of producing new characters, though characters may be grouped by its means, as in Prof. Biffen's wheats. The real question is that of the origin of heritable features. In this connection there is a pronounced tendency to break loose from the old obsession of Weismannism.

It is beginning to be realised that the whole mechanism of sexuality in the two kingdoms of living things has been homoplastic in origin; for the segregation of the kingdoms (if they ever had a common origin) certainly antedated the distinction of sex, and apparently also the existence of any form of conjugation. Accordingly it is quite immaterial to the botanist (except for purposes of interesting comparison) what views may be held by zoologists as to the way in which inherited characters may have appeared in animals. In particular, the early segregation of the gonad in animal embryology has no counterpart in the plant, and with this falls away any cogency as regards plants that Weismann's argument from that source may have possessed, against the inheritance of characters acquired during the lifetime of the parent. The readiness with which the individual plant is moulded by the conditions under which it develops would make it appear probable that the race should also be so moulded. Given the latitude of secular time for the effect to be impressed as heritable, in contrast to the brief period of experiments which appear to give a negative result, it would seem, *a priori*, probable that many characters held as adaptive may have been so inherited: in fact that the distinction between fluctuating variations and mutations is not absolute. In the case of the filicales, with their long palaeontological history, a consecutive argument may be advanced supporting this view (*see* Evolution).

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[1] W. Goldring, *New York State Museum Bulletin* (March 1924).

The "Mnemic Theory."—In his presidential address to the British Association in Dublin in 1908, Sir Francis Darwin advanced a Mnemic Theory as applicable to plants. He had found it possible to impose rhythmic movements upon certain plants experimentally, by stimuli repeated at intervals; the rhythmic reaction was continued after the stimulus was removed. This suggested to him a reception of engrams, such as played a part in the mnemic theory of Semon. His address has received less attention than it deserves. Botanists should allow themselves full freedom from the views of Weismann, which have been imposed upon them on grounds which in plants have no cogency. When this is done the way will appear open for a rational explanation of those characters which are held to be "adaptive": without it they appear unintelligible, and even fortuitous.

Development of Plant Physiology.—The opening of the present century has been marked by great extension in the opportunities for research into the physiology of plants. Not only is this seen in the better equipment of departments in universities and colleges, but also in separate establishments carrying on physiological enquiry apart from teaching. It will suffice to mention as examples of these in Britain, the John Innes Institute at Merton, the Royal Horticultural Society's Station at Wisley, the Lawes Institute at Rothamsted, now greatly extended with increased staff, plant-breeding establishments, such as those of Corstorphine and Aberystwith, and marine stations, such as Plymouth and Millport. Similar stations exist also abroad, notably in America, where they culminate in such centres as the Desert Station at Tucson, the Marine Laboratory at Woods Hole, and in the newly established and richly equipped Thompson Institute at Yonkers. Funds have become available in many lands for purchase of costly apparatus necessary for experiments under constant and controlled conditions, such as are necessary for arriving at quantitative physiological results. Since special articles appear under the headings Ecology, Pathology, Photosynthesis and Physiology, it is not necessary here to pass into detail on these branches. But in case any workers less richly endowed than others should be discouraged by lack of financial support, it may be well to remember that money cannot buy mentality, while the excellence of the work in an institute is often in the inverse ratio of the facilities, as Reinke long ago remarked.

During the period, the physiological work of Sir Jagadis Chandra Bose has been brought prominently before the public eye in the newspapers. His observations were based upon the use of remarkably elaborated recording instruments, the readings of which require most accurate checking and correction. Unfortunately the statement of the results has been in terms pictorial rather than scientific, which has aroused criticism rather than acceptance both in Europe and in America.

Importance of Systematic Botany.—Increase in the facilities for physiological research may bring certain risks with it, and there is at the present time some reason for entering a caution based upon the history of a past period. Between 1860 and 1880 the condition of botanical teaching in British universities was deplorable. This was due partly to a want of initiative in the professoriate that is not likely to recur, but more to perverted ideals consequent upon the insistent demands of Empire. A similar state characterised also the American universities. There, as in Great Britain, botanists were chiefly engaged in systematic and descriptive work, and physiology in the broadest sense was in abeyance. It required a minor revolution, conducted by those who found their stimulus in foreign text-books and continental laboratories, to adjust the perverted balance. By its means a safe middle position had been attained by the end of the century. The head of any university department was then expected to cover adequately the whole field of his science: to turn out graduates well grounded in all its branches, and able to specialise in any of them. The tendency now appears to be towards a completion of the pendulum-swing to an opposite extreme to that of 1870, and to turn out specialists highly expert in certain branches only, and, in particular, physiologists who know little or nothing of morphology.

The demand of the Govt. for the supply of fungologists, plant pathologists and the like enhances this risk, and encourages rapid production of the highly specialised expert rather than the fully equipped botanist. Official sanction has lately been given to a lop-sided training in the pages of *The New Phytologist*. It has there been urged that morphology should be given a subordinate place in botanical education, and physiology a superior position. Thus within half a century we see evidence of an extreme swing of the pendulum, from 1870 when systematic botany ruled and physiology was ignored, to a present position when physiology is advanced by some at the expense of morphology. It must be borne in mind that systematic botany is but the methodised product of morphology, and morphology the record of continued physiological action. The several branches can never be detached with impunity. Preferential treatment of physiology would tend to restrict the supply of those trained systematists of whom the British Empire has constant need, but of whom the supply is already deficient. The divergence of interests here referred to is not restricted to Great Britain. It is liable to occur wherever there is a large and specialised departmental staff. High specialisation brings a risk of a loss of general view over the whole field of a science, such a view as is essential for well-balanced judgment; and it is most of all necessary in those whose duty it is to direct large organisations, such as a government garden, or more particularly the department of botany in a university. Here the training should be such as to fit students equally for the pursuit of all branches of the science, rather than to turn out finished experts ready to meet at once governmental needs in any one branch.

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(F. O. B.)

BOTHA, LOUIS (1862–1919), Boer soldier and statesman (*see* 4.303). Botha's conciliatory policy in the Transvaal was one of the prime factors in promoting a better feeling between Dutch and English throughout South Africa and so encouraging the movement towards closer union. He himself had long realised the need of such union for the peace of South Africa, and he welcomed Lord Selborne's *Memorandum* of 1907 as a basis of discussion. The delegation from the Transvaal to the Convention of 1908–9, composed as it was of Dutch and English, most of whom had been fighting one another six years before, was, of all, the most effective and harmonious. This was chiefly due to the tact and careful preparation of Botha and his lieutenant, General Smuts, who with their colleagues had worked out the policy of close union which ultimately found expression in the constitution adopted. In the lengthy deliberations of the Convention his influence, supported by his Transvaal colleagues, was outstanding; while the final difficulty about the capital, which threatened to wreck the whole proceedings, was overcome by his personal appeal to his own die-hards.

First Premier of South Africa.—Botha was one of the delegation that took over the new constitution for sanction by the Imperial Parliament in 1909, and on the proclamation of the Union in May 1910 was asked by the governor-general to form the first South African Ministry. Though he rejected the idea of a coalition ministry as impracticable at the time, he had no idea of governing solely in the interests of the Dutch; on the contrary he believed that his great object, the fusion of the two races, could be best attained by showing that his South African party, mainly, but by no means entirely, Dutch in composition, could under his guidance deal fairly with English as well as Dutch. As General Smuts said of him, he "had a vision of a great Afrikander nation . . . one great people of the white sections of the population of South Africa." He gave signal proof of this spirit when one of his ministers, Mr. J. B. M. Hertzog, made anti-English speeches in the country, by excluding him from the Ministry (Dec. 1912); and he persuaded a great meeting of his party, in spite of strong opposition led by De Wet, to endorse his policy (1913).

The confidence of his own party and the growing appreciation by the Unionists of his conciliatory policy gave him the needful backing in dealing with two serious domestic difficulties in 1913 and 1914. The first was the question of settlement by Indian immigrants, to which there was strong opposition in South Africa. M. K. Gandhi, supported as he was by the Indian Government, proved an able advocate of the Indians' views; but finally General Smuts, acting on behalf of the Cabinet, made a compromise with which Gandhi professed himself satisfied.

The other difficulty was more serious. In July 1913 there was great unrest on the Witwatersrand followed by a strike of the white miners and threats of a native rising also; many acts of violence occurred, and, to make matters worse, the Union forces were being reorganised and so were not available. Much against his will Botha had to call on the Imperial troops to deal with a domestic difficulty, and, after a collision between them and the Johannesburg mob, he and Smuts signed an unsatisfactory agreement with the strikers. In the following Jan. a still more serious strike broke out, which became general and stopped the entire railway service. But this time the Government was prepared. The burgher force was called out, martial law was declared; and nine of the labour leaders were summarily deported without trial. The strike thereupon collapsed; and, though there was some criticism both in England and in South Africa at the high-handed methods of repression adopted, the South African Parliament endorsed the action taken by Botha and Smuts.

The Outbreak of War.—At the Imperial Conference of 1911 Botha had familiarised himself with the foreign policy and the military resources of the Empire. Accordingly when war was declared against Germany in Aug. 1914, Botha, contrary to the view of many of his Dutch supporters, at once declared that South Africa, as a part of the Empire, was at war also. He suggested that the Imperial troops might be recalled for service in Europe, and offered to assure the defence of South Africa by the Union forces alone. Further, on the invitation of the Imperial Government, he agreed to invade German South West Africa. But this was going much further than a large part of the Dutch in South Africa were prepared to follow him. While preparations were being made for the campaign, C. F. Beyers, the commandant-general of the Union forces, and S. G. Maritz, the commander on the German border, suddenly revolted and in Oct. were joined by De Wet.

Before the end of the year it is estimated that 12,000 rebels were in arms in the Transvaal and the Free State. Though all the leaders and most of the rank and file of the rebels had been his comrades in the South African War, Botha never hesitated as to his duty to suppress the rising. But he was determined to do it with as little racial feeling as possible, and employed purely Dutch commandos of his loyal followers for the purpose. Moreover, in the two short campaigns in the Transvaal and the Free State he took command himself, saying, "It is my duty and it is the only thing for me to do. Beyers and De Wet are strong men and have a strong following in the country. There is no one else I can put in their place just now, so I must go myself." Little fighting was needed to quell the revolt: on Oct. 28 he defeated Beyer's force in the Transvaal, and their leader was drowned, while trying to escape across the Vaal, on Dec. 8; early in Nov. Botha took the field against De Wet in the Free State and on Dec. 2, De Wet himself was captured; while on Feb. 3 1915 Maritz's force surrendered. After this brief civil war, described by Botha as "the saddest experience of his life," he showed a wise clemency in his punishment of the leaders and at the end of two years had released all the prisoners.

Conquest of Southwest Africa.—He then turned his attention to the conquest of German Southwest Africa, delayed by the rebellion, and again took the chief command. He divided the Union forces, this time composed of men from both white races, into four columns, the southern (Deventer's), the eastern (Berrange's), and Mackenzie's from Lüderitz Bay, all under Smut's general direction, while the fourth from Walvis Bay, the chief fighting force, was under his own immediate orders. In March 1915 the four columns started on a converging movement into the country, sweeping all the Germans before them. The chief difficulty came from the sandy and largely waterless country, which, in spite of an excellent organisation of transport and commissariat, told heavily on the troops. Most of the fighting fell to Botha's own column, which occupied Windhoek on May 12 and obtained the final surrender of the German forces on July 9 1915. After this Botha took no further share in active fighting, though with Smuts he helped to organise the South African Brigade for service overseas as well as the expeditionary force sent to German East Africa.

He was indeed much needed at home, for after the election of Oct. 1915, when his majority was seriously reduced, he had no easy task in governing the country, partly with the support of the Unionists. Some of his Dutch supporters were still discontented, and in 1916 and again in 1918 created trouble which, under anyone but Botha, might have led to another rising. His last voyage to Europe was to attend the peace negotiations of Versailles in 1919, as one of the delegates for South Africa. There he impressed all those present by his sound judgment, always used on the side of moderation, especially towards the conquered foe; for he never forgot that his own people also had been conquered and, as he said on signing at Versailles on June 28 1919, "To-day I look back in thought to May 31 1902."

He landed at Cape Town on July 24, already a very sick man, and on Aug. 28 1919 died at his beloved farm, Rusthof in the Transvaal. The secret of Botha's power over every man who came into contact with him was his absolute sincerity, due to his simple belief in the guiding hand of God, combined with a chivalry and courtesy springing from a truly loving nature. "Never kill a man if you can capture him, or he will never have a chance to be sorry," was one of his sayings, illustrated by his every action. The service of this noble man to Britain and to South Africa can hardly be exaggerated. He fought a clean fight to the end against the whole might of Britain, but having once given his word to become with his people a part of Britain, he was better than his bond, and added to the best traditions of

British statesmanship by his example, especially in doing all that in him lay to weld into one harmonious nation the Dutch and British elements in South Africa. "You in England," he said in 1911, "have given us the hand of friendship, and we have taken it and shall not let it go."

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BOTULISM: *see* Food Poisoning.

BOULE, PIERRE MARCELIN (1861–), French scientist, was born Jan. 1 1861 at Montsalvy. Educated at Toulouse, he graduated early at the university there and in time acquired his degree of *docteur-es-sciences*. After becoming assistant professor of geology at Clermont-Ferrand, he devoted himself to the study of palaeontology. He became a member of the commissions on Historical Monuments and the Geological Map of France and was also president of the French Geological Society and of the French Archaeological Institute. Later he became director of the institute of Human Palaeontology. Among his many works are *Le plateau de Lannemezan* (1895), *Les volcans de la France centrale* (1900), *Les grottes de Grimaldi* (1906–19), and *Les hommes fossiles* (1923).

BOULOGNE, CONFERENCE OF (June 21–22 1920), a meeting of the Supreme Council of the Allies, in which Japan, Greece and Belgium participated, as well as the principal European Allied Powers. Like the conference of Hythe on May 15–17 (*see* Hythe, Conference of), it was preparatory to the Conference of Spa (*see* Spa, Conference of). The question of allocating among the Allies the prospective reparation payments from Germany was taken up, and a counter proposal (the so-called "Boulogne agreement") was prepared, in view of the expected German offer of a lump sum payment, in case that offer should prove inadequate.

BOULOGNE-SUR-MER (*see* 4.323) had a population in 1921 of 55,336. The town and port were under British administration during the World War, and devoted to military uses. The first British troops disembarked here on Aug. 9 1914, and from that date it formed the main channel for reinforcements, some millions of troops passing through and being accommodated in rest camps. The labour department of the British Expeditionary Force was housed in the town and many hotels and the casino were used for Red Cross work. The army base was shifted to Saint-Nazaire for a short time during the retreat from Mons, when the possibility of abandoning the Channel ports had to be faced, but when the German attack was checked it was brought back to Boulogne. The town was heavily bombed in 1917–8, and was awarded the Croix de Guerre for the fine behaviour of its inhabitants. A war memorial was unveiled in July 1924. In 1911 a monument to the actors Coquelin was erected behind the Chamber of Commerce.

The Port Facilities.—The equipment of the port was largely added to during the British occupation, and the opening of the Loubet Basin in 1925 has increased the quay length of the port by 1,000 feet. Improvements were made in 1924 to the railway to enable expresses from Calais to pass through Boulogne at high speed, and a scheme to rebuild the maritime station and construct a tunnel to connect with the main line at Outreau was approved. Extensive harbour works were undertaken during 1924 to provide accommodation for large liners which, it is hoped, will make Boulogne a port of call. The Carnot breakwater has been lengthened by 400 metres and the entrance to the harbour widened. Two new moles, one of about 1,000 and one of 1,300 yds., are to be built. The work of replacing the old wooden jetty by a stone pier, begun before the War, was again taken in hand in 1924. The estuary of the river Liane, behind the old harbour, is to be converted into an inner harbour and dock for the important fishing industry.

BOURASSA, HENRI (1868–), French Canadian politician and journalist, was born Sept. 1 1868. After a private education he studied law and was called to the bar in 1899. He established a name as a writer on political subjects, and was for a time editor and proprietor of *L'Interprète*. Later he became a leading contributor to *Le Nationaliste* and finally editor and joint proprietor of *Le Devoir*. In 1896 he was elected to the Dominion House of Commons as a Liberal, being at that time a follower of Sir Wilfred Laurier. In 1899, however, he disagreed with Laurier regarding Canadian participation in the South African War and resigned as a protest against Laurier's policy.

On his resignation he became the accredited leader of the Nationalist party and in 1900 and 1904 was elected to the Dominion Parliament in that interest. In 1907 he resigned in order to accept nomination for the Quebec Legislature. He was a member of the Quebec Legislative Assembly from 1908 to 1912, when he resigned. During the World War Bourassa opposed, both from the pages of *Le Devoir* and from the public platform, the enforcement of conscription in Canada and the naval policy of the Liberal party. In 1925 he returned to politics and was elected as an Independent to the Dominion House of Commons.

BOURGEOIS, LÉON VICTOR AUGUSTE (1851–1925), French statesman (*see* 4.330). During the World War he was minister without portfolio in the Briand Cabinet. He was elected to the Senate in 1905 and was president of that assembly from 1920 to 1923. M. Bourgeois was the first French delegate to the Hague Conferences of 1899 and 1907. After 1907 he evinced special interest in international arbitration and was one of the first to suggest a League of Nations. For this reason he was appointed by his Govt. to represent France during the negotiations of 1919 concerning the league. When this was constituted he was, until a year before his death, the principal representative of France, both in the Council and in the Assembly and thus acquired an international reputation. In 1920 he was awarded the Nobel Peace Prize. He died Sept 29 1925.

BOURNE, FRANCIS (1861–), English cardinal, was born at Clapham, London, March 23 1861, the second son of Henry Bourne, a high official in the Post Office, and Ellen Byrne. Educated at Ushaw College and St. Edmund's College, Ware, he went later to Cardinal Manning's Seminary at Hammersmith, London, and St. Sulpice in Paris, where he received the diaconate from Cardinal Richard in 1883. After a course at Louvain, he was ordained in 1884, and worked at Blackheath, Mortlake and West Grinstead, afterwards becoming rector of St. John's Diocesan Seminary, Wonersh. In 1893 he published *Diocesan Seminaries*, the result of his controversy with Cardinal Vaughan on the question whether there should be diocesan seminaries or only one for all the dioceses. In 1895 he was made Monsignor by Leo XIII., and in 1896 he was consecrated Bishop of Epiphania and Coadjutor-Bishop of Southwark, to which See he succeeded in the following year.

On the death of Cardinal Vaughan in 1903, Mgr. Bourne was nominated to Westminster as archbishop by Pius X. The cathedral, designed by Bentley, was finished at this time and was consecrated by the new archbishop. In 1911 he was made a cardinal. In connection with the meeting of the Eucharistic Congress in London in 1908 he arranged for a procession of the Host to take place in the streets, but eventually this was cancelled as it was represented that it would lead to a breach of the peace. Cardinal Bourne attended the Eucharistic Congresses held in Metz, Cologne, Vienna and Montreal. At Montreal he came into sharp conflict with Canadian Nationalism, and was accused of British Imperialism by M. Bourassa, the leader of the French Canadians.

At the outbreak of the World War, he immediately appealed for army chaplains. As Lord Kitchener was unwilling to transport the number deemed necessary by the cardinal, he approached Mr. Asquith, who overrode the War Office and gave his consent. Thenceforward the cardinal devoted himself to the spiritual side of the War, visiting the army in France and Belgium and the navy at Scapa. In Aug. 1914 he attended the Conclave by which Benedict XV. was elected to the Papacy, and in Feb. 1922 the Conclave electing Pius XI.

Immediately after the Armistice he made an unofficial tour sanctioned by the Holy See and the British Govt. through the East, visiting Jerusalem, Constantinople, Bucharest, Sofia and

Belgrade. He was the first cardinal to enter Sancta Sophia after its capture by the Turks.

The policy of Cardinal Bourne has been to aim at steady progress by multiplying small churches so that the faithful throughout London should find Mass within half a mile, and at dividing unwieldy dioceses. On the education question he has sailed on an even keel between Liberal and Conservative governments. Modernism he reproved, but was merciful to individual Modernists. His pastorals have been models of moderation, although one alarmed capital and another offended Sinn Fein. He declined to support the idea of a Catholic university or party in England, preferring that Catholics should join the national universities and parties. In Italy he claimed for the Papacy an independence, similar to that of Belgium, based on international guarantees, not at the mercy of the Italian Parliament, and allowing Italy to enjoy the honourable position of representing all nations in the guardianship of the Papal sovereignty. (S. L.*)

BOURNEMOUTH (*see* 4.333).—The boundaries of the borough were extended to an acreage of 6,643 by the inclusion, in 1914, of part of Holdenhurst. The population in 1921 was 91,761. The East Undercliff drive was extended to Boscombe in 1914, making an unbroken promenade of 1½ m., and the promenade was later extended for another ½ m. to the east of Boscombe pier. Art galleries were added to East Cliff hall and museum, presented by Sir Merton Russell-Cotes in 1908; these were opened to the public in 1919. Boscombe pier was extended and improved and the corporation purchased property at the foot of Sea Road, Boscombe, for open air tea gardens. The large municipal college was built in 1912, a central public library in 1913, and branch libraries at Boscombe in 1910, at Westbourne in 1916, and at Southbourne in 1925.

The court-house in Stafford Road was opened in 1914, and in 1920 a large hotel, used as a hospital during the War, was bought by the corporation for a town hall and municipal offices. The parish of St. Alban was formed from three others in 1919, that of St. Andrew in 1919, and that of St. Ambrose in 1921. A church, Christ Church, was built in Westbourne in 1914; All Saints, West Southbourne in 1915; and a synagogue in Wotton Gardens in 1911. In 1924 a War Memorial was erected in the upper pleasure gardens. The broadcasting station was opened Oct. 17 1923. In 1924 a company was formed to join Bournemouth and Swanage by a road to Poole Harbour and a ferry. From 1920 to 1924 a musical festival was held by the municipal orchestra in Easter week in the winter gardens, and, in Sept. 1925, the foundation stone of a music pavilion to seat 1,700 people was laid. In 1918 Bournemouth was made a parliamentary borough returning one member.

BOWELL, SIR MACKENZIE (1823–1917), Canadian politician (*see* 4.342), died at Belleville, Ont., Dec. 11 1917.

BOWLS (*see* 4.345).—Although during the period of the World War few men played bowls, the game has continued to make progress since 1910. The game is sharply divided into four styles of play, each with its own predominant association. The flat green game, called Rink Bowls (known in Canada as lawn bowling), is ruled in England, Scotland, Wales and Ireland by national associations. The International Board controls the laws of the game and directs the international matches between these four countries and the British overseas dominions. Of late years Canadian, Australian and New Zealand teams have visited Great Britain to play the flat green game, and English teams have visited Canada, South Africa and Australasia.

The crown green game is governed by the British Crown Green Assn., the counties controlling their own championships and ruling their own particular areas. In Lancashire, the crown green game is played by professionals, who have their own board of control. In East Anglia, a mixture of flat and crown is played, being governed by the Norfolk and Suffolk Association. In Nottinghamshire there are thousands of bowlers who support their own county association and play a game that is nearer to the English Assn. flat green game than that of East Anglia. South Warwickshire is developing its flat green game.

The flat green game has, perhaps, experienced the greatest growth since 1919. The English Bowling Assn. can claim that its individual membership stands at 100,000, and it has nearly 900 clubs affiliated. For greens in London, turf is brought from the Solway Firth or the marshlands around the Ribble mouth.

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(G. T. B.)

BOXING (*see* 4.350).—In 1910, though France was beginning to cultivate it as a spectacular sport, the old indigenous kicking game of *La Savate* having fallen into disrepute, boxing was hardly known at all outside the English-speaking countries. In 1926 it was a cosmopolitan game, familiar to all the Western nations and actually gaining a foothold here and there in the East. During the period since 1910 it has become a real national sport, a game pursued for its own sake, in Great Britain and in America, where although the number of amateur practitioners is still insignificant, the chief professional contests are the most crowd-compelling of popular spectacles.

The adoption of boxing as a recognised form of physical training in the Services for officers and men alike, while millions of men were being called to the colours as the World War ran its course, has been the principal factor in a revival of intelligent interest, which has not only vastly increased the number of amateur boxers in Great Britain, but has also raised the status of the professional. Though it has not quite succeeded in throwing off its disreputable adherents, boxing is now generally admitted, except by a very few Puritanical moralists, to deserve the praise given to it; in a letter to Tommy Burns, for a time the world's heavyweight champion, Father Bernard Vaughan said "Boxing is an education—you learn self-control, to give and to take, to punish and be punished, smiling all the time." The average professional glove fighter is now almost always a decent citizen, and for such experts as Driscoll, Basham, Wells, Summers, Britt, Frank Moran, McFarland and Tom Gibbons, to name only a few out of many, those who knew them well had a real regard and no little respect.

Some Great Boxers.—As regards technique, however, it cannot be said that any notable advance was made during the period in question. It is true that the best amateur form reached the professional championship standard. Outstanding amateurs, such as the cricketer, J. H. W. T. Douglas, who had the best of a private trial with Burns when the latter was still champion, and John Hopley, the Cambridge University heavy-weight, would certainly have attained the highest honours, if they had made boxing their profession. Hopley's hitting power and other physical gifts for the game were equal to those possessed by any holder of the world's heavy-weight championship, with the exception of Jeffries. The Amateur Boxing Association Championships were sometimes made stepping stones to a professional career, and several of those who adopted this plan did very well indeed in the professional ranks.

But, generally speaking, the best professional boxers of the period, especially as regards the heavier divisions, were not quite as good as those of the previous generations. Jeffries, Fitzsimmons, Corbett, Sharkey and Ruhlin were a quintette of great heavy-weights, especially Jeffries, each of whom combined unusual skill with extraordinary punching power and the real fighting temperament. They were succeeded by four very formidable coloured fighters, Johnson, Langford, McVea and Jeannette, of whom the first-named was not much inferior to Peter Jackson—a "white sportsman" and the first negro heavy-weight of all time—though the Jeffries he beat at Reno, in a fight that proved a provocation to racial riots all over America, was only the husk of the former world's champion.

The contest at Havana in which Johnson lost his title to Willard was unquestionably a "frame-up," though riotous living had not taken the keen edge off the negro's amazing artistry in what the old connoisseurs of the prize ring called "milling on the retreat." It is a debatable point whether Dempsey, who knocked out Willard, when the latter was untrained and past his prime, in three rounds, is the equal of any of the great heavy-weights mentioned above. Comparisons are unsatisfactory because the modern heavy-weight adopts a more intensive style than his predecessors, attempting to obtain a decision from the first, instead of using the preliminary rounds to test his opponent's methods and get an insight into his plan of campaign. But, whenever he was held for three or four rounds, Dempsey relapsed into mediocrity. As regards middle-weights, America has not produced a Stanley Ketchel or even a Papke in recent years, and among the smaller men who have held championships McFarland, a graceful exponent of the classic style, and Attell, have probably not been equalled, much less surpassed.

It is only in the lighter divisions that British and French boxers have reached the American standard, even in a period when, as has been suggested, championship form on the American side of the Atlantic showed a certain falling off. Wells, the most interesting and popular of the English heavy-weights, lacked the well-fortified physique and fighting temperament which are required for success, and was easily beaten by two second-rate Americans. Carpentier, for 10 years the most picturesque figure in the European ring, would not have been much more than a "pork and beaner" (*i.e.*, a fighter of preliminary bouts who just exists by his profession) if he had been born in America. During his career he fought 12 Americans and was decisively defeated by seven of them, and was lucky to get the decision over four of the others, his only clear-cut victory being over Levinsky, a rather indifferent light-heavy-weight. Gun-boat Smith, a second-rate American heavy-weight, whom he met in London in 1914, was winning when he was disqualified. In all the contests between American and European boxers in the heaviest divisions the superior skill of the former in in-fighting, when the body is the objective of the attack, has proved a decisive factor.

Among the little men, however, Great Britain and France have held their own fairly well. Ledoux, a pocket Hercules and Criqui, a glove fighter of genius handicapped by wounds received in the War, were two French boxers who were, for a time, in the world's championship class. Britain has had in Driscoll and Wilde, two real prodigies who were for years supreme at their weights. Driscoll was by general consent the perfect stylist, the boxer's boxer, in fact, whose method in its graceful effectiveness, severity and economy of exertion, will always be remembered as a classic model. Wilde, on the other hand, was an eccentric genius, who made the most of a physique which, like that of Fitzsimmons, seemed expressly invented to get the maximum hitting punch for the minimum weight. In America, the melting pot of racial types, such freaks of physique are far more common than in the European countries, where the human body is more or less standardised, and they are scientifically utilised for securing extraordinary results in various athletic feats. That is yet another reason why America produces so many men with a special aptitude for pugilism. Mentally, as well as physically, Wilde was very much of a *lusus naturae*, for he kept his Celtic temperament on ice, so to speak, and he could control his nervous system in such a way as to be indifferent to the most painful punishment.

Control of Boxing.—In Great Britain amateur boxing is admirably organised, the executive of the Amateur Boxing Association consisting of men with a personal experience of the game and having its welfare at heart. On the professional side, however, no effective organisation yet exists with the power to (1) rule out the unscrupulous promoter and the incompetent referee and (2) suspend the unfair boxer and insist that championship holders should meet an approved challenger within a reasonable limit of time. It is to be regretted that the National Sporting Club, though it has been a great influence for good, has not been able to establish itself as the final authority. The Lonsdale championship belts, each of which is worth £500, are much sought after and can only be won in the club arena. The boxer who wins one of them three times becomes its owner and is also entitled to a pension of £1 a week after reaching the age of 50. Outside promoters, however, are able to offer such large purses that the club is unable to secure control of all the British championship contests, at the various weights. However, a British Board of Control is now in being and is gradually strengthening its position, especially as regards the selection of referees, but it is unlikely to attain the authority of the Government Commission which absolutely controls professional boxing in the State of New York and can put any promoter or boxer out of the game, if such a course seems warranted.

The Financial Side.—During the period the problem of the big purse presented itself in a form that would have seemed incredible in the days of Tom Sayers and John Heenan, who fought the most famous contest ever decided on English soil for stakes limited to £200. In 1887, when Kilrain and Jem Smith fought with the bare fists in France for a sum slightly exceeding £2,000, it was generally believed that the limit had been reached. It was so until 1906, when Joe Gans and Battling Nelson were matched for the light-weight championship of the world, and announced their intention of accepting the best bid for a much-discussed contest which, owing to the former's superlative skill and the latter's extraordinary power of endurance, created as much interest as a fight between leading heavy-weights.

It was then that Tex Rickard, a successful mining prospector who was then in Alaska, looking for an opportunity of investing his gains profitably, startled American promoters of boxing shows by offering a purse of $20,000, provided the contest took place in a small mining town in Nevada. Tex Rickard believed that huge profits could be made by staging *bonâ fide* championship contests in open-air arenas constructed for the purpose, and making such arrangements that every ticket-holder would be sure of his (or her) seat, and an uninterrupted view of the boxing, while at the same time there would be no danger of a disturbance at the conclusion of a contest which had aroused the passions of the spectators. It is in the few minutes immediately following the decision that violence is to be feared; for a single combat between partisans may act as the powder in a cap, and bring about a vast explosion.

At the fights arranged at Jersey City by this capable impresario there were, as a rule, in addition to 500 police, 1,000 to 1,200 firemen, ushers, sellers of refreshments, etc., all of whom were stalwart men able, if necessary, to suppress disorder by physical force. Rickard and his chief assistant were always able to secure the co-operation of those in charge of the various means of transport, and the charting and selling of the seats were carried out in such a way as to win the confidence of the public and avoid the necessity of using ticket agencies. At his first promotion, the Gans-Nelson contest, which was a fight to a finish, lasting 42 rounds, the gate money amounted to nearly $70,000 and the promoter's net profit exceeded $10,000. In subsequent ventures, all of which seem to have shown a very substantial profit, these figures were greatly exceeded. The following list illustrates the surprising vogue of the big purse in the United States since the famous Johnson-Jeffries encounter:—

Date	Place	Combatants	Gate Receipts
July 4 1910	Reno, Nevada	Johnson-Jeffries	$270,755
March 25 1916	New York	Willard-Moran	151,524
July 4 1919	Toledo, Ohio	Dempsey-Willard	452,522
Oct. 12 1920	Jersey City	Carpentier-Levinsky	120,000
Dec. 14 1920	New York	Dempsey-Brennan	200,000
July 2 1921	Jersey City	Dempsey-Carpentier	1,626,580
Feb. 10 1922	New York	Leonard-Kansas	126,768
June 25 1922	New York	Britton-Leonard	130,265
July 27 1922	Jersey City	Leonard-Tendler	367,862
July 4 1923	Shelby, Mont.	Dempsey-Gibbons	201,485
July 12 1923	Jersey City	Firpo-Willard	390,837
July 23 1923	New York	Leonard-Tendler	452,648
July 26 1923	New York	Dundee-Criqui	134,416
Sept. 14 1923	New York	Dempsey-Firpo	1,188,822
Sept. 11 1924	Jersey City	Wells-Firpo	700,000

Rickard himself has said that he will not be content till he owns an enclosure which will seat 250,000 spectators comfortably and give them all a clear view of the boxing. He believes that such enclosures will be built in the near future, not only in the great American centres of population, but also in such cities as Buenos Aires, Berlin, Vienna and Paris. The enormous expansion of motor traffic, moreover, will tend, at any rate in the United States, to the staging of crowd-compelling contests in places where lumber and labour are available to build a temporary arena at a reasonable cost, though world's championship fights, especially when, as in the case of Dempsey's contests with Carpentier and Firpo, an American champion, meets a foreign challenger and spectators are drawn from both sides of the Atlantic, or from both halves of the Double Continent, will have to take place in New York or some other seaboard city.

C. B. Cochran's Promotions.—In England, though the remuneration of the successful boxer has greatly increased since 1910, nothing approaching the higher American figures has yet been recorded. In the boxing boom which followed the World War, C. B. Cochran, who in 1914 had staged the Welsh-Ritchie match at Olympia and who was one of the bidders for the Carpentier-Dempsey contest, became a serious rival to the National Sporting Club. A consummate showman, he conceived the idea, and certainly realised it, of giving boxing shows which should be as well conducted as a theatrical performance. In his book of reminiscences entitled *The Secrets of a Showman* (1925) he gives the full financial details of some of these ventures. The contest between Wilde and the American bantam-weight Moore, which was won by the former after an amazing display of skill, hitting power and stamina, was perhaps the most interesting of his promotions, which were never mere money-making affairs. The purse for this contest, which took place at Olympia, amounted to £5,000 and the total receipts were £14,205 8s. 6d. Beckett *v.* M'Goorty at the same arena brought a gate of £18,680 4s. od. and Beckett *v.* Carpentier at the Holborn Stadium, for which the former received £3,000 and the latter £5,000, brought close on £30,000, which is probably the English record, though it must have been nearly equalled by the figures for the absurd Carpentier-Lewis encounter at Olympia.

The Cochran boxing shows, some of which were watched by the Prince of Wales, might almost be described as social functions, and they recalled the great days of the old prize ring, when men fought with the naked fists for 50 or 100 guineas a side in the presence of all the social celebrities of the day. At these well-conducted modern spectacles a small proportion, never more than 1%, were women. In France, where purses have never yet approached the English maximum, the number of women attending a contest in which a popular favourite, such as Carpentier or Criqui in their prime, is engaged, is apt to be very large. The same phenomenon has been noticed in Italy and Spain, and the Latin-American countries. It is all largely a question of national temperament, and the horror of seeing bloodshed, which is thought to be a characteristic of northern races, is not likely to prevent women, who are in the habit of attending bull fights, from watching boxing matches.

As regards ring-side crowds, some keen observers are of opinion that the huge open air assemblies now common in America will never be seen in England. English people, they say, will pack a covered arena as big as the Albert Hall, London, to see a championship fight just as, previously, they would crowd into a boxing booth. But boxing or wrestling matches staged in an open space have not proved attractive, a case in point being the failure to pay expenses of the much-advertised heavy-weight contest between Tom Gibbons, at the time Dempsey's most formidable rival, and Jack Bloomfield, then the British heavy-weight champion, which took place in the Wembley Stadium, an arena capable of accommodating more than 100,000 spectators. Our ancestors, however, were quite willing to watch pugilists fighting in a field, despite the vagaries of the climate, and posterity may recover that lost predilection.

Effect of Big Purses.—Whether it is true to say that big purses and small personalities go together in the modern prize ring is a question worth asking, not easily answered. The fact that a successful boxer, if only he be reasonably thrifty, as many are in these latter days, can amass a competence, while being the subject of hero worship and living in the full glare of publicity, has certainly persuaded young men of a better type than the translated, but not transmuted, navvies and butchers of the old days to adopt boxing as a temporary profession. It is especially so in America, where the boxer of high repute is now almost always a quite intelligent person, who makes a keen study of his craft, lives decently, and behaves as a civilised member of the community.

The many failures of English boxers, when meeting American champions in the ring, have been the result, in nine cases out of ten, of their intellectual inferiority, and the lack of moral self-discipline that goes with it as a general rule. More than once England has had heavy-weight champions who had every physical requisite for the game, yet failed to make the most and best of themselves owing to their inability to learn from bitter experience, much less from experimental work in the gymnasium, or their unwillingness to keep fit between one special preparation for a fight and the next. The old bruiser type, whose chief asset was an insensitiveness to pain, still survives in England, but he has long since been scrapped as useless in America. It is recorded of Deaf Burke, that famous pugilist of a century ago, that he was so ignorant as to be unable to tell the time, and when a friend, well aware of the fact, would ask "What's o'clock, Deaf'un?" he would pull out his fine gold watch, turn its face to the inquirer, and reply "Who would ha' thought it was that time?" Even the more intelligent English boxers still limit their ambitions to becoming publicans or bookmakers when their fighting days are over, whereas the American champion as a rule looks forward to entering upon a business career, in which he is frequently successful.

Large purses, it would seem, bring into the ring young men of brains as well as brawn, who are capable of perfecting their technique by taking thought to it and have the mental resources that enable them to endure with patience the tedious régime of training and practice year after year. But, once a championship has been achieved, they do not fight often enough to develop their gifts to the fullest extent. A world's champion finds it now so easy to make a large income by exhibition work on the music hall stage, by film acting, etc., that he will not risk the loss of his title until he is compelled to do so by the force of public opinion. The no-decision contest, which is so popular in America, enables him to keep up his form, but the practice of choosing opponents whom he is certain of beating tends to prevent any improvement in technique.

Moreover, exhibition work of any kind has a debilitating effect and may tend to an utterly unexpected defeat, as happened when Siki, a third-rate Senegambian fighter, disposed of Carpentier in a few rounds. Dempsey, who fought more than 40 contests in the year preceding the victory over Willard, which gave him the world's heavy-weight championship, is hardly the equal of the great glove fighters of the Jeffries era. He is a mechanical boxer with little variety of attack who relies for victory on hard hitting (never straight) at close quarters, and he "explodes" after the fifth or sixth round. On his actual form, after becoming champion, he cannot be put in the same class as Peter Jackson, Fitzsimmons, Corbett and Sharkey. But if he had lived up to the adage that fighting is the best preparation for a fight, as Fitzsimmons did throughout his long career, he might have improved his boxing technique in such a way as to have been ranked with the four great heavy-weights who are mentioned above. Wills, again, though easily the best negro heavy-weight of post-War days, could not have beaten Jack Johnson, whose ability was never really plumbed, Sam Langford or Sam McVea. On the whole, big purses, though they have indirectly raised the standard of boxing in general, in the manner described, have not made for a superlative degree of proficiency in the heavier divisions. We have not seen among the middle-weights, for example, a boxer equal to Stanley Ketchel or Papke since their day.

A Cosmopolitan Profession.—Professional boxing now receives recruits from many countries and races, the old idea that only men of English or Irish descent could excel at it having long since been confuted. This point may be made clear by considering the list of world's champions at the beginning of 1925, and their racial derivation.

Heavy-weight	Dempsey	A complex mixture of Polish, Irish, Scotch, and Red Indian
Light-heavy-weight	McTigue	Irish
Middle-weight	Greb	German descent
Welter-weight	Walker	Irish (Northern)
Light-weight	Leonard	Jew
Feather-weight	Dundee	Italian
Bantam-weight	Martin	Italian
Fly-weight	Villa	Filipino

The Latin physique, which does not accumulate internal fat, perhaps as a result of frugal eating and a racial preference for wines rather than malted liquors, is admirably adapted for a game that requires a high degree of stamina. No oriental boxer has, as yet, reached the highest class, though Indians, Japanese and Chinese are occasionally seen in minor contests, but there seems no reason why the Eastern races, which have produced so many fine wrestlers, should not learn to excel in the sister-art in course of time. India has sent us some very skilful amateur boxers.

A proof that boxing is rapidly becoming popular in the Latin countries is found in the way renderings, often very comical in appearance, of English technical terms have been adapted into the French, Italian and Spanish languages. Outside the British Is., however, there are few amateur boxers of merit. Even in America those who take up the game for the game's sake are vastly inferior, both in quality and quantity, to the increasing multitude of made-in-England amateurs. There is no annual competition there comparable with the English Amateur Boxing Association Championships, and there is nothing equivalent to the flourishing boxing clubs at Oxford and Cambridge in the great American universities. If the American athlete thinks he can excel in such an exacting man-to-man game, nine times in ten he adopts it as a professional vocation. And in France, though the brilliant victories of Carpentier gave rise to a temporary craze for what was significantly styled "Byronic Boxing," fencing has now regained its old position as the gentleman's art of self-defence, an indispensable accomplishment.

In the Scandinavian countries, however, and in Germany, there is a real enthusiasm for amateur boxing. Denmark produces excellent amateurs, and her representative teams have done very well in matches against teams selected by the amateur boxing association. Such amateur international matches are a new development and are certain to become more numerous and more popular as spectacles in the near future. The impetus to boxing in Germany was given by returned prisoners of war who had acquired the rudiments of the game in concentration camps. Two sailors, Breitenstraeter and Prenzel, who were captured at the beginning of the War and learned to box fairly well in the large internment camp at Douglas, Isle of Man, were the pioneers of professional boxing in Germany. They started travelling boxing booths, and whenever demonstrations of the art were given, ex-prisoners of war attended in large numbers, and local clubs were formed. The popular impression that the excellence of the British soldier as a fighting man was due to his training in boxing greatly helped the new form of athletic propaganda, and Blücher's approval of pugilism was a stock quotation in many favourable newspaper articles. Professional boxing shows have become very popular, especially in Berlin where they are rigorously controlled by a boxers' union, the *Verband Deutscher Faustkämpfer*, and a promoters' association, the *Verband der Boxkampf Unternehmer*. For a few appearances on a Berlin stage with sparring partners Dempsey received $50,000 and all the travelling expenses of himself and his camp from London. To-day amateur boxing clubs exist in every German city and town and when the problem of obtaining competent instructors is solved, there can be little doubt that skilled exponents will be produced.

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(E. B. O.)

BOYLE, JOHN J. (1851–1917), American sculptor (*see* 4.354), died in New York Feb. 10 1917. He was made an associate member of the National Academy of Design in 1910, and received a silver medal at the Panama-Pacific Exposition, San Francisco, 1915.

BOYLESVE, RENÉ (1867–), pen name of René Tardiveau, French novelist, was born April 14 1867 at La Haye-Descartes (Indre-et-Loire). He began his education at the Jesuit College of Poitiers, and passed from there to Tours. He completed his studies at the faculté de lettres of Paris, the faculté de droit and the school of political science. His output as a novelist is considerable but he has paid more attention to style and to the development of an agreeable descriptive talent than to characterisation and psychology. Among his works are:—*Le parfum des Iles Borromées* (1899); *Le bel avenir* (1905); *La marchande de petits pains pour les canards* (1913); *Le bonheur à cinq sous* (1917); *Le carrosse aux deux lézards verts* (1921).

BOY SCOUTS. The Boy Scout movement, which was established in 1908 in the British Is., extends to-day to every civilised country in the world.

Ideals and Method.—The aim of the movement is the promotion of good citizenship among the rising generation. The method adopted is that of active self-expression and the desire to learn on the part of the boy, rather than his passive reception of instruction. The scope is unlimited by class, creed, colour or political distinctions. The movement is non-military, non-political, non-class and interdenominational. Honour is made the high ideal for the boys. The Scout Law, on which the movement hinges, and which is binding on every scout, was taken from the code of the knights.

Every boy, on joining the movement, makes the following promise:—

> I promise on my honour to do my best—
> To do my duty to God and the King
> To help other people at all times
> To obey the Scout Law.

Administration and Training.—The administration of the movement is decentralised, each county in Great Britain having at its head a county commissioner responsible to headquarters. Under him are district commissioners, local associations and Scout troops, The troop numbering from 20 to about 40 boys is divided into patrols of 6 or 8, each under its own boy leader. The troop is purposely kept small in numbers in order that the scoutmaster may have personal knowledge of each of his boys and so develop the individual character.

The movement is subdivided into three groups:—

1. Rovers—*i.e.*, scouts of 17 years and over.
2. Boy Scouts and Sea Scouts—from 11 to 17.
3. Wolf Cubs—juniors from 8 to 11.

The principles underlying the training are identical for each group, but the details differ to suit the different stages of development.

The training is carried out generally under four main headings:—

1. Character and intelligence.
2. Skill and handicraft.
3. Physical health and self-care.
4. The practice of service for others and for the state.

The activities and practices of scouting are framed to develop in (1), (2) and (3) the efficient individual and then to harness this individuality for the good of the community, *i.e.*, (4) citizenship. The training is carried out mainly through activities in the open air, and the attributes of frontiersmen, backwoodsmen and explorers are held up as examples for Scouts to emulate. Military training is not employed as being contrary to the ideals of peace and educationally wrong. Through an extensive system of badges for proficiency the boys are encouraged to develop their natural gifts, to become all round handy-men, and to specialise in those subjects which are likely to help them afterwards in making a career. Through the daily "good turn" they are gradually led on to the practice of service for others and so to unselfish citizenship.

Progress and Results.—From a trial experimental camp in 1907 the movement has spread with remarkable rapidity to every part of the world. In 1908 the handbook, *Scouting for Boys*, was published in fortnightly parts. By 1910 the movement in the British Empire numbered over 123,000 members and had been taken up in many foreign countries. In 1912 the aims and methods of the movement were inquired into by the Privy

Council and a royal charter of incorporation granted. Over 100,000 Scouts served in His Majesty's Forces during the World War, 10,000 of whom gave their lives. Those who were under serving age carried out public duties at home, one notable service being that of coastwatchers, in place of the coastguardsmen who were called up for service afloat. This service was maintained by Boy Scouts from the outbreak of the War until after the declaration of peace, some 23,000 boys in all taking their turn at it.

The movement, though hampered by the loss of practically every able-bodied scoutmaster, managed not only to hold its own, but to increase steadily in numbers throughout the years of war. Numbers of troops were carried on entirely by their patrol leaders and courts of honour, without the help of officers, In 1920 an international meeting or *jamboree* was held at Olympia, London, in which Scouts of 26 nations took part. As a result of this meeting an international council was formed, with a bureau in London. A second international jamboree took place in 1924 at Copenhagen, at which 33 nations were represented. The fundamental principles, the Scout Promise and Law, are in every country identical with those of the parent movement, the details of training differing slightly here and there to suit climatic and temperamental differences. The Scout movement in 1925 extended to every corner of the world, and numbered nearly 2,000,000 members. Of these, some 700,000 belonged to the United States.

Bibliography.—Sir R. S. S. Baden-Powell, *Yarns for Boy Scouts* (1910), *Scouting for Boys* (1916), *Wolf Cubs' Handbook* (1916), *Aids to Scoutmastership* (1920), *What Scouts Can Do* (1921) and *Rovering to Success* (1922). See also the publications and reports of the Boy Scout Association. (R. B.-P.)

United States.—The Boy Scouts of America was incorporated in 1910 and chartered in 1916 under Act of Congress. Boy Scouts are organised in patrols, 8 boys or less to a patrol, under the direction of an older boy, 2 to 4 patrols to a troop. Each troop is under the charge of a scoutmaster, who must be an adult American citizen, and one or more assistant scoutmasters. Troops are organised in connection with schools, churches and other institutions, or under the auspices of groups of representative citizens. For each troop there is a supervising group of adults known as a troop committee. Where there are two or more troops in a community, their activities are directed and supervised by a local council. The National Council is made up of representatives from these local councils and other distinguished men from every state in the Union. This body meets annually in New York City, where the council has its administrative and executive headquarters.

The purpose of the Boy Scouts of America as stated in its constitution is "to promote through organisation, and co-operation with other agencies, the ability of boys to do things for themselves and others, to train them in scout-craft, and to teach them patriotism, courage, self-reliance and kindred virtues, using the methods which are now in common use by Boy Scouts, by placing emphasis upon the Scout oath and law for character development, citizenship training and physical fitness." The movement is non-sectarian and non-partisan. The motto of the organisation is: "Be Prepared." Membership in April 1926 was 769,717 registered scouts, 157,429 scout officials, 23,646 troops, 661 local councils.

The Boy Scouts of America publish three handbooks, for professional leaders, for scoutmasters and for boys. The *Handbook for Boys* has been immensely popular among all interested in out-of-door activities. Thirty-four editions were printed between 1911 and 1926, totalling 3,000,000 copies. Nearly 80 merit badge pamphlets are published, forming an excellent vocational library at modest cost; a manual on nautical scouting; several pamphlets on citizenship training and co-operation with churches; and some half a hundred other general and technical pamphlets. Three monthly magazines are also published. *Boys' Life*, which is for all boys everywhere, is particularly successful and steadily increasing in popularity.

Over 312,000 Boy Scouts spend a week or more in camp each summer. In 1925 there were over 3,300 camps, not including week-end and winter camps. Rigid standards of safety and health are maintained by the A.B.C. grading system, and regular inspections are made by the National Staff. Trained waterfront leaders, boats and safety devices justify the Camp Dept. in maintaining that a boy is safer in camp than on the streets. In camp each summer some 15,000 boys are taught to swim.

The National Court of Honor has made over 1,100 awards to Boy Scouts for life saving; 69 gold medals have been presented for rescues made at the extreme risk of the scout's own life. More than 1,300,000 merit badges were awarded before Jan. 1 1926. Over 194,000 were won in 1925. These are awarded for proficiency in various activities, including several practical vocations. The emphasis is on doing, rather than text-book knowledge. In 1924 the representative Boy Scouts of America troop won the world Scout Championship in competition with scout troops from 33 other nations at the International Jamboree in Copenhagen.

The National Council holds a conference annually. Regional conferences, in each of the 12 regions into which the scout field is divided, are also held annually. Biennially the scout executives of the movement hold a national conference. Professional leaders number about one to every 171 volunteer workers.

Over 50% of scout troops are organised through the churches of America, and practically every denomination has endorsed the movement and is using the programme. Committees have been organised to promote the work among boys of Catholic, Protestant and Jewish faiths.

An important feature of scout work is the training courses for the 162,000 scout leaders. These are conducted not only by local scout councils, but in connection with colleges, normal schools and theological seminaries. Nearly 300 such courses were conducted in 1925 for scoutmasters, involving a minimum of 16 hours of work. Certificates are awarded to students who complete the course. The National Headquarters are at 200 Fifth Ave., New York City. (J. E. W.)

THE GIRL SCOUT MOVEMENT

In March 1912 Mrs. Juliette Low organised in Savannah, Ga., a group of Girl Guides, similar to the organisation developed in England by Lt.-Gen. Sir Robert and Lady Baden-Powell. On June 10 1915 the organisation was incorporated and its name changed to Girl Scouts. The national headquarters are in New York City. In April 1926 the number of Girl Scouts (including officers) was about 119,000. The purpose is to instil patriotism, to arouse the spirit of helpfulness and to develop character, largely through outdoor group activity. The slogan is "Do a good turn daily." Each member promises: "On my honour, I will try to do my duty to God and my country, to help others at all times, to obey the Scout laws."

These laws require a Girl Scout to be trustworthy, loyal, helpful, friendly, courteous, kind to animals, obedient, cheerful, thrifty and clean in thought, word and deed. The age limit was fixed from 10 to 18 years; but later a separate division was formed for little girls, known as Brownies or Junior Scouts, and another division for mature girls, known as Citizen Scouts. The unit is a patrol of 8 girls, who choose from their number a leader. One or more patrols form a troop, with a captain at least 21 years old and one or more lieutenants at least 18 years old approved by the national headquarters. The official magazine is *The American Girl*, a monthly publication.

Camp Fire Girls.—Another organisation, wholly distinct, is the Camp Fire Girls, for girls over twelve, founded in 1912 to promote the ideals of the "home, health and citizenship." The training stimulates love of being out of doors and an interest in simple handicrafts like block-printing and weaving. The work of the organisation is financed by the dues earned by the girls themselves. The slogan is "Give Service." There were 158,000 members in 1926 in the United States and 2,000 in Great Britain. An allied junior organisation is the Blue Birds. The official organ is *Everygirl's Magazine*. The headquarters of the Camp Fire Girls are in New York City.

BRACQUEMOND, FÉLIX (1833–1914), French painter (*see* 4.369), died in Paris Oct. 29 1914.

BRADBURY, JOHN SWANWICK BRADBURY, 1ST BARON (1872–), British civil servant, was born at Winsford, Cheshire, Sept. 23 1872, and educated at the Manchester Grammar School and Brasenose College, Oxford. He entered the Civil Service in 1896. Beginning in the Colonial Office, he was soon transferred to the Treasury. In 1911 he was appointed a member of the National Health Insurance Commission, but in 1913 returned to the Treasury as joint permanent secretary. In that capacity it fell to his lot to sign the currency notes issued by the Govt. when gold was withdrawn from circulation on the outbreak of the World War. He was made K.C.B. in 1913, and in 1919 was appointed chief British representative on the Reparations Commission. He resigned the post at the beginning of 1925 when he was raised to the peerage as Baron Bradbury of Winsford. In July of the same year, following upon the report of the Royal Commission on Food Prices, he was chosen chairman of the Food Council that was set up.

BRADDON, MARY ELIZABETH (1837–1915), British novelist (*see* 4.369), died at Richmond, Surrey, Feb. 4 1915. Among her latest novels were *The Green Curtain* (1911) and *Miranda* (1913). Her son, William Babington Maxwell, born June 4 1866, became known as a novelist and writer.

BRADFORD (*see* 4.370) had a population of 279,767 in 1901, and of 285,979 in 1921. In 1923 it was estimated at 290,800. The Board of Control for Wool, formed in 1917, was housed in the Great Northern Hotel there. Since 1918 the city has returned four members to Parliament. In 1920 the diocese of Bradford was formed from those of Ripon and Wakefield and the parish church of St. Peter was made the cathedral. The parish of Thornbury was formed in 1912, and a church, St. Margaret, was built.

BRADLEY, FRANCIS HERBERT (1846–1924), British philosopher, was educated at University College, Oxford, subsequently becoming a fellow of Merton College. His *Ethical Studies* (1876) were mainly critical, but his *Principles of Logic* (1883) showed that Idealism had at last found an English-speaking champion. What Hegel had done in Germany, Bradley did in England, and once and for all established the supremacy of idealism over realism, in dialectical controversy. *Appearance and Reality* (1893) is said by Prof. Sorley to have exerted more influence upon English-speaking countries than any other philosophical treatise of his generation. In revising the *Principles of Logic* in 1922, Bradley found much to correct. His mind seemed to be moving to a new viewpoint. But he was too old to press his ideas to their logical consequences.

Bradley was neither a legitimate descendant from the Hobbes-Locke-Hume school of English philosophy, nor was he able, like William James, to contribute a hard technique. What he did, and what none of his contemporaries could do, was to bring to philosophy a unique intelligence, a brilliant style and a number of new criteria. There have been philosophers more profound, but none has arisen who played more gaily with the formulas of the past. In June 1924 he was, belatedly, admitted to the Order of Merit, and on Sept. 18 he died.

BRADLEY, HENRY (1845–1923), British philologist, was born at Manchester, Eng., Dec. 3 1845. He was educated at Chesterfield Grammar School, became a teacher and later a clerk in a commercial house in Sheffield. At the same time he wrote a little for the literary reviews, and this work brought him to London. There he worked for *The Athenaeum* and *The Academy*, and through F. York Powell was introduced to *The New English Dictionary*, then in preparation and this became his life-work. He succeeded Sir James Murray as senior editor on the latter's death in 1915 and remained on this undertaking until his death He worked with Skeat on certain Chaucerian studies, and published several works of his own, notably *The Making of English* (1904). His eminence as a scholar was recognised throughout the learned world, and at Oxford by the degree of D. Litt., 1914, and a fellowship at Magdalen College, 1916. He died at Oxford May 23 1923.

BRAGA, THEOPHILO (1843–1924), Portuguese writer and politician, was born at Punta Delgada, in the Azores, Feb. 24 1843. Educated at the University of Coimbra, he began writing at an early age, publishing his first volume of poems in 1859. His written works fall into three groups: poetic, historic and philosophic. The first includes some six volumes of poems, published between 1859 and 1868; in the second are four important works, including his greatest literary work, *The History of Portuguese Literature*, published in 20 volumes between 1870 and 1881. In philosophy he was a Positivist, as is shown in his six principal philosophical works.

Braga did not take up active politics till about 1909. He was elected deputy for Lisbon in Aug. of that year, and in Oct. 1910, when the new-born Portuguese Republic was faced with the difficult task of political reconstruction, this man of unquestionable attainments and irreproachable character was selected as first provisional president. He remained in office till the election of Dr. Arriaga as first constitutional president, Aug. 24 1911, and when Arriaga resigned on May 27 1915 Braga's services were again requisitioned, and he returned to the presidency for the remainder of the term. He died Jan. 24 1924.

BRAGG, SIR WILLIAM HENRY (1862–), British physicist, was born at Wigtown, Cumberland, July 2 1862, and was educated at King William's College, Isle of Man, and Trinity College, Cambridge. In 1886 he was appointed professor of mathematics and physics in the University of Adelaide, South Australia, where he carried out his earlier researches in radioactivity. In 1909 he was appointed Cavendish professor at Leeds University and in 1915 Quain professor of physics in the University of London. His researches upon various radio-active phenomena and his power of lucid exposition brought recognition from scientific bodies both at home and abroad; in 1906 he was elected a fellow of the Royal Society; in 1915 he received the Nobel Prize for physics and the Barnard Gold Medal (Columbia University), both of which distinctions he shared with his son William John Bragg (b. 1890).

The joint work of father and son went far toward elucidating the arrangements of atoms and crystals, an achievement rendered possible by their development of the X-ray spectrometer. During the World War Sir William Bragg acted in an advisory capacity to the British Admiralty especially with regard to the problem of submarine detection. He was created K.B.E. in 1920. In the same year he was elected an honorary fellow of Trinity College, Cambridge, and was president of the Physical Society of London. In 1923 he was appointed Fullerian professor of chemistry at the Royal Institution and director of Davy-Faraday Research Laboratory. In addition to many publications, chiefly upon radio-activity in *The Philosophical Magazine* and *The Proceedings of the Royal Society*, he also wrote *The World of Sound* (1920); and *Concerning the Nature of Things* (1925). (*See* CRYSTALLOGRAPHY).

BRĂILA (*see* 4.391).—One of the three Danubian ports of Rumania, Brăila has seen considerable development since 1910. The Danube below the town has been deepened and the navigation shortened by canalisation by the Danube Commission. The minimum depth of the Sulina branch is 18½ ft. with 12 to 28 ft. in the docks of Brăila, which accommodate 20 steamers and 29 laden barges. Brăila is a comparatively modern town and fully a quarter of the site of some 148 ac. is closely built over. In May 1921 an arrangement was made for Poland to use the port as Czechoslovakia uses Trieste. In Jan. 1917 the Russians evacuated Brăila, after destroying the granaries, and it was occupied by the Germans and Bulgarians. A branch office of the American Red Cross, which did valuable work in Rumania, was established there after the Armistice, and in 1919 and 1920 there was great activity in the port; large quantities of goods accumulated owing to the lack of transport. (*See* DANUBE).

BRAKE: *see* MOTOR VEHICLES.

BRANDEIS, LOUIS DEMBITZ (1856–), American jurist, was born in Louisville, Ky., Nov. 13 1856. He was educated in the public schools of his native city and at the Annen Realschule, Dresden, Germany. He graduated from the Harvard Law School in 1877, was admitted to the bar in 1878, and practised in Boston from 1879 to 1916. He was much interested in labour legislation, acting as counsel for the people in cases concerning the power of the Govt. to fix hours of labour and a minimum wage in several states. In 1910 he was counsel for Mr. Glavis in the Ballinger-Pinchot investigation in Congress; in 1910–1 was counsel for the shippers before the Interstate Commerce Commission in the advance freight-rate case; and in 1913–4 was special counsel for the commission in the second advance freight-rate case. In Jan. 1916 he was appointed by President Wilson associate justice of the Supreme Court, being the first Jew to attain this position. He was the author of *Other People's Money* (New York, 1914) and *Business as a Profession* (Boston, 1914), besides numerous articles on public franchise, business efficiency, labour and trusts.

BRANDL, ALOIS (1855–), German scholar, was born at Innsbruck, Austria, June 21 1855. He studied at Innsbruck, Vienna, Berlin and London and in 1881 was appointed lecturer on English philology in Vienna. He was successively professor in Prague, Göttingen, Strasbourg and Berlin. He became president of the German Shakespeare Society in 1903 and chairman of the *Verein für Deutschtum im Auslande* (Association of Germans Abroad) from 1899–1903. He was also co-editor of *Quellen und Forschungen*, of *Palaestra*, of the *Shakespeare Annual* and of the *Archives for the Study of Modern Languages*. In 1903 he became a member of the Prussian and Viennese Academies of Science.

Brandl's chief works are: *B. H. Brockes* (1878); *Thomas of Erceldoune* (1881); *S. T. Coleridge und die Englische Romantik* (1886); *Geschichte der alt-englischen Literatur und die englische Volkspoesie* (1892–1908); *W. Shakspeare* (1894); *Quellen des weltlichen Dramas in England vor Shakspeare* (1898); and the valuable *Geographie der altenglischen Dialekte* (1915).

BRANTING, KARL HJALMAR (1860–1925), Swedish statesman, was born in Stockholm Nov. 23 1860, the son of Lars Gabriel Branting, head of the Central Gymnastic Institute, Stockholm, and Emma Georgii. Branting was educated at the Beskow school and passed his student examination in 1877. Both at school and university he took a great interest in astronomy and from 1878–80 and 1882–3 he was secretary at the Observatory of Stockholm. He continued his scientific studies at Uppsala University, where he came under the radical influences which were instrumental in forming the students' union "Verdandi." This union produced several of Sweden's more noted radical politicians. About the same time he joined the labour movement to which he henceforward devoted his whole life.

In 1884 Branting associated himself with the Radical newspaper *Tiden* and shortly afterwards became editor. In 1886 he worked on the *Socialdemokraten*, a newspaper started in 1885. In 1887 he was made editor and held this post, except for some short intervals, till 1917. From that time onwards he devoted himself entirely to parliamentary and political work. As the responsible editor of the *Socialdemokraten* he was sentenced in 1888 to 3½ months imprisonment for libel. Between 1887–90 and 1892–6, he was obliged, for economic reasons, to combine his editorship of *Socialdemokraten* with work on the Liberal newspaper *Dagens Nyheter*, and his genius for journalism and his good education very quickly placed him in the first rank of Swedish publicists.

When the Social Democratic Labour party was formed in 1889, Branting was generally considered the greatest intellectual force in the movement. Even at that time he combined a socialistic outlook with a marked capacity for practical politics. He considered it vitally important that the theoretical tendencies of the Labour movement should be in line with the socialistic ideas promulgated by Karl Marx. Above all he wished to make of the movement a power which, on the one side, would be useful to the working classes in their economic struggle, and on the other of service to political democracy. It must be acknowledged that it is chiefly due to Branting that the Swedish trade-union movement has always been of a pronounced social democratic character and as an organisation still keeps in close touch with the Social Democratic party. At the time the party was formed there was a demand, strongly supported by Liberal middle class opinion, for adult, equal and direct suffrage. The first task of the new party was to broaden the basis of this demand and to mobilise the working classes in support of it. Thus Branting soon became the most influential leader in the franchise movement. As early as 1890 he linked up the policy of the Labour party with that of the progressive middle class party and made co-operation between them possible. The result was a Liberal Socialist government in 1917, and in 1918 the constitutional reform which facilitated the spread of social democracy throughout Sweden.

Although Branting had been the most prominent figure in the Labour party in Sweden ever since its formation, it was not until 1907 that he became its leader. As early as 1897 he was a member of the second Chamber where till 1902 he was the only Social Democrat. At that time the most pressing political problem, with the exception of the franchise reform, was the question of the separation of Norway from the Swedish Crown. In face of a powerful Chauvinistic group, Branting, strongly supported by the Labour party, demanded a peaceful settlement between the two countries, and his contributions to the cause of peace when the union was dissolved in 1905, together with his valuable work in the same cause during and after the World War, qualified him for the Nobel Prize which was awarded him in 1921. During the World War he energetically supported the demand for strict neutrality on the part of Sweden, although he displayed a marked sympathy for the Western Powers, owing to his conviction that their policy, if successful, would hasten the advent of truly democratic and peaceful progress.

Within the international socialist ranks Branting had early attracted attention, and at the end of the War when it became necessary again to mobilise international social democracy, great hopes were placed on his ability to re-unite all those whom the War had placed in opposite camps. A worthy attempt had been made in this direction in 1917 at the Swedish-Dutch conference known as the Stockholm Conference. Branting who presided was the dominating personality. He was honoured with the Chairmanship of the first post-War conference of the Socialist International, held in Bern 1919, and he held a leading position in the permanent international commission which was to complete the work of reconstruction within the International.

At the same time Branting's great abilities were needed for official work connected with foreign politics. He was consequently appointed delegate to the Peace Conference in Paris in the spring of 1919 and at the negotiations concerning Aaland 1919–21. After the entry of Sweden into the League of Nations, Branting was the first representative of his country on the League Assemblies, and in 1922 was made a member of the Council. There he won the respect of all for his integrity and impartiality. His aim was to make the League a truly democratic alliance of the nations, a real instrument for peace. Although he disapproved strongly of the imperialist and militarist Germany during the War, he was a warm friend of the democratic Germany which arose from the ashes of the World War. His great desire was that the new Germany, as a member of the League of Nations, should have an opportunity of contributing towards peaceful development in the world. During the Corfu affair he was the courageous and far-seeing champion of right that he had always been.

His defence of the Council of Ambassadors on this occasion gained for him the sympathy and gratitude of the whole world. In the handling of the English-Turkish conflict over Mosul Branting's influence was no less significant. He was appointed reporter to the Council, a task he accomplished with an impartiality acknowledged by all. In the Swedish Parliament the question of constitutional reform and natural defence interested him keenly. On the latter question Branting took the view that from the military standpoint Sweden should confine herself to a "neutrality defence." The total disarmament tendencies which now and again appeared in the Social Democratic party had in him an irreconcilable opponent.

His ministerial career began in 1917, when the Liberal Socialist Ministry was formed, with the Liberal leader, Professor Nils Edén, as Premier. Branting accepted the post of Minister of Finance, but resigned after a few months on account of illness. When the Liberal-Socialist coalition broke up on account of differences over the communal rates question in the spring of 1920, Branting undertook the task of forming Sweden's first Social Democratic Ministry. The parliamentary elections in the autumn of the same year made it impossible for him to carry on the government, but after a fresh election in the autumn of 1921 the parliamentary situation was such that he was again placed at the head of a government in which he filled the posts of Prime Minister and Minister for Foreign Affairs. This government remained in power until April 1923, when it was forced to resign after a defeat over the unemployment relief question. After the elections in the autumn of 1924 Branting formed his third Ministry. But his health was failing and shortly after his condition was so serious that he was forced to resign the premiership, but remained in the Government as minister without portfolio. He died in Stockholm Feb. 24 1925.

During his long life journalism and politics had claimed so much of his time and energy, that he had no opportunity of enriching either the social or political literature of his country with any notable or comprehensive writings. In 1906 he published a work of some importance entitled *The Age of Social Democracy*. This, however, was not an original work, but an adaptation of a Danish publication of the same name. Some small pamphlets are all that bear his name. Branting was married to the authoress, Anna Branting, née Jäderin. (S. H.*)

BRASSEY, THOMAS BRASSEY, 1ST EARL (1836–1918), British politician (*see* 4.435), was created an earl in 1911, and died in London Feb. 23 1918. He was succeeded by his son, Thomas Allnutt Brassey (1863–1919), who before his father's death was known as Viscount Hythe. The second earl had been, since 1910, the editor of the *Naval Annual*, founded by his father, and like him was much interested in imperial questions. He was largely instrumental in raising a considerable sum of money for the endowment of the University of Oxford, to which he belonged. His works include *The Case for Devolution*, 1913. He died in London Nov. 12 1919 and, as he left no children, the earldom became extinct.

BRATIANU, JON (1864–), Rumanian statesman, was born at Florica, Rumania, on Aug. 20 1864, the son of Jon C. Bratianu (*see* 4.436). He was educated at the Polytechnic School in Paris and on returning to Rumania took up a position as engineer on the state railways. In 1895 he joined the Liberal party, and was elected a deputy. In the following year he was appointed Minister of Public Works in the Cabinet presided over by D. Sturza (*see* 25.1051) whom he succeeded as Prime Minister and chief of the Liberal party when the latter retired in 1909. He remained in power until Jan. 1911, when he resigned, but in 1913, after the signature of the Treaty of Bucharest, he again formed a Cabinet. At the opening of the World War Bratianu was in power and it was his Govt. that guided Rumania's destinies throughout the period. He resigned on Jan. 29 1918 following the decision of the military command to conclude an armistice with the Germans. In Dec. 1918, however, he was again called to power following upon the decision of Gen. Coanda's Govt. to denounce the separate peace signed with the Central Powers.

Bratianu was chief Rumanian delegate at the Peace Conference in Paris, but he refused to sign the Treaty of Versailles, as a protest against the division of the Banat of Temesvar between Rumania and Yugoslavia, whereas Bratianu, in accordance with the treaty of alliance concluded between Rumania and the Allies in 1916 claimed that province entirely for Rumania. In consequence he resigned and remained in opposition until Jan. 1922, when he became Prime Minister again. Bratianu followed closely the policy of consolidation inaugurated by his father, and most of the chief reforms, such as the introduction of universal suffrage, agrarian reform and the settlement of the Jewish question, were enacted during the period when he was in power. (G. Bo.)

BRATISLAVA or PRESSBURG (*see* 22.299), the chief Danubian port of Czechoslovakia, had a population in 1921 of 93,189. Before the War it was largely dependent on Vienna, but after the creation of the Czechoslovakian Republic its development was actively pushed forward. The daily capacity of the port increased from 400 tons in 1919 to 2,100 tons in March 1921. The scheme of development aims at the creation of a harbour containing large docks capable of dealing with 3,000,000 tons a year, with a free zone equipped with bonded warehouses and factories. The work made good progress in 1924 and 65,000,000 crowns were set aside for the improvements of port works. New quays and railway sidings were constructed, and the winter harbour was deepened.

Bratislava is the seat of the International Danube Commission, which, under the Treaty of Versailles, controls navigation on the river Danube. Its annual Orient Fair is of importance; the town is developing into an important distributing centre for Balkan trade. Its industries include glass grinding and the manufacture of mineral oil, explosives, leather, and edible and industrial fats. In 1919 the Slovak Komenskelo University was opened. A summer service with Prague was maintained in 1924 and 1925. (*See* DANUBE.)

BRAUN, KARL FERDINAND (1850–1918), German physicist, was born at Fulda on June 6 1850 and was educated at Marburg and Berlin. In 1877 he was appointed a professor at Marburg and after other university appointments at Strasbourg, Karlsruhe and Tübingen, became in 1895 professor of physics and director of the Physical Institute at Strasbourg. He pursued important researches concerning the electrical phenomena of cathode rays and the problems connected with the foundations of wireless telegraphy. In 1909 he received, with Marconi, the Nobel Prize for physics. He died in New York April 20 1918.

BRAUN, LILY (1865–1916), German socialist and writer, was born at Halberstadt July 2 1865. The daughter of Gen. von Kretschmann, she was brought up in an atmosphere of Prussian militarism, but was nevertheless drawn to the Socialist movement, and married a Socialistic professor, Georg von Gizycki. He died in 1895 and the following year she married Heinrich Braun, a Socialist writer and politician. In connection with her interest in Socialism she visited England and met leading members of the Fabian Society. Much of her written work deals with the place of women in politics, for example *Die Frauenfrage* (1901); *Frauenarbeit und Hauswirtschaft* (1901); and *Die Politik und die Frauen* (1904). Her outstanding work, however, is her *Memoiren einer Sozialistin*, published in two volumes, *Lehrjahre* and *Kampfjahre* (1910 and 1911). Cast in the form of a novel, this work was largely autobiographical, and gave a striking account of the growth of the German Social Democratic movement at the end of the 19th century. Among her other books are *Die Liebesbriefe einer Marquise* (1912); and *Lebensucher* (1915). She died at Zehlendorf, near Berlin, Aug. 9 1916.

BRAUNER, BOHUSLAV (1855–), Czech chemist, was born May 8 1855 at Prague. He studied chemistry at Prague and also under Bunsen at Heidelberg and Roscoe in Manchester, where, in 1881, he was elected Berkeley fellow of Owens College. In 1883 he was appointed lecturer and in 1890 professor of chemistry at the Czech University of Prague. Brauner devoted himself mainly to the field of modern inorganic chemistry, with special reference to the grouping of the elements in Mendeleyev's periodic system, and did important work on the atomic weights and chemistry of the rare elements. He became a fellow of the Bohemian Scientific Society, a member of the Czech Academy, and a corresponding member of the American Academy of Science.

The results of his extensive chemical research have been issued in numerous publications, the chief of which are as follows: *On Fluorescence* (1877); *On the Atomic Weight of Beryllium* (1878 and 1881); *Contributions to the Chemistry of the Rare Earths* (1882 and 1883); *On the Atomic Weight of Cerium* (1885); *Experimental Studies on the Periodic Law* (1889); *On the Volumetric Determination of Tellurium* (1890); *On the Constitution of Certain Metallic Chlorides* (1889); *Observations on Argon* (1895); *A Method of Preparing Argon in Large Quantities* (1895); *Revision of the Atomic Weight of Cerium* (1903).

BRAZIL (*see* 4.438), a republic of South America which covers an area of 3,291,416 square miles. The population, according to the census of Sept. 1 1920, was 30,635,605—an increase of over 13,000,000, or 77%, since 1900, which is largely attributable to immigration. The Federal District, comprising the city of Rio de Janeiro and suburbs, had 1,157,873 inhabitants; other towns of over 100,000 inhabitants were São Paulo, 579,033; Bahia (São Salvador) 283,422; Pernambuco (Recife), 238,843; Pará (Belem), 236,402; and Porto Alegre, 179,263.

I. POLITICAL HISTORY

The electoral defeat of Ruy Barbosa in the presidential election of March 1910 by Hermes da Fonseca was followed later in the year by revolutionary outbreaks in the north and at Rio de Janeiro. On the night of Nov. 22 the crews of the two new dreadnoughts "Minas Geraes" and "São Paulo" mutinied, threatened to bombard the city and demanded reforms. The revolt spread to other naval units, and when the President delayed a reply fire was opened on the city; this was followed by a grant of the mutineers' demands and a general amnesty, which brought about a general surrender of the ships. The defeat of the Marine Corps at Cobras Island in Rio harbour on Dec. 10 was the end of the revolt, which resulted in many reforms in naval administration. The presidency of Hermes da Fonseca was marked by:—

(*a*) the amicable settlement, largely through the offices of Baron Rio Branco, the Minister for Foreign Affairs, of several boundary disputes, whereby Brazil's territory was increased;

(*b*) increased budget deficits, intensified by the rapid decline in the price of coffee and rubber and by the reduction of exports and imports with a consequent falling off in customs receipts;

(*c*) the widespread rebellion of unemployed rubber collectors in Ceará under Padre Cicero;

(*d*) the culmination of a series of minor financial, industrial and commercial troubles in a grave national crisis in 1914; the Government was unable to meet the demands for money by local and foreign contractors, and in October announced a funding scheme, whereby interest on most foreign loans became payable in script for three years and the redemption of the majority of securities was postponed for 13 years.

War Period.—President Wenceslao Braz, who succeeded Hermes da Fonseca in 1914, was greatly assisted in his efforts to restore national prosperity by overseas demand, notably from the United States, for Brazilian products. By the end of 1915 the high prices received for coffee began to affect the national exchequer so favourably that, with a reduction in expenditure, a small surplus was shown in the budget. In 1916 prosperity was definitely restored, and, for the remaining years of the World War, optimism prevailed in commerce and finance, and was reflected in the comparative quiet of internal politics. In foreign relations progress was made towards a consolidation of understandings with Argentina and Chile (known as the A.B.C. Entente); a treaty was ratified by Brazil in Oct. 1916 by which these three countries undertook to submit differences to arbitration, and to avoid open hostilities until an appointed arbitral committee had given a decision. The remaining two years of Wenceslao Braz's presidency were years of increased prosperity and with that a feeling that assertion should take the place of the almost passive part Brazil had hitherto taken in international affairs.

A series of War incidents (during which popular sympathies were with France, Italy and Great Britain) intensified this feeling; and the sinking of the Brazilian S.S. "Paraná" off the coast of France by a German submarine on April 3 1917 provided an opportunity for satisfying national ambition. Three days later the United States formally declared war on Germany, and from that date Brazil did not hesitate as to her attitude. On April 10 the German Minister at Rio de Janeiro was handed his passports. During the crisis Dr. Lauro Müller, the Foreign Minister, who was of German descent, resigned, and his place was taken by Nilo Peçanha, a former president. Rupture with Germany did not involve immediate abandonment of neutrality, for, despite fairly widespread anti-German demonstrations, the passing of a bill on May 29 authorising a revocation of the declared neutrality, and the seizure of German shipping in Brazilian waters, it was not until after the sinking of another Brazilian vessel, the S.S. "Macao," that a state of war was formally declared on Oct. 26 1917.

Brazil sent physicians and aviators to France; several destroyers and other smaller vessels went on active service. The means of equipping an army for European service were lacking, however, and the important naval units required overhauling. But the will to help was shown, not only by the provision of raw materials, commodities and merchant shipping, but by the passing in Dec. 1917 of a military law by which all citizens between the ages of 21 and 30 were made subject to selective draft. The years 1917 and 1918, up to the cessation of hostilities, were notable for their prosperity and for a considerable development in local industries, largely owing to the War and the measures taken for its prosecution. German banks were placed under control in Nov. 1917, and decrees were passed for the encouragement of national industries and schemes for industrial development. Brazil was forced, for the first time in her history, to recognise the necessity of making herself independent of much of the foreign assistance upon which she had been accustomed to rely. Goods manufactured at home began to take the place of European articles, and the predominance of the United States in the import trade began to be felt. The steady economic progress of this period affected the political life of the country, in that there were no noteworthy incidents apart from activities and legislation made necessary by the War.

Post-War Period.—In 1918 there was no contest for the presidency, the only candidate being Sr. Rodrigues Alves, who had been president from 1902–6. Considerable confusion was caused in Nov. and Dec. 1918 when it was found that Alves was unable, through illness, to assume office and therefore unable to sign legislative measures or assist congress in fulfilling its duties. Alves died on Jan. 15 1919 without having assumed office; his place was taken by Dr. Epitacio da Silva Pessoa, who was elected (during his absence in Paris as chief of the Brazilian delegation to the peace conference) by a large majority over Barbosa.

The year 1919 was the record year for Brazilian foreign trade, but from May 1920 a downward tendency showed itself. In Brazil the balance of foreign trade acts as the barometer of the country's prosperity, and on prosperity depends peaceful political life. The Minister of Finance, Dr. Homero Baptista, was unable to devise measures adequate to meet the difficulties into which national finances drifted, although the Government authorised the issue of large quantities of paper money. Fluctuations in exchange, and a rapid increase in the cost of living, brought strong criticism of the Government and added to the existing tension. During this period Dr. Epitacio Pessoa introduced an ambitious scheme to provide a series of great dams for the storage of flood-waters to safeguard the states of Ceará, Parahyba and Rio Grande do Norte against the periodic droughts which have retarded their economic progress. It was recognised that such a scheme must, if successful, enrich Brazil; but the moment for its initiation was considered to be inopportune. The visit of the King and Queen of the Belgians during Sept. and Oct. 1920 helped momentarily to distract attention from the serious financial problems to be faced. Another notable event was the signing by the president, on Sept. 3 of the same year, of a decree repealing the Act of Banishment of the Imperial Brazilian family of Dec. 21 1889; the remains of Dom Pedro II. and the Empress were brought from Portugal to Brazil in Jan. 1921, accompanied by the Conde d'Eu, son-in-law of the Emperor. Diplomatic relations with Germany were formally renewed in Dec. 1920.

The financial crisis continued throughout the years 1921–2 and was the subject of much oratorical recrimination during the presidential election of 1922, when Dr. Arturo Bernardes, president of the State of Minas Geraes, was elected to succeed Dr. Epitacio Pessoa, whose administration was accused of having brought the country from prosperity to the verge of ruin. Followers of the defeated candidate Nilo Peçanha attempted to create disaffection in the army and navy, and on July 5 the garrison in a fort of Rio de Janeiro harbour was led to revolt by a son of ex-president Hermes da Fonseca. Pessoa showed great firmness, during his last months of office, in suppressing the revolt, which, in itself, caused very little damage; but as a consequence many people feared to come to Rio de Janeiro for the exhibition that had been organised to celebrate, on Sept. 7 1922, the centenary of Brazil's independence. The centenary exhibition was notable in that special missions, representing countries interested in Brazil and amounting in all to some 300 persons, were accredited. The first South American Olympic Games were held in Rio de Janeiro in recognition of the event; the exhibition closed in Dec., having proved very successful.

The presidency of Dr. Arturo Bernardes, 1922–6, was one of the most trying in Brazilian history. It was characterised by a strong policy of attempted retrenchment and reform, which caused considerable hostility amongst the elements thereby affected. The year 1923 was, on the whole, a quiet one. A press law, introduced with a view to stamping out libel, was received with indignant protests from the newspapers. The most disquieting event was a wordy quarrel with Argentina regarding a proposed conference on armaments; the bitterness caused by this controversy, as reflected in the Press of both countries, went a long way towards dispersing the good feeling that had been growing during the preceding five years. The year closed with the suppression of a rebellion in the State of Rio Grande do Sul through the intervention of the Federal Govt., and it was realised that President Bernardes was progressing in his efforts for reform. Finance still remained the worst problem to be faced, and in his efforts to do this the President invited a mission of British financial experts to investigate and report upon the state of Brazil's finances. Early in 1924 the report of the mission was published; it recommended drastic economies and retrenchment, the development of national industry, the freeing of industrial undertakings from state control, and the necessity for the influx of foreign capital. These proposals were welcomed by the President and his Finance Minister although they did not please the public.

On July 5 1924 a serious revolutionary movement broke out in the State of São Paulo, attributed to general military discontent and hostility toward the *régime* of President Bernardes. The leader of the rebels was General Isidoro Dias Lopes, whose efforts were directed towards deposing the President. To this end the rebel forces occupied the city of São Paulo, hoping thereby to attract the main body of the Federal army and thus leave the capital unprotected. But the President retained a strong force, augmented by recruiting, in Rio de Janeiro, and sent detachments in increasing numbers to surround the rebels. From July 9–27 São Paulo was held against the Federal forces, but the withdrawal of the insurgents at the end of the month was a signal for the general collapse of the movement. In the north there was a revolt on July 26 of Federal troops at Pará; outbreaks were also reported at Manaos, Sergipe, Amazonas and Bahia, but all were quickly suppressed; the Federal districts and State of Rio de Janeiro remained quiet. On Nov. 4 the crew of the dreadnought "São Paulo" mutinied, seized the ship and proceeded to Montevideo, whence it was restored to the Brazilian Government by the Uruguayan authorities. Early in 1925 order had been so successfully restored by the Federal Govt. that President Bernardes was again able to turn his attention to the readjustment of the finances, broadly in accordance with the recommendations of the British financial mission.

The year 1925 showed a small though steady progress. The revolutionary movement of July 1924 was responsible for many isolated manifestations of unrest, and in a few places minor conflicts took place; the country had not returned to a normal state by the end of the year. Trade and commerce easily adapted themselves to the changed conditions, which had but little effect on commercial life. Political troubles have not, as a rule, greatly affected traders in Brazil, although serious trade depressions have considerably affected politics. In 1925 the annual deficit was again reduced, and it was believed that the efforts of the President to restore financial normality would, if continued, be successful. Sr. Washington Luiz was elected on March 1 1926 to succeed Dr. Arturo Bernardes in the presidency. The speech in which the president-elect declared his policy indicated that, with few modifications, he proposed to continue the reconstructive efforts that had been begun by his predecessor.

As a signatory of the Treaty of Versailles, Brazil was not only one of the original members of the League of Nations, but the first Latin-American republic to become a member, having also a non-permanent seat on the Council. In 1921 Dr. Gastão da Cunha was nominated as President of the League, and in 1923 Brazil, while showing her anxiety to be elected to permanent membership of the Council, was satisfied with Dr. Epitacio Pessoa's appointment as Judge of the Permanent Court of International Justice. By a decree of March 12 1924 a permanent representation with the League of Nations was organised, consisting of a representative equivalent in status to ambassador with a staff of secretaries. In March 1926 the Brazilian demand for permanent representation on the Council of the League, expressed by her representative at Geneva, caused a postponement of the admission of Germany to permanent membership of the Council, the view of Brazil being that if further permanent seats were to be created, she also was entitled to one, as the senior representative of Latin-America. It was found impossible to reconcile these differences and in June 1926 the representative of Brazil gave official notice of the withdrawal of his country from the League, this withdrawal to take effect on June 13 1928.

Defence.—The navy in 1920 comprised two battleships of dreadnought type, two cruisers, three light cruisers, 10 destroyers, three submarines and various auxiliary vessels. Five destroyers and three large submarines were under construction. The navy is manned by approximately 900 officers, 100 cadets and 10,000 ratings. A naval mission from the United States arrived in 1922, and under its guidance many administrative improvements were effected by 1925. There is a naval floating dock for ships up to 23,000 tons; three dry docks at Rio de Janeiro, one of which accommodates dreadnoughts; and repair docks at Pará and Ladario de Matto Grosso. Under the military law of 1923 every Brazilian between 21 and 44 years of age is liable for service, which consists of two years with the colours, seven in the first-line reserve, seven in the second line and eight in the national guard. The strength of the army in 1925 was 40,390 maximum; the first line mobilisation is estimated to yield 500,000 officers and men. A French military mission, from 1919–25 effected improvements in discipline, armaments and efficiency. There is also a gendarmerie of 26,000. Air forces were, by 1924, divided between army and navy, each possessing its own flying branches. Naval aviation was centred at a base in Rio de Janeiro harbour; a new and larger base was in course of construction at Ilha do Governador. In 1924 the navy possessed 25 aircraft for instructional purposes, and 43 for service use. Naval flying personnel consisted of a director, 35 qualified pilots and 450 other ranks. Army aircraft consisted of about 70 machines, with 14 administrative officers, 15 pilots, 11 observers and over 600 other ranks.

Education.—Elementary education is free but not compulsory. Secondary and university education are administered by the Federal and states governments; primary, by states and municipalities. By decree, a Federal University was established in Rio de Janeiro in 1915, comprising faculties of medicine and law and a Polytechnic School. The Federal Ministry of Agriculture and the states governments have under their immediate inspection and direction many agricultural colleges.

II. FINANCIAL AND ECONOMIC HISTORY

The World War gravely affected Brazil's financial position. Foreign sources for borrowing were closed, trade was interrupted in 1914–5 with a corresponding fall in customs receipts, and internal borrowing largely replaced foreign. Again, from 1919–22 there was an economic crisis (which had not ended in 1925) caused by over-importation and speculation, over-exportation on consignment and the inability of Brazilian exporters to retain markets gained during the period 1915–8; in addition, the Federal Govt. in 1920 renewed the payment of interest abroad, while little foreign capital was available. Government bonds and paper money were issued, and budget deficits became the rule; from 1914–8 the internal debt increased by over 100,000,000 milreis, and the foreign debt by £12,000,000. The total Federal indebtedness (calculated at 6d. to the milreis) on Dec. 31 1924 was nearly £300,000,000 of which about one-half was foreign. The following table shows the revenue and expenditure for each year from 1920–5:—

Year	Revenue, £	Expenditure, £	Balance, £
1920 .	41,688,000	41,243,000	+ 445,000
1921 .	22,936,000	24,869,000	− 1,933,000
1922 .	28,903,000	42,992,000	−14,089,000
1923 .	28,175,000	33,220,000	− 5,045,000
1924 .	34,106,000	36,335,000	− 2,229,000
1925[1] .	34,623,000	35,611,000	− 988,000

[1] Estimate.

Production and Industry.—The main crop is coffee, of which Brazil produces four-fifths of the world's supply. More than half of this is grown in the State of São Paulo; the remainder is mainly from the States of Minas Geraes, Rio de Janeiro and Espirito Santo. The coffee crop fluctuates greatly in the 5,000,000 ac. under cultivation, but the total steadily increased, until the years 1920–5 showed an annual average of 12,000,000 bags of 60 kilos (132 lbs.) each. The value of the coffee crop to Brazil may be estimated from its share of total exports, which increased from 50% in 1913 to about 75% in 1925. A constant effort is made to maintain a good price by encouraging consumption through propaganda abroad, and by means of "valorisation" (*see* 6.647, Coffee convention scheme of 1907), which was again resorted to in 1917. The Federal Govt. bought stocks of coffee at firm prices, to be released for sale as and when prices became remunerative; this policy was continued in modified form up to 1925. Every confidence has been officially expressed that coffee plague (ascribed to a minute beetle of the *Stephanoderes* type) could be combated, and that the measures devised to this end by the Government committee under Dr. Arthur Neiva in 1925 were efficacious.

Cotton is native to Brazil and can be grown in all parts of the republic. The best lands are in the centre and along the northeast coast to the mouth of the Amazon, whence the finest varieties are equal to the Egyptian. Annual production averages 130,000 metric tons, of which the greater part is shipped to England. In 1920–1 the question of the culture of cotton was much in evidence. In 1921 Mr. Arno Pearse, secretary of the Federation of Master Cotton Spinners, arrived with experts from England to study the problem. From this visit, and the international cotton conference held in Nov. the same year, it was made evident that Brazil's potentialities were great, but that better methods of seed-producing, planting and grading were essential. Since the presidential decree of March 27 1920 the Federal Govt. has encouraged and facilitated such enterprise.

Stock raising has made considerable progress, notably in the states of Rio Grande do Sul, Minas Geraes, Paraná, São Paulo, Rio de Janeiro, Matto Grosso and Goyaz. The World War gave a great impetus to cattle breeding and its derived industries. In 1914 only one ton of frozen meat, valued at £40, was exported; in 1917 this had increased to 66,400 tons, valued at £3,000,000; by 1923 exports of frozen and chilled beef amounted to 76,829 metric tons, valued at nearly £2,000,000, and of hides and skins 62,000 metric tons, valued at £3,626,000. A census of livestock, taken in 1920, showed some 34,000,000 oxen, 5,000,000 horses, 1,800 asses and mules, 7,000,000 sheep, 5,000,000 goats and 16,000,000 pigs: the greatest numbers were in Rio Grande do Sul and Minas Geraes. The industry has been modernised and is encouraged by the Federal Govt.; packing plants of the latest design and efficiency are in operation and the treatment of by-products has received increased attention.

After 1910 the rubber industry suffered severely from foreign competition, notably from the Far East. In 1910 Brazil exported 38,547 metric tons, valued at £25,000,000; exports then fell steadily, both in quantity and value, until in 1923 only 17,030 metric tons valued at £1,713,990 were exported; 1924–5 showed little difference, and the prospects generally were not encouraging. Sugar is produced largely in the states of Pernambuco, Rio de Janeiro and Minas Geraes. There are some 200 sugar factories in the country with an average annual production of 480,000 tons. From 1884 the export steadily declined, touching the minimum in 1912; after that date there was an increase reaching its maximum in 1921 with 252,110 metric tons, but falling in 1923 to 153,710 metric tons. The introduction of modern machinery is gradually making sugar one of the principal sources of national wealth. Tobacco is grown in Bahia, Rio Grande do Sul and other states. The Bahia product (85% of the whole Brazilian crop) is of good quality and finds a ready market abroad. Brazil is the second tobacco producing country in the world, its annual production approximating 100,000 tons. The lumber industry, with its derived products (fibre and woodpulp for paper-making), has progressed in Paraná. Other important agricultural products are cacao, nuts, wool, caranauba wax, bran, rice, wheat, manioc flour, herba matte and beans.

Mineral Wealth.—Brazil is known to be rich in minerals, but they have been little exploited. Iron ore is abundant, especially in Minas Geraes, and contains a high percentage of hematite. Large quantities of manganese were exported to the United States during the War. Since 1919 much attention has been directed to investigating the commercial possibilities of petroleum deposits. Wolfram and tin are found at Encruzilhada. Brazil is one of the few world sources of mica. A small amount of gold is produced, the average annual value of the output approximating £650,000; copper is found in Parahyba and Bahia. Coal of rather poor quality exists in Santa Catharina and Rio Grande do Sul. Bauxite, chromite, lead, nickel, diamonds and other precious stones are also found. Natural gas has been discovered at Graminha. The Ministry of Agriculture has a geological branch, which undertakes surveys and the preparation of geological maps.

Manufacturing Industry.—Local manufactures of every description developed considerably after 1910. The difficulties of importation during the World War stimulated home manufacture, and from 1916 onwards great progress was made. São Paulo is the chief industrial centre. Cheap hydroelectric power was made available in limited quantities in Rio de Janeiro, São Paulo and Minas Geraes; the development of water-power resources is of immense importance to the home manufacturer. The textile industry is the most important; from 1921–4 it accounted for 40% of the total production of manufactured articles, and in 1925 there were altogether some 300 spinning and weaving mills in operation. The whole of the native textile output is sold in Brazil, supplying 80% of the fabrics in use. The tanning industry, with its derived manufactures of boots, shoes, leggings, slippers and sandals, supplies a large percentage of the home demand for footwear. Brazilian manufacturing industries are encouraged by heavy import duties, from which the Federal Govt. derives the greater part of its revenues; without this tariff they could not easily compete with foreign goods.

Foreign Trade.—The following tables show the value of the foreign trade of Brazil between 1911–24, and the percentage trade with certain countries in 1913–9–24:—

Years	Imports	Exports	Total
1911–5 (Annual Average) . .	£49,795,000	£61,538,000	£111,333,000
1916–20 (Annual Average) . .	68,175,600	83,653,300	151,828,900
1921 . .	60,468,000	58,587,000	119,055,000
1922 . .	48,641,000	68,578,000	117,219,000
1923 . .	50,543,000	73,184,000	123,727,000
1924 . .	68,949,000	95,103,000	164,052,000

Proportion of Total Imports and Exports by the Following Countries

Country	1924		1919		1913	
	Imports Per Cent	Exports Per Cent	Imports Per Cent	Exports Per Cent	Imports Per Cent	Exports Per Cent
United Kingdom . .	24·2	3·4	15	8	24·5	15
U.S.A. . .	23·9	42·8	50	42	15·5	32·5
Germany .	12·2	6·6	...	..	17	14
France . .	6·7	12·1	3·5	22	10	10

Immigration and Labour Conditions.—Immigration is of vital importance to the development of so scantily peopled a country as Brazil, and it is encouraged and facilitated by various schemes of the Federal Government. The years 1910–3 showed a steady increase in the numbers of immigrants, which, however, fell from 192,000 in 1913 to an annual average of 39,728 for the period 1914–9, rising again in the post-War period to 86,967 in 1923. Immigrants are mostly from Portugal, Italy and Spain. The labour question as understood in Europe exists only to a limited extent in Brazil. Trade unions exist but are badly organised. The enormous size of the country, the lack of communications, and, outside the Federal district and São Paulo, the sparse population, render combined action difficult and completely ineffective; notwithstanding these factors, however, strikes grew in numbers and extent. In 1923 a decree was published creating a national council of Labour to act in an advisory capacity to the Government. It began by considering hours of work, arbitration, insurance and other problems directly affecting workers, and in 1924 suggested that the 1918 Law of Accidents should be amended, in view of the prevalence of accidents (125,000 per annum) and the unsatisfactory state of employers' liability under the 1918 law.

Communications.—Brazilian railways have developed as a series of independent systems because of the wide separation of populated centres; thus Pernambuco is the focus of one system, Bahia, Rio de Janeiro, Santos, Pará and Rio Grande do Sul of others. The lack of transport facilities hinders economic progress; communication with the vast outlying district is slow and difficult, but apart from this the existing transport facilities are inadequate to deal satisfactorily with the output of the great productive zones. The extent of lines in operation on Dec. 31 1924 was officially stated as 31,310 km. (approx. 19,570 m.); there were over 2,000 km. under construction, and plans were approved for nearly 10,000 km. more. The need for railway development is recognised by the Federal Govt., but financial difficulties have greatly hindered progress. The lines in the interior running north and south are slowly being connected to afford communication independent of the sea; connection has been made from Natal to Maceió, and from Rio de Janeiro north to Victoria, and south to the Uruguayan frontier, where connection was made in 1913 with the Central Uruguayan Railway for Montevideo. Construction was not limited to the coastal region; for example in 1916 an important line was completed between Itapura and Porto Esperança, near Corumbá on the Bolivian frontier; this reduced the time from Rio to Corumbá from six or more weeks' travelling by water to six days by rail. Many other minor schemes were carried out or are being planned. The Federal Govt. operates 25% and has leased a further 25% of the lines. Many electrification schemes are planned or have been completed, notably in the State of São Paulo.

The development of telegraphic communication with the interior was largely the work of the Brazilian army. In 1924 there were 50,000 m. with more than 1,000 offices; more than half of the systems belong to the Government. Wireless telegraphy progressed after 1910 and communication is maintained from Manaos to the interior of Amazonas and the Acré district. Over 40 stations existed in 1923 and a powerful station was planned and commenced in that year to establish radio-communication with the rest of the world; on Sept. 5 1923 the Brazilian Press began to receive a news service by wireless from France. In 1924 Brazil was connected with Europe by three submarine cables, with the United States of America by two, and with the River Plate by two; connection was established with Monrovia (Liberia) in 1911. The high cost of transport and lack of adequate means of communication have caused a constant deficit in post-office administration since 1840; in 1922 there were over 4,000 post offices in the republic. Civil aviation had made little progress. The Budget law of 1925 authorised the issue of regulations governing aviation in Brazil. A company was formed in 1925 mainly with the object of mail carrying. At the end of 1922 the Brazilian mercantile marine consisted of 556 steamers with a total gross tonnage of 522,663, and 107 sailing vessels of 41,535 gross tons; half the total tonnage belonged to the Government-owned Cia. Lloyd Brazileiro, which extended its foreign service, after having acquired 15 of the 45 German ships interned during the War. The river systems are largely used for transport purposes, notably the Amazon, which is navigable up to Iquitos.

Banking.—Efforts to stabilise foreign exchange resulted in the creation during Penna's presidency (1906–10) of a conversion fund (*Caixa de Conversão*), which, though effective in its early years, was unable, partly through lack of continuity in its original policy, to stop fluctuations after the outbreak of the World War. The *Caixa* issued, from time to time, notes based upon a gold deposit, the maximum, on Feb. 12 1913, amounting to 420,924,300$000. The first set-back to its policy was the raising in 1912 of the rate of exchange to 16d. In 1914–5, trade depression, speculation, and war conditions also had an adverse effect, and the *Caixa* became indebted to the Treasury by increasing amounts annually, until on Dec. 5 1917 it was closed; by 1919 there were still 20,[illegible]1,610$000 of its notes in circulation, a drop of over 60,000,000 milreis. The Budget law of 1920 suspended its functions, which were taken over in 1921 by the guaranteed *Caixa de Amortisa ção*. By a contract of April 24 1923 the Federal Government authorised the Bank of Brazil to become a Bank of Issue for 50 years; thus the issue of currency no longer lies with the Federal Government. Paper money in 1914 amounted to 980,000,000$000 and in 1925 to 3,000,000,000$000. Banking transactions showed a steady increase, particularly those of national banks; in 1921 they amounted to 11,302,604,000$000 and in 1924 to an estimate of 16,000,000,000$000.

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(C. Du.)

BREAD MAKING (*see* 4.465).—Since 1910 no entirely new and different methods of preparing bread have been introduced, but there has been a slow evolution of methods and machines which were introduced in earlier years. The machinery has been passing through a process of perfection and elaboration so that as near an approach as possible is being made towards an automatic system of forming the dough and shaping the loaf.

Arrangement of Plant.—In a modern bakery, the plant is arranged on three floors. In the upper is the flour store where the mixing and sieving machines pass the flour on to the automatic weigher. From there, it passes to the mixing machine where the water at a proper temperature is added. From the dough mixer the dough passes into the trough where it is to ferment. Large pieces are cut out at the end of that period and fed to the automatic divider which passes the weighed pieces of dough on to a machine called the rounder up or moulding machine which first gives shape and form to the piece of dough. The loaf then passes into the travelling trays which move slowly through a large proofing chamber which can be kept at a uniform temperature and where the dough again expands. Afterwards, the dough again passes through the moulding machine which gives it the final shaping before it passes into the oven.

Motive Power.—With the increased use of machinery more attention has been given to motive power. Electricity is largely used and the motor is part of the machine so that there is no waste of power by carrying loads unnecessarily.

Ovens.—The machine bakery demands a type of oven capable of being used more speedily than the older forms, where the oven was filled by means of the long-handled wooden spade, known as a peel, and much greater use is being made of travelling ovens. The bread to be baked is placed on rows of tins or otherwise on platforms which are carried through the oven by power at such a rate that when it reaches the further end of the oven it is completely baked.

Fuel.—For firing purposes, solid fuel is being replaced by more modern and cleaner methods of heating. In newly installed ovens, gas either from a producer furnace or from the ordinary municipal supply is used. Where heating by steam pipe is still in use, the heating is obtained from oil burners, the necessary power for the spraying of the oil being obtained from that already in use in the bakery. The use of oil fuel means a decrease in cost and labour and a great increase in cleanliness. In a large bakery where oil fuel has been introduced, the ratio of cost per sack between coke and oil firing is as 9 to 5. There is the absence of all dust which is bound to be present where solid fuel is used and a steady heat is kept up for a continuous process of baking. From every point of view, the ideal oven is one that is heated electrically. Fine ovens of this type are now available and the only requisite for their extensive use is a current supply at a reasonably small rate per unit.

Recent Changes.—The operations in a modern bakery are no longer carried on by rule of thumb and traditional methods but are based on technical knowledge. The number of revolutions of the mixer is predetermined and the speeds of the divider, rounder, proofer, moulder, travelling oven, cooler and wrapping machine are synchronised so as to eliminate waste time and motion. The humidity of the dough room is fixed. Temperatures are exactly observed and often thermostatically controlled. Some advance has been made, in America mostly, in arriving by a rapid method of indicators at the correct degree of acidity in the dough when it is ready for moulding. Fermentation in two stages, first in a thin sponge of flour, salt and water, and finally in a thicker dough made by mixing in a further quantity of flour, is being superseded by a shorter process where the first mixture of flour, water, yeast and salt is the final one. In this process the fermentative action of the yeast is usually stimulated by the use of some form of the many chemical yeast foods that are now obtainable. These usually contain phosphates and are sold under proprietary names and are not considered legally to be adulterants. In the large bread factories in the west of Scotland, the process of preparing dough is still the sponge and dough process, with the fermenting agent a fairly acid barm called Parisian barm, the epithet being merely distinctive. The use of enriching materials such as whole and skimmed milk has improved the character of bread and its nutritive value, protein and mineral content of milk being removed in the process of milling the flour.

Delivery.—A further development in the hygiene of the bread supply has taken place within the past few years. The bread, before being delivered, is allowed to cool in ordinary bread racks, or in specially devised ones, and then passed through a machine which automatically wraps it in paper ready for delivery. The transport to the customer in a motor delivery van completes the whole process of the mechanical handling of this food product, perhaps, the most important of them all.

See J. Grant, *The Chemistry of Bread Making*, 4th ed. (1924); J. Stewart, *Bread and Bread Baking* (1924).

(J. St.*; H. E. Ba.)

BRÉAL, MICHEL JULES ALFRED (1832–1915), French philologist (*see* 4.481), died in Paris Nov. 25 1915.

BREASTED, JAMES HENRY (1865–), American orientalist and historian, was born at Rockford, Ill., Aug. 27 1865. After graduating from Northwestern College in 1888 he studied at the Chicago Theological Seminary and at Yale University. In 1894 he obtained the degree of Ph.D. from the University of Berlin, and subsequently honorary degrees from the Chicago Theological Seminary and the universities of California and Oxford. Obtaining an appointment at the University of Chicago in 1894 as an assistant in Egyptology, he became professor of Egyptology and oriental history in 1905, and in 1915 was made chairman of the department of oriental languages, becoming also, four years later, director of the Oriental Institute of the university. By commission of the royal academies of Germany in 1900 he was appointed on a mission to the museums of Europe to copy and arrange the Egyptian inscriptions in those museums for an Egyptian dictionary. He directed archaeological expeditions for the University of Chicago in Egypt in 1894–5 and 1905–7 and in Mesopotamia in 1920. In 1925 he headed an expedition organised for the excavation of Armageddon in Palestine.

He has published, among other works, *De Hymnis in Solemn sub Rege Amenophide IV. Conceptis* (1894); *A New Chapter in the Life of Thutmose III.* (1900); *Ancient Records of Egypt* (5 vol., 1906–7); *A History of Egypt* (1906, 2nd ed., 1909; also French, German and Russian editions and editions for the blind); *Egypt Through the Stereoscope* (1905); *The Battle of Kadesh* (1903); *The Temples of Lower Nubia* (1906); *A History of the Ancient Egyptians* (1908); *The Monuments of Sudanese Nubia* (1908); *Development of Religion and Thought in Ancient Egypt* (1912); *Survey of the Ancient World* (1919); and *History of Europe, Ancient and Medieval* (with J. H. Robinson, 1920).

BREGUET, LOUIS CHARLES (1880–), French engineer, a descendant of the famous watchmaker, Abraham Louis Breguet, was born Jan. 2 1880 in Paris. He received his education at the Lycées Condorcet and Carnot, and graduated in science. He was from the outset of his career a prominent member of the engineering firm that bears his family name, and eventually became head engineer of its electric service. The Maison Breguet, which came to the front in French aeronautical construction, provided him with ample ground for research; he published a quantity of reports on aerodynamics, on the energy set in force by propellers in motion and on the rise of aircraft from the ground. He studied and equipped in 1909 the first helicopter able to rise perpendicularly carrying a passenger.

BREITNER, GEORGE HENDRIK (1857–1923), Dutch painter, was born Sept. 12 1857 at Rotterdam. He began to study painting at The Hague, and was a pupil of William Maris. His early work showed the influence of Rochussen, who was the first to discover Breitner's great talent. In later years he was strongly influenced by Jacob Maris' colouring, but afterwards became an independent impressionist, occupying a prominent place in modern painting. The subjects of Breitner's pictures were chosen from the old parts of Amsterdam, from popular life in the town or from the vigorous movements of manoeuvring cavalry and artillery. He died at Amsterdam June 5 1923.

BREMEN (*see* 4.493) had a population in 1919 of 269,806; in 1921 two fresh communes and parts of two others were added to the city. Bremen is the chief port in Germany after Hamburg for international trade, and in 1925 the shipping had almost reached its pre-War level. In 1913, 3,876 vessels, totalling 2,149,000 tons, entered the port. In 1923 the number was 3,407, totalling 3,256,000 tons. Sailings to New York by the North German Lloyd line, which lost nearly nine-tenths of its tonnage during the War and under the Peace Treaty, were resumed in 1922. The total water area of the docks is 126 ac., and the waterway is kept open as far as the Hohethorshaven in winter by icebreakers. The museum in the Bahnhofsplatz was enlarged between 1907 and 1911. The cathedral, bourse and town hall were damaged in the Spartacist disturbances of 1919, when the city was bombarded and occupied by government troops.

BRENTANO, LUDWIG JOSEPH (1844–), German economist (*see* 4.496), was one of the delegates sent over to London in Nov. 1919 to attend the economic conference convened by the "Fight the Famine" Council. At the first session of the conference, held at the Caxton Hall on Nov. 4, he urged the organisation and encouragement of German industry to enable Germany to fulfil her treaty obligations. His more recent publications include a pamphlet on the proposed League of Nations, and two short works, *Ist das System Brentano zusammengebrochen?* and *Russland, der kranke Mann* (1918).

BRESLAU (*see* 4.498) had in 1919 a population of 528,260, including the suburb of Gräbschen, which was included in 1911. An estimate in 1925 was 563,000. It is the capital of the Prussian province of Lower Silesia, the largest town in Silesia, the seventh in the republic, and the chief industrial centre of eastern Germany. In 1913 an exhibition to celebrate the centenary of the Wars of Liberation was held in a building specially built to the east of the city. A vast, circular building, called the Jahrhundert Halle and seating 10,000 people, was also erected; the dome has a span of 220 feet. Since 1918 fairs have been held three times a year in these buildings. A canal, the Breitenbachfahrt, for the use of barges from Upper Silesia, which branches off the Oder near Wilhelmshaven and joins the Alte Oder below the Gröschel Bridge, was made between 1912 and 1917. In July 1923 Communist outbreaks occurred here.

BREST-LITOVSK, BATTLES OF.—Under this heading are related the fortunes of Mackensen's third forward bound in the great offensive of the Central Powers against Russia in 1915. The period covered is from the middle of July to the middle of September. The aim of Mackensen's group of armies, directed between the Bug and Vistula rivers toward Brest-Litovsk—the same direction as that of the first Austrian offensive of the War—was to force the retirement of the Russians from the Polish salient, and, if possible, to cut their line of retreat. His attack was combined with one from the north by Gallwitz's XII. Army against the Narew line. In the upshot, though both attacks were successful, Russian resistance slowed them down sufficiently to enable the forces in the Polish salient to escape.

Mackensen's two previous attacks had carried him from the Dunajec to the San, then, after a pause, to Lemberg, which was captured on June 22, and northeast toward the Chelm (Kholm)-Lublin line. Again a short pause was necessary to reorganise his forces and prepare a fresh advance. Meanwhile the Russians had transferred three corps, Guard, II. Siberian and VI. Siberian from their northwestern armies to the III. and IV. Armies opposite Mackensen. The IV. Army (Ewarth) had, on July 8, administered a sharp check to the Austrian IV. Army, under the Archduke Joseph Ferdinand, at Krasnik.

The Armies Employed.—In the middle of July, when Mackensen resumed his advance, the position of the opposing forces was roughly as follows: The Russian IV. (Ewarth), III. (Lesh) and XIII. (Gorbatovski) Armies faced southwest, from the Pilica river near its junction with the Vistula to about Sokal on the Bug (northeast of Lemberg), covering Dęblin (Iwangórod), Lublin, Chełm and Włodimierz Wolynski. On the right of this group, the II. Army still held the Bzura-Rawa-Ruska positions west of Warsaw; on the left, the VIII., XI. and IX. Armies stretched south along the Upper Bug to Zloczów and thence to the Rumanian border. The Russian losses had been extremely heavy; in the III. Army, for example, five corps mustered between them only 25,000 bayonets. Their morale had naturally suffered.

Mackensen's group comprised, in that order from northwest to southeast, the Austrian IV. Army, the German XI. Army, the new German Army of the Bug (Linsingen), and the Austrian I. Army (Puhallo). The first three were to carry out the main attack between the Bug and the Vistula, while the I. Army was to cover the right and advance towards Włodimierz Wolynski. Further south, the Austrian II. Army and German Southern Army were to cover the offensive against counter-attack from the east, the same task that the Austrian II. and III. Armies had failed to perform at the beginning of the War. On the extreme right, the VII. Army (Pflanzer-Baltin) was to push forward and clear the southern portion of East Galicia. West of the Vistula, Woyrsch's corps of Landwehr was to advance in conjunction with Mackensen's left and if possible cross the river below Dęblin.

The Fighting Begins.—Mackensen's attack began on July 15. From the first, progress was slow. The Austrian I. Army captured Sokal and established a bridgehead east of the Bug, and the XI. Army took Krasnystaw. The Russians withdrew a few miles, but in no part of the line was any decisive success achieved. On the 18th, for the first time in history, the Prussian Guard met the Russian Guard on the field of battle; honours appear to have been even between them. Meanwhile Woyrsch had overcome the right wing of the Russian IV. Army and reached the Vistula; he crossed on July 28, some 20 m. north of Dęblin. Mackensen attacked again on the 29th and broke through the Russian front half way between Lublin and Chełm; the former place was evacuated on July 31 and the latter on Aug. 1. It had taken Mackensen 17 days to make good the 25 m. from his starting point to these places.

Gallwitz in the north had also been unable to gain a rapid success and was advancing only slowly. But before the triple threat of the forces of Mackensen, Woyrsch, now firmly established east of the Vistula, and Gallwitz, the Russians were compelled to evacuate Warsaw and Dęblin, the former on Aug. 4, the latter on Aug. 5. The Russian left wing (IV., III., XIII. Armies) in front of Mackensen was now executing a wheel to the east, to conform with the retreat of the centre from the salient. Positions had been entrenched in anticipation of this movement. Mackensen made a last effort to break through and intercept the Russian centre between Warsaw and Brest-Litovsk. But his attacks at Lubartow between Aug. 5 and 8 only gained ground slowly. By Aug. 9 the Russian line ran from Loniza, west of Siedlce and north of Lubartow-Włodawa. It was obvious that they had escaped from the noose which it had been proposed to draw round their centre. The main portion of Mackensen's group moved northeast towards Brest-Litovsk, exercising a purely frontal pressure on the retreating Russians. The only out-flanking movement now possible in this part of the field was east of the Bug, directed against the rear of Brest-Litovsk. This was attempted by the Austrian I. Army and the Army of the Bug. The Austrian I. Army had crossed the Bug early in Aug. and had pushed its cavalry as far as Włodimierz Wolynski. It now advanced on Kowel, while the Bug Army, which had crossed the river at Włodawa, advanced through the Pinsk Marshes (Polyesie) to cut the Brest-Litovsk-Kobryń-Pinsk railway line.

The Final Stages.—The remainder of the story can be quickly told. Under increasing pressure from the Austrian IV. Army and the German XI. Army, the Russians evacuated Brest-Litovsk on Aug. 26. But they held off the Bug Army from Kobryń sufficiently long to allow of the safe withdrawal of their forces from Brest-Litovsk. The Austrian I. Army, after reaching Kowel, sent Heydebreck's cavalry corps across the Pinsk Marshes to join the Bug Army, and itself became involved in battle against the southwestern group of Russian Armies towards Luck (Lutsk) and Równe.

At the end of Aug. Mackensen's force was reduced. The Austrian IV. Army was transferred to the right group, south of the Marshes; portions of the XI. Army had already been withdrawn for the Serbian campaign, to which Mackensen himself was now called. What remained of his forces was placed under Linsingen and pursued the Russians as far as Pinsk, where a line was taken up which remained unaltered to the end of the War.

The poverty of the communications had much hampered Mackensen. In his previous drives from the Dunajec and from the San he had depended principally on the effect of his heavy artillery. The lack of roads and railways south of Lublin and Chełm made it difficult to advance his guns and to keep them supplied with ammunition. The Russians, too, had shown all their traditional stubbornness in retreat. In this part of the theatre the Pinsk Marshes made a wide enveloping movement impossible, and the direction of Mackensen's advance was inevitable. Ludendorff had foreseen the slowness of advance on this line and had persistently counselled that the main blow should be directed by Kovno and Wilno (Vilna) on Minsk. *See* also EASTERN EUROPEAN FRONT and Map; DUNAJEC-SAN; LEMBERG; NAREW.

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(A. P. W.)

BREST-LITOVSK, TREATY OF.—There were two treaties of Brest-Litovsk, the first a treaty between the Ukrainian Rada and the Central Empires, signed on Feb. 9 1918, and the second a treaty between the Soviet Govt. of Russia and the Central Empires, signed three weeks later. The Ukrainian Treaty was signed by the representatives of a Ukrainian Govt. which had no longer any footing in the Ukraine, where it had been replaced by the Soviets. It was followed by other agreements which invited the occupation of the Ukraine by the Germans. It was never annulled because, although the Germans restored the government that had signed it to power in Kiev, that government ceased to exist as soon as the Germans, having occupied the Ukraine, had no further need of it. The second of the two treaties is that generally known as the Treaty of Brest-Litovsk.

An armistice between Russia and the Central Empires was arranged in Brest-Litovsk on Dec. 5 1917.[1] Peace negotiations were to begin at once. The Russians, who hoped to secure the support of the working classes of Germany and to rouse those of other countries to demand an immediate ending of the War, wished to ensure publicity for the negotiations, and proposed that they should be held in Pskov or in any neutral capital[2] (Stockholm was suggested). The Germans, for precisely opposite reasons, wished that they should be held within the walls of what was then a German fortress. The negotiations were held in Brest-Litovsk.[3] It soon became clear that the Germans wished to conclude an oppressive peace and to secure the connivance of the Russians in covering it with a "democratic" formula. Negotiations were adjourned on Dec. 28 for 10 days, in the hope that other fighting Powers might be induced to join in them. Meanwhile, the Soviet Govt. was to consider the German proposals. When the negotiations were renewed, the Russians showed at once that they had no intention of pretending that the German proposals fulfilled the conditions they had previously announced of "a peace without annexations or contributions on a basis of the self-determination of peoples."

It is impossible to say whether the Germans would or would not have modified their demands if their task had not been suddenly made easier for them by the readiness of the Ukrainian delegates to conclude a separate treaty. The Ukraine was at this time in a state of civil war between the Ukrainian Soviets and the Ukrainian Rada, which had sent its own delegates to Brest, where, at first, they worked in contact with the delegation from the Soviet Government. On Feb. 9, the Ukrainian delegation, knowing that the Rada which they represented had been driven from Kiev and the rule of Soviets proclaimed there, concluded a separate peace,[1] thus cutting the Russian front (such as it was) in half and admitting, even inviting, the Germans into the Ukraine. Trotsky, who knew that the Russian trenches were already empty, then made a desperate appeal over the heads of the German delegation to the German people, and declared that Russia would not sign an abominable peace but would demobilise her army and no longer consider herself at war. He hoped that the Germans would not be able to move their troops.

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[1] *Proc. of B. L. Peace Conf.*, pp. 35–6.

[2] *Proc.*, pp. 46–8.

[3] Dec. 22. *Proc.*, p. 36.

Three days later the Germans denounced the armistice and on Feb. 18 began a practically unopposed advance towards Petrograd.[2] The Bolshevik leaders were almost equally divided, half of them thinking that they could best serve world revolution by being destroyed, half of them led by Lenin urging that they would do better to secure a breathing space for the revolution in Russia. After a series of debates, Lenin got a majority by one vote (given him by Trotsky, who crossed over) and a telegram was sent stating Russian willingness to sign the treaty at once. The Germans continued to advance and preparations were begun for a hopeless struggle.

Finally, the Germans offered peace on conditions much worse[3] than those originally refused. Russia lost the Baltic Provinces and had to cede Kars, Ardahan and Batum to Turkey, to demobilise even the post-revolutionary formations, and to pay a thinly disguised indemnity of 300,000,000 gold roubles. This treaty was signed on March 3 1918, was ratified by the Congress of Soviets on March 11, and accepted by the Reichstag on March 22. It was annulled by Germany in accordance with Point XV. of the Armistice, concluded on the Western Front on Nov. 11 1918, and annulled by the Soviet Govt. on Nov. 13 1918.

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BRETON, JULES ADOLPHE AIMÉ LOUIS (1827–1906), French painter (*see* 4.501), died July 5 1906.

BREZINA, OTTAKAR: *see* JEBAVÝ, VACLÁV.

BRIAND, ARISTIDE (1862–), French statesman (*see* 4.515). In Oct. 1906 M. Clemenceau formed his first government, and in it M. Briand remained Minister of Public Instruction and Worship. During the life of this Ministry his principal work was in connection with the Separation Law (*see* 10.891), in the application of which there were certain difficulties, due to the hostility of the Vatican. It was then that M. Briand gave proof of his essential liberalism. Though he held fast to the principle of the new legislation, he made possible the carrying on of the rites of the Catholic Church under the laws as to associations and public gatherings. On the death of M. Guyot-Dessaigne in Jan. 1908 he was appointed to the Ministry of Justice.

When the Govt. of M. Clemenceau fell in July 1909 M. Briand formed his first Cabinet, himself taking the portfolio of Interior and Worship. He announced that he would adopt a policy of national understanding and tranquillity. In Oct. 1910 there was a threat of a general strike on the railways. M. Briand mobilised all the railwaymen who were still subject to military service, dismissed those who disobeyed, and had the members of the strike committee arrested. A majority in the Chamber approved his action, but in spite of this the Govt. resigned on Nov. 2 1910 as a result of the withdrawal of M. Viviani, the Minister of Labour, who disagreed with his colleagues on the question of the right to strike.

M. Briand immediately formed a new Cabinet, of a more radical tendency than its predecessor. This alteration, which offended the moderate Republicans without conciliating the Radicals, weakened the position of the Ministry. A Colonial difficulty embarrassed them still further. The Franco-German Convention of 1909 had provided for economic collaboration between the two countries both in Morocco and French-Congo. In Dec. 1910 M. Pichon, the Minister of Foreign Affairs, and the German ambassador signed an agreement by which German capital was to be invested in a French undertaking in the Congo, the N'goko-Sangha, which was also to receive a large subsidy from the French Government. The Opposition criticised this scheme, and the Cabinet did not venture to ask Parliament to ratify, thus exposing themselves to the reproaches of the German Government. This affair, which was one of the causes or rather pretexts of the Agadir crisis of the following July, was among the principal reasons for the resignation of the Govt., although this was not stated at the time. A parliamentary incident gave M. Briand an excuse for an unobtrusive withdrawal. In Feb. 1911, when he was accused by the Radicals of failing in the strict application of the law with regard to religious houses, his majority fell to six and he resigned.

After some months out of office, he became Minister of Justice in M. Poincaré's first Cabinet on Jan. 13 1912. When M. Poincaré was elected President of the Republic in Jan. 1913 M. Briand succeeded him as Premier. The life of this Govt. was brief. Its most important work was to ask Parliament to lengthen the period of military service from two to three years as a rejoinder to the increase in German armaments. On March 18 1913, on the question of electoral reform, the Ministry was overthrown by the Senate, which defeated a proposal to introduce proportional representation that had already been passed by the Chamber.

M. Briand remained more or less in retirement until the outbreak of the World War. On Aug. 26 1914 M. Viviani felt himself obliged to broaden the base of his Govt. and offered M. Briand the portfolio of Justice. On the fall of the Viviani Cabinet, M. Briand on Oct. 29 1915 formed a government in which he himself took over the direction of foreign affairs. He made its character as a national coalition clear by including as ministers, without portfolio, the Socialist Guesde, the Catholic Conservative Cochin and the three former premiers, de Freycinet, Combes and Bourgeois. However, in the beginning of the summer of 1916, he was accused in certain political circles of a lack of vigour in the prosecution of the War. M. Clemenceau was one of his fiercest critics. In June he was forced to agree to the holding of secret sessions in both Chambers, and to the appointment of a parliamentary commission to supervise the affairs of the army.

By the end of autumn, the Rumanian disaster, and especially the situation in Greece, made him the object of further attacks. He was accused, for instance, of being the willing dupe of King Constantine. The question of the higher command was also causing much anxiety. At this time Joffre, who had been made a marshal, was replaced by Nivelle. M. Briand thought it advisable for all these reasons to reform his Cabinet. He appointed Lyautey Minister for War, and called in experts who were not in Parliament to take charge of the more technical offices. On March 14 1917 a difference of opinion between the Chamber and Lyautey brought about the latter's resignation. After a vain attempt to reform his Govt., M. Briand decided to resign.

For three years M. Briand took scarcely any part in public affairs. It must, however, be noted that in Sept. 1917 von der Lancken, the civil commissioner of Germany in Brussels, renewing an attempt which he had already made in the spring, proposed to M. Briand, through a Belgian intermediary, a meeting in Switzerland to discuss the possibility of peace. M. Briand was inclined to accept the offer, but M. Ribot, the Minister of Foreign Affairs, counselled him to avoid it as a snare.

During the years which immediately followed the War, M. Briand still remained in retirement. He showed, however, by one or two speeches in the Chamber, that he was inclined to move to the Left. In Jan. 1921, on the fall of the Leygues Ministry, he was called upon to form a government, and himself took charge of Foreign Affairs. He interested himself particularly in the application of the Treaty of Versailles, especially with regard to reparations. In the autumn he went to Washington as the French representative at the conference on naval disarmament. From that moment he was fiercely attacked by those who accused him of having failed to safeguard the interests of his own country. This campaign reached its height when, early in 1922, the Inter-Allied Conference met at Cannes, and M. Briand discussed with Mr. Lloyd George the question of an Anglo-French defensive pact. A telegram which he received from M. Millerand, then President of the Republic, decided M. Briand to return to Paris and confront his enemies. When he arrived he realised that his position had become untenable. He announced his resignation to the Chamber on Jan. 12 1922.

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[1] *Proc.*, p. 159; Temperley, pp. 227–8.

[2] *Proc.*, pp. 172–4.

[3] *Proc.*, p. 176.

In April 1925 he was offered the portfolio of Foreign Affairs in M. Painlevé's Cabinet, and he remained in the same office in the second Govt. formed by this leader in October. The Locarno Agreement in Oct. 1925 enormously increased the influence of M. Briand, who had played an important part in the negotiations. When M. Painlevé resigned on Nov. 22, M. Briand became the new head of the Government. A great parliamentarian, although he broke with the extreme Left in 1906, he retained his connection with many of the more advanced political thinkers. His genuinely liberal ideas, and his constant endeavours toward national unity, gained him the sympathy of the moderate parties. His ease and animation as a speaker, his parliamentary experience, and his well-known ability in the conduct of foreign affairs, all contributed to that great influence which made him, up to that time, Premier more often than any other politician in France. (P. B.)

BRIDGE, AUCTION (*see* 4.531).—As the game of bridge had succeeded whist among card players, so in turn, after 1908–10, did the first form of simple or straight bridge give way to auction bridge.

Even before 1908 it had been recognised that the great weakness of simple bridge was the restriction of the trump-making power to the dealer and his partner, and their inability to evade that privilege at will, a ruling which enforced the playing of too many poor hands and the forfeiture of too many good ones. Hence arose the plan of putting up every hand to auction. The dealer must open the bidding; every player had a chance to buy the declaration, naming at each bid the suit which he desired to play, and this was sold to the highest bidder, or to his partner in the event of that partner being the first to name the final suit, in which case the second partner was considered merely as the raiser, not the bidder. Bidding continued until three successive players had passed in lieu of bidding, doubling or redoubling; any player might abandon his original suit and switch on to a new suit, to his partner's suit or even to his adversary's. The bidding having closed, the partner of the buyer became dummy, and the buyer's left-hand adversary became the leader.

At first the original suit values and ranks were retained as at straight bridge, but many vital changes were made. The rubber bonus was raised from 100 to 250. The adversaries of the buyer, hereafter called the declarant, were debarred from scoring points towards game, or below the line, taking their profits invariably in the honours column or above the line at 50 a trick regardless of suit. The book for the declarant remained at six; over that he had to take as many tricks as he had bid. If he took more, he could score them all; if he took fewer, he could score nothing except for possible honours, his adversaries scoring 50 for each trick stolen from his contract.

The book for the adversaries varied with the size of the bid, being always the number of tricks that the declarant dared to lose; it was determined by deducting the bid from seven; in a 2-bid the adverse book was 5, in a 3-bid 4, and so on. In a doubled hand the adversaries scored 100 for each trick over their book; in a redoubled hand 200. But if a declarant, who had been doubled, succeeded in keeping his contract, his trick points were doubled; he received a 50-point bonus in the honours column, and an additional 50 points for every trick over contract. If he had redoubled, each of these 50's was raised to 100, and his trick points went to four times their normal value. Doubling was restricted to one double for each side.

Changes in the Game.—All these points remain in the game as played in 1926, but meanwhile the next move after 1910 was to change the suit values, as competition in bidding had proved that their discrepancy was too great, and had shown also that a good spade hand was invariably wasted. The dealer being still forced to bid, his solace on a poor hand was provided by spades at 2 a trick and a stop-loss of 100 honour points, while good spades were to be bid as "lilies" or "royals" and at 9 a trick. The suits thus ranked: Clubs 6, diamonds 7, hearts 8, royals 9 and no-trumps 10, with the merely nominal spade at 2.

All went well until certain American players seized the chance to use the low spades as codes, telling their partners the exact make-up of their hands without assuming proper responsibility or risk. It was thus that the first "false" bids appeared. A system of high spade bids came into vogue in American play ranging from 2 to 7, inclusive, and forming a code; 6 spades, for instance, meant "Partner, take your choice between hearts and no trumps; I can play either." The point value being but 12, the partner was enabled to make a comparatively low bid without serious risk. Though this became known temporarily as the American game about 1912–3, the sobriquet was really unfair to the majority of American players.

These false bids received no support in England and they were equally anathema to the majority of American players, though accepted by most of the contemporary American writers on the game. Eventually, however, the system was killed and of necessity the game was re-made. Spades at 2 vanished, and spades at 9 took the place of royals, the latter term disappearing. The dealer's refuge in the case of a poor hand having been thus removed, the forced opening bid was also abolished. Three successive passes still closed the bidding, except in the case of three opening passes, when the fourth player was still given his chance to bid. An entire hand might be thrown. It was thus that the game was played in 1926.

Variant Games.—Certain variants were experimented with during 1913–21, but without disestablishing the recognised game of auction. Nullos were an early variant, their object being to destroy the undue advantage of high cards. The nullo player had to lose tricks on a poor hand, a much harder thing than to win them on a good one. The idea had long been discussed, but had been deemed impossible, as no player could contract to lose all the tricks while carrying an exposed dummy of whose make-up he knew nothing when bidding. Miss F. Irwin evolved the plan of allowing 6 safe tricks to the bidder of 1 nullo, 5 safe to the bidder of 2 nullos and so on. She became an ardent champion of this difficult and scientific variant, collecting a large following. But it was a losing fight; the nullo game was far too difficult for most people.

Another variant appeared in America under the name of pirate auction, but it never received any official recognition, and died almost before it lived. More support was given in some London and Paris clubs to contract auction, of which the essential point is that no more tricks can be scored toward game than the declarer has contracted to make, a special system of scoring, different from that of ordinary auction, being adopted; but it failed to penetrate beyond a limited circle.

In American play the method of false bidding was meanwhile revived under the form of a false double. In this system to double any low bid is not meant as a genuine double, but operates as a code. The person who doubles a one-trick bid in any particular suit practically says, "Partner, I have a no-trumper except that I do not stop that suit. Do you?", while the person who doubles one no-trump says, "Partner, I, too, have a no-trumper. Bid 2 in your best suit, for I have general assistance."

Laws of the Game.—The American laws have always followed the English laws in substance, with one important exception. In England, the total of a bid must exceed the total of the previous bid, or must equal it and contain more tricks; in America, it is merely necessary to equal it with more tricks, or to out-bid it in number of tricks regardless of total value. Thus in 1925, in England, it was still necessary to bid 5 clubs (30) to out-bid 3 no-trumps (30) and 6 diamonds (42) to out-bid 4 spades (36); whereas in America, 4 clubs and 5 diamonds suffice. The American laws have also reduced the revoke penalty and abolished chicane as having no place in a bidding game; and they make a touched card in dummy a played card.

The Laws of 1926.—In the spring of 1926 the American Whist League appointed a committee to revise the laws and eliminate some of the defects of the existing system. The two most important changes are a different method of scoring honours and a new penalty for revoking. Up to 1926, honours, that is, the ten, jack, queen, king and ace, had had different values for the four suits, the basis for that value being that of the trick. Thus, for example, four club honours in one hand were worth 48 above the line, while the same holding in spades amounted to 72. The fault of this system was that a good minor suit in diamonds or clubs, was not played, while a poorer heart or spade hand was played for the sake of the score above the line. The new law gives all suits the same value for honours, making for more even bidding and, since they are scored in multiples of ten, greatly simplifying the scoring. The revoke laws had always been complicated and confusing. The law now stands that the sole penalty for the revoke, whether it be made by declarer or an adversary, is two tricks. There is no alternative point penalty as in the earlier system. These tricks are taken from those of the revoking side and count exactly as if they had been won in play. See Milton C. Work, *Auction Bridge Complete with the 1926 Rules* (1926). (F.I.)

DEVELOPMENTS IN GREAT BRITAIN

The original laws of auction formulated by the Portland Club and Bath Club, London, followed closely on the laws of the old game, only such alterations being made as were necessitated by the new method of declaration. The values of the suits were the same as in bridge (spades 2, clubs 4, diamonds 6, hearts 8 and no-trumps 12). A brief experience of the game showed that the value of 12 given to the no-trumps bid restricted competition in the bidding and that the low values of spades and clubs (2 and 4 a trick respectively) practically prevented the holders of them from taking part in the bidding.

From America was introduced the royal spade or lily idea which gave to the spade suit a double value and altered also the values of the suits, thus: Spades 2, clubs 6, diamonds 7, hearts 8, royal spades 9 and no-trumps 10. The Metropolitan Club of New York and the Somerset Club of Boston were responsible for its introduction. It was afterwards taken up by the Racquet Club of Philadelphia and was finally adopted by the Whist Club of New York early in 1912. In the same year it was introduced into England where it rapidly became popular. After a comparatively short trial it was found that the double value of the spade suit had many inconveniences and, when the English laws were revised in 1914, the lower value was abandoned altogether and the spade suit was given one value only, viz., nine points per trick. In the framing of the English laws the card committee of the Portland Club had the co-operation of a representative of each of the following clubs—Baldwin, Bath, St. James', Turf and White's. The laws were finally approved and adopted by the committee of the Portland Club in May 1914. The revised method of scoring was soon adopted in America and the Whist Club of New York framed a new law doing away with the lower value of the spade suit.

Changes in the Laws.—After the publication of the English Laws in May 1914, further experience of the game led to a demand for further revisions. It was realised that, just as the laws of bridge were merely the whist code revised, so the laws of auction bridge were little more than the English laws of whist twice revised. Some more drastic revision was demanded. In Jan. 1924 the Portland Club issued a new code of laws under its own authority, not calling into consultation any representative of the five clubs which co-operated in the framing of the laws of 1914.

There were no drastic revisions. The new laws numbered 100 as against 110 in the previous code. There were many verbal alterations. The term " bid " was substituted for " declaration," it being recognised that in auction bridge only the final bidder whose bid is accepted by the table, can be said to make a declaration. The meaning of the laws was in many cases made clearer. They were re-arranged and an alphabetical index was added. The American numerical count was rejected deliberately, but American precedent was followed in making all the cards rank in order of their suit values for cutting, and in the reduction of the revoke penalty from 150 points to 100 points. The American code of 1920 reduced the revoke penalty from 100 points to 50 or from 3 tricks to 2.

An alteration of importance was making a pass rank as a bid. Heretofore a player who said no bid out of turn was subject to no penalty. Under the new law a player passing out of turn is liable to the same penalties as a player making any other bid. Illegal bids were clearly defined and a new option given about an under call. Further a player who looks at a trick which has been turned and quitted incurs a penalty of 50 points above the line for each offence. The new laws met on the whole with a good reception and were adopted by most clubs throughout the country. In Jan. 1925 the Portland Club issued an eighth edition of the laws bound up with cases and decisions which had reached them during the year. There were no less than 84 important decisions involving correct interpretations of the laws. When framing their revised code of laws of 1924 the Portland Club had before them the American Whist Club laws of 1920 which consisted of a code for the first time written for the game of auction. The American laws of 1920 have been again subjected to revision and a new code became effective in the United States in the spring of 1926.

The existence of two distinct code laws in the bridge world is unfortunate. On the European continent for example, American laws are usually followed, while the English laws are not even universally accepted in British Dominions. In Canada, while both codes are used, the American is more popular as is the case also in India. In Australia both codes are also in use, but the English is more widely played.

Apart from questions of law English theories and practice in bidding and play have been largely influenced by American principles during the 10 years 1915–25. In spite of vigorous opposition the American informatory doubling system was introduced and in 1925 the Portland Club, which was the stronghold of opposition, capitulated. The informatory double has now become part of the recognised English method of playing auction bridge, although all the variations of it practised in the United States have not yet been adopted.

Informatory Bids.—The two doubles of an informatory conventional character recognised in England are (*a*) the double of a no-trumps bid and (*b*) the double of a suit bid. The informatory double of a no-trumper applies only to a bid of " One no-trumps "—not two or more. The doubler should have considerable strength, at least four or five tricks, and probable support in either of the major suits. The partner of the doubler should take out the double into his longest suit, should no intervening bid have been made, even though the suit be only four, unless his hand is so strong that he can see substantial penalties in leaving in the no-trumps bid. If the player on the left of the doubler, however, makes a bid the doubler's partner is under no necessity to call and should not do so unless he has a very strong hand.

The informatory double of a suit bid of one or two announces strength in the other three suits, but probably none in the suit that is doubled. The doubler tells his partner that no matter which of the three other suits he bids, he will find a helpful dummy, while if he has two stops in the suit doubled he can go no-trumps, however weak the rest of his hand. The result of the procedure is frequently to make the player who has not got the no-trumper play the hand, and the advantage is that the first lead of the adverse suit comes up to instead of through him. This may make a no-trumper successful which would otherwise fail. The requirement for the double of a suit bid of one is that the doubler should have the three undoubled suits stopped and a hand containing better than average high cards.

(A. E. M. F.)

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BRIDGEMAN, WILLIAM CLIVE (1864–), British politician, was born in London Dec. 31 1864 and educated at Eton and Trinity College, Cambridge. He was elected Conservative Member for the Oswestry division of Shropshire in 1906, and became a frequent speaker in the House of Commons, especially on educational and agricultural questions. From 1911 he acted as an opposition whip. He was a junior Lord of the Treasury in the first Coalition Govt. and afterwards assistant director of the War Trade Department. Under Mr. Lloyd George he became successively Parliamentary Secretary to the Ministry of Labour (1916) and of the Board of Trade (1919) and was secretary of the Mines Dept. (1920–2). In 1923 he became an ecclesiastical commissioner. In the Conservative Ministry of Mr. Bonar Law and Mr. Baldwin he was Home Secretary. His action in ordering the deportation and internment in Ireland of Irish prisoners in England was declared illegal by the Court of Appeal, and an Indemnity bill was passed for his protection. Having become, in Nov. 1924, First Lord of the Admiralty in Mr. Baldwin's second Ministry, he revived the proposal for establishing a dockyard at Singapore. He represented the Govt. in the abortive negotiations with the miners in the summer of 1925.

BRIDGEPORT, Conn., U.S.A. (*see* 4.532).—After the outbreak of the World War this city received large orders from the Allies for firearms, ammunition and other articles, and within two years (1914–6) the population increased 40 to 50%. The congestion in dwellings, schools, streets and trolleys became serious and there were numerous strikes. Before the end of the War, housing developments to provide for 2,000 families had been undertaken by the Remington Arms Co., the U.S. Housing Corp. and a limited dividend company which was organised at the height of the demand. A city plan was prepared in 1916 and a vice commission made a thorough study in 1915–6. After the Armistice the industries readjusted themselves to normal demands. The construction of schools and houses was able to overtake the increase in population. The general death-rate fell from 15·1 per 1,000 in 1910 to 10 or 11 in 1923 and 1924; infant mortality from 110 (deaths under one year of age per 1,000 births) to 56·2. The Federal Census (1920) found the population to be 143,555, an increase of 40·7% in the decade, of whom 46,782 were foreign-born. The value of manufactured products was $65,609,000 in 1909; $208,090,000 in 1919; $108,400,255 in 1921; $148,856,051 in 1923. The average number of wage-earners in the factories in the same years was 25,775; 42,862; 25,892; 33,207.

BRIDGES (*see* 4.533).—In the general anatomy of steel bridges no sensational developments have occurred since 1910 and evolution in this respect took place along lines previously laid down. Extreme simplicity and truthfulness of outline are the leading characteristics of modern long-span bridges, and dignity is obtained by the rigorous avoidance of meaningless curves and redundant members.

Modern practice continues to favour bridges whose anatomy is so simple that the total loads carried in the main members can be determined by the simple methods of rigid body statics, and there is a growing tendency to eliminate stresses arising from deformations and temperature variations by the introduction of suitably arranged articulations. This point is illustrated by the three-hinged arch. By the introduction of a third hinge at the crown in addition to the hinges at the abutments, the computation of the thrust in the arch is brought within the scope of rigid body statics, and stresses due to temperature variations are reduced to insignificance. Although there have been no radical alterations in the anatomy of bridges, yet in the details of design and in the methods of manufacture the vast change in the economic conditions which have taken place since 1910 are clearly reflected on both sides of the Atlantic.

In the bygone days of cheap and abundant labour large bridges were built up *in situ*, plate by plate, just as a ship is built. Economy in labour was a relatively minor consideration, and it was possible and legitimate to indulge in features of design which would have to be ruled out under modern labour conditions owing to their prohibitive cost. Nowadays as much work as possible is done in the machine shops, and field work operations are cut down to a minimum. Design in consequence turns more and more on ease of erection and the transportation of massive members, and when inviting tenders for a large bridge it is customary to allow manufacturers to submit their own designs whereby they can avail themselves of their own special experience and equipment. In short, the main difference between modern bridges and those of the past may be fairly well summed up by saying that the latter were made by hand whereas the former are machine made.

Advances in metallurgy have provided structural engineers with alloy steels which possess every advantage except that of low cost. For instance, nickel steel containing 3·5% of nickel is, roughly speaking, twice as strong as ordinary structural steel. This particular alloy was used for the central suspended span of the Quebec bridge, reduction in weight in this case being an urgent necessity. With special steels, higher working stresses effect a saving in weight, but too often this economy is more than neutralised by the extra cost per ton demanded by the steel makers, and until this difficulty is overcome ordinary mild steel is likely to remain the standard material for structural purposes. This objection does not apply with equal force to high carbon steels, and for compression members in particular there is a tendency to increase the carbon content and make use of the enhanced strength thereby obtained. The use of high tensile alloy steels greatly increases the limit of span associated with any particular type of bridge, and if spans are to exceed by any considerable amount those already in existence the employment of special steels is almost inevitable.

Among the most notable steel bridges constructed since 1910 are the Quebec cantilever bridge over the St. Lawrence river and the Hell Gate arch bridge over the East river, New York City. But the Suspension Bridge continues to be a favorite with engineers. At Bear Mountain, across the Hudson, a span of 1,632 ft. has been achieved, and at Philadelphia, the Delaware is crossed by a bridge of this design, the span of which is no less than 1,686 feet. (*See* CAMDEN.)

The Quebec Bridge (see fig. 2 on plate).[1]—The Quebec bridge is constructed on the site of the one which collapsed in Aug. 1907, when in an advanced stage of construction. Forming an important link in the transcontinental railway system, it carries a double railway track across the St. Lawrence river, about six m. above Quebec. The design and construction was the work of the St. Lawrence Bridge Co., acting under the supervision of a board of control appointed by the Canadian Government. The bridge is a cantilever construction.

Its clear span of 1,800 ft. establishes a record, and the central portion, 640 ft. long, resting on the projecting ends of the cantilevers, is also the record length for a single span. The triangulation adopted for the cantilevers is a novelty known as the K triangulation, so called because the letter K appears prominently in the pattern, and the advantages claimed by its designers in the matter of ease of erection and freedom from deformation stresses have been so amply justified that its adoption for other cantilever constructions is confidently anticipated. In contrast to the Forth bridge, there is no tapering in width of the cantilever arms either vertically or horizontally. The trusses being truly vertical, erection was facilitated and the parallel arrangement of the top chords provided a convenient track along which the erection traveller could advance during construction. The bottom chords of the cantilevers are straight, and in view of the failure of the previous bridge great care was bestowed upon their design and manufacture; an elaborate set of experiments with quarter-size models being carried out to verify the validity of the calculations. These great compression members consist of four parallel I section girders braced together with a very rigid system of diaphragms and lattice bracing. The section of this lower chord reaches the value of 1,941 sq. in. as it approaches the piers and it is considered to be the largest compression member in existence.

The top chords, being tension members, are altogether different in design. They consist of a number of eye bars packed side by side in two tiers, and, since the length between panel points was

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[1] *Engineering*, vol. 106 (Sept. 13 1918).

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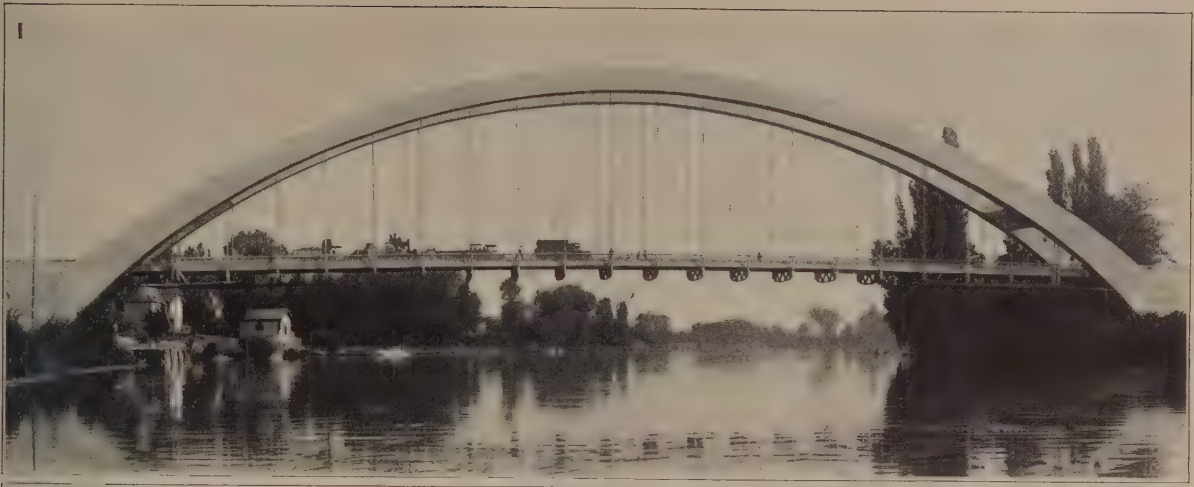

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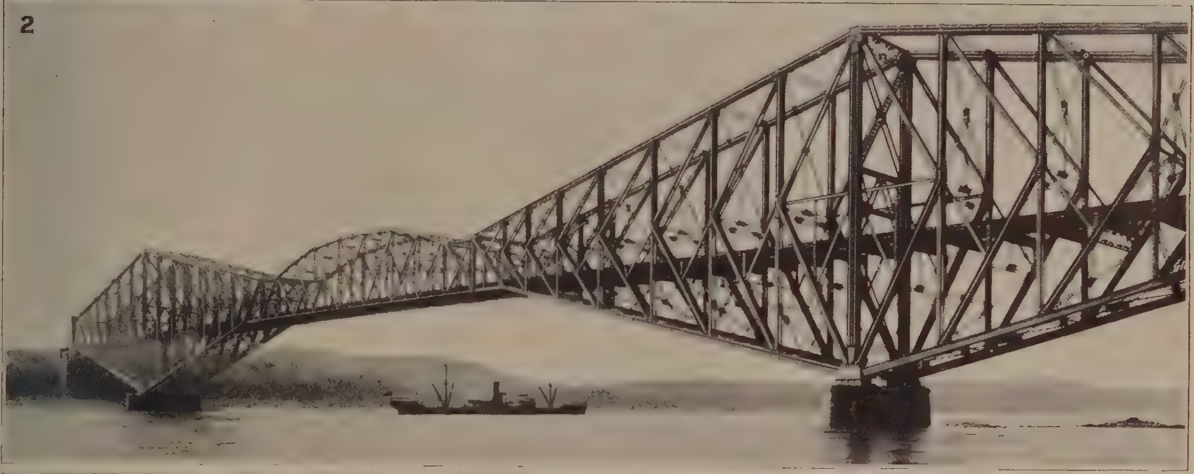

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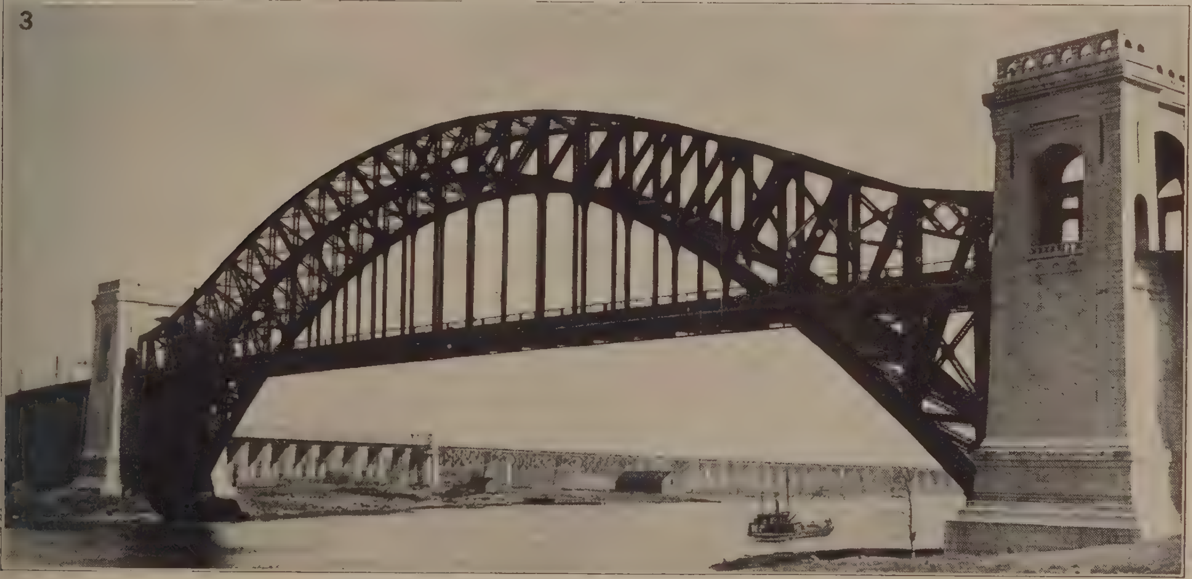

EXAMPLES OF MODERN BRIDGE CONSTRUCTION

FIG. 1. Reinforced concrete bridge over the Seine, at St. Pierre du Vauvray, France (1924). FIG. 2. Quebec Bridge over the St. Lawrence River, Canada (1917). FIG. 3. Hell Gate Arch Bridge, over the East River, New York (1917).

(Fig. 2. Courtesy of Canadian National Rys. Fig. 3. Photo by Ewing Galloway, N. Y.)

excessive for single length eye bars, these members are made in two lengths and joined together with a pin at the centre. To prevent sag occurring, the weight of the central pins is carried by a light steel truss which bridges the distance between the panel points. With the object of facilitating erection, pin joints were extensively used throughout the bridge for connecting the ends of adjoining members.

The length and weight of the central suspended span precluded the possibility of building this out as extensions of the main cantilevers, and this great girder was accordingly floated into position and hoisted up bodily by hydraulically operated slings. As the weight to be lifted was over 5,000 tons, and the lift was 150 ft., this constituted a weight-raising effort of unprecedented magnitude. The first attempt ended in failure. Owing to the fracture of an insignificant cast steel pedestal one of the corners of the girder escaped from the supporting sling and, under the torsional stresses thus produced, the suspended span collapsed and plunged into the deep waters of the St. Lawrence. No harm was done to the cantilevers. A new span was constructed, and a year later this was successfully hoisted into position, the process occupying only three days.

Hell Gate Arch (see fig. 3 on plate).[1]—This bridge (1911–7), which achieves a high degree of aesthetic perfection, carries four lines of railway track across the East river in New York City. Measured between the faces of the abutment towers it has a span of 1,017 feet.

Technically it is classified as a two-hinge spandrel-braced arch, and it is the lower chords of the arch framework which constitute the real backbone of the bridge. These members, constructed of a fairly high carbon steel, are of box section. Their width is 6½ ft. throughout, but in depth they vary from 7 ft. at the crown to 10 ft. 10 in. at the abutments, this latter dimension reaching the limit fixed by railway transport considerations. The heaviest length of bottom chord transported to the site weighed 150 tons. A novel method of butt joint was employed to connect adjoining lengths of these compression members. Close contact was made over only the middle third of the adjoining edges, and for the outer two-thirds a slight taper clearance was provided. When the member received its full working thrust this clearance practically disappeared, but this device ensures that there is no serious eccentricity of load, and that the resultant thrust in these lower chord members is approximately axial in position.

The bearing surfaces at the ends of the lower chords are perfectly plane, but in order to give the desired degree of articulation the opposing bearing surface provided at the abutments is curved to a radius of 96 feet. The bearing pressure is 120 tons per lineal inch measured along the line of contact, but, owing to the elastic deformation of the surfaces, contact actually occurs over a strip instead of along a line, and the maximum bearing pressure is thereby reduced to about 12 tons per square inch.

The arch truss was built out from the two ends as cantilevers. To balance these cantilevers during erection a ponderous system of back stays and counterweight was required, most of this being material subsequently incorporated into the structure. Powerful hydraulic rams were provided by shortening or lengthening the back stays. By slightly shortening the back stays the middle lengths of the lower chords were inserted and then with great care the hydraulic rams were eased off until the arch became self-supported. The bottom chord at the crown being comparatively flexible, the bridge at this stage was in effect three-hinged. The upper chord and the two centre diagonal members were subsequently inserted free of stress, and these members come into operation only under the influence of train loads. Thus for dead loads the bridge may be regarded as a three-hinged arch, and for live loads it possesses the additional rigidity associated with an arch of the two-hinge variety. The Hell Gate Arch was designed by Gustav Lindenthal. It is the longest span arch but a very similar arch now in process of construction across the entrance to Sydney Harbour is designed to have a clear span of 1,600 feet.

Reinforced Concrete Bridges.—The use of reinforced concrete for bridging purposes have made such rapid progress that brick and stone have been practically ousted from the list of bridge-building materials. Short-span highway bridges are almost invariably made of reinforced concrete; for moderate spans this material is a formidable rival to steel, and it is only in the case of really long spans of 500 ft. and upwards that the supremacy of metal bridges remains unchallenged.

Reinforced concrete bridges are in effect castings poured *in situ*. The construction of the timber moulds constitutes a bridge problem in itself, and for long spans the expense of this temporary work is such a high proportion of the total cost that this system of construction ceases to be an economical proposition.

For spans up to 50 ft. or thereabouts, construction may take the form of a deck slab supported on longitudinal beams, but reinforced concrete work is seen in its most economical and artistic form when applied to the construction of arches or bowstring girders.

Unlike metal girders of the same character, no diagonal members are included in its anatomy, experience having proved that such members in concrete constructions are a source of weakness rather than strength. The vertical posts which support the decking are generally of slender build, and in this form the bowstring girder approximates in principle to an arch, the horizontal thrust on the abutments being taken by the ties which connect the opposite ends of the arch members at the level of the springings. The abutments, being free from horizontal thrust, need not be very substantial in character, and this fact, added to certain obvious advantages of clearance under the roadway, are sufficient reasons to account for the extensive adoption of the bowstring type of bridge. The longest reinforced concrete bridge in 1926 was an arch over the Seine at St. Pierre du Vauvray.[2] This bridge (see fig. 1 on plate) is a road bridge having a clear span of 432 ft. 6 inches. It was completed in 1924, and was constructed by Messrs. Limousin et Cie. to the design of M. Freyssinet. The two arch ribs supporting the roadway are hollowed reinforced concrete tubes of rectangular section. They have the uniform width of 8 ft. 2½ in., but in depth they vary from 8 ft. 2½ in. at the crown to 13 ft. 6 in. at the springings. A novel feature in their construction was the method of removing the timber frames on which the curved ribs were constructed. Each rib was discontinuous at the centre, the two halves being separated by a small gap. In this intervening space hydraulic jacks were installed and, when the time arrived, these jacks pushed the opposing halves slightly more apart, and the centering relieved thereby of its load was readily removed. This having been done, into the gap a key consisting of metal plates coated with cement was inserted, and as the hydraulic pressure was released the gap closed up on the plates and the arch became self-supporting.

Reinforced concrete arches are usually of the hingeless type, but during the process of construction it is customary to introduce temporary hinges at the springings and crown. In these regions the section of the rib is cut down until only a short and small diameter strut of heavily reinforced concrete remains, and the local flexibility consequent on this local reduction in section provides in effect the action of a hinge. When the centering is removed, the arch, by a small rise or fall of its crown, can adjust itself to any slight change in span arising from abutment movements or contraction in the concrete arch during the process of setting. After the arch has settled down into its natural position it is made hingeless by filling in with concrete the reduced sections which provided the temporary hinges.

Reinforced concrete bridges of the arch or bowstring type by their simplicity and truthfulness of outline convey a sense of fitness which never fails to please, and if sufficient attention is given to details of design bridges of these types can attain the very highest pitch of artistic perfection.

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BRIDGES, ROBERT SEYMOUR (1844–), English poet (*see* 4.532), was appointed Poet Laureate in succession to Alfred Austin in 1913. In later years he wrote little, but he published *October and Other Poems* in 1920, and *New Verse*, written during 1921 and in 1925. However, his nobly conceived anthology, *The Spirit of Man* (1916), was perhaps a more satisfactory offering to these troubled years than the official odes which his critics called for in vain. Dr. Bridges was a founder of the Society for Pure English. In 1924 he visited the United States to deliver university lectures.

BRIDGING, MILITARY.—The construction of light bridges for the passage of attacking infantry is one of the most important duties of engineers in battle. In the warfare of the future, when tanks are employed, more use will certainly be made of physical obstacles, particularly canals and rivers, to hamper or prevent the employment of tanks.

The crossing of a river will usually commence by the infantry establishing a footing on the far bank, and pack artillery following in close support. Then for the armoured cars, field artillery, transport and supply lorries, as soon as the bridgehead is pushed forward sufficiently, substantial bridges must be constructed. When the crossing is fully established heavy bridges must be got into place and these must have approaches that are firm enough to carry the heavy artillery, tractors and heavy mechanical transport.

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[1] *Engineering*, vol. 108 (Aug. 8 and 22, Sept. 5 and 26, Oct. 17, Nov. 1 and 21 1919).

[2] *Concrete and Constructional Engineering*, vol. 19 (May 1924).

Initial Operation .—In the face of an enemy holding the river bank and strongly defending it, the tactical operation of forming a bridgehead is by no means simple. All existing approaches will be fully commanded and will probably have been damaged by explosives; existing bridges have probably been destroyed, and in any case their position is so well known that an attack on these lines is likely to be repulsed. To effect success, therefore, the first crossings must be made well away from the known lines of approach. Moreover, surprise is an important element, so that the cover of darkness is needed for the collection of material and the actual commencement of the operation.

The engineers who have to bridge the river, or get the leading infantry across by any other means, must be equipped with the lightest possible material that will stand the rough handling of carriage across broken, and often swampy, ground, some distance from the nearest point to which it can be brought by transport. The standard equipment for this purpose is the kapok assault bridge shown in fig. 1. This bridge consists of a canvas float stuffed with kapok and bearing, strapped to it, a wooden transom plate, or saddle, with a metal coupling to which is affixed the timber duckboard which forms the bridge from float to float. At each end of the float are handles so that the bridge, after its parts have been assembled at a convenient spot near the river, can be lifted bodily by two men for each float and carried forward for launching.

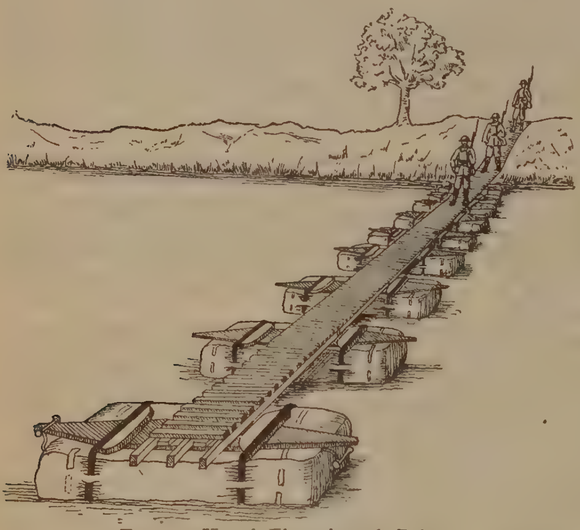
FIG. 1.—Kapok Float Assault Bridge.

The operation of launching and pushing the bridge across the river can be effected in a few seconds, and as soon as it has been secured on the far bank the assaulting infantry can commence to cross. The articulation of the saddle joint allows sufficient play for the bridge to be carried and launched over rough ground whilst providing sufficient lateral rigidity to steer its head across the stream, even against cross-wind and current. The buoyancy of the floats is ample and the bridge is stable in the water.

The use of such an equipment, with which the sappers are fully conversant, immensely facilitates the operation of assault bridging, providing that sufficient material, and men skilled in its use can be provided; but other means may often have to be improvised. Such expedients take the form of petrol float bridges of similar design, but with floats made of petrol tins crated together, or of cork floats, or little ferry boats made of waterproof sheeting lashed over a timber framing, or tarpaulins stuffed with straw, or planks and hurdles made into rafts; in fact almost any floatable material may with some ingenuity be pressed into the service. For the formation of a pack bridge three of the kapok assault bridges are laid side by side, with chesses to form the roadway, or where the water is not too deep a planked trestle bridge may be suitable.

Pontoon Bridge.—For the next stage of the operation the pontoon equipment is brought up. The pontoons are large, flat-bottomed boats with a scow bow and completely decked in, having a buoyancy each of about 6½ tons. They are built to give the maximum flotation for light weight with a skin of *consuta* two or three-ply wood on a mahogany framework and are designed so that two pontoons may be coupled stern to stern. A lifting handrail is provided along nearly the whole length of each side and additional detachable lifters are fixed by hooks and chains to bow and stern. The keelson gunwales and chines are of Oregon pine to protect the light mahogany skin from rubbing. A saddle bed of Oregon pine carries a saddle formed of two mild steel channels on which the roadbearers rest. The roadbearers are of nickel chrome steel and are fitted with steel pins which engage with slots in the saddle. The roadway is formed of planks of Oregon pine and, when laid, they are held in place by ribands which are racked down by chains with a screw attachment for binding the members together.

The equipment formed into a bridge is shewn in fig. 2 which illustrates the three forms in which the pontoon bridge may be made up: as a light bridge to carry field artillery and horsed transport, the pontoons being used singly with five steel roadbearers from saddle to saddle; as a medium bridge to carry medium artillery and lorries in which two pontoons are coupled stern to stern and seven roadbearers are used in each bay; as a heavy bridge to carry heavy artillery and track vehicles up to the 18-ton tank in weight, the piers of which are formed of four pontoons coupled in piers and carrying an extra central saddle on which 11 roadbearers are placed to carry the roadway. In either form each bay of bridge spans 21 ft.

An integral part of the pontoon equipment is the steel trestle; this is used in place of the pontoons to form a pier of the bridge in shallow water, to bridge over dry gaps, or to form the tidal ramp when the floating bridge has to rise and fall with the tide. It consists of two mild steel legs with pitch pine mud shoes, a nickel chrome steel transom and two jacks for raising or lowering the transom. The legs are drilled with holes along the centre of the web into which the pins of the transom engage so that the transom and, with it, the roadway can be raised or lowered by means of the jacks as occasion requires. When used in conjunction with a heavy bridge, as shown in fig. 2, a double trestle pier is formed, but with a medium bridge a single trestle suffices to form the pier.

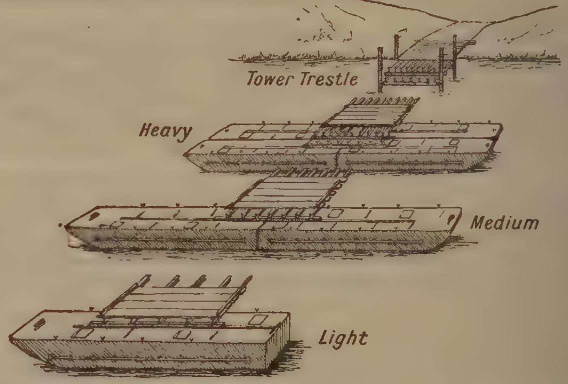

FIG. 2.—Light, medium and heavy types of Pontoon Bridge and Tower Trestle Bridge.

The pontoon equipment carried with an army is so essential to its mobility that it cannot be left long in place on one river. As soon as the crossing has been effected or whilst it is still in progress, steel girders or other form of semi-permanent bridges must be constructed on all the main crossings to take the place of the pontoon bridges which must go forward. These will be of various patterns to suit the different spans and conditions met with according to the theatre of war, but only one standard type of portable steel girder is retained for practice.

Box Girder Bridge.—This is known as the Martel box girder bridge; it is designed to enable all spans, up to about 100 ft., to be bridged in the simplest manner and also to secure that the bridge so built will be strong enough to carry either light, medium or heavy loads, or tanks. The bridge is of the deck type and the chesses lie flat on the top of the box girders. The girders are skeleton steel box girders made up in sections, each 8 ft. long. The sections are joined together by plain pin joints; no nuts or bolts are required. There are thus only two essential parts, viz., the box girders and the chesses.

Three types of bridge can be built by using two, three or four box girders under the chesses. In fact the gap is to all intents and purposes spanned by using skeleton steel roadbearers which can be made up to any desired length in 8 ft. sections. A further advantage is that any desired width of roadway can be laid. To obtain a wider bridge it is merely necessary to add more box girders and use longer chesses, or a double row of chesses. The decking is held in position by angle steel kerbs fixed down by hook bolts, and the handrail consists of posts which fit into the sockets in the centre of each 8-ft. length of kerb and piping. The handrail pipes are also used as carrying bars for carrying sections of the girders.

The bridge will usually be fitted with horn beams at each end, a construction which enables the girders to be lowered onto masonry abutments, or onto a timber bankseat so that the level of the roadway may be kept down and a ramped-up approach avoided; but where headroom under the bridge is required, or the approach level is suitable, these are not necessary.

Launching the Bridge.—Launching is usually by means of a derrick and winches. A derrick is erected on the far bank, and the bridge, having been placed on rollers, is hauled bodily across by means of tackle, a preventer winch and tackle being used from the near bank to check it. The cantilever method may in some cases be more convenient, especially when the bridge is a heavy one with three or four girders, as each girder can be used in turn as the counter-weight for the next, the last girder being rolled across on deck planks laid on those already in position and then jacked down. The third alternative, the cantilever method with launching nose attached to the horn beam, may be the quickest, and at the same time more advantageous as it can be used with lighter tackle.

The erection and launching into position of a girder bridge cannot be carried out under fire and the sequence in which the operation has been described involves a space of time which will usually place this work at a safe distance, except for intermittent long-range shelling. The construction of approach roads to a heavy bridge is often a work of greater magnitude than the construction of the bridge itself, as they must be sufficiently permanent to carry the heavy strain of mechanical transport. Thus, whilst the assault bridges are intentionally thrown well away from the main lines of traffic and the lighter forms of pontoon bridge can be used wherever a reasonable cross country approach track can be made, the heavy bridges are confined closely to the route of the main roads. This site will probably be continuously shelled until the enemy's artillery is silenced and so artillery and aerial co-operation is essential to aid the rapidity with which full communication may be established.

The engineering operations connected with a river crossing are subject to tactical requirements and it is by no means certain that a set sequence will be followed; for example, it may be essential for the tanks to go forward with, or in front of, the leading infantry. The bridging problem then is one of extreme difficulty; but it has been solved. An instance occurred in 1918 in the crossing of the Selle where, under the nose of the enemy holding the opposite bank, a crib causeway for tanks, built of railway sleepers bolted together and sunk in the bed of the river, was constructed during the nights immediately preceding the attack and kept concealed from view and from aerial photography by being completed just below water level.

Bridging in Wartime.—In uncivilised countries the chief problems for the bridge-builder are to devise the best use to which to put the scanty supply of materials available, and to adapt the local resources of the country to advantage. But, great as is the task of bridge-building for an army in undeveloped countries, greater still is the work of reconstruction during an advance in a highly developed theatre of war such as France. There the accumulation of means of attack and defence on a grand scale is made possible by the fullness of the communications, yet at the same time each of these many lines of communication is sensitive at every river crossing. Almost without exception the bridges are destroyed by the enemy on his retirement, and an army cannot safely push on its advance without its full equipment and without clear routes for its supply transport. Hence, in the final campaign of 1918 in France, the power of the British Army to advance depended on the speed with which the Royal Engineers could construct bridge crossings and roads.

During the period August–November 1918 no fewer than 539 heavy bridges were erected on this front alone, of which 326 were standard steel bridges and 213 of heavy timber or salved material. This does not include the innumerable light improvised crossings and footbridges by which the leading infantry were enabled to attack, and the pontoon and light trestle bridges for field artillery and horse transport. (*See* ENGINEERS, MILITARY.) (E. N. S.)

BRIGGS, CHARLES AUGUSTUS (1841–1913), American theologian (*see* 4.566), died in New York June 8 1913. His last published works were: *Church Unity* (1909); *The Fundamental Christian Faith* (1913); and, posthumously, *Theological Symbolics* (1914).

BRIGHTON (*see* 4.570) has developed its amenities in many directions. The population was 142,427 in 1921, and the area of the municipal borough, which includes Preston, is 2,545 acres. In 1923 part of Patcham was added.

The whole seafront of Brighton and Hove is now one long promenade, with a memorial to King Edward VII., unveiled in 1913, on the boundary between the two boroughs. A winter garden was made in 1912, and since 1921 there have been improved facilities for embarking on or disembarking from steamers. An amphitheatre to seat 1,600 was built at the head of the chief pier in 1913. New buildings for the Grammar School were opened in Dyke road in 1913, and a Municipal Day Training College in Eastern Terrace in 1911. Hollingbury Park, a large tract of downland north of the town, was acquired. The Royal Pavilion and Dome were used as a hospital during the World War and until 1920, and in 1921 the south gateway was replaced with one presented by the princes and people of India in gratitude for the hospitality shown to sick and wounded Indian officers and men.

Three new parishes have been formed: St. Matthias, Preston, in 1913; St. Alban, Preston, with a new church in Coombe road, in 1915; and St. Wilfred, with a church in Elm Grove, in 1922. Two Roman Catholic churches have been built, one in Hove in 1915, and one in Preston Park in 1911. After the War some 700 disabled ex-service men were employed in the diamond-cutting industry here, and a large factory was built in 1920, but was sold in 1924. The Brighton War Memorial, a Roman colonnade and water garden, is at the bottom of St. James street, and that of Hove is at the junction of Grand avenue and the Drive.

In 1924 the railway station and its approach were improved; the electric supply system was reorganised, and plants at Shoreham and Kemp Town extended. £100,000 was voted by the corporation for extensions to the water-supply undertakings, with £60,000 for a tidal bathing pool. In the same year it was arranged to clear the Aquarium site, and lay it out as gardens, with a theatre and restaurant, but later it was decided to retain the main part of the fish tanks.

BRISBANE, ARTHUR (1864–), American newspaper editor, was born at Buffalo, N.Y., Dec. 12 1864. After an education in the American public schools and five years spent in France and Germany, he entered the employ of the New York *Sun* in 1883 as a reporter, later becoming its London correspondent and subsequently editor of *The Evening Sun*. From 1890 to 1897 he was connected with the New York *World*, as managing editor of different editions, and from 1897 to 1921 he was editor of the New York *Evening Journal*. He purchased *The Washington*

Times of Washington, D.C., in 1917, and *The Evening Wisconsin* of Milwaukee, Wis., in 1918, selling both papers to William Randolph Hearst in 1919. After 1918 he was editor of the Chicago *Herald and Examiner*. His editorials, which for over two decades appeared in all the newspapers owned by W. R. Hearst, obtained for Mr. Brisbane a national reputation. He published *Editorials from the Hearst Newspapers* (1906) and *The Brisbane Editorial Review* (1922).

BRISBANE (*see* 4.574) had a population (1924) of 248,015. South Brisbane and suburbs were merged in 1925, giving greater Brisbane an area of 380 sq. miles. It is the capital, chief seaport and commercial centre of Queensland. A comprehensive sewage system was installed in 1924. The first part of the cathedral was consecrated in 1910, and the Queensland University established in 1911.

BRISSON, EUGÈNE HENRI (1835–1912), French statesman (*see* 4.574), was again elected president of the Chamber in Jan. 1912, and died at his official residence April 14 1912.

BRISTOL (*see* 4.579) had a population of 377,061 in 1921 and an estimated population in 1925 of 386,400. Since 1910 many public buildings have been erected or enlarged. Mr. H. H. Wills built and endowed St. Monica's Home for Incurables at an expenditure of upwards of £1,000,000, and Sir George A. Wills, Bart., a public library in the Bedminster district at a cost of £10,000. At Avonmouth the lending library was removed to more commodious premises and new rooms were opened in 1916. A branch library was opened at Knowle in 1922. A library of commerce was instituted in the central building in 1920. Separately administered children's libraries have been opened in the four quarters of the city. In 1921, the St. George branch library was reorganised and reopened as an open access library, and since this date the central and remaining branch libraries have been similarly reorganised. The premises of the Grammar School, opposite the main University buildings, have been enlarged and a new wing was opened in 1914. In 1912 a new organ was placed in the church of St. Mary Redcliffe and in 1913 the south porch was restored. The Berkeley Chapel in the cathedral has also been restored. The Royal West of England Academy was rebuilt in 1912 and the Hippodrome, a large variety theatre, was opened.

At the city's lowest point, near St. Augustine's Bridge, old buildings have been razed and premises for the Co-operative Wholesale Society erected upon the site. Additional playing-fields were provided for Clifton College at its jubilee in 1912 and a War Memorial Gateway in College Road was unveiled in 1922. The King Edward Memorial Wing of the Royal Infirmary was opened in 1912, and the Victoria Gibbs Memorial Home for Homeless Babies at Kingsdown in 1921. Colston Hall was bought by the city in 1919. Other improvements include extensions to Temple Meads station, new central police and fire stations and a central Y.M.C.A. building in Colston street. A Wesleyan Hall was opened in Old Market street in 1924. A contract for the extension of the Avonmouth Docks was placed in January 1924. A low-level road between Bristol and Avonmouth has been made, and the railway station at Hotwells abolished to make room for it.

BRITISH COLUMBIA (*see* 4.598), a province of the Dominion of Canada. Its area is 355,855 sq. miles. The population is predominantly of British stock. In 1921, out of a total population of 524,582, 221,145 were English, 104,965 Scotch and 54,298 Irish. Other racial groups were Scandinavians 19,002, French 11,246, Chinese 23,533, Japanese 15,006 and Indians 22,377. The population in 1925 was estimated at 587,000. The principal cities are Vancouver—population 117,217 in 1921—Victoria, New Westminster, Nanaimo, North Vancouver and Prince Rupert. Vancouver is the chief Canadian seaport on the Pacific coast. The opening of the Panama Canal has led to the development of grain shipments from the prairies to Europe *via* Vancouver. For the crop year 1923–4 shipments of wheat from Vancouver amounted to 53,809,505 bu. and there was a considerable trade in other commodities.

The Provincial Legislative Assembly has 48 members, with an executive council of seven. The province was represented in the Dominion Parliament in 1925 by 14 members in the House of Commons and six senators. Except in cities having charge of their own schools, to which grants are made, the school system is financed and administered by the provincial authorities. Two normal schools for the training of teachers are maintained. The British Columbia University at Point Grey, near Vancouver, is financed by the provincial government.

Production and Industry.—The area of farming land is limited to approximately 19,000,000 ac., and is distributed in widely separated valleys. Small mixed farming is predominant. Commercial fruit-growing has rapidly increased in importance. The area devoted to fruits in 1891 was estimated at 6,500 ac.; in 1924 the acreage under tree fruits was approximately 30,716, and under small fruits about 6,310. In 1924 the total value of agricultural products was $60,029,224. The amount of standing timber of merchantable size in 1925 was estimated at 360,000,000,000 and 47,500,000 cords of pulpwood, posts, etc. In 1924 there were 359 sawmills, 78 shingle mills, two pulp and paper mills and three wood-pulp mills in operation. Timber production was valued at $80,702,000 in 1924. Pulp production in the same year was 216,243 tons, and 136,281 tons of newsprint and 9,653 tons of other paper were produced.

The total value of the fisheries in 1924 amounted to $21,257,567; salmon yielded $13,027,251, halibut $5,427,542 and herring $1,392,580. Cod, clams and quahaugs, black cod, pilchards, crabs and oysters are also marketed. Fish canneries and curing establishments numbered 134 in 1924.

Since 1907 British Columbia has occupied second place among the Canadian provinces in regard to the value of mineral production. In 1925 the output was valued at the record figure of $61,491,600. Lead, coal, copper, zinc, silver and gold are the most important metal products. Manufacturing industries developed considerably during the War and post-War periods: in 1924 there were 3,345 industrial establishments in the province, employing some 75,000 hands. The tourist industry is increasing in importance, its value in 1925 being placed at $45,000,000. (*See* CANADA.)

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BRITISH EMPIRE (*see* 4.606).—The area is 12,389,874 square miles and the population 438,761,015. The British Empire or British Commonwealth of Nations, as it was styled for the first time officially, in the Irish Treaty, comprised, in 1926, the following classes of territory:—

(1) The United Kingdom of Great Britain and Ireland, consisting of England, Wales, Scotland and Northern Ireland. It possesses full sovereignty, external and internal, with the sole right to declare war and peace, but is limited in action as regards the Dominions by certain recognised conventions. Northern Ireland has a Parliament and a Government responsible to it for local matters. The Channel Is. and the Isle of Man, are in an anomalous position inasmuch as they have independent legislatures and semi-independent executives, subject to the supremacy of the United Kingdom Parliament.

(2) The self-governing Dominions, possessing membership in the League of Nations and therefore a quasi-international status, but not full sovereignty, and, though subject to the supremacy of the United Kingdom Parliament, enjoying in practice autonomy in internal affairs and membership of the Imperial Conference. These are Canada, Australia, New Zealand, South Africa and the Irish Free State.

(3) A self-governing Dominion with membership of the Imperial Conference, but without membership in the League of Nations: Newfoundland.

(4) Two self-governing colonies, with a wide but not unrestricted autonomy, and not entitled to representation at the Imperial Conference: Malta and Southern Rhodesia.

(5) Crown colonies, or colonies not possessing responsible government, that is, colonies in which the executive government

is controlled by the British Govt. through the Secretary for the Colonies. The Legislatures in these cases may be entirely independent of the executive, as in Bahamas, Bermuda and Barbados, with their nominee Upper Houses and their elective Assemblies, but normally are, either in case of emergency as in Ceylon or regularly, subject to control either because there is an official majority or because the governor alone constitutes the Legislature.

(6) Protectorates administered on colonial lines. These differ from colonies mainly in that they are not annexed to the British Crown, and their inhabitants are not British subjects. The protectorate status in such cases normally preludes annexation when administration has become more developed; it usually rests on promises of protection granted to more or less uncivilised tribes and the administration often makes wide use of the agency of chiefs in government, especially in Nigeria and Uganda.

(7) Protected states, retaining distinct personality. Some of them, as Sarawak, possess internal autonomy, while others, like Zanzibar, are administered in effect by British officers.

(8) Mandated territories, held under mandates granted with the approval of the Council of the League of Nations and subject to a certain measure of supervision.

(9) India, including British India and the Indian States. The former is administered under the governor-general; the latter possess various degrees of internal autonomy. India as a whole possesses membership of the League of Nations and representation at the Imperial Conference. (*See* India.)

(10) To the Australian Commonwealth are attached, as dependencies administered on crown colony lines, Papua and Norfolk I.; to New Zealand the Cook Is. and the Ross Dependency. These Dominions and also the Union of South Africa hold mandated territories. Nauru was mandated to the British Empire, the administration to be entrusted first to the Australian Commonwealth, and then as might be agreed upon between the Commonwealth, the United Kingdom and New Zealand.

I. CONSTITUTIONAL HISTORY

Conference of 1911.—The Imperial Conference of 1911, convened in accordance with the constitution decided upon by the Colonial Conference of 1907, met under the influence of the prevailing tension in European relations, and the most important part of its deliberations centred in the question of the control of foreign policy. The Dominions by that date had secured the right to adhere to, or remain exempt from, commercial treaties concluded by the British Govt. and at their request their representatives were from time to time empowered by that Govt. to negotiate, subject to its approval, special commercial arrangements with foreign powers.

Moreover, in political matters directly affecting them, they had established the right to be consulted before the British Govt. came to any decision. In general political issues the Dominions had no say, but their acquiescence in this state of affairs had been disturbed by the controversy which had arisen regarding the Declaration of London of 1909, which was thought to diminish the power of the British Navy in time of war. Hence Sir J. Ward, on behalf of New Zealand, propounded what was virtually, though not in name, a scheme of imperial federation, contemplating the creation of a Federal government and parliament to deal with issues of foreign policy, war and peace; this scheme, however, was rejected by Canada, Australia and South Africa, and negatived by Mr. Asquith for the United Kingdom.

It was, however, agreed that in such cases as general peace conferences, agreements arrived at should be communicated before signature, to the Dominions for their observations, and that the general policy adopted by the British representatives at such conferences should, as far as practicable, be discussed with the Dominions prior to the meetings. Moreover, at a secret meeting of the Committee of Imperial Defence, the Dominion representatives were informed of the British position in regard to the grave political issues of the time, including the menace due to the friction between Germany and France. The conference also decided the terms on which the Dominions could maintain distinct naval forces, which, even in time of war, would only come under the control of the British Admiralty on transfer by the government concerned; areas were assigned for the normal operations of the Dominion fleets, and it was laid down that in any contact with foreign governments the commanders would act on any instructions given by the British Foreign Office.

The fall of Sir W. Laurier's Govt. in Canada in 1911 installed a government more inclined to intervene in world politics, and Sir Robert Borden, on a visit to London in 1912, was fully informed by the British Govt. of the state of European politics. A definite offer was made to Canada and to the other Dominions to afford them greater opportunities of taking part in foreign affairs through the appointment of resident ministers in London, who would be given full information and be able to express Dominion views, though the final responsibility must continue with the British Government. Canada alone, after some delay, accepted the suggestion for a time, while Sir R. Borden's proposal to strengthen the British Navy by a grant of $35,000,000 was defeated by the Senate.

In 1912 also a significant step was taken to assert the distinct personality of the Dominions. Hitherto at international conferences the King had been represented by one delegation only, which might contain Dominion representatives, but which acted as a whole; at the radio-telegraphic conference of that year the King was represented by distinct delegations acting under separate full powers, those granted to the Dominion representatives empowering them to act for the Dominions. This recognition for external purposes of a distinction long familiar for purposes of internal sovereignty was followed in the Conference on the Safety of Life at Sea in 1913–4.

The Empire in War.—The World War came so swiftly, on Aug. 4 1914, that it was impossible to consult the Dominions, but all the Dominion Govts. promised aid, placing under the Admiralty their naval forces, comprising the Australian fleet and the small forces of Canada and New Zealand. Similarly, the troops raised by the Dominions for oversea service were voluntarily placed under British command, though in the last year of the War a certain measure of independence was secured for the Canadian Expeditionary Force.

In the earlier period of the War the Governments were too busy to hold the Imperial Conference due under its constitution to meet in 1915; but, on the resignation of Mr. Asquith in 1916 and the advent to office of Mr. Lloyd George, the determination to secure greater efficiency in the conduct of the War and the more complete mobilising of the strength of the Empire led to the summoning of representatives of the Dominions and of India —not a member of the Conference under the constitution of 1907—for discussions with the British Government. Meetings in 1917 and 1918 took a double form; on the one hand the immediate issues affecting the War and the conditions on which peace might be made were debated at sessions of the Imperial War Cabinet, while matters of secondary importance were dealt with by the Imperial War Conference.

The Imperial War Cabinet, closely connected with the British Cabinet, was a Cabinet of quite new character, a "cabinet of governments" as Sir R. L. Borden described it. There was no Prime Minister on whom it depended; each Dominion, India and the United Kingdom were represented by independent delegates, the British Prime Minister presiding merely as *primus inter pares*. There was no joint responsibility, and the Cabinet could only pass resolutions, not take decisions. It remained for the several Cabinets to decide what effect to give to the resolutions, to which the Dominion representatives agreed only on the understanding that they must be approved by their colleagues and Parliaments. On the other hand the meetings afforded a valuable opportunity for the Dominion and Indian representatives to express their views, and thus, in some measure, to share in the supreme direction of the forces of the Empire, though final responsibility necessarily rested with the British Govt. in view of the preponderant share of the burden of the War borne by British resources. It was recognised that the new departure was essentially due to War conditions, but it was agreed, in 1917, that the constitutional relations of the Empire should be reconsidered at a conference to be summoned after peace was achieved.

The Peace Conference.—The second meeting of the Imperial War Cabinet held in 1918 was followed shortly by the final defeat of the German forces, and the body was reconvened to consider the terms of peace, being transformed finally into the British Empire delegation to the Peace Conference of 1919. The unity which had hitherto marked the representation of the Empire was now difficult to maintain; it had been contemplated by the British Govt. that the Empire should speak at the Peace Conference through a single delegation. It was, however, felt by the Dominions that they must have the same measure of recognition as the minor powers taking part in the conference. A compromise was, accordingly, reached. Under this, in addition to the British Empire delegation on which the Dominions might be represented from time to time on the panel system, there were recognised delegations from Canada, Australia, South Africa, New Zealand and India, Newfoundland being omitted in view of her small population. The delegations were accorded the right of being heard on matters specially affecting them on the same footing as the minor belligerent Powers, but importance really attached to the influence which the Dominion representatives had in deciding, in the discussions within the British Empire delegation, what attitude should be adopted by that body, or, when matters were increasingly left to the heads of the delegations of the five Great Powers, by Mr. Lloyd George.

The Dominions insisted that the ratification of the treaty with Germany should not be carried out until approval of it had been expressed by their Parliaments, and, after demur, this demand was conceded by the British Government. In the form of the treaty the participation of the British Empire was marked by its signature, generally, by the delegates of the United Kingdom and, specifically for each Dominion and for India, by their representatives, a plan adopted from the precedent of the Radiotelegraphic Convention of 1912. This form, however, was not followed in the supplementary treaty by which the British Empire, like the United States, undertook to aid France in the case of German aggression, but that instrument, which failed to take effect through refusal of ratification by the United States, expressly provided that the obligations of the treaty would not apply to the Dominions unless undertaken by their Parliaments.

The mode of procedure in the case rested on two fundamental principles, the right of the British Govt. to conclude treaties binding the whole Empire as a matter of international law, and the duty of that Govt., in any international arrangement, to respect the autonomy of the Dominions; its importance lay in the fact that it negatived the claim made in the Canadian Parliament in 1919 and also by Gen. Smuts that signature by Dominion representatives was requisite if any treaty were to bind the Dominions in international law. This paramount power of the British Govt. stood on the same footing as its sole right to declare war or conclude peace in the name of the Crown, although the effect of a declaration of war was immediately to impose on the Dominions, without their consent, the burden of belligerent status and liability to attack.

Membership of the League of Nations.—Of paramount importance was the decision reached after hesitation, but at the request of the Dominions, to secure them an independent position in the League of Nations as created by the Treaty of Versailles. This was done by including in the list of original members the British Empire, followed immediately by the Dominions and India, ignoring the United Kingdom altogether. The effect was to confer on the Dominions and India for all purposes of the League of Nations an international status apart from the British Empire, which was to be represented at Assembly meetings by delegates appointed by the British Government. It was ruled, too, that the Dominions were eligible for election to the Council of the League to fill the places left open to election, despite the fact that the British Empire as such had a permanent place on the council. In the rather unlikely event of a Dominion obtaining election to the council, it was presumed that it would not be regarded as a distinct entity for voting purposes if any occasion should arise in which the British Empire was involved in a dispute and the matter fail to be decided by the unanimous vote of all other members of the council.

The Dominions instructed their representatives at the League Assemblies without regard to the views of the British Govt.; cases not rarely occurred of voting in different ways by British and Dominion delegations. Mandates were held direct by the Dominions from the League, and this responsibility rested on them only. Similarly, as regards the Permanent Court of International Justice, the Dominions had a distinct status, and it appeared that the Court would have jurisdiction in cases of disagreement between a Dominion and the United Kingdom, or between two Dominions. The British Govt., however, asserted in 1924 that it did not consider that the provisions of the Covenant of the League as to the registration of treaties applied to the treaty between the United Kingdom and the Irish Free State, but a contrary view was taken by the Irish Free State, apparently with the sympathy of some of the Dominions. On the other hand, it was understood that the action of the British Empire, as a member of the council, should have regard to Dominion and Indian interests, and the equity of this understanding was obvious, since the permanent membership of the council allotted to the British Empire inevitably greatly reduced the probability of the election of a Dominion to that body. A Dominion, however, is entitled to special representation on the council in the event of any matter specially affecting it, coming before that body to the same extent as that right is enjoyed by other members of the League.

The obligations of the Covenant were regarded, in one vital matter, rather differently by the United Kingdom and by the Dominions and India. As a European power the United Kingdom accepted as necessary the implications of the guarantee of the territory and independence of members contained in Article 10. Canada, however, only acquiesced in it originally under protest, and later pressed, though unsuccessfully, for the formal modification of the Article; similarly the Geneva Protocol of 1924 proved unacceptable to the Dominions and India, and except in New Zealand considerable reluctance was manifested in respect of accepting obligations under the Locarno Pact of Oct. 16 1925, which exempted the Dominions and India from obligation unless expressly accepted by their governments. On the other hand, the Dominions and India showed interest in the carrying out of the Labour clauses of the Treaty of Peace under which their distinct individuality was expressly recognised.

The demand for recognition as distinct entities conceded in the Treaty of Versailles was admitted in the negotiation and signature of the other treaties with ex-enemy Powers and the succession states in 1919, and it led, inevitably, to the claim by Canada for the right of separate diplomatic representation where that was desirable in her own interests, and primarily in the United States. The claim was conceded, subject to the willingness of the United States Govt., to permit such representation, and to the declaration that it was not the intention of either the British or the Canadian Govt. to diminish in any degree the diplomatic unity of the Empire. The assent of the United States was at first doubtful, as one of the objections there urged against the constitution of the League of Nations was that it accorded separate votes to different parts of the Empire, but ultimately the necessary approval was accorded. Difficulties in Canada delayed an appointment, and advantage of the concession, which had automatically to be extended to all the Dominions, was first taken in 1924 by the Irish Free State. The functions of the Irish minister at Washington were declared to be to deal with matters affecting solely Irish interests, but no indication was given of the mode in which this restriction would be insisted upon in practice.

The Conference of 1921.—Owing to the development of national consciousness nothing came of the movement for closer union in foreign affairs induced by the War, which had led to the resolution of 1917 in favour of holding a constitutional conference after the War. A conference met in 1921, only to declare itself satisfied that no reconstruction of imperial relations was desirable. Feeling in the Dominions indeed rendered any closer union out of the question. Labour in Australia, which had defeated conscription during the War, was resolutely opposed to anything even suggesting loss of autonomy; French Canada, which had bitterly resisted conscription in the Dominion and rendered it argely ineffective in Quebec, was definitely hostile; Nationalist opinion in South Africa had adopted the ideal of a republic, and he great majority of the people in the Dominions were indif-erent, satisfied that an organisation which had weathered the War would be adequate for the future. The value of the plan of onferences, on the other hand, was strikingly confirmed by the meeting, for it was found possible to adjust the very discrepant iews of the Dominions and the United Kingdom regarding the enewal of the Japanese alliance by adopting the policy which ulminated in the Washington Conference and the treaties of 922 regarding the maintenance of the *status quo* in the Pacific, he limitation of naval armaments and the relations of the Western Powers with China. A difficulty arose regarding the epresentation of the Empire at the Washington Conference; he invitation was addressed by the United States Govt. to the British Govt. only, but the proposal of that Govt. for a single delegation was objected to by Gen. Smuts, and ultimately it was rranged to send distinct delegations, as in the case of the Paris Conference. The delegations, however, when at Washington, were regarded and regarded themselves as a unity, and no question of separate voting arose.

Later in 1922, however, a distinct discrepancy of feeling be-ween the United Kingdom and Canada was manifested when Mr. Lloyd George asked the Dominions to support his Chanak policy. The Dominion view was that, as it had not been effec-ively consulted on the policy which led to the situation, it could ot be expected blindly to pledge itself to military support. The resignation of Mr. Lloyd George and the settlement of the mmediate issues removed the difficulty for the moment; but urther questions were raised in March 1923, in connection with he signature of a treaty with the United States regarding the alibut fisheries. Canada successfully contended that such a reaty, as predominantly of Canadian interest, should be signed y a Canadian representative alone, contrary to the rule laid own by Lord Ripon in 1895 and Sir E. Grey in 1907, under which any such agreement should be signed also by a British epresentative.

Conference of 1923.—The whole matter was considered at the mperial Conference of 1923, at which the Irish Free State was epresented, as well as India and the other Dominions. It was greed that treaties should normally be negotiated and signed, nder full powers granted by the King, by representatives of he part or parts of the Empire affected, and that in negotiating ny treaty it should be the duty of the government primarily con-erned to secure that any other government which was affected hould be invited to take part in the negotiations; in the case f international conferences the procedure adopted at the Paris onference should be followed. Ratification of treaties thus ne-otiated should be expressed under the same conditions—that s, on the request of the government or governments concerned.

This mode of procedure left to the British Govt. a final re-ponsibility, for it must, in the first place, issue full powers to egotiate and sign, and secondly, it must advise ratification; he primary responsibility rested indeed with the Dominion oncerned, but the British Govt. was bound to secure that othing was done by one part of the Empire likely to be gravely etrimental to the interests of another part; doubtless in the vent of a serious difference of opinion recourse would be had to iscussion by an Imperial Conference. At the same time the onference recognised and approved a practice which had gradu-lly grown up but had hitherto been deemed irregular. This was the conclusion of minor agreements, mainly of a technical r administrative character, by Dominion Govts. with for-ign powers. These were not negotiated by plenipotentiaries r ratified by the King, and such agreements thus escaped any ntervention by the British Government. It insisted, however, hat in concluding such agreements Dominion Govts. should have due regard to the interests of other parts of the Empire.

The conference also discussed foreign policy. It approved the principle of supporting the League of Nations, and reaffirmed the doctrine laid down in 1921, that each part of the Empire should make provision for local defence; it also approved the view that the naval forces of the Empire should be equal to those of any other power, and that suitable bases should be provided, thus homologating the British Govt.'s proposals regarding Singapore. The absolute autonomy of the Dominions was, however, stressed, and no pledges of aid in the maintenance of the Navy were offered, the decision resting with the Dominion Parliaments.

An unfortunate misunderstanding, however, arose out of the conference. Apparently it was held that the discussions there of the terms of peace to be made with Turkey involved the Dominion Govts. in responsibility for the Treaty of Lausanne when finally agreed upon by the British representatives, who alone took part in the discussions. When, however, Canada was asked to approve of the ratification of the treaty she made it clear that her attitude was that, while she took no exception to ratification, responsibility for it, and for the obligations which might be imposed on the Empire under its terms, must rest with the British Govt. only. The doctrine was thus established that the Dominions would only accept active obligations when they had taken part in the negotiations and agreed to their results. A further representation from Canada resulted in the admission of the principle by the British Govt. in connection with the London Reparations Conference of 1924, though lack of time prevented the adoption there of any other than a makeshift arrangement for their special representation. The British Govt. then proposed that the question of more effective consultation on international subjects should form the subject of a special conference, but its fall from office was followed by an intimation that further experience of the working of existing arrangements was desirable, a view acquiesced in by the Dominions.

In 1925 the Prime Minister of the Australian Commonwealth arranged to station in London a liaison officer to keep him fully informed on foreign political questions and the views of the British Govt.; but neither this device nor the alternative of sending a member of the Dominion Cabinet to act as minister resident in London received general approval in the Dominions, largely because such a minister would inevitably cease to be in effective touch with Dominion feeling and would be apt to commit his government to British views, while, if he merely acted as a channel of information, his employment would hardly serve any useful purpose. Consultation, therefore, was conducted freely by telegram, both as regards the Geneva Protocol of 1924 and the Security Pact of 1925.

The attitude revealed by these consultations was one of reluctance on the part of the Dominions to take an active part in British foreign policy save in so far as it directly concerned their interests. It was admitted that the Dominions might be involved in war by British action, which they could not as matters stood effectively control, but it was recognised that it remained for each Parliament to decide whether in the event of hostilities it would afford aid, and, if so, in what manner, to the United Kingdom. The constitutional position was summed up in Article 49 of the Irish Free State constitution, which provided that, except in the case of invasion, the state could not be involved actively in war save with the assent of its own parliament, a doctrine which was also definitely approved by Canada and accepted by the other Dominions.

The Irish Treaty.—The aspect of the British Empire as an informal alliance of autonomous states, special powers as to foreign relations being vested in the United Kingdom, was emphasised by the conclusion of the treaty of 1921 between the United Kingdom and the Irish Free State. The status of a Dominion was by that measure formally granted and the instrument was styled a treaty, although concluded by the British Govt. merely with representatives of forces in armed rebellion against the Crown. As has been seen, the British Govt. held that, despite the name, the treaty was not one in the sense of international law, since it did not confer independence but merely Dominion status. The new state was admitted in 1923, with the assent of the Empire, to membership of the League of Nations. The adoption of a special flag and the enactment of a distinct Irish citizenship marked the assertion of autonomy; projects in the same direction were announced in South Africa in 1925, to be carried into effect by agreement of the parties in 1926. Canada in 1921 defined Canadian nationals; in that case, however, the definition was motived by the necessity of distinguishing between British subjects in general and Canadian British subjects in particular in respect of eligibility for nomination by Canada for candidature for election to the Permanent Court of International Justice.

THE CROWN AND DOMINION INTERNAL AFFAIRS

As regards the relations of the Dominions to the United Kingdom in internal affairs no special action was recommended by the conferences of 1911–23. The retention by the Colonial Secretary of responsibility for the Dominions was objected to in 1911 by New Zealand, and Australia suggested that Dominion relations should be entrusted to the Foreign Secretary, while an alternative proposal suggested that the Prime Minister should accept the duty, delegating the detail work to a deputy minister. The suggestion was rejected on the score of the great burden already resting on the Prime Minister, but it was conceded at the conference of 1918 that Dominion Prime Ministers should have the right of direct correspondence, on matters deemed sufficiently important, with the British Prime Minister, and this arrangement was accepted as satisfactory in 1921. In 1925, on the initiative of the British Govt. a new office of Secretary of State for Dominion Affairs was created, but the retention of the post in the hands of the Colonial Secretary indicated that the change was formal rather than of importance.

Of greater consequence was the steady tendency of the Colonial Office to negative any intervention in Dominion internal affairs; thus, in 1920, the Secretary of State declined to disallow certain legislation of Queensland which was alleged by landholders, both in the state and in the United Kingdom, to be confiscatory. The governors of the Australian states were encouraged to assimilate their relations with ministers to those of the Crown with the British Government. On the other hand, the paramount character of Imperial legislation was reasserted in the Act of 1922 sanctioning the constitution of the Irish Free State. Efforts made by Canada and the Irish Free State to secure the removal of the limitation of the effect of Dominion legislation, save where expressly authorised by Imperial Acts, to the territorial limits of the Dominions, had not succeeded in securing Imperial legislation by 1925.

Appeals to the Privy Council.—The objections raised by the Irish Free State to a continuation of the power of the Judicial Committee of the Privy Council to grant leave to appeal from decisions of Irish courts under the new régime of Dominion status were overruled to the extent that it was provided that constitutional issues must be liable to appeal at the discretion of the committee while it was left to the Free State to prevent appeals in other cases if it thought fit. The question of restricting appeals from Canada to the Privy Council, though frequently debated in the Dominion, did not lead to any action, owing in part to the insistence by Quebec on the maintenance of the existing practice as a safeguard of her rights. Proposals for the merger of the House of Lords with the Judicial Committee in a single court of appeal for the whole Empire failed to arouse interest, either in England or the Dominions, but increasing effect was given to the existing legislation permitting the utilisation of the services of Dominion judges when in England as members of the committee, with the result of diminishing in some degree Dominion objections to the decision of their cases by an external authority.

Dominion Status for India.—The admission of India to Dominion status by representation in the Imperial War Cabinet in 1917 and 1918 and her inclusion as an original member of the League of Nations was based on recognition of the great services rendered by her people during the War. The anomaly of the grant of such a position in the league to a territory which did not enjoy autonomy was lessened by the formal announcement made in 1917 that the British Govt. intended to confer on India a constitution leading up to responsible government. This undertaking was carried into effect by the Act of 1919, which became fully operative in 1921 (*see* INDIA).

The Secretary of State for India remained responsible for the actions of the central government, and through it of the provincial governments as regards reserved subjects, but his power of control and that of the central government were drastically reduced as regards transferred subjects, with regard to which it was contemplated that responsibility should rest with the Legislatures. The complexity of the new scheme, coupled with strong local movements in favour first of non-co-operation and later of demanding immediate responsible government in all provincial matters and defence, and in central matters other than foreign affairs, resulted in the very imperfect operation of the scheme of dyarchy during the period. A strong movement in favour of responsible government manifested itself in Ceylon. The solution of dyarchy as a transition stage adopted in India found no support, and no practicable scheme was brought forward for securing control by the Legislature of the executive. It was, however, decided to increase the legislative council so as to present a large elective majority and to instruct the executive to pay due regard to its wishes, though power was reserved to obviate the possibility of a complete deadlock by authorising the governor, in case of emergency, to secure legislation by the official vote only.

West Indies.—Representations from the West Indies in favour of concessions were met by the experiment of introducing an elective element into the legislative councils of Trinidad and the Leeward Is., while wider powers, subject to the reservation of authority to the governor similar to that accorded in Ceylon, were bestowed on the council of Jamaica.

Africa.—In the case of the West African colonies, which showed staunch loyalty in the struggle with Germany, provision was made for increased representation, partly elective, of the people. Much more serious problems arose as regards Kenya Colony, transformed from a protectorate by annexation in 1920. On the one hand the European settlers aimed at securing control of the executive as well as dominating the Legislature, and received in this effort the sympathy of South Africa. On the other hand, Indian settlers, who had been encouraged to settle there when South Africa was barred to them, claimed that there should be no racial discrimination, and this claim was supported by the Govt. of India. Finally, in 1923, a compromise was reached, the British Govt. asserting that its paramount duty was to the native population, and that this excluded any surrender of control of the executive or the Legislature, but meeting the views of the European settlers in some degree by refusing equal electoral rights to Indians, who were granted in lieu special community representation.

Cyprus and Malta.—Cyprus was annexed on Nov. 5 1914, immediately after War broke out with Turkey, on the ground that it was necessary to terminate the ambiguous position of the territory which had hitherto been held by an anomalous tenure from that Power. The demand for self-government in Malta, which had long rendered relations between the Maltese and the British Govt. difficult, and had encouraged aspirations in Malta for annexation to Italy, was granted in 1921, when full responsible government in domestic affairs was accorded, imperial issues being reserved to the governor acting with a nominee council.

Rhodesia.—In the case of Southern Rhodesia the obstacle to responsible government was of a different kind. The British South Africa (Chartered) Co., in whose hands the administration lay, had large landed interests as well as mining rights, while a decision of the Privy Council in 1918 laid it down that the amount of the administrative deficits of its earlier years of administration should be refunded from land revenues; moreover, the large native population had to be assured against exploitation. By a popular vote Southern Rhodesia declined to enter the Union of South Africa, though generous financial and other terms were offered by General Smuts. After financial terms had been arranged by the British Govt. with the British South Africa Co., responsible government was conceded in 1923, but subject to special provisions requisite in the interests of the native population and of the company in respect of its railway holdings. Northern Rhodesia received a constitution of the usual colonial type with a Legislature partly elective. While, however, Southern Rhodesia was annexed as preliminary to the grant of responsible government, Northern Rhodesia was left as a protectorate.

The Right of Secession.—The grant of a distinct position in the League of Nations to the Dominions inevitably raised the question of the extent of their autonomy within the Commonwealth. An observation of Mr. Bonar Law, that a Dominion might secede if it thought fit, was adopted by Gen. Hertzog and the Nationalist party in South Africa as justifying the avowed purpose of that party to seek, as an ultimate goal, the restoration of independence to the Transvaal and Orange Free State and the creation of an independent republic. This policy was laid aside as an immediate aim as part of the conditions for the coalition of the Nationalists and Labour which resulted in the defeat of Gen. Smuts's government in 1924, and on April 24 1925 Hertzog as Prime Minister, declared that, while the right of secession existed, to exercise it "would be a flagrant mistake and a national disaster," if it were brought about in such a way as to make either section of the people feel that secession had been imposed upon it by the other.

Sir Robert Borden, on Aug. 17, while asserting that Canada was free to leave the Empire if she chose, emphasised the advantages of the British connection as assuring greater protection, giving increased prestige and influence in the world, and yet eaving the Dominion absolutely autonomous, views in accord with those repeatedly expressed by Gen. Smuts, save that the atter held that secession was not a right enjoyed by the Dominions. In the controversies in Ireland between the Govt. of he Free State and its republican adversaries the issue was discussed at length without achieving any definite result, though it was pointed out that the existing constitutions of the Dominions agreed in assuming the permanent union of the Dominions with he United Kingdom, and that no normal constitutional means existed by which that union could be dissolved.

The Mandated Territories.—A further innovation in constitutional usage was introduced by the creation of the mandatory system (*see* MANDATES), and the allocation by the principal Allied Powers to the British Govt. of mandates for Mesopotamia, renamed 'Iraq, Palesine, portions of Togoland and the Cameroons, and German East Africa; to Australia for German New Guinea; to New Zealand for Western Samoa; to the Union of South Africa for German Southwest Africa and to the British Empire for the island of Nauru. The erms of the mandates approved by the League of Nations authorised he administration of Togoland, the Cameroons, New Guinea, Western Samoa, Nauru and Southwest Africa as portions of the territory of the mandatory power, subject to the observation of certain principles in the interest of the natives and under obligation to report nnually to the League, whose permanent commission on mandates was established to deal with such reports; authority was expressly given for the application to such territories of the customs and mmigration laws of the mandatory state.

In the case of East Africa, as also in those of Togoland and Cameroons, further restrictions were imposed. These provided for qual treatment of nationals of members of the league; the territory was given a constitution of the usual protectorate type under the tyle of the Tanganyika Territory. 'Iraq, which was at first to have een administered directly by the United Kingdom, was recognised y treaties of 1922–4 as an independent kingdom, and the obligation ndertaken as a mandatory power by the United Kingdom was held y the Council of the League to be satisfied by the acceptance of esponsibility for the due carrying out of the treaties, which, however, were to lapse if 'Iraq should be admitted a member of the League before their expiry by lapse of time in four years. This period, owever, was extended to 25 years by the treaty of Jan. 13 1926, n accordance with the recommendation of the League Council of Dec. 16 1925, for the settlement of the boundary with Turkey. In he case of Palestine the mandate was granted subject to the obligaion, voluntarily assumed by the United Kingdom, of furthering the stablishment of a home for the Jews; efforts to carry this out reulted in strong resistance by the Arab majority, which declined to work the constitution conferred in 1922, with the result that all xecutive and legislative power remained in 1925 in the hands of the epresentatives of the mandatory power.

Racial Problems.—The growth of Dominion autonomy and the grant f a new position to India resulted in constitutional innovation. n lieu of seeking redress for the grievances of Indian subjects hrough the mediation of the British Govt. the Indian Govt. entered nto direct relations with the Dominions in addition to pressing the ssue at the conferences of 1921 and 1923. The attitude of India was o concede, though reluctantly, the right of any Dominion to exclude ndian immigration, provided that the method adopted was not eedlessly injurious to Indian sentiment, but to claim that all ndians lawfully resident should be accorded full rights of citizenship nd be immune from discriminations on racial grounds. Some progess in securing the acceptance of these principles was made as regards the Dominions other than South Africa, but the Union then declined to make any concession, announcing instead the policy of applying to Indians the plan of racial segregation and promoting the eturn or removal to India of those who had settled or been born in South Africa. Deep feeling was aroused in India by the attitude of he Union, and the question was raised whether India could permanently remain associated with the Union in the Commonwealth if her people were denied the possibility of existence in South Africa.

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(A. B. K.)

II. DEFENCE

The word "defence" has so often been taken to imply simply the defence of land frontiers against potentially hostile armies, that it is necessary to emphasise the point that in the British Commonwealth the word has a far wider meaning, embracing questions of sea, land and air forces, of central control, of political and diplomatic issues, of finance and economics. The problem of the defence of the British Commonwealth contains one outstanding factor, the need for adequate sea-power to ensure safety of communication between Great Britain as the centre and the various component parts of the Empire, and also between those parts. To that must be added an essential demand for security, against sea, land or air forces, of Great Britain as the centre of organisation and effort.

From the point of view of defence, treated comprehensively, the period from 1910 to 1925 was of outstanding importance in the history of the British Empire. Up to 1910, the people of the United Kingdom had been able to maintain a two-power standard in sea forces, thus enabling the Admiralty to guarantee the security of the territory and sea-interests of the self-governing Dominions, amongst which the Union of South Africa was included during the course of that year.

The Political Issue.—In considering the problem of defence, it is essential to bear in mind the political issue, which necessitates drawing a distinction between the "Commonwealth of self-governing nations," in an advanced stage of national development and the British Empire proper, comprising the United Kingdom, the Colonies and Protectorates governed therefrom, and the mandated territories for the defence of which the people of Great Britain are temporarily responsible. India, an empire in itself, did not come precisely into either of these categories in 1925. The forces of the second group are controlled from Great Britain. Those of the first group are not.

Another point to be noted is that the British Is. no longer form, from the defence point of view, a homogeneous whole, owing to the grant of self-government to the Irish Free State, which controls its own defence forces. The need to take account of these points before proceeding to details is obvious. With a few exceptions, the "over-sea" nations of the Commonwealth take no part in time of peace in the defence or policing of territories beyond their own borders. This responsibility, when local resources do not suffice for the purpose, falls upon the people of England, Scotland, Wales and Northern Ireland, and, to a limited extent, upon India.

Three Events of Importance.—Before summarising, from the defence point of view, the period 1910–25, it is necessary to mention three outstanding events immediately preceding that period. These were the establishment (*a*) of the Committee of Imperial Defence by Mr. A. J. (Earl of) Balfour; (*b*) of the general staff of the army by the late Mr. H. O. Arnold-Forster; and (*c*) of the Expeditionary Force and Territorial Army by Mr. R. B. (Lord) Haldane.

Through the agency of the Committee of Imperial Defence, the principles of Empire defence put forward by the general staff of the army had been generally accepted by the self-governing nations. These principles can be summarised as (1) security of sea communication, (2) local provision for local defence and (3) mutual support where local resources do not suffice for the purpose. It will be observed that, in these established and accepted principles, no account was taken of combined action in foreign territory in support of treaty obligations. One of these, affecting the neutrality of Belgium, had been undertaken by Great Britain before self-government had been conferred upon the Dominions, but the obligation was well known, and the Dominions rose nobly to the occasion in providing sea, land and air forces, of their own free will, to support those of Great Britain when the frontier of Belgium was crossed by the German Army in 1914.

As affecting Empire defence, the outstanding events of the years 1910–4 were the reduction of the two-power standard at sea, to a standard of 60% in capital ships above Germany; a warning issued to Canada by the British Govt. in 1912 that the possibility of sending effective sea forces to the Pacific, without courting disaster in home waters, would be diminished with the growth of foreign navies; the organisation of the regular troops in the United Kingdom as an expeditionary force of six infantry and one cavalry divisions, with line-of-communication troops; the development of the Special Reserve (late Militia) to provide drafts to replace casualties in that force; and the organisation of the Territorial Force in 14 infantry divisions for home defence, with the option of volunteering for service abroad. During the same period, the Committee of Imperial Defence, in its purely advisory capacity, was instrumental in carrying through a policy of uniformity in organisation, training, equipment and material in all the sea and land forces of the British Commonwealth. Through the activities of the same body a "war-book" was compiled, to ensure combined action by all departments of state and all parts of the Commonwealth in the event of a great war; an organisation was prepared to stabilise the rates of war insurance on shipping and cargoes; and a plan was worked out in detail for transporting the Expeditionary Force across the sea, and placing it on the left flank of the French Army as rapidly as possible, should such action ever be demanded. The value of these preliminaries was evident in 1914.

The Committee of Imperial Defence, was (and is) a purely advisory body. No provision was made for an executive body responsible for the conduct of war, excepting a large Cabinet containing 22 ministers, which proved to be too unwieldy for prompt action. After various expedients had been tried, a small "War Cabinet," was established in Dec. 1916 and remained in power until normal conditions obtained after the conclusion of the conflict. The need for some such form of central control in time of war was one of the most important of the many lessons learned about Imperial defence. Another lesson showed the tremendous potential forces, sea, land and air, economic and financial, which the British Commonwealth has at its disposal if certain conditions are satisfied; these are the inspiration of a great cause, time for development and safe sea communications. The rapid progress in aviation which resulted from the impetus of war caused a new demand for an air force of sufficient strength to make Great Britain secure.

The Post-War Years.—The post-War period was one of unrest abroad and exhaustion at home, resulting in an urgent need for recuperation. Events in North Russia, Afghanistan, Ireland, Mesopotamia, Egypt, Palestine, Turkey and elsewhere threw a considerable strain upon British forces. An undertaking to provide a contingent in German occupied territory caused additional military responsibilities, which were further increased by the acceptance of mandates, for ex-German and ex-Turkish territories. At the same time, economic and financial exhaustion led to the reduction, almost to cadres, of the immense sea, land and air forces employed by the British Empire in the World War. Meanwhile, the United States and Japan, which had suffered comparatively little loss, embarked upon new programmes of naval construction, and the British fleet was further reduced from a 1·6 to a one-power standard.

The British Army was reduced below its pre-War strength, and the Air Force to a standard below that subsequently considered as essential to the safety of the United Kingdom. In 1919 the principle was laid down by the Cabinet, that the strength of the British fighting forces should be based upon the assumption that war on a large scale would not occur within a period of 10 years. An outstanding event of the post-War period was the Washington Conference of 1921 (*q.v.*) at which an agreement was arrived at between the principal naval Powers, Great Britain, the United States, France, Italy and Japan, to limit the total and individual tonnage of capital ships and aircraft carriers, and to take certain other measures designed to bring about the limitation of sea armaments. A later event of importance was the Conference of Empire Prime Ministers held in London in 1923, at which conclusions were agreed upon that the territories and trade of the several countries of the Empire must be adequately defended, each Parliament deciding for itself what its government should do. Also that the guiding principles, affecting the general defence problem, should be (*a*) the provision of naval bases to ensure the mobility of sea forces, (*b*) equality with the naval strength of any foreign Power (the one-power standard) and (*c*) a common system of Air Force organisation.

Finally, and most important of all, came the Locarno Pact in 1925. (*See* LOCARNO.) Looked at from the point of view of British Empire defence, they can be described as greatly increasing the military commitments of Great Britain (the other self-governing nations of the Empire are not parties to them) in the event of another Franco-German War, whichever side might be the aggressor, but at the same time introducing a new spirit in international relationship, which should make such an event much less probable.

A Comparison.—Comparing the situation in 1926 with that in 1910, the most important points to be noted were the reduction in strength of the British Navy, compared with those of other nations; a reduction in the strength of the Regular Army and the abolition of its Special Reserve; the establishment of the Territorial Army on new principles, rendering it available for overseas service in grave emergencies; and the establishment of an Air Force, which was being worked up to a one-power standard. At the same time, it was necessary to take note of additional military commitments in Europe, involved by the Locarno Treaties, and in ex-Turkish and ex-German territories in Asia and Africa under mandates resulting from the Peace Treaties, and the establishment of the League of Nations. Upon the people of Great Britain fell the main burden of Empire defence which involved the safeguarding of much foreign territory, besides that of the British Empire proper.

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III. AREA AND POPULATION

The World War resulted in a considerable addition to the area of the British Empire. The greater part of the overseas possessions of Germany were conquered by British troops, and by the Treaty of Versailles were retained by the British under mandate from the League of Nations. These mandated territories together cover over 950,000 sq. m. and contain more than 9,000,000 inhabitants. In 1914, Cyprus was annexed and Egypt declared a British Protectorate, thus adding these areas to the Empire, but in 1922 the protectorate over Egypt was terminated. In 1924, an area of about 34,000 sq. m. bordering Italian Somaliland was ceded to Italy. The total area of the Empire (1926) approached 13,350,000 sq. m., containing about 450,000,000 inhabitants. This total includes the mandated territories.

The following table shows the area and population of each part of the Empire. The figures are mainly based on *The Statistical Abstract for the several British Oversea Dominions and Protectorates in each year from 1907 to 1921* (1924), which should be consulted for explanatory details. Population statistics in general are for 1921:—

Area and Population of the Various Parts of the British Empire

	Area (sq. m.)	Population
Europe		
England	50,874	35,678,530
Wales	7,466	2,206,712
Scotland	30,405	4,882,288
Ireland, Northern	5,263	1,284,000
Man, Isle of	227	60,238
Channel Islands	75	89,614
Irish Free State	26,592	3,165,000
Gibraltar	2	18,061
Malta	122	212,258
Cyprus	3,584	310,469
North America		
Canada	3,729,665	8,788,483
Newfoundland	42,734	259,259
Labrador	120,000	3,774
Central and South America		
West Indies	12,482	1,728,735
Bermuda	19	20,127
Falkland Islands	7,500	3,431
Guiana, British	89,480	297,691
Honduras, British	8,598	45,317
Africa		
South Africa, Union of	473,096	6,928,580
Swaziland	6,678	106,961
Basutoland	11,716	498,781
Bechuanaland	275,000	152,983
Rhodesia, Southern	148,575	899,187
Rhodesia, Northern	291,000	983,539
Nyasaland	39,467	1,201,983
Uganda	110,300	2,921,608
Kenya	211,060	2,529,133
Zanzibar	1,020	197,000
Somaliland	68,000	347,000
Sudan	1,014,600	4,853,000
St. Helena	47	3,666
Ascension	34	250
Nigeria	336,778	18,070,608
Gold Coast	78,650	2,110,474
Sierra Leone	30,000	1,541,311
Gambia	4,010	210,530
Mauritius	809	384,879
Seychelles	156	24,523
Asia		
India	1,805,252	318,885,980
Ceylon	25,481	4,498,605
Aden (and Perim)	80	56,500
Socotra	1,382	12,000
Straits Settlements	1,600	883,769
Malay States, Federated	27,648	1,324,890
Malay States, Unfederated	23,355	1,123,944
Brunei	4,000	25,451
Borneo, British North	31,106	257,804
Sarawak	42,000	600,000
Hong Kong	391	625,166
Weihaiwei	285	154,662
Oceania		
Australia	2,974,581	5,435,734
New Zealand	103,284	1,218,913
Papua	90,540	275,000
Fiji	7,435	157,266
Gilbert and Ellice Is.	180	29,897
Solomon Islands	14,800	150,516
Tonga Islands	390	24,935
Total	12,389,874	438,761,015

The following areas are administered under mandate from the League of Nations:—

	Mandatory Power	Area	Population
Cameroons, British	United Kingdom	31,000	632,309
‘Iraq		116,511	2,849,282
Palestine		9,000	761,796
Tanganyika		373,494	4,123,493
Togo, British		13,040	187,939
South-West Africa	South Africa	322,000	227,739
New Guinea	Australia	91,000	254,000
Western Samoa	New Zealand	1,260	37,157
Nauru	British Empire	8	2,166
Total		957,313	9,075,881
Grand Total		13,347,187	447,836,896

(W. H. Wi.)

IV. FINANCE

The most important inter-Imperial financial problems are those of debt and currency. In 1900, when Mr. Joseph Chamberlain was Secretary of State for the Colonies, the Colonial Stock Act was passed, under which the British Dominions, on agreeing to certain conditions, were enabled to borrow under the Trustee Act, 1893, and their loans became trustee securities in Great Britain. The Dominions were thus placed on equal terms with the British Govt. and other high-class British borrowers and India in so far as eligibility of appeal to the general body of investors in Great Britain was concerned. Just before the World War the funded debts of the Dominions were as follows:—

	Borrowed in London	Raised Internally
	£	£
Canada	60,000,000	143,000,000
Australia (Commonwealth and States)	230,000,000	104,000,000
New Zealand	78,000,000	16,000,000
South Africa	111,000,000	14,000,000
Total	479,000,000	277,000,000

The following figures (1924 for South Africa, 1925 for the other Dominions) show how the total funded debt increased, largely on account of the World War.

	Borrowed in London	Borrowed in New York	Raised Internally
	£	£	£
Canada	62,000,000	60,000,000	380,000,000
Australia (Commonwealth and States)	481,000,000	4,000,000	537,000,000
New Zealand	118,000,000	. .	104,000,000
South Africa	133,000,000	. .	74,000,000
Total	794,000,000	64,000,000	1,095,000,000

After 1914, the proportion of the funded debt raised internally greatly increased in each Dominion. For Canada, practically no further loans were raised in London, and in Dec. 1925 her debt payable in New York was almost equal to that payable in London.

Currency Conditions.—Within the British Empire there is an absence of uniformity in the conditions under which the gold standard is supposed to operate. For the gold standard to be fully effective two conditions are necessary:—(*a*) that there should be no obstacle to the free flow of gold between the countries adopting the gold standard; and (*b*) that the external movement of gold should produce like results on currency and credit in the internal economy of the respective countries. Any deviation tends to throw the gold standard out of balance (*see* CURRENCY; EXCHANGE).

In England, under the Gold Standard Act, 1925, both Bank of England notes and currency notes were made convertible into gold bullion in bars of 400 oz. troy of fine gold, and the embargo on the export of gold was removed.

In Canada, although sovereigns taken at par are legal tender, and there is a branch of the Royal Mint at Ottawa, the unit of account is the dollar, and the currency almost wholly consists of Dominion notes, issued by the Govt., and notes issued by the chartered banks, both of which are legal tender. In 1925 gold could only be exported under licence (*see* CANADA).

In Australia, there are branches of the Royal Mint at Melbourne and Perth, where sovereigns are coined. These are held by the banks in their cash reserves but are not put into circulation. The currency consists of notes issued by the Commonwealth Bank, which functions both as a central and as a commercial bank. The notes are legally convertible, but, in practice, convertibility is not enforced. There is no embargo on the export of gold. The Commonwealth Bank Act, 1924, provides that: “ The Board may issue Australian notes to the Bank or to other banks in Australia in exchange for money or securities lodged with the London branch of the Bank.” It lies with the Commonwealth Bank, however, to determine to what extent this facility should be made available (*see* AUSTRALIA).

In New Zealand, bank-notes constitute the currency. They are issued by the two New Zealand and the four Australian banks which conduct the banking business of the Dominion. Notes can be issued against a reserve of one-third in gold and two-thirds in securities of the New Zealand, British and Australian (Commonwealth and State) governments. While the gold has to be held in New Zealand, the securities may be held either in New Zealand or, on complying with certain conditions, in London or Australia. Although the embargo on the export of gold was removed in 1925, the notes are inconvertible (*see* NEW ZEALAND).

South Africa, as the largest producer of gold, not only in the British Empire but in the world, occupies a unique position. A branch of the Royal Mint has been established in Pretoria, and not only are sovereigns coined there but they are put into circulation. The notes of the South African Reserve Bank, which functions as a central bank, are also freely convertible into gold coin. The action of South Africa in encouraging the use of gold as a circulating medium can perhaps be appreciated from the standpoint of the largest gold producer, but it is not economical and therefore tends to make England's task of maintaining the gold standard harder.

The Egyptian System.—Although the Protectorate over Egypt was terminated in 1922, the currency system, as modified during the World War, was retained and still served the Sudan. The currency, which before the War was partly gold, consists of notes of the National Bank of Egypt. During the War the notes ceased to be convertible into gold and, for practical purposes, became convertible into sterling. By arrangement with the Egyptian Govt. British Treasury Bills are held in place of gold. The par of exchange is at the rate of £E97½ for £100 sterling, and at this rate the National Bank of Egypt, which has an office in London, is prepared to give the banks Egyptian currency in Egypt against sterling paid in by them in London; and, conversely, to receive, also at the same rate, Egyptian currency and pay out sterling in London—advice being sent by cable both ways. Thus parity of exchange with London has been absolutely maintained throughout the whole period, notwithstanding heavy movements in both the volume of currency and the trade balance (*see* EGYPT).

Empire Currency Bills.—The success which attended the Egyptian system led to proposals for the adoption of the principle throughout the Empire. On the initiative of the New Zealand Govt., a scheme for an issue of Empire Currency Bills was placed before the Imperial Economic Conference held in 1923 and submitted to a committee on inter-Imperial exchanges. The scheme provided for a composite issue of treasury bills, limited in amount, in which each of the participating countries in the Empire would have a share. The bills, which were to be given the utmost degree of negotiability and mobility throughout the Empire were to be used as a basis for currency, and as interest-bearing reserves by the banks. The scheme was rejected, partly because of the "joint and several" nature of the liability. Further, an early restoration of the gold standard, which it was thought would provide an automatic remedy, was contemplated. A supplementing and correlative scheme for an Empire gold pool has also been suggested in order to secure economies in the use of gold throughout the Empire. (J. F. DA.)

V. TRADE AND COMMERCE

After the World War there was a marked increase of interest in Empire trade in Great Britain and also in all the countries that comprise the British Empire. The evidence of trade statistics as to the increasing importance of Empire purchases to British manufactures led to a widespread adoption of the view that if Great Britain was to maintain her pre-War leadership in world economic affairs, she must adopt some method of organising the production and marketing of Empire foodstuffs and raw materials, with a view to ensuring (1) her own supplies and (2) a continuous redistribution of population throughout the Empire, made possible by an assured demand for Empire products in the British market.

If the combined effect of geographical and social conditions upon trade are considered, the countries making up the British Empire can be classified into six economic groups:—

1. The British Is., which exercises economic influence over all Empire countries in varying degrees.
2. Canada, Newfoundland, the West Indies and British Guiana. This may be called the American group because it falls directly within the economic orbit of the United States of America.
3. and 4. West and East African Colonies. The conditions governing production, commerce and transport in West, East and South Africa are so different that separate grouping is necessary.
5. India, Ceylon, Malaya and the Strait Settlements.
6. The three great southern Dominions—Australia, New Zealand and South Africa. South Africa, on account of its similarity in economic and political conditions with those of Australia and New Zealand, falls more naturally into this group than into either of the African groups.

Trade of Great Britain with the Empire.—Great Britain is the nerve centre of political, banking and business activity, and the most important part of Empire trade is the trade of Great Britain with other Empire countries. The following table shows the Empire share of British exports, pre-War and post-War:—

TABLE I.

Year	Total	To Empire	
	£	£	%
1904–13[1]	408,439,504	141,934,405	34·75
1922	719,507,410	270,201,638	37·5
1923	767,257,771	300,602,626	39·2[2]
1924	795,364,581	332,536,252	41·8[2]

[1] Annual average.

[2] It should be noted that this percentage does not take into account the territorial alteration in the British Empire as between pre-War and post-War years; especially should it be noted that without exports to the Irish Free State, these percentage figures would be 37·2% and 38·5%, respectively.

It must not be forgotten, however, that while these figures indicate the proportion of British exports taken by the Empire, they do not, as a result of the rise in the price level between pre-War and post-War years, show the actual volume of trade. Table II. gives the British export figures for 1904–13 and for 1922–3–4 reduced to the 1913 price level.

TABLE II.

Year	Total	To Empire	
	£	£	%
1904–13	408,439,504	141,934,405	34·5
1922	361,836,000	143,287,000	39·8
1923	404,404,000	158,526,000	39·2
1924	420,582,000	174,962,000	41·8

The importance of the Empire as a market for the different categories of British exports varies greatly. In 1913 the Empire share of British exports under the head of Food, Drink and Tobacco was 39% and in 1924 54·5%. Coal is the most important raw material exported from Great Britain, but the Empire took in 1924 only 8·5% of the total value of £72,000,000. Britain's exports of "articles mainly or wholly manufactured" amounted in 1924 to £618,000,000, out of a total export of £800,000,000, and the Empire share in this year was 46%, a rise of 4% on the 1913 share. It is estimated that the Empire provides a market for not less than 50% of Great Britain's completely finished manufactured exports.

The importance of Empire markets to British manufactures is clearly realised when the proportion of manufactures in the total British exports to Empire and foreign countries is contrasted. This is done in the following table for 1924.

TABLE III.

	%		%
India	95·0	Germany	57·6
Canada	82·5	U.S.A.	78·0
Australia	93·5	France	48·0
New Zealand	87·5	Italy	42·0
South Africa	91·5		

Of Great Britain's total imports for the annual average 1911–3 the Empire supplied 21% and for the annual average 1922–4 (the Irish Free State being excluded) the Empire supplied 30·7%. Table IV. gives the Empire share of the actual volume of British imports on the same basis as Table II. (*i.e.*, reducing post-War figures to the 1913 price level).

TABLE IV.

Year	Total	Empire	
	£	£	%
1913	659,168,000	135,356,000	20·5
1922	570,073,000	180,713,000	31·6
1923	641,691,000	189,940,000	29·5
1924	719,503,000	218,729,000	30·4

The development of primary production in Empire countries is clearly reflected in the British import returns. In 1913, the Empire supplied 25·8% of British imports of food, drink and tobacco and in 1924 38·2%. Foodstuffs are the largest item of imports, valued in 1924 to £571,000,000. Britain's requirements of raw materials were met by the Empire in 1913 to the extent of 25% of the total, and in 1924 to the extent of 32·5%. The share of the Empire in British imports of wholly or partly manufactured goods is small. In 1913, it was 6·6% and in 1924 11·5%, and even this small proportion consisted in the main of semi-manufactured metals—the raw material of many British industries. These figures indicate the non-competitive or complementary nature of British trade with the Empire. The relative importance of Empire supplies of certain essential foodstuffs and raw materials is shown by the following figures:—

Imported article	Empire share of imports in 1924
Wheat and flour	53·0
Beef	9·2
Mutton	60·5
Butter	42·4
Fruit (fresh, dried and canned)	22·3
Wool	80·5
Hides and skins	46·6

Before considering the trade of the overseas groups, it is necessary to mention the new commercial position of the Irish Free State. From April 1 1923 Southern Ireland became an independent economic unit. In 1924 69·3% of her total imports, valued at £66,000,000, were of British origin and 84% of her total exports, valued at £48,000,000, went to Great Britain. In that year the Irish Free State was the fifth most important market for British goods. Direct Irish trade with parts of the Empire other than Great Britain is negligible.

Canada, Newfoundland, etc.—The American group, in which Canada takes the leadership, is in some instances less affected by the inter-Imperial aspect of trade than the other groups in the Empire. This is the inevitable result of the immense economic influence of the United States of America.

Canadian Trade: Annual Averages

	1911–3 (000's omitted)		1922–4 (year ending March 31) (000's omitted)	
	$	% of total	$	% of total
Exports				
Total exports	306,765	..	905,611	..
Exports to Great Britain	149,853	48·8	346,174	38·2
Exports to Empire[1]	168,130	55·0	407,312	45·0
Imports				
Total imports	548,778	..	814,583	..
Imports from Great Britain	121,861	22·0	137,359	16·9
Imports from Empire[1]	143,330	26·2	174,711	21·4

[1] Including Great Britain.

Though Great Britain's share of Canadian imports as between 1911–3 and 1922–4 fell from 22% to 16·9%, her share rose to 19% in 1924–5.[1] The United States is naturally Canada's chief source of supply. Canada's export trade showed a remarkable increase as between 1911–3 and 1922–4. Taking the figures for the latter period on the basis of 1913 price levels, the increase amounted to over 60%. In June 1920 a reciprocal trade arrangement was entered into with the West Indies, and in 1925 this agreement was enlarged. It seems probable that the mutual tariff advantages so arranged will lead to Canada becoming the chief source of supply of manufactures and foodstuffs to the West Indies and a valuable market for their tropical products, chiefly sugar and bananas. Although the trade between Great Britain and the West Indies is the oldest established branch of Empire trade, it is severely handicapped by the lack of adequate shipping services.

The import trade of Newfoundland is greatly affected by the United States, whose share of her imports in 1924 amounted to 31% of the total as against Canada's share of 41·6% and Great Britain's share of 22·6%. The British share of Newfoundland exports in this same year was 38·6% of the total. Newfoundland exports a limited range of products, the most important of which are dried fish, cod liver oil and paper pulp.

West African Group.—The West African group is composed of the following colonies and protectorates: Gambia, Sierra Leone, Gold Coast (which includes British Togoland) and Nigeria (which includes British Cameroons). The typical West African exports are palm kernels and palm oil, which, in the case of Nigeria, represent over 60% of the total value of the exports. The actual proportion of British imports and exports which arrived from and were sent to West Africa greatly increased after 1910. This fact is mainly due to the general increase of prosperity in West Africa and to the accession of certain parts of German West Africa. The total value of the trade with Great Britain amounted for the annual average of 1922–4 to £22,000,000. The inter-Imperial trade of West Africa, apart from that with Great Britain, mainly consists of trade between the several West African Colonies. Foreign trade plays a relatively small part in West African economic life.

East Africa.—Though the area of British East Africa (which includes Kenya, Uganda, Tanganyika Territory, Nyasaland and Zanzibar) is twice as large as that of West Africa, the volume of East African trade is only about two-thirds of that of West Africa. The bulk of British East African trade is with Kenya and Uganda. A significant feature of the post-War trade of East Africa was the immense increase of exports going to India. The Indian share of the exports of Kenya and Uganda in 1911–3 was 4·2%, and in 1922 had risen to 36·8%. The imports from India, on the other hand, had fallen slightly from a pre-War share of 19·5% to a post-War share of 15% of the total imports into these two colonies. Uganda is becoming of increasing importance to the Empire as a supplier of cotton. Her cotton exports have increased from 25,000,000 lb. in 1922 to 51,500,000 lb. in 1924: the value of this item of export accounted in the latter year for 56·8% of the total exports of Kenya and Uganda. In 1924 Kenya coffee represented 29% of total supplies sent to Great Britain and 80% of Empire-grown supplies. The Sudan, which is of rapidly growing importance as a source of cotton, may also be included in this group.

Indian Group.—India is the largest market in the world for British goods. Therefore the Indian group is economically the most important part of the Empire to Great Britain. The following table shows the share of Great Britain in Indian imports for the annual average 1911–3 and 1922–4:—

Indian Trade: Annual Averages

	1911–3 (year ending March 31) (000's omitted)		1922–4 (year ending March 31) (000's omitted)	
	£	% of total	£	% of total
Imports				
Total imports	107,293	..	163,164	..
Imports from Great Britain	67,883	63·5	93,496	57·5
Imports from Empire[1]	74,623	69·9	104,730	64·8
Exports				
Total exports	157,193	..	238,342	..
Exports to Great Britain	39,032	24·8	56,248	23·6
Exports to Empire[1]	62,839	40·0	90,093	37·8

[1] Including Great Britain.

The extremely close trade connection established between India and the home country is thrown into relief if Great Britain's share of the imports of another large Far East market—China—is noted. In 1924, Britain's share of Chinese imports amounted to only 12% of the total as compared with 57·5% in the case of India. The disproportion between the Empire percentage of Indian imports and exports should be noted. Indian exports to Empire countries other than Great Britain are marked by a large trade in jute goods to Australia and New Zealand, and by a more general trade with Mauritius and the Straits Settlements. Malaya has developed a great export trade in rubber and tin, and is one of the largest exporting countries per head of her population in the world.

Australian Trade: Annual Averages

	1911–3 (000's omitted)		1922–3 to 1923–4 (000's omitted)	
	£	% of total	£	% of total
Imports				
Total imports	74,958	..	136,188	..
Imports from Great Britain	37,729	50·4	66,000	48·5
Imports from Empire[1]	46,249	61·6	82,572	60·6
Exports				
Total exports	79,033	..	118,678	..
Exports to Great Britain	33,841	42·6	48,741	41·2
Exports to Empire[1]	47,898	60·5	63,269	53·5

[1] Including Great Britain.

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[1] *Preliminary Report on the Trade of Canada*, published by the authority of Canadian Minister of Trade and Commerce.

Southern Group.—While the majority of the Empire countries showed an increased share of British exports, the most marked instance was that of Australia, whose share rose from 6·56% in 1913 to 8·25% in the year ending Sept. 30 1925. Australia's trade with Empire countries, apart from her total trade with Great Britain, amounted to approximately one-eighth of the total. On the assumption that prices had increased by about 50% over the pre-War price level, the volume of Australian imports for the annual averages taken showed a considerable increase and the exports a slight decrease. The chief Australian exports are wool and wheat. The Australian wool exports are of the greatest importance to Empire trade, as they represented in 1924 37% of Great Britain's total imports of wool.

Of the three great southern Dominions, New Zealand, though the volume of her trade is not so great as that of either Australia or South Africa, maintains the closest touch with the trade of Great Britain and the other Empire countries.

New Zealand Trade: Annual Averages

	1911–3 (000's omitted)		1922–4 (000's omitted)	
	£	% of total	£	% of total
Imports				
Total imports	20,933	..	42,306	..
Imports from Great Britain	12,533	60·0	22,774	54·0
Imports from Empire[1]	17,306	82·8	33,303	78·8
Exports				
Total exports	21,261	..	47,102	..
Exports to Great Britain	16,708	79·0	38,505	81·9
Exports to Empire[1]	19,956	94·3	42,287	89·9

[1] Including Great Britain.

The figures of total trade given above indicate that, even allowing for the rise in price level, New Zealand's volume of trade within the Empire has increased since the immediate pre-War years. Official estimates give the increase in the 1923 exports to the Empire as being 33·5% above the 1913 level. A large proportion of New Zealand's inter-Empire trade consists of exchange and transit trade with Australia. New Zealand is predominant in the Empire as a supplier of butter, mutton and lamb to the British market. In 1913, her exports of butter amounted to 5% of British imports; and in 1924 amounted to 20%. In the same two years New Zealand mutton and lamb represented 46·6% and 53% respectively of British supplies from overseas.

South Africa is alone among the Dominions in showing a slight decrease in her share of British exports and imports since the War in comparison with 1911–3. On the other hand, deducting the British share of South African imports and exports, the total trade of Empire countries with South Africa increased from approximately one-fifth in 1911–3 to one-quarter in 1922–4.

South African Trade: Annual Averages

	1911–3 (000's omitted)		1922–4 (000's omitted)	
	£	% of total	£	% of total
Imports				
Total imports	38,129	..	55,407	..
Imports from Great Britain	21,754	57·0	28,892	52·0
Imports from Empire	25,737	67·5	35,251	63·5
Exports				
Total exports	63,190	..	73,513	..
Exports to Great Britain	57,956	92·0	54,013	71·5
Exports to Empire	58,396	92·5	61,076	83·0

In the general distribution of imports and exports there was little change. In the immediate post-War years, the United States of America and Japan made serious inroads into many Empire markets, but by 1923 British trade had largely regained the lost ground. The special importance of Empire trade to the Dominions and India is shown by the fact that in every case, except Canada, about 50% or over of the total is carried on within the Empire. New Zealand had, in 1924, an Empire trade of 84·5%, South Africa 75%, Australia 57% and India 49%. Canada's trade with the Empire amounted to 33·8% of her total. As to the actual volume of inter-Imperial trade—apart from its distribution—statistics indicate that the self-governing Dominions and India suffered from the general depression following the World War. In most cases there was an actual loss of purchasing power and, except in the case of New Zealand and Canada, exports also declined.

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(F. L. M.)

VI. COMMUNICATIONS

The first line of communication of the Empire is by sea. Until the outbreak of the World War the great majority of the ships serving Empire ports were owned by companies operating from the British Is.; but during the War and immediate post-War periods, the Dominions, notably Canada and Australia, developed mercantile marines which largely operate on Empire routes. About 400,000 gross tons of shipping engaged in overseas trade were actually owned by these Dominion Govts. in 1925, but whilst they assisted trade development they were also a cause of substantial losses. These government-owned fleets had at first an advantage in immunity from taxation, but at the Imperial Conference of 1923 it was agreed that liability to taxation should be the same as for privately owned vessels.

Liner routes steadily increased after 1910, and in 1925 there were 560 such routes from the British Isles. Not all were Empire routes, but there was at least one and frequently more than one liner route connecting Great Britain with each of the Dominions and Colonies, whilst there was a marked development in the organisation of lines working directly between the overseas Dominions. An effect of this was to give greater stability to freight rates, but also to make them less flexible. Sea carriage remained the cheapest form of transport. In 1925 it cost only 1d. to bring 1 lb. of meat from Australia to Great Britain; ¼d. per quarter for wheat from Canada or ⅔d. from Australia and $\frac{3}{20}$d. per lb. for rice from Rangoon.

Freights are, however, subject to considerable variation, due to changes in the balance of cargoes on the routes at different times and seasons. The serious drop in coal exports from Great Britain during the post-War period caused British shipping to be less remunerative, and kept up freights for the carriage of raw products to Great Britain. The Australian trade is, from a shipping standpoint, unusually well balanced. The worst balanced route is that across the Atlantic to Canada and Newfoundland, for the United Kingdom exports to Canada and Newfoundland mainly manufactured goods, occupying moderate cargo space in relation to their value, and imports grain, timber, pulp, flour and other comparatively bulky goods. A notable development, particularly after the War, was the growth of direct trade of the Dominions or Colonies with one another. The Imperial Shipping Committee, founded in 1920, materially assisted in the coordination and standardisation of practice within the Empire.

With the growth in the size of ships—British ships of 8,000 tons and upwards increased from 214 at the end of 1913 to 395 at the end of 1925[1]—the need for deep water ports and for dock equipment which would provide for a rapid turn round of the ship was emphasised. The outcome was a marked tendency for the traffic to pass through a limited number of ports. Though the Board of Trade publish returns for over 100 ports in Great Britain, the bulk of the traffic passes through 14 or 15 of them, while London and Liverpool together handle over 50% of the total. Taken as a whole, the Empire is well provided with ports with a depth of water of 35 ft. upwards, or with ports which can readily be deepened as soon as the necessity arises. The tendency, however, has been to develop a large number of ports, and this often compels ships to call at several to insure a full cargo. New Zealand perhaps suffers from this more than any other part of the Empire, which accounts for freights being relatively high.

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[1] *Lloyds' Register* (1926).

Railways.—The railway systems of the various parts of the Empire differ very much in their adequacy. The plan of transferring the ailways to a state company, or to have a railway budget independent of the national budget, was suggested. The Union of South Africa ed the way, whilst Canada followed suit in 1917, when the Canadian National Railways Co. was created; and India in 1925, when the ecommendations of the Acworth Commission of that year were adopted. These changes should make for a more even development of railways in the Dominions, with material advantages to trade. Lack of standardisation seriously hindered the development of railway communications in Australia, each state having chosen its own ailway gauge irrespective of that of neighbouring states. In the Crown Colonies, the prospect of improving the supply of raw materials produced within the Empire depends largely upon railway development.

Air and Wireless Services.—In speeding up transport, the biggest prospect comes from the development of air transport. In 1925 its possibilities were limited, particularly by the difficulties of night flying. For communication with Great Britain, its uses were restricted to the carrying of passengers or mails for a terminal stage of the ourney. A day, for instance, might be gained on the Indian mail by use of the aeroplane service to Paris and Marseilles, and a saving of 15 days made by the air service from Cairo to Baghdad for the London mails. If airship services should develop, the times necessary for mails to reach the East or Australia would be cut about two-thirds. In 1925 the only direct wireless service of an Empire character was that between the United Kingdom and Canada, which had been in existence since 1907, though a limited service with India was maintained by way of Egypt. The first suggestion for an Empire wireless scheme was made in 1911, and had it not been for the War this would probably have been put into operation. Afterwards a question arose whether the Marconi Co. or the Government should carry out the scheme in Great Britain. Eventually a decision in favour of the Post Office ownership and operation was reached, though the Marconi Co. was employed for the construction of the high power station at Hillmorton near Rugby, which was opened on Jan. 30 1926. This station is used for broadcasting the Government bulletin and other purposes, but is no longer part of the general Imperial scheme, now carried out on the short-wave beam system.

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BRITISH ISLES: *see* GREAT BRITAIN; IRELAND; SCOTLAND; WALES; etc.

BRITISH LEGION.—In 1921 there existed in Great Britain four national organisations of ex-service men, namely the Comrades of the Great War, the National Association of Discharged Sailors and Soldiers, the National Federation of Discharged and Demobilised Sailors and Soldiers and the Officers' Association. These had all come into being owing to the World War and in 1921 they united, forming the British Legion, which thus became the one national organisation of ex-service men throughout the country. In 1925 the Legion was incorporated by royal charter.

The policy of the Legion is entirely non-political and non-sectarian. In the words of its charter—

> The Legion shall exist to perpetuate in the civil life of the Empire and of the world the principles for which the nation stood in the Great War; to inculcate a sense of loyalty to the crown, community, state and nation; to promote unity amongst all classes; to make right the master of might; to secure peace and good will on earth; to safeguard and transmit to posterity the principles of justice, freedom and democracy, and to consecrate and sanctify our comradeship by our devotion to mutual service and helpfulness.

Practically speaking, any person, man or woman, who is a British or naturalised British subject, who subscribes to the above principles and who has served at least seven days with H.M.F. or forces allied to the latter in the World War (except in the case of conscientious objectors) is eligible to apply for membership.

The Legion assists all its members with advice, financially in many cases, as regards to unemployment and sickness and in many other ways. It makes special appeals, the best known of which is that made on "Poppy Day." Its headquarters are at 26, Eccleston Square, London, S.W. For administrative purposes England, Ireland and Wales are divided into 13 areas in which there are 2,626 branches, and in addition to these there are 36 overseas branches. Branches are also being established overseas outside the Empire. The total membership of the Legion is over 1,750,000. (J. L. Co.)

BRNO: *see* BRÜNN.

BROADCASTING, as distinguished from wireless telegraphy and telephony, may be said to have come into being about 1920. It may be defined as the systematic diffusion by radio telephony of programmes of music and speech and other sounds for the entertainment, information and interest of all who are equipped with appropriate receiving apparatus. Further, the word "appropriate" must be understood in this connection as applying not only to technical suitability but also to qualities, such as cheapness and ease of management, which render the apparatus available for the greatest possible number of persons; and correspondingly, the rôle of broadcasting (in the executive aspect of the word) is to reach the greatest possible number of people with suitable programmes.

Development in the United States.—As it was in the United States, prosperous and relatively unstrained by the War, that broadcasting arose, the principal causes must be sought in the growing dislike of farmers and country-people for the old, self-centred isolation, and the almost universal interests of modern youth in practical science. The monotony of working hours, since machinery has replaced handicraft, has probably accentuated the need for variety and interest to fill leisure hours.

The demand first became effective in the United States, and the measures taken to cope with it were typical of the country and the time. It is a cardinal maxim of American life that individual enterprise should be subject to almost no governmental control; and, further, advertisement on the grand scale is customary and acceptable in America to an extent that is unknown in Europe. It accorded perfectly then with the American outlook, that the possibilities of wireless broadcasting should be grasped promptly and exploited daringly for "boosting" ideas or products. Consequently stations sprang up by hundreds, (mostly of very low power) to subserve all kinds of interests in serving all kinds of demands, such as police-notices, the propaganda of sects and movements, advertisement, music, education, frankly trivial entertainments, market prices, news, etc.

By Aug. 1924, 1,105 stations had been licensed in the United States, of which, only 533 were surviving in 1926, and it is certainly arguable that the movement began by overshooting the mark. The present tendency to which the indications point, is toward consolidation for better service (in point both of utility and of entertainment) and toward an economically sounder radio industry. Experience has taught—and not in the United States only—that broadcasting, unlike "listening," is both an expensive and an exclusive service, requiring for its activity (*a*) financial stability, (*b*) co-ordination of effort and resources for the equalisation of service as between town and country, (*c*) an appreciation of artistic and cultural needs and of ways of balancing these with public demands, and lastly (*d*) the elimination or minimising of mutual interference between stations, which is more and more difficult in proportion to the number attempting to operate in the narrow "wave-band" (range of wave-lengths) that the other wireless services can be induced to leave vacant for broadcasting.

Development in Europe.—The broadcasting movement, when it crossed the Atlantic, found Europe impoverished and war-weary. Yet, so prompt and general was its popularity that we must conclude that other forces, besides those which had stimulated broadcasting in America, were at work. After nearly five years in which strain and the sense of insecurity had found occasional relief in somewhat hectic pleasure-seeking, it was an opportune moment for the appearance of a form of pleasure which could be enjoyed at home, naturally and without effort, as well as cheaply.

Nor was the need one of pleasure only. The War had had a widening effect on the average man's outlook—and in this connection it is worth noticing that the two European nations whose citizens fought entirely abroad, namely the British and the German, are precisely those which have welcomed and developed broadcasting most whole-heartedly. Lastly, in the state of high hope that followed the Armistice and the foundation of the League of Nations, the peoples, partially at any rate, shook off narrower prepossessions. In short, post-War Europe asked for something which both combined ease with pleasure, and reconciled broadened interests and outlook with domesticity, and this exactly was what wireless broadcasting offered.

From 1920 onward, amateur wireless experimenters, who were numerous even before the War, worked more and more in telephony in preference to Morse telegraphy, and in England and several other European countries (see below) broadcasting began spontaneously with transmissions of gramophone records and amateur performances. At the same time the radio industry began to foresee and prepare for a future of evidently great but unknown possibilities. Experimental work was undertaken for the improvement of microphones, and for the development of listening apparatus which could be operated with a minimum of technical knowledge. And presently arrangements began to be made (in some cases under difficulties due to the claims of vested interests) for the regular transmission of programmes.

Thus, an innovation, comparable in cultural importance to the introduction of printing, was launched tentatively upon a responsive Europe, before either the financial organisation of broadcasting services or their relations with the theatre, the musical profession, the press or the wireless industry had been properly settled, and while the conditions for good broadcasts were unexplored. Nor at that time—in advance of experience—could it be seen to what extent existing wireless services would be affected by, or would interfere with, broadcast telephony. Problems were in short largely left to the future, and the nations of Europe pushed on with the organisation of regular broadcasting services so fast that already by the end of 1924 not merely national, but international, regulation was becoming urgently necessary.

By Dec. 1925 there were over 90 broadcasting stations in Europe operating on wave lengths between 300 and 600 metres. In the hope of remedying this "overcrowding of the ether" an international union of broadcasting companies, with its seat at Geneva, was formed in April 1925, on the initiative of the British Broadcasting Co., but the functions of this body are at present limited to negotiating reciprocal concessions (technical and other) amongst members and making collective representations to the different national governments. Nevertheless, nationally at any rate, organisation and practice are now sufficiently stabilised for a general account of purposes and methods to be possible. Technical aspects are dealt with elsewhere; here we are concerned chiefly with "programme" considerations.

Programmes: Music.—As a broad classification, programme elements may be divided into music and speech. For broadcasting purposes, music, whether concerted or solo, instrumental or vocal, is best classified according to character and appeal, viz., as serious, "popular" and dance music. The proportions of each that are included in any day's or week's programmes vary according to the conceptions of the programme authorities, their resources in artists from day to day, and the demands of the public. This last is, and must remain, a source of controversy, since broadcasting is the only form of concert-giving in which the attempt is made to interest every sort of people every day. Agreed criteria are impossible, and the only sure guide is artistic feeling modified by such practical contact with the public as is possible through correspondence, the Press and discussions, but fortified by definite standards, and by a sense of the responsibility incurred—for it is in the power of the broadcasting organisation to bring the highest class of music to the very hearths of millions who have never before heard it, or, on the other hand, to debase the community's taste irretrievably.

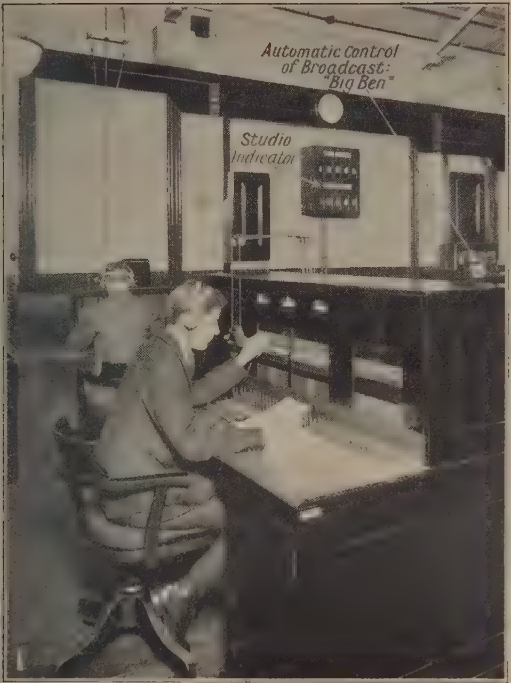
Broadcast Speech.—Broadcast speech includes (*a*) informative and practical utility matter such as news, market prices, weather reports, time signals, agricultural bulletins and notices of various sorts (*e.g.*, appeals for charity, police notices, club or association bulletins and notifications of dangerous illness to relatives whose address is unknown); (*b*) "talks," *i.e.*, short lectures or series of lectures on all sorts of subjects, critiques of literature, drama, music and films, courses of education addressed to schools in school hours or to adults, and debates; (*c*) important public speeches, ceremonies and events taken by a microphone on the spot; (*d*) religious services, either specially arranged for broadcasting, or taken by a microphone from church or chapel; (*e*) radio drama, a form of dramatic presentation in which all effects other than vocal have to be conveyed to the ear or suggested to the imagination, and which calls, therefore, for a special technique in playwriting and acting; (*f*) humorous entertainment; (*g*) advertisement; and (*h*) political or other propaganda.

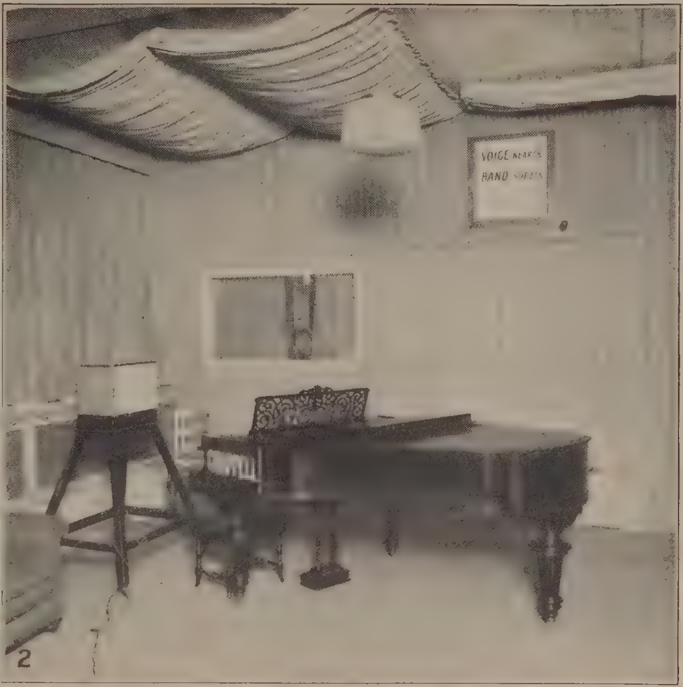
In addition there are miscellaneous special broadcasts, such as words of command for physical exercises performed by listeners at home, or messages from an explorer in the heart of a distant country. How many of these categories are admitted depends upon the constitution and policy of the broadcasting authority or concern; for example, advertisement and propaganda on controversial subjects are barred in Great Britain and certain other countries, while many stations (especially in America) are maintained solely for one or two of the named purposes.

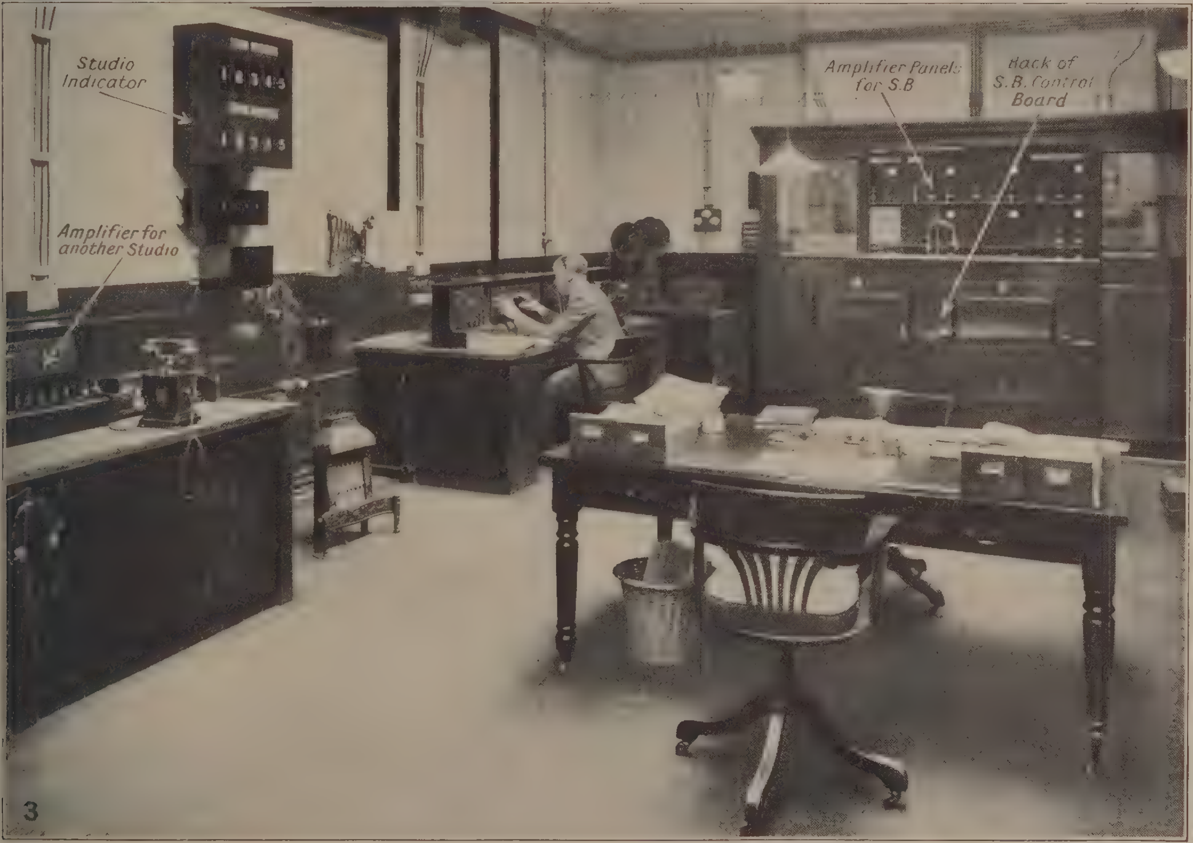
The Principles of Selection.—The mere catalogue of these activities is enough to indicate the immense social importance of broadcasting, but at the same time to display it as what it is—a means, and not an end. Its function is to render all these sorts of entertainment, all these departments of thought, all these services of information, accessible simultaneously to the maximum number of people in their own homes. But in the presence of so vast an array of material, selection must necessarily be exercised. So far, it is only under the heading (e) (*i.e.*, radio drama) that radio has created an expression-form peculiar to itself, and in all other respects programme-building is creative only in the sense that the programme-builders can create (or evoke and nurse) a mass-disposition towards certain aims and preferences. Practically, then, their power is no more—and also no less—than the power of selection. Even so, it is at present far from being an absolute power. Established interests such as the Press, the theatre and the musical industry, have in many cases safeguarded their special fields in various ways; and the technical requirements of transmission also operate to a certain extent as a check, in spite of the great improvements which have been made in the first three years of systematic practice. Nevertheless, it is gradually coming to be recognised by other interests that broadcasting has obtained a permanent hold, and, moreover, that it is really an addition to, rather than a substitute for, the older modes of intercourse.

Standards and Ideals.—It is coming to be recognised also, that from the social standpoint it is not only inevitable that programme-builders should select, but vitally important that their selection should be governed by ideals and standards defined by themselves as a rule of conduct. This question, already alluded to in connection with music, affects every other aspect of a programme service also. A well-developed national broadcast system has the ear of far more people than any two or three newspapers, and this, coupled with the fact that the microphone is the most intimate and insinuating of all known vehicles of general communication, makes it perhaps more potent for good or evil than any other social influence. A broadcasting concern, therefore, must, above all, be honest, *i.e.*, if not definitely propagandist, it must be incorruptibly disinterested. Modifications of the strict rule occur and are bound to occur—for a broadcasting service is not quite a "state within the state" and cannot in practice be inflexible—but in principle the broadcasting authority must follow its view of the public interest.

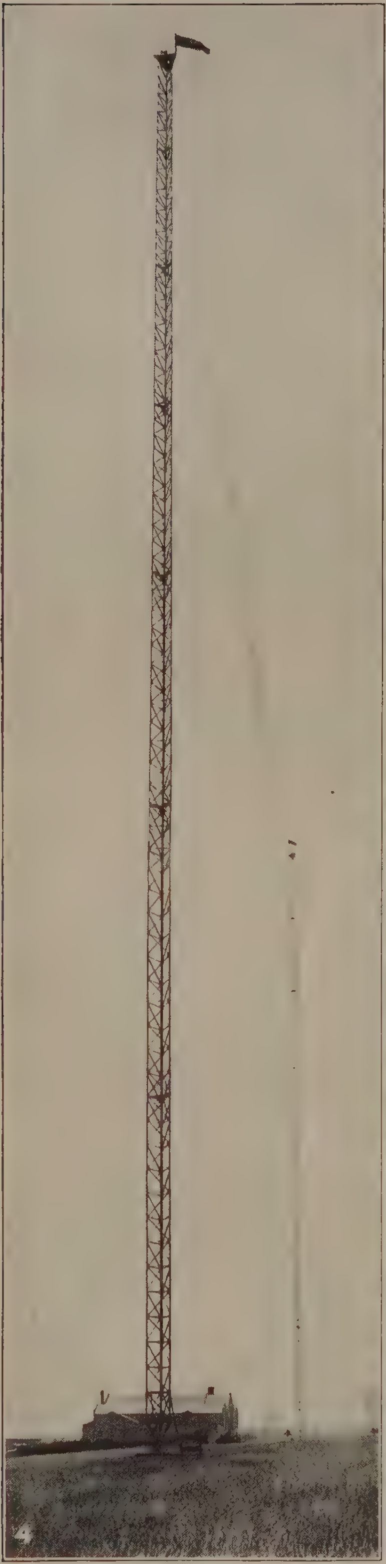
Alternative Programmes.—Nevertheless, as no one is entitled to dictate that the public shall hear only what he himself would care to hear, as the available programme material exceeds the capacity for dealing with it, and as the listener's temporary mood must be catered for, no less than his settled tastes—programme policy must seek to provide (so far as the technical and financial possibilities of each case permit) for more than one programme to be available at any given time for any given listener. The American system of unrestricted competition was expected to provide this very freedom of choice. But in practice the alter-

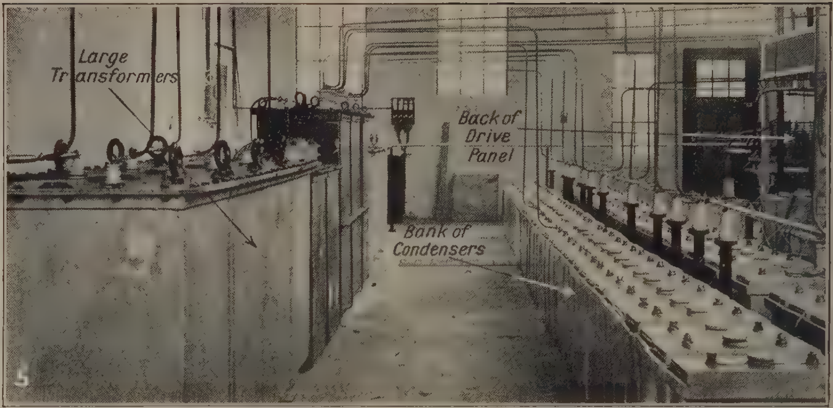

Automatic Control of Broadcast: "Big Ben"
Studio Indicator

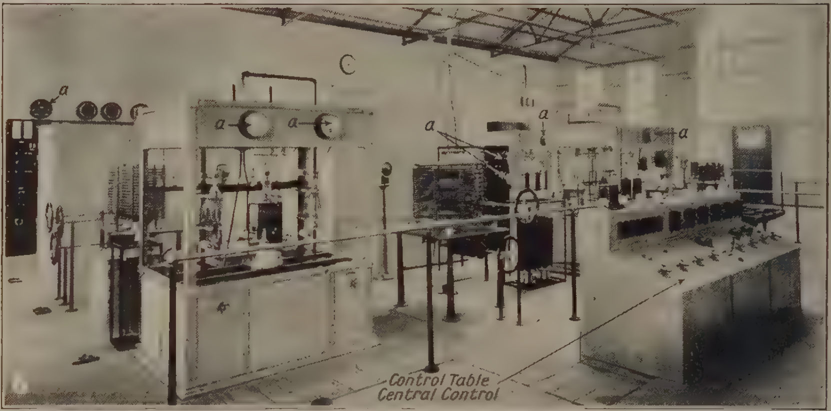



Studio Indicator
Amplifier for another Studio
Amplifier Panels for S.B
Back of S.B. Control Board
3

2. LO. LONDON STATION OF THE BRITISH BROADCASTING CO.
FIG. 1. Switchboard for simultaneous broadcast to 21 stations. FIG. 2. Studio, showing screen on which controlling engineer flashes instructions to artists. FIG. 3. Control room, showing engineer at work on amplifier.




Large Transformers
Back of Drive Panel
Bank of Condensers
5


a
C
a
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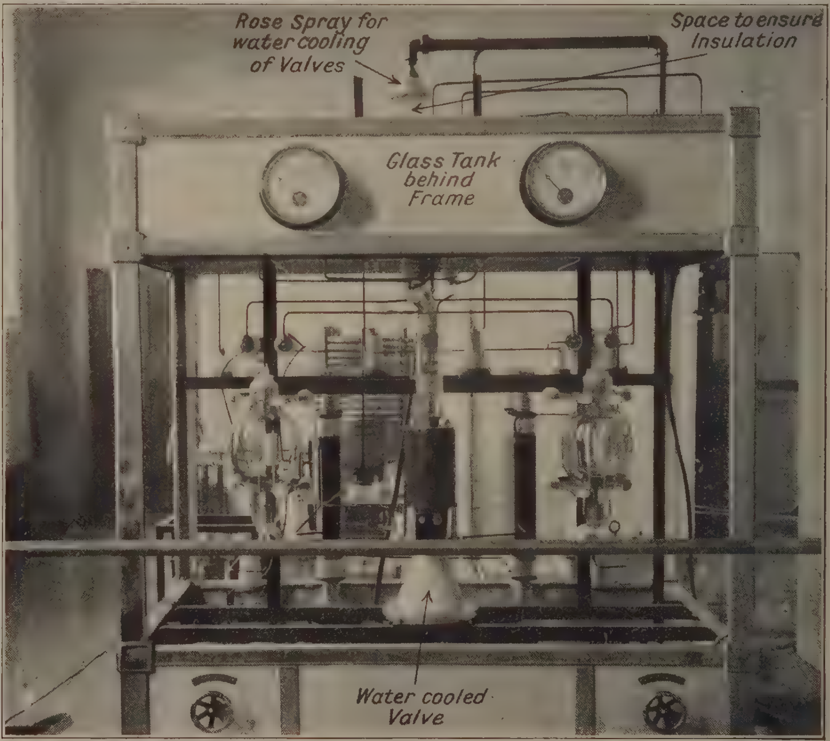
Control Table
Central Control
6


Rose Spray for water cooling of Valves
Space to ensure Insulation
Glass Tank behind Frame
Water cooled Valve

5XX. (DAVENTRY) HIGH POWER STATION OF THE BRITISH BROADCASTING CO.

FIG. 4. Aerial masts, and power house. FIG. 5. View showing condensers and transformers. FIG. 6. The arrangements for one-man control of transmission; meters (*a*) all visible at control table. FIG. 7. Drive panel, showing water-cooled valve.

atives simultaneously transmitted are apt to be simultaneously eceived also. Experience tends to show that the number of vailable programmes is simply the number of really and locally eparable wave-lengths; it is a function, therefore, of the selecivity of the average receiving set, the power of the stations and heir position. In Europe, in the present state of knowledge and f cost of popular apparatus, an effective service of "alternaive" programmes depends on (*a*) the skilful use of some "sinultaneous broadcast" system (see below), and (*b*) high-power ransmission, which gives great range to the individual station nd therefore, over a given region, fewer stations and more sepaation between wave-lengths.

The Process Explained.—The actual process of broadcasting, hough complicated in detail by the variety of the items broadast and their volume (which amounts for instance to about 6,000 transmission-hours annually for the system of the British roadcasting Co.) is simple enough in outline. Most of the erformances take place in a "studio," which is carefully aranged so as to give, for the necessarily small room, an acoustial condition that is pleasing to a musical judgment as applied to he receiver. This requires a certain amount of echo elimination, y drapery and otherwise. Speakers, singers and players address hemselves to the microphone, which reproduces in the form of lectrical pressure the variations of air pressure that impinge n the form of sound. These variations of electrical pressure are mplified finally to "modulate" the output, in the form of ether vaves, of the wireless telephony transmitter. An expert operator n a control-room, following closely the speech or music, continuusly makes fine adjustments of the amount of electrical impulse nodulating the transmitter to allow for changes of original ound volume, an operation necessitated by the fact that the ransmitter is of fixed and limited power. The transmitting gear roper is usually separate from the "studio," and may be as nuch as 70 or 80 m. away, connected with the studio by a speially connected and balanced overhead telephone line.

Outside Material.—Another class of broadcast which is of rowing importance is the picking-up at the place of origin of ublic concerts and public speeches, as well as of ceremonies, rowd noises, countryside sounds, etc. This is done by a portble microphone connected, not necessarily by wire, to the conrol-room; the special interest of these broadcasts to the listener s that they enable him to feel himself as a participant or memer of the audience. In the case of music, large-scale performnces are often, for psychological as well as acoustic reasons, nore successful as "outside" than as "studio" broadcasts, ut, of course, public halls, churches, theatres and opera stages, pen spaces and so on, all present special acoustic problems vhich have to be solved according to the special circumstances.

Simultaneous Broadcast.—Of outstanding importance in the rganisation of broadcasting is the simultaneous broadcast or "S.B." This involves a system of interconnected telephone ines by which a studio or other place of performance can be connected to as many transmitters as may be desirable or possible. Thus, in the case of Great Britain the London microphone may e connected to all stations of the British system for a news buletin, and immediately afterwards all, or some, stations (London ncluded) may be similarly connected to a microphone installed n a Manchester concert hall; or, again, the sound of the sea aken up by microphone on the shore at Plymouth may provide background for a drama performed in London and broadcast y Plymouth, London and all other transmitters.

Needless to say, "S.B." requires the closest timing and cordination over the whole system, and it is carried out most ompletely and successfully when all the stations of a country re under one management, as in Great Britain. In the United States and Canada the method is practised wherever a distributed etwork of stations happens to be controlled by a large corporaion. In Germany, where provincial feeling is strong, artistic esources well distributed and operation decentralised, "S.B." is usually practised only between a main station and its relay staions considered as a group. The "wireless link" (*i.e.*, the substitution of the telephone wire by a wireless telephone system) is sometimes employed where land line facilities are either unavailable or unsuitable.

Listening Problems.—Lastly, the listeners' end of the transmission system presents problems of its own. Private receiving sets are divided, conventionally rather than scientifically, into "crystal" and "valve" (vacuum tube sets). The sounds that they generate in response to the excitation of their aerials are heard either in headphones or from loud-speakers, the latter varying in power from small drawing-room instruments to large-scale installations capable of reaching crowds assembled in halls and open spaces. Listening conditions vary from room to room, and listeners rarely attempt to create for themselves the acoustic and psychological atmosphere in which to receive broadcast properly. More important still, the receiving sets themselves vary in sensitiveness, selectivity and other qualities, according to design, workmanship, nature of aerial and earth employed. Over these variables the broadcasting authority or company as such has usually little, if any, direct contact. But in actual practice the listener's tastes and means, the broadcasting service's programmes, technique and finance, all react upon one another intimately. The crucial distinction in the nature of sets, though roughly coinciding with that between "crystal" and "valve," really turns upon the distance at which a station can be heard without extraneous interferences accompanying, and more or less spoiling, reception.

There are in fact two distinct and—at present—opposite conceptions of "listening," from the listener's point of view. On the one hand, there is the desire—which may arise from technical interest, or from dissatisfaction with the local programme, or both—to listen to far-away stations. This has produced the long-distance set, which is so sensitive as to be able to pick up 1·5 kw. stations as much as 1,000 or even 2,000 m. away, but which, from the very fact of this sensitivity, is more or less open both to local and remote electrical disturbances, such as those caused by "oscillation" (re-radiation from a nearby receiving set which, when mishandled, acts as a small transmitter), by heterodyning between stations, by "atmospherics," by harmonics emitted by powerful W.T. stations, by the spark transmitters still largely used by ships and occasionally, by inductive effects, by power due to alternating-current installations.

On the other hand there are the listeners who are content with the programmes of the nearest station (which, as we have seen, do not necessarily depend on that station's own artistic resources) either because they have little or no interest in the technical side of wireless telephony, or because the local programmes are, in fact, artistically and otherwise satisfying. The interest of such listeners is concentrated upon the programme. The receiving apparatus that they need is simple, easily manageable, and owing to the nearness of the station and the consequent strength of its signals, free from extraneous interference (other than purely local troubles such as oscillation). For the listeners thus equipped variety of choice of programmes obviously depends upon the power of the stations around them and the extent to which "simultaneous" broadcasting is feasible, and, therefore, ultimately on the technical and financial organisation and unity of the broadcasting system.

For listeners equipped with long-range sets, on the other hand, interference limits both their theoretically complete freedom of choice and the artistic satisfaction that they can derive from listening. And thus, although an element of wonder will always adhere to wireless reception, public interest in the broadcast movement tends to centre itself more and more on the programmes rather than on the means of receiving them. And this in turn brings forward new problems of extending, by co-operation between national, as well as by co-ordination of local and regional, broadcasting stations, the field whence material for "alternative" programmes can be taken and locally re-broadcast.

International Aspects.—We may now glance at broadcasting in its international aspect, and more especially European broadcasting, as a possible cementing influence between nations now becoming dimly conscious of a unity that the foreground of their history seems to deny. In 1925, when all countries of western, northern and central Europe had to a great extent absorbed broadcasting as a normal element in their national life, it became manifest that apart from incidental divergences, all broadcasting concerns, acting quite independently of one another, were putting much the same classes of fare before their respective publics, and thereby disclosing a cultural unity in Europe hitherto scarcely suspected. The barriers of political and racial geography were over-leaped. In each country, those of the public who possessed long-range listening-sets acquired (in spite of the interferences which hamper this type of reception) a double interest in remote stations, on account of their transmissions and on account of their interferences with home stations. Strange place-names—and even, through modulated telephony, distant personal voices—became familiar. The movement in favour of an international language acquired new life and importance. In fact, a whole new world of possibilities of European intercourse is being opened up.

Measures for Co-ordination.—While trans-oceanic wireless telephony remained fragmentary and impure even as late as the winter of 1925–6, the co-ordination of European broadcasting was already a clamant necessity. The work of the central office at Geneva, which has been mentioned above, on the readjustment of wave-lengths, is still tentative and dependent on goodwill. And behind this question yet others await solution, for example, problems of international copyright and rights of relay and re-broadcasting as between concerns of different nationality, limitation of *ex parte* propaganda, exchange of information as to artists and the relaying of pronouncements or proceedings of international significance. In sum, European interstate broadcasting is still in its infancy. But this at least is certain, that broadcasting—a subtle but at the same time a very vulnerable element in the new European life—depends, for its effectiveness, even within the national frontiers, upon international goodwill; and, allowing for the steady progress of technical knowledge, it is reasonably certain that this interdependence will in a not very distant future become world-wide.

Progress in Various Countries

United States.—This country was the pioneer in the field of large-scale broadcasting and it was there that the new medium received its name. The Press and commerce were prompt to recognise the possibilities of this method of getting into immediate and close touch with all classes of the population. Countless radio firms sprang up which, without delay, placed on the market both complete apparatus and the components necessary for the home assembling of sets, and soon a large number of stations of varying power (mostly small) were "on the air." Licences continued to be issued lavishly and in Dec. 1925 there were still 578 stations transmitting some kind of entertainment (apart from those specialised to transmissions of particular classes), and maintained by the proceeds of broadcast advertisement, profits on the sale of wireless gear, or in various indirect ways.

As a result of transmitters having been erected without a concerted plan, there was by 1925 a state of very considerable interference between locally overcrowded stations, while large tracts of the country were ill-served. Moreover, in many cases the quality of the programmes no longer satisfied the now experienced public, and some form of higher control and co-operation in the broadcasting movement was being demanded from both inside and outside the broadcasting system, the more urgently as the power employed increased and the possibilities of long-range work came into the foreground. Of the stations at present operating, 197 possess a power of at least 0·5 kw., and during 1925 a number of larger transmitters were erected, including a 50 kw. station at Bound Brook, N.J., and also a station for reception of European broadcasts at Belfast, Maine. Certain stations have a European reputation, for instance WGY. of Schenectady, N.Y., and KDKA., East Pittsburgh, which has experimented extensively in the very short wave-lengths.

The situation, therefore, was ripe for review when the Fourth National Radio Conference was held in Nov. 1925. At that Conference Mr. Hoover, Secretary of Commerce, announced a changed governmental policy in the words, "We can no longer deal on the basis that there is room for everybody on the radio highways," while the concerns participating in the conference declared, for their part, in favour of restrictions on advertising. Thus the limitation of stations and the adoption of a standpoint in the question of the cultural rôle of broadcasting have been established in principle. Opinions vary considerably as to the actual methods of solving the administrative and financial problems involved. A national system financed out of licence revenue and taxation on receiving sets are each widely advocated, but for the near future at any rate the indications point to a policy of amalgamation and grouping of various privately owned stations in order to cut down wasteful expenditure and to make the highest and most expensive class of programmes available over wider areas than has been the case hitherto. These developments are in fact already in progress.

Great Britain.—In Great Britain as early as 1919 experimental transmissions were conducted for a time at a station of the Marconi Co. at Chelmsford, but these were not continued, and in 1922, on the initiation of wireless amateurs, broadcasting was begun afresh from a station at Writtle, near Chelmsford. Shortly afterwards, as the result of negotiations between the Postmaster General, the leading radio firms and other interests, the British Broadcasting Co. was set up to work a single national system of stations for Great Britain and Northern Ireland. The original licence granted expired in 1924, but after a Govt. inquiry had in 1923 reviewed the experience gained up to date, it was renewed till the end of 1926. In Dec. 1925 a second governmental inquiry commenced its sittings in order to consider the situation that would arise in 1927.

Constitution of the B.B.C.—The "B.B.C." is constituted as a limited company, the shareholders being wireless manufacturers and traders. The Board of Directors is composed of representatives drawn from the industry with an independent chairman nominated by the Post Office and a managing director as executive officer. The company, as such, neither manufactures, sells, nor recommends apparatus, and its revenue is derived from a share in the proceeds of receiving licences levied by the Post Office. Although its nominal constitution is that of a commercial company, the B.B.C. is in effect a public service, since the dividends payable to those who provided the capital (which is very small in proportion to revenue) are limited to 7½% per annum, reserves are allowed only for covering depreciation and the like, and the Postmaster General has certain powers of limiting the company's revenue.

As the general description of broadcasting methods and aims already given is based very largely upon British practice, it is only necessary here to allude to a few particular features of the British system. The scheme of unified control over a nation-wide system, worked in close collaboration with the Post Office, has made possible the development of simultaneous broadcasting (see above) on a scale unknown elsewhere. The organisation is bound to work in the spirit of British constitutional practice that is, democratically and with studious avoidance of biased or tendencious transmissions. Advertisements are not accepted. The Government exercises a certain control over the character of the transmissions and the general policy of the "B.B.C." and has a right to require a part of programme time to be given to non-contentious matter (such as agricultural bulletins) supplied by public authorities, and the Board of Education and local educational authorities co-operate officially with the broadcasting service in the development of educational transmissions. Of special interest and significance is the institution of religious advisory committees; on these every Christian church that is numerically important in Great Britain is represented, and they have succeeded in reaching an agreement as to the form and substance of "studio" services that shall be acceptable to Roman Catholics and Protestants alike.

In 1925 the system of the B.B.C. comprised main stations (1·5–3 kw.) at London, Bournemouth, Cardiff, Birmingham, Manchester, Newcastle-on-Tyne, Glasgow, Aberdeen and Belfast; relay stations (0·2 kw.) at Plymouth, Swansea, Liverpool, Stoke-on-Trent, Nottingham, Sheffield, Leeds, Bradford, Hull, Edinburgh and Dundee; and a high-power (25 kw.) at Daventry. This system provided approximately 90% of the population with one programme daily on crystal receivers, and some 35% with an alternative programme as well. Developments are in prospect which involve a general increase in power and the re-sitting of transmitters on a regional scheme, so as to provide an alternative service on a much larger scale. The number of licencees totalled in Dec. 1925 over 1,500,000, which represents an "audience" of perhaps as many as 10,000,000 people.

Irish Free State.—In the Irish Free State, broadcasting began in the winter of 1925–6 with the opening of a main station at Dublin. From this it is intended to supply other parts by means of a relay system. The Govt. controls the service.

France.—In France broadcasting began in Nov. 1922 with transmissions from the experimental station, "Radiola" of Paris, and from the military W.T. station of the Eiffel Tower. These were followed at intervals by "P.T.T." (the research station of the École Supérieure des Postes et Télégraphes in Paris), by *Petit Parisien* (a station owned by the newspaper of that name), and a few small stations in other parts of the country. In 1924–5 the Cie. Française de Radiophonie set up "Radio Paris" (the successor of "Radiola"), and provincial stations at Toulouse and Lyons, while the post-office set up "P.T.T." stations at Lyons, Toulouse, Marseille and Grenoble; others are projected at Lille, Strasbourg and Angers. The Eiffel Tower continued to broadcast, and various small stations operate in different parts of France. No broadcasting monopoly has been granted, and stations receive neither subsidies nor licence-revenues, expenses being met out of royalties on apparatus, subsidies by interested parties and public subscriptions. At present, then, there is no co-ordinated national system, but two opposed groups; on the one hand, the state with its P.T.T. stations and the Eiffel Tower, and a reserve power of promoting legislation, and on the other hand the private wireless enterprises headed by "Radio-Paris" which, in Dec. 1925, formed a union for joint action and in 1926 commanded considerable support in the Chambers and the Press.

Italy.—In Italy, the development of broadcast telephony was slow, until a decree of Oct. 1925 removed many irksome restrictions, both economic and legal, and *inter alia* enabled stations to accept advertisements. The Unione Radiofonica Italiana (an organisation constituted on commercial lines) now operates stations at Rome and Milan. A small military station at Centocelle near Rome has also broadcast occasionally. Other stations are projected. The Govt. reserves to itself control of the system for a certain period of time daily, with a view to the broadcasting of special notices.

Spain and Portugal.—Spain, arriving late in the field, endeavoured to catch up, in a few months, the progress which had been made by other European countries in two or three years. Many different organisations offered to erect stations, and in all, up to Dec. 1925, about 24 public transmitting licences, five in Madrid alone, had been conceded. There is a small receiving licence charge, but no portion of its proceeds is paid over to the broadcasters, who, for the most part, derive their revenue from royalties on apparatus manufactured by affiliated concerns, and from sums paid for broadcast advertisement. Some installations, operated by wireless clubs, are supported by voluntary contributions. Attempts are being made to consolidate these irregular services into a national system. In Portugal, broadcasting has not yet advanced beyond the state of occasional transmissions by small stations.

Belgium.—In the winter of 1925–6 Belgium possessed but one regular broadcasting station, *i.e.*, Brussels, opened in Nov. 1923, which is owned by the Société Radio-Belgique. This company does not hold a monopoly, nor does it derive revenue from licences, being, therefore, dependent upon a share in royalties on apparatus, on income from advertisements and on voluntary contributions. Other stations are projected at Antwerp and Liége.

Holland.—In Holland, as in Belgium and France, the question of finance has considerably retarded development. The first station was built at Hilversum near Utrecht, and commenced operations as early as 1919, relying upon voluntary support and some small amount of commercial subsidy. In spite of continuing financial difficulties a new plant was installed in the winter of 1924–5, and since then Hilversum has become one of the best known stations in Europe. There are also two or three small stations which broadcast only occasionally. Hitherto listeners have not been required to take out licences, nor has the Government subsidised the broadcasting concerns in other ways. A national concessionaire company supported by licence revenue is, however, being formed.

Germany.—Proposals by the Govt. and others for the establishment of broadcasting were made in the early part of 1922, but economic conditions delayed their translation into fact, and it was not until Oct. 1923 that the first regular station (Berlin-"Voxhaus") was opened. As on the one hand the Govt. could not shoulder the responsibility for possible losses, and on the other the constitution of Germany is, to a large extent, federal in character and her artistic resources well distributed, it was decided to de-centralise control without admitting free competition, and to create separate broadcasting organisations which between them covered the bulk of the population.

The concession for transmitting entertainments was granted to "Die Deutsche Stunde," that for transmitting news, lectures, etc., to "Buch und Presse." These in their turn formed programme companies (in each of which they hold a controlling interest) in the various cities selected as the sites of stations. The transmitters are the property of the Post and Telegraph administration, and are run by government engineers under government control, while the programme work is the task of the companies.

The financial arrangements between the companies and the Govt. are complicated, and here it must suffice to say that provision is made for pooling a part of the licence revenue (so that, for example, Berlin receipts are available to assist the Königsberg or the Stuttgart company) for limiting shareholders' profits as in Great Britain, and for returning surpluses to the Reichspost. In the spring of 1925, the programme companies combined for certain purposes in a central organisation known as the Reichsfunkverband. The revenue from receiving licences (paid in monthly instalments to the postman) is divided between programme companies and the Post Office.

After the opening of the Voxhaus station in Berlin, the remaining stations of the national system were built in quick succession. These are:—

Berlin (Voxhaus), Frankfort-on-Main (with relay at Cassel), Hamburg (relays, Bremen and Hanover), Münster (relays, Dortmund and Elberfeld), Munich (relay, Nüremberg), Leipzig (relay, Dresden), Stuttgart, Breslau, Königsberg. In addition, a new station at Berlin (Witzleben) was brought into operation in 1925 and the programme service from "Voxhaus" was extended to the powerful W. T. transmitter of "Königswusterhausen," northeast of Berlin, which was adapted for telephony. Other stations are under construction, or projected. Important advances in the direction of higher power were made in the latter part of 1925.

Parallel with the ordinary broadcasting system, there is a network of small governmental stations in some 70 different towns which are intended for the local re-broadcasting of government communications and addresses from the "Deutschlandsender" (Königswusterhausen). It is probable that in future this system will be used for educational purposes also. At the end of 1925, the total of licensed listeners was about 1,000,000.

Austria.—The Vienna broadcasting station (opened Oct. 1924) is owned and worked by the "Radio-Verkehrs A.G." a monopoly formed by the fusion of various trade interests. Its revenue is derived partly from a share in licence fees, and partly from royalties on the sale of apparatus. The cost of licences varies according to the income of listeners, and the purpose of the installation, but it cannot yet be said that broadcasting is within the reach of the masses. Educational and other public institutions (*e.g.*, those for the blind) are exempt from paying fees. Other stations have been or are being erected at Graz, Innsbruck and Salzburg, and a high-power station on the Rosenhügel near Vienna.

Switzerland.—In Switzerland broadcasting began with the radio clubs, but the Federal Govt. very early came to the assistance of the movement. In a land where three different languages are regularly spoken, it is difficult, if not impossible, to maintain a centralised service, and for this reason separate companies have been formed for the purpose of broadcasting entertainment in the various regions of the republic, all of which receive a generous measure of state support. The stations operating in Dec. 1925 were Zurich, Lausanne, Geneva and Berne, and a station was under construction at Basel. The charge for receiving licences varies according to the nature of the apparatus. Four-fifths of the licence revenue is paid over to the programme-transmitting companies.

Denmark.—In Denmark, after a period of irregular, and even unlicensed, broadcasting (1921–3) the Govt. permitted the broadcast transmission of concerts and entertainments by duly appointed clubs through government stations. This system was initiated in the summer of 1923, developed in 1925 into an official broadcasting service, managed by a Radio Council (Radioraadet), on which are represented the amateur wireless clubs, the Press, the Artists' and Musicians' Union, Government Departments, educational institutions and listeners' societies. The Govt. contributes the technical officials and plant. A methodical arrangement of new stations is projected, but the council at present broadcasts from a number of unequally equipped government and club stations, the greater part of the programmes being relayed from Copenhagen. The cost of receiving licences varies according to the apparatus and the uses to which it is put.

Sweden.—In Sweden, after preliminary experiments and negotiations, a sole concession was granted in Jan. 1925 to the "Svenska Aktiebolaget for Radio-tjanst, a syndicate formed by the Press and the wireless industry. During 1925 a network of 10 main and relay stations was set up by this organisation and the postal and telegraph authorities jointly, the former providing the programmes and the latter the plant and the engineer staff. Of the proceeds of listeners' licences half goes to the company. Direct advertisement is admitted, but confined to a very small portion of programme time; the privilege moreover is practically limited to organisations which share in the general liabilities of the syndicate. Owing to inequalities in the distribution of the population—and therefore of artistic resources—the greater part of the programmes are relayed from the Stockholm Station. The high power W.T. Station of Karlsborg is to be adapted for telephony and broadcasting and new relay stations are projected at various points on the coast.

Norway.—In Norway, since April 1925, control has been centred in the "Kringskastingselskapet," a company of wireless manufacturers and traders, which works in close co-operation with the postal authorities. The station at Oslo began regular transmissions in the summer of 1925, and soon acquired a wide reputation. In addition, a station at Aalesund (to be transferred to Haugesund) serves the needs of sailors and fishermen. Broadcasting is maintained by licence revenue and a share in taxes upon apparatus.

Baltic Countries.—In Latvia, Estonia and Finland, there are small broadcasting stations at Riga, Revel and Helsingfors respectively. Other stations are planned in Finland. In Lithuania, no service had yet come into operation at the end of 1925. In Poland, there was in 1925 only one low-power station, at Warsaw; but developments were under consideration by the Govt. and the radio industry jointly.

Russia.—Wireless telephony was released for the use of the general public in Sept. 1924 and from Oct. 1924 weekly concerts were sent out by the Moscow central station. Other stations came into being in Moscow and elsewhere, and in 1924–5 the problem of the broadcast service was tackled as a whole. The Govt. realising the great possibilities of broadcasting as a means of direct communication with all classes of an enormous and scattered population, promoted the establishment of wireless clubs and of technical advice offices and provided for the equipment of halls and open spaces in and around which a great number of listeners could be gathered. In the special conditions of Russian village life, communal listening is of course of prime importance, but individual receiving licences are also issued. The broadcasting company (Radio Peredacha) is a combination between certain electrical firms, the Rosta news agency and the Commissariat of Posts and Telegraphs. It receives the greater part of the licence yield and possesses the monopoly for the sale of apparatus.

At the end of 1925 stations were either in operation or in course of construction at Moscow, Leningrad and Kiev, and other transmitters are being erected, or to be erected at different centres both in European and Asiatic Russia. The existing wireless telegraphy transmitters are to be adapted to telephony and placed at the disposal of the Radio Peredacha when not required for the ordinary traffic, and it is expected that eventually 50 broadcasting transmitters will be in daily operation.

Hungary.—In Hungary a broadcasting company, formed by the amalgamation of a Budapest concern supplying concerts, etc., over the wires to telephone subscribers, with a leading newspaper, works a station at Budapest, in conjunction with the Posts and Telegraphs and with the wireless club of the Technical High School. Receiving licences are granted at a cost varying according to whether private reception or loud-speaker delivery in public is intended, and also according to geographical situation. Special licences are required by manufacturers and dealers, who are compelled to take out a certificate of technical efficiency and to guarantee that the sets sold by them do not reradiate. But concessions in the licence fees are made for receivers used exclusively for experimental work, and invalids, blind people, hospitals and educational institutions pay no fees.

Czechoslovakia.—In Czechoslovakia, a broadcasting company, formed under the name of Radio-Journal, began regular broadcasting in May 1923 from Kbely, near Prague. Somewhat later, another station was set up at Komarov, near Brno (Brünn) and at the end of 1924, Kbely was replaced by a more modern installation at Strasnice, also near Prague. A problem of peculiar political difficulty, the provision of broadcast programmes for the German-speaking population, was eventually dealt with by reopening the old Kbely transmitter in Oct. 1925 for lectures, etc., in German. As yet the country is inadequately served, so far as crystal-set users are concerned. Relay stations are projected for various centres, but future developments are conditional upon popular support or upon capital being forthcoming in anticipation of such support. In the present company the Govt. holds a 51% interest.

The Balkan States.—In Yugoslavia, Greece, Bulgaria, Rumania and Turkey, little progress has so far been made in wireless telephony. Apart from the United States, the only countries outside Europe in which broadcasting services have so far become regular and systematic are the Dominions of the British Empire. The republics of Central and South America, as stated above, contain amongst them many thousands of wireless amateurs, but broadcasting proper is still embryonic.

Canada.—Canada followed the example of the United States early, but on a much smaller scale and with a greater regard for interference difficulties that might arise. Of the 43 stations listed by the Canadian Govt., in June 1925, the most important were the 10 stations of the Canadian National Railways which form a chain across the continent. These not only broadcast entertainment and information but also enable the management of the railway to keep in touch with its widely-dispersed staff. The remainder are owned by newspapers, religious bodies, radio firms and others, operating practically independently. In many cases programme time has to be shared between adjacent stations as in the United States, and thus there is little or no "alternative" service. One station, at Winnipeg, is operated by the Govt. of Manitoba, which enjoys a certain autonomy in the management of local wireless and the disposal of licence revenue. An interesting feature in the Canadian administration is its corps of part-time inspectors for dealing with interference matters. Wave-length agreements have been negotiated with the United States.

South Africa.—In South Africa stations have been opened at Cape Town, Durban and Johannesburg. Licence fees are heavy and the juxtaposition of languages creates difficulties, but the new method of intercourse is popular in both town and country.

Australia and New Zealand.—In Australia stations owned and operated by companies and financed out of licence revenues have been established at Sydney (two stations), Melbourne (two stations), Hobart, Adelaide and Perth. At Brisbane there is a Queensland Govt. station.

In New Zealand, after a period of intermittent private broadcasting, a national system came into force, which is supported by licence revenue and maintains stations at Wellington, Auckland, Christchurch and Dunedin.

In India and Burma broadcast transmissions were, until 1926, given only from a few small local stations, but an all-India scheme was authorised at the beginning of that year.

(J. C. W. R.)

TECHNICAL AND SCIENTIFIC ASPECTS

In broadcasting the transmission is sent out from one station for the purpose of reaching a large number of receivers scattered over an area, whereas other forms of telephony generally involve two-way transmission between two terminal stations only. Moreover, the apparatus used in broadcasting not only must transmit intelligible speech but must also transmit the subtle intricacies of vocal and instrumental music with the highest degree of faithfulness and freedom from distortion.

Stated briefly, the purpose of a broadcasting system is to pick up air-pressure variations due to sound waves, transport a facsimile of them by radio means to a multitude of receiving points, and reproduce at these points sound waves as nearly as possible like the original ones. The pickup or input end and the reproducing or output ends of the system, respectively, are composed of two pieces of apparatus which in principle are essentially like the corresponding parts of the ordinary telephone instrument. At the input end is a telephone transmitter or microphone to produce electric current having variations in intensity corresponding to the variations in air pressure on the diaphragm caused by the sound waves. At the output end some form of telephone receiver is used to reproduce from such electric currents the corresponding sound waves. Since the method of transporting the electrical counterpart of the sound waves from the microphone to the telephone receiver is not by electric currents or waves on wires as in ordinary telephony, but by electromagnetic waves in free space, the mechanisms which intervene in the process are of a distinctive character.

The radio transportation or transmission is accomplished by sending out from the transmitting station electromagnetic or radio waves which vary in intensity in the same manner as do the telephonic currents from the microphone. At receiving stations these radio waves are intercepted and their intensity variations converted back into intensity variations of a telephonic current, which actuates the telephone receiver. There are several distinct processes involved:—

1. Producing the high-frequency alternating electric current which, when introduced into a radio antenna, causes the radiation of electromagnetic waves. This current is produced by an electrical "oscillator."
2. "Modulating" this current, or causing its intensity to vary in the same manner as does the intensity of the telephone current from the microphone.
3. Radiating the electromagnetic waves by causing the modulated high-frequency current to flow in a radio antenna or aerial.
4. Intercepting some of the radiated waves energy by a receiving antenna in which modulated high-frequency currents similar to those flowing in the transmitting antenna are thereby caused to flow.
5. "Detecting" or converting the modulated high-frequency current into telephone currents having the same variations in intensity.
6. At both the transmitting and receiving stations, amplifying the currents to increase their power and to make up for losses in power suffered in transmission through the various parts of the entire system.

The mechanisms involved in items 1, 2 and 3 constitute the transmitting system, while those involved in items 4 and 5 constitute the receiving system. In the transit of the waves through space between these two terminal systems lies the field of radio transmission.

Thermionic Valve.—The most important device used in the transmitting and receiving systems is the ubiquitous vacuum tube or thermionic valve. It is employed in the most modern apparatus for performing many functions, including generation of high-frequency currents, modulation of these currents by telephonic currents, detecting or converting the high-frequency currents to reproduce telephonic currents, and amplifying both high-frequency and audio-frequency (telephonic) currents (*see* AMPLIFIERS). Discussion of the fundamental principles underlying the six processes itemised above and of the vacuum tube which plays such an important rôle in carrying them out will be found under WIRELESS TELEGRAPHY AND TELEPHONY (*q.v.*) and TELEGRAPH (*see* 26.529). This section is concerned only with those features of radio telephony which are of special importance in broadcasting.

THE TRANSMITTING SYSTEM

The transmitting system comprises the microphone (*q.v.*), which is placed at the studio or theatre, and toward which the sound waves of the voice or instrument are projected; the amplifier and control devices, which magnify the electric currents from the microphone by the desired amount; and the radio transmitting station, which sends out radio waves modulated in accordance with the amplified microphone currents.

Microphones.—Highly specialised forms of microphones (*q.v.*) are necessary in order to respond accurately to the wide range of sound frequencies and intensities of speech or music. The music, for instance, that comes from a symphony orchestra consists of tones which range from fundamental bass notes of less than 100 vibrations or cycles per second up to harmonics at 5,000 cycles or more. Thus it covers a range of frequencies of at least 5,000 cycles or, as it is expressed by the engineer, a band of frequencies at least 5,000 cycles wide. One kind of microphone in wide use consists of a tightly stretched duralumin diaphragm having two carbon microphone buttons attached to opposite sides of it at the centre. The two buttons are connected with the electrical circuit in such a way that distortion tends to be balanced out. The placing of the microphone with reference to the performers and the acoustic qualities of the surroundings are of great importance in achieving the best results. For this reason, where possible, the programme is performed in a studio room especially designed for control of placing, sound absorption and echoes.

Amplifiers.—Since the range of volume or loudness covered by the programme may be very large, the amount of amplification applied to the microphone currents before the currents go to the radio transmitter must be adjusted frequently in order that they may neither overload the transmitter, giving rise to distortion, nor fail, through weakness, to actuate the transmitter sufficiently. The amplifier adjustment, therefore, requires to be manipulated by a control operator who is provided with a radio receiver so that he can hear the programme exactly as it is heard by the radio audience. To guide his judgment further in manipulating the volume control, the operator is usually provided with an electrical device called a "volume indicator," which gives him a visual indication of the strength of the telephonic current at the output of the amplifier. The amplifier and control apparatus, and the radio transmitter, as well as the wire telephone circuits between them in case they are physically separated, must be carefully designed to transmit the telephone currents without distortion.

Transmitters.—The radio transmitters employed in broadcasting are not different in principle from those employed in other forms of radio telephony, but are designed with special attention to stability, freedom from distortion and purity of transmission. In most types the telephone currents delivered from the control apparatus are amplified and impressed upon the oscillator tubes, which generate high-frequency currents. The output of the oscillator is thus modulated to correspond with the original sound variations. In the smaller power transmitters the modulated high-frequency currents then go directly from the modulating system to the antenna, but in some larger equipments amplifiers containing powerful metallic, water-cooled vacuum tubes are interposed. The antenna systems do not differ materially from those used in modern wireless telegraph installations.

Carrier Frequencies.—The assignment of carrier frequencies to broadcasting stations is an important consideration. When there is no modulation—that is, during the silent intervals of a programme—a broadcasting station sends out waves of a single frequency as in continuous wave radio telegraphy. This frequency is known as the carrier frequency, and is expressed in kilocycles of thousands of individual waves or vibrations per second. When modulation takes place by speech or music there are also transmitted two "side-bands" or sets of waves which occupy two bands of frequencies, one on either side of the carrier, each about 5,000 cycles wide, making the total transmission cover a band some 10 kilocycles in width with the carrier frequency in the middle. The frequency range available for broadcasting is limited, being, for instance, in the United States and Canada, from 550 kilocycles to 1,500 kilocycles. Thus there are only 95 non-overlapping 10-kilocycle bands or channels. Two stations in the same service area cannot occupy the same band or even closely adjacent bands without causing interference, so it is necessary to assign station frequencies in accordance with some form of geographical zoning system, and the total number of stations which can operate simultaneously is definitely limited. In popular usage the wave-length in metres is commonly used as a measure of the carrier frequency of a station, and in classified lists of stations both the carrier frequencies and wave-lengths are often given. The numerical relation between the two is the same as for any propagated wave motion, either one being equal to the velocity of propagation divided by the other.

THE RECEIVING SYSTEM

The functions of the receiving system are (*a*) to collect the radio wave energy in its antenna, in the form of high-frequency currents, (*b*) to select to the exclusion of other channels the currents lying in the band of frequencies occupied by the station to which it is desired to listen and, then, (*c*) to amplify these currents and (*d*) to convert them into audio-frequency (telephonic) currents which are in turn amplified and delivered to the telephone receivers or a loud speaker.

Forms of Antennae.—Two kinds of antennae are in common use, the one an elevated wire similar to a transmitting antenna, and the other a loop antenna consisting of a coil of a few turns of wire wound on a frame or other support. The former is electrically more efficient, but the loop being relatively small is often more convenient. The selecting of stations is done by means of tuning circuits having electrical inductances or coils and electrical capacities or condensers. These are adjustable, so that the circuits may be tuned to respond most strongly to currents in the band of frequencies sent out by the station it is desired to receive. Making these adjustments is known as "tuning in."

Receiving Sets.—In the arrangement and form of the tuning circuits and the vacuum tube amplifiers, receiving sets have a wide variety of differences in detail, but broadly they fall into three main classifications: (1) regenerative sets, (2) high-frequency amplifier type sets, (3) intermediate-frequency amplifier (superheterodyne) type sets. In addition to these types there is a class of much simpler and less sensitive receiving sets known as "crystal sets," which contain no vacuum tubes. A crystal set consists merely of an antenna, the tuning circuits and a "crystal detector" which serves to convert the modulated high frequency currents into audio-frequency (telephonic) circuits. A crystal detector is a device which utilises the electrical rectifying properties of certain crystalline minerals. The lead ore *galena* is one mineral thus commonly employed.

Regenerative Sets.—In regenerative sets a controllable coupling of some kind is provided between the output and input circuits of the amplifying or detecting tube or tubes, so that some of the amplified signal voltage may be fed back into the tubes again and again and be reamplified many times. This gives more effective use of a small number of tubes. Such sets when the "feed back" coupling is wrongly manipulated will generate continuous high-frequency oscillations which cause waves to be sent out from the antenna as at a transmitting station. These waves may be a troublesome source of interference to other receivers, and for this reason a decline in the use of regenerative sets is being forced by public opinion.

High-frequency Amplifiers.—In the second type (high-frequency amplifier) the high-frequency currents are amplified by a multi-tube amplifier before being impressed on the detector tube, which converts them to audio-frequency currents. If no precautions are taken to avoid coupling between the output and input of the amplifier this type may also be regenerative. Various expedients are employed in the design and construction of high-frequency amplifier types to guard against regeneration and to make them stable and non-oscillating.

Intermediate-frequency Type.—In this type the modulated high-frequency currents from the antenna are combined in a converter tube with continuous high-frequency currents generated by an oscillator tube circuit. From their interaction in the converter tube there results a modulated intermediate frequency, usually of the order of 50 kilocycles. The intermediate-frequency currents are amplified and passed to a detector tube, which reproduces audio-frequency currents from them. This type of set is stable and easily adjusted. It is, however, usually more complicated and expensive than the other types.

Amplifiers.—All types of receiving sets except the simplest contain or must be used with audio-frequency amplifiers, which, coming after the detector tube, amplify the audio-frequency currents to a sufficient intensity so that they will operate the telephone receivers or loud speakers which reproduce the sound vibrations. In order not to distort the high-frequency or audio-frequency currents it is necessary that the various circuits in the receiving set pass these currents with equal efficiencies for the different frequencies in the band, and that the various tubes, particularly the detector and audio-frequency amplifier tubes, be of sufficient size to transmit the currents without becoming overloaded.

The portions of the receiving system in which distortion is hardest to avoid are the audio-frequency amplifier and loud speaker. The best amplifiers are designed to amplify uniformly all frequencies ranging from 100 cycles, or even less, to 5,000 cycles or more, since all these frequencies are important in accurate reproduction of speech and music. In the same way the transfer efficiency from electric energy to sound energy by the loud speaker should be substantially constant over this range. The load-carrying capacity of the amplifier and loud speaker must be adequate to provide the desired volume or distortion due to overloading will result.

Loud Speakers.—Loud speakers are roughly divided into two classes: the horn types and the hornless types. In the horn type the diaphragm is attached by its edges to the small end of a horn which forms a sort of megaphone to concentrate the sound. In one of the most common hornless types the diaphragm is a shallow cone, 1 ft. to 3 ft. in diameter, made of paper or cardboard. The cone types have become very popular because they reproduce the lower frequencies or bass notes which give rich fullness and naturalness to music better than do the ordinary horn types. For the higher frequencies the two types are not so widely different. Horns if made sufficiently long are also capable of reproducing the low notes. Such long horns may be looped or coiled to avoid unwieldiness. It is not certain whether the horn or hornless type will ultimately be developed to the greatest perfection.

Forms of Sets.—In physical form receiving sets range all the way from an assemblage of the various elements or parts as separate units wired up by the user, to the most pretentious sets in which the entire system, including loud speaker and power supply sources, is housed in an elaborate cabinet designed to be a beautiful piece of furniture. The most ordinary arrangement, however, consists of the receiving set proper (enclosing the tuning and high-frequency circuits and very often also the audio-frequency amplifier), the batteries or other power supply sources for the vacuum tubes in the receiving set, and the telephone receivers or loud speaker. This combination is flexible, and the various parts of it may be purchased separately to suit the owner's preference.

Power Supply.—From the user's standpoint one of the annoying problems is that of power supply. The power supply for filament current is usually a storage or dry battery called the "A" battery. Storage battery units have been developed which are simple and convenient for use in the home. They contain within one box both the battery and a means of charging it from electric lighting circuits. Small dry batteries made up in block form and called "B" batteries are commonly used to supply the small current at 50 to 150 volts required by the vacuum tube plate circuits. There are also used to a considerable extent so-called "B battery eliminators." These are devices in which alternating current from a lighting circuit is rectified and filtered to supply plate circuit current. In some receiving systems using vacuum tubes that require only a small filament current, this also is obtained by rectification from lighting circuits and the entire set is operated from an electric-light socket, thus doing away entirely with batteries.

PROBLEMS OF RADIO TRANSMISSION

When the radio waves are thrown out or radiated from the antenna at the transmitting station they tend to spread out in all directions somewhat as do the waves in a pool of water when a stone is dropped into it. As they travel outward in ever-increasing circles their initial energy is spread over a larger and larger circumference, so that the intensity of the waves must correspondingly decrease. If the energy merely spread out in this way, none of it being lost, the wave intensity would change inversely as the distance increased. But due to the absorption in the atmosphere and in the ground of a part of the wave energy, which is thus dissipated as heat, the falling-off of wave intensity with distance is more rapid. The amounts of absorption caused by various kinds of terrain differ widely, being smallest for transmission over the ocean or bodies of salt water, and increasingly greater for fresh water and dry land. Since a broadcasting station is usually not surrounded on all sides by a uniform terrain, the efficiency of wave-travel in different directions is not the same. As a result the received wave intensity may not be the same at all points equidistant from the transmitting station.

Mountains and steel frame building areas of large cities cause particularly heavy absorption, which may amount to almost complete suppression of the waves, so that on the far side of such obstructions there is sometimes an area of very low wave intensity called a "dead spot." At such places, or near places where the terrain changes abruptly, as at a coast line, the waves may be deflected somewhat from their course and be thrown across the path of another part of the waves which has not been deflected. This gives rise to wave interference patterns of the same nature as those produced at the edges of shadows by diffraction of light. Since radio waves are millions of times longer than light waves the patterns are relatively gigantic, and one such pattern may cover an area of 100 sq. m. or more. Within the area the wave intensities at points separated from each other by only a fraction of a mile may show wide differences.

Interference.—If the wave intensity were the only factor in radio reception it would theoretically be possible to receive from a station at any distance, since, as the waves became weaker, the sensitiveness of the receiving system could be increased by using more amplifiers. However, the atmosphere is nearly always filled with vagrant radio waves which enter the receiving set, producing noises called "interference," which submerge the weak radio signals it is desired to receive. These vagrant waves come from a multitude of sources. The most potent come from the atmosphere itself, which, in a manner not yet fully understood but commonly thought to be due at least in part to thunderstorms, produces waves which cause in the receiver crackling sounds known as "atmospherics," or, less properly but more popularly, as "statics." The various sorts of electrical systems which are a part of every modern community where broadcasting exists are capable of throwing off radio waves when the currents flowing in them change abruptly. These may give rise to clicking, buzzing and chattering noises.

The vagrant waves are present at all frequencies and therefore cannot be tuned out by the selectivity of the receiving set. For this reason satisfactory, noise-free reception from a station can be obtained only in areas where its signal wave intensity is much greater than the intensity of the vagrant waves. The intensity and amount of the "atmospherics" change with the time of day and season of the year, being greater at night and much greater in the summer time. Superimposed on these regular changes are large fortuitous variations. The amount of absorption of radio waves at broadcasting frequencies is influenced markedly by sunlight, being less at night. On account of these two variables, which are not closely related to each other in detail, satisfactory reception from distant broadcasting stations is largely a matter of chance. In densely populated areas, where there also is interference from powerful nearby broadcasting stations and perhaps from a multitude of regenerative receivers, reception from distant stations becomes well-nigh impossible.

Fading.—Another impediment to radio reception at distances of more than 100 or 200 m. is an annoying waxing and waning of the signal intensity, called "fading." The causes of this phenomenon are not fully known, but the evidence so far adduced has led to a theory that at distant points waves from the transmitter arrive by two or more routes at least, one of which is by way of the upper reaches of the earth's atmosphere. At times these waves coming by different routes oppose and nullify each other, while at other times they add together and assist each other. In going through these two states in progressive alternation they produce fading. The fading may be selective as to frequency, so that the different frequencies within the band transmitted by a station are differently affected and there is distortion of the received speech or music.

Interconnection of Broadcasting Stations.—The method of achieving widespread distribution of a broadcast programme which has been applied most successfully is that of interconnecting a number of stations by telephone wires so that they all simultaneously broadcast the same programme. These broadcasting stations, located at strategic points scattered over the area to be served, permit most listeners to receive the programme just as satisfactorily as they receive local programmes. The audio-frequency currents from the microphone which picks up the programme, after passing through the control operator's amplifier, are delivered to a system of telephone lines which in many respects resembles an electric power distributing network. Trunk wires go out from the programme centre to various parts of the country, and from these, at appropriate points, connecting wires branch off to the broadcasting stations. Telephone repeaters are placed in the circuits at suitable points to amplify the currents so that they may reach the broadcasting stations without material loss in volume. As has already been pointed out, distortion of the telephone currents must be very small or the faithfulness of reproduction at receiving points will be spoiled. On this account the very best kinds of telephone circuits and associated apparatus are employed.

This form of large scale broadcasting has reached its greatest development in the United States and England. In the United States as many as 29 stations have thus been tied together to broadcast a common programme of national importance. On such an occasion many thousands of miles of land wires are involved, and stations on the Pacific and Atlantic coasts 3,000 m. apart broadcast the same programme in unison. In England as well as in the United States chains of stations less widely scattered are in everyday use.

BIBLIOGRAPHY.—Technical development in radio broadcasting has been so rapid and so recent that up-to-date information must be sought in current issues of technical periodicals. Articles on receiving systems are usually confined to one type or to the products of one manufacturer. For fundamental information see references under WIRELESS TELEGRAPHY AND TELEPHONY. For transmitting systems and transmission the following articles are suggested: Edward L. Nelson, "Transmitting Equipment for Radio Telephone Broadcasting," *Proceedings of the Institute of Radio Engineers*, vol. 12, p. 553 (1924); Julius Weinberger, "Broadcasting Transmitting Stations of the Radio Corporation of America," *Proceedings of the Institute of Radio Engineers*, vol. 12, p. 745. Ralph Brown, Deloss K. Martin, and Ralph K. Potter, "Some Studies in Radio Transmission;" *Proceedings of the Institute of Radio Engineers* (Feb. 1926).

(R. Bo.)

BROCK, SIR THOMAS (1847–1922), British sculptor (*see* 4.623c), produced amongst other works after 1910: busts of King Edward VII. (1911), Lord Lister (1913, for the Royal College of Surgeons, London) and Edwin Abbey, R.A. (1917, for the British School in Rome); statues of Capt. Cook (1914, in the Mall, London) and of Lord Sydenham (1915, in Bombay). In 1911 he was created K.C.B. He died in London Aug. 22 1922.

BROCKDORFF-RANTZAU, ULRICH, COUNT VON (1869–), German diplomatist, was born in Schleswig May 29 1869. After some years in the army he transferred to the diplomatic service. From 1909 to 1912 he was consul-general at Budapest, and from 1912 to 1918 German minister at Copenhagen. On Dec. 20 1918 he was appointed Secretary of State for Foreign Affairs, in which capacity he led the German delegation at the Peace Conference at Versailles in April 1919. Unwilling to advise the German Govt. to accept the terms of the Treaty of Versailles, he resigned on June 20. In 1922 he was appointed German ambassador in Moscow.

BRONCHITIS: *see* RESPIRATORY SYSTEM, DISEASES OF THE.

BROOKE, RUPERT (1887–1915), British poet, second son of W. P. Brooke, a master at Rugby School, was born at Rugby Aug. 3 1887 and educated there. He entered King's College, Cambridge, in 1906, where he took the classical tripos (1909) and achieved considerable personal distinction among his contemporaries, notably by his foundation of the Marlowe Dramatic Society. He returned to Rugby for a short time as acting housemaster in 1909. In 1911 he travelled in Germany and Italy, publishing his first *Poems* in that year. After election to a fellowship at King's College in 1913, he set out on wide travels in the United States, Canada, Hawaii, Fiji and New Zealand, and had hardly returned to England when war broke out. In Sept. 1914 Brooke received a commission in the Royal Naval Division and took part in the Antwerp operations in October. In the Hood Battalion of the Div., he sailed for Gallipoli early in 1915, but died suddenly of blood poisoning at Scyros April 23 1915, where he was buried. His posthumous book of poems, *1914 and Other Poems*, appeared in 1915; the war sonnets therein made his name familiar to thousands beyond the smaller circles of readers who had already appreciated his talent. His other published works were a study of *John Webster* (1916) and *Letters from America* (1916).

See *Collected Poems of Rupert Brooke, with a Memoir* (1918).

BROOKE, STOPFORD AUGUSTUS (1832–1916), British divine and man of letters (*see* 4.645), died at Ewhurst, Surrey, March 18 1916.

See L. P. Jacks, *Life and Letters of Stopford Brooke* (1917).

BROQUEVILLE, CHARLES MARIE PIERRE ALBERT, COMTE DE (1860–), Belgian politician, was born at Moll, Belgium, Dec. 4 1860. From 1892 to 1919 he was Catholic deputy for Turnhout, Limbourg. From 1910–2 he was Minister of Railways, Posts and Telegraphs and he became Prime Minister of the Govt. formed on June 18 1911. After the elections of 1912 he formed a new Cabinet, in which he acted as Minister of War until Aug. 1917. He introduced an army bill, making general service personal and obligatory, which became law in 1913. In 1914 de Broqueville was responsible for the mobilisation of the army, which enabled Belgium to resist the German onslaught. While at Havre, after the battle of the Yser, he undertook the reorganisation of the Belgian Army and established munition factories.

In consequence of the peace proposals emanating from Prince Sixte de Bourbon and the emissaries of von der Lancken, the German civil representative in Brussels, de Broqueville handed in his resignation as head of the Cabinet. In 1917 he became Foreign Minister, afterwards acting as Minister of Reconstruction until May 1918. He became a Minister of State on May 31 1918 and was Minister of the Interior in M. Delacroix's Cabinet from Nov. of that year until Nov. 1919, when he resigned from the Chamber of Representatives and was elected Senator for the province of Namur.

BROWN, FRANCIS (1849–1916), American Semitic scholar (*see* 4.658), died in New York Oct. 15 1916. He had been president of Union Theological Seminary, New York, since 1908. In 1911 he was tried for heresy before the Presbyterian General Board on the ground that he had published statements "contrary to cherished Presbyterian and evangelical doctrines," but was exonerated.

BROWN, JOHN GEORGE (1831–1913), American painter (*see* 4.661), died in New York City Feb. 8 1913.

BROWNE, EDWARD GRANVILLE (1862–1926), British orientalist, was born at Uley, near Dursley, Gloucestershire, Feb. 7 1862. Educated at Trinity College, Glenalmond, and then at Eton and Pembroke College, Cambridge, he studied medicine and oriental languages. In 1887 he was elected a fellow of his college in the same year qualifying M.B. at St. Bartholomew's Hospital, London, but he never practised as a doctor. In 1887–8 he travelled in Persia, becoming afterwards lecturer in Persian at Cambridge. In 1902 he was appointed Adams professor of Arabic at Cambridge, a post he held until his death. In 1906 he married Alice Caroline Blackburn Daniell, who died in 1925. Browne's published works include *A Traveller's Narrative* (1891); *Literary History of Persia until the time of Firdawsi* (1902), continuations of which were published in 1906, 1920 and 1924; *The Persian Revolution, 1905–9* (1910); a translation of *Chahár Magála*, with notes (1921); and *Arabian Medicine* (1921). He died in Cambridge Jan. 5 1926.

BROWNING, JOHN M. (1854–), American inventor, was born at Ogden, Utah, of Mormon parentage. From childhood he displayed a remarkable talent for invention. In 1879 he secured his first patent for a breech-loading, single-shot rifle, which patent he sold to the Remington Company. He designed many types of sporting firearms such as the Remington autoloading shotguns and rifles; the Winchester repeating shotguns, single-shot and repeating rifles; the Stevens rifles; and the Colt automatic pistols. In 1890 a machine gun of his design, but known as the Colt, was adopted by the U.S. Army. He always avoided publicity. In one establishment only was his name used, the Fabrique Nationale at Liège, Belgium. Browning was made a Chevalier of the Order of Leopold by King Albert, on the occasion of the completion of the millionth Browning automatic pistol at Liège. He later developed two types of machine-guns, which were adopted by the United States in 1918 for use in the World War. One of these guns on test fired 39,000 rounds before breakage developed. In lieu of royalties, which would have amounted to some $10,000,000, he accepted from the U.S. Govt. a lump sum of $1,500,000.

BROWNING, OSCAR (1837–1923), British writer (*see* 4.670), published *Memories of Sixty Years at Eton, Cambridge and Elsewhere* in 1910, and *Memories of Later Years* in 1923. He died in Rome Oct. 6 1923.

BRUCE, STANLEY MELBOURNE (1884–), Australian politician, was born in Victoria of a wealthy mercantile family. Educated first at Melbourne Grammar School, in 1902 he went to Trinity Hall, Cambridge. He rowed in the university boat-race in 1904, and after graduating was called to the bar by the Middle Temple in 1907, but shortly afterwards he inherited a partnership in the Melbourne firm of merchants, Paterson, Laing and Bruce. He was again in England when the World War began, received a commission in the Royal Fusiliers, took part in the landing at Suvla Bay and was seriously wounded in the first day's fighting. Later he served with such distinction in France that he was awarded the Military Cross and the Croix de Guerre, and was promoted to the rank of captain; and in 1917, having been wounded again, he was invalided back to Australia. He resumed his commercial work in Melbourne, and in the same year, on the elevation of Sir William Ervine to the Chief Justiceship of Victoria, successfully contested the vacant constituency of Flinders and was returned to the Commonwealth Parliament.

Partly owing to his own ability and partly owing to circumstances, Mr. Bruce's political progress was extraordinarily rapid. In 1921 he chanced to be in Europe when some one was required, at short notice, to represent Australia at the second Assembly of the League of Nations. He was appointed, and his report to the Commonwealth Parliament increased his reputation as a clear thinker and logical, if uninspired, speaker. Soon afterwards, when Sir Joseph Cook became High Commissioner in London, Mr. Bruce succeeded him, after only four years' experience of politics, as Treasurer in the Cabinet led by Mr. W. M. Hughes. In this office, which is second only to that of the Prime Minister, Mr. Bruce's knowledge of commerce and law proved extremely useful and he soon built up a reputation as an essentially sane and level-headed man of affairs rather than an orator or picturesque leader of men. These qualities appealed to a country burdened by heavy war debts and many problems arising out of the War. Mr. Bruce profited, too, by the growing dislike of the National party formed by Mr. Hughes during the War. In Feb. 1923 the tottering Hughes Ministry fell, and Mr. Bruce, as the leader of the Liberal wing of the National party, succeeded in forming an alliance with the leader of the Country party, Dr. Earle Page, who took office as Treasurer.

Mr. Bruce's leadership was not, perhaps, distinguished by the brilliance and personal magnetism that were such conspicuous attributes of Mr. Hughes, but he showed judgment and restraint in his relations with Labour, marked administrative ability and a sound grasp of Australia's problems and sentiment; and if, by the end of 1925, his term of office had not been marked by any outstanding achievement he had at least made no bad blunders. In Imperial affairs he might be described in Bagehot's phrase as an apostle of animated moderation, standing for as warm and close a relationship with Great Britain as is consistent with Australia's interests as a completely self-governing Dominion. Under his leadership the Federal Parliament maintained the customs preference to British goods and agreed to a great migration scheme—though the fruits of this latter project were, owing to the difficulties of the states, rather disappointing; and at every opportunity, notably the Imperial Conference in 1923, he showed himself to be a vigorous leader of Australian thought and sentiment and a staunch believer in the future of a British Commonwealth of Nations with Great Britain as its head. Like Mr.

Hughes, however, he strongly distrusted any plan for Imperial Federation, under which any one Dominion would necessarily have only small representation, and was content to insist upon the national status granted to Australia at the Peace Conference (1919) together with the right to be consulted by the British Cabinet in any matters affecting Australia's welfare.

(G. C. D.)

BRUCH, MAX (1838–1920), German musical composer (*see* 4.677), died in Berlin Oct. 2 1920.

BRUGES (*see* 4.678) had in 1923 a population of 52,861. The improvement of transport between the town and Zeebrugge, which was beginning to make itself felt before the World War, promises to restore something of Bruges' former prosperity. New docks have been built communicating with the sea by a canal 23 ft. deep.

During the World War, Bruges remained some 20 m. behind the German front at Dixmude and was at first of little military importance, but with the growth of submarine warfare and the abandonment of Ostend as a naval base it became a centre for assembling the parts of submarines. By the spring of 1918 the various docks and concrete shelters could accommodate 35 destroyers and about 30 submarines. Captain Fryatt, of the "Brussels," was shot with 11 Belgians and one Frenchman in the cavalry barracks in the Rue Longue on July 27 1916. A tablet to their memory has been placed on the wall, now called "Mur des Fusillés," and in the same enclosure is a separate memorial to Fryatt. Little material damage was done to the town, except to the canal docks where enormous numbers of bombs were dropped, but property was taken to the value of 20,000,000 francs and an elaborate rest house, baths, etc., for the use of German officers were built at the expense of the townspeople. The town was in German occupation for four years, though the Allies were within sight of it after the capture of the Passchendaele ridge in Nov. 1917. The Belgians re-entered it unopposed in Oct. 1918.

BRÜNN or **BRNO** (*see* 4.684) is now in Czechoslovakia, the seat of the Supreme Court, and the centre of the woollen industry of the country. The population in 1921 was 221,758, so that it has more than doubled since 1900, when the figure was 108,944. The Masarykova (Czech) University was opened in 1918.

BRUNNER, HEINRICH (1840–1915), German historian (*see* 4.685), published in 1909 *Geschichte der englischen Rechtsquellen im Grundriss*. In 1913 he issued a 6th ed. of *Grundzüge der deutschen Rechtsgeschichte*. He died at Bad Kissingen Aug. 11 1915.

BRUNO, PAUL (1874–), German architect and painter, was born Jan. 19 1874 at Seifhennerstorf in Saxony. He received his artistic training at the Kunsgewerbe Schule (School of Applied Arts) at Dresden, and at the Academy at Munich. He first made a name as an artist by his drawings for *Simplizissimus*. Later his designs for the Munchner Werkstätts (Fine arts industry) attracted attention. In 1900 he received the Grand Prix in Paris; in 1902 the highest distinction at Turin; in 1904, the Grand Prix at St. Louis; and in 1906 the highest distinction at Dresden. In 1907, he was appointed Director of Instruction at the State Museum of Applied Arts in Berlin. He was also elected a member of the Academy of Arts in Berlin and the Deutsche Werkbund. He wrote a pamphlet on *The Education of Artists at State Schools* (1919), which has become a classic.

BRUSA, Turkey (*see* 4.691c), had a population, at the census of 1924, of 102,217. But for the comparative proximity to the sea this ancient and beautiful city would probably have become the capital of the new Turkish Republic. During the Greco-Turkish conflict (1919–22) Brusa and neighbourhood was the scene of severe fighting. In April 1920 the sultan's force under Anzavur Bey, when advancing on Brusa, was defeated by the Nationalists, who in their turn were defeated and driven out of the city in Aug. by the northern army of the advancing Greeks. When the final rout of their main forces took place, in 1922, the Greeks offered a stubborn resistance at Brusa, and did not finally withdraw until Sept. 12. Before this retirement a commission of Allied officers arrived to prevent any wanton damage being done to the architectural masterpieces in the city.

BRUSILOV, ALEXEI ALEXEIEVICH (1853–1926), Russian soldier, was born Aug. 19 1853, of an old family. He began his military career as a cavalry officer in the Caucasus and in the Russo-Turkish War of 1877–8 he distinguished himself by his courage and resource. In 1900 he was appointed director of the Officers' Cavalry School at St. Petersburg (Leningrad). After commanding the Second Guard Cavalry Division, he was in 1909 placed in command of an army corps, and later became assistant to Gen. Skalon, commander-in-chief of the Warsaw military district. On the outbreak of the World War Brusilov took command of the VIII. Army, which participated in the invasion of Galicia from the east. By Sept. 1915, after varying fortunes, his army had secured possession of Rovno, and was in temporary occupation of Lutsk. In April 1916 Brusilov succeeded Ivanov as commander of the Russian armies (VII., VIII., IX., XI.) south of the Pripet Marshes. A great offensive was launched during the summer of 1916 which brought much-needed relief to the Italian armies by compelling the withdrawal of considerable enemy forces to face the crisis of Lutsk, but, owing to the lack of artillery munitions, this relief was bought at the price of very heavy Russian losses.

After the Lvov Coalition Cabinet was formed in May 1917, Brusilov was given supreme command of the Russian armies, which, however, he did not long retain. During the fighting in Moscow in Nov., he was wounded by a chance bullet, though not himself actively engaged. He early realised that the Communists were in fact creating anew the Russian Army and took no part in conspiracies against them. The Polish War brought from him an appeal to Russian officers to join in the national defence. He put his own knowledge and experience at the service of the Red Army. Always a keen sportsman, he was latterly at the head of the state horse-breeding establishments and was always to be seen at the races. He died in Moscow March 17 1926.

BRUSSELS (*see* 4.692).—The population of the city and suburbs in 1923 was 787,060. The suburbs comprise 12 communes: Anderlecht, Etterbeek, Forest, Ixelles, Jette, Koekelberg, Molenbeek St. Jean, St. Gilles, St. Josse-ten-Noode, Schaerbeek, Uccle and Woluwe St. Lambert. A law of April 2 1921 decreed the annexation to Brussels proper of the communes of Laeken, Haeren, and Neder Overheembeek, as well as part of Molenbeek and a small part of Schaerbeek, in order to facilitate the construction of the new outer port which the authorities wished to bring entirely within the area of the city proper. As a result, the area of the city proper has more than tripled; it covers over 12½ sq. m., instead of just about four, and includes an additional population of about 54,000.

During 1910–21 Brussels underwent considerable transformation. In 1910 the old harbour basins were filled in; the Isabelle quarter of the city, situated between the Rue Royale and Place Royale, as well as the Putterie quarter near the university, were demolished. Numerous banks were established in the upper town—in the Rue Royale and Place Royale. In the Schaerbeek area new arterial roads were made and the Parc Josaphat was endowed with a fine sports ground. The palace of the Count of Flanders became the Banque de Bruxelles, and in Nov. 1918 the city acquired the palace of the Duke of Aremberg and gave it again its old name of Palais d'Egmont. The Royal Palace has been considerably enlarged and a public park was opened at Mollenbeek in 1922. Various memorials have been erected since 1918. On the National Rifle Range at Schaerbeek is one in memory of 35 civilians shot by the Germans. The British monument nearly opposite the Palais de Justice, erected to commemorate the brotherhood of the two nations during the War, was unveiled in 1923; it is a replica of the Belgian monument on the Victoria Embankment, London. In Place St. Jean is a monument to a Belgian, shot at the same time as Edith Cavell, whose cell in St. Gilles prison has been made into a museum of relics relating to her. A replica of the Peter Pan statue in Kensington Gardens was unveiled in the gardens of the Palais d'Egmont in 1924.

The foundation stone of new buildings for the university was laid in Nov. 1924 by Prince Leopold. A large sum was provided towards these by the American Relief Commission from the balance of funds provided for the relief of the Belgian population during the German occupation. In 1920 a commercial fair, managed by the municipality and held in the Cinquantenaire Park and Halls, was inaugurated; in 1925, 27 nations were represented, and the area of the fair was more than doubled. An international exhibition to celebrate the centenary of Belgian independence was arranged for 1930. The terminus of the London-Brussels air service, previously at Evere, is now in the suburb of Haeren. An aerial service, Antwerp-Brussels-Basle, was started in March 1924.

The harbour works, planned in 1896, were completed in 1908. They included the widening of the canal and the construction of three large basins, the largest of which, the Vergote basin, has 20,000 metres of quayage. These basins being found inadequate, an outer port in the plain between Laeken and Vilrode was opened in 1922, with a canal 12½ m. long, connecting Brussels with the Rupel and thence with the Schelde. The canal can be used by vessels drawing 19 ft. and access to the Rupel is gained by means of locks.

The German occupation of the capital during the World War extended from Aug. 1914 to Nov. 1918. General Sixt von Armin's troops entered on Aug. 20, and on Sept. 2 Field-Marshal von der Goltz was appointed Governor-General of Belgium. He was succeeded by Gen. von Bissing in 1915. Numerous social relief movements were instituted in spite of German intervention; among them the Comité National de Secours had its headquarters at Brussels, and with the aid of Mr. Hoover's American committee organised the feeding of the Belgian population. On the suppression of Allied newspapers, a journal, *La Libre Belgique*, was secretly printed in Brussels and widely circulated. Among the many infamous executions, that of Philippe Baucq and of Edith Cavell stand out. A revolt of German soldiers against their officers broke out on Nov. 10 1918 and a violent conflict occurred in the Place Roger opposite the Gare du Nord. The Belgian Army reoccupied Brussels on Nov. 18 1918 and the King and Queen re-entered the city in state on Nov. 22. (O. J. R. H.)

BRUSSELS, UNIVERSITY OF (*see* 27.768).—Since its foundation in 1834 this university has known no more difficult days than those of the German occupation, when its activities were suspended. It is true that, in common with other universities, it has suffered from the economic consequences of the peace but it has displayed, with other Belgian institutions, a power of recuperation indicating a vitality of remarkable strength. The faculty organisation comprises philosophy and letters, jurisprudence (with a section of maritime law), science and medicine (with special sections for anatomy and physiology and applied science). The university includes a school of political and social science, a school of commerce and an educational section. The library of the university is expanding and, by the institution of chairs in special subjects, such as Flemish history and literature, colonial jurisprudence and international law, the intimacy of theoretical discipline and practical economic and political conditions is admirably maintained.

BRYAN, WILLIAM JENNINGS (1860–1925), American politician (*see* 4.697), announced that he was not a candidate for the Democratic presidential nomination in 1912, but he attended the Democratic convention, and it was largely owing to his personal influence that the nomination went to Woodrow Wilson, instead of to Champ Clark. In 1913 he was appointed by President Wilson Secretary of State, and from the start devoted much attention to the negotiation of peace treaties with foreign countries. He declared that America should wage no war while he was Secretary. Soon after entering office he went to California and urged, unsuccessfully, that the state Legislature and the governor should delay action on the proposed Webb anti-alien land ownership bill, so displeasing to the Japanese Government. In 1914 he supported the repeal of the Panama Canal tolls bill, which excluded American coastwise shipping from the payment of fees.

After the outbreak of the World War he was deeply interested in attempts to restore peace. His attitude towards foreign war loans was clearly expressed in an announcement from the Dept. of State (Aug. 15 1914). "There is no reason why loans should not be made to the governments of neutral nations, but in the judgment of this Govt. loans by American bankers to any foreign nation which is at war is inconsistent with the true spirit of neutrality." When, however, in Dec. of the same year, Senator Hitchcock introduced a bill to lay an embargo on the shipment of arms, the Secretary informed the British ambassador that it had not been introduced "at the suggestion of the Administration"; and later, in 1915, in a letter "to the German Americans" he declared that it would have been in violation of the laws of neutrality to change international rules during war by forbidding the exportation of arms.

After the sinking of the "Lusitania" in 1915, he signed the first strong note of protest to Germany. Upon the receipt of the German reply, and while the second note was being prepared, Dr. Dumba, the ambassador of Austria-Hungary, called at the Dept. of State and asked Secretary Bryan why the United States dealt more harshly with Germany than with Great Britain. The Secretary replied that Great Britain had only interfered with the commerce of the United States while Germany had drowned its citizens. This plain statement was ignorantly or wantonly misinterpreted by some German official, and the report was widely spread that Mr. Bryan had said that the note was for "home consumption," and not to be taken too seriously. There was, however, absolutely no truth in this report, even Dr. Dumba denying it in a dispatch to his government. When the President wrote his second "Lusitania" note, Secretary Bryan resigned, June 8 1915, saying in his letter of resignation: "You have prepared for transmission to the German Govt. a note in which I cannot join without violating what I deem to be an obligation to my country."

During his term of office he had negotiated 30 treaties with foreign nations, requiring the submission of disputes to impartial inquiry and a delay of a full year for arbitration before going to war. Such a treaty had not been concluded with Germany, but was under consideration when interrupted by the World War. As Secretary he was often criticised because of numerous paid engagements on the lecture platform, undertaken, he said, to supplement his inadequate salary; but it was never shown that he was less attentive to the demands of his office than any predecessor. He continued, after his resignation, to work in the interests of peace; opposed the Anglo-French War Loan; attacked the Navy League and the National Security League; and tried to resist the growing demand for preparedness in America. In 1916 he was defeated in Nebraska as candidate for delegate-at-large to the Democratic National Convention. He went, however, as a reporter and gave full support for the renomination and later the re-election of President Wilson.

From the announcement by Germany of the resumption of submarine warfare to the actual declaration of war, he favoured any measure that would keep America neutral, no matter how largely it involved the surrender of American rights on the sea. But when War was declared he asked to be enrolled as a private, though then 57 years of age; urged loyal support of the President's war measures; and in his own paper, *The Commoner*, strongly condemned obstruction of the selective draft as well as abuse of liberty of speech. He supported the League of Nations, but thought that the Monroe Doctrine should be specifically recognised. He desired a constitutional amendment changing the two-thirds vote required in the Senate for making a treaty, so that the country could get out of war as easily as it got in. In 1920 he was present at both the Republican and the Democratic National Conventions, attending the former as a reporter for his newspaper and the latter as a delegate-at-large from Nebraska, and worked in vain for a dry plank in their platforms.

The same year he was tendered the presidential nomination of the Prohibition party, but declined. He was disappointed with the nomination of James M. Cox as Democratic candidate, but declared that he would not leave the party. He took no part, however, in the campaign, it being the first time in 40 years that his voice was not heard on the platform. In 1921 he became a resident of Miami, Florida. He attended the Democratic National Convention of 1924 in New York as a delegate from Florida, but his influence in the party councils had perceptibly waned and he took very little part in the ensuing campaign. As a politician his work was completed. For the most important "progressive" measures adopted by the United States in recent years, the popular election of senators, an income tax, the requirements of publication of ownership and circulation by newspapers, the creation of a Dept. of Labour, national prohibition and woman suffrage, Bryan laboured earnestly, and their adoption was due in part at least to his popular, persistent appeal.

His last public appearance was in 1925 at the trial of J. T. Scopes, a school teacher of Dayton, Tenn., who was arrested on a charge of violating the state law prohibiting the teaching in public schools of any theories that deny the divine creation of man as taught in the Bible. Scopes was a biologist and had been teaching evolution. Bryan, a firm believer in the literal interpretation of the Bible, went to Dayton to assist the prosecution. Widespread popular interest was manifested in the case, which in the hands of Bryan and Clarence Darrow, chief defence counsel, assumed the form of a contest between fundamentalism and modernism. The outcome was that on July 21, after a hearing extending over three weeks, Scopes was found guilty and fined $100, though Bryan was prevented, through the tactics of Darrow, from delivering the elaborate speech which he had prepared in refutation of Darwin and his theories. On the conclusion of the trial he was taken ill, and died at Dayton, Tenn., July 26 1925.

BRYANT, SOPHIA (1850–1922), English educationalist, daughter of Rev. William A. Willock, was born in Dublin Feb. 15 1850. Her family removed to England in 1868 and Sophia won a scholarship at Bedford College, London. At the age of 19 she married Dr. William Hickes Bryant who, however, died within a year. Having passed the general examination for women in London University, she was from 1875 to 1895 form mistress at the North London Collegiate School for Girls. In 1881 she graduated B.Sc. with honours in mathematics and moral science and was the first woman admitted D.Sc. (1884). She excelled as a mathematical teacher with original methods, but became known also as a writer and lecturer on general educational subjects. From 1895 to 1918 she was headmistress of the North London Collegiate School, and served on many important educational committees. In 1904 the hon. degree of Litt.D. was conferred on her at Dublin University. She met her death in a mountaineering accident near Chamonix in 1922. She was last seen alive on Aug. 15 and her body was recovered on Aug. 28. Mrs. Bryant published many educational works and several books on early Irish history.

BRYCE, JAMES BRYCE, 1ST VISCOUNT (1838–1922), British politician and man of letters (*see* 4.699), remained in the United States as British ambassador till 1913, a period of six years. The appointment, criticised at the time as withdrawing from the regular diplomatic corps one of its most coveted posts, proved a great success. The United States had been in the habit of sending, as minister or ambassador to the Court of St. James, one of its leading citizens—a statesman, a man of letters, or a lawyer—whose name and reputation were already well-known in Great Britain. For the first time Great Britain responded in kind. Mr. Bryce whose eminence as a man of letters had recently been recognised by the grant of the Order of Merit, and who was already favourably regarded in America as the author of a classical work on the American Commonwealth, made himself thoroughly at home in the country; and after the fashion of American ambassadors in England, he took with eagerness and success the rôle of public orator on matters outside party politics, so far as his diplomatic duties permitted.

These duties he performed to the satisfaction of his own Govt. and of the Govt. to which he was accredited. The difficulty between the United States and Newfoundland about fisheries was referred to the Hague Tribunal for final settlement. Most of the questions with which he had to deal concerned the relations between the United States and Canada, and in this connection he paid several visits to Canada to confer with the governor-general and his ministers. He was criticised, both in England and in Canada, for forwarding in 1911, in the course of his duties as ambassador, an arrangement for mutual tariff concessions between the two North American states; but the general election, which put Sir R. Borden in power as Prime Minister of Canada in place of Sir W. Laurier, brought the negotiations to an end. At the close of his embassy he told the Canadians that probably three-fourths of the business of the British embassy in Washington was Canadian, and of the 11 or 12 treaties he had signed 9 had been treaties relating to the affairs of Canada. "By those 9 treaties," he said, "we have, I hope, dealt with all the questions that are likely to arise between the United States and Canada."

For his services he was created a viscount in 1913, and in 1914 his old university, Oxford, gave him an honorary degree (Litt. D.). Along with other English scholars, who had ties of close association with German learning and German savants, he was extremely reluctant in the last days of July 1914 to contemplate the possibility of war with Germany; but the violation of Belgian neutrality and the outrages committed in Belgium by German troops brought him speedily into line with national feeling. He was appointed chairman of a committee to consider the evidence of such outrages not only in Belgium but in France; and his report convinced the most incredulous that the charges were based on fact. He welcomed warmly the entrance of the Americans into the War in 1917. He also presided, as an eminent constitutional lawyer, over a committee set up in that year to consider the reconstruction of the House of Lords, and spent much labour on a task which all parties were disposed to shirk. During these latter years he was largely engaged on the composition of a valuable book, published in two substantial volumes in 1921, on *Modern Democracies*, a comparative study of a certain number of popular governments in their actual working. For this monumental work he had been gathering material for several years before the War. Besides visiting Switzerland and other parts of Europe, he availed himself of his experiences in the United States and in Canada, and journeyed to Spanish America, Australia and New Zealand. While yet another book, *International Relations*, a series of lectures delivered in America, was in the press, Lord Bryce died, on Jan. 22 1922, after a long, full and distinguished career. He married, in 1880, Elizabeth Marion, daughter of Thomas Ashton, of Hyde, and sister of the 1st Lord Ashton of Hyde. (G. E. B.)

BRYUSOV, VALERY YAKOVLOVICH (1873–1924), Russian poet, was born in Moscow Dec. 13 1873. His early verses are decadent in style, and although they brought him a certain notoriety, were not taken seriously. At one time he was the acknowledged head of the Russian "decadent" school of poetry. The influence of Balmont is seen in his earlier work, and of Verhaeren in his poems of the town and in his revolt against social evils, e.g., *The Stonemason*. His later poems, however, are more scholarly and rhetorical in subject and style. He also wrote prose, his most interesting work being the historical novel, *The Flaming Angel* (1909), and was a great student of Pushkin. After the Oct. revolution in 1917 he joined the Communist party. He died in Moscow Oct. 9 1924. His poetical works include: *Tertia Vigilia* (1901); *Urbi et Orbi* (1903); *Stephanos* (1905).

BUBONIC PLAGUE: *see* PLAGUE.

BUCCLEUCH, WILLIAM HENRY WALTER MONTAGU-DOUGLAS-SCOTT, 6TH DUKE OF (1831–1914), British politician (*see* 4.712), died at Montagu House, Whitehall, London, Nov. 5 1914. His wife, Louisa, a daughter of the 1st Duke of Abercorn, had died at Dalkeith March 17 1912. He was succeeded by his son, John Charles Montagu-Douglas-Scott (b. 1864), who, as Earl of Dalkeith, was Unionist M. P. for Roxburghshire, 1895–1906.

BUCHAN, JOHN (1875–), British author, was born in Perth, Scotland, Aug. 26 1875. Educated at Glasgow University and Brasenose College, Oxford, he had a distinguished career at Oxford, where he won the Newdigate Prize for a poem on The Pilgrim Fathers and was president of the Union Society. Called to the bar by the Middle Temple in 1901, in the same year he became private secretary to Lord Milner, then High Commissioner for South Africa. In 1903 he returned to England, and soon became a member of the publishing firm of Thomas Nelson and Sons, Edinburgh. During the World War he served on the British Headquarters Staff, and in 1917 was appointed Director of Information under the Prime Minister. After the return of peace he was appointed deputy chairman of Reuter's News Agency. As a novelist Buchan is probably best known for his tales of adventure, such as *John Burnet of Barns* (1898); *Prester John* (1910); *The Thirty-Nine Steps* (1915); *Mr. Standfast* (1919); *Midwinter* (1923); and *John Macnab* (1925). He wrote also a number of historical books, particularly after the World War, including a popular *History of the Great War*. In 1907 he married Susan Charlotte, daughter of the late Hon. Norman Grosvenor.

BUCHAREST, Rumania (*see* 4.717), had a population of 308,987 in 1917, estimated at 400,000 in 1919. The city has seen considerable industrial development since 1910. After the World War conditions were bad in every way, but the American Red Cross, which had its headquarters and warehouses in Bucharest, did much to encourage reconstruction. The first steps towards putting in force the Ostend agreement, which provides for the settlement of the city's external obligations, were taken in Sept. 1925. An American company and the municipality came to an agreement for the erection of a hydroelectric power station on the Arges river to supply power for the industries of the city and neighbourhood.

Events during the War.—The fortress was evacuated as a result of an unsuccessful battle in the foreground at the end of Nov. 1916. The arsenal was blown up on Dec. 4, and the Germans under Mackensen entered without opposition on Dec. 6. The Rumanian capital was removed to Jassy until after the Armistice. During the German occupation there was much destruction and thieving, but the city was thoroughly cleansed.

BUCHNER, EDUARD (1860–1917), German chemist, was born at Munich May 20 1860. He became a professor at the University of Berlin in 1898 and subsequently accepted similar appointments at Breslau (1909) and Würzburg (1911). He devoted himself to researches in connection with fermentation and enzyme action. In 1903 he was able to confirm Traube's theory by demonstrating that the active cause of alcoholic fermentation is due to the action of different enzymes contained in yeast and not to the yeast cell itself. Concerning the physiological nature and meaning of fermentation he showed that a ferment (zymase) can be extracted from yeast cells which causes sugar to break up into carbon dioxide and alcohol. Buchner, who gained the Nobel Prize for chemistry in 1907, was killed in the World War on Aug. 24 1917.

BUCKLE, GEORGE EARLE (1854–), British man of letters, was born at Twerton, near Bath, June 10 1854, the eldest son of Rev. George Buckle, Canon of Wells. He was educated at Winchester and New College, Oxford, being a scholar of both colleges, and graduated first class both in *literae humaniores* (1876) and in modern history (1877). He won the Newdigate Prize in 1875. From 1877 to 1885 he was a fellow of All Souls College. In 1880 he joined the editorial staff of *The Times*, London; four years later, while still under 30, he succeeded Thomas Chenery as its editor. This position he occupied for more than 28 years, retiring in Aug. 1912. When Mr. Monypenny, the biographer originally entrusted with the official *Life of Disraeli*, died in 1912, leaving his task unfinished, Mr. Buckle took over the work of completing it; under his authorship vol. 3, 4, 5 and 6 were published between 1914 and 1920. Mr. Buckle also edited *The Letters of Queen Victoria*, second series (1862–78), 2 vol., published in 1926.

BUCKMASTER, STANLEY OWEN, 1ST BARON (1861–), English lawyer, was born Jan. 9 1861 and educated at Christ Church, Oxford. He was called to the bar, and after a short time began to practice in the chancery courts. An advocate of considerable skill, in 1902 he became a K.C. In 1906 he successfully contested Cambridge in the Liberal interest, and revealed unusual oratorical powers, which he also showed in the House of Commons. Defeated at the general election of 1910, he re-entered the House in 1911 as member for Keighley, and, in 1913, was appointed solicitor-general, being knighted in the same year. In May 1915 Sir Stanley Buckmaster was appointed Lord Chancellor and was raised to the peerage in the following month. Here he was energetic, receptive of new ideas and powerful in debate; while, as a judge, he was sound without being brilliant. In 1916 he went out of office with Mr. Asquith; but he continued to sit in a judicial capacity in the Lords. He became prominent also as a strong advocate of divorce law reform, taking the civil rather than the ecclesiastical view of marriage. In 1926 he accepted the chairmanship of an important commercial undertaking.

BUCKNER, SIMON BOLIVAR (1823–1914), American soldier and political leader (*see* 4.732), died in Munfordville, Ky., Jan. 8 1914. He was the last surviving major-general of the Confederacy and the then oldest living graduate of West Point Military Academy.

BUDAPEST (*see* 4.734), capital of Hungary, remains the political, commercial and intellectual centre of the country, but its development came to a standstill during the World War. In 1910 the civil population was 863,735, showing an increase of 20·5% on the previous decade. In 1920 it was 928,996. The city suffered severely during the Bolshevik ascendancy after 1918, and from looting by the Rumanian troops who occupied it from Aug. to Nov. 1919 in disregard of the decisions of the other Allied Powers. The cessation of building during and after the War, together with the influx into the capital of thousands of refugees and unemployed officials from the territories detached from Hungary by the Treaty of Trianon, created a terrible housing shortage. A faculty of political economy was founded at the university in 1919, and the Geological and Meteorological Institutes were also established after the War. The new rampart below the Matthias Church, on the heights of Buda, with a bronze statue of St. Stephen, commands a magnificent view of the river and of the city. At the northern extremity is the new building of the National Archives.

Work on the reconstruction of the docks was started in 1922, and in the following year capital was obtained from a French syndicate to enable it to be carried forward on a larger scale. The city lives chiefly by its milling industry, which has a capacity greater than that of any other European city, but owing to the high import duties on grain coming into Hungary and the unwillingness of the former customers of Hungary to accept their cereal imports in the form of flour, the industry was seriously depressed. In Feb. 1925 it was still only working up to 25% of its capacity.

Owing to the policy of high protection adopted by the Hungarian Govt. to counter the commercial hostility of the other succession states a number of new industries have arisen in and around Budapest, notably in the textile and chemical trades. The machine industry, which worked at full power during the War, employed 50,000 workers in 1923, but the numbers have since declined. Budapest was, though in a less degree than Vienna, a great financial centre for southeast Europe, and the cessation of financial business brought ruin to many great houses. The position began to improve after the financial reconstruction of 1924. In Jan. 1925 an International Committee of Enquiry met at Basle, by agreement with the Budapest authorities, to examine the financial position of the city in the interests of the bondholders. It was agreed that £140,000 raised by taxes on tramway tickets and electric-light supply should be paid in 1924, and £168,000 in 1925.

BUDDHISM (1) (*see* 4.742).—The rivalry between Hinduism, Buddhism and Jainism quickened each religion to fresh efforts, in order to retain its own people, to win others, and to secure for itself a dominating position in India. This triangular struggle is one of the most important and significant facts in the religious

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[1] The figures in parantheses in the article BUDDHISM refer to the bibliography at the end.

history of India for over a thousand years; but it does not take a prominent place in the earliest records.

What the Buddha preached was a system of teaching and discipline whereby, he affirmed, men could win *release* from transmigration, kārma, and all the bonds of this world; and he had two groups of disciples, viz., monks and nuns. He also made friends with the laity wherever he went; gave them excellent advice with regard to their daily lives and their political troubles; and from them he received very large help in various ways; but he formed no new lay religion for them. They adored the Buddha, and listened gladly to his teaching but they remained in Hinduism (2).

His death and the stupas in which his relics were enshrined probably led to the beginnings of actual worship within Buddhism. What is clear is that, as the years passed, the monks drew the laity nearer to themselves; and there gradually grew up a sketchy system which bound the layman and his family to the local monastery and provided them with a simple form of worship and a few rules for their lives as Buddhists. Perhaps the largest element in the new organisation was the provision of Chaityas, or halls of worship, adorned with small stupas and other symbols of Buddhist faith, in which monks and laymen worshipped together.

Asoka, Maurya emperor of the 3rd century B.C., ruling three-fourths of India and a huge slice of territory to the west of the Indus, became a Buddhist early in his reign, and strengthened the religion of his choice not only by great buildings and monuments erected for it, and by large administrative arrangements he made to help it, but also by his royal example and the propaganda of his edicts, set up all over his dominions. He is the greatest of Buddhist laymen.

The belief that the Buddha, "the Enlightened One," was the crown of humanity, coupled with the doctrine of transmigration, necessarily created the belief that he had gradually risen to perfect knowledge and supreme character in a long series of lives previous to the culminating life. Since, during those previous lives, "bodhi," *i.e.*, enlightenment, was believed to have already been the basis of his nature, his followers spoke of him as *The Bodhisattva* down through the ages to the moment of his full enlightenment under the Bodhi tree.

Innumerable tales of the Buddha during his lives of preparation appeared; and in each his sympathy with men and animals, his unbounded liberality and his readiness to serve and to suffer were painted in glowing colours. All this appears in the Jātakas and later in the Avadānas.

Since truth never changes, Buddhists argued that there must have been other Buddhas in previous ages, who taught precisely the same truth which Gautama taught; and, necessarily, in future ages, other Buddhas would emerge with the same message. Thus Gautama is only the latest of a series of Buddhas, which stretches far back into the past and will stretch far into the future; and there must be Bodhisattvas in existence now, who in later ages will appear as Buddhas.

Unity in belief and teaching was not fully maintained. There were numerous variations within the Church; yet all Buddhists continued to worship together in the Chaityas. These divisions were, however, so deep as to be called sectarian differences; and they became more prominent as the years passed. In the teaching of some of these sects we meet the beginnings of systematic philosophy among Buddhists. The most important of the groups are the Vibhajyavadins of Ceylon and the Sarvastivadins, the Sautrantikas, and the Mahasanghikas of India (3).

Each sect had its own literature. Of those which have survived, at least in part, the literature of the Vibhajyavadins of Ceylon is in a literary dialect called *Pali*, while the other literatures are in Sanskrit or what is known as *Mixed Sanskrit*, *i.e.*, Sanskrit with an infusion of vernacular words and phrases, varying in the several sects. The common memorised tradition of the life and teaching of the Buddha and the early history of the movement assumed a more or less divergent form in each sect. The Pali canon alone has survived in completeness; of the others only portions, large or small, have come down to our days (4).

Round about the Christian era Buddhists began to use images in their worship; and during the first century A.D., in the province of Gandhara, both west and east of the Indus, where there were still many Greeks, images of the Buddha of great dignity and beauty were created by Greeks or men trained in Greek ideas and methods (5). Thus the simple cult of the Chaityas was transformed into temple-and-image worship.

Then, towards the end of the first century A.D., all these movements culminated in the creation of a new Buddhism called "The Mahayana," *i.e.*, the Great Vehicle. Clearly, there was already within the Church a large and growing party who were convinced that the old discipline was not enough, that the ancient religion of India, founded on the great and impregnable rock of the Hindu laity, was far too strong for Buddhist monasticism.

Therefore, the Buddhas and the Bodhisattvas (6) became the Buddhist pantheon, and lofty temples of noble architecture were built for their worship. A rich liturgy of great beauty was formed to accompany a new ritual as gorgeous, as attractive, as emotional as anything that Hinduism could show. Priests and acolytes, incense and music, banners and processions completed the spectacle. The Buddhist temple thus became a dangerous rival to the Hindu temple.

The new system appealed powerfully to the laity. Three noteworthy features are to be noticed:—

a. They were taught to cultivate rich devotional feeling, *bhakti*, for the Buddhas and the Bodhisattvas.

b. They were told that the monastic life was no longer necessary for the attainment of the highest spiritual ends. Married men and women were urged to enter on the new discipline by taking the vow to toil towards Buddhahood, in imitation of the great Bodhisattva. Asceticism was unnecessary; the family and society were the best training ground for the spiritual life. Love, sympathy, service were far more powerful than austerities. The taking of the vow at once transformed the devotee into a *Bodhisattva*.

c. A new philosophy was taught, which each *Bodhisattva* was urged to study, viz., *Sunyata*, the philosophy of the emptiness of all things.

A very large, varied, and attractive literature was also created which did much to strengthen the new Buddhism. One of the earliest and most influential of these books is the *Saddharma Pundarika*, "The Lotus of the True Religion," which is the Buddhist *Gita*. The Mahayana thus gave Buddhism a great uplift.

While the Neo-Buddhists spoke of their own system as the *Mahayana* or Great Vehicle, they depreciated the old monastic discipline as the *Hinayana*, or humble vehicle. But, although the Buddhist community thus became organised in two distinct churches, each with its own characteristic worship, teaching and discipline, there was no absolute separation. Multitudes of the laity did not definitely join either side; and, in the universities, the two parties worked side by side in kindly harmony.

At a later date, possibly about 500 A.D., another type of theology and practice appeared in Buddhism, viz., Tantrism, *the adoration of goddesses*, accompanied by much magic and superstition and a good deal of eroticism. This is the culmination of the Hinduising of Buddhism. A large literature accompanied this movement also.

In spite of the new vigour released in the Mahayana, Hinduism proved victor in the age-long fight. By the 7th century A.D., it could be seen that the struggle was practically over.

But meantime Buddhism, partly in the Hinayana form, but chiefly as the Mahayana, had spread to most parts of Asia. To the west of India Buddhist propaganda failed altogether, but southwards, eastwards, and northwards vast numbers of people passed into the Church. In Ceylon, Burma, Siam, and Cambodia, it is the Hinayana form that is professed; in Korea, China, and Japan both are held, the Mahayana predominating; while the Buddhism of Nepal, Tibet, and Mongolia is the Mahayana with a considerable infusion of Tantrism (7).

A large selection from Hinayana, Mahayana, and Tantrik literature was translated into Chinese and was at later dates printed and published under the care of the Government. This canon contains 1,662 distinct works (8). In Tibetan a canon was formed of Mahayana and Tantrik works, consisting of 1,083 distinct books. It is called the *Ka-gyur*. A supplementary group of books is called the *Tan-gyur*. This mass of Tibetan translations was, at a later date, translated into Mongolian (9).

When a knowledge of Buddhism was first brought to Europe, it was received in Britain, Germany, America, and elsewhere with great enthusiasm; and societies were formed in a number of centres for the practice of the religion. In Britain and some other lands the movement has weakened, but in Germany and elsewhere there are still many Neo-Buddhists.

In Buddhist lands in Asia, Christian missions and western education led, at the outset, to a certain amount of scepticism and criticism of Buddhism; but in recent years Buddhists have developed fresh scholarship (10), and numerous societies for the exposition and defence of the religion have been formed. The movement is specially noticeable in Ceylon and Burma, in China and Japan.

Buddhist scholarship in Europe reached a climax during the last decade. The publication of the Pali canon has been completed; and a large number of the books of that collection have been translated into European tongues. Great progress has also been made with the publication of Mahayana and Tantrik texts and translations, while several great works by European scholars at last enable the student to understand clearly the historic movement of Buddhist thought and the real significance of the philosophies of the Mahayana.

BIBLIOGRAPHY.—(1) Three great works which, taken together, deal with the whole history, teaching, and practice of Buddhism, have been published since 1921: Sir Charles Eliot, *Hinduism and Buddhism* (1921); Oltramare, *L'Histoire des Idées Théosophiques dans l'Inde*, vol. ii (1923); Keith, *Buddhist Philosophy in India and Ceylon* (1923). These are referred to in this article by their authors' names. Hastings' *Encyclopaedia of Religion and Ethics* (1908–21) is referred to as *ERE*. (2) Eliot, 1–185 ff.; Oltramare, 87–255; Keith, 33–134. (3) Keith, 148–159. (4) Oltramare, chap. 3. (5) Cambridge, *History of India*, 1–648ff. (6) ERE, *Bodhisattva*. (7) Eliot, vol. iii; *ERE* "Lamaism." (8) Bunyiu Nanjio, *The Chinese Buddhist Tripitaka*, *1883*. (9) *ERE* 7–786. (10) E.g., Aung (Burma), *A Compendium of Philosophy* (Abhidhammatthasangaha) (1910); Sadaw (Burma), *Dissertation on the Gamaka* (1913); Sureyagoda Sumangala (Ceylon), *Dhammapada* (1914); Suzuki (Japan), *Outlines of Mahayana B.* (1907); Takakusu (Japan), *Abhidhamma Lit. of the Sarvastivadins* (1905).

The whole history of Buddhism is now known in outline; large masses of its literature are available in MSS., and a considerable percentage have been published. Many works have been translated into European languages, and a large historical and expository literature has appeared in Europe and America. The whole of this literature, as it existed in 1912–3, is discussed and catalogued in Winternitz, *Geschichte der Indischen Litteratur*, 2., 1., 1913. A sketch of the whole, published seven years later, may be found in Farquhar, *An Outline of the Religious Literature of India* (1920). (J. N. F.)

BUDENNY, SIMEON MIKHAILEVICH (1876–), Russian soldier, was born in southern Russia, the son of a farmer of the Cossack country. He entered the Russian Army in 1903 and rose to be a non-commissioned officer. In 1917, after the Revolution, he was elected president of the divisional soviet of the Caucasian troops. He did not join the Communist party until 1919, but soon after the beginning of the civil war found himself in conflict with the Whites and, with only a few friends and relations, began to wage guerilla warfare against the Cossacks in the district. His forces increased and early in 1918 he joined the Red army. With the nucleus of his own men he organised the Red cavalry, and after a rapid series of promotions became commander of the first cavalry army. In this capacity he took an active part in the operations against Wrangel and in the Polish War (1920). He eventually became chief of the Red cavalry and was a member of the military revolutionary council of the Soviet Union.

BUDGET, NATIONAL (*see* 4.750).—The most important condition to be attached to a budget is that it shall be a comprehensive statement of revenue and expenditure during the financial year, preferably in comparison with corresponding data for the preceding year. If important items are omitted, it is obviously impossible to obtain a complete review and a clear grasp of the financial position as a whole. A glance at a summary table should reveal whether there is a genuinely balanced budget or a deficit to be provided for. The practice of special accounts is only too often an expedient to conceal a deficit. In the years 1919–24 France, Switzerland and several other countries, charged various extraordinary items of expenditure to accounts outside the general budget, and protracted calculations were needed to arrive at a consolidated statement in either case. In the two countries mentioned the budgets for 1925–6 have contained tables showing total expenditure, and their Governments have not only expressly condemned the former methods but have undertaken to indicate in future budgets the total estimate of expenditure for the financial year.

I. GENERAL CONSIDERATIONS

The condition that the budget should include all items of revenue involves a plea for so-called gross budgeting, *i.e.*, that the special receipts collected by a service, such as court or hospital fees, and not merely the expenditure after reduction by reason of those receipts, should be accounted for. The converse system of net budgeting does not reveal the total expenditure on account of the several services. Most countries have adopted in principle the system of gross budgeting, but there are frequent illogical exceptions. The British method of stating both gross and net expenditure has the advantage of showing the total expenditure as well as the appropriations to be made from general revenue funds obtained principally from taxation. The budget figures reviewed in the budget speech by the Chancellor of the Exchequer and habitually quoted in Great Britain are the net figures with the exception of those of the Post Office, for which gross receipts and working expenses are shown.

Public Undertakings.—Special problems arise with regard to public undertakings of a quasi-commercial character (such as railways, naval dockyards, etc.) and to funds constituted for special purposes (*e.g.*, for granting loans at a reduced rate of interest to farmers or to shipping companies, etc.). It is generally thought desirable to separate the accounts of public undertakings from the general budget. The general budget becomes less clear if railway receipts and so on are permitted to swell the figures, and on the other hand these undertakings should be free to adopt a form of accounting on strictly commercial lines which are more complicated than the usual form of state accounting. It has sometimes been proposed that all public services should adopt the principles of commercial or cost-accounting. It would, of course, be ideal to know the exact cost of each administrative and combatant unit, but the system of commercial accounting when applied to all branches of the administration has proved to be complicated and expensive, and, moreover, to necessitate a great number of more or less arbitrary estimates (*e.g.*, rental value of state owned barracks). After the War cost accounting was introduced in many branches of the British Army; but in accordance with a decision taken in July 1925, the govt. announced that, subject to the approval of the Public Accounts Committee, it was proposed to discontinue the cost-accounting method in all save operative establishments (*i.e.*, laundries, electrical departments, bakeries, etc.). The practical method would seem to be that of applying cost-accounting to all quasi-commercial undertakings and to other services which delegate wide discretionary powers to the official in charge or are administered by bodies not directly subject to permanent Treasury control. If, however, certain accounts are kept separately from the ordinary budget accounts should there not be a link between the former and the latter? Generally there is such a link. The net proceeds resulting from the operations of the undertakings or the appropriations required to meet their deficits, as the case may be, are included in the general budget accounts (Austria, Czechoslovakia, Denmark, Sweden and the United States); but in certain countries (Switzerland and the Union of South Africa) the state railways have independent budgets.

To the latter system the objection may be raised that a deficit is less conspicuous in a special budget than when included in the general budget to be covered at the expense of the taxpayer. To indicate the impossibility of generalising in this field, it may be mentioned that public undertakings of the Netherlands are treated in three different ways:—

(a) The state railways are run by two companies, in which the state owns shares.

(b) The post, telegraph and telephone services and some other undertakings are worked as independent concerns, net figures of surplus or deficit being carried to the general budget.

(c) The state mines are treated as ordinary government departments, the gross receipts and working expenses being included in the general budget.

The question of commercial accounting for public undertakings is often connected with a modern tendency to grant them the status of autonomous concerns, so that their management is more or less independent of the general political administration. It is thought that such a system facilitates the introduction of strictly commercial methods of calculation and reduces undue political interference, but the fact should not be overlooked that it also reduces the possibilities of Parliamentary and Treasury control. No doubt the growth of state activities of a socialistic character creates new constitutional and budgetary problems, and in many countries these problems have been studied by select public committees, among the reports of which that of a Swedish committee on railway management, published in 1924, is perhaps particularly noteworthy.

When funds are constituted for special purposes, these funds are often kept quite independently of the general budget. A road fund, a land settlement fund, may be drawn upon as long as there is any unexpended balance available. It is only natural that the system of distinct funds should prevail in new countries in process of rapid development, like Australia and New Zealand. But the practice leads to obscurity and thus involves dangers. The same objection may be raised, to a certain extent, to funds constituted for social insurances; in what way these funds may be linked to the general budget is, however, at present a very knotty problem.

Classification.—It seems almost self-evident that revenue and expenditure should be classified according to logical principles so as to permit of rational analysis and discussion of the problems which arise. In practice all kinds of difficulties present themselves. The fact that budgets are legal documents having a certain binding character introduces many mystifying complications. If, for instance, a distinction must be made between appropriations which are permanent and those which must be voted annually, between appropriations which may be exceeded by the Govt. and those which may not, or between sources of revenue subject to differing constitutional procedure, such a distinction, if shown in the budget, may completely upset a rational system of accounting for purely informative purposes. The Govt. of the United States, therefore, separates the budget from the Acts of revenue and appropriations and publishes the estimates and the statutes in different documents. In the British budget a very curious development has taken place, viz.: that details of estimates, presented for information only, have acquired by custom a binding force (*see* R. G. Hawtrey, *The Exchequer and the Control of Expenditure*, p. 59, 1921).

In many countries (Czechoslovakia, Germany, Rumania, etc.) the revenue side of the budget is grouped according to the various branches of administration responsible for the collection of receipts so that tax-revenue, for instance, is shown in the Ministry of Finance, together with various administrative receipts; surpluses from government undertakings in the Ministry of Communications. In other countries (Denmark, United Kingdom, Finland, Italy, Sweden, United States of America and the British Dominions) revenue is classified according to its nature (tax and non-tax revenue, income tax, customs and excise duties, etc.). The latter system shows more clearly and undoubtedly more quickly the facts of primary interest, and is more easily understood.

The expenditure side, on the other hand, is almost necessarily grouped according to organisation units, although this method is often combined with a secondary classification according to objects of expenditure (*e.g.*, an appropriation is given for a certain purpose in a lump sum which is not distributed among the various departments concerned). In most countries the character of the expenditure (whether ordinary, extraordinary, capital outlay or current expenses) is permitted to influence the classification. If the classification is not determined by one basic principle, the result is only too often obscurity and confusion.

In the British budget the historical division of expenditure items into Consolidated Fund Services and Supply Services is hardly logical, but the defect is of small practical importance since almost the whole of the Consolidated Fund expenditure consists of the Debt Service, the Road Fund and the Local Taxation Account. The Supply Services are grouped under administration units and the system is often praised for its clearness. But in England sums may be issued under special Acts for capital improvements (*e.g.*, the extension of the telephone system or the erection of public offices). These issues form the nearest equivalent to a capital account or an extraordinary budget in the British financial system.

In the Swedish budget a primary distinction is made between current expenditure and capital outlay (the latter term employed in a very restricted sense) so that it is clearly shown how much is expended for current requirements and how much investments which will yield a return in the future. In the United States budget current expenditure and constructions are shown as sub-headings of the primary divisions according to organisation units. In the British Dominions great prominence is generally given to the distinction between current and capital expenditure.

Extraordinary Expenditure.—On the European continent budgets are often divided into ordinary and extraordinary, but these terms are unfortunately used in widely different senses. In Germany the extraordinary budget originally included only capital expenditure, which term, however, was employed to comprise military and naval constructions also. Since the War reparation payments have been accounted for as extraordinary expenditure; moreover, in the ordinary budget there is a special distinction between permanent and non-recurrent expenditure. In Czechoslovakia the extraordinary budget comprises exceptional expenditure, but not capital outlay, while in France and Belgium the extraordinary budgets include both capital expenditure and other more or less non-recurrent expenditure. It is maintained that the whole conception is dangerous, as it may mislead the public into believing that extraordinary expenditure may properly be covered by proceeds of loans instead of by the yield of taxation. In the budgets of Austria and Hungary the League of Nations has insisted upon obtaining a clear statement of capital expenditure for strictly productive purposes, and has disregarded the distinction between ordinary and extraordinary expenditure. It is extremely difficult to strike a proper line of division between permanent and non-recurrent items. Even appropriation to alleviate hardships caused by earthquake may become a fairly regular item in the budget, as, for instance, is the case in Italy.

Subsidiary Tables.—If a budget is drawn up on fairly simple lines it may be necessary, and is greatly to be advised, to provide full explanation and recalculation in subsidiary tables, which, for instance, might show the amounts expended for certain purposes (say education) by different administrative branches (ordinary schools in the Ministry of Education, agricultural schools in the Ministry of Agriculture, technical schools in the Ministry of Trade, etc.). These tables might also attempt to evaluate, in the case of each department, what provision is made for it in other notes (*e.g.*, postal services, stationery, local rates). It is really a question rather of supplying information than of classifying expenditure in the budget. Whatever method is adopted, it is of much importance that there should be continuity of practice, successive changes greatly prejudicing comparisons from one year to another and—even worse—causing the real position of the country's finances to be misunderstood. In some European countries scarcely a year passes without some change in the system.

The Cash and Accruals System.—In some countries the yearly accounts comprise the amounts actually expended and the revenue actually collected in the course of a given year (England, Sweden). In other countries, which have adopted the system of accruals, the accounts comprise the amounts which had been legally incurred, so that claims against and revenue acquired by the Treasury are shown irrespective of the time of the actual payments or collection of revenue. The main advantage of the second method, which corresponds to private accounting practice, is that it takes into account unpaid bills, which a reckless Government may leave behind it, and it is thought to facilitate detailed parliamentary control. On the other hand, accounts on an accrual basis do not show the amount to be collected and to be spent in a given period of time, which is an important consideration for the banking community. It is not surprising to find that England has adopted the cash system. This system can only work well, however, if the English rule is firmly established: that the normal course of business shall determine the date of payment without any manipulation. Under the cash system the monthly statements of revenue and expenditure may more easily be compared with the yearly budgets. An important feature in the budget system of a country is the publication of closed accounts with the least possible delay after the financial year ends, as these accounts form, after all, the only sure basis for judging of the soundness of the budget estimates. The closed accounts often include a valuable review of the capital wealth of the state, total liabilities, etc.

II. POST-WAR CONDITIONS IN VARIOUS COUNTRIES

Great Britain.—In Great Britain the most important change in the budget system since the War is represented by the attempts to introduce so-called cost accounting, which were not entirely successful (*see* above). In the House of Commons, Mr. Asquith on several occasions criticised the inclusion of proceeds of the sale of War stocks as current revenue in the budget; he urged that these proceeds should have been separated from the budget-accounts and devoted exclusively to debt redemption. During the period 1920–5, however, more than £700,000,000 of public debt have been so repaid.

In Sweden the proceeds of sale of stocks held by certain war commissions were handed over direct to the Public Debt Commissioners for debt redemption.

United States.—In the United States a very noteworthy reform of the budget system was introduced by means of the Budget and Accounting Act of 1921. Before that year there had been no attempt to consider the problem of government financing as a whole. The Secretary of the Treasury when submitting estimates to Congress had acted as a mere compiling authority; he had no power to modify the proposals transmitted to him by the heads of the administrative departments. The President, although legally entitled to secure co-ordination of the estimates, had no service at his disposal through which he could effectively exercise his authority. There was no budgetary message, no balance sheet, no collection of summary, analytical or comparative tables. In Congress there was also division of responsibility. Revenue and expenditure were considered by different committees; provisions for expenditure were made by passing 13 general appropriation Acts emanating from no less than 9 different committees. All this was radically changed in 1921. The President was charged with the preparation of the budget estimates to be transmitted to Congress. The budget must include analytical statements and comparative tables, data relating to public debts, etc. If a deficit is foreseen, the President has to make recommendations for new taxes, loans or other action, and he may likewise make proposals as to the utilisation of a budget surplus.

To assist the President in his task a Bureau of the Budget has been established in the Treasury Dept., under a director responsible to the President. No department may submit an estimate or a request for appropriations directly to Congress, if not specifically requested to do so by a competent committee of Congress. The procedure in Congress was reformed by the appointment of a strong committee on appropriations in the House of Representatives. The results obtained during the first four years' working of the new system were highly satisfactory, and were most conspicuously evidenced by the considerable savings in expenditure, which have led to reduction in taxation. There are very few administrations for which budgetary data are available in so clear and concise a form as that of the Federal Administration of the United States.

France.—In France the numerous special expenditure accounts existing after the War were gradually discontinued during 1922–4 and in 1925 a comprehensive budget was prepared, but the problems connected with the reconstruction of the devastated districts, the army of occupation and the reparation recoveries from Germany still cause some confusion in the budget system. Closed accounts have not been published for any post-War financial year, but monthly figures of actual revenue and expenditure are published by the Ministry of Finance.

Germany.—In Germany the budget estimates were submitted to the Reichstag by the prescribed date in both 1925 and 1926, but the votes were delayed, the budget for the financial year March 30 1924–April 1 1925 being finally voted on Aug. 9 1925. In several instances payments were made on the basis of authorisations not incorporated in the budget. Monthly figures of revenue and expenditure, however, are published with great promptitude.

Italy.—In Italy where public accounting ranks almost as a special science, monthly returns of revenue and expenditure are published regularly and closed accounts were available for post-War years without delay. The accounting system was simplified to a certain extent, the central powers of the Treasury having been strengthened and established on lines similar to those of the British Treasury.

Miscellaneous.—By means of the reconstruction schemes it has drawn up and put into operation and the control it has exercised in Austria (*q.v.*) and Hungary (*q.v.*) the League of Nations has had a definite influence on the budget systems of those countries. The reforms which have been introduced in Austria and Hungary have been studied by different countries in Europe, and their importance as an example to be followed already begins to become evident.

The diversity of system obtaining in different countries makes it very difficult to establish international comparisons. The question of international financial statistics was discussed by the International Statistical Institute at The Hague before the War. In connection with the Brussels Financial Conference of 1920, a memorandum of financial data was prepared, and the Secretariat of the League of Nations has issued two further volumes on public finance. These memoranda are not intended primarily to give directly comparable data—but to furnish sufficient information concerning the budget systems to enable the reader to understand the figures presented. An attempt has been made to prepare summary tables of total expenditure and revenue, to show the budget surpluses or deficits of the several countries and to give statements of foreign and domestic debts. The League has also published in the Armaments Yearbooks statistics of defence expenditure in different countries, which furnish material indicating the development and tendency of defence expenditure in each individual country.

The Dawes Report contains a digression on the subject of comparing tax burdens, but does not go very much farther than reviewing the difficulties. Obviously no complete picture can be drawn without taking into consideration local budgets, which raises a new set of problems, as local, even more than state, finance is concerned with public undertakings of a quasi-commercial character (gasworks, public baths, etc.). The urgent financial problems awaiting solution in almost every country have stimulated inquiry in this field of research by government bureaux, private associations and individual students of finance and economics.

See also the sections on finance under the headings GREAT BRITAIN, GERMANY; UNITED STATES, etc.

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(P. J.*)

BUENOS AIRES (*see* 4.752) continued to rank in 1925 as the largest city in South America and the fourth largest in the Americas, being exceeded in population only by New York, Chicago and Philadelphia. An official estimate of April 30 1925 placed the population at 1,850,718, an increase of 274,904 since the national census of 1914.

The celebration of the country's centenary in 1910 in Buenos Aires attracted many visitors, not only from Argentina but also from abroad. In 1913 new diagonal avenues were begun, the plan being to change the rectangular pattern, previously followed, by cutting diagonal avenues through the city on the model of Washington and Paris. Work on the two chief thoroughfares, radiating from the corners of the central Plaza de Mayo, though interrupted by the World War, was far advanced in 1925, and did much to relieve the traffic congestion in the centre of the city. The project involves also the widening of alternate streets from the river and the demolition of many of the older parts. The parkway lying between the city proper and the Rio de la Plata was greatly improved during the period 1910–25; much land was reclaimed from the river, and a post-office and custom house were erected on this parkway, adding greatly to its beauty.

The city has been further beautified by the centenary gifts of various nations to Argentina; these include the handsome clock tower erected by the British colony at a cost of £50,000 opposite the new railway station opened in 1916, the largest in South America; the statue of George Washington erected in Palermo Park by the U.S. colony; and statues from the Spanish, French, Syrian and other foreign communities. The Congress building was finished in 1912, the park in front of it, the Plaza del Congreso, having been opened for the centenary celebrations in 1910.

Buenos Aires, transacting approximately 80% of the entire foreign trade of the republic, is the busiest port in Latin America. As the industrial and banking centre of the country, it has benefited by the protective tariff, through the aid of which a large number of factories have sprung up in and near the city. Branches of U.S. and European factories also have been established there, manufacturing chiefly textiles, hosiery, and small iron and steel articles. A branch of the National City Bank of New York was established in Buenos Aires in 1914, an example since followed by several other U.S. banks, including the First National Bank of Boston which, in 1924, opened there the largest office building in Latin America. Other improvements during the period 1910–25 were the erection of a number of modern hotels and apartment buildings and of a greatly improved immigration station, through which pass about 90% of the republic's immigrants; the opening of some 80 new parks and plazas; the construction of a new subway; and the expansion of the University of Buenos Aires. (C. L. C.)

BUFFALO (*see* 4.754).—The population in 1920 was 506,775, an increase of 83,060 or 19·6% for the decade. The state estimate in 1925 was 538,016. The population of the metropolitan district in 1920 was 602,847, and the area of the city is 42·89 sq. miles.

Administration.—Since Jan. 1 1916 the city has been under commission government. The citizens choose by direct nonpartisan nomination and election a mayor and four councilmen. These constitute the sole municipal legislature and are also the chief executive heads. The mayor, *ex officio*, heads the departments of Fire, Police, and Health, which comprise the Department of Public Safety. The four other departments are Finance and Accounts, Public Works, Parks and Public Buildings, and Public Affairs, each in charge of a councilman. The principal subordinate officials are nominated by the mayor and appointed by the Council. The mayor has a vote in the Council, but no veto power. Ordinances and appropriations, outside ordinary city expenses, may be referred to vote of the people on petition of 5% of qualified citizens. The city completed in 1915 a new pumping station and tunnel 6,500 ft. long, by which water is brought from Lake Erie. The capacity of the plant is 150,000,000 gal. each 24 hours. A filtration plant at a cost of $4,000,000 was completed in 1926. The schools are under a Board of Education appointed by the mayor and council, but subject mainly to state laws.

University Developments.—The University of Buffalo acquired a new site of 106 ac. in the northern part of the city to which 44 ac. were added in 1919 and in 1920 an endowment fund of $5,200,000 was raised by popular subscription. Other important gifts have been received and rapid expansion has begun. Samuel P. Capen became chancellor in 1922. A unique gift provides for the conferring by the university annually of a civic medal to the citizen of Buffalo who is adjudged to have done the most distinguished service to the community and the world. The first medal was given in 1924 to Bishop Charles H. Brent, delegate of the United States to the international opium conference. Canisius College (Jesuit) raised, by popular subscription, an endowment fund of $1,000,000 in 1920, and was again greatly enlarged in 1924–5. D'Youville College for women (Roman Catholic) was opened in 1908.

The new City Hospital in Buffalo and the J. N. Adam Memorial Hospital for tuberculous patients at Perrysburg, N. Y., are maintained by the city. Important new buildings are the Statler Hotel, Liberty Bank, and the Walbridge, Genesee, Marine Trust, Athletic Club, General Electric, and New York Telephone buildings.

Commercial Importance.—Located at the foot of Lake Erie, Buffalo's waterborne commerce makes her the second greatest inland port in the United States and one of the ten greatest in the world. There are 37·4 m. of water frontage. The New York State Barge Canal gives water transport to the seaboard for barges up to 2,000 tons capacity. Eleven main railway lines also make the city an exceptional centre of land transport. The greatest growth in recent years has been in manufactures, particularly flour, iron and steel, and rubber products. Its proximity to Niagara Falls enables the city to depend largely on electric power obtained therefrom.

War Record.—Buffalo furnished over 10,000 volunteers and selected service men to the U.S. Army in the World War. The greater number of these served in the 77th and 78th divisions and had an active part in the Argonne and other battles. In addition, the 74th Infantry, N.G.S.N.Y., became the 108th Infantry in the U.S. service; the Third Field Artillery, N.G.S. N.Y., became the 106th Field Artillery; Troop I., N.G.S.N.Y., became the 102nd Trench Mortar Battery, and Base Hospital No. 23 was recruited in Buffalo. The 108th Regiment, forming a part of the 27th Div., participated in the breaking of the Hindenburg line, Sept. 29—Oct. 1 1918 (*see* VICTORY, ADVANCE TO). The 106th Field Artillery and the 102nd Trench Mortar Battery were in the battle of the Meuse-Argonne. Nearly 4,000 Buffalo men served in the Navy and about 1,000 in the U.S. Marine Corps. (M. M. W.)

BUFFALO: *see* BISON.

BUKOVINA, a province of Rumania, formerly included in the Austrian Empire. Its area is 4,030 sq. m.; population, 819,230.

According to the official census of the Austrian authorities made in 1910, taking the language spoken as the criterion of nationality, the total population of Bukovina numbered 794,930 inhabitants consisting of 273,250 Rumanians, 305,000 Ruthenians, 168,850 Germans (of whom 102,920 were of the Jewish faith), the rest being composed of Poles, Hungarians and Czechs. Rumanian statistics for 1923 give the population of Bukovina as 819,230, divided as follows:—Rumanians 365,000, Ruthenians 251,000, Jews 128,000, Germans 47,000, Poles 16,000, the rest being composed of Hungarians, Czechs and Slovaks.

The preponderance of Ruthenians over the other nationalities explains the policy of "Ruthenisation" adopted by the Austrian Govt., against which the Rumanian element rose to defend their nationality in 1848. In 1910 universal suffrage with secret polling was introduced into Bukovina, and by this means the Ruthenians were assured of a large number of representatives both in the Bukovinian Diet and in the Parliament in Vienna, where the Rumanians with their five Deputies formed the smallest national group in the Chamber.

Political History.—Upon the collapse of the Austro-Hungarian Empire in Oct. 1918, the last governor, Count Etzdorf, before leaving Bukovina, placed the administration of the province in the hands of the Ruthenians. For the space of four days the utmost anarchy reigned. Then, to put an end to the danger of revolution and Bolshevism that threatened the province, the representatives of the Rumanian population held a meeting on Oct. 27 at Cernauţi, and proclaimed a Constitutional Assembly, which voted the union of Bukovina within her historical boundaries with the Kingdom of Rumania. In consequence, the Assembly applied to the Rumanian Govt. at Jassy for the help of Rumanian troops, which made their entry into Cernauti on Nov. 11 1918.

Administration.—For administrative purposes Bukovina is divided into five Districts, each district being placed under a prefect appointed by the central administration at Bucharest. The official language of the administration, of the law-courts and of instruction is Rumanian. Schools for minorities, with teachers paid by the Rumanian state, are established in those centres in which the majority of the population is non-Rumanian. In these schools the language of the respective minority is used, the only obligation being that Rumanian should also be taught.

Production.—The abundance of raw materials and especially the extraordinary wealth of the province in forests (which cover 470,000 hectares of the total area of 1,040,290 hectares), and water-power place Bukovina in an exceptionally favourable position from the point of view of industrial development. In addition to the already existing brewing and milling industries, a number of new industries have been established since 1918. There are five factories for the manufacture of furniture, parquet flooring and modern joinery. The large production of potatoes has given a strong impetus to the distilling industry, and owing to the neighbourhood of Bessarabia a leather and a wool industry have sprung up. Since 1921 eleven knitting- and weaving-mills have been created, while the bacon and ham industry is in a very flourishing state.

Communications.—Being placed on the international railway line which links central Europe with Bucharest and Constantsa, Cernauti is the principal transit centre between Rumania and Poland, Czechoslovakia, Austria and Germany, and the export centre for the chief products of Bukovina (timber, horned cattle, pigs, spirit, eggs, etc.). Moreover, owing to the re-opening of the old ways of communication between northern and southeastern Europe, which before the annexation of Bukovina to Austria in 1774, passed through Cernauti to the Black Sea, the province has—in spite of repeated invasions and devastations during the War—been able to recover economically with remarkable rapidity. (G. Bo.)

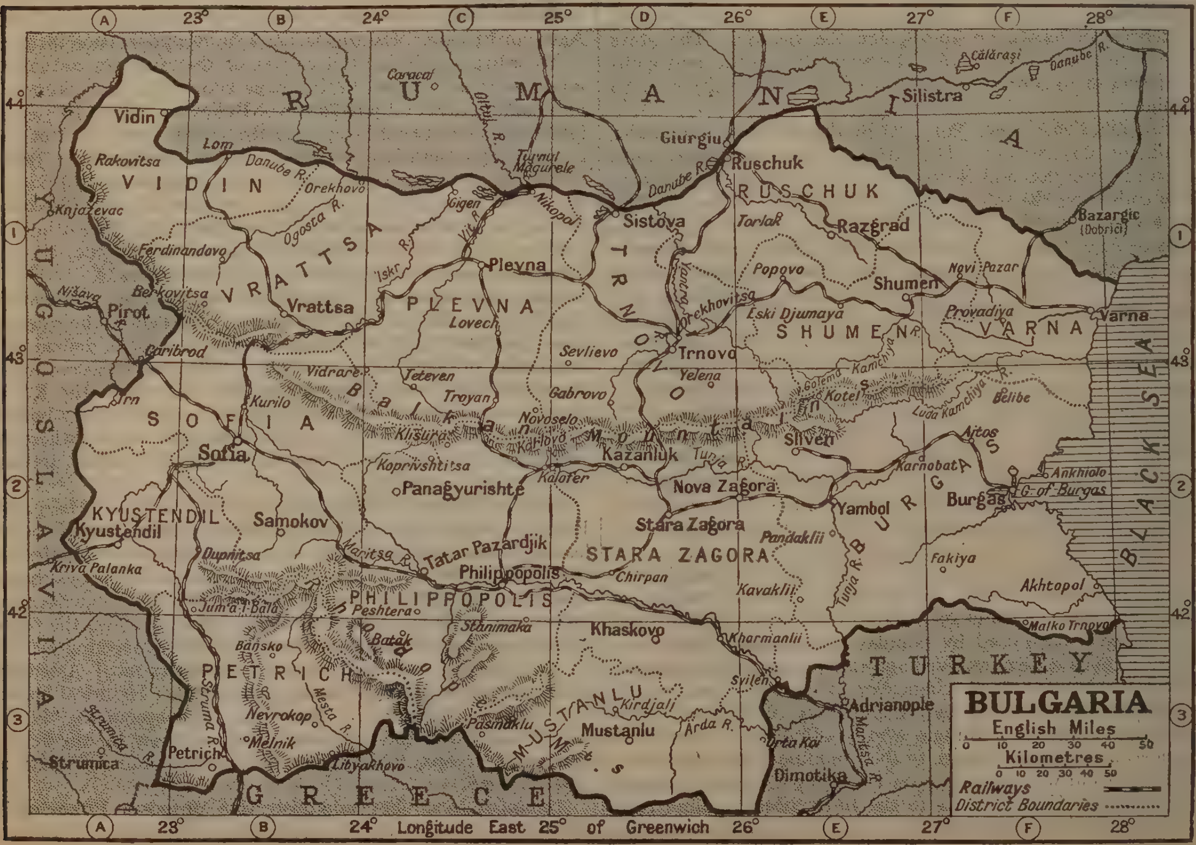
BULAWAYO (*see* 4.771).—This town of Southern Rhodesia had a population (1921) of 6,831 compared with 3,840 in 1904. It retains its position as the chief commercial and railway centre of Southern Rhodesia. The public and business buildings are, for the most part, handsome and substantial. The museum, opened in 1910, has a large collection of objects taken from Zimbabwe and other ancient sites. There are good public primary and high schools. The Rhodes estate, five miles from the town, is now a government experimental farm (115,000 acres). Bulawayo is the best place from which to visit the Matopo Hills. Here, at a spot some 30 m. from Bulawayo, the body of Sir Starr Jameson, brought from England, was, in 1920, buried near the grave of Cecil Rhodes.

BULGARIA or BLGARIYA (*see* 4.772), a country of south-eastern Europe. The area is 39,814 sq. m. and the estimated population (1920) 4,846,971. For the changes in boundaries *see* NEUILLY, TREATY OF, and below.

I. POLITICAL HISTORY

The condition of Macedonia and Thrace, which had always been a source of anxiety for Bulgaria, became even worse under the Young Turks. Serb propaganda here had greatly increased since the return of the Karageorgević dynasty in 1903 and the definite triumph of the Radical party. Rival bands of Serbs, Greeks, Bulgars, Wallachs, Albanians and Turks carried on their respective propaganda in Macedonia by force of arms, and the life of the peasants became unbearable. Menace of war with Turkey, and, latterly, with Greece and Serbia, entailed a military expenditure on Bulgaria, which in 1909 was proportionately higher than that of any European state. Bulgaria had, moreover, to support thousands of destitute refugees who had escaped from Turkish territory in fear of a general massacre.

The Balkan Alliance.—In March 1911 the Malinov Cabinet fell, and Gueshov, head of the Nationalist party, became Presi-


BULGARIA
English Miles
0 10 20 30 40 50
Kilometres
0 10 20 30 40 50
Railways
District Boundaries
Longitude East 25° of Greenwich
23° 24° 25° 26° 27° 28°
44° 43° 42°
A B C D E F
1 2 3
R U M A N I A
TURKEY
GREECE
BLACK SEA
Vidin
Lom
Rakovitsa
Knjazevac
Ferdinandovo
Berkovitsa
Pirot
Nišava
Tsaribrod
Vrattsa
Orekhovo
Gigen
Pleyna
Lovech
Caracal
Turnul Magurele
Nikopol
Sistova
Giurgiu
Ruschuk
Călărași
Silistra
Danube R.
Torlak
Razgrad
Popovo
Shumen
Novi Pazar
Bazargic (Dobrich)
Provadiya
Varna
Eski Djumaya
Orekhovitsa
Trnovo
Sevlievo
Gabrovo
Yelena
Kotel
Teteven
Troyan
Vidrare
Kurilo
Sofia
Trn
Kilsura
Koprivshtitsa
Panagyurishte
Karlovo
Kalofer
Kazanluk
Sliven
Karnobat
Aitos
Ankhialo
Burgas
G. of Burgas
Nova Zagora
Yambol
Stara Zagora
Pandaklii
Fakiya
Akhtopol
Malko Trnovo
Kyustendil
Samokov
Tatar Pazardjik
Philippopolis
Chirpan
Kavaklii
Kriva Palanka
Dupnitsa
Juma-i-Bala
Peshtera
Stanimaka
Batak
Khaskovo
Kharmanlii
Bansko
Nevrokop
Melnik
Petrich
Strumica
Pasmaklu
Kirdjali
Mustanlu
Arda R.
Svilen
Adrianople
Orta Kai
Dimotika
Libyakhovo
VIDIN
VRATTSA
PLEVNA
RUSCHUK
SHUMEN
VARNA
TRNOVO
SOFIA
KYUSTENDIL
STARA ZAGORA
PHILIPPOPOLIS
PETRICH
MUSTANLU
BURGAS
Balkan Mts.
Iskr R.
Vit R.
Yantra R.
Osma R.
Ogosta R.
Olt R.
Tunja R.
Maritsa R.
Mesta R.
Struma R.
Kamchiya R.
Luda Kamchiya
Golemo Kamchiya
Belibe

dent of the Council. Balkan statesmen at last began to realise that only joint action could put an end to Macedonian troubles. In 1910–1, negotiations were opened at Athens between Bulgaria and Greece. The first steps took the form of private conversations between J. D. Bourchier, principal correspondent in the Balkans of *The Times*, London, and Venizelos. Eventually, Venizelos entrusted Bourchier with the transmission to King Ferdinand of a definite proposal, which was known only to King George, Venizelos and Bourchier. On May 29 1912 a secret treaty of defensive alliance between Bulgaria and Greece was signed in Salonika.

Negotiations with Serbia proved difficult. The Bulgars desired autonomy for Macedonia; the Serbs held out for a division of Macedonia into an uncontested Bulgarian and an uncontested Serbian zone, with a third zone, on which the Russian Tsar was to arbitrate. By the treaty finally signed in Sofia by Gueshov and the Serb Premier Milanović on March 13 and supplemented by the secret military conventions of Varna, May 12 and July 12, Serbia recognised "the right of Bulgaria to the territory east of the Rhodope mountains and the river Struma;" while Bulgaria recognised "a similar right of Serbia to the territory north and west of the Šar mountains;" if autonomy for the rest of Macedonia proved impossible, an agreed line from Goleš Mountain to Okhrida was to be accepted, subject to the Tsar's approval. Hartwig, the Russian Minister at Belgrade, had kept his government informed throughout. Early action was necessary in view of the approaching end of the Italo-Turkish War and the unrest in Macedonia. The Great Powers endeavoured to prevent war by the tardy offer of a guarantee for the autonomy of Macedonia. The Balkan Allies mobilised on Sept. 30. On Oct. 8, Montenegro, with which country no formal agreement had been made, declared war on Turkey. On Oct. 13 the Balkan Allies sent an ultimatum to the Porte; on Oct. 17 Turkey declared war on Serbia and Bulgaria; on Oct. 18 Greece declared war on Turkey.

First Balkan War, 1912–3.—The war with Turkey was popular, for the Bulgars, though they are usually deemed self-centred and materialistic, had felt the sorrows of their kinsfolk in Macedonia as their own, and were prepared for any sacrifice to set them free. The success of the campaign, though it showed once more the admirable qualities of the Bulgarian soldier, was less complete and brilliant than at first appeared. Although, after five weeks' fighting, the position seemed everywhere favourable to the Allies, the Bulgarian troops had suffered greatly from deficiencies in both medical and supply services, and casualties had been very heavy. On Dec. 3 an armistice was signed between Turkey, Bulgaria and Serbia. A conference met in London to decide terms of peace, but the delegates were uncompromising, and negotiations broke down over the possession of Adrianople. On Feb. 3 1913 hostilities reopened. Again the Allies were everywhere successful, and after the surrender of Adrianople to the Bulgars and Serbs (March 26), the Turks sought the mediation of the Powers, and a second armistice was concluded between Bulgaria and Turkey on April 16. On May 30 1913 the delegates to the second London Conference were induced to sign a treaty, the terms of which had been drafted by the Powers. Turkey surrendered to the Allies all her possessions in Europe up to a line drawn from Enos on the Aegean to Midia on the Black Sea. Albania was granted independence. (*See* BALKAN WARS.)

Rupture of the Balkan Alliance.—Apart from the national antagonism and mutual distrust which made an alliance between the Balkan States almost a miracle, difficulties arose as to the interpretation of the treaty. The Serbs claimed that, after the unforeseen success of the campaigns and the modification by the Powers of the arrangements on the Adriatic coast, a revision of the treaty was necessary, while the Bulgars held out for the letter of the territorial agreement. The secret annexes (March 13 1912) stated that "all territorial gains acquired by combined action . . . shall constitute the common property (*condominium*) of the two Allies" until final settlement. The Serbs and Greeks, as a result of their victories, held much territory in Macedonia that had originally been assigned to Bulgaria, and they seemed to be preparing for a permanent occupation. Early in 1913 Bulgaria began to suspect that her Allies were combining against her, and the military party, with King Ferdinand at their head, prepared for action. Bulgarian troops were transferred from Thrace to the Macedonian frontier during June; the Serbs made corresponding preparations on their side.

On June 1 Gueshov and Pasitch met in the hope of averting war; on the same day a treaty between Serbia and Greece was signed at Salonika. Gueshov, finding no support from King Ferdinand in his efforts for peace, resigned; he was succeeded by Danev. Russia urged restraint, but Austria-Hungary appeared to encourage active measures. On June 29 the Bulgarian IV. Army, acting on orders signed by Gen. Savov, made a treacherous attack on their Serbian and Greek Allies. It must, however, be remembered that the attack was not unexpected, and that it probably only just forestalled a declaration of war by Serbia and Greece. Gueshov states in his memoirs that the reports of the Ministerial Council contain no minute ordering the attack. A judicial inquiry into the case was opened in Sofia, but never concluded. Savov asserted that Ferdinand as commander-in-chief gave the order to attack.

The Second Balkan War brought calamity on both Bulgaria and Macedonia. By the Treaty of Bucharest (Aug. 10 1913) Rumania acquired the rich lands of the Southern Dobruja, which had belonged to Bulgaria since 1878; Serbia and Greece divided Macedonia between them; Bulgaria was accorded the mountainous region of the Pirin and Dospat down to the Aegean, with the two indifferent ports of Dedeagatch and Port Lagos.

Radoslavov Government, 1913–4.—The Radoslavov Cabinet, which took office on July 5 1913, declared for a policy of close friendship with Austria-Hungary. Several of the new ministers, including Radoslavov himself, had been prosecuted for corrupt practices during their previous tenure of office, and the King found them conveniently subservient. The December elections of 1913 gave the Opposition a majority of 14 in the Sobranje. An appeal for a loan to meet obligations and for constructive work met with an unfavourable response in France, England and Russia successively. The German Disconto Gesellschaft eventually (June 1914) provided a loan of 500,000,000 fr., the syndicate obtaining control of the state coal-mines, of the projected railway to Port Lagos and of that port. These terms were strongly criticised, for it was clear that Bulgaria was thereby handing over some of her chief economic assets to Germany.

Period of Neutrality, Aug. 1914–Oct. 15 1915.—At the outbreak of the World War, the great majority of the Bulgars wished to preserve neutrality; but the pro-German sympathies of the King, the German loan, the establishment of friendly relations with Turkey, resentment against Russia for her non-intervention in Aug. 1913, together with the deep humiliation created by the Treaty of Bucharest, had already drawn Bulgaria into the orbit of the Central Powers. Negotiations for a treaty had been in progress throughout 1914 and were approaching completion in Aug. (*see* EUROPE). Macedonia, the dominant factor of Bulgarian policy throughout her existence, was divided between Serbia and Greece, and it was unlikely that the Allies of Serbia would deprive her of her fruits of victory, in order to obtain the co-operation of Bulgaria. The King, who feared the victory of the Entente might mean the loss of his throne, believed, moreover, that Germany was invincible.

During the summer of 1915, the Entente made a series of guarded proposals to Bulgaria, but the propaganda and promises of the Central Powers were for obvious reasons more skilful and effective. Neither Greece nor Serbia would cede any portion of territory as the price of Bulgaria's support. On Sept. 6 a military convention and treaty between Bulgaria and the Central Powers was signed at Pless (Pszczyna) and on the same day Turkey made the concessions demanded by Bulgaria. On Sept. 10 Radoslavov stated publicly that Bulgaria "was coming in on the side of the victors"; two days later the Opposition issued a widely-signed protest against the step. On Sept. 15 the Entente promised part of Macedonia unconditionally, if Bulgaria would declare war on Turkey. On Sept. 17 at 11 P.M., the King received the Opposition leaders in audience. Malinov, Tsanov and Stambolisky, the Agrarian leader, demanded the convocation of the Sobranje, and protested vehemently against the King's policy. Stambolisky was, in consequence, condemned to imprisonment for life for lèse-majesté. On Sept. 22 the terms of the Turco-Bulgarian agreement were published, and mobilisation was decreed. On Oct. 12 Bulgaria declared war on Serbia; on Oct. 15 Great Britain declared war on Bulgaria, while France and Italy declared war on her on Oct. 16 and Oct. 17 respectively.

The World War, 1915–8.—Mobilisation was carried out unwillingly, but when once war had begun, the Opposition became silent, for all realised that the fate of their country was at stake. The great Bulgarian successes in Serbia made the war more popular. On Aug. 27 1916 Rumania declared war on Austria-Hungary, and, in spite of Opposition efforts for neutrality, on Sept. 1 Bulgaria declared war on Rumania. Resentment against Rumania ran high, but when the troops had retaken the Dobruja, they considered their work was done. The harvest was poor, and people were indignant because much produce was sent to Germany. German officials took control of the railways, but did not otherwise interfere with internal administration.

In 1917 the Opposition urged in the Sobranje that Bulgaria, having gained her objective, Macedonia and the Dobruja, should retire from the War. Secret negotiations in this direction were carried on in Switzerland. In Oct. the Kaiser visited Sofia. In Jan. 1918 Germany ceased to pay the subsidy of 50,000,000 fr., which she had paid yearly since Bulgaria entered the War, and after March she sent no more munitions or equipment. Shortage of food, the soldiers' dislike of trench warfare and, above all, the hopes raised by President Wilson's Fourteen Points, combined to create a yet stronger desire for a separate peace. On May 7, by the Treaty of Bucharest, Rumania ceded the Dobruja to the Central Powers, Bulgaria regaining what she had lost in 1913, with immediate occupation of the southern half. On June 18 the Radoslavov Cabinet fell and Malinov took office. When the Bulgarian line was broken and the country was invaded (Sept. 19–27), Malinov asked for an armistice (Sept. 25) which was signed unconditionally on Sept. 29. Stambolisky was released on Sept. 25 and was sent by the King to the front, in the hope that he would calm the troops, who were on the verge of mutiny. Stambolisky was, however, carried away by the situation; he proclaimed a Republic and advanced with the troops on Sofia. The loyal troops, assisted by the Germans, after some fighting, succeeded in restoring order. On Oct. 3 King Ferdinand abdicated and left Bulgaria; he nominated his son Boris as his successor. Radoslavov also fled the country. On Nov. 20 Malinov resigned and a Coalition Cabinet was formed by Todorov.

The Treaty of Neuilly.—By the Treaty of Neuilly, which was signed on Nov. 27 1919 by Stambolisky on behalf of his country, Bulgaria lost the southern Dobruja to Rumania; on the west, she ceded Caribrod and Strumica to Yugoslavia; while on the south she gave up to Greece the territory in Macedonia, which she had won in the Balkan Wars, including all access to the Aegean. Her southern frontier reaches the Black Sea at Sveti Stefan. Apart from the financial conditions of the treaty, the cession of territory, the population of which was essentially Bulgarian—not least, perhaps, the cession of Caribrod; an act which, it was alleged, brought Sofia within range of Serbian guns—was very bitter for the Bulgars. They suffered a further blow, when at the Conference of San Remo (April 1920), at which Bulgaria was not represented, all Western Thrace, with the exception of a small cession west of Adrianople to Turkey, was assigned to Greece (*see* NEUILLY, TREATY OF).

The Agrarian Government, 1920–3.—A reaction set in against all who had been responsible for bringing Bulgaria into the War, and Stambolisky became the hero of the moment. The Agrarian party had been weakened, morally as well as numerically, by the secession of Draghiev and his followers, and it was only after the elections of March 28 1920 that the Agrarians secured a definite majority. Stambolisky became Premier of an Agrarian Cabinet. He announced that he was against any policy of adventure and that he intended to fulfil, as far as possible, all treaty obligations and to live in peace with his Balkan neighbours. Relations with Yugoslavia and Greece remained, however, in a state of tension. The Bulgarian population under alien rule complained of injustice and ill-treatment; thousands escaped into Bulgaria as destitute refugees, while armed bands were formed to protect those who remained in Macedonia and to carry out reprisals. The Bulgarian Govt., in reply to protests, asserted that they could not prevent the passages of bands across the frontier, because they could not recruit even the limited force allowed by treaty, owing to the peasants' dislike of long-service conditions. Bulgaria was admitted to the League of Nations on Dec. 16 1920, and at each subsequent meeting of the council her representatives brought forward the grievances of the Bulgarian minorities in Thrace and Macedonia, where Bulgarian churches and schools had been suppressed and every effort made to stamp out the Bulgarian tongue and sense of nationality.

Stambolisky did not attack the King's position, but he at once declared war on the bourgeoisie, asserting that the exploitation of the peasant by the town politician was at last to be avenged. He himself denied that he was a communist, but in his campaign against the bourgeoisie his methods and ideals closely resembled those of the Russian Bolsheviks, with whom he later opened up direct communication. He also allied himself secretly with the communists in his own country, varying this attitude with violent denunciation and persecution. One of his schemes was for the organisation of the peasants of the world in a "Green International." His programme comprised measures for the exclusion of all lawyers from the Sobranje and civil posts; for the expropriation of Crown and Church lands and of properties over a certain size[1] in favour of landless men (*see* LAND TENURE; STAMBOLISKY); for the confiscation of houses at a merely nominal price; for changes in orthography; for a year's obligatory service for the state by all members of the community and for the prosecution on various charges of almost all ex-ministers and their supporters. Not all these measures were passed and others were repealed or modified, but the agrarian law has not been rescinded and obligatory labour in another form still continues. In 1921 the Opposition Parties, with the exception of the communists, formed a bloc against the Agrarians. In Aug. 1922 some leading members of the bloc were violently assaulted by supporters of the government. A plebiscite declared in favour of prosecuting ex-ministers for high treason, and in Sept. 1922 Danev, Malinov, Todorov, Majarov, Liabchev and others were thrown into prison.

At the Lausanne Conference (Dec. 1922 to Feb. 1923) the Bulgarian delegates pressed for the fulfilment of Clause 48 of the Treaty of Neuilly. The Allies offered an *enclave* 8 m. west of Dedeagach, railway access to which would be controlled by an international commission. This offer was declined, because a port, the construction of which would be costly, "detached from Bulgaria and only accessible across Greek territory by a foreign railway," would be of no value to Bulgaria.

At the Second Conference of Lausanne (treaty signed July 24 1923), Bulgaria declined an offer from Greece of a 99 years' lease of a coastal area on the Aegean. Owing to the cession of Karagach (Qara Agach) to Turkey, Bulgarians would have had to cross two frontiers to reach their port. Up to Dec. 1925 the promise of an Aegean port (Clause 48) had not been fulfilled.

Bulgaria complied with treaty conditions as regards destruction of arms, evacuation of territory, reparations of coal and live stock, upkeep of foreign commissions, etc., but she was unable to pay any instalment of her reparation debt. Her trade was at a standstill; prices were high. After long negotiations, the sum total due from Bulgaria was reduced from £90,000,000 to £22,000,000, payable over 60 years.

At the elections in April 1923 the Agrarians secured 212 out of 245 seats in the Sobranje, but these elections were undoubtedly controlled. Stambolisky had been much abroad, and there had been dissension in his Cabinet. The vindictive prosecutions, ruinous fines and other arbitrary measures imposed by Govt. had antagonised moderate opinion in the country, and there was indignation at certain malversations of public money, while Nationalist and Macedonian widely believed that Stambolisky had sold their interests in the Agreement of Nish with Yugoslavia (March 1923). During the night of June 8–9, the Govt. was overthrown by a *coup d'état* organised by a group of intellectuals and bourgeoisie, supported by army officers. Most of the Agrarian ministers were taken quietly to prison; Stambolisky, who was in his native village of Slavovitsa, was deserted by his followers and was killed—it is said while attempting to escape. His "Orange Guards," which had struck terror in Sofia, were disbanded. The country as a whole remained calm. Unscrupulous as he was, Stambolisky had shown on occasions the courage, shrewdness and tenacity of his race; his character was not fitted to stand the test of power, and his reputation suffered yet more by revelations which followed his violent death.

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[1] Thirty hectares for peasant proprietors, 10 for married, 4 for single urban proprietors who do not themselves cultivate the soil.

The Tsankov Government, 1923.—M. Tsankov, formerly professor of political economy at Sofia University, became president of the Council, and Col. Kalfov Foreign Minister. Few of the Cabinet had had any previous connection with politics. The position of the Govt. was strengthened by the subsequent fusion of all political parties, except Liberals and Communists, into a single group, the "Democratic Entente." There was, however much unrest in the country, fostered by adherents of Stambolisky and Communists who were in close touch with the Bolsheviks. The Russian Red Cross, which had, it was asserted, organised murders and planned a revolution, was expelled from the country. In Sept. the discovery of a plot led to the arrest of some 1,000 Communists; several local disturbances, in which some 5,000 persons, it is said, were killed, were repressed by the troops with great severity. These outbreaks were followed by drastic measures against any persons suspected of communism, many of whom remained in prison for months without being brought to trial.

Relations with Greece became increasingly difficult in 1923. As a punishment for an attempted rising in the Maritsa Valley, the Greeks interned some 10,000 Bulgars in the Aegean Is. and in unhealthy places in Thessaly for over a year. More than 2,000 of the prisoners perished. In July 1924 feeling was further embittered by events near Tarlis in Greek Macedonia. According to the report of the mixed Commission of Inquiry appointed by the Council of the League of Nations, some bomb-throwing—apparently without intent to kill—at Tarlis on July 26 was attributed by the Greeks to Bulgarian *comitadjis*. On July 27 the Greeks arrested some 70 Bulgars, 27 of whom were sent off tied together, escorted by a civil guard under one Doxakis. The guard opened fire on the prisoners, killing half of them, an act which the commission described as an unjustifiable massacre. The commission commented on the terror caused among the Bulgarian peasants who were then trying to emigrate *en masse.* On Sept. 29 1924, after prolonged negotiations, a protocol was signed at Geneva, under the auspices of the League of Nations, by Greece and Bulgaria, which seemed to guarantee at last the execution of the provisions for the Protection of Minorities contained in the treaties and the Covenant. This protocol was, however, soon afterwards repudiated by Greece at the instance of the Yugoslav Government.

The acute divisions within the ranks of the associations working on behalf of the Macedonians led in 1924 to many deeds of violence. The powerful Internal Organisation, whose leader was Todor Aleksandrov, a man of marked ability and influence, looked on autonomy as the only solution for Macedonian troubles; his opponents worked for some scheme of federation. On Aug. 31 1924 Todor Aleksandrov was treacherously murdered. This murder was followed by a series of mutual reprisals. It must be remembered that a large fraction of the present population of Bulgaria is of Macedonian origin, and that the Macedonians exercise a definite influence on Bulgarian politics. The Macedonians in Bulgaria are well organised, both for philanthropic and political purposes, and they are in close touch with their compatriots abroad, especially with the considerable colony in the United States. Many of them are men of marked ability, and there has generally been at least one Macedonian minister in the Bulgarian Cabinet. The majority of the exiles cannot reconcile themselves to the partition of Macedonia, and until conditions become more equitable for the Bulgarian minorities in Macedonia, there must necessarily be a sense of injustice and resentment in Bulgaria which must strengthen the hands of the extremists. The Agraro-Communist agitation continued throughout 1924. Bands of brigands in the pay of political conspirators made life unsafe; there were attempts to wreck trains, and some 200 persons, chiefly government officials, were assassinated; among them was Prof. N. Milev, who had recently been appointed Minister at Washington.

On April 14 1925 an attempt was made at Orkhanie on the life of King Boris. The King who, in spite of the seclusion of his life, had won the respect and affection of his people, escaped unhurt. On April 16 a bomb exploded in the Cathedral of Sveta Nedelia in Sofia during the funeral of Gen. Gheorghiev who had been murdered the previous day. One hundred and twenty-three people, including many notabilities, were killed and 323 injured. The Govt. acted promptly; martial law was proclaimed and a large number of persons, many of whom were subsequently proved innocent, were arrested. Five persons, including the sacristan of the cathedral, who were found guilty of planning and executing the outrage, were publicly hanged. House to house visitations throughout the country led to the imprisonment of some 5,000 persons. These measures were carried out with the methods of severity customary in the Balkans, but the situation appeared grave enough to justify strong measures. The Govt. obtained permission from the Conference of Ambassadors for a temporary increase of the armed forces by 10,000 men in the hope of maintaining order. The outrage was not, however, followed by any general rising; in the view of the Govt. the crime was not the work of local agitators but of Agrarians who had fled the country, aided by funds supplied through Vienna from Russia. The trials of the accused continued during the year; many were acquitted, others were sentenced to varying terms of imprisonment, banishment, fines, loss of civil rights and, in some cases, to death.

Changes in Education.—The Bulgars have always set a high value on education, and statistics show a steady increase in the number of those who can read and write; in 1920 about half the population were counted as literates. The period of compulsory education was raised by the Agrarian Govt. from 4 to 7 years in the lower and higher primary schools. Above these schools are the gymnasiums or lycées, classical, semi-classical and modern, with a five-year course. There are two universities, both in Sofia. Many Bulgars complete their education abroad. The type of education provided in the past has led to the overstocking of the clerical professions and to the neglect of technical occupations. The Agrarian Govt. aimed at giving a more practical bent to instruction and at equalising opportunities for all classes. It is generally recognised that—when funds permit—the establishment of schools for vocational training would tend to diminish the number of unemployed and discontented persons, who have been unfitted by their education for life as it is in Bulgaria.

The Refugee Problem.—The ground was favorable for Bolshevik propaganda. After the remarkable material progress of the first decades of Bulgarian independence had come a period of catastrophe and humiliation. The people had been repeatedly deceived by their rulers, they had been disappointed of their national hopes and disillusioned generally. Since 1918, there had been an influx of some 260,000 refugees, chiefly from Macedonia and Thrace, some of whom had migrated to escape persecution, while others had been dispossessed of their homes to make room for Greeks coming from Asia Minor. When this influx took place, the refugees from the Balkan Wars had hardly yet been absorbed. The presence of these unfortunate people, the great majority of them destitute and home-sick and all needing houses, land and work, constituted a most painful problem, and a heavy financial burden for the state. Salaries generally had been drastically reduced; thousands of discharged officers, N.C.O.s and officials had to live on insufficient pensions. A spirit of discontent and insubordination became apparent, especially in the younger generation. In Bulgaria, however, where 90% of the population are agriculturalists, most of these being small holders, the people would have little to gain by a general upheaval.

On Oct. 19 occurred a fresh frontier incident with Greece, in the course of which Greek troops occupied 70 square miles of Bulgarian territory near Petritch. The League of Nations settled the matter, on appeal from Bulgaria (for details, see *League of Nations, Work of the First Six Years*). On Jan. 2 1926 the Tsankov Govt. resigned, and a Cabinet was formed by Liabchev, one of the leaders of the Democratic party, as president of the Council. Gen. Volkov, the chief organiser of the *coup d'état* of 1923, remained as War Minister. The Tsankov Govt., though it had steered Bulgaria through a difficult period, was necessarily identified with measures of repression, and it had long been felt that a more democratic government would be better able to carry on the work of reconciliation and pacification which the country needed. The first work of the new Cabinet was the promulgation of an amnesty on a broad basis for political offenders; the preparation of which had been the last task of their predecessors. The amnesty was promulgated Feb. 4 1926 and affected 6,325 persons.

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(E. F. B. G.)

II. ECONOMIC AND FINANCIAL HISTORY

From 1879, the year of Bulgaria's liberation, up to 1911, the economic and financial development of that country proceeded steadily. Undisturbed by wars or internal troubles, with the exception of the short Serbo-Bulgarian War in 1885, the nation was able to devote itself entirely to its own welfare, with the result that very great progress was made. But this progress did not continue after 1911, for the Balkan War (1912–3) caused an interruption, and the World War had extremely serious economic and financial consequences.

Area and Population.—In 1911, the total area of the country amounted to 96,345 sq. km. with a population of 4,337,513 and a density of 45 per sq. kilometer. Later on, however, its territory was increased to 114,424 sq. km., with 4,978,600 inhabitants, as a result of the Treaty of Bucharest in 1913 and the Convention with Turkey in 1915. The Treaty of Neuilly reduced the area to 103,146 sq. km., with a population of 4,846,971 (1920).

The chief towns of Bulgaria in order of importance and population are:—

	Pop.		Pop.
Sofia	154,025	Shumen	25,314
Plovdiv (Philippopolis)	63,415	Stara-Zagora	23,753
Varna	50,810	Burgas	21,170
Russé (Ruschuk)	41,652	Yambol	19,875
Sliven (Slivno)	28,590	Kaskovo	19,418
Pleven (Plevna)	27,446	Pazardjik	19,362

These figures are taken from the 1920 census returns, but the population of the above-mentioned towns, especially of the first four, have increased considerably since then, chiefly through the big influx of refugees from Macedonia and Thrace.

Foreign Trade.—The consequences of the Balkan War, although heavy from a political point of view, were of practically no permanent economic or financial importance, except for a drop in the value of the lev that had very little effect on the normal course of the country's foreign trade in 1914. The entry of Bulgaria into the World War in 1915, however, completely changed the situation. Although the trade balances for 1915, 1916 and 1917 were favourable, much importance cannot be attached to that fact, as the country, both economically and financially, was almost at a complete standstill; the small amount of trade that was done was carried on exclusively with the Central Powers. But for the first time in Bulgarian history, Bulgarian tobacco began to be exported in considerable quantities.

After the Armistice in 1918, and the Treaty of Neuilly in 1919, the position became steadily worse. The trade balances for 1918, 1919 and 1920, were adverse. An enormous need was felt in the country for manufactured and semi-manufactured goods from abroad, all stocks being exhausted as far back as 1917, with the result that imports increased, greatly exceeding the relatively small and diminished exports. The decrease in the latter was due chiefly to two reasons. The first was that, as a result of the Neuilly Peace Treaty, Bulgaria had to concede to Rumania her richest wheat-growing province, the Dobruja, temporarily recovered in 1916. This entailed a loss of 7,695 sq. km. of extremely fertile land, cultivated on comparatively modern lines, and producing 11% of the total grain crop. The second reason was the general disorganisation brought about throughout the country by the War.

In 1911, 1912, 1913 and 1914, the export of grain was 973,844 tons, 691,001 tons, 370,110 tons and 613,339 tons, respectively, whereas in 1919, 1920 and 1921, exports only amounted to 490 tons (when the country was on the verge of famine), 142,937 tons, and 198,362 tons, respectively. At the same time, tobacco went up to the head of the Bulgarian export list, a place it still occupies. During 1924, 32,000 tons of Bulgarian tobacco valued at 2,000,000,000 leva, equivalent to 48% of the total exports of that year, were exported. For the same year grain exports amounted to 278,000 tons with a value of 1,500,000,000 leva. At the same time as the falling-off in the exportation of cereals, the country began to be recognised as one of the biggest producers of oriental tobacco.

In 1922 and the following years, the position improved. As a result of various measures taken with a view to stabilising the lev, and also of good crops, especially that of tobacco in 1923, the trade balance began to recover. On a total turnover of 11,500,000,000 leva for the period 1918–21, a deficit of 1,800,000,000 leva was registered, whereas on a turnover of 27,900,000,000 leva for the period 1922–4, the deficit only amounted to 1,900,000,000 leva. With the latter figures, the trade balance returned to its pre-War dimensions, with an upward tendency. Imports for the period 1911–25 consisted mainly of manufactured and semi-manufactured goods, while exports were agricultural products and raw materials. Textiles hold the first place in imports, followed by metals, machinery, lumber, leather and hides, vegetable and mineral oils, coffee, etc.

Up to 1915, exports were headed by cereals. From 1918 onwards, however, the latter were displaced by tobacco and now occupy second place, with eggs, skins and hides, cocoons, live animals and rose oil following them. Great Britain held until 1924 the first place in the provision of textiles for the Bulgarian market, but conceded the place in that year to Italy. Bulgaria's biggest supplier of metals, machinery and hardware was, and still is, Germany, followed by Belgium and Great Britain. Imports of lumber are practically monopolised by Rumania, while Germany heads skin and leather imports, with France coming second. The latter country is also Bulgaria's greatest supplier of vegetable oils, with Greece and Great Britain occupying second and third places. Mineral oils are imported exclusively from Rumania. Coffee, tea and other colonial goods are imported from various countries, among which Great Britain takes the first place.

Until 1915, the largest importers of Bulgarian grain and flour were Belgium and Turkey respectively, but from 1921, the year in which Bulgaria really recommenced exporting after the War, her best client for these articles has been France, followed by Turkey, Greece, Austria and Belgium. From 1917, in which year the country began exporting tobacco on a large scale, up to the end of the War, Austria and Germany were the sole purchasers. For 1921 and following years, Bulgaria's best customers were, in order of importance, Germany, Italy, Czechoslovakia, Austria, Holland, Hungary, Poland and the United States. Eggs are exported in very large quantities to Germany and Switzerland, while Italy is the sole purchaser of Bulgarian cocoons. Attar of roses is chiefly exported to France, the United States and Germany.

On the total imports for the period under consideration, Germany holds the first place against Italy and Great Britain, her most dangerous rivals. The latter country has been losing ground to Germany during the last few years in the metal and machinery departments, and to Italy for textiles. Germany also comes first on the total exports list, chiefly because she is the biggest purchaser of Bulgaria's staple article, tobacco. Italy as an importer of cocoons, tobacco and hides, is second. Great Britain now takes only insignificant quantities of Bulgarian produce.

Agriculture.—As in the past, agriculture still constitutes the chief occupation of Bulgaria's population. In 1912, the area of cultivated land amounted to 3,385,101 hectares, of which 2,564,588 were sown with cereals. The output of the latter amounted to 2,672,038 tons. After a considerable falling-off during the first few years after the War, during 1923–4 the area cultivated rose to 2,288,125 hectares. The production for the same year, in spite of a bad wheat crop, is estimated at about 1,950,000 tons. The most important fact to be noted during and after the World War is the great progress made in the culture of plants used for industrial purposes, the chief of which are tobacco, sugar beet and sunflower. The sugar beet and sunflower seed satisfy internal needs and produce a surplus for export.

Wheat is the most important cereal grown, covering about one-fourth of the land under cultivation, followed in order of importance, by maize, haricot beans, barley, rye and oats. Vegetable-growing has developed considerably during the period under observation and certain quantities of seeds are exported. Although vine-growing has decreased in area, in no other culture has so great progress been made from a scientific point of view. Many diseases have been stamped out, and old vineyards ravaged by phylloxera have been replaced, with great cost and sacrifice, by new vines grown on the American system. Orchards have increased, especially in southwestern Bulgaria, and it is worth noting that the entire apple crop for 1925 in the Kyustendil district was bought by Germany. In short, it may be said that, although agriculture in Bulgaria is not yet modernised, great efforts are being made in that direction, which is proved by the large imports of agricultural machinery and implements.

Industry.—Bulgaria has made some progress in industry. According to statistics for 1921, flour-milling is the most important industry, with an annual production valued at 654,713,965 leva: the mills are scattered over various parts of the country, and produce a surplus of flour, which is exported mainly to Turkey and Greece. The second industry in importance is sugar-refining: there are five refineries, having an annual output valued at 205,214,121 leva. The textile industry is third, with a yearly production estimated at a value of 243,122,395 leva: as in the past, woollen goods are the principal articles manufactured, and the industry still remains centred in the Gabrovo and Sliven districts. Other industries are pottery, metal-working, lumbering and cigarette-making. The great obstacle in the development of Bulgaria is lack of capital.

Mining.—Since 1915 all importation of coal has ceased, for Bulgarian collieries are meeting the local demand and are even producing for export. The largest coal-mines are the government mines in the Pernik, and the privately-owned mines in the Maritsa valley: the latter, however, have only recently been worked on a large scale. In 1911, the state mines' output amounted to 251,605 tons, in comparison with 17,000 tons from the private mines. In 1918 the figures were 632,488 tons and 40,393 tons, and in 1924, 1,085,935 tons and 128,905 tons respectively. Although a large number of concessions have been granted by the state for copper, lead, iron, zinc and silver mining, very few of them have been worked up; only copper is remuneratively extracted on a comparatively big scale, four mines working in 1924. The mining industry in Bulgaria is still in a very backward state through lack of capital and railway communications.

Finance.—From 1913 to 1923, Bulgarian finance was in a very unsettled state. Owing to expenditure caused by the Balkan War, the budget for 1914 showed a deficit of 18,000,000 gold leva, with receipts standing at 224,000,000 gold leva, and expenditure amounting to 242,000,000 gold leva. After the World War, things became still more disorganised as a result of the uncertain position of the country, the fluctuations of the lev, the heavy reparations amounting to 2,250,000,000 gold francs,[1] various other indemnities, and an entire lack of credit from abroad. In addition to the foregoing, in accordance with the Treaty of Neuilly, the Bulgarian Army had to be organised on the voluntary basis, which cost the state a minimum sum of 20,000,000 gold leva annually. All these factors had a very distressing effect on the financial position of the country, with the result that, although the ordinary yearly budgets showed a surplus, that surplus was always too small to cope with the requirements of the extraordinary budgets, which always closed with a deficit. During the period 1923 to 1925, very serious attempts were made with a view to balancing the budget, among which the most noteworthy are the successful efforts to stabilise the lev, the drastic cutting-down of government expenditure, and finally the Reparations Agreement of March 21 1923 by which payments for account of reparations were to be made on a moderate scale for some years.

The lev depreciated very heavily in value from 1913 to 1923. After the Balkan War in 1913, it was quoted at the rate of 32 leva for £1., a drop of seven leva from 1912, when it stood at 25 leva = £1. Owing to the reasons stated above in connection with the budget, the lev decreased disastrously in value, reaching the rate of 807 for £1. in 1922. This state of uncertainty, and the sudden fluctuations, also lasted through 1923, until, in Dec. of that year, foreign exchange business was restricted by law to the National Bank of Bulgaria. Thanks to this measure, together with increased exports and moderate reparations payments, the rate of the lev has been fairly successfully maintained during 1925 at about 650 leva to the pound sterling.

Banking and Currency.—The National Bank of Bulgaria is the State Bank of Issue, and has the sole right of issuing bank-notes. One of its functions is the conduct of the Treasury service of the state. During the War period, the bank had to render services to the state far beyond the limits of its resources, with the result that it was obliged to issue great quantities of bank-notes. Inflation reached its highest point in 1922, when the direct and indirect liabilities of the state exceeded the sum of 4½ milliard leva, and the bank-note circulation amounted to nearly four milliards. On June 30 1922, however, a law was passed fixing the limits of the latter, and of the Treasury debt to the National Bank. Under this law the total sum advanced to the state was not to exceed 4·7 milliard leva, while the total amount of bank-notes in circulation was not to be greater than 5½ milliards. The latter, at the end of 1925, was under four milliards, with a gold reserve of 40,000,000 gold leva. At the end of the War, this gold reserve amounted to 70,000,000 gold leva, but owing to the bad crop in 1919, Bulgaria was obliged to purchase flour from America, paying 30,000,000 leva in gold before it was delivered. This is the only instance on record of a European country dealing under such conditions with America after the World War.

Conclusion.—Bulgaria has been through a very severe economic and financial crisis, and serious and successful efforts are being made to extricate the country from its difficult position. Remarkable results, such as the stabilising of the lev, had already been registered in 1925. (V. B. C.)

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BULGARIAN LITERATURE (*see* 4.785).—Since the liberation of Bulgaria (1878) Bulgarian Literature has been under the twofold influence of the modern literature of France and Russia. The three principal inspirations of contemporary Bulgarian writers are mysticism, realism and philosophy, and the general impression left by their works is sadness. A nation of peasants, depending almost entirely for their existence on the forces of nature cannot fail to endow her with supernatural powers and this tendency has created innumerable Bulgarian legends. As to realism the simple and patriarchal life of the Bulgarians offers a wide field for such studies. National trials encourage philosophical speculation. Sadness is an attribute of the Slav.

Two Poets.—The greatest poet of the modern school is Pentscho Slaveikoff (1866–1912). He died at Como, Italy, just after his name had been submitted for the Nobel Prize. German as well as Russian influence is apparent in his work. His style is bold and beautiful; his poems, philosophical, pessimistic and deep, are always dedicated to lost joys, vain enthusiasms and hopeless causes. He was an exponent of new ideas and tendencies, but the individual note is always clear and strong. In his *Island of the Fortunate* (1910), he develops the idea that a strong personality can shake off the fetters of convention and so reach the "superstate." His most remarkable work is *The Song of Blood* (1913), an epic poem in nine cantos. K. Yavoroff (1877–1914) is almost his equal, but the influence of the French symbolists and of Henri de Régnier are apparent. He is fired with pity for the oppressed and has thus gained great popularity. He also glorifies both social idealism and individualism. His arguments are passionate and convincing, his method is synthetic, his style full of harmony and beauty. He is the author of lyric poems and two dramatic plays: *On the Slopes of the Vitoche* (1911) and *When Lightning Strikes* (1912).

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[1] Reduced by agreement in 1923 to 550,000,000 gold francs, of which, however, only one-fourth was to be paid in the ten years following the agreement.

But, with a few exceptions, the works of the writers of this period show a strong Russian influence and indicate a tendency toward extreme realism. Petco Thodoroff (1879–1916) has written some excellent dramas (*Zidari*, 1899; *Samodiva*, 1910), national legends and folk songs. His style is original and vigorous, and reflects a hopeful and strong personality. Eline Peline, (b.1878), the pen name of Dimitri Ivanoff, in his village songs and poems, describes nature with the eyes and experience of a born peasant. Nicolas Raynoff (b.1889) is one of the most interesting contemporary Bulgarian authors, and draws his inspiration from Bulgarian history, the Gospels and mythology alike. He is quite unaffected by foreign influence, and writes with all the art of a great painter. His historical dramas are very remarkable, the best known being *Once Upon a Time* (1923).

Ivan Vazoff.—The real foundations of modern Bulgarian literature were, however, laid by the great national poet and novelist, Ivan Vazoff who died in 1921. Of his disciples Stoyan Michaelovsky (b.1850) is by far the most important. His works *Eastern Legends* (1904), a play, *When the Gods Laugh* (1921) and satirical essays reveal his logical mind, great powers of analysis and the influence of the French classics. The other disciples of Vazoff are Constantin Velitchkoff (b.1856), dramatist and literary critic; M. Gheorgieff, an author of popular tales; V. Vlaikoff; Tzerkovsky; and A. Strachimiroff. Cyril Christoff (b.1875) is the leader of a more individual and modern school. He is a lyric poet, his chief works being *Hymns to the Dawn* (1911) and *Songs of Victory* (1916).

The new Bulgarian school includes Geo Mileff, lyric poet, editor of two literary reviews, author of *Ballads* (1920) and excellent translations in verse of French and Belgian poets including Verhaeren; Gheorghi Raitcheff, novelist, a disciple of Dostoyevsky; Tchavdar Moutafoff, novelist and art critic, author of *Puppet Shows* (1921); Gheorghi Stamatoff; Yordan Yovkoff, and Nicolas Yaneff, 1888–1921.

The lyric poets, Dimitri Schichmanoff, critic and novelist (b.1888), Emanuel Dimitroff (b.1887) and Lioudmil Stoyanoff (b.1888) are working for a national literature. Todor Trayanoff is the leader of Symbolism in Bulgaria, and author of *Bulgarian Songs* (1922) and the *Hymn of Hymns* (1922), but his verses lack the vigour of Dimtcho Debelianoff's *Offertory* (1919). This gifted young poet died in 1921. Nicolas Lilieff (b.1885), author of *Flowers for him and Songs for her* (1919), is one of his most promising disciples. Tzanko Bakaloff (b.1866), a popular writer, is the author of village songs and poems. Alexander Stambolisky (1879–1923) the agrarian Prime Minister published several books of social interest, namely *Authority, Anarchy and Democracy* (1910), *What a Politician ought to be* (1915), *The Psychology of Prisons* (1916). Other writers of merit are Michael Kremen; Wladimir Moussakoff, who died in 1916, the author of clever studies of the War; K. Konstantinoff; Petar Ghenoff; and Nicolas Rakitin.

The best known Bulgarian historian and political writer is Simeon Radeff, author of *The Founders of Contemporary Bulgaria* and *The History of Macedonia.* Dimitri Stancioff, Bulgarian minister in London till 1924, has written many important diplomatic studies and political essays.

Literary Women.—Several gifted women have contributed inspired poems to the modern literature of Bulgaria. Among them are Anna Karima (b.1871); Dora Gabe-Peneva, author of *Yesterday* (1920); Mara Beltcheva, poet and philosopher; and Elisabeth Beltcheva, whose lyric verses are full of beauty. Nadejda Stancioff (b.1895), formerly in the Bulgarian diplomatic service, has written historical and political essays and short stories. Since the War the best periodical is the *Zlatorog* which often achieves considerable literary merit.

The literature of to-day in Bulgaria is full of promise, but in order to develop a strong national character authors will have to avoid the cross-currents of foreign influence. The craving for instruction shown by the Bulgarian people is a great and valuable asset as regards the expansion of literature; but it may suffer from lack of discernment and the tendency toward imitation. By cultivating their natural gifts, and dedicating them to the service of their country alone, without attempting to invade foreign ground, Bulgarian writers may yet hope to furnish an original and sound contribution to international literature.

(N. Mu.*)

BULLARD, ROBERT LEE (1861–), American soldier, was born at Youngsboro, Ala., Jan. 15 1861. He graduated from West Point Military Academy in 1885 and was appointed first lieutenant in 1892. He served in various capacities in the Spanish-American War, and in the Philippines from 1902 to 1904. He was made lieutenant-colonel in 1906. In 1907 he was special investigator for the U.S. Provisional Govt. in Cuba, and the following year was superintendent of public instruction there. In 1911 he was promoted colonel, and in 1917 brigadier-general. He commanded the 2nd Brigade of the 1st Div. of the American Expeditionary Force in France in 1917, and was made major-general, National Army. From the middle of Dec. 1917 to the middle of July 1918 he commanded the 1st Div.; and from Oct. 1918 to the following July the II. Army. In Nov. 1918 he was appointed major-general in the regular army.

BULLET: *see* AMMUNITION.

BÜLOW, BERNHARD HEINRICH KARL MARTIN, PRINCE VON (1849–), German statesman (*see* 4.793), after his resignation of the German chancellorship in 1909 lived principally in retirement at his villa in Rome. On the outbreak of the World War he was once more employed in the service of his country. Italy, which had declared her neutrality at the outbreak of the War, had already intimated (July 5 1914) that she considered the action of Austria-Hungary against Serbia to be aggressive and provocative. Prince Bülow was entrusted with the temporary charge of the German embassy in Rome in Dec. 1914. He was active in the negotiations between Italy and Austria concerning the Trentino and Trieste; his chief aim being the preservation of Italian neutrality and to this end he used every means in his power. He was, however, unable to prevent the entry of Italy into the War on the side of the Western Powers, although he was instrumental in concluding certain economic agreements between Italy and Germany which deferred Italy's declaration of war on the latter country until Aug. 1916. On May 24 1915 he left Rome. During the War he lived in Berlin, but after the peace he returned to Rome and continued to reside there for part of every year. In a ministerial crisis of 1921 his name was mentioned as a possible chancellor, but he was entirely unacceptable to the vast majority of the German people and of the Reichstag.

BÜLOW, KARL VON (1846–1921), German soldier, was born in Berlin March 24 1846. Commissioned to the 2nd Guards regiment in 1864, he served in the campaign of 1866 and the Franco-Prussian War of 1870. After a distinguished career, he was placed in charge of the II. Army on the outbreak of the World War, and was at the head of the invasion of Belgium. During the subsequent advance into France, Von Kluck's I. Army was also placed under his direction, a faulty arrangement soon abandoned but not replaced by effective control from German headquarters. From this time the two armies were repeatedly taking divergent action, a confusion which ended in the retreat from the Marne. The responsibility for this strategical disaster was the subject of acute controversy, and public opinion in Germany was induced to fix the blame on Von Bülow. But the view of the Supreme Army Command was shown by their placing Von Kluck on the retired list and promoting Von Bülow to field marshal in Jan. 1915, and post-War knowledge has confirmed this verdict. In June 1916 he was, at his own request, placed on the retired list. He died in Berlin Aug. 31 1921.

BUNIN, IVAN ALEXEYEVICH (1870–), Russian poet and novelist, was born Oct. 10 1870 of noble family in Voronesh. His first poems were published in 1889. His poems were awarded the Pushkin Prize, the highest academic distinction in Russia, and the same distinction was awarded to his translation of Longfellow's "Hiawatha." His other masterly translations from English poets include those of Byron's "Manfred" and "Cain," and of Tennyson's "Lady Godiva." In 1909 he was elected a member of the Russian Academy.

Bunin's poetry stands outside all modernist tendencies and has very distinctive qualities and high merits of its own. It is mainly descriptive—not lyric—impassive, of classic simplicity and harmony, of jewelled perfection, minute observation and vivid perception of colour. He derives his inspiration from many sources. A fine nature poet, he also gives realistic descriptions of human life and his pictures of the East display his keen sense of colour. He ranks highest, however, as a prose writer. The best known among his novels, tales and short stories are *The Village*, *A Gentleman from San Francisco*, *Suchodol*, *An Evening in the Spring*. The first two have been translated into English as also *Dreams of Chang and other Stories*. The principal theme of all his novels and tales is the decay of the old Russian gentry which he views in the melancholy poetic colours of an autumn sunset in the country, and the life and psychology of the peasantry and its relation to the town. Far from idealising the peasants he describes them under a very gloomy aspect. There is much affinity in his novels with Turgeniev and Chekhov—but he might be best described as the Russian Flaubert. He is a great master of classic prose. The complicated structure of his style has been likened to a tree with innumerable branches; and shows a great love of detail in his realistic rendering of life.

BURBANK, LUTHER (1849–1926), American naturalist and experimental botanist, born at Lancaster, Mass., March 7 1849. After attending the public schools and Lancaster Academy, he worked for two years in a factory at Worcester, Massachusetts. At the age of 21 under the stimulus of Darwin's *Animals and Plants under Domestication*, he bought a 17-ac. tract of land at Lunenburg, Mass., and began experiments for the improvement of economic and ornamental plants. Among his earliest achievements was the evolution of the Burbank potato (1872), which became one of the leading varieties in many parts of the world. Attracted by its horticultural potentialities, he moved to California in 1875 and established a nursery and experimental farm at Santa Rosa. Here he conducted many experiments on plants and trees, and produced many new varieties, including various forms of the edible thornless cactus; plumcots, derived from a cross of plum and apricot; improved forms of prunes and plums, peaches, and grapes; the Burbank, Abundance, Giant and other cherries; the Burbank and other new roses; gigantic forms of amaryllis; the shasta daisy, and Giant and Fragrance callas. At times he had over 6,000 experiments in hand and grew over 1,000,000 plants yearly for testing. He was a special lecturer on evolution at the Leland Stanford Jr. University and published *Luther Burbank, His Methods and Discoveries*, 12 vol. (1914–5); and *How Plants are Trained to Work for Man*, 8 vol. (1921). He died at Santa Rosa, Cal., April 11 1926.

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BURBIDGE, SIR RICHARD (1847–1917), British merchant, was born in Wiltshire March 2 1847. At the age of 13 he was apprenticed to a provision merchant in Oxford street, London, and at 19 started in business on his own. Fourteen years later he became general superintendent of the Army and Navy Auxiliary Stores. In 1882 he was appointed general manager of Whiteley's, Westbourne Grove, and in 1891 entered the service of Harrods, Brompton Road, of which he was afterwards managing director. Under him the stores became one of the largest in London. He anonymously presented about £30,000 to the fund for acquiring the Crystal Palace for the public in 1913. During the World War he was a member of the advisory committee of the Ministry of Munitions. He was created a baronet in 1916, and died in London May 31 1917.

See Mrs. A. C. Stuart Menzies, *Modern Men of Mark* (1920).

BURGENLAND, a province of the Austrian Republic, composed of districts ceded to her by Hungary. Area, 1,586 sq. m.; population (1923), 286,299, about one-third of whom are Magyars and Croats. Capital, Eisenstadt. The Burgenland forms a long, very narrow strip, bounded E. by Hungary, W. by Lower Austria and Styria, and touching Czechoslovakia N., Yugoslavia south.

Immediately after the War this small district became an international problem. The statesmen of Czechoslovakia and Yugoslavia desired to make of it a "Slav corridor" connecting their countries; while Austria claimed it on ethnographical, Hungary on historical grounds. The Peace Conference decided (July 20 1919) to allot the whole strip, including its local centre Ödenburg (Sopron) to Austria without a plebiscite. A commission headed by an Italian, a French and a British general entered Sopron Aug. 6 1921; the Hungarians were to withdraw on Aug. 29.

Meanwhile, however, the Hungarians had been carrying on a violent propaganda, based on Austria's financial collapse and socialist tendencies. Hungary's ex-Premier, Friedrich, and others, organised and armed bands on the estates of the Magyar landowners; and these attacked the Austrian gendarmerie when it entered the country on Aug. 29, repelling it and the troops sent to support it. The Hungarian Govt. declared itself powerless over these irregulars. The generals, whose sympathies were confused, recognised the brigands as a local police force, and referred the matter to the Conference of Ambassadors.

The Question of Sopron.—The difficulties centred around the town of Sopron, which was mainly Magyar in population, but all communications centred here and the country districts depended on it. The Italian Govt. offered its mediation; a conference of the Italian, Austrian and Hungarian Foreign Ministry agreed by the Protocol of Venice (Oct. 13) that a plebiscite should be held in Sopron and the eight surrounding communes. The generals were to conduct the plebiscite eight days after they were satisfied that the country was pacified. The Conference of Ambassadors ratified this agreement Oct. 27 1921.

On Oct. 20 the ex-King Charles landed in the district by aeroplane; the local brigands formed themselves into a legitimist army, and only with difficulty was Charles induced to withdraw. The Little Entente renewed its claim for a corridor, and protested against the Venice arrangement. Allied troops reached the plebiscite area on Dec. 8, Austria having already occupied the other districts. The Hungarian troops only left Sopron Dec. 12, and the plebiscite was held Dec. 14 and 19, giving a majority for Hungary in Sopron. Austria protested that the voters had been terrorised and the lists manipulated, and appealed against the verdict, but the Conference of Ambassadors recognised the decision (Dec. 23) and persuaded Austria to do likewise (Feb. 29 1922). Sopron and district were handed back to Hungary Jan. 1 1922. The result of the decision was to leave the Burgenland without a proper centre. Communications between Austria and Southern Burgenland were very bad, and these rich fruit-growing districts suffered economically in consequence, although the completion of the Friedberg-Pinkafeld railway, in Oct. 1925, will doubtless bring an improvement. *See* AUSTRIA. (C. A. M.)

BURIAN VON RAJECZ, STEPHEN, COUNT (1851–1922), Austro-Hungarian statesman, was born at Stampfen, near Pressburg (Bratislava), Jan. 16 1851 of a Hungarian noble family and early in life entered the consular service. From 1882–6 he was consul-general at Moscow and he lived for many years at Sofia as envoy extraordinary. From 1903–12 he was Finance Minister and as such administered the provinces of Bosnia and Hercegovina. In June 1913 he was appointed Hungarian minister to the court of Vienna, and on Jan. 13 1915 he succeeded Count Berchtold at the Foreign Office. The monarchy was at this time in the midst of negotiations with Italy. Burian, however, was unable to prevent the secession of that country into the ranks of the Entente, but he did great service to Austria-Hungary in arranging the alliances with Bulgaria and Turkey. With regard to Poland he advocated the creation of an independent state co-equal with Austria-Hungary. In general, he maintained that in military, political and economic matters Austria-Hungary must be treated as an equal partner with Germany, her ally.

On the question of peace, too, there was a sharp antithesis between the views of Burian and those of German statesmen. He proposed, as early as Nov. 1915, that Germany should make a public declaration of her willingness to guarantee the national independence of Belgium, and during 1916 repeatedly urged that the way should be paved for negotiation with the enemy on the basis of the renouncing of conquests in the west. The peace note of Dec. 12 1916, which put an end to this quarrel, was the last important official act of Burian as Foreign Minister. A few days later he laid down his office, but was recalled after the resignation of his successor, Count Czernin, on April 15 1918. Burian now worked energetically for peace. On Sept. 14 1918 he addressed to all the belligerent nations an invitation to end the War by diplomatic negotiations. The invitation had no success; he therefore resigned, and from this time onwards ceased to take an active part in politics. He died at Vienna Oct. 20 1922.

See S. Burian von Rajecz, *Drei Jahre aus der Zeit meiner Amtsführung im Kriege*, 1923, Eng. trans., *Austria in Dissolution*, 1925.

BURMA (*see* 4.838), a province of British India, has an area of 238,738 sq. m. and a population of 13,212,000 (1921). When the pacification of Upper Burma, after the annexation of King Thebaw's territory, had been completed, the country settled down under regular administration.

I. POLITICAL HISTORY

Consolidation of the Border.—The years 1910 to 1925 fall into four periods: 1910–4, 1914–8, 1918–22 and 1922 onwards. The history of the first period, under Sir Harvey Adamson as lieutenant-governor, was one of internal development hampered by straitened finances; but action was taken to avoid Chinese encroachment upon the "no man's land" between Burma, China and Tibet by the occupation of Hpimaw, and the constitution of the Putao district to enable the Hkamti Long Shan states north of Myitkyina and the northeast border tracts to come under supervision and control. The area covered was about 10,000 sq. m., and posts of military police were established at suitable points to preserve order in these borderlands.

Tribal Unrest.—With the second period, rumours of the World War began to cause unrest in tribal areas, and there was a rising of Kachins at the end of 1914, which was, however, soon suppressed by the military police aided by some regular troops. The ringleaders were captured and sentenced to death. During 1915 Sir Harcourt Butler became lieutenant-governor; he was succeeded by Sir Reginald Craddock in 1917. The principal disturbing events of 1915 were the successive efforts of revolutionary Sikhs to enter Burma from Siam and incite mutiny among the military police as part of a larger scheme of the Sikhs on the Pacific coast of America to start a general rising in India. These efforts entirely failed. In 1917 the Chin Hills on the west and northwest became the scene of a local rebellion among the Haka Chins in sympathy with similar revolts among the tribes under the Govt. of Assam.

This rebellion had its origin in local excitements caused by recruitment for labour corps from tribes on both sides of the Burma-Assam border. The Haka rebellion was followed by a further rising among the Kukis on the Manipur border. In both cases the military police of the two provinces co-operated. The operations against the Kukis in 1919 were controlled by the general officer commanding the Burma Division, and the Somra tract on the northwest of the Upper Chindwin district was taken under administration. Once these risings had been suppressed the hills settled down peacefully, the rebels were pardoned and the Chins now supply excellent material for the army. Since these risings there were two incursions from over the Chinese border in 1921 and 1922, heralded beforehand as serious invasions with Mandalay as the objective, but in reality pitiful raids by the dupes of Burmese pretenders across the Chinese frontier. With these exceptions a profound peace reigned in all these wild areas.

War Contributions.—The efforts made by Burma during the World War are deserving of mention. The people subscribed Rs.29 lakhs to a special war gift and contributed most generously to Red Cross and other funds, including £60,000 for the "our day" fund. They put up about £2,000,000 in the 1917 War Loan, and £337,000 in the War Loan of 1918. Before the War a single Burmese company of sappers and miners had been the sole contribution to the Indian Army, but, under the spur of the Empire's demand for men, 2,500 were raised for labour corps in France, and sufficient recruits to man four battalions of Burmese Infantry, as well as three or four mechanical transport companies for service in Mesopotamia. Service in the army in peace time is, however, very unpopular among Burmans, and in the four battalions of the 20th Burma Rifles there are now only two companies of Burmans remaining and one company of Shans. Kachins supply 5½ companies, Chins 3¾, and Karens two and three-fourths. The British garrison in Burma has since the War been reduced to two British regiments.

Politics.—Before 1918 there were no politics in Burma. With the people, at large, pleasure came first, business second and politics nowhere. The Morley-Minto reforms had scarcely modified conditions at all, and by the end of 1917 the Legislative Council consisted of only 19 members, of whom 2 only were elected members representing the chamber of commerce and the traders' association. There were only 2 Burmans proper, with a Shan chief, a Karen, a Chinaman, a Parsee and an Indian Mahommedan, the rest being Europeans, mostly officials. In 1920 the numbers were raised by nomination to 30, the maximum provided by the Morley-Minto reforms. The period 1918–22 represents a development of politics in Burma so rapid as to be without parallel. Recruiting campaigns during the War had stimulated the idea of nationality, and when Mr. Montagu and Lord Chelmsford made their famous inquiry the doubtful position of Burma under an India progressing to self-government leapt into such prominence that the small group of Burmese lawyers and journalists in Rangoon were carried off their feet. Rangoon contained its group of Indian agitators, with whom the young Burmese party, hitherto so aloof, began to coquet, while the Indians in their turn were rejoiced to find congenial soil in which to sow their own doctrines. Each side was glad of the help of the other, while each was ready to throw over the other if the occasion offered. The exclusion of Burma from the Montagu-Chelmsford scheme was regarded by Burmans as an insult to their national pride. They had accepted without demur British control, but they had no idea of submitting to Indian rule.

The task of devising a constitution specially suited to Burma as a politically backward country devolved on the lieutenant-governor (Sir Reginald Craddock), but while he was devising a scheme, and promulgating it for criticism, the new political party made such strides that a scheme which would have exceeded all expectations in 1917 was rejected as inadequate by the now ardent Burmese politicians. Two deputations of Burmans visited London in 1919 and 1920 to demand that Burma should have the same constitution as the Indian provinces; but when, after long consideration by Rangoon, Simla, Whitehall and a parliamentary committee, it was decided to accede to their request, the second deputation returned only to find themselves completely thrown over by a political party asserting that nothing but complete Home Rule would satisfy Burma's dignity.

During this period of agitation the new university and the government schools were boycotted, and temporarily lost a large number of their pupils; and a general boycott on the lines of Gandhi's non-co-operation, but professing to be quite original, was proclaimed by the national party. These movements were met by enforcement of the ordinary law against sedition and by the passing of the Anti-Boycott Act to combat organised intimidation which the ordinary law was unable to deal with effectively. The Defence of India Act was used in a few cases to check the Indian-inspired agitation to boycott the Prince of Wales, and, when the people were thus relieved of the intimidation of the boycott, the Prince received a magnificent welcome in Burma.

The principal features of politics in Burma are the participation of the religious orders, viz., the Yellow Robe, the emancipation of the women and the ease with which political organisations are extended to rural areas. Burma has now been given a much wider franchise than India, and women qualified by property tests have been accorded the vote. At the first elections in 1922 the proportion of the electorate exercising their vote was exceedingly small—about one-sixth. The Legislative Council now contains 103 members, about four-fifths elected. The reformed government has been carried on without any serious crises and in the new councils elected in 1925 the extreme Swarajists were discomfited. Sir Harcourt Butler returned to Burma as its first governor in 1923.

II. ECONOMIC AND FINANCIAL HISTORY

Population.—In spite of straitened finances and the set-back of the War Burma has continued to progress rapidly under orderly government. The population, which was 10,490,000 in 1901, had risen to 12,115,000 in 1911 and by 1921 had increased further to 13,212,000. But for heavy plague mortality during the last decade and the effect of the great influenza scourge of 1918–9, which claimed over 200,000 victims, the increase would have been greater. The population of Rangoon has mounted rapidly to 341,000 and Mandalay, which has steadily lost population as a dethroned capital and has been stricken by frequent epidemics, has now begun to recover, and shows a rise of 10,000 to a total of 149,000. These two cities account for more than half of the population of the 24 towns of 10,000 and over in Burma, but the rural population still amounts to 90% of the total, and so vast are the forests and hills that over the whole area the density of population is still only 57 per square mile. By religion 85% are Buddhists; Hindus and Mahommedans together number 7½%; Animists 5%; and Christians only 2%. By race the Burmans proper amount to 72%, Karens number 1,250,000, and Indians 900,000. Europeans and Anglo-Indians total 25,000, Shans nearly 500,000, and Chinese 150,000. The rest of the population consists of the numerous tribes on the frontier, of whom 9,500,000 are engaged in agriculture, and 2,500,000 in industry and commerce. Public services, railways and professions employ 750,000.

Commercial Products.—Rice, timber and oil are the chief commercial products of Burma. Since 1910 the occupied area has grown from 17,000,000 to 19,500,000 ac., and the cropped area from 13,500,000 to 15,500,000 acres. The area under rice has risen from 10,000,000 to 11,500,000 ac., and the normal yield of paddy is 7,000,000 tons, of which 3,000,000 are available for export. The normal yield of ground-nuts is 120,000 tons. Sesamum covers a large area, but is not much exported. Cotton is of importance only in the dry zone. There are numerous rubber plantations, of which the most important are in Mergui. The Shan States produce potatoes and oranges. Fisheries are more important than in any Indian province. The burden of interest paid by the cultivator has been somewhat relieved by the growth of co-operative credit, from 172 societies with 5,363 members in 1910, to 5,563 societies with a membership of 157,000 in 1924. Petroleum is the most important of the mineral products, the output from seven districts totalling 280,000,000 gal. in 1922, of which the principal oil-fields, Yenangyaung and Singu, supplied about 90%.

The Burma Corp. Bawdwin silver-lead mine in the Northern Shan states has developed very greatly. Some 250,000 tons of silver-lead ore were extracted in 1923, yielding 45,000 tons of refined lead and nearly 5,000,000 oz. of silver. Zinc concentrates are now being exported in quantity. The Mogok stone area administered by the Burma Ruby Mines Co. has continued to give fluctuating outputs of rubies, sapphires and spinels. One beautiful ruby, cut in London to 11·22 carats, was sold for £4,000. Jade and amber continue to be produced from the jadeite area north of Myitkyina. The tin mines in Tenasserim have developed, and produced 2,400 tons in 1923; while the Mawchi mines in Karenni have recently been reopened. Wolfram produced in the same area enjoyed a remarkable boom in the War, but has dwindled into insignificance since. Coal exists in Mergui, on the Chindwin, and in the southern Shan states, and prospecting continues vigorously. The gold dredging in Myitkyina has been abandoned.

Forests, etc.—One of the greatest assets of the province consists in its forests of which 28,000 sq. m. are now reserved forest and 94,000 sq. m. unclassified forest. The teak extracted in 1923 amounted to 500,000 tons, and 200,000 tons were exported, mostly to India. Many other valuable woods exist, and specimens were exhibited at Wembley, but the process of exploiting them has been slow. The extraction of bamboo pulp for paper manufacture is still in a nascent condition, but there is immense scope for this industry if it can be made a commercial success.

Commerce.—The imports and exports forming the external trade of Burma, taking the average for periods of five years, 1909–14, 1914–9 and 1919–24, are as shown in the table in the next column The development of the port of Rangoon has been rapid. In 1911 the port revenues were Rs.36 lakhs. In 1924 they had risen to Rs.77 lakhs. The tonnage of shipping using the port was 3,500,000.

		Values in lakhs of rupees	
		Imports	Exports
1909–14	Foreign	1,310	2,312
	Indian	1,095	1,411
1914–19	Foreign	1,076	1,931
	Indian	1,209	1,907
1919–24	Foreign	2,053	3,127
	Indian	1,829	3,009

Provincial Finances.—The provincial finances, partly by normal expansion and partly by more favourable adjustments with the Govt. of India, have risen from under five crores of rupees in 1910–1 to over nine crores in 1923–4. The province also enjoyed a windfall of over nine crores from the control of rice in 1918–9, which has enabled it to pay off its debts to the central government and to spend large sums on railways, irrigation works and roads.

Communications.—An eastward extension of the railway into the southern Shan states to Heho, and new branches in the Yamethin, Magwe, Sagaing and Shwebo districts, and a line from Moulmein to Ye in the Tenasserim peninsula, are the chief railway developments. Water communications in the delta have been improved by the Twante canal connecting the Rangoon river with the China Bakir. Large sums have also been spent on roads, but construction is very costly, as in many areas road metal has to be brought from long distances.

General Progress.—Among other indications of progress, besides the constitutional reforms, many important administrative developments have signalised the post-War period. A High Court has been established at Rangoon; the Federation of the Shan states has been effected as a separate entity from the rest of Burma; District Councils elected for the administration of rural areas have been brought into being; a Development Trust has been created in Rangoon; and the Rangoon municipality has been elevated into a corporation with largely increased powers. Burma has always been famous for its elementary education, imparted at monastic schools; but secular education, imparted by public schools, has greatly developed. There are now 6,289 schools with 345,000 pupils of whom 121,000 are girls. Since the establishment of the Rangoon University in 1920 further progress has been attained in higher and technical education by the establishment of an agricultural college and of university courses in forestry, medicine and engineering, while the numbers attending the two arts colleges in Rangoon have very largely increased. There are now also 284 hospitals in Burma, attended by 2,000,000 patients. The Burmans are also devoting more attention to commerce and industry, hitherto almost entirely in the hands of Europeans, Indians and Chinese. The province affords enormous possibilities of further development.

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BURNAND, SIR FRANCIS COWLEY (1836–1917), British humorist (*see* 4.848), died at Ramsgate April 21 1917.

BURNETT, FRANCES ELIZA HODGSON (1849–1924), American writer (*see* 4.853), published in 1911 *The Little Princess*, a play for children and grown-up children, in Three Acts. Her subsequent writings include *My Robin* (1912), *T. Tembarom* (1913), *A Lady of Quality* (1913), *The Lost Prince* (1915), *The One I Know the Best of All* (1915), *The Little Hunchback, Zia* (1916), *The Way to the House of Santa Claus* (1916), *The White People* (1917) and *The Head of the House of Coombe* (1922). She died Oct. 29 1924 at Plandome, Long Island.

BURNHAM, DANIEL HUDSON (1846–1912), American architect, was born at Henderson, N.Y., Sept. 4 1846. He was educated at Chicago and at Waltham, Mass. He worked as an architect in Chicago, and in 1871 formed a partnership with John W. Root. They were entrusted with the planning of the Chicago World's Fair (1893). On the death of Root this work fell wholly upon Burnham. In 1894 he was elected president of the American Institute of Architects. His success with the Chicago World's Fair buildings soon led to his being called upon to design other large structures, including "The Rookery" and "Railway Exchange" in Chicago; the "Flatiron building" and new Wanamaker's store in New York; the Pennsylvania Railway station in Pittsburgh; Filene's store in Boston; the Union station in Washington and Selfridge's stores, London. He also was asked to propose plans for improving several cities, including Cleveland, San Francisco, Chicago and Baltimore. In 1905 he was asked by the U.S. Govt. to design plans for cities in the Philippines, including Manila. He was made chairman of the national committee appointed for beautifying Washington, D.C. He died in Heidelberg, Germany, June 1 1912.

BURNHAM, EDWARD LEVY LAWSON, 1ST BARON (1833–1916), English newspaper proprietor, was born in London Dec. 28 1833 and educated at University College School. His father, Joseph Moses Levy (d. 1888), acquired *The Daily Telegraph and Courier* in 1855, a few months after it had been founded by Col. Sleigh, and, aided by his son, soon changed the current of its fortunes, raising it to a leading position among the London dailies, of which it was the pioneer penny paper. Edward Levy (he took the added name of Lawson under his uncle Lionel Lawson's will in 1875) acted as editor of *The Daily Telegraph* till his father's death and then became its managing proprietor and sole controller till 1903, when he was made a baron and passed over these duties to his son. He had received a baronetcy in 1892.

For many years Edward Lawson was one of the outstanding figures in English journalism. No one in Great Britain did more than he to brighten and humanise the daily newspaper and transform it from a plain, severe chronicle of the day's events—only mitigated by the occasional ferocity of its political judgments—into a readable and entertaining presentation of the world's news. The abolition of the last of the paper duties in 1861, in which Edward Lawson himself bore an active part, called into being a host of fresh newspaper readers among the middle classes, which welcomed the popular features of the new journalism. Edward Lawson's conception of a popular daily paper was that it should be a faithful mirror of the times and make a strong appeal to the sentiment and the emotion of its readers. Under his direction *The Daily Telegraph* raised many large funds for various national, patriotic and charitable objects, dispatched missions of exploration and discovery to Central Africa and elsewhere, and started many novel features, such as popular correspondences on live topics of the day, which have since become the established commonplace of journalism. For many years *The Daily Telegraph* warmly supported the Liberal party, but it strongly dissented from Mr. Gladstone's anti-Turkish policy and the final severance came on his Irish policy of Home Rule. Edward Lawson was not by nature a strong political partisan; what interested him most was the social advancement of the people, and the development of the British Empire, to both of which causes he gave strong support, whatever the political complexion of the government of the day.

He was more than once president of the Institute of Journalists and the Newspaper Press Fund, and in 1909 presided over the first Imperial Press Conference in London. On his 80th birthday his long and eminent services to journalism were fitly recognised by the presentation of a laudatory address, signed by the leading journalists of the British Empire, the United States and many foreign countries. A man of keen business discernment, sure intuition, rapid decision, generous sympathies, unfailing kindness of heart and catholicity of interest, Lord Burnham enjoyed the honour of King Edward's friendship. He married Henriette Georgiana (d. 1897), daughter of the actor-manager, Benjamin Webster (*see* 28.459), and died Jan. 9 1916. (J. B. F.)

BURNHAM, HARRY LAWSON WEBSTER LAWSON, 1ST VISCOUNT (1862–), eldest son of the 1st Baron Burnham, was born in London Dec. 18 1862 and educated at Eton and Balliol College, Oxford. Entering political life when young, he represented, as a Liberal, West St. Pancras from 1885 to 1892, East Gloucestershire from 1893 to 1895, and the Mile End division of the Tower Hamlets from 1905 to 1906, and again, but this time as a Unionist, from 1910 to 1916, when he succeeded to his father's title. He also served on the London County Council from 1889 to 1892 and from 1897 to 1904 and was Mayor of Stepney in 1908 and 1909.

In 1903, when his father retired from the active duties of the managing proprietorship of *The Daily Telegraph*, the Hon. Harry Lawson, as he then was, became the sole director of the conduct and policy of that newspaper. These duties, however, did not prevent him from devoting a large share of his time to public work, and few busy men of the period have responded more generously to the claims of public service. Lord Burnham was a member of the committee which drafted the Reform Act of 1918, and of Lord Bryce's committee on the problem of the reform of the powers and constitution of the second chamber. He has been a member of innumerable committees, commissions, conciliation boards and the like and has been chairman of many. He was chairman of the officers' resettlement committee and of the promotion committee of the War Office, and was a member of Lord Tennyson's Empire settlement committee and Lord Justice Shearman's seditious literature committee. For three years he was chairman of the executive committee of the King's Fund for Disabled Ex-Service Men and a leading member of the Overseas settlement committee of the Colonial Office. In 1921 he was unanimously elected President of the International Labour Conference of the League of Nations at Geneva and was re-elected to the same post in the following year. Another conspicuous public service rendered by Lord Burnham was in connection with the salaries of teachers. He presided over the standing joint committees and made an award on the proposed new scales of payment. The Burnham scales, as they are universally called, received the support of the teachers, the local authorities and the Ministry of Education, and when they came up for revision in 1924 Lord Burnham was again asked to undertake the task.

During these years of parliamentary and public activity, he gave the closest attention to the direction of *The Daily Telegraph* and was prominent in the various organisations of the newspaper Press. He succeeded his father as president of the Newspaper Press Fund and the Newsvendors' Benevolent Institution. In 1910 he was president of the Institute of Journalists, chairman of the Newspaper Proprietors' Assn. from its foundation, during the War he was chairman of the Press Conference, to which the Govt. consigned the responsible duty of the regulation of news. Lord Burnham succeeded his father as president of the Empire Press Union and presided over the National Press Conferences in Canada in 1920 and in Australia in 1925. In 1917 Lord Burnham was made a Companion of Honour and in 1919 a viscount. He married in 1884, Olive, daughter of Sir Henry de Bathe, Bart., and he has one daughter. The heir to the barony is his brother, Col. the Hon. William Arnold Webster Lawson (b. 1864). (J. B. F.)

BURNS, JOHN (1858–), British politician (*see* 4.855), held the office of President of the Local Government Board for more than eight years, during which he underwent comparatively little hostile criticism save from his old friends of the Labour party. He was zealous in forwarding substantial measures of social reform, but did not take a prominent part in the great party disputes over the budget of 1909 and the Parliament bill. His activity and success in the administration of his department were recognised—much against his own wish—by the raising of the president's salary in 1910 from £2,000 to £5,000 a year; but his policy was thought to be too conservative even by some members of the Conservative party, and early in 1914 he was promoted to the presidency of the Board of Trade. He left the Govt. in the following Aug., as he disagreed with the Cabinet's decision to join in the World War. He resigned without making any public statement of his reasons, and took no further active part in Parliament. At the general election of 1918 he desired to stand again for Battersea in the Labour interest. As, however, he refused to join the Labour party, he was unable to get local support. He therefore withdrew his candidature and continued in private life.

BURNS AND SCALDS (*see* 4.860).—Burns are caused by dry heat of 140° F. and over, and scalds by moist heat of over 120° F. Their severity is dependent on the degree of temperature, the duration of the exposure and the size of the burnt area, the gravity being proportionate to the extent rather than the depth of the injury.

Burns vary in degree from a slight scorching of the skin to complete charring of the affected parts, extending down to the muscles, and even the bones. The most superficial burns are characterised by redness, swelling and tenderness, and on healing either leave no trace or a slight pigmentation. In more severe burns blisters follow, associated with considerable inflammation and pain, or the tissue becomes devitalised, forming a dark, leathery patch, known as the eschar. This at first is adherent to the underlying tissue, but in a few days suppuration occurs beneath it, followed by sloughing, and a raw surface, covered with a purulent discharge, is left, which, on healing, results in a reddish scar. In burns of greater severity the suppuration may be so great as to lead to absorption, associated with symptoms of septic poisoning. In severe burns healing takes place slowly, with the formation of an uneven, unsightly scar, which, owing to contraction, may be followed by deformity and disfigurement.

The constitutional effects of burns vary with the situation and the extent of surface involved. They may be primary, consisting of pain, shock, collapse, or death; or secondary, consisting of toxic symptoms due to absorption of poisons from the dead tissue, or of inflammation of the underlying internal organs.

When burns are fatal, death usually supervenes during the period of shock, within 36 hours of the burn. It may occur later from toxaemia, septicaemia or even from sheer exhaustion from the pain and weakening discharges. The outlook in burns, except in those of slight degree, is invariably grave, especially when they occur on the chest and abdomen, and, should an area larger than a third of the cutaneous surface be burnt, a fatal issue is almost inevitable within a few days.

Treatment.—The treatment is both general and local. The general treatment in severe burns consists in dealing promptly with shock before attempting to treat the burn itself. Stimulants should be avoided, and every effort made to soothe the patient, a useful aid being immersion in a hot bath. After the stage of shock has passed, the secondary effects, such as toxaemia and septicaemia, must be dealt with on general medical principles. The local treatment should aim at preventing sepsis, avoiding frequent dressings, favouring the removal of the eschar, and of obtaining a pliant scar and avoiding deformity. Greasy applications, such as carron or carbolic oil, have been largely replaced by moist dressings with soothing astringent lotions, containing bicarbonate of soda, lead, aluminium acetate, etc.

Blisters should be opened with proper antiseptic precautions, and a moist dressing applied. This dressing should be left untouched as long as possible, and only when the lesion becomes septic should it be soaked off and renewed. When the eschar has separated and an ulcerated surface is left, the best method of healing it is that known as the "open" method, in which healing is allowed to take place under a natural scab, produced by powdering the moist surface with an aseptic powder, such as sterilised magnesium carbonate or stearate of zinc. Where the granulating surface of a burn is large and deep, it may be necessary to graft to ensure healing. To avoid deformities, it is essential that the affected parts should be put in proper position during healing.

Scars from burns may be reduced to some extent by radium and X-rays, provided the treatment is commenced within a few months of the injury.

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BURROUGHS, JOHN (1837–1921), American naturalist and writer (*see* 4.863), continued to write frequent essays on out-of-door life, some of which were assembled in the following volumes: *Time and Change* (1912), *The Summit of the Years* (1913), *The Breath of Life* (1915), *Under the Apple Trees* (1916) and *Field and Study* (1919). In 1910 the degree of Litt. D. was conferred on him by Yale University and in the following year he received that of L.H.D. from Colgate University. He died March 29 1921 while returning from California to his country home in New York State.

BURROWS, RONALD MONTAGU (1867–1920), British scholar and archaeologist, was born at Rugby Aug. 16 1867 and educated at Charterhouse and Christ Church, Oxford. While assistant to Prof. Gilbert Murray in the Greek department at Glasgow University, 1891–7, he started his excavations at Pylos and Sphacteria (1895–6), which had the important result of vindicating Thucydides as an accurate historian. From 1898 to 1908 he was Prof. of Greek at University College, Cardiff, and from 1908 to 1913 at Manchester University. In 1905 and 1907 he excavated tombs at Mycalessus (Rhitsona) in Boeotia, thereby systematising for the first time the study of Boeotian archaeology, and in 1907 published *The Discoveries in Crete.* He also published many archaeological papers in the classical journals. From 1913 until his death in London on May 14 1920 he was principal of King's College, London, being the first layman to hold that post. From 1913 onwards he was the leading British Philhellene, having "discovered" Veniselos in 1912, and being invited by Veniselos during the World War (1916) to be the semi-official diplomatic representative in London of the Greek Provisional Government. In 1915 the British Cabinet adopted his plan for bringing Greece into the War by the offer of Cyprus. Confidant and adviser of Veniselos, he wrote and lectured extensively on Near Eastern political problems. At King's College, he founded the many chairs concerned with European history and literature, and the School of Slavonic Studies. See George Glasgow, *Ronald Burrows: A Memoir*, with foreword by E. K. Veniselos (1924). (G. Gl.)

BUSINESS ORGANISATION: *see* OFFICE MANAGEMENT; SCIENTIFIC MANAGEMENT.

BUSONI, FERRUCCIO (1866–1924), Italian pianist and composer, was born at Empoli, near Florence, April 1 1866. After studying in Vienna and at Graz, he became a member of the Accademia Filarmonica of Bologna. In 1888 he was appointed professor at Helsingfors and in 1890 became professor at the Moscow Conservatoire, when he won the Rubinstein prize. After giving recitals and piano lessons in U.S.A. his concerts in different countries brought him world-wide fame as a virtuoso. In 1913 he became director of the Liceo Musicale at Bologna and in 1920 of the Meisterklasse for composition in Berlin, where he died July 27 1924. As a pianist Busoni possessed a superb mastery over the keyboard, probably unequalled since the time of Liszt, together with a great sense of beauty. His compositions include an opera *Brautwahl* (1913), chamber music, orchestral works, piano solos and songs. His brilliant and scholarly arrangements, notably of Bach's "well-tempered clavichord" have been invaluable to pianists; while his talent as a writer is shown in his essays, which include *Entwurf einer Neuen Ästhetik der Tonkunst* (1916).

See H. Leichtentritt, *F. Busoni* (1916) and G. Seldon-Goth, *F. Busoni* (1922).

BUTCHER, SAMUEL HENRY (1850–1910), British scholar, was born in Dublin April 16 1850, being the eldest son of Samuel Butcher, Bishop of Meath. Educated at Marlborough and Trinity College, Cambridge, he graduated as senior classic in 1873 and was awarded a chancellor's medal. After a year as assistant master at Eton he returned to Trinity College as fellow and lecturer in classics. In 1876 he married Rose, daughter of Archbishop Trench of Dublin, and was elected tutor and married fellow at University College, Oxford. In 1882 he succeeded Blackie as professor of Greek at Edinburgh University. In 1904, two years after his wife's death, he resigned and took up residence in London. In 1906 he was elected Unionist member for Cambridge University. Butcher sat on several Royal Commissions on education and was president in turn of the English Classical Assn., the Irish Classical Assn. and the British Academy. In 1908 he was made a trustee of the British Museum. His written works include *Some Aspects of the Greek Genius* (1891); *Aristotle's Theory of Poetry and Fine Art* (1895); *Greek Idealism in the Common Things of Life* (1901); and *Harvard Lectures on Greek Subjects* (1904). In 1887 he published, in collaboration with Andrew Lang, a prose translation of the *Odyssey*. He died in London Dec. 29 1910.

BUTLER, HENRY MONTAGU (1833–1918), British educationalist (*see* 4.882). In 1914 he published *Some Leisure Hours of a Long Life*. He died at Cambridge Jan. 14 1918.

See Edward Graham, *The Harrow Life of H. M. Butler* (1920).

BUTLER, NICHOLAS MURRAY (1862–), American educationalist (*see* 4.885), was elected a member of the American Academy of Arts and Letters in 1911. In 1912 he was chairman of the New York State Republican Convention and also a delegate to the Republican National Convention. Vice-President Sherman was renominated, but died shortly before the general election, and the Republican electoral votes were cast for Dr. Butler for Vice-President. He was, however, overwhelmingly defeated on the ticket with President Taft, Wilson receiving an electoral vote of 435 (40 states), Roosevelt 88 (6 states) and Taft 8 (2 states). On the outbreak of the World War in 1914 he supported the peace policy of Wilson's administration as responding, he declared, "to the best wishes and hopes of the whole people." He disapproved of the organisation of the American Legion. In 1916, however, he urged America's entrance into the War. The same year he was again a delegate to the Republican National Convention. He favoured woman suffrage and was an advocate of the short ballot. At the Republican National Convention in 1920 he received 69 votes for the presidential nomination on the first ballot, the number gradually falling to two on the tenth and last ballot.

As an educationalist Butler was a bold critic of many contemporary tendencies in American education. He upheld the old theory of mental discipline, and in the face of the widespread vocational movement in schools and colleges remained a steadfast and eloquent defender of liberal education. Under his guidance Columbia University became a cosmopolitan institution, its total registration in 1926, including University Extension and Summer Session, Barnard Teachers' College and the College of Pharmacy, being 33,647. He was chairman of the National Committee of the United States for the restoration of the University of Louvain, destroyed by the Germans in 1914. In 1920 he resigned the editorship of *The Educational Review*, becoming instead advisory editor. In 1923 he became a member of l'Institut de France, taking the place of the late Lord Bryce, and in 1924 was chancellor of the American Academy of Arts and Letters. He was the author of *Why Should We Change Our Form of Government?* (1912); *Progress in Politics* (1913, a pamphlet); *The Meaning of Education* (1915, an enlargement of one published in 1898); *A World in Ferment* (1917, interpretations of the War for a new world); *Is America Worth Saving?* (1920); *Scholarship and Service* (1921); *Building the American Nation* (1923).

BUTLER, SIR WILLIAM FRANCIS (1838–1910), British soldier (*see* 4.888), died in Tipperary June 7 1910.

BUYSSE, CYRIEL (1859–), Flemish writer, published his first book in 1893. In his portrayal of the lives and people of eastern Flanders he is a follower of the French naturalists, and Maurice Maeterlinck was able to declare him the equal of Maupassant. He has the gift of making his characters living men and women; certainly there is no writer of fiction who shows us with more realism every aspect of the Flemish people. He is an excellent story-teller, not without humour, and with his virile art and sober, yet vivid, style he knows well how to accentuate the essential characteristics of men and things never losing sight of their natural environment. He has written over 40 novels and short stories, three of which have been translated into French.

BYELUY, ANDREI (1880–), pen name of Boris Bugaiev, Russian writer, was born in Moscow Oct. 7 1880, the son of a well-known mathematician. When he graduated in 1904 from the Moscow University, he had already published poetry of a symbolic type. His books of poetry and rhythmic prose: *Gold in Blue* (1904), *Ashes* (1909), *The Urn* (1909), four symphonies: *The Northern* (1903), *The Second-Dramatic* (1902), *The Third-Return* (1905), *The Fourth Cup of Snowstorms* (1908), are symbolic phantasies, in essence spiritual, yet expressed in realistic images. His prose is best represented in three novels: *The Silver Dove* (1910), a psychological study of Russian religious sects, reminiscent of Gogol, *Petersburg* (1916), a gloomy, fantastic tale about Russian pre-revolutionary realities, *Kotik Letaiev* (1922), an imaginative autobiography—the problems of life and the mind, seen through the soul of a child. In his books, *Symbolism* (1910), *Poetry of Words* (1923) and others he founded a suggestive theory of phonetic values of words. His mystic tendencies turned to anthroposophy, and from 1912–6 he was an ardent disciple of the famous Dr. Rudolph Steiner at Dornach, Switzerland. Later, he went to live in Moscow and one of the most remarkable of his later books is *The Reminiscences of A. Blok*. His outstanding gift is that of word creation, and as a master of an ultra-modern style in poetry and prose he greatly influenced the younger generation of Russian poets and novelists.

BYNG, JULIAN HEDWORTH GEORGE BYNG, 1ST BARON (1862–), British general, was born Sept. 11 1862, son of the 2nd Earl of Strafford, and joined the 10th Hussars in India in 1883. He passed through the Staff College, and was a major when the South African War broke out; there he raised and commanded the South African Light Horse, and later a column, gaining promotion to brevet colonel. In 1912 he was sent to Egypt to take command of the army of occupation.

In Oct. 1914 he took the 3rd Cavalry Div. to France, and he succeeded to the command of the Cavalry Corps in June 1915. But two months later he was despatched to the Dardanelles to take charge of the IX. Army Corps there and he became responsible for the Suvla area, from which he withdrew his troops most skilfully in the following December. Called back to the Western Front, in May 1916, he took over the Canadian Army Corps, a tenure distinguished by the capture of Vimy Ridge on April 9 1917. In June 1917 he succeeded to the leadership of the III. Army, which he retained till the close of the War. On Nov. 20 he carried out the now famous tank surprise attack on the Cambrai front. In Oct. 1919 he was raised to the peerage as Baron Byng of Vimy and Stoke-le-Thorpe, and received a grant of £30,000. In June 1921 he was appointed Governor-General of Canada, retaining the position until 1926.

BYRD, RICHARD EVELYN (1889–), American naval officer and explorer, was born in Winchester, Va., Oct. 24 1888. He was educated at the Shenandoah Valley Academy, Winchester, and at the age of 12 made a trip round the world unaccompanied. He attended the Virginia Military Institute from 1904 to 1907 and the University of Virginia in the session 1907–8. Entering the U.S. Naval Academy May 25 1908, he graduated in Jan. 1912. After four years' sea service he was placed on the retired list with the rank of senior lieutenant, March 15 1916, through an incapacity resulting from an incident of service. This retirement was in reality nominal since he continued in active service, taking up the study of aviation. During the World War he held the temporary rank of lieut.-commander in command of the U.S. naval forces operating in Canadian waters, and built up the naval aviation stations at North Sidney and Halifax, Nova Scotia, the latter of which he was in charge. He was appointed lieutenant Sept. 2 1918, and was promoted lieut.-commander on the retired list by special Act of Congress in 1922. In 1924 when Amundsen requested help from the U.S. Navy in his projected flight across the North Pole, Byrd volunteered but, being married, was not accepted. In 1925 he went to Greenland with the D. B. Macmillan Expedition under the auspices of the National Geographic Society. Acting as flight commander he supervised 6,000 m. of arctic flight and himself flew 3,000 miles. The experience thus gained convinced him that a flight to the

Pole was feasible if undertaken in the month of May, and on his return he immediately commenced making preparations with that end in view. The machine he selected was a Fokker monoplane equipped with three Wright air-cooled motors—a commercial type—which had already flown more than 17,000 m. in the United States and Cuba. Leaving New York City in April 1926 Spitsbergen was reached without mishap and Byrd made his attempt May 9. Accompanied only by his pilot, Floyd Bennett, he started from Spitsbergen at 12:50 in the morning of May 9 1926, having two objectives, viz., a flight to the Pole 680 m. distant and back and alternatively a flight to Peary Land. Taking off from King's Bay, Amsterdam I., he flew in a straight line to the Pole, which he reached and circled around several times, incidentally verifying the observations of Adm. Peary in 1909. Returning his course was to Verlegen Hook, New Frieseland, thence west to his starting point, Amsterdam I., which he reached at 4:20 in the afternoon. His flying time was 15½ hours and the total mileage covered was 1,600.

BYWATER, INGRAM (1840–1914), British scholar (*see* 4.906), died in London Dec. 17 1914. He left a bequest to provide for the study of Byzantine Greek at Oxford.

See W. W. Jackson, *Memoir of Ingram Bywater* (1919).

CABELL, JAMES BRANCH (1879–), American author, was born at Richmond, Va., April 14 1879. He was instructor in French and Greek at William and Mary College 1896–7, graduating with the degree of B.A. in 1898. He then engaged in newspaper work at Richmond and was on the staff of the *New York Herald* 1899–1901. He also contributed short stories to magazines and interested himself in genealogical research. His first novel, *The Eagle's Shadow*, was published in 1904. His work has a distinct individuality, presenting a central conception of human life fitted to an imaginary medieval country, Poictesme, in which the principal actions take place, its inhabitants being ancestors of the other characters appearing in his novels. His method, more or less consistently followed, is the depiction of a decisive event in the lives of two persons, then a similar untying of knots in the life of a child of that couple, and, subsequently, in one of the grandchildren's life history. Following the publication of *Jurgen* (1919) the New York Society for the Suppression of Vice brought action to have the book suppressed on the ground of obscenity. When the case came to trial, however, in Oct. 1922, the publisher, as defendant, was acquitted and the work released for circulation. Among his best known works are *The Line of Love* (1905); *Gallantry* (1907); *Chivalry* (1909); *Domnei*, originally published as *The Soul of Milicent* (1913); *The Cream of the Jest* (1917); *Beyond Life* (1919); *Figures of Earth* (1921); *The High Place* (1923); *Straws and Prayer-Books* (1924); *The Silver Stallion* (1926).

CABLE, GEORGE WASHINGTON (1844–1925), American author (*see* 4.920), died at St. Petersburg, Fla., Jan. 31 1925. Among his later publications were *Posson Jone' and Père Raphael* (1909), *Gideon's Band* (1914), *The Amateur Garden* (1914), *The Flower of the Chapdelaines* (1918) and *Lovers of Louisiana* (1918).

CABLE: *see* TELEGRAPHY, SUBMARINE.

CADBURY, GEORGE (1839–1922), British manufacturer and philanthropist, was born Sept. 19 1839 at Edgbaston, Birmingham, of Quaker parents, and was brought up a member of the Society of Friends. In 1861, when he succeeded to his father's business, it gave employment to 12 workers only, but under the management of himself and his brother Richard (1835–99) it developed rapidly, and in 1879 he founded for the employees the garden village of Bournville, which served as a model for other social ventures of this kind. He became chief proprietor of *The Daily News* (London) in 1901, and his family acquired an interest in *The Star* (London) in 1909. He died Oct. 24 1922. See A. G. Gardiner, *Life of George Cadbury* (1923).

CADORNA, LUIGI, COUNT (1850–), Italian general, was born at Pallanza, Lake Maggiore, Sept. 4 1850. His father was Count Raffaele Cadorna, a distinguished soldier of the wars of the Risorgimento and the Crimea. Luigi Cadorna entered the army in 1866, and served in the infantry, in the artillery and on the staff, becoming colonel in 1892. In 1905 he became lieutenant-general, and a year later was chosen as an army commander in the event of war. In the manoeuvres of 1911 he opposed Caneva, who as victor was given the command in Tripoli.

In 1914, however, on the death of Gen. Pollio, chief of the general staff, Cadorna was appointed to succeed him (July 10). He found the army in a deplorable condition, with regard to personnel and material; moreover, within three weeks, the outbreak of the World War forced the problems of army reform to the front. One of Cadorna's first acts as chief of staff was to adopt the Deport field-gun, and this prompt decision was of the greatest value to Italy. Though handicapped by lack of money and by Italy's low industrial capacity, in the interval between Aug. 1914 and the entry of Italy into the War Cadorna fashioned a weapon with which it was possible to strike, and to strike hard.

For 29 months, handicapped always by lack of means, Cadorna directed the operations against Austria-Hungary with insight, vigour and determination. Facile critics have found fault with his plan of campaign, but the more carefully and objectively this is studied, the more it justifies itself. For a year Cadorna had the full confidence of his country. The first check came with the initial success of the Austrian offensive in the Trentino-Asiago area in May 1916. As time went on, and signs of war-weariness became visible among the troops, Cadorna entered the strongest protest against the policy of the Govt., which, he said, permitted an anti-war propaganda which was detrimental to the morale of the army. Though these protests were largely justified, it must be admitted that a part of the responsibility for declining morale lay at Cadorna's own door, for he did not seem to have fully realised the strain of modern war upon the troops. The disaster of Caporetto led to Cadorna being transferred in Nov. 1917 from the command of the Italian armies to the newly formed Allied Military Council at Versailles. But before leaving his command he had organised the defences on the Piave-Monte Grappa front, and thus had made a stout resistance possible.

Cadorna came to Versailles under the shadow of defeat, but his personality and military insight soon impressed his colleagues and removed the initial handicap. It was a misfortune for Italy when, in Feb. 1918, consequent upon the appointment of the Caporetto inquiry commission, it was thought necessary to remove him from Versailles. As a result of the inquiry he was placed on half-pay on Aug. 29 1918, and four days later his definite retirement was gazetted.

In March 1921 Cadorna published a book dealing with his tenure of the post of chief of staff (*La Guerra alla Fronte Italiana*), which effectively answered much of the criticism that had been directed against his leadership. This work was followed by *Altre Pagine sulla Grande Guerra* (1925). But with the passage of time this criticism had already begun to lose force. More and more it was realised that Cadorna had fitted the Italian Army for war, and that he had conducted the campaign under grave handicaps. Perhaps the most serious defect in Cadorna's leadership was that he failed to secure the loyal co-operation of many of his subordinates. But his achievement was great, and he remains, in spite of the disaster which closed his career, the foremost Italian military figure of the War. On the sixth anniversary of the Italian victory (Nov. 4 1924), the newly created rank of marshal was conferred on him. Cadorna has literary gifts and among his writings is *Il Generale Raffaele Cadorna nel Risorgimento italiano* (1922). (W. K. McC.)

CAFETERIA: *see* FOOD SERVICE.

CAILLAUX, JOSEPH MARIE AUGUSTE (1863–), French politician, was born March 30 1863 at Le Mans. His father, Eugène Caillaux, was an engineer and represented the Dept. of the Sarthe first in the National Assembly and later as Senator; he was Minister of Public Works from 1873 to 1875 and Minister of Finance in the year 1877.

In 1888, after a brilliant academic career, Joseph Caillaux was admitted to the Ministry of Finance. Later he was appointed lecturer at the École des Sciences Politiques in Paris. It was not until 1898 that M. Caillaux, at the instigation of the Republican delegates of the Sarthe, decided to become a candidate for the *arrondissement* of Mamers. His eloquence, his genuinely democratic opinions, his force and readiness in argument, enabled him after a hot contest to defeat the Royalist member, the Duc de la Rochefoucauld-Doudeauville, by 1,800 votes. He continued to represent Mamers until 1917. In 1899, M. Caillaux' great political career began. Waldeck-Rousseau, a name still dear to Republicans, made him his Minister of Finance. During the 3 years that he held this office, M. Caillaux showed not only great financial but also great administrative ability. He inaugurated several important measures, such as the reform of the method of taxing alcoholic drinks, the increase in the scale of the inheritance tax and the reform of the sugar laws, thus introducing into French fiscal legislation the progressive policy which characterised his future work. He left office in 1902, but four years later was re-appointed by M. Clemenceau. During this second term of office he introduced an income tax, the first serious attempt at a just and democratic form of taxation in France.

The Agadir crisis in 1911 marked the next important stage in his career. The Monis Ministry resigned in June and M. Caillaux was entrusted with the formation of a new ministry. As head of the Govt., he conducted with signal ability the difficult negotiations with Germany. No small part of his title to fame and the gratitude of his fellows is due to the fact that he succeeded in postponing the War which in 1914 was to overwhelm the world. In 1912, however, he was obliged to retire before the hostility of the Commission of the Senate, appointed to enquire into the Franco-German Treaty. In Nov. 1913 he returned to his former post as Minister of Finance in M. Doumergue's Government. Though his re-appointment was approved by public opinion in general, a virulent press campaign was started against him in the *Figaro*. Not only was M. Caillaux's policy in 1911 attacked but also his private life. Intimate letters which had passed between M. Caillaux and his wife before their marriage were published. The latter deeming her honour to have been assailed shot the editor, M. Calmette. M. Caillaux was forced to resign, and at the subsequent trial of Madame Caillaux defended her with such force and eloquence that she was acquitted. Had it not been for this affair, it is probable that he would have been asked to form an administration after the general election and the War might then have been averted.

On the outbreak of hostilities he was appointed paymaster-general to the forces and some months later was entrusted with an economic mission to South America. During his absence the campaign of calumny and insinuation broke out afresh. He was accused of desiring a premature peace and of caballing in secret against the Government. He returned to France in 1915, however, and entirely ignored the accusations. In July 1917 M. Clemenceau led the attack upon the Ribot Govt. and M. Malvy's administration. The Govt. was overthrown and M. Clemenceau came into power with the one idea to carry on the War, despite all obstacles. His one serious rival was Joseph Caillaux. M. Clemenceau, therefore, on Dec. 11 1917, demanded the suspension of Caillaux' parliamentary immunity, moving a vote of no confidence in the Chamber. If M. Caillaux had attempted to oppose the motion his cause would have been lost. He proclaimed his innocence in one of the finest speeches ever made in the Chamber, and was cheered to the echo by members of the Left. Nevertheless, he demanded to be heard in the Courts. His parliamentary immunity was suspended and on Jan. 4 1918 he was arrested. The case for the prosecution was based on vague rumours and more or less distorted conversations. It was said that Germany had counted upon M. Caillaux' support to secure favourable peace terms. Various cases of high treason were pending at this time and an attempt was made to connect these with the accusations against M. Caillaux. It was not until Feb. 1920 that he was brought before the Senate sitting as the High Court of Justice and indicted for "plotting against the security of the state abroad."

After a lengthy debate of the utmost vigour on both sides, the accusations fell to the ground one by one. By 213 votes to 28 the arguments of the Procureur-Général, Lescouvé, were refuted. Nevertheless, he was not completely exonerated. He was condemned to three years' imprisonment, the loss of his civic rights for ten years and to five years' residence within a zone to be indicated by the Govt., as well as the costs of the case amounting to about 53,000 francs. The venerable M. Demange, the senior advocate of the court, rose in his seat and said indignantly: "Remember, gentlemen, that you are condemning a man on a count on which he has not been defended." As he had already spent three years in prison M. Caillaux was released the next morning. He returned to Mamers and devoted his time to writing two books which appeared also in English under the titles of *My Prisons* (1921) and *Whither France? Whither Europe?* (1922). Their success was widespread and the popularity of the exiled politician increased.

The amnesty passed by the National Assembly in 1924 restored his political and civic rights to M. Caillaux. In 1925 he was asked by M. Painlevé to join his Govt. as being the one man capable of reducing French finances to order. He accepted the duty and it seemed that at last this difficult task would be accomplished. He attacked first the problem of inter-allied debts. He initiated conversations in London with Mr. Churchill and in Washington with the United States Debt Commission. But political considerations proved too strong. He was accused of belonging to the Radical Socialists. Serious friction arose, with the result that M. Painlevé handed in the resignation of the Govt. on Oct. 28 and formed a new Ministry, excluding M. Caillaux. The latter had, in the meantime, been elected Senator and president of the council of the Sarthe. He retired from office with dignity, preferring failure to the countenancing of measures which, in his opinion, would almost certainly prove ruinous to the country. In June 1926, after another Cabinet Crisis, M. Caillaux again became Minister of Finance. (A. Du.)

CAIRO, Egypt (*see* 4.953), the largest city in Africa, has a population estimated in 1925 at over 850,000. At the 1917 census the inhabitants numbered 790,939, of whom 79,867 were foreigners. Italians and Greeks each numbered over 15,000; there were 12,000 Turkish subjects, mostly Syrians, 8,252 French and 7,524 British, including Maltese and naturalised subjects.

Much has been done between 1910 and 1925 to improve the amenities of the city. A new main drainage system was made, the Bulaq and Zamalik bridges built across the Nile, motor roads constructed to Helwan, Alexandria and Upper Egypt, the tramway system extended and a garden suburb laid out near Qasr el 'Aini. The suburbs have extended considerably, particularly that of Heliopolis, where a large aerodrome was constructed during the World War. After 1918, Heliopolis became the chief air station in North Africa. The inland ports of Atar en Nabi and Rod el Farag, at the northern and southern ends of the city respectively, increased in importance during the War.

A progressive housing policy has been followed by the municipality since the end of the War; many private houses and blocks of flats have also been built, particularly on Roda Island and at Heliopolis. Several public buildings have been erected, including the Lord Kitchener Memorial Hospital for Women at Shubra, the Houses of Parliament in Shari Dawawin, a building for the Ministry of the Interior and an ophthalmic laboratory at Giza, a gift by the British in memory of Egyptians who lost their lives in the World War. At Zaaferan 40 ac. of ground were taken in 1925 for a hospital and a university.

While modern requirements received attention, care was taken of Arab monuments, a law passed in 1918 enlarging the scope of the department charged with the preservation of such monuments, so as to include all buildings dating from the Arab conquest to the reign of Mehemet 'Ali. Coptic ecclesiastical buildings and the Roman fortress of Qasr esh Sham at Old Cairo were specially cited. Important excavations were made at the Roman fortress; the mosque of Ibn Tulun was carefully restored, while the mosque of Bibars was rescued from being a slaughter-house and its great court was turned into a public garden. A public garden was also constructed round the Daher mosque. After the abolition of the British Protectorate there was, however, a slackening in the work of preservation, to which public attention was called in the summer of 1923, with good results. The palace of Mussafer Khan and the mosque of 'Abdin were restored and other urgent work put in hand. Pains were also taken to make the Royal Egyptian library fully representative of Arab literature: by 1925 the library contained over 100,000 volumes, about half being in the Oriental section.

Excavations conducted at the Giza and Saqqara pyramids and at Abu Roash, all places in the neighbourhood of Cairo, yielded valuable results. Certain of the finds were transferred to the Cairo Museum, to which were also brought the remarkable statues of the Pharaoh Akhnaton, found at Karnak, and many beautiful funerary objects from the tomb of Tutānkhamūn, including the golden coffin of the king. See E. Reynolds Ball, *Cairo of Today* (10th ed., 1926).

CALAIS, FRANCE (*see* 4.965), had in 1921 a population of 73,001. The tonnage of the port almost doubled between 1913 and 1918, in spite of the stoppage of civilian traffic, owing to the enormous quantity of war material that was dealt with. The port equipment was much improved to cope with military needs; a quay, 280 metres long, was finished in 1918, and the new west dock has a depth of from 26 ft. to 30 ft. on the sill. Work on the entrance to the port, which was stopped during the World War, was resumed in 1921, and the west jetty was nearing completion in 1926. By the construction of an elevator, canal boats of 300 tons can reach the large canal dock. The Dover-Calais mail and passenger service, stopped during the War, was resumed at the end of 1919.

Calais is the principal centre of the French lace trade. In 1923 goods worth 80,000,000 fr. were exported to the United States, as against 43,000,000 fr. in 1922 and 60,000,000 in 1913. The lace machines are driven by electrical power. Calais underwent some 60 aerial bombardments during the War; there were many casualties and a large amount of material damage was done, the Church of Nôtre Dame and the Town Hall being ruined. The town was awarded the Croix de Guerre.

CALCULATING MACHINES (*see* 4.972).—During the years 1910–25 great improvements have been made in these machines and in the art of calculating by mechanical means.

Machines designed to carry out all kinds of accounting work, in any currency or system of weights and measures, are used in banking, insurance, municipal, and many other offices in all parts of the world. Some are of large capacity, many are driven by electric motors, and some, *e.g.*, the Burroughs Duplex, have two sets of adding wheels that add two separate groups of figures simultaneously.

Many of the improvements effected have been in connection with automatic locking mechanism for preventing the movement of parts of the calculating machines when they should remain at rest, the mechanism for preventing overrunning of rapidly moving parts, and means for checking everything done by the machines and enabling them to work with the minimum of supervision.

Machines Described.—The Burroughs Adding and Listing Machine, invented by William Seward Burroughs in 1888, is a key-set, multiple-bank machine, with independent crank handle or motor operating means. Its adding mechanism includes a series of sectors, each pivoted near its centre, and carrying printing types at one end and, at the other end, a toothed segment with which the corresponding adding wheel is put into or out of gear during the operation of the machine. In operation the keys are set for each item which is then printed and added by a pull of the operating handle, the total being printed by a final pull, after depression of the total key.

The Sundstrand Adding and Listing Machine and the Dalton machine are key-set, independently actuated single-bank machines, with item and total printing apparatus. The successive depression of the keys, to set up an item, positions a number of corresponding stops to limit the subsequent movement of the totaliser-actuating racks and type members.

The Comptometer, invented in 1885 by Dorr Eugene Felt, is a key-driven machine, *i.e.*, the depression of a key actuates a lever which operates a train of gears rotating the numeral wheel in the register. The machine, consequently, is rapid in its operation. The register is in the front of the machine and is cleared by a single movement of the cancelling handle. Recent improvements of the Comptometer include the "controlled key" mechanism to prevent operators' errors, through their making partial key strokes, and signals designed to prevent a new calculation being attempted before the register is clear.

Experimental Work.—Many attempts have been made to design machines to multiply and divide numbers, however large they may be, by a method as direct and automatic as possible and thus reduce the mental work of the operator. Leibnitz made an attempt in this direction, and Thomas of Colmar's machine, which employed the stepped barrel of Leibnitz and was the early form of Layton's Arithmometer, was modified for the same purpose. Later, the Steiger-Egli (*see* 4.974) was brought into use about 1894 and the Mercedes-Euclid (German Patent Specification No. 209817) about 1909. Other machines designed for the same purpose include Monroe, Hopkins, Guy's, Brunsviga, and Muldivo machines. These have a totaliser carriage mounted on the machine and arranged to be moved laterally step by step, the movement being either manual or automatic. An actuating crank handle is moved in one direction for addition and multiplication and in the opposite direction for subtraction and division. Multiplication may thus be performed by successive entry in the totaliser of partial products formed by the machine. The partial products are formed by adding the multiplicand repeatedly in accordance with each digit of the multiplier and these products are registered upon the totalising counter in the correct denominational order, by a requisite movement of the carriage so that the whole product is entered in the counter.

In the Monroe machine use is made, for controlling the number wheels, of special two-part toothed wheels, each part being moved axially under the control of a rocking plate actuated from the keyboard (British Patent Specification No. 195694). The Brunsviga, Guy's, and Muldivo machines employ forms of Odhner's pin wheel with variable teeth. In the Hopkins machine multiplication is effected under the control of stepped plates grouped to represent the units and tens of the partial products.

A machine has been patented, by Alexander Rechnitzer of Vienna, designed to attain complete automatic action. Any two numbers to be multiplied together are set up on the machine and its motor is released, whereupon the partial products are entered automatically and the complete product is shown on the totalising counter. The completely automatic performance, however, of these operations necessitates the use of complicated mechanism. (See British Patent Specifications Nos. 4550 of 1910 and 18642 of 1912).

Combination Machines.—Several forms of combined typewriters and calculating machines have been introduced. The Ellis, Elliott-Fisher, Hopkins and Underwood-Hanson are examples. The Barbel system of automatic calculation uses a unique method. The figure keys of a typewriter are hooked to the figure keys of a calculator underneath. The values are registered by the counting of small steel balls which may be done at the rate of 80 per second. The balls are delivered to the counters by triggers and, during their passage, register their numbers upon dials connected electrically to the printing apparatus. After passing the counters, the balls are returned automatically to the tubes in which they are stored. The various operations in the machine are electrically controlled, current being supplied by a small electric generator in the machine.

Since 1910, automatic means have been brought into commercial use for compiling, classifying, and recording the numerous details of transactions (*see* BOOKKEEPING), which otherwise are entered in ledgers or on filing cards. The details are represented on cards by perforations in columns, the position of any perforation completely identifying one and only one of the details. In the Hollerith system, the cards are read electrically by being passed along contact brushes which complete the circuit when a perforation arrives. The cards are first sorted into groups by an electrical sorter, the passage of a card into its proper group compartment being controlled by the passage of current through the corresponding perforation in the card.

The tabulation of the details is the work of an electrical tabulator having totalisers which are actuated by means of electromagnets controlled by the contact brush circuits. The Hollerith system was designed for use by the U.S. Census Bureau and was used for dealing with the results of the British census of 1911. In the Powers system, similar cards are used, but reading is effected by longitudinally movable pins, which pass through the perforations in the cards, as these are presented to the pins.

Much has been done, especially since the War, in designing apparatus for use in anti-aircraft and naval gunnery, whereby the future positions of moving targets are predicted, use being made of the best data available.

Calculating Areas.—The principal commercial use, during recent years, of area-calculating machines lies in the measurement of hides and sheets of leather. The machine generally employed is of the type known as the Sawyer machine, in which a summation of the peripheral motions of coaxial wheels beneath which the hide or sheet of leather passes is registered on a dial and may be stamped on the leather or hide. Improvements in this type of machine have been designed to enable the machine to deal accurately with sheets of very thin leather.

No new calculating machines of the harmonic type, to which Lord Kelvin's Tide-Predicting Machine belongs, have been invented since 1910. According to the British Assn. Reports, 1920, p. 321, harmonic predictions of the tides have been found to be unreliable for ports in estuaries or comparatively shallow seas. Research is being directed, therefore, mainly towards ascertaining the nature of the disturbing causes in shallow-water areas. (*See* TIDES.) The future of tide-predicting machines will depend largely on the results of this research. (T. E. L.)

CALCUTTA, INDIA (*see* 4.981), was until 1912 the seat of the Govt. of India, which was in that year transferred to Delhi. Calcutta became the seat of a governor in council, being thus on an equality with the other presidential capitals, and in 1924 the corporation was remodelled. This consists of 85 councillors, 75 of whom are elected by the ratepayers, with a mayor, deputy mayor and aldermen elected by the council. The population of the city and suburbs, including Howrah, was 1,327,547 in 1921, and is a mixture of many races and religions, the majority being Moslems. Many languages are spoken, of which Bengali is the chief. The town hall and part of the government offices accommodate the Bengal Legislature, and the Governor of Bengal lives in Government House, vacated by the Viceroy when Delhi was made the capital of India.

In Jan. 1912 the Bengal Legislature created an Improvement Trust. Since its creation it has carried out the clearing of insanitary areas, the widening and construction of roads, the chief being the north-south Central avenue, of which 1½ m. was opened in 1924; a playground in Shambazar, and parks in Cossipore and Karaya; great improvements in the Bhowanipur district; the provision of model dwellings for families dispossessed under these schemes; and the laying out of suburban land for private building. A Victoria Memorial, the conception of which was due to Lord Curzon, built on the site of the old jail, was opened in 1921. It is a domed marble building, chiefly Renaissance in style, which contains pictures, documents, etc., illustrating Indian history. In the grounds are statues of Queen Victoria and the Marquess Curzon and King Edward VII. Memorial Arch. The War Memorial to the lascars of Bengal and Assam is near Prince's Ghat. Several magnificent buildings have been erected in the commercial quarter, including the Royal Exchange; the Howrah railway station has been enlarged, and in 1924 it was decided to build a steel cantilever bridge over the Hooghly to Howrah. An iron reservoir, said to be the second largest in the world, has recently been finished at Talla, to the north of the city. In 1919 the Calcutta University Commission produced a scheme of reform. Calcutta suffered severely from the influenza epidemic of 1918, and for some years afterwards the death-rate from bronchitis was very high.

The trade of the port, which since 1911 has been under the control of a port trust, was much affected by the War, and owing to the position of the city there was little military traffic as compensation. Recently, after much variation, a real improvement has been noticeable. In 1913, owing to the increased trade, it was decided to build a new dock and quays below the Kidderpore docks, and four riverside berths with sheds, as a temporary measure. Work on the main scheme was begun in 1920, and the first portion with five berths, and also two graving docks, was expected to be finished in 1927. The limits of the port were extended 9 m. to the north in 1921. The Hooghly is a dangerous river and new shoals are constantly forming, but considerable improvements have been made by dredging and by lighting the river between Sangor and Kulpi. Vessels of 10,000 tons, drawing 28 ft. and more, ascend to Calcutta. A new storage depôt for petrol has been built at Budge-Budge.

CALCUTTA, UNIVERSITY OF.—The University of Calcutta was founded, together with those of Madras and Bombay, by an Indian Act in 1857—as the result of the famous educational dispatch of Sir Charles Wood in 1854—on the model of the University of London, then an "affiliating" university. After the report from Lord Curzon's universities commission in 1902 it was given teaching powers by an Act in 1904; and the university is still working entirely under the Acts above named save for the substitution by an Act of 1921 of the governor of Bengal for the governor-general as chancellor, and of the local government for the governor-general in council, as the determining authority for a number of university matters.

The university exercises almost complete control over the hundreds of secondary schools in Bengal by means of the matriculation examination, for which from 16,000 to 19,000 candidates present themselves annually; it exercises control over the "affiliated" colleges by determining the curricula and examinations in the faculties of arts, laws, teaching (education), science, medicine and engineering; and it carries on in Calcutta "post-graduate" teaching in arts and science and teaching in law in the university law college. A comprehensive survey of the university work was made by the Calcutta University Commission presided over by Dr. (now Sir) Michael Sadler in 1917–9. They found "the university system in Bengal fundamentally defective in almost every aspect," and that in so far as it did good work this was in spite of the method of organisation in vogue (*Report*, vol. 5, p. 302).

The system of secondary education was radically defective. The mechanical system of marking at the examinations, devised to secure uniformity of treatment, encouraged pure memorisation at the expense of intelligence, and tended to the deterioration of mental efficiency throughout the schools and university (*loc. cit.*, p. 345). The only changes of importance made since the report were the removal of an area with a radius of five miles in the Dacca district and of the province of Burma from the educational jurisdiction of Calcutta, and the creation of the University of Dacca (*q.v.*) and of the University of Rangoon in 1921. There are 45 "affiliated" colleges (spread over Bengal and Assam), including three in teaching, three in law, two in medicine and one in engineering, some of which, like the Presidency college, the Bengal Medical college and the Bengal engineering college, are maintained by Government, but of which the majority are maintained by private enterprise and missionary effort. The colleges differ very greatly in their level of efficiency. A large number of "post-graduate" courses are restricted to teaching for the M.A. and M.Sc. degrees, and others are specialised and advanced. The teachers of the post-graduate courses have produced a considerable amount of original work. The university has a number of endowed chairs and lectureships, and a very large number of benefactions for scholarships and prizes.

See Calcutta University Commission *Report*, 1919 (5 vol., with 8 vol. of appendices); Calcutta University *Calendars* up to 1924–5. (P. J. H.)

CALENDAR: *see* EASTER, FIXED.

CALGARY, Canada (*see* 4.1004), had in 1921 a population of 63,305. In 1925 it was estimated at 75,000. It is the centre of the ranching and grain-producing region of central and southern Alberta, a distributing point for the mining districts in the mountains, and the western general headquarters of the Canadian Pacific Railway. The Canadian National Railways has large workshops there, and it is an important station of the Royal Canadian Mounted Police. Large water-power stations, lumber-mills, lighting plants, banks, wholesale houses, hotels, churches, private and public schools and a large public creamery, all go to constitute a flourishing city. Natural gas is piped from the Bow Is. field, and electric power is developed from the Bow river. An institute of technology and art was opened in 1916. Four miles south of Calgary is situated the Agricultural Experimental Station, maintained by the Provincial Govt., one of the largest of its kind in the world. Calgary is fast growing as a manufacturing city, and its industrial products include beet sugar, soap, furniture, boilers, farm implements and miscellaneous machinery. Several meat-packing factories have been established. The city stands near an oil-field of growing importance and a large oil refinery has been built.

CALIFORNIA (*see* 5.7a).—In 1920 the population was 3,426,861 as against 2,377,549 in 1910, an increase of 1,049,312, or 44·1%. The population in 1925, as estimated by the U.S. Census Bureau, was 4,021,320. The urban population (in places of 2,500 or more) in 1920 was 2,331,729, an increase during the decade from 61·8% to 68% of the total population. Of the cities, three had more than 200,000 inhabitants in 1920: Los Angeles (576,673), San Francisco (506,676) and Oakland (216,261). The total land area is 155,652 square miles.

Political History.—Between 1910 and 1925 many changes were made in the constitution and government of the state. In response to a popular movement, the Legislature, elected in 1908, passed a law giving the voters more direct control of the political parties at the primary elections. This led in 1910 to the election of Hiram W. Johnson as governor on a platform opposing the "special interests." The new administration carried through legislative changes which were both numerous and far-reaching. In addition to legislative enactments, 78 constitutional amendments were approved during the period 1910–25. Among the more important were those of 1911 providing for the initaitive and referendum, the recall (including the recall of judges), increased powers to the state railway commission and the adoption of the short ballot; provision for the free distribution of text-books in elementary schools, in 1912; the authorisation of a minimum wage law for women, in 1914; the enlarging of the operations and support of the public schools, in 1920; and a budget law, in 1922.

Important legislation included a Working Men's Compensation Act; limitation of the working hours for women to 48 a week; a Teachers' Pension Act; provision for the cure of drug addicts; a Mothers' Pension Act; a Blue Sky law, designed to protect investors from unscrupulous promoters; the Webb Alien Land Holding Act, to prevent Japanese from holding real estate; provisions for absent voters; regulation of stages and automobiles as common carriers; a compulsory part-time education law raising the compulsory school age limit from 15 to 16 years; and provision for the vocational re-education of disabled men.

While these Acts were generally recognised as having high social value, many of them added materially to the rapidly increasing cost of government. In 1910 the cost of state government was $14,866,850; in 1920 it was $36,125,456; and in 1924 $57,944,154. By a constitutional amendment in 1910 the system of taxation was so changed that state expense was to be borne by taxes on corporations, which were, on the other hand, relieved of county and local taxation. In 1919 the problem of governmental cost was made an object of special study and legislation, and in 1921 a remedy was sought by the consolidation of many state boards and commissions into a few state departments and also by raising the rate of the tax on corporations. This action brought forward the problem of state expense as an acute political issue, and resulted in the adoption of a constitutional amendment providing for an executive budget, and in the election of Friend W. Richardson as governor on a platform of strict economy. The prosecution of this programme divided the state into two political camps, one urging the full discharge of the social and educational responsibility of government, the other demanding relief from the burdens of heavy taxation.

Education.—The number of pupils enrolled in the public elementary and high schools rose from 513,319 in 1914 to 1,019,739 in 1924. In the latter year there were 977 kindergarten, 18,861 elementary and 9,291 high school teachers in the public school system. Expenditures for public education have increased enormously, rising from about $6,000,000 in 1910 to $75,576,031 in 1924. Much of the increase was due to the introduction of the free textbook system and to the construction of buildings.

Agriculture.—In 1920 there were 29,365,667 ac. in farms, of which 11,878,339 ac. were improved land. The total acreage had fallen to 27,565,440 in 1925. The average acreage per farm decreased from 316·7 in 1910 to 249·6 in 1920 and to 202 in 1925, but the value per acre increased from $47.16 in 1910 to $94.77 in 1920 and to $114 in 1925. In 1920 the total value of all farm property was $3,431,021,861: this value had fallen to $3,161,818,824 in 1925. There were 4,219,040 ac. under irrigation in 1920. In 1925 the total value of all farm crops was $458,469,000: the following table shows the production and value of certain crops in that year:—

	Production	Farm Value
Hay	5,621,000 tons	$77,556,000
Cotton lint	60,372,000 lb.	12,980,000
Beans	4,080,000 bu.	16,728,000
Barley	32,240,000 bu.	24,180,000
Rice	4,738,000 bu.	8,055,000
Wheat	11,475,000 bu.	16,956,000
Potatoes	6,510,000 bu.	13,020,000
Corn	3,026,000 bu.	3,517,000

Fruit growing is by far the most important branch of agriculture. The chief crops are oranges, apples, lemons, grapes, prunes and peaches. In 1925 the total value of the fruit crop was $216,164,000.

Pastoral Industry.—The value of dairy products for the fiscal year 1923–4 was $118,647,544, distributed as follows:—

Butter . .	$37,513,481	Ice Cream . .	$12,247,904
Cheese . .	2,096,135	Milk and Cream	66,790,024

The following table shows the number of live stock slaughtered and the principal products of the same for the calendar year 1923:—

Slaughtered		Products	
Beeves . .	549,155	Fresh Beef .	293,443,739
Calves . .	175,419	Fresh Veal .	24,763,322
Sheep . .	1,607,538	Fresh Mutton .	60,682,334
Hogs . . .	1,187,767	Fresh Pork .	105,894,358
		Cured and Salted Pork .	44,077,673

During 1925 the wool clip was 17,150,000 lb., valued at approximately $5,800,000.

Minerals.—The total value of the mineral production in California in 1924 was $374,620,789. The production of gold decreased from $17,398,200 in 1919 to $13,150,175 in 1924, which was approximately 30% of the gold output of the United States. The silver output was 3,555,153 fine oz., valued at $2,381,952; copper, 52,089,349 lb., valued at $6,823,704. The value of the non-metallic minerals was practically three-fourths of the total value: the chief item was petroleum, which, in 1924, produced 228,933,471 bar., valued at $274,652,874. Cement production reached 11,655,131 bar., valued at $23,225,850.

Industry.—The total value of manufactured products in 1923 was $2,215,281,250, in producing which there were employed 246,154 workers, who received $353,183,000 in wages. The principal industries were petroleum refining, $267,382,871; canning and preserving, $170,620,075; slaughtering and meat packing, $102,568,576; lumber and timber products, $82,228,916; planing mill products, $82,228,916; printing and publishing, $72,012,079; motor vehicles, $67,160,192; bread and bakery products, $60,401,871; and motion-picture production, $54,332,060.

Communications.—The total railway mileage operated in the state on June 30 1924 was 16,439, of which 3,155 m. were electric railways. The chief lines are the Southern Pacific; the Atchison, Topeka and Santa Fé; the San Pedro and Salt Lake; and the Western Pacific. After 1910 there was a rapid improvement in highways. The state highway system in 1924 had a total mileage of 6,400. The use of motor vehicles expanded rapidly between 1910 and 1925, and on Aug. 1 1925 there were 1,382,821 automobiles and motor vehicles in the state.

(O. C. C.)

CALIFORNIA, UNIVERSITY OF (*see* 5.22).—During the period 1910–25, the University of California grew to such an extent that in 1925 it stood first in number of students among American universities. On Nov. 1 1925 the enrolment was as follows: at Berkeley, in the colleges of Letters and Science, Engineering, Agriculture, Chemistry, Commerce, Jurisprudence, Medicine (part), Education and Architecture, 8,726 undergraduates (4,757 men and 3,969 women) and 943 graduates (484 men and 459 women); at San Francisco, in the Hastings School of Law, schools of Medicine (part), Dentistry, Pharmacy, Hooper Foundation for Medical Research, 656 students; at Los Angeles, in the southern branch (instruction in lower division), 872 students, and in the teachers' curricula, 1,108 students, making a total, less duplicates, of 11,197. There were in the university extension division courses, 13,792; in the agricultural extension courses, 5,625; in the summer session and intersession courses, 6,436, and on the university farm, 530, making a grand total, less duplicates, of 37,480.

Many new buildings were erected in this period, including the Boalt Hall of Law (1911), costing $190,000, partly the gift of Mrs. Elizabeth Josselyn Boalt as a memorial to Judge Boalt and partly subscribed by the lawyers of California; Agriculture Hall (1912), costing $267,000; Benjamin Ide Wheeler Hall (1917), costing $700,000; and Hilgard Hall (1917), costing $350,000, both the gift of the people of California; Gilman Hall for the Chemistry Dept. (1917), costing $197,000; Sather Tower (1914), costing $200,000, in addition to $25,000 for the bells; the University Library (1917), costing $1,442,000, of which $730,000 was bequeathed by Charles Franklin Doe; Stephens Memorial Hall (1921), costing $300,000, provided for by popular subscription as a memorial to Henry Morse Stephens, for 17 years a professor in the university; Le Conte Hall (1922), costing $500,000, housing the Physics Dept., a gift of the state; Haviland Hall (1923), costing $350,000, of which $250,000 was provided by bequest of Mrs. Anna N. Haviland; Stadium (1923), costing $1,361,000, made possible by public subscription; and Hesse Hall, costing $41,750, and Veterinary Science Hall, costing $11,500, built from the general funds of the university.

Dr. Benjamin Ide Wheeler resigned the presidency in July 1919 after 20 years of service. Dr. David P. Barrows, head of the Political Science Dept., who then succeeded, resigned in 1923 to resume instructional work, and Dr. W. W. Campbell became the tenth president.

Mrs. Phoebe Apperson Hearst, for 22 years a regent of the university, died April 23 1919. Among her many gifts to the university were the Hearst Mining Building, Hearst Hall; scholarships amounting to more than $30,000; contributions to the Anthropological Museum, $130,000; and the swimming pool for women. Hearst Hall, destroyed by fire, is being rebuilt as a memorial to Mrs. Hearst by her son, William Randolph Hearst, at a cost of more than $1,000,000. The endowment of the university in 1924 was $9,593,354, yielding a gross income of $362,542. The total assets, including real estate and improvements, were $33,834,997. The total income for the year ending June 30 1924 was $9,591,498. (W. M. H.)

CALIPHATE (*see* 5.23).—There has been much diversity of opinion in the Moslem world on the subject of the Caliphate since the 1st century of the Mahommedan era, but only one theory—that of Sunni orthodoxy—has obtained more than temporary or local realisation (*see* MAHOMMEDAN INSTITUTIONS, 17.411). This theory of the Sunni Caliphate grew out of the actual political facts connected with the establishment of the vast Arab empire stretching from the shores of the Atlantic to Transoxiana; it assumed that all believers would always live under one Moslem ruler, who would be of the tribe of Quraish (to which the Prophet himself had belonged), and for nearly nine centuries the Caliph was actually a Quraishite. But the empire remained undivided for little more than a century, and broke up into a number of ndependent states; so that by the 10th century the authority of the Caliph in Baghdad hardly extended beyond the walls of that city, and he himself was a puppet in the hands of his Turkish mercenaries. The theory, however, survived its failure to realise tself and even independent monarchs recognised the Caliph as the source of all authority, and would apply to him for a diploma of investiture or a title of honour, in order that their position might be legitimatised and the tender consciences of their subects satisfied. After the last Abbasid Caliph in Baghdad was put to death by the Mongols in 1258, a shadowy continuation of the dynasty was set up in Cairo under the protection of the Mameluke Sultans and, though the Caliph was now powerless to exercise any influence on political affairs, he was still regarded in popular sentiment as the only legitimate source of authority, and requests still came for titles and diplomas from independent princes. On the other hand, particularly after the Mongol conquests, a new theory of sovereignty was devised by the Mahommedan legists, who began to represent the authority of the ruler as derived directly from God Himself, "Who giveth the kingdom to whomsoever He wills, and raiseth whomsoever He wills to honour." No authorisation therefore from the Caliph was any longer held to be necessary, and the legists impressed the duty to obedience to any ruler who had established his position by force of arms.

Development from 13th Century.—Accordingly, from the latter part of the 13th century onwards, independent Sultans—Maghrebins, Indians, Seljuqs and even Turkomans and Shaybanids—began to assume to themselves the title of Caliph in addition to other high-sounding titles and this title, which in earlier ages had been considered to be the exclusive prerogative of one supreme sovereign, now came to be applied to any number of princes, some of whom were persons of quite insignificant status. The rising power of the Ottoman Sultans naturally fell in with the prevailing fashion, and we accordingly find that the title Khalīfah was applied as early as 1362 to Murad I., and afterwards to each one of his descendants on the Ottoman throne. There is, therefore, no justification for the legend that the first of the Ottoman Sultans to assume this title was Selim I., and still less historical evidence is there for the story that after his occupation of Cairo in 1517 the dignity of the Caliph was transferred to him by the last of the Abbasid Caliphs, Mutawakkil. This legend was first put forward in 1787 by D'Ohsson and passed unchallenged from one European history to another, and was adopted by Turkish writers also, and in modern times it became a commonplace in the propagandist literature of the Mahommedan world in support of the Ottoman claim to the Caliphate. As the Ottoman conquests extended the boundaries of their enormous empire, it became clear that the Turkish Sultan was the only Mahommedan monarch possessing territories, power and wealth commensurate with the dignity of so exalted a title, and the same halo of glory gathered round Constantinople as in former centuries had been associated with Damascus and Baghdad.

The Ottoman Diplomacy.—The Ottoman Sultans do not appear to have attached much importance to the title of Khalīfah until in the 18th and 19th centuries Turkish diplomatists found it convenient in their relations with Christian Powers to make use of the false analogy current in Europe between the Caliph and the Pope, and to claim for the Sultan spiritual authority over Moslems who were not actually his subjects. Abdul Hamid II. (1876–1908) especially emphasised this claim, and from the outset of his reign endeavoured to obtain recognition of himself as Caliph by sending emissaries to Egypt, Tunis, India, Afghanistan, Java and China. His deposition in 1908 did not entail the abandonment of this policy, and in the treaties made between the new constitutional Government in Turkey and the states which between 1908 and 1913 annexed territories formerly provinces of the Turkish empire, *e.g.*, Bosnia, Hercegovina, Libya, Bulgaria and Macedonia, it was stipulated (in regard to the first three) that the name of the Sultan should continue to be mentioned in the public prayers as Caliph, and that in all of them the appointment of Moslem ecclesiastics should be authorised by the Shaikh ul Islam in Constantinople.

When Turkey entered into the War in 1914 a further attempt was made to make political use of the Turkish claim to the Caliphate by the proclamation of a Jihād in which all Moslems were called upon to fight in defence of the Khalīfah and were threatened with the punishment of hell if they supported his enemies. The lack of response to this appeal revealed the unreality of this assumption of authority, but many Moslems, especially in India, were undoubtedly distressed at the fact of hostilities between Turkey and the governments under which they themselves lived, and after the Armistice in 1918 much sympathy was aroused for the Caliphate, and fears were expressed lest the terms of peace should cripple the power of Turkey.

Abolition of Sultanate and Caliphate.—In Nov. 1922 the National Assembly declared a republic and abolished the Sultanate; Mahommed VI. was deposed and his cousin, Abdul Majid, elected Khalīfah of all the Moslems, but the exact nature of his functions had not been clearly defined before he was sent into exile in March 1924 and the Ottoman Caliphate abolished altogether. A few days later King Hussain of the Hejaz was proclaimed Caliph in Mecca and Transjordan, and received some recognition in Palestine and Syria; but in the following Oct. he abdicated, just before the victorious Wahhabis entered Mecca.

Strong protests against the action of the Turkish Govt. were made in Egypt, India and Java, and great consternation was aroused by the disappearance of an institution which for so many centuries had served as a rallying point for the ideal of the unity of the Moslem world. Many proposals have been put forward for dealing with this new situation; the most conservative body of opinion refuses to accept the action of the National Assembly and still regards Sultan Mahommed VI. as the only legitimate Caliph, maintaining that the Sultanate and the Caliphate are inseparable. Some of his supporters who had organised on the model of one of the religious orders a movement for his restoration, were tried and condemned at Angora in Aug. 1925.

Future of the Caliphate.—Caliph Abdul Majid has been able to retain the sympathy of only a small band of supporters, who wish the spiritual functions of this head of the community to be free from any contact with political organisation. Others, whose opinions are most clearly voiced by the theologians of the great Mahommedan University of Al-Azhar in Cairo, hold that the post has now become vacant, and that representatives of all the Moslem races and communities in the world should elect a new Caliph; such a congress was proposed for March 1925, but it has been postponed for a year. They propose to revive the primitive practice of election as exemplified in the appointment of Abū Bakr, the first successor of the Prophet; for the legists have never abandoned the theory that the office of the Caliph is elective and, though actually from the middle of the 1st century of the Mahommedan era, almost every Caliph has nominated his successor (except when a new dynasty has been instituted), the fiction of election has been preserved in the ceremony of *bay'ah*, or paying allegiance to the new Caliph. These persons also cling to the orthodox Sunni doctrine that the Moslem world must always have an Imām, or leader, who as head of the community can alone perform certain functions, such as the proclamation of a general Jihād, and delegates to the Qādīs, or judges, his powers of executing judicial and disciplinary functions, without which authorisation their decisions and marriage contracts are held to be invalid.

Indian Suggestions.—Meanwhile the field has been opened for fresh speculations on the subject, and an Indian scholar named Muhammad Barakatullah has put forward a scheme for the election of a Caliph who is to be merely the spiritual head of Islam, having no concern with politics; he is to be president of a council of learned persons, elected by religious organisations throughout the Moslem world, who are to be heads of departments, *e.g.*, the Ministry of Religion (for the organisation of mosques, schools and religious foundations), the Ministry of Finance (with control of the religious taxes to be used for the maintenance of the Caliphate and the support of charities), the Ministry of Education and Research, and a department of propaganda and missionary organisation. The future Caliphs are to be elected from among the members of this council.

Contrary Views.—There are other Moslem thinkers who agree with the Turks in holding that there is no longer any need for such an institution in the Moslem world, although they do not sympathise with the religious policy of the Turkish Republic. From the 2nd century of the Mahommedan era there have been Moslem teachers who have maintained that the Caliphate lasted only 30 years, *i.e.*, up to the death of Ali in A.D. 661, and that from that date there has only been the rule of temporal monarchs. This was the view of al-Nasafī (*ob.* 1141), one of the greatest legists of the Hanafī school, whose exposition of Moslem doctrine used to be the accepted text-book in Turkey, and the same opinion was adopted by the Turkish legist, Ibrahim Halabī (*ob.* 1549), who compiled the Ottoman code of law which was authoritative up to recent times. In India this doctrine has also found exponents. Such persons deny the need of a Caliph in the modern world, and their point of view has recently received emphatic expression in a work on *Islam and the Principles of Government* by one of the 'ulamā of Egypt, Shaykh 'ali 'Abdur Rāziq. He maintains that the Caliphate was based entirely upon force, and has no authorisation either in the Qur'ān or the teaching of the Prophet. Containing as it does a somewhat violent attack upon the whole body of the 'ulamā, this book has aroused much attention.

There were in 1926 three Caliphs in exile—Sultan Mahommed VI., 'Abdul Majid and King Hussain; the Sharif of Morocco is recognised as Caliph by his subjects, and four petty chiefs in the Malay Archipelago enjoy the title. Each of these has his own supporters, but a large part of the Moslem world is indifferent to the claims of all of them.

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(T. W. A.*)

CALMETTE, GASTON (1858–1914), French journalist and writer, was born at Montpellier July 30 1858. In 1884 he joined the staff of *Le Figaro*, and in 1894 became editor at a time when the journal, which had started as an aggressive and half-frivolous periodical, was becoming the mouthpiece of the extreme Right and of the party known as "les Ralliés". Calmette helped to make *Le Figaro* an important political factor, without allowing it to slip back into its former pamphleteer style. He attracted much notice in 1913 and 1914 as the originator of the bitter attacks on the policy of M. Caillaux; especially with regard to M. Caillaux's attitude in the Rochette case of 1911, in which it was alleged by *Le Figaro* that the director of public prosecutions had been influenced by the Ministry to delay the course of justice. As a result of these newspaper attacks Mme. Caillaux called at the office of *Le Figaro* on March 16 1914 and shot M. Calmette dead. *See* CAILLAUX, J. M. A.

CALORIMETER: *see* GAS, MANUFACTURE OF.

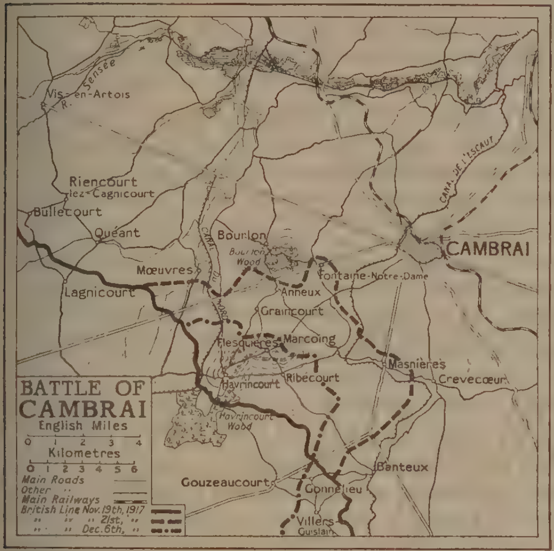
CAMBON, JULES MARTIN (1845–), French statesman (*see* 5.85), when ambassador in Berlin from 1907 till the outbreak of the War, was instrumental in signing, Nov. 4 1911, with A. von Kiderlen-Waechter, the convention about Morocco. During the years immediately preceding the War he was acutely apprehensive of the Kaiser's intentions, and sent repeated warnings to his Government. In 1920 he was chosen President of the Council of Ambassadors.

CAMBON, PIERRE PAUL (1843–1924), French diplomatist (*see* 5.85), died in Paris May 29 1924.

CAMBRAI, BATTLE OF.—In the history of the World War of 1914–8 this battle, fought in Nov.–Dec. 1917, stands out as a landmark in the history of warfare. On Nov. 20 1917 the British III. Army launched an attack, based on a new method, with an initial success so striking that on the morrow the bells of London were rung in joyous acclaim of the "victory." Little more than a week later, on Nov. 30, after the hopes of exploiting the success had already faded, there came a German retort so full of menace that the public thereafter showed a strong distaste for premature celebrations. Yet if the battle in itself was a tragedy of error and missed opportunities, its eventual effect on the fortunes of the Allies was beneficent—it pointed the way to the victorious method of 1918.

Origin of the Battle.—The question of the origin of the Cambrai operations is of primary historical importance, both because of the outcome, and because of the method of Nov. 20. The initial source is to be found in the third battle of Ypres, which opened on July 31 1917 and died away three months later in the swamps of Passchendaele. The lesson of these operations was that the method of an overwhelming artillery bombardment stultified its own objects by rendering impassable the ground over which the advance was planned to follow. If the ultimate appreciation of this lesson by the High Command paved the way for the Cambrai method, the initial impulse came from another source, where the lesson had been absorbed within three days.

On Aug. 3 1917 an alternative proposal was drawn up at Tank Corps Headquarters by the chief general staff officer, Col. Fuller. The preface to it contained this significant example of prevision: ". . . from a tank point of view the third battle of Ypres may be considered dead. To go on using tanks in the present condition will not only lead to good machines and better personnel being thrown away, but also to a loss of *morale* in the infantry and tank crews through constant failure. From an infantry point of view the third battle of Ypres may be considered comatose. It can only be continued at colossal loss and little gain. . . ."



Then came the alternative proposal, to restore British prestige, before the winter set in, by a tank blow against St. Quentin, as a strategical prelude to an advance towards Valenciennes the following spring. Discussion of this project brought out the objection that it required a combined British and French operation, which might lack the simplicity and smooth working essential to a novel method. Therefore, on Aug. 4, a second project was framed, for a great tank raid south of Cambrai. The word raid should be stressed, for, as originally conceived, the object was "to destroy the enemy's personnel and guns, to demoralise and disorganise him, and not to capture ground." As the preliminary notes stated, "the duration of the raid must be short—eight to twelve hours—so that little or no concentration of the enemy may be effected for counter-attacks."

Had this plan been followed there would have been no need to lament Nov. 30. For the raid a force of six tank battalions supported by "one, or better two," divisions with extra artillery, was suggested, operating on an 8,000 yd. front. The object, as proposed, was "to raid the re-entrant formed by the L'Escaut Canal between Ribécourt-Crèvecoeur-Banteux." The raiding force was to be divided into three groups, the main one to scour this canal-enclosed pocket, while the smaller groups formed offensive flanks on each side to protect the main operation.

The detailed project, from which the foregoing are extracts, was taken to Gen. Byng, commander of the III. Army, on Aug. 5. On Aug. 6 Byng went to G.H.Q., saw the commander-in-chief and suggested an attack with tanks on Sept. 20. Sir Douglas Haig is understood to have been favourable to the idea, but counter arguments, for concentrating every possible man in the Ypres area, seemed to have delayed its adoption. However, the continued lack of definite success at Ypres lent emphasis to an alternative, and on Sept. 7, as a result of a consultation at III. Army Headquarters, a letter was addressed by Tank Corps Headquarters to G.H.Q. asking that the tanks might be withdrawn from the Ypres area, and suggesting two operations, one on the I. Army front and one on the III.

On Sept. 11 G.H.Q. approved the withdrawal of the bulk of the tanks and gave instructions to the Tank Corps to reconnoitre the Lens front (I. Army). After a report and project had been submitted to G.H.Q. the area was changed back to Cambrai, and on Oct. 25 the first general conference on the Cambrai operation was held. The date had been fixed for Nov. 20. Among the factors which induced the British command to approve the Cambrai scheme were the need of disarranging the enemy's plans of withdrawing troops from France to strengthen the Austro-German thrust against Italy, and the urgency of striking any such blow before the stream of German reinforcements released by the Russian revolution could swell to its full strength. Despite the heavy drain on British resources, caused by the Ypres offensive, these arguments prevailed.

The Plan Adopted.—The basis of the tactical plan was the use of a mass of tanks in a surprise onslaught, to replace the customary method of an intense preparatory bombardment by artillery. The historical interest of the Cambrai scheme centres around two points, the general plan and the tank plan.

The III. Army plan was (*a*) to break the German defensive system, the famous Hindenburg line, in the neck of land between the Canal de l'Escaut and the Canal du Nord; (*b*) to seize Cambrai, Bourlon Wood and the passages over the river Sensée; (*c*) to cut off the Germans in the area south of the Sensée and west of the Canal du Nord; and (*d*) to exploit the success towards Valenciennes. The force allotted for this ambitious plan was the III. and IV. Army Corps, comprising six divisions and part of another, the Cavalry Corps of two divisions, 381 fighting tanks and approximately 1,000 guns. They were to be employed on a front extending from Gonnelieu to Havrincourt Wood. The German defences opposing them consisted of the Hindenburg line system, and behind this the Hindenburg Reserve line and the unfinished Beaurevoir-Masnières line. Thus of the original project there remained only the fundamental idea—the massed tank surprise, the tank method and the locality.

In the alterations to the original plan lay the germ of disaster. The raid had been transformed into a large-scale offensive, with far-reaching aims. Instead of scouring a pocket and withdrawing, an organised advance was to be made up a narrow lane bounded by two canals. As protection to a raid, these became a danger to such an attack, circumscribing the action of the tanks and preventing the formation of tank offensive flanks. Otherwise the ground was good, and ideally chosen indeed for the original purpose, being mostly rolling downland, excellent for tank movement. It was marked by two features, the Flesquières-Havrincourt ridge and Bourlon Hill.

The fundamental weakness of the plan was not topographical, but the almost complete lack of reserves. To undertake such an important operation in such a condition was surely a violation of one of the cardinal axioms of war. There were local reserves, naturally, in most divisions, but there was no general reserve, unless the two cavalry divisions can be considered such—and, apart from their limited strength, the futility of so regarding them was amply shown in their fresh inability, in face of modern weapons, to influence the action.

The six divisions employed in the initial attack were all that the III. Army commander had at his disposal, for a plan that visualised a penetration beyond Cambrai towards Valenciennes. It is difficult to understand what was in mind as to the future, for without reserves complete success could only mean the creation of an excessively deep and narrow salient, requiring many divisions to hold it. It is true that the Guards and one or two other divisions could be made available, and were ultimately brought to the scene, but they were too far away for prompt intervention. The situation indeed had some reminder of Loos. The French also moved a special force forward in readiness to co-operate, but their aid was not called upon.

If the excuse be that the third battle of Ypres had drained the British of reserves, then it surely reflects on the choice of that swamp-like area and the failure to try earlier the method that at Cambrai unlocked the doors to decisive success. On the other hand, it may be urged that G.H.Q. put an initial time-limit of 48 hours on the operation. To this the reply is that if the lack of resources was appreciated, the objectives were excessively ambitious, and that the powerful raid originally proposed was far more in accordance with the principle of security than an offensive involving occupation of newly consolidated positions.

Turning now to the tank plan, the problems were to gain surprise, to cross the wide and deep obstacle of the Hindenburg line and to ensure co-operation between the infantry and tanks for their common security. Careful organisation and the absence of a preliminary bombardment contributed to the accomplishment of the first object. The difficulty presented by the Hindenburg line was overcome by devising super-fascine, huge bundles of brush wood, which were carried on the nose of each tank and released on reaching the edge of the Hindenburg trenches; the tanks, working in sections of three, had thus the power to cross three such successive obstacles. Thirdly, a strictly drill attack was worked out and practised, by which in each section an advanced guard tank moved about 100 yd. ahead of the two main body tanks, keeping down the enemy's fire and protecting the main body tanks as they led the infantry forward. The infantry, moving in flexible file formations, followed immediately behind the main body tanks. While the tanks cleared a way for them through the deep belts of enemy wire and subdued the hostile machine-gun fire, the infantry acted as "moppers-up" to the tanks and were also ready to protect them from the enemy's guns at close quarters. The one fault of the tank plan was that, against expert advice, the tanks attacked on the whole frontage instead of against selected tactical points, with the result that no tank reserve was kept for use in the later stages.

The Battle.—The preparations for the battle were made with great skill and secrecy, while to mislead the enemy as to the scale and frontage of the attack, gas and smoke attacks, dummy attacks with dummy tanks, raids and feints, were carried out on a wide front both north and south of the real sector of attack.

At 6:20 A.M. on Nov. 20 the tanks and infantry moved forward to the attack on roughly a six-mile front, achieving complete surprise and a demoralising initial success at all points, save in the left centre in front of Flesquières. The cause of this one serious check appears to have been that the 51st Div. here adopted formations of its own instead of conforming to those devised by the Tank Corps and adopted in all the other divisions. Whatever the reason, the result was that the infantry fell too far behind the tanks, lost the gaps in the wire and were stopped by machine-gun fire. This loss of touch lay also at the root of the losses which befell the tanks when they came over the ridge and under the close fire of several German batteries, for infantry accompanying them could have picked off the gunners.

But the effect of this battlefield incident has been unduly magnified. On the right the 12th, 20th and 6th Divs. secured their objectives rapidly, though the 12th had severe fighting at Lateau Wood. The 29th Div. passed through and captured Masnières and Marcoing, securing the passage of the canal at both and even the bridge intact at the latter. On the left the 51st and 62nd Divs. made a brilliant advance, advancing by nightfall as far as Anneux, over 2 m. in rear of Flesquières. The Flesquières resistance was thus only an islet, cut off and overlapped by the waves which swept round its flanks and on to Marcoing, Anneux and even to the edge of Bourlon Wood. A penetration of 5 m. had been made—the equivalent of months of heavy fighting and heavier losses on the Somme and at the third battle at Ypres. Decisive success was within the grasp of the British forces, the enemy's main defence systems had been overrun, only a half-finished line and the open country lay beyond. But the original divisions and the tank crews were exhausted, and apart from one squadron of the Canadian Fort Garry Horse the two cavalry divisions could contribute nothing toward fulfilling their rôle of exploitation.

On Nov. 21 local reserves made some further progress. The village of Flesquières fell at 8 A.M., and the 51st and 62nd Divs. pressed rapidly on, clearing the German salient formed by this resistance on the first day and carrying the tide of the British advance as far as Fontaine-Notre-Dame, 1½ m. beyond the high-water mark of Nov. 20. But on the right, little ground was gained—a relieving German division had arrived just in time to occupy the rear defence. The High Command's time-limit of 48 hours had expired, but owing to the menace of the uncaptured Bourlon Hill, to the new British position, as well as to the hope of an enemy withdrawal and the desire to relieve the enemy pressure on Italy, the commander-in-chief decided to continue the offensive, placing a few fresh divisions at the disposal of the III. Army. But the Tank Corps, the essential cause of the early success, was tired out, men and machines—all had been staked on the first throw. The fresh attacks met with more failure than success against an enemy now braced to meet the danger.

The German Counter-Attack.—On Nov. 22 the Germans recaptured Fontaine-Notre-Dame; on the 23rd, the 40th Div. with tanks captured the whole of Bourlon Wood, but the attempts on Bourlon village and Fontaine-Notre-Dame failed. Bitter and fluctuating fighting followed; Bourlon and Fontaine-Notre-Dame were won and lost again, and meanwhile there were signs of a strong German counter-thrust. In the early morning of Nov. 30 the blow fell, the German Army commander, von der Marwitz, making a convergent attack against the northern and southern flanks of the salient which the British advance had created. In the north, round Bourlon Wood, the attack was stopped after bitter fighting, but in the south, where the blow fell on the joint of the salient and also on the weakly held front to the south, it broke right through. This was a finely planned surprise assault, unheralded by any preliminary bombardment, and made more effective by the cloud of gas and smoke shells. Villers Guislain and Gonnelieu soon fell and the thrust penetrated deeply behind the old British front line as far as Gouzeaucourt, overrunning gun positions and headquarters. Disaster was only averted by the superb counter-attack of the Guards Div., which recaptured Gouzeaucourt, and later of the 2nd Tank Bde., which brought out the value of this arm for defence.

Fresh attacks on Bourlon and Masnières failed, but further German progress was made towards Villers Plouich. The British position in the Masnières-Bourlon salient was thus rendered so precarious that on the night of Dec. 4–5 most of the salient was evacuated and the line drawn back roughly to the Flesquières ridge. Although the result left the British with a slight gain of ground on balance, and better still had a helpful influence on the Italian campaign, Cambrai would be remembered mainly as a tragedy of mistaken aims and lost opportunities, were it not for its revelation of a new key to victory, turned to effect in 1918.

BIBLIOGRAPHY.—Lt.-Col. C. H. Rowcroft, *The 9th Hodson's Horse at Cambrai, 1917* (1917); Maj.-Gen. T. T. Pitman, *The Part Played by the British Cavalry in the Surprise Attack on Cambrai, 1917* (1923); Col. W. H. F. Weber, *A Field Artillery Group in Battle* (1923).

(B. H. L. H.)

CAMBRIDGE, England (*see* 5.90).—The architectural amenities of the town, as distinct from the university, were increased by the erection of the County Hall in Hobson street (1913), a Wesleyan church at the corner of King street and Short street (1913), and a handsome gate-house to the Leys School (1914). An institute of agricultural botany on the Huntingdon road was inaugurated in 1922.

The University.—In spite of the incidence of the World War, the period 1910 to 1925 must rank as one of great activity in the university. On constitutional proposals of more than ordinary moment, such as those of conferring greater legislative power on resident university and college teachers with the partial disfranchisement of the senate and the electoral roll (1910 and 1920), or the admission of women to degrees, but not to full membership of the body academic (1923), the university maintained a conservative attitude, but in matters secondary only to these in importance it followed a policy of continuous reform.

The courses of study for honours, and more especially for pass men, underwent considerable revision. After prolonged deliberations, Greek, as a compulsory subject, was dropped from, and other noteworthy changes were effected in, the previous examination (1919); the regulations governing the pass degree were entirely remodelled (1920); several of the honours examinations, notably the classical tripos and the oriental languages tripos, were reconstituted with a division into two parts, the first of which does not normally carry the B.A. degree with it. New triposes were established in anthropology (1913) and geography (1919), while the medieval and modern languages tripos, greatly enlarged in scope, was split into the modern and medieval languages tripos and the English tripos (1917). The university further recognised the value of graduate studies by establishing the degrees of Ph.D. (1919) and of M.Litt. and M.Sc. (1920). A series of enactments (1912–4) made several changes in the mode of procedure to the degree of D.D. and threw it open to others than those in Holy Orders of the Church of England.

The increasing diversity of studies resulted also in the establishment of new professorships, readerships, and boards of studies: professorships of English literature (1910), genetics (1912), Italian (1919), naval history (1919), French (1919), physics (1919), aeronautical engineering (1919), physical chemistry (1920), biochemistry (1921), and animal pathology (1923); readerships in Spanish, modern history, geography, agriculture, agricultural physiology, physiology, morphology of vertebrates, petrology, pharmacology, electrical engineering, geodesy, biochemistry, preventive medicine and experimental psychology.

Aids to learning and research of a more material nature were provided by the erection and augmentation of numerous institutes. The engineering laboratory on the north side of Downing street was twice enlarged and finally removed to a completely new site behind Scroope terrace, Trumpington road (1920–1). Part of the buildings thereby vacated, as well as new buildings erected close to them, were taken over by the neighbouring chemical laboratories. On the south side of Downing street sites were found for the School of Agriculture (1910), the Museum of Archaeology and Ethnology (1910–5), the Psychological Laboratory (1913), the Physiological Laboratory (1914), the Forestry School (1914), the Molteno Institute of Animal Parasitology (1921), a low temperature station for research in biochemistry and biophysics (1922), and the Sir William Dunn School of Biochemistry (1924). The Arts School, off Benet street, a fine brick building faced with stone, designed by G. Hubbard, which contains a number of lecture-rooms and also houses several departmental libraries, was opened in 1911. In that year the university accepted the Government's proposal to take charge of the Solar Physics Observatory, then at South Kensington, and the necessary accommodation, in close proximity to the existing observatory on the Madingley road, was completed in 1913. Field laboratories in connection with the agricultural and other departments on the Milton road came into use in 1910–1.

Emmanuel, Queens', Sidney Sussex, and Clare colleges added to their fabric and the chapels of Sidney Sussex and Corpus Christi colleges were enlarged and redecorated. Wesley House, a postgraduate theological college for the training of accepted candidates for the ministry of the Wesleyan Methodist Church, was opened in 1925; and Cheshunt College, a theological seminary which was removed from Cheshunt to Cambridge in 1905, found permanent quarters at the end of Bateman street (1915).

Effects of the War.—The immediate effect of the World War on Cambridge University, 16,000 alumni of which were engaged on active service, was to reduce enormously the numbers of teachers and students. The place of those who had gone was, spatially, taken by cadet battalions and officers attending staff courses. The absorption of many university teachers by government departments and the first-hand acquaintance with academic training gained by a still larger number of servants of the Crown greatly advanced the co-operation between university and state, which had already begun practically with government grants to the schools of agriculture and forestry and to the departments concerned with instruction of medical students (1914).

The cessation of hostilities did not effect any weakening of this tie; the Admiralty, the Air Ministry, and the War Office organised temporary and permanent training schemes in Cambridge for officers. When the university, confronted with a serious decline in the value of money and an abnormal increase in the number of students, was left with the unpleasant alternatives of a serious financial deficit, or an equally serious diminution of its educational efficacy, the Govt. accorded it, in 1919, a temporary annual grant of £30,000, which was raised to one of £85,000 in 1925. At the same time, it appointed a royal commission, which reported in 1922, and whose recommendations a statutory commission was, in 1925, still engaged in putting into practice. The two principal aims are the creation of a Regent House of resident instructors and other officers of the university and colleges, with powers almost as great as those of the present senate; and the concentration of all formal teaching in the university, which will exercise this function through newly erected faculties and derive the necessary funds from increased taxation of the colleges and permanent government grants.

(B. W. D.)

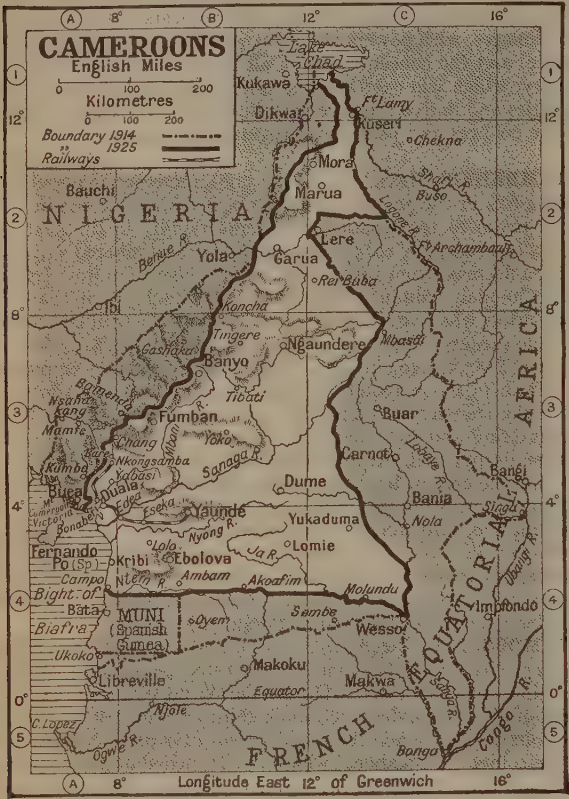
CAMBRIDGE, Mass., U.S.A. (*see* 5.96), increased in population only 4·6% in the 10 years after 1910, reaching 109,694 in 1920 (91·6 males to 100 females); but more rapidly in the next five years, to 120,053 in 1925. The foreign-born numbered 33,296 in 1920, a decrease from 1910; about half of them were from Ireland and Canada. Manufactures increased much more than the population, whether measured by value of products or by number of wage-earners. The value was $44,227,000 in 1909; $127,865,000 in 1919; $185,524,463 in 1923. The number of factory employees rose from 15,260 in 1909 to 22,500 in 1919 and to 25,674 in 1923. With the transfer of the packing industry to the Middle West, slaughtering and meat-packing, formerly the leading industry, almost disappeared. At the top of the list in 1919 were confectionery and ice cream, bread and other bakery products, electrical machinery, printing and publishing (book and job), foundry and machine-shop products. A city-planning board was created by ordinance in 1913. In 1915 the Massachusetts Institute of Technology moved from the site in Boston, which it had occupied for 50 years, to a tract of 50 ac. on the Cambridge side of the Charles river. (*See* HARVARD UNIVERSITY.)

CAMDEN, N.J., U.S.A. (*see* 5.101), had 323 industrial plants in 1925, with a varied output including steel pens, soups, talking-machines and battleships. During the World War the New York Shipbuilding Corp. delivered more ships than any other yard in the country, and made the world's record for rapid construction in the collier "Tuckahoe," which was launched on the 27th day after work was begun on the laying of her keel. The population in 1920 was 116,309, of whom 8,500 were negroes and 20,354 foreign-born; in 1925 it was 128,642, according to the official estimate. The value of the factory output was $49,138,000 in 1909; $218,165,000 in 1919; $180,766,319 in 1923. Enrolment in the public schools increased during the 10 years 1914–24 nearly twice as fast as the population.

Camden's water supply comes from 136 artesian wells. Trolley and 'bus service are co-ordinated in a unified system. The commission form of government was adopted in 1923. In 1925 the Hotel Walt Whitman, a community enterprise, was opened, a large convention hall was under construction, a civic centre was being developed as part of a comprehensive city plan, the first municipal pier had been built, a movement was under way to make Camden a world airport and a new bridge across the Delaware to Philadelphia, the longest, broadest, highest and heaviest suspension bridge in the world, was nearing completion. Walt Whitman's grave is in Harley Cemetery and his home in Mickle street is kept as it was during the last years of his life.

CAMERON, JAMES DONALD (1833–1918), American politician (*see* 5.109), died at his country home, Lancaster county, Pa., Aug. 30 1918.

CAMEROONS (*see* 5.110).—In 1911 some 107,000 sq. m. of French Equatorial Africa were added to the German colony of Cameroon or Kamerun, as it was called, as compensation for the recognition by Germany of a French protectorate in Morocco. In 1914–6 Cameroon was conquered by French and British native troops, and by the Treaty of Versailles, Germany renounced all her rights over it. The country had been provisionally divided into French and British spheres, and in May 1919 the Supreme Council gave the mandate to administer it to France and Great Britain. It was unequally divided, France obtaining five-sixths of the country. The terms of the mandate were not approved by the Council of the League of Nations until July 20 1922. Delay had been caused by negotiations between the mandatory powers and the United States; these negotiations ended in U.S. citizens being given equal economic rights in the Cameroons with nationals of the members of the League. The area added to the Cameroons in 1911 was not included in the mandated territory, but was in 1919 restored to French Equatorial Africa.


CAMEROONS
English Miles
0 100 200
Kilometres
0 100 200
Boundary 1914
" 1925
Railways
A
B
C
8°
12°
16°
1
2
3
4
5
12°
8°
4°
0°
Lake Chad
Kukawa
Dikwa
Ft Lamy
Kuseri
Chekna
Mora
Marua
Shari R.
Buso
Logone R.
Bauchi
NIGERIA
Lere
Ft Archambault
Benue R.
Yola
Garua
Rei Buba
Ibi
Koncha
Tingere
Ngaundere
Mbasai
Gashaka
Banyo
Bamenda
Nsanakang
Tibati
Fumban
Mamfe
Chang
Yoko
Mbam R.
Bare
Nkongsamba
Sanaga R.
Kumba
Yabasi
Buea
Duala
Mt Cameroon
Victoria
Bonaberi
Edea
Eseka
Yaunde
Dume
Buar
Carnot
Lobaye R.
Bangi
Bania
Singa
Nola
Yukaduma
Nyong R.
Lolo
Lomie
Ja R.
Fernando Po (Sp.)
Kribi
Ebolova
Ntem R.
Ambam
Campo
Akoafim
Molundu
Bight of Biafra
Bata
MUNI (Spanish Guinea)
Oyem
Sembe
Wesso
Impfondo
Ubangi R.
Ukoko
Makoku
Libreville
Makwa
Equator
Sanga R.
Njole
C. Lopez
Ogwe R.
FRENCH EQUATORIAL AFRICA
Bonga
Congo R.
Longitude East 12° of Greenwich

The British sphere is a long strip of territory adjoining Nigeria with an area of about 31,000 sq. m. and a population (1924) of 660,024 natives and Arabs and 77 Europeans. The British sphere includes in the north the emirate of Dikwa (Dikoa), formerly German Bornu, and in the south Mt. Cameroon, the hill town of Buea and Port Victoria. This portion is known as Cameroon province. The whole sphere is administered as part of Nigeria, Dikwa possessing a large degree of autonomy.

The cocoa, rubber and banana plantations established in the Victoria district by the Germans (with 48,000 ac. under cultivation) were in Nov. 1924 sold by auction in London, realising £224,670. There are considerable forest areas in which are mahogany, ebony and other valuable timbers. The chief exports are cocoa and palm kernels; two-thirds of the imports are cotton piece-goods. Deficits in the public finances are made good by the Nigerian treasury. Slave-raiding, reduced latterly to kidnapping, and slave-trading had been almost stamped out by 1925. Progress was made in hygienic conditions and education.

The French sphere has an area of some 160,000 sq. m. and a population estimated (1924) at 1,500,000. It includes Duala and Kribi, the chief ports of the Cameroons, and is administered as a separate entity by a commissioner aided by a council. In 1921 the French transferred the capital from Duala to Yaunde, a town occupying a comparatively healthy position on the central plateau 110 m. south-southeast of Duala, with which it was connected by railway. The chief exports are palm kernels and palm oil, cocoa, rubber, timber and cattle. Lack of adequate means of transport hindered the economic development of the country. A small military force (under 2,000) was maintained.

See I. von Puttkamer, *Gouverneursjahre in Kamerun* (1912); *Reports on the British Sphere of the Cameroons* (1922) and subsequent Annual Reports issued by the Colonial Office, London; also the Annual Reports on the French Sphere published by the French Govt. and by the League of Nations. (F. R. C.)

CAMEROONS, OPERATIONS IN.—The German forces in the Protectorate at the outbreak of the World War were commanded by Col. Zimmerman, an able and resolute soldier, and consisted of approximately 200 Europeans and 1,550 natives in the military force and 40 Europeans and 1,255 natives in the police force. Some hundreds of settlers were available, as were a number of sailors from ships which made for the Cameroons estuary when war was declared. Considerable numbers of natives were trained as *askaris* during the campaign, and to some extent local levies co-operated, though the natives generally were hostile to their German masters. These forces were scattered, the main portion of them being about Duala, the chief port.

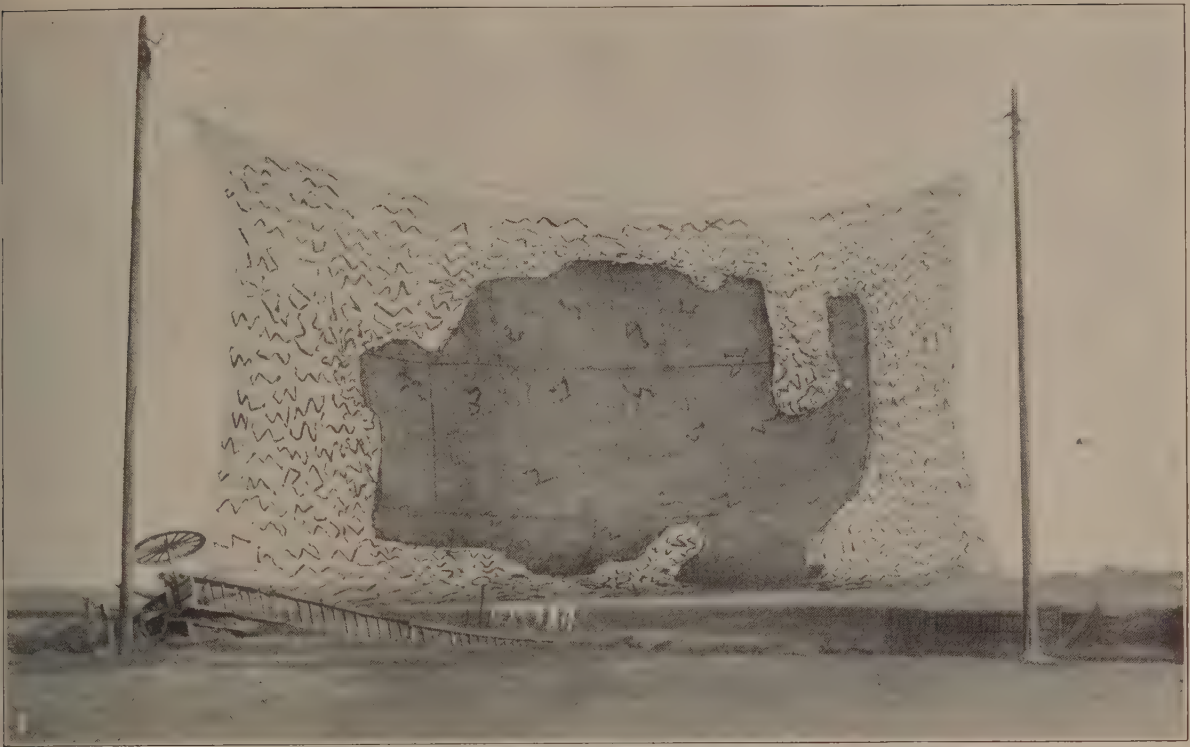
The offensive was initiated by the Allies. Bonga and Singa, the most advanced enemy posts in the two salients, were captured by the French on Aug. 6 and 7 1914, a German offensive being thus forestalled by Gen. Aymerich, the French commander-in-chief. Two French columns were then dispatched. The one (Hutin) north along the Sanga, with Lomie as its objective, the other (Morrison) moving west on Dume from Singa along the Lobaye. These enemy posts were in the centre of the Cameroons. On Sept. 21 Gen Largeau in the north occupied Kuseri in the Lake Chad region.

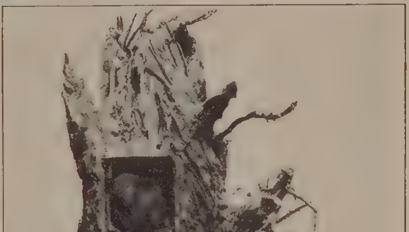
British Movements.—Meanwhile British forces had moved from Nigeria, and a column under Capt. Fox crossed the frontier on Aug. 25, and unsuccessfully attacked Mora, a hill post in the north held by Capt. von Raben. A French column (Brisset), sent to co-operate with Fox, occupied Marua south of Mora on Dec. 12, with the result that the Lake Chad region was cleared of the enemy, except the garrison of Mora, which gallantly held out through all the campaign, surrendering upon terms at its conclusion. Unsuccessful attempts to storm the place were made between Aug. 23 and Sept. 15 1915.

Two other British columns invaded the Cameroons on Aug. 25. One (Lt.-Col. Maclear) moved from Yola on Garua, was heavily defeated and retired to Yola, its commander having been killed; the other entered the Cameroons at the southern end of the northwest border, and, surprised by the enemy from Duala, sustained a severe reverse with 168 casualties. The troops employed were Nigerian natives under British officers.

Anglo-French Offensive.—About the middle of Sept. an Anglo-French expeditionary force, 4,300 strong, formed in equal proportions from British and French negro troops, and under the British commander-in-chief, Maj.-Gen. Sir C. M. Dobell, embarked at different ports, and, forcing the barrier at Duala, bombarded that port on Sept. 26. On the surrender of the port on the following day 400 Germans and 30,915 tons of shipping were captured. Col. Zimmerman withdrew to Edea, 40 m. to the southeast. Three columns were at once directed in pursuit of the enemy at Edea which, after continuous opposition, was occupied on Oct. 26. A French garrison under Col. Mayer was installed at Edea, the German commander-in-chief having retired to Yaunde, 100 m. east, on a plateau beyond the forest belt.

Mayer, owing to the weakness of his force, being condemned to passive defence, the British forces proceeded to clear the country between the Cameroons estuary and Nigeria. By the end of 1914 the whole of the northern railway and Buea, the enemy administrative capital, had been occupied. On Jan. 5 1915 Mayer beat off an attack on Edea with heavy loss to the attackers. Elsewhere the Allied offensive had almost ceased.





DEVICES USED IN MILITARY CAMOUFLAGE

FIG. 1. Field Gun cover, of fish netting, with painted "scrim" centre, and strips of painted canvas. Such a cover is erected horizontally over a gun. FIG. 2. Imitation tree as observation post. The original tree can be seen on the left. FIG. 3. Imitation tree, as in Fig. 2, with side cut away to show position of observer.

(*Fig. 3. Crown copyright.*)

Hutin's column alone had made some progress, and he had been joined by a small Belgian contingent. Reorganisation was effected and Brig.-Gen. Cunliffe was appointed to command the Allied troops in the north, where the enemy was taking the offensive. Reinforcements reached Gen. Dobell at Duala in February.

A concentric advance upon Yaunde was decided upon, but was begun prematurely, largely in consequence of the usual difficulties which beset allies who endeavour to co-operate for the first time. On April 7 a British column under Col. Haywood moved east and Mayer left Edea on May 1. On May 3 Haywood, moving north of Mayer, captured Wum Biagas after 18 hours' fighting. The two columns then joined forces under the command of Col. Mayer. On May 25 Mayer resumed the advance, but was strongly opposed in the dense bush. When Yaunde was still 40 m. distant, dysentery became rife and withdrawal began, and on June 28 Mayer was back in the Edea district. In April Gen. Cunliffe in the north invested Garua, held by Capt. von Crailsheim, a daring and skilful soldier. Cunliffe captured Garua on June 10, and on June 28 occupied Ngaundere, some 300 m. northeast of Yaunde. Here, simultaneously with the return of Mayer to Edea, a halt was called. Hutin occupied Lomie—150 m. south-southeast of Yaunde—on June 25 and Morrison took Dume a month later.

The general Allied offensive was resumed, and by early Oct. Gen. Dobell was moving in from the west, Cunliffe from the north and Hutin and Morrison from the east. The maximum Allied strength, about 15,000, was now disposed against the enemy, whose forces were estimated at 10,000 (inclusive of 700 Europeans). The opposition was, as before, vigourous and protracted. On Oct. 9 the British re-took Wum Biagas, and on Oct. 30 the French occupied Eseka, the railhead.

The British force emerged first from the forest belt and on Dec. 17 were at Mangås in open country and about 50 m. west of Yaunde. On Dec. 21 the French column, which had had severe fighting and many casualties, reached Mangele's 20 m. southeast of Mangås. The British troops were instructed not to await Mayer's arrival at Mangele's, and accordingly pushed straight on for Yaunde, which Col. Gorges entered unopposed on Jan. 1 1916.

Conclusion of the Campaign.—From Dec. 22 opposition by the enemy had ceased. Col. Zimmerman, as soon as he knew that the Allied columns were clear of the forest, and that Cunliffe and Aymerich were approaching, decided to give up the contest. He evacuated Yaunde and, together with the governor and 823 Germans, including civilians and his troops and carriers, headed southwest for Spanish Guinea, of which the nearest point was 125 m. distant. He was pursued, and fought a rear-guard action on Jan. 8.

The next force to reach Yaunde was Brisset's column, followed by Aymerich's troops. Cunliffe's forces had had very stubborn fighting during the closing phase of the campaign, the most difficult operation being the capture (Nov. 4–5) of Banyo, a hill fortress some 200 m. north of Yaunde and on the edge of that corner of the Cameroons, the region towards the Cross river, where German resistance was continued to the last. In this quarter the enemy continued vigourously to dispute Cunliffe's advance, and when, on Jan. 1, Yaunde had fallen, the latter's advance troops were still 40 m. distant from that objective.

Col. Zimmerman eluded the columns which had been sent to the borders of Spanish Guinea and were waiting to bar his entry into neutral territory. The first part of his forces, quickly followed by the rest, entered Spanish territory on Feb. 4 and with the surrender of the gallant garrison at Mora on Feb. 18, the conquest of the Cameroons was complete.

See E. Dane, *British Campaigns in Africa* (1919); H. C. O'Neill, *The War in Africa* (1919); Maj.-Gen. Sir C. Dobell, *The Campaign in the Cameroons, 1914–6* (1922). (J. J. C.)

CAMOUFLAGE.—The word camouflage, in the broad sense of military deception, is applicable to all stratagems designed to mislead the enemy. In the following account it is used in the restricted sense of deception practised by artists.

I. MILITARY CAMOUFLAGE

The application to war of camouflage, as thus defined, is by no means novel; dummy guns have been successfully employed to mislead an opponent on occasion ever since guns became a normal part of military equipment. Many historical instances could be brought forward in which camouflage was practised by individuals as an expedient. But it was not till the World War that it was practised by armies as a policy.

A transitional stage between the spasmodic use of camouflage in emergencies and its regular and systematic use is marked by the painting, or other treatment, of coast defence forts to blend with their surroundings, in order to render them less conspicuous from the sea. The well-known chequered black-and-white of the Spithead forts was an attempt to mislead the enemy as to the exact location of the gun embrasures. The same artifice was used in the case of the loopholes of blockhouses in the South African War of 1899–1902.

A further stage was reached in the adoption of uniforms coloured to blend with the usual or typical colours of the countryside in a theatre of war. The first of these was the Indian khaki (*see* 15.770), and after the experience gained in the South African War, when the importance of concealment came into great prominence, the British and most other armies adopted dust-coloured, light-blue, grey or grey-green uniforms.

Hitherto deception in war had been limited to the comparatively simple task of deceiving the human eye, at a considerable distance and for a short time. In the World War its rôle was extended to circumventing the camera in addition to deceiving for long periods the eyes of observers armed with powerful glasses, and for the first time in history a military unit was organised for the definite purpose of practising scientific deception.

This policy was initiated by certain French artists serving in a French battery toward the end of 1914. The interest of a French commander was aroused and his sympathy enlisted, with the result that a "section de camouflage" was formed early in 1915, for the purpose of assisting units in the concealment of battery positions and other military works, and the construction of concealed posts of observation. The success attained by this section led to the organisation of the British camouflage service, as a unit of Royal Engineers, early in 1916.

Principles and practice may be dealt with under three heads: (1) the concealment of gun positions and the like from the enemy's aeroplanes; (2) the concealment of observation posts and machine-gun emplacements from direct view; and (3) miscellaneous applications of camouflage.

PROTECTION AGAINST AIR OBSERVATION

The purpose of camouflage is to render objects indistinguishable or unrecognisable by means of imitation or disguise. Concealment in the limited sense of "hiding from view" is not the primary aim. The ideal is non-interference with the natural or normal aspect of the locality as viewed from the air, with which the enemy has become familiar through the agency of visual observation and photography, the latter being the more accurate. A photograph will always record something. The art of camouflage lies in conveying a misleading impression as to what that something signifies. The photograph records colours and accidents of ground (such as bare earth, vegetation, woods, etc.) in terms of light and shade, forming a patchwork or pattern of black and white meeting in varying intensities of grey. A cultivated district presents a regular chess-board pattern, with large rectangular expanses of monotone, the only accidents to break the monotony being large hedges, banks or houses with their attendant shadows. Broken ground, such as demolished villages, shelled areas or patchy vegetation, presents a highly complex pattern, full of merging lights and shades.

Photographically, the effect of colour is not so marked or important as the effect of light and shade. Earth is toward the white end of the scale and grass or vegetation toward the black—not because of their respective colours but on account of the amount of contained shadow or "texture." Contrasts in tone are much accentuated on snow and the effects of shadows are more marked. Consequently it is essential, when judging the colours of a locality, to view it vertically and not obliquely as one is accustomed to see a flower bed.

Therefore the most practical method of planning the concealment of any work is to plan it with reference to a recent photograph which records the ground pattern, and the natural facilities for concealment which exist in the locality. Such facilities abound in a neighbourhood whose photographic pattern is complex. Any slight error in exact reproduction may escape notice in the prevailing complexity, because detection depends on comparison, and comparison is rendered difficult by the very intricacy of the pattern.

There are certain characteristic clues which betray new work to the reader of aerial photographs. They are disturbance of soil; tracks; shadows; regularity; blast marks of guns. To achieve success these clues must be suppressed from the very beginning; conversely, if deception is to be achieved by the use of dummies, these clues must be supplied.

Shadows.—The form of any erection, or excavation, is revealed in a photograph by the shape of the shadow cast. Two intersecting planes, *e.g.*, the two sides of the roof of a building, will show differently on the photograph (except for a very brief period every day) because they receive light at different angles, and therefore reflect it differently. It follows that an artificial reproduction of locality must be erected parallel to the contours of that locality, or in other words the planes of the imitation and the real must not intersect. A mound must be imitated by a mound, and a flat surface by a flat surface. Any departure from this principle is most easily detected in a photograph taken when the sun is low, the shadows being long in consequence.

Regularity.—No shape in nature is of regular outline; consequently anything of a regular shape in a photograph invites scrutiny because it must be the work of human hands. In a battery position, regularity is usually displayed in the geometric shape of the gun-pit and the regular spacing and alignment of the guns.

Summary.—To sum up the theoretical conditions which govern the concealment of gun positions, and other works, from the enemy in the air, the material of which the camouflage is composed must at all times appear on the photograph like the object or surface it represents, and likewise appear natural to the observer's eye. As to material, it must be light, strong, impervious to weather, fireproof and easily manufactured. Disturbances of soil, tracks, shadows, blast-marks and regularity must never seem associated with an active gun position or occupied work.

Natural materials such as branches, grass, etc., are of little use for camouflage purposes if protection from view is required for more than two or three days, for, when withered, they become very conspicuous. The most satisfactory cover is afforded by some form of net having an opaque centre of a boldly irregular shape, with a border becoming decreasingly opaque towards the edges. Such a cover is illustrated in fig. 1 (plate). The centre should be only so opaque as to prevent the object underneath (gun or excavation, as the case may be) being visible from the air and the border opaque enough to mask the shadow of the object without casting a shadow itself. Such a cover is erected at a suitable height above the object to be concealed, and parallel with the contour of the ground. It follows that the higher the erection the greater must be the area required to cover object and shadows. Evidence afforded by tracks is perhaps the most difficult of all to eliminate. Positions which are admirably concealed in every other way, are betrayed by the tracks leading up to them, so much so, that it is often possible to count the number of guns in a battery by the paths leading to each gun-pit and to distinguish between gun positions and other works.

The following afford good illustrations of methods of concealing approaches to positions in the open: (*a*) Leading the track close past the gun position and on to join an existing track, the connection to each pit being treated with camouflage material or cut grass, etc. (*b*) Similarly, but close in front of the gun-pits in order to use the track to hide blast marks. This method has the disadvantage of restricting traffic while the guns are in action. (*c*) Siting a battery in the midst of an existing network of tracks, taking precautions to reproduce on the camouflage any path interrupted by a gun-pit. It is not practicable to conceal long trenches. If a covering sags or differs materially in tone from its surroundings the mere length and regularity will betray it.

Material and Production.—The principal desiderata in camouflage material are durability and portability. It is almost inevitable that production must be standardised in the case of operations on a large scale. It is possible to deal individually only with a few special positions and the exterior of observation posts and the like. Square, woven, weather-proofed fish netting provides the most portable foundation. For a field gun 30 ft. x 30 ft. is sufficiently large as larger sizes than this become unwieldy and difficult to erect. Wire netting is more durable and therefore best suited for large works. Small rolls—30 ft. x 6 ft.—are a convenient size. Open meshed canvas (scrim) is very suitable material for use on the ground and in conjunction with wire or fish netting. Fireproofing should be adopted if possible.

For colouration, sunproof dyes are the ideal medium, failing this, water paints. Oil paints are a source of danger owing to their tendency to cause spontaneous combustion in stacked material. In order to achieve standardisation it will probably be necessary to adopt four appropriate colourations, viz., all vegetation, all earth, and two mixtures of vegetation and earth.

PROTECTION AGAINST DIRECT OBSERVATION

The concealment of observation posts, machine gun nests, etc., is comparatively simple, being merely an adaptation of the craft of theatrical property-making. Natural features may be selected, in places from which good observation can be obtained, and these must be copied exactly. At night, the real is removed and replaced by the imitation, *e.g.*, trees, sand-bags, mile-stones, mounds of earth, chimney-stacks, walls. The copy is a thin outer shell containing a bullet-proof lining in order to give confidence to the occupier. The loopholes, when subject to scrutiny at short range, can be made quite invisible by the use of gauze, which though painted to resemble the exterior of the O.P., remains transparent from the inside. This method should only be adopted when absolutely necessary, because gauze interferes with vision—especially through glasses; in other cases care must be taken to give the loophole an irregular shape.

The following conditions govern the successful employment of such observation posts, particularly in the case of the more elaborate examples such as trees.

1. Concealed access is essential.
2. The works connected with installation must, like other works, be concealed from the air.
3. They should not be erected in places that are normally subject to heavy shelling, for the reason that careful observation will be prejudiced and accidental damage will probably reveal the observation post to the enemy.
4. Provision must always be made to prevent daylight showing behind the loophole, thus rendering it transparent to the enemy.
5. The comfort and security of the observer must always be studied, otherwise the full value of the observation will never be obtained.

Imitation trees (figs. 2 and 3 on plate) can be designed either to accommodate an observer at a good height above the ground, or to conceal a long periscope, the user of which is protected in a strong dug-out. In the former case the observer has a better view, but is uncomfortably cramped. The periscope is limited in respect of magnification, field of view and clearness of vision, in proportion to its length (*see* PERISCOPE). On the other hand advantage may be taken of its length to obtain high command with comparative security, or increased security with low command. Further, with suitable mountings, it can be used as an instrument of precision in conjunction with map and compass. Provision should always be made to give bullet-proof protection to the periscope when in use, and to allow of its being lowered for cleaning and safety when not in use.

MISCELLANEOUS APPLICATION

The following are examples from the World War. In the dummy attack, series of painted silhouettes made of stout millboard

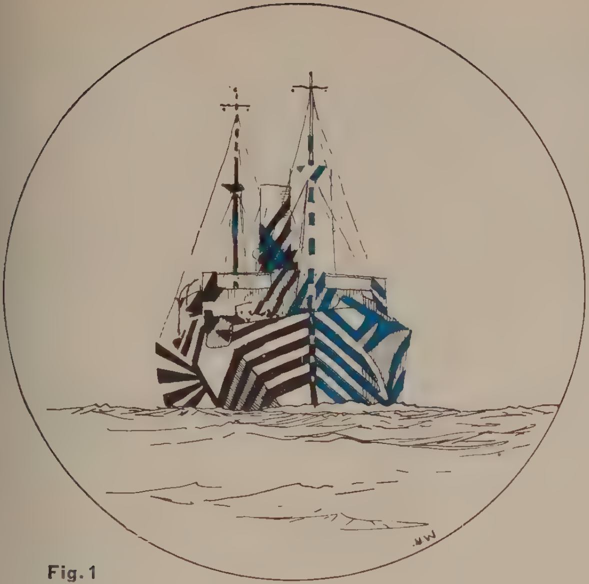


Fig. 1

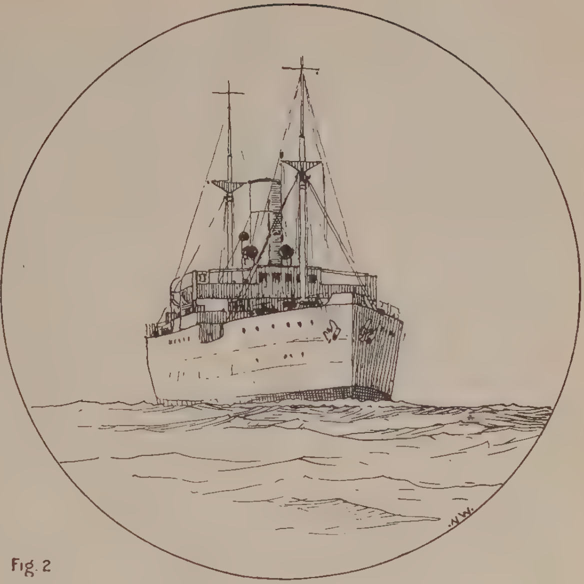


Fig. 2

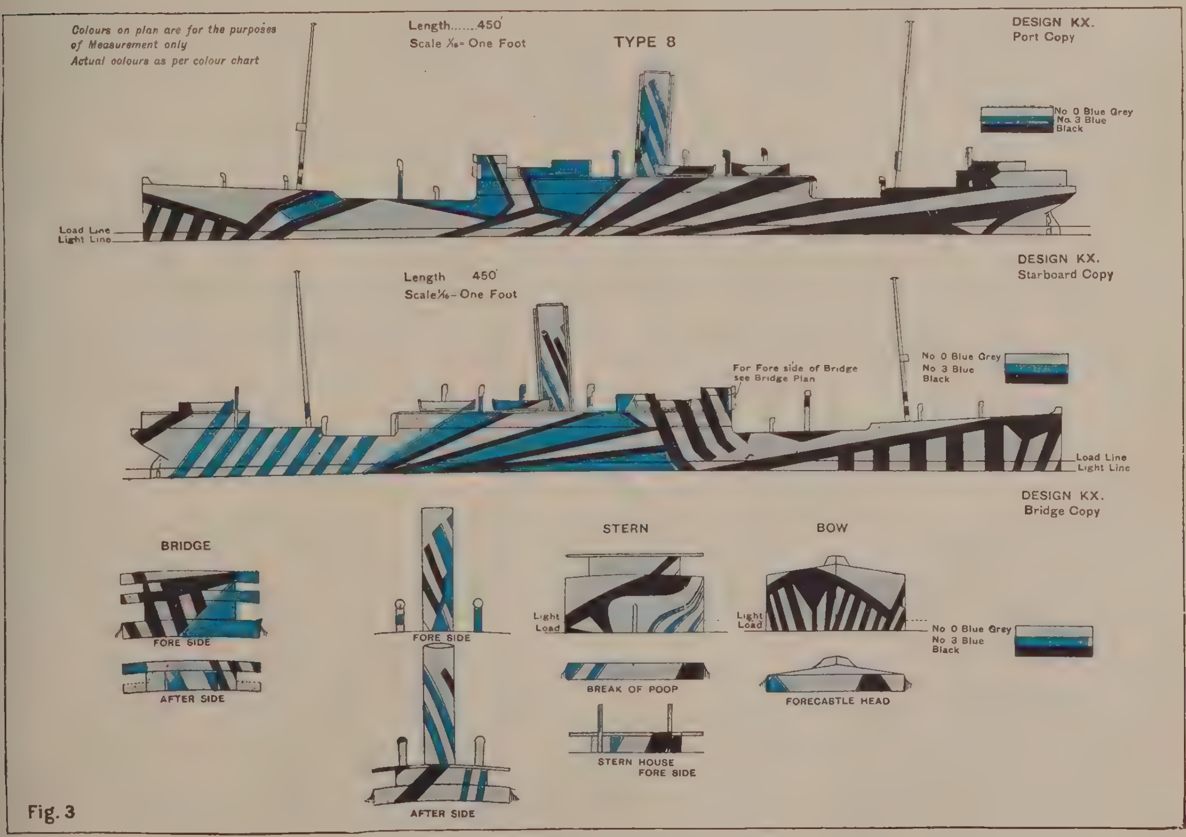

Colours on plan are for the purposes
of Measurement only
Actual colours as per colour chart
Length......450'
Scale ⅟₁₆ = One Foot
TYPE 8
DESIGN KX.
Port Copy
No 0 Blue Grey
No. 3 Blue
Black
Load Line
Light Line
DESIGN KX.
Starboard Copy
Length 450'
Scale ⅟₁₆ - One Foot
For Fore side of Bridge see Bridge Plan
No 0 Blue Grey
No 3 Blue
Black
Load Line
Light Line
DESIGN KX.
Bridge Copy
BRIDGE
FORE SIDE
AFTER SIDE
FORE SIDE
AFTER SIDE
STERN
Light
Load
BREAK OF POOP
STERN HOUSE
FORE SIDE
BOW
Light
Load
FORECASTLE HEAD
No 0 Blue Grey
No 3 Blue
Black

Fig. 3

DAZZLE PAINTING

FIG. 1. A dazzle-painted merchant vessel, as seen through a periscope. FIG. 2. The same vessel painted gray. FIG. 3. Typical plan as issued to painting contractors under the Dazzle Scheme (1-5th scale of original).

representing the various postures of advancing troops, were mounted in frames, which could be raised or lowered from places of safety, so as to represent the waves of an attack. This was to draw fire off a real attack. Dummy heads made of papier mâché were used for location of enemy snipers, the exact position of whom could be gauged by producing the alignment of the holes of exit and entry of the sniper's bullet. Sniper costumes painted and garnished with local material enabled a skilful wearer to attain close proximity to the enemy without detection.

The screening of roads from observation by the enemy is not in the province of camouflage, in that no deception is attempted. It is unnecessary to erect a screen which is completely opaque in order effectively to conceal traffic on a road. A screen consisting of wire netting with two-thirds of the surface covered with interlaced strips of canvas is sufficient—especially if a chequered effect of black and white be adopted. (F. J. C. W.)

II. NAVAL CAMOUFLAGE

Camouflage on various lines, but with the invariable idea of reducing visibility, had been attempted in the British Navy for many years before the World War. None of these schemes had met with any success, and each in turn had been abandoned after furtive trials. The two factors which led to this abandonment were, first, the failure to realise that anything in the nature of invisibility at sea is impossible of attainment, and, secondly, the inability of the proposers of these schemes to provide definite instructions of a practical nature by which vessels could be painted with some degree of consistency.

The Board of Admiralty eventually adopted a partial form of camouflage by painting all vessels a light grey as opposed to the black hulls and light upper works previously in force. But even this simplest form of all protective measures was somewhat haphazard in application, since the individual vessels of a squadron varied considerably in colour, ranging from a light bluish grey to a dark slate according to the ideas of the commander.

It was not until 1917, during the height of the submarine peril, that a practical scheme having a definite end in view and formulated on scientific lines was put forward and officially adopted by the British authorities. This scheme embodied entirely new ideas on sea camouflage, and was rescued from the early decease which had attended all its predecessors by the fact that the proposer was able to supply designs to scale in large numbers, all bearing out a central idea. It was called for distinction's sake in official documents "dazzle painting."

Objects.—The sole object of dazzle painting was so to distort the normal appearance of a vessel that her actual course became a matter of doubt in the mind of a submarine officer, the estimation of a vessel's true course being the prime factor required to ensure a successful attack.

Application.—Dazzle painting was intended primarily for application to merchant ships. These vessels were in far greater need of protection than warships owing to their slow speed and vulnerability and also to the fact that the enemy were making a concerted attack on England's supplies of food and materials essential to the conduct of the World War. Warships as a rule possessed high speed and were moreover protected by destroyers, a type of vessel which, while being the most deadly opponent of the submarine, was comparatively immune from attack. A certain number of war vessels were, however, dazzle painted. These were chiefly ships engaged on convoy work, although a certain number detailed for special duties such as mine-laying and patrol service valued this special form of protection.

At first sight it would appear impossible to treat a vessel with paint in such a way that an experienced seaman could be deceived as to her actual course, but dazzle-painted ships proved that this could be done. Juxtaposition of violently contrasting colours, black and white predominating, combined in accordance with the laws of perspective, could make it extremely difficult to judge the accurate inclination of a vessel even at a short distance.

Colouration.—In the early stages of dazzle painting a large range of colours was employed to achieve the end in view. Experience showed that this could be attained by a much smaller number, and toward the end of the War the principal colours in use were black, white and blue, these being employed in varying intensity. A factor which led to the simplification of the colours used was the knowledge that the German naval authorities had introduced the use of colour screens in their submarine periscopes with a view to reducing the camouflaged ship to a silhouette, and so neutralising the effect of the colours used. These screens, however, had no effect whatever on a design depending solely on black, white and blue for its contrast. Shortly after its adoption by the Admiralty dazzle painting was ordered under the Defence of the Realm Act and the whole merchant service was ordered to be painted. Numbers of war vessels operating with merchant ships were also painted: these comprised chiefly convoy cruisers, sloops and destroyers. The 10th Cruiser Squadron, engaged in blockade duties, was also painted. These vessels were specially liable to attack, being at sea for long periods and constantly under slow speed or altogether stopped.

On the introduction of the scheme a considerable volume of maritime opinion was directed against it from lack of a proper grasp of its objects and because it appeared to render a vessel more conspicuous than was the case when painted grey. In point of fact, at the date of the submission of the scheme the proposer, who was on patrol duty in the Channel, had noted that all transports were painted a dead black from water-line to truck. The opposition, however, rapidly disappeared as soon as the objects of the scheme were thoroughly grasped and the rapidly increasing numbers enabled seamen to judge for themselves the difficulties of accurately estimating the exact courses of dazzle-painted ships met with at sea.

Extension of Use.—Soon after the establishment of the Dazzle Dept., inquiries were made by the Allied maritime governments as to the efficacy of this new form of defence against the submarine. The French Ministry of Marine attached three officers for training under the new scheme and shortly afterwards set up a similar department in Paris. The U.S. Navy Dept. asked that an officer might be sent to Washington; shortly after his arrival a dazzle department was formed to deal with U.S. shipping. The Belgian Govt. arranged for all their merchant vessels to be dealt with directly in the British department. Complete sets of plans were forwarded to Italy and Japan. All U.S. destroyers and other patrol vessels in European waters were painted from plans supplied from the British department.

The number of vessels saved by this device can never be definitely ascertained, as it cannot be known how many attacks were broken off by enemy submarines owing to wrong position having been taken up as a result of inaccurate estimation of the vessel's course due to the dazzle painting. But the rapid expansion to all Allied merchant shipping showed that the authorities were satisfied that it played a great part. Approximately 4,000 merchant ships were painted and upwards of 400 war vessels, engaged principally in convoy and patrol duties, were also painted. The total cost of painting amounted to some £2,500,000. (N. W.)

CANADA (*see* 5.142), a Dominion of the British Empire and a member of the League of Nations. Its area is 3,797,123 sq. m., including the water area, or 3,729,665 without it; its population (1921 census), 8,788,483.

I. POLITICAL HISTORY

The year 1911 saw the end of a long period of Liberal rule. During the previous half century Canada had been governed, with but slight interruption, by two Prime Ministers, Sir John A. Macdonald and Sir Wilfrid Laurier. Laurier had come into power in 1896 and held office until 1911. The chief issue in the election of that year was a proposed agreement for reciprocity in trade with the United States. In 1854 a treaty had been made under which Canada had enlarged her markets. It was to endure for at least 10 years, but when this period ended the United States, to the chagrin of Canada, abrogated the treaty, chiefly, it seems, because of the British sympathy with the South during the Civil War; but partly because Canada was said to be the chief gainer. From this time freer trade with the United States had been an object of desire to all political parties in Canada.

The Reciprocity Issue.—It seemed therefore that when, in 1911, Mr. Taft, the President of the United States, proposed, and public opinion in the United States supported, a renewal of reciprocity, Canada would agree. This was the opinion of Sir Wilfrid Laurier. Reciprocity was to have two aspects: free trade in a wide range of natural products and raw material and an identical tariff on certain manufactures, including automobiles, farming implements and cutlery. There was to be no formal treaty and either side might end the pact at any time. The opponents of reciprocity pressed the point that Canada might first be exploited under the more highly developed system in the United States and then find the door for freer trade suddenly closed upon her.

In Sept. 1911, though it was still two years before the end of its term, Parliament was dissolved. Railway interests urged against reciprocity that lines running east and west, built at great cost to the nation, would suffer by diverting western traffic southward to the United States; finance feared dominance by New York; national sentiment feared political absorption by the United States. It was urged especially that, as against Great Britain, the United States would have a privileged position in Canadian trade. Advocates of reciprocity denied all these results. Eastern Canada was alarmed while the West was for freer trade, and the result of the election was that the Conservatives, led by Mr. Robert L. Borden, carried 138 seats to 88 for the Liberals and Sir Wilfrid Laurier resigned.

Naval Defence.—The Govt. of Mr. (Sir) Robert Borden was destined to face the crisis of the World War. Canada had long been urged to share in naval defence, and with a frontage on both the Atlantic and the Pacific and the open coasts of the lower St. Lawrence, she was particularly vulnerable to attack by a hostile fleet. On the other hand, most of her population lived remote from the sea coast. The rapid increase of the German Navy had alarmed the whole British Empire. If Canada was to aid in naval defence, growing national sentiment favoured a Canadian Navy, built, if possible, in Canada, controlled by Canada, but available in emergency as auxiliary to the British fleet. Sir Wilfrid Laurier, always having in mind that his fellow French Canadians centred their political thought wholly in Canada and were opposed to adventures in parts of the world where her interests were not affected, had moved cautiously. In 1910 he had created a Naval Department. There was to be a Royal Canadian Navy which should fly the white ensign and the national flag of Canada. But before anything effective could be done he was driven from power.

In 1912 Sir Robert Borden visited England for a conference with the British authorities, who convinced him that, in view of Germany's preparations, there was an emergency in naval affairs which did not permit of awaiting the formation of a Canadian Navy. In consequence, in Dec. 1912, the Prime Minister submitted to Parliament a proposal to build three warships at a cost not exceeding £7,000,000, to be placed at the disposal of the King for naval defence. The plan of a Canadian Navy was not abandoned, but was postponed in view of urgency. The proposal was hotly debated. Even the mild naval policy of Sir Wilfrid Laurier had aroused a nationalist group in Quebec which scented imperialism. Its leader, Mr. Henri Bourassa, was as fiery as his grandfather, Joseph Papineau, had been in 1837, when his attacks on arbitrary official rule led to armed rebellion. Though formerly a Liberal, Bourassa had assailed Laurier's dominance in Quebec. But now his Conservative allies went farther in naval policy. The session of 1913 saw determined obstruction, which led to the adoption of the closure in debate, already found necessary in England. The House of Commons, by 101 votes to 68, supported the naval bill which, however, failed to pass in the Senate. Thus on the eve of the World War Canada was giving almost no aid in naval defence.

The World War.—On the outbreak of the War Canadian opinion was at once clear. To the measure of her strength she was ready, in an hour of deadly peril, to fight side by side with Britain in a great cause. It should be said that Canadian national opinion demurred to the widely received view that Canada went into the War blindly "to help England," as the phrase ran. The desire to stand by England was indeed dominant in the public mind, but conviction went deeper than this. Canada was looking, for herself, at the issues of the War, and, like England, was convinced of the German menace to freedom. When, for a breathless day or two, it seemed doubtful whether Britain would declare war, there were some in Canada who talked of Canada's entering it on her own account, an impossibility under the conventions of the Dominion Constitution. The point is worth mentioning because it emphasises the growth of a national consciousness which became more marked as the War went on. Before Parliament met on Aug. 18 mobilisation had begun. One of the first acts of Parliament was to make a gift of 1,000,000 bags of flour to Great Britain, a gift which required 200 trains, each of 30 cars, to take to the ports. By Oct. a volunteer Canadian Army of 30,000 men had reached England, and a second contingent of more than 20,000 were drilling. The War Minister, Sir Sam Hughes, said that 150,000 were then eager to go. In all, Canada enlisted during the War 595,441 men; of these about 52,000 were killed in action and something like 10,000 died from other causes.

The events of the War are too complex and were too prolonged to find here more than mention. At the beginning it was doubtful whether non-professional soldiers could receive, in a short time, training adequate to meet in the field the professional German Army. When it was first proposed to send to Europe volunteer forces from Canada, Lord Roberts supported the plan less, as he said, because such a force would be effective in the field than to give to the world an illustration of the unity of the British Empire. In fact, after a training of less than a year, the regiments from the Dominions were found equal to the best battalions of Germany. The initiative acquired by the need of self-reliance in a younger society fully compensated for the longer disciplinary training of European regiments. In the end the four divisions of the Canadian Army Corps were placed under the command of Lieut.-Gen. Sir Arthur Currie.

The Canadians fought in some of the hardest battles on the Western Front; in 1915, in April at the second battle of Ypres, and later in the further severe fighting in that region; in 1916, at St. Eloi, Sanctuary Wood and other points and in the prolonged battle of the Somme; in 1917, at the taking of Vimy Ridge and in the desperate struggle in mud and slime which ended in the taking by the Canadians of Passchendaele, on the Ypres salient; in 1918, in driving back the Germans after their success near Amiens in March until, early in Aug., the Canadians helped to break the German lines and, with heavy losses, pressed the Germans back, cutting through a part of the supposedly impregnable Hindenburg line in Sept. and finally, after the great battle of Arras, taking Cambrai on Oct. 9. When the Armistice came on Nov. 11 the Canadians were at Mons, whence the British had begun their great retreat in 1914.

Developments in Canada.—Meanwhile in Canada the War was the one dominant interest. The destruction by fire of the Parliament Buildings at Ottawa on Feb. 3 1916 disorganised for a time the machinery of government. New buildings were occupied in 1920. The term of five years of the Canadian Parliament expired at the end of 1916, but by consent of all parties it was prolonged for a year. By the end of 1916 a lull had come in voluntary enlistment and Sir Robert Borden proposed to enforce conscription. The Prime Minister urged that the pledge of support to the men facing death at the front required the drastic method of raising 100,000 new troops by compulsion. This developed an issue which has since played a large part in Canadian politics.

Canada is unique in having a population of French and of British origin, united in a single Federal state, with one of the provinces almost wholly French. French Canadians cling to the language, the religion, the laws and the traditions derived from the older France. Their impulses and instincts are not the same as those of the English-speaking Canadians; their ancestors became British subjects by conquest, without any root in the culture and outlook of the nation to which they were tied. But while they remain French, in the sense that they are devoted to the culture of France, during more than a century and a half they have had no political tie with France. Meanwhile France herself has changed; she has broken with her ancient faith and even persecuted its adherents and she has become a republic; while the French in Canada still cling to the Roman Catholic faith and to the principle of monarchy. The expectation that, with France and Britain allied, the French Canadian would feel doubly called to share in the War was not realised. Many French Canadians had the outlook, expressed by the President of the United States, that their homes were in America and that Europe must be left to settle its own disputes. While Sir Wilfrid Laurier himself gave strong support to the War, in Quebec, as in no other Canadian province, there were voices making another appeal. M. Bourassa, in his well-written newspaper *Le Devoir*, denounced alike German and British imperialism. None the less French Canadian volunteer regiments served in the War with the spirit of that military France from which their ancestors came.

Conscription.—By May 1917 the Govt. of Sir Robert Borden had adopted conscription. The Liberal leader's position was difficult. He was in ardent sympathy with the aims of the Allies. If, however, he should support conscription he would endanger his position among his own people of the Province of Quebec. In Jan. 1917 he issued an appeal to all Canadians to forget party differences in pursuit of victory in the War. As to conscription, he urged that, on so vital an issue, the example of Australia should be followed and a plebiscite taken. This attitude lost him many Liberal supporters outside of Quebec and his resolution in favour of a plebiscite was defeated in the House of Commons, by 118 to 55, with the minority almost wholly from Quebec. When, finally, after announcing conscription, Sir Robert Borden asked Sir Wilfrid Laurier to join in a coalition, with half the Cabinet Liberals, he declined. He could not face Quebec as a supporter of compulsory service.

On other grounds Quebec was resentful and suspicious. In 1913 the Conservative government of the neighbouring province of Ontario had adopted severe restrictions on the use of French as the language of instruction in the bi-lingual schools, most of them at points in Ontario adjacent to the Province of Quebec. In Ottawa, the Federal capital, in particular, this action was bitterly resented. Canada is in Federal affairs bi-lingual, with English and French on an equal footing. Many French families live in Ottawa but, since it lies in Ontario, it has the school law of that province, and the new regulation forbade the use of French as the language of instruction for all but very young children. The French are particularly sensitive as to the use of their language, and the new rule was challenged in the courts. An ultimate appeal to the Privy Council brought the decision that jurisdiction in respect of the language to be used in the schools lay entirely with the provinces. When some schools in Ottawa continued to defy the law, their grants from the Govt. were cut off. The resentment aroused by this dispute was increased by gibes from some quarters at Quebec's backwardness in aiding in the War. When conscription was enforced, riots and bloodshed in the city of Quebec led to its occupation by troops. There is little doubt that Sir Wilfrid Laurier judged rightly that his own Quebec would desert him should he support conscription. In 1918 a motion was introduced in the Quebec Legislature for secession from the rest of Canada, but so extreme a step was not encouraged by any considerable section of opinion.

A Coalition Formed.—In Oct. 1917 a coalition government was formed under Sir Robert Borden, with seven Liberal members. Dissolution followed and Sir Wilfrid Laurier fought his last campaign with but few of his former followers supporting him, except in Quebec. The coalition won by 137 to 93 and 62 of the minority were from Quebec. The election of 1917 was noteworthy, in that for the first time women voted in a Federal election. A War Franchise bill passed in 1916 gave votes to women who had relatives serving in the War, the qualifying clause being removed in 1918, when women who had reached the age of 21 received the franchise. The provinces, which control their own franchise, also gave votes to women. During the War knighthoods and other honours were freely distributed by British ministers in the name of the King, especially in connection with services relating to the War. In England the principle is deeply rooted in social life, but to many it seemed alien to the life of Canada, and, in the end, sharp protests culminated in an undertaking by the Canadian Prime Minister to request the King not only to cease conferring hereditary titles on citizens of Canada, but also that other honours should only be given on the advice of his Canadian ministers. Since that time the giving of such titles has ceased in Canada.

The Prohibition Issue.—The period of the War brought with it great social changes. The agitation of many years in the cause of prohibition was reinforced by the sense of waste which the liquor traffic caused, during the War. A wave of opinion in favour of prohibition swept over both the United States and Canada. The United States dealt with the problem as a national one and in the 18th Amendment to the Constitution decreed prohibition for the whole nation, so that it lay no longer among the issues to be settled by the state legislatures. In Canada jurisdiction in respect of the liquor traffic is divided, under the British North America Act, between the Federal and the provincial authorities. The Federal authority has control over manufacture and export, the provincial authorities over sale. The Federal Govt. would not prohibit manufacture and export because of the refusal of the Senate, an appointed body, to endorse restrictive legislation passed by the Commons.

The Federal Govt. left to the provinces the right to control importation and their right to regulate sale was never challenged. The result of the control of sale by the provinces is that each one has its own type of restriction. In Ontario the law is severe; the Govt. alone may import and sell, and then only for medicinal purposes, as certified by a physician. Private persons may, however, without cost, obtain licences to brew beer for their own use. A beer weaker than lager, containing about 4% of alcohol, may be sold retail. In parts of Ontario the grape is easily grown and the law provides that the wine of the province may be sold by the manufacturer in bulk direct to the consumer for his own use. Quebec, in contrast with Ontario, while closing the bars and closely restricting the traffic, did not prohibit it.

The sale of wine and spirits was made a government monopoly. On whisky and other strong drinks the tax is heavy; on wines it is not, with the aim, which appears to be successful, of encouraging the use of light wines. The laws in the other provinces vary from the severity of Ontario to the freedom under government control of Quebec. Monopoly of sale by government is making the traffic a source of revenue in all the provinces. A province may at any time remove or increase restrictions by an Act of its Legislature. In contrast, therefore, with what is possible in the United States, prohibition might disappear in Canada within a few months. The issue is still acute in political life. Rural areas seem fairly content with prohibition; opposition is chiefly urban, but all parties seem to oppose the return of licenced drinking places.

Post-War Politics.—The War unsettled the two old political parties and led to the organisation of dissatisfied elements into new groups. Of these the most powerful was that of the farmers, who took the name of Progressives and were especially strong in the West. They favoured freer, if not free, trade and, indeed, proposed free trade with Great Britain. The Labour party and the Socialist party have never been strong in Canada, but in the spring of 1919 Labour agitation brought on a general strike in Winnipeg. All public services were put out of commission and during five weeks Winnipeg was the scene of a struggle unprecedented in Canada. The scenes of violence and intimidation which accompanied the closing down of the street car system and the blocking of the means of distributing supplies aroused sharp antagonism and caused the strikers to lose all public sympathy. Citizens volunteered to carry on these services with so firm a resolution that the movement was defeated and Winnipeg returned to its normal activities.

A provincial election in Ontario in 1919 showed the strength of the farmers and brought a surprising defeat of what seemed a strongly entrenched Conservative Government. Of 110 seats it held only 24; the Liberals had 30; and the Farmers' party and Labour combined secured 56, thus giving them a small majority. With the Hon. E. C. Drury as Prime Minister, a new administration was formed dominated by the Farmers' party. Mr. Drury found difficulty in forming a Cabinet composed of men sufficiently experienced for the tasks of government. No one doubted his own integrity, but his Cabinet had weak elements. After lasting for four years it went to the country in 1923 and the Conservatives returned to power with a large majority. In two other provinces, Alberta and Manitoba, the unsettlement of the other parties led to the coming into office of Farmers' governments which at the end of 1925 still endured and seemed to command confidence.

Sir Wilfrid Laurier died in Feb. 1919. The cleavage in the Liberal party on the issues of the War left him a rather lonely figure during his last two years and the problem of a successor was not easy. Quebec was the chief Liberal stronghold and it resented the action of those Liberals who had broken with Sir Wilfrid Laurier. The choice went to Mr. William Lyon Mackenzie King, Minister of Labour under Sir Wilfrid Laurier and a sharer of his attitude on conscription. Mr. Bourassa, leader of the Nationalists in Quebec, is the grandson of Papineau, the rebel of 1837; Mr. King is the grandson of Mackenzie, who in the same year had led a rebellion in Ontario and had had a price put upon his head. The coincidence is interesting as showing that in Canada, as in South Africa, liberty under British institutions is a great reconciler.

A General Election.—Membership of the Imperial War Cabinet and of the Peace Conference at Versailles, added to his duties as Prime Minister, had worn down the strength of Sir Robert Borden. In 1920 he resigned and was succeeded as Prime Minister by Mr. Arthur Meighen, a member of his Cabinet. Mr. Meighen had a difficult task. The coalition was in process of disintegration, chiefly on the issue of the tariff, and one by one the Liberal members were retiring. It was in vain that, when dissolution came in 1921, the foundation of a so-called " Liberal and Conservative party " was announced. The Liberals were returning to their former allegiance or joining with some Conservatives in the Farmers' movement. In the election of Dec. Mr. Meighen stood stiffly for Protection and suffered overwhelming defeat. The Conservatives carried 51 seats and the Liberals 117, among them the entire representation of Quebec, and there was the new and advanced group of 65 Progressives. Labour remained weak, returning only two members. Over both parties Mr. King had a majority of one. He took office but his path was difficult. Though he reached a working arrangement with Mr. T. A. Crerar, the Progressive leader, this support was always conditional.

Representation.—The census of 1921 showed what is always desired in scantily peopled countries, a satisfactory increase of population. The principle of representation in proportion to numbers is applied to the Canadian House of Commons. Quebec has always 65 members and those from the other provinces are in proportion to the number from Quebec. A redistribution follows each census and that of 1922 showed the marked increase in population in the west. The members from Nova Scotia and Ontario were reduced by two and one respectively. New Brunswick, Prince Edward Island and Yukon remained unchanged, while the increases in the west were Manitoba two, Saskatchewan five, Alberta four and British Columbia one. Such changes indicate that policy must be adjusted to the needs of the relatively larger agricultural population of the west. Though increased expenses probably justified the measure, there was sharp criticism of the action of Parliament in 1921 in increasing the pay of members from $2,500 to $4,000 for each session.

The Liberal Govt., which carried its budget in 1923 by a majority of only one, had always to confront an adverse majority in the Senate, to which only Conservatives had been appointed during the Conservative régime. This situation is always a feature of Canadian political life when a government long in power quits office. In 1923 the Senate showed great activity in respect of railway policy. Sir Henry Thornton, the head of the vast government railway system, with more than 20,000 m. of lines, proposed to build 26 small branch lines, chiefly in the west, as feeders of the trunk lines. The House of Commons endorsed the building of the lines at an estimated cost of $29,000,000 but the Senate objected that, while a few of the lines might be needed, it was unwise to increase an already crushing burden of debt at a time when trade was depressed. The cost, it was also urged, would go far beyond the estimate. When the Senate rejected the proposal, its action caused sharp criticism of a body not directly responsible to the people. Since that time the Liberal party has been committed to the reform of the Senate, a well-worn cry of the party in a minority in that body.

Removal of Cattle Embargo.—The loss of purchasing power in Europe after the War so lowered the price of wheat as to make the market price cover little more, and often less, than the cost of production. This brought severe depression in western Canada. The cattle industry found some relief when, in 1922, after prolonged discussion, the British Govt. removed the embargo on the importation of live cattle from Canada. It had endured for 30 years, though the cause—disease in Canadian cattle—had long since disappeared. Canadian cattle can now be sent across the ocean to be fattened in England for slaughter. The relief in this direction was timely, for the farmers of the United States were complaining of Canadian competition. In 1922, on the plea that both land and labour were cheaper in Canada, Congress empowered the President to proclaim a tariff against Canadian grain and cattle which should represent this difference. At first the duty on wheat was 30 cents a bushel, and on oats 15 cents, but in 1924 the President increased the duty on wheat to 42 cents, with proportionate duties on other produce and on sheep and cattle. The duty on wheat affected but slightly the Canadian producer, since the price is determined in the world market, but that on cattle was a heavy blow, owing to the great distances for which cattle must be carried to other markets.

When, in 1922, Mr. Crerar, the Progressive leader, retired, the new leader, Mr. Robert Forke, had to face discontent in his own party on the ground of undue subservience to the Liberals. In 1924 a so-called " ginger group " was formed of some 10 Progressive members and their support was so uncertain that at last in 1925, more than a year before the term of five years had expired, Mr. King appealed to the country on the plea that he needed a decisive Liberal majority.

The Election of 1925.—This appeal gave the country an opportunity to consider the effect upon Canada of the long strain of war and of unsettlement after war. The public debt had been increased to an amount which represented about $300 for each inhabitant of Canada. The cost of government had risen to about $1,000,000,000 yearly when Federal, provincial and municipal taxes were included and there was a large deficit on the two great railway lines united to form the Canadian National Railways. Burdens so heavy necessarily hampered commerce. While the farmers, competing in an unprotected world market, complained of the high prices paid to the protected manufacturer, he in turn complained that the tariff was so low as to enable the mass production of the United States to close Canadian factories, and that Canadians, unable to secure employment at home, were going in considerable numbers across the frontier. The reduction of one-third of the tariff in favour of British imports, it was claimed, was ruining especially the textile industry.

This cleavage on the tariff fortified sectional cleavage. The Maritime Provinces resented the more rapid development of the provinces further west. In the previous election Quebec had sent only Liberals to Parliament and this unanimity was rather on racial than on political grounds, in antagonism to English-speaking Ontario. The agricultural west thought it was being exploited by the industrial east. During the election in Oct. all these grievances found expression. The result showed a weakening of the hold of both the Liberals and the Progressives. The Conservatives, with 117, were the strongest party. The Liberals ad 102 and the Progressives 23, and there were 2 or 3 Independnts. No party had a majority. Union between the protec-onist Conservatives with low-tariff Progressives to turn out iberals who denounce protection would involve a paradox. Mr. ing consequently did not resign, but faced the new parliament, ealising that on any question of confidence he would have the upport of the Progressives. On June 28 1926, however, followng the refusal of the governor-general to dissolve Parliament, Ir. Mackenzie King resigned, and his place was taken by the onservative leader, Mr. Arthur Meighen.

Religion.—While the Roman Catholics have the largest single hurch membership, the total number of Protestants in Canada s greater by about one-half. Union among Protestants had long een urged, and in 1925 three groups, Presbyterians, Methodsts and the minor body of Congregationalists, finally completed he organisation of the United Church of Canada. The union as the interesting feature that, while the traditions of Presbyerianism are linked with Scotland, and those of the Methodists re linked chiefly with England, in Canada they have united in ne stream distinctively Canadian in type. Among the Methodsts there was no movement against union. Many Presbyteians, however, opposed the break with the long traditions of the resbyterian system. This opposition was chiefly in the cities f eastern Canada and, while the Methodist Church of Canada as disappeared, there is a continuing Presbyterian Church of anada with less than one-quarter of its former membership.

The Canadian Annual Review of Public Affairs (Toronto, anually) gives full accounts, each year, of political and financial atters in Canada. *The Canada Year Book*, issued annually at ttawa by the Govt. of Canada, gives elaborate statistics. On olitical events since 1911, O. D. Skelton's *Life and Letters of Sir Vilfrid Laurier* (New York, 1921) is a good account from the Liberal oint of view. So also is J. W. Dafoe's *Laurier, a Study in Canadian olitics* (Toronto, 1922). The *Canadian Historical Review* (pubshed quarterly at Toronto) is a guide to current literature relating o Canada. (G. M. W.)

II. CONSTITUTIONAL DEVELOPMENT

The incidents of Canada's constitutional development during he period 1910–25 are important. During the Imperial Confernce of 1911, Dominion delegates for the first time were admitted o what Mr. Asquith termed the *arcana imperii*. That is to say, hey were received at a special conference by Sir Edward Grey, vho imparted to them important confidential information as to oreign relations. At the same conference it was resolved, on he motion of Sir Wilfrid Laurier, that the British Govt. should pen negotiations with foreign governments with a view to securng liberty for any Dominion, which might so desire, to withdraw rom the operation of a treaty affecting that Dominion, without mpairing the effectiveness of the treaty for the rest of the Emire. A rather ineffective resolution was passed as to consultaion with the Dominions respecting the negotiation of international agreements affecting them.

Boundary Waters.—The Boundary Waters Treaty between he United States and Canada, negotiated under the direction of Sir Wilfrid Laurier and submitted by him to the Canadian Parliament in 1911, established an International Joint Commision of six commissioners, three appointed by the President of the United States and three by His Majesty on the recommendation of the governor-general in council. Thus, the Canadian Govt. in ubstance, although not in form, appoints the Canadian comnissioners. All important questions respecting rights in, and he user of, boundary waters are referred to this commission, vhich may also, with the consent of the governments of the United States and of Canada, exercise powers still more compreensive, including the determination of all rights, obligations or interests of the United States or of Canada, either in relation to each other or to their respective inhabitants. In the relations between Canada and the United States this treaty is a landmark, almost as notable as the Convention of 1818, which brought about disarmament upon the Great Lakes, and in effect upon the entire boundary line.

In 1912 Sir Robert Borden, the Prime Minister, and three of his colleagues attended a meeting of the Imperial Defence Committee at which the foreign relations of the British Commonwealth and the necessary safeguards against aggression were usefully discussed. In the same year the British Govt. gave assurances to the Govt. of Canada that, pending a final solution of the question of voice and influence in foreign relations, a Dominion Minister resident in London would be regularly summoned to the Committee of Imperial Defence and regarded as one of its permanent members; and that no important step in foreign policy would be undertaken without consultation with such representative.

In Oct. 1916 the Canadian Govt. established in London a Ministry of Overseas Military Forces with a resident minister. This Dept. was charged with the administration of military affairs overseas, and with the expenditure connected therewith. Eventually, it became an overseas Canadian War Office. Military operations in the field were under the final direction of British General Headquarters, but otherwise the Canadian forces serving in the War were administered as a thoroughly autonomous body, under the primary direction of the Overseas Ministry, with ultimate responsibility to the Canadian Govt. and Parliament.

Canadians and the Cabinet.—The Prime Minister of Canada was summoned to and attended a meeting of the British Cabinet in 1915. This was regarded as an event of constitutional significance. In 1917, however, a more important step was taken. The British Prime Minister called into operation the Imperial War Cabinet. It included the five Ministers of the British War Cabinet, the Prime Ministers of the Dominions and a representative from India. Thus ministers from all the self-governing nations of the Empire sat on terms of equality at a common council board, acting in co-operation and responsible to their respective Parliaments. Each minister or group of ministers represented a government, and the conference might fairly be termed a Cabinet of governments. In 1917 the British Govt. advanced the view that it had authority to requisition ships owned and registered in Canada. This view was effectively controverted by the Canadian Govt., who held firmly to the principle that in such case the executive power was properly vested in the Govt. of the Dominion. The legal power which undoubtedly existed was effectively limited by the controlling force of constitutional right.

Imperial War Conference.—The Imperial Conference sat as the Imperial War Conference in 1917 and 1918, and was occupied with questions not directly concerned with war measures and operations. In 1917 the question of immigration from India to the Dominions was considered, and the principle of reciprocity of treatment between India and the Dominions was adopted by resolution as a working basis. The most important contribution of the conference in that year was a resolution to which the British Govt. was a party. This recorded the conclusion that the readjustment of the constitutional relations of the component parts of the Empire, while thoroughly preserving all existing powers of self-government and complete control of domestic affairs, should be based upon a full recognition of the Dominions as autonomous nations of an Imperial Commonwealth and of India as an important portion of the same; should recognise the right of Canada, the other Dominions and India to an adequate voice in foreign policy and in foreign relations; and should provide effective arrangements for continuous consultation in all important matters of common Imperial concern, and for such necessary concerted action, founded on consultation, as the several governments may determine. This resolution, which formed the basis of future co-operation, gives distinct recognition to equality of nationhood between the Dominions and the mother country.

The principle thus established was carried to its logical conclusion at the Peace Conference of 1919, at which Canada, the other Dominions and India were distinctively represented by their delegates. There was serious opposition at Paris to such distinctive representation; but the insistence of the Dominions, with the strong support of the British Govt., eventually prevailed. The Imperial War Cabinet functioned at Paris under the designation of the British Empire Delegation. As a corollary to representation it was determined that Canada, the other Dominions and India should be parties to the Peace Treaty and members of the League of Nations, and that the treaty should be signed by Dominion and Indian plenipotentiaries and submitted for approval to Dominion Parliaments. Thus, at the Council of the Nations, the British Commonwealth entered on a new stage of its existence and development. The situation so created may not be free from anomalies; but the governance of the British Commonwealth has been developed through effective practice based upon needs as they arise, and is not founded upon speculative theory or strict logic. The outstanding fact is that the Dominions and India secured a certain status in the family of nations. An eminent authority has declared that the Versailles Treaty is the Magna Charta of the Dominions.

In 1918 a resolution of the Conference acknowledged the inherent function of each Dominion Government and of India to enjoy complete control of the composition of its population by restricting immigration from any other communities. In the same year the Conference by resolution declared that the Prime Ministers of the Dominions should have the right to direct communication with the Prime Minister of the United Kingdom and vice versa. This principle was affirmed at the Conference of 1921.

Canada and the United States.—A Canadian War Mission had been established at Washington at the beginning of 1918. It was in effect, although not in form, a diplomatic mission, and during the last year of the War and the first year of reconstruction it proved of immense service. In view of this the Canadian Prime Minister discussed with British ministers in 1919 the right of legation, which was acknowledged by an arrangement announced to the Canadian Parliament in 1920. The proposed appointment of a Canadian minister at Washington was not to denote any departure from the principle of the diplomatic unity of the British Empire, and was wholly consistent with the general practice under which Canadian Ministers in their negotiation of treaties with the United States held for the time being an informal diplomatic status. Nor was there any advance upon the principle actually in operation in the International Joint Commission which deals with many matters formerly referred to diplomatic negotiation.

In 1921 the Canadian Parliament passed an important measure to define Canadian nationals, which was rendered necessary by the status of Canada under the Versailles Treaty and especially as a member of the League of Nations. In the same year the voice of Canada and of other Dominions with regard to the proposed renewal of the Anglo-Japanese Treaty exercised an important influence upon the subsequent course of events.

Washington Conference.—The President of the United States did not extend to Canada and the Dominions separate invitations to the Disarmament Conference (1921) at Washington. Precedent existed for separate invitations, and there was a question as to whether certain Dominions would not stand aloof. It was wisely decided that the absence of special invitations should be overlooked and that the Dominions should be represented at Washington by their special plenipotentiaries, to whom full powers should be issued under the practice established at Paris in 1919. In the result the status and distinctive consideration that the Dominions had received at Paris were accorded to them at Washington. In the formal parts of the treaties the special representation of each Dominion was recognised; and each Dominion plenipotentiary signed on behalf of his Government.

The Canadian Model for the Irish Free State.—The agreement (Dec. 6 1921) between Great Britain and Ireland, that was subsequently ratified by Imperial Statute, provides that the Irish Free State shall have the same constitutional status as the Dominions and that its position in relation to the Imperial Parliament and Government shall be that of the Dominion of Canada. By Article 1 of its Constitution it is declared to be "a co-equal member of the Community of Nations forming the British Commonwealth of Nations."

The Treaty Power. A question having arisen with respect to the signing and ratification of treaties which concern only the interests of one Dominion, the whole subject was under consideration at the Imperial Conference of 1923, when principles were formulated and procedure laid down which should govern such cases and which fully recognise the right of each Dominion to negotiate and enter into a treaty affecting only its own interests, but not without due consideration of its possible effect on other parts of the Commonwealth or on the Commonwealth as a whole. Such a treaty, imposing obligations on one part only, should be signed by a representative of the Govt. of that part. The ratification of such a treaty is effected at the instance of the Govt. concerned.

The Anglo-French Treaty of 1919 (Defence of France) which was ratified by the British Parliament, but which never came into force as the corresponding Treaty between the French Republic and the United States was not ratified, provided that it should impose no obligation upon any of the Dominions unless and until it should be approved by the Parliament of the Dominion concerned. The Security Pact (Locarno, Oct. 16 1925) between Germany, Belgium, France and Great Britain, provides (Article 9) that it shall impose no obligation upon any of the British Dominions or upon India unless the Govt. of such Dominion or of India signifies its acceptance. In the one case Parliament, in the other case the Government, must approve. At Locarno (as at Lausanne) the Dominions did not take part in the negotiations and it does not appear that they were invited to do so. Thus at Locarno there was a distinct departure from the spirit of the 1917 resolution and from the precedent established at Paris. The reasons for such departure have not been made public.

Summary.—Apart from this incident, the development up to the end of 1925 may be summarised as follows:—

1. During the War each Dominion received a recognised place in the War Council of the Commonwealth and took an active part in the co-operation and direction of the Commonwealth's war effort.
2. The British and Dominion governments have definitely agreed that the principles of autonomy and equal nationhood shall govern their future political relations, and that the Dominions shall have an adequate voice in foreign policy and relations.
3. At the Paris Peace Conference and at the Washington Disarmament Conference there was distinctive representation of the Dominions; their plenipotentiaries were appointed upon their own nomination and the treaties were signed on behalf of the respective Dominions.
4. The Dominions entered into international affairs as members of the League of Nations with equal representation in the Assembly, and with such recognised status as would enable them to be represented on the Council.
5. Under suitable arrangements approved by the British Govt., and without departing from the principle of diplomatic unity, Canada became entitled to appoint a Minister Plenipotentiary at Washington who would be the ordinary channel of communication between the governments of Canada and the United States, and who would act upon instructions from, and report direct to, the Canadian Government.

In effect the British Commonwealth may be regarded as a league of nations, owning a single allegiance. In all essentials touching its continued existence and development there must be a real unity among its members, based upon the ideals of liberty and autonomy and upon close and sympathetic co-operation between the Commonwealth governments, and each, with due regard to its own point of view and special interests, must survey the aspects of external relations from the higher standpoint of Commonwealth unity and welfare.

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(R. L. B.)

III. DEFENCE

After 1910 Canadian military organisation changed very much. Its two most important features were the final war organisation, and the peace organisation which succeeded it. The principal military effort of Canada from 1914 to 1918 consisted in the organisation and maintenance of the Canadian Corps, consisting of the I., II., III. and IV. Canadian divisions and corps troops. This force, while technically an army corps of the British Army, differed from other army corps in that it was an integral tactical unit, moving and fighting as a whole.

War-time Organisation.—Its high tactical value resulted mainly from (*a*) great mobility, aided by two additional mechanical transport companies (for machine-gun battalions and engineer brigades); (*b*) high and consistent infantry strength, due to each division having three brigades of four battalions of 1,100 men each, one engineer brigade of three battalions in each division (eliminating the necessity of supplying working parties from nfantry) and to the possession of its own system for handling einforcements; (c) staffs almost double strength and staff officers onstantly interchanged; (d) an unique machine-gun organisaion, comprising two motor machine-gun brigades with the corps nd one machine-gun battalion of 96 guns with each division, lso a machine-gun headquarters at corps headquarters; (e) nlarged signal service; (f) high strength in permanently attached rtillery (corps troops included one extra divisional artillery nit and one extra brigade of field artillery); and (g) mechanialisation during stationary periods by extended use of light ailways, husbanding strength of men and horses. Other Canaian formations in France were the Canadian Cavalry Brigade nd Canadian Railway Troops, which included headquarters, 4 battalions and four operating companies, making a total of early 15,000 men and several supply units. There were Canaian sections with the I. and III. Echelons of G.H.Q., the former upplied liaison between Canadian units, G.H.Q. and the Canaian Ministry in England.

The Canadian Army Medical Corps operated in France, Engand and Salonika, supplying the regular medical services with he corps and other troops and also 14 general and seven staionary hospitals, four small forestry corps hospitals, 12 convaescent hospitals and one mobile laboratory. The Canadian Forestry Corps operated in England and France with 24,000 all anks. The Canadian Army Dental Corps had a strength of 03 all ranks. Special formations were the Accountant General's Branch, the Canadian Army Pay Corps and the Department of he General Auditor. Canadian troops in France and England were administered by the Minister of Overseas Military Forces of Canada with a headquarters in London.

Post-War Organisation.—During the session of 1922 a Naional Defence Act was passed, consolidating the Naval Service, he Air Board and the Dept. of Militia and Defence into the Dept. of National Defence. The Act became effective by proclamation on Jan. 1 1923. Under it there is a Minister of National Defence and a deputy-minister; a Defence Council was constiuted to advise the minister. The senior non-civil officer is the hief of the general staff.

Military Forces.—The small permanent military force is used or the maintenance of organisation and the instruction of the on-permanent troops, who constitute the first line fighting force. For purposes of training, discipline, mobilisation, etc., the counry is divided into 11 districts, each district under permanent ommanders with small staffs. Infantry is organised on a regimental system with active and reserve battalions (122 in all), perpetuating by their names the pre-War militia regiments and nits of the Canadian Corps. The organisation of other arms is uch as to provide for the formation of complete divisions with he necessary depots for reinforcements. The strength of the permanent militia was limited by the Militia Act Amending Act of 1919, to 10,000, but the authorised establishment in 1924 was less than 3,500. Royal schools of instruction are conducted t all stations of the permanent force; the Canadian Small Arms School is the only school, however, which is an independent unit f the permanent force. The total establishment of the non-permanent militia in 1923 was 10,568 officers and 112,893 other anks. A reserve militia has also been established.

Naval Service.—The Royal Canadian Navy and its reserve orces are under the direction of the Director of Naval Service, who is a member of the Defence Council. The service consists f permanent headquarters at Ottawa, and the Royal Canadian Navy, Naval Reserve and Naval Volunteer Reserve. In 1925 he personnel of the navy was 73 officers and 394 ratings. The majority of the men serve under seven years' engagements. A proportion of the officers serve periodically in ships of the British Royal Navy, and training courses are arranged for selected officers at the instructional schools of the Royal Navy. The Royal Canadian Navy consisted in 1924 of two destroyers and four minesweepers in commission and one light cruiser and two submarines in reserve. Naval training establishments and dockyards are maintained at Halifax and Esquimalt. The naval reserve consisted in 1924 of 70 officers and 430 men, and the volunteer reserve of 70 officers and 930 men. In 1925 and 1926 the naval service was in process of reorganisation.

Air Force.—The Royal Canadian Air Force in 1924 included a directorate under the control of the chief of the general staff which has its headquarters at Ottawa, and units at Vancouver, B.C.; High River, Alta.; Winnipeg, Man. (with operating bases at Victoria Beach, Norway House and The Pas); Camp Borden (the main training base); Ottawa, Ont.; and Dartmouth, N.S. The strength of the force on March 31 1924, was 61 officers and 262 men. Its functions were air force training and operations, the control of commercial flying and the conduct of flying operations for civil branches of the government service. In 1925 and 1926 the force was in process of reorganisation. (A. Cu.)

IV. FINANCE

In 1911 the net public debt of the Dominion of Canada was $335,996,850; in 1920, $2,248,862,624 and on March 31 1924, $2,417,783,275. In 1911 the interest on the public debt was about $13,000,000; by 1920 it had risen to $138,824,782, reduced in 1924 to $133,198,052. War pensions, the growth of population, increasing government activities, railway deficits and rising prices, all added to public expenditure, quite apart from the vast sums raised during the War for the maintenance of the army. The expenditure in 1911 on account of the consolidated fund was about $80,000,000. In 1924 it was $324,813,190. To this latter sum must be added various capital expenditures and railway deficits, which brought the total expenditure of 1924 to $370,589,247. The national wealth of Canada in 1921 was estimated at $22,195,000,000 and the national income of 1922 at some $4,000,000,000. The amount of income assessed for income taxes in 1922 was $1,463,000,000, and in 1924 it was $1,108,000,000. This latter change reflects the fall in prices and the depression in trade that began in 1921.

The financial problem of the country was made more difficult by the burden of the vast railway system which had to be taken over by the Govt. soon after the War. At the end of 1924 the Canadian National Railways, a combination of practically all the systems not included in the Canadian Pacific Railway, had about $914,000,000 worth of securities outstanding in the hands of the public. Not all of these securities were guaranteed by the Govt. but all must be reckoned among the national obligations. The railway requirements are met in part by direct advances from the Govt. and partly by the sale of guaranteed bonds, which become indirect public liabilities.

Sources of Revenue.—Customs duties provided the largest source of revenue in 1925. Additional revenue was obtained by the imposition of war taxes, the most productive of these being the sales tax, introduced in 1920, which was payable by manufacturers at the rate of 5% of their monthly sales. The income tax, introduced in 1917, is calculated at a normal rate of 4% with a surtax which rises to 65% on incomes over $1,000,000 per annum. Allowances include $1,000 per annum for a bachelor, $2,000 for a married man and $500 for each dependent child. A war tax on business profits was introduced in 1916 but discontinued at the end of 1920. Other war taxes included stamps on commercial documents and various luxury taxes.

Loans.—Canada was still a considerable borrower abroad in 1925, but it is important to note that after 1914 the greater part of these borrowings were from the United States, instead of from Great Britain which had supplied almost all the foreign capital borrowed by Canada before 1914. The increase in the prosperity of the country is clearly shown by the following table giving the sales of Canadian bonds in Canada, Great Britain and the United States by five year periods from 1905 to 1924. Percentages of the total for each period are shown in parentheses.

Period	Canada	G.B.	U.S.A.	Total
	(in millions of dollars)			
1905–9	158(21·7)	535(73·5)	35(4·8)	728
1910–4	199(15·2)	951(72·7)	157(12·1)	1,307
1915–9	2,222(71·6)	116(3·7)	768(24·7)	3,106
1920–4	1,330(57·4)	18(0·8)	967(41·8)	2,315

(A. J. Gl.)

BANKING

The main circulating media in Canada consist of Dominion notes, issued by the Dominion Govt. and bank notes, issued by the chartered banks in virtue of the terms of the Bank Act. Under the Dominions Notes Act, 1914, passed just before the outbreak of the World War, Dominion notes were issuable up to a total of $50,000,000 with a cash reserve of 25%, any notes in excess to be fully backed by gold.

As amended by the Finance Act, 1914, and the Dominion Notes Act, 1915, the redemption in gold of Dominion notes might be suspended by an order-in-council; whilst the volume of notes against which only a partial reserve was required was increased. The Finance Act, 1923, continued the order-in-council suspending convertibility, at the same time making permanent the system inaugurated by the Finance Act, 1914, by which Dominion notes could be advanced to the chartered banks against approved security. Thus the Canadian dollar, though at par with gold, had not by March 1926 been made redeemable at sight in gold; on the other hand, the Canadian Finance Ministry had been given some of the attributes of a central bank of issue.

The Note Issue.—The chartered banks may at all times issue notes up to an amount equal to the sum of their paid-up capital and the holding of gold and dominion notes in the Central Gold Reserve. Up to 1923, under special War regulations, the banks also possessed the right at all times to issue excess notes, up to 15% of the paid-up capital and reserve of the bank issuing the notes. This right to issue excess notes was then confined again to the period originally contemplated by the Bank Act, *i.e.*, to the crop-moving season from the beginning of Sept. to the end of February. Such excess notes are taxable at the rate of 5% per annum. The notes are secured by the maintenance of a Bank Circulation Redemption Fund, to which each bank contributed an amount equal to 5% of the average amount of its notes outstanding, and by the gold and Dominion notes in the Central Gold Reserve, constituted under the supervision of trustees, three of whom are appointed by the Canadian Bankers' Assn. and one by the Ministry of Finance.

The Chartered Banks.—Canadian commercial banking is in the hands of the chartered banks, incorporated under the Bank Act, first passed in 1871, and revised decennially. During the present century, the amalgamation movement resulted in a considerable diminution in the total number of banks; their number fell from 34 in 1900 to 25 in 1913, and was further reduced to 10 in 1925, the reduction being particularly marked in the years 1922–5. During this last period, one of depression following the post-War boom, some of the smaller banks showed marked weakness. The case of the Home Bank, which suspended payment in Aug. 1923, in particular revealed great maladministration; the bank had to be liquidated, the Bankers' Assn. and the government having to come to the assistance of the depositors, though the association advanced on the security of assets of the bank. In spite of the pressure of the Progressive party in the Dominion Legislature, the revision of the Bank Act in 1923, though resulting in several amendments, did not produce any fundamental changes.

Inspection of Banks.—But in 1924, in consequence of the Home Bank revelations, the important principle of government inspection of banks was incorporated in the Bank Act, a new section 56A being added. This section, which provides for annual inspection and report to the Minister of Finance, gives the Minister of Finance power, in case the inspector is satisfied that a bank is insolvent, and so reports, to request the Canadian Bankers' Assn. to appoint a curator to supervise the affairs of the bank, and such request shall have the same effect as if the bank had actually suspended payment.

Whilst the economic set-back from which Canada was suffering during the post-War period affected the banks and caused a recession both in the number of branches and the volume of business, the Canadian banking system had long ceased to be a purely domestic one. It has expanded to the West Indies, Central and South America, France, the United States and elsewhere. Whilst loans current in Canada fell off between Oct. 1921 and Oct. 1925, from $1,243,000,000 to $906,000,000, current loans elsewhere than in Canada increased in the same four years from $156,000,000 to $227,000,000. Canadian deposits increased in the same period by $50,000,000 and deposits elsewhere by $61,000,000. The total assets and liabilities in the four years increased from $2,806,000,000 to $2,882,000,000. (T. E. G.)

V. EDUCATION

The British North America Act, which was passed in 1867, placed education under the provincial Legislatures, subject to "any right or privilege with respect to denominational schools which any class of persons have by law in any province at the Union." Ontario, Quebec, Alberta and Saskatchewan provided separate schools for Catholics and English Protestants, but in Manitoba, although there were separate schools until 1890, there was only one system of public free schools in 1926; an arrangement to which the French Catholic population never acceded and which did not satisfy all parties.

Difficulties in Ontario and Quebec.—In Ontario, a school regulation passed in 1912 provided that all instruction, excepting in the first form, should be in English. The claim was made by the Catholic minority that this regulation was an invasion of their rights, but it was still in force in 1926. In Quebec, where education is under Catholic and Protestant sub-departments, there has grown up a third group, the Hebrew, living mostly in Montreal and treated as Protestant, although not entitled to representation on school boards or to separate schools. It is making an effort to obtain recognition and the matter is now before the courts. In Montreal, the community of English-speaking Catholics, who felt that no satisfactory provision was made for them in the high-school system, in 1922 erected by private subscription a high school of their own. The sparsity of rural population, together with the many foreign-born in the western provinces, has necessitated a centralised system, and the departments of education continue to issue all instructions concerning the conduct of schools, leaving little to the discretion of the local school boards or trustees of separate schools.

Teachers and Teaching.—Teachers are appointed by the respective school boards. The maintenance of one-room rural schools was becoming difficult in 1925; it was not easy to obtain qualified teachers; the cost of living had increased, and there had been local agricultural depression. In Manitoba, for example, the annual cost of maintaining a one-room school-house was as high as $1,300; salaries varying from $850 to $1,100 were mostly paid by the district, a small provincial grant being available. The result was that a large number of schools had been closed altogether. In the rural districts of Quebec, where the Protestant population is very scattered, an effort was being made to consolidate schools and to provide free transportation for pupils. In Saskatchewan a number of schools had been consolidated into two-room schools, enabling two teachers to share work and living expenses. The western provinces made a great effort to replace the unqualified foreign-born teacher, too often found before 1918. Alberta appointed official school trustees where it was found impossible to obtain satisfactory appointments.

In Saskatchewan, instruction is allowed for only one hour per day in a language other than English. In Manitoba, the clause allowing bilingual instruction has been repealed, and good effects have resulted. These difficulties must not be emphasised without remarking that there were over 1,900,000 children in ordinary day schools in 1925, and that the percentage of illiteracy, much smaller than in 1910, was decreasing. Another circumstance affecting education is the evident effect of European systems. In the English-speaking communities one result has been the freedom of discussion enjoyed by teachers, and the recent violent controversy on this subject in the United States had few echoes in Canada. Among the French-speaking institutions receiving their inspiration from France, the universities have no Faculty of Arts; but the Bachelor's degree, given by the universities to graduates of junior colleges conducted by Catholic authorities and giving an eight-year course, has now been made prerequisite to all professional degrees and examinations for admission to professional associations.

The French-speaking model schools in Quebec were abolished n 1924 and replaced by two additional grades in the elementary chools. In Quebec the Catholic academies teach no classics, but he classical college course for the B.A. has been standardised and improved. The provincial government since 1922 has aided hese institutions by annual grants of $10,000 each. The Ontario Adolescent Act requires school attendance up to 16 years of age, and some higher English schools have been opened to cover the post-elementary period. Since 1918 commercial and technical high schools have been instituted in most large centres, replacing for those attending them the regular high schools; these, with the agricultural colleges, are the only educational institutions which can legally be and are aided by the Dominion Government.

University Education.—In the universities, progress has been made both by growth and by federation. McGill University has absorbed Macdonald College and greatly extended its faculties, schools and departments. The University of Toronto has been reconstituted on a federal basis, and the Ontario Agricultural College affiliated to it. The French-speaking University of Montreal, long a branch of Laval University, was in 1920 granted a new charter. Western University, which changed its name to the University of Western Ontario, is now carried on in close co-operation with the municipal authorities of London, Ontario, and the neighbouring counties. The University of King's College was removed to Halifax and federated with Dalhousie. The western universities of British Columbia, Manitoba, Saskatchewan and Alberta have shown a remarkable growth.

Recent investigators suggest the need of more co-ordination between school and university courses, and propose that the schools give part of the arts course or satisfy matriculation standards co-ordinated with university requirements. It is probably fair to say, in surveying the whole situation, that the period 1910–25 has been one of the most remarkable in the history of Canadian education, marked so far as universities are concerned by unparalleled material growth, and in elementary education by remarkable improvement in methods, in public interest and in results. (A. Cu.)

VI. AREA AND POPULATION

The land and water areas of the Dominion, by Provinces and Territories according to revised calculations made in 1925 are given in table in next column.

Provinces and Territories	Land	Water[1]	Total	Population per sq. m. of land area
Nova Scotia	21,068	360	21,428	24·86
Prince Edward Island	2,184	..	2,184	40·56
New Brunswick	27,911	74	27,985	13·90
Quebec	690,865	15,969	706,834	3·42
Ontario	365,880	41,382	407,262	8·02
Manitoba	231,926	19,906	251,832	2·63
Saskatchewan	243,381	8,319	251,700	3·12
Alberta	252,925	2,360	255,285	2·33
British Columbia	353,416	2,439	355,855	1·48
Yukon	206,427	649	207,076	0·02
Northwest Territories:				
Mackenzie	493,225	34,265	527,490	0·006
Keewatin	218,460	9,700	228,160	
Franklin	546,532	7,500	554,032	
Total	3,654,200	142,923	3,797,123	2·41

[1] Exclusive of all tidal waters excepting that portion of the river St. Lawrence between Point des Monts and the foot of Lake St. Peter.

The population increased from 5,371,315 in 1901 to 7,206,643 in 1911 and to 8,788,483 in 1921. In 1911–21, the net increase was therefore 1,581,840 and the rate 21·95%. Within the Dominion, the four western provinces increased in relative importance in 1911–21, the others declined. The heavy immigration movement accompanying the settlement of the western provinces was chiefly responsible for the increase.

With regard to natural increase, comprehensive statistics are lacking prior to 1921, but the net increase of births over deaths is set down at 853,566 for the decade 1901–11, and at 1,150,659 for the decade 1911–21. The population is of high masculinity as a result of the large part which immigration has played; notwithstanding the War, which, both by its check upon immigration and by the toll which it levied upon male lives, considerably reduced the excess of males, there was an excess in 1921 of 3 in the number of males as compared with females in each 100 of the population. Through the same causes, the Canadian median age has been increasing and in 1921 was 23·943 years or 5·144 years higher than in 1871.

The subjoined tables assemble the more important facts of population growth by provinces. A post-censal calculation *pro formula* of the population as at June 1 in each year since 1921 gave the following results: 1922—8,940,150; 1923—9,082,840; 1924—9,226,740.

Racial Origin and Citizenship.—The problem of the assimilation of foreign immigrants, superimposed upon the basic division of the Canadian population into two great national groups, makes the statistics of origin of unusual significance. During the decade ended in 1921, the population of British stock increased from 3,896,985 to 4,868,903, or by 971,918, whilst the descendants of the original French colonists increased from 2,054,890 to 2,452,751, or by 397,861. The British "races" (using the latter term in the sense of original family habitat rather than of ethnic strain) increased from 54·08% of the whole population in 1911 to 55·40% in 1921, but the French declined from 28·52% to 27·91%. Those of alien race increased by 206,739, making them 15·43% of the whole, as compared with 15·94% in 1911. Foreign immigrants have been chiefly from Scandinavia, Russia and Austria. The Indian, who is treated as the ward of the Canadian Govt., numbered 111,597 in 1925, a slight increase having taken place during the period 1910 to 1925. Except in the northern regions the Indian population is almost wholly on reservations. Oriental immigration has been markedly on the decline in recent years owing to restrictive legislation. In 1925 it reached only 547. In 1921 there were 39,587 Chinese, 15,868 Japanese and 1,016 East Indians resident in Canada, 69.9% of the whole being in British Columbia.

Provinces, etc.	Population			Increase (+) Decrease (−)				Birth Rate 1924
				1911 over 1901		1921 over 1911		
	1901	1911	1921	No.	%	No.	%	
Nova Scotia	459,574	492,338	523,837	+ 32,764	+ 7·13	+ 31,499	+ 6·40	22·1
Prince Edward Island	103,259	93,728	88,615	− 9,531	− 9·23	− 5,113	− 5·46	21·1
New Brunswick	331,120	351,889	387,876	+ 20,769	+ 6·27	+ 35,987	+10·23	26·9
Quebec	1,648,898	2,005,776	2,361,199	+356,878	+ 21·64	+355,423	+17·72	32·2[1]
Ontario	2,182,947	2,527,292	2,933,662	+344,345	+ 15·77	+406,370	+16·08	23·4
Manitoba	255,211	461,394	610,118	+206,183	+ 80·79	+148,724	+32·23	23·9
Saskatchewan	91,279	492,432	757,510	+401,153	+439·48	+265,078	+53·83	26·4
Alberta	73,022	374,295	588,454	+301,273	+412·58	+214,159	+57·22	22·9
British Columbia	178,657	392,480	524,582	+213,823	+119·68	+132,102	+33·66	18·3
Yukon	27,219	8,512	4,157	− 18,707	− 68·73	− 4,355	−51·16	..
Northwest Territories	20,129	6,507	7,988	− 13,622	− 67·67	+ 1,481	+22·76	..
Royal Canadian Navy	..	..	485	..	..	+ 485	..	..
Total	5,371,315	7,206,643	8,788,483	1,835,328	34·17	1,581,840	21·95	23·4[2]

[1] 1923.

[2] Excluding the Province of Quebec, which is not included in the registration area.

Language is of an interest akin to that of race, especially as between the use of English and French, both of which are officially sanctioned in the province of Quebec and in the Federal courts and Parliament. Of a total population of 10 years of age and over in Canada amounting to 6,682,072, some 5,665,527 can speak English, leaving but 15·21% unable to speak the dominant language. The number speaking French, as mother tongue, is 1,757,193. A good deal of effort has recently been directed toward spreading bilingualism as a means of removing misunderstanding between those of British and French extraction in Canada. More than half the French-Canadians speak English, but less than 5% of the British-Canadians speak French. In 1921, 9·25% of the population of five years of age and over could neither read nor write, compared with 10·5% in 1911 and 14·38% in 1901.

Movement of Population.—An outstanding feature of Canadian progress has been the rapid growth of the towns, and particularly of the larger cities, at the expense of the country sections. In 1871 only 19% of the population lived in urban districts. The proportion has mounted steadily until in 1921 it stood at 49·52%. Particularly marked was the tendency in this direction during 1901–11, though the mainspring of the progress of that decade was agricultural development. The period 1911–21, again saw an intensification. Montreal and Toronto both passed the 500,000 mark in the 1921 Census. The small towns, as well as the farming communities, are helping to feed the cities, most of the older rural sections of Ontario and Quebec having lost population. Only on the prairies is a larger rural than urban growth taking place, over three-fourths of the entire rural growth of the past decade having taken place in Manitoba, Saskatchewan and Alberta, while most of the remainder occurred in British Columbia. The population of the 15 largest cities in 1921 was as follows:—

Cities	Population
Montreal, Que.	618,506
Toronto, Ont.	521,893
Winnipeg, Man.	179,087
Vancouver, B.C.	117,217
Hamilton, Ont.	114,151
Ottawa, Ont.	107,843
Quebec, Que.	95,193
Calgary, Alta.	63,305
London, Ont.	60,959
Edmonton, Alta.	58,821
Halifax, N.S.	58,372
St. John, N.B.	47,166
Victoria, B.C.	38,727
Windsor, Ont.	38,591
Regina, Sask.	34,432

(R. H. Co.)

Immigration and Settlement

During the years immediately preceding the outbreak of the World War the number of immigrants was steadily increasing. The war period was marked by a great decrease in immigration, particularly from Great Britain. At the end of the World War, Canada hoped to secure many capable immigrants from Europe, particularly as the Immigration Quota laws of the United States restricted both British and continental immigration into that country.

Instead of this desire being realised, however, immigration into Canada decreased from 1921 to 1923. Many new immigration policies were adopted in the years 1920–5, but no solution of this unsatisfactory state of affairs was discovered. During the 10 years following 1911, Canadian Govt. records show 747,170 American immigrants into Canada, while American Govt. records for the same period show the admission of 742,195 Canadians into the United States. After 1921 the exodus from Canada to the United States largely increased owing to the great prosperity of the United States and the high wages offered. No record was kept before March 1924 of the number of Canadians returning to Canada from the United States. During 1925 about 50,000 returned. The table in next column gives the official Canadian figures of immigrant arrivals from 1911 to 1925.

Fiscal Years	Immigrant Arrivals from			
	United Kingdom	United States	Other Countries	Total
1911	123,013	121,451	66,620	311,084
1912	138,121	133,710	82,406	354,237
1913	150,542	139,009	112,881	402,432
1914	142,622	107,530	134,726	384,878
1915	43,276	59,779	41,734	144,789
1916	8,664	36,937	2,936	48,537
1917	8,282	61,389	5,703	75,374
1918	3,178	71,314	4,582	79,074
1919	9,914	40,715	7,073	57,702
1920	59,603	49,656	8,077	117,336
1921	74,262	48,059	26,156	148,477
1922	39,020	29,345	21,634	89,999
1923	34,508	22,007	16,372	72,887
1924	72,919	20,521	55,120	148,560
1925	53,178	15,818	42,366	111,362

Land Settlement.—Immediately after the Armistice, Canada was confronted with the problem of repatriating her soldiers and sailors. The Canadian Govt. established the Soldiers' Settlement Board to assist her ex-service men to establish themselves permanently upon the land. Supervision and substantial assistance by way of loans from the Canadian Govt. enabled the definite settlement by the end of 1924 of 30,604 of these men, for which the Canadian people advanced over $100,000,000. So successful was this national operation that, up to March 31 1924, $19,399,800 had been repaid. Recurring war disability and other causes withdrew from this scheme several hundred farms, subsequently made available for British settlers. Realising that this land settlement machinery was available, the Canadian Govt. made an agreement under the Empire Settlement Act with the Imperial Govt. to receive and care for 3,000 British families, to each of which the British Govt. loaned for farm equipment, etc., an amount not exceeding £300.

During the first year of the scheme, 1925, 482 families were received and placed upon the land. Owing to the increased cost of the passage to Canada, a further agreement was made under the Empire Settlement Act. The Imperial and the Canadian governments agreed to share the greater part of the expense of the journey from England to Canada, thus enabling a selected British immigrant to cross the Atlantic to Halifax, St. John or Quebec for £3; the expense for further distances into Canada was in proportion, the farthest destination being Vancouver, which could be reached for £9. Unfortunately, the agreement applied only to persons of agricultural experience, so that its effect was limited.

(J. O. S.)

VII. PRODUCTION, INDUSTRY AND TRADE

The expansion of wheat production is the most striking feature of Canada's economic development after 1910. In the years immediately preceding the World War Canada was passing through a boom period. Optimism was rampant, and, under the stimulus of lavish land and cash grants, railways were rapidly pushed into new and thinly settled areas, some 10,000 m. being added to the railway system in five years. In the period 1910–4 immigrants numbered about 1,660,000, and in the same period wheat production was doubled. The next great stimulus came from the War. The annual exportation of wheat, which averaged 92,500,000 bu. in the period 1912–4, reached 150,000,000 bu. valued at $366,000,000, in 1918. The immediate post-War period saw a continuance of this development, and in 1925 the yield was about 400,000,000 bu. from 22,000,000 ac., valued at about $450,000,000—an increase since 1901 of 300% in area, 600% in yield and 1,100% in value.

A most important contributory cause of this expansion was the plant-breeding research of the Dominion Govt. Experimentalists, notably Dr. William Saunders and his son, Dr. Charles Saunders. In 1903 the world-famous Marquis wheat was evolved, and in 1918 upwards of 300,000,000 bu. of it were raised in North America. The fame of Marquis wheat is chiefly due to its earlier ripening, heavy yield, weighty and plump kernel, whiteness and baking strength, which enable the baker to obtain a maximum number of loaves to the sack of flour. To it probably more than to any other single factor did Canada owe her high place among wheat producers in 1925. The supremacy of Marquis wheat, was, however, challenged by the Garnet wheat (a cross between Preston A and Riga M), which promised to mature in 10 days less than the Marquis—100 as compared with 110. This quicker maturing, if established, would bring under cultivation vast new areas where the winters are bnormally long and the summers abnormally short, though hot see AGRICULTURE; SCIENTIFIC DEVELOPMENT).

The following table shows the great increase in the production of he principal field crops between 1910 and 1925:—

	Acreage (000's omitted)		Yield in bushels (000's omitted)		Value (000's omitted)	
	1910	1925	1910	1925	1910	1925
Wheat	9,295	22,000	149,990[1]	400,000[1]	$112,973	$450,000
Oats	9,864	14,670	323,449[1]	515,000[1]	114,365	206,000
Barley	1,834	4,000	45,148[1]	112,000[1]	21,400	55,850
Rye	84	851	1,544[1]	15,500[1]	1,084	9,316
Flax for seed	477	1,128	6,538[1]	9,500[1]	7,899	19,000
Corn (Maize)	328	1,000	..	..	10,135	39,000
Hay	8,515	10,000	15,497[2]	15,163[2]	149,716	167,000
Total	30,397	53,649	..	..	417,572	946,166

[1] Bushels. [2] Tons.

Adding minor crops, the total area under field crops in 1926 approximated 57,000,000 acres. It is officially estimated that the area suitable for agriculture approaches 300,000,000 acres.

Wheat Pools.—The War entirely dislocated the machinery by which the agriculturists of Canada conducted their business. Before the War grain exchanges such as the Wheat Pit of Winnipeg were the normal agencies for marketing grain, which was collected at country points, assembled in large quantities at the terminal points, and distributed among the mills of America and Europe. Insurance against fluctuation in price was developed by the system known as future trading, which made possible the financing of grain by the banks without incurring undue risks. So disturbing were War conditions that in May 1917 the price reached the peak figure of $3 a bushel as contrasted with only 94 cents in May 1914.

The consequent clamour among consumers, and the urgent War needs of the Allies, resulted in the co-operative intervention of the British and Canadian Governments as buyers and controllers. Out of these conditions of war upheaval came a remarkable development of co-operative marketing. Voluntary wheat pools were organised in each of the three prairie provinces, with a total membership in respect to the 1925 crop of 125,000 out of 255,000 farmers, and a control of about 200,000,000 bu. of wheat, about one-half of the total crop, and about 150,000,000 bu. of other grain. Instead of using the former channels of trade these farmers turned over their wheat to their own selling organisation, and all farmers ultimately received the same average price based on the official grading of the wheat supplied. The wheat pools seek to acquire their own elevators at country centres, thus replacing the elevator-owning companies who formerly held the trade. Two of the co-operative companies with a capital of $16,000,000, mostly provided by the wheat growers themselves, owned 450 and 323 country elevators respectively in the licence year 1923–4, as well as large store elevators at the head of the Great Lakes and at Buffalo (*see* CO-OPERATION, AGRICULTURE).

Stock Raising.—As contrasted with grain-growing, the Canadian stock-raising industry only advanced at a moderate rate. Three factors have tended to restrict the industry: (1) The invasion by wheat and mixed farmers of the ranch areas of Alberta and of areas formerly condemned as "bad" or "alkali" land; (2) the high protective tariffs of the United States, which deprived Canadian livestockmen of their best market; and (3) the British embargo on Canadian store cattle imposed in 1896 and retained until 1923. Nevertheless, the number of beef and dairy cattle increased by some 30% between 1910 and 1925; in the latter year beef cattle numbered about 5,500,000 head, and dairy cattle some 3,750,000 head. More rapid development was shown in the horse-breeding industry, and the number of horses in 1925 approximated 3,500,000. Sheep increase slowly in number, probably because of the fencing problem and, especially in the West, the danger from wolves. The annual value of the livestock products as a whole was officially estimated for 1925 at $500,000,000.

Forestry.—In Canada's commercial growth the forest industries stand second to agriculture, and in 1925 there were over 3,100 saw-mills at work. The annual production of lumber from 1905 to 1925 varied between 3,200 and 4,900 million of feet, board measure. As well as providing the raw materials for saw-mills and pulp-mills, the forests of Canada provide annually about 16,000,000 railway ties, 1,000,000 poles for telegraph, telephone and power lines, 14,000,000 fence posts, and over 8,000,000 cords of firewood, together with piling, round mining timbers, wood for distillation, charcoal and excelsior manufacture, bark and wood for tanning extracts, maple sugar and wood for the manufacture of artificial silk. Quebec, Ontario and British Columbia are the chief producing provinces. The total value of the annual output of forest products is about $300,000,000, United States buyers taking more than all other customers combined. Because of propinquity and the comparative exhaustion of United States home supplies, this preponderance is likely to continue, but British purchases are increasing.

Minerals.—Coal and iron are generally regarded as the basis of industrial strength. To these, in the case of Canada, may be added water power and petroleum. Upon the coal of Nova Scotia and the iron ore brought to it from Wabana in adjacent Newfoundland, are based the iron and steel industries of Sydney and New Glasgow; and at the other end of the Dominion, the coal fields of the Crow's Nest Pass district and Vancouver Is. support the smelting industries of British Columbia. An economic development of high national importance is the effort to free Central Canada, Ontario and Quebec from dependence upon imported coal by the rapid development of hydroelectric power from Niagara and other sources, the establishment of coking plants, and the wider distribution of Nova Scotian and Albertan supplies. Canada has long been the world's principal source of nickel, asbestos and cobalt. Mineral production was greatly accelerated during the War, exports of metals, which averaged $27,000,000 in value in the three years before the War, reaching by 1918 a total value of $92,000,000. An outstanding feature has been the rapid increase of gold production, especially in Ontario. Petroleum production was not very large in 1925, but an extensive drilling campaign was being carried on in the western areas, particularly in the Mackenzie and Peace river basins.

The progress of mineral production in the period 1910 to 1925 is shown in the following table:—

	Quantity (000's omitted)		Value in $ (000's omitted)	
	1910	1925	1910	1925
Gold	..	1,730 oz.	10,225	35,768
Silver	31,983 oz.	19,494 oz.	17,107	13,469
Nickel	37,271 lb.	73,150 lb.	11,181	24,140
Copper	56,598 lb.	112,526 lb.	7,209	15,813
Lead	32,988 lb.	253,964 lb.	1,237	23,238
Zinc	..	111,010 lb.	235	8,469
Coal	12,797 tons	13,022 tons	29,812	49,024
Asbestos	76 tons	260 tons	2,459	8,700

Industry.—Canadian policy is increasingly directed to the home conversion of raw materials into finished products. This policy is assisted by the almost inexhaustible supply of these raw materials from lands, forests and mines, by the enormous resources of water power, and by the readiness of Americans to apply their capital and business enterprise to Canadian industry. (In 1925 there were over 700 American branch plants in Canada carrying an investment of $150,000,000.) The concentration of population in the region of the lower Great Lakes and St. Lawrence, the nearness of the American coal-fields, and the rapid development of water-power resources go far to explain the fact that some 75% of Canadian manufacturing establishments are situated in Ontario and Quebec, in such centres as Montreal, Toronto, Hamilton, Ottawa, Oshawa, London, Kitchener and Quebec. A lesser industrial advancement has been made in Winnipeg (Manitoba), Vancouver (British Columbia) and St. John (New Brunswick).

Within the period 1910–25 Canada became second only to the

United States as a producer of pulp and paper. The output increased fivefold in value; in 1923 it was worth more than $122,000,000, over 100 mills being in operation. The iron and steel industry is favoured in an especial degree by the abundant supply of cheap hydroelectric power, which helps to offset the disadvantage that nowhere in Canada are workable deposits of coal and iron found in juxtaposition, and also by the abundance of nickel, chromium, molybdenum and other metals used in the manufacture of alloy steels.

The insufficiency of the earlier returns prevents an exact statement of the development in each industrial group, but the following table shows, as far as information was available, from the census returns, the numbers of employees in each group in 1910 and 1920, and the value added to raw materials by processes of manufacture:—

Group	No. of Employees		Net value, *i.e.*, value of products less cost of materials (in million dollars)	
	1910	1920	1910	1920
Wood and paper	132,000	143,700	120	416
Iron and steel	48,558	146,200	61	365
"Vegetable" products	..	72,900	..	236
Construction, hand trades and repairs	..	89,000	..	200
Textile	72,672	99,700	64	193
Animal products	..	48,700	..	153
Non-metallic mineral	17,502	18,800	40	54
Non-ferrous metal		23,200		53
Miscellaneous	..	24,900	..	95

The War had a profound and lasting effect upon Canada's industrialism. The war demand was first felt in respect to shells, and brought new employment to many centres throughout the Dominion. Canada exported for the use of the allied fighting forces over 65,000,000 shells, together with many millions of fuses, fuse-parts, cartridge cases, percussion primers, exploder containers, and shell and adapter forgings. Of the 1,800,000 tons of steel used about 75% was produced in Canada. The forests of British Columbia, and to a lesser degree of Ontario, Quebec and New Brunswick, provided spruce for aeroplane purposes and for shipbuilding, while the mines supplied large quantities of copper, zinc, nickel, lead, asbestos, aluminium, carbide and other mineral products. The metals and compounds exported during the War period reached a total of 10,700,000 lb. and the total value of the exports of munitions and materials was $1,002,000,000. Annual exports increased from a value of $57,000,000 in 1915 to $388,000,000 in 1917.

Water-Power.—Another all-important new factor in Canadian industrialism was the revelation of the extent of available water-power. In the official records of 1910 no mention is made of this form of energy, but in 1925 every large industrial centre was served with hydroelectric power and had within easy transmission distance ample reserves for the future. The importance of this water-power to Canadian industry cannot be overestimated. It is capable of great development, and during 1925 alone 719,000 H.P. was added, bringing the total installation in the Dominion to 4,290,000 horsepower. The benefits of the new motive power are especially felt in the central provinces of Ontario and Quebec, where there is no coal. A significant contrast in method is presented in the two leading provinces. In Quebec the development was left in the hands of private corporations, while Ontario led the way in public ownership. Hydroelectric power commissions have been set up by the respective governments in Ontario, Nova Scotia, New Brunswick and the city of Winnipeg to operate power plants and transmission systems as publicly owned utilities.

Labour Conditions.—The following table of index numbers of rates of wages for various classes of labour in Canada is based on those of 1913 as 100:—

	Building Trades	Metal Trades	Printing Trades	Electric Railways	Steam Railways	Coal Mining	Common Factory Labour	Miscellaneous Factory Trades	Lumbering
1911	90·2	91·0	91·6	88·1	96·4	97·5	94·9	95·4	93·3
1913	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0	100·0
1918	125·9	155·2	123·7	142·9	133·2	157·8	152·3	146·8	150·5
1924	169·7	175·5	191·9	186·4	157·4	192·4	183·2	197·6	183·1

Prices rose greatly during the War period and reached their maximum in 1920, when, taking the level of 1913 as 100, wholesale prices stood at 243·5 and the cost of living at 192. By 1924 a considerable fall was recorded, wholesale prices in that year standing at 155·1 and the cost of living at 152. After 1920 wages in all groups decreased, and the tendency in 1925 was still downward, notwithstanding the higher rates offered in the United States, which induced a serious exodus of artisans from Canada.

The hours of labour in 1925 were generally as follows:—

Building trades	44	Carriage manufactures	44–55
Metal trades	44–50	Furniture and wood-cutting	44–60
Printing trades	46½–48	Rubber manufacture	40–55
Electric St. Rys.	44–48	Boots and shoes	48–55
Textiles	44–50	Automobiles	44–50
Clothing and miscellaneous manufacture	44–56	Common labourers	44–60
Meat packing	48–60	Coal miners	44–46
Pulp and paper making	48–50	Other miners	48–54

In 1907 the Canadian Parliament passed the Industrial Disputes Investigation Act, commonly called the Lemieux Act. The primary object of the Act was to further the settlement of industrial disputes through the appointment of a Board of Conciliation and Investigation, to which board—representing both interests—any employer or employee might refer a dispute. It was made unlawful for the employer to lockout or for the employee to strike pending the reference made to such board of conciliation, and any breach of this provision was made punishable by a fine. This Act worked to the advantage of both employers and employees, and there was general regret at the decision of the Privy Council in London on Jan. 20 1925, declaring that the Lemieux Act was *ultra vires* of the Canadian Parliament, holding that such legislation was only within the jurisdiction of the provincial Legislatures, some of whom have since enacted similar legislation, which however, can only be effective within the boundaries of a province.

Trade.—The great increase in Canada's trade from 1911 to 1924 is shown in the following table:—

Imports for Consumption and Exports of Domestic Produce

Year	(Millions of dollars)		(Per capita)		(Per capita at 1924 prices)	
	Exports	Imports	Exports	Imports	Exports	Imports
1911	274	453	$38.06	$62.82	$62.14	$102.54
1912	290	522	39.40	70.93	61.35	110.44
1913	356	671	47.26	89.17	73.30	138.30
1914	432	619	56.10	80.49	84.89	121.80
1915	409	456	52.08	57.99	74.10	82.51
1916	742	508	92.21	63.24	109.02	74.70
1917	1,151	846	144.75	103.48	125.77	89.91
1918	1,540	964	184.91	115.69	144.12	90.26
1919	1,216	920	143.48	108.48	106.37	80.43
1920	1,239	1,065	143.61	123.34	91.47	78.56
1921	1,189	1,240	135.31	141.12	122.16	127.40
1922	740	748	82.55	83.40	84.23	85.10
1923	931	803	101.84	87.75	103.24	88.96
1924	1,045	893	112.60	96.22	112.60	96.22

The outstanding feature of the period was the growth of trading relations with the United States, largely at the expense of that with the United Kingdom. Tariff obstacles on both sides have tended to alter the character of the trade, but its volume increases continuously. In 1925 Canada was second only to Great Britain in the list of overseas markets for exports from the United States. The directions of trade in 1910 and 1924 are shown in the following table (percentages of total imports and exports respectively are given in parentheses):—

	Canadian Imports from (in million dollars)		Canadian Exports to (in million dollars)	
	1910	1924	1910	1924
U.S.A.	218 (59%)	601 (67%)	104 (37%)	431 (41%)
Great Britain	95 (26%)	154 (17%)	139 (50%)	360 (34%)
Other Countries	57 (15%)	138 (16%)	36 (13%)	254 (25%)
Totals	370 (100%)	893 (100%)	279 (100%)	1,045(100%)

Coal, iron ore and products, petroleum, cotton, rubber and other raw materials of industry are largely imported from the United States; the chief exports to the United States are wood pulp and paper. Canada's exports to Great Britain consist almost entirely f vegetable and animal products, chiefly wheat and flour. With egard to imports, Canada is a large and increasing purchaser f British textiles and other manufactures. Assisted by treaty nd tariff arrangements, a substantial increase has taken place n commercial intercourse with other British Dominions and olonies, notably Australia, New Zealand, the West Indies and ewfoundland, as is shown by a comparison of the following able with the one given above:—

	Canadian Imports from (in million dollars)		Canadian Exports to (in million dollars)	
	1910	1924	1910	1924
British Empire	112	195	155	436
Foreign countries	258	698	124	609
Totals .	370	893	279	1,045

Apart from the United States, the trading relations of Canada ith foreign countries show the most promising results in the case f Japan, France, Belgium, Germany, Italy, Cuba, China and he Netherlands; and as the abnormal post-War conditions disapear Canada's trade with these countries should expand considrably. In this expansion the Panama Canal must take an inreasing part, for in the transit of goods by sea between Vancouver and Liverpool it saves 5,666 m. and an ever-growing percenage of the wheat and other products of the western prairies may e expected to find their cheapest route to market via Vancouver nd the Canal.

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VIII. COMMUNICATIONS

The chief development in communications in Canada since 1911 has been the great increase in railways on the Western prairies. In railway organisation, the outstanding event was the union of two transcontinental lines with the existing government railways, and their consolidation into a state railway company. In 1925 nearly 90% of the railway mileage was included in two systems—the Canadian Pacific and the Canadian National. The route mileage of the railways grew from 25,400 m. in 1911 to 39,788 m. in 1924: the Canadian Pacific Railway alone increased its mileage in Canada from 10,247 to 15,054. The prairie provinces of Manitoba, Saskatchewan and Alberta doubled their mileage, and accounted for 8,200 m. of the increase, whilst British Columbia, with an increase of some 2,500 m. progressed even more rapidly. The rate of growth has been, however, more rapid than the expansion of population, the number of miles per 1,000 inhabitants having increased from 3.52 to 4.42, an abnormally high figure. A feature of the Canadian railways is the large amount of mileage owned in the United States. In 1924 the Canadian Pacific had 5,117 such miles and the Canadian National 2,093 miles.

The following comparative figures show the growths in traffic, etc., from 1911 to 1924:—

	1911	1924
Revenue tons carried . .	79,884,000	106,429,000
Revenue tons mileage . .	16,048,478,000	30,513,819,000
Passengers	37,098	42,922
Locomotives	4,219	5,857
Passenger cars . . .	4,513	6,849
Freight cars	127,158	226,163
Capital investment . .	$1,648,305,000	$3,413,866,000
Gross earnings . . .	$188,733,000	$445,924,000
Operating expenses . .	$131,034,000	$382,484,000
Operating ratio . . .	69·4%	85·8%
Number of employees . .	141,224	169,970
Salaries and wages. . .	$74,614,000	$239,864,000

Over half the increased capital is accounted for by additional expenditures of the older government lines, the construction of the National Transcontinental and government advances to lines absorbed in the Canadian National. The remainder is chiefly in the form of securities in the hands of the public. The year 1924 was hardly a typical year in consequence of the poor harvest, and 1925 showed a great improvement in the operating ratio.

The railways have a much improved record for safety, as the following figures show:—

	1911	1924
Passengers killed 1 in	1,300,000	2,200,000
Employees killed 1 in	620	1,330

Whilst the Canadian Pacific has continued its expansion on sound lines and has maintained its dividends at 10%, it has now to meet the competition of two trans-continental lines organised as a government company and backed by the credit of the state. The Canadian National system is composed of the Intercolonial, the National Transcontinental, the Grand Trunk, the Grand Trunk Pacific and the Canadian Northern railways. The last named came under government control in March 1917, the Grand Trunk Pacific in March 1919 and the Grand Trunk in May 1920. The consolidation was rendered necessary by war financial stringency coming on the top of reckless over-building. Between 1918 and 1925 the roads composing the system had $674,975,273 invested in them, $534,026,156 of which was advanced by the government. In 1924 the system had an operating surplus of $17,244,000, but this meant a final deficit after interest had been paid of $54,860,419, only $497,656 less than the deficit in 1919 on the constituent lines. The operating surplus increased to $32,264,000 in 1925, but the final deficit was still heavy. Electric railways have developed considerably, the mileage increasing from 1,223 in 1911 to 1,736 in 1923.

The growth in the use of motor vehicles has been very rapid, the number registered increasing from 21,519 in 1911 to 653,121 in 1924. This expansion has necessitated a large expenditure on roads and, under the Canada Highways Act, 1919, the Dominion provided $20,000,000 to assist the provinces in road building. Grants are usually 40% of the cost of construction or improvement. By the end of 1925 some 8,000 m. had been or were being, constructed. The revenue for roads is assisted by registration and licence duties for motor-vehicles, chauffeurs, dealers, etc., each province having its own scale.

Shipping.—One of the most interesting features of Canadian development during the War period was the growth of shipping facilities for Canada's overseas trade. The phenomenal growth of her mercantile marine was indicative of the country's progress, but during the immediate post-War period construction of cargo steamers by the government outstripped the requirements of trade. In 1923 the tonnage of ships of Canadian registry totalled 1,230,830 tons as compared with 896,965 tons in 1911. In 1924 the Canadian Pacific operated, on lakes and ocean, a steamship service of 60 vessels, including car ferries. The National Board, under the name of the Canadian Govt. Merchant Marine, operated a fleet of 45 ocean steamships, which, however, involved the government in substantial losses.

The tonnage of traffic on the canals dropped from 38,030,353 tons in 1911 to 12,869,097 tons in 1924, mainly due to the transfer of traffic from the Canadian Sault Ste. Marie Canal to the United States Canal. Only the Welland and St. Lawrence Canals are holding their own. In 1925 a new Welland Canal with a depth of 30 ft. was being built, and a joint board of Canadian and United States engineers was investigating a similar waterway from the ocean to the head of the Lakes.

Telegraphs and Aviation.—The telegraph wire mileage increased from 168,017 in 1912 to 316,113 m. in 1924. In the field of wireless the stations in 1924 totalled 33,456, of which 31,609 were amateur receiving stations. Commercial aviation has received considerable attention, aeroplanes being of particular use as means of communication and transport with the northern areas not yet linked up with the railway system. In 1923 there were 69 licensed aircraft, by which 2,238 passengers and 17,600 tons of freight and express matter were carried. The aeroplanes are also employed in locating forest fires. (E. W. BE.)

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CANADIAN LITERATURE, ENGLISH (*see* 5.165). The literary history of Canada 1910–25, although it falls into three fairly well-defined periods—pre-War, War and post-War—may now be dealt with more conveniently as a whole. Of books relating to or growing out of the World War, most have been of ephemeral interest. Perhaps the best general survey is *Canada in the Great World War* (1917–21).

The most important achievement of the period was the publication of *Canada and Its Provinces* (1913, etc.), a comprehensive history of the country in 23 volumes, edited by Dr. A. G. Doughty and Dr. Adam Shortt, and counting among its contributors most of the recognised authorities in Canadian history, biography and economics. Another notable essay in Canadian history was the series known as the *Chronicles of Canada* (1920), in 32 volumes, edited by George M. Wrong and H. H. Langton, a series designed to present in attractive and at the same time authoritative form the outstanding events of Canadian history. A new and revised edition, with several additional volumes, of *The Makers of Canada*, is in course of publication, including an *Encyclopaedia of Canadian History*.

Of individual works, in history and biography, the more important were H. P. Biggar's *Voyages of Jacques Cartier* (1924), J. S. McLennan's *Louisbourg* (1918), Chester Martin's *Lord Selkirk's Work in Canada* (1916), G. C. Davidson's *North West Company* (1918), William Wood's *In the Heart of Old Canada* (1913), George M. Wrong's *Fall of Canada* (1914), James Douglas' *New England and New France* (1913), Goldwin Smith's posthumous *Reminiscences* (1910), *Life and Opinions* (1913), and *Correspondence* (1913), all edited by Arnold Haultain, Sir Richard Cartwright's *Reminiscences* (1912); the lives of Lord Strathcona by Beckles Willson (1915) and W. T. R. Preston (1914), O. D. Skelton's *Sir Alexander Galt* (1920) and *Sir Wilfrid Laurier* (1921), Sir Joseph Pope's *Correspondence of Sir John Macdonald* (1921), Sir Charles Tupper's *Recollections of Sixty Years in Canada* (1914), Mrs. Skelton's *Thomas D'Arcy McGee* (1925), L. J. Burpee's *Sir Sandford Fleming* (1915), John Boyd's *Sir Georges Etienne Cartier* (1914), Sir John Willison's *Reminiscences* (1919), E. M. Saunders' *Life of Sir Charles Tupper* (1916), Harvey Cushing's *Life of Sir William Osler* (1925), James Mavor's *My Windows on the Street of the World* (1924).

Of agencies which, each in its own way, have been making for the development of intellectual life and scholarship in Canada, none have been more important than the Public Archives, the Royal Society, the Champlain Society, and the Canadian reviews. The Archives perform a triple service, in collecting and safeguarding the manuscript treasures of Canada, in affording facilities for research to students and in publishing selected documents from the unrivalled collections. The Champlain Society devotes itself to the publication of important works bearing upon Canadian history, and the reprinting of old works in the same field. Among its publications are J. B. Tyrrell's editions of Hearne's *Journey* (1911), and David Thompson's *Narrative of his exploration . . .* (1916), Arthur G. Doughty's edition of Knox's *Historical Journal* (1914–6), Grant's and Biggar's edition of Lescarbot's *New France* (1911), William C. H. Wood's *Canadian War of 1812* (1920–3), and H. P. Biggar's *Champlain* (1922, etc.) (to be completed in six volumes), all admirable examples of Canadian scholarship. The Royal Society, in literature as well as in science, has become a stimulating influence in Canadian life. The *University Magazine* (which has since ceased publication), *Dalhousie Review* and *Canadian Historical Review* have afforded an invaluable medium for the publication of thoughtful and timely articles.

In imaginative literature, the outstanding books of verse of the period are Bliss Carman's *April Airs* (1916) and *Far Horizons* (1925), William Wilfred Campbell's *Sagas of Vaster Britain* (1914), William Henry Drummond's *Poetical Works* (1912), Marjorie L. C. Pickthall's *Drift of Pinions* (1913) and *The Lamp of Poor Souls* (1916), Frederick George Scott's *Poems* (1912), Duncan Campbell Scott's *Beauty of Life* (1921), Arthur J. A. Stringer's *Open Water* (1914), John McCrae's *In Flanders Fields* (1919), Norah Holland's *Spun Yarn and Spindrift* (1918) and *When Half Gods Go* (1924), Beatrice Taylor's *White Winds of Dawn* (1924), Charles Roberts' *New Poems* (1919), Louise Morey Bowman's *Dream Tapestries* (1924). In 1913 Dr. Wilfred Campbell brought out his anthology, the *Oxford Book of Canadian Verse*, and in 1916 Sir Andrew Macphail his *Book of Sorrow*. Here may also be mentioned the collection of *Folk Songs of French Canada* by C. M. Barbeau, translated by Edward Sapir (1925).

Fiction.—In fiction, probably the outstanding figure of the period is Mrs. L. Adams Beck, of Victoria, who writes fascinating tales of the Orient under her own name, and equally delightful historical stories under the pen-name of E. Barrington. Frederick William Wallace has written a number of stories, long and short, of the deep sea fishermen of Nova Scotia and the glorious days of the "Bluenose" clipper ship. In the Prairie provinces, a rather remarkable group of Scandinavian-Canadian novelists has been doing excellent work in the interpretation of the life of their people in the novel environment of the Canadian west. The outstanding names in the group are Martha Ostenso, Philip Grove and Laura Salverson. Of the older novelists, Sir Gilbert Parker, Ralph Connor (C. W. Gordon), Arthur Stringer, Harvey O'Higgins, Basil King and L. M. Montgomery must at least be mentioned. An exceptionally effective group of short stories is Marjorie Pickthall's posthumous volume *Angels' Shoes* (1923).

Children's books of distinct merit are Cyrus MacMillan's *Canadian Wonder Tales* (1918) and *Canadian Fairy Tales* (1922), Isabel Ecclestone MacKay's *The Shining Ship* (1918), T. S. Marquis' *The King's Wish* (1924), Marshall Saunders' *Jimmy Goldcoast* (1924), Helen B. Sandwell's *Valley of Colour Days* (1924), and the animal stories of Charles Roberts and Ernest Thompson Seton.

Essays in a variety of subjects are Sir Robert Falconer's *Idealism in National Character* (1920), J. L. Morison's *British Supremacy and Canadian Self-Government* (1919), W. L. Mackenzie King's *Industry and Humanity* (1918), R. M. MacIver's *Labour in the Changing World* (1919), G. M. Wrong's *The United States and Canada* (1921), W. G. Smith's *Canadian Immigration* (1920), A. H. Reginald Buller's *Essays on Wheat* (1919), W. H. Blake's *Brown Waters* (1915) and *In a Fishing Country* (1922), C. M. Barbeau's *Indian Days in the Canadian Rockies* (1923), A. MacMechan's *Old Province Tales* (1924), and *Headwaters of Canadian Literature* (1924), V. L. O. Chittick's *Thomas Chandler Haliburton* (1924), R. P. Baker's *History of English Canadian Literature to Confederation* (1920), Stephen Leacock's *Nonsense Novels* (1911), and *Sunshine Sketches of a Little Town* (1912), Lloyd Roberts' *The Book of Roberts* (1924), W. B. Basil King's *The Conquest of Fear* (1921), Peter McArthur's *In Pastures Green* (1916) and *Around Home* (1925), the last-mentioned published posthumously. (L. J. B.)

CANADIAN LITERATURE, FRENCH (*see* 5.167a).—The literary revival which took place in the 20th century continued to exert its influence in the period 1910–26, with Quebec and Montreal as the chief centres of intellectual activity.

Belles Lettres.—The most striking characteristic, however, was the increase in output of the more purely intellectual writing—philosophical, sociological and critical. Mgr. Louis Adolphe Paquet, a professor at the Laval University, perhaps produced the soundest and best written work of this kind. *L'organisation réligieuse et le pouvoir civil* (1912), *L'action réligieuse et la loi civile* (1915) *and Etudes et appréciations*, 4 vol. (1917–22), dealing with social science and apologetics, are among his publications. Other writers on sociology and political economy were Henri Bourassa, the nationalist leader, and Edouard Montpetit, of Montreal University. Mgr. Camille Roy also continued to publish works of literary criticism. These include *Nouveaux essais sur la littérature canadienne* (1914), *Erables en fleurs* (1923) and *A l'ombre des erables* (1924). Henri d'Arles also assisted in the development of this *genre*. The result of this movement was to attract the attention of the public to the writers of French Canada and the creation of an indigenous literature, expressed in both prose and verse. Adjutor Rivard and Frère Marie-Victorin, the former in *Chez nous* (1914) and *Chez nos gens* (1918) and the latter in *Récits* (1919) and *Croquis laurentiens* (1920), wrote delightfully on French Canadian life.

Fiction.—Canadian novelists who formerly confined themselves to descriptions of the life and customs of their country tended to produce novels on serious questions and historical romances; but the only work of outstanding merit in this period is *L'appel de la race* (1922), by Alonié de Lestres (abbé L.-A. Groulx).

Poetry.—The school of poets which grew up in Montreal during the former period gradually dispersed. The members were united by no common inspiration, and therefore went their several ways. Albert Lozeau, who published in 1907 *L'âme solitaire*, produced a further two volumes of poems, *Le miroir des jours* (1912) and *Lauriers et feuilles d'érables* (1916), together with a prose series in three volumes, *Billets du soir* (1911, 1912 and 1918), the subtle and delicate style recalling that of his poetry. Paul Morin, in his *Le paon d'émail* (1911) and *Poèmes de cendres et d'or* (1922), displayed a talent, new to Canadian poetry, for describing beauty for beauty's sake as revealed in form and colour. Jean Charbonneau in *Les blessures* (1912) and *Les prédestinées* (1923); Albert Dreux in *Les soirs* (1910) and *Le mauvais passant* (1920); Englebert Gallèze in *Les chemins de l'âme* (1910) and *La claire fontaine* (1913); and Hector Demers in *Les voix champêtres* (1912) have each in turn sought inspiration in the soul and in nature. But Quebec has produced the better nature poets. The scenery, the quaint customs, the retired life, of the Gaspé peninsula have been best interpreted by Madame Blanche Lamontagne, whose principal works are: *Les visions gaspésiennes* (1913), *Par nos champs et nos rives* (1917) and *La vieille maison* (1920). Alphonse Desilets of Quebec describes the same scenes without quite the same charm in *Mon pays, mes amours* (1913) and *Dans la brise du terroir* (1922). M. l'abbé Arthur Lacasse mingled religious poetry with natural description in his *Heures solitaires* (1916) and *L'envol des heures* (1919).

History.—Historical studies however occupy the first place in the prose of this period. Historians, already noteworthy in the preceding period, continued their work. A general study of the history of the Catholic Church in Canada by August Gosselin was published in the form of monographs on the Bishops of Quebec. This work, which was begun in 1910, was cut short in 1918 by the death of the author. Two professors of the Laval University of Quebec have done some very valuable research. Mgr. Amedée Gosselin, in his *L'instruction au Canada sous le régime français* (1911), made an interesting contribution to a little known subject. M. Thomas Chapais published in 1911 an excellent biographical study of the Marquis of Montcalm, who was defeated by Wolfe on the Plains of Abraham, outside Quebec, in 1759. In 1916 M. Chapais inaugurated, at the Laval University of Quebec, a course of lectures on English rule in Canada. They were published in a collected edition, *Cours d'histoire du Canada* (4 vol., 1919–23), and form a detailed political history of the country from 1760–1850. Although illuminated by a fervent French-Canadian patriotism, his method throughout is objective, and his conclusions carry great authority.

While M. Chapais was writing in Quebec the story of the English dominion, M. Lionel Groulx was delivering at Montreal University lectures on Canadian history more controversial in tone. Among those lectures, the following were published: *La Confédération Canadienne* (1918), *La Naissance d'une Race* (1919), *Lendemains de Conquête* (1920), *Vers l'Emancipation* (1921). The conclusions arrived at tend to be biased by the extreme nationalism of the author, but the work is enlivened by his vivid imagination and keen perceptions.

The work of the theatre is almost negligible. This form of literature appears to find difficulty in flourishing in Canada. French Canadian literature is launching out, however, in many other directions. A higher level of general culture and intelligence is providing native writers with an increasing public, and the universities of Quebec and Montreal have done much to enlarge the field of French-Canadian letters.

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CANAL: *see* RIVER AND CANAL ENGINEERING.

CANALEJAS, JOSÉ (1854–1912), Spanish politician, was born in Ferrol July 31 1854. Coming of a middle-class family, he graduated in 1871 at the University of Madrid, took his doctor's degree, and became in 1873 lecturer on literature. He entered his father's engineering works as general secretary and studied railway problems, but continued his literary work, publishing a history of Latin literature in two volumes. He was early attracted to politics, first as a Republican, then as a Liberal. Deputy for Soria in 1881, he became under-secretary for the Prime Minister's department in 1883, then Minister of Justice (1888), of Finance (1894–5), president of the Chamber in the Moret Administration, and Prime Minister and chief of the Liberal party in 1910. He was still in office when he was murdered in Madrid Nov. 12 1912. Canalejas was a remarkably consistent statesman. He believed in the possibility of a monarchy adopting a thorough-going democratic policy both in economic and in all civil and political matters. A sincere Catholic, he was nevertheless a strong anti-clerical, and a champion of the rights of the state against the encroachments of the Church.

CANBERRA, AUSTRALIA.—In 1909 the Commonwealth Govt. acquired from New South Wales an area of 912 sq. m. for the purpose of establishing a new federal capital. The territory is situated some 150 m. southwest of Sydney and 60 m. direct from the east coast. It is traversed by the Murrumbidgee and Molonglo rivers, on the latter of which is the site for the Federal capital itself. In 1913 a further area of 28 sq. m. was acquired at Jervis Bay, 70 m. east-north-east of Canberra, to be used for a port. The right to join the two places by a railway accompanied the transfer.

The actual vesting of the larger area in the Commonwealth Govt. dated from Jan. 1 1911, and the Jervis Bay area was formally taken over by an Act of 1915. The plan for the new capital was adopted after world competition, and before building was begun a water supply was provided by impounding the Cotter river. After the official commencement of work on March 12 1913 the main lines of the city were laid out and a considerable amount of afforestation was done, but this was practically stopped between 1916 and 1920.

In 1923 the director-general of works moved to Canberra and work was begun on Parliament House, which was nearly completed in 1926, and it was expected that Parliament would meet there in 1927. By the beginning of 1926 a considerable number of roads had been metalled and many miles pegged out; a number of bungalows and two hotels had been built in the residential quarters to accommodate the state officials; and a power house with a capacity of 1,350 kw. was supplying power and light to the brick, tile and cement works, carpenters' shops, houses and camps. Parks and avenues had been planted, sewage works and reservoirs constructed; and a school built at Telopoea Park. The railway from Queanbeyan to Canberra was opened for goods traffic in 1914, and for passengers in 1923. Before 1925 it had been extended to the power house and beyond, about eight miles in all. A survey had also been made for the line to Jervis Bay.

The estimated population of the Federal Territory in 1924 was 3,677. Much of the land not required for the capital had been let on lease, about 24,000 ac. of it to ex-soldiers. The plan was to classify the whole of the lands in the territory with a view to granting them out on long leases, those referred to above being short leases of from 5 to 25 years.

CANCER RESEARCH (*see* 5.175).—This subject falls naturally into two periods divided by the beginning of the present century. From 1850 to 1900 investigation was on the clinical and anatomical sides and the great work of Virchow between 1850 and 1860 upon cellular pathology and upon the malignant new growths laid the foundation of our present knowledge concerning cancer. When it is remembered that staining methods for microscopical purposes were not introduced until about 1872. the accuracy of Virchow's descriptions becomes even more remarkable. Virchow laid great stress upon the importance of chronic irritation in the causation of new growths and in large measure this view still holds the field. Reference is made to it later. The rival theory put forward by Cohnheim about 1880 that new growths arise from embryological remnants included within the tissues owing to some slight error in development has, at the present time, few adherents. In the case of certain special varieties of tumour (teratomata, cysts), however, it is held to be a sufficient explanation.

Main Divisions.—As examination of cancer proceeded it became clear that it is not a single disease but rather a group of diseases having certain features in common. First there came the great division into (1) the carcinomata, growths built up on the type of squamous, columnar or spheroidal epithelium and (2) the sarcomata, growths built on the type of one of the members of the connective-tissue group. To these were added later (3) the endotheliomata, a group of somewhat undetermined characters, which are regarded as being derived from the flattened cells that line lymph spaces or channels or blood-vessels. In this way there has become recognised a long series of malignant growths with more or less defined microscopical characters.

Special Divisions.—Later it was found that the three main groups mentioned above were insufficient to include certain varieties of tumour arising in special organs, *e.g.*, muscle, lymphatic glands, testicle, adrenal, sympathetic ganglia, and special terms were applied to new growths originating in these parts. It was shown, further, that in some degree it is possible to correlate clinical with histological features, particularly so far as the primary growth is concerned. Thus it is probable that a primary cancer of external skin or of the lining to the alimentary tract between the lips and the lower end of the oesophagus will be a squamous-cell carcinoma, of intestine will be a columnar-cell carcinoma, of bone will be some variety of sarcoma, of cerebral meninges or of pleura will be an endothelioma. These tumours will breed true so that if secondary growths (metastases) are produced they will within limits, resemble the parent growth in histological characters.

Local or Constitutional Origin.—To this 19th-century period also belongs the great controversy whether the malignant growths are manifestations of a local or of a constitutional condition. The controversy is important in that treatment must depend largely upon the view held. If the disease be local in its origin it will be possible to eradicate it by surgery so long as it is dealt with before it passes from the local condition and becomes generalised. If, on the other hand it be a manifestation of a constitutional or blood condition, local surgery must be ineffective. The local view received and still receives the greatest amount of assent, but it is becoming more generally accepted, even by those who hold that cancer depends upon local mechanical irritation, that some biochemical change of the tissues is necessary and that this change may be brought about by conditions affecting the body as a whole.

Bacteriological Results.—The remarkable results of bacteriological research about 1880, too, were not without effect, for attempts were made to show that cancer depends upon a micro-organism. That micro-organisms were cultivated from new growths is certain, but the varieties were so diverse that, no doubt, they depended upon faulty technique or upon prior and accidental infection of the growth. Moreover, inoculation of these micro-organisms into animals failed to produce new growths, though in some instances tumour-like collections of inflammatory cells (torulae) resulted. It is now generally agreed that no bacillus or micrococcus in the accepted sense of those terms is the cause of cancer.

Cancer not "Infectious."—Again, certain appearances met with in microscopical sections were regarded by their discoverers as being of an animal nature, parasitic and causative of the condition. It is now agreed that these appearances are due to the inclusion of tissue debris in living cells. It follows from what has been said above, that cancer is not an infectious disease in the sense that tuberculosis, diphtheria, typhus fever and malaria are infectious diseases. Many enquiries were carried out upon the subject of " cancer houses " and " cancer localities." Examples were adduced in which several persons inhabiting a single house or numbers dwelling in the same locality were said to have died of cancer. Careful examination, however, failed to show that they could not be explained by the average age distribution of the population, by improved diagnosis or by errors of random sampling. While, therefore, there is nothing to show that special cancer houses and localities do not exist, there is no satisfactory proof of their occurrence.

The Present Century.—Since the year 1900 cancer research has entered upon a new phase largely owing to the fact that modern experimental methods have been adopted. Special laboratories devoted to cancer research were instituted and within a few years were at work at the Imperial Cancer Research Fund, The Middlesex Hospital, The Cancer Hospital (London), The Christie Hospital (Manchester), The Royal Cancer Hospital (Glasgow), The Samariterhaus (Heidelberg), The Crocker Foundation, The Memorial Hospital, The Rockefeller Institute (New York City), The Gratwick Foundation (Boston, Mass.). Recently a large institute for cancer research has been opened at Buenos Aires. In addition, associations for the study of cancer have been founded in several countries. These associations differ somewhat in their aims, but in most instances through their agency statistical and sometimes laboratory investigations are being carried out. The most important of these associations are the Cancer Sub-committee of the Health Section of the League of Nations, which, of course, is international; the Cancer Committee of the Ministry of Health in Great Britain; The British Empire Cancer Campaign; local committees in Manchester, Liverpool, Birmingham, Leeds; l'Association Française pour l'Étude du Cancer; Komite für Krebsforschung and similar bodies in Belgium, Holland, Austria and Japan. It must be understood that the institutions and associations mentioned above are exclusive of numerous bodies such as The Medical Research Council, various universities and teaching hospitals which further cancer research as part of their general activities, and often to a considerable degree, but have no special department devoted to the subject. One of the most recent decisions of The British Empire Cancer Campaign is the foundation of a *Journal of Cancer Abstracts and Reviews* in which publications directly or indirectly bearing upon the cancer problem will be analysed.

Passing now to consideration of the results obtained by this mass of workers on cancer during the first quarter of the 20th century it may be said that much of the labour has been spent on clearing the ground.

Heredity in Cancer.—In Chicago a laboratory was built and equipped on the most approved plan for investigating the question of heredity and cancer in mice. From three original mice, stocks were raised ultimately numbering many thousands of which the full history of each individual from birth to death was recorded including an account of the autopsy. The experiment has been in progress for some 20 years and by special breeding Miss Maud Slye has produced two strains, all members of which and no members of which, respectively, suffer from new growth. She has also produced familial proclivity to new growths of a special type, *e.g.*, squamous-cell carcinoma, or affecting a special organ, *e.g.*, the liver. From these experiments there can be no doubt that a hereditary factor obtains in cancer, but it is only by controlled work of the kind mentioned and intense inbreeding that its existence can be demonstrated. Even in so segregated a population as that of Gol and Hemsedal, two parishes on the eastern slope of the mountains in the centre of Norway where intermarriage is common, the most that a study of 5 large cancer families in which 367 deaths had occurred between 1902 and 1921 showed was that the crude mortality rate from cancer for persons over the age of 35 was 18·2% for these families compared with 12·1% for the total population.

Other Statistical Enquiries.—Much time has been spent and many papers have been published on the question whether the incidence of cancer is increasing. It cannot be said that this question has been settled beyond dispute. Increased notification of deaths from cancer has undoubtedly occurred in practically all countries, but how far correction of the annual figures has to be made for increase of population, improved diagnosis, improved standard of health whereby a larger portion of the population reaches the cancer age, improved education and means of transport whereby a larger proportion of the population comes under observation and treatment, it is impossible to say. Nevertheless it is the opinion of most authorities that even if due allowance be made for all these factors there is still evidence of a gradual increase in the incidence of cancer particularly at more advanced ages. The opinion often expressed that cancer affects persons at an earlier age than formerly is apparently without sound foundation.

Primary Sites.—Statistical enquiries in various countries have shown that the commonest primary site of the disease differs considerably. Thus in England and Wales notified deaths from cancer of uterus and of breast are more numerous than from gastric cancer whereas the reverse is the case in Holland and Italy. This observation has been made the subject of exhaustive enquiry by the Cancer Sub-committee of the Health Section of the League of Nations with the result that it is fully substantiated but all endeavours to correlate it with habits of the respective peoples has failed entirely. It is said that the same peculiarity concerns descendants of the same nationalities when they have emigrated to another country and this point is receiving attention at the present time.

Duration of Cancer.—Another useful statistical enquiry concerns the natural duration of the untreated disease from reputed onset to death. Papers have been published giving the information derived from four different institutions in Great Britain. These have been collected and analysed statistically by the Cancer Committee of the Ministry of Health and present a base line against which all forms of treatment can be measured.

Distribution by Races.—Enquiries in all parts of the world have shown that cancer affects all races of mankind and examination of lower animals has demonstrated its occurrence in them also. It may not be, and certainly in the case of lower animals is not the fact, that all species and varieties are affected with equal frequency. Thus the mouse is the subject of cancer more frequently than the rat, and the rabbit and guinea-pig are far less frequently affected than either. Inasmuch as dogs, cats, horses and cattle are relatively more frequently attacked by cancer it is considered that it is a disease of domestication. Similarly there appears with great probability to be a higher incidence of cancer in the more civilised races of mankind.

Experimental Transmission by Grafts.—The observation that cancer affects the lower animals has rendered experimental work possible. The fact was first shown 40 years ago by Hanau who successfully transplanted a squamous-cell carcinoma from the vulva of a rat into the peritoneal cavity of other rats. Ten years later Morau succeeded in transmitting a mammary adenocarcinoma from a white mouse to other white mice. For many years the indications afforded by these experiments were not followed up, in part because of a doubt how far the analogy between growths in these lower animals and cancer affecting man holds good. Extensive research, however, carried out mainly by the Imperial Cancer Research Fund, proved clearly their essential similarity, and from that time much knowledge has accrued from the experiments on malignant tumours of the mouse and rat. Amongst the conclusions reached was that on the rigorous specificity exhibited by growths. Thus a tumour of the mouse will not grow if inoculated into the rat or vice versa. Under special conditions temporary growth may occur in those cross inoculations, but these exceptional cases do not invalidate the truth of the general statement.

Susceptibility and Resistance.—As might be expected much work has been done on the question of susceptibility and resistance to transplanted grafts in the hope that it might throw light upon treatment in man. Important differences were shown to obtain between spontaneous growths in respect of the ease or difficulty with which they can be transplanted into other animals of the same species. In some cases grafts take in nearly 100% of experimental animals, in others failure is consistent, even with the greatest care. It was found, however, that inoculation of a graft beneath the skin of the animal bearing the primary tumour (autologous grafting) is almost always successful. This indicates some peculiarity of the animal bearing a spontaneous tumour, but so far the difference has eluded explanation.

Blood Content.—It has been suggested that there is a larger amount of potassium in the blood and tissues of an animal bearing a spontaneous tumour. Supporting this view are the observations (*a*) that the blood and tissues of persons suffering from cancer contain more potassium than those of persons suffering from non-malignant diseases and (*b*) that if the potassium content of the blood of mice be raised by feeding them with potassium metaphosphate, transplanted grafts of a mouse carcinoma take in a larger proportion of cases, appear earlier and grow at a more rapid rate.

Immunity.—An important observation, repeatedly confirmed, is that if an animal spontaneously recover from a transplanted tumour it is immune to subsequent inoculations with the same tumour. This has been made the basis of innumerable attempts on the curative side, the most important of which consists in removal of a portion of the tumour, irradiation to a degree just sufficient to prevent growth of the cells on re-inoculation and then introduction of the irradiated mass beneath the skin of the original patient. In experiments on rats the method has been shown to confer a good degree of resistance against growth of inoculated grafts, though it is not so effective against established tumours. It has been found, also, that the tissue into which the irradiated mass is introduced is not without importance, introduction into liver or spleen being more effective than beneath the skin. Subcutaneously the method has been applied in man but the results are not conclusive.

In all experiments upon resistance and susceptibility to cancer a great subject of difference amongst workers lies in their view as to the essential factor concerned. Some investigators hold that it is the fluids of the body that are of importance, the cellular elements being subsidiary. For others the cells, and particularly the lymphocytes, are the prime factor in resistance; if the particular line of treatment adopted be associated with accumulation of lymphocytes locally, resistance is high; if lymphocytes be few or absent, resistance is low. Experiments can be adduced supporting or refuting either contention but if it be allowable to use the analogy of immunity and susceptibility to bacterial disease it may well be that tissue fluids and tissue cells take varying parts in the process according to circumstances as yet hardly understood.

Serum Treatment.—Here it is convenient to consider attempts at treatment of cancer by various sera. Influenced by a belief in the microbial causation of cancer and the efficacy of antisera produced against such a disease as diphtheria, earlier workers had endeavoured without success to treat the disease by injection of ascitic or other serous fluids derived from cancer patients. More recently attempts have been made in the laboratory to produce an antiserum by the usual methods and test its efficiency against cancer cells growing *in vitro*. The growing cancer cells were found to be killed almost instantaneously by this antiserum whereas normal cells were unaffected and the method was applied *in vivo*, with the addition that contact between the antiserum and the cancer cells was rendered more intimate and prolonged by combining venous and lymphatic obstruction with introduction of the antiserum. Grafts were inoculated into the hind feet of rats and when they had reached a certain size the antiserum was introduced in the neighbourhood of one of the growths and was held in position to a large degree by constriction of the thigh. In a large proportion of cases the growth in this foot underwent absorption and not only so but at a little later date the growth in the other foot also disappeared. It would seem that the antiserum led to absorption of the growth to which it was locally applied and that in accordance with the general principle that absorption of a cancerous mass in an animal is associated with increased resistance to the same type of growth, absorption of the first growth in the treated foot led to absorption of the second growth in the untreated foot.

Criticisms.—The main criticisms of these important observations are (1) that the growth treated was of the transplanted and not of the spontaneous variety, (2) that the foot is by reason of its small size, large amount of bone and tendon, and smallness of its blood-vessels a region naturally somewhat unfavourable to growth of a transplanted tumour and (3) that the constriction, which, apparently, is essential to success, is itself an abnormal condition and might well turn the scale against a growth that was struggling for existence or at least was not growing freely. Workers with these animal tumours know well how widely the behaviour of grafts varies even under conditions that are apparently identical. Although the experiment is of great interest and full of suggestion it must not be assumed at present that it paves the way to an analogous treatment of cancer in man.

Tissue Culture in Vitro.—This method was popularized by Carrel. By its means it is possible to determine the action of various agents under controllable conditions. The technique itself is delicate. Originally the portions of living tissue were cultured in plasma, but the method has been simplified by adoption of a modified Ringer's solution with the addition of embryonic tissue juice. Subcultures must be made every two or three days, but under suitable conditions tissue can be kept alive and growing for prolonged periods. In 1922 the description was given of a ten-year old strain of fibroblasts originally obtained from the heart of a chick embryo and then in the 1860th generation; increase in size under the artificial conditions was as rapid as at first. Besides fibroblasts, large mononuclear cells and cartilage cells, each in pure culture, cardiac muscle from chick, duck, frog, etc., tissue from kidney, thyroid and from various animal tumours has been cultivated. It has been shown that foetal tissues are capable of growing *in vitro* 72 hours after death of the animal and in 1924 evidence was adduced that spleen, liver, kidney, ovary, lung and cornea from adult animals may develop *in vitro* many hours after death. The development very likely proceeds from surviving cells perhaps activated by the autolytic products of the dead ones. A remarkable point was shown in connection with *in vitro* cultures of kidney. It was possible to obtain cultures of fibroblasts or of renal cells and in each instance growth took place in all directions with production of a solid mass. But if fibroblasts were introduced into a mass already containing proliferated renal cells a tubulation occurred that recalled the microscopical structure of the kidney. This experiment may be correlated with the observation that in the growth of a transplanted tumour graft the stroma is furnished by the host and therefore that the microscopical appearance of the growth is determined largely by the fibrous tissue.

Experiments on Aetiology.—The frequency with which cancer of the tongue is associated with a jagged tooth or an ill-fitting denture, cancer of the lip with smoking of clay pipes, the occurrence of cancer of the skin in workers with paraffin and tar, of soot cancer in chimneysweeps, arsenic cancer, kangri cancer amongst the Kashmiri users of the kangri basket, cancer of the cheek amongst betel-nut chewers, cancer of the bladder in workers with anilin and around the parasitic ova in persons infected with bilharzia, are examples where irritation caused by a mechanical agent seems to bear a causal relation to the cancer.

X-Ray Cancer.—Of recent years X-ray cancer has been added to the list, and there is reason to believe that cancer of the skin may result from prolonged exposure to the gamma rays of radium. Lazarus Barlow has found minute quantities of radium to exist in a large proportion of cancers examined for the purpose, and produced in the gall bladders of rabbits a condition indistinguishable from cancer by introducing into the gall bladder human gallstones into which small quantities of radium had been introduced artificially.

Irritation and Cancer.—Subsequently Leitch produced cancer of the gall bladder in guinea-pigs by the use of gallstones or of small pebbles. The exact relation of the chronic irritation to the subsequent cancer is unknown, and there is no doubt that in an even larger number of cases chronic irritation occurs without any subsequent development of cancer. In most instances the chronic irritation must persist over a number of years and the actual cancerous condition is preceded by the formation of warty outgrowths and other local manifestations of cell destruction accompanied by cell proliferation.

Tar Cancer.—In the case of tar a cancerous condition has been produced in mice and rabbits, but hitherto never in rats, by repeated local painting with coal tar. The cancer is of the squamous variety and runs a normal course. Under the same conditions of painting the length of time before cancer supervenes varies between 3 and 18 months for individual mice. An observation that may have important bearings is that when growth has been produced in one part of the body by means of tar it is impossible to produce another cancer elsewhere by the same means. This is complementary to the experience derived from transplanted cancer in which resistance to one variety of new growth may coincide with susceptibility to another variety. Strenuous efforts have been made to isolate the carcinogenic principle in tar and crude paraffin oils but without success. On the other hand "tars" prepared from isoprene and acetylene by distilling at temperatures between 700° and 900° C. were some of the most effective cancer producers yet known. The same was true for "tars" produced by the same temperatures on various tissue derivatives.

Artificial Infection.—Fibiger succeeded in producing cancer of the stomach and tongue in rats by feeding them with cockroaches infected with spiroptera neoplastica, and Bullock and his collaborators produced a malignant condition in rats by feeding them with taenia crassicollis, a tapeworm infesting the cat. The sarcomatous growth occurred round the cysts formed in the liver by the tapeworm and was produced within a few weeks.

The Rous Experiments.—In the attempt to find some common factor behind these widely diverse conditions antecedent to cancer, attention was directed towards observations made by Peyton Rous on a chicken sarcoma that could be transmitted by inoculating with dead cells or, in the absence of cells, by a tumour extract that had passed through a Berkefeld filter. Subsequently Rous found two other varieties of sarcoma in hens which could be transmitted by filtered tumour juice. In each of the three instances the special characters of the original growth were repeated in the experimental tumours. He and his collaborators brought forward strong evidence that the filterable agent was a living but extremely small microbe.

Gye's Two Factors.—Although all attempts to discover a filterable virus in mammalian cancer had failed and successful transplantation can only be carried out by means of living cells, it occurred to Gye that two factors might be concerned in the production of one of these chicken sarcomata, viz., a filterable virus and a specific factor derived from the animal. By special means he separated the two and found that either alone was insufficient to produce a tumour but in conjunction they were effective. He then applied these results to four standard malignant tumours in rats and mice and one human mammary cancer with the result that he obtained from all but one mouse tumour a factor he regards as almost certainly a filterable virus which can replace the virus of the Rous tumour in the production of a chicken sarcoma. The failure to transmit mammalian growths in the same fashion as the Rous chicken sarcoma he ascribes to the more rapid destruction of the mammalian specific factor, probably by oxidation. For the last-mentioned conclusion he has brought forward experimental evidence.

These researches, which are still in progress, have led Gye to ook *on cancer—using the term in its widest sense—as a specific lisease caused by a virus (or group of viruses). Under experimental onditions the virus alone is ineffective; a second specific factor obtained from tumour extracts ruptures the cell defences and enables he virus to infect. Under natural conditions continued irritation f tissues sets up a state under which infection can occur.* The iltered material isolated by Gye and supposed to contain a irus, after subculture, was examined photographically by Barnard with special optical apparatus, ultraviolet light and, where necessary, quartz in place of glass. Barnard obtained and has published appearances of a particular agent in the culture medium which he and Gye regard as the virus under discussion.

Filterable Virus.—This work, without doubt, is of great importance but caution must be exercised in its interpretation. The occurrence of unsuspected minute bodies in what are regarded as normal animals has been shown in monkeys, rabbits and guinea-pigs, *e.g.*, in the work on lethargic encephalitis, and Rivers and Pearce while investigating varicella found in rabbits a filterable virus which, at first thought by them to be that of varicella, proved ultimately to be indigenous in rabbits. This possibility must be eliminated before Gye's observations can be taken to prove that his filterable virus came from the sarcoma as distinguished from the chicken. Moreover Rivers and Pearce also found that rabbits bearing intratesticular growths of a transplantable tumour, first discovered in syphilised rabbits, are immune to their rabbit filterable virus, though the virus infects the growth itself and multiplies therein.

Specific Factors.—It may be that filterable viruses peculiar to certain animals exist but are unable to produce tumours until some "specific factor" is present, or that a filterable virus peculiar to new growths exists but also requires the presence of a specific factor, or it may be that the filterable virus inhabits the tumour and is, in a sense, accidental. It is clear that some stimulus for the increased and atypical multiplication of cells which characterises the new growths is necessary but it seems that much more work is needed before it can be accepted that a filterable virus is aetiologically connected with all varieties of malignant new growth. For the sarcomata—with their many histological and clinical resemblances to infective and inflammatory conditions—causation by a particular filterable virus is more easily acceptable and it will be noted that Gye's experiments, with a single exception, are concerned with sarcomata. The great merit of his work lies in the experimental evidence it affords of the interaction between an extrinsic and an intrinsic factor in tumour formation and the definiteness it aims at giving, at all events in certain instances, to the characters of the extrinsic factor.

Concluding Remarks.—Most of the work on biochemical lines is unsuited for remark here, and of the remainder much consists of diagnostic tests for cancer that have been put forward. Unfortunately none of these has stood the test of time. In view of the general belief that cancer in its earliest stages can often be successfully treated by surgery and of the frequency with which the disease first comes under observation at a stage when operation is impossible, a reliable diagnostic method is urgently needed. X-ray examination has facilitated diagnosis of internal cancer particularly when affecting the alimentary tract, but search must still continue for some chemical test applicable at an early date in the disease. Brief reference must be made to Dawson's recent work on the melanomata; from a consideration of all the data, and especially the pigment-forming function of epithelial cells, he concluded that the melanomata, usually termed melanotic sarcomata, are epithelial and therefore carcinomatous.

Action of Radium.—In treatment, research has been directed chiefly toward the action of radium and X-rays. At first employed empirically the scientific basis of their action is being discovered by degrees. The X-ray spectrum has been mapped out, and by means of apparatus of very high voltage (180–200 kv.) rays of wave-length and penetrating power approximating to the very short waves of gamma radiation have been produced. The biological action of rays of different wave-length has been studied and radiological treatment is becoming more scientific.

There are still wide gaps in knowledge both on the physical and the biological sides and though immediate results can be foretold with some degree of accuracy in certain varieties of cancer, late results often appear to be fortuitous. Upon the whole, however, treatment of cancer by radiation is a method with which the clinician has to reckon. This is more than can be said concerning medicinal or dietetic methods, none of which has been supported so far by evidence that can be regarded as sufficient to warrant its serious consideration. (W. S. L.-B.)

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CANEVA, CARLO (1845–1922), Italian soldier, was born at Tarcento (Friuli) April 22 1845, and entered the Italian Army in 1866. He served in the African campaign of 1897, and in 1902 was promoted lieutenant-general. Caneva commanded one side in the much-discussed manoeuvres of 1911, his opponent being Cadorna and it was probably owing to the result of the manoeuvres, in which Caneva was declared victor, that he was selected to command the Tripoli Expeditionary Force in Oct. 1911. Caneva was given a thankless task, being sent to occupy the coast towns in the belief that the Turkish garrison, unsupported by the tribesmen, could be easily overcome. He was speedily undeceived, and for a time could do nothing, as he had no transport and was hampered by orders from home. In spite of these handicaps he was generally considered to have carried the waiting policy too far. He was recalled in Sept. 1912, and retired shortly afterwards. He presided over the commission that was appointed to enquire into the Caporetto disaster of 1917. He died Sept. 25 1922.

CANNES, CONFERENCE OF (Jan. 6–13 1922), a meeting of the Supreme Council of the Allies with the primary object of considering the Anglo-French suggestions regarding reparations, which had been drafted at the preliminary Conference of London on Dec. 18–22 1921 (*see* LONDON, CONFERENCE OF). At Cannes, however, the reparation question entered on a new phase through being brought into connection with a project for the general reconstruction of Europe, and with another project for an Anglo-French pact. In regard to reparations the conference opened with a criticism of the Anglo-French suggestions by the French Minister of Finance, who was supported by the Belgian representative. After long and complicated discussions this resulted in a modification of the London suggestions, but a deadlock was avoided, and representatives of Germany, as well as the Reparation Commission, were summoned to Cannes to make proposals on the basis of the agreement finally reached as between the Allies.

The wider questions of security and reconstruction were broached by Mr. Lloyd George in a memorandum submitted to M. Briand on Jan. 4, before the formal opening of the Conference. Mr. Lloyd George's thesis was that the three problems of reparation, security and reconstruction were inter-related, and that any general scheme for European reconstruction must include Russia. In the same document he offered to conclude an agreement by which Great Britain would pledge herself to assist France with all her forces in the event of unprovoked German aggression upon French soil. In effect this was an offer to revive the Anglo-French Guarantee Treaty which had been signed simultaneously with the Versailles Treaty (*see* VERSAILLES, TREATY OF) but had not come into force because that had been conditional upon the ratification of the parallel treaty between France and the United States. At the same time Mr. Lloyd George warned M. Briand at the outset that the British Empire would not be willing to incur military commitments in Central and Eastern Europe.

On Jan. 6 Mr. Lloyd George introduced in the Conference a resolution for the convening of a general Reconstruction conference to which both Soviet Russia and the United States were to be invited, and this resolution was adopted by the Supreme Council, together with an outline agenda. Meanwhile M. Briand had been making counter-proposals in regard to the Anglo-French pact. The guarantee, he declared, must be reciprocal, and it must be supplemented by a technical military convention. While this second condition would probably have proved an insuperable obstacle from the British point of view, M. Briand was violently attacked in the French Senate and Chamber, in the belief that he was giving way unduly to Mr. Lloyd George. On Jan. 11 he was recalled to Paris by the President of the Republic, M. Millerand, on the 12th he resigned and therewith the work of the Cannes Conference was brought to a sudden stoppage. Its main results were the provision for the Genoa Conference and the avoidance of a deadlock over Reparations.

See British White Paper, *Resolutions adopted by the Supreme Council at Cannes, Jan. 1922, as the basis of the Genoa Conference* (Cmd. 1621 of 1922); A. J. Toynbee, *Survey of International Affairs, 1920–3* (1925). (A. J. T.)

CANNING (*see* 10.612).—Several factors have tended to develop the food canning industry in various countries of the world during the period 1910–25, and although the United States maintained the leading position, keen competition arose from other foreign countries, particularly from the British Dominions. Undoubtedly the chief cause for the remarkable advance—quite 100% in many countries—was the great disturbance in economic conditions occasioned by the World War, which gave rise to a range of new problems, not only in providing food for the various armies, but in supplying the needs of the people of the various belligerent nations.

I. IN THE UNITED STATES

According to the U.S. Census returns, the value of canned foods packed in the United States increased from $139,000,000 in 1909 to about $550,000,000 in 1923. After due allowance is made for changes in price levels, these figures show that the output of canned foods increased during that period about two and a half times. The quantity of canned fruits, vegetables and soups increased from 41,000,000 cases of 24 cans each in 1909, to 110,000,000 cases in 1923. Corresponding figures for fish, shellfish and meat cannot be given, because quantitative statistics for the pack of 1909 are not available. Canned foods have thus come to occupy a more important place in the diet, which is thereby broadened, and the consumption of seasonal foods is less and less confined to short periods of the year. This increased production was made possible by improvements in canning machinery. Cans which were formerly made by hand were in 1925 made by machine at the rate of 12,000 per hour. Machines developed for the various steps in canning have replaced hand labour, cheapened and speeded up production, and contributed to the sanitary condition of the plant, while the raw product, by means of motor-trucks, is brought long distances to the factories without loss of quality. There has been a pronounced tendency to remove canning plants from large cities, in which the majority were formerly located, to smaller towns, and to establish them in areas producing products to be canned. This makes it possible to can the products within a shorter time after harvesting, and in that way to secure a higher quality.

The method of canning is, briefly, as follows: the raw product, after proper cleansing, peeling, trimming, etc., is placed in the can, usually with sufficient water, syrup or dilute brine to cover the product and facilitate penetration of heat. The raw product or the liquid surrounding it is usually preheated, or else the can is passed through a steam-box or vacuum chamber before sealing, in order that the contents may be heated sufficiently and the can eventually show a substantial vacuum. The can is then sealed and processed (sterilised) in steam or hot water. During the years 1910–25 fundamental changes were made in the character of the cans employed. The soldered can, formerly used exclusively, was largely superseded by the open-top or sanitary can, which is sealed by crimping the ends to the body of the can, the seam being made tight by rubber composition or paper gasket. With this type of can no solder is employed except on the side seam, which is soldered on the outside.

The temperature required for sterilisation varies with the nature of the food to be canned. Acid products, such as fruits, need be heated only for a short time in boiling water, so that all portions of the contents come to a temperature of at least 180° F. The acidity of the fruit suffices to prevent bacterial spores from germinating, and it is only necessary to destroy the vegetative form of bacteria. Substances of lower acidity, such as meat, fish, shellfish and the majority of vegetables, must be heated to a higher temperature in order to destroy bacterial spores. The length of time required for sterilisation depends on the rate at which the heat penetrates the product. Such penetration is most rapid in foods containing a free liquor, and slowest in closely packed solids, and in products of a pasty consistency.

The canning industry has led the way in the organisation of co-operative industrial research, having been the first in the United States to provide for research on such a basis. Laboratories established by the National Canners' Association in 1913 have made fundamental contributions to the knowledge of sterilisation and other processes of manufacture. The Bureau of Raw Products Research, organised later, has been instrumental in greatly increasing the attention given by government and state investigators to the agricultural questions involved in raising crops utilised by the canning industry. In several universities, also, investigations relating to food poisoning and the vitamin content of foods have been financed by the industry, the results of which have appeared in scientific literature. It had been assumed that the nutritive value was diminished by the canning operation, through destruction of the vitamins. These investigations, however, showed that the antiscorbutic vitamin (vitamin C) is destroyed to a less extent by the canning operation than by cooking in an open vessel, as is customary in the home. Canned foods are therefore richer in vitamin C than the same varieties of foods cooked by the ordinary kitchen methods, while retaining the same content of the other vitamins. Broadly speaking, the nutritive value of canned foods is substantially the same as the nutritive value of the same foods cooked in the home from the raw product. (*See* MILK.) (W. D. B.)

II. IN THE BRITISH EMPIRE

The canning industry was of considerable importance in Great Britain during the pre-War period, and a large export trade in canned meats, fish and vegetables had been developed. War demands gave a great impetus to the industry, particularly in the production of canned "rations," hams, etc., for the British and Belgian armies. The export trade, however, was greatly reduced, but it quickly revived after the end of the War. Fruit canning eveloped rapidly in the post-War period, model plants being et up in various parts of the country.

Australia, New Zealand, Canada and South Africa have made onsiderable progress in the canning industry, and during the ost-War period trade has greatly increased. The industry has een in existence in Australia since the last decade of the 19th entury, but the output was principally confined to home requirements to the end of the World War. As a result of the overnment scheme for the settlement of ex-soldiers, canning lays a very important part in the development of the soft fruits ndustry in the Dominions. In several of the states, such, for nstance, as Queensland, New South Wales and Victoria, the espective governments have advanced large sums for the erecion of modern plants with which to deal with the produce of the rchards. Considerable attention is paid to stemming, grading, veighing and packing, and the methods employed make any andling of the fruit unnecessary. War demands stimulated the xports of dried and preserved fruits, and the trade greatly inreased during the post-War period. The following table gives he values of exports of dried and preserved fruits for the years 913, 1917–8 and 1923–4:—

	1913	1917–8	1923–4
	£	£	£
Dried fruits	31,000	265,000	1,238,000
Preserved fruits	21,000	255,000	621,000

New Zealand.—In New Zealand the process of manufacture s under careful supervision and is subject to the provisions of strict law against adulteration. Canned sheep tongue is an mportant item of export: other packs include ox-tongue, boiled nutton, boiled beef, corned mutton, corned beef and meat exract. Boiled mutton has a large sale, mainly for ships' stores, ut other lines had not been extensively developed by 1926.

Canada.—The Canadian export trade in preserved foodstuffs reatly increased after 1910. Packing and canning factories vere established and close attention was given to grading and tandardisation. The chief commodity is fish, although canned ongues, fruit, tomato soup, milk powder and other articles of ood are making considerable progress. The total value of the sheries production of Canada in 1924 was approximately $45,00,000. This total represents the value of the product as marketd, whether fresh, domestically prepared or factory made. The sh includes salmon, halibut, cod and lobsters, a large proportion f which is canned. The first fish canning plant was established n the Pacific coast in 1863, but the fruit canning and by-prodcts industry is of much later growth. During the period 1922–5 ritish Columbia salmon canneries experienced severe compeition in the British market from Japanese and Siberian salmon, nd have had to look to other markets, particularly France. In Newfoundland the canning of fish products was only in the iniial stages in 1925, except in the case of lobsters. Lobster canning vas, however, owing to over-fishing, subjected in 1924 to a close eason of three years. The canning of codfish, salmon, codfish ongues and halibut was developed during the post-War period, nd in 1925 a small export trade was carried on in these products.

South Africa.—In 1910 the Union of South Africa imported an ppreciable quantity of dried fruits of various kinds, but progess in the canning and dried-food industry was so rapid and ustained that by 1925 not only were all local requirements met, ut a considerable export trade had been developed. The Govt. mposes certain regulations regarding grading, etc., with which ll exporters must comply before their produce is permitted to eave the Union. Fruit canneries are established in many of the rincipal towns throughout the Union, the chief centres of the ndustry being Durban, Port Elizabeth and Cape Town, with the Paarl and Worcester districts of the Cape Province. The canning f crayfish is of great importance. The lobster occurs in abundance n the coast of South West Africa, and four large factories were started in 1924 at Lüderitz Bay. Great advances were quickly nade and an extensive export trade both to the United Kingdom nd the Continent developed.

Federated Malay States.—In the Federated Malay States the pineapple is extensively grown for canning purposes; the chief planted areas are in the neighbourhood of Singapore where several large canneries engaged in the preserving of the fruit have been established. The local industry is very large, as will be seen from the following official figures, showing the exports from Singapore:—

	Quantities	Value
1919 Cases	255,873	3,286,001
1920 Cases	446,890	7,177,976
1921 Cases	662,360	6,210,383
1924 Tons	39,203	8,873,977

The rise in the value of exports in 1920 was due partly to the post-War revival of trade, and partly to the fact that supplies of tin plate, practically unobtainable during the War, were available. The principal country for export is the United Kingdom, but Canada, British India and the United States of America absorb fairly large quantities.

III. IN OTHER COUNTRIES

In Italy, where the canning industry is firmly established, the export of canned fruit and vegetables, particularly tomatoes and cherries, has shown a steady increase, the general standardisation, packing and canning being most efficient. Before the War, France also had many canning establishments and exported a large quantity of sardines, vegetables and preserved fruits. During the post-War period she began to re-establish her trade and by 1925 was regaining a number of her lost markets. Norway's canned fish and meat industry is of great importance to the country. From 1895 until the outbreak of the World War, the fish-canning trade expanded at an exceptionally rapid rate, and by 1925 Norway was one of the leading exporters of canned fish. This expansion is clearly instanced in the exports of brisling sardines, the main product of the industry, which are about 22,000,000 kegs yearly. Norway has over 200 canneries employing some 6,500 hands. The total weight of canned goods exported during 1924 was 40,249 metric tons, of which 28,202 tons were smoked sardines, 5,061 tons unsmoked sardines and 5,389 tons kippers. Canning machinery is exported from Norway to other countries engaged in the industry.

Spain, Portugal and Siberia are all engaged in the canned sardine industry, while Spain and Portugal also devote considerable attention to canned fruits, the exports of which are increasing. In Belgium the canning industry rapidly developed after 1910. The oldest and the most flourishing branch is that of canned vegetables. The manufacture of canned fruits on a very large scale has been developed largely in co-operation with British firms. An industry which has made great strides is the manufacture of canned and crystallised fruit, in which 22 manufacturing firms were engaged in 1925 as against less than 10 before the War. The works engaged in the preparation of canned and dried fish are located for the most part along the coast, and specialise in sprats and sardines and shellfish.

Japan, through the organisation of a large trust of canned provision merchants, has become important in the canned crab and salmon trade. In 1923 she shipped to America and Europe 220,000 cases of crab, but in 1924 the output somewhat decreased and the value fell from yen 50 to yen 40 per case. As a result of the influence of the trust, however, and also of improved packings, the industry in 1925 showed signs of greater expansion. (A. F. W.)

CANTEEN.—The term is chiefly used for the bar or general shop attached to barracks, but it is also used for other places where food is provided, *e.g.*, in connection with factories and workshops. Canteens exist, too, in warships. In a less-known sense, a canteen is the small tin utensil carried as part equipment in marching order for cooking, eating or drinking.

Service Canteens.—Prior to 1914 canteens were generally worked in the British Navy by a ship committee, and in barracks as a regimental institute, but with the rapid growth of new units after the outbreak of the World War, it was found desirable to have a central organisation to provide canteens for barracks, hutments and for all the expeditionary forces. Much experience in this direction had been gained in the South African War, where the canteens had done much for the comfort of the troops, and yet made tremendous profits, providing capital sums spent for the sailors' and soldiers' benefit on the Union Jack Club, Union Jack Hostel, etc.

From 1915 onwards, the Expeditionary Force Canteens became a vast organisation, providing right up to the front lines, for officers and men, good shopping facilities and rest and recreation centres, and for officers excellent hotels. Mention must be made of the auxiliary work of the Y.M.C.A. and the Church Army, which carried on similar work on a very large scale both at home and abroad.

With the American Army, the canteen work was largely carried out by the Y.M.C.A. and by the U.S. Red Cross, already established in France, and to a certain extent by regimental institutions. In Great Britain, the outcome of the canteen organisation was the Navy and Army Canteens Board, which, since the War, has taken over nearly all the naval and other service canteens. A few units particularly situated still manage their own canteens on the old lines.

Civilian Canteens.—In Great Britain the need for providing canteens for industrial workers is widely recognised and an Act of Parliament of 1916 empowered the Home Secretary to require employers to provide canteens or messrooms when it appears that such are necessary for securing the welfare of the workers. The exact words are in section 7 of the Police, Factories (Miscellaneous Provisions) Act, 1916:

> The occupier shall provide and maintain for the use of all persons employed in a factory and remaining on the premises during the meal intervals a suitable messroom, which shall be furnished with (*a*) sufficient tables and chairs or benches with back rests; (*b*) adequate means of warming food and boiling water; (*c*) suitable facilities for washing, comprising a sufficient supply of clean towels, soap and warm water. The messroom shall be sufficiently warmed for use during meal intervals.

Welfare Pamphlet No. 2 issued in 1924, by the Stationery Office, London, gives advice on the provision of these accessories, the information being accompanied by plans of model canteens.

CANTIGNY, a small village in northeast France, west of Montdidier and 18 m. south of Amiens, was the scene of the first U.S. offensive in the World War. After the great German advance in March 1918, the 1st Div. of the American Expeditionary Force, under Gen. Bullard, relieved two French divisions in the Picardy section of the Allied front. The German line ran west of Montdidier, and, immediately facing the American front, formed a small salient of which Cantigny was the nucleus. It was decided to reduce the salient, and for this task the 28th Regt. with 150 men of the 1st Engineers were detailed, supported by French tanks. On May 28, at 6.45 A.M., after an hour's artillery preparation, the U.S. Infantry advanced on a front of 2,200 yd., and in 45 min. they had overcome the German defences, capturing 250 prisoners. The Germans made fierce counter-attacks, extending over three days, but failed to retake the position. The total casualties sustained by the American forces in this operation were 45 officers and 1,022 men. (*See* GERMAN OFFENSIVE).

CANTON, China (*see* 5.218), suffered perhaps more damage as a result of the Chinese internal wars of 1924 and 1925 than any other Chinese city. Under the governorship of Dr. Sun Yat-sen (*q.v.*), heavy taxes were imposed for the upkeep of the army. These were naturally detrimental to the city's trade, though the important silk exports were maintained. Many merchants, however, gave up business here and transferred their operations to Hongkong.

Since 1910 a new quarter has sprung up west of the river, and a bridge has been built between Canton and Honam. The population in 1925 was variously estimated between 500,000 and 900,000. The Canton Christian College, begun in 1905, subsequently expanded until it possessed about 50 buildings on a site of 350 acres. The Women's Department was opened in 1913, the College of Arts and Sciences in 1915 and that of Agriculture in 1921. In 1914 a Board of Conservancy Works of Kwangtung, appointed particularly to deal with flood prevention, was started by the Chinese Govt. the difficulties of Canton as a port having become more and more obvious. Thereafter a sluice was built on the north river and a floodgate on the east river, and about 18 m. of dikes were dug. Plans for improving the harbour and approach, and regulating the west and north rivers, were under consideration at the end of 1925, and several miles of quays had been constructed. The railway of Hankow reached Shihwan in 1919, but at the close of 1925 it was in a very bad state of repair, while the working of the line to Kowloon, opened in 1911, was constantly interrupted for military purposes during the stormy days of 1924 and 1925. In 1924 there was a severe outbreak of smallpox, and other diseases were brought by the troops, among whom they were rife. A Health Department which was started failed owing to the disturbed conditions and financial difficulties.

Disorder in the City.—Civil war was carried on in and around the city from 1921 onwards, and in 1924 there were conflicts between the troops of Sun Yat-sen, holding the city, and the Cantonese merchant volunteers, who banded themselves together to resist the orgy of taxation imposed to pay for the large numbers of troops, and declared a general strike, which spread all over the province, in May. In Oct. the merchant volunteers were attacked by the government troops in the most crowded part of the city with artillery; over 400 houses were burnt and a number of noncombatants killed. The volunteers, who were greatly outnumbered, were defeated and disarmed. The communist element, in a loosely organised trades union, obtained control. During the fighting in the city some 50,000,000 dollars' worth of damage was done. By the end of 1925 effective connection with Peking had been severed and a boycott on British shipping from Hongkong had been declared, supplies being received from Vladivostok.

CAPEK, KAREL (1890–), Czech dramatist and novelist, was born at Malé Svatoňvice in Bohemia (Yugoslavia) Jan. 9 1890. He is perhaps best known as the author of the successful play *R.U.R.* (1920; Eng. trans. 1923), in which he satirises the mechanical tendencies of modern civilisation, and *The Life of the Insects* (1921; Eng. trans. 1923), a spectacular play written in collaboration with his brother Josef, and satirising various phases of modern society. He also attracted much attention with the *Makropulos Affair* (1922), a play dealing with longevity. Of his fiction the best is contained in *Painful Tales*, a collection of short stories which deserve comparison with Maupassant, and in his two novels, *The Manufacture of the Absolute* (1923) and *Krakatit* (1924; Eng. trans. 1925). He achieved considerable success with his series of feuilletons, *Letters from England* (1924; Eng. trans. 1925), *Letters from Italy* and *Concerning the Nearest Things* (1926), all of which are distinguished by powerful imagination and sparkling wit.

CAPELLO, LUIGI (1859–), Italian soldier, was born on April 14 1859. His career until he became a general officer was passed in the infantry. During the World War he conducted in Aug. 1916 the attack which led to the capture of Gorizia. As commander of the Gorizia zone II. (VIII., VI. and II. Corps) he conducted the first phase of the Italian offensive in May 1917. In June he was given command of the II. Army and in Aug. he directed the attack on the Bainsizza plateau, but his desire to continue the attack led to differences with Cadorna, his commander-in-chief, who favoured a defensive disposition. It is probable that Capello's faith in his own method of meeting the enemy counter-attack prevented his wholehearted co-operation with Cadorna. After his retirement in July 1918 he took some part in politics and supported Fascism but later joined the Opposition and, in Nov. 1925, was arrested on a charge of complicity with Zaniboni in the plot against the life of Mussolini.

CAPE PROVINCE (*see* 5.225), the largest and most thinly populated of the provinces of the Union of South Africa, has an area of 276,966 sq. miles. Population (1911) 2,564,965; (1921) 2,782,719. In 1921 the white inhabitants numbered 650,609, an increase of 68,232 since 1911, roughly 28,000 males and 40,000 females. The discrepancy in the increase was due to a steady migration of men from the Cape to other provinces of the Union, chiefly the Transvaal. Of the 2,132,110 non-white inhabitants in 1921, Asiatics numbered 7,696, Bantus 1,640,162 and mixed or other races 484,252. The "coloured persons," as they are officially called, form a distinct and important element in the community. Of the Bantus 938,990 lived in the Transkei, a purely native area under special jurisdiction. Many parts of the province are arid or semi-arid and, the Transkei apart, the population is mainly in the fertile south and southeast coast regions.

Administration.—The affairs of the province are managed by a provincial council elected for three years and not subject to dissolution save by effluxion of time. The council elects its own chairman and an executive committee of four, not necessarily members of the council. It has powers of legislation on subjects specifically assigned to it; its enactments are called ordinances and are not valid if repugnant to any Act of the Union Parliament. There is no separate judiciary or police force or civil service, and harbours and railways are under the control of a separate department of state. The New Cape Railway from Worcester to Mossel Bay, 209 m. long, the chief privately owned line in the Union, was bought by the Govt. in Aug. 1925. The chief executive officer, styled the administrator, is appointed by the Union Ministry. He holds office for five years and is irremovable. The Union Ministry also appoints the provincial auditor and an attorney-general as legal adviser.

The first administrator was Sir Frederic de Waal, who had been Colonial Secretary in the last Ministry of Cape Colony. He was twice reappointed, being succeeded in 1926 by Mr. Adrian P. J. Fourie, Nationalist member of Parliament for Somerset East. During the period 1910–25 the province showed a progressive spirit, particularly as regards education. There arose, however, such an increase in provincial expenditure (not in the Cape alone) that the Union Parliament passed an Act in 1922 limiting the subsidy to be paid to not more than 3% over the amount due in the preceding year. In the schools the bilingual requirements gave rise to a little friction; in 1921 the council passed an ordinance providing that the medium of instruction up to standard IV. should be the "home language" of the scholar. In place of High Dutch, the local form of the language, called Afrikaans, is taught. Education for all European children between the ages of 7 and 16 is compulsory; primary education, since 1920, has been free up to and including standard VI. Both primary and secondary education is provided for all races. In 1924 there were 137,000 white and 167,000 non-white pupils.

There was, in the period 1910–25, considerable agricultural and industrial development, as well as a period of unhealthy inflation after the World War, followed by reaction. An event which caused a deep and lasting impression on the public mind was an epidemic of influenza in 1918. It was estimated that a quarter of the inhabitants of the province suffered, and the deaths were very numerous. In 1925 much opposition was aroused by Gen. Hertzog's proposal to withdraw the franchise from the natives, as it was in the Cape only that natives had the right to vote.

Finance.—The revenue, apart from the subsidy, is derived mainly from transfer duties, licences (trade, liquor, motor, etc.) and a provincial property tax. The average revenue 1915–6 to 1919–20 was £567,000; it had risen to £1,261,000 in 1922–3. The Union Govt. subsidy in 1915–9 averaged £1,085,000, and was £1,569,000 in 1922–3. The sudden rise in the figures was the reflection of educational demands. The average expenditure on education in 1915–6 to 1919–20 was £1,224,000; in 1922–3 it was £2,514,000. *See* South Africa.

See also the following reports issued at Pretoria by the Union Govt.: *Report of the Provincial Administration Commission 1915* (1917); *Report of the Provincial Finances Commission* (1923).
(F. R. C.)

CAPE TOWN (*see* 5.252b), capital of the Cape Province, and seat of the Legislature of the Union of South Africa. In 1913 all the suburban municipalities except Wynberg were incorporated in the city, which extends for 17 m. across the Cape peninsula, from Table Bay to False Bay, and has an area of 59 square miles. The population, including suburbs, was 161,570 in 1911 and 207,404 in 1921 (of whom 113,202 were whites). The chief feature of the period since 1910 has been the development of the suburbs and the making more accessible the natural beauties of the peninsula, enterprises in which the municipality took the lead. Cape Town in the season (Oct.—March) is the chief pleasure resort of South Africa. In Oct. 1918 influenza caused over 7,000 deaths in the city in three weeks.

On the sea front at Table Bay a promenade pier (1,500 ft. long) and esplanade (1,000 yd.) were completed in 1914. The pier replaces the old central jetty, and is in a line with Adderley street and Government avenue, the principal thoroughfares. To the Houses of Parliament, in Government avenue, a new wing was added (1910). At the foot of the avenue is the National Art Gallery. The Max Michaelis collection of Flemish and Dutch masters—presented to the Union in 1912 is in "The Old Town House," in Greenmarket square. The building, a fine example of colonial Dutch 18th-century architecture, was transferred to the Govt. in 1916. The castle has been cleared of disfiguring additions and restored approximately to its 18th-century condition.

Rondebosch, five miles from the centre of the city, is the chief residential suburb. It contains Groote Schuur, formerly the property of Cecil Rhodes, since 1910 the official residence of the Prime Minister of the Union. In 1918, on the incorporation of the South African College (founded in Cape Town in 1829) as the University of Cape Town, a site for new buildings was granted in the grounds of Groote Schuur. Building operations began in 1921. In 1925 the Prince of Wales was installed as chancellor of the university. In 1912 a Rhodes memorial was unveiled at Groote Schuur by Earl Grey. In front of the memorial, a granite temple in the Doric style approached by a flight of steps, is the equestrian statue of "Physical Energy" by G. F. Watts. In the temple is a bust of Rhodes. Not far from Rondebosch, at Kirstenbosch, are the National Botanical Gardens, established 1913.

Since 1913 Cape Town has ranked second to Durban as a seaport in respect to cargo, but it retains first position for passenger traffic and, as the port whence the raw gold from the Transvaal is shipped, its exports greatly exceed in value those of Durban. Long-needed improvements in Table Bay harbour were undertaken in 1924. In 1913 the tonnage of ships entering Table Bay was 3,965,000 (3,251,000 being British); in 1923 the figures were 4,007,000 (3,299,000 British); in 1924 they were 3,964,000 (3,202,000 British). See Juta's *Directory of Cape Town* (Cape Town, 1926.)
(F. R. C.)

CAPE TOWN, UNIVERSITY OF.—The foundation dates from April 2 1918, when the council, created by Act 14 of 1916, received a bequest from Sir Julius Wernher of £250,000 and a donation of £250,000 from Mr. Otto Beit, who added £50,000 to a lapsed bequest by Mr. Alfred Beit. By 1921 a special appeal for funds had raised about £280,000, inclusive of £50,000 for the Jameson Memorial Hall. Pending the erection of buildings on the site provided by the Government at Groote Schuur, the university carries on its work in the buildings formerly occupied by the University of the Cape of Good Hope, of which it is the successor. The university created in 1925 chairs in commerce, fine art and accounting. The faculty of law was strengthened by a third professorship and arrangements were made to take over classes in architecture, hitherto conducted by the Cape Institute of Architects and the School of Art controlled by the Education Department.

CAPITAL, EXPORT OF.—This expression denotes investment of capital abroad by a country or its inhabitants. The term may be applied either broadly to the gross amount of capital so invested during a given period, or more narrowly to the net amount, represented by an excess of capital invested externally over capital concurrently invested in the country from outside. Export of capital is not an expor in the ordinary sense, since it is rarely possible to indicate particular goods which represent the investment of capital; it is to be regarded rather as an item in the international trading balance sheet of a country.

British Investments Abroad.—British investments abroad were built up by an almost unintermittent export of capital between the end of the Napoleonic wars and the outbreak of the Great War. Sir George Paish estimated that at the end of 1913 the amount of capital publicly invested by British citizens in the colonies and foreign countries amounted to over £3,700,000,000, to which should be added a large amount invested privately, bringing the total to about £4,000,000,000. Of the amount publicly invested, Sir George Paish found that some £1,780,000,000 was invested in British Dominions and possessions, some £754,000,000 in the United States, and some £764,000,000 in other foreign countries on the American continent. A comparatively small amount (less than £200,000,000) was invested in European countries—mainly Russia, Spain and Turkey. Sir George Paish estimated that no less than £1,521,000,000 was invested in railways; £959,000,000 in Government securities; £273,000,000 in mines; £244,000,000 in land, investment and finance companies; £147,000,000 in municipal loans; and £145,000,000 in commercial and industrial securities.

Other European Countries.—Several other European countries emerged as exporters of capital during the 19th century. Apart from Holland, which had established her position earlier as an investing country, these included France, Germany, Belgium and Switzerland. The amount of French capital invested externally was estimated in 1912 at some fr. 40,000,000,000 to fr. 42,000,000,000. French investors tended to concentrate their investments in Europe, Egypt and the French African colonies; and showed a marked preference for Government bonds including Russian Government issues which were held very extensively. They also held considerable investments in South America, Mexico and the Transvaal.

The amount of German investments was variously estimated at £1,000,000,000 to £1,250,000,000 before the World War: A large part was represented by Russian bonds, railway and industrial securities; and German investors had large interests in Austria-Hungary, Italy, Rumania and the Balkans. They also had substantial interests farther afield, in the United States and Canada, South America and the Far East.

The position then before the World War was that Great Britain, and to a smaller extent France, Germany and some other European countries, had built up substantial external investments and were in the habit of adding to them year by year through the export of capital. Apart from these no other countries exported capital on balance, though some capital importing countries also invested capital abroad.

United States.—Among these countries was the United States, which, during the two decades before the War, had invested considerable sums in the development of industries in Canada, in Mexico and Cuba; and had also repurchased from Europe considerable amounts of American railway securities. The flow of capital, however, continued, on balance, to be into the United States. At the outbreak of the War in 1914 European holdings of American securities were probably between $4,500,000,000 and $5,000,000,000. American external investments probably did not exceed one-third of this amount.

Changes Due to the War.—The War wrought enormous changes in the sphere of international indebtedness, changes, the extent of which cannot even now be precisely gauged. The initial shock to the credit system at the outbreak of war caused an immediate stoppage in the normal flow of capital from lending to borrowing countries and gave rise to demands on the part of the former for the repayment of maturing obligations. The borrowing countries experienced at first great difficulty in making remittances, as was indicated by the position of the exchanges.

Later, as purchases of war supplies by the belligerents increased, this difficulty disappeared and the exchanges turned in favour of the borrowing countries. From that time the European belligerent countries were confronted with an increasingly serious problem of financing their purchases abroad. It was a problem much more serious for the Allies than for the Central Powers, because the latter were largely cut off from the possibility of importing from countries out of Europe; but it applied to the Central Powers in connection with their purchases from European neutrals.

Great Britain bore a large part of the burden of financing the external purchases of the Allies prior to the entry of the United States into the War, and an account of the arrangements made forms part of the history of British War finance (*see* GREAT BRITAIN). So far as purchases could not be paid for out of ordinary credit items in the trade account they were met out of money obtained (*a*) by selling abroad holdings of foreign securities (*b*) by borrowing abroad on the market or (*c*) by borrowing from foreign or Dominion Governments. Each method was adopted so far as practicable, the last becoming commoner as more countries joined the Allies.

In view of the magnitude of British investments overseas it might have appeared that vast sums could be raised abroad by the sale of securities if not by borrowing. The extent to which investments could be realised was, however, in fact comparatively small. Only exceptionally did it prove possible to sell any of the sterling securities which represented the bulk of British holdings, and sales were for the most part limited to securities expressed in (or convertible into) foreign currencies—particularly American dollar securities. The sale of these securities proceeded to some extent in response to ordinary economic motives, and subsequently the British Government itself organised the acquisition, by purchase or on loan, of suitable dollar and other securities which could either be sold abroad or used as collateral for advances.

In the course of its operations the so-called American Dollar Securities Committee purchased American and Canadian dollar securities to the value of £184,266,540, and obtained the deposit on loan of others valued at £100,290,052. More important in amount than the sale of American and other securities was the direct borrowing by the floating of loans abroad and by arrangements with foreign bankers or with governments. The aggregate external debt of the British Government amounted at March 31 1919 to £1,364,850,000 at par of exchange. Of this £840,822,000 represented debt owing to the United States Government, £91,808,000 was owing to the Canadian Government and £113,500,000 represented loans from certain Allied Governments, which could be regarded as available to be set off against debts owed by the same Governments to Great Britain.

Britain, France and Germany as Creditor Nations.—While dollar securities were being sold abroad and money was being borrowed, advances were being made to European Allies and to certain of the Dominions, the aggregate nominal amount of these advances being undoubtedly in excess of the amount raised abroad by selling securities and by borrowing. Regarded as a commercial asset, however, these advances are by no means equivalent in value to the amount realised by the sales of dollar securities and by external borrowings. Their commercial value cannot even yet be exactly estimated. On the whole, it is clear that the creditor position of Great Britain at the end of the War was considerably, though certainly not fundamentally, impaired.

The effects of the War upon the creditor position of France were more disastrous owing to the extent to which French capital had been invested in Russia and other countries affected by the War. In addition to incurring considerable debts to private interests abroad, the French Government borrowed very heavily from the British and United States Governments. A settlement with regard to the latter debts had not been made in 1926.

Germany, like France, had large investments in Russia which were lost. She also suffered from the sequestration of German property and enterprises in the territory of hostile countries, though to some extent this was set off against property of those countries in Germany sequestrated by the German Government. Like the Allies, Germany incurred heavy debts in certain foreign countries, notably Holland, Sweden and Switzerland; and she mobilised salable foreign securities with a view to effecting payments abroad. On the other hand, she advanced large sums to her Allies, but had to forego her claims to repayment as one of the conditions of peace. Her defeat in the War resulted in the loss of her position as a capital exporting country.

Position of Neutrals.—The urgent demands of the European belligerents for supplies of many kinds provided an exceptional opportunity for countries which were in a position to take advantage of it. This applied to a considerable extent to some of the neutral countries of Europe, especially Holland, Sweden and Switzerland; but their capacity to furnish supplies on loan or otherwise was restricted by economic difficulties resulting from their position in the war area. It was estimated nevertheless with regard to Switzerland that by the end of 1918 she had lent the Allies fr. 400,000,000 and the Central Powers fr. 200,000,000, and that she had at the same time repurchased securities in French, German, English and Austrian hands to the value of at least 800,000,000 francs. The experience of Holland and Sweden was not dissimilar.

The United States as a Creditor Country.—The country which above all others was in a position to furnish supplies on credit and to repurchase securities was the United States. It has already been indicated that for some years before the War, America had been investing capital abroad, although she was not a balance and capital exporting country. Clearly, however, her financial strength was increasing and it was only the great demand for capital for internal development which kept her from becoming a capital exporting country. The War greatly hastened her progress in that direction. She was able to repurchase with ease from Europe large amounts of American securities, the aggregate being estimated at $2,000,000,000 up to the end of 1918. Private loans were also floated in the United States to the amount of $1,500,000,000 while advances by the United States Govt. to the governments associated with it in the War exceeded $7,300,000,000 at the end of 1918. The exact commercial value of the government advances remained to be determined and is not yet completely settled. It was clear, however, at the end of 1918 that the United States was no longer on balance as a debtor. During the following years she rapidly established her position as a great creditor. After the Armistice Europe needed large quantities of foodstuffs and other supplies for which payment could not be made in cash. The United States was able and willing to furnish the goods and did so to a large extent on open credits from the banks. These advances were subsequently in large part funded in various ways. To some extent they were liquidated by further sales of European owned dollar securities, of which it is estimated that $500,000,000 were repurchased in 1919 and 1920. A certain quantity of South American, Canadian and other sterling securities were also purchased in America.

Flotations of Capital.—Flotations of capital were effected in the United States to a vast aggregate amount on behalf of foreign Governments and Municipalities whether Canadian, South American, European or other; and large sums were invested in industrial undertakings especially in Canada and South America. The amount of new flotations of capital in each year from 1920 to 1925 is computed by *The Financial and Commercial Chronicle* to have been as follows:—

Foreign Issues Placed in U.S.A. Excluding Refunding Loans
(In thousands of dollars)

	1920	1921	1922	1923	1924	1925
Canada and Canadian Provinces and Municipalities	45,780	75,982	98,984	26,308	132,365	49,158
Other Foreign Govt. and Municipal	191,000	329,270	416,305	186,845	570,945	540,781
Total Foreign Govt. and Municipal	236,780	405,252	515,289	213,153	703,310	589,939
Canadian Corporate Issues	107,795	106,115	40,476	29,631	97,850	94,511
Other Foreign Corporate Issues	39,925	15,150	80,445	24,100	195,410	398,735
Grand Total	384,500	526,517	636,210	266,884	996,570	1,083,185

The flotation of new foreign capital issues fell off markedly in 1923, owing largely to distrust arising out of the French occupation of the Ruhr. Following the settlement on the lines of the Dawes Report, which increased confidence in the stability of Europe, the amount of new issues rose to unprecedented figures in 1924 and 1925, when very large sums were lent to European governments and municipalities as well as to industrial enterprises. Parts of these new issues were, however, subsequently sold back to Europe.

American foreign investments (exclusive of debts owing by foreign governments to the United States Govt.) are estimated in 1925 to have been as follows:—

	Government Guaranteed Obligations	Industrial Securities and Direct Investments	Total
	$	$	$
Canada and Newfoundland	1,125,000,000	1,420,000,000	2,545,000,000
Latin America	915,000,000	3,225,000,000	4,140,000,000
Europe	1,665,000,000	450,000,000	2,115,000,000
Asia and Oceana	442,000,000	280,000,000	722,000,000
Totals	4,147,000,000	5,375,000,000	9,522,000,000

By far the greater part of these investments has been made since 1914, and when account is taken of the fact that foreign holdings of investments in America have been reduced to comparatively small proportions by the repurchase of some $2,500,000,000 of securities, and further of the debts owing by European governments, the magnitude of the change which has occurred in the financial position of the United States is clearly apparent. New York has in fact been for some years the principal centre of the world's capital market and has been able to provide immense quantities of capital to borrowers of all nations. Whether America will continue to export capital at the same rate or whether a rising standard of consumption and the demand for capital for internal purposes will restrict the amount invested abroad is by no means certain.

France and Germany in post-War Finance.—For the time being at any rate Europe has ceased to be able to provide large amounts of capital for other parts of the world, and on the whole the flow is at present rather into than away from Europe. The resources of France have been fully taken up with the restoration of the devastated areas. Germany has been borrowing heavily for reconstruction, and having regard to reparation payments is not likely to be in a position to invest capital abroad for many years.

Recovery of the London Market.—On the other hand, Great Britain has been in a position to resume the export of capital, though on a reduced scale. The external debt incurred during the War was reduced by over £200,000,000 between March 1919 and March 1921, since when further substantial reductions have been made. During 1920 considerable blocks of South American, Chinese and other foreign securities were purchased at low prices from the Continent, although at the same time other securities were being sold to the United States and also to Canada until the imposition by the latter country in the autumn of 1920 of an embargo on importation of securities. Considerable flotations of capital were also made for British possessions and foreign countries, as indicated by figures compiled by *The Economist*, shown in tabular form: "New Capital Issues in London."

Estimates of the actual export of capital based upon an analysis of the balance of trade indicate that in 1920 the nominal amount may have been as high as in the years immediately preceding the War, when it approached £200,000,000 per annum. In the following years, however, the amount fell off, reaching only £153,000,000 in 1923, £63,000,000 in 1924 and £28,000,000 in 1925. The general depression of trade has affected British industry severely, and while the aggregate accumulation of capital has certainly been much reduced, it is probable that a much larger proportion has been invested in Great Britain.

New Capital Issues in London

	For British Possessions	For Foreign Countries	Total
	£	£	£
1920	31,639,800	7,888,400	39,528,200
1921	90,577,800	22,223,900	112,801,700
1922	74,924,200	55,233,100	130,157,300
1923	92,722,900	44,754,700	137,477,600
1924	72,276,900	52,436,800	124,713,700
1925	60,919,000	16,276,500	77,195,500

During the greater part of 1925 it was felt to be necessary to maintain an embargo upon the issue of new foreign and colonial loans in London. This was consequent upon the measures taken to restore the gold standard and was intended to prevent a strain on the foreign exchanges at a time when owing to incomplete adjustment of internal prices imports into the United Kingdom were likely to be unusually great and exports unusually small. The embargo was not statutory, but was effected by arrangement with the Bank of England which used its influence with the big issuing houses.

In Nov. 1925 the embargo was held to be no longer necessary and was withdrawn. Its withdrawal was followed by the placing of a large number of new foreign and colonial issues in London. Whether this is the beginning of a revival of the export of capital remains to be seen, but there can be little doubt that such a revival will result sooner or later from a recovery of world prosperity which will cause a renewed demand for British exports.

Bibliography.—C. K. Hobson, *The Export of Capital* (1914); A. W. Kirkaldy, *British Finance 1914–21* (1921); Bullock, Williams and Tucker, "Study of the Balance of Trade of the United States," in *The Review of Economic Statistics* (Harvard, July 1919).

(C. K. H.)

CAPITALISM.—Upon the concept of "Capital" in political economy theoretical dispute is interminable. To mix in that discussion is not to the present purpose. "Capital" is most briefly described as wealth used in producing more wealth; and "Capitalism," as the system directing that process. This latter term came into general use during the second half of the 19th century as a word, chiefly signifying the world-wide modern system of organising production and trade by private enterprise free to seek profit and fortune by employing for wages the mass of human labour. No satisfactory definition of the term has yet been found, though nothing is more familiar or important than the thing itself. Arthur Young (1792) calls capitalists "moneyed men." Coleridge as early as 1823 distinguishes them as having "labour at command." This aspect, seized upon by Karl Marx, is emphasised as a main distinction by economists whether favourable or hostile to individualist enterprise. The expression "Capitalism" is of Socialist origin and was used at first with an implication of reproach. It has been accepted with increasing confidence by those whom it meant to stigmatise; and is now the name—as opposed to Socialism—of a predominant economic system, always improving its sinewy and flexible organisation, adopting higher social ideas, and strongly progressive in effect. As the ruling alternative to Socialism it claims to be more modern in thought, more creative in method, more fertile in result, surer of the future because more capable of raising the average level of material prosperity and happiness, while enhancing the vigour, variety and zest of life by a richer play of personal initiative.

In this sense the economics of Capitalism are so deeply involved with politics and all sociology that it was regarded until lately as a subject unfitted for scientific treatment. While the Socialist indictments were elaborately considered, the statement of the positive case for Capitalism was much neglected. Only in recent years has it begun to be found under a separate heading in works of reference. It is still excluded from the latest re-issue of the English *Dictionary of Political Economy*. After some hesitation it has been rightly included and treated at length in the new post-war edition of the massive German compilation, *Handwörterbuch der Staatswissenschaften*. It was not amongst the thousands of headings in the eleventh edition of *The Encyclopædia Britannica*, though introduced into the Supplement of 1922. It demands unquestionably a separate article in an encyclopaedia not confined to economics, as more narrowly interpreted, but dealing with all the aspects of life.

1. *Capitalism in Action.*—It is extraordinary that the reality and practice of Capitalism have received not a tithe of the attention devoted in our time to Socialist theory. Science has been defined as accurate description of observed results. Modern Capitalism offers to accurate description a subject to be studied like physiology. It is more nearly a universal force than any other, spiritual or material, yet known. It operates and extends amidst all races, colours and sects. It is active more or less in all nations. Even Soviet Russia, after plunging through catastrophe in the hope of fulfilling the anti-capitalist dream has found itself compelled to recognise private ownership of the land—including the superiority of richer peasants over poorer—and to restore private trade to a considerable extent in towns. The only anti-capitalist Government is driven to seek loans from capitalist nations. In consequence of these lesssons, the Socialist and Communist pleas for the overthrow of the existing system of private property and free enterprise are more decisively rejected by a large majority of the world. Capitalism prevails more strongly than ever, in at least six-sevenths of the world. In the remaining part—the immense Eurasian territories of the Soviet Republics, more truly called the Soviet Empire—a still more complete reversion to private ownership and trade is to be expected, though the residue of State control seems likely to remain larger in the Russian system than in Western societies. Elsewhere private enterprise animates economic life in all the continents and impels their interlinking traffic. It is the strongest factor and the pervading influence in the daily affairs of all civilised peoples.

Everywhere the soil which feeds all other human activities is in the hands of private owners whose numbers have largely increased, especially in Eastern Europe and Russia, since the World War. Mines everywhere are worked by capitalist enterprise. Transport by land, sea, inland waterways and air is conducted generally by private direction utilising the funds supplied by hosts of individual investors. The dense towns and cities with their factories and workshops; with their swarming populations sustained by work for wages; with their myriad agencies of distribution by middlemen; with their conditions of housing, supply and conveyance—all these are creations of modern Capitalism. It is the agency whereby the intellectual achievements of thought and invention enter into the practical service of human life in all its forms at all its moments by means of an inconceivable number and innumerable variety of mechanisms ranging from engines of giant mass and power to the most minute and delicate devices. The tall chimney appears as a symbol at Rome and Athens, at Jerusalem and Benares, at Peking and Tokyo. This enormous enhancement of the productivity of human hands has brought into being some hundreds of millions of civilised populations who could not have existed and subsisted without it. As it has enlarged and altered out of recognition the white societies, Capitalism reaches into the depths of the newer continents and is stirring the most ancient Asiatic peoples. As an agency working ever more widely, yet ever more intensely, to transform by creative revolution the activities and conditions of mankind, to change ideas and stimulate effort over all the world, history has never known anything to approach the material power and saturating influence of modern Capitalism in bringing applied science to bear on life in the machine-age.

2. *Freedom of Individual Enterprise.*—This freedom to undertake risk and accumulate possession, is the breath and the lifeblood of this system. Its edifices, its productive plant, the interconnecting chains of traffic and networks of communication by which goods and services are exchanged, different needs in all their multiplicity mutually supplied—all these to an overwhelming extent are created at the cost of private persons; and the complex organisations of human intelligence and labour required to work this system function under private ownership and control. Governments may facilitate and assist—as they may hamper and impede—the exertions of free enterprise; but Governments derive their own funds from taxes levied directly or indirectly on individual effort; nowhere has the State itself become a separate wealth-making power; nowhere has Socialism been able to make itself in the least degree a working substitute for modern Capitalism. The Bolshevik experiment rejected in agriculture by that 90% of the Russian people whose preference for private ownership is invincible, is especially inferior in industrial efficiency. This is why the Russian Communists by paradox feel the need of foreign capital for loans to postpone the collapse of anti-capitalism or disguise the reversion to its opposite.

3. *Rise of Machine Industry.*—The impartial history of Capitalism, not yet written, deserves many volumes by a Gibbon of economics. Only recent phases can be dealt with in this place. A golden age of equality and harmony is a dream of the future, but has never been a reality of the past. In dimmest prehistoric times the exceptionally competent individual must have been relatively more powerful than now; useful enough to be deified by his fellows. The superior craftsman and artist, possibly the superior director of average labour, emerged in the making of flint weapons and tools. Acquisition like leadership went with strength and skill. From the beginnings of recorded history, rich and poor appear. Kings and chiefs, able warriors and civil administrators, priests, merchants commanded the labour and services of the mass of men. In that sense, Egypt and Babylonia, Greece and Rome were full of capitalism and of every kind of private ownership including its extreme form, slavery. The Middle Ages passed through feudalism and serfage. The Renaissance and the Reformation alike carried Capitalism and the wages-system into wider development and more detailed activities. On the one hand the Renaissance enriched all creative ideas and multiplied desires; while the voyages of discovery opened the epoch of world-trade with its new classes of merchants and makers and its necessary retinue of middlemen superseding more and more the direct contact of producer and consumer usual in the more local intercourse of medieval times. On the other hand, acute economists have insisted that after the Reformation the spirit of Calvinism and Puritanism developed thrift, exertion, method, diligence, and all the other efficient qualities of what we call acquisitive individualism, to a degree, which prepared the ground for modern Capitalism.

Then in the latter half of the 18th century came the industrial revolution which has worked and spread with cumulative effect through five generations of invention and social change. Fixed and mobile machines, steam-power, oil-power and electric energy with its long-distance transmission of signs, sounds, light, heat and propulsion—these, purchased and directed by free enterprise in the economic sphere, are the present instruments of capitalist organisation in the 20th century as already very generally described. There is as much difference between the contemporary world and the world of a little more than a century ago as between the 18th century and the higher stone-age of ten thousand years before. The strong characteristics of the present phase are as follows: First the magnitude of capitalist operations far exceeds former example: the vigilance of their intelligence-departments must reach to the ends of the earth; trade and investment are international; every manufacturing nation, even the United States with all its self-supplying resources, seeks to derive raw material or choice commodities from every region of the globe and to find in every one of them a market for goods or money. Second, larger aggregates of labour are directed by larger corporations and companies, amalgamated or federated. With its trusts and syndicates and other ways of consolidating interests, capitalist management is forming into fewer but more massive units. The relations between employers and employed depend more and more upon impersonal system, less and less upon individual attachments or dislike; though exceptional personality as in the case of Mr. Henry Ford is more important than ever for progressive efficiency of production on the capitalist side and for promoting payment, welfare-work and other encouraging conditions in the way most likely to induce labour to give its best effort. Thirdly, though Capitalism concentrates the control while extending the scope of its operations as Karl Marx foresaw, the company-system confounds his chief expectation by immensely increasing the number of participating investors—multiplying small shareholders, and widening the social basis of the system.

4. *Early Abuses and Surviving Prejudice.*—The sharpest points of Socialist criticism were originally thrust against admitted and gross abuses in a period which has passed away. The worst of these evils have been remedied in most countries and remaining defects are as remediable. The positive case claims that Capitalism to-day in its altered working is not only the most productive economic system possible in the present state of society but that it is the most conducive to social welfare and progress.

During the last few decades and especially since the World War, the improvement in the character of the system has been in fact sweeping. That when the Marxist creed was framed much of his terrible indictment was true must be confessed by those who think his constructive theories fantastic. Machine-industry still in the crude beginnings of its evolution was like Milton's animals emerging at creation, half in the earth and half out of it. Many of its aspects were deformed and its effects vile. Swarming populations were huddled into mazes of mean streets, alleys and courts, put up and linked on without civic plan and regardless of health and decency. Throughout Great Britain the foul slums had already appeared and presented a scene of ugliness and squalor such as civilisation had never beheld. The large majority of the adult workers, and more than half their children, were totally uneducated. The Factory Acts were only just beginning to build up what became one of the finest codes of humanitarian legislation in the world. Before the first Act was passed, parliamentary committees had exposed the horrors of child-slavery in the mills; women stood at the loom from morning to night sometimes for 15 and 16 hours.

As the common soldiers had been called " food for cannon " in war, the common people at this time were " food for factories " in peace. The defensive efforts of Trades Unionism were still scattered and feeble. The employer was in an absolute sense the " master." As profits rose and fell hands were thrown on the streets or taken on again. The hours of all labour were cruelly long and wages wretchedly low. Capitalism at that phase was in fact a wrongful exploitation of flesh and blood. We must not lay all the blame on the capitalists. Narrow lights were usually all they had. The prevailing classical economists taught that unrestrained competition was the spring of effort and the key of progress; that the poor in the lump must always be cheap; that labour by fatalism would always breed fast enough to keep wages at the lowest level required for human subsistence. In the leading industrial nations these conditions and ideas have been swept away long since in a manner that Marx could not foresee; but the memory of former wrongs and evils still prejudices the name of Capitalism.

5. *The Creativeness of Capitalism.*—Now, while much remains to be done the working of the system is incomparably more satisfactory and enlightened maintaining the industrial masses of most white communities, but above all in America, at a higher level of prosperity and convenience than ever was reached before. Temporary post-War conditions shadow the European picture; but it is true even in Europe that the workers generally are better paid for shorter hours than in any previous period; that they are better fed and educated, housed and clothed; that they are better secured against all the preventable ills of human life; and that their opportunities for advancement and enjoyment have largely increased. Take first the question of creative success. Capitalism claims that however great may be the rewards it acquires for itself, it results in higher earnings, cheaper consumption and more various advantages than labour could have obtained otherwise; and this because, by ceaselessly seeking extension, improvement, novelty, by seizing on every idea likely to cheapen costs and enlarge turnover, by looking vigilantly for the ablest persons, the system is dynamic and progressive through the rule of its nature.

More surely and quickly than ever before the backward or stationary methods in business are eliminated by energetic and resourceful rivalry. Freedom of enterprise is the creative element in economic life. It stimulates the originality of idea, ingenuity of method, boldness of attempt that the routine of public administration tends to fetter or stifle. The capitalist in this way shares the spirit of the adventurer, to whom pursuit of the personal idea is the breath of his being, and of the artist for whom freedom of individual expression is the vital condition of creativeness. Capitalism swarms with imagination in action. Every day thousands of heads in business relying on their own perception and courage are taking decisions and risks from which any public official or committee would shrink. Fresh initiative and invention never can be the characteristics of government departments, least of all under democratic conditions where the dread of hostile criticism is a continual deterrent from attempting any purpose, however successful in the long run, which at first only appeals to a few or to one. Again the swift use of time is part of the essence of success in private enterprise. Public officials and offices have to wait until "opinion is ripe"—until they can count upon the approval of the many, and that commonly takes a long while. For these reasons, Capitalism gives to economic life a vigour of impulse and creative fertility which no other method yet suggested seems likely to supply in anything like the same degree. By comparison—argue the modern advocates of individual ownership and direction—Socialism would mean at least arrested development, and probably an actual decline in general prosperity and welfare. Many a great undertaking employing thousands of workers has sprung from the idea of a single mind or from the intrepid judgment of a single character finding beforehand amongst other men little support or none.

6. *Vital Elasticity of Capitalist Organisation.*—Further, capitalist enterprise large and small concentrates in a million ways particular minds on particular problems. The needs, desires of every day in a civilised society, the new wishes always being awakened by new things offered, these are as the sands for number and as the sea for endless changes of shade and motion. Consider the numbers of capitalist persons who are engaged on making in gross and detail the countless adjustments between supply and demand in their infinite variety. Conceive all the different processes of specialised intelligence that are involved. It becomes impossible to imagine in the present state of science how this living maze of private activities, each bent upon some one part of supply and demand, could be replaced under any form of Socialism by officials and committees without the same scope for personal initiative and contrivance—thus lacking the acute attention and supple adaptability that the present system on the whole compels. This is a chief ground for the conviction of thoughtful interpreters of Capitalism in every great industrialised nation that private enterprise is not only the most powerful force of economic creativeness but also the most elastic means of economic organisation for adjusting supply and demand.

Private Capitalism makes overseas investments. In any country it may provide funds for developing the productiveness of other countries; of regions thousands of miles away; building railways, opening mines and oil-fields, financing plantations—as for rubber—founding banks. British investments, for instance, in North and South America, in Asia, Africa and Australia—above all in United States railways during the generation after the Civil War—have done more than anything else to provide British labour with an abundance of cheap and varied food on the one hand, and on the other with cheap raw material to the benefit of employment and wages. Once more, we find it not easy to see how any kind of Socialist State could make overseas investments in this way, or conduct inter-connected banking, or maintain the present complex and sensitive mechanism of credit—that most wonderful achievement of creative Capitalism—or provide and allocate the fresh capital required for enterprise and industry, for employment and wages. Under the present system, that fresh capital is furnished by the private accumulations made possible by freedom of private action.

7. *Progress of Labour-Enhancing Equipment.*—Turn to another aspect—progressiveness in equipment. Modern Capitalism results from the steam-driven or electric machine dependent on coal, oil or water-fall. The rapid increase in our own time of the part played by mechanism in comparison with hand-labour is not less marvellous than were the beginnings of industrial invention. It is stated, for example, that in the most modern engineering shops 80% of the work is done by the machines and only 20% by the attendants. One attendant may now keep in play several machines doing the former work of scores of men. The eagerness of private capital to perfect equipment has given increasing stimulus to invention. In any Socialist State political pressure arising from fear of unemployment would have prevented that State, were its democratic opinion genuinely free, from pushing technical progress to the utmost as Capitalism largely does. By the astonishing increase of miracles in metal, performing their intricate processes as though actuated by a mysterious intelligence of their own, the present productiveness of manual effort is enormously raised by contrast even with the latter part of the 19th century. This means that supply is cheapened, demand widened, the conveniences of life made more numerous and accessible, while employment is steadily enlarged in civilisation as a whole, and human well-being is energetically advanced in all material respects.

Other characteristics of Capitalism, especially in the United States, where it shows its highest powers of technical progressiveness and many of its best effects on the conditions of work, are the standardisation of models and parts, the speeding-up of processes, and the elimination of waste whether of material or time. These things are now made the subject of close and even subtle study. Nothing human we know ever can be finally perfect; ideas always advance beyond achievement. But when we look at such large effects of Capitalism as are unquestionably good, every dispassionate thinker must admit that the system is as prodigious in ingenuity as tremendous in power. The present writer holds it to be altogether improbable that production and exchange in the modern world could have been as progressively organised by any other means.

8. *The Human Factor and the American Example.*— We pass here to another and deeper part of the examination. We have studied the working of modern Capitalism as a means of animating production and facilitating exchange, stimulating demand and adapting supply; and we have seen reason to think that any extensive attempt to replace it by public ownership and management would mean something far less plastic and fertile, incapable of the same degree of wealth-making power and distributed prosperity. But what is the effect of Capitalism on the labour it employs—that is upon the large majority of human beings where the system prevails? How far does it serve the greatest good of the greatest number? Again we must note—though ideals must always move ahead however far practical improvement marches—that since the time when Socialism formulated its charges and framed its dogmas, there has been a surprising change for the better in the principal matters of wages, hours and provisions for personal health and physical security. A steady general movement has reduced working time, and raised money-earnings, still more real earnings as measured by purchasing-power. That any system of public ownership and official control could enable a less amount of labour to enjoy an equal buying-power is an assertion out of the region of proof and any man is free to think it as far beyond credibility. This is, of course, a central point in the discussion.

It cannot be said any longer that capital habitually and necessarily extracts from labour an undue effort for an unjust reward; that manual workers are demonstrably and usually paid less than that part of the value which they contribute to the selling-price of the common product; or that average labour could hope to earn more or as much per hour if the creative aid of free enterprise were abolished. "Exploitation," in the sense of the old-fashioned Socialist phrase, when the evil fact prevailed, is no longer a ruling accompaniment of the economic system in the leading capitalist nations. No doubt, the success of labour in securing the utmost proportion of the selling-price compatible with production at a profit differs much in different countries. On the European continent, as in Germany, wages on the whole bear a lower ratio to profit than in Great Britain where various convergent influences—trade unionist pressure reinforced by political power on the one hand, and on the other, a unique degree of freedom from indirect taxation coupled with large contributions by the minority of direct taxpayers to popular benefits—enable the working-classes to exact as full a payment in proportion to output as can be given without threatening the disappearance of profit and the debility of enterprise.

In America, however, where what we may call the new or reformed Capitalism is in operation on the largest scale, high wages are accepted and welcomed as a vital principle of creative capacity in a way that Europe is only just beginning to comprehend. But what is the inference? Obviously that Capitalism everywhere can follow where America leads—that Capitalism as a system is by way of becoming a more willing and vigorous instrument for the greatest good of the greatest number than original Socialism could imagine. In the United States over a hundred millions of people have reached common standards of comfort and enjoyment far above the best known in Europe and immeasurably above any social achievement in the world's history. As has been said this gigantic example in the United States of wealth-making with a large-minded distribution of the proceeds, is the result of equipping man-power with all the mightiest and nicest aids of machine power. Models and parts of the things to be made are standardised to cheapen repetition and replacement; all unserviceable complications are cut out; the processes of production are speeded up while more and more waste is eliminated. Far as that remarkable process has already gone, its further possibilities are seen to be very wide. Profits are sought not by making high prices an object in themselves but by reducing prices in order to enlarge demand and quicken turnover. In American enterprise individual abilities find the freest scope, the promptest recognition and the amplest reward.

The welfare of the workers is seen to by bringing into the factory system more safety and health, more lightness and brightness. Expert research into the possibility of improving mechanism, processes and use of materials is more widely and liberally encouraged than anywhere else. The spectacle of hosts of American workmen with their own motor-cars is a thing that would have staggered Karl Marx, most of whose generalisations drawn from the temporary conditions of mid-Victorian England are confounded by 20th century America in general and particularly by the methods of Mr. Henry Ford. As an instance of the extent to which material progress may increase moral resources it may be noted that more money is spent in America on education than in all the other nations together. It need hardly be said that we must not conceive a too ideal picture even of the United States. Not all the fields of American industry are Elysian fields. American thinkers assert that in some coal-areas in America relations between Capitalism and Labour are harsher than in western Europe; and that in other industries the example of the most progressive employers is far from being sufficiently followed. Some European experts protest that superabundance of wealth and material are still causing more wastefulness in certain directions than the scientific anti-waste movement is removing in other ways. But on the whole the American scene is magnificent in economic achievement and full of human promise. As against the culmination of the success of private enterprise in the United States, the only example of thorough Socialist attempt on a large scale is Russia as we see it.

9. *The Widening Social Basis of Capitalism.*—Above all, perhaps in significance for social advantage are the modern facts which refute the prediction that wealth would be concentrated in fewer and fewer hands until Capitalism more and more isolated was either terminated by helpless surrender or overthrown by the insurgent violence of the exploited masses. Taking civilisation as a whole the relative numbers of those personally interested in the maintenance of private enterprise grow every day. Under the company system we have seen continual and accelerating reinforcements of the ranks of small investors and owners of every kind. Hosts of people who work for salaries and fees prefer the private system and decisively reject the other, many of them no doubt as much desiring the further reform of Capitalism as opposed to its abolition. This movement has begun to act on labour proper in a manner that is one of the more suggestive revelations of our time. The United States is far ahead on this line also but it only leads the progressive ideas of Capitalism elsewhere. It is estimated that the number of small stockholders in the United States will be 20,000,000 in a few years more. Large numbers of workers have holdings in the concerns which employ them. In some cases, thousands of workers contribute their savings to nourish capitalist enterprises and are members of the corporations they serve. In one large motor concern over 90% of the employees are buying stock on the instalment plan. In another business the investments of the workers give controlling power. Yet another company's employees doubled in one year their holdings of its stock. It would seem difficult to overestimate the importance of several influences belonging to this novel development.

With bigger wages for bigger output there is incentive to thrift; a spur to energy and aspiration; a discipline of character; an interest in the business as a whole and in the wider life which it serves; a stimulus of economic intelligence; an added sense of responsibility; and a gain to the spirit of existence. It must be remembered that the actual majority of the population in France are small capitalists whether as property owners or rentiers. In Great Britain, on the one hand individual investors in company shares are a big aggregate; while, on the other hand, many millions of the working-class population, probably a third of the whole, are interested in the public funds through the War Certificates and Savings Banks deposits. Lively interest is aroused by plans for profit-sharing and co-partnership. The familiar instalment system in the United States and building societies in Great Britain have induced some millions of persons in the last half-decade to become private owners by buying the houses they live in. In Great Britain as in Germany the schemes for associating labour by consultative committees with the management of industry are more or less officially encouraged, while in the United States the voluntary action of capital has made a beginning with the same method. This movement as yet is rather an experiment than a power; but later, in connection with stock-holding by labour and other methods of profit-sharing, the method of joint councils may well arrive at epoch-making results.

10. *Summary of the Present Position.*—We may now state the salient features of a full view. Capitalism generally in its worldwide undertakings has risen to this height and breadth of productive and distributive success. Where Capitalism is most powerful, as in the United States, labour is more prosperous than at any previous phase of history and asserts a better individual status. Where wealth thus created is most abundant, either the provision for education is more liberal, as in the United States, or as in Britain the evils belonging, amongst the workers, to sickness, accident, disablement, widowhood, orphanage and old age, are mitigated by State-aid maintained by increased taxation chiefly levied on the capitalist classes. While Capitalism does in fact tend to concentrate into fewer and larger organisations the total number of investors has grown rapidly. The capitalist system is indeed built pyramidwise, but instead of coming to a last hopeless attempt to stand upon its apex, according to the Marxist vision, it broadens its basis more than it raises its altitude. The original Socialist predictions have been falsified, with the usual irony of human anticipation.

11. *Capitalism and Unemployment.*—None the less we must take account of revised Socialist criticism and inquire into its validity. Charges to some extent contradictory have been partly answered in passing. Capitalism is still accused of responsibility for avoidable unemployment, arising from the periodic alternations of climaxes and depressions in trade activity, of " booms " and " slumps," to use the coarse but telling jargon. It is certain, however, that though there must always be some tidal movement of rise and fall, the former violence of these rhythms is now much abated in times of peace owing to longer experience and fuller knowledge; to swifter information in every part of the globe of what is happening in every other; to quicker transport, the better-calculated control exercised by the great trusts and syndicates as indirectly by the great banking combinations; and to the better adjustment altogether of the world-forces of supply and demand. These improving tendencies, we must note, belong in their nature to a condition of peace. General war in the modern world is a catastrophe necessarily followed by an exceptional mass of unemployment in the countries where trade

and finance have been most severely dislocated by hostilities. Extreme Socialists blame capitalism for war as for every evil. They are deluded. Racial passions, fears and claims are main causes of war far older than capitalism, which though in some of its forms sharing and even stimulating the bad or mad feelings existing without it, is on the whole amongst the more pacific influences, especially in its form of international finance. Before the War chronic unemployment in a country like Germany had been reduced to about 2% of a volume of labour continually expanding. This shows that the higher figure in Great Britain was not due to any defect necessarily inherent in capitalism.

The United States at the same time was subject as it were to larger and looser forces which have since been restrained. Unemployment is far from being only a question of economics. It is profoundly affected by biology in the shape of a lower or higher birth-rate and by policy in the shape of more or less restricted emigration or of tariffs. Psychology plays its part, as in the changes of taste and fashion, which throw out particular bodies of workers from time to time. As nothing suggests that official management of industry could have created the extent of employment now existing in the world, so there is no reason to believe that the most complete State control could make the movements of rise and fall in trade milder than they have become. No human system, let us repeat, can hope to be perfect. Before modern capitalism existed—for instance, in medieval times often absurdly regarded as a golden age—the chronic unemployed abounded as beggars and vagabonds; while every bad harvest diminished work in the towns; and recurrent famine meant disaster for urban labour as well as rural.

12. *The Questions of Speeding-up, Subdivision and Monotony.*—Frequently capitalism still is accused of injuring the physique of the worker by the modern intensity of speeding-up in machine production; the mind and moral being of the worker by a remorseless monotony. The first indictment generally seems untrue, and the second very exaggerated. As regards human health the statistics for many manufacturing centres are more favourable than they have ever been in history. For instance, the industrialisation of Germany after 1871 was followed by an increase of longevity. The average duration of individual life was raised from about 37 years in the decade 1871–80 to about 47 years in 1900–10. Though sanitation plays its part here, capitalism is evidently no obstacle to the progress of sanitation any more than to education or of any other good human purpose. The wealth it makes supports these things. But then it is repeated that machine-industry at least injures the mind and spirit of the worker by extreme subdivision of effort, involving an eternal repetition of work on small parts and thereby a soul-killing monotony. We come to a very interesting discussion where the worst conclusion of the argument would cut both ways. In fact this general injury to the cheerfulness of the workers is not to be observed. Their demeanour at football or baseball matches and at the cinema or on any of their holiday occasions does not confirm the theory of their psychic depression. On the one hand, those workers who execute with their own hands and repeat endlessly only one small part of a process of manufacture are in sight of the manifold and stirring organisation of the whole. More and more, as in America, the miracles of the machine quicken their intelligence, especially as their education advances. Again, millions of the more expert artisans work in teams, as it were, on mechanisms of colossal power and intricate cunning which are always dramatic. The linotype operator, yet again, repudiates the suggestion that he is a more soul-less being than the old compositor who set type by hand, while no chauffeur will admit that he is less intelligent than the old coachman.

13. "*Socialism no Solution*"—*Capitalism or* "*Erewhon.*"—In any case this particular argument against capitalism is a tool which turns its other edge against the user. So far as the modern subdivision of machine industry is disadvantageous, that is evidently the result of the whole modern movement of technical science and not of the capitalist application. Under Socialism a factory would be still a factory. Public ownership would have to take over the buildings and plant, and pursue the same methods of mechanical efficiency, with all such monotonies of minute repetition as are now denounced. Without destroying the basis of industrial employment and of the manufacturing towns Socialism could not do otherwise; and therefore by no possibility could it make such large changes for the better in the average conditions of human life as it is accustomed to assume.

Some anti-capitalist thinkers say, indeed, that the whole system of industrial civilisation is a mistake; that it has brought into being excessive masses of people who are only a higher kind of automatic machines; that man loses his true happiness and deepest faculties and strongest character when divorced from nature and the soil; that the country originates the abilities which the town devours; and that the true solution, as in that profound satire "Erewhon," is to destroy the machines, prohibit their revival, and to return to agriculture and handicraft. This is a fascinating vision of ideal romance, and it sounds a moving chord to the ear of imagination; but as a practical argument it offers no escape. It comes too late. The industrial revolution is there, far advanced, and irreversible except by some catastrophe which would engulf all white civilisation. Labour on the soil means monotony and repetition of another kind with a harder life. Variety and leisure are far from the traits of the French peasant's existence. No average town-worker afflicted by the evils imputed to capitalism is willing to go back to the spade and the plough. On the contrary, agricultural labour is more attracted by the towns; while, further, the prosperity of farming and pasture depend on supplying the swarming populations called into being by capitalist industry. These inter-relations of machine civilisation must be accepted. The real problem is to make the best of them.

14. *Reformed Capitalism Likely to Prevail.*—The Russian example and the failure of Socialism everywhere to reach any kind of constructive success have resulted in a ruling and strengthening conviction that the suppression of private enterprise and its replacement by official control would be a leap in the dark with the presumption of coming to grief. The old-fashioned centralising Socialism with its army of bureaucratic agents would mean a slow sterilising régime fatally influenced by political patronage, discouraging initiative and repressing independent personality. That this plan would be unendurable is felt by the younger Socialists. Their Guild system, however, with self-rule for each industry, raises many more difficulties than it solves. How could the same work in the same factory become more pleasurable than now because the State or a guild owned it? Human nature is not so constructed. How could the big guilds adjust their exchanges, their relative claims to importance and reward, without formidable disputes? What would happen to the smaller miscellaneous industries? To picture this theory as a key to natural harmony is a myth. Who would entrust savings, did they continue practicable, to Socialist banks, and who would invest by preference in a Socialist country?

Private accumulation being impeded or prevented, how could democratic ownership and control keep in flow the supplies of fresh capital always needed for progressive industry and enlarging employment? If any national total of such fresh capital were available at all, how could it be allocated to meet the competing claims of different publicly owned industries? If the present possessing classes were abolished, so that annual revenue could not be raised from them as now, and direct taxation consequently were applied to the multitude, how would the people like that change? Would not hope be frustrated and subversive discontent aroused when it was found immediately that the part of the social dividend distributed to the average worker was disappointingly limited, low indeed, by comparison with the dream, and lower than the highest rates of wages now paid? The large majority of thoughtful men acquainted with the creation and management of business are utterly persuaded that every imaginative alternative to capitalism yet proposed for advanced societies, would either be a practical recipe for chaos or for a cruder order amounting to a throwback in civilised organisation. It is thus probable that for a long time to come social progress will seek its goal not in Socialist proposals inspired by obsolete criticism of former conditions now so largely removed or remedied or shown to be remediable under the system of private enterprise; but rather in the development of the present tendencies of what we have called the new or reformed capitalism.

15. *Remaining Defects and Problems.*—Some of the strongest defenders of capitalism as the best system are yet amongst the frankest analysts of its remaining defects and abuses. These defects and abuses are in the way of correction by the convergent power of several growing forces—scientific thought, public criticism, the political power of democracy, the consequent pressure of legislation and the enlightened self-interest of capitalism itself. More and more subject in society to the conscious sovereignty of the greatest number seeking their greater good, intelligent capitalism sees that it must set itself in every way to serve the common interest. It must work so that its preservation shall be recognised as a vital part of the common interest. One broad remaining defect is that very many employers everywhere, especially of the older school, still fail to recognise that where capitalism stakes money, labour, taken as a whole, to a vastly larger extent, stakes life. Labour on the initiative of wise capitalism must be taken more and more into partnership by profit-sharing schemes, by extending stockholding amongst employees, by joint councils not impeding the executive, but entitled to discuss general questions of policy or management and furnished with all details of costs and profits. Evasion of publicity with regard to costs of production and real profits is the mother of suspicion. A more hardy frankness must come.

In some countries, certainly in Great Britain, the chief complaint against excessive profits comes rather from the consumers. They complain of middlemen even more than of "rings"; and political action in Great Britain distinctly tends toward restrainng prices thought unfair. The threat of interference is in itself some deterrent; and the consumers have no belief that labour control would mean cheaper supply. Yet public opinion insists strongly that trusts and syndicates shall not exploit the consumer in the temper of the old monopolies. Capitalist concentration may safely result in any extent of profit to the promoters so long as, by lower not higher prices, and by more assiduous services, it conduces to the plain advantage of the general community. Other evident and even glaring problems are inherited wealth, the "idle rich"; pretentious and wasteful ostentation or what is called "prurient luxury"; efforts to acquire oligarchical or even pro-consular power over the nominal forms of political democracy by the influences of money. All these things the ightly judging majority of capitalists condemn as wrong in principle and most dangerous to the system. The man who makes his own wealth is looked upon with approval or tolerance by public opinion, and the most dazzling fortune personally achieved is apt to be admired rather than censured.

But it seems tolerably certain that democracy will restrict everely the possibilities of passive inheritance; and will prevent or limit the enjoyment of the advantages of wealth by those not contributing to its creation by personal usefulness. Even on this question, which affords a facile means of appealing to popular indignation, we must discriminate. We must remember as a rule the "idle rich" do not represent idle riches. Their money is for the most part invested in productive enterprise, and their personal waste in its effect upon the community is by comparison an inconsiderable mischief. Nevertheless wealth without work, however its actual evil may be magnified in popular imagination, is seriously obnoxious to democratic susceptibility. The case for active capitalism is fortified by every measure public and private tending to restrain the power of money in the hands of indolence. That excess of personal ndulgence described as "prurient luxury" has been known in all ages under all systems, and occurs in the present day under capitalism, Bolshevism, Fascism, Kemalism as an abuse not only of the corrupting possibilities of private wealth but of the equally corrupting possibilities of every kind of political and social influence wherever those who possess it seek to gratify a vicious habit. This immemorial disease has no moral relevance to modern capitalism as a system, and could not be cured by the abolition of private wealth. It is a problem of personal morals which has recurred under every social system, and can only be grappled with by methods not inspired by economic considerations.

Lastly, it must be recognised that a different kind of abuse is the broadest blot on the capitalist system. In cases no longer so common but still not infrequent, the providers of capital, taking no part whatever in the active management of business, are content to receive big dividends without extending any kind of profit-sharing or co-partnership to the salaried experts and workers for wages who in combination produce the dividends. The principle promising to spread in the future is that the interest on passive capital should be limited to some definite though not grudging figure; and that the bulk of the profit should be divided amongst those whose exertions and contrivance create it.

16. *The Future of Capitalism.*—While prophecy is vain, "probability is the guide of life." We must frame our estimate of what is probable, as well as of what is attainable and ought to be attained. As Socialism inspires vivid dreams, Capitalism for its moral vindication must have ideals as definite and more practicable. There is a rising supremacy of liberalising public influence. Advanced social thinkers who are yet strongly opposed to Socialism believe that private enterprise which they hold to be the best wealth-creating force is in gradual process of becoming also the best wealth-distributing system in a way that will raise the average of human prosperity to the highest attainable level. They anticipate therefore that the interest on money itself will be limited by maximum rates never so low as to discourage saving and investment; that the directing ability of active capital must remain entitled as now to large rewards in proportion to success in enterprise; but that as the education of democracy progresses labour will not only receive wages steadily increasing relatively to profits, but will everywhere share in the division of profits; while becoming more and more associated in consultative councils with the management of industry, and enjoying every possible opportunity to rise from the ranks.

In this fashion, therefore, capitalism would realise in the end all that is really sound in the practical ideals of Socialism while preserving that creative play of free ambition and adventure which is most surely stimulated by the chances and prizes of personal success expressed in terms of high income and acquired fortune whether large or small. To consider private profit in itself as sordid or immoral is superficial. Artists as usually as capitalists dream of large gains and splendid habits. Poets, dramatists and novelists, painters and architects, musicians, actors, still seek, or at least readily receive, as in fact they always have done, the largest personal gains that the demand for their achievements can bring. On the basis of more and more intimate partnership between capital and labour as here contemplated, methods of arbitration and conciliation would prevail and the lingering barbarism of strikes and lock-outs would disappear. The total yield of industry would be so largely enhanced by the fullest energy and harmony of common effort, that the earnings of the average might be far higher than now but the rewards of exceptional success not less ample nor even less dazzling. That freedom which maintains inequality does in fact lift the general level of existence, which forced equality would depress. Nevertheless, there is an ardent tendency throughout civilisation to insist that the privileges of society shall only be enjoyed by those who sufficiently participate in its activities and duties; that up to a reasonable age personal work must go with wealth.

Nor is this all. As capitalism for its own sake must be an instrument for applying the results of science to the general advantage, its function in that respect is becoming ever more effectual and hopeful. From the dirt and crudity, the utilitarian ugliness and social miseries of the generations immediately following the beginning of the machine-age, we are moving towards a smokeless civilisation commanding more sovereign and more subtle powers than we yet possess. The disappearing smoke is a physical symbol of the disappearance of moral evils in human relations and conditions. The machine which in some industries already does four-fifths of the work must come to perform nine-tenths of it in most industries. It is bound to eliminate the coarser kinds of heavy manual toil. We may reasonably expect that amongst the advanced industrial nations whom America is leading, every worker will become on the one hand a skilled man using fine touch with understanding, and on the other hand an associate of capital; taken into counsel on the general conduct of business, sharing profit and responsibility. Evolution in this manner seems more likely to be the general way of the world instead of revolution whether by legislation or violence. While maintaining all the energy and nimbleness of free private enterprise, enlightened capitalism, consciously working everywhere towards the ideals here described, can bring about so large an improvement upon the best social conditions at present existing that Socialism, no longer able to promise a new heaven and a new earth by comparison, will cease to think it worth while to seek a change. Not conflict between capital and labour but their real partnership in counsel and profits is the sure path of social vision between theories leading into the unknown or violence that either plunges into a morass or heads for a precipice. One of the deep problems is not economic. Capitalism in the past has contributed too much to ugliness in the world. The capitalism of the future must seek to enter into the service of art and beauty.

BIBLIOGRAPHY.—The classic work on economic freedom is Adam Smith's *Wealth of Nations* (1776). Much of his argument as to the value of private enterprise and initiative remains valid. Alfred Marshall's *Principles of Economics* (8th ed., 1920) and *Industry and Trade*, 2nd ed. (1919), contain a masterly analysis of the principles underlying the existing economic system. In a brilliant essay on "The Social Possibilities of Economic Chivalry," published in *Memorials of Alfred Marshall* (1925), he contrasts the sterility and the deadening influence in the long run of governmental management of industry with the elasticity of private enterprise.

An excellent account of economic tendencies and their practical operation is given in a recent work by an American economist, Professor F. W. Taussig—*Principles of Economics* (1921–2).

Besides these general treatises, other recent works which bear directly on the form of the economic system, and which are written from a scientific standpoint, include: Edwin Cannan, *The Economic Outlook* (1912); R. G. Hawtrey, *The Economic Problem* (1926); D. H. Robertson, *The Control of Industry* (1923); J. H. Jones, *Social Economics* (1920). M. H. Dobb in *Capitalist Enterprise and Social Progress* (1925) makes an acute critical analysis of the place of the *entrepreneurs* in the evolution of the present industrial system.

The above-mentioned books are all academic in outlook and treatment. Very few of those who are or have been engaged in industrial or commercial enterprises have utilised their experience and practical knowledge to write in defence of capitalism against the onslaughts of its Socialistic critics. Amongst such works the following are of special importance: *My Life and Work* (1922), by Henry J. Ford and S. Crowther, gives a very valuable first-hand account of the methods by which one of the greatest and most successful modern businesses has been built up.

Both in *Confessions of a Capitalist* (1925), by Sir E. J. Benn, and in *The Case for Capitalism*, by Hartley Withers (1920), a vigorous defence of capitalism is put forward from a practical point of view. A. Shadwell in *The Socialist Movement*, 2 vol. (1921), urges the superiority of private enterprise.

A number of important books dealing with the history and theory of capitalism have appeared in German, of which the following may be mentioned here: Fritz Gerlich, *Geschichte und Theorie des Kapitalismus* (Leipzig, 1913); J. Strieder, *Studien zur Geschichte Kapitalistischer Organisationsformen* (Munich, 1914); Werner Sombart, *Der Moderne Kapitalismus*, 2nd ed. (Leipzig, 1919); this is a very comprehensive work characterised by much originality of ideas and clearness of exposition, in which is set out the history of modern Capitalism down to the end of the 18th century, together with a brilliant analysis of the chief psychological and other factors governing its origin and progress. Richard Passow, *Kapitalismus* (Jena, 1918); Karl Bücher, *Die Entstehung der Volkswirtschaft* (1918–9); Georg von Below, *Probleme der Wirthschaftsgeschichte* (1920); O. Spann, *Der Wahre Staat* (1921); L. Pohle, *Kapitalismus und Sozialismus*, 3rd ed. (Leipzig, 1923), a good defence by the Professor of Economics at Leipzig of capitalism on economic and general grounds, and a critical account of the theoretical but especially of the practical errors of Socialism. August Pieper, *Kapitalismus und Sozialismus als seelisches Problem* (1924); J. Walcher, *Ford oder Marx* (Berlin, 1925), a comparison of the consequences to the whole community, and above all to the working classes, that would result from the adoption on the one hand of the principles advocated and applied by Henry Ford, and on the other of the destructive and barren tenets of Karl Marx.

Among French and Italian works consult: C. Gide, *Principes d'économie politique* (1910); D. Bellet, *La machine et la main-d'œuvre humaine* (1912) and *Crises économiques* (1918); A. Aftalion, *Crises periodiques des surproductions* (1913); Yves-Guyot, *L'industrie et les industriels* (1914); N. Colajanni, *Il progresso economico* (1913); G. Arias, *Principii di economia commerciale* (1917). (J. L. G.)

CAPITAL LEVY.—During the first year of the World War it was thought in Great Britain that a loan policy should take the first burden of its cost, but as soon as it became obvious that the War would be a long one, it was equally clear that the amount of the war debt would reach figures quite unprecedented in financial history. There was the apparent impossibility of meeting the cost from current resources, either by taxation or by loan, and also a strong desire to avoid the evils of currency inflation. Great Britain had so long been regarded as a very wealthy country that it seemed that its accumulated wealth might well be laid under toll.

Early Suggestions for a Levy.—The first suggestions for a levy in Great Britain seem to have been made by Mr. W. Watson Rutherford (Nov. 19 1914) in the House of Commons. He proposed a 5% tax on capital, which would produce £500,000,000 and be taken in kind in the case of shares or real estate. He thought that the majority of persons would gladly pay if they understood that the levy was to take the place of a high income tax. It was put forward therefore as a sound business proposition. Sir Thomas P. Whittaker, M.P., in May 1915 proposed a 2½% levy to raise £250,000,000, which was described as an attractive proposal, but very difficult to carry out. Professor A. C. Pigou, one of the earliest academic supporters of the scheme, incorporated a detailed proposal for the special taxation of earned income to balance the special levy on objective wealth and thus make the whole scheme logical.

Development of the Plan.—The theory of "commutation," or the "business deal," did not, however, long hold the field. A considerable degree of inflation was taking place, and many were preoccupied with the inevitable fall in prices expected after the War. It was obvious that the repayment of £1,000,000,000 of debt at such a time involved far less real production and effort than the repayment of a similar amount when the price level should be lower in years to come. Moreover, what was a tolerable burden of interest at a high level of prices would become intolerable at some future period at a much lower level. It was said that "where we had borrowed one pair of boots we should really be repaying two," for, the debt being in sterling, sterling would in future have a much greater purchasing power with a lower price level. The proportion of the debt charge to the national income at that time was probably not more than one-eleventh or one-twelfth, whereas if the price level went back to its pre-war position that same sterling debt charge might represent one-sixth or one-seventh of the same real national income. Everything else in the national income might go down with the price level, but the debt charge could not. It was urged, therefore, that the opportunity to make a very substantial reduction in the indebtedness by a special levy on individual fortunes should not be missed.

During the last two years of the War the case for the levy became reinforced by two powerful semi-ethical considerations. In the first place enormous fortunes were being made, despite heavy taxation by income tax, super-tax and excess profits duty, at a time when large numbers of people were impoverished through the War, and it was considered to be wholly unjust that people who were able to avoid the fighting line should in addition secure a much greater personal wealth than they had at the beginning of the War.

Moreover, conscription brought into prominence the so-called contrast between "life" and "wealth," and it was said that conscription of life on the part of the able-bodied should be matched by conscription of wealth on the part of the rich. Simultaneously, the argument arose that the War was one brought about by the old and fought by the young, that the old would chiefly benefit, and that it was unfair for the young to bear first the burden of fighting, and then, for the rest of their lives, by a toll on their effort and production, the burden of interest payments to those who had never borne their physical share of the conflict. These and other arguments led to considerable discussion.

Approval of the principle of the levy was at first not confined to any particular political party. Mr. Bonar Law at one time showed a definite leaning towards the proposal, and a small group of economists were in favour of it on broad grounds. The chief battle-ground of controversy was the question of the practicability of carrying through so gigantic a financial operation without dislocating the delicate financial mechanism of the country, bringing about a wholesale slump in stock exchange prices, robbing industry of credit, and generally undermining the whole foundation of stable values upon which the idea of the levy rested.

Proposed Levy on War Wealth.—After the War the discussion took a specific direction, viz., it proposed to confine the levy to "war fortunes." It was realised that a capital levy would tax two fortunes of £20,000 identically, although one might have been reduced from £50,000 owing to the War, while the other might have been built up from practically nothing. The capital levy, therefore, was seen to work considerable injustice, judged from purely ethical standpoints. The proposal for the moment thus became limited to the levying of a tax upon fortunes, which by a common public sentiment were regarded as specially fit for such a burden. It was soon, however, agreed to be administratively impracticable to examine every individual circumstance and to decide in which particular cases the increase was actually due to the War, so that a new proposition was put forward that *anybody* who had had an increment in his fortune between 1914 and 1919 would probably be a suitable subject for such a tax.

Report of a Select Committee.—Early in 1920 post-War inflation and the great amount of the floating debt, with its continual renewal in cost and competition, created a difficult and dangerous situation. It was thought that a special levy would raise from £500,000,000 to £750,000,000 and, by reducing the floating indebtedness, would conduce to stability. A select committee of the House of Commons considered the question early in 1920. Its report was not conclusive, but, in any case by May 1920, the financial situation had definitely turned, prices declined, and it was thought to be positively dangerous to adopt such a highly difficult expedient at such an unpropitious time.

Resumption of the Capital Levy Proposal.—Under those conditions the financial objections to a general capital levy became stronger and more pronounced on many sides. Apart from a few supporters in academic circles, the programme became almost entirely identified with the Labour party, and the grounds upon which it was put forward were also gradually shifted. It was no longer specially urged as a composition by the taxpayer for his own future liabilities. The main dynamic argument with the Labour party was the fact that the heavy interest charges included in the Budget necessitated such high rates of direct taxation and such pressure for reductions in taxation that it became impossible to budget for any substantial new programmes for social reform, and to incur greater expenditure on housing, education, pensions, etc.; it was clear that the burden might delay expansion indefinitely. It was thus desired to relieve the Budget of a large part of its annual interest on the expenditure side, in order to allow room for expenditure on other objects.

On coming into power the Labour party appointed a special committee to consider questions relating to national debt and taxation (the Colwyn Committee). Eminent academic witnesses who had previously supported the scheme assumed that the opportune moment had passed, and others, because it appeared that the net yield would be inadequate, having regard to the disturbance and risk entailed relinquished the idea.

Summary.—The chief financial and economic contentions on the two sides for and against a levy may now be set out. The ethical considerations that once loomed so large became later less prominent. The chief objections may be classified as follows:—

1. *Repetition.*—A successful levy, although definitely aimed at relieving war debt, can give no guarantee against repetition for other purposes in the future, and possibly even in the near future. No ordinary assurance against this possibility is of any use because no Government can bind its successor. Indeed the more successful the levy, the greater may be the incentive to repeat it. The consequence of this would be that under a fear of repetition the accumulation of capital would be restricted and slow, and, in consequence, all industrial progress must be retarded.

Against this view it has been contended that repetition is not a thing to be feared, because no one would think of imposing a special charge of this character except in a great emergency. In the event of a great emergency it would be a positive advantage to have the national accounts cleared of such indebtedness, and to be able to enter upon a war without a colossal debt. All war loans have conditions attached to them which are honourably observed by Governments, and there is no reason to suppose that a similar assurance cannot be given to the taxpayer so that any economic effects through fear of repetition could be avoided.

2. *Effects on Prices.*—The second main contention is that the financial operation would be so huge, that the attempts to carry it out on practical simultaneous lines must destroy its own basis by depressing prices. If the treasury were satisfied to take only cash this would involve putting large blocks of shares on the market, for which there would be no ready sale, panic prices would ensue, and confidence would be destroyed. If, in order to avoid forced sales, the Government were to take stocks and shares in payment, they would find themselves with large miscellaneous holdings in industry which they could not realise without disastrous consequences. The mere passive holding of securities is no relief to the Budget.

It has been rejoined that the notion that a large quantity of securities must be put on the market and result in depressing it, is quite mistaken. It is merely a matter of synchronising the supply of securities with the demand, for whenever debt is redeemed an investor will be ready in the market to buy securities that are on sale, either by taxpayers or the Government. It is true that the banks and finance houses could talk the market into a state of panic, but if they were determined to support the scheme with their good-will, depression of prices would be quite unnecessary.

3. *Damage to Individual Businesses.*—The third contention is that the ordinary business in private hands could not pay a large levy without encompassing its own destruction. It could not divide its business, and would be forced to raise mortgages or debentures which, in view of the uncertain financial future, could only be obtained on onerous terms.

A counter contention to this takes the following form: If a business were really valued at a figure necessitating a payment to the Government, it would also have sufficient credit to raise a mortgage and the charge or levy would be evidence of the fact. The money for this would be forthcoming in the market because of the funds set free by the redemption of debt. The utmost difficulty that could arise would be some slight redirection of capital. In all cases of hardship, or where a business was likely to be inconvenienced, the Government would grant payment by instalments. Against this it has been replied that a levy honeycombed with instalments and special cases would be very similar to a special income tax, but levied on an insecure and unfair basis. Such a system, it is urged, would take 10 or 20 years to bring to a definite conclusion.

4. *Valuations Impracticable.*—The next contention is that so much of the wealth of the country is held in contingent titles, such as life interests and reversions, and that the valuation of these would make an insoluble problem. However actually correct the valuation may be at the time, the results would be belied by subsequent events, and wherever duty was being paid by instalments there would be overwhelming demands for adjustments. These would be sufficiently important to reduce the levy to chaos.

5. *Repayment of Part of the Debt Makes the Repayment of the Remainder more Difficult.*—The fifth argument relates to the deflationary effect of the levy itself. It is stated in some financial circles that the sudden cancellation of £3,000,000,000 of debt according to the programme of the Labour party, would remove from businesses a very large amount of collateral security. This would cause credit to be withdrawn and restricted. In other cases credit would be withheld, and prices would fluctuate with disastrous effects on business enterprise and employment.

Against this it is contended that the argument is a gross exaggeration. Only a small proportion of the war loan is used as the actual basis of credit operations, and many people who so use it have other securities which can be used instead. Again, credit is much more largely personal, and does not depend upon collateral of this kind. Moreover, others contend that deflation can only be brought about by operations through the Bank of England, and the inability of an individual borrower to be granted a loan means that, in practice, a loan is given to someone else because the banks have this credit available. The total amount of effective credit, it is said, cannot be affected by the demands of the particular borrowers.

6. *Future Saving Impaired.*—The sixth contention relates to the effects of redistribution of wealth upon future saving. The idea that the wealth-accumulating classes would have not only to give up a part of their existing fortune, but also to suffer rates of tax in future as high, or higher, would, it is said, strike at the root of all thrift and lead to national wastefulness, because the other classes of the community would not themselves save an equivalent sum.

Against this it is stated, however, that the outlook is too serious for any ordinary arguments about the redistribution of wealth to avail. Money must be taken where it is to be found. Whatever the immediate disadvantageous effects of the levy, the dynamic effects in future are by far the more important. Greater good to the community would come about by relieving the worker and the middle classes of some of the burden of taxation or by expending state funds on proper social purposes. This would lead to greater productivity, to lower rates of taxation and to greater general average prosperity.

7. *The Price Level Argument.*—In the next place, the price level contention is disputed. The idea that it will be an advantage to repay debt before the price level falls, must be qualified by the fact that the operation of the levy itself would bring about lower prices and thus make the remaining £4,000,000,000 sterling of the debt charge a much more onerous charge than would otherwise be. In view, however, of the denial that the price level will be necessarily lower in the long run, this contention is not accepted. But in so far as it might prove to be true, it is said that it would be so much to the advantage of the workers to have higher real value in their earnings that the whole country would gain. It is said that there are more factors making for a rise in prices than for a fall in the long run, and therefore future repayment may be easier than present repayment.

8. *The Net Annual Relief.*—In the last place the opponents of the levy say that the whole basis of the programme is fallacious, because it has been assumed that the effect would be to set free the whole of the interest on £3,000,000,000 of debt, say £150,000,000 a year, and allow of expenditure programme to this amount, or of a reduction of taxation *pro tanto*.

It is stated that this view ignores the progressive features in the existing income tax, supertax and death duty schemes. Taking large sums away from individual fortunes would reduce their taxpaying power in future, and the revenue side of the Budget would also be seriously affected, so that all that could be reckoned upon would be a certain *net* saving. One authority has estimated that, in the long run, out of a saving of expenditure of £140,000,000, something between £90,000,000 and £98,000,000 per annum would have to be set aside to make good the effects of the levy on future revenue, so that the net advantage to the Budget would have to be reduced to some £42,000,000 or £50,000,000 a year. No effective counter statistics have been so far put forward to alter this result.

The Rate of Levy.—The proposals of the Labour party were that persons with less than £5,000 should pay nothing, but that those owning more than that sum should pay on the following scale:

£	%	£	%
6,000	5	50,000	35
8,000	10	100,000	40
10,000	15	200,000	45
15,000	20	500,000	50
20,000	25	1,000,000	55
30,000	30	Above 1,000,000	60

Some authorities doubt whether the capital wealth of the country is sufficient for the operation of this scale to produce the £3,000,000,000 assumed.

The Levy in Other Countries.—There have been no first-class experiments abroad illustrating all the features of the levy as proposed for the United Kingdom. In 1920 in Czechoslovakia a levy was introduced which was to bring in £63,000,000 or about £5 per head of the population, with a low limit of exemption, *i.e.*, 10,000 crowns free, 1% on the first 25,000 crowns, and then on a progressive scale up to 30% on amounts over 10,000,000 crowns. The actual yield was £17,000,000 in the first two years, and the instalment system which was allowed gave it, as a matter of fact, the character of a heavy income tax. The results have been regarded as disappointing, and the consequent arrears in income tax are heavy.

In Switzerland in 1922 the Socialist party proposed a levy with the idea of devoting the proceeds mainly to social purposes. On a referendum the proposal was rejected in every canton, but while it was under discussion the effects upon financial conditions were very obvious.

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CAPITULATIONS (*see* 5.283).—For the most part the old capitulatory system was swept away by the World War nowhere more notably than in Turkey, where for centuries it had been the cause of endless disputes among the European Powers themselves as well as between those Powers severally and the Porte. The post-War position of capitulations may be briefly stated. Capitulations are still in force in Abyssinia, China, Egypt, Morocco and Persia; they may be said to exist in Bulgaria, as Art. 175 of the Treaty of Neuilly provides that the immunities and privileges of foreigners as well as the rights of jurisdiction and of consular protection enjoyed by the Allies and Associated Powers in Bulgaria by virtue of the capitulations, usages and treaties, may form the subject of special conventions between each of the Allied and Associated Powers and Bulgaria; Great Britian possesses extra-territorial jurisdiction in Bahrein, Hejaz, Kuwait and Muscat. The capitulations still in force may be thus summarised according to countries.

Abyssinia.—Austria, Belgium, France, Germany, Great Britain, Hungary, Italy and the United States have consular jurisdiction.

China.—Extra-territorial jurisdiction is enjoyed by Belgium, Brazil, Chile,[1] Denmark, France, Great Britain, Italy, Japan, Mexico, the Netherlands, Norway, Peru, Portugal, Spain, Sweden, Switzerland and the United States.

Egypt.—Capitulatory rights are possessed by Belgium, Denmark, France, Great Britain, Greece, Italy, the Netherlands, Norway, Portugal, Russia, Spain, Sweden and the United States. Rumania has limited capitulatory rights, and Persia has a consular court.

Morocco.—Great Britain and the United States retain capitulatory rights in the French zone; Italy and the United States in the Tangier zone. In the Spanish zone Great Britain, Japan, the Netherlands, Switzerland and the United States retain these rights.

Persia.—Extra-territorial rights are possessed by Argentine, Belgium, Brazil, Chile, Denmark, France, Germany, Great Britain, Italy, Mexico, the Netherlands, Norway, Spain, Sweden, Switzerland, the United States and Uruguay.

Since 1911 capitulatory rights have been abandoned in very many countries, notably as the result of the political and territorial changes effected by the War. In one instance alone—Tripolitania—were such rights relinquished prior to the War. The following summary reveals the extent to which capitulations have been abandoned since 1911:—

Albania.—By Great Britain, Feb. 6 1926.

China.—By Austria, Germany and the Soviet Union. Extra-territorial rights have also been lost by the subjects or citizens of the Succession States (Poland, Czechoslovakia, etc.), formed as a consequence of the dissolution of the Austro-Hungarian and Russian Empires.

Crete.—By Great Britain, Aug. 25 1914.

Egypt.—By Austria, Germany and Hungary.

Greece.—By Great Britain Aug. 2 1914 in territories acquired by Greece after the Balkan Wars of 1912–3.

Morocco.—In the French zone by Belgium, Bolivia, Costa Rica, Denmark, Greece, Italy, Japan, the Netherlands, Norway, Portugal, Russia, Spain, Sweden and Switzerland. In the Spanish zone by Belgium, Denmark, France, Greece, Italy, Norway, Portugal, Russia and Sweden. Austria, by articles 96–98 of the Treaty of Saint-Germain, Sept. 10 1919; Germany, by articles 141–143 of the Treaty of Versailles, June 28 1919; and Hungary, by articles 80–82 of the Treaty of Trianon, June 4 1920, have renounced their capitulatory rights.

Persia.—By Austria, the Soviet Union and Turkey. By the termination in May 1924 of the Greco-Persian Commercial Treaty of Oct. 28 1861 Greek rights in Persia lapsed.

Siam.—The protocol relating to jurisdiction, annexed to the general treaty with Siam of July 14 1925, has abolished the system of jurisdiction heretofore established in Siam for British subjects, who now become amenable to the Siamese Courts. In the interests of justice, however, cases may be evoked from the Siamese Courts and be dealt with by a British diplomatic or consular officer in accordance with English law (*see* SIAM).

Tripolitania.—By Great Britain in Oct. 1911.

Turkey.—By those signatories to the Treaty of Lausanne, July 24 1923, who possessed capitulatory rights in Turkey at the outbreak of the European War; and by Germany, Persia and the Soviet Union. The United States have agreed to abrogation in the (as yet unratified) treaty signed at Lausanne, Aug. 6 1923.

BIBLIOGRAPHY.—For the texts of the Treaties mentioned, excepting that with Siam, see H. W. V. Temperley, *The History of the Peace Conference at Paris*, vol. 6. (I. F. D. M.)

CAPOK: *see* CELLULOSE; FIBRES.

CAPORETTO, BATTLE OF.—The Italian offensive of Aug.–Sept. 1917 had reduced Boroević's armies to the limit of resistance, so much so that, as Ludendorff records, "the responsible military and political authorities of the Dual Monarchy were convinced that they would not be able to stand a continuation of the battle and a 12th attack on the Isonzo. . . . In the

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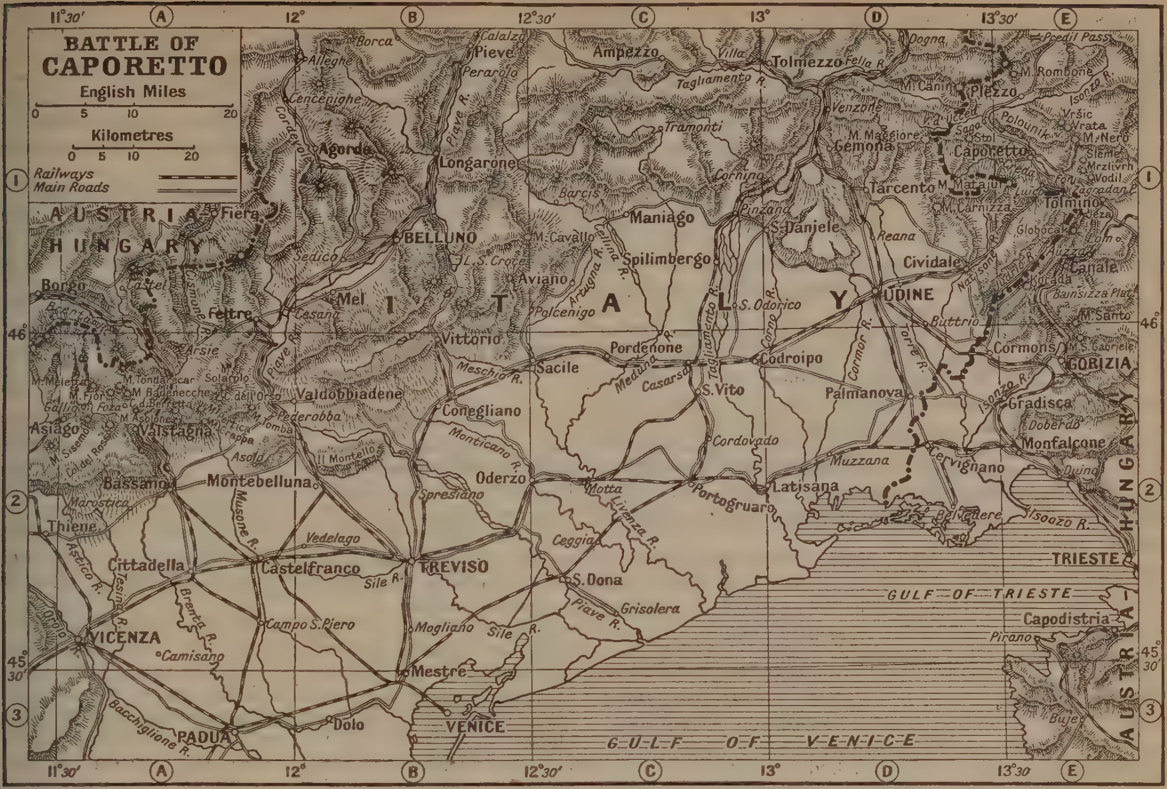
[1] The Chinese Govt. do not recognise Chile's right to extra-territorial privileges; the question is still (1926) in dispute.


BATTLE OF
CAPORETTO
English Miles
0 5 10 20
Kilometres
0 5 10 20
Railways
Main Roads
AUSTRIA HUNGARY
ITALY
AUSTRIA HUNGARY
GULF OF TRIESTE
GULF OF VENICE
11°30′
12°
12°30′
13°
13°30′
46°
45° 30′
A
B
C
D
E
1
2
3
Borca
Calalzo
Pieve
Ampezzo
Villa
Tolmezzo
Fella R.
Dogna
Predil Pass
M. Rombone
Plezzo
Isonzo R.
Vršic
Vrata
M. Nero
Sleme
Mrzlivrh
Vodil
Zagradan
Alleghe
Perarolo
Tagliamento R.
M. Canin
Cencenighe
Cordevole
Piave R.
Tramonti
Venzone
M. Maggiore
Gemona
Stol
Caporetto
Agordo
Longarone
Cornino
Tarcento
M. Matajur
Luico
Tolmino
M. Carnizza
Fiera
Barcis
Maniago
Pinzano
S. Daniele
Reana
Globocak
Lom
Jeza
Auzza
BELLUNO
M. Cavallo
Spilimbergo
Cividale
Canale
Sedico
L. S. Croce
Aviano
Natisone
Korada
Bainsizza Plat.
Borgo
Mel
Polcenigo
S. Odorico
UDINE
M. Santo
Feltre
Casana
Buttrio
Vittorio
Pordenone
Codroipo
Cormons
M. S. Gabriele
GORIZIA
Arsie
Meschio R.
Sacile
Torre R.
Cormor R.
M. Meletta
M. Tondarecar
M. Badenecche
Solarolo
M. Fiora
Foza
Gallio
Valdobbiadene
Pederobba
Medund R.
Casarsa
S. Vito
Palmanova
Gradisca
Asiago
Valstagna
Conegliano
Doberdò
M. Sisemol
Col del Rosso
Monticano R.
Cordovado
Monfalcone
Asolo
Il Montello
Muzzana
Cervignano
Bassano
Montebelluna
Oderzo
Latisana
Duino
Marostica
Spresiano
Motta
Livenza R.
Portogruaro
Thiene
Musone R.
Vedelago
Ceggia
Belvedere
Isonzo R.
Astico R.
Cittadella
Castelfranco
Sile R.
TREVISO
TRIESTE
Tesina R.
Brenta R.
S. Dona
Piave R.
Grisolera
Campo S. Piero
Mogliano
Sile R.
Capodistria
VICENZA
Pirano
Camisano
Mestre
Bacchiglione R.
PADUA
Dolo
VENICE
Buje

middle of Sept. it became necessary to decide for the attack on Italy in order to prevent the collapse of Austria-Hungary."

There was a clear difference of opinion on the Italian side as to the best way of meeting the forthcoming attack. Cadorna felt he must stand on the defensive. Capello, who commanded the II. Army, was anxious to anticipate the enemy's move by an attack northeast from his positions on the Bainsizza plateau. His army was in the main aligned for attack, for a continuation of the offensive which had been broken off in Sept. and he judged it impossible, given the difficulty of communications and the risk of imminent attack, to take up the positions best adapted for defence. In this idea he had the support of more than one of his corps commanders, but Cadorna did not think that he could throw in the forces necessary for such an attack when he was uncertain as to the direction of the forthcoming blow.

I. THE AUSTRO-GERMAN ATTACK

Disposition of Italian Forces.—Cadorna had received satisfactory reports concerning the *morale* of his troops. He had enough men, though a number of his units were below strength; and he had enough guns, in spite of the withdrawal of the Allied batteries, though he would have been glad of more heavy artillery. Between Monte Rombone and Monte San Gabriele, Capello had some 2,200 guns and nearly 800 trench mortars. North of Tolmino the line on the left bank of the Isonzo was held by Cavaciocchi's IV. Corps, whose left wing held the Plezzo basin and was in contact with the Carnia force on Monte Rombone. Next came Badoglio's XXVII. Corps, whose left wing, the 19th Div., raised to the strength of an army corps, held the lines opposite Tolmino. The other three divisions which completed the XXVII. Corps were across the river south of the Lom plateau. Behind Cavaciocchi's right and the 19th Div., on the mountains west of the Isonzo, lay the VII. Corps, newly reconstituted with units from other corps, and commanded by General Buongiovanni. On the right of the XXVII., holding the line as far as Monte Santo, were Caviglia's XXIV. Corps and Albricci's II. Corps.

The weak point of the Italian line was the Tolmino sector; the weakest part of this sector was at the junction of the XXVII. Corps (19th Div.) with the IV. (46th Div.), and the weakest position of all was that held by the right of the 46th Div., which was clinging to the slopes of Sleme and Mrzlivrh completely dominated by the enemy, and badly off for communications with its neighbours. The Tolmino sector was chosen for the main enemy attack, and here, owing to a complex of circumstances, the Austro-German forces won a success that led to a great Italian disaster. The Italian preparations were much handicapped by the illness of Capello.

The Attack Launched.—The main attack came in the direction anticipated, between Monte Rombone and south of Tolmino, and was conducted by a mixed German and Austrian army under General Otto von Below. The army, which was known as the XIV. Army, consisted of nine Austrian divisions and seven German, in four groups. The northern group of four divisions (three Austrian and one German Jäger) was commanded by Krauss, who had been called back from the Bukovina. Next came a group of three divisions (one Austrian and two German) under the German Von Stein, and a group of two German divisions under the German Von Berrer. South of these two central groups was a mixed group (one Austrian and two German) under the Austrian Von Scotti. East of Tolmino lay four divisions in reserve. Boroević had 20 divisions in his two Isonzo armies between Auzza and the sea. Below and Henriquez (2nd Isonzo Army) had some 2,500 guns and 500 trench mortars.

The bombardment began at 2 o'clock on the morning of Oct. 24 in wild autumn weather. There was a drizzle of snow on the high ridges, rain below, and mist everywhere. Towards dawn the fire died down, and it was thought on some parts of the defending front that the bad weather had counselled a delay in the attack. But the attackers were to make skilful use of the weather conditions, and only on Monte Rombone, on Krauss's extreme right, an attack in conjunction with the left wing of Krobatin's X. Army had to be given up owing to the snow.

Krauss's main attack was a straight drive through the Italian lines in the Plezzo basin, his first objective the Saga defile. But he meant to reach without delay the ridge of the Stol (6,467 ft.), which stood athwart a further direct advance. For this attack he detailed the 22nd Schützen Div., followed by a Kaiserjäger and a Kaiserschützen battalion, which were to go straight for the Stol, and by six battalions of the 3rd (Edelweiss) Div., which were to make for the Val Fella by way of the Wal d'Uccea. Krauss's left wing, the 55th (Bosnian) Div., attacked the Vršic-Vrata ridge, with the object of breaking through to the Isonzo and Caporetto.

Krauss's drive, after hard fighting, broke through the three front lines held by the Italian 50th Div., but the attacking troops were checked at the Saga defile. When evening fell, this position was still in the hands of the Italians, but the battle had gone badly for the defenders farther south, and a retreat to the Stol became necessary. Krauss's Bosnians had met with no success against the left wing of the Italian 43rd Div., but Stein's group had carried all before it. Stein opened his attack with his right wing, the Austrian 50th Div., at 7:30 A.M., attacking the Italian 46th Div. between Monte Nero and Vodil. A little later the Bavarian Alpenkorps, advancing from Tolmino, attacked the ridges east of the Passo di Zogradan, while Berrer and Scotti attacked farther south.

Success of the Silesians.—When both Stein's initial attacks were under way, the 12th Silesian Div., under Gen. von Lequis, was sent in between them. Lequis attacked in two columns, one on each side of the river, making for Caporetto, where it was hoped he would join with Krauss's Bosnians. Both columns were completely successful. The right-hand column, aided by the strong attacks of the Austrian 50th Div., pierced the extreme right of the Italian 46th Div., and pushed northwest with all speed. Across the river, where the Alpenkorps was making good headway on the slopes above the road, Lequis's left-hand column quickly reached the Italian second line, where the valley narrows below the hamlet of Foni. This line had been held until the eve of the battle by a brigade of the IV. Corps, but at the last moment the sector was transferred to the XXVII. Corps, and the Napoli Brigade was given to Badoglio to hold this important point. Only one battalion, however, was placed near the river. The rest of this regiment (the 76th) lay at the Zogradan Pass high on the ridge to the southwest, and the other regiment of the brigade (the 75th), together with the brigade command, was nearly 3 m. away, on the western slopes below Zogradan. The single battalion, of which only a platoon was on the road, seems to have been taken completely by surprise. It was run over by the Silesians, who proceeded on their way up the valley practically unmolested.

Meanwhile, the Alpenkorps, Berrer's two divisions and Scotti's right wing were breaking up Badoglio's left, while the latter's right, across the river, and Caviglia's corps were being strongly attacked by Scotti's left and Henriquez's right. The attack from Tolmino had been carried out with skill, speed and resolution, and by a capital error which has never been satisfactorily explained the Italian guns remained silent until too late. Definite orders had been given both by Cadorna and by Capello that immediately upon the opening of the enemy's bombardment the Italian artillery should open fire on the enemy's trenches and zones of concentration and that they should lay down a heavy barrage as soon as there were signs of movement. These orders were not carried out and, owing to great destruction of telephone wires, when the guns finally began, their fire was fitful and uncertain. And they were too late: the enemy's attack had already developed. Taken by surprise, puzzled by the comparative silence of their own guns and blinded by mist, the troops of the 19th Div. opposed only a weak resistance to the Austro-German attack.

Henriquez's attack on the Bainsizza plateau, although it met with some initial success, was readily repulsed. Badoglio had hoped to hold the enemy attack from Tolmino and turn the scale by a counter-attack on the Lom plateau with his three divisions on the left bank of the Isonzo. But he was not afforded the chance of attempting any such manoeuvre. It was long before he received any news of how the day was going on the front of the 19th Div., and from the beginning of the action he was unable to communicate with his divisions across the river. In a message sent to Army Headquarters at 4 P.M. he reported the enemy success south of Jeza, but said that he had no news from the commands of the 19th Div. and the IV. Corps, and that he was unable to communicate with anyone.

By 4 P.M. Lequis's Silesians were approaching Caporetto. The left-hand column was unmolested on its march. The right-hand column, which had cut in behind the Italian 43rd Div., was making the task of the Austrian 50th comparatively easy and brushing aside the spasmodic opposition of such small detachments as came in its way. Cavaciocchi had filled his front lines too full, and sent practically all his reserves across the river, in immediate support of the 43rd and 46th Divisions.

II. THE ITALIAN RETREAT

By evening the situation was very favourable to the attacking forces. Stein was pouring troops through the breach made by the Silesians and was making good headway with the Austrian 50th Div. on their right, while the Alpenkorps, Berrer and Scotti, had in several places gained the high ridges dominating the head of the Judrio valley. Krauss was still held up at Saga and Polounik and his Bosnians had gained no more ground. But the break-through between Tolmino and Caporetto had made the Italian positions untenable.

At Cividale, where Capello had his headquarters, and at the Comando Supremo in Udine, the first news that came from the IV. Corps and the absence of news from the XXVII. made a grave impression. Capello sent up the army reserves by the valley roads and dispatched Montuori to direct the "left wing" (the IV. and VII. Corps). By evening it was clear that the enemy had won a big success, though it was not yet clear to what an extent the whole Italian left was crumbling. There seemed good reason to hope that the advance might be blocked in the narrow valleys west of the Isonzo. But by nightfall both the IV. Corps and the 19th Div. were practically broken in pieces. The VII. Corps was beginning to be attacked at Luico, and its right was uncovered by the destruction of most of the 19th Division. The right wing of the 19th was still holding on Globocak and down to the river, and troops were being brought back from the left bank to strengthen this line. But it was obvious that the positions on the Bainsizza could not be obtained, and orders were given to Caviglia, who had taken over Badoglio's troops beyond the river, to prepare for a retreat across the Isonzo.

At the moment the most dangerous point appeared to be the extreme left wing, where it was clear that Krauss would try and push through the Val d'Uccea, the shortest way to the Tagliamento. Two Alpine groups had been dispatched to this sector the day before, and Cadorna gave orders that the Val d'Uccea must be blocked at all costs. He sent out orders for resistance on three successive lines, all radiating from Monte Maggiore, which was the key position, but at the same time, as a precaution, he directed that plans and orders should be drawn up for a general retreat to the Tagliamento.

The news on the morning of Oct. 25 was increasingly grave. Krauss was pressing upon the Stol, and finding a weak resistance; no stand was being made at Creda; Monte Matajur had fallen, practically undefended. Other positions were seriously threatened, and there was no confidence that they would be held, for it was now known in Cividale and Udine that the behaviour of some of the troops in the line had been very unsatisfactory, and that this unexpected lack of spirit was communicating itself to some of the reserves. These had a difficult task in getting to the scene of action, for as they marched up the narrow mountain roads they were met by ever-increasing masses of fugitives, the bulk of whom belonged to the non-combatant services. This unfortunate state of affairs undoubtedly hastened the break-up of Capello's whole left wing.

Preparations for Retreat.—On the afternoon of Oct. 25 Capello, who could fight no more against his illness, and had been told by the chief medical officer of the army that he must resign his command, proposed an immediate retreat to the Tagliamento, arguing that it was useless to send more reserves into the chaos among the hills west of the Isonzo. Cadorna felt that unless he could delay the enemy advance down the Natisone and Judrio valleys he ran the risk of having his centre and right cut off. Montuori, who now succeeded Capello in command of the II. Army, thought that he could hold on a line from Monte Maggiore to Monte Carnizza and thence across the valleys to Monte Korada. Cadorna decided to attempt a further stand while warning Tassoni (Carnia Force), di Robilant (IV. Army) and the Duke of Aosta to hold themselves in readiness for retreat, but at midnight on Oct. 26 he was wakened to hear that Monte Maggiore had fallen. He at once drew up the orders for a general retreat beyond the Tagliamento and his plans were already matured for the longer retreat across the Piave which he foresaw would be necessary in order to get to a shorter line. The retreat began on Oct. 27, and two days later provisional orders and plans were issued for the further retirement to the Piave.

Fortunately for Italy, and for the cause of the Entente, the Germans and Austrians were outrunning their transport. Krauss complained that only he and Krafft von Delmensingen, Below's chief-of-staff, had been inspired by adequate ambitions for the attack. The objective had been Cividale, or at best the Tagliamento. Krafft thought they should have had the Adige in view. Krauss expressed the opinion that the real objective should have been Lyons. It must be remembered, however, that the transport difficulties were very great. Germany could not spare troops or material for an unlimited effort here and the unexpectedly weak resistance of the Italian II. Army could hardly have entered into the calculations of those who were bound not to take too many risks. Krauss admits that if Cavaciocchi had held the Stol in force his own move would have been frustrated.

The critical days for the Italians were Oct. 30 and 31, when the pressure from north and east threatened the flank and rear of the III. Army, whose task had been made more difficult by the premature blowing up, owing to a false alarm, of the permanent bridges at Casarsa and by the fact that the Tagliamento had come down in sudden and violent flood. But by the evening of Nov. 1 the last of the Duke of Aosta's troops had been successfully withdrawn across the river.

Cadorna's weakest point was the stretch of the river west of Tarcento, for which Krauss and Stein were making with all speed. Two divisions under di Giorgio had been dispatched to hold this line, but their march athwart the line of the retreat had been very difficult. Stein's troops were repulsed with heavy loss, but on the evening of Nov. 2 Krauss's Bosnians succeeded in crossing at Cornino and the following morning di Giorgio was strongly attacked at Pinzana. Two days later his left was pushed back still farther, endangering the line of retreat for the Carnia force and once more threatening the whole Italian line with envelopment from the north.

On the morning of Nov. 4 Cadorna ordered the retreat to the Piave and that night the troops holding the line of the Tagliamento resumed their march westward. The IV. Army in Cadore was now in a difficult position but di Giorgio and the other covering troops of the worn-out II. Army slowed down the enemy's advance and gave time for most of di Robilant's troops to get away from Cadore and come into line between the I. and III. Armies. But the greater part of Tassoni's Carnia Force was caught between Krauss's troops and Krobatin's X. Army.

III. THE RECOVERY ON THE PIAVE

New Italian Positions.—By Nov. 8 the bulk of the IV. Army was in line. On Nov. 9 and 10 the last covering troops of the II. and III. Armies crossed the Piave from Pederobba to the sea. The line chosen to defend the fortunes of Italy implied a withdrawal of the right wing of the I. Army. Pecori-Giraldi retired from Asiago and Gallio and based his right on the fortified lines of the Meletta group, giving up the XVIII. Corps to di Robilant, who held the line from the Brenta to the Piave and the short stretch of the river as far as the Montello.

Reserves were coming in fast from the depots, including the young class of 1899. French and British divisions were already in Italy and others were on the way. But Diaz, who took over the command from Cadorna on Nov. 9, had to face a situation that seemed almost desperate. The Italian armies had lost some 320,000 men in killed, wounded and missing, the number of prisoners being estimated at 265,000. The bulk of the II. Army had to be counted out altogether and the total number of troops to be reorganised and refitted was over 300,000. More than 3,000 guns had been lost and over 1,700 trench mortars. It seemed very doubtful whether these greatly weakened forces could resist the renewed attacks of the victorious armies which had followed so closely on their heels. Fortunately, the plans for defence had been well and truly laid by Cadorna in the limited time that was available and still more fortunately, as a result of the danger in 1916, he had caused elaborate preparations to be made in the Grappa sector. It was due to this forethought that resistance on the line now chosen was possible.

Diaz had little breathing space, though some days elapsed before the enemy could prepare for an attack in force on the new line, for Conrad, on the Trentino front, saw a chance and, though he was short of troops, struck at once while calling for reinforcements. He attacked Pecori's troops on Nov. 10 as they were preparing to come back to the line already indicated and continued his attack on the new positions. But 10 days' fighting brought heavy losses and no success. Meanwhile, Boroević had tested the river defences. He got troops across in two places but failed to make further progress, and on Nov. 16 an attack in force failed completely, the Austrians losing some 1,500 killed and nearly as many prisoners.

Conrad and Boroević were making no headway, but a very dangerous attack was being conducted by Krauss, between the Brenta and the Piave. Attempts to break through by the valley roads were quickly frustrated and persistent efforts to capture the all-important ridge of Monte Tomba-Monfenera, which runs down from the Grappa *massif* to the Piave, failed to pierce the thin Italian lines. The struggle at this point lasted for five days, Nov. 18–22, and the Italian IX. Corps, under Ruggeri Laderchi, fought a great fight. The critical day was Nov. 22, when Krauss's Bosnians and German Jäger made a final effort to break through. The attacking columns reached the crest of Monte Tomba, but their bolt was shot. In the evening, Ruggeri Laderchi counter-attacked and drove the enemy off the ridge, except at one point. Next day reserves arrived and the line was firmly established.

Meanwhile, in the Grappa sector, Krauss had attacked on Nov. 21 with his centre and right, but after a week's fighting, in spite of reinforcements drawn from Stein and Krobatin, he had to call a halt. A fresh attack was preparing when the situation was eased by the arrival of the British and French divisions which had hitherto been waiting in reserve. On Dec. 2 three British divisions under Gen. the Earl of Cavan, took over the Montello sector and a similar French force under Gen. Duchesne relieved the IX. Corps in the Monte Tomba region. It was expected that both these points would be the object of early attack, but as it turned out they were both left unmolested. Conrad and Krauss continued their attempts on the mountain front, but Krauss confined his efforts to the Grappa sector. Krauss could not immediately renew his attack, but on Dec. 3 Conrad, reinforced but still complaining that he was starved for means of attack, opened a heavy bombardment on the curve of the Italian front from Monte Sisemol to east of Monte Badenecche.

Next day he pinched up the Meletta-Badenecche salient and took Monte Fior and Castelgomberto in the rear and the day following he pushed down towards Foza. The position was critical, but the Italians succeeded in establishing a new line farther south, covering Valstagna and the mouth of the Frenzela valley. On Dec. 23 after careful preparation, Conrad launched a new attack on the lines between Monte Sisemol and the Frenzela valley. He gained a big initial success, taking both Col dell 'Orso and Monte Melago and cutting off a large number of prisoners. The next day the Italians counter-attacked and retook both the hills. They established themselves firmly in their reserve lines and repulsed another attack, the last, on Christmas Day.

Krauss's Final Effort.—Meanwhile, between Conrad's two efforts, Krauss had made a determined attempt to drive the Italians off Monte Grappa. His command had been increased to 10 divisions, six Austro-Hungarian and four German and he did not spare his troops. He opened his attack on Dec. 11 by a push on each wing; from the Brenta valley and Monte Pertica against Col della Berretta, and against both sides of the Col dell 'Orso-Solarolo salient. On the left, in spite of repeated attacks that lasted 10 days, his German divisions made little headway, but on the right, at the end of four days' hard fighting, he had taken Col Caprile and Col della Berretta. Four days more and he was in possession of Monte Asolone, which looks down the Valle di Santa Felicitá to the longed-for haven of the plain. This was the term of the Austrian advance. On Dec. 20 the Italians counter-attacked and won back a good deal of the lost ground, the last move in the long struggle. Krauss accepted failure for the moment, hoping for an early spring offensive farther west. Five days later the snow came, the heavy winter fall that was a month late. The invaders had been favoured by the tardy coming of winter, which greatly prolonged the strain on the sorely-tried armies of Italy. But it gave also to the defending troops the chance to remake at once a shaken reputation. They took the chance and their recovery was a remarkable feat of courage.

Conclusion.—The narrative has indicated briefly the causes which led to the Italian disaster. The defending troops were subjected to a very severe trial; but it would seem clear that failure and disaster might have been largely averted if the preparations against the Austro-German attack and the actual conduct of the defence had been different. To sum up, there were too many troops in the front lines and too few in the "battle positions." Cadorna had not succeeded in making all his subordinates grasp the principles of defence in depth or of "elastic" defence. And, given the erroneous dispositions of the defensive lines, the reserves were too far back. The Italian Armies on the Julian front had been constantly on the offensive. They had had no recent practice in meeting an attack on the grand scale. It was this lack of practice, no doubt and a false confidence based on obsolete experience, which led to the belief that even if the opening phases of the battle were unfavourable to the defence, there would be ample time to restore the situation.

When retreat became inevitable, the prospects might well have seemed desperate to those who had to organise it. For the army, long used to the war of positions that had been the rule for 28 months, was in no condition to move. The retreat, with all its confusion, its mistakes and its tragedies, remains an astonishing achievement. The resistance which followed it, when the retiring armies turned and stood at bay on the mountains and on the Piave, was the greatest of Italian victories.

BIBLIOGRAPHY.—W. Örtel, *Vormarsch in Oberitalien, vom Isonzo zur Piave (1917)* (1918); V. Coda, *Dalla Bainsizza al Piave (Oct.-Nov. 1917)* (1919); L. Cadorna, *La Guerra alla Fronte Italiana* (1921). *See* also WORLD WAR: BIBLIOGRAPHY. (W. K. McC.)

CAPPS, EDWARD (1866–), American classical scholar, was born at Jacksonville, Ill., Dec. 21 1866. He was educated at Illinois College, where he took the degree of A.B. in 1887, and at Yale University, where he received that of Ph.D. in 1891. In 1890 he was appointed tutor at Yale. He was professor of Greek language and literature at the University of Chicago from 1892 to 1907. In 1903 he was special lecturer at Harvard, and during the next two years studied at Athens, and Halle, Germany. During 1906–7 he was managing editor of *Classical Philology* and in 1907 was called to Princeton University as professor of classics. In 1914 he was president of the American Philological Assn. and in 1917 was Turnbull lecturer on poetry at Johns Hopkins University. In 1918 he was appointed head of the American Red Cross commission to Greece, and became also chairman of the managing committee of the American School of Classical Studies at Athens. In 1920 he was appointed Minister to Greece, resigning in March 1921, and returning to Princeton. He is a leading authority on the Greek theatre.

His works include: *The Greek Stage according to the Extant Dramas* (1891); *From Homer to Theocritus* (1901); *The Introduction of Comedy into the City Dionysia; a Chronological Study in Greek Literary History* (1903); and *Four Plays of Menander* (1910). He was editor-in-chief of the University of Chicago decennial publications, 29 vol., and became the American editor of the Loeb Classical Library.

CAPUS, ALFRED (1858–1922), French author (*see* 5.296), produced his last play, *L'institut de beauté*, in 1913 and was elected a member of the Académie française in the following year. He died in Paris Nov. 1 1922.

CARBON, SYNTHESES OF (*see* 5.305).—The technical synthesis of organic compounds has only attained importance during the present century. It is still convenient to retain the artificial distinction between inorganic and organic chemistry, whether one includes the chemistry of all carbon compounds in the latter branch or considers only such compounds of carbon as contain atoms of carbon directly united to hydrogen, nitrogen or other carbon atoms.

The artificial production of urea (Wöhler, 1828) by isomerisation of ammonium cyanate showed that products of animal metabolism might be produced without the intervention of "vital force" and eventually it was recognised that any carbon compound of known constitution may be built up from carbon itself. The majority of organic compounds are still obtained from animal or vegetable sources or by distillation of oil and coal, but several products, formerly obtained by the distillation of wood are being rapidly displaced by synthetic products from carbon (coke).

Direct Syntheses.—Carbon unites directly with hydrogen, silicon, oxygen, sulphur and fluorine, whilst carbides of many metals are known and are usually produced by heating coke with a metallic oxide in the electric furnace. As actual or potential sources of organic compounds, methane, the oxides of carbon and calcium carbide are of greatest importance.

Methane yields certain substitution products on chlorination from methyl chloride, CH_3C_1 to carbon tetrachloride, CCl_4. The first of these yields methyl alcohol on hydrolysis. Carbon monoxide unites directly with caustic soda yielding sodium formate; the latter can be decomposed into hydrogen and sodium oxalate. Complete reduction of carbon monoxide gives methane, by incomplete reduction it is possible to make methyl alcohol. Carbon dioxide, with ammonia (*q.v.*), is a source of urea; further, it unites directly with sodium, giving the oxalate.

Acetylene.—Calcium carbide and water give acetylene (*q.v.*). This hydrocarbon unites with water in presence of acids and mercury salts giving acetaldehyde, $CH_3.CHO$ which can be polymerised to alcohol, $CH_3.CHOH.CH_2.CHO$; on loss of the elements of water, the latter compound gives crotonaldehyde, $CH_3.CH{:}CH.CHO$. Oxidation of acetaldehyde yields acetic acid, $CH_3.CO_2H$, from which, by removal of the elements of water, acetic anhydride is produced. If, in addition, the elements of carbon dioxide are also removed, acetone is formed. $2CH_3.COOH = H_2O + CO_2 + CH_3.CO.CH_3$. Butyl alcohol can be obtained from crotonaldehyde by catalytic hydrogenation.

$$CH_3.CH{:}CH.CHO + 4H = CH_3.CH_2.CH_2.CH_2OH.$$

Acetylene also combines with chlorine giving tetrachloroethane, $C_2H_2Cl_4$, from which hexachloroethane, C_2Cl_6, trichloroethylene, C_2H_3, pentachloroethane, C_2HCl_5, and dichloroethylene are obtainable. Hydrolysis of trichloroethylene gives chloroacetic acid, $CH_2Cl.COOH$, an intermediate in indigo synthesis. Calcium carbide reacts with nitrogen at a high temperature giving calcium cyanamide, CN_2Ca, from which urea is obtainable (*see* CYANAMIDES; CYANIDES).

Formates have been manufactured synthetically for several years before 1926; in the case of the other simpler carbon compounds the sources of supply afforded by natural products appeared to be sufficient, and confusion and delay were occasioned by disregard of the thermodynamic principles underlying gas reactions and lack of knowledge with regard to catalysts.

Using Van't Hoff's *reaction isochore*

$$d \log_e K/dT = -Q/RT^2$$

the equilibrium attained in a reaction involving gases may be calculated for an absolute temperature T if the heat of reaction, Q, at that temperature is known. This is possible if the heat of reaction at some definite temperature is known as well as the variation of the molecular heats of the reacting substances with changing temperature. Thus, if the data are available, one may calculate in advance whether a reaction is likely to take place under experimental conditions.

Velocity of Reaction.—Velocities of reaction which are low at ordinary temperatures may be accelerated by heating; at the same time, the equilibrium is often displaced in a direction contrary to that desired. An example is afforded in the synthesis of methyl alcohol, $CO+2H_2=CH_3OH+27{\cdot}2$ Cal. Catalysts are ineffective at ordinary temperature; on heating, equilibrium is displaced from right to left. On the other hand, since $K=p_1p_2^2/x$, where p_1,p_2 and x represent the pressures of carbon monoxide, hydrogen and methyl alcohol respectively, it is evident that increase of pressure will displace the equilibrium from left to right. Thus Matignon (*Bull. soc. chim.*, 1925, iv. 37, p. 827) calculates that at 227° C. (T=500) if $p_1=1$ (atmosphere) and $p_2=2$, then $x=0{\cdot}06$, but if $p_1=50$ and $p_2=100$, then $x=7{,}000$. x is reduced to 0·8 for the same values of p_1 and p_2 at 427° C. (T=700). Evidently for a given reaction and catalyst there will be an optimum temperature from the point of view of yield; above this temperature the equilibrium is unfavourable; below it, the velocity of reaction is too small.

Applying these principles, Matignon shows that the following syntheses should be capable of accomplishment: aliphatic alcohols generally; a lower one, *e.g.*, CH_3OH, being transformed into the next higher homologue, $C_nH_{2n+1}OH+CO+2H_2=C_nH_{2n+1}CH_2OH$; ethyl alcohol from ethylene and water; hexane from ethylene and hydrogen; acetone from ethylene, carbon monoxide and hydrogen; and propyl alcohol from ethylene and methyl alcohol. Little hope exists of reducing carbon monoxide to formaldehyde, making ethyl alcohol from methane, carbon monoxide and hydrogen or converting methane into a mixture of ethane and hydrogen.

Methane.—Berthelot (1856) first synthesised methane, hydrogen mixed with the vapour of carbon disulphide being passed over red-hot copper, $CS_2+2H_2S+8Cu=4Cu_2S+CH_4$. Brodie (1873) obtained methane by passing electric sparks through a mixture of carbon monoxide and hydrogen whilst Sabatier and Senderens (1902) reduced both carbon monoxide and dioxide to methane using nickel (250°–300°) or cobalt as catalyst.

Bone and Jerdan (1897) first obtained methane by the direct union of carbon and hydrogen; they found it was the only hydrocarbon produced on leading hydrogen over pure carbon at 1,200°. Berthelot had previously found that carbon unites with hydrogen at the temperature of the electric arc; he doubted the results of Bone and Jerdan. M. Mayer and V. Altmeyer (1907) studied the reaction between carbon and hydrogen in presence of nickel and cobalt as catalysts; the equilibrium, $C+2H_2\rightleftarrows CH_4$, was approached from both sides and, at 475°, the partial pressure of the methane actually exceeded that of the hydrogen.

The direct production of methane from carbon and hydrogen is not promising, the gas occurs in large quantities naturally (oil-wells, mud volcanoes, fire-damp, etc.) and synthesis could be more readily effected by complete reduction of carbon monoxide by hydrogen, both being formed in the water-gas reaction. Processes based on this reduction have been patented by Elworthy. Methane can also be obtained by decomposing aluminium carbide, Al_4C_3, with water.

Syntheses from Methane.—The use of methane as a source of other carbon compounds is restricted, chlorination to methyl chloride and hydrolysis of the latter to methyl alcohol have been mentioned above. The regulated chlorination of methane has formed the subject of patents by Walter (1909) and Pfeiffer and Szarvasy (1910). Another use of methane might be its oxidation to formaldehyde, $CH_4+O_2=CH_2O+H_2O$. Bone (1903) obtained small amounts by oxidation at 400°–500° in contact with porous tile and applications of the reaction have been patented by G. Glock (1898), Hansmann and Co. (1906) and the Verein für Chemische Industrie in Mainz (1913). Experiments carried out at the Royal Naval Cordite Factory, Holton Heath (Report of the Department of Scientific and Industrial Research, 1924–5), lead to the conclusion that formaldehyde would be recovered in too dilute solution for economical concentration. The chlorination of methane has also been studied at Holton Heath; the production of carbon tetrachloride on a large scale appears to be practicable as, also, that of methyl chloride under certain circumstances. Traun (British patent 156148) states that methane is oxidised by carbon dioxide to formaldehyde at 500°–700° (up to 56% conversion). H. Dreyfus (British patent 226243) proposes the realisation of the reactions, $CH_4+CO=CH_3.CHO$ and $CH_4+CO_2=CH_3.COOH$, at 12 to 50 atmospheres and temperatures of 120°–300°, the catalysts consisting of finely-divided iron or nickel carbonate, the latter being preferably mixed with finely-divided nickel or iron.

Carbon Monoxide.—The oxides of carbon are formed by the combustion of carbon in air or oxygen or by the reaction between coke and steam at a high temperature. ($C+H_2O=CO+H_2$, $C+2H_2O=CO_2+2H_2$.) Formation of carbon monoxide is favoured by a high temperature, equilibrium in the reaction, $CO_2+C\rightleftarrows 2CO$, being displaced from left to right with increasing temperature. The reversibility of the reaction was discovered by H. Sainte-Claire Deville (1864) and afterwards studied by Boudouard (1901), Schenck and Zimmermann (1903), Rhead and Wheeler (1910, 1912) and Jellinek and Diethelm (1922). Increased pressure favours production of carbon dioxide; at 1,000° and 1 atmosphere the amount of the latter gas is only 0·7% (by volume), but at 200 atmospheres this amount becomes 47·7%. (Calculated by Jellinek and Diethelm.)

Carbon monoxide is reduced by hydrogen in presence of a catalyst to methyl alcohol or methane; according to E. R. Lush (British patent 180016), carbon monoxide and hydrogen yield formaldehyde when passed rapidly over a catalyst of copper, nickel and aluminia under certain conditions. With potassium hydride, potassium formate is produced and carbon liberated (Moissan, 1902); caustic potash gives potassium formate ($CO+KOH=H.COOK$, Berthelot, 1856), whilst sodium alkyloxides yield sodium salts of fatty acids, *e.g.*:—

Phosgene.—Phosgene (carbonyl chloride, $COCl_2$) is formed by direct union with chlorine under the influence of light or on a suitable catalytic surface. Losanitsch and Jovitschitsch (1897) submitted mixtures of carbon monoxide, water, hydrogen, methane, hydrogen sulphide and ammonia to a dark electric discharge obtaining respectively formic acid, polymeric glycolaldehyde, acetaldehyde, thioformaldehyde and formamide.

Formates.—Berthelot's synthesis of potassium formate was followed by the production of formates from carbon monoxide using caustic soda (Geuther) and soda-lime (Merz and Tibiriçá, 1880). De Lambilly (British patent 3735, 12604—1893) prepared ammonium formate by leading carbon monoxide and damp ammonia over pumice or charcoal at 80° C. to 150° C. M. Goldschmidt (German patent 86419—1894) obtained a nearly quantitative yield by using a ground mixture of caustic soda and slaked lime at 6 or 7 atmospheres pressure and 150°–170° C.

Aqueous alkaline solutions were used by R. Koepp and Co. (British patent 7875—1904 and 772—1906) and claims were made for a reaction between alkaline carbonates and carbon monoxide. Exposure of fresh surfaces of the caustic soda is essential and may be effected by stirring, a small amount of water being subsequently added (Elektrochemische Werke in Bitterfeld, German patent 179515—1905). Further patents introduce no essentially new principle, *e.g.*, Meister, Lucius and Brüning (British patent 8012—1908; G. A. Hempel, German patent 248254). The nitrile of formic acid, HCO_2H, is hydrocyanic acid, HCN. (*See* CYANIDES.)

Oxalates.—The formation of oxalates from formates, $2H.COOK=H_2+C_2O_4K_2$, by heating above 400° was known in 1840. (Dumas and Stas, Peligot.) Several applications have been made of this reaction. Goldschmidt (German patent 111078) heats sodium formate with its own weight of carbonate to 360°; Elektrochemische Werke (German patent 144150) use previously made sodium oxalate. Koepp & Co. (German patent 161512) use 1% alkali at 290°–360°. The Elektrochemische Werke (German patent 204895) heat in vacuo at 280°, the Gesellschaft für Chemische Industrie in Basle pre-heat the vessel and keep the temperature above 400° throughout the course of the reaction (U.S. patent 995041) although Landshoff and Meyer (German patent 269833) lay stress on keeping the reaction at 385° to 400°. C. Bochringer und Söhne (German patent 229853) add a small amount of boric acid, G. A. Hempel (U.S. patent 1070806) makes and decomposes the formate in the same vessel.

Methyl Alcohol.—Realisation of the reaction, $CO+2H_2=CH_3OH$, under the influence of an electric discharge has been recorded by Solvay and Slosse (1898) but Sabatier and Senderens were unable to arrest the reduction of carbon monoxide at the methyl alcohol stage. Patents were taken by the Badische Anilin und Soda-Fabrik (German patents 293787, 295202, 295203) for the reduction of the oxides of carbon by hydrogen in the presence of catalysts (*e.g.*, cerium, chromium, cobalt, manganese, molybdenum, osmium, palladium, titanium, zinc, their oxides and salts, carbides of iron, molybdenum and tungsten) with the object of obtaining liquid hydrocarbon mixtures suitable as fuel. The reactions are generally described as carried out at about 300°–400° under 100 atmospheres pressure.

Synthol.—Products of this nature ("Synthol") have been examined by Fischer and Tropsch and found to contain fatty acids, methyl, ethyl and propyl alcohols, various aldehydes, ketones, esters and hydrocarbons (Brennstoff-Chemie, 1923, 4, p. 276). E. R. Lush (British patent 180016—1921) found that methyl alcohol, as well as formaldehyde was formed from carbon monoxide and hydrogen, and G. C. Calvert (1921) claimed production of methyl alcohol in good yield by reduction of water gas. G. Patart (French patent 540343) patented carrying out the reaction between one volume of carbon monoxide and two volumes of hydrogen at 300°–600° under high pressures in presence of metals, their oxides or salts.

The patents of the Badische Co. (British patents 228959, 229714, 227147, 231285, 237030, 240955) claim a process for manufacturing methyl alcohol very similar to that of Patart. Stress is laid on removing iron and nickel compounds from the reacting gases as well as the ordinary catalyst poisons; the catalyst masses must be free from iron, nickel and cobalt, or alternatively they should only be present in traces provided that there are present at the same time other metallic catalysts which will prevent the iron, nickel or cobalt giving rise to methane or other hydrocarbons.

Contact masses consisting of mixtures of metallic oxides which cannot be reduced under the operating conditions of the reaction may be used; the most basic of the oxides employed must predominate in a mixture. Contact masses practically free from the alkali metals or from mixtures of non-reducible oxides and a metal may be used. When a mixture of two or more metals whose oxides are reduced by hydrogen on carbon monoxide at ordinary pressures below 550° are employed, metals of the fourth to seventh groups, as well as boron, are excluded. The Badische Co. specifies pressures of 50 atmospheres and upwards and temperatures of 200°–600° C. When contact masses containing a difficultly reducible metallic oxide, with a little potassium carbonate are employed, higher alcohols are also formed; this takes place more readily on increasing the percentage of carbon monoxide and diminishing the rate of flow. Besides the plant at Merseburg, fresh units are to be opened at Ludwigshofen and Oppau; the production of methyl alcohol by the Badische Co. is estimated at about 15,000 tons for 1925 and 25,000 tons for 1926. The Patart process is to be exploited in France in the near future. (With regard to priority, see *Chem. Trades Jour.*, 1925, 76, pp. 699, 754. *Cf.* British patent 180016, *v.s.*)

Patart, in laboratory experiments, attained regular production of methyl alcohol at 400°–420° C. and 150 to 250 atmospheres using zinc oxide as catalyst (*Chemie et Industrie*, 1925, 13, i., p. 179). E. Audibert (*ibid.* 186) utilises the suboxides of certain elements and describes the results when employing contact masses obtained by reducing uranium trioxide (UO_3) and chromic oxide (Cr_2O_3) respectively, in contact with copper in both cases. With an uranium suboxide and gas remaining in contact with the catalyst 60 to 80 sec. conversion was 8 to 10 per cent. In these experiments, temperatures of 220°–250° and 280°–300° and a pressure of 200 atmospheres were employed; the surplus gas was found to contain 1–2% carbon dioxide and up to 1% methane; the ratio $H_2:CO_2$ showed a small increase of 3–4 per cent. The condensed liquid was nearly pure methyl alcohol. The chromium suboxide at 325°–350° gave a mixture of water, methyl alcohol and other organic compounds.

Carbon Dioxide.—This gas can be used for the synthesis of carbamide (urea). Basarow (1870) obtained it by heating ammonium carbamate (the product obtained thus, $2NH_3+CO_2=NH_2.COONH_4$) to 130°–140°. Dexter (1882) passed ammonia and carbon dioxide through a hot tube. Fichter, Steiger and Stanisch (1916), finding the initial rate of urea formation accelerated by a small amount of water, conclude that ammonium carbonate is the immediate source of urea,

$$NH_4.COONH_4+H_2O \rightleftarrows (NH_4)_2CO_3 \rightleftarrows CO(NH_2)_2+2H_2O$$

Above 135°, only the second equilibrium need be considered, the ammonium carbamate disappearing. Matignon and Fréjacques (1920–2) find urea formation is accelerated by catalysts at lower temperatures; they are without benefit at 150°.

The Badische Anilin und Soda-Fabrik carry on the manufacture, apparently at 130°–140°. Their suggestions include the use of silver- or lead-lined autoclaves; acceleration by catalysts, *e.g.*, charcoal, sugar or carbamide itself; and addition of 10–20% ammonium carbonate. The equation shows that the reaction is incomplete, unaltered ammonia and carbon dioxide and, subsequently, water can be distilled off under reduced pressure. (British patents 23939, 24042, 24117 of 1914, 145060, 182331.)

Fréjacques (French patent 527733) heats ammonium carbamate to 145°–200°, *e.g.*, 2 to 4 hours at 150°, allows the temperature to fall to 65°–100° and removes carbon dioxide, ammonia and water, carbamide remaining in the autoclave. Urea is also manufactured from calcium cyanamide. The isomerisation of ammonium thiocyanate gives thio-carbamide, $CS(NH_2)_2$. It is used in the rubber and synthetic resin industries and is manufactured by the British Cyanides Co., Ltd.

Carbon dioxide unites directly with sodium yielding sodium oxalate. Haupt claims a process of spraying molten sodium with pre-heated carbon-dioxide. (German patent 286461.)

Acetylene.—(*See* I.137.) This is obtained by the action of water on calcium carbide, ($C_2Ca+2H_2O=C_2H_2+Ca(OH)_2$); there is an extensive literature relating to generation and purification of the gas.

Acetaldehyde, Acetic Acid and Acetone.—Addition of the elements of water to acetylene gives acetaldehyde. $CH\vdots CH+H_2O=CH_3.CHO$. Oxidation of acetaldehyde yields acetic acid, $CH_3.COOH$. Distillation of calcium acetate gives acetone . . . . $(CH_3COO)_2Ca=CaCO_3+(CH_3)_2CO$, which may also be formed by catalytic decomposition of acetic acid, $2CH_3\ COOH=H_2O+CO_2+(CH_3)_2CO$.

Other products may also be obtained, thus acetaldehyde can be polymerised to alcohol, removal of the elements of water from the latter compound gives crotonaldehyde and catalytic hydrogenation of crotonaldehyde yields butyl alcohol. $2CH_3.CHO \rightarrow CH_3.CHOH.CH_2.CHO \rightarrow CH_3.CH:CH.CHO \rightarrow CH_3.CH_2.CH_2.CH_2OH$. Acetone vapour is decomposed in contact with certain metallic oxides giving methane and ketene, $CH_3.CO.CH_3=CH_4+CH_2:CO$, and ketene can be used as an acetylating agent, $R.OH+CH_2:CO=R.OCO.CH_3$. From sodium acetone and acetylene a tertiary alcohol of the constitution $(CH_3)_2C(OH).C\vdots CH$ is obtained which can be employed in the manufacture of isoprene.

Acetylene was first converted into acetaldehyde by solution in sulphuric acid (specific gravity 1·35), dilution with water, and distillation (Lagermark and Eltekow, 1877).

Kutscherow (1881) used water and mercuric bromide, Erdmann and Köthner (1898) passed acetylene through boiling dilute sulphuric acid to which mercuric oxide had been added.

N. Grünstein (1910) proposed the technical preparation of acetaldehyde from acetylene with the aid of mercury compounds in acid solution, working at a lower temperature than had been usual in laboratory experiments. His first patent, German patent 250356, was followed by others (German patents 253707, 253708, 267260, 270049). Several patent applications by the Consortium für elektrochemische Industrie in Nürnberg were withdrawn but Fr. Bayer and Co. patented the use of aromatic sulphonic acids in place of the mineral acids usually employed. (German patent 291794.)

The oxidation of acetaldehyde by air to acetic acid is slow at ordinary temperature, moreover, acetaldehyde, b.p. 21° C. is very volatile. Grünstein, in conjunction with the Chemische Fabrik Griesheim-Elektron overcame this difficulty by dissolving the acetaldehyde in a large excess of acetic acid and blowing in air or oxygen at 70°–100° C. Catalysts (*e.g.*, 0·1% UO_3 on weight of acetic acid) enable the use of a temperature of only 30° (British patent 17424—1911, 8076—1912; United States patent 1081959; German patent 261589; French patent 440658). Meister, Lucius and Brüning suggested the use of increased pressure together with a catalyst (British patent 10377—1914).

Patents referring to special points in converting acetylene to aldehyde have been numerous since 1915. Thus those of H. Dreyfus (French patent 479656) and Union Carbide Co. (United States patents 1213486, 1213487) relate to low hydrogen ion concentration, Acieries et Forges de Firminy (British patent 124194) to electrolytic regeneration of acid liquids containing mercury salts, Deutsche Gold- und Silber-Scheide Anstalt (German Patent 334357) to the interaction of steam and acetylene at high temperatures in pressure of a catalyst, Société anonyme de Produits chimiques (Malétra) (British patent 140784) and Tokyo Industrial Laboratory (Japanese patent 38752—1921, *Chem. Soc. Abstr.* 1922, 1, p. 523) to use of ferric compounds and of Société chimique des Usines du Rhône (British patent 238520) to acid solutions of ferrous and copper sulphates with metallic mercury.

Increased demand for acetic acid and acetone during the War was met by Canadian Electro Products, a subsidiary of the Shawinigan Water and Power Co. of Montreal. According to J. T. Rooney (*Chem. & Met. Engineering*, 1920, 22, p. 847) absorption vessels of acid-resisting iron were used to contain 60% sulphuric acid at 70° to which yellow mercuric oxide had been added, for dissolving the acetylene. The crude acetaldehyde was concentrated to 99–100% and oxidised by air under pressure at 60°, manganese acetate being used as a catalyst. The vapour of acetic acid was decomposed into acetone, water and carbon dioxide by passing over iron balls coated with lime at 485°.

Acetylene is absorbed by acetic acid in presence of mercury salts with production of ethylidene acetate, $CH_3CH(OCOCH_3)_2$ (Griesheim-Elektron, British patent 14246—1913; compare Consortium für Elektrochemische Industrie, British patent 182112). This compound is decomposed above its boiling point giving acetic anhydride, $CH_3.CH(OCOCH_3)_2 = CH_3.CHO + (CH_3.CO)_2O$. (Bosnische Elektrizitäts A.G.). The production of acetic anhydride in this way has been further developed by the Société chimique des Usines du Rhône.

Ethyl Acetate.—Tischtschenko (1906) observed the production of ethyl acetate from acetaldehyde under the influence of aluminium ethoxide, $Al(OC_2H_5)_3$. Improved methods of carrying out the reaction $2CH_3.CHO = CH_3.CO.OC_2H_5$ have been patented by the Consortium für elektro-chemische Industrie (German patents 277111, 277187, 277188, 285990, 286812).

Butaldehyde and Butyl Alcohol.—These compounds can be obtained by the catalytic hydrogenation of crotonaldehyde in presence of 20–25% water or steam. (N. Grünstein, British patent 147118.) Nickel (5–15%) on pumice or kieselguhr is used as catalyst, optimum temperature 110–120°. Formation of high boiling products is minimised by using a large excess of hydrogen.

Ethylene and Ethyl Alcohol.—The hydrogenation of acetylene usually proceeds completely to ethane or ethylene, when formed, partially polymerises. Efforts to overcome these difficulties have been made by W. Caro; Lane, Ryberg and Kinberg; Traube. As a product of the distillation of coal, ethylene is produced in large quantities at gas-works and coke-oven plants. Concentration of ethylene has been effected by selective absorption by charcoal (Bury at Skinningrove) with a view to alcohol production. The Compagnié des Mines de Bethune, who manufacture ammonia by the Claude process, have adopted a different method. (*Chimie et Industrie*, 1925, 13, i, 718.) The hydrogen obtained from the coke-oven is purified by liquefaction of ethylene and benzene. The ethylene is absorbed in sulphuric acid to form ethyl sulphuric acid which is hydrolysed on dilution and heating, the ethyl alcohol being distilled off. The residual dilute sulphuric acid is used for the manufacture of ammonium sulphate.

Acetylene and Chlorine.—Several compounds obtained with the help of acetylene and chlorine find application as solvents and, more recently, for synthetic purposes. Berthelot and Jungfleisch (1869) obtained an addition product of acetylene and antimony pentachloride, $C_2H_2.SbCl_5$, which gives dichloroethylene, $CHCl:CHCl$, on distillation; with excess of antimony pentachloride, tetra-chloroethane, $CHCl_2CHCl_2$, is produced. The latter compound loses hydrogen chloride on treatment with alcoholic potash giving trichloroethylene, $CHCl:CCl_2$.

Direct union of acetylene and chlorine may give rise to a violent reaction; to avoid this, the Salzbergwerk Neu-Stassfurt (German patent 174068) used sulphur chloride with a contact substance, *e.g.*, iron powder, and passed in acetylene and chlorine alternately. Tetrachloroethane, a liquid boiling at 147°C., was thus obtained; saturation at the boiling point before distillation gave hexachloroethane C_2Cl_6.

Various modified processes have been proposed. Tompkins (British patent 19568—1904) specified the presence of both antimony tri- and pentachlorides. Lidholm (British patent 22094—1905) diluted with carbon dioxide and exposed to the light of a mercury lamp. Griesheim-Elektron (British patent 13411—1907) used a solid diluent. Ornstein (British patent 2375—1911) led acetylene and chlorine at different places into previously prepared tetrachloroethane containing iron.

Trichloroethylene.—Removal of hydrogen chloride may be effected in various ways. Heating with milk of lime or slaked lime (Consortium, German patents 171900, 208834); thermal decomposition (Tompkins and Clayton Aniline Co., Ltd., British patent 23780—1906); action of metal chloride at 300° (Griesheim-Elektron, German patent 263457); use of thorium oxide (Chemische Fabrik Buchau, German patent 274782); action of aqueous ammonia (Cie. d'Alais et de la Camargue, British patent 132755).

Dichloroethylene is not only formed by direct union of acetylene and chlorine (Griesheim-Elektron, British patent 16620—1912) but also by reduction of tetrachloroethane with aluminium, iron or zinc and water (Consortium, British patent 19576—1907). Of these compounds, trichloroethylene has become a synthetic reagent. Paterno and Oglialoro (1874) obtained dichlorovinyl ethyl ether by the action of alcoholic potash. $CHCl:CCl_2 + KOC_2H_5 = KCl + CHCl:CCl.OC_2H_5$. This, in turn, gives ethyl ethoxyacetate with an excess of the alcoholate, $CHCl:CCl.OC_2H_5 + C_2H_5OK + C_2H_5OH = KCl + C_2H_5Cl + C_2H_5O.CH_2COO\text{-}C_2H_5$ (Geuther, 1873; Nef, 1897).

Imbert and the Consortium für Elektrochemische Industrie (German patent 216940) discovered that the last reaction proceeds in stages and gives a ready method of making ethyl chloroacetate. $C_2HCl_2.OC_2H_5 + C_2H_5OH = CH_2Cl.COOC_2H_5 + C_2H_5Cl$. Water may be used at this stage in place of alcohol (German patents 209268, 210502), but complete hydrolysis gives chloroacetic acid (German patents 216716).

Hydrogen chloride acts on dichlorovinyl ethyl ether giving chloroacetyl chloride. $CHCl:CCl(OC_2H_5) + HCl = C_2H_5Cl + CH_2Cl.COCl$. (Consortium German patent 222194). Reactions of this type have been studied by Compton and Vanderstichele (*Jour. Chem. Soc.*, 1920, 117, p. 691).

By heating trichloroethylene with sulphuric acid containing a little water, monochloroacetic acid is formed (Simon and Chavanne, French patent 519833, United States patent 1304108). The reaction is possibly due to formation of an intermediate addition product which is then hydrolysed. $CH_2Cl.CCl_2.SO_4H + 2H_2O = CH_2Cl.COOH + 2HCl + H_2SO_4$. Since the product is free from dichloracetic acid it is useful in the synthesis of indigo. Chlorinated propanes have been obtained by the action of aluminium chloride on mixtures of chloroform or carbontetrachloride with halogenated ethylenes (German patent 261689), *e.g.*, $CCl_4 + CHCl:CCl_2 = CCl_3CHA.CCl_3$.

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(J. T. H.)

CARBURETTER: *see* MOTOR VEHICLES.

CARDIFF, WALES (*see* 5.316), had a population in 1921 of 200,262; the estimate for 1923 was 226,200. The city has grown largely since 1910, most of the numerous industrial establishments being grouped round the docks. Roath Park, the largest in Wales, has a miniature lighthouse in the lake as a memorial to Capt. Scott. New buildings in Cathays Park are the Glamorganshire County Hall (1911), and a Technical College (1916). Plymouth Great Wood (42 ac.), presented to the city by the late Earl of Plymouth, was opened in 1923. A large reservoir in Taff Fawr Valley, begun in 1911, was finished after the World War, and, at the end of 1925, a central power station was under construction at Treforest. A tuberculosis hospital, the Welsh national memorial to King Edward VII., was opened in Llandaff in 1913, and the National Museum of Wales has absorbed the Municipal Museum and Art Gallery, previously in the public library building. New churches include St. Luke, Canton (1911), St. Joseph, Cathays (1913) and St. Samson (1923). In 1912 the parish of St. Stephen was formed, in 1920 that of Upper Grangetown and in 1923 that of St. David. In 1922 the city boundaries were extended to include Llandaff and most of six other outlying parishes, and the area of the borough was thus increased to 13,649 acres. Cardiff has a considerable Roman Catholic population, and when Wales was made a separate Roman Catholic province in 1916, it became the seat of the archbishop.

CARDINALS, COLLEGE OF (*see* 5.321).—The Codex of Canon Law, ordered to be codified by Pius X. and promulgated by Benedict XV. by the Bull, *Providentissima Mater*, in 1917, contains perhaps the last word to be said concerning the cardinalitial dignity and the privileges and duties attached to the office of those who wear the *ruber galerus*. The matter is there so well digested that little further compression is possible or comment necessary.

The cardinals are described as the Pope's counsellors and adjutants in the three orders of 6 cardinal bishops, 50 cardinal priests and 14 cardinal deacons (the number symbolises the 70 elders). They are to be chosen freely from all countries for their doctrine, piety and prudence. At the moment (1926) the college contains 36 Italians, 8 Central Europeans, 2 Poles, 7 French, 5 Spanish, 4 North Americans, 2 English and one each from Ireland, Portugal, Holland and Brazil.

Prohibitions.—From their number the Code excludes bastards, even though legitimised by subsequent marriage, also those who have children or grandchildren by legitimate marriage themselves (this would have excluded the English Cardinal Weld) and also those who are related to a living cardinal by the first or second degree (this has been dispensed by Pius XI. in favour of Cardinal Gasparri's nephew). The cardinal bishop first in promotion becomes dean of the Sacred College, but only as first among equals. Cardinals are required to live in Rome, even the cardinal bishops of suburban Sees. Cardinals occupying Sees abroad are required to approach the Pope on arrival in Rome, and not to leave without his permission.

Cardinals enjoy a number of privileges, the chief of which are as follows:—

1. To hear and absolve in confession anybody, anywhere, even the Religious of both sexes, and even from reserved sins and censures, with a few very special exceptions such as revealing the secrets of the holy office.
2. To choose confessors for themselves and households on similar conditions.
3. To preach the word of God anywhere.
4. To celebrate or allow another to celebrate in their presence a mass on Maundy Thursday or three masses on Christmas night.
5. To bless religious objects everywhere with every Indulgence.
6. To erect with one blessing the Stations of the Cross in private or public oratories or churches, with all Indulgences included.
7. To celebrate on portable altars mass in their private houses and wherever they go.
8. To celebrate mass at sea.
9. To celebrate mass everywhere according to their own Calendars.
10. To enjoy the privileged altar daily.
11. To gain in their private oratories the Indulgences which are attached to public visits in the places where they are staying.
12. To give the episcopal blessing everywhere except in Rome and there in churches only.
13. To wear the episcopal cross and mitre and carry the pastoral staff.
14. To celebrate mass in any private oratory without prejudice.
15. To pontificate with throne and canopy anywhere except in Rome.
16. To receive the honours of the Ordinary everywhere.
17. To confirm abroad the word they have heard from the Pope.
18. To enjoy their oratories free from episcopal visitation.
19. To dispose freely, even by will, of the revenue of their benefices.
20. To consecrate everywhere altars, abbots, and the like with the exception of the holy oils (unless the cardinal is a bishop) and a holy place, without leave of the Ordinary.
21. To precede all prelates and patriarchs and legates except a cardinal legate in his own country.
22. To confer tonsure and Minor Orders.
23. To confer Confirmation.
24. To confer an Indulgence of 200 days upon persons under their protection.

The Interregnum.—The new Code contains the Constitution of Pius X. *Vacante Sede Apostolica*, which summarises most minutely the duties of the cardinals between one pontificate and the next. The cardinals have no power, except in matter of immediate business. The offices of the Cardinal Camerlengo and Grand Penitentiary continue during the Interregnum. The cardinals are required to meet and make the ceremonial arrangements for burying one Pope and for electing another. The ingress of the cardinals into conclave and their closure is minutely ordered. Secrecy is imposed upon all the cardinals and the conclavists under pain of excommunication. (The details of the conclaves electing Leo XIII. and Pius X. were pretty well known, but the conclaves electing Benedict XV. and Pius XI. have been kept a profound secret; their tendencies being judged by historians entirely on ante-conclavicular knowledge concerning the *Papabili* or probable candidates compared with the results.) By the *Commissum nobis* Pius X. abolished the veto claimed by the Catholic powers under an unwritten law. Pius XI. extended the time allowed to cardinals travelling to the conclave, from 10 to 15 days. During the 20th century the Red Hat has been enjoyed by British subjects in England, Ireland, Canada and Australia. The English-speaking cardinals are now the equal of those representing any Catholic power in any future conclave. (S. L.*)

CARDIOLOGY: *see* HEART, DISEASES OF THE.

CARIBBEAN, THE.—Events in the Caribbean region during the period 1910–26 were dominated by the steady advance of the political and economic power of the United States. This development dated from the Spanish-American War, which led to the annexation of Porto Rico in 1898 and to the occupation of Cuba by American forces from 1899 to 1902. Cuba's later independence was qualified by the Platt Amendment (*see* 7.604d) and by the lease to the United States of naval stations at Bahia Honda and Guantánamo.

The construction of the Panama Canal (*q.v.*) gave the United States another highly important vantage point in the region and brought virtually under American control the State of Panama. In Santo Domingo, where an American receiver-general had been placed in charge of the customs-houses in 1907, recurrent revolutions following Nov. 1911 led to the military occupation of the country by U.S. Marines in 1916. The American flag was withdrawn in 1926, leaving as a reminder of the occupation only good roads, good schools, quick communications and a well-trained constabulary, together with the receiver of taxes to safeguard interest payments on the external debt. A similar occupation of Haiti was authorised by President Wilson in 1915. Congress tacitly approved, as it did also in connection with similar situations in Costa Rica and Nicaragua. In each case there was increased local prosperity, accompanied by larger American investments. In 1917 the United States acquired by purchase the Danish West Indies (Virgin Is., *q.v.*) with the dual purpose of securing thereby another potential naval base in close proximity to Culebra, Porto Rico, and of preventing the installation in the Danish West Indies of what at the time was a great and growing European naval power.

Political Grouping.—The political units of the Caribbean in

1926 were classifiable into four principal groups, American dependencies, such as Porto Rico and the Virgin Is.; virtual protectorates of the United States, such as Cuba and Panama (with their own governments but subject to limitations imposed by treaties with the United States) and Santo Domingo, Haiti and Nicaragua (under partial control); independent republics, such as Guatemala and Venezuela; and, finally, insular and continental colonies of Great Britain, France and the Netherlands. The latter include Jamaica and French and Dutch Guiana. In all, these political divisions of the Caribbean owe allegiance to 15 different national flags.

In the British West Indies in the period under review, there has been a fuller appreciation of the advantages accruing from the connection with the home Govt., among which have been reciprocal trade agreements based on the principle of Empire preference. A West Indian contingent, over 20,000 strong, served in the World War under the British flag.

In 1920 the Prince of Wales, while visiting these islands, took occasion to state that Great Britain would not dispose of her West Indian possessions in part settlement of her World War debt. Under the Ottawa agreement (June 1920) the Dominion of Canada conceded to British West Indian products a tariff preference ranging from 25 to 50% while provision was made on a subsidy basis for greatly needed mail and steamship facilities. In return the Islands conceded extensive favours to Canadian products and trade. While sugar still remained king of the West Indian trade, a rapid development of the petroleum deposits in Trinidad took place.

Pan-Americanism.—In large part the problem of the Caribbean is involved in the question of pan-Americanism. In the decade 1915–25 Washington has been the scene of political and financial conferences and of press, good roads and better business conferences, in all of which, with the other republics of Latin speech, the republics of the Caribbean have been well represented and have sought and found their advantage.

The lessons of the decade have been many and varied. Only a few need be mentioned here. It is clear now, if there ever was room for doubt, that territorial propinquity creates special relations between countries; that the Panama Canal, quite irrespective of the Monroe Doctrine, has given the United States a profound and increasing interest in these islands and the bordering mainland; that United States control of the Caribbean is necessary to the naval protection and economic welfare of that region; that many of the islanders would rather be misgoverned by their own people than well governed from Washington; that the islands irrespective of political complexion, have become important natural markets on a great commercial highway of limitless possibilities; that to prevent foreign intervention the United States must make certain that legitimate outside interests are protected; and last, that inescapably the United States is charged with the task of assisting the countries of the Caribbean in their long-delayed quest of economic and political well-being.

Yet in spite of a more general recognition of the responsibilities that these lessons have driven home, it cannot be said that a systematic course of action has been followed. Four policies, however, have been proposed, and it may perhaps be said without injustice that all have been practised—intermittently. These are: regulation, as in Cuba and Santo Domingo; neutralisation, as in the Central American states; annexation, as in Porto Rico; and abstention, as in many quarters. Under these circumstances, the people of the Caribbean can hardly be blamed for regarding the policy of Washington as always individualistic and at times temperamental. To most observers it seems that abstention is impossible and that regulation is the most practicable; but to succeed, the policy of regulation must be systematically pursued.

The Political Future.—In view of these conflicting currents, the immediate political future of the Caribbean region is obscure. Notable changes in sentiment may, however, be noticed. In the United States 20 years ago there were individuals, and perhaps organised groups, who more or less openly sought the annexation of Cuba. In 1926 there were no such groups. On the contrary, there are many persons in Cuba who contrast the cost of government to the Porto Ricans under the American flag with the cost and quality of government under the Cuban flag and who sigh for at least fiscal control by the United States.

In countries like Cuba, Santo Domingo and Haiti, where there have been in the period under review internal upheavals followed by foreign intervention, the paramount question is that of the degree of political education and stability acquired as a result of these experiences of imposed political and fiscal restraints naturally so irksome. It may be suggested that there are signs of an increasing aptitude for the tasks of self-government and a growing appreciation of the dangers as well as the advantages of foreign contacts. In the main the answer to the basic questions that the actual situation propounds must be left to the future.

The increasing dominance of the United States in the Caribbean area cannot be ignored. It is almost daily emphasised. It is equally true that innumerable opportunities and even provocations to extend the flag over these islands have been presented and that they have been, without the slightest hesitation and with the practically unanimous approval of the American people, ignored or flatly rejected. It would seem that the charge of American imperialism—at least as far as the Caribbean is concerned—should no longer receive a respectful hearing.

An Era of Progress.—In the 20 years 1905–25, with extraordinary rapidity and probably finally, the Caribbean world has been removed from the list of " backward areas " in which it figured so long. Geographically, economically and politically, the islands of the American Mediterranean have entered into the closest relations with the great continental Power that has become at once the sponsor of their democratic institutions and the guarantor of their political independence. More than a century ago Thomas Jefferson foresaw it all, when he said that the islands of the Caribbean protected or menaced the mouth of the Mississippi. To-day the American seaway is not solely across the Atlantic Ocean, as it was when Jefferson lived, but also due south through the diversified islands of the Caribbean to the Panama Canal, the gateway to the markets beyond. (*See* PANAMA CANAL.) (S. B.)

CARICATURE (*see* 5.331), regarded merely as the comic pictorial interpretation of life, followed normal lines between the years 1910 and 1925, though the standard of representation greatly improved. In Great Britain *Punch* continued to reflect the prejudices rather than the judgments of the educated middle class, and remained at the head of humorous publications. A comparison of the various artists' work in that paper during the period under review is fraught with enlightenment, for artists whose drawings passed muster in 1910 had advanced almost beyond recognition by 1925. Regarded as draughtsmen J. A. Shepherd, George Morrow, G. L. Stampa, Frank Reynolds, Bert Thomas, Lewis Baumer, together with the regular cartoonists, Sir Bernard Partridge and L. Raven-Hill, were amongst the foremost black and white artists of the day.

On the other hand true caricature, that is, individual portraiture in which salient peculiarities are exaggerated with a view to making a definite comment, has never been generally appreciated in Great Britain since the early years of the 19th century, and since then has not taken a prominent, or at all events a popular, place in the pictorial art of the country. True caricature demands of the artist an uncompromising honesty, which expediency has done little to encourage, and which squeamishness has found difficult of acceptance. European caricature, however, unshackled by prejudice, is frequently vulgar and coarse, and it certainly typifies that " brutality of the intellect " which G. K. Chesterton, in one of his stories, once declared to be its moving spirit.

Sir Leslie Ward (" Spy " of *Vanity Fair*), who was " Ape's " successor, gradually reduced the physical exaggeration in his weekly caricature until it became a " mere " portrait. Amongst other occasional contributors to *Vanity Fair* in that paper's later years should be mentioned a gifted amateur, Roland le Strange, who under the signature " A-O " (abbreviated from Armadillo) made various caricatures, that of Sir Harry Keppel being of exceptional brilliance.

Max Beerbohm's Work.—One outstanding caricaturist of the age was Max Beerbohm, whose immature work was first published in *The Strand Magazine* and in *Pick-me-up*. He made a contribution to *Vanity Fair* with his amusingly delicate drawing of George Meredith and worked for *The Yellow Book* and *The Savoy*. For some years his drawings were exhibited biennially at the Leicester Galleries, London, and reproduced in book form. The merit of his work, which was for many years quite independent of draughtsmanship or pictorial beauty, lies in his subtle appreciation of character, which he demonstrated as a rule without the grosser physicial exaggerations which found favour in the days of Gillray. Descriptive passages, often in the form of highly skilled parodies of his victims' speech and writings, form an ironic accompaniment to the drawings, and indeed, in a wider sense, Max Beerbohm's two vehicles of expression complement each other. Long practice in the use of pencil and wash gave his unconventional work, in which the representation of idea always supplanted the representation of fact, a definite beauty which challenges the work of serious and normal artists on its own ground.

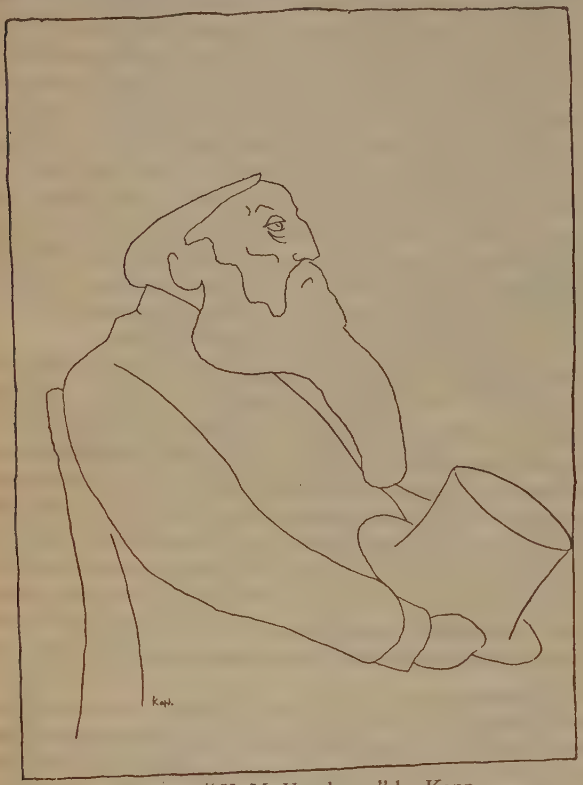


FIG. 1.—" H. M. Hyndman " by Kapp.

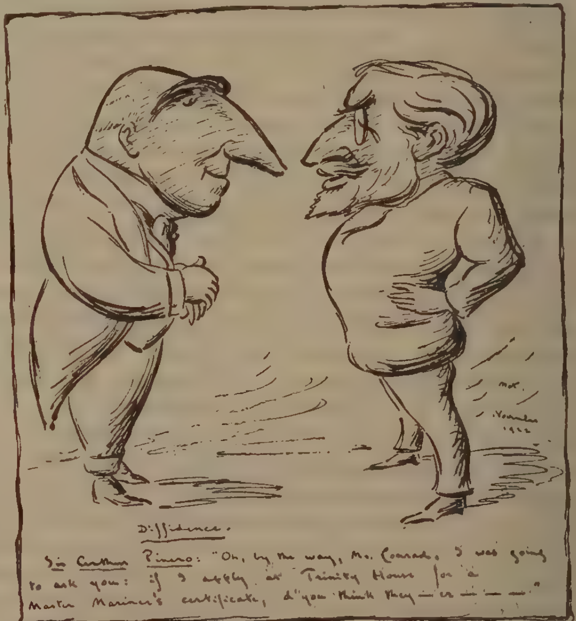
The very earliest of Beerbohm's drawings undoubtedly show the influence of Carlo Pellegrini (" Ape " of *Vanity Fair*), but he soon developed a style of his own based upon very accurate observation, although without academic knowledge of drawing. He was, so to speak, a caricaturist by nature, whilst other men such as Kapp and " Quiz " were artists first and caricaturists by chance. Beerbohm's best work was invariably done from memory, with an unfaltering line and comeliness of grouping which fills the observer with delight. His aim was to expose the weaknesses of the strong and his outlook was far too straightforward for him to avoid the charge of occasional malice. Beginning, as he himself said, a " petit maître " who would take nothing seriously, in his maturer work, still enlivened by a sense of the ridiculous, he ripened and ascended from cleverness to wisdom, from a rare spitefulness to an almost exuberant scorn.

His series of nine drawings exhibited in 1921 entitled *Tales of Three Nations*, dealing with the relative positions of Great Britain, France and Germany during the preceding hundred years, is a solid contribution to historical commentary. His lighter vein is admirably exemplified by *Rossetti and his Circle* and the series of *The Old and the Young Self*, exhibited in 1921 and 1925 respectively. In the latter notables are found in characteristic conversations with themselves in their own youth. These drawings show at its best Max Beerbohm's profound insight into other men's personalities. His work ably illustrates the impact of events upon a scholarly and cultivated mind, more prone to perceive the absurdity of wrongdoing than the evil, and of some forms of righteousness, the beauty equally with the absurdity. His expression is never heavy or pompous, he has no truck with the surface emotions, and his work, therefore, never has and never will be, in a wide sense, popular.

Claud Lovat Fraser (d.1921) made a few caricatures from time to time of considerable distinction, his method being to " catch " a likeness in remarkably few lines. Henry Ospovat (d. 1910) combined keen perception in true caricature with accomplished portraiture.

Edmond X. Kapp was an excellent draughtsman and his " straight " portraiture, usually in pencil or chalk, commands admiration. His caricatures are diverting and original, showing considerable observation not merely of a physical kind. His work appeared from time to time in the periodical press, and exhibitions of it were held at the Leicester Galleries, London. His most memorable caricatures were a series of judges which appeared in *The Law Journal* (1924), and a number of musical notabilities. Kapp's manner of drawing was extremely diverse, ranging from elaborate effects of light and shade made with broad-pointed chalk to a fine clean pen line. He was the first artist in Great Britain to make intelligible use of " abstract " drawing in conjunction with true caricature, and he shared with Max Beerbohm the distinction of making his drawings, apart from their ostensible purpose, of definite aesthetic interest.

" Quiz " (Powys Evans) contributed weekly to *The Saturday Review* (London) from 1922 onwards. His caricatures, drawn in pen and ink, were variously successful, and occasionally brilliant. His comment is mainly physical. Portraits from his hand appeared in *The London Mercury*. Among other artists who made successful caricatures from time to time were Edmund Dulac and W. K. Haselden, whose weekly illustrations to the dramatic criticisms in *Punch* were really of remarkable excellence. With


Diffidence.
Sir Arthur Pinero: "Oh, by the way, Mr. Conrad, I was going to ask you: if I apply at Trinity House for a Master Mariner's certificate, d'you think they—er——"

From *Things New and Old* (Heinemann, London)

FIG. 2.—" Diffidence " (Sir A. Pinero and Mr. J. Conrad) by Max Beerbohm.

extreme economy of line he contrived to unite likeness to his victims with judgment on their performance or personality. Will Dyson, an Australian who first became known as a contributor to *The Bulletin* (Sydney), made powerful caricatures in black and white, though his work came as a rule rather under the head of cartooning. Other personal caricatures which appeared from time to time in the daily or periodical press consisted usually of large heads on little bodies—a convention which has the merit only of enabling the artist to draw especial attention to facial peculiarities, but which has the disadvantage of frequently inverting the figurative as well as the physical truth. It remained for Max Beerbohm to put very small heads on very large bodies when that reversal of the usual procedure seemed warranted.

German Caricature.—On the continent of Europe the best personal caricature was undoubtedly produced in Germany, where the satirical weekly paper *Simplicissimus*, formerly published from Munich, and later from Stuttgart, continued to lead the way in manner and content, followed by *Kladderadatsch* (Berlin). *Jugend* (Munich) devoted less space and talent to caricature than formerly. The World War gave the German caricaturists daily opportunities of malicious exposition of current events, and it was on the whole remarkable how they restrained themselves; their satire during those years was frequently tinged with manifest respect. Caricature in *Simplicissimus* was outstanding, not only for the excellent likeness to individual victims, but for the wealth of original and daring conventions by which such likenesses were built up. The best work in *Simplicissimus* was done latterly by two Scandinavians, Olaf Gulbransson, and "Blix," who treated the affairs of the world at large week by week in a spirit of bitterness, sometimes entertaining, sometimes revolting in its harsh realism, but always skilful. The caricatures of E. Thöny, an old contributor, were remarkable for their fertility of invention and variety of treatment.

In Great Britain, the name that most conspicuously emerged from the War in this respect was that of the Dutch artist, Louis Raemaekers, who, though not to be highly regarded as a caricaturist, contrived to adapt the skilled inventions of a continental technique to a bitter commentary on the conduct of the German Army. In Italy, Musacchio contributed brilliant caricatures to the *Giornale d'Italia*.

French and American Work.—In France, the personal caricatures of "Cabrol" in *L'Humanité* were noteworthy for physical likeness skilfully caught by unusual means; but it is to be observed that the continental draughtsmen in this *genre* seldom, in their estimate of individuals, went beneath the surface of reported utterances, and no particular insight into character was demonstrable, either in the drawings themselves or the words written beneath them. Very little true caricature worth mention appeared in other European countries during the period 1910–25, and in the United States, too, irony generally found expression in cartoons which typified rather than identified. Exceptions are found in the drawings of Ralph Barton, whose caricatures appeared in the New York *Life*, and, occasionally, in the work of Boardman Robinson, who became known also in Great Britain for his political cartoons in *The Outlook* during 1922 and 1923. The best true caricature seen in the United States after 1910 was the work of a Mexican, Miguel Covarrubias. (*See* CARTOON.)

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CARNARVON, GEORGE EDWARD STANHOPE MOLYNEUX HERBERT, 5TH EARL OF (1866–1923), English egyptologist, was born at Highclere, Berkshire, June 26 1866 and educated at Eton and Trinity College, Cambridge. In the course of extensive travels he acquired a knowledge of the Near East, but, though much interested in foreign politics, was prevented from taking part in public life owing to a motoring accident. Always interested in Egyptian archaeology and politics, he began excavations near Thebes with Mr. Howard Carter in 1906 and discovered tombs of the XII. and XVIII. Egyptian Dynasties in the Valley of the Kings. A further concession having been obtained in 1914, operations in another part of the Valley were conducted after the War, resulting in the discovery by Mr. Carter in Nov. 1922 of the antechamber of the tomb of Tutankhamun (*q.v.*) of the XVIII. Dynasty. On Feb. 16 1923 the sepulchral chamber was opened, the actual sarcophagus being discovered on Jan. 3 1924. Meanwhile Lord Carnarvon had died in Egypt on April 5 1923, from the results of a mosquito bite and pneumonia. See *The Tomb of Tut-ankh-Amen* by Howard Carter and A. C. Mace (1923).

CARNEGIE, ANDREW (1835–1919), American capitalist and philanthropist (*see* 5.364), died at Lenox, Mass., Aug. 11 1919. His ideals are shown by his benefactions (*see* CARNEGIE TRUSTS). In 1910 the Pan-American Union building erected in Washington by Carnegie at a cost of $850,000 was dedicated. In 1911 he established his last and greatest endowment, the Carnegie Corporation of New York, and before his death placed in its charge $125,000,000 to be used for promoting civilisation in whatever way should seem best to the trustees.

In 1913 the Hague Peace Palace, given by Carnegie and costing $1,500,000, was dedicated. By the close of 1918 he had erected 2,505 library buildings (1,679 U.S.A.; 660 Great Britain and Ireland; 125 Canada; 41 elsewhere) at a cost of more than $56,000,000. He had provided 7,624 church organs throughout the world, costing about $6,220,000. In his will he provided that after certain enumerated bequests the residue of his estate (his family having already been provided for) should pass to the Carnegie Corporation. Appraisal of the estate, smaller than had been estimated, was made in 1921 and showed a net value of $22,880,000. Since according to the law of New York only half of an estate can be assigned as public bequests in case husband, wife, parent or child survive, the residue passing to the Carnegie Corporation was less than $11,000,000. Before his death Carnegie had made public gifts, including those mentioned above amounting to $350,000,000. If he did not die poor, as he claimed every man should, he at least gave away all but a relatively small portion of his wealth. His *Autobiography* appeared in 1920.

CARNEGIE TRUSTS, the second largest, and in some respects the most remarkable, group of charitable foundations in the world. Andrew Carnegie's theory of wealth is summed up in the following sentence: "This, then, is held to be the duty of the man of wealth: to set an example of modest, unostentatious living, shunning display or extravagance; to provide moderately for the wants of those dependent upon him; and, after doing so, to consider all surplus revenues which come to him simply as trust funds, which he is called upon to administer . . . the man of wealth thus becoming the mere trustee and agent for his poorer brethren." In this spirit, he founded the following trusts in the United Kingdom and in America.

I. TRUSTS IN THE UNITED KINGDOM

Carnegie Trust for the Universities of Scotland (Edinburgh).—Founded in 1901 this has a capital of £2,000,000. One half of the income is to be applied to the improvement and expansion of the four Scottish universities, chiefly in the field of research; one half to the payment of the whole or part of the fees of university students of Scottish birth or extraction.

Carnegie Dunfermline Trust.—Founded in 1903 with £750,000, this is the counterpart of the Pittsburgh Institute (*see* below). This trust is limited to the founder's native city of Dunfermline, but the income may be spent on anything which tends to bring "sweetness and light" to the community. The trustees are, however, charged to maintain the beautiful park known as Pittencrieff Glen, which was presented by the founder separately. They have established a number of institutes, a clinic, a craft school, a school of music and a physical training college, and have substantially assisted the public library, the baths and a large number of local societies, educational, literary and artistic.

Carnegie Hero Fund Trust.—This fund is administered from Dunfermline by the trustees who are in charge of the Carnegie Dunfermline Trust.

Carnegie United Kingdom Trust (Dunfermline).—Founded in 1913 with a capital of £2,000,000 this is the analogue of the

Carnegie Corp. of New York "for the improvement of the well-being of the masses of the people of Great Britain and Ireland by such means as are comprehended within the meaning of the word charitable." This trust has carried on the founder's library policy, having erected a number of public libraries, established more than 100 county libraries and assisted many special libraries. It has published an edition of Elizabethan music and a number of modern compositions. Grants have been made for the erection of six child welfare model centres, to the Old Vic and Sadler's Wells theatres, London, as the nucleus of a national theatre for England, and to many musical and dramatic enterprises. The trust has also taken a prominent part in rural development by founding county community councils.

II. TRUSTS IN THE UNITED STATES

Carnegie Institute of Pittsburgh.—This consists of a group of cultural and educational departments of the municipal type, library, concert hall, technical college, museum and art gallery. The foundation really dates from 1881 when Carnegie offered to provide a public library; this offer was accepted in 1886. The idea expanded until the institute was finally constituted as such in 1896. It has a capital of $28,000,000.

Carnegie Institution of Washington.—Founded in 1902 with a capital of $22,300,000, this is a great combination of research departments, working in collaboration and including: Experimental Evolution (1903); Marine Biology (1903); Historical Research (1902); Economics and Sociology (1904, discontinued 1917); Terrestrial Magnetism (1904); Mount Wilson Observatory (1904); Geophysical Laboratory (1905); Botanical Research, including a laboratory in Monterey, Cal. (1905); Nutrition (1906); Meridian Astrometry (1907); Embryology (1914); Eugenics Record Office (1917). The published reports of the Institution constitute a highly valuable library of research and are presented in a liberal spirit to all well-established libraries. The numerous voyages of the non-magnetic ship "Carnegie," designed to test the variations of the magnetic compass, may be specially mentioned.

Carnegie Hero Fund Commission (Pittsburgh).—This is a group of foundations, dating from 1904, designed for the purpose of giving suitable recognition to persons engaged in peaceful occupations who risk their lives in heroic efforts to save others. Recognition takes the form of medals, pecuniary grants, pensions, educational help for children, etc. The funds are: U.S.A., Canada and Newfoundland $5,000,000 (1914); British Isles $1,250,000 (1908); France $1,000,000 (1909); Germany $1,500,000 (1910); Norway $125,000 (1911); Switzerland $130,000 (1911); Netherlands $200,000 (1911); Sweden $230,000 (1911); Denmark $125,000 (1911); Belgium $230,000 (1911); Italy $750,000 (1911); Total $10,540,000.

Carnegie Foundation for the Advancement of Teaching (New York).—This was founded originally in 1905 to provide pensions for teachers in the form of free gifts. The system was at first non-contributory, but after elaborate investigation, a new system was adopted by which colleges and teachers both contribute on a properly calculated actuarial basis. The Foundation has also undertaken many inquiries in the field of education, and issued numerous reports. Its capital is nearly $30,000,000.

Carnegie Endowment for International Peace.—Founded in 1910 with a view to "the speedy abolition of international war between the so-called civilised nations," this has a capital of $10,000,000. It is divided into three sections concerned respectively with "Intercourse and Education," "Economics and History" and "International Law." The endowment is very broad in its scope, being free to work in any way for the promotion of good feeling and understanding between the nations. Since the World War one important project has been a series of volumes on European economics in connection with the War and its aftermath.

Carnegie Corporation of New York.—Founded in 1911 this is the largest in size and scope of all the Carnegie Foundations, its capital being $125,000,000. It exists for "the advancement and diffusion of knowledge and understanding among the people of the United States." In 1917 its scope was extended to include Canada and the British Colonies. It may spend its large revenue through the other five American Trusts or through any other suitable channels. Its policy is in fact fluid, the founder having said in the deed, "Conditions upon the earth inevitably change. . . . . I give my trustees full authority to change policy or causes hitherto aided when this, in their opinion, has become necessary or desirable." The corporation has done a great deal for the American Library Service, and for adult education generally, *e.g.*, fine arts, the study of modern languages, law, engineering.

All the above foundations, except the Carnegie Corporation of New York and the United Kingdom Trust, have functional or local limitations. The two general trusts work largely on the same lines, seeking to promote adult education in the widest sense of the term, to make accessible to the public at large the cultural resources of the community and especially to finance carefully devised pioneer experiments for which, without practical demonstration, state subsidies and private liberality cannot be expected.

See the *Annual Reports* issued by the various Trusts; *Manual of the Public Benefactions of A. Carnegie* (Washington, 1920). *See* also LIBRARIES. (J. M. M.)

CARO, NIKODEM (1871–), German chemist, was born May 23 1871 at L̃ódź. He studied at Berlin University and at the technical high school, Charlottenburg, and founded a public chemical laboratory. He was engaged in agricultural research work, and experimented on peat as a source of power. He interested himself in the problems of calcium carbide and acetylene, and in the liquefaction of water gas for the production of hydrogen, also in ammonia oxidation. In conjunction with Frank, he devoted himself to the development of a process for the fixation of nitrogen (cyanamide) and organised the cyanamide industry founded theron. Large works for this industry were also erected at Piesteritz and Chovzow. Dr. Caro made a special study of the question of Bavarian sources of water-power with a view to utilising them in the chemical industry.

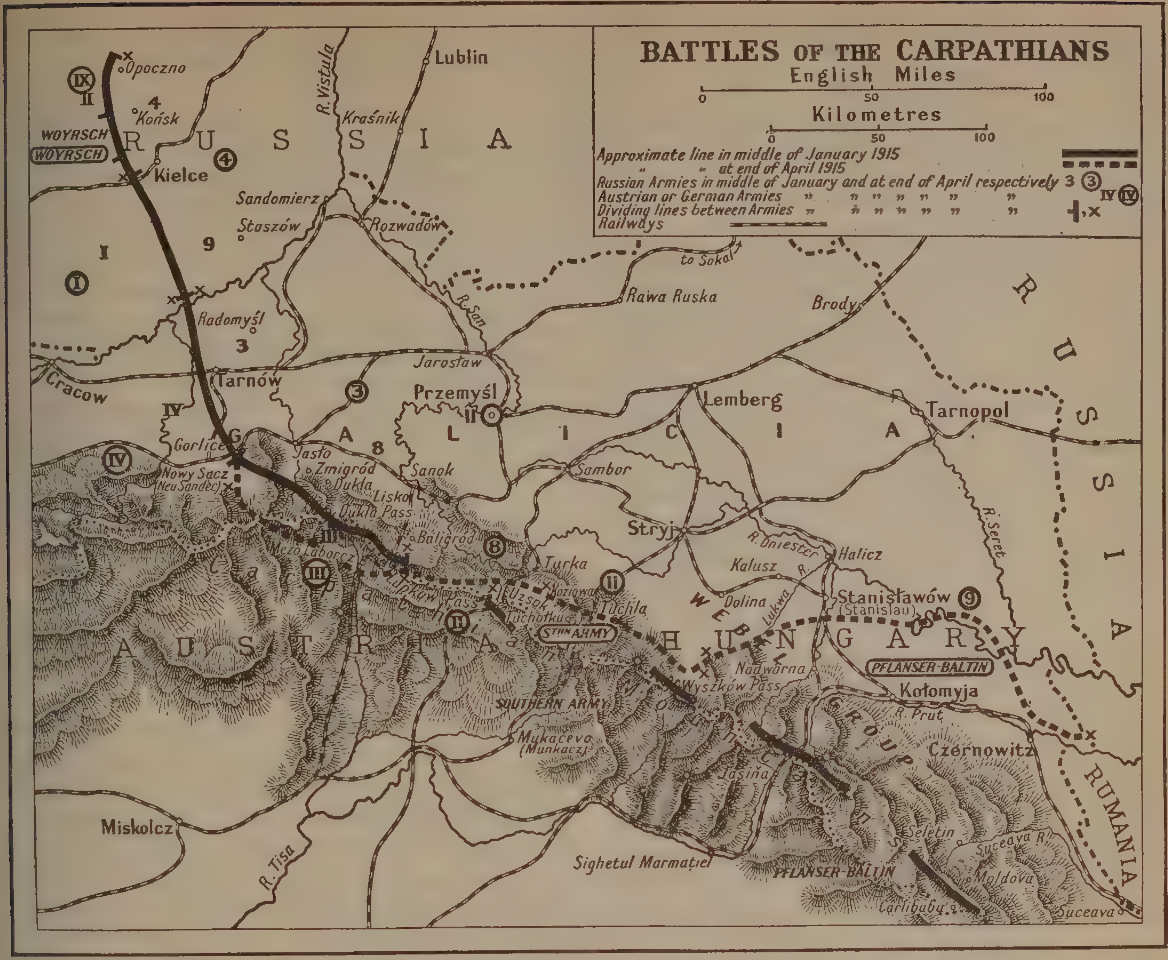
CAROLUS-DURAN (1837–1917), French painter (*see* 5.381), died in Paris Feb. 18 1917.

CARPATHIANS, BATTLES OF THE.—Under this heading is recorded the fighting of the first four months of 1915 in the wooded Carpathians, from the Dukla pass, south of Jaslo, to the Rumanian border. The average height of the crest of the main ridge in this section of the range is between 2,500 and 3,000 feet. The slopes are steep on the Galician side, gentler on the Hungarian side. The winter climate is extremely severe, the temperature being often many degrees below zero; snowstorms and blizzards are frequent. Why both sides chose these inhospitable highlands for a winter battle—for each side in turn attacked in great strength—invites some examination.

Object of the Operations.—For Austro-Hungary the main motives were the relief of the fortress of Przemysl and the security of the threatened plains of Hungary. But Conrad von Hotzendorf, Chief of the Austrian General Staff, hoped for more; the attacks, if successful, would develop into a large scale offensive against the southern flank of the whole Russian battle line. On the Russian side, the Grand Duke Nicholas sought during this winter to secure his flanks as the necessary preliminary to a direct advance from the Polish salient aimed at the heart of Germany. The undisputed possession of the Carpathian passes, with freedom to debouch at will into the Hungarian plains below, would go far towards breaking the resistance of Austro-Hungary and so safeguarding the Russian southern flank. The Grand Duke trusted to the greater endurance of his men under winter conditions to give them the advantage over enemies bred in less rigorous climates. He forgot that the Russian is a plainsman, and that hill fighting requires a special aptitude and training.

By the end of 1914 a continuous front had been established in the Carpathians only as far east as Baligrod. Thence to the Rumanian frontier, the conditions were those of open warfare; detachments on either side attacked and defended points of strategic importance, but no solid battle line had been formed.

Disposition of Troops.—The disposition of the opposing forces


BATTLES OF THE CARPATHIANS
English Miles
0 50 100
Kilometres
0 50 100
Approximate line in middle of January 1915
" " at end of April 1915
Russian Armies in middle of January and at end of April respectively 3 ③
Austrian or German Armies " " " " " " " IV Ⓘⓥ
Dividing lines between Armies " " " " " " "
Railways
R U S S I A
R U S S I A
G A L I C I A
A U S T R I A
H U N G A R Y
RUMANIA
Lublin
R. Vistula
Kraśnik
Opoczno
Końsk
Kielce
WOYRSCH
Sandomierz
Staszów
Rozwadów
to Sokal
Rawa Ruska
Brody
Radomyśl
Tarnów
Cracow
Jarosław
Przemyśl
R. San
Lemberg
Tarnopol
Gorlice
Nowy Sacz (Neu Sandec)
Jasło
Zmigród
Dukla
Dukla Pass
Sanok
Lisko
Baligród
Sambor
Stryj
R. Dniester
Halicz
Kalusz
Mezö Laborcz
Lupków Pass
Uzsok
Turka
Koziowa
Tuchla
Tuchołka
STH ARMY
Dolina
R. Seret
Stanisławów (Stanislau)
WEBEL'S GROUP
Nadworna
Wyszków Pass
PFLANZER-BALTIN
Kołomyja
R. Prut
SOUTHERN ARMY
Mukačevo (Munkacz)
Czernowitz
Jasiňa
Seletin
Suceava R.
Moldova
Miskolcz
R. Tisa
Sighetul Marmației
PFLANZER-BALTIN
Cârlibaba
Suceava
IX II 4 ④ I ① 9 3 ③ IV ⓘⓥ 8 ⑧ II III ⓘⓘⓘ XI ⑪ ⑨ G

when the campaign opened in mid-January were approximately as follows. The Russian III. Army (Radko Dimitriev) extended from the Vistula, northeast of Cracow, by Tarnóv to about Gorlice; on its left came Brusilov's VIII. Army, which stretched from Gorlice to Baligrod and held the important Dukla pass. Further east, Webel's Dniester group (second-line infantry divisions and Cossacks) had pushed up the slopes of the Eastern Carpathians, capturing the Uzsok and Wyszkow passes and overrunning the Bukovina. The XI. Army was besieging Przemysl. On the Austrian side, the IV. Army (Grand duke Joseph Ferdinand) faced Radko-Dimitriev, and Boroevich's III. Army was opposed to Brusilov. Further east, Linsingen's newly formed Southern German Army (four German and two Austrian divisions and two cavalry divisions) had assembled at Munkacs and was moving forward. Further east still, beyond the Wyszkow pass, the group of Pflanzer-Baltin extended up to Dorna-Vatra on the Rumanian border.

Austrian Offensive.—The Austrian offensive, which opened the campaign, was made by the right of Boroevich's III. Army, by Linsingen's Southern Army and by Pflanzer-Baltin's group. The offensive began on Jan. 23 1915. The attack of the III. Army, after an initial success which carried it to the line of the Upper San, soon lost its impetus. The Russians retaliated with a counter-offensive which began on Jan. 26 against the left of Boroevich's Army astride the Mezö Laborcz railway; from now to the end of the battle the Russians maintained the initiative in this part of the field, to which both sides began to transfer forces from other sectors of the front. Linsingen's Southern Army recaptured the Uzsok and Wyszkow Passes and pushed slowly forward on Tuchla, but with the III. Army on its left falling back before the Russian counter attacks could accomplish little. Meanwhile, Pflanzer-Baltin, whose group had been reinforced in the last week of Jan. by a fresh corps, drove the Russians out of the Bukovina with his right wing, while his left wing reached in succession Kolomea, Nadworna, and finally, on Feb. 20, Stanislau. He now purposed to wheel to the left, to come in on the flank and rear of the Russian forces facing Lingsingen. This move was checked by the assembly to the north and west of Stanislau of Lechitski's IX. Army, which had been transferred from the Russian-front in Poland.

Attempt to Relieve Przemysl.—During the first half of Feb. the Austrians transferred the II. Army (Bohm-Ermolli) from the Polish to the Carpathian front, with the intention of making a last attempt to relieve Przemysl. By the end of February, when this II. Army was ready to advance, the situation of the Austrian forces in the Carpathians seemed critical, in spite of their numerical superiority. The left of Boroevich's III. Army had almost reached breaking point under the continual pressure of Brusilov's forces, which had captured Mezö Laborcz and the Lupkow pass; Linsingen's Army held its ground, but could make no headway; Pflanzer-Baltin's Army was threatened by Lechitski's concentration; and Przemysl was in sore straits. The offensive of the II. Army, if it was to restore the situation, required a rapid and striking success. The principal offensive was made in the direction of Baligrod, astride the shortest road to Przemysl. At no time did the attack meet with any great measure of success; and by the middle of March it was stopped as hopeless, the Austrians being completely exhausted by the weather and their heavy losses. The formations which had borne the brunt of the assaults had lost over 50% of their strength. Przemysl was now abandoned to its fate.

Meanwhile, during the first fortnight in March, Lechitski's forces had driven Pflanzer-Baltin some 20 m. back from Stanislau and had reached the line of the Prut in northern Bukovina. An opportune reinforcement enabled Pflanzer-Baltin to check the Russian advance. There was some further fighting; but little material change took place in this eastern portion of the battlefield up to the end of April.

Russian Offensive.—On March 20 the Russians, now sure of the fortress of Przemysl (it actually fell on March 22) launched a final great offensive against the Austrian III. and II. Armies. The attack was made by the left wing of Radko-Dimitriev's III. Army, which had been extended eastwards, and by Brusilov's VIII. Army. For a month their effort lasted. Both the Austrian Armies were driven over the crest of the main ridge. But both managed to maintain their positions on the other side of it, though it was only the arrival of fresh German divisions (the Beskiden corps) which saved the III. Army from breaking. Linsingen's Southern Army obstinately withstood all shocks and indeed made some ground forward. It held fast to the important Uzsok Pass. By April 20 the Russians paused, breathless. They had appreciably enlarged their gains south of the Dukla Pass, but their effort to break through the Austrian front had failed.

Conclusions.—It is a little difficult to arrive at a just balance of profit and loss between the two antagonists in this long drawn-out struggle. The Austrians seem to have attached undue importance to their fortress of Przemysl; their obstinate efforts to relieve it brought them to the verge of collapse and cost them heavier losses in men than did the eventual surrender of the garrison. The Russians, though they secured a "bridge-head" over the barrier of the Carpathians, did not succeed in forcing the obstacle, and squandered valuable resources in men and munitions by their persistence.

The result showed in fact that both commanders had been ill-advised to embark on this winter battle. On the whole the consequences were more disastrous for the Russians, whose obsession with this Carpathian struggle induced them to withdraw two corps from the right wing of their III. Army, and was thus a direct cause of its crushing defeat by Mackensen at the beginning of May (*see* Dunajec-San). No special lessons of tactics can be drawn from the fighting. The conditions of weather and ground were against elaboration of manoeuvre. Hill fighting requires a degree of individual skill and of tactical leadership which neither side possessed.

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CARPENTER, JOHN ALDEN (1876–), American composer, was born at Park Ridge, Ill., Feb. 28 1876. He was educated at Harvard University, graduating in 1897, and joined his father in business in Chicago. Subsequently he studied music in Europe under Elgar, and in Chicago under Ziehn. His compositions include *Gitanjali,* a song-cycle with words by Tagore (1914); *Adventures in a Perambulator* (1915); a symphony (1917); *The Birthday of the Infanta,* a ballet pantomime, produced by the Chicago Opera Co., Dec. 23 1919; and *Krazy-Kat,* a ballet, produced Dec. 23 1921. His published works also include a sonata for violin and piano and a number of songs. As a composer he became distinguished by his adherence to modern tendencies, and displayed great skill and variety in his handling of the orchestra.

CARREL, ALEXIS (1873–), Franco-American surgeon, was born at Sainte-Foy-les-Lyon, France, June 28 1873. He graduated at the university of Lyons in 1890, and for two years was *Prosecteur à la Faculté de Médecine.* He went to the United States in 1905, and worked at the University of Chicago. In 1906 he was appointed to the staff of the Rockefeller Institute for Medical Research in New York, becoming a member in 1912. He developed a new method for suturing blood-vessels, which made it possible to perform blood transfusion safely, and to transplant arteries, veins and organs. He also studied the preservation of tissues outside the body and its application to surgery. This work led him in 1911 to investigate the conditions of tissues when they are living actively outside the organism. He was awarded the Nobel Prize in physiology and medicine in 1912 for his contributions to the surgery of blood-vessels. On the outbreak of the World War he returned to France and devised the Carrel-Dakin treatment for wounds, by means of which many lives were saved and countless amputations were avoided. At the same time, with Dr. du Noüy and other collaborators he studied the laws of the cicatrisation of wounds. In 1919 he resumed his work at the Rockefeller Institute for Medical Research.

CARSON, EDWARD HENRY CARSON, Baron (1854–), British politician and lawyer, son of Edward Henry Carson, a civil engineer of Dublin, was born Feb. 9 1854 and educated at Portarlington School and Trinity College, Dublin. He became an Irish barrister and made his reputation as crown prosecutor in the difficult years when Mr. A. J. Balfour was Chief Secretary for Ireland. His pluck, readiness, wit and skill in cross-examination soon brought him to the front, both in legal and in political circles. He became a Q.C. at the Irish bar in 1889; but his ambitions could not be satisfied with legal eminence in Dublin. He was called to the English bar, and took silk there in 1894.

Meanwhile he had been returned to Parliament in 1892 in the Unionist interest as member for his own University of Dublin and was for a few months Solicitor-General for Ireland. He entered Parliament just when Gladstone was about to make a second effort to pass a Home Rule bill, and he helped to defeat the measure. But during the next 20 years he was mainly occupied with his professional work. Having risen to a leading place at the bar in Ireland, he achieved an even more striking success at the English bar and in 1900 became Solicitor-General, a post which he held till the fall of Mr. Balfour's Government in Dec. 1905.

It was not until 1911, when another Home Rule bill was imminent, that Sir Edward Carson, who had gradually become the spokesman of the Irish Unionists in Parliament, emerged as a political figure of importance. He strenuously resisted the Parliament bill, which was to curtail the power of the Lords and enable a measure of Home Rule to be passed without a direct appeal to the people. He was one of the "Die-hards" who urged the peers to take the responsibility of throwing out the bill in spite of the ministerial threat to swamp their House with sufficient new creations to make its passage secure. He told the House of Commons that Home Rule, if carried by force, would be resisted by force and that the resisters would be constitutionally right.

Feeling against the Home Rule policy was most bitter in Ulster, which, Protestant and loyal, would be placed thereby at the mercy of the Roman Catholic, and largely disloyal, majority of the other three Irish provinces. He went to Ulster in the autumn, and at an enormous Unionist demonstration at Craigavon, near Belfast, endorsed the threats of rebellion against Home Rule which previous speakers had made. Belfast, he said was the key of the situation; Ulster would never submit to a Parliament in Dublin. They must be prepared, if necessary, to take over the administration of those districts which they were entitled to control. Practical measures were immediately taken in this direction, though Liberals and Nationalists scoffed. His position was that he and his Ulster friends were loyal to the constitution as it existed; they were only rebels, he said, in the sense that they desired to remain under the King and the Imperial Parliament.

In anticipation of the introduction of the Home Rule bill in the spring of 1912, he presided over a gigantic gathering in Belfast in Easter week, which Mr. Bonar Law, the newly appointed Unionist leader, came to address; and he made those present repeat after him, "we will never, in any circumstances, submit to Home Rule." He himself, in a speech instinct with passion, moved the rejection of the bill on its introduction, and took a leading part in opposition during its subsequent stages. But his activity was mainly outside Parliament. He made frequent speeches in the next two years in different parts of England and Scotland, particularly at a great demonstration at Blenheim in July 1912, at which Mr. Bonar Law pledged the support of the Unionist party to Ulster.

His principal work, however, was in the organisation of resistance in Ulster itself, including the formation of a local volunteer force, which speedily assumed large proportions. In Sept. 1912 he was the chief figure at a series of demonstrations in all parts of the province, culminating in an enormous assemblage at Belfast on Sept. 28. There he took the lead in signing a solemn covenant, by which the men of Ulster bound themselves to stand by one another in defending their position of equal citizenship in the United Kingdom, and in using all necessary means to defeat the proposal to set up Home Rule, and further pledged themselves to refuse to recognise a Home Rule Parliament. He followed this up by moving (unsuccessfully) in Parliament on New Year's Day 1913 the exclusion of Ulster from the bill.

In the autumn of 1913 the Ulster Unionist Council organised itself, under his supervision, into a provisional government, of which he was the leading member, and a guarantee fund of £1,000,000 was initiated to which he himself contributed £10,000. He reviewed the Volunteers, who were rapidly becoming a formidable military force, approaching in number 100,000 men. But when ministers who had refused to prosecute him or to interfere with his activities began to realise the determination of the six northeastern Protestant counties he did not repulse their overtures for a settlement by consent, but said that it must not establish a basis for separation. His advice during the following winter to his Ulster friends was "peace but preparation." He entirely declined to accept Mr. Asquith's offer, in the early spring of 1914, of a county option of exclusion for six years. That was "sentence of death with a stay of execution." There was only one policy possible, he told the House of Commons: "Leave Ulster out until you have won her consent to come in." He became a member of the abortive Buckingham Palace Conference convened by the King, and when that broke down, at the end of July, it looked as if he and his Ulster friends would have to make good in action their policy of force.

The World War intervened and switched off his activity into another direction. Though he resented, as a breach of the political truce between parties, Mr. Asquith's determination to pass the Home Rule bill into law, while suspending its operation and promising some form of special treatment for Ulster, he went to Belfast in order to stimulate Ulstermen and especially Ulster volunteers to join the British Army, and had a considerable success. He was eager for a thorough prosecution of the War, and accordingly joined Mr. Asquith's Coalition Ministry of 1915 as attorney-general, resigning however in October because he thought that the policy of the Cabinet, after the defection of Greece, involved the desertion of Serbia, a small country in whose fate he took a profound interest. He was strongly in favour of the Compulsory Service bill in 1916, and regretted that Mr. Redmond should insist on exempting Ireland from its provisions.

He looked favourably upon Mr. Lloyd George's efforts that summer to arrange an agreed settlement of the Irish question; and when that statesman formed a new Government in December for the more efficient conduct of the War, he accepted office as First Lord of the Admiralty. At this period the Board of Admiralty were mainly engaged in devising means to counter the German submarine attack, which was steadily increasing in intensity; and he devoted all his energies to the pursuit of this vitally important aim. Outside his departmental duties he warmly promoted the Irish Convention which the Govt. assembled in 1917. In July he quitted the Admiralty to become a member of the War Cabinet without portfolio, a position which he resigned at the beginning of 1918. But, in or out of office, his activity was directed wholeheartedly to the vigorous prosecution of hostilities.

After the War was over Ulster and Ireland regained the first place in his thoughts. At the General Election of 1918 he left Dublin University in order to represent one of the divisions of Ulster's capital, Belfast. On the anniversary in July 1919, of the battle of the Boyne, he restated, speaking near Belfast Ulster's position and claims, and threatened to call out the Volunteers if any attempt were made to change her status. When, however, Mr. Lloyd George proposed in the winter his bill for the reform of the government of Ireland, establishing parliaments and executives both in Dublin and in Belfast, and a Federal council for all Ireland, he modified his attitude. Though he would have preferred no change, yet, as this bill gave the six Protestant counties of Ulster a Parliament of their own, besides representation in the Imperial Parliament, he would not oppose it.

After it had passed, he exerted himself with success to secure a strong Unionist majority in the elections in May 1921 for the first Parliament of Northern Ireland. He had thus achieved his main political object of saving Protestant Ulster from domination by the Roman Catholic majority of the south and west. Throughout the past ten exhausting years he had, save while in office, combined with his political work an immense practice in the law courts; and after the Ulster elections he accepted a lordship of appeal and a life peerage as Baron Carson of Duncairn. But, though he had become a judge, he did not hesitate to avail himself of his opportunities as a member of the House of Lords to continue to give his countrymen the benefit of his counsel at critical moments of the Irish question. Thus, he bitterly denounced the treaty which constituted the Free State, both at the time of its conclusion and when the bill to carry it into effect was before his House. He also protested in 1924 against the bill which empowered the British Govt. to appoint, owing to Ulster's default, a third commissioner on the Irish Boundary Commission. But he cordially welcomed the agreement, made at the close of 1925, between the British Govt., the Govt. of the Irish Free State, and that of Northern Ireland, which finally settled this question. He was twice married—in 1879 to Sarah A. F. Kirwan, who died in 1913, and in 1914 to Ruby Frewen. (G. E. B.)

CARTEL (*see* TRUSTS, 27.334).—During the last decade before the World War, in Germany and in other countries cartels were gaining greater importance. They were by no means confined to the so-called heavy industries, which are most suited for the formation of cartels owing to their large scale; industries with smaller units, especially the textile industries, were also increasingly organised in such groups. The increasing formation of cartels in merchanting, partly under the influence of the great industrial cartels, may also be mentioned.

During the War the Govt. of the German Reich made use of cartels for supplying the enormous requirements of the army. As the output capacity of the individual undertakings was known, it was possible to allocate orders amongst them in a satisfactory way. It is true that the sudden demand, even apart from the scarcity of raw materials which soon set in, necessitated the grant of higher profits, but the price increases were often much higher where application had to be made to individual firms.

Many cartels, especially the so-called contracts cartels, were formed during the War for the exploitation of urgent army requirements, and, later, associations of traders were formed to exploit the increasing scarcity of goods; but the great and well known cartels were moderate in their price-fixing. The fixing by the state of maximum prices was not so often necessary in their case, and was, in any case, more easily effected. Nevertheless the Govt. soon found themselves compelled to intervene in the cartel system, because many cartels failed to show proper consideration to consumers. The textile cartels in particular were compelled to reduce prices to the consumer.

State Interference.—But state interference with the cartels went further, as a rule in the form of maintaining existing cartels or of compulsory amalgamation. It was recognised that dissolution of the cartels and return to unregulated competition was economically undesirable, and would render impossible the economic utilisation of raw material and labour. Following the precedent created in the case of the Potash Syndicate, which in 1910 was compulsorily reconstituted in order to prevent its collapse, the German Govt. have created compulsory syndicates, especially in mining. Under the threat of such action the Rhenish-Westphalian coal syndicate was reconstituted just before the contracts expired. The state justly feared that if this great organisation fell to pieces, the maintenance of a regular supply to the consumers and a uniform control, both of export and of internal consumption, would not be possible.

The industrialists have for the most part not been opposed to such compulsory cartels, because the accompanying rationing of production, raw materials and marketing also facilitated future monopolistic combination. Herein, however, lies the danger of these methods, which the state endeavours to counter by granting the consumer and also the workers certain rights in these organisations and by consulting with their representatives.

The power of the State in relation to industry, which had grown extraordinarily during the War, was still further strengthened in Germany when the Socialists came into power after the collapse in 1918, and demanded the socialisation of these industries. In practice, however, the existing compulsory syndicates for potash, coal, and iron were merely further extended, and far-reaching powers for the regulation of prices were given to the Federal Coal Council and the Federal Potash Council, on which workers and consumers were represented. In the iron and steel federation (Eisenwirtschaftsbund) state intervention was not carried so far. On the other hand, in the electrical industry, where the so-called "mixed undertakings" (whose capital was raised jointly by public and private bodies) had played a great rôle in the production and delivery of power over large areas before the War, the attempt was made to increase the influence of the Reich and of its constituent states.

Trusts in Germany.—Even before the War cartels were by no means the only form of combination of several undertakings. After the strong cartels in coal-mining had come into being, it was more advantageous for the large iron and steel works to possess their own coal mines. The so-called "pure" rolling-mills, which had to buy their raw material from the combined steel works, which were also their competitors in the sale of the manufactured products, were likewise at a disadvantage. Thus the association of raw material producing and manufacturing concerns in a single undertaking became increasingly common. Great combined undertakings arose, above all in the mining industry and in the electrical and other metal industries, which extended far into the finishing industries. The term "trust" made its appearance; but real trusts—the amalgamation of a whole industry into a single monopolistic undertaking—these were not. Such trusts only arose in a few specialised industries, thus in the Dynamite Trust in association with English undertakings, in the amalgamation of all German rice-mills in a holding company, and also in the accumulator industry.

With the increase in the number of joint-stock companies in many industries, the tendency to fusion and still more to the acquisition of participations in other industries was very active. In banking, the linking of provincial banks to the great Berlin banks had been going on for a long time. Participation and the formation of subsidiary companies was most extensive in the electro-technical industry and in large constructional undertakings. A substitute for cartels is provided in a smaller category of undertakings by the *Interessengemeinschaften.* These consist chiefly in a pooling of profits to secure an equalisation and distribution of risk; they are mostly formed for long periods, and practically exclude competition between those concerned. As a rule there is also an interchange of directors and members of control boards (*Aufsichtsräte*), and often participation by the acquisition of shares. After the crisis of 1900 the first important *Interessengemeinschaft* was the agreement concluded in 1902 for 20 years between the two largest German shipping companies and the International Mercantile Marine Co., which ended at the outbreak of the War.

The Chemical Industry.—Of still greater importance were the two great *Interessengemeinschaften* formed in 1904 in the chemical industry. The first, between the Höchster Farbwerke and the firm of Cassella & Co., took the form of an exchange of shares, the second, between the Badische Anilin und Soda Fabrik, the Elberfelder Farbenfabrike and the Berliner A.G. für Anilin Fabrikation, took the form of pooling profits in the proportion of 43: 43: 14. In 1916 these groups combined to make common cause against the fierce foreign competition expected after the War, and two other large factories also came into the combine.

Cartels after the War.—In the post-War period, with its economic insecurity and its colossal inflation, financial forms of organisation became more prominent, while the cartels lost for the time being in importance. With the shortage of goods and the apparent prosperity due to inflation, high prices could be obtained without cartels. These played a larger rôle in local industry and trade, where it was important to make prompt adjustments to the daily price increases. In large scale industries, however, certain traders and speculators took advantage of the opportunity of buying up whole groups of undertakings with cheap credits. There arose the great vertical combines (*Konzerne*), such as had already existed in the electrical and mining industries, whose scope was now greatly extended.

By the dissociation of the Lorraine and Luxembourg works many of the greatest undertakings had lost their economic basis and had to be completely reconstructed. Thus Hugo Stinnes created in the Siemens-Rhine-Elbe-Schückert Union a close *Interessengemeinschaft* of three great mining undertakings with the electro-technical Siemens-Schückert-Konzern. At the same time he built up a great private combine with a number of very distinct undertakings. Other mining combines also, such as the Phönix, Klöckner, Lothringen, etc., were further extended. In the potash, cotton and cement industries great vertical combines were also created. The penetration of wholesale trade, which had made very large profits during the War, into industry is worthy of note; often even very large undertakings suddenly came into the hands of a large trader or speculator. In many cases undertakings were thus grouped together which stood in no organic relation to one another and which were only kept united by the financial transactions of the founders. In 1926 about 75% of the German coal output, 75% of the coke output, and about 79% of the steel output was produced in the great vertical combines of the mining industry.

With the stabilisation of the mark in 1924 and the great scarcity of capital consequent on the destruction of all liquid capital, many of these artificial combines broke down with great losses for those concerned. On the other hand the shortage of capital and the unfavourable economic outlook demanded a great reduction of costs and the most efficient technical and commercial organisation. Thus many new amalgamations came into being, mostly in the more rational form of a complete fusion. These would have attained even greater importance but for the quite indefensible tax on fusions, although its burden was eventually reduced. The complete fusion of the seven chemical firms already mentioned as being associated in an *Interessengemeinschaft* is noteworthy. They were absorbed by the oldest and largest of them, the Badische Anilin und Soda Fabrik, which increased its capital for this purpose from 176,000,000 marks to 646,000,000 marks, and took the name of Interessengemeinschaft Farben-Industrie A.G. This group had already a monopoly position in many products, so that here we may speak of a real trust.

An equally great concentration of capital is found in the projected union of several of the greatest vertical combines of the Rhine-Westphalian iron and steel industry, namely, the Phöenix A.G., the Thyssen undertakings, the combine of the Gelsenkirchen and German-Luxembourg Mining Co., to which the Bochum Cast Steel Union also belongs, and of the Rheinische Stahlwerke. This gigantic combine, whose capital and type of fusion remained to be determined, had not a monopoly position; it maintained its participation in the various cartels of the coal and iron industry. The continuance of the union of the Gelsenkirchen with the Siemens-Schückert group was not certain.

In spite of these great amalgamations, the number of cartels has not become less; the desire of employers to restrict competition is further increased by the severe economic crisis. The saying that cartels are children of necessity holds good.

The Cartel Court.—For a long time a cartel Act was demanded in Germany. In July 1922, a Cartel Advisory Committee was formed, including members of the Reichstag, the Reichsrat and the Federal Economic Council. On Nov. 2 1923 the Govt.

issued an "order against the misuse of monopoly power." A cartel court was erected which can be set in motion by the Govt. as well as by the contracting parties. The chief provisions are as follows:—

Section 1. "Contracts and regulations which lay down obligations in regard to production and marketing, conditions of business, the nature of price fixing or price lists (syndicates, cartels, conventions and similar agreements) must be made in writing." Verbal contracts and the like are invalid.

Section 4 is the most important: "If a contract or regulation of the type described in Section 1. . . endangers the economic system as a whole or the well-being of the community, the Federal Minister of Economics can (1) appeal to the Cartel Court to declare the contract or regulation to be invalid . . . (2) decree that all parties to the contract or regulation can at any time cancel the contract or withdraw from the regulations, (3) demand the submission of copies of all agreements. The welfare of the community is to be regarded as endangered when production or marketing are restricted in an economically unjustified manner, when prices are raised or kept high, or when price increases are made to cover the risk of currency depreciation, or when economic freedom is inequitably restricted by embargoes on purchase or sale or by discriminating prices or conditions."

These provisions are only permissive, since power is merely given to the Federal Minister of Economics under certain circumstances to apply for a declaration rendering the contract null and void. Section 8 goes much further. It runs:—

"Contracts or regulations of the type described in Section 1 can be cancelled without notice where an important reason exists." An important reason is always to be held to exist if the economic freedom of the cancelling party is inequitably restricted in regard to production, marketing or the determination of prices.

Section 9 runs: "Guarantees may not be demanded, nor embargoes or similar prejudicial measures be imposed, in virtue of contracts and regulations of the type described in Section 1, without the consent of the chairman of the Cartel Court. Those concerned can appeal within a week of the decision to the Cartel Court."

Hitherto sections 8 and 9, which are directed against the so-called exclusive contracts (obligations to trade exclusively with members of the cartel, boycotts, embargoes on delivery and the like) have been mainly enforced. But in the summer of 1925 the Govt. resolved, in connection with its endeavours to bring about a fall in prices, to proceed more energetically against the cartels, and a number of them have been dissolved, while others have been compelled to alter their trading conditions.

Bibliography.—S. Tschierschky, *Zur Reform der Industriekartelle*, (Berlin, 1921); *Das Problem der Staatlichen Kartellaufsicht* (Mannheim, 1923); R. Liefmann, *Kartelle und Trusts und die Weiterbildung der volkswirtschaftlichen Organisation* (6th ed., Stuttgart 1924; also in French, Swedish, Dutch, Russian and Japanese translations); H. v. Beckerath, *Kräfte, Ziele, und Gestaltungen in der deutschen Industriewirtschaft* (2nd ed., Jena, 1924); Lehnich-Fischer, Hausmann, Holländer und Tschiersky-Isay, *Kommentare zur Kartellverordnung*. See also *Kartellrundschau*, Berlin, (1903 ff.); *Sammlung der Entscheidungen und Gutachten des Kartellgerichts herausgegeben von der Kartellstelle des Reichsverbandes der deutschen Industrie* (Berlin); also the *Berichte* (Reports) that are issued by the same institution. (R. Ln.)

CARTOON.—The word cartoon is now used so diversely that it is necessary to be more precise in definition in order to get an appreciation of the art of cartooning in the best sense. The highest order of cartoon is educational or propagandist, but unrecognisable as such. It is not a mere drawing of some episode, condition or situation of life, but conveys a message, by reason of the purpose, thought and spirit underlying the drawing, for which the situation as depicted is merely a cloak. Cartoons of this class, however, need not be only what are known as "political cartoons," which are obviously propagandist in structure. They can be so subtle in form as to convey propaganda and sway moods or opinions without the cause being detected. This is the highest form of cartoon and is an immense weapon in whatever direction it is used. Cartoons have a larger scope of appeal in a shorter space of time than equivalent education coming by a literary route. They can reach all classes and be either serious or jocular, provided the necessary hidden quality is present.

The technique of the drawing—though of course the better, the more pleasing—is of secondary importance. The psychological strength emanating from the cartoon is the most important feature. The best artists are not necessarily the best cartoonists. The usual political cartoon is of a positive nature. A situation, apt and symbolic in form, parodied by the artist, deliberately states a point of view; the cartoonist endeavours to educate observers thereby or to satisfy the ideals of observers whose judgment is already formed. Far deeper and more potent is the cartoon which by means of its own peculiar and subtle statement of life causes the observer to find unconsciously a point of view, this process being the education intended. It is easier to portray the wishes and policy of a party or a nation by cartoons than to express the culture and civilisation of a nation or an age in such a way as to help in the bringing about of a change—an achievement wrought by Hogarth, amongst others, who was quite possibly unaware of the education that a study of his piercing cartoons afford. There are some who can, by placing their personal outlook on paper, be great and unconscious cartoonists. They can achieve the highest form of the art of cartooning—the distribution of acceptable propaganda in arresting form. (*See* also Caricature.) (B.B.)

CARTRIDGE: *see* ammunition.

CARTWRIGHT, SIR RICHARD JOHN (1835–1912), Canadian statesman (*see* 5.435), died at Kingston, Ont., Sept. 24 1912.

CARUSO, ENRICO (1873–1921), Italian singer, was born in Naples Feb. 25 1873. He was early apprenticed to a mechanical engineer. He began to sing in the choirs at Naples when he was eleven years old and later studied under Guglielmo Vergine. He made his début in 1894 in *L'Amico Francesco* at the Teatro Nuovo, Naples, and first won marked success as Marcello in *La Bohème*, at Milan, in 1898. From 1899 to 1903 he was at St. Petersburg (Leningrad) in the winter, and in the summer at Buenos Aires. He appeared also in many cities, including Moscow, Warsaw, Rome, Paris and London (Covent Garden, 1902). In America he first appeared in 1903 at the Metropolitan Opera House, New York, where for 18 years he was the leading tenor. Caruso had a very extensive Italian and French repertory, but never appeared in Wagner's operas. He won special success in *Aïda*, *Carmen*, *Huguenots*, *L'Elisir d'Amore*, *Pagliacci*, *Rigoletto* and *Samson and Delilah*. He died Aug. 2 1921 at Naples.

CARY, ANNIE LOUISE (1842–1921), American singer (*see* 5.438), died April 3 1921 at Norwalk, Connecticut.

CASABLANCA, Morocco (*see* 5.440), had a population in 1921 of 101,790, including 48,890 Moslems, 15,136 Jews, 21,579 French, 16,185 other Europeans. The two chief thoroughfares in the city are the Boulevard de la Gare, from the Place de France to the station and industrial quarter near the port, and the Grand Traverse running east and west. A new native quarter lies southeast of the city, near the Sultan's palace. Health conditions have been improved, and extensions of the water supply undertaken. Large electric power works, to be utilised for the railways in the flatter parts of the country, were finished in 1924. There are railways to the phosphate fields of El Boruj district (near which a valuable iron-field has been found), to Fez and Rabat, and to Marrakesh (171 m.). Metalled roads link Casablanca with the principal centres. A daily air-service connects Casablanca and Toulouse, and a bi-weekly service, Casablanca and Oran. An outer harbour, consisting of a jetty 2,050 metres long, with a transverse pier of 1,600 metres, was completed in 1925. Further extensions of the harbour works were taken in hand in 1925. A superphosphates factory has been built outside the town. Other industrial establishments include brick, cement, lime, biscuit and printing works and foundries.

CASEIN.—An albumin occurring in milk, as a lime salt in a very finely divided state, giving the milk an opaque appearance. It is manufactured from cow's milk, which contains about 3% of casein.

Pure casein is a white, amorphous substance without taste or smell. It is a weak acid, readily soluble in solutions of caustic alkalis and of the carbonates, borates and other salts of the alkali metals. Water dissolves casein only to a very small extent, but causes it to swell. Casein is converted by the action of formaldehyde, or formalin, into a hard material quite insoluble in water. This result, of great importance in connection with the use of casein in the arts, was first obtained by *Chemische Fabrik auf Aktien* (formerly E. Schering) of Berlin and is described in British Specification No. 23,585 of 1894. Casein is non-inflammable. Its specific gravity is about 1·25. Commercial casein of good quality is a dry, friable, white, or slightly brown powder; casein of inferior quality has an unpleasant smell and is usually moist and dark coloured.

Processes of Manufacture.—Three of the commercial processes for making casein depend mainly on the precipitation of the casein from previously heated skim or separated milk by means of an acid. These processes are: (1) the rennet process; (2) the process in which an acid, *e.g.*, dilute sulphuric or hydrochloric acid, is added to the milk; and (3) the self-curdling process, in which the milk is allowed to rest until it is curdled by the action of lactic acid formed from the lactose or milk-sugar of the milk by the activities of a bacillus (*B. acidi lactici*). In the United States, the substance precipitated by the action of rennet is commonly called paracasein, the term casein being reserved for that precipitated by acids. Two other processes of exceptional interest have been used in France. In one of them the milk is run into a closed vessel provided with agitators and is subjected to the action of great pressure; the precipitation of the curd may be hastened by introducing carbonic acid gas. The second process is electrolytic and has been carried on at the casein factory of Aigrefeuille, Charente Inférieure. The details of the process are secret, but it is said that a very high quality casein is obtained. In all these processes, the precipitated curd is separated from the whey, washed with cold water, passed through a press or a centrifugal separator, broken up, and dried by currents of dry air or other means. The dry casein is ground and packed for sale.

Uses of Casein.—In many countries casein is produced on a commercial scale and a large amount is used in the making of confectionery and special foods of which Sanatogen, Lactorin and Plasmon are examples. Casein preparations are also used as media for administering quinine, lithium salts, iodides and other drugs and medicines. Casein preparations are used for printing on calico, sizing yarns and sizing waterproofing, and coating in the paper industry. Formalin-hardened casein has been employed in making photographic films, and it has been proposed to make from such casein fibres to be spun like artificial silk. Casein is used largely in the production of cold water paints and distempers, of cements for porcelain and glass, and of glues for use in bookbinding, wood-working and aircraft construction.

The production of casein plastics intended to imitate ivory, tortoiseshell, amber, horn, ebony, agate, malachite, celluloid and other substances is important. The casein is made plastic by being thoroughly mixed with colouring and filling materials, according to the nature of the substance to be imitated, and moulded into blocks or other forms which are hardened by exposure to the air or by means of formalin. Casein plastics can be turned, carved, or otherwise worked. They are good electrical insulators, hard and insoluble in water, but can be softened to some extent in hot water.

See Robert Scherer, *Casein, its Preparation and Technical Utilisation* (1921) and E. L. Tague, "Casein," in A. Rogers' *Handbook of Industrial Chemistry* (4th ed., 1925). (T. E. L.)

CASEMENT, ROGER DAVID (1864–1916), British consular agent, was born near Dublin Sept. 1 1864. After serving in the Niger Coast Protectorate he entered the British consular service. In 1910 the British Govt. commissioned Casement to investigate certain charges brought against the Anglo-Peruvian Amazon Co., and for the adequate performance of this service he was knighted (1911). From about 1912 Casement seemed to develop an intense hatred of England. On the outbreak of the World War he went to the United States and thence, in Nov. 1914 to Berlin. During 1915 he published various anti-British pamphlets, and attempted to form a brigade, for service against England, of Irish soldiers who were prisoners of war. He planned to aid a rising in Ireland for Easter week, 1916, and on April 12 sailed for Ireland in a German submarine, which was accompanied by a vessel laden with arms and ammunition. The latter was captured by a patrol boat. Casement landed in a collapsible boat, but was captured on April 24 and brought to London. Tried for treason before the Lord Chief Justice, he was convicted and sentenced to death on June 29, being deprived of his knighthood on the following day. His appeal against conviction was dismissed on July 18, and on Aug. 3 he was executed at Pentonville, London.

CASSATT, MARY (1855–1926), American artist, was born at Pittsburgh, Pennsylvania, a sister of A. J. Cassatt, president of the Pennsylvania Railroad. In 1875 she went to Europe to study art, spending some time in Spain, afterwards proceeding to Paris, where she was greatly influenced by Manet, Renoir, Degas and the Impressionist school. Her first exhibition of paintings in Paris was in 1893 at the gallery of M. Durand-Ruel, where in later years her works were frequently exhibited. She also contributed to the various exhibitions of the Impressionist school, but never to the salons. Her work was warmly appreciated in French artistic circles. Mothers and babies or children were to her the chief subjects of inspiration, and her pictures are distinguished by great firmness in drawing and boldness of tone and colour. As a pastellist she attained high rank. Exhibitions of her works have been held in New York and Pittsburgh, and she is represented in the public art galleries of the United States and in private collections. She died in June 1926.

See Achille Legard, *Un Peintre des Enfants et les Mères: Mary Cassatt*, illustrated (Paris, 1913).

CASSEL, SIR ERNEST JOSEPH (1852–1921), Anglo-German financier, was born at Cologne March 3 1852, the son of a small banker in that city, and at the age of 16 became a clerk in the banking firm of Elspacher. In 1870 he went to London and entered the foreign banking house of Bischoffscheim and Goldsmid. There he attracted notice by his skillful disentanglement of the accounts of the Khedival loans. In 1884 he set up for himself and became interested in South-American finance. He reorganised the finances of Uruguay, and issued three Mexican loans, as well as acquiring the Royal Swedish railway and financing enterprises such as Vickers' absorption of the Maxim-Nordenfelt Co. and the building of the Central London railway. He also raised a Chinese loan after the war with Japan. His principal achievement was, however, the financing of the Nile irrigation work, and in connection with that the founding of the National Bank of Egypt. During the War, though he had long been a naturalised British subject, an unsuccessful attempt was made to have his name removed from the Privy Council. Sir Ernest retired in 1910 and died in London Sept. 21 1921. His daughter married Mr. W. W. Ashley, M.P., Minister of Transport, and their daughter, who inherited much of her grandfather's great wealth, married Lord Louis Mountbatten.

CASSEL, GUSTAV (1866–), Swedish economist, was born at Stockholm Oct. 20 1866. He began his career as a mathematician but became in 1904 professor of economics in the *Högskola* at Stockholm. He was consulted by the Govt. as an expert on taxation and budget matters and his memorandum on "The World's Monetary Problem" at the Brussels Conference in 1920 attracted great attention. In another memorandum to the League of Nations Finance Committee in Sept. 1921 (printed together with the first under the title of *The World's Monetary Problems. Two Memoranda*, 1921), he discussed the questions connected with the financial crisis of 1920. Cassel was attached to the Swedish delegation as a financial expert at the 1922 Genoa Conference and was a delegate at the meeting of International Chambers of Commerce in London in 1921 and 1922.

Among Cassel's published works are *The Nature and Necessity of Interest* (1903); *Theoretische Sozialökonomie* (1918); *Money and Foreign Exchanges After 1914* (1922); *Weltwirthschaft und Geldverkehr unter besonderer Berücksichtigung des Valutaproblems* (1920); *Fundamental Thoughts on Economics* (1925). He also wrote articles in *The Economic Journal* (London). (*See* EXCHANGES FOREIGN).

CASTELLORIZO, the ancient Megiste, an island of the Dodecanese. It was included by the Turks in the privileged group known as "the Dodecanese" (*q.v.*), but did not form part of the Italian "Dodecanese," occupied during the Libyan War of 1912. The outbreak of hostilities against Turkey during the World War gave the Italians an opportunity of adding Castellorizo to their Dodecanesian possessions, after the French had occupied it on Dec. 27 1915, and articles 122 of the Treaty of Sèvres in 1920 and 15 of the second Treaty of Lausanne in 1923 provided that "Turkey renounces in favour of Italy all rights and title . . . over the island of Gastellorizo." Thenceforth the chief Italian authority in the Southern Sporades styled himself first "governor of Rhodes and Castellorizo" and then "Governor-general of the Dodecanese and Castellorizo." Disputes arose with the Turks over the ownership of some islets between the island and the coast, used by the islanders for purposes of fishing. Castellorizo has a small harbour but no exports, and the inhabitants engage in the sponge-fishery. Its liability to a sudden attack from the adjacent coast (actually said to have once occurred since the Italian occupation) may be set off against its utility as a base for the Italian penetration of the mainland. Its population is entirely Greek, and the Neapolitan domination (1450–1522) is the only precedent for its present ownership.

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CASTELNAU, EDOUARD DE CURIERES DE (1851–), French soldier, was born at Saint-Affrique, Aveyron, Dec. 24 1851, third son of the Marquis de Curières de Castelnau. He entered the military school of St. Cyr, near Versailles, in 1869; and during the Franco-German war took part in the Loire campaign. Captain in 1876 and commandant in 1889, he was appointed by General de Miribel in 1893 to a post in the chief department of the general staff; later as head of the department he built up the vast system of French mobilisation. In 1910 he became general of division, and in June 1911 assistant to the chief of the general staff. On the outbreak of war he commanded the II. Army in Lorraine. After the French offensive was driven back at Morhange in Aug. 1914, General Castelnau in turn successfully repulsed the Germans at the Trouée de Charmes and the heights of the Grand Couronné. On Sept. 18 the II. Army was moved to the west between the Somme and the Oise in the abortive attempt to outflank the German armies—known as the "race to the sea."

On June 13 1915 General Castelnau took command of the group of four armies which constituted the French centre, and directed the Sept. offensive in Champagne. In the following Dec. he became chief of the general staff under General Joffre. He was next sent to Salonika on a tour of inspection, returning by way of Athens and Rome. Three days after the opening of the German attack at Verdun on Feb. 21 1916 Castelnau was sent there on an emergency mission, with full powers, and appreciating the danger gave orders that the right bank of the Meuse should be held at all cost; he returned to Chantilly only when the position was secure. On the appointment of Nivelle in place of Joffre, Castelnau was sent on a mission to Leningrad in Jan. 1917. On his return he was given the command of the group of armies in the east with a view to directing the large-scale operations which were anticipated in Nov. 1918, and which the Armistice happily forestalled. After the War General Castelnau entered the Chamber as deputy for Averyron; he acted as president of the army committee, and allied himself to the group known as the *Entente démocratique et sociale*. See Victor Giraud, *Castelnau* (1921).

CATALYSTS (*see* CATALYSIS, 5.501).—The term catalytic agent (Gr. to break up) was introduced by Berzelius (Jahresbericht, Tübingen, 15,1836) to include those substances which by their presence accelerate the rate of reactions proceeding with a decrease in free energy towards equilibrium without undergoing any change in themselves. In reversible systems catalysts thus necessarily accelerate the rates both of the forward and reverse reactions.

Many cases of supposed alteration in the conditions of equilibrium for the catalysed and noncatalysed reaction have been noted, but closer examination has shown in many cases, either that true equilibrium was not attained or that the catalyst was added in quantity sufficient to affect the active mass of one or more of the reactants. Although taking part in the reaction a catalyst, being constantly reformed, should be able to effect the conversion of an unlimited amount of reactant. In practice, this is not realised, as loss of the active catalyst occurs. This loss may occur (*a*) through side reactions, unconnected with the main reaction, as in the gradual reduction of sulphuric acid in etherification processes; (*b*) through the formation of inactive compounds with impurities present in the reactants, as in the formation of nickel sulphide from sulphur compounds present as impurity in hydrogen employed in hydrogenation processes; (*c*) through removal from the reacting system, either by vaporisation as in the case of platinum catalysis for the formation of sulphur trioxide, or by coagulation as occurs in colloidal metal catalysts employed for hydrogenation; (*d*) through sintering and fusion due to overheating of the active surfaces.

Causes of Acceleration.—Acceleration of reaction rates by catalysts is due to the opening of a fresh avenue for molecular reaction in which the catalyst plays a part. If two substances A and B react and form a product C a reaction accelerated by a catalyst X two simultaneous reactions take place

$$(1)\ A+B\rightarrow C,\quad (2)\ A+B+X\rightarrow C+X$$

Catalytically accelerated reactions may be homogeneous or heterogeneous in character, the former taking place in gases and liquids, the latter at interfaces more especially at gas solid and liquid solid interfaces. In all cases it is now generally assumed that reaction proceeds through the formation of temporary complexes; thus the above reactions can be expressed as a sequence of changes

$$(1)\ A+B\rightarrow(AB)\rightarrow C,\quad (2)\ A+B+X\rightarrow(ABX)\rightarrow CX\rightarrow C+X.$$

Whilst in many cases unstable intermediary complexes of the type AB, *e.g.*, benzoyl peroxide, ester-acid compounds can be isolated at low temperatures, the ternary complex reactants-catalyst ABX is usually present in subanalytical quantities and its existence frequently postulated from identification of the more stable binary compounds AX, BX, AB. All binary collisions between reacting molecules are not effective in producing combination, a large fraction generally undergoing collision and elastic reflection. Two types of such reactions may be readily identified. In the union between gaseous atoms such as the reaction $2H\rightarrow H_2$ before the hydrogen molecule can exist as a stable system, the energy liberated during combination has to be dissipated. In some cases such energy is liberated as radiation but frequently a third atom strikes the system within the life period of the unstable molecule, ca. 10^{-7} seconds, and effects the removal of the energy thus catalytically accelerating the union of the atoms. In this way surfaces catalyse the union of hydrogen atoms and sodium vapour the union of sodium and iodine atoms.

Effect of Temperature.—More frequent are those reactions which are markedly temperature sensitive, the reaction velocity increasing exponentially with elevation of the temperature. Sv. Arrhenius (*Zeit. Physikal. Chem.*, July 1889) inferred that there existed in the reacting system, active or excited, and inactive or normal molecules in mass equilibrium with each other.

$$A\rightleftarrows A^1$$
$$B\rightleftarrows B^1$$

Only excited molecules underwent reaction on collision, their number increasing exponentially with the temperature. In simple cases the energy required for excitation or the critical energy increment E may be calculated from the velocity temperature coefficient with the aid of the equation $\frac{dby}{dt}K=\frac{E}{RT^2}$.

Trautz in 1906 and, independently, Perrin and McLewis in 1913 advanced arguments in favour of the view that the energy of activation required for the conversion of normal into excited molecules was supplied by radiation flowing into the reacting system. In a number of cases this hypothesis is not necessary, for if it be assumed that there are no active molecules in the system but only those molecules react which impinge on one another with such initial speeds that the available kinetic energy exceeds the critical energy increment, the agreement between the observed and calculated rates of reaction is excellent. Confirmation is seen in the decomposition rates of Cl_2O, N_2O and HI (C. N. Hinshelwood, *Jour. Chem. Soc.*, vol. 123, 1923; *Proc. Roy. Soc.*, vol. 106, series A, 1924; and M. Bodenstein, *Zeit. Physikal. Chem.*, vol. 110, 1924).

Gas Reactions.—These bimolecular gas reactions are catalysed by hot metal surfaces and the reactions there appear unimolecular in respect to the gas. Catalytic acceleration is thus produced by converting a bimolecular reaction, with a large critical energy increment, necessary for two molecules, and thus a small velocity at low temperatures, into what is virtually a series of reactions, each with a lower critical energy increment and a greater velocity, although the critical energy increment per molecule may be very similar in the two cases.

Whilst homogeneous gas reactions are more simple in character than reactions in liquids, or at interfaces, very few cases of true catalytic action in such systems are known. In addition to the cases of atom combination referred to above, two other reactions appear to be chiefly, if not completely, homogeneous in character. The decomposition rate of ozone is accelerated by gases such as helium, nitrogen and oxygen (Griffith and McKeown), whilst the numerous experiments of Dixon and Baker on the influence of traces of moisture on chemical actions lead to the conclusion that some of these reactions are undoubtedly homogeneous catalytic gas reactions, although surface phenomena on the walls of the containing vessel are frequently of predominating importance. To explain such reactions on the hypothesis of activation by collision it is necessary to assume that a molecular complex, *e.g.*, Br_2H_2O is more readily activated on collision than a simple molecule Br_2. Evidence from a study of absorption spectra of wet and dry vapours and liquids is beginning to support the view that the energy of excitation for such complexes formed with polar molecules is less than that necessary for simple molecules.

Liquids.—In liquids, cases of catalytic acceleration of reactions are common, the classical examples being the catalytic activity of hydrogen and hydroxyl ions on hydrolytic changes. Other ions exert marked specific effects in many cases, such as the iodide in the decomposition of hydrogen peroxide, the chloride ion in the decomposition of chloramine, organic anions in the decomposition of nitramide and the ions of polyvalent elements such as cerium, vanadium and chromium in oxidation processes. In the cases of hydrogen ion catalysis in the hydrolysis of an ester, the reaction velocity in dilute solutions may be considered as proportional to the concentrations of the three reactants or

$$\frac{dx}{dt}=KC_HC_{ester}(C_{H_2O}).$$

When more concentrated solutions are employed, or neutral salts are added to the solution, the reaction velocity rises more rapidly than would be anticipated from a consideration of the above equation. For other reasons we have cause to believe that electrostriction occurs in solutions and the reactants are solvated thus removing free water from the system, consequently the "thermodynamic concentration" or "activity" is actually greater than the apparent concentration.

If the reaction velocity be assumed proportional to the concentration of the complex ABX, or $\frac{dx}{dt}=R(ABX)$ we obtain, according to the law of mass action

$$K=\frac{(A)\,(B)\,(X)}{(ABX)}\cdot\frac{fA\,fB\,fX}{f(ABX)}$$

where $fA\,fB\,fX$ are the activity coefficients of the reactants and K the mass action equilibrium constant. Hence we obtain

$$\frac{dx}{dt}=\frac{R}{K}\cdot\frac{(A)\,(B)\,(X)}{f(ABX)}f(A)\,f(B)\,f(X).$$

The dependence of the reaction velocity on the activities of the reactants and catalytic agent has been demonstrated in the inversion of sucrose, the decomposition of acetylchloramino benzene and the decomposition of hydrogen peroxide in the presence of hydrobromic acid. The energies of activation of catalysed reactions in aqueous media lie between 26,000 and 10,000 calories per given molecule, values sufficiently low to permit of relatively rapid reaction at ordinary temperatures. If no catalyst be present the energies of activation for the binary complexes (A B) are proportionately higher; thus if the ester water hydrolysis in the absence of a catalytic agent required an energy of activation of some 60,000 calories, reaction would only occur at a perceptible rate at temperatures in the neighbourhood of 700° C. The velocity of catalysed reactions in homogeneous solutions depends on the magnitudes both of the energy of activation and of the equilibrium constant for the system reactants complex: thus it does not necessarily follow that a reaction with a low energy of activation will proceed at a great speed. The following data from H. E. Cox, *Jour. Chem. Soc.*, vol. 119 (1921), on the rate of addition of aniline to bromacetophenine in various solvents may be cited in this connection.

Solvent	Energy of activation	Velocity constant
Benzene	8,088	·000985
Chloroform	10,700	·00186
Methyl alcohol	12,440	·0748
Ethyl alcohol	13,910	·0626

Technical Applications.—The most important technical applications of catalytic methods are to be found in heterogeneous systems where reactions between gases such as nitrogen and hydrogen to form ammonia (*see* AMMONIA) at the surface of iron, carbon monoxide and hydrogen to form methyl alcohol and the higher alcohols at the surface of zinc oxide and sulphur dioxide and oxygen to form sulphuric anhydride at the surface of platinum have been developed industrially on a large scale. Other large industries falling under this category include the hydrogenation of oils and fats, the oxidation of ammonia to nitric acid and the manufacture of acetic acid.

Heterogeneous gas reactions operate through the formation of adsorption complexes between catalyst and reactants and thus the catalytic layer at the surface of a catalytic solid is but one molecule thick. At high temperatures a reaction zone is formed on the solid surface which may be relatively thick. It is probable however that in these cases the catalyst serves to start a series of reaction chains which spreads out into the surrounding gas, at the same time thermionic emission of electrons from the hot surface occurs and it would appear that these in turn serve as exciting agents.

Adsorption.—At surfaces both the reactants are generally adsorbed and the reaction velocity attains a maximum when the partial pressures of the reacting gases or the concentration of reactants in solution are so adjusted as to preserve an optimum surface concentration. Such maxima have been experimentally observed in the following systems: sulphur dioxide, oxygen on the surface of platinum; ethylene, hydrogen on a nickel surface; oxalic acid, oxygen on a carbon surface. Such surface reactions proceed generally at a rate which is slow compared with gaseous diffusion but in liquid systems we frequently find a limitation of the speed of reaction imposed by the slowness of diffusion. A catalytic metal is not uniformly active over the whole of its surface, but the surfaces of the microcrystals, the edges, corners and the amorphous portions of distended crystal lattices all possess different surface energies. The fraction of the area which is capable of functioning as a catalyst is frequently minute. A good nickel catalyst has a surface efficiency of the order of 1:1000. The existence of patches of varying activity on a catalyst surface, has been demonstrated not only from consideration of surface energies and adsorption of various gases but also from the effect of substances which are strongly adsorbed, *i.e.*, poisons on the catalytic activity. It is, as shown by the experiments of Vavin and Husson, possible to poison a catalyst progressively, eliminating in stages the catalytic power of the surface for various reactions. The molecules adsorbed on the surface are attached by particular groups and may be considered as forming definite surface compounds similar in properties to co-ordinated compounds, although a distinction must be drawn between the properties of such substances as CuO or Ni $(CO)_4$ and oxygen or carbon monoxide adsorbed on copper and nickel respectively. By kinetic transfer of energy and also, in certain cases, by absorption of radiation these surface compounds may be excited or brought to a reactive level, thus on the adsorption of hydrogen by nickel it is found that hydrogen atoms, formed on the surface by excitation of the adsorbed molecules, may be recovered by evacuation at low pressures.

Promoters.—The activity of a catalytic surface may be modified by promotion, *i.e.*, the addition of small traces of other substances termed promoters. Thus palladium will promote copper, ceria iron oxide, molybdenum iron and iron will promote carbon. Three distinct effects may be produced by the addition of a promoter: the total catalysed area may be increased by dispersion, the fraction catalytically active may be increased, or again specific atoms or atom groups may be augmented in activity by the juxtaposition of the foreign material. This latter appears to be similar to, if not identical with, the instability of molecules at phase boundaries first noted by Faraday in the case of the efflorescence of hydrated salts. Promoters are now extensively employed in industrial catalytic processes: thus zinc oxide is promoted with chromium oxide in the synthesis of alcohols from water gas, iron is promoted with alkali in the synthesis of ammonia from nitrogen and hydrogen, two typical high-pressure reactions.

Specific Action.—Inorganic catalysts are far less specific in character than the ferments and enzymes; nevertheless certain reactions present interesting peculiarities indicating a specific action. In homogeneous reactions Abel noted that the following oxidations by hydrogen peroxide catalytically accelerated by iodine ions and sodium molybdate were almost specific

$$2S_2O_3'' + H_2O_2 \xrightarrow{I'} S_4O_6'' + 2OH'$$

$$S_2O_3'' + 4H_2O_2 \xrightarrow{Na_2MoO_4} 2SO_4'' + 2H + 3H_2O.$$

In heterogeneous reactions we find that the alcohols can undergo catalytic decomposition in two ways, *e.g.*,

$$C_2H_5O_4 \begin{array}{l} \nearrow C_2H_4 + H_2O \\ \searrow CH_3CHO + H_2 \end{array}$$

The dehydrogenating reaction is more marked on metals; the dehydrating reaction on metallic oxides. It is as yet uncertain whether the difference is due to differences in structure of the adsorption compounds formed or whether the same adsorption compound can undergo different modes of decomposition when raised to different energy levels. The energies of activation of the adsorption products are, as determined from the temperature coefficients of the two reactions, at least very different.

Efficiency.—Catalyst efficiencies are usually compared by observation of the space time yields (S.T.Y.) in which the yields per litre of catalyst space per hour is determined. Since in general the systems are strictly reversible, complete conversion of reactants into products is not obtained when the conditions of equilibrium are attained. It follows that for slow velocities of gas flow, equilibrium is attained and the S.T.Y. increases in a linear manner with the gas velocity. Above a certain critical velocity equilibrium conditions are not obtained, but the S.T.Y. still increases, although less rapidly, with the gas velocity. Finally the S.T.Y. succeeds in attaining a maximum value.

For industrial gas reactions it is necessary to prepare the catalyst in a form which will withstand considerable loads without crushing and present a minimum resistance to gas flow without undue diminution in catalytic efficiency, inert support materials or binders being frequently incorporated to achieve this end. Limits to attainment of the maximum S.T.Y. of a catalyst may be set by the excessive cost of pumping gases or fluids at high speeds or by the difficulties associated with the maintenance of uniform temperatures in the case of strongly exothermic reactions.

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(E. K. R.)

CATHER, WILLA SIBERT (1876–), American author, was born at Winchester, Va., Dec. 7 1876. After graduating at the University of Nebraska in 1895, she took up newspaper work, contributing also to magazines. From 1906 to 1912 she was associate editor of *McClure's Magazine.* Her novel, *One of Ours*, was awarded the Pulitzer Prize in 1923, and her delicate and individual work was warmly welcomed by English critics as well as by those of her own country. Among her other novels are *O Pioneers!* (1913), *My Antonia* (1918), *A Lost Lady* (1923) and *The Professor's House* (1925). In 1917 she became Litt.D. of Nebraska University.

CATT, CARRIE CHAPMAN (1859–), American suffragist leader, was born at Ripon, Wis., Jan. 9 1859. She was educated at the State College of Iowa and took a special course in law, subsequently becoming high school and general superintendent of schools at Mason City, Iowa. She devoted her subsequent career to the cause of woman suffrage, in furtherance of which she lectured throughout the United States and in Europe. She held the office of president of the National American Woman Suffrage Assn. from 1900 to 1904 and from 1915 until the close of the campaign which resulted in the passing of the woman-suffrage amendment to the United States Constitution. She organised and was president of the International Woman Suffrage Alliance from 1904 to 1923.

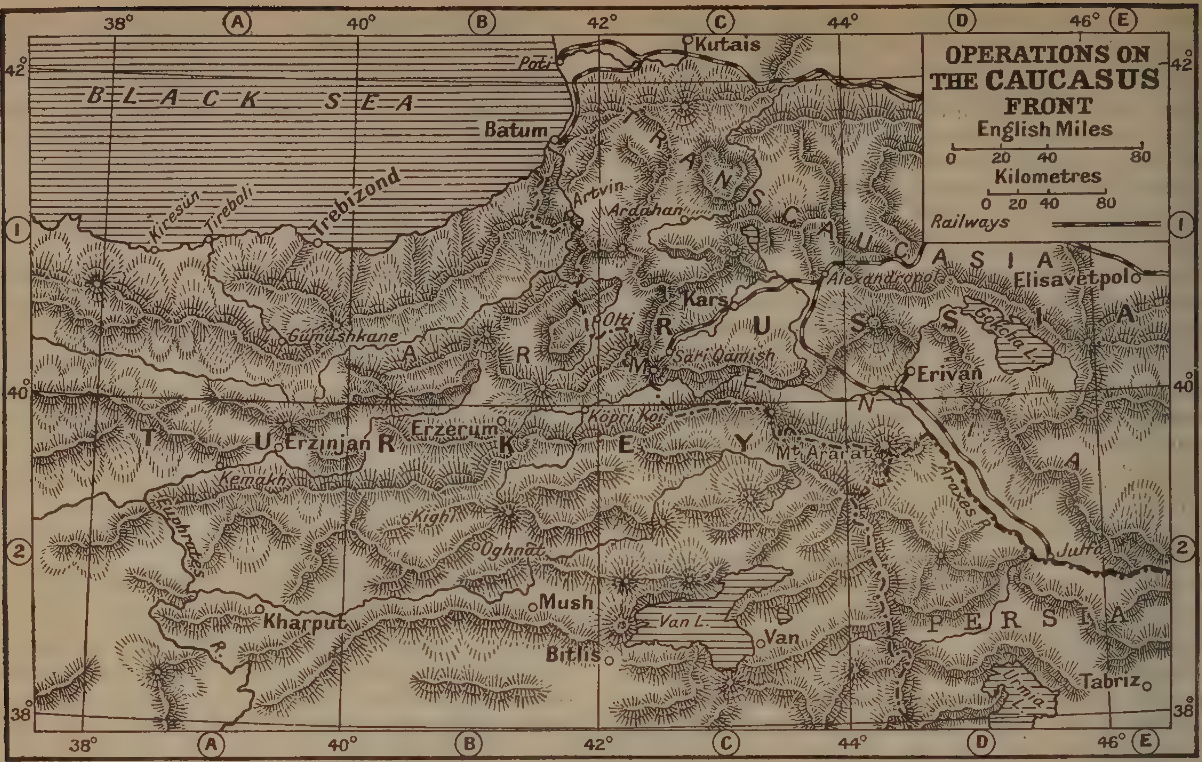
CAUCASUS, CAMPAIGN IN THE.—Though both Russian and Turk spoke of a "Caucasus front" and gave to their armies engaged on this front the designation "Caucasian," the operations actually took place at a considerable distance from the Caucasus.

The Terrain Described.—The main theatre of these operations may be defined as lying within the following limits: on the east, Batum (on the Black Sea)-Kars-Mount Ararat; on the south, Lake Van-Mush-Kharput; on the west, Kemath-Erzinján-Kiresün; and on the north, the south coast of the Black Sea. The whole of this region is covered by the historical term Armenia—not merely the present republic of that name, but, in the wider sense of the term, the country which was inhabited in 1914 largely by the ill-starred Armenian nation. Outside this main theatre of operations, a somewhat desultory warfare was carried on by detachments from the main forces up and down the western parts of Persia. Though some of the valleys are fertile, the area as a whole is bleak, sparsely populated and almost undeveloped.

The poverty of the communications and the severity of the climate render military operations on a large scale difficult and arduous. In 1914, on the Russian side, railway communication ended at Sari Qamish, some 40 m. southwest of Kars and 15 from the frontier; on the Turkish side, 600 m. of indifferent roads and tracks separated their armies operating in the Erzerum area from the nearest railhead at Angora or Ulu Qishla, on the Baghdad railway northwest of Adana. Thus the advantage in land communications lay, at the outset, very decidedly with the Russians, who had also, except for a short period after the outbreak of War, command of the Black Sea. On neither side, however, could the communications be considered in any way adequate for operations on the grand scale.

Few commanders would welcome a campaign in such extreme conditions of climate and difficulties of movement and supply. Neither army was up-to-date in its technical organisation. The higher leading and staff work in both armies was rough and ready rather than scientific, though there were a number of German staff officers with the Turk and many highly educated and intelligent men in the Russian General Staff. Given the characteristics of the two armies and the restrictions to manoeuvre which the terrain imposed, it was sufficiently obvious that the campaigns were likely to be marked by hard, straightforward fighting rather than any striking display of military art. Only the hardiest of soldiers could have come to grips with each other at all in that waste of snow-clad hills, in the depths of winter when the campaign opened. It was at the end of October 1914, that Turkey definitely entered the World War on the side of the Central Powers, and opened hostilities by naval-bombardment of Russian ports in the Black Sea.

The strategy of the Central Powers would have naturally



dictated as the most useful contribution of her new ally to the common effort a diversion likely to withdraw most Russian troops from the hard-pressed Austrians; and Liman von Sanders, the chief of the German Military Mission in Turkey, is known to have proposed a scheme for the landing of a Turkish force at Odessa with this object. But this scheme, even apart from doubts whether command of the Black Sea could be effectively secured, was, perhaps not unnaturally, viewed with disfavour by the Turks, who preferred the hope of reconquest of some of the territory, notably the fortress of Kars, lost to Russia in previous wars. The III. Turkish Army had been assembling during Sept. and Oct. in the neighbourhood of Erzerum. It consisted of the IX. and XI. Corps, the 2nd Cav. Div. and some mounted irregulars. During Nov. the X. Corps was added, bringing the fighting strength of the army up to approximately 100,000 men. All three corps were composed mainly of Anatolians, the best fighting material in Turkey.

The Turkish Plan of Campaign.—The plan evolved by Enver, whose megalomaniac mind seems to have dreamed of campaigns rivalling those of Alexander and extending even up to India, was a wide enveloping movement with Kars as the objective. The XI. Corps was to attack frontally toward the Russian railhead at Sari Qamish, while the IX. and X. Corps moved north from Erzerum, swept by difficult hill passes through Olti, on toward Kars and Sari Qamish. Still further north, a detachment which had landed at Trebizond was to advance on Ardahan. This grandiose plan wholly ignored the absence of communications and the climatic conditions. The Russian attitude was, at the outset, purely defensive; their main preoccupation was on their Western Front, which had absorbed nearly all the available forces; two of the three regular corps, stationed in the Caucasus in peace, had been sent on mobilisation to defend the Western Front against Austria and Germany. Only two complete corps, the I. Caucasian and II. Turkestan, were at first available for the defence of the Caucasus. Yet the Russians made the first advance, moving a force across the frontier to Köpri Köi on the road to Erzerum. This advance was made to secure room for manoeuvre in front of the important base at Sari Qamish. The Turks promptly attacked, and some fierce fighting took place between Nov. 8 and 20, which ended in the withdrawal of the Turks.

Enver now arrived from Constantinople and assumed personal command of the III. Army. He insisted, against the views of his German advisers, on putting into execution the ambitious plan he had conceived. The routes by which the turning movement was made were mere mountain tracks deep in snow; the greater part of the artillery and transport had to be left behind, and the attempt seemed madness. Yet such fortitude and endurance did the poorly equipped and ill-fed Turkish troops display that they almost achieved the impossible. While the main Russian body was engaged with the XI. Corps, the IX. Corps appeared, in the last days of Dec., on the heights above Sari Qamish, and the X. Corps on its left approached the railway between Kars and Sari Qamish; the detachment from Trebizond had already driven the Russians out of Ardahan.

The Russian commander's nerve failed him at the crisis; and the situation was saved only by his chief of the staff, Gen. Yudenich, a man of considerable ability and imperturbable resolution. He collected forces for a counter attack, which resulted in the complete defeat and practical annihilation of the two Turkish turning corps, worn out and disorganised by their formidable approach march; the XI. Corps was then in its turn driven back. The total losses of the Turkish III. Army are said to have approximated to 85%. Enver at once handed over the command to Hawis Hakki Pasha and returned to Constantinople. Hawis Hakki died shortly after, and the command was given to Mahmoud Kiamil. The alarm caused in Russia by the Turkish incursion was such that an appeal was made to Great Britain for a diversion against the Turks. This led to the first suggestion for the Gallipoli expedition.

During the whole of 1915 the fighting on the Caucasus front was of minor importance only. The main preoccupation of the Russians lay on their Western Front, of the Turks in Gallipoli. The shattered III. Army was gradually reconstituted, and the Russians raised fresh units to increase their strength. But neither side was yet in shape for a serious offensive. The detachment of Turks which had in the previous winter advanced to Ardahan and then been driven back to Artvin attempted in April a *coup de main* against Batum, but without success. On the other flank the Russians advanced their left wing into Armenia during May and June, occupied Van and threatened Bitlis. The Armenian rising which assisted the Russians led to bloody reprisals on their compatriots still in Turkish power. In Sept. 1915 the Grand Duke Nicholas took over command of the Caucasus front, an event which was to produce a marked enlargement of the Russian effort in this theatre. Grand Dukes in Imperial Russia could still obtain reinforcements in men and material denied to ordinary commanders. Nor did the character of the Grand Duke make it likely that he would adopt a passive rôle. Though not a great strategist, he was shrewd and energetic, and, as he had already shown while in command on the Western Front, a most loyal and unselfish supporter of the Allied cause. He found an able executive commander in Gen. Yudenich, already mentioned.

The Taking of Erzerum.—Once again an offensive on a large scale was made in the depth of winter. The Grand Duke wished to anticipate the arrival of Turkish reinforcements released by the British evacuation of Gallipoli. This enterprise was completely successful. The Russian capture of Erzerum was one of the finest feats of arms of the whole War. Its assault did not form part of the original plan, but the attacks up the Araxes valley, begun on Jan. 11 1916, so completely surprised the Turk that it was decided to attempt it. The famous fortress, though many of the works and much of the armament were not modern, occupies a position of great natural strength, which the Turks under German supervision had improved with field works in addition to the existing forts. Its capture on Feb. 16 was mainly the result of a turning movement from the north, made by the II. Turkestan Corps under Przjevalski, the ablest of the Russian Corps commanders on the Caucasus front, who had an intimate knowledge of Erzerum, where he had spent 15 years as military attaché. The Turks retired in considerable disorder with heavy losses in men and material.

The next Russian objective was Trebizond; its capture in April considerably simplified the supply problem. Meanwhile, the Turkish Higher Command, alarmed at the fall of Erzerum and continued advance of the Russians, had decided on a counterstroke. They ordered the assembly of a new army, the II., under Izzet Pasha, in the Mush-Kharput region, to attack the Russian flank and rear and recapture Erzerum. The plan was sound enough, had the communications allowed of a speedy concentration and swift advance. But the assembly of the II. Army, begun in April, was not complete in July. The Grand Duke became aware of the Turkish intentions and anticipated their attack by a heavy blow at the III. Army, which eventually broke in complete rout. The Russians occupied Erzinjan in July. So heavy were the losses of the III. Army that it had subsequently to be completely reorganised. To do this divisions were formed out of army corps, regiments out of divisions, battalions out of regiments.

The defeat of the III. Army delayed and weakened the counterstroke of the II. Army, which did not take place till August, giving the Russians time to transfer troops from their right wing to meet it. After some heavy fighting on the Oghnat-Kighi front the II. Army's effort was definitely held. It had gained little ground at a considerable sacrifice in men. Both armies then took up defensive positions for the winter. The line now ran approximately from Tireboli on the Black Sea, west of Gumushkane to Kemakh, then southeast by Kighi, Oghnat, Mush, and Bitlis to Lake Van. Further east, on the Turko-Persian border and in Persia, both armies had detachments to protect their flank, and fighting took place with varying fortune during 1915–6.

During the winter of 1916–7 no movements took place. The Turkish II. and III. Armies (Mustapha Kemal and Wahib Pasha respectively), now combined under Izzet Pasha, suffered terrible privations from lack of supplies and the weather. Nor were the Russians in very much better case. A light line was being built from Sari Qamish to Erzerum, but progress was very slow and railhead was still some miles short of Erzerum in March 1917. Their command of the sea enabled them to feed their right wing from Trebizond; but from Erzerum and Trebizond to the front, supply was dependent on horse transport over indifferent tracks, sometimes closed for days by blizzards of snow. The Russians, too, suffered severely from poor rations and typhus.

Attempted Russo-British Co-operation.—In Dec. 1916 the British Army in Mesopotamia, under Gen. Maude, commenced the attacks on the Turks at Kut, which were eventually to lead to the capture of Baghdad in March. Unsuccessful efforts had previously been made to concert the operations of the British in Mesopotamia and the Russians in the Caucasus; and now, with the approach of Maude's forces to Baghdad, an opportunity for effective combination seemed to have arrived. It was agreed that the Cavalry Corps of Baratov from Persia and of Chernozubov from between lakes Urmia and Van (both these corps, though composed mainly of cavalry, had a strong backing of infantry and artillery) should advance on Mosul; and thus, it was hoped, in co-operation with Maude, finally liquidate the Mesopotamian campaign. However, it was not to be. The Grand Duke adopted the plan whole-heartedly, and the Turk would not have been in a position to offer effective resistance. But, first of all, the weather conditions and the difficulty of organising a line of supply through the mountains of the Persian border caused delay; then, before the movement had well begun, the Russian revolution broke out. With the recall of the Grand Duke toward the end of March—only to be described as an incredible blunder on the part of Kerenski—the best hope of energetic action had gone.

Collapse of the Russian Army.—Throughout the summer the Russian Army lay inactive, gradually disintegrating; by the early autumn it was sufficiently obvious that the troops would make no further forward movement, and could only be relied on to hold their positions so long as they were not attacked. Yudenich, who had succeeded the Grand Duke, gave up the command in August and was succeeded by Przjevalski. But the end was near. In December an armistice was concluded on the Caucasus front, and in Jan. 1918, after the peace of Brest-Litovsk, the Russian troops still remaining retired. The condition of the Turkish armies had been too wretched to allow them up till now to take advantage of the Russian collapse; but when the Russians finally retired, the Turks were once more fired with hopes of territorial gains; and advanced on the Caucasus with troops which from the military point of view would have been more profitably employed in strengthening their front in Palestine. They occupied Batum on April 14 and Kars on the 26th. All Russian regular troops had disappeared, and their only opponents were Georgian and Armenian bands defending their homes.

The British Expedition to Baku.—The British General Staff, alarmed at the prospect of a Caucasus under Turkish control being used as a base of propaganda and even operations against India, had meanwhile organised a group of British officers and non-commissioned officers under Gen. Dunsterville to be sent to the Caucasus to rally the local Armenian and Georgian populations against the Turk. But this force, dispatched through Persia from Mesopotamia, was delayed by the anarchic conditions which followed the collapse of the Russian forces in Persia, and arrived too late. When it reached Baku in August, things had gone too far; and after a short but gallant defence it was compelled to withdraw. But the Turkish control of Trans-Caucasia was shortlived, for Allenby's crushing victory in Palestine a month later spelt the loss of the War for the Turks.

Criticisms of the Campaign.—The operations of the so-called "Caucasus Front" described above thus led to no decisive results on either side. In view of the poor means of communication in the theatre of operations it is difficult to see how decisive results could have been expected. The lure of territorial conquest and false strategical conceptions led the Turks to attach an undue importance to this front, which had disastrous consequences for them from a military point of view. The unnecessarily heavy losses in their best troops caused by the offensives of the III. Army at the end of 1914 and of the II. Army in 1916 caused the weakness which proved their undoing on the Palestine and

Mesopotamian fronts. Had the Turks been content with a defensive attitude on the Caucasus Front, British difficulties in these theatres might have been greatly increased.

The purely defensive attitude which the Russians took up at the outset was strategically correct; they had no other objective than the protection of their Transcaucasian provinces from invasion; the state of the communications would obviously never allow them to penetrate far enough into Asia Minor to produce any decisive effect on Turkey. That they advanced as far as they did—farther, perhaps, than was strategically wise—was due to the influence and energy of the Grand Duke. From the military point of view these campaigns are likely to be remembered only for one great feat of arms—the boldness and endurance displayed in the capture of Erzerum—and as affording to soldiers one more example of the dependence of strategy on communications.

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CAVALRY (*see* 5.563).—In the years immediately preceding the World War ideas on the employment of cavalry were distinctly confused. The leading military nations were agreed that its chief uses would be as an arm of reconnaissance and pursuit, but only the British realised that the mobile fire power now given it by the possession of an efficient breechloading rifle had made it an effective arm of protection as well. No nation had realised the amount of auxiliary fire power cavalry formations would require if they were to act independently and carry out a dismounted assault when necessary.

Theories Compared.—The Germans, with the exception of divisional cavalry, intended to employ the whole of their cavalry, independently to seek out and destroy the opposing cavalry and so from the outset gain superiority in the area to be reconnoitred. They put intelligence first, did not consider security and had no protective cavalry whatever. The French had a small amount of protective cavalry as well as the divisional, but, like the Germans, intended to employ the bulk of their cavalry independently against the opposing cavalry. The British considered that it would often be more important to screen one's own movements than to fight for intelligence, which might arrive too late to be of use, and intended, after allotting a small proportion as divisional cavalry, to employ the bulk of their cavalry protectively and send forward only small detachments for independent reconnaissance.

French and German cavalry training was, therefore, devoted mainly to reconnaissance duties and the mounted action, which they considered would be the decisive factor in the inter-cavalry struggle they so confidently expected. They neglected musketry and dismounted action and overlooked the possibility that they might never meet the opposing cavalry owing to the wide front over which the enormous armies of this period would be operating, or that their opponent might decline a mounted combat and use his rifles and machine-guns instead. Neither nation had fully realised the limitations which the introduction of the breechloading rifle and machine-gun and the difficulties of the terrain in western Europe had imposed upon the possibility of employing a mounted assault against a dismounted enemy, nor recognised that, unless surprise and a short distance to cover were obtainable, he had first to be disorganised and demoralised by fire if such an attack was to succeed. British cavalry, recognising both the advantages and limitations of the mounted assault, and trained to fight either mounted or dismounted, as well as to reconnoitre, was distinctly superior to that of any other nation when war broke out in 1914.

Cavalry in the World War.—Both France and Germany employed 10 cavalry divisions in the west and the failure of these large bodies of cavalry to effect any decisive results is attributable to faulty employment and tactics. The Germans put five divisions in their centre and left, where there were no flanks and the country unfavourable, and these divisions, which received very poor instructions, never got ahead of the leading infantry. The remaining five were employed with their right, the offensive wing, where there was an open flank, favourable terrain and ample scope for exploiting the mobility of cavalry—its chief asset—to the full. Here all 10 divisions, skilfully employed, might have altered the result of the whole campaign.

But these five divisions were given such misleading original directions, and were so misdirected subsequently, that golden opportunities were missed and their action was ineffective. Their tactics were poor. The expected inter-cavalry struggle never took place, and after two divisions had failed disastrously to gallop down a weak rearguard of Belgian cavalry and cyclists at Haelen, Aug. 12 1914, over unsuitable ground with no covering fire, they rarely attempted a mounted assault again, nor did they make full use of their mobility. At Le Cateau three cavalry divisions were employed in dismounted frontal attacks against the British II. Corps and the latter's exposed flanks and isolated condition were never discovered.

The original French dispositions were equally faulty. They placed only three divisions on their exposed left flank, where there was ample scope for effective cavalry action, and speedily exhausted these by orders and counter-orders without obtaining any effective results. The remaining seven were distributed along the front where there were no flanks and the country was unfavourable, and, not having been trained in dismounted action, they effected very little. Their tactics showed immense gallantry but little skill, mounted attacks being attempted regardless of circumstances.

The British Cavalry.—The British cavalry, consisting of one division of four brigades and an independent brigade, played a most effective rôle in these opening stages. It successfully covered the advance to and withdrawal from the Mons position and the subsequent advances to the Aisne and into Flanders. The soundness of its pre-War training was demonstrated and the action of Cerizay, fought in the early days of the World War, is a model of the combination of fire and shock action. All three combatants found divisional cavalry invaluable during this period of open warfare, though here again the British cavalry with better training and tactics proved itself superior. Once trench warfare set in, all the cavalry were employed most effectively as a mobile reserve to occupy or reinforce rapidly a sector of the line or fill a gap, and here the training in dismounted action and high standard of musketry of the British cavalry proved invaluable.

In 1915 the Germans transferred most of their cavalry to the east, where conditions were favourable and they did most effective work, but in 1917, owing to shortage of horseflesh and manpower, three divisions had to be dismounted. They never sent the remaining seven back to the west for their great offensive in the spring of 1918, an error to which Ludendorff attributes its failure, for they had no cavalry with which to exploit the extremely favourable situation created in its opening stages and, in his own words, " without cavalry it is impossible to reap the fruits of victory." The British commander-in-chief never lost sight of this necessity for mounted troops and, despite considerable criticism, retained all his five cavalry divisions throughout the long period of trench warfare, though two were sent to Palestine early in 1918.

By this period cavalry had been considerably strengthened in fire power by the addition of extra machine-guns and automatic rifles, and was to be reinforced by armoured cars, light tanks, extra artillery and infantry in lorries directly mobile warfare reappeared. The battle of Amiens in Aug. 1918, where the advance of the cavalry was limited only by the extreme difficulties of crossing an old trench warfare battle-field, showed to a great extent what possibilities lay open in European warfare to fast moving, hard hitting formations of cavalry, reinforced by other mobile troops, and capable of independent action in almost any nature of country, but the Armistice a few months later, which came just as the German resistance was completely collapsing and an opportunity for effective cavalry action was imminent, prevented this wise retention of his cavalry by Haig from being justified as it deserved.

Allenby's Use of Cavalry.—The value of cavalry in suitable country and against an inferior opponent was well demonstrated in the later stages of the campaigns in Palestine and Mesopotamia, and Gen. Allenby's employment of his cavalry in his offensive in Sept. 1918 will always remain a historic example of how this arm should be employed in pursuit. The enemy's right flank was broken down by an infantry assault and three divisions of cavalry were pushed through and directed, first well in rear, to destroy vital nerve centres, such as headquarters and railway junctions, and then to place themselves astride the enemy's line of retirement. With complete air superiority they were not hampered by air attack, and covering 70 m. within the first 36 hours, within 14 days completely destroyed the whole of the Turkish forces in this theatre of war, over 100,000 prisoners and 500 guns being captured.

In Mesopotamia, with small forces engaged, cavalry, besides proving invaluable for reconnaissance, were again employed most effectively in pursuit, notably at Ramadi, 1917, and Sharqat, 1918, where in each case cavalry were pushed round the flank of a retreating enemy, and, occupying positions well in rear across his line of retirement, compelled his complete surrender. In both these eastern theatres of war, mounted action was successfully employed on many occasions, such as at El Mughar in Palestine, Nov. 1917, where a yeomanry brigade successfully charged the flank of a position which had been holding up an infantry division for some hours, and demonstrated once again the superiority of this form of attack to any other, given suitable ground, bold and skilful leading and adequate covering fire.

Some Conclusions.—The peculiar conditions of trench warfare, which prevailed for so long in the main theatre of war and gave such little opportunity for the effective employment of cavalry, have caused its successes in open warfare to be overlooked, and a great deal of ill-informed criticism to be directed upon it. A new, and at present most effective, arm of assault has been introduced in the tank, and because cavalry, unless reinforced by other arms, has now such distinct limitations in this rôle, it has been suggested that it should either disappear or replace its horses with mechanical vehicles. Its capabilities as an arm of reconnaissance, of protection and of pursuit have been forgotten. For reconnaissance it is essential. Aircraft can go further and bring back information quicker, but cavalry is the only mobile arm which can operate in almost any nature of country, take prisoners, examine documents, search ground closely and work by night or in rough weather. For protection and pursuit a mobile arm is again required which can operate in all natures of country including unsuitable tank country, such as covers a great portion of Western Europe, and which cannot only reconnoitre, but seize and hold positions, protect a flank or cover a retirement; so that even if a nation had sufficient light tanks available at the commencement of a future war to employ any large number as covering troops, a force of cavalry would be essential as well.

For close co-operation with infantry as scouts and messengers, divisional or corps cavalry are invaluable, the trained mounted man being one of the most efficient means of inter-communication once battle is joined. For warfare against a civilised opponent, cavalry will, in future, require reinforcing by armoured cars or light tanks, extra artillery, cyclists or some form of mobile infantry and aeroplanes, and will possibly be most efficiently employed in brigades, any larger formation being difficult to control effectively when dispersed, and too vulnerable a target to artillery and aircraft when concentrated, unless only moved at night, which would seriously diminish its efficiency. Against an uncivilised opponent, in country that is suitable for cavalry, larger formations such as divisions or corps should prove most useful.

With regard to the "arme blanche," the French doctrine that "cavalry manoeuvres on horseback and fights on foot" has been forced upon them by the impossibility of turning a short service conscript into anything more than a mounted infantryman in the one year's training available. To sacrifice the value of a well-trained cavalryman who can fight equally well, either mounted or dismounted, by not teaching our long-service volunteers to ride home with a steel weapon as well as to scout and shoot, would be a serious mistake.

Mounted action, as exemplified in the World War, will still be possible by individuals or small bodies, given surprise and a short distance to cover and by larger bodies against an inferior enemy, or one already disorganised and demoralised by fire. The leading patrols must not gallop blindly into ambushes, as the French cavalry so often did in 1914, but rather go straight for their enemy mounted whenever they have a reasonable chance of doing so, and thus establish a moral superiority over him such as the British had over the German cavalry in 1914.

The results of the opening stages of a campaign are of far-reaching importance, and it is in the preliminary skirmishes between the opposing covering troops that a cavalry trained to use the "arme blanche" will have an immense advantage, while for pursuit or for operations against an uncivilised enemy, the mere possession of a steel weapon has the greatest moral effect. *See* STRATEGY; TACTICS; WAR.

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CAVAN, FREDERICK RUDOLPH LAMBERT, 10TH EARL OF (1865–), British general, was born Oct. 16 1865, and succeeded to the title in 1900. Commissioned in the Grenadier Guards 1885, he was A.D.C. to the governor-general of Canada 1891–3, and served in the South African War 1901. Retiring from the army in 1913, he was recalled in Aug. 1914 and in Sept. went out to France to take command of the 4th (Guards) Brigade. In June 1915 he was promoted to command of the 50th Division, and in Aug. to the Guards Division. Winning a reputation as a trusted and admired fighting commander, his next step was the command of the IV. Army Corps at Ypres, which he held from Jan. 1916 to March 1918, when he was appointed to succeed Gen. Plumer as commander-in-chief of the British Forces on the Italian front. A notable mark of trust was that the Italian command put him in charge of the X. Italian Army for the final offensive. It was through the initial forcing of the passages of the Piave by the mixed British and Italian troops under his command that the way was paved for the decisive successes which followed. Remaining on the active list after the War, Lord Cavan was appointed to the Aldershot command in 1920 and in 1922 was advanced to be chief of the Imperial General Staff, a unique distinction in that a retired officer was not only brought back to the active list but became the chief of the army. Cautious, perhaps, in his attitude to military progress and new weapons of warfare, he was a tranquilising influence rather than a driving force. But in view of the political war weariness and military soreness which prevailed during the first stages of rebuilding the regular army, the former quality was an unquestionable aid in paving the way for subsequent reforms.

CAVE, GEORGE CAVE, 1ST VISCOUNT (1856–), British lawyer and politician, was born in London Feb. 23 1856 and educated at Merchant Taylors' School, London, and St. John's College, Oxford. Called to the bar in 1880, he became K.C. in 1904. In 1906 he entered Parliament as Conservative member for Kingston. The House of Commons soon recognised that the new member was a man of sincerity and judgment with a wide knowledge of affairs, and Mr. Cave came to be regarded as a leading member of the Conservative party. In 1915 he became solicitor-general and was knighted. On the formation of the first Coalition Govt., in 1916, he was appointed Home Secretary. In 1918 he was raised to the peerage. When, in 1919, he became a lord of appeal, it appeared that Lord Cave's political career had come to an end; but on the break-up of the Coalition, Mr. Bonar Law appointed him Lord Chancellor (1922). The election of 1923 brought about a Conservative defeat, but when Mr. Baldwin returned to power in 1924 Viscount Cave was reappointed to his former office. He was elected chancellor of the University of Oxford in 1925.

CAVELL, EDITH LOUISA (1865–1915), British nurse, was born Dec. 4 1865 at Swardeston, Norfolk. She entered the London Hospital as a probationer in 1895. In 1907 she was appointed the first matron of the Berkendael Medical Institute, Brussels, which became a Red Cross hospital on the outbreak of the World War. From Nov. 1914 to July 1915 wounded and derelict English and French soldiers were hidden from the Germans by Prince Reginald de Croy at his château near Mons, thence conveyed to the houses of Edith Cavell and others in Brussels, and furnished by them with money to reach the Dutch frontier with the aid of guides obtained through Philippe Baucq. On Aug. 5 Edith Cavell was arrested and imprisoned. She admitted having sheltered and helped to convey to the frontier some 200 English, French and Belgians. A court-martial was held Oct. 7 and 8 and a Belgian lawyer, M. Sadi Kirschen, defended Edith Cavell. On Oct. 9 Edith Cavell and Philippe Baucq were sentenced to death with three others who were afterwards reprieved. Despite efforts to obtain a reprieve in which Mr. Brand Whitlock, the U.S. Minister at Brussels, was active, Edith Cavell and Philippe Baucq were shot on Oct. 12. Miss Cavell, who had tended many wounded German soldiers with devoted care, faced the firing squad with a dignity which moved the world. To the British chaplain who administered a final sacrament, she made the remark "patriotism is not enough" which at once became as historic as Nelson's utterances at Trafalgar. On May 15 1919 her body was removed to Norwich Cathedral after a memorial service in Westminster Abbey. A memorial statue stands opposite the National Portrait Gallery, London.

See *The Case of Miss Cavell from the Unpublished Documents of the Trial*, interpreted by Ambroise Got (1920); Sadi Kirschen, *Devant les Conseils de Guerre allemands* (1919); *Correspondence with the United States Ambassador respecting the Execution of Miss Cavell at Brussels*, Cd. 8013, Stationery Office (1915).

CAVIGLIA, ENRICO (1862–), Italian soldier, was born at Finale Marina (Genoa) May 4 1862. After Italy's entry into the World War, he was promoted to major-general and commanded the Bari Brigade. In June 1916 he took over the 29th Div. and later was promoted lieutenant-general. In July 1917 he was given command of the XXIV. Corps, which broke through the Austrian lines on the Bainsizza plateau. In June 1918 he was chosen to command the VIII. Army which played an important part in the final victory of Vittorio Veneto. From Jan. to June 1919 Caviglia was Minister of War, and as such became a senator, and in Nov. of the same year he was promoted army general. In Jan. 1920 he took over the command in Venezia Giulia. His task was difficult, since the discipline of the troops had been severely shaken by the example of D'Annunzio's Fiume raid. He restored discipline, and when it became evident that only force would drive D'Annunzio from Fiume, he did not hesitate to carry out his task (Dec. 1920).

CECIL, LORD HUGH RICHARD HEATHCOTE (1869–), English politician (*see* 24.76), youngest son of the 3rd Marquess of Salisbury, the Prime Minister, was born Oct. 14 1869 and was educated at Eton and University College, Oxford, where he obtained a first class in Modern History in 1891, and was elected a fellow of Hertford College. He gained his first insight into politics as one of his father's secretaries, and was returned to Parliament as a Conservative in 1895. He took a particularly keen interest in ecclesiastical matters and was remarkable in debate for his oratorical powers and the loftiness of his ideals, thus establishing a reputation which was confirmed and heightened during the progress through Parliament of Mr. Balfour's Education bill of 1902. In regard to the religious difficulty, he maintained that the only possible basis of general agreement was that every child should be brought up in the belief of its parents. He and Mr. Winston Churchill gathered round them, in the early years of the 20th century, a small group of young and able Conservative members, whose independent proceedings attracted some attention. He took a decided part in resisting tariff reform, and consequently lost his seat in 1906.

Lord Hugh did not return to Parliament until 1910, when his high character and his academic outlook recommended him, in spite of his hostility to tariff reform, as a fitting member for Oxford, his own university. He threw himself immediately and with passion into the struggle over the proposed curtailment of the powers of the House of Lords, and was active in resistance to the Parliament bill. But he never quite regained the authority which he had possessed in the House in his earlier years. During the World War he joined the Flying Corps, becoming a lieutenant in 1915, and he also served as a member of the commission that enquired into the Mesopotamia expedition. After the War he took a less active part in politics, but generally found himself in agreement with his brother, Lord Robert (later Lord Cecil of Chelwood), in adopting a more independent attitude toward the Coalition Government. With him, too, he supported the Enabling bill, and he became a prominent member of the Church Assembly set up in accordance with its provisions.

CECIL OF CHELWOOD, EDGAR ALGERNON ROBERT CECIL, 1ST VISCOUNT (1864–), British politician (*see* 24.76), known before his elevation to the peerage as Lord Robert Cecil, was the third son of the 3rd Marquess of Salisbury, the Prime Minister. Born Sept. 14 1864, he was educated at Eton and University College, Oxford, and obtained a second class in law in 1886. He was a prominent speaker at the Oxford Union, and obtained political experience as one of his father's private secretaries from 1886 to 1888; but he determined to approach an active political career by way of the bar, and was called in 1887. Making good progress in his profession he took silk in 1899, and soon established his position as a capable lawyer and advocate.

It was not until 1906 that he entered Parliament as Conservative member for East Marylebone, and he was one of the principal critics of Mr. Birrell's abortive Education bill of that year. Though in this respect he showed himself in sympathy with the position of his younger brother, Lord Hugh Cecil, he made his reputation mainly by assuming, in conjunction with Mr. Harold Cox on the Liberal side, an attitude of individualist opposition to measures such as those for eight hours for miners, and old-age pensions. He also dissociated himself from the tariff reform policy of his party, and was consequently out of Parliament from 1910 to 1912, when he was returned at a by-election for Hitchin. He immediately resumed his prominent position in the House, and was active in his opposition to schemes of socialism and disestablishment. He was a leading advocate of woman suffrage, and, though not palliating militancy, was a strong critic of forcible feeding. Ultimately, after women had been granted the suffrage, he had the satisfaction of carrying a resolution permitting them to sit in the House of Commons.

Lord Robert was in office throughout the World War from the time that the Unionists associated themselves with the Govt. in May 1915 till the Armistice. His functions, at first as Under-Secretary for Foreign Affairs, then as Minister of Blockade and lastly as Assistant Secretary of State for Foreign Affairs were mainly concerned with the vital question of blockade, and it fell to him to announce in June 1916 to the general satisfaction, that the Allies had decided to abandon altogether the Declaration of London. Lord Robert resigned at the general election of 1918 on the ground that he could not support the decision of the Coalition Ministry to treat Welsh Disestablishment as a *fait accompli*. Though out of office, he nevertheless went over to Paris in 1919 to assist in the formation of the League of Nations, of which from the first he was an enthusiastic advocate. He was subsequently indefatigable in pressing its claims upon both Parliament and people; and in 1920 he attended the first Assembly of the League in Geneva as a representative of South Africa. In Parliament he steadily drifted into opposition to the Coalition Ministry, and, though he did not form part of Mr. Bonar Law's Unionist Ministry in 1922, he joined Mr. Baldwin's first Cabinet in May 1923 as Lord Privy Seal. Before that Cabinet resigned, he had been raised to the peerage in Dec. 1923. His close association with the League of Nations was fitly recognised in Dec. 1924, when he received the first annual award of the Woodrow Wilson Peace Prize of $25,000. He returned to office in Mr. Baldwin's second Cabinet, in Nov. 1924, as Chancellor of the Duchy of Lancaster, and on several occasions acted as deputy for the Foreign Secretary, Sir Austen Chamberlain, on the Council of the League of Nations.

CELL: *see* CYTOLOGY.

CELLULOID.—This artificial substance, known also as artificial ivory and xylonite, is a compressed, solid solution of nitrated cellulose in camphor or a camphor substitute. It is colourless or slightly yellow, transparent in thin sheets, and capable of being stained with the most delicate colours, which permeate its entire mass. Celluloid is of uniform composition and its specific gravity is about 1·35; it is insoluble in water or dilute acid, usually emits a faint smell of camphor and is inflammable.

Celluloid becomes plastic when immersed in water at or near boiling-point and can then be moulded into any desired form. At ordinary temperatures it can be cut, turned, sawn, drilled and otherwise worked to form numerous useful and ornamental articles. Having a tensile strength of 10,000–12,000 lb. per sq. in., it is one of the strongest of artificial materials. Celluloid is elastic, and can be produced in very thin sheets and films; celluloid films 0·0000039 ($\frac{1}{256,000}$) in. thick were made in 1924 by the U.S. Bureau of Standards, for use in X-ray researches.

The solubility of nitrated cellulose in camphor is the important property on which the success of making ordinary celluloid depends. Tissue paper, cotton, wool or other cellulose material is nitrated by means of a mixture of strong nitric and sulphuric acids. The product, which is of the nature of, but less highly nitrated than, gun-cotton, is bleached, washed and dried; it is then incorporated in a mixing-machine, with natural or synthetic camphor and alcohol. At this stage colouring matter and filling material, selected according to the kind of celluloid required, may be added. The gelatinous mass obtained is transferred to heated adjustable rollers by which it is kneaded and rolled into sheets of any desired thickness. After removal from the rollers, the sheets are pressed and dried or seasoned, most of the volatile solvents being thus eliminated from the celluloid.

Numerous modifications of the process thus briefly described have been proposed, the most important having for their objects the production of so-called "non-flammable celluloid" and the use of a substitute for camphor, the price of which is usually high and subject to great fluctuations.

The attempts to make a celluloid which is less inflammable then ordinary celluloid have been to some extent successful. To achieve this result, a chloride, *e.g.*, stannous chloride, is added to the celluloid-making materials, or acetyl cellulose is used, or a bromate or other substance capable of liberating flame-extinguishing gases. In some processes, the pasty mass is pressed into a block by hydraulic pressure, cooled and then planed to any desired thickness.

If supplies of cheap camphor were always available, the search for a substitute for it would lose much of its importance. There have been, however, very many attempts, mostly unsuccessful, to obtain a suitable camphor substitute. In 1914 the Badische Anilin und Soda Co. claimed that the acyl compounds of completely hydrogenised aromatic amines were very efficient in dissolving nitrated cellulose and were obtainable in large quantities.

The term celluloid was first applied by J. W. and I. S. Hyatt, who began the manufacture of the material in the United States in 1869. Their work was based on that of A. Parkes and D. Spill, who, in 1855 and 1868 respectively, succeeded in England in making plastic materials with pyroxylin as a base. The advance of J. W. and I. S. Hyatt was due to their investigations into the action of camphor upon cellulose and to their improved mechanical methods. The industry has become established in the United States, Great Britain, France, Germany, Austria, Switzerland and Japan, the total output being in excess of 200,000 lb. per day.

Not only ivory but also horn, tortoise-shell, amber, agate, ebony and many other natural substances may be imitated by means of celluloid, and it is used in making numerous useful and ornamental articles. These include cutlery handles, billiard balls, collars, automobile windows, piano keys, buttons, combs, brush and mirror backs, fancy boxes, dolls, hollow balls and other toys, cinematograph films, dental plates, accumulator cases, telephone mouthpieces, transparent screens and parts of drawing and optical instruments. During the War the demand for celluloid articles such as, for instance, accumulator cases and transparent screens, was very great.

See F. Boeckmann, *Celluloid* (1921); H. H. Hodgson, *Celluloid* (1925). (T. E. L.)

CELLULOSE (*see* 5.606).—The term cellulose is used broadly and comprehensively as equivalent to "the component elements of plant structures." Cellulose as a substance, however, is a chemical individual. In the working and fashioning of cellulose structures as such, the most important industries engaged are the textile, twine and rope making, and paper making (*q.v.*).

The stress of War conditions incident upon Germany in regard to supplies of textile and raw materials led to an extraordinary development in that country of the manufacture and use of twisted paper yarns. A paper web, cut to plane strips, twisted to cylindrical form in continuous length, formed a yarn serviceable as a substitute for the staple textile yarns in many and unexpected directions.

The manufacture was rapidly developed to an extensive industry, the yarns being woven into clothing, dress-fabrics and wrapping cloths, or worked by plaiting into belting.

Certain of these uses survive on the merits of the goods produced; but in the main a "felt" of short fibre lengths put together necessarily by wet process is inferior in structural quality to the lowest grades of whole-length-fibre felts produced by the dry process of carding preparation, and the twisting of the felts to yarns only intensifies the fundamental contrast.

This development involves a fundamental principle implicitly stated in the foregoing paragraph, and there remains open the problem of putting together long fibre by wet process to a continuous web, to be slit to strips which are then twisted to yarns as in the process applied to plane paper strips.

Kapok.—The use of kapok fibre under naval War exigency was specially developed in the confection of life-saving appliances.

The kapok seed hair is a thin-walled tubular cylinder with a smooth surface and therefore lustrous. When tightly packed in a container it still occupies a very large volume—in specific terms 12 to 13 c.c. per 1 gramme. The container being a bag of textile material and suitably waterproofed, the kapok filling confers a floating capacity 2–3 times that of cork, such that a belt made up with special attention to life-saving conditions, has proved greatly superior in all respects to the cork jackets and other appliances of pre-War times. Under the stress of the naval and marine conditions of the World War, these life-saving appliances came in under enormous demand, and kapok floss was elevated to a position of unique value. This is a conspicuous illustration of the adaptation of plant structures as such to man's necessities.

Use in Aeroplane Construction.—Another development due to the War is the application of cellulose material to the aeroplane, furnishing the air-resistant surface of the wings. To complete the structure as a taut, and, at the same time, water-resistant membrane, a "dope" or varnish was required. Of the many possible colloidal preparations, the only one filling the specification of qualities was the cellulose acetate or acetic ester; a special form of the product, acetone-soluble, was dissolved in the liquid dope in association with "plastifiers," which, after evaporation of the solvent, remained in permanent union with the acetate, modifying its properties to increased plasticity and resistance to strain (*see* ARTIFICIAL SILK).

Cellulose in Industry.—There are three groups of industries based on derivatives of cellulose synthesised by chemical process and retaining the exceptional colloidal characteristics of the mother substance.

(*a*) *Anhydro esters:* mainly nitric and acetic esters formed by combination with the respective acid radicals and with consequent large increase of weight (60–80%)—soluble only in special solvents.

(*b*) *Hydrate esters:* the sodium cellulose-xanthogenic derivatives dissolved by water to "viscose."

(*c*) *Colloidal disperse systems* or solutions formed by interaction in aqueous solution with cuprammonium, zinc chloride, sulphocyanides, etc.

Nitrates and Viscose Derivatives: Explosives and Artificial Silk.—In order of technical and industrial importance, the nitrates and the viscose derivatives are of outstanding prominence. The former, as the basis of modern military explosives, were produced in almost incredible quantities throughout the War period

1914–8. The latter as the main raw material of the artificial silk industry has been produced and worked in rapidly increasing proportions, even during the World War. The growth of the industry from 8,000 tons in 1910 to 62,000 tons in 1924 is mainly that of the viscose products, and, in the main, attributable to British enterprise and capital.

In respect of the War-production of the nitro-cellulose explosives in Great Britain, the mere dimensions of the manufacture, reaching a weekly production of 2,000 tons of cordite (from 1,000 tons cellulose raw material), represent great achievement. But outside the industrial, there were technical scientific problems to be solved in standardising the products, for controlling manufacture, securing uniformity under storage and developing ballistic efficiency.

A main problem is that of chemical purification of the raw material and it is known that the cellulose is modified by the processes, necessarily severe, to which it is subjected. Changes in the cellulose are measured by change—the viscosity of its solutions (Group 3). For a standard of normal condition of the colloid a special method of preparation and a viscosity test based on cuprammonium solution was devised and adopted.[1]

The stability of the nitrate explosive is prejudiced by minute residues of non-cellulose matters. For special types of cordite ammunition, it was found necessary to employ an original "long cotton" prepared by the spinner to the stage of "sliver." This preparation imports a considerable removal of non-cellulose foreign matters, and chemical treatment following this mechanical purification was found to realise the optimum; and the result justified the obviously large increase of cost.[2]

Under the exigency of shortage of supplies of cotton cellulose the wood pulps (cellulose) were adapted in Germany to this manufacture by processes of controlled hydrolysis, removing β and γ cellulose components and incidentally residues of resinoid and other non-cellulose impurities. (*See* EXPLOSIVES.)

Paper-making.—The production of the nitrate from this form of cellulose certainly reached relatively enormous figures. But in point of tonnage the figures in either case are only a fraction of the world's consumption of wood cellulose in the paper-making (*q.v.*) industry, for which the production of wood pulp (cellulose) by chemical process has progressively increased in 1925 to the figure of 6–7,000,000 tons per annum. In point of cost and money value of the product, the figures, ton for ton, *i.e.*, for cellulose as nitrate, and in the form of paper, represent a large multiple ratio.

The extension of artificial silk, the second of the industrial developments of the cellulose industries, from its position in 1910 to an estimated production of 100,000 tons per annum, is one of the most conspicuous features of the age. The basis of the artificial silk industry in 1925 is very much as in 1910.

Properties of Cellulose.—Having fulfilled its predominant functions in the plant world, of which it is the structural basis, it becomes, as nitric ester, a high explosive, but with associated properties by which it can be controlled as the most powerful of agents for calculated destruction and in effect the primary material basis of modern warfare. On the other hand, by chemical process it is restored to the plastic condition of a water-soluble hydrated colloid, analogous in essential properties to the form in which it subserves its constructive functions in the plant, to be then transformed at will into thread, film or massive solid, to subserve, in continued service, the needs of the complex civilisation of our age.

Research.—There has been a remarkable extension and concentration of research on the fundamental problem of the subject-matter: what is cellulose in the language and terms of pure science? In America the Chemical Society has created a special section for the subject—in Germany an important technical society has founded a special publication, *Cellulose Chemie*, also in the *Kolloid Zeitschrift* investigations of cellulose and derivatives are prominent. In Great Britain there are several centres of specialised research: *e.g.*, at Woolwich, Ardeer (Nobel's Explosives) and the Naval Cordite Factory. The Shirley Institute has been founded for research in connection with the cotton industries and its published records (Shirley Inst. Memoirs) have already taken a prominent position in science literature. Important developments in respect of the root problem of constitution as a chemical individual have resulted from the investigations of Sir J. C. Irvine and his collaborators at St. Andrews University. It has long been known that cellulose is hydrolysed by acid to the simple "sugar" dextrose, and that no other product of such resolution could be identified. Later investigations (Flechsig, Ost, Monier-Williams) claim to establish the quantitative realisation of the effect:—

$$N(C_6H_{10}O_5+H_2O)=N\cdot C_6H_{12}O_6$$

In a comprehensive critical survey and investigation Irvine avails himself of the newer experimental methods. The cellulose is fully acetylated and the acetate hydrolised to the simpler sugars, chiefly a biose (C_{12}) (H. Ost). In etherification and hydrolysis, the replacement of the OH groups by $O\cdot CH_3$ and $O\cdot C_2H_5$ is a preliminary to hydrolysis (W. S. Denham: Lilienfeld).

Obtaining the products of resolution in corresponding derivative forms, and avoiding complications otherwise attending the breakdown of the cellulose complex, Irvine establishes the quantitative relationship above formulated and is able to draw definite inferences in respect of constitution and configuration of the products, which may apply to the original complex.

One other contribution must be mentioned as of critical importance in relation to the mode of aggregation of the nexose (dextrose) units to the complex of indeterminate dimensions. A. Pictet has shown that cellulose (and starch) when heated at 210°–250° under reduced pressure (10–15 mm.) gives a distillate with a high yield (45%) of a glucosan.

This definitely raises the critical question whether the hexose anhydride as such is the unit constituent, or main component group of the cellulose complex, and therefore whether the polymerisation of the unit is not of a different order from that which has been generally assumed, *i.e.*, a definite alternative to the C_6–O–C_6 linking upon which hypothesis units of $2.C_6$, $3.C_6$, $4.C_6$ dimensions have been put forward as established by different investigations. This aspect of the constitutional problem is still the subject of active controversy that is sustained by distinguished German chemists and others, as Willstaetter, Hess and Wittelsbach, Karrer, Wislicenus, Herzberg, Hibbert and Haworth. The researches of Irvine are specially mentioned as comprehensive—covering the whole field of the sugar carbohydrates, and rigorously and exhaustively methodical, in continuation in fact of the classical researches of Emil Fischer.[3]

Bisulphite Process.—The chemical mechanism of the bisulphite process of treating wood for the isolation of cellulose, *i.e.*, the industrial production of "chemical wood pulp" has been variously interpreted by technologists over the long period of its industrial evolution (1880–1925). It is now shown[4] that the attack on the lignone components of the wood is that of direct sulphonation by the sulphurous acid SO_3H_2, the sulphonic group SO_3H combining at relatively low temperatures (90°–100°), the reaction taking place with the aqueous acid at 4–6% SO_2 and not being in any sense determined by the basic component of the bisulphite (CaO, MgO, Na_2O).

As an industrial process it is facilitated and controlled by the addition of ammonia in small proportions. The soluble by-products from these sulphurous acid processes have many advantages over those from the bisulphite process, in which the proportion of associated salts is a large percentage of the total solids, and excludes them from a number of industrial applications for which they are otherwise available. (C. F. C.)

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[1] *Jour. Chem. Soc.*, 117, pp. 472, 484, 819 (1920)—Robertson, Gibson, McCall, Spencer and Marson; also *Jour. Soc. Chem. Ind.*, 39, p. 172 (1920).

[2] This interesting chapter in the history of "cellulose" development is fully treated by Sir R. Robertson in *Trans. Faraday Soc.*, 16, 66; R. Susti, Lecture, 1921, "War Development of Explosives"; "Chemistry in the 20th Century" 1924.

[3] The records of these researches will be found in *Jour. Chem. Soc.*, 1911–25; the constitutional problem is generally dealt with in *Researches on Cellulose*, vol. 4, C. F. Cross and C. Dorée (London, 1924).

[4] *Jour. Soc. Chem. Ind.*, 1924–5, C. F. Cross and H. Engelstad, C. Dorée and L. Hall.

CENSORSHIP (*see* PRESS LAWS, 22.299).—In practice the censorship may be generally defined as action taken by any governing authority to prevent the dissemination of false statements, inconvenient facts or displeasing opinions among the governed.

I. GENERAL

The outbreak of the World War in 1914 made censorships necessary in all belligerent countries from a purely military point of view. Broadly speaking, they were then established with the following objects: (1) to prevent information of military value from reaching the enemy; (2) to obtain information as to the enemy's strength, disposition, morale and intentions from the indiscretions of his Press or his people; (3) to control the enemy's channels of communication; (4) to prevent false statements, inconvenient facts or enemy-inspired propaganda from reaching the public. The methods of communication which lend themselves to censorship from such points of view are (1) postal communications; (2) telegrams and wireless communications; (3) printed publications.

Postal Censorships.—The communications dealt with by such censorships were divided broadly into (*a*) correspondence with the combatant forces, (*b*) private correspondence, (*c*) commercial correspondence, (*d*) printed publications arriving from abroad. In practically all the armies field censorships were established to deal with the correspondence of the combatant forces. The censoring was performed in the area of military operations by regimental officers, or if necessary at the base by staff officers specially appointed for the purpose. In Great Britain only such letters arriving from the area of military operations as appeared to have escaped the eyes of the field censors were submitted by the post office for scrutiny to the censors in London. With regard to the other categories of communications, it will be convenient to describe the history and methods of the English censorship, which (partly owing to geographical circumstances and partly owing to able organisation) became during the War more efficient and comprehensive than those of most other countries.

In Great Britain the censorship of postal communications, like that of cables, was placed at the beginning of the War on a military basis. The competent military authority for these purposes was a general officer responsible to the Army Council, and the officers of the censorship acted under his directions. Non-postal communications to and from the United Kingdom were prohibited by a regulation under the Defence of the Realm Act, and a similar regulation allowed a search at the ports of persons embarking and disembarking in order that written communications which were intended to escape or might escape the censorship might be discovered. The postal censorship officers were established in London, and in May 1915, nine months after the beginning of the War, the number of censors of all grades was 800. They then examined each week a ton of private correspondence and five tons of commercial correspondence. By the end of the War the Censor's staff numbered 4,608, and an average of 375,517 letters were being scrutinised per day. The procedure throughout the War was as follows: Outgoing mails were examined, so far as legitimate correspondence was concerned, for any information (or misinformation) which might, if conveyed to the enemy through neutral channels, supply useful information or useful propaganda. All such passages were deleted and the correspondence was then allowed to go forward. Correspondence, which from its origin or destination there was any reason to suspect as a channel of enemy communication, was specially examined, along with any suspicious correspondence, the derivation of which was not obvious.

This part of the censorship's activities was really a part of the *contre-espionage*, a service designed to defeat the enemy's attempts to extract useful information from behind the lines. Such services were general in all belligerent countries, and involved, so far as the censorship was concerned, a strict examination of any suspect or suspicious documents which might possibly convey, by the use of cipher, code, sympathetic ink or any other device, a message to the enemy. In the British, French and German postal censorships special branches were organised to deal with these problems, and as a result messages were discovered through which enemy agents were apprehended and enemy channels of communication were closed. In Great Britain arrangements were made by which communications intended for enemy persons might be placed in open envelopes and enclosed in covers addressed to a neutral country. All such letters were of course submitted to careful examination. Mails for neutral countries contiguous to the enemy were censored from the first, and as the area involved by the War extended to extra-European territory it became necessary to examine practically all outgoing mails, for information which might be of military value to the enemy and for statements which might damage Great Britain in the eyes of neutrals or raise the enemy's morale.

Communications obtained from known enemy agents were in many cases altered in such a way as to convey false information and then allowed to proceed. Incoming mails were examined for any information regarding the enemy's strength, dispositions, plans and morale, and for any statements which could be used to discredit the enemy in the eyes of neutrals or to raise the morale at home. Printed publications emanating from enemy sources and found in postal packets were difficult to deal with. Many of them were of a highly propagandist nature, and were therefore seized and condemned. Others, less objectionable, were condemned because of the extreme ease with which secret communications can be made (by code and derivation) through printed matter and the extreme difficulty of detecting such messages. Certain neutral publications were placed on a "black list" and destroyed whenever found, either as being enemy-inspired or as being calculated to lower morale at home. Protests at the destruction or detention of printed books and periodicals were constantly made in Parliament, but for the reasons enumerated they were disregarded.

Neutral Protests.—During the early days of the War the censorship brought many protests from neutral countries, and early in 1915 it was actually suggested by a harassed Government that the censorship of neutral mails should be abolished. The military authorities, however, were able to prove conclusively that such a step would have been fatal. When the blockade was declared and enforced neutral protests redoubled, it then became necessary to examine all mails entering the area of the blockade for contraband of war which, though addressed in postal packets to neutral countries, was suspected of enemy destination. Mail-boats sailing to neutral ports within the blockade area were stopped by naval patrols. The so-called transit mails were landed in the north of Scotland, sent to London, examined and then returned. This caused much unavoidable delay and consequently much neutral protest. It was quickly justified, however, by the finding of large quantities of contraband, rubber, cotton and even contraband metals concealed in these transit mails. America in particular protested vigorously against the censorship delays. In the autumn of 1915 a test examination was made of the direct outgoing mails to the United States, and the results yielded were of such importance from the censorship point of view that it was decided to establish a special branch of the censorship at Liverpool to deal with the American mails. This branch was established on Jan. 1 1916 and disbanded exactly two years later. It was of great advantage in minimising delays. Censorship was practically confined to trade letters and letters to suspect addresses. Trade letters of enemy origin or destination had been examined from the first in London and action taken to close down all enemy transactions abroad. It was early discovered that such letters were of the utmost importance, as they often contained messages in code or sympathetic ink.

There is not much of importance to be said of postal censorships in the other belligerent countries. The problems were the same as in the British censorship, though the methods adopted to meet them were sometimes more radical and based on the principle that no correspondence can be dangerous which the addressee never receives. When America came into the War an officer of the British censorship was sent to New York to assist in conducting a censorship on the London model.

Inefficiency of Russian Censorship.—It was, from the Allied point of view, important that there should be a strong censorship in Russia, for it was early discovered that the enemy were communicating freely by this route with Asia and America. But the Russian censorship was inefficient, and remained inefficient throughout the War. There was no attempt at field censorship, and the small staff in Petrograd were entirely inadequate for any proper postal censorship duties. Early in 1916 an officer of the British censorship was sent to Russia to reorganise the censorship, but found it impossible to put it on a sound basis. All that could be done of value was to stop enemy commercial communications. No staff was available to deal with code or secret writing, and the censorship yielded very little information of value to the Allies.

Of the enemy postal censorships it will be enough to say that the German organisation, like the British under military control, was efficient, though a good deal escaped the eye of the German—as indeed that of every other—censor.

Cable Censorship.—The position of Great Britain gave her a most valuable control over enemy communications by cable. A cable censorship was established at the beginning of the War, and was placed on the same footing as the postal censorship, being conducted under a military chief responsible to the Army Council. The action taken by the cable censors, however, was based on the International Telegraph Convention of 1875. Scrutiny of private messages was conducted on the same general principles as those adopted in the postal censorship, *i.e.*, to prevent information reaching the enemy and to prevent him from communicating with persons outside his lines. Between 30,000 and 50,000 telegrams passed through the hands of the cable censors in the United Kingdom every 24 hours. British cable stations elsewhere in the Empire were also under central control so far as censorship was concerned.

Great importance was attached to the censorship of commercial cables. All cables were stopped which showed evidence either by the text of the telegram or by the known facts as to the sender or addressee that they related to a transaction whether in contraband or non-contraband to which a resident in an enemy country was one of the parties. The principle adopted was purely to withhold, as far as British cables were concerned, all facilities for carrying on trade with an enemy country. At various times there was much neutral protest against the actions of the cable censors, but the British policy was upheld and shown to be in accordance with the International Convention. Trade cables were often found to contain military, and especially naval, information.

Censorship of Printed Publications.—The censorship of the Press in Great Britain is dealt with at length in the next section of the present article. Here we need only refer to the German censorship of printed publications.

In Germany, as in other European countries, a political censorship of the Press existed in peace time. When war was declared all executive powers, including the control of the censorship, were transferred to the military command under the fundamental law governing the state of siege. The censorship was administered from the headquarters of the army corps districts into which Germany like most continental countries was divided. Every two or three days instructions were issued to the Press in every district as to (1) what they were definitely forbidden to publish, (2) the attitude they were to take up with regard to certain questions, (3) inspired articles—often taken from other newspapers—which they were requested and given permission to reproduce. At the beginning of the War there was much inequality in the working of the censorship in the various districts. Statements, for instance, would appear in the Saxon Press regarding the food supply which would have been forbidden in the Brandenburg command. In Oct. 1915 a war press bureau was established in Berlin, one section of which was devoted to securing uniformity of censorship throughout the Reich. It had, however, only advisory powers. It acted as a liaison between the Press censorship authorities (*i.e.*, the military authorities) and the various Government departments.

In practice the political and economic censorship was exercised by the Ministries of the Interior and of Foreign Affairs through the military. The Government was thus always sheltered in its political censorship by the higher command. There were two methods of exercising the Press censorship: (1) Editors were allowed to produce their papers without preliminary examination of proofs. If they transgressed any regulations they could be prosecuted and their paper suspended or placed under "preventive censorship." Except where purely military subjects were involved, it was impossible for an editor to escape responsibility by submitting his copy to the censor by way of precaution. (2) "Preventive censorship" involved the submission of all proofs before they are passed for press. The censor was thus in a position to strike out all matter to which he objected, whether it was actionable or not.

The German censorship as a whole was undoubtedly severe. It was conducted on the general lines of allowing practically no discussion of doubtful topics, such as war news or the economic situation, no criticism of the Government and above all no criticism of the higher command. All information which might be of military value to the enemy was excluded, though, in spite of the efforts of the censors, much military information was obtained by the British War Office from the German Press. An organisation was created in London to scrutinise all enemy periodicals, and a similar institution existed at Berlin. Both organisations were able to obtain much information from the indiscretions of the enemy Press.

A peculiar feature of the German censorship was the censors' insistence that the published periodical should bear no obvious traces of censorship. This was not so in the Allied countries, where most papers appeared daily either heavily *caviaré*, as it was called in Russia (*i.e.*, with paragraphs blacked out), or with large numbers of blank spaces. In Germany it was considered bad for morale that censorship should be so obvious. (W. E. B.*)

II. THE BRITISH PRESS CENSORSHIP

The following note to newspaper editors, dated July 27 1914, was the first official intimation to the British Press of the approach of war:—

> At a meeting of the Admiralty, War Office and Press Committee, it was resolved that as, in view of the present situation, the authorities may have to take exceptional measures, the Press should be asked to refrain from publishing any information relative to movements of British warships, troops and aircraft, or to war material, fortifications, and naval and military defences, without first communicating with the Admiralty and War Office respectively in accordance with the arrangement which was notified to you by me in January of last year.
>
> Having regard to the nature of the case it is found impossible further to indicate the character of the information the publication of which is undesirable in the national interests. The request does not affect the dissemination of news concerning ordinary routine movements or training on the part of the navy or the army; its object is to prevent the appearance of anything concerning steps of an exceptional kind which may be rendered necessary by the existing state of affairs.
>
> I may add that the authorities from time to time will continue to issue such information as may be made public.

Apart from the Official Secrets Act, no legislation existed which enabled the authorities to suppress naval and military information. Notwithstanding this, the newspapers loyally observed the request, followed by others of a more detailed character. The result was that British preparations were made with such secrecy that the Germans subsequently admitted that on Aug. 20 they knew neither when nor where the British troops were landed, nor their strength.

The Press Bureau.—On Aug. 11 the Press Bureau (the outward and visible sign of the censorship) was established. Its objects were the censoring of (1) incoming and outgoing press cablegrams, (2) certain inland press messages, chiefly those passing through the General Post Office and (3) matter voluntarily submitted by the Press. The Bureau was also intended as the medium for the issue of official information. The censorship was, for the most part, carried out in accordance with the wishes of the government departments concerned. It was an open secret that in some instances the directors of the bureau disagreed with the policy they were called upon to enforce.

On Aug. 8 1914 the Defence of the Realm Act was passed, followed by a series of censorship regulations.

They were amended from time to time and in their final form stood as follows:—

> Reg. 18. No person shall, without lawful authority, collect, record, publish or communicate, or attempt to elicit, any information with respect to the movement, numbers, description, condition or disposition of any of the forces, ships, or aircraft of His Majesty or any of His Majesty's allies, or with respect to the plans or conduct, or supposed plans or conduct, of any operations by any such forces, ships, or aircraft, or with respect to the supply, description, condition, transport or manufacture, or storage, or place or intended place of manufacture or storage of war material, or with respect to any works or measures undertaken for or connected with, or intended for the fortification or defence of any place, or any information of such nature as is calculated to be or might be directly or indirectly useful to the enemy, and if any person contravenes the provisions of this regulation, or without lawful authority or excuse has in his possession any document containing any such information as aforesaid, he shall be guilty of an offence against these regulations. . . .
>
> No person shall, without lawful authority, publish or communicate any information relating to the passage of any ship along any part of the coast of the United Kingdom. . . .
>
> Reg. 27. No person shall by word of mouth or in writing or in any newspaper, periodical, book, circular, or other printed publication—
>
> (*a*) spread false reports or make false statements; or
>
> (*b*) spread reports or make statements intended or likely to cause disaffection to His Majesty, or to interfere with the success of His Majesty's forces or of the forces of any of His Majesty's allies by land or sea, or to prejudice His Majesty's relations with foreign powers; or
>
> (*c*) spread reports or make statements intended or likely to prejudice the recruiting of persons to serve in any of His Majesty's forces, or in any body of persons enrolled for employment under the Army Council or Air Council or entered for service under the direction of the Admiralty, or in any police force or fire brigade, or to prejudice the training, discipline or administration of any such force, body, or brigade; or
>
> (*d*) spread reports or make statements intended or likely to undermine public confidence in any bank or currency notes which are legal tender in the United Kingdom or any part thereof, or to prejudice the success of any financial measures taken or arrangements made by His Majesty's Government with a view to the prosecution of the war; . . .

The maximum penalty was imprisonment with or without hard labour for six months or a fine not exceeding £100, or both.

The regulations gave the Government power in certain cases to seize the plant of a newspaper which had offended, or in others to seize the type on suspicion that an offence was about to be committed. These regulations placed heavy shackles upon the Press, but in the main were accepted with patriotic equanimity. Prosecutions were few.

It will be seen that the bureau had no power to insist upon submission of matter for censorship. Responsibility rested with the editor, who could publish what he thought fit, subject to complying with the regulations. If he erred he was liable to prosecution, and even if the matter were passed by the bureau he would not be relieved, although the fact might be pleaded in mitigation. From time to time secret instructions were issued for the information and guidance of editors. At the end of the War these numbered several hundred.

Regulations at the Front.—Messages from authorised British correspondents on the several fronts were primarily, and compulsorily, censored by military censors on the field, but were transmitted through the bureau, which occasionally exercised a further censorship. The methods adopted caused constant grumbling and discontent. In France almost from the first newspaper correspondents were not allowed to proceed beyond the fringe of the area of operations, and their movements were strictly controlled. In Sept. 1914, owing to demands for more information, an official "Eye-witness" was appointed. He wrote according to order, and no question of censorship arose. The news supplied was meagre and inappropriate, and it did not take long for mischievous results to accrue. On March 12 1915 the following notice was issued by the bureau:—

> The magnitude of the British task in this great war runs serious risk of being overlooked by reason of exaggerated accounts of successes printed daily in the Press and especially by exhibiting posters framed to catch the eye and magnify comparatively unimportant actions into great victories. Reported reverses to the enemy are proclaimed as crushing defeats, Germany is represented as within measurable distance of starvation, bankruptcy and revolution, and only yesterday a poster was issued in London, declaring that half the Hungarian Army had been annihilated.
>
> All sense of just proportion is thus lost, and, with these daily, and often hourly, statements of great Allied gains and immense enemy losses, the public can have no true appreciation of the facts or of the gigantic task and heavy sacrifices before them.
>
> The Director appeals to all those who are responsible for the Press to use their influence to bring about a better knowledge of the real situation, and rather to emphasise the efforts that will be necessary before the country can afford to regard the end for which we are striving as anything like assured. The posters, more especially those of the evening papers, are very often preposterous as well as misleading, and, at such a time, those responsible may fairly be asked to exercise a reasonable restraint and help the nation to a just appreciation of the task it has undertaken and the necessity for unremitting effort to secure the only end that can be accepted.

The newspapers did not receive this without protest. On March 26, through Lord Riddell, they sent the following letter to Mr. Asquith, the Prime Minister:—

> My Council have had under consideration your Memorandum of 12th March 1915, Serial No. D 183, for which, in their opinion, there is no adequate justification. The Press has dealt faithfully with the news furnished by the naval and military authorities, but it may well be that the public misunderstand the situation and that this misconception is producing serious results. If, however, the people are being unduly soothed and elated the responsibility lies with the Government and not with the Press. In this connection my Council desire to direct your attention to the optimistic statements of the Prime Minister, Sir John French, "Eye-Witness," and other persons possessing official information. The Press acts upon the news supplied. If this is inaccurate or incomplete, the Government cannot blame the newspapers. My Council desire to represent that the methods now being adopted are fraught with grave public danger. Ministers are continually referring to the importance of energy and self-sacrifice on the part of the industrial population, who cannot be expected to display these qualities unless, generally speaking, they are acquainted with the facts. In dealing with the news, the naval and military authorities should consider not only our enemies and the army in the field, but the commercial and industrial classes at home, upon whom so much depends. It is futile to endeavour to disregard the long-established habits and customs of the people.
>
> As you know, I am writing on behalf of the London Press only, but my Council are confident that their views are shared by the provincial newspapers.

The result of this letter was that Mr. Asquith invited the Press to appoint a representative who would interview Lord Kitchener and Mr. Churchill, then First Lord of the Admiralty, each week with the object of receiving private information for circulation to editors. As a result of further urgent representations by the Association, correspondents on the French front were authorised in May 1915. At the beginning, regulations for their guidance were prescribed, but for the most part they were allowed to write as they wished. Before long, however, the regulations were rigidly enforced, and an attempt was subsequently made to strengthen them. The severe restrictions on the liberty of the correspondents led to continual complaints by the Association. Notwithstanding these, no marked improvement took place until July 1917. From that date onwards the stringency of the censorship was gradually relaxed, and the army eventually set up an organisation to supply correspondents with information. By the exercise of tact, discretion and good faith, the correspondents gradually won the confidence of the army, so that towards the end of the War officers of all ranks were keen to have the correspondents with their troops and to give every facility permitted by official regulations. Thus a great victory was achieved and a great service rendered by the correspondents to the country.

Until Nov. 1917 the censorship was controlled by the Intelligence Department at G.H.Q. At that date it was transferred to a department known as "staff duties." The difficulties were accentuated by the lack of association between the correspondents and the real head of the censorship at G.H.Q. The man who gave the orders did not censor the "copy," and was not in continuous and direct touch with those who did. The censors worked under great pressure, and complaints were due chiefly not to their decisions, but to principles laid down by those in command at G.H.Q. At other military fronts the system adopted was similar.

The navy had its own censorship. Generally the policy was to suppress all information, and in particular to suppress information of unfavourable events. Little was published concerning mercantile tonnage sunk by the enemy. There was, however, much to be said for suppressing these figures, publication of which would have put fresh heart into the enemy and given valuable information as to the submarine campaign. In many instances German submarine crews were unaware of the effect of their operations.

Domestic News.—Within the British Isles a rigid censorship was exercised concerning publication of information as to production of munitions, measures of defence, bombardments, air raids, arrests, trials and executions of spies, etc. Books, magazines, etc., were subject to censorship on the same principles as newspapers. In many cases the authorities refused permission to reproduce matter which had already appeared in American and other publications, the contention being that publication in Great Britain would tend to confirm and increase belief in the statements made.

As a method of suppression the censorship may be regarded as a complete success. The vast task was efficiently done, but the authorities displayed little imagination, and during the first two and a half years failed to realise that the War was a conflict between nations, not armies. They did not appreciate that the united effort of all classes was essential to victory, and that such effort could be secured only by telling the people the facts and letting them know that the War was a matter of life or death to the nation. Experience showed that in dark days the country always rose to the occasion. The authorities also failed to appreciate the necessity for telling other peoples, and in particular the Overseas Dominions and America, what Great Britain was doing. The rule prohibiting correspondents, except in rare cases, from describing the achievements of the different units, who were thus robbed of the glory to which they were entitled, had most unfortunate results. The Australian, Canadian and New Zealand censorships adopted a different system, so that the exploits of these troops were well known throughout the world. This led to the circulation of malicious stories to the effect that Great Britain was not doing her share, and was preserving her soldiers at the expense of those from overseas. Reference to the weekly casualty lists would at once prove the falsity of this statement. The truth is that, so far as the British effort was concerned, the main burden was borne by troops furnished from Great Britain.

The policy of secrecy was not confined to naval and military operations. It was only after continued protests that publicity was given to the achievements of the Ministry of Munitions, and of the manufacturers and millions of workers associated with it. Nothing was published about the working of the railways, one of the most remarkable feats in history. The Admiralty was a great offender. It was stated officially that "the navy did not wish for publicity." The result was that the British seamen, including the mercantile marine, mine-sweepers and fishermen, did not receive adequate recognition of their services. After continued representations by the newspapers, more publicity was given to their doings in the later stages of the War. Censorship bristled with difficulties, therefore the authorities may be excused for their inability in the early days to grasp essential facts, but they laid themselves open to severe criticism for delay in realising the necessity for a change of policy.

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III. CENSORSHIP IN THE UNITED STATES

Censorship.—The theory of censorship implies a stratified society with the right of the uppermost stratum to control those below. The controlling power may be the Church, using it to suppress heresy. It may be the State, using it to check sedition. It may be the representatives of the nation, using it to enforce an artificial patriotism. But whatever the authority putting censorship into effect, there seems substantial agreement that censorship is necessary. The United States, however, prior to 1914, had not accepted this theory, and censorship was considered outworn in practice. Trials for heresy were rare, sedition was unknown, and universal patriotism was assumed.

The War brought a rude awakening. While technical censorship was not instituted, every form of censorship was virtually established, though under different names. Preventive censorship was known as "voluntary censorship." Punitive censorship was enforced against the foreign language Press and against the American Press suspected of radical or even liberal tendencies. Regulation of the Press appeared in the restrictions put on second-class mail matter. Direct control of the Press was established under a committee euphemistically called a "Committee on Public Information." The result was a censorship described as "a web which caught small flies but which big ones broke through." The effect was an excessive irritation on the part of the Press, but it must be said that this opposition did not always extend to protesting against the censorship of the foreign language Press and the radical Press.

Censorship and Patriotism.—The explanation is found in the rapid development during the War and subsequent to it of an intense, fierce and aggressive patriotism. With no clear conception of the meaning of the term, no appreciation of the protean forms it had assumed, and no knowledge of the history of the sentiment, many individuals and self-constituted committees harried the public into hounding weak and defenceless newspapers because they did not conform to the standards arbitrarily and suddenly erected. It seems probable that freedom of thought, speech and Press suffered quite as much from the super-patriots as from recognised legislative authority. Censorship had been begun to maintain the integrity of the Government but the result was a progressive indirect censorship that even since the War has looked askance at freedom of thought. In the state it has passed from a formal official repression to a positive unofficial insistence on a defiant patriotism that seeks to protect the public from the contamination of foreign thought. For this an ignorant public rather than the Government has been responsible.

The habit of censorship once formed, extension to other fields has naturally followed. Literature, the drama and the moving picture have all come under suspicion. But censorship in these fields has had a different basis from that of censorship of the Press. Great diversity in standards of taste and morals has led to efforts to protect the public from crude art, drama and literature. But since criticism of taste is specially offensive to those criticised, the censorship desired has been preferably referred to the effect of low standards on morals. Thus far legislative censorship in these fields seems to have been averted and to have been exercised by special unofficial committees.

Since the War, official censorship of the Press has rapidly declined, and discussion concerning it is now confined to the desirability of the Press itself voluntarily limiting the publication of news of crime and scandal. The occasion has been the crime wave and lowering standards of morality usually regarded as an aftermath of the War. The objection to censorship of the Press has been to the idea of censorship itself: that comparatively few newspapers have suffered from it seems apart from the question.

Censorship of thought is applied by one wing of the Church to insistence on a forced orthodoxy of belief. It is desired by one class in society to protect the weak and the ignorant from low mental and moral standards. These applications of censorship are not universally accepted, but they find a good deal of support in various quarters.

Note.—These necessarily general statements are subject to many exceptions. The conclusions reached are based on about 10,000 clippings collected by the writer during the War with the object of discovering how far it affected the Press and the general subject of censorship. The collection is now in Vassar College Library.

(L. M. S.)

CENSUS OF PRODUCTION: *see* PRODUCTION, CENSUS OF.

CENTRAL AMERICAN UNION.—The idea of a Central American Union dates back to 1821, when the old Spanish viceroyalty of Guatemala proclaimed its independence (*see* CENTRAL AMERICA, 5.676). The year 1840 saw the complete breakdown of the first federal system, and between that date and 1907 five important attempts were made to re-establish the federation:—

1. 1842: Delegates from Salvador, Honduras and Nicaragua made a treaty providing for a confederation.
2. 1849: A treaty was signed by the central republics providing for common action in foreign affairs and a union for defence.
3. 1852: Further efforts were made along the same lines.
4. 1885: Rufino Barrios, President of Guatemala, made a forceful attempt to restore the old federation and failed.
5. 1895: Representatives of the three central republics met at Amapala and drafted a treaty establishing a diet to elaborate a plan for closer permanent union. A weak federation, under the name of the Greater Republic of Central America, was formed, and a constitution drafted, but, owing to faction differences and activities, the whole scheme had to be abandoned.

In 1907 President Zelaya of Nicaragua overthrew the Govt. of Bonilla in Honduras and attacked Salvador. This war was brought to an end by the mediation of President Roosevelt of the United States and Porfirio Diaz of Mexico. A conference of the Central American countries followed at Washington, which resulted in recommendations for a unification of communications, fiscal systems, customs and coasting trade; provision was made for the formation of a court of compulsory arbitration and for the holding of conferences to discuss federation. A treaty embodying these recommendations was signed. The conferences held from time to time after the 1907 treaty came to a head in Dec. 1920, when the five republics made a further attempt at unification. Agreement was reached, Guatemala, Honduras and Salvador signed a Pact, Costa Rica assented and Nicaragua refused; but when President Herrera of Guatemala was overthrown by a *coup d'état* on Dec. 6 1921 the project was again abandoned.

Meeting at Washington.—On Dec. 4 1922 representatives of the five republics met at Washington, D. C. A conference, lasting until Feb. 7 1923 was held under the chairmanship of Mr. Charles E. Hughes, the United States Secretary of State, with the object of negotiating a treaty to make effective the provisions of the treaty of 1907. As a result of this conference a general treaty of peace and friendship, 11 conventions and three protocols were approved for signature. Of these the treaty was the most important: it contained those parts of the 1907 treaty which it was considered would be practicable in maintaining peace among the five nations. Provision was made for measures to help in checking revolutionary movements, civil war and violent alterations of constitutions; on each Government was imposed an obligation not to intervene in the internal political affairs of the other four countries, and no secret treaties were to be entered into by any of the five republics. The other documents signed provided for the diplomatic settlement of controversies, arbitration, limitation of armies and control of arms, commissions to simplify and unify financial systems of the five parties and the establishment of an international Central American tribunal, to which 15 United States citizens may be appointed if necessary.

The 1923 agreements are by far the most important step towards Central American union that has been taken since 1840. The republics themselves thoroughly recognise the necessity for a unified system, and the 1923 general treaty of peace and friendship should go a long way towards removing the faction differences that have always been the chief obstacle to union.

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CERAMICS (*see* 5.703).—The progress made in the study of Chinese ceramics since 1910 almost amounts to a revolution. It is revealed in a mass of fresh ceramic literature of which quite a large proportion is of serious interest, the outcome of scientific methods and industrious research; and it has resulted in a much more accurate classification of the known wares and in the identification of many new types, as well as in the correction of innumerable minor inaccuracies. In fact at least 30% of the labels in every ceramic collection must have needed revision. Fruitful excavations have been made on many ancient sites in Asia and the countries bordering on the Mediterranean; and much interesting, if fragmentary, pottery has been found; but this belongs rather to the domain of archaeology and can hardly be included in the present brief survey.

We may, however, allow ourselves reference to one type of primitive pottery which seems to have been common to the whole of western Asia and parts of eastern Europe in the late neolithic and bronze ages. It is a comparatively fine pottery of buff, red or grey colour with painted decoration, mostly geometrical designs, in black or red slips. The latest finds in northern China have included a ware of very similar appearance, though rather more advanced in technique and more elaborate in decoration, which belongs to the third, perhaps the fourth millennium B.C. These finds not only open up a new vista in Chinese ceramics, but also raise important questions as to the origin of Chinese civilisation.

Chinese Ceramics.—Passing from the primitive periods, it is in Chinese ceramic history again that the most remarkable developments have taken place in the last decade and a half. Not merely a few pages, but whole new chapters have been written, and a quantity of entirely fresh material has been found to illustrate them. Thus, much has been learnt about the glazed and unglazed tomb wares of the Han dynasty (206 B.C. to 220 A.D.) which were first studied by Dr. Laufer in 1909. The period of the Six Dynasties (220–589 A.D.), so long regarded as a no-man's land, has been peopled with the charming Wei figures, with artistically pigmented vases and with the so-called proto-porcelain. The T'ang dynasty (618–906 A.D.), barely mentioned by the older writers, has been proved as great in its pottery as in the other arts; and even the tomb wares show that the T'ang potter was little behind the mature craftsman of the 18th century in technical knowledge, and not a whit behind him in artistic perception.

A fresh study of the Chinese texts in the light of the new material which has reached us, has made it possible seriously to attempt the classification of the beautiful Sung wares (960–1279 A.D.). Before 1910 we had barely learnt to distinguish the sea-green celadon of Lung-ch'üan, the cream-white Ting Chou porcelain, the mottled black tea-bowls of Chien-an and the brilliant Chün Chou flower bowls. These are now quite familiar; and we have gone on to identify the rare Ju type in the *ying ch'ing* (misty blue) porcelain, a translucent white ware with thick soft-looking glaze of pale duck-green or blue, of which many beautiful specimens have recently arrived in Europe. The Chien-an tea-bowls have expanded into a large group of stoneware and semi-porcelain with "temmoku" glazes, black and brown, including the Kiangsi temmoku and the multifarious Honan temmoku which doubtless include the wares of other northern provinces besides Honan. Another and even larger group of stoneware, with black and brown painted designs on a cream glaze or with bold *graffiato* decoration (both capable of many variations in colour and technique), is almost entirely new to us. These wares are generally labelled Tz'ŭ Chou, though Tz'ŭ Chou was doubtless only one of many centres which produced them in northern China. Cream-glazed stoneware painted in enamels of the muffle-kiln—green, yellow and iron-red—has now been traced back to the Sung dynasty; and there is little doubt, though circumstantial proofs are still wanting, that some blue and white porcelain should be assigned a similar date. As to the actual origin of porcelain, conjecture now dates it somewhere in the period of the Six Dynasties, and we have concrete proof in the excavations at Samarra on the Tigris that it was not only made in China in the 9th century but that it was already an article of export. The fragments found at Samarra include white and cream-white porcelain and two kinds of green celadon. Meanwhile the later Chinese porcelains have not been neglected, and some new light has been thrown on Korean ceramics.

Excavations to Near East.—After China the Near East has produced the most important additions to ceramic knowledge. Excavation has brought to light the earlier types of Persian pottery, the so-called Gabri ware with its bold *graffiato* designs covered with green and yellow glazes, the lead-glazed and tin-glazed pottery with lustre decoration or painting in blue, and the splashed and mottled wares which were obviously made in imitation of the T'ang pottery of the Chinese. Very early dates have been claimed for all these types, especially the *graffiato*, but without much justification. The excavations at Samarra are our only sure guide and from them we learn definitely that the splashed and mottled, the blue and white and the various kinds of lustred wares were made in the 9th century, as also a ware with incised designs under splashed glaze but differing widely from the bold *graffiato* of the Northern Gabri. The Mesopotamian ware is distinguished by a soft, close-grained body, usually pale buff, sometimes buff red and not unlike that of our European faience. Lustred ware resembling the Mesopotamian has been found at Fostat in Egypt and in the ruins of Medina Azzahra in Spain, linking up the lustre of the Near East with the Hispano-Moresque.

No major work has appeared on Italian majolica, though it and European faience as a whole have been skilfully treated in at least one large general work (Hannover). A detailed study has been made of the numerous German faience factories; and much has been learnt of the early history of Dutch faience and of the Antwerp ware, which preceded the celebrated Delft, and of its connections with Italy. In continental porcelains, some excellent studies have been made of the German figures; and the work of several individual modellers has been identified, notably that of Bustelli of Nymphenburg who was perhaps the most accomplished of the German porcelain sculptors.

English Ceramics.—The knowledge of English ceramics has been sensibly increased by research and excavation. The site of a pot works in Lord Street, Liverpool, yielded fragments of delft and saltglaze, besides an artificial porcelain decorated in blue in the Lowestoft style. The site of Whieldon's pottery at Little Fenton, Staffordshire, yielded a great variety of wares, including saltglaze and the Astbury types as well as the typical clouded Whieldon glazes. Excavations at Brislington, Bristol and Wincanton have shown that large quantities of Delft were made in the western counties from the middle of the 17th century and that Bristol produced the well-known " blue-dash " dishes among numerous other types. A large number of the moulds used at the Chelsea factory have been found, and identification of Chelsea figures has been made from them. A serious attempt has been made, with no little success, to segregate the early Derby figures, and analysis of the paste has led to the recognition of a few rare Worcester figures.

Similarly the porcelain made at Loudin's short-lived Bristol factory has been separated from the mass of early English blue and white and enamelled wares; and it has been clearly established that Loudin's plant was taken over by the men who founded the Worcester factory in 1751. Minor discoveries of this kind going on all over Europe, have helped to swell the volume of ceramic knowledge and, though there is no space to discuss them here, the attached bibliography will show where records of them are to be found.

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CEREALS: *see* FOOD SUPPLY; GRAIN.

CEYLON (*see* 5.778), a British crown colony in the Indian Ocean. Its area is 25,332 sq. m. and its population, according to the census of 1921, 4,504,549.

Constitution.—The elective principle of representation was first introduced in 1910 in the Legislative Council which was formerly on a nominated basis. In 1912 Sinhalese and Tamil representation was increased and the legislative council was composed of 11 official and 10 unofficial members, of whom four were elected. In 1920 the constitution was again altered, and for the first time provided for an unofficial majority, the council being composed of 14 official and 23 unofficial members, 16 of whom were elected; 11 of the elected members were for territorial constituencies.

In 1923 another change was made; the unofficial majority was further increased, while for the first time provision was made for an elected majority under the order in council of Dec. 19 1923. The legislative council was to consist of 12 official and 37 unofficial members, of whom 34 were to be elected; 23 of the elected members were to represent territorial divisions. The executive council is purely advisory to the governor, who may accept or reject its opinions. Until 1921 it consisted of a few of the highest officials only, but in that year its composition was changed so as to include four official and three unofficial nominated members —a European, a Sinhalese and a Tamil being appointed. The letters patent constituting the executive council do not limit its membership, and beyond three ex-officio members the governor may appoint as many persons as he likes, either official or unofficial.

Local Government.—The big towns—Colombo, Kandy, Galle—are administered by municipal councils, half the councillors being elected, and half nominated by the governor. Of lesser importance are local boards and boards of health, supplemented by provincial and district road committees and village tribunals and committees. The Local Government Ordinance, 1920, was intended to develop self-governing institutions which would be guided, assisted and controlled by a central local government board composed of official and unofficial members in equal numbers. Wherever there is a clear demand by the people of a district, the governor may order a district council to be constituted

ILLUSTRATIONS

Plate I.

Lung-Ch'üan yao, or "Celadon," vase, probably made by the younger Chang, who lived during the Southern Sung dynasty (1127–1279), of white porcelain biscuit covered on exterior, interior and under foot with brilliant, unctuous green glaze, clouded slightly with olive green on two sides, running unevenly over surface, in places so thinly as to allow the biscuit to show through, and again inside of mouth forming thick blobs. The shape is that of the jade tubes, huang ts'ung, or symbols of earth, with the typical tsu or tooth decoration, set off in eight rectangles on the corners. Southern Sung dynasty (1127–1279). Height, 16½ inches. Warren E. Cox Collection.

Plate II.

Pair of beaker-shaped Chün yao flower pots, marked with the Chinese numeral "1," probably indicating that they are of the largest size, from the Imperial Palace in Mukden. Of a greyish white porcelainous stoneware, covered with a thick plum-coloured and pale-blue glaze, in the depths of which are bubbles, streaks and mottlings, including the small "ch'un ying wen," or earthworm marks, which rarely appear except on the finer types. Sung dynasty (960–1279). Height, 10½ inches. Parish-Watson Collection.

Plate III.

Figure of Bactrian horse, excavated at Kai Feng Fu, in Honan province, modelled in buff-coloured biscuit, the body of which is covered with a warm aubergine or brown-black lead glaze very rarely used for this purpose. This type of large horse was unknown in China until the Han dynasty (206 B.C.–220 A.D.), when it was introduced from the west and interested the artists of the country because of its size and noble proportions. T'ang dynasty (618–906). Height, 33½ inches. Yamanaka Collection.

Plate III.

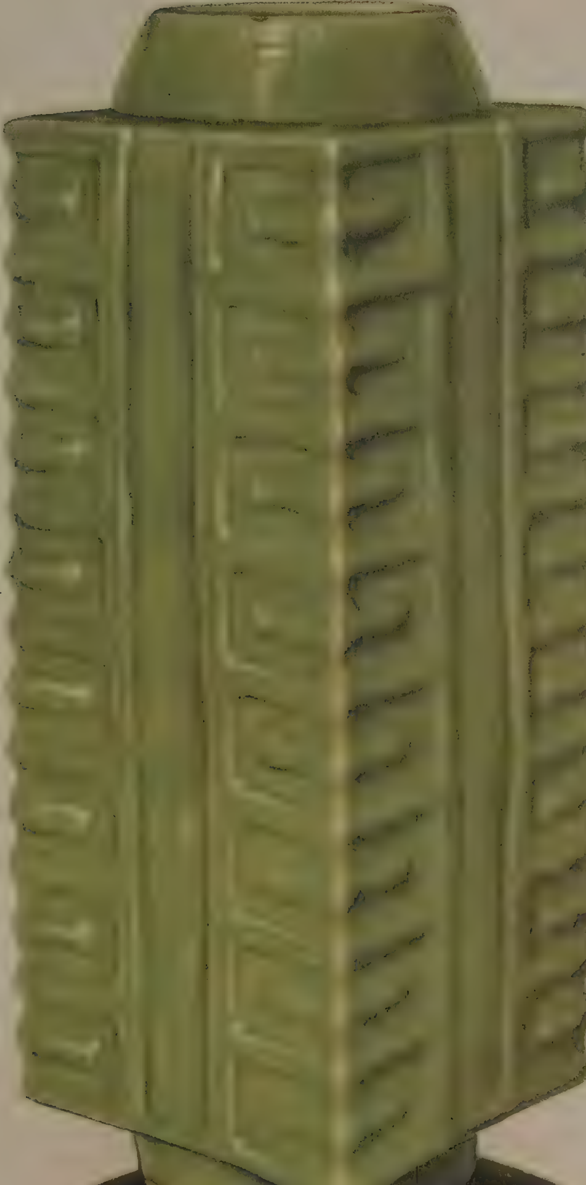
Incense burner of buff grey biscuit with wash of white slip and transparent cream white glaze with stops inside of mouth, decorated on each side, when originally made, with a free and beautiful painting, in the typical Sung feeling, of a lotus, in red (of copper, reduced with iron oxide), and outlined in the same colour, surrounded with foliage, in yellow and green enamels, outlined with black. It is impossible that these enamels could have been applied later, as undoubtedly was the case with most of the specimens of this character, as the crazing in several places extends clearly up through them and shows no trace under the glass of their having sunk into it. Tz'ŭ Chou (?) Sung dynasty (960–1279). Height, 7 inches. Warren E. Cox Collection.

Plate III.

Figure of pony, of buff biscuit with wash of white slip and transparent cream white glaze, finely crackled, extending down to just below body, leaving base and part of the legs exposed in the biscuit. Decorated with green and muddy yellow enamel, dulled and frosted over by burial, on crudely drawn saddle, top of mane and two harness ornaments at head. Faint pinkish traces outlining the harness and decorating the mane would seem to indicate that a red, similar to that used on the incense burner, had been applied and had almost entirely worn off. A comparison of this modelling with that of the noble T'ang dynasty specimen on the same page shows the typical gentle humour of the artist of China. Tz'ŭ Chou (?) Sung dynasty (960–1279). Height, 5½ inches. Warren E. Cox Collection.

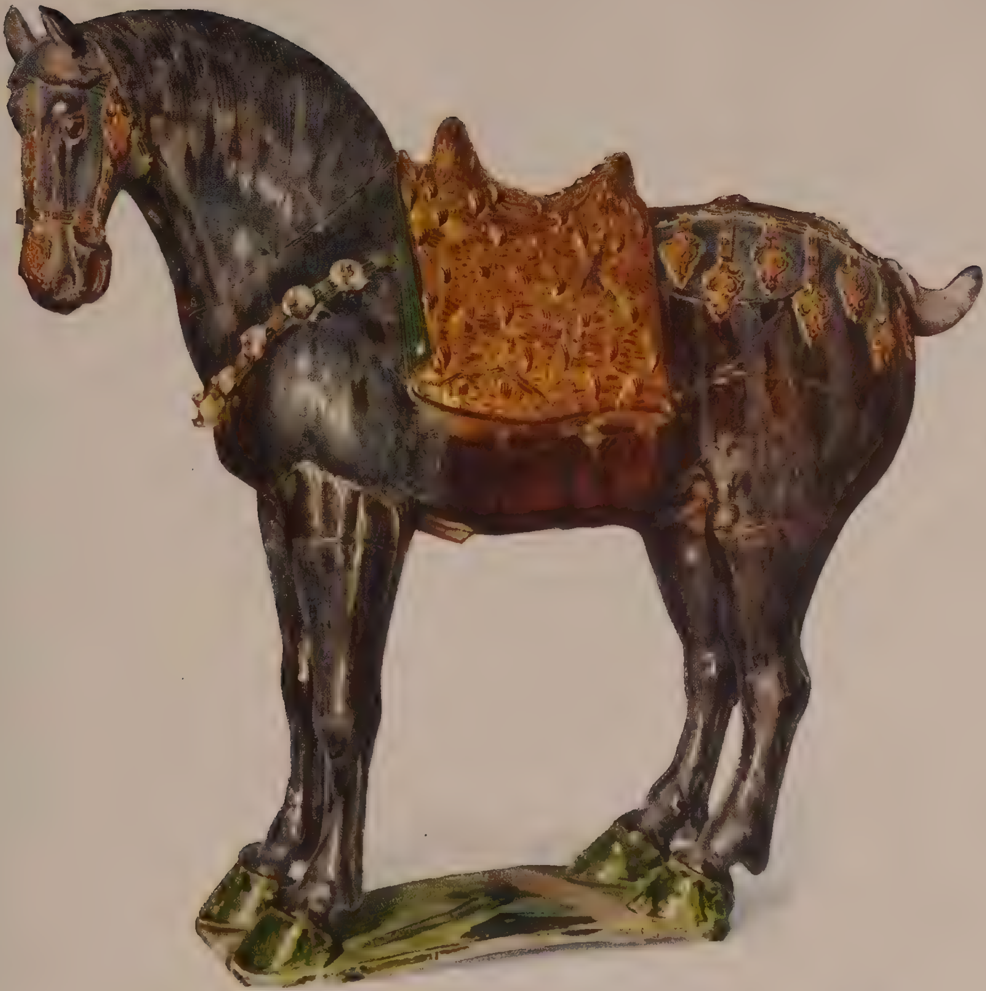
Plate III.

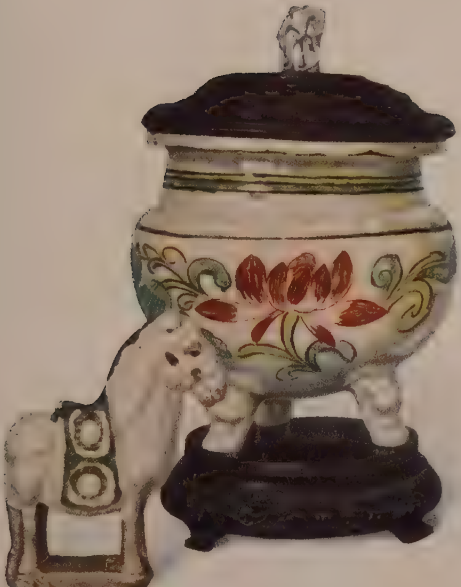
Tz'ŭ Chou vase, excavated at Lo Yang, Honan province, of dark buff grey stoneware, covered with white slip and transparent, clouded brown glaze. On the body of the vase are the four characters: Hsueh (snow), Yueh (Moon), Feng (wind), and Hua (flower), incised in the slip, allowing the biscuit to show through the glaze. Around the shoulder is a superbly direct and vigorous painting, in thick, dark olive glaze, of lotus blossoms, each petal of which is executed with a single brush stroke. Sung dynasty (960–1279). Height, 15 inches. Yamanaka Collection.

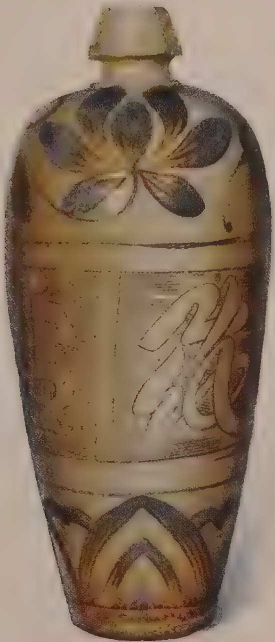


CERAMICS

PLATE III.







Under the Village Communities Ordinance the inhabitants of a village may hold a meeting, presided over by an official, and elect a committee to manage village affairs. This committee is a minor court of law, free from all formalities and where no lawyer may plead, deciding petty, civil and criminal cases, subject to appeal to the government agent. Guiding and assisting all these urban, rural and general district councils, village committees and tribunals, is the government officer, sometimes himself presiding, but often unseen, training and helping the people to be self reliant and self governing.

Justice.—The judicial system was established in 1833. Roman-Dutch law—a relic of the Dutch occupation—is the common law of the Maritime provinces, whilst in the Kandyan provinces the old Kandyan or Sinhalese laws prevail; but whereever possible the tendency is to apply the Roman-Dutch law. The administration of justice is complicated by the influence of Tesawalamai or Tamil custom in the north and the Mukkuvar law in the east, of Mohammedan or Buddhist (religious) laws, and of English commercial law. The Supreme Court has a full bench of five—a chief justice and four Puisne judges—and is the final criminal court of appeal, while appeal to the Privy Council is permitted in civil cases involving over Rs. 5,000. The island is divided into four circuits for holding assizes, and each circuit into several judicial districts where district courts have a limited criminal jurisdiction. Below the district courts are courts of requests and police courts, and below these are the village tribunals already referred to.

Population.—The census of 1921 showed the population as 4,504,549 composed of low country Sinhalese 43%, Kandyan Sinhalese 24%, Tamils 25%, Mohammedans 6%, Europeans 2%. The birth rate for all races is 38·9 per thousand (varying from 22 for Europeans to 40 for Sinhalese), while the death rate is 30 per thousand (varying from 10·9 for Europeans to 34·9 for Malays). Of the whole population 61·6% are Buddhists, including some 91% of the Low Country Sinhalese and Kandyans. Christianity was introduced by the Portuguese, and in consequence 368,499 out of the 443,000 Christians of all races in the island are Roman Catholics, only 44,730 belonging to the Church of England, while 31,000 are Christians of other denominations. Followers of the Hindu faith form 21·8% of the population, the bulk being Tamils. The country is divided into nine provinces. The largest of these is the North Central with an area of 4,008 sq. m., but the most populous is the western with a population of 1,246,847.

Apart from the university, medical and law colleges, education is controlled by the government director of education. In addition to over 1,000 government schools there were, in 1925, some 2,000 missionary and private schools receiving a government grant-in-aid. Pupils in attendance numbered nearly 10% of the entire population, and government expenditure on education equalled 7% of the entire revenue.

Finances.—Government revenue in 1910–1 was Rs. 4,70,00,000; by 1924–5 it had risen to Rs. 10,20,00,000 of which 40% was from import and export duties and port dues. Only 2% of revenue is expended on military forces. The financial position is very sound, for while the public debt is only about Rs. 16,00,00,000, less than two years' revenue, assets show an excess over liabilities of over Rs. 2,00,00,000 in cash, gilt edged securities and stores. In addition the government owns the railways, posts, telegraphs, telephones and many public works and buildings. A railway extension to Trincomalee was completed in 1925 and extensions to Batticaloa and Puttalam were under construction. There are over 4,000 m. of excellent metalled roads in the island. Government ownership of the port of Colombo brings in a revenue of about Rs. 50,00,000 annually, while railway gross revenue amounts to some Rs. 2,45,00,000.

Production.—Situated near the equator, with cultivation from sea level to 7,000 ft. (the highest peak in Ceylon is 8,200 ft. elevation), annual rainfall from 34 in. (in the north) to 319 in. (in the southwest centre), and shade temperatures varying from 27° F. (Nuwara Eliya) to 103° F. (Trincomalee), Ceylon offers scope for the production of a variety of products. Its prosperity rests upon agriculture, and the development of the plantation industry in the island makes a romantic story. The coffee crop, formerly the staple crop of the island, was destroyed by disease, and by 1924 exports had fallen to only 15 hundredweight. Faced with disaster the planter had sought to make good his losses by planting cinchona and tea, but the consequent falls in price, owing to the supply exceeding the demand, made cinchona production hardly a profitable business and restricted the extension of tea cultivation. Tea, however, was definitely established as the principal planting product of the island by 1900.

Yet again the planter sought for some other product for profitable enterprise, and the planting of rubber on a large scale was begun. In 1901 there were only 2,500 acres under rubber: by 1906 the area had grown to 100,000 acres, by 1912 to 217,000 acres, by 1919 to 385,000 acres and in 1925 it was roughly 435,000 acres. From 41,798 lb. in 1903, rubber exports rose to 45,000 tons in 1919. But yet again production outstripped consumption, and the industry in Ceylon and Malaya was therefore assisted by a temporary restriction scheme which, after two years operation, enabled the industry to rest again on a profitable basis (*see* RUBBER). Exports in 1924 were 37,351 tons.

Tea was still the principal product in 1925; its production employed more labour than any other industry, and the value of its exports exceeded that of any other product. The area under coconuts in 1925 was about 800,000 acres; the nut is used very extensively in the island as a necessary article of food, yet the exports of the fresh and desiccated nut, copra oil and fibre amounted to over Rs. 7,00,00,000 in value in 1924. In the same year the value of tea exported was Rs. 21,50,00,000, and of rubber Rs. 6,30,00,000. The production of cocoa, cinnamon, pepper, vanilla and cardamoms leaves a surplus for export, but, unfortunately, though there are 850,000 acres under paddy, the island is not self supporting in rice and annually imports 13,000,000 bu. worth £6,000,000. Plumbago is the chief mineral product; the export reached 703,666 cwt. in 1906, but in 1924 it was only 193,017 hundredweight. Rubies, sapphires and other precious stones are found.

Trade.—The development and prosperity of the island can be judged from the trade returns. Between 1910 and 1924 trade more than doubled in value. In the latter year the total value of imports (exclusive of bullion and specie) was Rs. 30,23,72,926 while domestic exports (exclusive of bullion and specie but including the value of stores supplied to vessels) were valued at Rs. 37,66,70,299. The principal imports are cotton, linen and silk piece goods, grain, coal, tobacco, hardware, sugar, tea and rubber chests, motor cars, manure, oil fuel, kerosene oil, cement and spirits. The chief exports are tea, rubber, coconut products, plumbago, cocoa, cardamom, cinnamon and citronella oil. Some 70% of the total trade is with the British Empire. In 1924 23·06% of imports came from the United Kingdom and 53·76% from other parts of the British Empire. Of exports 44·72% went to the United Kingdom and 18·20% to other parts of the British Empire. The number of vessels entering Ceylon ports in 1924 was 3,858 and their tonnage 10,649,557 tons: over 60% was British.

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CHAFFEE, ADNA ROMANZA (1842–1914), American soldier (*see* 5.800), died in Los Angeles, Cal., Nov. 1 1914.

CHALIAPIN, FEODOR IVANOVICH (1873–), also spelt Shalyapin, Russian singer, was born at Kazan on the Volga, Feb. 15 1873. His early career was a varied and adventurous one, and after being by turns porter, shoemaker, hunter and street sweeper, he became a singer and dancer and obtained engagements at the Tiflis Opera House in 1892 and in 1894 at the Summer Theatre, Leningrad (St. Petersburg), and later at the Imperial Opera House. After visiting Milan he took important parts in the Mamantof opera company, and at a private opera house in Moscow in 1896. In 1913, during the brilliant Russian opera season organised by Sir Thomas Beecham at the Drury Lane Theatre, London, he appeared in *Boris*, *Ivan the Terrible* and *La Khovantchina*. His superb bass voice and remarkable dramatic powers took his audience by storm and he had a similar success in *Prince Igor*. His seasons in New York were brilliant and among his rôles were Ivan the Terrible in Rimsky-Korsakov's *Maid of Pskof;* Salieri in the same composer's *Mozart and Salieri;* Leporello in Mozart's *Don Giovanni* and Don Basilio in Rossini's *Barber of Seville*.

CHAMBERLAIN, ARTHUR NEVILLE (1869–), British politician, was born March 18 1869, the son of Joseph Chamberlain by his second wife. Educated at Rugby and Mason College, Birmingham, in 1911 he entered the Birmingham city council, became chairman of its town planning committee and was lord mayor in 1915–6. During the early part of the World War he was an active member of the Central Board of Control of the Liquor Traffic under the Munitions Act, and in Dec. 1916 was appointed by Mr. Lloyd George Director of National Service. His schemes for co-ordinating military and civil employment met with much opposition, and in 1917 he resigned. At the general election of the following year he entered Parliament as member for the Ladywood Division of Birmingham, and was Postmaster-General from Oct. 1922 to March 1923, and Minister of Health in 1923. In the latter capacity he was responsible for the Housing and Rent Restriction Acts of 1923. He was appointed Chancellor of the Exchequer by Mr. Baldwin in Aug. 1923, but the Government fell before he could present a Budget. Again he became Health Minister in Nov. 1924, when the Conservative Government returned to power.

CHAMBERLAIN, JOSEPH (1836–1914), British statesman (*see* 5.813), died at Highbury, Birmingham, July 2 1914, having taken little part in public life for some years. In 1916 Mr. Chamberlain's widow married Canon W. H. Carnegie, rector of St. Margaret's, Westminster, and chaplain to the House of Commons.

CHAMBERLAIN, SIR JOSEPH AUSTEN (1863–), the eldest son of Joseph Chamberlain (*see* 5.813) and of his first wife, Harriet Kenrick, was born at Birmingham Oct. 16 1863. He was educated at Rugby and Trinity College, Cambridge, and afterwards studied in Paris and Berlin. During the early stages of the Home Rule controversy he acted as his father's private secretary, and in 1892 entered the House of Commons unopposed as M.P. for East Worcestershire. This seat he retained until 1914 when, on his father's death he succeeded him as member for West Birmingham. "I was born in Birmingham," he said when he was given the freedom of that city in 1926. "I was bred in Birmingham; Birmingham is in my blood and in my bones, and wherever I go and whatever I am, I shall remain a Birmingham man."

His maiden speech drew from Mr. Gladstone the famous compliment, uttered in his father's presence, that it was one which must have been "dear and refreshing to a father's heart." After a short apprenticeship as a private member, he was a Civil Lord of the Admiralty (1895–1900), Financial Secretary to the Treasury (1900–2) and Postmaster-General (1902). This rapid promotion was due rather to the towering influence of his father, during the days of his great Colonial Secretaryship, than to his own abilities, which were of a solid rather than of a showy order, while as a speaker he lacked the paternal dash and fire. In 1903 he was promoted to the Chancellorship of the Exchequer. He ardently espoused his father's fiscal policy of Tariff Reform, nor did he slacken in its advocacy when Joseph Chamberlain left the Balfour Administration in order to prosecute, with less embarrassment to the Prime Minister, his unofficial campaign. Unfriendly critics suggested at the time that the son's promotion to the second post in the Government was made in the hope of continuing his father's activities within reasonable bounds and preventing the threatened rupture in the party. Austen Chamberlain remained at the Exchequer till the Conservative débâcle at the polls in 1906 and there acquired the reputation of being a departmentalist of the best Victorian type—safe, cautious, hard-working and loyal to his official advisers and subordinates.

During the long Liberal domination from 1906 to the World War Austen Chamberlain consolidated his position as a Conservative leader and gained the high esteem of all parties. He suffered, however, a great disappointment when Mr. Balfour, dispirited by failure in the two General Elections of 1910, and weary of the intrigues against his authority, resigned his leadership of the Conservative party in 1911. Austen Chamberlain aspired to the succession and had the support of a considerable section of the party. But a slightly stronger section favoured the claims of Walter Long, and as neither would yield to the other, both honourably agreed to the election of Mr. Bonar Law, who became joint leader with the Marquis of Lansdowne. Austen Chamberlain did not allow his natural disappointment to affect his relations either to the party or to its new leader, and steered a straight course as a resolute anti-Home-Ruler and a convinced Tariff-Reformer.

When the first Coalition Govt. was formed in 1915, Austen Chamberlain entered Mr. Asquith's Cabinet as Secretary of State for India, and held this post until 1917, when he resigned in consequence of the Government's decision to submit to a judicial investigation the charges and criticisms embodied in the report of the Mesopotamia commission. In his view the public interest and his personal honour alike required his resignation, though not one of the charges referred to him. The official responsibilities for the "horrible break-down" of the hospital arrangements during the first advance on Baghdad were incurred without his personal knowledge. But he did not long remain out of office. In April 1918 he became a member of the War Cabinet and after the Armistice returned to the Chancellorship of the Exchequer in succession to Mr. Bonar Law. His guiding principle during the next two years was to strengthen British credit and pay off debt, and to that end he called upon the taxpayer to make unprecedentedly heavy sacrifices, especially in respect of income tax, super-tax and Excess Profits Duty.

In 1921 Mr. Bonar Law's failing health caused his withdrawal from active politics. Austen Chamberlain stepped into the vacant leadership of the House of Commons amid general acclamation. The post carried with it the virtual promise of the leadership of the Conservative party and thus a laudable ambition, frustrated in 1911, seemed certain of fulfilment ten years later. But the restraints and compromises of coalition had already begun to be irksome to many Conservatives, who distrusted the direction in which the Liberal Prime Minister of the Coalition was leading them. Austen Chamberlain, as Lord Privy Seal and Leader of the House, soon found that his staunch loyalty to his chief was bringing him into disfavour with many of the Conservative rank and file. The complaint was that he did not stand up to Mr. Lloyd George with sufficient firmness and that he sacrificed too many Conservative principles to the expediency of keeping the Coalition together. This feeling was sharply intensified when it was found that Austen Chamberlain had taken a leading part in the "surrender to murder"—as the Die-Hards described it—in connection with the signing of the Irish Treaty Dec. 6 1921. He had been, indeed, the first to suggest to the Prime Minister that a choice had to be made between negotiations with the rebels and a thorough reconquest of Ireland.

The Conservative party accepted the treaty with reluctance and with forebodings, and party confidence in Austen Chamberlain was weakened still more by his steady refusal to listen to those who suggested that fidelity to Conservative principles required him to lead his party out of Coalition bondage into party independence and freedom. His view, and it was shared by his principal Conservative colleagues in the Lloyd George Administration, was that Coalition was still necessary to deal with the difficult problems of the post-War period and not less to obviate the dangers of a Socialist Govt., which, without co-operation between the two older parties, could not in their view long be averted. When, therefore, the discontented Conservatives carried their revolt to a successful issue and at the Carlton

Club meeting on Oct. 19 1922 offered the leadership to Mr. Bonar Law—who accepted it—Austen Chamberlain once more saw the ruin of his legitimate hopes. He and those of his colleagues who shared his views and quitted office with Mr. Lloyd George, naturally had no place in Mr. Bonar Law's Cabinet, though Austen Chamberlain gave the new Government loyal support and uttered no word of recrimination. He remained a private member during Mr. Baldwin's first Administration and during the short period of the succeeding Labour Government. The dissensions in the Conservative party were gradually healed and when Mr. Baldwin formed his second Administration, at the end of 1924, the post of Foreign Secretary was offered to and accepted by Austen Chamberlain.

He entered on his duties at a singularly favourable moment. The settlement of the intricate problem of Reparations by the acceptance of the Dawes Plan had prepared the way for the settlement of the other great European problem of security. The plan of the Geneva Protocol being unacceptable to the British and Dominion Govts., Austen Chamberlain revived the plan of a Guarantee Pact between certain Western Powers, which by dint of his skill in conciliation he succeeded in getting adopted by Germany, Belgium, France, Great Britain and Italy.

The conclusion of the Pact of Locarno and the spirit of general good-will in which the Conference had been conducted created great hopes that at last the post-War era had closed and the nations of Europe no longer regarded one another exclusively as Allied or ex-Enemy Powers. Austen Chamberlain's work was highly eulogised at home and abroad, and the Order of the Garter was bestowed upon him by the King. The sequel to the Locarno Pact, together with a detailed examination of the Pact itself, is dealt with under the article SECURITY. (J. B. F.)

CHAMBERLAIN, JOSHUA LAWRENCE (1828–1914), American soldier (*see* 5.819), died at Brunswick, Me., Feb. 24 1914.

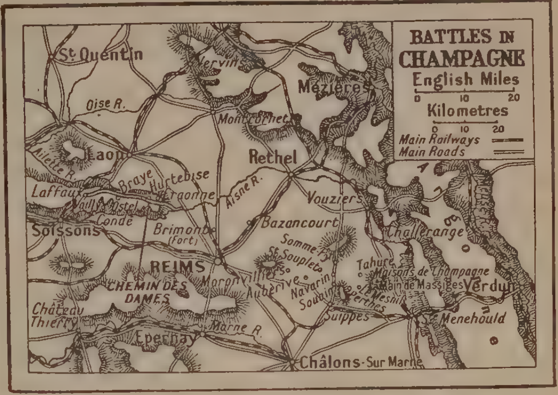
CHAMPAGNE, BATTLES IN.—Under this title appear critical accounts of the offensive that was launched by the French on the Champagne front in Sept. 1915, and of the one undertaken early in 1917. British forces co-operated in the latter; but although important results were obtained in 1917, neither operation can fairly be said to have fulfilled the hopes of the Allied commanders.

I. THE SEPTEMBER OFFENSIVE

All through the summer of 1915 local attacks had been proceeded with in the Vosges and Argonne area, while at the same time preparations were being made for operations in Champagne on a larger scale than the preceding ones and for a powerful diversion in Artois. The objective in Champagne was the rupture of the German front from Bazancourt to Challerange, so as to outflank their positions to the north of Rheims and in the Argonne. It was hoped thus to sweep up the Eastern Front. Attacks were to be made between the heights of Moronvilliers and the Aisne. At the beginning of Sept. the Germans had 70 battalions of the III. Army (Von Einem) in Champagne. During the artillery preparations which preceded the French attacks they reinforced these by 29 battalions and later by 93 others. Their strength in Champagne was thus raised to 192 battalions, but the mix-up of units was calculated to make their command difficult.

On the side of the Allies, the arrival in the Albert region of the British III. Army, and the extension northwards of the French VI. Army, had permitted the transfer of the II. Army (Pétain) from Artois to Champagne. Under the direction of Gen. de Castelnau, this II. Army with the right of the IV. (de Langle de Cary) and the left of the III. (Humbert) represented a total of 35 divisions or at least 420 battalions, more than double the enemy forces engaged. However, the secret of the future offensive was so badly kept that as early as Aug. 15 a German order had foreseen it. The artillery preparation commenced on the morning of Sept. 22 and continued with great effect for three days and nights. On Sept. 22 and 23 the weather was favourable, but the 24th was cloudy. Rain fell from 9 A.M. on the 25th and continued for several days—an important factor.

At 9:15 A.M. on Sept. 25 the assault took place along the whole front and generally speaking succeeded brilliantly. Nearly everywhere there was a gain of from 2,000 to 4,000 yd. in depth, reaching even the second position in one sector. A break through seemed certain, but the French front was very irregular, some parts were facing east, some west and the rest north. In the region of Perthes-Souain, Sept. 26 and 27 were devoted to reinforcing the line and pushing it as far as the second position. On the 28th the reconquered territory between Aubérive and the western part of the Valley of Souain measured about 20,000 sq. yd. and 3,000 prisoners and 44 guns had been captured. Progress in the east had also been made on the 27th in the neighbourhood of Tahure; a counter-attack retook Maisons de Champagne on the 26th and the attack on La Main de Massiges only progressed with difficulty. On the 28th, contact had been made with the second position on a front of about 9 m. to the south of St. Souplet and of Somme-Py, but Aubérive remained in the hands of the Germans as well as the hill of Le Mesnil and the woods to the east. These positions, however, were menaced on their flanks.



On Sept. 28 and 29 a part of the second position was carried to the west of Le Mesnil and Navarin farm and a break through was made in a narrow section, but the enemy was able to reestablish his front. The French Cavalry Corps had to retire on the 28th to the rear lines without having been engaged. On the 30th a general order announced the end of the operations with the capture of 25,000 prisoners and 150 guns. Nevertheless, abortive attacks continued until Oct. 8. The Champagne offensive cost the French 80,000 killed and missing and 100,000 sick and wounded. The results were not in due proportion to this sacrifice, mainly because the attacks had lacked the characteristics of surprise, rapidity and continuity, and had been continued over a longer period than was necessary. (B. E. P.)

II. FRENCH OFFENSIVE ON THE AISNE

The plan of campaign of the Allies for 1917 was made out in a conference at Chantilly, Nov. 18 1916, between the commander-in-chief, Joffre, and Haig, together with the British, Italian, Russian, Belgian, Serbian and Rumanian military representatives. The formation of new German divisions argued a second offensive in the spring, probably on the Western Front. It was decided to forestall this. The Allies held themselves ready to make a general offensive move with all their available strength about the first fortnight in Feb. 1917. On the Aisne, the French offensive was to extend from Vailly to Rheims. Gen. Pétain, consulted by Nivelle on the proposed action, criticised it freely and refused the leadership, which was entrusted to Gen. Michelet. The V. Army (Masel) which had held this front since 1914, closed on its right to make room for the VI. (Mangin), while the X. Army (Duchesne) was in reserve.

Nivelle's Plan of Attack.—Nivelle had decided on a sharp attack, aiming at carrying the positions and all the artillery zone at the first assault. This was in accordance with Joffre's scheme of Dec. and resembled the method twice employed at

Verdun. No one raised any serious objection, but Nivelle foretold an immediate exploitation of the success by the X. Army, which should carry it as far to the north as possible. Michelet estimated that the whole operation might be accomplished the first day, or at latest on the morning of the second. He indicated as objectives the foot of the heights to the north of the Ailette, the plain of Laon, and the east of Brimont Fort. The only objection was raised by Mangin, who called attention particularly to the importance of good atmospheric conditions. This did not modify Nivelle's wishes, and Michelet exaggerated them by giving such detailed orders that no initiative was left to the army commanders.

The preparation for the offensive was in full swing when, on March 14, the German retreat to the Hindenburg line commenced, and on the 19th it extended to the front between the Oise and the Aisne. These well prepared movements, cleverly carried out, were very successful. The spoils captured by the Allies were relatively unimportant and the evacuated country had been systematically devastated. Nivelle's plan had to be modified by this retreat, the Oise-Somme attack lost all interest and that upon the Aisne alone remained. Mangin called attention to the fact that the retirement had left a right-angled salient about the Laffaux mill and that an attack to the north would be able to take the Chemin des Dames in reverse. The commander-in-chief admitted this and two divisions were devoted to this local operation. In addition it was decided that the IV. Army (Anthoine) should attack the Massif de Moronvilliers, east of Rheims.

Two other events entirely modified the general situation—the entry of the United States into the War and the Russian revolution. On top of this a political incident led to the retirement of Gen. Lyautey, Minister of War. He was replaced by M. Painlevé, who was hostile to Nivelle's plans. This weakened the confidence of the commander-in-chief's subordinates, and Nivelle went so far as to offer his resignation, which was refused.

The Anglo-French Advance.—The offensive commenced on April 9 before Arras, and continued up to the 14th with considerable success. There was no break through, but 14,000 prisoners and 104 guns were taken by the British. On April 14, Franchet d' Esperey's group of armies came up to the Hindenburg line in the neighbourhood of St. Quentin, but Franchet d'Esperey decided that with the means at hand a successful attack was impossible. The operations on the Aisne should have commenced on April 12, but were put off, first to the 14th, then to the 16th on account of the bad weather. The front of attack measured 25 miles. The VI. Army (Mangin) operated on nearly 10 m. with 17 divisions plus a cavalry division and a territorial division, 1,669 guns, of which 823 were heavy or large; the V. Army (Masel) had a nearly similar strength but with 1,967 guns (1,107 heavy or large). The artillery preparation commenced on April 5 and continued until the 15th on account of the postponement of the attack. It sufficed, but its duration permitted the Germans to make suitable dispositions and there was no surprise. On the morning of April 16 the Allies carried the first German line on the whole front. The right and centre of the V. Army gained a depth of 1½ to 2 m., but on the left a tank attack, badly conducted, failed with heavy losses and the infantry rapidly came to a standstill on the plateau of Craonne. The right of the VI. Army took the position of Hurtebise and pushed as far as the Ailette, but further east the fighting was desperate and the gain insignificant. In the centre progress was more satisfactory, though difficult. On the left, the commencement was good, but the advance quickly became wild, and at certain points it was practically negligible.

Results Obtained.—To sum up, although some good results had been obtained the hoped for success had not been won. Badly informed, Nivelle imagined that on the 17th he ought to stop the northern advance of the VI. Army and push the V. Army towards the northeast. This order became delayed, so on the 17th Mangin continued his attacks, notably in the centre, where he made a marked advance on the front Braye en Laonnois-Ostel. The situation having changed, Mangin ordered a vigorous pursuit, in spite of the stopping order. The fort of Condé was occupied and a slow push was made towards the Chemin des Dames. On the same date (17th), the IV. Army (Anthoine) had made good progress in the Massif de Moronvilliers. Between the 16th and 20th, they had captured 21,000 prisoners and 183 guns, progressed some 5 m. on the Aisne front of 7½ m., seized a dozen villages, the fort of Condé, and all the observation posts which overlooked the Aisne; in the front line the morale was good, particularly in the VI. Army. Of the 52 German divisions in reserve available on April 1, only 16 remained unengaged. This result was less than had been hoped, but it was nevertheless appreciable and certainly superior to those of preceding offensives.

Unhappily the morale behind the front line was rapidly declining, the losses being greatly exaggerated. Nevertheless Nivelle continued his operations. The X. Army took up its position on the plateau de Craonne, between the V. and VI. Armies, but on April 27 Michelet wrote that he had not strength enough for a general offensive toward the north and that he proposed to limit himself to local attacks. Nivelle accepted this solution. It was sought to carry Brimont, to enlarge the position on the Massif de Moronvilliers and to complete the conquest of the Chemin des Dames. These operations, rendered more difficult by the unfortunate intervention of politicians, produced very poor results.

Attitude of the British.—The British Govt. and Sir Douglas Haig saw with regret the arrest of the French operations. Haig was called to Paris on April 26 to confer with Ribot and Painlevé, who pointed out the French losses, deducing from them the necessity of stopping the offensive. Haig held to his opinion and appeared to have won, a result confirmed by two inter-Allied conferences at Paris. Mr. Lloyd George vigorously seconded Haig's view. The French Govt. seemed to be convinced and made promises which were not carried out. The British Offensive continued on the Scarpe and that of the French IV. Army on the Massif de Moronvilliers and on the plateau of Craonne, the latter being captured on May 4. Laffaux mill was carried on the 5th, together with the neighbouring positions. For several months, however, the X. Army could only with difficulty hold on to the crest of the Chemin des Dames.

The Franco-British attack of April 1917, resulted eventually in the capture of 62,000 prisoners and 446 guns. The French had lost from April 16 to 25, 15,000 dead, 60,000 wounded, and 20,500 missing. On the whole 50 m. front of attack the enemy had been obliged to construct new lines of defence. He had lost the Vimy crest, Laffaux mill, Condé Fort, the Chemin des Dames and the Massif de Moronvilliers. Important lines of railway were under fire from the Allies. All the 52 reserve German divisions of April 1 had been employed by May 4, and quiet sectors had been robbed to reinforce the Aisne line. On May 25, 99 divisions had already appeared on the front attacked, of which 11 had appeared twice. This expenditure was triple that before Verdun in 10 months. The Germans could not stand this long, for they had only 150 divisions on the Western Front against the Allies' 178, and it was easier for the Allies to repair their losses, for they had adequate reserves.

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CHANCE: *see* PROBABILITY.

CHANG TSO-LIN, Chinese general, was born about 1875 and little is known of his early life. He first came into prominence as a leader of bandits in northern Manchuria. After the Russo-Japanese War of 1904–5, in which he fought for the Japanese, he joined the regular army, and in 1911 was appointed military Governor of Fengtien. As the Central Govt. weakened Chang Tso-lin became more and more independent, and in 1922 a clash occurred which resulted in his defeat. But the Chihli Army did not pursue him to his stronghold at Mukden, and in 1924 he decisively defeated the opposing forces. Fighting recurred in 1925, and he again defeated the Chihli Army under Wu Pei-fu, but was robbed of the fruits of victory by the treachery of his ally Feng Yu-hsiang, who seized Peking. As the year 1925 drew to a close, the struggle for mastery entered on a new phase. Wu Pei-fu was for a time eliminated, Chang Tso-lin subdued a revolution in Manchuria, ere Feng Yu-hsiang entered Tientsin after a big battle. In the spring of 1926 Feng was overthrown and fled to Mongolia in consequence of a powerful alliance between the old enemies, Chang and Wu. Regarding the control of Peking and national policy as a whole, his relations with Wu were uncertain, but Chang seemed firmly master of his old ground in the north. (*See* CHINA.) (G. C. D.)

CHANNEL ISLANDS (*see* 5.840).—The population, according to the census of 1921, was 89,614; the effective population, *i.e.*, excluding visitors, was estimated at about 87,500.

During the World War the Islands provided a considerable number of men for overseas service. In 1917, when the Imperial Govt. relieved the Insular funds of the cost, previously borne locally, of the local militia, the question of a contribution from the Islands of Jersey and Guernsey to Imperial funds was raised. In recognition of this relief of their revenue, the States of Jersey voted, in Dec. 1917, a gift of £25,000 towards the cost of the War. In 1918 it was suggested by the British Home Secretary that the Islands should share in the financial burden of the War, and the States of Jersey made further contributions of £50,000 in Dec. 1918, and £25,000 in March 1919, making £100,000 in all. In Dec. 1918 Guernsey made a contribution of £100,000.

The Question of Financial Aid.—In the report of the committee of National Expenditure of Feb. 21 1922 the committee commented on the fact that the Islands made no annual contributions to the Imperial revenue, though they obtained practically the same benefits as though they were part of the United Kingdom. As taxation in the Islands was very light, the committee recommended that the Government might suggest an annual contribution from the Islands to the Imperial Exchequer.

In Jan. 1923 the Home Secretary again invited the Islands to consider the question. In view of the fact that no response was made by Jersey to this invitation, and that the contribution offered by Guernsey was below that the Government considered equitable, a committee of the Privy Council was appointed on March 9 1925 to consider the whole matter. The committee recommended that the contributions to the Imperial funds should be annual sums of £120,000 from Jersey and £75,000 from Guernsey, payable for a period of 100 years.[1] The states of Jersey and Guernsey did not accept this recommendation. Jersey offered a final contribution of £300,000, and Guernsey of £220,000.

Trade.—Exports from the Islands to Great Britain, mainly potatoes, tomatoes, grapes, fresh flowers and granite, are valued at about £3,500,000 annually; imports from Great Britain are valued at some £3,750,000 annually. The two main sources of income in Jersey are agriculture and the tourist trade. Imports increased in value from £1,163,811 in 1913 to £2,744,648 in 1924, and exports from £970,671 to £1,647,214. Cattle rearing is of considerable importance.

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CHANTAVOINE, HENRI (1850–1918), French man of letters (*see* 5.847), died at Galuire (Rhône) Aug. 15 1918.

CHAPLIN, HENRY CHAPLIN, 1ST VISCOUNT (1841–1923), English politician (*see* 5.852). Mr. Chaplin on his return to the House of Commons in 1907 as member for Wimbledon was generally welcomed as a type of parliamentarian who was fast disappearing. He intervened with effect on questions of land and of social and tariff reform, but otherwise was not so prominent in debate as in past years. When the first Coalition Govt. was formed in May 1915, he was left almost alone on the front Opposition bench, and it was felt to be a fitting close of a distinguished career in the Commons, when he was raised to the peerage in April 1916. He died in London May 29 1923.

CHAPLIN, CHARLES SPENCER (1889–), motion-picture actor, was born April 16 1889, of English parentage, and passed his early years in London. At an early age he appeared on the music hall stage with his father and brother Sydney, taking small parts in vaudeville. After a short experience on the legitimate stage he re-entered vaudeville in London, as a member of the Fred Karno Company. In 1910 he went to the United States as leading comedian in a Karno production, *A Night in an English Music Hall.* He attracted the attention of Joseph M. Schenck, and on the latter's suggestion he was engaged by Mack Sennett to make moving pictures with the Keystone Comedy Company at Hollywood, California. In his first picture, made in 1913, he adopted the eccentric costume which has ever since been associated with his name. His success was immediate, continuous and universal. In 1918 he formed his own company, and produced a series of motion pictures which placed him in the front rank of artists and in a category of his own in the field of screen comedy. Among the more successful of his later releases were *A Dog's Life* (1918), *Shoulder Arms* (1918), *The Kid* (1921), *The Idle Class* (1921), *The Gold Rush* (1925) and *The Circus* (1926). In all of these he was the central figure. In 1923 he directed, but did not personally appear in, *A Woman of Paris*, a serious picture, displaying extraordinary skill in construction and ensemble, which has been used as a model by subsequent directors.

CHARACTER.—To ask what character is reveals the confusion of ordinary thought about it. Instincts, habits, impulses, desires, emotions, sentiments all belong to it. But what relation do they bear to one another? What is the part of character that has to be controlled and what is its controlling part? Whence come those things that are called "principles" of conduct, and "ideals," and the multitude of "qualities of character"—courage, steadfastness, sincerity, tolerance, generosity, patience and honesty, and their opposites? We do not know. The first general problem of the psychology of character is therefore to transform the chaos of the ordinary conception of it into one in which the parts of character are seen to bear a clear and intelligible relation to the whole.

There are certain common but useful antitheses "character and intelligence"; "character and circumstances"; "character and conduct." Conduct is the expression of character; only actions that are in some degree under voluntary control are included in conduct. Reflex actions are not included in conduct; instinctive actions are. Character is the driving force; intelligence guides it to its destination; together they sum up the human mind and are inseparable in it.

Stages of Character.—These may be classed under three heads, which roughly correspond to three levels of mental development: (1) the instinctive; (2) the emotional; (3) the level of sentiment; and again roughly these three are represented in (1) the life of the animal; (2) the life of the child; and (3) the life of the adult human being. The first is the most perfect in organisation; but also the most rigid, in which intelligence has least formative influence. The second is the most helpless and marks the transition from a lower to a higher form of organisation, for which the guidance of the adult mind is indispensable. The third is the most plastic and comprehensive; but its organisation is never completed. In it reflection, reason and self-control have their full opportunities; yet it is the region of folly and error, with which we can hardly charge the animals; of mistaken valuations followed by disillusions; of progress and decadence; of constancy and infidelity. It has never been understood.

These three, instinct, emotion, sentiment, each after its kind, are systems. As everything in the body is a system or a part of a system, so is it in the mind. Reason and self-control are priceless; but they do not function in a void. They are the properties of the highest systems of the mind—the sentiments.

The Human Instincts.—Animal instincts are inherited dispositions having specific patterns of behaviour for the attainment of their ends. An impulse felt in consciousness precedes their operation; attention accompanies it, and serves to adapt the pattern of behaviour to the actual situation. Human instincts have lost these patterns except in the case of simple instincts, as sucking, shrinking and clinging; in others the child must learn by experience to acquire new means to replace the old. Apart from these acquired processes his instincts are revealed as impulses innately determined to pursue certain ends. But with the loss of their instinctive behaviour they have become more plastic. How many ways of concealment has not man learnt! The end itself has been conceptualised. The end for an animal is perceived—a hole or cover; the end for man may be conceived—a secret thought. In this sense, as instinctive impulses defined by their ends, we can enumerate the most important human instincts. They are flight and pursuit, concealment and display, domination and submission, attraction and repulsion, destruction and construction, crying for protection and giving protection, curiosity and search, and the food and sex instincts. The ends are only proximate ones, assumed to have been selected first for their biological utility; but in man they are also indispensable to the ends which he invents—wealth, power, fame, well-being, happiness, perfection.

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[1] *Report* of the committee of the privy council on the question of contributions to Imperial funds from the islands of Jersey, Guernsey and Man. (Cmd. 2586.)

The instincts sometimes act independently of emotion, finding in their own impulses when unchecked the force to attain their ends; but (1) when their impulses are obstructed they tend to arouse anger or fear; (2) when they attain their ends, joy or satisfaction; (3) when they fail completely, sorrow or despair. The emotions never act independently of instincts, and tend to organise in their systems all that subserve their ends. Hence we find concealment not only in fear, but in the anger of revenge; in shame; in envy; in sorrow; in the joy of children's games. This seems to be the relation between instincts and emotions.

Difference Between Instinct and Emotion.—They are often confused because so often combined together. An instinct advancing to its end unchecked does not need to arouse emotion. In itself it is unlike emotion; it is most like habit. Both instinct and habit are orderly and stable, showing so little variability in action that we forecast the course of it. Emotion unrestrained is unstable and disorderly; its actions often surprise us. We follow our strong habits often without recognising them; they are calm and unobtrusive; we cannot help recognising our strong emotions. Hence it is, when emotion and instinct are conjoined, the second as it comes into operation tends to calm the first. It is the moments before action, we remark, that are so tense. For the force which emotion brings is for the needs of a certain situation. It should not therefore persist for long, and if it does, it tends to become pathological, as we see in the case of our morbid fears. But it is the nature of instinct and habit, and love and hate, to persist indefinitely.

Besides these differences between instincts and emotions there are those based on the nature of their systems. Emotion is potentially more complex. Concealment is only one of many instincts organised in fear which may choose this instinct or any other better adapted to the actual situation: flight, shrinking or clutching, or shrieks for protection. From the time of Bain it has been recognised that strong emotion is accompanied by a diffused nervous disturbance; and this may render emotion more adaptable to a changing situation; whereas when an instinct is unchecked, and following out the normal course of its behaviour, the nervous discharge tends to be restricted to those channels which sustain this behaviour. Here the intervention of emotion would be not only superfluous but harmful.

The value of emotion lies in these two points of difference from instinct: (1) the force which it brings to deal with a given situation, and (2) its potentially more complex and adaptable system. It is indispensable to the sentiments, and without it there could neither be love nor hate. All great changes of character are initiated by emotion.

The Stage of the Sentiments.—Whence comes the power that man has to hold up his emotions and the ideas of action they thrust upon his attention and would forthwith accomplish? That which has to exercise control must have a wider outlook than that which is to be controlled; but unless it moves us its warnings are ineffectual. It must move us by some other influence than emotion. The emotions cannot cure their inherent defects of impulsiveness and lack of reflection, being without self-control. Self-control comes from a higher system than emotion, and one that by its comprehensiveness more adequately represents the self. Love and hate, the chief sentiments, have this comprehensiveness. They are that governing part of character to which we have referred; and all the part which has to be governed is beneath them, under their authority. But if the sentiments are, as we now take them to be, systems of emotional dispositions, how do these provide them with the self-control they need? Joy and sorrow, hope, anxiety and disappointment, are the common lot of all of them; but there is something else in their systems. The impulses of their emotions become desires, these grow more abstract and general with experience, until at length the desires that change give rise to the desires that are always the same: from meetings and separations, from agreements and discords, the desire for union; from passing enjoyments, happiness and well-being; from acts of love the desire for reciprocity of love. Thus love obtains its great organising desires directed to its unchanging ends of union, happiness and well-being of the loved object, reciprocity of love, and the desire to be happy in the love of the object. But in hate these ends are reversed: not preservation and union, but destruction and separation; not happiness and well-being, but misery and the worst possible state of the object, and yet withal, the desire to be happy in the separation, misery and destruction of the object.

In these great desires love and hate find the principles of their self-control—not in their emotions. Here is the governing part of their systems; the centre on which the rest depends. Hence the long-continued struggle between this central part and the emotions, impulses and momentary desires that surge up against it from the inferior part, the imperfect self-control attained, and from its failures the birth of the highest part of the systems—its ideals. With these ideals come those familiar qualities of character—courage, patience, steadfastness, sincerity, sweetness, tolerance and generosity—some of which every love discovers anew for itself in the mirror of its own failures.

These are the three parts of love, restricted in impersonal forms of the sentiment, but still substantially the same, revealing too the mixture of love and self-love in the very desire for union, reciprocity and happiness.

Repression.—Repression is an extreme form of the self-control of sentiments. For if some of their emotions have to be regulated as being either too strong or too weak, others which are judged to be harmful in view of their ends have to be repressed. Such repression of things within the mind corresponds most nearly to "destruction" of things without us. We would destroy some things in our character if we could; but we can only repress them, which means to exclude them from consciousness, and prevent as far as possible their return to it.

In this sense we not only try to repress emotions, like unreasonable fears and false shames, but loves that are disgraceful or even unfortunate, and most of our hates. Such repressed fears, loves and hates are now called "complexes." For as it is essential to a sentiment to be accepted by the subject of it, so it is essential to a "complex" to be repressed.

There are different degrees of repression: (1) Those with which medical psychology deals. Here the dissociation of the repressed constituents from the consciousness of the individual is so complete that unaided he cannot recall them; (2) those, much more common, which, though completely repressed, he could recall to consciousness if he desired to; (3) those which are imperfectly repressed, and after a certain time reinstate themselves in consciousness independently of his desire. To this class belong all the vices from which man struggles to escape, which, strengthened by habit, make him recognise his weakness: debauchery, perversions, drunkenness, gambling. Repressions therefore in all degrees have great importance for character as indicating the different ways in which self-control may be defective.

Conscience.—There is another sentiment distinct from both love and hate, which, like them, often undergoes repressions. The uniqueness of conscience makes it difficult to interpret, for there is a particular conscience belonging to all love of which its ideals are a part. This is partial to the loved object. The conscience is general, and being neither love nor hate, when it acts, it acts impartially. It has its own emotional system: a calm joy, sorrow, remorse, shame, fear and indignation; all are penetrated by its approvals and disapprovals. It is the repository of that part of the moral beliefs of the community in which the individual has been instructed and which he has adopted through authority and suggestion. It is therefore apt to differ from one person to another. But when it is a living force of character, it grows with a man's experience of life, and through the illusions and disappointments of love. These impress certain ideals and duties upon his mind differently from hearsay, however often repeated. They become the most vital part of his conscience, being there freed from the partiality to which love at first confined them. And as the ideals of love are much the same in its different varieties, the most general and important duties come to be impressed, sooner or later, on most men. There are those who have to repress some part of them from remorse, and shrink from having to face it again in consciousness; but their denials of its beliefs, to which they try to make other men conform, never wholly convince themselves.

Thus is shewn in merest outline how the parts of character are related to one another and the whole—how the instincts, habits, emotions and desires function in the sentiments of man, and there represent the unity of his character. Yet how incompletely they represent it. The potentials of his character transcend for better and worse everything that he has drawn from them to build up his actual loves and hates, and remain a perpetual enigma to him. See A. F. Shand, *Foundations of Character* (1914).

(A. F. S.)

CHARLEROI, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

CHARLES (1839–1914), King of Rumania (*see* 5.925), died at the castle of Pelesh, Rumania, Oct. 10 1914.

CHARLES I. (1887–1922), Emperor of Austria and King of Hungary, born Aug. 17 1887 at Persenbeug, in Lower Austria, was the son of the Archduke Otto (1863–1906), and Princess Maria Josepha of Saxony (b. 1867). The death of his father in 1906 and the renunciation by his uncle, the Archduke Francis Ferdinand, on the occasion of his marriage with the Countess Chotek (1900), of any right of succession for the children of this union, made him heir-presumptive to his grandfather, the Emperor Francis Joseph. In Oct. 1911 he married the Princess Zita of Bourbon-Parma. Of this marriage there were several sons and daughters, the eldest of whom, Otto, was born in 1912. Charles' relations with the Emperor were not intimate, and those with Francis Ferdinand not cordial. It was only after the death of Francis Ferdinand that the old Emperor took steps to initiate him in affairs of state; but these studies were interrupted almost immediately by the outbreak of the World War. After a period of duty at headquarters at Teschen, Charles commanded the XX. Corps in the offensive of 1916 against Italy, later commanding an army on the Eastern Front.

Charles as Emperor.—On Nov. 21 1916, he succeeded to the throne, at a period of the most extreme difficulties. The military and economic resources of the monarchy were beginning to fail after two years of warfare. Behind the front there was much shortage and suffering. Anti-dynastic feeling was spreading widely, especially in Slav and Latin territories. Charles' programme on his accession was to combat this feeling, to renew the splendour of the dynasty, to achieve peace abroad and national settlement in the monarchy. With this end he made a complete change in the leading military and political posts in the monarchy. But the new men—except only the new Foreign Minister, Czernin—were, unhappily, less talented than their predecessors. Least of all was Charles himself equal to his exacting position. He was an amiable man of excellent intentions, but his abilities were mediocre and his preparatory training inadequate. He lacked calmness and endurance, and was prone to headlong, precipitate actions. He was powerfully influenced by his immediate entourage—his wife and mother-in-law—while distrusting all other advisers. But he was most bitterly—and justly—reproached for insincerity. Not merely his enemies, but his allies too, particularly German statesmen and the Emperor William, soon felt that they could not trust his word. The peoples of the Danubian monarchy, moreover, gradually began to doubt his sincerity, although he did not spare pains to win them over.

On Charles' accession the constitution in Austria was still suspended. In May 1917, he summoned Parliament once more. The earliest pronouncements of the Slavonic deputies showed how far their separatist ambitions had advanced, and all the concessions now made to them remained fruitless, merely alienating the majority of the German Austrians. In Hungary, too, Charles' wide concessions to the Magyars failed to check the growing separatist movement while earning for him the displeasure of the elements in Vienna which stood by the unity of the Empire and the ill-will of the non-Magyars in Hungary.

Peace Proposals.—Charles soon grew convinced of the necessity in his own interest and in that of the dynasty of securing a peace which would allow of the maintenance of the Empire. Yet the numerous attempts made, always with his approval and often upon his own initiative, to secure advantageous conditions, preliminary to a peace of reconciliation, failed. Undoubtedly Charles neither could nor would consider the proposal of the Western Powers to make a separate peace; not only from regard for his allies, particularly for Germany, but also owing to the refusal of the Italian Govt. to renounce any acquisition promised by the Treaty of London. Charles therefore informed Germany that Austria could no longer carry on war, and that Germany must buy a general peace by territorial concessions in the West.

Count Czernin opened up negotiations to this end with the German Govt. but met with little sympathy from the civilian government, none from the supreme army command. Disputes arose, breeding ill-will on both sides. The mistrust for Charles' sincerity entertained by the Emperor William and his advisers increased, the tension reaching its climax after the publication in the spring of 1918 of Charles' letter of March 24 1917, to his brother-in-law, Sixtus of Parma, announcing his readiness to support in Berlin "the just claims of France to Alsace-Lorraine." Charles' failure during the ensuing polemic openly to avow the authorship of the letter and his resort to subterfuges deprived him of his last remnant of authority abroad and at home. In order to propitiate the Emperor William and the German Govt. he was compelled to accept an arrangement with the latter which, if carried into effect, would have rendered the monarchy entirely dependent upon the German Empire. At the eleventh hour Charles sought salvation for himself and his dynasty in the manifesto of Oct. 16 1918, which held out the prospect of the conversion of Austria into a federal state, in which each race was to form a political commonwealth of its own upon its own territory. But the offer came too late, and was in any case unacceptable to the Southern Slavs, since the Magyars had insisted on a clause affirming the integrity of the Hungarian kingdom.

Departure from Austria.—The disruption of the dual monarchy pursued its way. Charles now mainly attempted to protect his dynasty by means of a separate peace with the enemy; but in vain. Abandoned within the Empire and without, he voluntarily renounced on Nov. 11 1918, all participation in the government in order, as he himself expressed it, "not to hinder the free development of his peoples," but actually because he would otherwise have been compelled to abdicate. Two days later he made a similar renunciation in the case of Hungary. The German Austrian Republic was proclaimed on Nov. 12, the Hungarian on Nov. 16 1918. But Charles did not resign the crown of his dominions. He retired to his castle of Eckartsau; thence he went, the Austrian Govt. having demanded his departure, on March 24 1919 to Switzerland, where he stayed first at Schloss Gstaad and later at Prangins. His attempt at the end of March 1921 to secure his restoration as King of Hungary failed owing to the attitude of the Regent Horthy and other leading Hungarians and the unanimous opposition of the Succession States and the Entente.

Charles returned to Switzerland, where a provisional prolongation of his residence was accorded him subject to certain conditions. Disregarding his undertakings towards Switzerland, he made a new attempt in Oct. 1921, to assert his claims as King of Hungary. Having made a surprise air flight with his wife from Switzerland to the Burgenland, Charles was there joined by a small force of armed Royalists, at whose head he marched on Budapest. But the Allied Powers, as well as the "Little Entente," at once made it clear that a *coup d'état* would not be tolerated; and there was a strong rally at Budapest to the side of the Horthy Government. The Royalists were met near Budapest and defeated, Charles and Zita being themselves arrested at Tihany.

On instructions from the Powers, the definite deposition of Charles and renunciation of his claims to the throne were insisted upon, and he and his wife were handed over to the custody of the Allies for internment. Refused the right of asylum by Switzerland, on the ground that he had not adhered to the conditions agreed upon, and accorded a reception by Portugal alone, he was conveyed upon the English ship "Cardiff" to Funchal, Madeira. Here he lived in straitened circumstances until released by death on April 1 1922.

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CHARNAY, DÉSIRÉ (1828–1915), French traveller and archaeologist (*see* 5.947), died in Paris Oct. 24 1915.

CHASE, WILLIAM MERRITT (1849–1916), American painter (*see* 5.956), died in New York Oct. 25 1916. In 1912 he was awarded the Proctor Prize by the National Academy of Design for his "Portrait of Mrs. H." At the Panama Pacific Exposition (1915), a special room was assigned to his works.

CHÂTEAU-THIERRY, a small town in the northeast of France, on the Marne, 47 m. east and north of Paris. It was the farthest point reached by the Germans in their offensive of May 27 1918. The 2nd and 3rd Divs. of the American Expeditionary Force were sent to the Marne in the Château-Thierry region to assist the hard-pressed French forces. At Château-Thierry itself a U.S. machine-gun battalion took part in the successful defence of the river crossing, while to the west of the town the 2nd Div., under Gen. Bundy, fought the fiercely contested engagement of Belleau Woods. (*See* GERMAN OFFENSIVE; MARNE, SECOND BATTLE OF THE.)

CHEKHOV, ANTON PAVLOVICH (1860–1904), Russian novelist and dramatist, was born Jan. 17 1860 in Taganrog on the Sea of Azov. This name is also spelled Tchekhov, Tchehov and Chehov. His father was a tradesman and the son of a serf. The writer was educated at the gymnasium of his native town, and in 1879 went to the University of Moscow, where he studied medicine. He took his degree in 1884 but practised very little (except during the cholera epidemic of 1892–3). He began his literary career while yet a student, and soon became one of the most welcome contributors to the comic papers. His early stories appeared over the signature Antosha Chekhonte. In 1886 some of his stories were published in book form (*Particoloured Stories*). The book had a great success and attracted to Chekhov the attention of the publisher and editor Suvorin, who became his friend and through whom Chekhov was able to emancipate himself from the comic papers and from the obligation of being a humorist.

In 1887 he produced his first play *Ivanov*. In 1890 he travelled to the convict island of Sakhalin and the result of his journey was *Saghalien Island* (1891), which had a considerable effect on the mitigation of the penal régime. From 1891 to 1897 he lived together with his parents on a small estate he had acquired not far from Moscow. After 1897, as he was threatened with tuberculosis, he was forced to live the greater part of the year in the Crimea and abroad. In 1896 he produced his second play, *The Seagull*, which met with a complete failure in St. Petersburg (Leningrad). But in 1898 it was revived by the Moscow Art Theatre of Stanislavsky and proved a great success. Henceforward Chekhov's connection with that theatre became very close. *Uncle Vanya* (1899), *The Three Sisters* (1901) and *The Cherry Orchard* (1904) were produced there. In 1901 he married the actress Olga Knipper. In 1900 he was elected an honorary fellow of the Academy of Science, but resigned his fellowship when the election of Maxim Gorky was cancelled by the Government. He died July 2 1904 at Badenweiler in the Black Forest.

Early Work.—The early stories of Chekhov, up to about 1886, are chiefly humorous. They are, in Russia, the most widely popular part of his work, and more people know him by them than by *My Life* or *The Three Sisters*. Chekhov's humour is not strikingly above the level of the papers he wrote for. But very early he began to lay the foundations of that manner which is the essential Chekhov. Such a story as *The Chorus Girl* (1884) is almost a mature masterpiece. It was, however, only after 1886 that he found the necessary leisure and independence to give definite expression to his imaginative experience. The years 1886–8 are a period of transition during which he experimented in various directions. To these years belong a series of stories of atmosphere against a background of nature (*The Steppe, Happiness, Easter Eve*) where the lyrical element of his genius received its fullest expression, and short stories of morbid experience in which the knowledge of the doctor is balanced by the sense of form of the artist. By 1889, however, he had attained perfection in his style. To this and the following years belong a succession of masterpieces, the principal of which are *A Dreary Story* (1889), *The Duel, Ward No. 6* (1892), *The Teacher of Literature* (1894), *Three Years: An Artist's Story* (In Russian *The House with the Maisonette*) (1895), *Peasants* (1897), *The Darling, Ionitch, The Lady with the Dog* (1898), *The New Villa* (1899), *The Bishop* (1902).

Chekhov's art has been described as psychological, but his psychology ignores the individual. His characters are not persons but just men and women, the genus *homo*, an indifferentiated mass of humanity, divided into watertight compartments by the phenomenon of individuality, which does not make one being different from another but only inaccessible to him. A typical story by Chekhov is the life-story of a "mood," of a state of mind, usually of the relation of one person to another and the gradual transformation of that state of mind under the action of the incessant infinitesimal and unforeseen pinpricks of life. Sensitiveness to these pinpricks is the main feature of Chekhov's people, of those at least who are made to kindle the reader's sympathy, and the standard by which Chekhov gauges the worth of a human being. Those who suffer and succumb are the higher race, those who do not are unfeeling brutes. Hence a deep-rooted aversion (present in pre-Chekhov Russian literature, especially in Turgenev, but enormously magnified by Chekhov) for the strong and efficient man. None but "Hamlets" may receive sympathy.

The construction of Chekhov's stories may be described as musical or infinitesimal. It is at once fluid and precise. They are built along exactly calculated curves, of which only certain points are marked in the story, but each two points are sufficient to calculate the whole curve. The curve is the mood which begins as almost a straight line, then under the influence of "pinpricks" begins to deviate and at last shoots out in an entirely opposite direction. By far the greater number of Chekhov's stories end on a minor note, "not with a bang but a whimper." A story where the direction is in the opposite way, as in *The Lady with the Dog* (where the hero begins by regarding his love for the lady as a mere insignificant intrigue and ends in self-forgetful passion), is an exception. The "pessimistic," destructive, descendant tendency of the Russian novelists of the mid and later 19th century reaches its extreme expression in Chekhov, all the more extreme as it is so consistently muffled and "understated." To him, better than to any one, the words of M. Albert Thibaudet apply, that a Russian story is always the story of the undoing of a life.

Somewhat apart from the other stories of Chekhov stand, what are perhaps his two masterpieces, *My Life* (1895) and *In the Ravine* (1900). They have a clearer and harder outline; they are free from the atmospheric, autumnal haze that pervades the others, and animated by a more active sense of moral and human values. *My Life*, especially, is a creation of vast and pregnant significance, with a symbolical grasp that gives it an almost religious character.

Chekhov's dramatic work consists of the same element as his narrative work. It includes numerous one-act plays which were extremely popular in Russia. Belonging to a later period than the comic stories, they are also on a higher artistic level. The serious plays are five in number—*Ivanov*, *The Seagull*, *Uncle Vanya*, *The Three Sisters*, *The Cherry Orchard*. They have many points in common with his stories; not only is his vision of life the same, but his methods are similar. One main difference is that while the stories are invariably centred round a single person from whose standpoint the situation is developed, the dramas have no such central figure, and all the characters have more or less equal rights on the stage. The plays are, as it were, symphonies for an orchestra of parts, and the resultant is arrived at by the complex interaction of the various voices. They are plays of "atmosphere," the English word that comes nearest to the Russian *nastroenie* (Stimmung). The principal thing in them is not the action but the emotional accompaniment of the action. In the "de-theatricalisation" of the theatre, in the complete avoidance of all traditional stage effects (though he introduced a new kind of "atmospheric" effect, as the famous string (bursting at the end of *The Cherry Orchard*), Chekhov is the logical limit of the preceding development of the Russian drama. He did not go much further in this respect than Turgenev or Ostrovsky, but he built a more consistent dramatic system with a completely adequate technique.

The Novelist's Influence.—The influence of Chekhov on Russian literature has not been extensive. The last realists (Andreyev, Gorky, Bunin, etc.) learned little from him, and soon after his death the rise of an entirely new movement put an end to all possibility of continuing in his tradition. His plays were imitated by Gorky, Andreyev and others, but they invariably missed the constructive principle without which the whole system is stultified. There has been no school of Chekhov, and his work has to be regarded as an end rather than as a beginning. It is the swansong of 19th-century Russia. To the Russia of to-day Chekhov is perhaps more alien than any other Russian writer of his rank.

On the other hand, his vogue and his influence outside Russia have of recent years grown immensely and were in 1926 probably near their zenith. England has proved particularly sensitive to his charm. He is almost universally regarded as the greatest Russian writer and as the greatest story-teller and dramatist of modern times. English critics have even called him the greatest dramatist since Shakespeare. Nor can there be any doubt that English literature has profited by his example as Russian literature never did, and that if there is to be a school of Chekhov it will be in England.

The lovers of Chekhov are attracted as powerfully by the man as by the artist, and will find an infinite source of joy in his letters.

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(D. S. MI.)

CHELMSFORD, FREDERICK JOHN NAPIER THESIGER, 1ST VISCOUNT (1868–   ), British administrator, born Aug. 12 1868, was the eldest son of Frederick Augustus, 2nd Baron Chelmsford. He was educated at Winchester and Magdalen College, Oxford, and held a fellowship at All Souls' from 1892 to 1899. Having been called to the bar he was a member of the London School Board for four years, and in 1904–5 served on the London County Council. In the latter year, when he succeeded his father as Baron Chelmsford, he was appointed Governor of Queensland and he held that office till 1909. These years saw the inauguration of the new policy of replacing the repatriated Kanakas by white labour. It was also a period of bitter political conflict. Chelmsford's action in granting the request of the Premier, Mr. Philp, for a dissolution of Parliament led to widespread agitation for the appointment of governors in Australia. In Aug. 1909 Chelmsford left Queensland for New South Wales of which state he was governor till 1913. It was a period of great development for the colony, and also of great labour unrest.

Chelmsford, who was created G.C.M.G. in 1912, served in India with the Dorset Regt. in the early part of the European War. From April 1916 to the spring of 1921 he was Viceroy of India. During this period the system of dyarchy founded upon the joint report of the Viceroy and the Secretary of State, Mr. E. S. Montagu, was introduced. A considerable measure of autonomy was accorded to the provinces. The Council of State and Legislative Assembly were to be elected, and the annual budget, with some reservations, submitted to the latter. Indians were given representation on the Viceroy's Council, and India was given the same power over tariffs as the Dominions.

But the new reforms were opposed by a combination of Hindus and Moslems under Gandhi, and a system of non-co-operation adopted, whilst the repressive legislation recommended by Mr. Justice Rowlatt's committee to deal with sedition provoked serious riots in Guzerat and the Punjab, culminating in the Amritsar disturbances (April 1919). However, an amnesty for political offences accompanied the promulgation of the reforms which were gradually accepted by moderate opinion. Meanwhile the Viceroy had also to meet a Mahommedan agitation directed against British policy toward Turkey. This was actively supported by an Afghan Army after whose defeat the subsidy was withdrawn from the Amir, together with the privilege of importing arms from India. The new institutions were inaugurated by the Duke of Connaught early in 1921. On his retirement Chelmsford was created a viscount and received Indian orders. He was First Lord of the Admiralty in Mr. Ramsay MacDonald's Labour Ministry of 1924. (G. LE G. N.)

CHEMICAL ENGINEERING.—The branch of engineering which relates to the "design, construction, erection and operation of plant and works in which matter undergoes a change of state or composition." This definition, due to the Institution of Chemical Engineers, is rather broad but logical. A chemical engineer should possess a good general knowledge of chemistry and physics, a special knowledge of physical chemistry and thermodynamics, a thorough grasp of mechanical and electrical engineering, and those branches of civil engineering which deal with the strength of materials and the theory of design of structures.

Since the object of chemical engineering is ultimately economic, industrial economics and law, business management and factory organisation must be given a primary place. He must be able to devise simple and effective methods of recording operations and determining actual costs, prepare designs, specifications and estimates free from ambiguity and error, report efficiently on any problem investigated, and obtain technical information readily and compile and index it for future use.

Foundations in Practice.—The practice of chemical engineering has naturally preceded the scientific analysis of its principles. Typical chemical engineering operations have been performed in certain industries to such an extent as to evolve special types of plant peculiar to those industries. The chemical engineer, however, must understand the underlying scientific principles upon which such operations or processes depend, so as to be able to design efficient plant for any particular purpose, rather than to allow it to be evolved by rule-of-thumb guess work with expensive large scale experiments and costly alterations in construction before reasonable efficiency is obtained. There is little doubt that the material rewards of scientific chemical engineering are greater to-day than any other branch of engineering can offer, while its national importance cannot be over-estimated.

Scientific Basis.—The adoption in the factory of one unit of weight and volume together with the decimal system is a first step and facilitates recording, avoids errors, saves time and makes the scientific control of processes comparatively easy.

Types of Processes.—Chemical engineering processes are of three general types: (*a*) the conveyance and storage of materials, (*b*) the production, transfer and conservation of heat and (*c*) the treatment of materials. In these processes an exact knowledge is required to secure the greatest industrial efficiency, and questions relating to rent, capital cost, repairs, labour and superintendence, output, material efficiency, character of the market, etc., must be considered. Unfortunately some of these conditions vary from year to year and the chemical engineer must be somewhat of a seer to achieve the greatest success.

Transport.—Transport is often the most important item of the cost of production; in the factory itself, the cost of carrying materials to a machine is often as great as that of the operation conducted. Methods of weighing and measuring materials in their progress through the factory need careful study, for it is only by maintaining the highest rate of output as a uniform thing, that the best results can be obtained.

Flow of Fluids.—In industrial practice fluids may flow in two distinct ways, usually referred to as " stream-line " and " turbulent " flow. The former method offers advantages in certain operations, filtration, classification, separation, etc., while the latter is essential to secure the greatest heat transfer. The criterion by which it can be approximately determined whether stream-line or turbulent flow is occurring in a tube is given by the value of the modulus $\frac{vd\rho}{\mu}$ where v is the velocity of the fluid, d is the diameter of the tube, ρ the density of the fluid and μ its viscosity. The value of the fraction is the same in any system of units and when it exceeds 2,000 the flow is turbulent.

Semi-fluids.—The laws governing the flow of semi-fluids such as dry sand, wheat, etc., which occupy an intermediate position between solids and liquids, must be understood. A peculiarity of such materials is that their flow from an orifice is proportional to the cube of the area of the orifice and independent of the head. The transport of fluids in factories is obviously a simple and cheap process, so that a solid material which is used in solution will be transported more cheaply and conveniently by dissolving it at once and pumping the solution to stock tanks, rather than by conveying the solid itself.

Transfer of Heat.—The production and transfer of heat involves a knowledge of combustion, the study of fuels, their calorific value and intensity, while the electrical generation of heat is becoming more and more important in the development of industrial processes. The design of furnaces of different types, often a matter of rule-of-thumb evolution, involves questions of heat transmission and radiation, the factors of which are very difficult to estimate. The great diminution in density of the hot gases and the increasing importance of radiation as a factor in heat transmission, as the temperature rises, are points needing the most careful study. The loss of heat from exposed hot surfaces by radiation and air contact may be fairly closely estimated, a factor often very important in the operation of a plant.

The transmission of heat through a metal diaphragm from gas to gas, gas to liquid, saturated vapour to liquid, liquid to liquid, gas to solid, etc., varies so enormously as to demand the most careful experimental research. The transmission of heat from a gas to a gas through copper 1 mm. thick, is of the order of 5 calories per square metre of surface per hour, per one degree Centigrade of temperature difference between the gases; under similar circumstances the transmission from gas to non-boiling water is about 20 calories, from liquid to liquid about 350 calories, and from steam to water about 1,540 calories. If the liquid is boiling the heat transfer may be increased greatly; it is usually at least twice and may be over four times that to non-boiling liquid. The importance in steam boilers and evaporators of keeping the liquid constantly boiling is obvious.

Again, an increase of velocity of either fluid will raise the rate of heat transmission considerably by an amount which is capable of estimation. The effects of corrosion, of deposited scale, the influence of salts in solution and of precipitates in suspension on the rate of heat transmission are matters of great industrial importance. When a gas or liquid moves over a solid surface or when a gas moves over a liquid surface there exists a film of the moving fluid over the stationary substance in which there is practically no motion. The thickness of this film is mainly responsible for the great differences in heat transmission already mentioned. Much chemical engineering research is necessary to elucidate these questions adequately, and great wisdom in design is necessary to secure the highest economic efficiency.

Solid Materials.—In the treatment of solid materials, size reduction by crushing, grinding and impact must be well understood. The relative cost of the different methods and machines and the different character of the final products must be known, for the size and uniformity of the solid material treated in a chemical operation has, in practically every case, a profound influence on the cost of production of the final product. The separation of solid particles from each other and from liquids involved in the processes of sifting, electrical, magnetic, hydraulic and air separation, classification, flotation, filtration, centrifuging, etc., often determines the profitable treatment of the material. New discoveries in flotation and similar methods of separation have in recent years proved of the highest value.

Power.—A study of the power required for different processes is of importance and may prevent false conclusions. In size reduction for example, the power required is approximately proportional to the increased surface produced, so that a simple calculation will readily show how costly it is to produce the finest powders from solid materials.

Many processes though well understood are difficult and costly; their avoidance or replacement by some other method of separation at some other stage of the process are important points in the economic possibilities of manufacture. Again, it is a common experience in technical manufacture, that a method by which one process is rendered easy may cause a later process to fail and give rise to a faulty product.

Processes of Separation and Extraction.—Processes of separation in which a change of physical state takes place are peculiar subjects of study to the chemical engineer. Leaching and extracting, evaporation, distillation and condensation, drying, crystallisation, absorption and adsorption, etc., are processes needing the highest research. Processes of extraction which formerly took twelve hours are now being carried out more efficiently in one hour as a result of chemical engineering study. Evaporation is now being done in many works at one-sixth of its former cost while distillation and condensation in certain industries are now carried on with a fuel saving of nearly 80% in comparison with the methods of a few years ago.

Wet Distillation.—The process of " wet " distillation, *i.e.* distillation by means of direct steam, is used in many industries for separating a particular substance, essential oil, hydrocarbon etc. If such substance does not mix with water, then each develops that particular vapour pressure which it would have i heated separately to the same temperature, and the sum of th vapour pressures is the pressure in the still. A study of th vapour pressure curves of each substance and the conditions o decomposition of the particular one, will give the most profitabl still pressure at which to work. By this alone, materials which a ordinary pressure require 200 parts of steam to distil one part o substance, may be treated under suitable pressure by which only say, 30 parts of steam are required. Again, by a reduction o pressure before condensation has taken place, a separation of th particular substance will take place and the steam may b " boosted " back into the still again, thus securing a furthe economy in fuel.

Drying Processes.—The drying of gases, liquids and solids is common requirement of many industries. The study of dryin and drying plant may mean a change from comparative failur to great success. The drying of gases by chemical reagents suc as calcium chloride, which after absorbing moisture is itself drie by hot air or flue gases, cooled and again used, is well understoo but the use of adsorption processes for this purpose is a develop ment in industry of the last few years. The " gels " (silica ge alumina gel, etc.) are treated in a similar way to the calciu chloride previously mentioned, but are free from any risk of failure through overheating and have many other advantages. The fuel saving of about 30%, produced by the use of this process for the drying of the air blast of blast furnaces is an important addition to our fuel resources.

Gas Masks.—The efficiency of the gas mask in warfare is paralleled by the importance of the same means in peace to recover benzene and other solvents from air and gas effluents, to remove sulphur from oil and to perform many other chemical functions in a physical way. The absorption of water by "silica gel" is so energetic, and the substance can be so readily regenerated that its general use for refrigeration may be only a matter of time. The chemical engineering problems involved in this process are both interesting and profitable. The treatment of the air of factories to render it constant in temperature and humidity also offers a large field to the chemical engineer.

Chemical Reactions.—The treatment of materials in chemical reactions such as roasting, calcining, destructive distillation, electrolysis, catalysis, hydrolysis, fermentation, etc., demands careful consideration of physical, chemical and engineering factors of increasing exactitude. An examination of these processes on a laboratory scale must precede their study on a manufacturing scale. The chemist does the former and the chemical engineer the latter. Additional factors involving time of reaction, strength of materials, presence of traces of impurity, cost of materials and plant, continuous or discontinuous operation, the handling and disposal of by-products, etc., arise. Great increase in efficiency can be obtained often by changing an operation from an intermittent, or batch, method to continuous working.

Materials.—The design of plant involves the preparation of flow sheets showing the flow and expenditure of material, energy, time and labour, the experimental study of the nature and properties of the materials involved in plant construction and a continuous search for new materials to meet the conditions of service better than those at present in use. The name of a material, unfortunately, is no indication that it is suitable for a chemical engineering purpose. "Chemical cast iron" is a distinct kind of cast iron, characterised by the amount of silicon, sulphur and carbon content and its treatment. Other materials, alloys, bricks, compositions, cements, etc., must be specified for their work both as to composition and history if success is to be made certain. In recent years, great advances have been made in the production of chemical engineering materials of construction, silica-ware, stoneware, glass, alloy steels, alloys, etc., all of which tend to cause modification of design. The effect of heat on the strength of materials is becoming better known every year and the production of non-scaling steels which are as strong at a white heat as ordinary mild steel at the ordinary temperature will make many developments possible which have hitherto failed. The design of the plant from the point of view of the flow of material, charging and discharging, facility of erection and repair, ease of control with a limited staff, etc., calls for experience and wisdom.

Lay-out.—The lay-out and construction of factories involves a knowledge of several branches of civil engineering and cannot be neglected, for the erection of buildings, heavy plant and chimneys on marshy soil is a common necessity in industry. The construction of foundations, roadways, railways, etc., must also be understood. In the provision of power, heat and light, the relative value and use of the different methods must be considered for a sound view to be taken as to whether steam, electricity, gas or water-power shall be used. High-pressure steam providing power by means of turbines which exhaust into receivers from which evaporating steam may be drawn, presents the most efficient power plant in many chemical industries, while electricity generally provides the best method of power distribution, and occasionally of heating, in process work. The use of producer or water gas for heating and other purposes must not be neglected nor the value of compressed air and hydraulic water for many purposes. Finally the chemical engineer must be familiar with the Factory Acts, trade union law and all those legal points which factory managers have to face. (J. W. Hy.)

CHEMICAL WARFARE.—The use of irritant and poisonous substances to diminish the resistance of an opponent is probably as old as organised warfare. Thucydides describes two instances of the use of burning sulphur and pitch in sieges in the Peloponnesian War and throughout classical times and the Middle Ages such methods were frequently employed, Greek fire being a device of this kind. As war became more mobile and the range of actions increased, the opportunities for using such a weapon in its primitive form disappeared, but in 1855 Lord Dundonald proposed a scheme for burning sulphur on a large scale under favourable wind conditions in order to reduce the Malakoff work during the siege of Sebastopol. The suggestion was rejected on the ground of humanity.

International Law.—The use of toxic substances was foreseen at the Hague Peace Conference of 1899 when the governments represented pledged themselves not to use any projectiles, the sole object of which was the diffusion of asphyxiating or harmful gases. At the Hague Convention of 1907 the following rule was adopted: "It is expressly forbidden (*a*) to employ poison or poisoned arms, (*b*) to employ arms, etc., of a nature to cause unnecessary suffering." It has been argued that toxic gases were not contemplated as coming within the scope of this clause, but this was not the interpretation put on it by most of the Powers, and the Treaty of Versailles assumed that their use in any form was contrary to international law. This view was confirmed by the nations represented at the Washington Conference in 1922.

GAS IN THE WORLD WAR

At the outbreak of war none of the combatant nations had made any preparation for the use of gas or were equipped with any defence against it, but after the failure of the initial German attack and the development of trench warfare, means were sought by the Germans to assist the artillery preparation for an offensive against entrenched positions, in order to get back to a state of open warfare again. Proposals to use gas were made at an early date and on Oct. 27 1914, shrapnel containing an irritant substance (dianisidine chlorsulphonate) were used by the Germans at Neuve Chapelle without, however, any success. They were followed by shell containing a strong lachrymator (xylyl bromide) in place of part of the charge of high explosive, which were used on the Russian front in Jan. 1915, when the low temperature made the lachrymator ineffective.

The introduction of gas as an effective weapon in modern warfare really dates from April 22 1915, when the Germans discharged chlorine from cylinders on a front of about four m. at Langemarck opposite a sector held by the French. The effect of the discharge, which came as a complete surprise, against unprotected troops, was to eliminate all resistance on the front affected, for a depth of several miles. A similar attack was made on the Canadian front near Langemarck on April 24. Owing to various reasons the Germans failed to take advantage of the opportunity offered by these first attacks for a decisive stroke and within a few days the Allied troops were equipped with a crude form of respirator and the immediate danger was over. The Germans soon found considerable difficulties in combining an infantry attack with a cylinder discharge, which was dependent on a favourable wind. Consequently they abandoned the cloud gas attack except as a means of inflicting casualties on the Allies. From Dec. 1915, their cloud attacks became more dangerous owing to the admixture of an increasing amount of phosgene with the chlorine, which added greatly to its toxicity, but of course the protection of the Allies was improving at the same time.

The Allies were quick to adopt retaliatory measures: the first British gas attack was made at Loos on Sept. 25 1915, with cylinders of chlorine, and from then to the end of the War, frequent cloud discharges were made as the wind was more often favourable to the Allies than to the Germans.

As a weapon for use in an attack, the gas shell offers great advantages over the cloud discharge, as it allows the use of a much greater variety of toxic substances and its employment is independent of the wind. The Germans scored one success with lachrymatory shell in the Argonne in July 1915, but the French were the first to realise the possibilities of a gas shell filled with a highly toxic gas such as phosgene, with a small bursting charge just sufficient to open the shell. The French shell of this type surprised the Germans in the spring of 1916 and were of considerable assistance in the defence of Verdun. Subsequently the Germans modified their gas shell to the same type and made considerable use of them both at Verdun and in the Somme battle.

Gas in 1917.—In this year gas shell first became a serious factor in the tactical situation, as both the Allies and the Germans had provided themselves with considerable quantities as a result of their experience in 1916. The German shell contained mainly trichlormethyl chloroformate and chlorpicrin, toxic substances of a semi-persistent nature, the French phosgene, or prussic acid, the British chlorpicrin or lachrymators. Gas shell were used mainly during active operations for neutralising the enemy's batteries, for interfering with the movements of troops and for general harassing purposes. By firing gas shell it was always possible to compel the wearing of a respirator and especially at night this resulted in a considerable diminution of efficiency. Also sudden bursts of lethal shell were fired at targets known to be occupied in order to produce casualties by surprise before respirators had been adjusted. In order to achieve this, it was necessary to set up suddenly a high local concentration of gas and the most effective weapon for this purpose was the Livens Projector first used at Arras in March 1917. This was a crude form of trench mortar, firing a bomb weighing 60 lb. containing 30 lb. of phosgene. Large numbers could be installed together and fired simultaneously at the same target, producing very high concentrations of gas without any warning beyond the flash and noise of the discharge and the bursting of the bombs. The projector became one of the deadliest weapons of those used in trench warfare.

July 1917 is notable for the introduction of two new gases by the Germans, who had seen that with the improved methods of protection, gases such as those mentioned above, which all betray their presence at once by their immediate irritant action on the eyes and respiratory tract, were losing much of their value. They therefore introduced two new substances, dichlorethyl sulphide, commonly known as "mustard gas" from its smell or as "Yperite" from the place where it was first used and diphenylchlorarsine. Mustard gas was the most effective agent used in chemical warfare and it was responsible for the majority of gas casualties. Owing to its slight smell it is less easily detected than other gases and although it produces no immediate sensations of discomfort, exposure to a very low concentration is sufficient to put a man out of action owing to the effects of the gas on the eyes and lungs. As the liquid has a low vapour pressure at atmospheric temperature and reacts very slowly with water, it may remain for days or weeks in the soil and continue to produce a dangerous concentration of gas wherever the temperature is high enough. In addition to its effects on the eyes and lungs, serious blisters are produced either by splashes of the liquid or by contact with ground or any object contaminated by it.

Diphenylchlorarsine, a solid melting at 46°C., when finely divided in the air causes sneezing, irritation and intense pain in the nose and throat and nausea. There is a slight delay in the onset of the symptoms. Bottles of this substance were embedded in high explosive shell, so that on the burst of the shell it is scattered as a fine dust in the air. Unless respirators are provided with a special form of filter they may be penetrated by these small particles and the resulting sneezing may compel the removal of the respirator. However, this did not occur in the field of battle.

Gas in 1918.—For their offensive in 1918 the Germans made great use of gas shell on which they relied to produce rapid neutralisation of the Allied artillery, thus enabling them to reduce the length of their preliminary bombardment to a few hours without previous registration. As much as 80% of gas shell was allotted for some tasks. The gas shell available at this date can be divided into two classes from the point of view of tactical employment in an attack:—

(1) Shell containing liquids such as mustard gas, which may persist for long periods in the soil and cannot be used on ground which it is intended to attack or occupy.

(2) Shell containing volatile liquids such as phosgene or diphosgene, or non-volatile solids such as diphenylchlorarsine, which owing to their low persistence may be used immediately before an attack.

The Germans used shell of the first class on the flanks of the attack and in other sections of the front to produce casualties, while the preliminary bombardment before each attack was mainly with gas shell of this second class, which compelled the continuous wearing of the respirator and added greatly to the strain and fatigue of the troops and interfered with movement and communication. The weather conditions in each offensive were suitable for gas shell except on July 15 when the attack failed. The Allies also were using large quantities of gas shell in 1918, including mustard gas after June, and so effective had they proved for various tasks, that the proportion of gas shell was steadily increasing. It is noteworthy that no gas was used in naval actions during the World War, or from aircraft.

Gas as a Weapon.—The use of gas has added many complications to war. It compels all troops to carry a respirator involving additional weight of equipment and training. The presence of gas compels the wearing of the respirator, thereby reducing a soldier's efficiency both by the interference with vision, speech, etc., and by the added fatigue, and the respirator cannot be worn for long periods without arrangements which admit of eating and drinking. Also the possibility of a gas attack increases the strain on troops both by the constant watchfulness that is necessary and the moral effect of gas which cannot be neglected.

Gas accounted for a moderate porportion of the casualties in the War. During the last year of the War 16% of the British casualties were due to gas and 33% of the American casualties, but its tactical value cannot be judged by casualties alone; it proved invaluable in the neutralisation of artillery, interference with movement and hampering communication. Also, by the use of a persistent gas like mustard gas, it was possible to make a position untenable except at the cost of heavy casualties; this occurred at Bourlon Wood in Nov. 1917 and at Armentières in April 1918. In such ways gas proved itself a valuable auxiliary to existing weapons. Again, a heavy gas would penetrate into the deepest dugout which was immune against high explosive or shrapnel, and gas shell might be effective without getting a direct hit, as the gas from each burst to the windward of a target would drift over it. And above all, gas always carries with it the possibility of surprise.

Types of Gas Used.—The gases used in war can be classified roughly as follows according to the predominant effect which they produce on the body, although many gases may belong to more than one class:—

(1) Acute lung irritants, *e.g.*, chlorine and phosgene, which exert an intense irritant action on the respiratory organs leading to acute pulmonary oedema.

(2) Lachrymators, *e.g.*, xylyl bromide, which even in low concentrations make vision impossible by their irritant action on the eyes, although the effect may not outlast the exposure to the gas.

(3) Paralysants, *e.g.*, prussic acid, which in sufficiently high concentration cause death almost instantaneously by their effect on the nervous system.

(4) Sensory Irritants of the Eyes, Nose and Upper Respiratory Passages (also called Sternutators as they often cause sneezing), *e.g.*, diphenylchlorarsine; these are often effective in very low concentrations causing intense pain in the eyes, nose and throat, nausea and subsequent depression.

(5) Vesicants, *e.g.*, mustard gas, which cause inflammation and blistering of the skin, eyes, and respiratory tract, the effect being produced as a rule some hours after exposure.

Broadly speaking, the gases in groups (1) and (3) may be regarded as lethal agents, those in groups (2) and (4) as putting a man out of action immediately though temporarily, while the vesicants are delayed in action but have a great casualty producing power, even when used against troops trained in defensive measures.

The following tables give the principal gases used in the World War with a brief summary of their important characteristics:—

Substance	Chemical Formula	Date of Introduction	Boiling Point, degrees Centigrade	Approximate Concentration to incapacitate a man in a few seconds owing to lachrymation or coughing	Approximate Concentration which if breathed for more than one or two minutes would cause actual damage to the lungs	Used by B = British F = French G = Germans
Acute Lung Irritants						
Chlorine	Cl_2	1915	−33·6	1:10,000	>1:10,000	B F G
Phosgene	$COCl_2$	1915	+8	1:100,000	1:50,000	B F G
Trichlormethyl chloroformate	$Cl\cdot COO\cdot CCl_3$	1916	+128	1:200,000	1:50,000	F G
Chloropicrin	CCl_3NO_2	1916	+112	1:200,000	1:50,000 (Cumulative)	B F G
Lachrymators						
Xylyl bromide	$CH_3\ C_6\ H_4\ CH_2Br$	1915	+218	1:2,000,000	..	G
Ethyl iodoacetate	$CH_2ICOOC_2\ H_5$	1916	+180	1:5,000,000	1:50,000	B
Paralysants						
Hydrocyanic acid	HCN	1916	+26·5	>1:2,000 (immediately fatal)	No cumulative action.	B F
Sensory Irritants of Eyes, Nose and Chest (Sternutators)						
Diphenylchlorarsine	$(C_6H_5)_2AsCl$	1917	+333 (M.P. +43)	<1:10,000,000	1:50,000	G
Diphenylcyanarsine	$(C_6H_5)_2AsCN$	1918	>+300 (M.P. +31)	<1:10,000,000	1:50,000	G
Ethyl dichlorarsine	$C_2H_5\ AsCl_2$	1918	+156	1:500,000	1:20,000	G
Vesicants						
Dichlorethyl sulphide (Mustard Gas)	$(CH_2Cl\ CH_2)_2S$	1917	+217 (M.P. +14)	..	1:1,000,000 with 60 min. exposure	B F G

Methods of Liberating Gases.—The method selected for liberating gas depends partly on the object to be attained and partly on the physical properties of the gas.

Gas can be discharged:—

(1) from cylinders as cloud gas;

(2) from projectiles, *e.g.*, shell, trench mortar bombs, or projectors, either as a true gas or in the form of liquid drops or as a fine dust;

(3) from aeroplane bombs as from other projectiles;

(4) as a spray from containers carried in aeroplanes or tanks.

Cylinder or cloud gas attacks were made by installing a large number of steel cylinders containing compressed gas in the front line trenches, and discharging these in a suitable wind so that the gas was carried over into the enemy's trenches. The gas used must be denser than the air so that it does not rise when discharged, and it must be at a sufficient pressure to ensure that the contents of the cylinders are discharged rapidly when the valves are released. Chlorine and mixtures of chlorine and phosgene were employed mainly for this purpose. Gas projectiles contain a toxic substance and a bursting charge, and the effect on burst depends on the nature of the filling and the size of the burster.

A volatile substance like phosgene forms a small cloud which drifts with the wind, while with a liquid like mustard gas part of the filling is dispersed as a cloud, but a considerable proportion will be scattered over the ground in or near the shell crater, and may continue to give off a dangerous concentration of vapour for days. A solid such as diphenylchlorarsine is dispersed as a cloud of fine dust which drifts down wind leaving no persistent effect. Similar results are obtained with aeroplane bombs. Liquids can be sprayed either from tanks or aeroplanes, but in the latter case there may be considerable losses by evaporation if the drops have to fall from a great height.

Protection Against Gas.—Like all other weapons gas has its antidote. This takes the form of a respirator which filters out toxic materials from the air before it reaches the lungs. The early patterns consisted of a pad of cotton waste dipped in a solution of sodium thiosulphate and sodium carbonate which was tied over the mouth. This was replaced by flannel or flannelette helmets dipped in various solutions, which were worn over the head and protected the eyes as well as the lungs. The measure of protection obtainable by such means is obviously very limited, and the use of a general absorbent such as charcoal has many advantages to offer. All the combatants in the World War finally adopted respirators in which the inspired air was filtered by passing through activated charcoal in a small container, with various admixtures of other substances to increase the protection against specific gases. Pads of cellulose or other filtering material were added to give protection against the fine particles produced by the explosion of shell containing such substances as diphenylchlorarsine. The container was attached directly to an impermeable facepiece held in position by elastic bands over the head so as to make an airtight joint round the face as in the German respirator, or it was carried in a haversack and connected to the facepiece by a rubber tube carrying a mouthpiece as in the British Box Respirator, in which case it was necessary to prevent breathing through the nose by a nose-clip attached to the facepiece. In the French respirator, which resembled the German, the inspired air passed over the glass eyepieces and prevented the depositions of moisture on them, thus securing clear vision.

The ideal respirator represents a compromise between safety and military efficiency. Its weight must be small, it must admit of easy carriage and rapid adjustment, and offer little resistance to breathing, also it must be comfortable to wear and interfere as little as possible with vision and hearing. At the same time it must give a sufficient measure of protection against all gases likely to be encountered in the field.

But the respirator alone is no guarantee of safety; the soldier must be able to recognise the presence of gas by its smell or other effects, and thus know when he needs protection. Also he must be trained to carry out his duties while wearing a respirator for long periods so as to suffer the minimum loss of efficiency.

Apart from these measures of individual protection, there are a number of precautions which may be grouped together under the heading of collective protection. These include arrangements for giving the alarm in case of a gas attack, the provision of protected shelters in which men can remain during a gas attack without wearing respirators, or to which they can go to eat or drink, and the clearing of gas and the decontamination of ground after a gas attack of any kind.

Future of Chemical Warfare.—After the experience of the War there is a general feeling that gas may figure again in some future war in spite of international agreements, and all nations are taking steps to equip their troops with protection against it. Gas proved itself so effective a weapon, it offers such possibilities of surprise and it can be produced so easily in the peace equipment of the chemical industry, that it would be rash to discount the possibility of its use under the conditions of war psychology. Moreover it is difficult to maintain that it is less humane than other weapons. For example, the total recorded British gas casualties were 180,983 with 6,062 deaths, whilst the mortality amongst other battle casualties was about 25%, and it was striking how small a proportion of the gas casualties who survived suffered any permanent disablement.

Most forecasts of future wars assign to gas an important rôle in its use from aircraft against mobilisation and manufacturing centres and even against the civilian population, and under certain conditions there can be little doubt as to its effectiveness. As regards its use in the field, much depends on whether the type of warfare is such as to permit of its employment in sufficient quantity and concentration. Position warfare offers exceptional opportunities for its use, but the tank and the aeroplane which favour a return to some form of mobile warfare, may themselves become the means by which gas may be discharged most advantageously.

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CHEMISTRY (*see* 6.33) is the study of the components of the universe, of its ultimate materials, a branch of natural science. In ordinary life, we judge of man's character from his actions: so also in chemistry. The science had its beginning when man became a living soul and not only began to see and compare the objects about him and to notice changes but also to make logical constructive use of his observations.

Fire.—Fire, in the form of the sun, must have been his first wonder, but the fear of fire will have come upon him by accident, we may suppose—if not from the volcano, in the thunderstorm. His appreciation of its value will have varied with the conditions under which he lived, whether in a cold or a hot climate. The North American continent is without fire, though at times visited by devastating electric displays. England is not far from mounts Vesuvius and Etna and close to Iceland, one of the great volcanic regions of the world, though a region of ice and snow. The English owe much to their Scandinavian ancestry and, as Carlyle has told us, the primary character of the old Northland mythology was "the impersonation of the visible workings of Nature. Earnest, simple recognition of the workings of physical Nature, as a thing wholly miraculous, stupendous and divine. What we now lecture of as 'Science' they wondered at and fell down in awe before as Religion." Our task to-day is not only to recover this attitude but to put aside mythology and elevate our science into a pure religion—the pursuit and use of truth.

Discovery of Fire.—Sooner or later, man will have sought to make fire for himself. The most primitive method is by friction—by forcibly twisting a stick backward and forward in a hole in another piece of dry wood or by rasping one piece rapidly across another. This method may conceivably have been discovered in drilling holes into stones—in making hammer heads—or through pieces of bone, etc. Women early wore necklaces of rude beads and perhaps began by threading berries or flowers upon grass stems or rushes, as children do to-day, so discovering the decorative effect of colour. That red-ochre was used to decorate the body from an early period is clear from its constant occurrence among the remains of primitive man. The production of fire by friction, however, must have entailed a vast exercise of thought—as the heat that is generated has to be applied in raising easily inflammable material to the burning point. A second primitive method was to catch the sparks produced on striking the mineral *pyrite* with a piece of stone. Modern travellers have found this method in use among the Esquimaux, who actually mine the material for the purpose. We know this method came before the use of flint and steel, as pieces of the mineral have been found in the earliest cave-dwellings along with the most primitive flint implements: the latter method, necessarily, did not arise until the discovery and use of iron—itself one of the marvels of early human inventive power.

The Heat in Lime.—Thunder, as Carlyle tells us, to our Northland ancestors, was not mere electricity, as it is to us—it was the God Donner or Thor, God also of beneficent summer heat. Savages, when they have first seen fire, have thought it to be a devil or God that bit you sharply when you touched it and that lived upon dry wood. Familiar as we are with it to-day, we use it more often than not without a thought of its meaning; indeed the nature of fire has been but slowly disclosed to man, although its effects have long been obvious. Some of these, we can easily picture. In England and throughout Europe, wherever possible, primitive man has lived in limestone caves and excavations. One of the most inhabited parts of the island was the southeastern district where the soft limestone, chalk, prevails—in this region, indications of early human occupation are everywhere present. Living in such caves, man will often have built his fire surrounded by blocks of chalk, as we do to-day with any stones at hand, if we wish to boil our kettle in the open.

The harmless, unobtrusive limestone will thus have been burnt (calcined) and necessarily, from time to time, lumps will have been cast out of the cave and wetted by rain. Some observant person will have noticed that, when thus wetted, the lumps have burst asunder and grown hot, even giving off steam, whilst falling into the finest powder. Thus for all time, the easy method of reducing limestone into powder will have been discovered. Sooner or later, also, the greater growth of grass in places where the powder had been spread about will have been noticed and the use begun of lime and limestone as an agricultural fertiliser. Children playing with the wet lime must have felt its caustic effect, and spilling it upon their skin clothes will also have found out its hair-removing power: hence its use by the tanner. A distinction will thereafter have been made between mild (unburnt) and caustic (burnt) lime. Many such "simple" discoveries will have been made, in course of time.

Other stones will have been collected and burnt, just to see what happened. Being burnt in contact with charcoal, metallic ores will have been reduced and thus metals discovered, such as tin, copper and eventually iron. Tin and copper often occur together and their ores are very easily reduced—so it came, probably, that bronze was the first metal made, though we may suppose that the conception of metal was first excited in the mind of man by gold, which occurs native.

Experimental Science.—Chemistry, above all others, is *the* experimental science. The science began when wise men advisedly made experiments—apparently either with the object of discovering ways of transmuting metals into gold or of finding remedies for sickness, if not of lengthening life. We can almost restore the course of action followed. *Pyrite*, being of household value, will have been collected and stored. When stored, under ordinary conditions, especially if exposed to moist air or rain, it gradually "decays," changing to a soft brown solid, like the rust which so easily collects upon iron that early man must have known well. As when pyrite is burnt a pungent smell is obvious, like that from burning sulphur—a substance well known from its occurrence in volcanic districts—glimmerings of the presence of both iron and sulphur in the mineral will have been excited in observant minds and the foundation laid of modern methods of qualitative analysis. Stored in the open, the heaps of decayed pyrite will often have been washed with rain: here and there the washings may have been collected in pools, and when these dried up, in fine weather, green glass-like crystals of *green vitriol* will have been deposited. Glass-like substances generally were distinguished as *vitriols* by the early workers. They tested everything with fire, so "distilled" this vitriol and thus discovered *oil of vitriol;* later on this was made by burning sulphur under special conditions. The name oil of vitriol is still popular, though *sulphuric acid* is that now given to the liquid because of its connection with sulphur. No doubt, the discovery was very soon made that oil of vitriol or *vitriolic acid* was an extraordinarily corrosive substance, and its effect upon substances generally was therefore studied. When added to common salt, it expelled a vapour or spirit—*spirit of salt*—which was very soluble in water. To the present day, the solution is sold as *spirits of salt* or *muriatic acid*, because of its preparation from salt (*murium*). Vitriolic acid was also found to act upon nitre, again a natural product often met with near to human habitations, giving rise to a very volatile, corrosive liquid, which dissolved nearly all the metals—hence the name *aquafortis*, still in use among jewellers, which later gave place to *nitric acid.* Thus were foundations laid.

Exact Science.—Chemistry came to rank as an exact science with the introduction of the balance. The first *systematic* inquiry involving the use of the balance was that of Joseph Black, in 1755, into the nature of magnesia alba and limestone. His account is a classic, to be read by everyone who has the slightest desire to understand chemical method—for Black's method is our modern method and it is to him, more than to anyone else, that we owe the introduction of the logical quantitative spirit into our subject, though it was not until Lavoisier had made firm the foundations laid by Black that the force of the method was fully recognised and its use became systematised and established.

Let us endeavour, as far as possible, to put ourselves into Black's position. To-day, when cement is so much used in place of lime as a building material, and few of us see lime slaked to reduce it to a fine powder before mixing it with sand, we may best open our inquiry by procuring several lumps of limestone and—if we be unable to make it ourselves—of the lime made by "burning" it and begin by slaking a lump of the lime, laid upon a plate, first weighing the lime. As it is always well to deal with known quantities, we may also take a known amount of water. Tins are at hand everywhere and it is easy to beat out a spout at the edge of a small tin box and to weigh this, say, half-full of water.

Pouring the water over the lime but down a rod—a pencil will do—to prevent spilling, distributing it evenly and allowing it to soak in before adding more, we stop when the lime is visibly wet. Soon, if not at once, the block grows hot, begins to crack and fall to pieces and much steam is given off. The change is marvellous—that cold water should so produce heat is astonishing! What has happened? Is the water all got rid of as steam? On weighing the cold slaked lime, now a fine, dry powder, it appears that from 100 parts of lime and x parts of water, there is produced $100+y$ parts of the slaked lime, only $x-y$ parts of the water having been given off as steam. So the lime has, in some way, been joined to water and apparently the heat has been produced as a consequence of the act. *Limestone* never behaves in this way to water—what happens then when it is burnt to lime? What is the effect of burning things? Usually they are more or less completely destroyed. Is the limestone? Experiment shows that, when strongly heated, all limestones lose in weight, some as much as 42–43%. The cleaner the limestone, the more it loses, the best whiting (so-called because it is used in making whitewash), prepared by levigating finely ground chalk, losing the most. Sometimes, in limestone rocks, crystalline masses and even crystals are found of the mineral *calcite;* this also appears in limestone caves in the form of stalactites. When this is burnt, it not only gives lime but more than any other form of limestone. When every possible care is taken to be exact, the amount obtained is constantly—within the limits of experimental error—56 % by weight of the calcite; so 44 % is in some way lost! Precise determinations of the amount of water taken up by the 56 parts of lime so produced show it to be the merest trifle above 18 parts. What of the 44 that are lost in "burning" the limestone?

Tests of Calcite.—As calcite is thus found to have a definite composition and seems to be a pure limestone, the term may be used in preference to "limestone," which is the name not of a mineral species but of a rock that is found all over the world. How is it to be tortured into displaying its character? Its actions must be studied in full. As it is deposited as stalactite by the evaporation of water which has drained through limestone rock, the material must be soluble to some extent even in water. Solvents more powerful than water are known—do these affect it? Muriatic and nitric acids dissolve it readily but with effervescence—*i.e.*, gas is given off, *calcite gas*, let us call it provisionally: how much? The experiment being made in an apparatus which can be weighed before and after the escape of the gas, this also being collected and measured, it is found that 100 grammes of calcite afford about 44 grammes of gas and that these 44 grammes of gas measure about 22 litres. The missing 44 are thus caught and shown to be a gas—no wonder that when limestone is burnt nothing is seen to escape. What of lime? Is lime soluble in acid? Experiment shows that it is and that, as was to be expected, it dissolves without effervescence. It is thus made clear, that a gas is imprisoned in limestone which may be expelled by heating and also by means of acid. Hence the name "Fixed Air," used by Black. What is this gas, this fixed air? Is it one of the gases we know? We know *air*—we feel it as wind—though we do not see it. Everyone knows vaguely that air is life—that we inhale it and that we are kept warm by its use; it is also known that fire is in some way promoted by it: that burning involves an interaction of air and the fuel. Some few have learnt that less than 150 years ago the discovery was made, that the active constituent of air is the gas *oxygen*, of which there is nearly 21 %, all but about 1 % of the remainder, as we now know, being nitrogen, which is inert. Today, oxygen is produced in large quantities by liquefying air under pressure and separating the oxygen and nitrogen by distillation, just as we separate, for example, alcohol from water or pétrol from crude petroleum. To compare these gases with calcite gas, we may ascertain the weights which have the same volume as the 44 parts of this gas obtained from 100 of calcite—the weight of the oxygen is 32, that of the nitrogen 28.

Oxygen.—Oxygen being thus easy to get—it is used on the streets from big iron cylinders into which it has been compressed, in welding iron rails by the oxy-acetylene blowpipe—we may test its behaviour in promoting burning. Anything which burns in the air, if kindled and introduced into oxygen, burns far more easily, often with great brilliance and energy. Wood, charcoal, coal, oils and alcohol all burn but only the flame is conspicuous: there is neither visible nor obvious product. Sulphur, used of old on matches, because it is easily fired, evidently yields a product, judging from the smell that is noticeable. Phosphorus, which burns with great brilliancy, yields a white solid. Why the name oxygen? The terminal *gen* is an indication that it is a generative material. The name was devised by the great Lavoisier—who was decapitated by the French revolutionaries in 1796, because the Republic had no need of savants—to express the fact that common combustibles were converted by it into *acids*, from the Greek *oxys*, acid, *gennao*, to produce. Oxygen remains, to-day, the most significant term in chemistry. Lavoisier's prescience in selecting it was absolute. The white snow from phosphorus, the fumes from sulphur, dissolved in water, taste acid and turn a vegetable blue colour, such as violet-juice, red; what of the product from charcoal, if there be one? On kindling charcoal in a current of oxygen and passing on the gas into a solution of blue litmus, the solution is reddened, though not made red. All vegetable matters, when burnt, together with more or less water, give a similar product, in that it is weakly acid. What of the gas from calcite? Passed into a solution of litmus, it causes faint reddening: at least a clue to its nature is thus obtained. That it is to be connected with coal or carbon was known at an early date—not only to Black but to his forerunners. Let us now consider how the connection may be established. Calcite, we have seen, is easily resolved into lime and calcite gas.

Can the gas from calcite be reunited with lime to reproduce calcite? Though but slightly soluble, lime is more soluble than calcite: lime-water has long been used medicinally: so if the lime in lime-water were to associate with the gas, when the two are brought together, the reproduced calcite might become evident by falling out of solution as it was formed. On passing the gas from calcite into lime-water, a white precipitate is formed. Having ascertained the solubility of lime, it is easy to prepare enough lime-water and from this make enough of the product to find out whether it can be burnt to lime and, if so, what percentage will be lost, also how much gas be set free on dissolving it in acid. The values agree with those obtained with calcite—moreover, seen under the microscope, the crystalline form of the product is like that of calcite. It being thus established that calcite can be reproduced from the two substances into which it is resolved by "burning," lime-water becomes a test for calcite gas. On burning charcoal or other "carbonaceous" material in oxygen and passing the product into lime-water, precipitates are obtained which prove on examination to be *calcite*, being like it in crystalline form and in composition, 100 parts yielding 56 of lime and 44 of gas. It is thus discovered not only that *carbon* is a constituent of limestone but that calcite gas contains both oxygen and carbon: the proportions in which these are associated are found, by burning known weights of carbon, to be as 12 to 32 in the 44 parts of gas obtained from 100 of calcite. As equal volumes of the gas and of oxygen weigh as 44:32, the gas may be said to contain its own volume of oxygen. It is now possible and desirable to use the more significant name *carbonic acid gas*, in place of calcite gas.

Having thus resolved limestone into three components, lime, carbon and oxygen, we may ask, what of lime? What happens when it is attacked by, say, muriatic acid? This latter is a solution of the *spirit of salt* in water—take away the water, which is known to have but a slight solvent effect upon lime, what will be the action of the spirit of salt?

On passing the gas from salt through a tube containing lime, this grows very hot and gradually liquefies; ultimately, with care, a liquid may be distilled off. On examination, this behaves exactly as if it were *muriatic acid*, a solution of the "spirit" *in water*. Apparently, water has been produced from the two interacting materials—what is water? What else is formed? The tube contains a solid, looking much like fused common salt. Is this "muriate," perhaps, common salt? If so, it should behave like salt and give spirit of salt when "tortured" by vitriolic acid. The experiment being tried, spirit of salt is found to be given off—but the residue differs from that obtained on thus treating salt, being but slightly soluble in water. The product from lime and spirit of salt is, in fact, a muriate, a *sea-salt* like substance—a *haloid*—but not sea-salt. When the "vitriol" from the lime is studied, it is eventually found to be the well known common mineral *gypsum*, which thus becomes connected with limestone. Clearly, something passes from the spirit of salt to the lime—does the reverse happen, perhaps? Is it a case of exchange? What is water? What is spirit of salt? Such questions were only recently answered. The compound nature of water was not suspected until towards the close of the 19th century. Priestley, in 1781, observed that "inflammable gas," as it was then called (made by dissolving iron, zinc or tin in muriatic acid), gave *dew* when exploded with air. Cavendish, repeating the experiments, came to the conclusion that the dew was plain water and subsequently produced water by exploding inflammable air with oxygen. Even earlier (1776), Macquer, in France, had recognised that water was produced on burning inflammable air. Lavoisier then studied the matter fully and eventually gave the name *hydrogen* (water-producer) to inflammable air. The first step toward proving that spirit of salt was a compound was the accidental discovery of the gas we now call *chlorine*, by Scheele, in 1774, on dissolving a new mineral (manganese) *pyrolusite*, which he was examining in "marine" or muriatic acid. Gay-Lussac and Thénard subsequently showed (1809) that hydrogen was produced on passing the gas spirit of salt over heated iron, and that spirit of salt could be formed by the interaction of equal volumes of hydrogen and chlorine gas (*cf.* T. M. Lowry's *Historical Introduction to Chemistry*).

The Caustic Alkalies.—The production of water from lime and the spirit of salt or hydrogen chloride is, therefore, a proof that lime is an oxide—of what? The nature of the caustic alkalies was scarcely suspected until Davy, at the Royal Institution, in 1807, obtained the metals potassium and sodium from caustic potash and soda, by decomposing them by an electric current. Limestone had long been classed with the common alkalies—soda and potash. Moreover, Lavoisier had conjectured that the alkaline earths (lime and baryta) were compound substances and like metallic oxides. This view was confirmed when Davy prepared calcium from lime (1808). The 56 parts of lime in 100 of calcite are now known to consist of 16 parts of oxygen and 40 parts of the metal calcium. As no further simplification can be affected by the means at the disposal of chemists, nor even by any mental process, the conclusion has been drawn that oxygen, carbon and calcium are simple materials or elements—within the meaning of the act chemical, the act in which an element is defined as a chemically unresolvable substance, for chemists are ruled by acts. Taking the percentage composition of calcite into account, it is noticeable that the ratio in which oxygen is present in the two oxides is 16 : 32 = 1 : 2, which justifies us in speaking of lime as a *monoxide* (calcium oxide) and of calcite gas as a dioxide (carbon dioxide).

A vast amount of labour has been expended in determining the composition of water—the quantity obtainable from 56 parts of lime is 18·016, of which 16 are oxygen and 2×1·008 hydrogen. To produce this amount of water from lime, hydrogen chloride (spirit of salt) must be used in the proportions of 56 of lime to nearly 73 of chloride. The amount of chloride used contains 2×1·008 of hydrogen and 70·92 of chlorine. Calcite, we have already seen, is a substance of unvarying composition.

Such values found an interpretation in the doctrine proclaimed by the Latin Lucretius (B.C. 99–55) in his celebrated poem "On the

Nature of Things." The doctrine was borrowed, in the main, from Democritus, a Greek philosopher (*c.* 460–380 B.C.). Lucretius taught that everything was formed of indivisible particles or atoms, eternal and unchangeable; these atoms, "by various combinations, in infinite time, with the void in which they move, formed the universe." The doctrine was resuscitated and developed by John Dalton in 1808; to-day it is the accepted, proved basis of chemistry.

Matter is known to us in the three states of gas, liquid and solid. In the true gas, the particles are practically independent and very far apart, yet, as they are in very rapid motion, the distance they are apart is constantly varied and they often come into collision; they also constantly come into collision with any object exposed to their blows. Gaseous pressure is due to the impact of the particles upon the surface affected.

There is a temperature—the critical temperature—above which no pressure will cause a gas to liquefy: below this temperature, if a gas be compressed, ultimately its particles are brought sufficiently close together to exert an inherent attractive force—more or less powerful, according to the nature of the gas. The gas then liquefies. When the liquid is sufficiently cooled, it becomes solid and crystalline: the particles then take up certain definite positions.

Avogadro's Theorem.—Avogadro, in 1811, was the first to enunciate the view that the similar behaviour of gases, under comparable conditions, is to be explained by the assumption that *equal volumes contain equal numbers of particles:* consequently, the relative weight of the particles or molecules are as the relative weights of equal volumes at the same temperature and pressure; *i.e.*, as the densities of the gases. Taking hydrogen and oxygen, for example, the latter is found to be 15·880 times as heavy as the former. Having acquired a strange affection for the number 16 in connection with oxygen, having so often to deal with oxygen in their analyses, chemists have preferred to retain this number and to raise that of hydrogen to $\frac{16}{15{\cdot}88} = 1{\cdot}008$, although hydrogen is their unit of reference in practically every other respect—being the lightest of known elements. Though oxygen molecules are thus determined to be about 16 times, nitrogen about 14, carbon dioxide about 22 times as heavy as hydrogen molecules, it in no way follows that these are more than the relative masses of the molecules. Reflection shows that Avogadro's theorem has important consequences. If we consider compounds, taking water as the most familiar, the gas obtained by vaporising water (dry steam) is only 9 times as dense as hydrogen under comparable conditions. We know that of 9 parts of water, one is hydrogen, whilst eight are oxygen. The oxygen molecule, however, is 16 or 2×8 times as heavy as the hydrogen molecule—so that if there be one particle of oxygen in a molecule of water, there must be two particles of hydrogen. As a matter of fact, we know that when water is formed, by exploding a mixture of hydrogen and oxygen, twice as much hydrogen, by volume, as of oxygen is required—twice as many molecules, therefore, of the one as of the other interact.

As the volume is diminished by a third during the explosion, the number of water molecules formed must be only two-thirds the number of hydrogen and oxygen molecules concerned in their production—some division of both molecules, some new association of their parts, must have been effected. It is thus discovered that the molecules have parts: how many? we may ask. Extending the inquiry to the formation of other compound gases from hydrogen, taking spirit of salt or hydrogen chloride, this is found to contain hydrogen and chlorine in the proportion of 1·008 : 35·46. The density of the gas, however, is only about $18 = \frac{36}{2}$, compared with that of hydrogen: a value, however, one-half of the minimum value $(1{\cdot}008 + 35{\cdot}46)$ which can be assigned to the amount containing the unit weight of hydrogen. Interaction of hydrogen and chlorine gases to form hydrogen chloride, moreover, takes place between equal volumes, without change of volume. Therefore, the two molecules must be supposed to have been each divided into two, one half of the one going to one half of the other: each molecule is a similar composite, the product being a dissimilar composite. It is as if a couple, say, two lively boys, dancing in a ball room, were to meet a dissimilar similar couple, say two sedate girls, and the two couples exchanged partners: there would still be two couples dancing, their joint effect in the room in occupying the floor would be the same as that of the original two couples, though they might be less agile than the one of these and more agile than the other.

Chemists have chosen to term the ultimate constituent of the molecules, atoms. The chemist to-day constantly applies the term molecule to the kinetic unit—the dancing couple, the term atom being reserved for the ultimate chemical unit. Physicists, thus far, have not made up their minds to use the terms consistently. The atoms, as in the case of mercury, for example, sometimes elect to dance alone, as molecules. Molecules are not necessarily complex units. Emphasis may also well be laid here upon the fact, that the *molecular weight* of any uniform substance, in the gaseous state, relatively to that of hydrogen, is arrived at very simply, hydrogen being taken as the unit of gaseous density, *by doubling the value of the gaseous relative-density.* Moreover, representing the hydrogen molecule as H_2, as 2 grammes of hydrogen occupy 22·32 litres at 0° and 760 mm. pressure, the gramme-molecular proportion (the molecular weight in grammes) will occupy 22·32 litres. Equations written in terms of molecules can, therefore, be at once read in gaseous volumes, as well as in mass proportions.

Symbols.—The entire system of atomic weights and of chemical formulae rests upon the foundations afforded by Avogadro's theorem. Each element is indicated by a special symbol, wherever possible the initial letter of its name—as H, Hydrogen, C, Carbon, O, Oxygen, Cl, Chlorine, Ca, Calcium. This symbol represents an atomic proportion and with it is always associated a certain numerical value—the atomic weight, *i.e.*, the smallest proportional weight known to be present in any molecules of the compound, hydrogen being given unit value, thus—

Hydrogen . . .	$H = 1{\cdot}006$	Chlorine . . .	$Cl = 35{\cdot}46$
Carbon . . .	$C = 12$	Sulphur . . .	$S = 32$
Nitrogen . . .	$N = 14$	Calcium . . .	$Ca = 40$
Oxygen . . .	$O = 16$		

Properties of Elements.—The properties of an element are not to be defined in terms of any one set of measured values but from its behaviour generally—in fact, the portrait of an element is a great composite into which much must be read that cannot be expressed in exact terms. Chemistry is an art as well as a science and, as in all walks of life, few of its adherents have the artistic sense sufficiently developed to be able to appreciate fully the works that may be set out before them. To give an example. We deduce the properties of the element oxygen, not from the gas as we know it—which indeed is itself an oxygen compound O_2—but from the behaviour of this and all other oxygen compounds. We probably come far nearer in water and in ozone to what would be the behaviour of oxygen-stuff if it were alone than we do in that of the gas oxygen upon which we live. It were far better if we had distinct names for each of the stuffs we think of as an element, and for the compounds which the atom forms with itself. We are told that the diamond consists of carbon, but the conception the chemist has of atomic carbon (carbon-stuff) is as far removed from diamond as any two conceptions possibly could be. No elemental name could be more appropriate than that of azote, given by Lavoisier to the inert gas in our atmosphere—no name better for the stuff of which it is composed, one of the most active known, we have reason to believe, than that he had in mind, though unfortunately he did not know enough to justify him in proposing its use: aminogen. Ordinary oxygen gas were far better spoken of as azote—unfortunately the name is unpalatable. Chlorine is a particularly fit name for the gas we so-call; the name chlorhalogen (green salt-forming) would be more suitable for the atomic component of its molecules were it not that it lacks euphony.

Diverse Properties of the Elements.—Some of the elements are gases, very few are liquids, most are solids. Some, the majority, are *metals*—a term that needs no special explanation; some are very different from metals, *non-metals;* some show a half-way behaviour, whilst looking like metals—these are called *metalloids*. In all about 90 are known. It is being said that only 92 are possible. The elements are not only thus divisible into three types but into families. The members of human families tend to be more or less alike in their general conduct—though very different maybe in some particulars; indeed we class animals and plants in families because of resemblances—what is more, we think of the members of a family as genetically related. The lion, the tiger, the leopard, the domestic cat are all cat-like, we call them all *felidae*. Hydrogen stands alone in the esteem of chemists—it is Jove: they have made it their unit of adoration they measure the loves of other atoms by comparing them with the hydrogen atom. Oxygen, however, is the most potent of al the elements; its character is the most marked, it is the most full of energy and shows the widest range of affection for other elements—few decline to be associated with it; it compels al the active non-metals, except fluorine, to join with it in forming acidic compounds; it marries with all the metals to form compounds which neutralise the acids, alkylic (alkaline) oxides—though if the metals be allowed sufficiently to satisfy their polygamic tendencies towards oxygen, they are in the end overcome by it and the outcome of the union is acidic; it also ha particular affection for itself.

The Halogens.—As to families, chlorine—the major con stituent of common salt—is one of a family of four *halogens:* fluorine, chlorine, bromine and iodine. They are a striking company, in so much as they are all more or less coloured and directly offensive to the nose and animal tissues, being highly corrosive and poisonous. Their chief chemical peculiarity is their ability to enter into association with hydrogen, atom for atom, forming the hydrides HF, HCl, HBr, HI. These are all colourless gases, very soluble in water; though not acids themselves, they form acids when thus dissolved. The halogens form compounds with the metals generally.

The Oxygens.—Oxygen is remarkable among the elements as the dominant parent of water. This is commonly represented as a neutral substance and appears so to us, because it is so much a part of ourselves: actually it is the most universally active and potent of known compounds. With it are to be associated, as members of its family, though somewhat distant relatives in many of their characters, the elements sulphur, selenium and tellurium. These all form hydrides characterised by powerful odours, analogous to *Hydrone*, OH_2, the unit-molecule of water, in composition; they also form a series of corresponding acidic oxides, SO_2, SO_3, etc. They combine with the metals generally.

Aminogens.—Lavoisier hesitated whether he should not give the alternative name *Nitrogen* to the chief constituent of air. In selecting *azote*—a name which the French have logically preferred to the present day—he recognised the peculiarity which renders it of value as a diluent in our atmosphere. Recognising the remarkable properties of *ammonia*, he was inclined to use the term *aminogen*, but was eventually led to select nitrogen, because of the relation of the element to nitre and nitric acid. At that time, little was known of the great part played by nitrogen in nature and of the existence of ammonoids derived from other elements. Nitrogen is to be associated with the elements phosphorus, arsenic and antimony, because these all form hydrides like ammonia, NH_3; they also form acidic oxides and acids like those formed from nitrogen.

Carbon is a host in itself, the most wonderful of all elements, in giving rise to a vast number and variety of compounds, all of which may be regarded as built upon the single simple foundation stone afforded by its lowest hydride, CH_4, *methane* or marsh gas. It is usual to associate it with silicon and titanium, particularly because of the analogy in the empirical composition of the oxides; the relationship is a distant one, however. Methane is an entirely neutral substance.

Metals.—The non-metals are distinguished, speaking generally, by the formation of simple gaseous hydrides. The metals are not to be thus characterised, though hydrides of many are known. They are to be recognised rather by their behaviour towards acids, from which they displace hydrogen, forming salts; also by combining with chlorine and with oxygen in characteristic proportions.

Several families are to be distinguished. The sodium family containing lithium (7), sodium (23), potassium (39), rubidium (85·4) and calcium (40), is characterised by the fact, that they are all soft metals which act vigorously upon water, liberating hydrogen and forming hydroxides, such as caustic soda (NaOH) and its analogues. They all unite with the halogens, forming halides or haloids similar to common salt, NaCl.

The metals of the calcium family, calcium, Ca, strontium, Sr, barium, Ba, are also soft and readily attack water, forming hydroxides resembling " caustic lime " $Ca(OH_2)$, and combining with the halogens to form dichlorides, $CaCl_2$, etc.

In fine, if the symbols of the elements generally be written in a continuous series, in the order of their atomic weights, it is obvious that throughout the series there is a progressive alteration in properties, accompanied by a periodic rise and fall, certain properties reappearing at intervals throughout the series. This peculiar relationship was specially insisted upon by the Russian chemist Mendeléeff and is commonly referred to as Mendeléeff's periodic classification. This periodicity comes out most strikingly when the volumes calculated as occupied by atomic proportions are contrasted with the atomic weight, and also when comparison is made of the variation in the heat-capacities of the elements at the boiling point of hydrogen (−253°), as in the following diagram:—

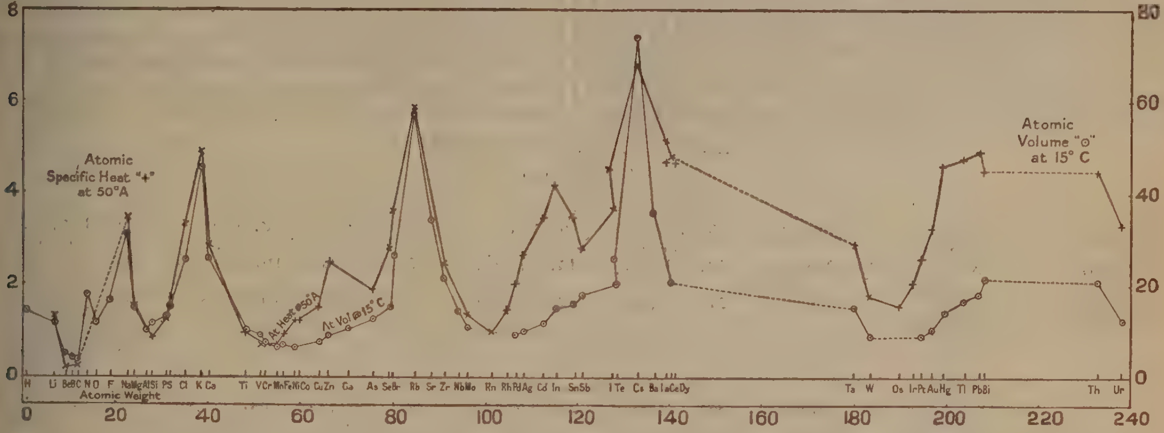


FIG. 1. Diagram showing periodic variations of heat capacity and atomic volume.

Radium.—Chemists, especially those who are conversant with the manner in which function is correlated with structure in carbon compounds could not fail to be struck by these relationships. They have, therefore, long held the belief that ultimately the supposed elements would be found to be composites that were in some way structurally related. The important discovery of radium (*q.v.*), suddenly gave substance to this view, and the modern electronic conception of the structure of matter is no more nor less than its justification. At present, radium is the riddle of our chemical universe. To all appearance an element, in that it closely resembles the metal barium, it differs from all that were previously known, except thorium and uranium, in that it spontaneously undergoes decomposition, at a definite rate, giving rise to helium and another gas (radon), the which gas, in turn, again gives off helium and is ultimately converted into lead (*see* RADIO-ACTIVITY). Strangely enough, we cannot influence these changes by any of the means at our disposal. Whatever lead may be, radium and the intermediate elements seem to be its helides. Helium (*q.v.*) is suddenly become to the chemist one of the most interesting of known substances.

Isotopes.—Ballistics (*q.v.*) have played a great part in the further recent development of our knowledge. The molecules in gases are always in turbulent motion. First Sir J. J. Thomson, then F. W. Aston, have developed methods of firing atomic molecules (molecules reduced to their ultimate degree of fineness) through a very narrow tube and directing their course of travel by electric and magnetic controls, so that they are delivered at a photographic plate at points determined by their mass and the electric charge they carry. From the photographs so obtained, it is possible to deduce the masses of the impinging particles (*see* ISOTOPES). Treating nitrogen and oxygen in this way, hits are scored in positions 14 and 16—showing that the ordinary diatomic molecules of the gases are resolved into monatomic molecules. Hydrogen hits are scored slightly off position 1, in agreement with the conclusion that it is slightly heavier than unity.

The strangely fractional atomic weight of chlorine, 35·36, has always puzzled chemists: some have even thought it to be a mixture. Aston has shown that this is so. Firing the molecules at his photographic plate, he has scored hits at two points, 35 and 37, the impression produced at 35 being about double as intense as that at 37, justifying the assumption that ordinary chlorine is a mixture in the proportion of 2:1 of two sets of molecules, one of mass 35, the other of mass 37. These two constituents of chlorine, apart from the difference in atomic mass, differ so little in chemical behaviour, that they pass as alike: they are like "identical" twins born at slight intervals apart. Such are termed *isotopes*.

Classification of Elements.—Chemists are still further indebted to physicists for the aid they have recently received from them in classifying the elements and "fixing" their possible number. When a slit of light falls upon a plate upon which fine lines have been ruled close together (a diffraction grating) the slit is spread out into a coloured band or spectrum. In like manner, when X-rays fall upon a crystal surface, striking the atomic centres, which may be regarded as forming lines corresponding to those on a grating, they are deflected to an extent which depends upon the atomic masses (*see* CRYSTALLOGRAPHY). When the X-ray spectra of the elements are arranged in the order of the atomic weights, one below the other, they form a stepped series. The staircase is seen to be complete, except in very few places—the number of steps indicated between hydrogen and uranium being 92; in the table below the elements are arranged in the order of their atomic weights, horizontally and vertically in great families. As in human families, there may be marked diversity of character within a family.

Electricity.—Having thus sketched, in barest outline, the manner in which chemists have gradually developed their knowledge of the materials open to study and established an atomic theory of the constitution of matter, of which an extension is foreshadowed in the electronic conception of atomic matter, we may pass on to consider the value of the several pieces on the chemist's chessboard and the manner in which the game of chemistry is played in the laboratory and in Nature. Progress has not always been premeditated but has often been the outcome of some happy accident to a shrewd observer. Such was the case when Galvani (1779) noticed that a frog's leg was caused to twitch when pieces of two different metals touching at the one end were placed, some distance apart, upon the bared muscles; hence arose the discovery of what became known as the Galvanic current. Soon afterwards (1780), Volta constructed his electric pile, consisting of alternate discs of copper and zinc separated by discs of paper moistened with a solution of salt. Workers were thus provided with a means of producing an electric current. Good use was soon made of this, especially by Sir Humphry Davy. His successor, Faraday, was the first to show, though not until 1833, that the electricity of Volta's pile was

GENETIC TABLE OF ELEMENTS

				1. Hydrogen 1·008 o			
2. He 4	**3.** Li 6·94 (7–6)	**4.** Be 9·1	**5.** B 10·9 (11, 10)	**6.** C 12 o	**7.** N 14·01 o	**8.** O 16 o	**9.** F 19 o
10. Ne 20·2 (20, 22)	**11.** Na 23 o	**12.** Mg 24·32 (24, 25, 26)	**13.** Al 27·1	**14.** Si 28·3 (28, 29)	**15.** P 31·04 o	**16.** S 32·06 o	**17.** Cl 35·46 (35, 37)
18. A 39·88 (40, 36)	**19.** K 39·1 (39, 41)	**20.** Ca 40·07	**21.** Sc 44·1	**22.** Ti 48·1	**23.** V 51·06	**24.** Cr 52	**25.** Mn 54·93 **26.** Fe 55·85 **27.** Co 58·97 **28.** Ni 58·68 (58, 60)
	29. Cu 63·57	**30.** Zn 65·37	**31.** Ga 69·9	**32.** Ge 72·5	**33.** As 74·96 o	**34.** Se 79·2	**35.** Br 79·92 (79, 81)
36. Kr. 82·92 (78, 80, 82, 83, 84, 86)	**37.** Rb 85·45 (85, 87)	**38.** Sr 87·83	**39.** Yt 88·7	**40.** Zr 90·6	**41.** Nb 93·5	**42.** Mo 96	**43.** —— **44.** Ru 101·7 **45.** Rh 102·9 **46.** Pd 106·7
	47. Ag 107·88	**48.** Cd 112·4	**49.** In 114·8	**50.** Sn 118·7	**51.** Sb 120·2	**52.** Te 127·5	**53.** I 126·92 o
54. Xe 130·2 (129, 132, 131, 134, 136)	**55.** Cs 132·81 o	**56.** Ba 137·37	**57.** La 139 **58.** Ce 140·25 **59.** Pr 140·6 **60.** Nd 144·3 **61.** —— **62.** Sa 150·4 **63.** Eu 152 **64.** Gd 157·3 **65.** Tb 159·2 **66.** Dy 162·5 **67.** Ho 163·5 **68.** Er 167·7 **69.** Tm 168·5 **70.** Yb 173·5 **71.** Lu 175	**72.** Hf 178·6	**73.** Ta 181·5	**74.** W 184	**75.** —— **76.** Os 190·9 **77.** Ir 193·1 **78.** Pt 195·2
	79. Au 197·2	**80.** Hg 200·6 (6) 197 to 204	**81.** Tl 204 (various radio elements)	**82.** Pb 207·2 206, 208 (various radio elements)	**83.** Bi 208 (various radio elements)	**84.** Polonium (various radio elements)	**85.** ——
86. Nt 222 (Th Em 220 Ac Em 218)	**87.** ——	**88.** Ra 226 (Th X 224 Ac X 222)	**89.** Ac 226 (Ms Th II 228)	**90.** Th 232·15 (various radio elements)	**91.** U X 2	**92.** U 238·2 (U II 234)	

(For latest Isotope numbers *see* ISOTOPES.)

dentical with that produced by friction or let loose in the thunderstorm. The difference was only in concentration or potential. Frictional electricity, though small in quantity, is of high potential—able to leap across considerable spaces—whilst that from the Voltaic pile or Galvanic battery (both terms were long in use together) is of low intensity but of any desired quantity. Prior to Faraday, in 1801, Nicholson and Carlisle had passed the electric discharge through water, obtaining hydrogen and oxygen; Davy, in 1807-8, obtained the alkali and alkaline-earth metals by similar means.

Electrolysis.—Faraday, from 1834 onwards, systematically studied, in an exact manner, the effect of electric currents upon compound substances generally. Some, relatively few, carried or conducted the current and, as a consequence, were decomposed. He established two classes of electric conductors—(1) Metallic conductors, the metals generally (all *elements*), which carried the current more or less well, conductivity always diminishing as the temperature rose; (2) Electrolytic conductors, compounds which carried the current but were decomposed as a consequence—conductivity ncreasing as the temperature rose. All such compounds belonged to the class of "salts," including acids and alkalies, in this class. Apparently, no compound acts as a metallic conductor. The term electrolysis was coined by Faraday to express decomposition by an electric current; he termed the compound affected the electrolyte; electrolysis being effected by plunging two platinum plates attached to the two poles of an electric battery into the fused substance or a solution of the substance in water. He termed the plates electrodes, the one the kathode, the other the anode. The two substances into which the salt was immediately resolved were termed *ions*—travellers—one the kation, the other the anion.

By no means are all salts by themselves electrolytes, in the liquid state. Sodium chloride, silver chloride, lead chloride and tin dichloride are all easily electrolysed; beryllium chloride, stannic chloride, $SnCl_4$, mercuric chloride, $HgCl_2$, to mention only a few, are not, however. In fact, *per*-salts generally are nonconductors. There is reason to think that only metallic salts are conductors, and proof has yet to be given that these would be electrolytes, if free from all impurity. The liquid hydrides, apparently, are non-conductors. Thus, the conductivity of water diminishes rapidly as it is purified and is ultimately so slight, that if the impossible were done and all impurity removed, we may well suppose that it would be a non-conductor. *There is no other logical conclusion to be drawn from the facts.* Liquefied hydrogen chloride behaves similarly. Yet if the two be mixed, solutions are obtained which conduct readily: the specific conductivity rising rapidly, as the chloride is diluted, to a high maximum, then falling but much less rapidly to nil when water is reached. It seems that two types of electrolyte must be distinguished—(1) simple: certain fluid salts; (2) composite: solutions of salts in water (and a few other media).

Electrolysis is a very definite operation. The substance affected is always split into two equivalent portions or radicles (ions). If a current be passed through a series of solutions, the radicles are separated in equivalent proportions, which are not necessarily atomic. Thus sodium, silver and lead chlorides yield their radicles in the proportions

Cl	Na	Ag	Pb/2
35·46	23	108	103

—Faraday recognised that a definite quantity of electricity was associated with the atom and that the unit quantity (the equivalent) carried the unit electric charge. Much later, Helmholtz insisted on the importance of the conception of atomic charge and Johnston Stoney termed it an electron. Finally, Sir J. J. Thomson gave precision to the idea, claiming that the electron is, as it were, a material particle of negative electricity, about 1/1800 of the mass of the hydrogen atom. None the less, it seems to be the most masterful unit with which we have to deal. To-day, it is supposed that the atoms consist of highly-condensed, positively charged mass centres surrounded with electrons, in numbers depending upon the mass of the nucleus (*see* ATOM; ELECTRICITY; ELECTRON; MATTER).

All such speculation is of infinite interest but at present it is outside the chemist's ken; he must await the time when the physicist has developed the subject to the point at which it may be of constructive use to him, particularly in explaining dynamic peculiarities which thus far have met with no feasible interpretation. His own formulae are sufficiently vague and wooden, in their implication. The poor paraphrase, those who dabble in electrons would substitute, has no real meaning at present. In fact, the time is not yet ripe for the considered use of the electron in chemistry: the substitution of an artifice for a system of proved efficiency, by no means yet exhausted of value, is to be deprecated. At the present day we need more than ever to go back to the laboratory and work seriously and constructively at things we understand and dare speak of truthfully—without pretence of knowledge.

Nature of Chemical Change.—The electric current "reverses" chemical change but is itself produced by means of chemical interactions—in the voltaic cell. Faraday was the first to recognise the *inseparability* of the two phenomena. No student of chemistry should fail to study his electro-chemical researches from this point of view. A cheap reprint is published in the *Everyman Series.*

What is a voltaic cell? How does it function? Volta's pile consisted of discs of zinc and copper with an electrolyte (a solution of salt) in between. This has served as the model of all developments of the "cell," which always consists of a metal used as anode, which can be associated with one radicle of the electrolyte, the kathode being an inert metal, usually platinum—or a conducting char (coal). *Three* conductors, therefore, are thus coupled in a circuit: *one* of them, however, is composite and a conductor. This is the inevitable arrangement of an electrolytic couple or voltaic element. Originally, common zinc was used but this is readily attacked by acid when "uncoupled" and so is used wastefully. Gradually, it was discovered that the less impure the zinc, the less readily it was attacked when uncoupled: then it was found that if it were coated with mercury (amalgamated) it was not attacked in open circuit.

Notwithstanding this definite statement made by Faraday, and his insistence (in 1833) upon the essentially electrolytic character of the change when a metal, like zinc, is attacked by an acid, like sulphuric, practically to the present day, in the textbooks generally, little or no heed is taken of his findings. Hydrogen is spoken of as prepared by dissolving zinc in sulphuric acid. Hydrogen and oxygen are said to interact to form water, etc. etc., and bare equations are given in illustration. The conditions under which such changes take place are rarely, if ever, pointed out and made clear. During the past 50 years, however, a large amount of exact work has been done, particularly by H. B. Baker, which entirely justifies Faraday's statements. It was early observed, by Wanklyn and others, that carefully dried chlorine has little if any action on metals which are readily attacked by the undried gas. Then H. B. Dixon showed, that a mixture of carbonic oxide and oxygen could not be fired, if it were dry.

H. B. Baker extended the observations to charcoal and phosphorus, showing that these did not burn in dry oxygen. On this last occasion (1885), H. E. Armstrong insisted that the conditions required by Faraday's generalisation must be fulfilled, if chemical action were to take place in such cases. Taking the formation of water, as an illustration, he contended that oxygen and hydrogen could not interact, as neither was an electrolyte; further, that interaction would not be induced even by the presence of water, as this was not an electrolyte and did not form one with either oxygen or hydrogen: the presence of impurity (a trace of acid or alkali) was essential to constitute the needed electrolyte. Several years later, this forecast was verified by H. B. Baker, and so many similar verifications of the view have been secured that it may now be regarded as an expression of the facts generally. Apparent exceptions have been shown, one by one, to fall out, when proper precautions have been taken to secure the necessary freedom from dirt—defining dirt as matter in the wrong place.

The equation of chemical change may be written generally

$$A_2 + \epsilon\delta + B_2 = AB + AB + \epsilon\delta$$

where $\epsilon\delta$ represents *maybe a mere trace* of the indispensable *electrolytic determinant*.

Catalysts.—The term *determinant* should not be confused with that of *catalyst* (*q.v.*) which is of frequent occurrence in modern chemical literature. The latter term was first applied by Berzelius not only to the action of sulphuric acid in promoting the formation of ether from alcohol and of glucose from starch but also to the action of platinum black in promoting the oxidation of alcohol to acetic acid, as well as to the action of the enzyme (ferment) diastase in malt upon starch. These are not comparable changes: the first two occur in solution, the second two at the surface of solids and, as the solid has a specific surface-effect in hastening the change, such actions may be treated apart. It is desirable, in fact, to confine the term catalyst to the solid agent which thus acts, not as mere determinant but in quickening a change already proceeding or which may proceed under the influence of a determinant, the change being one which could not occur in the absence of this latter. The equation of change, when a catalyst (κ) is operative, may be written:

$$A_2 + \epsilon\delta\kappa + B_2 = AB + AB + \epsilon\delta\kappa.$$

Even when the necessary condition of impurity (the determinant) is secured, no metal can be caused to dissolve in an acid, *unless it have a positive heat of dissolution*—or, stated more simply, unless the heat of formation of its oxide be in excess of that of hydrogen. Thus copper is insoluble in acids generally. The approximate heat of formation of copper oxide being only 40,800 or 37,000 units, according as that of cuprous or of cupric oxide be taken, that of hydrogen being 68,000 (gramme degree) units—these being the quantities of heat liberated in the use of 16 grammes of oxygen at atmospheric temperature. If, as is contended here, water be concerned, at least in most chemical interchanges, this is but a rational result. Though insoluble alone, copper is easily dissolved in presence of oxygen—which acts as an *adjuvant*, throwing energy into the circuit—as shown in the following empirical equation:—

$$Cu + SO_4 \; . \; . \; . \; H_2 + O_2 = CuSO_4 + \; . \; . \; . + H_2O_2.$$

The action of copper sulphate in the Daniel cell and of nitric-nitrous acid in the Grove cell is of the same kind: $Zn + SO_4 \; . \; . \; . \; H_2 + SO_4 \; . \; . \; . \; Cu + Cu = ZnSO_4 + \; . \; . \; H_2SO_4 + \; . \; . \; . + CuCu$.

In a simple zinc-sulphuric acid-copper couple, the copper plate soon becomes "polarised" by the accumulation of hydrogen. This is prevented by the copper sulphate, as copper is displaced from the salt by the hydrogen and the electrode surface remains uniform; but such displacement involves the liberation of energy, so the compound cell has both a higher electromotive force than the simple cell and gives a steady current. Substances which thus act as adjuvants are termed, generally, *depolarisers*. The importance of this limiting effect, imposed by the need of electrolysing water in a circuit of chemical change, has yet to be recognised.

Acid Action.—Had simple considerations of this kind and the function of the depolariser been appreciated, the complex series of interactions observed on dissolving metals in more or less impure nitric acid—one of the most involved chapters in chemistry—would have been interpreted without difficulty. It would have been realised that the acid proper acts only in one way—as a compound of the two ions, H and NO_3. It must be incapable of acting directly as a depolariser. The depolarising action of the impure acid is to be attributed, if not to nitrogen dioxide itself, to some nitrous compound which this forms with the acid. The various products, other than the nitrate, obtained in dissolving metals in the acid, are all reduction products, less or more remote, formed by the interaction of hydrogen displaced in the electrolytic current in which the nitrous compound acts as depolariser, the rapidity of delivery of the hydrogen determining the extent to which the reduction is carried.

Corrosion of Metals.—In recent years, there has been a vast amount of discussion over the corrosion of metals. In this case also, had the elementary principles of chemical interchange been grasped and taken into account, much of this would have been unnecessary and a more useful direction would have been given to the work. To take only the rusting of iron—this may clearly occur in two ways, either in a simple or in an aided circuit. In so far as the iron itself is concerned, it may be said, without hesitation, that it is acted upon only by acid and in one way: $Fe + 2HX = FeX_2 + H_2$ (*see* Rustless Steel). Out in the open, carbonic acid is the effective agent; in towns this may be anything. If the liquid film in which the action takes place be free from oxygen or reducible substance, the negative element in the couple (carbide or other active impurity in the iron) is soon polarised and the action takes place irregularly and slowly. If, by the intervention of dissolved oxygen, the polarisation be prevented, action will not only be continued but accelerated, owing to the adjuvant effect exercised by the depolariser. Such attack is corrosion but not rusting. Rusting is due to the separation at the surface of the iron of oxide either from the ferrous salt which is initially produced or from ferric salt formed from this ferrous salt: these salts are continually being hydrolysed as they are produced. So long as acid can penetrate through to the iron surface, the action must continue. The character of the deposit will depend upon secondary changes, due, usually, to the intervention of oxygen as depolariser.

Water.—Of all substances known to us not only the most active and useful but the most marvellous is water. Without water, apparently, "chemical change," as we know it, could not occur—the world would not merely be lifeless but subject only to "mechanical" decay. The contrasts water affords, in its three states, is shown by no other compound—specially remarkable is the change that attends the passage from the liquid to the solid state, involving a sudden growth in volume of about one-tenth. Some new "planetary system" may well be supposed t come into existence, owing perhaps to a great rearrangement o orbits. When this can be fully explained, in terms of electrons chemists may well begin to take these seriously in their work—not before. The life-history of water is a wonderful story. Commencing with the two gases, hydrogen and oxygen, two of th least coercible that are known to us, on interaction (under th influence of a determinant and probably also of a catalyst) these afford the liquid *water*. Much "energy" is set free in th process, ultimately as heat, the amount developed in the creatio of the gramme-molecular proportion (18.016 grammes) bein enough to raise the temperature of nearly 700 grammes water from 0° to 100° C.

What meaning are we to attach to the word *water*, however It should be reserved for and applied to *the liquid alone*, whic undoubtedly is a complex. The fundamental unit molecul represented by the symbol OH_2, is best spoken of as *hydron* This is a gas under ordinary conditions. The formation of wate from this gas may be pictured as a chemical process or interactio in no way distinguishable, in principle, from that involved in th primary interaction of the gases hydrogen and oxygen. Aitken experiments are held to have proved that the condensation "aqueous vapour" and the formation of drops of (liquid) wate in the atmosphere—of cloud—only takes place around a soli nucleus—a catalyst, in fact. It is more than probable, that will eventually be found and admitted that a *determinant*—trace of some "salt"—is also necessary. Such impurity always present, in the form of carbonic acid, nitrous and nitr acids, if not of sulphurous or sulphuric acid, an ammonium sa or sea salt. The nature of the interaction, the composition of t product, is undetermined. Probably, water is a mixture of va ous liquid components, of *polyhydrones* $(H_2O)_x$, $(H_2O)_y$, et saturated with the gas hydrone OH_2, the proportions of t constituents depending upon the temperature. Even above the point of maximum density, the liquid must be saturated wi ice-molecules: the complexity of these is also undetermined—maybe the hydrone unit simulates the carbon unit and prefere tially combines in sixes. It is a matter of interest that "ices of greater density than ordinary ice may be obtained by subjecting ice cooled to various temperatures to great pressure. All suggestions hitherto advanced as to the composition of "water" molecules, under various conditions, may be regarded as purely speculative.

Water is a specially active solvent of compounds—after its own heart: of compounds of oxygen and of the halogens, in a lesser degree of nitrides (compounds of the ammonia type), not at all of "neutral" compounds of carbon (the hydrocarbons). Dissolution—whatever the solvent—presumably, is a chemical process, in the main: not a mere intrusion of the dissolved molecules among those of the solvent but the consequences of some degree of "affinity" between the contending molecules. The process cannot, therefore, well be considered without reference to the affinities of molecules and of their constituent atoms.

Affinity and Valency.—The gas hydrogen, as we know it, is an almost neutral material. It is condensed to a liquid only under high pressure, at a low temperature; the liquid boils at −253°. The molecules of hydrogen, therefore, have but little affinity for each other. The molecule is diatomic, being represented by the formula H_2. As the two atoms are firmly held together in the molecule, they must have considerable affinity for each other and nearly satisfy one another: the molecule has but a slight, obvious, *residual* affinity. The same may be said of gaseous oxygen. Being far heavier than those of hydrogen, the molecules are, in a measure, less swift in movement and more easily "caught" by other molecules. Oxygen is definitely more active and displays a high degree of residual affinity. Moreover, we must picture atomic oxygen, like atomic hydrogen, as gifted with intense affinity—with an almost indiscriminating affinity, as excepting the argonides and fluorine, it forms compounds with all the elements, most of which are of a relatively high order of stability. It is a far more companionable element than hydrogen. Bring hydrogen and oxygen together, in presence of the necessary negotiators of change, allow them to interact in the sense of the equation,

$$2H_2 + \epsilon\delta\kappa + O_2 = 2H_2O + \epsilon\delta\kappa$$

they give rise to hydrone and eventually to water. These products differ in an astounding way from their generators. The molecule of hydrone has little more than half the mass of that of oxygen, yet—given proper conditions—it condenses, with the greatest ease, to water. Not only so, the amount of energy set free in the interactions of the molecules of hydrone, $x\ OH_2 = (OH_2)_x$, is about one-tenth of that liberated in the original gaseous interaction. The molecules of hydrone are thus shown to be possessed in a far higher degree of residual affinity than is even oxygen. Hydrone, indeed, may be said to be a really active form of oxygen-stuff—far more so than oxygen itself. Hence water is so good a solvent: at least, there are molecules in the liquid mass which are very active, chemically speaking. Water, we shall see, must be regarded as a complex mixture, in which are present molecules of varying degrees of complexity: H_2O, $(H_2O)_x$, $(H_2O)_y$, etc., in proportions which depend upon temperature.

Hydrogen and Chlorine.—Similar considerations apply to hydrogen and chlorine and to hydrogen chloride, the product of their interaction—under appropriate conditions. Although chlorine is much more easily condensed than is oxygen, and therefore is to be credited with an even greater store of residual affinity than is oxygen, strange to say, hydrogen chloride, though a more massive molecule than hydrone, has little attraction for itself, being far less easily liquefied than is hydrone; moreover, the liquid is a poor solvent compared with water. Nevertheless, hydrone and hydrogen chloride attract each other irresistibly—the chloride is very soluble in water. We have to consider what the nature of the interaction may be in this and in other cases of dissolution in water.

Azote.—Azote is more extreme in its behaviour than is even hydrogen. The molecule N_2 is all but inert under ordinary conditions, yet we have every reason to believe that its component, atomic nitrogen, is gifted with intense affinity. Whereas hydrogen and chlorine, respectively hydrogen and oxygen, interact readily, when merely brought together in presence of the necessary determinant and the mixture is sparked, azote and hydrogen interact only under high pressure, at a fairly elevated temperature and in presence of special catalysts. The interaction, moreover, is very partial: in fact, the product, ammonia, is formed reversibly: $N_2 + 3H_2 \leftrightharpoons 2NH_3$, interaction taking place far more readily backwards than forwards.

Ammonia.—Ammonia, like hydrogen chloride, has little affinity for itself, though more easily liquefied than the latter; the liquid has special solvent properties of a most interesting character. The gas is readily dissolved by water but is easily expelled from the solution. Most characteristic of ammonia is its behaviour with hydrogen chloride: the two interact, when properly impure, on admixture, forming the white crystalline solid, ammonium chloride

$$HCl + \epsilon\delta + NH_3 = NH_4Cl + \epsilon\delta$$

a salt which bears the closest possible resemblance to common salt.

Carbon.—Lastly, we have to consider the most attractive to the fair sex of all elementary materials—carbon. We ought to confine this term to the ideal represented by the symbol C—which we cannot directly handle. We only know it in its compound polyatomic form, as diamond: a compound of extraordinary interest. If the chemist were properly mindful of the wondrous power of carbon as the foundation stone of the organic world, he would wear the biggest diamond procurable—as "mark of the beast." It is customary, in the text-books, to speak of forms of carbon other than the diamond—to wit, graphite and the charcoal-carbons. No proof has yet been given that these are carbon—much may be said in favour of the view that they are but highly condensed hydrocarbons.

Carbon and hydrogen interact only under special conditions—at the high temperature of the electric arc—the product being the gas acetylene, C_2H_2. The simplest "hydrocarbon" is methane, CH_4, known generally as miners' fire damp (*dampf*, vapour) and as marsh gas, as it is often met with as the product of the natural decay, under the influence of special microorganisms, of cellulosic materials. Methane is an inert material, in so far that the four affinities of the carbon atom appear to be satisfied by the four hydrogen atoms and, reciprocally, the affinities of the hydrogen atoms by those of the carbon atom: it is one of the least coercible of gases. Derivatives are only to be obtained from it by displacing one or more of the four hydrogen atoms by some equivalent radicle or radicles.

The four hydrides considered, taken in conjunction with hydrogen, form a remarkable series:—

$$H_2 \quad HCl \quad H_2O \quad NH_3 \quad CH_4.$$

Three of these are eminently active compounds, obviously possessed of residual affinity, whilst the fourth, methane, appears to be individually inert: in this compound, carbon and hydrogen, apparently, are mutually *satisfied*. What is to be the conclusion from such evidence? Is it to be, as appears from the behaviour of hydrogen itself and of methane, that the hydrogen atom is a single-minded individual, able to grasp at most a single other atom: that the unsaturated character of the hydrides of chlorine, oxygen and nitrogen is a consequence of the inability of one, two and three atoms of hydrogen respectively to satisfy the desires of these elements? This, indeed, has long been the opinion of chemists generally. Hydrogen is considered to be a consistently *monadic* or univalent element and those with which it associates are often elements of variable valency, the desires of which it cannot fully satisfy. In recent years, the reputation of hydrogen as a simpleton has been impugned—yet not seriously: on careful consideration of the statements made, in the light of the facts, there seems to be little reason as yet to regard them as of more than imaginative value.

The hydrides of fluorine, bromine and iodine—all elements of the chlorine family—are in most respects scarcely to be distinguished from hydrogen chloride.

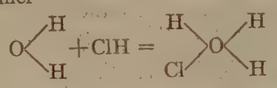
Water may be said to be entirely peculiar in that the "restraining" effect of hydrogen upon the oxygen atom, in the unit molecule OH_2, is so slight. The hydride of sulphur—the element akin to oxygen and next below it in the oxygen family—although similar to hydrone in composition, hydrogen sulphide, has none of the properties of the oxide. It is gaseous and not easily liquefied and the liquid is a poor solvent. Strangely enough, however, if the hydrogen in the two hydrides be displaced by the hydrocarbon radicle (C_2H_5), compounds are obtained in which the properties are, in a measure, reversed. Ether, $(C_2H_5)_2O$, has little tendency to associate with other compounds. The diethyl sulphide $(C_2H_5)_2S$, however, is readily combined with the iodide C_2H_5I, forming the iodide $S(C_2H_5)_3I$, a beautifully crystalline substance in which sulphur appears to be definitely quadrivalent—like carbon in methane. In short, affinity, the valency of a radicle, like human affection, is clearly a relative rather than an absolute function: valency is a variable, not a constant, at least in many cases. Perhaps the only element of constant valency is hydrogen—but this is singular in many ways. This assumption is, at least, a desirable one to make, so long as it cannot be disproved: *in fact, it is that upon which our entire system of structural formulae in organic chemistry has been built up*. The consistency of that system is so marvellous, that our confidence in it will not easily be disturbed.

Accepting the conclusion that oxygen has more or less residual affinity when associated with two hydrogen atoms, as it is in hydrone, what interpretation is to be placed upon the process of dissolution in water? What is water, as compared with hydrone? By what act do two diverse liquids give rise, upon admixture, to a solution conducting more or less well, which apart are without the power of acting as electrolytic conductors? When hydrogen chloride is dissolved in water, a highly conducting solution is obtained; when ammonia is similarly dissolved, the conductivity of the solution is low, at best. What is the difference? When hydrogen chloride and ammonia gases are mixed in equal volumes, they at once interact in the sense of the equation

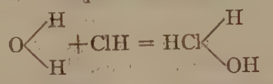
$$NH_3 + \epsilon\delta + HCl = NH_4Cl + \epsilon\delta.$$

The product is a crystalline solid, a definite compound, the salt ammonium chloride, which most closely resembles common salt, NaCl. We cannot well do otherwise than assume that whilst only tervalent to hydrogen, the nitrogen in ammonia becomes excited to a higher valency when a fourth *positive* hydrogen atom is offered to it *together* with a fifth *negative* (chlorine) atom. The two molecules, ammonia and hydrogen chloride, do not merely combine but that of the chloride, apparently, *is divided and distributed upon the ammonia molecule*, the nitrogen functioning as a quinquevalent radicle.

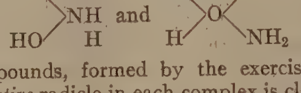
If the same simple assumption be made, the interaction of hydrogen chloride with hydrone, in water, may be represented in the following manner



As, however, oxygen and chlorine are observed to act in a similar and equivalent manner, interaction should also take place as expressed in the equation



The interaction of ammonia and hydrone molecules, in like manner, should give rise to molecules of two kinds, viz.,

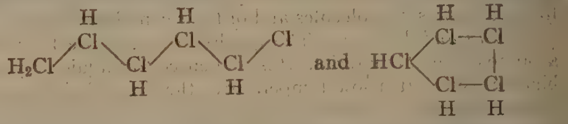


In such compounds, formed by the exercise of secondary affinity, the *negative* radicle in each complex is clearly less firmly held than in the simpler compounds from which it was formed and, therefore, should be more easily separated, we may suppose: the "residual" affinity of the radicle must be greater than it was in the simple molecules. For example, in the complexes formed from hydrogen chloride and hydrone,

$$H_3O{\cdot}Cl \text{ and } H_2Cl{\cdot}OH$$

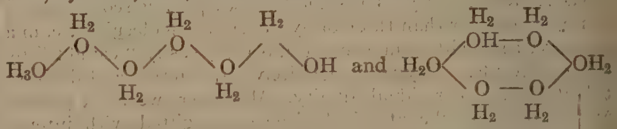
the chlorine radicle in the one, the hydroxyl in the other, is less firmly held than it was in the original simpler molecule. The atoms are all less firmly knit together in the complexes. Their condition is, perhaps, that sometimes spoken of when such molecules are said to be "electrically charged."

Complexes such as are here contemplated are also formed, it is to be supposed, from the fundamental units which constitute the gaseous substance. On liquefaction, these undoubtedly become associated in various ways. Thus, liquefied hydrogen chloride may well be supposed to consist of complexes such as

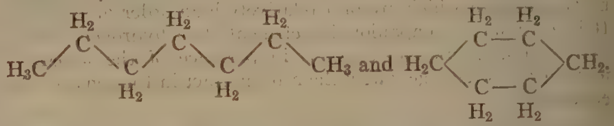


saturated with the simplex HCl. It is impossible to say in what proportions these are present: possibly the one form is dominant.

Water, we may aver, is equally a mixture of the fundamental unit, hydrone, OH_2, with complexes such as



Carbon compounds of these types are well known as stable structures, such as



There is general agreement among chemists and physicists that the carbon compounds are thus constituted. The angles at which the carbon atoms meet in the diamond, the distance apart of the atomic centres (of the carbon atoms), have been exactly determined, in recent times, by means of X-rays. The carbon atoms meet at 109°28′, the tetrahedral angle; the centres are little more than an Ångström unit (one hundred-millionth of a millimetre) apart. There is no reason why we should not see, with the mind's eye, in the liquefied hydrides of chlorine, oxygen and nitrogen, a structure such as we have seen, largely with the actual eye, in hydrides of carbon.

Common water will convey or conduct an electric current—electrolytically. The more it be purified, the less readily it conveys the current. *It is logical to assume, that water free from every contamination, would be a non-conductor.* Such water is an ideal. Water cannot be dealt with without a containing vessel: whatever be the nature of the vessel in which it be received and stored, the surface will be more or less contaminated and more or less subject to attack. The "best water" that has been made has been made in glass and measured in glass—glass we know is *attacked* by water. In testing electrically platinum electrodes are used—platinum, we know, is an absorptive material and pure platinum is inconceivable as a reality. A *pure* substance is the thing itself—there may be degrees of impurity but not of purity. We are so accustomed to an impure world, that it is difficult to rise into the empyrean of ideal purity: physicists have long been noted for their lack of the sense of cleanliness; chemical sanitation is not yet generally at the height at which it should be—and gullibility, of the order pictured by Carlyle, still plays a large part in our Society. Naughty and undisciplined as we may seem to be, the general tendency is to obey and follow the pretending leader.

Electrolytic Action.—To explain the observation that any electromotive force, however small, would produce electrolysis in a solution, causing the ions of the solute, say the hydrogen

(H) and chlorine (Cl) of hydrogen chloride (HCl) dissolved in water, to pass to opposite electrodes and there unite and appear as hydrogen (H_2) and chlorine (Cl_2), Clausius long ago "pretended" that some few of the molecules of the chloride "banged themselves to pieces"—so that no work had to be done by the electric current in separating the ions: it only was necessary to give them direction and set the one to wander to the negative, the other to the positive electrode. This electrical test, however, is one of infinite delicacy—no thought has been given *to the fact* that the reduction of the "impurity" at an electrode surface to an extent beyond or even equal to that of the delicacy of the electrical test is a practical impossibility. Chemists have been led to base their faith, the entire theory of chemical change, upon the observations of two German physicists working in the dim and distant past of 40 years ago—both honourable men but both physicists and mathematicians, not practised chemists alive to the need of the most excessive sanitary precautions, if a chemical clean bill of health were to be secured. Helmholtz is supposed to have electrolysed water by means of non-polarised electrodes. In fact, he used two platinum plates and a third plate of palladium charged with hydrogen: his solution was, therefore, necessarily charged with hydrogen and one or other of his plates was "hydrogen polarised."

Arrhenius, in 1885, extended the Clausius hypothesis but dropped his mechanical explanation. To account for the development and increase of electrical conductivity on dissolving a "salt" in water, to an extent varying with the nature and the proportion of salt used, he assumed that the molecules of the dissolved salt just fell to pieces into separate *electrically charged ions*. Why or wherefore they did so, where the energy to break them up came from, was never explained.

As a matter of fact, what has to be explained is the appearance of electrical conductivity and also of chemical activity, on bringing together two substances which, if logic have any meaning, by themselves are inert. Logic seems to indicate some *interaction* as the only possible cause of the change. The electrolytic dissociation school did, after a time, attribute the change to the high "specific inductive capacity" of the solvent—whatever that may mean. Directly the solvent is called in, the explanation becomes chemical, however, not merely mechanical nor based upon a display of mere wilfulness. "We will dissociate, nothing shall prevent us," was the war cry of the molecules, according to Arrhenius. The chemist had more belief in their moral character and that they would observe the marriage tie.

What Arrhenius really did—and the service was a great one at the time—was to lay great stress upon the existence of an active as distinguished from a passive part, in a chemically active medium, by correlating the electrical conductivity developed in a solvent by the addition of a "salt" with the chemical activity of the dissolved substance—assuming the dissolved substance (in the form of its ions) to be the sole active agent. He also developed Kohlrausch's conception of molecular conductivity, as distinct from that of specific activity (of the solution as a whole), by referring the conductivity to the ions of the solute alone and correlating this, to some extent, with chemical activity.

The generalisation came at a time when much attention was being paid to the determination of molecular weights of dissolved substances. Raoult especially had shown that equimolecular proportions of many substances produced the same effect upon the properties of a solvent: for example in raising the boiling point; moreover, that, within limits, the effect was proportional to the concentration, *at low concentrations*. Van't Hoff also had advanced a kinetic explanation of the phenomena of so-called osmotic pressure—the pressure developed within a cell, containing a solution, by water passing through the lining membrane without the solute passing out.

Osmotic Pressure.—The pressure developed within a cell, by the entry of water (as shown by the rise of liquid in a gauge tube attached to the cell) *into dilute solutions*, appears to be the same as would be developed by the entry of a gas, in equivalent amount, into a cell already filled with the gas, at a known pressure, through a wall permeable only by the entering gas. For example, when a cell of palladium (which is permeable by hydrogen and not by nitrogen) filled with nitrogen at atmospheric pressure, is surrounded with hydrogen at atmospheric pressure, the hydrogen passes through until equilibrium is reached—when the hydrogen pressure is the same within and without the vessel: at this stage, the molecules of hydrogen are travelling at equal rates and in equal numbers both ways. The pressure within the vessel is thus raised to two atmospheres—by the addition of the atmosphere of "pressure" due to the hydrogen. In the same way, when a dilute solution, say of x grammes of sugar in 22·3 litres of water, filling a finely porous cell provided with a gauge tube, is plunged into water, the liquid rises in the gauge tube until the pressure is $\frac{x}{342}$ of an atmosphere, 342 being the relative weight of the molecule of sugar. The late Prof. E. F. FitzGerald, a distinguished physicist of unusual breadth of outlook, speaking of this phenomenon, says:—

> It is a most remarkable thing that osmotic pressure should be even roughly the same as what would be produced by the molecules of the body in solution if in the gaseous state but to imply that the dynamical theory of the two is at all the same or that the dynamical theory of a gas is in any sense an explanation of the law of osmotic pressures is not at all in accordance with what is generally meant by the word "explanation." This so-called explanation is not a dynamical explanation at all, it is only a very far-fetched dynamical analogy. These osmotic pressures are much more closely connected with Laplace's internal pressure in a liquid, which is essentially dependent on the forces between the molecules than with the pressure of a gas, which is essentially almost independent of the forces between the molecules. There must be some dynamical reason why the solvent gets through the membrane while the body in solution does not. It must be due to capillary forces between the solid and the molecules of the solvent (Helmholtz Memorial Lecture, *Chem. Soc. Jour., 1896*).

An understanding of osmotic phenomena is a matter of great importance, because of the part they play in the exchanges between the cells which constitute living structures: the cell walls acting as discriminating septa.

It should be noted that solutions in water have a lower vapour pressure and therefore a higher boiling point, also a lower freezing point than has water. This is true of solutions generally, whatever the solvent. In fact, all the properties of a solvent are modified by the presence of dissolved matter, whatever its nature may be, the alteration being proportional to the amount dissolved—so long as the solution remains dilute.

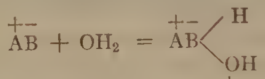
The striking contribution made by Arrhenius in discussing van't Hoff's generalisation was in associating the superior, if not abnormal, effect of electrolytes upon the solvent with the increase in molecular electrolytic conductivity of dissolved salts upon dilution. Whereas non-electrolytes produce the unit osmotic effect, molecular proportions producing the same effect, electrolytes have more than unit effect and as the solution is diluted the effect increases, until, in the case of binary compounds such as hydrogen chloride, HCl, for example, the molecular effect is practically doubled—as if the radicles H and Cl were acting independently.

Arrhenius made the assumption that they were, but that the water remained unchanged. It is impossible to grant such an assumption. No valid reason has ever been given which will account for the separation, which is one involving a great absorption of energy. Actually, a not inconsiderable amount of heat is evolved when hydrogen chloride is dissolved in water, part of which, of course, is due to the liquefaction of the gas. Again, the assumption is one that involves a sharp distinction being drawn between hydrogen chloride and hydrone—speaking chemically, this is impossible, what is generally true of the one being true of the other.

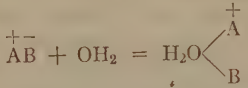
The nature of the change which it is conceivable takes place when hydrogen chloride and hydrone interact has already been pictured. In view of the known behaviour of hydrogen chloride towards ammonia, the chemist is in a position to assert that hydrogen chloride and hydrone must be able to interact and do interact in a similar manner. He can produce and exhibit in a crystalline form a compound formed from methylic oxide, $(CH_3)_2O$—the analogue of hydrone—and hydrogen chloride.

The question then arises—how are the alterations in the properties of water and of solvents generally induced by the presence of a substance in solution to be explained—how, in particular, is the peculiar and enhanced effect of (potential) electrolytes as compared with non-electrolytes to be pictured. The first assumption that may be made is—that, in all cases, the primary, chemically active unit is the simple molecule, hydrone, OH_2, in the case of water. It will easily be granted that water is saturated with hydrone, the proportion varying with the temperature. As a matter of fact, the vapour pressure of an aqueous solution is lower than that of water. One effect of the solute molecules is, therefore, to capture and restrain a certain proportion of the hydrone molecules. It may be urged that as soon as hydrone molecules are withdrawn, others should come forward—produced by the breaking down of polyhydrones—to take their place and restore the equilibrium. The facts negative this assumption: the dissolved substance exercises an abiding influence. It is almost necessary to assume that the residue of the solvent is modified: that the complexes present along with the simple, fundamental molecule exist in a different proportion: that inasmuch as the freezing point is lowered, the crystallisable form is diminished in amount. Water near to its freezing point must be saturated with "ice-molecules" whatever the complexity of these may be. When a substance is dissolved in water, the hydrone solute complexes which are formed—whatever their nature—doubtless exercise a disturbing influence upon the rest of the liquid and the equilibrium is perhaps altered in such a way that fewer "ice-molecules" are present.

As to the peculiar influence of electrolytes—we know that the departure from the "normal" behaviour of non-electrolytes varies with the compound dissolved and the strength of the solution, the specific molecular effect being always greater the more dilute the solution. Let it be assumed that hydrone and the solute, AB, interact in the following manner

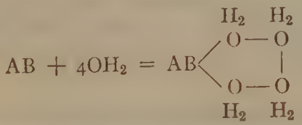


$$\overset{+-}{AB} + OH_2 = \overset{+-}{AB}\!<\!\begin{matrix}H\\OH\end{matrix}$$



$$\overset{+-}{AB} + OH_2 = H_2O\!<\!\begin{matrix}\overset{+}{A}\\B\end{matrix}$$

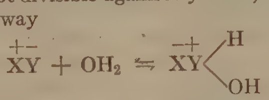
Each of these products will be an active unit—one that is more active than the molecule from which it is derived—than hydrone on the one hand, than the salt molecule on the other. The relative proportions in which the two are formed will vary with the concentration. In concentrated solutions, however, a large proportion of the salt molecules will not form active complexes but, it may be supposed, will be associated in grouped or closed systems, *e.g.*,



$$AB + 4OH_2 = AB\!<\!\begin{matrix}\overset{H_2}{O}-\overset{H_2}{O}\\ \quad\ \ |\\ \underset{H_2}{O}-\underset{H_2}{O}\end{matrix}$$

which are non-valent and only possessed of slight residual affinity.

Non-electrolytes may be regarded as differing from electrolytes in that they are not divisible against hydrone, interactions taking place only in one way



$$\overset{+-}{XY} + OH_2 \rightleftharpoons \overset{-+}{XY}\!<\!\begin{matrix}H\\OH\end{matrix}$$

To explain the enhanced effect of potential electrolytes and the increase of the effect as the solution is more and more diluted is more difficult. As these are effects of dilution, they are clearly due in some way to the action of the water. The solution of the problem suggested by H. E. Armstrong (*Roy. Soc. Proc.* 1923, vol. A103, p. 610) is, that when the "couple" formed of the two systems $AB\!<\!\begin{matrix}H\\OH\end{matrix}$, $H_2O\!<\!\begin{matrix}A\\B\end{matrix}$ and hydrone (OH_2) is resolved, it may and does give rise to hydronol, $H_2O\!<\!\begin{matrix}H\\OH\end{matrix}$—a more active unit even than hydrone itself. Further, that as dilution proceeds, AB is more and more completely resolved against hydrone and converted into $H_2O\!<\!\begin{matrix}A\\B\end{matrix}$. When this action is complete, AB has exercised its maximum effect. Hydronol, however, being produced concurrently, is ultimately present in an amount equivalent to that in which the system $H_2O\!<\!\begin{matrix}A\\B\end{matrix}$ is formed. Finally, two active systems are present: if the action be complete, the combined effect they produce is twice the unit effect.

When a solution is placed in contact with water, separated by a diaphragm through which only the water can pass, hydrone is attracted into the solution, molecule for molecule of the active systems present. The so-called osmotic pressure within the cell may be conceived of as due to the directed oscillatory impacts of the hydrone molecules paired with the active systems.

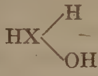
In a sufficiently dilute solution, ultimately, two osmotically active, reciprocal molecules would be produced, at the expense of each single molecule of the salt: in other words, the single molecule of the potential electrolyte, hydrogen chloride, would apparently have double the effect of a single molecule of a non-electrolyte.

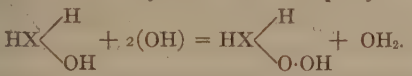
Assuming that electrolysis involves the interaction of two diverse "distributed" systems, under the influence of an electromotive force, the (molecular) conductivity of the dissolved chloride would also be at its maximum in the fully diluted liquid.

Solutions.—The activities operative within solutions are too little considered. They are best realised by studying the interactions of soluble salts. When, for example, potassium chloride and magnesium sulphate, $MgSO_4{\cdot}7H_2O$, are dissolved in equivalent proportions and the solution is sufficiently concentrated, a large amount of the double sulphate $MgSO_4{\cdot}K_2SO_4{\cdot}6H_2O$, gradually crystallises out. It follows that much of the chloride is converted into sulphate and of the sulphate into chloride, in fact, magnesium chloride is ultimately obtained from the liquid. Often, in such cases, a number of double salts and of salts with varying amounts of water of crystallisation are produced, the product varying with the concentration and relative proportions of the materials present. The presence of the variety of salts met with in natural salt deposits, such as those in Alsace and Hanover, is thus accounted for.

Finally, it may be urged that extreme caution is required in dealing with the problems of solution, because of the fact that the molecules are crowded together. Whatever seeming analogies their behaviour may present with that of the gaseous state, the effects cannot be really gaseous effects—as intermolecula affinities come into play which are practically excluded in the gas

The conclusions deduced by studying solutions made by dis solving substances all to the same volume—a method in no way comparable with that involved in dealing with equal volumes o gases—are obviously not comparable, as the molecular propor tions in which solute and solvent are present will vary more o less, according to the nature of the dissolved substance. Mos of the peculiarities to which attention has been directed ar traceable to this illogical practice. At most, very dilute solution prepared in this manner will afford comparable results. On th other hand, if the molecular proportions of solvent and solut be kept constant, there is always the difficulty that the ultimat volumes vary—that the volume occupied within the solvent b the solute is subject to variation. In fine, it would seem to b impossible to make any strict comparison of solutions—the con clusions must always be open to many corrections.

Electrolysis of Water.—The production of hydrone by th interaction of hydrogen and oxygen has already been discusse The inverse change must be subject to similar conditions. Wate itself and by itself cannot be electrolysed—*ex hypothesi*, it ha no conducting power. To speak of the production of hydrogen and oxygen by electrolysis, as if the process were simple and direct, is as wrong as to speak of the production of water itself from oxygen and hydrogen: the electrode face must be the seat of a whole series of changes. Without considering the nature of the internal process (within the liquid), it may be assumed that the complex  $HX{<}^{H}_{OH}$ (formed from the acid HX) at the one electrode surface is initially converted into a perhydrol



$$HX{<}^{H}_{OH} + 2(OH) = HX{<}^{H}_{O\cdot OH} + OH_2.$$

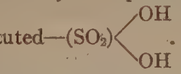
Such compounds are well recognised products of electrolysis. At times, they undergo hydrolysis and perhydrone HO·OH is formed, but this, apparently, is never an initial product.

At high concentrations and particularly at high current densities, the attack by OH becomes more and more concentrated upon the molecule and probably higher perhydrols are formed, which break up at the electrode surface into oxygen or ozone—whether directly or owing to hydrolysis or perhydrolysis.

Acidity: Apparent and Effective.—The term *acid* has long been a bone of contention among chemists and there is great need of a clear understanding on the subject. A Latin term, the equivalent of the Teutonic *sour*, it appeals to the ear and is familiar because of the occurrence of acids in foodstuffs—in vinegar, fruit, etc. The opposite of an acid—an alkali or base—in the sense that it will neutralise the acid and destroy its sourness to the palate—is unfamiliar, as such substances are not in ordinary use, at least in connection with food. When acid and "base" interact, a salt is formed. The base, however, is no more *the base* of the salt than is the acid: it happens to have been so-called, only because "acid" was already appropriated and had a distinct, identifiable meaning. "Alkali" has no etymological significance in itself and the conventional use of base is misleading when transferred to chemical practice.

Acids were known long before the isolation of the vital principle of air. When this was isolated, Lavoisier gave it the name oxygen, because the oxides formed on burning common combustibles, such as carbon, sulphur and phosphorus, were "acid."

The oxides of the non-metallic elements then became known as acids. To the present day, the public speak of the acidic oxide of carbon as carbonic acid, a far better name for general use than that of the chemist, carbon dioxide, which by a silly and most reprehensible practice is now often converted into *See-Oh-Too* (CO_2), especially in biological circles. Formulae should never be used as spoken words. Lavoisier supposed that acids generally contained oxygen and, on this account, being a constituent of muriatic acid, chlorine was supposed to be an oxygen compound. When this was disproved by Davy and "spirit of salt" was shown to consist simply of hydrogen and chlorine, the swing of the pendulum set in and acids were defined to be compounds of hydrogen (hydrogen salts) in which the hydrogen could be displaced by metal, if not directly, through the agency of a metallic oxide or base. The name sulphuric acid was then transferred from the oxide SO_3 to the hydrate, $SO_3+OH_2=H_2SO_4$, oil of vitriol or vitriolic acid, as it was long called. Fifty years or so ago, there were two contending schools—one calling the oxide the acid and the hydrate either simply monohydrate (a name long used in commerce) or hydric sulphate. A salt was said to be formed by the union of acid and base and, in hydric sulphate, hydrone was supposed to take the place of the base soda in sodic sulphate: the acid, in fact, was regarded as a hydrogen salt.

The other school regarded a salt as derived from its acid by the displacement of hydrogen and the hydrogen as itself present in the form of hydroxyl (OH). The halhydrides were again treated as peculiar. The basicity, we may say equally well the acidity, of an acid varies with the number of displaceable hydrogen atoms. Phosphoric acid H_3PO_4 has long been supposed to be an acid in which the three atoms of hydrogen are of different value but sulphuric acid has almost always been formulated as if the two hydrogen atoms were alike in function. It has been customary to represent the latter acid as symmetrically constituted— $(SO_2){<}^{OH}_{OH}$. When the matter is studied historically, it is clear that this view is largely an academic conclusion. No significant evidence of structure can be adduced in proof of such a formula and we must admit that we do not exactly know how the acid is constituted—simple as it is.

Acidity.—The issue is complicated by the fact that "acids" vary greatly in strength—some are "strong"; the majority are weak. Defining *apparent acidity* as the equivalent proportion of "acid" present in a solution, which is measured by determining the amount of standardised alkali required to neutralise the liquid, the *effective acidity* is measured by using the acid as a hydrolytic agent, for example, in effecting the resolution of cane sugar into glucose and fructose:—

$$C_{12}H_{22}O_{11} + OH_2 = 2C_6H_{12}O_6.$$

The activity of an acid such as acetic contrasted with that of an equivalent amount of chlorhydric or nitric, is very slight—it has not one-two hundredth of the strength of these strong acids as a hydrolytic agent. There is very little, if any, doubt that the explanation of this fact is, that but little of the acetic "acid" becomes real and active. On the other hand, almost the whole of the dissolved hydrogen chloride in muriatic acid seems to be in the active state—as the electrolytic conductivity, referred to the molecular proportion of hydrogen chloride present, is relatively little changed and increased by high dilution. Nearly 90% of the chloride appears to be present as the active acid even at low dilutions.

Instead of representing real or effective acidity as a fraction of the apparent acidity, thus avoiding the introduction of any hypothetical interpretation of the facts, an unfortunate practice has grown up of representing real acidity in terms of "hydrogen-ion-concentrations." Nay, worse, the hydrolytic effect has been represented as due to the hydrogen ion and not to the ions of the acid acting in conjunction. Terms are thus used which only the elect can understand—which is undesirable in all interests. At the moment, the term acid has no clearly defined meaning.

Much light is thrown upon the nature of multiacidic (multibasic) acids by the study of their action as hydrolytic agents. Especially is this true of sulphuric acid. This acid readily acts upon a variety of hydrocarbons and other compounds, forming *sulphonic acids*, e.g.,

$$C_6H_6 + H_2SO_4 = C_6H_5\cdot SO_3H + OH_2.$$

The sulphonic acids are strong unibasic acids. It is usually said that they are formed simply by the displacement of one of the two hydroxyl groups (OH) in sulphuric acid by a hydrocarbon or similar radicle. If so and the two (OH) groups be of equal value, the sulphonic acids, it might reasonably be supposed, should have about half the effective strength of sulphuric acid. As a matter of fact, tested by cane sugar, they have little less than 90% of its strength. Hence, it would seem probable, that sulphuric acid is in reality uniacid (unibasic) but has a slight residual acidity. The argument may be extended to all multiacid inorganic acids. These seem to be comparable with lactic acid, $CH_3\cdot CH(OH)\cdot COOH$, which from early times has ranked as part alcohol, part acid—as essentially uniacidic. The argument is of consequence as pointing to some dissymmetry in the structure of sulphuric, carbonic and other multiacidic acids. (Compare *Roy. Soc. Proc. 1914*, vol. A90, p. 73.)

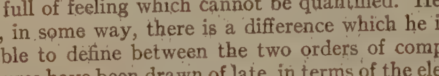
Function as Determined by Structure.—Having thus considered a case in which function and structure are clearly in close connection, attention may now be directed to carbon compounds, which afford a vast mass of evidence of the absolute correlation of function with structure.

The structural basis of chemistry is very simple—one of astounding simplicity, in fact. It is expressed in the fixed series: HCl, H_2O, H_3N, H_4C. Taking the hydrogen atom as unit, the atom-fixing power or valency of the four elements indicated is one, two, three, four-fold. Chlorine and its analogues are monads, oxygen and its analogues dyads, nitrogen and its analogues triads, carbon and its analogues tetrads. All other elements (excepting the inert) fall into one or other of the four classes. The facts of chemistry generally show that hydrogen is consistently a monad. The facts also show that generally carbon does not exceed the tetradic power of which CH_4 is witness. The other elements and their analogues are not so fixed in their affections. Thus nitrogen, in the ammonium compounds, such as ammonium chloride NH_4Cl, carries two additional units, five in all. Oxygen and chlorine also may carry two additional units but their hold upon these is never so firm as is that of nitrogen. The problem of varying valency (atom-fixing power) has given rise to much discussion, over a long period of years; it is in no way ended. At one time, the view was held that in ammonium chloride, the two molecules H_3N and HCl, were still existent, as radicles; such compounds were in consequence termed "molecular." Phosphorus pentachloride, PCl_5, in like manner, was thought to be a compound of the chloride PCl_3 with a molecule of chlorine Cl_2. Of late years, the alternative view has prevailed, that the two molecules interact and do not merely "associate," so that the units are distributed and arranged about a central atom.

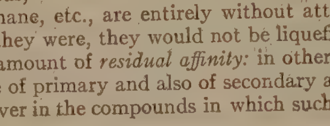
Chemistry, however, is an art as much as a science and the chemist is full of feeling which cannot be quantified. He is satisfied that, in some way, there is a difference which he is in no way yet able to define between the two orders of compounds. Fancy pictures have been drawn of late, in terms of the electronic hypothesis, to represent the two kinds—but these are but paraphrase and as they carry us no further are premature. At most, we know, from the behaviour on electrolysis, that the various atoms carry atomic electric charges (electrons) corresponding to the primary valency—the hydrogen atom one, oxygen two, nitrogen three. The evidence thus far seems to be against the view that the atomic charges may be varied. What then is to be our explanation of secondary valency and still further of the residual affinity which is manifest when secondary affinities are engaged!

No compounds, not even the inert gases, helium, etc., nor hydrogen, methane, etc., are entirely without attractive power or affinity. If they were, they would not be liquefiable. All display a certain amount of *residual affinity:* in other words, whatever the nature of primary and also of secondary affinities, some affinity is left over in the compounds in which such affinities are exercised.

In the early days of structural formulae, chemists were satisfied with plane representations upon paper, in which lines were drawn proceeding from the symbol of the element in accordance with its valency, thus



Then models were constructed of balls with holes drilled into them, in number according to the valency of the elements represented. Other atoms were attached by inserting rods into the holes in the balls. No attempt was made to give any special direction in space to the affinities thus signified. Gradually, it was realised that such formulae and models implied both too much and too little. On the one hand, they gave rise to expectations which were not fulfilled. Thus, two pictures can be drawn of a compound of the type CH_2Cl_2



$$\begin{array}{c} Cl \\ | \\ H-C-H \\ | \\ Cl \end{array} \qquad \begin{array}{c} Cl \\ | \\ H-C-Cl \\ | \\ H \end{array}$$

In the one, the two atoms of chlorine are *opposite*, in the other they are *contiguous*. Exhaustive inquiry failed to discover any difference in the compound, however prepared. On the other hand, many compounds were found to exist which were of the same composition but structurally similar—differing only in one peculiar respect: in that one was the morphological and optical opposite of the other. When the crystal of the one form was compared with that of the other, they were seen to be identical, except that the one was a mirror-image of the other, as a right hand to a left hand. There was a corresponding difference in the behaviour of solutions of the two compounds in plane polarised light—the rays of light being twisted in one direction by the one, equally (if the solutions were of identical strength) in the opposite direction by the other. This was Pasteur's great discovery, made in 1848. Van't Hoff, in 1875, building upon Pasteur's suggestion, that such compounds were geometrically different in structure, resuscitated and expanded Pasteur's suggestion that carbon was itself a tetrahedral unit and in his *Chemistry in Space* fully developed a doctrine of spatial structure already foreshadowed by Kekule, which has proved to be very generally applicable. Representing carbon by a regular tetrahedron (such as may be made by joining together four equilateral triangles), he drew attention to the well-known fact, that if one, two or three faces only were different, two being alike, object and mirror image were alike—they could be superposed. If all four faces were different, the image could not be superposed upon the object—such compounds were asymmetric, their models could not be halved, as could those in which only two or three faces were different. He was able to show that all known optically active compounds might be regarded as constituted in the manner suggested and to predict that all such compounds would be optically active. His forecast has been verified in all respects (*see* ISOMERISM, 14.881).

Van't Hoff represented the four affinities of carbon as proceeding from the centre of mass of the regular tetrahedron to the four solid angles. They therefore meet at an angle of 109°28′. He represented compounds in which carbon atoms were united by single affinities by tetrahedra joined at their apices—not as filling space. Sir William Bragg has shown, by means of X-rays, that in the diamond the atoms of carbon are thus related—each being surrounded by four others, each of the four meeting it at the tetrahedral angle (*see* CRYSTALLOGRAPHY). A model of the diamond—a sheet of atoms in the diamond—may be made by arranging cardboard tetrahedra side by side, placed alternately base downward and base upward (choosing any face arbitrarily as base). The van't Hoff generalisation has thus been verified in its entirety in principle.

Van't Hoff doubtless found more than sufficient material needing discussion to extend his explanation and correlate it with the crystalline form of solids. The "solid significance" of the doctrine was never considered by him. Before dealing with this, it is desirable however to consider certain peculiarities in the behaviour of carbon.

Carbon Combinations.—The atoms of most of the elements seem to be capable of uniting with themselves and even with others only in very limited numbers. The number of carbon atoms which can unite with one another, however, appears to be illimitable and there seems to be no falling off in grip as the number grows. The simplest hydride, CH_4, is but the beginning of a long series of hydrocarbons, known as the *Paraffins*, in all of which carbon and hydrogen are present in the relative proportions in which they occur in methane, so that they may be represented by the general formula C_nH_{2n+2}. Like methane, these are all *saturated*, in the sense that they do not combine with any substance whatever. The name paraffin is derived from the fact, that especially chemically, they have little affinity for chemical agents in general. They may be oxidised, they are acted upon by chlorine and bromine, yet not easily. They yield only *substitution* derivatives, *i.e.*, one or more hydrogen atoms are exchanged for an equivalent radicle. Thus—

$$\begin{aligned} CH_4 + Cl_2 &= CH_3Cl + HCl \\ CH_3Cl + Cl_2 &= CH_2Cl_2 + HCl \\ CH_2Cl_2 + Cl_2 &= CHCl_3 + HCl \\ CHCl_3 + Cl_2 &= CCl_4 + HCl \end{aligned}$$

The solid paraffin, used in making candles, is a mixture of higher members of the series. Petrol contains low terms—such as hexane, C_6H_{14}, heptane, C_7H_{16}, etc.—the illuminating and lubricating oils from petroleum are mixtures of terms intermediate between those in petrol and paraffin.

Organic chemistry has often been spoken of as the chemistry of the hydrocarbons and their derivatives, because all other compounds may be derived from the hydrocarbons by processes of simple substitution, by the introduction of various simple atoms or compound radicles (groups of atoms) in place of one or more of the hydrogen atoms of the hydrocarbon.

The paraffin hydrocarbons may be built up to any desired degree of complexity by various simple methods. Thus methane is converted into methylmethane or ethane by the process indicated in the equation:

$$CH_3I + CH_3I + 2Na = CH_3\cdot CH_3 + 2NaI$$

Ethane is converted into the next term, propane, in a similar manner:

$$CH_3I + CH_3\cdot CH_2I + 2Na = CH_3\cdot CH_2\cdot CH_3 + 2NaI$$

or into tetrane:

$$CH_3\cdot CH_2I + CH_3\cdot CH_2I + 2Na = CH_3\cdot CH_2\cdot CH_2\cdot CH_3 + 2NaI$$

It will easily be seen that there are two ways of introducing CH_3 (methyl) into propane:

$$\underset{\text{Tetrane}}{CH_3\cdot CH_2\cdot CH_2\cdot CH_3} \longleftarrow \underset{\text{Propane}}{CH_3\cdot CH_2\cdot CH_3} \longrightarrow \underset{\text{Isotetrane}}{CH_3\cdot CH(CH_3)_2}$$

In one the "chain" is simply extended, in the other, two links are associated with the one terminal link. Three and even four links may be attached to one, as in trimethylmethane $CH(CH_3)_3$ and tetramethylmethane $C(CH_3)_4$.

Compounds of the same gross or molecular formula, differing in structure, are termed *isomeric* (*see* 14.881). The successive terms in the series are termed homologues. They are homologous in the sense, that apart from differences in physical properties, boiling point, density, etc., they are generally alike in their chemical behaviour. This is true also of the isomeric hydrocarbons.

Hydrocarbons are all more or less easily attacked by chlorine or bromine but not by iodine; the iodo-derivatives are obtained by indirect methods.

They are also easily oxidised but the product is often, if not usually, a mixture, as the products are more easily oxidisable than the original hydrocarbons. We speak of oxidation but in reality the process is always initially *one of hydroxylation* and, for the sake of simplicity, may be represented as effected by perhydrone, H_2O_2. Thus ethane is converted into ordinary fermentation or ethylic alchol:

$$CH_3\cdot CH_3 + HO\cdot OH = CH_3\cdot CH_2(OH) + HOH$$

The primary product of the oxidation of methane, in like manner, is methylic alcohol—the alcohol of wood spirit

$$CH_4 + HO\cdot OH = CH_3\cdot OH + HOH$$

The alcohols are the organic analogues of caustic soda (sodic hydroxide) thus—

$$Na\cdot OH + HCl = NaCl + HOH$$
$$C_2H_5\cdot OH + HCl = C_2H_5Cl + HOH$$

This is true so long as only the (OH) radicle be attacked. In the carbon compound, however, the hydrocarbon radicle is attackable, as in the oxidation process:

$$CH_3\cdot CH_2\cdot OH + HO\cdot OH = CH_3\cdot CH(OH)_2 + OH_2$$
$$CH_3\cdot CH_2\cdot OH + HO\cdot OH = CH_3(OH)\cdot CH_2(OH) + OH_2$$

Both actions take place, according as one or other oxidising agent be used. The two products differ in a characteristic manner, the one being unstable, the other stable. Whenever two hydroxyls are associated with a single carbon atom, the product is unstable, readily losing the elements of a molecule of hydrone

$$\underset{\text{Aldehydrol}}{CH_3\cdot CH_2(OH)_2} = \underset{\text{Aldehyde}}{CH_3\cdot COH} + OH_2$$

In aldehyde, the dyad oxygen atom takes the place of two monad hydrogen atoms in the hydrocarbon and of the two monad hydroxyl radicles in the alcohol which is the initial product of hydroxylation. Hydroxylation may be carried a stage further

$$CH_3\cdot CH(OH)_2 + HO\cdot OH = CH_3\cdot C(OH)_3 + OH_2$$

The trihydrol thus formed is even less stable than the dihydrol and easily loses hydrone

$$CH_3\cdot C(OH)_3 = CH_3\cdot CO(OH) + OH_2$$

The product, acetic acid, is methane in which a single atom of hydrogen is displaced by the radicle *carboxyl*, CO(OH). This radicle is characteristic of organic acids generally—the term acid is given only to compounds which contain it or an equivalent radicle, such as SO_3H.

Methane may be oxidised in the following manner:—

$$CH_4 + HO\cdot OH = \underset{\text{Methylic alcohol}}{CH_3\cdot OH} + OH_2$$
$$CH_3OH + HO\cdot OH = \underset{\text{Formaldehydrol}}{CH_2(OH)} + OH_2$$
$$CH_2(OH)_2 + HO\cdot OH = \underset{\text{Formacidhydrol}}{CH(OH)_3} + OH_2$$
$$CH(OH)_3 + HO\cdot OH = \underset{\text{Orthocarbonic acid.}}{C(OH)_4} + OH_2$$

Formaldehydrol passes by dehydration into formaldehyde, $CH_2(OH)_2$, formacidhydrol into formic acid, orthocarbonic acid into carbonic acid, $CO(OH)_2$, ultimately into carbon dioxide.

The possibility of the formation of isomeric compounds must not be overlooked. Thus, propane may be hydroxylised only to two monohydric alcohols but each of these may conceivably be oxidised in several ways, thus

$CH_3\cdot CH_2\cdot CH_2\cdot OH$ Propylic alcohol	$CH_3\cdot CH(OH)\cdot CH_3$ Isopropylic alcohol
$CH_2(OH)\cdot CH_2\cdot CH_2\cdot OH$	$CH_3\cdot CH(OH)\cdot CH_2\cdot OH$
$CH_3\cdot CH(OH)\cdot CH_2\cdot OH$	$CH_3\cdot C(OH)_2\cdot CH_3$
$CH_3\cdot CH_2\cdot CH(OH)_2$	

These dihydric alcohols are all known, though they are not produced exactly in the manner indicated. Attention should be drawn to the isomeric compounds

$$CH_3\cdot CH_2\cdot CH(OH)_2 \qquad CH_3\cdot C(OH)_2\cdot CH_3$$

Deprived of hydrone, these yield

$$\underset{\text{Propionic aldehyde}}{CH_3\cdot CH_2\cdot COH} \qquad \underset{\text{Acetone}}{CH_3\cdot CO\cdot CH_3}$$

both keto-compounds, closely related in character, the one, however, an aldehyde, the other a ketone. The difference between these is particularly well brought out by their behaviour on oxidation

$$CH_3\cdot CH_2\cdot CH(OH)_2 + HO\cdot OH = CH_3\cdot CH_2\cdot C(OH)_3 + OH_2$$
$$CH_3\cdot C(OH)_2\cdot CH_3 + HO\cdot OH = CH_3\cdot C(OH)_3 + CH_3\cdot OH$$

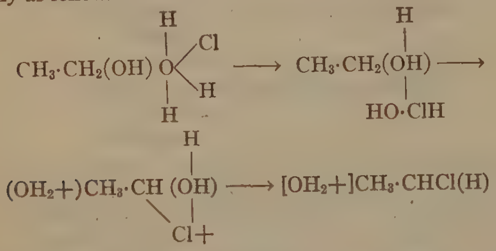
The one yields the corresponding acid, a characteristic of aldehydes, the other is broken down. Actually, the methylic alcohol shown in the equation is further oxidised as it is produced and escapes recognition. Both propaneglycols should yield a stable trihydric alcohol on further hydroxylation

$$\begin{tikzcd} CH_2(OH)\cdot CH_2\cdot CH_2(OH) \arrow[dr] & & CH_2(OH)\cdot CH(OH)\cdot CH_3 \arrow[dl] \\ & CH_2(OH)\cdot CH(OH)\cdot CH_2(OH) & \end{tikzcd}$$

Actually, this change has not been realised but the alcohol indicated is the well-known substance glycerol (glycerine), obtained as a by-product in making soap, by saponifying hard animal fats and fatty oils with caustic soda.

Reduction.—Hydroxylation (oxidation) is the process involving the displacement of hydrogen by hydroxyl (OH); it is one of the most important of natural processes, especially of those in a downgrade direction. The reverse operation, the displacement of hydroxyl by hydrogen—reduction—is equally frequent and important, especially in upgrade changes. More often than not the two occur, if not in conjunction, in rapid succession. All the changes above considered are reversible by hydrogen (atomic) acting "in circuit" with the hydroxy compound.

Hydroxylic Interactions.—Although similar in their functions to metallic hydroxides, the alcohols are in one respect strikingly singular in their behaviour, inasmuch as they do not give rise to conducting solutions when dissolved in water. Metallic hydroxides and acids interact immediately; alcohols are but slowly attacked by acids. The apparent outcome of the interaction of alcohol and acid is the substitution of the acid radicle for the hydroxylic radicle. Actually, the interaction may be more complex and involve a structural change. To give a specific illustration, alcohol and hydrogen chloride do not interact, except in the presence of water. Hydrogen chloride and water together, however, form an electrolyte. The process of interaction, in their presence in association (as a composite electrolyte), may be less direct and more complex than is commonly supposed, perhaps broadly as follows:—



$$\mathrm{CH_3\cdot CH_2(OH)}\,\overset{H}{\underset{H}{O}}\begin{matrix}\mathrm{Cl}\\ \mathrm{H}\end{matrix} \longrightarrow \mathrm{CH_3\cdot CH_2}\overset{H}{\underset{HO\cdot ClH}{(OH)}} \longrightarrow$$

$$(\mathrm{OH_2}+)\mathrm{CH_3\cdot CH}\,\overset{H}{\underset{Cl+}{(OH)}} \longrightarrow [\mathrm{OH_2}+]\mathrm{CH_3\cdot CHCl(H)}$$

The H in brackets is that which may be supposed to take the place of (OH) originally in the alcohol. Some such process as this may be at the root of the Walden inversion, in which an asymmetric compound is produced of opposite sign to that taken, the change being reversed when the inverse interaction is effected. It is probable that such "inversions" often happen unperceived, and that not a few inferences of structure may be affected by the occurrence, particularly in the sugar group. The active part taken by "a neighbouring hydrogen atom" may also be at the root of the "steric" hindrance observed in "etherifications."

Unsaturated Hydrocarbons.—So soon as hydroxyl is introduced into a saturated hydrocarbon—one in which the four affinities of the carbon atom are separately satisfied—a condition of instability is established. The hydroxyl tends to separate with hydrogen as hydrone—thus alcohol gives ethylene, $C_2H_5{\cdot}OH = C_2H_4 + OH_2$. "Dehydration," in reality, is an indirect process and may be effected in various ways, as by heating alcohol with either sulphuric or phosphoric acid: a sulphate or phosphate is first formed and decomposed. The loss of OH and H by alcohol is equivalent to the withdrawal of two atoms of hydrogen from the hydrocarbon ethane, C_2H_6. The operation may be repeated —ethylene may be converted into acetylene, C_2H_2, now a common frequenter of society in company of the motorists and largely used in welding and cutting steel. It is also made more directly by heating carbon together with lime, CaO, in an electric furnace, so producing calcium carbide, Ca_2C_2, which is transformed back into lime and acetylene by the action of hydrone (water) thus: $Ca_2C_2 + OH_2 = 2CaO + C_2H_2$

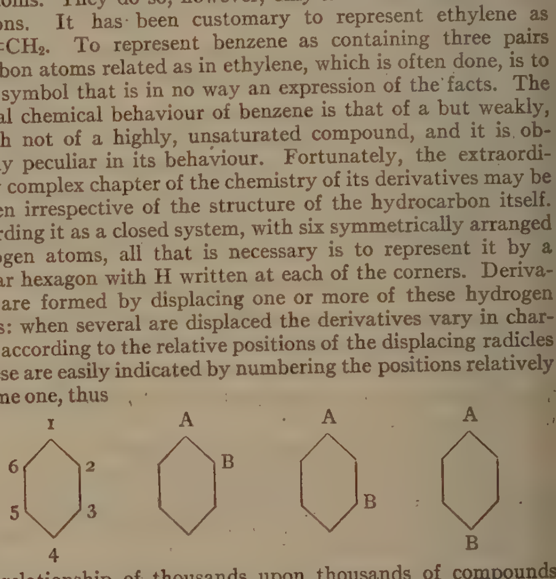
Ethylene differs by two units, acetylene by four, of affinity from ethane. Both hydrocarbons combine with bromine, giving rise to compounds of the ethane type, $C_2H_4Br_2$ and $C_2H_2Br_4$ The structure of these unsaturated hydrocarbons is not yet settled. Frankland said originally: "Let it be assumed that two affinities of the one satisfy two affinities of the other carbon atom in ethylene, three of the one, three of the other in acetylene—write $H_2C{=}CH_2$ and $HC{\equiv}CH$." It was so assumed—the conception was simple and easily committed to memory. Van't Hoff said, join two tetrahedra edge to edge to represent the carbon in ethylene, solid-face to solid-face to represent acetylene: the mandate was obeyed, so open to suggestion are we.

Whether or no such conjunction be possible, the fact remains that both compounds behave as if they were *un*saturated and full of energy. Julius Thomsen, as the result of his determinations of "heats of formation," has contended that actually less work is done in "doubly"-combining two carbon atoms, still less in "trebly"-combining them, than in combining them by single affinities. For the present, it is better to term the one "*linkage*" ethenoid, the other *acet(yl)enoid*, than double or treble bonded. The ethenoid linkage is commonly repeated but not the acetenoid.

The paraffins (C_nH_{2n+2}) and the corresponding *ethenes* (C_nH_{2n}) and *acetenes* (C_nH_{2n-2}) are all open-chain hydrocarbons: carbon atom is united to carbon atom in a continuous series, we may now say, in a zigzag, each setting to the other at the tetrahedral angle 109° 28′. This conception is now found to be in agreement with the verdict given by X-rays.

Phenoid Carbon.—A change comes over the scene as more and more hydrogen is removed and the compounds become less and less saturated algebraically. Faraday, a hundred years ago, discovered in the liquid condensed from "oil gas"—the gas obtained by decomposing oil at a red heat—the hydrocarbon, C_6H_6, which is now known as benzene. Theoretically, it is derived from the paraffin Hexane, C_6H_{14}, one of the chief constituents of petrol of low boiling point. It is a highly refractive liquid, whence the name *Phene*, which was given to it by Laurent, obvious to-day in phenol (carbolic acid). It crystallises readily. Benzene is nearly *saturated*. Chemists account for this fact by supposing the six carbon atoms arranged in a "closed chain or ring," and that each carries a single hydrogen atom.

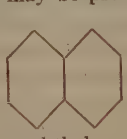
The distribution of the fourth affinities has given rise to much controversy, in large part futile, because no clear conceptions were behind it and discussion was based upon imperfect appreciation of the facts. Chemical formulae, in the main, are but symbols of character—"shorthand" expressions indicative of the general behaviour of the compounds represented. They also portray the general structural relationships or arrangement of the atoms. They do so, however, only in terms of certain conventions. It has been customary to represent ethylene as $H_2C{=}CH_2$. To represent benzene as containing three pairs of carbon atoms related as in ethylene, which is often done, is to use a symbol that is in no way an expression of the facts. The general chemical behaviour of benzene is that of a but weakly, though not of a highly, unsaturated compound, and it is obviously peculiar in its behaviour. Fortunately, the extraordinarily complex chapter of the chemistry of its derivatives may be written irrespective of the structure of the hydrocarbon itself. Regarding it as a closed system, with six symmetrically arranged hydrogen atoms, all that is necessary is to represent it by a regular hexagon with H written at each of the corners. Derivatives are formed by displacing one or more of these hydrogen atoms: when several are displaced the derivatives vary in character according to the relative positions of the displacing radicles —these are easily indicated by numbering the positions relatively to some one, thus



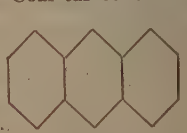
The relationship of thousands upon thousands of compounds may be satisfactorily represented by this simple device.

By, as it were, soldering phene upon phene, polyphenes of any desired complexity may be produced. Coal tar contains three such:

benzene
C_6H_6



naphthalene
$C_{10}H_8$



anthracene
$C_{14}H_{10}$

These are the foundation stones upon which the great modern dyestuff industry is built. The various "chars" (charcoals) are probably highly complex compounds of this pattern with but a very small number (in proportion to the carbon atoms) of hydrogen atoms, which prevent the carbons from lapsing into the diamond state.

Diamond is one great carbon-phene—the benzene unit is but a small, highly symmetrical block dissected out from a single layer of atoms in the diamond and clothed with six hydrogen atoms.

Model Representations.—To obtain a model of the diamond, it is only necessary to make a considerable number of regular tetrahedral groups of equal spheres and to arrange these interlocked in sheets, placing them alternately upon base and upon apex, then piling sheet upon sheet, all closely interlocked. Each unit tetrahedral group within such a close packed mass will be equally surrounded with four other like tetrahedral groups interlocked in *face contact.* Each face-centre between two blocks being a centre of affinity, the model will embody the conception that the carbon atom has four equal affinities ranging outwards and operating, in so far as other carbon atoms are concerned, at the tetrahedral angle, from the centre of the mass. Occasion may be taken here to point out that the individual atoms at the surface of any mass of diamond must each have an affinity free. This must generally be true of all compounds. It does not follow, however, that such affinities have their full force.

An attempt to correlate crystalline form with chemical structure and develop solid models of complex carbon compounds was first made by Barlow and Pope in 1899.

They advanced two primary propositions—first, that valency may be given volume significance. Taking an arbitrary sphere of unit volume to represent a monad atom such as that of hydrogen, a sphere of twice the volume was used to represent a dyad atom such as oxygen, one of thrice the volume to represent a triad (nitrogen), and one of quadruple volume to represent the tetrad carbon. Second, that the relative valency volume remained the same in a series of related (corresponding) compounds, though the absolute volume might vary. This assumption is made to satisfy the facts of isomorphism—for example, in a series such as that of the three halides, NaCl, NaBr, NaI. If the densities of these salts, referred to molecular proportions—the volume occupied by the gramme molecular proportion—be taken and the assumption made that the sodium maintains its relative volume in the three compounds, the volume increases from chlorine to iodine. This is true generally. Pope and Barlow assumed that there was mutual adjustment and that the 1:1 volume ratio was retained in all the compounds. This is not only rational but apparently necessary.

Unfortunately, the use of spheres varying in volume entailed the construction of models on which the units were not close packed, and the attempt was unsuccessful on this account.

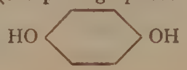
Mr. Barlow has elaborated a simpler method of treatment which appears to satisfy the conditions to be met. Using a sphere as unit of valency, the dyad is represented by two, the triad by three, the tetrad by four such spheres. Models so constructed can be "close packed" to any extent. If a mass of spheres be compressed, the units are ultimately reduced to dodecahedra and are then in contact over their entire surface. Mr. Barlow adopts such a dodecahedral unit in constructing his models. The carbon atom is represented by a pyramid of four dodecahedra. When two such are brought together to represent atoms united as in the diamond, the faces interlocked may be said to be *terfaces*, as surfaces of three of the four constituent units of the tetrahedron are present. A series of tetrahedra united in this manner, in a rectilinear zigzag, represents the paraffin structure. Lines drawn between the mass-centres of contiguous units meet at the tetrahedral angle in a zigzag. Whilst such straight chains may be dissected out of a sheet of diamond atoms to form the paraffins and their derivatives generally, benzene and the phenoid compounds may be built up from hexagonal blocks—sets of six carbon units—dissected out from the diamond sheet. To produce the benzene model, three "sameway" oriented tetrahedra should be placed symmetrically, each resting upon a surface, apex meeting apex at a common centre; then, three other similarly arranged tetrahedra should be placed upon these, so that each rests upon an apex, thus filling the three spaces between the lower three, the six together forming a block in which three affinities appear at the upper and three at the lower surface, each of the carbon units in the mass being united to two contiguous units. In such models there are two layers of valency units. To typify benzene, six hydrogen units have to be attached around the hexagon, one being assigned to each carbon atom and alternately placed one in the lower, the other in the upper plane of valency units. The engaged affinities are thus all operative in two planes, as it were.

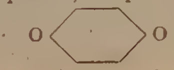
Mr. Barlow has thus constructed solid, close-packed geometric models of a large number of benzene derivatives, taking into account the crystallographic data. In all but a few cases the models are a direct representation of the compound. In some instances, notably in that of parabromophenol, to obtain a model which is in harmony with the crystallographic data it is necessary to effect a slight readjustment of some of the units attached to the carbon complex, which remains fixed and invariable. The shift is of an entirely rational and simple character. The hydrogen unit remains attached to its appropriate carbon atom but is moved from an upper into a lower—or the reverse—plane of the carbon unit.

The models serve to bring out relationships which are patent to the chemist but not hitherto quantified, particularly in connection with the residual affinities shown by compounds generally. The higher paraffins and fatty acids are solid compounds, maybe of high melting point. It has always been difficult to account for this fact. In the model of a paraffin, the carbon skeleton is a two-layered structure like that of benzene; but whereas, in benzene, the carbon units rest upon "terfaces," in the paraffin the chain rests upon a succession of simple dodecahedral faces: the carbon units are, in fact, skewed. The hydrogen units are arranged in pairs on either side of the chain, therefore *not* at the tetrahedral angle; again, the affinities are exercised in two planes, those of the single carbon atom. In consequence, although each carbon affinity is engaged, it is but "partly covered or spoilt" and there is a considerable uncovered carbon surface. When the unit models are superposed or conjoined these surfaces come into apposition, thus typifying the exertion of what for want of a better expression, may be termed residual affinity. It is impossible, using such models, to typify carbon atoms as united by more than single "full" affinities. Only two forms of union seem possible, one that described, characteristic of paraffin and bezene; the other less complete in one sense, though it is such as to affect and "spoil" two affinities of each atom.

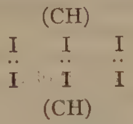
In the paraffins, three dodecahedra in each carbon unit are concerned in the single union. In the second geometrically possible mode of union, the jaws as it were of two atoms are interlocked—the result is that only two dodecahedra of the one are in contact with two of the other; the dodecahedra, however, do not belong to one "affinity face" as in the paraffin but to two. The model does indeed typify the eminently unsaturated condition of the ethenoids. In the acetenes, the third affinity of each of two carbon atoms is frankly to be regarded as unsatisfied, if the model be in any way a representation of the actual conditions. Whatever their ultimate value in connection with crystalline forms, such solid geometric models are undoubtedly bound to prove of great importance in the study of structure; their use, however, would seen to entail the use of a "geometric sense" but little developed hitherto.

Colour.—Whatever be the nature of the ethenoid form of union, it is the cause especially of marked optical peculiarities and in many cases of visible *Colour.* It is almost possible to assert that coloured compounds are all of one type—all *Quinonoid.* Quinone is a benzene derivative, formed by the removal of the two hydrogen atoms from the two hydroxyl groups in paradihydroxybenzene (the photographer's hydroquinone) or quinol





The white quinol becomes yellow. To mention other simpler cases, mercuric iodide, which is a yellow or red crystalline solid, is colourless in certain solutions. Probably it is present in these as the simple molecule HgI_2, and in the solid form as a complex $(HgI_2)_x$. Iodomethane and diodomethane, CH_3I and CH_2I_2, are colourless liquids; triodomethane (iodoform) is a yellow solid. In these iodo-compounds the appearance of colour is probably determined by the "residual affinity" of the iodine. It is uncertain whether or no the simple molecule of iodoform be coloured; perhaps it is not, and the solid may be better formulated as



$$\begin{array}{ccc} & (CH) & \\ I & I & I \\ \vdots & \vdots & \vdots \\ I & I & I \\ & (CH) & \end{array}$$

and the assumption made that the *three unsaturated* centres developed between the three iodine atoms co-operate to produce visible colour. If so, a sufficient number of simple molecules of mercuric iodide may be supposed to associate to give at least three unsaturated ethenoid centres. The faint blue colour of liquid oxygen may well be due to the association of several molecules in a complex system.

The three centres in quinone are conceivably the phene nucleus itself plus the two unsaturated CO groups. It is, however, possible that the simple quinone molecules are associated—through the CO group—and that the origin of the colour is in part extramolecular. This is certainly true of a number of cases in which colour is apparent. When the number of unsaturated centres is increased, the colour is intensified and almost reaches black. The blackness of charcoals is perhaps to be explained in this way: probably these and graphite are highly complex molecules in which carbon is present not in one form as in diamond but as ethenoid carbon, together with phenoid and paraffinoid. It is possible that it will ultimately be found that there is but one form of carbon—diamond—and that the supposed allotropes contain a very small proportion of hydrogen—that they are complex hydrocarbons in fact.

Organic Chemistry.—Organic chemistry, now a vast science, including hundreds of thousands of compounds, is entirely built upon the carbon foundations which have been described: the paraffinic and the benzenoid, the one open, the other a closed system. Infinite as is the variety of compounds, they are nearly all formed from the hydrocarbons by the introduction of oxgyen (in relatively few cases, sulphur) or nitrogen, sometimes both, in place of one or more atoms of hydrogen. No two compounds are alike, and yet, within families, the resemblances are close. At bottom, the power of the carbon atom to combine with the carbon atom almost indefinitely is the reason why so many carbon compounds are possible. No other element appeals and clings to itself in the same way. No other element could well give rise to life. We are essentially creatures of carbon, using water as lubricant and oxygen as stimulant. Perhaps the greatest work before us is to interpret molecular structure and the functions of the materials made use of by the organism in terms of solid geometry. We shall then begin to have feeling knowledge of ourselves.

To be a chemist, it is necessary to have full appreciation of the characteristics of the families that enter into the world of carbon and to be in close acquaintance with many of its individuals. It is a difficult but fascinating occupation: once engaged in, the proper spirit of wonder and reverence being developed, it will be found to be the forecourt to many mansions of marvellous beauty.

We can only deal with life as built upon life, but our knowledge of the materials upon which its images are graven and of the graving processes is already astounding. Yet we are only on the outermost fringe of the inquiry, the difficulty of the problems to be solved is clear only to those who are absorbed in the study. The beauty of the solutions already found is in many cases beyond description, but to how few is this revealed! The plant is the great builder. Beginning with the simplest materials, it raises these to levels at which they become available to the animal organism, whose constructive power is limited to the arrangement and incorporation, not of simple bricks such as are handled by the plant, but of larger units previously fashioned by the plant. Plant, in turn, is dependent upon soil, as well as upon sun. We are indeed of the earth, earthy whilst children of the sun.

Plant Activities.—Falstaff, in his day, could well say, "The World is mine oyster, which I with sword will open:" such was the method of old. To-day, we work with knowledge, and hope to have done with swords—for a time, at least; the more we use our knowledge the more our cry may be, "The world is one great gasholder, whose holding we with our lungs devour." As the rays of the rising sun strike the earth, they enter upon their daily task of keeping the holder filled, whilst its contents are constantly consumed by plant and animal alike, chiefly by the latter. Our great luminary has been thus engaged throughout time, and much of his energy has been founded for us in ways and forms of which we take too little cognisance. We dispute much over coal and oil but take scant notice of oxygen—without which they would be worthless and life impossible: yet we have no full understanding of the ways of that oxygen, we pay little heed indeed to its marvellous power.

The initial act, on the part of the plant, is the absorption of carbon dioxide—present in the atmosphere in the minute proportion of only about three parts in ten thousand. Under some conditions, where much organic matter is undergoing decay, more may be present and there is much evidence that growth is more rapid when the concentration is above the normal. It is beyond question that oxygen is evolved, in proportion to the amount of carbon dioxide assimilated, as if action took place in the sense of the equation:—

$$CO_2+OH_2=COH_2+O_2$$

that is to say, as if the final oxidation product of carbon had been lifted back and up two steps towards methane, CH_4. No one doubts the explanation, although the compound COH_2, formaldehyde, has never been shown to be present in the plant cell by means which preclude the idea that it has not been developed in the course of testing. Chemists generally accept the explanation, because it appears to be the only one that will satisfy the conditions of the problem, the visible products of assimilation being such that not only may their production be accounted for by assuming that "formaldehyde" is their progenitor, but it is scarcely possible to suppose that they are produced in any other way. Moreover, formaldehyde, in the guise of $CH_2(OH)_2$, its hydrol, is a compound of intense chemical activity, and it is not to be supposed that it could accumulate in the vegetable cell.

This is not to say that we know precisely how the aldehyde is produced: we do not. Still, it is already proved that assimilation only takes place under the influence of light absorbed by the chlorophyll, in the green region of the visible spectrum. The process may, therefore, be regarded as an electrolysis. Every chemical interaction, be it remembered, is an electrolysis effected by light, in which water is electrolysed in circuit with carbonic acid, this latter being eventually reduced to the aldehyde, whilst the complementary product, perhydrone, is resolved into oxygen and water. Written empirically, the change may be expressed by the equation:—

$$CO(OH)_2+(H.....OH)_4 = COH_2+2OH_2+2HO{\cdot}OH$$

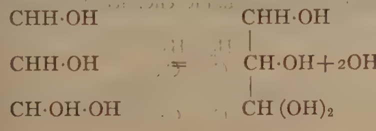
If so, the oxygen in reality is derived from water. The carbonic acid primarily serves the purpose of taking charge of the hydrogen which must be separated from hydrone to produce oxygen. The reduction product is alone of special (constructive) value to the plant; oxygen is returned to the atmosphere, in place of the carbon dioxide removed, sooner or later to play a destructive part, but, in so doing, to let loose and pass on the energy derived from the sun. Much energy from the sun is also stored in the formaldehyde. The quantity of solid formaldehyde corresponding with the formula (CH_2O) expressed in grammes (30 grammes, since $C=12$, $H=1$, $O=16$), when burnt, gives rise to 122,880 gramme-calories, that is to say, sufficient heat to raise the temperature of this number of grammes of water 1° Centigrade.

The contained carbon and hydrogen, if burnt alone, the former in the form of charcoal-carbon, would furnish 96,960+68,360 gramme-calories. Formaldehyde, therefore, has within itself about three-fourths of the energy of the contained carbon and hydrogen. It is thus shown how great a work is done by the sun.

Chlorophyll.—As chlorophyll is concerned and solar energy made operative through its absorptive action, it is necessary to assume that the electrolytic circuit is one in which the chlorophyll is included. Chlorophyll is a nitrogenous compound of great complexity and one of the most remarkable known. It is closely related to blood haematin, but, whilst iron is a characteristic constituent of the latter, magnesium is similarly the outstanding constituent of chlorophyll. Haematin has the power of combining with oxygen; it combines even more firmly with carbonic oxide (CO), but not with carbon dioxide. Chlorophyll shows no such associative tendencies, yet to explain its action we are almost forced to assume that it can combine, at least loosely, with carbonic acid. It has been surmised—it is only a surmise—that the association is through the magnesium atom, that this becomes partially unclasped through the action of carbonic acid, so that an acid carbonate, $XO\cdot CO\,(OH)$, is formed. That such a carbonate might undergo reduction, in an electrolytic circuit, to the *formaldehydrol* derivative $X\cdot O\cdot CH_2(OH)$ is possible, to say the least; indeed, it is probable that it would. Still, as chlorophyll is a pyrole derivative and laden with nitrogen, it is conceivable that it may act basically, apart from its magnesium. More it is impossible to say: the problem is one, however, which should not be put aside.

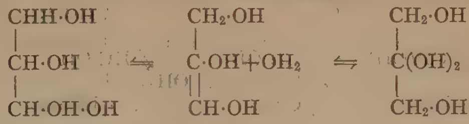
Whatever be the precise nature of the operation whereby formaldehydrol is produced, we have no reason at present to believe that it is otherwise than the sole immediate product of solar activity. In like manner it is at least probable that the higher carbohydrates which are formed by its condensation are the only compounds which are in the direct line of succession as solar products; of these, be it said, cellulose is the only one which is of structural value as cuticular material. The plant cell is a laboratory of wondrous activity. Within it are built the great variety of products which form the plant—quietly, without perceptible ostentation, at ordinary temperatures, often in the dark, underground, as in the potato tuber. Thus we have been unable to prepare starch or even cane sugar. To imitate the operations of nature we need most elaborate and expensive appliances, and often work at high temperatures and pressures. When we think of the way in which nitrogen and hydrogen are converted into ammonia in the root nodules of leguminous plants, apparently by a minute organism living an imprisoned, airless life—when we contrast this with the great array of pumps, compression vessels and many other mechanical appliances used in the factory to the same end, we may indeed hang down our heads in very shame at our ignorance of all that is fundamental in the minute operations of nature. To pour such material, so made, as fertiliser upon the soil, when the humble bacterium by which it is populated can do the work on the spot if only properly encouraged, may some day come to be regarded as soil sacrilege.

Formation of Carbohydrates.—Under laboratory conditions, formaldehydrol rapidly undergoes change in presence of a mere trace of an alkali. The product is a complex mixture and has never been successfully unravelled: it contains *fructose*, however, one of the components of cane sugar. The process of change is only partly understood, and is in doubt, so far as the precise nature and succession of the changes between aldehydrol and sugar is concerned, but is, in essence, a *condensation* and typical of a great number of up-grade changes which take place under natural conditions. It may therefore well be discussed at length. Perhaps *three* molecules interact simultaneously thus:—



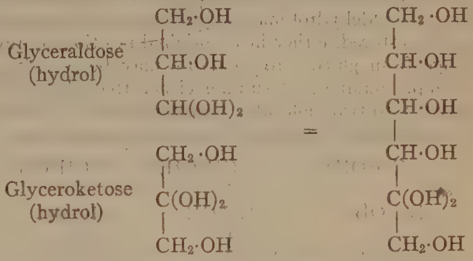
$$\begin{array}{lcl} CHH\cdot OH & & CHH\cdot OH \\ & & | \\ CHH\cdot OH & \rightleftharpoons & CH\cdot OH+2OH_2 \\ & & | \\ CH\cdot OH\cdot OH & & CH\,(OH)_2 \end{array}$$

This product, glyceraldose (hydrol), the aldehyde of glycerol, at once suffers internal change and is converted into the corresponding isomeric ketone—glyceroketose (hydrol),



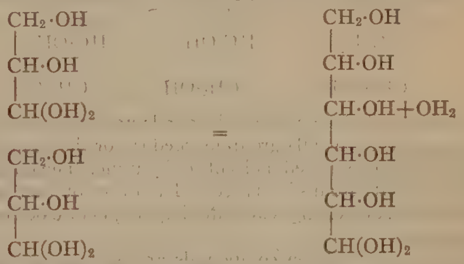
$$\begin{array}{lcccl} CHH\cdot OH & & CH_2\cdot OH & & CH_2\cdot OH \\ | & & | & & | \\ CH\cdot OH & \rightleftharpoons & C\cdot OH+OH_2 & \rightleftharpoons & C(OH)_2 \\ | & & \| & & | \\ CH\cdot OH\cdot OH & & CH\cdot OH & & CH_2\cdot OH \end{array}$$

These triplets interact, in pairs, in various ways. The production of fructose may conceivably take place in the following manner, by the condensation of glyceraldose and glyceroketose,



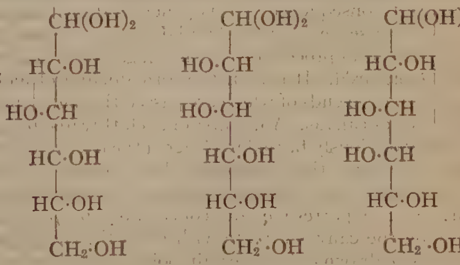
$$\begin{array}{llcl} & CH_2\cdot OH & & CH_2\cdot OH \\ & | & & | \\ \text{Glyceraldose (hydrol)} & CH\cdot OH & & CH\cdot OH \\ & | & & | \\ & CH(OH)_2 & & CH\cdot OH \\ & & = & | \\ & CH_2\cdot OH & & CH\cdot OH \\ & | & & | \\ \text{Glyceroketose (hydrol)} & C(OH)_2 & & C(OH)_2 \\ & | & & | \\ & CH_2\cdot OH & & CH_2\cdot OH \end{array}$$

The production of glucose may be represented as involving the interaction of two molecules of glyceraldose (hydrol),



$$\begin{array}{lcl} CH_2\cdot OH & & CH_2\cdot OH \\ | & & | \\ CH\cdot OH & & CH\cdot OH \\ | & & | \\ CH(OH)_2 & & CH\cdot OH+OH_2 \\ & = & | \\ CH_2\cdot OH & & CH\cdot OH \\ | & & | \\ CH\cdot OH & & CH\cdot OH \\ | & & | \\ CH(OH)_2 & & CH(OH)_2 \end{array}$$

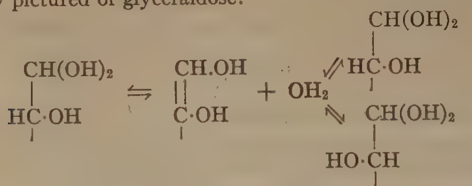
The formulae here used are mere paper-written expressions and not intended to indicate actual structure—they do so only broadly. It will be noted that in the glucose formula four of the carbon atoms, and in the fructose formula three, each carry four different radicles; the two sugars are therefore structurally asymmetric materials and should be optically active. The natural products are but the compounds produced in the laboratory, are not optically active simply because the latter are mixtures of compounds of opposite optical activity. In point of fact, variations in internal structure are brought about by merely varying the relative position of the (OH) groups in the CH(OH) member of the structure. In all, 16 isomeric glucoses are possible: these form two sets of eight, corresponding terms in which are of equal, opposite structure and optical activity. The three isomeric natural sugars, glucose, mannose and galactose, are represented by the following expressions, showing the relative arrangement of the hydroxyl groups in the asymmetric members:—



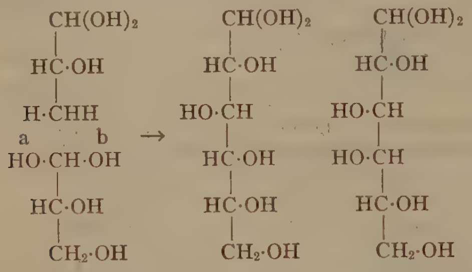
$$\begin{array}{ccc} CH(OH)_2 & CH(OH)_2 & CH(OH)_2 \\ | & | & | \\ HC\cdot OH & HO\cdot CH & HC\cdot OH \\ | & | & | \\ HO\cdot CH & HO\cdot CH & HO\cdot CH \\ | & | & | \\ HC\cdot OH & HC\cdot OH & HO\cdot CH \\ | & | & | \\ HC\cdot OH & HC\cdot OH & HC\cdot OH \\ | & | & | \\ CH_2\cdot OH & CH_2\cdot OH & CH_2\cdot OH \end{array}$$

Glucose Mannose Galactose

The structural relationship between these three forms is of a very simple character. If the position of the topmost OH group in glucose on the right of the formula be reversed, the formula becomes that of mannose. As a matter of fact, this change gradually takes place, to a slight extent, when merely a little alkali is added to a solution of glucose. The process is probably that already pictured of glyceraldose:—



The peculiar ethenoid linkage developed by withdrawal of hydrone from the aldehydrol may be broken on either side and the OH may be restored, either in its original position or reversed. The change from glucose to galactose may be pictured in an equally simple manner. Assuming either that the glucose be first resolved into two molecules of glyceraldose, or that the two sugars be each formed directly from two such molecules,



either glucose will be reproduced or galactose will be formed, according as either the OH group marked (a) or that marked (b) be removed in the extruded molecule of hydrone. The position of only one of the OH groups is changed. These are not mere matters of speculation: such changes actually happen, before our eyes, in the laboratory.

Optical Activity.—When compounds are produced artificially which are potentially (by structure) optically active, the two optically active forms, of equal opposite activity, are both produced and in equal amounts, so that the product is optically inactive. The chances of the action going this way or that, unless specially directed, are equal. In nature, all such compounds are produced initially in the one optically active form—nature, as it were, is one-handed and wears but a single glove. Nature's factory turns out only gloves for, let us say, right-handed wearers. When both appear, as happens in a few cases, there is reason to believe that a change has taken place after nature has ceased to exercise her directive influence.

Of all the facts disclosed by the study of natural products, this restriction placed upon herself by nature is the most remarkable. The discovery is the outcome of Pasteur's initial, most wonderful, prime discovery that racemic acid, an optically inactive product got from wine-lees, could be resolved into equal parts of ordinary right-handed tartaric acid and of a left-handed twin thereof. It is an important consequence of this generalisation that natural chemistry is, in a sense, simpler than laboratory chemistry.

How is the natural process by which a sugar such as glucose is formed to be pictured? It is as if the formaldehydrol molecules were threads the two ends of which are passed through contiguous holes in a piece of canvas. A number of such threads, being thus arranged, may obviously be tied together at the back of the canvas in various ways and the loose ends then clipped off, leaving distinctive elements of the thread arranged in some pattern on the front. Such a pattern might conceivably be produced by lowering upon the canvas a plate with holes through which the threads could be drawn only at certain points, and thereby determining the ways in which they could be tied together. In the plant, more probably, the reverse influence may be at work. The pattern may exist in the plant in the form of the substance to be produced: a sugar molecule may conceivably be formed upon what is practically a sugar molecule; that of starch upon a starch molecule; hence the apparently immediate appearance of starch. If such be the case, we can understand the formaldehydrol molecules becoming properly placed upon the guiding molecule, particularly in virtue of the attraction exercised by the (OH) groups in this upon those in the corresponding positions in the formaldehydrol molecules, leaving others in the position of loose ends to be snipped off at the right moment. When models of benzene derivatives such as have been described are packed together to form the crystal, more often than not they form a stepped pavement, as it were, alternate units being at one or other of two levels. Starch may well be so constructed, and it is possible to picture a series of formaldehydrol molecules dropping into place, in orderly arrangement, upon such a platform, ready to be tied together.

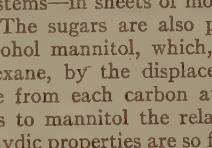
Enzyme Action.—How is the tying done? it may be asked. The operation is so easily effected in the laboratory that no special mechanism may be required. A trace of alkali or even acid may suffice. On the other hand, there is much evidence that, under natural conditions, the more complex carbohydrates are usually broken down through the agency of special agents, known as *enzymes;* therefore, it is at least probable that they are formed by the converse process, as such interactions are known, in many cases, to be reversible, and should be in all, though the point of equilibrium may be so near to the side that the change may appear to be unilateral. The general equation of enzymic hydrolysis may in fact be written thus:—

$$A'B'+\epsilon\delta\kappa OH_2 \leftrightharpoons A'(H)+B'(OH)+\epsilon\delta\kappa.$$

The difficulty that arises in the attempt to apply this generalisation is that the necessary agent is not always obvious. Thus, it is known that the constituents of cane-sugar, glucose and fructose both travel down in large quantity from the leaf to the bulb, and there become associated as cane-sugar: the bulb, however, does not contain the enzyme *invertase,* although this is present in the growing leaf. The enzyme appears to travel down into the bulb only when the growing period sets in, and the store in the bulb is utilised in forming a new season's growth.

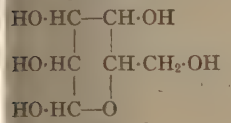
A further structural peculiarity in the sugars may now be referred to, as it is one that must be taken into account in discussing their formation. In the paraffins, as already explained, the carbon atoms are simply arranged in a series or row, atomic centres meeting at an angle of 109′28″, at successive corners of a zigzag. In the phenes, the angle of the approach of the carbon atoms may be supposed to be the same, but they are arranged in compact closed systems—in sheets of more or less frequently repeated hexagons. The sugars are also peculiar. Glucose is derived from the alcohol mannitol, which, in turn, is derived from the paraffin hexane, by the displacement of six of the hydrogen atoms, one from each carbon atom, by the radicle (OH). Glucose bears to mannitol the relation of aldehyde to alcohol, but the aldehydic properties are so feebly displayed that chemists have always dubbed it an aldehyde with hesitation. One peculiarity of glucose is the ease with which it is etherified. When it is dissolved in methylic alcohol, and the solution is slightly acidified with hydrogen chloride, it is soon converted into a mixture of products chief of which are two monomethylic derivatives—α- and β-methoglucoside, $C_6H_{11}O_5(OCH_3)$. In neither of these is the slightest trace of aldehydic behaviour to be found. A (third) γ-glucoside isomeric with the α and β forms has also been isolated, which is chemically a far more active substance. A solution of glucose appears to contain but a minute proportion at most of this form, and consists mainly of the α and β forms in equilibrium.

Chemists are now of opinion that the glucoses and these glucosides are closed systems, analogous to that of phene (benzene), but saturated. Phene itself may be converted into a saturated system, C_6H_{12} (hexahydrobenzene or hexamethylene), which is scarcely distinguishable chemically from the paraffin hexane.

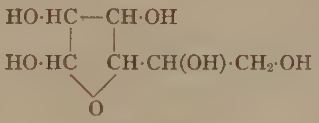


A hexhydric alcohol, $C_6H_6(OH)_6$, derived from this hydrocarbon, is a natural product. Being closed systems derived from phene, but saturated like methane and its substitution derivatives, such compounds are conveniently spoken of as *phanes*.

Phanes.—A simple and rational formal expression of the peculiar behaviour of glucose, and especially of the methoglucosides, is given if it be assumed that they are *oxophanes*, phanes in which several atoms of carbon are linked in a closed system by means of an oxygen atom. If so, one end of the paraffinic chain of mannitol becomes, as it were, soldered to a link along the chain, when, by hydroxylation, the terminal carbon atom is converted into the aldehydrol and a molecule of hydrone is thereupon withdrawn from the compound. To what "link" down the chain is the terminal atom thus united? The problem has given rise to a large amount of work and an equal amount of speculation, extending over years—we are not yet satisfied that the solution is in our hands. The most probable "interpretation" of the character of glucose and the glucosides, however, is now thought to be that given by the assumption that they are *phanoids:* that α- and β-glucose and the corresponding glucosides—are hexaphanes (hexoxophanes) and γ-glucose and the γ glucosides pentaphanes (pentoxophanes).

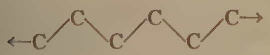


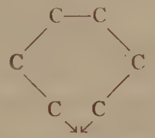
α and β



γ

Assuming such to be the case, what is mannitol—is it truly paraffinic or is it potentially *phanoid?*

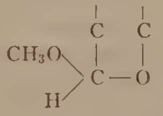


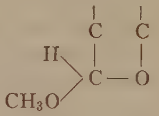


When hexane is gradually hydroxylised, does the carbon chain remain essentially a straight one, like a billiard cue, or does it bend? If the latter, when is the "screw" put on? This is an inquiry into the art of the chemical stevedore which the X-ray analysts must help to solve. Whenever it occurs, the "bending" is doubtless a necessary consequence of the loading of the molecule with oxygen and the attraction which oxygen has for oxygen. It may be added that although the formulae are written as "rings": actually in the model the carbon atoms are close packed either in clumps or in closed systems. Four and five may be united by an atom of oxygen, but the minimum number of carbon atoms in a closed system is probably six.

Returning now to the consideration of the manner in which carbohydrates are formed in the plant, it may be pointed out that although glucose is the fundamental carbohydrate unit, the opinion prevails, at the moment, that cane sugar, not glucose, is the primary product; starch may also be a primary product, but, as it is scarcely present in the leaves of monocotyledons, it is no longer supposed, as it once was, that this is *the* one and only initial product of assimilation. In any case, the carbohydrates should be regarded as immediate primary products of solar activity, if built up, as such, from carbonic acid, as this is reduced under the immediate influence of chlorophyll. If formed from formaldehydrol first set free in the cell fluid they are but secondary products. The fact remains that in some plants the chloroplasts become laden with starch; in others, in which cane sugar rather than starch seems to function as reserve material, they do not. Yet in these latter, if the concentration of the sugar within the leaf be raised by dipping the cut end into a strong solution of sugar, their chloroplasts equally become laden with starch. Apparently, in monocotyledons, the conditions of concentration are not normally those required for the production of starch; or maybe they are such that the starch is no sooner formed than it is hydrolysed and passes out as a lower sugar. The more probable explanation seems to be that the units assembled upon the template are tied together perhaps only in pairs and that these float away. Dilution would operate against continued linking up of molecules.

The essential carbohydrates are certainly glucose and fructose, cane sugar, starch, inulin and cellulose. Whilst cane sugar is compounded of glucose and fructose, inulin is composed of fructose, starch and cellulose, being formed of glucose alone. The units are differently arranged and in different numbers in the higher sugars, in unknown numbers in inulin, starch and cellulose. The difficulty of dealing with starch is enhanced by recent discoveries: that what is commonly called starch is not a single substance, and that, apparently, a single layer in a granule may be a mixture of "starches." Though starch and cellulose are ultimately resolved by hydrolysis into the same glucose, diverse products are obtained on the way—the one yielding *maltose*, the other *cellobiose*, both isomerides of cane sugar. The relation of these three, however, is simple, as fructose, which is associated with glucose in cane sugar, is but glucose slightly modified, and the other two are perhaps respectively α and β glucosides corresponding to the α- and β-methoglucoside already considered, the difference between these being simply that the methyl group is attached in one or other of the two possible positions to the carbon atom next to the oxygen link in the oxophane.





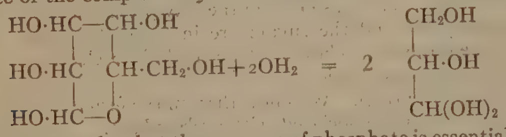
There is still much uncertainty on these points. Taking all the peculiarities into account, which are thus apparent, it is clear that the formation of sugar is a directed process from the beginning—that the sugars are all, as it were, formed against templates or patterns present in the plant cell. Whether formaldehydrol be produced and sent into circulation, or whether it be directly laid down to one or other carbohydrate, matters little—the primary elements are ultimately arranged and linked up in definite ways. The pattern cannot well be other than the thing itself. Cane sugar, however, being an intensely soluble material, cannot be thought of as acting as such. Yet it is not difficult to picture molecules of cane sugar being built into the protoplasmic structure of the chloroplast and the assembly, at such centres, either of formaldehyde or of glycerose molecules, which thereupon interact and give rise to cane sugar itself. But how? Some mechanism must be imagined to tie the threads (OH+OH) and cut off the spare ends (as OH_2) in the way previously considered. Formaldehydrol and the sugars are in themselves inert—they are not electrolytes. They must be made into electrolytic conductors, by means of acid or alkali, before they will act together or give way to attack. We know that, in the fermentation process, glucose is first associated with a phosphate. We know that in the plant phosphate plays a determining part. It is not going far to assume that phosphate comes into play in the formation of carbohydrate: how exactly, whether in the shape of a floating mechanism—such as an enzyme—or as a molecule held in the protoplasmic complex, much as the crane is now placed on a building in course of erection, it is impossible to say. That the phenomena are of such an order would seem to be highly probable. Away from the leaf, leucoplasts are met with in which transitory starch is often found, so that the enzymic mechanisms would seem to be widely distributed.

These mechanisms are clearly things apart—little factories in which special operations are carried on. For example, in sorrel, which is a strongly acid plant, the chloroplasts in the leaf are to be seen tucked away, as it were, in corners of the cells and are clearly independent of the acid in the fluid in which they float, their lining membrane being impervious to acid; for if this membrane be broken down by exposing the leaf to chloroform, at once the chlorophyll is changed in appearance. Normally, it would seem, sugar must be able to pass out, although acid cannot pass in—but sugar is not an electrolyte. Such observations are the clearest possible evidence that the reduction of carbonic acid takes place within the chloroplast: that the formation of carbohydrate is effected under its influence would also seem to be open to little doubt. In the starch granule, there seem even to be traces left, between " the starch molecules," of the erecting mechanism. We have yet to learn whether the silica in the cereal stem be not such a survival, not a mere strengthening inclusion.

Constructive Metabolism.—Having made sugar, the plant proceeds to use it in its many wondrous feats of constructive metabolism. The micro-organism—the yeasts and all unicellular organisms—we know is able from sugar alone as organic pabulum, with the aid of a few mineral salts, to reproduce itself to an unlimited extent. Raulin's nutrient solution, much used by Pasteur, was composed as follows:—

Water	1,500	Carbonate of Magnesia	0·4
Sugar candy	70	Sulphate of Ammonia	0·25
Tartaric acid	4	Sulphate of Zinc	0·07
Nitrate of Ammonia	4	Sulphate of Iron	0·07
Phosphate of Ammonia	0·6	Silicate of Potassium	0·07
Carbonate of Potassium	0·6		

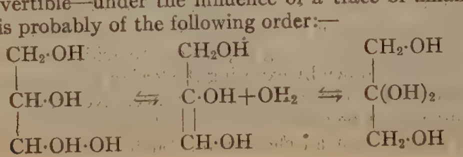
Apart from the singular power possessed by the higher plants, with the aid of chlorophyll, of reducing carbonic acid and of meeting the many requirements of cells of different orders, the chemical functions of unicellular and multicellular organisms would seem to be similar. When the compounds other than sugar present in the plant and more particularly in the animal, in which sugars play a very minor constructive part, serving mainly as fuel, are considered, it is obvious that they all contain very much smaller proportions of oxygen than the sugars. The life of the plant is essentially a reductive process—as indeed it is in the beginning, as the evolution of oxygen is but an accident of the reduction of carbonic acid by means of hydrogen derived from hydrone, the oxygen being cast aside as a by-product of no account to the plant. We have to explain the constant withdrawal of oxygen. Only one agent is at disposal for the purpose —that used in the first act: hydrone. We have to account for the disposal of its oxygen—without further direct assistance from the sun. Inasmuch, however, as starch contains about half the energy the carbon and hydrogen that are in it would furnish if burnt alone, the plant actually continues to work even in the dark with energy derived from the sun, the more as it also makes use of oxygen. Whatever the carbohydrate reserve material, it is brought down to a hexose, chiefly glucose, for use. Experimental evidence favours the view that glucose first undergoes resolution, by hydrolysis, into two molecules of glycerose. This seems the first stage in alcoholic fermentation under the influence of the complex enzymic mechanism in yeast (zymose).



$$\begin{array}{llcl} HO\cdot HC—CH\cdot OH & & & CH_2OH \\ \quad\ \ | \qquad\ \ | & & & \ \ | \\ HO\cdot HC \quad CH\cdot CH_2\cdot OH+2OH_2 & = & 2 & CH\cdot OH \\ \quad\ \ | \qquad\ \ | & & & \ \ | \\ HO\cdot HC—O & & & CH(OH)_2 \end{array}$$

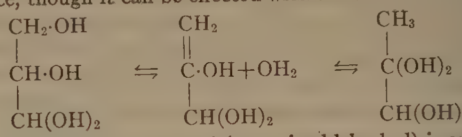
It is noteworthy that the presence of phosphate is essential, and that, in a preliminary stage, the phosphate and hexose interact. The argument has already been put forward but may be repeated, that, in the converse process, in the plant, phosphate is also operative and that this is an indication of at least one reason why phosphate is essential for plant growth. The reason why phosphate is essential is perhaps not far to seek. Glucose by itself, in aqueous solution, is not an electrolyte and, therefore, should not be open to attack—by the introduction of an acidic radicle into its structure, it becomes an electrolyte and can therefore be included in a circuit of change.

The two isomeric trioses, glyceraldose and glyceroketose, like the two isomeric hexoses, glucose and fructose, are mutually interconvertible—under the influence of a trace of alkali. The process is probably of the following order:—



$$\begin{array}{lclcl} CH_2\cdot OH & & CH_2OH & & CH_2\cdot OH \\ | & & | & & | \\ CH\cdot OH & \leftrightharpoons & C\cdot OH+OH_2 & \leftrightharpoons & C(OH)_2 \\ | & & \| & & | \\ CH\cdot OH\cdot OH & & CH\cdot OH & & CH_2\cdot OH \end{array}$$

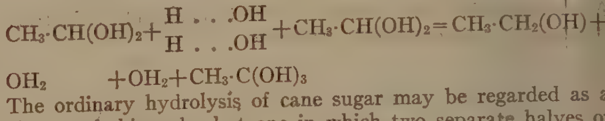
This change takes place rapidly and, when equilibrium is attained, both compounds are present in large proportions. Glucose is only very partially changed into fructose and the reverse, by a similar isomeric change. In the fermentation process, this type of change is carried a stage further, apparently under enzymic influence, though it can be effected with the aid of alkali:—



$$\begin{array}{lclcl} CH_2\cdot OH & & CH_2 & & CH_3 \\ | & & \| & & | \\ CH\cdot OH & \leftrightharpoons & C\cdot OH+OH_2 & \leftrightharpoons & C(OH)_2 \\ | & & | & & | \\ CH(OH)_2 & & CH(OH)_2 & & CH(OH)_2 \end{array}$$

The compound thus produced (pyruvic aldehydrol) is eminently oxidisable and easily oxidised to pyruvic acid—$CH_3\cdot CO\cdot CO(OH)$. It is thought that this acid is formed and, by hydrolysis, resolved into aldehyde and carbonic acid—$CH_3\cdot CO(OH)+OH_2=CH_3\cdot COH+CO_2+OH_2$. It is known that yeast contains a peculiar enzyme, *carboxylase*, which will effect this change. Also, that if the fermentation be carried out in presence of a sulphite, aldehyde may be obtained in large quantity, in place of ethylic alcohol. Further, if the liquid be maintained alkaline, much of the glyceraldose (ketose) escapes oxidation and is reduced to glycerol—which is but a very minor product of fermentation under ordinary conditions. It is thus seen how the glycerol of fats may be produced.

The production of alcohol in the fermentation process may be regarded as one in which two separate molecules are concerned and *reciprocally hydrolysed in circuit*, the one being hydrogenised; the other hydroxylised:—



$$CH_3\cdot CH(OH)_2+\begin{array}{l}H\ .\ .\ .OH\\H\ .\ .\ .OH\end{array}+CH_3\cdot CH(OH)_2=CH_3\cdot CH_2(OH)+$$
$$OH_2 \qquad +OH_2+CH_3\cdot C(OH)_3$$

The ordinary hydrolysis of cane sugar may be regarded as a change of this order but one in which two separate halves of the molecule are affected, the one being hydrogenised, the other hydroxylised.

To bring the two processes into complete agreement, proof i required of some mechanism in the fermentative process, where by the two aldehyde molecules are assembled in circuit with hy drone. Possibly, only suitable determining conditions of acidit and concentration are necessary—no special catalyst.

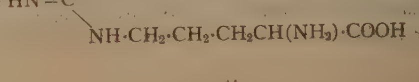
It is possible to ferment sugar in a variety of ways. Thus from it may be produced normal butylic alcohol and acetone, in stead of ethylic alcohol. It is not difficult to explain the process Aldehyde is easily condensed in the following manner:—

$$CH_3\cdot CH\cdot OH\cdot OH+CH_3\cdot CH(OH)_2=$$
$$CH_3\cdot CH(OH)\cdot CH_2\cdot CH(OH)+OH_2$$

This compound is convertible, by direct reduction, into norma butylic alcohol, whilst on oxidation it gives acetoacetic aci $CH_3\cdot CO\cdot CH_2\cdot CO\cdot OH$, which is easily resolved into acetone an carbonic acid. It is not difficult to visualise the formation of con plex fatty acids as a consequence of continued condensation an reduction, accompanied by the necessary amount of hydroxyla tion to form the necessary hydrogen.

Proteins.—The origin of proteins is to be sought in this san direction. It is known that these are but collocations of simp molecules, formed by condensation of molecule upon molecul a great variety of molecules being thus linked together. Tl units range from amino-acetic acid, $CH_2(NH_2)\cdot CO\cdot OH$ upward as shown in the following table.

Glycine $CH_2(NH_2),COOH$
Alanine $CH_3\cdot CH(NH_2)\cdot COOH$
Valine $(CH_3)_2:CH\cdot CH(NH_2)COOH$
Leucine $(CH_3)_2:CH\cdot CH_2\cdot CH(NH_2)\cdot COOH$
Isoleucine $(CH_3)(C_2H_5):CH\cdot CH(NH_2)\cdot COOH$
Serine $CH_2OH\cdot CH(NH_2)\cdot COOH$
Lysine $H_2N\cdot CH_2CH_2CH_2CH(NH_2)\cdot COOH$
Arginine



Phenylalanine $C_6H_5{\cdot}CH_2{\cdot}CH(NH_2){\cdot}COOH$

Tyrosine $HO{\cdot}C_6H_4{\cdot}CH_2CH(NH_2){\cdot}COOH$

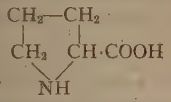
Aspartic acid $HOOC{\cdot}CH_2{\cdot}CH(NH_2){\cdot}COOH$

Glutamic acid $HOOC{\cdot}CH_2{\cdot}CH_2{\cdot}CH(NH_2){\cdot}COOH$

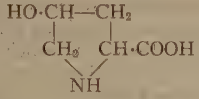
Hydroxyglutamic acid $HOOC{\cdot}CH_2{\cdot}CHOH{\cdot}CH(NH_2){\cdot}COOH$

Cystine $HOOC{\cdot}CH(NH_2){\cdot}CH_2S{-}SCH_2{\cdot}CH(NH_2){\cdot}COOH$

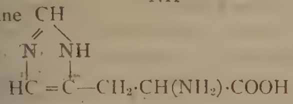
Proline



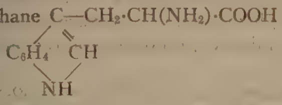
Hydroxyproline



Histidine



Tryptophane



The production of such amino-acids is to be accounted for without much difficulty, bearing in mind what is said above, of the manner in which hydroxy-(keto) acids, such as pyruvic acid, are formed in the fermentation process and the readiness with which these are attacked by ammonia:—

$$CH_3{\cdot}C(OH)_2{\cdot}CO{\cdot}OH+NH_3=CH_3{\cdot}C(OH){\cdot}(NH_2){\cdot}CO{\cdot}OH+H_2O$$

Such acid, on reduction, is converted into aminopropionic acid or alamine, a constituent of many proteins. Aminoacetic acid (glycine) is conceivably derived in a similar way from glyoxylic acid, $CH(OH)_2{\cdot}CO{\cdot}OH$ this being one of the normal oxidation products of glycerose.

The only series of compounds present in plants of which the origin is at present obscure are the phenoid derivatives, phenylalanine, tryptophane and tyrosine, which are present in most of the proteins. Broadly speaking, however, it is clear that they are formed from simple materials by condensation processes such as those explained.

As to the structure of the proteins, we have no conception, at present, whether their molecules are long-drawn-out systems like those of the fatty acids or compressed like the saccharons. The latter is the more probable. Regarding them as forming sheets of a pavement-like character, it is possible to conceive the arrangement of the several units upon pre-existent molecules of the protein and the consequent determination of the order of arrangement. Without some such interpretation, it is impossible to explain the persistence of particular proteins in particular materials of either animal or vegetable origin.

Nitrogen Absorption.—Plants of non-leguminous orders apparently derive their nitrogen, at least for the most part, from ammonia in the soil. Nitrate, we know, passes into the plant and may even be stored in the cells in considerable amounts. Nitrates are not easily reduced, however. Still, proof has yet to be given that they are directly utilised by the plant. The remarkable direct absorption of nitrogen by organisms in the soil and by others living in the nodular growths found especially upon the roots of leguminous plants is in no way understood at present. Probably, it is to be associated with the occurrence of intense oxidative changes, which make hydrogen disposable at a high potential. The absorption of so inert a material appears to be less remarkable than it did, now that vast quantities of ammonia are produced by the direct interaction of hydrogen and nitrogen under the influence of a catalyst—but this is effected at a high temperature and under a high pressure not within the cold soil. Strangely enough, the production of ammonia by direct reduction of nitrogen has never yet been observed under ordinary simple laboratory conditions.

Methyl Alcohol.—A reference may be interposed to modern synthetic methods of producing organic materials which may well put fermentation processes and natural sources into the shade. Methylic alcohol has long been produced as a by-product in the manufacture of charcoal—formerly much used for gunpowder. Formaldehyde, which has been greatly in demand of late years, has been prepared by oxidising such alcohol. It has recently been shown that, in presence of a suitable catalyst, under appropriate conditions of temperature and pressure, carbonic oxide and hydrogen interact directly and may be converted all but completely into methylic alcohol. At higher pressures the product is more complex, and apparently a whole series of paraffinic alcohols may be produced. Clearly, it is a case in which formaldehyde molecules are formed and brought into interaction and condensed, as they are in the plant, the product being, however, at once reduced.

Oxidation.—In the animal, oxidation is at the root of muscular activity. The extent to which it is effected as an independent process is not clear but, at least, the fats must be primarily oxidised to some extent before they are rendered available for the purposes of muscular activity. Oxygen is so essential to plant life that the gas must take part in its vital activity, but it is in no way clear what special function oxygen subserves. Many organisms can live without air, the yeasts all do; oxygen becomes necessary, however, at the reproductive stage, though only in minimal amount. Aerobic organisms use up a large amount of oxygen. In the animal, oxygen is stored in haemoglobin as oxyhaemoglobin and thence passes into solution as required, a definite equilibrium being maintained between the oxygen within the red-blood corpuscles and the solution without the cell. Oxyhaemoglobin itself, apparently, has no action as an oxidising agent. At root, the oxidation (hydroxylation) process in plant and animal is alike in its nature, it may be supposed. Usually, if not always, a catalyst as well as a determinant, is involved in the change—the oxidising catalysts are known generally as oxidases. These have been classed as enzymes, but modern work is tending more and more to show that, though they may differ and be limited in their range of activity, they are not enzymes in the sense of being selective agents, in some way structurally related to the compounds they affect. The enzymes, as a class, are apparently all hydrolytic agents; at least, it may be desirable to confine the use of the term to agents exercising this function alone.

Thanks to the refined work of Fletcher, Hill and Hopkins in particular, it is now clear that the act of muscular contraction derives its energy from an essentially enzymic process, akin to that of fermentation, whereby hexose (glucose) is converted into lactic acid, $CH_3{\cdot}CH(OH){\cdot}CO{\cdot}OH$—only then does oxygen become directly operative. It may well be that the lactic acid is merely hydroxylated and that the product, $CH_3{\cdot}C(OH)_2{\cdot}CO{\cdot}OH$, is resolved into carbon dioxide and a residue which is rebuilt to hexose.

In this connection, it may be well to discuss more closely the phenomena of oxidation in general. It may be submitted that not only, as already stated, (1) is oxidation primarily, in so far as the oxidised compound is concerned, a process of hydroxylation, but (2) that oxygen or whatever oxidising agent be used is active only indirectly—as depolariser and adjuvant in an electrolytic circuit. The oxidation of hydrogen has already been formulated from this point of view, thus:—

$$\begin{array}{c}H\\|\\H\end{array} + \begin{array}{c}HO\ldots H\\ \\HO\ldots H\end{array} + \begin{array}{c}O\\|\\O\end{array} = 2H_2O+HO{\cdot}OH$$

Note.—Dots are used here and elsewhere to indicate the electrolyte of which HO and H are the terminals.

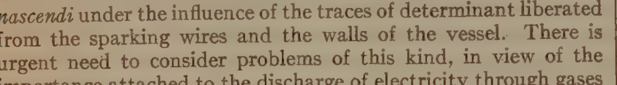
Whereas hydrogen and oxygen interact readily, at the surface of a platinum plate (in presence of the necessary determinant), a mixture of carbonic oxide and oxygen not only remains unaffected but, if carbonic oxide be added to the mixture of oxygen and hydrogen, it actually inhibits their interaction, under the influence of platinum.

Carbonic oxide and hydrogen have very nearly the same heats of combustion, that of hydrogen (to liquid water) being slightly above, that of carbonic oxide, slightly below, 68,000 units. It may be suggested that 68,000 is a *limiting value* and that no interaction in which a less amount of energy is developed will take place directly—without an adjuvant or depolariser. This seems to be an immediate corollary to the view, that as the action is electrolytic the determinant is necessarily liquid and composed of water and a salt. Carbonic oxide should be incombustible in the absence of a depolariser, if this view hold good, as water must be electrolysed in the circuit of change.

The fact that it explodes when moist may be accounted for by the assumption that the spark or flame applied to the mixture causes the production or introduction of a slight amount of hydrogen, which is burnt along with it, a supply of hydrogen being kept up by a slight decomposition of water in the wave front as the explosion spreads. Prof. Bone has found that the mixture becomes less and less easily exploded, requiring the application of a greater and greater intensity of current to force a discharge across the sparking gap, as the drying is more and more complete. Using phosphoric anhydride as drying agent, a limit is reached but only after several months. Explosion ultimately takes place but only when a very powerful electro-motive force is applied and is attended with a most brilliant flash of light, but the interaction is far from complete. What is the explanation of this behaviour? It may be either a case in which a sufficient amount of the electrolytic determinant is expelled from the platinum wire electrodes by the discharges in the form of previously imprisoned hydrogen molecules and "spluttered" platinum motes, or one in which the gas is dissociated into its elements and the released carbon is exploded in *statu nascendi* under the influence of the traces of determinant liberated from the sparking wires and the walls of the vessel. There is urgent need to consider problems of this kind, in view of the importance attached to the discharge of electricity through gases by physicists, who are paying no attention whatever to the purity of the materials and the possible variation in the system through which the discharge is passed.

Carbonic oxide is perhaps the most interesting of all oxidisable gases. It needs little drying to render it incombustible, and its combustibility grows as the amount of moisture present is increased over a considerable range. The probable explanation of this behaviour is that it is hydroxylised, not as such but indirectly through the determinant which becomes associated with it. The compound $\mathrm{CO}\!\left\langle\begin{matrix}\mathrm{H}\\ \mathrm{OH}\end{matrix}\right.$, being of a very low order of stability, would necessarily be in very small proportion unless a considerable proportion of hydrone molecules were present. Its condition is comparable with that of a *very weak* acid in solution.

The influence of hydrogen and of hydrocarbon in promoting the combustion, when present together with the gas, may be ascribed to the initial formation of perhydrone from the hydrogen, which then functions as active depolariser in the carbonic oxide circuit.



$$\mathrm{CO}\!\left\langle\begin{matrix}\mathrm{H}\\ \mathrm{OH}\end{matrix}\right. + \begin{matrix}\mathrm{HO}\ldots\mathrm{H}\\ \mathrm{HO}\ldots\mathrm{H}\end{matrix} + \begin{matrix}\mathrm{HO}\\ |\\ \mathrm{HO}\end{matrix} = \mathrm{CO}\!\left\langle\begin{matrix}\mathrm{OH}\\ \mathrm{OH}\end{matrix}\right. + \mathrm{OH_2} + \begin{matrix}\cdots\\ \cdots\end{matrix} + 2\mathrm{H_2O}$$

In other words, carbonic oxide, in reality, is burnt at the expense of pre-existent perhydrone, not in any "direct" way, at the expense of oxygen.

In most cases of oxidation under laboratory conditions, the agents used are salts and therefore electrolytes. The only agents which are not are perhydrone and oxygen (or ozone) itself. There is much evidence to show that these are inert in themselves; they need the aid of a determinant. Thus, to make perhydrone effective, it is commonly associated with ferrous sulphate and is probably active as the perhydrol $\mathrm{Fe}\!\left\langle\begin{matrix}\mathrm{SO_3H}\\ \mathrm{O{\cdot}OH}\end{matrix}\right.$, an electrolyte. The oxidases, to which reference has been made, seem to be, in the main, colloid catalysts—substances which are reversibly hydroxylisable and convertible into perhydrols. Some are undoubtedly iron or manganese compounds. Apparently, the activity of these is largely dependent upon the effective acidity of the media in which they are placed, and they are mostly active only if it be near to the point of neutrality.

Control of Oxidation.—Warm-blooded animals are gifted with a remarkably efficient heat-controlling mechanism. Considering the high average temperature of the blood and the amount of easily oxidisable material available, it is probable that without such control temperature would rapidly rise to "impossible" heights, as in fever. The question may be put: To what extent, if at all, is any chemical control exercised? It is only during recent years that special attention has been called—particularly by Moureu and Dufraisse—to the way in which an oxidation may be antagonised and potential oxidation prevented by the presence of a second oxidisable substance. The aldehyde acrolein, $CH_2{:}CH{\cdot}CHO$, a highly volatile, tear-exciting liquid, is extraordinarily sensitive to oxidation; it soon becomes acid and then rapidly passes over into a hard, resinous condensation product. This and similar changes are prevented by a whole series of oxidisable substances—phenol, quinol, pyrogallol, even by potassium iodide, only a minute proportion of the antagonising agent being necessary.

Many such instances are known. Phosphorus does not glow in the presence of a trace of volatile oil. Solutions of ferrous sulphate and of alkaline sulphite, taken separately, are easily oxidised by air: in admixture, they are not. Perhaps the most remarkable case is that already referred to—the prevention of the interaction of hydrogen and oxygen at a platinum surface by carbonic oxide, which itself is not oxidisable at such a surface, however.

It may well be that such antagonisms play a determining part, at least at times, in the economy of animal and plant life. Poisoning by hydrogen cyanide has long been thought to be a consequence of the inhibiting effect on oxidation which it exercises at certain nerve centres. It at once puts a stop to the evolution of oxygen from perhydrone by yeast and also by finely divided platinum. Arsenic may perhaps have a similar influence. It is conceivable that the intense poisonous activity of some alkaloids may be of a similar order: it cannot be a mass effect, the quantity required is so minute. The nearest explanation of such antagonistic action would seem to be that the oxidisable materials in competition are "reversibly" oxidised and converted into "perhydrols," which in turn interact, reproducing oxygen and the original substances.

Such matters are assuming great technical importance in connection with the internal combustion engine, using vaporised liquid fuel (*see* Internal Combustion Engine). The various petrols differ greatly in explosive behaviour—in the rapidity with which they are "burnt." The most successful regulative agent hitherto used has been lead tetrethide, $Pb(C_2H_5)_4$. It would seem likely that the effect this exercises—whatever its precise nature—must depend upon the lead functioning as an oxidising "catalyst."

Lastly, we are becoming more and more alive to the fact that life is regulated by a number of mysterious secretions from special glands, in different parts of the body—the pituitary, the thyroid, etc. (*see* Endocrinology). Our vegetable food is proved to contain accessory factors or adjutants, in minute amount, in absence of which nutrition breaks down (*see* Vitamins).

Another case in point is insulin (*q.v.*), a characteristic pancreatic secretion but of frequent occurrence in animal tissues and apparently also in yeast. If used in very small amount, this material makes good the disturbance in function, whatever it may be, from which diabetics suffer; actually, it causes the disappearance of glucose from the blood. Such agents are all active in very minute amount and their effect would appear to be regulative. One of the most striking cases yet brought forward is the apparent need of a most minute, indeed altogether infinitesimal, amount of borate by the nodules which form on the roots of leguminous plants. Unless borate be present, the nodular organisms are not brought into effective, reciprocal relationship with and fed by the plant.

The chapter is one of infinite importance in its vital connection but scarcely entered upon as yet, especially on the theoretical side.

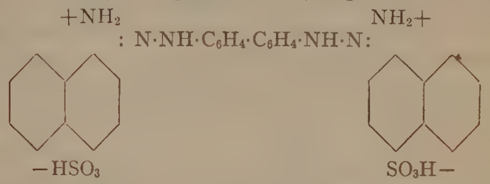
The Colloid Nature of Natural Products.—Apart from the compounds dissolved in the cell fluid and certain reserve materials (the simpler sugars), the components of animal and plant structure are all highly complex, slightly soluble, if not insoluble materials—proteins for the most part. The term colloid (*q.v.*) was early applied to them by Graham, because of their glue-like character. It is to be deplored that the term has been widened and applied generally to finely divided materials in suspension in liquid media—still more that a bastard, hybrid nomenclature has been developed which successfully serves but to obscure the obscure. As Jacques Loeb has shown, when the proteins are fairly considered from a chemical standpoint, they are as other compounds in general behaviour.

Thus far, the phenomena of solubility have been dealt with in the vaguest possible manner; structural considerations have scarcely if at all been taken into account.

Solid paraffin is not even wetted by water: the hydrogen in it would appear to be unattractive and in the "saturated state" in which the carbon is present, this also, apparently, has no residual affinity to water. Yet the molecules are not without residual affinity. Sir William Bragg's X-ray measurements show that when paraffin is fused upon glass and then cooled, the molecules become ranged like scaffold poles side by side, and these interlocked poles become erect and ranged in rows. When the terminal group is oxidised and the paraffin is converted into stearic acid, it is wetted by water but only at the carboxylic tip: in other words, it is soluble at the tip but not as a whole. The higher fatty acids form such films upon water, the molecules standing upright, side by side, the carboxylic tips resting upon the liquid. The paraffins are efficient lubricants, because they are so slightly attracted to solid surfaces. All other fluids are more or less "held" by the surface, their "grip" depending upon the nature of the surface and the character of the material; this is clearly a function of structure, and the effect would seem to be exercised at and upon the centres of residual affinity in the molecules.

It would seem to be permissible and rational to extend this point of view to substances in solution. Difficult as it may be to define the term solubility and confine its use, it were time that we had some definite conception of the nature of the reciprocal relationship of solvent to "dissolved" substance. In view of what is said above, stearic and oleic acid may be said to be in solution only at the carboxylic tip. When the alkali-metal salts of these acids (soaps) are dissolved in water, again only the carboxylic tip is in solution; definite reciprocal relations are established between it and the near-by water molecules, but the rest of the molecule is to be thought of as merely making a hole in the water, as it were. Hence, perhaps, we may arrive at a distinction between dissolved and undissolved substance and picture this as, in a measure, analogous to that to be drawn between airship and balloon. The balloon but makes a hole in the air. It is a mere floating body, itself mechanically inert but knocked about by the impacts of the air molecules. So is the *body* of the airship—like the balloon, it merely makes a hole in the air. In virtue of the engine and propeller, however, as the propeller grips the air, the airship is brought into more active relationship with the air; at least, it has a directing mechanism, though, as in the balloon, the interaction between ship and air is purely kinetic—no selective affinity of any kind comes into play. A neutral particle—if there be such—suspended in a fluid may be pictured as in the condition of the balloon; under the microscope, the particles are seen to be in rapid movement (Brownian motion), due apparently to their bombardment by the active unit-molecules within the liquid. Perhaps the only strictly neutral particle conceivable is that of a paraffin—all other materials seem to be possessed of some degree of surface attraction, to display some affection for fluid molecules in general.

The airship, however, is the analogue of nearly all organic molecules more or less soluble in water. There is an all but insoluble body, often very large, which is associated with a radicle more or less avid of water. Alcohol is a derivative on the one hand of the hydrocarbon ethane C_2H_6, which is insoluble in water; on the other hand, of hydrone, being formed by the withdrawal of an atom of hydrogen from each and the fusion of the residues. It is miscible with water in all proportions—such is the avidity of the residual OH for water. None the less the ethane residue is to be thought of as but dragged under by the associated oxygen. Benzene, C_6H_6, spreads out as a layer upon water and is practically insoluble; phenol, $C_6H_5{\cdot}OH$, is but moderately soluble; the sulphonic acid, $C_6H_5{\cdot}SO_3H$, formed by the interaction of benzene and sulphuric acid, is intensely soluble. A large class of dyestuffs, the direct cotton dyestuffs, is formed from benzidine, $NH_2{\cdot}C_6H_4{\cdot}C_6H_4{\cdot}NH_2$, an insoluble material, by coupling it through the agency of the NH_2 groups with certain more or less complex sulphonic acids. Congo-red is one of these.



The slight "solubility" of this huge molecule may be ascribed to the two primary SO_3H groups. As a matter of fact, there is reason to believe that the dissolving influence this group usually exercises is greatly lowered in amino-compounds of the type shown by the "control" exercised by the basic nitrogen atom. The lower sugars are easily soluble—cane sugar liquefies in one-third of its weight of water. As already explained, in these each carbon atom carries an oxygen atom and the oxygen atoms undoubtedly are centres of attraction for "water." As complexity grows, the sugars become less soluble and starch is practically insoluble; in some way, the residual affinity of the oxygen atoms becomes lowered. Starch, however, is a typical colloid when properly distributed in water. The proteins are equally so. In these the centres of attraction are either oxygen or nitrogen, and such centres are frequently repeated. Such colloids may be pictured as having "water" collected about them at the various active centres. They are "held up," as it were, by these in the liquid. Only compounds of this type deserve the name of colloids.

If such be a true picture, we cannot well say where dissolution begins and where it ends; the passage from soluble to insoluble must be continuous. Degree of solubility must be a question of relative affinity, as between the molecules of solute, between the molecules of solvent and between the molecules of solvent and solute, that of the molecules of solute being more and more easily overcome, the greater the attraction exercised by the molecules of solvent. From this point of view, the plasticity of clay is practically the "plasticity" of thin films of water. Very finely divided (deflocculated) particles of clay, in an alkaline medium, may be pictured as the condition of soap molecules swimming in water; if the medium be made acid, in either case, molecules are formed which have less affinity for water and, therefore, tend to aggregate. Finely suspended matter may be of three kinds: acid, alkaline or neutral. Neutral particles show no tendency to wander to either electrode in an electrolytic field; the acid form wanders to one electrode, the alkaline to the other, and in this behaviour we may have before us what may be visualised as happening to dissolved (potential) electrolytes.

(H. E. A.)

CHEQUERS.—Chequers Court, Buckinghamshire, a typical English country home of the early Renaissance period, became an official residence of British Prime Ministers in 1921. It is situated in a beautiful part of Buckinghamshire, not far from Princes Risborough and 38 m. from London. The house and estate, about 1,500 ac. in extent, with adequate means for maintaining them, were generously put in trust for this purpose by their owners, Lord and Lady Lee of Fareham.

Here Caractacus had a stronghold, of which the earthworks are still visible. "Radulphus," clerk to the Exchequer, was owner under Henry II., and the place appears to have taken its name from his office. Here, in 1565, his descendant, William Hawtrey, remodelled the house of his ancestors and gave it much of its present character and appearance. Here in the 18th century, came, and still remains, a unique collection of Cromwell portraits and other relics, the Russells, who had inherited the estate, being descended from one of the Protector's daughters. The Russells maintained the Elizabethan house with little alteration, but Robert Greenhill, who inherited from them early in the 19th century, plastered the whole of the outside and redecorated the interior in Strawberry Hill Gothic fashion.

When the Lees entered on a long tenancy in 1909 they sought to reveal all the remaining ancient features, and to introduce others characteristic of the days of the Hawtreys and the Russells. Their activities covered not only the interior and exterior of the house, but its immediate environment, forecourt and formal gardens with due architectural features completing the picture. To much that was interesting in the way of pictures, books and furniture belonging to the house, a great deal of fine quality was added, and thus Chequers became one of the most beautiful and complete expressions of the historic English country house. In 1917 Lord and Lady Lee changed their tenancy into a freehold, and proceeded to create a trust, which, on their deaths should make the house an adequate seat where the Prime Ministers could entertain guests. The original draft for the Chequers Trust declared that:—

> The main features of the scheme are, therefore, designed not merely to make Chequers available as the official country residence of the Prime Minister of the day, but to tempt him to visit it regularly, and to make it possible for him to live there, even if his income should be limited to his salary. With this object a sufficient endowment is provided to cover the cost of a permanent nucleus staff of servants, of keeping up the gardens and grounds, of maintenance and repairs, and other necessary outgoings. There is also a residential allowance for the official occupant calculated in a fashion deliberately designed to encourage regular week-end visits.

The draft, however, insisted upon the unaltered preservation of both house and contents:—

> Another cardinal object of the scheme is to preserve, so far as possible, the main architectural and archaeological features of the house and surroundings in their present restored condition. It will, therefore, be provided and strictly enjoined in the trust deed that no alteration, mutilation, addition or subtraction shall be made to the principal features of the house.

In 1920 Lord and Lady Lee resolved that this generous scheme should not await their demise but should take immediate effect. All the preparations for establishing and working the trust having been completed by the end of that year, Mr. Lloyd George, then Prime Minister, held his house-warming on Jan. 8 1921. After that date Mr. Lloyd George and his successors, Mr. Bonar Law, Mr. Stanley Baldwin, Mr. Ramsay MacDonald, and Mr. Baldwin again spent part of their time here during their respective terms of office. (H. A. T.)

CHEQUE WRITER: *see* OFFICE APPLIANCES.

CHESS (*see* 6.93).—Chess has gained very considerably in popularity since 1910, and especially since the conclusion of the World War. During the War, tournaments were promoted and financed by local authorities at Hastings, Scarborough, Weston-super-Mare, Stratford-on-Avon and other places in England; and at San Sebastian, Scheveningen, Carlsbad, Baden-Baden, Marienbad and several other resorts on the European continent.

Although no international contests were held during the War, 18 first-class international tournaments were played in different parts of Europe and America between 1910 and 1925. The principal events were:—San Sebastian, 1911 and 1912, the first won by J. R. Capablanca, and the second by A. Rubinstein; Petrograd, 1914, first E. Lasker, second Capablanca, third A. Alekhine; London, 1922, first Capablanca, second Alekhine, third Milan Vidmar of Yugoslavia; and New York, 1924, first Lasker, second Capablanca, third Alekhine.

In the tournaments mentioned only three new players came to the fore, namely, Alexander Alekhine, of Moscow; E. D. Bogoljuboff of Ukraine; and Richard Réti of Czechoslovakia. Alekhine won several first prizes in competitions only slightly less important than the Petrograd, London and New York tournaments. He established a record for blindfold play, by playing 28 games simultaneously *sans voir* in Paris.

Bogoljuboff's best performance until 1926 was winning the first prize in a strong tournament at Breslau in 1925. Réti, a strong original expert, won some notable honours. At Göteborg in 1920 he won the first prize from Rubinstein and Bogoljuboff, and at the New York meeting in 1924 he was the only competitor who won a game from Capablanca. An expert blindfold player, he became the leader of a new school, and published a book, *Modern Ideas in Chess*. Honourable mention should be made of Sir George Thomas, Bart. and F. D. Yates, England; Max Euwe, Holland; F. Samisch, Germany; and the clever Mexican player, C. Torre.

After many years of negotiation a match for the World's Championship was contested at Havana in 1921 between Lasker and Capablanca. The result was disappointing. The conditions stipulated for 24 games, but after the fourteenth game, with the score Capablanca 4, drawn 10, Lasker 0, Lasker resigned the match and the chess Championship of the World. An International Masters' Tournament was held at Moscow in Dec. 1925, being subsidised by the Russian Govt. to the extent of about £3,000. The competitors included the champion, Capablanca; the ex-champion, Lasker; the United States champion, F. J. Marshall; also Rubinstein, Réti, Tartakover, Torre, several very strong Russian players, and last, though by no means least, Bogoljuboff who, despite the fact that he was beaten by Capablanca and drew only with Lasker, nevertheless won the first prize, with a score of 15½ points out of a possible 20. In Great Britain excellent work has been done by the British Chess Federation, the organisers and managers of the London International Congress, 1922, and of the annual national chess congresses.

Methods of Play.—No vital changes in the actual playing of chess since 1910 can be recorded. A slight alteration in the technique of opening games has been observed, though none of it is new. The development, for example, of the king's bishop, at K Kt2, instead of at Q3, in the queen's pawn game, is, at least, as old as the days of Blackburne and Steinitz. The selection of Kt to KB3 for the first move was consistently practised by Zukertort, in the London tournament of 1883. "Réti's Opening" (1.Kt. to KB3, P to Q4, 2.P to QB4) is an unimportant deviation of the customary development of the queen's pawn game. Finally, there is the so-called "Alekhine's Defence" (P to K4, Kt to KB3), first adopted by Alekhine in a tournament at Budapest in 1921, but, as a matter of fact, often played in London before Alekhine was born. The games played for the World's Championship in 1921 appear only slightly different from those contested between Lasker and Steinitz in the World's Championship match of 1893.

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(L. VAN V.)

CHETWODE, SIR PHILIP WALHOUSE (1869–), British soldier, was born Sept. 21 1869, and in Nov. 1889 was commissioned to the 19th Hussars from the Militia. He saw active service in Burma and South Africa, and later became assistant military secretary to Sir John French at Aldershot. Promoted to the command of the 5th Cavalry Brigade in May 1914, his brigade accompanied the Expeditionary Force to France and helped to cover the retreat from Mons, bringing off at Cérizy one of the rare cavalry charges of the War. He went out to Egypt to command the Desert Column in 1916, and won early distinction by the decisive surprise attack at Rafah, which finally freed Sinai from the Turks. After the second battle of Gaza in April 1917, he succeeded General Dobell in command of the whole Eastern Force. When General Allenby came out to take over the supreme command he based his plan on Chetwode's plans, and the latter, commanding the XX. Army Corps, after the reorganisation of the forces, played a distinguished part in the advance to Jerusalem and in the crowning victory in Sept. 1918. Shortly after the War, Chetwode was appointed military secretary at the War Office, then in Sept. 1920, succeeded General Harington as deputy chief of the Imperial Staff, and two years later became adjutant-general to the forces. This post he gave up in April 1923, taking the Aldershot Command.

CHEVALIER, ALBERT (1861–1923), British comedian (*see* 6.113), produced at the Lyceum Theatre, London, in 1920, a play *My Old Dutch*, based on the famous song of that title. He last appeared in Nov. 1922 at the same theatre in a revival of this play. He died in London July 10 1923.

CHEYNE, THOMAS KELLY (1841–1915), British divine and biblical critic (*see* 6.116), died at Oxford Feb. 16 1915. His later works include *The Two Religions of Israel* (1910); *Mines of Isaiah Re-explored* (1912); *The Veil of Hebrew History* (1913), and *Fresh Voyages on Infrequented Waters* (1914).

CHICAGO (*see* 6.118).—With a population in 1920 of 2,701,705, an increase of 23·6% over 1910, Chicago easily maintained its position as the second city of the United States. The census bureau estimated the population on July 1 1925 at 2,995,239. On the basis of the daily increase it was announced that the city had passed the 3,000,000 mark Aug. 10 1925. While the city's growth from 1910 to 1920 was greater proportionally than that of New York it was considerably less absolutely. The percentage of increase was less than that of any other decade, and the estimates of present growth indicate a still smaller rate of increase for the present decade.

In common with most American cities, the population growth of Chicago has decreased relatively to the growth of the outlying communities of its metropolitan area. The total population of the city and these districts was estimated officially as 3,986,331 on Jan. 1 1925. The rate of regional growth about the city seems to be increasing as the rate of strictly urban growth declines, largely because of the extension of motor traffic and hard surfaced highways. Chicago's percentage of population increase in the last census decade was smaller than that of Detroit, 113·4%, and Cleveland, 42·1%, these two cities being Chicago's closest rivals in the Middle West.

Negro Population.—In 1920 the negro population was 109,594, an increase of 148·5% over the preceding census. The influx of negroes was due to the demand for unskilled labour, especially in the packing industry, during the period of the World War, when European immigration was slight. A shortage of housing facilities for these negro labourers was one of the underlying causes of the race riots of 1919. The negro influx slackened during the industrial depression of 1920–1, to be resumed in 1923. In the following year it again declined, and with the rapid development of conveyor and construction machinery to displace manual labour the movement has probably passed its crest. By annexation of suburban areas and accretion on the lake front the area of Chicago increased from 191·4 sq. m. in 1910 to 204·9 in 1925.

Industries.—The value of manufactures produced in Chicago increased enormously between 1921–3, but as 1921 was a year of industrial depression and 1919 a year of very high prices, the rates of change between the three censuses are not an accurate index of physical volume. The value of all products in 1919 was $3,657,424,471; in 1921 $2,185,819,374; in 1923, $3,323,341,460. But the physical volume of the output of 1923 was undoubtedly greater than that of 1919. In 1923 there were 9,334 manufacturing establishments within the city limits of Chicago. These employed 385,685 persons, paying wages which amounted to $571,724,743.

Despite financial difficulties and reorganisation of two of the great corporations the packing industry has maintained a growth in its receipts and output, in the face of the pronounced trend toward decentralisation of the industry. In 1924 the industry showed the turnover of livestock to be 18,653,539 head, valued at $528,489,268. The trend of the grain trade is shown by the following facts. Between 1920–4 flour increased from $955,000 to $1,858,000, wheat from $28,997,000 to $69,012,000, corn from $85,487,000 to $99,524,000 and oats from $74,939,000 to $82,831,000, and in the case of corn and oats higher figures were reached in intermediate years. The growth of the city's financial power has been marked by the growth of the independent suburban banking, fostered by the Illinois laws, and associated with real estate and suburban operations building up the ring of communities about the city. Some of the outlying institutions can now rival the central banks.

The City Plan.—The most striking feature of Chicago's recent history is the plan for the reconstruction of the city and the progress of its execution. This plan had its genesis in a report, prepared under the guiding spirit of Mr. Daniel H. Burnham. The first step was the appointment of the Chicago Plan Commission, composed of aldermen and citizens. In furtherance of the Chicago plan, Roosevelt road was widened between Ashland avenue and Michigan avenue; Michigan avenue was widened between Roosevelt road and the river, and between the river and Chicago avenue. Widening the part of the street between Randolph street and Chicago avenue was a difficult matter, involving the acquisition of valuable private property and the construction over the Chicago river of a large two-level bascule bridge. The new thoroughfare was opened to traffic in 1920.

Twelve major street improvements are now either under way or finished. The street scheme in the plan of Chicago is divided into four phases, the first of which is the project to reduce congestion by means of the development of a quadrangle of wide streets about the business centre. Other phases of the plan, all of which are designed to provide through traffic systems by the widening of streets, the creation of boulevards, drives through the growing park system, and bridges over the river and railway depressions are in process of piecemeal execution. The Chicago plan is being carried out in co-operation with the park boards and forest preserve system with the view of realising the artistic and humanitarian advantages of three features of the city, the lake front, the Chicago river and the belt of wooded country about the city.

The South and Lincoln Park boards have been reclaiming land from the lake until nearly half of the city's water front now consists of parks and artificial lagoons. Over two sq. m. have been added to this area and a further extension of Lincoln Park northward has been authorised by the voters. The lake front park system and the smaller inland parks have a total of 71 bathing beaches and pools attended in 1924 by 3,523,393 people. The large and small parks together number 211, with an area of 5,524 ac.; there are 25 free and 41 private golf courses, and 73 playgrounds frequented by 5,000,000 annually. Inland, the city is being gradually encircled by the forest preserves, which contained over 28,000 ac. in 1925 and are being extended. The recreational facilities of the forest preserves were used by over 3,000,000 visitors in 1924.

The development of the South Park system on the lake front south of the Chicago river, is proceeding hand in hand with railway terminal development and the opening of new boulevards through the park to provide better access to the south side of the city. The Illinois Central Railway, formerly on the lake front, is now inland occupying a depressed area in the parks. Electrification of this railroad within Chicago will be completed in 1932. The new building for the Field Museum, located on made land on the lake front, was completed in 1920 at a cost of $6,000,000, which was provided by the will of Marshall Field. It is 350 ft. wide and 700 ft. long, and is built of Georgia white marble in the Ionic style of architecture. South of the Field Museum is a large stadium—Soldiers' Field, the ultimate seating capacity of which is expected to be 100,000.

Railways.—Although Chicago is the greatest railway centre in the world and the hub of the American rail system, its terminal problems have not yet been solved, although a great advance toward that end has already been made. In 1911 the new passenger station of the Chicago and North Western Railway, a dignified structure, was opened to service.

The railways using the Union station—the Pennsylvania, the Burlington, the Chicago and Alton and the Chicago, Milwaukee and St. Paul—completed in 1925 their terminal just south of the

Northwestern station at a cost of $75,000,000. With the construction of a mail terminal this settled the problem of the six railroads with terminals on the west side of the Chicago river, but the 32 railways using the three stations on the south side of the business district have not worked out a comprehensive plan among themselves or with the city. The new Illinois Central station to be constructed at 12th street may be used by all, or other terminals may be built further south, but any plan involves the straightening of the Chicago river and the opening of five new direct north and south streets. Chicago took front rank in the great building revival that marked the end of war conditions. Under the zoning ordinance the height of buildings is limited to 264 ft.; but towers, if set back, are permitted.

Municipal Undertakings.—One of the most important municipal undertakings is the municipal tuberculosis sanatorium, erected after 1909, in which year a site of 164 ac. was acquired in the north western part of the city. Its revenues, derived mainly from taxation, amount to more than $1,000,000 a year; in 1920 there were about 1,000 patients. A notable structure completed late in 1915 is the municipal pier. It projects 3,000 ft. into Lake Michigan just north of the mouth of the Chicago river. The outer portion, 660 ft. in length, is a three-decked structure devoted to recreation purposes. The new pier has not been much used by shipping interests but the recreation part of the pier proved popular from the outset.

Industrially the trend of Chicago is toward the electrification of manufacturing and transport. The city's electrical equipment now includes the largest steam generating station in the world, and a series of great stations to the north and south interconnected for the exchange of current. Within the city proper the consumption of electric current in 1924 was 845 kw. hour *per capita* against a general American average of 518.

Education and the Fine Arts.—In Chicago there are two large universities of national reputation—Northwestern University and the University of Chicago. Students to the number of 25,400 were enrolled in the seven recognised universities in Chicago in 1924. There are 304 public schools with an enrolment of 485,885 pupils, employing a teaching staff of 12,125. Three large public libraries contain a total of 2,000,000 vol., with an average daily circulation of 33,300 volumes. The Art Institute of Chicago has a larger attendance than any other art school. Five of the city's music schools alone had an attendance in 1924 of 19,000 pupils. The trustees of the Art Institute administer the Ferguson monument fund, left by the will of Benjamin Franklin Ferguson, to be used for the erection of statuary and monuments in Chicago. Among others, two notable pieces by Lorado Taft have been purchased; one "The Fountain of the Great Lakes," stands just to the south of the Art Institute; the other "The Fountain of Time," at the head of the Midway, between Washington and Jackson parks.

Chicago was the first American municipality to give direct official encouragement to local art. In 1914, at the suggestion of Mayor Harrison, the city council appropriated $2,500 for the purchase of works by resident artists and sculptors, and an appropriation has been made each year since. The city's musical life has been stimulated by grand opera, which became a fixed institution in 1910, with the establishment of the Chicago Opera Association. The Chicago Civic Opera Co. has lengthened its season and in 1925 inaugurated a policy of employing Americans although retaining notable European singers.

Finance.—Chicago's finances have been readjusted to post-War values and the disappearance of excise revenues from the liquor traffic, but the city's capacity to incur debt is still restricted by provisions of the state constitution to a degree unknown by other great cities of the world. A summary of the city's most important revenues and expenditures for 1923, the last report available, gives a total revenue of $137,928,745.09 and expenditure of $130,765,478.19. This does not include expenditures for the larger parks, for the sanitary district, or for other purposes which are in the hands of separate taxing bodies.

History.—Carter H. Harrison (Dem.), who was elected in 1911 to his fifth term as mayor of Chicago, was succeeded in 1915 by William Hale Thompson (Rep.), who was re-elected in 1919. After the United States entered the World War, Thompson was criticised for various actions that seemed to indicate a reluctant support of the War policy of the Government. William E. Dever (Dem.) was elected in 1923. To the surprise of the "Liberal" element the mayor publicly announced that the police would hereafter be required to act in sympathy and co-operation with the governmental agencies striving to enforce prohibitory laws.

The long-drawn-out litigation over the right claimed by Chicago to withdraw 10,000 cu. ft. of water per sec. from Lake Michigan for diversion into the drainage canal for the dilution of sewage resulted adversely to the city in the Supreme Court of the United States in 1925; but fears of a disaster to health were alleviated by a permit to withdraw 8,500 cu. ft. per sec. pending the execution of a programme for metering the consumption of water by domestic users to eliminate waste, and the construction of sewage disposal plants over a period of years to dispose of sewage according to modern methods. During the execution of this programme the amount of water withdrawn is being progressively reduced. A proposal to settle the transportation difficulties of the city by the municipal purchase of the surface lines and building elevated extensions and subways was defeated by a referendum vote in 1925.

The disappearance from the newspaper field of *The Inter-Ocean* and *The Herald* left Chicago for a time with only two English morning dailies, *The Tribune* and *The Herald and Examiner*. In 1920 *The Chicago Journal of Commerce* was established as a morning paper for business men. The Joseph Medill School of Journalism was opened in Feb. 1921 as a part of the Northwestern University. *The Chicago Tribune*, of which Joseph Medill was founder, agreed to underwrite the deficit of the school for a five-year period.

Abandonment by the American steel industry of the "Pittsburgh plus" system, under which the price of steel to consumers was formerly the market rate plus the freight from Pittsburgh to the point of consumption, no matter where the steel was made, has already resulted in great stimulation to the steel industry on the lake front south of the city.

The twenty-eighth Eucharistic Congress of the Roman Catholic Church was held in Chicago, June 20–24 1926, being attended by the Papal Legate, Cardinal Bonzano, and seven other European cardinals, in addition to the American cardinals. This was the first occasion upon which a Eucharistic Congress was held in the United States. (H. Le.*)

CHICAGO, UNIVERSITY OF (*see* 6.125).—The grounds of the University of Chicago increased between 1908 and 1925 from 60 to 100 ac. so that the university's holdings occupied both sides of the Midway Plaisance continuously for three-quarters of a mile. New buildings were erected, at an aggregate cost of $2,000,000, for a general library (William Rainey Harper Memorial), for classics, for geology and geography (Julius Rosenwald Hall), for pathology (Howard Taylor Ricketts Laboratory), and for a women's gymnasium, refectory and clubhouse (Ida Noyes Hall). In 1916–7, funds amounting to $5,461,000 were secured for the development of the medical work of the university, and arrangements were made for co-operation with the Presbyterian Hospital, the Otho S. A. Sprague Memorial Institute and the McCormick Memorial Institute. A Graduate School of Social Service Administration, continuing and developing the work previously done by the Chicago School of Civics and Philanthropy, was added to the schools by the university in 1920.

Upon the entrance of the United States into the World War, the president placed the resources of the university at the disposal of the Govt. and led a political and philanthropic mission to Persia in 1918–9. In all, 4,355 members of the university, including students, alumni and members of the faculties, were in the service of the Govt.; 70 of these gave their lives for their country. Between 1908 and 1920 the university's total resources more than doubled, and on June 30 1922 exceeded $50,000,000.

Upon the retirement of President Judson in February 1923, Prof. Ernest DeWitt Burton became president. He immediately carried through the Northern Baptist Convention a change in the university's charter, increasing the number of trustees from 21 to 25, the proportion of Baptists becoming three-fifths instead of two-thirds, and abolishing the requirement that the president should be a Baptist. In his brief administration (1923–5) President Burton vigorously carried forward the organisation of the Medical School and the erection of buildings previously projected. The consolidation of the Rush Medical College with the university was effected in 1924, and the Rawson Clinical Laboratory was erected on its site adjoining the Presbyterian Hospital. In 1925 the erection of the Medical School, the Billings Hospital and the Epstein Dispensary, costing over $4,000,000, was begun. In 1924–6 the Theology Building and the Joseph Bond Chapel of the Divinity School were erected at a cost of $600,000. The Whitman Laboratory of Experimental Biology was built in 1925. President Burton resurveyed the needs of the university and set in motion large plans for its further development. As the first step the university undertook to secure $17,500,000 in 1925, and this fund was nearly half raised when he died, May 26 1925. Prof. Max Mason was appointed to succeed him in August.

The libraries of the university contained in 1925 nearly 1,000,000 volumes and pamphlets. The University Press, the first to be organised under university ownership in the United States, publishes from 30 to 60 books annually, and 12 scientific journals. Beginning in 1914 the Meadville Theological School united its summer quarter with that of the Divinity School, and in 1915 the Chicago Theological Seminary (Congregational) became affiliated with the university. Between 1892 and 1925, 95,000 students matriculated and more than 15,000 took degrees; 1,500 of them that of Doctor of Philosophy. In 1924–5 the university enrolled nearly 14,000 students.

See T. W. Goodspeed, *A History of the University of Chicago: The First Quarter Century* (1916), and *The Story of the University of Chicago* (1925). (E. J. G.)

CHICHERIN, GEORGHY VALENTINOVICH (1872–), Russian politician, was a member of a diplomatic family that had filled important positions in the intellectual and public life of Russia. He was nephew of the distinguished economist Professor Chuprov and of the great Russian jurist, Boris Chicherin, who was mayor of Moscow at the time of the coronation of Alexander III., and who was summarily dismissed from that office because he suggested to the new Emperor that it was the first duty of a ruler to inaugurate reforms. Chicherin began his career in the diplomatic service, being attached to the Russian Embassy in Berlin, in which city he came in touch with the local Social Democrats in 1905. Imbued with socialistic ideals he threw up his appointment, renounced the estates he inherited and associated himself with the Socialist movement. In 1907 he became a member of the central committee of the Berlin Social Democratic Bureau, and played an important part amongst the Russian political emigrants in Germany. In 1908 he was arrested at Charlottenburg, fined and banished from Germany. He went to Paris, where he lived for some time, and subsequently to London. After the Russian revolution of March 1917 he worked in London to assist in the repatriation of Russian refugees. After the Bolshevik revolution in Nov., when Russia was no longer considered an ally, but an enemy, Chicherin was arrested on the ground of "enemy associations" and placed in Brixton Gaol. On Jan. 3 1918, however, he was liberated and banished from England. He returned to Russia, and was appointed People's Commissary for foreign affairs in March 1918. In 1922 he headed the Soviet delegation to the conference at Genoa (*see* RUSSIA).

CHICKEN POX: *see* INFECTIOUS FEVERS.

CHILDERS, ROBERT ERSKINE (1870–1922), Irish politician, the son of Prof. Robert C. Childers of London, was educated at Haileybury and Trinity College, Cambridge. From 1895 to 1910 he was a clerk in the British House of Commons. He served as a trooper in the South African War in 1900 and from 1910 to 1914 was engaged in political work and writing for Irish Home Rule. During the World War he served in the Royal Naval Air Service and in the Royal Air Force, in which he attained the rank of major and won the D.S.C. From 1917 to 1918 he served on the secretariat of the Irish Convention. On his demobilisation he returned to Ireland and was elected to Dail Eireann as deputy for Wicklow in May 1921. He was principal secretary to the Irish delegation of plenipotentiaries to Westminster, Oct.—Dec. 1921. He afterwards opposed the Anglo-Irish Treaty of 1922, supported Mr. De Valera in the Dail and joined the Republicans when they again took up arms. He was captured in Wicklow Nov. 10 1922 and tried by military court martial on Nov. 17, on the technical charge of having possession of an automatic pistol without proper authority. He was found guilty of treason, and executed on Nov. 24 1922.

Among his publications are: Vol. V. of *Times History* of the South African War, dealing with the guerilla campaigns; *The Riddle of the Sands* (1903); *The Framework of Home Rule* (1911); *Military Rule in Ireland* (1920).

CHILD LABOUR AND CHILD WELFARE (*see* 6.138).—Systematic child welfare work, the object of which is to promote the mental, moral and physical well-being of children, is a comparatively modern development and it received little official recognition in any country before the middle of the 19th century. At first, the work was developed on local national lines. Later, under progressive influences, the work became of common interest to different countries and a subject of mutual co-operation between them. Finally, child welfare has been definitely accepted as a subject of international concern and interest, and this aspect has been further emphasised by the inclusion of international child welfare work among the social and humanitarian activities of the League of Nations.

I. CHILD WELFARE

In all civilised countries there will be found legislation directed towards securing care and protection for children. Side by side with these official provisions, there will be found work carried on by voluntary and charitable organisations which supplements, and has even in many cases initiated, official child welfare measures. An outline of the English system gives the chief features of the work and a general indication of the lines on which, subject to local differences of outlook and of organisation, each country covers the field of child welfare.

Welfare of Children of School Age.— Under various Education Acts, and notably the Act of 1918, provision is made for the primary, secondary, technical and higher education of school children. The Board of Education administers the Acts through the Local Education Authorities. Special provisions are made for the education and care of physically and mentally defective children, for the feeding of necessitous cases, and for school medical inspection and treatment. The Board of Education has power to give grants to voluntary societies organising supplementary work, such as play centres, continuation classes and educational club work.

Neglected or Necessitous Children.—Under the Poor Law Act 1889, as amended by the Act of 1899, Boards of Guardians have powers enabling them to adopt neglected children. Such children may also be dealt with by Juvenile Courts under the Children Act 1908. The reorganisation of the poor law, under consideration in 1926, contemplates the transfer of the powers of boards of guardians to the local authorities.

Progressive movements in child welfare work tend to spread beyond the country of their origin. The main reasons for this extended influence are that child welfare is an interest common to every country, that much of the work is carried on by organisations which are international, and, lastly, that the co-operation of one country with another is necessary for solving certain child welfare problems.

The Influence of National Schemes.—New experiments in other countries often lead directly to the local development of national schemes. Thus, the *Consultation des Nourrissons*, started in Nancy in 1890, and the *Gouttes de Lait*, instituted a few years later in France, attracted widespread attention, and were largely instrumental in inspiring other countries, including England, to develop infant welfare work. Codifying and consolidation of national child welfare legislation, as exemplified in the English Children Act 1908 the Belgian Loi sur la Protection de L'Enfance 1912, and in the Children's Codes of the United States of America, have also influenced the legislation in other countries. The Federal Children's Bureau, established in Washington in 1912, is another interesting national scheme, consisting of a special department of State established to deal with child welfare.

Influence of Voluntary Societies.—Voluntary societies, engaged either on general or on some specialised child welfare work, are often international, and so form another channel through which progressive ideas pass from country to country. These associations, from their central office, guide and develop the policy of their many branches throughout the world, and can thus introduce enlightened methods from one country into their institutions in another. Official international child welfare work will be shown, later, to derive its source from the formation of international child welfare organisations and from their congresses. Even where international associations are not primarily concerned with children, it is common to find at their congresses, whether on penology, on industry, on hygiene, or whatever the subject may be, resolutions which encourage international co-operation in some branch of child welfare.

Agreements Between Different Countries.—Lastly, where there are problems affecting the mutual interests of two or more countries a national solution is insufficient, and must be replaced by agreements for reciprocal action. As regards child welfare such problems arise chiefly in questions of relief, of repatriation, and of emigration. Reciprocal agreements for relief often contain clauses to include the relief of children. France has recently concluded a series of "assistance" agreements with other countries, *i.e.*, with Italy (1919), Poland (1920), Belgium (1921), and with Luxembourg (1923). Belgium and Luxembourg exchanged a "Declaration" on similar lines in 1923. General repatriation agreements concluded between States cover also cases in which children are to be repatriated. There are two agreements which relate only to minors, *i.e.*, between Belgium and Holland in 1913, and between Belgium and France in 1925. Where these two agreements apply, a minor can be repatriated to his home country, but it must be judicially proved that this is done in his own interests.

A few agreements on emigration and kindred subjects contain clauses relative to young people. There is, for instance, an arrangement between France and Italy, dated June 15 1910, regulating the formalities which govern young workers of the one country emigrating to work in the territory of the other. Child migration from Great Britain to her colonies is subject to regulations made on either side, but not usually to joint agreements. An exception to this arrangement is the agreement of April 11 1923 between Canada and Great Britain concerning a grant towards the cost of emigrating children. The First Hague Convention 1902 relates to the guardianship and protection of the person and of the interests of minors in a foreign country. By Dec. 1923 this Convention had been ratified by Germany, Belgium, Spain, Hungary, Italy, Luxembourg, Netherlands, Portugal, Rumania, Sweden and Switzerland.

INTERNATIONAL CHILD WELFARE

It is convenient to consider international child welfare work under three divisions. Firstly, there is the history of its development, which includes Children's Charters; secondly, there is the organisation and scope of the work under the League of Nations; and, thirdly there is the specialised subject of the regulation of child labour, which falls within the province of the International Labour Office.

Development of International Child Welfare.—Several international congresses were held in Belgium between 1890 and 1911, which were known as Congrès des Patronages. These "Patronages" were semi-official associations which dealt primarily with the after-care of prisoners; but, so far as child welfare was concerned, they early began to interest themselves in the particular type of child who was in moral danger or who was delinquent. Switzerland, in 1911, was the first country to plan the institution of a central office to deal with all branches of child welfare on an international basis. The Belgian Govt. also interested itself in the matter and organised the First International Congress for the Promotion of Child Welfare at Brussels in 1913. The congress resolved to found an international child welfare association, but the outbreak of war in 1914 prevented any immediate realisation of this project.

In 1921 the Council of the League of Nations had before it a suggestion from three international organisations recommending that international child welfare work should be carried on by the League itself. This suggestion was based on Article 24 of the Covenant, which provides for placing under the direction of the League all international bureaux to be established "for the regulation of matters of international interest." After consideration the Council decided to await the outcome of another child welfare congress about to be held in Belgium.

The second International Congress for the Promotion of Child Welfare was held in Brussels in 1921, and resulting from this Congress the International Association for the Promotion of Child Welfare was founded in Brussels. It was established to facilitate study by centralising all information on child welfare work, to assist co-operation between one country and another, and generally to further and encourage international interest and progress. The new office did not, however, obtain the full measure of support that had been anticipated, since some countries desired, as a matter of principle, to see its work carried on by the League of Nations. This principle was finally accepted, and the Council was asked to recommend to the Assembly that the League of Nations should undertake international child welfare work. The recommendation was made, and was agreed to by the Assembly in 1924. The Association continues its activities as a private organisation, serving as a link between voluntary child welfare work in different countries.

The famine and privation in many lands after the War told especially heavily upon the children. Relief was organised by the Save the Children Fund, and branches of the society were established in many countries. Starting at first as a relief organisation the Save the Children Fund gradually enlarged its scope to include general child welfare work. The headquarters of the Save the Children Fund (International Union) was established in Geneva in 1920, and under its auspices the First General Child Welfare Congress took place in Geneva in 1925. In America, also, a general Child Welfare Association was set up in Montevideo in 1924, as a result of Pan-American Congresses for Child Welfare. It is known as The American International Institute for the Protection of Children.

Children's Charters.—National measures for the protection of children are generally found embodied in a special child welfare law, and this legislation is often popularly described as a Children's Charter. The term has, however, been applied specifically to a new development in the field of child welfare. It seems to have been felt that though in theory child welfare had been accepted as an international responsibility, yet practical results would not follow unless a clear statement was drawn up as to what that responsibility represented. To meet this requirement a Children's Charter was enunciated by the International Council of Women in 1922. This Charter sets forth under headings, and in some detail, the minimum rights which should be accorded to childhood. The form of the Charter is general, but it is intended that each nation shall remodel the Charter for its own use, and make it an exposition of practical child welfare aims capable of being worked out locally. The National Council of Women of Great Britain, in conjunction with the Save the Children Fund, have followed this lead, and issued in 1924 a Children's Charter for Great Britain.

Akin to these Children's Charters is a shorter and more generalised expression of the duty of humanity to childhood known as the Declaration of Geneva. This Declaration, published in May 1923, was drawn up by the Save the Children Fund (International Union) and has been translated into many languages. The League of Nations has recommended the Declaration as a guide to the principles which should inspire child welfare work.

Child Welfare under the League of Nations.—By resolution of the Fifth Assembly on Sept. 26 1924, the League of Nations undertook the promotion of international child welfare, and the work of organisation was entrusted to the Advisory Commission on Traffic in Women and Children, which is served by the Social Section of the Secretariat. The Advisory Commission reconstituted itself into two Committees, one to deal with traffic in women, and the other to be known as the Child Welfare Committee. The Child Welfare Committee consists of the delegates of certain governments named by the Council, and of special assessors, representing international organisations dealing either with general child welfare, or else with special branches of the work, such as recreation. In addition, a representative from the Health Section of the League, and one from the International Labour Office, serve as liaison officers. The scope of the work falls into three categories:—documentation, or the collection and analysis of national child welfare laws, which includes the administration of these laws; research, or the local investigation of child welfare schemes or problems; and discussion or the consideration by the Child Welfare Committee of the results of the work of documentation and research. A subject of special international importance may be referred for consideration to international conferences, and may form the material for an international convention. The Child Welfare Committee, as reconstituted, held its first annual meeting in March 1926. The subjects submitted included infant welfare, child labour, the legal age of marriage and the age of consent, the repatriation of foreign children, family allowances and the effects of the cinema. Other matters of equal importance will, in due course, claim attention.

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II. CHILD LABOUR

The most important question relating to the protection of children against industrial exploitation is the fixation of a minimum age below which all employment is prohibited. As a consequence of the adoption by the International Labour Conference of the I.L.O. of Draft Conventions in which the minimum age is fixed at 14, a general tendency has developed to incorporate this age in national legislation. A survey of existing national legislation will make this clear.

Argentina.—The Act of Sept. 30 1924 forbids the employment of children under 14 in industry or commerce. It also prohibits the employment of children under 12 in agricultural work.

Australia.—In Australia labour legislation comes within the competence of the states of the Commonwealth. In five of the states the minimum age for industrial employment is 14, viz.: New South Wales (Factories and Shops Act, 1912), Victoria (Factories and Shops Act, 1915) with a minimum age of 15 for girls, Queensland (Factories and Shops Act, 1900, 1908 and 1914), Western Australia (Factories Acts, 1904 and 1911) and Tasmania (Factories Acts, 1910, 1911 and 1917); in one state, South Australia (Factories Acts, 1907, 1908, 1910 and 1915) the minimum age is 13.

Austria.—The Act of Dec. 19 1918 provides that children under 14 shall only be employed insofar as health is not injured and the carrying out of compulsory school attendance is not prevented.

Belgium.—The Act of June 14 1921 provides that children under 14 shall not be employed.

Canada.—The Act of July 19 1924 provides that no child under 14 may be employed on board ship. In the case of employment in industry, conditions are governed by Provincial legislation. The minimum age is fixed at 14 in the following Provinces: Alberta (girls 15), British Columbia (girls 15), Manitoba (girls 15), Nova Scotia, Ontario, Quebec and Saskatchewan (girls 15).

Chile.—The Act of Sept. 8 1924 fixes 14 as the general minimum.

China.—The Provisional Factory Regulations of March 29 1923 provide that employers shall not hire boys under 10 or girls under 12.

Czechoslovakia.—The Act of Dec. 19 1918 provides that in industrial undertakings and also in agriculture and forestry children shall not be employed before the conclusion of their compulsory school attendance and before they are 14. The Act of July 17 1919, however, permits, with certain provisos, the employment of children over 12, and the employment of children on light work in agriculture and domestic work as soon as they attain the age of 10.

Denmark.—The Act of July 10 1922 provides that children under 14 shall not be employed in undertakings, in handicrafts, industry or transport or in branches of such undertakings, and the Seamen's Act of May 1 1925 provides that children under 14 shall not be employed on board ship.

Estonia.—The Act of May 20 1924 provides that children under 14 shall not be employed or work in any public or private industrial undertaking.

Finland.—The Act of Oct. 24 1919 respecting conditions of employment in shops and commercial establishments, offices and warehouses, provides that no child under 14 shall be employed in any establishment to which the Act applies.

France.—The Labour Code (Bk. II. Sect. 2) fixes the general minimum age for the employment of children at 13.

Germany.—The Act of March 30 1903 fixes the general minimum age for the admission of children to industrial employment at 13, if the child is not required to attend school. In some respects this Act has been amended by the Home Work Act of June 30 1923.

Great Britain.—The Act of Dec. 23 1920, Women, Young Persons and Children (Employment) Act, provides that no child (*i.e.*, "person under the age of 14 years") shall be employed (*a*) in any industrial undertaking, or (*b*) on board ship, except to the extent to which and in the circumstances in which such employment is permitted under the relative Draft Convention. Detailed measures with regard to the employment of children are also embodied in the Education Act, 1918, and the Education (Scotland) Act, 1918.

In certain British Colonies special Ordinances are in force governing child employment. Thus in Ceylon the Ordinance of July 30 1923 provides that no child under 14 shall be employed in any industrial undertaking, and further that no child under 14 shall be employed in any ship. In Hongkong the Industrial Employment of Children Ordinance of 1922 provides that no person shall employ any child under 10 in any factory, and further that no person shall employ any child under 12 in carrying coal or building material or debris.

Greece.—The Act of July 29 1922 provides that "young persons who have not attained the age of 14 years shall not be employed unless they are provided with a certificate showing that they have completed their attendance at an elementary school."

Hungary.—The Act of Feb. 23 1922 provides that children liable to compulsory attendance at an elementary school shall not be employed in undertakings covered by this Act or the Act XVII. of 1884. The Act of March 24 1923 provides that children under 14 years of age shall not be employed in the work of manufacture in industrial undertakings for the production of bread, bakers' wares or confectionery.

India.—The Act of July 1 1922 provides that no child shall be employed in any factory under 12. This Act also prohibits night work of persons under 15, and stipulates that no person under 15 shall be employed in any factory for more than six hours per day. By the Act of Feb. 23 1923 it is further provided that no child under 13 shall be employed in a mine or be allowed to be present in any part of a mine which is below ground.

Italy.—The Act of Nov. 10 1907 provides that no child under 12 shall be employed in work in factories, workshops, building operations or above ground in mines, quarries and pits. For work below ground a higher age limit is fixed. The Regulations of June 14 1909 contain further detailed provisions.

Japan.—The Act of March 29 1923 stipulates that persons under 14 shall not be employed in industry; provided that this rule shall not apply to persons over 12 who have finished the course at an elementary school. This Act has not yet been enforced. Another Act, of March 29 1923, provides that persons under 14 shall not be employed as seamen, except as permitted by the Genoa Convention.

Latvia.—The Acts of March 24 1922 and April 26 1924 fix 14 as the minimum.

Mexico.—The Federal Constitution of 1917 provides that the work of children under 12 shall not be made the subject of a contract.

Netherlands.—The Act of July 21 1922 provides that a child who is under 14 or who is still bound to attend school shall be excluded from all work. This general prohibition is, however, modified by provisions permitting the employment of children of 13 who are exempt from school attendance. The Decree of Oct 7 1922 provides in addition that boys under 14 shall not be employed in mines or works above ground, and boys under 16 shall not be employed underground. The Decree of Dec. 19 1924 provides that a child under 14 shall not be employed on board ship.

New Zealand.—The Factory Act prohibits the employment of children below the age of 14 in any building, office or place in which two or more persons are employed.

Norway.—The Act of Sept. 18 1915 fixes 14 as the minimum age for admission to employment in factories and works where handicrafts or other industrial operations are carried on. By the Act of Feb. 16 1923, it is provided that children under 15 shall not be employed on board ship.

Persia.—By the Decree of Dec. 17 1923, concerning the protection of workers in carpet factories in Kerman and Baluchistan, it is provided that boys under 8 and girls under 10 shall not be employed in carpet factories.

Peru.—The Act of Nov. 25 1918 provides that children under 14 shall not be employed in industrial or commercial undertakings. But children under 14 but above 12 may be employed if they are able to read, write and reckon, and if they produce a medical certificate of physical fitness.

Poland.—The Act of July 2 1924 fixes 15 as the general minimum.

Rumania.—The Acts of Feb. 11–24 1906 and July 3 1924 fix 12 as the minimum if the required educational standard is reached.

Russia.—The Labour Code of Soviet Russia (Nov. 9 1922) fixes the general minimum age for employment of children at 16. It is, however, provided that the labour inspector may give permission in exceptional cases for the engagement of young persons of 14.

Kingdom of the Serbs, Croats and Slovenes.—The Act of Feb. 28 1922 provides that children under 14 shall not be employed in undertakings carrying on handicrafts, industry, commerce, transport, mining and similar activities.

South Africa.—The Act of April 15 1911 fixes 14 as the minimum.

Spain.—The Act of March 13 1900 fixes the general minimum age for admission to employment at 10. For work on board ship, however, the age of 14 is fixed by the decree of May 31 1922.

Sweden.—The Acts of June 29 1912 and June 17 1916 fix 14 as the minimum age for the employment of girls and 13 as the minimum age for the employment of boys in industrial work. The Acts of June 15 1922 and Feb. 27 1925 provide that children under 14 shall not be employed on board ship.

Switzerland.—The Act of March 31 1922 and the order of July 5 1923 provide that children who have not attained 14 shall not be employed in the undertakings covered by the Act (in general, industry and transport, but not agriculture or commerce).

Turkey.—The Labour Act of 1925 contains a provision that no children under 12 may be employed in any public or private undertaking, either as apprentices or as workpeople.

The legislation which has just been analysed relates to industrial undertakings and in some cases to work on board ship or in commerce, but it does not usually cover employment in agriculture. The scope of its application to industrial undertakings varies widely, as the definition of "factory" or "workshop" is by no means uniform. Minimum age legislation usually does not apply to work-places or ships in which only members of the same family are employed, nor to work done by children in technical schools, provided that such work is approved and supervised by public authority. In the case of dangerous or unhealthy work, and night work, employment is often forbidden under 18. For work in mines the minimum age is usually fixed at 16. Enforcement usually depends on the factory inspectors, and in order to facilitate their work it is often provided that every employer of young persons shall keep a register of all such workers up to 16 or 18 showing their date of birth. The provisions of minimum age legislation are reinforced, in actual everyday practice, by a variety of other measures.

Under the family allowance system, for instance, now widely applied in France, Belgium, the Netherlands, Germany and other countries, by which wage earners in certain industries receive, in addition to the basic wage, allowances for dependent children, an age limit is fixed beyond which children are not considered to be dependent. As this age limit is usually 14, the system has some influence in inducing parents not to put the children to regular employment before this age. The same sort of influence is exercised by social insurance systems. While national systems of workmen's compensation, health insurance, unemployment insurance and other forms of social insurance differ greatly from country to country, the existence of dependent children is generally taken into account in assessing benefits. These provisions, therefore, tend to protect the children from being sent to work at too early an age. Most important of all, in this connection, is the system of compulsory school attendance regulations. In most industrial countries the statutory age-limit is now 14, coinciding, as it logically should, with the minimum age for admission to employment.

In general, it may be added, most labour legislation has some sort of repercussion, however remote, on the welfare of the children. Legislation providing for the establishment of minimum wages, for instance, by preventing the payment of sweated wages, results normally in safeguarding the standard of life of the family as a whole. Similarly, legislation fixing an eight-hour day may be considered to have a real influence on child welfare, inasmuch as it permits the normal man to devote more of his time to family life and to the well-being of his children.

THE AMERICAN SYSTEM

The U.S. Census of 1920 reports over one million (1,060,858) children 10 to 15 years of age, inclusive, as "engaged in gainful occupations" in the United States. This number was approximately one-twelfth of the total number (12,502,582) of children of that age in the entire country. The number of child workers 10 to 13 years of age, inclusive, was 378,063. The census does not report the number of working children under 10 years of age, but it is known that such children are employed in large numbers in agriculture and in smaller numbers in other occupations.

Of the child workers 10 to 15 years of age, inclusive, in 1920, 647,309 or 61%, were reported to be employed in agricultural pursuits, the majority (88%) as labourers on the home farm. There were 185,337 children, or 17·5%, employed in manufacturing and mechanical industries. Over 80,000 children were engaged in some type of clerical occupation; approximately 63,000 were in trade; 54,000, the majority of them girls, were working at occupations classified under "domestic and personal service"; and 7,191—almost all of them boys—were employed in the extraction of minerals.

During and since the World War the number of working children fluctuated greatly. The serious industrial depression which followed the outbreak of the War brought a sharp decrease. By the latter part of 1915 the effect of foreign orders for war goods was beginning to make itself felt, and an unprecedented rise in the number of employed children followed. After the United States entered the War, the rising cost of living, the absence of older members of the family on military duty, high wages because of labour shortage, and a restlessness on the part of the children themselves, led many under 16 to leave school for work. Available statistics show that in most places the peak in the employment of children was reached in 1918. The shutting-down of war industries and the return of soldiers resulted in a temporary decline in 1919.

The census of 1920 records a considerable decrease since 1910 in the number of children reported at work. Although the total child population 10 to 15 years of age, inclusive, increased 15·5% the number of working children reported decreased almost half (46·7%). A corresponding decrease took place in the proportion of all children of these ages who were employed in gainful occupations, from 18·4% in 1910 to 8·5% in 1920. The decline is most striking in connection with agricultural pursuits, in which the number of children employed decreased 54·8%.

The most important legislation between 1910 and 1920 was the enactment of the first Federal child labour law, which came into operation in Sept. 1917. This Act prohibited the shipment in interstate or foreign commerce of the product of any mine or quarry in which children under 16 were employed, and the products of any mill, cannery, factory, workshop or manufacturing establishment in which children under 14 were employed or children between 14 and 16 were employed more than eight hours a day, or six days a week, or before 6 A.M. or after 7 P.M. It was attacked as unconstitutional and on June 3 1918 the U.S. Supreme Court held, by a vote of 5 to 4, that it did not constitute a valid exercise of Congress' constitutional authority to regulate foreign and interstate commerce. A child labour tax clause was then inserted in the Revenue Act of 1918. It placed a 10% tax on the net incomes of establishments employing children of the ages and for the hours specified in the Act of Sept. 1 1917. This was held an unconstitutional exercise of Congress' authority by the Supreme Court in 1922. A proposal for an amendment to the United States Constitution specifically giving to Congress the right to regulate or prohibit the labour of persons under 18 years of age received the requisite two-thirds vote in Congress and was submitted to the States in June 1924. Up to Jan. 1 1926 four States had ratified the amendment and it had been rejected by both Houses of the Legislatures of 21 States.

In the child-labour legislation enacted by the various states there are many differences. It is usually required:—

(1) That a child must reach a specified age and an educational and physical standard before he can be industrially employed;
(2) That an official work permit must certify his ability to meet the standards established by the statute;
(3) That the age at which children may be employed at night or in hazardous or unhealthful occupations must be higher than the age at which they may be employed in general occupations.

Of these standards the minimum age was the first to be generally adopted. With some exceptions, every state except two (Utah and Wyoming) has prohibited the employment in industry of children under 14 years of age. That the present tendency is toward the establishment of a higher age is indicated by the fact that seven states (California, Maine, Michigan, Montana, Ohio, Rhode Island and Texas), representing all parts of the country, have raised the age above 14 years.

In 44 states child-labour laws prohibit the employment at night of children at least up to 16 years of age in an enumerated list of occupations. The hours vary. For example, New York prohibits the employment of children under 16 years after 5 P.M. or before 8 A.M.; California after 10 P.M. or before 5 A.M. In 31 states, including those of most importance industrially, laws prohibit the employment in certain unhealthful processes of children, usually under 16 years of age, sometimes 18 years of age.

Dependent Children.—According to a census taken in 1923, there were in the United States nearly 220,000 dependent children being cared for away from their own homes. Of this number approximately 140,000 were in institutions and 80,000 in family homes. Information compiled by the Children's Bureau indicates that approximately 125,000 were supported in their own homes through so-called mothers' pensions. The first laws providing for such pensions were enacted in Illinois and Missouri in 1911. This movement for public aid to dependent children in their own homes spread rapidly so that by Jan. 1 1926, 42 states (all except Alabama, Kentucky, Georgia, Mississippi, New Mexico and South Carolina) and Alaska and Hawaii had adopted legislation of this sort. The principal consideration was aid for the children of widows, and many of the laws are restricted to such children. The trend of recent legislation is toward a broader application of the law, giving the benefit of the aid to all dependent children if the circumstances are such that in the interests of the child the home should be maintained and assistance is necessary to secure that end. In 25 states the aid may be given for all children under 16 and in two states under 17 years of age. In New York City allowances were paid to 8,440 widows for the care of 23,108 children in their own homes at a cost of $4,500,000 in 1923. That year the city paid $4,000,000 for care of 13,680 children in institutions.

The laws of six states—Arizona, Colorado, Maine, Massachusetts, Rhode Island and Virginia—do not specify the amount of the aid that may be granted to each child or each family but leave the determination of the amount to be made on the basis of the family need for providing adequately for the children. Most of the states fix a maximum amount varying with the number of children. For three children the maximum is between $50 and $70 in eight states, and less than that in 27 states—10 states fixing the maximum monthly allowance for three children at from $20 to $29. For delinquency among children, *see* CHILDREN'S COURTS. (G. AB.)

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Texts of Child Labour Laws are in the *Bulletin of the International Labour Office* (Basle, 1906 and 1919), and in the *Legislative Series* (International Labour Office, Geneva, 1919). Information on the application of legislation is contained in the Factory Inspectors' Reports and in official reports issued by Government departments in the various countries. (R. CR.)

CHILDREN, DISEASES OF.—The study of this subject, known also as Paediatrics, is comparatively modern. There was no recognition of the need for special instruction in it as part of the curriculum at the medical schools, until, in 1899, King's College Hospital (London) appointed a physician to treat children only and to teach the students this subject. Gradually the recognition of this need has spread to other medical schools, or been forced upon them by examining bodies.

Infant feeding has passed through various phases. In the 17th century, when the mother was unable to suckle, wet nursing was the recognised alternative. In the 18th century hand-feeding began to replace suckling and brought with it the ills of faulty feeding; in the latter half of the 19th century the importance of infant feeding as one of the largest factors in infant mortality and diseases began to be recognised.

Methods of Feeding.—An attempt to replace the haphazard methods of the time was made by the introduction of percentage feeding in America. This necessitated an exact knowledge of the percentage composition of milk, cream, etc. Directions for feeding were given as a prescription ordering the percentage of proteid, fat, and sugar, and laboratories were established in which such foods could be prepared. This method involved fallacies of theory and practice, but it encouraged more accurate and intelligent understanding of infant feeding.

A new departure is the so-called calorie feeding. The energy-producing value of a food, calculated in units of heat which the food would produce on combustion (1 calorie = heat required to heat 1 kilo of water 1° C.), determines its adequacy for the infant. At certain ages a certain number of calories per lb. weight are found to be requisite, so that food requirements can be determined by mathematical calculations. The fallacies of this method are considerable, but it is occasionally useful.

Whilst the physicians and laboratory workers were investigating the subject from the scientific standpoint, a great step forward was made by the establishment of Consultations de Nourrissons (1892) in France, and a little later of Infant Consultation Centres or Infant Welfare Centres (1906) in Great Britain and in other parts of the world. Mothers take their healthy infants to these and are instructed as to their feeding and care.

Biochemical research has shown that, besides the gross chemical composition of foods, there are subtler constituents, viz, "accessory factors" or "vitamins," which are essential to health and, indeed, to life. (*See* BIOCHEMISTRY.) Related to lack of these vitamins are two diseases, infantile scurvy and rickets, the former definitely due to lack of vitamin C, the latter to deficiency of some anti-rachitic factor of which little is known.

In connection with the latter, the value of ultra-violet rays has recently been recognised; whether from sunlight, arc lamp, or mercury vapour lamp, these rays improve the general health and vigour and are beneficial in certain diseases, particularly rickets, in which they effect a rapid cure of the bone affection. To a less degree they are useful in some forms of tuberculosis. Amongst diseases affecting nutrition in infancy, congenital hypertrophy of the pylorus was formerly one of the most fatal; but now has been so successfully treated by surgery that the majority recover.

The rise of bacteriology has revolutionised our views of many diseases of children, but some still await fuller knowledge. Infantile paralysis is one of these. Flexner and his co-workers in New York, by a series of experiments on monkeys, have shown that, as had already been suspected, this disease which wrecks the lives of so many children is due to some infection, and they have investigated the conditions and ways in which it can be communicated (*see* SPINAL MENINGITIS). The exact nature of the virus is uncertain, but experiments have shown that infection may enter by the naso-pharynx and may probably be spread by carriers. Isolated cases occur every summer and occasionally epidemics, as in England in 1911 and in America in 1910.

The specific fevers (*see* INFECTIOUS FEVERS) to which children are most liable, scarlet fever, measles, chicken pox, and mumps, are still a mystery as to their exciting cause. Whooping cough, however, has been traced to a specific bacillus and a vaccine of this organism has been used extensively, but with doubtful benefit. The discovery of an antitoxin for diphtheria in 1893 led to a large reduction in the mortality from that disease; the deaths from laryngeal diphtheria fell within two years from 62% to 28%, and a few years later to 11·7%.

Tests for Diphtheria.—Various efforts have been made to immunise children against measles by serological methods and successes in this connection have been reported. The most notable advance touching specific fevers has been the Schick test for diphtheria (1913). Susceptibility to this disease can be detected by intracutaneous injection of a minute dose of the toxin of diphtheria; a slight redness or swelling at the site of infection within 24–48 hours indicates that the person showing it is susceptible. Such a means of distinguishing between children liable to infection and those who are not liable is clearly of great value when diphtheria occurs in a school or institution. As a sequel to this a new method has been introduced of conferring immunity by subcutaneous injections of a toxin-antitoxin. In this way a child found by the Schick test to be susceptible can be immunised for several months, whereas an ordinary antitoxin protects only for a few weeks. A similar test, the Dick test, has been used to detect susceptibility to scarlet fever by the intracutaneous injection of a very dilute toxin prepared from streptococci.

There has been a striking decrease in the mortality of the specific fevers of childhood during the past forty years. The annual mortality in England and Wales per million persons living was in 1883: scarlet fever 1270, measles 962, whooping cough 1086; in 1923, scarlet fever 83, measles 508, whooping cough 399.

The effects of congenital syphilis (*see* VENEREAL DISEASES), first studied in detail by Diday of Lyons in 1854, have been more fully realised since the introduction of the Wassermann test (1906), in which the examination of the blood indicates the presence or absence of this disease. It may be present when no characteristic symptoms occur, indeed without symptoms of any sort.

Applied indiscriminately to children attending hospitals, this test has shown a positive result in proportions varying from 0·59% in London to 10·4% in Glasgow, but for the general child population these figures are probably too high. Syphilis causes a large waste of potential lives by miscarriages and still-births, of which there were 40% in a series of 187 pregnancies in syphilitic families, whilst of 112 live-born children in these families 33% died in infancy or early childhood. Nor does this represent the full extent of its mischief, for mental deficiency, various forms of paralysis, impaired sight, deafness, and various deformities in the child are in some instances direct or indirect results of syphilitic parentage. Of late, a wider knowledge of the effects of syphilis and its prevention and treatment in adults has reduced the frequency and severity of the inherited disease in children. The latest treatment is by subcutaneous or intravenous injections of arsenical or bismuth preparations.

Tuberculosis.—Amongst the diseases which not only account for a considerable mortality in childhood, but also add to the number of the unfit when the child grows up, are tuberculosis and rheumatism (*see* TUBERCULOSIS). Of children dying in hospitals about one-third have tubercle, although in some of these it is not the cause of death. Tuberculous disease of bones or joints in children is responsible for much lifelong crippling, and tuberculosis of the lungs or other organs often means at a later age years of delicacy and unfitness for the battle of life. Tuberculosis takes its heaviest toll during the first five years of life, especially in the second year, to which belong 26% of the deaths from tuberculosis in children under 12 years of age. The danger of tuberculous cow's milk has become recognised. In 1913 9·3% of samples of London milk showed tubercle bacilli. The education of the public to the danger of unboiled milk is tending to safeguard children from this infection.

Rheumatism.—Rheumatism, unlike tuberculosis, hardly ever occurs under three years of age. It affects chiefly children from 5 to 12 years of age of the hospital class, and perhaps more amongst the poorer middle class than amongst the very poor. Of children from 6 to 12 years old admitted to the medical wards of a hospital, nearly 25% were suffering from some rheumatic affection and in an out-patient department of children 5 to 12 years old 13% were attending for rheumatic troubles. Rheumatism in children affects the joints much less than in adults. Often, especially in girls, it takes the form of chorea, often the only indication is vague pain mistaken for growing pains, or perhaps a stiff neck, but however slight such manifestations the rheumatism which they indicate is specially liable in children to attack the heart. Heart disease in childhood is mostly rheumatic; sometimes it is rapidly fatal, more often after some years of invalid existence the heart gradually fails and the child dies. The duration of life in these children with rheumatic heart disease depends chiefly on the possibility of prolonged rest and careful restriction of exertion, perhaps for two or three years. Complete recovery is not impossible in some cases, and in others life may be prolonged many years in usefulness and comfort if such treatment can be obtained.

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CHILDREN'S COURTS (*see* 6.140).—Special tribunals for dealing with juvenile offenders. The system, first suggested and established in the United States has since been extended to the principal civilised countries.

I. COURTS IN THE UNITED STATES

Age of Delinquency.—The age of delinquency has been raised in most states to include all children under the age of 18 years, and in two states (Wyoming and California) under the age of 21 years. To be consistent with the disabilities of minors in civil matters, it is believed that eventually the age of delinquency will be made 21 in all the states, with exceptions covering certain serious felonies like highway robbery, murder, etc. The theory underlying these special laws for delinquent minors is not an assumption that the child cannot commit a crime, nor do they aim at excusing him for it without punishment in proper cases, any more than in civil cases is it assumed that a child could not make a contract. He could; but only under conditions different from those applying to adults. In the same way a child (if over the age of seven) could commit a crime, but the commission of a crime in this case is assumed to differ sufficiently from the commission of such crimes by adults as to justify a different, more elastic, intelligent method in dealing with the offender.

Methods of Probation.—The laws referred to also provide for the use of probation in the cases of offending children. The power to place a person on probation in these courts was legally authorised and used in Massachusetts as early as 1878. Probation in such cases is an effort of the state to enable offending children " to overcome evil with good," to accomplish their own redemption with the aid and assistance provided in the juvenile court. The " good " is the more intelligent attitude of the state in literally teaching children, brought to these courts, to overcome bad things. This is generally attempted in the child's own home. Proof of a child's good conduct is furnished in some courts by reports from his parents, teachers, playground or community-house directors in the neighbourhood. Similar reports are also obtained by the visitation of probation officers who keep in kindly touch with the child and his parents.

There may be more severe methods of discipline provided by these laws, such as confinement in a detention home school, or in the industrial or training school, or even in a jail, but always with the proviso that if so incarcerated the child is to be separated from adult criminals. In this so-called " jail " there is generally a tutor or teacher and a kind of home life which, while designed to correct children, is also designed to protect them against the evil influences which attach to other jails.

Methods Employed.—In juvenile courts, the state now furnishes probation officers, doctors, psychiatrists, child experts and social workers, with their various agencies to search for the causes of crime in childhood and youth. The child's health, mental condition, social and economic status, as well as that of his parents, his neighbourhood, his opportunities and temptations *as causes* of crime are all carefully considered. There are few limitations upon what the juvenile court may do since its chancery procedure is free from the hampering and inflexible rules of criminal courts. As the entire purpose of the court is to help and not to hurt the child, its actions are seldom questioned. Not one case in thousands heard in juvenile courts is ever excepted to or appealed to other courts. The juvenile court may in fact be properly regarded as a moral hospital rather than a court. It is believed that 80% to 90% of offenders dealt with in this attitude correct their faults and become good citizens, as against what has been shown to be about 75% who usually repeat the offence or return to serious crime when dealt with only by the old criminal court and incarceration methods.

Enlarged Activities.—The juvenile courts of the United States, especially in the years following 1910, show a marked widening of scope. The power of *parens patriae*, as first applied to children, has in a limited way and in some states notably in Colorado, been applied to adults, their jurisdiction being broadened to include all cases concerning children or adult persons (parents or others) whose offences are against children or whose conduct, responsibilities or controversies concern them. A judge, selected for his particular qualifications to preside in such a court, is specially appointed or elected for that purpose.

In this type of juvenile court, as well as in that conducted as a part of the already established judicial procedure, in which different judges are usually assigned to the juvenile court for limited periods, the jurisdiction differs in different cities. Even in the juvenile courts, administered as part of the regular judicial system, a tendency is observable to assign one particular judge to this special work. While good results may be accomplished in either type of court, the weight of opinion in the United States (1926) seems to be in favour of the separate special court presided over by a specially chosen judge, for the handling of all cases concerning children and also cases of adults who offend against or have responsibilities for or controversies over them. (*See* also BORSTAL SYSTEM; PROBATION; PUNISHMENT.)

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II. COURTS IN OTHER COUNTRIES

Great Britain.—For the main provisions of the Children's Act (1908) regarding juvenile delinquency *see* 6.140d. Section 131 of the Act defines "a child" as "a person under the age of fourteen" and "a young person" as "a person aged fourteen and upwards and under the age of sixteen." By section III. (5) separate juvenile courts for the metropolis may be set up by order in council. The London courts function now, however, under the provisions of the Juvenile Courts (Metropolis) Act 1920, by which the holding of the courts is arranged in places other than ordinary police courts, and the court is constituted of a police magistrate, nominated by the Secretary of State and two justices, one of whom should be a woman, selected on the grounds of special qualifications for dealing with juvenile cases. These arrangements operate at seven out of the nine London juvenile courts. Another special feature of the London system is that twelve highly qualified probation officers are attached to these courts. They are appointed by the Home Secretary and all of them are women.

Juvenile delinquency has diminished considerably in recent years. Returns furnished by the children's branch of the Home Office in 1905 show that the number of persons tried in the juvenile courts was 38,351 in 1912 and that the figure had fallen to 29,264 in 1924. It should be stated that during 1917 the number rose to 51,323. Since the passing of the Children's Act in 1908, there has been a marked increase in the number of juveniles placed upon probation. In 1910, 10·62 % of the persons tried in juvenile courts were placed upon probation. In 1924 the figure had risen from 3,568 to 5,812 or 19·62 per cent. At the same time the number of children and young persons committed to Home Office schools has decreased from 5,744 in 1913 to 1,891 in 1924.

The practice of the various courts in dealing with juveniles is marked by wide divergencies, and suggestions for widening the scope and character of the juvenile courts were considered (1925) by a departmental committee presided over by Sir Thomas Molony. The evidence given showed that Liverpool, for instance, was the only city possessing a juvenile court specially constructed for the purpose. In 676 cases there was no rule requiring the police to attend in plain clothes. Reports on the children's homes were obtained in 404 courts from the police. Only 203 courts relied entirely on the probation officer. The school record was obtained in 303 courts, but 285 dispensed with it altogether. Only 27 courts made a medical examination an essential preliminary of dealing with the case. In 260 cases no medical examination was asked for at all, and in 462 cases only when it appears necessary. The question of further medical help for the courts, of extending their jurisdiction to young persons up to 18 years and especially of altering their general procedure by applying the principle of the chancery court in place of a criminal jurisdiction were considered by the committee.

The British Dominions.—To Ontario (Canada) and to South Australia belongs the honour of having taken the initiative of setting up children's courts by legislative enactments as early as 1893 and 1894. Ontario, by section 30 (1) of the Protection of Children Act 1893 required towns with a population of more than 10,000 inhabitants to make separate provision for the detention of children awaiting trial, and laid upon the judge the duty of trying children's cases in premises other than police courts or where this was not practicable in the private room of the judge or in some room in municipal buildings. Under the Juvenile Courts Act 1914, power was taken to pay the magistrate or officer constituting the juvenile court.

The Juvenile Delinquents Act 1908 and its amendments operate in most of the larger centres of the Dominion of Canada. The spirit of the measure may be judged from Section 16 (5) which provides that "the action taken shall in every case be that which the court is of opinion is for the child's own good and the best interests of the community."

Juvenile courts were established by ministerial order in South Australia in 1890. Legislative action followed in 1895, when it was laid down by Section 31 of "The State Children Act," that the hearing of complaints against children within the city of Adelaide and the town of Port Adelaide should be held in some room or place approved by the chief secretary but not in any police or court house. Outside the city, hearings were to take place at a different hour from ordinary trials. Special children's courts are now the rule throughout the Commonwealth of Australia.

In the Union of South Africa there are juvenile courts in operation at Cape Town and at Johannesburg.

The Continent of Europe.—On the continent of Europe the provision of juvenile courts has made much headway. By the Belgian law of Mar. 15 1912 for the protection of children ("La Protection de l'Enfance"), special children's magistrates are appointed under Art. 11, whose jurisdiction extends to all minors under 16 and to young persons charged with begging and vagrancy up to 18 years. This measure is notable for requiring full investigation into the physical and mental health of the children charged and into the social and moral condition of their environment (Art. 27). In the Netherlands and in Austria and Germany, the jurisdiction of the juvenile courts is concerned with young persons up to the age of 18. This is the case also in the canton of Geneva and in Sweden.

In France the children's courts only deal with juveniles under the age of 13, offenders between 13 and 18 being tried *in camera* in the ordinary courts. There are no juvenile courts in Italy, but cases of child offenders are heard *in camera*. Juvenile courts have been set up in Egypt and since 1922 in Japan. The Japanese law of 1922 defines minors under the age of 18, as "juveniles."

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CHILE (*see* 6.142).—A republic of South America and a member of the League of Nations. Its area is 289,810 square miles. By the census of 1920 the population was 3,754,723, an increase of approximately 15·5% over that recorded at the previous census of 1907. The southern provinces showed an increase and the northern a decrease from 1907 to 1920, attributed largely to a movement into the towns. The chief towns and their populations in 1920 were: Santiago, 507,296; Valparaiso, 182,422; Concepción, 64,074; Antofagasta, 51,531; Iquique, 37,421; and Talca, 36,079. The population of the country was estimated at 3,937,678 in October 1925.

I. POLITICAL HISTORY

Apart from the economic repercussions of the World War, the period 1910 to 1920 was not of great significance in the history of Chile; but the years 1920 to 1925 were more pregnant with troubles than any period since the civil war of 1891. The election on Dec. 23 1910 of Ramón Barros Luca as president marked a triumph of the moderate Liberal over the Conservative and Clerical party. In the same year the celebrations of the centenary of Chilean independence were held, and, apart from their effects in stimulating patriotism and national pride, they were made the occasion for according special honours and attention to Argentina, thereby strengthening the *rapprochement* that had been growing between the two nations since the settlement of their boundary dispute in 1902. The opening in 1910 of the Transandine Railway, to connect Santiago with Buenos Aires, formed another link with the sister republic. Relations with the United States were strengthened by a settlement in 1911 of the long outstanding Alsop claim, in accordance with the award of George V. of England. Two years later the Arica-La Paz Railway, built by the Govt. of Chile with the co-operation of Bolivia, was opened; although a useful aid to the prosperity of both countries, the treaty governing its construction and working later provided matter for controversy, for Bolivia desires free and unhampered access to the sea. The immediate pre-War years were years of optimism and progress, with a comparative quiet in internal affairs. There was no really important political event, and little to record beyond the continuance, at intervals, of uneasiness in the northern provinces, because of the outstanding boundary dispute with Peru, which assumed serious proportions from time to time.

The War Period.—The outbreak of war in 1914 placed Chile in a position of difficulty. An influential section of her population was dominated by German ideas and ideals, fostered by a thoughtful propaganda. The Chilean Army was trained on the German system, by German officers; the educational system was largely German; southern Chile contained many German colonists; and the clergy were mostly favourable to the Central Empires, because of France's anti-clerical policy. The commercial position was also an important factor, for Germany was the chief source of Chilean imports, and ranked third amongst her customers abroad. The navy, which for some years had followed English ideas, was largely favourable to England. The third section of the population, that which leaned toward French culture, was small but influential, and showed its existence by skilled propaganda. With these factors at work there was only one safe course for the Govt. to pursue, and that was one of strict neutrality, which was not altered even by the entry of the United States into the War, or by the sinking of the German cruiser "Dresden" in Chilean territorial waters by British warships.

The presidential election of 1915 was marked by great excitement and disorder, and resulted in the election of Juan Luis Sanfuentes, representing a coalition of Liberal Democrats with Conservatives and Nationalists, as against a combination of Radicals, Liberals and Democrats. The relative strength of the different political parties caused a continuance of the instability of Cabinets, which had long been characteristic of political history in Chile. The years 1917, 1918 and 1919 saw the fall of one government after another, and consequently the general impossibility of achieving any satisfactory solution of national problems. Anti-Peruvian riots at Antofagasta and Iquique were followed by the mutual withdrawal of consular officers of both countries. Had it not been for a general wave of prosperity during 1917 and 1918 (due to the Allied demand for nitrate and other materials used in the manufacture of munitions) serious unrest might have occurred. With this wave of prosperity came a consciousness in the working classes of the desirability and necessity of better conditions of life generally; the agitation which followed, and led up to the presidential election of 1920, was significant as the real turning point in the general Conservative tendency which Chilean politics had, without serious interruption, always shown.

Post-War Years.—In 1920 the political parties consisted of three groups (*a*) the Conservatives, (*b*) the Nationalist Liberals and Democratic Liberals, known as the Union, and (*c*) the Left wing Liberals, Radicals and Democrats, known as the Alliance. The Union had a majority in the Senate and the Alliance in the Chamber of Deputies. The Union candidate for the presidency was Don Luis Barros Borgoño, and Don Arturo Alessandri represented the Alliance. The presidential election was held on June 25 after a campaign of unprecedented intensity and excitement, and when the result was declared a month later Alessandri was victorious with 179 votes against 174 to Barros Borgoño. Under the constitution it remained for Congress to proclaim as president the candidate who had secured an absolute valid majority (178 of the total 354 votes) and it was thought that, when the Chambers met in joint session for this purpose, a means would be found of preventing Alessandri from assuming office. A cry was raised that he was to be robbed of his victory, and it was generally felt that the defeat of the popular, as against the aristocratic candidate, would lead to revolution. It was finally agreed that a tribunal of honour should be formed of seven members to decide the question, and that their decision should bind Congress. This was published on Sept. 30 giving Alessandri 177 valid votes and Barros Borgoño 176.

Alessandri assumed office on Dec. 23 1920 in circumstances which did not favour the working of the ambitious democratic programme he had promised during his election campaign. Political parties were so represented in the Senate and the Chamber of Deputies that the formation of a Cabinet capable of receiving sufficient support for government was almost impossible. The high cost of living, the industrial and commercial stagnation and the steady increase in unemployment, with the inevitable instability of currency and budget deficits, all added to the difficulties. Furthermore there was the relentless hostility of traditionalist politicians to the reform policy, in which the Senate, with its safe Union majority, could block any measure. The country itself was impatient to see some materialisation of the promised measures of reform. The political atmosphere of 1921 was one of expectancy, and was marked by a steady decrease in the President's influence: the forces against him were from the outset too strong, and, faced with the open hostility of his enemies, he began to lose his friends through his inability to carry out his promises. A split in the ranks of the Alliance (which followed a general election to the Chamber of Deputies) added to the strength of the Conservative groups; and a strong working-class agitation, resulting from increased unemployment, further jeopardised Alessandri's position.

After several attempts to govern in accordance with his ideas, the President, finding the obstructions insurmountable, tendered his resignation on Nov. 17 1921, partly for that reason and partly on grounds of ill-health. Dissuaded from this step by Don Ismael Tocornal, head of a non-party Ministry, he remained in office, but almost powerless to effect not only his projected reforms but even the ordinary measures that were imperatively necessary to the routine of government. The main activities of Congress in 1922 centred round national finances and the old Tacna-Arica problem, which was productive of the most bitter controversy; a revival in the nitrate industry relieved for the time the pressing labour problem, which had been the chief cause of tension during Alessandri's first year of office. Many ministerial crises occurred, for neither of the two most powerful parties—Conservatives and Radicals—would consent to take part in the formation of a Cabinet. Nevertheless two very important laws were passed, the first on Feb. 6 reserving all traffic along the coast to Chilean vessels, and the second ratifying the Washington Protocol of Arbitration for the boundary dispute with Peru. The holding in April and May 1923, at Santiago of the fifth Pan-American Congress helped momentarily to distract attention from the anxiety that prevailed throughout the year, during which no solution was found for any of the serious political problems.

The Coup d'Etat of 1924.—The year 1924 opened with a repetition of the events of 1923—ministerial crises followed by deadlocks, which continued until September. In that month a military *Junta* was formed under Gen. Dartnell; having obtained the adherence of the navy, a joint memorial was presented in the form of an ultimatum to the President, demanding that certain legislative measures be immediately passed. The existing Ministry of Aguirre Cerda thereupon resigned, and the President accepted unconditionally the terms of the ultimatum. A "Committee of Government" (*Junta de Gobierno*), which had the support of public opinion and was received almost without disturbances, was formed under the leadership of Gen. Altamirano on Sept. 5. Having notified the public and his representatives abroad of the success of this *coup d'état*, President Alessandri resigned on Sept. 8, his place *ad interim* being taken by Gen. Altamirano; Congress rejected the resignation, and, instead, granted the Señor Alessandri six months leave of absence, which he accepted. On Sept. 10 he left for Buenos Aires by special train under the U.S. flag, escorted by the ambassadors of the United States and Argentina. The self-creation of the *Junta de Gobierno* with executive and legislative powers, the dissolution of Congress and the appointment of a Ministry by the *Junta* on Sept. 12 1924 marked the final departure from a constitutional régime.

Early in Nov. a very elaborate scheme was passed, based upon electoral reform, for the restoration of constitutional government. A series of laws, in the form of decrees, was inaugurated and applied to the most varied subjects, with the intention of effecting the reforms which the wasted time of Congress in preceding years rendered imperatively necessary. The municipalities of Santiago and Valparaiso were dissolved and replaced by local boards appointed by the *Junta;* provincial governors were replaced; general investigations into the working of government departments were instituted; and, generally, the activities of the *Junta* made themselves felt everywhere. No violence or bloodshed accompanied this revolution; the country accepted the position, in the hope that at last it might be possible to purify political life and thus obtain relief from the anomalous and uncomfortable state to which it had drifted.

The Return of Alessandri.—The revolutionary Govt. appeared to be making steady progress with the necessary reforms when, on Jan. 23 1925, a new *coup d'état* overthrew the provisional Govt. and established a new *Junta* in its place. The new movement was directed by Señor Bello Codesido, Gen. Dartnell and Adml. Ward, who, recognising Alessandri as the constitutional President, appealed to him to resume office. All political parties approved of this appeal, which reached Alessandri at Venice; and he having assured himself that his return was desired by the whole country, agreed, upon conditions, to do so. A new Cabinet was appointed to carry on the government until his return on March 20, on which date he was received with enthusiasm by ministers, officials and the populace. The system of decree-laws inaugurated by the first *Junta* was copied by their successors, and the President found himself, in the absence of Congress, obliged to legislate on this system. The public soon began to demand the return of constitutional régime, but Alessandri, fearing a recurrence of political chaos (which he had attributed to the impractical constitution), refused, declaring that before Congress could be convoked a thorough revision of the old constitution of 1833 would be necessary. On April 16 this was completed, and on Aug. 31 a plebiscite was held to take the opinion of the country on the proposed changes. The revised constitution was given a great majority; it was promulgated on Sept. 18, and came into force a month later.

The new constitution is presidential in character. Its chief points of difference from that of 1833 are:—

(1) Ministers are now responsible to the President only; theoretically no amount of adverse criticism can affect their position if they can count upon presidential confidence; (2) the budget must be presented to Congress four months before it is due to come into force; it becomes law automatically if, by the end of that period, it has not been passed by Congress; (3) a provincial assembly is created, to control the finances of municipalities and to report yearly thereon to the President; (4) all religions not subversive of public morals or peace are permitted—and the Roman Catholic is no longer the state religion.

Apart from these important changes in the constitution the year 1925 was one of many changes in the general trend of affairs. After an embittered controversy (regarding candidatures for the forthcoming presidential election), Alessandri resigned on Oct. 16, his place being taken by Barros Borgoño, the Vice-President. On Oct. 24 the election was held—under the new constitution—and passed off without disorder, the result being that Don Emiliano Figueroa was elected by a large majority over Dr. Salas, the ultra-democratic candidate. Two days later the supporters of the defeated candidate declared a general strike, and on Oct. 26 Santiago was the scene of serious rioting; business and traffic were suspended, a few shops were looted, and at one time the mob was in complete command of the city. By the end of the year there were still many signs of the prevalence of the restless democratic spirit, and that, combined with the grave state of the national finances, provided a difficult problem for the new President.[1]

Defence.—Military service is compulsory for one year, recruits being called up in their 20th year, followed by nine years in the active reserve, and thereafter up to the age of 45 in the second reserve. The active army in 1924 consisted of 18,700 men and 1,100 commissioned officers. The first-line reserve numbered about 100,000 trained and 125,000 untrained men, with a second-class reserve of 200,000. The army has been trained and organised largely on the German system. Cadet, artillery, cavalry, engineering and infantry schools are maintained by the state; in 1924 a school for non-commissioned officers was formed. The navy consisted in 1925 of one battleship, five cruisers, five destroyers, six submarines and various minor craft, personnel being 650 officers and 7,000 ratings. Service aviation is divided between army and navy. In 1925 the army air force acquired some 83 new machines of various makes, giving a total of 100 machines; 36 pilots were gazetted in 1924. The naval air force was still in its infancy in 1925, when 12 hydroplanes were ordered. The police force numbered 10,237 officers and men in 1922.

Education.—Primary education was made free and compulsory in Aug. 1920. The state also assists higher schools and the universities. In 1924 there were 3,271 primary schools with 8,779 teachers and 392,183 pupils; 92 secondary schools and 15 public normal schools with 420 teachers and 2,391 pupils; a number of vocational and professional schools, and the University of Chile with 5,000 students.

II. FINANCIAL AND ECONOMIC HISTORY

National Finance.—The unit of currency is the gold peso valued at 18d., but paper, issued by the Govt. and guaranteed by a conversion fund, is chiefly used. Exchange fluctuated considerably from 1910–25, declining from 9·75d. in 1913 to 5·73d. in 1924 with an increase in the premium on gold of from 85·31 % to 218·89 % in the same period. In 1912 a demand was made for a new issue of Treasury notes, and permission was given to the *Caja de Emisión* to issue notes against gold at the rate of 1s. to the peso. The Govt. had guaranteed to convert the existing paper currency into gold at 18d. a peso, but this project had to be deferred owing to political conditions and to economic stress generally. In 1914 the conversion fund stood at 108,160,754 and in 1925 114,721,780 gold pesos. The following table shows the state of national finances in 1913 and from 1920 to 1925, the figures being translated into sterling:—

Year	Revenue	Expenditure	Public Debt[1]
	£	£	£
1913	13,714,270	12,395,582	46,936,000
1920	16,522,000	19,812,860	51,675,000
1921	15,150,000	15,675,000	63,050,000
1922	15,000,000	14,880,000	65,100,000
1923	20,775,000	23,250,000	62,608,317
1924	15,500,000	16,350,000	66,612,534
1925	17,945,000	17,950,000	Not available

[1] Includes government guarantees.

The Kemmerer Financial Mission spent three months in Chile in 1925 inquiring into the financial system of the country. It dealt with tax laws, banking, currency and the financial administration of the state. A number of recommendations were made to the Govt., three of which were adopted up to Sept. 1925:—

(*a*) A central bank, called the Banco Central de Chile, was created by Decree Law No. 486 of Aug. 21 1925, for the purpose "of stabilising currency and regulating the rate of exchange and discount"; the bank's operations were to be limited to member banks and it was to have the exclusive right of issuing notes in terms of gold pesos as set out in the Monetary Law;

(*b*) A monetary law was signed on Sept. 16 1925 (Decree Law No.

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[1] The dispute with Peru in regard to the provinces of Tacna and Arica is treated in a separate article. (*See* TACNA-ARICA.)

528) establishing as the monetary unit of Chile the gold peso containing ·183057 gm. of fine gold;

(*c*) A bank law was signed on Sept. 23 1923 (Decree Law No. 550) creating a superintendency of banks, and making regulations for the establishment and operation of all national and foreign banking institutions.

Production.—That part of Chile which lies between latitudes 33° and 44° contains the agricultural districts, the chief of which is the great central valley between the Andes proper and the smaller range running along the coast. Irrigation has been developed and this, together with the introduction of modern methods and machinery, caused considerable increase in production after 1910. Wheat, the chief product, is cultivated from Chiloé to Atacama. Other products are barley, flax, forage, fruit, maize, oats, potatoes, rye, and in Tacna, sugar-cane. Viticulture has been assisted by the Government. In 1921 the area planted in vineyards was 66,585 hectares; from this 1,250 thousand hectolitres of wine, grape cider and other beverages were produced. In 1924 Chilean livestock comprised 329,454 horses, 33,580 asses, 43,816 mules, 1,995,538 cattle, 4,569,166 sheep, 525,106 goats and 263,330 pigs. A Ministry of Agriculture was formed in 1924 to encourage and assist the development of national agricultural production.

Industry.—National prosperity depends mainly upon the nitrate industry, some 75% of the state revenue being derived from the export duty on nitrate; Chilean companies produced 55% of the total national output. Conditions resulting from the War affected the industry in that Germany (Chile's greatest buyer before 1914) was compelled to increase her domestic supply by synthetic products; so that, whereas Chile in 1913 supplied 54·7% of the world's nitrate, in 1924 she supplied only 30%; nevertheless 1925 saw an improvement, and it was believed that the synthetic product could never satisfactorily supplant the natural, in which Chile has great resources. From 1910 to 1918 the production of copper grew steadily, the output increasing from 38,231 tons in 1910 to 44,665 tons in 1914, 106,814 tons in 1918 and 235,000 tons in 1924. The production of coal increased from 898,971 tons in 1909 to an annual average of over 1,000,000 tons. Imports of foreign coal decreased during the same period from 1,303,000 tons to 165,517 in 1923, with little difference during 1924 and 1925. Manufactures showed considerable growth from 1910 to 1925, especially during the years of the World War. In 1910 there were 5,270 manufacturing establishments in the republic; in 1923 there were 9,000 employing nearly 100,000 workpeople. The chief industries, apart from mining, were: foodstuffs, flour-milling, sugar-refining, and other by-activities of agriculture; next in importance came leather goods, clothes, chemical products, printing, lumber-mills, metal-working, textiles, tobacco products and construction materials, in that order. The mining industry is that upon which Chile mainly relies for her prosperity, and, apart from nitrate, copper and coal, mentioned above, she also works iodine, iron ore, borates, silver, gold, sulphur, salt, lead, manganese, lime, guano and gypsum. Kieselguhr and apatite are found, but up to 1925 there was no export demand for them.

Trade.—A large portion of the national revenue comes from the customs tariff, of which a revision is considered every five years. The 1921 amendment provided for an increase of 50%; but the year 1923 showed a decrease of £864,393 on the 1913 figures. The outbreak of the World War interrupted trading, but from 1915 onwards there was a steadily increasing demand for nitrate, meat, wool and metals. In the five years 1914–8 the value of exports exceeded that of imports by $1,200,000,000 gold.

Foreign Trade 1913–24

	Imports £	Exports £
1913	24,713,836	29,723,283
1914–20 (Annual average)	24,568,321	39,285,145
1921	28,597,688	33,281,485
1922	17,788,618	25,394,027
1923	24,698,299	40,742,069
1924	27,244,307	45,448,437

Trade with Foreign Countries

	British Empire		U.S.A.		Germany	
	Imports	Exports	Imports	Exports	Imports	Exports
	%	%	%	%	%	%
1911	24	44	13	15	26	21
1913	35	38	17	21	25	21
1919[1]	26	24	48	42	. .	. .
1924[1]	26	24	23	41	13	. .

[1] Estimates.

The chief imports in 1925 were: Manufactured goods (chiefly textiles), machinery, crude petroleum, sugar, metal goods, printing paper, chemical and food products, tea and yerba maté. The principal exports in order of importance were nitrate, bar copper, iodine, borax, iron ore and miscellaneous mining and agricultural products.

Communications.—In 1925 Chile had 5,624 m. of railway of which 3,100 m. were state-owned, the remainder being worked by private enterprise. The state lines run north-south down the centre of the country, with branches to the coast. By treaty of 1904 Chile agreed to pay Bolivia the value of the Chilean section of the Arica-La Paz International Railway, and the last payment was made in 1924. A state line of 128 kilometers from Iquique to Pintados was commenced in 1914 and was nearly completed by the end of 1925. The Chilean and Argentine sections of the Transandine Railway came under unified administration in 1921, and in 1922 a convention with Argentina was signed for the construction of a second transandine line viâ Salta and Lonquimay concomitantly. Electrification schemes were begun in 1920 and by 1924 the first zone of the state railways was completed, from Valparaiso to Santiago viâ Llai Llai and from Llai Llai to Los Andes, thus connecting with the Transandine which it is also proposed to electrify. Many minor schemes have been planned, since ample hydroelectric power can be made available.

Telegraphs in 1922 totalled 16,494 m., of which 10,141 m. belong to the state. Telephones numbered 25,000 subscribers in 1922, and new trunk lines between Valparaiso and Santiago were planned in 1925. In 1922 there were 22,101 m. of roads in the country. Shipping in 1922 totalled 101 steamers with 69,790 tons, and 26 sailing vessels with 9,252 tons. From Aug. 9 1922 a new law reserved all coastwise shipping to Chilean vessels, and this gave impetus to the national mercantile marine. A chain of wireless stations has been erected along the coast from Arica to Punta Arenas.

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CHINA (*see* 6.166), a republic since 1911 and a member of the League of Nations. Its area, including Mongolia, Chinese Turkestan and Tibet, is 4,278,352 square miles. The population according to the 1910 census is 342,639,000, including the Chinese estimate of the population of Tibet at 6,500,000.

The years following 1909 were marked in China by changes which were to work a greater revolution in the civilisation of the country than had been known for many centuries. These changes were due primarily to the impact of western peoples upon China. The impact had been continuously in progress since the close of the 16th century, and in it traders, missionaries, diplomats and armed forces had all had their share. It was not, however, until the last decade of the 19th century that Chinese culture had begun to show any marked modifications. Then, after the fleeting reforms of 1898 and the spectacular failure of reaction in the Boxer uprising (1900), the long resistance that had been presented to the West seemed suddenly to crumble, and old institutions, ideas and customs were discarded or modified with unprecedented and startling rapidity. The political revolution of 1911–2, with the deposition of the Manchu rulers and the substitution of a republican for a monarchical form of government, accelerated the alterations in other phases of the nation's life, and by the beginning of 1926 this more inclusive revolution had proceeded far and was still in progress. The changes were especially marked in the realm of government, of education and of literature, but they were also noteworthy in religion and economics, and had begun to appear in social customs and the structure of the family. The entire movement may in time prove to have been one of the most important developments in human history. It has already shown itself to be one of the most noteworthy in the long history of China.

I. POLITICAL HISTORY

To the uninitiated observer the political history of China of the years from the beginning of 1910 to the close of 1925 must seem a hopelessly confusing kaleidoscope of names and factions, accelerated as the years passed and tending more and more rapidly toward the breakdown of all ordered government. Even for the expert observer it is often difficult to distinguish more than the main figures of the drama, a drama that often appears to degenerate into melodrama. Certainly the years have witnessed increasing political chaos and a progressive weakening of the central government. There have not, however, been wanting some movements that give promise of a more stable and hopeful future.

It helps to simplify the situation to recognise that in the main two factors have been at work, the traditions of China's past and contact with the West. It has long been one of the features of Chinese history that when one dynasty has given way to another the transition has been marked by a period, sometimes prolonged, when the processes of government have broken down in whole or in part, when banditry has been rife and when rival military leaders have been striving to achieve the mastery of the entire nation and to ascend the imperial throne. Often no one of these rivals has been able to control the entire country, and the empire has been divided into warring principalities which have risen, altered their boundaries and then disappeared, all with disconcerting rapidity. Eventually, however, some one has always succeeded in reuniting the country under one imperial sway. This traditional process was in part repeated in and after 1911. The Manchu dynasty had long been decadent, and after the death of the great Empress Dowager it needed only a timely rebellion to topple it off the throne. That rebellion came in 1911, and the Manchus promptly collapsed. From time to time various leaders, most of them military men, have been in supreme power in Peking, but they have each had to face rebellions and none has succeeded in long remaining in power. Here and there men, supported by more or less well-organised bodies of troops, have for longer or shorter periods made themselves masters of part of a province, an entire province or several provinces; and between these leaders, either acting singly or in cliques or "parties," there has been intermittent civil war.

The entire process was complicated by relations with the West, for this contact brought with it new political ideas, the interference of foreign powers, and the incentive to a strong feeling of nationalism. For more than 2,000 years a change of dynasty had meant little alteration in the form of government. The new rulers adopted, usually with some modifications, the laws and institutions of their predecessors. Now, however, there was an effort to substitute for a monarchy a republic—a purely Western creation—and to recast political institutions in moulds that were partially occidental. No people, however, can hope to destroy its traditional political structure and erect a new one without a near approach to anarchy. Then, too, as though the nation were not confronted with enough difficulties, foreign powers did not permit it to work out its problems alone, but insisted upon interfering, either to extend their possessions and privileges or to prevent others from doing so. On the other hand, contact with the West and the aggressions of foreign peoples helped to arouse among the Chinese a new sense of nationalism, and this displayed itself in deep resentment against alien interference and in the attempt to bring about the reorganisation.

THE FALL OF THE MONARCHY

Yüan Shih-k'ai.—Most chroniclers are agreed in dating the revolution of 1911 from the outbreak which took place at Hankow in Oct., after the accidental explosion of a bomb and the arrest of a number of anti-dynastic plotters, but the country had undoubtedly contained all the materials for an upheaval since the death of the Empress Dowager in 1908. For 100 years it had been evident that the dynasty was about to pass the way of its predecessors. The ability of its leaders was declining, and internal rebellions and the encroachments of foreign powers were constantly bringing problems. With the passing of the Empress there was removed the last person strong enough to postpone the débâcle. The Manchus, seeking some means of averting the impending crisis, had tried several methods of concession intended to placate their opponents. In 1906 there had been announced a plan for reorganising the government. The central ministries of state were to be remodelled and the gradual introduction of representative bodies had been promised. In accordance with this project, provincial assemblies had been convened in 1909, a national assembly had met in 1910, and a national parliament had been promised. In Nov. 1910 the Manchus had yielded to the demand of the National Assembly and had promised the convening of the promised parliament for 1913; six months later, the Regent had agreed to replace the Grand Council by a responsible Cabinet. The imperial clan was divided against itself at this critical juncture, but even had it presented a united front the forces which brought about the abdication of the dynasty were beyond its strength.

If those leaders who came rapidly to the front after the initial successes of the rising at Hankow were able to bring about the downfall of the Manchu dynasty and the establishment of a republic almost without a struggle, it was not because they represented any conscious objection to the monarchical form of government on the part of the masses, but because they constituted at the moment practically the only organised body of educated opinion in the country and were inspired by definite aims and ambitions. Dr. Sun Yat-sen and other active leaders of the revolutionary movement had for some years been conducting an anti-dynastic propaganda in the central and southern provinces, and their activities led to the formation of numerous associations which displayed great activity in the press and in the National Assembly. The signing with a foreign banking group of the Hukwang Railway loan agreement (April 5 1911) led to friction in one of the provinces affected, Szechwan.

In Sept. the province was in rebellion. On Oct. 10, in consequence of a revolutionary plot in Hankow, there occurred in Wuchang a mutiny of troops which was the signal for the formal beginning of the revolution. When, immediately after the outbreak at Hankow, the mutineers captured the Wuchang mint and the arsenal at Hanyang, it became apparent that the Regent possessed no resources either of strength or of statecraft. Seriously alarmed by the rapid spread of the rebellion, he was persuaded to call to his aid the famous viceroy, Yüan Shih-k'ai, whom he had disgraced and dismissed from office in Jan. 1909. In Oct. 1911 Yüan was recalled from his retirement and appointed viceroy of Hunan and Hupeh, with supreme command of the imperial forces. Yüan's military operations on behalf of the monarchy were half-hearted at best, and require but little comment. He took the field toward the end of Oct., but returned to Peking in Nov., having been chosen Prime Minister. At the end of Nov., after desultory fighting, the position of the rebels in and around Hankow had become untenable, but by this time the propaganda of Sun Yat-sen's emissaries, combined with the helplessness of the Manchus, had borne fruit.

The Emperor's Abdication.—Fourteen provinces had declared against the monarchy. Nanking, moreover, was captured by the revolutionaries. In Dec. Yüan Shih-k'ai agreed to an armistice. At the outset Yüan was not in favour of a republic, but the Manchus were hopelessly incompetent, officialdom and the revolutionaries would have made it impossible for him to seize the throne for himself even had he desired then to do so; he failed to win the moral and financial support of the foreign powers; the regent had abdicated (Dec. 6), and Tang Shao-yi, the ablest of Yüan's lieutenants, had declared his sympathy with the Cantonese republican party. The only courses open were surrender or negotiation.

The armistice negotiations commenced at Hankow in Dec., with Tang Shao-yi as imperial delegate. On the 18th they were transferred to Shanghai. The result was a foregone conclusion; before the end of the month the Manchu court had agreed to submit to a national convention the question of monarchy or republic. Late in Dec., Sun Yat-sen, who had been out of the country when the revolution began, arrived at Shanghai, and a council of provincial delegates at Nanking elected him President of the Republic. In Feb. the Emperor's abdication was proclaimed in an edict which transferred the government to the people's representatives, declared that the constitution should henceforth be republican, and gave Yüan Shih-k'ai full powers to organise a provisional republican government. The Nanking Govt. agreed that the Emperor should retain his title through life and receive a large pension. Sun Yat-sen resigned the presidency in favour of Yüan Shih-k'ai, who was thereupon elected provisional president by the Nanking parliament. Li Yüan-hung, who had come into prominence in the initial stages of the rebellion at Wuchang, was elected vice-president. A provisional constitution was promulgated in March by the Nanking parliament. On April 2 the government was transferred from Nanking to Peking.

Yüan Shih-k'ai's position as President was one of great difficulty and danger. From the outset he was held in suspicion by the Radicals, who in Aug. 1912 took the party name of Kuo Min Tang[1] and who were in control of Parliament. Rival military leaders were, moreover, already beginning to appear and to engage in the time-honoured struggle for supremacy. Then, too, Yüan was faced with grave financial problems, chiefly due to the fact that the fiscal machinery of the country had been disorganised by the revolution. There were, moreover, difficulties in the field of foreign affairs. Nevertheless during the next four years Yüan brought something like order out of the chaos, and gradually restored in the provinces the authority of the central Government. In April 1913, after prolonged negotiations, Yüan concluded the "reorganisation" loan with a financial group representing Great Britain, France, Germany, Russia and Japan. This loan was a large one, and was secured by a lien on Chinese revenues, principally on the income from the salt monopoly. His financial position and the moral support of the foreign powers thus assured, Yüan proceeded to defy the Kuo Min Tang. The latter had obtained a majority at the elections held in the beginning of the year, and came to Peking for the opening of Parliament in a belligerent mood, greatly exasperated by the assassination at Shanghai of one of their ablest leaders, Sung Chiao-jen, the Speaker-elect, whose death was probably due to the President's orders. Assembled under these conditions, the new Parliament was destined to have a stormy career. Yüan Shih-k'ai refused to recognise its claim to supervise his loan negotiations, and ordered the conclusion of the agreement with the foreign banks in spite of the protests of the Radical leaders. Realising the danger of their position, many of these now fled from Peking, and in the central and southern provinces "a war to punish Yüan" was begun. It lasted only two months and ended in complete rout. Yüan was now firmly in the saddle.

Monarchical Activities.—After thus forcibly asserting his authority, Yüan proceeded to consolidate it. In the first place, in Oct. 1913, he forced through his election as President for a term of five years, his title having hitherto been provisional. A few weeks later, by a mandate endorsed by his docile Cabinet, he ordered the unseating of all the Kuo Min Tang members of Parliament, on the ground of their treasonable conspiracies. As half of the Senate and more than half of the House of Representatives were thus disposed of, no parliamentary quorum was left. The surviving remnant of Parliament was soon replaced by a political council, and "an administrative conference for the revision of the constitution," composed almost exclusively of officials and literati of the old school, selected by the President or by his agents and representatives in the provinces, and the provincial assemblies were dissolved. By the beginning of 1914 it was evident that Yüan intended to restore the old orthodox autocracy. In 1914 a revised provisional constitution lengthened the presidential term to 10 years and gave the President decisive control over Parliament. Late in 1914 the President performed the time-honoured imperial Winter Solstice ceremony at the Temple of Heaven. In the summer of 1915 the movement for the restoration of the throne assumed definite form and direction.

The Chou An Hui, a group composed chiefly of Yüan's supporters, organised an energetic monarchical propaganda at Peking and in the provinces. One of the ablest and most influential scholars in China, Liang Ch'i-ch'ao, who had strongly supported Yüan's fight for the preservation of the monarchy in 1911, boldly denounced the Chou An Hui's propaganda and warned the President of the perils which threatened the course upon which he was embarking. Resigning his position on the State Council, Liang proceeded to publish his opinions in the Peking *Gazette*. Yüan, well aware of the far-reaching influence of Liang's views, did all in his power to win his support. Failing in this, he made a pretence of constitutional procedure by referring the question of the monarchy to a vote of the provinces, or rather to the vote of a number of individuals appointed by himself to represent them. The result, a foregone conclusion, was a practically unanimous vote in favour of Yüan's accession.

Yüan's Failure.—Yüan, however, was to fail to seize the coveted throne. The World War had broken out, in the Far East the Entente powers were submissive to the wishes of Japan, and Japan was opposed to the proposed change. In the autumn of 1915 Japan, Great Britain, Russia, Italy and France joined in counselling Yüan to delay the change to a monarchy, and Japan later reiterated the advice. There was, too, among many of the articulate classes of the country opposition to a monarchy. Moreover, and this was extremely important, many military chieftains were by no means content with the assured mastery of Yüan and the formation of a new dynasty, for this might check their own ambitions. In Dec. 1915 a rebellion, led by Tsai Ao, a military official educated in Japan, broke out in far-western Yünnan, and the province, through its officials and local gentry, declared its independence in opposition to the monarchy. The insurrection spread with a rapidity which justified the foresight of Liang Ch'i-ch'ao and emphasised the fact that, as matters stood, Yüan had not achieved either the personal prestige or the pecuniary resources sufficient to command for his authority as Emperor the loyalty of the semi-independent chieftains.

By the end of Jan. Kwangsi and Kweichow had renounced their allegiance and other provinces were wavering. His star was so rapidly declining that his advisers persuaded Yüan to issue an official announcement postponing indefinitely the establishment of the monarchy. Having thus confessed to failure, Yüan's fate was sealed. By the end of March his opponents had become so many and so active that his remaining friends advised him to resign the presidency. A month later he had been denounced as a usurper in nearly every province by the very men who had "elected" him to the throne in Nov., and even at Peking there were but few to do him reverence. Nevertheless he declined to retire, but to placate his opponents he announced his intention of reintroducing parliamentary government without delay. The Kuo Min Tang leaders, however, were not disposed to come to terms with Peking. Repudiating Yüan, they proclaimed the establishment of a provisional government at Canton and elected Li Yuan-hung to the presidency. But at this juncture Yüan died (June 6 1916), Li Yuan-hung, as Vice-President, duly succeeded to the presidency.

While these developments were taking place in China's internal politics, events of great moment were happening in her foreign relations. The revolution had brought few startling changes in the country's relations with the Powers. Tibet and Outer Mongolia, at best none too firmly attached to the empire, took the opportunity afforded by the change in government to effect their virtual independence, and Great Britain in the former case and Russia in the latter were not slow to attempt to extend their influence over states which so directly abutted on their territory. China recognised the autonomy of Outer Mongolia in return for the acknowledgment of her suzerainty, but she was less pliant in yielding to British ambitions in Tibet. On the whole, the Powers made little objection to the republic, although recognition was more prompt on the part of some than of others.

THE WORLD WAR

The outbreak of the World War, however, brought to China some very serious difficulties. Germany was well established in Shantung, with the leased territory of Kiaochow and its port

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[1] The Kuo Min Tang was the first purely party organisation in China. With a strong nationalist and anti-foreign bias, it was evolved out of the Tung Meng Hui founded by Sun Yat-sen and other advanced leaders in Japan, and gradually acquired a membership of 500,000, scattered throughout the world. Throughout the revolutionary period it has been exceedingly active, especially in Canton, and worked for the accession of Sun Yat-sen to the presidency. Its left wing is very favourable to the Bolsheviks.

Tsingtao, and with railway lines and mining concessions. The British naturally looked askance at this occupation, and the Japanese were not at all averse to finding in the Anglo-Japanese Alliance a reason for coming to the assistance of Great Britain in the Far East. Japan had for some years been extending her influence in China. Firmly seated in Southern Manchuria by the Russo-Japanese War and subsequent events, and with a rapidly expanding trade throughout China, the World War seemed to afford her an opportunity for assuming the leadership in the affairs of her great neighbour. To this policy her economic interests seemed to urge her. In need of a source of raw materials, especially of coal and iron, and of a large market for her manufactures, she believed that both of these were to be most conveniently found in China. Western powers had threatened to close the door there against her, and now that they were absorbed in war Japan's statesmen believed that theirs was the chance to control the inchoate republic. Japan's future prosperity and even her existence seemed to depend upon propping open the door into China. Accordingly, Japan entered into the war against Germany in Aug. 1914, sent an expedition to Shantung, and with the co-operation of a small British force captured Tsingtao and the other German possessions. It was supposed[1] that the German property would eventually be returned to China, but Japan had disregarded Chinese neutrality, and had been high-handed in dealing with the Chinese population in Shantung. In Jan. 1915 she presented to Peking a formidable array of 21 demands in five groups.

1. In Shantung, China was to agree to any transfer of German possessions to Japan that the latter might obtain. China was not to alienate to a third power any territory in the province, she was to declare additional cities to be open ports and was to grant certain railway privileges.
2. In South Manchuria and Eastern Inner Mongolia, the lease of Port Arthur, Dairen (Dalny) and the railways was to be extended from 25 to 99 years. Japanese might anywhere in these regions lease land and travel or reside. There were, too, demands for mining and railway concessions, and for the Japanese control of loans and the employment of Japanese official advisers.
3. The Han Yeh P'ing Company, the largest Chinese iron-mining and smelting concern, was to be made a Chino-Japanese enterprise and China was not to sell her interest in it without Japan's consent.
4. China was to promise not to cede or lease to any third power any harbour, bay or island along her coast.
5. China was to employ Japanese as advisers to the central government; the police departments in certain districts were to be jointly administered by Japanese and Chinese; China was either to buy 50% or more of her munitions from Japan or to establish a Sino-Japanese arsenal, which was to use Japanese materials under the direction of Japanese; Japanese were to be granted the privilege of owning land in the interior of China for schools, hospitals and churches; certain railway concessions in the Yangtze Kiang valley were to be promised, and Japan was to be allowed to scrutinise all proposed loans of foreign capital for mines and works in Fukien.

For a time Japan kept the demands secret, but as they became known a wave of indignation swept over China, and there was criticism both in Great Britain and in the United States. After some weeks of negotiation, the first four groups were granted in a modified form, but the fifth was indefinitely postponed. Japan had made gains, but at the expense of alienating the Chinese.

In Aug. 1916 there was trouble on the Manchurian-Mongolian border between Chinese and Japanese troops which led to further ill-feeling and fresh demands upon China—demands from which, however, Tōkyō subsequently largely retreated. Then, in Feb. and March of 1917, Japan made secret arrangements with Great Britain, France, Russia and Italy[2] whereby she was assured of the support of these Powers at the Peace Conference in her demands for the former German holdings in Shantung.

Internal Difficulties.—The War was, too, to bring still further problems for China. With the death of Yüan Shih-k'ai, the prospect for the early unification of China under a strong central government did not immediately disappear, but it became remote, and in 1917 complications arising out of China's entrance into the World War hastened the process of disintegration. Tuan Chi-jui, the Premier of the new Cabinet, endeavoured to disarm the opposition of the southerners by convening the Parliament which Yüan had broken up in 1913. At the opening of Parliament two facts were speedily made manifest: first, the Kuo Min Tang's repudiation of Peking's authority had not been inspired solely by Yüan Shih-k'ai's attempt to restore the monarchy and would not end with it; second, the existence and proceedings of Parliament, no matter under what constitution convened, were completely at the mercy of the military governors. Parliament, in which the Kuo Min Tang predominated, declared its intention of adhering to the Nanking provisional constitution, pending the completion of a new and permanent instrument, for the preparation of which a special drafting committee was appointed. But the military governors made it plain that their practice would continue to be determined by their own necessities.

During the latter part of 1916, however, progress seemed to be made toward the establishment of order and unity, and it is possible that this might have continued had it not been for an internal conflict over the country's relations with the Central Powers. In the winter of 1916–7, the question of China's joining the Allies came to be seriously considered by Tuan Chi-jui's Cabinet. The premier and most of his colleagues were eager to take this step, but among the older officials there were some who preferred a policy of passive neutrality. In Feb. 1917 the American minister at Peking invited the Chinese Government to follow the example of the United States by formally protesting against Germany's submarine campaign and by severing diplomatic relations. On Feb. 9 the Chinese foreign office sent a warning to Germany, and on March 14 broke off diplomatic intercourse with that country. The premier and his supporters were now eager, and especially after the declaration of war by the United States (April 1917), to secure the benefits of complete identification with the cause of the Allies by declaring war against the Central Powers. A conference of military governors convened by the premier at Peking on April 26 voted for war; a few days later the Cabinet adopted a unanimous resolution to the same effect. But members of Parliament who professed to see in the attitude of the military governors a menace to parliamentary government, or who were alarmed by the increasing rumours of secret agreements between Tuan's party and Japan, constituted an opposition sufficient to prevent the Cabinet from carrying its resolution into immediate effect.

On May 19 Parliament adopted a resolution to the effect that it would decline further to consider the question until the Cabinet had been reconstructed. Tuan countered the move by a communication from the military governors to the president demanding the immediate dissolution of parliament. Thus challenged, the president issued a mandate (May 23) dismissing the premier. Tuan fled from the capital and, taking refuge with the military party's leaders at Tientsin, announced his intention of defying the President's authority. The military governors of several provinces north of the Yangtze Kiang thereupon proceeded to declare their independence of the central Government, and at the beginning of June established a "Provisional Government" at Tientsin with an aged ex-viceroy, Hsü Shih-chang, as titular head. At the same time they warned Li Yuan-hung that if he desired to remain president he must dissolve Parliament. To enforce their demands they proceeded to mass troops in the vicinity of the capital. Li Yuan-hung now summoned to his aid as "mediator" Chang Hsun, a famous swashbuckler chieftain. Chang promptly came north with a "bodyguard" of several thousand troops, but the value of his mediation was discounted by the announcement that he would insist upon the dismissal of Parliament. On June 12 Li Yuan-hung yielded, and Parliament was dissolved by presidential mandate.

Personal Feuds.—The question of joining with the Allies against Germany was now by common consent relegated to the background, and all attention concentrated on the struggle of personal ambitions at Peking. Tuan Chi-jui, with his tuchun supporters, was still in watchful waiting at Tientsin. Many members of the Kuo Min Tang had fled to Shanghai and Canton and were preparing to take the field against Peking. The vice-president, Feng Kuo-chang, announced that the region in which he was in control, the lower Yangtze Kiang Valley, would remain "neutral." The danger of internal dissensions on a wide scale was unmistakably more serious than at any time since the overthrow of the Manchus. In June the United States addressed a note to the Chinese Government deploring the prospect of civil war, and intimating that the restoration of national unity was a matter of more immediate importance to China than the declaration of war against the Central Powers. This advice aroused resentment in Japan, and was proclaimed by the Kuo Min Tang as an intimation that the United States was opposed to the policy of Tuan Chi-jui. Chang Hsun soon showed that he had no intention of attempting to bring about a reconciliation between president and premier. His policy became fully revealed by a *coup-de-main* (July 1) which withdrew the young Emperor from his retirement and proclaimed the restoration of the Dragon Throne. Tuan Chi-jui and the northern military chiefs were not, however, disposed to see Chang Hsun thus easily assume a dominating position, and while they had no especial enthusiasm for the republic their personal ambitions left them no other recourse but to denounce the change and to take active measures against it. Tuan, therefore, led his army to the capital to defend the republic. After a few days of desultory and half-hearted fighting, Chang Hsun capitulated (July 12) and the young Emperor was consigned once more to the tranquil dignity of his court without a kingdom. Tuan Chi-jui now resumed the premiership, and with enhanced prestige and power. The position of Li Yuan-hung as president had, however, become impossible, and from the Japanese legation, whither he had fled for safety upon the proclamation of the monarchy, he announced his intention of retiring into private life. He was succeeded by the vice-president, Feng Kuo-chang, who declared his readiness to endorse the policy of the premier. The declaration of war was formally issued on Aug. 14.

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[1] A statement made by Count Okuma, the Japanese Premier, early in the Tsingtao campaign, ran as follows: "I now state to the American people and to the world that Japan has no ulterior motive, no desire to secure more territory, no thought of depriving China or other peoples of anything which they now possess."

[2] For the text of these understandings see H. W. V. Temperley, *History of the Peace Conference*, Vol. vi. p. 63.

The Kuo Min Tang members of the former Parliament continued to denounce the Peking Govt. as illegal, and, under the leadership of Sun Yat-sen, in Sept. organised a provisional Goverment which they declared to be the only constitutional one in China. Not to be outdone by Peking, moreover, this government issued a separate declaration of war against the Central Powers. Almost before the new president had assumed office at the capital, his adherents were in conflict with the premier concerning the policy to be adopted in dealing with the south, Tuan Chi-jui being for strong measures, and Feng Kuo-chang for conciliation. As the result of these differences, Tuan Chi-jui once more resigned; but again his friends intervened and proclaimed their intention of carrying on the war against the south, with or without the consent of the Government, and Chang Tso-lin, the tuchun autocrat of Manchuria, moved a body of troops into Chihli. Tuan Chi-jui thereupon resumed the premiership and took the offensive against the southern provinces.

Having "vindicated the Republic," it was necessary for Tuan Chi-jui to maintain the appearance of constitutionalism. He therefore convened an assembly, which proceeded to revise the law for parliamentary elections. This having been duly promulgated (Feb. 17 1918), a new parliament was chosen in time to deal with the quinquennial election of the president. On Sept. 4 the presidential election took place, but the matter had been decided in advance by the tuchuns assembled in conference at Tientsin. Feng Kuo-chang was passed over, because he could not work with Tuan Chi-jui, and Hsu Shih-chang was elected.

China's Part in the War.—China's internal discord and financial straits were such that she could take no active part in the World War. She permitted, it is true, the recruiting of labour battalions for service behind the lines in France, Mesopotamia and Africa, and about 175,000 Chinese served in this way; but the Government's part was passive, for the initiative was taken and the transportation and organisation were conducted by the Allies. China seized, too, the German and Austrian vessels interned in her ports, and chartered at least some of them in the service of the Allies. She obtained, moreover, relief from the payment of instalments on the Boxer indemnities, for she cancelled the unpaid portions due to Germany and Austria and was permitted to suspend for the time the sums due to the Allies. There was some promise made of her helping in the maintenance of order in the north against disintegrating Russia, and in May 1918 Japan and China entered into an agreement for defence against disorder and possible invasion from that direction.

A "War Participation Board" with a Japanese adviser and an "Arms Contract" of Jan. 1918 still further betokened the increase of Japanese influence at Peking. The augmented revenues were squandered, largely by selfish militarists. The United States had seemed to the Chinese their strongest foreign support against the encroachments of Japan, and now (Nov. 2 1917) Washington, partly to insure friendliness with Japan while the two were in the War, entered with Tōkyō into what is known as the Lansing-Ishii Agreement, which, while reaffirming the open door into and the territorial integrity of China, carried the recognition by the United States that Japan had "special interests" in China and seemed to surrender the Asiatic republic to the will of her island neighbour. Moreover, the group around Tuan Chi-jui, the "Anfu" clique, were concluding agreements with Japan for the construction of railways in Shantung, Manchuria and Mongolia (Sept. 1918) and were borrowing extensively from the Japanese on the security—not all of it very reliable—of railways, mines, forests, telegraphs, taxes and bonds.

The Peace Conference.—When the War at last came to an end, China—thanks to her participation in the conflict—was allowed representation at the Peace Conference. The delegation was ably led, and presented a strong plea for the restitution to China of the former German properties in Shantung. It also asked for the cancellation of spheres of influence within China's borders, for the withdrawal of foreign troops, post offices and wireless and telegraphic communications, for the abolition of consular jurisdiction, the relinquishment of leased territories, the restoration of foreign concessions and settlements and for tariff autonomy. In all of these requests, however, China was doomed to disappointment. The American delegation favoured the restoration of the Shantung properties, but against it were the agreements of 1917 between Japan and the European Allies. The remaining questions were held not to come within the purview of the conference. By the Treaty of Versailles, therefore, Japan was confirmed in the possession of her holdings in Shantung. Her assurances that these would eventually be returned were not taken very seriously either by the Chinese or by the rest of the world. The hopes of the younger educated Chinese had been raised by the war speeches of President Wilson, and this seemingly utter failure of their cause at Paris both disillusioned and angered them. Their indignation was so great and so forcibly expressed that the pro-Japanese Peking Govt. could not but instruct the Paris delegation to refuse to sign the treaty with Germany, and two members of the Cabinet who had been most prominent in the loan negotiations with Japan were forced to resign. In 1919 there followed a very effective nation-wide boycott against Japanese goods.

China was not, however, to emerge from the war period without some gains. She obtained membership in the League of Nations by signing the treaty with Austria, for that document did not contain the objectionable Shantung clauses. In her separate treaty with Berlin, the German share of the Boxer indemnity and German participation in extra-territoriality were cancelled, and her treaties with the new states that arose in Europe out of the War did not concede extra-territorial privileges. In 1920 the payments to Russia of instalments on the Boxer indemnity ceased, and Russian extra-territorial privileges fell into abeyance. Moreover, in 1920 there came into existence, largely through the efforts of Americans, a new financial consortium whose purpose it was to assume international control of all further foreign loans to China, and so to avoid the granting of special privileges to individual nations.

Washington Conference.—The Treaty of Versailles was followed in 1921 and 1922 by the Washington conference (*q.v.*). Not all the agreements and treaties which arose out of the conference affected China, but the Chinese question loomed larger than any other except possibly that of disarmament. The main actions, in so far as they concerned China, were as follows:—

1. One treaty between Japan, the United States, the British Empire, France and Italy, limited naval armaments and forbade the construction of new fortifications and naval bases on most of the island possessions of the first three Powers. One of the effects of this treaty was to confirm Japan in the naval domination of the north-eastern coast of Asia. No Power could now hope to penetrate by force through her curtain of islands to the coast of China.
2. Peace in the Pacific was further assured by the "Four Power Treaty" between Great Britain, France, the United States and Japan, which pledged the signatories for a term of years to respect each other's insular possessions in the Pacific and to confer on any controversy which arose concerning these and which could not be settled through the ordinary channels of diplomacy.
3. A "Nine Power Treaty" signed by all those represented at the conference, was an agreement to respect the sovereignty, independence and territorial and administrative integrity of China, to give China opportunity to develop a stable government, to maintain the principle of equal opportunity in China for the commerce and industry of all nations and to refrain from taking advantage of conditions in China to seek special privileges that would abridge the rights of subjects or citizens of friendly states.
4. The nine powers signed a treaty whereby the customs schedule of duties was within four months to be raised to an effective 5% and provision was made for the convening of a special tariff conference and for the periodical readjustment of the customs tariff, first at the end of four years and thereafter at the end of every seven years.
5. By a resolution a board of reference was to be established in China to which questions connected with the enforcement of the "open door" and equal railway rates could be referred.
6. A resolution expressed the sympathy of the powers with China's desire to see removed "immediately or as soon as circumstances will permit existing limitations upon China's political, jurisdictional and administrative freedom," and provided for the early establishment of a commission to inquire into the practice of extra-territoriality in China and the progress in judicial reforms.
7. On Jan. 1 1923 foreign postal agencies in China were to be abolished.
8. The powers declared their intention to withdraw their armed forces from China as soon as China "shall assure the protection of the lives and property of foreigners," and resolved that as soon as China should request it they would appoint representatives to see whether these conditions had been fulfilled.
9. There were resolutions concerning radios in China.
10. There were resolutions concerning the unification of the railways of China, the employment of foreign technical experts for these railways and the Chinese Eastern Railway.
11. The conference expressed the earnest hope that immediate and effective steps would be taken by China to reduce her military forces and expenditures.
12. There was provision for machinery by which the powers were to be notified of all treaties, conventions and agreements with or concerning China.

So far as formal declarations could do so, then, the Powers agreed to respect China's independence, to seek no special privileges, and to look with favour upon the aspirations of Young China to achieve freedom from foreign control.

The Washington conference also afforded Japan and China an opportunity to come to an understanding over the thorny Shantung question. Following the signing of the Treaty of Versailles, Japan had made attempts to adjust the dispute, but always on conditions which had been repulsed by the Chinese. Now, however, Japan adopted a much more conciliatory attitude, and an agreement was reached whereby the former German holdings in Shantung were to be returned to China. There were conditions attached into which there is no space here to enter fully. It is well to note, however, that the Japanese still retained a share in some mines in the province and large commercial interests and land-holdings in Tsingtao, that China borrowed from Japanese on the security of the railways the sum needed for the redemption of the roads and that during the continuation of the loan the roads were to have a Japanese traffic manager. The Lansing-Ishii Agreement which had never been satisfactory either to America or to China, was terminated (March 30 1923).

The better relations established between Japan and China at the Washington conference were to continue until after the close of 1924, but not always without difficulty. China still recalled the humiliation of the Twenty-one Demands, and in the spring of 1923, as there approached the termination of the 25 years for which the lease on Dairen (Dalny) and Port Arthur was originally made, Peking requested that the Sino-Japanese agreements of 1915 be abrogated. Tōkyō, of course, refused, but a formal protest which might later be useful had been lodged against the extension of the lease to 99 years.

CHINA AFTER THE WORLD WAR

Post-War Policy of Powers.—Following the World War the Powers were disposed to act somewhat less aggressively in China than they had in the preceding half-century or more. This change in attitude had been shown at the Washington conference, and further evidence of it was to appear as the years passed. In May 1924 the Congress of the United States authorised the remission of the unpaid portion of the Boxer indemnity and plans were developed for using it to promote education in China. Russia, by an agreement dated May 31 1924, assigned her portion for educational purposes. Great Britain, France and Japan also allocated their portions partly to philanthropic enterprises and education in China, the arrangement being completed in June 1926. The danger was that the sums so released would be used to promote educational propaganda in favour of the respective powers; in other words, that there would appear in China educational "spheres of influence." This danger was particularly marked in the case of Russia, who, under the Soviets, seemed intent on using the indemnity once due to her—larger than that exacted by any other power—for the inoculation of Chinese youths with Bolshevist principles.

At the close of 1924, indeed, one of the outstanding features of China's relations with other powers was the growing influence of Soviet Russia. The Soviet Republic had (1919 and 1920) assumed the attitude that China was the prey of capitalistic states, and that she could look for different treatment from the new *régime* in Russia. By agreements and declarations signed May 31 1924 the Soviet Govt. seemed to adopt a most conciliatory policy, remitting the unpaid portion of the Boxer indemnity, relinquishing extra-territorial consular jurisdiction, and recognising Outer Mongolia as an "integral part of the republic of China," and providing for the ownership and administration of the Chinese Eastern Railway (*q. v.*). This policy led to a growing admiration for Russia on the part of many of the Chinese, but others were not without a suspicion that the seeming change of front was only another form of the time-honoured Russian policy of penetrating China under the guise of friendship.

Faction Fights.—At the close of the World War, it will be recalled, Hsu Shih-chang was in the presidential chair and Tuan Chi-jui, the Premier, was in control. There was a separate Government at Canton, maintained largely by members of the Kuo Min Tang, under the leadership of Sun Yat-sen, Tang Shao-yi, and Wu T'ing-fang. For a time most of the provinces in the south and southwest were in sympathy with Canton, and the alignment seemed to be between the north and the south. Then dissensions broke out in the south. A Kwangsi faction ousted Sun Yat-sen and his associates from Canton. These latter were offered support by T'ang Chi-yao, tuchun in Yunnan, but he was discomfited, and it was under the aegis of Ch'en Ch'iung-ming, who drove out the Kwangsi faction, that Sun Yat-sen and his group returned once more to Canton. Here, in April 1921, Sun Yat-sen began another chapter in his varied career by being elected "President of the Chinese Republic" by such members (about one-fourth) of the Parliament of 1913 as could be got together. His government professed to be the only constitutional one in the country, and he proceeded to organise an expedition to seize control in the Yangtze Kiang Valley and the north. In 1922, however, he fell out with Ch'en Ch'iung-ming and for a time was an exile from Canton. When, in 1923, he was able to return to that city he had support sufficient only to maintain a precarious foothold there and in a part of Kwangtung. Southern and southwestern China were a confusing medley of warring factions, and leaders and troops from Yunnan, Kwangsi, Hunan, Kiangsi and Kwangtung rapidly appeared and disappeared on the stage. In 1923, Sun, in dire need of funds, made an attempt to seize the revenues of the Canton customs, but failed to do more than involve himself in controversy with the Powers.

Peking in the meantime was largely the victim of warring factions. The group in control, the Anfu clique, was arousing enmity. Especially did one of its members, the notorious Hsu Shu-tseng ("Little" Hsu, assassinated Dec. 1925) come in for criticism. In 1920 the rising powers in the north were Wu P'ei-fu, a scholarly and able commander, his titular superior, the tuchun of Chihli, Ts'ao Kun and Chang Tso-lin, the master of wealthy Manchuria. These three came into collision with Tuan Chi-jui, and in the summer of 1920 drove Tuan and the Anfu leaders out of power. Hsu Shih-chang was for the time being left in the presidential chair, and rapidly changing ministries tried to carry on the nearly bankrupt government. In 1921 friction arose between Chang Tso-lin and Wu P'ei-fu which in the spring of 1922 led to war. Wu P'ei-fu defeated Chang Tso-lin and drove him back into Manchuria. Wu thereupon took steps which he hoped would reunify the country. Hsu Shih-chang resigned the presidency and fled to Tientsin. Li Yuan-hung, who since his retirement in 1917 had been living in a foreign concession in Tientsin, once more assumed the presidency, and the Parliament of 1913 (dismissed by Yüan in 1913, reassembled after his death and dissolved by Li in 1917), which seemed to be the last elected body on which the whole country had been united, was recalled to Peking. The hopes of a unified China thus aroused proved disappointingly fleeting. Funds for the government were insufficient. Parliament proved venal, cabinets were unstable, and in June 1923 President Li Yuan-hung again fled from the capital. In Oct. 1923 Parliament, probably as the result of heavy bribes, elected to the presidency Ts'ao Kun. In the same month there was promulgated a "permanent" constitution on which Parliament had long been working, and which had been rushed to completion to synchronise with the accession of Ts'ao Kun to the presidency.

The Christian General.—During the remainder of 1923 and the first eight months of 1924 no new major incident occurred in internal politics. Early in Sept. 1924, however, there broke out a fresh civil war which was to lead to a new government at Peking. Lu Yung-hsiang, the tuchun of Chekiang and a member of the Anfu group, and Marshal Chi Hsieh-yuan, one of the supporters of Wu P'ei-fu and in power in Kiangsu, fell to fighting. The struggle shortly involved the major military figures. Chang Tso-lin, eager for an opportunity to retrieve his defeat of 1922, espoused the cause of Lu Yung-hsiang, and Sun Yat-sen also announced his determination to support him. Wu P'ei-fu could not but come to the help of Chi. Then, in Oct. 1924, came a surprising development. General Feng Yu-hsiang, one of Wu P'ei-fu's major subordinates and in control of the forces in Peking, abandoned Wu, deposed Ts'ao Kun, and ousted the Manchu ex-emperor from his palace. Feng Yu-hsiang, for several years past one of the rapidly rising men in China, had been brought up in the military life. He had become a Protestant Christian, and his new faith led him to make his army exceptional for its iron discipline and for the absence of the vices usually attendant upon camp life. A large proportion of Feng's troops professed the Christian faith. Feng's defection from Wu led to the withdrawal of the latter to the central Yangtze region. Chang and Feng now conferred at Tientsin with Tuan Chi-jui, who had helped to bring about the new alignment of forces, and late in Nov. 1924 Tuan assumed the office of chief executive (not president) of the republic and announced a provisional government. Sun Yat-sen came north at the close of the year to have a part in the new *régime.* At the end of 1924, then, Sun Yat-sen, Feng Yu-hsiang, Chang Tso-lin and Tuan Chi-jui were co-operating—with more or less friction—and Wu P'ei-fu was in the Yangtze Kiang Valley, where he was still strong.

Civil War and Strikes.—The hopes entertained that 1925, which was to witness the opening of the tariff conference, would put an end to the civil wars, were not realised; on the contrary, the possibility of an increase of duties being sanctioned by the Powers meant more money for the Government of Peking, and therefore an additional temptation to war-lords anxious to increase their authority and replenish their waning resources. The year opened with better prospects for Marshal Tuan Chi-jui, the "chief executive of the Republic of China," who summoned to Peking on Feb. 1 a "Reorganisation Conference" for the purpose of securing some working arrangement between the central government and the tuchuns—a project impossible to realise in the distracted state of the country. In connection with this conference Sun Yat-sen as head of the Kuo Min Tang and president of the southern Republican party travelled to Peking, but was seized with illness and died at Peking on March 12.

To the middle of Oct. despite the continued rivalry of Chang Tso-lin and Feng Yu-hsiang, there was comparative quiet, but the uneasy peace was broken when the difficult position of Chang Tso-lin with his long communications and his heavy responsibilities in Manchuria began to be realised. The first blow came from Sun Chuan-fang, the energetic tuchun of Chekiang, who had driven out Lu Yung-hsiang in Oct. 1924. He invaded Kiangsu and after having driven Chang's forces as far as Hsüchow on the Pukow railway, consolidated his position in the five provinces of Chekiang, Kiangsu, Kiangsi, Anhwei and Fukien. It was then expected that Feng would make a move, but possibly owing to fears of the renewed activity of Wu P'ei-fu, the Christian general came to an understanding with Chang Tso-lin.

The truce was short for an attack on Fengtien troops retreating in Chihli was generally accepted as the beginning of another long struggle between the two war-lords. But a dramatic revolt on the part of Kuo Sung-ling, commander of a Fengtien army, compelled Chang Tso-lin to retreat suddenly to Manchuria and to Tientsin, while another blow came from a declaration of independence on the part of Li Ching-lin (tuchun of Chihli and Chang's own nominee). Feng was now master of the situation. Kuo advanced 100 m. into Manchuria, and Feng prepared to advance on Tientsin. He, however, found himself confronted by a serious obstacle in Li Ching-lin, and it was only after desperate fighting and after the successful retreat of Li Ching-lin towards Shantung that he reached his objective. Chang's fortunes now began to revive, and were greatly strengthened by an overwhelming and mysterious victory over Kuo on Dec. 24.

As a result of these fluctuating struggles, Chang was able once again to threaten an advance on Peking and Tientsin. Wu P'ei-fu resumed activity by advancing slowly into Honan, and Feng took refuge in Mongolia, declaring in reply to the requests of his hard-pressed generals for his return that he was finished with warfare. Early in 1926 Wu P'ei-fu and Chang Tso-lin joined forces and in the late winter and early spring drove the Kuo Min Chun (Feng Yu-hsiang's army) out of Peking. The Peking government was now left without a head, for both Ts'ao Kun, the former president, and Tuan Chi-jui, the chief executive, disappeared for the time from official scenes. The able W. W. Yen was in June 1926 trying to gather a cabinet and to hold together some semblance of a national government. In the meantime (May 1926) Sun Chuan-fang declared the independence of the province in the Yangtze basin. The early summer of 1926 found the chief figures on the political landscape Chang Tso-lin in Manchuria and the Northeast, the Kuo Min Chun in the Northwest, Wu P'ei-fu in the central north and the heart of the Yangtze Valley, Sun Chuang-fang in the lower part of the Yangtze Valley, and the Canton government in the South. Large portions of China, especially in the West, South and Southwest were not under the control of any of these major forces.

In addition to the vicissitudes of civil war, China was distracted in 1925 by a recurrence of anti-foreign demonstrations "such as have not existed since the Boxer Rebellion" to quote Mr. Kellogg, the American Secretary of State. In Shanghai particularly a strike in a group of Japanese-owned cotton mills led to demonstrations and disturbances which, aggravated and brought to a head by the shooting down of some students on May 30 1925 by the foreign police in Shanghai and then taking an anti-British and anti-Japanese direction, caused serious trouble to the trade and shipping of these two countries. This anti-foreign movement was fanned by the Bolsheviks, by the Red

Government of Canton, and by Feng, who published a series of manifestos against what he called "foreign imperialism." There was a widespread movement through the nation, partly led by students, which demanded the abolition of the "unequal treaties," and which was directed especially toward the cancellation of exterritoriality and the recovery of full customs autonomy. Towards the end of the year, there were signs that the anti-British movement was losing much of its force, but in Canton and adjoining sections it persisted, and it produced a most serious situation in Hong-Kong.

Despite these struggles, the tariff conference, in accordance with the terms of the Washington treaties, opened at Peking on Oct. 26 1925 but soon met with difficulties owing to the inability of Chinese delegates to give any adequate guarantees for the abolition of that irregular taxation (likin) which has caused such damage to trade in China. An agreement was reached for the restoration of full customs autonomy and the cancellation of likin, but delays were caused by discussion of ad interim duties, and with the increasing disorder in Peking due to the civil war, the conference practically came to an end in June 1926. The extraterritoriality commission, also arranged by the Washington treaties, began its sittings early in 1926.

II. ADMINISTRATIVE AND SOCIAL CONDITIONS

Government and Administration.—The revolution of 1911 brought with it a greater change than had occurred since the Han dynasties (206 B.C.–214 A.D.). The institution of emperor, which had its origin in prehistoric times, was abolished, and with it much of the political theory of the Confucian school on which the state had so long depended. In the struggle to find a substitute, ambitious military and political leaders, old ideas and standards and new political concepts from the Occident were inextricably mixed. It is no wonder that chaos resulted. Of paper constitutions there were a number, chief among them being the provisional one of 1912, which, much as in France, made the cabinet responsible to parliament and left the president largely a figurehead; the various attempts under Yüan Shih-k'ai; and the "permanent" constitution of 1924, with a division of powers between the central and provincial governments, a bicameral parliament, a president elected and partly controlled by parliament, and a premier responsible to the lower house. These constitutions were more honoured in the breach than in the observance, however, and were important chiefly as tentative and interesting experiments. In practice there was a president with a good deal of power, a premier and a cabinet constituted by the faction or factions in control in Peking, usually with scant regard to parliament, and during much of the time some kind of parliament. Political parties in the European and American sense of the term were largely unknown. The Kuo Min Tang, led by Sun Yat-sen and representing the radical elements that brought about the revolution, was probably the nearest approach to a party as that term is understood in the Occident.

The provincial and local administrations did not change as greatly as did the central Government. The old 21 provinces were maintained and a new one, Sinkiang, was added. New administrative areas were from time to time created, usually in the dependencies. At the head of each province there were in theory a military governor (tuchun) and a civil governor, with powers divided between the two, but in practice there was often no civil governor and the tuchun was usually supreme. There were, too, usually major divisions of the province, taos, with a *tao yin* over each. As in imperial days, the chief local administrative unit was the county, or *hsien*, and over each *hsien* was a magistrate with judicial, tax-collecting and policing powers and duties. The method of choosing or appointing officials has, in practice, varied greatly. Here and there were developments toward a different type of city government. Modern police forces of varying degrees of efficiency appeared in many cities.

Civil Service.—The political unrest and disorganisation is to some extent ascribable to the suddenness with which the ancient system of classical examinations for the public service was abolished (1906), and to the subsequent failure to develop a scheme which ensures the continuity of the competitive principle. Under both the empire and the republic there were various attempts to construct a new system of examinations, but none of these had the prestige or the success of the old plan. Nevertheless, the holding of office remained the chief highroad to wealth and distinction in China, and the number of aspirants to position under the government continued very large.

Justice.—Even before the Republic, beginnings had been made toward the compilation of new codes of law, partly on Western and Japanese models, but with the old code partly in theory and largely in practice remaining the law of the land. The chief new codes are the Provisional Criminal Code promulgated in 1912 and amended in 1914, the Penal Procedure Code, 1921, and the Civil Procedure Code, 1921. The Criminal Code seems to be the only one of these that is widely in operation. There has been sitting uninterruptedly since 1914 a Law Codification Commission, with able leadership and foreign advisers. A system of courts is planned in three grades, one in each department (*fu*), a higher one in each province, and a supreme court at Peking. These courts are to have officials with purely judicial powers. For the most part, the new courts have not been organised and justice is still locally administered by the *hsien* official. Military courts, too, have widely usurped the functions of the regular courts. Here and there, however, the new courts have appeared. There were, too, a good many modern prisons, the first one having been organised in Peking in 1912.

Defence.—As the result of the political disorganisation the Chinese Army, as a national defence organisation, practically ceased to exist, but the troops actually serving under one or other of the tuchuns are probably more numerous to-day than at any period of the Manchus' rule. The equipment and discipline of the troops have varied greatly, some armies being fairly well organised, as, for example, that of Feng Yu-hsiang, and others being little if any better than bandits. The transition from bandit to soldier has often been easy. No one knows the exact number in the various armies, but it is probably about a million.

Education.—Fully as significant and important as the political changes, and perhaps more so, has been the revolution in the realm of the intellect. This has been due primarily to contact with the Occident, a contact which has come through a variety of channels. Chief among these channels have been the extensive educational system conducted by missionaries, the migration—unprecedented for size in the history of the world—of thousands of students to foreign countries, the translation of a great many Western works, the writing of many books containing Western science and thought, and a new educational system built up by the Government and private individuals.

Probably the first of these chronologically has been the alteration in the educational system. When, in 1906, the ancient civil service examinations were abolished, the incentive for maintaining the older strictly classical type of education largely passed away. The new type of school which became popular usually taught some of the Chinese classics, but introduced so many "Western" subjects that the former were relatively neglected. The older classical scholarship was held in high respect and was in part perpetuated, but for a time it seemed in a fair way of becoming extinct. The new schools were conducted by various agencies—Christian missions (Protestant American ones leading), by Chinese in their capacity of private citizens and by the Government. In some fields of education missionaries led in efficiency, but as time went on the Government schools came to be more and more important. The educational institutions were of many kinds, primary, secondary and higher, with technical and professional schools. During the latter part of the period the most influential government institution was probably the National University of Peking, but there were others which attained prominence, notably the Southeastern University at Nanking, Pei Yang University in Tientsin, Nanyang University—largely for engineering—in Shanghai and Tsing Hua College at Peking for the preparation of students for the Boxer Indemnity scholarships in the United States.

Probably the most noted foreign-controlled institutions of higher rank were the splendidly equipped Peking Union Medical College, maintained by Rockefeller money and setting a high professional standard for the new medical profession of China, Canton Christian College, St. John's University, the University of Nanking, Yenching (Peking) University, Shantung Christian University and West China Union University. The Chinese have had a traditional respect for education, and in their perplexity over the existing disorder, with almost pathetic enthusiasm and trust, thoughtful and patriotic citizens have turned to education as the door out of the nation's difficulties. In 1922–3 there were said to be in all grades and types of schools 6,819,486 students, of whom 6,601,802 were in elementary schools, 182,804 in secondary schools, and 34,880 in colleges and universities. Only a small minority of these students were in foreign schools. Although education had improved greatly under the Republic, both in quantity and in quality, it was badly handicapped both by a lack of experience in the new educational methods and by a paucity of funds. Given a Government with revenues already insufficient for its needs, and constantly drained by great armies, teachers were often unpaid and important forward steps could not be taken. Since the great masses of the nation have remained illiterate, there have been various projects for their education. One of the most recent has been a plan begun after the World War by Y. C. James Yen for teaching illiterates to read the most frequently used characters.

One of the outstanding features of the new educational system was the part that students took in school and national affairs. They often controlled the institutions in which they studied, and when dissatisfied went on strike. Student strikes, indeed, formed one of the fairly constant features of this period. Students were enthusiastically interested in politics, and from time to time organised for action on a national scale. Thus the anti-Japanese boycott of 1919 was in large part their work. They took an active share in the Shanghai disturbances in 1925, and in the same year showed strong Bolshevik tendencies in Peking. Since the number of university students was relatively small, the larger proportion of the members of the student unions were still not out of secondary school, although they were often directed by older men. Youthfulness combined with other conditions to make the students often turbulent and lacking in poise and judgment, but they were ardent in their patriotism and were resentful of any infringement on China's dignity or sovereignty.

Religion.—Changes in the field of religion between the beginning of 1910 and the close of 1924 were less marked than in some other phases of Chinese life, but they were by no means absent. The monarchy could not be destroyed without serious damage to the dominant religious-political system (known to Westerners as Confucianism) which was bound up with it. The imperial sacrifices to Heaven and to other divinities that for centuries had been a part of the nation's life were discontinued, to be renewed in part and for a brief term by Yüan Shih-k'ai and then again allowed to fall into abeyance. After the revolution Confucius himself was partially discredited in radical circles. The Confucian temples that were so prominent a feature of the cities tended to fall into disrepair. They and the ceremonies in them, however, were usually not abandoned, but were frequently maintained, often by Confucian associations made up of scholars, gentry and officials. Ceremonies in the schools in honour of Confucius tended to fall off, but were usually not entirely given up. A system that had so long moulded the life and thought of China was not to disappear either quickly or easily. The time-honoured local ceremonies to the gods recognised by the older official religion largely continued, the ancestral cult had apparently as strong a hold on the nation as ever, and the ethics of Confucius and his school remained on the whole the standards of conduct. Even in the first flush of the success of the Revolution, the power of old traditions was seen in the official announcement of the establishment of the republic before the Ming tombs at Nanking. There were various attempts to revive or reform Confucianism. Thus in Peking was founded a Confucian Association, and in the "model province," Shansi, Governor Yen established halls for the regular preaching of Confucian ethics and for meditation. All of these attempts, however, seemed singularly lacking in enthusiasm and vitality.

Buddhism fared somewhat differently in various places and times. In the early days of the revolution there seemed to be a reaction against it, but before the close of 1924 many temples were being repaired, many neophytes were being ordained in the monasteries, and especially in east central China there was a revival of interest with a new literature and the reissue of old books.

Taoism showed little if any new life, and the large Moslem groups for the most part continued their existence without either decay or much new interest. Quite a number of new cults appeared, most of them attempts to combine older faiths into one. Prominent among them were the Tao Yüan, the T'ung Shan Shih, the Tao T'ung I Hui and the Lu Shen Chen.

Probably the greatest religious change was in the growth of the Christian Church. Catholic missionaries had been in China continuously since the 16th century, and Protestants since 1807. Their communities had been increasing steadily for 100 years. After 1900, however, and especially for the first few years after 1911, the breakdown of resistance to Occidental civilisation and the popularity of things Western, together with a fresh influx of missionaries, had led to a rapid growth of the churches. In 1923 the number of Roman Catholic Christians was put at 2,208,800, an increase of 71% since 1910, of foreign priests at 1,481, of native priests at 1,071 and of bishops at 57. Protestant communicants in 1922 numbered 402,539, the total Protestant community was estimated at 795,075 and the total number of missionaries at 7,663. The number of Protestant communicants had increased 132% since 1910, and the Protestant community 167% in the same period. Although smaller, the Protestant groups were more noticeable than were the Catholic.

The Roman Catholics were touching the life of the nation through churches, schools and orphanages, and the Protestants through churches, schools, especially secondary and higher schools, hospitals, Young Men's and Young Women's Christian Associations and many kinds of philanthropic endeavour. A number of Protestant Christians were prominent in national affairs. This rapid growth of the Christian Church aroused the antagonism of some of the student class, and in the spring of 1922 there began a violent anti-Christian movement which protested against Christianity partly on the ground that it was superstitious and unscientific and partly on the ground that it was an agent of Western imperialism. In 1924 the movement revived, and in addition to its earlier criticisms protested vigorously against Christian educational institutions. It looked as though the Christian Church were for some time to come to have a less rapid growth. Within Protestant communions there was, too, an increasing demand for independence from the control of foreign missionaries and an impatience with what were deemed Western interpretations of Christianity.

Social Customs and Institutions.—Social customs and institutions could not escape the change taking place in other features of Chinese life. Many of the older elaborate forms of courtesy were abandoned by the younger generation. At the time of the revolution there was extensive cutting of queues, for this form of head-dress was associated with subjection to the Manchus. For a time many Chinese affected foreign dress, but with the nationalistic reaction following the World War there was a tendency to return to native costume. Women often claimed and were given greater privileges. During the early years of the republic, for example, woman's suffrage was here and there granted. As the years passed, coeducation was introduced in many of the schools, including the higher schools, and in student circles the sexes, long so carefully segregated, mixed with much freedom. All this was, of course, a radical departure from the past, and in some cases led to moral shipwreck. The fundamental institution of Chinese society, however, the family, for the most part remained unshaken. Here and there it was threatened by the new customs, by life in the big cities and by the gathering of workers into the new factory communities, but for the most part it was unaltered.

III. FINANCIAL AND ECONOMIC HISTORY

The economic side of Chinese life was affected, on the whole, by three agencies: continued contact with the commerce and industry of the West, the World War and internal disorder. These agencies were helping to bring about the following changes: (1) a progressive disintegration of government finances in spite of attempts at budgets and the foreign supervision of some of the main sources of revenue; (2) an increase of the public debt, both foreign and domestic; (3) the continuation of chaos in the currency; (4) the growth of a Western type of Chinese bank; (5) the growth of chambers of commerce; (6) the beginnings of the industrial revolution, including the rise of modern factories; (7) a general increase of prices; (8) an irregular increase in foreign commerce; (9) the stability of agriculture, but certain modifications in it, especially the renewed cultivation of the poppy for opium; (10) a continuation of famines in various sections of the country; (11) the beginnings of modern forestry; (12) a slowing down of the development of mining; (13) a decline in railway building and the deterioration of many of the lines already constructed, but a growth in modern roads; and (14) a rapid increase in the telegraph and postal service. These will be briefly considered in the order given.

Finances.—The partial breakdown of the machinery of the central government at the time of the revolution led to trouble with finances. Order was in part restored by Yüan Shih-k'ai, but after his death much of the revenue that would ordinarily have gone to the central government was absorbed by the military leaders. The chieftains in more or less temporary control of a district or province often collected the land tax for several years in advance and transmitted little or none of it to Peking. Official peculation probably increased rather than declined. In the face of this disorganised revenue, the government needed increased sums, not only to maintain the immense and profitless armies of the tuchuns, but to meet such new expenses as those for education. The difference had to be met by loans. There were professed attempts at budgets, but these were not an accurate picture of the situation and had very little effect. The budget of the eighth year of the Republic for July 1919 to June 1920 was as follows:—

Revenue

I. Ordinary		II. Extraordinary	
1. Land tax	$86,845,388	1. Land tax	$3,703,399
2. Customs revenue	93,268,907	2. Customs revenue	695,749
3. Salt revenue	98,815,071	3. Tax on commodities	26,685
4. Tax on commodities including likin	39,224,837	4. Regular and miscellaneous duties	3,911,410
5. Regular and miscellaneous taxes	29,182,693	5. Income from government investment	31,522
6. Regular and miscellaneous duties	4,332,541	6. Miscellaneous income of provinces	293,037
7. Income from government investment	2,411,368	7. Income of central administration	3,519,838
8. Miscellaneous income of provinces	5,579,263	8. Income directly received by central government	17,451,910
9. Income of central administration	3,105,869	9. Miscellaneous income of central government	
10. Income directly received from central government	47,072,064	10. Loans	50,948,235
	$409,838,001		$ 80,581,785
Total Revenue			490,419,786

Expenditure

I. Ordinary		II. Extraordinary	
1. Foreign affairs	$ 4,807,336	1. Foreign affairs	$ 1,168,555
2. Interior	43,279,539	2. Interior	4,891,183
3. Finance	39,154,446	3. Finance (including loan service)	136,113,435
4. War	129,588,829	4. War	78,243,653
5. Marine	9,194,482	5. Marine	185,024
6. Justice	10,323,124	6. Justice	6,852
7. Education	6,058,723	7. Education	461,912
8. Agriculture and commerce	3,257,050	8. Agriculture and commerce	442,357
9. Communications	1,865,586	9. Communication	163,508
10. Mongolian and Tibetan affairs	1,318,842	10. Mongolian and Tibetan affairs	50,000
11. Central administration	22,441,350	11. Central administration	2,748,192
	$271,289,207		$224,473,681
Total Expenditure			495,762,888

In 1923 a commission for the readjustment of finance, under the chairmanship of Dr. W. W. Yen, was appointed. In a preliminary report it said that the income of the central government actually was only $148,000,000, that of this $141,000,000 went for domestic and foreign loans and military subsidies, leaving $7,000,000 to meet expenses estimated at $128,000,000. A general report by the Commission, submitted to Marshal Tuan Chi-jui in Feb. 1925, outlined a series of financial reforms, including the consolidation of national indebtedness, the reapportionment of national and political revenues, the enforcement of economy in national expenditure and the encouragement of industrial development, but in its final recommendations it added: "The key to the solution of the present situation is to be found in the reduction of military forces. Unless military forces are greatly reduced, the provinces will not be in a position to reduce their expenditures. If the provinces cannot reduce their expenditures, they will not be able to remit the entire collections of national revenues to the Central Government. If the Central Government be denied complete control of such national revenues, it will scarcely have sufficient funds either to meet its loan obligations or pay all the administrative expenses. If that should be the case, then China will not be able to maintain her national prestige abroad, nor can she effectively carry out the work of consolidation at home."

Customs Revenue.—The revenues collected by the Maritime Customs for the years 1916–20 were as follows:—

	Hk. Taels		Hk. Taels
1916	37,764,311	1921	59,007,129
1917	38,189,429	1922	59,359,194
1918	36,345,045	1923	63,378,000
1919	46,009,160	1924	69,550,000
1920	49,819,885		

sterling equivalent of the 1924 collection at the average exchange of the Haikwan or Customs Tael of 3/7 $\frac{15}{16}$ being £12,732,000.

The maritime customs, under its foreign leadership, continued to function for the entire country, but most of its proceeds were pledged to meet sums due abroad.

By an agreement concluded between the Allied Powers and China in the autumn of 1918, the import tariff was revised and new duties fixed at specific rates, calculated to produce an effective 5% *ad valorem* levy. There was an additional revision in 1922 by a commission authorised by the Washington conference.

Salt Gabelle.—In Jan. 1913, during negotiations for a loan from the group banks, it was decided that all salt revenues were to be held as a special account. The following figures show the net revenue paid into the group banks:—

1914	$60,409,675.75[1]
1919	80,607,000
1921	77,988,000
1922	85,789,049.57
1924	70,544,475.86

the decline in 1924 being mainly due to transport difficulties owing to the civil war.

China's Indebtedness.—With the revenues in such a deplorable condition and the government so disorganised, recourse was constantly had to loans. Some of these were obtained abroad, and the creditor usually insisted on fairly good security. Large amounts, however, especially those owing to Japanese, were not considered to be good risks, and by 1922 the foreign legations found much of their occupation in trying to wrest instalments of interest and principal from an impecunious government. Large loans were, too, floated in China itself. Sometimes the "loan" was to a chieftain in control of some city, and was merely a euphemism for an illegal tax levy.

The best report of late years seems to be that of Dr. Lo Wen-kan, made at the end of 1922. It showed the total indebtedness at the end of Sept. 1922 to be $1,726,400,000 (or less than $5 per capita of the Chinese population), of which $208,400,000 were domestic loans with security, $249,000,000 were domestic loans without security, $1,029,000,000 were foreign loans with security, and $240,000,000 were foreign loans (including interest in arrears) without security. In addition, unpaid military and civil expenses amounted to $180,000,000. This total indebtedness was not large when compared with the total wealth of the country and the debts of other nations. Given, however, a government whose income was constantly exceeded by its expenses, further loans were hard to obtain even at large premiums and high rates of interest. It must be added, however, to make the picture complete, that some loans, even some of those owed in China, have been repaid in whole or in part during the past few years. Some of the security, moreover, is excellent, including especially the maritime customs and the salt gabelle, which are collected under foreign supervision. Since, however, the fairly reliable sources of income have been so largely used to secure loans, the revenue available for current government expenses has been further reduced and further loans necessitated. The end of 1925 saw little if any prospect of relief.

Currency.—In the commercial treaty concluded with Great Britain in 1902 China undertook to create a uniform national coinage. In 1908, the government considered that the best solution of the matter would be a standard "tael," and orders were issued to the provincial authorities accordingly. In 1910 this plan was abandoned and a 72 candareen dollar was adopted as the standard national coin. In April 1911 an agreement was concluded between the ministry of finance and the four-power consortium for a loan of £10,000,000 of which £8,500,000 were to be used for the reform of the currency. Owing to the outbreak of the revolution, however, the loan was not floated. In 1912 the establishment of a gold standard was discussed, but in March 1914 the silver dollar was definitely adopted, and in 1914 and 1915 coins bearing the effigy of Yüan Shih-k'ai were minted at Tientsin in large numbers. There had already been a considerable production of "standard" dollars by the mints at Nanking and Wuchang. A memorandum by the minister of finance in 1918 put the total coinage of new dollars (of 89% fineness) between 1914 and 1918 at 184,000,000, against which 52,000,000 of old coins were withdrawn from circulation. The currency law promulgated in March 1914 was intended to secure a limited coinage of dollars and subsidiary decimal coins of fixed values. Regulations to this end were adopted by a currency commission advised by Dr. G. Vissering, President of "De Javasche Bank," but the government authorities themselves failed to observe them and the output of the mints continued to be regulated by the necessities and opportunities of the officials concerned. The copper coinage, in particular, rapidly deteriorated. In Aug. 1918 the minister of finance (Tsao Ju-lin) proposed the issue of gold currency notes and the establishment of a currency department under the direct control of the premier. The president endorsed the scheme by mandate, but the opposition was so strong that it was indefinitely postponed. With the increased number of dollars minted in China the number of foreign dollars, especially the Mexican, has declined. Many Mexican dollars have been melted down and the bullion either reminted or exported.

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[1] Administrative expenses amounted to $4,897,054, or 9·7% of the revenue, while during the year $31,304,818.22 was released to the Chinese Government.

The chaotic condition of the metal currency has been aggravated by the fact that numerous native banks and provincial governments have issued large quantities of bank-notes, in taels and dollars, for the most part unsecured by bullion reserves and circulating at varying rates of discount. During the revolution, moreover, military notes were indiscriminately issued. The government has since redeemed part of them. Now and then there has been an attempt to put some of the provincial notes on a specie basis, the old issues being redeemed at a discount, but as a rule efforts at reform have been transient. Many foreign banks having branches in China also issue bank-notes and these circulate freely in the treaty ports.

The currency, then, is in greater chaos even than under the Manchus. Dollars accepted at par in one city circulate at a discount in another; subsidiary coinage passes at various rates of exchange, and neither the copper ten-cash pieces nor the cash pieces are uniform. Paper money of various degrees of security and lack of security and many different kinds of taels help to make the confusion worse confounded.

Banks.—There had been, of course, foreign banks in China for many years, and the number increased during the republic, especially by the addition of Japanese and American firms. These were for the most part stable institutions, and the failure of the (French) Banque Industrielle de Chine in 1921 made quite a sensation. There continued to appear an increasing number of Chinese banks organised on Western models, some of them with governmental participation such as the Bank of China (organised 1911) and the Bank of Communications (established 1908), but most of them are purely private concerns.

Manufactures.—One of the marked developments has been the rapid growth of factories. These are still largely confined to the treaty ports and to northeast China and the lower and central parts of the Yangtze Kiang Valley. By far the larger proportion of Chinese industry is, as it has been in the past, in the handicraft stage and organised by guilds. However, in such centres as Shanghai, the Wu-han cities (Hankow, Wuchang and Hanyang), and Tientsin modern factories are important and seem to presage a beginning of a great industrial revolution.

In his report on trade for 1919, the statistical secretary (Inspectorate General of Customs) observed that there were then few foreign type articles of domestic use that were not made in China by factories on modern lines, the majority of them without foreign assistance. In 1906 there were 14 cotton-spinning mills in China, with a total of 400,000 spindles; in the *China Year Book* for 1919, the number given is 56. The *China Year Book* for 1924 gives the number at about 200 and takes 62 pages to list the various factories—and the list is admittedly incomplete. The most numerous of those given are albumen factories, canneries and biscuit companies, cement and brick works, cotton mills, distilleries, breweries and aerated water factories, dockyards, shipbuilding and engineering works, electric light and power plants, flour mills, ice and cold storage plants, iron and steel works, leather tanneries and factories, match factories, oil mills and bean cake factories, printing and lithographing works, rice-hulling and cleaning mills, silk filatures, soap and candle factories and tobacco factories. The great majority of these are operated by Chinese capital, although a good many important ones are owned by foreigners. With the shortage of raw materials and the growth of labour troubles in Europe Chinese capitalists, and the rich merchants of the treaty ports came to realise after the War how great and lucrative are the opportunities awaiting the industrial development of China, with its vast resources of cheap labour and raw materials, in competition with the manufactures of the West. Japanese capitalists and captains of industry showed themselves equally alive to the possibilities of the situation. As a result, the development of industrial enterprises of many kinds, but especially in textiles, in the period immediately following upon the Armistice was limited only by the impossibility of obtaining the necessary machinery. There came in time the inevitable reaction, and since 1922 nearly all factories have been working only part time or with greatly reduced forces.

The gradual industrialisation of labour has complicated the situation, particularly in regard to the employment of children, concerning which the Child Labour Commission appointed by the Shanghai Municipal Council issued a valuable report in July 1924. The industrial changes have also led to an increase in the number and activities of labour unions, particularly in the south, in Central China and in Shanghai; but owing to their tendency to work in the dark it is impossible to obtain reliable statistics. The most powerful union is that of the seamen, which organised the great strike at Hongkong. Serious strikes were those of the Chinese workers on Shameen (the foreign concession of Canton), the silk workers' strike in Shanghai in the summer of 1924, and the strike in the Japanese cotton mills in Feb. 1925. The Bolshevik propaganda in China is more political than economic, and is more successful among the students than the workers. Labour too is mobile, and when a Chinese artisan is dissatisfied with life in the city he can always return to his native village.

Prices.—One of the features of the late years has been a rise in prices, with a consequent increase in the cost of living. This was probably inevitable. Prices in China compared with those in the rest of the world were formerly phenomenally low, and increasing commerce with the West has tended to force them upward, particularly during and since the World War. No accurate survey has ever been made of cost of living and wage statistics throughout the whole country, but the following figures may serve to indicate the general trend. In Shanghai the wholesale index number of commodity prices for April 1923 was 157·7 as compared with prices for Feb. 1913 and 118·4 as compared with prices during Sept. 1919. This does not include the cost of rent. The cost of living of a middle-class family in Peking is reported to have increased from $77.50 in 1912 to $116 in 1922, and the following is a table of food prices in Peking:—

	1902 cost	1912 cost	1915 cost	1919 cost
Ordinary cloth (1 foot) . . .	5	70	120	140
Rice (per catty)	40	80	90	100
Flour (per catty)	35	50	70	80
Pork (per catty)	70	200	220	230
Beef (per catty)	60	180	200	200
Mutton (per catty)	60	180	190	190
Cabbage (per catty)	2	5	6	7
Anthracite coal (per ton) . . .	$. .	$3	$12	$13

These prices, of course, are in cities directly in contact with foreign commerce. The increase in prices has probably not been as rapid in the interior. Whether the increase in wages has kept pace with the increase in prices is uncertain. The general level for skilled and semi-skilled labour has risen more rapidly than that for unskilled.

Agriculture.—The principal industry of China is agriculture. Probably from 70 to 80% of the population are engaged in it, and 73% of the exports of China are agricultural products. Since the revolution it has been remarkably stable, the farming population being less influenced by the changes abroad in the nation than any other class. There have been some modifications in the crops raised, however, which may affect the welfare of the country. Such new economic factors as the widespread revival of opium-growing (forbidden by imperial edicts and actively suppressed between 1907 and 1911), and the extension of the cotton-growing area due to the successful development of the spinning industry, probably involve a reduction of the home-grown food supply. These changes, unless accompanied by an increase of national wealth sufficient to replace it by purchases from abroad, may expose the nation to increased danger of famine in bad years.

According to the report on trade published by the statistical secretary of the maritime customs in April 1920, the cultivation of the poppy had been regularly resumed on a wide scale in several provinces, notably Szechwan, Yunnan, Kweichow and Fukien. By 1924 Anhwei, Honan, Hunan, Kansu, Kiangsi and Shensi were also reported to be cultivating the poppy extensively. This was at least partly due to military commanders who found in opium a convenient source of revenue and insisted upon the cultivation of the poppy in districts under their control. In 1925, however, there was evidence of a decline in opium cultivation except in Fukien and part of Szechwan, Yunnan and Kweichow due probably to economic disturbances. Between 1913 and 1918 the area under cotton cultivation steadily increased, in response to the growing demand of the spinning and weaving industries in Japan and at Shanghai, Hankow, Tientsin and other industrial centres, the chief producing areas being Chihli and Kiangsu. By 1919 China was third on the list of cotton-producing countries. By the close of 1921, however, there was a marked decline in the production of cotton. One estimate placed the crop at 1,002,000,000 catties in 1918, 931,000,000 catties in 1919, 675,000,000 in

1920 and 543,000,000 in 1921. The decline seems to have been due to internal war, brigandage and floods. The year 1922 showed an improvement, as probably did 1923. Other recent features of the agricultural situation are the rapid extension of the bean-growing area in Manchuria and the development of wheat cultivation (combined with a steady increase of the flour-milling industry) in North China and the central Yangtze provinces.

Famines.—Throughout her long history China has periodically suffered from famines, and with the disorganisation of the government which followed the revolution these naturally did not cease. A year seldom passes without one or more sections of the country experiencing an extreme dearth of food. In 1911 there was a severe famine due to floods in the Hwai river basin, and there was a serious one in North China in 1917 following floods. The most extensive and severe famine of recent years was in 1920 and 1921 in Chihli, Shantung, Honan, Shansi and Shensi, and was due primarily to prolonged drought in 1920 following a poor crop in 1919 and floods in 1917–8. Out of a population of about 50,000,000 nearly 20,000,000 were said to be destitute. Relief on a large scale was undertaken by the government and foreign and Chinese private agencies. Much of the foreign aid, especially that of the American Red Cross, was given in return for work done by those relieved, especially in the building of roads which would help to prevent future famines.

EXPORTS AND IMPORTS

The World War and the years immediately succeeding it brought from abroad a great demand for foodstuffs and raw materials, and Chinese exports increased rapidly. The totals of imports and exports for the years 1918–23 were as follows:—

Year	Net Imports[1] Hk. Taels	Exports Hk. Taels	Total Hk. Taels
1914	569,241,382	356,226,629	925,468,011
1915	454,475,719	418,861,164	873,336,883
1916	516,406,995	481,797,366	998,204,361
1917	549,518,774	462,931,630	1,012,450,404
1918	554,893,082	485,883,031	1,040,776,113
1919	646,997,681	630,809,411	1,277,807,092
1920	762,250,230	541,631,300	1,303,881,530
1921	906,122,439	601,255,537	1,507,377,976
1922	945,049,650	654,891,933	1,599,941,583
1923	923,402,887	752,917,416	1,676,320,303

[1] Net imports, *i.e.*, the value of the foreign goods imported direct from foreign countries, less the value of the foreign goods re-exported to foreign countries during the year.

The following statistics show the amount of China's direct trade with the foreign countries concerned and indicate some of the important changes due to the War:—

Table I.

Imports from	1913 Hk. Taels	1919 Hk. Taels	1922 Hk. Taels	1923 Hk. Taels
Great Britain	96,910,944	64,292,239	145,292,550	120,397,229
Germany	28,302,403	368	24,744,130	3,735,472
France	5,299,517	3,375,809	4,555,510	7,548,654
Japan	119,346,662	246,940,997	231,428,885	211,024,297
U.S.A.	35,427,198	110,236,706	169,004,534	154,447,651
Hongkong (for transhipment)	171,366,099	153,631,544	239,347,671	248,083,456
British India		26,980,705	43,139,628	55,240,982
Korea	..	9,431,450	9,685,698	..
Russia (overland trade)	17,258,180	1,724,603	7,111,932	10,202,819[1]
Russia (Amur and Pacific ports)	..	12,323,532	7,129,539	..

Table II.

Exports to	1913 Hk. Taels	1919 Hk. Taels	1922 Hk. Taels	1923 Hk. Taels
Great Britain	16,346,413	57,186,242	38,507,874	43,207,130
Germany	17,025,224	163,886	9,804,806	11,914,718
France	40,749,782	34,285,989	40,755,834	39,577,659
Japan	65,544,186	195,006,032	159,754,351	198,517,546
U.S.A.	37,650,301	101,118,677	97,579,046	126,803,772
Hongkong (for transhipment)	117,128,661	131,495,296	169,995,691	175,796,249
British India	..	9,599,413	9,816,734	12,329,306
Korea	..	22,617,954	21,237,383	..
Russia (overland trade)	3,095,826	5,516,517	7,597,051	34,092,022[1]
Russia (Amur and Pacific ports)	..	15,770,598	31,646,422	..

[1] These figures include imports and exports *via* European ports, Russian Amur ports, Pacific ports and by the Siberian land frontier.

The major articles of import and export had varied somewhat, as is shown in the following table:—

Imports

	Opium	Cottons	Metals	Foodstuffs	Machinery and Vehicles	Kerosene	Tobacco
	%	%	%	%	%	%	%
1879	44·43	27·48	5·03	..	..	..	..
1899	13·5	39	3·5	16	..	5	..
1919	..	33	9	13	5	8	4
1922	..	27·56	5·28	19·01	5·23	6·71	4·40

Exports

	Tea	Silk	Sugar	Oil-seeds, oil and oil cake	Cereals flour, etc.	Animal food-stuffs
	%	%	%	%	%	%
1879	46·03	39·60	3·07	..	...	..
1899	16	41·4	..	6	3	1·4
1919	4	22	..	24	6	5
1922	2·59	26·28	..	16·37	2·07	3·96

The returns of shipping entered and cleared at Chinese ports during 1919 show comparatively little change during and since the War except in 1924, when the Yangtze Kiang shipping was seriously affected by the civil war. The figures for the principal foreign nations concerned are as follows:—

Nationality	1913		1919	
	Vessels	Tonnage	Vessels	Tonnage
American	2,458	898,750	4,433	2,569,887
British	32,186	38,120,300	36,074	36,284,312
Norwegian	637	739,328	311	302,959
German	5,382	6,320,466	..	...
French	1,020	1,232,763	471	414,161
Japanese	22,716	23,422,487	27,182	27,532,449
Dutch	..	..	362	461,782
	1922		1923	
	Vessels	Tonnage	Vessels	Tonnage
American	4,670	4,846,437	4,994	5,968,261
British	40,075	47,698,139	44,055	51,965,230
Norwegian	699	959,463	588	848,138
German	126	447,050	364	1,369,016
French	1,707	1,626,586	1,948	1,839,731
Japanese	25,281	32,961,333	25,063	33,288,617
Dutch	502	1,487,121	525	1,644,279

In addition, it is well to note that Chinese vessels of foreign style, sailing under the Chinese flag, increased in number from 43,638 in 1918 to 52,146 in 1922, and in tonnage from 16,984,523 in 1918 to 28,644,588 in 1922. Vessels of Chinese type, built and owned by Chinese and cleared at the Maritime Customs, decreased in number from 87,164 in 1918 to 58,973 in 1922, and in tonnage from 4,798,181 in 1918 to 4,213,157 in 1922.

Forestry.—Scientific and careful work in forestry has long been one of the great economic needs of China, partly to provide needed timber and partly to regulate the flow of streams. Various attempts at a scientific forestry policy, all more or less abortive, have been made by the central government under the republic. A few of the provinces have been somewhat more successful, among them Kiangsu—its forest nursery near Nanking has a yearly output of 3,000,000 seedlings; and a number of private and semi-private companies, among them some of the railways, have undertaken reafforestation. Forestry schools have been founded, probably the best of which is that connected with the (Christian) University of Nanking, and there have been attempts at educating the public on the importance of forest conservation. The Tsingtao forest reserve, begun by the Germans and continued by the Japanese, is the most successful experiment of its kind in China, but the progress made in this direction has not been great.

Mining.—The mineral industry in China has advanced under the republic, but not as much as might have been expected. In 1913, inspired by a minister of commerce (Chang Chien) with some practical knowledge of modern industrial methods, the government of the republic took up the subject of mining regulations. The result was over 300 of these, issued under seven headings, at various dates between March 1914 and July 1915. By this code the government for the first time asserted the claim of the state to dispose of all mineral rights, and "no longer to allow landowners to hinder mining development"; at the same time, it reduced the hitherto exorbitant rate of direct taxation levied on the industry. But it still left the miners' produce exposed to export duties and transit taxes amounting to over 10%, in addition to property tax, land tax and output tax. The unwillingness of Chinese officialdom under the republic to encourage any extensive development of mining enterprise by means of foreign capital has evidently been inspired, as it was under the monarchy, by fear that the employment of foreign capital and experts is likely to produce the extension of foreign influence. The chief of the Chinese geological department (V. K. Ting), writing on the subject in May 1917, declared that the chief obstacle to the rapid extension of mining operations by foreigners in China lies in the continuance of their claim to extra-territorial rights; that China cannot afford "to allow people who are outside Chinese jurisdiction to locate mining areas under the claim system." Quite a number of foreign mines have been developed, however, especially by the Japanese.

Coal mining is the most important of the mining industries of China. The supply was probably formerly overestimated. Late figures (those of the Geological Survey of China) give the reserve at 6,252 million tons of anthracite and 17,183 million tons of bituminous and lignite, and the reserve may total 40 or 50 billion tons. While at the present rate of production this would supply China for more than 2,000 years, consumed at the rate that prevails in America it would last only 70 years. The total production of coal in China was estimated in 1913 at 13,190,000 tons; two years later the estimate was 18,000,000, of which 8,000,000 came from mines equipped with modern plant and the rest from small native workings. In 1920 the amount produced was estimated at a little over 20,000,000 tons, and in 1922 at a little less than that figure. An increasing proportion was produced from modern mines. The amount of coal exported in 1918 was 1,708,149 tons; in 1919 it fell to 1,744,433 tons; in 1923 it rose to 3,108,682 tons. The most important coal-producing enterprises are the Kailan Mining Administration (an Anglo-Chinese co-operative company) in Chihli and the Fushun mines (Japanese) in Manchuria, both of which are rapidly expanding. The principal metals which China has so far been able to produce in quantities sufficient for export are antimony, tungsten (for these two metals and their ores China is the leading producer of the world), pig-iron, iron ore and copper. The trade in antimony was stimulated and the price advanced during the War, but in 1919 the demand had greatly diminished. The iron resources of China, like those of coal, were formerly overestimated. The amount of ore is probably about 1,000 million tons. The output in 1917 was 890,282 tons, and in 1923 1,150,828 tons. Much of this is shipped to Japan for smelting. Just how much petroleum is in the country no one knows. Great expectations were aroused by a concession to the Standard Oil Company in 1914, but after more than $2,000,000 had been spent in investigation, chiefly in Shensi, work was stopped, presumably because the supplies found did not justify further expense.

IV. COMMUNICATIONS

Waterways.—In Dec. 1913 a National Conservancy Bureau was established, under the presidency of the progressive minister of commerce Chang Chien, with Mr. Van der Veen as consulting engineer, to deal with irrigation and river conservancy matters. The conservancy of the Hwai river, with a view to the prevention of floods in Kiangsu and Anhwi, received special attention. In July 1914 this river was surveyed by engineers sent to China by the American Red Cross; their investigations were followed by an agreement between the American International Corporation and the Chinese Govt. for a conservancy scheme. As the cost of the proposed work necessitated the raising of a foreign loan, the scheme was perforce postponed upon the outbreak of the World War. In 1922 the Chinese Foreign Famine Relief Committee renewed the project by forming the Hwai River Conservancy Board. Conservancy operations were begun in 1916 to improve the bar at the mouth of the Liao river. The bar at the mouth of the Hai Ho, leading to Tientsin, has been dredged, and a little progress made toward regulating the streams of Chihli and the Yellow river. Much work has been done in canalising the Hwangpu (to Shanghai) and in improving the Min river below Foochow.

Railways and Roads.—The outbreak of war and the impossibility of raising further foreign loans resulted in the suspension of several railway enterprises, projected and commenced. Several important agreements had been concluded by the Chinese Govt. in 1913 and 1914 for the construction of new lines. Most of these were compelled to await the restoration of conditions favourable for financing these undertakings abroad. The railways for which preliminary or final agreements were thus concluded, included the following:—

Tatung to Chengtu (Franco-Belgian capital); approximately 960 miles. This line forms part of a general scheme intended to provide through communication betweeen French Indo-China and Kalgan, connecting with the Peking-Kalgan railway extension, with the Hukwang system and with a French line to Yunnanfu.

Yamchow (near Pakhoi) to Yunnanfu, and thence to Chungking (in the Yangtse Kiang basin) (French capital); about 1,000 miles.

Sinyangchow to Pukow (Kiangsi Province) (British capital). This is the final agreement (Nov. 14 1913) for a concession originally granted in 1898. Length of line, about 275 miles.

Shasi (Hupeh Province) to Singyi (British capital), a "construction" contract (Dec. 18 1913) for about 800 miles.

Nanking to Hunan (British capital), about 1,000 m. of line, via Ningkwo and Nanchang to Pingsiang.

In addition to these, agreements were made by the Chinese Govt. with the German and Japanese Govts. respectively for the construction of a number of railways in Shantung and Manchuria and Mongolia. (In Oct. 1918 the Industrial Bank of Japan issued a loan of 50,000,000 yen for the building of these lines, including two of the ex-German railway concessions in Shantung.) Two other important railway agreements were made by the Chinese Govt. during the War, namely, one (March 1916) with the Russo-Asiatic Bank, for a Chinese Govt. Railway from Harbin to Aigun, with several branch lines, and another (May 1916), with an American syndicate, for the construction of a number of proposed Railways, aggregating 1,500 miles. In 1919 and 1920 a contract was signed for the construction of 37 m. of additional line on the Taokow-Tsinghwachen line. In 1920 a contract was signed with Belgian and Dutch concerns for the construction of the Lunghai Railway.

The World War put an end to most construction work, although the line from Wuchang to Changsha was finished (on the Canton-Hankow road) and there was some work on the Peking-Kalgan line until the autumn of 1915. After the War, work was pushed on the Lunghai Railway and on the Kalgan line, and there was some work on the Peking-Moukden line. Financial conditions in Europe and political and financial chaos in China, however, checked construction. During 1924 the extension of the Lunghai Railway was carried on, and Wu Pei-fu interested himself in a number of new schemes.

Coincident with the government's adoption of the programme of active construction indicated by these concessions, the policy was definitely adopted of centralising control of the various provincial railway systems and unifying their accounts and methods of management. A commission was appointed for the purpose in 1913, under the presidency of Tih Kung-Chao (minister of communications, 1920), with the assistance of an American adviser. On Jan 1 1915 the unified methods came into operation, with the result that the annual reports on Chinese Govt. Railways, subsequently published by the ministry of communications, afford a comprehensive statement of the financial and general situation. The following figures are taken from the ministry's report for the year ending Dec. 31 1919:—

The total length of railway lines in China at the beginning of 1920 was 6,813 m. (10,963 km.), consisting of government and "concessioned" railways, as follows:—

	Km.	Km.
Government Railways—		
In operation	..	6,027
Operation by construction forces:		
Lunghai	368	..
Hupeh-Hunan	15	383
Total Govt. Railways	..	6,410
Provincial and Private Railways—		
Kwangtung	225	..
Kiukiang-Nanchang	136	..
Sunning	171	..
Swatow-Chaochowfu	42	..
Nanking City	11	..
Chung Hsien Mining Co.	52	..
Liu Chiang Coal Mine	12	..
Tayeh Mining Co.	30	..
Ching Hsing Mining Co.	15	..
Kailan Mining Administration	16	..
Tayaokow Mines	29	..
Tsitsihar City	29	..
Ma Chiapu Narrow Gauge	5	773
Total subject to control of the Ministry of Communications	..	7,183
"Concessioned" Railways—		
Chinese Eastern	1,722	..
South Manchurian	1,107	..
Shantung	451	..
Yunnan	465	..
Canton Kowloon (British section)	35	3,780
Total kilometres of railway in China (6,813 miles)	..	10,963

The Ministry's report for 1922 showed on government lines a surplus for the year of $29,584,800.49; the number of passengers carried, 35,600,834; and the number of ton kilometres, 3,981,534,813. The surplus in 1923 was $23,753,359 and in 1924, $22,641,643. Progressively during the past few years, however, rail service has been disorganised owing to internal strife. Contending generals have seized portions of lines, disarranged the schedule, mishandled the rolling stock, failed adequately to maintain the road bed, and appropriated much of the income. This disorganisation was especially marked after 1922.

Over most of the country, roads remained as they had been under the empire, in what in the Occident would be considered a wretchedly poor condition. In some few places, however, notably as the result of foreign famine relief agencies, better and modern roads began to appear, some of them metalled. Considerable progress has been made in Kiangsu, Shantung, Shansi and Chihli.

Telegraphs.—In 1912 the head office of the Chinese Telegraph Administration, until then located at Shanghai, was transferred to the Telegraphic Bureau of the Ministry of Communications at Peking and a uniform scale of charges was introduced. In 1915, the total length of lines in operation was 42,518 m., with 710 stations. In 1921, the length of lines was 55,331 m. and of stations 909. There has been, as may be gathered from these figures, a marked increase in the use of the telegraph. Messages are transmitted either in foreign languages or in Chinese, the rate for foreign messages being 50% higher than that for Chinese. A beginning has been made in wireless communication. A few foreigners (Danes) are still employed in the administration, and a Danish adviser is attached to the telegraph departments of the ministry at Peking.

Posts.—It has been one of the anomalies and one of the encouraging features of the Chinese situation that, in spite of internal disorder, there has been a great increase in the postal service. Originally organised as a branch of the imperial maritime customs, the postal service was separated from that administration and placed under the ministry of posts and communications in May 1911. Under the republic it has remained a department of that ministry, but responsible for its own budget and organisation. Since 1911 the department has been controlled by a Chinese director general and a French associate director. Its activities extend not only over the 18 provinces, but through the New Dominion and Manchuria.

During the three years 1916–8, after the death of Yüan Shih-k'ai, postal operations and extensions in many provinces were seriously hampered by the depredations of bandits and lawless soldiery. In Shensi alone, 78 post-offices were looted in 1918. Nevertheless, in that year the number of district offices and agencies had increased to 9,367 (as compared with 5,357 in 1910), employing 27,000 Chinese, with a foreign staff of about 110. The growth of the service is shown by the following figures:—

	Offices and agencies	Articles posted	Parcels posted	Courier lines *li* (33 miles)	Steamer and boat lines *li*
1906 . . .	2,096	31,994,143	400,126	153,000	17,000
1911 . . .	6,201	116,748,914	954,740	319,000	45,000
1916 . . .	8,797	233,234,373	2,232,100	421,000	64,700
1920 . . .	10,469	400,886,935	4,126,220	603,300	74,600
1921 . . .	11,032	442,116,358	4,569,660	637,800	79,300
1922 . . .	11,306	426,363,616	4,791,420	658,400	82,900
1923 . . .	11,596	473,641,716	5,307,910	667,900	83,500

	Money Orders issued	Money Orders cashed
1904	$ 752,507.52	$ 749,773.69
1911	5,937,582.36	6,008,958.95
1916	15,965,588.76	15,787,069.94
1918	35,335,846.56	34,798,589.80
1920	58,923,606.12	58,409,255.11
1922	76,517,900.00	75,795,600.00
1923	95,993,800.00	96,021,200.00

The surplus of income over working expenses increased from $238,715.72 in 1915 to $4,456,823.94 in 1923. The staff increased from 8,863 in 1908 to 35,487 in 1924. Of these, 97 in 1908 and 115 in 1922 were foreign employees.

The Minchu or native postal agencies which had flourished before the organisation of the postal administration continued to exist, but with a declining importance.

China joined the Postal Union in 1914. In 1922 the foreign postal agencies in China ceased to operate, as provided by the Washington Conference. The number discontinued was ninety-two.

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CHINESE EASTERN RAILWAY (*see* 14.553).—In 1895 there was formed, under Russian charter, but with a predominance of French capital and with some capital owned by the Chinese Govt., the Russo-Chinese Bank. When, in 1896, Russia obtained from China permission to shorten the Trans-Siberian Railway by building a line across Northern Manchuria the Tsar's Govt. had already paved the way, by an agreement with the Russo-Chinese Bank, for the organisation of a railway company. Accordingly, in 1896, the bank formed the Chinese Eastern Railway Company. The statutes of this corporation were to be co-ordinated with those of the Russian railway companies. Only Russians and Chinese were to be shareholders, and a Chinese appointed by Peking was to be president. After 80 years the line was to revert to China free of charge, or the Chinese Govt. might purchase it at the end of 36 years. The original board of directors was entirely Russian in membership, and the capital stock was all owned by the Russo-Chinese Bank. In 1898 a convention between China and Russia provided for the construction by the company of the South Manchurian line of the Chinese Eastern Railway from Harbin to Port Arthur and Dairen (Dalny). The roads so provided for were completed in 1905 and for that purpose the Russian Govt. advanced about 800,000,000 roubles. In 1905, as a result of the Russo-Japanese War, the South Manchurian Railway south of Changchun passed into the hands of Japan. Such, in brief, was the history of the railway until 1910.

In 1910 the Russo-Chinese Bank was amalgamated with the Northern Bank to form the Russo-Asiatic Bank, and the new institution became heir of the Russo-Chinese Bank's interest in the Chinese Eastern Railway. The new bank had a Russian charter, but the majority of its stock was in French hands. The Chinese Govt. remained a part owner. In 1915 an agreement was formed for the operation by the Chinese Eastern Railway of the short private line connecting Tsitsihar and the main line, and in March 1916 an agreement was entered into by the Russo-Asiatic Bank and the Chinese Govt. for the building of a line from Harbin to Blagovyeshchensk with a branch from Mergen to Tsitsihar. In a treaty of July 3 1916 Russia ceded to Japan 60 m. of the Chinese Eastern Railway between Changchun and the Sungari river.

The Railway and the War.—The World War naturally brought a strain on the railway, owing to the heavy and sometimes interrupted traffic and the depreciation of the rouble. Then came the Russian revolution, the Bolshevik *coup d'état*, and disintegration in Siberia. The board of directors was scattered from Petrograd and the manager espoused the cause of Adml. Koltchak. With the disorder in Russia and Siberia, the railway's traffic and finances naturally suffered. The Russian Legation in Peking, which remained loyal to the old régime, caused the Russo-Asiatic Bank to call, in Peking, a meeting of the shareholders to elect a new board of directors. China had meanwhile (in the summer of 1917) entered the World War and in March 1918 had signed an agreement with Japan for military co-operation. In pursuance of this agreement Japanese troops appeared in the Chinese Eastern Railway zone.

The Chinese saw in the disturbed conditions in the north an opportunity to extend their control over the railway and in 1920 displaced Horvath, put Pimenoff in his place, and appointed three Chinese to vacant posts on the directorate. The Russo-Asiatic Bank protested against this action and was supported by the French Government. Negotiations between the bank and the

Chinese Govt. followed and an agreement was signed Oct. 2 1920, providing for temporary Chinese control of the railway under a directorate, five of whose members were to be elected by the bank and four by the Chinese Government.

The Chinese Eastern Railway came up for discussion at the Washington Conference in 1921–2, but the Chinese representatives could not agree with those of the Powers, and while all accepted a resolution (adopted Feb. 4 1922) stating that better protection should be given the railway, that the personnel should be more carefully selected, and the funds more economically used, the Powers other than China reserved the right to insist later upon the responsibility of China for the fulfilment of the obligations due to the foreign stockholders, bondholders and creditors of the railway. Under this reservation the consular body in Harbin interfered when in Aug. 1923 the Chinese attempted to seize the land department of the railway.

The 1924 Agreement.—When the Soviet Govt. began the resumption of Russian relations with China, the railway became one of the chief topics in the negotiations. The agreement of May 31 1924, by which normal diplomatic relations were restored between China and Russia, contained a long article which, among other things, had an assurance that China might buy back the railway, a provision for a conference to settle more definitely the future of the railway and a clause which stipulated that the future of the railway would be decided by the two contracting parties to the exclusion of any third party or parties. Simultaneously, another agreement was adopted for the joint administration of the railway by the two governments pending the final adjustment. Until this adjustment, too, the statutes of 1896 were to remain in effect. It is interesting to note that in 1924, in spite of unsettled conditions, the railway showed a profit in its operation of 7,365,000 gold roubles, and for the first seven months of 1922 of 3,560,594 gold roubles, as compared with 6,406,702 roubles in 1913 and 7,896,436 roubles in 1914.

Events of 1926.—Early in 1926 trouble arose between the Soviet Govt. and Chang Tso-lin over the transport of troops on the railway. In pursuance of a design, so it was alleged, for preventing an advance of the Manchurian troops into Chihli against Kuo Min Chun forces, M. Ivanoff, the Soviet general manager, closed the railway to the free use of the military. He was immediately arrested, along with three other Soviet directors on the instructions of Chang. M. Karakhan, the Soviet Ambassador at Peking, handed on Jan. 24 an ultimatum to Tuan Chi-jui, who of course had no control over Chang, demanding M. Ivanoff's release and the restoration of order on the railway. A copy of the ultimatum was also forwarded to Mukden. After some delay, M. Ivanoff was released and some kind of settlement patched up, but further complications are always possible, particularly as Chang is credited with a desire to secure complete control of the railway. (K. S. L.)

CHINESE LITERATURE (*see* 6.222).—The intellectual revolution of the present century displayed itself not only in education, but also in the language itself. Many new terms were introduced to express the new ideas, so that the vocabulary of the educated man was greatly altered.

Linguistic Changes.—An attempt was made to provide the country with a uniform spoken language to replace the numerous dialects which, especially in the south and southeast, have often been mutually unintelligible. To this end the Pekingese form of *Mandarin* was extensively taught in the schools as the *Kuoyu*, or national language. The written characters being numerous and at best rather difficult to learn, the effort to promote literacy led to the invention of a phonetic alphabet of 39 symbols, later increased to forty. In 1918 the Ministry of Education gave this official authorisation, but in 1925 it had not come into extensive use. More important was the production of literature in the spoken language. Formerly the great bulk of Chinese literature was in the classical style, and such literature as appeared in the vernacular was usually held in contempt by scholars. The classical style resembled the spoken language but was for the eye rather than the ear and was sufficiently different to make its acquisition a serious bar to universal literacy. About 1917, some Chinese students in America, among them Hu Shih, had the courage to challenge the supremacy of the classical language and began to produce literature in the *pei hua*, a purified form of *Mandarin* (which in one form or another is the colloquial tongue of most of Central and North China). When they returned to China they continued their efforts and there came a literary revolution which may prove as important and significant as that which occurred in Europe when the modern languages took the place of Latin as the medium of scholarship. Books and periodicals in the *pei hua* were soon issued in an increasing stream, all largely with the purpose of making literature and ideas more widely accessible to the public.

The break with the literary forms of the past probably aided in the revolt against tradition in other fields. After the World War, the intellectuals of the modern school began to question all accepted standards, Western and Chinese, of conduct and belief. The older orthodox forms of ethics, philosophy and politics, as well as those of literature were subjected to re-examination. Since the 17th century the spirit of criticism and revolution had been fostered by certain scholars who questioned the dominance of the great philosophers of the Sung dynasty, but their rapid increase and their scope were the result of the impact of the Occident. No custom, belief or institution, political, religious, economic, philosophic or social, foreign or Chinese, was too sacred or well-established to be challenged. The movement had its centre in the National University at Peking, and it was reinforced by the extended visits of such Western scholars as John Dewey and Bertrand Russell. The radical writers of the West were read with avidity and older Chinese philosophers, long condemned by the Confucian school as unorthodox, were re-examined.

The New Learning.—The new learning and the new ideas and questions were given wide circulation by a greatly increased output of newspapers, magazines and books. Under the Republic, newspapers multiplied rapidly. The vast majority were of rather low grade and they were often dominated by individuals or factions who used them for selfish propaganda and partisan attack, but here and there was one of better type. Magazines, too, were issued in large numbers. Many were short-lived, but they all bore witness to the intellectual ferment abroad in the land. Of books there were a great number—translations from other languages, new works in Chinese, text-books, essays, histories and political and philosophical treatises. Here and there an older writer, like Liang Ch'i Ch'ao, maintained his popularity and influence. Liang, indeed, wrote voluminously in the *pei hua* on many subjects—chiefly those connected with national and international affairs and philosophy and religion—and was probably the most widely read of modern authors. There were many younger writers, however, such as Hu Shih—with productions chiefly in the realm of philosophy, including a fresh study of the history of Chinese philosophy—and Liang Siu-ming—the author of two widely read books, *The Civilisations of the East and the West and Their Philosophies* and *An Introduction to the Philosophy of India*, and the student class seemed obsessed with the idea of expressing itself in print. The demand for the new literature gave rise to many publishing houses and the great Commercial Press, begun before the Republic, was the largest concern of its kind in the Far East.

This ferment of thought, with its revolutionary and critical attitude toward language and ideas and its vast output of literature, was so marked in the years just following the World War that it came to be known as the Renaissance, New Thought or, to use an expressive Chinese term, "New Tide" movement. It was intensely patriotic, and before the end of 1924 it had begun to react against the popularity which everything Occidental had had after 1911, and began to resent the aggressions of Western Powers, and was antagonistic to Christianity. Largely destructive in its criticism, and often immature, ill-informed, prejudiced and superficial, it was not without constructive features. Certainly it marked the greatest intellectual activity that China had known for many years, and may presage the dawn of a new culture. (K. S. L.)

CHIROPRACTIC, the name given to a method of healing employed in the United States, is based on the theory that most disease is the result of displacement of the vertebrae of the spinal column, resulting in abnormal pressure upon the nerves as they emerge. It is held that the articular joints are frequently thrown out of alignment, it may be only in slight degree, and the constricted nerves are thereby prevented from transmitting to the various bodily organs the mental impulse necessary for proper functioning. The human body has been charted, and it is claimed that the nerves emanating above each vertebra regulate particular organs; hence the cause of different diseases can as a rule be readily localised. Health is possible only when all the organs function harmoniously, and disease of one organ may affect some other. The chiropractor attempts to find the subluxated joint, and with the bared hand to adjust it. He never resorts to drugs or surgery; he merely tries to relieve the impinged nerve and leaves the rest to nature.

The first reported healing by chiropractic was made in 1895, when Dr. D. D. Palmer (b. near Toronto, Canada, March 5 1845; d. at Los Angeles, Cal., Oct. 13 1913), a "magnetic healer," in Iowa treated a man who had been deaf for 17 years. He claimed to have discovered that a displaced vertebra was pinching a certain nerve and that its adjustment was quickly followed by complete restoration of hearing. Little was done to work out a theory in detail until 1903, when Dr. B. J. Palmer (b. Sept. 10 1881), a son of the discoverer, began its formulation, resulting in the development of a well-defined system of articular adjustment with the hands. He established the Palmer School of Chiropractic (Chiropractic Fountain Head) at Davenport, Ia., which remained the best known, although later many others were founded in different parts of the United States.

The course of study extends over three collegiate years of six months each, and the subjects studied correspond with those of the usual medical school, materia medica alone being ignored. In 1926 there were about 25,000 graduate chiropractors to be found in some 40 of the United States of whom 15,000 were practising. In several states they were still debarred from practice, but 37 states had laws which accorded a measure of recognition to chiropractors and in others legislation was pending.

CHISHOLM, HUGH (1866–1924), editor of *The Encyclopædia Britannica*, was born in London Feb. 22 1866. He was of Scottish descent, the son of Henry Chisholm, who became warden of the standards in the Board of Trade. Educated at Felsted School and Corpus Christi College, Oxford, of which he was a scholar, he graduated in 1888 with a first class in *literae humaniores*. He then read for the bar, being called at the Middle Temple in 1892, but occupied himself also with occasional journalism and finally adopted that profession. From 1892 to 1897 he was assistant editor, and from 1897 to the end of 1899 editor, of *The St. James's Gazette*, and during these years he also contributed numerous articles on political, financial and literary subjects to the weekly journals and monthly reviews, becoming known as a literary critic and Conservative publicist.

On resigning the editorship of *The St. James's*, he became a leader writer for *The Standard*, and later, in 1900, was invited to join *The Times*, under whose management he acted as the responsible co-editor, with Sir Donald Mackenzie Wallace and President A. T. Hadley of Yale University, of the new volumes, constituting the tenth edition (1902), of *The Encyclopædia Britannica*, becoming in 1903 editor-in-chief of the eleventh edition. Throughout his editorship he worked in close co-operation with Horace Everett Hooper, publisher of *The Encyclopædia Britannica*, and manager of its sales and publicity. The alliance between the two men, based on mutual respect and confidence, was a very close one and productive of happy results, H. E. Hooper supplying the business ability and Hugh Chisholm the scholarship. Under his editorship the 11th edition of the *Britannica* appeared in 1910–1.

Rejoining *The Times* in 1913 as day editor, he became financial editor at the end of that year, and occupied this responsible position all through the momentous period of the World War, resigning his connection with *The Times* in March 1920, in order to reassume the editorship of *The Encyclopædia Britannica* and to organise the publication of the new volumes constituting the 12th edition.

As editor of *The Encyclopædia Britannica* Chisholm displayed remarkable ability. His gift for organisation, combined with his wide range of knowledge, enabled him to scheme out a subject, or an article, sometimes better than the expert whom he was inviting to write on it. He had an unusual power of visualising the right arrangement of details, and his letters to contributors, written always in his own hand, were practically a synopsis of the contents of the *Encyclopædia*. In politics he was a Conservative and Tariff Reformer with clear and definite views. In literature his taste was catholic and his judgment sound. As financial editor of *The Times*, Chisholm displayed great courage and remarkable quickness in grasping the financial situation. Bringing a fresh mind to bear upon the intricacies of the money market, he wrote with lucidity and authority, and contributed in no small degree to the maintenance of a high standard in financial journalism. His point of view was always that of a true patriot, and both privately and publicly he rendered very valuable services to the state in connection with the raising of the various war loans.

The influence which he had won in the City led to the offer of one or two directorships, and the last two years of his life were mainly devoted to developing his gifts as a financier. He was a keen freemason and a man of many friends, both in London and in New York. He had a retentive memory, and his general knowledge of public affairs, in Great Britain and also in the United States, qualified him in a very special degree for the editorial positions he occupied. He died in London Sept. 29 1924. In 1893 Chisholm married E. Beatrix Harrison, of Ardkeen, County Down, and had three sons. (J. E. C.)

CHIVALRY: *see* KNIGHTHOOD AND CHIVALRY.

CHLOROFORM: *see* ANAESTHETICS.

CHLOROSIS: *see* ANAEMIA.

CHOATE, JOSEPH HODGES (1832–1917), American lawyer and diplomat (*see* 6.258).—Upon the outbreak of the World War he ardently supported the British and Allied cause, and severely criticised President Wilson's hesitation to recommend America's immediate co-operation, but shortly before his death retracted his criticism. He was chairman of the mayor's committee in New York for entertaining the British and French commissions in 1917. His death, which took place in New York May 14 1917, was hastened by the physical strain of his constant activities in this connection. Among his last works were *Abraham Lincoln and Other Addresses in England* (1910, and *American Addresses* (1911).

See T. G. Strong, *Joseph Choate, New Englander, New Yorker, Lawyer, Ambassador* (1917); *Joseph Choate, a Great Ambassador* (1918); Edward Sandford Martin, *The Life of Joseph H. Choate* (1920).

CHOLERA (*see* 6.262).—During the period of 1910–25 cholera continued to be widely prevalent in India, and the recorded mortality exceeded 500,000 in both 1918 and 1919, when the disease was also epidemic in China, but, with the exception of moderate prevalence in eastern and southern Europe, including Italy in 1911, there has been little spread to Europe. Bengal maintains its unenviable reputation as the home of cholera, from which it extends over India, and no adequate attempt has yet been made to utilise the undoubted protective power of inoculation and good water supplies to prevent the disease being carried from Puri and other pilgrim centres in the endemic areas, and to lessen the danger of further world-wide pandemics originating somewhere in India.

Treatment.—Happily, during the decades 1905–25, important progress has been made in the treatment of cholera, which has robbed the disease of half its terrors when hospital accommodation is available. Leonard Rogers of the Indian Medical Service, as the result of his researches on the blood changes in the disease and of the action of permanganates in destroying the toxins formed by the cholera vibrios in the intestines, has established a system of treatment which has reduced the mortality in the Calcutta Hospital cases to about one-third of its former rate.

The great loss of fluid and salts from the blood, and the reduction of the alkalinity of that fluid are combated by the intravenous injection in severe cases of three to five or more pints at a time of the following solutions: (1) sodium bicarbonate grains 160 and sodium chloride grains 90 in a pint of sterile water, and (2) sodium chloride grains 120 and calcium chloride (as a cardiac tonic) grains 4 to a pint; one pint of the former alkaline solution and the remaining two to four pints of the second hypertonic saline being given whenever collapse occurs, or the blood is found to be concentrated by the specific gravity test; 20 to 30 pints being sometimes administered successfully in the course of a few days in very bad cases, while the alkaline solution is also given in half-pint quantities in enemata every two to four hours until the renal excretion is fully re-established.

In addition two permanganate pills of grains 2 each are given orally every 15 to 30 minutes during the stage of acute evacuations to destroy the toxins in the bowel. Kaolin, or fine China clay, has the power of loosely combining with cholera toxins and preventing their absorption from the intestines, so equal quantities of kaolin and water should be given to drink *ad libitum.* Pituitarin injections are of value to maintain the blood pressure and increase the renal secretion in the later stages, and injections of atropine in doses of $\frac{1}{100}$ grain twice a day are also of value as first suggested by Lauder Brunton. As the cramps and other symptoms are immediately relieved by the saline injections, opium is unnecessary and should never be given in any stage of cholera, as it strongly predisposes to fatal suppression of urine.

By these methods the mortality in over 1,000 severe cases in the Calcutta cholera ward over a number of years past has been reduced from 60% to 20% and equally good results were obtained in China in 1919. In the Bombay and Central Provinces the administration of large quantities of permanganate pills in outbreaks in villages remote from hospitals has reduced the death-rate one-half to one-third of that in untreated cases in the same epidemics, although the severest types require intravenous salines in addition if life is to be saved.

The great paucity of skilled medical men in Indian villages alone prevents greater saving of life by these methods, and prevention, especially by good water supplies and greater sanitary control of cholera-spreading places of pilgrimage within the endemic areas of the disease in Lower Bengal and southeast Madras, together with the compulsory inoculation against cholera of all pilgrims before being allowed to return to their homes from cholera areas, should be generally adopted without further loss of time if this very serious cause of mortality in India is to be reduced, as it well might be, and Europe saved from further pandemics of cholera. (L. Ro.)

CHORAL SINGING.—In Great Britain choral singing, from 1910 to 1925, falls into three periods— the splendid activity which was checked by the World War, the struggles during that dark period, and the efforts since 1919 to find the means of meeting the new situation. In the first period there was extraordinary vitality and much new impetus.

Some Notable Figures.—The old tradition of solid, square-toed choralism had been shaken to the roots by the personality of Dr. Henry Coward, the Sheffield chorus master. He had turned the big, heavy, unwieldy body of the provincial choral society into a living, sensitive, functioning organism, and his exploits had created a sensationsal interest in this form of art. Some of his disciples, no doubt, carried his ideas too far and lost sight of the end in exploiting the means. There were other notable workers in the field, with different aims, each contributing to the general good. Harry Evans, by his work in Wales and Liverpool, his keen personality and penetrating insight, made a great impression on the choral world. He was particularly successful in modern works for large choirs exploiting vivid colouring. His comparatively early death in 1914 was a severe loss.

Two other choirs, also under men of outstanding personality, were beginning to attract attention. Both were breaking away from the lines traditionally followed by the average British choral society. In 1904 Charles Kennedy Scott, an able and versatile musician, founded in London the Oriana Madrigal Society, a small body originally intended to arouse interest in the English madrigal school. It eventually widened its scope and devoted much attention to modern British unaccompanied choral works, and in the period in question it was becoming firmly established in public notice. The choice of programmes struck out new lines and gave fresh ideas to choral conductors all over the world.

In Glasgow an amateur musician, Hugh S. Roberton, was attracting attention by the skilled singing of his Orpheus Choir, a body of about 120 singers, concentrating mostly on Scottish song arrangements and unaccompanied works on a small scale. Dr. E. C. Bairstow, organist of York Minster since 1913, was proving himself one of the ablest choral conductors in the land.

An interesting episode in choralism was a world tour from March 17 to Sept. 30 1911, by a choir of 200 voices drawn from Sheffield, Leeds, Huddersfield, Halifax, Newcastle and other centres, under the direction of Dr. Henry Coward. In 1908 a similar tour had been taken in Canada and the United States of America, but that of 1911 was on a larger scale, and comprised, in addition to these, Honolulu, Suva, New Zealand, Australia and South Africa. The large works given were *The Messiah*, *Elijah*, *Gerontius*, *The Golden Legend*, Berlioz' *Faust*, Elgar's *The Kingdom*, Verdi's *Requiem*, Parry's *Blest Pair of Sirens*, Beethoven's *Ninth Symphony*, Bach's *Sing ye* and a number of madrigals, part songs, and humorous ditties.

The period under discussion was also remarkable for experiments in choral composition. The new technique acquired by large choral societies and the enormous strides made by choirs in touch with the competitive festival movement opened up new possibilities to composers. The most daring experimentalist was Granville Bantock, who, in 1912–4, wrote *Atalanta in Calydon* and *The Vanity of Vanities.* Entitled choral symphonies, they are divided into four movements on the lines of the traditional orchestral form, and are written for unaccompanied voices. The voices are disposed in 20 and 12 parts respectively, not with a view of polyphonic writing, but to obtain contrasts of colour on the lines of strings, wind and brass of the orchestra. Many highly original effects are obtained, and severe problems set for choir and trainer.

Pre-War Period.—During the War choral singing all but collapsed. Not only were societies robbed of most of their men, but public halls were commandeered, the energies of active people were deflected, and subscription lists fell rapidly. Many choirs were extinguished, others turned their attention to hospital, camp and charitable work. Some were suspended for the mistaken idea that people at home should not sing in times of trouble. At a later stage, however, the absurdity of this view was realised and societies began to struggle into existence again. Some mixed choirs resolved into female voice bodies; in other cases societies in one district agreed to sing the same works and pooled their male forces at each concert.

On emerging from the gloom, the task of reconstruction was even greater than had been anticipated. Traditions had been broken and the formerly constant supply of tenors and basses was not, and has not, been recaptured. Subscribers who had supported institutions for many years as a duty did not resume their help. The War, too, had accelerated a change of taste which had gradually been coming about. Standard societies had always been able to rely upon the popular oratorios of Handel and Mendelssohn to crowd houses and fill coffers. *The Messiah* had paid many and many a deficit. But, generally speaking, this is no longer the case. Moreover, costs of halls, orchestra, printing and advertising, are all higher, and in addition there is the entertainment tax. Consequently few societies can meet their expenses.

Competitive Festivals.—There has, however, been a new awakening in the direction of competitive festivals, which, firmly established before the War, have attained an extraordinary vitality since. Nearly 200 of these exist and at every one of them choral singing is an important, if not the most important, feature. The great value of this movement is that it affords a *raison d'être* for the existence of every kind of society, except the larger choral bodies. Rural festivals bring into existence choirs in the smallest of villages, and the larger festivals stimulate the virtuosity of the leading bodies. Choirs connected with churches and chapels, women's institutes, guilds, boy scouts, all sorts of male, female and mixed organisations, are encouraged, improved and given a new outlook. In this way the problem of finding an audience for a concert and making ends meet may be avoided.

There has been a remarkable development of male voice choirs, mostly of working men, often connected with factories or works of various kinds and these have, to a certain extent, thinned the male ranks of mixed choirs. A much higher standard of music is now used through the influence of these festivals. The singing of madrigals has received an immense impetus. Choral arrangements of folk songs and compositions by the best of our modern composers are being brought within the ken of many thousands of people. For some festivals choirs prepare choruses from an important work which is finally given by combined forces. In this way tiny rural villages know their Bach cantatas and are even intimate with the B minor Mass and other large scale compositions.

A striking development is the growth of "works" choirs, some of which are very fine bodies. The Glasgow Police and Tramways Choirs and the L.N.E.R. Musical Society are examples. One interesting fact is being disclosed by this activity. It was thought that the best choral singing was to be found only in Yorkshire, and that other parts of the country could not hope to rival that county. But the opinion of most adjudicators is that first-rate work can be produced anywhere. Without doubt the most robust voices come from the county in question, and in other parts of the country the current quality is less adapted to powerful and brilliant results, but a good conductor can produce superlatively good results from material existing in any district in the British Isles. Adjudicators of the widest experience have found astonishing results in places which were supposed to be unmusical. The general consensus of opinion among critics at the Leeds festival of 1925 was that although vocally the choir there was perhaps the finest in the world, technically it was inferior to many bodies in other parts of the country. This change of centre foreshadows a new era in choral singing.

In London the Oriana Choir continues to do excellent work, forming a model for madrigal singing, and producing the latest works of modern British composers. In 1919 the Philharmonic Choir was formed in order that a large choral body might be affiliated with the Philharmonic Society. Kennedy Scott was appointed conductor, and he has proved as brilliant with a large choir as with a small one. Among the important works produced, in addition to classics, have been Bax's motets and the choral works of Delius. In particular, the performance of the *Mass of Life* in April 1925 reached a remarkable standard. London possesses, for the first time in its history, both a large and a small choir which can give performances unexcelled anywhere else in the kingdom. The Glasgow Orpheus Choir has reached a state of popularity unprecedented in the history of choral singing. It attracts numerous crowded audiences in Glasgow, gives concerts all over Scotland, and makes annual raids into England. It has done much to stimulate choral singing; its policy has been to afford opportunities for the training of conductors and to give advice and assistance on the question of formation of new choirs. It is probably the first time that any choir has undertaken missionary work on such a large scale.

One significant feature in recent years has been the decline of interest in Handel, or rather in one or two of his stock works, and an enormously increased interest in Bach. At the beginning of the century Bach was considered only suitable for the finest choirs and especially cultured audiences. His cantatas were almost unknown in Britain. Now large and small societies produce his larger works frequently, his church cantatas are becoming regular features in programmes.

A Newcastle Experiment.—Reference must be made in this connection to an experiment, the founding of the Newcastle-upon-Tyne Bach Choir in 1915 to perform the works of the master, not with the wrong proportions of an orchestra of 50 and a choir of 300, but with forces approximating to those used in his day. The choir, after a period of experiment, was fixed at 40, 10 to a line. The orchestra varies according to the work concerned; in some cases it is practically equal to the choir in numbers. Besides all the large works of Bach and the motets, 65 of his cantatas have been given. A three days' Bach Festival was given by the choir in London in Feb. 1921. British composers are also included in the scheme of work, over 60 having been represented. It gave in Newcastle Cathedral in 1924 the first known complete performance of Byrd's recently discovered *Great Service*, and the Carnegie United Kingdom Trust sent the choir to give three performances of it in St. Margaret's, Westminster, London, in November of the same year. Several choirs have been formed on its lines, and are helping to spread a knowledge of Bach unrivalled in any other country outside Germany. A Bach cantata club began operations in London in Feb. 1926, under the direction of C. K. Scott.

It is impossible in a short article even to mention all the manifestations of choral singing throughout the country. As a result of the competitive festival movement, new conductors of merit are appearing everywhere. Works which a few years ago were looked upon as extremely difficult, for instance, Elgar's *Gerontius*, are now sung in many small towns. The work in question will receive 50 or 60 performances every winter. To take a single example, an isolated town like Kendal, with a population of 14,000, can produce such works as Holst's *Cloud Messenger* and Vaughan Williams' *Sea Symphony*. In 1925 a movement for establishing community singing was inaugurated. Meetings are organised at which folk, national and simple classical songs are sung in unison, and easy rounds are rehearsed, the music being taught by pattern so that no technical knowledge is demanded from the singers.

Visits of continental bodies have been few. In 1919 the Choral Union of Moravian Teachers gave concerts in London. It made a great impression by its enormous rhythmic vitality and the dramatic quality of its consonants, features somewhat lacking in our native singing. In 1925 a Cossack male choir surprised London by its tremendous range of tone power and its fiercely dramatic methods.

Choirs in the Dominions.—The dominions bid fair to follow the good example of the mother country. Dr. Fricker, late of Leeds, is doing splendid work in Toronto. The Winnipeg Male Voice Choir, under Mr. Hugh Ross, impressed visiting adjudicators greatly. Possibly by virtue of its climate Australia produces splendid women's voices, which rather overweigh the men's. There is much choral activity in the main centres of that continent. *The Dictionary of Modern Music and Musicians*, ed. by A. E. Hull (1924), gives a list of the principal choirs in Europe, the United States and the British Dominions. (W. G. W.)

CHORAL SINGING IN THE UNITED STATES

United States.—Among the older choral organisations in the United States still active on a large scale are The Handel and Haydn Society, Boston (1815); Worcester Musical Festival (1858); The Apollo Club, Boston (1871); Cincinnati Musical Festival (1872); The Apollo Club, Chicago (1872); The Oratorio Society, New York (1873); The Cecilia Club, Boston (1874); The Choral Union and May Festival, Ann Arbor, Mich. (1878).

Choral singing in the United States is fostered as a social element rather than as an artistic force. There it may be said that practically every community, church and college maintains a group of singers either as a mixed chorus, a glee club of men's voices or a women's chorus. Large business houses have also found it a benefit to organise choral societies. Most of these choruses appear annually in three concerts and not a few have already availed themselves of the radio to enlarge their circle of listeners. Unfortunately, America has not yet produced a composer of outstanding choral works to add lustre to the festivals and concerts of these bodies.

The Vogue of the Negro "Spiritual."—During the first decade and a half of the present century, American singing societies, discovering little in contemporary choral composition to attract them, turned their attention to the folk music of their own country. Indian music was found from the first to be unadaptable to choral forms and was discarded in favour of the undeveloped melodies of the negro slaves. This interest animated a revival of the negro "spiritual," popularised by the Fisk Jubilee Singers in 1871, replacing in part the Stephen Collins Foster type of plantation song and sweeping aside the negro minstrel chorus. By 1926 the negro spiritual had won an attractive place on the programme of almost every American choral society and had even crept into some churches, occasionally taking the place of the customary anthem in the service.

A second influence which left its impress on American choral activity was the introduction of Russian church music. The Aeolian Choir (Brooklyn, New York) under N. Lindsay Norden, the Russian Cathedral Choir (New York) under Ivan Gorokhoff and the Mendelssohn Club (Philadelphia), to which Mr. Norden later transferred his leadership, led the way to an American appreciation of the hitherto unknown musical treasures of the Russian Church. The influx of Russian singers and companies, notably the Russian ballet in 1916, gave a strong impetus to the movement.

When the World War drew the United States into the conflict, many choral organisations reduced their activities; some ceased altogether. Most of the German male singing societies (Gesangvereine) disbanded and in 1926 were but slowly returning to the field. Their place was taken, to a certain extent, by the college glee clubs and private male quartets. During the War the country's musical forces were organised to aid the cause of patriotism. Song leaders, as they were called, were attached to the army camps and singing became a feature of the military routine. Independent song leaders formed choruses in factories, mills and shops and in public squares. Community choruses, too, sprang into being everywhere.

Since the War, colleges in particular have done much to promote chorus singing. Many have been able to recruit much talent and have given creditable concerts in their auditoriums and local concert halls. Some have been so venturesome as to arrange interstate tours for their glee clubs. Annual competitions after the manner of the German Gesangvereine, which competed for the much-coveted Kaiserpreis, have been instituted. The third of these events occurred on Feb. 6 1926, under the auspices of a board called the Associated Glee Clubs. Twenty-five glee clubs, numbering 1,200 male voices, participated in a programme conducted by Walter Damrosch at the 71st Regiment Armoury in New York.

To stimulate greater interest in American choral composition, many choral organisations have offered monetary prizes to native composers. Four such prizes, totalling $1,200, were announced in 1925–6 for works in smaller forms. Whether the incentive thus given will be productive of significant results remains in the hands of the fates; in itself it is one of the signs of the growing desire in the United States to develop an American school of composers. (J. MAT.)

CHOSEN: *see* KOREA.

CHRISTCHURCH, New Zealand (*see* 6.274).—Since 1907, 12 outlying suburban districts have been included in its area, and the population in 1924 was 115,360. The city has extensive reserves and parks, totalling 7,071 ac., of which 3,200 are leased to farmers, and afforestation has been carried out in some parts. In 1922 the birth-rate was 19·7 per thousand, and the death-rate only 9·6. Buildings to the value of over £800,000 were erected in 1924, the house shortage having been previously very acute. The fine new municipal offices, on the site of a theatre burnt down in 1917 and including the old façade, were opened in 1924, and at the close of 1925 plans were being considered for a concert hall to be built adjoining. At the same time land reclamation work was in progress outside the west breakwater at Lyttleton; and a railway line was being extended to make the site available for factories. The water area of the harbour is 106 acres.

CHRISTENSEN, JENS CHRISTIAN (1856–), Danish politician, was born in North Jutland. The son of a peasant farmer, he was an elementary school teacher from 1877 to 1901. In 1890 he entered Parliament and eventually became leader of the Liberal party. In 1901 he was Minister of Education in the first Liberal government, and from 1905 to 1908 was Prime Minister. In 1909 he was Minister of Defence and in this capacity carried through the Army bill. From 1912 to 1913 he was Speaker of the *Folketing* (Lower House), from 1916 to 1918 minister without portfolio, and Minister of Worship from 1920 to 1922. He retired from politics in 1924. He has published a book, *Frå min Barndom og Ungdom* (1925).

CHRISTIAN X., King of Denmark and Iceland (1870–), was born Sept. 26 1870 at Charlottenlund Castle, near Copenhagen, the eldest son of Crown Prince Frederik, later King Frederik VIII. (1906–12), and Louise, Princess of Sweden and Norway. After matriculating in 1889, the prince embarked upon a military career, becoming chief of the royal guard, and attained the rank of major-general. He married, in 1898, Alexandrine, Duchess of Mecklenburg-Schwerin. In 1906 he became Crown Prince and in 1912 ascended the throne.

During the World War the necessity of friendly intercourse between the Scandinavian kingdoms resulted in several meetings between the three kings of which the first was held at Malmö in Dec. 1914. On June 5 1915 King Christian signed the new constitution of Denmark which extended the franchise to women. He signed, on Dec. 1 1919, the Federal Act whereby Denmark acknowledged Iceland as an independent kingdom and King of Iceland was incorporated in the King's title. In July 1920 he rode over the old frontier into North Schleswig, which had been ceded to Denmark by the Treaty of Versailles, and received an enthusiastic reception from the people. In 1921 the King and Queen and their two sons, Crown Prince Frederik and Prince Knud, journeyed to Iceland and the west coast of Greenland. King Christian, by moving freely among the people, increased his popularity with all classes.

CHRISTIANIA: *see* OSLO.

CHRISTIANITY (*see* 6.280).—In the 18th century, religion was taken to be a body of intellectual conclusions mainly about God, providence and immortality. Revelation was regarded as supernatural information supernaturally guaranteed. Religions were classified, with the utmost simplicity and definiteness, as true and false. Unless it were to be admitted that, where all others must be false, one alone could not be true, Christianity had to be defined as the one true religion with the one authenticated supernatural revelation, and defended as such.

The historical studies of the 19th century tended to obliterate such a distinction as true and false, and to reduce all religions to a process in which everything was linked together and all was temporal and relative. Much of this was due to the idea, which dominated the science as well as the history of the century, that if you could put things in a series you had explained their origin and guaranteed their progress. But there was also the discovery that the religions are not theories or information, and that, therefore, no question regarding them could be reduced to mere logical truth or falsehood. But this has not meant that there is no distinction in value between religions, or that value is determined by something different from correspondence with reality. Every classification which is not merely geographical is an attempt to arrange religions according to value.

In a general way most recent classifications follow Siebeck's: (*a*) The beginnings of Religion, (*b*) Religions of Morality, (*c*) Religions of Redemption. The last is taken to be the highest class, and Christianity the highest in it, because, while Buddhism and Neo-platonism are negative religions of redemption, Christianity is the sole positive. If redemption is the highest religious need and there is real provision for it, Christianity would still be the one true religion, only this would be understood in less intellectual terms.

Religion and Redemption.—But all religions are religions of redemption; and, only when we see this, do we understand how a religion differs from a body of intellectual opinions. All religions, even the lowest of what are called nature religions, are pessimistic about the world on its face value, and in some way wish to find in it a better meaning, a greater security, a greater good. The problem of God is in a sense subordinate to this problem of the world. God is never a mere inference from the world, but He is the power needed to redeem the world, and is found according to the quality of the redemption sought, and verified according to the kind of victory it gives. In that case, religions are to be classified according to the kind of redemption they offer, though there goes with it the kind of God who so redeems. Thus the religion which is concerned only with the redemption of the natural life from trouble cannot reach beyond an animistic force, vaguely many and indefinitely one; yet even this is a power by which redemption is sought from the mere world of the senses. When the stage is reached that law is conceived as the exact equivalent of material good to moral good regarded as obedience to rules, a negative redemption like Buddhism, which seeks only escape from the world, means practically no God; whereas, a positive one like Zoroastrianism or ecclesiastical Judaism, which seeks victory over it, means a God much concerned about the clean and the unclean and a succourer of the good understood as the clean.

Christianity and Redemption.—In its general conception of redemption Christianity had a forerunner in the Hebrew prophets. The pessimism of both goes far deeper than Buddha's. Buddha's pessimism of the superior, sensitive class would have seemed a very thin-skinned affair to the robust Jewish peasant. The Prophets faced a doomed civilisation and inconceivable ruin and calamity, and Jesus faced a people who would crush themselves by the evil spirit with which they would crush Him. And the moral judgment was also deeper. The Prophets saw far beyond rules, and the virtues of Buddha are for Jesus mere respectable hypocrisies.

History as Progressive Revelation.—In the sense of something from which there can be no advance, history does not admit anything absolute, and if history is a necessary way of the patient working of God with His children, religion cannot admit it any more than history. The difficulty with infallible, final revelations is that, if at any point there were finality, history, as a progressive revelation, would be meaningless. Yet there is no meaning in progress were we not discovering absolute standards as well as applying them better; and it has been held that this alone remains when time which built is finished with destroying. Moreover, there are final methods which make other methods merely of antiquarian interest, and which, being right, do not themselves become antiquated. The question of the absoluteness of the Christian religion thus concerns the kind of redemption it has manifested, and the relation of Jesus to it. If this is at once our true dependence on our mortal experience and victory over it, and if Jesus manifested, in His perfect and creative dealing with it, God as the Father to whose rule we can be reconciled in spite of all the evil in the world, there is therefore an important sense in which we can speak, if not of the absoluteness of Christianity, yet of a finality of revelation and method, which as it works in all the historical forms of Christianity, can be distinguished as its true leaven from all it has absorbed in its journey through time.

The Personality of Jesus.—This, however, does not mean that any actual form of Christianity is more than a relative historical product. This problem begins with Jesus Himself. Criticism of the Gospels has been continued in recent years, and it has led farther and farther away from the Robertson and Drews view of a mythical Christ. Serious and competent students of the documents recognise some exaltation of miracle, but they are sure of a person of marked individuality in a certain and concrete historical situation. But this has, in recent years, raised sharply the question of the extent to which the idea of the Messiah and the Kingdom bore the contemporary Jewish form. The Apocalyptic School, of which Johannes Weiss is perhaps the most original representative, maintains that the Kingdom of God was the purely Jewish expectation of a visible rule to be introduced by the power of God, and the Messiah the head of this rule. The unique spiritual religion and an ethic identified with it cannot be wholly denied, but the attempt has been made to derive the idea of God as Father from this rule, with its morality as the high interim requirement in view of the immediacy of the Kingdom. That Jesus, in all He said and did, was a child of His time is the chief ground for believing in the reality of the narratives concerning Him; therefore, only enquiry can determine where this influence ended and His own admitted power and insight and originality began.

The Fatherhood of God.—Yet, however far it may have been clothed in contemporary forms, the Fatherhood of God is there, not merely in the abstract, but as interpreting nature, man, society, death and eternal life, and it is not easy to see how this could be a mere corollary of a visible apocalyptic kingdom. In a certain logical sense the Kingdom is first. It is the family which is essential to the understanding of God as Father. Precisely because it was reached in this way of finding in an evil world and evil men a world which is God's and in mankind His family, the monotheism of Jesus is not, like Mahomet's, a mere business of saying God is one, but rests on a victory over evil which does away with all final division in God's rule of the world, and makes religion and morality identical both in their sphere and in their power. And this is the unique, self-evidencing element, which we are sure came from none but Jesus, so that, so far as there may be crude material apocalyptic in Early Christianity, it may more easily be ascribed to His simple Jewish disciples than to Him. Moreover, the idea of the Father cannot really be derived from the Kingdom, because this is already pre-supposed in it, seeing that it is not because of what the world by itself could ever be, however much God changed it, but by the active purpose of God now in the world that life is turned from frustrated desire to blessed purpose.

Universalism in Judaism.—A universal conception, moreover, had abundant historical possibility in the Jewish outlook at that time, and the titles which connect Jesus with the Kingdom are very difficult to interpret except universally. They are Messiah, Son of Man, Son of God. Messiah, the one which had the most narrow Jewish association, He most avoided. An explanation of this is given, different from the old one that he wished to avoid the material Jewish expectation, but it is roundabout and not convincing. Paul at once universalised it as the "Christ," a thing only possible because of the outlook of Judaism as a world religion at that time. The Son of Man is only a poetic form for man, and Son of God had not the meaning it received in later theology, but surely the names universalise His vocation both toward man and God. Paul at least passed easily to this universalised meaning: and there is no hint that it was any part of the difference which arose between him and the immediate disciples of Jesus.

The Character of Christianity.—But the more important question concerns the abiding apocalyptic character of Christianity. This question also the events of recent years have raised more definitely than at any time since the 1st century. The Kingdom of God is not another name for the slow moral progress of the race, and the Father is not a mere name for the moral power that watches over this process. The first idea of the Church was the fellowship of this rule and not a useful institution to give shelter and continuity. All true morality is interim morality, a morality which lives in another order than the compromising present, and Christian morality does not strive or cry, but lives in a rule of God that is both present and to come. It is not a trust in safeguards, but a venture on the love of God as the power that is above all, valid for all. It is not yet manifested only because it is patient. Because God's rule is of the spirit, it cannot be displayed till idolatry vanishes from the heart of man and he worships the Father in spirit and in truth. But, then, it could come like a descent from Heaven. Because Christianity thus rests everything on the ultimate faith of the heart, it can regard God's action as a revolution, while still maintaining that the conditions of it are spiritual.

The Evolution of Catholicism.—Nothing, at least in the history of Christianity, has had such vast and manifest effects, especially in Europe, as the evolution of Catholicism from the religion of

Jesus. Yet there is no part of it about which we have fewer documents, or documents so difficult to interpret. The outside world gave no heed to the change, being unaware of its importance, and the Christians themselves were unconscious that it was change. They merely imported new meanings into old forms, without deliberate intention. Hence the great difficulty is to determine when the same terms cease to have the same meaning.

The Apostle Paul.—The sharpest difference of learned opinion on this point, in recent years, concerns the apostle Paul. That a large part of the process was the meaning given to his words has long been recognised, but this was usually ascribed to misunderstanding, due to the possibility of reinterpreting a phraseology, necessarily drawn from Greek religious expressions, back into its primitive meaning, by imperfectly Christianised converts who were ignorant of the apostle's Old Testament foundations and unable to rise to the level of his gospel free from the law. Thus legal, mystical, magical, hierarchical ideas and the conception of doctrine as dogma resting on authority, were reintroduced from Hellenistic Judaism and the mystical cults and Greek philosophical and political thought. But the modern school, of which Reitzenstein is perhaps the best known representative, finds the germ of it all in Paul, who is taken to have been influenced by those ideas through Hellenic Judaism. In spite of setting aside the Jewish law, Paul, it is said, by his Christ mysticism, opened the door to substitution and sacrifice, to officials, to mysterious doctrines and mystical sacraments.

Contacts with Heathenism.—That these ideas came in with the converts from heathenism, as they are doing in China to-day, is, in abstract probability, far more likely than that it was originated by this Hebrew of the Hebrews. His dominant thought is the Old Testament view of man as made in God's image, and from it he has Christ as the second Adam, and the new humanity in Him, while the natural interpretation of his favourite phrase "in Christ" is "in this new order," and no more mystical than "in Moses," while his insistence on all things being ours shows that redemption for him is essentially reconciliation. The Church also is a communion, a fellowship of the good news of the Kingdom of God, and in no form yet a present hierarchy; while a doctrine which was offered to the heathen, who acknowledged neither ecclesiastical nor biblical authority, could not have been Catholic in form.

The Influence of John.—In John it is easier to see that legal, sacerdotal, mystical and even imperial ideas were in the air, but it is still difficult to say how far the influence of John was by understanding or misunderstanding, because for him the Logos was still the revelation of the mind and purpose, and not of the omnipotence, of God, and eternal life a present and not merely a future possession, while the mixed society had not yet replaced the ideal Kingdom of God. This last change we find only in Matthew and the Pastoral Epistles. But it is there, so that, even in the New Testament, we find the first step from the Kingdom as an ideal, prophetic conception, which we enter as we are reconciled to the Father's purpose, to the Church as an ecclesiastical institution, which we enter as we accept its doctrine and obey its rules. This transferred the interest from a changed world by a changed loyalty, to a future life, into which the only way is the Church which possesses the correct doctrinal deposit safeguarded by its hierarchy and which has the proper rites effectively administered by a guaranteed sacerdotal succession. Then, alongside of redemption by reconciliation, we have all the other ways —sacrifice as propitiation, mystic rites, ascetic practices, etc.

Christianity and Other Religions.—Here we come to the crux of our problem, which is the place of Christianity among other religions. Is it this organised form of it, or something merely working in it that we are to consider? The view that the ecclesiastical institution itself is not merely relative to human progress, but that Jesus founded it, appointed the Apostles its rulers, settled its rites, gave it its doctrine, and guaranteed its fidelity, and that what it is it has been and will be, can only be maintained by making historical inquiry anathema. Last century this was modified into the view that what has grown to be the present Catholic doctrine and order, Christ planted only in germ. But even this is becoming increasingly difficult to maintain. Among those who differ only in detail about what happened, there are, however, diametrically opposite judgments of the value of the change. Liberal Protestant scholars, on the whole, regard it as the kind of corruption to which religions are always subject as they absorb alien elements with their only imperfectly instructed converts. They find the essential Christian element to be a power, shown by no other religion, first of elevating and spiritualising these alien elements and then of eliminating them. This they ascribe to the higher idea of redemption inseparable from the faith in Christ, which, however much overlaid, has always wrought like leaven, and to what goes with it—the revelation of the Father. Thus, for them, an essential quality of Christianity is its power to regenerate itself by a return to the Jesus of the Gospels. They would maintain that all other religions have their place, but it is as preparation, or, if their elements remain in Christianity, it is only as a temporary substitute for the true Christian redemption.

Syncretism in Christianity.—The Liberal Catholic scholars on the other hand regard it as the highest perfection of Christianity that it can thus syncretise what has appealed to human need in any religion, holding that, just by its comprehensiveness, Christianity was turned from an enthusiastic movement into a permanent and effective institution, with its bald Puritanism enriched in all kinds of profitable ways. If pagan mystical ideas were adopted, did they not meet a need? If Platonism was almost as dominant as Paulinism, was not Plato also inspired?

The Distinction of Christianity.—As a protest against the position which reduces the essence of Christianity to a mere doctrine of the Fatherhood, this position has value, for doctrines are life and life is doctrine, if either belong truly to religion. Yet we cannot thus deify history with its confusion of opposites and equalising of truth and error. Lower kinds of redemption may have to carry on till we are able to venture wholly on a higher, but no two forms are in the end compatible. Plato concerns himself mainly with safeguards, and Jesus wholly with venture: and Jesus does not rule where Plato does. Here is the essential part. All forms of ecclesiastical Christianity are largely concerned with safeguards. But the real challenge of the Cross is the high venture of living in a world not realised. It is this that distinguishes Christianity from all other historical forms of religion, this that is in some sense absolute in method, if not in any particular result. In any case, this seems to be the only aspect of it likely to be adequate to the thought and the enterprise of our time.

Yet the Catholic Church is there, with all its large variety, to remind us that this is no mere matter of intellectual conclusion, but is a victory of life only to be won in fellowship, and that there is no aspect of redemption we can abandon till its good is given in a better form by a higher. Yet it raises the question whether this fellowship should not be beyond any visible organised society, a question which is being raised acutely by the need of our time for a religious order in the chaos of our age, which, far beyond the political order, shall be able to embrace greater differences in a closer fellowship, for a higher and more permanent good. (*See* also ANGLICANISM; BAPTISTS; CHRISTIAN SCIENCE; CONGREGATIONALISM; LUTHERANS; METHODISM; ROMAN CATHOLIC CHURCH, etc.)

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CHRISTIAN SCIENCE (*see* 6.291).—In the history of Christian Science the year 1910 marked the beginning of a new era. Until Dec. 3 of that year, when she passed away, Mary Baker Eddy, the founder and leader of this religion, had taken the principal part in every step of its progress. Nothing had been initiated by anyone but her; nothing of moment had been done without her approval. Furthermore, although the organic law of the Christian Science movement, *The Church Manual*, applicable to The Mother Church and in many respects to its branches, conferred full and sufficient powers upon an administrative board, the Christian Science Board of Directors, yet until then this board had functioned under Mrs. Eddy's immediate supervision. Her demise, therefore, tested at once the adequacy of the Church Manual as an organic law and the loyalty of Christian Scientists to this law, in the absence of its author. In spite of doubts and predictions, in many instances concomitant with friendly interest, both the law of the Church and the loyalty of its members have fulfilled the most confident expectations. As developments have actually occurred, the 15 years from the end of 1910 to the beginning of 1926 have been the most fruitful and prosperous in the history of Christian Science.

Legal Difficulties.—By her last will, Mrs. Eddy devised the bulk of her estate as a charitable trust to be held and used for the purpose of promoting and extending the religion she taught. Thereupon, her next of kin began contests in the courts of Massachusetts and New Hampshire on the theory that a devise to promote Christian Science could not be a charity or charitable trust because Mrs. Eddy's teachings were so contrary to generally accepted beliefs and legally established practices as to be contrary to public policy. This contention, though argued ingeniously as a consequence from the tenet of Christian Science that all forms of evil are unreal, failed to impress the highest courts of these States, both of which dismissed the contests. The residuary estate thus devised consisted mainly of Mrs. Eddy's copyrights (valued at $2,500,000) which have yielded since her decease an income of even more than this sum (approximately $3,000,000).

This income has been expended by the trustees mainly as follows: (*a*) to put the Christian Science text-book, *Science and Health with Key to the Scriptures*, and other books by Mrs. Eddy, into public libraries throughout the United States, Canada, Great Britain and certain other countries; (*b*) to contribute toward the cost of public lectures on Christian Science in countries or places where this religion has few adherents; (*c*) to help branch Churches of Christ, Scientist, erect, enlarge or improve their church buildings; and (*d*) to assist them in their free distribution of Christian Science literature.

The Christian Science Monitor.—While *The Christian Science Monitor* dates from 1908, the development of this unique publication belongs essentially to the period 1910–25. For several years largely a Boston daily, later it dropped its local character and became, as it is, an international daily newspaper. It is read to some extent wherever English is spoken. Its circulation, while not great all told (100,000 or more), is almost as large in Chicago, San Francisco or London as in Boston. Never limited to Christian Scientists, *The Christian Science Monitor* now has a world-wide vogue among editors and public men. It is also said to have, of all daily publications, the largest number of readers for each copy, many copies being passed along by the original recipients to other readers.

Benevolent Activities.—During the period in question, Christian Science benevolences have been developed and systematised to an extent previously unknown. Funds provided by Christian Scientists have been administered by them for the purpose of relief in nearly all of the more important instances of great disaster or extensive destitution. The explosion at Halifax, the flood at Dayton, tornadoes in the Middle West, famine in the Near East, earthquakes in Japan and destitution in Europe after the World War, are among the occasions which can be mentioned in this connection. Christian Scientists also are doing an extensive missionary work among the inmates of penal institutions and among persons released therefrom. This work has been frequently commended, as being of exceptional value, by officers in charge of such institutions and by trained sociologists. Akin to this work was the extensive service rendered by Christian Scientists as chaplains and "camp welfare workers" among soldiers and sailors during and after the World War. In 1919 The Christian Science Benevolent Assn. opened a sanatorium in a suburb of Boston at a cost of $1,500,000, where persons may stay while having Christian Science treatment.

Deflections.—As in the earlier history of Christian Science, there occurred in the period under review a number of deflections from this movement. As founded by Mary Baker Eddy, the Christian Science movement consists of The Mother Church, The First Church of Christ, Scientist, in Boston, Mass., and of branch churches or local congregations wherever there are the requisite number of adherents. Each of them is designated as First Church of Christ, Scientist, of its locality, or as Second Church of Christ, Scientist and so on. Thus, the words Church of Christ, Scientist, furnish the distinctive part of the name of the Christian Science denomination as distinguished from several small and unrelated groups, which have adopted titles containing the words Christian Science.

Relations to Other Churches and to Medicine.—The successful application of Christian Science to the cure and prevention of disease has also produced some notable reactions in other communions and in the practice of medicine. In public addresses a number of prominent physicians have credited the practice of Christian Science with remarkable healings, while many others have commended as wholesome the habits of thought inculcated by this religion. On the other hand, many physicians have continued to deny or minimise the power of prayer or thought to effect cures in cases of organic disorder.

The reaction to Christian Science in the Anglican, Episcopal and Jewish communions has been most notable. In each of them, extensive inquiries have been made concerning the power of faith or prayer to cure or prevent disease, and in each of them methodical efforts have been made to employ mental and spiritual practices for this purpose. Christian Science, nevertheless, continues to make its distinctive contribution to the systematic application of theology to all human needs, including the cure and prevention of disease.

On June 8 1925 the total number of Christian Science churches ("branches of The Mother Church, The First Church of Christ, Scientist, in Boston, Mass.") was 2,202 (1,913 in the United States, 148 in England, 57 in Canada, 84 elsewhere). On Jan. 1 1920 the number was 1,804 (1,590 in the United States, 98 in England, 46 in Canada, 70 elsewhere). In 1910 the number was 1,201 (1,077 in the United States, 58 in England, 38 in Canada, 28 elsewhere). As a Christian Science church invariably has two readers—one to read the Bible, the other to read the text-book (*Science and Health with Key to the Scriptures*)—the number of readers in 1925 was 4,404; in 1920, 3,608; in 1910, 2,402. On June 8 1925 there were 7,828 recognised practitioners of Christian Science healing and 216 nurses. Statistics of membership are never given officially and estimates vary all the way from 300,000 to upwards of 1,000,000.

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CHURCHILL, WINSTON (1871–), American writer, was born in St. Louis Nov. 10 1871. He graduated from the United States Naval Academy in 1894. After brief service in the navy he resigned, and for a time was connected with *The Army and Navy Journal*. In 1895 he became managing editor of *The Cosmopolitan Magazine;* but in less than a year he retired in order to devote himself to writing. His first novel, *The Celebrity*, appeared in 1898. His next book, *Richard Carvel* (1899), had a sale of nearly 1,000,000 copies. Its scene is laid in Maryland during the American Revolution. Then followed *The Crisis* (1902), the heroine of which is the great-great-granddaughter of his former hero, Richard Carvel; and *The Crossing* (1904). His other works are: *Coniston* (1906); *Mr. Crewe's Career* (1908); *A Modern Chronicle* (1910); *The Inside of the Cup* (1913); *A Far Country* (1915); and *The Dwelling Place of Light* (1917). All his novels treat of phases of American development, and form a sort of chronological sequence. Mr. Churchill took an active part in state politics. From 1903 to 1905 he was a member of the Legislature of New Hampshire, and in 1912 he was an unsuccessful candidate for the governorship as a Progressive.

CHURCHILL, WINSTON LEONARD SPENCER (1874–), British politician, the elder son of Lord Randolph Churchill and Jennie, daughter of Mr. Leonard Jerome, of New York, U.S.A., was born Nov. 30 1874. He was educated at Harrow and Sandhurst. Entering the army in 1895, his principal war service was with the Malakand Field Force, 1897, and the Nile Expeditionary Force, 1898; and on both campaigns he wrote books distinguished equally by ability and confident criticism. During the South African War, 1899–1902, he was correspondent for *The Morning Post*, London. He was taken prisoner by the Boers, but escaped.

As war correspondent, author, lecturer and politician he was indefatigable, and when elected conservative M.P. for Oldham in 1900 his personality, combined with hereditary interest, made him a fascinating figure in the new Parliament. His maiden speech attracted unusual attention. A slight defect of utterance was noted, and against this he had to struggle for many years. He excelled in the set speech elaborately prepared on the classic models, but was not at first a ready speaker, which led Lord Balfour to say of him once that he carried " heavy but not very mobile guns " and it was only very much later that he achieved distinction in the cut and thrust of debate. He had a filial reverence for the political memory of his father and his *Life of Lord Randolph Churchill* is one of the best political biographies in the language.

It was soon discovered that Mr. Winston Churchill was no more inclined than his father before him to tread the path of party docility. In his first session he opposed Mr. Brodrick's scheme of army reorganisation mainly on financial grounds and later Mr. Joseph Chamberlain's Tariff Reform Campaign afforded a great opportunity for his spirit of revolt. He threw himself into the ranks of the Free Traders with uncompromising vehemence. When he took the plunge and joined the Liberals his former political friends were very embittered. Returned as a Liberal for North-West Manchester at the general election of 1906, he became Under-Secretary for the Colonies in Sir H. Campbell-Bannerman's Govt., and the spokesman of his Department in the House of Commons. Even at the time of the South African War he had held liberal views about the treatment of the Dutch, and with Sir H. Campbell-Bannerman's policy of self-government for the Transvaal and Orange River colonies, leading up to the Federation of South Africa, he warmly associated himself. In 1908 he entered the Cabinet as President of the Board of Trade, where, and later at the Home Office, he developed an eager interest in social legislation, coming strongly under the influence of Mr. Lloyd George, whose National Insurance Policy he was to champion with great ardour. He himself carried a Trade Boards Act establishing a minimum wage in certain sweated industries, an Act setting up Labour Exchanges, and a Shops Act. The Old Age Pensions Act and other social measures appealed to him as creating the basis of a system that would give general security and comfort to the working classes.

By 1909 Mr. Churchill had become a great power in the Liberal party. His platform oratory had a vivacity, a boldness and an epigrammatic quality that stirred popular gatherings. Into the conflict that followed the rejection of the Budget of Mr. Lloyd George by the House of Lords, he threw himself with characteristic impetuosity and almost persuaded those Radicals who had been reluctant to believe in his whole-hearted conversion to their principles. As president of the Budget League he was a driving force in the campaign against the Lords' veto on finance. On the question of Irish Home Rule he had also made a definite advance.

But events on a larger stage were shaping themselves to give a new direction to Mr. Churchill's career. In July 1911 Great Britain came into dangerous contact with Germany over what was known as the Agadir incident. A conflict was avoided, but the German menace now presented itself as a reality to responsible British statesmen. Churchill was transferred from the Home Office to the Admiralty, with explicit injunctions laid upon him by the Prime Minister, Mr. Asquith, to " put the Fleet into a state of instant and constant readiness for war in case we were attacked by Germany "—a disclosure made at Dundee by Churchill in June 1915. The reason for Mr. Churchill's appointment to the Admiralty was that a serious disagreement had arisen between the War Office and the Admiralty concerning the strategy to be adopted in the event of war and Mr. Haldane had told Mr. Asquith that he would resign from the War Office unless the Admiralty worked in accordance with the War Office plans and a Naval War Staff was created. To that the existing Admiralty Board and Mr. McKenna were opposed and it was therefore one of Mr. Churchill's first duties to make a new Board. " He is knocking over the admirals like ninepins," it was said at the time. The formation of a naval war staff was less easy and years were necessary before it could do its work adequately. Later Mr. Churchill used to wonder whether, at the time of his own appointment, he would not have done well to bring Lord Fisher back to the Admiralty; he was, however, at this time, in constant though not always obedient consultation with the admiral.

It was now that the rift between Churchill and Lloyd George began, for Churchill was convinced that war was coming, whereas Lloyd George, despite his speech at the Mansion House on the Agadir crisis, was not. When war did come it found the Fleet, owing to the coincidence of the manoeuvres, on a war footing. Churchill had done important work in preparing the Fleet for war, but the operations of the navy in the first few months of the struggle suffered from the lack of clear and consistent direction which a naval war staff would have supplied. Mr. Churchill presently found himself the leader of a minority and opposition school of war strategy of which the Antwerp expedition and the Dardanelles enterprise were the main products. In both cases the strategical conception was not only sound but brilliant, but the forces against their success were too strong, and Churchill's own impatience contributed to their failure. Lord Fisher in particular, who had been recalled to the Admiralty, disliked the Dardanelles enterprise and his resignation in May 1915 was one of the causes of the downfall of the Liberal Govt., including Churchill who was succeeded at the Admiralty by Mr. Balfour. For a few months he remained in office as Chancellor of the Duchy of Lancaster, but resigned on Nov. 13 on the ground of his non-inclusion in the new War Committee of the Cabinet.

This step was followed by a lengthy and vigorous speech of personal explanation and vindication in the House of Commons, which was a performance of real power and made a great impression. Denying an improper usurpation of authority while at the Admiralty, Mr. Churchill described the Dardanelles adventure as a legitimate war gamble. He blamed Lord Fisher for not speaking out in the War Council if he did not approve the operation, declaring at the same time that he had not received from the First Sea Lord either the clear guidance before the event or the firm support after that he was entitled to expect. After this Mr. Churchill went on active service.

In 1917, on a ministerial reconstruction, he was again on the Treasury Bench as Minister of Munitions and became successively Secretary for War and Air Minister. He was Secretary for the Colonies when peace came. He directed the return of the army to a voluntary basis, but apart from his conspicuous part in the Irish settlement he was not in the inner counsels of Mr. Lloyd George's second Coalition and the close touch with Lloyd George, lost when Churchill went to the Admiralty, was never afterwards renewed. Lloyd George disliked his Russian policy and the expensive campaigns conducted against the Bolshevists under his inspiration. The outward sign of this estrangement was the appointment of Sir Robert Horne instead of Mr. Churchill to the Chancellorship of the Exchequer left vacant by the retirement of Mr. Bonar Law. This was probably one of the greatest disappointments of Churchill's career. Out of favour with Lloyd George and still unpopular with the Conservatives, he was rapidly drifting into extreme insecurity and isolation.

The downfall of the Coalition which seemed likely to complete his political ruin was in fact his salvation. After his rejection by Dundee, Mr. Churchill had a period of retirement, during which he devoted himself to writing, painting and other pursuits. He now published the first volume of *The World Crisis*, a work which did much to dispel popular prejudices against his part in the War.

In March 1924 Churchill challenged attention by presenting himself as an independent anti-Socialist candidate at a by-election in the Westminster Abbey division. Backed by powerful Conservative support he polled heavily, but was defeated by the official nominee. The idea of a strong Centre Party, combining Conservatives and Liberals against Socialism, had appealed strongly to him, but in the following September he was adopted as Conservative candidate for the Epping division. Elected to the House of Commons he took his place as Chancellor of the Exchequer in the second Baldwin administration. On April 28 1925 he presented his first Budget, his proposals including a return to the gold standard, a new duty on silks, a reimposition of the McKenna duties, provision for pensions for widows and a reduction of the tax on earned incomes, but his ingenuity in the debate was more distinguished than the Budget itself. In 1908 Mr. Churchill married Clementine, daughter of Sir H. M. Hozier, K.C.B. (H. Si.)

CHURCH OF ENGLAND: *see* ANGLICANISM.

CINCINNATI (*see* 6.370).—During the period 1910–25 the area of Cincinnati was extended from 44 to 72 sq. miles. The population in 1920 was 401,247, an increase since 1910 of 10·4%. The official estimate July 1 1925 was 409,331. In 1925 the city possessed parks covering 2,725 ac., including the Mt. Airy forestry project which embraces 1,132 ac.; the Kessler plan was being carried out with further extension by utilising the boulevards and bluffs. The Parkway Boulevard covering the old Miami canal road-bed through the centre of the city and extending a distance of 4·6 m. was building at a cost of $3,330,000. The much discussed statue of Lincoln by George Grey Barnard presented to the city by Mr. and Mrs. Charles P. Taft was unveiled in Lytle Park in 1916. The rapid transit loop, at an initial cost of $6,100,000, encircling the city in connection with subway, surface and elevated railways giving access to inter-urban traffic, was nearing completion in 1925.

Manufactures.—In 1925 there were more than 2,350 manufacturing establishments in Cincinnati proper covering 90 industries, with capital of $600,000,000 and products valued at $750,000,000, employing 185,000 persons. The most important industries in the Cincinnati district were soap and soap products, $100,000,000; foundry and machine-shop products, $60,000,000; slaughtering and meat-packing, $40,000,000; clothing, $50,000,000; shoe and leather, $40,000,000; printing and publishing, $35,000,000. In 1924 the chief freight cargoes were coal, stone, sand, lumber, grain, metals and live stock.

Government.—A new charter was adopted in 1917 providing that the city "shall have all the powers of local self-government"; which, amended in 1924, effective in 1926, provides for a city manager form of government with a small council of nine including a mayor elected by proportional representation ballot. A city-planning commission prepared in 1925 a city plan controlling the future development and construction of streets, subways, bridges, playgrounds and parks, which has been enacted into law, the first of such comprehensive character in the country. An ordinance enacted in 1919 forbids the erection or maintenance of bill-boards within the residential blocks without written consent of property holders. The tax valuation for 1926 was $1,018,498,100. The municipally owned waterworks and the Southern Railway, also municipally owned, were more than self-supporting. As a result the net debt on Dec. 31 1925 was $42,480,600.

Education and Charities.—In the period 1910–25 extensive additions were made to the Jewish, Good Samaritan, Bethesda and Christ hospitals, and to the tuberculosis sanatorium. The General Hospital with its group of 24 buildings occupying 27 ac. and considered the best example of the pavilion type on the continent was finished in 1915 at a cost of $3,500,000, with a capacity of 850 beds. It is under the administration of the University of Cincinnati, whose new medical school adjoins it. Other new buildings and departments of the university (7,008 students) included the law school, the college of engineering and commerce, the college for teachers, nursery and health training school, school of household arts, household administration, applied arts, department of hygiene and physical education, new gymnasium and athletic field. The co-operative system, originated in Cincinnati, of supplementing college instruction by practical training in various shops and manufacturing establishments, was greatly expanded between 1910 and 1925.

Several new high-school buildings were erected, with improved facilities which enabled the student to pass at public expense from the kindergarten through the graduate schools of the municipal university. The Roman Catholic College of St. Xavier in 1919 moved its college department to a 26-ac. tract in the suburbs adjoining the newly-developed boulevard system of the city and constructed administration, science, library, dormitory and recitation buildings. The colleges of music increased in buildings and faculties, and in 1915 the Cincinnati Symphony Orchestra received an endowment of $1,000,000 as a bequest from Cora M. Dow. Of special importance was the establishment of the American House for the training of aliens for citizenship, and for social service work. The model town, Mariemont, with public buildings, banks, parks, schools, churches, athletic fields, hospitals, etc., constructed as an entirety, was nearing completion in 1925.

Between 1910 and 1925 among the new buildings were the Union Central Life of 34 storeys, 495 ft. high, the tallest building west of New York; the court-house in modern Ionic style, completed in 1919 at a cost of $5,000,000; the Dixie terminal for the Kentucky traction lines; a $2,500,000 storage warehouse; and several large clubs and hotels. (C. T. G.)

CINEMATOGRAPH: *see* MOTION PICTURES.

CIRCUS (*see* 6.390).—There are now three distinct types of circus. The British is a caravan, the continental a music-hall fitted with arena and stables, and the American a mobile arsenal of amusements. In none of these are the traditions of Philip Astley, father of the modern circus, strictly upheld. His amphitheatre, a combination of riding-school and music-house, retained much of the ancient dignity of horsemanship.

Since about 1920, interest in the circus has been re-awakened in several countries, including Russia, where the Soviet has permitted companies to be reorganised. In France, where the vogue took long to die, as the building of the handsome Cirque de Paris a few years before the War proves, the revival came quickly, partly because of the enthusiasm for the ring shown by the modern school of painters. This return to popularity was first marked by the redecoration of the Cirque Medrano in 1921; in the same year the Nouveau Cirque, which from 1914 had been an ordinary music-hall, was occupied by a menagerie, and, as the next step, the American bar was abolished so that the stables could be restored; the Cirque d'Hiver, the scene of Gémier's production of *Œdipe Roi*, in the season 1919–20 and afterwards a cinematograph theatre, once more became a circus in 1923–4; and this upward progression was crowned in 1923 when the French Minister of Public Instruction made the three Fratellini, the most popular clowns of France, officers of the Academy.

American Circuses.—Unlike the French circus, whose mainstay is the clown, the American three-ring exhibitions dwarf his antics into insignificance. The largest is the Ringling Brothers and Barnum and Bailey Circus, which was begun at Baraboo, Wis., in 1884, by five brothers. In 1907 they bought the Barnum and Bailey "Greatest Show on Earth" which they combined with their own "World's Greatest Shows" in 1919. After opening at Madison Square Gardens, New York, in the spring, this vast organisation set out in four or five trains on a seven months' tour of over 15,000 miles. Even before the union of the two concerns, the Ringlings' methods had revolutionised the American circus. When William F. Cody (Buffalo Bill) tried to renew his early successes by appearing before the public with Gordon

W. Lillie (Pawnee Bill) in a Wild West and Great Far East Circus from 1909 to 1913, his material had to be sold by auction to meet the heavy liabilities.

In Australia the Wirth Brothers have conducted a railroad circus on the American model for many years, but the mammoth show has yet to establish itself in Europe despite the success of Barnum and Bailey's visits between 1880–1900. In 1925, however, the Circus Krone aroused keen interest in Berlin as the only three-ring tent on the Continent, and three rings were installed in the stadium of the British Empire Exhibition, Wembley; but here the space was too large for the romantic smell of sawdust and tanbark to reach the audience.

International Circus.—Successful attempts to create an international circus have been made at Olympia, London. For the Christmas holidays of 1906–7, C. B. Cochran installed there a company from the Cirque de Paris with other acts; for the season of 1913–4 he brought instalments of the Hagenbeck Zoo from Berlin, thus introducing the idea of Mappin terraces into England, and engaged a German stud of 250 horses, besides an American trick rider, French clowns, and many other performers, mostly from the European continent. Each Christmas since 1920 there has been at Olympia an international circus managed by Bertram W. Mills. Otherwise the British circus is still a kind of large family party travelling from town to town in little cottages on wheels and congregating each Christmas at the Agricultural Hall, Islington, just as they congregated 100 years ago in St. George's Fields.

To-day they still perform the tricks that amused the country before the circus was invented. Thus, in 1925, dogs and monkeys were acting in Bostock's Royal Italian Circus a scene called *The Deserter*, ending with the execution of a Pomeranian by a monkey seated on a pony, which recalls the drama of *The Deserter* acted by dogs and a monkey at Sadler's Wells in 1785. After most of the buildings installed by Hengler, Sanger, and others, in the chief towns and cities of the United Kingdom had been put to other uses, the " tenting " companies became more like the old fair folk than Astley's performers. They exhibited personal skill instead of combining to present " equestrian dramas," of which the last relic was the Wembley stag hunt and Roman chariot races, two favourite circus items since Astley's was first built. Likewise the jester is disappearing, the fun now being provided mainly by silent clowns wearing the one-piece garment of the French " grotesque," the ill-fitting evening clothes of the " Auguste," or the costume of Charlie Chaplin of the films.

Entertainments of a character similar to the circus include the International Rodeo, held under C. B. Cochran's management at the British Empire Exhibition in 1924, which was a contest in steer-wrestling and buck-jumping between cowboys who were showmen in the sense that prize-money was their livelihood. In July 1925 a band of Cossacks gave an exhibition of horsemanship in London and Paris, including a dramatic spectacle enlivened by comic tumbles from horseback.

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CITY GOVERNMENT.—The authorities charged with city government are constituted upon one or other of the following principles: free local election of indigenous growth, as in Great Britain and as transmitted to her dominions overseas; a more or less complex mixture of free local election with central government appointment, as in most European countries; a somewhat intricate mixture of free local election with bureaucratic administrative method, exemplified practically throughout the United States. Recent change—for change there has been under every heading—has taken one or both of two directions: that of form or constitution and that of subject. The general tendency has been to broaden the scope of the admittedly legitimate activities of city government or to develop particular services already administered, though in the United States there has been at least for a period up to 1921 a tendency in the opposite direction.

The effect of the World War upon city government, at least in those countries which suffered most, has been to stimulate a communal sense. If progress is measured by approximation to " government of the people by the people for the people," this stimulation will in its turn make for the betterment of city government throughout the world. This, however, is a matter rather of administrative efficiency than of form or of subject.

I. THE ENGLISH SYSTEM

English city government is in form the least changed of any instrument of government in the world. Apart from measures of standardisation, such as the Municipal Corporations Act, 1882, the city governments of England are the same in form to-day as on this day 500 years ago. The municipal corporation, with its mayor, aldermen and councillors elected by the burgesses and its machinery of town clerk, surveyor and other paid officers is still to-day the staple form of authority by means of which an English city is governed; committees of elected members or councillors under whose orders the paid officers act are its medium.

Poor Law.—It is true that other agents exist. For poor law purposes boards of guardians are elected, also under a broad franchise. And to meet special needs there are specially constituted local authorities having duties of limited scope. Little has yet been attempted for the amalgamation under one administrative control of all the many subjects of city government, while in London a dual system of central and local authorities deliberately set up has been equally deliberately continued. The last great example of amalgamation of functions took place in 1902, when education was added to the roll of duties of city government as distinct from government by authorities *ad hoc*, and signs of renewed development in the direction of amalgamation are not wanting.

As a direct result of the suspension of building operations during the War, the responsibilities of city government in the matter of destroying slums and providing new houses were largely increased by special legislation culminating in the Housing Act, 1925. The net result of the housing activities of the civic authorities throughout the kingdom is that in England and Wales during the years 1920–5 no fewer than 190,000 houses have been added by civic enterprise to the houses available.

Housing.—The Housing Act, 1925, also deals with town planning. The duty of planning and controlling urban development, now freely recognised as a civic duty of first-class importance, was entrusted to civic authorities only in 1919. Since then civic authorities have thrown themselves whole-heartedly into a great and difficult task. Up to March 31 1925, schemes had been approved or were in preparation in no fewer than 281 urban districts, and in the larger cities the correlated problem of controlling redevelopment of areas already built up by some system of zoning is receiving careful attention.

Other Services.—Many other services, which a few years ago would by popular opinion have been unhesitatingly placed in the category of matters fit only for handling by private enterprise, are now treated as municipal services. Public health services are steadily enlarging to embrace treatment not only of material but of persons. Medical examination and treatment of school children are now municipal services, while tuberculosis and venereal disease are recognised, in addition to infectious disease, as evils for the prevention and cure of which all the forces of the civic authorities must be mobilised. Gas and electricity services, the first of which in London is still in the hands of companies and the second of which is just about to be dealt with by an authority constituted for the purpose, have, in Birmingham, Manchester and many other large cities, as well as in some of the metropolitan boroughs, long been within the acknowledged sphere of city government. Many of the larger cities, following the example of Glasgow and Manchester, regard the provision of traffic facilities in a broader sense than the mere provision of new or wider roads as of civic concern.

Spain.—The type of civic authority dealt with under this heading is not entirely confined to Great Britain. Spanish city government has developed strongly upon these lines. Since 1890, communes have been administered by *ayuntamientos*, elected by registered male citizens above 25 years of age domiciled in the communes for at least two years, with a president or chairman (*alcalde*) appointed by the *ayuntamientos* from amongst its own members. It is true that there has always been a governor appointed by the state, who represents the state's authority in each province, but his duty as regards municipalities has been no more than to see that their actions do not overstep the powers granted to them.

In 1923 all *ayuntamientos*, together with the alcaldes, were abolished and replaced by associated councils of householders. In 1924 the *estatuto* municipal was passed giving communes through their *ayuntamientos* the right to choose whatever organisation best suits them. The statute also prescribes methods for determining the revenue and expenditure, as well as for the fixation of taxes, etc. Municipal accounts are not subject to approval by the state government, and ayuntamientos may form their own budgets.

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II. THE MIXED SYSTEM

Under the second heading fall the city governments prevailing throughout Europe (except Spain) and their derivatives (including Spanish) in Asia, Africa and North and South America. The outstanding feature of change in Germany, France, Belgium, Italy and the Balkan States is not a change in the form or constitution of the civic authority, but in the broadening on democratic lines of the basis upon which the free elective element is now chosen. The mixture of that element with the national government element is not affected, but the local franchise is extended. The most striking examples are perhaps to be found in Germany and Belgium, where since 1919 a municipal vote has been given to every citizen, male and female, over an age varying from 20 to 25 years. Of the second class—Holland, Norway, Sweden and the countries of European derivation in other continents—little change other than natural and normal growth can be postulated. City government in continental countries is summarised in rough outline below:—

France.—For local government purposes France is divided into departments, arrondissements, cantons and communes. The local affairs of the commune are managed by the municipal council elected by male (over 21) suffrage for four years, but many of its decisions and especially its budget must be approved by the prefect of the department, who is a political official nominated by the Minister of the Interior and appointed by the President. On the other hand, a *conseil gènèral* elected by male suffrage from business men in the cantons controls the departmental administration of the prefect. The municipal council elects from among its members a mayor who as executive head of the commune proposes the budget and supervises the police, revenue and public works, and appoints to or dismisses from communal offices. The mayor is also the agent of the government, and in his sphere of administration is charged with carrying out the laws of the country. Assistance is given to mayors by deputies (*adjoints*) elected by the municipal council and varying in number, according to the population of the commune, to not exceeding 12 (though in Lyons there are 17). The communal council draws up a list of *répartiteurs*, whose duty it is to apportion among the taxpayers the commune's share of direct taxes, but the actual selection from the list is made by the sub-prefect of the arrondissement. Direct taxes are imposed by the *conseil gènèral* on the district councils (*conseils d'arrondissements*) who allot to each commune its share of these taxes.

Germany.—Before the War, each state of the Empire regulated its own plan of municipal rule—there was, therefore, a lack of uniformity but nevertheless a closer approach to a single type of city government than in the United States. The dominating example had always been Prussia, and other states were falling into line except in adopting the three-class system of voting. On the formation of the Republic this system was abolished everywhere in Germany, and the disappearance of the autocracy and the extension of the franchise referred to above have increased the interest of the citizens in local affairs. City authorities are empowered to do whatever is deemed necessary in the interests of the city, subject to nothing being done which is prohibited either by law or by the veto of higher authorities. Speaking generally, the powers exercised by the German municipality correspond fairly closely with those exercisable by its English counterpart, with the important additions that poor law relief and all the public services of gas, electricity, water and tramways are almost universally included.

The general form of city government in Prussia and Hesse is by way of (*a*) municipal council, which elects a chairman, substitute chairman and secretary or clerk who may or may not be a member of the council, (*b*) *magistrat*—an executive board consisting of unpaid and paid members, the latter being usually expert officials. The head of the *magistrat* is the burgomaster, who is appointed by the council; he is usually an expert and has frequently been successful in a similar position elsewhere. Like the American city manager, the office of burgomaster provides a professional career.

The exercise of the powers of the municipality is restricted first by the overriding authority of the Minister of the Interior; secondly, by the intervention on occasion of the *oberpräsident* of the province. He, too, is appointed by the state and corresponds to the French prefect, as he is also the local agent of the national government.

A third form of control is by a district board (*Bezirksausschuss*) appointed by the provincial committee and composed of trained officials. They are a sanctioning authority and the arbiter between the municipal council and the *magistrat*. The part played by the state government as distinct from the national government is therefore considerable.

Italy.—Each commune has a communal council (*Consiglio Communale*), which is a deliberative and not an administrative body, and is elected for four years. Male persons over 21 years of age, and women over 25 years under certain conditions, are entitled to vote. The head of the administration is called the *Syndic* (*Sindaco*) and is elected, by secret vote, by the members of the communal council from among themselves; he is a representative of the state in the same way as the French mayor. The members of the communal council also select from among themselves a municipal council (*Giunta*), over which the *syndic* presides, which appoints officials, etc., and may be said to govern the commune.

Each communal council is supervised by the prefect or sub-prefect (state officials) and also mainly from a financial aspect by the provincial administrative *giunta*—composed partly of persons nominated by the government and partly of persons elected by the provincial council. The prefect has power to suspend the deliberations of the communal council and municipal council and to annul any action proposed by them when contrary to law or regulation. There is a right of appeal, however, to the government (Minister of Interior) by the communal council against the prefect and provincial *giunta*. Furthermore, the government can dissolve the communal council and appoint a commissioner to act in its place. The system has been modified under a Fascist law, which abolishes self-government in the smaller communes with less than 5,000 inhabitants. There have also been drastic changes in the Govt. of Rome.

Belgium.—Municipal councils are elected by the qualified voters (of either sex over 21 years of age) for six years—half being chosen every three years. The burgomaster is appointed by the King in accord with the supposed wishes of the majority of the council, usually from among its members. Executive affairs are performed by *échevins* (échevinal college) holding office for six years and consisting of the burgomaster, aldermen elected by the council and the council secretary. The burgomaster is at once the servant of the commune and a representative in the commune of the executive power of the state. The office often descends from father to son. Provincial councils, the executive committee of which is known as the *députation permanente* and consists of six members, exercise a considerable measure of supervision over the actions of municipalities, and the state, too, through the provincial governor, but decentralisation is better realised in Belgium than in France.

Netherlands.—The municipal councils are elected bodies varying in numbers in accordance with size of towns. The mayor or burgomaster is appointed by the sovereign but in supposed deference to the wishes of the council. The councils are elected for a four-year term. Executive powers are given to *wethouders* (six in large towns) chosen by the council, and as such paid salaries. The police are under the burgomaster, who is an expert civil servant rather than a citizen magistrate, often holds his position for life, and is well paid. Municipal self-rule is more complete than in France, though budgets have to be approved by executive committees (" deputed states ") of provinces, and the " commissioner of the Sovereign " has also a controlling influence, corresponding to that of the French prefect, though not so powerful.

Norway.—Oslo and Bergen have a governor (*fylkesmann*) appointed by the state, as they rank with counties. Other cities and towns are administered by a town council (*bystyre*) elected for three years, and an executive committee (*formannskap*) of one-fourth the number of the council. The chairman of the council is elected by the members of the council from their midst. These chairmen, with the governor of the county in which the municipalities are situated, meet annually, and decide upon the taxes, etc., to be raised in the various cities and towns. There is also a burgomaster appointed by the council but his work is mainly secretarial.

Since 1910 women over 23 years of age have had the suffrage and are eligible for office under the same conditions as men.

Japan.—The larger cities have a municipal assembly (for administrative purposes) and a municipal council (for executive purposes, partly elective and partly nominated by the central government), the mayor, who is one of three persons elected by the assembly and approved by the Emperor, presiding over both bodies; towns have a municipal assembly presided over by a chief magistrate (headman), who is elected by the assembly and approved by the governor of the prefecture or province, who is himself appointed by the government. All male subjects of 25 years and over have the suffrage provided that they are resident in the city or town, and pay land tax or state tax of a certain amount. The main functions of the municipal authorities are concerned with finance.

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III. THE AMERICAN SYSTEM

Lord Bryce's *American Commonwealth* (1888) may be said to mark the turning point in the consideration of city problems in America. From the end of the Civil War in 1865 to 1888 the United States was engrossed in problems of readjustment, reconstruction, transport and internal development. Municipal affairs, where not wholly neglected, were at low ebb and in the hands of selfish political organisations, whose interests were wholly those of personal aggrandisement and profit. Lord Bryce's criticism stung the country into consciousness of the shortcomings.

Philadelphia Conference.—A national conference on city government was held in Philadelphia in 1894, out of which grew the National Municipal League. There was no regular form of American municipal government, and the greatest diversity of types. The general tendency, however, was toward a Federal plan modelled on that of the national Government with a division of functions (legislative, administrative and judicial). Out of the league's efforts grew a " municipal programme," the fundamental features of which were:

> That every community should have the right of self-government in local affairs without the interference of outside governmental or party machinery;
>
> That the city's public property in land, and especially its franchise rights, should be preserved unimpaired;
>
> That all barriers should be removed which prevented the popular will from expressing itself freely and effectively;
>
> That municipal administration should be conducted in the main by a class of public servants who by reason of experience and special training were particularly fitted for their official duties;
>
> That official responsibility should be so placed, through simplification of governmental machinery and full publicity of accounts;
>
> And that the people could hold their public servants to the execution of the public will with the least possible delay and uncertainty.

Example of Galveston.—In the year in which this programme was adopted (1900) the Galveston hurricane-flood nearly destroyed that city. Among other things swept away was the typical old-style mayor and council form of government, which was replaced by a commission of five men appointed by the Governor of Texas. This commission worked so swiftly and efficiently, and with so much less annual cost that, after the emergency passed, an attempt was made to continue it with a commission of five members, three appointed by the Governor and two chosen by popular vote. A court decision declared such appointments to be unconstitutional, and the entire commission forthwith became elective. To the surprise of most observers, no demoralisation ensued, and through successive elections changes in the personnel were slight.

In 1908 Des Moines, Ia., adopted the Galveston system, with the addition of the initiative, referendum, recall and non-partisan primary. This broader plan was even more widely copied than the Galveston plan. Among the larger cities (over 100,000 population) which adopted it are Buffalo; Newark, N.J.; New Orleans; Jersey City; Portland, Ore.; St. Paul; Oakland, Cal.; Omaha; Birmingham, Ala.; Memphis; San Antonio; Dallas; Houston, Tex.; Trenton; Salt Lake City; Reading, Pa.; Fort Worth; Spokane; Kansas City, Kan. Twenty-nine cities of over 50,000 population had adopted it by 1915; 67 of over 20,000; and 90 of over 10,000. Illinois leads in the number of commission-governed cities, followed by Texas, Kansas, New Jersey, Pennsylvania, Oklahoma, California, Michigan, South Dakota, Alabama, Louisiana, Tennessee and Florida.

City Manager System.—Few changes of importance were made in the Des Moines plan (except the preferential ballot first added by Grand Junction, Colo., 1909) until the appearance in 1913 of the modification providing for a city manager. Operating under an old form of government, the Council of Staunton, Va., appointed a business manager. Later Dayton, O., after a disastrous flood, adopted the commission-manager form of government, the essential feature of which was a small council of five, acting as a policy-determining body, and a city manager to be elected by the council to execute its policy. Out of this grew a city-manager form, which the National Municipal League recommended to charter-makers, then multiplying in great numbers due to the growing dissatisfaction with existing conditions. A second "municipal programme" formally adopted by the National Municipal League in 1914, definitely embodied the city or commission manager plan and later recommended that the council or legislative body be elected on the principle of proportional representation.

The city manager movement is justly regarded as the ripest fruit of the movement for better municipal government. It embodies the short ballot, responsiveness to public opinion, concentration of executive power and responsibility, expert administration of city affairs and elimination of legislative control over the administrative: all essential principles of sound governmental practice. The success of the plan has been abundantly proved, although here and there expectations, because unreasonable, have not been met. Moreover, its application to an increasing number of cities is developing municipal policies as perhaps no other single factor has. City planning, zoning, budget making, improved personnel and administration, more effective purchasing, the preparation of adequate and carefully devised plans for transportation, intelligent housing—all have been stimulated by utilising experts in municipal affairs.

On March 1 1925 there were 352 cities and towns operating under a city manager form of government; 261 by virtue of charter provision, and 91 by virtue of ordinance provisions. These were distributed as follows: Michigan, 38; California, 33; Texas, 30; Florida, 26; Virginia, 23; Oklahoma, 18; Ohio, 16; Pennsylvania, 15; Kansas, 13; Georgia and North Carolina, 12 each; Iowa, 11; Illinois and New York, 7 each; Colorado, Tennessee and West Virginia, 6 each; Oregon and Washington, 5 each; 15 other states from 4 to 1 each. The cities over 20,000 population operating under this form of government are: Cleveland (769,841); Cincinnati (401,247); Kansas City, Mo. (324,410); Norfolk, Va. (159,080); Grand Rapids, Mich.; Dayton, O.; Fort Worth, Tex.; Knoxville, Tenn.; San Diego, Cal.; Wichita, Kan.; Sacramento, Cal.; Springfield, O.; Wheeling, W. Va.; Portsmouth, Va.; Berkeley, Cal.; Tampa, Fla.; Long Beach, Cal.; Roanoke, Va.; Niagara Falls; Jackson, Kalamazoo, and Bay City, Mich.; Pasadena, Cal.; Greensboro, N. C.; Lima, O.; Beaumont, Tex.; Kenosha, Wis.; Charleston, W. Va.; Stockton, Cal.; Dubuque, Ia.; San Jose, Cal.; Muskegon and Pontiac, Mich.; Auburn, N. Y.; Waco, Tex.; Newport News, Va.; Austin, Tex.; Columbus, Ga.; Lynchburg, Va.; Colorado Springs, Colo.; Muskogee, Okla.; Phoenix, Ariz.; Alameda, Cal.; Newburgh and Watertown, N. Y.; East Cleveland, O.; New London, Conn.; Middletown and Sandusky, O.; Durham, N. C.

Progress in Recent Years.—There can be no lasting improvement in the personnel of city officials until the short ballot becomes an established fact. This change will come less quickly than the others because of the "vested interests" of the great political organisations, which will yield with the greatest reluctance, for the short ballot means the substitution of citizen management for party organisation.

Prof. Frank Parsons, in summing up the municipal activities of American cities, declared the following subjects had been held to be proper public purposes and proper subjects of municipal ownership and control: "Roads, bridges, sidewalks, sewers, ferries, markets, scales, wharves, canals, parks, baths, schools, libraries, museums, hospitals, lodging-houses, poor-houses, police, jails, cemeteries, prevention of fire, supply of water, gas, electricity, heat, power, transportation, telegraph and telephone service, clocks, skating rinks, musical entertainments, exhibitions of fireworks, tobacco warehouses, employment offices."

According to the Federal Census of 1920, America had become preponderantly urban, over 50% of the population being reported as living in cities. The municipal problem is, therefore, an outstanding one, and questions of regional planning and city and county consolidation become of increasing importance.

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(C. R. W.)

CITY PLANNING.—In some directions the World War speeded up the work and achievements of city planning. The devastated areas in France and Belgium provided opportunities for applying new ideas with much wider scope than would have otherwise occurred; new societies, such as the Renaissance des Cités,[1] have prevented a repetition of the haphazard rebuilding that happened after the Great Fire of London. In Great Britain the War and the consequent housing shortage have produced an immense amount of municipal house building; houses by the thousand have been planned and built in complete new suburbs, exhibiting the looser method of suburban planning with about 12 houses to the acre (in place of the old 40 or 50) which was being timidly attempted before the War. Again, the large amount of unemployment caused by post-War trade depression has provided labour for an outburst of road construction that almost equals the work of the Romans in the British Isles. The new arterial roads round London, planned out and agreed to by a series of conferences before the War, have now nearly all been actually constructed, and the trees are already springing up along their routes.

But these pushes do not represent uniform and complete progress. There has been a tendency to slip back to old standards, on the score of the saving in finding immediate cash. It has always, however, been demonstrable that town planning is an economy in the long run. It is true that it will cost less to-day to construct a road 30 ft. wide than one 60 ft. (but not much, if the extra 30 ft. are only laid down in grass); but if in 20 years' time it is necessary to pull down the buildings which have been erected up to the 30 ft. road, widen it to 60 ft. and rebuild, then it would have been found considerably cheaper to make your road sufficiently wide at first. Town planning means the exercise of a little forethought, and using the skill of the designer to decide which roads will be eventually wanted at 60 ft. wide and which can remain at 30. Other questions require forethought. Zoning (a word that has come into common use) means deciding what is the best use to which land should be put and confining it, with of course reasonable elasticity, to that use. If a man now builds a house in a residential zone he knows that he will not wake up one morning and find a blast furnace started next door; if a certain town (as has happened in Sheffield) has a limited amount of land eminently suitable to industries, it may be necessary to prohibit houses being built there, in order to reserve the land for industrial expansion. In both cases it might pay for the moment to allow the blast furnace among houses and use up industrial land for residential; but in the long run the whole town suffers as well as the individuals; and in both cases the houses find themselves damaged by being mixed up with industrial buildings. Zoning, therefore, attempts to look ahead, and also gives a man a sense of security in his property; it stabilises rateable values.

City Planning in Various Countries

The following points from different countries will give some idea of the international character of the practice of city planning. Its theory is cosmopolitan, as the habits and customs of living in cities tend to approximate, with nevertheless an occasional sharply determinating factor which produces different effects, as, for example, the New York skyscraper and her elaborate height zoning regulations, necessitated by the fact of the business section being confined within a small island.

The British Isles.—In England town planning has been legalised by the Act of 1909, subsequently slightly enlarged in its

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[1] Renaissance des Cités, Paris.

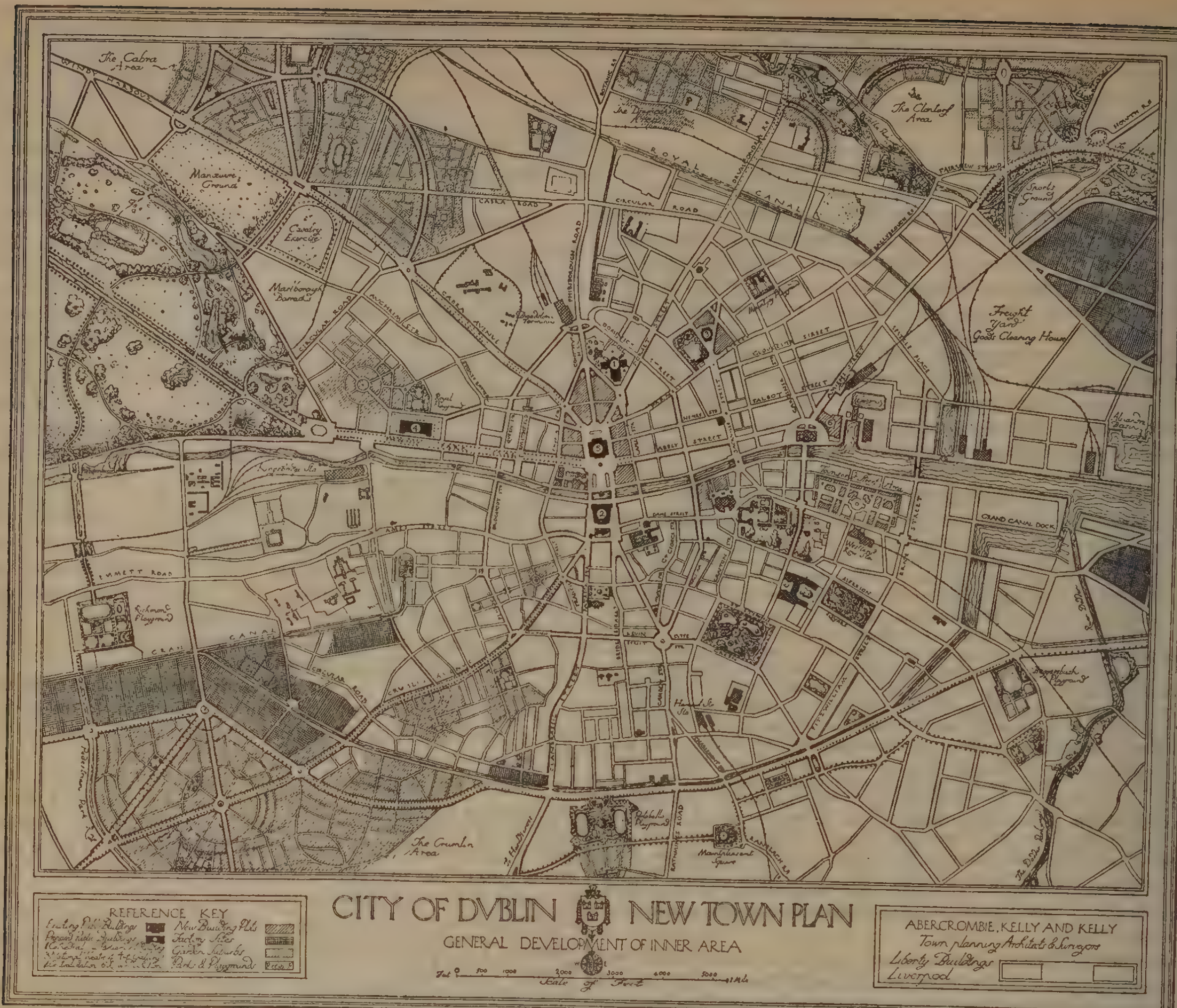
The Cabra Area
The Clontarf Area
Manœuvre Ground
Cavalry Exercise
Marlborough Barracks
Cabra Road
Royal Canal
Circular Road
Freight Yard Goods Clearing House
Sports Ground
Grand Canal Dock
Emmett Road
Grand Canal
Circular Road
The Crumlin Area
Rathmines Road
CITY OF DVBLIN NEW TOWN PLAN
GENERAL DEVELOPMENT OF INNER AREA
REFERENCE KEY
Existing Public Buildings
Proposed Public Buildings
New Building Plots
Factory Sites
Garden Suburbs
Parks & Playgrounds
Scale of Feet
ABERCROMBIE, KELLY AND KELLY
Town planning Architects & Surveyors
Liberty Buildings
Liverpool

FIG. 1.—City of Dublin; development of central area.

scope and finally codified in 1925. Town-planning powers are still almost entirely concerned with suburban development on the outskirts of the great towns, though they are applicable equally to smaller isolated communities and even rural districts. All boroughs and urban districts with a population of over 20,000 at the census of 1921 must prepare a scheme for all land in their district which comes within the definition of the Act as land likely to be used for building purposes. This definition somewhat paradoxically includes open spaces, roads, parks and recreation grounds. Towns of historic or architectural interest may include their built-up areas if they can persuade the Ministry of Health that they are worth preserving in themselves. So far Oxford and Chester are the only ones that have taken advantage of this widening of the scope of the Acts. No fewer than 281 authorities had (by March 1925) presented schemes covering nearly 1,800,000 ac. of land thus under control; 17 schemes, prepared by 12 different local authorities, and covering approximately 28,000 ac., were finally completed and approved.

Regional planning may be said, so far as Great Britain is concerned, to have been practically invented as a definite policy during the period 1911–5. Towns, in attempting to plan out their future, found that in many cases it was essential to know what the neighbouring authority intended to do; at times in thickly populated districts such as southeast Lancashire, the west riding of Yorkshire and the neighbourhood of Birmingham one scheme insensibly merged into another. It was discovered that a group of authorities forming a natural unit might be well advised to combine together to produce a report and plan, in skeleton, for the whole region, thereby attempting to secure the best lines of development for main roads, zoning and other town planning purposes. One of the first regional plans of this nature was an unofficial one for London produced by the London Society during the War, and published in the form of a magnificent map as a development plan of Greater London. The object was to show the local authorities, from London county council to the smallest rural district within the metropolitan area, that their interests were inextricably bound up. It is significant of the difficulty found in dealing with capital cities that London is still without a complete regional committee, several small partial ones having alone been formed. The Doncaster scheme was the first regional plan to be prepared; others are in hand for regions of which the centres might be described as (1) Manchester, (2) Leeds, (3) Birmingham, (4) Newcastle, (5) Middlesbrough, (6) Chester, (7) Cardiff, Swansea and Newport; there are several others of less marked centralisation. In this direction England has been a pioneer. In east Kent, where an entirely new coalfield is being opened up, a far-reaching regional plan is prepared which it is hoped will inaugurate a new era in coal production, both as to the working of the pits and as to the creation of new towns, without impairing rural amenities.

The main lines of garden village design are by now familiar: the limitation of houses to 12 per acre, the sharp distinction between main roads and residence approaches, the retention ot natural features so far as possible in the layout and the importance given to grass, trees and open spaces. Many of the municipal housing schemes are models of layout and house design, and it would be invidious to pick out any for special comment.

The most important new departure since the founding of Letchworth on a single site has been the companion garden city of Welwyn, Hertfordshire. Both these are independent places, hence the use of the word "city," not "village"; but Welwyn is more in the nature of a satellite town to London—that is to say, its position was selected with a view to allowing a certain number of its inhabitants to go backwards and forwards. This satellite method of growth is one of the results of regional planning combined with the garden suburb planning of 12 houses to the acre, and is affected by improved train service and the increased use of motor-cars and buses. The question has thus arisen whether, instead of spreading the suburbs out continuously from the towns, it may not be better to start a new satellite further afield with a centre of its own, albeit dependent for its main nourishment on the parent body. The movement is only in its infancy, and would be facilitated by a better distribution of electrical power throughout the country. Welwyn must be regarded as a typical forerunner of the satellite town.

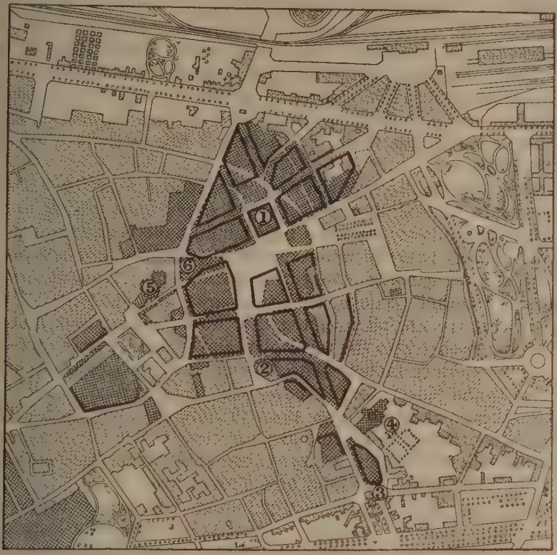

FIG. 2.—Rebuilding of Cambrai. Plan of centre of town. Hatched portion shows buildings destroyed by bombardment and fire. (1. Town Hall. 2. Beffroi. 3. Porte de Paris. 4. Cathedral. 5. St. Géry.) Heavy black lines show new City-Planning alignment of streets. The site of the British War Memorial is shown at 6.

Several cities have put forward tentative suggestions for remodelling the centre of the town, and Birmingham has aimed at relating central improvements to suburban planning under the Acts and to the regional planning of the surrounding local authorities. Birmingham has schemes for buying up land wherever possible and re-laying it out in such a way that the city benefits as landowner for the newly planned area. The great contribution made by Liverpool during this period has been the construction of a magnificent series of external arterial roads, including an outer ring, known as Queen's Drive.

Another interesting direction of study is preliminary survey work, using the word in the widest sense of studying a place from every angle. Some valuable work was done under the auspices of the Royal Institute of British Architects during the War in London and at Manchester and other places as a centre. The object of these surveys is to familiarise the public, city councillors and officials with every aspect of the place, so that the town-planning proposals may really meet the needs and be in harmony with the character of the district. Perhaps the most detailed civic survey for an individual town was prepared by Sheffield, accompanied by a tentative plan of future growth.

Probably the biggest scheme (on paper) of general town planning (apart from urban schemes under the Act) has been produced for Dublin, as a result of a competition promoted just before the outbreak of war by the Marquess and Marchioness of Aberdeen. Other schemes, also not advanced in 1926 beyond the paper stage, were prepared for Bath, Plymouth, Kilmarnock, Northampton and Bolton.

France.—The importance of the French contribution to international town planning has hitherto been dominated by the achievements of the past, owing to the fact that a homogeneous and consistent architectural style had given continuity to the work of city planning and improvement from the reign of Louis XIV. continuously down to the end of the Second Empire. It must be remembered that, though the legal and utilitarian aspects of town planning are soon out of date, artistic achievement is perennial, even if the precise objects to be served may have changed. In France, city extension was being carried out before the War on what we should call town-planning lines as a matter of course. Gyratory traffic, introduced in 1926 into London, was being thoroughly studied as a practical proposition, and two interesting housing laws (1894–1906) giving encouragement to individual workmen to acquire their own houses had been passed. Since the War, as has been said, the whole energy has been directed to the restoration of devastated areas. Perhaps the two most spectacular events have been the passing of the law of March 14 1919, calling on every city, town and commune, of over 10,000 inhabitants to prepare a plan of extension, improvement and embellishment within three years' time; the other event, which indeed was concerned with it, was the great competition for the future of Paris, perhaps the largest town-planning competition ever held. The three special requirements asked for were (1) regional developments, (2) central improvements, (3) the existing fortifications, which latter it had been proposed to pull down just before the War. The scale of the work may be judged from the fact that the winning design (by M. Jaussely) was planned for a city that should contain 10,000,000 inhabitants.

Germany and Austria.—Germany before the War was in the full swing of city building. She was actually expanding more rapidly in her towns than any other European country. These were being systematically planned, and were in the majority of cases excellent examples of municipal foresight, but in two directions the work was not satisfactory. Artistically they were undistinguished, and as regards the health of the inhabitants the housing conditions left much to be desired owing to a still prevalent predilection for dwelling in tenements. The road planning was, within its artistic limitations, of a monumental and striking character, with great "places" formed at the railway stations and each important centre of the town; but this ample road provision was carried to excess when these big thoroughfares were provided also for residential streets, with the result in many cases of forcing up the value of land to very high prices.

An important competition was held for Berlin. The winning design, by Herr Jansen, contained among others two striking features: first, five great radial roads, whose object was to make the country round accessible in all directions; and, secondly, the knitting together of the fine woods and lagoons round Berlin into a great circular outer park belt, extending as far as Potsdam. Cologne has also produced a bold scheme of development and others are in prospect.

Vienna is naturally grouped with Germanic town planning, but resembles Paris in that its most remarkable achievements belong to an earlier period; but again its most important contribution to modern town planning is to be found in the girdle of wooded hills and meadows which it had completed shortly before the War. These comprise some 68,000 ac. of open spaces within the city boundary of the most varied topography, ranging from mountain slopes, rocky and wooded, to pleasant meadow lands and wide stretches of country and water lagoons in the neighbourhood of the old Danube bed and on the banks of the stream further down at Löbau.

Belgium.—Brussels during all this period has been in the throes of a reconstruction into which it was plunged by the ambitious schemes of Leopold II. The chief and still incomplete work was the creation of a great new central station in the midst of the old city: for this purpose a large part of the central area has been laid waste. This is the best European town in which to study the vexed problem of the single union through-station as against a series of terminals. The difficulties of the levels in central Brussels have complicated the solution; and this town-planning project became at an early stage an acute political issue. Contiguous to the station, but not theoretically connected, is the new garden which Leopold had constructed on the site of the old steep street, the Montaigne de la Cour; this is the best example of picturesque town landscaping carried out in recent times. Every other aspect of modern city planning may be studied in and near Brussels.

The rest of Belgium is naturally remarkable chiefly for the post-War reconstruction work, which has advanced very rapidly; the artistic policy adopted has been a re-creation of imagined 17th-century Flemish towns.

Italy.—As regards Rome, the great "Piano Regolatore" of 1908 was one of the biggest attempts of modern times at a city improvement and extension scheme; it remains in force with necessary modifications until 1933. Unfortunately, in spite of its boldness it is conceived in a somewhat hard and mechanical spirit, the remarkable topography of Rome not being allowed sufficiently to dominate the layout of the new streets. The main features of the plan are an immense encircling boulevard, "Avenue of Circumvallation," an archaeological zone, improvements to the ancient city centring on the Piazza Colonna and eight or nine large new suburban areas. Central improvements in the neighbourhood of the Capitol and the Victor Emmanuel monument are in hand. More normal examples of city extension are to be found at Milan, Turin and Florence: this work is still carried on under the Act of 1865.

Sweden, Denmark and Holland.—The extent of Swedish work in town planning was shown by the Exhibition and City Planning Conference, Gothenburg, in 1923. Whereas the previous town plans are of a hard and uninspired sort, the later work, which confesses a debt of acknowledgment to English planning, is extremely free and flexible, as may be seen at Stockholm, Gothenburg, Uppsala, Kalmar and other places. In a monumental direction the great new town hall at Stockholm stands among the first half dozen modern buildings.

Denmark, which in Copenhagen has always possessed one of the most charming and up-to-date capitals in Europe, has an interesting and progressive regional scheme of decentralisation and many charming examples of garden-suburban planning, founded possibly on English originals, but distinctive in architectural treatment.

Amsterdam possesses perhaps the most interesting town "Spider's-web" plan in Europe: the modern proposals are continued in the same spirit. Rotterdam, an uninteresting town plan, has some remarkable and completely planned suburban extensions and proposals for "gyratory" traffic places. No other continental country is so valuable to England as a field for the study of housing as Holland: modern methods of construction, traditional examples of design, brickwork, layout, etc., all may be seen in varying degrees of costliness and cheapness.

Finland.—The town plan of Helsingfors is a grandiose conception, and studies and models for the new suburbs have been made in greatest detail. The design for the study of Munksnas-Haga by M. Eliel Saarinen is a remarkable example of modern Finnish civic design.

Russia.—The most interesting piece of city planning in Russia is Moscow: the old capital has always been one of the foremost examples of instinctive "spider's-web" planning, caused by the successive walls of fortifications with the Kremlin at the centre. The extension plan carrying on the same type, with ring and radial roads, makes Moscow one of the largest and most marked examples of continuous-spreading towns, the reverse of the satellite method of growth.

United States.—Among the most marked features of the period in America has been the city-planning report which many towns have issued, not usually by official action, but as a result of the interest of the citizens at large and business men in the future of their city. Of the 43 cities in the United States with a population of 150,000 or more, only one has not had some sort or other of town-planning report prepared. The Chicago report, which appeared in 1909, was the first of these magnificent schemes to appear, in this case prepared for the Commercial Club, and presented to the city; and the main lines proposed have been adopted. Since then the San Francisco, Cleveland, Philadelphia, Boston, Rochester, Minneapolis, Pittsburgh, New Haven, New Jersey, Newark and many more reports have appeared, their tenor varying from monumental vision to severely practical and statistical suggestion.

The almost universal "gridiron" type of plan upon which American towns have been laid out has given a considerable degree of uniformity to many of these schemes, and has sharply cut them off from the normal European town plan. The aim of these plans has therefore been largely to cut diagonal lines through the square chequer board (the Fairmount Parkway has thus been thrust right through the very heart of Philadelphia at the City Hall); to create an encircling boulevard connection (as proposed for Chicago); to give the city a manifest centre, the gridiron being continuous and devoid of climax. These civic centres, in which were massed all possible public buildings with gardens and monuments, threatened at one time to become an obsession, but latterly have assumed juster proportions in the general scheme of things. San Francisco, St. Paul (Minnesota), St. Louis, Denver, Rochester and Springfield are among the more remarkable civic centres in course of realisation. Great attention has also been given to the railway station and its connection with the town; at Cleveland this is the key of the civic centre.

In the systematic provision of open spaces America has led the world: nearly all the statistical bases upon which parks and playgrounds are disposed in England have been founded on United States practice and experience. Small children's playgrounds, local gardens, connecting park strips, riverside drives and tree-planted boulevards, large parks and stretches of reserved country are all knit together into a continuous system which interpenetrates the town plan and in some places appears to be its guiding factor. The Boston and Metropolitan park system is the oldest, and is on a truly regional basis, as it embraces the areas of no fewer than 38 different local authorities who all contribute to its cost and upkeep. Other fine park systems are found at Kansas City, Cincinnati, Minneapolis, Philadelphia, Baltimore, Portland and Providence

The most characteristic city-planning term in use to-day in the United States is "zoning." This has been so enthusiastically taken up that zoning legislation and plans have been passed for cities, quite apart from other aspects of town planning. This is the exact converse of what has frequently happened in England, where main road plans have been prepared without any thought of what buildings are to face on them or occupy the districts through which they pass. Some 300 cities, towns and villages have passed zoning ordinances determining with some exactitude the character of every building to be erected in each district. This control of the use of land, density of population and height and bulk of buildings is administered directly by the courts under what is known as "police power," and not by the municipality under by-laws. Comprehensive zoning was first applied about nine years ago in New York; its growth and codification of practice took place in a decade.

New York, already zoned, is pursuing its city and regional plan. It is the biggest thing in city planning in the States, the area extending to 3,500,000 ac. and the population being about 9,000,000. Detailed monographs are prepared of all trades and their requirements; traffic and other data are collected and preliminary studies made. Rapid transit routes and freight distribution plans have been prepared in order to control the future spread of the population.

Washington, specially designed as a capital city, has been thoroughly overhauled by a commission and its original plan amplified; this was rendered possible by the reclamations from the Potomac river. The railways have been grouped together into a Union station facing down one of the avenues to the Capitol. The Mall, in front of the latter, has been cleared of blocking buildings and irregular gardening and is being restored as a great processional park leading up to the Washington monument; beyond this, the main axis is continued to the new Lincoln Memorial, and a bridge is planned across the river to the national cemetery at Arlington. The park system of Washington has been augmented by a series of magnificent riverside drives.

Other Examples of Town Planning.—The most remarkable city-planning study of Canada is that which has been prepared for Ottawa. Imposing plans have also been designed for Calgary and Vancouver.

Canberra, the Australian capital, is being built. The design was obtained by a competition, which was won by Mr. Walter B. Griffin of Chicago. Delhi, the monumental centre of British administration in India, is conceived on a scale of the greatest magnificence. Madras, Bombay and Lucknow have each of them great schemes in course of realisation.

International Organisations.—At Ghent in 1913 there was held the first international congress on town planning and organisation of city life, on the occasion of the great exhibition. There was also the Cities Exhibition arranged by Professor Patrick Geddes. At this congress was founded the "Union Internationale des Villes et Communes," with its headquarters at 3, rue de la Régence, Brussels. This Union is intended to be the meeting ground of all cities for a discussion and comparison of problems concerning city life, of which town planning is one. The secretariat publishes a valuable periodical bibliography, "Tablettes Documentaires," which summarises international happenings in relation to civic life. Conferences are held from time to time, the last being in Paris in 1925.

Closely allied to the above, but dealing strictly with city and regional planning activities, is the "International Federation for Town and Country Planning and Garden Cities": headquarters, 3, Gray's Inn place, London. A very large number of technical and sociological organisations are represented on the council, and the leading technicians of the world belong to the society. The conference held in New York in 1925 was attended by representatives of states, affiliated societies, municipalities, technical bodies and individual members from 26 countries.

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(P. A.*)

CIVIL SERVICE (*see* 6.412).—This term usually refers to the officials of the central government only, but in France and certain other countries persons employed by municipalities and other local authorities are also civil servants.

GREAT BRITAIN

In Great Britain, in 1926, the Civil Service consisted of about 300,000 persons, of whom 187,500 were in the postal service. This excludes the industrial staffs of such services as admiralty dockyards. Of the total number 73,500 are women, of whom 50,600 are in the postal services. Of the men about 143,000 served in the armed forces in the World War.

The work of the Civil Service has not only increased since 1911; it has also in some sections changed in character. There are many more technical officials than there were, as the task of government has changed in regard to health, transport, etc. The machinery of administration is not very different in the various departments; but there are specialist functions performed by some officials: for example, the inspectors of the Home Office, the inspectors of the Board of Education, the employment exchange officials, etc. New departments have come into existence, *e.g.*, the Ministry of Labour (1917), which took over the "labour" divisions of the Board of Trade; the Ministry of Health (1919), which combined the work of the old Local Government Board with that of the Health Insurance Commissioners, etc.; the Ministry of Transport (1919), which took over some old functions of the Board of Trade and fulfils some new functions in regard to railways; the Ministry of Mines, combining some old work of the Home Office with some old work of the Board of Trade; the Dept. of Overseas Trade and the Air Ministry. The Ministry of Pensions deals with War pensions and may be regarded as a survival from the war period.

War Departments.—Some new departments created during the War, have ceased to exist: for example, the Ministry of Munitions (1916–20), the Ministry of Shipping (1917–20), the Ministry of Food (1916–21), the Ministry of National Service (1917–20) and the Ministry of Reconstruction (1917–20), and some sections of older departments, which grew up during the War, have also disappeared: as, for example, the postal censorship under the War Office, and the War Trade Dept. under the Foreign Office. During the War there were departments which hardly affected the character or functions of the normal Civil Service, such as the Ministry of Information, and these have disappeared.

Conditions of Entry.—The normal methods of entry to the Civil Service remain much the same as they were before the War. Examinations for entry are under the supervision of the Civil Service Commission; but this body has not the extensive powers of the United States Civil Service Commission. The Treasury is the co-ordinating authority for the British service. Under an order in council of July 22 1920, the Civil Service Commissioners issue regulations from time to time as to the conditions of entry and the subjects of examinations. Special arrangements were made in the years immediately following the War for recruitment; but all these have now come to an end. The special arrangements are recorded in the Reports of the Gladstone Committee (Cmd. 34, 1919; Cmd. 36, 1919; Cmd. 164, 1919) and of the Lytton Committee (1920, 1921, 1924).

Changes in Administration.—The organisation of the Civil Service has been considerably affected by the Reports of the Royal Commission on the Civil Service, especially the Fourth Report (Cd. 7,338, 1914). Again, a joint council for the Civil Service administrative and legal departments was established in July 1919. A joint committee of this council issued a report (Feb. 17 1920) on reorganisation, and the suggestions made in that report, agreeing with principles advocated by the Royal Commission, have been made the basis of the present organisation of the home service. The foreign services were reported upon by the Royal Commission (Fifth Report Cd. 7,748, 1914).

The general order in council of Jan. 10 1910 still remains the chief statement of the conditions of employment by the Crown. The present classification of the members of the Home Civil Service is as follows: an administrative class, concerned with the formation of policy, an executive class and a clerical class. Besides these there is a class of writing assistants in certain departments, for filling up forms, etc., and a separate section of typists and shorthand typists.

Pay and Pensions.—The pay of civil servants in Great Britain in permanent grades includes salary proper together with a bonus fixed in 1920 on the basis of a cost of living percentage of 130 above that of 1914. The bonus is given to all civil servants except those with salaries of £2,000 a year and over, but it is graduated so that the rate of bonus decreases as salaries increase. The bonus is subject to review every six months, when it is increased or decreased by 1/26th for every five full points by which the average of the official increased cost of living figures for the preceding six months rises above or falls below 130.

Disregarding the bonus, the pay of the principal classes of civil servants in London is as follows: the pay of those receiving more than £500 a year varies in different departments, but heads of departments receive in some cases £3,000 a year. Assistant secretaries receive from £1,000 to £1,200 a year and principal clerks £700 to £900. In accounting and supply departments the higher posts are usually paid on two scales, £550 to £700 and £850 to £1,000. Lower rates are at present generally fixed for appointments held by women.

Pensions and retiring allowances are granted to civil servants who retire on account of ill-health, age or because the office which they hold is abolished. No civil servant retiring before the age of 60, except for ill-health or on the abolition of his office, is eligible for any pension or gratuity. No civil servant with less than 10 years' service is eligible for any pension or gratuity. No civil servant with less than 10 years' service is eligible for pension, and the maximum number of years' service for which pension is granted is 40, or, for additional allowances, 45 years. But civil servants retiring for the reasons given above, with less than 10 years' service, are eligible for a gratuity. If a male civil servant dies in the service, a gratuity is paid to his estate equal to a year's pay, or the amount of the allowance which would have been due to him had he retired at the time of his death. Apart from pensions under earlier Acts, the Superannuation Act, 1909, which governs most of the cases, grants an annual pension to male civil servants of one-eightieth of the salary and emoluments for each year of service: there is also an additional allowance of a lump sum equal to one-thirtieth of the salary and emoluments for each year of service.

Position of Women.—The position of women in the Civil Service of Great Britain has changed considerably since 1914. At that date the divisions of the service known as Class I., second division and assistant clerks were not open to women. There were about 3,000 women in certain self-contained branches of three or four departments, but most of these were in the General Post Office. There were about 500 women in the Labour Exchanges, some typists and shorthand typists and a class of female writing assistants numbering about 1,800. There were also some women inspectors for factories, health insurance, education, etc.

The Royal Commission proposed a large extension of these practices (Cd. 7,338, chapter x.); but it was the War which radically altered the situation. Men were needed for military service at the very time when the activities of the Civil Service greatly increased; and by July 1919, there were more than 115,000 women in the service. Evidence of their work is given in the Report of Lord Gladstone's Committee (Cmd. 164, 1919). The Sex Disqualification Removal Act, Dec. 29 1919, removed certain obstacles, and required that an order in council which might "prescribe the mode of admission for women to the Civil Service" should be laid before Parliament forthwith. The Reorganisation Committee of the Joint (Whitley) Council, referred to above, made detailed suggestions in regard to the employment of women in the Civil Service (Feb. 1920); and the House of Commons on May 19 1920 passed the following resolution:—

> That it is expedient that women shall have equal opportunity of employment with men in all branches of the Civil Service within the United Kingdom and under all local authorities, providing that the claims of ex-service men are first of all considered, and should receive equal pay.

The Govt. refused to act on this resolution, but accepted a modified resolution of Aug. 5 1921, including the phrase:—

> Having regard to the present financial position of the country this House cannot commit itself to the increase in Civil Service salaries involved in the payment of women in all cases at the same rate as men.

The employment of women has been curtailed owing to the necessity of finding places for ex-service men. Regulations in regard to the dismissal of women on their marriage were published on Aug. 26 1921 (E. 3,754/03): and further regulations reserved to men certain branches of the Civil Service (E. 3,242, in draft in Cmd. 1,244, April 11 1921).

Rights of Combination, etc.—The organisation of the Civil Service has been greatly affected by the adoption of the policy expressed in the Reports of the Whitley Committee of 1917, on the relations of employers and employed. The Govt. accepted the application of the principles of that report, and a joint council for the Civil Service, administrative and legal departments, was established in July 1919. This council consists of representatives of the Treasury and other departments, standing for the public as employers, and of representatives of the employees taken from associations and unions of civil servants. There are subordinate departmental joint committees. The central council produced, through an *ad hoc* committee, the plan of reorganisation of the Civil Service referred to above. There are also Joint Councils for industrial establishments under the Admiralty, Office of Works, War Office, Air Ministry and Stationery Office. Civil servants are organised on a trade union basis in certain sections: for example, the Civil Service Clerical Association has a membership of about 17,500, the Post Office Workers Union has a membership of about 80,000 and the Post Office Engineering Union, a membership of about 15,300.

A board of conciliation and arbitration in the Civil Service, established in 1917, came to an end in 1921; but in April 1925 new machinery for the same purpose was set up under the Industrial Courts Act, 1919. The Court of Civil Service Arbitration, described in the official letter of the Treasury (No. 6/25, March 14 1925), has power to deal with "claims affecting emoluments, weekly hours of work and leave of certain classes of civil servants." Claims of those classes receiving more than £700 a year will not be referred to the court except by the consent of both parties. Cases of individual officers are excluded from the competence of the court. The official announcement says that "subject to the overriding authority of Parliament, the Government will give effect to the awards of the Court."

The political rights of civil servants, *i.e.*, in regard to appearing on political platforms or standing for election to Parliament and local authorities, are defined by order in council. At present a civil servant is not allowed to criticise or express opinions publicly in regard to public affairs with which his own department is specially concerned; and with regard to candidature for Parliament, a civil servant is required to resign his post on the announcement of his candidature and has no right to reappointment even in the event of failure to be elected. A Treasury committee has reported upon this problem (Cmd. 2,408, 1925). The report contains information as to the existing regulations for parliamentary candidature of persons serving in the army, navy or air force as well as civil servants.

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THE BRITISH EMPIRE

In the Crown Colonies the Civil Service is frequently drawn from among residents in this or that colony, but the higher officials are appointed directly through the Colonial Office. In the self-governing Dominions the Civil Service is controlled by the Govt. of the Dominion in question.

Canada.—The "spoils" system was abolished and competitive examinations made effectual for the inside service by the Civil Service Act of 1908; and the same principle was established for the outside service by the Act of 1918. In that year a report was made by a body of American experts, on which a reclassification of the service was instituted and special examinations established for 1,600 different offices. The experts have thereby introduced two new conceptions; (*a*) that technical detailed knowledge of each office should be required of a candidate before entry, and (*b*) that there is no serious difference between routine and intellectual administration. The Act of 1918 contains most of the existing regulations in regard to political rights, promotion, dismissal, etc. (See R. M. Dawson, *The Principle of Official Independence* (1922), ch. iii., "The Civil Servant".)

Australia.—The Public Service Act, 1922, governs the situation. The Act of 1902 was the first to regulate the Civil Service under the Commonwealth constitution; and under that Act a Civil Service Commissioner was appointed. The Royal Commission on Public Service Administration reported in 1919, and another commission reported on Economies in 1920. As a result the Act of 1922 was passed, which established a board of commissioners for the public service with extensive powers, similar to those of the United States Civil Service Commission rather than to those of the British system. The Arbitration (Public Service) Act, 1920, superseded the original Arbitration Act of 1911, and established a public service arbitrator, holding office for seven years, for giving awards on claims from associations of public servants; but this Act of 1920 appears to conflict in some particulars with the Act of 1922, in regard to the powers of the board. The decisions of the arbitrator have raised salaries by over £1,000,000 since 1913 without the board having any power to control such decisions. There is a system of contributions towards a superannuation fund. The number of civil servants in 1923 was about 202,476, of whom 26,277 were in the Commonwealth service. (*First Report of the Public Service Board of Commissioners*, Oct. 1924.)

New Zealand.—The Public Service Act, 1912, places the service under a commissioner and two assistants, appointed for seven years and responsible only to Parliament, but the Postal and Telegraph Act, 1918, excludes those services from the authority of the commissioner, except in regard to making appointments. There is a contributory superannuation fund under an Act of 1908 (*Year Book of New Zealand*).

Union of South Africa.—The Public Service Act, 1923, carries out the recommendations of the committee of enquiry which reported in 1920. Regulations have been issued in government notices under the 1923 Act. There is an advisory council representing associations of public servants which gives advice to the public service commissioners, when asked. The commissioners were appointed Nov. 27 1923, and have the extensive powers usual in the Dominions. The number of civil servants in 1925 was 26,612 (*Official Year Book of the Union*).

British India.—The situation is now governed by the Govt. of India (Civil Service) Act, Dec. 1925. The whole problem, however, is still fluid owing to the development of general policy in regard to the Govt. of India. The Islington Committee recommended certain improvements in the Civil Service in Aug. 1915, but the report was only published in Jan. 1917. On Aug. 20 1917 the Secretary of State for India in the House of Commons announced that there would be "increasing association of Indians in every branch of the administration"; and in that year the enquiries began which led to the Montagu-Chelmsford report (Cd. 9,109, 1919) and the Govt. of India Act, 1919, the preamble of which allows for the Indianisation of the services. The MacDonnell Committee reported on difficulties of recruitment in 1922 (January) and the O'Donnell circular of May 30 1922, gave, in a letter to local governments, the arguments for and against drastic reduction of the number of Europeans. Finally, the Lee Committee reported on the superior civil services (Cmd. 2,128, 1924) and the Act of 1925 implements their recommendations.

The United States

The changes in the Federal Civil Service in the United States since the War are (*a*) an increase in the number of employees, (*b*) an increase in the proportion of women employed, and (*c*) modifications in the laws and regulations. In June 1914 there were 482,721 employees in the Federal Civil Service, of whom 292,460 had entered by competitive examination. In June 1923 there were 548,531 employees. During the War the number of women employed was increased, and since 1919 all the examinations under the Civil Service Commission have been open to women. In 1923 about 15% of the employees of the Federal Civil Service were women; and the greater number of these (41% as compared with 11% of the whole Civil Service) were in the District of Columbia, since outside that district the positions are such as are not usually sought by women (letter carriers, mechanicians, etc.). One member of the Civil Service Commission since 1920 has been a woman.

The statutes and Presidential rules affecting the Civil Service are printed in the *Report of the Civil Service Commission* for 1923. The chief new statutes and rules since the War are as follows: the Retirement Act, May 22 1920; the Classification Act, March 4 1923; a Presidential Order, March 3 1923, granting preference, under amended terms, to veterans, etc. The number of posts entered by competitive examination has been increased by the Presidential Order of May 10 1921, requiring examinations for the three superior grades of postmasters. The general tendency to abolish "political" appointments has been continued: but there are still about 15,000 positions filled by appointment by the President, besides 12,000 excluded by law from the classified Civil Service. The positions of deputy collectors of internal revenue are still regarded as "spoils" for the victors in political contests; and cases of illegal appointment for political reasons still occur and are dealt with by the commission. The Civil Service in the various states is developing along similar lines.

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The French Service

The number of civil servants under the Second Empire was 200,000 and in 1909 it was 757,678, not including workers on the state railways. These numbers, however, cannot be compared with those given for Great Britain, because in France they include local government officials and teachers, who would not be included as civil servants in Great Britain. The constitution of Feb. 25 1875, Art. 3, gives power to the president to nominate for all offices or posts in the service, and the conditions of entry, etc., are to be found in rules administered finally under the Conseil d'Etat. Examinations are held for candidates for most posts, and a university degree is in some cases necessary for entry. The organisation of the service in France is in three particulars strikingly different from that in Great Britain: (*a*) the Conseil d'Etat, (*b*) the cabinet of a minister, and (*c*) the position of the prefects and the connection between the central and the local administration.

The Conseil d'Etat, apart from its functions as court of appeal in cases of administrative law, is a central advisory body of permanent civil servants for assisting the Govt. of the day in its executive functions. The ordinary members of the conseil number 35; they must be at least 40 years of age and are partly officials who have had responsible positions elsewhere and partly chosen from among the 37 *maîtres des requêtes* who act as part of the conseil in preparing reports. The Conseil d'Etat discusses all matters of foreign policy, finance, police, education, etc., but its advice does not bind the Government.

The cabinet of a minister is a small body of officials chosen by a minister as a private secretariat to advise on policy. The law of July 13 1911, Art. 142, takes cognisance of the cabinet and prevents certain dangers of favouritism in the cabinet system; but the control over policy exercised by a cabinet naturally turns the rest of the officials in the ministry into mere instruments. A long controversy is connected with the right to trade union organisation among civil servants; and there seems to be an agreed distinction between civil servants who "give orders" (*fonctionnaires d'autorité*) and those who perform quasi-industrial services (*fonctionnaires de gestion*). The problem was discussed in the Senate and the Chamber in April and July 1919, but no solution was adopted. The present situation is that the law of 1884 does not allow trade unionism among civil servants, but that the laws of 1901 and 1920 are believed by some authorities to permit such trade unionism. In any case in practice *syndicats des fonctionnaires* are recognised and there is a powerful Fédération des fonctionnaires. (See H. Barthélemy, *Traité élémentaire de droit administratif*, 10th ed., 1923; J. Barthélemy, *Le Gouvernement de la France*, 1924.)

The German Service

In Germany the position of civil servants has been affected by the revolution and the Weimar Constitution of Aug. 14 1919, of which Articles 128, 129, 130 and 143 affect the Civil Service directly. The number of civil servants has increased since 1914 in spite of the loss of Alsace-Lorraine and although the Federal Post Office is to be conducted as a quasi-private undertaking. In spite of considerable reductions after the War, the number of full-time Federal civil servants in 1925 was about 94,300 as compared with 19,200 in 1913. But this has not decreased the number of civil servants in the various states; for example, in Prussia there are 11,500 more than in 1913, an increase of 10%, and in Bavaria the number has risen from 23,000 to 33,000, or nearly 44%. It is recognised that these numbers should be reduced, but as all these officials are pensionable, reduction of numbers would still leave a large expenditure necessary.

The chief increase of Federal officials is in the financial administration, in which there are now 73,200 persons. Before the War, taxes were levied by the states through the communes; but now, largely owing to the financial requirements of the Versailles Treaty, taxes are imposed and collected by the Federation, and, therefore, a large Federal organisation has been created, which is staffed by Federal officials. Women are eligible for any posts in the Civil Service, but in practice women are still excluded from judicial office. The political rights of civil servants have not been much changed so far as the letter of the law goes, since the War; but in practice civil servants used not to be free to engage in political activities, and particularly membership of socialistic parties was made impossible; and in this matter the Prussian administration was exceptionally strict. All this, however, is now changed, and civil servants are now as free politically as any other citizens. Freedom of combination is guaranteed by Art. 159 of the Weimar Constitution to all, and therefore to civil servants both in the states and in the Federation. There are several unions of officials. (See H. Oppenheimer, *The Constitution of the German Republic*, 1923.)

The League of Nations

An important development since the War has resulted in the establishment of an international civil service. It is true that ever since the middle of the 19th century, for example, in the office of the Universal Postal Union since 1870, there have been small numbers of officials under authorities representing the joint action of sovereign states; but the establishment of the League of Nations and its International Labour Organisation has considerably modified the situation. There are now 475 officials of the league in Geneva and elsewhere and 360 officials of the Labour Organisation. Their work is partly to carry out the decisions of international councils, or committees, and partly to co-ordinate the activities of the governments of the states in the league. The league Civil Service thus forms an integral part of the whole machinery of government.

The Civil Service of each of the fully developed states is now in contact with the relevant services of the other fully developed states, since it is now recognised in practice that the work, for example, of public health organisation or education cannot be effectual unless there is co-operation between states. The league officials therefore are a necessary inter-connection of the parts of modern administration. Appointments are generally made after competitive examinations, which are held periodically. But apart from competence, some regard is paid to nationality. In 1925 there were 34 different nationalities in the League Secretariat. Of the 475 officials, 161 are British (including the Dominions), 93 French and 101 Swiss.

See *Annual Reports* on the Budget of the League and of the Director of the International Labour Organisation. (C. De B.)

CLARETIE, JULES (1840–1913), French man of letters (*see* 6.436), completed *La Vie à Paris* in 1913, later published in 21 vol. in 1914. He retired from the Théâtre Français in 1913 and died Dec. 23 of the same year.

CLARK, CHAMP (1850–1921), American politician, was born in Anderson Co., Ky., March 7 1850. He first entered Kentucky University but finished his course at Bethany College in 1873. The following year he was elected president of Marshall College, West Virginia, and one year later was admitted to the bar. After 1880 his law office was in Bowling Green, Missouri. He was city attorney for Louisiana, Mo., and for Bowling Green from 1878 to 1881; and was prosecuting attorney for Pike Co. 1885–9, and then for three years was a member of the Missouri House of Representatives. He was a member of Congress from 1893 to 1895, and from 1897 to 1919, being Speaker from 1911 to 1919. At the Democratic Convention for the nomination of a presidential candidate held at Baltimore in 1912, he led on 27 ballots and on 8 had a clear majority, but not the necessary two-thirds. He was finally defeated by Woodrow Wilson of New Jersey. He died in Washington, D.C., March 2 1921.

CLARKE, THOMAS SHIELDS (1860–1920), American artist (*see* 6.447), died in New York City Nov. 15 1920.

CLASSICAL EDUCATION.—In the principal secondary schools in Great Britain, classical studies are not losing ground (*see* Public Schools). As historical links exist with university foundations, the great public schools conserve the best traditions of classical scholarship. The introduction of modern methods, together with the development of interest in local and general archaeology, serves to maintain these studies in a position of basal importance. As characteristic of new methods the following account of an interesting and successful experiment in classical education deserves notice:—

The Direct Method.—The direct method of teaching foreign languages aims at teaching by use. It connects the foreign word, phrase or sentence directly with a thing, or an act or thought, without the intervention of English words. When a certain number of words have been learned, new ones are explained by a paraphrase in the same language; and in the final stage, the literature is read and discussed in the original.

This has long been recognised as the proper method for modern languages; and a working system has been devised by which it can be applied to Latin and Greek. Time is saved, because the whole lesson is taken up with the language, instead of its being largely occupied with English explanations; attention is kept, because the language used expresses what we do or think, and it is real to us instead of artificial; understanding is easy, because what we do or see, explains what is said. In proportion as we exclude English words from our minds, we come to think in the language, and a feeling for its idioms and turns of speech is soon developed. Idiom is usually the last thing to be learned, and then only by the select few; with this method, it is the first thing, and it is learned by all. Since the vocabulary used is simple and deals with every-day and familiar life, the attention can be exercised on the novelties, that is, the peculiar inflections which distinguish the ancient languages.

Grammar is learned as much on the direct method as on any other; but it is learned after use, not before, and is therefore less irksome. Short exercises are also used, if necessary, to illustrate grammar; they do no harm if they come in their proper place (after use) and in due proportion (not excessive).

With the reading book, from the very first all is read aloud and explained in the same language, the explanations being written and learned. English is never used unless it cannot be helped, and then with a kind of apology. The less English we use, the more Latin or Greek we shall learn. When the pupils are fit to read an author, they know enough to dispense with English altogether or nearly so. Formal translation from English into Latin or Greek, the most difficult of all exercises, is reserved for the last two years of school life. Whoever does not understand must ask. No one is blamed for not understanding; all are blamed, and punished if necessary, for not asking.

The reading lesson is the most important part of the direct method. Every line of the matter is read aloud; and very often the mere manner of reading shows at once whether the text has been understood, and if it has not, it can be explained simply by correct reading. By reading the memory is filled, the ear is taught, the taste is trained; the language, in short, is learned in the most effective way. So much so, that verses of all sorts, lyrics included, are written with ease by imitation. But the real merit of this method lies in its effect on the learner. From the first stage to the last, the learners are willing to learn, and happy in learning; their attention is kept without trouble and discipline is easy. (W. H. D. R.)

Universities.—In the universities archaeology, anthropology, numismatics, epigraphy, psychology, philology and geography are recognised as essential to the classical scholar who would understand and describe clearly conditions of life in the ancient civilisations. Western Europe has learned to realise the measure of its debt to Greece and to estimate the nature of the legacy it has received from Imperial Rome. To the Greeks modern science owes much—the spirit of ceaseless enquiry; from Rome come political ideas and methods as yet unexhausted. The precision of classical literature leads to a sense of proportion, a standard of values, a respect for the truth of words, and accuracy of thought—qualities of abiding worth in the turmoil of public life or in the contests of scientific debate.

France.—In France during the greater part of the 19th century, the position of classics in secondary schools was supreme. They alone led to the baccalaureate;—sole entrance to the universities and the liberal professions. Towards the end of the century, a strong movement in favour of modern languages and science arose. In 1898 a parliamentary committee was appointed to inquire into the subject. They reported in 1899, but it was not till 1902 that their conclusions were embodied in the establishment of four alternative courses, a full classical, a Latin-modern languages, a Latin-science and a purely modern course, all of which led to the university. These courses remained unchanged for nearly 20 years, and during that period the classical candidates for the baccalaureate, who in 1904 numbered 3,337, fell to 2,775 in 1924. The Latin-modern rose from 1,217 to 5,964, the Latin-science from 2,229 to 5,241 and the science-modern languages from 2,742 to 5,241. Thus, while Greek declined, the students taking Latin increased more than twofold and amounted to over 70% of the candidates.

The war brought its aftermath of discussion. In 1922 M. Bérard, the Minister of Public Instruction, proposed to make Latin and Greek obligatory in the earlier stages, and to cut down the courses to two (classical or modern). A bitter struggle followed, in which the majority of expert opinion was against him. None the less, in May 1923 the President of the Republic issued a decree embodying the proposals of M. Bérard, and requiring a certificate of proficiency in Latin and Greek from all future candidates for the baccalaureate. A year later the Ministry fell and was replaced by a Radical one. The two courses have been maintained, but Classics are no longer obligatory for all, though as the curricula of the girls' schools have now been assimilated to those of the boys, a classical education is equally open to the former.

Germany.—In Germany up to the end of the 19th century, Classics were likewise supreme. The full classical school, the Gymnasium, was with one or two exceptions the sole avenue to the university and liberal professions. In 1890, at the instance of the Kaiser, a conference was called in Prussia. Its conclusions, largely embodied in the curricula of 1892, reduced the number of hours given to classics and dethroned the latter in favour of the mother tongue, while the universities were thrown open to pupils from the Realgymnasium (Latin-Modern School) and to a large extent to those from the Oberrealschule (Modern Studies School). Similar reforms had already been adopted by other German states. The next outstanding feature was the founding of Reformgymnasia, where the first language was French, Latin not being introduced till the fourth and Greek till the sixth year, both being taught intensively. This type was largely adopted in Prussia before the war. Classical studies have been open to girls since 1904, but the number taking them has not been very great. For education since the war, no statistics are available, but according to one authority, "the desertion of schools with Latin as a central subject is general." Others are less pessimistic and the prevailing opinion seems to be that the Reformschulen will ultimately be the future type of German classical education.

Italy.—Of the other European countries, the most interesting one from the classical standpoint of view is Italy. Here, thanks to the reforms of Gentile, there has been a strong reaction in favour of classics, and by the royal decrees of May and Nov. 1922, classical studies have been strengthened in the Higher Schools not only of the purely classical but also of the scientific type. Latin in fact is now obligatory in all secondary schools. Room for this increase has been found by cutting down the number of subjects and reducing the time given to mathematics; the main object of the reform being to replace the former encyclopaedic aim of the school by a cultural one based on direct knowledge of the classics. Latin is also a principal subject in the girls' high schools.

Belgium.—In Belgium again the position of classics appears to have improved. A committee was appointed after the war to consider the reform of the school syllabuses and the position of Greek. As a result, classics have been maintained in the Athénées Royales (High Schools) and further Greek and Latin can be studied in those *écoles moyennes*, which are not within convenient distance of an Athénée.

Norway.—In Norway, likewise, the classics have recovered ground. In 1896 Greek was entirely banished from secondary education; to-day it is included in one section of the higher schools (Gymnasia), and can be studied by girls as well as boys.

Czechoslovakia.—The republic of Czechoslovakia has largely maintained the previous types of education, which were on German lines and as the system is co-educational, classical or Latin studies are equally open to girls.

Sweden.—In Sweden classics seem to have somewhat lost ground. The pupils following a full classical or Latin course, who ten years ago were in a majority, are now outnumbered by those taking modern studies.

To sum up: In Italy classics are supreme. In Spain Latin is obligatory for all university entrants. In France, while Greek is on the wane, Latin forms part of the education of at least two-thirds of the secondary pupils. In Germany for the moment Latin is losing ground, but in the new Reformschulen classical pupils still abound. In Sweden classics appear to be slightly losing popularity; in Czechoslovakia the old forms of classical education have been preserved. In the other European countries, where classics have been ousted from intermediate education and confined to one or more sections of higher education, they are apparently either holding their own, or have recovered some of the lost ground, as in Norway and Belgium. (C. Bre.)

In the United States

United States.—The limitation of the Latin vocabulary required in the secondary schools to the words of greatest value for further study of Latin was modified by a study of the Latin words most important for the correct use of English, and a definite place in teaching was assigned to the derivation of English words from Latin. Greater attention was paid to the historical, political, social and literary values of the authors read, and less emphasis was laid on the formal side of the language. The Direct Method, demonstrated by Dr. W. H. D. Rouse in New York in 1912, was found ill adapted to the inelastic programmes of the large public high schools, but its influence was seen in the greater provision for oral Latin in new textbooks.

In 1920 the General Education Board arranged with the American Classical League to conduct an investigation of the Classics (chiefly Latin) in American secondary schools. This investigation was carried out by experts and extended over a period of three years. The results were published in 1924 in the elaborate General Report, Part I. This covered statistical information, chapters on the aims of Latin teaching, the curriculum, the methods of teaching, etc. The aims as organised were, in order of importance, to read and understand Latin; to increase the pupil's ability to understand the Latin element in English, and to read, speak and write English; to develop historical and cultural background, correct mental habits and right attitudes toward social situations; to increase the ability to learn foreign languages; and to give an elementary knowledge of the principles of language structure. The chapter on curriculum recommended a graded restricted vocabulary organised largely with reference to English derivatives; an elimination of the unusual syntactical constructions from the early work; an increase in the amount of easy reading; less attention to Caesar, Cicero and Vergil; a wider range of selection in authors; and an extensive use of collateral reading illustrative of the civilisation of Greece and Rome. In the chapter on method a functional rather than a formal approach was suggested, with careful attention to the transfer of training, a large use of oral Latin, including reading aloud with proper expression, and the employment of translation rather as a sure training in English than as a means of testing comprehension of the text.

The suggestions of this report have been received with general approval and bid fair to be widely adopted. The College Entrance Examination Board has approved them, and textbooks are being modified to meet the new demands. (G. L.*)

CLAUDEL, PAUL (1868–), French poet, dramatist and diplomat, was born Aug. 6 1868 at Villeneuve-sur-Fin. He was educated at the Lycée Louis-le-Grand, and entered the consular service in 1892. The early part of his diplomatic career was spent in the East as consul at Foochow, Shanghai and Tientsin. As first secretary at Peking he gained a valuable acquaintance with Chinese life and thought. In 1921 he was made French Ambassador at Tokyo after a series of European appointments and three years in Rio de Janeiro. He was one of the earliest contributors to the *Nouvelle Revue française*, founded in 1908–9, but as early as 1900, he was recognised by the discriminating few as a writer of the first rank. His works and especially his plays are definitely Catholic in inspiration; they are, however, often marred by a vague mysticism tending to obscurity.

Among his works are *Connaissance de l'est* (1900; Eng. trans. by T. Frances and W. R. Bénet, *The East I Know*, 1914); *L'échange, La tête d'or, La jeune fille Violaine* (1901); *Cinq grandes odes* (1910); *L'otage* (1911; Eng. trans. by Chavannes, 1917); *L'annonce faite à Marie* (1912; Eng. trans. by L. M. Still, 1916); *Deux poèmes d'été* (1914); *Corona* (1915); *Poèmes de guerre* (1915). He was also responsible for translations of the Agamemnon and the Eumenides of Aeschylus (1920).

CLAUS, ÉMILE (1849–1924), Belgian painter, was born at Vive Saint-Éloi, Flanders, on Sept. 27 1849. Receiving early training at the Antwerp Academy of Fine Arts, Claus began as a traditionalist. His early works are genre scenes and portraits, correctly drawn and painted in a stereotyped manner and showing no originality. Soon, however, he came under the influence of certain French painters who had determined to break from the rut, and he completely changed his style, in spite of the fact that he had achieved a certain reputation and his work was remunerative. He started to paint in high lights by the juxtaposition of pure colours. He settled at Astène, in a house on the banks of the Lys, which he called *Zonneschijn*. There he began to paint that beautiful series of views of meadows, gardens, fields, streams, roads, seen at every time of the day, at every moment of the season. He became the painter of the sun and of the moonlight, of the blue or of the grey sky, of rain, of wind, of mist, of snow, of dew, of fog, rather than the painter of earth, trees, cottages, cattle or human beings in the open fields, which appear to be his subjects.

During the World War Claus resided in London, and from the windows of a house on the Victoria Embankment painted views of the Thames, showing the changing effects of the light and the weather. In 1917 he accompanied the Queen of the Belgians to La Panne, and visited the devastated regions. In 1920 he returned to Astène and worked there until his death, on June 6 1924. He was a member of the Belgian Royal Academy, Commander of the Order of Leopold and the recipient of numerous Belgian and foreign honours. He is represented in the Luxembourg, Paris, and in galleries in Venice, Brussels, Antwerp, Ghent and Liége. His works are also found in numerous Belgian and foreign private collections. (P. L.)

CLEANING: *see* DRY CLEANING.

CLEMENCEAU, GEORGES (1841–), French politician (*see* 6.482).—In 1911 M. Clemenceau entered the Senate and went on the Commissions for Foreign Affairs and the Army. He could have had no better position for surveying European fluctuations and German activities; or for inquiry into the real condition of French armaments—this last his dominant concern. Convinced that Germany meant war, and was organising war, he was haunted by the fear that again France might be caught unprepared. Significant was his speech in the Senate, Feb. 10 1912, on the Franco-German Convention (of Nov. 4 1911). "Germany relies above all on force . . . her whole thought is how to utilise that force. I see it constantly stated in the German papers that she intends to invade France, and extract from us an immense indemnity. All her newspapers are insisting that France shall be made to pay the costs of the new German fleet."

The Senate, however, gave little opportunity for sounding the alarm. Accordingly, on May 5 1913 appeared a new daily paper, *L'Homme Libre*, its editor—Georges Clemenceau. In its pages he waged daily battle for security and liberty. The issue of May 5 contained the following: "Our past defeats have exposed us to a perpetual menace from the most formidable army that ever was. We must live; and the nation has the right to insist that the maximum of efficiency shall be obtained from its manpower." Though *L'Homme Libre* dealt every day with home politics and social problems, it returned always to the terrible theme of the German menace.

The following extracts are from articles which appeared in 1913: "The issue of this appalling conflict will be nothing less than the life or death of France." (May 25); "Germany has but one aim—to wipe out France." (June 14); "Only an absolutely determined Government can ensure our being prepared for war." On March 6 1914 he wrote: "Let Germany choose her own time; she will soon learn how much can be accomplished by the moral force of a good cause backed by courage and full preparation." To stir the nation by his urgent appeals this ardent controversialist seized every pretext: Alsace-Lorraine, the Zabern affair, the illusions of French pacificists, the vain attempts at a Franco-German rapprochement, the imprisonment of Hansi the Alsatian caricaturist by the Germans. In the spring of 1913 the question of restoring the three years' term of conscript service suddenly arose. Would France make this mighty sacrifice in view of the German peril? M. Clemenceau took an impassioned part in the debates on armaments. The Minister of War admitted that France had allowed herself to be outstripped by Germany in the production of scientific means of warfare, but he added: "Moral force is supreme. With its aid inferior weapons can deal splendid blows." "Why don't you buy crossbows then?" cried M. Clemenceau from his seat in the Senate.

Then came Aug. 1914 and the War. M. Clemenceau was living in the rue Franklin at Passy, in a three-roomed flat crammed with books. The flat was on the ground-floor of a five-storied building, on the far side of the courtyard. At the back, on a terrace overlooking the boulevard Delessert, was a small garden planted with rose-bushes and Japanese dwarf-trees. During the first three years of the War, M. Clemenceau's day was spent as follows: He rose at one or two in the morning, lit his lamp, and worked intensely for three to four hours on the daily article of two columns for his paper. Sometimes this long article was written straight off at one heat; at other times it was worked out after many alterations and erasures. At six or seven o'clock he breakfasted, did physical exercises and received his daily flow of visitors. Next he coped with his correspondence—one to two hundred letters from all parts of France, enabling him to keep his finger on the national pulse. After a hasty lunch of perhaps a cutlet and some fruit, he used to face the two formidable commissions of the Senate, where the ministers of national defence had to appear. After these sittings, M. Clemenceau quitted the Luxembourg to drive off immediately into the heart of Paris. At his newspaper office in the rue Taitbout he went through his article, conferred with his sub-editors and political correspondents, read the evening papers. At eight o'clock he returned home, dined and went to bed. This was the average working day of M. Clemenceau, who in 1914 was already 73 years old.

But at the hands of the Censor *L'Homme Libre* soon suffered for M. Clemenceau's plain speaking. He knew that the war problem was complex, and was determined to insist on all the vital needs. The whole youth of France must be mobilised. He denounced the shirkers, demanded that technical efficiency raised to the highest pitch must become worthy of the outpouring of blood. He attacked all incompetency, red tape, inadequate munition factories, with their shortage of guns and rifles, and badly-run hospitals. He made war in short, upon all who failed to realise that this was a conflict of supplies and organisation, and upon every kind of apathy and feebleness. The civil and military officials were staggered. M. Clemenceau had actually dared to say that all was not well, and that peace habits must cease when the nation was fighting for life. The result was that in Sept. 1914 *L'Homme Libre* was suppressed. Two days later, however, it reappeared as *L'Homme Enchaîné*, but wore its fetters lightly. For three months—until M. Clemenceau came into power—there was a daily struggle with the Censor. Which would tire first? For some time not a week passed without articles being mutilated, but M. Clemenceau won. His hammer hit the nails on the head. The Censor relaxed more and more until excisions became very rare. Meanwhile in the Senate, M. Clemenceau agitated for more and still more guns, munitions, soldiers. He pleaded for a judicious use of the available man-power, for a better medical service.

But above all he strove to create the indomitable and desperate "will to victory." He was supported by other members of the Army and Foreign Affairs Commission, like MM. Jeanneney, Chéron, Doumer, Humbert, Berenger. The War dragged on; weariness, slackness and pacificism began to appear. M. Clemenceau was the first to draw public attention to that growing peril; he now felt that his warning must be more resounding; that neither the columns of his newspaper nor the secrecy of the commissions gave him scope enough. He first spoke behind the closed doors of the Senate, but it was at a public debate there on July 22 1917 that he sounded a clarion call which rang through France. At this time M. Malvy, who had been Minister of the Interior since 1914, was Chairman of an important Committee in the Chamber; and probably even his warmest admirers would admit that during his term of office he had not treated revolutionaries with a firm enough hand. His justification, it is true, was that he desired to "gain the confidence of the working-man"; but M. Clemenceau retorted that there was no comparison between those working-men who were loyally doing their duty to their country and a number of abject "defeatists." In vain the Minister of Justice declared that crimes had been punished and precautions taken; M. Clemenceau denounced the measures as inadequate. "We are at war," he said, "the Germans are at St. Quentin: the morale of the country has been shaken. Yet all you do is to quibble about legal forms and talk about fines of 15 to 300 francs! . . . What we must have is order within, that the army with peace behind it may face its task of war."

Four months later M. Clemenceau came into power. He had never sought office and he knew that his task meant victory or death. It is significant to recall the state of France when Clemenceau became premier. Although some maintained that all was going well, and that victory was in sight, the situation in reality was miserable. The morale at the front was bad, and at home even worse. Resources were nearly at an end, and except in the flowery speeches of officials, no solution whatever could be discerned.

At this point M. Poincaré sent for M. Clemenceau; not because he loved him: it would be hard to imagine two men with less in common than the impetuous, explosive Vendean, and the cold precise Lorrainer. But M. Poincaré realised that of all men M. Clemenceau was the impersonation of the idea of war to the death. In his new Government M. Clemenceau himself took the portfolio of Minister of War. He was not altogether a favourite with his colleagues in Parliament; for hitherto he had been chiefly a fighter, giving and taking hard blows. His warnings had been harsh; his candour scathing. But now they welcomed him. One ministry after another had been dismissed. The last, that of M. Painlevé, had fallen amid feelings of doubt and anxiety. A War Minister was needed who would carry on the struggle without flinching or respite. Such a leader was found in M. Clemenceau, who was then 76 years of age. He formed his Victory Cabinet on Nov. 16 1917 and was destined to see Germany defeated on Nov. 11 of the following year. On Nov. 20 1917 he made the following declaration: "Pacificism must go; no more German intrigues; no more treason or semi-treason. War, and nothing but war!" Thenceforward till Nov. 11 1918, Clemenceau did in fact concentrate on war only. But first he made it clear that France was bent on absolute victory and would brook no half-measures. Those who spoke of wavering or yielding were immediately silenced; any one who obstructed the path to victory was ruthlessly removed. By these means Clemenceau restored the nation's self-confidence, and with it the conviction that its long-drawn out martyrdom would not be in vain. No one who was in France at that time will ever forget that extraordinary resurgence of hope and resolution transforming the French people.

The soldiers at the front redoubled their efforts; in vain the Central Powers alternately brandished the sword and held out the olive branch. The whole nation was solidly united by the will to victory. In March 1918 the Anglo-French line was broken through; Clemenceau joined in organizing the unity of command with Foch at the head. In April the Austrian Minister Czernin proclaimed that France was ready to negotiate. M. Clemenceau merely replied: "Il y a des consciences pourries." In May came the disaster of the Chemin des Dames; the French troops were driven back on the Marne, while the commander-in-chief was criticised. "Our soldiers," said M. Clemenceau, "have officers who are in every respect worthy of them," and three months later he made Foch Marshal of France. During that long year of ceaseless effort M. Clemenceau's resolution remained unshaken. France was determined on victory, for he had infused into her the temper of fine steel. Every night German aviators raided Paris, demolishing whole blocks of houses and dropping bombs even on the Ministry of War itself. "Big Berthas" fired on churches and the hospitals of the Maternité and Saint-Gervais were both struck. Whole towns and districts were wrapped in mourning; but resistance only stiffened. Conviction strengthened that the Germans were being beaten. On Nov. 8 1918 Erzberger was already in the train of the Commander-in-chief of the Allied Armies. On the 11th the guns roared for the last time; the nightmare was over.

From Nov. 11 1918 to June 28 1919 M. Clemenceau devoted himself to the international settlement. The Peace of Versailles was in preparation, and this necessitated strenuous days of work and delicate negotiations. Up till now M. Clemenceau had merely had to contend with his enemies; now his task was to reconcile the interests of France with those of her friends. He defended her cause with enthusiasm and conviction, forcing his view alternatively on Mr. Lloyd George and President Wilson. Meanwhile Germany was disarming, and M. Clemenceau took care to supervise that disarmament. But the French Parliament began to grow restless, for it saw itself put to one side in the peace negotiations. It therefore no longer regarded M. Clemenceau as indispensable. The great patriot, who was anxious to finish the work he had begun, did his best to smooth matters over. Momentous problems had to be solved; demobilisation had to be faced, a general election was looming ahead, and the questions of Alsace-Lorraine and the liquidation of war stocks had to be settled. M. Clemenceau decided to deal simultaneously with these questions as of equal importance.

Peace was signed on June 28, and on Nov. 11 the new chamber was elected. M. Clemenceau counted on its support; for he believed that its members, many of them ex-soldiers, would have profited by the lesson of the War. Although he never stood as a candidate—it is certain that he would have been ready to give the last years of his life by taking M. Poincaré's place at the Elysée. And thus outside and above the changing Governments, he could have secured continuity in political action by a strict application of the 1919 treaties.

M. Poincaré left the Elysée . . . but M. Deschanel was elected President of the French Republic. And without doubt the electors, under the cloak of the ballot, had voted according to their hearts. M. Clemenceau had saved his country, but members could not forgive the fact that he had excluded them from the final work for victory. During the War he had undoubtedly worked alone; he felt that large assemblies were not made for action. Probably he would have admitted the Commissions to the deliberations on the Treaty of Versailles if diplomatic obstacles had not intervened to prevent it. M. Clemenceau had also to face—both in the Chamber and in the Senate—the hostility, not only of the clerical party of the Right who suspected him of indifference to the Vatican, but also that of the extreme Left, who were alienated by what they considered to be his militarism. Clemenceau thus met the fate which overtook other War Ministers and on Jan. 20 1920 his cabinet fell, M. Deschanel being summoned to office. He had earned the gratitude of his country and returning to his beloved books, might well have sought repose; instead he sailed for India. There he was able to study an ancient civilisation, whose splendours had always fascinated him. "The Tiger" hunted the tiger; and his English friends welcomed him magnificently. He travelled over the whole country, and retained a vivid impression of the Ganges and the temples of Benares in particular. In Paris *L'Echo National* of André Tardieu carried on the fight for the Treaty of Versailles. M. Clemenceau returned to the rue Franklin and to his books. Once more he was able to enjoy his Aeschylus and the roses in his garden.

But it now appeared that the United States was endeavouring to dissociate herself from European affairs. Though she had fought to win the War, she would not help to win the Peace. M. Clemenceau was now 81 years old, but he sailed at once for America at the end of 1922. From town to town he carried the message of France to the citizens of the Union. He had no official mission, for he had neither asked anything nor received anything from the French Government. His progress was none the less triumphant. Once more he returned to the rue Franklin, but not to rest. Life and work with him were synonymous, and by the end of 1925 he was already writing two books; one on philosophy and the other on Demosthenes. What better subject for the French patriot than the great Athenian who would not have his country false to itself. (J. Mt.*)

CLÉMENTEL, ÉTIENNE (1862–), French politician, was born March 29 1862 at Riom and educated there. He was elected a deputy in 1898 and became Minister for the Colonies in Rouvier's Cabinet, in 1905, afterward occupying ministerial posts in departments where his knowledge of economics could find full play: the ministries of Agriculture, Colonies, Finance, Public Works and Marine. His collaboration was particularly valuable in organising the supply of raw materials for the Allied Armies between 1914 and 1918. By effecting the agreement for the establishment of the Inter-Allied Wheat Executive (*see* Control, Inter-Allied) with Mr. Walter Runciman in Nov. 1916 Clémentel helped to tide over a difficult situation. The creation of the Inter-Allied Maritime Transport Council was due in great part to his energy, for, as early as Aug. 1917, he had occupied himself with drawing up a general inventory of his own country's requirements, an initiative quickly followed by the Allied Governments. After the Armistice, M. Clémentel was chosen " Président fondateur " of the International Chamber of Commerce. His work at the London Conference of July 1924, which he attended as Minister of Finance in the Herriot Cabinet, was eminently appreciated. He was elected Senator for the Puy de Dôme in 1918. Among his writings may be mentioned: *L'Âme celtique* (1899) and *Un drame économique* (1914).

CLERMONT-GANNEAU, CHARLES SIMON (1846–1923), French orientalist (*see* 6.498), died Feb. 13 1923.

CLEVELAND (*see* 6.503), the largest city in Ohio and the fifth in the United States, had in 1920 a population of 796,841, a gain of 42·1% for the decade. In 1924 the population was estimated at 902,457. The area in 1925 was 69·154 sq. m. as against 41 sq. m. in 1910. Of the three new viaducts across the valley of the Cuyahoga river, the noteworthy one is the High Level Bridge with a central span of 591 ft. in length and 96 ft. above water. The total length, with approaches, is 5,630 ft., the cost $5,407,000.

The centre of retail trade has moved steadily eastward, crowding out the large houses with spacious grounds which had made Euclid avenue famous. New residential sections were developed, especially near Wade Park and on the heights east of the city. Noteworthy buildings added include the County Courthouse, the City Hall, the Public Auditorium and the Public Library (of the uncompleted " group " plan); the Union Trust, the Engineers Bank, the Federal Reserve Bank and Hanna buildings; *The Plain Dealer* newspaper building; the Cleveland Trust Co's. Bank; the Museum of Art and the Church of the Covenant (Presbyterian), St. Agnes (Catholic), The Temple (Jewish) and the Amasa Stone Memorial Chapel of Adelbert College.

Education.—The schools were reorganised in 1917 as a result of a survey. Significant features were the development of junior high schools, of which there were 19 in 1925, and the establishment of departmental supervision. The Normal School, now the Cleveland School of Education, was affiliated with Western Reserve University. To the university group was added a night college called Cleveland College. In 1924–5 the university had 514 instructors and 3,410 students. The most important addition to the educational and artistic life of the community was the Museum of Art. The building, of classical design, was completed in 1916. Its directors have succeeded, through classes, lectures and special exhibitions, in making it a power in popular education. Another valuable influence has been the Museum of Natural History opened in 1922. The musical development of the city was stimulated by the creation of a symphony orchestra and a school of music.

In its charities Cleveland has carried far the principle of co-operation, seeking to obviate through a welfare federation the waste in soliciting contributions. The Cleveland Foundation was created in 1914 to enable a competent commission to institute inquiries on the best methods of furthering the interests of the community, and, when the funds entrusted to it become large enough, to apply the income directly to schemes of betterment.

Cleveland is the seat of a Federal Reserve Bank. Its two largest banks in 1925 were the Union Trust Co., formed in 1921 by the consolidation of several older banks, and the Cleveland Trust Company. The Brotherhood of Locomotive Engineers Co-operative National Bank, the first labour bank in the United States, organised in 1920, had resources in 1925 of $28,082,840. The city's manufacturing enterprises expanded steadily during the period 1910–25. The increase in automobile production was among the most striking. The harbour facilities were developed by the completion of the government breakwater, 5¼ m. long. The city still retained its position as the greatest ore market in the world, and led also in the manufacture of many steel products.

In accordance with the authority conferred by the home-rule amendment of the state constitution, a charter, submitted by a special commission, was accepted by the citizens on July 1 1913. This reduced the number of elected officers to the mayor and 26 councilmen. By an amended charter, which took effect on Jan. 1 1924, the manager system was introduced. The council of 25 members was chosen by districts, four in number, instead of by wards. The president of the council was called the mayor, but full administrative authority, with the duty of choosing heads of departments, was entrusted to the manager, elected by the council and holding office at its pleasure. Subordinate officials were appointed according to the merit system. The city added to its waterworks a filtration plant for its western section, with a capacity of 150,000,000 gal. a day, and a high-level reservoir for the eastern section, and in connection therewith a filtration system with a capacity of 166,000,000 gallons. (H. E. B.)

CLIFFORD, JOHN (1836–1923), British Nonconformist divine (*see* 6.507), died Nov. 20 1923.

CLIMATE AND CLIMATOLOGY (*see* 6.509).—Climatology is largely a science of the future. The full value of much of the great mass of data already collected and now being collected will really not be reached until the averages, the extremes and the variability of the different climatic elements can be based upon longer series of records than most of those now at hand. The essential facts concerning the climates of most of the world, although not yet known as completely or as accurately as is desirable, or as will eventually be possible, are nevertheless sufficiently well ascertained to meet ordinary needs.

General Climatology.—The third edition, in three volumes, of Julius von Hann's *Handbuch der Klimatologie* (Stuttgart, 1908–11) constitutes the one indispensable handbook for all who are in any way concerned with the study of climate. In them, a summary of what is known concerning the climate of every part of the world may be found. The climatic pictures are made notably complete and accurate by means of vivid descriptions of weather types; by frequent references to the effects of climate upon vegetation, crops and human activities and by well-chosen quotations from the writings of residents and of travellers who are familiar with the climates concerning which they have given accounts. Temperature, rainfall and other essential data for large numbers of stations are in many cases here worked out in detail and summarised for the first time. Kendrew's *The Climates of the Continents* (Oxford, 1922) is the first comprehensive survey in English of the climates of the land areas of the world. Tables of monthly average temperatures and rainfalls for more than 400 stations, and numerous maps and diagrams, are included. A vast amount of information is here available, in one volume, in convenient form for ready use.

Wladimir Köppen's *Die Klimate der Erde* (Leipzig, 1923), after a general discussion of the principles of climatology, gives a description of the essential features of the world's climates. This description ignores political boundaries, using instead a series of climatic provinces, distinguished from one another by certain critical values of the essential climatic elements. A brief, simple scheme of two or three reference letters or numbers (climatic formulae) is used for the characterisation of each province. Eckardt's *Grundzüge einer Physioklimatologie der Festländer* (Berlin, 1922) is original in title as well as in method of treatment. It deals with the climatology of the continents, but dispenses with all tabulations and contains very few numerical data. The changes in seasonal pressures are taken as the fundamental controls of climate. These three volumes are valuable supplements to von Hann's standard work.

Local Climatology.—Many recent publications deal with the climate of individual countries or of smaller areas as given in the classified *Bibliography of Meteorology* issued semi-annually (since Sept. 1920) by the Royal Meteorological Society (London), or in the bibliography regularly published in the *Meteorologische Zeitschrift.*

United States.—Especially marked progress has been made during the past decade in the scientific investigation of the climatology of the United States. The preparation of a section on climate for a new *Atlas of American Agriculture* (1918 and later years) marks an important advance in the accurate charting and discussion of many of the essential features of the climatic conditions of this large area. This atlas will, for many years to come, be the standard authority on all the subjects with which it deals. The data used in the construction of the large series of maps relate to temperature, precipitation, humidity, frost, sunshine and wind all cover a uniform period of 20 years or longer, or have been reduced to that period. Many details are further set forth by means of special diagrams and graphs. All the essential facts regarding the climatology of the United States are cartographically shown in this new atlas with a detail not hitherto attained in any other area of equal size in the world. The text accompanying the charts, while brief, is adequate in calling attention to the more important facts.

In *The Climates of the United States* (Boston, Mass., 1925) R. DeC. Ward has given a compact general description and explanation of the essential characteristics of the climatology of the United States, fully illustrated with charts and diagrams, and based on all available information. Full bibliographies are included on each topic, and special attention is paid to the economic and other human relations of climate.

Australia.—Australia is another large area, a knowledge of whose climatology has advanced very rapidly. The Australian Commonwealth Bureau of Meteorology has issued an unusually valuable series of reports, dealing especially with rainfall, but also presenting many other essential facts concerning the general climatic characteristics of the country. These studies are clear and concise in treatment, and emphasise the practical economic aspects of the subject. A report on the climate and weather of Australia (1913) is one of the best available discussions of the meteorological and climatic conditions of any part of the globe. The main thesis of these monographs is the climatic limitation and control of agriculture and of stock-raising. The results will be of practical value in the future development of Australia. The extreme importance of rainfall is emphasised, not only of the annual amounts but also of the season at which the rain falls, and of its reliability.

Latin America.—The climatology of Latin America is receiving increased attention. The establishment of the new Directoria de Meteorologia (1921), in Brazil, has already resulted in an increase in the number of observing stations, and in the publication of important climatic data in the regular bulletins of that service.

For Mexico there is a very complete study of the temperature conditions, equal to that available for many other countries.[1] New rainfall maps of Latin America have been constructed.[2] The scattered data for the several countries of Central America have been compiled in convenient form,[3] and a useful annotated bibliography of South American climatology has been published.[4]

It is significant that, with the increasing accuracy of climatic data resulting from the availability of records covering longer and longer periods of time, there is a marked tendency to publish these data in cartographic rather than tabular form. They thus become available for easier and more effective use. Hellmann's *Klima-Atlas von Deutschland* (Berlin, 1921); a new edition of Mohn's *Atlas de Climat de Norvège* (Christiania, 1921); Angot's monographs on the rainfall of France (Paris, 1913, etc.); Gorczynski's new isothermal and isobaric charts of Poland, Europe and the World (Warsaw, 1917–8) may be noted here. Mention should also be made of a very complete discussion of the rainfall of the British Isles, based on all available data, by Salter.[5]

Arctic Regions.—While the meteorology of the Arctic has made relatively little progress in recent years, the Antarctic has been visited by a large number of expeditions, most of the results of whose scientific work, as well as some of the results of work done prior to 1910, have been published in the last decade or so. These discussions include those relating to the British expeditions of 1901–4, 1910–3 and 1914–7; the Australian expedition of 1911–4; the Norwegian of 1910–2; the German of 1911–2, etc. Meteorological observations are now available for complete years, made at fixed land stations; on board vessels drifting slowly in the ice, on sledge journeys, and from the upper air by means of kites and balloons. The material is, however, still too scattered and incomplete to give an accurate and satisfactory picture of Antarctic climate. Most of the discussions concern the physical problems of Antarctic meteorology.

In all studies of the controls of the seasonal weather conditions, and hence also of climates, the *Réseau Mondial* is practically essential.[6] This is a compilation of world data by 10° squares of latitude and longitude based on observations at land stations averaging two for each square. Monthly and annual summaries of pressure, temperature and precipitation are included.

Climate and Crops.—Recent studies of the larger controls of climate over crop distribution, and of weather factors which most affect the critical periods of growth and of yield of field and garden crops, have brought out much information which will prove of importance in the advance of agricultural climatology. The geographic origin of the world's food supply and of other essential agricultural products, and of the climatic and other factors which control the present distribution of the world's crops and livestock, are discussed in the *Geography of the World's Agriculture.*[7] In this atlas the essential climatic controls in the case of the important crops in all parts of the world are briefly stated. Another publication, also of wide interest, deals with cotton.[8] The climates of all the cotton areas are discussed, detailed consideration being given to the United States. The facts here given are of practical value in the selection of the most favourable climates for future cotton growing. An outstanding publication whose aim is to elucidate the methods that may be used in studying the aetiology of plant distribution, and to give the essential climatic data necessary for carrying out such work in the United States, has been issued by the Carnegie Institution of Washington.[9] This is the most notable investigation of its kind for any area of comparable size. J. Warren Smith's *Agricultural Meteorology: the Effect of Weather on Crops* (New York, 1920) is a serviceable guide to the use of correlations and of similar processes in the study of climate and crops, and also summarises results already achieved.

Climate and Health.—The intimate study of solar radiation in relation to health (*see* HELIOTHERAPY) is making very rapid progress. At Davos, Switzerland, Dorno has made himself the recognised authority on solar and sky radiation.[10] He has there measured the light, heat, chemical and bactericidal effects of radiation which is found to vary widely in its ray elements, even at the same station, the same solar altitude and under a clear sky. The results are of great importance in medicine and in biology, recent medical researches having shown the value of certain of the finer rays in the treatment of tuberculosis, rickets and other diseases. The essential facts on open-air and sunshine in relation to health and diseases are given in a popular handbook by Dr. Leonard Hill,[11] and in A. C. Rollier's *Heliotherapy* (London, 1923). It appears that in the use of climate for medical purposes the variable quality of sunshine must be known, and not merely its duration.

Physiological Climatology.—It has for some time been recognised that conditions which are best for human beings are moderately cool and moderately moist air, in motion, together with a reasonable variability of temperature. (*See* PUBLIC HEALTH.) Dr. Leonard Hill has devised a so-called "Katathermometer" (*q.v.*) which indicates by the rate of cooling of wet and dry bulb thermometers, heated to about the surface temperature of the human body, the combined effect of temperature, humidity, wind evaporation, etc., in a way comparable with the experience of a human body.[12] Several investigators have sought to determine, in actual numerical values, the most favourable atmospheric conditions for man. Dr. Griffith Taylor, using wet bulb temperatures and relative humidities, has worked out the criteria of a suitable climate for Anglo-Saxons in the tropics.[13] This study suggests, as representing ideal conditions, a wet bulb reading of 62° F. and relative humidity of 68·5% in summer, and 37° F. and 81% in winter. Köppen gives 64·4° F. (18° C.) as the temperature of greatest comfort.

Climate and Civilisation.—Using statistics of the efficiency of factory operatives, students and others in the eastern United States, Huntington has determined what he calls the "Optimum" temperatures for man's greatest efficiency.[14] These are outdoor temperatures of 60°–65° F. for maximum physical efficiency and 40° F. for maximum mental efficiency. Beneficial stimulating effect was found in a certain moderate degree of temperature variability associated with storm controls. The different parts of the world are graded according to their approximation to such a climate, and the civilisations of those areas are also graded. A close agreement is found between the results. The conclusion is reached that a certain special combination of climatic conditions prevails to-day where high civilisation is found, and that past climatic fluctuations which brought a similar type of climate were associated with corresponding periods of high civilisation. Criticism of these far-reaching conclusions has been based on the insufficiency of the data upon which the study rests; a lack of any general agreement as to the facts concerning the distribution of civilisation and the occurrence of special climatic types in past times, and upon the fact that the controls over human development and historical events are far too complex for any simple evaluation.

Variations of Climate.—The whole question of climatic variations is still under active debate, both as to the occurrence, characteristics and frequency of any such "changes," and also as to their possible causes. Dr. Ellsworth Huntington has been a prolific writer on this problem. His investigations, which began in central Asia, have been extended over parts of western Asia, Palestine, the Libyan Desert, the south-western United States and portions of Central America.[15] From an examination of a large body of evidence—archaeological, physiographic, historical, including the rings of the giant *Sequoias* of California and of other trees, the conclusion is drawn that from the beginnings of human history a gradual change from moister to drier climates has been going on. This process has, however, not been steadily progressive, but has taken place in a more or less irregular, pulsatory fashion, drier and moister epochs alternating, without definite periodicity, as subordinate irregularities on the general curve of desiccation. The major fluctuations are believed by Huntington to have been essentially synchronous, and of the same general character under similar geographic conditions, in central and western Asia, in the Mediterranean area and in North America. These pulsations are further believed to have been potent factors in bringing about certain great historical migrations and events, such as the decay of Rome, the rise and fall of the Central American civilisations, and so on.

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[1] The references refer to the Bibliography at the end of the article.

While much evidence in favour of changes of climate in historic times has been brought forward, the opinion is quite widely held that a good deal of this is not wholly trustworthy. Much of it is so distinctly contradictory that in certain cases nothing less than a complete deadlock exists. Further, a considerable number of meteorologists think that much of the evidence seems to have been interpreted without due consideration of controls other than climatic fluctuations. In cases where careful examination of the evidence has been made by experts in archaeology, botany, geology and history, there has usually been hesitation in ascribing the facts solely, or often even partly, to fluctuations in climate. At the present time, the opinion of the majority of the most competent authorities seems distinctly to be that there is not sufficient unimpeachable evidence to justify a belief in any permanent progressive change of climate within historic times. That there are certain fluctuations in the values of the climatic elements is, however, a well-established fact. The so-called Brückner period, averaging about 35 years in length, is generally recognised. No definite or universally accepted conclusion has yet been reached regarding the existence of other longer periods. A period of about 11 years in temperature, rainfall and certain other meteorological phenomena has been made out by several investigators, but on the whole the variations in the values of these elements appear to be very slight, and the results are often debatable, if not contradictory. Köppen has greatly extended his investigations of sunspot controls over temperatures, begun some 30 years ago, and has found that the 11-year periodicity appears to be somewhat less marked but more regular than he at first thought it to be.[16] (*See* ATMOSPHERIC ELECTRICITY; METEOROLOGY.)

Douglass has for some 25 years been studying the evidences of climatic fluctuations given by tree rings in California and elsewhere.[17] Some of his conclusions have been used by Huntington and others in their investigations of climatic fluctuations. Douglass believes that a close relation exists between the thickness of tree rings and the annual amount of precipitation, and finds evidence of periodicity over large areas, in agreement with the sunspot cycle or multiple of it. A 100-year cycle also appears very prominently in the 3,000 years of *Sequoia* record and in the 500 years of the yellow pine. The climatic chronology based on the tree rings has also been studied in the tree trunks and beams discovered in the ruins of prehistoric dwellings in the south-western United States.

Causes of Climatic Fluctuation.—There is not yet any agreement as to the causes of climatic fluctuations. Very important work on the variations in the intensity of the sun's heat has been carried on during the past two decades by Dr. C. G. Abbot, and his associates of the Astrophysical Observatory of the Smithsonian Institution. The sun is a variable star. There are variations associated with the sunspot period of about 11 years, and there are also variations in shorter intervals, of the order of a few weeks or even days. There has been much discussion, but there is no unanimity of opinion, as to just how such variations in the amount of solar radiation will affect conditions on the earth's surface. Instead of being higher at times of greater solar activity, temperatures over most of the world are slightly lower. A highly complex train of effects must obviously result, in which temperature, pressure, evaporation, cloudiness and rainfall are all concerned, and in which readjustments in the general circulation of the atmosphere play an important part. The varying strength of the atmospheric and oceanic circulations, and the resulting effects upon the development and location of the great "centres of action" and of the wind and rain belts, seem to many writers competent to account for any climatic variations which may have taken place in historical times. In one of the outstanding publications of the past decade, Helland-Hansen and Nansen, in their study of North Atlantic temperatures, conclude that variations in the supply of solar energy, acting through the atmospheric circulation are the initial cause of temperature changes on the earth's surface.[18]

So far as changes of climate during the geological past are concerned, there has been a decided tendency towards seeking an explanation in factors which are recognised as being effectively at work in determining present-day climates, and a lessened appeal to purely astronomical causes, which in the past were most widely advocated. E. Huntington and S. S. Visher in *Climatic Changes, Their Nature and Causes* (New Haven, Conn., 1922), however, incline to the view that variations in solar activity may arise from some effect induced by the approach to the solar system of some of the greater stars. Such variations in solar energy, acting on storms and on the position of storm tracks on the earth's surface are believed to have been concerned in the climatic changes or fluctuations of the past. W. J. Humphreys, who may perhaps be taken as most emphatically advocating terrestrial as opposed to extra-terrestrial or cosmical controls, believes that past climatic fluctuations were due to changes in topography, in the distribution of land and water, in elevation of the land, in atmospheric and oceanic circulations, in volcanic dust, etc. In other words, the same controls over climate were at work in the past as are observed to-day, only in different combinations.[19] In *The Evolution of Climates* (London, 1925), C. E. P. Brooks holds that past changes of climate, such as the glacial periods, were mainly due to changes in the extent and elevation of the lands, especially in the higher latitudes.

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CLYNES, JOHN ROBERT (1869–), English politician, was born at Oldham, Lancs., March 27 1869, of working-class parents, and worked himself as an artisan for many years. He was active in the trade-union movement, and eventually became president of the National Union of General Workers, and chairman of its executive council. He entered Parliament as Labour member for Northeast Manchester (Platting Division) in 1906, when the Labour party was returned for the first time in numerical force, over 50 in all; and he has sat uninterruptedly for the same constituency ever since.

It was not, however, till the World War that he attracted general attention. He protested, in Feb. 1915, on behalf of his party, against the rise in prices, which he attributed mainly to contractors and dealers exploiting the needs of the people. In 1917 he was appointed parliamentary secretary under Lord Rhondda soon after the latter accepted the position of Food Controller. In the arduous and successful work of that office he took his full share, and, when his chief died in June 1918, he succeeded him to the general satisfaction. He gave special encouragement to the creation of national kitchens, the number of which had grown by the end of August to over 600, and he set up, inside the Ministry, a food council to consider questions of policy, and to co-operate with other bodies dealing with food problems. Public appreciation of his admirable work in the War was shown by the honorary degrees conferred upon him in 1919 by the universities of Oxford and Durham. In consequence of the decision of the Labour party to terminate its support of the Coalition Govt., he resigned office in Nov. 1918, just before the general election.

At the beginning of the session of 1919 Clynes was elected vice-chairman of the party, and since then he has been reckoned among its principal leaders. He was chosen chairman in 1921, but after the election of 1922 the Labour party at Westminster elected Mr. Ramsay MacDonald. Mr. Clynes became deputy chairman, and in that capacity moved on Jan. 17 1924 the Labour amendment of want of confidence in Mr. Baldwin's Govt. which brought that Govt. down and put the Labour party in office. He became Lord Privy Seal and deputy leader (in the necessary absences of Mr. MacDonald on Foreign Office business) of the House of Commons. Whether leader, or deputy leader, of his party, Mr. Clynes always spoke in the House of Commons with a moderation and appreciation of the standpoint of other classes not always manifested by Labour members. He showed himself opposed to "direct action," and has treated a capital levy as a suggestion rather than a definite proposal. Though a very lucid and respected speaker, he never attained great parliamentary power. He left office in Nov. 1924.

COACHING.—The London meets of the Coaching Club are fairly well attended, seven or eight members generally putting in an appearance at the Magazine in Hyde Park at the two or three meets which are held every year. This number is supplemented by coaches sent from the Royal Artillery (Aldershot) and the Royal Artillery (Woolwich) and sometimes by a coach from the Army Service Corps.

At the Richmond Show in June 1925 there were 21 entries for the Coaching Marathon. Of these 12 were private coaches, seven road coaches and two military coaches, and the full number did not exhaust all the coaches which were then seen about London. There were also Marathons at Olympia and at one or two other shows in 1925, and, though some of the road coaches which took part in these events were infrequently seen on the roads, two at least had a long and regular season. One coach ran regularly in the north of England during part of the summer.

Driving.—As regards the driving of single-harness horses, the dog-cart, gig, buggy and governess cart are still found in fair numbers, more particularly perhaps in countries where there are many lanes and by-ways and no great amount of traffic on the main roads. Welsh farmers, for example, use a dog-cart more frequently than a car, the approaches to many of the hill farms being almost impossible for a car. In this single-horse traffic the cob is favoured rather than the horse, and for the pair there is almost no demand. The teams which have been seen in and about London during the 20th century are better looking and have better action than their predecessors of two or three generations ago, and the improvement in horseflesh applies in a considerable degree to all breeds of light horses and has come at a time when, except for hunters and polo ponies, the demand is smaller than it has ever been in modern times. (C. Ri.)

COAL (*see* 6.575).—A considerable advance was made during the period 1911–25 in the scientific knowledge of coal, and the production and distribution of coal were largely changed by the World War and other circumstances.

I. COMPOSITION AND CHARACTER

Research work as to the composition and character of coal has been greatly intensified in Great Britain, being carried out particularly in the provincial universities and other educational institutions. The coal owners themselves have promoted it; and, in 1916, the Government set up the Fuel Research Board which since has engaged upon important investigations, more especially in regard to the low-temperature distillation of coal. In Germany, France, Canada and the United States much important work on coal and lignite has been carried out. Nevertheless little more has been discovered as to the chemical composition of coal than was known in 1900.

Coal, being a complex colloidal organic substance, of high molecular aggregation, requires for the elucidation of its chemical constitution the application of the best trained minds in organic chemistry. Again, coals are so varied, from both the chemical and physical standpoint, as to constitute a very wide field for investigation. For years the ordinary black bituminous coal of commerce has been known to be made up of layers of "bright coal" (the *Glanzkohle* of Germany) and "dull coal" (*Mattkohle*), the layers being divided by an amorphous powdery substance known as mineral charcoal. Of late years, and for no very obvious reason, it has become customary to designate these varieties as "vitrain" and "clarain" for the bright coal, "durain" for the dull coal, and "fusain" for the mineral charcoal. The exact origin of these substances, which vary in composition, is not quite clear.

Composition.—Coal is made up of various constituents: (*a*) woody or xyloid substances which are so characteristic of lignite or brown coal, called by some "anthraxylon," from *anthrax* coal and *xylon* wood; (*b*) canneloid material, consisting largely of the spores of cryptogamic plants, of which cannel coal is chiefly composed; (*c*) resinous matter, occurring largely in lignites but rarely in cannels; (*d*) macerated material mixed with woody matter and best described as débris, as it contains all the previous mentioned substances; (*e*) the "fundamental matter" of White and Thiessen, which is the colloidal ground mass in which the other constituents are embedded and which is composed chiefly of the more readily decomposable parts of the vegetable matter. The vegetable constituents of coal are therefore cellulosic and resinous.

Chemists employ three experimental methods for the investigation of the coal substance: (*A*) thermal decomposition, (*B*) fractionation by a sequence or combination of solvents and (*C*) oxidation of the coal, hydrogenation, halogenation, etc. The principal facts which have been established by these methods are:—

(*A*)—M. J. Burgess and R. V. Wheeler (*Chem. Soc. Trans.*, vol. 97, 1910; vol. 99, 1911; vol. 105, 1914) by thermal decomposition applied up to a temperature of 1100° C. determined:—

(1) That the decomposition of the coal substance commenced at about 350° Centigrade;

(2) That in respect of the coals examined, whether bituminous, semi-bituminous or anthracitic, there is a well-defined critical temperature between 700° C. and 800° C. which corresponds with a marked and rapid increase in the quantity of hydrogen evolved; and

(3) That the evolution of methane and other paraffin hydrocarbons almost entirely ceases at about 700° Centigrade.

They concluded that the coals examined by them contained two types of compounds of different degrees of stability, viz., the "resinic" or less stable, which on thermal decomposition yield principally paraffins and no hydrogen, and the "cellulosic," which yield principally hydrogen. The facts hold good, but the interpretation of them as given above is not universally accepted. For instance, Messrs. H. C. Porter and G. B. Taylor, who have carried out researches on American coals (*Proc. Amer. Gas Inst.*, vol. 9 [i.], 1914), repudiate the suggestion that the "resinic" constituents of coal would be less than the "cellulosic" and attribute the great increase in the evolution of hydrogen between 700° C. and 800° C. to secondary decomposition, and they found that more than two-thirds of the organic substance of coal is decomposable below 500° Centigrade. Their views about the composition of coal are best expressed in their own remarks:—

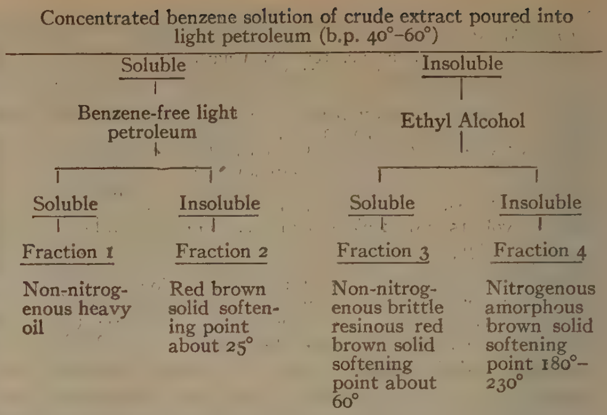
"All kinds of coal consist of cellulosic degradation products more or less altered by the process of ageing, together with derivatives of resinous substances, vegetable waxes, etc., in different proportions, more or less altered. They all undergo decomposition by a moderate degree of heat, some, however, decompose more rapidly than others at the lower temperature. The less altered cellulosic derivatives decompose more easily than the more altered derivatives, and also more easily than the resinous derivatives. The cellulosic derivatives decompose so as to yield H_2O, CO_2, CO and hydrocarbons, giving less of the first three products the more matured and altered they are. The resinous derivatives, on the other hand, decompose on moderate heating so as to yield principally the paraffin hydrocarbons, with probably hydrogen, as a direct decomposition product. The more mature bituminous coals, having good coking properties, contain a large percentage of resinous derivatives and their cellulosic constituents have been highly altered. The younger bituminous or sub-bituminous coals are constituted of cellulosic derivatives much less altered than those in the older coals. They undergo a large amount of decomposition below their fusion point, and possibly for that reason many of them do not coke."

Professor W. A. Bone points out (*Soc. Chem. Ind.*, June 19 1925) in his paper on the "Constitution of Coal," that in most recent coal research work little, if any, importance appears to have been attached to the nitrogenous constituents of coal, and there seems to be at least some room for doubt whether the supposed "resinic" constituents of coal have been rightly so called. He is inclined to think that our whole coal-nomenclature might be overhauled with advantage. Though there may be some doubt as to the feasibility of drawing a sharp line between the evolution of the various gaseous products in the case of a highly matured type of coal when under thermal decomposition, it is otherwise in the instance of an immature brown coal or lignite, as Bone's work has shown. The results being: (*a*) that up to a certain temperature (in the case of a dried sample of brown coal, from Morwell, near Melbourne, 375° C.) the only gases expelled from the dried coal are steam and oxides of carbon, which evolution continues right up to (and perhaps beyond) 700° C.; (*b*) that at a somewhat higher temperature range (in the case of the Morwell coal 375°–500° C.) methane and other hydrocarbons (without oxygen) appear; and (*c*) it is not until the temperature exceeds 500° C. that hydrogen appears among the products.

(*B*)—1899, Bedson discovered the solvent action of pyridine on coal, and much later, A. H. Clark and R. V. Wheeler (*Chem. Soc. Trans.*, vol. 103, 1913) fractionated coal substance into three parts by first dissolving it with pyridine, then treating the pyridine extract with chloroform. The coal substance was divisible into: (1) that insoluble in pyridine, (2) that soluble in pyridine but insoluble in chloroform, (3) that soluble in both pyridine and chloroform. These fractions are frequently referred to as *alpha*, *beta* and *gamma* constituents respectively, as though they were distinct and definitely separate chemical substances, which is unfortunate seeing that they all contain carbon, hydrogen, nitrogen, oxygen and sulphur—in fact, nearly the same percentage of nitrogen and sulphur in each fraction. In the extraction of coal substances by benzene under pressure, Bone's work is of great interest. He employs benzene in a special form of extractor on the Soxhlet principle at pressures between 500 and 700 lb. per sq. in., and at temperature 260° to 285° C., and afterwards fractionates the extract by a suitable solvent treatment. He and his co-workers have by this means obtained four distinct benzene soluble fractions (*Proc. Roy. Soc.*, 105, Ser. A., 1924).

The result is shown diagrammatically in the next column.

When working on a coking coal it was found that fractions 1 and 2 could be disregarded from the point of view of containing substances of a "binding" character. With regard to fraction 3, Professor Bone says "the amount of this fraction was always very small, ranging between 0·3 and 0·8% only of the whole coal substances; so that, although it has good 'binding' properties, and therefore would be to some extent a contributory factor, it cannot be considered as the chief cause of the coking properties of the coals."


Concentrated benzene solution of crude extract poured into light petroleum (b.p. 40°–60°)
Soluble
Insoluble
Benzene-free light petroleum
Ethyl Alcohol
Soluble
Insoluble
Soluble
Insoluble
Fraction 1
Fraction 2
Fraction 3
Fraction 4
Non-nitrogenous heavy oil
Red brown solid softening point about 25°
Non-nitrogenous brittle resinous red brown solid softening point about 60°
Nitrogenous amorphous brown solid softening point 180°–230°

The substances contained in fraction 4 were different from the so-called "coal resins" and seemed to be rather of the "humic" type. Their chemical nature has not yet been finally established, but they constitute from 4·6 to 7·0% of the parent coal substance and have very pronounced "binding" properties, so that the relative coking properties of bituminous coals run nearly parallel to their yields of this fraction. These may therefore be considered as the chief cause of the coking properties of coals.

F. Fischer, H. Broche and J. Strauch (*Brennstoff-Chem.*, 1925) in an account of similar experiments made upon German bituminous coals some little time after the appearance of Bone's paper, divided their crude benzene extract into two fractions only, which probably explains the apparent discrepancy in interpretation of the results. The benzene extracts from a brown coal are chemically different from those yielded by sub-bituminous or bituminous coal. It would seem that the coking quality of a coal is the result of the maturing of coal and is a product of age, for in black lignite there is evidence of the incipient formation of substances closely resembling the coking constituents of the more mature coals.

(*C*)—Recent chemical research on the character of coal includes the work of Dr. Bergius, the German chemist, during the period 1915–25. By subjecting coal to the influence of hydrogen under heat and pressure, he saturates the hydrocarbons in the coal, converting them and, it is claimed, some portion also of the fixed carbon, into saturated hydrocarbons, thus achieving the liquefaction of coal, the objective of chemists for many years. The process has not yet emerged from the laboratory stage, but should it prove a commercial possibility, the results on industry would be far-reaching indeed.

Classification.—Frequent attempts have been made towards a scientific classification of coal, the broad division of anthracite, bituminous coal, and lignite and brown coal, not having been deemed sufficient. Perhaps the best is that adopted by the International Geological Congress held at Toronto in 1913. Coal were then divided into four main classes and three subclasses, letters instead of names being used, and the fuel ratio is taken as the basis of classification:—

$$\frac{\text{Fixed carbon}}{\text{Volatile matter}}$$

and, in the cases of B_3, D_1 and D_2, the split volatile ratio of

$$\frac{\text{Fixed carbon} + \text{volatile combustible}}{\text{Hygroscopic moisture} + \tfrac{1}{2}\ \text{volatile combustible}}$$

The classes were as follows:—

Class A

(1) Burns with short blue flame; gives off 3 to 5% volatile combustible matter.
Fuel ratio 12 and over.
Calorific value 8,000 to 8,330 calories or 14,500 to 15,000 B.T.U.

Mean composition—

Carbon	93 to 95%
Hydrogen	2 to 4%
Oxygen and nitrogen	3 to 5%

(2) Burns with slightly luminous short flame and little smoke, does not coke and yields from 7 to 12% of volatile matter.
Fuel ratio 7 to 12.
Calorific value generally 8,300 to 8,600 calories or 15,000 to 15,500 B.T.U.

Mean composition—

Carbon	90 to 93 %
Hydrogen	4 to 4·5%
Oxygen and nitrogen	3 to 5·5%

Class B

(1) Burns with short luminous flame and yields 12 to 15 % volatile matter; does not readily coke.
Fuel ratio 4 to 7.
Calorific value generally 8,400 to 8,900 or 15,200 to 16,000 B.T.U.

Mean composition—

Carbon	80 to 90 %
Hydrogen	4·5 to 5 %
Oxygen and nitrogen	5·5 to 12 %

(2) Burns with luminous flame and yields from 12 to 26 % volatile matter; generally cokes.
Calorific value 7,700 to 8,800 calories or 14,000 to 16,000 B.T.U.

Mean composition—

Carbon	75 to 90 %
Hydrogen	4·5 to 5·5 %
Oxygen and nitrogen	6 to 15 %

(3) Burns freely with long flame; withstands weathering but fractures readily and occasionally has moisture content up to 6 %; volatile matter up to 35 %; makes porous, tender coke.
Fuel ratio (split volatile) 2·5 to 3·3.
Calorific value 6,600 to 7,800 calories or 12,000 to 14,000 B.T.U.

Mean composition—

Carbon	70 to 80 %
Hydrogen	4·5 to 6 %
Oxygen and nitrogen	18 to 20 %

Class C

Burns with long smoky flame and yields 30 to 40 % volatile matter on distillation, leaving very porous coke.
Fracture generally resinous.
Calorific value 6,600 to 8,800 calories or 12,000 to 16,000 B.T.U.

Class D

Contains generally over 6 % of moisture; disintegrates on drying; streak brown or yellow. Cleavage indistinct.

(1) Moisture in fresh mined, commercial output, up to 20 per cent.
Fracture generally conchoidal.
Drying: cracks irregular, curved lines.
Colour generally lustrous black, occasionally brown.
Fuel ratio (split volatile) 1·8 to 2·5.
Calorific value 5,500 to 7,200 calories, or 10,000 to 13,000 B.T.U.

Average composition—

Carbon	60 to 75 %
Hydrogen	6 to 6·5 %
Oxygen and nitrogen	20 to 30 %

(2) Moisture in commercial output over 20 %.
Fracture generally earthy and dull.
Drying: cracks generally separate along bedding planes and often show fibrous (woody) structure.
Colour generally brown, sometimes black.
Calorific value 4,000 to 6,000 calories or 7,000 to 11,000 B.T.U.

Average composition—

Carbon	45 to 65 %
Hydrogen	6 to 6·8 %
Oxygen and nitrogen	30 to 45 %

This classification, giving names to the letters, may be interpreted thus:—

A_1 corresponds to anthracite.
A_2 corresponds to semi-anthracite.
B_1 corresponds to semi-bituminous coal (in this class would be included the so-called smokeless steam coal of South Wales).
B_2 corresponds to bituminous coal.
B_3 corresponds to bituminous coal of low fixed carbon content.
C corresponds to cannel coal.
D_1 corresponds to sub-bituminous coal or compact black lignite.
D_2 corresponds to lignite or brown coal.

Bituminous coal is divisible into gas, coking, house, manufacturing and steam coal.

II. THE WORLD'S COAL

The International Geological Congress also made an estimate of the world's resources of coal, for which purpose they took as the minimum thickness of seams, workable to a depth of 4,000 ft. from the surface, 1 foot, and between depths of 4,000 ft. to 6,000 ft., 2 feet; 6,000 ft. being regarded as the limit in respect of workable depth. The figures are given in millions of metric tons. (A metric ton = 2,204·6 pounds.)

Continent	Anthracites including dry steam coals	Bituminous coal	Sub-bituminous coals, lignite or brown coals	Total
Europe	54,346	693,162	36,682	784,190
Asia	407,637	760,098	111,851	1,279,586
Africa	11,662	45,123	1,054	57,839
America	22,542	2,271,080	2,811,906	5,105,528
Oceania	659	133,481	36,270	170,410
Total	496,846	3,902,944	2,997,763	7,397,553

In 1926 coal mining is being carried on to a depth of 4,000 ft. (in Belgium), and the mining of mineral deposits to a depth of 6,000 ft. (in Brazil) from the surface. The working of coal at great depths is, however, more difficult than the extraction of ore from a metalliferous vein at like depth, for, whereas in the latter case the plane of the deposit is, as it were, on edge reaching to the surface, in the former case it is, usually, more or less flat lying at great depth from the surface, the whole of the coal being derived from, approximately, the same depth, and it is very doubtful whether it will ever prove commercially possible to produce coal from a depth greater than 5,000 feet. On the question of supply, it is not so much the duration of the world's ultimate resources of coal that matters, but how long will the better and more cheaply got coals last. European countries are rapidly exhausting their supplies of readily available coals, and, if the present relative rates of exhaustion are continued, the period of their complete exhaustion will arrive long before that of Asia and the New World.

In available resources of coal the American continent far exceeds the rest of the world. In North America there are 5,073,431,000,000 tons; and in South America there are 32,097,000,000 tons; of all individual countries the United States of America takes first place, her resources, for example, being considerably in excess of those of the whole of the British Empire. At the present rate of output the North American resources, more especially those of the United States, will outlast all other countries, and will probably suffice for 2,000 years. Great Britain's supplies at the present rate of consumption will not suffice for more than 600 years at most, and if we take into consideration the coal existing to a depth of 4,000 ft. (the limit taken by the British Royal Commission on Coal Supplies of 1905) they will only last for 450 years. Germany, before the ceding to Poland, after the World War, of a part of her Silesian coalfield, and to France of her Saar and Lorraine fields, had resources of coal sufficient to last at the pre-War rate of output for 1,000 years, but much of her remaining coal is lignite which is of much lower calorific value than true coal. France will have to live on imported coal much sooner than Great Britain or Belgium. The latter country has supplies sufficient for nearly 500 years. Switzerland could mine all her resources in a few years.

The most important of all classes of coal is that which is termed bituminous, for not only does that coal provide the gas, the coking, the house and manufacturing, but many of the steam coals also. It is, too, from this class of coal that we obtain our coal derivatives, *e.g.*, tar, pitch, sulphate of ammonia, paraffin hydrocarbons, benzene, toluene, dyes and some medicines. It is fortunate, therefore, that nearly 4,000,000,000,000 tons, or more than half of the world's coal reserves, are bituminous coal.

Coal Production.—The following statement shows, in comparative form, the production in long tons, of coal by continents for 1913 and for 1924:—

Country	Production	
	1913	1924
North America	531,600,000	525,400,000
South America	1,600,000	1,700,000
Europe	730,000,000	710,000,000
Asia	55,000,000	82,000,000
Africa	8,300,000	12,500,000
Oceania	15,000,000	16,000,000
Entire World	1,342,300,000	1,340,000,000

About 90% of the world's coal is derived from the coalfields of the United States of America and the coalfields of Europe (see fig. 1). The War wrought great changes in the coal-mining industry of the chief coal producing countries of the world and it is of value, in view of recent events and from the point of view of the future, to compare the economic position of the industry as existing at the outbreak of war and in 1925 more particularly as regards production and distribution.

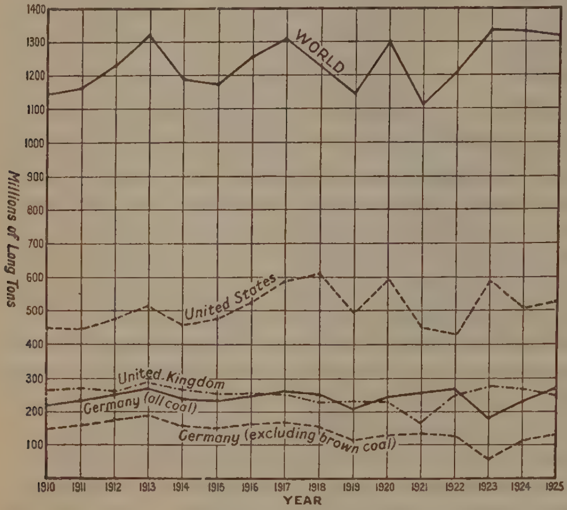


FIG. 1.—Annual production of coal.

III. GREAT BRITAIN'S COAL TRADE

Of all the industries that contributed to the successful issue to the Allies of the World War, the coal industry was perhaps the most important. In 1913 Great Britain contributed 21·7% of the world's output, and in that year there were 1,110,884 persons employed in about 3,000 coal mines which were worked as about 1,500 separate undertakings. The coal properties, or royalties, as they are called in the industry, were vested in about 4,000 owners. Various estimates of the amount of capital invested in the coal mining industry have been attempted, that by Sir Josiah Stamp, £135,000,000, based on the output of five years preceding the War, being perhaps nearest the mark.

Production and Prices.—The estimated cost of production and of profit to the coal owners arising from the sale of the coal may be taken to have averaged as follows:—

	s.	d.
Wages	5	6
Stores and pit wood	1	0
General expenses, inclusive of everything, except depreciation and interest	1	3
Total	7	9
Profit	2	5
Grand total	10	2

The average royalty rent payable to the owners of the coal averaged about 6d. per ton of coal raised.

For some years the selling price of coal had been on the upgrade, and it has been estimated that during the period 1897–1910 the pit head price had advanced no less than 38%, but during 1914 the tendency of selling prices was downwards, especially in regard to industrial coal, due to the fact that the iron, cotton and other staple industries were in a somewhat depressed state. In fact, when war broke out, trade in Great Britain was on the eve of one of those cycles of depression which are the aftermath of periods of inflated trade and temporary over-expansion.

There was at this time comparative peace in the coal mining industry as between employers and workmen. The year 1913 had been a good year, and wages were high. The settlement of disputes regarding wages was dealt with through the medium of district joint boards or representatives of colliery owners and workmen, presided over by independent chairmen. But there was a movement amongst the advanced or extremist wing of the Miners' Federation in support of national, in preference to district, settlements of wages, and towards nationalisation of the industry. With a view to determining how the available coal supply could be best distributed to meet the national interest in the best possible way, the following comparison as between the years 1903 and 1913 was arrived at:—

	1903	1913
Total output	230,334,469 tons	287,430,473 tons
Reserved for home consumption (not including bunker coal for foreign trade)	166,529,120 tons	189,092,369 tons

The balances were devoted to export and bunkers.

The average pit head value of a ton of coal in 1913, all kinds included, was about 10s. 2d. Of the home consumption it was estimated that at least 80,000,000 tons were absorbed in the production of power, inclusive of railways. The following table shows for 1903 and 1913 the uses to which the coal was put:—

	1903	1913
	Tons	Tons
Railways	13,000,000	15,000,000
Coasting steamers (bunkers)	2,000,000	2,500,000
Factories	53,000,000	60,000,000
Mines	18,000,000	19,000,000
Iron and steel industries	28,000,000	31,000,000
Other metals and minerals	1,000,000	1,250,000
Brick works, potteries, glass works and chemical works	5,000,000	5,750,000
Gas works	15,000,000	18,000,000
Domestic	32,000,000	35,000,000

Effect of the World War.—The immediate effect of the War on the coal trade of Great Britain was to close several important foreign markets. Transport facilities, by reason of the diversion of rolling stock and shipping to military purposes, was also impeded. The result was that there was a temporary glut of coal at the collieries for home consumption. The Allies, especially France and Italy, became largely—the latter country entirely—dependent on Britain for their supplies of coal. France's demands were soon double that of the normal importation. The great expansion in the manufacture of the munitions of war at home greatly augmented the fuel requirements of the iron and steel works and on top of all this the war requirements made a constant drain on the staff of young miners. Up to the end of March 1916, no less than 282,200 men from the coal mines had voluntarily enlisted in the fighting forces. So that, although the decline in exports of coal and coke during the year 1915 amounted to about 14,000,000 tons, this was more than balanced by decreased output, amounting to nearly 12,500,000 tons, and increased demands for home consumption. The average pithead price of coal rose from 9s. 11·21d. in 1914 to 12s. 4·8d. per ton in 1915.

The Coal Mining Organisation Committee, consisting of representatives of the colliery owners and miners, presided over by the chief inspector of mines, was set up by the Government in Feb. 1915 to organise the industry to the best advantage to meet the exigencies created by the War. It had no plenary powers; it could only investigate, report and arbitrate. It continued in almost constant session until the financial control of the industry by the State in 1917, and but for the very strained relations between the colliery owners and workmen in South Wales, which culminated in a complete impasse at the close of 1916, it is probable that the Committee could have functioned successfully right through the War. Two other committees dealing with coal problems were established on the advice of the Coal Mining Organisation Committee, viz.: the Coal Exports Committee, under whose control was placed the whole of the export trade of the country in coal, and the Coal and Coke Distribution Committee, which dealt with the inland distribution of the coal and coke supplies.

In 1916 the output of coal showed an increase of over 3,000,000 tons on the previous year, and the average pithead price had risen to 15s. 2·57d. per ton. Exports still further decreased, but this was occasioned by the unavoidable restriction which had to be imposed to meet home requirements, due to the starting of munition factories and the extensions of works. On the advice of the Coal Mining Organisation Committee the Government instituted the Price of Coal Limitation Act which became law as from July 29 1915, and remained in being until the end of March 1921, being repealed when Government control ceased.

The coal trade had reached a purely artificial state which continued onwards throughout the War, the natural laws governing supply and demand being largely disturbed by Government control of prices and of export. The limitation of the price of coal, which was in the nature of a self-denying ordinance on the part of colliery owners and the miners, constituted one of the chief events in the history of the coal mining industry of Great Britain. It was almost the first attempt at a statutory limitation of the price of an essential commodity and, on the whole, it achieved a remarkable success. By the Act certain maximum pithead prices for the sale of coal for inland consumption were fixed, the coal owners being left free to obtain the best possible price for coal for export, with the exception of a limitation in the case of coal sold to the Allies. Thus at one time the price of the same coal was for home consumption 16s. 6d. per ton and for export 60s., 62s. 6d. and 65s., and after the Armistice, but before the repeal of the Limitation Act, the same coal actually reached 140s. a ton for export.

Government Control.—Owing to the wage disputes in South Wales terminating in an impasse, the Government took possession of the coal mines in Wales and Monmouthshire as from Dec. 1 1916, with the object of eliminating war profits, the avoidance of industrial disputes, and of securing the best results from labour in the mines during the War. In Feb. of the year following it was succeeded by a more stringent control by Government, which was extended to include all coal mines, the three Advisory Committees mentioned above being merged in the control. An agreement arrived at between the Controller and the coal owners as to the compensation to be paid to the latter under the control, was confirmed by an Act of Parliament on Feb. 6 1918.

The management of the collieries remained with the owners, and a profit standard was fixed in respect of each undertaking based on any one of the three years preceding the War which the owner chose to select, such profit being guaranteed to him during the period of control provided he worked up to a standard output. Eighty per cent of all the profit over and above the guaranteed profit was paid to the inland revenue as in the case of the excess profits of other concerns. Of the remaining 20% the Coal Controller took 15%, which went to form a pool from which he met deficiencies that arose in respect of the guaranteed profits of any of the undertakings, the colliery owners receiving the remaining 5%.

Perhaps the two most important actions taken by the Controller of Coal Mines were those in respect of the transport and rationing of coal. On Sept. 8 1917, the Transport of Coal Order was issued, under which Great Britain was divided into 20 areas, shown on maps accompanied by a table indicating the area to which coal produced in each of the production areas might be forwarded by public railway for inland consumption for (1) steam and manufacturing purposes, (2) gas and coking purposes, and (3) domestic purposes. It was estimated that, on the basis of the year 1917, the scheme would effect a saving in transport of rail-borne coal of 700,000,000 ton-m. per annum: though it is doubtful whether the saving effected actually reached this figure. The rationing of domestic coal first applied to London under the Household Coal Distribution Order of Aug. 10 1917.

The Distribution Order, 1917.—Three principal objects were aimed at by this order: (1) the establishment of minimum stocks of coal to be held in reserve throughout the winter; (2) a priority in distribution of any available stocks of coal, in case of shortage, to be conferred on consumers requiring or taking supplies in quantities not exceeding 2 cwt. per week; and (3) restriction in the consumption of coal where it was in excess of the normal average requirements of houses of different sizes. In July 1918 compulsory rationing in respect of domestic coal was made applicable to the whole of England and Wales, and in Oct. 1918 to Scotland also.

Certain advances in wages had been given to the miners during the War and a state of peace reigned in the industry for two years of the control. But at the conference of the Miners Federation of Great Britain at Southport in the summer of 1918 a programme was decided upon which included:—A National wage-board in substitution of district wages boards; a five-day working week; a six-hour working day; and alliance with the railway men and transport workers in order to enforce their demands.

The Sankey Commission.—Active agitation towards securing nationalisation of the mines commenced. The year 1919 was largely one of labour difficulties. To the demands specified above was added one for a 30% advance in wages, and other items. The Government appointed the Coal Industry Commission (known since from the name of its Chairman, Mr. Justice Sankey, as the Sankey Commission), to report, by March 20, as to wages and hours. Unanimity was not secured. There were three reports, that signed by the chairman and three other members of the committee being accepted by the Government. The chief recommendations were, that as from July 16 1919, the hours of underground workers should be reduced from eight to seven, and that, as from Jan. 9 1919 (when the demands of the union's executive were first formulated) workers over 16 years of age should receive an increase of wages of 2s. per shift worked and those under 16, 1s. per shift worked. These recommendations were carried into effect. On June 20, the Sankey Commission, though not unanimously, reported in favour of nationalisation. The measure was not acceptable to the Government, but a stoppage of work was averted.

End of War Time Control.—The financial control of the coal mines was terminated by the passage, on March 31, of the Coal Mines (Emergency) Act 1920, which specified that it should be deemed to have ceased as from April 1 1919. In Aug. 1920, the Mining Industry Act was passed, under which a separate Department of Mines was set up. Although the mines were still under Government control, a national strike of the miners took place in Oct. 1920, and lasted for 12 days. They had received a 20% advance in April (including "war wage" and "Sankey wage") and they now sought a further advance and a reduction in the price of coal. They obtained a settlement on the basis of a temporary scheme put forward by the Government.

The financial decontrol of the mines took place on March 31 1921. As the temporary scheme was drawing to a conclusion, the representatives of the owners and workmen met in order to work out a permanent settlement. Their efforts failed, and, on April 1 1921, another national strike took place; it lasted until July 4, when a settlement was arrived at embodying for the first time the idea of profit-sharing.

The coal mines of the country were divided into 13 districts, each district constituting a unit for the ascertainment of wages. A standard wage was to be paid, being the existing basis rates plus the percentages which were payable on basis rates, in July 1914, in each district. These were to be a first charge on the industry. After deduction of standard wages and costs of production other than wages, the surplus was to be divisible in the proportion 83% to wages and 17% to profits. The standard wages, and the share of the surplus apportioned to wages, were added together, and the sum expressed as a percentage on basis rates, which percentage constituted the rate of wages payable during the next period. In no case could wages fall below a point 20% above the standard wages. Thus was created a national board and district boards to effect a national agreement. In 1924 the agreement was modified, the standard profits to the owners being 15% in relation to the standard wages. Of the gross profits remaining after the deduction from the gross proceeds of costs other than wages, standard wages and standard profits, the workmen received 88%, the minimum percentage on standard wages being 33⅓%.

Depression in the Trade.—Complicated though this agreement was, and therefore not very intelligible to the miners, it could undoubtedly have worked well had the industry continued in a normal state; but the selling price of coal fell considerably, and though it had not reached an economic basis by the end of 1924, it was, by reason of the high cost of production, too low to enable the collieries to be carried on at a profit under the conditions imposed by the agreement. The depression in the coal trade was world-wide. The United States and Germany, great competitors in the coal industry, were in very much the same plight as Great Britain, for the demand was not equal to the supply. In July 1925 the Government decided to make to the coal industry a financial subvention as from Aug. 1 to April 30 1926, by which wages could be paid at the current rate. By March 31 1926 this subsidy had £19,000,000. In the meantime a royal commission was appointed to enquire into the industry in order to find a way out of the impasse. The chairman was Sir Herbert Samuel, who had just returned from Palestine.

The 1926 Report.—The report of the Commission, which was unanimous, was issued on March 10 1926. It showed that, excluding the subsidy, 73% of the coal was produced at a loss. It condemned the principle of a subsidy. To meet the immediate problem it considered a revision of the "minimum percentage addition to standard rates of wages" fixed in 1924 as indispensable in order to save the industry from immediate collapse. This, however, could not prevent the closing of a number of uneconomic collieries, the labour employed at which should be transferred to the "economic" collieries, while the Government should prepare plans for, and assist financially in, the transference of the labour. The wage arrangements were to be governed by "an economic wage determined from time to time on ascertained facts as to the economic condition of the industry in each district, and that of a minimum wage settled for each district on principles approved nationally." The Commission recommended the maintenance of the standard working day, which averages 7½ hours, but an optional redistribution of hours within the present weekly total over a week of five days instead of six, and the expansion of the multiple-shift system.

The industry should be continued under private enterprise, but state ownership by purchase should be effected of the minerals (royalties) where they have a market value, and by a declaration of state ownership in the case of unproved coal, or coal at deep levels, which has now no market value. Efficient organisation demanded amalgamation of small units of production. Large financial advantages might be gained by the formation of co-operative selling agencies, which in particular are needed in the export trade, and in co-operation and combination, with allied industries. Local authorities should be empowered to engage in the retail sale of coal. Larger mineral wagons should be used and a greater concentration of ownership of wagons instituted, a standing joint committee of the Ministry of Transport and of the Mines Department being set up to promote this improvement.

They favoured augmented provision for research in order that coal may be used more scientifically. If processes of low temperature carbonisation of coal were perfected, great national advantages would ensue because a smokeless fuel would be produced for domestic and industrial use and there would be provided large supplies of mineral oil from the country's own resources. The state should give financial support to the further experiments, on a commercial scale, which are necessary. Methods of payment should be devised in respect of the workmen not employed at the face which would induce a direct interest in output and measures were recommended having for their object the improvement of the economic interests of miners by family allowance schemes, and copartnership which should be made obligatory. The schemes and suggestions made in the Report involved the creation of a permanent coal commission, a national fuel and power committee and joint pit committees, as well as legislation of a far-reaching character.

Although the owners, under pressure, accepted the report in principle, it was rejected by the miners and on Saturday, April 29, the men ceased work. To support them a general strike was ordered (*see* STRIKES), but in a few days this was abandoned. The miners, however, remained idle throughout May and June and the attempts made by the Prime Minister and others to bring about a settlement of the dispute were unavailing. A meeting between the parties, called by the owners early in June, failed, like the debates in the House of Commons, to bring about a return to work. The miners persistently refused to consider any extension of working hours or any reduction of wage rates, while the owners adhered to their view that without these concessions they could not continue in business. Meanwhile, unemployment was growing, railway and other services were restricted and other industries were suffering in an increased degree from the shortage of coal. In June the government introduced legislation into Parliament to carry out the recommendations of the Samuel commission.

IV. THE TRADE OF OTHER COUNTRIES

United States.—The output in the United States rose rapidly during the War years, attaining the enormous figure of 605,546,343 tons in 1918. After that it was subject to great variations, due principally to industrial unrest resulting in strikes of the miners; the production for 1925 being 522,474,999 tons. But the productive capacity of the United States coal mines is far beyond the actual output.

Germany.—Like Great Britain, the year 1913 marked a record with 187,054,115 tons of "black" coal, or including brown coal, 272,885,210 tons, one ton of "black" coal being equal to 2·8 tons of brown coal in point of heat value; and, when the brown coal is converted into briquettes, which is done to a considerable extent, to 1·4 tons of briquettes. Although her Saar and Lorraine coalfields passed to France in 1919, and part of her Upper Silesian field to Poland in 1922, yet Germany's output of "black" coal has suffered less than might have been expected. A heavy fall took place in 1922, due to "passive resistance" upon the occupation of the Ruhr by the Allies; recovery set in later, the output for 1925 reaching to 130,595,951 tons or, converting brown coal into terms of "black" coal, 174,127,935 tons.

Taking the whole of Germany and comparing pre-War and post-War results, the following figures show the relative outputs exclusive of brown coal:—

Germany's Production of Coal

1913		1923	
	Tons		Tons
Ruhr	112,695,000	Occupied Territory	33,552,000
Upper Silesia	43,097,000	Unoccupied Ruhr Mines	7,863,000
Lower Silesia	5,438,000	German Upper Silesia	8,604,000
Saxony and Lower Saxony	5,872,000	Lower Silesia	5,223,000
Aix-la-Chapelle	3,212,000	Saxony	5,214,000
Lorraine	3,735,000	Aix-la-Chapelle	984,000
Saar Area	13,005,000		
Total	187,054,000	Total	61,440,000

The table below shows the export trade in coal of the three great coal producing countries in 1913 and 1924.

World's Coal Export Trade (in Millions of Long Tons)

(Including coal shipped as bunkers by vessels engaged in overseas trade, and also coal equivalents of brown coal, coke and briquettes)

Compiled from Coal Tables, 1924, issued by the Mines Dept. of Great Britain

Country	Quantity		Per Cent of Total	
	1913	1924	1913	1924
Great Britain	98·3	82·0	49·8	51·2
Germany, including reparation deliveries[1]	47·4	25·1	24·0	15·6
United States	23·6	19·8	12·0	12·4
Total of above	169·3	126·9	85·8	79·2
The World	197·3	160·2	100·0	100·0

[1] Coal equivalent of brown coal briquettes delivered on reparation account is included here.

These figures show that Great Britain had improved her position in point of her percentage of the world's export, but inasmuch as the total amount of coal exported from all countries had declined, the weight of coal exported by Great Britain had also declined (see figs. 2 and 3). The year 1925 showed a further decline of nearly 11,000,000 tons, and Great Britain's figures for 1926 were seriously affected by the strike.

Germany.—The total home consumption of coal and lignite in Germany during 1924 was as follows:—

	Tons
Coal from home sources	118,828,644
Lignite, home sources (converted ⅓)	41,453,276
	160,281,920
Plus imports	15,240,108
	175,522,028
Less exports	4,358,568
	171,163,460
Less reparation deliveries	19,680,243
Net consumption	151,483,217

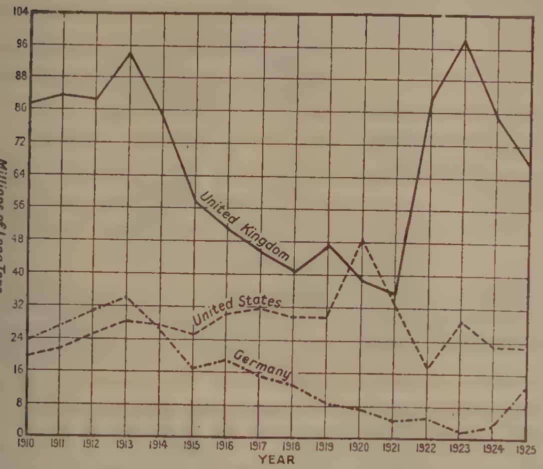


FIG. 2.—Domestic exports of coal of all kinds, including coal shipped as bunkers for use of steamers engaged in overseas trade. Note the steady decline in British exports during and after the War, and the great increase in 1923 and 1924 during the occupation of the Ruhr by the French.

The German exports of coal for 1925 rose to 13,500,000 tons. Taking the frontiers in 1925, the consumption in 1913 was 156,000,000 tons, which is not far short of the British home consumption in 1913 of 189,000,000 tons, and points to the increased industrial activity of Germany. The chief consumption of lignite was in the generation of electrical energy. In 1913 lignite was the source of 23% of the power generated in Germany, and in 1922 of 41·2%; the generation of electric power more than trebled in the 10-year period 1913–22, amounting in the latter year to 7,200,000,000 kw. hours. Increased saving in fuel consumption in large power plants and increased use of lignite in the generation of power have liberated a greater quantity of high class "black" coal for export, which competes with British coal in European and other markets.

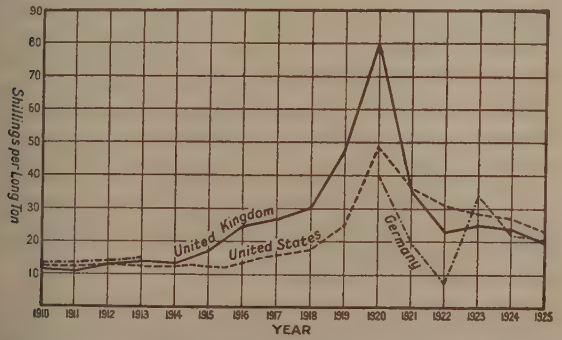


FIG. 3.—Average annual value (f.o.b.) per long ton of domestic coal exported. Note the great increase in value, particularly of British coal, during 1920.

United States.—The coal produced in the United States of America was estimated in the year 1922 to be distributed as follows:—

	Per Cent of Production
Domestic consumption	13
Railways	28
Power utilities	12½
Iron and steel industry	15
General manufacturing	19½
Export and bunker trade	12
	100

Consumption per Head of Population.—The comparative apparent coal consumption per head of population as between Great Britain, the United States, Germany, France and Belgium for the years 1913–24 inclusive, is shown in the following table:—

Apparent Coal Consumption per Head of Population
(Long Tons per Annum)

Country	1913	1914	1915	1916	1917	1918
United Kingdom[1]	4·22	4·08	4·48	4·76	4·81	4·45
United States	4·98	4·44	4·48	4·94	5·35	5·52
Germany[2]	3·08	3·34	3·27	3·49	3·68	3·70
France[3]	1·44	1·04	0·98	1·03	1·17	1·06
Belgium	3·44	(4)	(4)	(4)	(4)	(4)
	1919	1920	1921	1922	1923	1924
United Kingdom[1]	3·96	4·07	2·77	3·52	4·00	4·18
United States	4·44	5·08	3·90	3·78	5·00	4·31
Germany[2]	3·06	3·66	3·86	4·18	3·35	4·15
France[3]	1·04	1·23	1·14	1·29	1·54	1·69
Belgium	1·98	2·96	2·73[5]	3·03[5]	3·53[5]	3·78

[1] Figures for 1915–8 are based upon populations consisting of English and Welsh civilian populations only, Scotch population making no allowance for movement of Scottish troops overseas, and Irish population allowing for movement of military forces. Figures for 1923 and 1924 refer to Great Britain and Northern Ireland.
[2] Including brown coal.
[3] Excluding Saar.
[4] Information as to trade is not available.
[5] Belgium-Luxembourg Economic Union.

Germany's Selling Methods.—In Germany the colliery owners must by law sell through syndicates arranged according to districts. A severe penalty is imposed on any owner selling coal outside the syndicate of the district in which his colliery is situated. The syndicates, which are not worked in order to make profit, determine the output of each colliery and fix the selling price of the coal, all coal being divided into classes, *e.g.*, gas coal, coking coal, steam coal, etc. There is one price only for any given class, except in respect of coals grading from steam into anthracite, intermediate of "dry" steam coals; in these "border-line" cases here may be more than one price. The syndicates are as follows:—

A. Black coal (German "Stone coal").—1. Ruhr, 2. Aix-la-Chapelle, 3. Hanover, 4. Saxony (Zwickau), 5. Lower Silesia and 6. German Upper Silesia.

B. Some Black coal but chiefly Lignite (Brown coal).—7. Bavaria.

C. Lignite.—8. Cologne, 9. Saxony (Halle) and 10. East of Elbe (Berlin).

All of these syndicates are combined into the Reichskohlenverband over which is a coal council composed of representatives of the coal owners, workmen and consumers' associations, termed the Reichskohlenrat, which has conferred upon it, by government, power to make laws and regulations for the control of the coal mining industry, subject, however, to a power of veto vested in the Minister of Economics (Reichswirtschaftsminister). There are at least 100 members of the Kohlenrat, 25 of whom are appointed by the management, 25 by the miners and 10 by the Reichstag, and the rest—of whom not more than one-third may be officials—by the President of the Reich.

Output per Man and Hours of Work.—The output per man per shift has of late years shown a decline in Great Britain. The annual average quantity of coal in long tons raised per person employed under and above ground in the countries named over the period 1910 to 1924 was as follows:—

Year	Great Britain	United States	Germany (d) (excluding brown coal)	France (e)
1910	256	618	242	192
1911	259	614	252	193
1912	243	660	282	200
1913	259	681	286	(a)
1914	(b) 238	601	260	182
1915	(b) 269	648	302	182
1916	(b) 260	731	311	179
1917	(b) 247	768	291	170
1918	(b) 229	794	275	153
1919	(b) 195	637	174	122
1920	(b) 187	749	181	120
1921	(c) 144	549	165	130
1922	217	504	184	137
1923	220	693	103	134
1924	220	654	209	143
1925	225	(a)	(a)	(a)

(a) Information not available.

(b) These figures refer to the United Kingdom.

(c) Low figures due to coal strike, which lasted for three months; comparable annual figure = 192.

(d) From 1912, inclusive, figures are based upon numbers of insured workers.

(e) Excluding Saar district.

These figures have been obtained by dividing the annual output by the number of persons employed, and, for comparative purposes as between countries, are vitiated by the fact that the same number of days and hours may not have been worked in each country in respect of any given year: nor are the natural conditions with which the miner has to contend the same in each country—for instance, the conditions prevailing in the United States are perhaps the best in the world. On the average the seams are thick with good roofs, and lying at shallow depths from the surface. In respect of the black coal of Germany, the conditions are somewhat more difficult than in Great Britain. Making the fairest comparison, namely that of output per shift, calculated over all persons employed that for Great Britain is at present about 17·85 cwt. as against 19·5 cwt. for the whole of the Ruhr coalfield. In the latter field the rise in production per man per shift has been on the up grade. The output per shift in Germany of lignite is very considerable, much of it being quarried "open-cast." In Great Britain the hours of work of the underground miner are 7 hours exclusive of winding time, say, on the average, 7 hrs. 37 minutes. In Germany (Ruhr) they are 8 hours inclusive of one winding time, so on the basis of the same length of winding time as in Great Britain the average time below ground is 8 hours.

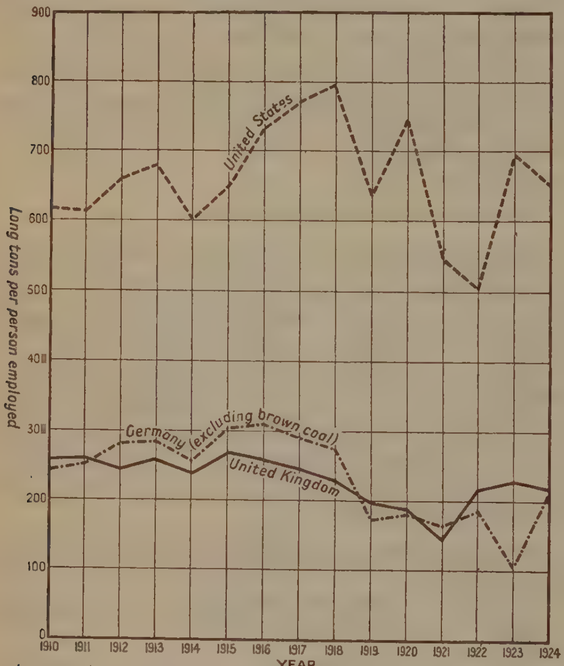


FIG. 4.—Annual average quantity of coal raised per person employed under and above ground.

In France the working time is 8 hours inclusive of both winding times, so that miners actually work less time than in Great Britain. In the United States the time is 8 hours, exclusive of both winding times, but as in the majority of the mines the inlet is by way of adit or day-drift, the actual time below ground is probably on the average more than 8 hours, though, from the report of the recent United States Coal Commission, the miners would appear to go into the mines and come out pretty well as they like, so long as they do not exceed the time during which the mine is open.

Cost of Working.—The cost of working in Great Britain and the Ruhr may be stated thus:—

	Great Britain—Quarter ending Sept. 30 1925		The Ruhr Year 1924
	With subvention	Subvention deducted	
	s. d.	s. d.	s. d.
Cost of working portion	16 7·57	17 11·64	15 1·50
Proceeds of working portion	16 4·75	16 4·75	14 2·75
Loss	0 2·82	1 6·89	0 10·75

V. STATE COAL MINES

In Great Britain and America there are no state-owned mines. The German State formerly owned a large number of collieries. The Prussian State owned and managed three large coal mines in Upper Silesia, now in Polish territory, three lignite mines and eight bituminous coal mines in the Ruhr, together producing about 9,500,000 tons per annum. Prussia also had control of the Hibernia coal mines, which, however, were run on the lines of a private company. In 1924 all these mines were denationalised, though the state continued to hold all the shares and other capital, the only difference being that, though the directors are appointed by the state, the officials and control generally of the mines are not under the state.

Russia.—All the collieries in Russia, once privately owned, are under the Soviet. Figures based on returns by the Soviet—the latter likely to be favourable than otherwise—present a very bad comparison with pre-War conditions. A considerably reduced output has been obtained and that output only with the aid of important state subsidies. In the fiscal year ending Sept. 1924, the coal mining industry received subventions in cash amounting to 24,800,000 chervonetz (1 ch. = £1 1s. 0d.) and a credit of 50,000,000 ch. in addition. The industry is greatly in arrears with payment of taxes. The position of the miner is far worse than before the War: in the Donetz basin he received, in March 1924, 15 gold roubles compared with 36·8 gold roubles in 1914, calculated upon the index cost of living. The output in 1913, exclusive of the area assigned to Poland, was 28,990,000 tons, whereas in 1924 it was only 14,580,000 tons; the country cannot even absorb this greatly diminished output. In 1913 the output per man per annum was 149·4 tons; in 1924 it was only 86·8 tons.

Holland.—Holland has some state coal mines, the production from which in 1924 exceeded that from the privately owned mines for the first time. The state-owned mines produced 2,912,899 tons out of a total for the country of 5,787,020 tons. The gross working profit from all the state mines in 1924 was 7,320,000 florins as compared with 8,340,000 florins in 1923.

British Empire.—In the British Empire there are several cases of state ownership of collieries on a very small scale, *e.g.*, the Udi Mine in Nigeria, the Mount Mulligan Mine in Queensland and the James and Liverpool Collieries in New Zealand, but all of them are very small concerns.

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COAL-TAR PRODUCTS (*see* 6.595).—Many attempts have been made since 1910 to effect the low temperature carbonisation of bituminous coal commercially, in which process a coal-tar is obtained, differing materially from that produced by carbonisation of such coal at high temperatures. It is therefore usually distinguished as low-temperature coal-tar, or in Germany as *Urteer, i.e.*, primary tar. This low-temperature coal-tar represents approximately the mixture of such primary decomposition products of the coal as are liquid at the ordinary temperature. It is always also first formed even when the coals are carbonised at high temperature, but these primary products then, by the further action of heat, undergo secondary changes, resulting in the production of a different liquid product and the conversion of much of the primary tar into permanent gas.

Low-Temperature Coal-Tar.—The low-temperature coal-tar produced from bituminous coals containing 28–35% of volatile matter at temperatures not exceeding 600–650° C. is usually a brownish-black liquid, less viscous than the high-temperature tars obtained from the same coal; the yield is usually from 8–10% by weight of the coal, or approximately double the amount obtained from the same coal at high temperatures (900–1200° C.), and the specific gravity of the low-temperature coal-tar from such coals is mostly between the limits 1·02 and 1·07. Hitherto the amount of such low-temperature coal-tar produced has been small in proportion to the output of high-temperature coal-tar in gas-works and coke-ovens, the highest production having been in Germany. Smaller amounts have also been produced in Great Britain and in the United States.

Variations of Analyses.—A number of analyses of such low-temperature coal-tar have been published. The results of these analyses are, in detail, in some respects contradictory, due largely to the fact that the composition of the tar obtained varies with the kind of coal carbonised, and to the fact that, even with the same coal, the composition of the tar alters with variation in the temperature reached in the carbonisation, and in the length of time during which the vapours first produced are exposed to that temperature. Broadly, the results so far obtained may be summarised as follows:—

Tar Acids.—Very characteristic of these tars is the high proportion of tar-acids, or phenolic bodies, present, which may form 30% or more of the whole. The lower-boiling products obtained by distillation of the tar, up to about 200° C., consist chiefly of hydrocarbons, but the higher fractions usually contain 25–50% of tar-acids, the proportion rising with increasing percentage of oxygen in the coals. Only a portion of these phenolic bodies, usually less than half, consists of true homologues of phenol, the remainder being complex acidic bodies of as yet unknown constitution. Phenol itself, the lowest member of the true phenol series, is either absent, or present in small amount only, but the three cresols, the xylenols and higher homologues are always present. The tar also contains up to about 1% of nitrogenous bases, which have not as yet been closely examined, but it appears that derivatives of aniline, pyridine and quinoline are all present.

Residues.—After removal of the tar-acids and bases, the residual neutral oil consists to the largest extent of hydrocarbons, but contains in addition considerable quantities of neutral carbon-hydrogen-oxygen compounds, the nature of which is hardly known. Whereas the hydrocarbons in high-temperature coal-tar consist for the most part of members of the aromatic series, those in the low-temperature tar belong mainly to the aliphatic group, true aromatic hydrocarbons being present in small proportion.

The aliphatic hydrocarbons present partly belong to the saturated series including both paraffins and naphthenes, and the higher-boiling fractions often deposit paraffin wax on cooling, the amount of the latter being sometimes sufficient to cause the tar to "set" at the ordinary temperature. Considerable quantities of olefines are present, and the low-boiling fractions include an amount of dienes which is much higher than in the corresponding fractions of high-temperature tar. If the temperature of carbonisation is kept as low as possible, the amount of the true benzene homologues is very small, but tends to increase with increasing temperature; as with the phenols, the lowest member of the series, benzene, is even then only present in small quantity, the higher members, toluene, xylene, etc., being chiefly formed. Naphthalene and anthracene themselves are absent or present in very small amounts, but small quantities of their higher homologues have been isolated, and derivatives of hydrogenated naphthalene, anthracene, etc., are also present.

Pitch.—The proportion of pitch in low-temperature tar is much less than in high-temperature tar, being only about one-third of the tar as compared with two-thirds for high-temperature tar, and the physical properties of the low-temperature residue differ considerably from those of high-temperature coal-tar pitch. The low-temperature tar also contains very much smaller amounts of the so-called free carbon or suspended solid matter, the quantity present being from 1 to 4%.

Up to the present, owing to the limited quantities of the material available, no extensive working up of the low-temperature tar into refined products has taken place. Commonly the lighter fractions are distilled off and after refining are employed as motor spirit, the residual oil being used as oil fuel with or without the previous removal of pitch by distillation. Owing to the large amount of tar-acids and other oxygen compounds present, such crude oil has, however, a distinctly lower calorific power than the corresponding crude petroleum oils.

Crude Oils.—Low-temperature crude oils are also obtained by the similar distillation of cannels, lignites, etc., but these are more nearly allied to shale oil.

Coal-Tar from Gas-Works.—In the period since 1910, the average quality of coal-tar produced in gas-works has altered, due to the increased substitution of vertical retorts for horizontal retorts in gas-making. Although the carbonisation temperatures in the former are at least as high as with horizontal retorts, the carbonisation conditions are such that the primary tar-vapours are less subjected to the action of heat, so that the resulting tar has a character intermediate between that of high- and low-temperature tar. The vertical-retort tar, therefore, contains a higher proportion of aliphatic compounds than the former and a lower proportion of "free carbon"; it still, however, remains predominantly aromatic in character and is worked up along with horizontal retort and coke-oven tar. Vertical-retort tar has a specific gravity of from 1·07 to 1·10, and its yield is from 5·5 to 6·5% of the coal, as compared with about 5% from the same coals in horizontal retorts.

Road Tar.—In the working up of coal-tar, the chief change in recent years has been in the production of treated tar for road preparation. To this purpose a large proportion of the total tar output is now devoted. Such tar may be prepared simply by distilling off the water and light spirits from the crude tar, leaving a dehydrated tar which is employed direct. The quality of such a product varies however greatly, according to the composition of the crude tar employed, and a much better and more uniform refined tar is produced by first carrying out the full preliminary distillation of the crude tar, and then suitably blending the pitch and distillates to produce a tar of the qualities required for different purposes in road construction.

In the distillation process itself and the preparation of such tar products as is normally carried out in tar-works, few fundamental changes have taken place in recent years. An increasing number of continuous distillation plants have been erected, some working under vacuum; and larger and more efficient stills for the production of benzene, toluene, etc., and for the separation of the phenols have been set up. The demand for anthracene has greatly diminished and comparatively little of this is now recovered; vertical-retort tars and many coke-oven tars are quite unsuitable for its production as the anthracene from these is very impure.

Resins.—Among the newer products obtained from coal-tar may be mentioned the coumarone and indene resins. The fraction of coal-tar naphtha boiling from 165–185° C. contains considerable amounts of coumarone and indene, and when this fraction is treated with suitable agents such as concentrated sulphuric acid, these undergo polymerisation, forming resins which remain behind on distilling off the unaltered hydrocarbons and are employed as artificial resins in industry.

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(H. G. C.)

COAST DEFENCE (*see* 6.599).—The War of 1914–8 has naturally caused changes in the realm of coast defence, as it has in every branch of the military art.

EFFECT OF NEW WEAPONS

Opinions have been expressed to the effect that Great Britain's whole scheme of coast defence must be changed, owing to the introduction of new weapons, of which by far the most prominent is the use of aircraft. Against this it is contended, on general principles first of all, that history has shown that a new weapon has never caused a revolution in the art of war. Naturally a new effective weapon will cause a change; and the introduction of aircraft has caused a change, but it is not a revolution. It will be found that the new weapon or the fresh invention takes its place in the armoury of war alongside of, but not at first, and sometimes never, in place of what has gone before. Before dealing with this suggested fundamental change it will be well to glance at the occasions on which coast defences were brought into play during the World War. These were not numerous.

Practically the first one was the German raid on the Yorkshire coast on Dec. 16 1914. During this the "Seydlitz," "Moltke" and "Blücher," mounting 64 guns altogether, from 11-in. down to 6-in. bombarded Hartlepool for nearly an hour. The only guns on shore were three 6-inch. Of course a large number of casualties were caused among the civil population, but no damage was done to the shore battery or its garrison of Durham Territorial Artillery. Later on the Germans admitted the loss of 10 killed on the "Blücher," while it was plainly visible that the upper works of the ships were suffering from the battery's fire, which was sufficiently annoying to draw off the enemy's attention from a small naval vessel which had emerged from the harbour and had been suffering loss. During the War a long series of engagements took place between British ships and the numerous batteries erected by the Germans on the Belgian coast. Admiral Bacon's book on the Dover Patrol mentions at least 40 of these engagements, and yet no gun, mounting or magazine of these batteries was ever hit.

Dardanelles and Zeebrugge.—In the naval operations in the Dardanelles, on March 18 1915, a deliberate action was fought between the main batteries of the Turks at the Narrows and 16 British and French battleships at the comparatively short ranges of from 14,000 to 10,000 yards. The Turkish batteries and guns were old, their sites were ill-chosen, as a rule close to the water, and their high traverses and deep embrasures rendered them very conspicuous. The batteries were, however, helped by the existence of mines, the position of which was imperfectly known to the ships. At the end of the day three battleships had been sunk by mines, and three others so badly damaged by shell fire as to necessitate their immediate withdrawal to a dockyard. The damage to the batteries was very small. For instance, the Hamidieh I. battery near Chanak, which contained three 14-in. and six 9·2-in. guns, had one of the latter put out of action and suffered some losses in its garrison. A war-time battery of five 6-in. guns at Dardanos, skilfully sited near the top of a conspicuous hill some 150 ft. high and in advance of the Narrows, received a large amount of attention from the fleet, not only during the main action, but for some days previously, but the only result was that splinters made three dents on the gun-shields.

The most spectacular action of the War between ship and shore was the successful blocking of the Bruges ship canal on April 23 1918 by Sir Roger Keyes's ships. This operation had been tried at Santiago de Cuba by the Americans and several times at Port Arthur by the Japanese; in both cases the attempts were unsuccessful. The success at Zeebrugge is an excellent instance of the fact that a fleet which is fully determined to come to close quarters with coast defences will most surely find out any weak spots. And there were weak spots at Zeebrugge. Most of the German guns were sited as if they were meant to defend the water outside the Mole and none seemed to have been allotted to deal specifically with block-ships, although the Germans quite realised the possibility of such an attack. The search lights especially were poorly sited; there was no concentration of illumination at the zone where the guns would have been most effective. On the other hand, the flanks of the canal entrance were crowded with machine-guns, trench-mortars and rifles. These weapons were useless for stopping the ships themselves, but were admirably placed for killing the crews, especially when the latter were leaving the ships. That the losses among the crews of block ships and motor boats were small can only be put down to the theory that "Fortune favours the brave."

Value of Aircraft.—Coming now to the action during the War of aircraft in the realm of coast defence the instances are few, and practically none are recorded of such action against coast defences. Attempts were made to bomb the "Goeben" in Jan. 1918, when she made a sortie and grounded on Nagara Point, remaining there for six days, but the results were practically nil, as she was only once hit, on a funnel, in a series of over 200 flights.

There was also the case of the German cruiser "Königsberg," laid up in a river in East Africa. She was bombed by two seaplanes, one of which was brought down by her gunfire and the other of which did her no harm. The ship was finally destroyed by indirect gunfire from two monitors, the fire being controlled by seaplane observation. Admiral Sims, in his book *Victory at Sea*, recalls the fact that although the U.S. Navy had 500 planes, a large number of which were operating over the North Sea, Irish Sea, Bay of Biscay and the Adriatic against submarines, only one boat was destroyed by direct bombing and one was "probably damaged."

In action against a ship, aircraft are heavily handicapped compared with a gun ashore. Aircraft really provide a form of long-range bombardment, in which the aircraft's engines take the place of the propellant charge in the gun. But every bomb that is dropped is a trial shot and no information gained from the first bomb is of any use for correcting the dropping of the next. No gun commander, ashore or afloat, expects a hit with his first shot, but he uses it to correct the fire of his next. But with aircraft, every bomb is a "first shot." There is no intention here of decrying the value of aircraft in its main sphere of observation; the only contention is that aircraft cannot take the place of artillery in coast defence.

Deliberate trials have taken place since 1918 to ascertain the effect of aircraft against ships. The most important of these were made in the United States in 1921. Two old warships, the "New Jersey" and the "Virginia," were anchored and exposed to aerial attack. Although 75 planes were used against them it was 9½ hours before the ships were sunk. Other trials have been made, but the results were no more favourable to the aircraft.

Since the War, aircraft have been designed to carry torpedoes for the attack of ships and great results have been expected from them. Hitherto they have been in the trial stage only, but they have the disadvantages that they must descend to from 10 to 15 ft. from the water before releasing their torpedoes and must get within some 1,000 yards of their target, thus rendering themselves peculiarly vulnerable to every kind of fire from a ship.

Taking into account all the experiences gained in the late War, and fully weighing what aircraft can do in their present stage of evolution, it is firmly contended that the basic principles underlying the British idea of coast defence before the War are still thoroughly sound, and that, it is correct policy to regard the gun as the main weapon for use now against an enemy's fleet.

Guns and Batteries

On the assumption that the gun is still the main weapon of coast defence, it will be well to consider in what way the differences of the conditions under which the shore gun and the naval gun carry out their work have altered since 1914.

(1) The fact that ranges have greatly increased has affected the question in several ways:—

(*a*) The handicap against the naval gun, in being on a platform which is not immovable, has been accentuated, since the longer the range the greater will be the distance any movement of the ship, however small, will throw the shell off its intended target.

(*b*) Guns are not mathematical instruments. Their shooting is affected by very slight variations of propellant charge in quality and quantity, of weight of projectile, of the distance by which the latter is rammed home in the bore, and by the wear of the gun itself, not to speak of change of atmospheric conditions. Increased range magnifies the inaccuracies caused by these factors and necessitates a greater number of rounds being fired to produce a given effect than was the case with shorter ranges. The amount of ammunition in a ship, especially for heavy guns, is not large, and it is far less easy to replenish this afloat than it is for the gun ashore with all the resources of the land.

(*c*) Increased range is more helpful in rendering a shore gun inconspicuous than it is as regards a ship. Probably, too, heavy guns will be sited behind low hills so that they are invisible from the sea.

(2) The methods adopted and under trial for range-finding and the control of fire have made greater advances ashore than afloat. This is owing to the inherent inferiority of ships in this respect, compared with guns ashore, since all arrangements to this end are restricted to the dimensions of the ship and its masts, whereas the shore gun has the whole coast within the limits of vision at its disposal and will often have the advantage of using commanding heights. In this connection, too, the shore gun may be able in the future to make use of sound-ranging, which proved so useful on land in the World War. This would be especially valuable for dealing with a ship which protected itself by a smoke screen. This form of ranging is denied to a ship, since a long base is necessary.

Aerial Observation.—Both sides can make use of aerial observation of fire, but, in addition to the use of smoke screens, which is also available to both, it will be possible to take other steps to render the elements of a coast battery indefinite objects when regarded by the eye of an aerial observer. This is a measure which is impossible to a ship which, apart from smoke screens, must always be a well-defined object on a flat surface. As regards aerial observation, the possibilities of jamming the wireless of spotting aircraft by either contestant have not yet been fully explored. The Americans have done some experiments in this direction and, if this should prove possible, the value of aerial observation would largely disappear.

It may be argued that if ships find that, in the attack of coast defences, they are too greatly handicapped by long ranges they will close in to shorter ranges and endeavour to overwhelm batteries by their superior volume of fire. This manoeuvre, however, would be the means of giving the superior instrumental system of control of fire possessed by the shore gun the very chance of proving that superiority, as it is at the very long ranges that all instrumental observation, ashore and afloat, is weakest. And shorter ranges would give lighter guns their opportunity.

At present (1926) there seems a disposition to ignore the damage that can be done by medium and light guns to heavy ships, but the fighting efficiency of a ship can be greatly impaired without penetrating its armour. So that it is quite possible that this view is overdone. The 6-in. guns at Hartlepool were hopelessly outclassed in number and size by those of the German, yet they took their toll of their powerful opponents and came off scatheless. The dispatches of the Admiral in command during the Dardanelles operations often refer to the great annoyance caused to his ships, armoured and otherwise, by two 6-in. batteries, Messudieh and Dardanos, while Admiral Lord Wester Wemyss, in his book, refers to the "Prince George," an old battleship, being hit by a 6-in. shell, taking a list and having very shortly to be withdrawn to a dockyard on account of the damage done.

Size of Guns.—The heaviest British pre-War gun was the 9·2-in., firing a 380 lb. projectile to a range of some 17,000 yards. It is now necessary to have a longer range weapon. To obtain this it is not really essential to have a gun of much larger calibre, although the life of a large long-range gun is longer than that of a smaller one of equal range. But against capital ships now it is necessary to have a projectile with greater power than that of the 9·2-in. and such guns as the 12-in. or upwards are required.

It has often been advocated that guns on railway mountings should be used for coast defence,[1] as they can be moved from place to place as the situation demands, while their appearance would be unexpected. But the railway mounting is most unsuitable for use against moving targets since it does not give sufficient traverse, as it can be fired only a few degrees off the axis of the railway. For larger variations a railway gun has to be on a curve and move along it as required to alter the line of fire. This is much too slow for coast defence purposes. Also, modern arrangements for control of fire demand fixity of position, while from the point of view of training the detachments, especially with local forces, it is vital to have the gun always on the spot. Finally, a railway mounting is more expensive than a fixed one. For these reasons its use is not advocated.

Design of Batteries.—As regards heavy guns, when the long ranges now required are considered and the great improbability that ships will come close in, there are many advantages to be gained by siting the guns behind features of the ground, so that they are unseen altogether from the sea. In any case, such guns would have to be controlled by some form of position-finding instruments, so that nothing is lost in this way. The advantages gained are increased protection from hostile fire, much greater latitude in choice of sites and probably easier communications up to the battery. The disadvantages are a small loss of range, an area of dead water owing to the shell having to clear the intervening higher ground and the difficulty of fighting the guns if the communications of the control of fire system be damaged. The loss of range is generally immaterial, the dead-water, even assuming that it is navigable, can generally be covered from another battery, while adequate protection for the communications, with possibly their duplication, would reduce the third disadvantage to a minimum. All the heavy German guns on the Belgian coast were sited for indirect fire.

The actual design of batteries can be considerably simplified. In this the guiding principles may be said to be that everything must be done to facilitate the service of the guns, while protection from hostile fire will be sought for by dispersion of the vulnerable points, *e.g.*, magazines, and not by giving them thick material cover. The guns will still require their solid concrete platforms, but parapets are unnecessary. Ammunition will be distributed in small expense stores at some distance apart, and these will not be shell-proof but only weather-proof and splinter-proof. It will be useless for a ship to aim at a battery as a whole; each element of it, gun or expense store, will form a separate target.

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[1] The Ordnance Department, U.S. Army, has designed railway mounts (the largest being for a 14-inch gun of approximately 40,000 yards range) in which this difficulty has been overcome. The design permits of rapid emplacement on a prepared base and ensures the same all round traverse, and speed and accuracy of fire, as obtain for the gun on a fixed mount. (Ed. *E.B.*)

Batteries for use against cruisers and light craft, mounting medium and light guns, say 9·2-in. and 6-in., will still be sited for direct fire, and so will be visible from the sea. The same guiding principles will apply to them as in the case of the heavy batteries, except that special care must be taken to render them difficult targets for ships at sea. The guns must have a background close behind them and the ways of communication, from the ammunition stores up to the guns, must be kept out of view from the sea, as well as the stores themselves.

Air Attack.—The War introduced this new feature which must be reckoned with. As already mentioned, aircraft can and will be used for controlling the fire of both shore and ship guns. But aircraft can also act offensively against coast defences by dropping bombs. The best protection of batteries against aerial attack will be in the use of counter aircraft and of anti-aircraft guns. Even with the latter only—and their action is becoming more and more effective—hostile aircraft will have to keep high up and the accuracy of their aim in bombing will thus be greatly impaired.

The largest vulnerable element of a coast battery will be the gun and its emplacement, which will not exceed 20 yd. diameter with the heaviest guns. If an aeroplane were travelling at a speed of 120 m.p.h., in order to get a direct hit on the emplacement the bomb must be released at an exact third of a second, and if there is any wind this must be allowed for. These conditions are very difficult to fulfil conjointly, but practically direct hits are necessary to put out of action any of the elements of a battery, whether guns or stores. It is also easy to erect traverses round the vulnerable elements which would guard against bombs dropping close by. As a rule, every battery will be within the region of anti-aircraft guns.

Land Attack.—This has very often been the most effective form of attack on a coast fortress, but it is a branch of land warfare and cannot be dealt with here.

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(J. C. M.*)

COAST PROTECTION (*see* RECLAMATION 22.954).—There is a difference of opinion about the value of much of the works for coast protection, and in the opinion of some, money expended thereon does not give an adequate return. Even in Holland, whose existence depends on the maintenance of its sea walls and defences, authorities are divided on many important questions both of principle and practice. Since 1910 there has been remarkably little development in the means adopted to combat coast erosion, and, generally speaking, the methods of construction which still find favour, not only in Great Britain but also abroad, are the same in principle as those which have been used for generations previously. The Royal Commission on Coast Erosion, appointed in 1906, whose final report was issued in 1911, collected and placed on record much useful information on the subject of coast erosion, protection and reclamation, not only relating to the United Kingdom but also in reference to foreign countries and in particular Holland and Belgium.[1]

The recommendations of the commission regarding the control of the foreshore of the United Kingdom and the constitution of a central sea defence authority have not yet been given effect to by legislative enactment. The report, however, has served to dispel certain erroneous ideas, particularly as to the extent of the loss of land due to erosion in the United Kingdom, and proves conclusively that the expense of protecting purely agricultural land is out of all proportion to the value of the land thereby saved from destruction.

Subsidence and Upheaval of the Earth's Crust.—It has been sometimes asserted that the continuous loss of land on the south and east coasts of England is partially due to subsidence of the earth's crust, but there is no evidence to show that either upheaval or depression has, during historic times, affected the encroachment or recession of the sea on the coasts of Great Britain, and it may be safely asserted that the whole of the changes in the coast-line since the dawn of history have been due either to accretion or denudation.

Physical Causes of Sea Encroachment.—The encroachment of the sea on the coasts is due to the erosion of the cliffs and shore material. Of the detritus derived from such erosion a portion is carried along shore by the combined action of wind, waves and tides, remaining in a state of more or less constant movement until it is finally deposited to swell some accreting sand or shingle bank or is driven against some natural or artificial barrier, where it lies and is perhaps buried under subsequent deposits. The travelling shingle and sand or "littoral drift" is the principal source of the beach materials which form, and make good the wastage from, the foreshores of the coast. In the course of this lateral travel the particles, large and small, forming the detritus are still further disintegrated. The lighter material is carried off in suspension by the sea and ultimately finds a resting place on the ocean bed at a level below the influence of wave action or tidal scour. The remaining portion of the solid materials derived from the destruction of the cliff or shore is immediately transported into deep water, the finer particles being rapidly swept away by the current until finally deposited on the sea bed, and a certain proportion of the larger material too heavy to be carried in suspension for any considerable distance, is drawn down the foreshore and the bed of the sea by the undertow of the waves and ultimately makes its way by gravitation into deep water, where it finds a resting place.

River Detritus.—The amount of solid matter thus finding its way into the ocean is vast and is increased by the addition of detritus brought down by rivers and derived from the land surface. River detritus, on reaching the sea, shares much the same fate as the material derived from the coast line. A part finds a resting-place in sand banks and alluvial deposits at the mouths of rivers and estuaries, the remainder spreading itself over the deep-sea bed.

Relation of Littoral Drift to Eroded Material.—It is impossible to form any exact estimate of the relative proportions of the material more or less immediately carried away to the deep sea and that other part which we may call littoral drift. In the case of chalk cliffs and foreshores it is probable that the immediately removed material amounts to nearly 90% of the whole, while alluvial cliffs and those consisting of boulder clay or other similar material may yield 20% to 30% of solids not at once carried away from the foreshore into the deep sea. Gravel and rock cliffs naturally yield a higher proportion of heavy and harder particles. On the whole it is unlikely that on the average more than 20% of the solid material falling on to foreshores and derived from the decay of the coast line remains above low-water mark for any length of time.

Deep Sea Erosion.—The process of erosion and littoral drift is not confined to the foreshore and beach above low-water mark. Such changes are continuously in progress below low-water mark where wave action or tidal scour is capable of affecting the sea bottom. These agencies and the gravitating tendency of the particles continue at work until a condition of equilibrium of the opposing forces is reached. It has sometimes been asserted that material is derivable from the deep sea for the replenishing of foreshores. Fragments of rock, boulders and flints dislodged from the sea bed in comparatively shallow depths below low water are sometimes cast up on the foreshore, but such instances are exceptional and cannot be taken as evidence of the supply of any considerable volume of material from the deep sea bed. Undoubtedly material lying on the sea bed below low water and in shallow depths is, under certain conditions, driven back on to the foreshore, but this is merely a temporary phase in the progress of littoral drift. With change of wind or tide the conditions may be reversed.

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[1] See *Reports and Evidence: Royal Commission on Coast Erosion;* particularly final report, Cd. 5,708 (1911).

Effect of Protective Works on Adjoining Coast-Line.—In order to increase the extent of any foreshore or to maintain it even in its existing condition, the natural and incessant losses must be made good by accretion or the trapping of material derived from other parts of the coast. This may be done in favourable circumstances by the construction of groynes or other works similar in effect, but the accretion through their agency is in every case accomplished to the detriment of neighbouring foreshores. Thus the large groynes at Brighton trap for the time being the greater part of the shingle travelling from west to east, and very little passes on to the foreshore to the east of Brighton, which, in consequence, has become denuded.

Conditions Affecting Littoral Drift.—The direction of the prevailing littoral drift is in general governed by the direction of the flood tide, the prevailing winds, and the shape of the coast. Authorities differ as to the relative effect of the tide and wind, and although the direction of drift is at times varied by the wind direction and the consequent wind waves, most competent authorities agree in the opinion that, in the case of England, at any rate, the prevailing drift coincides with the set of the flood tide. On the English coasts the direction of the flood tide does, in fact, in general coincide with the direction of the prevailing winds. On the east coast the drift is from north to south and on the south coast from west to east, both in the direction of the flood tide and prevailing wind.

Where a coast-line is broken up by deep bays and indentations no continuous drift can take place, each bay retaining its own characteristic material, which is prevented from leaving it by the projecting headlands extending to low water or beyond and forming natural groynes. Numerous examples of these conditions are found on the south coast of Devon and Dorset. The direction of the flood tide is also in many cases altered locally by the configuration of a bay, *e.g.*, the deflection of the tide along the shores of the bay in a direction opposite to that of the normal coastal current. In cases where a coast-line is broken up by estuaries or rivers the results are variable, depending upon the continual struggle which takes place between the opposing forces affecting littoral drift and the tidal inflow and outflow of the river, the latter sometimes aided to a material extent by the addition of large volumes of fresh water.

During strong winds in a direction contrary to the set of the tide the normal travel of drift may be nullified or even reversed. The accumulation of material on a foreshore is generally brought about by tidal action in calm weather. A beach which has been depleted during a long spell of heavy weather usually makes up again, at any rate to a partial extent, on the occurrence of calm sea and the cessation of wind. This replenishing is due to the return of a portion of the material previously drawn down into shallow water below low-water mark. Generally speaking, on-shore gales result in the drawing down of the beach material and its gravitation towards the deep sea. Off-shore winds, on the other hand, frequently lead to the accumulation of material on a foreshore.

Effect of Pier Works and Other Artificial Projections.—The construction of solid piers or other similar obstructions at an angle with the general shore line and projecting into the sea is, when occurring on a coast-line subjected to erosion, almost inevitably followed by serious depletion of the foreshore to leeward. The solid projection, which in many cases is carried sufficiently far in a seaward direction to reach comparatively deep water, effectually hinders the passage of littoral drift from its windward to its leeward side.[1] Thus the erosion of the lee shore is accelerated by the loss of the travelling material which under natural conditions makes good to a partial extent the ravages of the sea. Instances of such stoppage are numerous on the English coast. The Folkestone harbour pier has arrested the travel of the beach from the westward, and led to the accumulation of a large bank on that side and the denudation of the foreshore to the east of the harbour and towards Dover. The construction of the harbour works at Dover has stopped the eastward drift at that point and accelerated the destruction of the cliffs in St. Margaret's Bay. At Lowestoft the construction and subsequent extensions of the harbour pier and other works which project at right angles to the coast-line at the sea outlet of Oulton Broad have resulted in the accumulation of a bank of shingle to the northward and serious encroachments on the town frontage to the south of the harbour.

Sea Walls.—The conditions affecting the design of a sea wall differ so materially that every case must be considered on its merits and provided for accordingly. Sea walls may be divided roughly into two classes, sloping and upright, each class having its advocates among engineers. Generally speaking, walls having a sloping face are used in Holland and Belgium, whilst a vertical or nearly vertical face is more common in Great Britain. The immediate effect of the construction of a wall is detrimental to the beach in front of it, although affording protection to the cliff or banks behind. Thus, the construction of a sea wall on a sand or shingle foreshore is in itself calculated to bring about the denudation of the beach and the wall may become before long the agent of its own destruction. Whilst the wall will prevent erosion by the sea of the cliffs in rear of it, the beach in front of the wall must be protected and conserved by the construction of groynes. Many walls have failed through the displacement of the filling behind them by wave action; the provision of a substantial and wave resisting surface or paving behind the wall is, therefore, of great importance, and has been too often neglected. Suitable provision for the drainage of the cliffs, where they exist at the back of sea walls, is also a matter of high importance, which has often been neglected with disastrous results.

Much can undoubtedly be done by draining, sloping and planting, to preserve and protect cliff faces, and these works ought to proceed simultaneously with the carrying out of sea-defence undertakings, when the cost of the latter is justified, to protect the foot of the cliff. Sea walls subjected to abrasion by shingle are, if faced with concrete, very liable to progressive and serious damage. In such positions a concrete wall is frequently protected by a facing, at any rate over that portion subjected to abrasion, of hard stone or flints. For this reason also reinforced concrete is unsuitable for use in the face work of walls on a shingle beach, as the abrasion of the concrete surface soon results in exposure and deterioration of the steel reinforcement.

Groynes.—However effective they may be in collecting travelling material, groynes will not in all cases prevent the waves reaching the toe of a cliff or bank and eroding it to a greater or less extent. A combination of the two forms of protection—groynes and wall—is frequently desirable, but groynes alone have on many low-lying foreshores, particularly where there are no cliffs, proved successful and efficient without the construction of sea walls or protected banks, as for instance on the four miles of shore between Worthing and Shoreham. In some cases protection of the crest of a beach above high water has been secured with success by the construction of a timber barrier or wave screen formed of piles spaced apart and driven parallel to the line of shore.

Groynes may be divided into two main classes: (1) high and substantially built structures of timber or other material; (2) low groynes of inexpensive and light construction usually placed at short intervals apart. In general, low, light groynes are suitable on flat sandy foreshores which are not exposed to sudden and extensive changes of level. In any case it is undesirable to build up the planking of a groyne to a considerable height above the foreshore level existing at the time of construction, and it is preferable to raise the groyne by the addition of planking to keep pace with the accretion of beach material. The use of reinforced concrete for the construction of groynes has frequently been advocated, but is unsuitable on shingle beaches on account of the rapid abrasion of the thin concrete coverings of the steel reinforcement.

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[1] The terms "windward" and "leeward" are used in the sense understood by engineers engaged in coast protection work, viz., "windward"—the direction whence the prevailing littoral drift proceeds; and "leeward"—the direction towards which such drift takes place.

Groynes, speaking generally, to be of maximum efficiency should be at distances apart about equal to or little more than their length. They should extend continuously from the shore or work to be protected to the vicinity of low water of spring tides. There is much diversity of opinion and practice with regard to the direction in which groynes should point. Some authorities advocate their direction at right angles to the shore line, others pointing slightly to windward, and some authorities advocate a leeward direction. No general rule can be laid down and a plan suitable for one locality may prove a failure in another. The opinion of most authorities, however, appears to favour a direction pointing slightly to windward.

Removal of Shingle.—Beach material is too often limited in quantity and the question arises whether its removal for commercial purposes should be allowed. The results of natural erosion and denudation are, in many instances, aggravated by this practice. The powers possessed by the Board of Trade provide for the issue of prohibitory orders and in certain circumstances where the removal of beach or sand can be shown to be injurious, such orders have been frequently made.

Relative Extent of Loss and Gain of Land.—The evidence as regards the total superficial area gained and lost in recent years on the coasts and in the tidal rivers of Great Britain shows that far larger areas have been gained by accretion and artificial reclamation than have been lost by erosion. Evidence laid before the royal commission by the Ordnance Survey Dept. in 1907 showed that within a period, on the average, of about 35 years, about 6,640 ac. had been lost to the United Kingdom, while 48,000 ac. had been gained. Most of the gain has been in tidal estuaries, while the loss has been chiefly on the open coast. Moreover, the gain has been due in the main to the deposition of sediment brought down by rivers and to artificial reclamation. It is, however, probable that the land lost has been more than compensated for by land naturally accreted. The report of the royal commission contains the following statement:—

> The erosion . . . would have been far more serious if extensive works of defence had not been constructed by local authorities, railway companies and others, at a great cost, though, on the other hand, such works in many places have been responsible for erosion of the neighbouring coasts by interfering with the normal travel of the beach material. On the whole we think, however, that while some localities have suffered seriously from the encroachment of the sea, from a national point of view the extent of erosion need not be considered alarming.

Cost of Coast Protection.—The cost of construction of groynes varies very considerably with the design and local conditions. Before the World War light low groynes might be constructed at a cost of from 10s. to £1 per foot lineal, and groynes of more substantial construction at from £1 to £3 per lineal foot, while some of the large concrete and masonry groynes of the type frequently constructed at Brighton and Hastings cost as much as £7 or £8 per lineal foot. The initial capital cost of protection per mile of shore was seldom less than £4,000, even when no sea wall was constructed. Under present conditions these figures should be nearly doubled. The annual charge for repairs, interest on capital, and replacement may be put at not less than 10% of the original capital cost.

The cost of protecting purely agricultural land which is subject to erosion must of necessity, under the conditions which usually prevail, be considerably in excess of the value of such land. Protection under such conditions is only justified when agricultural land is in the vicinity of towns and its erosion, if it be not stopped, is likely to lead to those towns being outflanked by the sea, and in situations where the works have as their object the preservation from inundation of areas of low-lying land of considerable extent. It is not desirable, even if it were practicable, to prevent erosion of all parts of the coast, as the waste of the cliffs provides the greater part of the beach material which acts as the most valuable agent of protection.

The expenditure incurred in the construction of sea defences by many of the coastal towns of England in recent years has been very considerable and in some cases has imposed a heavy burden on the inhabitants. As an instance the case of Sidmouth, a seaside town on the south coast of Devon, having a population of about 6,000, may be referred to. As a result of exceptional gales the sea defences of the town over a frontage of under half a mile were seriously damaged and undermined between the years 1917 and 1925 and the construction of new sea walls and groynes, completed in 1926, entailed an expenditure of over £100,000.

Sand Dunes and Alluvial Flats.—The preservation of sand dunes is most important along certain parts of the coast where they afford protection to low-lying areas behind them, and they should in these cases be maintained and fostered by the encouragement of the growth upon them of marrum and other grasses, which help to bind the sand together. Where drifting of blown sand occurs much may be done to check it by the fostering of such grasses. The process of natural accretion on alluvial flats has been hastened in many cases by the planting of suitable vegetation such as rice grass (*spartina*), and in this way land may in time be reclaimed by entirely natural means.

Conditions in Holland and Belgium

A large part of Holland and some portions of Belgium are below the normal sea level and are protected from inundation by artificial embankments (dikes) or by narrow belts of sand dunes. The foreshore works on the coast of Holland and Belgium, although of great interest and attended with considerable success, do not afford examples to be followed as affecting the sea defences of the United Kingdom and other countries exhibiting physical characteristics similar to those of the latter. The protection works in such cases as Blankenberghe, Heyst, Scheveningen, Kallantsoog and Petten are of great magnitude and the engineers responsible for these works, particularly in Holland, have at their command the accumulated experience of centuries of sea-defence work. The local conditions with which these works have to conform, viz.: low flat foreshores consisting entirely of sand, are wholly different from those generally associated with sea-defence works in England. The large expenditure involved is justified by the necessity of securing the safety, not only of the sea-board, but of large tracts of the countries themselves. Investigations in Holland are said to indicate a continuous subsidence of the land of that country relative to the sea level, amounting to about 15 cm. per century.

The North Sea foreshores of Holland and Belgium consist for the most part of fine sand; similar deposits border the lower portions of the numerous river estuaries which penetrate far inland, but in the higher parts of these the foreshores are generally composed of fine sand covered with clay or mud. The foreshores of the North Sea between high and low water have an average gradient of about 1 in 45 and the shores above high water normally slope at about 1 in 25. Submerged sand banks more or less parallel to the shore are a characteristic feature of the North Sea and estuary coast lines of Holland and Belgium. These, where they exist, afford considerable protection to the sandy shores during on-shore gales. In calm weather and with off-shore winds sand accumulates on the foreshores.

The two most important forms of sea-defence works in common use in Holland are (*a*) groynes, (*b*) fascine-mattresses with stone ballasting. Groynes are usually constructed at right angles to the shore line and are maintained as a rule at a small height above the average foreshore level. On those portions of the North Sea coast which are most exposed groynes are placed about 250 metres apart and are extended out beyond the low-water line. Many of the groynes on the Dutch coast are constructed of layers of fascine mattresses covered by heavy stone, having their crests almost flat or turtle-backed with side slopes of 1 in 2, or flatter. The fascine or brushwood mattresses are held together and pinned down by rows of piles. Wide brushwood aprons, with heavy stone covering forming flat slopes, are constructed on either side of the groyne in order to protect the flanks against scour. The groynes are carried up above the line of high water to meet the base of the sand dunes or the protecting dikes. These groynes, inclusive of the side aprons, are often of considerable width, sometimes as much as 30 metres at their deepest and widest parts. The cost of groynes built in Holland has varied from £4,000 to £11,000 each.

The underwater banks of some of the estuary channels and sea inlets on the coast of Holland frequently stand at a steep slope with deep water alongside. Under these conditions there is serious liability to erosion and it is usual to protect the banks both above and below water by artificial means. For many years fascine mattresses have been used for this purpose. These are made up on a convenient sandy foreshore, covered at high tide and when completed are towed to the place where they are to be used and sunk on the sea bottom by ballasting with stone. They consist of two layers of grids of brushwood, each built up of crossed rows of parallel brushwood ropes, 0·4 metre circumference, and spaced 0·9 metre apart centre to centre, bound together with a filling of brushwood in three layers between them.

On the top of the upper brushwood grid some open-work partitions are formed for the reception of stone ballast. Formerly, clay mixed with a little stone was used for ballasting, but in modern practice stone alone is employed, the mattresses being weighted to the extent of 1,000 kg. per sq. metre. The cost of continuous protection of the steep banks of the estuary channels where the depth of water alongside is sometimes as much as 30 metres, is very considerable, amounting in some cases to as much as £100 per metre run of bank. In some localities the cost has been reduced by the construction of intermittent mattress work, leaving short unprotected stretches of bank between projecting spurs which serve to deflect the main current away from the unprotected embayments. In cases where the sea bed of the deep channels consists of clay, erosion is not so uniform as that of sandy bottoms and the side slope is sometimes almost vertical. In such situations rubble stone ballasting or surfacing of the bank is preferred to the employment of mattresses. The protection of the shore lying between the steep submerged and partially submerged banks of the channels and the base of the dike or wall, which forms the immediate protection of the land behind, is usually effected by means of groynes. These shores, which are sometimes of considerable width above the level of normal high water, have in most cases flat gradients.

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COATES, JOSEPH GORDON (1878–), New Zealand politician, was born at Matakohe, the son of a farmer. He was elected M.P. for Kaipara in 1911, and favourably impressed his leader, Mr. W. F. Massey, with his solid, if not brilliant, qualities. From 1917 to 1919 he served in France with the New Zealand Forces, in which he attained the rank of major and gained the military cross. Shortly after his return home, he was invited to join the Cabinet, and, as head of the Public Works, Railways and other departments proved himself a capable administrator. His energy and sincerity amply compensated for any lack of eloquence; and when Mr. Massey died in 1925 he was his obvious successor. As Prime Minister the chief aim of his domestic policy was the consolidation of the primary industries of New Zealand, thus paving the way for a development of secondary industries. In overseas affairs he was a staunch Imperialist.

COBLENZ, GERMANY (*see* 6.612), had in 1919 a population of 57,393. New law courts, churches and a theatre were built after 1910. Coblenz was bombed by the Allies in 1917 and 1918. After the Armistice the town and bridgehead were occupied by Allied troops under the Treaty of Versailles, Art. 429–432, Coblenz forming the second zone to be evacuated after 10 years, should Germany fulfil her obligations (*see* RHINELAND). Coblenz was the seat of the Rhineland high commission, and was first occupied by American troops, becoming General Pershing's headquarters. On Jan. 10 1923 the American troops were withdrawn and replaced by French. On Oct. 21–26 1923 Separatists carried out a coup, proclaimed a Rhineland Republic, and declared that they had been recognised as a *de facto* Government by the French high commissioner. The Separatist leaders quarrelled among themselves, and the movement had collapsed by Feb. 1924.

COCHERY, GEORGES CHARLES PAUL (1855–1914), French politician (*see* 6.619), died in Paris Aug. 8 1914.

COCHIN, DENYS MARIE PIERRE AUGUSTIN (1851–1922), French politician (*see* 6.619), joined the Briand National Defence Cabinet on the outbreak of the World War as a minister of state and was sent on a diplomatic mission to Greece. He died in Paris March 24 1922.

COCOA (*see* 6.628).—The moderate prices of cocoa in 1925 were largely due to the development of cocoa-growing in British West Africa. In 1905 the world's production of raw cocoa was 141,000 tons, of which 23% was grown in the British Empire; in 1913 255,000 tons were produced, of which 35% was British; and in 1925 the world's production was about 500,000 tons, of which 60% was produced in the British Empire.

Gold Coast.—In 1922, out of a total world output of 403,000 tons, 159,000 tons were grown on the Gold Coast. There were no organised plantations, the trees being cultivated around the native villages. The crop is gathered, fermented and dried and brought in in small but very numerous consignments to the river and rail collecting stations, whence it is shipped down to the warehouses at Accra. The bean is not of the highest quality, being flat in shape and somewhat bitter in taste, owing to imperfect methods of native cultivation and preparation. But it is the most important cocoa available in bulk and at a low price, and forms a basis for all cocoa and chocolate productions, at its best readily blending with any other sorts. Dangers to further development of production on the Gold Coast are the felling of the forests, causing the climate to become drier and the country more exposed to winds; and the multiplication of pests and diseases. These matters are carefully watched and dealt with by the Department of Agriculture and by the Gold Coast Agricultural and Commercial Society.

Other Producing Areas.—Nigeria presents conditions which make possible a production equal to that of the Gold Coast; 37,192 tons were exported in 1924. Other important producing countries, and their approximate production in 1924, are: Brazil, 70,000 tons; Ecuador and Trinidad, 30,000 tons each; Santo Domingo and Venezuela, 25,000 tons each; and San Thomé, 20,000 tons. The bulk of high grade beans, to which the flavour and richness of good cocoa and chocolate are due, comes from Trinidad, Venezuela, Grenada and St. Lucia; and these, with the small quantity from Ceylon, of the plantation variety, fetch the highest prices on the London market. The entire crop of Java beans, which are comparable with those from Ceylon in quality, is shipped to Amsterdam and is sold there by auction six or seven times a year.

During the World War, Hamburg lost its position as the largest cocoa market: most of the Gold Coast crop was landed at Liverpool and London, which handled more cocoa than Hamburg during the post-War period. London has a public auction, the prices at which cocoa changes hands being wired all over the world and forming the basis of negotiation. In 1918, prices at which the various kinds of raw cocoa should be sold in Great Britain were fixed, Accra being quoted at 65s. per cwt. and Ceylon Plantation, Java and Samoan at 100 shillings. In 1919, when control was abolished, the price rose rapidly, and by Feb. 1920 Ceylon was 200s., with that of other sorts in proportion; but by 1921 the price had fallen to the normal level of 80 shillings.

(C. L. T. B.)

CODY, WILLIAM FREDERICK (1846–1917), American scout and showman known throughout the world as "Buffalo Bill" (*see* 6.637), died in Denver, Colo., Jan. 10 1917. He was buried in a tomb which was blasted from solid rock on Lookout Mountain, 20 m. from Denver.

CO-EDUCATION (*see* 6.637).—Co-education as an administrative procedure of assembling the two sexes in the same educational institution for purposes of instruction under like auspices has made steady progress since 1910. This has been due to a number of causes. Women have taken an ever-increasing share in commercial and industrial activities and as a result have demanded and secured opportunities for training that fits them for these activities. Economic pressure has operated to consolidate the educational activities of communities, especially where communities are small.

It was undoubtedly the frontier conditions in the middle and western sections of the United States which led to the widespread establishment in these regions of co-educational schools. Like economic limitations are leading to the establishment of co-educational schools in the countries of Europe where segregation was common in the past. Further, there is appearing everywhere in the world, especially in the Occident, a disposition to accept social equality between the sexes. This has broken down the barriers in schools as well as in other institutions. Social freedom was greatly promoted by the World War, during and after which women took over many forms of industrial and professional service which earlier had been monopolised by men. The social consequences of this radical change are obvious.

Internal Separation.—While administrative co-education has been steadily increasing in Europe and the United States, a tendency has appeared toward separation of the sexes within co-educational institutions. Women and girls, having secured the right to enjoy educational opportunities equal to those offered to men and boys, are now beginning to specialise more than ever before and are found in increasing numbers in classes where they are pursuing courses regarded by them as appropriate to their sex, even though these courses are administratively conducted by an institution that provides instruction also for men and boys. Co-education being administratively established, differentiation in electives is producing a new type of segregation.

Statistics.—The high school of the United States is very generally committed to the policy of co-education. The extent to which the high schools of the United States are co-educational is shown by the fact that in 1910 there were only 34 public high schools exclusively for boys and 26 for girls. The corresponding figures for 1920 and 1922 are 39 and 37 special schools for boys, 37 and 42 for girls. The situation with regard to private high schools is somewhat different as the following figures show:

Number of Private High Schools of Various Types in the United States at Different Periods

	1924	1920	1910
For boys only	403	385	348
For girls only	739	728	511
Co-educational	982	980	922

When both private and public schools are considered, it is evident that the secondary schools of the United States are in the main co-educational.

The aggregate attendance of girls is greater than that of boys in both groups of schools according to the latest statistics.

	Public High Schools			Private High Schools		
	1922	1920	1910	1922	1920	1910
Boys .	1,033,739	822,967	398,525	100,116	84,222	55,474
Girls .	1,195,668	1,034,188	516,536	116,406	99,931	61,926

Girls in general have somewhat greater leisure and consequently a larger opportunity to secure a high-school education than boys have.

Subjects Chosen.—The two sexes do not take advantage in equal degree of the various elective opportunities offered to them. The process of distribution of the pupils of the two sexes is taking place along lines which comport with their social and occupational interests. That this is a progressive tendency is shown by such facts as that in 1910, 3·78% of the pupils in high school elected home economics, while in 1922, 14·29% registered in this subject. During the academic year 1921–2 the registration in certain selected subjects was as follows:—

	Boys	Girls
Home Economics	2,572	304,982
Biology	88,955	100,333
Agriculture	75,859	35,383
Physics	112,747	79,633
Algebra	444,499	421,016
Trigonometry	27,733	8,197

Institutional Variation of Choice.—The fact that separation of the sexes is going on along lines of special interests is further shown by an examination of the registrations in different types of institutions. The normal schools and teachers' colleges of the country are professional schools devoted chiefly to the preparation of teachers for elementary schools. The student body in these schools is very largely made up of women, although men are admitted. The facts are as follows:—

Registration in Normal Courses in American Normal Schools and Teachers' Colleges at Various Periods

	1921–22	1919–20	1914–15	1909–10
Men	32,694	19,110	19,978	19,746
Women . . .	161,840	116,325	80,347	68,815

There is a very marked departure here from complete co-education in the administrative sense. Corresponding figures from the other professional schools show a preponderance of men. In schools of law, medicine and engineering, women constitute but 2 to 5% of the total registration.

The separation of the sexes by subjects of instruction rather than by institutions is a natural consummation of the movement for complete equality of educational opportunity. In the United States the vigorous discussions of the wisdom of co-education which were carried on during the first five years of this century closed the theoretical argument. After those discussions it was conceded that women shall have an education equal to that offered to men and the right to choose their subjects. The latter right to natural election is now being exercised in increasing measure with the results noted.

General Conditions.—So far as the rest of the world is concerned, women have been conceded the right to attend universities in all European and colonial countries and they have taken advantage of this right on a large scale. Co-education in the elementary schools has been common in small communities in all countries. It has also been practised in an increasing measure in larger communities in the northern countries of Europe and in Australia and South Africa. It has been, and is still, avoided in France, Italy, Spain and South America wherever communities are large enough to support separate schools.

In the secondary schools of countries other than the United States, co-education is less common than in the elementary schools and the universities. The history of secondary education in Europe and in countries which have borrowed their educational systems from Europe, inhibits the adoption of a policy of co-education. Girls did not enjoy opportunities of secondary education in former generations except as this was administered in the strict privacy of the home. Even now, when the right of higher education is generally conceded, there is reluctance to disturb the traditions of the secondary schools which were established for boys. The conservatism of tradition shows some signs of weakening. In the new republics of Europe co-education in secondary schools is commonly practised. In newer countries on other continents it is not uncommon.

The Orient.—The statements made above do not apply to the Orient. The oriental attitude on the matter of the social and economic status of women is in general too fixed to be overcome even when the examples of America and Europe are fully understood. Mission schools and native schools in oriental countries maintain in general a strict separation of the sexes, except in a few of the lowest primary schools. Furthermore, the extent to which girls receive any education is very limited.

Separate Institutions.—The discussion of co-education would not be complete without explicit reference to the fact that, along with the general tendency to organise public education on a co-educational basis, there is still a disposition in some quarters to favour separate institutions for the two sexes. The presence of such a disposition is seen in the large registrations in the women's colleges and in the relatively few surviving men's colleges in the United States. The older foundations in England allow women to attend lecture courses given by men and primarily organised for men. These survivals of an earlier type of educational separation are usually favoured by those communities and social classes which are beyond the reach of the economic motives which dictate the consolidation of educational opportunities. As long as the two sexes are to participate in equal degree in the advantages of education, it is much more economical and probably more efficient to conduct all instruction under the same auspices. Social traditions of exclusive rearing, as well as favourable economic conditions, are to some extent recognisable in those institutions where separate education is still practised. On the whole, however, the tendency in Europe, and to a greater extent in America, is increasingly to disregard social traditions and to establish a single system of institutions for the two sexes, allowing such separation as is to take place to appear within the institutions. (C. H. J.)

COFFEE (*see* 6.646).—During the post-War period, Brazil and British East Africa commanded most attention as coffee-producing countries: Brazil because of her control policy and its effects in the United States, and British East Africa because of the rapid growth of coffee planting in that area.

Brazil.—The importance of Brazil in coffee production is shown by her production in 1924–5, which was about two-thirds of the world's supply. In that crop year over 5,000,000 ac. were planted with coffee; 13,721,000 bags of 130 lb. net were produced and 13,682,000 bags exported. All other countries produced 6,762,000 bags and exported 6,824,000 bags. The protection of the crop is under the control of the São Paulo institute for the permanent defence of coffee, the Federal Govt. having relinquished in its favour all rights conferred by law.

The law of the State of São Paulo provides that the chairman and the vice-chairman of this body shall be its ministers of Finance and of Agriculture respectively, the three remaining members of the governing body being elected by the two associations of planters and the commercial association of Santos, subject to the approval of the president of the State. The powers of the institute include the regulation of the amount of coffee to be retained in the official warehouses through which all coffee produced in the interior must pass; 10 of these had been erected throughout the coffee-growing districts of São Paulo and one in the State of Rio, their total capacity being 11,500,000 bags per annum. Other powers of the institute extend to the amount of coffee to be exported, the making of agreements with other producing countries for the protection of coffee, the concluding of financial arrangements, the levying of an export tax on coffee, and the establishment of an agricultural loan bank. To obtain funds for the institute £4,000,000 of 7½% bonds were issued in London and £1,000,000 in Holland and Switzerland in Jan. 1926. Interest on this capital is to be raised by a transport tax of one gold milreis (2s. 3d.) levied on each bag of coffee grown in and transported through the State of São Paulo.

The effects of the "permanent defence of coffee" in the United States, Brazil's greatest customer, were higher prices and reduced consumption. In June and July 1925, a mission from the United States, consisting of three representatives of the trade in coffee, visited the institute and the producing centres in Brazil. After conference, the following measures were agreed: the daily regulated entry into Santos of coffee for export in accordance with the crops and the needs of consumption; the maintenance of a stock in Santos of never less than 1,200,000 bags, to facilitate the buyers finding the qualities required; the constant attendance of American buyers on the Santos market; full publication of statistics and of data relative to crops, stocks, etc.; and the resumption of coffee-propaganda in the United States. It was also arranged that similar conferences should be held in 1926 and annually thereafter. (*See* BRAZIL.)

Colombia.—Next in importance to Brazil as a coffee-growing country, Colombia showed signs of following her example. A law providing for the establishment of coffee bonded warehouses and the official classification of coffee, with the issue of negotiable bonds, was passed, but the declared policy of the Government was to help the industry without interfering with prices.

East Africa.—Coffee growing under British auspices in Kenya Colony and Protectorate has rapidly developed. In 1920 there were 27,813 ac. under coffee; on June 30 1924 there were 60,054 ac. an increase of 7,805 ac. over 1923. The production in 1923–4 was 144,952 cwt. The exports from Mombasa in the same year were 186,081 cwt. valued at £636,744. The colony also had 27,883 ac. planted with trees less than three years old, which had not come into full bearing. On the London market Nairobi and Uganda coffees now appear as Kenya.

The annual British consumption of coffee remained stationary at 7 lb. per capita. British taste in coffee is satisfied largely with the produce of the Central American Republic of Costa Rica; the demand for the produce of Kenya Colony is increasing. In Sept. 1915 the import duty on raw coffee was increased from 14s. to 21s. per cwt. and again to 42s. in 1916. On Sept. 1 1919 the duties became 42s. on foreign grown, and 35s. on that from British possessions. Later changes were: in 1922, 28s. and 23s. 4d.; and in 1924, 14s. and 11s. 8d. Annual consumption in the United States rose from 11 lb. *per capita* before the War to 12·4 lb. in 1923: in 1925 it had fallen to 11·09 lb. About two thirds of the imports in 1925 came from Brazil and the greater part of the remainder from Colombia.

The following table shows the exports of coffee from the principal producing countries from July 1 1924 to June 30 1925:—

	Lb.
Brazil	1,778,660,000
Colombia	273,984,139
Dutch East Indies[1]	145,850,108
Venezuela[2]	102,366,000
Salvador	72,007,584
Haiti	67,687,620
British India	32,280,640
Costa Rica	31,617,040
Nicaragua	21,729,185
Kenya Colony	20,841,072
British West Indies	12,973,389
Guatemala	7,275,247

[1] 1925 estimated.

[2] 1923–4.

(C. L. T. B.)

COHAN, GEORGE MICHAEL (1878–   ), American actor, author and producer, was born at Providence, R.I., July 4 1878. His parents were of the theatrical profession, and at an early age he appeared with them in juvenile parts, subsequently taking comedy rôles in vaudeville and on the legitimate stage. His first appearance in New York was at Keith's Union Square Theatre in 1893. Since that date he has been continuously engaged in writing and producing plays and musical revues, in the majority of which he also acted. Among his productions may be mentioned *The Governor's Son* (1901); *Forty-five Minutes from Broadway* (1905); *The Talk of New York* (1907); *Get-Rich-Quick Wallingford* (1910); *Broadway Jones* (1912); *Seven Keys to Baldpate* (1913); *Musical revues* in 1914, 1915 and 1916; *The Tavern* (1920); *The Song and Dance Man* (1923); *American Born* (1924). In addition he wrote numerous musical numbers and songs, one of which, *Over there*, acquired an international vogue during the World War. He wrote also an autobiography, *Twenty Years on Broadway* (1924).

COHN, GUSTAV (1840–1918), German economist (*see* 6.652), died at Göttingen Sept. 20 1918.

COINAGE.—The World War of 1914–8 placed an unprecedented strain upon the monetary system of both the belligerent and neutral nations. How the various systems endured the strain is discussed fully in the article on CURRENCY; the following article deals with one aspect of the problem, namely, the question of coinage and the provision of small change in the various countries concerned.

Great Britain.—The sudden change of circumstances produced less confusion in Great Britain than in any other country involved. To provide for the quick production of small change, before the Mint could get to work on a large scale with the coinage of silver, postal orders were made legal tender for all amounts during the early months of the War. But by the beginning of 1915 the subsidiary currency was being coined freely, and the circulating power of the postal order was abolished. The Treasury Notes issued in 1914 did not at first supersede the use of gold. The Royal Mint coined £15,000,000 worth of sovereigns and half-sovereigns in 1914 and over £21,000,000 in

1915. It was not till 1916 that the public was asked to pay in gold to the banks, while the banks were prohibited from paying it over the counter to those who demanded it. In 1916 and 1917, only something over £1,000,000 of gold money was struck in each year, and this was ear-marked for regions such as Arabia, where subsidies to the rulers of the Hejaz and Nejd continued to be paid in gold. Stringent legislation was framed against those who tried to take gold money out of the realm, or offered to pay a larger sum than £1 in Treasury Notes for the sovereign.

Meanwhile the issue of silver money for small transactions was portentous and unprecedented. The Mint in the years immediately preceding the War had been putting out silver to the net value of under £1,000,000 on the average. But in 1914 over £5,000,000 in silver was minted in the last six months, after the declaration of war, and in 1916, 1917 and 1918 over £7,000,000 in each twelve-month. By the end of the War there was twice as much British silver circulating within and without the realm as there had been in 1913. Silver bullion for a few months in 1920 rose to the unprecedented price of 82 pence an ounce, a figure which so terrified the then Chancellor of the Exchequer, Mr. Austen Chamberlain, that he insisted on the passing of a measure which introduced 50% of base alloy into the silver currency. The bill was wholly unnecessary, as silver fell to 40 pence per ounce before the end of 1920, and to 32 or 33 pence by 1921, so that coinage on the old scale of alloy could have been continued at a good profit. The new base money was so unskilfully compounded that its first issue turned brown or green after a little wear, or even came to pieces from inadequate mixing of the good and bad metal.

Germany.—At the outbreak of the War the Imperial Govt. did not have to improvise everything as the British Govt. was bound to do. It had collected much treasure by means of the forced loan of 1913, and it had ready for war emergency the long-hoarded military chest stored in the castle of Spandau, where a large proportion of the gold paid in the French War indemnity of 1871 had been kept intact for more than 40 years. This was used freely in the autumn of 1914 for German purchases abroad. But gold money, despite all preparation, disappeared more quickly in Germany than in Great Britain, and from the first days of the War the internal currency was paper. Silver, which never failed the British public, disappeared in Germany at an early date in the struggle. By 1915 of the old currency only the minute copper 1- and 2-pfennig pieces remained in circulation, and these too disappeared later.

To replace the nickel 5-, 10- and 20-pfennig pieces, withdrawn for military purposes, the German Govt. issued from 1916 onward immense quantities of iron and zinc coins, reproducing the old types: but both these metals proved unsatisfactory substitutes, being prone to rust and decay. The government issues proving insufficient for trade necessities, many municipalities and *Kreises* followed the Imperial lead and produced in 1917 and 1918 not only paper money but zinc and iron 10-pfennig, 5-pfennig and occasionally 20-pfennig pieces. They generally bore the town coat-of-arms or badge on the obverse, and a large figure of value on the reverse. It was apparently only after the Armistice of Nov. 1918 that a few towns put out small change of more unusual material—porcelain in some cases, wood in others. But these were very exceptional freaks.

The year 1922 found republican Germany issuing metallic subsidiary coins from its mint, but now made of aluminium and bearing on one side the accepted republican eagle, on the other a strongly conventionalised sheaf of grain. Coins of 1, 2 and 5 marks denomination were added by the end of the year. The same year saw some transitory private issues of banknotes printed on aluminium foil. With the introduction of the Rentenmark standard in 1924–5 came an issue of more durable subsidiary coins of that standard and by the close of 1925 the coinage of silver 1-mark pieces had been resumed.

France and Belgium.—The history of the French War coinage presents many similarities to that of the German, but the chaos at the beginning of hostilities was rather worse. All gold disappeared at once into the proverbial "stocking" of the thrifty peasant or bourgeois, and much silver also. But for some little time there was an endeavour to keep up a silver currency: the dies and presses of the Paris mint were moved in Aug. to the remote town of Castelsarrasin, close under the Pyrenees, and there remained to the end of the War, striking in 1914 5-franc and 2-franc pieces. They are only to be distinguished from Paris-struck money by a small capital "C" under the value on the reverse. As the French exchange grew worse, there was a steady migration of silver 5-franc pieces to Switzerland. As they were, and had been for many years, legal tender in Switzerland, the Berne Govt. had scruples about demonetising them, and they were only denied currency after the War had ended, when a vast quantity of them were recoined into Swiss 5-franc pieces.

Since the French Govt. had made no preparation to face a dearth of small change, its provision fell, far more than in Germany, into non-governmental hands. At first the situation was quite chaotic; not only municipalities but chambers of commerce, associations of merchants and shopkeepers, companies of all sorts, private firms and even individuals not engaged in trade, put out paper or metallic token-money of the most varied shapes, sizes and materials. The most characteristic pieces of the time were the *carton* (cardboard) sou and two-sou tokens. They were simply pieces of thick cardboard printed on both sides, generally with the name of the issuing town, firm or person on one side, and the value in large figures on the other. They were of all sizes and shapes and all degrees of thickness. Some, on very thin cardboard, were provided with a metal rim, to prevent them from creasing or breaking. Others were made inordinately thick for the same purpose. A very few municipalities, particularly in the south of France, tried countermarking old or foreign copper coins with a superimposed stamp, the name of the town and the value, 5 or 10 centimes, obliterating the original type.

From 1915 onward local metallic currency began to appear, superseding in most places the fragile and rubbishy cardboard. These sou, two-sou and 25-centime pieces were generally of aluminium or zinc, occasionally of iron or copper. They were in many cases very neatly struck, with simple heraldic types. Metallic tokens were issued not only by chambers of commerce and large industrial firms, but by tramway companies, electricity supply companies, military and civil clubs, the *Union des cafêtiers* of Toulouse, the bakers of Nantes in syndicate and thousands of private shopkeepers. Late in the War this maddening situation led to the creation of both paper money and aluminium small change for federated towns or districts of the same region. For example, the chambers of commerce of Marseilles, Nice, Avignon, Arles and Toulon, issued zinc sous and 10-centime pieces which passed current in all five places.

In northern France and Belgium the invader, after seizing all the legitimate currency on which he could lay hands, organised a new circulating medium. The Belgian fractional currency, all nickel, was requisitioned for military purposes. To replace it the intrusive administration at Brussels coined zinc 5-, 10- and 20-centime pieces in great profusion. They imitated in general appearance the old national small change, having the lion and the large figure of value, but the inscription *Royaume de Belgique* and the king's monogram were suppressed, and the bilingual inscription was only BELGIQUE-BELGIE. In northern France there was no such metallic substitute for the small change, and the result was the issue of very small-denomination paper money, either in cardboard or in note form on ordinary paper. The round or polygonal cardboard sou, so common all over uninvaded France, was rare in the region of German occupation, though it existed in the cities of Lille and Ghent. The town of Ghent seems to have been unique in issuing a metallic currency of coins of considerable denomination. It put out a handsome gilt-bronze 5-franc piece, with subsidiary 2-franc, 1-franc and 50-centime pieces, in the same metal but of a square form.

Other Countries.—On the other side of Europe, in the enormous belt of Polish and Lithuanian territory which the Germans overran in 1915–6, a zinc fractional currency in kopeks was issued for small transactions. The Austrian War currency was in most respects a mere reflection of the German. There was a comparatively small amount of metallic (zinc or iron) fractional currency, and one or two examples of strikings in a sort of amalgam or earthenware material. Issues by private firms or individuals also existed, but not in such profusion as in France. Czechoslovakia issued a handsome nickel crown in 1922.

In Italy gold had been almost unknown before the War, though silver was circulating: the bulk of the fractional currency was in bronze, which did not disappear so quickly as the nickel pieces of Germany, Belgium or Austria. But the *ventino* or 20 centesimi piece of nickel, vanished for military reasons. Despite the continued existence of the bronze soldo, there was an acute lack of small change, for which *experto crede* such odd substitutes as postage stamps, cigarettes and tramway tickets were substituted. Even government packets of matches were sometimes given as change to the spender of a lira note.

In Russia, a country already using paper for all purposes during the first year of the War, the only currency problem which seems to have caused some trouble was the deficiency of small fractional change, which was in some degree met by issuing cardboard money, composed of the dies of postage stamps struck off on very thick paper. The stamps of 1, 2 and 3 kopeks replaced copper coins; those of 10, 15 and 20 kopeks had printed on their backs a notice that they were equivalent to, and were to be taken for, government fractional silver coins. In 1925 the victorious Soviet, throwing over the problem of how to deal with incalculable masses of worthless paper, started striking silver coins equivalent to a rouble, and even gold money, of the so-called *chervonetz* type.

European neutrals were somewhat affected in their currency by the nickel-famine, caused by military demands, which prevailed among all combatant powers. Finding their own small change surreptitiously departing to the seat of war, Denmark, Norway and Sweden all issued iron pieces of 1, 2 and 5 öre, and Switzerland brass 5- and 10-centime pieces. These last had all disappeared by the end of 1925, and the familiar and handsome Swiss nickel currency was once more employed. (C. W. C. O.)

COKE: *see* FUEL PROBLEMS.

COLAJANNI, NAPOLEONE (1847–1921), Italian author and politician, was born at Castrogiovanni (Sicily) April 28 1847. In his youth he followed Garibaldi, and was once deported and once imprisoned for his republican activities. After graduating in medicine, he studied social science, and in 1892 was appointed professor of statistics first at the University of Palermo, and subsequently at Naples. He published many books and essays on social and political problems. For many years he edited *Rivista popolare*, by means of which he strove to improve the moral and intellectual standard of the masses and combat all forms of intolerance and hypocrisy. He began his public career as a municipal councillor in his native town in 1872, and in 1890 was elected deputy for the same place. In Parliament he sat as a Republican with Socialist tendencies. He was a strong opponent of Crispi's somewhat autocratic policy (*see* 15.79). Though he had always opposed militarism, on the outbreak of the World War he became a warm supporter of Italian intervention. After the Armistice he conducted a campaign against the bolshevism of the Socialist party. He died at Castrogiovanni Sept. 2 1921.

COLBY, BAINBRIDGE (1869–), American politician, was born at St. Louis Dec. 22 1869. After graduating from Williams College in 1890, he studied at the Columbia Law School and the New York Law School and began to practice in 1892 in New York. He was a member of the New York Assembly, 1901–2. He supported Theodore Roosevelt for the Republican presidential nomination in 1912. Following the split in the Republican party he became one of the founders of the National Progressive party. He was a member of the American Mission to the Inter-Allied Conference at Paris in 1917, a commissioner of the United States Shipping Board, and a member of the United States Shipping Board Emergency Fleet Corp., 1917–9. He was Secretary of State in President Wilson's Cabinet March 22 1920–March 4 1921. On leaving office he resumed private practice.

COLBY, FRANK MOORE (1865–1925), American editor, was born at Washington, D.C., Feb. 10 1865. He was educated at Columbian University, Washington, and Columbia University, N.Y. (receiving a degree of A.B. in 1888 and of A.M. in 1889). He was acting professor of history at Amherst College (1890), instructor in history and economics at Columbia University (1891), and professor of economics at New York University (1895–1900). In 1893 he joined the editorial staff of *Johnson's Universal Cyclopaedia.* In 1895 he became editor of *The International Cyclopaedia* and *The International Year Book*, and from 1900 he was editor of *The New International Encyclopaedia.* He was also editor of *The Bookman*, 1904–8. He died in New York City March 3 1925. He wrote, among other works, *Imaginary Obligations* (1904); *Constrained Attitudes* (1910); and *The Margin of Hesitation* (1922).

COLD STORAGE: *see* REFRIGERATION.

COLLINGS, JESSE (1831–1920), British politician, was born at Littleham, Exmouth, Devon, Jan. 9 1831. He was educated at home and at Church House School, Stoke, near Plymouth. In 1866 he settled in Birmingham, where he founded the mercantile firm of Collings and Wallis, and had a highly successful business career. Entering municipal life, he was intimately associated with Joseph Chamberlain, and in 1878 was elected mayor of Birmingham but retired from business in 1879. In 1880 he entered Parliament as Liberal member for Ipswich, and became prominent as an advocate of the Radical land policy, associated with the phrase, "three acres and a cow." In 1886 he became Parliamentary Secretary to the Local Govt. Board, but resigned with Chamberlain over Gladstone's Home Rule policy. In 1895 Collings became under-secretary to the Home Office, retaining the post till 1902. He resigned his seat in Parliament in 1918. He was the founder (1872) of the Rural Labourers' League, and also of the Exminster Industrial school. In 1906 he published *Land Reform;* in 1914, *The Colonisation of Rural Britain* (2 vol.); and his *Autobiography*, written in conjunction with Sir J. L. Green, appeared in 1920. He died at Edgbaston, Birmingham, Nov. 20 1920.

COLLINS, MICHAEL (1890–1922), Irish politician, was born near Clonakilty in County Cork, the eighth child of John Collins, a prosperous farmer who, as an old bachelor of 62, married Kate O'Brien, his junior by 40 years. Michael Collins entered the second division of the British Civil Service and went to London as a junior postal clerk in 1907. After two years he left the Civil Service to be clerk in an accountant's office. His life in London was spent mostly among Irish people interested in the Gaelic League and in distinctively Irish sports—such as hurling. During this period he joined the Irish Republican Brotherhood, or Fenian Society.

At the beginning of 1916 Collins and several other young Irishmen of similar views, being opposed to conscription, returned to Ireland and took a hand in the rising which by that time was expected in extremist circles. He joined the Irish Volunteers in Dublin and was one of those who fought under Pearse in the General Post Office during Easter week. He escaped being taken under arms, but later was arrested and sent with the great body of suspects to the detention camp at Frongoch. Released with the rest in July 1917, he became conspicuous in the movement by his energy, and at the general election in Dec. 1918 he was returned as Sinn Fein member for County Cork. Out of 73 elected only 29 were present when they met in the Mansion House and declared for the Irish Republic. Mr. de Valera, their elected president, was in gaol, so was the vice-president, Arthur Griffith. All effective decisions were taken by the men who were clever enough to avoid arrest. These were Collins, Cathal Brugha and the headquarter staff of the Irish Volunteers. In actual practice Collins was dictator.

Brugha (Charles Burgess), as Minister of Defence in Mr. de Valera's Republican Ministry, was head of the Irish Volunteers, known later as the I.R.A. (Irish Republican Army). In this military organisation Collins was head of the Intelligence Department. But, in the administration as a whole, he was Minister of Finance. In this dual capacity Collins controlled the entire correspondence of the movement. All enterprises were considered, financed and many were carried out by him. In March

1919 he and Harry Boland arranged the escape of Mr. de Valera from Lincoln gaol; and it is claimed that he directed the campaign waged at this time against the more active members of the Dublin secret service police. How far he was responsible for the spread of the guerilla war cannot now be ascertained. Dan Breen in *My Fight for Irish Freedom* traces its beginning to the spontaneous action of a small group of volunteers in Tipperary, which was disapproved of at first by the Dublin headquarters. Breen says, however, that Collins was the man from whom they received most encouragement; and that in one of the projected attacks on Lord French, Collins was among the men in ambush.

By 1920 his name, first gradually, and then universally, had become known as that of the man most wanted by the British authorities. A reward of £10,000 was offered for his arrest, and pictures of him were published. Yet letters addressed to him through Sinn Fein channels were promptly delivered and immediately answered. He used no disguise, went about Dublin alone on a bicycle and frequently made appointments for an interview in the public streets. He succeeded in completely demoralising and dislocating the British secret service and in creating a most effective spy system of his own which ran through the whole British administration.

At the close of 1920 important secret negotiations, conducted through the Australian Archbishop Clune, were held with Collins, who afterwards maintained that all the concessions obtained six months later could have been secured then but for the action of a county council which called for cessation of hostilities. This, he held, encouraged the British to insist on a surrender of arms, upon which demand the negotiations broke down.

In July 1921 when the truce with Britain was proclaimed, Collins for the first time became directly known to the Irish public. No other figure was so popular. When the negotiations between Mr. de Valera and Mr. Lloyd George failed to reach any conclusion, Griffith, Collins and three others were appointed to renew the attempt. Collins, by his genial personality, undoubtedly smoothed over many of the difficulties and though in principle a republican, he had the instinctive sense to know when the utmost possible had been gained. Griffith alone could not have forced the Dail to accept the treaty against Mr. de Valera's opposition; this achievement was mainly due to the magnetic personality of the younger man.

When the result of the voting showed the narrow margin of seven for acceptance, Collins instantly rose and gravely warned the assembly of the anarchy that might follow dissension. He proposed a joint committee of public order, but the proposal was rejected. In the debate he had declared that he accepted the treaty as a stepping stone to a republic but he was careful both in his speech and his published volume, *The Path to Freedom*, to disavow any desire to force a separation which would injure Britain or leave her exposed. In his opinion, the Dominions were destined to detach themselves naturally and without a wrench, like ripened fruit.

The first result of the Dail's decision was confusion. Griffith was elected president, not of the Free State but of the Irish Republic. He met the situation by appointing a provisional government to carry on the administration till the Free State was legally created; and Collins was appointed chairman of this body. But administration in the ordinary sense was impossible. Civil life had been destroyed in the guerilla war; the police were now necessarily disbanded since the struggle had left a blood feud between them and the people; the British garrison was evacuating the country, and the Irish Army, still considered the Army of the Republic, was deeply disaffected.

Collins had two main objects. The first was to reach a settlement with Ulster, where a state bordering on a war of religion existed. To succeed in this would have helped him with his main purpose, the peaceful establishment of the Free State. He therefore entered into personal negotiations with Sir James Craig, Prime Minister of Northern Ireland. But no settlement was reached, largely because of the evident imminence of civil war in the South. Mutiny broke out in the army and Collins, hoping against hope to avoid civil strife, refrained from drastic action. He was instrumental in postponing the general election (stipulated for under the treaty) and when at last a date for it was fixed in June, he entered at the eleventh hour into a compact with Mr. de Valera by which he and the Republican leader agreed to appeal for the unopposed return of candidates jointly nominated by them. This would have given a very large representation to opponents of the treaty. But when independent candidates were put forward, Collins at the last moment advised his countrymen to vote as they wished. This he knew would mean the acceptance of the treaty. At the elections the republicans were heavily beaten and the Irish Govt., challenged by force even in the capital, decided to use force in return.

Civil war began; and Collins, assuming chief command, flung himself into the struggle with all his energy. Opposition was crushed in Dublin and all the large towns. Suddenly, on Aug. 12, Griffith fell dead and Collins became at once head of the state and of the army. The newly enrolled forces needed impetus and he went down to give it to them by his presence in Munster where the chief resistance lay. On Aug. 22 1922, motoring with a strong escort from Skibbereen to Cork, his party was ambushed, and in the skirmish he was shot through the head. No man since Parnell had so caught the imagination of Ireland. Perhaps the moment of his death was fortunate, for he died when victory was more apparent than real, and he was spared the task of executing those who had been his comrades. But his work stands, and he emerges from the struggle with a reputation less tarnished than some of his contemporaries. (S. G.)

COLLOIDS (*see* Dialysis 8.157).—In the course of investigations (1861–4) on the diffusion of substances in solution, T. Graham, professor of chemistry in University College, London, and Master of the Mint, found that certain substances, *e.g.*, sugar and common salt when in solution, can pass through or diffuse through a membrane of parchment paper, whereas other substances, *e.g.*, starch and gelatin, cannot do so. Since the substances which could pass through the membrane were such as generally crystallise well, whereas those which did not pass through were, as it was thought, non-crystallisable and of a gelatinous nature, Graham divided substances into crystalloids and colloids (from the Greek κόλλα, glue).

Although this distinction was for long maintained, more recent investigation has shown that Graham's classification is unsuitable; and the terms crystalloid and colloid are now no longer employed to connote different kinds of substances but only different states or degrees of sub-division of matter. In a solution of cane sugar, for example, molecules of sugar are distributed homogeneously throughout the solution, or, as it is said, the sugar is molecularly dispersed. In the case of gelatin and other so-called colloids, the substance does not exist in the molecular but in a coarser state of aggregation. The particles, however, are too small to be seen by the ordinary methods of microscopic examination. In short, the term "colloid" or "colloidal state" is now used to connote a state or range of sub-division of matter lying between the limits of the microscopically visible and the molecular states. These limits may be taken as, approximately, one ten-thousandth of a millimetre ($0{\cdot}1\ \mu$) and one-millionth of a millimetre ($1\ \mu\mu$).

Although Graham's classification of substances into crystalloids and colloids was imperfect, the process of dialysis which he introduced gave a means, still universally employed, of distinguishing between molecularly dispersed matter and matter in the colloidal state. By a refinement of the process, it is possible, using collodion membranes of varying permeability, to separate colloids of different degrees of dispersity.

General Properties.—Since the peculiar and characteristic properties of the colloidal state do not depend on the physical state of the finely sub-divided matter or of the medium in which the matter is dispersed, colloidal properties are exhibited both by colloidal suspensions and emulsions (solid particles and liquid droplets dispersed in a liquid medium), and by smokes and mists (solid particles and liquid droplets in a gaseous medium), foams (gas bubbles in a liquid dispersion medium), and so on.

Whilst it could be inferred from the experiments of Graham that the colloidal systems, although apparently homogeneous like a solution of sugar, are nevertheless heterogeneous or contain particles which have a magnitude greater than molecular, the actual existence of such particles is rendered evident by the scattering of light which they bring about (the so-called Tyndall effect). The introduction of the ultramicroscope by Siedentopff and Zsigmondy enables the eye to detect the presence of particles of a magnitude of about six millionths of a millimetre, about sixty times the dimensions of a hydrogen molecule.

Dispersion of Light.—In the scattering of light by finely divided particles, the light of shorter wave length is scattered most, and the light which reaches the eye is therefore blue or bluish in colour. Consequently, a system containing colloidally dispersed particles, when illuminated from the side and viewed against a dark background, will appear blue. As Leonardo da Vinci suggested long ago, we can, in this way, explain the blueness of the sky as due to the scattering of the sunlight by finely dispersed particles in the atmosphere; or, as is now thought, by the molecules of the atmospheric gases themselves, the background being the blackness of infinite space. The blue colour of the eye and the colour of many feathers also find their explanation in the scattering of light by finely dispersed matter.

Surface Changes and Adsorption.—Since the colloidal state is a state of very fine sub-division, the extent of surface exposed is very large relatively to the total volume of the matter. Surface forces, consequently, play a predominant part and bring about changes in the distribution or concentration of matter at the surface of the particles. This change of concentration at a surface, brought about by surface forces, is spoken of as *adsorption*, a phenomenon readily observed in the decolourisation of liquids and the removal of noxious or obnoxious gases by the very porous, and therefore surface-active, material, charcoal.

In the production and characterisation of colloidal systems, adsorption plays a part of the highest importance. By the adsorption of ions from the dispersion medium or from electrolytes present in solution, the colloid particles acquire an electric charge. Adsorption of the dispersion medium as a whole may also take place to a greater or less extent, whereby variation in the general behaviour of colloids may be brought about. In the case of the so-called suspensoid or hydrophobe (or, generally, lyophobe) colloids, the dispersed particles may adsorb none or practically none of the dispersion medium; and they exist, therefore, in suspension as non-hydrated or non-solvated particles, the stability of which is due mainly to their electric charge and to their Brownian movement. In the case of the so-called emulsoid or hydrophile (lyophile) colloids, such as solutions of gelatin or of starch, adsorption of the dispersion medium itself takes place, and the stability and properties of such a colloidal solution (colloidal sol), are due to the adsorbed dispersion medium as well as to electric charge on the particles. The greater the extent to which the adsorption of the dispersion medium takes place, the more will the stability and properties of the colloid be dependent on the adsorbed medium and the less will they depend on the electric charge.

Electrolytes.—If the electric charge on a suspensoid colloid be neutralised, agglomeration of the particles followed by precipitation takes place, and this neutralisation of the electric charge can readily be effected by the addition of electrolytes. Negatively charged colloid particles will preferentially adsorb the positive ions of the added electrolyte, and positively charged colloids will preferentially adsorb the negative ions, the charge on the colloid being thereby neutralised. Although multivalent ions are, in general, more effective in producing precipitation than are univalent ions, recent investigation shows that there is no exact relationship between the valency of an ion and its precipitating power, and that the adsorbability of the ion may exercise an important influence.

Natural Electrolytes.—The precipitation of fine particles by electrolytes is well illustrated on a large scale in nature, the finely divided clay carried by many rivers being caused to deposit when the river water mingles with the sea. In this way the silting up of river mouths and the formation of deltas, as in the case of the Nile and of the Mississippi, are brought about.

The electrical charge on a colloid particle may also be neutralised by another colloid carrying an electric charge of opposite sign. Colloids of opposite sign may mutually precipitate each other and give rise to "adsorption complexes" which simulate chemical compounds. Purple of Cassius, for example, is an adsorption complex of stannic oxide and colloidal gold.

Action on Solutions.—In the case of solutions (or sols) of hydrophile (lyophile) colloids (*e.g.*, gelatin), the stability of the colloid is due mainly to adsorbed water or other dispersion medium, and consequently such solutions are not so sensitive to added electrolytes. Even though the addition of small amounts of an electrolyte may produce changes in the amount of water adsorbed by the colloid, actual precipitation does not take place until the concentration of added electrolyte is relatively large.

The relatively great insensitiveness to electrolytes which is shown by hydrophile colloids may be transferred to hydrophobe colloids or suspensoid colloids. When gelatin, for example, is added to a colloidal gold sol, the gold is adsorbed by the gelatin and a much greater concentration of electrolyte is required in order to precipitate the gold than is necessary in the absence of the gelatin. The gelatin is said to protect the gold, and this so-called protective action, which varies greatly in the case of different hydrophile colloids, is of much importance in many directions (*see* ELECTRO-METALLURGY).

Gelatin Types.—Many colloids of the hydrophile type exhibit, when cooled, the property of passing into a jelly by a coalescence of the hydrated colloid particles. The jelly so formed may be dried to a more or less hornlike material, such as ordinary dry gelatin. These jellies have the important property of taking up or imbibing water, even against very great pressures. The amount of water imbibed is greatly affected by the presence of electrolytes, being increased by acids and alkalies, up to a certain concentration; but the increased swelling produced by dilute acids is diminished by the addition of salts.

The properties of colloid matter play a part of the greatest importance not only in physical but also in biological science. In agriculture, the presence of colloids in the soil is of importance by their water-retaining power and by their power of adsorbing salts and plant foodstuffs and of retarding the washing away of these materials by rain.

Colloids in Industry.—Adsorption, also, plays an important part in the dyeing of textiles and the staining of animal tissues. The negatively charged colour ion of the acid dyes will be predominantly adsorbed by a positively charged fibre, and a positively charged dye (basic dye) will be predominantly adsorbed by a negatively charged fibre. After the dye has been adsorbed, secondary changes may take place, leading to the formation of a more stable adsorption complex (*see* DYEING).

By the use of "protective" colloids, sparingly soluble substances produced in chemical reactions can be kept in a colloidal state and so prevented from undergoing flocculation and sedimentation. In the production of the photographic plate, the silver bromide, formed by mixing silver nitrate with potassium bromide, is prevented by the gelatin from forming a precipitate of coarse particles unsuitable for photographic purposes, and is kept in a finely divided form. In normal bile, the bile salts, albuminoids, etc., act as protective colloids which keep the sparingly soluble substances, such as cholesterin and the calcium salt of bilirubin, in the colloidal state and so prevent their deposition; but when a reduction of the amount of protective colloids is brought about by pathological conditions, deposition of the sparingly soluble substances takes place in the form of gall-stones (*see* BIO-CHEMISTRY).

Colloids in Milk.—The nature of the curd which separates from milk and the readiness with which it is formed are greatly affected by the presence of protective colloids. In cow's milk there is a relatively large amount of casein and a relatively small amount of the protective colloid, lactalbumin. Cow's milk, therefore, readily curdles. In human milk there is a smaller proportion of casein and a larger proportion of lactalbumin; the casein is therefore more effectively protected and curdling takes place less readily. In asses' milk, the relative proportion of protective colloid is highest of all and curdling takes place with greatest difficulty. The digestibility of asses' milk is consequently greatest. By increasing the amount of protective colloid in cow's milk through the addition of gelatin or white of egg or of barley water (starch), curdling is caused to take place less readily and the digestibility of the milk is increased.

The living protoplasm (*see* CYTOLOGY) of the animal or vegetable cell, finally, is a complex system of colloids in which there occur processes of adsorption, changes of dispersity, alterations in the distribution of water between the colloidal particles and the dispersion medium, a system in which the mutual relations between the colloids are in a constant state of flux. Only in such a colloid system is it possible to have the flexibility and adaptability to the varying requirements of what we call life and growth. Moreover, the many diverse chemical reactions involved in breaking down complex foodstuffs into simpler substances and building up again these simpler compounds into the complex proteins of the protoplasm are accomplished in the living body under the catalytic activity of the enzymes, and these are themselves colloidal. The living organism, therefore, is a vast colloidal community, the diverse members of which are held together in common service by surface forces and by mutual actions and reactions of electrical charges. In this community the colloidal workers are engaged in carrying out the multifarious and complex chemical operations on which the life and the health of the community depend. (A. FY.)

COLLYER, ROBERT (1823–1912), American divine (*see* 6.694), died in New York City Nov. 30 1912.

COLMAN, SAMUEL (1832–1920), American landscape painter (*see* 6.695), died in New York City March 27 1920.

COLOGNE (Ger. KÖLN *see* 6.697), the third city of Germany, had a population in 1925 of 693,266, including Mülheim, Meiheim and Worringen (with a population of 84,000) incorporated in the city in 1914. Cologne is an important commercial centre and is the retail town for the industrial cities of the Rhineland and Westphalia. The first international Cologne fair was held in 1924. The city is now visited again by numbers of tourists. Cologne was one of the chief military centres of Germany during the World War, and was bombed in 1917 and 1918. The Allies occupied the city and a bridgehead of 18 sq. m. on the other bank of the Rhine under the terms of the Armistice. The Cologne zone was to be evacuated after five years if Germany fulfilled her obligations under the treaty. It was formally entered, in Dec. 1918, by Sir. H. Plumer's army, and formed the headquarters of the British army of occupation. The evacuation was postponed owing to the report of the Inter-Allied Commission of Control that Germany had not fulfilled her obligations with respect to disarmament, but it was finally evacuated on Jan. 30 1926. The great bell of the cathedral, weighing 27 tons, was melted down during the War, and a new one was dedicated in 1924 (*see* also RHINELAND).

COLOMBIA (*see* 6.700), a republic in South America and a member of the League of Nations. Its area is 462,024 sq. miles. At the census of 1918 the population was 5,855,490. In 1925 it was estimated to be 6,617,833, about half being whites or of mixed blood.

I. POLITICAL HISTORY

On Aug. 3 1909, Gen Ramón González Valencia was elected by Congress to serve as President for one year in place of Gen. Rafael Reyes. The latter's dictatorial rule had aroused popular indignation, and after two terms as President he left the country. González-Valencia found the country suffering from bad administration, and still feeling the disturbing effects of the civil war of 1899–1902, and the secession of Panama. On July 15 1910, Dr. Carlos E. Restrepo was inaugurated as President, after a formal election, and more stable conditions prevailed. The law of 1906 for the representation of minorities in Congress and other public bodies came into effect, and its application, even to the appointment of judges and other office-holders, led to the co-operation of all parties in the pacification and good government of the republic. The law of 1898, guaranteeing the liberty of the press, had been disregarded under the régime of Gen. Reyes, but after 1910 it was rigorously observed. The movement toward currency reform and financial stability was also begun, and further efforts were made toward a settlement of differences with Panama and the United States arising out of the secession of the former from Colombia and its constitution as an independent republic. Relations between the three countries had long been delicate. The visit of Gen. Reyes to Washington had proved futile, and the treaty negotiated in 1909 between Colombia's envoy, Enrique Cortés, and the U.S. Secretary of State, Elihu Root, did not prove acceptable to Colombia.

At the regular presidential election in Feb. 1914, Dr. José Vicente Concha, the Conservative candidate, was returned. He had the support of the Liberal party, and in the formation of his Cabinet he filled some of the offices with Liberals, thus inaugurating a coalition form of government and fulfilling the spirit of the minority representation law. During 1914 renewed efforts were made to adjust Colombia's differences with Panama and the United States, and on April 6 a treaty was signed by Thaddeus A. Thompson, U.S. Minister at Bogotá, and Francisco J. Urrutia, Colombian Minister of Foreign Relations. This treaty was ratified by Congress on June 9 1914, but did not obtain approval by the U. S. Senate till seven years later, nor come into final effect without prolonged negotiations. President Concha was installed in office on Aug. 7 1914. Apart from fiscal and diplomatic problems inherited from his predecessors, he had to face new difficulties created by the outbreak of the World War. The neutrality of the republic was proclaimed, and to ensure its observance Suárez, the Foreign Minister, addressed a circular letter to the newspaper editors throughout the country on Nov. 27, exhorting them to be strictly neutral in their comments on events. Colombia passed through the War period without any diplomatic difficulties arising.

The Panama Settlement.—In Feb. 1918 Marco Fidel Suárez was elected President, and took office on Aug. 7. On Nov. 3 1919 Congress authorised Colombia's adhesion to the League of Nations, but served notice that her acceptance of Article 10 of the Covenant did not imply her acknowledgment of Panama as an independent nation. Two delegates attended the Assembly of the League at Geneva in 1920. The old trouble arising from the secession of Panama again absorbed attention, and the terms of its settlement excited political feeling. The Thompson-Urrutia Treaty, as originally drafted, had been ratified by the Colombian Congress, but the U.S. Senate proposed several drastic modifications. One of these involved a pledge on the part of Colombia of her recognition of the independence of Panama. The privileges allowed to Colombia in the use of the Panama Canal were also somewhat reduced. The treaty stipulated that Panama should accept as her southern boundary the line sketched in a Colombian law of 1855. Of the indemnity of $25,000,000 for the loss of Panama it was further provided that $5,000,000 should be paid within six months of the treaty coming into force, and the balance in four annual instalments. Because of the factious opposition in the Colombian Congress to these modifications, President Suárez resigned his position on Nov. 11 1921 and was succeeded by Gen. Jorge Holguín. On Dec. 22 1921 the Colombian Congress ratified the modified Thompson-Urrutia Treaty, which had been adopted by the U.S. Senate in April, and two days later it was approved by President Holguín. On Feb. 12 1922 Gen. Pedro Nel Ospina, candidate of the Conservative party, was elected President, and was installed on Aug. 7 1922.

Questions of financial reform came under review early in the régime of Gen. Ospina, and at the invitation of the Government a commission, headed by Prof. Kemmerer of Princeton University, arrived in Colombia in March 1923, to undertake the task of introducing greater financial efficiency and establishing an effective gold standard. In May 1924, at the instance of the United States Govt., the envoys of Colombia and Panama in Washington signed an agreement which provided that each government should designate a Minister to the other contracting party and thus formally establish normal diplomatic relations between the two states. On Aug. 1 1924 Nicolás Victoria, the Minister of Panama, was received at Bogotá, and Colombia's representative to Panama was duly accredited. A mixed commission was appointed to survey the boundary between the two countries. In Feb. 1926 Dr. Miguel Abadia Mendez, Chancellor in the Cabinet of Gen. Ospina, was elected President for the term 1926–30.

Constitutional Changes.—In the period 1910–25 important modifications of the constitution of 1886 were made. A law of June 6 1910, provided that in case of vacancy in the presidency, two persons selected by Congress were temporarily to exercise the powers of the president in a designated order. It was also provided that no person could be re-elected for a second term as president. On Oct. 31 1910 another law made important constitutional amendments, among which was a provision that only male citizens who were able to read and write and either owned real estate or had an income, should be allowed to vote in congressional and presidental elections. The method of constituting the Senate was also altered by providing that its members should be chosen by the assemblies in the different departments into which the country is divided. The Supreme Court was empowered to determine whether or not a law should be enforced if the national Government, or a citizen, denounced it as unconstitutional: in the exercise of this power certain concessions, originally granted to Colombians and then transferred to foreign corporations, were held to have been unconstitutionally granted, and as the terms had not been fulfilled, were cancelled. During the administration of President Concha, Congress enacted a law providing for the re-establishment of the council of state, which was to act as an advisory body to the president.

Defence.—In 1925 Colombia had a defence force with a peace establishment of about 5,000. The system of compulsory military training was nominally in force, the conscripts undergoing six months training. Actually exemption from service is freely granted. In 1924 arrangements were made with the Swiss Govt. to send out a military mission of five officers, besides aviators, to introduce the Swiss system of training and organisation. The infantry is armed with the Mauser rifle and the artillery has Schneider-Creuzot guns. Expenditure on defence amounted in 1924 to $2,648,300.

Education.—There are primary, secondary, professional, industrial and art schools in Colombia, as well as the University of Bogotá (founded in 1572) and the four provincial universities of Cartagena, Popayán, Medellín and Pasto. Education is under the control of the Ministry of Public Instruction, but the Church has wide powers, and so far as direction and supervision go, dominates the entire scholastic system. The industrial and art schools are mostly directed by the religious orders. Primary education is free. In 1924 a German commission of three members began to advise the Colombian Govt. on educational matters, and aided by a council of three Colombians, headed by Dr. Tomás Vargas, took in hand the modernisation of the system. In 1924 there were in Colombia 6,674 primary schools having on the average only one teacher each. The attendance at these schools was 417,054. The vote for public instruction in 1923 was $1,108,190, and in 1924 the actual expenditure under the heading of "Instruction and Public Health" was $2,234,672. In addition departments and municipalities spend money on education.

II. ECONOMIC HISTORY

Staple Products.—The principal industry of Colombia is the production of mild coffee, in which the expansion has been remarkable, the value of exports rising from $18,369,768 in 1913 to $53,630,661 in 1924, dropping through crop shortages to $42,968,544 in 1925. The country is the second largest world producer of bananas. Cattle breeding has also been developed as the result of the clearing of forests and the sowing of imported grasses. In 1921 there were estimated to be 8,000,000 head of cattle, a figure which increased to 9,000,000 in 1925. The carrying capacity of the cattle lands is estimated to be 50,000,000 head. Cocoa, sugar, tobacco, balata, pita fibre, ivory nuts, sisal-hemp, silk, tropical fruits, wheat and maize and cotton are the staples of agricultural produce. In 1925 arrangements were made for a British expert commission to visit the country and report on the development of the cotton industry, which is increasing in importance. The mission arrived in Colombia on Feb. 27 1926. Medicinal plants such as cinchona, ipecacuanha, sarsaparilla, etc., are also grown. The forests are valuable chiefly for the production of cedar and dyewoods. Rubber grows in most of the departments. On the coasts there are valuable pearl fisheries.

The republic is famous for emeralds and platinum. Other mineral products of importance are gold, silver, copper and iron, while a small amount of coal is produced. Asphalt is also being worked and there are large salt deposits under state control. Of recent years the country has been vigorously prospected for oil, and rich fields have been tapped by British and American companies. Colombia has been classified by the U. S. Geological Survey as the largest potential oilfield in the world. The Tropical Oil Company has a big concession in the Department of Santander, and at the end of 1925 was producing 20,000 bbl. a day. To convey the oil from the Santander fields to the point of shipment the Andean National Corporation, under a contract with the Government, laid down a national pipe-line, the first section of which (240 m.) was under construction at the end of 1925.

Encouraged by high protective tariffs, manufacturing industries progressed considerably after the War. The development of cotton growing, sheep raising and silk production assisted the growth of the textile industry, and factories were erected at Barranquilla, Medellín, Bogotá and Cartagena. The manufacture of Panama hats, and the export of the finished product, greatly increased in the post-War period. The country's industrial development, however, is still greatly retarded by inadequate means of transport.

Foreign Trade.—Colombia's foreign trade, which had previously shown only a slight annual increase in volume, was seriously checked during the World War. Since then, however, it has greatly increased.

	Imports	Exports		Imports	Exports
	$	$		$	$
1913	28,535,779	34,315,251	1921	33,078,317	63,042,132
1915	17,840,619	31,579,131	1922	44,148,024	53,816,331
1918	21,783,002	37,443,991	1923	57,783,798	60,257,172
1919	47,451,724	79,010,983	1924	52,347,914	70,615,819
1920	101,397,906	71,017,729	1925	57,783,796	60,115,435

With the exception of 1920, when there was a "boom" in imports to replenish stocks depleted during the War, a favourable balance of trade was maintained. The main item of exports was coffee, the volume and value of which rose from approximately 450,000 bags, worth $18,369,768 in 1910, to 2,500,000 bags, worth $42,968,544 in 1925. Other important exports were bananas, platinum, hides, tobacco, cattle and Panama hats. The export trade was largely to the United States, Great Britain, Holland, Mexico, Germany and Belgium. Imports mainly comprise railway material, locomotives and rolling stock; engineering, road-building and general construction materials; agricultural and other machinery; commercial vehicles, hardware, jute bags, cutlery, crockery, wines and spirits, drugs and chemicals and provisions. In 1925 the chief countries from which imports were received were the United States, Great Britain, Germany, Italy, France, Spain and Holland.

National Finances.—There was a great improvement in the national finances in the period 1910–25, and particularly in the two years immediately following the adoption of fiscal and other reforms recommended by the Kemmerer Financial Mission. This body spent six months in 1923 in investigating the entire system of national accountancy, revenue and expenditure, banking and the monetary system. Drastic reforms followed, the results of which are admitted to have placed Colombia among the most healthy and stable of Latin American countries so far as public finance is concerned. A proper valuation of the national assets was made and a system of independent audit of accounts introduced. In the same period the payment of the instalments of the indemnity for the loss of Panama helped to strengthen the financial position of the republic. The first instalment of $5,000,000 was paid on Dec. 7 1922 and was used the following year to establish the central bank as recommended by the Kemmerer Mission. Three subsequent payments were made before the end of 1925, and there was a gain to the republic on exchange.

In 1910 the revenue of Colombia totalled $10,827,569, and the expenditure was $11,501,442. In 1924 the ordinary revenue amounted to $33,458,053, to which was added extraordinary revenue (mainly the instalment of the American indemnity) of $6,391,982. Ordinary expenditure (national services) amounted to $32,024,244, while that on extraordinary account was a further $6,899,693. On both accounts the year closed with a surplus of $926,097. The year 1925 closed with total receipts of over $40,000,000, not including the quota of the indemnity, and the biggest surplus that had been known in the history of the country was realised.

On Dec. 31 1910 the public debt was $17,495,127, consisting of external obligations of $14,839,000, and internal debts of $2,656,127. At the end of 1924 the gross debt was $36,716,827, the external debt being $19,293,862 and the internal $17,422,965. During 1924 the gross indebtedness was reduced by $6,049,984. Colombia's credit stands very high abroad owing to the regular fulfilment of the debt services and the steady amortisation of the loans. The main operations after 1910 were the loan of £1,500,000 at 6% obtained in London in 1913, and that of $5,000,000 (U.S.) raised in the United States in Oct. 1922, with interest at $6\frac{1}{2}$%, these and other loans carrying a sinking fund of 1%. Long credits have been obtained for the purchase of railway and other material. Owing to the reorganisation of the finances and administration, and also to the influx of money in the form of the Panama indemnity, no further effort was made by the Central Govt. to float foreign loans.

Money and Banking.—The monetary unit is the gold peso ($) worth $0.975 United States currency, and four shillings English. The five peso gold piece has the same weight and fineness as the English pound, which is also legal tender in Colombia. The peso is divided into 100 cents. The currency consists of nickel coinage of 1, 2 and 5 cents; silver for 10, 20 and 50 cents; notes for 50 cents, 1, 2, 5 and 10 pesos, and gold coins for $2.50 and $5. Before 1910 the paper peso had dropped to a value of one cent, and all foreign coinage was allowed to circulate. The Government of the day exchanged one gold peso for every 100 paper pesos. From 1910 the money in circulation was restricted to a total of about $10,000,000.

The whole question of the currency system was reviewed by the Kemmerer Mission. Among the proposals adopted in 1923 were those for a new banking system embodying the creation of a central national bank, and the reformation of the currency. While the mission was at work the collapse of one of the biggest of the local banks threatened to precipitate a commercial crisis. The Banco de la Republica was hastily established, with the sole right to issue notes based on a minimum gold reserve of 60%, supplemented by short-dated commercial paper. At the same time arrangements were made to reduce the circulation of old notes issued by other banks. In the first year of its existence the Banco de la Republica stabilised the currency on an effective gold basis, reduced the discount rate, increased the gold reserve against the legal requirement, and generally restored complete confidence. Against the total note issue of $33,555,890 in circulation on June 30 1925, there was a gold reserve of $26,286,703. All local and foreign banks in Colombia are under the control of the law through a state banking superintendent. During 1925 an agricultural mortgage bank was established to afford credits for the agricultural development of the country.

Communications.—The main approach to Colombia from Europe and the United States is, on the Atlantic side, through the port of Cartagena, and on the Pacific, through Buenaventura. Vessels of the United Fruit Company call at Cartagena, Puerto Colombia and Santa Marta. The Harrison, Leyland and Horn Lines maintain services from Europe, and other companies, using the Panama Canal, serve the Pacific ports. Colombia can also be reached through Venezuela, *via* Lake Maracaibo. Inland traffic from the Atlantic to the capital of Bogotá mainly follows the Magdalena river, which is navigable for some hundreds of miles. Short railways exist in various parts of the republic and the policy of the Government is to link them up and form three grand trunk systems, one connecting the capital with the Magdalena, the second from Cartagena through the Cauca valley southward to the frontier of Ecuador, and the third eastward from Buenaventura to Bogotá. Colombia's railway policy is to construct, own and operate her own lines. The director general of railways reported at the end of 1925 that the state operated 517 m. of line and had under construction, or had planned, a further 370 miles.

Colombia devoted most of the Panama indemnity to public works, including the construction or purchase of railways. A vigorous programme of road building was also adopted in 1925. The republic possesses the longest aerial ropeway in the world, and in 1925 the construction was begun of a ropeway for passengers and goods from Gamara on the Magdalena to Cúcuta, a distance of 105 miles. Aviation services have proved very successful, especially for shortening the time of travel between Cartagena and other Atlantic ports and Bogotá. Aerial services are operated over a distance of 1,000 miles. Telegraph lines exceed 15,000 m. in length, and there is wireless communication with the United States and Europe. Cable communication is maintained *via* Colon with the United States, and direct with Europe.

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(W. S. Ro.; L. Ma.)

COLOMBO, Ceylon (*see* 6.713), had, in 1921, a population of 244,163, which includes Parsees, Tamils, Malays and a number of people of mixed Portuguese and Dutch descent. In 1921 the birth rate, 25·8 per 1,000, was the highest for 14 years. The death-rate was 25·2 per 1,000. An ambitious drainage scheme for an area of 10 sq. m., taken in hand by the municipality, was modified for financial reasons, and the reduced scheme, with main works at Madampitiya, was brought into use in 1921. In that year a university college was founded, and the college building and laboratories were erected in 1922. The harbour, with a water area of about 600 ac., has fine accommodation for large vessels since the extension of the southwest breakwater in 1911. A dredger is regularly at work in the harbour. Communication has been established between Colombo lake and the harbour, and a railway built to connect with the main line. Oil depots have been established at Blomendhal and Kolonnawa.

COLORADO (*see* 6.717).—The estimated population of the state in 1925 was somewhat in excess of 1,000,000. The census of 1920 showed 939,629; in 1910, 799,024, an increase of 140,605, or 17·6%, as compared with 48% in the preceding decade. In 1919, 83·8% of the population were native-born, 98% being whites. Negroes and Indians numbered 12,935, and there were 3,736 Chinese and 2,300 Japanese. The density of population increased from 7·7 persons to the sq. m. in 1910 to 9·1 in 1920

	1920	1910	Increase per cent
Denver	256,491	213,381	20·2
Pueblo	43,050	41,747	3·1
Colorado Springs	30,105	29,078	3·5
Boulder	11,006	9,539	15·4
Greeley	10,958	8,179	34·0
Trinidad	10,906	10,204	6·9

and to about 9·8 in 1925. The decay of mining towns altered the balance between urban and rural population. In 1920 the urban population was 48·2% of the whole, the rural 51·8%. The table on the preceding page shows the comparative population figures for the six largest cities.

Agriculture.—During the decade 1910–20 agriculture displaced mining as Colorado's most important industry. The number of farms increased 29·8% to 59,934; their area 80·8% to 24,462,014 ac. and their average size 39·2% to 408·1 acres. The value of all farm property increased 119·1% to $1,076,794,749. Land values were estimated at $763,722,716, buildings at $102,290,944, implements and machinery at $49,804,509 and live stock at $160,976,580. Reports for 1924 indicated increased acreage in cultivation, but decreased numbers of farms, capital valuations and values of products, due to post-War price adjustments.

The farm crops (partly estimated) in 1924 were:—

Crops	Acreage	Production	Value
All crops	6,427,215	..	$132,015,097
Cereals, total	3,915,000	51,587,000 bus.	55,435,000
Corn	990,000	9,900,000 "	9,000,000
Oats	260,000	6,500,000 "	3,770,000
Wheat	1,457,000	21,030,000 "	24,815,928
Barley	340,000	8,160,000 "	5,875,000
Sorghum grains	308,000	3,050,000 "	5,817,600
Beans, dry	290,000	986,000 "	3,057,000
Sugar beets	229,000	2,548,000 tons	20,868,120
Hay and forage	2,475,000	4,250,000 "	45,400,000
Vegetables	146,000	..	13,200,000
Orchard fruits	..	4,520,000 bus.	6,250,000
Misc. fruits	..	..	550,000

The irrigated area was 2,792,032 ac. in 1909, 3,348,385 ac. in 1919, while acreage under all irrigation enterprises, whether completed or not, had decreased from 5,917,457 to 5,220,588 acres. Organised drainage enterprises, most of them having been rendered necessary by faulty irrigation, had affected 171,656 ac. at a cost of $1,081,875. In 1924 county assessors reported in the state 290,323 horses, 35,325 mules, 972,828 range cattle, 149,421 milch cows, 809,761 sheep, 246,206 swine, 16,819 goats, 211,490 dozen poultry and 53,990 stands of bees.

Mining.—As in the case of agriculture, the mining industry in Colorado has been depressed by post-War adjustments, but a revival of production under more favourable conditions began in 1923. Radium and tungsten production almost entirely ceased in 1921. In 1924, with an output of $8,447,900, the state ranked second among the states in gold mining. It was seventh for silver, with an output worth $3,286,996, and ranked fifth for lead and zinc, of which it produced 50,982,000 lb. and 59,200,000 lb. respectively. Coal mined in 1923 was 10,336,735 tons. Petroleum production had fallen to 67,000 bbl. in 1923. Exploratory drilling in 1924 developed several new petroleum fields which promised to be of great value.

Forests and National Parks.—A marked influence on Colorado's economic life is found in the existence of large forested and mountain areas, and the consequent establishment of forest reserves and national parks. The forest acreage in 1925 was 13,280,000 ac. in national forests and there were two national parks and three national monuments. Timber supplies, grazing for stock, irrigation and hydroelectric power are important. The tourist business is a leading industry of the state.

Manufactures.—From 1900 to 1920 the number of manufacturing establishments in Colorado nearly doubled, the number of persons engaged more than doubled and the capital invested increased 225%. State authorities estimated that in 1924 there were 2,750 manufacturing establishments, employing 36,663 persons, with products to the value of $375,000,000. Beet-sugar manufacture has been the leading factory industry since 1914. There were 16 operating plants in 1924, which manufactured sugar valued at $45,000,000. Slaughtering and meat-packing products amounted to $45,000,000. Flour and mill products were valued at nearly $20,000,000. Butter, cheese, condensed milk, crackers, candy, cement, steel and machinery were important products.

Education.—In 1924 there were in the state 1,944 school districts, with 3,243 schools and 3,635 buildings. There were 1,336 male and 7,263 female teachers. The school population was 297,934, and the enrolment in the public schools 249,813. The income of the permanent school fund, derived from Federal land grants, is annually apportioned among the districts. In 1924 there were 180 consolidated rural schools teaching combined high and grade classes of 33,000 pupils. Enrolment in secondary schools had increased from 24,404 in 1920 to 48,559 in 1924.

Finances.—The bonded indebtedness of the state in Dec. 1924 was $10,536,500, excluding $6,700,000 for the Moffat Tunnel district and $3,600,000 for the Pueblo Conservancy district. There were outstanding county bonds amounting to $3,662,630, municipal bonds of $47,895,100 and school district bonds of $20,854,470. The general assessment valuation of taxable property in 1923 was $1,543,211,892, on which there was a state levy of $4,480,000. The tax revenue of the state in 1923 was $6,080,798, of counties $8,710,145, of municipalities $7,954,168, of school districts $19,493,711.

History.—A constitutional amendment adopting initiative and referendum was ratified in Nov. 1910. In the same year a primary election law provided for direct nominations by the people of candidates for the U.S. Senate, representatives in Congress and all elective state, district, county, ward and precinct officers, as well as members of the state legislature. This Act provided for party assemblies, at which party candidates might be designated to seek nominations in the primaries, every candidate receiving 10% or more of the votes of the delegates to the assembly being certified by the assembly as a candidate to enter the primaries. It was also provided that persons not entering the assembly might become candidates for any of the offices above mentioned by petition, the number of signers required being 300 for any official who is to serve any political district in the state greater than a county, and 100 for other officials. The expense of candidates in such primaries was limited by the Act and severe penalties were provided for violations.

In 1911 an Act was passed providing for registration of voters for all elections to be held in the state except school elections, and providing severe penalties for false registration and other violations of the Act. In Nov. 1912 the people approved amendments to the state constitution providing for the recall of elective officials and, in certain cases, for the recall of judicial decisions. An Act, proposed by initiative, was passed at the same time, providing for a ballot without party headings. The voters adopted in Nov. 1914 an amendment to the state constitution prohibiting the sale and manufacture of intoxicating liquor, which became effective Jan. 1 1916; and the prohibition amendment to the Federal Constitution was ratified by the Colorado Legislature in regular session Jan. 15 1919.

The Legislature in 1919 passed an Act providing for a budget system in making appropriations and creating a state budget and efficiency commissioner. The first budget prepared under this Act was presented to the Legislature in 1921. In 1920 the voters adopted an initiated constitutional amendment raising the limit on state tax levy from $4,000,000 to $5,000,000, the additional $1,000,000 to provide buildings for educational institutions. In 1921 a proposed amendment to extend the tenure of office of state and county officers and a proposal for a convention to revise the state constitution were defeated. The Legislature in that year revised and strengthened inheritance tax laws by raising the rates thereof. Persistent advocacy by the governor secured the passage of laws for the re-establishment of a national guard and for a Dept. of Safety, with a force of rangers as a state police force. A special session of the Legislature in 1922 passed laws for a bond issue of $6,700,000 to finance the construction of a tunnel through the mountains northwest of Denver, and for a bond issue of $3,600,000 to finance a flood control district on the Arkansas river for the protection of Pueblo. In 1923 laws were passed to facilitate co-operative marketing of agricultural products and to grant compensation to veterans of all wars beginning with the Civil War. Condemning the maintenance of a state police force as violating rights of local self-government, the new Democratic governor in 1923 secured the disbanding of the state rangers. In 1924 referendum votes on several constitutional amendments defeated the proposals. Issues raised by the Ku Klux Klan were politically prominent in 1924–5. Many men favourable to the Klan were elected to municipal, county and state offices, including the governor and a U.S. Senator.

There were a number of serious labour disturbances between 1910 and 1920, some of them marked by violence and virtual insurrection which had to be put down by the military. A notable contribution to better relations between capital and labour was the industrial representation plan put into effect by John D. Rockefeller, Jr., in the properties of the Colorado Fuel and Iron Co. in 1916. Employees, by districts and classified groups, elect representatives who have the right to confer with executives on all questions affecting wages, conditions of employment and operation and general welfare. The system has had a marked influence on similar large industrial organisations elsewhere, but it has been opposed by labour unions.

In 1910 the state administration was in the hands of the Democratic party, with Joseph H. Shafroth as governor. The Democrats again elected a governor in 1912, Elias M. Ammons, a result largely due to the split in the Republican party throughout the nation. In 1913 George A. Carlson, Republican, was governor. He was succeeded by Julius C. Gunter, Democrat, elected in 1916. A reunited Republican party, profiting by popular reaction on World War issues, elected Oliver H. Shoup governor in 1918, and re-elected him in 1920 with an increased majority and a Legislature almost completely Republican. The Democrats elected William E. Sweet governor, and Mary A. Bradford superintendent of public instruction in 1922, although Republicans mostly elected their candidates for other offices. In 1924 C. J. Morley, Republican, was elected governor.

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COLORADO RIVER (*see* 6.724).—The Colorado river, with its drainage of 250,000 sq. m., its 7,500,000 acres of irrigable land, its annual flow of 18,000,000 ac.-ft. of water, its capacity to develop more than 5,000,000 continuous H.P., and its devastating floods reaching 240,000 cu.ft. of water per sec., is a vexatious problem. The immediate danger of inundation of the great Imperial Valley, which has been impending since the disastrous break of 1905, has been lessened by the diversion of the river into the Pescadero Channel and the completion, in 1922, of a substantial levee. The relative security attained remains uncertain, however, as long as occasional extraordinary floods might undermine or overtop existing levees; while nearly 5,000,000,000 cu. ft. of silt brought down annually to Yuma produces dangerous meandering in the leveed section and builds up the delta channels causing the river to seek new outlets. These conditions necessitate large expenditures for revetment and the raising of the levees to prevent disaster to the rich irrigated lands of the delta region.

To ameliorate these conditions and to increase the low water flow for further irrigation, Congress has been urged to provide for the construction of Boulder Canyon reservoir to be formed by a dam 605 ft. high in Black Canyon, east of Las Vegas, Nevada. Such a dam would store 34,000,000 ac.-ft. of water and would provide for the reduction of floods, the regularisation of the stream flow, the interception of silt and the development of 650,000 continuous horsepower. The cost of the dam is estimated at $50,000,000, while the power development, including transmission lines to southern California power markets, would add $80,000,000, a total of $130,000,000.

Besides securing flood protection, three large irrigation developments, Palo Verde, Yuma and Imperial Valley, would utilise the regulated flow to increase their 700,000 ac. of irrigated land to about 2,000,000 acres. Since one-third of the irrigated lands of the Imperial Valley and much of the main irrigation canal lie in Mexico, the agitation for the Boulder Canyon dam has been accompanied by a demand for the construction of a new canal entirely on American territory. Opposition to these projects has been based upon two principal grounds: they are not the best means of accomplishing the results desired, and the projects should not be financed and built by the national government.

Developments in the lower basin having appeared likely to acquire water rights that might prevent future developments in the upper basin, a commission, with a member from each of the states of Arizona, California, Colorado, Nevada, New Mexico, Utah and Wyoming and one from the United States, prepared, in 1922, a plan for the distribution of the waters, giving 7,500,000 ac.-ft. annually to the upper states (Colorado, New Mexico, Utah and Wyoming), and 8,500,000 to the lower states. This plan, known as the Colorado river compact, requires ratification by each state and subsequently by Congress. Arizona having failed to ratify the compact, the Federal authority has been withheld, in order to await an adjustment of the conflict of interests. (H. T.*)

COLOUR (*see* 6.728).—The sensation of white light is caused by electromagnetic waves of a certain wave length impinging on the retina of the eye. The sensation of colour is produced by the absorption of one or other of the coloured components of white light when the light strikes some suitable surface or passes through a suitable medium—the light reflected from the surface or transmitted through the medium consequently conveying to the retina a sensation of colour complementary to that absorbed.

General and Selective Absorption.—Many substances do not absorb any definite portion of the visible spectrum—the name applied to the range of colours into which white light can be resolved—but give *general* absorption throughout the range.

Such substances appear, therefore, colourless both by transmitted and reflected light and it is only those materials which cause selective absorption, that is which absorb some definite portion of the visible spectrum, that appear coloured. It follows, therefore, that there must be some special property possessed by substances which produce the sensation of colour which distinguishes them from other substances that appear colourless.

Physical and Chemical Colour.—As a matter of fact it is quite easy to detect the causes leading to the main underlying difference between the two types, for they may be divided into two classes which, for the sake of convenience, may be named the physical cause and the chemical cause; and, in the first instance at any rate, the reason for production of colour is quite clear and it is a comparatively simple matter to reproduce the effect mechanically. For example, white light is resolved into its component colours when it is allowed to impinge on a glass surface which has been ruled with a number of fine lines, and there are a number of other ways by which the sensation of colour can be imparted by purely mechanical means.

Subjective Colour.—As a matter of fact many natural objects, especially in the animal kingdom, owe their colour to the physical cause. The vivid green of certain beetles, the colours of the peacock's feathers, the colours of butterflies' wings and the colour of blue eyes are all produced in this way, the colour effect being caused by the interference of white light through the agency of minute excrescences or fine filaments on the surface of the objects that appear coloured. The colour effects in such cases are, therefore, subjective and it would be just as reasonable to attempt to extract a coloured substance from the peacock's feather as it would be to do so from the rainbow.

Chemical Colour.—On the other hand there are a great number of substances the colours of which must be ascribed to the second or chemical cause. These occur both naturally and artificially and are distinguished from those of the first or physical section by reason of the fact that the coloured substances in them can be extracted from the coloured materials and, when extracted, are found to be definite chemical compounds which owe their colour to their chemical constitution.

The Colours of Flowers.—In nature such coloured substances are to be found mainly in the vegetable kingdom, in the colouring matters, for example, of the flowers and of green grass or leaves. Moreover, it is easy to distinguish by a practical test between the two types because if a peacock's feather is viewed by transmitted light the brilliant colours will disappear, whereas, if a red rose leaf is treated in the same manner no change in colour will be noticed.

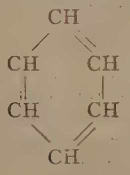
Intermolecular and Intramolecular Interference.—Nevertheless, it is only reasonable to suppose that the two types of phenomena are of the same order and that whilst the physical or subjective colour is due to the *intermolecular* interference of white light, the chemical colour is due to *intramolecular* interference, or, in other words, white light is "filtered" through the molecular structure of the chemical substance, leaving a "portion" behind in its passage. The colour is therefore dependent on the chemical composition of the particular compound. It remains then to compare those chemical compounds which produce colour with those that are colourless so as to reach some conclusion as to the influence of molecular structure on colour production. In the first place, however, it is necessary to attempt to arrive at some definition of what is meant by colour in a strictly scientific sense.

The Visible Spectrum in the Range of Electromagnetic Vibration.—The range of the visible spectrum which is produced, for example, when a beam of white light passes through a quartz prism, represents a range of electromagnetic vibrations of wave lengths between 4,000 and 8,000 Ångström units. This is, however, only one octave in the range of 62 octaves of wave lengths from $0{\cdot}01$ to $3{\cdot}5 \times 10^{16}$ Ångström units which has been investigated. It is clearly, therefore, scientifically illogical to restrict the term "coloured" to those substances which cause absorption only in the short region capable of detection by the eye, because a substance which produces selective absorption in any other region of the electromagnetic range is also "coloured" although such colour requires the aid of some external influence in order that it may be detected.

Visible and Invisible Colour.—It is necessary, therefore, to distinguish between *visible* colour and *invisible* colour and to describe those substances which give selective absorption in the visible region as visibly coloured and those which give selective absorption in other regions as invisibly coloured.

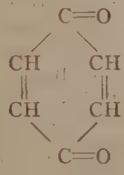
Infra-red and Ultra-violet Regions.—It is fortunate that the photographic plate is more sensitive to waves immediately outside the visible region of the spectrum than is the eye, for by its aid it is possible to detect selective absorption in those regions immediately outside the visible spectrum, which are known as the infra-red and the ultra-violet, and thus to show that many substances which appear colourless to the eye possess nevertheless intense invisible colour. Moreover, it is possible by simple chemical reactions to transform compounds having this invisible colour into those having visible colour or, in other words, by a change of structure, to throw the absorption from the invisible region into the visible region. In this way it is possible to correlate structure with visible colour.

Invisible Colour of Benzene.—For example, the hydrocarbon benzene (C_6H_6) appears colourless to the eye both by reflected and transmitted light, nevertheless when its spectrum is photographed marked selective absorption in the ultra-violet region is manifested. Benzene is, therefore, a substance having a strong invisible colour. By a simple series of reactions it is possible to transform benzene (I.) into quinone (II.) and by so doing to shift the absorption from the invisible to the visible region of the spectrum, thus obtaining visible colour (yellow).



I.

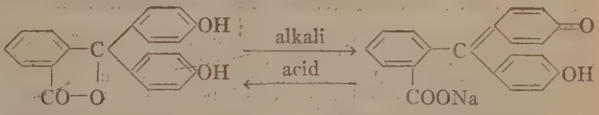
Benzene (invisibly coloured)



II.

Quinone (yellow)

The Shift of Absorption.—This change, in the case of many derivatives of benzene, takes place with remarkable ease and with astonishing rapidity, thus the change from phenol-phthalein (III.), the benzenoid or invisibly coloured form, to the sodium salt (IV.) the quinonoid or visibly coloured form, by the action of alkali, and the reverse change which is effected by the action of acid, is so rapid and sensitive that the substance is used as an effective indicator in alkalimetry.



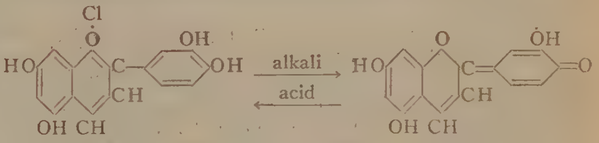
III. Benzenoid form (invisibly coloured)

IV. Quinonoid form (red)

The hydrocarbons naphthalene ($C_{10}H_8$) and anthracene ($C_{14}H_{10}$) provide further examples of the same kind and, in fact, the occurrence of colour among organic compounds which has led to the foundation of the coal-tar colour industry is based mainly on this change.

It is also possible to start with a benzenoid derivative which by reason of its structure is visibly coloured and by a simple chemical change, such as that illustrated above, to throw absorption from one end of the visible spectrum to the other and thus to transform a red substance into a blue one.

Red and Blue Flowers.—As a matter of fact Nature has utilised this method to produce her red and blue flowers:—



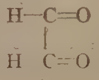
Red (rose)

Blue (cornflower)

The red flowers are those in which the cell sap is acid, the blue those in which it is alkaline. If the cell sap is neutral the flowers are purple.

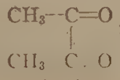
It would appear, therefore, that the occurrence of visible colour is mainly adventitious and depends on molecular conditions which are subject to control. It happens to be a property of the quinone ring because the parent substance benzene possesses the power of causing absorption just outside the visible region. Even so, the formation of the quinone ring may not shift the absorption of benzene far enough to bring it within the visible region, and there are thus derivatives of quinone which have no visible colour. On the other hand the shift of the bands may be caused by other structures and there are, in consequence, derivatives of benzene such as azobenzene, $C_6H_5{-}N{=}N{-}C_6H_5$, to which no quinone structure can be assigned, yet which possess strong visible colour.

Infra-red Absorption.—If the wider definition of colour be accepted it is probable that there is no such thing as a colourless material, because it is likely that every substance gives selective absorption somewhere within the range of electromagnetic vibrations. It appears to be in the power of many substances belonging to the aliphatic series of organic chemistry to give selective absorption in the infra-red region of the spectrum. Visibly coloured substances in this portion of organic chemistry are not of frequent occurrence, but when such colour occurs it is always associated with the presence of what is known as the conjugated system of double linkages; thus glyoxal (V.) and diacetyl (VI.) are yellow:—



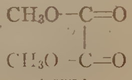
$$\begin{array}{l} H{-}C{=}O \\ \;| \\ H\;\; C{=}O \end{array}$$

(V.)



$$\begin{array}{l} CH_3{-}C{=}O \\ \qquad | \\ CH_3\;\; C{=}O \end{array}$$

(VI.)



$$\begin{array}{l} CH_3O{-}C{=}O \\ \qquad\;\; | \\ CH_3O{-}C{=}O \end{array}$$

(VII.)

Methyl oxylate (VII.) is, however, visibly colourless and it must be assumed that in this case the infra-red absorption has not been thrown into the visible region. It is of interest to note that the same system of conjugated linkages is present in the conventional formula for benzene (I.).

The Definition of "Colour."—It is also significant that visible colour is shown only by unsaturated carbon compounds and that in no case has a visibly coloured saturated compound been prepared. It follows therefore:—

1. That both visible and invisible colour are associated with unsaturation.
2. That they are associated with the occurrence of selective absorption either outside or within the visible region of the spectrum, the former causing invisible, and the latter visible colour.
3. That occurrence of this absorption is bound up with the presence of a system of conjugated double linkages within the molecule.

Colour in Inorganic Chemistry.—The causes leading to the production of visible colour in inorganic compounds will not be clearly understood until more is known about the molecular structures of such substances. It is obviously due, initially, to the presence of a colour-producing element such as copper, chromium, cobalt, etc. The cause of colour in these elements is probably molecular, as instance the change in colour iodine undergoes when heated. Nevertheless the structure of the salt must also play a part as is shown, for example, in the disappearance of the blue colour of hydrated copper sulphate when it loses part of its water of hydration. In any case the causes of visible colour in this section of chemistry are not so clearly defined as they are in the organic section, and no useful purpose would be served by dealing with them in the present state of our knowledge.

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(J. TH.)

COLOUR AND RACE, PROBLEMS OF.—The narrowing of the world by improved transport, the levelling of mankind by the spread of education, and the increase of wealth and rise in social position of coloured peoples are bringing the races into relationships which may provide the most difficult problems of this century. The progress of civilisation is threatened by the serious danger of racial conflict and the still more serious evil, the demoralisation caused by inter-racial and colour prejudice.

I. PRIMARY RACES

Mankind, according to most authorities, includes three primary divisions or races which are as difficult to delimit as the breeds of dogs. According to some authorities the three races are so different that they should be regarded as distinct species; but the fact that all their members can interbreed and produce fertile offspring is weighty evidence of their specific unity. In opposition to the view that the human races are specifically distinct is the claim that there is no real difference between them, and that the apparent distinctions are no more significant than those variations in complexion, head form and size, that occur between members of the same family. That claim is based on the differences between the extremes of any one race being greater than the difference between the races. This overlap, however, no more proves the invalidity of racial distinction than the fact that a bee has more points in common with mankind than it has with a barnacle is evidence that man is an insect.

The characteristic which seems to be most constant and useful in the classification of man is the hair, which marks off three primary races: in Cymotrichi (wavy-haired), Leiotrichi (smooth-haired), Ulotrichi (woolly-haired). The division into these three races is now generally accepted. Apart from the hair the physical characters of each of the races vary so greatly that their definition is difficult. The main distinctions are remarkably stable, for the negro and the Caucasian are clearly represented in early Egyptian pictures, and the three races were probably distinct in the Stone Age.

As Haddon points out, "the Ancient Egyptian artists who decorated the royal tombs at Thebes in the XVIII. Dynasty distinguished between four races: (1) The Egyptians, whom they painted red; (2) the Asiatics or Semites, who were coloured yellow; (3) the Southerners or negroes, who naturally were painted black; and (4) the Westerners or Northerners, white. We ourselves speak loosely of white men, yellow men, black men, red men and brown men." The correspondence between colour and races founded on hair form is not complete. The negro has woolly hair, the straight hair belongs to the Mongolians, while the Caucasian peoples have wavy hair. The negroes vary in colour from chocolate hue to a brown which is so dark that it is often called black; the hue of the American section of the Mongolian race differs so much from the typical yellow that the American aborigines were called the Red Indians. The Caucasians include the whites of Europe, the brown races of Asia, North Africa and Australia, and some of the blackest of the African tribes.

Characteristics.—The social and intellectual differences are well marked, though in these respects the races overlap. As regards courage, endurance and self-sacrifice the three races are not unequal. The brown people have contributed to progress most of the chief handicrafts and the founders of all the chief religions—Buddhism, Confucianism, Hinduism, Islam and Christianity. The Mongolian is characterised by steady industry, high skill in craftsmanship and habitual self-surrender to his community. The negro, on the other hand, has a strong individuality which is less adapted to political stability and social coherence; he generally lives in village communities, which, except where ruled and organised by non-negroes, have never united into a powerful or wide-ruling nation. The Caucasian race is not a political unity; for it is divided into the white section or European, including therein the white settlers in the other continents and the brown Caucasians, who are grouped with the Mongolian and the negro as the coloured section of mankind.

The European people have shown the greatest capacity for initiative, combination and subdivision of work, and have thereby subdued the forces of nature, achieved the infinite complexity of organisation required for success in industry on a great scale and yoked the powers of steam and electricity. The European in administration has by his success rendered inevitable a readjustment between the white and coloured sections of mankind. The white nations during the past four centuries, owing to the mental alertness due to their superior education, have gained world-wide supremacy—commercial, political, military and intellectual. They have established their dominion and direct rule over eight-ninths of the habitable land of the earth. Yet they number only one-third of its inhabitants. The recognition of European superiority in some respects and the benefits received from the European's skill in administration have made many Eastern and African people accept his help and even his rule.

The Ballads of Bengal, recently collected and published by Dines Chandra Sen, show that in the 16th century northern India under its Mogul rulers was in appalling disorder. British rule has contributed to the country's prosperity and peace, and European influence has frequently had that effect elsewhere. The European commercial pioneers were either preceded or followed by missionaries who often gave important secular help and faithfully upheld the interests of the native population when they tended to clash with those of the trader. Hence the growth of European influence was often welcomed. The Chinese, for example, appreciated not only the work of the early Jesuit missionaries, but the help of the European staff in its Imperial Customs Service. The eastern people also prized the benefits of European trade; but they could not have had much share in it without giving European capital and traders the security of extraterritorial privileges, which lapse as the necessity for them disappears. In time, however, the material disadvantages of foreign control, the galling symbols of inferiority, religious fanaticism and the mistakes of government have led to reaction.

Reaction.—The control of the world by the European peoples is a comparatively recent development and may be only temporary. The uprising of national sentiment since 1900 has already lessened the European domination. The most important single factor in this change was the Russo-Japanese War of 1904. Japan, alarmed at the attempts to exclude her or her influence from the adjacent parts of the mainland of Asia, attacked Russia, and by brilliant victories secured control of Manchuria and struck a resounding blow at European prestige. In India the rise of the professional class with the spread of western education, the irritation of some genuine grievances and the stimulus to Indian nationalism by the Japanese success led to the establishment of partial Indian self-government by a measure which contains the machinery for its further extension. The establishment of a republic in China with its remarkable development of scientific and educational activity among the intellectual classes of that country, the recovery by Afghanistan of the management of her foreign affairs, the wresting by Arabia of its independence from Turkey and the establishment of Egypt as an independent Sultanate are some results of the growth of Asiatic nationalism.

European Problems.—Europe is a mass of racial problems. The surge from the East which brought the Magyars into the heart of Europe, the pressure of the Turk, the thrust of the Alpine race to the plains and peninsulas, the clash of Slav and Tartar and Mongol in Russia, have played, and still play, a decisive part in shaping the political conditions of Europe. Differences of culture, religion, language and institutions go with differences of race, and, in southeastern Europe, the tangled mountains enhance the separatist tendencies of the folk that dwell there.

Contact with Northern Africa and the Mediterranean littoral is of great antiquity. The population of Portugal has a strong African element. The Moorish occupation of Spain has left its mark on the characteristics, physical and political, of the Spanish people. The population of southern Italy and Sicily contains elements of African origin. The population of the south of France is very mixed. The extension of the French and Italian colonial empires to Africa has enlarged the area of contact, and with it, the range of problems. The Mediterranean peoples historically display a comparative readiness to absorb coloured groups, while the Nordic stock holds aloof from such intermarriages.

Asia is firmly held by the Mongolians and dark Caucasians. Africa is the home of the negro and of a negro-dark Caucasian intermixture in the north, and taking the continent as a whole, the pure whites are in a small minority. Native influence tends to increase. The three other continents are the possible heritage of the European, though North America may have to absorb a considerable proportion of negro, and Australia will have to accept inevitable delays in the cultivation of its tropical lands by white labour. From tropical and sub-tropical countries come the raw materials which Europe needs for her factories. These areas are valuable markets for European products. The problems vary with the historical circumstances in which European control was established in each area, and with the local political and economic conditions.

II. THE BRITISH COMMONWEALTH

Thus race problems in the British Commonwealth are of extreme complexity, for its autonomous dominions, with their different circumstances and traditions, necessarily adopt different labour and immigration policies. This differentiation is possible so long as each dominion shows reasonable consideration for the responsibilities of the Empire as a whole, and is prepared to tolerate the limitations involved in partnership.

Canada.—The racial problems in Canada are comparatively simple, in spite of the complications due to the French-speaking population, which is increasing in numbers and spreading westward both in Quebec and Ontario. The Indians of Canada are few and of no political importance. The colour line is an issue only in British Columbia, where there has been a considerable immigration from India, China and Japan in the past, though it is now insignificant. The main racial problem in Canada concerns the mixture of the present population, which is derived from northwestern Europe, with immigrants from eastern and southern Europe. A vast immigration of Italians and Slavs has been flowing into the United States; and Canada, like that country, may restrict her Slav and Italian immigrants.

South Africa.—In South Africa the position of "the poor white" forms a serious problem. South Africa has an extremely mixed population, for both the white and coloured sections are composite. The white settlers include Dutch, British and some French Huguenots. The coloured population consists of negroes from many different South African tribes, the descendants of West African negroes introduced in the 18th century, and Asiatics. The West African negroes and Asiatics have given rise to the class known as the Cape Boy.

The European position in South Africa has been weakened by the feud between British and Boer due to difference of ideas on native policy. It early led to the quarrel over the abolition of slavery, and is still shown by Cape Colony having granted the negro the franchise, which is refused him in the other South African states. The racial problem in South Africa illustrates the difficulty of maintaining a fair standard of life for the less efficient members of a dominant minority.

In the effort to save the position of the white artisan the South African Govt. proposes the policy of segregation. No white man can settle in some parts of South Africa without the sanction of the Governor-General; and it is proposed that in some areas certain occupations should be reserved to the white artisan. The principle of segregation was adopted by the Natives' Land Act of 1913, and its extension was proposed in measures under consideration in 1925. It is opposed by many capitalists on the ground that it will raise the cost of labour; but the elections in South Africa in 1924 show that a large section of the white population regards some plan of segregation as indispensable for the maintenance of the European position.

Tropical Africa.—In Tropical Africa the race policies are based upon two different principles. In West Africa the Govt. acts as the trustee of the native, and protects him against the sale of his ground or produce on unfavourable terms. The native is encouraged to become a small holder and cultivate his own land. The resultant increase in numbers and wealth of the population has given the Europeans probably greater prosperity as merchants than they would have achieved as planters using native labour. In Kenya (East Africa) European settlers were invited to develop the fertile lands beside the railway, large land grants were given and the natives were expected to enter the service of the Europeans. The Indians, including many who had been employed in the construction of the railway, spread through the country and were especially useful in retail trade with the negroes. The extension of European plantations has now created a greater demand for labour than the population can supply. More labour is required to reap a harvest than to sow the crop. Hence efforts have been made to discourage the natives from working in their reserves and to force them by taxation and other means into the European service. The problem in Kenya Colony is how to work both the native reserves and the European estates without forced labour, which has been rejected by the responsible leaders of each of the three British political parties as approximating to slavery. The opposition of Europeans in Kenya to the further immigration of Asiatics has been strongly criticised by Indian public opinion.

Australia.—Australia is the one continent which is blest with the absence of any inter-racial problem. When European colonisation began it was inhabited only by a few nomads. After the Federation of Australia in 1901, the White Australia Policy was adopted, and the coolies who had been imported to work the sugar plantations were sent back, excepting those who had made homes in the country. The Queensland sugar industry was thus left dependent on white labour. Despite emphatic predictions to the contrary it has continued to develop. Its success, the health of the people of tropical Queensland and the general trend of medical opinion (see, for example, Gregory, *Menace of Colour*, chapters 8 and 9) show that tropical Australia can be developed by white labour provided the standard of life be maintained by the absence of coloured labour.

India.—India presents inter-racial problems of peculiar difficulty due to the great diversity of race, language and religion. The population is mainly dark Caucasian, with some Mongolian elements and in the south possibly a negro strain. Racial differences are vital in India. Much evidence has been collected by Indian scholars in support of the view that the caste system is in origin a colour reaction of a dominant light-skinned group which, by its superiority, imposed hegemony and its institutions upon the indigenous, darker-skinned stocks. Caste is *varna* and *varna* is colour. In the south where the dark-skinned proto-Indics (*see* RACES OF MANKIND) are most numerous, the segregation of the lower groups is still a feature of the social polity. The languages are a Babel, and the two chief creeds, Hinduism and Islam, represent the very antithesis of religious thought. The problem for the Govt. of India is how a small oligarchy can harmonise the conflicting interests of 320 millions of such diverse people. The growth of Indian Nationalism has led to an extensive measure of self-government, which has so far proved only a partial success. The establishment of elective councils is a mark of the faith of the British Govt. in the depth of British influence in India. The spread of western education has rendered many Indians capable of taking a responsible part in the administration of the country.

III. THE UNITED STATES

In the United States, after the Civil War of 1861–5, the negro was given his freedom and endowed with full political rights. Then followed a period after 1867, which was known as the "Reconstruction," when the Southern states suffered from deplorably incompetent and corrupt government. In 1876 the Northern states, distressed by the failure of the system which they had forced upon the South, withdrew support from the "carpetbaggers" and allowed the whites in the Southern states to resume control.

By trickery, fraud and legislative measures, some of which, such as some clauses in the Oklahoma constitution, in recent years have been declared unconstitutional by the Supreme Court, the negro was practically disfranchised. Negroes were excluded from many universities, schools and theatres used by the whites, especially in the South; they were debarred even from the churches and from such organisations as the Young Men's Christian Association, unless they founded separate centres of their own. They complain and, according to many independent investigators, with justice, of unfair treatment in the law courts, which is not surprising as the judges and officials are appointed by public election in which the negro has no vote. Moreover, in 29 of the states intermarriage between whites and negroes is illegal, and according to the Virginia "Act to Preserve Racial Integrity" of 1924, no marriage in that state is legal between a white person and any person who has a trace of non-Caucasian blood other than one-sixteenth or less of American Indian.

The policy of racial repression seems now impracticable. It has led to increasing bitterness which has been remarked by many observers during the past 20 years. It is held responsible for the fierce race riots in 1919 at Houston, Texas, at Washington, D.C., Chicago, Elaine (Ark.), East St. Louis, Knoxville (Tenn.), Omaha (Neb.) and Bogalusa, Louisiana. The traditional Southern policy toward the negro may become impossible owing to his migration to the Northern states. There the negro has long enjoyed, theoretically, all the rights of a full citizen. In the words of Lincoln he is "in his right to eat the bread he earns equal to any other man"; but the Northern system prevented him from earning his bread except in small numbers in menial employments. The conditions are now changing in consequence of the Immigration Restriction Act of 1917 and the still more rigorous act of 1924. Labour scarcity compels the Northern manufacturers to turn to the South for negro labour. Southern agriculture, and especially the cotton crop, is dependent on the negro. Yet the movement of negroes to the Northern towns, if continued, may embarass the Southern states industrially.

The U.S. Dept. of Labor (Bulletin 1924, p. 35) enumerated as the causes of the migration "poor wages, poor housing, abuses due to the overseer system of farming, inadequate educational facilities, the 'Jim Crow' law, inequality in law enforcement, the Labor Contract Law which renders possible the peonage system, mob violence and disfranchisement." The negroes themselves at a representative conference in Atlanta, Ga., declared that the migration was due to their complete loss of faith in the willingness of the white people ever to treat the coloured people justly. This migration actually brings Southern colour problems to Northern thresholds.

IV. THE POLICIES CONTRASTED

As the permanent subjection of one race by another appears under modern conditions impracticable, as well as unjust and undesirable in the interests of both peoples, the available policies are reduced to assimilation or independent evolution. The policy of assimilation means that the race question might solve itself by the fusion of the races by intermarriage, since the absorption or extinction of the weaker race appears to be the inevitable result of co-residence.

Fusion.—According to some authorities race prejudice is so mischievous that the world would be much happier if the races were completely fused. Many observers in the United States consider that racial feeling there is becoming less acute, and that the repression is being reduced as numerous half-castes form a complete transition between white and negro. The policy of fusion is supported on the ground that intermarriage produces superior offspring. The success of some European nations has been attributed to the varied qualities which they have inherited from their mixed ancestry.

The crossbreeding of races which are nearly akin is often beneficial. "Heterosis," or hybrid vigour, has been proved experimentally by the crossbreeding of plants and domestic animals. The evidence is weighty, however, that the intermarriage of races that are very different produces offspring inferior to either parent. Herbert Spencer recommended Japan to avoid the intermarriage of Japanese and Europeans. National character is a hereditary complex, which has been developed by generations of natural selection. The interbreeding of two stocks of which the hereditary complex is slightly different may be expected to lead to improvement, but if they are very dissimilar the progeny will probably be inferior. Herbert Spencer's view has been reaffirmed by many modern eugenists as the result of careful investigation of such cases as the intermarriage of the Scandinavians, who are Teutonic, with Lapps, who are Mongolians.

Segregation.—The third policy is the independent evolution of the different races when geographically separated in mass, under conditions which allow of such individual intercourse through missionaries, teachers, men of commerce, scientific experts, administrators, etc., as will enable the races best to cooperate in the development of the world. The conditions in most of South and Central America illustrate the results of racial fusion. Independent evolution is possible in the other continents.

CONCLUSION

Inter-racial hatred is one of the serious menaces to human progress. Men of different races engaged in a joint enterprise often work together harmoniously and with true affection; but race hatred easily develops where men of different civilisations compete side by side for the necessaries of existence. The repulse of the negro capacity for affection is the bitterest element in his lot, as expressed by the negro poet, Paul Lawrence Dunbar:—

> Because I had loved so deeply,
> Because I had loved so long,
> God in his great compassion,
> Gave me the gift of song.

Because I had loved so vainly,
And sung with such faltering breath,
The Master in infinite mercy,
Offers the boon of death.

To avoid such poignant disagreement the most hopeful policy available seems to be segregation in mass, combined with such individual intercourse as will enable the different races to help each other, without arousing the violent repulsion generated when people of dissimilar cultures and colours meet with grating friction in competition for their daily bread.

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COLOUR PHOTOGRAPHY: *see* PHOTOGRAPHY.

COLOURS OF ANIMALS (*see* 6.731).—Since 1910 important advances have been made in the study of mimicry and in our knowledge of adaptive colour changes in fishes, but consideration may first be given to the work of Thayer on concealing coloration and to Mottram's researches on the general principles underlying the colour patterns of animals.

Concealing and Revealing Coloration.—Thayer established that what he terms obliterative countershading is of very general occurrence, *i.e.*, that in most animals the colour grades from dark on the back to pale below, tending to counteract the effect of light falling from above and so to conceal the solidity of the animal when seen against a background of the same tint. He also proved that many patterns that appear very conspicuous when an animal is seen out of its natural habitat may help to conceal it in its usual surroundings. Markings tend, by their separate and conflicting patterns, to obliterate the visibility of the details of boundary and form, and when an animal is covered by sharply contrasted bold patterns of pale and dark the contour will be broken up against either a pale or a dark background; such patterns, cutting up the aspect of the animal, Thayer terms seccant. The white rump marks of the prong-buck would be seen against the sky by a crouching carnivore and at night would merge into this background, rendering the animal almost invisible.

Although Thayer's researches are valuable, he goes too far in claiming that all patterns are for concealment, and some of the pictures which he gives with specially painted backgrounds are not very convincing. Mottram has shown that a pattern of dark and pale squares, spots or stripes blends to a uniform colour at a distance which is dependent on the size of these areas. In many mammals the effect of obliterative countershading is produced by many or large dark spots, or broad dark stripes on the back, gradually changing to few or small spots or narrow stripes, below. The zebra has stripes of this type, and Mottram considers that at the blending distance this pattern has the advantage over obliterative countershading, as it produces a blurred outline. With the cheetah the spots are closer together on the back. Within the blending distance such patterns may imitate the surroundings, but Mottram thinks this is unusual, and contrasts the striping of the tiger, effective for concealment among reeds, with that of the zebra, which would in his opinion be ineffective in such an environment. Mottram finds that most concealing patterns break out along the animal's margin and tend to obscure its characteristic shape, whereas revealing patterns often follow the margin and tend to accentuate the animal's shape and to isolate it from its surroundings. A pattern of this kind, commonly seen in butterflies, is a broad black band following the outer margins of both wings and often enclosing a brilliant yellow or blue central area. Experimental evidence and the study of the habits do not bear out the view of Thayer and his school that all coloration is for concealment.

Without observation of an animal in its natural surroundings it may be difficult to comprehend the meaning of its coloration. A number of unrelated species of sea-perches of the large genus *Epinephelus* are covered with more or less hexagonal reddish spots separated by a pale network. The reason for this was made clear by Alcock. He was in a boat with an Indian fisherman who tried to spear a large fish of this type; the wounded fish at once made for an adjacent clump of corals, where it lay concealed, the red spots exactly resembling the coral polyps; although it could easily have escaped, the fish would not leave its shelter and was eventually captured.

Mimicry.—Poulton, who has made special study of mimicry in butterflies, has recently given an account of the most interesting and elaborate example known. An African swallowtail butterfly, *Papilio dardanus*, is represented in Madagascar and Abyssinia by closely allied forms, in which both sexes are alike and nonmimetic. Elsewhere in Africa the male is of the same type, but the females have lost the tails to the hind wings and differ from the males also in coloration, mimicking butterflies of a very different group, the Danainae. Three forms of female of *P. dardanus* mimic three very distinct Danaine patterns; two of these patterns are modified in passing from one area to another, and in the same regions the mimetic females are correspondingly altered. In Uganda and West Africa a fourth form of female occurs, mimicking two species of Acraeinae. Experimental breeding has shown that the different female mimetic forms may occur in the same brood.

The work of Gahan on mimicry in the Coleoptera is an important contribution to our knowledge of this fascinating subject. In this group mimicry is not so restricted as in butterflies; beetles may mimic ants or wasps, and may be mimicked by flies or moths. Gahan points out that there are some who believe that mimicry is wholly the result of chance. Nature, they say, who is engaged in turning out thousands upon thousands of different patterns, is bound sometimes to repeat herself.

Although this may possibly be the true explanation of a few such resemblances, Gahan rejects it for the great majority. Pascoe had pointed out a close similarity in appearance between two unrelated species of beetle from widely separated parts of the world, but Gahan remarks that this is not due to chance, but to the fact that both species are mimics of ants. The beetles of the family Lycidae are conspicuously coloured, fly slowly and secrete distasteful liquids. They show little diversity in form, and, in the same region, but little in colour, most of the Asiatic species being red and the South American black and yellow. Thus they are easily recognised, and it is established by observation and experiment that they are singularly free from the attacks of insectivorous birds and mammals. Wherever the Lycidae occur, they form mimetic associations and are mimicked by day-flying beetles of other families, and sometimes also by day-flying moths and other insects. Some critics have suggested that mimetic resemblances are due to the direct action of the environment, or to similarity in habits and mode of life, or even to relationship, the species concerned being supposed to have retained their ancestral coloration, while they have diverged in structural characters.

To this Gahan replies that the Lycidae and their Longicorn mimics belong to widely separated groups; they differ from one another as larvae as much as they resemble one another when they reach the perfect state, and they lead a different kind of life. Gahan contrasts with the uniformity of the Lycidae the diversity of the Cerambycidae, which are not protected by a distasteful secretion. Many of these look quite unlike their nearest allies, but show a close resemblance in form, size and colouration to unrelated insects, either noxious beetles of other families or stinging insects such as wasps. In the coloured plate[1] (see note below) are shown a number of Cerambycidae and the insects that they resemble, the mimics (Cerambycidae) being placed on the left (figs. 1 to 7), their models, wasps (figs. 1*a* to 4*a*, 7*a*) and noxious beetles (figs. 5*a*, 6*a*) on the right. Attention may particularly be directed to the fact that the beetles have one pair of wing-covers, or elytra, and one pair of wings, whereas the wasps have two pairs of wings, and that the one pair of wings of the mimics generally resemble the two pairs of their wasp models in form, size and colour. As a rule the elytra are small and inconspicuous in the mimicking beetles, but there are some exceptions: for example, in *Acyphoderes odyneroides* (fig. 7) the wing-cases have a glistening appearance, imitating transparent wings. In an Australian species, *Tragocerus formosus* (fig. 4), the elytra are quite long and are coloured with bands of black and red to look like the banded abdomen of the wasp; moreover, the elytra are strongly emarginate on the outer edges near the base, giving free play to the wings when the elytra are kept close together. The same wasp serves as a model for another beetle (*Esthesis ferrugineus*) belonging to quite a different group from *Tragocerus*, and in this the resemblance is brought about in another way, the elytra being short and the abdomen banded.

Gahan points out that mimicry is unknown in beetles that fly by night, which as a rule have a colouration that harmonises with the object on which they rest during the day. He concludes that one of the chief operating causes in bringing about mimicry must be some agency that is at work only in the hours of daylight, and he thinks that the facts of mimicry strongly support the theory of natural selection, which is the only one that offers an adequate explanation of them.

Critics of the natural selection theory have naturally turned their attention to mimicry, especially in relation to butterflies, the main group that has been studied in this connection. Some critics have asserted that butterflies are not attacked by birds, the enemies believed to be responsible for the deceptive resemblance of mimics to models. Attention having been thus directed to the subject many naturalists have made a special study of it. and have proved this assertion to be unfounded.

Under the heading of mimicry may also be considered the work of Stuart Baker (1923) and Jourdain (1925) on the eggs of cuckoos. These birds form a large family with a nearly cosmopolitan distribution; most of them have the habit of laying their eggs in the nests of other birds, which hatch and rear the young cuckoos. The eggs of those species of cuckoo which make their own nests and rear their own young are white or pale blue in colour, but the eggs of the so-called parasitic cuckoos exhibit a great diversity, generally resembling those of the birds in whose nests they are laid. Some cuckoos—for example our British species—are polymorphic as regards the colour of the eggs; individuals of such forms not infrequently lay in nests of birds whose eggs they do not match; some of these birds appear to take no notice, whereas others may eject the egg or desert the nest.

Baker gives some interesting examples of dimorphism, *e.g.*, *Cuculus pliocephalus*, which in Japan lays chocolate eggs only, in the Himalayas white ones, but in Assam both kinds, generally in appropriate nests; and *Hierococcyx sparveroides*, which lays pale blue eggs in the nests of laughing-thrushes and olive brown ones in those of the giant spider-hunter. Baker, who has formed and studied a collection of over 2,500 eggs of cuckoos from Europe, Asia and Australia, says that several species lay only one type of egg, and these always choose the same foster-parents. Thus the two commonest Indian species, *Clamator jacobinus* and *Hierococcyx varius*, lay their deep blue eggs in nests of birds of the common Indian genera *Argyra* and *Turdioides*, the eggs of which are extremely similar; and a large Indian cuckoo, *Eudynamis scolopaceus*, has its eggs pale blue, blotched with red, coloured like those of the Corvidae which it uses to rear its young.

Colour Changes in Fishes.—A great advance has been made in our knowledge of colour changes in fishes, especially through the experiments of Mast (1916). The tropical sea-perches from Bermuda in the New York Aquarium are a source of constant interest to visitors on account of their changes of colour and markings, one species suddenly changing from crimson to dull green, another from yellow to red or dark brown, whilst a third may turn on or off cross-bars, spots or other markings. These changes appear to have little meaning under such conditions, although Townsend has noted that alarm generally produces a pale colouration and excitement and intensification of pattern; but under natural conditions the different colour-phases may harmonise with different environments. The flat-fishes have long been known to simulate closely the ground on which they lie. Sumner, experimenting with a Mediterranean flat-fish (*Platophrys podas*), obtained some remarkable results by placing them on patterns such as black and white squares, to which they were not accustomed in nature; on such backgrounds the fish responded more slowly than when placed on sand, gravel or mud, but with practice acquired the power of changing more rapidly than at first. The capacity of this species to adapt itself is limited to the black, brown, grey and white of its customary habitat; also it has definite spots and markings, which vary in their relative intensity and may disappear, but when present always have the same form or position. Thus pale and dark areas are reproduced by areas of about the same size, but not of the same form; squares and circles produce the same effect.

Mast has carried the matter much further; for he has found that flat-fishes of the genus *Paralichthys* on white, grey, black, brown, blue, green, yellow, orange or pink assume a colour very near that of the background, but that reds are less accurately simulated. Yellows and browns take much less time to copy than reds, greens or blues; for the latter some days may elapse before the full effect is produced. These effects are produced by the concentration or distribution of granules of pigment in the pigment-cells of the skin, under the control of stimuli received through the eyes. The flat-fish has to see the ground before it can resemble it, but there is no visual comparison of skin with ground.

One important result of Mast's experiments is that he concludes that in respect to motion and colour the vision of these fishes is much the same as human vision, although it is less acute in distinguishing differences of size and form. It is a fair assumption that, if the colour vision of these fishes is like our own, this is true of vertebrates in general; thus an argument that has sometimes been urged in relation to the adaptive coloration of insects, that we have no evidence that the exact resemblance to the surroundings or to other insects is necessary to deceive birds, loses much of its validity.

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(C. T. R.)

COLOUR VISION AND COLOUR BLINDNESS.—The images of external objects are formed upon the outer layer of the retina, the layer furthest away from the front of the eye, so that the light has to pass through all the other layers before it reaches the sensitive portion. This sensitive layer consists of two elements, which are called respectively, on account of their shape, the rods and the cones. A slight depression in the centre of the retina, the fovea, is the region of most distinct vision. In the fovea, only cones are present.

In the region external to the fovea each cone is surrounded by a group of rods, and the number of rods to cones increases as portions of the retina further from the fovea are taken, except at

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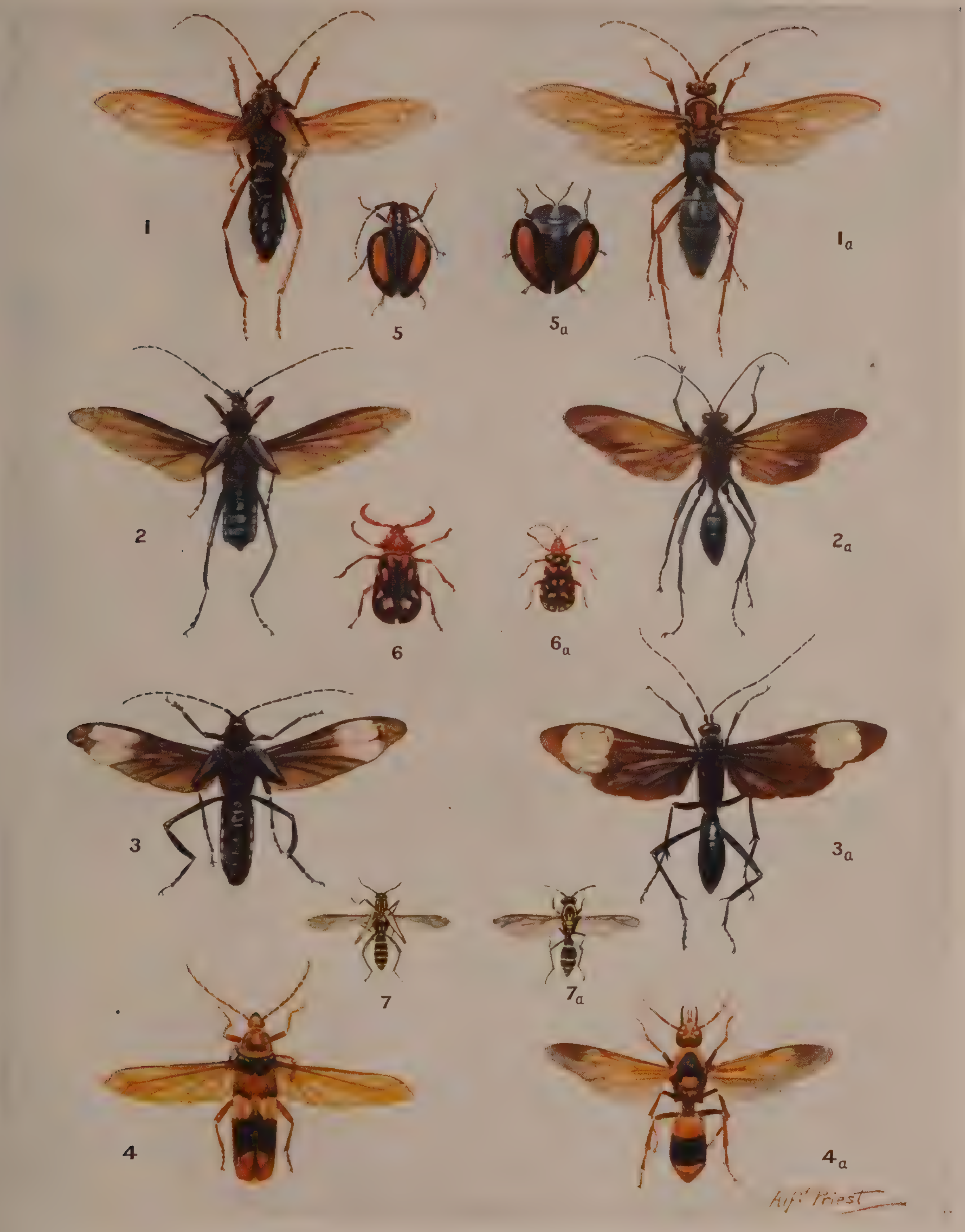
[1] Explanation of Plate.—Mimetic Beetles and their Models.

Mimics (Cerambycidae)	*Models*	*Habitat*
Fig. 1. Nothopeus auricomus.	1*a*. Salius ceylonicus (Wasp) .	Ceylon
Fig. 2. Nothopeus hemipterus	2*a*. Macromerus splendida (Wasp)	Burma
Fig. 3. Nothopeus fasciatipennis	3*a*. Mygnimia princeps (Wasp)	Borneo
Fig. 4. Tragocerus formosus .	4*a*. Abispa ephippium (Wasp) .	Queensland
Fig. 5. Ites plagiatus . .	5*a*. Mesomphalia Latevittata (Beetle, Fam. Cassididae) .	Ecuador
Fig. 6. Ctenodes decemmaculata	6*a*. Cephalodonta spinipes (Beetle, Fam. Hispidae) .	Brazil
Fig. 7. Acyphoderes odyneroides	7*a*. Polybia liliacea (Wasp) .	Brazil


1
5
5a
1a
2
6
6a
2a
3
3a
7
7a
4
4a
Alfd Priest

MIMETIC BEETLES COMPARED WITH THEIR MODELS

Palatable Beetles of the family Cerambycidae (1-7), compared with wasps (1a-4a and 7a), and unpalatable Beetles (5a and 6a), showing the striking similarity in appearance.

the extreme periphery, where, again, only cones are found. In the outer segment of each rod there is a rose-coloured substance, the visual purple, which is photo-chemically sensitive to light. This visual purple is not found in the cones, but only in the rods. For this reason it was not considered to be essential to vision, because it was absent from the cones, and only cones are to be found in the fovea, the region of most distinct vision. Though visual purple is not present in the cones of the fovea, it is found between them, four special canals aiding the flow from the periphery to the centre of the fovea. When there is no visual purple in the fovea it is blind, as shown by the varying sensitiveness of the fovea, and the disappearance of objects in the central area of vision when there is no stimulation of the periphery. The rods and cones project into a thin layer of fluid, which is kept in its place by a membrane.

The visual purple is diffused into this liquid and on being decomposed by light stimulates the cones, thereby setting up a nerve impulse, which causes the sensation of vision. The movement of after-images shows that the stimulus in vision is fluid and situated outside the cones. The rods are not percipient elements but regulate the formation and distribution of the visual purple.

The decomposition of the visual purple by light stimulates the ends of the cones, and a visual impulse is set up which is conveyed through the optic nerve fibres to the brain. The character of the impulse differs according to the wave-length of the light causing it. Therefore, in the impulse itself we have the physiological basis of the sensation of light, and in the quality of the impulse the physiological basis of the sensation of colour. The impulse, being conveyed along the optic nerve to the brain, stimulates the visual centre causing a sensation of light, and then, passing on to the colour-perceiving centre, causes a sensation of colour. But though impulses vary in character according to the wave-length of the light causing them, the colour-perceiving centre is not able to discriminate between adjacent impulses, the nerve cells not being sufficiently developed for the purpose.

Even with the normal-sighted, there is room for much further development in the discrimination of colour, but when the development is not up to the normal standard, or there is a defect in any portion of the apparatus diminishing the power of discrimination, colour blindness is the result.

On numerous points in the above theory there is no evidence. We do not know whether one nerve cell is able to appreciate all colours according to its stimulation by impulses of varying character, or whether distinct nerve cells are required for different colours. We do not know whether nerve impulses differ in character, but we do know that light and colour perception are quite distinct and, therefore, we require a different set of nerve cells for the perception of light and colour. The colour-perceiving cells may be only indirectly connected in the visual path.

Though the position of the visual centre in the brain has been accurately determined, the position of the colour vision centre is still unknown. It may, indeed, be in some portion of the visual tract between the eye and the visual centre. For instance, one portion of the end of the cone when stimulated may possess fibrils which are either connected with, or pass through, a portion of brain giving rise to the sensation of red, whilst stimulation of the other end of the cone stimulates fibrils which, with their neural connections, give rise to the sensation of violet. The intermediate portions give rise to the sensations of green, yellow and blue. There is a considerable range both at the red and the violet ends of the spectrum which does not vary in hue, but only in luminosity, and it is therefore extremely probable that rays from these regions affect only one portion of the cone respectively, but in different degrees.

Colour Blindness.—Now, whether the colour vision centre be above or below the visual centre, the results will be the same. The nerve fibrils from one end of the cone may be connected with one side of the colour vision centre so that stimulation of one side of the centre causes the sensation of red and the other side the sensation of violet, and stimulation of the intervening portions the sensations of yellow, green and blue. It should be noted, however, that this does not support the trichromatic theory, because there is the strongest evidence showing that colour sensation can be abolished without interfering with light sensation and that the colour perceiving centre—whether it be above or below the visual centre—is more easily affected than the latter. A man may entirely lose his sensation of colour without interference with his perception of light and form, as in a case of a signalman on the railway who became totally colour blind after tetanus.

Again, the continued use of the eyes for colours of high luminosity may cause colour blindness. After an illness a person may become temporarily colour blind. A man, after an attack of influenza, was so colour blind as to designate the whole of the green region of the spectrum as white. Tested with the lantern he called green, white and red; red, white; and white, red. A few months afterwards his colour sense was quite normal. There is much less likelihood of an accident occurring through acquired colour-blindness than congenital, because in acquired colour-blindness the man knows that his colour vision has altered.

Cases of colour blindness may be divided into three classes, which are quite separate and distinct from each other though one or more may be present in the same person. In the first class there is light as well as colour loss. In the second class the perception of light is the same as in the normal-sighted, but there is a defect in the perception of colour. In the first class certain rays are either not perceived at all, or very imperfectly. Both these classes are represented by analogous conditions in the perception of sounds. The first class of the colour blind is represented by those who are unable to hear very high or very low notes. The second class is represented by those who possess what is commonly called a defective musical ear. Colour blind individuals belonging to this class can be arranged in a series. At one end of this series are the supernormal-sighted and at the other end the totally colour blind. In the third class of the colour blind there is defective perception of colour through the fovea or central region of the retina not being normal.

Tests.—The test which should be used for the marine and railway services is a lantern in which the requisite conditions are represented. A lantern of this kind is used in Great Britain by the Admiralty and the Board of Trade. A man who cannot distinguish the red, green and white lights in these lanterns will not be able to do so in actual practice, and this fact is easily proved by testing with signal lights.

The wool test is a failure. It is now obsolete, as it allows over 50% of dangerously colour blind persons to pass, and it will be noticed in certain reports that of those who were rejected by the wool test and who appealed, over 50% were found to be normal-sighted and had been wrongly rejected. See F. W. Edridge-Green, *The Physiology of Vision* (1920). (F. W. E.-G.)

COLUMBIA UNIVERSITY (*see* 6.739).—The work of Columbia University during the period 1910–25 was greatly extended. A school of journalism was founded in 1912, a school of business in 1915, a school of dentistry in 1917 and a school of library service in 1926. The degrees of doctor juris (J.D.) and bachelor of science in engineering were established in 1923. By agreement with the Presbyterian Hospital the university will rebuild the school of medicine on property adjoining the new hospital buildings as the nucleus of a great medical centre. In co-operation with the Ministry of Education in Porto Rico the university in 1924 assumed responsibility for educational and scientific work of the school of tropical medicine on the island of Porto Rico. Three research institutes have been organised—the Institute of Educational Research, the Institute of Cancer Research and the Institute of Public Health. In order to render the largest possible service to the community, courses in university extension were organised for men and women who could give only a portion of their time to study, but who desired to pursue subjects included in a liberal education. These courses, as such, do not lead to degrees, but may be offered as credit toward a degree under one of the faculties. Under university extension there was organised also an Institute of Arts and Sciences which conducted a series of lectures and recitals of a popular nature, as well as a system of courses for home study for persons unable to attend classes in the university. These courses also do not lead to academic credit or degrees. Women are admitted by all faculties of the university with the exception of those of law and applied science. During the period 1910–26 the physical equipment of the university was greatly increased by the addition of Kent Hall, Philosophy Hall, the President's House, Avery Hall, School of Journalism, Furnald Hall, Crocker Research Laboratory, School of Business, Russell Hall, Barnard Hall, Faculty House, Physics Research Laboratories, an additional wing to Havemeyer Hall and four faculty residential halls and John Jay Hall. The university has acquired by gift of Geo. F. Baker 28 ac. of land at the upper end of Manhattan I. for use as an athletic field. In 1924 there were in Columbia University in all departments 2,000 instructors and administrative officers, and in the twelve months ending June 30 1925 were enrolled 34,845 students. Of these, roughly one-third were registered in the 1924 summer session; one-third in the degree-granting schools and faculties during the academic year 1924-5; and one-third in university extension during the academic year 1924-5.

The productive endowment of the university, including the endowments of Teachers College, Barnard College and the College of Pharmacy, amounted in 1924 to $57,456,803, which, added to the property occupied for educational purposes, made a total capital investment of $93,162,938. To meet the increased costs of education, the fees in the several schools were raised so that they ranged in 1925 from $300 to $500. The alumni of the university were given a definite part in the government of the institution by an agreement under which 6 of the 24 trustees were elected on alumni nomination. In 1912 the corporate title of the university was changed from the " Trustees of Columbia College in the City of New York " to the " Trustees of Columbia University in the City of New York.".

The university took an active part in the World War. Immediately upon the severance of diplomatic relations with Germany in Feb. 1917, it placed its resources, both physical and intellectual, at the service of the Government. There were established at the university, schools for training men for both the army and the navy, including work in radio, photography, quartermaster's routine, explosives, gas-engines, submarine detection and the Students Army Training Corps, which prepared men for the various officers' training camps of both armed services. Students, faculty and alumni to the number of 4,125 were enlisted in the army and navy, and 2,175 left their previous occupations and assisted the Govt. in some one of the civilian branches. Two hundred Columbia men died in the War. (N. M. B.)

COLUMBUS, O., U.S. (*see* 6.746), increased in population 30·6% in the decade after 1910, reaching 237,031 in 1920, of whom 22,181 were negroes (an increase of 74·1 % due to migration from the south) and 16,187 foreign-born (a slight decrease). In 1925 the census bureau estimate was 279,836. The area was 13,018 ac. in 1910, 14,427 in 1920, 22,705 in 1925. The factories within the city limits had an output valued at $49,032,000 in 1909, $184,022,000 in 1919, $186,842,798 in 1923; and an average force of 16,428 employees in 1909, 26,751 in 1919, 27,618 in 1923.

In the floods of 1913 about 100 lives were lost, three bridges were destroyed, over 4,000 dwellings were flooded and some 20,000 persons were temporarily homeless. Flood-protection works undertaken to prevent a recurrence of such losses involved a widening of the channel of the Scioto, building revetments and reconstructing three bridges in addition to replacing the three that were destroyed. Columbus took advantage of the home rule amendment (1912) to the state constitution, adopting a new charter which, taking effect on Jan. 1 1916, provided for a mayor as executive, a legislative council of seven elected at large, a non-partisan ballot, preferential voting, the recall of elected officials and the referendum. A city planning commission was created in 1920; a zoning ordinance was adopted in 1923.

Ambitious plans were made for a civic centre on the Scioto river, embracing two of the new concrete bridges, the central high school on the west side of the river, completed in 1925, a new city hall to replace the one destroyed by fire in 1921, a Masonic temple (site acquired), an Oddfellows' temple and the proposed building of the City Federation of Women's Clubs. The city's water supply was greatly increased by the construction of the O'Shaughnessy dam (1922–4) to impound 5,000,000,000 gal. in a reservoir covering 800 acres. One of the three general reserve depôts of the U.S. Army is located in east Columbus on a government reservation of 281 acres. The warehouses, built in 1918, have a floor area of 2,406,334 sq. ft., and the supplies stored in them (1924) represented a value of $150,000,000. Norton Aviation Field was established near by in 1923. In 1922 Columbus Barracks was chosen as headquarters of the V. Corps area of the army, and later was renamed Fort Hayes. Ohio State University had a registration of 9,002 students in the autumn of 1925. Its magnificent horseshoe stadium, which covers 10 ac. and has permanent seats for 62,110, was opened in 1922.

COLYN, HENDRICK (1869–), Dutch politician, was born June 22 1869 at Haarlemmer Meer, Holland. After serving as a government official in the Dutch East Indies, he returned to Holland in 1909 and became a member of the Second Chamber. From 1911 to 1913 he was Minister for War. In 1914 he left politics and became manager of the Batavian Oil Co., a position which he held until 1919. From 1919 until 1922 he was managing director of the Asiatic Petroleum Co. and director of the Royal Dutch Shell and Anglo-Saxon Companies. In 1922, after the death of Abraham Kuyper, Colyn returned to political life as leader of the anti-revolutionary party. He became Minister of Finance in 1923, and retained this portfolio in the new Cabinet formed by him in 1925 and which resigned after a few months. Colyn, who is a sound business man, contributed much toward the balancing of the Netherlands Budget after the World War.

COMBES, ÉMILE (1835–1921), French statesman (*see* 6.751), was one of the five Elder Statesmen in the Briand Ministry of 1915–6, but without portfolio. He died May 25 1921.

COMBINE: *see* TRUSTS.

COMBING: *see* TEXTILE MACHINERY.

COMMERCE, DEPARTMENT OF, one of the executive departments of the U.S. Government. It succeeded the earlier Dept. of Commerce and Labour by an Act of Congress, approved March 4 1913, which also created a separate and independent Dept. of Labour (*see* LABOUR, DEPARTMENT OF). The Secretary of Commerce is a member of the President's Cabinet but is not in line of succession to the Presidency. It is his duty to promote the commerce, domestic and foreign, of the United States. There is also an assistant secretary and a solicitor, the latter acting as legal adviser to the secretary and to the heads of the various bureaux of the department.

As originally organised there were nine bureaux, as follows: (1) The bureau of the census, charged with the collection of data concerning population, agriculture, manufacture, mining etc.; (2) the bureau of foreign and domestic commerce, for the collection and diffusion of information of use to the manufacturer and exporter; (3) the coast and geodetic survey, for charting coast waters and surveying rivers to the head of tidewater or ship navigation and for making deep-sea soundings, magnetic observations, etc.; (4) the bureau of fisheries, for regulating and conserving fisheries; (5) the lighthouse service, in charge of the aids to navigation on all U.S. territory, except Panama and the Philippines; (6) the bureau of navigation, having general superintendence of the commercial marine and merchant seamen, and the enforcement of navigation laws; (7) the steamship inspection service, which inspects steam vessels for the purpose of ensuring safety at sea, and issues licences to masters, mates, pilots and engineers of the merchant marine; (8) the bureau of standards, for determining all American measurements; and (9) the bureau of corporations. The last-mentioned bureau, on March 16 1915, was transferred to, and merged with, the Federal Trade Commission (*see* FEDERAL TRADE COMMISSION). In 1925 two bureaux were added, being transferred from the Dept. of the Interior by order of the President: the Bureau of Mines, which investigates scientific and economic problems in the mining, metallurgical and quarrying industries; and the Patent Office, which issues letters patent, including designs, and registers trade-marks and commercial prints and labels under the copyright law.

Because of the importance to manufacturers, there had long been agitation among various commercial organisations of the United States for the creation of a governmental department for promoting commercial interests; but it was not until 1903 that a bill establishing the Dept. of Commerce and Labour was passed by Congress; it was approved by President Roosevelt, Feb. 14. For the next 10 years the joint interests of labour and capital were entrusted to this department. The arrangement proved unsatisfactory because of the frequent conflict of these interests, and, in 1913, an independent Dept. of Labour was created, the name of the Dept. of Commerce and Labour being changed to Dept. of Commerce.

COMMERCIAL EDUCATION.—The history of commercial education is rather a chequered one. On the whole, much has been done, but done piecemeal, and no adequate general plan has been made to grapple with the problem, because the state has been slow to concern itself with it, as with elementary, secondary and even technical education. Commercial education, when recognised at all, has frequently been looked on as a sort of poor relation of the latter.

I. IN GREAT BRITAIN

The Institute.—The beginnings of public commercial education in England may be largely ascribed to the activities of the Mechanics' Institutes in the early and middle periods of the 19th century, in which evening classes in both bookkeeping and languages gradually grew up. These were succeeded by Technical Institutes, such as the Birmingham and Midland Institute and the Manchester high school of commerce. In fact, up to 1890, and even later, the north of England and the Midlands were, as regards commercial education, in advance of London and the rest of the country. In 1890 the School Board gained the right to undertake evening work. This ultimately led to the country being covered with a network of evening schools. The work at first was of a rather elementary nature, consisting of bookkeeping, shorthand, typewriting, English and often French. The Technical Education Act likewise gave a considerable impetus to the spread of commercial education in Polytechnics and similar institutions.

Still the movement had to face a good deal of opposition, or at least inertia, mainly from the widespread belief, which has not yet entirely disappeared and which is based on a half-truth, that commerce is best learned in the shop and the counting-house. Again, there was a good deal of muddle-headed thinking on the subject. Mr. Sidney Webb, who was one of the first to clarify public opinion on the subject, pointed out in a London conference held at the Society of Arts in 1897 that the term commerce covered a multitude of things—a vast number of distinct callings, from accountancy and banking to typewriting. It therefore involved an education of very varying degree, from elementary to university.

Universities.—Mr. Sidney Webb was largely responsible for the creation in 1895 of the London School of Economics and Political Science as an institute for higher commercial work. Beginning largely as a college for evening work, it subsequently developed a flourishing day side, and became a school of London University. Further developments in the course of higher education were the creation of faculties of commerce in the University of Birmingham (1900) and the re-constituted University of Manchester (1904), while London in 1917 established a bachelorship and mastership of commerce. A commercial degree can also be obtained at Newcastle (University of Durham) and at Liverpool a B.A. is awarded for proficiency in certain commercial subjects.

Economics figure as a prominent subject in the syllabus of other universities, but are taught mainly on theoretical lines, and no degree in commerce is obtainable. Probably the most complete choice of subjects for commercial study is offered by the London School of Economics and Political Science, amounting to nearly 270 courses given by some 80 lecturers and assistants. More than half of its departments are concerned wholly or partially with commerce. The school prepares for the bachelor of commerce and master of commerce, and provides for research work

Schools of Commerce.—Below the universities come the various day schools of commerce, often forming a section or department of a technical institute. The age of entry is generally 16, and some prepare for the bachelorship of commerce. Such are, for instance, the City of London College, the Regent Street Polytechnic Higher School of Commerce, the West Ham Technical Institute, with its course in commerce (three years), the Manchester municipal high school of commerce. There are also junior commercial schools, where the age of entry is usually 13 and the course is two years (occasionally three). Such schools (generally forming part of a technical institute) are to be found at Chatham, Blackburn, Southport, Wigan and other places.

Secondary Schools.—Certain secondary schools, like Hackney Downs and Holloway (London), prepare their students for degrees in commerce, while at least one of the public schools (Bradfield) has a definite commercial section. A large number of girls' secondary schools also do commercial work, which in many cases is confined to pupils who have passed the first school examination. In others it is begun by pupils of 15 who desire to specialise in commerce. Typewriting, shorthand and bookkeeping, with commercial French, history and geography, are the staple subjects.

Higher Elementary Schools.—Up to 1908 the curricula of the higher elementary schools were based on lines giving a general education. In that year, the London schools of this type were reorganised with a dual bias, commercial and technical, and renamed Central—a school might have one or both sections. The London Central School largely became the model for other central schools for the rest of the country. In the voluntary day continuation school, the teaching, which at the outset was general, became, in London at least, largely commercial.

Evening Work.—Some evening work in the London School of Economics and elsewhere is of university standard. Below this ranks the work of the evening schools, many of which, especially in the country, are situated in technical institutes, notable examples being the Manchester and Birmingham Municipal Schools of Commerce, the Hull Central School of Commerce, the Bradford Commercial College, the City of London College and the 24 London Evening Institutes.

The range of work is considerable, and, apart from typewriting, shorthand and bookkeeping, includes preparation for examinations in accountancy of all kinds, banking, insurance (life, fire, marine), railway administration, civil service (post-office, inland revenue, customs and excise), courses for solicitors' or stockbrokers' clerks, for secretaries or grocers' assistants. This involves classes in economics, including economic history and geography, and the economics of shipping, railways, etc.; the theory and practice of commerce, banking, currency, foreign exchanges, statistics, the machinery of business secretarial practice, knowledge of commodities, law of all kinds—general, conveyancing, banking, company, commercial, mercantile, marine, joint stock, income tax, etc.

The teaching in languages comprises French, German, Spanish, Italian, Esperanto and other less known languages. Again, by the course system, all students under 18 who have not had a good secondary or central school education are obliged to take a course in which a language often forms a part. Students enter the institutes at sixteen. Below these are the junior institutes, usually entered at 14, where all the pupils are obliged to take a course. In some of these, French is taught. They are generally affiliated to senior institutes.

Private Initiative.—There also exist a number of schools attached to big business houses, as well as many private institutions, which prepare mainly for the lower and intermediate walks of commerce and the Civil Service, such, for instance, as Pitman's and Clark's colleges. Two hundred thousand young people had successfully passed through the latter up to 1926, while Pitman's trains over 10,000 students a year.

Examinations.—In addition to the examinations mentioned above, and some higher commercial certificates, a large number of students in the evening institutes and elsewhere take the examination of the Society of Arts, the Chamber of Commerce and other societies. The Society of Arts held its first practical examination in 1856, and among the subjects were French and bookkeeping. The candidates, mainly drawn from mechanics' institutes, numbered 56. In 1925, the number of papers worked was over 70,000. The London Chamber of Commerce, which began in 1890 with 65 candidates and 17 passes (all junior), had, in 1925, 22,114 candidates, with 12,159 passes. Since its inception, 246,346 candidates have entered for its examinations, and 129,333 have passed. (C. Bre.)

II. IN THE UNITED STATES

The agencies which provide for the training of those who enter upon commercial vocations are public secondary schools, private business colleges, correspondence schools, corporation schools and colleges of commerce.

Private Institutions.—The oldest of these institutions is the private business college. In 1910 the number of persons registered in such institutions was 134,778; in 1915 this number had increased to 183,286; and, in 1920, the number was estimated to be somewhat more than 300,000. The private business school flourishes because it usually gives shorter courses than the public high school, and because it makes provision for individual students by allowing each one to progress as rapidly as he can, and by assuming more responsibility for securing positions for graduates at the end of the course.

Public High Schools.—The number of commercial courses given in public high schools has increased rapidly in recent years. In 1922 there were 191,901 pupils in public high schools taking shorthand and 281,524 taking typewriting. In addition there were pupils taking courses in commercial arithmetic, commercial law, commercial geography and other commercial subjects. There are no reliable statistics earlier than 1922 to show the rate of increase in these subjects, but two indications are to be found in the following facts: In 1915 there were 39,816 pupils registered in book-keeping; this was 3·42% of the total number of pupils registered in these schools. In 1922 the registrations in book-keeping were 270,517, or 12·55%, of the total high-school population.

In 1911 a survey made by the City Club of Chicago showed that as much money was being paid to private business colleges in that city, in the form of student tuitions, as the city was paying for the maintenance of all its public high schools. These findings led to the rapid development of high-school courses in commercial subjects. What happened in Chicago is paralleled in all parts of the country. The competition of the private institutions has led the public high school not only to introduce commercial courses, but also to attempt to give the training necessary for entrance on practical positions in as short a period and as early in life as possible. The result is that there are in many high schools two-years' commercial courses. In some cases the experiment has been tried of offering commercial courses to pupils in their seventh and eighth school years. The experiment has, however, in general proved unsuccessful, because pupils at this stage are not sufficiently trained in fundamentals to make them mature enough for practical positions.

There are two methods of providing commercial courses in public high schools. In some cities separate schools called commercial high schools are organised; in others commercial courses are conducted as electives in a general high school. The quality of the students who take commercial courses has improved in recent years. In earlier years only students incompetent in other lines were usually to be found in these courses. The quality of the teaching staff is often inferior. Until very recently there have been no higher institutions which give advanced courses, and teachers were recruited from private business colleges or selected from among the secretaries who wished to withdraw from business.

Universities and Colleges.—A number of universities and colleges have set up business divisions. The first institution of this type in the United States was the Wharton School of Finance and Economy of the University of Pennsylvania, founded in 1881. There were 22 such schools in 1921, a number of them giving graduate courses. The student registration in these schools is estimated at 20,000.

Corporation Schools.—The corporation commercial schools are of various types according to the needs of the concerns which organise them. In retail stores there are schools for the training of salesmen and saleswomen; in insurance companies there are schools for salesmen and managers; in banks and houses with large accounting departments there are schools for office employees; and so on. The range of subjects covered in these corporation schools and the time given to instruction have steadily increased in recent years under the stimulation of business competition.

Courses similar to those given in the institutions described in foregoing paragraphs are made available to a great many persons through correspondence courses and night sessions of high schools. By these means persons who are regularly employed may take courses during unoccupied hours. It is estimated that 38,495 persons were pursuing correspondence courses in 1922, and 842,863 were registered in city evening schools. (C. H. J.)

COMMERCIAL TREATIES.—Down to the outbreak of the World War of 1914, almost all states in the world were linked together by a close network of commercial treaties, by means of which the need of each country for customs revenue and for protection of its products could be reconciled with the ever-increasing need for expansion of foreign markets resulting from the growth of industrialisation.

The War made a serious breach in this development. It is true it did not alter the basic principles of the policy of concluding commercial treaties, but it brought financial and protectionist interests so strongly into the foreground that the interest in international trade was extraordinarily restricted and is only now beginning to receive greater recognition. Two forms are characteristic for all modern commercial treaties: tariff rates and the most-favoured-nation clause. By tariff rates are meant the concessions in the rates of the customs tariffs on both sides. Treaties which embrace both forms are called tariff-treaties and are preferred by states which carry on a very active commerce with one another. By far the greatest number of all commercial treaties are restricted to the most-favoured-nation (M.F.N.) clause; they are called most-favoured-nation treaties, for, although the first type also include M.F.N. treatment, this is subordinated to the tariff rates which constitute their chief feature. Treaties of a different type, merely comprising tariff rates without M.F.N. treatment, were of rare occurrence and were mostly a survival of an earlier period.

Most-Favoured-Nation Clause.—M.F.N. treatment secures to the treaty state equality of position with those foreign countries which receive most favourable treatment. In the form in which it has developed since the year 1860, it secures for this state not merely all the privileges which any other state has received in the past and still enjoys, but also those which it will receive in future, and moreover immediately and without additional compensation. There is, it is true, a still more favourable treatment than the foreign parity given by the M.F.N. clause, namely inland parity or national treatment, which places the persons and goods of the country concerned on an equality, not with those of other foreign countries, but with those of the nationals of the country itself; but its sphere of application is a different and at the same time a more limited one.

By its nature it only applies to such economic measures as are not confined to foreign goods and persons, such as import duties, admission of consuls, etc., but may affect both domestic and foreign goods and persons, so that discrimination in their treatment would constitute a new and arbitrary protection for the home country, *e.g.*, taxes on consumption, admission to trade and settlement, conditions for the use of railways and roads, etc. In oriental countries in which foreigners received special privileges, it sometimes occurred that the foreign parity was more favourable than the inland parity. Reciprocity, by virtue of which a favour is only accorded to the treaty state in return for an equivalent compensation, is less favourable than M.F.N. treatment or foreign parity. This principle was to be found in many commercial treaties down to the middle of the 19th century and still exists in later commercial treaties, in cases where it is a matter not merely of a passive permission, but of an active intervention on the part of the state, *e.g.*, the admission of joint-stock companies, privileges for commercial travellers, the granting of benefits of workers' insurance, etc.

There are several varieties of M.F.N. treatment. The unconditional is to-day the most common, but the conditional is also to be found, by virtue of which the treaty state has a right to a privilege granted to another country if it was given without compensation, but can only secure it for an equivalent compensation if this privilege has been acquired by the other country as a result of a concession on its part. This latter form is distinguished from reciprocity by the fact that it contains an obligation to grant equality of position when the necessary condition is fulfilled, which is not the case with reciprocity. Unconditional M.F.N. treatment has, it is true, the disadvantages (1) that it diminishes the value of every concession, because the area to which this applies is extended, (2) that it hinders a concession to one treaty state because this would subsequently benefit automatically a stronger competitor, (3) that by adapting the concession to the special conditions of the treaty state, its extension to the other most favoured countries can in practice be excluded. It has, however, the great merit that it guarantees to the treaty state equal competitive conditions in the territory of the other for the whole period of the treaty and greatly facilitates the conclusion of commercial treaties.

Conditional M.F.N. treatment involves fresh negotiations with the other states on the conclusion of each tariff treaty, and may give rise to technical and political difficulties which may endanger the whole treaty structure. The post-War period has brought about an interesting and characteristic change; while the United States in contrast to the European countries maintained before the War conditional M.F.N. treatment which, by its nature, is relatively unfavourable to the treaty method, they have gone over in the latest commercial treaties, *e.g.*, the treaty with Germany of Dec. 8 1923, to unconditional M.F.N. treatment. This change is attributable to an alteration in their commercial interests. Formerly they supplied mainly raw materials (cotton, copper, etc.), which the European states needed urgently for industries, while they constituted an important market for European manufactures and therefore were in a strong position when treaties were negotiated.

Now, however, the export interests of their industries have come into greater prominence and demand a modification of their foreign commercial relations. On the other hand, France, which before the War had not favoured the treaty method, is now contemplating, in accordance with the law of July 20 1919, the conclusion of commercial treaties in which reciprocal tariff concessions are granted, and has thus in theory returned to the principle of reciprocity. This policy has, it is true, been substantially modified in practice, for she has not merely allowed the former M.F.N. treaties to continue in force, but has also adopted M.F.N. treatment in newly concluded commercial treaties, though subject to considerable restrictions.

M.F.N. treatment as a rule binds both contracting parties to reciprocal treatment, but this is not a necessary condition, for in the treaties with countries in the East it only applies unilaterally in favour of the European states. The victorious states also chose the unilateral form for the Peace Treaties of 1919, but only for a period of five years; the Council of the League of Nations has made no use of the power granted to it to extend the application of this clause. In many commercial treaties of the former enemy states, the limitation was already set aside at an earlier date.

M.F.N. treatment can, however, be restricted not only in its form, but also in its contents. In its widest scope it covers all matters of trade and shipping, but in all cases it applies to the customs tariff and customs procedure. In the post-War period some states have restricted it to certain customs items or parts of the customs tariff. On the other hand, the commercial treaty between England and Germany concluded on Dec. 2 1924 contains reciprocal, unconditional, unlimited M.F.N. treatment.

Tariff Systems.—Tariff treaties depend largely on the tariff system which is at the basis of the tariffs of the treaty states. We can distinguish the single-line tariff, which has only one tax for each article for all countries, from the double tariff which consists of two columns of tariff rates of which the one with the lower rates is applicable to the most favoured countries, and the other with the higher rates to remaining countries. Depending on the origin of the lower column, the double tariff can be a general-conventional tariff in which only the higher general tariff is fixed by an autonomous law of the country concerned, while the conventional tariff is composed of the concessions or binding rates granted to other countries by commercial treaties.

By a binding rate is meant the transfer of a tariff rate from the general tariff to the conventional tariff at the same figure, in order to secure its application for the whole period of the treaty, since an autonomous tariff can at any time be modified by the country concerned, by a new law. The double tariff can, however, also be a maximum-minimum tariff, in which the column with the lower rate is also fixed by autonomous legislation and therefore provides the limit to which tariff concessions can be granted to foreign countries.

The single-line tariff which Great Britain and some countries of northern Europe have applied, necessarily involves M.F.N. treatment because it leaves no room for tariff concessions, but there is the possibility, of which Belgium has taken advantage, of granting tariff concessions by commercial treaties which are then taken over into the single-line tariff and thereby extended to all countries, whether or no they have granted M.F.N. treatment by treaty. In the general-conventional tariff which is predominant in Germany and other Central European states, the chief emphasis lies in tariff treaties with M.F.N. treatment. The maximum-minimum tariff is less favourable to the treaty method. This, although of Spanish origin, can to-day be described as the French tariff system, because the unilateral and therefore relatively high minimum rates offer small inducement to the conclusion of commercial treaties, and their autonomous regulation affords no security against subsequent increases. In its most extreme form it might result in the same article being subject to divergent tariff rates according to the country of origin, which would naturally exclude any M.F.N. treatment. Even if France herself has never gone so far as this yet, her commercial treaties in the post-War period exhibit great specialisation. In the treaty with Czechoslovakia of Aug. 17 1923 she grants some tax rates of the minimum tariff (list B), then some rebates from the tariff rates of the maximum tariff (list C) and applies elsewhere the maximum tariff. In the case of preference granted by France to Austria and Hungary, she extends unconditional M.F.N. treatment, but for the tariff rates of lists B and C only conditional M.F.N. treatment.

Post-War Changes.—The pre-War commercial treaties corresponded to the normal market conditions in which production outran demand, so that it was the concern of the seller to find a market for his goods and not of the purchaser to obtain the goods he required. The state only sought to facilitate the path of trade in foreign countries; whether and how far advantage was taken of this was the concern of the merchant. The scarcity of goods brought about by the War, however, upset the normal market conditions; instead of the purchaser the seller had the stronger position, and it was not the man who wanted the goods who dictated conditions, but the man who controlled their supply. Commercial treaties of the old type were temporarily pushed into the background by two new types; the compensation treaties and the treaties based on quotas, which are distinguished from the ordinary forms by the fact that the contracting states pledge themselves, not merely to permit movement of private trade, but to a definite undertaking. In the compensation treaties the state declares that it will supply specified quantities of certain goods, in return for which it receives others of which it is urgently in need. Here the obligation to deliver is in the foreground, since it is mainly a matter of essential goods, such as wheat, coal, etc.

Occasionally, as for example in the case of France in relation to Switzerland, there was also an obligation to accept delivery, when the other party was at pains to secure at least part of a market for its high-grade luxury products (embroideries) which it had lost as a result of the War. A condition of these treaties was the suppression of private trade and the setting up of state *Centrales* for the most important goods, because the state administration can only deliver goods which are under its own control. The treaties with quotas which arose later are distinguished from the above by the fact that the treaty states do not pledge themselves to the delivery of goods against goods, but merely agree to the issue of export licences for specified quotas of goods, for which it was also necessary that an import licence should be granted by the receiving state, but whose actual delivery, where the goods were not still subject to state control, remained in the hands of private trade. Such treaties were often not published at all but only communicated to the government departments and the undertakings concerned.

After the War, normal market conditions gradually returned, though less owing to a rise in production than to a general fall in purchasing power. The consequence of this equalisation of supply and demand on a lower level was that the struggle for foreign markets gave place to a struggle for the retention of the home market. Protection came so strongly to the fore that even England had to sacrifice part of its traditional free-trade policy. The Protectionist tendency was appreciably strengthened by the currency depreciation in many countries, which results in an export bounty for the products of the country concerned. The countries with high exchanges protect themselves against such exchange dumping by raising their import duties or by special additional duties (*e.g.*, Spain, Czechoslovakia). The countries with weak exchanges in turn are forced to prohibit imports of luxury goods, and to hinder payments to foreign countries by controlling exchange transactions, in order to prepare for stabilisation by improving the balance of payment. Hence it resulted that the protectionist system was even accentuated by a system of prohibitions such as people had believed to have finally disappeared with mercantilist ideas by the middle of the 19th century.

It is true that gradually the need for normal commercial treaties with M.F.N. treatment and tariff rates has been receiving greater recognition, but the after-effects of the conditions of political and commercial war have by no means vanished. The commercial treaties concluded before the War were determined by the belligerent Powers contrary to former custom, when their operation used merely to be suspended for the period of the War. Negotiations entered into since then have been confronted with such great conflicts of interest and uncertainty of conditions that often agreements could only be made for a year, terminable at three months' notice, whilst formerly they used to hold good for 10 years and more. M.F.N. treatment amongst the European states has often been only conditionally granted, and restricted to certain categories of goods. Further, events in Russia have caused a severe dislocation of the old-established trade relations, for she demanded the recognition of her state monopoly of the export trade and of the abnormal political institutions of the Soviet régime.

On the other hand, owing to the economic crisis and the political unrest of Europe, endeavours have been made to join certain states into a customs union by abolishing the customs duties between them. Thus abortive proposals were made that Austria, whose continued existence appeared hopeless, should be united to Germany or should join with other neighbouring states into a Danubian Federation. Schemes for economic union have also been discussed in the Balkans and between the Baltic states. But such preferential relations arouse political objections, because the union of economic interests may also bring about political ties, and are also impeded by the fact that the states receiving M.F.N. treatment are not willing to be excluded from the advantages of preferential relations. Up to now these ideas have nowhere been realised. (*See* also TREATIES.)

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COMMUNISM (*see* 6.791) is a special movement within Socialism (*q.v.*) with the same ultimate goal, namely the abolition of social stratification by the destruction of private ownership of the means of production.[1] By this means it is hoped to liberate the oppressed and to emancipate the proletariat. Communism is peculiar, in that, basing itself on the utterances of Marx and Engels, it holds that this end is *only* attainable by means of a revolution. Revolution is not rejected by Socialism as a last resort for overcoming historical and social obstacles; but communism regards revolution as *necessary* and a period of the dictatorship of the proletariat based on open terror as the only means of creating the socialist economic and social system.

Modern Developments.—Communism has undergone very far-reaching changes since the World War, not so much in theory as owing to its international expansion. Russia, by coming under the rule of a communist party, has become the parade ground of communist practice. Communism, in its Russian form, has some remarkable features which originally did not belong to it. Russian communism forsakes the path of Marxian Socialism when it regards the social revolution as possible in every capitalist country of Europe without regard to the stage of its economic development. This clearly springs from its thesis of a world revolution which can break out anywhere, and which must then spread from the country of origin over the whole world.

Modern communism, especially Russian communism, based as it is on the "Communist Manifesto" issued by Marx and Engels in 1848, emphasises the initial necessity of civil war. It regards the Paris Commune not as a purely political movement but as an economic revolution for the emancipation of the proletariat which was stamped out with bloodshed. Similarly, the 1905 revolution in Russia is treated as a prelude to communism. Communism in its Russian form is closely allied to syndicalism but not to anarchism, as is often falsely maintained. Syndicalism is the revolt of the rank and file of the workers against the democratic State, against capitalism, but also against trade union bureaucracy. It is born of impatience of the compromises brought by daily life. It is the transplanting of the *élan vital* into the social conflict. Just as syndicalism places action above everything, and moreover direct action—not only strikes but also sabotage—just as it seeks to conquer the capitalist structure even at the cost of the temporary destruction of productive forces, so also in the case of Russian communism (Bolshevism) force is the necessary road to success and the militant period constitutes a necessary training of the proletariat for the control of society.

On the other hand, communism differs from syndicalism in that the latter glorifies the "militant minority" and believes that a determined minority is necessarily superior both in wisdom and power to the loosely associated majority, whereas communism considers that the acquiescence, at least, of the majority must be obtained by propaganda. Furthermore, syndicalism is in revolt against all forms of centralised control, above all, of economic processes. If the proletariat is to achieve its aim it must as a class elect its own representatives. Just as in the French commune the sections, *i.e.*, the individual city quarters, elected their representatives directly, so also Russian communism has created a similar direct representation of the proletariat in the workers and peasants' councils. But the proletariat itself, according to Communist ideas, does not form a political body suitable for democratic organisation. For, according to Communist theories, the proletariat at the beginning of the revolution is no homogeneous mass but contains within itself the various stages of historical development. Only the most enlightened workmen employed in the technically most advanced branches of industry are capable of grasping the situation. The great mass of the workmen employed in medium and small workshops, or in handicraft, the exploited, degenerate masses of the home workers are not in a position to recognise their interests and their "social status" in the moment when revolution breaks out.

For the domination of the bourgeoisie and of capital is not only an economic and (in the first stages of the industrial system) a physical dictatorship. The bourgeoisie, according to Communist theory, rules over the proletariat, not only by virtue of unemployment and through the police; its rule is at the same time a spiritual one, in that the whole ideas and ambitions of the workman are perverted by the interests of the bourgeoisie. A proletarian revolution, therefore, based on democratic franchise, even if confined to the workmen, would have little chance of success, and the proletariat must, therefore, trust to its advance guard, the Communist party, which includes only a small fraction of the workmen, and must not include more in the interest of its fighting strength. For all these reasons the Soviet system, which originally (1905) had been based on democratic ideas, was soon transformed; voting was made public, in order to ensure the election of communists. The Communist party, furthermore, drew up the lists of candidates in such a way that candidates other than Communists could not be elected in the electoral assemblies. The system of indirect election to the higher Soviets serves the same purpose. The working proletariat alone is entitled to vote for these bodies; the other social classes, in so far as they exist at all, are deprived of any political rights as "exploiters."

According to Russian communist theory the working classes as such are quite capable of seizing the power of the State, but not of maintaining it with success. For this purpose they require a Committee which acts for them: the Communist party. This party must therefore exercise the dictatorship during the period of civil war, and hence it is necessary that only members of the Communist party, or those in sympathy with it, should be elected to the councils. The period of dictatorship is regarded as a transitional stage, in which a freely democratic expression of will would lead to the victory of the counter-revolution, in view of the greater mobility and the economic strength of the former ruling classes. It is only when the socialist society has been achieved that a free expression of will and the representation of the whole people is again possible. Communists do not reject the current conceptions of democracy because they believe in the superiority of the few, but because they believe that the phrases of democracy bear no relation to present realities. True democracy is held to be unrealisable in capitalist society because of the fundamental helplessness of the propertyless man; parliamentary forms only serve to veil the reality of the " bourgeois dictatorship " by an appearance of popular consent which is rendered unreal by the capitalist control of the social structure.

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[1] The communism discussed in this article has nothing in common with that "ideal" communism often aimed at in the past by religious or utopian "communities." Modern communism is built up on the basis of the *Communist Manifesto* issued in 1848.

The Theory of the Dictatorship.—The Russian practice of communism, especially the Dictatorship of the Proletariat and its maintenance by the Terror, has its theoretical basis in the "true Marxian doctrine of the State," as this was developed by Marx and Engels. According to this, the State is not the reality of the ethical idea, nor the realisation of a universally valid system of law, nor a power standing above society, but the State is an organ of class rule, an organisation of the exploiting class in power at any time for the maintenance of its external conditions of production, and especially for the suppression of the exploited class. It is finally a " special force of repression " even in the case of the democratic State. Hence it can never represent the whole society, except where this consists of one class—the proletariat. For whereas all previous class struggles have resulted simply in the rule of a new minority, the victory of the proletariat carries with it the emancipation of the whole of humanity, because there is no remaining class below them to be freed. The struggle of the working class is thus the struggle of the humanity of the future.

When the State seizes the means of production in the name of Society (and that is the Social Revolution), then, and not till then, does it represent the whole Society. Then government over persons is replaced by the administration of things and the control over productive processes. The State is not " abolished;" it dies out. " The machine of the State is put into the museum of antiquities, alongside of the spinning wheel and the bronze axe " (Engels). For in proportion as the proletarian State carries out its task of suppressing class distinctions, it destroys its own class basis, and the State as a special organ of class power and repression gives way to the machinery of a homogeneous communist society. It is only in this subsequent phase of communism that freedom becomes realisable.

This end cannot be attained immediately by the conquest of the State power. If the proletariat overthrows the bourgeois government and takes over the army and the administration, socialism and the classless society are not yet achieved. On the contrary, the workers must then, by means of the dictatorship of the proletariat, take and maintain possession of the State as the " special force of repression " for keeping under the bourgeoisie. This is, briefly, the theory.

Practical Modifications.—Since communism to-day is no longer a mere theoretical political system, but has become a political power, it is going through different phases. Faced with reality, principles melt like snow in the sun. Further, there are the rapidly changing conditions which may necessitate quick changes in tactics or even the temporary sacrifice of principles. As the Soviet State has developed in Russia, many concessions have had to be made to economic necessities. The early militant phase of War Communism gave place to the new economic policy and to a far-reaching recognition of private trade and in particular of the right of the peasant to the free disposal of his products, subject to certain fixed taxation. This in turn has been modified in certain respects, but Russian Communism is still essentially in a transitional condition, and it may be argued that it has very little right to the name of Communism at all. Communist thought in other countries has been relatively little affected by the changes in Russian practice, and is still very greatly influenced by the theoretical writings of Lenin and the policies advocated by the Third International (*see* RUSSIA: THIRD INTERNATIONAL). Just as the political development of the 19th century was profoundly modified by the French Revolution, so economic life during the present century will continue to feel the repercussion of the ideas of the Russian Revolution, even were a new Napoleon to arise and to restore the former capitalist system in Russia.

The strength of the Communist movement outside Russia varies greatly in different countries, being greatest wherever economic distress is most acutely felt. The continuance of the intensive propaganda of the Third International, despite very prejudicial effects on the political relations between the Soviet State and other Governments, is mainly attributable to the sense of insecurity of the Russian Communists, and to their belief that the Russian experiment depends for its lasting success upon the accomplishment of the world revolution. (*See* also THIRD INTERNATIONAL.)

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COMMUNIST INTERNATIONAL: *see* THIRD (COMMUNIST) INTERNATIONAL.

COMPANIES AND CORPORATIONS (*see* 6.795).—This article deals first with the position of certain classes of trading companies in Great Britain, and afterwards with companies, or corporations, as they are called, in the United States and France.

I. GREAT BRITAIN

As regards Great Britain, the term " company " is used with special reference to two types of company—(1) registered companies, *i.e.*, companies which are registered under the Companies Acts, 1908 to 1917, and (2) statutory companies, *i.e.*, companies incorporated under special Acts to carry on works of public utility. This classification follows that previously adopted with the modification that the prefix public is used no longer to denote companies in class 2, but those companies in class 1 which are not private. As in the previous article attention is concentrated on companies " limited by shares " as distinct from " unlimited companies " and " companies limited by guarantee," types which still remain comparatively unimportant.

REGISTERED COMPANIES

The progress of British joint stock enterprise during the period 1910 to 1925 illustrates Lord Bowen's observation that " very often the course of business in the city walks in front of the law merchant," for the uses to which the commercial world has put the Companies Acts have undergone extensions more striking and important than any of the legal changes introduced.

Legal Changes.—The statutory changes, comprised in three Acts which supplement the Companies (Consolidation) Act, 1908, may be summarised as follows:—

1. By the Companies Act, 1913, safeguards were provided to prevent private companies from continuing to enjoy the privileges and exemptions accorded them under the Companies (Consolidation) Act, 1913, when any of the conditions mentioned in that Act

(Section 129) and embodied in the companies' Articles are no longer fulfilled.

2. By the Companies (Foreign Interests) Act, 1917, Companies which by their articles restrict the amount of capital which may be held by aliens were prohibited either from eliminating such restrictions or entering into voluntary liquidation without the consent of the Board of Trade.

3. By the Companies (Particulars as to Directors) Act, 1917, the provisions of the "Registration of Business Names Act, 1916" were applied to companies and the disclosure of certain particulars respecting directors was made obligatory.

Although something on the lines of the Registration of Business Names Act had been contemplated before the War, it is plain that both the Acts of 1917 were directed to minimise the danger of the control of British-registered companies by enemy or ex-enemy aliens. In a case which came before the House of Lords in 1916 (Daimler Co. Ltd. *v.* Continental Tyre Co. Ltd. (1916) 2 A.C.) Lord Parker, referring to the history of joint stock enterprise used these words:—

> English legislation and decisions have developed mainly since this country was last engaged in a great European war and have taken little if any account of warlike conditions. The ideal of joint stock enterprise that, with limited liability the more unlimited trading the better, is an ideal of profound peace.

In the case in question the main point at issue was whether a company, registered in England (and therefore British) but in fact controlled by Germans, had or had not certain legal rights as a British subject (*e.g.*, in the matter of recovering a debt). By a majority the House of Lords decided that it had not—thus abandoning the doctrine which it had formerly established (in the case of Saloman *v.* Saloman and Co. Ltd. (1897) A.C. 22), that a company once incorporated "must be treated like any other independent person with its rights and liabilities appropriate to itself."

The Wrenbury Report.—Early in 1918 a committee under the chairmanship of Lord Wrenbury was set up by the Board of Trade to inquire what amendments were expedient in the Companies Acts "particularly having regard to the circumstances arising out of the War and of the developments likely to arise on its conclusion." The committee reported (Cd. 9138) in favour of amendments (*a*) to ensure the disclosure of alien nationality by shareholders, and (*b*) to ensure that, in the case of companies engaged in shipping or in "key" industries, "not more than 20% of the power of control should be in alien hands." Neither of these recommendations has found a place in the statute book.

Growth of Joint Stock Enterprise Since 1910.—Apart from a heavy additional burden of taxation taking the form of higher stamp duties and (from 1921–5) of a special tax on profits (the Corporation Tax) the restrictions imposed upon joint stock enterprise as a result of the War proved to be of a temporary nature. On the other hand War and post-War conditions were favourable to joint stock activity in many directions.

According to the Board of Trade Annual Reports on Companies the number on the register in 1910 was 51,787, having a paid-up capital of £2,178,619,734; by the end of 1924 it was 90,918 for England and Scotland with a paid-up capital nearly twice as large (£4,355,869,530). The increase was not continuous. During the war years 1915 to 1918 the net addition was only 866 companies with a paid-up capital of £194,048,192, but the two years 1919 and 1920 more than made up for the falling off by adding 12,689 companies and a paid-up capital of £1,293,537,410. During the next four years, in spite of a setback in 1921, the rate of increase both in numbers and capital was comparable to the rate of increase in the four years 1910 to 1914.

Relatively to that of public companies, the increase in private companies has been remarkable. In 1910 the proportion of private to public companies was stated (*see* 6.800) to be one-third. In 1918 the Wrenbury Committee found that out of 66,000 on the register no less than 50,000 were private. In 1924 the proportion was 89% (81,809 out of a total of 90,018). This rapid increase is reflected in the Board of Trade returns regarding the capitalisation of English companies. Between 1911 and 1917 companies with a nominal capital of less than £5,000 comprised over 50% of the total in each year. During the boom years that followed the proportion declined to 31·5%, but in 1921 companies with less than £5,000 were once more in the majority, the numbers reaching over 62% of the total in 1924. When it is realised that there were registered in 1919 95 companies and in 1920 121 companies (compared with 27 in 1913 and 14 in 1924) with a nominal capital of £750,000 and over, the increase during 1919 and 1920 in the proportion of companies with a quite small capital will be understood. After allowance has been made for the possibility that an increase in the stamp duty (from 5s.% to £1% of the nominal capital in 1920) may have been a contributory factor in favour of low capitalisation, it seems reasonable to infer that, since 1910, small private businesses and firms have, to an increasing extent, found it advantageous to adopt the company form of organisation.

The full significance of the above figures will be missed unless some attempt be made to answer the following questions: (1) Into what parts of the industrial field have joint stock companies spread most during recent years? (2) To what extent have the shares in public companies been bought by small investors? (3) What have been the main effects on the joint stock system of the economic disturbances arising out of the War?

Spread of Joint Stock Organisation.—General statistics showing the extent to which the corporate form of trading has permeated business undertakings in the United Kingdom are unfortunately not available (*cf.* United States statistics referred to below under corporations in the United States). There can, however, be little doubt that in those branches of production and distribution where the growth of large-scale organisation has been most rapid, companies—especially of the "holding" type—have become common. The British United Dairies Ltd. is a good example. Registered in 1915 with a capital of £1,000,000 this company (with a capital now four times as large) was, according to the "Linlithgow Report" of 1924, in control of "by far the greater part of the London wholesale milk trade" and—through its 16 subsidiaries—one-third of the London retail trade as well.

In regard to other commodities the advent of the multiple shop has brought many departments of retail trading under corporate ownership, such as groceries, household stores, drugs, etc. In a memorandum submitted to the Greene Committee (*see* below) the Manchester Chamber of Commerce stated (*Minutes of Evidence*—26th day, *Appendix KK*) that, among undertakings covering 85% of Lancashire spinning and weaving mills, companies now comprised 90% of those engaged in spinning, 75% of those engaged in weaving, and 89% of those which combined spinning and weaving. As in weaving, so also among merchant exporters there was stated to be a growing tendency for private concerns to take advantage of the private company form.

The Small Investor.—In his last work, *Money, Credit and Commerce*, Prof. Alfred Marshall, commenting on the fact that "many railways and other undertakings are owned in great part by multitudes of small capitalists," said: "The main effect of this development is to strengthen the position of the middle classes relatively to the working classes on the one hand and to the wealthy classes on the other." While there is no reason to doubt that small investors have been increasing in number relatively to large, reliable statistics to show this tendency are lacking—at any rate for the United Kingdom. Between smallholdings in land and those in shares there is no analogy: and the fact that the average size of the shareholdings in 19 representative companies was in 1925 no more than £267 (*vide* an analysis made by the Liverpool and District Economic League) may perhaps only indicate that large investors now-a-days prefer to distribute their capital in small parcels over a wide field.

Economic Effects of the War.—With the prolongation of the War the number of trades drawn into the orbit of war-time demand tended steadily to increase until nearly the whole range of private enterprise was occupied in catering for a market the absorbent qualities of which seemed to be unlimited. At the same time restrictions were imposed by the Government on the flotation of new share issues. The result was that successful companies were compelled largely to provide for their capital requirements out of profits. In particular open reserves, represented by investments in stock-exchange securities, increased rapidly. An analysis by *The Economist* of some 1,000 companies showed that between 1914 and 1917 the average percentage of profits placed to reserve increased from 26·3 in 1914 to 37 in 1917, while in some industries such as iron and steel and oil the percentage rose to over 60.

The termination of the War found the financial position of most public companies still further strengthened. To open reserves were now added secret reserves, automatically created by the enhanced and increasing value of their physical assets. According to a decision of Lord Justice Fletcher Moulton in 1911 (Spanish Prospecting Co., Ltd., 1 Ch. 92) such reserves might be treated as profit and paid out as dividend. In general, however, companies adopted the practice of distributing their surplus profits (including these increases in the valuation of their assets) in the form of bonus shares. And in fact, in 1920 alone bonus shares to the nominal value of £65,249,398 were distributed on a paid-up capital of £97,957,114 by 235 public companies. Wealthy shareholders in particular benefited by this practice, since it was decided by the House of Lords (The Commissioner of Inland Revenue *v.* Blott, 1911) that such property in the hands of shareholders is not liable for super-tax.

Bonus share distributions in 1919 and 1920 account only in part for the enormous increases in issued share capital that occurred in those years. A period of rapidly rising prices had always been favourable to the merger of companies and the buying up of the smaller by the larger concerns. And so it proved then. Since, however, the payments involved in these transactions had to be made (whether in cash or shares) in accordance with the high prices which business assets then commanded, the nominal value of the shares issued to cover these payments was necessarily large.

At the end of 1920 prices began to fall and a prolonged trade depression set in. Industrial companies generally, and especially those created or reconstructed during the boom period, were now faced with the position that their liabilities (*equitable*, not legal liabilities, of course) in respect of paid-up share capital were in excess of the true value of the assets, tangible and intangible, set against them. This excess was the measure of the amount of " water " in their share capital. Watered capital meant that the weaker companies were unable to earn dividends even on preference shares, while the heavy fall in the market price of their shares made it difficult for most companies to raise working capital except by borrowing. According to the Monthly Review of the Midland Bank (for March 1926) the ratio of loan capital to share capital raised by companies rose from 9·6% of the annual total in 1919 to 46·8% in 1921 and 49·5% in 1922. The remedies were no doubt obvious. The remedy for over-valuation of assets was a drastic writing down of share values. The remedy for falling markets was a reduction in working costs. But neither was easy to apply. The first meant the expense and inconvenience of an application to the Court for leave to reduce capital. The second meant a reduction of wages on the ground that shareholders were entitled to expect at least some return on their investment. This argument, however, carried little weight with trade unions, able to point out that perhaps 50% of the share capital was water. To the knowledge of this fact and the publicity given to it has been attributed the collapse at the end of 1923 of the opposition of the shipping companies to a wage demand from the organised dock labourers.

At the end of 1922 only a small part of the water had been squeezed out by capital reductions. The burden of this legacy from the sanguine days of rising prices, coupled with the fact that the unsheltered industries still showed no genuine signs of recovery, makes all the more remarkable the recuperative power shown by companies in general from 1923 to 1925. According to *The Economist*, if 100 be taken to represent the general level of profits realised in 1920, then the profits in 1921 were 79·9, in 1922 56·7, in 1923 74, in 1924 78·9, and in 1925 85·8. The same upward tendency from 1922 to 1925 is indicated by the rise in the average rate of return paid on ordinary shares from 8·4% in 1922 to 10·3% in 1925, as well as by a decrease in the ratio of loan capital to total capital (raised by companies annually) from 49·5% in 1922 to 34·2% in 1925.

Companies as Investors.—For this unexampled power of recovery some explanation is required. The secret lies, it is believed, in the strides which the financial integration of companies (through investment by companies in other companies' shares) has taken in recent years. For companies as for private investors the field of profitable and safe investment has widened considerably since 1910, not merely because the market in securities is larger but because the lesson has been learnt that debentures and other gilt-edged securities offer no better prospect of a safe return than a varied assortment of holdings in which ordinary shares as well as government bonds have a place.

Investment by companies has developed three distinct forms: (*a*) The investment by companies in general of their reserved profits; (*b*) the investment by companies (the so-called investment banks or trusts) whose sole or main object is investment; (*c*) the investment by holding companies in the shares of subsidiaries.

With regard to (*a*), attention has been drawn to the extent to which industrial companies during the depression have found their trade losses counterbalanced by profits in the shape of income from investments. The reserve fund has become an instrument for making past profits earn future profits. Speaking of Insurance Companies' profits in 1925 *The Economist* noted that " in these days the profit from interest is most substantial, a good deal larger than it was before the war." This statement is fully borne out by an analysis of the income of 21 insurance companies in 1924, showing that the return from investments amounted to 46·5%, net trading profits to 53·5%, of a total income of over £12,000,000.

With regard to (*b*), the growing importance of the rôle played by the investment company in the modern joint stock system has been often emphasised. The primary function of this type of company is to act as an expert investment agency which brings the private and especially the small investor into touch with joint stock enterprise in all parts of the world. Sir George Paish has estimated that in 1913 British foreign investments had reached a total of £3,800,000,000 of which £750,000,000 were in the United States of America. The main vehicle of this huge capital export has been the investment company. To its pre-War activity must be attributed in large measure the services which " dollar securities " rendered to the British Govt. during the War.

The Holding Company.—With regard to (*c*), one must note that in this case investment is a mere device for securing an amalgamation or consolidation of interests between separate undertakings. The typical holding company is a public company which derives its profit, if any, from having a controlling interest in a number of subsidiary private companies, carrying on allied trades or different branches of the same industry. One of the great advantages of this arrangement (from the point of view of the directors of the parent company) is that the combine can conduct its affairs in complete secrecy. The private companies do not (as the law does not compel them to) publish balance sheets; the balance sheet of the holding company merely shows the income which it has derived (in the course of a year) from its investments in subsidiaries. Thus nothing is revealed as to the amount of profit (or loss) made by any of the subsidiaries. The convenience of this was well described by Mr. D'Arcy Cooper, Chairman of Lever Bros., Ltd. (a large, if not the largest holding Company with some 200 subsidiaries) when he said in evidence before the Greene Committee (Minutes of Evidence, 3751):—

> If you are asked to publish details of these private companies the result will be that you will get tremendous competition in regard to the particular articles on which you are making good profits.

It is clear that the holding company is a product of the modern trust movement in industry and trade (*see* TRUSTS); it may in fact be described as the principal vehicle in which the British trust movement travels.

Company Law Reform Proposals.—It was not to be expected that the popularity of private companies and the advent (through inter-investment) of co-operation or combination among companies would not bring in their train a good deal of dissatisfaction with the existing state of the law in regard to companies. Early in 1925 a departmental committee under the chairmanship of Mr. W. Greene, K.C., was appointed by the Board of Trade "to consider and report what amendments are desirable in the Companies Acts 1908–1917." Some of the proposals made before the Committee favoured a greater degree of freedom in the conduct of companies' affairs than is at present possible under the Acts, and others a tightening-up of the law so as to diminish the opportunities for deceit or fraud in the promotion and direction of companies. In the first category are to be placed such proposals as the following: the right to issue shares at a discount (*e.g.*, one pound shares fully paid at a discount of ten shillings); the right to issue shares of no par value (*i.e.*, new shares to be sold for what they will fetch in the market at the time of issue); the right to issue redeemable shares or stock (*see* below under statutory companies); greater latitude in regard to "objects." In the second category are to be reckoned proposals: to abolish or restrict the power of companies to give a floating charge on their present and future assets; to compel private companies to file balance sheets; to increase the responsibility of directors (the vexed question of directors' liability was brought to the fore in connection with the notorious "Bevan case" in 1922); to give reality to the "minimum subscription" clause (*see* 6.798); to compel issuing houses when offering new shares of a company to the investing public to give the same full and complete information as the law would require the company to give if it were offering these shares to the public direct.

The Greene Committee in its *Report* (1926, Cmd. 2657) favoured a proposal made by the Federation of British Industries to allow companies to issue redeemable preference shares, though they were not in favour of allowing a redemption out of profits to have the effect of a reduction of capital without the consent of the court. With regard to the issue of shares at a discount and the issue of shares of no par value, the committee were in favour of conceding, under restrictions, the former privilege, but not the latter.

On the whole, apart from these innovations, the tenor of the report is conservative and cautious. The private company's privilege of financial secrecy is not assailed; the commercial convenience of the holding company type of organisation is accepted without criticism; complaints of the prejudice created by the floating-charge type of debenture have failed to move the committee in favour of any drastic change. On the other hand, the committee's proposals in regard to the marketing of the shares of public companies, both new and old, are designed to ensure full disclosure (or the means of obtaining full disclosure) of a company's prior history and prospects (sections 38–41 and 92–93). The shareholder is to be further protected by disallowing the insertion in Articles of clauses enabling either directors or auditors to contract out of the general law for negligence or breach of duty (sections 46, 47 and 73), and by prohibiting the directors of public companies from proceeding to allotment unless and until a certain minimum amount of capital (set forth in the prospectus as necessary for certain specified purposes) has been raised.

The firm hold which the company has taken on the business world, has given rise in recent years to a good deal of critical speculation. Dr. Rathenau in Germany and Prof. T. N. Carver in America, have seen in the modern company a departure from the naked individualism of the 19th century and a promise—a kind of instalment in advance—of socialisation. Others, such as Lord Haldane and Lord Milner, have taken a more sober view of its social value. Criticism has concentrated mainly on the position of shareholders vis-à-vis their companies. The shareholder has been compared (by Veblen) to an "Old Man of the Sea" who sits tight, secure in the knowledge that through his shares he retains (for an unlimited period) along with his co-shareholders a right to or equitable lien over the whole of the future net profits earned by his companies.

STATUTORY COMPANIES

By far the most important event in connection with the incorporation of companies by special Act has been the Railways Act of 1921 (*see* GREAT BRITAIN: COMMUNICATIONS). In 1920 the Public Utility Companies (Capital Issues) Act was passed which authorised the Board of Trade to consent to the variation of the provisions regulating the raising of capital by gas, water, water power, electricity and tramway undertakings. Such companies were to be allowed (inter alia) to issue stock at a discount and to issue redeemable preference stock in lieu either of ordinary stock already authorised or of irredeemable preference stock. The Act was to expire (but so as not to affect the validity of anything done in pursuance of it) on May 20 1925. The second provision was clearly intended to enable public utility companies to effect a conversion of preference stock on favourable terms when money rates were lower by redeeming or retiring preference stock entitled to a high rate of return at the time of issue. It thus belongs (together with those older expedients,—the auction clause and the sliding scale of prices and dividend) to a type of provision which the legislature has seen fit to introduce into the constitution of particular companies in order to ensure, for the benefit of consumers, that the companies in question shall not pay an excessive price for their capital.

II. THE UNITED STATES AND FRANCE

An important legal change that affects the legal powers of corporations has been the permission given to issue stock of no par value. The first legislation authorising this change was adopted by New York State in 1912. Subsequent alterations have made it possible for any New York corporation (other than a financial one) to issue no par stock of any class, save that in the case of public service corporations the permission of the appropriate Commission must be sought. Since 1912 34 States had (up to May 1924) passed legislation either on the model of the New York law or of that of the State of Delaware. Unlike New York Delaware goes so far as to permit a corporation to be formed without any stated capital whatever.

The policy behind the Act of 1912 has been described as recognising

> "That shares in a corporation represent only aliquot interests in its capital whatever that may be and that their nominal or par value is no indication of the actual capital of the corporation." (V. Morawetz.)

The supporters of no par value stock claim that (1) it compels investors before applying for stock to rely upon the real value of a Corporation's assets instead of on an illusory nominal value attributed to the stock; (2) it prevents Corporations from issuing stock at a discount (when the market price of the same class of stock is below par) and so "watering" the capital. On the other hand the practice has excited unfavourable criticism in some quarters. Thus the eminent American jurist, Mr. W. W. Cook, has pronounced against it in the following terms:—

> These no par value statutes are destroying the respectability of the corporate form of organisation. The abolition of real capital stock and the freedom as to dividends on no par value stock render it the ready instrument of concealment and fraud.—(*Principles of Corporation Law*, 1925).

It seems probable that whether wise or the reverse, the introduction of no par value stock has been brought about by the issue of shares or stock at a discount,—a practice which, though hitherto denied to British registered companies, has been allowed to American corporations.

Valuable comparative statistics illustrating the steady growth of joint stock enterprise in the United States were furnished by the Census Department after the last Census. The returns showed that in 1909 25·9% of total establishments were owned by corporations, 21·7% by partnerships (including co-operative undertakings) and 52·4% by individuals; in 1919 the percentages were 31·55, 20·85 and 47·6 respectively. In 1909 of the total value of American products, corporations contributed 79%, partnerships, etc., 11·1% and individuals 9·9%; in 1919 the percent-ges were 87·7, 6·6 and 5·7 respectively. In 1909 of all wage arners in the U.S.A. corporations employed 75·6%, partnerships, tc., 12·2 and individuals 12·2; in 1919 the percentages were 6·6, 6·6 and 6·8 respectively.

As regards the distribution of corporate ownership Mr. H. T. Varshaw in an article under that title (*Quarterly Journal of Economics* for Nov. 1924) has conjectured that while the total apital stock of all corporations had risen from 64 billion dollars 1 1910 to nearly 71½ billion dollars in 1923, the number of stockolders had increased from about 7,400,000 in 1910 to about 4,400,000 in 1923. This calculation was based partly on (*a*) an anlysis of income tax returns between 1916 and 1922, partly on (*b*) gures showing the growth in the number of separate stockholdngs relatively to the growth in the capital stock of all corporations. The first analysis showed that in 1916 large payers of income ax (on incomes of over $20,000) received 79·3% of all the ividends paid which figured in the returns, but in 1921 only 6·8%, while the share taken by incomes of $1,000 to $5,000 rose rom 9·5% in 1917 to 22·7% in 1921. The second analysis howed that the average size of stockholding had declined from 8,630 in 1910 to $4,970 in 1923. Although, as already noted bove, the second analysis does not by itself afford conclusive vidence of a more widespread distribution of capital, the first nalysis, confirmed as it is by evidence from other quarters, ertainly suggests that the working class in America is becoming nore and more also an investing class.

That the War has been largely responsible for this change in istribution is the conclusion arrived at by the National Bureau f Economic Research which reported that "the net effect of ur participation in the War was to diminish somewhat (at least emporarily) the inequality in the distribution of American ncomes. The top 5% took a share declining from 33% in 913–6 to 25% in 1918–9."

France.—A recent important innovation in French company aw has been made by the Act of March 7 1925 which has enabled sociétés à responsibilité limiteé" to be established. This private company law" contrasts with the British Act of 1907 n imposing conditions of a restrictive kind. Thus under the 'rench Act:—(*a*) shares must be fully paid before the company an be incorporated; (*b*) if there are more than 20 members a upervision committee of three members must be set up which is eld liable for the non-fulfilment of duties to the company and to hird parties, and (*c*) $\frac{1}{20}$ at least of the yearly profits must be ut to reserve until the reserve so created is equal to at least of the company's capital.

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COMPAYRE, JULES GABRIEL (1843–1913), French educaionalist (*see* 6.809), died March 23 1913.

CONDOURIOTES, PAUL (1855–); Greek admiral and tatesman, was born April 14 (new style) 1855 in the island of Iydra. He adopted a naval career and served in the Greco-Turkish War of 1897. He commanded the fleet in the Balkan Var of 1912–3, and twice defeated the Turkish Navy in the Darlanelles. In the Zaïmes and Skouloudes Cabinets of 1915 he vas Minister of Marine, but followed M. Veniselos to Salonika n 1916 and formed with him and Gen. Danglès the Provisional Govt., opposed to that of King Constantine. After the King's irst deposition in 1917, he again became Minister of Marine in the third Veniselos Cabinet, resigning in 1919, when Parliament bestowed on him the title of "admiral" for life. In 1920, on the death of King Alexander he was for a short time regent. Soon after the defeat of M. Veniselos he resigned and went abroad, but returned, and on Dec. 20 1923, the day after George II. left Greece, was again appointed regent. On March 25 1924 the National Assembly, after deposing the dynasty, confirmed his mandate until after the plebiscite of April 13, and his title was then changed to that of president of the republic.

CONDUCTION, ELECTRIC (*see* 6.855).—The principal advances since 1910 have resulted from attaining unprecedentedly low temperatures, high pressures and large single crystals.

I. CONDUCTION IN SOLIDS

Supraconductivity.—Five metals are known to experience sudden well-nigh total disappearance of resistance at characteristic temperatures T_0 superior to the lowest (1·5° K) yet attained; viz., indium ($T_0 = 3{\cdot}41°$ K), tin (3·78°), mercury (4·19°), thallium (2·3°), lead (7·2°); also a tin amalgam (4·29°). In the supraconductive state existing below T_0 the resistivity is less, probably much less, than 10^{-9} as great as at 273° K. Currents in supraconductive lead rings started by a transient E.M.F. (caused by annulling a magnetic flux originally linked through the rings) were observed to remain constant to within $\frac{1}{20000}$ part of an hour (this being deduced from constancy of their electrodynamic interaction). Magnetic field pervading the conductor displaces T_0 downward, tension (on tin) shifts it upward. Hall-effect vanishes with resistance, but thermal conductivity, elasticity, specific heat and (for lead) crystal lattice change little.

Effects of Pressure, Tension, Melting.—Resistance decreases steadily with increasing pressure over the range 0–12000 kg/cm² for 38 out of 44 metals (including a few metalloids) tested; increases steadily for 5 (Li, Ca, Sr, Sb, Bi) and passes through a minimum for one (Cs). The largest alterations from the values at zero pressure are 97% increase (P), 72% increase (K), 82% decrease (Sr); most changes are much smaller. Tension usually increases resistance (to current-flow along the direction of stress), but there are at least three exceptions, two of which (Bi, Sr) are likewise exceptions to the usual rule for sign of the pressure-effect, while one (Ni) is not. At melting the conductivity always changes in the same sense as the density. Ohm's law ceases to be valid when the current-density in gold or silver surpasses 10^6 amp./cm².

Single crystals (except cubic ones) show dependence of resistance upon orientation of current-flow; the characteristic values of resistance are that for currents along the axis of 3-, 4- or 6-fold symmetry, and that for currents in the basal plane. Often, but not always, currents flowing perpendicularly to the planes of easiest cleavage or slip encounter the greatest resistance. The variation of resistance with direction may be in a proportion as great as 9:4. The pressure-coefficient of resistance varies relatively more than the resistance itself, and an instance is known (Sb under certain conditions) in which increase of pressure increases the resistance to currents in some directions and decreases it for those in others. Cubic crystals are isotropic in conducting electricity; their conductivity is stated for very pure Cu to exceed that of a polycrystalline mass, while for very pure W there is reported to be no difference.

There is no adequate theory of metallic conduction; the data acquired since 1910 merely augment the evidence that the so-called "classical" theory (of free electrons moving like atoms of a gas in thermal equilibrium in the interspaces between the metal atoms) is untenable. The rule that conductivity increases with pressure shows that if an analogous theory should be devised the electrons must be supposed to move within the atoms instead of the interspaces; but the exceptions to this and other rules show that no simple theory can suffice universally. Supraconductivity shows that the straight, free paths postulated in the classical theory cannot exist, for they would be 1,000 times as long as the longest straight line that can be drawn in a coiled supraconductive wire. As there is no supraconductivity for heat, thermal and electrical conduction cannot be as intimately linked as was formerly believed.

Photoconductivity.—The extra current-flow occurring when certain non-metallic solids are illuminated while exposed to electric field appears to be unusually simple in certain cases of single homogeneous crystals of substances which are good insulators in the dark and have high refractive indices (diamond, ZnS, HgS). If the light-intensity and the field are kept below certain limits, the primary effect of the light apparently consists in loosening electrons initially fixed in the lattice, one electron per absorbed quantum. These electrons flow towards the anode, leaving the interior of the crystal positively charged; a compensating process (apparently a creeping of electrons inward from the cathode side) eventually sets in, or may be hastened by infra-red light. Similar effects occur in crystals of NaCl in which free sodium has been isolated by X-ray irradiation, and in phosphorescent solids, the excitation of phosphorescence evidently beginning with such detachment of electrons.

For the conduction of electricity through gases, the reader should consult the Article by Sir J. J. Thomson on GASES, ELECTRICAL PROPERTIES OF. (K. K. D.)

II. CONDUCTION IN LIQUIDS

The experiments of Faraday, Kohlrausch and Hittorf demonstrated that the conductivity imparted to a badly conducting liquid such as water by the addition of a salt was due to the movement of the charged ions of the salt under the influence of the applied electromotive force. According to the older views a salt such as sodium chloride on solution in water underwent partial ionisation which would be expressed in the form of the equation

$$NaCl \rightleftarrows \dot{Na}+Cl'$$

The fact that solutions of salt in different media exhibited different conductivities brought into prominence the effect of the solvent which might be interpreted as affecting the equilibrium of the ions and molecules—

$$NaCl+H_2O \rightleftarrows \dot{Na}(H_2O)_y+Cl^1(H_2O)_z$$

The conducting particles are accordingly not simple ions but ions with a solvate atmosphere around them. From an analysis of the heats of ionisation and solution of salts in water Born has compiled the following table for heats of hydration of individual gas ions.

Ion +	Heat evolution in Calories per gr. ion	Ion	Heat evolution in Calories per gr. ion
H.	262,000	Cs.	74,000
Li.	110,000	Cl′	77,000
Nȧ	103,000	Br′	68,000
K.	82,000	I′	57,000

The thermal effects are large, indicating a marked affinity of ions for water. Since the conductivity of a solution is dependent on both the mobility and number of such solvated ions, many investigations have been made to determine these values for solutions of different concentrations. The direct determination of ionic velocities under the influence of definite potential gradients or ionic mobilities has been made by Lodge, Whetham and Steele, and values have been calculated from transport ratios by Kohlrausch and Hittorf; that for the hydrogen ion in water is ·003139 cm. per sec. under a potential gradient of one volt per cm. at 18° Centigrade. The evaluation of the number of such ions in a solution presents greater difficulties. If it be assumed that the ionic mobilities are independent of the concentration of the ions, then the molecular conductivity should be a true measure of the number of free ions in a solution of definite concentration. Experimental determinations indicate that the number of free ions computed from conductivity data is always less than the total salt present, a fact in accordance with our preconceived opinions in respect to a mass law equilibrium between hydrated salt and ions.

If one gram molecule of a binary salt be dissolved in V litres of water and a fraction α be imagined as dissociated into ions, we obtain for the conditions of equilibrium between hydrated salt and ions $K=\frac{\alpha^2}{(1-\alpha)V}$ where K is the equilibrium constant, independent of the actual concentrations employed. Further, the fraction of free ions which alone contributes to the conductivity can be determined from a comparison of the conductivities at various dilutions. At two dilutions we obtain the expression $\frac{\lambda_1}{\lambda_2}=\frac{\alpha_1}{\alpha_2}$ where λ_1, λ_2 are the conductivities and α_1, α_2 the respective ionic concentrations, each divided by the concentrations at which the determinations are made.

This method of determining the number of ions in a solution yields a satisfactory constant for the mass equilibrium expression noted above in the case of weak electrolytes. In the following table are given the experimental data of Kendall for the case of acetic acid dissolved in water.

V	λ	$\alpha \times 100$	$\frac{\alpha^2}{(1-\alpha)V}=10^6K$
13·57	6·086	1·570	18·45
54·28	12·090	3·118	18·49
217·10	23·810	6·141	18·51
434·20	33·220	8·568	18·49
868·40	46·130	11·900	18·50
1,737·00	63·600	16·410	18·54
3,474·00	86·710	32·360	18·55
6,948·00	116·800	30·130	18·70
∝	387·700	..	..

The accuracy of this dilution law has been confirmed for many hundreds of weak acids, bases and salts. For strong electrolytes on the other hand, that is, for electrolytes in which the conductivity data would lead us to suppose that practically all the hydrated salt was present in the solution in the form of the solvated ions—the values of K determined in this way are by no means constant, as is in evidence from the data of Kohlrausch and Maltby for aqueous potassium chloride at 18° Centigrade.

V	λ	$\alpha \times 100$	$\frac{\alpha^2}{(1-\alpha)V}=10^3K$
1	98·27	75·65	2,350·0
2	102·41	78·83	1,434·0
5	107·96	83·10	815·4
10	112·03	86·24	540·5
20	115·75	89·10	364·2
50	119·96	92·34	222·1
100	122·43	94·24	154·2
1,000	127·34	98·02	48·5
10,000	129·07	99·36	15·4

It is claimed, however, that even strong electrolytes appear to obey the mass law at sufficiently great dilutions; the disturbing factor thus appears to be the concentration of free ions in the solution. If this view be admitted it immediately raises the question whether the premises on which these calculations of the ionic concentrations are made may be considered as correct. It was assumed firstly that the mobility of the solvated ion was always constant irrespective of the concentration; and secondly that all free ions of the same species possessed identical mobilities in solution. By the method of ionic migration developed by Hittorf, it is possible to examine the ratio of the mobilities of the cation and anion $\frac{u}{v}$. If the mobilities of each ion remain constant over a range of dilution, or if their mobilities change equally with the variation in concentration, this ratio will remain unchanged. It is found that the relative mobilities of ions do in fact change with the concentration, as is indicated by the following data for the transport number NK of the silver ion in silver nitrate solution and the mobilities of the sodium and chlorine ions in sodium chloride at 18° Centigrade.

AgNO₃		NaCl		
V	NK	Molarity	uNȧ 10^6cm/sec	vCl′ 10^6cm/sec
0·42	0·532	0	450	690
1·00	0·500	0·0001	448	681
2·00	0·483	0·0010	440	670
4·00	0·473	0·0100	415	644
40·00	0·475	0·1000	360	592
..	..	1·0000	278	487
..	..	5·0000	153	285

This change in relative ionic mobilities with the concentration is indicative of marked changes in the ionic mobility of each ion. Again, it is clear from a consideration of the mode of passage of an ion through a solution containing other ions that the "mobility" is no more than the average rate of progress in a linear direction by an ion which is being continuously deflected from its path by repulsion or attraction by neighbouring ions. These considerations have led to two diverse methods of attempting to explain the alteration in conductance with dilution of solutions of strong electrolytes. Nernst and Jahn assume that the law of mass action is fundamentally correct, but that the active masses or effective concentrations of the molecules and ions present are affected by two factors, the degree of hydration and the electrostriction exerted by the dissociated molecules. Others, especially Bjerrum, Milner, Debye and Hückel, reject the concept of a mass law equilibrium between molecules, in which a kation and anion are held close together possessing no power of relative movement, and ions which are all equally free in the sense that they can move independently of one another, *i.e.*, that all ions of one species possess identical mobilities. They assume that the interionic electrical attraction obeys the usual inverse square of the distance law, and that the mobility of any one particular ion will thus naturally depend upon the total concentration of ions present and their distances from the ion under consideration. A sharp distinction between the terms "bound into molecules" and "freely movable as ions" is therefore lost.

We have noted that the heats of hydration of the ions are relatively great, and the view that each ion is hydrated, is supported by the parallelism which is found to hold between the temperature coefficients of conductance and viscosity. Attempts have been made in various ways to determine the number of molecules of water bound by each ion. These methods include determination of the transport ratios of the ions in the presence of a non-electrolyte; from these values relative ionic hydrations may be evaluated.

The development of these ideas, especially by Debye and Hückel, has shown that the observed alteration in the conductivity of a salt such as potassium chloride with increasing concentration, can be calculated with reasonable accuracy over a relatively wide range of dilute solutions, but for strong solutions the agreement between theoretical and experimental values is by no means good. It appears probable that a second factor in addition to the interionic attraction or electrostriction; viz., the hydration of the ions and its variation, has to be considered.

Varying results are obtained with minor modifications of method; thus we find values of ionic hydration ratios of α': k varying from 2·8:1 to 7·5:1. A second method involves the determination of some property which is taken as proportional to the "free" water in a solution. These include solubility determinations both of solids, liquids and of gases in salt solutions and the effect of neutral salts on catalytic activity. Von Hevesy assumes that gaseous ions on solution in water will acquire a constant potential of 70 millivolts. Since the potential of an ion is expressed by the relationship $V=\frac{\epsilon}{Kr}$ monovalent ions will acquire a radius on immersion in water of dielectric constant 81 a value of $2{\cdot}8\times10^{-8}$ centimetres. Thus small ions will acquire a large water envelope; very large ions, on the other hand, may possibly coalesce together to form an ionic micelle. This view may be criticised in that the small hydrogen ion with a large water envelope moves with great velocity, and the potential of 70 millivolts assumed to be acquired by the ion is a value obtained by considering the rates of electric endosmose and cataphoresis in colloid particles. It has been shown, however, that the mobility of colloid particles is not affected so much by their charge, but rather by the magnitude of the electrokinetic potential, which represents but a fraction of the total potential difference between the two phases and is in no way related to it. Since water molecules are essentially small dipoles, orientation around a charged ion is to be anticipated, and since the molecule of water is somewhat elongated the effect of orientation in close packing (as opposed to the more open packing obtaining in ice) will be to effect a decrease in volume. In aqueous solutions the contraction amounts to 10–12 cc. per equivalent of univalent electrolyte ionised.

Conductance in Non-Aqueous Solutions

Fused metallic alloys are good conductors. Whilst in solid metals the conduction of current takes place by the movement of electrons in a space lattice through the space lattice of the metal, this method of conduction does not appear to be the only method for fused metals, especially for liquid mercury amalgams. In sodium amalgams Lewis noted the transport of alkali metal from cathode to anode. In fused salts of the heteropolar type the conductivity is high and Faraday's laws are obeyed. In these cases the undissociated solvent such as water is absent, and calculations on the degree of dissociation as determined from conductivity data must be misleading, the alteration in conductivity being attributable to alteration in electrostriction and the formation of complex ions.

Increasing attention has been paid to the determination of the conductivity of salts dissolved in non-aqueous media. The close parallelism between the magnitude of the conductivities of a salt solution in various solvents and the dielectric constant of the medium was noted by Sir J. J. Thomson and Nernst. Walden has suggested that the relationship between the apparent dissociation as measured by conductivity methods and the dielectric constant may be expressed in the form $R=(1-\alpha)K\sqrt[3]{V}$ where R is a universal constant and K the dielectric capacity of the medium. This apparent alteration in the degree of dissociation may, however, be ascribed to the alteration in the electrostriction, for the force between two charged ions varies inversely as the dielectric capacity of the medium. Walden's rule, however, cannot be considered as anything more than a qualitative expression indicating a close relationship between K and α. Part of the discrepancies between the experimental data of Walden and others with the simple theoretical expression may be ascribed to lack of precise information on the values for the dielectric constant. Not only does the dielectric constant of a medium change with the frequency of the field which is employed to measure this property, but it is also affected by application of strong fields. Again, evidence is accumulating that the dielectric constant for material in thin films is different from that in bulk; thus water K=81 at 18°C. appears to possess a value of K=ca 6 in very thin films. In solutions of electrolytes it is clear that all these factors have to be taken into consideration. It is thus not surprising that the mass law expression which is found to hold for weak electrolytes in aqueous solutions but not for strong electrolytes likewise fails for electrolytes in non-aqueous solvents, as can be exemplified by the following data of Cohen for solutions of potassium acetate in alcohol.

V	λ	K
11·4	8·28	·242
113·0	17·18	·055
1,120·0	27·00	·014
3,520·0	29·20	·006

In dilute solutions where ionic migration can proceed without serious disturbance due to the effect of electrostriction the mobilities of the ions in various solvents will be determined to a great extent by the characteristics of the medium. Thus we find that the ratios of the limiting conductivities of many salts in water and ethyl alcohol are identical with the ratios of the diffusion coefficients, as is noticed in the following data—

Salt	KI	CH_3COOK	LiCl
$\frac{\lambda H_2O}{\lambda C_2H_5OH}$	0·37	0·33	0·33
$\frac{DH_2O}{DC_2H_5OH}$	0·33	0·32	0·33

The conductivity of a weak electrolyte may in fact be greater in a medium of low dielectric constant than in a solvent of greater ionising powers owing to the increase in ionic mobility. If the mobility were governed entirely by the mechanical resistance suffered by a solvated ion moving through a homogeneous fluid of uniform viscosity, it might be anticipated that Stokes' law would be applicable from which ionic radii might be calculated. The investigations of Cunningham and Millikan, however, have indicated that Stokes' law breaks down for small particles. In spite of this failure a general relationship of the type

$$\lambda\propto\frac{1}{\eta}$$

where λ is the conductivity at great dilution and η the viscosity of the medium is found to obtain. In the following table are given a few of Walden's data for potassium iodide dissolved in various solvents at 25° Centigrade.

Solvent	η	λ	ηλ
Water	0·00891	151·30	1·350
Glycol	0·16800	8·00	1·320
Glycerine	6·33000	0·35	2·220
Formamide	0·03230	26·30	0·849
Formic acid	0·01620	65·00	1·050
Hydrazine	0·00914	118·00	1·100
Ethylene cyanide	0·02490	35·50	0·800

Two interesting examples of conductance in non-aqueous solvents may be mentioned. Fused lithium hydride is found to be an electrolytic conductor in that the products of decomposition appear at the electrodes. It is found that the alkali metal appears at the cathode, the hydrogen at the anode; we must consequently assume that dissociation is effected to yield a hydrogen anion:—

$$\mathrm{Li\,H} \rightleftarrows \mathrm{Li^{+}+H'}$$

Again, the solutions of the alkali metals and alkaline earth metals in liquid ammonia were found by Kraus to yield good conducting blue coloured liquids. According to this investigator, two definite stages in dissociation can be determined; firstly, the dissociation of the small quantity of sodamide present in a sodium solution, viz.,

$$\mathrm{Na\,NH_2} \rightleftharpoons \mathrm{Na^{+}+NH'_2}$$

and secondly, the dissociation of the metallic sodium to yield a sodium ion and an electron.

$$\mathrm{Na}x\mathrm{NH_3} \rightleftarrows \mathrm{Na'}y\mathrm{NH_3}+\mathrm{e}z\mathrm{NH_3}$$

The ionic mobility of the amminated electron is 19·890, or some seven times greater than that of the sodium ion in the same solution.

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CONDUIT: *see* AQUEDUCTS.

CONFUCIANISM (*see* 6.907).—Confucianism is a general term embracing the teachings of the Chinese classics upon cosmology, the social order, government, morals and religion. While Confucius has been associated with the system, he is not the founder of it, but is the transmitter of the teachings of antiquity and the editor of some of the classics. Mencius (372–289 B.C.) interpreted the work of Confucius. Confucianism was formulated in the Han dynasty (206 B.C.–221 A.D.). Beginning with the first century of our era the system came into contact with Buddhism and underwent certain changes which were interpreted by Chu Hsi (1130–1200) and by Wang Yang Ming (1472–1528). Though the government of the Manchu dynasty (1644–1912) made Chu Hsi's commentaries the standard, the scholars attempted to restore the primitive teaching of Confucius and the ancients. In this they were hindered by the impact of the West upon Chinese culture.

Cosmology.—In cosmology Confucianism starts out with the Tao, the world ground, an impersonal cosmic energy and principle which produced the *yin* and the *yang*, the negative and the positive principles. These by their interaction produced Heaven and Earth and all beings. The social order evolved from the universal order or the Tao. The models of government, social life and morals existed in the universal order as ideas or images. These were transmitted as symbols to the saints and the sages and interpreted and adapted by them to the needs of the people.

Government.—The government was modelled upon that of the patriarchal family, the country being regarded as a large family. The emperor was considered as appointed by Heaven to be the father and the mother of the people and ruled as a benevolent patriarch. The conception of the state as an abstract entity was never developed. The emperor was assisted by the officials recruited from the people on the basis of a civil examination in the classics. They were arranged in ranks, each possessing certain rights and duties and were bound together and to the emperor by a rigid ceremonial. The emperor and officials united all the functions of government, being the priests, executives, the law-makers and the judges. The government was one of men rather than of laws.

Moral System.—The moral system started with the axiom that all men were by nature good, formulated by Mencius. A corollary to this was the dogma that goodness is developed by the study of the classics. Society was divided into five relations: ruler—subject, father—son, husband—wife, older brother—younger brother, friend—friend. The fundamental theory underlying these relations was that of reciprocity expressed by the words "What you do not wish done to yourself do not do to the other man."

The virtues were finally grouped under five: love, the root of all the others, corresponding to our word humanity in its old meaning; justice, which assigns to each one his place and his duties and rights in that status; reverence, through which the rights are acknowledged and the duties performed; wisdom, which discriminates between good and evil; sincerity, which imparts reality to all. The outstanding virtue was filial piety, which also includes loyalty and is the outgrowth of reverence.

As Religion.—Confucianism as religion was a mixture of nature worship and ancestor worship. There were three classes of sacrifices under the last dynasty; the great sacrifices, namely, Heaven, Earth, the imperial ancestors and the gods of the grain and the ground; the middle sacrifices, the sun, moon, certain cultural heroes including Confucius and nature gods; the general sacrifices, performed entirely by the officials, including cultural heroes, nature gods and departmental deities. To the people were left their ancestors and gods approved by the state. The emperor as the high priest of the nation worshipped Heaven at the winter solstice and Earth at the summer solstice. The purpose of the worship was the conservation and the perpetuation of this system.

In China the establishment of the republic in 1912 brought with it far-reaching changes. The relation between Heaven and the emperor upon which the government was based was abandoned and the new idea that the people are the real rulers of China is being inculcated. Confucianism ceased to be a state system, though certain practices have survived. It has become a church and is slowly trying to collect and organise its heritage. The new cult is being organised about Confucius. Religious toleration, however, is granted by the constitution and Confucianism after over 2,000 years as the dominant state system is taking its place as one of the cults of China.

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CONGO FREE STATE: *see* BELGIAN CONGO.

CONGREGATIONALISM.—The outstanding features in the development of Congregationalism during the first quarter of the 20th century have been an intensifying of the denominational consciousness and a strengthening of the tendency towards Connectionalism.

I. IN THE BRITISH DOMINIONS

England and Wales.—On its practical side this forward movement took the form of collecting £500,000 in order to establish the various organisations of Congregationalism on a sounder financial basis, and to supply more adequate retiring pensions for aged ministers. The latter object was the main element in the scheme, proving conclusively that the Congregational Union is now more prepared than it was to recognise some corporate responsibility for its ministers. This point was further emphasised by certain new and more stringent regulations for the admission and recognition of ministers. The normal entry to the ministry is through a recognised college. Failing this, exceptional cases may be provided for by a three years' probation and periodic examinations under the supervision of a county union. Nothing here interferes with the autonomy of the individual church. Churches are still at liberty to call whom they will to minister to them. But recognition by the union and a share in the union grants and superannuation funds is only available for those who submit to the conditions which the union imposes. The churches generally have accepted these conditions which safeguard their interests as well as those of the ministers and establish the status of the ministry on a much more satisfactory footing.

Organisation.—In 1919 the country was divided into nine administrative areas called provinces and a moderator appointed over each area to act as adviser and "Father in God" to the churches within it. The tentative scheme then adopted was after a few years' trial amended in 1924. It was provided that the provinces should be formed by the grouping of county unions, and that a moderator, who might be either a minister or a layman, should be appointed for each such group. The duties of the moderators were defined in the following terms:—

> The general duties of the moderators shall be:
>
> (*a*) To stimulate and encourage the work of the denomination within their own provinces, and to act as the friends and counsellors of ministers and churches.
>
> (*b*) To act as advisers with regard to all financial assistance from denominational funds.
>
> (*c*) To assist churches and ministers in all matters connected with ministerial settlements and removals by personal action and by constant and regular conference with one another. This is not to be understood as excluding other means of effecting changes of pastorates, but it is desirable that the moderators should be kept informed of any introductions effected so as to avoid overlapping.

N.B. Whereas it may be considered fitting that the moderator attend the ordination, induction or recognition services in his province, his presence shall not be deemed essential, nor shall he preside *ex officio*, but only when invited to do so.

It was further provided that moderators shall act in concert with the county union executives and with special provincial committees elected *ad hoc*. Moderators are to be appointed for periods of five years, and the following rules were laid down for their election:—

The appointment of moderators shall rest with the Assembly of the Congregational Union of England and Wales, acting for the purposes of nomination through a joint committee consisting of

(*a*) Representatives of the province, not exceeding 14 in number, appointed by the provincial committee, each county union having at least one representative and (*b*) Representatives of the Congregational Union of England and Wales, not exceeding 9 in number, to be appointed annually by the council, on the nomination of the general purposes committee.

Before being submitted to the assembly of the Congregational Union of England and Wales the nomination made by the joint committee with regard to a particular province shall be confirmed by a joint meeting of the assemblies or by a joint meeting of the executives of the county unions concerned (as may be determined by the provincial committee), or where so desired by the provincial committee acting in their name. The general purposes committee shall have the general administration of the scheme and shall report annually to the council.

It is perhaps too soon as yet to form any definite estimate of the result of these constitutional changes, but the fear that these would interfere unduly with the autonomy of the churches has not yet been realised. The system of moderators seems to be making for efficiency and closer co-operation.

Statistics.—So far as numbers are concerned the Congregational churches have no great increase to report. There is a decline in the number of Sunday-school scholars, and a distinct shortage of candidates for the ministry, while new chapels are not being built in sufficient numbers to meet the normal increase in population. At the same time there is a more hopeful spirit abroad. The Forward Movement has entered on a new phase. On the material and mechanical side it has been thoroughly successful. What is needed now is that this should be followed by a revival of faith, hope and self-sacrifice. Conscious of this the churches are everywhere girding themselves for a new missionary campaign both at home and abroad. There has been a marked increase in denominational loyalty, and the churches are conscious of their unity and corporate responsibility as they have never been before. The two new publications, *The Congregational Quarterly* and *The Congregational Church Monthly*, reached a paying circulation in a very short time and have contributed very materially to the maintenance and strengthening of the new denominational spirit. As to Congregationalism overseas, numerically little or no progress has been made. The churches in some cases have a struggle to hold their own. Movement is rather in the direction of consolidation than of expansion. This has made for an increased efficiency and for a strengthening of the denominational consciousness.

Canada.—In Canada the Congregational churches, with a few negligible exceptions, are now merged along with the Methodists and Presbyterians in the United Church of Canada. This reunion is the culmination of negotiations and discussions which have been going on for some years. Congregationalists have taken a leading part in the reunion movement. They have shown themselves willing to accept a central organisation and a closely-knit church fellowship, while safeguarding spiritual liberties. In the doctrinal basis of the United Church they helped to secure that the declaration of faith accepted by the partners to the union should be purely declaratory and should not be made " an imposition upon any." To them the union will bring a great accession of strength in social, evangelistic and educational work. Though their identity will be sunk in the United Church the Congregational churches of Canada will continue to give their distinctive contribution to the religious life of the Dominion all the more effectively through the union. Their college at Montreal, affiliated with others in the theological faculty of McGill University, is doing fine work in training men for the very varied types of ministry which the country requires.

Australia.—Congregationalism in Australia has not kept pace with the growth of population. In spite of its freedom and adaptability it has made less progress than the more closely organised churches. It maintained too long an individualist type of independency and rather lived on the reputation of certain large and prosperous churches led by men of outstanding ability. But the general level of the ministry is higher than it ever was, and with three colleges in Sydney, Adelaide and Victoria it should not be difficult to maintain it. The Congregational Unions foster a sense of corporate responsibility among all the churches. The down-town and country churches now feel themselves part of a living organism and they and their stronger brethren stand or fall together. The establishment of provident, sustentation and building funds has done much to increase the denominational consciousness and makes for efficiency and home missionary enterprise. The failure of the recent negotiations for reunion among the Australian churches may prove a blessing in disguise. It is said that Congregationalism now breathes more freely and is preparing to give itself more heartily to its distinctive witness. The difficulties are very great in a country where practical materialism and religious conservatism seem to go hand in hand. But these very difficulties constitute a challenge and an opportunity, and there are many indications that the Congregational churches are alive to the need and are preparing themselves to meet it.

South Africa.—The Congregational problem in South Africa is much complicated by the existence of native and coloured churches. These greatly outnumber the white churches, and since the withdrawal of control by the London Missionary Society, have tended to interpret their independency very literally. But guidance and fostering are supplied partly by the white churches, which have to find men for administrative posts and most of the money, and partly by the Colonial Missionary Society. The Congregational Union of South Africa now comprises all the churches under a central organisation and is creating a new sense of corporate fellowship and responsibility. It is tackling the educational problem among the natives, training teachers and preachers and initiating social work.

Other Unions.—In the smaller Congregational Unions of Nova Scotia, British Guiana, New Zealand, Jamaica, Tasmania and Newfoundland, the new spirit of fellowship, co-operation and denominational responsibility is making itself felt to the great advantage of the Churches themselves and to the increase of their capacity for aggressive work. They represent a new and very effective type of federated independency. (W. B. Se.)

II. IN THE UNITED STATES

The years since 1910 have been one of the most formative and significant periods in the history of the Congregational churches in the United States. In point of institutional development the following table shows what has taken place:

	1924	1910
Churches	5,680	6,033
Members	878,995	735,563
Benevolence	$ 3,112,520	$1,269,409
Home Expenses	19,507,607	8,965,894

The decrease in the number of churches from 1910, the year of maximum since 1620, is due to the closing of a large number of small congregations, often by federation or union. The increase in membership and benevolent gifts is noteworthy.

Administration.—The ideals of Congregational church government are the independence of the local congregation and the fellowship of the independent churches for mutual counsel and for the prosecution of those enterprises which no single church alone could compass. Harmonious balance between these two principles involves and assures the symmetry and success of the whole plan. The years 1910–26 have witnessed a striking development of the fellowship of the churches. This appears in the growth of the influence of the state conferences and the larger function of the state superintendent, not merely because of counsel and financial support given to the small or missionary-aided congregations, but also through increasing co-operation in the affairs of the larger and self-supporting churches. In effecting pastoral relations, organising and carrying out their own community programmes and in all matters of policy, the churches have come to look for guidance to the superintendent and also, through him, to the board of directors, of the state conference. This service is rendered without assuming any rights of judicature, and it issues in a gratifying increase of practical efficiency.

National Organisation.—The development of the national organisation of the Congregational churches has kept pace with that of the state units. The effort to perfect closer organisation, cut down overhead cost, and increase the community service of the churches has been strongly influenced by similar movements in the economic world. After a period of careful study by a commission chosen for its representative character, the first step in advance was taken at Kansas City in 1913. The National Council was given larger functions in the work of the church, still safe-guarding the autonomy of the individual congregation. A general secretary was chosen to represent the churches of the nation in their relations with smaller Congregational groups, other denominations and in international relationships. The various societies through which the churches had carried on their missionary work were more closely integrated with the National Council. Again, after intensive study by a commission, new plans were adopted by the National Council in 1925, by which the work of the denomination is divided into two groups, home and foreign, and the administrative costs are further simplified.

Doctrinal Position.—The Congregational churches always have laid more emphasis upon their covenant with God and with one another, entered into in order to constitute church membership, than upon formal creeds. All Congregational creeds have been looked upon as platforms for action and testimonies as to faith generally accepted rather than as dogmatic statements and tests. No single statement can be indicated as the authoritative creed of all the Congregational churches, since each congregation adopts its own creed and there is wide variety. During a period of intense doctrinal debate, which has proved divisive in other bodies of American Protestantism, the Congregational churches have not been seriously disturbed. All shades of opinion are represented among the clergy and laity: their deepest unity seems to be in their worship and their programmes of service. They occupy in general a liberal evangelical position. Interdenominational movements towards comity and unity have been shared largely by the Congregational churches and their missionary programme has been sustained with growing power and enthusiasm. (O. D.)

CONJURING (*see* 6.943).—Advancement in conjuring is mainly to be measured in the improved manner of achieving the limited number of effects possible to the art. These are, chiefly, apparent creation; destruction and restoration; disappearance ("evanishment"); surprising transformations; substitutions; transportation ("apporting") and similar acts seemingly done in defiance of natural laws.

The decapitation act (involving the apparent severance of the left arm, left leg or head of a man), introduced by Dr. Lynn in 1874 under the title of "Palingenesia," was revived, and a variation presented in the form of "sawing a woman in half." The effects depend on optical illusions and mechanical principles cleverly utilised. Among acts done in apparent defiance of the law of gravitation is that known as "Asrah," which involves the disappearance of a floating form and its reappearance.

Houdini's Performances.—The most radical development in conjuring in the present century is the series of sensational escapes which have been devised or developed by Houdini. His success depends partly on his great physical strength and the fact that he is slightly bow-legged. In an outdoor exhibition he allowed himself to be suspended, head down, some 75 ft. above the ground, in which position he freed himself from a straight jacket previously fastened upon him. The release is accomplished by first gaining slack of about two inches at the shoulder. Another remarkable act is that from the so-called "Chinese water torture cell." The "cell" is a metal-lined mahogany tank having a front of plate glass. This tank is filled with water, into which Houdini is lowered head first, his feet being fastened in stocks, that is, a mahogany cover in two sections, brass-bound. When he is submerged, the cover is padlocked on the tank, which is enclosed in a curtained cabinet. By his unaided effort he effects an escape within the space of two minutes.

In his "overboard act" he is shackled with irons and placed in a box, which is locked, roped and weighted. The box is then submerged from a boat, to which he returns after freeing himself under water. The "milk-can escape" involves the use of a trick can. The top is locked to an outer section, which envelops the inner can containing the liquid. A simple lifting movement puts the operator safe from harm and makes escape easy. Other sensational effects produced include the "evanishment" of an elephant from a cabinet situated in the centre of a fully-lighted stage and the so-called "Hindu needle trick," in which upwards of 100 needles and several yards of thread are apparently swallowed, and afterwards withdrawn from the mouth with the needles threaded at intervals.

Mind Reading.—Logically classifiable under conjuring are those effects produced through natural means by many so-called spirit mediums and mind readers. The mortality of the World War quickened interest in psychic phenomena and thereby opened a frequently lucrative field for clever charlatans. A noted performer claimed a vision able to penetrate metal, reading the time through a closed watch case and deciphering messages placed in a closed metal box. It was subsequently shown that his power depended on normal vision, view of the objects being obtained by such adroit handling of the object that he was able to obtain a glimpse of the contents. A medium, "Eva" of Paris, attracted much attention by her ability, in suitable surroundings, to emit and reabsorb "ectoplasm," the movement of which, on investigation, was shown to be obstructed when a veil was placed over her mouth.

Another notable instance was that of "Margery" (Mrs. Crandon of Boston), whose acts of levitation, bell ringing and other phenomena, ostensibly through a spirit, "Walter," were investigated in 1924 by a committee on which were psychologists from Harvard and other universities and shown to be reproducible by natural means. Among other effects commonly produced by mediums are slate writing, spirit photography and the revelation of information of which the medium is presumably unaware. The devices for securing these effects by natural means are very numerous, many of them requiring great adroitness of mind as well as much mechanical ingenuity.

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CONNAUGHT, ARTHUR WILLIAM PATRICK ALBERT, DUKE OF (1850–), the third son of Queen Victoria (*see* 6.950), went, in 1910, to South Africa to open the Union Parliament on behalf of King George V. He was appointed in 1911 to succeed Earl Grey as Governor General of Canada, retiring from this office in 1916. In Dec. 1920 he went to India as the representative of King George in order to inaugurate the provincial legislative councils of Madras, Bengal and Bombay. It was agreed, on his return to England, that valuable help had been given by his speeches to the work of self-government in India under the new régime.

The Duchess of Connaught died in London March 14 1917. The Duke's only son, Prince Arthur of Connaught (b. 1883), married, in 1913, Princess Alexandra, Duchess of Fife, daughter of the Princess Royal, who had succeeded in 1912 to her father's dukedom by special remainder. Prince Arthur was, in 1920, appointed Governor General of the Union of South Africa. The Duke of Connaught's elder daughter, Margaret (1882), was married in 1905 to the Crown Prince of Sweden, and died at Stockholm May 1 1920. The younger daughter, Patricia

(b. 1886), married, in 1919, the Hon. Alexander Robert Maule Ramsay, third son of the 13th Earl of Dalhousie. Princess Patricia of Connaught resigned her royal title on her marriage, and elected to be known as Lady Patricia Ramsay.

CONNECTICUT (*see* 6.951).—A state of the United States of America. In 1920 the population was 1,380,631 as compared with 1,114,756 in 1910, an increase for the decade of 23·9%. The total land area of the state is 5,004 square miles.

Political History.—In 1911–2, the 34th and 35th and in 1915–6 the 36th amendments to the Connecticut constitution were adopted. The first stated the conditions under which the lieut.-governor was to take the place of the governor; the second provided that the General Assembly should adjourn not later than the first Wednesday after the first Monday in June; and the third allowed the passage by the General Assembly of a law to cover the payment of mileage to the legislators. In 1914 a workmen's compensation law, which applied to all work-places in which five or more persons were employed, was passed.

In 1925 a commission vested with power to end the pollution of streams, whether the nuisance be committed by firms, corporations or municipalities, was established. In the same year a new medical practice Act provided for more strict supervision, and a commissioner of agriculture was substituted for the older Board of Agriculture in order to make state assistance in the development of agriculture more effective. During the years 1920–5 a marked development took place in the amount and the conduct of the public welfare work of the state.

Connecticut failed to ratify both the 18th (Prohibition) and the 19th (Woman Suffrage) amendments to the Federal Constitution, and in 1925 refused by a large majority to ratify the proposed child-labour amendment. The governors of Connecticut from 1909 to the beginning of 1925 were Frank B. Weeks (1909–11); Simon E. Baldwin (1911–5); Marcus H. Holcomb (1915–21); Everett J. Lake (1921–5). On Aug. 16 1924 Anson T. McCook was appointed Treasurer to fill the unexpired term of S. Harold Gilpatrick; he reorganised and improved the methods of handling and safeguarding the State's money and securities. On Jan. 7 1925 Hiram Bingham was inaugurated as governor. He resigned the following day, having been chosen a senator of the United States in a special election to fill the unexpired term of Frank J. Brandegee, and the lieutenant-governor, John H. Trumbull succeeded to the office of governor.

Education.—Beginning on July 15 1909 the organisation of public education was changed from the district type to that of town management. In 1921 there were less than 10 townships that had not availed themselves of the law by which all the schools are under the direction of the town school committee. Appropriations for the support of the schools are made at a town meeting. Compulsion was made more rigid by the enactment providing that after Sept. 1 1911 no employment certificate should be accepted by any employer except such as were issued by the State Board of Education. On July 1 1917 a law provided that all new public school teachers must pay 5% of their salary into a pension fund. The outstanding educational development of the five years ending 1925 was the improvement in the professional preparation of teachers. In 1911 the Connecticut Woman's College was opened at New London, and in 1925 a woman's college, Albertus Magnus (Roman Catholic), was opened at New Haven. In 1925 Trinity College established an extension department.

Agriculture.—In 1920 32·2% of the population was classed as rural, though the actual farming population was somewhat smaller. In 1920 the farms of the State numbered 22,655, a loss of 4,160 since 1910. The average value of land per ac. in 1920 was $53.28 as compared with $33.03 in 1910. Tobacco is the most important agricultural product; the crop increased from 28,110,453 lb. valued at $4,415,948 in 1910, to 42,193,196 lb. valued at $15,189,551 in 1919. In the season of 1922 the Connecticut Valley Tobacco Association, a pool with a Connecticut membership of 2,400 growers farming 90% of the acreage of outdoor tobacco in the State, was formed for the collective marketing of the crop. The association sorts, packs, sweats and sells the leaf. Dairying is practised on more than four-fifths of the farms of the State. The quality of the milk is being steadily improved through a system of inspection put into effect by the Milk Regulation Board and administered by the Dairy and Food Commission. The number of milch cows fluctuates around 120,000. The production of milk increased from 45,749,849 gal. in 1909 to 49,458,287 gal. in 1919. In the same period the output of butter fell from 3,498,551 lb. to 1,926,127 lb.; cheese output rose from 79,156 lb. to 90,500 pounds. The poultry industry increased very rapidly owing to the favourable climate and the large market close at hand. For the same reasons market gardening increased, the gardeners being organised into one State and 16 local organisations. The estimated values of five leading crops of 1924 were: tobacco, $12,223,312; hay, $10,400,000; potatoes, $3,425,000; apples, $2,363,000; and corn for silage, $2,310,000. These figures indicate a very considerable decline from those of 1923.

Manufacturing Industry.—The World War brought a great volume of orders to Connecticut factories and caused large numbers of plants to change the character of their product. In May 1918 80% of Connecticut manufacturing was directly or indirectly engaged in producing munitions, rifles, machine guns, clothing and other articles used by the military forces, and there were five plants where ships and power boats were constructed. Wages were high during this period. In the years of rapid expansion there were a great many strikes, and labour organisations increased in membership. During the two years following the Armistice the factories began the process of readjustment to peace-time conditions, which was completed by the depression of 1920–1. The leading branches of manufacturing industry and the values of the products of each in 1921 were:—

Brass, bronze, copper and allied products	$65,795,194
Cotton goods	62,987,202
Silk goods, including products of throwsters	50,838,974
Hardware	50,277,218
Foundry and machine shop products	46,144,807
Electrical machinery apparatus and supplies	33,839,350
Woollen goods	20,504,074

In 1922 the situation steadily improved; unemployment declined, and in Dec. 1922 the Department of Labour reported an actual shortage of labour in the State. The growth of industry after 1922 was indicated by the fact that in 1923 and 1924 the cost of new factory construction and additions was $16,807,775. The years 1923–4 were remarkably free from strikes and lockouts.

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(R. H. G.)

CONRAD, JOSEPH (1857–1924), English novelist (*see* 6.968), was born on Dec. 6 1857 in the Ukraine, of a Polish family of the name of Korzeniowski; his father, a man of letters, became involved in the Polish insurrection of 1863 and was banished to Vologda, whence he returned to Cracow before his death. In Cracow, the son, Joseph, passed his boyhood. He learned to speak and write French with fluency as a boy; his first acquaintance with English literature was made through Polish translations of Shakespeare and Dickens; later on, the novels of Marryat and Fennimore Cooper—particularly Cooper's *The Pilot* (1888)—inspired him with romantic ideas of the seaman's life.

At the age of 19 he found his way to Marseilles, and for two years served in French ships in the Mediterranean and on the South American coast. With hardly a word of English speech at his command, he came to Lowestoft in 1878, qualified as able seaman on coasting vessel, and in Aug. 1880 sailed as third mate to Sydney on the Clyde-built, Clyde-owned sailing ship "Loch Etive," commanded by a famous clipper captain, William Stuart of Peterhead, of whom, later, in *The Mirror of the Sea* (1906) Conrad said "To this day I preserve his memory, for indeed it was he, in a sense, who completed my training." Four years later he was a master in the British Merchant Service, and for years his calling sent him to many parts of the world and through a constant succession of adventures, all contributory to the cosmopolitan spirit and the range of incident in his subsequent stories.

A Sequence of Novels.—During a period of ill-health (the result of Congo fever whose *sequelae* were to give pain to his later years and shorten his life), he started his first novel, *Almayer's Folly*, the writing of which engaged him, with frequent and protracted intermissions, from 1889 till 1894. Into its composition went many personal experiences of his own as first officer of a ship in which he had sailed between Singapore, Borneo, Celebes and Sumatra. When published in 1895 it was recognised, by acutely discerning readers, as a portent of something new in English fiction, the product of a rare temperament and of unusual experiences, expressed in a fastidious choice of phrase, in a studied cadence whenever that would carry an emotional effect, or best suggest half-lyrical moods evoked by natural scenes or moments of human crisis. His style in general had dignity, clarity and idiomatic vigour, with an elusive quality of charm which few readers probably suspected might be due to the writer being a foreigner, with at least three languages at his command wherefrom to choose and adapt the colours and harmonies of his verbal palette.

This first novel was enough to establish a small though devoted band of permanent Conradians, but neither it, nor its immediate successors—*An Outcast of the Islands* (1896), *The Nigger of the Narcissus* (1897), *Lord Jim* (1900), *Youth* (1902) and *Typhoon* (1903), found any large body of the reading public to share the enthusiasm of the critics till many years after. Of *The Nigger of the Narcissus*, Conrad, in the year before he died, declared it was " the story by which as a creative artist I stand or fall; at any rate, no one else could have written it." It and *Youth* and *Typhoon* brought out hitherto unexploited aspects of life at sea with amazing effect, and gave ocean storms and the trials and endurance of the mariner an epic grandeur. The scene of *The Outcast of the Islands* and of *Lord Jim* was laid on the same coasts as *Almayer's Folly*.

Soon after his emergence as a writer, he gave up the sea, and went to live in Kent. But the public apathy regarding his work, and the stress of pecuniary cares paralysed his pen for a while; ever a slow writer, he began to find a whole day at the desk produced no more than a few sentences, and thoroughly disheartened, decided to go to sea again. Fortunately for himself and English letters, his efforts to get a command on a Clyde ship, four years after giving up the sea, failed. A modest Civil List pension was secured for him, and relinquished as soon as the sales of his books made his circumstances easier. Still in the prime of life, he wrought industriously and could yet call up reserves of zest, passion, poetic and romantic mood to vivify the recollections of his earlier strange experiences. In the following 25 years he produced a score of volumes of fiction; complete novels for the most part, others, collections of his short stories; as well as several volumes of his own reminiscent experiences.

Conrad's " first period " is generally classified as ending with *Nostromo* (1904), a tale of an imaginary state in South America, with its atmosphere created from an old book of South American travels. *The Mirror of the Sea* which followed, a blend of reminiscence, fable and reflection, may be looked upon as commentatory on a chapter closed.

The Second Period.—It was, in many respects, a new Conrad who produced in 1907 *The Secret Agent*, a fantastic tale of the anarchist and criminal underworld, which 15 years later, he dramatised. *Chance* (1919), *Within the Tides* (1915)—a series of short tales—was followed by *Victory* (1915) (with the old Celebes and Java background), *The Arrow of Gold* (1919), *The Rescue* (1920) and *The Rover* (1923). For many of Conrad's earliest admirers those novels, though delightful, missed something of his first creative ecstasy, but by them he secured a great vogue for all his works in Britain and America, and on his death he was recognised and honoured on both sides of the Atlantic as a classic novelist.

The Rover—an historical tale with its scene laid in the peninsula between Toulon and Hyères—was, in a sense, the residual product of a much greater Mediterranean story he had been brooding on since 1907, dealing with French intrigue at Napoleon's Elba period. This latter work, begun only June 1920, was but half or two-thirds done when he died, and was published in its fragmentary state in 1925, with the title of *Suspense*.

An Estimate.—Conrad, as has been said, brought to his first essays in English writing at least tri-lingual knowledge, and although he never contemplated writing in the language, found in the best French writers effects of balance, light and shade, a delight in words for their own sake, as well as more subtle psychological results arising from the indulgence of personal mood even at the cost of action, held momentarily in suspense. This French influence was rarely absent from his work, and wonderfully enriched it.

He came to the study and practice of English in his maturity, with an instinctive sense of verbal beauty, a respect for good technique, a cultivated mind and high ideals as an artist. In all his books is manifest a scrupulous avoidance of *cliché* either of thought or phrase, and a philosophy that forbade surrender to romantic sentimentalism on the one hand or " realistic " squalor on the other. It was his conviction that only through an unremitting care for the shape and ring of sentences, an approach could be made to plasticity, to colour, and the light of magic suggestiveness could be brought to play for an evanescent instant over the commonplace surface of words worn thin by ages of careless usage. " The sincere endeavour to accomplish that creative task, to go as far on the road as his strength will carry him, to be undeterred by falterings, weariness or reproach, was " he said, " the only justification of the worker in prose."

There was no deliberate ethical purpose in his books. " I suspect " he said, " that the aim of creation cannot be ethical at all. I would fondly believe that its object is purely spectacular—a spectacle for awe, love, adoration or hate, if you like, but in this view—never for despair. These visions, delicious or poignant, are a moral end in themselves." For the most renowned Russian novelists he had neither respect nor admiration, which perhaps is not to be wondered at in a Pole. Though he disliked the appellation of " romantic novelist " and preferred to be known as a " creative artist," he greatly vindicated romance in a period of " realistic " reaction. He died at Bishopbourne, near Canterbury, on Aug. **3** 1924. A volume, *Last Essays*, was published in 1926. (N. Mu.)

See Ford Madox Ford, *Joseph Conrad* (1924); A. Symons, *Notes on Joseph Conrad: With some unpublished letters* (1926).

CONRAD VON HÖTZENDORF, FRANZ (1852–1925), Austro-Hungarian soldier, was born in Vienna Nov. 11 1852. Conrad was the leading military figure of the old Dual Monarchy, and also one of its most influential politicians. In 1899, as a brigadier in Trieste, his observations on Italian Irrdentist propaganda inspired him with a lasting mistrust of the third member of the Triple Alliance. Here he made the acquaintance of the heir to the throne, the Archduke Francis Ferdinand, whose ideas coincided with his own in many respects. Francis Ferdinand's influence elevated Conrad to the post of chief of staff in 1906. His predecessor, General Beck, had held this post for some 20 years, in the course of which Beck, who shared the Emperor Francis Joseph's optimism, had allowed the army to lag far behind modern progress, in technical matters, and had paid little attention to the nationalist problems which complicated the home and foreign politics of the Monarchy.

Conrad at once began to reorganise the army, especially the artillery. His activities earned him the hatred not only of the German Liberals but also of the Slavs and the Magyars, all of whom, if for different reasons, were opposed to an aggressive army policy. His most serious conflict, however, came with the Emperor himself and the minister of foreign affairs, Count Aehrenthal. Conrad was convinced that the Monarchy could not avoid a conflict with Serbia; and further that Italy must be considered not as an ally but an enemy. He believed the only salvation to be in aggressive " preventive " measures. Both before and after the annexation of Bosnia and Hercegovina he urged that the only solution of the Southern Slav question would be the "preventive" annexation of Serbia. When Italy became engaged in war with Turkey in 1911, he again advocated a "preventive" war against the Monarchy's ally. This last suggestion led to such a conflict of views with Aehrenthal, who believed that peace could be maintained, that Conrad was forced to resign. He was reappointed, however, a few months later, when events in the Balkans again grew critical. Conrad did not overestimate the strength of his army, and, therefore, when war broke out and the attitude of Italy and Rumania grew critical, he urged—vainly—that these former Allies be appeased by territorial concessions. Meanwhile he conducted the operations of the Austro-Hungarian troops in Galicia with skill and boldness, and later, when they entered the World War, also saved his country from much devastation by his bold strategy. When, however, the young Emperor Charles himself took over the command of his army in place of the previous nominal commander, the Archduke Frederick, he took offence at Conrad's assured manner and dismissed him from his post. From March 1917 on Conrad commanded an army group on Austria's Italian Front. No further successes crowned his efforts, and finally the troops under his command disintegrated with the collapse of the Monarchy.

Conrad's political views aroused much controversy. From his own point of view—the maintenance at all costs of the dynastic power of the Habsburgs—they were undoubtedly correct; he took too little account however of the stronger but more remote influence of world politics. As a strategist he was bold and skilful but unlucky. As a personality he was simple and deeply respected; his chief failing was his often faulty judgment of human character. After the downfall of the Monarchy Conrad withdrew entirely into private life and occupied himself with the preparation of his monumental memoirs *Aus Meiner Dienstzeit*, of which five volumes had appeared in 1925. He died at Mergentheim Aug. 26 1925. (C. A. M.)

CONRADY, AUGUST (1864–), Austrian orientalist, was born at Wiesbaden April 28 1864. In 1897 he was appointed a professor at the university of Leipzig, where he eventually became director of the school of oriental studies. He achieved great distinction as an authority on Chinese languages and literature and on Indo-Chinese philology of which he originated the study. Among his works are *Eine indochinesische Kausativ-Denominativbildung* (1896); the section on "China" in J. von Pflugk-Harttung's *History of the World* (1910); *Die Chinesischen Handschriftenfunde Sven Hedins in Lou-Ian* (1920).

CONSERVATIVE PARTY (*see* 6.976).—The Conservative, or as it was temporarily named the Unionist, party had not, by 1911, fully recovered from the débâcle of 1906. For 10 years prior to 1906 the Conservatives, in close alliance with the Liberal Unionists, had been continuously in power. Twice Gladstone had attempted to carry a Home Rule bill for Ireland; twice it had been resisted by the Conservatives and Liberal Unionists in Parliament, and twice (1886 and 1895) the conservative attitude had been emphatically endorsed by the electorate.

In 1903, however, Joseph Chamberlain raised a new issue by promulgating his policy of Tariff Reform. Tariff Reform split the Unionist party as Home Rule, 20 years before, had split the Liberal party, and at the General Election of 1906 the Unionists suffered a crushing reverse, and the Liberals came into power, fettered only by the still co-ordinate authority of the House of Lords. Unsparingly did the Lords work their will on radical measures from 1906–10. Consequently the King's speech of 1910 foreshadowed proposals "to secure the undivided authority of the House of Commons in finance and its predominance in legislation"; and in April the Parliament bill was introduced.

This did much to reunite the Unionist party, which, ever since 1903, had been hopelessly divided on the fiscal and perhaps on other issues. To the Parliament bill, however, the Unionists were stoutly and unanimously opposed, but their leaders took part in the conference at which all parties were represented that followed the accession of George V. After this broke down the struggle was renewed. The Unionists fought it strenuously, though vainly in the Commons, but in the Lords the Tory peers were divided: the "hedgers" led by Lord Lansdowne favoured an acceptance of the inevitable, the "ditchers" with Lord Halsbury at their head preferred the bolder but more perilous policy of compelling Mr. Asquith to carry out his threat and ask the King to create 500 new peers. The former prevailed and on Aug. 10 the Lords accepted the Parliament bill.

In the following November the Conservative party was compelled, by the resignation of Mr. Balfour, to elect a new leader. Its internal condition had not for months, indeed for years, past been satisfactory. Mr. Balfour, in a laudable attempt to prevent an open schism between free traders and protectionists, had given the impression of vacillation. He now insisted that he had no longer the vigour to conduct a ministry; that grave questions which might involve another early dissolution were impending, and that he could best serve the interests of the party by handing over the leadership to a younger man. The industrialists and protectionists urged the claims of Mr. Austen Chamberlain; the old Tories, the Churchmen, and the country folk preferred Mr. Walter Long. Ultimately both stood aside in order to secure unanimity, and the choice of the party fell on Mr. Bonar Law.

Leadership of Bonar Law.—The choice proved a happy one, though the new leader's powers were displayed to much greater advantage in the House of Commons than on the platform. His presence was undistinguished and his voice thin, but by his simplicity and modesty, no less than by his considerable intellectual gifts, he established a strong hold over those with whom he came into contact. His leadership continued until his resignation of the Premiership, after only a few months' tenure, in 1923.

To resume the sequence of events. After the passage of the Parliament Act in April 1912, Mr. Asquith introduced a Home Rule bill. The Conservatives fought it in the House of Commons, but the third reading was carried by 367 to 257. The Lords, however, rejected it by 326 to 69. It met a similar fate in 1913 and 1914, but the Parliament Act had deprived the Lords of the power to prevent it from becoming law.

Meanwhile, however, Ulster was preparing to resist forcible disjunction from the United Kingdom, and behind Ulster stood the bulk of the Unionist party. At the eleventh hour (July 1914) the Buckingham Palace conference of eight leaders attempted a settlement, though in vain. But by that time the issues of European peace and war were hanging in the balance. Party controversies were instantly put aside, and on Aug. 2 1914 Lord Lansdowne and Mr. Bonar Law addressed to Mr. Asquith an historic letter promising, in the event of war, the whole-hearted support of the Conservative party to the Government.

The War Period.—That promise was fulfilled in the letter and the spirit and the whole of the party organisation was diverted to national service. In May 1915 Mr. Bonar Law and other Conservative leaders joined forces with the Liberals and Labour men in an administration, formed to conduct the War to a successful issue. But the issue was not yet; victory tarried; public dissatisfaction grew, and in Dec. 1916 a political crisis supervened. Mr. Asquith announced (Dec. 3) the reconstruction of the Govt., but ultimately preferred resignation. Mr. Bonar Law was invited to form a Government but declined, and chose instead to serve as Chancellor of the Exchequer and Leader of the House of Commons under Mr. Lloyd George as Premier. A real coalition of the three parties ensued, and was maintained until the conclusion of the Armistice (Nov. 11 1918).

Post-War Changes.—The long Parliament was at last dissolved (Nov. 1918) and Mr. Lloyd George and Mr. Bonar Law jointly appealed, as leaders of the Coalition, to the new and vast electorate created by the Reform Act of 1918. The country gave them an overwhelming majority and, as spokesmen for the nation, they attended the Peace Conference at Paris. After the conclusion of peace the cohesion between the two wings of the Coalition manifestly weakened. A considerable section of the Conservative party became increasingly restless under Mr. Lloyd George's leadership, and after the concession of Dominion Home Rule to Southern Ireland (1921), the "die-hards," as they were termed, decided that when the inevitable appeal to the country came, they would make it as Conservatives, *sans phrase* and under their own leaders. In the early part of 1922 the uneasiness of the Conservative wing of the Coalition was heightened by rumours that the Prime Minister intended to anticipate, and if possible avert, schism by a premature appeal to the country.

Matters reached a crisis on Oct. 19, when a meeting of Conservative M.P.'s was held at the Carlton Club, London, under the presidency of Mr. Chamberlain, the leader of the party in the House of Commons. Mr. Chamberlain definitely refused to break from Mr. Lloyd George and was supported by Lord Balfour, and the majority of his colleagues in the Cabinet. The meeting, however, decided by 187 to 87 votes, "that the Conservative party while willing to co-operate with the Liberals, should fight the election as an independent party, with its own leader and with its own programme."

To this result two speeches largely contributed. One was a singularly direct, manly and courageous speech by Mr. Stanley Baldwin; the other was a firm declaration by Mr. Bonar Law, who had been reluctantly persuaded to emerge from retirement and head the revolt against the Coalition. But it was a soldiers' battle; the victory was that of the rank and file who for the last two years had been increasingly suspicious of Mr. Lloyd George's policy.

The die was now cast. The Coalition was smashed; Mr. Austen Chamberlain and the bulk of his Cabinet colleagues went into the wilderness; Mr. Lloyd George resigned, and Mr. Bonar Law became Prime Minister and the head of a purely Conservative Ministry, the first since 1905. The electorate showed its confidence in the new administration by returning (Nov. 1922) 344 Conservatives as against 53 Asquithian Liberals and 61 National (or Lloyd George) Liberals, and 142 Labour-Socialist members. The Parliament elected in Nov. 1922, on the cry of rest and recuperation, was short-lived. Mr. Bonar Law was compelled by illness to resign in May 1923. Who was to succeed him? Length and distinction of service, great experience, superb intellectual endowments—all pointed to Lord Curzon of Kedleston. The King, however, decided that a peer premier was, under the circumstances, impracticable, and his choice fell on Mr. Stanley Baldwin.

The new Govt. did not last long. Mr. Baldwin, convinced that only Protection could provide a positive cure for unemployment, asked the country (Nov. 1923) to endorse that conviction. At the ensuing general election the country declined. The Conservatives, who at the dissolution numbered 344, returned only 258 strong. The Liberals, impelled towards unity by the threat of Protection, numbered 159, and the Labour-Socialists 191. The two latter parties combined to turn out Mr. Baldwin's Government; the Labour party took office on Liberal sufferance, but in the early autumn became involved in irretrievable difficulties and appealed to the country. The country showed even less liking for Socialism than for Protection, and Mr. Baldwin achieved a victory almost national in dimensions. The new Parliament contained nearly 420 Conservatives and 151 Labour men, while the Liberal parties were in the aggregate reduced to 40. Mr. Baldwin, rightly interpreting the verdict of the country as a call to the union of all Constitutionalists, included in his new Ministry not only those Unionists who, like Mr. Austen Chamberlain and Lord Birkenhead, had gone into temporary exile with Mr. Lloyd George, but Mr. Winston Churchill, who took office as Chancellor of the Exchequer. Thus the Conservative party has regained the position which under Lord Salisbury and Mr. Balfour it had for 20 years (1885–1905) enjoyed. (*See* English History.) (J. A. R. M.)

CONSTANS, JEAN ANTOINE ERNEST (1833–1913), French statesman (*see* 6.986), resigned from the embassy at Constantinople in May 1909 and died April 7 1913.

CONSTANTINE, King of the Hellenes (1868–1923), eldest son of George I. (*see* 11.746) and of the Grand Duchess Olga Constantinovna of Russia, was born Aug. 2 1868 and succeeded to the throne March 18 1913, on the assassination of his father. Having received an early private education in Athens, on reaching the age of 18 the prince was sent to Germany, where he attended the university of Leipzig, served in the Guards and studied at the Prussian Staff College. It was then that the future King met the Princess Sophia Dorothea of Hohenzollern, daughter of the Emperor Frederick, whom he married in 1889. This union was popular in Greece because of the superstition that when a Constantine and a Sophia were upon the throne the Empire of Byzantium would be restored, and, coupled with the fact that he was appointed a field marshal in the Prussian Army in 1913, it played a prominent rôle in shaping the King's attitude during the World War.

On returning to Greece, the Crown Prince was given various military appointments; in 1897 he took over the command of the army in Thessaly, and he was held largely responsible for the disastrous campaign of that year. In 1909 the Diadoch Constantine and his brothers were once more made scapegoats by the Military League and they were compelled to resign their commissions. Subsequently, on the initiative of Veniselos, the royal princes were recalled from their practical exile. Thenceforward, acting in co-operation with the French military mission, Constantine, now Inspector-General of the Army, devoted himself to reforms which were markedly apparent during the Balkan wars, and the successes that were then gained completely re-established his prestige.

In spite of the victories of the Balkan campaigns, various factors influenced the King's policy in the World War; the future of Greece depended largely upon the rôle of Turkey, and the people, who are not hard fighters by nature, always had leanings towards neutrality. The Sovereign was immensely popular; he admired Germany, and believed in her efficiency, and he was anxious to stand well with his brother-in-law. Beyond the fact that on Aug. 7 1914 Constantine expressed his personal sympathy for the German Emperor and advocated a neutrality which would be useful to him, nothing of marked importance, however, happened until early in 1915. But after the entry of Turkey, and in connection with the Allied attack upon the Dardanelles, the King, probably influenced by his military advisers, vetoed Veniselos' proposal to co-operate with the Western Powers in exchange for their promises of concessions in Asia Minor. Veniselos resigned (March 1915), but at the subsequent election in June he obtained a large parliamentary majority.

By this time, however, the King was ill, the operations at the Dardanelles were not going well, and the negotiations with Bulgaria having been mishandled by the Allies were reaching a critical stage. When Veniselos was recalled in Aug., therefore, the King had secured increased support for his policy of neutrality, Bulgaria had ordered a general mobilisation in Sept. and Veniselos was in favour of a loyal interpretation of the Greco-Serbian frontier agreement made prior to the Treaty of Bucharest in 1913; but when he announced in the Chamber that if Greek support for Serbia brought Hellenic troops into contact with the German Army they would act in accordance with their honour, the King demanded his immediate resignation upon the plea that in questions of foreign policy he alone was responsible. Subsequently Serbia was left to her fate and a fresh dissolution of the Chamber was ordered. At the elections held in Dec. the Royalists secured a large majority, principally because the Veniselists abstained from voting, and from then until the departure of the King, in June 1917, the Government was in the hands of various Royalist politicians, who favoured neutrality.

For some months the struggle between the King and Veniselos continued, but from Oct. 1915 the rupture was complete and thenceforward his Majesty was more occupied by his relations with the Allies than by the internal crisis. There are those who contend that Constantine had always been determined to support Germany to the utmost of his power, and there are others who suggest that he favoured neutrality as being in the interests of Greece. However this may be, the King pursued a policy detrimental to the Allies, and this policy gradually became more and more marked.

The closing months of 1915 and the earlier part of 1916 passed without any overt signs of hostility, but in May of the latter year Fort Rupel, which commanded the Struma Pass into eastern Macedonia, was surrendered to the Bulgarians and the

Allies demanded the complete demobilisation of the Hellenic Army, which menaced them in Macedonia. Five months later (Oct.) the Greek fleet (except three vessels) was taken over by the Allies, and in Nov., the demobilisation having proceeded slowly, a further demand was made for the cession of war material. This request was not complied with, and, although it would appear that the King had given personal assurances to the French admiral, an Allied landing at the Piraeus was opposed and the naval contingents, disembarked there on Dec. 1, had to be withdrawn after material losses. A month later a further blockade was declared and the removal of the whole Greek army to the Peloponnesus was insisted on. This was agreed to and a formal apology was made for the events of Dec. 1, but it soon became obvious that the Allies could not continue to accept a régime dangerous to their whole position at Salonika.

The final stage in this part of King Constantine's history occurred when the transference of the army had proceeded unsatisfactorily, when the downfall of the Tsar (March 1917) had taken place, and when the question of the distribution of the Thessalian harvest to the whole of Greece and not merely to the Royalist section of the community had become a matter of urgency. In June, M. Jonnart, acting as the High Commissioner of the protecting Powers, arrived at Athens, where, backed up by strong forces, he demanded better guarantees for the safety of the Allied army in Macedonia, the more true working of the constitution and the departure of the King. Constantine, accompanied by the Queen and the Crown Prince, sailed from Greece on June 12, leaving his son Alexander upon the throne; but, whilst it was generally claimed that he had abdicated, the proclamation then issued by the King clearly left open the way for him and for his supporters to contend, as they subsequently contended, that he had no intention of finally renouncing his rights to the throne. Constantine spent the following three years of his life in Switzerland, where the climate seems to have improved his health. At the end of this period, too, arrangements were made for the marriages of the Diadoch to Princess Elizabeth of Rumania and of Princess Helen of Greece to Prince Carol, then Crown Prince of Rumania.

As a result of the election of Nov. and of the subsequent plebiscite, Constantine returned to Athens at the end of Dec. 1920. This event met with almost general approval, but the King was once more placed in a nearly intolerable situation. Never recognised by Great Britain and France, he was compelled either to pursue the Asiatic policy of his predecessors—and this without the international support which they might have continued to enjoy—or to make himself unpopular by sacrificing gains promised to Greece under the already signed Treaty of Sèvres. Rightly or wrongly, he adopted the former alternative; he declared himself in favour of a continuation of the Turkish campaign and he failed to condemn, if he never encouraged, the Greek objections to the several offers of mediation made by the Western Powers.

The King, accompanied by various members of the royal family, went in person to Asia Minor, where he was present at the time of the temporary successes of Aug. and Sept. 1921. But the difficulties of the campaign were too great, the Hellenic army was not sufficiently strong to secure a decision and the whole international and local situations were modified by the Franco-Turkish agreement signed in October. Thus, when the Royalists had placed the Hellenic cause in the hands of the Great Powers and when the King had been back upon the throne for almost exactly 12 months, the close of the year 1921 found the military and diplomatic positions at a serious discount.

The opening months of 1922 were occupied with developments bound up with the Paris conference held in March and it is difficult to define whether or not Constantine was personally responsible for the delays and complications which hastened on the ultimate disaster of September. The Greeks nominally accepted the proposed evacuation of Asia Minor, but this was not carried out. In July, the Hellenic Govt. proclaimed its freedom of action and announced a plan for the occupation of Constantinople and the Greek High Commissioner declared that Ionia would be autonomous.

These events, coupled with a speech made by the British Premier on Aug. 4, so infuriated the Turks that, three weeks later, they initiated the attack which resulted in the recapture of Smyrna and in the driving of the Greeks out of Asia Minor. By the last week in Sept. an insurrection had broken out in the army, and, at the demand of a revolutionary committee headed by Col. Gonatas, the King abdicated in favour of his son George. On Sept. 30 Constantine left Athens for Palermo, where he died on Jan. 11 1923 from haemorrhage of the brain. The revolutionary government having refused to allow his remains to be brought to Athens, they were transferred to Naples, where an impressive funeral service was held in the Greek church.

Thus ended the life of a man whose greatest misfortune was a series of events over which he had but little control and whose want of success constituted his worst sin.

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(H. C. Wo.)

CONSTANTINE VI. (1861–), Patriarch of the Greek Orthodox Church, was born in 1861 at Bighi near Mudaniya on the Asiatic coast of the Sea of Marmora, his family name being Araboghlou. After studying at the theological college of Halki, he was in 1896 appointed Bishop of Kirk-Kilisse (Saranda Ekklesiai) in Thrace. In 1899 he was nominated Metropolitan of Trebizond, being subsequently transferred first to the see of Cyzicus, and then, in 1924, to that of Derkos, with residence at Therapia. After the death of Gregory VII., he was, on Dec. 17 1924, elected Œcumenical Patriarch. But his Patriarchate was brief. On Jan. 30 1925 he was expelled from Constantinople by the Turks, on the ground that, not having been registered as residing at Constantinople, he did not come under the category of *établis* or those persons exempted from the exchange of populations by the Treaty of Lausanne. His expulsion at first caused great indignation at Athens, and he was honourably received at Salonika, where he took up his residence; but a compromise was eventually made, by which in May he was induced to resign, and he retired to Khalkis. Another Patriarch, who took the name of Basileios, was elected in his stead.

CONSTANTINOPLE (*see* 7.3), a city and vilayet of Turkey (Turkish, ISTAMBUL). The city, formerly the capital of the Turkish Empire, includes the old city of Stambul, the Europeanised quarters of Pera and Galata on the opposite side of the Golden Horn, suburbs on the Golden Horn and the Bosporus; and on the Asiatic side, Scutari, suburban towns on the Marmara and the Princes Islands. Estimated population 881,000 (1925).

Constantinople passed through several periods of political and economic disaster, relieved only by very brief periods of normal life and prosperity, during the years 1900 to 1925. Four wars following each other in quick succession caused at times a complete cessation of trade, the influx of hordes of refugees, demoralisation in the organisation and regulation of civic life, loss of population and an acute impoverishment of all classes. Within this period also Constantinople lost, in theory as well as in fact, the position held well-nigh uninterruptedly for 16 centuries—that of the headship of a great empire.

War Periods.—During the Balkan wars (1912–3) the city narrowly escaped capture by the Bulgarians; the refugees who poured in from Thrace taxed the resources of the city to the utmost, and the loss of European provinces unfavorably affected its trade position. During the World War the city was in a state of complete blockade by sea, subjected to numerous air attacks, and during the last months before the Armistice, almost denuded of food, fuel and other necessities of life. The outstanding features of the period of the occupation by Great Britain, France and Italy (Nov. 13 1918–Oct. 2 1923) were: a short period in 1919–20 of intense commercial activity and relative prosperity, brought to an abrupt end in 1921 by the combined effects of the War in Anatolia and the worldwide trade depression; the outbreak in 1919 of the nationalist movement and the Greek war; the invasion of the city in 1919 and 1920 by some 100,000 destitute refugees, the bulk of whom were Turks (30,000) and Russians (65,000); the arrival in the city at intervals, mostly in 1922 and 1923, of over 200,000 Greek deportees from Anatolia, most of whom were speedily moved on to Greece; the seizure of the machinery of government by the nationalists after the Mudaniya armistice in Oct. 1922; the flight of the deposed Sultan, Mehmed VI., on Nov. 17 1922; and the formal evacuation of the city by the Allies on Oct. 2 1923.

Transfer of the Capital.—The vital factor in the fortunes of the city was its relation to the nationalist movement. When in March 1920, the British attempted to suppress the activities of those supporters of the nationalist movement who were still in the city, many were exiled to Malta, and thousands of sympathisers left for Anatolia to assist in the task of liberation. These circumstances brought about a certain moral isolation of Constantinople from the rest of Turkey, and induced a sentiment of hostility towards the city on the part of the nationalists, who considered the political leaders who remained and co-operated with the Allies as traitors to their cause and the city as the centre and symbol of the old order. The determination on the part of the Anatolian leaders that Constantinople should no longer exact that tragic tribute of lives and treasure which had repeatedly exhausted their country in the past had no doubt much to do with the decision taken after the evacuation to maintain the seat of national administration at Angora. The subordination of Constantinople to Angora and Anatolia was definite and complete when, on March 3 1924, the Caliph, Abdul Mejid, was expelled and the city thus deprived of even the shadow of its former sovereignty.

The effects of the transfer of the capital are seen in the departure of a part of the large official class and the extreme poverty of the remainder; in the absence of the picturesque and imposing ceremonies of the days of imperial grandeur; and in the down-at-heel condition of the palaces of princes and pashas, many of which have been converted into tobacco factories. Resentment of the ascendancy of Anatolia made the city the centre of the short-lived political opposition on the part of the adherents of the old party of union and progress and of fierce press attacks against the government. With the passage of time the population became more or less resigned to the new situation, and came to understand that the national leaders are not obstinately antagonistic to the city, but desire its economic wellbeing in the interests of the country at large.

Modernised Constantinople.—The modernisation of the city made remarkable strides in spite of the adverse conditions. In 1912 electric lighting and in 1913 and 1914 the first electric tramways and telephones were introduced. During the war period the municipal organisation and services seriously deteriorated. With the restoration of complete Turkish control, and particularly under the energetic administration of the prefect, Dr. Emin Bey, a decided change for the better took place. A genuinely effective fire-fighting organisation was created for the first time in the history of the city, periodically devastated throughout its long history by terrible fires; the condition of the streets, which during the occupation were morally and materially in a deplorably unclean state, was improved; 25 km. of new roads were constructed and 250 km. of old roads repaired; the water supply was augmented; the construction of a thoroughly modern sewage system was begun in Stambul; a new slaughter house, an ice factory and refrigerating plant, six dispensaries and a hospital were built and placed under municipal management. During 1925 the city budget was increased from £T4,000,000 to £T6,500,000. Two of the former imperial palaces, Yildiz and Cheragan, were leased to an Italian *entrepreneur* for conversion into casinos, and it was hoped that their operation would be a source of revenue to the city.

The city remains the educational and cultural centre of the nation. The National University was installed in the commodious buildings of the old War Office. The two normal schools, one for men and one for women, continue to function. Since 1923, 40 new secondary and primary schools have been established, making a total in 1926 of 562 schools with 81,865 students. The foreign schools which existed before 1914 are allowed to continue their work, but no new ones may be opened.

The most striking social changes relate to the status of women. The veil was almost completely discarded during the World War, and in 1925 the European hat began to supplant the traditional "charshaf." Men and women mingle freely in the streets and at public gatherings, and the compartments reserved for women in public conveyances have been done away with. The university has opened all its departments to women. The complete suppression in 1925 of the fez and the adoption of European headgear for men removed one more picturesque and distinctive feature of the life of the city.

With the abrogation of the capitulations in 1923 the situation of the foreign elements radically changed in that they lost all their old rights of extra-territoriality. The results of this subjection to the Turkish administration of justice and *régime* of taxation have not been as calamitous as was predicted by most foreigners. Although some regulations are arbitrary and vexatious, life and property are secure.

Population.—No accurate statistics of the city's population up to 1926 could be obtained. The first scientific census was to be undertaken in 1927. It is estimated that the population fell in 1923 and 1924 to 700,000 as a result of war mortality and the departure of Greeks and Armenians. No reliable estimates of the Christian exodus are available, except in the case of the 70,000 Greeks who came to the city after 1918 and who were included in the scope of the agreement for the exchange of populations. It is presumed that altogether some 100,000 Greeks and 60,000 Armenians have left. In 1925 the population increased by about 100,000, owing to the transfer of large numbers of Turks from Greece. Although substantial Greek, Armenian and Jewish communities still remain (Greek—175,000; Armenian—60,000 to 70,000; Jewish—50,000 to 60,000) the population is much more nearly homogeneous and preponderantly Turkish than ever before in the history of the city.

Trade.—The trade position was seriously undermined by the succession of political cataclysms. During the World War foreign trade was almost completely extinguished, but in 1919 and 1920 the city performed for a brief period a rôle in keeping with its natural situation—that of a port of transit for commodities shipped to Russia, Rumania and other parts of the Black Sea littoral. A sudden cessation of buying and an acute fall in prices occurred in 1921, and for three years the city was in the throes of an economic depression so severe that many predicted it would never recover. But very definite improvement was evident in 1924 and in the first months of 1925, and still more substantial progress was made in the latter half of that year.

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(H. Sc.)

CONSTANTSA (*see* 7.11), the chief port of Rumania, is in the Dobruja and had in 1914 a population of 27,662, an estimate in 1924 being 65,000. Building has been carried on fairly extensively since 1910, but even in 1925 the public services were poor much of the town was in darkness at night in 1924, owing to shortage of electric current, and the water supply from the Danube was irregular. The industries are few and small, though a glass factory was started in 1924; the communications are poor; and the facilities for loading and unloading in the port inadequate, though the main quay, destroyed during the World War, was rebuilt. In 1925 the port provided 28 berths for general cargo and 6 for petroleum ships, with 37 oil reservoirs, connected by pipe-line with the Wallachian oil fields. The actual tonnage was rather more in 1925 than in 1913, but the number of ships entering has decreased since the War. Much damage was done to Constantsa before its evacuation by the Rumanians in face of the Austro-German advance, and the pipe-lines were destroyed.

CONSUMPTION: *see* TUBERCULOSIS.

CONTINUATION SCHOOLS (*see* 26.489).—Early in the 19th century, it came to be recognised in Great Britain that the existing elementary schools could no longer satisfy the national educational needs, which had increased considerably through the immense social and economic changes brought about by the Industrial Revolution: accordingly, attempts were made to supplement their work by that of night schools for persons fully occupied during the daytime. Under the influence of such men as Dr. Birkbeck and Lord Brougham, Mechanics' Institutes were founded with the object of giving the new race of factory workers instruction in the scientific principles in workshop practice.

Early History.—These institutes at first attracted large numbers of artisans, but their popularity amongst working men uickly declined; one of the most important reasons for this was hat the elementary education of the workman was in general ot sufficient to enable him to profit by the instruction provided n science and mathematics. Other organisations, including ' night schools " taught by elementary teachers came into existnce and were carried on for many years without any public asistance. In 1851, however, the Government decided to make dditional grants to elementary day schools which held continution classes and the number of these increased steadily until 870, when they had more than 80,000 students. Elementary ducation became compulsory after 1876 and the attendance t night schools declined for a time; the attendance increased, owever, after the removal by the evening school code of 1893 f the previous age limit of 21, and of the requirement that all cholars should be instructed in elementary subjects.

The Act of 1902.—Side by side with these night schools, there vere in existence from 1856 state-aided classes in science and rt. There was, however, no definite connection between the wo: the "night schools" were carried on by the managers of lementary schools and aided by the Education Dept.: the scince and art schools were conducted by voluntary committees nd aided by the Science and Art Department. After the fusion f the Education Dept. and the Science and Art Dept. into a ingle Board of Education, steps were taken in 1901 to secure ome connection between the two groups of schools. When the Education Act of 1902 placed the responsibility for both elementary schools and schools for "further education" on the ounty and county borough authorities the continuation schools began to be organised in a definite relation to the technical schools, as the science and art schools had come to be called.

The technical school and the continuation schools in a single rea are now commonly directed as an organised system by the principal of the technical school; and, even where this is not the ase, the continuation schools exist partly, though not solely, or the preparation of children who have left the elementary school at 14 for entrance at 16 to the more specialised instruction of the technical school. The course of instruction usually requires attendance at school for three evenings a week from Sept. until Easter. For boys who are in industrial occupations, instruction is usually given in mathematics, technical drawing, science and English, since every boy to be engaged in a skilled occupation should be familiar with workshop calculation and workshop drawing, have some understanding of natural phenomena and be able to express himself readily and accurately either orally or in writing. For those in commercial occupations, the instruction includes English and arithmetic, together with subjects of a more vocational character. For those not needing vocational instruction, general and domestic courses are provided.

Statistics.—During the year 1922–3—the latest period for which statistics are available—there were 118,974 boys and girls between 12 and 15 years of age attending evening schools; during that year the number of children of the same age-range who left elementary schools on or after becoming exempt from school attendance was 491,592.

Act of 1918.—The Education Act of 1918 laid upon local authorities for higher education the duty of establishing and maintaining day continuation schools in which suitable courses of study, instruction and physical training extending over 320 hours a year were to be provided for all persons between 14 and 18 not attending other schools: attendance at these schools was to be compulsory and free. During a period of seven years from the "appointed day" for each authority attendance was, however, to be compulsory only on children from 14 to 16 and for a period of 280 hours a year.

A number of authorities, including the London County Council decided to exercise their powers at once and proceeded to establish day continuation schools: accordingly in 1921–2 there were in the country 122 of these schools with 95,530 pupils. During the next year all the authorities except Warwickshire (Rugby) discontinued, for financial reasons, their compulsory schools, and replaced them, in some cases, by schools at which attendance is voluntary: the number of day continuation schools during 1922–3 had diminished to 82, with 23,317 pupils. Usually, the curriculum has no decided vocational bias, but resembles very closely that of the evening continuation school, even when, as sometimes happens, the pupils are nearly all engaged in the same industry or are employed by a single firm (*see* EDUCATION). (A. AB.)

IN THE UNITED STATES

In the United States continuation (or compulsory part-time) schools are now (1926) found in more than half the states, the age of required attendance reaching 17 or 18 in several states, as New York, California, and Wisconsin. Generally, however, four to six hours of daytime attendance per week is required for all employed young persons between 14 and 16 years of age.

The first state to establish compulsory continuation schools was Wisconsin (1909). Before 1915 Massachusetts and New York had enacted legislation permitting any community to require such attendance. All other state legislation has been enacted since 1915, and very generally its application is now state-wide, leaving no option to local areas.

American interest in continuation schools derives from several sources. As far back as the middle of the 19th century the decay of apprenticeship as a means of superior technical training led to the foundation of "Mechanics' Institutes" in many cities. These inspired the extensive establishment of public evening classes, especially in industrial centres. But evening classes, valuable as they might be for young adults, seemed poorly adapted and inhumane for juvenile workers.

Investigations made in Massachusetts (1905), New York (1919), and elsewhere very generally indicated: (*a*) excessive withdrawal from schools of poorly equipped juvenile workers between 14 and 16 years of age; (*b*) unsuitability of evening classes for their needs, and (*c*) possibilities of either full-time or part-time training, for industrial pursuits or for still much needed general education of part-time day attendants. The successful examples of Bavaria, Saxony, Baden and Scotland in providing such schools were carefully studied. The passage of the (English) Education Act of 1918 served as an additional stimulus.

Continuation schools are now generally administered by city and town school authorities, but with exceptional state and some Federal supervision because of the fact that relatively large proportions of their support derive, not from local funds, but from state and (under the Smith-Hughes Act) Federal sources. A few cities (notably Boston, Milwaukee, New York and Newark) have established central schools exclusively for continuation-school pupils. In some cases classes are maintained in commercial or industrial establishments employing large numbers of workers within the required attendance age.

The difficulty of providing competent teachers for continuation schools has heretofore prevented the public from having anything like a full realisation of their possible benefits. Classes or groups formed in continuation schools are necessarily more heterogeneous than are classes in ordinary public schools. Each teacher must meet from 150 to 300 pupils per week, with a consequent dispersion of personal contact and impairment of understanding. Theoretically, at any rate, the subjects taught should be very differently organised from subjects of similar names in ordinary public schools.

The problems of appropriate curricula have been found still more complicated. Doubtless many of the earlier supporters of compulsory part-time schools believed that these schools would solve problems of vocational training. In practice they have done so only in a limited number of instances. On the other hand, at best these schools have been found very efficacious in making more real and significant such kinds of general education as pupils had already had, and also in keeping them in touch with school procedures in such ways that many have returned to full-time schools.

Authorities still differ considerably as to the actual educational functions that should be made the primary objectives of these schools. One group favours a considerable range of studies, even though profound learning is not practicable within the limits of the time available. Another group favours much concentration on the part of individual pupils according to bent, outside employment, possibilities ahead and the like. In the meantime, minority groups of dissatisfied employers or parents in certain states have made many attempts to repeal the legislation establishing continuation schools. In practically no instance have these attempts succeeded. It is therefore reasonable to assume that continuation school education has finally been adopted as an integral and important part of the American public-school system. (D. Sn.)

CONTRACEPTION: *see* BIRTH CONTROL.

CONTROL, INTER-ALLIED.—The national controls of shipping and commodities, especially foodstuffs, which gradually developed in each combatant country throughout the World War were, during its last years, linked together in a comprehensive international system. This international control was a counterpart of the unity of military command which was achieved at about the same period, and it was among the decisive factors in the issue of the struggle. It was different, not only in its enormous range and extent, but in the principles of its organisation from anything previously known in administration. And it has had a profound effect on the developments of the methods and machinery by which post-War world problems are now handled. For these reasons it deserves more attention from the student of political and economic science than it has yet received.

A full account would need to describe not only the purely international system but the national organisations in all the countries concerned on which it was based, and through which its decisions were translated into action. The present brief account will describe the international machinery, and it will give a short account of the national controls in Great Britain, without which the international system is scarcely intelligible.

It will deal only with the arrangements designed to secure the supplies of the Allies, and not with those designed to intercept the supplies of their enemies (*see* BLOCKADE). No consideration is needed of the system in Germany or the countries allied with her, for her unchallenged predominance in her own system made any real international organisation unnecessary; nor of the controls in neutral countries which were separate and independent.

Controls before the War.—Before the War most of the organised and continuous international activities of the world were on a voluntary basis. When we turn from the sphere of voluntary to that of official action we find that international organisation was of the most modest and limited character. There were a few institutions devoted to scientific research and not involving executive action, like the Institute of Agriculture at Rome, and some others with power of action, but of a very definitely restricted or intermittent character, like the Danube Commission or the Postal Union. But the official organisation of the world was essentially national. Except for such secondary and strictly limited tasks as those just mentioned, there was no permanent machinery of international administration or even consultation. Where agreement between countries was needed negotiations were conducted through the Foreign Offices and their embassies. Conferences were arranged from time to time, but these were improvised for special tasks, leaving no nucleus of permanent machinery when these tasks were finished. It is necessary to bear clearly in mind this almost exclusively national character of the official organisation of the pre-War world, if we are to understand the significance of the fundamentally different Allied system during the War and the development of international machinery which succeeded it.

At the same time such bodies as the Danube Commission were, within their restricted limits, independent and autonomous authorities. Once they had been established by agreement between the governments concerned they were independent of those governments and of their administrations for the conduct of their current work. They possessed sufficient delegated authority to act without reference back to the governments by which they were originally constituted. This was only possible because of the narrow range of their task and the fact that its execution did not seriously affect national policies.

The War organisation was in the nature of the case fundamentally different from this. The essence of its work was to guide and direct the vital supplies system of the Allies, which was a basic factor in the national policy of each country. No international authority could, under these conditions, have been entrusted with delegated powers independent of, and overriding, the national governments. The principle of the new system therefore was to link together the national systems. Every international control was based on national control. It would indeed be more correct to say that the national controls were incorporated into an international system than that a new system was created. It is for this reason that we must begin by understanding the national controls, particularly in Great Britain, which was the main centre of the Allied supply organisation.

I. THE BRITISH SYSTEM

We are all familiar with the ordinary economic system by which supply and demand were adjusted before the War and which afterwards was being painfully and with modifications re-established. Its essential characteristic, so familiar and yet so wonderful, is that it works itself. The equation is balanced without any human brain understanding it or needing to understand it. Over the whole range of human activities and human need, production is adjusted to consumption by a process which is automatic, elastic and responsive. If the public demands more of any article than the market can at that moment supply, prices rise. Those least willing or least able to pay the higher prices abandon or defer their purchases. A little later the higher profits encourage greater production. Neither consumer nor producer need calculate by how much consumption need be reduced or production increased. Each finds his sufficient guide in the changing price level. The adjustment is thus effected by a mechanism which registers and expresses the desires of myriads of consumers, not by the individual decisions of a few who judge between these desires and direct accordingly.

But for the conditions of War needs and shortage this system, independent of deliberate direction and control, proved blind and wasteful. It produced too little, it produced the wrong things, and it distributed them to the wrong people. It produced too little. It had, it is true, the spur of individual enterprise and individual profit. But the exact adjustment to the individual taste of the consumer effected by the ordinary economic process involves the allocation of an enormous proportion of work to what may, in the widest sense, be called distribution as distinct from production. Marketing is as important, and as expensive, as making. In war, however, the state can make its own demands in mass. It can order direct, and without middlemen. And the commodities which the individual consumers need, and all that in a national crisis they should have, are the necessities of life for which the demand exceeds the supply. For these conditions, the economic system, surveyed from the central point of view of the country's necessities, was seen to be swarming with middlemen who had suddenly become superfluous. Under these special conditions of mass orders by the Govt., and a pressure of demand from the civilian population, which transformed the problem of marketing into one of rationing, the economies of central control proved enormous.

Similarly the ordinary economic system, by the new standards of the country's necessities, produced the wrong things and distributed them to the wrong people. Its criterion was not essential need, but effective economic demand. Under conditions of national shortage this criterion is no longer a tolerable one. With production reduced by recruiting, the manufacture of luxuries will compete with supplies to the front. With only bread enough for bare physical needs it will cause alternate surfeit and starvation.

Under the special conditions of the War the normal mechanism of the adjustment of supply to demand thus proved inadequate. It failed to respond to the imperative need for intensive production, for selection between the essential and the superfluous, for a tolerably fair distribution. Within a year the delicate machine was smashed. In its place the constructive brain had to build rapidly something to replace it; to survey needs and resources as a whole; to measure the relative importance of food beyond a certain amount, and of munitions beyond a certain amount, when more or both were wanted but, through shortage of production, of transport or finance, more could not be supplied. So, one by one, the necessities of life were brought under control, their purchase centralised, their transport allotted, their prices fixed, their consumption rationed.

And, for the central problem of this huge task, there was no expert knowledge to draw upon. No one before had had to weigh the competing claims of munitions, of raw materials and of food; to decide up to what point each should be met at the expense of the others; and in accordance with his judgment to determine. For this new task the skill had to be developed, the experience acquired, the organisation improvised.

The new system was not introduced full-fledged on any recognition of such general principles as have just been indicated. On the contrary it was applied piecemeal, gradually and often with obvious reluctance, to one commodity after another under the compelling force of a breakdown of the peace system. Usually, though the order varied from commodity to commodity, the first motive was to save the Treasury the expense of inflated competitive prices for war materials, then to mitigate the public indignation at similar prices for their own purchases, and lastly the need of distributing equitably what had become a bare sufficiency of the necessities of life.

Sugar.—The first commodity to require action was sugar. Over three-quarters of British supplies in 1913 were drawn from Germany and Austria-Hungary. War therefore threatened immediate shortage. The Govt. acted promptly, and within the first three weeks of the War had made large purchases and appointed the Royal Commission on Sugar Supplies. The loss from Austria and Hungary was made good from the West Indies, Cuba and Java. The Commission arranged distribution throughout the trade, allotting amounts and fixing prices. At first it was found sufficient merely to instruct the retailer to sell at a certain price under penalty of the stoppage of supplies. But later the distributing trade became in effect the agents of the Govt. selling on public account at a fixed rate of profit. And ultimately the Ministry of Food rationed the individual consumer.

Wheat and Flour.—For a time wheat was bought, and bread made, under the normal system. The problem was less urgent and more intricate than that of sugar. For wheat was partly produced at home, and the balance was drawn, not from enemy countries, but from Dominions or neutrals whose supplies were still available up to the limits of finance and sea transport. Supply through private enterprise continued, and on the whole successfully, though at rising prices, until 1916. In that year difficulties of supply and of transport compelled the Royal Commission on Wheat Supplies to undertake the complete control of purchase and importation on the same principles as the Sugar Commission. In the following year control was extended from the comparatively simple task of purchase to the infinitely more intricate task of distribution; and it included not only sugar and wheat, but all the prime articles of food, other cereals as well as wheat, fresh as well as frozen meat, oils and fats and the scores of subsidiary foodstuffs.

In the same year most of the external arrangements were also put upon an official basis. The Australian and Indian governments already sold as governments, making their own internal arrangements with the individual producers. But hitherto the sellers in America had been the private trade. In June 1917, however, a Canadian Food Controller was appointed and in Aug. the American Food Controller obtained power to fix prices. Henceforth wheat was bought from Canada and the States, from Australia and India alike on the basis of bulk agreements between governments. The Argentine was the only producing country of the first importance still outside the system of official control.

Munitions Supply.—The same process of increasing control, each new step forced partly by the inadequacy or expensiveness of the private system and partly by the consequences of partial measures already taken, is to be seen in the sphere of munitions supply, which quickly absorbed practically all the metal imports and engineering resources of the country. When war was declared a few guns and rifles were being made at Woolwich and Enfield, a few explosives at the Royal Powder Factory. But even the small Expeditionary Force was largely dependent on private manufacture, and neither public nor private factories could cope with more than the smallest fraction of the new requirements. Gradually the Ministry of Munitions, created in June 1915, brought under its authority the manufacture of munitions throughout the country, developing new resources, building its own factories and controlling in every detail the manufacture in private establishments. For the latter purpose an intricate system of "costing" (afterwards a main feature of the food control) was devised, *i.e.*, a system of ascertaining the exact cost of each operation under different conditions of manufacture. The price of the finished article was then limited to this cost plus an addition giving a sufficient margin of variable profit to encourage rapidity of output.

The way in which the Govt. was forced on from step to step is well illustrated by the Ministry's experience with steel. Action was first forced by the necessity of limiting prices. The War Office was buying for Woolwich, Enfield and the army repair shops, private firms were buying for public and private work. The state was thus directly or indirectly bidding against itself through hundreds of different agents. The Ministry began by fixing a maximum price for shell steel. The immediate consequence was that "commercial steel" fetched prices more attractive to manufacturers and shell steel suffered. Prices had therefore to be fixed for all classes of steel alike. It then became necessary to arrange the distribution of the steel available among all the many departments and factories who needed it, whether for military or civilian work, because, once prices had been fixed, the automatic regulator of the price level was gone, and nothing but deliberate allotment could decide who was to get the steel available. Thus the Ministry was forced to a general survey of all resources, both foreign and internal, and of all needs, both public and private. With an infinite variety of method the Ministry extended its grasp over all the raw materials required for munitions, over the metals, both ferrous and non-ferrous and over the chemicals required for explosives: iron, ores, copper, zinc and spelter, lead, tin, platinum, aluminium, oils, nitrates, coal-tar, etc. By the end of 1917 the national system was practically complete for both metals and food, and the two great Ministries ultimately brought under their direct authority 70% of the national imports. (*See* MUNITIONS OF WAR.)

War Office Control of Raw Materials.—Many of the remaining raw materials were being simultaneously dealt with by the War Office. Wool, flax, jutes, hides and leather were required for uniforms, for tents, for sandbags, for saddles and boots. If these raw materials had been left under competitive conditions, no firm contract could have been made with the manufacturer of the finished article, for he could not estimate within wide limits one of the main factors in his costs. The War Office, therefore, purchased the raw materials in bulk. This, however, necessitated monopoly of purchase; otherwise private competition, under the conditions of shortage, would again have driven prices to fantastic heights. But, monopoly once obtained, the responsibility was thrown direct upon the Govt. to decide what quantities should be allotted for civilian consumption and under what conditions. The easiest method would, of course, have been simply to sell to the trade and let the trade deal with the different manufacturers. But, since the supplies available were far short of the full civilian demand, this would have meant exorbitant profits for the trade and intolerably high prices for civilian clothing and boots, etc. The War Office, therefore, supervised in detail the supplies of the whole country. They fixed the prices at which the manufacturer obtained his raw material and sold to the retailer, and at which the retailer sold to the public.

Board of Trade Control of Other Commodities.—Meantime, more slowly, less completely and by more commercial methods, the Board of Trade brought under its authority the remaining imports: timber (through a timber controller), tobacco, cotton (through a committee formed by the trade at Liverpool), paper and pulp (under a paper controller).

Ultimately over 90% of the imports of the country were handled by the Govt. or by committees acting for them, and through them the uses to which they were devoted were directed in the public interest. The system, with an enormous variety of method and expedient, was uniform in its main principles and, before the War ended, astonishingly complete and effective. The home Govt. bought in bulk from foreign countries, often from their governments or at prices fixed by them, and requisitioned at fixed prices the home supplies. With the raw materials thus in their hands they directed the uses to which they should be put, the distribution and the price of the finished article. The great bulk of the producing and distributing trades of the country, while working under their normal processes and methods of internal organisation, had become agents of the Govt., selling on public account on the basis of commission.

So much for the British control of commodities. With varying methods and varying efficacy national control was similarly established in Allied countries. These separate national controls were, as we shall see, the essential foundation of the joint Allied control which developed from them.

Merchant Shipping.—But, if we are to understand the process of this development, we must first consider one more control, which the submarine made the centre of the whole system, the control of merchant shipping.

A few statistics will show in a moment why shipping became the centre of the international supply organisation, and why London was its inevitable headquarters. Before the War the communications of the world were maintained by some 8,000 ocean-going ships. Of these over one-third were destroyed by the submarine. New building could make little compensation for these losses till 1918, when the immense increase in American building, combined with the successful protection afforded by the convoy system, began to redress the balance. And while the supply of shipping was thus reduced, the need of transport, for troops, for munitions, for the raw materials of the armies' supplies, was immensely increased. The result was that the total supplies of Great Britain and her Allies depended upon how much they could transport, and the character of these supplies on the way in which the available ships were allocated. And of the 8,000 ships the British Empire owned over 4,000, France, Italy, Belgium and Portugal owning barely 1,000 between them.

At the outbreak of War the Govt. at once requisitioned, at fixed prices, the ships it needed for its own direct requirements: liners for the transport of troops and colliers for the conveyance of coal to the fleet. Outside such requirements, however, the market was for the time left free. The way in which those entrusted with this power of requisition were gradually forced to extend their control over all shipping, and through it over all supplies, first national and then Allied, the expedients by which, with legitimate reluctance, they attempted to escape or postpone this immense responsibility, and the mechanism of control which was at last developed, form one of the most interesting tales in economic history. It can be only briefly summarised here.

The withdrawal of requisitioned tonnage for the transport of troops and army and navy supplies caused an immediate shortage and drove up freights. The higher freights drove up all prices; and comparative luxuries began to outbid necessities. Attempts were made for the first two years or so to meet this difficulty without controlling all ships and supplies, by a system of prohibiting or limiting certain classes of less necessary imports. This system, however, failed as the submarine became more successful; for the extent to which whole categories of imports can be classed as unnecessary is very limited. Moreover, as one commodity after another was controlled by the Govt., it was natural that transport should be arranged in requisitioned tonnage. With every such new extension the area of competitive chartering became reduced; and within the area of requisitioned transport the regulator of freight rates had necessarily disappeared. When sugar and cereals and munitions were all government commodities, when all were carried in requisitioned ships, and when there were not enough ships to go round, the Govt. alone could decide how much tonnage should go to each. And if the Govt. as a whole did not decide, the responsibility necessarily fell on those entrusted with the allocation of the ships, a responsibility for which they felt unfitted, which they were reluctant to assume, but which they could not escape.

The years 1915 and 1916 saw a series of expedients designed to mitigate or share this responsibility. A Ship Licensing Committee, a counterpart to the Prohibition of Imports Committee, restrained some ships from obviously unnecessary work. This was useful so far as it went, but it was not far. The shortage remained. When the shortage bore hardly on wheat imports, ships were directed into the wheat trade. The wheat trade was thus helped, but other essential trades only suffered the more. Finally in 1916 a Shipping Control Committee was formed, with Lord Curzon as chairman, to ease the burden on the shipping department. They attempted to increase enormously the list of prohibited imports. But their programme was too summary, too much based on purely shipping considerations and too little on a detailed examination of all the uses for which the imports they proposed to prohibit were needed, for which neither they nor anyone at that time possessed the necessary knowledge. They felt unable to undertake the detailed survey of all requirements without which allocation of shipping was a mere groping in the dark. And this expedient, too, failed with its predecessors.

Shipping Control the Pivot of Other Controls.—Meantime the extending control of commodities by a few great government departments was preparing the way for the real solution. In all the big supply departments, as we have seen, specialised experts were incorporated in the official machine. Day by day they were testing the requirements of each industry by the criterion, not of market prices (which control abolished) but of intrinsic importance in the general scheme of national policy. All under the daily pressure of insufficient finance, or of available resources, or of transport, were becoming more expert in distinguishing the essential from the merely useful. And the whole system was becoming centralised. The separate controls were soon nearly all grouped under four central authorities: the War Office, the Ministry of Munitions, the Ministry of Food and the Board of Trade. The Ministry of Shipping, therefore, no longer had to deal with innumerable demands from hundreds of private industries, nor even directly with a score of government controls, but only with a few great Ministries, which presented comprehensive programmes covering between them almost the whole range of imported supplies. A new committee, the Tonnage Priority Committee (Feb. 1917), presided over by Sir L. C. Money, the Under-Secretary in the Ministry of Shipping, included the executive officials from each of these great departments and advised the Ministry in the allocation of ships.

The Milner Committee.—The problem of organisation as a national one was now near its solution. It needed one further development. After the intensive submarine campaign of 1917, the allocation of tonnage became the crucial factor in the policies of the great supply departments, particularly those of Munitions and Food. The decisions involved in modifying programmes of supply exceeded the authority of the officials of whom the Tonnage Priority Committee was mainly composed. By the end of the year, therefore, a standing Cabinet Committee was formed under the presidency of Lord Milner, on which both the great supply departments and the Ministry of Shipping were alike represented by their ministers, attended by their chief officials. At this committee the competing claims for tonnage were fought out and in main principle decided. There was at last a mechanism, a central committee of supreme authority, and behind it centralised and co-ordinated commodity controls, by which the nation's requirements as a whole were surveyed, adjusted and directed. The problem of national organisation was solved; and with it was secured the foundation of the wider international organisation which was to follow.

II. THE INTERNATIONAL SYSTEM

For, from the beginning, the real problem was international as well as national. And the need for common action developed as the stress increased. France and Italy were buying supplies in the same neutral markets, and they needed transport from the same interchangeable pool of tonnage under British and Allied control. We must now follow the steps by which the international machinery necessitated by these conditions was built up.

Shipping was the centre of the final organisation, because in the end shipping was the "bottle-neck" of the whole supply system. But it had little to do with the early first efforts at Allied co-operation, because in the early part of the War the Allies wanted many things which Great Britain could best supply —guns, shells, uniforms, equipment of every kind, more than they needed ships. Above all they needed money, for money could buy all these things and, in 1914, most easily of all the use of ships to carry them.

Allied Purchases in London.—The first trouble to deal with was that the arrival of hundreds of Allied agents in England placing orders with private manufacturers in competition both with each other and our own War Office meant confusion and waste of every kind. To prevent this a body known as the Commission Internationale de Ravitaillement (C.I.R.) was established in London in 1914. It included representatives of the Allied purchasing departments and distributed their demands among British manufacturers with due consideration of similar British orders. It served a useful purpose in restraining prices, and to some extent in pooling knowledge and experience. It was, however, an essentially British organisation to help Allied purchasers. It was formed to co-ordinate purchases in Great Britain. It was under British direction, and obtained its effectiveness from the fact that the purchases were made with British credits. At the same time it was already a notable step in Allied co-operation. In ordinary times if the French Ministry of Commerce needs to arrange something with the British Board of Trade, *e.g.*, about shipping, it transmits its request through the British embassy in Paris, or the French embassy in London, to the British Foreign Office, who in turn send it on to the Board of Trade. The reply comes by the same channel, so that the communication between two specialised departments passes four times through the hands and pens of non-specialists—or to be more exact of those who are specialised not in shipping but in the foreign relations of the two countries. The principle of the system, and a natural one for ordinary times, was that if British and French departments needed to discuss shipping the primary fact was, not that shipping was the subject, but that it was France and Great Britain who were discussing. It was often a convenience to set off, say, a shipping concession on the one hand against a concession of quite another kind, perhaps political. This could only be done by those dealing with the general foreign policy of their countries.

But in War this procedure was obviously unsuitable. The intricacy of detailed administrative arrangements required direct contact between specialised ministers and officials of the different countries and the common interests of Allies clearly outweighed their divergences. We shall see, as we follow the development, how these two dominant facts gradually compelled the creation of quite a different system, of which it was a principle that a French official wanting British ships was primarily a person wanting ships from someone who could supply them, and not primarily a Frenchman negotiating with an Englishman. The common interest made it unreasonable to make arrangements about food or munitions or ships mere items in general policy between Great Britain, France and Italy, and their technical and complex character made it impracticable. The differences of interest remained, but they were fought out each in their own sphere between the appropriate specialists.

The C.I.R., although still on a national basis, already began the inevitable development towards this end. At first the British representative in the C.I.R. would collect Allied demands, centralise them and then himself deal with the British officials in the supply departments. Then he would bring the Allied supply specialist with him. Then he ceased to come himself. "Direct contact," the principle of the final system, was established in individual cases. It still needed to be developed and organised into a system.

Shipping assistance from Great Britain to the Allies was in 1915 and 1916 rather improvised than organised. Great Britain managed her own shipping programme. If appealed to for help she did her best to deal with the case on its merits. It was a haphazard method of emergency assistance not unjustified in the earlier part of the War, when shipping was among the least of the Allied problems. But as the pressure increased, more regular methods became necessary under much the same compelling forces as we have seen operating in the establishment of national controls. The Allies were for example all chartering neutral ships. At first they competed against each other. An Inter-Allied Chartering Executive formed to prevent competition, was successful in preventing the Allies from rushing up the rates against themselves and each other, but it did not touch the question of how they should be allotted and employed.

The British Shipping Control Committee, formed Jan. 916, tried to establish principles to guide the allocation of British ships to the Allies. It failed for the same reasons which made it unsuccessful in dealing with the internal British problem. It knew too little about British needs and less about those of the Allies. A year later (Jan. 1917) an advance was made by the creation of an Inter-Allied Shipping Committee, which included representatives of Great Britain, France and Italy, and attempted to survey the shipping needs of the three countries. This experiment again failed, partly because it was still not fully recognised that, in allocating shipping in time of serious shortage, knowledge of shipping is the least of the difficulties. The important thing, infinitely more intricate, is a knowledge of the supplies which require transport and the uses for which these supplies are needed; and at this date the national work in organising supplies in the different countries was insufficiently developed to enable a central committee to make an adequate survey. But the committee was also constituted on a wrong principle. It included neither ministers with power to bind their governments, nor the officials responsible for the daily work of arranging ships. An effective system required both. Though nominally "Inter-Allied" it was essentially a committee of Allied representatives negotiating for the grant of British ships, not a body bearing a common responsibility for a task examined as a whole. Like most of the earlier experiments it had some limited and temporary utility, but was chiefly useful in suggesting by its own failure the principles on which a true Allied organisation must be built. Meantime the path of real progress was being suggested more positively by some international developments in the system of controlling not ships but commodities.

Inter-Allied Allocation of Supplies.—The British Royal Commission on Wheat Supplies, established as we have seen in 1916, found itself at once faced with all the evils of competitive purchase in the same markets by France and Italy. A most effective Allied Committee, the "Wheat Executive," was therefore formed to arrange for the wheat supplies of all three countries and their allocation by agreement. The benefits of co-operation were at once apparent. Combined purchase restrained the rise in prices, and there were other and greater advantages. The cereal specialists of the different countries settled among themselves the proportion of the total supplies each country should have. Henceforth those dealing with shipping could deal with cereal demands in the mass. They had no longer to weigh France's claim against Italy's, but only the competing claim of cereals as a whole against munitions, other food, etc.

The next development to follow on the same lines was the creation of a body (ultimately developing into the Allied Munitions Council) to survey Allied munitions requirements as a whole. This body not only dealt with the question of purchase and claims for transport of all the raw materials required for the manufacture of munitions, but with the allocation of manufacturing facilities and the finished product.

Allied Purchases in the United States.—With the entry of America into the War in 1917 a new authority was created which, but for the continuing destruction by the submarine, might have occupied the central position in the international control system, the "Inter-Ally Council on War Purchase and Finance." This was a council formed to co-ordinate the demands of European Allies for American credit. So far as America wished to restrict credit to less than the full amounts asked for, this involved an examination of the rival claims for the different supplies. Had therefore finance been the limiting factor, as on the whole it was until America's entry, this body must have dominated the whole supply arrangements. Apart from what their own resources could produce, the Allies would have had just such supplies as they could persuade America to give them credits for. But in fact, with America's entry, finance ceased to be a fundamental factor in the Allied position. For the new alliance as a whole was almost self-sufficient, and finance in such conditions is a matter of national legislation and inter-allied arrangement. Within a country, or within an alliance of which every member is determined upon victory, finance can be created in a moment by a vote of Congress or Parliament.

Ships, however, cannot be so hastily improvised. Shipping was already desperately short and the immediate effect of America's entry was rather to increase than to relieve it. Till the end of the War the total number of American ships in War service was indeed less than the number required to carry American troops and supplies. Under these conditions it was only for the most vital supplies that transport could be found, and for such supplies it was certain that American credits would not be refused. The real struggle was therefore to squeeze supply demands within the limits of available shipping, not within those of available finance. This meant that the shipping organisation was the centre of the system. The Inter-Ally Council on War

Purchase and Finance, though in principle of co-ordinate authority, in fact accepted the results of the decisions fought out on shipping.

We now come to the final impulse, deriving from the shipping scarcity and directed by the shipping authorities, which linked all the highly developed national controls and the more partial Allied organs into one comprehensive international system

Transport Crisis of 1917.—By the autumn of 1917 the pressure on shipping was greater than it had ever been; 17,000,000 tons dead-weight of the world's shipping had been lost, and less than half had been replaced. More shipping had been lost in the first 10 months of this year than in the previous 30 months of the War. American building had not yet seriously begun. The prospect of her vital contribution to the armed forces meant further demands on transport. And, apart from this, the demands were constantly increasing. All the distant expeditions, except to the Dardanelles, were fully maintained, and both troops and supplies were being sent to Salonica, Mesopotamia, Palestine and East Africa. Drafts were still required from Canada, South Africa, Australia and New Zealand. The scale of the War in France grew constantly, and the development in the character of warfare involved a larger expenditure of munitions. The navies were at their maximum strength. And serious food troubles throughout the winter and spring were anticipated in Great Britain, France and Italy alike.

The strain on the shipping authorities, while there was still no comprehensive Inter-Allied organisation fitted to determine priority between the different supplies, was in these conditions an intolerable one. At any moment the allocation of a batch of ships to food might mean a shortage of vital munitions, an allocation to munitions might entail starvation.

But by this time, as we have seen, the national organisation in the several countries, which was the indispensable condition of the Inter-Allied system, was at its full development, and in wheat and munitions partial international arrangements were already working. In Great Britain the Ministry of Shipping had full and effective control over every voyage and every cargo, and the whole system supply was centralised under the Milner Committee. A Standing Committee under M. Clémentel, Minister of Commerce, played a similar rôle in France. Italy's problem resolved itself practically into coal and cereals, and she had both of these as well as her shipping under complete control. Except, however, for consultation between munitions experts and the more fully developed Allied action of the Wheat Executive, these national supply systems were working with little knowledge of each other's needs. As regards most commodities there was still no means of judging fairly whether the standards of sacrifice and restriction were approximately equal or not.

The Allied Maritime Transport Council.—Those who realised the desperate position of shipping were convinced that it was now essential to develop and complete the system by extending Allied Committees like the Wheat Executive over the whole range of supplies, and linking them up by dependence for their transport upon a supreme Allied Shipping Council. On their proposal the necessary decisions were taken at the important Allied Conference which met in Paris in Nov. and Dec. 1917; and the Allied Maritime Transport Council, consisting of two ministers of the three principal European Allies and two delegates, was constituted and furnished with an executive organisation.

What was the nature of this new council and of the Allied Supply organisation which now developed rapidly round it? It is essential to realise that it was not a supreme authority acting with a delegated power enabling it to override the governments which created it. No body of men could have been entrusted with such power, and those who at this time proposed either the appointment of a council with supreme executive power or a single economic dictator, were misled by the military analogy or ignorant of the realities of the supply situation. A single decision of such an authority, a reduction in sugar or in wheat imports for example, would penetrate in its effects every civilian household in the countries concerned. No Cabinet could abdicate responsibility for such decisions and for their effects. The Paris Conference rightly therefore rejected the proposal of an "International Board with complete executive power over a common pool of tonnage." "It would," they explained, "be difficult for any country, and particularly for America or Great Britain, to delegate absolute power to dispose of its tonnage (which is the basis of all its civilian and military requirements) to a representative on an International Board on which he might be outvoted. Under such conditions executive authority, even if conceded in principle, would certainly have broken down in practice."

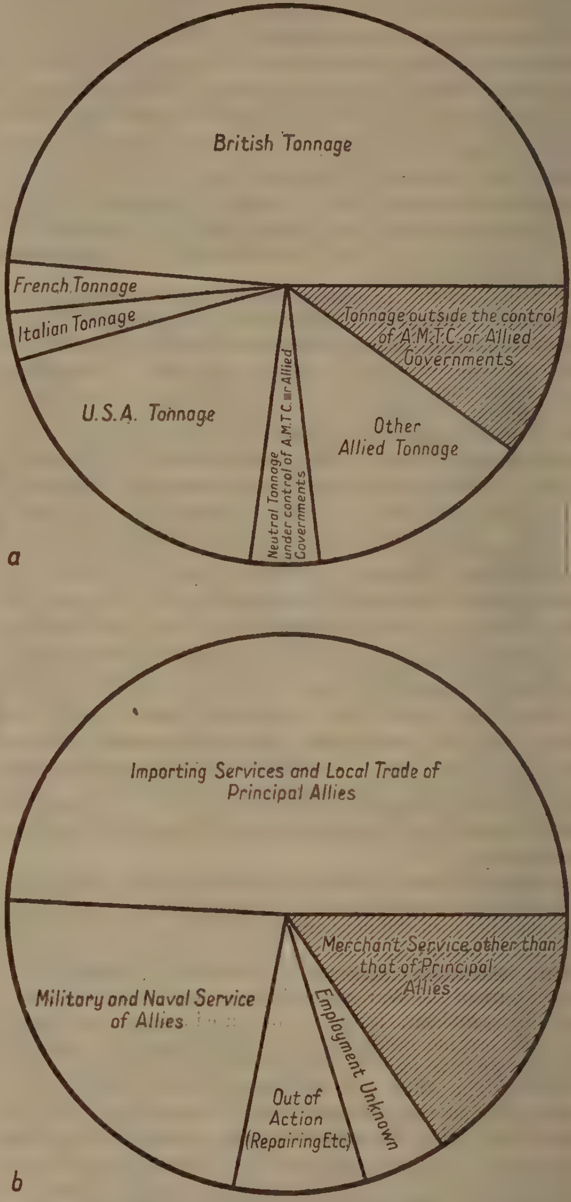

FIG. 1.—*a*. Extent of Allied Shipping Control, at the Armistice. *b*. Employment of World Tonnage, at the Armistice. (N.B. Tonnage covered by these diagrams consists of sea-going vessels of 500 G.T. and over.)

Its Constitution.—On the other hand, if the Allied Maritime Transport Council was not in principle executive, it was in practice much more than advisory. If the first was impracticable, the second would have been useless. How could the need for urgent and desperate decisions be met by a body which, when it had itself decided, could only make recommendations to four governments and wait for their assent?

The solution of this dilemma, and it is the fundamental principle of the whole of the new Allied system, was found in appointing as members of the council the ministers who in their own countries had the right to decide, and in forming the executive organisation of the officials who in their own countries actually directed, or could effectively influence, the execution. This principle practically destroyed the distinction between the executive and the advisory. In principle the council was advisory. But, if the British Shipping Controller agreed as a member of it to a decision involving orders to British shipping, he gave effect to it as a minister in his own department. So, too, if the French Minister of Commerce agreed as a member to a decision involving a change in French supplies.

influence in the Italian Supply departments, while the American was one of the American members of the council. The headquarters were in London, and the staff was grouped in four national divisions under the direction respectively of the four members of the executive. The council itself met only three times before the end of the War. But the executive met frequently, and in the long intervals between the council meetings was the instrument through which Allied co-ordination in the direction of shipping was secured.

In close association with this shipping authority, the supply authorities were linked together in "programme committees" created on a similar principle on the model of the Wheat Executive, and the more important of these were grouped under two great ministerial councils, the Munitions and Food Councils, formed on the same principle as the A.M.T.C.

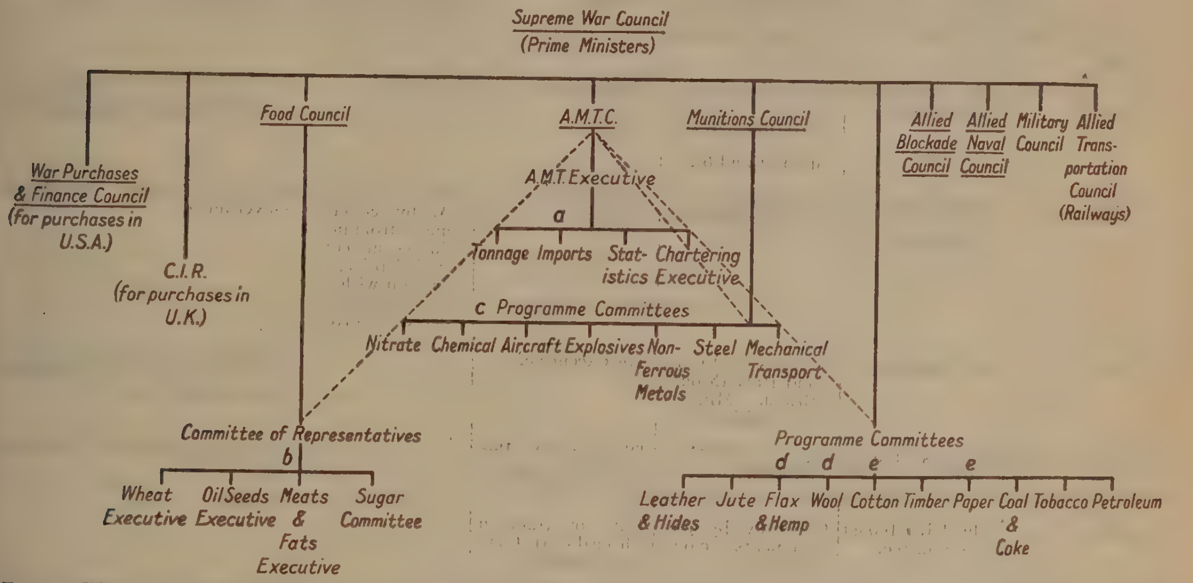
Supreme War Council
(Prime Ministers)
Food Council
A.M.T.C.
Munitions Council
Allied Blockade Council
Allied Naval Council
Military Council
Allied Transportation Council (Railways)
War Purchases & Finance Council (for purchases in U.S.A.)
A.M.T. Executive
a
C.I.R. (for purchases in U.K.)
Tonnage
Imports
Statistics
Chartering Executive
c Programme Committees
Nitrate
Chemical
Aircraft
Explosives
Non-Ferrous Metals
Steel
Mechanical Transport
Committee of Representatives
b
Wheat Executive
Oil Seeds Executive
Meats & Fats Executive
Sugar Committee
Programme Committees
d d e e
Leather & Hides
Jute
Flax & Hemp
Wool
Cotton
Timber
Paper
Coal & Coke
Tobacco
Petroleum

FIG. 2.—Diagram of Allied War Organisation. Straight lines ——— indicate direct dependence. Broken lines - - - - - - indicate dependence for sea transport. Councils underlined were composed of Ministers. Executives and Committees not underlined were composed of officials. The Ministers were usually those responsible for the Departments entrusted with the relevant national control, *e.g.*, the British Member of the Munitions Council was the Minister of Munitions. The officials were also usually officers of these Departments, *e.g.*, the British members of the "*a*" Committees were officers of the Ministry of Shipping; of "*b*" Committees, of the Ministry of Food; of "*c*" Committees, of the Ministry of Munitions; of "*d*" Committees, of the War Office, and of "*e*" Committees, of the Board of Trade.

Had this principle been confined to the ministerial councils it would have represented some advance, but a quite insufficient one. Departmental conferences of ministers had often taken place before. To develop these into councils with a regular constitution and periodical meetings would have been useful, but not decisive. Ministers meet for a day or two and return. On matters of such intricate and detailed daily administration as are involved by arranging supplies in war, no such occasional meetings can resolve the difficulties of diverging national interest. If ministerial decisions, often conveyed in ambiguous or over-simplified formulae dictated by the necessity of hurried agreement, are referred to different national administrations to execute, the old difficulties will recur in detail. The novelty of the new system consisted in the extension of this new principle, so far as was materially possible, to a series of committees of officials covering the whole range of shipping and supplies and responsible to the A.M.T.C. and two similarly formed Munitions and Food Councils.

Immediately under the A.M.T.C. was the first of these bodies, he Allied Maritime Transport Executive, of which, on the principle described above, the British member, who was the chairman, was the Director of Ship Requisitioning in the Ministry of Shipping, the French member the influential *chef du cabinet* of the French Minister of Commerce, the Italian an official of great

Ultimately the whole range of imported commodities was covered by the following committees:—

Under the (Allied) Food Council:

1. Cereals (the wheat executive).	3. Sugar.
2. Oils and Seeds.	4. Meats and Fats.

Under the (Allied) Munitions Council:

5. Nitrates.	9. Non-Ferrous Metals.
6. Aircraft.	10. Mechanical Transport.
7. Chemicals.	11. Steel.
8. Explosives.	

And (without being grouped under a similar ministerial council):

12. Wool.	17. Paper and Pulp.
13. Cotton.	18. Timber.
14. Flax, Hemp and Jute.	19. Petroleum.
15. Hides and Leather.	20. Coal and Coke.
16. Tobacco.	

It had been intended to group these last nine committees under a Raw Materials Council, but this council had not been formed when the Armistice brought the development to an end. The organisation may be shown in diagrammatic form (see fig. 2).

These committees secured combined Allied plans on all questions within their respective spheres on which combined action was necessary. Their character, authority and the range of their duties varied greatly from article to article. The most important had duties independent of arranging agreed demands

TABLE SHOWING THE ORGANISATION OF INTER-ALLIED CONTROLS

1. Commodity	2. Inter-Allied Body	3. Method of Purchase	4. Purchasing Body or Bodies	5. Represented in United States by	6. Represented in certain other countries as follows:
1. Wheat.	Wheat Executive.	Single buyer.	Royal Commission on Wheat Supplies (British).	Wheat Export Company of America.	Canada: Wheat exporters. India: Controlled firms. Argentine: Controlled firms. Brazil: Controlled firms. Russia: French Commission.
2. Sugar.	Inter-Allied Sugar Programme Committee.	Single buyer in London and from International Sugar Committee in U.S.A.	Royal Commission on Sugar Supplies (British).	Representatives of Royal Commission on the International Sugar Committee.	In addition to purchases made as in column 3, the produce of some small British colonies was secured through the British Colonial Office.
3. Meats and fats, covering many foodstuffs.	Inter-Allied Meats and Fats Executive.	Purchasing Organisation in each procuring country aimed at.	Various.	Allied Provisions Export Committee.	British Colonies and also Argentine by the British Government.
4. Oil and Oilseeds.	Oil and Oil-seeds Executive.	Purchasing through A.P.E.C. or the governments concerned (see columns 4 and 6).	The Executive.	A.P.E.C.	British and French Colonies by the respective governments. Brazil by agents of Wheat Commission.
5. Copper.	Copper Sub-committee, allocating powers only.	By the governments requiring supplies.	See Column 3.	Purchase in U.S.A. by governments from producers at controlled price, in account with allocation by Copper Committee.	Purchases in Spain by British Government.
6. Tin.	Tin Executive.	Supplies for France and Italy through British Ministry of Munitions.	Tin Executive.	..	The Executive generally represented in the producing countries by controlled firms.
7. Nitrate of Soda.	Nitrates Executives.	Agents on Commission.	Director of Purchases under the Executive.	..	Special agreement with the Government of Chile.
8. Rubber.	Allied Rubber Committee.	Generally by governments concerned.	Bulk of trade in hands of City merchants.	..	..
9. Wool, hair and products of wool and hair.	Wool Programme Committee (Advisory).	Australian and N.Z. clip bought by British Government, otherwise trade channels.	..	..	France partially controlled prices and quantities through Inter-departmental Wool Committee.
10. Cotton.	Cotton Programme Committee.	Usual trade channels except for Egyptian crop.	..	..	Egyptian crop bought by British and Egyptian governments.
11. Jute, hemp and flax:— (*a*) Jute.	Jute, Hemp and Flax Programme Committee.	Purchase by British Government from leading jute firms.	..	..	..
(*b*) Hemp.	Jute, Hemp and Flax Programme Committee.	British Government purchase for European Allies.	..	..	Controlled firms in Manila.
(*c*) Flax	Jute, Hemp and Flax Programme Committee.	Local Allied representatives at Archangel.	..	..	Informal Inter-Allied buying arrangements at Archangel.
12. Hides and Leather.	Hides and Leather Programme Committee (an Executive under consideration.)	British Government purchase in India through Buying Committee of British firms in Calcutta.	Great Britain and United States control the market (chiefly India and Argentina).	..	..
13. Timber.	Timber Programme Committee and Commission Internationale d'Achats de Bois.	Purchase centralised in Italy, France, Gt. Britain, C.I.A.B. control purchasing policy.	C.I.A.B.	Purchase in United States through War Missions.	..

TABLE SHOWING THE ORGANISATION OF INTER-ALLIED CONTROL—Continued

1. Commodity	2. Inter-Allied Body	3. Method of Purchase	4. Purchasing Body or Bodies	5. Represented in United States by	6. Represented in certain other countries as follows:
14. Coal.	Coal Programme Committee.	British Govt. controls the mines and works them through existing channels on basis of profits over period of pre-War years.		..	France.—Office National des Charbons, buying in United Kingdom through existing channels on a fixed basis. Italy.—All purchases made on Italian Government account.
15. Paper.	Paper and Paper-making Materials Programme Committee.	Central purchase of woodpulp in each country.	Centralized purchase through British Controller for European Allies suggested.	..	Italy.—Italian Paper Commission. France.—Office National de la Presse.
16. Petroleum.	Inter-Allied Petroleum Conference (Advisory).	By central purchase in United States of America at fixed price. Usual trade channels in other countries, subject to allocation by Conference.	..	United States Fuel Administration.	..
17. Tobacco.	Tobacco and Matches Programme Committee.	No purchasing arrangements between the Allies, price control being purely national through medium of the state monopolies in France and Italy, and the Tobacco and Matches Control Board in Great Britain.			..

for shipping. The Wheat Executive, for example, as we have seen, arranged common purchase in foreign markets, as well as distribution. The Munitions Committees discussed allocation of manufacturing facilities and of the finished munitions. For such duties they acted under the authority of their respective councils (Munitions or Food) or, in their absence, with the consent of the different governments obtained through the national members of the committees. It was only so far as their programmes needed shipping that they needed the approval of the A.M.T.C. But as the allocation of shipping was the crucial factor in all the main supply arrangements, the A.M.T.C. and its executive acquired the dominant position.

Working of the Machine.—As an example of the working of this system let us look at the duties of the most important of the Supply Committees, the Wheat Executive, say in the spring of 1918. The committee is working within a general programme agreed for the cereal year 1917–8. It has arranged through common agents for the provision of supplies in the United States of America, Canada, the Argentine and elsewhere. In contact with the shipping authorities, shipping has been sent to the loading ports. The ships are provisionally allotted for discharge in Great Britain, France and Italy; but the stocks, port facilities, etc., in each of these countries are watched daily, and the ships directed where desirable by orders sent to the ports of loading or even on arrival on the eastern side of the Atlantic.

Meantime, the Wheat Executive is negotiating with the Transport Executive as to the new programme for 1917–8. The latter, conscious of the competing claims for munitions, etc., is urging reduction. The Wheat Executive makes efforts at reduction and tries to distribute this reduction among the three countries. The margin of difference between the two executives is diminished, but not removed. An attempt is made by negotiations with the other food committees, and under the general authority of the Food Council, to balance the respective claims of cereals and other food stuffs. The final food programme put forward by the Food Council is still in excess of what is likely to be obtained, but the difference is reduced to manageable dimensions. And the final issue is presented to the A.M.T.C. when it is practically simplified to a decision between the competing claims of Allied food as a whole and Allied munitions.

The concluding stages of this process are best illustrated by the decisions taken at the A.M.T.C. meeting in Sept. 1918. The council, at that meeting, reviewed the whole of the prospective shipping position for 1918–9. They had before them estimates carrying the authority of the shipping experts of all the countries concerned to the effect that, after allowing for ships allotted to military expeditions and the fleets, the total imports could not exceed

$$72{,}500{,}000 \text{ tons} \left\{\begin{array}{l}\text{for coal}\\ \text{raw materials}\\ \text{food}\\ \text{munitions}\end{array}\right\} \begin{array}{l}\text{for Great Britain}\\ \text{France}\\ \text{Italy.}\end{array}$$

They decided, on the advice of the Transport Executive, that 25,200,000 tons must be allowed for coal, and 7,500,000 tons for raw materials, leaving 39,800,000 tons for food and munitions; against demands of 49,000,000 (27 for food and 22 for munitions). Finally, after difficult negotiations, they allowed 20,000,000 for food and 17,800,000 for munitions. The conclusion of the Armistice a few weeks later robbed these decisions of the practical importance they would otherwise have possessed. But they illustrate the way in which the whole Allied system was, by the end of the War, linked together and dominated by the supreme shipping authority.

It must be borne in mind that the new Allied mechanism was developing in authority and efficacy throughout 1918 until the Armistice. The centre of gravity shifted slowly from the national to the international administration. At the point of executive action the machine was always the national one, though more and more this action was determined by the comprehensive surveys and recommendations of the international bodies. But the new system was still not fully and equally working when it was brought to an end by the Armistice. It was tested and working fully for food and beginning to work for munitions; but was still in its preparatory stages for miscellaneous raw materials for civilian use.

Imperfect as it was, however, and having to build up its elaborate organisation and carry on its work simultaneously, its achievements were very striking. Though the shipping available for European supplies was some 2,000,000 tons less, the import services of France and Italy were, in 1918, for the first time put on a substantially satisfactory and substantially equal basis. Food stocks were raised to a much safer level. The Belgian relief requirements, previously in a desperate condition, were adequately met and the American trooping needs substantially assisted. These results were obtained partly through shipping economies effected by the pooling of tonnage and partly by supply economies effected by the common examination of needs and resources by the Programme Committees.

Essential Characteristics.—Before we follow the subsequent history of the system, let us consider again its essential characteristics. The fundamental principle is the *direct* contact of specialised ministers and officials of different countries effected through a regular organisation whose members are grouped according to their special experience and authority and not according to nationality.

We have seen how three great Ministerial Councils were formed on this principle; and how twenty Allied Programme Committees formed on the same principle covered the whole range of imported supplies. The members of these bodies were essentially national ministers or officials uniting for international work. The agreement they arrived at in Allied discussion was thus carried into practice in their own departments. Thus the new Allied principle did not override or replace the national organisations—it penetrated them. It linked them together. In fact the instrument of Allied action consisted of the national administrations themselves thus linked together and in union acting for a common end. The new mechanism was essentially a "coupling" between them.

Thus was co-operation between the Allies at last shifted from a diplomatic to an administrative basis. We have followed the steps by which the pre-War system of negotiations through Foreign Offices and embassies was gradually transformed. More and more frequently, and then as members of regular councils, department ministers dealt direct with each other and not through their respective Foreign Offices, and departmental officials met first for special transactions and then, as the need compelled, in more regular and constant contact to make shipping and wheat arrangements. Then, as the stress increased, the final stage was reached; the supply departments of the different countries were themselves linked together from within by programme committees composed of their own officials.

The national administrations now touched each other, not at one point (the Foreign Offices), but at scores (the officials engaged in the different controls) and the contact was no longer occasional but continuous. Any divergence of national interest was settled within its own sphere, and independently of differences elsewhere. Agreement once reached within each specialist committee, the further issue was not between nation and nation but between supply and supply. The Allied munitions demands were pressed as a whole with the support of the representatives of all countries against the claims of Allied food demands supported by all theirs.

These principles, of direct contact between specialists, and of forming an instrument of international action by linking together national departments through committees of their officials, are the necessary basis of all international administration that touches vital interests. A specific piece of limited technical work may be entrusted to a Danube Commission or a Postal Union acting with permanently delegated powers. But where the work seriously affects national interests the necessary authority will rarely be given, or if given will be withdrawn, as in practice it was from the Reparation Commission. The international administration which has vital work to do will supplement its own permanent organisation by specialised committees composed of those who represent not only the special knowledge required, but the special interests, both public and private, affected.

The Transition to Peace.—But before we follow these later developments, we must glance at the immediate history of the War system we have described in the interval between War and the re-establishment of normal peace conditions. It was the view of those who had built up this system that it should, with the necessary modifications, be continued for the scarcely less urgent tasks of the Armistice period.

The British Govt. pointed out immediately after the Armistice that Allied discussion was still essential as to the assistance required for the reconstruction of devastated territories, as to food supplies, and in general as to the acquisition and distribution of commodities of which there was a shortage. They proposed the transformation of the Transport Council into a General Economic Council, controlling, with some changes, the same subordinate organisation.

The American Govt., however, took the view that the termination of the War should at once be marked by the disbandment of specifically War organisations, and that appropriate new machinery should be created if required. This, under the diminished impulse to co-operation that attended the cessation of hostilities, proved to be a long and difficult matter. After months of discussion a new Council, "The Allied Supreme Council of Supply and Relief," was formed in Jan. 1919. Too restricted in its functions, and without the assistance of a personnel accustomed to work together, it proved entirely ineffective. It was replaced by the Supreme Economic Council which in personnel, in functions and in the principles of its organisation was almost exactly the same as the "General Economic Council" proposed two days after the Armistice.

This council, and an Allied system of committees responsible to it, though handicapped by the loss of three vital months, made rapid progress in the Armistice tasks of removing the blockade, bringing the German ships into use, re-allotting ships for the repatriation of troops and prisoners, for the import of raw materials required for reconstruction, arranging relief to the starving countries of Europe, and re-establishing railway transport and communications. The Supreme Economic Council, under the chairmanship of Lord Robert Cecil, remained in existence for some years. But its main work was finished, and the greater part of the connected Allied organisation disbanded before June 1919, when the Treaty with Germany was signed.

The League of Nations.—The experience gained in the war system, however, proved of great value in the construction of the great and permanent organ of international action which was then brought into being under the Covenant of the League of Nations. The task of the League was indeed very different in character from that which the Allied Councils and Committees had to carry through in the War. There was no longer the need of urgent executive action, no longer the same subordination of national interests in the face of a common enemy. Its organs of supreme authority, the Assembly and the Council, were composed of members representing their respective governments on all questions dealt with. There was no series of co-ordinate Ministerial Councils divided by function. But the system built up was in fact very different from the pre-War national one, in which every case was worked up from the beginning by purely national specialists till fully formed and opposing national policies confronted each other in international negotiations. For under the Assembly and Council an intricate, varied and elastic system of technical and specialist committees and commissions has been built up on the same essential principles which we have seen in the War system.

Before a question is settled by the Council (consisting of 10 national representatives) it will have been worked at by a permanent technical body, for finance, economics, transit, mandates, opium, etc., or a specially appointed commission. The members of such a committee regard themselves primarily as specialists in their particular subject-matter. At the same time, as they are in fact of differing nationality and know the tendencies of opinion and interest in their different countries, they afford just the kind of bridge between opposing views which we have seen were provided by the Programme Committees. It was perhaps useful that all three of the European members of the Transport Executive joined the Secretariat of the League and had a part in building up the new machinery. But essentially that machinery was constructed as it was because it is among the fundamental principles of the League itself, first that the common interests of nations are no less important than their differences, but secondly, that these common differences must be resolved by agreement and not by the overriding decision of a superior authority.

With some difference of emphasis these were the principles which determined the Allied system; with some difference of application the international system follows the same principles. With this system the real instrument of the League's action is not merely its permanent staff but the national organisations, public and private, which are linked together through its specialist committees and commissions. Its real executive is located not in one city but in sections, in all the main capitals of the world. Its central staff is the "coupling" which unites this intricate mechanism and enables it to achieve an international task. Geneva is not a centre of controlling power but an instrument to co-ordinate activity which is world-wide in its influence and means of action. It is an instrument, not for governing the world, but for assisting the world to govern itself in agreement and in co-operation. It permeates and transforms the policy of the world as the Allied organisation permeated and transformed, without an overriding authority, the policy of the Allies. (*See* also INDUSTRY, WAR CONTROL OF; RAW MATERIALS.)

BIBLIOGRAPHY.—Most of the documents concerned with the Inter-Allied control of shipping and commodities were secret, and remained unpublished. A selection of the more important papers are printed in J. A. Salter, *Allied Shipping Control* (Oxford, 1921), in the British series "Economic and Social History of the World War" (Carnegie Endowment for International Peace). This book covers control of commodities as well as shipping, and the national and international system. The full bibliography is very voluminous. The following English books may perhaps be specially mentioned as giving a good picture of the general principles and actual working of the Control system. J. L. Garvin, *Economic Foundations of Peace* (1919); Sir L. Chiozza Money, *Triumph of Nationalisation* (1920), written from the point of view indicated in title but includes much first-hand information not otherwise available; H. D. Henderson, *The Cotton Control Board* (Oxford, 1922); E. M. H. Lloyd, *Experiments in State Control at the War Office and Ministry of Food* (Oxford, 1924); F. H. Coller, *State Trading Adventure* (1925).
(A. SR.)

CONVERTER: *see* DYNAMO.

CONVOY (*see* 7.67).—The problem of mercantile convoy, the protection of groups of trading ships by naval escort, was fundamentally different in the World War from what it had been in the days of sailing ships. Merchant vessels in the 18th century made very few round voyages in the year, often only one. The length of each passage was uncertain, depending on wind and weather conditions and the delays caused by assembly, awaiting escort and sailing in groups, were comparatively unimportant. The owners of fast sailing vessels might lose the profits to be gained by forestalling the market, but the nation suffered little. Hence trade could be carried on in time of war by a comparatively few convoys of great size. A homeward bound West Indian convoy might comprise 100 or 150 vessels; there are records of Baltic convoys during the Napoleonic wars of over 500 sail.

Since those days, the greater frequency and certainty of voyages under steam had permitted the growth of massed industrial populations, depending for their very life, not merely on an immense volume of imported foodstuffs and raw materials, but on its arrival in a steady, continuous stream of cargoes. Throughout the World War the stocks of food, of munitions materials, and of materials for civil industries were small in comparison with annual requirements, and had to be continually renewed. The holding back of supplies for a few months, or even for a few weeks, might entail irremediable disaster. Thus, if trade were to be run in convoy at all, it must be in numerous small convoys run to a regular schedule, not in a few large convoys at irregular intervals. The contrast may be illustrated by the fact that, during the first two years of the War of the Austrian Succession, 35 outward and 45 homeward convoys sufficed for the requirements of the ocean trades; in the summer of 1918, 40 outward and 42 homeward convoys were run in the ocean trades alone every 32 days.

In these circumstances convoy called for a greater allocation of force and a far more elaborate organisation than in the past. At the best, too, it entailed very serious delays to the faster ships, owing to the wide discrepancies in speed between steamers even of similar type. Neither to the commercial nor to the naval mind was convoy a matter lightly to be taken in hand.

Early Part of the War.—During the first two and a half years of war, the use of convoy was restricted to the protection of troop movements. As the submarine campaign increased in intensity, escort was frequently given, within the danger zone, to tankers and vessels with important government cargoes; but the introduction of organised mercantile convoy was delayed until 1917. So long as the attack on commerce was carried on by surface warships, the total effect, despite the notoriety attained by the "Emden" and other raiders, was comparatively trifling, and even the submarine campaign, in its earlier stages, produced an astonishingly small effect on the flow of commerce. Towards the end of 1916, however, the losses of neutral as well as of British and Allied shipping, became very serious, and the outbreak of unrestricted submarine warfare in Feb. 1917 compelled a reconsideration of the whole problem of trade protection.

At this time the general run of opinion at the British Admiralty was strongly against convoy. It was condemned both as impracticable and undesirable; impracticable because there were not enough cruisers, destroyers and patrol craft to provide escorts for the trade, and because accurate station keeping would be impossible in a group of steamers of varied type and speed; undesirable because of the delays involved, and because any protection derived from escort would be outweighed by the disadvantage of offering a large target to torpedo attack.

Organised Convoys Begin.—The delays caused by the holding up of shipping and by deviation to avoid danger areas were now, in fact, so serious as to discount one of the chief objections to convoy, and the losses suffered during the first three months of unrestricted warfare (*see* SUBMARINE CAMPAIGNS) were so heavy as to threaten disastrous results to the supply system of the Allies. For the three months Feb.-April they amounted to over 1,200,000 tons of British and 800,000 tons of Allied and neutral shipping. The existing methods of protection were clearly inadequate, and the advocates of convoy became insistent. In Feb. 1917 the French coal trade was organised in a system of controlled sailings which rapidly developed into regular convoys, and in April a Scandinavian convoy was introduced to protect the helpless, unarmed neutrals trading on Allied account in the North Sea. Meanwhile, the application of convoy to the ocean trades was being persistently urged both within and without the anti-submarine division of the Admiralty. A special committee was appointed at the Admiralty during May to draw up a detailed scheme of convoys for the ocean trades, and during the same month two experimental convoys were sailed from Gibraltar and Hampton Roads respectively.

Both these experimental convoys arrived without loss, and the experience gained went far to dispose of the bogey of station-keeping. Meanwhile, investigation had shown that the difficulty of providing escort had been magnified by an exaggeration of the number of voyages to be protected, and the arrival of United States destroyers at Queenstown increased the available force. Regular convoys from Hampton Roads were started in June; from Sydney (Cape Breton), New York and Gibraltar in July; in Aug. the system was extended to the South Atlantic trades and the outward traffic.

The system adopted for homeward convoys was for a group of steamers, collected at a port of assembly, to be escorted by a cruiser or armed merchant cruiser, giving protection against surface raiders, to a rendezvous outside the submarine danger zone, where the convoy was met and brought in by a destroyer escort. Outward convoys, collected at assembly ports on the west and south coasts of England, were taken through the danger zone by a destroyer escort, to a point of dispersal outside the ordinary limits of submarine activity, whence the ships made their way individually to their ports of destination. In order to economise the forces used as destroyer escorts, which included destroyers, sloops and in some instances P-boats and trawlers, the escort, which had taken an outward convoy clear of the danger zone, was required to steam from the point of dispersal to the rendezvous with a homeward convoy, which it then brought in. The whole system thus depended on an exact synchronisation of the outward and homeward programmes, which threw an immense strain on the Convoy Section at the Admiralty, and on the commanders, officers and crews of the escorts themselves.

Work of the Convoys.—At the height of the system two homeward convoys sailed every 16 days from Halifax; two from Sydney, Cape Breton; four from New York; two from Hampton Roads; four from Gibraltar; one from Port Said for the "through" Mediterranean traffic, with destroyer escort throughout the voyage; two from Dakar; two from Sierra Leone; and two from Rio de Janeiro, combining with the Dakar convoys at sea. During each similar period two outward convoys sailed from Lamlash; seven from Liverpool, including one "through" convoy to Port Said; four each from Devonport and Milford; two from Falmouth and one from Southend. In the French coal trade there were daily sailings on four different crossings; the Scandinavian convoy, in its final form, sailed from Methil to Bergen and *vice versa* at five-day intervals; a small convoy ran about every six days to Dutch ports; and there were local convoys on the east coast of Great Britain and in the Mediterranean.

All these convoys, which included Allied and neutral ships bound for British or northern French ports, were organised by the British Admiralty, and the bulk of the escorts were provided by the British Navy, although valuable assistance was given by United States cruisers and destroyers in the Atlantic and by Japanese destroyers in the Mediterranean. The French Navy also assisted in the ocean escort of a special convoy started during 1918 for American storeships to ports in the Bay of Biscay.

The transport of United States troops to Europe was carried out in part by special troop convoys, organised and escorted by the United States Navy; but in the spring of 1918, when the great German offensive made it necessary to speed up reinforcements, a large amount of British tonnage was allocated to the service, and special fast troop and cargo convoys were inaugurated from New York to Liverpool and from Halifax to Liverpool and London. Thanks mainly to these convoys, well over 1,100,000 United States troops were carried in British ships, with a total loss, from war and marine perils, of 637.

Success of the System.—From the first the convoys proved a triumphant success, and conclusively refuted the arguments against the system. The grouping of the ships diminished the number of targets offered to the attack, and since the convoys themselves followed carefully chosen and carefully varied routes, and could be deflected, by wireless, from areas of known submarine activity, they proved as valuable in their power of evading attack, as in the actual protection provided by the escort. When located by a submarine, they proved far less vulnerable than the opponents of the system had supposed. The threat of instant retaliation by the escort, and the menace presented to a submarine by a group of ships manoeuvring in concert on a broad front, hampered the movements of the assailant and even when the attack was successful, there was no such wholesale havoc as had been feared.

In the North Sea there were two serious disasters, both due to attacks by surface vessels; but in the ocean trades, even when a successful attack was made on a comparatively large convoy, it was rarely that the submarine claimed more than one, or at the most two victims. The total percentage of loss was as follows:—

Ships escorted safely in ocean convoy	16,539	99·08 %
Torpedoed in convoy	102	0·61 %
Lost by marine peril	16	0·09 %
Lost after parting company, etc.	36	0·22 %
Total sailings	16,693	100·00 %

In the short sea convoys, Scandinavian, Dutch, British east coast, French coal trade and Mediterranean local—there were over 80,000 sailings, with a loss of less than .5%.

At the outset the advantages of convoy, more particularly in the North Atlantic, were partly neutralised by the additional delays due to steaming to the port of assembly, awaiting the sailing date and adjusting speed to that of the slowest ship in the group. These delays, however, were greatly reduced, during 1918, by a more careful grouping of the ships, and by co-operation between the Admiralty, the Ministry of Shipping and the shipowners themselves. Convoy Committees of shipowners at Liverpool, New York and London did yeoman service in the adjustment of sailings to the escort programmes, and the fast troop convoys, in particular, ran with almost the regularity of a railway time-table. In station keeping and manoeuvring also there was improvement and in the later convoys there were few stragglers.

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COOK, SIR EDWARD TYAS (1857–1919), British journalist, was born at Brighton May 12 1857 and educated at Winchester and New College, Oxford. Having settled in London, he was for a time associated with the university extension movement, afterwards becoming a contributor to *The Pall Mall Gazette*, then under the editorship of John Morley. He was later assistant editor, and editor 1890–2, resigning when the paper changed its politics. In 1893 he became first editor of the new Liberal journal, *The Westminster Gazette*. He resigned in 1896 and became editor of *The Daily News*, holding this position until 1901, when his refusal to denounce the South African War led to his resignation. From 1901 to 1912 he was a leader writer on *The Daily Chronicle*. During the World War, conjointly with Sir Frank Swettenham, he directed the official Press Bureau. The work by which he will be chiefly remembered is, however, his monumental edition of Ruskin—a tribute difficult to parallel in modern literature. He was knighted in 1912 and died at South Stoke, Goring, Berkshire, Oct. 1 1919.

Among Cook's publications are *Studies in Ruskin* (1890); *Rights and Wrongs of the Transvaal War* (1901); *The Life of John Ruskin* (1911); *Life of Florence Nightingale* (1913); *Delane of "The Times"* (1915); *Literary Recreations* (1918); and *More Literary Recreations* (1919). He also edited the works of Ruskin (1903–7).

COOK, SIR JOSEPH (1860–), Australian politician, was born at Silverdale, Staffs., and at the age of nine started life in a coal-mine. In 1885 he went to Australia and, six years later, entered the New South Wales Legislature, holding office as Postmaster-General 1894–8 and Minister of Mines and Agriculture 1898–9. He was elected to the Commonwealth Parliament for Parramatta as a free trader in 1901 and became Minister for Defence under Mr. Deakin 1909–10. In 1913, after the defeat of the Labour party, he became Premier and retained office until just after the outbreak of the World War in Aug. 1914, when, his party having lost the general election, he resigned. He did not take office again until 1917, when he was Minister for the Navy in Mr. Hughes' second Ministry. In 1921 he became high commissioner in London. In 1922 he was senior Australian delegate to the third Assembly of the League of Nations and Australian delegate to the International Conference at Genoa.

COOKING APPARATUS: *see* HOUSEHOLD APPLIANCES.

COOLIDGE, CALVIN (1872–), 30th President of the United States, was born at Plymouth, Vt., July 4 1872, the son of John C. Coolidge and Victoria J. Moor. He was descended from a long line of typical New England farmers and storekeepers, living in Puritan simplicity and taking a characteristic interest in local civic affairs. His father, like others in the ancestral line, was selectman and moderator of the town meeting; he held the office of town constable for many years, and became a member of each House of the state Legislature.

It is possible that much of the younger Coolidge's flair for practical politics was developed at an early age as he listened to the conversation that passed in his father's country store, where the Yankee democracy settled political issues over the nail and cracker barrels. His early education was characteristic of the region; he was first sent to the rural schoolhouse, later to Black River Academy and to St. Johnsbury Academy, where he was prepared for Amherst College, which he entered in 1891. There he displayed the qualities which were to distinguish his later career, a dislike of ostentation, a capacity for hard work and clear thought, an ability to express his ideas in phrases that were frequently humorous and invariably terse. Such qualities did not make him a leader in his class (1895), either as scholar, social light or athlete; they did capture the admiration of a small group of the stronger men, and finally led to his election as "Grove Orator" at commencement. His interest in history led him to prepare an essay on "Principles fought for in the War of the American Revolution," which was awarded the prize by the

Sons of the Revolution in a national competition of college students.

As Lawyer and Legislator.—Upon graduation, Coolidge studied law with a Northampton firm, Hammond and Field, and two years later, in 1897, began its practice. The members of the firm were interested in local politics, and he himself soon found opportunity to follow his natural inclination. He was elected a councilman of Northampton in 1899, city solicitor in 1900, and was appointed clerk of the courts, a county office, in 1904. He was a member of the Republican city committee. In 1907 and 1908 he served as a member of the general court of Massachusetts, the legislative body of the state, winning the reputation of a hard-working committeeman; he returned to Northampton to become mayor for two terms in 1910 and 1911. At the close of his second term he secured the Republican nomination for state Senator, which in his district was tantamount to election. From that time his political career in the state progressed by regular steps. In 1914 and 1915 he was chosen president of the Senate; he was elected Lieutenant-Governor of Massachusetts for three terms, 1916, 1917, 1918, and Governor of Massachusetts for two terms, 1919 and 1920. In each case of re-election he was returned to office by an increased majority.

His success was not achieved by conventional electoral methods, for he avoided ostentatious advertising and was regarded personally as a poor " mixer," shy, taciturn and apparently cold. Coolidge himself expressed in a characteristic phrase his conviction that electoral success ought to depend upon the candidate's devotion to official duty. " Let men in public office," he said, " substitute the light that comes from the midnight oil for the limelight." And again, " We need more of the office desk and less of the show window in politics." He translated his epigram into action, and the success he achieved as mayor of Northampton and as Governor of Massachusetts, in securing both economy and efficiency, explains much of his consequent recognition at the polls. At all times he displayed a political shrewdness which saved him from mistakes, and a dry common-sense, skilfully expressed in trenchant phrases that caught the imagination of his auditors.

Governor of Massachusetts.—Coolidge, as Governor of Massachusetts, proved himself an expert administrator; he was the first governor of the state to submit an executive budget for legislation and he pushed through various laws providing for the reduction in the number of administrative agencies in the state. But it is likely that his name would not have become nationally prominent if it had not been for his handling of the strike of the Boston policemen. The Boston charter provided that the police department should be under the direction of a commissioner appointed by the governor (in this case the commissioner had been chosen by Coolidge's predecessor); the mayor of Boston, however, may in certain contingencies take control of the police, and in " case of tumult, riot or mob," may call out such part of the state guard as is within the city of Boston; if the situation passes beyond his control he may call upon the governor to mobilise the remaining state militia.

The Boston Police.—During the first week of Sept. 1919, the Boston police threatened to go on strike because of the refusal of the commissioner to permit affiliation with the American Federation of Labor; the commissioner was steadily supported in his position by Gov. Coolidge. On the afternoon of Sept. 9, about three-fourths of the policemen left their posts; disorder in the streets commenced during the night, which became riotous the following morning. The mayor, who had been previously informed by the commissioner that he did not need the state guard, on the morning of Sept. 10 called out the state guard in Boston and requested the governor to send at least three regiments of infantry. Coolidge immediately issued the order. It is possible that, thus reinforced and with the aid of young college graduates, the local authorities might have handled the situation successfully. In view, however, of a threatened general strike calculated to disorganise transportation and business activities, as well as the danger of continued rioting, Coolidge called out the entire state guard, and on Sept. 11 took charge of the police department. The strike was broken and order restored. Coolidge steadfastly supported the commissioner in his refusal to reinstate the striking policemen, and in a public reply to an appeal of Samuel Gompers clarified the issues involved: " The right of the police of Boston to affiliate has always been questioned, never granted, is now prohibited. . . . There is no right to strike against the public safety by anybody, anywhere, at any time." Warned that labour would prevent his election to any office in the future, he replied, " It does not matter."

As Vice-President.—The action and words of Coolidge in this crisis were eminently characteristic. He took no step until it seemed necessary, but then he took it decisively. The effect upon the popular mind was impressive. In the election of Nov. 1919, standing for re-election as governor, he received a majority of 125,000. His name was at once included in the list of possible presidential nominees for the following year. Already mentioned in 1916 by a few supporters, he might have received the nomination in 1920 if he had been given the solid backing of politicians from his own state. But at the National Republican Convention, where the senatorial group in control did not approve him, the Massachusetts delegation was divided and he did not have the support of the senior senator, Henry Cabot Lodge. He failed thus to profit by the deadlock, which was finally broken in favour of Warren G. Harding. But when it came to a call for vice-presidential nominees, a wave of enthusiasm for Coolidge caught the convention which, with 674½ votes, nominated him on the first ballot. He was elected Vice-President of the United States in the following Nov., receiving with Senator Harding 404 electoral votes.

As Vice-President, Coolidge was the first who attended meetings of the Cabinet, but he made no attempt to enlarge the functions of his office. He attended faithfully to the routine duties that went with the presidency of the Senate, consistently supported the policies of the Harding administration, and did nothing to bring himself before the public eye. Early in the morning of Aug. 3 1923, in his father's house at Plymouth, Vt., he learned of the death of President Harding. The oath of office was administered by his father, a justice of the peace, and he immediately left for Washington.

Becomes President.—Characteristically, President Coolidge's first interest was to assure the efficiency of the public administration, his second not to weaken his future position by any false step. Following four months' silence, his first presidential message, in Dec. 1923, commanded universal attention. It was brief and categorical. In it he made plain his opinion on the major problems before the country. He approved the maintenance of the tariff without frequent revision, a reduction of taxes; he disproved the soldiers' bonus as well as any complicated scheme of government relief for the farmers. As regards foreign policy, he advocated co-operation without entanglement, opposing entrance into the League of Nations, but approving adherence to the World Court. The message was courageous in its lack of equivocation and attractive in its emphasis upon economic common-sense.

With its delivery Coolidge caught the admiration and confidence of the ordinary citizen of the United States as a whole, as he had previously in Massachusetts. None the less, he faced a difficult situation in Washington. The Republican party in Congress was broken into blocs, disinclined to accept his leadership, torn by factional struggles to secure advantage in the coming National Convention. Congress sustained the veto of Coolidge of the Postal Salaries bill by only one vote, and passed the Bonus bill over his veto. In the spring the disclosures of the Teapot Dome leases threatened to involve his Cabinet and discredit the Republican party. The President met the demands for wholesale purification of the Administration with discretion and restraint; he immediately appointed special counsel to prosecute an investigation, but refused to satisfy popular clamour by hasty dismissal of accused officials: " I do not propose to sacrifice any innocent man for my own welfare, nor do I propose to maintain in office any unfit man for my own welfare." Opinion finally accepted the President's judgment as decisive. At the

Republican Convention, largely because of popular feeling in his favour, his control was unthreatened and he was nominated with ease; the vote of the convention was in many cases an unwilling tribute by the party leaders to the overwhelming power of public opinion "back home."

Coolidge did not take an active part in the campaign, remaining for the most part in Washington and dealing with current problems of administration. In the few speeches which he made he reiterated the basic principles which he had already stated: economy in public affairs, efficiency of public service, abstention from the League of Nations, adherence to the World Court. He made slight effort to answer the bitter criticism passed on the Republican party for the scandals and its reactionary attitude, by the Democratic and Third party nominees; he relied upon the increasing prosperity of the country under his administration and the widespread feeling that he embodied a shrewd common-sense in which the nation might trust. He was vindicated by the result of the election, which gave him 382 electoral votes against 136 for Davis and 13 for La Follette. The popular vote was 15,700,000 for Coolidge, 8,400,000 for Davis, 4,800,000 for La Follette.

On March 4 1925 Coolidge was inaugurated President by virtue of election. His position in the country and the party was strong. He still met difficulties with the old Congress, for the insurgent Senators combined with the Democrats to refuse confirmation of his nominee for attorney-general. But the back of the insurgent-radical movement seemed broken, and his control of the new Congress was solidified. He made plain in his presidential messages of Dec. 1924 and Dec. 1925, that he did not plan to use his increased political strength for far-reaching legislative reform. But he insisted, with success, upon his plans for tax reduction and administrative economy. As regards foreign policy, he pushed irresistibly the demand for adherence to the World Court. By his willingness to co-operate in a disarmament conference to be held under the auspices of the League of Nations, he displayed a sincere desire to assist in solving the problem of the world peace despite the prejudices of the irreconcilables. Under his direction an arrangement of the foreign debt question was reached with Belgium and Italy, although negotiations with France broke down temporarily.

After two years as President, Coolidge appeared as a skilled administrator, shrewd in his judgments, an idealist, but, like his Puritan forefathers, eminently practical, determined to make sure of his footing before taking any step in advance.

On Oct. 4 1905 he married Grace Anna Goodhue, of Burlington, Vermont. Two sons, John and Calvin, were born on Sept. 7 1906 and April 13 1908, respectively. The younger died on July 7 1924, as a result of blood poisoning. (C. Sey.)

CO-OPERATION (*see* 7.82).—In the urban areas of industrial countries it is chiefly the middle and wage-earning classes which are interested in the co-operative movement. The needs which it attempts to fill by its programme of self-help and mutual aid are growing ever more numerous; nevertheless, three great forms of activity may be distinguished; consumers' co-operation, producers' co-operation and credit co-operation. In practice, it often happens that the same institution assumes more than one or even all of these functions; but this division is a convenient one.

I. DISTRIBUTION AND THE CONSUMERS' SOCIETIES[1]

The consumers' co-operative societies showed the most rapid growth in the urban co-operative movement between 1911–25. Even the insufficient statistics available show the important place taken by consumers' societies in the economic life of certain countries. The membership rose in Germany from 1,600,000 in 1911 to about 4,000,000 in 1924; in Finland from 87,000 in 1910 to 371,000 in 1924; in France from 856,842 in 1911 to 2,329,869 in 1922; in Great Britain from 2,640,429 in 1911 to 4,702,868 in 1924; in Sweden from 85,359 in 1911 to 289,704 in 1923. In Switzerland, 9% of the inhabitants, and in Finland 10%, belong to consumers' societies. As the members of these societies are generally heads of families, it is probable that in Finland and Switzerland, for example, one-third of the population make part of their purchases from the co-operative societies.

In the new European countries, especially in Poland, in Czechoslovakia and in the Baltic States, where the movement is strongest in rural districts, as it is in Denmark, there are numerous and prosperous consumers' societies which have done much to create and strengthen the economic and social structure of the country. According to Charles Gide (*Les Sociétés Co-opératives de Consommation*, 1924), there were in more than 50 countries over 50,000 consumers' societies with a total membership exceeding 35,000,000. The business done is proportionately large. In France in 1922 it amounted in value to 223,000,293 frs.; and in Great Britain in 1924, to £175,077,825. In Germany, these societies suffered during the period of inflation, but since the currency was stabilised in 1923 their development has been renewed, and their total turnover exceeded 600,000,000 marks in 1924. Similarly, the co-operative wholesale societies (C.W.S.) have become considerable enterprises. The total turnover of the C.W.S. of Hamburg increased from 109,605,470 gold marks in 1911 to 168,466,278 gold marks in 1924; while in Great Britain the total business done by the English and Scottish Wholesale Societies amounted in 1924 to £90,200,258. In 1911 it was £35,744,069.

The growing importance of the consumers' societies on the national markets and the important part which certain co-operative wholesale societies play on the international market, have produced a certain reaction in the national legislative and political activity of certain countries. The consumers' societies were long permitted to develop unnoticed by the Press, while political parties and public authorities remained indifferent or were even hostile. Socialists of all countries, under the influence of Karl Marx, remained hostile to co-operation. But in the late summer of 1910, a decisive change took place, when the International Co-operative Alliance (I.C.A.) at Hamburg and the Socialist International at Copenhagen held their Congresses simultaneously, and the Hamburg assembly received a resolution from Copenhagen recognising the autonomy of the co-operative movement but affirming its value as a factor of social transformation. During and immediately after the World War public authorities became similarly converted. In almost all the belligerent and in many of the neutral countries the Governments, confronted with the complicated task of rationing their populations, turned to the existing machinery of distribution of the non-profit making type of the consumers' societies, and asked them either to distribute provisions directly purchased by the State or to oppose the rise in prices.

In Russia, the Soviet Government tried to go further still. At first it hoped to absorb the consumers' co-operative movement, and to make it the single channel of distribution within the Communist State, to which the entire population, grouped in every town and village in consumers' communes, must adhere. When the new economic policy was adopted in the spring of 1921, compulsory membership was dropped, and the co-operatives recovered their autonomy. Nevertheless the State entrusted them to a very large extent with the organisation of internal trade, especially among the agricultural population, both to sell the products of state industry and to supply the towns with agricultural products.

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[1] By the side of the consumers' co-operative movement there should be mentioned the movement which compels small retail traders to associate to organise their common stock on a co-operative basis. In Germany these co-operatives have existed since 1879 and are already old and numerous. Yet they only acquired a certain importance in 1907, when they united in the federation of German co-operative societies of small merchants (Edeka). In 1923 this federation had a purchasing centre, a banking centre, a publishing centre, etc., and included 541 of the most important of the existing 1,421 societies. In the other countries of Central Europe, especially Austria, Switzerland and Czechoslovakia, and also more recently (1919) in France, similar groups have been constituted. So in the struggle for existence the small private concern, which is so profoundly individualistic, has had to borrow the principles of mutual aid or the methods of technical concentration from the co-operatives, the wholesale traders, and the great enterprises with numerous branches.

As a result of war services the co-operative movement was called to take an official part in public life. In Germany, and also in Czechoslovakia, according to a bill under consideration in 1926, chambers of consumers were created side by side with chambers of commerce and chambers of industry; while in Austria organised consumers are represented in the special committees constituted to examine economic questions in workmen's and employees' chambers. In the German Federal Economic Council the consumers' societies are represented, and the draft constitutions of similar proposed bodies in other countries contain provision for similar representation. The co-operatives are everywhere recognised as qualified to represent the consuming public.

Movement Towards Federation.—In the heart of the co-operative movement, which has acquired a fresh power and authority, two great tendencies are apparent: (*a*) the grouping of societies in powerful federations; and (*b*) the fusion of new or economically weak societies with each other or with stronger societies. Progress towards federalisation was made not only in countries where the consumers' movement is relatively young—as in Finland, where non-federated societies practically do not exist, or in Sweden, where the federated societies represented 70% of the total consumers' societies in 1910, 89·6% in 1923—but is also taking place in older and more highly developed movements, as in Switzerland, where the number of non-federated societies is extremely small, or in Great Britain, where the percentage of societies affiliated to the Co-operative Union was 83·2 in 1913 and nearly 90 in 1924. Non-federated consumers' societies are nearly always small.

In Great Britain the consumers' societies adhering to the Co-operative Union totalled 93·65% of the total membership in 1913 and more than 98% in 1924. In 1910 the Swedish Co-operative Union embraced a total of 67,928 members out of 85,358 consumers' co-operatives, or 79·6% of the total; in 1923 the federated societies included 257,163 members out of a total of 289,274 or 92·2%, and were responsible for 98·6% of the total turnover of all the societies. The concentration which has been effected in Poland is particularly remarkable in view of the long dismemberment of the nation and the scattered nature of the movement due to historical and political reasons. The rapid development in organisation astonished the most experienced co-operatives in other countries, and in 1925 existing unions of long standing were federated in a big union. In Czechoslovakia the Czech and German Unions began to consider the creation of organisations which should promote national unity.

The tendency to fusion has been even more important. It was particularly strong in Austria, in Czechoslovakia, and in Germany, where the number of societies only increased by 43 units from 1911–24, while the total membership of the societies increased by 2,400,000. In France, the regional societies formed since 1913 and known under the name of Co-opératives de Développement ou de Fusion, only numbered 46 on Jan. 1 1925; yet they maintained 2,600 shops and had 565,000 members. Their turnover in 1924 rose to about a quarter of the turnover realised by all the consumers' societies in France. In Great Britain the membership of consumers' societies increased by 2,000,000 between 1911–24, while the number of societies diminished by 89 during the same period. In Sweden, the average number of members per society has more than doubled for the same reasons and during the same period. This partly explains the size of the consumers' societies in great industrial centres, some of them having more than 100,000 members; Woolwich had 109,535 members in 1924; London had 117,266 members at the same date; Hamburg 150,000; Berlin and district 160,000; Vienna 167,000.

The Economic Unit.—The appearance of the large society has raised the problem of what is the best economic unit. The large undertaking, whether co-operative or not, clearly possesses certain advantages lacking to the small; better conditions of purchase, better financial resources, better possibility of utilising modern mechanical appliances, etc. But these advantages do not always increase on parallel lines with the increase in the dimension of the enterprise. There comes a point when the return ceases to increase proportionately with the increase of general expenses. There is a danger that the cumbersome and expensive administrative apparatus will bring the disadvantages of bureaucracy. Extension of area, in particular, does not necessarily result in greater efficiency because of the increase of transport costs entailed by stocking widely dispersed centres of distribution.

Moreover, the very large enterprise is rarely conducive to the best co-operative education; the social bond is loosened, contact between members and administration becomes less close, and the members cease to take a direct active share in the conduct, responsibility and control of the business. Thus an essential distinction between the co-operative society and the limited company vanishes. As the consumers' societies have grown, the functions of the general meeting have become more and more difficult or illusory. Members no longer know one another. They cannot appreciate the activity exercised by their society in all its details and in its entirety; they can no longer vote with full knowledge and with the sense of personal responsibility. Co-operative democracy tends to become formal, and the enterprise is no longer directed by the members as a whole, but by a small group of them. A very large membership sometimes even makes general meetings impossible for material reasons; and it has been necessary to consider replacing general meetings by meetings of delegates. This process, with certain modifications of detail, has been made legal in Germany (amendment of July 1 1922 to the law of 1899), in Poland (law of Oct. 20 1920) and in Switzerland (proposed revision of the Code des Obligations). In France, sections constituted by arrondissement or by commune within the Co-opératives de Développement ou de Fusion appoint delegates to the general assembly.

The virtues of the small society are beginning to be recognised; it is admitted that as forcing houses for the development of the co-operative spirit in the new generation they are justified if they receive the economic support of larger societies and are organically bound to a federation. A type is required which shall combine the economic advantages of the larger society, with the democratic control and the educative value of the small society. No formula has been reached. In some cases the large regional societies are being transformed into federations with the duty of controlling and performing common services for the small societies, which recover their autonomy and with it their social life. Sometimes the large regional societies are maintained, and autonomous centres of activity are formed within them in the shape of town or district shops, groups constituted for savings, social work, etc. Everywhere centres of education and propaganda are being organised for the women members to secure their effective collaboration.

Extension of the Movement.—The growth of the consumers' movement has had other aspects. It has considerably enlarged its bases of recruitment. Through the regional societies it has spread rapidly among the rural populations. In Finland, in 1922, 49·4% of the membership of the co-operative movement consisted of independent farmers or small holders or agricultural labourers. In Germany, the number of farmers and agricultural labourers grouped in the central union of German consumers co-operative societies has increased from 40,760, or 3·95% of the total, in 1911, to 226,003, or 6·51% of the total, in 1924. Similarly in Sweden, the number of farmers and agricultural labourers in consumers' co-operative societies increased fivefold between 1910–22 from 11,438, or 17·6% of the total, to 56,387, or 22·3% of the total. In the towns, while still catering especially for wage-earners, the consumers' movement, especially since the War, has attracted the middle classes. In 1922 this class represented 14·6% of the members in Finland; in Germany they had increased from 11·66% in 1910 to 20·3% in 1924 and in Sweden from 8·7% in 1910 to 18·8% in 1922.

Finally, the consumers' movement has penetrated the poorest sections of the urban proletariat. For this reason, and because of the conditions under which wages are paid, the societies are increasingly concerned with the problems of giving credit to their members. Ever since its inception the movement has been pledged for its own sake to insist on cash payments, since the giving of credit increases overhead charges and endangers the security of the enterprise. This is also in the interests of the member, who finds cash payment a guarantee of liberty and dignity as well as a stimulant to thrift. But in certain difficult situations or for certain purchases a working population undeniably needs credit and the total sum of its indebtedness of members at the end of the financial year rose in 1924, to £2,800,110. In fact, of 1,314 shops in Great Britain more than 1,100 give credit. In Finland, only 15% of the societies sell for cash; in the Scandinavian countries the extension of credit has given the directors of the movement some anxiety. In Norway the percentage of credit transactions grew continuously from 1916 onwards, passing from 1·7% at that date to 4·5% in 1924. In that country the rise of the exchange and the fear of an economic crisis and a period of unemployment, which seemed imminent, added to the disquietude and the question was brought up at the congress of 1925.

The Labour Question.—With the vast growth of the movement the societies have had to face the labour problem. In small societies the work of directors, managers, etc. was at first performed gratuitously by members in turn or as elected. As the societies grew and their responsibilities increased they had to seek professional skill and paid labour. In certain countries the consumers' societies and their federations have even become important employers. In 1924, the societies affiliated to the German Central Union employed 42,350 persons in their distributive and productive undertakings. At the same date the consumers' movement in Great Britain employed 207,211 persons with a wage bill of £25,596,987. Thus the problem of relations with the personnel employed and with the trade unions arose. Though the societies have tried to establish model conditions of work, and though they have to meet the competition of private enterprise, they have often led the way in improving hours of work, wages, insurance, holidays, collective agreements, etc. Thus, they have been able to establish with the trade unions relations which, if they have not always everywhere been so intimate as the two parties might desire, nevertheless show great mutual confidence. In Great Britain, France, Switzerland, Belgium, Czechoslovakia and elsewhere, committees have been established on which the representatives of the central trade unions and co-operative organisations sit in order to determine wages and conditions of labour, and to act in case of disputes as organs of conciliation and arbitration. It is generally understood that strikes, particularly those covering an entire trade, will not affect the co-operative societies; while the latter pledge themselves to apply trade union conditions of labour and wages.

In the main centres of distribution an effort has been made in some countries to place their managers in psychological and social conditions similar to those of the small retailer. Fixed salaries have been replaced or supplemented by a system of premiums for economies in working, commission on sales, etc. In Germany the employees have often pronounced in favour of fixed salaries, but in an increasing number of societies a variable fraction of the salary bears a relation to the sales effected. Similarly, in Austria, where the consumers' societies are most deeply impregnated with Labour and Socialist influences, the directors of the movement favour a basis of remuneration proportional at least in part to the commercial results. In France, the regional societies have entrusted the branch management to managers paid on a commission basis.

As their strength developed, the societies have tried to satisfy the greatest possible number of their members' needs. Starting with the provision of groceries and bread, they have in some cases gone on to found restaurants and cafés, shops for the sale of dairy products, drapery, clothing, shoes, hardware, household goods, fuel, furniture, etc. Many societies have even attempted to attract members by procuring them houses, either building themselves or assisting special building societies.

Relations Between Wholesale and Retail Societies.—The central organisations seek to extend their supply services to their affiliated societies. In return they expect the affiliated societies to reserve for them the highest possible proportion of their custom—not always with success, for reasons many of which are perfectly legitimate. In Germany the retail societies bought only 23·2% of their goods from the wholesale, and 23·8% in 1924. The proportion is more satisfactory in Sweden, having risen from 21·6% in 1913 to 32·5% in 1923; in Switzerland from 28·2% in 1910 to 49·9% in 1924; it is naturally most satisfactory in Great Britain (47·9% in 1911 and 51·77% in 1924). These figures show a relative increase of purchases made by the societies from the wholesale societies, corresponding roughly both to the progress effected by the wholesale societies themselves and to the steadily increasing loyalty of local and regional societies. Nevertheless some societies show regrettable neglect of their wholesale societies.

Productive Enterprises.—At an early stage the consumers' co-operative societies attempted to produce, either in their own establishments or through their central organisations, the greatest possible number of articles and goods which they required, with the object of eliminating the commercial as well as the industrial profit.

Progress in the quantity, variety and value of the products manufactured was considerable from 1910 onwards. The English C.W.S. has the greatest variety of productive enterprises, from the manufacture of flour, biscuits, chocolates, soap, cycles, motors and sewing machines to the ownership of tea plantations. It more than doubled its production between 1911–24, the value rising from £12,471,414 to £29,938,339. In Germany the production of the industrial enterprises of the Hamburg C.W.S. increased in value from 2,935,581 marks in 1910 to 26,298,325 marks in 1924. The value of the production of the French C.W.S., which was insignificant in 1911, was 23,700,000 fr. in 1924. The Swedish Union had no productive enterprise before 1921, but in 1923 produced goods to the value of 10,900,000 kroner. Its congress in 1922 voted the raising by subscription of a special fund of 3,000,000 kr. for production. This subscription was closed in 1924 after producing 3,500,000 kr. and in 1926 the Swedish consumers' movement had two of the largest flour mills in Sweden.

The development attained by certain productive enterprises raises a grave problem. Impelled by the necessity of cheap production, the co-operatives desire to extend their market and thus tend to introduce the risks and profits of capitalist methods. On this question divergent reports were presented to the international co-operative congress at Ghent in 1924 by Sir Thomas Allen and Max Mendel, and raised very animated discussions in the German co-operative Press and at the congress of the German Central Union at Stettin in 1925.

Moreover, it sometimes happens that the producing services are completely detached from the purely commercial services and are carried on by specialised, distinct and autonomous societies, of which their customers, the local or regional societies, become members if they wish. This specialisation of functions is well illustrated in the co-operative enterprises of the Swiss Union of Consumers Societies for special purposes: two flour-mills, a furniture factory, a creamery, a society for market gardening and a shoe factory. In Germany, a clothing society was formed in 1922 by the Hamburg C.W.S in conjunction with the State of Saxony. In France, at the Bordeaux Congress in 1923, a proposal was considered for the constitution of national societies for special purposes for each of the industrial undertakings carried on by the C.W.S. A society distinct from the French C.W.S. was constituted by the most important societies of northern and eastern France to exploit a salt mine.

In the course of the movement, which is leading them from distribution to production and even to the exploitation of raw materials, the consumers' societies, especially the central organisations, have undertaken direct agricultural production with the help of hired labour. Experiments in this direction have been made chiefly in Great Britain and on a smaller scale in Switzerland, but have not given very satisfactory results. Since the Nottingham congress in 1924 and still more since the Southport congress in 1925, the British consumers' movement appears to be taking a quite different direction. In Switzerland, the agricultural estates, exploited by the consumers' societies, are conducted merely with the idea of providing first-hand information on the cost of agricultural products.

II. RELATIONS BETWEEN CONSUMERS AND AGRICULTURAL CO-OPERATIVE SOCIETIES

By direct touch with agricultural co-operative societies, the consumers' societies seek to ensure the supply of farm products to their members. These relations, desirable and fruitful, as they are, pre-suppose a sincere and tenacious desire for rapprochement and adequate development on both sides, and they present certain technical difficulties. The acute disagreement between the rural and urban population in Europe caused by the War conditions has diminished. One proof of this is the spirit in which agrarian problems have been worked out after the War by the Socialists and Communist parties. The co-operative movement itself has been actively associated in securing an understanding. In those agricultural countries where both the consumers and the agricultural co-operatives are well organised, the union between them has long since been effected. In Ireland, the Baltic States, the Balkan States, Russia, Siberia, India, many states of North America, Palestine, etc., it often happens that the same societies fulfil the functions both of distribution and of agricultural supply and marketing. In other countries all kinds of societies belong to the same federations, and have formed committees to ensure understanding and common action among the specialised federations. In the overseas British Dominions a permanent and close rapprochement has even been brought about in political action (*see* CO-OPERATION, AGRICULTURAL).

Economic relations have been established in two directions: (1) the farmers buy from the consumers' societies not only foodstuffs, but also fertilisers, seed, agricultural implements, etc.; (2) the consumers' societies buy the farmers' products. Both kinds of transaction can be arranged either through the central organisations of the two movements or by the rural branches of societies of urban origin. Exchanges of this kind have been made with varying methods and success, in Germany, Denmark, France, Great Britain, Norway, Switzerland, Czechoslovakia, the United States, etc.

These exchanges may be occasional or part of an organised system. Perhaps the most ingenious form of organisation is that of the mixed society, in which the agricultural and the consumers' societies contribute equally the capital of the common enterprise and have equal representation in all meetings, committees, etc. Similarly, the profits of the enterprise are equally shared; each group then distributes its share among its members proportionately either to deliveries or purchases respectively.

In addition to local or national relations, exchanges have been made between agricultural societies in one country and consumers' societies in another. The outstanding example of these international organisations gives an apt illustration of the mixed society. This is the New Zealand Produce Association, Ltd., set up by the English C.W.S. and the New Zealand Producers' and Marketing Association. This association, which began operations in April 1921, sells New Zealand butter, cheese and other agricultural products in Great Britain. During the six months ending June 1924, the purchases made by the English C.W.S. from the New Zealand Produce Association amounted to £223,170. Another example, but a less purely co-operative and less elaborate one, is furnished by the Russo-British Grain Export Co., Ltd., founded in 1923 for the purpose of exporting Russian wheat to Great Britain and other countries of Western Europe, among whose members are the C.W.S. and Centrosoyus.[1]

Although a practical formula is still to be found, there is a real desire for rapprochement between the different forms of urban and rural co-operation, as witnessed by the following resolution adopted at the Ghent congress in 1924:—

> It is desirable that direct and organic relations be established between the consumers' co-operatives and the agricultural co-operatives in order to unite in local and national organisations the consumer-producers of the towns and the country and, in the international field, the industrial and agricultural countries, on the basis of mutual respect of their conditions of labour and life.

The same desire inspired the International Institute of Agriculture and the International Labour organisation. They undertook a joint enquiry on the relations between agricultural marketing societies and consumers' societies.

III. THE PROBLEM OF PRODUCTION

In the towns, co-operative production has four aspects: artisan societies, workers' productive societies, industrial undertakings belonging to consumers' societies and labour contracting societies.

Artisan Co-operative Societies.—Co-operative artisan societies are as numerous and as various in form as peasant societies. They include not merely organisations for the common utilisation of apparatus for certain operations, but also credit societies, societies for the purchase of raw materials and tools and marketing associations. They are distinguished from workmen's productive societies in that they do not organise work in common. The development of these artisan societies has greatly helped the single-handed worker and the *petit patron* to hold his own against large-scale industry.

The classical country of artisan societies is Germany, where they play an important part in the urban co-operative organisation which developed in the latter half of the 19th century. Inspired originally by Schulze-Delitzsch, the movement in 1920 included 1,373 societies with 134,489 members. Belgium, at the beginning of 1923, had 217 societies for the common purchase of raw material, machines, tools or the sale of products manufactured by their members. In Czechoslovakia these societies on Jan. 1 1924 numbered 944. In France, artisan co-operation dates from the passing of the law of Dec. 27 1923 (credits to co-operative societies and artisan co-operative unions).

There are also intermediary forms between the artisan societies, properly so-called and the productive societies, which are not always distinguished in statistical returns from Hungary, Italy, Yugoslavia, India, Japan and other countries. In Austria, where the development of labour societies has been greatly encouraged by the State, there were on Jan. 1 1923 858 societies of small industry and commerce; in Poland statistics show 357 societies on Jan. 1 1923 for supplying their members with industrial raw material; and in Russia, where small and home industry (Kustar) represents, according to some calculations, about one-third of the entire industrial production, there were on Jan. 1 1923 18,050 artisan societies in very diversified trades.

Productive Societies.—Productive co-operation has developed most characteristically in France; in Italy it has taken a slightly different form, and in Great Britain it is far less advanced. In France there were 498 productive societies in 1911, and 531 on Jan. 1 1923, though the business done has slightly decreased in real value. In Great Britain the number of productive societies increased from 91 with 22,919 members in 1911, to 98 with 27,767 members in 1924. Though the movement is not stagnant, a close examination shows that productive societies have a short life. The numerous dissolutions indicate the difficulties encountered; while the persistence with which new societies are formed indicates the strong desire of the workmen to escape from the status of the wage-earner. Productive societies show an increasing tendency to enter into relations with the public services and with the consumers' societies to find a market for their products. They sometimes even allow themselves to be absorbed by the central consumers' organisations. Success often leads the co-operatives into grave dangers, and those which succeed are liable to abandon co-operative principles. They make it difficult for new members to join by raising the cost of the shares, and evolve towards a capitalist system. Many of them employ a high proportion of paid assistants.

In France and Great Britain about 40% of the persons employed in productive societies receive wages. The productive societies are seeking a formula to secure the liberation of their members and also ensure their economic success and safeguard their social value.

Productive Undertakings Controlled by Consumers' Organisations.—Many people, perhaps most of the leaders of the movement, believe that production undertaken by the consumers' societies and by their federations is a true form of industrial democracy. The work of the employees acquires the character of a public service, from which capitalist profit is eliminated, or more exactly, the surplus realised is placed at the service, not of a few privileged persons, but of the co-operative community. Nevertheless, discontent and even strikes have broken out among the personnel employed. The truth is that in the workmen's revolt against the wages system there is a profound desire that the workman shall achieve his emancipation in the actual course of his work. Starting from these considerations, the international co-operative congress of 1924 discussed and adopted a resolution drawing the attention of the consumers' societies to the part which labour associations can play in the organisation of industrial labour.

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[1] The Central Organisation of the Russian Co-operatives.

Co-operative Labour Associations.—The co-operative labour associations, which often take permanent form as societies, are groups voluntarily constituted in which the members work under the direction of delegates whom they have chosen and can depose. The collective remuneration of the work of the group is shared on principles worked out by the members themselves. This differs from other methods of collective remuneration, where the employer himself engages the gangs, or the foremen of the gangs, or where he intervenes in the division of the collective salary. The labour associations provide a method of industrial organisation by the workers, since the members hire out their labour collectively and themselves exercise personally and through their delegates the functions of control and of the distribution of tasks. On the other hand, the labour associations differ from the productive societies in that they do not have to raise and manage capital; that they do not assume administrative and commercial organisation, and neither purchase raw material nor sell the finished products.

Labour associations and productive societies have developed in several countries, particularly in connection with agricultural labour and public works; also among transport workers, porters, etc. In Italy, the State has entrusted important public works—of drainage, hydraulics, building, railway construction—to societies known by the name of Co-operative da Produzione e di Lavoro. In New Zealand the labour associations operate chiefly in the mining industry and in railway construction. In Russia, labour associations are known as labour artels. They exist under various names in Germany, Australia, France, Hungary and Lithuania. Labour associations act chiefly in little-skilled or unskilled branches of labour and in small scale enterprises. Nevertheless, in certain countries in certain branches of highly-skilled labour, they have begun to enter into larger enterprises. This is the case in France in the printing industry, for instance, in New Zealand in the mining industry, etc. In France, these societies are known by the name of *commandite d'atelier*. The labour association, by substituting a contractual relation for that of a subordinate, constitutes a form of workmen's participation in management. In this way co-operation contributes to the perfecting of the organisation of labour.

IV. SAVINGS AND CREDIT

Credit in consumers' co-operation is concerned with the credit requirements of small independent enterprises, of common enterprises of consumers' societies and of individual households. Urban credit societies of the Schulze-Delitzsch type supply the credit needed by small merchants, industrial workers and artisans. Credit societies have recently been formed in France under the name of *banques populaires;* in 1924 they numbered 325, and their total balance-sheet amounted to 24,400,000,000 francs. The law of May 19 1917, in defining their legal status, insisted that the annual profit after the provision of reserves, must be divided among the depositors, not in proportion to the interest which they had received, but in proportion to business transacted.

The consumers' societies have not been able to reach their present development with their own capital alone. They soon began to ask their members for capital, either in the form of long-term loans or of deposits. In collecting the people's savings and utilising them, under the control and to the profit of the savers, in economic enterprises and social work initiated by themselves, they were educating their members and encouraging thrift. This explains the creation of savings and banking departments within the great federations of consumers' societies. The increase and development of these organisations was one of the salient features of the urban credit movement between 1911–25.

Relation to Wholesale Societies.—The banking departments and institutions of the consumers' movement have almost always developed out of the accountancy branches of the wholesale societies. In some cases, in the Hamburg C.W.S. and the English C.W.S., these are more or less independent departments, which yet remain integral parts of the wholesale society. Sometimes, as in France and Czechoslovakia, the banking department is completely separate from the wholesale society, and an autonomous co-operative bank has been established; sometimes, as in Austria or Denmark, the savings of the people are collected by collaboration between consumers' societies and trade unions. In other cases, as in Sweden, the trade unions abstain from forming a special workmen's bank and simply recommend their members to support the deposit and savings departments organised by the consumers' movement. In Germany, on the contrary, the trade unions have created the workmen's, employees' and civil servants' bank side by side with the banking department of the C.W.S. In Russia, the autonomous co-operative bank (Vsekobank), which was first instituted by the consumers' movement, has become the common bank for the whole of the Russian movement. The labour banks of the United States are more or less connected with the local co-operative movement and are partly co-operative in principle.

In Great Britain, the banking department of the C.W.S. received deposits in 1924 amounting to £552,837,668. From its beginning it has inspired the greatest confidence in the trade unions. Of the 18,732 current accounts, individual and collective, 8,766 have been opened by the trade unions. In France, the banking service of the Paris C.W.S. was transferred in 1922 into a bank which is known under the name of the Banque des Coopératives de France; in 1924 its deposits amounted to 106,000,000 francs. In Sweden, the savings department, founded in 1908 by the co-operative union, included at the end of 1922 355 savings banks with deposits amounting to 16,297,000 kroner. On June 6 1925 there were 31 labour banks in the U.S.A. with total deposits of $85,608,633.

Building Societies.—Co-operative building societies (which must be distinguished from building guilds) are purely credit institutions. The building societies aim at facilitating the acquisition of houses and in purely credit institutions. The original capital, supplemented by loans contracted by the society, is furnished by the members, each of whom is called upon to subscribe shares or to make deposits proportionate to the cost of the house. He receives interest and pays off the total price of the house in instalments spread over 10 to 15 years. Housing societies aim at building houses to be sold or let to their members. In housing societies each member can take up as many shares as he likes. The capital is made up of sums raised on mortgage, by issuing bonds and by the deposits of members. The supplementary payments made by members take the form of rent. In Great Britain there were 12,055 building societies in 1921; in 1922, 232 tenant societies, with 2,795 members and a turnover of £8,000,000. In Germany the number of housing societies rose from 1,056 in 1910 to 3,792 in 1924. In 1910 there were in the United States 5,869 building and loan associations with a total membership of 2,169,893 and total assets of $931,867,175. In 1924 the number of associations had increased to 11,844 with a total membership of 8,554,352 and total assets of $4,765,937,197.

Consumers' societies or their management often share in the foundation and management of building societies. They also seek to organise the savings of their members for other emergencies. Besides co-operative insurance funds, there are institutions like the provident funds of certain German consumers' societies. These funds, to which a part of members' dividends are added, enable members to accumulate reserves for critical periods—unemployment, strikes, illness, etc.

Credit Unions and Labour Banks.—The credit unions developed since 1910 in the United States certainly have the advantage of a purer and more elaborate formula. While the savings and credits institutions of the consumers' societies unite in the same organism, two functions distinct by their nature, the credit unions, which specialise in a most definite function, are better adapted to more numerous and various needs of credit. They are most highly developed in great cities like Boston and New York, where they render to workers' households services comparable to those which the Schulze-Delitzsch organisations render to the small independent workmen or the Raiffeisen banks to the rural population. In the credit unions members' responsibility is limited to the amount of the shares subscribed, and they do not usually grant loans for trade purposes; otherwise in their aims and methods they closely resemble Raiffeisen banks. Their members are usually recruited from a small and homogeneous group of persons, who either live near each other or work in the same establishment. The unions are thus perfectly adapted to collecting small savings. Like the Raiffeisen organisations, they can make small loans without other guarantee than that of the member. In principle, they give loans exclusively for productive ends, but they have had to admit a wide meaning for the word "productive." Thus they grant loans for current needs, but only if such expenditure improves the condition of the borrower. The credit unions are formed by share subscription. The denomination of these shares is generally low, five or 10 dollars. Each member has to subscribe for one or more shares; he can also make deposits. Credit unions have now (1926) developed in 24 States. In Massachusetts, where they started, there were 90 in 1924 with 34,469 members and total resources of $6,297,000.

The credit unions have carried on a successful war against money-lenders. An inquiry instituted in Boston in 1915 showed that every week 100 workmen spent half a day's work in payment to money-lenders, and that most of the loans were made at an interest of 180% per annum. Since the development of the credit unions, which charge 8% on loans, half the money-lenders in Massachusetts have disappeared, and the other half have lost half of their business.

These institutions have aroused interest in other countries, especially in Austria, France and Sweden. These credit unions, being autonomous, mitigate the hardship resulting from the strict application by the consumers' societies of the principle of cash sales. The insistence by the consumers' societies on cash may be prudent finance, but tends to diminish their turnover; if this insistence teaches members not lightly to run into debt, it does not meet legitimate emergencies or save them from recourse to money-lenders. The credit unions therefore render an essential service.

V. THE INTERNATIONAL CO-OPERATIVE ALLIANCE

The International Co-operative Alliance (I.C.A.) was suggested in 1886 at the British congress at Plymouth by the French co-operator, Boyve, and definitely constituted in 1895. Originally it included eminent persons interested in co-operation and its principles, not necessarily representing societies. But gradually, thanks to the activities of its first president, Henry W. Wolff, who employed in its service his personal influence and his extensive knowledge of all forms of co-operation, the Alliance rallied round it the co-operative organisations themselves. At the ninth international congress, held in Glasgow in 1919, its statutes were modified to give it the constitution of a union of national federations. Most of the affiliated organisations are federations of consumers' societies. But other forms of co-operation, notably productive societies, and the societies serving the multiple activities of the rural and agricultural populations, are also represented in the Alliance.

In Europe the I.C.A. includes almost all the federations of consumers' societies, the wholesale societies; federations of productive societies of France, Great Britain and Italy; the federations of agricultural societies of France, Hungary, Italy and Rumania; federations of societies (either specialised, or with multiple functions) of Denmark, Esthonia, Finland, Ireland, Italy, Latvia, Lithuania, Yugoslavia, Russia, the Ukraine and Georgia. The federations of consumers' societies of Canada, United States and Argentina have joined the Alliance, as have the federation of the Bombay societies, and the federation of the Japanese unions. The relations which have been established between the English C.W.S. and the overseas agricultural societies permit the hope of closer bonds in the near future and even of eventual formal union between the Alliance and the mainly agricultural movements of South Africa, Australia and New Zealand. Taking into account only the federations, actually affiliated to the I.C.A., where the number of societies and members is known to us, the following figures give a low estimate: 70 federations of 32 countries, with about 75,000 societies, and a total of more than 40,000,000 members. In the words of its statutes:—

> The Alliance is not concerned either with politics or religion; it considers co-operation as a natural ground on which persons of the most various opinions and different beliefs can act in common.

Its political and religious neutrality on which the unity of the co-operative movement rests, does not exclude affirmation of the moral and economic ideal which is common to all co-operators. This is why the Alliance has introduced in the first article of its statutes a definition of the end towards which it leads the co-operators of the whole world:—

> The International Co-operative Alliance, continuing the work of the pioneers of Rochdale, pursues quite independently and by its own means the substitution for the present competitive régime of private enterprise, the co-operative régime organised in the interests of the community as a whole and based on mutual assistance and self-help.

The international co-operative congresses constitute the highest authority of the Alliance. Eleven congresses have met: London, 1895; Paris, 1896; Delft, 1897; Paris, 1900; Manchester, 1902; Budapest, 1904; Cremona, 1907; Hamburg, 1910; Glasgow, 1913; Basle, 1921; and Ghent, 1924. In the intervals between its congresses the Alliance is administered by a general secretary, Mr. Henry J. May, and an executive committee, whose president is G. J. D. C. Goedhart; (vice-presidents, A. Whitehead and E. Poisson) and eight other members; and a committee composed of representatives of all the national organisations which are members. The development of the activities of the Alliance has therefore necessitated the institution of specialised auxiliary committees.

The international committee of the co-operative wholesale societies, constituted in 1919 and transformed in 1924 into a society under the name of the International Co-operative Wholesale Society, collects information concerning the commercial relations between the co-operative centres of the different countries and studies the possibilities of supply as a whole. The value of purchases made abroad by 13 of the wholesale co-operative societies rose in 1923 to £29,053,068. The purchases of the British wholesale societies were £25,127,472; of the merchandise bought abroad by 13 wholesale houses together 3% was manufactured articles and cloth, and 2% coal, wood and mineral products; the other 95% represented provisions.

Seven articles by themselves form 70% of the total value of the imports of wholesale co-operative societies:—

Butter	£5,214,259	Tea	£3,499,932
Wheat	5,018,001	Sugar	1,573,548
Lard and Bacon	4,682,046	Coffee . . .	659,837
		Rice	364,703

Europe furnishes 37% of the total of £29,053,068; America 28%; Asia 17%; Australia 53%; Africa 3%. The International Co-operative Banking Committee, constituted in 1922, has already collected important documents on the development of co-operative banking, and is in touch with 27 central organisations of 16 countries. Its immediate task is to facilitate the establishment of co-operative banking relations between country and country, such as the regulation of commercial operations with or without opening credits, the transference through co-operative channels of the savings of members, etc. The development of these relations will prepare the way for the establishment of an international banking centre. The International Co-operative Women's Guild (est. 1921) unites the national women's guilds. The first women's guilds were established in Scotland and Ireland and guilds were later formed in Austria, Belgium, Holland, Switzerland, France, the United States, Canada, etc., in order to educate women to take a more active part in the co-operative movement. The countries actually affiliated to the I.C.W.G. are: Austria, Belgium, Holland, England, Ireland, France, Norway, Scotland, Sweden, Switzerland and the United States.

Finally, the Alliance has taken under its patronage the committee constituted on the initiative of the Belgian Prévoyance Sociale to study the co-operative and workmen's insurance societies. The I.C.A. issued in 1906 a very complete bibliography of all works which had appeared up to that date on co-operation in any country, and in 1910 and 1913 it has published monthly an *International Co-operative Bulletin* in English, French and German, giving authoritative articles on co-operative questions and on the activity of the co-operative movement. Since 1907 it has issued a *Yearbook of International Co-operation.*

Of all the social movements, perhaps the international co-operative movement has recovered its unity most rapidly since the War. Strictly speaking, its unity was never formally broken, and as early as 1920 the International Co-operative Alliance again took up direct relations between the co-operators who had been separated by hostilities. It was also able to surmount the difficulties resulting from events in Russia. But experience has shown the importance of a practical activity applied to specifically co-operative tasks. It is by directing all its efforts to co-operative education and the practical tasks of organisation that the Alliance will be able to maintain its influence and bring all the countries of the world within its scope.

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CO-OPERATION, AGRICULTURAL (*see* 7.87).—The development of agricultural co-operation has taken widely different courses in various countries according to their specific needs. The main difference to be observed is between countries which are primarily producers of agricultural commodities for export, and those which produce mainly for home consumption. In the former, the co-operative movement has chiefly concentrated upon the organisation of marketing; in the latter—apart from the development of rural credit and insurance—mainly upon the purchase of farm requisites, or the formation of co-operative dairy, bacon, or other producing societies. Although this broad distinction holds good, it is nevertheless true that practically all types of co-operation are to be found to a greater or lesser extent in the principal agricultural countries.

Co-operation in Europe

In western Europe, where the majority of countries are importers of food or are approximately self-supporting, the growth of co-operation has been mainly in the direction of developing rural credit societies (*see* Agriculture: Economics) or of societies for the purchase of agricultural requisites, though often combining these functions with that of the sale of produce. But even here, Denmark, conducting a considerable export trade, has developed its marketing organisations on co-operative lines in addition to its highly organised system of supply societies; indeed it has been the model upon which many of the marketing organisations in the newer countries have been based.

Leadership in agricultural co-operation belongs to Germany and Denmark. Of the 38,000 agricultural co-operative societies in Germany in 1924, there were 19,000 rural banks, 4,700 purchase and sale societies, 3,500 dairies and 10,000 societies for other purposes, together with 98 "central" societies. In 1920, Denmark possessed more than 5,000 co-operative associations, including over 1,600 consumers' societies, 1,100 creameries, 40 bacon factories, besides a number of central associations, export associations and co-operative bodies for various minor purposes.

A general characteristic of the European co-operative movement is that both in its origin and subsequent development there has been a certain idealism which has given it a special vitality. Thus, in Denmark, the movement was associated with a moral educational revival accompanied with the development of the people's high schools; in Belgium the co-operative organisation had a basis of religious and social culture; in Germany the birth of the co-operative credit movement was largely a question of the social regeneration of the rural population. In most of these cases it started with the clubbing together of a small number of villagers to carry out a common object, whether it was the purchase or sale of produce, or the provision of credit. But, although built up upon this small foundation, the movement has gradually assumed a different character through the consolidation of the small units into large federated organisations, the gradual centralisation of control, and the development of many of the features of big-scale enterprises. Indeed, federation describes in a word the modern development of the co-operative movement in most agricultural countries.

The newer countries, taking advantage of the early experience of Europe, have extended co-operative organisations on a very large scale in connection with the special problems of marketing and export. It is shown particularly in the large co-operative marketing enterprises in the United States of America and in the development of wheat "pools" and other similar organisations in Canada and Australasia.

The main divisions of the co-operative movement in Europe are: supply, production, marketing, credit and insurance. Other minor, but important branches, are the co-operative use of farm machinery, cattle breeding, the supply of electric light and power, the manufacture of potato meal and potato alcohol, forestry and fishing. Supply and production are dealt with here; the other matters are discussed under Agriculture; Marketing.

Supply Societies.—These have aimed at purchasing agricultural requisites in bulk at wholesale prices and delivering them to members at cost. They have been widely developed upon "Rochdale" principles, the goods being delivered to members at certain fixed prices and the profits of the societies being distributed amongst its members as a "dividend" in proportion to the gross amount of their purchases. This principle applies in many European countries, though an exception is to be found in France, where the profits of the "syndicats" go to the formation of a reserve fund which belongs to the members equally, irrespective of the amount of their purchases. The recent tendency in the development of these societies is to federate the local distributive societies to central wholesale societies on the general plan of the British distributive movement. In the countries where agricultural co-operation was adopted comparatively early, such as Germany, Denmark and Switzerland, great progress has been made in this direction, resulting in a very large amount of farm requisites—and often household requisites in addition—being supplied through co-operative channels. Certain countries have adopted the principle under which members bind themselves by contract to purchase the whole of their requirements through their society.

In Germany, the pioneer society in the movement towards wholesale federation was the Haas Society at Insterburg, founded in 1871. This example was subsequently followed by the rest of Germany, membership of the provincial wholesales being usually confined to the local distributive societies. The first permanent successful federation amongst consumers' stores in Denmark started in 1884 with the formation of the Co-operative Wholesale Society of Denmark amongst the societies on the Island of Zealand, for the supply of farm requisites as well as ordinary household requisites. Four years later a similar wholesale society was started in the Jutland Peninsula, and in 1896 these two were amalgamated into one organisation—the Co-operative Wholesale Society of Denmark. Since then it has made remarkable growth, the number of consumers' societies which were members of the wholesale having risen from 310 in 1896 to 1,259 in 1910 and to 1,805 in 1922. The Co-operative Wholesale Society is a member of the Scandinavian Co-operative Wholesale Society, which is a joint buying organisation for the wholesale societies of Denmark, Norway and Sweden. Although the Co-operative Wholesale Society of Denmark initiated the first efforts towards the co-operative buying of farm supplies, subsequent developments in Danish co-operation have led to specialisation, resulting in the formation of independent purchasing associations, each to buy and distribute one particular kind of farm supply.

In Switzerland, very similar progress has been made. The Verband-Ost-Schweizerischer-landwirtschaftlicher-Genossenschaften was formed as a central society. The business was divided into two departments—the agricultural, dealing with seeds, manures, cattle food, etc., and the store department dealing with household requisites. The organisation has also undertaken the sale of members' produce, though its supply side remains its more important function.

In France, the local, and more particularly the communal, "syndicats agricoles" have united in departmental unions, and these unions have formed the starting point of larger organisations—the *unions régionales*. The growth of the movement in France may be judged from the fact that the number of syndicats rose from 39 in 1885 to 4,948 in 1910, and to 6,667 in 1914. In the latter year the total membership exceeded 1,000,000 persons.

In Great Britain, agriculturists have taken little part in the British consumers' co-operative movement except in so far as they may have been co-operators for the purchase of ordinary household requirements. Attempts to develop supply societies independently have been carried on particularly by the Agricultural Organisation Society (founded in 1901; came to an end in 1924), but in spite of some progress in this direction in 1923 the total number of farmers' supply societies was only 347, with a total membership of approximately 73,000. A central wholesale society known as the Agricultural Wholesale Society was founded in 1918, but failed in 1924 and went into liquidation. The important movement in Ireland is separately dealt with (*see* IRELAND).

Production Societies.—Probably the most successful branch of productive co-operation is to be found in the dairy societies existing in large numbers in all countries in which agricultural co-operation is firmly established. Leadership again belongs to Germany and Denmark, the former having as many as 3,491 co-operative dairies in 1924, while the latter had some 1,118 at the outbreak of the World War. Switzerland, France, Holland, Belgium and some of the countries of south-eastern Europe have also made considerable progress in recent years. Ireland, one of the most successful countries in developing co-operative creameries, had, in 1921, 336 of these societies. In Great Britain, the number of dairies in 1923 was 94, with a membership of approximately 13,000.

Mention should also be made of the bacon factories and egg and poultry societies, the former of which have been brought to a high degree of efficiency in Denmark. In 1922 there were 40 bacon factories, dealing with 2,215,000 pigs per annum. These are factories requiring a considerable amount of capital and provided with subsidiary plants for the disposal of by-products. They are usually financed by loans jointly and severally guaranteed by the members, and receive the pigs from members under contracts binding them to supply their whole output for a period of years. The individual bacon factories are federated in the National Federation of Danish Co-operative Bacon Factories, with head offices in Copenhagen. One of the most remarkable achievements of this co-operative organisation is the improvement of breed which it has enabled producers to bring about. A close study of the requirements of the British market (the principal export market) combined with scientific pig breeding under the supervision of the Govt. and the National Federation of Co-operative Bacon Factories, has led during the last 30 years to an improvement in quality, without parallel in other countries.

To Denmark also belongs the credit of laying the foundations of co-operative marketing which has lately been developed on an enormous scale in the newer countries. The tendency is to establish strong central selling or export agencies of which local productive societies are members. The need for co-operation amongst the local co-operative societies gave the impulse towards the centralisation of marketing, and the formation of provincial and ultimately national associations, but many difficulties were experienced before the structural development of the marketing organisations was complete. The turning point was reached when the principle of binding contracts for the supply of produce was adopted. Under this system the members of a local co-operative marketing association undertook to supply the whole of their produce to their society for a term of years. The term ranges from one to as many as 20 years. On this firm foundation it has been found possible to build up the modern organisation which markets the greater part of Danish agricultural produce. The local units, having a democratic membership control, are usually federated to the central society on "commodity" lines, that is to say, the federation of local societies is usually concerned with one agricultural commodity or commodities of closely allied character. Members are paid for produce by an advance at the time of delivery followed by a distribution of the profits at certain intervals. The produce thus delivered is classified and graded at the headquarters of the association, and the initial payment is made on the basis of this classification. For the purpose of marketing, the produce is "pooled." These principles—contracts, commodity organisation and pooling—form the basis upon which a great part of Danish co-operative marketing is conducted, and have been widely copied in America, Canada, Australia and elsewhere.

The benefits which agriculture has derived from the European co-operative system—apart from social amelioration which in many cases was the original aim—are many. By the centralisation of purchase and of sale, considerable economies have been effected not merely in consequence of the elimination of the middleman, and of bulk handling of the produce, but by the removal of the powers of exploitation which buyers and sellers of agricultural commodities not infrequently exercised over unorganised farmers. In organised marketing, large scale handling has enabled scientific grading and standardisation to be carried out, which in turn has led to the production of standard grades of produce and standard breeds of live stock on the farms. This again, as in the case of bacon, has led to a general improvement in the quality of farm produce, and has greatly added to the competitive strength of the central export associations in foreign markets. Their products have earned a reputation for uniformity and high quality against which unorganised farmers have found it increasingly difficult to compete.

AGRICULTURAL CO-OPERATION OUTSIDE EUROPE

The most rapid advance in co-operation of recent years, particularly since the World War, has been made in connection with marketing in the newer countries of the world—the United States, Canada, Australia, New Zealand and others. It forms by far the most remarkable development of co-operative enterprise of the present century; indeed, there is little similarity between the small village co-operative societies in Europe of the 'eighties and 'nineties, and the vast organisations that have sprung up on the continent of North America for handling some of the primary farm crops.

United States.—In its recent developments co-operation in the United States has been associated with the achievement of certain economic purposes which never entered into the schemes of the earlier pioneers of co-operative marketing. One is known as the "orderly marketing" of agricultural produce, another is the realisation of a high degree of monopolistic control by the central marketing association over the movement to market the crop or crops with which it is concerned. In some cases, not only in America but elsewhere, monopoly appears also to have been sought with the direct object of raising prices, but owing to the impossibility of limiting production this has usually ended in failure. Profiting by the previous experience of Denmark, the United States have developed and extended the Danish practice, with the result that certain working principles, applicable to some types of co-operative marketing organisation, may be said to have been established which may be summarised as follows:

(1) The organisation must be on a "commodity basis," that is to say, a single co-operative organisation must deal with only one commodity or with commodities closely allied to each other.

(2) The local co-operative associations must be federated to a central association in order to concentrate in a central authority the control of a sufficiently large volume of produce.

(3) Members must bind themselves under contract to supply the whole, or a definite proportion, of their produce prepared for market to the society of which they are members.

American co-operative marketing has not always been developed upon this pattern, but generally speaking it is the case that the aim has been to centralise in the hands of single authorities the control of the marketing of a large volume of produce in order that it may be able to exert an effective influence upon the amount of produce delivered to the markets. A full account of the various American co-operative marketing organisations is given under FARMERS' ORGANISATIONS.

How far the co-operative organisation will go towards solving the problem of "orderly marketing" it is still too early to say. Some critics are sceptical, and many of the newer organisations are still of an experimental character.

Canadian Wheat Pools.—Canada affords some remarkable examples of the development of large scale co-operative marketing enterprise, of which the wheat organisation is the most significant. The Saskatchewan Co-operative Elevator Co. (which handled in 1922–3 about one-fifth of the grain produced in the province, amounting to over 40,000,000 bu.) originated in the widespread discontent which was felt by farmers at the growing powers of the elevator companies. With financial assistance from the Govt. it acquired a number of elevators of its own situated at suitable centres for the collection of members' grain. In 1924, it owned 425 country elevators, and as development took place it was found necessary for the institution to own terminal elevators and "hospital" elevators for treating damaged grain, and they have at the present time over 6,500,000 bu. of capacity in terminal and hospital storage.

Alberta followed the lead of Saskatchewan by setting up the Alberta Farmers' Co-operative Elevator Co. in 1913, and four years later this company was taken over by the United Grain Growers, Limited. In the last year or two the movement towards centralised marketing has undergone further important developments. For the purpose of selling, an organisation known as the Saskatchewan Co-operative Wheat Producers, Limited, was formed, with headquarters at Regina. Members of the company, who already form a substantial proportion of the wheat growers in the province, enter into a five years' contract to sell the wheat through the company. Very similar arrangements have been made in Manitoba and Alberta, the respective organisations being the Manitoba Co-operative Wheat Producers, Ltd., with headquarters at Winnipeg, and the Alberta Co-operative Wheat Producers, Ltd., with headquarters at Calgary. To complete the system of centralisation only one step remained, namely, to unite the three provincial pools into one organisation. This step has now been taken. The Canadian Co-operative Wheat Producers, Ltd., with headquarters at Winnipeg, has been formed as the central selling agency for the above three producers' pools, and operated for the first time in respect of the 1924–5 crop. The handling of milk, butter and cheese; the marketing of wool, live stock, poultry and eggs, fruit and other produce by co-operative enterprise has also made considerable advance in Canada since the World War.

Australian Wheat Pools.—The co-operative wheat pools of Australia are an example of a somewhat different character, since they came into being as the result of direct state action in order to meet the abnormal conditions during the War. They have brought about a fundamental change in the system of marketing wheat in that country. The original scheme was compulsory. It was entered into by the governments of the Commonwealth, the states of New South Wales, Victoria, South Australia and Western Australia for the purpose of realising to the best advantage the wheat harvests of the respective states, and for making advances to farmers pending the realisation. The scheme was first applied to the 1915–6 crop, and it was subsequently decided to deal with the succeeding crops on the same principle. This actually took place in respect of each crop up to that of 1920–1. The duty of realising the crop was placed in the hands of the Australian Wheat Board, consisting of ministerial representatives of the governments of the Commonwealth and the respective states, and one representative of the growers from each state.

The board was assisted by an Advisory Board, consisting of well-known wheat shippers, and the distribution of freights amongst the respective states was undertaken by the Wheat Board. As the United Kingdom was the chief export market for Australian wheat, and London the chief port, a London Wheat Committee, consisting of the High Commissioner, and the Agents General of the states concerned, acting with the advice of the London representatives of the wheat shippers, arranged the overseas sale.

In each state a local board or commission controlled the operations of the scheme within its area, and the local board effected all local sales, including sales to millers. Under arrangements with the Australian banks made by the Commonwealth and state governments, advances were made to farmers upon delivery of their wheat at railway stations to the appointed representatives. The proceeds of the wheat sales were applied, as realised, in reduction of the bank overdrafts which had been used for the payment of advances and expenses. In 1922 the compulsory pooling of wheat was abandoned, but the principle of pooling the exportable surplus was continued on a voluntary basis under the respective state governments. Under this scheme, as in the case of the compulsory scheme, each state ultimately receives, in respect of the grain actually shipped, the average net profit from the overseas realisations, which, after paying expenses, is distributed *pro rata* amongst the growers. This system of pooling remains in operation (though some doubt has been expressed as to its future), and the grain exported to the United Kingdom is distributed in the United Kingdom, through the "Australian Wheat Pools Agency," consisting of two firms, which receive and market the whole of the wheat exported by the respective wheat pools (with the exception of Victoria, which sells independently) operating upon the British corn exchanges, mostly in London.

Other British Dominions.—In most provinces of Canada and in the states of Australia and New Zealand and South Africa (and the U. S. A.) special legislation has been enacted to enable co-operative associations to function on the general lines which have been indicated above. The case of Queensland provides what is perhaps the most remarkable example of the degree to which legislative support of co-operative marketing has been carried. Queensland not only permits, but in certain circumstances compels, producers to market through a co-operative association. Under the Primary Products Pools Act, 1922, provision is made for the constitution of a compulsory pool for any agricultural commodity at the request of a specified number of growers of such commodity, with provision also for a pool to be taken on the question if such is demanded. Under this act, pools have been constituted for the marketing of eggs, cheese, maize and pigs.

Mention must also be made of the rapid growth of agricultural co-operation in India, which has mainly taken place during the present century. Indian co-operation bears a much closer resemblance to European than to the American or Australian systems. As in Germany, it has been developed largely to provide credit (and insurance) facilities and to a limited extent for the purchase of requisites, and the sale of produce. Its remarkable growth may be judged from the figures. The total number of co-operative societies in 1907 was 149; in 1914 it was 15,673; at the end of the War 26,465; and in 1922 it had reached 52,000. Of this total, 46,700 are agricultural societies; 3,600 are non-agricultural; 1,200 are supervising and guaranteeing unions; and 480 are central societies, including provincial and central banks, and banking unions. Of the agricultural societies all except 1,165 are credit societies. Production is represented by 302 societies, the remainder being organised for purchase and sale.

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(R. E.)

CO-PARTNERSHIP.—By co-partnership, or labour co-partnership, is now generally understood a definite arrangement whereby capital and labour may co-operate in the same business undertaking on terms which give labour not merely a share in the net profits, but also a share in the control of, and responsibility for, the undertaking. Thus it is now more usual to associate co-partnership with profit-sharing than with producers' co-operation (*see* CO-OPERATION, 7.85). But while co-partnership necessarily implies profit-sharing, the latter does not necessarily imply the former.

The Labour Co-partnership Association (the chief propagandist body in the United Kingdom) only recognises a scheme as a co-partnership (a) where the workers receive a share in the final profits additional to their trade union or standard wage, (b) where in virtue of their position as working shareholders the workers have a share in the management, and (c) where the arrangement is a matter of fixed rules. In 1919 the labour co-partnership association further defined these conditions by adopting the principle that:

> The worker should acquire some share of the control of the business in the two following ways: (*a*) by acquiring share capital and thus gaining the ordinary rights and responsibilities of a shareholder. (*b*) by the formation of a Co-partnership Committee of workers having a voice in the internal management.

This principle has been applied in the well-known scheme of the South Metropolitan Gas Company which in 1889 adopted the plan of paying a bonus on wages varying in inverse ratio with the price charged for gas and set up a standing co-partnership committee, representing in equal numbers the officials and employees of the company. Since 1898 the employees have acquired the further right of representation on the board of directors.

With the publication of the first report of the Whitley Committee (*see* INDUSTRIAL RELATIONS) in 1917 the idea of co-partnership received an emphatic, if somewhat vague, blessing:

> We are convinced, moreover, that permanent improvement in the relations between employers and employed must be founded upon something other than a cash basis. What is wanted is that the work-people should have a greater opportunity of participating in the discussion about and adjustment of those parts of industry by which they are most affected.

In the report of the conference of operatives and manufacturers in the pottery industry the claim of the operatives to be regarded not as "hands" but as "partners in an important social task" was set forth. How far the Whitley scheme in its application to some 70 industries has succeeded in implementing this aspiration is a matter of opinion.

In a report on profit-sharing and labour co-partnership issued by the Committee on Industry and Trade in its *Survey of Industrial Relations* (1926) the Ministry of Labour had to record that by the end of 1924 some 230 firms exclusive of co-operative societies had in operation 242 profit-sharing schemes in which some 172,000 employees participated. These schemes were the survivals of 493 known to have been started, and only a proportion of them embraced an element of co-partnership as well as of profit-sharing. On the whole this report, like the more detailed report issued in 1920 (Cmd. 544), does not encourage optimism in regard to the practical success of co-partnership up to the present. There has been a marked falling off since 1921 in the number of new profit-sharing schemes started, and the average duration of the schemes abandoned during the past 50 years is stated to be not more than 8½ years. This comparative failure is largely attributable to the attitude of organised labour, which is described as "either unfavourable or, at best, indifferent." The following resolution agreed to at the Trades Union Congress of 1923 is significant:—

> That this Congress, believing that capitalist attempts to introduce forms of Co-partnership are designed to mislead the workers and to prevent Trade Union solidarity, instructs the General Council to explore all working of the various labour co-partnership and profit-sharing concerns in the kingdom with a view to reporting upon their advantages or disadvantages to the next Trades Union Congress.

No report however appears yet to have been issued. Mr. G. R. Stirling (*2 Jour. Soc. Comp. Leg.* 3rd Series, 1920) after a careful survey concludes that "there seem to be no important industrial businesses in this country where the workers have any control which is effective against the general body of shareholders." As far as company law is concerned there is indeed nothing to prevent a company from adopting in its Articles a scheme for ensuring a full measure of co-operation by employee shareholders. And in legislating for private companies Parliament has given at least negative encouragement to co-partnership by suspending any limitation to the number of shareholders in the case of employee or ex-employee shareholders.

The Movement Outside the United Kingdom.—In the United States, in spite of the fact that several large corporations have encouraged stock holding by their employees, it appears that the success of definite co-partnership arrangements has been no greater than in the United Kingdom. And this comparative failure contrasts with the rapid extension of the Producers' Co-operative movement among farmers. (See *Ministry of Agriculture and Fisheries, Economic Series*, No. 4, 1925.)

One of the most interesting and successful attempts to effect a gradual transfer of control over a business from the outside shareholders to those actively engaged in it, has been that made by the Dennison Manufacturing Company in Massachusetts. In 1911 after a long period of successful trading it was decided (a) to limit to ordinary interest rates the return of those connected with the business solely as investors; (b) to put back into the business all profits beyond this return and to issue against them partnership stock to the managerial employees; and (c) to transfer to the partnership stock as soon as it reached the sum of $1,000,000 all voting power in the company.

In 1921 the further step was taken of issuing partnership stock also to the non-managerial employees, but this stock was to be non-voting. The effect of these arrangements has been (a) that the original shareholders have received in place of their stock taken at the current market valuation 8% 1st cumulative preference stock; (b) that the managerial employees (numbering about 370) have now the legal control of the company subject to the right of the first preference stock-holders to recover their control if their dividends are in arrears for more than a certain length of time; (c) that the non-managerial employees have through their works committee a limited participation in the management and through their stock a share in the profits equal pro rata to that taken by the managerial employees; and (d) that all partnership stock is non-assignable, and the holders must, on leaving the company's employ exchange their stock for 7% 2nd cumulative preference stock (*see* Calvert Magruder "Labour Co-partnership in Industry," *Harvard Law Review*, vol. 35, pp. 910–25).

In France a noticeable attempt in 1917 to make labour co-partnership compulsory on joint stock companies (sociétés anonymes) resulted in the passing of a permissive Act (sur les sociétés anonymes à participation ouvrière). If a company decides to adopt the form "à participation ouvrière" it must divide its shares into (*a*) capital shares and (*b*) labour shares (actions de travail), which latter then become the collective property of the employees over 21 who have served the company for at least one year. These employees are incorporated in a société commerciale co-operative de main-d'œuvre, which is represented at the general meetings of the company and on its managing committee in proportion to the ratio borne by capital shares to labour shares.

(A. L. D.)

COPENHAGEN, Denmark (*see* 7.96), had a population in 1921 of 561,344, or, with suburbs, of 700,610. The city has expanded greatly since 1910 and numerous new quarters have appeared. North and east Voldgade have been levelled and laid out as a boulevard. Many of the wooden houses erected during the World War to meet the housing shortage were still in use in 1925.

New public buildings include the Technological Institute on a large site in the Aborrepark, the Andelsbank (1920), the Students' Union building and that of the Danish People's Insurance Company. The Christianborg, on the site of the old castle, has been occupied since 1918 by Parliament, the Supreme Court and the Foreign Office. During building operations fresh ruins of the old castle were found. The Hirschsprung Museum, with works by Danish artists, was opened in 1911; and since 1924 the Danish Museum of Applied Art has been housed in the old Frederiks Hospital. A large state hospital has been built in Faelled Park; in front of it is a monument to Finsen. The Finsen Institute has been state controlled since 1916. In 1919–20 the Arsenal was repaired and restored. The land and artillery defences, prepared during the War, were abolished in 1920. The Royal Porcelain Factory, which employs about 1,000 hands, was enlarged in 1920, and a contract for an electric power plant placed by the municipality in 1924. Between 1915 and 1919 the free port was enlarged from an area of 59·3 ac., with 4,116 yd. of wharfage, to 81·5 ac. with 5,217 yd. of wharfage. The equipment has been much increased, and the construction of a basin at the north end of the harbour was begun in 1920. A promenade, ending in a pier with a lighthouse and restaurant, has been laid out on the east mole.

COPPER (*see* 7.102).—A very large part of the world's supply of copper from 1910 onwards came from deposits so low in grade that they could not be worked under the conditions of 1905. The major developments were the enlargement of the scale of operations; reductions in the cost of mining by the introduction of the caving system and steam shovelling; reduction in the cost of milling and increase in the extraction of mineral by the introduction of the flotation process; reduction in the cost of smelting by the application of coal-dust firing to reverberatory furnaces and the successful operation of basic-lined converters; and the development of processes for the hydrometallurgical treatment of certain ores and the direct production of refined electrolytic copper.

These developments facilitated the exploitation of the "porphyry" deposits, which may be described as fine disseminations of copper minerals through large masses of igneous rock. These deposits are large, and occur at or near the surface in substantially horizontal positions. Fine disseminations of copper had been exploited for many years in the Lake Superior region, but there the copper occurred in its native form, and the mineralisation was in lodes dipping steeply. Previous to 1905 the occurrence of immense masses of rock, containing about 2% of copper in sulphide form, was known in Bingham Canyon, Utah, at Ely, Nev., and elsewhere, but it was not believed to be possible to exploit them profitably. The conception of profitable exploitation by taking advantage of improved methods and the prosecution of operations on a previously unparalleled scale was due especially to Daniel C. Jackling (b. 1869), of San Francisco. With modern developments it has been found possible to work ores containing little more than 1% of copper.

Steam Shovelling.—No detailed description is necessary, for the steam shovels and general methods are substantially the same as in any excavation work. In their application to the mining of copper-bearing ore, the latter is broken down in benches, a line of holes being churn-drilled back of the face, charged heavily with an explosive, and the ore blasted down in quantities of many thousands of tons. The steam shovel is moved along a track at the bottom of the bench and picks up the broken ore, transferring it to cars alongside. Excessively large boulders are broken up by block-holing and blasting, but the steam shovel can pick up very large pieces, its dipper being up to 9 cu. yd. in capacity. Shovels of 8 cu. yd. capacity weigh 325 tons and dig 300 cu. yd. (place measure) per hour. This method of mining is so cheap per ton of ore that it can be applied economically even when it is necessary to shovel away up to 200 ft. of worthless overburden in order to uncover 100 vertical ft. of ore. The process of removing the overburden, technically known as stripping, necessarily precedes the actual mining. The laying out of plans for the working of a mine in this way, and the figuring of the various factors, furnish complicated engineering problems.

Caving.—When the overburden is too thick, or is too thick with relation to the thickness of the ore deposit, mining by the caving system is adopted. In essence this system consists in opening permanent galleries under the ore body. Raises to the ore body are then made, and sub-galleries of relatively small size driven into it, with the purpose of so undercutting the ore body that its support by rock pillars is reduced to the minimum. Finally the pillars are blasted out, causing the superincumbent ore to settle in a great crushed mass. The crushed ore is then drawn off through chutes, previously prepared, into cars in the main galleries. This operation proceeds through the ore body section by section, the natural surface over the mines settling as the ore is drawn off. There are many modifications of this system of mining, but its application to large flat-lying ore deposits is substantially as above. Modifications of the caving system of mining are also applicable in many lode mines, when the lodes are of large size. It is a very economical system of mining owing to its reduced requirements for labour, explosives, timber, etc.

Flotation Process.—Copper ore as mined in 1925 contained generally only a small percentage of copper mineral, which was obtained by crushing the ore to such fineness as to liberate the mineral particles, and by separating these from the worthless gangue by mechanical processes, commonly performed by washing, in which advantage is taken of the difference in specific gravities. Although there had been great improvements in the process of ore dressing, the losses of valuable mineral continued relatively high up to 1910. In the flotation process advantage was taken of the discovery that when ore suspended in water was mixed with a small quantity of certain oils or other agents (the addition of oil being perhaps only 2 lb. per ton of ore), and was then subjected to violent agitation, the copper minerals (if sulphides) would rise to the surface in the form of a froth, while the worthless gangue would settle to the bottom. Separation in this way was possible at relatively low cost, and yielded a far higher percentage of the mineral than the older processes. The improvement might be generalised by indicating an extraction of 90%, compared with 65 to 75% previously. In recent years the use of additional chemical agents has developed the process of "selective flotation," whereby minerals of approximately the same specific gravity may be efficiently separated from each other.

Metallurgy.—Before 1910 the blast furnace and the reverberatory furnace were competitive choices for the smelting of copper ore. With the increasing fineness of the ore to be smelted, the leaning began to be definitely in favour of the reverberatory furnace, but with the advent of the Dwight-Lloyd sinterer, which enables fine ores to be agglomerated cheaply and efficiently, the blast furnace gained a new prestige. With the successful application of coal-dust firing, however, due especially to the work of David H. Browne at Copper Cliff, Ont., the reverberatory furnace obtained an unquestionable predominance, which it is likely to hold. The modern copper-smelting plant designed for the treatment of fine ore comprises roasting furnaces of the MacDougall type and very large reverberatory smelting furnaces. Before introduction of coal-dust firing, a furnace at Anaconda, Mont., 19 ft. by 112 ft., smelted 240 tons of charge, with one ton of coal per 4¼ tons of charge. By the new method a furnace 25 ft. by 144 ft. smelted 650 tons, and one ton of coal smelted seven tons of charge. For the smelting of coarse ore, especially of heavy sulphide, the blast furnace operated on the pyritic or the semi-pyritic principle still holds its place. These furnaces also are constructed of very large size. The Anaconda Co. attained dimensions of 72 in. by 1,044 in. at the tuyeres, but this is exceptional, the blast furnaces at most American works being something like 72 in. by 280 inches.

The converting of copper matte in a basic-lined vessel, long a hope of copper metallurgists, was accomplished by W. H. Pierce and E. A. Cappelen-Smith at the works of the Baltimore Copper Smelting and Rolling Co. In 1909–10 the process was introduced in the works of the Garfield Smelting Co. in Utah. Subsequently it was found that the process was not limited to the Pierce-Smith horizontal converters, but could be applied to other forms of converters, both horizontal and upright. The main advantages of the basic over the acid converter are the decreased cost of lining (one basic lining for 2,500 tons of copper compared with one acid lining for 10 tons), greater air efficiency, ability to convert low-grade matte with a mixture of silicious ore, reduction of intermediate products, neatness and cleanliness of plant and decrease in danger from accidents. The basic converters are lined with magnesite. Their use became general and they reduced the cost of converting copper matte by more than 50%.

The existence of immense ore deposits of the porphyry type, but with the copper occurring as oxide or chloride which rendered the ore unamenable to mechanical concentration, directed renewed attention to the hydrometallurgical extraction of the copper of such ore. At Chuquicamata, Chile, lies the world's greatest known deposit of copper, its development being estimated at about 700,000,000 tons assaying about 2% copper. Exploitation of this was undertaken by the Chile Copper Co., an American Corporation. The copper occurs in the ore as brochantite contaminated with chlorides. E. A. Cappelen-Smith devised a process for the leaching of this ore with sulphuric acid, purification of the solution, and deposition of the copper by electrolysis, using magnetic anodes; in practice, however, anodes of ferro-silicon have been substituted. The copper cathodes are melted and cast into bars of grade equivalent to standard electrolytically refined copper. Production in 1924 was at the rate of 212,000,000 lb. per annum. At Ajo, Ariz., the New Cornelia Copper Co. also produced electrolytic copper directly from ore, from which the copper was first leached by sulphuric acid. Hydrometallurgical extraction of copper was also applied on a large scale for the treatment of tailings, *e.g.*, by the Anaconda Copper Mining Co., and by the Calumet and Hecla Mining Co., the latter extracting the native copper by means of ammonia, and precipitating the copper as oxide by distillation, with recovery of the ammonia. A similar process was employed for ore treatment at the Kennecott mine, in Alaska.

A later development in copper hydrometallurgy was the leaching of copper ore in place, which is being done by the Ohio Copper Co. in Bingham Canyon, Utah. The ore broken down by the caving system is flooded with water from the surface. Having dissolved a proportion of the copper the water is drawn off and the copper is precipitated by metallic iron. Although the extraction of copper by this method is low in terms of percentage, the cheapness of the method enabled the low-grade ore of this mine to be treated profitably.

General Economic Conditions.—Before the World War about 15 cents per lb. was regarded as an average market price for copper. The cost of production to the largest producers was about 10 cents per lb. With the demand for copper for military purposes the price ran up to about 32 cents per lb. at the end of 1916; but increased production began to show its effect in 1917 and in the latter part of that year the American Govt. fixed the price at 23½ cents. Mining, smelting and refining capacities were rapidly increased, and in 1917 American electrolytic refiners attained a capacity for the production of 2,800,000,000 lb. of copper per annum. The surplus supplies in the hands of the Governments at the end of the War led to the greatest accumulation of unsold copper in the history of the metal, and a bad economic situation developed which continued into 1921. By 1923 the copper industry had regained normality, but at a price inferior to that of pre-War.

Production.—Before the War the world's production of copper had risen to about 1,000,000 metric tons. In 1916–8 there

World's Production of Copper[1] (*In Metric Tons of 2,204·6 Lb.*)

Country	1914	1915	1916	1917	1918	1919	1920	1921	1922	1923	1924
North America:—											
United States	525,529	646,212	881,237	872,065	879,026	548,677	576,450	216,295	464,459	684,029	742,997
Mexico	36,337	30,969	55,128	47,503	75,529	60,491	45,238	12,316	27,073	54,920	44,589
Canada	34,027	47,202	47,985	50,626	52,693	36,106	35,500	20,532	22,952	36,496	46,274
Cuba	6,251	8,836	7,816	10,313	12,337	9,974	6,796	7,802	10,694	10,853	11,560
Total North America	602,144	733,219	992,166	980,507	1,019,585	655,248	663,984	256,945	525,178	786,298	845,420
South America:—											
Bolivia	3,874	5,868	5,150	6,400	6,000	7,000	9,900	9,683	9,212	10,654	7,439
Chile	44,665	52,341	71,288	102,527	106,914	79,580	98,952	59,239	129,575	182,384	190,380
Peru	27,090	34,727	43,078	45,176	44,414	39,230	32,982	33,284	36,408	44,166	34,923
Venezuela	363	544	1,179	1,724	608	635	..	726	975	1,066	1,116
Total South America	75,992	93,480	120,695	155,827	157,936	126,445	141,834	102,932	176,170	238,270	233,858
Europe:—											
Austria-Hungary[2]	3,500	3,500	3,500	3,500	2,500	[2]647	1,585	4,173	4,581	4,833	4,051
France	10,067	882	1,287	1,001	623	873	1,559	2,173	2,902	8,193	5,000
Germany	25,000	25,539	24,796	28,632	15,101	15,775	17,255	19,000	17,000	17,000	19,500
Yugoslavia	4,443	3,200	5,000	11,200	6,000	1,209	2,436	3,970	5,222	6,837	8,145
Norway	2,859	2,826	1,614	1,810	2,856	437	556	5,725	9,615	8,000	9,900
Russia	31,938	25,881	20,887	16,000	..	..	..	..	2,000	2,000	3,300
Spain and Portugal	26,900	37,100	35,400	40,900	45,900	35,000	23,000	33,200	36,500	51,815	55,079
Sweden	4,692	4,561	3,181	4,540	3,785	4,030	1,627	1,329	61	4,700	2,800
Total Europe	109,399	103,489	95,665	107,583	76,765	57,971	48,018	69,570	77,881	103,378	107,775
Asia:—											
Japan	70,463	75,416	100,635	108,038	90,341	78,443	67,792	54,092	54,126	63,790	62,940
Other Asia	..	..	..	..	..	996	538	1,161	1,054	735	1,250
Total Asia	70,463	75,416	100,635	108,038	90,341	79,439	68,330	55,253	55,180	64,525	64,190
Australasia	38,667	37,709	39,885	36,564	44,722	16,441	26,605	18,932	12,478	18,139	14,253
Africa	27,033	31,300	39,815	42,656	31,064	31,350	30,580	38,557	52,816	72,948	104,055
Other countries	3,000	3,000	3,000	3,000	3,000	4,000	3,000	3,000	3,000	3,000	4,000
Grand Totals	926,698	1,077,613	1,391,861	1,434,175	1,423,413	970,894	982,351	545,189	902,703	1,286,558	1,373,551

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[1] So far as possible, these statistics are based on blister copper, referred to countries wherein ore originated.

[2] After 1918, Austria only.

was an annual production of about 1,400,000 tons. After 1918 production was curtailed for several years, but in 1924 it approached the War-time maximum. Important new sources of supply are Chile and Peru, where American interests control the major part of the production, and the Katanga, which is under Belgian control. The table on p. 733 shows the world production of copper from 1914 to 1924.

The consumption of copper greatly increased after 1910, especially in the United States, owing mainly to electrical development. In the period 1922–4 the American consumption was at the rate of 12·19 lb. per person, compared with 8·09 lb. in the period 1912–4. Corresponding figures for other countries were France, 6·81 and 6·33; Germany, 4·40 and 7·01; and Great Britain, 4·54 and 7·25.

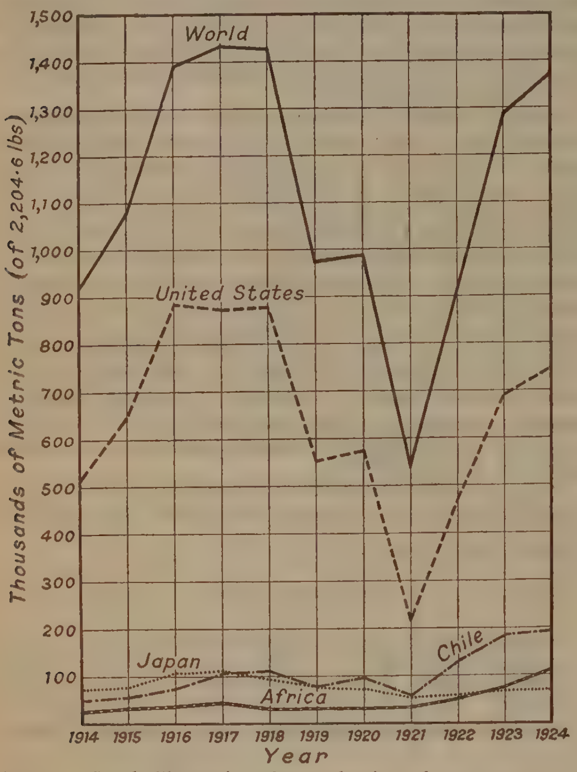

FIG. 1.—Graph illustrating the production of copper 1914–24. (*Note.* The African production is mainly from the Katanga province, Belgian Congo.)

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(W. R. I.)

COPYRIGHT (*see* 7.118).—A branch of law to which important additions have been made since 1910. As it has been impossible to deal exhaustively with so vast a subject in so limited a space, this article deals with the big principles of copyright, and, when it goes into detail, with that copyright property of the greater financial value.

I. INTERNATIONAL COPYRIGHT

International copyright can at the present time be divided into three parts: (1) the Berne Convention; (2) the United States; (3) The British Copyright Act, 1911.

Owing to the outbreak of the World War in 1914, many of the regulations surrounding the enforcement of the Berne Convention in the signatory countries were upset. When the Peace of Amiens was signed, certain stipulations were made as part of that treaty with regard to the signatories and the convention. In addition, countries were called into existence as separate entities which had never previously existed as such. The anxiety of these young independents to gather in the best literature from the older countries made the translation rights of considerable value. For these and other reasons it is essential to set out in fuller detail the main features of the Berne Convention, which is, after all, almost the first and certainly one of the most important of international conventions.

THE BERNE CONVENTION

In 1886 an Act was passed enabling the United Kingdom of Great Britain, its Dominions, Colonies and Dependencies, to join the Berne Convention, which had been settled by the representatives of most of the continental Powers in Sept. 1885. The central idea of the convention was very simple—work that was copyright in one of the countries of the union was copyright in the other countries of the union, but the duration of copyright could not exceed the duration in the country of origin. These provisions were added to by the Additional Act of Paris 1896, and by the Revised Convention of Berne signed at Berlin in 1908.

The first point of importance is the acquisition of the right to protection. Those entitled are set out in the following articles. namely, Article 2 of the Berne Convention; Para. 1, Article 2 of the Additional Act of Paris; and Articles 4 and 6 of the Revised Convention.

Berne Convention, Sept. 9 1886. Article 2.—Authors who are subjects or citizens of any of the countries of the union, or their lawful representatives, shall enjoy in the other countries for their works, whether published in one of those countries or unpublished, the rights which the respective laws do now or may hereafter grant to natives.

Additional Act of Paris 1896. Paragraph 1, Article 2, is the same as the above up to the words "their works." It then reads: "whether unpublished, or first published in one of those countries, the rights, etc., etc."

Revised Convention as Signed at Berlin Nov. 13 1908. Article 4.—Authors who are subjects or citizens of any of the countries of the union shall enjoy in countries other than the country of origin of the work, for their works, whether unpublished or first published in a country of the union, the rights which the respective laws do now or may hereafter grant to natives, as well as the rights specially granted by the present convention.

The enjoyment and exercise of these rights shall not be subject to the performance of any formality; such enjoyment and such exercise are independent of the existence of protection in the country of origin of the work. Consequently, apart from the express stipulations of the present convention, the extent of protection, as well as the means of redress secured to the author to safeguard his rights, shall be governed exclusively by the laws of the country where protection is claimed.

The country of origin of the work shall be considered to be, in the case of unpublished works, the country to which the author belongs; in the case of published works, the country of first publication; and in the case of works published simultaneously in several countries of the union, the country the laws of which grant the shortest period of protection. In the case of works published simultaneously in a country outside the union and in a country of the union: the latter country shall be considered exclusively as the country of origin.

By "published works" must be understood, for the purposes of the present convention, works copies of which are issued by a publisher. The representation of a dramatic or dramatico-musical work and the performance of a musical work shall not constitute a publication.

Article 6.—Authors not being subjects or citizens of the countries of the union, who first publish their works in one of those countries, shall enjoy in that country the same rights as native authors, and in the other countries of the union the rights granted by the present convention.

The second question concerns the subject-matter of the protection. This cannot be better set out than by quoting Article 4 of the Convention and Articles 2 and 3 of the Revised Convention, which is the latest dictum on the subject. Articles 12, 13 and 14 of the Revised Convention must also be quoted.

Berne Convention. Article 4.—The expression literary and artistic works includes books, pamphlets and all other writings; dramatic or dramatico-musical works and musical compositions, with or without words; works of design, painting, sculpture and engraving, lithography, illustrations, geographical charts, plans, sketches, and plastic works relating to geography, topography, architecture or the sciences in general; finally, every production whatsoever in the literary, scientific or artistic domain which can be published by any mode of impression or reproduction whatsoever.

Revised Convention. Article 2.—Any production in the literary, scientific or artistic domain whatever may be the mode or form of its reproduction, such as books, pamphlets and other writings, dramatic or dramatico-musical works, choreographic works and pantomimes the acting form of which is fixed in writing or otherwise, musical compositions with or without words, works of design, painting, architecture, sculpture, engraving and lithography, illustrations, geographical charts, plans, sketches and plastic works relative to geography, topography, architecture or science.

Translations, adaptations, arrangements of music and other reproductions in an altered form of a literary or artistic work, as well as collections of different works. These works are protected as original works, without prejudice to the rights of the author of the original work.

Works of art applied to industrial purposes shall be protected so far as the domestic legislation of each country allows.

Article 3 includes photographic works and works produced by a process analogous to photography.

Article 12.—The following are specially included among the unlawful reproductions: Unauthorised indirect appropriations of a literary or artistic work, such as adaptations, musical arrangements, transformations of a novel, tale or piece of poetry into a dramatic piece, or *vice versa*, etc., when they are only the reproduction of that work, in the same form or in another form, without essential alterations, additions or abridgments; if they do not present the character of a new original work.

Article 13.—The authors of musical works have the exclusive right of authorising (1) the adaptation of those works to instruments which can produce them mechanically; (2) the public performance of the said works by means of these instruments.

Reservations and conditions relating to the application of this article may be determined by the domestic legislation of each country in so far as it is concerned; but the effect of any such reservations and conditions will be strictly limited to the country which has put them in force.

The provisions of paragraph 1 shall not be retroactive, and consequently shall not be applicable in any country of the union to works which have been lawfully adapted in that country to mechanical instruments before the coming into force of the present convention.

Article 14.—Authors of literary, scientific or artistic works have the exclusive right of authorising the reproduction and public representation of their works by cinematography.

Cinematograph productions shall be protected as literary or artistic works if, by the arrangement of the acting form or the combinations of the incidents represented, the author has given the work a personal and original character.

Without prejudice to the rights of the author of the original work, the reproductions by cinematography of a literary, scientific or artistic work shall be protected as an original work.

The above provisions apply to the reproduction effected by any other process analogous to cinematography.

Finally, the length of duration of the protection is dealt with. For this purpose Articles 7 and 11 of the revised convention may be quoted:—

Revised Convention. Article 7.—The term of protection granted by the present convention shall include the life of the author and 50 years after his death.

Nevertheless, in case such term of protection should not be uniformly adopted by all countries of the union, the term shall be regulated by the law of the country where protection is claimed, and must not exceed the term fixed in the country of origin of the work. Consequently, the contracting countries shall only be bound to apply the provisions of the preceding paragraph in so far as such provisions are consistent with their domestic laws.

For photographic works and works produced by a process analogous to photography, for posthumous works, for anonymous or pseudonymous works, the term of protection shall be regulated by the law of the country where protection is claimed, provided that the said term shall not exceed the term fixed in the country of origin of the work.

Article 11.—The stipulations of the present convention shall apply to the public representation of dramatic or dramatico-musical works and to the public performance of musical works whether such works be published or not.

Authors of dramatic or dramatico-musical works shall be protected during the existence of their right over the original work against the unauthorised public representation of translations of their works.

In order to enjoy the protection of the present article authors shall not be bound in publishing their present works to forbid the public representation or performance thereof.

In the recital above on the question of international copyright two important points have been omitted intentionally, namely, translation rights and protection as it affects those connected with the profession of journalism.

Translations.—The three paragraphs quoted below will show how translations are protected under the convention. The dates of publication of the original work, the dates of the adhesion of the signatories and of the dates of the original convention and its additions, are of considerable importance:—

Berne Convention, Sept. 9 1886. Article 5.—Authors being subjects or citizens of one of the countries of the union, or their lawful representatives, enjoy in the other countries the exclusive right of making or authorising the translation of their works until the expiration of ten years from the publication of the original work in one of the countries of the union.

For works published by instalments, the period of ten years shall not begin to run until the publication of the last instalment of the original work.

For works composed of several volumes published at intervals, as well as for reports or papers published by literary or learned societies or by individuals, each volume, report or paper shall be, with regard to the period of ten years, considered as a separable work.

In the cases provided for by the present article, and for the calculation of the period of protection, the 31st Dec. of the year in which the work was published is admitted as the date of publication.

Additional Act of Paris and Interpretative Declaration of May 4 1896.—Authors belonging to any one of the countries of the union, or their legal representatives, shall enjoy in the other countries the exclusive right of making or authorising translations of their works during the whole term of the right in the original work. Nevertheless, the exclusive right of translation shall cease to exist when the author shall not have made use of it within a period of ten years from the time of the first publication of the original work, by publishing or causing to be published, in one of the countries of the union, a translation in the language for which protection is claimed.

Revised Convention, Nov. 13 1908.—But the authors of unpublished works, being subjects or citizens of one of the countries of the union, and the authors of works first published in one of those countries, enjoy, in the other countries of the union, during the whole term of the right in the original, the exclusive right of making or authorising a translation of their works.

Emphasis is laid on these distinctions, as some nations have signed the original convention, some the original convention with the Act of Paris, some the revised convention with limitations. It is important therefore for an author to know the duration of his own property in other countries, but more important for the would-be translator to know the duration of translation rights in other countries. Certain journalistic work is not protected by the convention, as is shown by further quotations from the same source.

Berne Convention. Article 7.—Articles in newspapers or magazines published in any country of the union may be reproduced, in original or in translation, in the other countries of the union, unless the authors or publishers have expressly forbidden it. For magazines it is sufficient if the prohibition is made in a general manner at the beginning of each number of the magazine.

No prohibition can in any case apply to articles of political discussion or to the reproduction of news of the day or miscellaneous items.

Revised Convention. Article 9.—Serial stories, tales, and all other works, whether literary, scientific, or artistic, whatever their object, published in the newspapers or periodicals of one of the countries of the union, may not be reproduced in the other countries without the consent of the authors.

With the exception of serial stories and tales, any newspaper article may be reproduced by another newspaper unless the reproduction thereof is expressly forbidden. Nevertheless, the source must be indicated: the legal consequence of the breach of this obligation shall be determined by the laws of the country where protection is claimed.

The protection of the present convention shall not apply to news of the day or to miscellaneous information which is simply of the nature of items of news.

Certain work used for educational purposes cannot be made the subject of an action for infringement under the convention.

Berne Convention. Article 8.—As regards the liberty of extracting portions from literary or artistic works for use in publications destined for education, or having a scientific character, or for chrestomathies, the effect of the legislation of each country of the union and of special arrangements existing or to be concluded between them is not affected by the present convention.

Revised Convention. Article 10.—As regards the liberty of extracting portions from literary or artistic works for use in publications destined for educational purposes, or having a scientific character, or for chrestomathies, the effect of the legislation of each country of the union and of special arrangements existing or to be concluded between them is not affected by the present convention.

MEMBERS OF THE UNION

The following countries are members of the Union:—

State	*Date of joining*
Germany	Dec. 5 1887
Protectorate Countries	Jan. 1 1909
Austria	Oct. 1 1920
Belgium	Dec. 5 1887
Brazil, United States of	Feb. 9 1922
Bulgaria	Dec. 5 1921
Denmark (with the Faeroes)	July 1 1903
Danzig (free town of)	June 24 1922
Spain (with Colonies)	Dec. 5 1887
France (with Algeria and the Colonies)	Dec. 5 1887
Great Britain	See below
Greece	Nov. 9 1920
Haiti	Dec. 5 1887
Hungary	Feb. 14 1922
Italy	Dec. 5 1887
Japan	July 15 1889
Liberia	Oct. 16 1908
Luxembourg	June 20 1888
Morocco (except the Spanish zone)	June 16 1917
Monaco	May 20 1889
Norway	April 13 1896
Netherlands	Nov. 1 1912
Dutch Indies, Curaçao, Surinam	April 1 1913
Palestine	May 26 1925
Poland	Jan. 28 1920
Sweden	Aug. 1 1911
Switzerland	Dec. 5 1887
Czechoslovakia	Feb. 22 1921
Tunisia	Dec. 5 1887
United Kingdom and all territories in which the Imperial Copyright Act, 1911, is in force other than Tanganyika Territory and as follows:—	
Guernsey, Alderney, and Sark	July 1 1912
Commonwealth of Australia	July 1 1912
Newfoundland	July 1 1912
Norfolk Island	July 1 1912
India	Oct. 30 1912
Papua	Feb. 1 1913
Jersey	Mar. 8 1913
New Zealand	April 1 1913
Union of South Africa	May 1 1920
Canada	Jan. 1 1924

ACTS IN FORCE BETWEEN THE UNION COUNTRIES

Berne Convention Revised from Nov. 13 1908

(*a*) Without Reservations:—

Germany
Austria
Belgium
Brazil
Bulgaria
Danzig
Spain
Haiti
Hungary
Liberia
Luxembourg
Morocco
Monaco
Poland
Portugal
Switzerland

(*b*) With Reservations:—

Denmark: Newspaper and review articles (Article 7 of the Berne Convention 1886, revised by the Additional Act of Paris 1896).

France and Tunis: Applied works of art (maintenance of prior stipulations).

Great Britain: Retroactivity (Article 14 of the Berne Convention 1886 and No. 4 of the closing Protocol, revised by the Additional Act of Paris 1896).

Greece: 1. Exclusive translation right (Article 5 of the Berne Convention 1886). 2. Newspaper and review articles (Article 7 of the Berne Convention 1886). 3. Right of representation performance (Article 9 of the Berne Convention 1886).

Italy: 1. Exclusive right of translation (Article 5 of the Berne Convention 1886, revised by the Additional Act of Paris 1896). 2. Right of representation with regard to translations of dramatic and dramatico-musical works (Article 9, paragraph 2 of the Berne Convention 1886).

Japan: 1. Exclusive right of translation (Article 5 of the Berne Convention 1886, revised by the Additional Act of Paris 1896). 2. Public performance of musical works (Article 9, paragraph 3 of the Berne Convention 1886).

Norway: 1. Works of architecture (Article 4 of the Berne Convention 1886). 2. Newspaper and review articles (Article 7 of the Berne Convention 1886). 3. Retroactivity (Article 14 of the Berne Convention 1886).

Netherlands: 1. Exclusive right of translation (Article 5 of the Berne Convention 1886, revised by the Additional Act of Paris 1896). 2. Newspaper and review articles (Article 7 of the Berne Convention 1886, revised by the Additional Act of Paris 1896). 3. Right of representation in regard to translations of dramatic or dramatico-musical works (Article 9, paragraph 2 of the Berne Convention 1886).

Sweden: Newspaper and review articles (Article 7 of the Berne Convention 1886).

II. UNITED STATES COPYRIGHT

The United States stands outside the International Convention, and in consequence has complicated enormously the question of international copyright. The Act of March 1909, with its amendments, governs its present position, but is so complicated in its enactments, and in many ways so badly drafted, that it is impossible to give more than an outline of its many requisitions.

The Act opens as follows:—

> That any person entitled thereto, upon complying with the provisions of this Act, shall have the exclusive right—
>
> (*a*) to print, reprint, publish, copy and vend the copyrighted work;
>
> (*b*) to translate the copyrighted work into other languages or dialects, or make any other version thereof, if it be a literary work; to dramatise it if it be a non-dramatic work; to convert it into a novel or other non-dramatic work if it be a drama; to arrange or adapt it if it be a musical work; to complete, execute, and finish it if it be a model or design for a work of art;
>
> (*c*) to deliver or authorise the delivery of the copyrighted work in public for profit if it be a lecture, sermon, address or similar production;
>
> (*d*) to perform or represent the copyrighted work publicly if it be a drama, or, if it be a dramatic work and not reproduced in copies for sale, to vend any manuscript or any record whatsoever thereof; to make or to procure the making of any transcription or record thereof by or from which, in whole or in part, it may in any manner or by any method be exhibited, performed, represented, produced, or reproduced; and to exhibit, perform, represent, produce or reproduce it in any manner or by any method whatsoever;
>
> (*e*) to perform the copyrighted work publicly for profit if it be a musical composition; and for the purpose of public performance for profit and for the purposes set forth in subsection (*a*) hereof, to make any arrangement or setting of it or of the melody of it in any system of notation or any form of record in which the thought of an author may be recorded and from which it may be read or reproduced: Provided, That the provisions of this Act, so far as they secure copyright controlling the parts of instruments serving to reproduce mechanically the musical work, shall include only compositions published and copyrighted after this Act goes into effect, and shall not include the works of a foreign author or composer unless the foreign state or nation of which such author or composer is a citizen or subject grants, either by treaty, convention, agreement or law, to citizens of the United States similar rights; And provided further, and as a condition of extending the copyright control to such mechanical reproductions, That whenever the owner of a musical copyright has used or permitted or knowingly acquiesced in the use of the copyrighted work upon the parts of instruments serving to reproduce mechanically the musical work, any other person may make similar use of the copyrighted work upon the payment to the copyright proprietor of a royalty of two cents on each part manufactured, to be paid by the manufacturer thereof; and the copyright proprietor may require, and if so the manufacturer shall furnish, a report under oath on the twentieth day of each month on the number of parts of instruments manufactured during the previous month serving to reproduce mechanically the said musical work, and royalties shall be due on the parts manufactured during any month upon the twentieth of the next succeeding month. The payment of the royalty provided for by this section shall free the articles or devices for which such royalty has been paid from further contribution to the copyright except in case of public performance for profit: And provided further, That it shall be the duty of the copyright owner, if he uses the mechanical composition himself for the manufacture of parts of instruments serving to reproduce mechanically the musical work, or licenses others to do so, to file notice thereof, accompanied by a recording fee, in the copyright office, and any failure to file such notice shall be a complete defence to any suit, action or proceeding for any infringement of such copyright.
>
> Section 3.—That the copyright provided by this Act shall protect all the copyrightable component parts of the work copyrighted, and all matter therein in which copyright is already subsisting, but without extending the duration or scope of such copyright. The copyright upon composite works or periodicals shall give to the proprietor thereof all the rights in respect thereto which he would have if each part were individually copyrighted under this Act.
>
> Section 4.—That the works for which copyright may be secured under this Act shall include all the writings of an author.
>
> Section 5.—That the application for registration shall specify to which of the following classes the work in which copyright is claimed belongs:
>
> (*a*) Books, including composite and cyclopaedic works, directories, gazetteers, and other compilations;
>
> (*b*) Periodicals, including newspapers;
>
> (*c*) Lectures, sermons, addresses (prepared for oral delivery);
>
> (*d*) Dramatic or dramatico-musical compositions;
>
> (*e*) Musical compositions;
>
> (*f*) Maps;
>
> (*g*) Works of art; models or designs for works of art;
>
> (*h*) Reproductions of a work of art;

(*i*) Drawings or plastic works of a scientific or technical character;
(*j*) Photographs;
(*k*) Prints and pictorial illustrations;
(*l*) Motion-picture photoplays;
(*m*) Motion-pictures other than photoplays.

Provided, nevertheless, That the above specifications shall not be held to limit the subject-matter of copyright as defined in section four of this Act, nor shall any error in classification invalidate or impair the copyright protection secured under this Act.

Section 6.—That compilations or abridgments, adaptations, arrangements, dramatisations, translations, or other versions of works in the public domain, or of copyrighted works when produced with the consent of the proprietors of the copyright in such works, or works republished with new matter, shall be regarded as new works subject to copyright under the provisions of this Act; but the publication of any such new works shall not affect the force or validity of any subsisting copyright upon the matter employed or any part thereof, or be construed to imply an exclusive right to such use of the original works, or to secure the extension of copyright in such original works.

Unpublished works are protected by common law. Copyright is granted to citizens of the United States and to citizens or subjects of foreign nations which give reciprocal conditions to American citizens. The question of reciprocity is determined by the President of the United States, and is proclaimed by him from time to time. Copyright is secured by publication with the notice of copyright required by the Act affixed to every copy so published. Such copyright is confirmed by registration. Publication with notice of copyright is essential. Registration is necessary. To this rule there are two exceptions: (1) under clause 11 when copyright can be obtained for certain works not reproduced for sale—a lecture or similar production, a dramatic, musical or dramatico-musical composition, etc. The copyright is secured by the registration of copies, but such registration does not exempt the proprietor from further deposit under the other sections of the Act when copies are reproduced for sale. The chief, but not the only, reason for this clause is to give a statutory protection to performing rights. (2) Under sections 21 and 22, where, in the case of books published abroad in the English language, the Act demands that these books—with the exception of dramatic, musical or dramatico-musical works—shall be published from type set up in the United States or plates manufactured there, but in order to give the author of such books some chance he is allowed to deposit and register one copy of his original work at Washington within sixty days from its publication abroad, and is required to publish the work in conformity with the other requirements of the Act within four months from the date of such deposit. Such author, therefore, is allowed a period which may extend to nearly six months in order to conform with the requirements of the Act. He is bound to make a further deposit—when the book is published in the United States in accordance with the Act—of the copyright of the book so published in accordance with the clauses of the Act for the deposit of foreign books.

Clauses 12 and 13 cover the details required by the registration office. With regard to books by American citizens, two copies of the best edition must be deposited; by foreigners one copy only, but a certain latitude is allowed, subject to penalty if the deposit is not promptly made after publication. Under section 16 an affidavit has to be filed with the deposit of copies, and section 17 refers to the penalties for making a false affidavit. Section 18 deals with the form of the copyright notice, which should be either " Copyright " or the abbreviation " Copr.," with the name of the copyright proprietor, and if the work be a printed literary, musical or dramatic work the year in which the copyright was secured by publication. Certain works are excepted from this special form. Section 19 deals with the place where the notice is to be affixed in or on the copy or copies deposited.

The copyright endures for a period of 28 years, subject to a further period of 28 years on application by the author or his representatives, provided that the application for such renewal and extension shall be made to the copyright office one year prior to the expiration of the existing term.

Then follow a series of sections dealing with the penalties for infringement and for false copyright notice, for the importation of copies, and various regulations dealing with registration, the registration of assignments, fees, etc.

Section 62 should be quoted, as it contains two definitions:—

Section 62.—That in the interpretation and construction of this Act " the date of publication " shall in the case of a work of which copies are reproduced for sale or distribution be held to be the earliest date when the copies of the first authorised edition were placed on sale, sold, or publicly distributed by the proprietor of the copyright or under his authority, and the word " Author " shall include an employer in the case of works made for hire.

To put the legal statement in plain language, the owner of a copyright literary work which has been published in the English language outside the United States is allowed 60 days from the date of publication in which to file a copy of the work at Washington. Provided that he files the copy within this period he obtains from the date of filing an *ad interim* copyright for four months in which to publish the work in the United States from type set up there subject to the other technicalities of the United States Act. Publication with the copyright notice on every copy is the essential for securing copyright. Registration coupled with an affidavit of manufacture is necessary. The essential copyright notice has been set out above. If by chance the work is being published in the United States as the country of origin, then it must be published in Great Britain simultaneously, or the copyright in Great Britain is lost.

III. BRITISH COPYRIGHT

The greater part of the British law of copyright is contained in the Copyright Act 1911, which came into force July 1 1912. Copyright is defined in the Act as the sole right to produce or reproduce a work or any substantial part thereof in any material form whatsoever, or perform, or in the case of a lecture to deliver, a work or any substantial part thereof in public; if the work is unpublished, to publish the work or any substantial part thereof. Copyright includes the sole right:—

(*a*) to produce, reproduce, perform or publish any translation of the work;

(*b*) in the case of a dramatic work, to convert it into a novel or other non-dramatic work;

(*c*) in the case of a novel or other non-dramatic work, or of an artistic work, to convert it into a dramatic work, by way of performance in public or otherwise;

(*d*) in the case of a literary, dramatic or musical work, to make any record, perforated roll, cinematograph film, or other contrivance by means of which the work may be mechanically performed or delivered,

and to authorise any such acts as aforesaid.

It will be seen from the above definition that a work as soon as it is completed, whether published or unpublished, is the author's copyright. In other words, all literary and musical work is now the creature of statute.

Duration and Assignment.—The next important point under the statute is the duration of copyright. Section 3 of the Act states that, with some few exceptions, copyright endures for the life of the author and 50 years after his death. One important exception is that in the case of a published work anyone may publish the work in the last 25 years of the period, subject to the payment of a certain fixed royalty to or for the benefit of the owner of the copyright. The term of copyright in photographs is 50 years from the making of the original negative; and for works published after the death of the author 50 years from the date of publication.

Section 5 (1).—The Act clearly states that the author of the work shall be the first owner of the copyright. Then follow certain exceptions—(*a*) where in the case of an engraving, photograph, or portrait the plate or other original of which was ordered by some person for valuable consideration, the copyright shall belong to the person giving the order; and (*b*) where in the case of work done in the normal course of employment by an author who is in the regular employment of another the copyright in such work shall belong to the employer.

Section 5 (2).—After stating that the owner of the copyright may assign the right either wholly or partially and either generally or subject to limitations as to country, either for the whole term or for any part thereof, and may grant any interest in the right by licence, the section continues; "but no such assignment or grant shall be valid unless it is in writing signed by the owner of the right in respect of which the assignment or grant is made or by his duly authorised agent." It must be added as a warning against the too strict interpretation of the section that the agreement to assign the copyright or grant a licence will be enforced however informal, and even if made verbally if valuable consideration therefor has been given or promised.

Publication.—In the marketing of copyright property certain advantages and privileges are dependent upon the date of publication, and it is important that the definition as set out in the Act should be quoted:—

> For the purposes of this Act, publication in relation to any work means the issue of copies of the work to the public, and does not include the performance in public of a dramatic or musical work, the delivery in public of a lecture, the exhibition in public of an artistic work, or the construction of an architectural work of art, but for the purposes of this provision the issue of photographs and engravings of works of sculpture and architectural works of art shall not be deemed to be publication of such works.

The performance of a dramatic or musical piece does not constitute publication, but the performing rights, only if the piece has been performed in public, run for the usual term of copyright, that is the life of the author and 50 years after his death. But in unpublished works which at the date of the author's death are still in copyright, and have never been performed, copyright shall subsist till publication or performance in public—whichever may first happen—and for a term of 50 years thereafter. If, therefore, a dramatic piece is performed in public during the life of the author, then the copyright runs for the author's life and 50 years afterwards. If the piece is performed in public after the death of the author, then copyright runs for 50 years after such performance; but as long as a literary, dramatic or musical work has not been published, and a dramatic or musical work has not been performed in public, copyright runs without time limit.

Infringement.—Copyright in a work shall be deemed to be infringed by any person who without the consent of the owner of the copyright does anything the sole right to do which is by the Act conferred on the owner of the copyright. No fair dealing with any work for the purposes of private study, research, criticism, review or newspaper summary constitutes an infringement of copyright. The usual civil and summary remedies are given, and there are special provisions with regard to works of joint authorship, posthumous works, government publications, reproduction on mechanical instruments. These are very complicated and cannot be set out in detail.

The Copyright Act of 1911 is of great importance, as Great Britain and Ireland, its Colonies and Dependencies, are bound by its rules and regulations. The majority of the Dominions have taken advantage of its regulations to pass their own legislation, but such legislation has been in every case along the lines of the Act of 1911, with slight alterations adapted to the domestic needs of each Dominion, and generally strengthening the power to take summary proceedings. Canada is the only Dominion whose Act has considerable alterations. The necessity for alterations in this case arose from its juxtaposition to the United States and the fact that the United States has never joined the Berne Convention; but the alterations in the Canadian law militate against its own citizens rather than against the citizens or subjects of those countries which are signatories to the convention in question. (G. H. T.)

CORELLI, MARIE (1864–1924), British novelist (*see* 7.143), died at Stratford-on-Avon April 24 1924.

CORFÙ (*see* 7.145), an island of Greece in the Ionian Sea. After the Greek victories in the first Balkan War of 1912, the Italian Govt. raised the question of "the channel of Corfù," seeking to push back the Epirote frontier of Greece as far south as possible, lest both sides of "the channel" should belong to the same state, and a naval base might thus be formed there. This argument, considered technically unsound by British naval experts, ignored the fact that Corfù was neutral.

In May 1914, there met in a Corfiote Hotel the Conference for the settlement of the dispute between Albania and the "autonomous Government of Northern Epeiros," which had risen against the inclusion of that district in the Albanian Principality. But the speedy outbreak of the World War rendered ineffective the decisions of the Corfù Conference (whose sittings coincided with the celebration of the jubilee of the union of the Ionian Is. with Greece). After the Serbian retreat across Albania, Corfù became an important position. Despite its neutrality and a Greek protest, the French landed there on Jan. 11 1916, followed by the first detachment of retreating Serbs four days later, and by Feb. 10 some 75,000 Serbian troops, soon followed by Montenegrin soldiers, had been landed in the island, whither on the previous day the Serbian Govt. had transported its seat and where, on Sept. 10, the Serbian Parliament met in the theatre. The mortality among the starved Serbian soldiers was considerable, and the islet of Vido still preserves, but in a state of great neglect, the graves of many Serbians who died "for justice and liberty." Corfù, however, will always be associated with the foundation of Yugoslav unity, for it was there, in July 1917, that the "Pact of Corfù" was signed, which proclaimed the union of the Yugoslavs.

Italian Nationalism had long coveted Corfù, and Italian schools were founded there to give gratis instruction to the Corfiotes. On Aug. 27 1923, the Italian delegate for the delimitation of the Albanian frontier, General Tellini, was assassinated at Kakavia, on the road between Joannina and Santi Quaranta. There was no proof whatsoever that the assassins were Greeks; but Signor Mussolini, the Italian Premier and Minister of Foreign Affairs, at once held the Hellenic Govt. responsible, and sent an Italian fleet to Corfù, of whose neutrality he was probably ignorant. Although Corfù was not a fortified place, and the "Old Fortress" was occupied by refugees and Armenian orphans, the fleet bombarded both it and the police school in the "New Fortress," firing a shell into the study of the (fortunately absent) British headmaster and killing 16 Greek and Armenian refugees and wounding 35 more. After exacting from Greece 50,000,000 *lire* as an indemnity, the Italians evacuated Corfù on Sept. 27. For the international handling of this dispute *see* LEAGUE OF NATIONS. Despite the feeling aroused against them by this high-handed action, the Italians celebrated in 1925 the centenary of the Italian Philhellene, Santarosa, by removing from Corfù the remains of the Venetian Admiral, Graziani, who died there in exile.

See *Documents Diplomatiques. Différence Italo-Grec. Août-Septembre, 1923* (Athènes, 1923); A. J. Toynbee's *Survey of International Affairs 1920–1923* (London, 1925), pp. 348 *et seq.* The full text of almost all the relevant documents are printed in *L'Europe Nouvelle*, Oct. 6 1923. H. Wilson Harris, *Italy, Greece and the League* (London, 1923); George Glasgow, *The Janina Murders and the Occupation of Corfu* (1923); S. P. Nicoglou, *L'Affaire de Corfu et la Société des Nations* (1925). (W. Mi.)

CORINTH, LOVIS (1858–1925), German painter, was born at Tapiau, in East Prussia, July 21 1858, the son of a tanner. He went to the school of art in Königsberg, painted in Munich under Ludwig Löfftz, stayed some time in Antwerp, and then studied for several years in Paris, in the Atelier Bouguerau of the Académie Julian. After a second visit to Munich he settled in Berlin, where, in company with his friend, Walter Leistikow, and also Max Liebermann, both painters, he became one of the main supporters of the Berlin Secessionists. The last years of his life he spent, for the greater part, in his cottage on the Walchensee in Bavaria, where some of his most beautiful pictures of still life and landscape were painted. Corinth died July 18 1925 at Zandvoort, Holland. One of the greatest personalities amongst German artists, he combined the vigour of the East Prussian peasant with the temperament of a Rubens.

His output was very considerable, and among his most famous pictures are his portraits of Graf E. Keyserling (1896), Pfarrer Moser (1899), Max Liebermann (1899), Peter Hille (1902), Konrad Ansorge (1904), Rudolf Rittner as Florian Seyer (1907), and of himself (1918). Corinth wrote: *Das Erlernen der Malerei* (1909); *Legenden aus dem Kunstlerleben* (1909); *Das Leben Walter Leistikows* (1910). See Alfred Kuhn, *Lovis Corinth* (1925).

CORK, Ireland (*see* 7.158), had a population in 1911 of 76,673. During the Sinn Fein troubles of 1919–20 there were serious riots and many outrages in and near the city, and the ambushing of British soldiers led to incendiary fires as reprisals in Dec. 1920, in which the city hall and the Carnegie library were burnt. It was decided to start reconstruction of the municipal buildings at once. In 1920 many Irish prisoners tried to obtain their release by hunger strikes, and the Lord Mayor of Cork, Terence James MacSwiney, died as a result in October. His burial in Cork was marked by intense public grief, and a requiem mass was said in the cathedral. In 1924 the corporation was dissolved in consequence of its irregular proceedings and its functions carried on by commissioners appointed by the Free State Government.

CORMON, FERNAND (1845–1924), French painter (*see* 7.161), died in Paris March 21 1924.

CORNELL UNIVERSITY (*see* 7.169).—The total enrolment of regular students in 1925 was 5,698 (including 1,292 women). In addition, 2,113 students were enrolled in the 1924 summer session, especially for teachers, and 180 in the short winter course in agriculture. The number of professors, assistant professors, lecturers and instructors on the staff of instruction, research and extension was 857. The productive funds in 1924 were $19,900,000 yielding in the fiscal year 1923–4 an income of $1,039,000; the income from public sources was $2,304,000 and from tuition and other fees, $1,156,000.

Tuition in the state colleges was free to residents of the state. The grounds, buildings and equipment were valued at $8,635,000. The area of the campus was 359 ac., and that of the experimental farms adjoining the campus was 1,170 acres. The productive funds had more than doubled between 1911 and 1925. Under the will of Goldwin Smith, $683,000 were received in 1911 for the promotion of liberal studies, and from Jacob H. Schiff, in 1912, $100,000 for the promotion of studies in human civilisation; by a bequest of Col. Oliver H. Payne, in 1913, the medical college was endowed with $4,850,000; August Heckscher gave $500,000 in 1920 for the endowment of research; a bequest of $77,000 from Hiram J. Messenger became available in 1923 for lectures on the evolution of civilisation. In 1919–20 new endowment was pledged to the amount of $5,700,000 to increase teachers' salaries, and gifts from alumni for current expenses aggregated $1,000,000 by 1925.

During the years 1911–25 the university's physical growth continued; the state added eleven large buildings to the equipment of the state colleges and built a new armoury for the department of military science; George F. Baker, the New York banker, gave $1,500,000 for a laboratory of chemistry; gifts of $350,000 from Mr. Baker and $300,000 from Mrs. Russell Sage provided four residential halls for students; Mrs. Florence Rand Lang of Montclair, N.J., added Rand Hall (machine shop and electrical laboratory) to the College of Engineering; Mrs. Willard Straight of New York built a large hall to serve as a social centre for the university community.

The colleges of Civil and Mechanical Engineering were reorganised in 1920 as the College of Engineering, comprising the School of Civil Engineering, the Sibley School of Mechanical Engineering and the School of Electrical Engineering. In 1921–2 the College of Architecture added courses leading respectively to the degrees of Bachelor of Fine Arts and Bachelor of Landscape Architecture. The State Legislature in 1923 put the state agricultural experiment station at Geneva, N.Y., under the direction of the trustees of Cornell University, and in 1925 established the state College of Home Economics, which, up to that time, had been a department of the College of Agriculture.

The university library in 1925 contained 750,000 volumes. Among the important recent accessions were the Charles W. Wason collection of works relating to China and the Chinese, 9,399 vol.; the James Verner Scaife collection of books relating to the American Civil War, and the engineering library of the late Emil Kuichling, 2,093 vol., presented by Mrs. Kuichling. The Willard Fiske bequests have been described in three important bibliographies: *Catalogue of the Icelandic Collection* (1916), *Catalogue of Runic Literature* (1918), both compiled by H. Hermannsson, and *Catalogue of the Petrarch Collection* (1916), compiled by Mary Fowler. The results of the Cornell expedition to Asia Minor and the Assyro-Babylonian Orient were published in 1911.

In 1924 appeared the eighth volume of *The Cornell Studies in English*, founded in 1916. Several volumes have also been added to *The Cornell Studies in Classical Philology*, *The Cornell Studies in History and Political Science* and *The Cornell Studies in Philosophy*. The valuable law library numbered about 60,000 volumes. The law school publishes *The Cornell Law Quarterly*, established in 1915. Since 1909 the Governor of New York State has appointed five members of the university's board of 40 trustees; 15 are co-opted, and the alumni elect 10; others are *ex-officio* members. Since 1916 the faculty has sent three representatives to the board who sit as trustees, but without a vote. Andrew Dickson White, who, at the request of Ezra Cornell, drew up the original plans for organising the university and served as its first president, died at Ithaca, N.Y., Nov. 4 1918. President Jacob Gould Schurman resigned in June 1920, and Dr. Livingston Farrand was inaugurated president in Oct. 1921.

During the World War the university, in co-operation with the War Dept. conducted at Ithaca, N.Y., schools of military aeronautics, of aerial photography, for military artisans and a unit of the Students' Army Training Corps, and, at the medical college in New York, a school of röntgenology for officers of the U.S. Army Medical Corps. Many members of the faculty gave professional or technical service to the Government. About 7,000 students or former students of the university were in uniform; 216 died in the service; 147 were decorated for distinguished services or gallantry in action. (W. Pa.)

CORONEL, BATTLE OF.—On Nov. 1 1914 a naval battle to which this name is given was fought between a British cruiser squadron under Rear-Adml. Sir Christopher Cradock and a German squadron under Vice-Adml. Graf von Spee. Coronel is in Chile and the battle was fought about 41 m. to the west of it. The Germans sometimes call it the battle of Santa Maria from the name of a small island about 20 m. to the west.

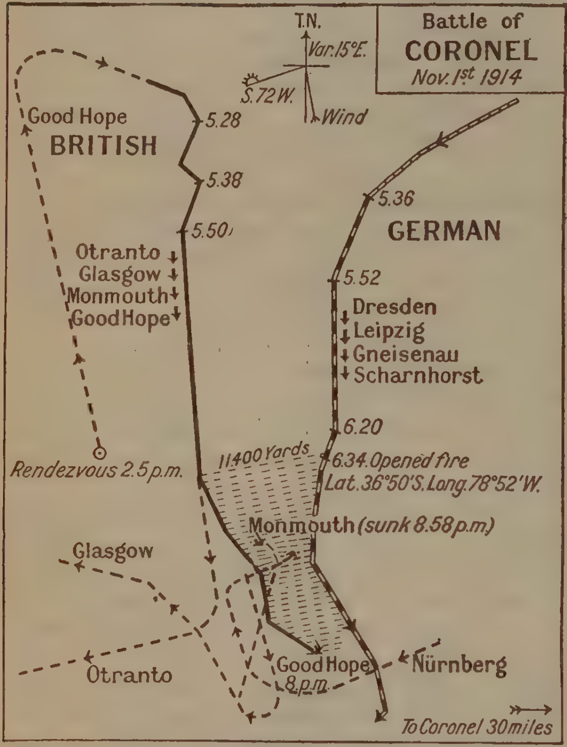
Ships Engaged.—The British squadron consisted of the armoured cruisers "Good Hope" (flag, Capt. Philip Francklin, 1902, 14,200 tons with 2 9·2-in. and 16 6-in. guns, designed speed 23 knots), and "Monmouth" (Capt. Frank Brandt, 1903, 9,800 tons, with 14 6-in. guns, 23 knots); the light cruiser "Glasgow" (Capt. John Luce, 1910, 4,800 tons, with 2 6-in. and 10 4-in. guns, 25 knots); and the armed merchant cruiser "Otranto" (Capt. Herbert Edwards, with 4 4·7-in. guns, 16 knots). The German squadron consisted of the armoured cruisers "Scharnhorst" (flag) and "Gneisenau," both vessels of 11,420 tons, with 8 8·2-in. and 6 5·9-in. guns, speed 22·5 knots, and the light cruisers "Leipzig" (1906, 3,200 tons, with 10 4·1-in. guns, 22 knots), "Nürnberg" (1908, 3,396 tons, with 10 4·1-in. guns, 23 knots) and "Dresden," (1908, 3,544 tons, with 10 4·1-in. guns, 24 knots). In gunnery and weight of broadside the Germans were undoubtedly superior. Their large ships had been in commission for over two years and were in a high state of gunnery efficiency. On the British side the "Good Hope" and "Monmouth" were third fleet ships with obsolete control fittings. They had been lying empty in the dockyards and were manned by reserve men on the outbreak of war.

In the heavy weather prevailing at the time, it may be assumed with certainty that the "Good Hope" and "Monmouth" could not use their maindeck 6-in. casemates, which would reduce the British broadside to 2 9·2-in. and 12 6-in., with a weight of 1,960 lb., against the German 16 8·2-in., with a weight of 2,904 pounds. The old battleship "Canopus" (Capt. Heathcoat Grant, with 4 12-in. and 12 6-in. guns), another third fleet ship, had been sent out to reinforce the squadron; but, as her engines could not be relied on to do more than 14 knots, she had been relegated to escort work and was some 300 m. to the southward escorting two colliers when the action began. Both in guns and gunnery Cradock's ships were unequal to their task and this had been seen as early as Sept. 10, when orders were issued for the armoured cruiser "Defence" to proceed from the Mediterranean to reinforce Cradock. These orders were unfortunately cancelled by the Admiralty on Sept. 16.

Meeting of the Rival Squadrons.—Cradock left the lonely harbour of Vallenar (Chonos Archipelago, Chile, 45° 24′S., 74° 18′W.) with the "Monmouth" on Oct. 30 and proceeded north to find the enemy, leaving the "Canopus" to remedy engine defects and bring on colliers. The "Glasgow" which had gone on to Coronel, joined her at 1:30 P.M. on Nov. 1 some 50 m. west of Coronel. A heavy sea was running and the mail had just been drifted on board the "Good Hope" when at 1:40 P.M.[1] German wireless sounded loud and clear.

Von Spee had come from Masafuera, the last port of call on his long Pacific trip. The "Prinz Eitel Friedrich," an armed merchantman, had been sent into Valparaiso on Oct. 30 and he was cruising slowly just out of sight of land. At 3 A.M. on Nov. 1 he received by wireless news of the "Glasgow's" visit on Oct. 31 and steered south to intercept her.

Cradock made a signal to spread 15 m. on a line of bearing northeast by east (in order from west—"Good Hope," "Monmouth," "Otranto," "Glasgow") course northwest by north 10 knots, to get in touch with the enemy. The line had not been formed when the "Glasgow" and "Otranto" sighted smoke, and at 4:10 P.M. the former reported enemy armoured cruisers in sight, steering southeasterly. She turned at once to S65°W and the whole line began to close on the "Good Hope." The "Canopus," which had left Vallenar at 9:30 A.M. on Oct. 31, was 300 m. to southward, toiling along with her colliers in a heavy sea.



Von Spee had been steering south at 14 knots. The "Nürnberg" and "Dresden" had been detached to examine passing ships and the former was 25 m., the latter 12 m., in rear. At 4:17 when some 35 m. north of Coronel (36° 26′S., 73° 23′W.), the "Glasgow" was sighted to the west and the German cruisers turned and followed her, working up to full speed. It was blowing hard from south by east (Von Spee says south) and a heavy sea was running, hurling sheets of spray over the conning towers. The "Good Hope" was 26 m. west of the "Glasgow" when the Germans were sighted and turned to the east to join her squadron. The signal to form single line ahead went up at 5:17 and by 5:20 the British squadron was on an easterly course, the "Good Hope" leading, with the "Monmouth," "Glasgow" and "Otranto" in line ahead behind her. The enemy was about 11 m. away to the east, steering to the southwestward. Cradock altered course to the south about 5:30, while Spee some 11 m. off was steering southwesterly. At 5:34 Cradock altered his course four points (45°) together toward the enemy, evidently in order to close the range while the sun was still high enough to dazzle the enemy, but Von Spee turned away two points to port, and Cradock resumed his course to the south.

The Action Described.—Cradock was evidently determined to fight and about 6 P.M. he informed the "Canopus" of his intention to attack. The ships were then going about 17 knots. At 5:50 Cradock again turned in to reduce the range and again Von Spee turned away, biding his time and waiting for the sun to set. The "Otranto," with neither guns to fight nor speed to run away, asked if she was to keep out of range and, not getting a reply, drew out on the "Glasgow's" starboard quarter.

At 6:20 the sun had begun to dip and Von Spee increased speed to 16 knots and turned in to reduce the range. As the sun sank below the horizon at 6:30 it left the British ships silhouetted against a deep blood-red glow, whilst the German ships were barely visible against the night clouds gathering in the east. At 6:33 the range was 11,367 yards and the "Scharnhorst" opened fire. In spite of the heavy sea and spray, the first shot fell only 500 yards short. The third salvo hit the "Good Hope" between the conning tower and fore turret, setting a fire ablaze. The rest of the German squadron joined in, the "Gneisenau" opening on the "Monmouth," the "Leipzig" on the "Glasgow" and the "Dresden" on the "Otranto," though seas were breaking right over the light cruisers and pouring into their conning towers.

The "Good Hope" opened fire, but in the failing light the shots could not be seen and her fire was poor and ineffective. Cradock had turned toward the enemy and the range was falling rapidly. By 6:53 it was down to 6,600 yards. The "Monmouth" had opened fire with rapid salvoes, but the German gunners found the target again and again and by 7 P.M. the British cruisers were obviously in distress. The "Monmouth's" fore turret had been struck by a shell and after spouting fire had been blown overboard; she had yawed out of line to starboard at 6:50 and the "Glasgow," following in the "Good Hope's" wake, had to ease down to avoid masking her fire. Fierce fires had broken out in the "Good Hope" and were increasing in brilliance. It was growing dark. At 7:15 the "Good Hope" was losing speed; the range had closed to 5,000 yards. About 7:20 an armour-piercing shell struck her between the second and third funnels and a minute or so later a vast column of fire rose into the air as high as the mast head. The port after-guns fired a couple of shots, then all was silent. The explosion seems to have blown the ship in two, leaving her little more than a gutted hull, lighted by a dying glare. Thirty-five hits had been counted on her by the "Scharnhorst's" gunners.

Sinking of "Monmouth."—At 7:26 the Germans ceased fire; nothing could be seen of the British squadron but the occasional flash of the "Glasgow's" guns. The "Monmouth" had ceased fire at 7:20; she had got her fires under and at 7:35 turned to the westward. The "Glasgow," which had received five hits, followed her round, signalling to her at 7:40 to steer west, but badly down by the bows and listing to port the "Monmouth" turned north at 7:15 to get stern to sea. The moon had risen above the clouds and was sending a fitful light over the stormy sea. Von Spee had launched his light cruisers to attack and they were hot on the trail.

At 7:50 the "Glasgow" could see them coming up astern and, after signalling to the "Monmouth" to steer west, left the stricken field and lost sight of the enemy at 8:20 P.M. It was the "Nürnberg," which had been making frantic efforts to overtake her squadron, that found the unfortunate "Monmouth," listing so badly that she could not use her guns. The "Nürnberg" missed her with a torpedo and opened fire at 800 yards. She heeled gradually over and at 8:58 went down with her flag flying. Not a soul was saved from her or the "Good Hope." The "Glasgow," working round to the southwest steered with the "Canopus" for Magellan Straits. The "Otranto" went round the Horn.

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[1] Time in Corbett, vol. 1, and in 12th ed. is the time kept by British ships and is half an hour behind the times here given, which are in Chilean time, five hours slow on Greenwich.

The British shooting was poor; the crews had had little time for training and the fire control equipment was obsolete. The "Scharnhorst" was hit twice by small shell with no casualties; the "Gneisenau" received four hits, one of which jammed the after 8·2-in. turret for a short time, and had two men slightly wounded. It would have been possible for Cradock, when the German squadron was sighted, to fall back on the "Canopus," but this would probably have meant the abandonment of the "Otranto"; Cradock was much disturbed at the refusal of the Admiralty to send him the "Defence," but from the first it seems to have been his definite intention to fight. When the enemy was reported he did not hesitate, but at once formed his battle line. He hoped no doubt to inflict some injury on the Germans who were far from any base of refitment and repair. His flag went down into the Pacific flying gloriously and any responsibility he bore lies buried fathoms deep. He fought his fight, checked Von Spee in his onward career and started the train of events which found its consummation at the Falklands. (*See* FALKLAND ISLANDS, BATTLE OF.)

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(A. C. D.)

CORPORATION: *see* COMPANIES AND CORPORATIONS.

CORSON, HIRAM (1828–1911), American scholar (*see* 7.204), died in Ithaca, N.Y., June 15 1911.

CORT VAN DER LINDEN, PIETER WILLEM ADRIAN (1846–), Dutch politician, until 1897 followed an academic career, mainly interesting himself in economics. In that year he became Minister of Justice and retained this post until 1901, when he was appointed a member of the State Council. In 1913 after the Social Democrats had refused to co-operate with the Liberal parties, Dr. Cort van der Linden formed an extra-parliamentary Cabinet which during the World War assumed the character of a national cabinet. In virtue of this he succeeded in bringing about a revision of the Constitution, which put an end to both the electoral "war" and the schools "war," which for half a century had dominated politics in the Netherlands. Bills were passed providing for proportional representation, universal manhood suffrage, which gave a prospect of extending the franchise to women. A bill was also passed by which denominational schools were placed upon an equal financial basis with public schools. After his Cabinet had resigned in 1918 Dr. Cort van der Linden was again appointed a member of the State Council.

COSGRAVE, WILLIAM THOMAS (1880–), Irish politician, was born in Dublin, and educated at a school of the Christian Brothers. His father, Thomas Cosgrave, was at one time a town councillor and poor-law guardian. William Cosgrave entered the grocery trade at an early age, and there was nothing in his life to indicate a career of importance. But, like most thoughtful young Irishmen who came of age about the turn of the century, he was attracted by the Sinn Fein movement. In 1913 he won a seat on the Dublin corporation in the Sinn Fein interest. Here he distinguished himself on the financial side and in 1916 was chosen chairman of the finance committee.

In 1913 he became a member of the Irish Volunteers, and when that body divided in Aug. 1914, he was with the minority who refused to follow John Redmond. At the Easter Rising, 1916, he was again in an extremist minority, for he joined the section which, against the order of Prof. MacNeill, then head of the organisation, went out to fight under Pearse. Afterwards, with other prisoners, he was detained at Frongoch in Wales until the general liberation in July 1917.

Mr. de Valera, having, immediately on his release, won a seat vacant in Clare, another vacancy soon occurred in Kilkenny city. Mr. Cosgrave was nominated and elected by a large majority. Re-elected in Dec. 1918, this time for Kilkenny co., he was a member of the first Dail Eireann which declared for an Irish Republic and was Minister for Local Government in the first Republican Ministry. During the struggle with the British, his task was to organise the refusal of local bodies to co-operate with Dublin Castle. Like all other members of this illegal ministry, he was the object of pursuit by the law and was more than once in prison.

During the debate in the Dail in Dec. 1921, on the newly signed treaty with Great Britain, Mr. Cosgrave's speech was one of the few that attracted attention. Later he became Minister of Local Government in the newly formed Provisional Government. In the summer of 1922 President Griffith, obliged to go to London for the negotiations concerning the treaty clauses, appointed Mr. Cosgrave as his deputy, and when, on Aug. 12, Griffith suddenly died and Collins was chosen President in his place, Mr. Cosgrave became acting chairman of the Provisional Government. Ten days later Collins was shot, and Cosgrave, a simple Dublin business man, was placed by force of circumstances at the head of a state fighting for bare life. Never was promotion more sudden or more accidental. Griffith and Collins had, in their different ways, a strong hold on the popular mind; Mr. Cosgrave was unknown as a personality and barely recognised as a name.

As soon as the newly elected Dail could be summoned, and it could meet only behind closed doors and strongly guarded entrances, he made clear his view that the day of individual leadership was over and team work must take its place. In that anxious period he left much of the work, especially the carrying of the draft constitution through the House, to younger and more brilliant subordinates. But he captained his team, and was always ready to shoulder responsibility. When tempers were roused he introduced a conciliatory spirit. He showed both breadth of view and a sense of humour, and endeavoured to make the Protestant minority at home in the Free State. The appointments made by his Govt., especially to judicial office and the first Senate, recognised merit irrespective of politics or religion.

As President of the Irish Free State he represented Ireland when she first appeared at a conference of the Dominions in Oct. 1923; and a month earlier he was welcomed as her first spokesman at the Assembly of the League of Nations. He saw the country pass from anarchy to a state of complete order. The Ministry of Finance, which he took over at the outset, was transferred in 1923 to Mr. Blyth who proved a success; the Ministry of Defence, which he took over in April 1924, in face of a threatened mutiny in the army, was handed over easily and without comment a few months later to a new minister, Mr. Hughes. In his political career Mr. Cosgrave was not ambitious. He never sought to thrust his personality into the forefront, but in Ireland, as well as overseas, he won a reputation for good sense and moral courage. (S. G.)

COST ACCOUNTING.—This term embraces methods of cost determination which are either a part of, or co-ordinated with, the general accounting of the enterprise as distinguished from estimates of costs not so controlled or checked. Cost-accounting methods have probably been developed more extensively in the United States than in any other country. This development has taken place mainly in the period since 1895, and it may be regarded as a natural phase of the general industrial development in that period. The same conditions which have stimulated the use of labour-saving methods and mass production have naturally lent new importance to the determination and analysis of costs, and have made it imperative that the substantial accuracy of the statistics of cost used shall be beyond question. This can only be assured by linking up cost statistics with general financial and accounting records and results.

In the problem of cost accounting there may be said to be usually three main objects to be achieved, three main classifications to be followed and three major considerations governing the scope of the methods to be employed. These nine elements are necessarily to some extent interrelated, and it may therefore be well to state them at the outset.

The main objects referred to are: (1) to afford a sound basis for selling policy; (2) to provide tests for operating efficiency; (3) to establish a basis for accounting records and financial policy. The classifications of cost are broadly: (1) labour,

(2) material, (3) overhead expenses. The character and scope of the methods to be employed must be determined largely by considerations of (1) speed, (2) accuracy, (3) expense.

The relative importance of the objects enumerated varies with different classes of enterprise. In the case of a builder, contractor or shipbuilder, or in the case of a plant capable of producing different types of products, a cost system may be of even greater value in the determination of selling policies than in producing operating efficiency. On the other hand, in the case of a plant producing standard articles for a highly competitive market, the value of a cost system may lie almost wholly in helping to secure manufacturing or operating efficiency.

The success of any cost-accounting system depends largely on correct judgment concerning the relative importance of the different elements of the problem in the particular case involved, and particularly on the success with which the naturally conflicting considerations of speed, accuracy and expense in the cost department are reconciled. If the cost system is to be of real service to those in charge of operations or sales, its results must be substantially accurate and sufficiently specific to enable those officers to localise waste and the responsibility therefor. Such results will, however, be of little value if in an attempt to secure accuracy the ascertainment of the results is unduly delayed, or an expense is incurred greater than the possible benefits to be derived from the greater accuracy ultimately secured. The recognition of this fact and the consequent resort to simpler, though perhaps less scientific and less meticulously accurate methods, have perhaps been the most marked characteristics of the development of cost accounting in the United States in recent years. The growth of interest in cost accounting, which began about 1895, was greatly stimulated by the consolidations which were effected about the year 1900.

Costings and Large-scale Production.—Among the results of these consolidations were the transfer of ownership on a large scale from persons immediately interested in the operations of plants to the general public, and also a transfer of the general direction from small groups of operating officers to boards of directors less intimately associated with actual operations. This change resulted in a demand for more frequent and more accurate reports of operating results as a guide to financial policies and for the information of those financially interested. In the development of methods to meet the new situation the importance of the purely accounting and financial uses of costs were not infrequently overrated.

Purely accounting uses of cost records have come to be viewed in a more accurate perspective, and accounting refinements and technicalities have been increasingly subordinated to practical usefulness. At the same time, remarkable results have been achieved in expediting the compilation of costs by careful organisation, so that to-day large corporations frequently have completed cost figures for a month available for the operating executives within three or four days of its close.

The accountant called upon to devise a system of cost accounting will be wise to regard the accounting uses of the system as entirely secondary, and to aim at making the system as valuable as possible to those controlling the policies and operations of the business. The sales manager, in fixing prices, must estimate costs in advance of sale, and the value to him of a system which records actual costs lies mainly in the check it affords on the correctness of his estimates, and the extent to which it permits and facilitates the use of actual costs of the past as a basis for estimates of cost in the future under changing conditions.

The operating or production manager's requirements are more extensive and more varied. He must be in a position to determine whether fluctuations in cost are due to conditions within the control of the management or not, and if so, to localise the responsibility. He must, for instance, be in a position to determine such questions as whether a higher cost of material at one plant than at another is attributable to less efficiency in purchasing, or to the use or the waste of more material, and how far apparent high costs of production are really costs of production, and how far they are attributable to lack of production, *i.e.*, to idle time and such causes. Every effort should therefore be made to frame a cost-accounting system so as to afford as much light as is practicable on manufacturing operations and to make that light available at the earliest possible moment.

Main Types of Cost Accounting.—Broadly, there are three main types of cost-accounting systems. The first undertakes to determine the cost for each *production order*, which may cover either a single unit of production where units are large, or a batch of units where they are smaller. The second takes account of costs by separate *processes or operations*—thus determining a unit cost for each process or operation and leaving the cost of any article produced to be determined by bringing together the costs of several processes or operations through which it passes. The third seeks to determine costs by *products or classes of products* and to compute the costs of the units produced by dividing the total costs incurred in producing similar units in any period by the number of units produced in that period. Multiple products from a common raw material, as in the case of petroleum and packing industries, constitute a separate and difficult problem.

An important question is the relation of the cost accounting to the general accounting records of the enterprise. From the standpoint of accounting technique the cost system, which forms an integral part of a general accounting system, possesses a unity and completeness which cannot be achieved in any other way. It is, however, easy to pay too great a price for this artistic completeness, and there has been a marked disposition to employ methods under which the cost accounting is less closely tied to the general accounting.

The value of cost figures is greatly enhanced by comparisons either with past achievements or with an "ideal" or standard of cost. Much attention has been given to methods of cost accounting in complex industries, based on standard costs for specific articles, processes or operations, supplemented by methods for adjusting these standard costs for changes in conditions, and for ensuring that the aggregate costs allocated as the results of these adjustments are in actual or substantial agreement with the aggregate costs incurred as shown by the general books. For discussion of the subdivision of costs, the reader must be referred to text-books. A warning may be given that accounting text-books are apt to overrate and engineering text-books to underrate general accounting and financial desiderata. In particular, the importance may be emphasised of avoiding use of a cost system in a way which would involve inventorying goods at more than true cost through the inclusion in costs of either (*a*) inter-departmental profits (and for this purpose wholly-owned subsidiary companies should be regarded as departments), (*b*) profits in the form of interest or otherwise, or (*c*) selling costs. All these items may, however, be included in appropriate ways in costs compiled for executive use in formulating policies.

Overhead costs per unit (up to the limit of economical production) decrease as the output increases, and vice versa. Sales may therefore be advantageous, even though they do not reimburse direct costs and a rateable proportion of overhead expenses. The cost accountant should therefore do all in his power, especially where profit margins are narrow, to segregate overhead costs, to analyse them and to interpret them to the executive, so as to ensure that they will be given due, but not undue, weight in the formulation of policies. The allocations of overhead costs are, at best, rough approximations, but much has been done to secure more accurate allocations by computing overheads for individual departments, machines or tools, by adopting bases of apportionment, more carefully selected and more closely related to the actual facts of production than previously, and in similar ways.

In some systems, standard rates of burden rather than actual rates are charged into cost, being credited to clearing accounts to which actual overhead expenses are charged. Where this is done, watchfulness and judgment in dealing with these clearing accounts are imperative. This is, however, only one illustration of the most important of all truths in cost accounting, that skill and judgment in applying, adjusting and interpreting cost methods in actual use are even more important than ingenuity in devising a system in the first instance (*see* BOOKKEEPING).

A. H. Church, *Manufacturing Costs and Accounts* (1917); Nicholson and Rohrbach, *Cost Accounting* (1919); G. C. Harrison, *Cost Accounting to Aid Production* (1921); L. R. Dicksee, *Fundamentals of Manufacturing Costs*. See also *Industrial Management* and other journals devoted to that and kindred subjects. (G. O. M.)

COSTA RICA (*see* 7.219).—A republic in Central America and a member of the League of Nations. Its area is 23,205 sq. m. and its population was estimated on Dec. 31 1923 at 498,435: no census had been taken since 1892.

POLITICAL HISTORY

In 1910 Ricardo Jimenez was chosen president by popular vote, but in 1914 recourse to the legislative branch was required for the election of Alfredo González. In Jan. 1917 González was forced out of office by Frederico Tinoco, who became the provisional chief of the Republic. A commission was appointed to draw up a new constitution, which was finally promulgated in June 1917. In April deputies were elected to a constituent assembly and a president elected, in accordance with the electoral law of Aug. 18 1913; Tinoco was proclaimed president from May 1917. In 1919 a counter-revolutionary movement under Julio Acosta took place; Tinoco resigned and Acosta became president. Following the entry of the United States into the World War, Costa Rica severed relations with Germany and finally declared war on May 25 1918.

The boundary dispute with Colombia, arbitrated by President Loubet of France in 1900, continued as a dispute with Panama and resulted in the White award in 1914. In 1921 Panama appealed to the United States Govt. against the award but was informed that it must be accepted. On Aug. 18 Secretary Hughes announced that Costa Rica need delay no longer in taking jurisdiction over the disputed territory and on Aug. 23 the Coto district was ceded by Panama. Costa Rica protested against the Bryan-Chamorro Treaty of 1916, alleging that it infringed her sovereign control over parts of the proposed Nicaraguan canal route. The protest led to a protocol, signed Feb. 8 1923, between Costa Rica and the United States, whereby the latter agreed to recognise the rights of Costa Rica in the San Juan river in event of canal construction. This protocol, however, was rejected by the United States Congress. In Oct. 1924 President Jimenez approved the Central American treaties signed at the Washington Conference of 1922–3, and in Nov. his Govt. ratified the General Treaty of Peace and Friendship (*see* CENTRAL AMERICAN UNION).

Education.—The school enrolment in 1923 was 41,277; in 1924, 38,672. Secondary, normal and professional schools have been established. Education during the post-War period received about 16% of the national budget. In Feb. 1925 a commission began the study of agricultural and vocational education in South America.

National Finance.—The budget showed deficits each year from 1914–21, totalling altogether over 27,000,000 colones. In 1922 revenue exceeded expenditure; in 1923 the surplus was over 1,500,000 colones. The internal debt on Dec. 31 1923 was 39,807,956 colones; the foreign debt consisted of gold refunding bonds, 1911, of £1,478,000, and the unpaid balance of the French loan, 1912, amounting to 32,269,500 francs.

Production and Trade.—Increased attention is being paid to agriculture, and a new department of school agriculture has been established. The chief products are coffee and bananas; the production of sugar is increasing in importance, while maize, cocoa, tobacco, rice and potatoes are also grown. Gold and silver mining rank next to agriculture. Few manufactures exist. The distillation of spirits is a government monopoly.

The value of imports declined during the period 1915–9, owing to the War and restricted shipping facilities. Exports, however, remained fairly steady, and consequently favourable trade balances were registered each year. The following table gives the value of exports and imports from 1914 to 1923:—

	Imports	Exports
	Lbs.	Lbs.
1914	1,554,033	2,235,272
Average 1915–9	1,121,000	2,209,000
1920	3,645,873	2,563,929
1921	2,390,600	3,095,548
1922	1,716,840	2,926,533
1923	2,013,353	2,640,321

Coffee and bananas represent over two-thirds of the total exports. Overseas trade is mainly with the United States and Great Britain. In 1923 59% of the value of total imports was from the United States and 16% from the United Kingdom. Of exports, 54% was to the United States and 38% to the United Kingdom.

There were 403 m. of railway in the country in 1925, 81 m. of which were state owned. Some 1,000 m. of roads existed, but only about 50 m. were suitable for motor traffic.

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COST OF LIVING.—Until recently the phrase "Cost of Living" was only used loosely by economists when the balance between movements of wages and prices was in question, but from 1914 onwards during the World War the need of a measurement of the rise of prices gradually resulted in making the expression prominent in industrial and statistical discussions. It has frequently been assumed that the term "Cost of Living" has a unique and definite meaning, and that accurate measurements can be applied to it, but in fact the meaning is vague and the statistical methods appropriate to it are complex and lead to results whose precision is not of a high order.

The phrase may be regarded as an abbreviation for "the cost in a defined region to persons of a defined social or industrial class of goods of a kind usually purchased at frequent intervals, by the consumption of which a certain standard of economic welfare is reached." We may usefully distinguish four cases:—(*a*) where the standard is a physiological minimum; (*b*) where some conventional or average budget of expenditure is taken and the cost of the items in it is measured at different times or places; (*c*) where the items are varied but the whole contents of the budget result in an unchanged standard of welfare; (*d*) where both the contents of the budget are modified and the standard is raised or lowered. Case (*b*) is that which has in recent years been the subject of measurement, but case (*c*) is that which is in reality appropriate to the problem of measuring or adjusting real wages.

I. GENERAL CONSIDERATIONS

The Physiological Minimum.—Attention was directed by Mr. Seebohm Rowntree (*Poverty, A Study of Town Life*, 2nd ed. 1902) to the cost of obtaining in York (England) and elsewhere food, clothing, heat, light and shelter sufficient for a family to maintain itself in health and efficiency for work, when all possible economy was practised, subject to the availability of commodities and the legal requirements for housing, decency, etc. The minimum of food was computed in relation to the quantity of calories, carbohydrates and protein calculated by Atwater and others as necessary for maintaining health and vigour under various conditions of life, and dietaries were drawn up which contained the necessary constituents at the minimum aggregate cost; to this cost was added the expenditure on clothing, fuel, cleansing materials, etc., and rent, which was found to be customary among persons in regular work at the lowest rates of wages for adult men. The most natural meaning of the cost of living is perhaps the cost of maintaining the minimum standard thus described.

The standard is, however, not scientifically definite; apart from questions as to the validity and applicability of the measurement by calories, it is clear that there must be a great difference between the amount of food necessary for work of low and of high efficiency; the Indian, Chinese and Japanese peasants live on a sparser diet and produce a lower output than English or American; definable points are where efficiency is a maximum (which needs a more liberal diet than that considered by Mr. Rowntree) where the value of additional efficiency exactly equals the cost of the additional food, etc., necessary (for whose ascertainment there are no observations); and Atwater's standard is in fact conventional (*see* Bowley, *Measurement of Social Phenomena*, chap. viii., 1915). If we drop the word "minimum" and speak of Mr. Rowntree's as a conventional standard for demarcating poverty, we can properly measure the change in the cost of living at this standard (if the facts are ascertainable). The varying cost of the official civilian rations, computed in Germany *circa* 1919, gave a measurement similar to that described. The cost of Mr. Rowntree's standard, and one modified in the direction of ordinary purchasers by Bowley, was worked out for certain English towns in 1913 (*Livelihood and Poverty*, 1915 and in 1924) (*Has Poverty Diminished?* 1925). A legal minimum wage could be based on a standard thus defined, but in fact it is generally related to a higher conventional standard.

The Conventional or Average Budget.—The usual method of measuring the change of the cost of living during and since the War has been as follows: Detailed statements of expenditure having been obtained from a number of working-class households (in most countries at some date prior to 1914), an average budget is formed showing so many pounds of meat, bread, etc., with the prices and expenditure in considerable detail. The average prices of the same foods is ascertained from time to time, and the expenditure necessary to purchase the former quantities at the new prices is computed. The cost of living (so far as food is concerned) is then taken as having increased or decreased in the same ratio as this standard budget. In many countries a standard of the same kind is established for clothing, fuel, light, rent, cleansing materials and some other articles, and the cost of the aggregate, including food, is computed from time to time. The result obtained (if the process were complete) would be the relative cost of maintaining a defined standard constant in every detail. It is generally expressed as a percentage; thus if the costs were 25s. and 30s. at the two dates, the ratio is 100:120, the index number at the second date is 120 and the percentage increase 20.

This method cannot be carried out in its entirety for two reasons, namely, lack of information and change of quality of the commodities in the market. In most countries data of expenditure and prices are only obtained for principal commodities (meat, bread, etc.) and not for those on which little is spent (currants, pepper, etc.) or in which the unit is variable (fruit, vegetables, etc.); but unless owing to shortage of supplies there is a run on the articles not included, these omissions cannot affect the result significantly. In some countries expenditure is not known, but only prices, and then the resulting calculation is generally valueless; and in others currency has been so variable that the computation has been meaningless. In nearly all cases there is no sufficient knowledge of expenditure on clothing either in total or in detail, and it is often difficult to obtain adequate data for fuel and light or for miscellaneous items. The sums included in the calculations, in fact, account for only a part of ordinary household expenditure, but where most care has been given to the question the part is a large proportion of the whole. Classes of expenditure that are not strictly necessary, such as amusements, tobacco, alcohol, etc., are generally omitted, as are occasional expenses (doctors, purchase of furniture, etc.), but in some cases subscriptions to trade unions, etc., insurance payments and travelling to work are included. The miscellaneous expenses omitted become a larger proportion of total expenditure as we go up the scale of incomes.

The difficulty due to the change of quality of goods which has been so marked since 1914 is even more fundamental. Over any long period the actual constituents and quality of a pound of bread, a cut of meat, a pair of boots, change considerably, but from some points of view these gradual changes are not important. During the War, however, substitution of one commodity or ingredient for another was sudden and common, and the pre-War quality was unobtainable at any price, or if obtainable had a quite altered position in domestic economy. Consequently the prices included in the calculations were frequently not for the same things at different dates and the precision of the measurement was greatly diminished. After the Armistice there was some return to former qualities, but the change has been sufficient to undermine the foundation of the numbers, and a new basis is necessary.

It should be added that separate budgets ought to be formed (and in some countries have been formed) for different grades of income and for different classes of occupation, and also for single persons and for married persons with dependants.

The structure of the index numbers of the cost of living is shown most clearly by algebraic symbols. If $Q_1, Q_2, Q_3 \dots$ are the number of units of the commodities in the standard budget, and $P_1, P_2, P_3 \dots$ the prices per unit at the date taken as starting point, and we write $Q_1 \times P_1 = E_1$, $Q_2 \times P_2 = E_2 \dots$ where $E_1, E_2, E_3 \dots$ are the expenditures on the commodities, then $E = E_1 + E_2 \dots = Q_1P_1 + Q_2P_2 \dots$ is the whole expenditure at the first date on the standard budget. Let $p_1, p_2, p_3 \dots$ be the prices per unit at a subsequent date; then $Q_1 \times p_1 = e_1$, $Q_2 \times p_2 = e_2 \dots$ are the presumed expenditures, and $e = e_1 + e_2 + \dots = Q_1p_1 + Q_2p_2 + \dots$ is the whole expenditure. The ratio of the cost of the standard budget at the second date to that at the first, is $\frac{e}{E} = \frac{Q_1p_1 + Q_2p_2 + \dots}{Q_1P_1 + Q_2P_2 + \dots} = \frac{E_1r_1 + E_2r_2 + \dots}{E_1 + E_2 + \dots}$ where $r_1 = p_1/P_1$ (the price ratio for the first-named commodity at the two dates), $r_2 = p_2/P_2 \dots$. The last expression shows that by this method the ratio of the costs of living is a weighted average in which the price ratios are weighted by the expenditures at the first date; hence we only need to know these expenditures and ratios, and not the actual quantities nor prices. In the official measurement in the United Kingdom only the quantities E and r are in fact used; this method is very convenient in dealing with rent (for which there is no natural unit of quantity) and with clothing (for which a general price ratio is obtained without any definition of unit). The general theory of weighted averages shows that a considerable roughness in the estimation of the smaller expenditures is smoothed out in the process of averaging, but that it is important to obtain precision in the case of large items, such as clothing, treated in a single entry, and rent. It is important, however, that the r's should be accurately known when they differ much from one another, and the quality of the commodities that are priced should be the same at both dates.

The index number for the second date is $\frac{e}{E} \times 100$, and the percentage increase is $\left(\frac{e}{E} - 1\right) \times 100$.

Variation in Detail on an Unchanged Standard.—It must be granted that when the cost of living is compared at two places or at two dates we ought not to assume that precisely the same quantities of the same commodities are purchasable in both cases, and in order to make a strict numerical comparison we need a test of equality of standard if not a means of comparing two standards. The problem so stated has not yet been completely solved. A measurement could be made on a strictly nutritive basis and the cost of purchasing in the most economic way the amount of calories (including the necessary protein) considered proper to health and efficiency could be ascertained in both countries or at both periods; but this would only give a theoretic solution, since it ignores the influence of custom and taste in diet, and, in fact, in developed countries relatively few people have been compelled to purchase their nutriment in the cheapest possible way. The actual practical question in England in 1921 was what was the cost of maintaining the pre-War standard of living in nutritive power and satisfaction or pleasure derived from food and clothing, allowance being made for changes in prices and available qualities. This statement introduces the vague word *satisfaction*, which it is not practicable to define exactly, though some mathematical methods based on economic principles have been suggested for ascertaining its equality in two cases.

One method would be to frame a new budget of goods obtainable and in fact purchased by housekeepers with the same skill of adjusting purchases to desires as in the case of the earlier budgets. This would mean obtaining from representative working-class women a budget which in their opinion would now give the same variety and pleasure as a selected budget of 1914, care being taken that the energy value is the same. The result would be a new conventional budget, the ratio of whose cost to that of the pre-War budget would give a rough measure of the cost of living (*cf.* Bowley, "Measurement of cost of living," *Journal of the Royal Statistical Society*, May 1919, p. 354; and "Cost of living and Wage determination," *Economic Journal*, March 1920, p. 117).

Another method was used in the British Board of Trade's investigation into the cost of living in the United Kingdom, United States, France, Belgium and Germany, which was initiated in 1905 (*cf.* official papers Cd. 3864, Cd. 5609, Cd. 4512, Cd. 5065, Cd. 4032). A comparison was made of the cost of living in the United Kingdom and in each other country on a double basis as follows: It was found that an English housewife purchasing in 1909 in the United

States a week's supply of food as customary in England, would have spent 38% more in the first-named country, the ratio of the costs of living being on this basis 100:138; on the other hand, an American housewife purchasing in England a week's supply of food as customary in the United States would have found her expenses reduced in the ratio 125:100 (Cd. 5609, pp. lxvi., lxvii.). If these ratios had been reciprocal either would measure the differences in the cost of living (so far as food is concerned); as it is, their divergence illustrates the want of definiteness in the problem.

Another method gives, perhaps, the most practical solution, though its adequacy can hardly be proved from theoretic conditions. Obtain typical budgets of expenditure at two dates; compile a new or mean standard of quantities which, item by item, are the averages of the entries in the budgets. Thus, if in one the consumption of 33 lb. of bread is stated, in the other 35 lb., enter 34 lb. in the mean standard; now find the cost of the mean standard at each date and take the ratio of these costs as the measurement of the change in the cost of living.

If all prices rose in the same ratio the methods now described would necessarily yield the same result; the need for choice arises from inequalities of increase, including the case where the goods are no longer in the market as one where the price is indefinitely great. Now if at one date purchases are made so as to maximise the satisfaction in the outlay of the week's housekeeping allowance, as we may reasonably assume, and prices rise irregularly, it is evident that somewhat less will be bought of the commodities which have risen most and more of those which have risen least if a maximum is still obtained, and that consequently the increase in the expenditure necessary to obtain the same satisfaction as before is less than the increase if exactly the same quantities had been purchased. For example, if oranges are doubled in price and bananas increased only one-half, more bananas and fewer oranges will be purchased.

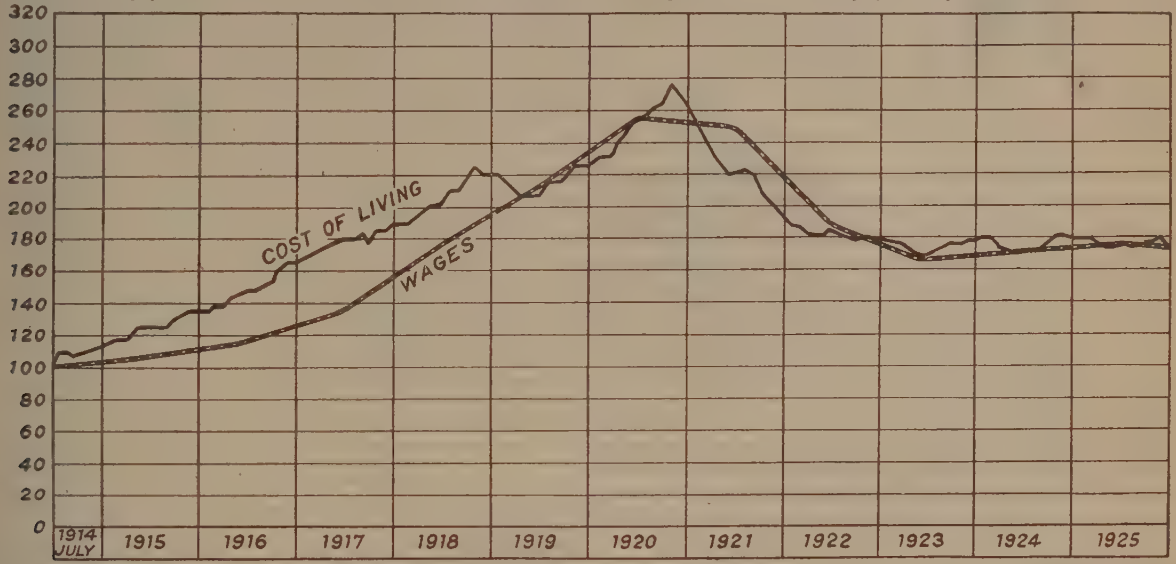

FIG. 1.—Diagram showing percentage changes in the Cost of Living from 1913 to 1925, and movements of time rates or piece earnings in Great Britain and Northern Ireland. The Cost of Living graph is based on figures given by the Ministry of Labour for the first day of each month. The Wages graph is based on figures given in the table in the article on WAGES (*q.v.*) for the normal week in July of each year from 1914 to 1925, and in Jan. 1926. In each graph, July 1914 is taken as equal to 100.

Variations in Content and in Standard.—The problem with which many countries were faced in 1920 and 1921 was in reality not that of preserving a standard of living on the level of 1914, but of adapting themselves to a lower average standard, whatever the fortunes of favoured classes. This may be illustrated by the arrangement of the salaries of civil servants in England in Feb. 1920. At that date the official measurement (on method *b*) of the increase in the cost of living over 1914 was 130%. The full increase of 130% was awarded to persons with a wage of 35s. weekly (£91 5s. per annum) or less, 60% was added to any excess of salary up to £200, and 45% to any excess over £200. Thus a man whose salary was £400 on the pre-War basis received an addition of £273⅞ (130% on £91 5s. = £118⅝, 60% on £108 15s. = £65¼, 45% on £200 = £90), about 68% in all. This increment was increased or decreased by one twenty-sixth part for every complete movement of 5 points in the official index number averaged over certain periods. It appears to have been assumed on the one hand that the expenses of the middle class had not increased so much as indicated by the index number based on working-class expenditure, and on the other that the standard of living must be lowered—the higher the income the greater the fall.

A similar scale was adopted at nearly the same date for railway officials. We are thus led to consider a conventional standard of living which changes from time to time. When there is no reference to a physiological minimum, the cost of living may be regarded as the cost of maintaining the standard customary to the social or occupational class concerned at a given time and place. In this sense the cost of living of Chinese labourers is lower than that of the Americans, though they pay the same prices for commodities. When "cost of living" is used in this sense it should always be accompanied by a description of the standard attained. Thus the British Committee on the Cost of Living in 1918 (Cd. 8980) estimated the average expenditure of working-class families in 1914 and 1918 and at the same time reported on the change of standard. In some of the statistics quoted below a conception of this kind is involved in the figures.

II. CONDITIONS IN VARIOUS COUNTRIES

Great Britain.—In the United Kingdom the basis of the official measurement of the cost of living is that of finding the cost of a standard budget of expenditure at various dates (see *Report on Working-Class Rents and Retail Prices*. Cd. 6955 of 1913, pp. 299 *seq.* and *Labour Gazette*, Feb. 1921). The standard budget was obtained from a collection of 1,944 records of weekly expenditure made in 1904; the average weekly family expenditure was 36s. 10d., of this 22s. 6d. was spent on food, and of the food 18s. 6d. is accounted for in the standard used prior to the War. A somewhat altered basis was taken in 1914. Rice, tapioca, oatmeal, pork, coffee, cocoa, jam, treacle, marmalade, currants and raisins (the expenditure on all of which was about 2s. 1d in 1904) were omitted and fish and margarine added (an addition equivalent to 6d. in each case). It was assumed that, though prices had increased between 1904 and 1914, the relative expenditure (which alone enters into the computation) on the different commodities was unchanged; this assumption is too rigid but not unreasonable, and the facts otherwise known about price movements and consumption show that the error introduced is insignificant.

Relative importance being determined, the next step was to ascertain the movement of prices. Prior to 1914 the records were obtained exclusively for London, but it was shown (Cd. 6955, pp. 299 and 306) that from 1907 to 1912 the average movement was very nearly the same in provincial towns as in London. From Aug. 1914 statements of prices were obtained for 650 towns and villages.

The index numbers of the cost of living, so far as food is concerned, were then obtained by the method *b* described above; prior to 1914, the year 1900 was taken as base, and the prices then equated to 100; from the beginning of the War July 1914 was taken as base.

The index number is in the form $100\times(E_1r_1+E_2r_2+\ldots)\div(E_1+E_2+\ldots)$ where E_1, E_2 . . . are the expenditures on the separate commodities in the standard budget and r_1, r_2 . . . are the ratios of the prices at any particular time to the prices at the basic date. The values actually taken for the E's in 1914 were as in Table I., being proportional to the expenditure.

TABLE I. *Relative Importance of Foods*

Bread	50	Fish	9
Flour	20	Milk	25
Potatoes	18	Butter	41
British Meat		Eggs	19
Beef	24	Cheese	10
Mutton	12	Margarine	10
Imported meat		Tea	22
Beef	24	Sugar	19
Mutton	12		
Bacon	19	Total	334

There are certain weaknesses in the method. It is assumed without explicit evidence, that expenditure on meat was in the proportion 2s. on beef to 1s. on mutton, and that British and foreign meat were of equal importance, while the price ratios taken for meat are for four selected joints only; during the period 1915 to 1919, when the relative quantities available varied and relative prices were altered, these assumptions affect the index numbers. The weight assigned to margarine is arbitrary. The number of eggs consumed (about 12 per household per week) is based on summer records and is no doubt higher than the average for the year.

Rent, Clothing, etc.—Next in importance to food comes rent. The figure included in the index number allows for such increases for rates, repairs, etc., as are legally permissible and is accurate for persons who by remaining in the same house since 1914 have the benefit of the Rents Restriction Acts; the increase for those who have moved must have been very variable and for it no estimate is available.

The cost of clothing, which ranks next to rent in expenditure, is always very difficult to measure owing to the difficulty of defining the garments or stuffs purchased, and of assigning their relative importance in the budget, and also there was great variability in the qualities in the shops during 1914 to 1921. The difficulties can be understood by comparing the estimates and method of the Cost of Living Committee (*loc. cit.*, pp. 21–3) with those of the official index number described in the *Labour Gazette*, April 1921, pp. 178–9; the former found an increase of 96% between July 1914 and the summer of 1918, the latter reaches increases of 210% in June and 240% in Sept. 1918. The differences are partly attributable to the great variability of the increases among the articles in consequence of which the relative importance given to each has great effect, and in this respect the committee's measurement was the more systematic; and partly due to the difficulty of obtaining quotations for the same qualities of goods or in allowing for substitution. The question is too intricate to discuss here; it can only be suggested that the results have little precision, and that the process of obtaining an estimate based on a new budget in which modifications of custom are allowed for is even more necessary than in the case of food.

Fuel and light present little difficulty when a general average for the country is in question since the retail prices of coal and of gas are ascertainable. The variations from north to south in price and consumption and that between winter and summer are not very important, since where coal is dear, gas is used for cooking, and in working-class households one fire is necessary throughout the year for cooking and this also provides heat.

The official index number allows only one-twelfth of the weekly expenditure for all items not already included, or about 1s. 6d. per household in 1914. This sum is exhausted by cleansing materials with a very small margin for tobacco, newspapers, household replacements and fares. Insurance and trade-union subscriptions are not included, nor is alcohol.

The five classes of expenditure now named are combined in the following proportions, stated for clearness on the basis of a pre-War urban weekly expenditure of 37s. 6d. Food 22s. 6d., rent (including rates) 6s., clothing 4s. 6d., fuel and light 3s., sundries 1s. 6d. Here the proportions on food, rent and light rest on good evidence; that on clothing, for which the expenditures vary greatly according to the income and personnel of the family and for which there has never been a satisfactory investigation, is little more than a guess based on vague estimates; that on sundries is the residuum when other expenses are met and is probably too low.

The results for selected dates are as follows:—

TABLE II.
Official Measurement of Cost of Living in Great Britain

	Food	Rent	Clothing	Fuel and Light	Sundries	All Combined
Relative importances	60	16	12	8	4	100
July 1914	100	100	100	100	100	100
July 1919	209	(1)	(1)	(1)	(1)	205 to 210
Dec. 1919	234	(1)	(1)	185	(1)	225
July 1920	258	117	430	230	220	252
Dec. 1920	282	142	305	240	230	269
July 1921	220	145	290	260	210	219
Dec. 1921	195	155	255	230	200	199
July 1922	180	153	240	190	195	184
Dec. 1922	178	150	225	187	180	180
July 1923	162	147	220	182	185	169
Dec. 1923	176	147	220	180	180	177
July 1924	162	147	225	185	180	170
Dec. 1924	180	147	227	185	180	181
July 1925	167	147	230	180	180	173
Dec. 1925	174	148	225	180	180	177

The statistics are for the beginning of each month.

[1] Not stated separately at these dates.

TABLE III. *Index-Number of Retail Prices of Food, Expressed in the Currencies of the Countries*

	1914	1919		1920		1921		1922		1923		1924		1925	
	July	July	Dec.	July	Dec.	July	Dec.	July	Dec.	July	Dec.	July	Dec.	July	Dec.
United Kingdom	100	209	234	258	282	220	195	180	178	162	176	162	180	167	174
France, Paris[1]	100	261	285	373	424	306	323	397	305	321	365	360	404	421	463
Italy, Milan	100	310	395	445	535	506	567	492	513[2]	496	500	508	579	602	660
Switzerland	100	..	..	..	..	210	189	157	155	164	167	168	170	167	163
Netherlands, Amsterdam	100	210	199	217	208	185	152[2]	140	142	136	144[2]	138	150	148	145
Denmark	100	212	..	253	..	236	191	184	180	188	194	200	215	210	177[2]
Sweden	100	310	..	297	..	252	..	179	168	160	164	159	172	169	164
Norway	100	289	299	319	334	295	268	233	215	228	226	248	274	260	221
United States	100	186	193	215	175	145	147	139	144	144	147	140	149	159	163
Canada	100	186	199	227	200	148	148	138	140	137	145	134	142	141	161
British India, Bombay	100	..	..	188	..	174	176	160	157	148	152	151	156	152	151
South Africa	100	139	170	197	188	139	125	116	118	116	118	117	121	120	116
Australia	100	147	158	194	184	161	143	148	146	164	156	149[3]	148	156	156
New Zealand	100	144	155	167	179	164	150	144	139[2]	142	147	148	150	151	154[2]

[1] Fuel and lighting included. [2] These numbers refer to the Jan. following. [3] For June 1924.

It is probable that the increase in cost was exaggerated, at least o the end of 1920, owing to evasion of the higher prices by the substitution of cheaper articles, without lowering the general standard btained. From 1921, however, supplies have been adequate and the inal change in the composition of the budget can hardly have reduced he number effectively by more than five points. The winter is igher than the summer number, partly owing to seasonal dearness, artly owing to the assumption that eggs, etc., are bought in the ame quantities winter and summer. On the average the July number is about 2% below the average for the year. For fine measurements this variation should be taken into account, but in fact the ndex-number is not precise within, say, five points, even for the most eneral purposes, and still less is it a perfectly accurate measurement f the change in the cost of living in particular localities or occupations.

Other Countries.—It is only possible in the space available to state vithout analysis the official statistics of the movements of retail rices of food. In other countries, the numbers are subject to the ame want of precision as in the United Kingdom and are compiled in a similar way. They represent the cost of purchasing from ime to time a defined and unchanged ration estimated as typical of re-War working-class consumption. These numbers are currently ummarised in the *Ministry of Labour Gazette* (London), the *Labor Review* (Washington), and the *International Labour Review* (Geneva) nd for each country in its official publication.

The prices are, of course, strongly affected by the relative value of he currencies in the countries. The result of expressing them on a gold basis may be illustrated as follows, July 1920 being selected s near the date of the maximum of prices:—

TABLE IV.

Retail Food Index Numbers

	July 1920			July 1925		
	Index in Currency	Currency as % of par	Index in gold	Index in Currency	Currency as % of par	Index in gold
Great Britain	258	76·6	198	167	100	167
Paris . .	373	39·4	146	421	24·8	104
Milan . .	445	27·6	123	602	19·0	114
Amsterdam	217	85·5	185	148	100	148
Denmark .	253	58·9	149	210	79	166
Sweden .	297	79	234	169	100	169
United States	215	100	215	159	100	159

Thus, if an American had gone to Paris in July 1925 with $104 he ould have converted them into as many francs as would buy the ood that cost $100 in Paris in July 1914. In New York he would ave needed $159 to purchase food that cost $100 in New York in uly 1914. The great variation in the index from country to country, ven after conversion to a gold basis, is noticeable. The increase is enerally the less the greater the depreciation of currency. (*See* NDEX-NUMBERS; PRICES; WAGES.) (A. L. Bo.)

COSTUME (*see* 7.224).—The changes in women's attire since 1910 complete a development which began about the beginning of the century. A motor-car of 1910 is already a pleasing and reasonably shaped object in comparison with the first automobiles that appeared. But, by the side of a well-designed body of 1925, the coach-work seems clumsy and untidy. The development of women's clothes has been upon parallel lines. In 1900 the figure was distorted into a series of opulent curves. The unhygienic wasp waist made, as it were, the intersection of two ellipses, and the aim of the *couturier* was to emphasise the fullness of the bust and the hips, and the narrowness of the intermediate tract, while a similar contrast was effected on the arms by sleeves that billowed at the shoulders and tightened to a cuff at the wrist.

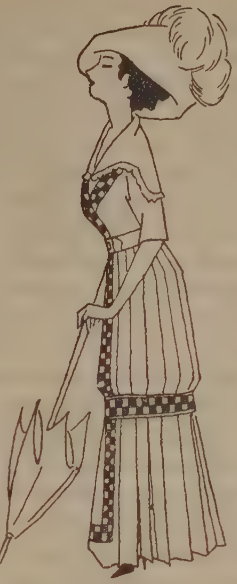

FIG. 1.—Silhouette of 1909–10.

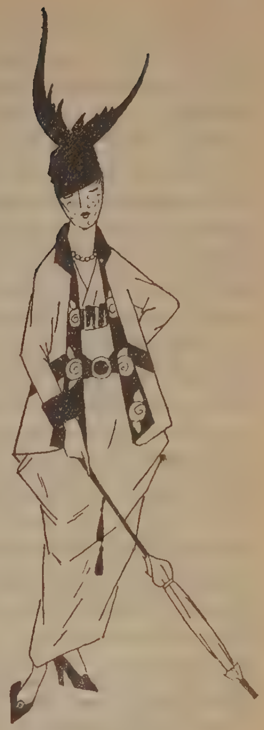

FIG. 2.—"Peg-top" Silhouette of 1914.

By 1910 the *Directoire* influence was firmly established. The arum lily had replaced the hour-glass as the model for a fashionable figure; the waist-line was high, but not pronounced, the hips were attenuated, and very long stays held the body in a gently curved mould over which the dress was tightly drawn. The hair was still puffed out, skirts still reached the ground, and enormous hats crowned the elaborate edifice. The effect did not suggest the real *Directoire* period so much as the still fashionable ornaments of the *Art Nouveau* style. In 1911 the bottom of the skirt was gathered tightly round the ankles in a hobble effect, and gradually the curves grew even less pronounced. The collar which had raised its palisade of bone and whalebone high all round the neck, disappeared at the front and, as if in compensation, rose higher at the back in the Medici shape. In 1912 the first appearance in western Europe of the Russian ballet introduced an oriental influence, better designs in ornament, and a new interest in strong contrasts of colour.

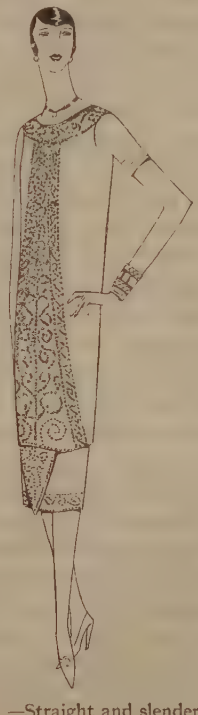

FIG. 3.—Straight and slender evening mode of 1925.

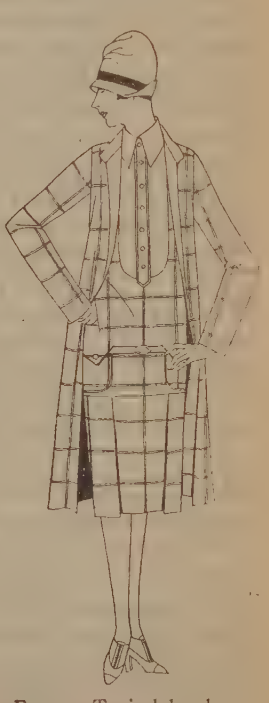

FIG. 4.—Typical day dress of 1925.

Although the so-called *Directoire* silhouette remained general, it was modified by the use of tiers and underskirts, and an unsuccessful attempt was made to make fashionable the Turkish trouser, and the panier. The trouser disappeared but the panier flourished, and in 1913 and 1914 the *Directoire* influence disappeared entirely to make way for a *Louis Quinze* silhouette. But skirts were becoming steadily shorter, and below the paniers they remained narrow. The very full skirt, suggestive of crinoline or farthingale, appeared about the same time in evening dresses, and under the name of *robe de style* has continued ever since. The tube-silhouette, which was afterwards to become general, first appeared, it is interesting to note, in the autumn following the outbreak of the War. Women were being called to do work previously done by men, and the tube reflected the fact.

Fashion and the World War.—But the time was not yet ripe. In 1915 the skirt still reached the boots and the high collar was still worn. But the petticoat began to disappear, the one-piece gown was worn, the waist was lower and shoes were less pointed. In 1916 the conical silhouette was general, being the woman's ideal to approximate to a walking sugar-loaf. The following year saw the success of the *tonneau* or barrel skirt, which, like a column, tapered at its head and base.

The effect of the War upon morals was being denounced; women had the audacity to show their ankles and evening dresses were cut at the back down to the waist. In 1918 the *tonneau* silhouette replaced the *tonneau* skirt and the waist entirely disappeared. In 1920 the short hobble skirt made walking difficult for the chic woman, but in the evening the *robe de style* gave her freedom to dance. A revival of late Victorian fashions produced a momentary taste for bustles, and the more lasting fashion of brushing the hair smoothly and tightly back from the forehead.

The next year saw sleeves disappear from evening dresses, and an increased vogue for the natural figure. Stays began to be discarded, and the straight line finally defeated the Edwardian curve. But it was not until 1923 that the tube-dress, the *cloche* hat, and the short hair arrived. With these, the modern woman presents a stream-line appearance like a modern motor-car. The exaggerated and meaningless ornaments have disappeared. Caprice is confined to a scarf round her neck, a flower on her shoulder, a handkerchief on her wrist, or a jewel on her hat.

The accessories of costume, on the other hand, have taken on a greater importance since 1910. A skirt which hardly reaches the knee makes stockings and shoes of the first importance. Against an unornamented costume the exact colour and shape of the handbag stand out with a boldness which makes its choice a serious affair. Attention is no longer dispersed over a hundred frills and laces, embroideries and buttons, but it is concentrated on a few crucial points. The dresses of 1925 were intended to clothe a woman who read modern books, listened to modern music, and looked at modern pictures. They reflected a new clearness in her sentiment, a new hardness in her intellect, and a new determination to live her life on equal terms with men. Her make-up was intended for adornment rather than disguise, and she attended to it in public. The *couturier* has to reach ever higher standards of excellence; he has ever to justify his modes upon aesthetic grounds. New materials are continually put forth by manufacturers, and the designs woven, printed, and embroidered upon them employ the most accomplished painters of the time. The costume of women is no longer a by-product; it is expressive of civilisation.

The Dress of Men.—During the same period men's clothes have changed comparatively little. Comfort and convenience have been more and more important. The starched collar has been increasingly replaced by the soft collar: brighter colours have been used, and, in the country especially, fancy has been given free play. If women in their neat and simple clothes, short hair, and straight silhouette have become boyish, men have allowed themselves to borrow from women, as witness the fashionable fancy wool pull-overs or jumpers. The differences between the sexes are no longer artificially exaggerated, and the clothes of both sexes reflect the free companionship which replaced the old flatteries, coquetries and artificial relationships. (D. T.)

COTTET, CHARLES (1863–1925), French painter (*see* 7.253), died Sept. 25 1925.

COTTON, SIR HENRY JOHN STEDMAN (1845–1915), Anglo-Indian administrator (*see* 7.254), died in London Oct. 23 1915.

COTTON, JAMES SUTHERLAND (1847–1918), British writer (*see* 7.255), died at Salisbury, England, July 10 1918.

COTTON (*see* 7.256).—Cotton, like all other important industrial commodities, has been profoundly affected by the economic disturbances of the World War and its aftermath.

I. PRODUCTION OF RAW COTTON

In 1911–2 the United States produced a cotton crop of 16,109,000 bales, with linters. This was the first time in history that the American crop had exceeded 13,750,000 bales; and the world cotton harvest was raised to 25,594,000 bales. The next year the American crop fell back to 14,091,000 bales and the world crop to 23,676,000 bales. A slight improvement in 1913–4 made the totals 14,614,000 bales and 24,422,000 bales respectively, but in 1914–5 the American crop established a record with a total output of 16,738,000 bales including linters, carrying the world total to 26,841,000 bales. The average world production for the five years 1910–1 to 1914–5 inclusive was 24,485,000 bales, of which the United States supplied an average of 60%. Egypt supplied an average amount approximating to 1,500,000 bales, falling to 1,298,000 bales in 1914–5, while in India, after a bad year in 1911–2, when production fell to 2,630,000 bales, the balance was restored by two good crops of over 4,000,000 bales in 1913–4 and 1914–5.

The years in which the effect of the World War was seriously felt, as will be seen from Table I., caused an almost universal restriction. The American crops remained under 13,000,000 bales and world crops nearer 20,000,000 than 21,000,000 bales. In 1919–20 the American crop fell to 11,921,000 bales, but this failure was compensated for by an unusually large Indian crop of 4,637,000 bales, which carried the world total for that year to just over 21,000,000 bales. The average world production for this cycle of five years was 20,593,000 bales, of which the United States contributed an average of 59%.

The following table illustrates the comparative steadiness of production during these first two cycles, as a contrast to the extreme fluctuations of the next five years, from 1920–1 to 1924–5:—

TABLE I. *World's Cotton Crops, 1910–1 to 1924–5*
(In Thousands of Bales of 500 Lb., Approx.)

Year	American[1]	Egyptian	Indian	Others	Total
1910–1 . .	11,966	1,515	3,082	5,330	21,893
1911–2 . .	16,109	1,485	2,630	5,370	25,594
1912–3 . .	14,091	1,507	3,688	4,390	23,676
1913–4 . .	14,614	1,537	4,052	4,219	24,422
1914–5 . .	16,738	1,298	4,167	4,638	26,841
1915–6 . .	12,013	961	2,990	4,465	20,429
1916–7 . .	12,664	1,022	3,602	3,681	20,969
1917–8 . .	12,345	1,262	3,200	3,274	20,081
1918–9 . .	12,817	964	3,182	3,355	20,318
1919–20 . .	11,921	1,114	4,637	3,475	21,147
1920–1 . .	13,700	1,206	2,845	2,942	20,693
1921–2 . .	8,360	972	3,570	2,858	15,760
1922–3 . .	10,320	1,243	4,458	3,465	19,486
1923–4 . .	10,811	1,306	4,129	3,824	20,070
1924–5 . .	14,497	1,455	4,846	4,784	25,582

[1] Including linters.

It will be seen that after a good average year in 1920–1 production fell sharply in the following season to a low total of 15,760,000 bales. Thereafter there was a sharp recovery, at first much more marked in cotton fields outside the United States, but with that country coming to the fore again in 1924–5. The average world crop during this period was 20,318,000 bales, the United States proportion falling to 56%.

Two distinct causes were operating to cause these wide variations in the supply of cotton after the World War. One was the general industrial and financial disturbance which followed the War. The post-War boom and slump, the fluctuations in the value of national currencies and in the relative prices of the staple commercial commodities, impoverishment of the population in large areas of the world, and the general feeling of political instability contributed to a restriction of the world's capacity to purchase and consume cotton goods. Thus in 1921, the carry-over of unconsumed American cotton at the end of the season amounted to no less than 9,944,000 bales. It was clear that the United States had produced in 1920–1 a comparatively arge crop of cotton which, owing to the world-wide financial stringency, had only been partially consumed.

Prices.—The average price received by the American cultivator for the crop of 1920 was 15·89 cents per lb. of lint as compared with an average of 35·36 cents per lb. for the crop in 1919. The winter and summer of the 1920–1 season saw cotton quoted well below 15 cents in New York, and there were occasions when futures fell below 11 cents. In the circumstances, a restriction of acreage under cultivation in the United States was a natural economic development, and the area planted for the 1921 crop was no more than 31,678,000 acres. From about 1915 until the end of the 1920–1 season, the chief influence at work was a restriction of consumption, which, with varying force at different seasons, caused a restriction in the quantity of raw material produced in the United States.

The Boll Weevil.—From 1921 onwards, however, a second factor came into play, namely, the boll weevil, and up to 1925 the position was reversed, for the restriction in the size of the American crop imposed upon the world a severe limitation of the volume of consumption. In 1921–2, on a harvested acreage of 30,509,000, the yield per acre was only 124·5 lb. as compared with an average of 179 lb. in the previous 10 years. The total crop was only 7,978,000 bales (exclusive of linters) which was the smallest yield in the United States since 1895. The weather had been favourable to the spread of the boll weevil and it was estimated that pests had destroyed 109·1 lb. of cotton per acre. The next few years aroused a fear that as long as scientists could find no adequate cheap method of exterminating the boll weevil, the United States would continue to grow deficient crops, and that the deficiency would not be filled until large cotton fields had been developed in other parts of the world.

American Crops.—The history of the American crop during these post-War years can be illustrated by the following table:—

TABLE II. *The American Cotton Crop (Exclusive of Linters)*

	(In thousands of acres)			(In thousands of bales)		
	Acreage Planted	Acreage Harvested	Yield per Acre (lb.)	Total Yield	World Consumption	Balance of Production over Consumption
1921–2	31,678	30,509	124·5	7,978	12,488	−4,510
1922–3	34,016	33,036	141·3	9,729	12,388	−2,659
1923–4	38,701	37,123	130·6	10,171	10,926	−755
1924–5	42,641	41,360	157·4	13,639	13,256	+383
1925–6[1]	48,160	45,945	162·3	15,603	..	..

[1] December estimates.

Annual Averages

	1906–7 to 1910–1	1911–2 to 1915–6	1916–7 to 1920–1	1921–2 to 1924–5
Total Production (bales) . . .	11,753,619	13,999,687	11,843,028	10,379,294
East of Mississippi river per cent of total . . .	55·6	54·7	50·5	42·8
West of Mississippi river per cent of total . . .	44·4	45·3	49·5	57·2
Exports from U.S.A. (bales) . . .	7,550,292	8,944,586	5,733,688	5,686,964

(Note: Seasons ending Aug. 31 up to 1915. Thereafter July 31.)

The lowness of the yield per acre in the American cotton belt during the years 1921, 1922 and 1923 was to a considerable extent attributable to the ravages of the boll weevil (*q.v.*). When, in 1923–4, on a largely increased acreage the American crop only amounted to less than 11,000,000 bales, the future outlook was serious. As shown in Table II., American cotton was being consumed, in spite of high prices, at a rate which was considerably larger than production, and the reserves were disappearing at a faster rate than other cotton-growing areas could possibly be developed. The history of 1924 and 1925, however, shows that, although the boll weevil may remain endemic in the United States, the decisive factor is still the weather, while a contributory factor of some importance is the great and speedy expansion of acreage which has been proved possible. Rainy weather provides the most favourable conditions for the propagation of the weevil, but the combination of extremely low temperatures in winter and hot dry weather in summer, or even the latter without the former, has kept the weevil within bounds and has enabled the United States to grow large crops once more. The situation has not been entirely free from anxiety, for excessive droughts are destructive to the cotton plant as well as to the weevil, but both in 1924 and in 1925 the advent of rain has been in time to save the crop.

Effect of High Prices.—The victory over the boll weevil made the years 1924–5 a landmark in cotton history, for they removed the fear that the United States would be a dwindling factor in the production of raw material. The high prices which had been ruling since the crop failure of 1921 were an incentive to experiments in cotton-growing. There were obvious advantages to be gained by the dispersion of cultivation, so that unfavourable weather conditions in one part of the globe need not necessarily mean a calamity to 50% of the world's cotton harvest. Costs of cultivation also were becoming a serious matter in the United States and for the rest of the world. If cotton prices fell below producing costs in any one year, there was a general agitation to restrict the acreage placed under cultivation in the next year. American costs of cotton cultivation, owing to the generally high level of wages and the falling-off in the yield per acre, were higher than in most other cotton areas of the world. Consequently, throughout the tropical and sub-tropical belt, both state and private enterprise have been actively extending the cultivation of cotton. The actual results by the 1925–6 season were not commensurate with the effort made, but it was possible to foresee a time when the basis of cotton prices would be the average world cost of cultivation and not the average cost in the United States alone.

The incentive to grow cotton in order to reap the benefit of high prices has also been operative in the United States, where, owing to a high development of agricultural knowledge, of labour supply, of means of transport and of marketing facilities, progress has been much faster than in all other areas combined. Thus, while in 1921 the area planted under cotton in the United States was 31,678,000 ac., the 1925 area was estimated at no less than 48,160,000 ac., while in the same period the expansion of area actually harvested increased from 30,509,000 to 45,945,000 acres. Whether the United States will maintain this increase depends on the yield per acre, for since the world crops of 1925–6 are considerably larger than the potential consumption of the 1925–6 season, the prices ruling during the spring of 1926 may be too severe a test for the American grower.

World Production.—This increase in American acreage and harvest is an important matter when compared with the slowness of progress in other fields. Table III. shows the position in these countries from 1910 to 1924.

An increase from 10,306,000 bales in 1910 to 10,747,000 bales in 1924 does not appear very much. Russia, however, is a drawback to any compilation of progress made, and if the Russian figures are excluded there is an increase of more than 1,000,000 bales. It was clear in 1925 that these figures would increase in the near future, but the chief consideration is that the development of irrigation and transport services, etc., during the past few years is only beginning to show results. Egypt is the one country where cotton cultivation may be regarded as approximately stationary, the production of a specialised type of cotton and the maintenance of a price premium over American qualities being considered of greater importance than an expansion of the total yield.

In India, the possibilities of a considerable enlargement in the production of a higher quality of cotton are considered promising. The problem of agricultural labour supply at a cheap rate does not arise, although the yield per acre is rather low. The two other main areas of prospective development are Africa and South America. The Sudan, Nigeria and Uganda are the chief producing countries in Africa outside of Egypt, and in all three large projects for irrigation and railway or road transport are under way. In the Union of South Africa and in Southern Rhodesia considerable interest is also being taken, and, in the absence of other crops showing an equivalent or larger profit, early progress is to be expected. In South America, the chief centres of cultivation are Brazil, Argentina and Peru. The last named is an established cotton producing country of some importance. The other two, however, are together probably the foremost potential fields of the world, providing the opportunities are properly exploited.

TABLE III. *World Production of Cotton Outside the United States (in Thousands of Bales of 478 Lb. Net) Estimates of the U.S. Dept. of Agriculture*

	India	Russia	Egypt	China	Brazil	Mexico	Peru	All other countries	Totals
1910	3,254	1,006	1,555	3,467	297	200	88	439	10,306
1911	2,730	969	1,530	3,437	300	160	96	441	9,663
1912	3,702	946	1,554	3,931	348	240	112	507	11,340
1913	4,239	1,026	1,588	4,000	397	205	133	515	12,103
1914	4,359	1,270	1,337	4,500	387	108	129	462	12,552
1915	3,128	1,512	989	3,000	282	95	113	378	9,497
1916	3,759	1,199	1,048	1,534	281	103	127	344	8,395
1917	3,393	634	1,304	2,092	345	135	125	345	8,373
1918	3,328	161	999	3,053	339	203	142	347	8,572
1919	4,853	81	1,155	2,599	506	199	155	415	9,963
1920	3,013	58	1,251	1,883	370	188	164	508	7,435
1921	3,748	43	902	1,517	505	147	157	357	7,376
1922	4,348	55	1,170	2,048	553	178	137	454	8,943
1923	4,247	321	1,213	1,992	576	136	212	663	9,360
1924	5,069	397	1,276	2,176	605	213	181	830	10,747

The Future.—The future of cotton-growing in these new fields, including the new cotton areas of the United States, must depend very largely on the course of prices, *i.e.*, on the maintenance of prices at a level which brings in a margin of profit after all costs of cultivation have been met. It is generally thought, however, that costs are much higher in the United States than in those areas where native tropical labour is available, but unfortunately no reliable comparative data exist. The United States Dept. of Agriculture is practically alone in making a detailed research into costs. An examination was made for 1923 of the results obtained by 2,519 widely dispersed cotton farms. Of these, 407 were estimated to present a reasonable return with yields averaging 124 lb. per acre. The average net cost of producing cotton on these farms was 22 cents per lb. of lint, and the average price received in that year was 30 cents. In subsequent years the improvement in the yield per acre would have reduced the costs, but it is not yet known whether the reduction in prices does not exceed the advantage gained. A price of 22 cents, however, is popularly regarded as adequate for most other cotton fields, although not holding out the prospect of large profits which has so far been the main stimulus.

There is therefore a certain correlation between the quantity of cotton produced, plus the reserve carried over from one season to another, and the prices ruling during the season. The history of prices during the period under review is shown in the table (IV.) of average seasonal quotations compiled by Prof. J. A. Todd.

Crop Forecasting.—A factor, however, which disturbs the correlation between price and cultivation is the system of crop forecasting which has been set up by the United States Dept. of Agriculture. Throughout the growing and picking season, *i.e.*, from June to Jan., the course of prices is governed by the official crop reports issued from Washington, and, starting as they do some time before the cotton plant has sprouted, there is often a wide variation between the early official indications and the final yield. The crop reporting system, as established by 1925, entailed a preliminary estimate of acreage planted and in cultivation on June 25, together with an estimate of the condition of the crop as expressed by a percentage of "normal" conditions for that date. From mid-July until the beginning of Nov., these condition reports are issued twice a month, accompanied by an indication of the prospective total yield as calculated at the date of the report, and accompanied also from the beginning of Aug. by the fortnightly ginning returns issued by the bureau of the census. The beginning of Dec. also brings a revision of the acreage estimate, together with an estimate of acreage harvested, which is again revised in the following June. The final ginning return is issued in March. The collection of crop information is elaborate, and probably as complete as can be expected under the circumstances. It works well in seasons when the conditions keep fairly close to the average condition of previous seasons but it breaks down when there is a wide deviation from the average. The frequency with which reports are issued, and the complicated method of compilation, has tended to exasperate the cotton market, and some change is looked for in 1926.

TABLE IV. *Liverpool Prices (Pence per Lb.)*

	American	Indian	Egyptian
	Fully Middling	No. 1. Good Oomra	F.G.F. Brown
1910–1	7·84	6·78	10·75
1911–2	6·09	5·44	9·56
1912–3	6·76	5·91	9·79
1913–4	7·27	5·62	9·45
1914–5	5·22	4·19	7·34
1915–6	7·51	5·79	10·42
1916–7	12·33	9·92	21·56
			F.G.F. Sakellaridis
1917–8	21·68	16·10	30·97
1918–9	19·73	17·15	27·85
1919–20	25·31	18·05	60·34
1920–1	11·89	8·21	30·24
1921–2	11·37	8·72	19·75
1922–3	14·92	10·25	17·29
1923–4	17·66	12·37	21·55
	Middling		
1924–5	13·76	11·04	29·82

II. CONSUMPTION

Turning from the question of supply to that of consumption, the first development to be considered is the growth of cotton manufacturing capacity. On this point accurate figures are available only for spinning spindles. Weaving capacity, as expressed in loom figures, is available for several countries, but in most of them only as an unreliable guess. The changes which have occurred since 1908 in the world distribution of cotton spindles are shown in Table V. The gaps do not indicate an absence of spindles but an absence of data.

The world's total grew from 128,923,000 spindles in 1908 to 161,363,000 in 1925. In Great Britain there was no considerable cotton-mill building between 1908 and 1925. The French figures were swollen in post-War years by the separation of Alsace-Lorraine from Germany, while the post-War Russian figures are deceptive in that a high proportion of the unemployed spindleage must be in a bad state of disrepair. The European and world totals for 1920 are not strictly comparable, as no allowance is made for the Russian spindles which must have been in operation in that year. Allowing for this discrepancy and for the destruction of spindleage in Russia, an examination of the above figures shows that the only important changes in Europe between 1913 and 1925 are territorial changes affecting France, Germany, Austria, Czechoslovakia, Poland and Russia. These changes are more important than mere alterations of nationality, for important industries have been separated, by means of tariffs, from the markets which they were built up to serve.

TABLE V. *Distribution of Cotton Spindleage*[1] *(000's Omitted)*

Countries	Aug. 31 1908	Aug. 31 1913	July 31 1920	July 31 1925
Europe				
Great Britain	52,818	55,653	58,692	57,116
France	6,731	7,400	9,400	9,428
Germany	9,883	11,186	9,400	9,500
Russia	7,855	9,213	...	7,246[2]
Italy	4,181	4,600	4,514	4,771
Czechoslovakia	...	...	3,584	3,471
Spain	1,850	2,000	1,800	1,813
Belgium	1,162	1,492	1,572	1,788
Switzerland	1,493	1,398	1,536	1,517
Poland	...	...	1,400	1,172
Austria	4,026	4,909	...	1,038
Holland	396	479	597	817
Sweden	390	534	670	555
Portugal	450	480	482	503
Finland	...	...	240	253
Denmark	78	90	117	78
Norway	75	75	73	58
Total Europe	91,388	99,509	94,077	101,124
Asia				
India	5,500	6,084	6,690	8,500
Japan	1,637	2,300	3,690	5,292
China	...	...	1,600	3,350
Total Asia	7,137	8,384	11,980	17,142
America				
U.S.A.	27,846	31,505	35,872	37,937
Canada	795	855	1,200	1,319
Mexico	...	...	720	814
Brazil	...	...	1,600	1,950
Total America	28,641	32,360	39,392	42,020
Sundries	1,757	3,200	250	1,077
Grand Total	128,923	143,453	145,699	161,363

[1] Doubling spindles excluded. [2] Only 4,203,056 actually in use.

Manufacturing Capacity.—For actual growth of manufacturıg capacity, it is necessary to look further afield to regions which ere encouraged to expand by the disturbance of shipping and urope's concentration on war supplies between 1914 and 1918. pindles in India increased from 6,084,000 in 1913 to 8,500,000 n 1925. Japan showed an increase from 2,300,000 spindles in 913 to 5,292,000 in 1925, while a similar rate of progress was naintained by China. Amongst American countries, Canada xpanded considerably, but the United States accounted for a rger increase than any other individual country in the world. he growth of the United States spindleage from 31,505,000 pindles in 1913 to 37,937,000 spindles in 1925, coinciding with he decline in the United States cotton crop, aroused the fear hat the United States would soon be needing most of the coton produced there, leaving only a negligible surplus for export. he development of the United States was also remarkable in hat the growth of manufacturing capacity was located chiefly n the southern or cotton-growing states which, owing to atural advantages in freight, labour and power costs, raised a erious problem of competition for the older industry located n New England.

Manufacturing plant, however, is an illusory advantage for ountries which are unable to use it. This failure to find full mployment has been an important problem since the World Var, but unfortunately no comparative statistics are available f the production of cotton cloth in the various countries of the vorld. The nearest approach to accuracy is to be found in the ables of cotton consumption on the following page. These are aluable for comparing the position of individual countries at lifferent dates, but in comparing one country with another a enerous allowance must be made for the fact that the finer the quality of production the smaller the quantity of raw material eeded. Thus Great Britain, working full time in 1912–3, onsumed 4,274,000 bales of cotton on 55,500,000 spindles, vhile the United States, with only 31,500,000 spindles, consumed 5,786,000 bales.

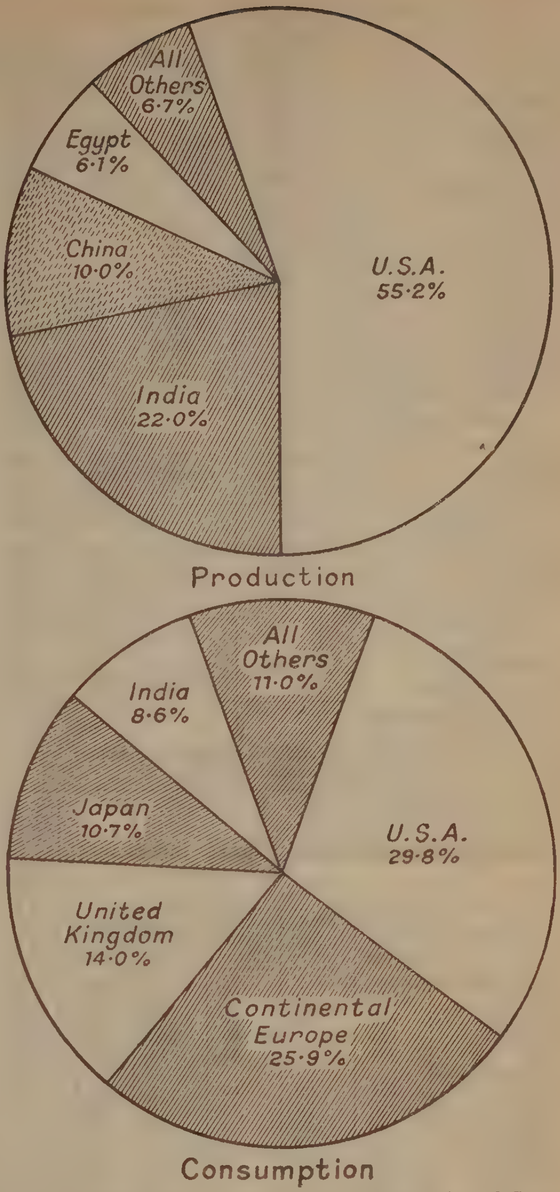

FIG. 1.—Total world production and consumption of Cotton. (Annual average 1922–3 to 1924–5.)

The annual averages compiled in Table VII. show that after ignoring the countries which have lost or gained territory the only countries which are on a lower plane of manufacturing activity are Great Britain, Italy and Scandinavia, but this reduction is sufficient to cause a slight diminution in the world total of average consumption. The most conspicuous instances of an increase in activity are afforded by the United States and Japan, while China would presumably figure in this list if pre-War statistics had been available. The small increase in India's average consumption can be explained by the irregularity of employment and the periodic over-production of cotton goods.

The decline in British consumption is largely due to the growth of manufacturing capacity in other countries, especially in countries like India and China, which, however, still provide the two largest individual markets for British cotton goods. The high costs of labour in Britain, the restriction of working hours, the financial disturbances of the post-War era and the high cost of raw material have also contributed to the restriction of an

TABLE VI. *World's Cotton Consumption*
(*In Thousands of Bales*)

	Season 1907–8	Season 1912–3	Season 1920–1	Season 1924–5
Great Britain	3,842	4,274	2,024	3,235
France	950	1,010	725	1,122
Germany	2,106	1,700	897	1,211
Russia	1,964	2,508	773	1,084
Italy	1,027	790	795	1,002
Czechoslovakia	..	..	260	484
Spain	343	358	297	352
Belgium	212	257	211	305
Switzerland	95	98	82	108
Poland	..	..	134	209
Austria	740	837	94	136
Holland	77	85	106	136
Sweden	88	114	71	83
Portugal	81	79	91	75
Finland	..	..	29	28
Denmark	21	25	11	18
Norway	11	11	7	10
Total Europe	..	..	6,607	9,598
India	2,195	2,177	2,243	2,440
Japan	1,024	1,589	2,122	2,459
China	(1)	(1)	1,072	1,610
Total Asia	..	..	5,437	6,509
U.S.A.	4,575	5,786	4,859	6,127
Canada	115	113	149	161
Mexico	(1)	(1)	120	193
Brazil	(1)	(1)	445	533
Total America	..	..	5,573	7,014
Sundries	708	1,121	39	173
Grand Total	20,174	22,932	17,656	23,294

[1] Included in sundries.

TABLE VII. *World's Consumption of Cotton*
(*In Thousands of Bales*)

Average of Five Seasons, Aug. 1 1920 to July 31 1925						Average of Five Seasons, Sept. 1 1908 to Aug. 31 1913
Countries	American cotton	East Indian cotton	Egyptian cotton	Sundries	Total of all kinds	
Great Britain	1,982	117	373	250	2,722	3,858
France	736	143	84	62	1,025	985
Germany	778	211	41	23	1,052	1,737
Russia	134	..	16	568	718	2,229
Italy	584	250	41	11	886	910
Czechoslovakia	261	80	12	5	358	..
Spain	246	70	23	6	346	334
Belgium	130	126	4	6	265	227
Switzerland	55	8	30	1	95	93
Poland	145	32	6	10	194	..
Austria	70	42	3	1	117	822
Holland	79	23	..	1	103	83
Sweden	76	3	1	..	80	103
Portugal	48	..	2	33	82	69
Finland	30	..	..	..	30	..
Denmark	18	1	..	..	19	23
Norway	7	..	..	..	7	11
Total Europe	5,379	1,106	636	977	8,099	..
India	25	2,195	7	38	2,263	2,183
Japan	682	1,530	30	132	2,373	1,392
China	95	304	1	1,052	1,451	..
Total Asia	802	4,029	38	1,222	6,087	..
U.S.A.	5,575	20	144	84	5,823	5,128
Canada	158	..	1	..	159	122
Mexico	25	..	1	121	146	..
Brazil	..	..	..	501	501	..
Total America	5,758	20	146	706	6,629	
Sundries	19	9	11	76	115	1,092
Grand Total	11,958	5,164	831	2,981	20,930	21,401

industry which is dependent largely on its export trade. In the meantime, the U.S. industry, with a prosperous and protected home market, has expanded, being dependent on the export trade only for the disposal of surplus production. Further expansion of manufacturing capacity, however, must necessitate greater attention to exports. In the interchange of cotton goods between nations, however, Great Britain maintains a long lead, although her position in several markets is seriously assailed by Japan and Italy.

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COTTON SEED: *see* OILS, FATS AND SOAPS.

COUÉ, EMILE (1857–1926), French psychotherapeutist, was born at Troyes, France, on Feb. 26 1857. From 1882 to 1910 he was a chemist at Troyes, and studied hypnotism and suggestion from 1901 onwards with Bernheim and Liébault. He then developed his own psychotherapeutical method of healing. In 1910 he established a free clinic at Nancy and there put his theories into practice. Coué's system of therapeutics deals principally with the power of imagination as opposed to that of the will and he claimed that by means of auto-suggestion ideas which tend to cause illness and disease may be eliminated from the will. He further claimed to have effected organic changes. Coué invariably stated with emphasis that he was not primarily a healer but one who taught others to heal themselves. His teaching and methods became widely known and he delivered lectures in England and the United States. His famous formula, "Every day, and in every way, I am becoming better and better," is now proverbial (*see* PSYCHOTHERAPY). He died at Nancy, July 2 1926. See C. Baudouin, *Suggestion and Auto-suggestion* (1920).

COUPERUS, LOUIS (1863–1923), Dutch writer, was born at The Hague June 10 1863 (*see* 8.728b). His early boyhood was spent in the Dutch East Indies, where his father was a prominent government official. His first novel *Eline Vere*, written under the influence of Tolstoy, appeared in 1889, and was followed by *Noodlot* (The Footsteps of Fate) in 1894 and *Extaze*, the first of his novels to be translated into English (1892). He next produced certain imaginative and idealistic works, such as *Majesteit* (1895) and several volumes of prose poems. The work by which he is best known to the English-speaking world is the series of "Books of the Small Souls," four novels entitled *Die Kleine Zielen* (*The Small Souls*), *Het Late Leven* (*The Later Life*), *Zielenschemering* (*The Twilight of the Soul*), *Het Helge Weten* (Eng. version *Dr. Adriaan*) which together with *Van Oude Menschen, de dingen de voorbijgaan* (*Old People and the Things that Pass*, Eng. version 1919) raised him to the first rank of European novelists. Couperus travelled much in Greece and Italy and embodied his classical researches in historical romances such as *De Berg van Licht* (*The Mountain of Light*), *De Komedianten* (*The Comedian*) and mythological romances such as *Dionyzos* (1905) and *Herakles* (1913), as well as volumes of essays, sketches and short stories. The greater part of his work has been rendered into English by A. Teixeira de Mattos. His historical novel *Iskander* (concerning Alexander the Great) appeared in 1920. He died at De Steeg, near Arnhem, Holland, July 16 1923.

COURTHOPE, WILLIAM JOHN (1842–1917), British writer (*see* 7.327), died at Wadhurst, Sussex, April 10 1917. A volume of verse, *The Country Town and other Poems*, with a prefatory

Iemoir of him by A. O. Prickard, appeared in 1920. See also W. Mackail, *W. J. Courthope* (1919).

COURTNEY, LEONARD HENRY COURTNEY, 1ST BARON 832–1918), British politician (*see* 7.328), died in London Iay 11 1918, when his title became extinct. His brother, Villiam Prideaux Courtney, died in London Nov. 14 1913.

COURTNEY, WILLIAM LEONARD (1850–), British jour- alist, was born at Poona Jan. 5 1850 and was educated at ath and University College, Oxford. He was elected fellow of Ierton College in 1872 and of New College in 1876. In 1890 he ft Oxford and joined the editorial staff of *The Daily Telegraph*, ondon, where he spent many years as literary editor and dra- iatic critic. He edited *Murray's Magazine* for a short time in 890–1 and became editor of *The Fortnightly Review* in 1894. Iis numerous published works include *Studies on Philosophy* 882); *Life of John Stuart Mill* (1889); *Kit Marlowe* (a drama n blank verse produced at the St. James's Theatre, London, n 1893); *The Feminine Note in Fiction* (1904); *The Literary Man's ible* (1907); *The Soul of a Suffragette* (1913); *The Literary Ian's New Testament* (1915); *Old Saws and Modern Instances* 918); *The Passing Hour* (1925). He retired from editorial ork on *The Daily Telegraph* in 1924.

COVENANT.—The Covenant of the League of Nations formed art I. of the draft Treaties of Peace presented to the delegates f the German Empire at Versailles on May 7, and to those of ustria at Saint-Germain on June 2 1919. It was subsequently ncorporated in all the Treaties of Peace with other belligerents. t was provided that these treaties should come into force as oon as they had been ratified by Germany and Austria respec- vely, and by three of the Principal Allied and Associated Powers. he Principal Allied and Associated Powers comprised the Brit- h Empire, France, Italy, Japan and the United States of Amer- a. The following articles embody (*in italics*) an amendment of rticle 6, in force from Aug. 13 1924, and amendments of Articles 2, 13 and 15, in force from Sept. 26 1924.

THE High Contracting Parties,

In order to promote international co-operation and to achieve nternational peace and security—

by the acceptance of obligations not to resort to war,

by the prescription of open, just and honourable relations between nations,

by the firm establishment of the understandings of international law as the actual rule of conduct among governments,

and by the maintenance of justice and a scrupulous respect for all Treaty obligations in the dealings of organised peoples with one another,

agree to this Covenant of the League of Nations.

Article 1.—The original Members of the League of Nations shall e those of the signatories which are named in the Annex to this Covenant, and also such of those other States named in the Annex as hall accede without reservation to this Covenant. Such accession hall be effected by a Declaration deposited with the Secretariat vithin two months of the coming into force of the Covenant. Notice hereof shall be sent to all other Members of the League.

Any fully self-governing State, Dominion or Colony not named n the Annex may become a Member of the League if its admission s agreed to by two-thirds of the Assembly, provided that it shall give ffective guarantees of its sincere intention to observe its inter- ational obligations, and shall accept such regulations as may be rescribed by the League in regard to its military, naval and air orces and armaments.

Any Member of the League may, after two years' notice of its ntention so to do, withdraw from the League, provided that all its nternational obligations and all its obligations under this Covenant hall have been fulfilled at the time of its withdrawal.

Article 2.—The action of the League under this Covenant shall be ffected through the instrumentality of an Assembly and of a Coun- il, with a permanent Secretariat.

Article 3.—The Assembly shall consist of representatives of the Members of the League.

The Assembly shall meet at stated intervals and from time to ime, as occasion may require, at the seat of the League, or at uch other place as may be decided upon.

The Assembly may deal at its meetings with any matter within he sphere of action of the League or affecting the peace of the world.

At meetings of the Assembly each Member of the League shall have one vote and may have not more than three representatives.

Article 4.—The Council shall consist of representatives of the Principal Allied and Associated Powers, together with representatives of four other Members of the League. These four Members of the League shall be selected by the Assembly from time to time in its discretion. Until the appointment of the representatives of the four Members of the League first selected by the Assembly, representatives of Belgium, Brazil, Spain and Greece shall be members of the Council.[1]

With the approval of the majority of the Assembly, the Council may name additional Members of the League whose representatives shall always be members of the Council; the Council, with like approval, may increase the number of Members of the League to be selected by the Assembly for representation on the Council.[2]

The Council shall meet from time to time as occasion may require, and at least once a year, at the seat of the League, or at such other place as may be decided upon.

The Council may deal at its meetings with any matter within the sphere of action of the League or affecting the peace of the world.

Any Member of the League not represented on the Council shall be invited to send a representative to sit as a member at any meeting of the Council during the consideration of matters specially affecting the interests of that Member of the League.

At meetings of the Council, each Member of the League represented on the Council shall have one vote, and may have not more than one representative.

Article 5.—Except where otherwise expressly provided in this Covenant or by the terms of the present Treaty, decisions at any meeting of the Assembly or of the Council shall require the agreement of all the Members of the League represented at the meeting.

All matters of procedure at meetings of the Assembly or of the Council, including the appointment of Committees to investigate particular matters, shall be regulated by the Assembly or by the Council and may be decided by a majority of the Members of the League represented at the meeting.

The first meeting of the Assembly and the first meeting of the Council shall be summoned by the President of the United States of America.

Article 6.—The permanent Secretariat shall be established at the seat of the League. The Secretariat shall comprise a Secretary-General and such secretaries and staff as may be required.

The first Secretary-General shall be the person named in the Annex; thereafter the Secretary-General shall be appointed by the Council with the approval of the majority of the Assembly.

The secretaries and staff of the Secretariat shall be appointed by the Secretary-General with the approval of the Council.

The Secretary-General shall act in that capacity at all meetings of the Assembly and of the Council.

The expenses of the League shall be borne by the Members of the League in the proportion decided by the Assembly.

Article 7.—The seat of the League is established at Geneva.

The Council may at any time decide that the seat of the League shall be established elsewhere.

All positions under or in connection with the League, including the Secretariat, shall be open equally to men and women.

Representatives of the Members of the League and officials of the League, when engaged on the business of the League, shall enjoy diplomatic privileges and immunities.

The buildings and other property occupied by the League or its officials or by representatives attending its meetings shall be inviolable.

Article 8.—The Members of the League recognise that the maintenance of peace requires the reduction of national armaments to the lowest point consistent with national safety, and the enforcement by common action of international obligations.

The Council, taking account of the geographical situation and circumstances of each State, shall formulate plans for such reduction for the consideration and action of the several governments.

Such plans shall be subject to reconsideration and revision at least every ten years.

After these plans shall have been adopted by the several governments, the limits of armaments therein fixed shall not be exceeded without the concurrence of the Council.

The Members of the League agree that the manufacture by private enterprise of munitions and implements of war is open to grave objections. The Council shall advise how the evil effects attendant upon such manufacture can be prevented, due regard being had to the necessities of those Members of the League which are not able to manufacture the munitions and implements of war necessary for their safety.

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[1] The Second Assembly, Oct. 5 1921, proposed an amendment by which the following clause should be inserted between the second and third paragraphs:

"The Assembly shall fix by a two-thirds majority the rules dealing with the election of the non-permanent members of the Council, and particularly such regulations as relate to their term of office and the conditions of re-eligibility." This amendment had not come into force in April 1926.

[2] The number of members of the Council selected by the Assembly was increased to six instead of four by a resolution of Sept. 25 1922.

The Members of the League undertake to interchange full and frank information as to the scale of their armaments, their military, naval and air programmes and the condition of such of their industries as are adaptable to warlike purposes.

Article 9.—A permanent Commission shall be constituted to advise the Council on the execution of the provisions of Articles 1 and 8 and on military, naval and air questions generally.

Article 10.—The Members of the League undertake to respect and preserve, as against external aggression, the territorial integrity and existing political independence of all Members of the League. In case of any such aggression or in case of any threat or danger of such aggression, the Council shall advise upon the means by which this obligation shall be fulfilled.

Article 11.—Any war or threat of war, whether immediately affecting any of the Members of the League or not, is hereby declared a matter of concern to the whole League, and the League shall take any action that may be deemed wise and effectual to safeguard the peace of nations. In case any such emergency should arise, the Secretary-General shall, on the request of any Member of the League, forthwith summon a meeting of the Council.

It is also declared to be the friendly right of each Member of the League to bring to the attention of the Assembly or of the Council any circumstance whatever affecting international relations which threatens to disturb international peace or the good understanding between nations upon which peace depends.

Article 12.—The Members of the League agree that, if there should arise between them any dispute likely to lead to a rupture they will submit the matter either to arbitration *or judicial settlement* or to enquiry by the Council, and they agree in no case to resort to war until three months after the award by the arbitrators *or the judicial decision*, or the report by the Council. In any case, under this Article the award of the arbitrators *or the judical decision* shall be made within a reasonable time, and the report of the Council shall be made within six months after the submission of the dispute.

Article 13.—The Members of the League agree that, whenever any dispute shall arise between them which they recognise to be suitable for submission to arbitration *or judicial settlement*, and which cannot be satisfactorily settled by diplomacy, they will submit the whole subject-matter to arbitration *or judicial settlement.*

Disputes as to the interpretation of a Treaty, as to any question of international law, as to the existence of any fact which, if established, would constitute a breach of any international obligation, or as to the extent and nature of the reparation to be made for any such breach, are declared to be among those which are generally suitable for submission to arbitration *or judicial settlement.*

For the consideration of any such dispute, the Court to which the case is referred shall be the Permanent Court of International Justice, established in accordance with Article 14, or any tribunal agreed on by the parties to the dispute or stipulated in any Convention existing between them.

The Members of the League agree that they will carry out in full good faith any award *or decision* that may be rendered, and that they will not resort to war against a Member of the League which complies therewith. In the event of any failure to carry out such an award *or decision*, the Council shall propose what steps should be taken to give effect thereto.

Article 14.—The Council shall formulate and submit to the Members of the League for adoption plans for the establishment of a Permanent Court of International Justice. The Court shall be competent to hear and determine any dispute of an international character which the parties thereto submit to it. The Court may also give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly.

Article 15.—If there should arise between Members of the League any dispute likely to lead to a rupture, which is not submitted to arbitration *or judicial settlement* in accordance with Article 13, the Members of the League agree that they will submit the matter to the Council. Any party to the dispute may effect such submission by giving notice of the existence of the dispute to the Secretary-General, who will make all necessary arrangements for a full investigation and consideration thereof.

For this purpose the parties to the dispute will communicate to the Secretary-General, as promptly as possible, statements of their case with all the relevant facts and papers, and the Council may forthwith direct the publication thereof.

The Council shall endeavour to effect a settlement of the dispute, and, if such efforts are successful, a statement shall be made public giving such facts and explanations regarding the dispute and the terms of settlement thereof as the Council may deem appropriate.

If the dispute is not thus settled, the Council, either unanimously or by a majority vote, shall make and publish a report containing a statement of the facts of the dispute and the recommendations which are deemed just and proper in regard thereto.

Any Member of the League represented on the Council may make public a statement of the facts of the dispute and of its conclusions regarding the same.

If a report by the Council is unanimously agreed to by the members thereof, other than the representatives of one or more of the parties to the dispute, the Members of the League agree that they will not go to war with any party to the dispute which complies with the recommendations of the report.

If the Council fails to reach a report which is unanimously agreed to by the members thereof, other than the representatives of one or more of the parties to the dispute, the Members of the League reserve to themselves the right to take such action as they shall consider necessary for the maintenance of right and justice.

If the dispute between the parties is claimed by one of them, and is found by the Council to arise out of a matter which by international law is solely within the domestic jurisdiction of that party, the Council shall so report, and shall make no recommendation as to its settlement.

The Council may in any case under this Article refer the dispute to the Assembly. The dispute shall be so referred at the request of either party to the dispute provided that such request be made within fourteen days after the submission of the dispute to the Council.

In any case referred to the Assembly, all the provisions of this Article and of Article 12, relating to the action and powers of the Council, shall apply to the action and powers of the Assembly, provided that a report made by the Assembly, if concurred in by the representatives of those Members of the League represented on the Council, and of a majority of the other Members of the League, exclusive in each case of the representatives of the parties to the dispute, shall have the same force as a report by the Council concurred in by all the members thereof other than the representatives of one or more of the parties to the dispute.

Article 16.—Should any Member of the League resort to war in disregard of its Covenants under Articles 12, 13 or 15, it shall *ipso facto* be deemed to have committed an act of war against all other Members of the League, which hereby undertake immediately to subject it to the severance of all trade or financial relations, the prohibition of all intercourse between their nationals and the nationals of the Covenant-breaking State, and the prevention of all financial, commercial or personal intercourse between the nationals of the Covenant-breaking State and the nationals of any other State, whether a Member of the League or not.

It shall be the duty of the Council in such case to recommend to the several Governments concerned what effective military, naval or air force the Members of the League shall severally contribute to the armed forces to be used to protect the Covenants of the League.

The Members of the League agree, further, that they will mutually support one another in the financial and economic measures which are taken under this Article, in order to minimise the loss and inconvenience resulting from the above measures, and that they will mutually support one another in resisting any special measures aimed at one of their number by the Covenant-breaking State, and that they will take the necessary steps to afford passage through their territory to the forces of any of the Members of the League which are co-operating to protect the Covenants of the League.

Any Member of the League which has violated any Covenant of the League may be declared to be no longer a Member of the League by a vote of the Council concurred in by the representatives of all the other Members of the League represented thereon.[1]

Article 17.—In the event of a dispute between a Member of the League and a State which is not a Member of the League, or between States not Members of the League, the State or States not Members of the League shall be invited to accept the obligations of member-

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[1] The Second Assembly, Oct. 4 1921, proposed that Article 16, paragraph 1, be amended to read:

"Should any Member of the League resort to war in disregard of its Covenants under Articles 12, 13 or 15, it shall *ipso facto* be deemed to have committed an act of war against all other Members of the League, which hereby undertake immediately to subject it to the severance of all trade or financial relations, the prohibition of all intercourse between persons residing in their territory and persons residing in the territory of the Covenant-breaking State, and the prevention of all financial, commercial or personal intercourse between persons residing in the territory of the Covenant-breaking State and persons residing in the territory of any other State, whether a Member of the League or not."

On Sept. 27 1924 the Fifth Assembly expressed the view that "it is no longer opportune for further Members of the League to ratify the said amendment" to Article 16, paragraph 1, and recommended "in place thereof" the following:

"The latter part of the first paragraph of Article 16 of the Covenant shall read as follows: 'Which hereby undertakes immediately to subject it to the severance of all trade or financial relations and to prohibit all intercourse at least between persons resident within their territories and persons resident within the territory of the Covenant-breaking State and, if they deem it expedient, also between their nationals and the nationals of the Covenant-breaking State, and to prevent all financial, commercial or personal intercourse at least between persons resident within the territory of that State and persons resident within the territory of any other State, whether a Member of the League or not, and if they deem it expedient, also between the nationals of that State and the nationals of any other State, whether a member of the League or not.'"

The Second Assembly, Oct 4 1921, also proposed to insert the three following paragraphs between paragraphs 1 and 2 of the original text:

"It is for the Council to give an opinion whether or not a breach of the Covenant has taken place. In deliberations on this question in ship in the League for the purposes of such dispute, upon such conditions as the Council may deem just. If such invitation is accepted, the provisions of Articles 12 to 16 inclusive shall be applied with such modifications as may be deemed necessary by the Council.

Upon such invitation being given, the Council shall immediately institute an enquiry into the circumstances of the dispute and recommend such action as may seem best and most effectual in the circumstances.

If a State so invited shall refuse to accept the obligations of membership in the League for the purposes of such dispute, and shall resort to war against a Member of the League, the provisions of Article 16 shall be applicable as against the State taking such action.

If both parties to the dispute, when so invited, refuse to accept the obligations of membership in the League for the purposes of such dispute, the Council may take such measures and make such recommendations as will prevent hostilities and will result in the settlement of the dispute.

Article 18.—Every Treaty or international engagement entered into hereafter by any Member of the League shall be forthwith registered with the Secretariat, and shall, as soon as possible, be published by it. No such Treaty or international engagement shall be binding until so registered.

Article 19.—The Assembly may from time to time advise the reconsideration by Members of the League of Treaties which have become inapplicable, and the consideration of international conditions whose continuance might endanger the peace of the world.

Article 20.—The Members of the League severally agree that this Covenant is accepted as abrogating all obligations or understandings *inter se* which are inconsistent with the terms thereof, and solemnly undertake that they will not hereafter enter into any engagements inconsistent with the terms thereof.

In case any Member of the League shall, before becoming a Member of the League, have undertaken any obligations inconsistent with the terms of this Covenant, it shall be the duty of such member to take immediate steps to procure its release from such obligations.

Article 21.—Nothing in this Covenant shall be deemed to affect the validity of international engagements, such as Treaties of Arbitration, or regional understandings like the Monroe doctrine, for securing the maintenance of peace.

Article 22.—To those colonies and territories, which as a consequence of the late war have ceased to be under the sovereignty of the States which formerly governed them, and which are inhabited by peoples not yet able to stand by themselves under the strenuous conditions of the modern world, there should be applied the principle that the well-being and development of such peoples form a sacred trust of civilisation, and that securities for the performance of this trust should be embodied in this Covenant.

The best method of giving practical effect to this principle is that the tutelage of such peoples should be entrusted to advanced nations who, by reason of their resources, their experience or their geographical position, can best undertake this responsibility, and who are willing to accept it, and that this tutelage should be exercised by them as Mandatories on behalf of the League.

The character of the Mandate must differ according to the stage of the development of the people, the geographical situation of the territory, its economic conditions and other similar circumstances.

Certain communities formerly belonging to the Turkish Empire have reached a stage of development where their existence as independent nations can be provisionally recognised subject to the rendering of administrative advice and assistance by a Mandatory until such time as they are able to stand alone. The wishes of these communities must be a principal consideration in the selection of the Mandatory.

Other peoples, especially those of Central Africa, are at such a stage that the Mandatory must be responsible for the administration of the territory under conditions which will guarantee freedom of conscience and religion, subject only to the maintenance of public order and morals, the prohibition of abuses such as the slave trade, the arms traffic and the liquor traffic, and the prevention of the establishment of fortifications or military and naval bases, and of military training of the natives for other than police purposes and the defence of territory, and will also secure equal opportunities for the trade and commerce of other Members of the League.

There are territories, such as Southwest Africa and certain of the South Pacific Islands, which, owing to the sparseness of their population, or their small size, or their remoteness from the centres of civilisation, or their geographical contiguity to the territory of the Mandatory, and other circumstances, can be best administered under the laws of the Mandatory as integral portions of its territory, subject to the safeguards above mentioned in the interests of the indigenous population.

In every case of Mandate, the Mandatory shall render to the Council an annual report in reference to the territory committed to its charge.

The degree of authority, control or administration to be exercised by the Mandatory shall, if not previously agreed upon by the Members of the League, be explicitly defined in each case by the Council.

A permanent Commission shall be constituted to receive and examine the annual reports of the Mandatories and to advise the Council on all matters relating to the observance of the Mandates.

Article 23.—Subject to and in accordance with the provisions of international Conventions existing or hereafter to be agreed upon, the Members of the League—

(*a*) Will endeavour to secure and maintain fair and humane conditions of labour for men, women and children, both in their own countries and in all countries to which their commercial and industrial relations extend, and for that purpose will establish and maintain the necessary international organisations.

(*b*) Undertake to secure just treatment of the native inhabitants of territories under their control.

(*c*) Will entrust the League with the general supervision over the execution of agreements with regard to the traffic in women and children, and the traffic in opium and other dangerous drugs.

(*d*) Will entrust the League with the general supervision of the trade in arms and ammunition with the countries in which the control of this traffic is necessary in the common interest.

(*e*) Will make provision to secure and maintain freedom of communications and of transit and equitable treatment for the commerce of all Members of the League. In this connection, the special necessities of the regions devastated during the war of 1914–8 shall be borne in mind.

(*f*) Will endeavour to take steps in matters of international concern for the prevention and control of disease.

Article 24.—There shall be placed under the direction of the League all international bureaux already established by general Treaties if the parties to such Treaties consent. All such international bureaux and all Commissions for the regulation of matters of international interest hereafter constituted shall be placed under the direction of the League.

In all matters of international interest which are regulated by general Conventions, but which are not placed under the control of international bureaux or Commissions, the Secretariat of the League shall, subject to the consent of the Council, and if desired by the parties, collect and distribute all relevant information, and shall render any other assistance which may be necessary or desirable.

The Council may include as part of the expenses of the Secretariat the expenses of any bureau or Commission which is placed under the direction of the League.

Article 25.—The Members of the League agree to encourage and promote the establishment and co-operation of duly authorised voluntary national Red Cross organisations having as purposes the improvement of health, the prevention of disease and the mitigation of suffering throughout the world.

Article 26.—Amendments to this Covenant will take effect when ratified by the Members of the League whose representatives compose the Council, and by a majority of the Members of the League whose representatives compose the Assembly.

No such amendments shall bind any Member of the League which signifies its dissent therefrom, but in that case it shall cease to be a Member of the League.[1]

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the Council the votes of Members of the League alleged to have resorted to war and of Members against whom such action was directed shall not be counted.

"The Council will notify to all Members of the League the date which it recommends for the application of the economic pressure under this Article.

"Nevertheless, the Council may, in the case of particular Members, postpone the coming into force of any of these measures for a specified period where it is satisfied that such a postponement will facilitate the attainment of the object of the measures referred to in the preceding paragraph, or that it is necessary in order to minimise the loss and inconvenience which will be caused to such Members."

The Sixth Assembly, Sept. 21 1925, proposed that the following amendment should be made to paragraph 2 of the original text (which becomes paragraph 5 of the text as amended in 1921):—

"The words 'in such case' in the second paragraph of the original text of Article 16 of the Covenant shall be deleted."

None of these proposed amendments had come into force by April 1926.

[1] The second Assembly, Oct. 3, 1921, proposed that Article 26 should be amended as follows:—

"Amendments to the present Covenant the text of which shall have been voted by the Assembly on a three-fourths majority, in which there shall be included the votes of all the Members of the Council represented at the meeting, will take effect when ratified by the Members of the League, whose Representatives composed the Council when the vote was taken and by the majority of those whose Representatives form the Assembly.

"If the required number of ratifications shall not have been obtained within twenty-two months after the vote of the Assembly, the proposed amendment shall remain without effect.

"The Secretary-General shall inform the Members of the taking effect of an amendment.

"Any Member of the League which has not at that time ratified the amendment is free to notify the Secretary-General within a year of its refusal to accept it, but in that case it shall cease to be a Member of the League."

This amendment had not come into force by April 1926.

COVENTRY, England (*see* 7.342), had a population of 128,205 in 1921, this figure showing a considerable increase since 1911. In 1923 the estimate was 131,200. The area of the borough is 4,147 acres. The normal engineering industries of Coventry were largely changed during the World War to the production of munitions, including aeroplanes, tanks and guns. Among industries established since 1910 are the making of artificial silk and of telephone and other electrical apparatus. Parliamentary powers were obtained in 1920 for the widening of several narrow streets and the construction of two new arterial roads in the centre of the city. A new council house, costing £100,000, was opened in 1920, and three branch public libraries in 1913; the tower of Holy Trinity Church and the Guildhall were restored. Coventry was created a separate diocese in 1918, the church of St. Michael being made the cathedral. Three new parishes have been formed in the city since 1910: St. Margaret, St. Barbara and Radford. A Roman Catholic church has been built in Harefield Road. Sir Thomas White's School and the Industrial School were acquired in 1910 for enlarging the hospital and housing the staff. In 1917 there was trouble over the activities of the shop stewards; and, in Nov. 1917, 50,000 workers went on strike. An effort was made to build a large number of houses on the Radford estate to the west of the city in 1925.

COWANS, SIR JOHN STEVEN (1862–1921), British soldier, was born March 11 1862, and commissioned in the Rifle Brigade, 1881. After early service in India, he graduated at the Staff College in 1892, and shortly after joined the newly formed mobilisation section at the War Office. Here he helped to lay the foundations not only of the mobilisation schemes—for future test in 1899 and 1914, but of his own mastery of detail and war organisation. In 1898 he supervised the transportation of the troops for the Sudan campaign, then, after a spell in the War Office at Aldershot, he became director of military education in India, under Lord Kitchener. In 1908 came his one brief spell in command of troops—the Bengal Presidency Brigade. In 1910 he returned home and was appointed director-general of the Territorial Force, and his success was rewarded by his advancement to quartermaster-general of the forces in 1912, his last post. This he held until 1919, the one continuous member of the Army Council throughout the War. His amazing energy and organising genius kept pace with his task, and the universal recognition of his success was aptly shown in his popular title of "The greatest quartermaster-general since Moses." In March 1919 he retired from the army and he died at Mentone on April 16 1921.

COWDRAY, WEETMAN DICKINSON PEARSON, 1st Viscount (1856–), was born at Shelley Woodhouse, Yorks., July 15 1856, and educated privately at Harrogate. He entered the family firm of S. Pearson & Co., contractors, ultimately becoming its head. Under him the firm greatly extended, undertaking many important contracts and acquiring large interests in Mexico and South America. In 1895 he was elected Liberal member for Colchester, holding his seat until 1910. In 1894 he was created a baronet, and in 1910 was raised to the peerage. He was in 1917 made president of the Air Board, and the same year was created a viscount. He was elected lord rector of Aberdeen University in 1918.

COX, JAMES MIDDLETON (1870–), American politician, was born near Jacksonburg, O., March 31 1870. After being educated in the common schools, he worked in a newspaper office, and for a short time was a country school teacher. Later he became a reporter on the Cincinnati *Enquirer*. In 1898 he purchased the Dayton *News* and five years later the Springfield *Press-Republic*, subsequently named the *Daily News*. In 1923 he purchased the Canton *Daily News* and the Miami (Fla.) *Metropolis*, which later became the Miami *Daily News*. From 1909 to 1913 he was a member of Congress for the Dayton district. He was Governor of Ohio 1913–5 and 1917–21. His career as governor was notable. Among the reforms introduced under his guidance were a workmen's compensation law; the elimination of the sweatshop; the establishment of a state industrial commission for dealing with questions of labour and capital; the provision of a minimum wage and a nine-hour day for women; mothers' pensions; a blue-sky law for protecting investors from unscrupulous promoters; the initiative and referendum; the establishment of a state tuberculosis hospital and the extension of safety devices on railways and in mines. He was energetic in suppressing violence in connection with strikes, his general policy being to hold local authorities responsible without recourse to the state militia. He favoured the abolition of the Federal inheritance tax, believing that the state alone should have jurisdiction over inheritances. He was a strong supporter of President Wilson's policies and especially of the League of Nations. He was charged with opposing prohibition, but repeatedly declared that all laws must be enforced. At the Democratic National Convention in 1920 he received the presidential nomination, but was overwhelmingly defeated by Mr. Harding, the Republican nominee. The electoral vote was 404 for Harding and 127 for Cox. The popular vote was 16,152,200 for Harding and 9,147,353 for Cox. The vote in Ohio, the home state of both candidates, was 1,182,022 for Harding and 780,037 for Cox.

COX, KENYON (1856–1919), American painter (*see* 7.353), died in New York March 17 1919. In 1910 he was awarded the medal of honour for mural painting by the Architectural League. In 1912 he published *The Classic Point of View*, being lectures delivered that year before the Chicago Art Institute. Other works are *Artist and Public* (1914, largely reprints from periodicals); *Winslow Homer* (1914); and *Concerning Painting* (1917).

CRACOW, Poland (*see* 7.359), had a population in 1921 of 181,700, of whom 152,590 were Poles. It is the capital of the province of the same name, the third city in Poland, and an industrial centre. A Ukrainian university, a mining academy and a fine arts academy have been inaugurated. Cracow is the seat of a Roman Catholic archbishop.

CRADDOCK, CHARLES EGBERT (1850–1922), American author (*see* 7.360), died at Murfreesboro, Tenn., July 31 1922. Her latest works were *Ordeal* (1912); *Raid of the Guerilla* (1912); and *The Story of Duciehurst* (1914).

CRADOCK, SIR CHRISTOPHER GEORGE FRANCIS MAURICE (1862–1914), British admiral, was born July 2 1862 at Hartforth, Yorkshire. He entered the naval service in 1875, and served in the Egyptian War in 1882 and the Sudanese Expedition of 1891. In 1900 he commanded the British naval brigade at the capture of the Taku forts and the relief of Peking. After Taku he was promoted captain and received the China Medal for gallantry. In 1910 he was promoted rear-admiral and in 1912 received the K.C.V.O. Early in the World War he was given command of a small British squadron in the Pacific, consisting of the cruisers "Good Hope" and "Monmouth," an armed merchantman and one light cruiser. On Nov. 1 1914 this squadron encountered five German warhips, the "Scharnhorst," "Gneisenau," "Leipzig," "Dresden," "Nürnberg." Though inferior in speed and gunfire he decided to attack, and the battle of Coronel was fought. As a result, the "Monmouth" was sunk and Adm. Cradock went down in his flagship, the "Good Hope," which was blown up while making for shore. (*See* Coronel, Battle of; Falkland Islands, Battle of the.)

CRAIG, EDITH (1869–), British theatrical producer, daughter of Dame Ellen Terry, was born Dec. 9 1869. She made her first appearance on the stage at the Court Theatre during the run of "Olivia" and subsequently played many parts both in England and America. She studied at the Royal Academy of Music and at Berlin, and at one time was engaged in the making and designing of costumes for London productions. Later she was mainly employed in stage-management and play production, and in addition to her purely theatrical enterprises, she both produced and acted in a number of cinema plays.

Her brother, Edward Gordon Craig (born Jan. 16 1872), was educated at Bradfield College and the University of Heidelberg. His first stage appearance was at the Court Theatre, London, in "Olivia." He, later, went to live in Florence, where he devoted much study to the art of the theatre. He was a frequent contributor to *The Mask*, and his book, *The Theatre Advancing* (1921), is his most noteworthy contribution to the subject of the art of the stage.

CRAIG, SIR JAMES (1871–), Irish politician, was born Jan. 8 1871, a son of James Craig of Craigavon, Co. Down, a Belfast business man. Coming of pure Scottish stock, he was educated at Merchiston School, Edinburgh, and destined for a business career. This was interrupted by the South African War of 1899–1902, when he joined the Royal Irish Rifles. On his return from that war he was gradually drawn into politics, and after a first failure in Fermanagh he won back for the Unionist party one of the seats in his native county of Down in 1906. In and out of Parliament he was in the confidence of Sir Edward Carson, and when, in 1914, it was decided to offer armed resistance to what Ulster Unionists regarded as the threatened destruction of their rights of citizenship in the United Kingdom, he shouldered a prominent share of the work and the risk.

The World War brought a partial truce at home. Belfast was one of the best recruiting centres in the kingdom and Col. Craig devoted his energies to recruiting and organising the 36th (Ulster) Division. When the Coalition Govt. was formed in 1916, he was appointed Treasurer of the Household. In 1919 he was Parliamentary Secretary to the Ministry of Pensions, and in 1920 Financial Secretary to the Admiralty. When the Govt. of Ireland Act, 1920, came into force he resigned his office and his seat in the Imperial Parliament and became Prime Minister of Northern Ireland. In 1918 he was created a baronet, and in 1921 a Privy Councillor. The Govt., under Sir James Craig's leadership, promptly got to work, the Ulster Parliament being opened by the King in person in the spring of 1921. After a period of incendiarism and bloodshed unparalleled in Irish history, the Imperial Govt. agreed on a truce, and at a conference held in Downing street, "Articles of Agreement for a Treaty" were drawn up and duly passed into law by the Imperial Parliament in 1922 (*see* Irish Free State; Ireland, Northern).

Sir James Craig and the Northern Parliament promptly repudiated the conference and the treaty arising from it and continued to carry on the government of the six counties allotted to them by the Act of 1920. The Republican section of the Sinn Fein party, defeated in the Dail, also repudiated the treaty, and strife and bloodshed again broke out. The two Irish governments concerned succeeded, however, in restoring order, and when the country was once more at rest, a boundary commission, nominated by the Imperial Govt. and the Govt. of the Irish Free State (the Northern Govt. still standing aloof) was appointed and set to work late in 1924.

There followed a year of peace, during which an Education Act and a Licensing Act stand prominently to the credit of Sir James Craig's Administration. The Northern Govt. paid little attention to the proceedings of the commission, but when the time approached for the commission to deliver its award the situation again became acute. Several conferences were held in Downing street in which Mr. Baldwin, Mr. Churchill, Sir W. Joynson-Hicks and Mr. Amery on the one hand and Sir James Craig and Mr. Cosgrave, the Premier of Southern Ireland on the other, took part with the most satisfactory results. On the night of Dec. 3 1925 a comprehensive agreement was signed for the final and definite settlement of all outstanding differences, territorial or financial, affecting alike the relations between the two states in Ireland and Ireland and the United Kingdom. The agreement was promptly ratified by the Imperial Parliament and the Parliament of Northern Ireland and, after some heated discussion, by the Dublin Parliament also. Sir James Craig is entitled to claim that his firm stand for the integrity of Northern Ireland, as defined by the Act of 1920, has been crowned with complete success. (J. R. Fi.)

CRAM, RALPH ADAMS (1863–), American architect, was born at Hampton Falls, N.H., Dec. 16 1863. He was educated at the Westford (Mass.) Academy and the Exeter (N.H.) high school. He studied architecture and in 1889 opened an architect's office in Boston. Recognised as an authority on mediaeval architecture and an able advocate of the Gothic style, he was appointed architect for the cathedral of St. John the Divine, New York, in 1911, and consulting architect for the Washington and San Francisco cathedrals. He was professor of architecture at the Massachusetts Institute of Technology, 1914–21, and was the first chairman of the Boston City Planning Board, 1915–22.

His numerous writings include *Church Building* (1901); *The Ruined Abbeys of Great Britain* (1905); *Impressions of Japanese Architecture and The Allied Arts* (1905); *The Gothic Quest* (1907); *The Ministry of Art* (1914); *Heart of Europe* (1915); *The Substance of Gothic* (1916, Lowell lectures); *The Nemesis of Mediocrity* (1918); *The Great Thousand Years* (1918); *The Sins of the Fathers* (1919); *Walled Towns* (1919); *Gold, Frankincense and Myrrh* (1919); and *Towards the Great Peace* (1922).

CRAMP, CHARLES HENRY (1828–1913), American shipbuilder (*see* 7.363), died in Philadelphia June 6 1913.

CRANE, WALTER (1845–1915), British artist (*see* 7.366), died at Horsham, Sussex, March 14 1915.

CRANE, WILLIAM HENRY (1845–1922), American actor (*see* 7.367), died in Dublin, Ireland, April 29 1922.

CRAWFORD, 26th Earl of (1847–1913), British astronomer and orientalist (*see* 7.385), died in London Jan. 31 1913. He was succeeded as 27th earl by his son, David Alexander Edward Lindsay (b. 1871). The latter published *Donatello* (1903) and *The Evolution of Italian Sculpture* (1910). As Lord Balcarres he was a Unionist M.P. from 1895 to 1913. In 1916 he was appointed President of the Board of Agriculture in Mr. Asquith's Govt., and he served under Mr. Lloyd George (1916–22) as Lord Privy Seal, Chancellor of the Duchy of Lancaster, and First Commissioner of Works, being admitted to the Cabinet in 1922.

CREDIT: *see* BANKING; CURRENCY.

CREWE, ROBERT OFFLEY ASHBURTON CREWE-MILNES, 1st Marquess of (1858–), English politician and man of letters (*see* 7.432), remained leader of the House of Lords till Dec. 1916. Though he was not Lord Granville's equal in the difficult task of endeavouring to win the peers' assent to unpalatable radical measures, he contrived, by his courtesy and charm, to retain their liking and respect throughout the critical period beginning with the Budget of 1909.

He succeeded Lord Morley at the India Office in Nov. 1910, and attended, as Secretary of State, the King and Queen on their visit to India in the winter of 1911–2. He was responsible for the high acts of policy announced at the Delhi Durbar; the removal of the capital of India from Calcutta to Delhi, and the reunion of the two Bengals under a governor-in-council. At the coronation of King George he was created a marquis. In the first Coalition Govt. he was Lord President of the Council, but he followed Mr. Asquith in declining to take office under Mr. Lloyd George and continued for six years to lead the independent Liberal opposition in the Lords. In Nov. 1922 he quitted active party politics, accepting from Mr. Bonar Law the post of British ambassador in Paris. In the anxious period of M. Poincaré's Ministry and the Ruhr expedition, when British and French policy became seriously divergent, his tactful diplomacy helped to prevent any actual breach of the Entente; and he acquired considerable authority in the Ambassadors' Conference.

CRICKET (*see* 7.435).—In 1911 cricket had not yet spread its tentacles so widely over the earth as it has done since the War. The game was, however, in a healthy condition. In England, Warwickshire, for the first time, won the championship, the whole season providing one long triumph for F. R. Foster, the Warwickshire captain, who headed both the batting and bowling averages of his county team. Another factor of the 1911 season was the bowling strength of the Gentlemen's side, through the medium of J. W. H. T. Douglas, F. R. Foster, P. R. Le Couteu and W. Brearley. The Gentlemen defeated the Players at Lord's by 130 runs, and drew with them at the Oval.

English Team in Australia.—The M.C.C. team which sailed for Australia in Sept. of that year and which C. B. Fry was invited to captain, was chosen with the greatest care, and was probably better balanced than any side England had previously put into the field. Unfortunately, C. B. Fry could not accept the committee's invitation and the captaincy devolved upon P. F. Warner. At this period the M.C.C. selectors were firmly of the opinion that it was time for youth to be served and, although the inclusion of 10 new choices was criticised, they stuck to their policy of blending youth with experience. Hitch had only just attained his 25th year, while Foster, Woolley, Mead, Smith and Hearne were all under that age. Results justified the selection and four Test Matches out of five were won. To England's success the bowling of Barnes and Foster and, in a lesser degree, that of Douglas contributed, while Hobbs and Rhodes batted superbly. The Australian wickets were perfect, but these bowlers kept a superb length, and it was their pace off the pitch that really won the rubber. The Australians, themselves, endorsed the general opinion that Barnes is the greatest bowler on all wickets that cricket has yet produced. He had every good quality, spin, break both ways, flight, accuracy and consistency.

In the 1911 period, and particularly on the Australian tour, the English fielding was excellent. Smith kept wicket superbly, especially to F. R. Foster, his own county captain; Hobbs ran out 15 men during the tour, and Woolley made six catches in one test match in the slips. Hobbs and Rhodes were a tremendous asset to the side as first wicket batsmen. The former made three centuries in succession and stood out as the champion batsman of the world. It was noteworthy of a great partnership that they made many short runs and yet never needed to call each other.

Warner was laid low by a serious illness after the first match, and Douglas captained the side. The standard of English cricket at that time is perhaps best exemplified by quoting the complete record of the Australian tour, which was 18 matches played, 12 won, 5 drawn and 1 lost. On their return to England, moreover, the M.C.C. team played the Rest of England, at Lord's and beat them decisively by an innings and 10 runs.

The Triangular Tournament.—From the international point of view, the great feature of the 1912 season was the triangular tournament between England, Australia and South Africa. It was a season of wretchedly wet weather, and this to a large extent spoilt county cricket, which was further overshadowed by the greater event. The South Africans were not up to the standard of international cricket, and, to make matters still worse, a dispute arose between the leading cricketers in Australia and the Board of Control. The result was that neither Hill, Trumper, Armstrong, Ransford, Cotter nor Carter made the tour, thus robbing Australia of a great deal of her strength. England, as in the previous year, had a fine side, and although they did not once bat on a good wicket, their play was conspicuously better than that of their rivals.

C. B. Fry, the captain, got the very best out of his men, Hobbs was equally at home whatever the state of the ground and Rhodes came off against the Australians, but failed against the South Africans, this state of affairs being reversed in the case of R. H. Spooner. Barnes bowled as well as ever, but Woolley was undoubtedly the great all-rounder of the side.

Of the Australians Bardsley and Kelleway batted brilliantly in the Test Matches against the South Africans, while Macartney proved himself a master of nearly every scoring stroke. Whitty and Hazlitt were consistently successful as bowlers, and Matthews performed the unprecedented feat of bringing off a double hat trick against South Africa at Old Trafford, Manchester. Emery, a googly bowler, of the pace of J. T. Hearne, was, on his day and when he had struck his length, an absolute match winner. The South Africans, who lost five of their six Test Matches, had two fine bowlers in Pegler and Faulkner, the latter one of the greatest all-rounders in the history of cricket. These two were called upon to do nearly all the bowling, but received little support, nor could their batsmen cope with the bowling of Barnes. On figures, Nourse was the best of the South African batsmen, but, in point of technique, H. W. Taylor was his superior.

The Season of 1913.—Fine weather favoured the 1913 season. No Dominion teams toured England that year, so English county cricket came into its own, and the championship was won by Kent. The Players, captained by Rhodes, had a particularly strong side, comprising Hobbs, Tarrant, Mead, J. W. Hearne, Woolley, Quaife, A. E. Relf, Booth, E. J. Smith and Barnes. The Gentlemen's side was distinguished for the bowling of Simms and Falcon, and the all-round excellence of these two and Foster, Douglas, S. G. Smith and P. H. Fender.

The War Period.—The year of the outbreak of War, 1914, witnessed the centenary of Lord's ground, which had been moved 100 years before from where Dorset Square now stands. The centenary was celebrated by a match between the M.C.C. team, which had recently returned from a successful tour in South Africa, and the Rest of England, the latter winning easily by an innings. The Players defeated the Gentlemen at the Oval that year, but the feature of the match at Lord's when the latter took their revenge, was the wonderful bowling of Douglas, who was on continuously except for three-quarters of an hour. His analysis read:—

Overs	Maidens	Runs	Wickets
38·2	8	105	9

In the second innings he took four wickets for 67 runs. Partnered by Foster they were, perhaps, the finest pair of bowlers the Gentlemen have ever had.

Owing to the outbreak of the Great War the concluding matches in the county championship between Surrey and Sussex, and Surrey and Leicestershire, were not played. It was officially stated that the M.C.C. had decided to regard Surrey as the winners of the championship, in view of the fact that Middlesex offered no objection, as they might have done, on the grounds that Surrey had not completed their programme. The effects of the War were very far reaching. The game was played spasmodically behind the lines, and in the schools, but it must be remembered, however, that the standard of instruction could not possibly be maintained during the years of strife. Almost daily, good cricketers were falling upon the field of battle, while, at the best, others were being deprived of years of practice.

Cricket After the World War.—In 1919 the game was resumed and it is noteworthy of the post-War period that great progress has been made in Denmark and Holland, in which countries the school-boys are exceptionally keen. There is keenness in Belgium, too, where a flourishing club exists in Brussels. Perhaps as a result of the War and the British occupation, the game is being played by the Germans.

In England the crowds which attend important matches are both larger and more critical than they were in pre-War days. In Scotland the schools play cricket, and there has been a good deal of improvement owing to the tours of English teams. The furtherance of the game in Ireland has always provided an uphill task, but since the War the Irish have asked for more and better cricket. Dublin University is still the great stronghold of the game, but, unfortunately, the Irish schoolboy is not as keen on cricket as he might be. In Australia the enthusiasm is even greater than in England, witnessed by the fact that the crowds at the Test Matches in 1924–5 completely eclipsed all previous records. Generally speaking it may be said that since the War the sway of cricket has spread across all the earth, until it now flourishes in such widely separated countries as England and Australia, Hongkong and the West Indies.

The Season of 1919.—Luckily, for cricket enthusiasts, the post-War resumption of the game was blessed by a season of good weather. On the other hand, the imposition upon county matches of a two days limit of play was a risky proceeding, which might well have caused irreparable damage. The appearance in England of the Australian Imperial Forces cricket team was a godsend. They did much to combat the heresy of the new innovation, by allotting three days to each of their matches, the position being still further strengthened by the M.C.C. also refusing to countenance the two days idea. The Australian Imperial Forces team, at first captained by Kelleway, and subsequently by Collins, contained outstanding cricketers in Gregory, Taylor, Pellew and Oldfield.

Other distinctive features of the 1919 season were the batting of D. J. Knight and the bowling of Douglas. Both represented the Gentlemen against the Players at Lord's, where Knight played two beautiful innings of 71 and 124 respectively, while Douglas took eight wickets for 49 runs in the Players first innings. For the Players, Hobbs proved himself to be as great a batsman as ever, scoring 120 not out at the Oval, 2 and 113 at Lord's and 120 at Scarborough, thus beating the record for these games which had previously stood to the credit of W. G. Grace. One feature was very noticeable; this, the bowling of the Players was not anything like up to pre-War standard.

The Season of 1920.—It was in 1920 that cricket really commenced its new lease of life. Middlesex secured the county championship, their victory over Surrey in the final match at Lord's being signalised by scenes of extraordinary excitement. At the beginning of Aug. the chance of Middlesex attaining championship honours had seemed small indeed; then they won nine matches in succession, one against Kent by five runs, and another against Yorkshire by four runs, and finally attained the honour by beating Surrey at Lord's.

England v. Australia.—Great as had been the English cricket recovery in so short a space of time, the Australians apparently were possessed of even greater powers of recuperation. The policy of the M.C.C. was to wait a while before sending teams abroad. But the Australians were insistent that an English side should visit them; and the M.C.C., much against their own wishes, consented to send a team to Australia at the end of the 1920 season. It was now seen that what has been said of the Players post-War bowling, in reality, applied to the whole country. The standard of English bowling, indeed, was considerably below that of the Foster-Barnes-Douglas period. The English side, moreover, had a long tail, and lost all five Test Matches to a fine Australian eleven. The main reason for Australia's pronounced superiority lay in their great batting strength and the possession of that wonderful all-round player, Gregory. Hobbs, Russell and Woolley batted finely for England, but the English bowling was weak and ill-supported in the field.

The Australians in England.—In 1921 the Australians returned the English visit. They won three out of the five Test Matches, the other two being drawn. England might have done better, but was forced to take the field without Hobbs and Hearne, the one out of action through illness, and the other through accident. In point of fact, Hearne did play through one Test Match, and Hobbs took the field at Leeds, but had to leave the ground almost at once, owing to a sudden attack of appendicitis. It was impossible to fill the places of two such players adequately; but, at the same time, it cannot be said that the selection committee made the best use of the material at their disposal. It seemed as if they had no definite policy; and, certainly, the elevens that represented England at Nottingham and Lord's were two ill-balanced sides, whose fielding was exceptionally weak. In the Fourth and Fifth Test Matches, England batted well on slow wickets.

On the season's form there can be no doubt whatever that the Australians were much the better side; they were, indeed, a great side. Their fielding, and this is saying a great deal, was probably better than that shown by any previous Australian eleven. Another great factor was the remarkably fine fast bowling of Gregory and MacDonald, cleverly controlled and applied by W. W. Armstrong, the Australian captain. Armstrong, himself, was invaluable as a bowler and every man on the side could bat. Bardsley, for the third time in his career, scored over 2,000 runs during an English tour. Macartney was really brilliant and, in connection with the fielding, the beautiful general efficiency and especially the throwing of Pellew, Bardsley and Taylor will be long remembered, as will the great work of Gregory in the slips. In justice to English cricket, however, it must be stated that, at that period, English batting was, speaking generally, guilty of a wrong method. Back play was overdone and the strokes required to meet certain types of bowling, such as the swerve and the googly, were applied, quite unnecessarily, to all types of bowling.

The Season of 1922.—The first indication of things having taken a turn for the better during the 1922 season was the fine cricket displayed in the Gentlemen and Players match at Lord's. None the less, there was a certain amount of anxiety felt in England as to the possible fate of the team, which the M.C.C. decided to send to South Africa that winter. In point of fact, this team, excellently led by F. T. Mann, had considerable difficulty in beating, on matting wickets, a South African side, which, on grass, would have been no match for them.

The West Indians.—In 1923 the West Indies sent over to England a notable side, under the captaincy of H. B. G. Austin, who has done much for the game in that part of the world. Batting was not the strong feature of the team, if one excepts G. Challoner, a player of the very highest class. Their main strength, indeed, lay in the fast bowling of Francis and John, who were not only really fast, but obtained their pace with a minimum expenditure of energy; and also in the brilliant fielding of Constantine at cover point. The team, at the end of their tour, achieved a decided triumph in running a very strong English eleven to a close finish at Scarborough. On the whole they created such a favourable impression that the M.C.C. were fully justified in sending out the strong team which left England in 1925 to take part in a series of matches in the West Indies.

The South Africans.—The following year the process of building up post-War cricket went on, but it was a poor side that South Africa sent to England, poor, that is, judged by the international standard. The bowling of the South African 1924 team was its weakest point, and it did not win a single Test Match. On the other hand, the great English batsmen, Hobbs, Sutcliffe, Woolley and Hendren, were quick to envisage the possibilities of their opponents' weakness and scored freely off them. England won the first three Test Matches with consummate ease, and it was only owing to rain that the other two resulted in a draw. It is significant of the disparity between the sides that in the first match A. E. R. Gilligan and Tate disposed of the South Africans for a total of 30 runs; Gilligan, the English captain, taking 6 wickets for 7 runs on a hard, true wicket.

The English Team in Australia.—The M.C.C. English team, which went out to Australia in 1924–5 under the captaincy of A. E. R. Gilligan, was a very good one, but not so well balanced as the team of 1911. Three leg break bowlers were included, but the team lacked a steady, medium pace, right hand bowler to give the necessary assistance to Tate, who had definitely proved his greatness in this department of the game during the two previous seasons. In this particular year the test teams were more evenly matched than would appear from the fact that the Australians won four out of the five Test Matches—incidentally, the Australian skipper also won the toss upon four out of these five occasions. There was, in fact, very little to choose between the English and Australian elevens. In the third Test Match at Adelaide, the English side was defeated by only nine runs, and in the second at Melbourne by 80 runs after Australia had scored 600 in the first innings.

The outstanding figures of the English side were Hobbs, Sutcliffe and Tate. The two first named batted magnificently, and created various new records. Of Tate the Australians themselves said that never since the days of Barnes had they seen so good a bowler on their wickets. Another respect in which the English eleven gained unstinted praise from their opponents, was for the fine fielding of the side in general, and the good wicket keeping of Strudwick in particular. As is stated in *Gilligan's Men*, written by M. A. Noble, "it was felt that English cricket had regained its old prestige."

The Australian side was well captained by H. L. Collins, its real strength being found in the fact that every single man was a batsman. One of the best batsmen in the Australian eleven was Oldfield, the wicket keeper, who went in number ten. Apart from the performances of Tate it may be justly said that both sides were weak in bowling. In W. H. Ponsford the Australians brought to light a remarkable young batsman, who, although said to be unsound in his methods, was, nevertheless, extraordinarily successful. He, indeed, had the satisfaction of scoring a century in each of his first two Test Matches.

It has already been said that the post-War attendances at cricket matches in England showed great improvement. In

Australia a like state of things prevailed. The attendances at the matches played by Gilligan's men broke all previous records, the venture turning out a great financial success for the M.C.C., who, since 1903, have always undertaken the management of these tours in Australia.

The Season of 1925.—The year 1925 will be remembered by cricketers as Hobbs' year. In it he beat the record number of centuries, *i.e.*, 126, previously held by W. G. Grace. Further, he scored over 3,000 runs and headed the averages. In addition to batting superbly, Hobbs fielded magnificently at cover point during the 1925 season, despite the fact that he was then in his forty-third year.

In 1925 Tate, in spite of having to do far too much work for his county, Sussex, was probably as good a bowler as ever; but, in point of merit, Macaulay, of Yorkshire, ran him very close. A survey of the personalities and performances of English cricketers during 1925 creates the impression that the country is well able to put a strong batting and fielding side into the field. The chief problem is to find another bowler to support Tate and Macaulay.

In 1926 the Australians sent a team to England, but a number of the earlier matches were spoiled by bad weather. The first test match, played at Nottingham, was a draw, only 50 minutes play being possible in the three days. The second test match, played at Lord's, was also drawn, but on this occasion it was the high scoring on both sides that prevented a definite issue. The immediate need of England seems to be a leg break bowler of the class of L. Braund of Somerset, while a fast bowler of the Lockwood or Richardson type would be invaluable.

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CRILE, GEORGE WASHINGTON (1864–), American surgeon, was born at Chili, O., Nov. 11 1864. After graduating from Ohio Northern University (1884), he studied medicine at Wooster University, taking the degree of M.D. in 1887, and later at Vienna, London and Paris. At first lecturer in histology 1889–90, he became professor of physiology in 1890 and professor of surgery at Wooster University from 1893 to 1900. He was professor of clinical medicine at Western Reserve University from 1900 to 1911, and was then appointed professor of surgery. During the Spanish-American War he served in Porto Rico (1898). He was made an hon. F.R.C.S. (London) in 1913. After America entered the World War he became major in the Medical Officers' Training Corps, and professional director (1917–8). He served with the British Expeditionary Force in France and was senior consultant in surgical research (1918–9). He was made lieutenant-colonel in June 1918, and colonel later in the year. He made important contributions to the study of blood pressure and of shock in operations. For his work in this field he received a gold medal from the National Institute of Social Sciences in 1914.

Among his works are: *Surgical Shock* (1899); *On the Blood Pressure in Surgery* (1903); *Hemorrhage and Transfusion* (1909); *Anemia and Resuscitation* (1914); *The Origin and Nature of the Emotions* (1915); *Man an Adaptive Mechanism* (1916); *A Mechanistic View of War and Peace* (1916); *The Fallacy of the German State Philosophy* (1918); and a *Physical Interpretation of Shock Exhaustion and Restoration* (1921).

CRIMINOLOGY (*see* 7.464).—The tardiness of the social sciences in bringing light to bear on the vital problems of modern society is strikingly illustrated in the definition under CRIMINOLOGY, vol. 7, "a new branch of social science devoted to the discussion of the genesis of crime," and the exposition and criticism of the views of the Italian savant, Cesare Lombroso. It seems incredible, but it is nevertheless a fact, that, prior to the publication of Lombroso's *L'Uomo delinquente* (The Criminal), which was given to the world in 1876, there had never been offered a serious, scientific approach to the study of the criminal. It is true that some 75 years earlier the Viennese physician and phrenologist, Franz Joseph Gall, then resident in Paris, had laid down the proposition that criminal tendencies were probably innate, and might be detected by the conformation of the skull, but his suggestion was not taken up by his disciples. There is no evidence that it was known to Lombroso.

The Positive School.—Lombroso's theory of the criminal as a sub-human anthropological freak, marked by anatomical and other "stigmata" and doomed by his nature to a criminal career, was at once accepted by a majority of students in Italy, and by scholars and writers of distinction in other European countries. Though subjected to weighty criticism, and though never received in any English-speaking community (due possibly, to the native resistance of what we call the Anglo-Saxon mind to ideas emanating from the other side of the Channel) it became, and for a generation remained, the dominant doctrine of European students of the problem of crime. The adherents of the doctrine, at first known as the Italian and later as the Continental School of Criminology, have, under the influence of its most eloquent and learned modern interpreter, Enrico Ferri, claimed the title of the Positive School.

But the central doctrine of these thinkers did not long stand in the unqualified form in which it was originally promulgated. Even Lombroso himself, before his death in 1909, had modified his views to the extent of admitting that the "born" anthropological criminals numbered perhaps not more than half of those committing criminal offences. These were the "true" criminals, the other half being made up of the victims of circumstances. These modifications of the original doctrine were the result partly of the researches and conclusions of some of Lombroso's immediate Italian disciples, such as Raffaele Garofalo and Enrico Ferri, but even more, perhaps, of the challenging writings of the Dutch publicist, William A. Bonger, who emphasised the influence of economic conditions, and of the French philosopher, Gabriel Tarde, and others, who attributed criminality mainly to the psychic impulse of imitation. While all these efforts, like the doctrine impeached by them, were vitiated by the aim of furnishing a single explanation of the extremely complicated and puzzling problem of the persistence of crime in an orderly civilisation, each and every one of them, nevertheless, made a contribution to the criminology of the future.

Absence of Physical Criminal Type.—It remained, however, for an English physician, Dr. Charles Goring, medical officer of H.M. Prison Service, to demonstrate the fallacy of the central assumption of the Italian criminologists. Adopting more rigorous methods of examination and measurement of inmates of the English prisons and correlating the results with similar examination and measurements of members of the law-abiding community, he proved conclusively that criminals, as a class, differ more widely among themselves than they do from the community outside and that the latter show the same "stigmata of criminality" that criminals possess. In his work, *The English Convict*, published in 1913, Dr. Goring announced, as an "inevitable conclusion" from his researches "that there is no such thing as a physical criminal type," a conclusion which is now accepted by every criminologist of standing. Dr. Goring's further conclusion, stated with equal positiveness, that "there is no such thing as a mental criminal type," while it is also generally accepted, rests upon no such satisfactory basis of evidence and may be regarded as open to contradiction.

Whatever may be the merits or the defects of the specific doctrine which will always bear Lombroso's name, his work has these outstanding merits: it first gave the study of the criminal a scientific basis and it powerfully stimulated technical as well as popular interest in the problem. Prior to his time there had been few to question the traditional view of the criminal as a wicked person deliberately and perversely choosing the evil rather than the good. Even the penal reforms with which the names of the Italian Beccaria and the English Romilly and Bentham are associated were inspired almost entirely by humanitarian motives. But since Lombroso's death the scientific study of the criminal and of the personal and social factors that are favourable to his development has been going on with increasing momentum.

American Progress.—Except in the field of penology, America was late in getting into the current of criminological thought. Here there were eminent prison reformers before Howard and Romilly, and the first American penitentiary, for better or for worse, became the model of the European convict prison. It is in the United States, too, that the most hopeful and daring experiments in the treatment of the convicted offender were undertaken. But it was not till the first decade of the present century that the scientific study of the criminal began to receive the serious attention of students of the subject. Teachers of the social sciences in several American universities incorporated the topic in their lectures and in 1909 the first American society for its study, The American Institute of Criminal Law and Criminology, was organised in the city of Chicago. It is worthy of note that the first half-dozen annual volumes of the *Journal* of the society are almost exclusively taken up with criminal law and its penological developments, while of the 160 pages of the last number of the *Journal* at hand (Nov. 1925), 93 are devoted to studies and methods of study of the delinquent.

The New Psychology.—This significant change of emphasis, which became apparent about 1915, was, perhaps, primarily due to the rapidly developing interest of the new psychology in morbid and defective mental conditions, an interest which has powerfully stimulated the growth of that branch of medical science now known as psychiatry (*q.v.*). The psychologist found his most interesting and revealing material for the study of the mind in the asylums or hospitals for the insane, and it was only a short step further to the study of similar abnormal types of personality in the prison, with the result that it is scarcely too much to say that in 1926 every psychiatrist is a criminologist. This development, which went on *pari passu* in England and on the Continent and which was, in fact, largely inspired by the writings of Freud, Jung and other European students, has, in recent years, become the dominant influence in criminological thought on both sides of the Atlantic.

Social Mechanism and Crime.—During the same quarter-century that has witnessed this extraordinary development of psychologic thought, the social sciences have been turning more and more from speculation and the discussion of general principles to the concrete study of the workings of the social mechanism. Particularly in America, where sociology is a highly favoured study, the science has been greatly enriched and is being in a measure reconstructed through the critical investigation of existing personal and social conditions. Thus we have "surveys" of cities and towns or of rural communities in which the social conditions which breed dependency and delinquency are brought to light, and "case-studies" of dependent families or of children "in trouble," through which the domestic or individual factors which lie back of the trouble are disclosed and analysed. Usually the psychologist with his mental tests or the psychiatrist, with his psychoanalytic apparatus and his interpretation of the reaction of the individual to his specific environment, is at hand to contribute his diagnosis to make up the sum of knowledge which the social worker requires. (*See* SOCIOLOGY.)

Present Attitudes.—From these combined influences three results of first-rate importance are already in evidence. The first of these is that criminology is less and less concerned with the identification and description of "the criminal" and more and more with the understanding of the individual offender; the second, that the principal emphasis is being laid, perhaps to an excessive degree, on the mental study of the delinquent; and the third, that the medical concept of treatment is by way of superseding the legal concept of punishment. The reference here is, of course, to the attitude of the criminologist and not of the public nor of the agencies of law enforcement, which cling to their idols. It is worthy of note how impervious the public and the courts are to the influence of criminological thought. Even the doctrines of Lombroso, during the generation when they were in the ascendant and commanded the allegiance of most continental students, made practically no impression on the criminal law or procedure of any European country. There is still too much diversity of opinion among criminologists as to the nature and causes of criminal misconduct to justify a confident statement of their views, but the following tentative summary may, perhaps, be ventured as representing the trend, if not a consensus, of opinion.

Relation to Sociology.—There is no criminal class except in so far as criminal misconduct has with certain individuals become habitual. Criminals are selected by force of circumstances (and here the economic factor comes into play) from the community at large. The insane, the mentally defective and the psychopathic stand the best chance of being so selected. It has been upon the whole a fortunate circumstance that, as outlined above, criminology has been adopted into the family of the social sciences. If this robs it of the independent status conferred upon it by its parentage, it has, on the other hand, enormously enlarged its range and utility. Crime now presents itself as only one of many inter-related social phenomena of a malignant character, such as the persistence of poverty, of widespread disease, and of mental disorder and defect. Criminology profits by, and it makes its peculiar contribution to, the study of each of these related disorders of the social body and, like the other social sciences, it furnishes a reflection of the state of health of the community in which crime is permitted to flourish.

Criminology in this later phase of its development, thus furnishes a solid body of knowledge as to the causative factors of delinquency, both the personal and the social, on which constructive efforts to abate the evil may hopefully be based. This analysis of the recent development of the science must record the great service that has been rendered by the American Institute of Criminal Law and Criminology, not only in the publication of its *Journal*, but even more, perhaps, by placing at the service of students in America and other English-speaking countries excellent translations of the leading criminological treatises published in foreign languages.

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(G. W. K.*)

CROATIA-SLAVONIA (*see* 7.471), since 1918 provinces of Yugoslavia (the Serb-Croat-Slovene State). Its area is 16,920 sq. m.; and the population (1920) 2,739,593.

The Struggle in the Dual Monarchy.—The triumphant vindication brought by the Friedjung trial to M. Supilo and his colleagues of the Serbo-Croat coalition (*see* FRIEDJUNG) gave a fresh incentive to the idea of unity throughout the Southern Slav provinces of Austria-Hungary. On April 3 1912 the Croatian constitution was completely suspended by royal decree and Cuvaj invested with far-reaching dictatorial powers. An attempt on his life by the student Jukić (Yukitch) June 8 was followed by still more reactionary measures, and on July 11 the autonomy of the Serbian Orthodox Church in Slavonia and Hungary was also suspended. The Cuvaj régime had a magical effect in furthering the movement for Yugoslav unity. Henceforward the Slovenes—Clericals no less than Progressives—began to take an increasingly active part in the Yugoslav movement. It was peculiarly unfortunate for Austria-Hungary that the Cuvaj régime should have been at its height when the Balkan League achieved its dramatic victory over the Turks. When Austria-Hungary mobilised, protests were heard on every side against the bare possibility of war with Serbia, which to the Yugoslavs would be a veritable civil war.

On Dec. 27 1912 Cuvaj was replaced by a colourless official, Dr. Unkelhäusser, who marked time until a fresh candidate for the post of Commissary or Dictator was forthcoming in the person of Baron Skerlecz (July 23 1913). This appointment at a moment when Austria-Hungary was again contemplating war with Serbia naturally increased the ferment. On Nov. 30 Skerlecz was made Ban, the illegal decrees of Cuvaj revoked and general elections ordered—the fifth since 1906. The coalition maintained its majority, the Government only obtaining 10 seats; but though this time the Diet was allowed to meet, no attempt was made to satisfy Yugoslav aspirations or to solve the real issues at stake between Hungary and Croatia. More and more the situation in the south of the monarchy was allowed to drift. On the eve of war the university and middle school students had five or six newspaper organs of their own, in Zagreb, Vienna, Prague and elsewhere; and every shade of opinion was represented, from doctrinaire radicalism to revolutionary terror. The Bosnian group was the most extreme (*see* BOSNIA-HERCEGOVINA), but the unrest was quite as pronounced among the Croats as the Serbs, and was rapidly spreading to the Slovenes also, and even the Moslems, who were the last to be infected by nationalistic feeling. The Sarajevo murder on June 28 1914 was the sixth outrage in four years, and four of these took place in Zagreb.

The War 1914–8.—Immediately on the outbreak of the World War measures of extreme severity were taken by the civil and military authorities of Austria-Hungary throughout their Yugoslav provinces. The exact number of persons arrested or interned will probably never be known, but the Yugoslavs were regarded, and treated, as a hostile population. In Croatia alone was there even a semblance of constitutional government. The Diet of Zagreb was allowed to meet, and the Serbo-Croat Coalition pursued a policy of pure opportunism, avoiding any pronouncement on matters of high policy.

Meanwhile, a certain number of Yugoslav leaders had managed to reach foreign soil before the outbreak of war, and during the winter of 1914 constituted themselves as the Yugoslav Committee with its headquarters in Paris and London. Its two foremost leaders were Dr. Trumbić and M. Supilo (two of the makers of the Resolution of Fiume) and it also included Dr. Hinković (known as the chief advocate in the Zagreb treason trial, and Ivan Meštrović (Meshtrovitch), the sculptor. In Dec. 1916 the Yugoslav Committee issued a manifesto in favour of complete independence and unity with Serbia and the deposition of the Habsburgs; but at home in Croatia the coalition sent its delegations to the coronation of Charles as King of Hungary. By its compliance it obtained the appointment of its nominee Mihalović as Ban and was thus able to husband Croatian resources and on occasion to practise passive resistance. It accepted the *status quo*, but no amount of pressure could ever wring from it a disavowal of Trumbić and the exiles: and meanwhile by secret agreement the Croats and Slovenes of Dalmatia and Istria took advantage of the political amnesty and the resumption of Parliamentary life in Austria, to form a unified Yugoslav Club in close alliance with the Czechs, and to demand the union of all the Yugoslav territories of the monarchy in an independent state organism. The Declaration of Corfu, concluded on July 20 1917 between Pašić as Serbian Premier and mouthpiece of all Serbian parties, and Trumbić as President of the Yugoslav Committee, defined the lines upon which the three branches of the Yugoslavs desired unity and independence.

The Birth of Yugoslavia.—In Sept. 1918 Count Tisza, with the Crown's approval, visited Zagreb, Sarajevo and Dalmatia in order to win support for a Magyar solution of the Southern Slav question, but he was everywhere met with a blank refusal. On Oct. 1, encouraged by Bulgaria's surrender, the Czech and Yugoslav deputies in the Reichsrat demanded separate representation at the peace negotiations, and proclaimed their absolute right to decide their own future state allegiance. On Oct. 10 the Yugoslav National Council was transplanted from Ljubljana to Zagreb and strengthened by the inclusion of representatives of all parties. When a week later the Hungarian Govt. declared in favour of personal union and the Emperor issued a decree in favour of the federalisation of Austria, Korošeć (Koroshets), in the name of the Czech and Yugoslav clubs, unreservedly rejected this project and claimed that the future of both nations was an international problem which only the future Peace Conference could solve.

Henceforth the Yugoslavs acted independently of both Vienna and Budapest, and President Wilson's answer to Burián's Peace Note (refusing to negotiate save on the basis of a recognition of Czechoslovak and Yugoslav national claims) was the signal for open repudiation of Habsburg rule. Local committees were formed in Dalmatia and Bosnia, which recognised the authority of the Yugoslav National Council in Zagreb and in its name disarmed the troops pouring northwards from the broken Albanian and Macedonian fronts. As early as Oct 23 a Croat regiment disarmed the Magyar militia in Fiume and took possession of the town, and on the 28th the military command in Zagreb handed over its authority to the National Council. Next day the Diet proclaimed the independence of Croatia from Hungary and assumed control of Fiume. The arsenals of Pola and Cattaro were already in the hands of the insurgents, and the Emperor Charles, in the hope either of winning the favour of the new régime in Zagreb, or of throwing an apple of discord between it and the Entente, signed a decree on the 31st, making over the whole Austro-Hungarian fleet to the Yugoslav State. Before this fact could become known to the Entente a daring Italian officer swam into Pola harbour and blew up the flagship "Viribus Unitis" with the new Yugoslav admiral on board. The Entente insisted upon the surrender of the fleet into their hands, but meanwhile prescribed the frontier line of the secret Treaty of London as the line of occupation under the Austro-Hungarian armistice.

This was keenly resented by the Yugoslavs, as a violation of Wilsonian principles, and when the Italians proceeded to occupy Trieste, Istria, north Dalmatia, and some of the islands, a dangerous situation arose. The Zagreb Govt. urgently invited the assistance of the Serbian Army, which during the final advance contained a large proportion of Yugoslav volunteers. On Nov. 18 the first Serbian troops entered Fiume, and on the 23rd the Zagreb National Council, under pressure of events and alarmed at the equivocal attitude of the Entente towards the new state, proclaimed the union of the territories under its control with the kingdoms of Serbia and Montenegro, and invited the Prince Regent of Serbia to assume the Regency of the new state. This decision took formal effect on Dec. 1, when 24 delegates from Zagreb appeared before Prince Alexander in Belgrade and invited him to proclaim the union.

Croatia in the Yugoslav State.—The first Yugoslav Cabinet was constituted under Stojan Protić as Premier and the Slovene clerical leader Korošić as vice-premier: Trumbić became Foreign Minister and the other portfolios were divided more or less equally between Serbia and the new territories. The dignity of Ban of Croatia was at first retained, but centralist tendencies soon gained the upper hand in the new state, and it was abolished under the new constitution of St. Vitus' Day 1921, and the provincial administration gradually wound up. This was much resented in Croatia, and Trumbić and other Croat deputies voted against the constitution, but they were left in a minority owing to the fatal policy of abstention pursued by the Croat peasant party under Stephen Radić, which made it possible for Pašić to carry through his centralist designs and refuse a reasonable compromise. Radić's capitulation to Pašić in the summer of 1925 and his acceptance of office in a Radical Cabinet marked the triumph of the centralist idea, at least for the time, but it also put an end to the conflict of Serb and Croat as a party issue and so marked a notable stage in the consolidation of Yugoslavia. (*See* also YUGOSLAVIA.)

CROCE, BENEDETTO (1866–), Italian philosopher, was born Feb. 25 1866 at Pescasseroli, Aquila, of an Abruzzese family, the seat of which had been transferred to Naples by his grandfather. There Croce was educated at a Catholic school. In 1883, having lost both his parents in an earthquake, he went to live in Rome with his paternal uncle and guardian, Silvio Spaventa. He entered the university but did not pursue his studies there, returning to Naples in 1886, where he occupied himself for several years with researches into local history and antiquities. His contributions to philosophy began with two essays (1893) upon the nature of history and the method of literary criticism the leading ideas of which he developed in two later papers in 1900 and 1904-5. Between 1896 and 1900 he published also a group of essays on points of Marxian economic doctrine. Shortly after, in 1902, he began the systematic exposition of his Philosophy of the Spirit, divided into Aesthetic, Logic, Philosophy of Conduct (Economics and Ethics) and Theory and History of Historiography. In 1903 he founded the journal *La Critica*, in which he reviewed the whole fine literature of Italy for 50 years, and later similarly reviewed its contributions to historical literature. During all this time he continued to publish a great number of important works on philosophy, European literature and history. His collected works in 1926 filled nearly 20 volumes. Though actively interested in educational administration, he never sought or occupied any university office. In 1910 he was nominated to the senate of the kingdom, and was Minister of Education in the Giolitti Cabinet (June 1920—July 1921).

Croce's Philosophy.—The philosophy of Croce, often erroneously classed as "Hegelian," had its avowed sources in the ideas underlying the literary criticism of Francesco de Sanctis, and, more generally and remotely, in those adumbrated in the *Scienza Nuova* of G. B. Vico, both like himself Neapolitans. More significantly, it arises from and perpetually returns to his own personal experience in his lifelong and multifarious activity as a student of literature and history. Here he finds himself in vital touch with concrete reality, and deliberately confines his reflections to the content of actual or enacted history with a view to its interpretation. Hence he has been led to assert the identity of concrete philosophy with history, and to define the task of abstract philosophy as the discovery and formulation of the mmanent methodology of history. From the common domain of both he excludes any supposed realities which transcend experience, and abstains from speculations about such, as he also does about primal origins and ultimate ends. History as enacted and occurring and history as interpreting what is thus "given" he views as the work of one Spirit, which there expresses and embodies itself. In every part and moment of history that Spirit s wholly and indivisibly present and active. Its presence and operation are not confined to human history, but extend in all directions to the utmost bounds of experience. The Spirit which s thus omnipresent throughout the whole content of experience is ndivisibly one, but its unity is also a quaternity, and it has in its tructure four eternally distinct and distinguishable "grades," he ordered circle of which in its life or progress it perpetually traverses, so endowing or filling itself with experience and ever nriching its being. Its four functions in their conjoint exercise generate the contents of experience, within which we can and must distinguish four corresponding grades, stages, kinds or ealms, the respective subject-matters of aesthetic, logical, economic and ethical theory, departments of philosophy, which together without addition constitute the whole of it.

In its total cognitive function this Spirit manifests itself as art, he first or "dawn" form of knowledge. In this grade it expresses tself in individual embodiments; in so expressing itself it at once reates and beholds what it creates, and has for its objects (which re also its works) whatsoever in experience presents a charcteristic individuality. In its second cognitive grade, as logic or bstract philosophy, it expresses, brings to existence and view, nd so knows whatsoever is universal. Uniting, as it cannot but o, both functions, and thus becoming concrete in history, it ffects an *à priori* synthesis between what is individual and what s universal; in doing so, it wins actual understanding of the real nd enters upon a course of knowledge which runs from sense-erception up to explicit history. The history which thus in history omes to be understood is wholly the work of the same Spirit in he exercise of its total practical function, which has two coresponding grades, in the lower or earlier of which it enacts what s individual, in the higher or later what is universal, or, rather gain, in its actual or concrete exercise, enacts both in one, and o fills the stage of history with its deeds. Still more actually or oncretely, it is active at once as making or creating and knowing or understanding its own history, which is its whole self. The only reality which can truly be called absolute is a history without beginning and without end, self-begotten and self-explaining.

The developments and applications which Croce gives to this fundamental doctrine are extraordinarily various, and often highly novel and even paradoxical. They have excited widespread interest and evoked abundant criticism and opposition. Against his critics Croce carries on a sustained and skilful polemic. He exercises an increasingly profound influence on the higher thought of his country and beyond it, and even those who most firmly dissent from his teaching acknowledge the daring originality of his philosophy, the patience and vigour shown in its systematic development, the literary dexterity displayed in its exposition and defence. To many it seems already to have established a place in the world of contemporary philosophy comparable with that occupied during a great part of the 19th century by the system of Hegel.

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(J. A. S.*)

CROCKETT, SAMUEL RUTHERFORD (1860–1914), British novelist (*see* 7.477), died at Avignon April 20 1914.

CROKER, RICHARD (1843–1922), American politician (*see* 7.481), died in Dublin, Ireland, April 29 1922.

CROMARTY (*see* 7.483).—The erection of defences at Cromarty was begun in 1912 and had made considerable progress by the outbreak of the World War. The port was used throughout the War as a coaling station and was one of the nine trawler stations under the control of the admiral of patrols. Cruiser squadrons, with their destroyer flotillas, used Cromarty as their base, and from Cromarty the "Invincible" and "Inflexible" started for the battle of the Falklands. One of the most serious naval disasters of the War occurred in the harbour of Cromarty on Dec. 30 1915, when the armoured cruiser "Natal" was destroyed by an accidental explosion.

CROMER, EVELYN BARING, 1ST EARL OF (1841–1917), British statesman and diplomatist (*see* 7.484). Lord Cromer's life was prolonged for nearly 10 years after his return from Egypt; and, in spite of enfeebled health he took an important share in political, social and literary movements at home. He was constant in his attendance at the House of Lords, and indefatigable in the work of its committees; he was a leading member of the free-trade section of the Unionist party; he was active in opposition to female suffrage, and in combating anti-vivisection propaganda. Besides publishing his two volumes of *Modern Egypt* (1911), he composed several addresses and pamphlets, wrote frequently for the periodicals, and from 1912 onwards was a regular contributor of signed articles and reviews of books to *The Spectator*.

When the British Protectorate of Egypt was proclaimed, he completed his history of the modern development of that country in a small volume entitled *Abbas II.* (1915), containing matter which it would have been indiscreet to publish so long as Abbas remained Khedive. While he was forward in promoting the study of oriental languages, his strongest affection was for the Greek and Latin classics with which he had only become acquainted in mature life; he became president of the Classical Society, and endowed a Greek prize for the British Academy.

In the critical period of which the main features were the Budget of 1909 and the Parliament Act of 1911, Lord Cromer played an energetic part. He failed to prevent the rejection of the Budget by the House of Lords; but he was successful in persuading moderate Unionist and cross-bench peers to counter the Die-hard movement, and to vote for the Parliament Act rather than force the Govt. to swamp the House of Lords by an unlimited creation of peers. It was in the performance of another patriotic duty, during the World War, that he met his death. In spite of age and indifferent health, he accepted the laborious and insidious task of chairman of the special commission to inquire into the Dardanelles operations. The sittings occupied the autumn of 1916, and while engaged on the draft report he was seized in December with an attack of influenza. Before he had recovered he resumed the work of the commission, which completely broke him down. He died in London Jan. 29 1917. Seldom has there been a life more singly and successfully devoted to the good of his country. See Lord Sanderson, *Memoir of Evelyn, Earl of Cromer* (1917). (G. E. B.)

CRONJE, PIET ARNOLDUS (1840–1911), Boer soldier (*see* 7·501), died at Klerksdorp, Transvaal, Feb. 4 1911.

CROOKES, SIR WILLIAM (1832–1919), British scientist (*see* 7·501), died in London April 4 1919. He was given the Order of Merit in 1910.

CROQUET (*see* 7·502).—In 1920 the "either ball" law was first included in the Croquet Assn. Year Book, although it had been played and tested before that date. Since then all championships and competitions have been played under that law. Since 1922 No. 2 Setting has also been used. In this the turning peg is omitted, the winning peg is equi-distant from the four corners and the two central hoops are placed on the central line seven yards on either side of the winning peg. This has made the game more difficult than formerly, and with 3¾-inch hoops, peeling is not so easy as formerly.

The Croquet Assn., which has 200 clubs and some 1,600 associates in membership, is a large and growing body, and at its headquarters, Roehampton, and in different parts of England, tournaments under its auspices are held during every week of the croquet season, April to October. For many years an open championship and a ladies' championship have been carried on simultaneously, but in 1925 a men's championship was instituted, which was played for in one week with the ladies' championship and the mixed doubles championship, the open championship and open doubles championship being contested the following week. Another competition, the champion cup, which is competed for by the 10 best available players chosen by the council of the Croquet Assn., is played on the American principle, each competitor meeting each of the other competitors twice, thus playing 18 games in all. Great interest was taken in the Australian team which visited England in 1925. Three test matches were played comprising the best of three singles and doubles, England winning all three tests and losing only one double in the last match.

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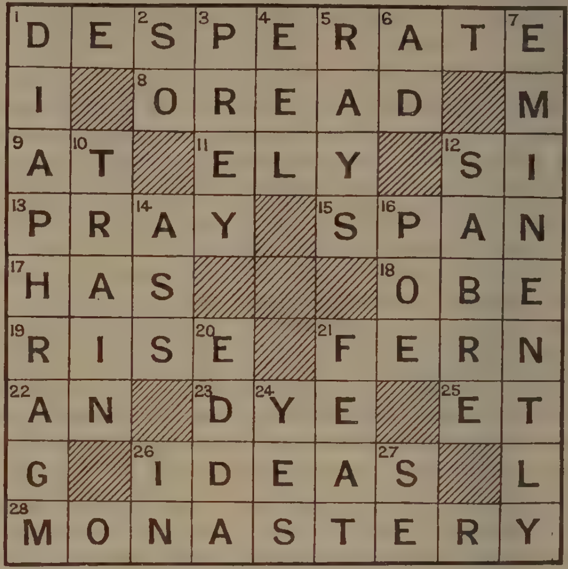
(D. D. S.)

CROSSWORD.—This form of puzzle became very popular in the United States and Great Britain after 1923 and many daily and weekly newspapers made a feature of their crosswords, which were also used for advertising purposes.

The crossword begins as a diagram, of varying shape, divided into squares, some blank and others blacked over. Each of the blank squares is intended to contain a letter and each letter forms part of one or two words. The words read both downwards and across, so that most of the letters must form part of two words. The clues to the words are given and are numbered to correspond to numbers on the diagram. The aim of the solver is to find out the words from the clues, so that each letter fits in with the others. A glance at the illustration in the next column will make this clear.

The figure most commonly used is the square of 15, but other forms are frequently adopted. Some figures contain spaces arranged in uniform design, whilst others are irregular, the objection to the former being the necessarily more frequent introduction of certain words, the repetition of which in puzzle after puzzle becomes monotonous, *e.g.*, to take one initial only, EDEN, EGO, EKE, EM, EMU, ENA, ENO, ERA, ERIN, ERSE, ETON, EVA, EVE. When the puzzle is built up irregularly, it can more easily bear on a certain subject, topical or otherwise, and words containing 8, 10 or 12 letters, which are difficult to use if uniformity is a first consideration, may be introduced without any trouble.

The history of the crossword puzzle is comparatively modern. It probably originated in England, but very quickly lost favour because no definite rules of construction were observed. It was taken up more successfully in the United States, where it was composed on certain stated lines, and the clues were less ambiguous. It is still open to improvement, especially in the definitions, which are often too meagre and too vague. The author, whose object is to entertain as well as to instruct, avoids as much as possible (*a*) technical terms, (*b*) obsolete words and provincialisms, (*c*) isolated letters—known as islands—which are surrounded by black squares on three sides and (*d*) the repetition of such threadbare words, as ADEN, ISIS, OASIS, OG, etc. The black spaces should not exceed 20% of the whole, and the definitions or clues should receive particular care, for on these chiefly depends the ease or difficulty with which the puzzle is deciphered. It should be remembered that the newspaper reader, who is not always gifted with the patience of the student, feels more satisfaction in finding the solutions than the author in constructing the problem. (E. Wr.)



1 D	E	2 S	3 P	4 E	5 R	6 A	T	7 E
I	▨	8 O	R	E	A	D	▨	M
9 A	10 T	▨	11 E	L	Y	▨	12 S	I
13 P	R	14 A	Y	▨	15 S	16 P	A	N
17 H	A	S	▨	▨	▨	18 O	B	E
19 R	I	S	20 E	▨	21 F	E	R	N
22 A	N	▨	23 D	24 Y	E	▨	25 E	T
G	▨	26 I	D	E	A	27 S	▨	L
28 M	O	N	A	S	T	E	R	Y

Fig. 1.—Example of regular crossword puzzle.

CLUES

Across

1. Hopeless.
8. Mountain nymph.
9. Place where.
11. Cathedral city.
12. Yes (Ital.)
13. Entreat.
15. Nine inches.
17. Possesses.
18. An order (abbr.)
19. Get up.
21. Elegant plant.
22. Indefinite article.
23. Colour.
25. And (Fr.)
26. Notions.
28. Abode of monks.

Down

1. Connected with respiration.
2. Thus.
3. Spoil.
4. A fish.
5. Lines of light.
6. The present era (abbr.)
7. Rising above others.
10. Runs on a railroad.
12. Cavalry sword.
14. Patient animal.
16. Wrote "The Raven."
20. Scandinavian mythology
21. Exploit.
24. Affirmative.
26. Preposition.
27. Point of the compass.

CROWDER, ENOCH HERBERT (1859–), American soldier, was born in Missouri April 11 1859. He graduated from the U.S. Military Academy in 1881, and while detailed as commandant at the University of Missouri took the law course there (LL.B., 1886). He was appointed judge-advocate in 1895. He served in the Philippine Is. (1898–1901), was observer with the Japanese Army in Manchuria (1904–5), and was in Cuba as Secretary of State and Justice (1906–8). He was a delegate to the 4th Pan-American Conference in July 1910, and visited Chile on a special mission in Sept. of that year. He became judge-advocate-general in 1911. He was provost-marshal-general from May 1917 to July 1919, and as such had full control of the U.S. machinery of conscription in the World War. He was re-appointed judge-advocate-general in 1919. Gen. Crowder was recognised as an expert in military law. In his book, *The Spirit of Selective Service* (1920), he describes the method whereby within 18 months after America had entered the World War 2,000,000 men were in France, almost as many more were in cantonments, and altogether no fewer than 24,000,000 had been registered and classified. He served as personal representative of Presidents Wilson and Harding in Cuba from Dec. 31 1920 to March 5 1923, on which latter date he became ambassador of the United States to Cuba.

CROWE, SIR EYRE ALEXANDER (1864–1925), British civil servant, was born at Leipzig July 30 1864. Educated at Düsseldorf, Berlin and Paris, he entered the Foreign Office in 1885, became counsellor of embassy in 1907, and assistant under-secretary of state in 1912. He was a British delegate at the second Hague Conference of 1907 and at the International Naval Conference held in London in 1908. He conducted the British case in the arbitration of 1911 regarding the recapture in France of the Indian agitator Savarkar, and was created K.C.M.G. Though his mother and wife were German, he was a vigilant critic of German foreign policy and before the War prepared an impressive memorandum for the Cabinet on the subject, whilst his scheme for seizing German shipping in British ports was adopted when the crisis came. He was one of the committee of six who drew up for Great Britain a draft convention of the League of Nations. He was an outstanding figure at the Paris Peace Conference and assisted Mr. Balfour, the British representative, to revise the treaty with Austria. He also rendered valuable services as a member of the Territorial Commission of the Conference. In 1920 he was promoted G.C.M.G. and became permanent under-secretary for foreign affairs. He died April 28 1925.

CROYDON, England (*see* 7.520), had an area of 9,012 ac. and a population of 190,877 in 1921. The Whitgift hospital or almshouse (1596) in the centre of the town, was only saved from destruction in connection with a road widening scheme in 1925 after a protracted dispute involving parliamentary action. The Government civil customs aerodrome, operated by the civil aviation department of the Air Ministry, is at Waddon, two miles to the southwest of Croydon town hall. It is officially known as the London Terminal Aerodrome, Croydon, and is one of the busiest air ports in the world (*see* AERODROMES). Three companies, Imperial Airways Ltd., the French Air Union and the Dutch K.L.M., operate direct regular services on well-organised air routes to several of the leading continental capitals, air connections to more distant European cities being obtained by special interworking.

CROZIER, WILLIAM (1855–), American soldier (*see* .520), was detailed in 1912 as president of the Army War College, and the following year was reappointed chief of ordnance with the rank of brigadier-general. He was made major-general and chief of ordnance, U.S. Army, in 1917, and major-general f the line in 1918. He was a member of the War Council, and n the discharge of this office was in France and Italy for the rst half of 1918. For the remainder of the year he was commandant of the N.E. Dept., U.S.A., retiring from active service Dec. 31.

CRYSTALLOGRAPHY (*see* 7.569).—The geometry of the external forms of crystals has been completely worked out. The 2 crystal-classes differing from one another in their type and egree of symmetry and the six crystal-systems into which these lasses can be grouped are now well established. The same is lso true of the geometrical conceptions of the internal structure f crystals. There are 230 possible types of homogeneous point-systems, referable to 14 kinds of space-lattices. Attempts have een made to trace a connection between the internal structure f crystals and their chemical constitution. Here there is ample cope for speculation; but since 1912, when X-rays provided a ew method of investigation, some real advance has been made. y this method it is possible not only to determine the internal tructure of crystals, but also actually to measure the distances etween the atoms.

Crystals consist of a homogeneous assemblage of particles, which are marshalled in certain definite ways. The grouping around any one particle (except those on the boundaries of the crystal) is the same as that around every other particle of the same kind. Further, the particles are arranged at regular intervals along straight lines. Throughout the structure there are several parallel sets of such lines, and these lie in several parallel sets of planes also at regular intervals apart.

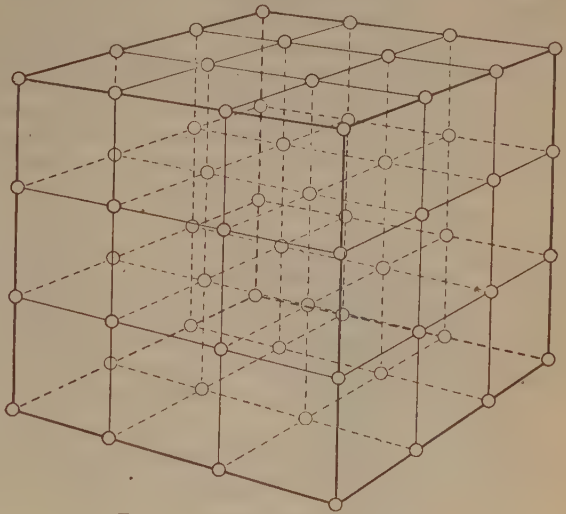


FIG. 1.—Simple Cubic Space Lattice.

An example of such a structure is the simple cubic space-lattice represented in fig. 1. Here the particles (all of the same kind) are placed at equal distances, say a, along parallel lines in three sets at right angles; the distance between the parallel lines in each plane and between the parallel planes of lines being also a. That is, the particles are situated at the points of intersection of a system of lines that form a square network or lattice in three dimensions. Or the structure may be regarded as a stack of small cubes each with a quarter of a particle at every corner; the four adjoining cubes at each corner then providing the whole particle. In this grouping, any one particle is surrounded by a set of 6 similar particles at distance a; further, it is surrounded by 12 particles at distance $\sqrt{2a}$ (*i.e.*, the diagonal of the square); and by eight other particles at distance $\sqrt{3a}$ (*i.e.*, the diagonal of the cube).

It is clear from fig. 1 that the three sets of lines are parallel to the edges of the cube, and that they lie in planes parallel to the

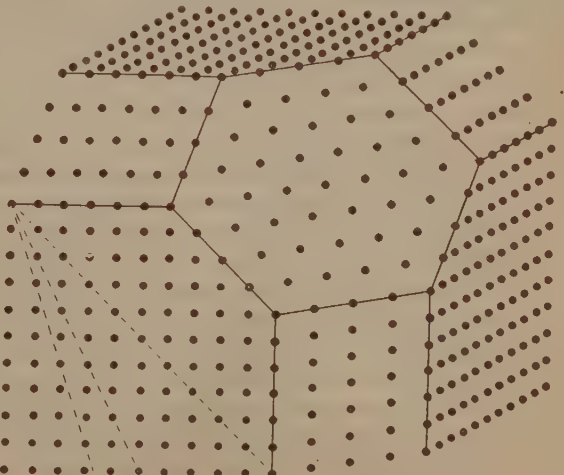


FIG. 2.—Arrangement of points on surface of Cubic Crystal.

faces of the cube. But the particles also lie in other sets of parallel lines, which fall in other sets of parallel planes. Certain of these additional lines and planes of particles are represented more prominently in fig. 2, which is drawn on a smaller scale with a larger number of particles (but to avoid confusion only those on the surface of the solid are marked). In this figure the three front edges of a portion of the main cube are truncated by planes of the rhombic-dodecahedron, and one corner has been cut off symmetrically by a face of the octahedron. (Since the octahedron face intersects both the cube and the rhombic-dodecahedron faces, its outline is hexagonal.) The several layers of particles parallel to any one of these faces are continuous over the other faces, although the particles themselves are ranged along lines of different directions. Hundreds of different planes of particles can, in fact, be traced out in such a structure; and these structure planes are parallel to possible external faces on the crystal. A close relation exists between the Millerian indices of these faces and the number of particles along certain lines in the corresponding planes. The dotted lines on the front cube face in fig. 2 represent the intersections or traces of such planes with the indices: (111), (211), (311), etc.; (221), (321), etc.; (331), (431), etc.; respectively for the lines from right to left. The seven planes of which the indices have just been given necessitate by symmetrical repetition the presence of 93 other structure planes, or, in all, 200 external crystal faces.

A study of fig. 2 shows that the spacing between the particles is not the same on each of the faces (allowance being made for foreshortening in the drawing; only on the front cube face are the particles represented at their true distance apart). On the cube faces the distances each way are, of course, a. On the faces of the rhombic-dodecahedron they are spaced at distance a in one direction, but along the second direction at right angles at distance $\sqrt{2a}$. On the octahedral face there is, instead of a rectangular grouping, a triangular and hexagonal pattern with the particles spaced at distances $\sqrt{2a}$ in three directions. Therefore the number of particles on each of the faces is not the same for equal areas. The network of particles is closer on the cube face than on the rhombic-dodecahedron, and more open on the octahedron. This "reticular density" of the different faces is important and is closely related to the cleavage of crystals. Minerals with cubic cleavage (*e.g.*, rock-salt and galena) would be expected to be of this structure.

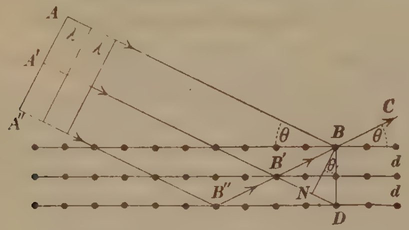


Fig. 3.—Reflection of X-rays by planes of particles.

In addition to the spacing of the particles in the planes, there are also to be considered the distances between the planes themselves. This can be represented by means of vertical sections through the structure perpendicular to the respective planes. The spaces between the cube planes is a, and the particles are also spaced at distance a; the pattern being, in fact, that on a cube face perpendicular to the first. The distance between the rhombic-dodecahedron planes is given by half the diagonal of the cube face, namely, $a/\sqrt{2}$. Here, however, the section-plane intersects lines of particles only in alternate rhombic-dodecahedron planes. The distance between octahedron planes is given by one-third the diagonal of the cube, namely, $a/\sqrt{3}$; and the particles are at distances $\sqrt{6a}$ apart along the traces of the octahedron planes, though only at distances a or $\sqrt{2a}$ across these planes.

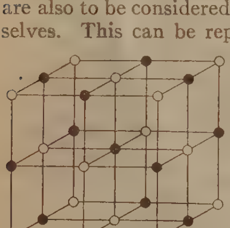


Fig. 4.—Structure of Rock Salt, or Galena (PbS).

There are two other types of cubic lattice. One of these has an additional point at the centre of each cube (this may be called the centred cubic lattice), and another has additional points at the centre of each face, giving the face-centred cubic lattice (represented by the white spots on the larger cube in fig. 4). The different relations afforded by these types need not be discussed here. But in the centred cubic lattice the greatest reticular density is in the rhombic-dodecahedron planes, whilst in the face-centred cubic lattice the particles are most closely packed in the octahedron planes. These would be expected to correspond to cubic crystals showing rhombic-dodecahedral and octahedral cleavage (*e.g.*, zinc blende and fluorspar) respectively.

Types of lattices other than the cubic are deduced by varying the distances of the particles along the different axes and by varying the angles between these axes, in a manner similar to that in which the six crystal-systems are deduced. In fact, the elements of the elementary cells of the lattice, namely, the ratios of their lengths and the inclination of their edges, are identical (except in certain cases) with the parameters $a:b:c$ and the axial angles α, β and γ deduced from the external crystal faces.

The "particles" referred to above may be crystal molecules, chemical molecules, or even atoms. They are represented in the diagrams as spots without committing ourselves as to their shape or size (in relation to their distance apart). Some authors represent them as spheres in contact with one another, regarding these as the spheres of influence of each atom. If the spheres are of equal size, the number of points of contact and the closeness of the packing will vary with the type of lattice. Or again, we may regard the particles (all of the same size) as completely filling space. In this case the particles in the simple cubic lattice will be cubes, each in contact with six other cubes; in the centred cubic lattice they are cubo-octahedra with 14 surfaces of contact; and in the face-centred cubic lattice they are rhombic-dodecahedra with 12 surfaces of contact.

The above outline of the geometrical structure of crystals has been necessary for the purpose of introducing the new X-ray methods of investigating the internal structure of crystals.

X-rays or Röntgen rays are propagated as waves in the same manner as rays of ordinary light, but are of much smaller wavelength. The very fine rulings of parallel lines (about 7,000 to a cm.) of diffraction gratings being of a magnitude (10^{-4} cm.) comparable with the wave-lengths of light, they produce well-known diffraction effects. It would be impossible to produce mechanically a grating which would be fine enough to diffract the much shorter X-rays. But it occurred to Dr. Max Laue, of Zürich, that the reticular structure of crystals would supply the necessary grating, since the distances between the atoms in the space-lattices are of the order 10^{-8} cm. In 1912 this idea was put to the test, with very surprising results. Plates cut from crystals parallel to certain faces were placed perpendicularly in the path of a thin pencil of X-rays, and beyond a photographic plate was exposed. The resulting photograph (known as a Laue photograph or radiogram, Röntgenogram or Röntgen pattern, or spot photograph) shows a larger central spot representing the direct rays, whilst surrounding it is a symmetrical pattern of smaller spots. The spots may also be shown directly by projection on a screen of fluorescent material. This pattern shows the same degree of symmetry as that on the crystal face. Thus a plate from a hexagonal crystal of beryl cut parallel to the basal plane (*i.e.*, perpendicular to the principal axis) shows a six-fold arrangement of spots symmetrical about six radial lines at 30°; whilst when the plate is cut parallel to a prism face of the same crystal, the spots are symmetrical about two lines at right angles.

The results obtained with these Laue photographs were at first explained as due to diffraction, but the problem is much more complex than diffraction by a single system of parallel lines in one plane, since we are here dealing with a lattice in three dimensions in which there are many series of lines in many planes. As explained by Sir William Bragg and his son, Prof. W. L. Bragg, in their book, *X-Rays and Crystal Structure*, 4th ed. (1924), it is due to the amplification of waves reflected from successive layers of atoms within the crystal. In fig. 3 a beam of X-rays AB, $A'B'$, $A''B''$, all of the same wave-length λ, strikes at a glancing angle θ the planes of particles, the distances between which are d.. They are reflected by successive planes as a single ray BC. Produce $A'B'$ to D (then BD is perpendicular to the planes) and draw BN perpendicular to $A'D$. Then, since $B'B=B'D$ and $AB=A'N$, the length of path of the ray $A'B'C$ is greater than that of the ray ABC by the distance $ND=2d \sin \theta$. Similarly, $A''B''C$ is longer than $A'B'C$ by the same amount. If, now, this distance is equal to the wave-length of the rays, if $\lambda=2d \sin \theta$, he rays reflected by successive layers of particles will be vibrating in the same phase and their amplitudes will be added ogether. If the glancing angle θ be varied but slightly, the re-lections from the millions of layers will vary in phase and they will mutually interfere. But at certain other glancing angles θ_2, θ_3, when $2\lambda=2d \sin \theta_2$ or $3\lambda=2d \sin \theta_3$, there will again be an accu-mulative effect, giving reflections of the second and third orders.

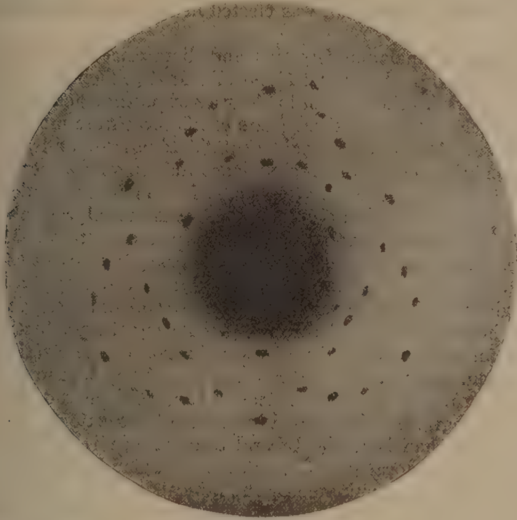


FIG. 5.—Laue X-ray Photograph Through the Basal Plane of Penninite.

In the Bragg apparatus, called an X-ray spectrometer, homoge-eous ("monochromatic") rays from an X-ray tube emerge hrough a narrow slit in a leaden screen and strike at a glancing ngle the crystal plate mounted on a goniometer. The reflected eam enters an ionisation chamber containing sulphur dioxide or methyl bromide and connected with an electroscope. The crystal is slowly turned on the goniometer until a maximum ef-ect is noted in the electroscope, when the angle θ is read. Plotting he readings of the electroscope against those of the goniometer, curve (X-ray "spectrum") is obtained which shows a series of sharply defined maxima or peaks corresponding to reflections of the first, second and other orders. Knowing the wave-length of the rays, the distance between the planes of particles can then e calculated from the above fundamental equation; or, alter-atively, knowing the spacing of the planes, the wave-length of he rays can be determined. As an example, rays from a palladium nticathode ("palladium rays") were strongly reflected from the ube face of rock-salt when the angle θ was 5·9°, 11·85° and 8·15°. Taking the spacing d between the cube planes of rock-alt as $2{\cdot}81\times10^{-8}$ cm., the wave-length λ is found to be $2\times2{\cdot}81$ $\times10^{-8}$ sin $5{\cdot}9°=0{\cdot}578\times10^{-8}$ cm., or $2\lambda=2\times2{\cdot}81\times10^{-8}$ sin $1{\cdot}85°=1{\cdot}154\times10^{-8}$ cm.

A third method of investigation was devised by P. Debye and . Scherrer in Germany in 1916, and independently by A. W. Hull in the United States in 1917. Here a beam of homogeneous "monochromatic") X-rays of known wave-length is trans-mitted through the finely powdered crystalline material, and the reflections received on a photographic film. The tiny crystal fragments are in all manner of orientations; and further to ensure all possible orientations in the aggregate, the tube containing the small amount of powder is rotated during the exposure. For structural planes with the spacing d there are bound to be some of the particles in the position shown in fig. 3 in which the equation $\lambda=2d \sin \theta$ is satisfied; but these will be lying in all azimuths, *i.e.*, sloping away in all directions at the angle θ from the axis of the rays. The reflected rays will consequently lie on the surface of a cone, the angle of which is 4θ; and, instead of a single spot, a continuous series of spots forming a circle will appear in the photograph. Similarly, in other fragments the same set of planes with spacing d may be inclined at angle θ_2 giving a second order reflection as required by the equation $2\lambda=2d \sin \theta_2$, and producing a wider-angled cone concentric with the first. Further, other structural planes with spacing d_1 and inclined at other values of θ will be provided by other fragments, giving still other conical reflections. Since, however, the experiment is performed with rays of one wave-length, only certain values of d will satisfy the equation, so that the number of reflections is really limited. Since only the angles of divergence of the concentric conical sheaths are to be measured, only a narrow strip through the centre needs be photographed. This strip is made semicircular, in order to embrace a wide field of reflected cones. Knowing θ and λ, the equation gives, as in the Bragg method, the spacing d between the structural planes of the crystal.

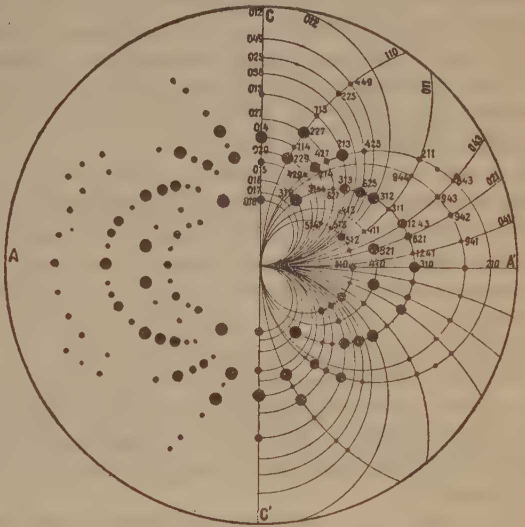


FIG. 6.—Stereogram of Laue Photograph of Anhydrite on the Face (010).

Although the Debye-Scherrer method may be regarded as a modification of the Laue method, yet the results it gives are the same as those given by the Bragg method, namely, the spacing between the structural planes of the crystal. The Laue method gives other supplementary information, but ideas of structure are built up mainly on the spacing between the planes of particles. A large amount of experimental work on crystals of different substances has been done in this direction, and deductions have been drawn as to their probable atomic arrangement. In this place only one or two examples can be briefly considered.

Rock-salt (sodium chloride) crystallises as cubes and possesses a perfect cleavage parallel to the faces of the cube. Plates cut parallel to the faces of the cube (100), the rhombic-dodecahedron (110), and the octahedron (111), respectively, give by the Bragg method values for the spacing between the planes of particles in the ratio of $1:1/\sqrt{2}:1/\sqrt{3}$. These ratios are the same as those mentioned above for the simple cubic space-lattice (figs. 1 and 2), and the conclusion may be drawn that this represents the structure of rock-salt. The two kinds of atoms, sodium and chlorine, may be placed alternately along the three directions, as shown in fig. 4. As so represented the structure may also be regarded as an interpenetration of two space-lattices of the face-centred cubic type, with the sodium atoms on one lattice and the chlorine atoms on the other. One lattice can be brought into the position occupied by the other by a parallel shift along a cube edge through the distance between two consecutive planes. The actual distance between the cube planes, and consequently also between the atomic centres, has been determined to be $2\cdot81\times10^{-8}$ cm., or rather more than a hundred-millionth of an inch. In the drawings, the scale of the lattice is enormously enlarged, and only an infinitesimal portion of the crystal is represented. Some idea of this may be conveyed by saying that if we took a cubic inch of rock-salt and represented the whole of the structure on the same scale as in fig. 4, the drawing would be rather more than 1,000 m. across. The same structure is also shown by galena (lead sulphide, PbS), the crystals of which also possess a perfect cubic cleavage; the two kinds of atoms shown in fig. 4 here represent lead and sulphur.

Examples of crystals with the structure of the centred cubic lattice are those of the metals iron, sodium, tungsten. The face-centred cubic lattice is represented by crystals of the metals copper, silver, gold, platinum. A special type of cubic lattice, known as the "diamond lattice," consists of another kind of interpenetration of two face-centred lattices. Particles belonging to one lattice are placed each at a centre of alternate sub-cubes in the other lattice, and a tetrahedral arrangement so results. Examples of this are diamond and zinc blende (ZnS).

Crystals of various substances are extensively used as radio-detectors in wireless telephony, but no satisfactory explanation of their action has yet been given. An essential character of crystals is a variation of many of their physical properties with the direction within the crystal—in other words, such properties are vectorial.

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CUBA (*see* 7.594), a republic in the West Indies and a member of the League of Nations. Area 44,164 sq. m. (including the Isle of Pines). Since 1909, when for the second time the management of Cuban affairs was turned back by the United States to the Cuban Govt., there has been a remarkable growth in the wealth and prosperity of the island. Population increased from 2,048,980 in 1907 to 2,889,004 in 1919. No fresh census was taken between 1919 and 1925, but estimates gave Cuba about 3,330,000 in the latter year, or over 60% more than in 1907. This increase was largely due to the rapidly advancing number of immigrants. While many represent a mere floating population who return to their own country within the year, a number remain permanently in the island. According to the census of 1919 there were only 65 persons per sq. m., in a country whose habitable area represents an unusually large proportion of the whole. The prosperity of the island is due mainly to its natural resources, but in part to the virtual underwriting of the republic by the United States, which has a right under the Platt Amendment to intervene in Cuba to maintain order, and also has some control over Cuban finances through the requirement that Cuba may contract no public debt beyond the capacity of the republic to repay, which virtually involves the consent of the United States.

I. POLITICAL HISTORY

José Miguel Gómez, who had been the candidate of the Liberals, became president on Jan. 28 1909, and remained in office until May 20 1913. His term was marked by a return to the traditional political evils of the former Spanish colony; but though the Government was corrupt the country prospered and public works were developed. Among a number of political disturbances the race war of 1912 was the most serious. This was a negro uprising in Oriente which, however, was quickly suppressed; a body of U.S. marines was landed for the protection of foreign nationals and their property. Owing to friction within the Liberal party the Conservative candidate, Gen. Mario G. Menocal, was elected in 1912 and took office in 1913.

Charges of maladministration and dictatorial methods were persistently brought against Menocal's Govt., which was unable, furthermore, to show much in the way of positive achievement. Nevertheless, the first three years of his term were moderately successful. Menocal was again a candidate in 1916, and won the election by the employment of violence and other improper methods. In consequence there was a serious civil war under the leadership of Gómez in Feb. 1917, but Menocal was able to defeat his opponents and entered upon his second term. Meanwhile, Cuba had followed the lead of the United States and declared war on Germany on April 7 1917. Little opportunity was given to Cuba to take an active part in the struggle, but great help was rendered through stimulating the production of sugar for sale to the Allies. In anticipation of the elections of 1920 Gen. Enoch H. Crowder of the U.S. Army was invited to Cuba in 1919 to draw up an election law. This he did, but the law was flagrantly disregarded in the ensuing elections. Alfredo Zayas, who had been the Liberal candidate in 1916, was now backed by Menocal in a Conservative-Popular alliance against Gómez, who was nominated by the Liberals. Zayas was successful but Gómez raised a protest, and new partial elections were called for at the suggestion of Gen. Crowder, who had been again sent to Cuba as the personal representative of the President of the United States. Gómez withdrew before they could be completed, claiming unfair methods of the Government, and Zayas had an easy victory.

Meanwhile, Cuba had enjoyed phenomenal prosperity in the "dance of the millions" of 1919, as it was called, but this was followed by a severe financial crisis in the depression of 1920–1. Despite the declaration of a moratorium in the payment of debts, many banks and other business concerns were forced into bankruptcy. Because of the financial difficulties of the republic the Government of President Zayas, who went into office on May 20 1921, was at first amenable to suggestions for reform made by the U.S. Government. A loan of $50,000,000 was approved by the United States and successfully floated in Jan. 1923, and financial conditions rapidly improved. The Cuban war loan of $10,000,000 was liquidated and the year 1922–3 closed with a surplus. But with the return of prosperity in 1923 President Zayas broke away from his advisers, and his political improprieties led to the formation of the Veterans' and Patriots' Assn., whose reform movement was badly mismanaged and failed in the abortive revolution of April–May 1924. Zayas would not indulge in the violence of his predecessor, however, and when he was defeated by Menocal, for the Conservative nomination, made a pact with Gen. Gerardo Machado, the Liberal candidate, to assist him against Menocal in the presidential election of 1924. Machado was victorious and assumed office on May 20 1925. During the Zayas administration the ownership of the Isle of Pines was decided in favour of Cuba.

Education.—Education called for greatly increased expenditure after 1909, but without commensurate beneficial results, because of political factors involved. It was stated that in 1924 53% of the population could neither read nor write. The University of Havana, with over 4,000 pupils, is tending gradually to model its curriculum on the pattern of universities in Europe and the United States. The university was thoroughly reorganised in 1923.

II. FINANCIAL AND ECONOMIC HISTORY

Under a law of Nov. 7 1914, a Cuban coinage system similar to that of the United States was introduced. American money is also legal tender and is in general use. The following table shows the national revenue and expenditure for 1913–4 and 1919–20 to 1925–6:—

	Revenue	Expenditure
1913–4	$37,940,200	$33,974,147
1919–20	91,308,314	91,726,152
1920–1	64,446,000	62,730,744
1922–3	53,628,800	54,852,102
1923–4	73,134,313	57,758,784
1924–5	68,500,000	61,672,169
1925–6	84,791,650	64,780,250

No detailed figures are available for 1921–2. The period 1923–6 showed a considerable surplus, which was applied to the reduction of the public debt. In 1925 Cuba had a foreign debt of about $87,000,000 and a domestic debt just under $12,000,000. In addition, the country has a floating debt of something like $14,000,000.

Production and Industry.—Sugar is the basis of Cuba's wealth. The crop, which in 1910–1 amounted to 1,379,609 tons, was 5,151,486 tons in 1924–5, or nearly a fourth of the world's total production. Between 1909 and 1925 the crop generally increased each year, but there were wide fluctuations in price. Sugar rose from a normal level of around 3 cents a pound, to as much as 5½ cents during the World War, and then to an inflated level of 22½ cents in 1920. In that same year the market broke, and the price fell to 3⅝ cents, rising again in 1923 to an average level of 4·9 cents. Heavy production in different parts of the world caused a fall in price to less than 3 cents in 1925. Many Cuban sugar estates are under control of American companies and in 1924 some 60% of the industry was in American hands: altogether the value of American investments in Cuban sugar approaches a thousand million dollars. The United States takes about 85% of the entire Cuban crop.

Cuban tobacco products are among the most highly regarded in the world, but the industry, though second in importance in the island, does not compare with that of sugar. The crop had a value of $82,289,686 in 1924. All other Cuban industries are insignificant by comparison with sugar and tobacco. In the War and post-war periods the market for molasses, a by-product of sugar, assumed considerable proportions. The climate and soil are favourable to fruit culture, notably citrus fruits, bananas, pineapples and cocoanuts, but the full possibilities of the industry have not been realised. The grazing industry has attained to some prominence, particularly in the province of Camagüey, where there were about 4,500,000 cattle in 1925. There are iron, manganese, copper and asphalt mines in the island, especially in Oriente; signs of oil have been reported over large areas. The henequen industry of Matanzas and sponge industry of Batabanó are locally important. The greater part of the capital in Cuban industries as a whole comes from the United States, which has a total investment of nearly $1,500,000,000. This compares with an investment of $80,000,000 in 1901. While most of the American money is in sugar, there are also large sums in tobacco, mining, fruit, railways, street-car companies, docks, electric light and power companies, telephone companies, banks, hotels, steamship lines and Cuban bonds.

Commerce.—Cuba exports all but a little of what it produces, and imports nearly everything it consumes, even including food products, which constitute some 35 to 40% of the total. Sugar makes up 85% or more of the exports in value, with tobacco 8 or 10%. The increase in the value of Cuban trade has been little less than phenomenal. In the period 1900-4 Cuba had an average annual volume of trade of about $136,000,000. This had reached a total of slightly more than $300,000,000 in 1914 and approximately $725,000,000 in 1924, the highest figure up to that time in Cuban history, except for the inflation period of 1919–20. In 1920 the volume of trade with the United States alone was $1,125,000,000, but value in dollars was hardly a correct index then. Cuban products enjoy a preferential tariff of 20% in the United States, while those from the United States get a concession of from 20% to 40% in Cuba. This is one of the reason for the dominant position of the United States in Cuban trade During the period of 1900–4 the average annual value of U.S trade was only some $101,000,000. Disregarding the abnormal figures for 1920, American commerce with Cuba had reached a total of $553,510,261 in 1924, or about 76% of the total. Cuban exports in 1924 were valued at $434,069,000 and imports at $290,525,585. During the period 1910–25 the balance of trade in favour of Cuba greatly increased.

Communications.—There are two principal railway systems in Cuba, which also control several lesser lines. The United Railways of Havana is an English company, which is the dominant factor in the west, while the Cuba Railroad, an American company, is in control in the east. The latter has greatly extended its sphere through acquiring virtual control of the Cuba Northern Railroad Co. in 1924. While the island is, on the whole, well served by railways, with some 3,250 m. in operation in 1925, the same cannot be said for the roads. Large sums were expended between 1909 and 1924 in roadbuilding, but with little benefit to the republic; at the beginning of 1925 the roads were generally in a bad state of repair. Direct steamship connection exists with numerous European and American ports, with frequent sailings, and there is a train service to the United States *via* a ferry from Havana to Key West. Air services for both passengers and mails are maintained between Havana and the United States.

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CUBISM: *see* PAINTING.

CULTURE: *see* ANTHROPOLOGY.

CULTURE CONTACT, PSYCHOLOGY OF (for PSYCHOLOGY, *see* 22.547).—Present-day psychology is less concerned with describing how and what a man thinks, feels and acts than with trying to understand the causes of his conduct. Every normal man's activities are to a large extent socially determined, and, whether he is aware of it or not, are directed towards the perpetuation and development of the complicated systems of culture characteristic of social groups. Consequently, the psychologist is as interested in culture problems as the ethnologist and the sociologist, and he has his own especial contributions to make towards the study of the growth, distribution, maintenance, and transformation of culture patterns.

Social Institutions.—No social group has ever been known which does not possess distinctive customs and institutions. These, and the tendencies which cluster about them, are, in fact, the characteristics that we use whenever we wish to give a psychological definition of any particular group. Such customs and institutions are constantly being elaborated or simplified; old features are built up into new patterns, or pass away. And the changes are never haphazard. They proceed according to certain principles. The discovery of these principles lays bare the secrets of the growth of culture, and for this and the formulation of the principles a psychological method of approach must be adopted.

The main, if not the only, general condition of mental and social development is that the individual or the group should come into contact with other individuals or other groups. The resulting clash of feelings, actions, ideas, customs and institutions is the great stimulus to change.

Modes of Contact.—But this consideration obviously does not carry us very far. Social contact may take several different forms. First, a number of people may migrate as a whole group, and, carrying with them all the features of their special culture, may find a new temporary or permanent abode. The customs and institutions of these immigrants will then mingle with, or perhaps even replace, those of the people to whom they have come. The complexity of many of the characteristics of Australian and Melanesian culture has been attributed mainly to a series of group contacts of this kind, and illustrations of the same mechanism of diffusion abound in almost every part of the world.

Second, an individual may break away from his original home, and, attaching himself to an alien group, assimilate certain features of their peculiar culture. Later, returning home, he introduces the borrowed elements into his old group, and there, under certain circumstances, they will root and thrive. This is a mode of diffusion particularly characteristic of modern society, and it is constantly illustrated in changes of culture which are open to daily observation.

Contact and Borrowing.—The two cases must be distinguished. The first is "diffusion by contact," the second "diffusion by borrowing." Both occur at all stages of social development, but the second probably plays a larger and larger part as civilisation advances. In a third, intermediate, form of diffusion, groups living in close proximity and friendly relationship constantly intermix, with much resulting interchange of cultural elements. It is clear then that there is no safe argument immediately from similarities of culture to "diffusion by contact." We must study carefully the mechanisms by which "contact" or "borrowing" may be set to work.

Mechanisms.—These mechanisms can, no doubt, be partially described in terms of the sphere of culture affected, whether material or ceremonial: for instance, of external environmental conditions; of the relative numbers of the groups involved, and in other more or less purely objective ways. But at the basis of these are the attitudes and tendencies of the individuals and groups in question, and in these and their consequences psychology takes an especial interest.

First consider the case of "diffusion by contact." The consequences which ensue when two groups meet, each with its own relatively complete and characteristic institutions, customs and beliefs, depend directly upon the dominant *social relationship tendencies* which are brought into play. Among man's instinctive endowment are certain tendencies which are peculiarly social. The three most important of these are: assertiveness, submissiveness and a characteristic tendency best termed the tendency towards "primitive comradeship" which leads to a social relationship with much interchange but no assumption of superiority or of inferiority. These tendencies come to dominate a man's attitude towards his fellows, and get so built up into group life that they prominently determine a group's reactions to other groups.

Survival and Instability.—When two groups come into contact for any length of time, the one being markedly assertive, and the other markedly submissive, the culture of the first seems completely to displace that of the second. But frequently there is only a surface victory. The customs of the submissive group are merely driven underground. They persist in secret and burst out again unexpectedly in times of social unrest. The community produced is socially unstable, and liable to profound regressions.

If, however, the dominance of one group is less pronounced, and the submissiveness of the other less complete, many of the customs of the indigenous and of the incoming people persist for a long time side by side. An apparently bewildering complexity of cultures is produced. But in the end genuinely new and stable social patterns are constructed. Finally, where "primitive comradeship" is the dominant social tendency, a true blending of cultures is secured, and a cultural structure is evolved which contains elements from both sides relatively unchanged.

Control of Existing Culture.—By whatsoever route the stimulus to new cultural developments reaches a group—whether by contact or by borrowing—all imported material has to be fitted into some already existing cultural pattern, otherwise its position in the new group remains exceedingly unstable. For the deep-seated human tendency towards *conservation* is immensely strengthened by social grouping. Conservation is, however, always subject to control and direction by other tendencies, and is, consequently, selective in its operation. Most commonly of all it is controlled by impulses that immediately serve practical needs. Thus a group may cling very tenaciously to a food-seeking *ritual*, but be comparatively ready to change its food-seeking *instruments* for others which are in practice obviously more efficient. The operation of this principle of selective conservation means that even when systems of culture move as a whole they are practically never accepted as a whole. They must submit to the inertia of the culture patterns of their new homes. In the end it will appear as if they moved, not as a complex unity, but as elements "lifted" from a whole. The elements that persist are those which have direct practical utility, those which present obvious affinities to an already existing culture, and very often those which appear odd, disconnected, incidental and of small importance. To understand why, in a given social group, certain features of culture are jealously guarded from change, while others can be fairly easily displaced, a thoroughgoing intensive study is necessary, not merely of what reaction tendencies are operating in a group, but especially of how these tendencies are arranged.

Formation of New Patterns.—Because conservation is selective, any change successfully introduced into a community from without tends to produce eventually a new social pattern. But in addition to this, the normal individual and the normal group both show a genuinely constructive capacity. No idea received into a mental life, no custom accepted within a group, remains isolated. It has to be built into a structure with other ideas and with other customs, and the result is often peculiar to the individual or group concerned. No social psychologist has yet carried out a radical analysis of what is involved in social constructiveness. The problem is one for the future, but undoubtedly in this sphere particularly the initiative of prominent individuals *within* the group plays a most important part. Definite foresight and articulated purpose have a great deal less to do with the matter than has frequently been supposed.

The Individual.—When considering "borrowing" we picture a migrant individual who leaves his group and settles for a while in an alien social environment. Some features of his new setting will attract his attention and inspire his envy; others he will notice and then ignore; yet others he will fail altogether to detect. From the psychological point of view there are three groups of conditions which are particularly important in determining these responses. First, there are the group of instinctive tendencies which this individual possesses in common with all other human beings, which have their unique arrangement in every person. Second, there are that endowment of specific tendencies and that development of "interests" which mark off the migrant individual in question from all other persons. Third, there are the social traditions, customs and institutions of his own people, which, in fact, though they belong to the wanderer's native group, yet affect his conduct in the most direct manner. These all, coming into operation together, determine what he will "borrow."

Eventually the borrower returns to his own group. He may, of course, make no attempt whatever to introduce the borrowed material into his native society. He may continue to practise the alien customs, but then, as a rule, they will not make much impression, and will speedily disappear. He may, however, have the temperament of a propagandist, or be what is called "public-spirited," and if this is the case he will seek converts to the new ways.

Innovations.—Here again the fundamental social relationship tendencies are important. There is a "primitive comradeship" type of innovator. Such a person at once, though unwittingly, modifies the newly accepted cultural material in the direction of the traditional customs and institutions of his own group. He has a distinctive mode of propaganda, in the main persuasive, and working along the established lines of social organisation of his society. But in spite of this, as soon as his innovations attract notice they are almost invariably met with hostility from one party and with acceptance from another party. At once the borrower becomes a centre of social attention, and this reacts strongly upon his whole attitude and practice. He is now apt o emphasise the difference between the new proposals and the ld culture, and to join reformers who are more radical than imself. There frequently grows up a definite cleavage between he new and the old. Despite everything, however, the powerful onservative tendencies of the group will gradually give to the nnovation something of the shape of the long-standing culture f the society concerned.

Special Groups.—Probably no new custom, however it may be ntroduced, makes social headway without the formation of a pecial group which takes the custom as its rallying-point. Any uch group is apt to be rendered conspicuous in the eyes of the ther members of the community. Thereupon it is subjected to recisely the same kind of socially initiated influences that, as ve have seen, affect the individual borrower. Such a group tends o become relatively assertive, or dominant, in the society to vhich it belongs, and endeavours to increase its prestige. Then he customs and institutions which are the peculiar stamp of the roup in question invariably undergo elaboration. At the same ime the group may jealously protect itself from new-comers, uarding its secrets with care, and making entrance into its anks difficult and perhaps dangerous. This is the typical ondition for the growth of elaborate social culture.

Simplification.—Elaboration of culture, however, may carry he elements of its own decay. If it proceeds to extremes the pecial groups concerned are apt to become cut off from contact vith the bulk of the people. Deterioration and simplification of ulture invariably follow. This may be called "simplification y isolation."

On the other hand, a group formed about new customs may pen its ranks widely, so that almost anybody who wishes can earn its secrets. This also leads to a deterioration of culture, nd may be called "simplification by spreading." Simplification y isolation is a common fate of systems of ceremonial culture; implification by spreading is more frequently found with mateial culture. It is an interesting fact that, as in the mental life f the individual, so in the social life of the group, a certain mount of conflict is the most general condition of constructive ffort.

The special devices by means of which elaboration and simplification are secured are also, to a large extent, psychologically letermined. For example, ceremonial practices, details and roducts of material art, artistic designs, songs, linguistic pecuiarities and even details of social organisation travel more eadily than the interpretations attached to them. Yet if retained in a new environment they must be interpreted. The interpretation given is often the work of some prominent individual. Details come from without, interpretations grow up from within a group, and a common interpretation of differing materials often aids greatly the construction of new cultural patterns. Reduplication and genuine conscious invention have their predisposing conditions, and their special functions in elaboration. Simplification may result from the fact that certain ideas, beliefs and practices may grow so strong in a community that they tend to absorb all others. The same general effect may follow unwitting omissions in copying or in imitation. Or *apparent* simplification may be caused by the repression of socially undesirable elements of a custom or institution through a conflict of groups or of social tendencies. Only the intensive study of particular groups and particular cultural problems can show exactly what has happened in any given case, and so disclose the principles which come into operation. Such intensive study contemporary psychology is beginning to undertake. A little has been accomplished, more remains to be done. No doubt the conclusions which have been reached so far will in the near future be corrected and supplemented.

Bibliography.—The field of study dealt with in this article has been as yet but meagrely explored. A great amount of important material is to be found in monographs and special studies of particular groups. These are very numerous, and no attempt can be made to indicate here important works belonging to this class. For more or less general discussions see F. M. Davenport, *Primitive Traits in Religious Revivals* (1905); W. H. R. Rivers, *Kinship and Social Organization* (1914); F. J. Teggart, *Prolegomena to History* (1916) and *The Processes of History* (1918); R. R. Marett, *Psychology and Folk-Lore* (1920); F. C. Bartlett, *Psychology and Primitive Culture* (Cambridge, 1923); L. Lévy-Bruhl, *Primitive Mentality* (1923); M. T. Price, *Christian Missions and Oriental Civilisations, a Study in Culture Contact* (Shanghai, 1924); F. J. Teggart, *Theory of History* (1925). (F. C. B.*)

CUMMINS, ALBERT BAIRD (1850–), American politician, was born at Carmichaels, Pa., Feb. 15 1850. He was educated at Waynesburg (Pa.) College, studied surveying, and was at first engaged in railway work. He then took up law, was admitted to the bar of Illinois in 1875, and for three years practised in Chicago. In 1878 he went to Des Moines and ten years later was a member of the Iowa House of Representatives. He was chairman of the Republican State Committee (1892–6), candidate for the United States Senate in 1894 and 1900, member of the Republican National Committee (1896–1900) and a delegate to the Republican National Convention on four occasions. He was elected Governor of Iowa in 1902 and re-elected for two succeeding terms. In 1908 he was elected to the United States Senate to fill the unexpired term of Senator Allison, and was re-elected in 1909, 1915 and 1921. He opposed the nomination of Mr. Taft in 1912, but did not leave his party. He was specially identified with measures concerning trusts and railways, and took a leading part in drafting the Esch-Cummins Act, under which the Govt. in 1920 handed back to private control the railways of the United States.

CUNLIFFE-LISTER, SIR PHILIP (1884–), British politician, was born May 1 1884 at Ayton, Yorkshire. The youngest son of Lieut.-Col. Yarburgh G. Lloyd Greame, he assumed by royal warrant the name of Cunliffe-Lister in Dec. 1924. He was educated at Winchester and University College, Oxford, and was called to the bar in 1908. During the World War he served with the King's Royal Rifle Corps, attaining the rank of major. Elected Conservative member for Hendon in 1918, he quickly made his mark in Parliament as a speaker on commercial subjects. He was chairman of the Labour Committee of the War Cabinet, and served on other important government committees. He was Parliamentary Secretary to the Board of Trade and of the Overseas Trade Department in the Lloyd George Coalition Government till his appointment by Mr. Bonar Law as President of the Board of Trade in Nov. 1922. He held the same office in both Mr. Baldwin's administrations, and presided at the Imperial Economic Conference held in London in 1923, when he advocated the extension of Imperial Preference. He carried through Parliament measures for safeguarding particular British industries through protective tariffs.

CUNNINGHAM, WILLIAM (1849–1919), British economist (*see* 7.633), died at Cambridge, England, June 10 1919.

CUNNINGHAME GRAHAM, ROBERT BONTINE (1852–), British writer, eldest son of William Cunninghame Graham of Ardoch and Gartmore, was educated at Harrow. He spent much of his youth cattle-farming in the Argentine, and travelled widely in Paraguay, Mexico, Spain and Morocco. A Spanish grandmother made the Spanish language and national temperament singularly congenial, and his writings are throughout coloured by these early experiences. Cunninghame Graham sat as M.P. for North Lanarkshire from 1886–92, and took an active part in Labour politics, being closely associated with John Burns and Keir Hardie in their early days.

Characteristic of his varied writings, essays, travel notes, biography and stories are these: *Mogreb-el-Acksa* (1898); *A Vanished Arcadia* (1901); *Success* (1902); *Hernando de Soto* (1903); *Faith* (1909); *A Brazilian Mystic*, a life of Antonio Conselheiro (1920); and a biography of his ancestor, *Doughty Deeds of Robert Graham, 1735–97* (1925). See also L. Chaundy, *A Bibliography of the First Editions of the Works of Robert Bontine Cunninghame Graham.*

CURIE, MARIE (1867–), French scientist, the daughter of Professor Sklodowski, a Pole, was born in Warsaw Nov. 7 1867 and studied in Paris, taking a science degree at the university there. In 1895 she married Dr. Pierre Curie (*see* 7.644), the French physicist; and after working for several years at the École de Physique et de Chimie in Paris, she carried out highly important experiments on the radio-activity of uranium compounds, a phenomenon discovered by Henri Becquerel in 1896. This research work led up to the epoch-making discoveries of polonium and radium. After years of arduous work (carried out in an abandoned shed with the most primitive equipment) Madame Curie succeeded in isolating pure radium salts. The Nobel Prize was awarded to her in 1903, in company with Dr. Curie and Becquerel; and in the same year she became a doctor of science.

On the tragic death of her husband in 1906, she succeeded him as professor at the Paris University and in 1911 was awarded the Nobel Chemistry Prize for her work on radio-activity. The Paris Radium Institute and the Warsaw Radio-activity Laboratory owe much to Madame Curie. During the World War she organised a valuable radiological service in the hospitals and later directed the Curie Laboratory in Paris. In 1921 President Harding, on behalf of the women of the United States, presented her in person with a gramme of radium in recognition of her great services to science. *See* RADIO-ACTIVITY; RADIUM.

CURRENCY (*see* MONEY, 18.694).—Currency means the media of payment. As usually understood, it includes money which is legal tender (*i.e.*, by which a debt may legally be discharged), and also bank notes which, though they may not be legal tender, pass freely from hand to hand. In business affairs, the predominant medium of payment is bank credit; a debt due from a banker is assigned from one creditor to another by a cheque or other instrument of transfer. A bank credit is not called currency, though sometimes a cheque is. A bank note is itself an instrument for transferring a bank credit.

The money of account is the unit in which debts (including bank credits) are measured. Whatever is legal tender must be expressed in terms of the money of account, in order to determine how great a debt it will pay.

Developments of Monetary Theory.—The quantity theory of money sets out to show how the value of the currency unit is determined. It used to be stated in the form that, other things being unchanged, the value of a unit of money is inversely proportional to the quantity of money in circulation. In other words the price level is directly proportional to the quantity of money in circulation. The theory is very often loosely stated in a fallacious form, omitting the condition "other things being unchanged." That condition can however be dispensed with if certain of the "other things" be introduced into the formula. The price level varies directly as the quantity of the means of payment and the rapidity of circulation, and inversely as the volume of transactions per unit of time. The means of payment of course include bank credit.

It is very commonly argued that post-War experience with the depreciation of paper currencies has confirmed the quantity theory. But it should be understood that the quantity theory states not merely that when the quantity of money increases prices will rise, but that prices will rise *in the same proportion* (subject to the necessary allowances). When the quantity of money changes, that usually in itself induces a change in rapidity of circulation. Once prices start rising, people spend their money more quickly; when prices are falling, they prefer to postpone their purchases. These tendencies accentuate the effects of either expansion or contraction in the supply of money and credit.

The quantity theory, in a form involving factors so unascertainable as the volume of transactions and the rapidity of circulation, has little direct application to practical affairs. The price level is in fact governed by the amount that people spend per unit of time, whether on consumption or on investment (for money saved is spent on the production of capital goods). What they have to spend (the total, that is, of incomes) may be called the consumers' income; what they do spend may be called the consumers' outlay. The stock of money and credit, representing the purchasing power which people have, but have not used, may be called the unspent margin. An increase or decrease in the unspent margin permits of a discrepancy between the consumers' outlay and the consumers' income, but this can only be so for a moment of transition. The consumers' outlay supplies the fund from which the greater part of the consumers' income is derived. People who produce or sell get their incomes from those who buy. It is easy to see how responsive markets and prices are likely to be to a change in the unspent margin. In a country with a banking system such a change is effected through the lending operations of the banks. The regulation of credit by a central bank (especially through adjustments of the bank rate or rediscount rate) is described in the article BANKING.

Monetary Movements and Unemployment.—Perhaps the most important development in currency theory in recent years has been the recognition of the intimate relation between monetary movements and unemployment. A contraction of credit, involving a rise in the purchasing power of the currency unit, that is to say a general fall of prices, is invariably accompanied (in an industrial community) by unemployment. It deters dealers in commodities from adding to their stocks and from giving orders to producers. The severity of the unemployment corresponds approximately to the magnitude of the monetary movement. Whenever credit is allowed to expand unduly, and prices rise, the value of the currency unit can only be restored at the cost of a credit contraction and consequently of unemployment. It is to guard against this, that a policy of price stabilisation has been advocated. If measures are taken to check any general rise of prices in time, the need for a contraction of credit to bring about a fall is avoided. The application of such a policy is not free from difficulty (especially in the measurement of the price level) and it cannot be put in operation mechanically and without the exercise of considerable discretion.

This policy received recognition at the Genoa Conference in 1922, in the form of a resolution in favour of international co-operation of the central banks of issue to regulate credit with a view to preventing undue fluctuations in the purchasing power of gold. Something approaching to it has been put into practice by the Federal Reserve Banks in the United States, since the influx of gold in 1922–4 made their reserve proportions inoperative and threatened an inflationary rise of prices. Prof. Irving Fisher has proposed a plan for stabilising the purchasing power of a currency by making the unit convertible into a variable amount of gold, to be increased as prices rise and decreased as prices fall (*see* DOLLAR STABILISATION). Mr. Keynes has proposed a plan of stabilisation which would dispense with convertibility into gold.

I. THE PRE-WAR PERIOD

The Gold Standard.—The years immediately preceding the crisis of 1914 saw the approaching completion of an evolution that had been in progress since 1872, the spread of the gold standard. The essential meaning of the currency system called by that name is that the monetary unit is equated to the value of a prescribed weight of gold. Since gold is a commodity with a world market, and its value at one place does not differ appreciably from its value at another, the currency unit of a country with a gold standard has a world value determined by its equivalent in gold (*see* EXCHANGE, FOREIGN). A gold standard may be maintained either (*a*) by the actual circulation of gold coin, the free coinage of gold and the free melting of gold coin, or (*b*) by the use of paper money convertible on demand into gold, or (*c*) by what is called an exchange standard, that is to say, paper money or token coin exchangeable, through a central bank or some other agency, into credits in other countries where the gold standard is maintained by one of the other two methods.

Gold coin circulated in England, France and Germany and in a few other countries, among which Egypt may be mentioned. Convertible paper money was the more prevalent plan, and it was often supplemented in practice by something very like an exchange standard. In Austria-Hungary, Russia and Greece the chief reliance was on the exchange standard. Several countries possessed token silver coins of unlimited legal tender (especially the five-franc pieces in the countries of the Latin Union, France, Italy, Belgium, Switzerland and Greece, and the standard dollars in the United States). These were a relic of the era of bimetallism, when there had been free coinage of both gold and silver. So long as the quantity of such coins in circulation was limited, they did not disturb the functioning of the gold standard. In Spain the coinage of five-peseta pieces (though no longer free) had not been restricted to the necessary extent, and the gold standard had never been established.

United States.—The United States had a currency system bearing traces of a complicated history. Side by side with the legal tender United States notes, or "Greenbacks," and the bond-secured notes of the national banks, there circulated standard silver dollars and gold. But gold coin was not popular, and was little seen except on the Pacific Coast. In its place were used gold certificates. The gold certificate differs from a bank note in that it is not evidence of a debt, but a title to a specified amount of gold. The gold for which certificates are issued is held by the Treasury in trust. That does not mean that the holder of a certificate is entitled to receive the particular pieces of gold for which it was issued, but the certificates are covered by gold, dollar for dollar, and cannot be made inconvertible. Silver certificates are likewise issued against silver dollars. All forms of currency in the United States other than gold and gold certificates were in one way or another limited in amount. The expansion of the currency had to be provided for by imports of gold, and the stock of monetary gold in the country rose from $599,000,000 in 1896 to $1,890,000,000 in 1914.

In South America the abuses of paper money had been rife, but by 1914 the greater part of that continent was on the gold standard (in some countries after repeated devaluations). In the East silver remained the standard in China, but the Indian rupee had become a token coin skilfully maintained at a fixed gold value of 1s. 4d. by means of an exchange standard. The exchange standard had also been successfully applied to the Straits Settlements, the Philippine Islands and Siam.

II. THE WAR PERIOD

The Crisis of 1914.—The imminence and outbreak of the World War in July and Aug. 1914 paralysed the investment markets, the foreign exchange markets and the money markets of the world. The most liquid assets were frozen up. The machinery of payment ceased to function. The system, usual in European countries, which made a central bank of issue the ultimate resort of everyone in need of credit, gave a monetary character to the crisis. What was needed was the means of payment, and that could be supplied by the bank which had power to issue legal tender notes. But it could only be supplied if the bank were relieved of legal limitations upon its power of issue. Hence these limitations were everywhere relaxed. All over the Continent the convertibility of notes into gold was suspended. Reserve proportions and similar restrictions were removed or modified. Where notes below a certain denomination were not allowed (as in France where the smallest notes had been of 50 fr.) small notes were legalised.

In England there were no notes below £5, and currency notes for £1 and 10s. were hastily provided. Under the Currency and Bank Notes Act, passed on Aug. 6, they were issued by the Treasury, and were made legally current as if they were gold coins. They were not debts or "promises to pay," but a legal obligation was placed upon the Bank of England on behalf of the Treasury to exchange them on demand into gold coin. Bank of England notes, being debts, became payable in currency notes, but as the latter were convertible into gold coin, specie payments were not suspended. The feared shortage of currency did not occur, but the currency notes were issued in rapidly increasing quantities. The gold they displaced from circulation was accumulated in the banks and became available for export to meet the insatiable needs of the Government for payment for foreign supplies.

War Inflation.—So far as currency is concerned, the history of the War may be summed up in one word—inflation. Essentially what happened was that the belligerent governments found their liabilities outstripping the funds they could raise by taxation and by the borrowing of genuine investible savings. After exhausting every expedient, they were faced with the imperative necessity of payment, and rather than let their current liabilities get indefinitely into arrear, they practically printed paper money for the purpose of paying. In form the governments "borrowed" from the central banks of issue, and the central banks placed at their disposal in the first instance not actual legal tender bank notes, but a credit on current account. In continental countries the credit would be quickly drawn out in notes. In England, where cheques are more freely used, this would not necessarily be so, but deposits at the Bank of England count as cash to the money market and the banks, in practically the same way as notes. Credit expanded in proportion, and when notes were required they were issued. As the quantity of money in each of the belligerent countries grew, the value of its currency unit fell; in other words prices rose. The foreign exchanges likewise became adverse.

In England the maintenance of gold payments threatened to become a sham. The exchanges were slipping below gold parity. Had gold been free to move, enormous profits could have been made by exporting it, particularly to America, where the exchange fell at the end of Aug. 1915 to 4·50 (7½% below par). With insurance against war risks at sea wholly in the hands of the Government, gold could not in practice be exported without the consent of the Government. Attempts to get round this form of control would be met by powerful moral dissuasion from the Bank of England.

The Government indeed did not hoard the gold. Large quantities were exported on Government account, and France, Russia and Italy were required, as a condition of the financial assistance they received from the British Govt., to export part of their cherished reserves. Energetic measures were taken to provide resources both by borrowing in the American market, and by requisitioning American securities held by British investors and selling or pledging them in New York. By such means it was possible to support the exchange and maintain the pound at 4·76, or about 2% below parity.

But that did not mean that inflation was avoided. It was less in extent than among the continental belligerents, but the flood of gold that was let loose upon the neutrals brought about a depreciation of gold itself in comparison with commodities. By April 1917, when the United States entered the War, the wholesale index numbers showed that the price level in Great Britain was about double that of 1913. The rise in the United States was only 60%, but the exchange was still successfully pegged at 4·76.[1] Although France had abandoned the gold standard, the French exchange was also pegged, but at a level averaging about 10% below par, by advances from the British Government.

The financial strain of these arrangements, which threatened to become unbearable, was immediately relieved when the United States became a belligerent and placed liberal advances at the disposal of her associates. The pegging of the exchanges continued, and in 1918 was extended to include Italy. But meanwhile the United States in turn resorted to inflationary finance. The reserve requirements of the Federal Reserve system were modified (June 1917). A substantial part of the Government's financial needs was met by the creation of bank credits. The export of gold was prohibited (Sept. 1917). There ceased to be a world market in gold. There was even a partial demonetisation of gold, the three Scandinavian countries having suspended the laws providing for the free transformation of gold on demand into coin or credit. Spain also bought gold at a discount. Everywhere the foreign exchanges ceased to depend on movements of gold, and in comparison with some neutral currencies the dollar fell to a heavy discount (and with it of course the pegged exchanges).

The Russian exchange was never pegged. The financial and political weakness of the country was reflected in a lavish recourse to inflationary measures, and by the time of the Revolution of March 1917 the Imperial Bank had made advances to the State amounting to eight milliards of roubles. The rouble was quoted at 17 to £1 as compared with its par value of 9½. The depreciation of the exchange mattered comparatively little to a country which was almost isolated from the world, but the economic and administrative confusion was seriously aggravated by the unsound monetary position. Prices were three times as high as before the War, and such was the distrust of paper money that the peasants could not be induced to sell their produce. After the March revolution a complete monetary breakdown began. In the eight months which intervened before the Communist Revolution of Nov. the note issue was doubled, and prices trebled. The country had already been entangled in that vicious circle of inflation, which has since become so painfully familiar to Europe, before the early enthusiasm of the Soviet was directed to extirpating the use of money. Because the currency was utterly discredited, the Government could not raise money either by tax or loan, and because it was driven to print notes to pay its expenses, the discredit was continually aggravated. There was no longer a market in foreign exchange, but prices leapt up. By the middle of 1918 they were 100 times the pre-War level, and were rising as rapidly as ever.

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[1] For the relation of the foreign exchanges to prices, *see* EXCHANGES, FOREIGN.

In the rest of Eastern and Central Europe the extremes of monetary collapse were warded off as long as the pressure of war enabled the Governments to exercise rigourous control over every form of economic activity. Upon Germany and Austria-Hungary the War imposed an isolation which was eventually nearly as complete as that of Russia, and the foreign exchange market was almost deprived of significance. By the end of 1918 the German note issue was 33 milliards of marks or more than five times the stock of currency, in paper and coin, that had been in use before the War. Yet the mark was still worth 56% of its par value in terms of dollars. Prices had not risen anything like proportionally to the circulation, for nearly all staple commodities were rationed at controlled prices. The position was similar in Austria-Hungary.

III. THE COLLAPSE AFTER THE WAR

The cessation of hostilities brought release from a tremendous tension. Neither peoples nor statesmen were in the mood to deal with the abstruse technical problems of currency, however urgent the necessity. As a matter of fact the statesmen were as innocent as the peoples of any knowledge that such problems called for solution. They were too preoccupied with the overwhelming fact of victory or defeat (defeat in some cases complicated by revolution) to give much thought to anything else. They had been bewildered by the magnitude of the financial operations of the War, and the one conclusion established by experience appeared to be that everyone who had ever said tha there was a limit to the amount of money that could be spen was wrong. In the first months after the Armistice demobilisation proved almost as costly as war. At the same time lavish public expenditure became the universal remedy for discontent. The high prices resulting from monetary inflation were attributed to every cause but the right one. The War-time expedients of rationing and controls broke down, for the discipline of War-time was no longer possible, and recourse was had to food subsidies. The subsidies, like all other increased expenditure, could only be provided by issues of paper money.

During the War each side had striven to cut off the other from receiving supplies from overseas. There was an extreme shortage of stocks of all natural products throughout Europe, and the new crops were short, owing to the insufficiency of labour and the scarcity of fertilisers. Europe, overflowing with money, was in desperate need of everything else. The moment communications were opened with those countries in America and elsewhere which were in a position to supply products so urgently needed, the redundant money in Europe began to be applied to buy these products. At once the weakness of the situation was revealed in a fall of the exchanges. Exporters in America and elsewhere hardly realised what was happening. Some were unwilling to remit home sums which they had received in depreciated currencies, and waited in the hope of an improvement. Others were induced to sell goods just because they would receive an apparently enormous price in a depreciated currency, which they hoped later on to exchange at or near par. But amid all these illusions there were always enough sceptics who turned the proceeds of sale into sound dollars without delay, and the value of marks, crowns, francs, lire in the foreign exchange market steadily fell.

That state of affairs lasted throughout 1919. In March of that year the pegging of the English, French and Italian exchanges had ceased. French and Italian paper money had been inconvertible since 1914; and the exchanges on those countries were free to vary. English currency notes on the other hand were convertible into sovereigns at the Bank of England, and, now that insurance against war risks was no longer required, there was nothing but moral pressure to prevent people from withdrawing gold from the Bank for export, and gaining thereby a large profit on exchanges. Despite the weighty recommendations of the Cunliffe Committee (*see* GREAT BRITAIN) the export of gold was prohibited. The melting of coin had been prohibited

Exchange Rates 1920–5 (in U.S. Cents)

	Par	Feb. 1920	June 1920	Nov. 1920	May 1921	April 1922	Feb. 1923	March 1924	Feb. 1925	Dec. 1925
Great Britain	486·66	338·19	395·14	342·60	397·85	441·49	469·08	429·06	477·24	484·98
Denmark .	26·80	14·94	16·90	13·40	18·00	21·23	19·09	15·68	17·81	24·86
Norway . .	26·80	17·40	17·61	13·37	15·72	18·67	13·57	13·57	15·25	20·31
Sweden . .	26·80	18·76	21·85	19·15	23·41	26·07	26·61	26·30	26·94	26·79
Switzerland .	19·29	16·55	18·22	15·55	17·86	19·45	18·80	17·29	19·25	19·30
Spain . .	19·29	17·53	16·56	12·89	13·42	15·54	15·67	12·76	14·22	14·18
Holland . .	40·20	37·38	36·12	30·17	35·60	37·94	39·53	37·06	40·17	40·19
France .	19·29	7·05	7·95	6·00	8·38	9·24	6·15	4·68	5·28	3·74
Italy .	19·29	5·51	5·94	3·60	5·31	5·37	4·82	4·28	4·11	4·03
Belgium .	19·29	7·18	8·31	6·38	8·37	8·52	5·40	3·87	5·07	4·53
Germany .	23·82	1·05	2·58	1·32	1·63	·35	·0038	22·0[1]	23·80[1]	23·81[1]
Austria . .	20·26	·369	·736	·312	·259	·013	·0014	·0014	14·06[2]	14·06[2]
Hungary .	20·26	. .	·644	·216	·489	·126	·0381	·0015	·0014	·0014
Poland . .	23·82	·794	·630	·279	·128	·026	·0025	([3])	19·18[4]	12·76[4]
Czechoslovakia	20·26	1·19	2·35	1·14	1·45	1·96	2·96	2·90	2·96	2·96
Yugoslavia .	19·29	3·57	4·72	3·04	3·08	1·45	·97	1·24	1·62	1·77
Rumania .	19·29	1·69	2·34	1·49	1·72	·73	·48	·52	·51	·46
Greece . .	19·29	12·22	12·06	9·03	5·62	4·47	1·17	1·63	1·61	1·29
Bulgaria . .	19·29	1·75	1·75	1·22	1·31	·69	·64	·74	·73	·73
Finland . .	19·29	4·40	4·87	2·23	2·19	1·94	2·61	2·53	2·52	2·52
Canada . .	100·00	84·10	87·89	89·09	89·71	97·89	98·91	97·06	99·86	99·96
Japan . .	49·85	48·47	57·49	50·81	48·46	47·56	48·44	42·90	39·08	43·19
India . .	. .	47·28	40·82	29·68	26·73	28·66	32·28	30·19	35·73	36·64
China . .	. .	161·00	106·05	78·83	68·27	73·94	71·82	70·00	75·26	75·68
Argentina .	42·45	43·37	42·35	33·78	31·75	36·53	37·23	33·88	39·75	41·45
Brazil . .	32·44	26·14	25·67	16·57	13·67	13·81	11·57	11·60	11·27	14·17
Chile . .	. .	21·75	20·80	14·06	12·03	11·85	12·27	10·12	10·84	12·16

[1] New marks, equal to 1,000,000,000,000 of the old. [2] Schillings equal to 10,000 kronen.
[3] 10·8 cents to 1,000,000 Polish marks. [4] Zloty, equal to 1,800,000 Polish marks.

ince 1916. The link between gold and money in the London narket being thus broken, it became possible for the sterling xchange on gold-using countries to vary as freely as that of the ranc or the lira.

Since Sept. 1917 the export of gold from the United States ad been prohibited, and at the Armistice the dollar still stood t a small discount (something like 5%) in relation to the prinipal neutral currencies. Freedom to import supplies urgenty needed quickly depressed the currencies of the European neutrals. By June 1919 all of them except Spain were beow par. In that month the prohibition on the export of gold rom the United States was removed.

Thus the gold standard was restored in the United States. The moment seemed a favourable one. Inflationary Governnent finance had ceased. The Government securities held by he banks were being gradually disposed of to the public. Nevrtheless there was an element of weakness. The abnormal xports to Europe were not being paid for, or were being paid or in depreciated currencies which the exporters hesitated to oring home. The gap in the American traders' cash resources ad to be made good by borrowing from their own banks. The esulting stimulus to trade borrowing soon began to produce nflationary symptoms. Prices rose. The Bureau of Labour ndex number, having fallen from 203 in Nov. 1918 to 193 in eb. 1919, rose to 233 in Jan. 1920. Enormous quantities of old were exported to the few countries still in a position to eceive it. By the end of 1919 the net exports of gold amounted o $300,000,000, chiefly sent to South America and the East; n Europe it went only to Spain. But the countries which still ought gold as currency (Spain, Japan, Argentina, Uruguay) vere inevitably contaminated with the American inflation, and ollowed not far behind.

The Crisis of 1920.—Thus, when European currencies depreiated headlong, it was in comparison with a standard which vas itself depreciating. The climax came at the beginning of 920. In Jan. the Federal Reserve Bank of New York raised ts rediscount rate to 6%. In the same month the American anks began to call in advances made to traders who were holdng European currencies. The result was a convulsive collapse f the exchanges, which brought sterling for a moment down to ·20, or 34% below par.

The table on p. 774 shows the exchange value of the principal urrencies, in terms of American currency, for certain months rom Feb. 1920 to Dec. 1925.

IV. GREAT BRITAIN AND THE UNITED STATES

The Process of Deflation.—The American currency system vas in a state of transition at the time of the crisis of 1914. The ederal Reserve Act of 1913 established a central bank system. t created a new form of currency in the Federal Reserve notes, vhich are not legal tender but are convertible into gold and acked by a gold reserve of at least 40 per cent. In the United tates, as in England, currency has long been altogether subidiary to credit. The Federal Reserve system set up an agency apable of exercising the same sort of control over credit as the ank of England.

This system was for the first time brought seriously into ction to check the inflation of 1920. The English authorities cted first. Bank rate was raised to 6% in Nov. 1919. In Dec. Treasury minute (an administrative instrument with no legal orce) put a limit on the currency note issue. In April 1920 ank rate went up to 7%. At the end of May the New York ederal Reserve Bank raised its rediscount rate to 7%. There ollowed a precipitate fall of prices in both countries.

The subsequent course of events is best shown in tabular orm in the next column.

Date	Exchange	English Price Index	American Price Index	Remarks
May 1920	3·85	325·5	247	Climax of inflation.
Nov. 1920	3·43	286·9	196	Autumnal pressure.
Jan. 1921	3·74	245·9	170	
July 1921	3·63	194·1	141	Fall of prices practically ended in America.
Jan. 1922	4·22	164·0	138	Fall of prices practically ended in England and rise started in America.
March 1923	4·70	160·0	159	Renewed credit restriction started in America.
June 1924	4·32	162·6	144·6	Credit expansion started in America.
March 1925	4·78	166·3	161·0	..
June 1925	4·86	157·6	157·4	..

The relation between the exchange and the relative price evels in the two countries illustrates the doctrine of purchasing ower parity (*see* EXCHANGES, FOREIGN). Essentially the fall in American prices signified a rise in the value of gold, which thus ppreciated 79% between May 1920 and Jan. 1922. The greater he value of gold, the greater the effort required to restore the pound to its former gold value. The reduction of prices by 50% in two years in England was only effected by keeping bank rate at 7% for 12 months (April 1920 to April 1921). It did not fall below 5% till Feb. 1922. The result was an intense depression of trade, which threw nearly 2,000,000 work-people out of employment. An equally severe depression appeared in America in the period of falling prices, but was dispelled by the expanding credit and rising prices of the period from Jan. 1922 to March 1923. Fluctuations in both countries in the following two years ended with the exchange close to par, with trade again active in America, and with 1,200,000 still unemployed in the United Kingdom.

Restoration of Gold Standard in Great Britain.—On April 28 1925 the Chancellor of the Exchequer announced that the export of gold would be free, and at the beginning of May was passed the Gold Standard Act, imposing on the Bank of England the obligation to sell gold bullion (in bars of 400 oz. troy) at the par price of £4 4s. 11$\frac{5}{11}$d. per fine ounce (£3 17s. 10½d. per standard ounce). The obligation to redeem currency notes in gold coin was repealed, and so was the free coinage of gold by the mint. Thus the Act provided for the free convertibility of pounds into gold in the form most convenient for the world market, but interposed a bar to the issue of gold coin for active circulation. Currency notes remained the principal legal medium of exchange, and Bank of England notes were convertible into currency notes. The substitution of Bank of England notes of £1 and 10s. for the currency notes, as recommended by the Cunliffe Committee, was contemplated at the end of 1925.

In the United States after 1921 the enormous imports of gold made the reserve proportions prescribed by the Federal Reserve Act quite inoperative, but the Federal Reserve banks prevented an inflation of the currency by holding idle a reserve some $1,500,000,000 in excess of the statutory requirements. The pre-War forms of currency remained in circulation. Gold certificates, however, were made legal tender in 1919.

V. THE EUROPEAN NEUTRALS

Norway, Sweden, Denmark, Holland, Spain and Switzerland, being neutral in the World War, escaped the worst extremes of currency collapse. Like England, they felt the stress of the exchange crisis in Feb. 1920, and their exchange rates then recovered. Like England, they failed to keep pace with the violent appreciation of the dollar, but their exchanges improved from the middle of 1921 onwards. The improvement brought some of them to parity. Sweden reached par in Nov. 1922, and remained there, except for a slight lapse in the winter of 1923–4. The Dutch florin touched par in Dec. 1922, but when sterling depreciated in 1923–4, took up a position between the dollar and the pound. Holland returned to the gold standard at the same time as England (April 1925).

Switzerland.—Switzerland was at par from Dec. 1921 to May 1922, and was overwhelmed by a grave trade depression. By reducing bank rate to 3½% (March 1922) and then to 3% (Aug.) the Swiss brought about an expansion of credit, which raised their price index from 162 (April 1922) to 187 (April 1923), lowered their exchange from 19·45 (April 1922) to 17·55 (July 1923), and reduced the number of unemployed from 99,541 (Feb. 1922) to 22,722 (July 1923). The same depreciation of the dollar which raised sterling to 4·78 in the latter part of 1924 raised the Swiss franc again to par, but with no burden of unemployment.

Spain.—Spain was swamped with gold during the War and afterwards in 1919, despite half-hearted attempts to exclude it. Notes of course were issued against the gold, and, being redundant, depreciated. She found herself in 1920 burdened with a gold reserve of 2½ milliards (£100,000,000) against a note issue of 4 milliards, although she had never pretended to have a gold standard. She did not attempt to maintain parity with gold, and, though prices fell in 1921, the fall was both smaller and more gradual than in England or America. She remains, as before the War, on a standard of paper and token silver, but with prices 90% above the level of 1913. The currency is about 25% below gold parity, but gold parity itself has no significance except in the gold contents of coins which do not circulate and of which there is no free coinage.

Scandinavian Monetary Union.—Denmark and Norway before the War belonged, with Sweden, to a Scandinavian Monetary Union (dating from 1873). The coins of each, both gold and silver, were legal tender in the others. During the War the Danish and Norwegian currencies had fallen below parity with the Swedish, and the Union had to be suspended. It was finally terminated in Feb. 1924.

The Danish exchange rose from 13·40 cents in Nov. 1920 to 21·54, or within 20% of par, in Aug. 1922. This huge rise meant a terrific fall in prices and very severe depression and unemployment. Denmark, like Switzerland, escaped from this condition at the cost of a rise in prices and a decline in the exchange. The price index rose from 176 in Aug. 1922 to 233 in July 1924. The exchange fell correspondingly to 16·05. Unemployment was by that time no more than normal. A 7% bank rate (imposed Jan. 1924) stopped any further rise of prices, and the same American credit expansion which brought sterling within reach of parity raised the Danish krone in Jan. 1925 to 17·81. The Government thereupon secured the adoption of a programme for the improvement of the currency aiming at a rate of 18·80 by Jan. 1927. Meanwhile the pressure of a 7% bank rate continued. Prices came down with a run, the index for Aug. 1925 was 168 or 28% below that for January. The exchange rose to 24·70. Unemployment began to increase again.

The movements in Norway were somewhat similar but not quite so marked. The rise in prices did not begin till March 1923, and was both more gradual and less in extent. The exchange, after rising from 16·68 in July 1922 to 18·67 at the beginning of 1923, was set back (partly by the stringency in America) to 13·51 in June 1924. Credit expansion in America brought it up again to 15·27 in Jan. 1925. As in Denmark, the pressure of 7% reversed the rise of prices, and brought the exchange up to 20.

VI. THE EUROPEAN BELLIGERENTS

France.—The French franc recovered somewhat after the exchange crisis of Feb. 1920 and, like other currencies, followed the lead of the dollar during 1921 at the cost of a precipitate fall of prices. Its fluctuations have otherwise been mainly due to political causes. When there was a prospect of a workable plan for securing payment of reparations, the franc rose; when friction developed with Germany or when German finances seemed in a worse tangle than usual, the franc fell. Serious weakness developed with the occupation of the Ruhr in Jan. 1923. The franc fell in Dec. 1923 to 5 cents, or well below the lowest level touched in 1920. In Jan. 1924, for the first time since the War, a loan was a failure, an ominous portent. Did not the fall of the *assignats* start with the failure of a loan? Despite the favourable prospect of reparations, the franc fell rapidly and reached 3½ cents in March 1924. Credits were hastily arranged in New York and London on the security of the gold in the Bank of France, and used to support the franc. It was forced up to 6·72 cents, and then let down again to 5 cents.

A new internal loan in the autumn was a very equivocal success, though issued at a price to yield 8½%. Difficulty was found in getting the floating debt (bills of three to 12 months) held. For a country which still had to find very large sums for the reconstitution of the devastated area, the situation was serious. Financial weakness was soon made painfully apparent by the increase in the advances from the Bank of France to the Government (an increase which infringed the law, and was desperately and vainly concealed for some months). The crisis was brought to a head by heavy maturities in July, Sept. and Dec. 1925. One Finance Minister after another failed to carry his measures, and the crisis was still acute in the first half of 1926.

Belgium.—The Belgian franc was till the autumn of 1925 closely linked with the French, partly through the intimate connection of the banking system of the two countries, partly through the similarity of their political interests in regard to reparations. In Oct. 1925 measures were taken to stabilise the Belgian franc at its then gold value (about 4½ cents), but this broke down in March 1926.

Italy.—The Italian currency has likewise followed the French franc, but less closely than the Belgian. The fall of prices in Italy in 1920–1 was less severe, the recovery of the exchange in 1921–2 less marked. The lira was for a time dragged down by the French currency crisis of 1925, but after Nov. of that year was approaching stability at a value of about 4 cents.

Germany.—Germany was till 1924 the principal storm centre of European currency disturbances. The collapse which brought the mark down to 1 cent in Feb. 1920 was followed by a recovery. In May, after the evacuation of Frankfurt by the French, it rose to 2·95 cents, and the average for June was 2·56. In 1919 the Government had been almost without resources. Revenue was a mere fraction of expenditure, a loan for a modest total was a failure; the deficit had to be covered by issues of paper money. But in Dec. 1919 and April 1920 Erzberger's new taxes came into operation, and for the moment German finances were on a relatively sound footing. The mark, it is true, fell steadily, and in July 1921 was worth only 1·30 cents. But it was the dollar that was rising, not the mark that was falling. The American price index fell from 247 in May 1920 to 141 in July 1921, while the German index fell from 1510 to 1430. The mark was a more stable unit than the dollar.

The Erzberger reforms practically balanced the ordinary budget, though time was still required to realise their full productivity. Reparation payments had not begun; but heavy payments for the armies of occupation threatened the equilibrium. The note issue rose from 50 milliards in May 1920 to 72 milliards in May 1921. But, if only confidence in the currency could be maintained, 72 milliards (equivalent to $1,200,000,000) was not an excessive supply of currency. The spring of 1921 brought the first demands for cash on account of Reparations. A schedule of payments was agreed (after some friction) in May.

The collapse started by that milliard was to bring the mark down to levels which strained the very language of arithmetic. Germany was required to make payments when the necessary funds had not been collected and could not be collected in time by tax or loan. The only resource was inflation, and the headlong depreciation of the currency destroyed the yield of the heavy direct taxes which were the corner-stone of the budget. For a year and a half this treatment was applied, and by Jan. 1923, when the French and Belgians occupied the Ruhr, a million marks were worth less than $150. Reparation payments being suspended, an attempt was made to stabilise the mark at a rate of $48 to a million or $\frac{1}{5000}$ of par, but it broke down in April and the final collapse ensued. By Aug. 18 a million marks were worth 24 cents, the par value of one mark. Three months later, in Nov., this was the value of a *billion* marks.

The value of incomes or long contracts fixed in money had long before evaporated practically to nothing. The problem was to accommodate the ordinary day-to-day transactions (especially the payment of wages) to a medium which lost on an average ⅔ of its value every week. In the final phase people reckoned in gold marks and stipulated for payment in paper marks at the exchange of the day. Public authorities and private employers began to issue irregular "emergency money," in the form of promises to pay, denominated in gold marks. This competition of the gold mark as a money of account was the final undoing of the paper mark. When liabilities were not fixed in paper money, there was no longer any motive for keeping paper marks on hand.

Credit, in the form of "emergency" tender, had thus prevailed over legal tender. So long as there was a basis for a money of account in which a debt could be calculated, credit could exist. Here was the way out of chaos. By decree was established on Oct. 15 a new bank of issue, the Rentenbank, the notes of which, expressed in "rentenmarks" were not legal tender, but were convertible into interest-bearing bonds of the bank expressed in gold. The new bank was provided with capital by means of a forced loan from industry and agriculture (the capital was not paid up, but was a mere guarantee).

The mere absorption of a new fiduciary currency provided resources which tided the Government over the critical period before the revenue began to yield on a gold basis. In the early months of 1924 the currency threatened to start falling again. This was not due to Government borrowings but to demands for credit for trade. Dr. Schacht, the new Governor of the Reichsbank, drastically restricted credit and saved the situation. It was soon found that the tax system in force was more than adequate to meet requirements, when the currency was in working order. The year 1924 saw the settlement of Reparations by the Dawes plan. The Reichsbank was reorganised. The billion-mark notes, that had been circulating alongside the rentenmarks, were replaced by the new Reichsmark notes at the ratio of one to a billion. The greatest currency collapse in history had become a thing of the past. Measures have been taken to mitigate the ruin of the rentier class, in some directions, by a valorisation measure, securing them a fraction of the gold value of former mortgages and debentures.

Austria and the Succession States.—Three states, Austria, Hungary and Czechoslovakia, had the old Austro-Hungarian crown as their sole medium of exchange in 1919. It circulated also in parts of Rumania, Yugoslavia and Poland. The first step was to put a stop to a state of affairs in which the Austro-Hungarian Bank was financing Governments in Vienna and Budapest by inflating the currency in all the other States. In Feb. 1919 Czechoslovakia and Yugoslavia closed their frontiers to the importation of bank notes, and required all those on their territory to be stamped with distinguishing marks. Thereafter only stamped notes were legal tender. Other States followed the same plan (Hungary not till March 1920). In the period following the exchange crisis of Feb. 1920 the countries of Central and Eastern Europe were greatly affected by German currency conditions. They had long been financially and commercially dependent upon Germany. The collapse of 1921 played havoc with all of them.

The first to emancipate itself was Czechoslovakia. It was the most industrially developed and was free from war burdens. The Finance Minister, Dr. Rasin, had already imposed heavy taxes, and in 1922 was able to raise loans in London and New York. That made possible a restriction of the note issue, which forced up the exchange value of the Czech crown from 1 cent in Nov. 1921 to 3¾ cents in Aug, 1922. The price index fell from 1675 in Dec. 1921 to 1003 in Dec. 1922. The result, as in the countries which had accomplished deflation on a similar scale in 1920–1, was extreme trade depression and unemployment, the number of unemployed rising to 436,000 at the end of 1922. But the effort once accomplished, a slight relaxation became possible. The exchange was stabilised at approximately 3 cents, the unemployed were gradually absorbed, and by 1925 business and currency conditions were normal.

Austria was unable to recover by her own unaided efforts. The collapse of 1921 was intensified in 1922. The economic position of the country, a financial and commercial centre politically severed from the region it had been accustomed to serve, was precarious. Vague but onerous reparation liabilities were imposed upon it. At last the League of Nations intervened, and a scheme of financial reconstruction was adopted in Oct. 1922. Reparation liabilities were suspended and postponed. A loan was raised with an international guarantee, and a certain amount of financial control was imposed through a representative of the League. The crown was stabilised at a value $\frac{1}{14400}$ of the former gold crown, the new currency unit being the schilling, equal to 10,000 paper crowns (about 7d.).

Developments in Hungary were somewhat similar. A courageous attempt by Dr. Hegedüs to restore the finances in 1921 failed for lack of parliamentary support. A League of Nations reconstruction scheme was adopted in April 1924. Hungary had more financial strength than Austria, and by the aid of the support and control of the League was able to raise her reconstruction loan on her own credit without any guarantee. The Hungarian crown was stabilised at the same gold ratio as the Austrian. The new unit (Jan. 1926) is the pengö of 12,500 paper crowns (8⅝d.).

Rumania and Yugoslavia.—Rumania and Yugoslavia escaped from the extremities of currency collapse, but have not as yet stabilised their currencies. In the Austro-Hungarian provinces of Yugoslavia the stamped notes of the Austro-Hungarian Bank were replaced at the ratio of one dinar to four crowns. In Rumania it was necessary to replace not only crowns in Transylvania and other parts but roubles in Bessarabia. The change was effected in 1920, two crowns being taken as equivalent to one leu. The Rumanian leu (formerly the equivalent of a franc) remained comparatively steady after the beginning of 1923 at about $\frac{1}{40}$ of its par value. The Serbian dinar, after falling in Jan. and Feb. 1923 below one cent, gradually recovered to about 1¾ cents, or $\frac{1}{11}$ of par, and in 1926 showed signs of being stabilised at that value.

Poland.—Poland came into existence as a state with a bewildering variety of currencies. In Congress Poland (the old Russian Poland) an issue of Polish marks had appeared during the German occupation. To it were added German provinces with German marks, Galicia with Austro-Hungarian crowns, Russian provinces with all varieties of Russian roubles. Ultimately these were all replaced by Polish marks. Poland was involved during 1919 and 1920 in war with Russia, with no resources to meet the overwhelming burden of war budgets. The lavish issue of paper money caused a wild and rapid depreciation. By 1924 Polish marks were worth no more than 11 cents a million. As in Germany, a money of account based on gold (the *zloty* or franc) had already come into use, and in May 1924 a scheme of stabilisation was introduced with the issue of *zloty* notes by a Bank of Poland (one *zloty* was the equivalent of 1,800,000 Polish marks). It was not found possible to maintain the *zloty* currency at par, and by March 1926 it had fallen to about two-thirds of its nominal gold value.

Other European States.—The Baltic States, Finland, Estonia, Latvia and Lithuania, all succeeded in the post-War period in placing their currencies on a gold standard. Finland retained the Finnish mark, reduced in value from 19·30 cents to 2½. Estonia and Latvia evolved stable currencies from an amazing complication of different kinds of roubles and marks. Lithuania used the German mark till the collapse of 1923. Bulgaria, Greece, Portugal and Turkey have heavily depreciated currencies, but by the beginning of 1926 had not adopted definite measures of stabilisation.

Russia.—In 1918 there ceased to be a foreign exchange market in Russia, and, up to the introduction of the New Economic Policy in 1921, the policy of the Soviet was to dispense with money altogether as soon as practicable. Nevertheless, the issue of paper money in ever-growing quantities to meet the daily expenses of Government continued, and, when the return to a general use of money was decided on in the autumn of 1921, the depreciation was such that prices were 80,000 times the level of 1913. That far transcended any price index recorded up to that time elsewhere in Europe. A new "rouble of 1922" was introduced equal to 10,000 of the existing Soviet roubles, but this was a mere change of nomenclature, adopted for the convenience of shortening the figures. The process of depreciation continued unabated, and a new money of account was instituted in the form of a "goods rouble." Its value in paper roubles was officially fixed, at first from month to month and then at shorter intervals, according to the index number of prices, so as to represent the quantity of wealth which a rouble would buy in 1913. Wages and other obligations were fixed in goods roubles and paid in paper roubles at the prescribed value.

The use of a stable unit of account was followed up towards the end of 1922 by the issue of a stable paper money. Bank notes expressed in Tchervontzi (a tchervonetz being 10 gold roubles) were issued by the State Bank. These notes were neither convertible nor legal tender, but they were accepted by the State and came into use for payments in terms of the goods rouble, which was renamed gold rouble. The reference to gold was really a fiction. There was no market in gold, and the standard of value still depended on the index of prices. The tchervontzi were in practice convertible into Soviet roubles at the appropriate rate. Transactions in foreign currencies gradually grew up, but in view of the Government monopoly of foreign trade they were on an entirely artificial basis.

In March 1924 the system of concurrent circulation of two forms of paper money was terminated, and the tchervontzi became the sole currency. A Soviet rouble of 1923, equal to 100 roubles of 1922 and therefore to 1,000,000 of the earlier issues, had been introduced, and when the Soviet roubles were finally withdrawn 50,000 of these were exchanged for one rouble of the bank notes ($\frac{1}{10}$ of a tchervonetz). The ultimate depreciation was therefore in the ratio of 1 to 50 milliards. The tchervontzi therefore were the Russian currency at the end of 1925.

VII. JAPAN, CHINA, INDIA, ETC.

Japan.—Japan succeeded in maintaining gold parity in the critical year 1920. In fact a financial crisis in the spring of that year produced an acute stringency, which put the yen for a time at a substantial premium over the American dollar, and the consequent imports of over $90,000,000 in gold contributed to the monetary stringency in the United States in the autumn. In the succeeding years the yen was allowed to lapse a little. The earthquake of Sept. 1923, coming at a time when prices in America were falling, intensified the decline. At the end of 1924 the yen was 23% below par, but during 1925 the discount diminished to 10%.

China.—Chinese currency has remained throughout the storms and stresses of the War and post-War period securely based on silver. The apparent vagaries of the exchange were mainly due to fluctuations in the value of the European units in which they are calculated. When silver rose to 89½ d. per standard ounce in 1920, or about three times its pre-War price, that was less than the rise of other commodities. The subsequent fall in silver, and therefore in Chinese currency, was greater in proportion than the fall of prices generally. That was due, partly at any rate, to the displacement of a very large amount of silver coinage from Europe. In many countries the depreciation of the currency has been such that the current value of the subsidiary silver coin fell below the bullion value. Much was therefore privately melted, to be sold as bullion. Extensive recoinage schemes were also set on foot. The value of silver was lowered by the release of these fresh supplies.

India.—From 1898 to 1917 the Indian rupee was successfully maintained by means of an exchange standard at a value in sterling of 1s. 4d. But when the price of silver rose above 43d. a standard ounce, the rupee became worth more than 1s. 4d. as silver. This price was reached in 1917 and it became impossible for the Indian Government to undertake to supply rupees at 1s. 4d. The exchange was raised to 1s. 5d. and then 1s. 6d., and for a time a further rise was staved off because the United States undertook to supply silver at $1 a fine ounce (47d. per standard ounce) by withdrawing silver certificates and melting down the reserves of standard dollars (Pittman Act). But in 1919 and 1920, this resource being withdrawn silver soared, and the rupee rose at one time to 2s. 8d.

Its value in *gold* was about 48 cents (2s. at par). An attempt to fix it permanently at that value broke down in face of the appreciation of gold in terms of commodities. The powerful credit apparatus by which prices can be forced down in England or America does not exist in India. The rupee fell to 24 cents in 1921, and recovered as American prices rose, to 32 cents in March 1923. After a reaction the renewed expansion in America in 1924–5 brought it up to 36 cents, or about 1s. 6d. A Commission of Inquiry was appointed in 1925 to consider the future of the Indian currency.

South America.—Those of the South American states which were still on a gold standard in 1920 were quickly shaken off it by the fall of prices in the United States. Argentina saw her gold peso turn into another kind of paper peso in the fixed ratio of 100 to 44 to the old paper peso.

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CURRIE, SIR ARTHUR WILLIAM (1875–), Canadian soldier and administrator, was born at Napperton, Ont., Dec. 5 1875 and for some time was engaged in business in British Columbia. On the outbreak of the World War his natural bent for military affairs quickly brought him into prominence. He commanded the 1st Canadian Div., 1914–7, and the Canadian Corps in France 1917–9. He gained the confidence of the English military authorities, and when Sir Julian Byng resigned his command of the Canadian troops Sir Arthur Currie was appointed in his stead. The manner in which he carried out his command marked him a military leader of unusual distinction. Currie was given the C.B. in 1915, K.C.M.G. 1917, K.C.B. 1918 and G.C.M.G. 1919; he was awarded the French Legion of Honour and the Croix de Guerre both of France and of Belgium, and was created Grand Officer of the Belgian Ordre de la Couronne. In 1920, after Sir Auckland Geddes (*q.v.*) had finally decided not to take up the principalship of McGill University, Montreal, on his appointment as British Ambassador to Washington, Sir Arthur Currie was elected to the post. (*See* CANADA.)

CURTIS, CHARLES GORDON (1860–), American inventor, was born at Boston, Mass., April 29 1860. He was educated at Columbia University (C.E., 1881; LL.B., 1883; M.S., 1907), and practised as a patent lawyer for eight years. He organised the C. & C. Electric Motor Co., and also the Curtis Electric Manufacturing Co., of which he was president. He invented a steam turbine of higher efficiency than the Parsons type with a new method of controlling speed, the land rights of which he sold to the General Electric Co. This corporation spent $3,000,000 in developing the patent, with the result that the Curtis steam turbine is widely employed both in electric power-plants and marine propulsion, being used in the U.S. and British navies.

CURTIS, CYRUS HERMANN KOTZSCHMAR (1850–), American publisher, was born at Portland, Me., June 18 1850. He sold newspapers when a boy, and in 1870 joined a Boston paper as advertising canvasser. In 1876 he went to Philadelphia and became publisher of *The Tribune and Farmer*, a weekly paper. In 1883 he established *The Ladies' Home Journal* and in 1891 organised the Curtis Publishing Co. In 1897 he purchased *The Saturday Evening Post*, which was a direct continuation of *The Pennsylvania Gazette*, founded in 1728 by Benjamin Franklin, and in 1911 he bought *The Country Gentleman*. *The Ladies' Home Journal* and *The Saturday Evening Post* attained a circulation of 2,000,000 each and probably carried more paid advertising than any other publications in the world. For this reason, although the cost of producing a copy of *The Saturday Evening Post* was many times its selling price to the public (5 cents), this magazine was highly profitable to the publisher. In 1913 he purchased *The Philadelphia Public Ledger* and in 1923 acquired *The New York Evening Post*.

See E. W. Bok, *A Man from Maine* (1923), and *The Boy Who Followed Ben Franklin* (1924).

CURTIUS, ERNST ROBERT (1886–), German scholar, was born at Thann, Alsace, April 4 1886. From 1913–9 he taught at the university of Bonn, from 1920–4 at Marburg, and in 1924 was appointed professor of French history and romance philology at Heidelberg. In 1914 he published *Ferdinand Brunetière, ein Beitrag zur Geschichte der französischen Kritik*. His work *Die literarischen Wegbereiter des neuen Frankreichs* (1919) is of importance in filling the large gap which the World War has made in the knowledge of the intellectual development of present day France.

Among his other works are *Maurice Barrès und die geistigen Grundlagen des französischen Nationalismus*; *Der Syndikalismus der Geisbesarbeiter in Frankreich* (1921); *Balzac* (1923); *Französischer Geist im neuen Europa* (1925).

CURZON OF KEDLESTON, GEORGE NATHANIEL CURZON, 1st MARQUESS (1859–1925), British statesman (*see* 7.665), received an earldom, along with the viscountcy of Scarsdale and the barony of Ravensdale, as a coronation honour in 1911. He was conspicuous in that year first by his strong denunciation of the Parliament bill and of the Liberal attack on the House of Lords, and then by the leading share he took, in the final stage, in persuading the bulk of the Conservative peers to abstain from voting in the crucial division and so to permit the bill to pass rather than have their House swamped by hundreds of creations.

During the vehement party conflicts of the next two or there years before the World War he established his position as the chief lieutenant of Lord Lansdowne in the Lords. But much of his time and attention during the period of opposition was given to the affairs of Oxford University, of which he had been elected chancellor; and he promoted the cause of reform there by personal effort and by publishing a detailed memorandum on the subject. He had, moreover, a scholarly love for antiquities, and bought and carefully preserved from further ruin the ancient castles of Tattershall in Lincolnshire and Bodiam in Sussex, and eventually presented them to the nation.

With other Conservative leaders he joined Mr. Asquith's Coalition Cabinet in the summer of 1915, as Lord Privy Seal; and in that capacity he introduced the bill constituting the new Ministry of Munitions under Mr. Lloyd George, and took charge in the Lords of the Munitions of War bill which was to furnish that Ministry with its weapons. In these and other ways he gave proof of a determination to prosecute the War with zeal and energy. He accepted the presidency of the Air Board in May 1916 and in July became a permanent member of the War Committee of the Cabinet.

When Mr. Lloyd George formed his Ministry in Dec., he was called to a still more prominent position. Lord Lansdowne and Lord Crewe—the two leaders of parties in the Lords—both retired from office, and Lord Curzon became the leader of the House with the office of Lord President. He was chosen also to be one of the four ministers (the others being the Prime Minister, Lord Milner and Mr. Henderson) who constituted the War Cabinet, and were charged with the permanent daily conduct of the War. After the Paris Conference he took over the Foreign Office from Mr. Balfour, retaining his leadership of the party in the House of Lords.

As leader, though not able to claim the sympathetic touch and close familiarity with their lordships' idiosyncrasies possessed by some of his predecessors, he exhibited remarkable intellectual powers and oratorical capacity, and gradually established his ascendancy in the House. In the Foreign Office he found a specially congenial sphere, as he had throughout his life made a study of the external relations of the country, and had travelled extensively. But foreign affairs in the years immediately following the War were still dominated by the Prime Minister and the Supreme Council; and it was at meetings of the latter, which Mr. Lloyd George attended—at Paris, San Remo, Spa, Lympne and London—that a settlement, or at least a temporary salve, was found for recurrent difficulties.

When the Coalition fell in Oct. 1922, Lord Curzon remained at the Foreign Office in Mr. Bonar Law's and Mr. Baldwin's administrations, and on Nov. 8 he announced that it had been decided that the department should, as in former days, do its own work, subject only to the control of the Cabinet and the general supervision of the Prime Minister. During the ensuing 15 months he had to deal with several thorny problems, in which only moderate success was possible, and his treatment of them subjected him to repeated, if not always justifiable, criticism. He had first to straighten out British relations with the Nationalist Turks, who disregarding the Treaty of Sèvres had driven the Greeks out of Thrace and Asia Minor by force of arms; and he spent the winter of 1922–3 presiding over a European Conference at Lausanne, and employing all his resources of knowledge, skill, patience and courtesy in the vain endeavour to win Turkish consent to a satisfactory settlement. Ultimately, as renewed fighting was abhorrent to England and Europe, Turkey was allowed to retain all she had regained, with the addition of Constantinople. With Russian relations, Lord Curzon's second difficulty, he had more success. By sharp remonstrances in the spring and summer of 1923, based on the stipulations of the Trade Agreement of 1921, he obtained from the Russian Govt. the suspension of their open anti-British action and propaganda, and the removal of their incriminated officials at Cabul and Teheran.

But Lord Curzon's principal preoccupation was the relations of England, France and Germany. M. Poincaré, the French Prime Minister, in spite of serious British protests, embarked in the winter of 1922–3 on the Ruhr expedition to exact reparations from Germany; and he continued and intensified the pressure throughout the year, accompanying it with the policy of encouraging Separatist movements in the Rhineland. Lord Curzon, who had begun by merely dissociating Britain from French action, while protesting that British policy was based on the Entente, gradually took up a position of decided antagonism; and finally in Aug. issued a note of severe condemnation, asserting the total illegality of the French movement. No remonstrances had any effect on M. Poincaré; but meanwhile Lord Curzon had encouraged Germany to make, in regard to reparation, offers of her own, which at first were so small as to provoke immediate rejection, but which eventually became sufficient to afford a basis for negotiation. Finally before he left office he had secured the consent of France and Belgium to an advisory committee of experts (in which the United States had decided to co-operate) to be appointed by the Reparations Commission. This developed under Mr. Ramsay MacDonald into the Dawes Committee, from whose report dated the improvement of European relations.

Lord Curzon had two serious disappointments in his last years, both of which he bore with dignity and in silence. The first was when, on Mr. Law's resignation from illness in May 1923, Mr. Baldwin, who had decidedly less experience and political eminence than himself, became Prime Minister, mainly because it was only in the House of Commons that the real opposition, the Labour party, could be encountered. The other was when Mr. Baldwin formed his second Cabinet in the autumn of 1924, and passed over Lord Curzon's claims to return to the Foreign Office, placing there instead Mr. Austen Chamberlain, who, as a previous leader of the whole party, was bound to receive special consideration. On the first occasion, Lord Curzon consented to take the chair at the party meeting which elected Mr. Baldwin to the leadership; on the second, he accepted the presidency of the Council, retaining of course the leadership in the Lords.

Lord Curzon's first wife, by whom he had three daughters, died in 1906, and in 1917 he married, as his second wife, Grace Elvina, widow of Alfred Duggan, of Buenos Aires, and daughter of J. Munroe Hinds, U.S. Minister in Brazil. He succeeded to the barony of Scarsdale on his father's death in 1916 and became a K.G. in the same year. He was created a marquess on the King's birthday in 1921. Never a strong man, he had forced himself throughout life by sheer will-power, in spite of serious physical disabilities, to do day by day more than a strong man's work; and in the early spring of 1925, his health suddenly broke down, and after a fortnight's illness he died in London on March 20. The first part of the funeral service was held in Westminster Abbey, where an immense congregation, including the foremost people of the country, gathered; the actual burial was at Kedleston, the family seat in Derbyshire. As he left no son, the marquessate and earldom became extinct; the viscountcy and barony of Scarsdale passed, with Kedleston, to his nephew; and his eldest daughter, Lady Irene Curzon, inherited the barony of Ravensdale.

After Lord Curzon's death two volumes by him were published, *British Government in India*, on the proofs of which he was engaged during his last illness. (G. E. B.)

CUSHING, HARVEY (1869–), American surgeon, was born at Cleveland, O., April 8 1869. He graduated from Yale University in 1891 and from the Harvard Medical School in 1895. After four years at the Johns Hopkins Hospital he studied abroad under Kocher at Berne, and Sherrington at Liverpool. On his return to Baltimore he held various positions in the department of surgery at Johns Hopkins University, becoming an associate professor in charge of cases of surgery of the central nervous system. He wrote numerous monographs on the surgery of the brain and developed the method of operating with local anaesthesia. His work on the pituitary body gave him a European reputation. He also made important contributions to the study of blood pressure in surgery. In 1911 he was appointed professor of surgery in the Harvard Medical School and surgeon-in-chief at the Peter Bent Brigham Hospital in Boston. From 1917–9 he was director of United States base hospital No. 5 attached to the British Expeditionary Force in France. In 1918 he was made senior consultant in neurological surgery for the American Expeditionary Force and held the rank of colonel in the Medical Corps at the close of the War. He wrote a *Life of Sir William Osler* (1925).

CUYPERS, PETRUS JOSEPHUS HUBERTUS (1827–1921), Dutch architect, was born May 16 1827 at Roermond, Holland. He studied under Viollet-le-Duc, and was inspired both by the Gothic and the Netherland style of the 16th century in building the Rijks Museum at Amsterdam (1877–85) and in restoring and rebuilding many Roman Catholic churches, town halls and other buildings. His chief merit however was that he awakened the interest of his countrymen in architecture and the decorative arts, and so prepared the way for Berlage, de Bazel and others who created the modern Dutch style of architecture. Cuypers received honorary degrees from the universities of Utrecht and Delft. He died March 3 1921.

CYANAMIDES (*see* 7.679).—The metallic cyanamides, of which calcium cyanamide, $CaCN_2$, is the only one of technical importance, are derivatives of dyanamide, H_2CN_2. In practice, calcium cyanamide is always formed by the action of nitrogen on calcium carbide. In 1892 Moissan showed that calcium carbide could be prepared easily and in quantity in the electric furnace; and in 1895 A. Frank and N. Caro (*Jour. Soc. Chem. Ind.*, vol. 27, 1908; *Trans. Faraday Soc.*, vol. 99, 1908; *Zeitsch. angew. Chem.*, vol. 22, 1909) began investigations on the absorption of nitrogen by metallic carbides which have led to the establishment of the modern cyanamide industry. Although pure calcium carbide does not absorb nitrogen even at 1,200°C. (Moissan), Frank and Caro found that technical carbides did so readily at much lower temperatures, probably owing to their impurities.

Formation of Cyanamides by Nitrogen.—By the action of nitrogen on metallic carbides, mixtures of cyanamides and cyanides are obtained, the proportions depending on the metal and on the temperature. The general type of the reaction may be illustrated by the case of calcium carbide.

$$CaC_2+N_2=CaCN_2+C \qquad (1)$$
$$CaCN_2+C=Ca(CN)_2$$

With alkali carbides, cyanide preponderates largely. With barium carbide about 30% cyanide and 70% cyanamide is obtained at 700°–800°C., whilst with calcium carbide cyanamide is practically the only product up to 1100° C. In all cases the proportion of cyanide increases with the temperature. These facts explain the formation of cyanide by fusing the mixture of calcium cyanamide and carbon with sodium chloride,

$$CaCN_2+C+2NaCl=CaCl_2+2NaCN \qquad (2)$$

Calcium Cyanamide.—The mechanism of the production of calcium cyanamide is by no means clear, in spite of numerous investigations. The chief difficulty in interpreting the results is the effect of impurities, always present in commercial carbide. If the reaction is according to equation (1), with three solid phases and a gaseous phase, a definite equilibrium pressure of nitrogen should correspond to a given temperature. Attempts to determine this equilibrium (Caro, Matignon, Thompson and Lombard) led to improbable or conflicting results; M. Le Blanc and M. Eschmann (*Zeitsch. Elektrochem.*, 17, 20, Jan. 1911) could not obtain reproducible values for the equilibrium pressures, and attribute this to (*a*) sublimation of cyanamide preventing its taking part in the reverse reaction; (*b*) alteration of the carbon rendering it inactive; (*c*) occurrence of side reactions, the effects of which could not be taken into account. They concluded that with impure carbide the system is divariant and that one of the phases is a melt of variable composition. Their results were confirmed by V. Ehrlich (*Zeitsch. Elektrochem.*, 28, 529, Dec. 1922), who, however, with nearly pure calcium cyanamide, free from carbon, obtained definite equilibrium pressures, which were much lower than the indefinite ones with impure cyanamide—carbon mixture for the same temperature. He concluded that pure calcium cyanamide decomposes reversibly into calcium subcarbide and nitrogen,

$$CaCN_2 = CaC + N_2$$

and that his equilibrium pressures were for this reaction. He suggested the formation of commercial cyanamide in stages,

$$CaC_2 = CaC + C$$
$$CaC + N_2 = CaCN_2$$

The dissociation of the carbide into subcarbide and carbon had been previously assumed by G. Erlwein, C. Warth and R. Beutner (*Zeitsch. Elektrochem.*, 17, 177, March 1911) to account for their experimental results on heating calcium carbide, but Briner and Kuhne (*Jour. Chim. Phys.*, 12, 432) could not confirm this. To sum up, the mechanism of cyanamide formation has not yet been fully explained; the importance of this for the cyanamide industry is obvious.

Absorption of Nitrogen.—The rate of absorption of nitrogen by carbide has been much studied. Pure calcium carbide does not absorb nitrogen at 1,200°C. With commercial carbide (containing about 10% lime) absorption is rapid and complete at 1,050°–1,100°C. Below 1,000°C. the absorption is less rapid and is incomplete, the nitrogen absorbed tending to a limiting value, which is lower the lower the temperature. These limiting values do not represent true equilibria (Foerster and Jacoby). Pollacci found that the velocity of absorption is proportional to the nitrogen pressure up to two atmospheres, but that further increase of pressure makes little difference.

Many substances when added to calcium carbide lower the temperature at which nitrogen absorption begins and increase the velocity of absorption for a given temperature. The most important of these substances are calcium chloride (Polzenius) and calcium fluoride (Carlson). Many other substances, including lime, act similarly, and this explains the action of commercial carbide. The rôle of these additions has been investigated by G. Bredig, W. Fraenkel and E. Wilke, F. Foerster and H. Jacoby, Rudolphi, G. Pollacci and others (*Zeitsch. Elektrochem.*, vol. 13, March 1907; vol. 14, Sept. 1908; vol. 15, Nov. 1909; *Zeitsch. anorg. Chem.*, 54, 170), and has been connected with the lowering of the melting-point of the mass which they cause; but how this increases the velocity of absorption, whether by removing protecting layers of reaction products from the carbide, by allowing the nitrogen to dissolve in the liquid mass, or by other means, has not been settled. Reaction (1) is strongly exothermic. The heat of reaction is about 77,800 calories at 25°C.

Technical Production.—On the commercial scale a mixture of calcium cyanamide and carbon ($CaCN_2+C$) is produced by heating ground calcium carbide in an atmosphere of nitrogen to about 1,000°–1,100° C. The nitrogen is generally prepared by the fractional distillation of liquid air by the Linde or Claude process, and should be as free as possible from moisture, CO, CO_2 and especially oxygen, as these act on either the carbide or cyanamide and diminish the nitrogen content of the final product.

Discontinuous Process.—In the discontinuous process a vertical steel drum lined with firebrick is fitted loosely with a thick paper or thin, perforated, sheet-iron cylinder. Down the centre of the retort passes a carbon rod contained in a cardboard tube to separate it from the carbide. This rod is connected to an alternating current supply and is used as a heating resistance to start the reaction. The ground carbide is packed between the inner tube and the outer cylinder. The lid is luted on airtight. Nitrogen is admitted by a pipe through the outer casing. The charge consists of 300–800 kilos of carbide. A battery of such units is connected to the current supply. The heated carbon resistor starts the reaction at the centre. After a time the current is cut off as the reaction produces sufficient heat to maintain the charge at about 1,000°C. and so complete the reaction. The drums are allowed to cool, the contents ground and treated with sufficient water to slake the lime and decompose any uncombined carbide. The ground product is sometimes mixed with a little oil to render it dustless before packing in bags. The crude cyanamide, known as "nitrolim," "lime nitrogen," "kalkstickstoff" or "stickstoffkalk," contains 20–22% of nitrogen, corresponding to 57–63% of $CaCN_2$ and about 20% lime, 7–8% silica, iron oxide and alumina and 14% of graphitic carbon.

Continuous Process.—In one type of continuous furnace the carbide is packed in perforated metal boxes which are sent through a tunnel filled with nitrogen and heated, electrically or by external gas firing, to the necessary reaction temperature. Another common type is a vertical iron shaft lined with firebrick and divided internally into sections by shelves. The carbide is fed in at the top and heated by arcs between carbon electrodes. It meets an ascending stream of nitrogen and is made to fall slowly from shelf to shelf by scrapers until it is discharged at the bottom. In the Carlson process calcium fluoride is added to the carbide to increase the velocity of absorption and to lower the reaction temperature.

Uses of Nitrolim.—Nitrolim may be used directly on most soils as a nitrogenous fertiliser. When treated with water or steam under pressure it gives up practically the whole of its nitrogen as ammonia (*q.v.*):

$$CaCN_2 + 3H_2O = CaCO_3 + 2NH_3$$

The addition of alkali increases the yield of ammonia by diminishing the formation of polymers of cyanamide. By fusing a mixture of nitrolim, common salt and calcium carbide in an arc furnace sodium cyanide is produced by reaction (2) above.

By rapidly cooling the melt the reverse reaction is prevented and the cyanide preserved (*Chem. Met. Eng.*, 22, 265; *Can. Chem. and Met.*, 6, 129). By suitable treatment numerous organic compounds (urea, dicyandiamide, guanidine, etc.) may be prepared from cyanamide (*Jour. Ind. Eng. Chem.*, 5, 159). It also forms the basis of "ferrodur," used for case-hardening iron. The world's production (1918) was 668,800 metric tons.

Bibliography.—*Final Report of Nitrogen Products Committee;* Joseph Knox, *Fixation of Atmospheric Nitrogen* (1921); A. J. Allmand, *The Principles of Applied Electrochemistry*, p. 643 (1924); J. R. Partington and L. H. Parker, *The Nitrogen Industry* (1922).

(J. Kn.)

CYANIDES (*see* Gold, 12.199).—The world's consumption of cyanides has increased by about 50% since 1910, and, owing to improvements in manufacture, the price is now 10 to 20% lower than that ruling in 1910–3.

Metallurgy.—The extraction of gold and silver from their ores is still the principal use of cyanides. Two grades of sodium cyanide (90% and 97% NaCN respectively) and, since 1916, an impure calcium cyanide containing cyanogen equivalent to 48 to 50% NaCN are in common use. While the principle of the methods employed is the same as before, the process is no longer regarded merely as a way of recovering gold which cannot readily be won by amalgamation. When the ores are very finely ground, so as to pass through gauze with 150 to 200 wires per in., the time needed to dissolve the precious metals is very much reduced, a more complete extraction is obtained (95% or more is not unusual), very dilute cyanide solutions, containing considerably less than 0·1% NaCN, can be employed and, finally, many ores formerly regarded as refractory can be treated successfully. The economic handling of finely divided ores presented difficulties which have only gradually been overcome. Each mining field has developed methods to suit the peculiarities of its ores and its own local conditions.

In general the ore is first crushed roughly in presence of cyanide solution; the mixture of ore and solution then passes to a tube mill for fine grinding. The pulp passes on to some form of hydraulic classifier which separates the coarser particles of ore and returns them to the tube mill for regrinding. The separation of the cyanide solution (which now contains the precious metals) is carried out either by settling and decantation or by filtration; in the most recent plants these operations are continuous. In the recovery of gold and silver from the cyanide solutions zinc dust is now often used in place of zinc shavings. The dust is stirred into the solution in suitable quantity and the precipitate of finely divided gold or silver which forms very rapidly is filtered off at once. The consumption of zinc is smaller and the bullion is recovered at shorter intervals than in the older process.

Control of Insects and other Pests.—The value of hydrocyanic acid as an insecticide was first recognised in 1886 by D. W. Coquillett, who used it in the control of scale insects on citrus trees in California. The methods of work were standardised by the investigations of R. S. Woglum in 1907–10 (*U.S. Dept. of Agriculture, Bureau of Entomology, Bull. 90*). In 1916, more than 1,300 tons of sodium cyanide were consumed in the fumigation of citrus trees in California alone (G. P. Gray, *J. Ind. and Eng. Chem.*, 10, 301, 1918) and the method is now practised in Florida, Porto Rico, Australia, Japan, South Africa, Spain and Italy. It was first tried on deciduous trees in 1894 in Virginia by Coquillett and in 1909 A. L. Quaintance (*U.S. Dept. Agriculture, Bureau of Entomology, Bull. 84*) showed that it was effective against the San José scale on apples; subsequently the fumigation of nursery stock, before planting, was made compulsory in several states of the United States.

Uses as Fumigant.—Hydrocyanic acid was first used for the destruction of vermin in the sleeping carriages of the Cape Government Railway in 1898 and its use for similar purposes spread so rapidly that the town council of Johannesburg found it necessary, in 1916, to draw up by-laws for the licensing of fumigators and for regulating the practice. Hydrocyanic acid was authorised as a fumigant in the United States Quarantine Regulations of 1910, but it was first used on a large scale for killing rats in ships, as a measure of plague control, at New Orleans in 1914; since then it has been used as a routine measure so that, for example, of 1,425 ships fumigated at the port of New York in the year 1921–2, all but 10 were treated with hydrocyanic acid. The method was first used in Germany in 1917 against weevils in a flour-mill, in Italy in 1919 against rats in granaries and in ships, and in Great Britain in 1922 for the fumigation of ships and greenhouses. (P. G. Stock and G. W. Monier-Williams, *Ministry of Health, Rep. on Public Health, No. 19.*)

In the fumigation of plants it is important to secure a concentration of hydrocyanic acid which will kill the insect pest without injury to the plant. Plants are more severely injured when they are exposed to sunlight than they are in the dark; fumigation is therefore done at night and at temperatures between 38° and 65° Fahrenheit. There is considerable variation in the susceptibility to damage of different plants; roses and sweet peas for example are easily burned, lemons are much less affected than oranges, and olives may even be fumigated in daylight.

In order to obtain the necessary concentration of gas, plants growing in the open are covered with a tent; the form in general use is an octagonal sheet of light, closely woven cotton cloth measuring usually from 36 to 45 ft. across. By means of two light poles this is drawn over the tree so that it hangs down touching the ground all round it. The distance round the bottom of the tent is then measured by a tape and the distance over the top of the tree read off from a scale which is painted on the tent itself; the quantity of cyanide required for an enclosure of the size defined by these measurements is then read off from a table which was constructed by Woglum (*loc. cit.*) as a result of his experiments. The table is based on the use of 1 oz. of potassium cyanide (or $\frac{3}{4}$ oz. of sodium cyanide) for 100 cu. ft. of enclosed space for trees 11 to 12 ft. high; smaller trees require rather more and larger ones less owing to the relatively greater or smaller leakage through the tent cloth. The exposure to the gas is usually one hour. In calculating the dosage allowance is also made for the kind of insect to be attacked; for example, the full dosage is needed for purple scale in California and for the "serpeta" in Spain, but a $\frac{3}{4}$ dosage suffices for black scale and about $\frac{1}{8}$ dosage for *Phleothrips oleae* on olive trees in Spain. The hydrocyanic acid is generated by mixing together sodium cyanide (1 oz.) concentrated sulphuric acid ($1\frac{1}{2}$ fluid oz.) and water (2 oz.). The water is placed in a 2 to 3 gal. stoneware jug, the sulphuric acid then added, within the tent, the charge of cyanide is then thrown in and the tent closed at once.

In more gas-tight enclosures, such as greenhouses, a smaller dosage is sufficient; $\frac{1}{2}$ oz. of sodium cyanide to 1,000 cu. ft. will eradicate aphides, in other cases a repetition of the treatment after a suitable interval may be needed, because the eggs and pupae are more resistent than the larvae and mature insects; most scale insects require about $2\frac{1}{2}$ oz. per 1,000 cubic feet.

In the fumigation of ships and mills modifications of the procedure are necessary owing to the larger quantity of gas required and the difficulty of protecting the operator from danger. The compartments to be treated are first closed as nearly as possible gas-tight; wooden barrels, placed so as to distribute the gas uniformly, are charged with water and sulphuric acid and the cyanide placed in hinged receptacles which can be tipped by means of wires communicating with the exterior. The holds, cabins, etc., are opened up 2 hours after generating the gas and several hours allowed for it to escape before anyone is allowed to enter; in calm weather ventilation is accelerated by a fan. The officer in charge finally makes an inspection, wearing an oxygen-breathing apparatus and carrying a cage of rats; if these are unaffected the ship is certified safe. There are several modifications of this method.

The necessity of handling strong sulphuric acid and difficulties in disposal of the poisonous acid residues have led to the introduction of pure liquid hydrocyanic acid. This was first manufactured commercially in California in 1917 and in South Africa in 1920. In California the liquid, which contains 2 to 4% water, boils at 27° C., and has density 0·7, is supplied in iron drums holding 100 lb. each. It is applied by means of a portable vessel, containing 17 to 21 lb., with attached hand pump. Each stroke of the pump delivers a measured quantity of the liquid to a spraying nozzle which is pushed into the tent. Another method passes the measured volume of liquid into a heated tube where it is vaporised and delivered into the tent as gas. In South Africa the liquid is put up in sealed glass tubes which are broken within the space to be fumigated.

Liquid hydrocyanic acid is unstable, more especially in presence of alkalis; it polymerises to a black substance resembling charcoal, with evolution of a considerable quantity of heat. As the speed of polymerisation increases with temperature the reaction may become explosive. (Walker and Eldred, *J. Ind. and Eng. Chem.*, 17, 1,074, 1925.) For this reason the transport and storage of liquid hydrocyanic acid are attended with risks which have contributed to confine its use to districts in which it is possible to distribute it from factory to consumer by motor transport. The usual dosage for ships, mills, etc., (in oz. NaCN per 1,000 cu. ft.) is:—for mosquitos 0·5, fleas 2·5, rats and mice 5, lice 10, bed bugs 5, with exposures of half an hour for the smaller quantities up to 2 hours for the larger. When liquid hydrocyanic acid is used 22 c.c. is equivalent to 1 oz. of sodium cyanide.

Case Hardening.—Since 1910 case hardening by immersion in fused sodium cyanide has come into use more especially in the United States and Canada. Mild steel absorbs carbon from fused sodium cyanide and is so converted, superficially, into steel which can be hardened by rapid cooling. The articles to be treated are suspended in a bath of fused sodium cyanide preferably diluted with sodium chloride or carbonate to contain about 50% of NaCN. The most suitable temperature is 850° C. The rate of penetration of carbon into mild steel is 1/100th in. (0·25 mm.) per hour, or about 50% more when 3% nickel steel is used. The rate of penetration is independent of the percentage of cyanide in the bath, but the carbon content, and therefore, the hardness after quenching, increases with it. The method has great advantages for small, accurately shaped machine parts since surface oxidation and distortion due to uneven heating are avoided and the depth of case can be controlled very exactly. The operation is rapid, an immersion of 10 to 15 min. being sufficient in some instances.

Electro-plating.—Close-grained, adherent deposits of several metals, especially silver and gold, are obtained by the electrolysis of solutions of their double cyanides. Such solutions are now largely used for the deposition of copper, zinc and brass. Owing to the better adhesion and more even distribution of the coating it is claimed that a smaller quantity of zinc will prevent corrosion of iron when the zinc is deposited by electrolysis than when it is applied by the older dipping method. By the use of pure cyanides the baths are easily maintained at the strength suitable for rapid deposition of the metals.

The following baths are in use for "still" plating, expressed in oz. per imperial gallon of water:—Copper plating, sodium cyanide 3·9, cuprous cyanide 3·75, soda ash 1·5, sodium thiosulphate 0·3; zinc plating, sodium cyanide 3·1, zinc cyanide 3·75, caustic soda 3·75, ammonium chloride 2·5; brass plating, sodium cyanide 5·6, copper cyanide 3·75, zinc cyanide 1·25, soda ash 1·5, ammonium chloride 0·4.

Flotation.—Intimate mixtures of the sulphides of lead, zinc, copper and iron with gangue often occur in nature. The separation of the minerals is done by agitating a mixture of the powdered ore, water and a little oil with air. A froth is formed in which the minerals predominate. G. E. Sheridan and G. G. Griswold (U.S. Patents 1,421,583 and 1,427,235 of 1922) have found that the addition of a small quantity of sodium cyanide and, preferably, zinc sulphate to the liquid, previously made faintly alkaline with soda ash, prevents the flotation of zinc sulphide and of iron pyrites without affecting the flotation of the sulphides of lead or copper. The iron and zinc may be separated by a second treatment in more strongly alkaline solution, the zinc alone floating. The process is already in use at several mines in North America.

Manufacture.—In 1910 cyanides were produced mainly (1) from sodium, ammonia and charcoal, (2) from the nitrogenous constituents of the sugar beet remaining after removal of the sugar, (3) from the hydrocyanic acid of crude coal-gas which was recovered as ferro-cyanide, a part of which was converted into sodium cyanide by fusion with sodium (*see* 22.529). Ferrocyanides are now more economically made from cyanides, but the two first-mentioned processes continue to produce. In addition to these, processes are used in which the nitrogen is derived from the atmosphere. The most important of these is based on the Erlwein & Frank process (U.S. Patent 708,333, 1902), in which calcium cyanamide is fused with common salt. This process had been worked experimentally in Germany with little success. In 1916, it was installed at Niagara and improved by raising the temperature of fusion from 950° to 1,200–1,400° C., by adding calcium carbide in order to supply active carbon (the reaction is essentially $CaCN_2+C=Ca\ [CN]_2$) and by cooling the product rapidly so as to avoid the reversion of cyanide to cyanamide which occurs at 400–700 degrees. (U.S. Patents 1,282,395, 1918 and 1,282,405, 1918).

A product containing cyanide equivalent to 48–50% NaCN is obtained in this way which, under the name "aero cyanide" has found extensive use in the extraction of gold and silver and in the preparation of hydrocyanic acid for fumigation. Much of the cyanide in this material appears to be present as the calcium salt which is readily hydrolysed, $Ca(CN)_2+2H_2O=2HCN+Ca(OH)_2$. For this reason powdered "aero cyanide" has found some application as a fumigant where the residual lime is not harmful, since mere exposure to moist air liberates hydrocyanic acid. (T. E.)

CYCLE OF TRADE: *see* TRADE CYCLE.

CYCLING (*see* 7.682).—During the period following 1910 the evolution of the bicycle was not maintained, mechanical changes being less frequent and not so drastic as had been the case during the early pneumatic era. After 1918 interest in every branch of cycling increased to a marked extent, and this had its origin in the attitude taken up by the big cycle makers, who, desiring the freedom from trouble which mass production provides, discouraged invention and development and allowed design to stagnate.

Business Conditions.—Thus an opportunity arose for the assembler or small maker, generally an active cyclist himself, and invariably a working mechanic. Numbers of such men started in business, making a specialty of bicycles built to order and complying with the customer's own specification. These assemblers purchased parts from the various houses specialising on the production of fittings for the trade and built them up into complete machines. Under their aegis, supported by a growing demand from the large number of club riders of both sexes, the light roadster bicycle was evolved, a type which the large manufacturer had persistently ignored for more than a generation.

In addition to reducing the weight of his product, the small maker incorporated certain improvements which hard riders were quick to appreciate; among these were the drop-out rear wheel and the caliper brake, both of which, it is worth noting, were old ideas, the advantages of which had not been realised when they originally appeared on the market. The light-weight bicycle with small (26 in.) wheels gave cycling a new lease of life; contemporaneously with its advent came a movement to popularise rational dress among lady cyclists. The fashion of wearing short skirts, aided by the adoption of breeches, by the many women who took up agricultural work during the War, enabled the bifurcated garment to overcome the prejudice and to score an almost complete triumph over the skirt. To-day nearly 90% of club women and keen riders wear rationals for their more serious cycling, though skirts are retained for shopping expeditions and short journeys. Many wearers of rational dress use diamond-framed machines.

Officials of the big factories were somewhat slow to note the tendency of demand, and allowed the small makers to obtain a long lead in the production of light bicycles. Ultimately they began to realise the position, and many of them designed light and speedy models to compete with the locally built machines. These may now be procured from most of the large manufacturers, but the small assembler still enjoys the great advantage of being able to comply with the whims of his client, and the ability to build "to order" without undue interruption of his works routine. Another feature of the post-War period has been the revival of interest in tandem riding. This, again, has been fostered by the little maker with the encouragement of club riders.

Racing.—Road racing has flourished exceedingly. In Europe, America and Australia competitions are run on ordinary racing lines, the riders starting together, or, in the case of handicaps, in the order of their time allowance, the first man to finish being the winner. In Great Britain and Ireland the time trial system is in vogue, and has proved an extraordinary success. So great has the number of events become that, in 1922, the most prominent cycling clubs came together and formed the Road Racing Council, to which 38 clubs are affiliated, and which has compiled regulations for the conduct of road trials. The most popular distances are 25, 50 and 100 m., while several races at 12 and 24 hours are organised each year. One of the best things the R.R.C. has done for the sport has been to limit the number of entrants for any race run under its jurisdiction, and in the more important events not more than 100 riders may take part.

Track racing continues to enjoy great popularity in France, Germany, Belgium, Switzerland, Holland, Norway, Denmark, America, Italy and Australia, but in Great Britain, Spain, Norway, South Africa and certain other countries, the scarcity of up-to-date tracks prevents the development of this branch of the sport. The annual races for the championships of the world have been continued, the Union Cycliste Internationale having taken over the series which were inaugurated by its predecessor, the International Cyclists' Association. In 1921 the motor-paced race for the amateur title was dropped, and its place as a distance test was taken by a road race, the distance of which is usually from 100 to 120 miles. (H. W. BA.)

CYPRUS (*see* 7.695).—The population of the Island at the 1921 census was 310,709, about 19·4% being Mahommedans. On the outbreak of war with Turkey on Nov. 5 1914 Cyprus was formally annexed to the British Crown and became an integral part of the British Empire. In the proclamation then issued, it was announced that every Ottoman subject residing in the island would become a British subject unless he notified in writing within a stated period his desire to retain his Ottoman nationality. With the exception of a few non-Cypriote Turks temporarily residing in the island, all accepted British nationality, the Greek-speaking inhabitants with enthusiasm and their Turkish-speaking compatriots without demur. The change of status of the island, from being a dependency of the Ottoman Empire administered by Great Britain to being an integral portion of the British Empire, was effected quietly and without incident of any kind, and involved no material alteration in administration. The so-called "Turkish tribute" of £92,800 a year continued to be borne by the revenue, being termed the "Cyprus share of the Turkish debt charge."

The annexation was recognised by Turkey in the treaty of

Lausanne, 1923. Following the Cyprus (legislative council) order in council of Feb. 6 1925, the Island was formally elevated to the status of a colony on May 1 1925; the high commissioner was to be known after that date as the Governor. In the legislative council the non-Moslem representation was increased to 12, the council thus consisting of nine official and 15 elected members. The Greek-speaking Cypriotes for many years clamoured for Cyprus to be united to Greece, which they consider as their mother country; but Greece has not shown any great desire to encourage the agitation, and the British Govt. does not recognise the claim as well founded.

The Island's finances were placed on a sound basis in 1911 by fixing an annual grant-in-aid of £50,000 from the Imperial Govt. in substitution for the unsatisfactory arrangement previously in force, whereby the Imperial Govt. had year by year made good any deficit that might occur between revenue and expenditure.

During the World War Cyprus was used as a convalescent camp for the troops taking part in the Gallipoli operations, and it supplied large quantities of firewood and agricultural products, and numbers of mules to Egypt. A large prisoners of war camp was also founded towards the end of the War, accommodating thousands of Turkish prisoners from Palestine and elsewhere.

Economic History.—The history of Cyprus during the period 1910 to 1925 was one of slow but continuous progress. Under British administration, education and agriculture have made great strides. Commercially the island prospered, not only owing to its large export of caroub beans, agricultural produce and livestock, but also from its minerals. Asbestos is exported in large quantities, and the old Phoenician and Roman copper mines are worked chiefly for the by-products of copper, which, when exported on a large scale, form a profitable commodity. The railway which was built in 1907 from the harbour of Famagusta through the Mesaoria plain was extended in 1915 to Evrykhou at the foot of the western hills, and the island has been covered with a network of roads most of which are suitable for motor traffic. Reafforestation has been actively taken in hand by the administration, and legislative measures have been introduced for protecting the young trees from the ravages of goats, which in the past have been the cause of the destruction of an incalculable number of young trees. The forests are under the charge of a special department, with a staff of forest guards to protect the trees, prevent or deal with forest fires, and generally see that the sylvan produce of the island is developed to the best advantage. The hills in the western part are covered with valuable forests of pine and cedar, and roads are cut to hitherto almost inaccessible parts in order to facilitate the extraction of their valuable timber. A mail service is maintained between Egypt and Cyprus by subsidised steamers of the Khedivial Steamship Company, the voyage between Port Said and the island taking about 18 hours. These steamers connect at Port Said with the Peninsular and Oriental Co. and the journey from London to Cyprus can be performed in about seven days.

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(C. W. J. O.)

CYRENAICA (*see* 7.702) has an area of about 230,000 square miles. The population (1925 estimate) is 250,000, including 12,000 Europeans. The capital and chief seaport is Benghazi (population about 40,000). When in 1912 Italy succeeded Turkey in the sovereignty of the vilayet of Benghazi, it was officially styled "Cirenaica," by which name the region had commonly been known from ancient times. It was made a colony distinct from the adjoining vilayet of Tripoli (Tripolitania), but up to 1914, owing mainly to the opposition of the Senussi, the Italians had occupied little more than the coast region. During the Great War Italian occupation was reduced to the ports of Benghazi and Derna and a few other places on the Mediterranean, but from 1919 onward Italian authority was gradually extended. By an agreement concluded in Dec. 1925, Egypt ceded to Italy the oasis of Jaghbub, and the possession of that oasis, which the Italians occupied in Feb. 1926, enabled them to strengthen their hold on the hinterland.

The people—Arabs and Berbers—rear large numbers of cattle, sheep and camels, and there is considerable trade in livestock with Egypt. Excellent barley is grown, and is usually exported to Great Britain, where it is used for making whisky and beer. The total value of the external trade in 1923 was about £1,000,000. The greater part of the country is a barren desert. There were in 1924 20 m. of railway, part of a projected line to join Benghazi and Derna. (*See* SENUSSI.)

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CYTOLOGY (*see* 7.710).—The effect of the work done in cytology up to 1910 may be summarised as follows:—

The bodies of animals and plants are made up of units termed cells, which may be compared to the bricks in a wall. Each cell is composed of a viscid, semi-fluid material termed protoplasm, surrounded by an elastic membrane termed a cell wall. This wall is composed of cellulose in the case of the vegetable cell, and may acquire considerable thickness and firmness; in the animal cell it is almost always very thin, and never consists of cellulose, but appears to agree in composition with the protoplasm, of which it may be considered a condensation. There is reason to believe that in most, if not all, cases the cell wall is porous, and that adjacent cells are connected with one another by bridges of protoplasm.

FORMS OF CELLULAR ACTIVITY

The activities of living cells are manifested in four ways, viz.:—

(1) By movement, which takes the form of alternating contraction and expansion.

(2) By secretion, *i.e.*, by the production of definite substances which accumulate in the protoplasm, but which are finally extruded from the cell.

(3) By the transmission of stimuli, so that shocks or stimuli of various kinds applied to one cell result in movement or secretion in a different cell.

(4) By reproduction, which takes the form of the division of the cell into two daughter cells.

All these activities are dependent for their continuance on the consumption of a certain portion of the protoplasm; and if life is to persist and if the cells are to increase in number this waste must be repaired. This is effected by the taking in and assimilation of food; and this assimilation can only be carried out if there exists in the protoplasm a specially differentiated portion termed the "nucleus," which appears to be of rather different composition from the rest. For this reason it is customary to use the term "cytoplasm" for the extra-nuclear protoplasm.

Cells may be specialised for rapid movement or for the reception and transmission of stimuli or for secretion. Locomotor cells may be provided with freely projecting filaments, termed "cilia" or "flagella," which are capable of rapid vibration, and act the part of oars in propelling the animal, or their cytoplasm may contain threads termed "myonemes" or "muscular fibrils," which are capable of thickening and contracting; and these threads may be simple or cross-striped, *i.e.*, composed of alternate disks of singly and doubly refracting material; cells provided with these threads are termed "muscle-cells."

Cells devoted to the reception and transmission of stimuli are known as "nerve-cells" or "neurones." Those which are situated at the free surface of the animal, and which are provided with stiff processes of various kinds which are easily affected by stimuli, are known as "sense-cells." Those which are more deeply situated have, in place of the stiff processes, one or more root-like branching processes, known as "receptive dendrites." Stimuli when received are transmitted by outgrowths of the neurone known as "axons," and these axons, after preservation by fixing fluids, are seen to consist of a series of delicate fibres, the "neurofibrillae." The axon ends in a brush of root-like processes called "terminal dendrites"; these dendrites are in contact either with the receptive dendrites of another neurone to which they hand on the stimulus, or with a muscle-cell in which they cause contraction, or with a secretory cell in which they initiate secretion.

In the case of secretory cells the secretion may be fluid and poured forth at a free surface only, from which it is washed away by the currents of the circumambient medium. Of this type are the mucous cells, which give rise to the slime which lubricates the skin of earthworms, or the similar cells which produce the mucus inside the human mouth cavity. On the other hand the secretion may take the form of fibres or of another form of solid material and may be extruded from the entire surface of each cell so that the cell becomes in this way separated from its neighbours by masses of the secretion or, as it is now termed, the intercellular substance. Cells of this kind are known as "connective-tissue cells" and give rise to the various supporting tissues such as fibrous tissue, cartilage and bone.

The reproductive cells or "germ cells" are, as their name implies, cells which have the capacity of giving rise to a mass of cells out of which the body of a new individual is built up. They occur in many forms amongst the lowest grades of animals, *i.e.*, the Protozoa, but amongst the higher animals, or Metazoa, they are remarkably constant in general characters, exhibiting practically the same forms throughout the whole range of animals from the sponges to the human race. They appear under two types, viz.:—(1) a small, motile male cell, which consists mainly of a head, which is a condensed nucleus, to which is added a vibratile flagellum termed the tail; and (2) a much larger motionless female cell or egg, in the cytoplasm of which there are deposits of food material known as yolk. Normally a male cell must unite with a female cell before development can be initiated, but the eggs of many animals can develop without this union and are then termed "parthenogenetic." In other cases where union with a male cell normally takes place eggs can be stimulated to develop without previous union with a male cell, and these cases are termed "artificial parthenogenesis."

The Nucleus.—Turning now to the consideration of the nucleus, we find that this is frequently invisible in the living cell, but when it can be made out, it appears either as a clear vesicle (as in many eggs) or as a slightly more granular portion of the protoplasm (as in Amoeba). When, however, it is fixed and stained it exhibits a characteristic structure. It then appears as a vesicle containing a fluid termed the "nuclear sap," and bounded by a membrane termed the "nuclear wall." The sap is traversed by a network of threads known as "linin fibres," and adhering to these fibres—suggesting the arrangement of beads on a necklace—are a number of granules termed "chromatin" because they attract and retain the colouring matter of the staining fluid so strongly. In addition there are usually one or two rounded bodies termed "nucleoli," which also attract stain strongly, but these are apparently not composed of exactly the same chemical substances as the chromatin granules, and it is possible by the use of certain stains to colour them differently from the tint assumed by the chromatin.

We have already seen that assimilation or the building-up of fresh protoplasm is impossible in the absence of a nucleus. This is proved by dividing a uninucleate amoeba into two, when it is seen that the non-nucleate piece, though capable of movement, cannot digest or assimilate food and, after a short period of activity, dies.

The division of the nucleus always precedes the division of the cell, and this division is occasionally direct, *i.e.*, by the process of simple constriction into two, or much more frequently indirect, by the process termed "karyokinesis" or "mitosis." In this method the chromatin grains were believed to become aggregated into a continuous spirally coiled thread termed the "spireme," which then became segmented into a definite number of segments called "chromosomes." The chromosomes always appear in the same number in the same species at every division of the nucleus. Meanwhile the nucleolus or nucleoli disappear, apparently dissolved in the cell sap; and the nuclear membrane becomes dissolved, so that the cell sap is mingled with the cytoplasm; and then a small body termed the "centrosome," lying at the side of the nucleus in the cytoplasm, becomes discernible. The centrosome can occasionally be demonstrated lying at the side of the resting nucleus, but when it becomes visible in the process of mitosis it is seen to be in process of division into two.

The chromosomes at the same time appear to be split longitudinally, whilst from the daughter centrosomes, as they move apart, a series of filamentous rays are developed, some of which ("astral fibres") extend out to the periphery of the cell, whilst others ("mantle fibres") become attached to the halves of the split chromosomes, one fibre from each centrosome going to a corresponding half of the chromosome. When the centrosomes have reached positions at opposite ends of the nucleus the mantle fibres proceeding from them have constituted the mitotic spindle; certain other fibres appear running directly from one centrosome to another in the axis of the spindle, which are termed "spindle fibres," whilst the split chromosomes, under apparent tension of the mantle fibres, have assumed positions lying at right angles to the axis of the spindle, and constitute what is called the "equatorial plate."

By a continuance of the apparent tension of the mantle fibres the two halves of each chromosome are dragged apart from one another, and eventually one set of half-chromosomes becomes massed together in the vicinity of each pole of the spindle, that is, close to each daughter centrosome. Each of such sets of chromosomes constitutes a daughter nucleus. The chromosomes become longer and thinner and more entangled with one another until the initial stage of a linin network with adhering chromatin granules is re-established, and round this a new nuclear wall is formed. The stages leading to the segmentation of the spireme thread and the solution of the nuclear membranes are termed the "prophases of mitosis"; those leading to the establishment of the equatorial plate are termed the "metaphase." The stage involving the separation of the halves of the chromosomes is termed the "anaphase," whilst the steps leading to the reconstitution of the daughter nuclei are termed the "telophases" of mitosis.

In the fertilisation of the egg it is penetrated by the head of the spermatozoön, which carries with it a segment of the tail termed the middle-piece. The middle-piece is distinguished by its diameter from the thinner more distal part of the tail and it includes a centrosome which has been derived from the centrosome active at the last division of the sperm mother cell. Sometimes the distal part of the tail is left behind at the surface of the egg—sometimes it penetrates with the rest of the spermatozoön. In the latter case it remains passive in one cell of the embryo and is absorbed and is without influence on the hereditary potencies of the embryo, since it is never distributed to any but the one cell. All the paternal influence must be carried by the head, which is a condensed mass of chromatin; hence is derived the strong belief that not only is the nucleus the bearer of hereditary powers but that the chromatin is the element of the nucleus in which they are concentrated.

The spermatozoön head, once immersed in the egg, swells up and assumes the characteristic structure of a nucleus: it acquires nuclear sap and a nuclear wall and its chromatin becomes resolved into the same number of chromosomes as are present in the egg nucleus. It is then known as the "male pro-nucleus," whilst the egg nucleus is termed the "female pro-nucleus." The centrosome derived from the middle piece gives rise to an enormous aster with radiating rays which is termed the "sperm-aster"; the two nuclei approach each other, and the sperm-aster then fades out and is replaced by two asters each radiating from one of the daughter centrosomes which become connected by a spindle. The chromosomes of both nuclei are arranged side by side on the equatorial plate of this spindle: so that when the compound or "zygote" nucleus divides, equal portions of maternal and paternal chromatin are distributed to the first two cells of the embryo, and the same thing follows at every subsequent division of the growing embryo, so that paternal and maternal chromatin is distributed in equal amounts to every cell of the body.

The ripe germ cell consequently possesses only one-half the number of chromosomes which the ordinary body cell possesses. This number is termed the *haploid* number, whereas the normal number found in the ordinary cells of the body is termed the *diploid* number. At some time therefore in the history of the germ-cell, a reduction of the diploid to the haploid number must take place. The older view was that this occurred at one of the ripening divisions in consequence of the spireme becoming segmented into half the usual number of pieces: each of these pieces then exhibited a transverse split, which was regarded as an indication of the belated appearance of the full number: at the first maturation division, these halves were, however, supposed to be distributed to different cells, so that each daughter cell received only half the original number of chromosomes—this division was known as the "reduction division," or "meiotic division."

Since the chromosomes are usually invisible during the resting stage of the nucleus the question has been raised whether they retained their individuality throughout the whole growth cycle. Various considerations lead to the conclusion that their individuality is retained. In some cases where the number is very small, as in the cells of the nematode worm *ascaris*, the chromosomes or at least their ends can be detected in the resting nucleus: moreover the chromosomes are not all alike, but differ in size and shape from one another, and to each paternal one there is a corresponding maternal one of similar size and shape, and it seems unlikely that, if they vanished in the resting stage, they should reappear in exactly the same form at the subsequent mitosis. It has been surmised that this individuality in form and size was an indication of a difference in function in distributing the hereditary qualities, and Boveri's discovery that, when an echinoderm egg was entered by two spermatozoa, one alone fused with the female pro-nucleus whilst the other acted as an independent nucleus, so that at the first division the egg was divided into four cells, led to the same conclusion. For Boveri showed that under these circumstances an abnormal spindle was formed connecting all four daughter nuclei, and on this spindle the chromosomes were irregularly distributed: and that if the four resulting cells were separated and allowed to develop separately they developed abnormally; whereas Driesch had previously proved that it was possible to rear any of the first four cells into which a normally fertilised egg divides, if such a cell were separated from the rest, into a perfect larva of diminished size. Since an unfertilised egg has also been induced by appropriate stimuli (*see* EMBRYOLOGY) to develop into a perfect larva, the conclusion is inevitable that one complete set of chromosomes (maternal or paternal) is essential to the normal development, and that cells receiving fewer chromosomes than these cannot grow into normal embryos; hence every kind of chromosome has its appropriate function to play in growth.

PROGRESS SINCE 1910

We now turn to the great advances made since 1910.

About 1899 Hardy published his first paper in which he showed that the effect of the usual preservatives used in killing cells was to produce fibrous networks which had no counterpart in the living protoplasm, for exactly the same effect could be produced by the use of these same fluids on dead proteid: that in fact all colloid solutions, which he termed "sols," could be easily induced to pass into a semi-solid or "gel" phase in which the molecules were arranged in strings. From such networks the intervening fluid could be easily forced out, but by gently heating colloid solutions a different form of "gel" was produced, from which a pressure of several atmospheres failed to force the fluid out. In the first case the fluid contents were called the continuous phase, and the fibres the disperse phase—but in the second case the fluid is locked up in tiny droplets inside the semi-solid gelatine and then the fluid was the disperse phase and the gelatine the continuous phase.

This discovery led to great scepticism as to the existence in life of the various structures seen in stained protoplasm. Fresh attention was given to the study of protoplasm in the living state and a most ingenious instrument designed by Kite was used with effect by Chambers for this purpose. This was an excessively fine needle point of hard glass, bent at right angles to the glass tube from which it was drawn, fixed so that the point projected into a glass cell from the roof of which in a hanging drop was suspended the living cell or cells it was desired to explore. The needle could be manipulated by screws and the glass cell was mounted on the stage of a microscope. It was discovered that, generally speaking, the cytoplasm of a cell was a sol which was sometimes very thick and viscid and sometimes more fluid, but that the outer layer next the cell-wall was a gel, of which indeed the cell-wall might be regarded as an intensification. The various inclusions contained in the central cytoplasm, such as coloured granules, oil drops, etc.—could be freely pushed about by the needle. When, however, the nucleus of the cell approached mitosis, a change took place, and the astral rays were found to be strings of semi-solid material, as was also the mitotic spindle but no "mantle-fibres" could be detected in the living cell: the astral rays became connected with the peripheral gel surrounding the cell. On the other hand no centrosome could be detected in the living cytoplasm, but the sphere surrounding the centrosome was found to consist of fluid material which Chambers supposed to be squeezed out from the cytoplasm during the process of gelatinisation of the astral rays, and from it proceeded fluid rays visible as clear streaks in the living cell which alternated with the astral rays. When the spindle divided, its centre passed into the sol state, and this change propagated itself toward the poles as the two daughter cells separated from one another.

Examined in the same way, the cross-striped myonemes characteristic of the muscle-cells of arthropods and vertebrates turned out to be composed of alternate discs of gels of different consistencies; but no trace could be made out of neurofibrillae in the living nerve fibre, and the nerve-cell, *i.e.*, the body of the neuron containing the nucleus, when examined in the living condition, exhibited Brownian movement—*i.e.*, the granules pulsated under the impact of freely rolling molecules—a circumstance which proves it to be in the sol condition. On the other hand it should be recorded that Chambers found that the cytoplasm of the ganglion cells from the central nerve-cord of the lobster was a very viscid substance which could be pulled out into long threads without undergoing essential change. When pulled away from the nucleus a clear empty space appeared on the side of the nucleus in the direction of the pull, which was only slowly filled by inflow of the plasma from the two sides.

It will be observed that in living protoplasm the change from the sol to the gel condition is reversible and very frequently takes place and many of the phenomena exhibited by living cells will find their explanation in this circumstance.

The Brownian movement affords a criterion of whether protoplasm is in the condition of a sol or a gel, although not an absolute one, for Chambers has shown that a sol may be so thick as to prevent this movement, and yet it may be possible to move particles in it freely by means of the glass needle. Bayliss has shown that the actively moving pseudopodia of Amoeba show a vigorous Brownian movement, but that when they are caused to retract by electric shocks the movement ends, showing conversion of the material into a gel.

Side by side with these observations on living protoplasm have gone renewed observations on its structure by means of more refined fixatives and stains. It has been shown that many of the older preserving fluids which were used to differentiate the nucleus and especially the chromatin of the nucleus from the cytoplasm, had a destructive effect in dissolving out many of the constituents of the cytoplasm.

A more refined technique has demonstrated the existence of bodies in the cytoplasm termed "mitochondria," which take the form of fibres or, less frequently, of small oval granules. What their function in the life of the cell is has not been fully determined. Meves supposed them to be bearers of heredity, like the chromosomes, and described them as dividing into two at the division of the cell, the halves being distributed to the two daughter cells. Later researches by Gatenby have failed to confirm this. He finds that the mitochondria are irregularly distributed at all divisions. Besides the mitochondria another element of the cytoplasm known as the "Golgi apparatus," has come to light. It is so called because it was first described by Golgi in nerve-cells.

To see it properly it is necessary to use preserving fluids which contain osmic acid, followed by treatment with salts of silver. In young cells this apparatus takes the form of a wreath surrounding the centrosphere, or area of clear cytoplasm, which envelops the centrosome in the young cell—*i.e.*, in the cell just after it has originated by division of the mother cell. During the growth of the cell this wreath dissolves into smaller elements which become scattered throughout the cytoplasm interspersed amongst the mitochondria. These elements in their typical form consist of disc-like bodies made up of a substance which stains faintly, edged for half or more of their circumference by a rim that stains intensely black with the reagents which are used to differentiate the Golgi apparatus. The earlier observers failed to note the disc-like form of these elements and fixed their attention solely on the deeply staining rim, which they regarded as a rod, and to which they gave the name "dictysome," but Bowen has brought out clearly the real structure of these bodies. The fact that the Golgi apparatus reacts strongly with osmic acid has been held to prove that it must be partially made up of a substance allied to lecithin, which contains a fat group in the molecule.

The most interesting fact about both mitochondria and Golgi apparatus is that the elements of both increase in number by transverse division, and hence they cannot be regarded as food reserves, or temporary deposits of excreta, but are in some sense elements of the living cytoplasm.

Considerable evidence has been adduced to show that the Golgi apparatus is a secretory organ. In nerve-cells, it forms a network permeating the cytoplasm, but nerve-cells once formed never undergo division. In other cells, as already mentioned, it is at first concentrated round the centrosome adjacent to the nucleus and becomes dispersed throughout the cytoplasm as the cell grows older. Now Nassonov has shown that the fixing agents which are used to demonstrate the Golgi apparatus stain also the walls of the pulsating vacuoles found in freshwater protozoa. The vacuoles, as is well known, continually secrete and expel to the exterior a clear fluid. Wheeler in the egg of the dab and Nath in the eggs of scorpions have shown that the Golgi elements are closely allied to certain peculiar yolk globules which grow in connection with them. It seems clear that the Golgi elements secrete this kind of yolk which is termed Golgi yolk in order to discriminate it from other kinds of yolk. The function of the mitochondria is less clear, but they also appear to be connected with secretion. In the egg of ciona, Harvey has found that the yolk globules stain like mitochondria. Brambell has shown that in the eggs of the molluscs, limnaea and patella, the mitochondria swell up and secrete a kind of yolk sharply distinguished by its staining reactions from Golgi yolk.

In the formation of the spermatozoa of insects and molluscs the mitochondria and the Golgi apparatus play a very definite part which has been elucidated by Gatenby. The former give rise to a sheath surrounding the base of the tail which forms the middle-piece of the spermatozoön; the latter becomes largely metamorphosed into the "acrosome" or pointed structure which is attached to the front of the head of the spermatozoön, and plays the part of a spearhead when the spermatozoön reaches and penetrates an egg. The remnant of the Golgi apparatus migrates round the head and eventually forms a bead projecting from the tail which is eventually rubbed off. The middle-piece penetrates the egg, but undergoes no growth there: it remains embedded in one cell of the embryo and is eventually absorbed so that the mitochondria can have no function as bearers of heredity. In living cells particles resembling mitochondria and Golgi discs in their shape have been observed, oscillating in the typical Brownian manner, whence it is inferred that these bodies really exist as such in living protoplasm and are not merely artefacts produced by preserving reagents.

Nuclear Structure.—As regards advances in our knowledge of nuclear structure, we may note especially the demonstration of the presence of sex chromosomes in many animals. Already before 1915 the fact was known that in certain cases an odd chromosome was present in the ripening germ cells, that is, a chromosome which in one of the ripening divisions of the germ cells passed without dividing to one pole of the mitotic spindle. But Wilson showed that not only are such odd chromosomes found in the developing sperm cells of certain insects but that their presence is apparently related to the determination of sex. The odd chromosome sometimes divides longitudinally at the first maturation division, but at the second passes undivided to one pole of the spindle. Sometimes it migrates to one pole in the first division and divides longitudinally at the second: in either case its presence causes the formation of two types of germ cell, one possessing one more chromosome than the other.

In the case of these insects the ripening eggs are all found to possess the same number of chromosomes: and this number is equal to that found in the sperm cells which have the larger number. It is clear, therefore, that when the eggs are fertilised with the sperm, two types of fertilised egg should be found; one characterised by having one more chromosome than the other, and these eggs should give rise to animals all of whose cells should have nuclei with a number of chromosomes equal to those found in the fertilised egg from which each one arose. If we now examine the cells of the males, it is discovered that they have nuclei with the smaller number of chromosomes, whereas the cells of the female enclose nuclei with the larger number of chromosomes. Therefore it is clear that the male has been produced by the fertilisation of an egg by a spermatozoon devoid of the odd chromosome: whereas a female arises when an egg is fertilised by a spermatozoon containing this chromosome.

Wilson showed further that sometimes the odd chromosome has a mate with which it pairs, but which is much smaller than itself. This mate is denominated by Wilson the Y chromosome, whereas the large one which alone is present in the case of many insects is termed the X chromosome. In some cases, however, as in the fly, Drosophila, which has been the subject of so many genetic experiments, the Y chromosome is as large as the X chromosome and differs from it only in shape. The male germ cell which receives the Y chromosome gives rise to a male when it fertilises an egg, whereas that containing the X chromosome gives rise to a female. Still other modifications, which lack of space prevents us entering into, are recorded by Wilson. There has been a diligent search for these sex-chromosomes in the germ cells of other animals, and enthusiastic investigators have announced their discovery in the spermatids of echinoderms, vertebrates and even of man himself, but these cases cannot yet be taken as fully proved.

The earlier conception of the preparation for the mitotic division of the nucleus has been that the chromosomes became arranged in a continuous thread termed the spireme, which then became transversely segmented into the characteristic number of chromosomes. This conception has gradually been superseded by a much simpler one, viz., that the chromosomes persist as long looped threads during the resting stage of the nucleus and that these long, U-shaped filaments become shorter and thicker as mitosis approaches. To this change of view many workers have contributed, especially Agar and Hogben. The free ends of these U's are attached to a spot on the nuclear wall immediately outside which lies the centrosome. In the preparation for the reducing division of the germ cells, when the chromosomes first become distinguishable they are said to be in the " leptotene " stage. These leptotene threads then approach one another in pairs, and these pairs are termed " zygotene " threads. Each pair fuses to form a single thicker thread known as " pachytene," and *in this way the number of chromosomes becomes reduced to one-half.*

The interpretation, however, of the fusion of the lepotene threads to form thicker pachytene threads, as the process by which the diploid number of chromosomes is reduced to the haploid number has been disproved by the researches of Walker on the developing eggs of the newt. By adopting the precaution neglected by Agar and Hogben of simultaneously observing mitotic division in somatic and germinal nuclei he has shown that leptotene and pachytene threads occur in them all, that in the telophase of somatic mitoses each chromosome splits longitudinally preparatory to the next division, and that in the resting stage the nucleus contains *four* times the haploid number of chromosome threads. In the prophase of the next division these threads unite in pairs and restore the diploid number, but it is only much later when the chromosomes have become much shorter and thicker that the diploid number of so-called " monovalent " chromosomes fuse with one another to form the haploid number of " bivalent " chromosomes. This second pairing is the real " meiosis " or reduction. In meiosis it is true that the first union of two sister chromosomes often appears to take place by their ends (metasyndesis). The union of two sister chromosomes in the prophases of the reducing division is frequently termed " synapsis." We have avoided this term because it has also been used to denote the bouquet contraction of the chromosomes, but subsequently the connected pair swing round so as to be parallel with one another, and side-by-side union (parasyndesis) then takes place.

Hogben has shown that in the egg of the cockroach, formerly cited as an instance of the occurrence of metasyndesis, parasyndesis really takes place. In the pachytene stage the chromosomes become contracted and are often bunched together at one side of the nucleus so as to form a characteristic bouquet. Each chromosome is in the form of a loop, the two ends of which are attached to the nuclear wall on the side adjacent to the centrosome. The nuclear wall is then dissolved and the chromosomes fly apart—a process known as diakinesis. It is after diakinesis that true meiotic pairing takes place. The conjoined pair then begin to separate from one another as the prophase of the meiotic division passes into the metaphase, and this separation usually takes place first in the middle, so that the conjoined pair assume the form of a ring. Each half of the ring corresponds to one of the two original chromosomes, and these halves are dragged apart in the ensuing mitotic division. Most frequently each half shows a constriction in the middle of its length, which was formerly interpreted as a precocious appearance of the longitudinal division of the chromosome which is consummated in the second maturation division. For this reason the name " tetrad " has been bestowed on the shortened, thickened and partially split chromosome. Agar has shown, however, that in the vast majority of cases this constriction has no relation whatever to the splitting of the chromosome in the second maturation division.

Some modern theories of heredity assume that a chromosome consists of a linear series of rudiments, each of which has its particular part to play in the up-building of the embryo. A side-by-side pairing enables us to see how corresponding rudiments belonging to maternal and paternal chromosomes could be brought together: an end-to-end pairing would of course render such a process impossible. Artificial theories of this kind, however, receive no support from detailed study of nuclear division, for they demand that when two chromosomes pair, each should be capable of breaking in a complicated way so as to exchange pieces which " cross over " with its fellow. Such a process might have been conceivable when leptotene threads were regarded as chromosomes; it is inconceivable when it is recognised that in the real meiosis the chromosomes are short, thick rods. Moreover Chambers has shown that in life the chromosome is a gelatinous elastic rod, which cannot be conceived to be capable of breaking in the way in which the " cross over " theory postulates.

In the ripening of the egg very peculiar phenomena occur which have only recently received an explanation. The unripe female germ cells or oögonia show nothing peculiar in their mitosis, but during the prophases of the first ripening division an enormous increase in size of the egg cell takes place. The leptotene threads are at first clearly visible and can be seen to pass into the pachytene stage, but then they fade from view. The nucleus becomes very large and gorged with nuclear sap, from which circumstance is derived the name, "germinal vesicle," which the older authors bestowed upon it. The nucleolus becomes large and conspicuous. At the close of the growth period the nucleolus has been completely dissolved; the nuclear wall disappears and the nuclear sap mingles with the cytoplasm; then the chromosomes can again be detected as minute tetrads which begin to arrange themselves on the mitotic spindle of the first ripening division. Now by the examination of specially favourable cases it has been shown that during this episode of growth the chromosomes swell up, become pressed against the nuclear wall and almost lose their capacity for absorbing stain. It seems to be clear that a chromosome consists of at least two substances—a framework which does not stain and an embedded material which stains intensely, and to which alone the name chromatin is, properly speaking, applicable, and that during the growth of the egg cell the framework swells up enormously. De Baehr has shown that in the male germ cells of the annelid *Saccocirrus*, a similar growth period exists, though it is of very much shorter duration than the corresponding period in the life of the female germ cell; but, short though it is, it is long enough to cause the chromosomes to swell up and temporarily fade from view.

The nucleolus or "germinal-spot" of the older authors, which is so conspicuous a feature in the unripe egg, has formed the subject of some most interesting researches. Hogben has shown that in the cockroach *Periplaneta* the nucleolus becomes vacuolated and that portions of it are extruded and that these can be recognised by their peculiar staining properties, scattered in the nuclear sap and even in the act of passing through the nuclear membrane. They can also be detected in the cytoplasm outside the nucleus. There seems to be no reasonable doubt that it is by this process of vacuolation and emission of pieces of itself that the nucleolus ultimately disappears.

Gatenby and Hogben have shown that in certain cases these emitted fragments may assume the appearance of nuclei, since they seem to secrete round themselves both nuclear sap and a nuclear wall. Ultimately they all disappear. Though it has not been possible to connect them directly with the formation of yolk spheres, yet it is an interesting fact that the beginning of this emission from the nucleolus often coincides with the first appearance of yolk spheres, and as we know by experimental evidence that the nucleus presides over assimilation, it is a reasonable hypothesis that the absorption of these pieces of nucleolus in the cytoplasm leads directly to the synthesis of yolk.

Nath by the comparison of the eggs of two genera of scorpions (Euscorpius and Palamnaeus) one with abundant yolk and the other with only scanty yolk showed that yolk formed by the Golgi apparatus is common to both, but that in Palamnaeus, where no nucleolar extrusion takes place Golgi yolk alone is present, whereas in the more heavily yolked eggs of Euscorpius additional yolk of a different character makes its appearance after the fragments of the nucleolus have passed into the cytoplasm and been absorbed. In these eggs no relation between what we may term nucleolar yolk and mitochondria has been traced. It has recently been asserted by Carleton that in ordinary tissue cells where the same disappearance of the nucleolus occurs as the cell grows, this is not complete—that a small kernel remains which can be stained in certain silver salts—and that this kernel takes its place on the mitotic spindle at the next division of the cell. This "nucleolinus," as Carleton terms it, becomes equally divided into two and the halves pass into the two daughter cells. If these observations should be confirmed we should have in the nucleolinus a part of the nucleus as permanent as are any of the chromosomes, the function of which was to form a centre for the synthesis of a mass of chromatin which constitutes the nucleolus and is destined to be emitted into the cytoplasm, where it no doubt profoundly affects metabolism and determines formation of cytoplasmic structures.

Parthenogenesis.—We have seen that the egg cell normally undergoes two ripening divisions, at the first of which the chromosomes are reduced in number by one-half. When the egg is fertilised by the spermatozoön not only is the full number of chromosomes restored by the addition of those brought in by the spermatozoön but the division of the egg is initiated by the centrosome which is carried into the cytoplasm of the egg along with the head of the spermatozoön. An interesting question now comes as to what happens in the case of those eggs which develop without fertilisation—or, as it is termed, "parthenogenetically."

Now parthenogenesis may be either artificially induced or it may be a natural event in the history of the species. If we take the case of "naturally" parthenogenetic eggs first, we find that a great deal of light has been thrown on the subject by the investigations of de Baehr. He took for his subject the plant-louse *Aphis palmae*, the eggs of which develop without the aid of the male throughout the summer. He shows that in these eggs the preparations for the reducing division occur. Out of the apparently irregular chromatin network leptotene threads differentiate themselves. These pair so as to form thicker pachytene threads—but then after diakinesis no further pairing takes place and the diploid number of chromosomes remains. Then the period of growth supervenes and the chromosomes become indistinct, but when they reappear in the metaphase they are in the full number and only one maturation division takes place at which all the chromosomes are longitudinally cleft. From these facts de Baehr draws the conclusion that the reducing division is suppressed and only the second maturation division takes place.

A somewhat different case is presented by the egg of the bee. The egg if fertilised gives rise to a female but if unfertilised grows into a male. In the latter case, of course, the resulting animal has in all its nuclei only the reduced number of chromosomes. When the male produces germ cells, the reducing division is suppressed. The nucleus of the spermatocyte enters on the prophases of mitosis and the cell divides, but one of the daughter cells is devoid of a nucleus and dies. The nucleus in the other cell goes back into the resting stage; and then, like the egg in *Aphis*, it enters on a single maturation division in which the chromosomes are divided longitudinally, and the spermatozoön has therefore the same number of chromosomes as that possessed by the nuclei of the tissue cells of the male, which is the reduced number as compared to the number in the nuclei of the cells of the fertilised female.

In still other cases, as in the eggs of the small crustacean *artemia*, the two ripening divisions may occur, but the first one can give rise to a nucleus which is not extruded as a polar body but remains in the egg and, reuniting with its sister nucleus, restores the full number of chromosomes.

Parthenogenesis can, however, be brought about in eggs which normally require fertilisation by the application of external stimuli. This stimulus in the case of the frog's egg may take the form of a prick with a needle. Under these circumstances an immense development of astral fibres takes place, centring on a particle lying adjacent to the egg nucleus, apparently a centrosome formed from this nucleus. This aster is speedily transformed into a short spindle with a radiating aster at each end of it. If this spindle lies near enough to the surface of the egg to initiate a division-furrow, parthenogenetic development may begin. It is interesting to observe, however, that the mitotic spindle formed by the nucleus of the unfertilised egg is only ⅘ of the length of the spindle formed by the fertilised egg; *the size of the spindle is directly related to the number of chromosomes.*

In the sea-urchin's egg the primary stimulus, which is usually momentary immersion in a fatty acid (such as butyric), only produces an aster on which the chromosomes are distributed, but which is unable to metamorphose itself into a spindle. If, however, the eggs are subsequently immersed in "hypertonic" sea water—that is, sea water in which the percentage of salt is raised above the normal amount, then one or more accessory asters are formed in the cytoplasm. Whence the particles arise which act as centrosomes for these asters has never been ascertained; that they have previously been emitted from the nucleus is a pure assumption. If only one accessory aster has been formed a mitotic spindle is formed between it and the aster which arises round the egg nucleus. On to this spindle migrate the chromosomes. A regular equatorial plate is formed, and division of the nucleus and of the whole egg ensues and development is initiated. As the accessory aster is usually smaller than the primary egg aster, the two blastomeres into which the egg divides are of unequal size, and we thus learn that the size of the daughter cells into which a given cell divides is related to the relative sizes of the asters at the two poles of the spindle. It is indeed the growth of these asters that determines the division of the cell.

When a sea-urchin's egg is broken into fragments not only the fragment containing the nucleus but also those devoid of the nucleus may be entered by a spermatozoön, and, under certain circumstances, will develop into an embryo. Chambers has, however, shown that this is only possible if the fragmentation of the egg takes place after the nuclear membrane of the egg is dissolved and the cytoplasm has become permeated by the nuclear sap and that pieces of cytoplasm not reached by this sap will not develop even when entered by a spermatozoön.

Conclusion

From the foregoing sketch the reader will gather that the science of cytology had attained in 1925 an extremely interesting stage of development. New discoveries had poured in, the exact significance of which was not yet fully understood, and although we had glimmerings of light they serve rather to pose than to answer questions. The yolk, for example, which we had been accustomed to regard as much the same kind of substance wherever it was found, is seen to be a name for a series of complex substances formed by different cell-organs which differ from one another in their staining reactions and, in all probability, in their chemical composition, and which are present in different proportions in different eggs.

What is the meaning of the centrosome, and how is it related to the formation of astral rays? It cannot be detected in the living cell and yet the study of stained cells would lead us to regard it as a permanent cell-organ—typically outside and independent of the nucleus and, like the nucleus, handed on by division from a cell to the daughter into which it divided. Yet, as we have seen, it can be formed *de novo* in the cytoplasm by the action of hypertonic sea water—and Lillie has shown that it can be formed *de novo* from the nucleus. In the fertilisation of the eggs of the annelid *Nereis* the spermatozoön penetrates the egg membrane but slowly. Lillie centrifuged eggs in which the head had penetrated but in which the middle-piece with the centrosome were still left outside and he succeeded in tearing away the middle-piece altogether. After the cessation of the centrifugal force the mutilated head completed the penetration of the egg and developed a new centrosome by the emission of a particle from itself which was just as effective in forming the first spindle as the original centrosome.

The astral rays and the mitotic spindle are formed by the gelation of the cytoplasm; yet their formation is dependent on the activities of the chromosomes; for an unfertilised egg responds to stimulation not only by the production of an aster but by the resolution of its chromatin into chromosomes, and the length of the spindle which is formed is dependent on the number of chromosomes.

The nucleus must, in some way, control the growth of the cytoplasm, and genetic experiments suggest (*see* Genetics) that each type of chromosome has a particular function to play in the building-up of the embryo; yet the only emission from the nucleus which has so far been detected has been that of nucleolar material.

Finally, the constitution of living cytoplasm seems to be normally that of a thick colloid solution, which at times changes to that of the gel condition. It baffles our imagination, however, to conceive how a solution can be the seat of internal structure and how in particular a nerve cell, with all its inherited and acquired aptitudes or " engrams," can be in life nothing more than a thick syrup.

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(E. W. MacB.)

CZECH LITERATURE (*see* 4.133).—The political efforts to vindicate and consolidate the national spirit were accompanied in the 'seventies and 'eighties of last century by a no less important endeavour to secure for the Czechs all the progressive acquisitions of Western Europe in the sphere of thought and creative art. Accordingly, to the writers of pronounced national tendencies—like Neruda, Cěch, Sládek and Jirásek in Bohemia, Hviezdoslav and Hurban Vajanský in Slovakia—were added those who pursued purely artistic aims and who manifested a European outlook.

The New Group and Its Leaders.—That the members of this group, whom their opponents dubbed cosmopolitans by way of reproach, advocated the principle of " art for art's sake " was only a temporary self-deception; that by their predilections for the cultures of France, Italy and England they liberated Czech literature from the long tutelage of German influences was an undeniable service; that they extended the scope of subjects, ideas and imagery was a token of their artistic powers. They derived new inspiration from the sea, from graphic art, from feminine beauty; they learned to absorb the cultures of foreign or exotic countries and of bygone ages and to imitate the metrical forms employed by them; they enriched the Czech poetical style with unprecedented verbal resources and obtained musical effects which had not hitherto been achieved in Czech verse.

Julius Zeyer (1841–1901), the elder of the two leaders of this group, was permeated by the Gothic spirit of the English pre-Raphaelites. In novels, short stories, epics and dramas, he evoked the exotic colours of the East and the romantic tales of the Middle Ages. His younger companion, Jaroslav Vrchlický (Emil Frida, 1853–1912) occupied two positions of equal significance in the literature of his nation. As a literary scholar of unrivalled erudition and as an adept at translation, this tireless worker made accessible to the Czechs all the chief products of Romance poetry from the time of the Renaissance onwards. As a poet with the prolific qualities of a Lope de Vega, he was the author of a whole library of lyrics and epics as well as of dramas and stories. By nature he was a hedonist with predilections for classical antiquity and the Renaissance, but life awakened in him an instinct for suffering, sorrow and the Christian scale of values. As a pupil of Victor Hugo he dreamed of a huge epic of humanity, conceived on evolutionary and humanitarian lines, half picturesque, half rhetorical in style, but this gigantic task was carried out only in fragments and in feverish haste, its progress having been interrupted by his lyric compositions, the melodious utterances from the depths of a spirit overwhelmed but also purified by the visitations of destiny. The incisive influence of Vrchlický left its traces on the whole of Czech poetry during the eighties and nineties of the 19th century and his followers were numerous. Of them may be mentioned Jaroslav Kvapil (b. 1868), a master of stagecraft, who as a poet is distinguished by beauty of form.

A violent reaction from Vrchlický is represented in the early works of scholarship and criticism produced by T. G. Masaryk, who later devoted himself wholly to politics. The new tendency was given the not altogether appropriate name of realism. Against the cult of personality it placed the social consciousness, against the charm of art the serious occupation with public questions, against the interest in form the exclusive criteria of ideas and subject matter. It continued the process of emancipation from German influences, but it preferred the English and the Russians to the French. It disregarded the Renaissance and identified itself with the religious reformation. It imposed upon authors the duty of studying the life around them, not merely on the surface, but in accordance with the ideas underlying it and of expressing the results of their observations in plain, concise language without adornment or rhetoric.

The chief poet who followed these principles was Josef Svatopluk Machar (b. 1864). He began with love poetry and political or social verses, the pitilessly analytical spirit of which is provocative rather than satisfying. His striving after an objective attitude led him to a versified epic of mankind. This consists of fragmentary poems, the best of which are concise and graphic, but the general tone of the work is dry and didactic. To his influence can be traced the work of a great political poet, Petr Bezruč (Vladimír Vašek, b. 1867), the author of only one book, the fiery spokesman of the Silesian miners, who is equally sincere whether enunciating the anguish of a dying race or rallying the victims of social injustice to defiance.

Realism and the Reaction.—Realism in Czech prose was satisfied mostly with the search for human documents and with the depicting of remarkable types. More rarely it illuminates the complex questions affecting the social structure. This applies particularly to the village novel, which was then much in vogue. Two writers of the older generation must be mentioned here. The Slavophil author Josef Holeček (b. 1853) returned, by way of his interest in the Yugoslav heroic legends and Russian orthodoxy, back to the Czech peasant, from whose stock he himself was descended. In a novel which consists of several volumes and which is written with great verbal skill, he depicted the old Czech peasant virtues in an idealistic light. Teréza Nováková (1853–1912), a very complex feminine personality, achieved an understanding of the spirit of the people slowly, but she then discovered that the moody highland peasants, whom she knew, were, at bottom, animated by a moral and religious fervour which attained an almost tragic intensity. In her stories the idealism of the conception is coupled with a realism of treatment.

Jan Herben (b. 1857) and Alois Mrštík (1861–1924) wrote chronicle-like narratives, rich in incident, from which an invaluable knowledge of Moravia can be obtained, and the racy tales of Martin Kukučín (M. Bencúr, b. 1860) render the same service for Slovakia. They are surpassed by Karel V. Rais (b. 1859) whose sensitive sketches from the Krkonoše (Giant Mountains) district are distinguished by the economy of their structure. Considerable success was attained by the novel of city life, notably with a Prague setting. Ignát Herrmann (b. 1854) revealed a richly humorous vein in his descriptions of lower middle-class life in Prague. M. A. Šimáček (1860–1913) gave first-hand accounts of factory-life, for the sociological aspect of which he showed a sound instinct. F. X. Svoboda (b. 1860), who was of rural origin, but who became acclimatised to Prague, handled feminine psychology with poetical understanding, and his novels, written with an abundance of impressionistic imagery, generally centre upon some phase of moral or family tradition. All these authors, however, were thrown into the shade by the crude naturalist K. M. Čapek-Chod (b. 1860). With an unbridled instinct for grotesque effects and pessimistic mockery, he portrays present-day Prague in a wealth of ruthless but faithful detail.

From the beginning of the 20th century there was a manifest decline in realism. This transition to a more spiritualised art is associated with the name of F. X. Šalda (b. 1867), the creator of modern Czech criticism and a scholar who is, fundamentally, a poet. The change was first exhibited in lyric poetry which has always formed the leading feature of Czech literature. In the case of Antonín Sova (b. 1864), a master of melody and metaphor, his whole work reflects the reactions of an altogether unusually sensitive temperament to the solitude of nature, to its own emotions and to the social phenomena of modern life.

This sensitive reaction to the internal and external world is found also in the work of such diverse poets as Jiří Karásek ze Lvovic (b. 1871), who has written elegiac verses of impeccable form and decadent subject-matter, Stanislav K. Neumann (b. 1875), eloquent and barbaric in his advocacy of unfettered instincts, who extols rustling forests, flowing waters, amorous women and turbulent multitudes and Karel Toman (Antonín Bernášek, b. 1877), admirably concise and suggestive in his melodious, profoundly emotional verses. This sensitiveness forms only one of the elements in the personality of Otakar Březina (Václav Jebavý, b. 1868), whose lyric poetry is prompted by a cosmic consciousness and exhibits a unique inventiveness of metaphor. In hymn-like poems, which are remarkable on account of their elaborate design and brilliant imagery, the poet, whose life is spent in philosophical seclusion, extols the flight of the soul through the universe to God and its return thence to the everyday world, clutched by myriads of praying and toiling hands. His influence is seen in the work of Otakar Theer (1880–1917), who in the end subordinated his sensual temperament to fertile ideas concerning will and suffering, eternity and God, patriotism and moral liberty. Viktor Dyk (b. 1877), a poet who occupies a place apart, is closely attached to his nation as a living entity which has uplifted him from nihilism and imparted a fervid charm to his simple and epigrammatic diction.

Prose Fiction.—In prose fiction the new sensitiveness made its appearance as a strengthening of the picturesque element, and later as an enhanced feeling for the subtleties of psychology, together with a close and sometimes exaggerated cultivation of style. It was on such lines as these that Vilem Mrštík (1863–1912) dealt with the unfettered destinies of youth, Růžena Svobodová (1868–1920) with the sorrows, yearnings and dreams of modern women, Karel Sezima (Karel Kolář, b. 1876), with the tragic aspect of everyday life in small towns. Here also a reference should be made to Fráňa Šrámek (b. 1877), ecstatically revelling in the beauty of the world and celebrating in luminous prose the grief and enchantment of youth. More recently, however, the tendency of the Czech novel has been towards a simplification as regards style and emotional content and it shows signs of becoming richer in ideas. Inspiration is also being derived from the facts of science, and there is an obvious return towards realism. Thus, Anna Maria Tilschová (b. 1873) is remarkably precise in analysing the decadence of urban society, while Karel Čapek (b. 1890), a whimsical philosopher of the commonplace, combines phantasy with warmth and delicacy of sentiment.

Drama.—Although the drama has always formed the height of Czech literary ambitions and although the handsome National Theatre, ever since its establishment in 1883, has been regarded as the supreme artistic institution, Czech drama did not thrive in the desired manner. Several of the authors who have already been mentioned tried their hands at writing for the stage. Vrchlický produced scenic poems, the subject-matter of which was derived from myths and history; Jirásek dramatic chronicle-plays from Czech history or based upon legends and village life; F. X. Svoboda realistic dramas from the life of the contemporary bourgeoisie. But it is only quite recently that the Czech drama has developed greater briskness and a sense of reality, both as regards the problems chosen and the language in which they are treated. Jaroslav Hilbert (b. 1871) and František Langer (b. 1882) are skilful psychologists in the modified realistic manner. Arnošt Dvořák (b. 1880) handles historical subjects with picturesque elaboration, Karel Čapek is a bold contriver of scenic utopias beneath whose satirical grimace is concealed the heart of an humanitarian.

Scholarship.—In Czech scholarship the closest connection with literature was maintained by writers on linguistic and historical subjects ever since the time of the national revival. In the 'eighties and 'nineties a new direction was given to Czech grammatical research by Jan Gebauer (1838–1907), who constructed a systematic history of the Czech language upon the strictly logical basis of the extensive material which he had collected. František Bartoš (1837–1906), a Moravian, supplemented this structure by compiling and analysing the Moravian dialects. Midway between philology and history stands Jaroslav Vlček (b. 1860), the founder of modern literary history and particularly successful in tracing the ideas underlying the age of enlightenment. In history Jaroslav Goll (b. 1846), an expert in critical method, trained three distinguished figures in the realm of historical research: Josef Pekař (b. 1870), who exhibited originality of mind whether he investigated economic history, the problem of popular legends or the question of the national revival; Josef Šusta (b. 1874), whose main subject was the history of Western Europe, on the background of which he outlined the development of the Czechs in a new light; and finally, Václav Novotný (b. 1869), who is profoundly versed in the religious Reformation.

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CZECHOSLOVAKIA (ČESKOSLOVENSKO or ČESKOSLOVENSKÁ REPUBLIKA), an independent Republic in Central Europe, which took over the heritage and continues the tradition of the ancient kingdom of Bohemia (*see* 4.121), came into existence as a result of the revolutionary action of the Czechoslovak people during the World War and the break-up of the Austro-Hungarian monarchy. The frontiers of the republic were fixed by the peace treaties of Versailles, St. Germain and Trianon, and by the decision of the Conference of Ambassadors on the question of Teschen (*q.v.*) in July 1920.

Area and Population.—The territory of the Republic extends along the 50th par. of lat. N. and between the 12th and 25th deg. of long. E., in a long strip bordering on Germany and Poland in the W. and N., Rumania in the E., and Hungary and Austria in the South. It embraces the lands of the old Crown of Bohemia (Bohemia, Moravia and part of Silesia), the Slovak territory of former Hungary, and the autonomous territory of Carpathian Ruthenia. The area of the Republic is 54,877 sq. m., of which Bohemia covers 20,333 sq. m., Moravia and Silesia 10,438 sq. m., Slovakia 19,148 sq. m. and Carpathian Ruthenia 4,958 square miles.

The population of the Republic in 1921 was 13,617,172 (Bohemia 6,670,582, Moravia and Silesia 3,335,152, Slovakia 3,000,870, Carpathian Ruthenia 606,568); 8,760,937, or 65·51% of the inhabitants, were Czechs and Slovaks; 3,123,568 (23·36%) Germans; 745,431 (5·57%) Magyars, and 461,849 (3·45%) Ruthenes; the remainder (2·11%) being composed of Jews (180,855 or 1·35%), Poles (75,853 or 0·57%) and others (0·19%).

I. CONSTITUTION

The Czechoslovak State is a democratic Republic with an elected President at its head. The territory of the Republic forms a single and indivisible unity, within which the territory of Carpathian Ruthenia is granted the widest possible autonomy compatible with the integrity of the Republic. Territorial changes require a sanction of a constitutional law which, like an amendment to the constitution, or declaration of War, has to be passed by three-fifths of all members of both Houses of Parliament.

Parliament.—Legislative authority is exercised by Parliament elected by universal, equal, secret and compulsory suffrage, based on the principle of proportional representation, and consists of two chambers, a Chamber of Deputies of 300 members, elected for six years, and a Senate of 150 members, elected for eight years. The franchise for the Chamber of Deputies is open to all citizens without distinction of sex who are over 21, that for the Senate to all citizens over 26; all citizens are eligible to the Chamber of Deputies when they have reached the age of 30, and to the Senate when they have reached 45 years of age. Members of both chambers possess parliamentary immunity, but may be handed over to the ordinary courts by resolution of the House to which they belong. Parliament must sit twice a year. Cabinet ministers, who need not be members of Parliament, may participate in the meetings of either House and on the request of either House must attend its session.

Both chambers enjoy the right of initiative, and Government Bills may be first introduced in either House. Only finance and army bills must be introduced first in the Chamber of Deputies. A measure passed by the Chamber of Deputies becomes law despite an adverse decision of the Senate if the Chamber of Deputies adheres to its original decision by an absolute majority of all its members. It is also the Chamber of Deputies alone that by a vote of no-confidence can compel the resignation of the Government. Thus the Chamber of Deputies, as the more fully representative of the popular will, possesses great powers, being enabled in certain cases to carry through its legislation in face of the opposition of the Senate. The Senate plays the part of an organ of supervision, and acts as a check on too hasty or too loosely drawn-up legislation. During the period when Parliament is not sitting, a permanent commission of 24 members (16 from the deputies and 8 from the senators) sits to enact urgent measures which have temporarily the force of law. They lose their validity unless confirmed within two months by the Parliament which subsequently meets.

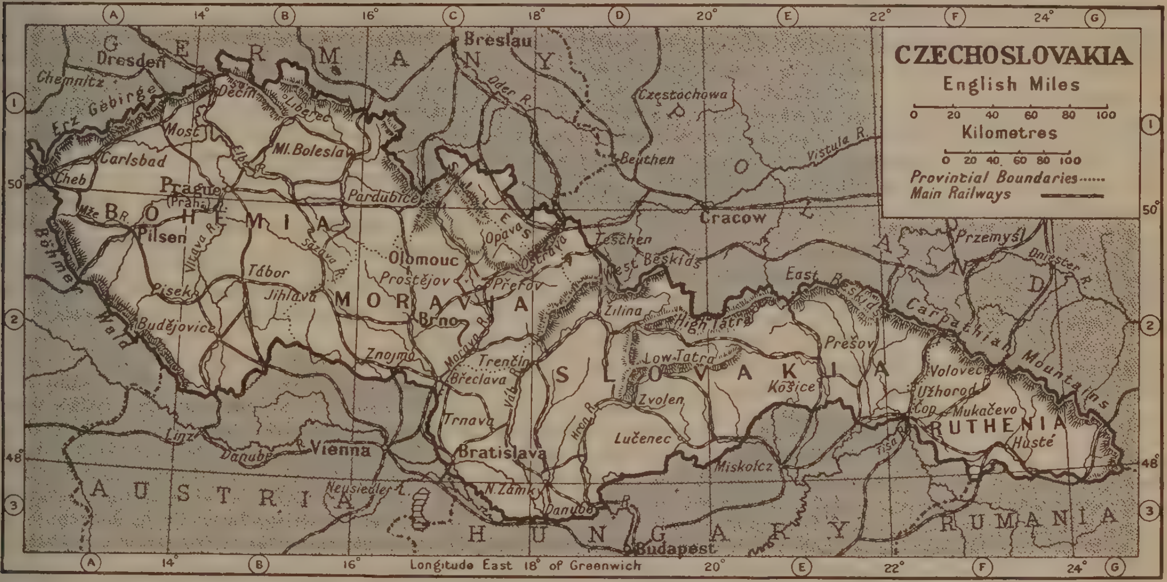
Powers of President.—The President of the Republic is elected in a joint session of the two Chambers. His period of office is fixed at seven years, and he may be re-elected at the end of his first term for a second period of seven years. For a third term, however, he cannot be elected until after the expiration of seven years from the conclusion of his second term of office. This restriction does not apply to the first president—President Masaryk. The President, as head of the State, represents the State in its relations with other States, negotiates and ratifies international treaties (some of them after the affirmation of parliament), receives and appoints diplomatic representatives, declares war with the previous consent of Parliament and submits to parliamentary approval treaties of peace; he is the commander-in-chief of the armed forces of the Republic; he appoints and dismisses Cabinet ministers, and convokes, prorogues and dissolves Parliament; he signs all laws enacted by Parliament and has the right to return with his comment any measure enacted by it; such a measure can become law only if repassed by an absolute majority of members of each of the two Houses, or by three-fifths of all the members of the Chamber of Deputies. He appoints higher officers and officials of the State, exercises the right of reprieve and is not answerable at law for his official acts. He is amenable to law only on a charge of high treason, in which case he can be impeached by the Senate upon an indictment found against him by the Chamber of Deputies; if found guilty his only punishment is the loss of his office and permanent disqualification for Presidency.

Law and Civil Rights.—The judiciary is separated from and independent of the administration. The judges are independent in the exercise of their functions and are bound only by law; they are appointed permanently and cannot be recalled.

In respect of civic rights the Constitution guarantees all citizens of the Republic full equality before the law and equal civil and political rights, whatever be their race, language, or religion; no privileges due to sex, birth or occupation are recognised; the Constitution further guarantees full personal freedom, inviolability of domestic rights and of the mails, freedom of the press, the right of free assembly and association, and of the expression of opinion by word, writing or print, freedom of scientific research, of instruction, of conscience and religious creed; all religious confessions are equal before the law; wedlock, family and motherhood are placed under special protection; special provisions of the Constitution protect the rights of language, religious and racial minorities, to whom it guarantees the maintenance of their schools, and prohibits every manner of forcible denationalisation. All persons residing in the Republic are guaranteed complete and absolute security of life and liberty without regard to origin, nationality, language, race or religion. All these guarantees and rights are protected by the Supreme Administration Court, which enforces the legality of public administration. A Constitutional Court decides whether laws promulgated by Parliament are in harmony with the character of the Constitution. An Electoral Court decides upon the validity of disputed elections or forfeiture of seats and other questions relating to Parliamentary or elected bodies.

Administration and Justice.—For the purposes of political administration the Republic has been divided into administrative subdistricts, the heads of which are appointed by and directly responsible to the central Government. Local civil government is carried on by parish, district, urban and municipal councils elected by popular vote.

The tribunals of the Republic are the Supreme Court of Justice, which sits at Brno and is the court of final appeal both in civil and criminal cases, two high courts sitting at Prague and Brno respectively, 33 provincial courts and 410 district courts, all of which possess jurisdiction in both civil and criminal cases. Commercial cases are dealt with by the ordinary courts, except at Prague, where a special commercial court sits. Litigation in mining matters is conducted before special benches attached to the district courts in mining districts. In large industrial centres there are also industrial courts to deal with disputes between employers and employees. (J. Cı.)


CZECHOSLOVAKIA
English Miles
0 20 40 60 80 100
Kilometres
0 20 40 60 80 100
Provincial Boundaries
Main Railways
Longitude East 18° of Greenwich
A
B
C
D
E
F
G
1
2
3
14°
16°
18°
20°
22°
24°
50°
48°
GERMANY
POLAND
BOHEMIA
MORAVIA
SLOVAKIA
RUTHENIA
AUSTRIA
HUNGARY
RUMANIA
Dresden
Chemnitz
Erz Gebirge
Breslau
Oder R.
Częstochowa
Vistula R.
Beuthen
Cracow
Děčín
Liberec
Most
Ml. Boleslav
Carlsbad
Cheb
Prague (Praha)
Pardubice
Plzen
Pilsen
Böhmer Wald
Vltava R.
Tábor
Písek
Budějovice
Jihlava
Olomouc
Prostějov
Přerov
Opava
Ostrava
Teschen
West Beskids
East Beskids
Brno
Znojmo
Trenčín
Břeclava
Trnava
Žilina
High Tatra
Low Tatra
Zvolen
Lučenec
Prešov
Košice
Přemysl
Dniester R.
Carpathian Mountains
Volovec
Užhorod
Čop
Mukačevo
Hosté
Tisa
Miskolcz
Linz
Danube
Vienna
Bratislava
Neusiedler L.
N. Zámky
Váh
Hron R.
Budapest

II. RISE OF THE REPUBLIC

Czechs and Slovaks in the Dual Monarchy.—The political frontiers of Europe at the beginning of the 20th century concealed the previous history, the actual life and the natural tendencies of the small nations in Central Europe, as well as the whole of the long cultural process by which these nations arrived at their racial consciousness in the course of the 19th century. The problem of nationality in Central Europe, and particularly in Austria-Hungary, became more and more acute as the process of national revival advanced, notably in the revolutionary period of 1848. The Poles and Czechs awoke to the knowledge of historical state rights and all nationalities felt the right to self-determination, the right to an independent existence with political autonomy which would ensure a free development of national individuality.

The leading German circles in Austria endeavoured to maintain their hegemony over the non-German nations in the Empire and neglected the possibility of solving the nationality problem in the spirit of federalism with equal justice for all. They arrived at an agreement only with the Magyars (1867) on the basis of dualism, the purpose of which was to secure domination over the Slav-Latin majority for the Austrian Germans in the Austrian portion of the Empire and for the Magyars in Hungary. To ensure this it was necessary that the Dual Monarchy, ruled over by an aristocratic German-Magyar minority, should ally itself with German imperialism and become the aider and abettor of its plans.

In spite of the honest endeavours of the Austro-Hungarian nations to reach a settlement within the framework of a federalistic and democratic Austria, in spite of the fact that even the Habsburgs on several occasions acknowledged the Czech state rights, in spite of several attempts to make the nationality problem in Austria-Hungary an international problem, in spite of the great cultural and economic advance made as the result of resolute efforts on a small scale, and in spite of certain successes of the positive policy in linguistic and political matters, the Czech nation, though possessed of a political consciousness, and with it also the other Central European nations, entered the 20th century subjected to a foreign régime, the domination of the Germans, the German-Austrians and the Magyars. Other nations were still the vassals of the absolutist Eastern empires of Russia and Turkey.

It was partly the wars of liberation in the Balkans, but especially the World War, which brought about a radical improvement in this state of affairs and caused revolution in the whole Central European zone of small nations, thus bringing the political aspect of Europe more in accordance with its ethnographical aspect, and completing in that zone the profound internal process which had been in preparation for centuries.

The Outbreak of War 1914.—The Czech nation, which in consequence of the Thirty Years War had been deprived of its political independence, had never abandoned the idea of recovering it, and in the 19th century did much to remove the far-reaching traces which the severe anti-Reformation régime of the Habsburgs had left in its organism. Having successfully withstood the absolutist pressure of Germanisation in Bohemia, Moravia and Silesia, while its Slovak kindred were slowly succumbing to the Magyarising endeavours of the Hungarian State, it clearly saw that the outcome of the World War would have a decisive effect upon its existence. By its traditions, its sympathies and its whole political outlook the Czech nation was on the side of Western European democracy and Slavonic Russia and Serbia against the central autocracies for whom the Czechs were called to fight. Open protest or revolution was impossible owing to the presence of great numbers of German and Hungarian troops on Czech territory, and also to the clear knowledge of the hopelessness of any direct revolutionary action, and direct political action was equally impossible owing to the suspension of the Austrian Parliament, of which the fear of the Czech attitude was one of the main causes. The opposition of the Czech nation, therefore, assumed the form of passive resistance, the passing over of Czech troops in great numbers to the Allies, and secret organisations, the purpose of which was to prepare for the decisive moment. The brunt of the Czechoslovak revolutionary movement was, however, borne by the political exiles who, having escaped abroad at the beginning of the War, began to carry on in the Allied and neutral countries an extensive anti-Austrian action of a diplomatic propagandist and military character, which aimed at achieving independence for the Czech and Slovak territories.

Prof. Masaryk and the Western Powers.—The necessity for systematic action abroad, and mainly in Western Europe, was soon realised by Prof. Masaryk, the leader of the small Realist party, who, as a member of Parliament and of the Austro-Hungarian delegations, had for many years past—especially during the Bosnian annexationist crisis—been an opponent of reactionary Austria and especially of its provocative and dishonourable foreign policy. As early as the autumn of 1914 it was clear to him that the War would not be decided on the Russian front, but in the West, and that it would last longer than was imagined by those who, guided by Slavonic sympathies, relied mainly on the strength of Russia. Apart from friendly relations with France, and relations and sympathies with Russia which had developed before the War as a result of the political, economic, but mainly cultural co-operation with the Slavonic nations expressed in the neo-Slavism of Dr. Kramář, Czech political leaders had no concrete arrangements with foreign countries for the eventuality of war. Prof. Masaryk could therefore only make use of the modest bonds of sympathy and friendship with the countries in Western Europe.

Accordingly in 1914 he got into touch with his French and English friends in the course of two journeys to Holland, of which he availed himself for supplying the earliest information to official, especially British, circles. His journey to Italy in Dec. 1914 was also intended to be of an informative character. Being warned on returning by way of Switzerland, where he continued to study the situation, that the Austrian police had orders to arrest him on his return, Masaryk decided to remain abroad and to organise the Czech campaign against Austria-Hungary, keeping, as far as possible, in continual touch with the underground activities at home concentrated in the "Maffia," a secret society which originated from the clandestine meetings of Czech politicians and their friends. The aim of his action was to make known to public opinion and political and official circles in the Entente countries the claims of the Czechoslovak nation, and to make the Czechoslovak question a subject of diplomatic negotiations on the part of the competent official circles of the Entente, which would effect its solution on international lines.

Organisation outside Austria-Hungary.—For this purpose Masaryk proceeded to organise Czechoslovak settlers or residents abroad in order to make use of their resources and their influence in favour of his programme, and particularly to obtain a financial basis for his action and for direct armed intervention against Austria in the ranks of the Entente. When the Czechoslovaks abroad were joined by a large number of Czechoslovak soldiers who crossed over to the Allied side, it was possible to consider the formation of special military units and a separate Czechoslovak army within the framework of the Allied armies.

In all the Entente states there were spontaneous organisations of Czechs and Slovaks for the purpose of actively supporting the Allies in the struggle against the Central Powers. In Russia, at the very beginning of the War, there came into existence what was known as the Czech brigade, a body, however, which was more propagandist than military in character. In France large numbers of Czechs joined the Foreign Legion and many Czechs entered the army in England and Canada. In the latter country they consisted largely of volunteers from among the Czechoslovak settlers in the United States, which were then still neutral. But the Czechs and Slovaks of America soon had an opportunity of doing important work, particularly in taking upon themselves the major part of the financial burden of the campaign. This had great moral significance, because it made the Czechoslovak movement independent of financial help from the Allies. Matters were made easier by the circumstance that Russia and France very soon adopted a relatively favourable attitude to the Czechoslovaks, who nominally were subjects of an enemy State, and by this concession they gained freedom of movement and organisation.

The Struggle against Austrophilism.—There were, however, certain obstacles. These were due partly to the fact that the number of capable workers abroad was very small; then, too, it became more and more difficult to keep in touch with the Czechs at home, as the severity of the persecution carried on by the Austro-Hungarian Govt. increased.

One extremely serious obstacle was the circumstance that the European public as a whole was unacquainted with Austro-Hungarian conditions in general and the Czechoslovak problem in particular, and also that at the beginning the Czechoslovak revolutionary movement did not meet with sufficient comprehension on the part of official circles in the Entente states. In the political public opinion of Western Europe Austria-Hungary was regarded as an element in the maintenance of European equilibrium. The Czechoslovak problem was looked upon as being an internal problem of the Dual Monarchy, which certain circles in the Entente were unwilling to alienate by formulating the final and extreme war aims, endeavouring rather to isolate Austria-Hungary from Germany and thus weaken the latter, who was regarded as the sole culprit in bringing about the world catastrophe.

Up to the moment when Austria-Hungary collapsed it was necessary to fight against Austrophilism, which was powerful both in the neutral states as well as in the Allied countries and Russia. It was also necessary to struggle against the intensive Austrophile propaganda, by revealing the pseudo-constitutionalism and minority rule which were the true foundations of Austria-Hungary.

The Formation of Foreign Committees.—The year 1915 resulted in a mobilisation of resources and the distribution of work for the Czechoslovak movement abroad, rather than in any positive successes. Masaryk inaugurated an open struggle against Austria-Hungary in the spirit of humanitarian and democratic ideals on the occasion of the Hus celebrations in Switzerland, and he prepared for further activities in the Press and by lectures. Up to the arrival of Dr. Beneš in the autumn of 1915 the headquarters of this work were in Switzerland, but after the arrival of Dr. Beneš and of the agrarian deputy Josef Durich, who left Bohemia with the knowledge and support of Czech political circles there, Masaryk chose London as his seat of action, while Beneš as secretary of the central foreign committee proceeded to Paris with Štefánik, the Slovak scientist, who served as an aviator in the French army. Durich was entrusted with the task of concentrating the work that had hitherto been accomplished in Russia by means of a unified Czech committee.

Steps were very soon taken to form a Czechoslovak foreign committee for the purpose of carrying on a united struggle against Austria. This idea was indicated by Masaryk in a circular addressed in March 1915 to a number of persons in the Czechoslovak settlements abroad and on Nov. 14 1915 the committee issued a manifesto, signed by Masaryk and Durich, by the leaders of the Czech colonies in the Entente states and notably also by the Czechs and Slovaks in America. This was the first official pronouncement by the Czechs abroad against Austria-Hungary, in favour of the Entente, and of the independence of the Czechoslovak state. This manifesto, which had also the approval of the Czechs in Austria-Hungary, was issued at a moment when not only was the result of the War not decided but the situation for the Allied states was not altogether favourable. At the beginning of Jan. 1916 the foreign committee was transformed into a National Czech Council, the president of which was Masaryk, the vice-president Josef Durich, and the general secretary was Dr. Beneš. The Slovaks were represented on this Council by Gen. Štefánik. The first political success of the campaign came on Feb. 3 1916, when Masaryk obtained a verbal promise from M. Briand, the French Prime Minister, that France would support the Czechoslovak endeavours to secure state independence.

The Czechoslovak Legions.—Considerable success and marked progress were achieved by the Czechoslovak movement in Jan. 1917, when the Allies in their reply to President Wilson's note on the peace conditions included the liberation of the Czechoslovaks from foreign rule among their chief war aims. In Russia the Czech brigade, referred to above, had in the meantime made further developments and, what was equally important, the diverging tendencies among the Czechs there achieved a singleness of purpose in Aug. 1916 by the agreement at Kiev which recognised the National Council in Paris as the supreme authority, Durich becoming its representative in Russia. In June 1916 the Tsar consented to the release of the Slav prisoners of war, but at the instigation of Stürmer, supported by the Tsaritsa, the consent was withdrawn at the beginning of August. In Oct. an independent Czechoslovak division in the Russian army was sanctioned but scarcely a month later this concession was also withdrawn. The Russian revolution of March 1917 did not bring any immediate advantage to the Czechoslovak movement there, and in particular it did not facilitate the recruiting of additional troops for the Czechoslovak brigade from among the prisoners of war. The Russian general staff at first gave permission for this to be done, but this was soon afterwards revoked. It was not until the Czech regiments distinguished themselves at Zborov on July 2 1917 that Kerensky was induced to restore the concession which had been revoked. Unfortunately the Russian army was already in a state of collapse and the Government of the March revolution was only short-lived. As early as March 1917 negotiations were opened with France for the transport of Czechoslovak soldiers and prisoners of war to France. An agreement to this effect was concluded between the French Govt. and the Czechoslovak National Council, and by a decree signed by President Poincaré on Dec. 19 1917 an independent Czechoslovak army was established in France; its constitution was completed on Feb. 7 1918 by a special agreement signed by Dr. Beneš and M. Clemenceau.

In Russia, where in the meantime Masaryk had taken charge of the Czechoslovak movement, having left England in May 1917, the establishment of the first independent Czechoslovak body was reached during the interim government in Oct. 1917, while in Aug. 1917 the Russian branch of the Czechoslovak National Council floated a revolutionary loan of 20,000,000 francs to carry on the Czechoslovak movement.

Developments Within the Dual Monarchy.—In Bohemia in 1916 the Austrian persecution reached its culminating point and in June of that year Dr. Kramář, Dr. Rašín and their associates were condemned to death. Under the military and police pressure no public political life was possible there. It was not until towards the close of 1916 that an attempt was made to unite the Czech parliamentary deputies and parties in a Czech League and in the National Committee. After the death of Francis Joseph, which strengthened the position of the independence movement, this solidarity on the part of the Czech politicians was particularly effective. It was however still impossible to issue any public manifestos, and any that existed could not show any disloyalty to the dynasty. For this reason the official manifesto of the Czech League on the occasion of the Allied reply to President Wilson's note could be used by the Austrophile propaganda abroad.

The effect of the Russian revolution was that the later manifestos of Czech circles, while still very cautious, were of a more open character. Thus the May manifesto of the Czech authors and the proclamation of the Czech deputies on May 30, at the first meeting of the Reichsrat in Vienna, demanding the transformation of the Austro-Hungarian Monarchy into a federative state with equal rights for the various nationalities, are indications of this tendency. The latter proclamation contained a claim for a Czech state and Slovakia, and it was signed by all the Czech deputies, especially the Czech social democrats, whose representatives at the Socialist Peace Congress at Stockholm in June 1917 advocated the right of self-determination and a demand for a sovereign Czechoslovak state within a Danubian federation.

The Czech Legions in Siberia.—The autumn Bolshevik revolution, the Armistice following it and, above all, the peace of Brest Litovsk, complicated the situation of the Czechoslovaks and the recognised Czechoslovak units of the Russian army (an army corps with two infantry divisions including a reserve brigade and two brigades of artillery). Masaryk had already announced the Czechoslovak policy there as one of neutrality and non-intervention in Russian affairs, and on Oct. 9 1917 he had obtained a promise from Gen. Dukhonin that Czechoslovak troops would not be used for the internal affairs of Russia. On the principle of armed neutrality it was arranged with the Bolsheviks that the Czechoslovak troops should be transported via Vladivostok to France and the first detachment was despatched at the beginning of November. In France in Feb. 1918 the National Council had organised among the Czechoslovaks there a system of general conscription for the Czechoslovak legions. At the same time the representatives of the Czechoslovak armies left France for Italy, where in April 1918 an agreement was reached between Orlando and Gen. Štefánik for organising legions among the numerous Czechoslovak fugitives there on the Russian model.

The nucleus of the Czechoslovak army in Russia withdrew from the Ukraine towards the east, covering its departure by means of successful encounters with the Germans, notably at Bachmach (May 1918). At that time the Czechoslovak army corps in Russia had already been proclaimed as a part of the French army, and from Muraviev, the Soviet Commander-in-Chief, it received a guarantee of armed neutrality and unhindered passage to France. This clear relationship between the Czechoslovak command and the Bolsheviks conditioned by the rejection of any plans aiming at intervention against the Bolsheviks, was complicated by the lack of loyalty shown by the Bolshevik Govt. which during the transport of the Czechoslovak divisions demanded their partial and even their complete disarmament. The branch of the National Council in Moscow vainly endeavoured to avoid a conflict, which was rendered more acute by the incident at Chelyabinsk with the local Soviet in the second half of May 1918, by the internment of the representatives of the National Council at Moscow and the instruction issued by the Soviet authorities and Trotsky for the forcible disarmament of the Czechs. At the end of May hostilities began between the Czechoslovak troops and the Bolsheviks. Gen. Gajda's division succeeded in gaining possession of 1,700 versts of the long railway track between Chelyabinsk and Marinsk. Čeček's western division at the same time occupied Penza, Samara and Ufa, and at the beginning of July joined Gajda's eastern division, which soon afterwards occupied the whole of the railway line as far as Irkutsk and gained possession of the Baikal and Chita railway.

Towards the end of Aug. the main Siberian line, measuring over 8,000 km., was in the hands of Czechoslovak troops, who also had taken Ekaterinburg, as well as Simbirsk and Kazan on the Volga. Masaryk, who in March 1918 left Russia and arrived in May in America, opposed all idea of armed intervention in Russian affairs, for which some of the Allied statesmen would have used the Czechoslovak legions. When, however, what was intended to be a peaceful march towards the sea was thus, contrary to the wishes of the Czechoslovaks, transformed into armed conflicts with the Bolsheviks, and the front was once more turned westward against Bolshevik Russia.

Masaryk was obliged to take advantage of his stay in Washington to ask America and the rest of the Allies for military and material help for the Siberian legions, who were suffering especially from lack of equipment. The Entente promised its support for this plan and on Aug. 2 the Japanese Govt. issued a declaration of military intervention in favour of the Czechoslovaks, while the day afterwards the Allied governments decided at Washington, notably by an American-Japanese agreement, to grant the military and material assistance asked for by Masaryk. The military help promised by the Entente was not forthcoming, with the exception of a small Japanese contingent, but abundant quantities of supplies and equipment were given. The victory of the Czechoslovak troops on the Volga and in Siberia caused a sensation in the Allied states, so that the Czech success had a considerable moral significance and denoted the strengthening of the Czech cause. What made the Czech achievement particularly valuable was that it had prevented the Soviet Govt., and thus also Germany, from obtaining the keenly desired contact with the Siberian supplies of raw materials and foodstuffs, and also that the vast numbers of German prisoners of war in the Siberian camps could not be used for strengthening the German army. As an example of the appreciation which the work of the Czechoslovak legions met with among the Allies, reference may be made to a telegram of Lloyd George on Sept. 11 1918, in which he thanked the National Council for the inestimable services rendered by the legions to the Allies.

Recognition by the Powers.—Great Britain had previously, in a pronouncement of Lord Robert Cecil on May 22 1918, officially recognised the right of the Czechoslovak nation to complete independence. When on May 29 1918 the Govt. of the United States approved the anti-Austrian resolution passed by the Congress of Oppressed Nations in Rome, which had been organised in April of that year by Dr. Beneš on the initiative of Prof. Denis, the War Council at Versailles associated itself with this American proclamation, while the Prime Ministers of France, England and Italy, and indeed of all the Allied nations, declared their sympathies with the Czechoslovak and Yugoslav aims for liberation. At the same time the British Govt. announced its willingness to recognise the National Council as the leading body of the Czechoslovak movement and also of the army that was fighting on the side of the Entente. The first country to grant actual recognition in this sense was France (June 29 1918), the Government of which recognised the right of the Czechoslovak nation to independence, and the National Council as the supreme body controlling general interests and as the first basis of the future government. On June 30 President Poincaré with the representatives of the French Cabinet handed over the colours to the 21st Czechoslovak regiment at Darney, and on the following day the British Govt. expressed its agreement with the speech made by President Poincaré on this occasion.

About the same time a second, supplementary agreement was reached with Italy concerning a Czechoslovak army within the framework of the Italian army and the Government of the United States in its pronouncement identified itself with the complete liberation of all branches of the Slav race under German and Austrian domination. Congress then passed an amendment to the emigration law which guaranteed the Czechoslovak legionaries in the United States an undisturbed return there as American volunteers in the Allied army. About 50,000 Czechs and Slovaks then offered themselves as volunteers for the army of the United States, apart from those in the Canadian army and in France. By a declaration on Aug. 9 the Government of Great Britain recognised the Czechoslovaks as an Allied nation, the three Czechoslovak armies as a single Allied army carrying on regular warfare against Austria-Hungary and Germany, and the National Council as the supreme body controlling national interests, a trustee of the future government and the supreme authority over the army. On Sept. 3 1918 the British Govt. recognised the future Czechoslovak Govt. upon the basis of the National Council and negotiated a convention with the National Council concerning an army and diplomatic relationships on the basis of the analogous international position of Serbia and Belgium. On the same day a similar recognition was obtained from the American Govt. (recognition of a state of war between Czechoslovakia and Germany and Austria, the National Council a *de facto* Government directing the military and political affairs of the Czechoslovak nation; government relations with this *de facto* Government for carrying on warfare against the common enemy), and on Sept. 9 1918 the recognition of the Japanese Govt. in the same sense was obtained.

The success of this intensive diplomatic struggle for independence, carried on partly from Paris by the headquarters of the National Council, partly by Masaryk at Washington, and achieved to a considerable extent through the merits of the Czechoslovak legions, was promoted in no small degree by the resolute action of the Czech political leaders in Austria-Hungary itself. Important in this respect are the manifestos of the Czech deputies on May 6 1918, the vow made by representatives of all sections of the nation on April 13 1918 that the struggle for Czech independence should not cease until the final victory, the May celebrations of the National Theatre at Prague which were attended by representatives of other oppressed nations in Austria, especially the Yugoslavs, Poles and Italians—all this enhanced the movement abroad, which in the autumn of 1918 was reaching its final goal. On Sept. 28 1918 the French Govt. reached an agreement with the National Council with regard to the position of the Czechoslovak nation in France and bound itself to establish a Czechoslovak State within the historical frontiers. On Oct. 1 1918 Great Britain entered into direct diplomatic relationship with the National Council as a Czechoslovak governing body. On Oct. 3 Orlando issued a parliamentary proclamation in favour of Czechoslovak independence.

Declaration of Independence.—Finally, on Oct. 14 Dr. Beneš notified the Entente States of the establishment of an interim Czechoslovak Govt. in Paris in accordance with the decision of the President of the National Council on Sept. 26, and Dr. Beneš as Minister for Foreign Affairs was appointed the first Czechoslovak Minister to the Entente States. This interim Czechoslovak Govt. was recognised by the French Govt. on Oct. 15, and by the Italian Govt. on Oct. 24, while on Oct. 18 1918 the interim Govt. itself proclaimed the independence of the Czechoslovak nation by a declaration dated at Washington. On the same day President Wilson rejected the Austro-Hungarian peace offer of Oct. 7 on the ground that since the issue of his Fourteen Points (*q.v.*) on Jan. 8 1918 the Govt. of the United States had recognised a state of war between the Czechoslovaks and Austria-Hungary, and intimated to the Austrian Govt. that it should apply to the National Council which had already been recognised as the *de facto* Govt. of the Czechoslovak nation.

By a manifesto of the Emperor Charles on Oct. 16, announcing the transformation of Cis-Leithan provinces into a union of national states on the basis of nationality, without, however, touching upon the question of the non-Magyar nationalities in Hungary, Austria-Hungary vainly endeavoured to meet Wilson's reply. In Bohemia even before this reply had been published the socialist parties, especially in the rural districts, had attempted to proclaim a republic on Oct. 14. Wilson's reply was published in Austria-Hungary on Oct. 21, and within a week, notably through the collapse of the army, all the conditions were furnished for the capitulation of Austria-Hungary which took place in the night between Oct. 27 and 28. On Oct. 24 the Czech deputies had already obtained permission from the Emperor to proceed to Geneva for the purpose of conferring with Dr. Beneš there. The National Committee at Prague, however, did not await their arrival, but drew its own conclusions from the Austrian capitulations and on Oct. 28 by its first law proclaimed the independence of the Czechoslovak state, taking into its hands the administration of the Czech territories without encountering any considerable opposition from the army or from the authorities. Two days later, on Oct. 30, by a manifesto of the Slovak National Council at Turčanský Sv. Martin, Slovakia pronounced itself in favour of Czechoslovak unity.

Oct. 28 remains the symbol of the national liberation from the centuries of Habsburg bondage, although the actual transformation was carried out early in the subsequent days by an agreement between the Government of the Czechoslovak state in Paris and the National Committee, which took over all the commitments of the former. The conferences at

Geneva also gave the renewed State its definite form of a democratic republic. On Nov. 13 the National Committee issued an interim constitution and a day later there was a meeting of the Czechoslovak National Assembly constituted in accordance with the proportional numerical strength of the individual political parties, containing 256 (later 270) members, of which 44 were Slovaks. There were no Germans among them, the German representatives having refused participation. At this first meeting of the National Assembly Masaryk was unanimously elected the first President of the Czechoslovak Republic and on the basis of the interim constitution the National Assembly elected its first Government. The Prime Minister was Dr. Kramář, the Foreign Minister Dr. Beneš and the Minister for War Gen. Štefánik. On Dec. 21 the President returned to Prague, and his inaugural message pronounced in the National Assembly on the following day and containing a concise survey of the Czechoslovak movement for independence abroad and a plan for the further consolidation of the republic, concludes the revolutionary period and begins the constructive period of the State. The Peace Conference had yet to define only a few details of the relations of Czechoslovakia to its neighbours and to the other members of the comity of nations. (T. G. M.)

III. THE POLITICAL HISTORY 1918–1925

The Kramář Ministry.—The first Czechoslovak Ministry consisted of 17 members, of which four belonged to the Agrarian party, three to the Czechoslovak (national) Socialists, three to the Social Democrats, three to the National Democrats, one to the People's party and one to the Slovaks. MM. Beneš and Štefánik were non-party. During its eight months of office, the Government had to maintain the integrity of the national territory, to keep the administration working and to defend the interests of the country at the Peace Conference. Further, it had to face the problems arising out of the economic difficulties of the period, especially as regards provisioning, and out of the international situation of the new state. It dealt with all these tasks successfully.

First, it quickly put down the attempted insurrections in the German-speaking districts of Bohemia and Moravia, which had attempted to unite with Austria. In Slovakia there were grave difficulties owing to the departure of most of the Hungarian bureaucrats, the hostility of the Magyar and Magyarophile elements of the population and to the fact that the frontiers were not yet regulated. On Dec. 10 1918 the Government passed a law authorising emergency measures to be taken in Slovakia, and sent further Šrobár as Minister of State with plenipotentiary powers to maintain order. On Feb. 1 1919 the Slovak Govt. was formally installed at Bratislava. After the Communist party came to power in Hungary (Feb. 4 1919) there were further grave complications. The Hungarian Communist troops invaded Slovakia, which Czech troops were occupying. They were repelled with the help of the Allies, who, as a result of this episode, fixed a provisional line of demarcation which was maintained without great change when the frontier was finally traced on June 12 1919. Similarly in Těšín (Teschen) the situation was grave owing to the conflict with the Poles, who had occupied part of this territory. The Czech Govt. in its turn occupied Těšín and there were conflicts attended by bloodshed. The Peace Conference had to intervene. An armistice was concluded on Feb. 19 and the dispute was referred to diplomatic negotiations (*see* TESCHEN).

Financial and Social Legislation.—The population was exhausted after the War, and the dismemberment of Austria-Hungary gave rise to further difficulties. The Government was obliged to purchase grain and flour for the population abroad; and to contract loans for this purpose. Rašín successfully accomplished the task of rendering Czechoslovakia fiscally independent of Austria-Hungary at the earliest possible moment. The law of Feb. 25 1919 ordered the bank notes in circulation to be stamped, a Banking Office to be established, and a loan in gold, silver and foreign currency to be raised to form a reserve of metal as a basis of the new currency. It was thus possible to carry through quite smoothly a currency reform which saved the country great crises and accelerated its economic and financial recovery.

Two further important reforms of strongly democratic tendency were carried through by the Kramář Cabinet. The Local Franchise Act gives all citizens, without distinction of sex, who have passed their 21st year and have been settled for at least three months in their community the local and municipal franchise. The agrarian reform was designed to satisfy the land hunger of the small peasants and at the same time to stop emigration and repair to a certain extent the injustice inflicted by the wholesale confiscations of landed property, and distribution to a foreign nobility, after the Battle of the White Mountain, 1620. The parliamentary commission entrusted with working out this reform completed its work on April 16 1919. The law in its final form (*see* LAND TENURE) was the result of a compromise between the socialists and the other parties. It was followed by a certain number of legislative measures, notably the Act of May 27 1919 which laid down the distribution of the ground to small holders.

The social legislation passed during this period shows very clearly the influence of the socialist groups (the two Socialist parties and the Progressives forming a bloc for this purpose). Socialism was very strong at the time throughout Europe, and the Socialist bloc exercised great influence in the National Assembly. Among the principal social measures may be mentioned the eight-hour day, which was adopted on Dec. 19 1918 and came into force Jan. 13 1919, the Act on unemployment benefit (Dec. 10 1918), the Act on insurance against sickness (May 10 1919), the Act on the protection of tenants (Dec. 27 1918) and various measures dealing with the housing crisis, etc.

In the sphere of public instruction great care and considerable credits were devoted to education, particularly in Slovakia, where it had to be completely reorganised, since formerly it had been merely a docile instrument in the hands of the Hungarian Govt., which used it to denationalise the Slovak population. The material and legal status of the body of teachers was ameliorated (Act of May 23 1919 which places the status of the teachers on a par with that of civil servants); popular instruction was developed (Act of Feb. 7 1919 on free popular courses). In higher education, the Act of Jan. 20 1919 established a second Czech University at Brno (Brünn) which the Czechs had often demanded unsuccessfully from the Austrian Govt. and the Act of June 27 established a University at Bratislava. The question of the separation of Church and State was not solved; a step was taken towards laicising all education by the Act of April 10 1919, which laid down that the office of teacher is open to any citizen without distinction of creed. The Act of Feb. 20 1919 forbade the use of the authority of the Church for political agitation.

The Kramář Cabinet stood for good will and tolerance among the parties and in fact accomplished important social and democratic reforms. Yet the rise of socialism at the time in Czechoslovakia, as in the rest of Europe, strengthened the moral position of the socialist bloc in the National Assembly, and made apparent the disproportion which existed between the number of socialist representatives in Parliament and the real force of Socialism in the country. The realisation of this disproportion troubled relations between the Socialists and the bourgeois parties and led the former to agitate for immediate municipal elections which would allow the two camps to measure their true forces. This discontent further provoked trouble in May 1919 in Prague and in the provinces on account of the high cost of living, and led to the resignation of the two National Democrat members of the Government, which brought with it that of the entire Government.

The First Tusar Cabinet.—The municipal elections of June 15 1919 clearly showed that the composition of the Government and of the National Assembly did not correspond with the real numerical importance of the different parties. Thus, the national democrat group which had hitherto had 46 deputies and four ministers only obtained 256,336 votes or 12% of all votes cast, while the Social Democrat party obtained 934,801, the Czechoslovak Socialists 484,743 and the Agrarians 637,013. The Cabinet accordingly resigned and on July 8 1919 President Masaryk appointed a second Cabinet under M. Tusar, a leader of the Social Democrats. The new Government represented a coalition of the parties which had been most successful in the elections. Besides Tusar (Minister President) it included three other Social Democrats, four Czechoslovak socialists, four Agrarians and two Slovaks, M. Beneš retaining his portfolio.

The Government, in presenting its programme, declared its intention of carrying on the policy of the preceding Cabinet and pursuing the work of national consolidation especially in Slovakia where order had to be re-established after the invasion of the Magyar troops. Further, it would attempt to create conditions which would make it possible for the Czechoslovaks to collaborate with the racial minorities in general and the German minority in particular; it would carry forward the economic policy of the preceding Government by developing good commercial relations with foreign countries, by balancing the budget and making important fiscal reforms, notably by instituting a capital impost; and it would pursue a progressive educational and social policy. It laid especial weight on the necessity of carrying through the agrarian reform, setting up workmen's chambers and establishing a complete system of social insurance. In general the new Government reflected the advanced tendencies of the Czechoslovak and European labour movement of the day.

During the period of office of Tusar's Cabinet Czechoslovakia consolidated her international situation. The interests of the country were successfully defended at the Peace Conference. On Sept. 10 1919 the Treaty of St. Germain with Austria had been signed and on the same day the so-called "little treaty" of St. Germain, which guaranteed the rights of minorities in Czechoslovakia. Under the guidance of M. Beneš commercial relations were developed between Czechoslovakia and her neighbours. The relations between Austria and Czechoslovakia soon became friendly and the ground was prepared for future political agreements.

The economic consolidation of the country was still impeded by great difficulties, which obliged the Government to have recourse to fresh loans. By the Act of April 10 1919 the Government was authorised to contract a loan of 179 million dollars from the United States, 54 million dollars of which were devoted to the purchase of foodstuffs and 100 million to currency reform. On Oct. 4 1919 a second internal loan of 880,000 crowns was voted and in Feb. 1920 a third internal loan (lottery) to revive production. By the Act of Oct. 7 1919 the Government readjusted the payment of civil servants; thus involving an expenditure of 600 million crowns. This new burden, to which others were soon added, (grants to the unemployed, to war invalids, etc.,) made clear the necessity of proceeding without delay to an extensive fiscal reform, and in particular of carrying through an extraordinary impost on capital. This question, which had been the subject of bitter struggles in the preceding Cabinet was only definitely settled in April 1920; when the levy on capital and on increases of capital was imposed. The State budget for 1920 provided for 10,416,175,920 crowns expenses, and 7,750,770,773 crowns revenue, a deficit of 2,665,405,147 crowns.

The Tusar Cabinet pushed forward the agrarian reform actively. The Act of July 11 1919 established a "land office"; other measures regulated the principles of the methods of reform, especially the distribution of the expropriated lands, which, since they were not devoted solely to the benefit of private proprietors, but also to that of co-operatives, thus showed a compromise between the agrarian and socialist points of view. As regards social policy, the Government passed an Act on children's labour; an Act granting a credit of 500,000 crowns for cripples and the survivors of deceased soldiers; an Act which gave workmen employed underground a share in the control and profits of mining enterprises; a further law set up local and works councils in the mining industry and thus marked the first stage in a whole branch of new legislation dealing with the share of workers in the control and profits of industrial enterprises. This Act was soon supplemented by others on courts of arbitration in the mining industry, on the regulation of wages in the metallurgical industry and on home work. In other fields may be mentioned legislation dealing with public libraries, the organisation of the so-called "economic" popular schools, marriage-law reform, the abolition of the prohibition of married women teachers and military organisation.

The most important task of Tusar's Cabinet was the elaboration of the constitution. In view of the attitude adopted by most of the German population it was resolved that this should be voted by the revolutionary National Assembly, rather than by a nationally elected parliament. A special commission elaborated its general principles and its text. Several points—the question of a second chamber, of the separation of Church and State, of the system of military organisation and especially of the incorporation of the language laws in the Constitution gave rise to vehement debate before the constitution was finally adopted on Feb. 29 1920.

The chief question which Tusar's Cabinet left unsolved was that of the German minorities, which remained in unrelenting opposition to the State. Nor were all the problems which arose in Slovakia wholly settled. Early in 1919 the People's (Catholic) party led by Father Hlinka developed tendencies hostile to the State. The internal situation was further troubled by a grave crisis within the Social Democrat party. In Jan. 1920 an oppositional group, the "Marxist Left" formed within this party, and, yielding more and more to the influence of communist propaganda, opened a violent campaign against the Governmental policy of the right wing. The efforts of the Social Democrat party to check this movement failed, and the campaign grew in violence after the return of M. Smeral, the leader of the dissentients, from Moscow in the spring of 1920.

The General Elections.—The general elections were held on April 18 1920 for the Chamber of Deputies and on April 25 for the Senate. The number of Deputies was fixed in accordance with the Constitution at 300, and of Senators at 150. Elections were not held in the districts of Těšín, the frontiers of which were not yet definitely regulated, and of Užhorod in Sub-Carpathian Russia, which was not yet fully in occupation of Czechoslovakia. Accordingly, only 281 Deputies and 142 Senators were elected. The Czechoslovak parties obtained 199 seats in the Chamber of Deputies and 102 in the Senate (Social Democrats 74 and 41; Agrarians 40 and 20; Catholic People's Party 33 and 18; Czechoslovak Socialists 24 and 10; National Democrats 19 and 10; Small Traders six and three; Independent Socialists three and none); the German parties 72 seats in the Chamber and 37 in the Senate; the Magyar and mixed Magyar-German parties 10 and three respectively. The Czechoslovak parties obtained 68·6% of the votes cast, the Germans 25·6%, the Hungarians 0·5%, the German-Magyar 4%, the Jewish parties 1·3%. Of the Czechoslovak votes cast 50·6% went to the Socialist and 49·4% to the "bourgeois" parties.

The Second Tusar Cabinet.—The results showed that the Socialists and Agrarians commanded a majority in the country. Tusar therefore again received a mandate to form a Cabinet. The new Ministry was completed on May 25 (although remodelled before the autumn session). It was composed of seven Social Democrats, including the Premier, three Czechoslovak socialists, three Agrarians and two non-party specialists (Engliš for Finance and Hotowetz for commerce); Dr. Beneš, who again took the portfolio of Foreign Affairs, was elected on the list of Czechoslovak socialists.

Assembling in May, the new National Assembly, in joint session of both Chambers, re-elected M. Masaryk as President of the Republic by 284 votes out of 411. On June 1 the new Cabinet read its programme, which envisaged an advanced democratic and social policy. Appealing to the German representatives, M. Tusar declared that if the two nations had hitherto failed to co-operate, this was not due to the fault or the wishes of the Czechoslovak majority, but to the attitude of the Germans themselves. The reply of the German bourgeois parties, however, which was repeated in a modified form by the German Socialists, showed their intention of persisting in their negative policy towards the Republic. The German problem remained as far as ever from a solution.

Tusar's second Cabinet had a difficult task, since its majority was very weak (144 votes out of 281 in the Chamber). It was opposed on the Left by the Communist elements of the Social Democrat party, and on the Right by the National Democrat party and by the conservative wing of the Agrarians. The National Democrats criticised the Cabinet's policy in its handling of the Těšin policy and the bill on the conversion of the Austro-Hungarian War Loan bonds, which the Government proposed to honour up to 75% of their nominal value, while the Conservative Agrarians chiefly opposed the Government's action in maintaining State control over the sale of the principal foodstuffs. The bill on the Austro-Hungarian War Loan was finally adopted by a small majority, while the harvest was commandeered for the benefit of the State by virtue of a decree.

The Cabinet secured the adoption of a Treaty with Austria which made provision for the protection of the minorities and regulated the question of rights of citizenship. Parliament then adjourned until October. Before it reassembled, important changes had taken place in the political situation. The crisis in the Social Democrat party reached its climax. A Party Congress had been convoked for Sept. 25; the Left wing, which was coming more and more under the influence of the Third International, opened a violent campaign in the hope of securing the majority in the party and of obtaining the adherence of the Congress to the Communist International. In view of this assault, the executive committee of the Social Democratic party met on Sept. 14 and it was decided that the party's representatives in the Government should tender their resignation. This decision was due both to the fact that the Social Democrat ministers now represented only a fraction of the party, and to the necessity of restoring to the group its entire liberty of action in view of the impending struggle. The resignation of the Social Democrat ministers was approved and that of the Cabinet was accepted by President Masaryk on Sept. 15 1920.

The Černý Cabinet.—On the same day M. Černý, the head of the provincial administration of Moravia, was entrusted with the formation of a Cabinet which could continue the policy of the resigning Government. MM. Beneš, Engliš and Hotowetz retained their portfolios in the new Government, the rest of which was composed of high public officials. This temporary arrangement was unavoidable in view of the composition of the National Assembly, as it was not possible to form a majority without the Social Democrats. The only solution was, then, a non-party Cabinet, backed by the Czechoslovak groups, including the majority of the Social Democrats. The last-named party had in fact determined on a radical solution of the Communist difficulty by forcing the extremist elements to leave the party and form an independent group. This division of the party brought with it a split in its parliamentary representatives, 26 members of which formed a new group. The strength of the opposition thus rose from 82 to 108 deputies, while the bloc of the parties of the old majority was reduced to 118 and the total of the Czechoslovak national parties to 173. This new division showed that government was not possible without the support of all the Czechoslovak groups. The Černý Cabinet then prepared the way for a stable parliamentary government which was to follow it after the end of the year, resting like it on this larger majority. A new organisation, the Council of Five (Pětka), composed of the leaders of the five Czechoslovak parties of the coalition (Social Democrats, Czechoslovak Socialists, National Democrats, Agrarians and People's Party), was formed to ensure contact and organise collaboration between the Government and the majority. The mission of the Pětka was to reconcile the divergent interests of these parties and to bring them into line with the interests of the whole. Thanks to this institution the situation of the Cabinet, which had been coldly received by public opinion, was alleviated, and it was able to carry through its most important and urgent tasks.

The chief obstacle in the way of the Černý Govt. was the Communist party, which had launched out on a violent campaign of agitation among the working classes, and was attempting to create trouble in the country. The Government took strong measures to ensure public peace and order. In Dec. 1920 the Communists, on the pretext of the restoration of the People's House, of which they were in occupation, to its legitimate proprietors, the Social Democrats, proclaimed a general strike, which was to prove the commencement of graver troubles. The Government did not hesitate to put down the movement with all the necessary severity. This policy had good results. The Communist party, which towards Christmas had given its open adhesion to the Third International, understood the lesson and attempted no further disturbances. From this moment onward the Communist movement in Czechoslovakia began to wane, a fact which was due partly no doubt to general international influence, but partly to the firmness of the Černý Government.

The budget for 1921 was adopted without difficulty. It was less easy to regulate the question of fiscal reform, but it was essential to do so if the equilibrium of the budget was to be attained. The problem of victualling the country was equally complex. It was only in June, after long and difficult conversations, that it was finally solved. To carry through the fiscal reform the Government proposed to increase the rate of the turnover tax, to introduce a succession duty and a duty on water power, to raise the rate of the income tax and the tax on profits. The representatives of industry and commerce and the National Democrat party raised numerous objections to the various measures proposed, particularly to the increase of the turnover tax. All efforts to overcome this opposition failed. M. Engliš, the author of the proposed reforms, resigned on March 4 1921. He was succeeded by M. Hanačik, whose efforts, however, were no more successful. This parliamentary session lasted, with certain breaks, from the end of May to the beginning of August. A number of bills were adopted by Parliament—homologation of foreign insurance companies; a commercial and customs agreement with Yugoslavia; an increase of unemployment benefit; a convention with Germany regarding rights of citizenship, etc. The opposition of the Germans in Czechoslovakia grew more and more violent, and led finally to their leaving Parliament and declaring their intention to abstain in future from any collaboration in the work of the legislature. Meanwhile the fiscal reform, after many vicissitudes, had at last been adopted by the Pětka. It was passed quickly through the Chamber in the last days of the session, simultaneously with the law of expropriation of the property of the Habsburgs and a bill relating to the organisation of industrial works councils, which satisfied Socialist claims.

M. Beneš' Government.—The Černý Cabinet lost its *raison d'être* as the Communist danger grew less, and with it the necessity of a close contact between Parliament and the Government. Further, if the delays incurred in treating various problems were in part attributable to the diversity of interests in the parties forming the majority, it appeared that these divergences could be better reconciled by a parliamentary government. In Sept. 1921 the Czechoslovak Social Democrat party, after a year of work and internal consolidation, declared itself ready to resume the responsibilities of government. The Černý Govt. therefore retired, and on Sept. 27 the decree was issued ordering the formation of the new government. The Government majority included the five great Czechoslovak parties, and also enjoyed the support of the minor Czechoslovak parliamentary groups, so that it could thus command a secure majority of 180 votes in the Chamber against the 78 of the National minorities and the 25 Communists. M. Beneš became Premier, his Cabinet included three Social Democrats, three Agrarians, two Czechoslovak Socialists and one National Democrat. The Premier, who also acted as Foreign Minister, and the Ministers of Finance, the Interior and Slovakia, were non-party men. M. Beneš' appointment was in general well received; the German press and deputies regarded it as a hopeful symptom.

The programme of the new government, which was first announced on Oct. 18, was one of firmness, consolidation, economy and administrative reforms at home and abroad; the general principles of preceding governments were to be carried further. In the debate which followed, Father Hlinka, the leader of the Slovak Catholics, declared his confidence in the Government. The Germans maintained their attitude of opposition, but their spokesman hinted at a possible future collaboration.

The Government remained in office from Sept. 26 1921 to Oct. 7 1922. The foreign situation during this year was particularly full of incident, including the second attempt at restoration (Oct. 20 1921) of the ex-King Charles in Hungary, as a result of which Czechoslovakia commenced mobilisation (*see* HUNGARY), the conclusion of a political convention with Poland (Nov. 6 1921), which, however, remained unratified (*see* LITTLE ENTENTE), of a treaty of guarantee and arbitration concluded on Dec. 16 1921 at Lány (Lana) with Austria (*see* AUSTRIA), the Conference of Genoa in March and April 1922, the negotiations for the expansion and strengthening of the Little Entente and the difficulties arising out of the fresh financial collapse in Austria in 1922. These questions preoccupied the attention of the Government somewhat to the exclusion of internal affairs. The internal economic situation was difficult and the cost of living high, both for general reasons and owing to the sudden rise of the Czech crown. There were serious labour troubles, such as the miners' strike of Feb. 1922 and the strike in the metal industry in May 1922.

The position of the Pětka in regard to the Government caused difficulties, now that the abnormal situation which had justified its establishment had passed away; and a further difficulty was caused by the desertion of the 12 representatives of the Slovak Catholics to the opposition on account of the Government's refusal to open three new Catholic high schools in Slovakia. As regards the question of the racial minorities, Beneš' Cabinet achieved no more than an indirect result by provoking a split within the German bloc, which divided it into a number of heterogeneous parties. The Government passed, however, numerous legislative measures, including the Acts for the encouragement of building, for the suppression of the Foreign Trade Office, for the revision of cost of living bonuses to State employees and those dealing with co-operative societies, the prohibition of the sale of alcoholic liquors to young persons, emigration, prevention of venereal disease, the teachers' status, etc.

Among economic measures may be mentioned the British loan of Jan. 1922, the purchase of the Rakovnik-Louny railway company, the modification of the customs tariff, the Act on the source of the pre-War public debt, the recasting of the duty on sugar, the Act on the issue of subsidiary coinage. Of special importance were the agreements reached with foreign countries, including the convention with Austria relative to the demarcation of the Austro-Czechoslovak frontier, the commercial and navigation treaty with Italy, the agreement respecting Czechoslovak traffic via the port of Trieste, the economic negotiations with Germany, the commercial treaty with Austria and the convention with Germany for mutual judicial assistance. The good results of the work of the Beneš Cabinet were shown in the increase of Czechoslovakia's prestige, the rise of her currency from 10 to 17 silver centimes—at which rate it was stabilised—and the internal consolidation, which was attested by the calm with which the country received the mobilisation of Oct. 1921.

The history of the Beneš Cabinet so conclusively proved the feasibility of a concentration Cabinet that when it resigned, on Oct. 5 1922, the system was maintained on an even broader basis. The new Ministry was formed on Oct. 7, its head being M. Švehla, leader of the Agrarian party and one of the most influential members of the Pětka.

The Švehla Cabinet.—The new Cabinet consisted of five Agrarians (including the Premier), five Social Democrats, three Czechoslovak Socialists (including M. Beneš, who retained the portfolio of Foreign Affairs), two members of the People's Party, and two National Democrats (including M. Rašín, who again took the Ministry of Finance). Its programme was presented on Oct. 24 in the form of three exposés by M. Švehla, M. Beneš and M. Rašín respectively. It proposed to retain, not only the general principles but also certain concrete points of the preceding ministry. Its financial policy was to stabilise the exchange, to assure a good financial administration, and to balance the budget by means of reduction of expenses. The tax on coal was to be reduced; the impost on increases of capital alleviated; the fiscal régime reformed; public works undertaken to combat the housing crisis; the agrarian reform completed; a system of social insurance and a number of economic measures carried through. The budget was voted without much difficulty in the autumn session. The Government then presented a bill dealing with the salaries of public officials. Based on the hypothesis that the stabilisation of the currency would result in a general fall of prices, this bill envisaged an increase of the basic rates of payment but a reduction of the various bonuses. It became law on Dec. 15, but was destined to involve the Government in grave difficulties, as the economic situation, and especially the maintenance of the level of prices, upset the calculations underlying it. On Jan. 5 1923 M. Rašín was assassinated by an unbalanced young man of anarchistic tendencies. Among the consequences of this crime, which shook the country, was the resignation of the Government on Feb. 18. The gulf between the Government parties and the Communists grew wider than ever. A bill for the protection of the Republic became law on March 6.

The autumn session of 1923 was devoted mainly to the discussion on the budget, which, thanks to the adoption of numerous economies in matters of public finance, showed a reduction of 3,000,000,000 crowns on that of 1922. The tax on coal was reduced, as promised, and the impost on capital below 50,000 crowns was lowered.

In consequence of a violent campaign opened by the Communists against the Government coalition regarding the management of the Government distillery, the majority parties brought forward a bill during the spring session of 1924 to the effect that cases of slander by the Press should be transferred from the competence of the civil to that of the criminal courts. The debates on this bill provoked violent scenes. Finally, a bill amending the press law was brought forward and carried. Other measures passed during this session included an Act reducing the peace establishment of the army; an anti-profiteering Act; an Act abolishing entails; and another on the institution of a national bank.

The Question of Agricultural Tariffs.—The chief object of parliamentary discussion in 1924 was, however, the question of customs tariffs on agricultural produce. The Agrarian party demanded that these tariffs be reintroduced, and attempted to make the question dependent on that of the Social Insurance Bill which had been introduced by the Government in 1923 and had now passed the committee stage. In order to ensure success, it obstructed the ratification of the commercial treaties. The divergence of opinion on the tariff question between the Agrarians and Social Democrats for a while endangered the existence of the Coalition. On Sept. 16 1924 the Social Insurance Bill was voted by both Chambers, and the question of the tariffs on agricultural produce was postponed in the hope of reaching a compromise between the parties. The budget for 1924, in which revenue and expenditure balanced, was passed; but the conflict on the tariff question broke out afresh. In April 1925 it provoked a real crisis in the governmental majority. The Social Democratic deputies refused to allow this question priority of treatment, demanding a debate on the bill to establish social insurance for independent workers, on which the application of the Social Insurance Acts already voted depended. On April 24 they declared that they would not oppose the application of protection to agricultural produce in cases where the price of such produce was lower than the costs of production. This formed a platform for future settlement. On June 13 the executive committee of the Social Democratic party accepted this principle in a resolution which, for the first time, envisaged the possibility of an appeal to the country. The bill for the establishment of social insurance for independent workers was brought forward on May 22 and adopted by both Chambers.

A fresh crisis was caused by the departure of the Apostolic Nuncio, Mgr. Marmaggi, on the day of the national festivities in honour of Jan Hus, and by his action in protesting to the Government on account of their participation in these festivities. The Czechoslovak Socialist party now brought up again the question of the separation of the Church and State, in which it was opposed to the other groups of the coalition. One of the Czechoslovak Socialist ministers resigned, thus complicating the situation and making the idea of new elections more probable than ever.

The Chamber met on Sept. 18 to discuss the budget estimates, which, for the first time, provided for a surplus of revenue. The budget was passed (the Germans abstaining), but the Chamber was unable to carry through a bill which introduced a slight amendment in the electoral system (dividing Prague into two constituencies). It was obliged to abandon the rest of its programme. The two Chambers were dissolved on Oct. 16, and new elections for both fixed for Nov. 15.

Second Švehla Cabinet and Second Cabinet of Officials.—The results of the elections brought about a considerable rearrangement of the strength of the parties of the coalition. The People's party gained greatly, the Agrarians to a lesser extent, the Social Democrats were weakened, mainly because Communist candidates split the labour vote. The National Democratic party was also weakened. In general, however, the five coalition parties did not lose their ability for government, especially as they were joined by the Traders' party as a sixth member, which almost made up for the losses which they had sustained. The detailed results were as follows: Agrarians 45 deputies and 23 senators, Communists (comprising all the nationalities) 41 and 20, Czechoslovak People's party 31 and 16, Czechoslovak Social Democrats 29 and 14, Czechoslovak Socialists 28 and 14, Slovak People's party 23 and 12, National Democrats 13 and seven, Traders' party 13 and six. Of the German parties, the Nationalists elected 10 and five representatives respectively to the two Houses, the Agrarians 24 and 12, the Social Democrats 17 and nine, the National Socialists seven and three, the Christian Socialists 13 and seven; four and two Magyar Christian Socialists were elected and one Polish representative, while two Jewish parties failed to obtain a mandate.

On Dec. 9 Švehla's second Cabinet was formed, its constitution being as follows: Agrarians four, Social Democrats three, Czechoslovak Socialists three, Czechoslovak People's party three, Traders' party one, National Democrats one. Two places were occupied by non-party ministers, one of these being Dr. Engliš, the Minister of Finance. This coalition Government, however, resigned on March 16 1926 owing to differences between the Social Democrats and the Agrarians, chiefly on the outstanding question of agricultural tariffs. On March 18 another Government of officials came into power. Of the former Cabinet, office was still held by Dr. Engliš, and Dr. Beneš, who was thus able to maintain a continuity in his important office as Foreign Minister. As in the case of the first Government of officials, the Prime Minister was J. Černý. (K. S.*)

IV. ECONOMIC HISTORY

Distribution of Population.—39·56% of the population of Czechoslovakia are occupied in agriculture; 33·87% in industry and 10·66% in commerce; the remainder in the civil and municipal services, liberal professions, etc. The percentage distribution by provinces is as follows:—

	Industry	Agriculture
Bohemia	40·99	29·69
Moravia	38·15	35·27
Slovakia	17·60	60·60
Ruthenia	10·56	67·64

Agriculture.—The climate of Czechoslovakia occupies a position between the moderate maritime climate of western Europe and the extreme continental climate of eastern Europe. The annual rainfall of about 25 in. is advantageously distributed throughout the seasons, a full two-thirds occurring in the spring and summer months.

The following table shows the division of the total area of the country in 1924:—

	%	Hectares
Arable land	42·04	5,907,000
Permanent meadows	9·87	1,385,000
Gardens and orchards	1·05	147,000
Vineyards	·13	17,000
Pastures	8·58	1,201,000
Forests	33·17	4,652,000
Fishponds and lakes	·56	78,000
Waste and building land	4·60	648,000
Total		14,035,000

The annual output of timber from the forests is estimated at 15,000,000 cu. metres, a large part of which is exported.

Sugar beet, corn and high-grade barley for beer-brewing are cultivated in the low-lying areas, while in the more elevated regions the cultivation of potatoes, rye and oats predominates; the high lands, except those covered by forests, are used for growing fodder crops or for grazing. Of the total amount of arable land 14.5% is under rye, 14·3% under oats, 11·5% under barley, and 10·3% under wheat. Maize is cultivated only in the low-lying areas of the southeast to an extent comprising about 2·7% of the total arable area. Some 17% is taken up with potatoes and sugar beet, which form the basis for the highly developed distilling and sugar industries.

The productivity of the soil varies considerably. Thus, in the west, where there is a high technical standard in agriculture, the productivity often exceeds the general maximum figures for Europe as a whole. But in the eastern areas (Slovakia and Carpathian Ruthenia) the productivity is much lower. The following table shows the average productivity for the whole of Czechoslovakia during the period 1922–4:—

	Yield per hectare quintals
Wheat	15·5
Rye	15·0
Barley	15·9
Oats	14·4
Potatoes	108·8
Sugar beet	255·9

The most important agricultural products of Czechoslovakia as regards the international markets are sugar beet, barley, which is exported partly in the form of malt, and the hops of Žatec (Saaz).

The distribution of cattle, which forms 75% of the total number of animals, exhibits similar variations. Productivity decreases from west to east, and while in the western regions there are 62 head of cattle per sq. km., a figure surpassed in Europe only by Denmark, Belgium and Holland, the number per sq. km. in the eastern areas is considerably less; the average for the whole republic is 52 head per square kilometre.

The prominent position occupied by Czechoslovakia among the most progressive agricultural States is due to the high standard of Czechoslovak agriculture. The technical equipment of agricultural colleges receives very careful attention from the Government, and there is also a very close co-operation between those engaged in agriculture and the home industries which are based upon agricultural activity. Before 1914 the total value of the agricultural output was estimated at about 2½ milliard gold crowns. In spite of the losses occasioned by the War the yield in 1925 was equal to that of the pre-War period. The foreign trade balance of agriculture is favourable to the country, if the export of products derived from agricultural industries (sugar, beer, alcohol) is included. In the production of barley, potatoes, oats, beer, alcohol, sugar and fruit, there is an ample surplus for export purposes. One of the important items in this respect is also the export of timber produce. The chief debit items occur in wheat, maize and cattle (meats and fats).

Agrarian Reform.—The Act of Parliament of April 16 1919 gives the State the right to take over for partition estates in so far as they exceed 150 hectares of arable land, or 250 hectares of land of any other category, indemnification being based on the average value between 1913–17. Elaborate provisions are made for the various eventualities likely to arise in the application of this reform, which is supervised by a department specially established for the purpose and known as the Land Office. The total area affected by this Act was 926,817 hectares. By the end of 1924, 654,710 hectares had been taken over and redistributed, 470,327 being agricultural land and 184,383 other land, mostly forest, of which half passed into the possession of the State. Of the agricultural land, 52% was allotted to small farmers, 21% to persons of various occupations, and 25% to landless peasants. During 1925 a further 253,000 hectares were distributed, and 203,490 hectares remain to be dealt with. The class of farmers owning medium farms in Czechoslovakia has been substantially strengthened by the Land Reform Act.

Minerals and Mines.—The mineral wealth of Czechoslovakia is of great importance. The most important items are pit coal and lignite. The former has its chief centres in the Ostrava-Karvinná coalfield, which is connected with the German and Polish coalfields of Upper Silesia. In addition, there are the coalfields of Kladno and Plzeň. The output of pit coal in 1924 was 14,359,401 metric tons and the number of workers employed was 73,000. Lignite is found in northwestern Bohemia, at the foot of the Ore Mountains. The output in 1924 was 20,507,178 metric tons and the number of workmen employed was 46,000. Coal is an important article of export, pit coal and coke being exported mainly to Austria and Hungary, and lignite to Germany. On the other hand, pit coal is imported from Germany and Poland, particularly for certain areas of northeastern Bohemia, Moravia and Slovakia.

Iron ore is obtained chiefly in Bohemia and Slovakia, but it is inadequate for the native iron industry, and accordingly about one-half of the total amount used is imported, chiefly from Sweden. Other metallic ores found include lead, manganese, antimony, cobalt, wolfram, silver and small quantities of gold (the annual output of pure gold is from 100 to 300 kilos). The uranium ores of Jáchymov, from which radium is obtained, are of great value. Extensive salt deposits exist, about 140,000 metric tons being obtained annually from Carpathian Ruthenia. Graphite of a high grade quality is also mined and forms the basis of a highly developed lead pencil industry. Crude mineral oil is obtained in small quantities, the yield being about 1,000 cisterns annually.

The abundance of excellent porcelain raw materials, particularly of kaolin, is of great importance both for home industry and for export purposes. The annual yield is about 400,000 tons, obtained chiefly from western Bohemia and southern Moravia. Under the heading of mineral wealth should be included also the numerous mineral springs, which have not only resulted in an extensive export trade in mineral waters but have exerted a large influence upon the development of such famous Czechoslovak spas as Karlovy Vary (Carlsbad), Marianské Lázně (Marienbad), Františkovy Lázně (Franzensbad), Poděbrady, Luhačovice, Pištany, etc. Systematic attention is being devoted to the exploitation of water-power resources, together with a systematic process of electrification, and large steam-driven central power stations have been erected. (V. B.*)

INDUSTRIAL DEVELOPMENT

Industry.—It has already been pointed out that the agricultural products of Czechoslovakia provide the raw materials for important agricultural industries. The most important of these is the old-established sugar industry, which is carried on in some 170 sugar refineries; by 1925 the pre-War output had been equalled, *i.e.*, more than 14,000,000 quintals of beet sugar annually, of which quantity about 10,000,000 quintals were available for export. In the manufacture of beet sugar Czechoslovakia occupied in 1925 a position second only to that of Germany, and its exports exceeded those of any other country. The beer-brewing industry has attained a world-wide reputation by reason of the excellent quality of its products, notably Pilsen beer. Alcohol (annual production 400,000 hectolitres), starch, coffee substitutes (chicory), preserved fruit and vegetables, fruit juices, confectionery, cheese and ham industries are also of importance.

The abundance of coal and the presence of iron ore have provided the necessary conditions for the development of the metallurgical industries. In 1923 there were 34 foundries in Czechoslovakia; the quantity of crude iron manufactured in 1925 was 8,200,000 quintals, in the preparation of which 13,500,000 quintals of iron ore were used, 7,000,000 quintals being obtained from abroad. There are 16 steel works, with 50 foundries and an annual output of about 2,000,000 tons. The annual capacity of the rolling-mills is estimated at 1,000,000 tons of rolled goods. The iron industry is mainly located near the bituminous coal districts. The development of the metal industry is closely connected with the progress of agriculture and the development of the various agricultural industries, which have resulted in an increased demand for agricultural implements and machinery, as well as for machinery for sugar refineries, breweries, distilleries, etc. The metal industry has been extended to numerous other branches, and among its products are boilers and steam engines, steam and water turbines, pumps, compressors, benzine and naphtha motors, bridges, cranes, railway engines and waggons, motor-cars, lathes and other special machinery and equipment. This highly developed industry, the products of which are now exported all over the world, employs about 150,000 workers.

The glass, porcelain and pottery industries also depend mainly upon the home supply of raw materials. The number of glass works is 140 and the number of workmen employed is nearly 30,000. All kinds of glass goods are produced, from ordinary glass bottles to plate and chemical glass. In addition, there are about 70,000 workers, who in their own homes make glass jewellery and beads which are known under the generic name of Jablonec (Gablonz) ware. Crystal, ground and coloured Bohemian glass, all of high-grade quality, is largely exported to all parts of the world. The manufacture of porcelain is concentrated mainly in western Bohemia. It occupies about 15,000 workers, and with it is associated an extensive pottery industry, which produces bricks and other building accessories, paving-stones and tiles. The large forest areas provide the raw material for the timber, paper and cellulose industries. The chief timber products are furniture of all kinds, the best known of which is bentwood furniture, barrels, building materials, frames, railway sleepers, pit props, walking-sticks, whips, pipes, etc. Basket ware, brushes, buttons, toys and musical instruments are also produced. The paper industry comprises 60 paper works, 38 cardboard works, 27 cellulose works and 80 timber planing works. A great part of the output is exported. The surplus output of paper is utilised in the production of paper goods, bags, cigarette holders, etc.

The textile industry, which occupies about 270,000 workers, is highly developed. The cotton group employs about 3,600,000 spindles and 130,000 mechanical looms, the woollen 1,200,000 spindles and 37,000 mechanical looms, the flax 285,000 spindles and 17,000 looms and the jute about 35,000 spindles and 3,500 looms. There are also 53 silk-spinning mills, with 14,000 looms. The raw materials forming the basis of the textile industry are obtained entirely from abroad, with the exception of small quantities of flax and wool, while the products of the industry represent about one-third of the total exports of the country. Among its special products are cotton and woollen fabrics, carpets, blankets, lace and embroidery, clothing, underwear and head-gear. The leather industry, which is making great progress, obtains about 80% of its raw materials from abroad. It also plays an important part in the export trade of Czechoslovakia, its main products being boots, shoes, gloves and small miscellaneous leather goods. The intensive agricultural activity of the republic also accounts for the development of the chemical industry, the chief products of which are artificial manures, glue, explosives, varnish, soap, candles, oils and the products of the dry distillation of wood, matches, blacking and ink. The lead pencil industry, based upon the abundant home supplies of high-grade graphite is one of the standard export industries, while matches, blacking and ink are also produced.

Communications and Transport.—The total length of railways is 13,549 km.; 9,125 km. are State railways, 4,135 km. are private lines carried on by the State, and 289 km. are private lines under private management. These railways, forming a direct connection between the systems of western and eastern Europe, are very important, both as regards passenger and goods traffic. The waterways are also important factors. The Vltava (Moldau) internationalised from Prague onwards, and the Labe (Elbe) from Mělník onwards, form the route to the North Sea, where the chief harbour for Czechoslovak trade is Hamburg. The Danube (*q.v.*), which is internationalised from Ulm, connects Czechoslovakia with the Black Sea. The Oder (*q.v.*) is not yet navigable as far as the Czechoslovak frontiers, but it nevertheless plays an important part in the transport of Swedish ore to the Czechoslovak iron industry in the Ostrava basin. The total length of navigable waterways is 418 km., of which 206 km. are represented by the Elbe and Vltava, and 172 km. by the Danube. Of the total foreign trade in 1923, 7% of the imports and 8% of the exports were carried by water. The following table shows the total amount of goods carried in this way:—

	Elbe tons	Danube tons
Exports	798,341	118,428
Imports	271,425	81,533

The Elbe is used chiefly for the transport of coal, timber, agricultural produce and the products of the agricultural industries; the Danube for the export of timber, and the import of cereals from the Danubian States.

In 1924 there were 4,557 post offices and 20,540 km. of telegraphs, representing a total length of 125,726 km. of wire. The total length covered by the local telephones was 16,338 km. and of the inter-urban 13,854 km., the number of call stations being 10,870. Prague is an important aviation centre, and is a station on the air route Paris-Prague-Constantinople, which has a branch line to Warsaw. An internal aviation route runs between Prague, Bratislava and Košice.

Foreign Trade.—The large export and import trade of Czechoslovakia required it to build up a system of commercial treaties with foreign powers. The guiding principle of Czechoslovak trade policy was that of the most-favoured-nation clause. Upon this principle it constructed its whole system of agreements, which it supplemented by means of tariff conventions for customs purposes. A custom tariff of the former Austro-Hungarian Empire, drawn up in 1906, was adapted to the changed economic conditions by means of a system of co-efficients and became the basis of Czechoslovak customs policy as far as not replaced by any new items. The tariff agreements concluded with France, Italy, Austria, Poland, Greece, Spain and Belgium led to a reduction of from 50% upwards in the customs rates applicable to more than two-thirds of the industrial products. It was also an important feature of the trade policy of Czechoslovakia that, having in view the best interests of international trade, it regarded the system of import and export licences introduced immediately after the War as being only temporary, and as conditions became more and more consolidated the application of the system was gradually reduced.

Trade agreements or tariff conventions concluded by Czechoslovakia with various countries are as follows:—

1920: Switzerland, Germany, Bulgaria, Yugoslavia and France.
1921: Italy, Rumania and Austria.
1922: Russia, the Ukraine, Latvia and Portugal.
1923: The Netherlands, Lithuania, Great Britain, France, Norway and the United States of America.
1924: Denmark, Italy, Iceland and Austria.
1925: Greece, Sweden, Poland, Austria, Spain, Turkey, Bulgaria, Japan and Belgium.

The table at the top of the next column shows the value of the foreign trade of Czechoslovakia from 1920 to 1925.

	Imports	Exports	Credit Balance
	Millions of crowns		
1920	23,384	27,569	4,185
1921	22,433	27,312	4,879
1922	12,696	18,086	5,390
1923	10,222	12,573	2,351
1924	15,855	17,035	1,180
1925	17,594	18,799	1,205

In 1924 the imports were cotton and cotton goods, wool and woollen goods, flax, hemp, jute, wheat and flour, live cattle, fats and tobacco. The chief countries of origin and the percentage of the total supplied were the Danubian States (*i.e.*, Austria, Yugoslavia, Bulgaria and Rumania) 19%, central and northern Europe (Germany and Poland) 39·8%, western Europe 18·5%, and other countries 22·7%. The principal exports were sugar, cotton goods, woollen goods, flax and jute products, timber, coal, glass, iron goods, fruit and vegetables, leather and leather goods, porcelain and pottery. The chief foreign markets and the percentage of the total taken were the Danubian States 36·9%, central and northern Europe 22·8%, western Europe 20·6%, other countries 19·7%. (J. Dv.)

V. FINANCE AND CURRENCY

In no other department of the State activities was there so energetic an endeavour to ensure the independent existence of the new republic as in that of finance and currency. In this respect there was a two-fold aim: to achieve an equilibrium of the State finances and establish a stable currency. The following are the chief figures from the State budgets for the period 1923 to 1926 (in millions of crowns):—

	Receipts	Expenditure	Special programme of public works
1923	18,812	19,377	3,000
1924	16,391	16,994	2,229
1925	9,301	9,574	1,319
1926	10,086	10,070	

The great difference between the budget for 1925 and that for 1926 lies in the fact that from 1925 onwards such State concerns as railways and the tobacco monopoly were to be managed upon a business basis, separate from the State administration. They appear in the budget only as a final figure after the balance has been drawn of all receipts and expenditures. Thus the budget for 1926 was not burdened by investment items; such items, amounting to 871,000,000 Czechoslovak crowns, are included in the ordinary budget as items necessary for the purpose of interest and amortisation. The main sources of State receipts for 1925-6 are estimated as follows (in millions of crowns):—

		%
Direct taxation	2,086	(20·7)
Tax on Turnover and Luxury Tax	1,606	(15·9)
Tax on Consumption	1,332	(13·2)
Customs receipts	808	(8·0)
Stamp dues and fees	1,534	(15·2)
Monopolies and State undertakings	1,165	(11·6)
	8,531	(84·6)

	Kč
Public Debt.—The total Publio Debt of Czechoslovakia on July 31 1925 was	30,540,724,334
Amount assigned for the funded internal debt (interest 3½ to 6%)	16,045,462,152
Short term internal loan (interest 5¼ to 6%)	6,757,794,000
Foreign debts in various currencies (according to the rate of exchange on July 30 1925)	4,478,468,181
Debt arising from the peace treaties	3,259,000,000

Of the above mentioned funded debt, amounting approximately to £95,843,000, the sum of £30,070,000 forms the share of the pre-War debt of the former Austro-Hungarian Empire which was taken over by the Czechoslovak Republic, while the sum of £47,167,000 represents the capital State expenditure during the period 1919–25 incurred by railways, telegraphs, telephones, high roads, etc. Similar capital expenditures are also covered partly by the foreign debts and the short term loan, while the remainder represents expenditure incurred in the maintenance and repatriation of Czechoslovak troops who were fighting for the Allies, as well as expenditure incurred immediately after the War for the benefit of the population, which was still suffering from the effects of the War. The above list includes the State debts as far as they can be specified. Whether Czechoslovakia will be called upon to make payments under Art. 208 of the Treaty of St. Germain and Art. 191 of the Treaty of Trianon, or to make payments designated as a liberation contribution, had not been settled in 1925.

Currency.—One of the most important acts of the first Government of Czechoslovakia was the establishment of an independent currency early in 1919. For this purpose it was decided to collect and stamp all the bank notes of the Austro-Hungarian Bank, which were then circulating upon Czechoslovak territory, as well as the deposit accounts in Czechoslovak branches of the Austro-Hungarian Bank, totalling about 10 milliard crowns. During the process of stamping, about 2·7 milliard crowns were retained as a compulsory State loan in order to reduce the amount of paper money in circulation, and the stamped bank notes were declared to be state notes with a face value in Czechoslovak crowns. At the same time a temporary bank of issue was established under the title of " Banking Office of the Finance Ministry." The stamped bank notes were later replaced by independent State notes in equal proportion. In order to defray the value of the uncovered State notes and the deposit accounts taken over from the Austro-Hungarian Bank, a tax on capital was levied, the estimated yield of which was 7·5 milliard crowns. Of this sum nearly 5 milliards had been paid off by the end of 1925. The value of State notes in circulation is strictly defined by law. The Banking Office, which is managed by a board of directors appointed by the Finance Minister, is not permitted to grant the State any loan, either direct or indirect. The general post-war financial and economic difficulties, the chaotic condition of the currencies in the neighbouring States, and the comparative ignorance of Czechoslovakia abroad, caused the exchange rate of the Czechoslovak crown to fluctuate up to 1922, although the financial administration continued to pursue sound principles. From the year 1922, however, the exchange rate of the crown was stabilised at about 100 crowns to $3 (U.S.). Thus, as a result of the energetic and judicious currency policy inaugurated by Dr. Rašín, the Czechoslovak crown maintained its stability and its relatively high exchange value at a period when the currencies of the neighbouring States were hopelessly unstable and depreciated. This caused Czechoslovakia to be described as " an island in a sea of inflation."

As a result of three years of stabilisation it was decided to change the banking office, during 1926, into a Joint Stock Bank of Issue, known as National Czechoslovak Bank, with a share capital of $12,000,000, which may be increased to $15,000,000. Of this amount one-third has been taken over by the State, although it will not have more than one vote at the general meetings. The aim of the bank is to issue bank notes and maintain the currency at the exchange level of the years 1924–5. This level is represented by the rate of 100 crowns to $2.90–$3.03 on the New York Stock Exchange, and brings Czechoslovakia into line with the countries possessing a gold exchange standard. To begin with, there will be a 20% gold covering, but this will be increased 1% per annum for a period of 15 years until it reaches 35 %.

Banking and Credit.—Amongst the oldest financial institutions existing upon the territory of the present republic were the communal savings banks. As a result of the development of industry, notably about the middle of the 19th century, these were followed by deposit banks, and as agriculture continued to progress a number of co-operative institutions were established in the rural districts. Savings banks, the activity of which is strictly defined by special regulations, numbered 373 at the end of 1925. On Dec. 31 1919 their total book deposits amounted to 5,326 million Kč., a sum which at the end of 1924 had increased to 11,454 million Kč. There are also 153 district agricultural deposit banks in Bohemia which are similar in character. Their total deposits amounted to 829 million Kč., which had increased to 2,122 million Kč., by the end of 1924. These establishments are guaranteed by the district authorities. As a result of the co-operative law of 1873, a number of credit co-operative societies on what is known as the Kampeličky or Raiffeisen system were founded in the rural districts. By 1925 the number had reached 3,965; their total funds amounted to 1,346 million Kč. at the end of 1919, and 3,265 million Kč. at the end of 1924. The same law provided for municipal deposit banks, of which there are 1,539, with deposits amounting 2,388,000,000 Kč. in 1919 and 6,840,000,000 Kč. in 1924.

Czechoslovakia contains 33 banking establishments with a share capital of 914,000,000 Kč. at the end of 1919, and 1,871,000,000 Kč. at the end of 1924. The reserve funds at these respective periods amounted to 378,000,000 Kč. and 1,032,000,000 Kč. Their total deposits amounted to 1,224,000,000 Kč. in 1919 and 6,587,000,000 Kč. in 1924. There are also 164 smaller banks of this description in Slovakia and Carpathian Ruthenia, whose total deposits amounted to 1,137,000,000 Kč., and 2,214,000,000 Kč. in 1919 and 1924 respectively. In addition, there are nine banks other than those with share capital, whose deposits amounted to 300,000,000 Kč. and 1,723,000,000 Kč. in 1919 and 1924 respectively. In all cases the Czechoslovak banks began on a small scale, collecting their deposits from all parts of the country and from all classes of the population. They take an active share in the establishment of industrial and commercial concerns.

The financial and credit organisation of Czechoslovakia is supplemented by a State-managed postal cheque office in Prague. In 1924 there were 81,507 deposit holders, whose total claims amounted to 1,953,000,000 Kč. The total transactions concluded in 1924 involved a turnover of 165,289,000,000 Kč. The most important of the Czechoslovak insurance companies are those dealing in life insurance and in insurance against fire, hail and other damage from the elements. The transport insurance companies are less developed, a circumstance which is due mainly to the inland position of the country. Czechoslovakia contains 14 mutual insurance companies, 21 joint stock insurance companies, and four companies controlled by public authorities. (V. P.*)

BIBLIOGRAPHY.—The fullest account of Czech activities before and at the outbreak of the War is contained in the *Urteilsbegründung des k.k. Landwehrdivisionsgerichtes Wien gegen Kramář, Rašín und Genossen* (Vienna, 1916), which is, however, much too bulky for the ordinary reader. A short but tendencious account based on the above is given by F. Wichtl, *Dr. Karl Kramarsch, der Anstifter des Weltkrieges* (Vienna, 1918); see also H. Friedjung, *Das Zeitalter des Imperialismus* (Berlin, 1922); R. W. Seton Watson (Scotus Viator) gives the Slovak case in *Racial Problems in Hungary* (London, 1908); good accounts of the Czechoslovak movement in Austria Hungary are given in O. Bauer's *Die österreichische Revolution* (Vienna, 1923); and S. Fischel's *Der Panslawismus* (Vienna, 1918). For the revolutionary movement during the War, *see* T. Masaryk, *L'Europe nouvelle* (Paris, 1918); also *Die Weltrevolution* (Berlin, 1924); W. Tobolka, *Diplomatické dokumenty o československém státu* (Paris, 1918); also *Česká politika za světové války* (Prague, 1922); also *Masaryk osvoboditel* (Prague, 1922); J. Červinka, Našina Sibíři (Prague, 1920). For constitution and history since 1918 *see* Národní Shromáždění Československe-Mezinárodní Informační Služba Parlamentní, *Z cizích parlamentů* (Prague, 1920, etc.); *Ústavní zikony Československé Republiky. Pro potřebu Národního Shromázdění vydalo Předsednictvo N. S.* (Prague, 1920); *Lois constitutionnelles de la République Tchécoslovaque* (Prague, 1920, etc.); H. Rauchberg, *Bürgerkunde der Tchechoslowakischen Republik* (Reichenberg, 1922); A. Rašín, *Financial Policy of Czecho-Slovakia during the first year of its history.* Economic and Social History of the World War (Oxford, 1923); E. Beneš, *Five Years of Czechoslovak Foreign Policy* (Prague, 1924); *see* also Státní Uřad Statistčký, *Manuel Statistique de la République Tchécoslovaque* (Prague, 1920, etc.); J. Císař and F. Pokorný, *The Czechoslovak Republic. A survey of its history and geography, its political and cultural organisation, and its economic resources* (London, 1922); S. Papánek, *La Tchécoslovaquie* (Prague, 1923); J. Gruber, *Czechoslovakia* (New York, 1924).

CZERNIN, OTTOKAR, COUNT (1872–), Austro-Hungarian statesman, was born on Sept. 27 1872, and became in Feb. 1912 a member of the Austrian Upper House, attaching himself to the Constitutional party. His speeches, in which he advocated a vigorous internal and external policy, made a great sensation.

In Oct. 1912, he went as Austro-Hungarian minister, to Bucharest. His dispatches published in the "Red Book" show that, even at that time, he was of opinion that the secret treaty signed by King Charles with the Triple Alliance was nothing but a "scrap of paper," and that in an international war Rumania would only be induced to take the side of the Central Powers by far-reaching concessions at the expense of the Habsburg Monarchy. After the outbreak of the World War he sought even at a cost to win over Rumania to the side of the Central Powers. But his efforts proved fruitless, because the leading Hungarian statesmen would not agree to Rumanian demands, involving the cession of Hungarian territory. For a long time Czernin succeeded in persuading Rumania to remain neutral. At the end of 1916 he became Minister for Foreign Affairs in succession to Count Burian.

Czernin was, and remained, a decided advocate of the view that the Central Powers could not obtain so crushing a victory over the enemy in the field as to be able to dictate the conditions of peace. Therefore, from the day of his taking office down to his resignation, he consistently maintained that, even at some sacrifice, they ought to seek the conclusion of a peace which should preserve to them their position as great Powers. Czernin did not indeed contemplate the conclusion of a separate peace with the enemy, but as against German statesmen he insisted that Germany also, especially on the questions of Belgium and Alsace-Lorraine, would have to reconcile herself to concessions. By gloomily painted pictures of the military, political and economic situation of Austria-Hungary he sought to influence the German Emperor and the German High Command, and succeeded in awakening sympathy with his peace ideas among the members of the German Reichstag.

Czernin was not only cognisant of the peace negotiations which the Emperor Charles opened with England and France through his brother-in-law, Prince Sixtus of Parma, but he approved of them. He knew nothing, however, of the wording of the letter of March 24 1917 in which the Emperor Charles spoke of his willingness to support the "just demand" of France for the return of Alsace-Lorraine by any means and by the use of his whole personal influence with his ally. But he himself was simultaneously engaged in trying to influence German statesmen in the same sense, promising, in the event of their making sacrifices in the West, to compensate them in the East, chiefly by the acquisition of Polish territory. But his efforts, then and later, broke down on the determination of the German army leaders to obtain a military decision.

During the negotiations at Brest Litovsk from Dec. 1917 to March 1918 the opposition between the views of the Austro-Hungarian delegation, led by Czernin, and the German delegation became strikingly manifest. In the negotiations leading up to the convention between Russia and the Quadruple Alliance, signed on March 3 1918, Czernin took a conspicuous part. A few weeks earlier, peace had been concluded at Brest Litovsk with the newly founded Republic of the Ukraine. The fact that Czernin, in order to secure this "bread peace" had ceded to Ukraine the district of Chelm, to which the Poles laid claim, aroused the most violent resentment among the latter, and led to unsparing attacks upon him by the Austrian Poles. In the beginning of April 1918, his position was no longer tenable. The immediate cause of his resignation on April 15 1918 was the conflict between him and the Emperor Charles over the "Sixtus letter."

BIBLIOGRAPHY.—For Czernin's activity in Bucharest and in the World War see his *Im Weltkriege* (1919). His dispatches from Bucharest are printed in the Austro-Hungarian "Red Book," *Diplomatische Aktenstücke betreffend die Beziehungen Oesterreich-Ungarns zu Rumänien, 22 Juli 1914 bis 27 August 1916*. A favourable view of Czernin's attitude in the "Sixtus affair" is taken by Count August Demblin in *Czernin und die Sixtus Affaire* (1920); the standpoint of Prince Sixtus is represented in *Prince Sixt de Bourbon: L'offre de la paix séparée de l'Autriche* (1920).

D'ABERNON, EDGAR VINCENT, 1st Viscount (1857–), British diplomatist, was born at Slinfold, Sussex, Aug. 19 1857, the youngest son of Sir Frederick Vincent, 11th Bart., of Stoke D'Abernon, Surrey. He was educated at Eton and entered the army, but in 1880 was appointed private secretary to Sir Edmond Fitzmaurice, then commissioner for Eastern Rumelia. In 1882 he was sent to Constantinople as the representative of Great Britain, Holland and Belgium on the council of the Ottoman public debt, of which in 1883 he became president. In 1883 he went to Cairo as financial adviser to the Egyptian Govt., remaining there until 1889, when he returned to Constantinople as governor of the Imperial Ottoman Bank, a post which he resigned in 1897. In 1887 he received the K.C.M.G. Sir Edgar Vincent entered Parliament in 1899 as Conservative member for Exeter, but lost this seat in 1906. In 1914 he was raised to the peerage as Baron D'Abernon, and during the World War was chairman of the Central Liquor Control Board. From 1920 to 1926 he was ambassador to Germany and in that capacity did much to pave the way for the Locarno Pact. In Jan. 1926 he was made a viscount.

DACCA, UNIVERSITY OF.—The creation of the University of Dacca was due to the desire of the Govt. of India to provide increased educational facilities for the Mussulmans of Eastern Bengal, to set up a new residential and teaching type of university and to relieve the congestion of the (affiliating) University of Calcutta. After reports from a special committee in 1912 and the Calcutta University Commission in 1919, it was opened on July 1 1921. The university has fine buildings, inherited in part from the former Govt. of Eastern Bengal and Assam, in part from the Dacca Colony, founded in 1841 and an estate of nearly a square mile, with large playing fields, three residential halls, well equipped chemical and physical laboratories, and residences for the staff. The constitution is similar to that of the English provincial universities, but on the residential side it is more akin to Oxford and Cambridge. There are about 85 teachers and 1,500 students (1926); research is carried on in all the departments and a high standard is maintained in the examinations. The library contains about 44,000 volumes.

DAHN, JULIUS SOPHUS FELIX (1834–1912), German historian (*see* 7.734), published the final volume of *Die Könige der Germanen* in 1911. He died at Breslau Jan. 3 1912.

DAHOMEY (*see* 7.734).—This French colony extends from the Gulf of Guinea to the Niger, and includes a much greater area (41,302 sq. m.) than the old kingdom of Dahomey. The last ruling chief was deposed in 1911. The population in 1925 was estimated at 1,000,000. Europeans number about 800. Some 65% of the natives inhabit Lower Dahomey, which is but one-third of the area of the colony. The principal railway runs from the coast at Kotonu, parallel to the Nigerian frontier, to Savé (162 miles). Thence a metalled road, over 300 m. long, connects with the Niger at Mladekali. Palm oil and palm kernels remain the chief source of wealth. Oil palms cover an area of about 600,000 acres. Maize is a growing export from the colony. (*See* West Africa, French.)

DAIL EIREANN: *see* irish free state.

DAINGERFIELD, ELLIOTT (1859–), American painter, was born at Harper's Ferry, Va. (now W. Va.), March 26 1859. He received his early education at Fayetteville, N.C., and went to New York City in 1880 to study art. He exhibited first at the National Academy of Design in 1880. Among his best known pictures are "Christ Stilling the Tempest" and "Slumbering Fog," in the Metropolitan Museum, New York City; "Storm Breaking Up," in the Toledo Museum; "The Child of Mary," in the National Gallery, Washington; "The Midnight Moon," in the Brooklyn Museum; "The Valley of the Dragon," in the Chicago Art Institute. He executed the beautiful mural decorations in the Lady Chapel of the church of St. Mary the Virgin, New York City.

DAIRYING (*see* 7.737).—Modern scientific research has led to remarkable progress in the technical side of dairying. Agriculture, physiology, veterinary medicine, physics, chemistry, biology, bacteriology, mechanics, alimentation and sociology have been drawn upon in turn, with the results already seen at the last international dairying congress at Washington (Oct. 2–10 1923), at the international cattle breeding congress at Scheveningen (Aug. 28–Sept. 4 1923), and at the international dairying congress in Paris (May 17–19 1926).

The following are some of the sections in which progress can be reported:—

Milk Recording.—The keeping of careful records as to the quantity and quality of the milk produced has inaugurated a new era in the improvement of dairy herds. The system was first put into practice in Denmark, Germany, England, Holland, Switzerland and the United States, but an enquiry undertaken by the International Institute of Agriculture shows that it has become general in progressive agricultural countries. The work of the milk and butter recording societies has facilitated the decision of certain very important points with regard to the selection of breeding animals. The study and analysis by Gowen, Kroon, Frateur, Leroy, White, Per Tuff, Van de Plank and others of the data given in the herd books has made it possible to state definitely:—

1. that the production of milk and butter does not increase indefinitely with the increase in the ration, but reaches a fixed maximum according to the individual capacity of the animal;
2. that the fat content of the milk of a given cow remains constant during her entire milking period;
3. that hereditary milk and butter yielding qualities are compatible with the production at an early age of a well developed frame bearing meat of good quality;
4. that these qualities are transmitted to the following generation, by the male equally with the female, and that it is therefore possible to produce a breeding bull, which would be the sire of a line of milk and butter givers; and
5. that if rationing is carried on on scientific lines, the animals with mediocre yields may be eliminated from reproduction, and those with high yields selected and bred in to carry on the herd.

Heredity.—The evolution of ideas on the doctrine of variation and selection has brought out the extreme importance of the individual in selection and the necessity of careful investigation of his or her qualities both from the point of view of breeding and rearing and from that of heredity. By this must be understood the estimation of the points of an animal, of their value from the breeding point of view and of the measure in which the hereditary disposition towards those points can be transmitted with certainty to the descendants, together with the probable reaction of this hereditary disposition to environment. Careful consideration must therefore be given to:—

1. the animals as individuals;
2. the information to be had with regard to their heredity, and their milk production; and
3. the following up and the appraisement of their descendants.

In this manner there has been created a new system of improving our dairy herds; *i.e.*, selection according to the results furnished by milk-recording, the examination into ancestry and the estimation of progeny. Thus arises the importance of the information derived from pedigrees. This question of the herd books has been closely studied by Wibbens, Baashuus, Jessen, Seymour, Marcq, Jaroslaw, Krizenecky, Peters, Van Damme and by many American investigators, who have gone carefully into the available information and figures. It would seem desirable that these herd books should be kept on an international system, so that the information given with regard to individual animals should be as complete and recorded as much on the same lines as possible.

A close study of the Mendelian theories has decisively proved that a hereditary disposition towards most of the different morphological and physiological qualities remains an independent factor in the development and that, by a fixed law, the new hereditary attributes introduced by a cross undergo in the following generation a sort of segregation. This leads to a conclusion which is very important from the point of view of animal breeding; *i.e.*, the theoretical possibility of a systematic combination of characteristics and qualities formerly diffused among different races and different hereditary types. We realise, in short, the possibility and even the most practicable method of creating by means of crosses, new hereditary types, and even new races.

It has also been proved that the method of reproduction by in-breeding, leads automatically to the increase of hereditary predisposition and that it results in the definite fixing of the desired strain. The undesirable consequences of in-breeding which show themselves particularly in the new bovine races, and in those in which it has not formerly been practised, may be immediately neutralised by the introduction of an out-cross. With regard to the various tables or notations employed to determine the intensity of the in-breeding, Wright's coefficient of reproduction is probably the best, since it shows the exact stage of in-breeding reached.

Feeding.—The researches of Fjord, Hansson, Nills, Fingerling, J. Wilson, Barron Morrison, etc., have made it possible to compare in detail the different systems of estimation from the point of view of production, of the various constituents of a given ration. The Scandinavian unit of nutrition, the starch equivalent of Kellner and Armsby's therms, must all be taken into consideration in any attempt to arrive at the essential nutritive value of a food-stuff. It has been proved that the productive value of a ration does not depend only on the animal and on the kind of production required, but also on the amount of assimilable protein, minerals and vitamines which the food contains. It is also influenced by the dietetic action of the particular blend, its flavour, its composition and by the quantity of the daily ration, as compared with the amount normally necessary to support life. The figures into which the intrinsic value for ration are translated are thus merely mean figures, which show the relative value, taking into account the kind of production that is required.

The discovery made by C. Eykmann and A. G. Voderman of the connection between the composition of decorticated rice and multiple neuritis in poultry and that between the composition of decorticated rice and beri-beri; that of Axel, Holst and Fröhlich with regard to the connection between scurvy and the diet; that made by Hopkins, McCollum, Wendel and Osborne concerning fat and water soluble factors (vitamines); the work of Hart, Mueller, Zilva, Golding, Drummond, Steenbock, Eckles, etc., on indispensable growth factors; and, finally, the discovery (to which the Germans Zuntz, Voeltz, Morgen, Windheuser and Ohlmer materially contributed) that the amino-acids derived from albuminoids are not interchangeable, have contributed to a new and important chapter in the science of dietetics.

New facts have also been brought to light with regard to the value and the effects of mineral substances, especially with regard to the metabolism of calcium. This latter discovery is due to the work of Browning, Forbes, Eckles, Meigs, Carry, Hart, Steenbock and Humphrey. This fresh information has directed attention to what are known as deficiency diseases. They have received much attention and can now be successfully dealt with. There should also be noted the progress made in the study of the food values of the various forage plants, the increase of knowledge with regard to the economic and physiological value of ensilage, and the question of electrified ensilage which has been specially studied in Germany by Kinzel, Kuckler, Schieblich, Schweizer, Mueller, etc.

Diseases.—Many diseases have been studied and important progress made towards their prevention and cure. Deserving of special mention are the researches of Theiler on trypanosomes, and sarcoptes, coccidiosis and diseases transmitted by ticks, those of F. S. Jones, J. Nathan, Frost, Nocard, Guillebeau, Savage, Smith and Brown, on diseases of the udder and their transmission by milking machines.

In the struggle against bovine tuberculosis in particular, important progress has been made almost everywhere, and especially in the United States. It has been proved that by means of public or private tuberculin tests (temperature tests, cuticle tests, eye tests, eyelid tests and intradermal tests) together with the isolation and slaughter of reacting animals and the disinfection of cowhouses, bovine tuberculosis can be slowly but surely conquered.

Mention should be made of a new method of treatment which has been studied for several years, galacto-therapy, or treatment by the milk itself, subcutaneously injected. It has been tried in numerous diseases, such as wasting fevers of cattle and pigs, gangrenous coryza, mammary affections, actinomyiosis or wooden tongue, and arthritis in foals. The injection is preferably made into muscular tissue, and the dose varies according to the species of the animal. It seems probable that its action is due to the fact that it introduces a foreign protein, which raises the proportion of disease-resisting elements, increases the number of leucocytes, and produces an important modification in the general internal economy. This new departure opens a fresh chapter in veterinary practice and in that department of medicine entitled colloidaltherapy (Dr. Windel and pupils).

Dairy Bacteriology and Biology are the two sciences which have most recently come to the assistance of the dairy industry. Their practical application is inseparable. The work of Gorini, Harthel, Burri, Orla Jensen and others has shed further light on the mammary microflora, their location in the parenchyma, their particular type, their qualitative and quantitative properties, their parasitic nature and their importance from the point of view of cheese making. There should also be mentioned the work of Orla Jensen on the systematic classification of the bacteria-producing lactic acid, that of F. S. Rettger, on the same organisms in relation to the type *Bacillus acidophilus*, the remarkable progress made as a result of the use of pure cultures in the manufacture of cheese, fermented milk, butter, etc., the work of Gorini on the regulation of the fermenting processes in cheese, and the influence of the lactic acid-forming bacteria on its ripening.

In conclusion, we must refer to the evolution of scientific knowledge concerning refrigeration, sterilisation, pasteurisation, the preservation of milk by concentration and by a drying process, the work of lactic ferments, mycoderms and oidiums, both in fresh milk and during the cheese-ripening process, and affections of milk, butter and cheese.

Physiology.—In this section of dairy science, important progress has also been made, by the work of Porcher, Terroine, W. H. Jordan, F. D. Fuller, C. H. Eckles, Isaachsen and many others on the physiology of milk secretion and the mammary gland. Lesne, Vagliano, Stepp, McCollum, Osborne and Mendel have inquired into the vitamine content of milk. They have shown that the mammary gland has not the power to compose vitamines synthetically but extracts those contained by the feeding stuffs provided for the animal, and that the food given has a great effect on the composition of the milk from this point of view. They have also demonstrated the properties of vitamines, the amount of their resistance to heat, to outside air, to light, to long keeping and the value from the point of view of vitamine-content of boiled, sterilised, pasteurised, condensed, dried and homogeneous milk. Researches into the varieties in the quality of dried milk and into the fat content of milk have, in various ways, afforded new and valuable data for the students of dairying technique. *See* AGRICULTURE; FARM.

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DALCROZE, JAQUES: *see* JAQUES-DALCROZE, ÉMILE.

DALEN, GUSTAF (1869–), Swedish inventor, was born at Stenstorp Nov. 30 1869. After passing his examination as an engineer at Göteborg in 1896 he completed his studies at Zürich. On his return home he invented hot-air turbines, milking and other machines. In 1906 he became chief engineer to the Gas Accumulator Co., which was exploiting in Sweden the French invention of dissolved acetylene. In 1909 he was appointed managing director of this company and then succeeded in composing a product called "Agamassan" which has the property of absorbing acetylene without any danger of explosion. Dalen's cleverest invention was what is called Solventil, which when placed in a fire kindles it automatically when twilight sets in and extinguishes it at daybreak. By a further series of inventions he perfected his discovery of "Agamassan" and in 1912 was awarded the Nobel Prize for physics. During an experiment in 1913 he became blind in consequence of an explosion, but nevertheless he continued to conduct his experiments.

DALLAS, Tex., U.S.A. (*see* 7.769), grew to a population of 158,976 in 1920, of whom 24,023 were negroes and 8,801 foreign born; in 1925 the estimate of the Census Bureau gave 194,450, to which the suburbs within a six-mile radius would add about 50,000. The area increased from 16 sq. m. in 1910 to 23 sq. m. in 1920, and 26 sq. m. in 1925. With the completion of Lake Dallas, a reservoir covering 10,444 ac. which will impound 63,000,000,000 gal., Dallas will have a water supply sufficient for a city of 1,000,000 inhabitants. Beginning about 1915, natural gas was available from Oklahoma and Northern Texas. A Union station was opened in 1916. In addition to 10 trunk lines and several local steam railways, there were (1925) six electric inter-urban lines, operating 258 trains a day over 352 m. of track. By 1925 business had again reached the war-time level, and the city was taking on a metropolitan appearance from its new buildings. The annual value of the jobbing business was about $700,000,000 compared with $125,000,000 in 1910. The value of the factory products was $26,959,000 in 1909; $93,650,000 in 1919; $92,188,697 in 1923. The joint "chest" of the non-sectarian philanthropic agencies amounted in 1925 to $458,421. Southern Methodist University, established in 1915, had by 1925 reached an enrolment of over 2,000. Dallas is the seat of a Federal Reserve Bank.

DALMATIA (*see* 7.772), since 1918 a province of Yugoslavia. Its area is 4,662 sq. m. and the population (1921) 621,429.

Dalmatia under Austrian Rule.—Since 1903 there had been a very marked growth in the national sentiment in Dalmatia. The Dalmatian Croat leaders, Trumbić, Supilo and Smodlaka played the leading part in bringing about the resolution of Fiume (Oct. 4 1905)—that *rapprochement* between Croat and Serb which all the efforts of Budapest and Vienna failed to destroy. With the coming of universal suffrage for the Austrian Reichsrat (1907) the Dalmatian deputies became more vocal in Vienna, allied themselves with the Slovenes and Czechs, and by constant interpellations drew attention to the scandalous conditions in Croatia under Rauch, Tomašić and Cuvaj (*see* CROATIA). The Italian deputies from Dalmatia also joined in protesting against the Zagreb treason trial. The improved relations between Slavs and Italians were illustrated by the former's appeal to Vienna for the recognition in Austria of degrees taken by Dalmatians at Italian universities.

During the same period publicity was thrown upon the neglected economic and social conditions of Dalmatia, which, owing to the political jealousies between Budapest and Vienna, remained without any railway connections with the north. The province was very inadequately supplied with primary schools, and had been seriously injured in its fishing and wine trade by Vienna's customs concessions to Italy. Poverty and isolation produced a high rate of emigration, and though the population only amounted to 635,000 in 1910, no fewer than 67,000 persons had left the province in the preceding 30 years, going mainly to Chile, Argentina, California and New Zealand. In 1902 and 1907 the Austrian Govt., under Christian Socialist influence, made special grants in aid of Dalmatian industry and education; but the root of the evil was hardly touched, and it was not till the Balkan War transformed the whole situation that the Austro-Hungarian general staff, for strategic reasons, insisted upon a railway connecting the main Zagreb-Fiume line through the Luka to Knin and Spalato (Spljet). This line was, however, only opened to traffic in 1925.

In 1912 Dalmatia was the scene of lively demonstrations in favour of the Balkan allies, and the Austrian authorities resorted to drastic press confiscations, and dissolved the municipalities of Spalato and Sebenico (Šibenik). This led to a monster meeting of protest in Zara, attended by almost all the deputies and delegates from the municipalities, when the Clerical leader, Dr. Drinković, openly declared that "in the Balkan sun we see the dawn of our day." By 1914 the tension was hardly less in Dalmatia than in Croatia and Bosnia, while there was still greater unanimity in favour of the Yugoslav ideal.

On the outbreak of the World War the leading Yugoslav intellectuals of Dalmatia (*e.g.*, the deputies Smodlaka, Čingrija, Tresić, Drinković and many priests, advocates and doctors) were arrested and interned, some being even used as hostages and forced to accompany railway patrols, under the threat of instant death in case of sabotage by the population. All the municipal councils in Dalmatia (with the solitary exception of Zara, which had an Italian majority) were dissolved at an early stage in the War. Political life came to an absolute standstill, but in the winter of 1917–8 an underground revolutionary movement steadily gained strength.

Incorporation in Yugoslavia.—On Feb. 1 1918 a mutiny placed the fleet and most of the strategic points in the Bocche di Cattaro for three days at the mercy of a revolutionary committee. The leader, Antun Sesan, flew over to Italy for help, but was held in arrest, and Austrian ships from Pola were able to suppress the movement. Early in Oct., however, a still more widely organised plot was prepared, and its spokesmen, the Czech Štěpánek and the Croat Giunio, crossed the Adriatic in a sailing boat with instructions to communicate with Marshal Foch and arrange with him the date for an insurrection. Had not they in their turn been held in custody for over three weeks by the Italians, and debarred from all intercourse with the Czech and Yugoslav national committees, the Allied fleets might have been in control of Dalmatia a fortnight before the Italian offensive was actually launched, and events might have taken a very different turn. At the close of Oct. a national committee was formed in Spalato which recognised the supreme authority of the Yugoslav national council in Zagreb, but made itself responsible for local order in the province and disarmed the Austrian and Hungarian troops as they retired northwards from the Albanian front. A very dangerous situation arose when Italian naval forces occupied northern Dalmatia and the islands, and some of D'Annunzio's followers tried to execute a raid upon Trogir (Traù) and Spalato. A conflict was averted very largely by the tact of the American admiral. By the Treaty of Rapallo between Italy and Yugoslavia (Nov. 12 1920) the whole of Dalmatia was assigned to the latter, save for the capital, Zara, and a small enclave round it. Under the new centralist constitution of 1921 the provincial autonomy was abolished. (*See* YUGOSLAVIA.) (R. W. S.-W.)

DAMASCUS (*see* 7.784).—Prior to the World War, Damascus was the headquarters of the IV. Turkish Army, and after the outbreak of hostilities became the base of the Turkish and German forces operating in Palestine and on the east bank of the Suez Canal under General Liman von Sanders. On Oct. 1 1918 the city fell into the hands of the Egyptian Expeditionary Force under Lord Allenby and the Arab troops of the Emir Feisal. The advance on Damascus was a purely cavalry operation, and at the city itself no resistance was made to the British and Arab troops. By Sept. 30 the Australians had worked round the north; the desert column was lying to the west; and the Arab force was at the southern outskirts of the city. Most of the Germans and Turks, after severe quarrelling, had already left.

During the night of Sept. 30 troops of the Australian Mounted Division and the advanced guard of Feisal's force had made their way into the city, and both claimed to be the first to set foot in Damascus. The formal entry was made at 6 A.M. on Oct. 1 when a British detachment and part of the Arab army marched through the streets. About 7,000 Turks surrendered to the Allied forces. On Oct. 3 Feisal made his official entry into Damascus, and this he did, according to ancient custom, by riding furiously through the streets with a large number of kinsmen, to the accompaniment of a *feu de joie* and the piercing shouts of the Arab population. After the formal occupation the Allied troops were withdrawn and an Arab administration under Feisal was set up. Sukry Pasha El Ayyubi, senior descendant of Saladin, was appointed head of the administration of the city.

Feisal and the French.—When in Nov. 1919 General Gouraud was nominated French high commissioner for Syria, the Feisal régime in Damascus was strongly antagonistic to the French and productive of much disorder. Raiding and pillaging were encouraged and public money was misappropriated. Finally, on March 7 1920, Feisal was elected King of Syria by a so-called General Syrian Congress, while the material opposition to French influence increased and the Arab army steadily grew in numbers. Eventually matters became so serious that in July 1920 General Gouraud had to issue an ultimatum. Feisal delayed his reply and questioned the terms, while an Arab detachment attacked one of the advanced French posts, with the result that a French force took up its position at 'Ain el Jedcida, on the road from Beirūt to Damascus, two days before the delivery of Feisal's reply. As Feisal still refused to accept certain conditions, the French force advanced and, after a fierce combat at Khan Meizalun with some 20,000 Arabs, entered Damascus. Feisal with his chief councillors took to flight.

On June 20 1921, the Syrian Confederation, consisting of the states of Aleppo, Damascus and the Alaoulites, was proclaimed at Damascus and, in order to preserve an equal balance between the north and the south, the city had to share the capital honours with Aleppo. This was superseded later by the establishment of one capital at Damascus, and in 1925, at the wish of the inhabitants, Damascus became the capital of the Syrian State, comprising the two districts of Damascus and Aleppo under a president with a French adviser as High Commissioner's delegate. On April 8 and 9 1925, the visit of Lord Balfour to Damascus was the occasion of considerable rioting, nominally as a protest against the Zionist declaration bearing his name, but more generally recognised as a demonstration of anti-French feeling.

The Druses.—When the Druse rebellion (*see* Druses) broke out in July 1925, Damascus played an important part as the French advanced base and as the key to the general situation in Syria. The Damascenes were sympathetic to the Druses and, their discontent being aggravated by an exceptionally bad harvest, a general rising was feared with serious consequences in other Syrian towns. Two attempts were made by the Druses to effect a Damascene rising by attacks on the city. The first was a complete failure, but the second attack of Oct. 18 was a great deal more serious. Bands of Druses entered Damascus from the south and, receiving the support of the lower elements of the population, overran certain quarters, looting and pillaging as they went. Most of the inhabitants, however, disappointed at the small numbers of the Druses, failed to take any decisive action. French troops were sent into the streets to repel the insurgents, but, as the situation became more serious, the French troops were withdrawn and the order was given to bombard the affected areas. The bombardment lasted until Oct. 20, and great damage was done, including partial destruction of the Palais Azm, recognised as the most beautiful building in the city.

This action of General Sarrail, the French High Commissioner, was severely criticised, and he incurred well-merited censure for permitting the situation in Damascus to become such that a bombardment was a military necessity, and for carrying out such a drastic measure without issuing either an ultimatum to the inhabitants or notices to the foreign consuls. General Sarrail was recalled to France in Nov. of the same year. His dismissal, however, brought no peace to Damascus. Fighting continued around the city, a section of which suffered further bombardment on May 7 1926. *See* Syria. (E. W. P. N.)

DAMROSCH, WALTER JOHANNES (1862–), American musician and conductor, was born at Breslau, Germany, Jan. 30 1862. He went to America in 1871 and ten years later began his career as conductor in Newark, New Jersey. On the death of his father in 1885, he was appointed conductor of the Metropolitan Opera House, the New York Symphony Society and the Oratorio Society. In 1894 he founded the Damrosch Opera Company for producing Wagner and in 1896 produced Wagner's *Parsifal* in concert form for the first time in the United States. In 1903 he was appointed director of the New York Symphony Orchestra. He is the composer of *The Scarlet Letter* (1894); *Cyrano* (1913); and music for Euripides' *Medea, Iphigenia in Aulis* (Berkeley, 1915) and Sophocles' *Electra* (1917). In 1918, at the request of Gen. Pershing, he reorganised the bands of the American Expeditionary Force. He wrote an autobiography, *My Musical Life* (1923).

His brother, Frank Heino Damrosch, was born at Breslau, June 22 1859. He was conductor in Denver, Newark, Bridgeport and New York (the Oratorio Society, 1898–1912). From 1905 he was director of the Institute of Musical Art, New York City.

DAMS (*see* 14.801).—Until quite recent times the great majority of dams were constructed for the purpose of storing water to ensure regular supplies to communities for domestic purposes. The storage required to give a regulated supply and to utilise the water resources of large areas for hydroelectric power supply and irrigation on a large scale, in countries having the requisite conditions and resources, is in many cases enormously greater than that required for water supply to the largest towns. Hence, the developments of large dam structures in recent years have been extensive.

Earth Dams.—Earth dams are largely used on account of their permanence and cheapness and convenience of construction where suitable material is available at the site. Recent developments relate to the method of forming the watertight core. The puddle core has been largely abandoned, even where suitable material is procurable, on account of the long time required for its proper construction. A thin watertight core wall of reinforced concrete finds more common use now as being practicable for most sites and quicker to construct than a puddle wall.

The trend of development in America for the construction of large earth dams is towards the attainment of watertightness by the formation of a wide hearting of fine material bound with fine clay and silt separated and washed into the centre by hydraulic sluicing from the earth as dumped in banks along the upper and lower sides of the dam. Fig. 1 shows a cross section of the David Bridge dam in Vermont,[1] 200 ft. high, with an earthworks volume of 1,900,000 cu. yd., which was constructed in less than two years by this method. The upstream and downstream banks were formed by side-tipping from standard tracks working towards the centre. Between the banks there was formed, to the width of the hearting, a central pool of water, in which floating craft with high pressure pumps and monitor nozzles operated to sluice material from the inner faces of the banks down into the pond. The outer and inner banks were raised in stages as required, partly by the use of trestles and partly by the use of a dragline, which formed, from the material already tipped, a raised bank to carry the track for the tipping of the next stage.

Rock-fill Dams.—A rock-fill dam depends for its stability on an embankment of tipped rock material and for its watertightness on a skin of concrete or reinforced concrete laid on the hand-built waterface and carried down in the form of a vertical cut-off wall to an impervious stratum. Lack of suitable earth material and excessive cost of concrete necessitate consideration of the rock-fill type of dam. The embankment is usually formed with rock of all sizes as blasted from the quarry, the outer face being roughly built to a plain surface with large blocks and the inner face more carefully and solidly built to a uniform surface and formed with grooves or keyways to furnish a grip for the concrete. For important dams, special drainage arrangements are made for catching up at the back of the skin any water which may percolate through it, and leading it by special drains through to the downstream side so as to obviate risk of scour under the dam. The water face is made steep (1:1 or steeper) to minimise the quantity of skin concrete, the outer face being generally somewhat flatter, about 4:3.

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[1] *Engineering News Record* (Feb. 27 1924).

The largest dam of this type yet constructed is the Dix River dam in Kentucky, U.S.A., built 1923–5.[1] This has a height of 275 ft. and a volume of rock-fill of 1,747,000 cu. yards. The upstream slope varies from 1:1 at the top to 1·2:1 at the bottom. Downstream, the slopes are 1:1 at top and 1·4:1 at the bottom. A thick layer on the upstream face was hand-built with large stones, while the rest of the material was side-tipped from wagons. The watertight skin of reinforced concrete varies in thickness from 8 in. at the top to 18 in. at the bottom.

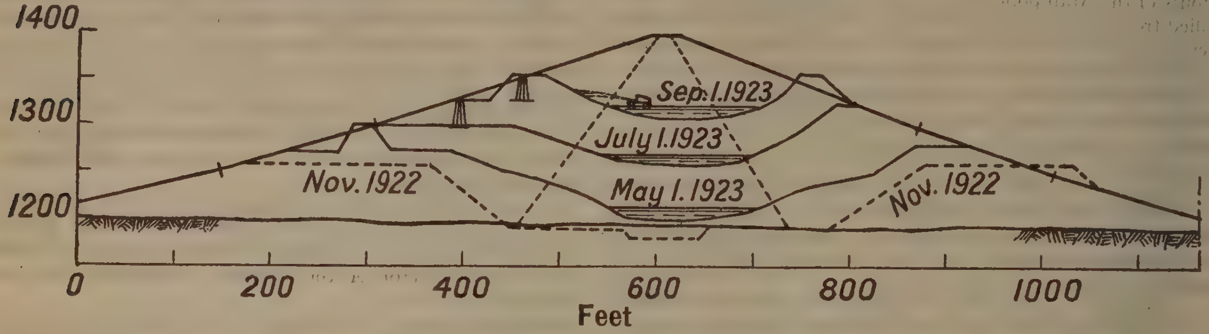

Fig. 1.—Cross section of the Davis Bridge Dam.

Gravity Concrete Dams.—The tendency in gravity dams is to use the simple triangular form for even the highest dam and to use concrete to the exclusion of masonry. The triangular form gives a uniform stability condition at any horizontal section, and the maximum stresses in the material are directly proportional to the depth below T.W.L. Assuming a usual inclination of the waterface, say 1:20, and concrete of normal density, the necessary inclination of the outer face will depend on the amount of upward water pressure on the base. If by means of effective drainage arrangements upward pressure is eliminated, an outer slope of about 0·65:1 will suffice. If the conditions require an allowance of upward water pressure on the base varying from the full head at the inner face to zero at the outer face, the outer slope will require to be about 0·80:1. If, in addition, it is necessary to allow for heavy ice pressure at the top of the wall, still greater slope, up to 0·85:1, will be required. These dimensions ensure that the resultant will pass within the middle third, so that there will be no tension on the concrete, and the maximum pressures at inner and outer toes when the slope is 0·80:1 will be slightly less than that produced by a column of concrete the same height as the wall. If, therefore, the compressive stress limit is put at the moderate value of 400 lb. per sq. in. the practicable height of the triangular gravity dam will be over 400 ft. (since 1 ft. depth of concrete produces a stress of about 1 lb. per square inch).

Sound construction requires a rich concrete mixture next the waterface and on the bottom to ensure watertightness and also in the regions of maximum stress at the inner and outer edges near the base in the case of high dams. The proportion of cement to mixed aggregate may vary from 4 cwt. per cu. yd. for the body of the dam to 5 cwt. or more for the places of maximum water pressure and stress.

The Barberine dam in Switzerland, completed 1925, and shown in cross section in fig. 2, illustrates the application of the triangular form, together with excellent arrangements for sealing the base by cementation through drill holes, and for providing for expansion and shrinkage in the upper part. The dam is of concrete with mixtures varying from 250 to 300 kgm. of cement per cu. metre, is without drainage arrangements and is designed for water uplift on the base varying from full-head at the inside to zero at the outside. The slope of the waterface is 1:20 and of the outer face 0·80:1. The cross section also indicates the masonry facing of gneiss applied on the outer slope, which has a southern exposure and is subject to severe temperature variations.

Horizontal Arch Dam.—The horizontal arch dam is suitable only for narrow gorges with sound rock at the sides to resist the great thrust from the abutments. The water pressure at any horizontal plane being constant, the appropriate arch form at that plane will be a segment of a cylinder of uniform thickness. If the radius of the extrados is constant at all depths the arch thickness required will be directly proportional to the depth of water. The vertical section will then be of triangular form, and if the waterface is vertical the angle of the outer slope will vary with the radius and the working compressive stress in accordance with the formula:—

$$\tan\alpha = \frac{0{\cdot}43r}{c}$$

where r = radius of extrados in feet.
c = average compressive stress in lb. per square inch.

The value of c for actual dams is usually between 200 and 400 lb. per sq. in., and should depend on the quality of concrete used. It should be noted that with c = 300 and r = 450, tan α will be = 0·65, which is the slope for the minimum gravity wall. As an arch dam is necessarily longer than a gravity dam for the same site, it follows that a radius of 400 ft. is near the upper limit of the field for installation of arch dams. The greatest economy of material can be shown to occur in a horizontal arch of given span when it subtends an angle of 133° at its centre. If the radius is constant and the gorge has flaring sides the arch angle will be variable and maximum economy of material will not be attained. Jorgensen's so-called constant angle

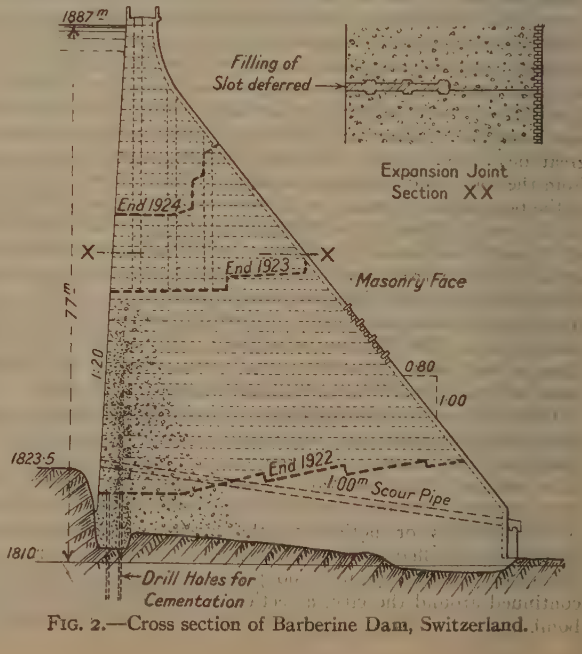

Fig. 2.—Cross section of Barberine Dam, Switzerland.

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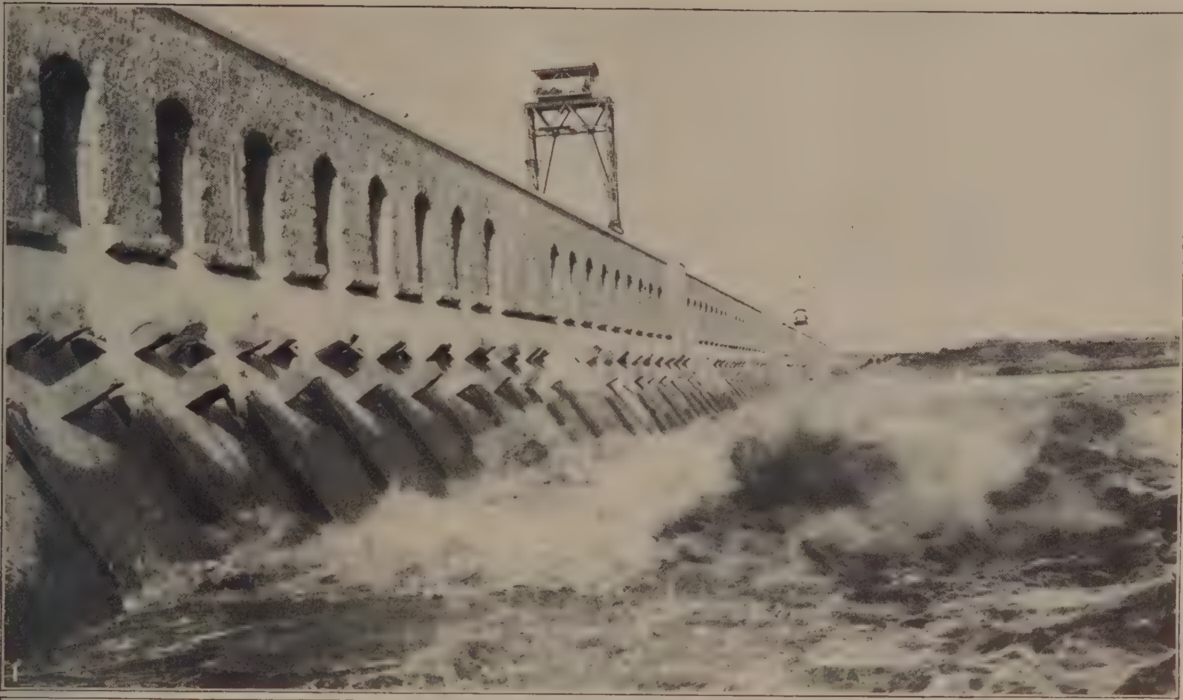
[1] *Engineering News Record* (April 2 1925).



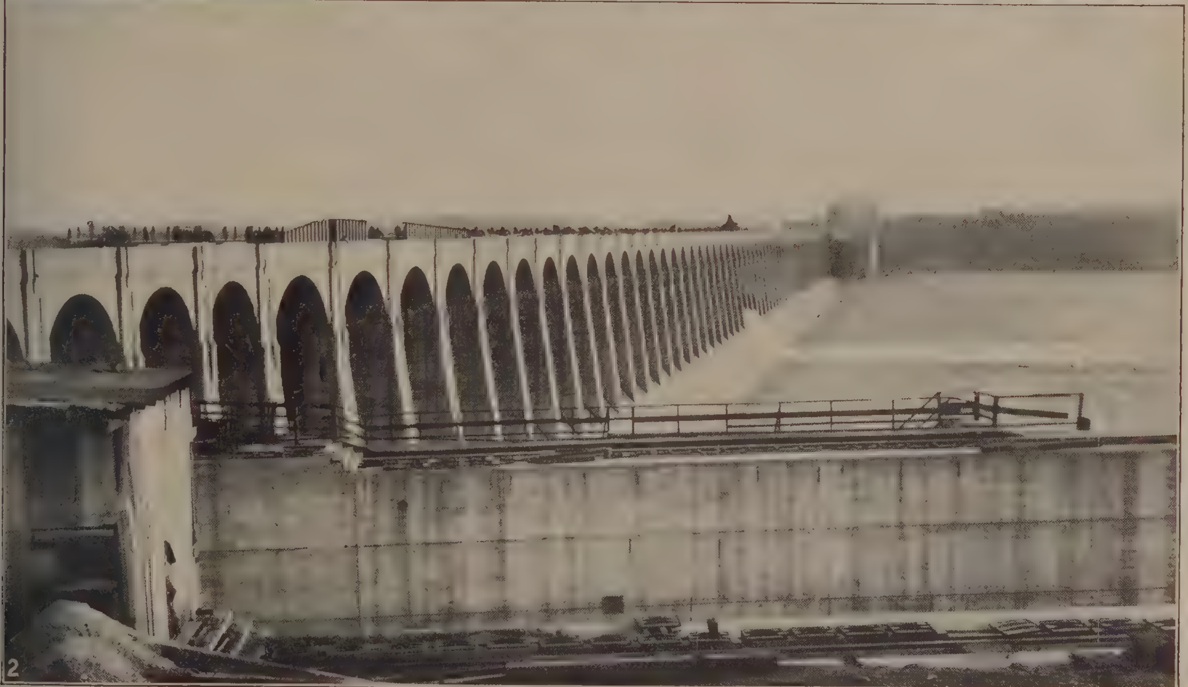


FIG. 1. SENNAR (OR MAKWAR) DAM ON THE BLUE NILE, SUDAN

The photograph presents a view of the dam from the east. The dam, designed as the principal unit of the Gezira Irrigation scheme, is composed of rubble masonry in mortar, continued on each side by earth embankments with heavy concrete facing walls, the total length of the entire structure being 9,925 feet. The height from the lowest point in the foundation to the top of the parapet is 130 ft., and it contains about 556,000 cu. yd. of masonry.

(*Photo by Central Press.*)

FIG. 2. WILSON DAM ON THE TENNESSEE RIVER, U.S.A.

The photograph presents a view of the dam from the north bank. The dam is a monolithic concrete structure, 4,500 ft. in length, 95 ft. high from river bed to crest, 140 ft. high from foundation to the level of the operating bridge, and 105 ft. thick at the base. It is the largest masonry dam in the world, containing about 1,353,000 cu. yd. of masonry.

type of arch dam has been introduced in recent years to economise in concrete, and results in variable radius of arch and warped curved surfaces of less satisfactory appearance than the cylindrical and conical surfaces of the constant radius dam.

The Salmon Creek dam in Alaska is an example of the constant angle arch type. It has a height of 168 ft., a maximum radius at the top of 332 ft. and a thickness varying irregularly from 6 ft. at the top, to 48 ft. at the bottom. An arch dam with a height of 444 ft. and a bottom thickness of 57 ft. is projected for the narrow gorge of the Drac at Sautet, France, by the Société des Forces Motrices Bonne et Drac.

Multiple Buttress Dams.—In multiple buttress dams the water load may be supported and transferred to the buttresses either by reinforced flat slabs or by arches. With flat slab construction a spillway section can readily be formed by providing flat slabs also on the outer face, formed to a suitable spillway curve. The Junction Brook main dam of the Newfoundland Power and Paper Company is of this type and carries a single line railway. The buttresses, spaced at 18 ft. centres, are of plain concrete from 16 in. to 44 in. thick. The slabs vary from 16 in. to 47 in. in thickness and are heavily reinforced as simple beams to support the water pressure. Flat slabs form an uneconomical type of construction for support of heavy water pressures as compared with arches and entail a multiplicity of buttresses with close spacing, the practicable maximum being about 20 feet.

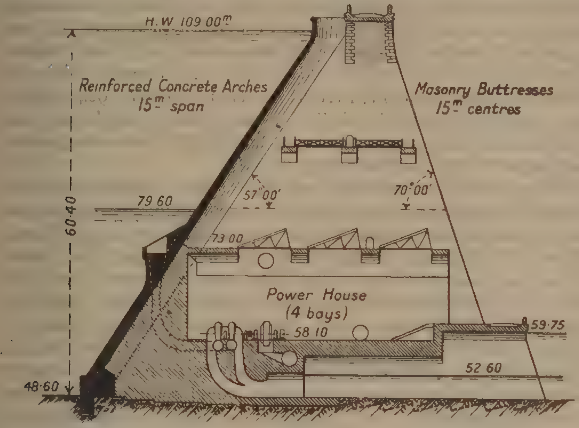


FIG. 3.—Cross section of the Tirso dam, Sardinia.

In multiple arch dams the buttress spacing may be from 15 to 60 ft., depending on the general height of the dam. The highest multiple arch dam yet constructed is the Tirso dam in Sardinia,[1] a cross section of which is shown in fig. 3. The buttresses, spaced at 50 ft., centres, are of masonry with courses sloped at the outer face to suit the direction of maximum pressure, and are designed to be independently stable and safe under the maximum loadings transmitted to them by the arches. The arches are of concrete, nearly semi-circular, lightly reinforced for temperature and shortening stresses, and have a thickness varying from 20 in. at top to 5½ ft. at bottom.

The dam provides storage for the triple purposes of power production, irrigation and river regulation, the power house being worked into the spaces between the buttresses.

Except in Italy, where masons are plentiful, the buttresses are generally formed in concrete or reinforced concrete, and the arches are made monolithic with the buttresses, so that the whole structure may be reckoned on for stability. The slope line of the arches usually makes an angle with the horizontal of between 45° and 60°, the outer face of the buttresses being considerably steeper. Proportions are generally so arranged that the maximum resultant pressure cuts the base of the buttresses nearer the middle than the one-third point, so that increased stability is obtained as compared with a gravity dam. Another satisfactory feature is the entire avoidance of water uplift on the bases. When properly designed, this type shows marked economy of material, the volume being only about one-fourth of that of a gravity dam and the possible saving in cost from 30 to 50%.

River Dams.—Special circumstances arise in regard to dams on large rivers, where it becomes necessary to control the flood and backing-up height above the dam, and especially where the wet season flow of a river carrying much silt has to be stored to give regulated supply during the dry season. For such cases, movable openings are necessary on a scale commensurate with the flood conditions, a series of large rectangular steel gates of Stoney roller type operated by machinery being most commonly used. Automatic gates operated by the rise of the water are also used to some extent, but for the extreme case where the barrage must not be allowed to become a trap for large volumes of silt brought down during high floods, a continuous series of gates is used, extending from bank to bank and having their sills at the level of the river bed. The gates are separated by piers, usually of concrete, which must be designed to support the maximum water load from a panel of the barrage, as well as the erections and machinery for handling the gates. The Vaal River barrage[2] is an interesting example of this type of dam. (*See* HYDROELECTRIC ENGINEERING.)

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(J. WI.)

DANCING (*see* 7.794).—The years 1910–26 saw a remarkable revival of the love of all kinds of dancing in England and America. On the one hand the organisation popularly known as the Russian Ballet has put new life into stage dancing, while on the other the Americans are responsible for a reawakening of the love of dancing in the ballroom. The present article treats only of the latter. For the revolution in stage dancing. (*See* BALLET.)

The American Dances.—The only dance that has survived the American invasion is the valse, but even this has altered so much in style that it now bears very little resemblance to the dance immortalised by Edward and Johann Strauss. The original tempo of the valse was a slow three-four (very much the same as in 1926), but the tendency of ballroom orchestras to quicken the tempo came into play as the 19th century drew to a finish, until by the year 1904 it had become so rapid that dancing a valse proved altogether too fatiguing an affair. Various expedients were devised to overcome this difficulty—the most important of which was the "Boston," danced in a slower cross-rhythm and less tiring in consequence. The valse continued to dominate the English ballroom until the arrival of the American dances in 1912. The new dances, which were of negro origin, were of a "two-four" rhythm, and this change of time from the valse and the attractive lilt of the American dance bands immediately captivated the upper-class ballrooms. Their popularity increased year by year until every class in England had its own rendezvous for dancing. Hotels which owned ballrooms, disused for many years save for public dinners, opened them again for dancing; large dancing halls sprang up all over England, and the success of the new dances was intensified by the sale of gramophone records and by broadcasting. They have undergone various changes since their introduction into Europe—there were successively the two-step, one-step and fox-trot—the first two of these were more lively in rhythm than the last. The valse has continued through the enthusiasm for the American dances and has reverted to its original slow tempo.

The music used in the American dances is not the traditional dance band of strings and piano, but a "jazz" band. This consists of various combinations, the most common of which perhaps is—piano, violin, alto or tenor saxophone, banjo and trap drum. This last-named needs some explanation. The drummer uses a side drum, a big drum and cymbals played with the feet, and various other instruments on which he beats a tattoo with his drum-sticks in alternation with the side drum. He is in fact a sort of one-man band in himself and adds considerably to the rhythm of the ensemble. There is as much variety in the method of playing dance music to-day as in the dances themselves.

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[1] *Engineering* (Nov. 7 1924).

[2] *Engineer* (Dec. 1 1922).

Dance bands therefore vary considerably in skill, as might be expected, and the best known command very high salaries. The skill of a modern dance band lies in two essentials: first, good rhythm; and secondly, cleverness in extemporising variations on the tune by the different executors.

Future of Ballroom Dancing.—With regard to the future of ballroom dancing one may perceive signs of the time becoming ripe for change. The tendency of dance orchestras to quicken the tempo is being felt to a small degree, and it is significant that there is an attempt to popularise a slower dance as a relief from what are now the very quick American fox-trots. This dance is the Argentine tango, and is not to be confused with the Spanish tango, which is a solo dance for a woman.

The present-day standard of dancing in Great Britain is, in all probability, higher than it has ever been, and dancing is as popular and widespread as it was in the days of Elizabeth, when the English were known abroad as the "dancing English." In 1925 there arose an entirely new type of ballroom dancing, known as the Charleston. Negroid in origin, its peculiar and strenuous steps aroused some misgivings on the part of the medical profession as to the danger to the body caused by the excessive strain on the muscles subjected to constant distortion. Public endurance contests were often the scene of complete breakdown on the part of the participants, sometimes with permanent injury. The Charleston was taken up to some extent in England, but the dance was too ungracefully violent to remain popular either there or in the U.S. for very long, and in 1926 was already dying out. (G. T.*)

D'ANCONA, ALESSANDRO (1835–1914), Italian man of letters (*see* 1.951), died at Florence Nov. 6 1914.

DANIELS, JOSEPHUS (1862–), American editor and politician, was born at Washington, N.C., May 18 1862. He studied at the Wilson (N.C.) Institute and University of North Carolina, and at the age of 18 became editor of *The Wilson Advance.* He was admitted to the bar in 1885, but preferred newspaper work, becoming in that year editor of the Raleigh *State Chronicle.* He was printer for the state of North Carolina from 1887 to 1893; and then, for two years, was chief clerk of the Department of the Interior. From 1904 he was editor of the Raleigh *News and Observer*, with which his former paper was consolidated. He was on two occasions a delegate to the National Democratic Convention, and from 1896 to 1916 was a member of the Democratic National Executive Committee. In 1913 he was appointed Secretary of the Navy by President Wilson. His personal interest in the enlisted men was shown by his provision of opportunities for training in various trades. On retiring from this office in 1921 he resumed the editorship of his newspaper. He was the author of *The Navy and the Nation* (1919) and *Our Navy at War* (1922).

DANISH LITERATURE (*see* 8.39).—Denmark, though fortunately not directly involved in the World War, inevitably felt, as did other countries, the effects of the War and all it meant. There was first a period of excitement and enhanced vitality, degenerating at times into coarse indulgence; then a collapse of old and established ideas under the pressure of military, political and social disasters; and finally an attempt at re-orientation towards the problems of existence. This last was apparent, partly in ardent devotion to spiritual and religious questions, and again in a cold and clear appreciation of human and material possibilities. Intellectual life (which in Denmark is by no means confined to the social "upper" classes) exhibits a forceful upward tendency in almost every sphere.

The Novel.—It is in this branch of literature that the movement is most clearly apparent. Jakob Knudsen (d.1917: coll. works 1917) in a series of novels, of which *Rodfaestet* (1911) and *Angst og Mod* (1912–4) belong to this period, writes with deep feeling of human lives upborne by religious and ethical values. His characters are chiefly taken from the Grundtvigian homesteads of the agricultural districts. Johan Skjoldborg (coll. works 1911 and 1921) and Jeppe Aakjaer (coll. works 1918–9) choose for their heroes a somewhat more modern type of peasant and smallholder. Thorkild Gravlund, again, takes up the conservative tendency found in Jakob Knudsen, but with more stress on the social-psychological aspect of the locality (*Nilavs*, 1915–8; *Herredet*, 1919). . . has also written purely scientific studies of folk psychology such as *Dansk-Folkekarakter*, 1–3 (1920). Among books dealing with peasant life, the works of Marie Bregendahl must also be mentioned. The monumental work of Martin Anderson Nexö introduces a new class, that of the proletariat (*Pelle Erobreren*, 1906–10; *Dette Menneskebarn*, 1917, *et seq.*).

The social novel on a large scale is represented by Henrik Pontoppidan (Nobel Prize, 1917), who adds to his previous novel sequences a new one, *De Dödes Rige* (1912–6), giving a general view of Denmark as it was before the War. Middle-class society in Copenhagen is dealt with by Poul Levin and Otto Rung (*Den lange Nat*, 1913; *Paradisfuglen*, 1918; *Da Vandene sank*, 1922). The action of the two last named stories takes place during the War, as also that of *Livets Arabesk*, 1921, by Tom Kristensen, a pronounced artist type. Quaint sketches of provincial life are given by Johannes Buchholtz (*Egholms Gud*, 1915) and Anders Thuborg (*En Afkrog af Verden*, 1918). A talented writer of seafaring stories appears in Knud Anderson (*Havet*, 1924). Mention must also be made of Thit Jensen, with Sven Lange and Karl Larsen, who commenced semi-biographical novel sequences dealing with the years following 1870.

The psychological problem novel, to which category most of the above-mentioned works belong in some degree, is represented more especially by Harald Kidde (d.1918: *Helten*, 1912), Knud Hjortö (*Tvelys*, 1917), Karin Michaelis (*Den farlige Alder*, 1910; *Pigen med Glasskaarene*, 1924), Johs. Anker-Larsen (*De Vises Sten*, 1923, awarded the Gyldendal Literature Prize) and Tom Kristensen (*En Anden*, 1923). Apart from all these is Johs. V. Jensen, one of the most important renewers of the Danish language since Oehlenschläger (coll. works 1916). Particularly noteworthy are his short stories, the novel sequence *The Long Journey*, translated into English 1924, and his collections of poems. Novels of a partly historical nature were written by Gyrithe Lemche (*Edvardsgave*, 1900–24) and Svend Leopold (*Holberg*, 1922–4).

Lyrical Poetry.—This has always been the favourite form with Danish writers, and the art of verse was represented during 1910–25 by a number of highly talented poets. Among the older writers, who made their *début* in the 'eighties and 'nineties, are Sophus Claussen, who at the age of 60 published his most beautiful collection of poems (*Heroica*, 1924; coll. works, 1918), Johannes Jörgensen (selected works, 1915: *Der er en Brönd, som rinder*, 1920). This generation also included Helge Rode, Ludvig Holstein, Olaf Hansen, L. C. Nielsen, Kai Hoffmann, Thor Lange (d.1915), Christian Rimestad and Thöger Larsen. Jeppe Aakjær, who is not uninfluenced by Robert Burns, excels in the writing of lyrics. Valdemar Rördam, the translator of Kipling (selected poems, 1–2, 1923) is unique in splendour of rhythm and imagery, and in his spiritual outlook contrasts with Johs. V. Jensen, whose tendency is scientific and materialistic. Among the younger writers, Harald Bergstedt (*Sange fra Provinsen*, 1–4, 1913–24), Tom Kristensen (*Paafuglefjeren*, 1922), Hans H. Seedorff (*Vinlöv og Vedbend*, 1916: *Mod fremmede Stjerner*, 1919) and Emil Bönnelycke (*Selected Poems*, 1922) attracted most attention. Kai Friis-Möller, and a new writer of talent, William Waagner, should also be noted.

The Drama.—There is little to show during that period. A few writers may be mentioned: Sven Lange (*Samsom og Dalila*, 1909; *Kaerligheden og Döden*, 1914), Otto Benzon (*Foraeldre*, 1923), Carl Gandrup (*Faldne Engle*, 1923; *Fru Beates' Regnskab*, 1925) and Svend Borberg (*Ingen*, 1920).

Books of Travel.—More or less in the form of stories and sketches, these include subjects from all parts of the globe. Knud Rasmussen deals ethnographically with the arctic regions which he has recently studied on his numerous journeys in the Danish colony of Greenland. Aage Krarup Nielsen has written of life in the Antarctic (*En Hvalfangerfærd*, 1921) and, like Ebbe Kornerup, of the Far East; Jürgen Jürgensen of the Congo; Henning Kehler of Bolshevik Russia (*Russiske Kroniker*, 1920). Mention must also be made of Johannes Jörgensen's beautiful sketches of the south.

A remarkable and valuable contribution to modern Danish literature is made by Icelandic authors writing in Danish (*see* Icelandic Literature).

Criticism and Literary History.—Georg Brandes, whose view of literature was rather that of the agitator than of the aesthetic critic, and who, despite his great age, produced notable works (*Goethe*, 1915; *Voltaire*, 1916; *Caesar*, 1918; *Michelangelo*, 1921), was followed by a series of highly dissimilar critics. Harald Nielsen (*Moderne Litteratur*, 1904, and a further collection 1923; *Holberg i Nutidsbelysning*, 1923) was the first to appear in opposition to Brandes, though as a critic he does not differ essentially from the older leader. The critical work of Hans Brix (*Gudernes Tungemaal*, 1911) has a marked aesthetic element, which has been further developed by Henning Kehler (*Om Ibsens Dramaer*, in "*Edda*," 1916). A decisive factor in the change of aesthetic views is the work of Wilhelm Wanscher (*Om den aestetiske Opfattelse af Kunst*, 1906; *Italien og den store Stil*, 1921).

The leading name among the older writers of literature history is unquestionably that of Vilhelm Andersen, whose great work on *Lines of Development in Danish Literature* (*Tider og Typer*, 1–4, 1907–16) was still in process of completion in 1925. In collaboration with Carl S. Petersen, he was also issuing at that period a *History of Danish Literature* (1922, etc.) to appear in three volumes. Valdemar Vedel described the development of European culture from the Middle Ages to the baroque, based on a comprehensive study of the literature. Among the younger writers may be mentioned Paul V. Rubow (*Dansk Literær Kritik i. XIX., Aarh.*, 1921). A factor of importance in the study of Danish literature is the Danish Literature Society, founded in 1911, which, in addition to critical editions of earlier Danish writers (Johs. Ewald, Sören Kierkegaard, Blicher, etc.), had undertaken to produce a *Dictionary of the Danish Language*, estimated to comprise 20 volumes, of which seven had already appeared in 1925. The study of Holberg was advanced by the publication of a Holberg Year Book, of which six volumes also appeared, and by several new editions of his works.

History, Philosophy, etc.—The abundant activity in various directions, inaugurated and, to some extent, maintained by older historians such as Kr. Erslev, Johs. Steenstrup, Troels-Lund (d.1921), was carried on by a younger generation. Erik Arup issued the first volume of a history of Denmark, based on materialistic principles. Individual periods and personalities have been dealt with by Aage Friis and Knud Fabricius. A work of remarkable intuition is Vilh. Grönbech's *Vor Folkeæt i Oldtiden* (1909–12). A fourth edition of the well-known topographical work *Traps Danmark* was about to be published at the close of 1925. The publications of the *Danish Folkemindesamling* should be noted, as also the *Memoirer og Breve* series (1–46), edited by Jul. Clausen and Rist (1905–25). Of the older philosophical writers, Kromann died in 1925. H. Höffding at an advanced age, published new works (*Den store Humor*, 1916). Among the younger generation Herbert Iversen (d.1920) attracted particular attention with his work *To Essays om vor Erkendelse* (1918). Theology had nothing of very great importance to offer after P. O. Ryberg Hansen's *Evangelierne som Kilder til Jesu Liv* (1904) and the various works of F. C. Krarup and J. C. Jacobsen. Religious history, on the other hand, attracted several writers, *e.g.*, I. P. Jacobsen (d.1918) (*Manes*, 1914–6), Johs. Pedersen (*Israel*, 1920) and Vilh. Grönbech (*Religiöse Strömninger i. det XIX., Aarh.*, 1922). An illustrated History of Religion, edited by E. Lehmann (1924), and a collection of the principal texts in the religions of the world (translated into Danish), edited by Poul Tuxen, appeared in 1919–24.

Bibliography.—Interesting documents illustrating the intellectual movements of the period appear in the autobiography of Johs. Jörgensen, *Mit Livs Legende*, 1–6, 1916–9 and V. Vedel's collections of essays, *Menneskelighed*, 1920, and *Firsernes Förere*, 1923; also Helge Rode's *Pladsen med de grönne Traeer*, in which a neo-Christian awakening finds expression.

The following works by the above authors have been translated into English: Karin Michaelis, *The Dangerous Age* (1912); Martin Andersen Nexö, *Pelle the Conqueror* (1920) and *Ditte Girl Aline* (1921–3); Johannes V. Jensen, *The Long Journey* (1922–4); and J. Anker-Larsen, *The Philosopher's Stone* (1924). (C. Ro.*)

D'ANNUNZIO, GABRIELE (1863–), Italian poet, man of letters and soldier (*see* 2.78). The years 1908–21 were of great importance in D'Annunzio's career, not only in the field of literature, but also in that of war and politics. In 1908 he produced *La Nave*, a vivid presentation of the early history of Venice, setting forth his aspirations for Italy's destiny as a great sea power and as the mistress of the Adriatic—a curious forecast of his future political action. The following year *Fedra*, a classical drama, appeared; and in 1911 *Le martyre de St. Sébastien*, a dramatic mystery play in French verse with musical interludes by Debussy, was first performed in Paris. Though a remarkable *tour de force* and appreciated as such by French critics, this play was hardly one of his greatest achievements. *La Pisanella ou la mort parfumée* (1914), also written in French and produced in Paris, was a picturesque reconstruction of the medieval Levant depicted by the author in gorgeous colours.

The same year he produced *Il Ferro*, an Italian version of *Chèvrefeuille* (Paris, 1913), a drama of modern life, with a plot adapted from Hamlet and containing some powerful scenes. *Parisina*, a lyric tragedy in a Renaissance setting, with music by Mascagni, was first performed at Milan, also in 1914. D'Annunzio, though greatly attracted by the stage, did not abandon the field of fiction, and in 1910 he published *Forse che sì, forse che no*, a powerful, but somewhat long-winded novel, in which aviation played a considerable part. *La Leda senza cigno* (1913), consisting partly of essays and partly of fiction, originally appeared in the *Corriere della Sera*, and was afterwards issued in three volumes with a *licenza* in 1917. His purely poetic output was limited to the *Canzoni della gesta d'Oltremara* (1912), which dealt with the Libyan war and contained some admirable verse, as well as violent invectives against the Powers which were, in his opinion, hampering Italy in her Mediterranean policy.

On the outbreak of the World War D'Annunzio was living in France, having had to leave Italy on account of financial difficulties; but the moment the conflict began he became convinced of the necessity for Italy's intervention, in order to attain complete unity and to establish her sovereignty in the Adriatic. His addresses to the Italian people, full of eloquent and inspiring patriotism, were afterwards published in a volume *Per la più grande Italia* (1915). In the spring of 1915 he returned to Italy; his speeches at Quarto (near Genoa), during the Garibaldi celebrations and also those which he made in Rome aroused widespread enthusiasm, and undoubtedly contributed largely to Italy's intervention. From the moment Italy declared war D'Annunzio's career became one of the most romantic of modern times; for the man who had hitherto been regarded merely as a sensuous aesthete and a decadent, and whose only claim to distinction had been his exquisite sense of beauty and his mastery of the language, now proved himself to be not only a man of action and a soldier of almost incredible bravery, but also a politician who for many months defied powerful governments and received the attention of the world.

On Active Service.—Although 52 years old, he at once volunteered for active service. Having been a reserve cavalry officer in the Novara Lancers, he first joined the cavalry; but as at the time there seemed little chance of active service in that arm, he attached himself to the 77th Infantry and spent many months in the Carso trenches, always in the most exposed positions. Impatient for still greater sacrifices, he next joined the headquarters of the navy in Venice, and took part in many torpedo and submarine raids. Finally he joined the air service in the hope of achieving immortality even at the cost of his life. His exploits in the air were of the most fantastic nature, and he became an airman of the first rank. In one of his flights he lost an eye, in another was wounded in the wrist and on several occasions his aeroplane was riddled with bullets.

In Aug. 1918 he led a flight over Vienna, dropping propaganda pamphlets over the city. This exploit was particularly audacious, owing to the great distance over enemy country which had to be covered. His gallantry caused him to be promoted lieutenant-colonel, and he was decorated with the gold medal for valour (a distinction corresponding to the British V.C.), as well as with four silver and two bronze medals; he was also created Officer of the Military Order of Savoy. On being demobilised in June 1919, he received an exceptionally flattering letter from the Chief of the General Staff, who regretted the loss of his valuable assistance, and expressed the hope that he would continue to remain "spiritually" in the army as an example of "faith, heroism and self-sacrifice." During the first period of the War he published 10 war poems, some of them of great beauty; and after Caporetto he delivered several eloquent addresses, which were afterwards collected in *La Riscossa*. On the Buccari enterprise he wrote *La Beffa di Buccari* (1918).

Seizure of Fiume.—After the Armistice the attitude of the Allied Powers, and especially that of President Wilson, towards Italy, aroused D'Annunzio's bitter indignation, and his letters and articles in this connection, collected in the volume *Contro uno è contro tutti* (1919), occupy a place in the literature of invective. The extreme violence of his language helped to embitter the relations between Italy and President Wilson. During the Nitti régime D'Annunzio personified the patriotic reaction against the government's policy; he not only became the idol of a small body of enthusiasts, but continued to attract the sympathies of the imperialists in Italy. The Fiume dispute symbolised in his mind the conflict between Italy's aspirations and the counter claims of her neighbours. When, as a result of the commission of inquiry into the anti-French riots at Fiume, it was decided considerably to reduce the Italian garrison and to police the town with Maltese or U.S. gendarmes, a movement was planned by Major Reina of the Granatieri brigade to reoccupy the town with regular troops and volunteers. D'Annunzio accepted the leadership of the expedition, and on the night of Sept. 11–12 he marched from Ronchi at the head of detachments of grenadiers and other troops and re-entered Fiume.

This action was vehemently discountenanced by the Italian Govt., and D'Annunzio was severely criticised by many of his admirers for having tampered with the discipline of the army and navy at such a critical moment, even for patriotic motives. On the other hand, the unpopular policy of Signor Nitti and the attitude of the Allies gained for D'Annunzio the sympathy of numbers of Italians. For 15 months he defied the Italian Govt. and indeed the whole of Europe with success. He assumed the style of ruler or commandant of Fiume and made of the town a new State. His "reign" was characterised by a picturesque mysticism, with Italian patriotism as the first article of his creed; and numbers of enthusiasts flocked to his standard from all parts of Italy. Men like General Ceccherini, one of the bravest soldiers in the Italian army, joined the commandant; as well as Maffeo Pantaleoni, the economist, De Ambris, the syndicalist leader and many officers of the army and navy. Others openly expressed their approval of D'Annunzio's action, among them the archaeologist Giacomo Boni, the poets Siciliani, Fucini and Orvieto, the aged Risorgimento patriot Senator Di Prampero, the scientist Professor Cian and Senator Del Lungo, the distinguished man of letters.

But D'Annunzio's newly acquired power finally went to his head. Both his language and action became more and more exaggerated and verged at times on the ridiculous; while the adventurous nature of his undertaking attracted many unworthy characters, not all of them Italians, who exercised an undesirable influence over him. He gradually came to regard not only the government and the army, but even the Italian people outside Fiume as his enemies, and on them he poured the vials of his wrath and eloquence, hitherto reserved for foreign Powers. When the Rapallo Treaty was concluded in 1920 he refused to recognise it, as he disapproved of its provisions regarding Fiume and Dalmatia; but his refusal not only caused the government serious inconvenience, but alienated the sympathies of many who had at first approved his action. The government was finally obliged to resort to force in order to carry out the Rapallo Treaty, and D'Annunzio, after vowing to hold Fiume to the bitter end, finally submitted in Jan. 1921, and left the city. He then went to live at Gardone on the lake of Garda. During his stay at Fiume he delivered innumerable speeches, all in a high-flown and exaggerated style, although passionately eloquent. Some of these appeared in newspapers, or were printed separately; while others were published collectively in two pamphlets: *Italia o morte* (1919) and *Italia e vita* (1920). His constitution of the *Reggenza del Carnaro* is a strange mixture of poetic concepts and mediaeval lore. His diplomatic correspondence with the Italian Govt., published by him in a "Green Book," also belongs to the domain of literature.

In 1921 he published *Notturno*, an analysis of his sensations during the blindness which resulted from an aeroplane accident; and in 1924 the first volume of *Le faville del Maglio* appeared. While at Gardone he was seriously injured in the head by a fall. He was from the first a strong supporter of the Fascist movement, and helped to organise the Fascist seamen's federation. In the spring of 1925 the premier, Signor Mussolini, spent three days with him at Gardone, a visit which aroused a good deal of curiosity. In 1924 the King conferred on him the title of Prince of Monte Nevoso, in recognition of his successful efforts to secure Italy's new eastern frontier, of which that mountain is the highest point. (L. V.*)

DANUBE (*see* 7.819).—In the new map of Europe the Danube passes through a considerable number of countries which are chiefly dependent upon it for their subsistence. It rises in Germany; flows through Austria, passing Vienna; past the Czechoslovak port of Bratislava; through Hungary, passing Budapest; through Yugoslavia, passing Belgrade; follows the Bulgar-Rumanian frontier for some distance, and runs out through Rumania into the Black Sea, passing the seaports of Brăila and Galatz. A boat going from Regensburg to the Black Sea crosses five frontiers, passes through the waters of seven countries and is obliged to stop at eight places for customs formalities before it reaches its port of destination. The traffic is as international as the river; before the War it was carried principally by Austrian and Hungarian companies, though Rumanian and Greek enterprises carried on a considerable traffic below the Iron Gate. Under post-War conditions the shipping shows the German, Austrian, Czechoslovak, Hungarian, Yugoslav, Bulgarian, Rumanian, Greek, French and Dutch flags, and in the Austrian and Hungarian companies important British interests are involved.

The Two Sections.—The Danube may be divided for traffic purposes into two quite distinct sections, the maritime Danube from the sea to above Brăila, and the fluvial Danube from this point up to Regensburg, where the river at present ceases to be navigable for large craft. Brăila and Galatz, situated respectively 171 and 150 kilometres from Sulina (at the mouth of the river), are the usual points for transhipment between seagoing vessels and barges. The export traffic on the maritime Danube consists principally of grain and other agricultural produce from Rumania, Bulgaria and Yugoslavia; timber from Rumania and Poland; and petroleum and its derivatives from Rumania. The import traffic is principally in manufactured and miscellaneous goods from western Europe. Besides transhipping goods on to barges, the seagoing vessels also tranship a considerable quantity on to the railways at the ports of Brăila and Galatz. A great part of the surplus agricultural produce of Hungary and Yugoslavia is carried up the Danube to Germany, Austria and Czechoslovakia. The normal traffic downstream consists of goods manufactured in the three last-mentioned countries, with some from Hungary. The volume of traffic has never approached that on the Rhine, where the countries are much more highly developed industrially and vast quantities of coal and ore are consigned from and to the Ruhr.

The European Commission.—The administration of the Danube was formerly controlled by the single European commission of the Danube, an institution set up with a provisional character by the Treaty of Paris in 1896. Its headquarters were at Galatz, and it administered the Danubian delta only, eight interested nations being represented on it. The conservancy of the other Danubian reach of international importance—the Iron Gate—was entrusted to Austria-Hungary, and assigned by her to Hungary.

In the Treaty of Bucharest (May 1918) the Central Powers reduced the membership of the European commission to "states situated on the Danube or the European coasts of the Black Sea." The Treaty of Versailles (June 1919) reinstated the commission in "the powers it possessed before the War." It went on that "as a provisional measure, only representatives of Great Britain, France, Italy and Rumania shall constitute this commission." The commission acquired definite character when the Danube statute was signed in Paris July 23 1921. In future, subject to the unanimous consent of the states represented on the commission, any European state which is able to prove its possession of sufficient maritime commercial and European interests at the mouths of the Danube may be represented on it. Up to 1926, however, the representation had not been increased.

The International Commission.—The Treaty of Versailles, Art. 347, provided that "from the point where the competence of the European commission ceases," *i.e.*, from above Brăila, "the Danube system referred to in Art. 331," *i.e.*, as far as the highest navigable point at Ulm, "shall be placed under the administration of an International Commission composed as follows:—

> Two representatives of German riparian states,
> One representative of each other riparian state,
> One representative of each non-riparian state represented in the future as the European commission of the Danube."

This Commission was to carry on the administration provisionally until the conclusion of a definitive statute concerning the Danube.

On July 23 1921 this statute was signed. Many of its provisos simply followed the lines of the "convention on the régime of navigable waterways of international concern" concluded at Barcelona April 20 1921. Article I. declared navigation on the Danube system to be unrestricted and open to all flags, on a footing of complete equality, from Ulm to the Black Sea, and the internationalised portions of the Danube tributaries were defined. The provisional composition of the International Commission was confirmed. It had to see that the declaration in Art. 1 was not infringed by any riparian state or states, to draw up a programme of public works for the improvement of the waterway on the basis of proposals submitted by the riparians, controlling and if necessary modifying the annual programmes of the riparian states for current works of maintenance. The cost of such works was borne by the riparian state concerned, assisted, if the commission so decided, by other states interested.

The cost of works of improvement (not maintenance) might be covered by navigation dues, to be imposed (with the Commission's authorisation) by the riparian state which had executed the works, or by the Commission itself, if it had executed them at its own charges. Dues were to be assessed on the ship's tonnage and not based on the goods transported, revenue from them was to be applied exclusively to the works for which they were imposed, there was to be no differential treatment of flags. Customs duties levied by a riparian on goods loaded or discharged at the Danubian ports in its territory were also to be levied without distinction of flag or hindrance to navigation, and were not to be higher than duties levied at other frontiers of the same state. The transport of goods and passengers, even between ports of the same riparian state, was to be unrestricted and open to all flags on a footing of perfect equality, with the exception of regular local services which may only be carried out by foreign craft subject to the observance of the national law of the local sovereign, and in agreement with the authorities of the riparian state concerned (Art. 22). Passage of goods and passengers in transit was to be free. Uniform police regulations were to be drawn up and applied by each riparian on its own territory. A special joint service of Rumania and Yugoslavia, organised with the approval of the commission, will have to take over the maintenance and improvement of the Iron Gate section, with headquarters at Orsova. The Commission was to decide on special works to be undertaken (and dues to be levied for the purpose) and to have power to abolish the service when its work was done; it could inaugurate like services elsewhere if necessary.

The commission was to determine its own procedure and administer its own budget, the presidency being held for six months by each delegation in turn. Its seat was to be at Bratislava the first five years, and thereafter it might be established at other towns on the Danube, selected at its discretion, for five-year periods in rotation. Its property and members were to enjoy diplomatic privileges and it was to fly its own flag. It was to deal in the first instance with questions regarding the interpretation and application of the convention; but the special jurisdiction set up by the League of Nations would ultimately have to deal with complaints from a state that the commission was acting *ultra vires*, or from the commission against a state for neglecting to carry out its decisions. Every effort was made to insure uniformity between the workings of the International and the European commissions, and between different signatory states.

The convention came into force June 30 1922. One of the most important questions that have been raised since that date was connected with the interpretation of Art. 22 (above), as certain states in eastern Europe were anxious to reserve to their own flag the passenger and goods traffic between ports in their own territory. In the discussion on Art. 22, the Rumanian delegate stated that the carriage of goods on river craft between two ports in the same country did not constitute cabotage if the goods were subsequently transhipped to a seagoing vessel to export, and that Art. 22 imposed no restriction on the traffic carried on up to that time by Greece. It would seem to be established by the decisions of the Powers' conference that casual transport by foreign vessels between two ports in the same state is to be unrestricted even if it takes place repeatedly. (*See* INLAND WATER TRANSPORT.)

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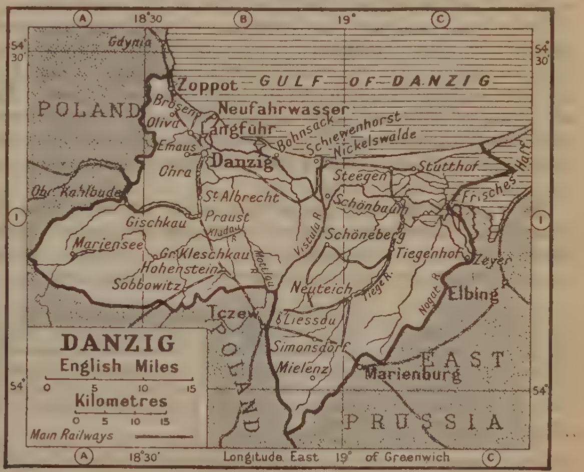
DANZIG, FREE CITY OF (*see* 7.824), a territory under the protection of the League of Nations, has an area of 791 sq. m.; the territory is divided into municipalities and rural districts. Population of the whole state (1924) 385,000 (96% of which were Germans), that of the Danzig municipality being 206,500. Besides the municipality of Danzig, there are the municipality of Zoppot (27,500 inhabitants), the two towns Tiegenhof (3,100) and Neuteich (2,900) and some greater communities as Oliva (14,000) and Ohra (12,500). Two-thirds of the population are Evangelical and one-third Roman Catholic, but the Mennonites



are represented in districts in the delta of the Vistula. A Roman Catholic bishopric of Danzig was created in Jan. 1926.

History.—Danzig, which until the close of the World War had been the capital of West Prussia, was separated with a considerable part of the surrounding country from the German Empire by the Treaty of Versailles, and received the status of a free city. The decision registered in Articles 100–8 of the treaty represented a compromise between the Polish demand for the cession to the new Polish state of the most convenient outlet and inlet for Polish commerce, and the reluctance felt by the Peace Conference to place a city, 96% of whose population was German, under another sovereignty. The separation became effective on Jan. 10 1920, and the administration of the city and the territory was placed temporarily under Allied administration. Sir Reginald Tower acted both as Allied administrator and as High Commissioner for the League of Nations, and two battalions of Allied troops under the command of Sir Richard Haking were stationed in the city. This interim régime lasted until Nov. 15 1920, when the formal proclamation of the free city of Danzig as an independent political state was made by the representative of the League of Nations. The troops were withdrawn, and Gen. Haking acted as high commissioner for the League until Feb. 1923, when he was succeeded by Mr. M. S. Macdonnell. In Feb. 1926, Mr. Macdonnell was succeeded by Dr. van Hamel, a Dutch jurist. Internal administration was under the burgomaster, Herr Sahm, who, as soon as the constitution came into force, was elected president of the Senate.

Constitution.—The constitution, drafted by a Constituent Assembly elected in May 1920, was ratified, with some small amendments, by the League of Nations, and finally authorised by the high commissioner in May 1922.

The international and public status of the free city as an entirely separate state and independent member of the community of nations under the protection of the League of Nations, represented in Danzig by a special high commissioner, is based on Articles 100–8 of the Treaty of Versailles and the subsequent treaties between Danzig and Poland as provided for in the Treaty of Versailles. Of these, the most important are the Danzig-Polish Treaty drafted by the Conference of Ambassadors with the assistance of delegations from the Polish and the Danzig states, and signed in Paris on Oct. 27 1920, and the Warsaw Convention of Oct. 24 1921 (a supplement to the first-named treaty). The high commissioner of the League of Nations decided in the first instance all differences arising between Danzig and Poland. The two parties retain the right of appeal to the Council of the League of Nations. Poland's rights in Danzig are exclusively economic and ensure her free access to the sea.

The administration of the harbour and waterways is carried out by a harbour commission consisting of five nominees each from Danzig and Poland under the chairmanship of a president of Swiss nationality appointed by the League of Nations. The settlement of this question led to much friction, and the document transferring the ownership of the state property in the port and waterways to Poland, Danzig and the harbour commission was only signed on May 3 1923.

The administration of the railways in the free city, with the exception of narrow gauge railways and street tramways, is under the directorate of the Polish State Railways, Danzig's special interests being protected by a representative of the free city.

The conduct of the free city's foreign relations is committed to the Polish Govt., which is also entrusted with the protection of Danzig nationals abroad. In foreign towns, where Poland is represented by a consulate and where Danzig has important commercial interests, Danzig officials are to be attached to the consulate. Danzig takes part in international conferences as an independent state. The official language is German.

The legislative body, the Volkstag, consists of 120 members. The Senate consists of a president and seven Senators holding chief office (elected for a term of four years) and a vice-president and 13 Senators in adjunct office (elected for an indefinite period, depending on the confidence of the Volkstag).

In accordance with the provision of the Treaty of Versailles the free city is in customs union with Poland. The organisation of the customs is under the government of the free city.

Posts, telegraphs and telephones are under the postal and telegraphic administration of the free city, which is a member of the international postal union. Poland is only entitled to have a postal service office in the harbour for the purpose of maintaining direct communication between Danzig and Poland, as well as between Poland and overseas countries. The area of the harbour has recently been defined to include most of the town of Danzig.

Education.—Besides numerous elementary schools, technical and advanced schools, as well as secondary schools, there is a technical university with an instructional staff of 58 professors. In the summer term, 1925, there were 1,526 students.

Trade and Shipping.—The situation of Danzig on the mouth of the river Vistula is most favourable. The Vistula connects Danzig with Poland and, by means of its tributaries and canals, with Germany, the Ukraine and Lithuania. The so-called "Dead Vistula" is navigable from the mouth at Neufahrwasser to a distance of four miles for ships drawing 30 ft. and for a further two miles up the river Mottlau for vessels of about 15 ft. draught. Facilities are available for the repair and maintenance of ships. Up to 6,000 tons these can be accommodated in floating docks, of which there are several. There are four dockyards: F. Schichau, International Shipbuilding and Engineering Co., Ltd. (comprising the former Imperial dockyard and the railway-workshops), Klawitter, and Wogan. The International Shipbuilding and Engineering Co., Ltd., has an original capital of £10,000, English and French capital participating each with 40% and Danzig and Polish capital each with 10%. Schichau has built vessels of 35,000 tons. The present annual building output of 20,000 tons could be largely increased. The free basin has a wharfage of about 3,600 ft., and vessels drawing to 25 ft. can lie alongside. Electric cranes and warehouse accommodation are provided and railway connection exists with the main system. An important adjunct to the port is the island of Holm, having a basin of great potential value as a commercial harbour.

The chief imports are foodstuffs, fertilizers, chemicals, building materials, ceramics, raw cotton and textiles; the principal exports are timber, sugar, grain, naphtha and coal. Large granaries and warehouses for sugar and grain stand near the wharves of the port, which also afford storage capacity for over 20,000 tons of naphtha, of which some 100,000 tons may be expedited in one year. As for timber, 1,500,000 tons can be loaded during one year. Large timber ponds are at Holm I. and extend for several miles along the bank of the "Dead Vistula" between Danzig and Plehnendorf. The port is practically ice-free, and has great commercial possibilities, the natural features of the waterways and surrounding country rendering expansion easy. Thanks largely to the protection afforded by the peninsula of Hela, it has special advantages of security. There is scarcely any current, the main river having received another outlet to the sea several miles further east, near to Schiewenhorst.

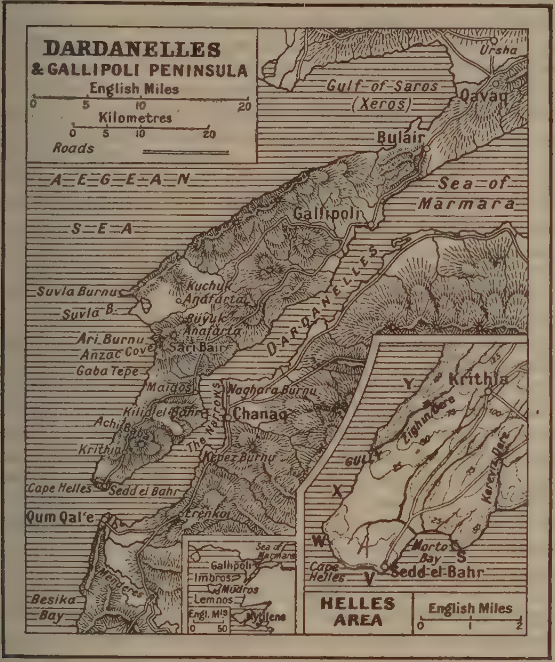
Danzig's mercantile fleet consists of 67 vessels with 117,000 gross registered tons. There are regular passenger-and-cargo sailings from the port of Danzig to nearly all the ports of the Baltic and the German Ocean, even to New York, Philadelphia and the Atlantic ports of Canada, and to London and Hull. As to the railway traffic, there are direct express passenger trains from Danzig to all the chief centres of Germany and the Baltic states. Danzig is an important junction of aeroplane communications. Aeroplanes leave Danzig regularly for Berlin, Marienburg, Königsberg, Stockholm and Warsaw.

Banking and Finance.—The free city has a currency of its own, the unit of which is the gulden (fixed at 1/25th of the £ sterling and divided into 100 pfennigs). This new currency was introduced by the Bank of Danzig, as an emission bank, in the beginning of the year 1924. The fully paid-up capital of the bank is 7,500,000 gulden. Besides the Bank of Danzig there are five big Danzig banks, as well as branches of most of the important German and Polish banks. There is also a produce and a stock exchange, and twice a year (springtime and autumn) international sample fairs are held.

BIBLIOGRAPHY.—*Official Journal of the League of Nations* (*passim*) and *The Saar Basin and Free City of Danzig* (League of Nations Secretariat, Geneva, 1924), where further relevant publications of the League of Nations are given; S. Askenazy, *Danzig and Poland* (trans. W. J. Rose, London, 1921); E. Keyser, *Danzigs Geschichte* (Danzig, 1921). (M. S. M.)

DARDANELLES (*see* 7.829), the strait uniting the Sea of Marmora with the Aegean. The question of the military, naval and political status of the Dardanelles and the Bosporus was raised by the defeat of Turkey in the War of 1914–8. In the armistice signed at Mudros (Oct. 30 1918), one of the principal conditions was that the straits should be opened to the Allied fleets, and the future régime of the straits figured prominently in the abortive Treaty of Sèvres (Aug. 10 1920), and in the definitive Straits Convention (July 24 1923), which was negotiated during the Lausanne Conference.

On the side of the Allies the initiative in this matter was taken by Great Britain, and British statesmen, under the influence of the failure to force the Dardanelles during the World War, were eager to introduce a régime which would keep the straits open, not only to merchant ships, which had enjoyed freedom of passage for more than a century, but to warships both in peace time and in war time. This marked a complete reversal of British policy which, for a century past, had aimed at closing the straits to the ingress or egress of all except Turkish warships, with the object of preventing the Russian Black Sea fleet from issuing into the Mediterranean and threatening the flank of the British line of communications with India. As a result of the World War, Russia had ceased for the time being to be a naval power, while the right to enter the straits, which had been secured to the British Navy under the Armistice with Turkey, had enabled Great Britain to intervene with considerable effect in the Russian civil war between Whites and Reds. For these reasons, partly practical and partly sentimental, but all based on an abnormal and probably temporary state of affairs, the permanent opening of the straits became one of the principal aims of British Levant policy during the long-drawn-out settlement after the War. For corresponding reasons, Russia, in her metamorphosis as the Union of Socialist Soviet Republics, likewise reversed her traditional policy and set herself to close the straits again to warships, in order to keep the British fleet out of the Black Sea.



Treaty of Sèvres.—In the Treaty of Sèvres the freedom of the straits for warships was provided for by three separate guarantees. First, the sovereignty over the two shores of the Dardanelles, which hitherto had both been under Turkish rule, was now divided, the Gallipoli peninsula and all eastern Thrace up to the Chatalja line being transferred from Turkey to Greece, while only the Asiatic shore of the Dardanelles was left to Turkey. Since Greece and Turkey were unlikely to find themselves on the same side in any war, either local or general, this division of sovereignty would have constituted a guarantee of a crude but effective kind, on the presumption that, if either party attempted to use its shore in order to obstruct the passage in violation of the treaty, the other party would place its shore at the disposal of the Powers who had been made guarantors of the treaty under other articles.

The remaining articles placed a military sanction in the hands of Great Britain, France and Italy. A zone of territory was laid down, including the whole of the Asiatic and the European shores of the Dardanelles, Marmora and Bosporus, with the adjoining territorial waters and a number of islands in the Sea of Marmora and off the mouth of the Dardanelles. Within this zone all the fortifications were to be dismantled permanently, and the territorial sovereigns, Turkey and Greece, were prohibited (with two unimportant exceptions) from maintaining armed forces, whereas the three principal Allied Powers, as guarantors, were permitted to do so.

It was further laid down that the waters of the straits should not be subject to blockade and that no belligerent right or act of hostility be committed within them unless in pursuance of a decision of the Council of the League of Nations. The commission (on which the eventual representation of both Russia and the United States was provided for) was to have two distinct though related functions. It was to organise and administer the freedom of the straits, and also to report upon any interference with that freedom. In addition to extensive conservancy duties, similar to those entrusted to the European Commission of the Danube, the Straits Commission was empowered to raise its own police force under foreign officers, to claim diplomatic privileges and immunities, and to exercise its powers in complete independence of the local sovereign.

Turkish Conditions Imposed.—These arrangements never came into force, for though the Treaty of Sèvres was signed by representatives of the expiring Ottoman Govt. at Constantinople, it was never acceped by the new Nationalist Govt. at Angora. The question of the straits was dealt with in Article 4 of the Turkish National Pact of Jan. 28 1920, which accepted the opening of the straits to commerce, but made this subject to the provision of security for Constantinople and tacitly repudiated, by passing it over in silence, the new claim that the straits should be opened to foreign warships. The debâcle of the Greek Army in Anatolia in the summer of 1922 enabled the Turks to impose their point of view upon the Allies.

In the armistice of Mudania (Oct. 11 1922), the retrocession of Eastern Thrace to Turkey was conceded, and this removed the first of the three Sèvres guarantees before the conference of Lausanne (*q.v.*) opened. At Lausanne, Lord Curzon concentrated his efforts upon saving what he could of his policy regarding the straits, and on this point the Turkish negotiators came some distance towards meeting him, though not till they had cut out so many of the Sèvres guarantees that the régime of the straits, as finally established, became a paper constitution rather than an arrangement on which reliance could be placed in time of stress.

The demilitarised zones of the Sèvres scheme were reduced in area; they were to be closed to Allied as well as to Turkish forces (which extinguished the positive military sanction of the Sèvres Treaty); any right of the Allies to occupy or even inspect the zones in case of actual or prospective violation on Turkey's part was passed over in silence; while, on the other hand, it was expressly stipulated that Turkey might maintain a garrison in Constantinople, including its insular and Asiatic suburbs, up to a maximum strength of 12,000 men; that she might utilise the demilitarised zones for lines of communication between her military forces in Asia and Europe; and that she might anchor her fleet (an arm which the Sèvres Treaty had forbidden her to possess) in the demilitarised waters.

The commission of the straits was maintained for conservancy purposes alone, but even then with diminished functions and under Turkish presidency. In return for the few points which they saved from the wreck of their policy, the three principal European Allied Powers and Japan pledged themselves to resist by force any violation of the freedom of navigation and also of the security of the demilitarised zones (a clause which virtually gave Turkey a territorial guarantee of her most exposed and most valuable territories). Under these conditions, the Turks conceded to warships a restricted right of passage.

It was noteworthy that the Russian delegation at the Lausanne Conference did its utmost to prevent agreement on these lines between Turkey and the Allies and made a formal protest in energetic terms against the text of the Straits Convention. Although the Soviet Govt. acceded to the convention on Aug. 4 1923, it had become evident at Lausanne that, as between Russia and Turkey, the problem of the straits was still unsolved.

Bibliography.—H. W. V. Temperley, *History of the Peace Conference of Paris*, vol. 6, part 2 (1920–4); A. J. Toynbee, *Survey of International Affairs, 1920–23*, pp. 374–76 (1925); British Blue Books, Cd. 1814 of 1923, and Cd. 1929 of 1923. (A. J. T.)

DARDANELLES CAMPAIGN.—This campaign, brought about by a desire on the part of the Allies that communications should be opened up from the Mediterranean into the Black Sea with a view to assisting Russia, was begun in Feb. 1915 as a purely naval undertaking (*see* World War, *Naval*).

But it had been realised from the outset that, even should the warships succeed in attaining their object, land forces would sooner or later be required to aid in the campaign, if only to secure the communications of the fleet after it had passed into the Sea of Marmora. Before the failure of the naval attack of March 18, Entente troops had been set in motion for the Aegean. Some were already in Lemnos, and Sir Ian Hamilton, chosen as commander-in-chief of the military contingents, had arrived in time to witness the fight of the 18th. In view of its result, the Allied Governments decided that from this time onwards the gathering army must assume the principal rôle in the effort to secure possession of the Straits. Hamilton was unable to initiate land operations at once. The Turks were making preparations to repel landings on both sides of the Straits, while the troops at his disposal were partly in Egypt, partly at Lemnos, and partly on the high seas, en route from England and France.

Organisation in Egypt.—He decided therefore that his army must in the first place be concentrated in Egypt, to be organised for the hazardous undertaking to which it was about to be committed, and that it must then be disposed in transports in accordance with tactical requirements in anticipation of a landing in face of the enemy. A month was lost in consequence. During that month the Turkish Army was formed (March 24) to guard the Straits. Marshal Liman von Sanders, head of the German military mission in Turkey, was appointed its commander-in-chief, and under his instructions the defence system, organised in consequence of the warning offered by the naval operations, was overhauled and developed.

Constitution of Attacking Army.—The Franco-British expeditionary force was composed of five divisions—two (the 29th and the Royal Naval) furnished by the United Kingdom, two formed of Australian and New Zealand troops, and one composed of French colonial troops. Against this force Liman von Sanders could pit six divisions, but these were perforce dispersed; two (3rd and 11th) were watching the coast on the Asiatic side, two (5th and 7th) were near Bulair to guard against a landing at the neck of the Gallipoli Peninsula, while the remainder (9th and 19th) were disposed towards its southern end.

I. THE FIRST LANDINGS

The expeditionary force concentrated in Mudros Bay, Lemnos, in the third week of April. Hamilton contemplated two distinct major operations to secure a footing on the Gallipoli Peninsula. The 29th Div., supported by the Royal Naval Div., was to be put ashore at its extremity, an area which it is convenient to designate as Helles; the Australian and New Zealand Divs. under Sir W. Birdwood were to land just north of Gaba Tepe, where there are extensive beaches. But part of the one available French division was furthermore to effect a descent at Kum Kale, opposite Helles, as a subsidiary operation, subsequently being transferred to Helles. After a short delay, enforced by bad weather, the armada put to sea during the nights of April 23–4 and 24–5, so that the transports and the covering warships should arrive at their various rendezvous at or before dawn on the 25th, and the day broke calm after a placid night.

Landing at Cape Helles.—Five points had been selected in the Helles area for attack. Enumerating from right to left the beaches were " S " in Morto Bay, " V " and " W " on either side of Cape Helles, and " X " and " Y " on the outer shore. The attacks at " S " and " Y " were intended to be subsidiary; but great importance was attached to " W " and " V, " as those two beaches offered the most suitable landing places from the point of view of subsequent operations. Owing to its vicinity to " W," " X " was calculated to play a very prominent part in the affair as a whole. Covered by the fire of battleships and cruisers, the troops started in flotillas of boats soon after dawn for all points, and, as it turned out, the actual disembarkations at " S," " X " and " Y " were carried out without any great difficulty. But at " W " the troops only gained a footing after incurring heavy loss, while at " V," where a large part of the landing force was carried in the steamer " River Clyde " which was run ashore, the effort nearly failed altogether. After hard fighting all day the position at nightfall was that the troops landed at " W " and " X " beaches had joined hands and that a battalion was established at " S, " while the situation at " V " was critical, as also at " Y"; but during the night more troops were got ashore at " V," and those at " Y " were safely withdrawn and re-embarked next morning. Losses had been severe.

Landing at Kum Kale.—In the meantime a French brigade had, after a tough struggle, effected a lodgement at Kum Kale (Qum Qal'e). The Turks were in strong force here, so that any advance by the French was out of the question, but their presence on the Asiatic side was being indirectly helpful to secure a footing on the further shore. Some little progress was made on the morrow in spite of determined resistance by the enemy, additional troops were landed, and during the night the French were withdrawn from Kum Kale and they were landed at " V " beach on the 27th. On that day the Allies' line was again advanced by a few hundreds of yards; but the Turks had received substantial reinforcements in this quarter, and but little ground was gained when Hamilton ordered a fresh attack on the 28th. The invaders had suffered very heavy losses during the initial landing and the subsequent strenuous encounters, and there were no reserves on the spot to fill the gaps that had been created in the ranks.

Landing at Anzac.—Birdwood's divisions had in the meantime effected a lodgement to the north of Gaba Tepe. The actual disembarkation had in this case been started before dawn on the 25th at a point about a mile and a half north of the Gaba Tepe promontory, and at a spot where the hills rose abruptly from the actual beach which came to be known as Anzac. A haphazard line on the heights immediately above the beach had been secured at once, the Turks being in weak force at the moment when the advanced parties of invaders reached the shore; but the defenders were able to hurry reinforcements to the point of danger and the actual area secured was of limited extent. Won practically at the first blow, it provided but a scanty water supply, it presented great inconveniences and its beach was much exposed in the event of bad weather setting in; it was but slightly extended during the following three months, for Liman von Sanders realised that owing to its proximity to the Narrows of the Dardanelles, it represented a very serious danger to the Turks, and he took steps accordingly. Although the Ottoman troops delivered vigorous counter-attacks on the 26th, these were beaten off with loss to the assailants, and by the night of April 27–28 the position of which Birdwood had contrived to gain possession had come to be, tactically, fairly secure.

Hamilton thus gained a somewhat precarious footing at two points of the peninsula. But his two forces were some 15 m. apart, and what amounted to little more than a patch of ground had been won in either case. His intentions were now completely exposed to the enemy, and the great advantage of surprise had passed away without his force having established itself in a dominating position capable of being turned to satisfactory account in subsequent operations. In both areas the Turks enjoyed the tactical command, they were at least equal in force to the Allies, their guns were able to bear with effect upon the beaches used as landing places and advanced bases, and, although at this time of the year the weather was generally calm, these beaches provided but inadequate facilities for the landing of ammunition, armament or stores.

Reinforcements.—Early in May the Allies' contingents planted in the Helles area were strengthened by the arrival of the British 42nd Div., an Indian brigade, and the French 2nd Division. Some ground was gained on May 6, and during the next day or two determined counter-attacks on the part of the enemy vere effectually repulsed. The two French divisions were ccupying the right of the line, next to the Straits; and that rrangement held good up to the time when the Gallipoli eninsula was finally evacuated early in Jan. in the following ear. Both here and facing the Australasian troops at Anzac the urks had dug themselves in, establishing elaborate defences, nd trench warfare was becoming the order of the day.

During the month a state of stalemate set in, and although round was gained by the Allies in attacks delivered in the Helles rea on June 4, 21 and 28 and during the month of July the line vas gradually pushed forward near Krithia, the situation was o unpromising that the British Govt. decided to send five nore divisions (10th, 11th, 13th, 53rd and 54th) to the Aegean. hese arrived at the islands of Mytilene and Imbros during the losing days of July and the first days of August. Hamilton's rtillery was at the same time strengthened, and his very indequate ammunition supply somewhat improved. But Liman on Sanders was likewise receiving reinforcements, and, although e Ottoman maritime communications with the Gallipoli eninsula were from time to time imperilled by the submarines f the Allies, the relative strength of the two opposing armies cing each other in the theatre of war was not, as it turned out, reatly affected by the appearance of the fresh troops sent out rom England to these waters. The Allies, in view of the coming f reinforcements, treated July as a month of preparation, al- hough a general attack was delivered by them in the Helles rea by which a little ground was gained. A few days later the rst of the reinforcing divisions, the 13th, arrived and was nded at Helles as a temporary measure.

II. SARI BAIR AND SUVLA BAY

How to employ the fresh divisions coming out from home had be decided by Hamilton. The French had from the outset voured operations on the further side of the Straits, and there as something to be said for such a plan of campaign. But a escent in that quarter must involve a disembarkation in face opposition, the perils of which had been made apparent on pril 25; moreover, granting the landing to be successful, the rces would start work much further from the Narrows of the ardanelles, the true objective, than were either Helles or nzac. There were also not wanting inducements for the Allies attempt a landing at Bulair, seeing that their presence at that oint would carry with it the severance of the Turkish land mmunications with the peninsula. But this would likewise ean a landing in face of opposition; and the distance of Bulair om the Island of Imbros, the nearest base of operations for the eninsula, provided a strong argument, from the point of view of ip transport, against such an undertaking. Moreover, a landg either on the Asiatic side or at Bulair meant a dispersion of e Allies' forces as a whole, unless Helles or Anzac, or both of em, were to be abandoned; and the fact that the Ottoman mmander-in-chief had to be prepared for his opponent adopting e of these two plans, offered a strong argument against selecting ther of them.

British Plans.—Hamilton decided that his great effort should made at, and immediately north of, Anzac. The rugged uffs on which Birdwood's men had taken root since April were urs of a tangled mountain mass known as Sari Bair, from the pmost ridges of which the Narrows were visible four or five iles off; Anzac was moreover situated almost at the narrowest int of the peninsula. The plan was to reinforce Birdwood cretly by a division and a half (the 13th and part of the 10th) d that, thus strengthened, he should secure possession of ri Bair by a night attack. A further force (the 11th Div. and e rest of the 10th) was on that same night to effect a landing an entirely new point—Suvla Bay—a few miles north of Anzac, here the Turks were known to be few. This force was to sist the troops attacking Sari Bair in due course; and the ssession of Suvla Bay would furnish troops ashore in and out this area with a much more sheltered landing place than e beaches about Anzac offered. The last divisions to arrive, e 53rd and 54th, were to be employed wherever should seem best after the offensive had begun; to land the whole of the reinforcements simultaneously would not have been practicable with the amount of water transport available.

The utmost secrecy was observed by the Allies' staff. Steps were taken to mislead the Ottoman authorities by means of feints and of reconnaissances executed at localities other than those selected for operations. False reports were circulated assiduously by the intelligence department. Liman van Sanders was well aware of the arrival of large bodies of British troops in the Islands; but he remained in complete ignorance of his rival's real design until this was actually in course of execution. He had organised his forces as a southern group watching Anzac, while two divisions were retained near Bulair, where he was disposed to anticipate that the blow would fall. There were also large bodies of Turkish troops in reserve about Chanaq, and others about Kum Kale and Besika Bay. Numerically the contending armies at this critical juncture were about equal, but the Turks were necessarily much dispersed, so that the result of the impending clash of arms really hinged upon the speed with which the attacking side should gain ground before the defenders had time to concentrate.

The Allies' offensive started on Aug. 6 with two preliminary enterprises. An onset was made upon part of the Turkish lines in the Helles area. Portions of Birdwood's force broke out of the southern end of the Anzac position and gained ground. But the real purpose of the two operations was to occupy the enemy's attention and to conceal a design of much greater moment.

Attack on Sari Bair.—So dexterously had the assembling of the reinforcements in the Anzac area been effected that the Turks were entirely unaware that Birdwood's army had been nearly doubled. The plan for gaining possession of the Sari Bair mountain was that several columns were to move out from the northern end of the Anzac position at nightfall on Aug. 6 and, on reaching their appointed stations, were to wheel to the right and to work their way in the dark up certain steep but well-defined gullies that led up to the summit. But, although the Turks were to some extent surprised, and although the outlets of the gullies were in consequence in the assailants' hands by midnight, so stubborn a resistance was offered by the defenders that by daybreak the columns were not much more than half way up, and all attempts to win the upper ridges failed on the 7th in the face of the Turkish reinforcements.

After a rearrangement of the troops during the night, the offensive was resumed on Aug. 8; but except at one point very little progress was made. After a fresh reorganisation during the dark hours another effort was made on the 9th, and on this occasion a small body of British and Indian troops actually fought their way to a commanding summit from which the Narrows were seen, but they were driven off again. Next day the Turks, now in great force, counter-attacked and thrust those opposed to them back down the slopes all along the line, whereupon strenuous fighting ceased. Both sides had lost heavily, but victory for all practical purposes rested with the Osmanlis, even if the Anzac position had been extended considerably in a northerly direction as a result of the operations.

Landing at Suvla Bay.—Stirring events had in the meantime been taking place around Suvla Bay. The troops detailed for the landing in this quarter belonged to the British "New Army"; they were not conversant with active service conditions, and they were being highly tried in being called upon to execute a landing in force at night in face of opposition. There was indeed no precedent for an undertaking of this kind under modern tactical conditions, but the Turks were known not to be in sufficient strength to offer serious resistance. As it was, the whole of the 11th Div. was ashore before dawn; but the urgent need of pressing forward at once was not realised by the attacking side, and some confusion arose when the 10th Div. arrived and began to disembark. No vertebrate advance in force took place until late in the afternoon, and at nightfall the attacking force had only reached the foot of the hills lying to the east of the landing places and captured one advanced spur. The troops had suffered greatly from thirst, the arrangements with regard to water having practically broken down, mainly owing to the inexperience of the troops themselves.

Attack in the Hills.—When Liman von Sanders learned during the night of Aug. 6–7 that the Allies were landing in force at Suvla and were attacking Sari Bair from Anzac, he ordered the two divisions at Bulair to proceed to Suvla with all speed. But this meant a two days' march along indifferent roads. Consequently there was still on Aug. 8 a great opening left for the attacking side to complete the first part of its programme, *i.e.*, to gain possession of the heights to the east of Suvla which dominated the landing places and a considerable area of level ground around Suvla Bay. But no organised move took place. The opportunity was allowed to slip by, and that night Turkish reinforcements began to arrive from Bulair and to occupy the all-important high ground. Next morning the 10th and 11th Divs., supported in a measure by the 53rd Div., which had arrived during the night, advanced to the attack. But the effort failed, and when it was renewed on the following day the Turks had been so effectually reinforced that the offensive enjoyed little chance of achieving success. That day, Aug. 9, was the last on which there remained any hope either of the Sari Bair offensive achieving success or of the Suvla force establishing itself in a satisfactory position. This force, however, made a fresh attempt on the 10th to wrest the heights in front of it out of Osmanli keeping; but this failed completely, and further offensives in this quarter were abandoned for the time being.

Hamilton's carefully devised scheme of offensive operations had in fact come to nought in its most important features. The determined effort to secure possession of Sari Bair had miscarried. A footing had, it is true, been gained at Suvla, giving the Allies control of a fairly well sheltered inlet on the outer coast of the peninsula; but as the high ground within easy artillery range of the landing places, which overlooked the whole occupied area, remained in the hands of the Turks, much of the benefit hoped for from its acquisition was neutralised. Only a restricted patch of Ottoman territory had in fact been occupied thanks to the new undertaking, and although the position at Anzac had been extended and improved it remained a very bad one. The Allies now occupied many miles of front in the peninsula, but there was scarcely a spot where the enemy did not enjoy the advantage in respect to ground; what the attacking forces needed from the outset was depth rather than breadth, and depth they had failed to secure. They had moreover incurred very heavy losses during the succession of combats lasting from Aug. 6 to 10, and, except for a mounted division coming from Egypt to fight on foot, no reinforcements were on the way; the 54th Div. had already been swallowed up at Suvla. The defending side had also, no doubt, suffered heavily in casualties, notably on Sari Bair; but Liman von Sanders could fairly claim that, even if some valuable ground had been lost by the Turks, he had held his own in a contest in which his adversary had enjoyed the initiative and had been in a position to effect a surprise.

An effort was made by the troops on the extreme left of the Allies' position at Suvla to gain ground along the ridge north of the Suvla plain on Aug. 15, but nothing came of it. Hamilton, however, did not despair of improving the situation in this area, so the mounted division from Egypt and another division from Helles were quietly concentrated there in support of the troops already on the spot, and on the 21st, a determined attempt was made to capture some of the high ground which had baffled the attempts of the invaders on the 9th and 10th. Large forces were engaged on either side in this battle, and the attack was prepared by a heavy bombardment of the Ottoman trenches, in which warships moored in Suvla Bay, where they were secure from submarines, participated. But after a sanguinary encounter the assailants met with a decisive rebuff, and from that date onwards no serious offensive operation was attempted by the Allies in the Dardanelles campaign. The conditions of stalemate which had prevailed before the arrival of the five new divisions from England set in afresh and continued to the end.

As a consequence of the failure at Suvla during the early days of its occupation certain changes in command were carried out, Gen. Byng, especially sent out from home for the purpose, taking over command in this area. Gen. Davies was in command at Helles, and, as the right of the Suvla force was in touch with the left of the Anzac force in the low ground near the shore, Byng and Birdwood now held a continuous front extending from a point on the coast about 3 m. northeast of Suvla Bay near to Gaba Tepe, overlooked for practically the whole of its length by high ground in occupation of the Turks. Owing to the losses that had been suffered during the August combat and even before the final reverse of Aug. 21, Hamilton had cabled home asking for reinforcements and for the very large drafts needed to bring his depleted units up to their war establishment, amounting to a total of 95,000 men. He had, however, been informed that no large bodies of fresh troops could be spared for the Dardanelles theatre. A temporary change of plan did occur a few days later owing to a French proposal to despatch four divisions to the scene to operate on the Asiatic side of the Straits, whereupon the British Govt. became disposed also to send fresh divisions.

III. EVENTS IN THE BALKANS AND EVACUATION

These projects were dropped early in September, owing very largely to the threatening aspect of affairs in the Balkans. (*See* SALONIKA CAMPAIGNS; SERBIAN CAMPAIGNS.)

Serbian Defeat.—The campaign by which the Central Powers and Bulgaria crushed Serbia for the time being, and by which communications were opened through Bulgaria between Austria-Hungary and the Ottoman Empire, profoundly influenced the situation in the Gallipoli Peninsula to the disadvantage of the Entente. Not only was all idea of reinforcing the Allied army that was planted in this region abandoned, but some of Hamilton's troops had before long been transferred to Salonika. The linking up of Turkey with the Central Powers by railway, moreover, connoted that Liman von Sanders would speedily be furnished with ample munitions of all kinds, which would make the prospect of Anglo-French forces gaining possession of the Straits remoter than ever.

Withdrawal Discussed.—By the middle of September the Paris Government had come to the conclusion that there was now no hope of victory in the Dardanelles theatre; but the British Cabinet, influenced by anxiety as regards prestige in the East and by disinclination to abandon an enterprise in which great sacrifices had been incurred and from which much had at one time been expected, could not make up its mind to cut losses and to withdraw. On Hamilton being asked to give his views concerning the question of evacuation, he pronounced himself as emphatically opposed to such a step, so Sir C. Monro was sent out from England to take his place. The new commander-in-chief, impressed by the very unsatisfactory positions occupied by the Allied troops, by the impossibility of their making any progress at their existing strength, and by the risks that the army ran by clinging to such a shore without any safe harbour to depend upon for base in stormy weather, declared unhesitatingly in the closing days of October for a complete withdrawal after examining the situation on the spot and consulting with Birdwood, Byng and Davies.

Lord Kitchener's Visit.—The British cabinet would not, however, accept the recommendation, and they despatched Lord Kitchener to the Aegean to investigate and report. He had viewed proposals to abandon the campaign with alarm; but after visiting the peninsula he realised that evacuation was the only justifiable course, and reported to that effect. All this time winter was drawing nearer and the need for a prompt decision was becoming more and more urgent, but the authorities in London lost another fortnight before, on Dec. 8, they at last sent instructions to Monro to withdraw from Suvla and Anzac, while retaining Helles.

Evacuation of Suvla Bay and Anzac.—Anticipating orders to this effect, Monro had already made certain preparations for evacuation, and, as he was also responsible for the British forces at Salonika, had placed Birdwood in command, Gen. Godley relieving Birdwood at Anzac. It was recognised that the withdrawal of the vast accumulation of stores about the beaches, and also of the bulk of the actual troops, must be carried out gradually on successive nights, and this process was at once set on foot both at Suvla and at Anzac. The decision come to as to the final stage of the operation was that the front trenches should be held up to the last on the night of definite evacuation, and that the troops manning them should hasten straight to the beaches, everything removable having already been embarked; at a given moment the trenches (which at many points were but a few yards from those occupied by the Turks) would be vacated by detachments which by that hour would have shrunk to mere handfuls of men. The final night was provisionally fixed as that of Dec. 18–19, and, thanks to favourable weather and to the efficiency of the arrangements, the very critical undertaking was carried out with triumphant success just as had been laid down by programme 10 days before. Night after night the landing places were scenes of unceasing activity as war material, food supplies, animals and finally large bodies of troops, were got away. During the daytime reliefs took place as usual, pretences were made of landing stores and animals, and the result was that the Turks remained in complete ignorance of what was passing close to their lines. On Dec. 18 only a meagre force, composed almost entirely of infantry and disposed almost entirely in the front trenches, was holding a front of 10 m. face to face with an enemy incomparably stronger in numbers.

At nightfall the very few guns not yet withdrawn were hurried off to the jetties; then the troops along the front were quietly withdrawn by successive detachments; finally the parties still n the trenches slipped away; and when dawn broke the Turks discovered that the invaders were gone. Practically nothing worth mentioning had been left behind at Suvla, and at Anzac, where conditions were more difficult, only a very few worn-out guns had to be abandoned and some valuable war material destroyed. The relaxing by the Allies of their frail hold upon a strip of the outer coast-line of the Gallipoli Peninsula had been effected more successfully than the most sanguine amongst them had permitted themselves to hope.

Yet, for a week subsequent to the good news reaching them, the British Government remained irresolute with regard to the policy to be pursued at Helles. Then, however, Monro received the expected sanction for evacuating that area likewise, and Birdwood promptly grappled with this fresh problem, a problem rendered more difficult than the last owing to Liman von Sanders having full warning of what might be expected and, moreover, now enjoying an enormous preponderance in force. He had 21 divisions available, while there were only four left to oppose him.

Evacuation of Cape Helles.—The same principles as had been adopted by Byng and Godley at Suvla and Anzac were put in practice at Helles, the withdrawal of stores, war material, animals and personnel being carried out on successive nights. While the front trenches were to be held up to the last, the fighting force ashore was to be gradually reduced, and the detachments holding the front trenches were at the given hour on the last night, fixed provisionally for that of Jan. 8–9, to vacate them and hurry straight off to the beaches. But the weather was none too favourable on several of the preliminary nights, and the enemy's guns gave a good deal of trouble on the beaches, causing many casualties. The Turks were aware that withdrawal was gradually being carried out; but they could not tell which would be the final night, nor could they make ure how far the number of combatants within the British lines had been reduced. So, with the intention of ascertaining the trength of their opponents, on Jan 7 they delivered a half-hearted attack upon the left of the British position. This was beaten off, and they came to the mistaken conclusion that the final evacuation was not imminent.

Shortly after dark set in on the night of Jan. 8–9 the wind rose ominously. Nevertheless the guns remaining to be embarked were got off, the infantry followed, and the last detachments quitted the front trenches at 11:45 P. M., without the Turks noting their departure. But when they reached the shore it was found, in the case of those detailed for Gully Beach, that embarkation there was impracticable; so these had to march to "W" Beach and they were not afloat till after 4 A. M., only being got off with great difficulty owing to the surf. Several worn-out guns had been intentionally left behind, besides much ordnance material and foodstuff; but practically all of this was rendered unserviceable, for, just as the last boats were lowered off, the masses of stores were set on fire, and only then did the Turks discover that their opponents had evaded them a second time. The withdrawal from Helles had been a masterly military and naval achievement.

IV. CONCLUSIONS

Most authorities on war agree that the failure of the Entente in this memorable campaign was primarily due to the abortive naval effort to force the Dardanelles. This gave the Turk such warning of what was in store that, when Hamilton's army was ready to land, the defenders were in a position to bring it at once to a standstill. The only chance of success after that lay in very substantial reinforcements reaching the scene promptly. But neither the British nor the French could divert the requisite military resources from the main theatre of war at the moment, and when some additional troops were sent later, their numbers were insufficient and it was too late.

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(C. E. C.)

DARLING, CHARLES JOHN, 1ST BARON (1849–), British judge, was born Dec. 6 1849. At the age of 24 he was called to the bar; in 1885 he took silk, and shortly afterwards entered Parliament as Conservative member for Deptford. He sat in the House of Commons from 1888 until 1897 when he was knighted. His appointment in 1897 to a judgeship was not received with universal approval; but he later justified the choice by proving himself to be a man of acute understanding, with an unusual insight into human nature. He achieved success rather by his mother wit than by his knowledge of the law; and his shrewd and entertaining dicta made him a favourite with the public. In 1923 he retired, and in 1924 was granted a peerage. Among his published works are *Scintillae Juris* (1877); *Meditations in the Tea Room* (1879); *Seria Ludo* (1903); *On the Oxford Circuit* (1909).

DARROW, CLARENCE SEWARD (1857–), American lawyer, was born at Kinsman, O., April 15 1857. He received a public school education and was called to the bar in 1875, afterwards practising in Chicago. He appeared as counsel in a large number of important cases, many of which attracted wide attention and became recognised as one of the leading criminal lawyers in the United States. He was retained by the labour organisations in nearly all their litigation of recent years. Among the celebrated cases in which he appeared were the Debs strike case (1895), anthracite coal strike arbitration (1902), Steunenburg murder (1907), *The Los Angeles Times* dynamite case (1911) and the Loeb-Leopold case (1924). In July 1925 he defended J. T. Scopes at the Tennessee evolution trial. He wrote *Crime, Its Cause and Treatment* (1922), and many other books and pamphlets on social and economic questions.

DARTMOUTH COLLEGE (*see* 7.838) in the period between 1908 and 1926 experienced a great expansion in its equipment, endowment and enrolment. It has 22 buildings devoted to lecture-rooms, laboratories, administration and similar purposes. The extensive gymnasium was erected in 1910; Robinson Hall, the home of all undergraduate organisations except athletic, in 1914; and the Steele Chemistry Laboratory in 1920–1. The construction of a new library costing $1,000,000 will begin in 1926. Six of the 18 dormitories, which together house 1,350 students, were added between 1908 and 1923. The value of the equipment is over $3,000,000. The college also has single or apartment houses for housing 50 faculty families. Its productive investment assets more than doubled in this period, approximating $7,500,000. In

1925–6 it had over 200 officers, administrative and professional, with 2,100 enrolled students. The tuition cost is $400 a year. Provision is made through scholarships for assisting students unable to pay this sum.

In 1910, 62% of the students came from New England. The constituency of the college gradually changed until, in 1924–5, the majority came from outside New England, only 44% of the men coming from homes within those states. The trustees set a limit on the number to be accepted—at about 2,000. Candidates were selected on a basis of character, scholarship and general accomplishments. In June 1925 certain major changes were made in the curriculum, providing *inter alia* for special treatment for students of higher grade, and for the granting of but one degree, Bachelor of Arts. One of the most interesting influences of the college is promoted by the Dartmouth Outing Club, for the stimulation of healthful outdoor activities. The total number of Dartmouth men, graduates, undergraduates and faculty, who served in the army, navy or marine corps during the World War was 3,319. Those dying in active service numbered 112.

(R. R. L.)

DARWIN, SIR GEORGE HOWARD (1845–1912), British astronomer, was born at Down, Kent, July 9 1845 and was the second son of Charles Darwin (*see* 7.840). He was educated at Cambridge University (second wrangler and Smith's prizeman) where he became Plumian professor of astronomy and experimental philosophy in 1883. His work on the application of harmonic analysis and prediction to oceanic tides is monumental, as is his discussion of the influence of tidal friction in determining the evolution of binary systems, with special reference to the earth and moon. In an early paper he discussed the possibility of geological changes having altered considerably the inclination of the earth's axis to the plane of its orbit, and came to a negative conclusion. These works constituted the first attempt to apply thorough dynamical analysis to cosmogony and the major problems of geological evolution. He also carried out important work on periodic orbits in the problem of three bodies, figures of equilibrium of rotating masses of fluid and the stresses in the earth's crust produced by continents and mountains. He was awarded the gold medal of the Royal Astronomical Society in 1892 and the Copley Medal of the Royal Society in 1911. He was made K.C.B. in 1905, and he died in Cambridge on Dec. 7 1912.

Among his works are *The Tides and Kindred Phenomena in the Solar System* (1898), 3rd ed. (1911); *Scientific Papers* (1909–16).

DAS, CHITTA RANJAN (1870–1925), Indian politician and leader of the Swaraj party in Bengal, was born at Calcutta on Nov. 5 1870. His father, Bhuban Mohan Das, an attorney of the Calcutta High Court, joined the Brahmo Samaj, and edited the *Brahmo* (afterwards the *Bengal*) *Public Opinion*. Chitta Ranjan was educated at the London Missionary College, Bhowanipore, and at the Presidency College, Calcutta, obtaining the B.A. Degree. He came to London to compete for the Indian Civil Service, but, just failing to secure a place in the examination, pursued legal studies instead and was called to the bar by the Middle Temple on June 26 1894. Joining the Calcutta bar, he first came into prominence as counsel for Arabinda Ghosh in the Manicktollah bomb conspiracy case. The acquittal of Arabinda after prolonged trial, and the small remuneration accepted by Das, brought him popularity and a large practice. His prosperity enabled him to meet all debts in connection with his father's bankruptcy, though he was under no legal obligation to do so. He defended relays of young political desperadoes, and assisted in keeping extremist papers, such as *Bande Mataram*, going, until they were checked by the Press Act, 1910.

More and more the young lawyer threw himself into Nationalist and literary activities. In 1895 he had published a volume of Bengali lyrics *Malancha* which "introduced a new element of freedom and realism into our modern lyrical literature" (Motilal Ghose in foreword of Speeches by Das, 1918), and two further volumes were issued during the War. In 1915 Das started the Bengali monthly *Narayana*, but his chief journalistic work was the founding and conduct of the aggressive Swarajist daily, *Forward*. "His dominating note was hatred—and dread—of everything that savoured of the West. . . . It was the pursuit of these false gods that had converted Bengal from a smiling land of happiness and plenty into a salt waste over which brooded stagnation and death" (Lord Ronaldshay's *Heart of Âryâvarta* (1925). Yet he was sufficiently interested in the shaping of political reforms on western lines to participate in discussions leading to a joint address of Europeans and Indians to the Secretary of State and the Viceroy in Nov. 1917 (see Lionel Curtis, *Diarchy*, 1920).

Das became an influential though not always tractable supporter of M. K. Gandhi in the non-coöperating movement launched in the autumn of 1918. Apart from defending in political cases, he abandoned almost entirely his large practice, took to the wearing of *khadar* (homespun cloth) and lived in the utmost simplicity in order to devote his means to the Swarajist cause. Late in 1921 it was found necessary to proscribe the "volunteer" movement in Bengal, as in other provinces. On Dec. 10, some days before Das was due to preside at the Indian National Congress at Ahmadābād he was arrested for issuing a public appeal for the proscribed organisation, and was sentenced to six months' imprisonment. The daily conflicts of his followers with the police in Calcutta were complicated by processions of Bengali ladies, headed by Mrs. Das, who was in thorough sympathy with her husband's views. She was arrested, but by order of the governor, Lord Ronaldshay, was speedily released. Das presided at the National Congress at Gaya in Dec. 1922, and endeavoured to secure revocation of previous resolutions against entering the Legislatures, suggesting obstructive tactics in place of boycott. The controversy sharply divided the non-coöperationists, but with the decline of Gandhi's influence the Das policy gained ground, and was largely followed at the end of 1923 in the second general election under the Reforms; Das was elected to the Bengal Council by more than one constituency. In the following April his party captured the majority of seats in the Calcutta Corporation elected under a new Act, and Das was elected the first mayor of Calcutta.

In the Bengal Legislature Das did not command a clear majority, but he knew how to bring pressure to bear on the Independents and also upon the Mahommedans, to whom he suggested a pact under which, when Swaraj came, a substantial proportion of elective seats and public appointments would be reserved for them. He secured a bare majority on March 24 1924 for refusal of the salaries of Ministers whom Lord Lytton, the governor, had provisionally appointed. Lord Lytton's offer of a ministership to Das, as commanding a larger body of votes in the Legislature than any other member, was refused after considerable hesitation. Das laid down unacceptable conditions, and offered vehement opposition to the Bengal Criminal Law Amendment Ordinance (Oct. 25 1924) subsequently embodied in a certified Act under which 110 persons were kept in imprisonment for terrorist conspiracy, some of them having close association with Das. His refusal of office and command of votes in the Legislature led to the suspension of the diarchical system in Bengal, all transferred subjects being taken over by the executive government.

At the Bengal Provincial Conference at Faridpur, early in May 1925, Das modified his position and a resolution was passed condemning revolutionary tactics, though a year earlier at Serajganj the conference had praised the patriotism of the murderer of Mr. Day, a European merchant who was assassinated in the streets of Calcutta in mistake for a high police official, the resolution receiving the approbation of Das' paper *Forward*. There can be no doubt that the connection between the Terrorists and the Swarajists under Das was more than mere sympathy of the latter for the former. While each party had its own separate aims, each was working to use and assist the other in so far as it was useful for the attainment of its own ends.

There was public surprise, not unmingled with amusement, when the Secretary for India in the first Labour government, Lord Olivier, stated in debate (July 21 1924) that he was informed by a high authority in Indian politics that Das had "the reputation of being a particularly upright and scrupulous politician second only to Gandhi himself in saintliness of character." Undoubtedly, the Indian mind was impressed by the great personal sacrifices of Das for the Swaraj cause, and by his courage in act and utterance. In resource and driving power he stood high above his associates. He was skilful in swaying Bengali audiences and individuals, being capable both of playing upon their weaknesses and appealing to what was best in them. He was eloquent, emotional and clever, generous, warm-hearted and a lover of popularity. His vision of India under Swaraj as a conglomeration of semi-autonomous villages had no relation to the hard facts that make centralisation inevitable.

Competent judges believe that Das was gaining a fresh outlook, more tolerant of Western ideas, in the closing months of his life. He was at Darjeeling in search of health when he died from heart failure following diabetes, on June 16 1925. The body was taken to Calcutta for cremation, and the funeral concourse was one of the very largest in living Indian memory. A national memorial was promoted and received support from Indians of all political views.

Das' book, *India for Indians* (1918), gives extracts from speeches. A substantial volume of *Speeches* (some translated from Bengali) was published in Calcutta 1918. *The Way to Swaraj* (1923) gives the speeches made during a tour in southern India, and expounding, according to the prefatory note, "the whole of Desabandhu's philosophy of Indian Nationalism." This philosophy is discussed with penetrating insight in Lord Ronaldshay's books: *India: A Bird's-eye View* (1924) and *The Heart of Âryâvarta* (1925). (F. H. B.*)

DATO, EDUARDO (1856–1921), Spanish politician, was born at Corunna Aug. 12 1856. He graduated in law at the University of Madrid and was elected a deputy in 1884. An Under-Secretary for the Home Dept. in 1892, he became Minister for the department in 1899, and was largely responsible for bills regarding accidents, insurance and women's labour. In Dec. 1902 he became Minister of Justice, in 1907 mayor of Madrid and then president of the Chamber. He was elected a member of the Royal Academy of Social and Moral Sciences June 20 1905. He belonged to the "Liberal-Conservative" variety of the Conservative party, which his friend and political chief Silvela had represented, and, after Silvela's death continued to maintain this attitude. When in 1913 Señor Maura refused to take power, Señor Dato dissented from his chief, carrying with him the majority of his party, which elected him as its leader. When the World War broke out, he was responsible for Spain's declaration of neutrality. Becoming Prime Minister again in June 1917, he faced with determination the revolutionary outbreaks and disturbances of that summer. He resigned in October, but in 1920 resumed office, and while Prime Minister was murdered in Madrid March 8 1921.

DAUDET, LÉON (1867–), French man of letters and politician, was born in Paris Nov. 16 1867, the son of Alphonse Daudet (*see* 7.848). He married a granddaughter of Victor Hugo. Like his father he began by writing numerous novels, but failed to gain distinction as a novelist. His true vocation was that of a pamphleteer, and his violent opposition to the Government gave him the opportunity for displaying his talents as a controversialist. He wrote for *Le Gaulois* and *Le Figaro*, and also for *La Libre Parole*, a violently anti-semitic paper, in the columns of which he was able to give full vent to his fiery temperament. Influenced by the writer, Charles Maurras, he adopted the doctrines of neo-royalism. At the time of the Dreyfus case, through the generosity of Madame de Loynes, the royalist paper, *Action Française*, was founded in 1899, afterwards appearing as a daily paper in 1908. Through its columns Daudet soon became a power in the political world. His inflexible will, the lucidity and force of his literary style, the wealth of his invective, often highly-coloured, combined to make him read and feared for 20 years. During the elections of 1919 he was elected to the Chamber as a deputy for Paris. But by this time his influence as a controversialist was no longer as strong as it had been. With the establishment of peace, he suffered a decline recalling the cases of Rochefort and Drumont. The suicide of his anarchist son caused a great sensation.

Daudet wrote about 20 novels, of which the best are those which reflect his own dominating personality, such as *L'astre noir* (1893); *Les Morticoles* (1894); *Le voyage de Shakespeare* and *Sylla et son destin* (1922). Among his philosophical and controversial works may be mentioned *L'Hérédo* (1916); *Le monde des images* (1919); *L'avant-guerre* (1913); *Le stupide XIXe. siècle* (1922); and *Souvenirs* (1914). It is by this last work, still incomplete, that Daudet will probably be best remembered; for with its series of pen-portraits and caricatures it suggest a whimsical Saint-Simon, and vividly depicts modern political and literary life.

See Robert Guillou, *Léon Daudet: son caractère, ses romans, sa politique* (1918); André Goucher, *L'honorable Léon Daudet* (1921).

DAUMET, PIERRE JEROME HONORÉ (1826–1911), French architect, was born on Oct. 23 1826 in Paris. He entered the École des Beaux-Arts in 1846, and in 1855 he was awarded the Prix de Rome. In 1861, he was sent on an archaeological expedition to Macedonia, and published, in collaboration with Léon Henzey, an important work on the researches in Thessaly, Thrace and Illyria. But he is principally known for his achievements in restoring monuments of French architecture, in particular the Castle of Chantilly, and the Palais de Justice, Paris, and the Theatre at Orange. In Nov. 1884 Daumet was entrusted with the construction of the Église du Sacré-Cœur on Montmartre, which had already been begun by the architect Abbadíe; but the following year he abandoned the task, after a dispute with the ecclesiastical authorities. In 1885 he was chosen a member of the Académie des Beaux-Arts, and in 1889, was awarded a gold medal for his designs exhibited at the Paris Exhibition. He died in Paris on Dec. 15 1911.

DAVIDOVIC, LJUBOMIR (1863–), Yugoslav politician, was born at Vlaška in Serbia. In 1901 he entered Parliament and, the next year, with Ljubomir Stojanović, founded the Independent Radical party. In 1904 he became Minister of Education, in 1905 President of the Skupština and in 1909 mayor of Belgrade. In that year he was one of the Serbian witnesses at the Friedjung trial in Vienna, and soon afterwards Professor Masaryk laid before the Austrian delegation the papers on which the forgers had practised Davidovic's signature. In the Serbian Coalition Cabinet, formed during the Austrian invasion in Nov. 1914, Davidovic again became Minister of Education, but in 1917 he resigned office and remained in active opposition to Pašić throughout the remainder of the World War. In 1919 he was elected chief of the newly formed Democratic party and was Yugoslav Premier from Aug. of that year until Feb. 1920. In later years he adopted a conciliatory attitude towards the Croats, and condemned the policy of extreme centralisation. In July 1924 he again became Prime Minister at the head of a coalition of Democrats, Slovene Clericals and Bosnian Moslems, supported by the Croat peasants. He was, however, unable to maintain himself in office, and was replaced, in Oct. 1924, by a purely Radical Government under Pašić.

DAVIDSON, RANDALL THOMAS (1848–), English divine (*see* 7.863), appointed Archbishop of Canterbury in 1903, was with King Edward VII. at his death in 1910, as he had been with Queen Victoria in 1901, and he crowned King George V. in 1911. He was one of the four counsellors of state who acted as His Majesty's Commission when the King went to India in 1911, and again in 1925 when the King went to the Mediterranean after illness. During the whole of this period he took a leading part as spokesman of the national Church in the House of Lords. Lord Morley bore public witness to the effectiveness of his intervention in the critical debate on the Parliament Act in 1914. He made important contributions in debates on temperance, divorce and various social and moral questions. His influence was also constantly and successfully exerted in matters affecting the welfare of native races, *e.g.*, in Kenya, and he made notable appeals on behalf of Christian minorities in the East. In general national and ecclesiastical affairs his attitude is admirably expressed in his Charge, *The Character and Call of the Church of England* (1912).

Trusted by Englishmen of all classes for his wisdom and goodness, the Archbishop commanded the confidence of Free Churchmen to a greater degree than any of his predecessors. He had a peculiarly anxious task during the World War, and his utterances from 1914–9 published in *The Testing of a Nation* (1919) show the combination of just patriotism with an international spirit by which his leadership was distinguished. On more than one occasion he lifted up his voice both in Convocation and the House of Lords against reprisals which had "as a deliberate object the killing and wounding of non-combatants." Twice he visited the troops in France. In 1916 he placed himself at the head of a national mission, which aimed at the deepening of religious life at home. At an early date he gave public support to the proposals for a League of Nations, and it was recognised as specially fitting that he should preach the sermon at the opening of the third Assembly in Geneva, 1922, since published with other post-War addresses in *Occasions* (1925). In 1922 Dr. Davidson took the lead in issuing a vigorous protest, signed by the leaders of the Anglican, Roman, Free Church and Jewish Communions, against religious persecution in Russia—one result of which was the saving of the Patriarch Tikhon's life. In 1923 he also made a successful public appeal for the retention of the Oecumenical Patriarchate at Constantinople.

The Archbishop also took a deep interest in the work of the Church overseas. He presided over the sixth Lambeth Conference in 1920, attended by 252 out of the 368 bishops of the Anglican Communion, and throughout the deliberations adopted a strong forward-looking attitude. After the issue of the Appeal to all Christian People by that conference he took a prominent part in securing widespread consideration of the proposals for the reunion of Christendom which it contained. He actively forwarded conferences with the Free Church representatives in England, a series of important meetings being held at Lambeth Palace. He further expounded the Appeal to the General Assemblies of the Church of Scotland, and the United Free Church of Scotland in 1921. In addition, the Archbishop markedly developed friendly relations between the Anglican and Orthodox churches, and it was to him that the Patriarch (Meletios IV.) of Constantinople communicated his Synod's acceptance of the validity of Anglican Ordinations in 1922. He also took "cognisance" of the conversations between Anglican and Roman Catholic theologians held at Malines (1921–4) under the presidency of Cardinal Mercier, and which took place with the cognisance of Pope Pius XI.

In 1920 two other events occurred with which he was closely identified in different ways. The first Archbishop of Wales was enthroned by him at St. Asaph, following upon the disestablishment of the Welsh Church. The National Assembly of the Church of England, with the powers conferred upon it by the Enabling Act of 1919, met for the first time. Dr. Davidson's chairmanship of the National Assembly gave it a vitality and coherence which would otherwise have been difficult to attain. The two chief church problems which confronted his primacy were those connected with modern criticism, and with ecclesiastical discipline in ritual and doctrine, including Prayer-Book revision. His own policy was to try to secure the fidelity to primitive Christianity, historical continuity, due regard to the needs of the present day and loyalty to truth, for which the Church of England stands. (G. K. A. B.)

DAVIES, ARTHUR B. (1862–), American painter, was born at Utica, N.Y., Sept. 26 1862. He was a pupil of Dwight Williams at Utica, afterwards studying in New York and Chicago. He became an adherent of the Romantic school of painting and made notable contributions in the fields of etching and colour-lithography. Among his more important works are "Dream" and "The Girdle of Aries," in the Metropolitan Museum, New York City; "Maya, Mirror of Illusions," in the Art Institute, Chicago; "Spring in a Valley" and "Night Overture," in the Minneapolis Institute of Art; and "The Place of the Mother" and "Children of Yesterday," in the Brooklyn Museum. In 1923 his picture, "After-Thoughts of Earth," procured for him from the Carnegie Trust a medal of the first class and $1,500. He had previously been the recipient of the Corcoran Gold Medal (1916).

DAVIES, SIR LOUIS HENRY (1845–1924), Canadian politician and jurist (*see* 7.865), was in 1901 appointed a judge of the Canadian Supreme Court. In 1918 he became chief justice and in the following year was sworn of the Privy Council. He died at Ottawa May 1 1924.

DAVIS, HENRY WILLIAM BANKS (1833–1914), British painter (*see* 7.866), died at Glaslyn, Radnorshire, Dec. 1 1914.

DAVIS, HENRY WILLIAM CARLESS (1874–), British historian, a son of H. F. A. Davis of Stroud, Gloucestershire, was born Jan. 13 1874 and educated at Weymouth College and Balliol College, Oxford. He was made a fellow of All Souls College and from 1902 to 1921 was a fellow of Balliol, where he was responsible for much of the history teaching. During the World War he served in the War Trade Intelligence Department. In 1921 Davis was appointed professor of modern history at Manchester and in 1925 he returned to Oxford as regius professor of modern history. He became director of the *Dictionary of National Biography*, when, in 1902, the copyright of that work passed to the Clarendon Press. Davis's early historical work was chiefly done in the medieval field and found expression in his *England under the Normans and Angevins*, 1905; *Mediaeval Europe*, 1911, and a revised edition of the *Select Charters* of William Stubbs, 1913. During the War period he turned to subjects bearing on the struggle, wrote *The Political Thought of Treitschke*, 1914; edited *The Oxford Pamphlets* and worked on a history of the Peace Conference.

DAVIS, JOHN WILLIAM (1873–), American lawyer, was born at Clarksburg, W.Va., April 13 1873, where he received his early education. He graduated from Washington and Lee University in 1892, and from the Law School there in 1895, being admitted to the bar in the same year. After a year as assistant professor of law at his alma mater, he returned in 1897 to Clarksburg, where he entered into an informal partnership with his father, also a lawyer, which continued until 1913. In 1899 he was elected a member of the West Virginia House of Delegates, and in 1904 was a delegate to the Democratic National Convention at St. Louis. He was elected to the 62nd (1911) and 63rd (1913) Congresses for the first West Virginia district. During his period of service he was one of the managers on the part of the House in the successful impeachment of Judge Archbald.

In Aug. 1913, he was appointed solicitor-general of the United States, an office which he held until 1918. In this position he conducted many important cases, among them the Midwest Oil case, involving the right of the President to withdraw from entry public lands thought to contain mineral deposits. From 1913 to 1918 he was counsel for the American Red Cross. In 1918 he was appointed American delegate to a conference with Germany at Bern on the treatment and exchange of prisoners of war, and in the same year succeeded Walter Hines Page as American Ambassador to Great Britain, retaining this post until 1921. Among the honours conferred upon him was that of election as a bencher of the Middle Temple.

During the Peace Conference John W. Davis was one of President Wilson's chief advisers, and was the American representative on the joint committee which drafted the form of Allied control and government in the occupied Rhineland territory. In 1921 he returned from England and accepted a partnership in the New York law firm of Stetson, Jennings and Russell, which had many distinguished clients, among them J. P. Morgan & Co. and the Guaranty Trust Company. Mr. Davis was nominated on the 103rd ballot as Democratic candidate for the presidency at the Democratic National Convention held in New York City July 1924. The ensuing election resulted in an overwhelming victory for Calvin Coolidge, the Republican candidate, the electoral vote being 382 for the latter, 136 for Davis and 13 for La Follette, the Progressive candidate, while the popular vote was 15,748,356 for Coolidge, 8,617,454 for Davis and 4,686,681 for La Follette.

DAVIS, RICHARD HARDING (1864–1916), American writer, was born in Philadelphia April 18 1864. He studied at Lehigh and Johns Hopkins universities and in 1886 became a reporter on the Philadelphia *Record*. After working on several newspapers he acted as managing editor of *Harper's Weekly*. He became widely known as a war correspondent, reporting every war from the Greco-Turkish War (1897) to the World War. Of his numerous works of fiction, the earliest are the best, especially *Gallegher and Others* (1891); *Van Bibber and Other Stories* (1892); and *Episodes from Van Bibber's Life* (1899). His other books include: *Soldiers of Fortune* (1897); *Captain Macklin* (1902); *The Bar Sinister* (1904); *Vera the Medium* (1908); and *With the French in France and at Salonika* (1916). His plays include: *Miss Civilization; The Dictator; The Galloper; The Orator of Zapata City;* and *The Zone Police* (1914). He died near Mt. Kisco, N.Y., April 11 1916.

DAWES, CHARLES GATES (1865–   ), American statesman and financier, was born in Marietta, O., Aug. 27 1865, the son of Gen. Rufus R. Dawes. He was educated in his home town, graduating from Marietta College in 1884 at the early age of 19. He then attended the Cincinnati Law School and in order to defray his expenses obtained employment during his vacation on the Marietta, Columbus and Northern Ohio Railway. Before finishing his two-year law course he was made chief engineer in charge of construction on this railway—a fact eloquent of the energy and versatility which were to distinguish his whole career. He received his LL.B. degree in 1886, before he was old enough to practise. Admitted to the bar several months later, he commenced practice at Lincoln, Neb., in 1887. Two years later he married Caro D. Blymer of Cincinnati.

Dawes' reputation as a lawyer was established by his part in the Nebraska rate case, in which he appeared successfully as counsel for the Lincoln Board of Trade in an effort to obtain a reduction in railway rates in Nebraska. In 1894 he became extensively interested in the gas business at Evanston, Ill., and at other western points, and removed to Evanston in that year. In 1896 he organised the movement in Illinois to nominate William McKinley as Republican candidate for the presidency. He was chosen a member of the executive committee of the Republican national committee, and was active in securing McKinley's nomination and election. He was appointed comptroller of the currency by President McKinley Jan. 1 1898. His tenure of office was conspicuous for efficiency of administration and disregard of "red-tape" methods, especially in the conduct of the many receiverships and trusts created by the financial disorders following 1893. Retiring from this office in 1902, he organised the Central Trust Co. of Illinois, which, under his presidency, became one of the strongest financial institutions in Chicago.

On the declaration of war against Germany by the United States April 6 1917, Mr. Dawes volunteered for service and was given a commission as major and later as lieut.-col. of the 17th Engineers (Railway), his well-known ability and early experience in railway construction outweighing the fact that he was over age. He landed in France July 17 and was placed on the headquarters staff of the American Expeditionary Force by Gen. Pershing as chairman of the General Purchasing Board and chief of supply procurement charged with the duty of collecting supplies in Europe and of co-ordinating their purchase in such a way as to guard against inflated prices and duplication of orders. His conspicuous success in directing these transactions, which secured for the American Army over 10,000,000 ship tons of supplies in Europe as against 7,000,000 shipped to it from the United States, led to his promotion to the rank of brigadier-general in 1918 and, on the unification of command of the Allied forces under Foch, Gen. Dawes was appointed as U.S. member of the Military Board of Allied Supply, the organisation of which had been largely due to his efforts. This board for the last four months of the War co-ordinated the movement of supplies for the Allied Armies in the zone of the advance.

After the conclusion of the Armistice, Dawes became a member of the liquidation committee of the A.E.F., charged with the task of disposing of the huge accumulations of American property in France and of settling outstanding claims against the army, which engaged his efforts until Aug. 1919, when he resigned his commission and returned to the United States. Upon the creation of a Budget Bureau by Congress, April 1921, the directorship of it was offered to Gen. Dawes by President Harding and was accepted on condition that the bureau should be non-political, that in gathering information the director should be assumed to be acting for the President and his calls for consultation or information should take precedence of all others. His work in organising this bureau and creating under executive order the existing system of co-ordinating boards now operating in government business was carried through with characteristic vigour and directness and resulted in savings estimated officially at $250,000,000 in the first year. Having completed the task of placing the budget on a satisfactory and permanent basis, he resigned his position June 30 1922.

In the meantime the collapse of the German financial structure and international reactions resulting therefrom had precipitated a crisis in European affairs, the outcome of which appeared ominous. At this juncture, the Allied Reparations Commission, in 1923, appointed Gen. Dawes and Owen D. Young as U.S. members of the committee of experts to report upon means of balancing Germany's budget and stabilising its currency. Dawes was selected as chairman, and the committee's report, known as the "Dawes Plan," was subsequently ratified and accepted by all the Powers concerned. By making the actual transfer of reparation payments conditional on the stability of German exchange, this plan provided a non-political and automatic means for determining Germany's ability to pay and so withdrew this vexed question from international controversy and paved the way for the later agreements entered into at Locarno (*see* REPARATIONS).

At the Republican National Convention held at Cleveland, O., June 10–12 1924, following the nomination of President Coolidge for re-election, Gen. Dawes was nominated for vice-president on the third ballot by a vote of 682½ against 334½ for Herbert Hoover and 75 for Judge Kenyon. Following the overwhelming triumph of the Republican ticket at the ensuing election, Gen. Dawes assumed office on March 4 1925. In his inaugural speech he called for a revision of the rules of procedure in the Senate so that a majority vote could apply the closure to debate. He later carried his proposals for senatorial reform before the people in a series of public meetings in various parts of the country.

Another aspect of Gen. Dawes' character is revealed by two acts of philanthropy. In memory of his son, Rufus Fearing, who was accidentally drowned Sept. 5 1912, he established the Rufus F. Dawes hotels in Chicago and Boston, at which impoverished men could obtain food and accommodation at nominal rates. As a memorial to his mother he established the Mary Dawes Memorial hotel, where women might live at small cost and retain the physical comforts and social opportunities compatible with self-respect. In the course of his varied and successful career as engineer, lawyer, politician, comptroller of the currency, public utility operator, banker, philanthropist, soldier, organiser of the Government budget, leading spirit in the settlement of German reparations, and Vice-President of the United States, Gen. Dawes found time also to become an accomplished musician on the piano and flute, and is the composer of the well-known "Melody in A Major." His outstanding achievements were rewarded with a number of decorations, including the D.S.M. of the United States, Croix de Guerre and Commander of the Legion d'Honneur of France, Companion of the Order of the Bath of England and Commander of the Order of Leopold, Belgium. His forceful expression "Hell and Maria," used in giving evidence contributed not a little to his popularity.

Dawes wrote *The Banking System of the United States and its Relation to the Money and Business of the Country* (1894); *Essays and Speeches* (1915); *A Journal of the Great War* (1921); and *The First Year of the Budget of the United States of America* (1923). (O. D. Y.)

DAWES PLAN: *see* REPARATIONS.

DAWSON OF PENN, BERTRAND EDWARD DAWSON, 1ST BARON, British physician. He studied medicine at University College and the London Hospital, where in 1896 he became an assistant physician, and in 1906 physician. He carried out extensive researches on gastric affections, and became one of the leading authorities on this subject. He was appointed physician extraordinary to King Edward VII. in 1907, and later physician in ordinary to King George V. and in 1923 to the Prince of Wales. During the World War he did very valuable work on war diseases, publishing various papers on paratyphoid and infective jaundice. He was made G.C.V.O. in 1917, K.C.M.G. in 1919 and in 1920 was raised to the peerage. Dawson has published *The Diagnosis and Operative Treatment of Diseases of the Stomach* (1908), various contributions to Allchin's *Manual of Medicine*, and many papers in medical journals on gastric disorders.

DAWSON, GEORGE GEOFFREY (1874–), British journalist, was educated at Eton and Magdalen College, Oxford, and was elected a fellow of All Souls College in 1900. Passing into the civil service, he was appointed to the Colonial Office, and in 1901 he went to South Africa as private secretary to Lord Milner, then high commissioner. On Lord Milner's retirement from the high commissionership in 1905 he accepted the editorship of the Johannesburg *Star*, which he held for the next four years. Returning to London in 1910, he was appointed a director of *The Times*, which was then in the early days of Lord Northcliffe's direction, and in 1912 succeeded Mr. G. E. Buckle as editor. The conspicuous success which *The Times* attained during the difficult years of the World War was largely due to Mr. Dawson's sound judgment and knowledge of affairs, which formed an admirable and often very necessary complement to Lord Northcliffe's imagination and genius. In 1919, however, Mr. Dawson found himself unable to carry out Lord Northcliffe's policy for *The Times* and resigned. He was succeeded by Mr. Henry Wickham Steed (*q.v.*). When in consequence of Lord Northcliffe's death in 1923 *The Times* was reconstructed, Mr. Steed retired and Mr. Dawson was recalled to the editorship. During his absence from journalism he was estates bursar of All Souls College (1919–23) and secretary to the Rhodes Trust (1921–2). In 1917, under the terms of a relative's will, he took the name of Dawson instead of Robinson.

DAYLIGHT SAVING.—In the second year of the World War nearly every country in Europe adopted the device of putting the clock forward an hour during the spring, summer and autumn months. The motive was quite simply to get people to bed an hour earlier and out of bed and at work an hour earlier, to save fuel for lighting and heating.

Great Britain.—In Great Britain, the idea itself did not arise out of the War at all. About 1907 it occurred to Mr. William Willett, a Chelsea builder, that civilisation got up an hour or two too late in the summer months, and had a short evening for outdoor recreation, when it might have a long one. He devoted himself to a campaign for putting the clock on by 80 min. in the spring and summer months. He made no attempt to found a league or society, but ran the campaign himself at his own expense and succeeded so far that in 1908 Mr. (afterwards Sir Robert) Pearce introduced a bill in the House of Commons to put the clock on by law. The bill was sent to a Select Committee the following year. In 1916, the expert committee set up by the British Government to study the question of fuel economy advised that the measure should be adopted. The scheme was simplified. Mr. Willett had proposed that the clock should be put on 80 min. in four moves of 20 min. each. The first Select Committee in 1908 had advocated one movement of the clock of one hour in the spring. This was the method adopted by the Act which was passed on May 17 1916 and put into operation the following Sunday, May 21. There was a good deal of opposition. Farmers objected to it because milkers would have to get up an hour earlier to do their work, which meant getting up in the dark during the greater part of the year. Hay and corn harvests could not be carried until the dew was dried off, which meant an hour during which labourers could do nothing. When put to the test of practice these difficulties proved to have been much exaggerated.

In the House of Commons Sir Frederick Banbury and Lord Hugh Cecil were the tellers against the bill in the division upon the second reading. In the House of Lords Lord Balfour of Burleigh opposed it as "the most absurd and ridiculous bill that had ever been presented to the House." He said further that

> He did not propose to give it strenuous opposition as it was but a temporary measure for the duration of the War. But if any attempt were made after the War to make it a permanent institution it would have to receive the most critical attention. He asked their lordships to carry their minds to the night in October when the clock was set back. At 1 o'clock the clock would be put back to midnight. Supposing some unfortunate lady was confined with twins and one child was born 10 minutes before 1 o'clock. If the clock was put back the registration of the time of birth of the two children would be reversed. The second child would be born 50 minutes before the other. Such an alteration might conceivably affect the property and titles in that House.

The actual introduction of summer time on Sunday, May 21 1916, was fortunate in the matter of weather. May 21 was a day of summer warmth and sunshine, and the fine evening was a strong popular argument for the advancing of the clock. Some few adjustments had to be made and warnings issued. The president of the Royal Meteorological Society sent out a letter stating that Greenwich mean time would continue to be used for all meteorological observations and publications, but asked that regular observers for this Society should state in their reports whether they were recording Greenwich or summer time. The Port of London Authority announced that the tide tables in the almanacs would remain Greenwich time. The Royal and L.C.C. parks decided to close at dusk by the sun, but Kew Gardens decided to follow the clock and closed an hour earlier by the sun. At Edinburgh the Castle gun continued to be fired at 1 P.M. summer time, but the ball on the top of the Nelson Monument on Calton Hill was dropped at 1 o'clock, Greenwich mean time, for the benefit of mariners who watched it from the Firth of Forth. The legal change of the clock was fixed for 2 A.M. in the morning, so that only travellers by long-distance trains running through the night actually saw the jump of an hour.

In Great Britain summer time was renewed after the War by a series of Acts of Parliament. The final and permanent Act of 1925 provided that summer time should begin on the day next following the third Saturday in April, or if that day is Easter day the day next following the second Saturday in April. Summer time closes in Great Britain on the first Saturday in October. The official time for altering the clock is 2 A.M. on Sunday morning. (H. D.*)

United States.—The course of the daylight saving movement in the United States has been different. No public interest was developed in the project till after the outbreak of the World War, and it was not until 1916 that a nation-wide campaign was initiated in its support. Opinion was divided, but in 1917 Congress passed an Act, to take effect in 1918, whereby the standard time of the United States would be advanced one hour on the last Sunday in March and set back one hour on the last Sunday in October. The Act was effective from March 31 till Oct. 27 1918, and again on March 30 1919. Strenuous opposition developed, however, from the farmers and the law was repealed Aug. 20 1919 over the President's veto. Since then the question has been left to the various state and local authorities, with the result that daylight legislation has been sporadic and intermittent. Daylight saving was observed in 1925 in the states of Massachusetts and Rhode Island by virtue of state laws, and by municipal ordinance in the New York Metropolitan district, Philadelphia, Chicago and a number of other cities and towns, but the movement as a whole has lost ground.

DAYTON, O., U.S.A. (*see* 7.877), made a remarkable recovery from its losses in the floods of March 1913, which covered 7 sq. m. of its area, including the business district and large residential sections, the water standing 12 ft. deep on Main street A pestilence was only averted by prompt and energetic measures. A relief fund of $750,000 was disbursed by the American Red Cross and the Citizens' Relief Committee. To prevent a recurrence of the catastrophe, the Miami Conservancy District, formed in 1915 under the provisions of a state law of 1914, constructed a series of dry reservoirs at a cost of $35,000,000, vhich met successfully the test of severe spring storms in 1922. The total value of the output of the factories rose from $60,378,-oo in 1909 to $174,991,000 in 1919 and $187,933,516 in 1923. The population increased from 116,577 in 1910 to 152,559 in 920, of whom 9,025 were negroes (an increase of 86·4% in 10 ears) and 13,165 foreign-born (a decrease of 5·3%); in 1925 the fficial estimate was 172,942. (*See* Cox, J. M.)

Dayton was the first large city to adopt the commission-ianager form of government which came into effect Jan. 1 1914. etween 1910 and 1925, nearly $7,500,000 was spent on public-chool buildings. The University of Dayton, until 1920 St. Iary's College, had an enrolment of 1,150 in 1925. The Civic Iusic League was organised in 1912, and an art institute was stablished in 1919 in a reconstructed factory building. The nportance of Dayton as an aviation centre, the home of Wilbur nd Orville Wright, was increased during the War, when the U.S. ovt. located its aviation experiment laboratories at McCook ield. When this became too small, the Wilbur Wright Field as expanded to 5,000 ac. by the gift of the people of Dayton 1924). This was accepted by the War Dept. as the permanent ocation for the engineering division of the air service.

DEAF AND DUMB.—The effects of deafness upon the physiology and the psychology of the individual necessarily vary ccording to its history, its degree and its possible physical and ental complications. It is practically impossible to obtain omplete or reliable statistics of the incidence of deafness in the eneral population; or of the history and nature of the affliction.

I. GREAT BRITAIN

The census authorities of Great Britain and Ireland still use eadings which, under the circumstances in which these are nswered, render the published results both incomplete and unatisfactory. The Board of Education is the only other official epartment which issues any statistics on the deaf, and these ecessarily relate to children. In his report for 1924, the chief edical officer states that there were, in that year, 3,584 deaf ildren and 423 partially deaf children in attendance at certied special schools: 288 deaf children and 1,279 partially deaf ildren were attending public elementary schools or other instiitions and 301 deaf children and 79 partially deaf children were no school or institution, while there were 586 vacancies for ch children in the special schools. The incidence of total deafss in children, as shown in the returns of the local education ithorities for 1924, was ·81 per 1,000 children; that of partial eafness in the same year was ·35 per 1,000 children. The incince of deafness in school children varies very widely in differt districts and is shown in the chief medical officer's report to 5·18 per 1,000 children in the Is. of Scilly and ·33 in Southport.

Classification.—The National College of Teachers of the Deaf s for many years past advocated the scientific classification of af children for the purposes of instruction according to the story and degree of their deafness and their mental condition. early, the partially deaf, and those who lose their hearing after e habit of speech has been naturally acquired, stand in a difrent relation to education from the deaf born, whose minds have ver been stimulated by heard speech. Up to comparatively cent times, both types were grouped together for instructional rposes, an entirely wrong procedure. The movement to give ese children the advantages of a hearing environment and to in them by methods adapted to children who hear is steadily owing, and schools for partially deaf children are increasing number. This is only part of the classification necessary to sure that each type and condition of deafness shall receive the ecial educational care it needs. The London County Council stitution for the defective deaf at Rayners is another step in is direction.

International Action.—At the International Conference of achers of the Deaf held in London in 1925, which was attended leading experts from some 15 nations, recommendations were opted, urging the need for opportunities for the higher educan and technical training of the deaf after school age; the ablishment of classes for the partially deaf in connection with schools for hearing children, such classes to be taught by specialist teachers of the deaf; the enforcement of a compulsory hearing test in elementary schools, in order to ensure the detection and treatment of deafness in its early stages; the appointment of national committees to enquire into, and report upon, all matters affecting the education, training, industrial and social conditions of the deaf in the various countries represented; and the establishment in every country of a national organisation to promote the general interests of the deaf throughout life. The Conference also decided to organise an international organisation of teachers of the deaf.

The British Association.—The British Deaf and Dumb Association is a national body consisting of deaf adults together with the leaders, hearing and deaf, of the local welfare societies, of which there are some 60 in existence, and is complementary to that of the teachers. The main consideration of its congress at Southampton was devoted to the industrial and social position of the deaf.

The great advance in the education of the deaf during the 20th century has established their fitness for higher educational and technical training. With this conviction the leaders of the schools and welfare societies for the deaf initiated, in 1923, a movement for the reconstitution of the then national bureau for promoting the general welfare of the deaf, established in 1911, which was reorganised as the National Institute for the Deaf and came into being in April 1925.

The National Institute.—The main attention of the institute has been devoted to the industrial conditions of the deaf, the conditions of the deaf in poor law institutions and mental hospitals and the care of the blind-deaf. One of the greatest needs at the present time is the establishment of provision for the training of the deaf who leave school, in skilled trades in order to prevent the wastage of intelligence and ability now too common.

In Great Britain the compulsory education of deaf children has been operative since 1894. No official enquiry has yet been made into the conditions and needs of the deaf after school age; and the committee of the National Institute are of opinion that the appointment of a departmental committee for this purpose is long overdue.

The general objects of the Institute are:—

The prevention of deafness; the education of the deaf, including the proper administration of the law affecting the attendance of deaf children at suitable schools, and the furtherance of their early training; the re-education of the partially deaf through speech-reading; the provision of efficient training in trades for children leaving school, and of opportunities for continued academic study; the adjustment of official and trade regulations, where they operate harshly against the deaf worker; the provision of opportunities for the higher education of the deaf; the adequate care of the blind-deaf and the mentally defective deaf; the social elevation and fuller citizenship of the deaf; supplying information to, and advising public departments, private bodies and individuals needing this assistance; and generally by propaganda, whether in the way of local or national action, to influence the public in favour of the deaf, with a view to bringing about necessary reforms. (F. G. B.)

II. THE UNITED STATES

During the years 1910–25 the number of schools for the deaf in the United States increased from 145 to 167. The school attendance during the same period has grown from 13,540 to 15,473. It is not likely that this increase in number of pupils means an increase in the actual percentage of deaf children in the United States, but that it is due to the passage of more compulsory school laws and to the more careful execution of such laws. Probably the increase is partly due also to the increasing tendency to transfer hard-of-hearing children, who are dropping behind in the ordinary public schools, to special schools for the deaf. The increase in the number of schools is largely confined to the establishment of small day schools, particularly in the middle western states.

Entirely new school plants have been built in Connecticut at Hartford, in Tennessee at Knoxville and in New Jersey at Trenton. These new plants are of three distinct types: the first, single building to include all the activities of the school; the second, a group of buildings separating the activities to some extent; and the plant at Trenton, a highly divided plant with many cottages accommodating small groups of children only. It is worthy of note that the plant in construction at the Tennessee School was designed and built under the direction of a deaf architect, a graduate of Gallaudet College. Many other schools have added to their physical equipment, particularly to their primary departments and their trades schools.

Labour bureaus for the deaf have been established as part of the state government in North Carolina and Minnesota, for the purpose of aiding deaf workers to obtain employment. Social workers to keep in touch with both the young and the adult deaf have been appointed in the states of Illinois, Pennsylvania and Minnesota. Considerable attention has recently been given in educational work for the deaf to the training of residual hearing and the improvement of speech and accent by the use of musical instruments, such as the piano. Various electrical inventions have been placed upon the market for use with hard-of-hearing pupils, some of which can be operated by one teacher for a whole class. Such instruments, however, are yet in their experimental stage, as far as value in educational work goes.

The course of instruction at Gallaudet College, which receives graduates from various state, city and private schools of the country, has been extended to include practical work for the men, such as printing, mechanical drawing, agriculture and chemistry. Courses in library cataloguing, domestic art and domestic science have been added for the benefit of the women students.

A survey of over 40 schools in the United States was undertaken in 1925 by the National Research Council. It covered, among other questions, that of hearing, speech and speech-reading powers of pupils, causes of deafness, courses of study given in schools, trades taught, laws under which the schools operate and the general equipment for instruction of pupils. Schools visited were both of the institutional and the day-school type. The results of this survey are being published in the *American Annals for the Deaf*. They already seem to show the need of more attention to auricular work and of better speech teaching in the American schools.

DEAKIN, ALFRED (1856–1919), Australian statesman, was born at Melbourne Aug. 3 1856. Educated at the University of Melbourne, for a time he worked as a journalist, being called to the Victorian bar in 1877. He entered the Victorian Legislature in 1878 and held several important ministerial posts. He played a prominent part in the Federation movement and, in 1901, as attorney-general, was included in the first Federal Cabinet of Sir Edmund Barton, whom he succeeded as Prime Minister in 1903. During his legislative career in Victoria he was active in promoting social legislation and an ardent advocate of preference in favour of Great Britain. This fiscal policy he pursued during his three Federal premierships (1903–4, 1905–8, 1909–10), and supported Australia's co-operation in Imperial defence, being responsible for the reception of the measure authorising Australian naval construction in 1909, and for the invitation to Lord Kitchener to visit Australia and report on the question of defence. After 1910 he led the Opposition in the Australian Parliament until compelled to retire owing to ill-health in 1913. He died Oct. 7 1919.

DEATH: WHY AND WHEREFORE (*see* 7.898).—The life cycle of individual multicellular organisms, standing relatively high in the scale of organic specialisation, as for example, a fly, a bird or a man, is typically divisible into five biologically differentiated, and usually distinct, phases as follows: (*a*) The formation of the *zygote*, which is the individual, by the union of ovum and spermatozoon in the process called fertilisation. The life-history of the individual, as a distinct and biological entity, begins with this event. (*b*) The period of *development and growth*, which has two sub-phases, commonly designated respectively as embryonic or foetal, and post-embryonic or post-natal. The duration of this growth phase of the life-cycle in time varies widely in different organisms, as from 8 to 10 days in the fruit fly, *Drosophila*, to more than 20 years in man.

This developmental and growth phase finally comes normally to an end in most forms of higher animal life, and is succeeded by (*c*) the phase of *adult stability*, in which no marked changes are observable either in the direction of growth or degeneration. This phase is the " prime of life " in common parlance. Its duration in time is again widely variable. Sooner or later the individual can be observed to have passed definitely into the next phase of the life-cycle, which may be designated (*d*) the period of *senescence*. This phase is characterised by a progressive waning in the intensity of the vital processes generally, accompanied by regressive and degenerative changes in the structures of the body. The duration in time of this portion of the life-cycle again varies greatly, but ultimately, in all the more highly specialised organisms, the life of the individual, as such, comes to an end with the terminal event of the cycle (*e*) *death*. By this term is designated the cessation of all vital capacity.

The Cycle of Life.—In the cycle of individual life as outlined, the most significant phases biologically are obviously (*b*) growth and (*d*) senescence. Phases (*a*) and (*e*) (fertilisation and death) are the terminal events of the important periods (*b*) and (*d*). Phase (*c*) is transitional between (*b*) and (*d*), and may be wholly absent, as when obvious senescent changes follow immediately upon the cessation of obvious growth. Indeed it is doubtful if phase (*c*) has theoretically any place in the life-cycle at all. Perhaps in cases where a stable adult plateau in the middle of the cycle seems to exist, it merely means that the changes of growth or of senescence are proceeding at too slow a rate to be observable by the relatively crude methods available.

Senescence and Death.—The special problem of the biology of death is the analysis and elucidation of phases (*d*) and (*e*) of the life-cycle, senescence and death. As a result of investigations in this special field of general biology certain broad generalisations are now possible. The more important of these will now be discussed.

Time Duration.—The time duration of the entire individual life-cycle varies enormously, both as between different forms of life, species, genera, families, etc., and also as between different individuals belonging to the same species. Thus the maximum duration of life of the rotifer, *Proales decipiens*, is 8 days (Noyes). At the other extreme there are other authentic records of individual reptiles living to as much as 175 years, and of individual birds and mammals living to well over 100 years.

Zoological Groups.—The differences between distinct groups of animals (species, genera, families, etc.) in respect to the length of the life-span stand in no generally valid, orderly relationship to any other broad fact now known in their structure or life-history. In spite of many attempts to establish such relationships every one so far suggested has been upset by well-known facts of natural history. Thus it has been contended that the duration of an animal's life is correlated with its size, in the sense that the larger the animal the longer its life. But plainly this has no general validity. Men and parrots are smaller than horses, but have life-spans of much greater length.

Individual Differences.—The differences between individuals of the same species in the duration of their lives are distributed in a lawful and orderly manner, in marked contrast to the apparently haphazard character of the inter-group variation in length of life-span just discussed. The individual variation in the duration of life is capable of exact mathematical description, and, indeed, its treatment constitutes a special branch of mathematics, known as actuarial science. It has been shown by Pearl and his students that if the life of different animals, such as the rotifer, *Proales*, the fly, *Drosophila*, various other insects and man, be measured not in absolute time-units of years or days, but in terms of a relative unit, namely a hundredth part of the biologically equivalent portions of the life-span in the several cases, then the distribution of individual variation in duration of life, or the distribution of mortality in respect to age, or, in short, the life-curve, is quantitatively similar in these widely different forms of life almost to the point of identity. This is illustrated in fig. 1.

These facts suggest that the observed differences between individuals in duration of life are primarily the result of inborn differences in their biological constitutions (their structural and functional organisations) and only secondarily to a much smaller degree the result of the environmental circumstances in which their lives are passed. This inference is supported by the further fact that:—

Inheritance.—The differences between individuals which find expression in varying degrees of longevity, or duration of life, are definitely inherited. This has been demonstrated statistically

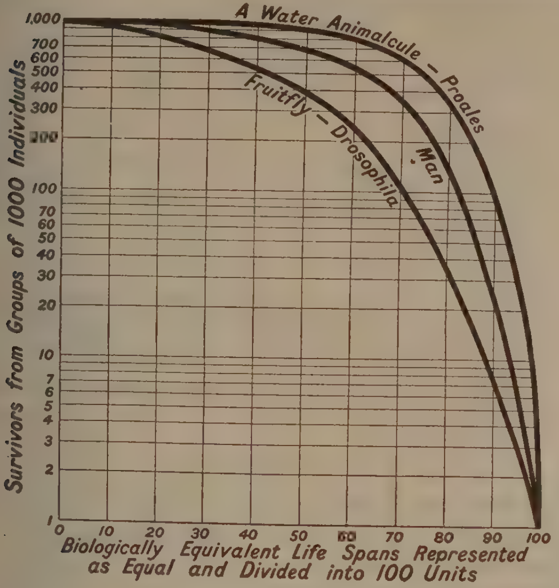

FIG. 1.—These curves show the survival rates for man, a fruit fly Drosophila) and a water animalcule (Proales) at corresponding ges. The remarkable similarity of these curves shows that actuarial bles constructed for man would apply with little change to these her animals, although the fruit fly lives, on the average, about 50 ays and the water animalcule less than 8 days.

r man by Karl Pearson, Alexander Graham Bell, Pearl and thers. It has been proved experimentally by cross-breeding ng-lived and short-lived strains of the fruit fly, *Drosophila elanogaster* (Hyde, Pearl and his students, Parker and González). The results of such an experiment are shown in fig. 2.

In the first generation (F_1) from such a cross the progeny hibit a life-curve essentially like that of the long-lived parent ock, but with a slightly greater average duration. If now these individuals are bred together *inter se* there are produced in e second cross-bred generation (F_2) two kinds of individuals, ne of which (long-winged) has a life-curve like the original ng-lived parent stock, while the other (short-winged) resembles duration of life the original short-lived parent stock. In addition to these experiments along Mendelian lines, it has been own that there can be isolated from a general population of ld *Drosophila* inbred strains showing definite and permanent nate differences in average longevity. The conclusion that dividual differences in life duration are fundamentally an expression of hereditary differences between individuals is firmly tablished.

Natural Death a Novelty.—Neither senescence nor natural eath are necessary, inevitable consequences or attributes of e. Natural death is biologically a relatively new thing, which ade its appearance only after living things had advanced a long ay on the path of evolution. The evidence supporting this nclusion is manifold, and may be considered under several ads. (*a*) Various single-celled organisms (*Protozoa*) have oved, under critical experimental observation, to be immortal. They reproduce by simple fission of the body, one dividual becoming two, and leaving behind in the process othing corresponding to a corpse. The brilliant work of Woodff and his students, in particular, has demonstrated that this ocess may go on indefinitely, without any permanent slacking of the rate of cell division corresponding to senescence, and without the intervention of a rejuvenating process such as conjugation or endomixis, providing the environment of the cells is kept favourable. (*b*) The germ cells (ova and spermatozoa) of all sexually differentiated organisms are, in a similar sense, immortal. Reduced to a formula we may say that the fertilised ovum (united germ cells) produces a soma and more germ cells. The soma eventually dies. Some of the germ cells prior to that event produce somata and germ cells, and so on in a continuous cycle which has never yet ended since the appearance of multicellular organisms on the earth. (*c*) In some of the most lowly organised groups of many-celled animals or *Metazoa*, the power of multiplication by simple fission, or budding off of a portion of the body which reproduces the whole, is retained. This asexual, or agamic, mode of reproduction occurs as the usual, but not exclusive, method in the three lowest groups of multicellular animals, the sponges, flatworms and coelenterates. More rarely it may occur in other of the lower invertebrates.

So long as reproduction goes on in this way in these multicellular forms there is no place for death. In the passage from one generation to the next no residue is left behind. Agamic reproduction and its associated absence of death also occurs commonly in plants. Budding and propagation by cuttings are the usual forms in which it is seen. The somatic cells have the capacity of continuing multiplication and life for an indefinite duration of time, so long as they are not accidentally caught in the breakdown and death of the whole individual in which they are at the moment located. (*d*) There is some evidence that in certain fish there is no occurrence of senility or natural death, but that instead the animal keeps on growing indefinitely, and would be immortal except for accidental death. The animal soma in such cases behaves like the root stock of a perennial plant. (For further discussion of this line of evidence see interesting correspondence by Geo. P. Bidder, in *Nature,* vol. 115, Jan. to June 1925, *passim.*)

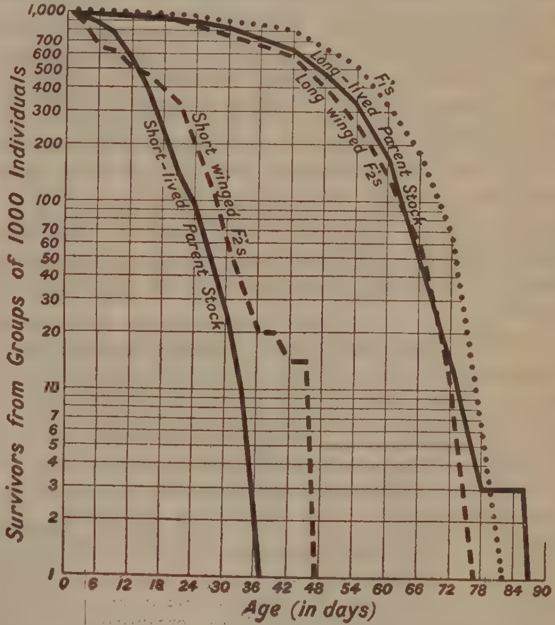

FIG. 2.—This chart shows the manner in which longevity is inherited among fruit flies (Drosophila) when a long-lived stock is crossed with a short-lived one (both represented by an unbroken line). The first generation of progeny (dotted line, F_1's) is longer-lived than either parent stock. The first generation, when inbred, produces progeny of two kinds (broken lines, F_2's): a short-winged, which approximates in length of life the short-lived ancestral stock, and the long-winged, which approximates the long-lived one. The Mendelian laws of heredity are thus seen to hold, in the case of these fruit flies, for longevity, which is thereby shown to behave like a definitely inheritable quality.

(*e*) The successful cultivation *in vitro* of the tissues of higher vertebrates, even including man himself, over an indefinitely long period of time, demonstrates that senescence and natural death are in no sense necessary concomitants of cellular life. Carrel and Ebeling, by transferring the culture at frequent intervals into fresh nutrient medium, have kept alive for more than 14 years, and in perfectly normal and healthy condition, a culture of tissue (*see* TISSUE CULTURE) from the heart of a chick embryo. There is every reason to suppose that, by the continuation of the same technique, the culture can be kept alive indefinitely. The experimental culture of cells and tissues *in vitro* has now covered practically all of the essential tissue elements of the metazoan body, even including some of the most highly differentiated of those tissues. Nerve cells, muscle cells, heart muscle cells, spleen cells, connective tissue cells, epithelial cells from various locations in the body, kidney cells and others have all been successfully cultivated *in vitro*.

Potential Immortality.—It may fairly be said that the potential immortality of all essential cellular elements of the body either has been fully demonstrated, or has been carried far enough to make the probability very great, that properly conducted experiments would demonstrate the continuance of the life of these cells in culture to any indefinite extent. It is not to be expected, of course, that such tissues as hair or nails would be capable of independent life, but these are essentially unimportant tissues in the animal economy, as compared with those of the heart, the nervous system, the kidneys, etc. Generalising the results of the tissue culture work of the last two decades it is highly probable that the cells of all the essential tissues of the metazoan body are potentially immortal, when placed separately under such conditions as to supply appropriate food in the right amount, and to remove promptly the deleterious products of metabolism.

Death among Multicellular Animals.—A fundamental reason why the higher multicellular animals do not live forever appears to be that in the differentiation and specialisation of function of cells and tissues in the body as a whole, any individual part does not find the conditions necessary for its continued existence. In the body any part is dependent for the necessities of its existence, as for example nutritive material, upon other parts, or put in another way, upon the organisation of the body as a whole. It is the differentiation and specialisation of function of the mutually dependent aggregate of cells and tissues which constitute the metazoan body that brings about death, and not any inherent or inevitable mortal process in the individual cells themselves.

When cells show characteristic senescent changes it is probably because they are reflecting, in their morphology and physiology, a consequence of their mutually dependent association in the body as a whole, and not any necessary progressive process inherent in themselves. In other words, in the light of present knowledge, it seems necessary to regard senescence as a phenomenon of the multicellular body as a whole resulting from the fact that it is a differentiated and integrated morphologic and dynamic organisation. This phenomenon is reflected morphologically in the component cells. But it does not primarily originate in any particular cell because of the fact that the cell is old in time, or because that cell in and of itself has been alive; nor does it occur in the cells when they are removed from the mutually dependent relationship of the organised body as a whole and given appropriate physico-chemical conditions. In short, senescence appears not to be a primary attribute to the physiological economy of individual cells as such, but rather of the body as a whole. The suggestion of Bidder that in air-breathing animals senescence and death are the alternative to physically impossible gigantism is essentially another way of expressing this idea.

Times of Death.—The different organ systems of the body have characteristic times of breaking down and leading to death. These differences probably represent in considerable part different innate degrees of organic fitness of the different tissues and organs, and also in part the degree of exposure of the different organ systems to environmental stresses and strains. The following table, based upon mortality returns o the U.S. Registration Area in 1910, illustrates these differences. The figures tabulated are (*a*) the mean or average age at death and (*b*) the median age at death (that is, the age so chosen that the same number of deaths occur below this age as the number occurring above it).

Deaths due primarily to organic breakdown or failure of	Mean age at death (years)		Median age at death (years)	
	Male	Female	Male	Female
1. Alimentary tract and associated organs of digestion	25·54 ± ·06	28·24 ± ·07	4·98 ± ·08	14·93 ± ·09
2. Respiratory system	32·24 ± ·05	32·57 ± ·06	31·86 ± ·07	28·24 ± ·08
3. Skeletal and muscular system	35·09 ± ·29	37·96 ± ·32	33·02 ± ·36	35·96 ± ·41
4. Endocrinal system	44·17 ± ·82	44·15 ± ·36	45·45 ± 1·03	43·42 ± ·46
5. Skin	46·73 ± ·34	42·45 ± ·46	53·47 ± ·43	48·96 ± ·58
6. Sexual system	47·37 ± ·32	42·47 ± ·08	57·96 ± ·40	40·88 ± ·11
7. Nervous system	49·11 ± ·08	51·56 ± ·09	54·64 ± ·10	60·29 ± ·12
8. Circulatory system and blood	54·50 ± ·07	54·25 ± ·08	62·04 ± ·09	62·14 ± ·09
9. Excretory system (kidneys and associated organs)	57·94 ± ·07	54·24 ± ·09	61·37 ± ·09	57·50 ± ·11

There are thus wide differences in the time of breakdown of the different organ systems, as reflected in mortality. The alimentary tract, on the average, "wears" rather less than half as long as the excretory system. The two organ systems which stand at the head of the list as leading earliest to death by their breakdown are the two (alimentary tract and respiratory system) which are in direct contact with external environmental agents (food and air) throughout life. The two which stand at the bottom of the list (the circulatory and excretory systems) practically never come into direct contact with the external environment.

Rejuvenation.—In recent years numerous attempts have been made to bring about "rejuvenation" of the ageing body, and to lengthen the span of life by various surgical alterations of certain endocrinal organs, particularly the essential organs of sex (*see* REJUVENATION). Whatever may be the immediate physical and psychological effects of such procedures, there is as yet no convincing evidence that they alter the expectation of life of the individual.

Senescence.—Many theories of senescence have been advanced. No one of them can be regarded as entirely satisfactory, or as generally established by the evidence. Most of them suffer from the logical defect of setting up some particular observed attribute or element of the phenomenon of senescence itself, such as protoplasmic hysteresis, slowing rate of metabolism (meaning essentially only reduced activity), etc., as the cause of the whole. More experimental work on the problem is essential; in particular in the direction of producing at will, and under control, the objective phenomenon of senility irrespective of the age of the organism, and conversely preventing the appearance of these phenomena in old animals.

LITERATURE.—The literature on the subjects treated in this article is widely scattered in biological, medical and statistical journals and separate treatises. The following books summarise the field, and will serve to introduce the reader to the detailed literature: C. M. Child, *Senescence and Rejuvenescence* (1915); E. Korschelt, *Lebensdauer, Altern und Tod* (1922); R. Pearl, *The Biology of Death* (1922); T. Brailsford Robertson, *The Chemical Basis of Growth and Senescence* (1923); R. Pearl, *Studies in Human Biology* (1924). (R. PE.)

DEATH-RATE: *see* POPULATION.

DE BOSIS, ADOLFO (1863–1924), Italian poet and man of letters, was born at Ancona. He studied at the University of Rome, where he graduated in law and practised for a few years, but was always more interested in literature. In 1895 he became editor of *Il Convito*, a literary review to which D'Annunzio and other distinguished writers contributed. Although he was afterwards largely absorbed by business affairs, as manager of the Italian Carbide Company, he continued his literary activities and made his reputation as the translator of Shelley (*Il Prometeo liberato*, 1922) and Homer into Italian verse. He was also an original poet of considerable distinction, and in 1900 he collected his own poems in a volume entitled *Amori ac silentio sacrum*, which was republished in 1914, together with *Le rime sparse*, and again in 1923. He was not a prolific writer, but he exercised considerable influence on the younger authors of his time, many of whom were inspired by his deep love of the classics and keen ense of beauty. He died near Ancona Aug. 29 1924.

DEBS, EUGENE VICTOR (1855–), American politician, was born at Terre Haute, Ind., Nov. 5 1855. On leaving the pubic schools he became in 1871 a locomotive fireman. In 1879 he was elected city clerk of Terre Haute and in 1881 was re-elected. During 1885 he was a member of the Indiana Legislature. Previous to this, in 1880, he was elected secretary and treasurer of he Brotherhood of Locomotive Firemen and was appointed edtor of *The Locomotive Firemen's Magazine*. In 1893 he organised he American Railway Union and was elected president of the Union, serving four years. In 1894 he led the strike which, beginning in the Pullman-car plants, soon involved the railways eading into Chicago (*see* 6:124).

Debs was arrested on a charge of conspiracy to kill, and acquitted, but was later convicted of contempt of court for violating an injunction, and sent to gaol for six months (May–Nov. 895). In 1897 he allied himself with the socialist movement. He was Socialist candidate for the presidency of the United States in 1900, 1904, 1908, 1912, but declined the nomination in 1916. n 1907 he was on the editorial staff of the *Appeal to Reason* and in 1914 became editor-in-chief of the *National Rip-Saw*, a Soialist paper published at St. Louis. He was a pacifist and in ept. 1918 was convicted of violating the Espionage Act and entenced to 10 years in the penitentiary. In 1920, while in prisn, he was again nominated presidential candidate by the Soialists and received 915,302 votes. His sentence was commuted y President Harding in Dec. 1921. He is the author of *Unionism and Socialism; a Plea for Both* (1904).

DEBTS, INTER-ALLIED.—An examination of the methods by which the Allies financed the cost of the War (that is to say, the ifference between normal pre-War expenditure and actual exenditure for the period 1914–9 inclusive) can only give approximate results, but it is estimated that of the total War expenditure % was met by taxation, 77·2% by home borrowing, 14·5% by oans between the Allied Govts. themselves and 2.3% by borowing in other foreign countries. In general the funds placed by he Allies at each other's disposal were utilised, not for internal xpenditure by the borrowing country, but for purchase in the ending country of military stores and supplies and, in certain ases, for exchange stabilisation and interest payments on pre-War external loans. At one time or another during the War all he Allies employed this means of obtaining funds abroad, but nly three of the Allied and Associated Powers acted to any ppreciable extent as lenders, namely Great Britain, the United tates of America and France, the advances made by Italy being omparatively unimportant. It is extremely difficult to arrive t any accurate estimate of the total sum of these transactions, he details of which are still the subject of dispute between the overnments concerned. In the majority of cases, however, offiial statements have now been published by the various creditors howing the total amount claimed by them from each of their ebtors (*see* CURRENCY).

I. STATEMENT OF LOANS AND FUNDING AGREEMENTS

Great Britain.—For Great Britain the figures in Table I. are aken from a statement made by the Chancellor of the Exchequer (Mr. Churchill) in the House of Commons on July 27 1925. They how the amount of the original advances and, after addition of nterest due and deduction of principal and interest repaid in ash, the net amount due on June 30 1925. The Belgian pre-Armistice debt of £110,000,000 is not given, as, under the Treaty of Versailles, this is a charge on German Reparations. The figures do not include loans made to the Dominions for War purposes, but do include advances made to certain new and ex-enemy states as well as to Allies, in the period immediately following the War:—

TABLE I.

Loans Advanced by Great Britain to Certain Countries for War and Post-War Purposes as at June 30 1925

(In thousands of £)

	Original Advances	Debt at June 30 1925
Allied Govts.		
France	446,226	626,182
Russia	483,321	756,705
Italy	369,824	589,530
Serb-Croat-Slovene kingdom.	22,383	29,905
Rumania	16,401	26,124
Portugal	15,611	22,678
Greece	16,391	21,237
Belgium (post-Armistice)	6,799	..
Total A	1,376,956	2,072,361
Loans for Relief		
Austria	11,578	11,341
Rumania	1,892	2,200
Serb-Croat-Slovene kingdom	1,884	2,388
Poland	3,682	4,770
Czechoslovakia	461	474
Estonia	241	251
Hungary	109	109
Armenia	88	111
Lithuania	17	..
Latvia	20	..
Loans for Reconstruction		
Belgium	9,000	9,000
Belgian Congo	3,550	3,550
Other Loans—Stores, etc.		
France	6,726	4,500
Greece	395	395
Armenia	747	908
Czechoslovakia (Wheat Loan)	1,901	...
Baltic States	2,435	2,435
Repatriation of Prisoners		
Czechoslovakia	827	827
Poland	168	168
Rumania	138	138
Serb-Croat-Slovene kingdom	187	187
Latvia	130	130
Total B	46,176	43,882
Total A and B	1,423,132	2,116,243

TABLE II.

Loans Advanced by the United States to Certain Countries for War and Post-War Purposes

(In thousands of dollars)

Country	Principal of Liberty Loan Acts Advances	Principal of Surplus Stores and Relief Credits	Total Principal
Armenia		11,960	11,960
Austria	..	24,056	24,056
Belgium	349,214	29,873	379,087
Cuba	10,000	..	10,000
Czechoslovakia	61,974	29,906	91,880
Estonia	..	13,999	13,999
Finland	..	8,282	8,282
France	2,997,478	407,341	3,404,819
Great Britain	4,277,000	..	4,277,000
Greece	15,000	..	15,000
Hungary	..	1,686	1,686
Italy	1,648,034	..	1,648,034
Latvia	..	5,132	5,132
Liberia	26	..	26
Lithuania	..	4,982	4,982
Nicaragua	..	167	167
Poland	..	159,667	159,667
Rumania	25,000	12,922	37,922
Russia	187,730	4,871	192.601
Yugoslavia	26,780	24,978	51,758
Total	9,598,236	739,822	10,338,058

Great Britain's only debt to another Allied Govt. was that of $4,277,000,000 to the United States. As will be seen from the above, her advances to Allies greatly exceeded the amount borrowed from the United States.

United States.—The United States was a creditor only; and after entry into the War in April 1917 incurred the main responsibility for financing the Allies. Great Britain was the principal debtor, but a considerable proportion of the funds which she obtained in this way were re-advanced by her to the other Allies. After the Armistice large sums were provided by the American Govt. for relief credits in Central Europe and for purchases of War stores. Table II. on p. 829 shows the total loans to the Allies and Hungary as given in the annual statement of the Secretary of the United States Treasury for 1925.

The majority of these loans have since been the subject of funding agreements, as the following official statement shows:—

TABLE III.

Funding Agreements of Certain Countries with the United States

(In thousands of dollars)

Country	Date of Agreement	Principal of Obligations Funded	Accrued Interest Funded	Funded Bonds Received or to be Received
Belgium	Aug. 18 1925	377,030	40,750	417,780
Czechoslovakia	Oct. 13 1925	91,880	23,120	115,000
Estonia	Oct. 28 1925	12,066	1,764	13,830
Finland	May 1 1923	8,282	718	9,000
Great Britain	June 19 1923	4,074,818	525,182	4,600,000
Hungary	April 25 1924	1,686	253	1,939
Italy	Nov. 14 1925	1,647,869	394,131	2,042,000
Latvia	Sept. 24 1925	5,132	643	5,775
Lithuania	Sept. 22 1924	4,982	1,048	6,030
Poland	Nov. 14 1924	159,667	18,893	178,560
Rumania	Dec. 1 1925	36,128	8,462	44,590
Total		6,419,540	1,014,964	7,434,504

N.B.—Cuba has repaid her debt in full.

France.—The position of France, which, like Great Britain, was both a borrower and a lender, is more obscure. In the first place, she has as yet (1926) made no final funding arrangements with either Great Britain, from whom she borrowed £446,226,000, or the United States, from whom she received $3,404,000,000. On the other hand, she advanced considerable sums to Russia and the smaller Allies; here, too, no refunding arrangements have been made, and in many cases the exact amount is in dispute. In the inventory of the French financial position laid before the Chamber in Dec. 1924 by M. Clémentel, the then Minister of Finance, the following list is given of advances made by France with the note that it must be taken as a general indication of the position as at June 30 1924 and not as a statement of exact figures. Foreign currencies are converted into francs at the rates ruling on June 30 1924, when the American exchange was 19 fr. to the dollar.

War and Post-War Loans Made by France Outstanding on June 30 1924

	Thousand francs
Russia (old régime)	6,023,300
Russia (various later governments)	490,000
Belgium	3,067,295
Yugoslavia	1,738,566
Rumania	1,132,000
Greece	537,514
Poland	895,400
Czechoslovakia	542,200
Italy	350,273[1]
Portugal	9,000
Estonia	3,500
Latvia	9,000
Lithuania	2,300
Hungary	800
Austria	331,926
	15,133,074

[1] This represents net debt due to France and is at variance with published Italian figures.

Italy.—Italy was in the main a borrower, although to som extent she made advances to other Allies. After her entry into th War in May 1915 she borrowed from Great Britain £369,824,00 and from the United States $1,648,000,000. According t official figures her loans to other Allies were as follows, but certain of the items in the French account are in dispute. Foreig currencies are converted at the rates ruling on April 23 1926.

	In thousand lire
Rumania	189,936
France	292,380
Russia	63,000
Yugoslavia	56,000
Greece	5,000
Austria	1,730,000
	2,336,316

Russia.—Russia, on the other hand, was entirely a borrowe Her loans from Allied Govts. up to the time of the revolutio in 1917 were as follows:—

Great Britain	£483,321,000
United States	$187,729,750
France	fr. 6,023,300,000
Italy	lire 36,045,000

Other Allies.—Belgium was also a borrower, and received considerable sums from the United States, Great Britain and France As a recognition, however, of the damage done consequent on th violation of the treaty of 1839, Germany undertook in Articl 232 of the Treaty of Versailles "to make reimbursement of al sums which Belgium has borrowed from the Allied and Associated Govts. up to Nov. 11 1918, together with interest at the rate of 5% per annum on such sums." At the time of the Peac Conference the representatives of Great Britain, France and th United States agreed, subject to ratification by their Governments, to accept German bonds to the value of the Allied pre-Armistice loans to Belgium, thus freeing Belgium from the responsibility of these debts. This was eventually carried out by Great Britain and France. The United States Congress, however, refused to ratify the agreement, and the pre-Armistice debt was the subject of a special arrangement in the subsequent Belgian Debt Funding agreement. For the sake of convenience, the following table gives the advances made by each of the Allies during both periods:—

	Pre-Armistice	*Post-Armistice*
Great Britain	£110,000,000[1]	£18,500,000
United States of America	$171,780,000	$207,307,194
France	fr. 3,219,474,742[1]	fr. 241,472,300

[1] Including interest at 5%.

Of the other Allies, Rumania, Yugoslavia, Greece, Portugal, Armenia, Nicaragua and Liberia were all borrowers, while after the Armistice the new States of Poland, Czechoslovakia, Finland, Lithuania, Latvia and Estonia received advances for various purposes, and Austria and Hungary, of the ex-enemy states, received relief credits. The actual amounts loaned can be seen from the preceding tabulations.

II. HISTORY OF THE LOANS

Any attempt to trace in detail the development of Inter-Allied borrowings, of which the above official figures represent the present position, must be one of great difficulty. For the greater part no authoritative information has been made available as to the dates at which these various obligations were incurred, and the figures given in the following survey must be taken as mere estimates. For the sake of convenience the history of these loans may be divided into three periods:—

First Period: 1914–7.—Up to the end of 1914 the various Allies were able in the main to finance their own foreign purchases. Russia, however, soon found herself in difficulties. Unlike Great Britain and France, her Government was unable to command large funds abroad, while her incapacity to manufacture munitions on a sufficiently large scale necessitated heavy purchases from her Allies. In addition, considerable sums were required for the payment of interest on the existing external debt. As early as Oct. 1914 she had been forced to apply to the British Govt. for assistance, and a credit of some £11,500,000 was opened on her account at the Bank of England against a shipment of gold to the value of £8,000,000. At the end of the year a further credit was granted, and in Feb. 1915 at a meeting in Paris the British, French and Russian Finance Ministers agreed to unite their financial resources, to share the advances made to Allied Govts., to issue a joint loan and to co-operate in the purchase of supplies abroad. Actually the second proposal was never carried out, but as a result of this and subsequent conferences large funds were raised for Russia in both France and England by the sale of Russian Treasury Bills on the open market and by the extension of governmental credits against a small proportion of gold from the Russian reserve. It is estimated that Russia, during the period 1914–Sept. 1917, borrowed £483,000,000 from the British Govt., against a deposit of gold in London of £60,000,000, and 6,000,000,000 fr. from the French Government. She also obtained credits from the United States Govt. between the months of April and Sept. 1917. In the United States and Japan, moreover, considerable sums were placed at her disposal by the British Government.

The next country to find difficulty in financing its War requirements abroad was France. In Oct. 1914 she had found it advisable to arrange for the issue of Treasury Bills on the London market. By May 1915 some £10,000,000 worth of these bills had een placed, and by the end of that year the figure of open market orrowings had risen to £33,000,000 and to £80,000,000 in 1917. In May 1915 it was agreed that the British Govt. should grant France substantial credits against shipments of gold in the proortion of three to one. This system lasted until the end of 1916, hen the shipment of gold ceased. During the same period rance raised considerable sums on the American market, of hich the most important was the joint Anglo-French loan for 500,000,000 in Oct. 1915, repaid in 1920. France, during this eriod, borrowed altogether nearly £200,000,000 from the British ovt. and dispatched to London some £53,500,000 in gold. o the other Allies the French Govt. lent approximately ,500,000,000 francs.

Great Britain during this period loaned to her Allies over 900,000,000. In addition to the above-mentioned advances to rance and Russia, £60,000,000 were advanced to Belgium and 27,000,000 to Rumania, Serbia, Greece and Portugal. Up to Oct. 915 Great Britain had not had occasion to borrow in the United tates, but it was found impossible to maintain the American xchange unless funds were available to cover the greatly increased purchases there of war materials. The joint Anglo-rench loan was raised on the market without other security han the credit of the two governments, but all moneys subseuently raised in America during this period took the form of redits or secured notes, collateral being deposited in each case. or this purpose the British and French Govts. encouraged their ationals either to sell or lend to the Government their holdings f American securities, which were either sold for dollars or emloyed as collateral.

Italy did not enter the War until May 1915, and from then ntil the end of this period confined her borrowing to the United ingdom (with the exception of a small amount raised in Canada). redits to the extent of some £153,000,000 were granted to her y the British Govt., gold to the value of £22,200,000 being deosited in London as security. On the other hand, she herself dvanced about 63,000,000 lire to Russia. Her advances to rance during this period are in dispute.

The Second Period.—This dates from April 1917, when the nited States entered the War, till the Armistice in Nov. 1918. owards the end of the previous period the Allies were beginning grow anxious as to their ability to continue the purchase of pplies in America on the then existing scale for an indefinite eriod. Accordingly, one of the first acts of the United States ovt. after the declaration of War was to obtain the consent of ongress to a law (Liberty Loan Act) authorising the extension credits to Allied Govts. up to a total of $3,000,000,000. This mit was subsequently raised three times up to a total of $10,000 million in July 1918. Such credits were granted without collateral and for an indefinite period, and were to bear the same rate of interest and be subject to the same conditions as the corresponding bonds to be issued on the United States market in order to raise the sums required. From that time the American Govt. assumed the responsibility for Allied purchases in the United States. Market borrowings by the Allies ceased with the exception of certain small amounts required for the purpose of refunding existing market loans, some of which, however, were also paid off with the funds obtained from the new credits.

The total advances by the United States Govt. to the governments of the Allies amounted during this period to some $8,200,000,000, of which Great Britain received approximately $4,000,000,000, France $2,800,000,000, Italy $1,030,000,000 and Belgium $171,780,000. Russia received $188,000,000 before the revolution, and certain smaller Allies account for the remainder. During the same period the British Govt. continued to finance the requirements of the Allies in the United Kingdom, and also assisted them by the employment, to a certain extent, of the credits extended to her in America. These credits were principally employed for the purchase there of raw materials required for the manufacture in the United Kingdom of war supplies for the Allies. For, as the needs of the United States Army increased, her ability to meet all the Allied requirements decreased to some extent, and Great Britain endeavoured to take her place. In Aug. 1918, however, it was arranged that each Ally should be debited by America with the cost of the necessary raw materials. In addition, during the early part of 1917 Great Britain advanced funds from her American credits to the Russian Govt. for interest payments due in America. Total loans by Great Britain to her Allies during these years amounted to over £550,000,000, of which France borrowed nearly £250,000,000, Italy £220,000,000 and Belgium £50,000,000. France, on the other hand, in addition to the advances made by Great Britain, borrowed nearly $3,000,000,000 from the United States, and loaned to her other Allies nearly 7,000,000,000 francs. Italy, Russia, Belgium, Serbia and Rumania were all borrowing nations.

Third Period: Nov. 1918–Sept. 1920.—Although the Armistice was signed on Nov. 11 1918, nearly two years elapsed before it was possible for the lending Governments to cease making advances to the other Allies for the payment of goods already supplied or ordered. They were also required to enable the Allies to purchase war stores left by the lending Governments in their territories. In addition, the impoverished condition of Europe made it essential, if complete economic chaos were to be avoided, for relief credits for the purchase of foodstuffs and for reconstruction to be granted not only to the poorer Allies but also to certain of the new states created by the peace treaties, and even to some of the enemy countries.

In the United States there was some doubt after the Armistice as to the legality of granting further credits under the Liberty Loan Acts. These Acts limited advances to the period of the War, and Congress had refused to approve any prolongation. On the other hand, the presidential proclamation announcing the official termination of the War was not published until July 2 1921, and the Administration felt themselves justified in continuing to make advances during the intervening period. The balance of $1,700,000,000 authorised under the Acts was, in this way, advanced to the Allies and utilised by them partly to meet existing contracts in America and partly for the purchase of supplies for the relief of Europe. Moreover, special credits were granted with the approval of Congress to the extent of $740,000,000, of which $600,000,000 were advanced for the sale of War stores to Allied Govts., and $140,000,000 for the sale of flour through the United States Grain Corporation. To this must be added a revolving credit of $100,000,000 opened in favour of the American Relief Administration.

Relief and reconstruction loans by the British Govt. amounted during this period to £32,522,000, loans for the purchase of war stores to £12,205,200 and for the repatriation of prisoners to £1,450,000. Similar advances by France amounted to some 1,500,000,000 fr. and by Italy to approximately 600,000,000 lire.

III. THE DEBT SETTLEMENTS

Before even the last inter-Ally loans had been made, it was clear that the problem of repayment would assume an importance in international politics second only to the question of reparations. Soon after the Armistice it became known that the British Govt. favoured a general cancellation of inter-Ally debts, but the United States was not prepared to agree to such a course. In May 1920 the inter-Ally Conference on Reparations at Hythe declared that it was "important to arrive at a settlement which will embrace the whole body of the international liabilities which have been left as a legacy of the War, and which will at the same time ensure a parallel liquidation of the inter-Ally war debts and of the reparation debts of the Central Empires." This was followed, however, a few days later by a statement by the Chancellor of the Exchequer in the House of Commons to the effect that the question of the United Kingdom debt to the United States of America was being dealt with independently of any question of the part of this country's share of indemnity from Germany. By 1922 the different points of view of the various Allied and Associated Powers on this subject became clearly defined. On Feb. 9 of that year the American Foreign Debt Funding Bill was signed, authorising the refunding of Allied debts to the extent of $11,000,000,000 into securities with a maximum currency of 25 years, carrying interest at a rate of not less than 4¼%, the negotiations to be carried out by a commission of five members (subsequently increased to eight) under the chairmanship of the Secretary to the Treasury. It was, at the same time, made clear that the United States Govt. would not consider the remission of debts due to them from the Allies but would look for repayment in full, though it was recognised that immediate payments would not be possible in every case. This action had a determining effect on the attitude of the Powers concerned towards the whole problem of inter-Ally debts.

The Balfour Note.—Great Britain, which had hitherto made no final pronouncement of policy, was now faced with the necessity of funding her debt to America, and consequently compelled to lay down a principle for dealing with her own debtors. Accordingly, on Aug. 1 1922, a Note was dispatched to the governments concerned which has since formed the basis of British policy. In this communication, commonly known as the "Balfour Note," it was stated that, while Great Britain would have been willing to forego all claims for reparations and the repayment of inter-Ally debts if this had formed part of an universal settlement, she must now ask for some measure of repayment. She would, however, be content with a total sum from her Allies and Germany sufficient to cover her own payments to the United States, though this was equivalent to only one quarter of the amount due to her. The French reply in Sept. was inconclusive and unsatisfactory, and the policy of that country was definitely revealed in Oct. at a meeting of the Reparations Commission.

At this meeting certain proposals were submitted by the British delegate for the settlement of the reparations problem, provided that the question of inter-Ally debts was settled at the same time. The French delegate rejected this scheme and put forward a counter-proposal which definitely made the payment of inter-Ally debts dependent on receipts from reparations. At the inter-Allied Conference in London in Dec. 1922 Signor Mussolini, on behalf of Italy, proposed the cancellation of part of Germany's reparation liability if Great Britain would agree to the cancellation of the debts due to her from her Allies. M. Poincaré elaborated this scheme and offered to hand over forthwith part of the French claim on Germany in payment of her debt to Great Britain and to accept similar terms from her own Allied debtors. Both these proposals were rejected by Mr. Bonar Law. The discussion was continued at the Paris Conference on Reparations in Jan. 1923. At this conference the French Govt. reiterated the principle of the dependence of inter-Ally repayments on German reparations.

The British proposal, which was contingent on the acceptance of their plan for the solution of the reparations question, rested on the basis of the remission of all European Allied debts to the United Kingdom except a small percentage which was to be paid in German obligations, while all German payments over a fixed minimum were to be available for the repayment of European debts to the United States. The failure of the Paris Conference which was followed by the French occupation of the Ruhr marked the last attempt to reach any common basis of agreement on this question, although the question was dealt with in the British Note of Aug. 11 1923 addressed to the French and Belgian Govts. regarding the occupation of the Ruhr. In this document the British Govt. offered as part of a general settlement of the Reparation question to accept in full payment of both reparation and Allied debts a sum equivalent to the amount necessary to cover the funded British debt to the United States, which was estimated on a 5% basis at 14·2 milliards of gold marks. The proposals contained in this Note were not accepted by the Allied Govts. concerned.

Anglo-American Funding Agreement.—Meanwhile, the constitution of the United States Funding Commission in Feb. 1922 was immediately followed by preliminary discussions between the British and American governments regarding the debt due from the United Kingdom. It was finally arranged that a British delegation, under Sir Robert Horne (the then Chancellor of the Exchequer), should leave for Washington in Oct. with the object of negotiating a settlement. Owing to the change of Government in Great Britain, its departure was postponed; but a payment of $100,000,000 was made on account—the first Allied payment in respect of interest on war debts. The mission finally sailed early in Jan. 1923 under Mr. Baldwin (the new Chancellor of the Exchequer), and returned to England at the end of the month with a proposed settlement which was accepted by the Cabinet on Jan. 31. Under the terms of this agreement the whole principal sum, which after allowing for interest due to Dec. 15 1922 at 4¼% per annum and for payments already made, was agreed upon at $4,600,000,000, is to be repaid over a period of 62 years in annual instalments increasing from $23,000,000 in the first year to $175,000,000 in the last. Interest is to be paid at the rate of 3% per annum on unpaid balances for the first 10 years and at 3½% for the remainder of the period. The total annual payments on account of interest vary between $161,000,000 and $187,000,000. Great Britain has the right to defer half the interest for the first five years, to anticipate payments and to make payments in U.S. Govt. bonds issued subsequent to April 1917. As these terms were not in accordance with those which the United States Debt Funding Commission was authorised to accept, it became necessary for Congress to approve the agreement, which was done on Feb. 28. On March 15 the first payment under the scheme was made by Great Britain.

Other Funding Agreements.—While the British negotiations were in progress, the United States administration had made their wish to be repaid known to the other countries concerned. The first country to respond was France, which in July 1923 dispatched a mission under M. Parmentier to Washington. No basis of settlement, however, was reached, and negotiations with the Czechoslovak Govt. led to the same negative result. In Oct. the Administration, hearing that the Rumanian Govt. contemplated raising a foreign loan, protested against such action before the American Relief Debt was funded. A Rumanian mission subsequently visited the United States, but failed to come to terms. In March 1923 an agreement was reached with Finland for the funding of its debt of $8,000,000 on the same terms as those accorded to Great Britain. No further settlements were reached until 1924, when an agreement was signed in April with Hungary for the refunding of the Relief credits to the extent of $1,939,000 on similar terms to those accorded to Great Britain and Finland. This was followed by settlements with Lithuania (Sept. 1924) and Poland (Nov. 1924).

In Dec. 1924 the authority of the Debt Funding Commission was extended for another two years and in the following May a *démarche* was made by the United States Govt. to induce the governments whose debts were still unfunded to negotiate for repayment on the basis of the capacity to pay of the debtor. Consequently, in the latter part of 1925 the majority of the remaining Allies either came to terms or initiated discussions. Thus in Aug. a Belgian delegation arrived at Washington and an agreement was shortly reached by which the debt was divided into two parts. The pre-Armistice debt of $171,780,000 was treated specially, as by the Treaty of Versailles Germany must pay the Belgian war debt as part of her reparations. Belgium undertakes to repay this sum in full over a period of 62 years, but no interest is payable. The post-Armistice debt of $246,000,000 is also to be repaid in full over 62 years, and in addition interest is to be paid at the rate of 3% for the first 10 years and at 3½% thereafter.

In Oct. an agreement was reached with the Czechoslovak Govt. which fixed the debt due at June 1925 as $115,000,000, repayable on terms similar to those reached with Great Britain. Latvia had already signed an agreement in Sept., and was followed by Estonia in October. In Nov. an Italian delegation signed an agreement which fixed the principal sum due at $2,042 million to be repaid over a period of 62 years. Interest, however, will not be paid during the first 10 years, and thereafter only at a rate rising by 10-year periods from one-eighth of 1% to 2% per annum, or an average of just under 1% per annum for the whole time. This was followed in Dec. by a settlement with Rumania, on the British model.

The French Debt.—Meanwhile, the French Govt., which, since the failure of M. Parmentier's mission in 1923, had made no move with regard to the refunding of its debt to the United States Govt., dispatched in Sept. 1925 a mission under M. Caillaux (the then Minister of Finance), but the proposals put forward at that time were unacceptable. Better fortune attended the next attempt, and on April 29 1926, an agreement was signed. By this France undertook to pay a total of $6,847,674,102 over a period of 62 years, and to issue bonds, beginning at $30,000,000 for 1926 and rising to $125,000,000 for the seventeenth and subsequent years. No interest is payable until June 15 1930, after which one per cent will be paid to June 15 1940, 2% to June 15 1950, 2½% to June 15 1958 and 3% thereafter.

Of the remaining debtors, Yugoslavia sent a delegation to Washington, while the Greek negotiations have reached a dead-ock. There is little hope of the Russian Govt. making any such nove. If the settlements which have already been made are considered, it will be seen that the terms of the Debt Funding bill with regard to the repayment of capital in full have been carried out in each case, and that, where concessions have been made, they have taken the form of a reduction in the rate of nterest. Thus, Great Britain is paying 76% of the 4¼% per annum laid down by the law, while Belgium pays 48% and Italy 5½%. These agreements were ratified by Congress early in 1926.

Debts to Great Britain.—Up to the end of 1924 little or no prog-ess had been made with regard to the repayment of debts due to Great Britain from her Allies. In Dec. of that year the Chancellor of the Exchequer (Mr. Churchill) made an official tatement to the effect that Great Britain would expect any ountry making a funding agreement with the United States o come to terms, *pari passu*, with his country. As a result, the French Govt. took advantage of Mr. Churchill's presence in Paris n Jan. 1925, at a financial conference on the Ruhr and the Dawes cheme, to state their intention of opening negotiations and to sk for a definition of the British position. An official reply in Feb. adhered to the principle of the Balfour Note, while no longer upporting the proposals contained in Lord Curzon's Note of Aug. 1923 on the ground that they were out of date. It further roposed that France should pay fixed annual amounts from her wn resources, together with a further annuity based on the French share of the Dawes annuities. Direct negotiations were esumed in London in July, when Mr. Churchill proposed the ayment by France for 62 years of an annuity of £20,000,000, ubsequently reduced to £16,000,000 and only a small proportion f which was based on payments to France under the Dawes cheme. M. Caillaux's counter-proposal of £10,000,000 led eventually to a compromise on a basis of an annual payment for 2 years of £12,500,000, with a partial moratorium until 1930, nd a vague proviso to suspend transfers if the French exchange was in danger. Further, these terms were to be revised if the final terms to be arranged with the United States Govt. should be more favourable to America. This proposal, which reduced the French debt to Great Britain by nearly two-thirds, was referred by M. Caillaux to the French Govt. and was in principle accepted, but the political situation in that country had up to 1926 prevented a formal agreement.

French opinion was subsequently moved towards the hope of obtaining better conditions by the terms of the Italian agreement with Great Britain signed on Jan. 27 1926. The total amount of the Italian debt at that date was calculated at £610,840,000, and it was agreed that Italy should pay 62 annual payments of £4,500,000 with a partial moratorium for the first seven years. In addition, the Italian gold to the extent of £22,200,000 which had been deposited in the Bank of England as part security for certain loans is to be returned to her by instalments over the same period. It will be seen that, while the total amount to be repaid is not so great in proportion as that which the United States will receive, the value is about the same. Of the remaining debtors Belgium has repaid her post-Armistice debts, and Rumania has reached an agreement on the same basis as that of the offer to France in Aug. 1925, while Yugoslavia, Greece and Portugal have either opened negotiations or are preparing to do so. Russia alone has made no move. As far as relief credits and credits for stores are concerned, Lithuania and Latvia repaid the amount due on Jan. 1 1925, while funding agreements for the full amount have been concluded with Poland, Czechoslovakia, Estonia, Hungary and Rumania, and early negotiations are anticipated with Yugoslavia and Greece.

Although it is the declared policy of both Great Britain and the United States to treat the problem of inter-Ally debts as entirely separate from that of reparations, the doctrine of repayment according to capacity, enunciated by the United States, has led to results which are not without interest. Great Britain has advanced to her Allies a total sum of £1,423,132,000, and, on the basis of arrangements already concluded or in course of negotiation, will receive a total sum on account of both principal and interest of £1,147,000,000 in the form of annual payments over a period of 62 years of £18,500,000. On the other hand, she borrowed from the United States approximately £960,000,000, on which she is now paying £30,000,000 and will later have to pay £38,000,000 per annum, so that, in effect, although she loaned over 50% more than she borrowed, she will receive from her Allies less than half the amount which she must in her turn pay. Even if she receives her full share of £20,000,000 per annum of German reparation payments under the Dawes scheme (which is a very optimistic estimate), her total receipts on account of inter-Ally debts and reparations combined would only just cover her payments to America. On the other hand, it is interesting to note that the United States should eventually receive on account of loans to her Allies an annual sum equivalent to 65% of that payable annually by Germany in a standard year under the Dawes scheme in respect of reparations. (R. J. S.)

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DEBUSSY, CLAUDE ACHILLE (1862–1918), French composer (*see* 7.906), died in Paris March 26 1918.

DE CAMP, JOSEPH RODEFER (1858–1923), American painter (*see* 7.909), died at Boca Grande, Fla., Feb. 11 1923.

DECORATIVE ART.—The hopes which came to birth at the end of the 19th century seemed, in the early years of the 20th, to have succumbed. The *art nouveau* of 1900, freed from imitation of the styles of the past, did not extend beyond a restricted circle of amateurs, and the mass of the greater public remained hostile, or at least indifferent, to its manifestations. In 1901 the *Société des Artistes Décorateurs* held, in Paris, the first of its series of expositions, which it continued without interruption for a quarter of a century, and from 1905 onwards the *Salon d'Automne* provided annual evidence of the efforts of the artists.

But between the great firms and the actual creators of models the divorce was an enduring one. The artists, thrown back on themselves and lacking the resources of capital, unknown moreover to the purchasing public, became isolated in researches whose originality was prejudicial to their realisation in practice. The heads of the industry, at the same time, content to repeat at small expense the currently accepted models, held firmly to routine. At the Turin Exhibition in 1911 the French section showed a general survey of modern art opposite the special pavilions erected as a homage to the styles of the 18th century and the empire. The splendours of the past still lay heavy on the efforts of the present. The art of the past remained, for the industrials, the true source of inspiration, the goal of artistic discipline, and the surest road to enduring prosperity.

But certain countries, less burdened by the extortionate demands of past glories, were striving to open the markets to contemporary creative efforts. In Germany the *Werkbund*, the league of crafts, had established a link between art and craft, and made into a reality the conceptions of Ruskin and Morris, though modified by the mechanical advances of modern days. The new society, founded under state auspices in 1907 and backed by powerful resources, selected, in all the arts and in all parts of the country, the men most qualified to collaborate. The result of this disciplined effort was made unmistakably clear at the Brussels Exhibition of 1910. Nor did it fail to make a lively impression on the French public on the occasion of the exhibition at the *Salon d'Automne* by the Munich group of artists.

A Great Exhibition Planned.—To reply to this effort, which had outstripped her own, France began, in 1911, to draft the plan of an international exhibition of decorative art. It was projected for 1915, but the War postponed it for 10 years. From its inception, its success was conceived as being dependent upon a previous understanding between factories and studios. More than ever did this seem indispensable. The decorative artists, for lack of any extensive market, found themselves faced by the gravest financial difficulties. The industrial side was threatened by dangers of another sort. On the one hand, they were forced to reckon with new tastes and aspirations among a section of their clients; on the other, foreign competitors were beginning to market for themselves works in reproduction of the old styles, having decided to cut themselves free from the useless tribute which they paid to French manufacture. Something else had perforce to be sought. Interests which previously had been in opposition were now tending to close their ranks, and the need for undertaking propaganda in common was to make them see eye to eye. In 1922 active negotiations ended in an agreement which was the veritable charter of modern decorative art. This agreement fixed the principles of future collaboration. It recognised the right of the signature of the artist and his sole authority in authorising any modification of the work, and allowed the contract between designer and factory to follow forms of extreme flexibility.

This collaboration gives modern decorative art its true character. No longer does it appear as a protest against the old formulae; no longer does it pursue novelty into the jungles of the bizarre. Our decorators are modern, just as, in their own day, were the contemporaries of Francis I., Louis XIV. or Louis XV. Far from denying the past, they continue it; for the claim to adapt the background of life to the aspirations of one's time is in itself a fidelity to the spirit of tradition. The art of the house, the street or the stage is now becoming, as it was in former times, the reflection of a society. The strange discordance, noticeable throughout 100 years, between scientific development and the stagnation of all the industrial arts, at last reached its term.

I. A GENERAL SURVEY

Decorative Art To-day.—Henceforth decorative art covers the whole field of social life. The exhibition of 1925 bore a close resemblance to a universal exhibition. With its 37 classes it surveyed the most diverse aspects of life—the house and its furnishings, clothing and its ornaments, the town with its thoroughfares and gardens. There were few problems touching public or domestic life which it was not called upon to deal with, if not to solve. Modern art stands no longer classified in show-cases, expressed in useless and costly playthings, in objects created for show rather than use. Art is no longer an accessory, a superfluous element, a pretty lace trimming stitched to the clothing of life. It is met with everywhere, without seeking it or thinking of it, in the shape of a hood, in the outline of a lock, in the curves of a plate or the lines of a steam radiator.

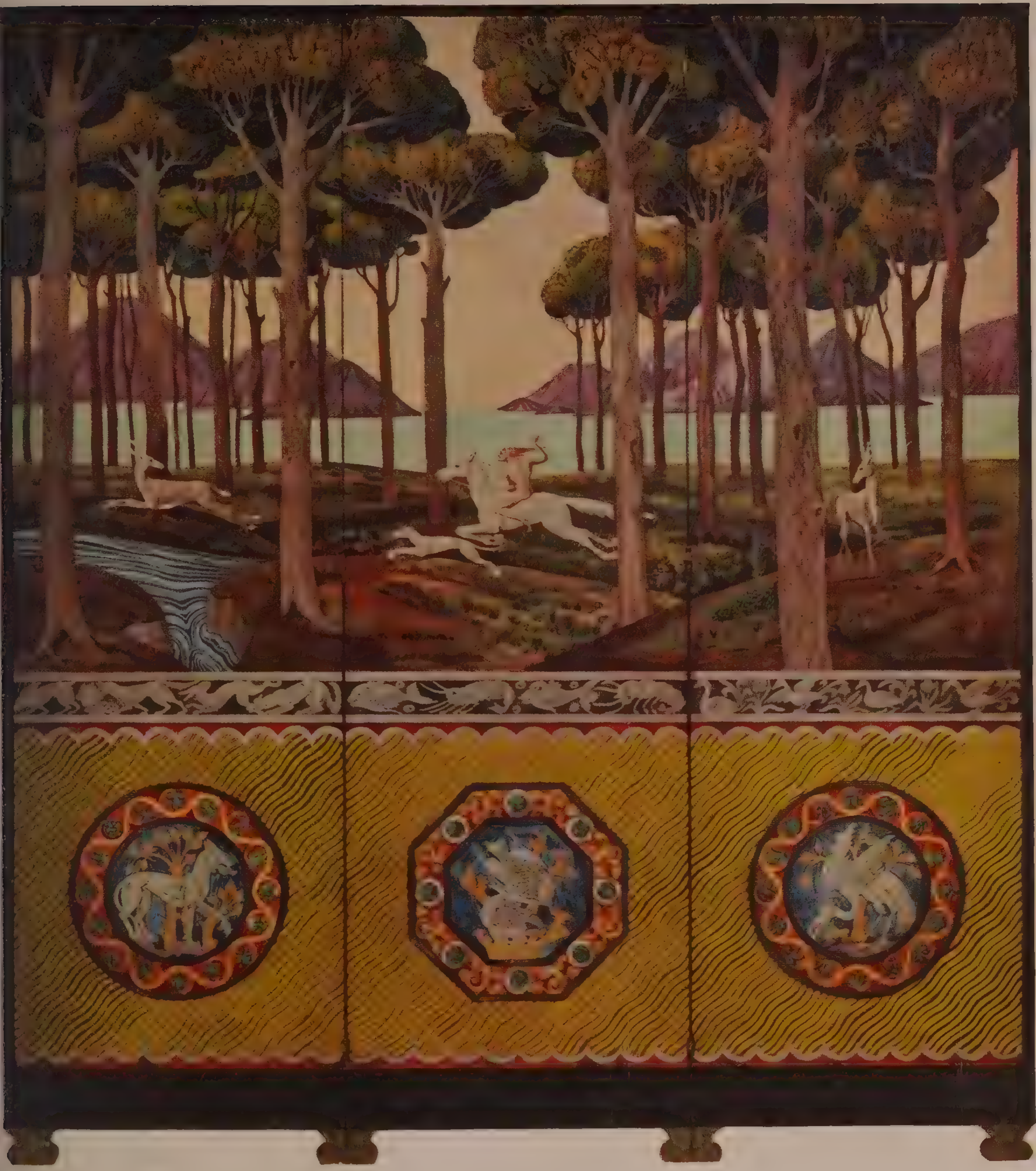
As in all the great epochs, every object is an object of art, so soon as its form accords with its function and its material. Whatever their variety, they reflect a common tendency. The maxim of Buffon that " the style is the man " applies, not only, to the expression of thought in writing, but to plastic expression as well. The decoration of 1900 had sought its renaissance in a return to nature, in the analysis of the forms of flowers and animals, in the graceful and cunning spirals of metallic architecture. The theories of Gallé and the influence of Japanese art fostered this tendency; the ornamental experiments of sculptors had developed its themes. Henceforth it seems as if science, the creator of a new world order, has imposed its influence on artists.

How could they remain indifferent to this neo-mechanical world, with its latent, intimate omnipresence, the vehicle of mankind's interdependence—steamships, locomotives and aeroplanes assuring the mastery over continents, oceans and seas; the aerials and receivers which capture the human voice over all the surface of the globe; cables marking out the roadways awakened to a new life; visions of the whole world projected at high speed on to the cinematograph screen? Must not all this confused seething of universal activity leave its marks on the brain of the artist? Machinery has fashioned all the forms of labour anew.

Work of the Architect.—It was in architecture that this influence first made itself felt. This art owes its greatest advance to the researches of engineers. The exhibition of 1889 had been, as it were, the consecration of architecture in metal. This has given place to-day to that of reinforced concrete. This material has solved the problems of wide arches and spacious openings which the Gothic builders tried to realise with the aid of the ogive arch and the flying buttress.

The architect of the present day, with this mastery as his starting-point, is able to open up immense naves in which the walls are no more than partitions independent of the structure of the edifice. Concrete, run and dried in moulds, imprints on our edifices the characteristic form of a cubic box, in which variety emerges only from effects of light, from projections and indentations, where the right angle reigns supreme, to the exclusion of the curve, familiar to the architects of the end of the 19th century. The flat roof, attempting to supplant the sloping roof of tiles or slates, has led us far from traditional ideas. Just as stone construction calls for the carvings of sculpture, so concrete seems to call for that facing with mosaic or marble which in former times enhanced the splendour of Rome, Byzantium or Venice.

The beauty of the facings of the porticoes was one of the attractions of the galleries of the exhibition. From this sprang the expansion of the scope of ceramic decoration. In the hands of architects, mosaic no longer produces its effects only from the variety of colour, but also from that of forms. Geometrical patterns, and conventionalised animals, form panels, the joins of which, of variable thickness, compose a subsidiary tracery com-



"THE CHASE"

Wooden screen painted by Carlo Ciampaglia. (By permission of the artist.)

parable with the leaded joins of the stained-glass window. The attempts made by the Sèvres manufactory to fashion panels of stoneware, of earthenware and of porcelain take on, in this light, a significant value.

Furniture.—The same causes and the same effects appear even more strikingly in the art of furniture: unified surfaces, straight lines and ornament laid on. Our epoch makes its own inexorable demands: the current price of building land tends to diminish the cubic capacity of the domicile; low ceilings, furniture made horizontal rather than vertical, beds reduced to the divan with a wooden frame. The chest of drawers has replaced the mirrored wardrobe; the mirror is in the interior of a folding toilet table; chairs are low and deep; the sideboard has no pediment, any more than the cornice has mouldings. Marble and metal do not add their polished coldness to the wood. Their virtue is comprised entirely in the surface covering taken from the most precious tropical woods, from their most intricately veined boles, from their richest freaks, cut in thin veneer and applied in layers which follow the formulae supplied by the aviation industry. Thus do advances in mechanical process respond to new social demands.

The exigencies of modern life act not only on the form but on he distribution of furniture. Apartments of a former day were divided by thick partition walls, impossible to shift, and the ooms were again subdivided in order to provide nooks for the amp and the fireside. The tendency to suppress the focus of istribution of light or heat derived from one single and external ource has modified the conditions of the problem and at the ame time facilitated the removal of all partitions whose exist- nce is no more essential to the solidity of the rooms than the aper walls of the Japanese house. Rooms are no longer exclu- ive or restricted in function. The bed shuts up into a different orm; screens, which form wall panels during the daytime, can e taken down at night to form enclosed rooms, in combinations t once ingenious, invisible and interchangeable. We are return- g to the medieval conception of the common hall, renewed in ur own epoch by the studio or living-room; and it is here that cope is found for the inventive gifts of the decorator in the crea- on of an *ensemble*, which is the aim of our modern furnisher. he artist who can carry out the *ensemble* has inherited powers hich belonged to the upholsterer, but under very different con- itions. He becomes a kind of chief engineer for the interior of e house. He will decide the shape of the piano, the distribu- on of the lighting apparatus, the binding of the books, the out- nes of the card-table. He imposes his conception on his client, ho henceforth becomes subordinate to its demands.

Other Forms of Decoration.—Analysis reveals a similar evolu- on at work in the numerous and varied elements of modern ecoration. Workers in ceramics are subordinating ornament to aterial. Ornament is born from the material, and unites with s support as flesh with bone. It is from the composition of the ass, from the juxtaposition of the layers in the infinite variety all the aspects of the clay, that Daum and Marinot seek their ost beautiful results. Stuffs and carpets show us designs of geo- etrical inspiration, akin to the Berber style; and here, too, the aterial itself plays the essential part, and the amazing variety dyeing processes allows a high degree of flexibility.

The Batik industry, borrowed from the Javanese, has enjoyed ide popularity. Dress itself has shed all useless frills and fur- lows; it hangs straight, without folds, conforming with the rm of the body itself, and giving liberty of movement. No ore ceremonial toilettes to make one stiff and embarrassed; ace and beauty lose nothing from these more genuine forms, much more adapted to everyday life. Jewellery aims at empha- sing the worth of the stone itself; fine cutting and worthy ounting become the artist's goal. The complex forms inspired 1900 by the return to nature have completely disappeared: more hooks or tentacles, no more medusas or sirens, seahorses gorgons, no more pine needles, no more thistles. The stone th sparkling facets is valued only for its brilliance. The trans- rency of diamonds, the whiteness of pearls, are wedded with e colour of jade or onyx or coral.

Book Production.—In book production, too, there is the same striving towards simplicity, where harmonious characters strike the keynote. Our publishers, like the decorators, aim for the *ensemble*, bringing the press work, the illustration and the binding, into one harmonious whole, the decorative quality of which borrows its value from the quality of the material, its geometrical design being often accompanied by fine tracery of gold and silver set in a delicately tinted leather. The poster is legible from a distance, its design strongly accentuated, and its composition cutting a clear pattern on the uniform whiteness of the background. It is associated with the bright lighting wherewith publicity is transforming the appearance of our streets, illuminated by lamps fewer in number, placed higher and of increased power. The theatre likewise can show us decorative schemes which produce their effect by what they suggest rather than what they reproduce. The subject-matter of the scenery counts less than the distribution of light, thus tending to give stress to the personality of the actor against the sobriety of the background. Russia, bringing us the renaissance in scenic decoration through Bakst and his ballets, points out the way we must follow towards the intensified movement of the figure grouping; scenic setting is no longer merely a support. (*See* BALLET; STAGE.)

Essentials of Modern Art.—From whatever angle one surveys modern art one discovers its common character. This is, as it were, a reduction to a scheme, indicating the essential lines without much heed to the detail. The artist is concerned less with reproduction in exact imitation of nature than with setting down its essential character, leaving detail on one side. This reaction against the excesses of the photographic conception of art has sprung from the extreme manifestations of Cubism itself. Painting turns more and more to seek decorative harmony, and sculpture sets itself to the representation of mass and volume; and the same tendency appears even in the figuration of the modistes' figures, which, freed from the banality of the old wax dummies, tend no longer to show a resemblance, but to hint at a gesture or to show off the draping of the material.

But while it is permissible to trace a tendency common to such various aspects, it would at the same time be foolish to exaggerate the universality of a formula. One style does not supplant another in a day. Art is not a meteorite, and has never indulged in processes of spontaneous combustion. For the most part our modern decorators are obliged to furnish houses which are not new. A house is not razed in order to modify a suite of its rooms. Among decorators themselves there may be affinities, but there are also differences. Men like Chareau, Francis Jourdain and Mallet-Stevens have broken deliberately with the existing traditions; but Groult has never shaken off the forms of the 17th century, Ruhlmann those of the Empire, Sue or Mare those of Louis-Philippe. Moreover, dates are not infallible oracles. Artists such as Lalique and Dufresne are very different from what they were in 1900. But nevertheless they are themselves; they have been modified, not metamorphosed.

Regional Art in France.—On the other hand, it is certain that the evolution takes on a different form in every province of a country. In France the capital tends to adopt a mode of uniform construction based on reinforced concrete. Does this mean that other regions will totally abandon their local traditions? The exhibition of 1925 proved that there is no ground for supposing so. Berry or Brittany, Alsace or Normandy, Provence or Franche-Comté, all give evidence of certain local traditions which none the less can be reconciled with the innovations. There exists an unmistakable renaissance of regional art. The drift toward Paris is doubtless more pronounced than ever it was, but it does not preclude the idea of return; between Paris and the provincial centres there is a constant interchange of ideas. A powerful contribution toward this was made by the creation, during the War, of a network of committees of the applied arts covering every part of the country.

This neo-regionalism is in no way a reversion to the fetish of the useless ornament. It is an effort to create forms appropriate to the needs of the modern world, making use of local materials and local processes. The achievement of the painter Lemordant in Brittany offers a striking example. The exhibition made it plain that, in all countries, the character of modernity, international as it may be, does not imply the disappearance of national traditions. Thus it was that Poland transferred into her pavilion the decoration of her rustic scenes, from which Mme. Stryjenska had drawn the essential themes of the decoration of the *salon d'honneur*. The tapestries and rugs which adorned the main hall of the Czechoslovakian building were a glorification of the country in its soil, its products and its crafts. Side by side with the very boldest conceptions of its futurist architecture, Soviet Russia exhibited the varied picture of its work-people. Slovaks, Slovenes and Serbs gave a prominent place to women's woven products. Throughout infinite local diversities there exists a common tendency very sharply defined.

Middle Class Needs.—The organisers of the exhibition of 1925 have often been reproached for not having contrived to make the creations of modern decoration accessible to the middle classes, but in this connection the increased cost of materials must be taken into account. Moreover, in any case, models have at all times been created in the first instance for an elect minority, and to-day the court still leads the town in its train. But however great the proportion, too large, perhaps, of products reserved for the patronage of the wealthy few, nevertheless a considerable number of interiors were designed for middle-class needs. The palace was less prominent than in the past, but there were many more shops, shop-fronts and counters. The demonstration was not confined to furniture meant for show. Numerous types of kitchens and bathrooms gave token of more immediate requirements. Covering materials and domestic appliances showed obvious advances. Wooden houses in sections, perfectly well adapted to permanent habitation, certain sets of furniture at low prices, such as that shown by the Primavera establishment, pointed the path to be followed. Special pavilions brought together all the methods of lighting by gas and of electrical distribution.

A group of architects made a happy assemblage of all the elements of a village, a trifle theoretic perhaps, and bereft of local roots, but supplied with all the typical elements which modern life has at its command: the church and its graveyard, the town-hall and offices, workshops for the weaver, stonemason and cobbler, the inn, the pharmacy, the baker's oven, fish-market and the wash-house—all simple edifices, inviting, with forms at once practical and gracious, in coloured materials, with simple and stout furnishings. It is to be regretted that types of this kind were not more frequently adopted in the course of the reconstruction of the French devastated regions. The experiments made in the workmen's centres of the Nord Railway Co. were isolated examples.

Machinery and Its Influence.—These tendencies are an augury of an auspicious future. The time is past when Morris and Ruskin, the apostles of the artistic renaissance, denounced the use of machinery, and saw salvation only in the return to the traditions of the mediaeval craftsmen. To-day machinery imposes its own laws upon us. Uniform manufacture seems to be indispensable. There is no other formula which can assure the expansion of the necessary production and the lowering of the net cost. It would be vain to overlook the influence of mechanical discoveries on the development of the industries of art. The use of woodcutting machinery, the process of acetylene and electric welding, advances in the chemistry of dyeing, have profoundly influenced the transformation of our industries in the domains of furniture-making, ironwork and the manufacture of textiles.

But however perfect the technical accomplishment, this is valuable only through the creative imagination which guides it. The participation of important artists, such as the exhibition witnessed, in the production of certain subsidiary equipment of the dwelling-house, until then restricted to the current commercial models, window-fastenings, locks, door-handles, is a striking example of the influence of creative ideas on forms. Moreover, it is in no way a question of specialists. One of the successful exponents of these models of ironwork, M. Lebourgeois, founded his reputation on work carried out in wood. A man who has made a name for himself in stuffs or in large mural paintings finds fresh talents in ceramic designing. It might be said, in this sense, that the exhibition was the work of an infinite minorit

The Need for Training.—It is equally clear that the evolutio of decorative art, in every country, is dominated by scholasti teaching. The poverty of invention, disclosed from the middl of the 19th century by all the critics of the different exhibition had shown the urgent need for artistic instruction. For the firs time the Vienna Exhibition of 1873 reserved one class for education. Drawing inspiration from the British example, Paris prepared for the foundation of a museum of decorative art on th model of the South Kensington Museum; it was inaugurated i 1885. After the exhibition of 1878 national or municipal school of art were set up throughout the whole of France, and at th same time the teaching of drawing was made obligatory in th *lycées* and primary schools.

For 20 years the instruction has definitely turned in the direction of decoration. The 1925 exhibition developed a series practical programmes, adapted so far as possible to each regior and all the schools of the Beaux-Arts took part with distinctior A random glance at the programmes shows: at Bordeaux, restaurant; at Dijon, a grocer's shop; at Lille, a chapel; at Lyon a silkmercer's; at Nantes, a villa; at Nîmes, a workman's dwelling; at Rouen, a ship's cabin. Paris offered a complete and illustrative scheme of professional and primary instruction. Th most modern and most original parts of their exhibits can b attributed to the schools of decorative art.

The facilities for comparison of the schools in different countries provided most suggestive comparisons. Alongside th schools of arts and crafts of London, Birmingham, Brightor Cardiff, Sheffield and Swansea, several of which were originall organised as models, and the activities of which remained s diverse, stand the schools of Switzerland, nowadays turning like the French schools, more and more towards practical applications: clockmaking at the Chaux de Fonds, ceramics at Berne graphic arts at Zurich. In the Netherlands the three schools Amsterdam, Haarlem and Rotterdam point in three quite different directions, the two first inclining towards a more theoreti art, the last more closely allied with maritime and colonial life, an by that circumstance more given over to a practical modernity

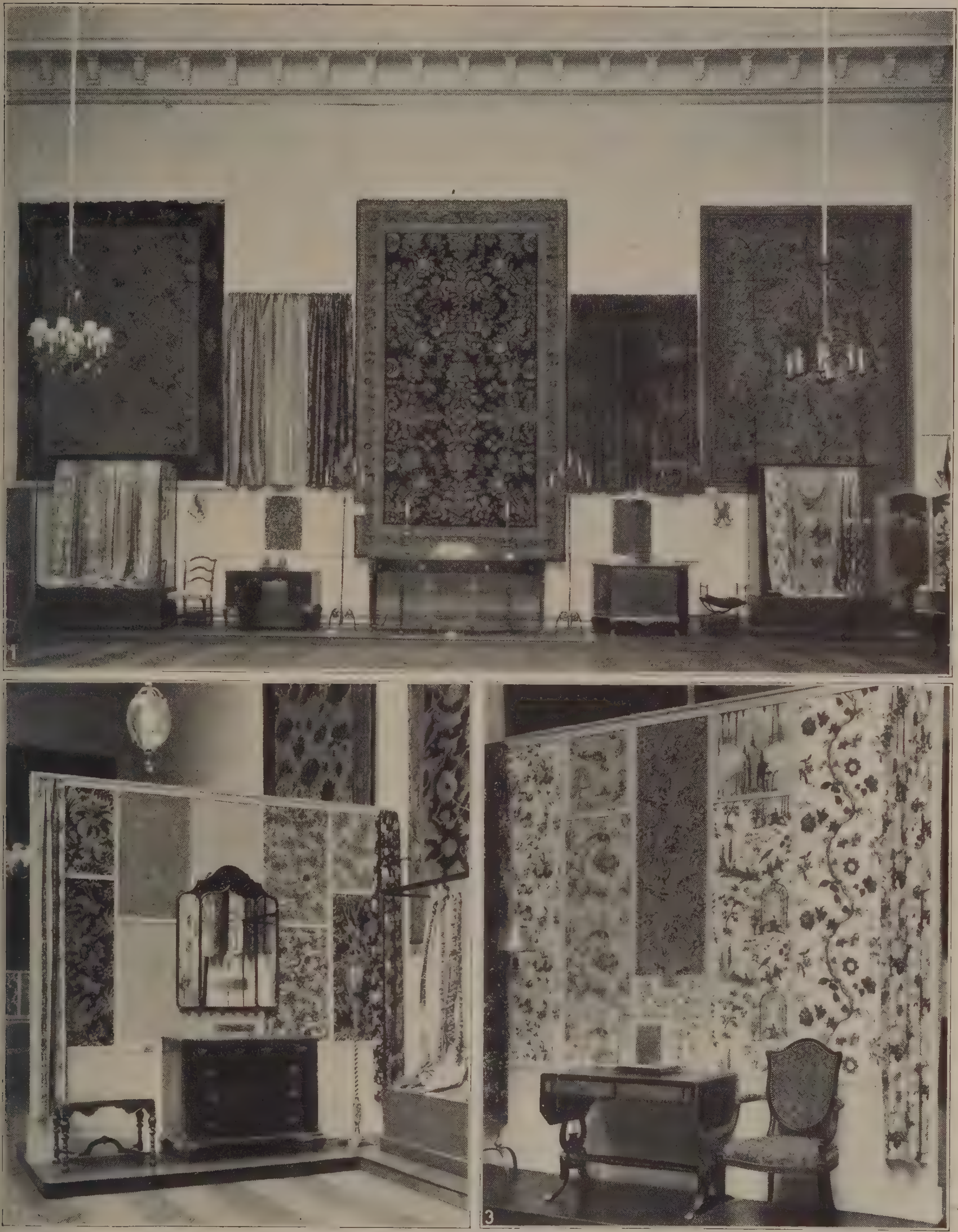
Austria, under the direction of Joseph Hoffmann, has multiplie and brought up to date its instruction in all the decorative arts i Vienna, in building construction at Graz, in woodworking a Hallstatt, in ironworking at Waidhofen. Poland and Czechoslovakia have made far-reaching changes in the ground plans o their instruction. At Warsaw, Cracow and Zakopane, just as a Prague, the programmes have turned towards modern creations

It can be said that in every country the existence of decorativ art is linked with that of the school. It is this art which, by reason of its permanent contact with industry, has the power t maintain the quality of the professional formation which, unde the old dispensation, was acquired in the close corporations. T unite, for one and the same work, the imagination of the artis and the hand of the craftsman would seem to be the essential la and the essential condition for the progress of modern decorative art. (*See* EXHIBITION.) (P. LN.)

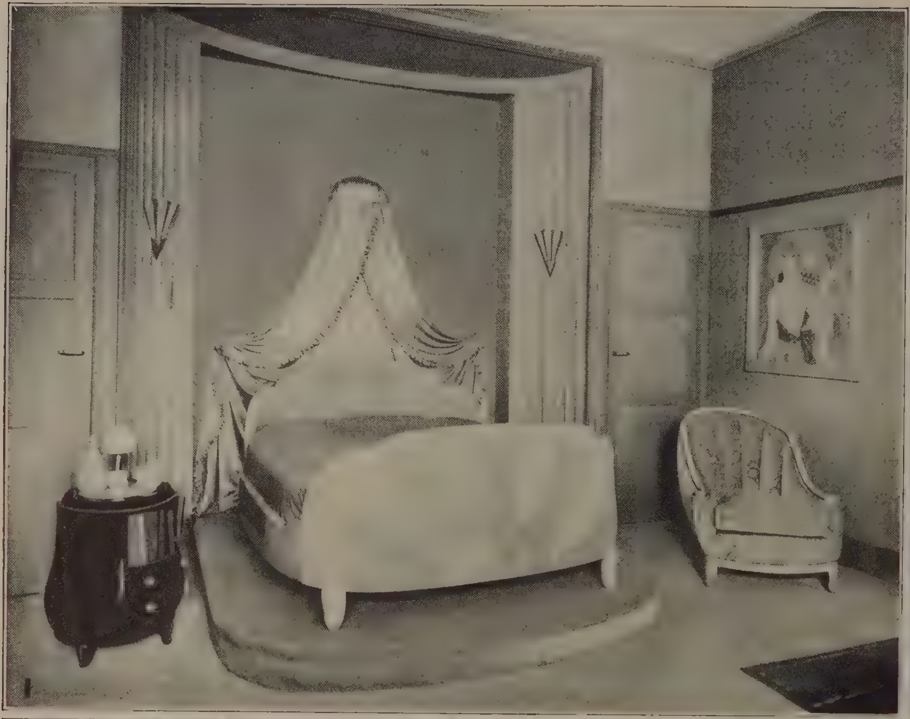
II. DECORATIVE ART IN GREAT BRITAIN

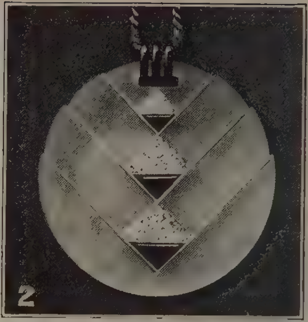
In Great Britain the tendency of decoration has been much i the same direction as on the European continent, but in accordance with the characteristic British temperament there has bee a slower and more deliberate development. Repeating pattern were based almost exclusively, at the beginning of the century on natural forms and built up with mathematical formulae t secure such variety as was possible within the severe restriction imposed by these conditions. Textiles and wall papers, to tak the two chief examples, have moved away from these limits.

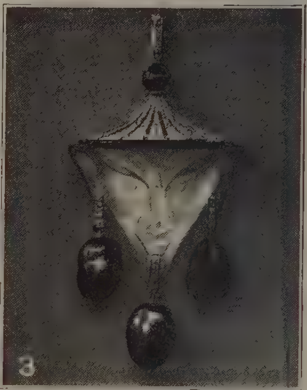
On the one hand, plain colour has come into favour, eithe without pattern of any kind or in panels relieved with vertica bands of simple ornament. On the other, masses of broken colour, irregular in form and superficially devoid of rhythm or apparent design—the so-called "jazz" patterns—have had a considerable vogue, responding to the feeling of unrest and rebellio against formalism which is one of the legacies bequeathed to th

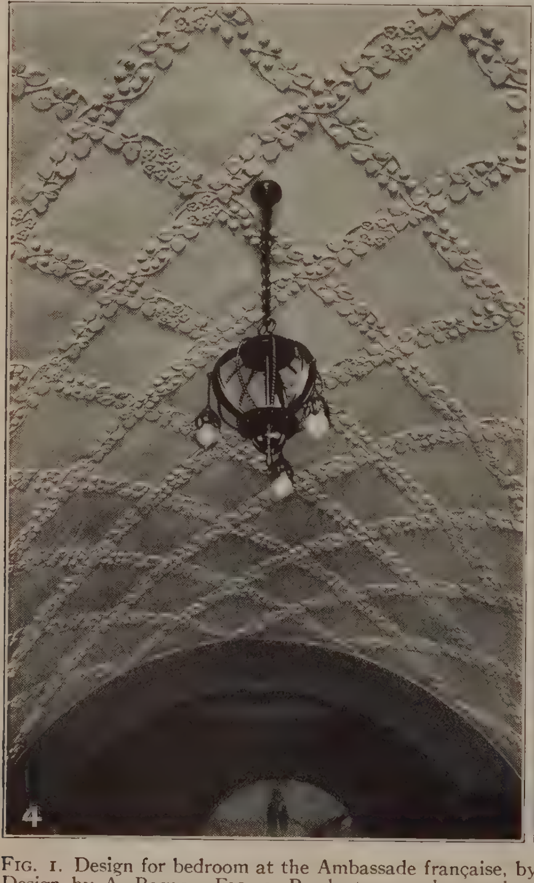


EXAMPLES OF AMERICAN INDUSTRIAL ART AS SHOWN IN THE NINTH ANNUAL EXHIBITION, 1925, AT THE METROPOLITAN MUSEUM OF ART, NEW YORK CITY









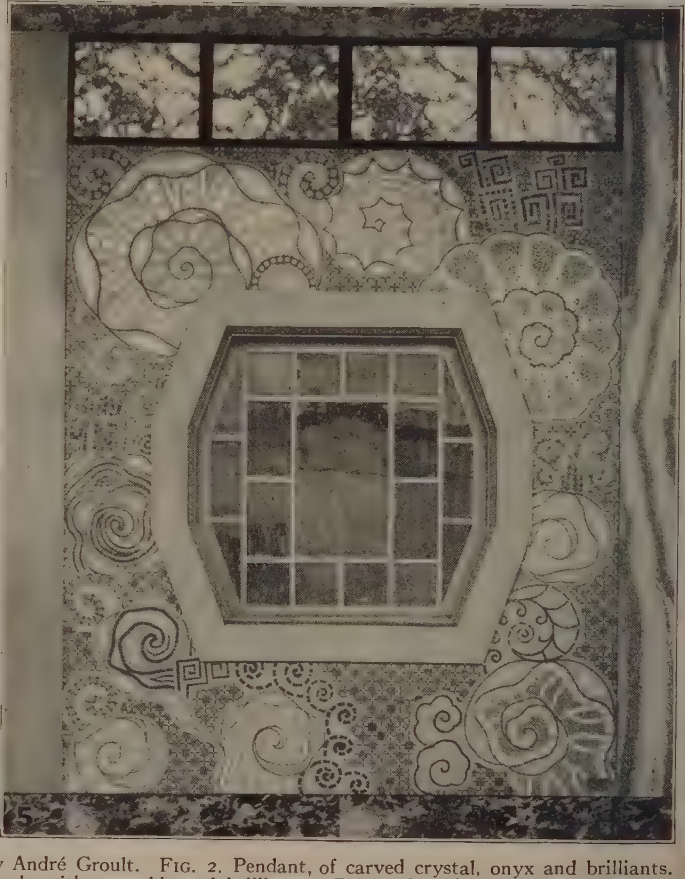


FIG. 1. Design for bedroom at the Ambassade française, by André Groult. FIG. 2. Pendant, of carved crystal, onyx and brilliants. Design by A. Bagge. FIG. 3. Pendant; carved crystal mask, with emeralds and brilliants. FIG. 4. Ceiling design, by George P. Bankart. FIG. 5. Design for mosaic, by Gentil and Bourdet.

(Figs. 1 & 5. Exhibition of Decorative Art, Paris. Courtesy of M. Paul Léon. Figs. 2 & 3. Courtesy of M. G. Fouquet, Paris. Fig. 4. Photo, Lewis & Randall, Birmingham.)

rts by the World War. In the latter movement Roger Fry nay be referred to as a pioneer of the new design. Similarly, the elicate tints of Walter Crane and his school have been replaced vith strong, often crude colour, violently contrasted, barbaric n general effect, but by no means unsatisfactory as decoration vhen used in appropriate environment.

A Retrograde Movement.—Side by side with these efforts to- vards originality must be recorded a retrograde movement, one irectly due to the influence of the museums and the growth of he cult of the collector. This has been manifested in the recru- escence of the historic styles, especially of the late 17th and 8th centuries. A large section of the public, whose education n taste has progressed only far enough to secure condemnation f Victorian types but has not yet so far advanced as to develop ndividual judgment, has welcomed the comparative security nd undoubted efficiency of Queen Anne, Chippendale, Adam r Wedgwood models, where the newer patterns have scared, ven shocked it. In mural decoration, the tendency, again, has een in the decoration of a scheme of vertical lines, with plain anels relieved with occasional bands of ornament; the latter hrowing back, in character, mainly to the late Tudor or early nglish Renaissance style. Good work has been done in plaster, pecially by the late Ernest Gimson and G. P. Bankart.

For the finest decoration in colour of our period, we have to hank the untiring genius and marvellous facility of Frank Brang- yn, R.A., whose great decorative painting in oils, "King John gning Magna Charta," done for the New Court House of Cleve- nd, Ohio (1912), may be selected as a specimen of his treatment a historical subject in a technique thoroughly individualistic. he same artist's series of 16 decorative panels, in pure egg tem- era, for the Chapel of Christ's Hospital, West Horsham, repre- nts another phase of his art; the last subject, "Let the people raise Thee, O God," being perhaps the most representative ample that could be chosen of a reverent but essentially mod- n treatment of a religious theme. The decorative work carried t by Robert Anning Bell, R.A., in the Houses of Parliament Westminster and his mosaics in Westminster Cathedral, while ore scholarly in style, are also far removed from mere con- ntion. (E. F. S.)

III. DECORATIVE ART IN THE UNITED STATES

A refreshing rejuvenation of the spirit of decorative design d a liberal infusion of that renewed spirit into the complicated achinery of manufacture and distribution may be considered ading characteristics of the present state of decorative and dustrial art in the United States. Still wrestling with prob- ns following in the wake of a mechanistic century, America s found at last that the cargo of quantity production cannot brought to port without the compass of design. The destruc- e influence of the machine has now been fully recognised by anufacturers and public alike as self-inflicted, the misuse of mplex and cunning tools whose marvellous ability had seemed tomatic.

This has led to a serious consideration of decorative design as element not only in portable commodities but in all the arts at contribute to a more pleasurable existence, and we find ogress in this regard not only among those who manufacture, t also among those who sell and those who use objects of deco- tive and industrial art, thus reaching producer, retailer and nsumer.

To meet this increased interest we note decided modifications d a re-study of the methods of art teaching in the schools, a oid growth in the number of museums of art and in their ecialised educational work, a heavy increase in the number of ops selling objects of decorative art, a studious use of museum llections by manufacturers and designers as an aid in preparing eir current material, an increase in the number of exhibitions decorative art, both public and other, and, finally, a definite eference for better designed things by the purchasers who tronise leading shops in large cities.

Stylistic trends are still mainly historical, running in cycles of motives applied to new uses and expressed in new materials. Yet there is discernible a triad of elements upon which reliance may be placed. There is, first, the appearance of a small group of thinkers and writers on the subject. Secondly, from the ruck of mass production we note the emergence of a limited number of manufacturers in small quantity whose products may be regarded as representative of the new organised craftsmanship which must set the pace for modern manufacture. Finally, and most recently, we record a new note of courage which can come only from conviction based on serious study, a willingness to use historic motives as the alphabet which itself has many forms, changing with time but serving to make always new words and languages.

No doubt this last is due in part to the general spirit of revolt which underlay the Exposition in Paris in 1925; but it is due more certainly to the fact that the United States as a nation has arrived at a point of cultural awakening, finding historic form a handmaid and not a copybook, realising fundamental values in Early American art as the beginning of a national culture, quickening to the consciousness of a throbbing life of to-day, which must express itself in its own way and yet must cleave to that line of stylistic continuity which is the standard of its progress and the assurance of its reasonable growth out of the realities of American life. (R. F. B.)

DEDEAGATCH (*see* 7.917), a port on the north coast of the Aegean Sea, west of the mouth of the River Maritza, and the natural outlet and inlet for the trade of the Maritza basin. Its population is about 4,000. The natural advantages of the port are few. It is an open roadstead with shallow water inshore. On the other hand, its geographical situation renders it of great importance to Bulgaria, since the upper valley of the Maritza covers a considerable portion of the total area of the Bulgarian state, while the railway connecting Central Europe with Constantinople via Sofia sends a branch down the western bank of the Maritza, which reaches the sea at Dedeagatch.

As a result of the Balkan Wars of 1912–3, Dedeagatch fell to Bulgaria; but under article 48 of the peace treaty between the Allied Powers and Bulgaria, which was signed at Neuilly on Nov. 27 1919, Bulgaria was compelled to cede to the principal Allied and Associated Powers the greater part of Western Thrace, containing her entire sea-board on the Aegean, including Dedeagatch. Bulgaria undertook to accept whatever disposal of this territory the Powers might make. On the other hand, the Powers undertook to ensure the economic outlets of Bulgaria to the Aegean Sea. On Aug. 10 1920 the Powers signed a Treaty under which they retransferred the ceded territory to Greece, and after this they withdrew their own troops and allowed the Greek Govt. to occupy and administer the territory.

Meanwhile, their pledge to ensure the economic outlets of Bulgaria remained unfulfilled. During the Lausanne Conference this question was raised by the then Bulgarian Prime Minister, M. Stambolisky, and the Conference appointed a sub-commission to deal with it. The sub-commission proposed that a permanent international commission should be set up with extensive powers for improving Dedeagatch as an international free port, and supervising the administration both of the port and of the railway, as far as the Bulgarian frontier. This proposal was rejected by the Bulgarian delegation on the ground that satisfactory economic facilities could not be secured unless Dedeagatch were removed from the political control of Greece. M. Venizelos then offered a Bulgarian free zone at Dedeagatch on the same lines as the Yugoslav free zone at Salonika, but this, too, was unacceptable to the Bulgarians, and since then the question has remained in suspense.

See.—*Admiralty Handbook of Macedonia*, pp. 463–4 (1920); *Survey of International Affairs*, pp. 338–40 (1920–3). (A. J. T.)

DE FILIPPI, FILIPPO (1869–), Italian scientist and explorer, was born in Turin April 6 1869. After graduating in medicine at the Turin University, he became assistant in the surgical clinic and lecturer in operative surgery in the University of Genoa, where he pursued researches of great value in physiological and biological chemistry. In 1897 he took part in the expedition of the Duke of the Abruzzi to Alaska as scientific observer and ascended Mount St. Elias. Although he did not accompany the Duke to the Ruwenzori in Central Africa in 1906, Dr. De Filippi wrote the report of the expedition, which produced the first detailed map of the higher part of the range. In 1909 De Filippi joined the Duke's expedition to the Western Himalaya and Karakoram Mts., where a point 24,600 ft. high was reached on a ridge of the Bride Peak close to K2, which established a record of altitude unsurpassed until the exploits on Mt. Everest (1922 and 1924). He later (1913–4) organised and led an important scientific expedition to the Karakoram range in Central Asia, under the auspices of the Indian and Italian Govts., and for valuable researches was created in 1916 an hon. K.C.I.E. During the World War he served in the Italian Army medical service.

He published *The Ascent of Mount St. Elias, Alaska, by H.R.H. Prince Luigi Amedeo di Savoia, Duke of the Abruzzi* (1900), *Ruwenzori* (1909), *Karakoram and Western Himalaya*, (1909) 2 vol. (1912), and *Storia della spedizione scientifica italiana nel Himàlaia, Caracorùm e Turchestàn Cinese, 1913-1914* (1924).

DE FOREST, LEE (1873–), American inventor, was born at Council Bluffs, Ia., Aug. 26 1873. He was educated at the Sheffield Scientific School, Yale, receiving B.S. in 1896 and Ph.D. in 1899, and continued his studies at the Armour Institute of Technology, Chicago. His earliest employment was with the Western Electric Co., Chicago, in their experimental telephone laboratory. He was the first to use the alternating current generator and transmitter, which were later universally employed in wireless transmitting sets. He designed and installed the first five high-power radio stations for the U.S. Navy. The most important of his inventions was the Audion amplifier, which made possible long-distance telephony. His other inventions include the oscillating audion, or three-electrode tube, and the four-electrode tube. After 1921 he devoted himself to the development of the so-called phonofilm talking motion picture, involving the synchronising of sound and motion by the photographic representation of sound waves.

DEGAS, EDGARD (1834–1917), French painter (*see* 7.931), toward the end of his life, when he began to go blind, retired into private life, and gave up exhibiting in the Salons. The influence of his infirmity soon showed itself in his work; yet though his style lacked its former precision, it may be said to have gained in breadth of outlook. He now produced pastels, such as groups of dancers, which were remarkable for their plasticity, and modelled silhouettes of women and horses which were not cast in bronze until after his death. His engravings consist of etchings, copperplates and lithographs. A special room in the Luxembourg Collection, Paris, is given up to his paintings.

DEGOUTTE, JOSEPH (1866–), French soldier, was born April 18 1866 at Charney (Rhône). He entered Saint-Cyr in 1888 and joined the 4th Zouaves in 1890. After service in Madagascar, he distinguished himself in the Chinese expedition of 1900, was made a lieutenant-colonel in 1911 and sent to Morocco to take charge of the depôt at Casablanca. During the World War he became general of brigade in 1916 and led the Moroccan Div. during the Somme, Champagne and Verdun campaigns. In the summer of 1918, at the head of the VI. Army, he helped Mangin to carry through the counter-offensive against the German flank. He was made major-general on the staff of the King of the Belgians in the same year, and entered Brussels after the Armistice at the head of the Allied troops. From Oct. 1919 to Oct. 1924 he was commander-in-chief of the French armies on the Rhine, and in 1920 became a member of the Supreme Army Council.

DE GUBERNATIS, ANGELO, COUNT (1840–1913), Italian man of letters (*see* 12.667), published in his later years a series of lectures on Italian poetry, *La Poésie amoureuse et la Renaissance italienne* (1907), and a *Dictionnaire international des écrivains du monde latin* (1905–6). He died at Rome Feb. 26 1913.

DEHMEL, RICHARD (1863–1920), German poet, was born in Wendisch-Hermsdorf, Brandenburg, on Nov. 18 1863. He was educated in Kremmen, Berlin and Danzig, and in 1882 began to study philosophy, natural sciences and social economy, and also became editor of a provincial newspaper. From 1887–95 he was secretary of the Union of German Fire Insurance Companies. In 1891 he published his first volume of poetry *Erlösungen*. This was followed by *Aber die Liebe* (1893), and *Weib und Welt* (1896). From 1899 until 1902 he travelled in Italy, Greece, Switzerland, Holland and England, and afterwards lived in Blankenese, near Hamburg. In collaboration with his first wife, Paula Dehmel, he published some books for children including *Fitzebutze* (1907). He wrote a novel in lyrical form, *Zwei Menschen* in 1903, the epic composition *Die Verwandlungen der Venus* in 1904 and also dramas and pantomimes. He took part as a volunteer in the World War, and in 1919 published his diary, *Zwischen Kreig und Menschheit.* Amongst his dramas, *Die Menschenfreunde* (1917) was successful. His *Collected Works*, 10 vol. began publication in 1906. His vigorous lyric poetry was distinguished by deep thought and power of imagery, having for its main themes erotic and social questions. He died at Blankanese Feb. 8 1920.

See *Selected Letters*, 2 vol. (1922–3); E. Ludwig, *Richard Dehmel* (1913).

DELAGOA BAY, Portuguese East Africa (*see* 7.942), is commonly known by the name Lourenço Marques, the port on its northwest shore. (*See* LOURENÇO MARQUES.)

DE LA MARE, WALTER JOHN (1873–), British poet and novelist, of Huguenot descent, was born on April 25 1873, at Charlton, Kent, and educated in London at St. Paul's Cathedral Choir School. From 1889 to 1908 he was employed in the Anglo-American Oil Co., but he had already printed poems and prose, writing as "Walter Ramal" in *The Cornhill* and other magazines, and in 1901 his *Songs of Childhood* appeared, his novel *Henry Brocken* following in 1904. A grant from the Privy Purse enabled him to devote himself fully to literary work, and he gradually found a growing audience for his delicate and highly individual work. *The Listeners and Other Poems* (1912), *Peacock Pie* (1913), *Motley and Other Poems* (1918) brought him to the front rank of his contemporaries, and his *Collected Poems, 1901–1918*, appeared in 1920. A fairy play, *Crossings*, was published in 1921, and also further poems, *The Veil*. His long novel, *Memoirs of a Midget* (1921), showed his prose gifts at their highest; somewhat short of that came two books of tales, *The Riddle* (1924) and *Broomsticks* (1925).

DELAND, MARGARETTA WADE (1857–), American writer, was born at Allegheny, Pa., Feb. 23 1857. She studied in private schools and at Cooper Union in New York, and for a time was a teacher of drawing. She attracted wide attention with her first novel, *John Ward—Preacher* (1888), which dealt with religious and social questions after the manner of Mrs. Humphry Ward. Her numerous works include *Sidney* (1890); *The Story of a Child* (1892); *Philip and His Wife* (1894); *The Awakening of Helena Richie* (1906); *The Iron Woman* (1911); *The Rising Tide* (1916); and *The Vehement Flame* (1922).

DE LA REY, JACOBUS HERCULES (1847–1914), Boer soldier (*see* 7.944), who was concerned in the rebellion headed by Col. Maritz (*see* SOUTH AFRICA), was shot dead by a police patrol near Johannesburg Sept. 16 1914.

DELAWARE (*see* 7.947).—In 1920 the population of Delaware was 223,003, as compared with 202,322 in 1910, an increase of 20,681, or 10·2%. The number per sq. m. in 1920 was 113·5; in 1910, 103. In 1920 the urban population exceeded the rural for the first time in the history of the state. Of the total population in 1920, 77·5% were native whites, 8·9% foreign-born whites and 13·6% negroes. Of 10,508 illiterates in 1920, 4,700 were negroes, 3,373 foreign-born whites, and 2,427 native whites. The population of the chief cities and towns in 1920 was as follows: Wilmington, 110,168; Dover, the state capital, 4,042; New Castle, 3,854; Milford, 2,703; Laurel, 2,253; Newark, 2,183; Seaford, 2,141; Lewes, 2,074.

Manufactures.—The intense industrial activity of the World War period influenced Delaware greatly, especially Wilmington and its environs. The outstanding phase of this activity was the part taken by the du Pont powder interests in supplying the needs of the Allies and the U.S. Army. In 1919 the principal industries were leather, pulp goods, cars and general shop con-

ruction and repairs by steam railway companies, iron and
teel, canning and preserving of fruits and vegetables, and
oundry and machine-shop products.

Agriculture.—After the passage of the Agricultural Extension
ct (1911) the most significant movement was the development
f co-operative associations, and especially (1918–21) the rapid
rowth of the Farm Bureau movement. In 1920 the number of
arms was 10,140 as compared with 10,836 in 1910, a decrease of
96, or 6·4%. The preceding decade had shown an increase
f 1,149 or 11·9%. Of the farms 6,010 were operated, in 1920, by
heir owners, 144 by managers and 3,986 by tenants. All land
n farms in 1920 amounted to 944,511 ac., being 75·1% of the total
and area of the state; 653,052 ac. were improved land, or 69·1%
f the farm land. The value of all farm property in 1920 was
80,137,614, an increase of 26·8% over the figures for 1910.
he value of all crops in 1919 was $23,058,906. The total value
f cereals was $9,638,010, of hay and forage crops $4,366,174, of
egetables including potatoes $6,271,714 and of fruits and nuts
2,566,807. The total value of cattle, sheep, swine, horses and
ules in 1919 was $7,373,260; of dairy products, excluding cheese,
2,442,253. The estimated total acreage in 1924 was 461,000.

Education.—During the period beginning in 1910 there was a
istinct advance made in the field of education. Better facilities
or the training of teachers were developed, and new school build-
ngs erected in many parts of the state. In 1913 the Women's
ollege was founded and affiliated with Delaware College in
ewark, with the same administration and in part the same
aculty, but entirely separate in buildings, classes and student
rganisations. In 1921 the two colleges were incorporated as the
niversity of Delaware. The internal relations between the
olleges, however, were left as before. The value of the university
roperty in 1924 amounted to $1,986,000, the income for the
scal year, 1923–4, was $506,000, and the total attendance in
925 was 363 men and 293 women. Increased Federal appro-
riations under the Purnell Act to the Agricultural Experiment
tation, also affiliated with the university, made possible greater
xpansion of education in better agricultural methods. An out-
tanding phase of educational development was the erection of
chool buildings in various parts of the state, made possible by
ifts approximating $4,000,000 by Mr. Pierre S. du Pont to an or-
anisation of citizens known as the Service Citizens of Delaware.

Finances and Taxation.—The cash receipts from all sources,
ncluding sales of highway bonds, during the fiscal year ending
une 30 1924 amounted to $9,137,563. The two largest sources
f revenue were the franchise tax and the corporation fees, the
atter amounting to $736,191. Other important sources of
evenue were the motor vehicle licence, motor vehicle fuel tax,
ncome tax, the so-called filing fee, property tax, railway, in-
urance, inheritance and corporation taxes, merchants and
nanufacturers licences, and reimbursements for the highways in
he form of aid from the Federal Govt., the counties and private
ources. The total amount of expenditures for the fiscal year
nding June 30 1924 was $7,870,969. Of this amount over
4,000,000 were expended upon the state highways and $2,000,000
vere appropriated for schools. A state Banking Dept. was
reated (1919), with a banking commissioner and a deputy,
vhose duty it is to examine every bank at least once a year.
n 1921 a budget plan was adopted for the state government,
vhich became effective in 1923.

History.—The passage of a considerable number of modern
nd progressive laws and the post-War reconstruction work
vere the two dominant phases in the history of the state in the
eriod from 1910 to 1925. In this period there were two progres-
ive governors, Charles R. Miller and John G. Townsend. Dur-
ng the administration of the latter a number of important
tatutes were enacted, including a Child Labour law (1917), a
Workmen's Compensation Act (1917), laws for the regulation of
abour for women, an Income Tax law (1917), a Direct In-
eritance Tax law (1917) and a thorough revision of the school
aws, known as the New School Code (1919). In 1923 the Child
Welfare Commission and the Tuberculosis Commission were
ombined with the state Board of Health. After 1910 the Republicans maintained their control of state executive offices, electing the following governors: Simeon S. Pennewill (1909–13); Charles R. Miller (1914–7); John G. Townsend (1917–21); William D. Denny (1921–5); and Robert P. Robinson (1925–   ).

Much of the time, however, the Democrats controlled the House of Representatives and also the Senate after the biennial elections of 1922 and 1924. In 1922 the Democrats elected Thomas F. Bayard to the U.S. Senate and William H. Boyce to the House of Representatives, but in 1924 Gen. T. Coleman du Pont was elected to the Senate by the Republicans to succeed Dr. L. Heisler Ball; and Robert G. Houston, also a Republican, defeated Mr. Boyce for the House. In the presidential election of 1912 the Democrats carried the state; in 1916, 1920 and 1924 the Republicans won by a considerable margin. A third characteristic of the period was the interest shown by public-spirited citizens in the advancement of education and the building of highways. The work of Pierre S. du Pont for education in Delaware had its counterpart in the building of a highway by Senator T. Coleman du Pont, upon which he expended upward of $4,000,000, and which he formally presented to the state on July 4 1924.

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DELBRÜCK, HANS (1848–   ), German historian (*see* 7.952). From 1899 to 1920 Prof. Delbrück edited the *Preussische Jahrbücher*, the most important political magazine in Germany. In the years directly preceding the World War he was emphatic in his warnings of the disastrous consequences which would ensue if Germany precipitated herself into a European conflict, and argued that national idealism, if carried too far, very soon degenerates into national fanaticism. During the early part of the War, however, he put up a strong defence of Germany's attitude. After the Armistice he endeavoured to prove that Germany could not be made solely responsible for the outbreak of hostilities. He was one of the delegates sent to the Peace Conference at Versailles to draw up a statement of the German case. In 1923, as one of the three experts in the Reichstag enquiry committee appointed to investigate the causes of the German defeat, he strongly criticised Ludendorff's 1918 offensive.

DELCASSÉ, THÉOPHILE (1852–1923), French statesman (*see* 7.953), emerged from retirement to censure the defective organisation of the navy after a series of disasters, and in 1909 presided over a commission of enquiry appointed by the Chamber. In March 1909 he became Minister of Marine in the Monis Cabinet, retaining this position in the cabinets of M. Caillaux (June 1911—Jan. 1912) and of M. Poincaré (Jan. 1912—Jan. 1913). On Aug. 24 1914 M. Viviani appointed him Minister for Foreign Affairs in his reconstituted Ministry. During the summer of 1915 Delcassé's schemes for winning Bulgaria over to the side of the Allies failed utterly to mature, and in Oct. he resigned, retiring from politics altogether in 1919. M. Delcassé, who played a considerable part in the evolution of the Anglo-French *Entente*, was possibly one of the greatest Foreign Ministers of the Third Republic, and rendered inestimable service both to France and to Europe. He died at Nice Feb. 21 1923.

DELHI, India (*see* 7.954), had a population in 1921 of 304,420. The planning and laying-out of a new Delhi has been in progress since 1912, as the outcome of the official transfer of the capital of British India from Calcutta, announced by King George V. at the Coronation Durbar on Dec. 12 1911. Two inauguration stones were laid by the King-Emperor on Dec. 15 1911. The first step was the appointment of a town-planning committee, and a site to the south of the old city was chosen. New cantonments to the west were occupied in 1923, and a temporary city, housing the official secretariats, has been built to the north.

The focal point of the new city is on Raisina Hill, and the buildings of the government centre are arranged symmetrically about what is practically an east and west axis connecting the focal point with the north-western, or Talaki, Gate of the old fort of Indrapat, or Purana Kila. The two great blocks of secretariats are situated to the north and south of this focal point, with Government Court between them. Westward from Government Court, a raised platform, or forum, connects Raisina Hill with the high ground of the southern ridge, so that the whole government centre appears to be built on a spur of the ridge itself. This raised forum is known as the Viceroy's Court and at its western end is situated Government House. At the intersection of these roadways with the east and west axis of the court is the Jaipur Column surmounted by the Star of India. Below the eastern façade of the secretariats a forecourt, known as the Great Place, is laid out. Eastward again is a park known as the Central Vista, on either side of which are the houses of the members of council. A second principal avenue of the city intersects at right angles the Central Vista about midway in its length. In the four angles formed by this intersection were planned four large buildings, to accommodate, amongst other institutions, the Imperial Record Office, the Ethnological Museum, the Medical Research Institute, the Library and the War Museum.

On Oct. 1 1912, by proclamation, there was constituted the administrative province of Delhi, taken entirely from the old Delhi district of the Punjab. Delhi will be the seat of government from October to May; the hot weather will be spent at Simla, as in the past. It is proposed completely to occupy the new city for the first time in Oct. 1926, and it is anticipated that the houses for the officials and the secretariats will be ready by that date. Government House, however, and the great circular building for the Chamber of Princes, the Legislative Assembly and the Council of State will not be finished until the following March. The roads were metalled and planted with trees and the sewage and water-pipes and electric cables laid by 1924. Old Delhi was again visited by plague in 1918, and in 1919 there were riots in the city. A room in the Mogul Fort is now an archaeological museum. (O. J. R. H.)

DELISLE, LÉOPOLD VICTOR (1826–1910), French bibliophile and historian (*see* 7.964), published, in 1909, his edition of the *Rouleau Mortuaire du B. Vital, Abbé de Savigny*, and also *Les Actes de Henri II*. (vol. 2 appeared in 1916). He died at Chantilly July 21 1910.

See R. L. Poole, *Léopold Delisle* (1911); X. Delisle, *Lettres de Léopold Delisle* (1911–4).

DELIUS, FREDERICK (1863–), British musical composer, was born at Bradford, Yorks., Jan 29 1863, the son of Julius Delius, a German, who, in 1860, became a naturalised British subject. He was educated at Bradford Grammar School and the International College, Isleworth, London. Declining the business career offered him in Bradford he went to Florida as an orange planter, but devoted his spare time to such musical study as he could obtain from the books in his possession. In 1886 he left Florida for Leipzig and there underwent a more or less regular training from Jadassohn and came under the influence of Grieg, then living in that town. In 1893 his fantasia-overture *Over the Hills and Far Away* was done by Dr. Haym at Elberfeld. The work was ultimately recast and produced in London in 1907 by Theo. Szanto. His first concert of his own works was held at St. James's Hall, London, in 1899. In the intervals of opera composing Delius produced purely orchestral works or works for chorus and orchestra. *A Mass of Life* (1905), produced in London in 1909, is generally considered his finest achievement. He also composed incidental music to J. E. Flecker's *Hassan*, produced at His Majesty's Theatre, London, in 1923.

DEMOCRATIC PARTY (*see* 8.2).—By the election of 1912 the Democratic party placed Woodrow Wilson in the presidency, and gained control of the Senate. Two years earlier it had won a majority in the House of Representatives. The Republican defeat in the congressional elections of 1910 portended the Progressive party split under Roosevelt, and a consequent period of divided counsels and national impotence.

Wilson's Leadership.—The advent to power of the Democratic party under the compelling leadership of Wilson in all branches of the Federal Govt. (except the Supreme Court, which, for ordinary partisan purposes, need not be considered) was followed by an impressive list of legislative enactments. Among the more important of these were the Underwood Act, which revised the tariff downward and imposed an income tax, and the Federal Reserve Act, which re-organised the banking system of the country. In 1914 the trust problem was dealt with by the Clayton Act and the establishment of a Federal Trade Commission. This halcyon period of Democratic control was brought to an end by the imbroglio with the revolutionary government in Mexico and by the outbreak of the World War, which diverted the attention of the American people from domestic reforms to foreign relations.

The Campaign of 1916.—As the campaign of 1916 approached it became apparent that the breach which had divided Republicans and Progressives since 1912 was to be closed. Charles E. Hughes (*q.v.*), who received the Republican nomination for the presidency, had the support of Roosevelt, a support which, considering the candidate's more cautious attitude on the War, was given perhaps too belligerently. The Democrats renominated Wilson; their platform, in accordance with the usual party practice of the "ins," being one long paean of praise of the achievements of the Administration. The Republican platform roundly condemned the legislative activities of the Democrats, with the single exception of the Federal Reserve Act. President Wilson's policy on Mexican and European troubles was denounced as vacillating. Both parties declared for preparedness and peace, but there was one particular passage in the Democratic platform praising the President who has "kept us out of war" which played a considerable part in the campaign. Unfortunately for the Republicans, the country (in spite of the Underwood low tariff as they saw it) was prosperous, both agriculture and industry being drawn upon heavily for war orders. The election of 1916 was exceedingly close, but Wilson won by 277 to 254 votes in the electoral college, his plurality over Hughes in a popular vote of 20,000,000 being less than 600,000.

The War Period.—During the participation of the United States in the World War "politics were adjourned," superficially at least. Nevertheless intense partisan rivalries were being generated beneath the surface. The spark which caused their explosion was President Wilson's appeal of Oct. 24 1918 for the return of a Democratic majority to both the Senate and the House of Representatives. It was bitterly condemned by leaders of the Republican party, and in the November election the latter gained control of the House by 46 votes, and of the Senate by a plurality of one. A long-drawn-out controversy ensued between President Wilson and the Senate over the Versailles Treaty and the proposed entry of the United States into the League of Nations, the latter becoming the paramount issue in the campaign of 1920. The Democratic platform of that year favoured the League; the Republican platform proposed *an* international association instead of *the* League of Nations. Other influences largely affected the vote: discontent over the new burdens and taxes, the industrial dislocations and high cost of living caused by the War, also the national antipathies of foreign-born citizens, which had been greatly exacerbated by the European struggle.

Elections of 1920 and 1924.—In the presidential election of 1920 the Democratic candidate, Gov. J. M. Cox of Ohio, was defeated by an unprecedented majority. With the inauguration of President Harding the Republicans resumed control of all branches of the Federal Government. During the campaign of 1924 the Democrats sought to capitalise administrative scandals of a grave nature which had occurred in the departments of the Navy, Interior and Justice. They were severely handicapped, however, by the fight which broke out on the floor of the New York Convention between Klan and anti-Klan factions; also by the bitter rivalries between aspirants for the nomination, as a result of which it became necessary to take 103 ballots before John W. Davis of West Virginia was nominated. The campaign of 1924 was further complicated by the emergence of the Progressive party under La Follette. President Coolidge, who had succeeded upon the death of Harding in 1923, received the Republican nomination, and was successful by a majority of 233 in the electoral college and of 2,000,000 in a total popular vote of nearly 30,000,000. In the 69th Congress, which was elected at the same time, the Democratic strength was again slightly reduced, the number of the adherents of that party being, in 1926, 40 in the Senate and 183 in the House of Representatives.

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DE MORGAN, WILLIAM FREND (1839–1917), British novelist (*see* 8.10), died in London Jan. 15 1917. His later novels include *An Affair of Dishonour* (1910); *A Likely Story* (1912); *When Ghost meets Ghost* (1914). In 1919 *The Old Madhouse* was published posthumously. His last but unfinished novel, *The Old Man's Youth*, was published, with additions by his widow, in 1921.

DENBY, EDWIN (1870–), American politician, was born at Evansville, Ind., Feb. 18 1870 and was educated there. In 1885 he went to China and entered the Chinese imperial maritime customs service. He returned to America in 1894 and, after graduating from the Law school of the University of Michigan in 1896 was admitted to the Bar, and practised in Detroit. On the outbreak of the Spanish-American War in 1898 he entered the navy. Later he was a member of the Michigan House of Representatives. From 1905 to 1911 he was a member of Congress and served as chairman of the House Committee on Naval Affairs. When America entered the World War in 1917 he enlisted in the marine corps. In Dec. 1920 he was appointed probation officer of the Detroit Municipal Courts. In 1921 he was appointed Secretary of the Navy by President Harding, and resigned this office March 10 1924, following a senatorial resolution urging the President to demand his retirement, because of his connection with the leasing of naval oil reserves at Teapot Dome.

DENIKER, JOSEPH (1852–1918), French naturalist (*see* 8.21), died in Paris March 18 1918.

DENIKIN, ANTON (1872–), Russian soldier, was born in humble circumstances Dec. 4 1872. He entered the Russian army in 1887, and during the World War rose to the rank of lieutenant-general. After the outbreak of the revolution he followed Kornilov and was arrested and imprisoned with him in Bykova. They escaped together and fled to the Caucasian shore of the Black Sea. There they joined Alexeyev, who was forming a small army of volunteers to fight the Bolsheviks. After Kornilov's death on March 31 1918, Denikin became military commander of the army, whilst Alexeyev was chosen "supreme leader" and organised recruiting and supplies. They successfully established contact with a Caucasian detachment led by Erdeli, with the Don Cossacks under Krasnov, and some 2,000 men led by Drozdovsky. By June the army counted some 12,000 men, and was able to attempt the reconquest of the Kuban territory. On Aug. 5 Gen. Alexeyev entered Ekaterinodar. By the middle of Sept. the army had increased to 60,000 men. On Sept. 25 Alexeyev died and Denikin took his place. The revolt of Siberia and eastern Russia against the Bolsheviks made victory possible for Denikin in the south. Stavropol was taken after a struggle and 35,000 of the Bolshevik army surrendered or were killed.

At the beginning of 1919 Denikin was at his zenith. After much discussion and many intrigues it was decided that for the conduct of the South Russian Govt. a "special council" should be formed combining legislative and executive functions. Most of its members were generals of the headquarters staff. The Government, however, did not succeed in achieving popularity. Denikin regarded the Assembly as a consultative organisation only. He insisted upon keeping military restoration and the liberation of Moscow from the Bolsheviks to the fore. At first his plans met with success, but his "white" armies by their drastic requisition of all available supplies and their failure to put an end to brigandage alienated the sympathies of the people. The movement for an independent Kuban republic in the southwest gained in force, and this hastened the disintegration of Denikin's army. Meanwhile, largely owing to the relentless discipline introduced by Trotsky, the Bolshevik resistance had stiffened. At the beginning of Nov. 1919 Budenny's cavalry broke through the "white" lines at Kupyansk and a general retreat set in. At the eleventh hour Denikin endeavoured to win back the Cossacks—Don Kuban, Tecek, Astrakhan—by promising a new Government on federal lines, but to no purpose. Early in 1920 Budenny retook Ekaterinodar and Rostov, the volunteer army dissolved and Denikin himself fled to Constantinople.

DENIS, MAURICE (1870–), French painter, was born at Granville, France, Nov. 25 1870. Although at first a disciple of Gauguin, he gave up symbolism in order to devote himself to decorative painting, following the example of the great Italian fresco painters of the 15th century. His most remarkable works are in the sphere of religious art, and mural decorations of this kind are to be seen in the churches of Le Vésinet and of St. Paul at Geneva as well as in the Priory Chapel at Saint-Germain-en-Laye. Maurice Denis decorated the ceiling of the Champs-Elysées Theatre, Paris; he has also illustrated numerous works including a translation of the *Little Flowers of St. Francis;* and has published two volumes *Théories, 1890–1910. Du Symbolisme et de Gauguin vers un nouvel ordre classique* (1912); and *Nouvelles théories sur l'art moderne, sur l'art sacré, 1914–1921* (1922).

DENISON, GEORGE TAYLOR (1839–1925), Canadian soldier and publicist (*see* 8.22), died at Toronto June 6 1925.

DENMARK (*see* 8.23).—A kingdom of northern Europe and a member of the League of Nations. Since the incorporation of North Slesvig (1,538 sq.m.), returned to Denmark in 1920 according to the Treaty of Versailles, the area of Denmark proper is 16,058 square miles. The population (1921) was 3,267,831. About 75% of the area is occupied by cultivated land, about 10% by woods and plantations, while the rest, 15%, is either uncultivated or is used as gardens, building lots, roads, etc. In addition, the Faeroes (540 sq.m.) and Greenland (a little more than 770,000 sq. m.) belong to Denmark.

I. POLITICAL HISTORY

After the Cabinet of J. C. Christensen had been forced by the Alberti catastrophe to retire, it was followed by three short-lived cabinets: Niels Neergaard, Count Holstein-Ledreborg, C. Th. Zahle, whereupon Klaus Berntsen (July 5 1910) formed a cabinet of the Left, which lasted until 1913. After violent contests on the defence problem, the Holstein Cabinet carried an arrangement whereby the army and navy were enlarged, Copenhagen's naval defences strengthened and the land defences were to be dismantled not later than March 31 1922.

The Zahle ministry prosecuted Christensen and Berg before the Rigsret for neglect of their ministerial duties in regard to Alberti (the former being acquitted, the latter sentenced to a fine). In 1910 the Left opened an agitation for a democratic amendment of the Constitution. The Right, which was strong in the *Landsthing* (Upper House) opposed, and no solution had been reached when the elections were held in May 1913. The Radicals and Socialists now held 63 seats out of the 114 in the *Folkething*, and united to force the reform under a new Zahle cabinet with Brandes as minister for finance, Rode minister for the interior, Erik Scavenias minister for foreign affairs and Munch minister for defence. The Right answered by obstruction in the *Landsthing*, which the Government then dissolved. The new *Landsthing* contained 38 supporters, 28 opponents of the constitutional amendment. No solution had, however, been reached when the War broke out. King Frederick VIII. died on May 14 1912, and was succeeded on the throne by his son Christian X.

The War 1914–8.—The European situation in 1914 caused Denmark great anxiety. On Aug. 1 the Rigsdag passed a number of emergency laws. The mobilisation of the emergency army, numbering in all about 70,000 men began on the same day. All political parties agreed in maintaining the neutrality of Denmark. An attack by Germany was especially feared. A difficult situation arose on Aug. 5 in consequence of an inquiry from Germany as to whether the Danish Govt. intended to block Danish waters with mines, an inquiry which could only mean that if Denmark refused Germany would lay the mines. The Government had to consider Denmark's responsibility as a neutral Power, and after some hesitation decided to lay the mines. With this Germany was satisfied, and Britain sanctioned the action in view of Denmark's precarious position. It became apparent that the war situation might have serious effects upon Danish economic life, and the Government was therefore granted emergency powers. As in military affairs, the Government adhered to the policy of keeping the belligerent nations constantly informed of the measures adopted, these establishing with both sides confidence in Denmark's desire for real neutrality, and an understanding of the importance of maintaining effective industries. This in time resulted in fixed agreements with Germany and England as to exports.

When the first anxiety was allayed the constitutional problem was again taken up. As the opposition of the Right was weakening, a result was reached without great difficulty and June 5 1915 the King signed the new constitution. This introduced equal suffrage in the elections for both Houses, men and women being entitled to vote under identical conditions; the voting age was fixed at 35 years for the *Landsthing* and was lowered successively from 30 to 25 years for the *Folkething*. Of the 140 members of the *Folkething*, 93 are elected in individual districts, 27 in greater Copenhagen according to proportional representation, and 23 supplementary seats are divided among the parties that have received too few representatives at the other polls in proportion to their number of votes. The *Landsthing* has 72 members, of which 54 are indirectly and proportionally elected in the large districts, while 18 are elected by the retiring *Landsthing* according to the same principles. In the case of a constitutional amendment a referendum must take place, and 45% of the eligible voters must vote for it to give it validity. The constitution came into force on April 21 1918.

Other important legislative Acts of the first years of the War, which the Zahle Govt. succeeded in getting passed unanimously, were the Reform of the Administration of Justice (April 11 1916), which separated the administrative and judicial systems, and introduced oral proceedings and publicity—with trial by jury in criminal and political cases—and the Accident Insurance law (July 6 1916), which made it the duty of all employers to insure their employees. The privileged suffrage in elections to the *Amtsraad* (county councils) was abolished with the consent of all parties.

In the late summer of 1916 the Political Bill was succeeded by a bitter struggle on the Government's announcement that it had concluded a treaty with the United States ceding the Danish West Indies to that country for $25,000,000. Finally the cabinet was supplemented by representatives of each political party and a plebiscite taken on the sale. At the polls (Dec. 14 1916) 283,670 votes were cast in favour and 158,157 against, and shortly afterwards the *Rigsdag* ratified the cession. A similar, but less far-reaching bitter contest, arose over the rearrangement of the relation of Iceland to Denmark. With increasing force, Iceland demanded political independence and integrity. Despite the opposition of the Conservatives, the support of the other three parties sufficed to pass an Act of Union (Nov. 1918), in which Denmark acknowledged the independence of Iceland. The King is joint ruler of both countries, and Denmark takes charge of Iceland's foreign relations. The Act of Union is valid till 1940.

From 1917 onwards unrestricted submarine warfare, combined with the stricter measures of the Entente, caused increasing difficulties in the economic life of Denmark. The Government made further efforts, by means of maximum prices, export prohibitions and by the rationing of certain articles, to create tolerable conditions for the people. It sought to mitigate the effects of the increase in prices by an extensive policy of relief. Through an increase of the succession, income and personal property taxes, and the introduction amongst others of a tax on exchange business, the Government tried to cover these and the greatly increased military expenses. After the spring of 1918 the elections could no longer be postponed. At the elections for the *Folkething*, when women voted for the first time (68% voted to the men's 84%), 72 supporters of the Government were elected, 39 Socialists and 33 Radicals, and 68 opponents. The *Landsthing* was constituted as follows: 17 Conservatives, 26 Left, 13 Radicals and 15 Socialists.

1918–25.—At the time of the Armistice the old problems were viewed differently and new questions arose. The troops were quickly demobilised, the special defence works were razed and on March 17 1920, a law was passed abolishing the land defence and artillery of Copenhagen. In 1919 the special military administration of justice had ceased. The Government's economic policy, which had caused some dissatisfaction, but as a whole had been supported by all parties, became the object of very strong criticism, as the Opposition thought it time to abrogate the War-time legislation in this respect. Instead of improving, economic conditions became worse: small exports, the falling value of the Danish krone both at home and abroad and numerous strikes, partly caused by the syndicalistic agitation, characterised the industrial and economic situation until late in 1920.

The Allied victory affected Denmark chiefly through the prospects of a reunion with the Danish part of Slesvig, where plebiscites were held in the spring of 1920 (*see* SCHLESWIG). While the plebiscite results in Zone 1 satisfied Danish expectations, this was not the case with the results in Zone 2, which caused great disappointment. The Zahle Ministry had for months been vehemently attacked for its cool attitude towards the national propaganda in Central Slesvig, and its assailants made it responsible for the poor result of the plebiscite. Certain circles fostered a forlorn hope of preventing the final union of Central Slesvig with Germany by a so-called "internationalisation" of Zone 2, which, however, was not thought of in the Versailles Treaty. The political opposition combined with this nationalistic agitation, and when the Government refused to order new elections, in view of the necessity for a new electoral law, the King dismissed it. A Cabinet of non-politicians, formed by Liebe, March 30 1920, took the responsibility for the King's action, which was regarded by the supporters of the dismissed Cabinet as unconstitutional, and had caused the threat of a general strike from the Socialists. During this "Easter crisis" Denmark looked as if it were on the verge of a revolution. The mediation of the city council of Copenhagen and others conciliated the Crown and the Socialists, and on April 5 a new Ministry, consisting chiefly of state officials, was appointed to formulate an electoral law and to order new elections. The new law was based on proportional representation in the county districts (*Amtskredse*), and the supplementary seats system was retained in a slightly altered form.

At the *Folkething* elections (April 26 1920) the Left received 351,000 votes (49 seats), the Conservatives 201,000 (28), "Erhvervsparti" (trades party) 29,000 (4), against the Socialists 300,000 (42) and the Radicals 122,000 (17). Niels Neergaard formed the new Left Cabinet on May 5. The new *Folkething* elections were held on Sept. 21 1920. In these the people of North Slesvig took part, and the voting age was 25 years for the first time. The results were 412,000 votes cast for the Left (52 seats), 390,000 Socialists (48), 217,000 Conservatives (27), 147,000 Radicals (18), 27,000 "Erhvervsparti" (3) and 7,000 for the German candidates (1). The Neergaard Ministry continued to direct the policy of the country, supported by the majority which its own party, the Left, composed of Danish farmers, formed in conjunction with the Conservatives, the citizen class of the market towns, against an opposition consisting of Social-Democrats, Labour and the Radicals, the small-holders of the agricultural districts and some portion of the Liberals in the towns.

The first task before the ministry was the complete incorporation into Denmark of the restored North Slesvig territory; the old frontier should, if possible, be obliterated entirely, and the new one firmly established in its stead. Many legislative measures and administrative acts were required to attain this end; and considerable financial sacrifices on the part of the former kingdom were needed to alleviate the manifold distress to which this portion of the former German Empire had been reduced by the War (*see* SCHLESWIG).

Denmark joined the League of Nations at an early date (March 8 1920); since then, a Danish delegation, representing all political parties, has taken part in the proceedings of the League. In 1920 also, negotiations were entered into with Soviet Russia, and, after a temporary interruption, led to a commercial agreement (April 23 1923), which was approved by the Rigsdag on June 8. The extension of the Danish monopoly in Greenland in 1921 to embrace the whole of that country led to some objections on the part of Norway, based on existing Norwegian interest in the East Greenland waters. After diplomatic discussions, negotiations began in Oct. 1923 and Jan. 1924, leading to an agreement of July 9 1924, whereby Norwegian subjects and Norwegian companies were guaranteed certain rights in East Greenland for a period of 20 years.

In Denmark, as elsewhere, it was the general economical development after the War, and its effect on home affairs, which presented the greatest difficulties. Unemployment, after a fall in 1920, had by Feb. 1922 reached 80,000. The Government could not therefore for a moment consider the essential reduction of Government grants to the unemployed which it had maintained as a necessity in face of the former ministry. Dr. O. Kragh, however, who had entered the cabinet in July 1921, as Minister of the Interior, succeeded in finding a method for reasonable restriction of the grant, while maintaining the principle that support of the unemployed in cases of extraordinary unemployment beyond the workers' control was a task for the State. Nor was it actually the purpose of the Government to renounce the social obligations assumed by the State and substitute retrogressive for progressive principles; it only sought to cut down expenses where they seemed to have risen too far, and to find a better basis. This was apparent, when, on Aug. 7 1922, Dr. Kragh succeeded in carrying an Old Age Pensions Bill, ensuring every man and woman on attaining the age of 65, a workers' pension from the State, amounting, for married couples without private means, to £56, and falling in proportion to such means until the right to pension becomes nil on the possession of a fortune amounting to 25,000 kr. (about. £1,500).

In 1922, however, the economical crisis reappeared in a more violent form. The rapid depreciation of the currency became the leading political question. It was generally feared that a continuation of the decline must reduce the nation to the same state of misery as Germany. The Government, however, took no measures to stop depreciation, considering that it must be a matter for the Danish National Bank to raise the value of the krone by suitable deflation with reasonable restriction of the note issue and of credit. It was urged, however, and rightly, that the Government was to blame for not taking measures to compel the National Bank to carry out this policy of deflation.

A new election to the *Folkething* took place on April 11 1924. The Social Democrats obtained 455,000 votes (55 elected), the Left 339,000 votes (45), Conservatives 213,000 (28), Radicals 166,000 (20) and the Germans 7,500 (1). The Social-Democratic party took over the Government on April 23 1924, forming the Stauning Ministry. This, though with a leading trade unionist at its head, consisted, for the rest, of the party's mainly academical members of Parliament, as Borgbjerg, Social Minister; Steincke, Minister of Justice; Bramsnaes, Minister of Finance and Fru Nina Bang, the first woman to hold office in a Danish Cabinet, as Minister of Education. The Danish Minister in Berlin, Count Moltke, also entered the Cabinet as Minister for Foreign Affairs. The new Government was at once faced with the task of carrying out the agreement with Norway; this was passed in June 1924 with the votes of the Left and Social-Democrats against the Conservatives and Radicals. The passing of this measure settled the question; and since then, England and France have sought and obtained from Denmark the same rights in East Greenland as Norway. The most important task, however, was the restoration of the krone. The Social-Democratic Government for the rest attracted most attention by passing through the Lower House a measure for the virtual disarmament of Denmark.

See Erik Arup, *Rids af Danmarks Historie* (1921); Fr. Nörgaard, *Danmark fra 1864 til Genforeningen med Sönderjylland* (1920); Alex. Thorse, *Grundrids of den danske Rigsdags Historie 1866–1915* (1920).
(ER. A.; H. LU.)

II. FINANCIAL AND ECONOMIC HISTORY

Denmark shared with the rest of the world in the general rise in values which culminated towards the close of 1913. Unemployment, which was 9·4% in 1911, fell in 1912 to 7·5 and in 1913 to 7·3%, and the production and export of agricultural products, especially butter, bacon and eggs, a factor of great importance in the economical life of the country, was on the increase. The total exports of home produce, to which agriculture normally contributes nearly 90%, amounted in 1911 to 537,000,000 in 1912 to 597,000,000, and in 1913 to 637,000,000 kroner.

The War Period.—Although a neutral country from first to last, Denmark experienced increasing economic difficulties throughout the World War. This was due primarily to the fact that it is necessary not only to import coal and the bulk of raw materials for industry, but also enormous quantities of oilcake and maize for agricultural purposes in the production of butter and bacon, as well as large quantities of fertilisers. It was therefore of the utmost importance to ensure a continuance of the most essential imports from overseas, not only for the maintenance of industrial employment, but also for the sake of agriculture, which had, on the one hand, to provide food for the population, and more especially, to maintain its exports in order to pay for imports required. As each of the two belligerent groups feared that these imports might find their way, directly or in a manufactured state, to the enemy, various commercial agreements were concluded, in which the two great central industrial organisations, the Industrial Council (Industriraadet) and the Committee of the Merchants' Society (Grosserer-Societetets Komite), guaranteed on behalf of their members that goods imported under the clause prohibiting export should not be dealt with contrary to the agreements.

These agreements did not at first include any provision as to limitation of the quantities imported; in course of time, however, rationing regulations were introduced for a whole series of commodities, and on the declaration of the unrestricted submarine campaign on Feb. 1 1917 imports were further reduced, while the American export restrictions and the blockade hindered the import of corn and fodder. In order to maintain the supply of necessary foodstuffs for the population, but more especially to maintain as long as possible a surplus of agricultural produce for export—still distributed in the same proportion west and south as before the War—rationing of bread and sugar was introduced at the beginning of 1917, and later also butter, bacon and lard were rationed. Various groceries were subsequently added to the rationing list as long as any supply of these remained in the country, which ceased to be the case early in 1918.

Foreign Trade.—The value, amount and prices of exports and imports for 1911–25 will be seen from the following table:—

Year	Imports, mill. kr.	Exports, mill. kr.	Import surplus mill. kr.	Quantitative index, 1913=100		Gross income shipping, mill. kr.	Wholesale price figure	Retail price figure
				Imp.	Exp.			
1913	855	721	134	100	100	119	89	..
1914	795	867	72[1]	88	114	102	100	100
1917	1,089	1,066	23	46	72	465	249	155
1918	946	758	188	33	33	563	302	182
1920	3,243	1,962	1,281	88	83	553	383	262
1921	1,697	1,564	133	89	88	205	253	237
1923	2,031	1,684	347	125	128	240	207	204
1924	2,366	2,154	212	126	130	270	233	214
1925	2,095	1,966	129	..	..	..	212	219

[1] Export Surplus.

The index figures for quantity show that the imports fell to a very low level in 1917–8, while exports even in 1919 were still not half the normal quantity. This was especially due to the after-effects of shortage in import of raw materials for agriculture, which led, *inter alia*, to the slaughtering of the entire stock of pigs. As regards industry, the stoppage of imports of raw materials sent up the unemployment percentage, which had been normal in 1915 and well below the normal in 1916, to 10% above normal in 1917, while in 1918 it was 106% and in 1919 still 24% above the average for 1909–13.

The table further shows that imports were only slightly in excess of exports during the actual years of war, and this excess was more than balanced by the income derived from shipping. In 1919–20, on the other hand, the excess was very high, partly because quantities of goods purchased during the War could now be brought home, and partly because of the anticipation of a great demand from Central Europe and the Baltic which, however, failed to materialise.

Rate of Exchange and Price Level.—These features in foreign trade were of great importance to the rate of exchange. The Danish krone rose above par in regard to the pound sterling and the dollar to such an extent that on Oct. 2 1917, the pound had fallen to kr. 13·00 (kr. 18·16 at par). Subsequently exports decreased greatly, and there was an expansion of credit, stimulated to no slight degree by the considerable loans advanced by the Note Bank and the leading private banks to German, English and French banks during the War, which resulted in an increase in the volume of purchasing power and helped to raise the level of prices and to move the exchanges against Denmark. At the end of the War, therefore, the value of the Danish krone fell below parity. During 1920, the value of imports rose to over 3,000,000,000 kroner, and the rate of exchange to the pound sterling mounted on Nov. 17 1920 to 25·86.

This again led to a rise in wholesale and retail prices, partly because the War-time price regulation arrangements were gradually being withdrawn, and also because the effects of the wage bonus granted in 1918 and 1919 to workers and civil servants were now being felt; and further, to some extent, owing to the fact that the State had to borrow extensively from the Note Bank. The deficit in the Budget was due partly to the fact that a low price for bread had been maintained also for the harvest year 1920–1, the State paying the farmers a fixed price based on that of the world market, and selling the corn itself to the millers at a reduced rate. Owing to the fall in prices which set in towards the close of 1920, however, the State did not, as had been anticipated, recover part of this expenditure by export, and the whole of the bread subsidy had therefore to be borne by the State.

Financial Policy.—The universal fall in prices, however, also had a very marked effect in Denmark; in 1921, unemployment was four or five times the normal, and the import surplus declined, as the table shows, to only 133,000,000 kroner. Before the middle of 1921, the pound sterling was almost at par. But this rate could not be maintained, and the exchange therefore rose again to 20–22 kroner. Here it remained during 1921 and for part of 1922, but the effects of the fall in prices now appeared, and several banks were in difficulties. The Landmandsbank, the largest in the country, was reconstructed with the aid of the National Bank. During 1923–4 the value of the pound sterling remained, with various fluctuations, about the level of 26 kroner. But there was still an active demand for a return to the old gold parity, and in March 1924, the National Bank commenced a systematic restriction of credit, which brought the gold value of the krone, measured in dollars, up to about 65 ore at the close of the year.

This financial policy was now supported by a law of Dec. 1924, authorising the Minister of Finance to levy extraordinary taxes for the covering of a loan with the National Bank in connection with the reconstruction of the Landmandsbank, and further, to give the State's guarantee for a cash credit of $40,000,000 taken up by the National Bank. This helped to support the financial policy introduced in March 1924, and in 1925 the value of the krone has risen very considerably, and has been for several months about 92 ore. The deflation which in 1925 sent the wholesale price level down from 243 to 176 naturally occasioned difficulties both for industry and for the banks, but the economic life of Denmark did not suffer any irreparable damage, owing primarily to the fact that the country's main source of revenue is agriculture, which, with its relatively low rate of wages, is far better able to maintain competition in foreign markets than is the case where the export of industrial products has to provide the bulk of the nation's income.

Bibliography.—H. Westergaard, *Economic Development in Denmark before and during the War* (Oxford, 1922); also a series of articles by Einar Cohn in *Nationalökonomisk Tidskrift* (Copenhagen) during the period. (E. Co.)

III. AGRICULTURE

Under the Treaty of Versailles Denmark increased her area by the addition of a part of the old Danish districts in Slesvig comprising about 3,280 sq. km. of farm land and 14,364 farms. The number of holdings has been increased, partly by private parcelling out and partly by the establishment of many small holdings with state aid, so that the total number of agricultural holdings in 1920 was 205,929 as against about 172,000 in 1901.

As a result of the Land Laws of 1899 and 1919 about 9,000 new small holdings were created during the 15 years 1910–24. The average number of holdings established each year from 1920 to 1924 was about 1,000. The total number of holdings in 1925 was about 212,000 of an average size of about 18 hectares each. With the increase in the number of holdings there was a change in the mode of tenure, from tenancy to freehold. The law of June 30 1919 abolished leasehold as far as large and middle sized holdings were concerned. Leasehold is still allowed for small holdings, and in 1919 about 5,700 small holdings were held on lease or rented, the Slesvig part excluded.

TABLE I. *Size, Number and Mode of Tenure of Farms in 1919–20*

Group according to size	Number of holdings	Total	Per cent of total area	Mode of Tenure in percentages			
				Free-hold	Lease-hold	Ten-ancy	Not stated
hectares		hectares					
0·55– 3·3	43,891	92,586	2·4	85·7	9·9	1·7	2·7
3·3 –10·0	65,254	449,627	11·8	93·9	2·6	1·4	2·1
10 –15	25,494	365,722	9·6	95·4	1·2	1·8	1·6
15 –30	43,364	1,092,880	28·6	95·2	1·1	2·2	1·5
30 –60	22,552	1,063,144	27·8	93·6	1·4	3·4	1·6
60 –120	4,039	387,216	10·1	91·2	0·6	6·6	1·6
120 –240	916	185,227	4·9	79·2	0·5	18·8	1·5
Over 240	419	181,893	4·8	63·5	0·5	32·2	3·8
Total .	205,929	3,818,295	100·0	92·4	3·5	2·1	2·0

It will be seen that the middle-sized farms of from 10 to 60 hectares form the majority, comprising 66% of the total area. The small holdings of under 10 hectares form 14% and the farms of about 60 hectares form about 20%. In 1919 only 5·7% of all the farms were not worked by the owners as against 11·6% in 1901.

Production and Marketing.—The War and its after-effects naturally vastly influenced production and marketing. The great development in and industrialising of animal production characteristic of Danish agriculture during the last 30 years previous to the War have made Denmark more dependent on international trade than the agricultural activities of most other countries. In 1913 Denmark exported agricultural produce to the amount of about 550,000,000 kr., about 97% of the exports being animal products, and imported corn and feeding stuffs to the value of 181,000,000 kroner. The War seriously affected this development, especially after the submarine warfare began in Feb. 1917. The effect of the blockade and the post-War recovery may be deduced from the following table:—

TABLE II. *Number of Farm Animals 1909–25 (in 1000)*[1]

	Horses	Cattle	Cows	Pigs	Sheep	Fowls
1909	535	2,254	1,284	1,468	727	11,816
1914	567	2,463	1,310	2,497	515	15,140
1918	545	2,124	1,024	621	470	9,884
1919	558	2,188	1,042	716	509	12,134
1920	602	2,504	1,196	1,116	540	14,395
1922	576	2,525	1,311	1,899	442	19,184
1924	548	2,667	1,369	2,868	302	20,284
1925	538	2,756	1,390	2,546	265	20,134

[1] Since and including 1920 the figures include the Slesvig part.

The large decrease in the number of milch cows and pigs during the War does not show the full decrease in animal products. The annual yield per cow decreased from about 2,750 kg. milk in 1914 to about 1,810 kg. in 1919, and in terms of butter this means a decrease in production from 143 million kg. in 1914 to 76 million kg. in 1918. It was not until 1922 that the yield reached the 1914 level, but in 1925 it rose by an additional 250 kg. per cow, the average yield of milk per cow per annum being estimated to about 3,000 kilogrammes.

TABLE III. *Export of Animals and Animal Products in Certain Years*[1]

	1000 head of			Million kg. of					
	Horses	Cattle	Pigs	Butter	Cheese	Condensed milk	Bacon	Beef	Eggs
1910–3	26·8	143·0	..	88·5	0·3	2·5	116·2	17·6	25·2
1914	95·7	188·9	..	95·3	0·5	2·7	147·1	17·4	27·5
1916	16·1	305·4	..	95·8	4·5	3·3	104·7	18·2	28·9
1918	29·2	113·8	..	14·7	3·2	1·4	2·7	13·9	19·7
1919	1·4	32·3	0·4	36·6	2·6	1·7	0·9	8·3	20·4
1920	24·1	61·2	53·6	74·8	9·7	6·3	42·4	17·6	32·8
1922	19·7	82·5	10·0	95·5	8·9	23·4	111·4	20·5	44·2
1924	12·6	172·9	205·7	123·4	8·8	34·2	197·2	3·8	50·0

[1] Since and including 1920 the figures also include the Slesvig part.

The heavy reduction after 1917 was mainly due to the absolute cessation of the import of feeding stuffs, but partly to the very poor harvests during the years 1917–8 especially with regard to grain crops. These reduced the bacon export in 1919 to the minimum of 1,000,000 kilogrammes.

In the figures from 1920 the export from Slesvig is included. The export of animal products only reached pre-War level in 1923 and 1924. The increase is largest for the export of dairy produce, pigs, bacon and eggs, while the export of cattle and beef taken as a whole is smaller than before the War and there is a considerable decrease in the export of horses mainly due to difficulties experienced on the German market.

The large increase in the export, both during and after the War, of live pigs, cheese and condensed milk is very remarkable. There has been a corresponding decrease in the export of fresh milk and cream. The total value of the export of animal products was in 1924 1,589,000,000 kroner against 462,000,000 kroner during the five-year period of 1909–13. The gold value of the export for 1924 is 987,400,000 kroner or about twice the value of the pre-War export. The large decrease in animal production from 1914–9 also decreased the plant production, as farm manure plays a prominent part in Danish agriculture, and the decrease in manure is roughly proportionate to the decrease in the import of feeding-stuffs. Moreover, the import of nitrogen and phosphates was partly stopped during the years 1917–8.

TABLE IV. *The Harvest 1909–24 (in million crop units)*[1]

	Corn	Roots	Potatoes	Sugar beets	Hay	Total
1909–13	2·992	1·394	0·201	0·101	0·717	5·405
1914–18	2·476	1·395	0·222	0·112	0·546	4·751
1919–23	2·880	1·577	0·306	0·102	0·554	5·419
1924	3·188	1·862	0·167	0·119	0·538	5·874
do. incl. Slesvig	3·467	1·990	0·175	0·121	0·610	6·363

[1] 1 crop unit equals 1,000 kg. of corn, or its equivalent in feeding value or money in the case of other crops.

The above statistics do not include the yield of the grazing and green fodder area nor the yield of various crops grown for the purpose of commercial transactions. If these crops are also included the total production of 1924 will be about 8,000,000 crop units including Slesvig. The decrease during the War is specially noticeable with regard to the corn and hay crop but it is partly due to a decrease in the arable area of these crops, while the area of roots, potatoes and sugar beets was greatly increased during the same period, and this increase in roots continued after the War so that the area under these crops in 1925 was about 13·5% of the whole of the cultivated area against 10% in 1912. Feeding roots in 1924 were 31·3% of the total harvest as against 25·8% in 1909–13. This increase is of course closely connected with the great number of cattle.

Financial Returns.—After the long period of depression at the close of the 19th century, prices improved and the relatively few financial accounts which are available for the years 1910–3 show an average yield of interest on capital sunk in well-worked farms of about 4 to 5%.

During the first years of the War the prices of corn and seed as well as of live animals and meat rose very considerably, causing an increase in the yield of interest on capital sunk in large and middle-sized farms. During the following years the prices of dairy produce, bacon and eggs also rose considerably, which was of special importance for small farms. The increase in prices since the War is to a large extent due to the low rate of exchange which prevailed.

During 1917–8 and onwards regular inquiries have been made with regard to the economic position of large numbers of agricultural holdings of an average area of about 45 hectares each. The results of these inquiries are shown in Table V.

TABLE V. *Working Results of Agriculture in Certain Years*

Financial year	Gross returns kr. per ha.	Working expenses kr. per ha.	Net Profit		Net profit in gold kroner per ha.
			kr. per ha.	per cent of capital	
1911–4	435	360	75	ca. 4·0	75
1917–8	699	482	217	6·8	245
1918–9	857	551	306	8·3	326
1919–20	1,024	743	281	7·4	213
1920–1	1,185	949	236	5·8	139
1921–2	831	798	33	0·9	22
1922–3	837	692	145	4·5	111
1923–4	1,023	813	210	6·1	136
1924–5	1,139	885	254	6·7	162

The great increase in gross returns and in net profit was noticeable as early as 1917–8, but while the increase in the gross returns was continued until 1920–1 the net profit was at its highest in 1918–9, decreasing until the critical year 1921–2, and rising again until 1924–5. During the spring of 1925 a new period of deflation began which developed quickly during the summer when the value of the krone rose in the course of three months from about 70 to 93% of its pre-War value. The fall in prices, which was almost as great as that of the autumn of 1921, has totally altered the favourable economic position of agriculture, and if deflation continues agriculture will be faced with heavy difficulties. It is to be hoped that during the good years some reserve capital was accumulated, and, if a market can be found for the increasing amount of animal products, Danish agriculture with its smooth-working co-operative organisations and its good position on the European market may be expected to tide over the crisis.

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DENTISTRY (*see* 8.50).—The progress of dentistry in the years following 1910 was more rapid and more radical than in any previous period. The cause of this progress was the general advancement in knowledge due to the accumulation of data from scientific investigation and the application of the knowledge thus acquired to the prevention and treatment of disease.

Causes of Dental Disease.—Until comparatively recent times the extent to which abnormal mouth and teeth conditions are responsible for derangements of health was imperfectly understood. The pioneer studies of W. D. Miller, of Berlin, especially, as reported (1891) in a series of communications entitled *The Human Mouth as a Focus of Infection*, first called attention to the fact that the oral cavity is the habitat and breeding ground for a large group of micro-organisms, many of them pathogenic, which under conditions of lowered resistance invade other parts of the organism and become the direct exciters of bodily disease.

Miller also showed that the mouth is the common portal of entry for most of the disease-producing organisms that infect the human body, and further demonstrated that certain mouth bacteria, when injected into the circulation of a test animal, could pass through the blood stream or lymphatic system and establish metastatic foci of inflammatory action at points and in organs remote from the seat of inoculation (*see* THERAPEUTICS). These early findings were afterwards confirmed by other investigators, more particularly by Sir Kenneth Goadby, of London. Recognition of the significance and far-reaching importance of the principles underlying these results of scientific research was only gradually accorded by the general body of the dental profession, and then merely as interesting facts without direct utility in dental practice.

Septic Foci.—In several communications on septic dentistry, notably in an address delivered in 1910 at the opening exercises of the annual session of the Medical School of McGill University, Montreal, Sir William Hunter, physician and lecturer to the Charing Cross Hospital, London, criticised badly conceived and unskilfully executed dental restorative operations, especially in crown and bridge work and the treatment of pulpless teeth, which were performed without regard to surgical asepsis. In this connection Hunter brought clinical evidence to prove the soundness of his contention that operations so performed leave septic foci that cause septicaemic conditions, as well as infections in remote parts of the body.

Hunter's revelation impressed at once the dental and medical professions, and his criticisms immediately bore fruit. The general use of the X-ray as a means for study of the apical region of tooth roots, the development and application of specialised bacteriological technique for determining in pulpless teeth the identity and character of the exciters of disease action and similarly those responsible for inflammatory lesions of the retentive structures of the teeth (commonly designated *pyorrhea alveolaris*), all stimulated by the realisation of the profound clinical importance of mouth infections as related to bodily health, quickly followed the communications of Hunter.

Change of Interest and Development.—The total effect of this evidence, both clinical and scientific, upon the development of dentistry has been little short of revolutionary. From time immemorial it has been believed from empirical observation that an unclean and infected mouth cavity is a source of bodily ill health, and much direct evidence of a clinical character had accumulated to strengthen that belief, but the evidence now available has definitely established the facts.

Until this development of knowledge concerning the systematic relationships of disorders of the teeth and their related structures and their bearing upon the bodily health, the major feature of dental interest, upon which the attention of the profession was concentrated, was the development and perfection of manipulative procedure in restorative operations. The ingenuity expended and the excellence of the results attained became the outstanding characteristics of dental practice; and the restoration by prosthetic or operative means of the masticatory mechanism damaged by partial or total loss of teeth was its dominating ideal. There is now an enforced recognition in the professional, as well as in the lay mind, of the importance of the welfare of the tissues and organs of the mouth. In the dental profession the consequent changes of technical procedure and objectives have been fundamental. The ideal of mechanical perfection in the methods and appliances by which the dental surgeon restores the patient's power to masticate is now regarded as a remedial measure subservient to the larger ideal of normal mouth health.

Oral Hygiene in Schools.—One of the principal factors which extended and popularised this knowledge is the oral hygiene movement, an effort to demonstrate practically the fact that school children, relieved of the disabilities arising from infected mouths and diseased teeth which handicap normal development, will show improved physical and mental efficiency. The Cambridge experiment, inaugurated in 1907 by the late George Cunningham, of Cambridge, England, was perhaps the earliest practical test. The analogous work of Dr. Ernst Jessen, of Strasbourg, introduced oral hygiene into the public schools of a number of towns in Germany. In the United States the oral hygiene movement took practical form in the test of its utility in the Marion school of Cleveland, O., in 1910 and in 1919 there was completed, under conditions yielding accurate figures, a five years' test of applied mouth hygiene in the public schools of Bridgeport, under the direction of Dr. A. C. Fones.

In this test 20,000 children of the first five school grades were under observation and treatment. The average number of carious cavities was found to be over 7% per child; 30% claimed that they brushed their teeth occasionally; 60% frankly stated that they did not use a tooth-brush and 10% were found to have fistulas on the gums, showing outlets from abscesses from the roots of decayed teeth. Systematic application of oral hygiene, the intelligent and systematic use of the tooth-brush and the elimination of accretions, dental decay and suppurative conditions achieved striking improvement in general health and mental efficiency. The statistics of the Bridgeport Board of Health show that the most common fatal diseases among children in that locality were diphtheria, measles and scarlet fever. The decrease in deaths from these sources after the introduction of oral hygiene in the public schools is shown by the following table, the figures for 1914 showing conditions before the test:—

	1919	1914
Diphtheria	18·7%	36·6%
Measles	4·1	20·0
Scarlet Fever	0·5	14·1

Dental Disease and Mental Efficiency.—The improvement in mental efficiency is shown by the reduction in the percentage of retarded children, *i.e.*, children who are not less than two years older than the normal age for the school grade to which they should belong. The percentage of retarded children before and after the introduction of mouth hygiene in the Bridgeport schools is shown in the following table:—

Percentage of Retarded Children

Grade	Sept. 1912	Nov. 1918	Drop in retardation
I	16·5%	8·1%	51·0%
II	37·0	15·3	58·0
III	53·0	24·7	53·0
IV	59·5	31·7	47·0
V	61·0	33·1	45·0
VI	54·0	30·4	44·0
VII	39·0	19·3	50·0
VIII	27·0	12·5	54·0
Average . . .	40·0	20·1	50·0

Retardation represents inability of the child to advance with his class, necessitates repetition of his grade work, and becomes an economic question of serious importance to the ratepayer. The cost of re-education in Bridgeport in 1912 was 42% of the entire budget, and for 1918 only 17%. Among the 20,900 children under observation in the schools of Bridgeport, 98% had various forms and degrees of malocclusion of the dentures, a condition now generally recognised as associated with asymmetrical development of the bones of the face and the brain case. Many children with malocclusion owing to the arrested development of the facial and cranial bones suffer from impeded nasal respiration, and develop adenoids and tonsillar hypertrophy, leading to infection with its systematic sequelae and the interferences with bodily nutrition incident to insufficient oxidation of the blood. Orthodontic treatment for the correction of malocclusion in children is a therapeutic and prophylactic measure having an important health relation rather than a procedure for the relief of deformity.

Work in Armies and Navies.—From small beginnings the U.S. Army and Navy Dental Corps rose to an allotment by law of one dental surgeon for each 1,000 of the army personnel, and before the close of the World War provision was made to double that allotment. After 1918 full provision was made by the U.S. Govt. for the dental care of its enlisted men and of those demobilised from service suffering from dental defects of disabilities since demobilisation. The proportion of dental surgeons to army personnel in 1917, as given by officials of the British Dental Assn. (see "Man Power and the Army Dental Service," *British Dental Journal*, Feb. 15 1918) for some forces, was: Canadian Expeditionary Force, one per 1,000 men; New Zealand Expeditionary Force, one per 2,500 men; Australian Expeditionary Force, one per 2,600 men.

Satisfactory figures for the German Army dental service are not obtainable, but according to Dr. Ernst Jessen, head of the dental work in Strasbourg, quoted in *The German Dental Review*, there were 810 dental surgeons active in the field in 1915. France, during the World War, had at least 1,500 army dentists working in various parts of the lines as fixed units, in addition to the dental ambulances. During the latter part of the War, when the man-power of France was seriously depleted, over 250,000 effectives were mustered into the French service as the result of efforts instituted by Dr. Georges Villain, of Paris, by which that number of men who had been previously rejected because of loss of teeth, but were otherwise physically sound, were subsequently fitted with artificial dentures and sent to the fighting line. Great Britain created by Royal Warrant, issued Jan. 4 1921, a military dental service, the Army Dental Corps, which is administered by the Director-General, Army Medical Service (*see* MEDICAL SERVICE, ARMY), and is a joint service for the army and R.A.F.

Experience during the War clearly demonstrated to all the belligerent nations the importance of dental service as a means of mouth sanitation and the practical utility of the latter in maintaining the physical efficiency of the fighting personnel.

National Dental Service.—Undoubtedly the most notable example of comprehensive planning for the national extension of dentistry and oral hygiene as a factor of the public health service is that proposed in the interim report on the Future Provision of Medical and Allied Services, made to the British Ministry of Health by the Consultative Council on Medical and Allied Services, May 1920. This report recognises oral hygiene and dental service as factors of public health and as proper subjects for control and development by the state. Oral hygiene comprehends much more than the correction of dental defects and oral infection due to neglect of the tooth-brush; its aim is prophylactic as well as corrective. Corrective procedure merely arrests the progress of disease and mechanically restores damage already done. The entire energies and skill of the whole dental profession can cope with only a small fraction of the corrective work needed.

Personal Hygiene.—To establish the habit of personal care of the mouth in school children is a field of activity that has developed the specially trained dental nurse or hygienist as an adjuvant to dental service, whose calling is now legalised in the principal states of the United States. The work of the dental nurse is limited to the surface treatment of teeth, in the removal of deposits and accretions thereon, the training of school children in the systematic use of the tooth-brush and their education in the importance of mouth cleanliness. A child who has learned to use the tooth-brush exhibits increased self-respect, greater attention to bodily and mental cleanliness, closer compliance with school regulations and an awakened interest in attendance and studies. The present trend is toward making dental and oral hygiene service in all civilised countries a public health measure.

War Surgery.—The many head, face and jaw wounds during the World War created a new field for oral surgery and surgical prosthesis. Surgical measures alone were insufficient for the successful treatment of these cases, as the loss of tissue from gunshot wounds of the head and face, as well as the unsightly scars resulting from extensive lesions when surgically treated, left the patient in many instances with repulsive deformities. The resources of surgery and dentistry were called into co-operation. In this work the aid of dental prosthetic technique was often necessary. These experiences furnished convincing evidence of the need by each profession of a more intimate acquaintance with the work of the other, now recognised in the practice of adding a professional dental service to hospital staffs.

Relations with Bacteriology.—Bacteriological and histological investigation of dental and oral pathology by numerous investigators (*see* BACTERIOLOGY) has improved dental and oral surgical technique. Notable progress has been made in the study of dental and oral infections and of physical irritations of nerve terminals in and about the teeth, in their relation to mental disorders and reflex neuroses (*see* PSYCHIATRY) that cause disturbances of the special sense organs as well as spastic disorders of a local or general character. Attention has been directed to the endocrine relationships (*see* ENDOCRINOLOGY) of the teeth and oral tissues, especially as to the probable connection between the activities of the ductless gland system and the reactions of the salivary secretion, and to variations in the calcified structures of the teeth and their susceptibility or immunity to caries. Corresponding changes in the objectives, the character, the content and extent of dental education have taken place in harmony with these developments. Practical teaching approximates more closely to the fundamental ideals and methods of general medicine in so far as they represent the principles common to the whole science and art of healing.

Oral Prophylaxis.—Oral prophylaxis, in so far as it has been intrumental in securing cleanliness of the mouth and its contained dental organs, has undoubtedly prevented dental disease to a considerable degree, but has not been wholly effective. As research has thrown light upon the causes and mode of action of the phenomena of dental disease, attention has been increasingly focused upon means for its prevention. The factors of susceptibility and immunity are undergoing active investigation with strong indications that nutritional errors and faulty metabolism play a rôle of primary importance in the causation of dental disease. Correction of faulty food habits and a rational hygiene should contribute materially toward the prevention of those dental diseases, caries and periodontal necrosis, the most common and widely distributed of human disorders. Because of the recognition of the vital relations of the teeth, a rapid reorganisation of the dental educational system is proceeding toward a more efficient adaptation of the knowledge of health relations of the teeth to the ends of dental practice.

A systematic survey of the whole field of dental education has been made by the Carnegie Foundation for the Advancement of Teaching, with a view to recommending such adjustments as will bring systematic dental education fully up to the standard of present requirements from a public health standpoint.

General Developments.—While the most conspicuous progress in dentistry since 1910 has been in the direction of its vital and hygienic relations, its technical and engineering features have shown a similar development. Until this period the construction of artificial dentures for the prosthetic restoration of lost teeth was almost wholly an empirical procedure depending on the judgment, manual skill and good taste of the operator. Scientific studies of the engineering principles underlying the mechanism of the human masticatory function, initiated about 1890 by W. G. A. Bonwill, of Philadelphia, and since prosecuted by his numerous followers, have brought the knowledge of masticatory movements and of the relations of the teeth and their morsal surfaces thereto to a state of completeness that enables the prosthetist, by the aid of mechanical articulating devices, to reproduce in the artificial denture a mechanism with possibilities approximating, both functionally and artistically, those of natural dentures. In 1913, Charles H. Mayo, the distinguished surgeon of Rochester, Minn., expressed the opinion that the next great step in medical progress in the line of preventive medicine should come from the dental profession. A review of the progress since made would seem to indicate a reasonable prospect of the fulfilment of that prophecy. (E. C. K.)

DENVER, Colo., U.S.A. (*see* 8.54), had in 1920 a population of 256,491 (105·9 males to 100 females), including 6,075 negroes and 38,230 foreign born. In 1925 the estimate of the census bureau was 280,911. Denver had no great volume of war business, and consequently suffered only moderately from the post-War deflation; while the general increase in freight rates (1915–20) created advantages for all Western manufacturers and in some cases worked in favour of Denver. The aggregate value of manufactured products was $46,925,000 in 1909; $125,411,000 in 1919; $120,789,757 in 1923. Receipts at the stock yards increased from 1,360,000 head in 1914 to 3,238,900 in 1924, of which 2,039,600 were sheep. At the National Western Stock

Show founded in 1907 pedigree breeding stock is bought and sold in carload lots, "feeder" stock by the trainload. The volume of Denver's jobbing trade in 1924 was about $125,000,000; of its retail trade $120,000,000. It is estimated that tourists spent $12,500,000 in the city in 1924.

Denver is the administrative headquarters for many oil producers and refiners, for the Colorado coal corporations and many other mining companies, for all lines of insurance and for numerous branches of the Federal Government. Its growing importance as a financial centre is indicated by the increase in bank clearings; from $459,708,000 in 1914 to $1,611,164,000 in 1924. The advantages of the climate for the treatment of tuberculosis, and the large number of invalids who go to Denver, have combined to stimulate the building of many hospitals and sanatoria, which, together with the new medical school of the state university, make the city an important medical centre. The cost of living is relatively low (93·7% of the average for 31 American cities Dec. 1924). A unique attraction is the chain of 19 mountain parks, over 10 sq. m. in area, owned by the city and connected with it and with one another by 100 m. of boulevard. Illiteracy and child labour are low. School attendance is high. The death-rate is kept high by the influx of invalids from other parts of the country.

A serious street-car strike occurred in 1920, involving considerable violence, the loss of seven lives, the importation of armed strike breakers, and the intervention of Federal troops and military rule for a month. The commission form of government was adopted in 1912, but was abandoned in 1916 for the mayoralty form. The completion of the Moffat tunnel, authorised in 1922, will place Denver on a direct route to the West, shortening the distance to Salt Lake by 173 m., and will give access to untapped sources of raw materials.

DE PROROK, BYRON KUHN (1896–), American archaeologist, was born at Mexico City Oct. 6 1896. He was educated at Folkestone, England, and the University of Geneva. He devoted himself to archaeological study and exploration in Yucatan and northern Africa, later collaborating with Father Delattre, who for 40 years had been excavating the ruins of Carthage. In his investigations in northern Africa, particularly at the sites of Carthage, Djerba and the Hoggar, Utica, he made some remarkable discoveries, including the tomb of Queen Tin-Hinan, declared by the French Institute to be the most important tomb ever discovered in the Sahara. He received the support of archaeological societies and universities in the United States, his field work being done under the auspices of the French Service des Antiquités. In 1926 he received from the French Govt. permanent permission for carrying on archaeological research in North Africa. He published *Digging for Lost African Gods* (1926).

DERAIN, ANDRÉ (1880–), French painter, was born at Chatou (France), June 10 1880. For a considerable time he shared a studio with the landscape painter Vlaminck; he then made the acquaintance of Picasso, Georges Braque and the poet Guillaume Apollinaire. It was from this small group that Cubism developed. Yet Derain cannot be considered as a representative of the Cubist School; his best works adhere to the great traditions of the classic landscapes, and are formal in character and restrained in colour, while his figures exhibit a grandeur and serenity, which reveal an admirer of the great masters.

DERBY, EDWARD GEORGE VILLIERS STANLEY, 17TH EARL OF (1865–), British politician (*see* 8.69), was in Jan. 1915 created a Knight of the Garter. In Oct. 1915 he became director of recruiting for the army, and as such was responsible for a new scheme for a final effort on behalf of voluntary service known as the Derby scheme. In Feb. 1916 Lord Derby became chairman of the naval and military air service joint committee, but resigned in April, becoming under-secretary for war in July. On the formation of Mr. Lloyd George's Government in Dec. 1916 he became Secretary for War, and in April 1918 was appointed British Ambassador to France. He retired from the latter office in Nov. 1920. In Oct. 1922 he became Secretary for War in Mr. Bonar Law's Cabinet, retaining this position under Mr. Baldwin until Jan. 1924.

DERBYSHIRE NECK: *see* GOITRE.

DÉROULÈDE, PAUL (1846–1914), French author and politician (*see* 8.74), died at Mont-Boron, near Nice, Jan. 30 1914. In 1910 he published a collection of his patriotic speeches, and a volume, *La Ligue des Patriotes*, containing further extracts from them, appeared in 1916.

DESCHANEL, PAUL EUGÈNE LOUIS (1856–1922), French statesman (*see* 8.91). After presiding over the Commission of Foreign and Colonial Affairs (1905–9) and acting as reporter of the Foreign Office Estimates Committee, M. Deschanel filled many responsible positions. In Jan. 1920, he was elected President of the Republic, as being a "safer" candidate than M. Clemenceau, though the latter's popularity spoke strongly in his favour. In the autumn of the same year, however, failing health obliged him to resign office. He died in Paris April 28 1922, from the effects of a fall from a railway carriage.

DESIGN: *see* DECORATIVE ART.

DES MOINES, Ia., U.S.A. (*see* 8.98), increased in population 46·4% in the decade beginning 1910, reaching 126,468 in 1920, of whom 5,512 were negroes and 11,224 foreign-born. The state census of 1925 gave a population of 141,441. Des Moines has the highest percentage of home ownership among American cities (51·1% in 1920); its percentage of illiteracy is one of the lowest; its death-rate also is low. It was one of the first American cities to plan on a generous scale for beauty in its development. The Civic Centre, including a new city hall ($500,000), a new municipal court building ($600,000), and the Coliseum (seating 8,500) extends along the river front through the heart of the city. The State Fair attracts each year about 400,000 visitors; and the city entertains annually 150 conventions. In the six years after the close of the World War over $50,000,000 was spent in building operations, representing more than 12,000 projects. Manufactures showed an increase at each Federal census, even in 1921. The aggregate value was $23,585,000 in 1909; $59,831,000 in 1919; $72,287,732 in 1921; $102,919,098 in 1923. The average number of wage-earners in the factories increased from 5,383 in 1909 to 9,558 in 1923. The printing and publishing of newspapers and periodicals was the largest industry in 1919. The city ranked fifth (1925) in second-class mailings, and was the largest centre in the world for the publication of farm journals.

DE STEFANI, ALBERTO (1879–), Italian economist and statesman, was born at Verona Oct. 6 1879. After graduating in law at the University of Padua he devoted himself to the study of economics and became Professor of political economy at the Superior Commercial Institute of Venice. In 1921 he was returned to the Chamber as a Fascist and soon gained the confidence of Mussolini, who, on coming to power, appointed him Minister of Finance. Later he was also entrusted with the Treasury department and welded the two into a single ministry. He at once began to reform the financial system. He abolished useless expenditure and simplified the fiscal system, reducing innumerable taxes to three main sources of revenue, with the result that, in three years a deficit of 6,500,000,000 lire was converted into a surplus of 209,000,000. His measures for restraining speculation in the currency and stock markets during the financial slump in the spring of 1925 were less successful, and he was superseded by Count Volpi. It is generally recognised, however, that he rendered invaluable service by rescuing his country's finances from the chaotic state into which they had fallen.

DÉTAILLE, JEAN BAPTISTE ÉDOUARD (1848–1912), French painter (*see* 8.110), died in Paris Dec. 23 1912.

DETROIT (*see* 8.113).—Commencing with the recovery from the industrial depression of 1907–8, the city of Detroit entered upon a period of growth almost without precedent among large cities. The area of the city in 1926 is 139 sq. miles. The census of 1920 gave a total population of 1,088,853 within the city limits. In May 1925 Detroit proper had a population of 1,200,310. The addition of the enclosed cities of Hamtramck and Highland Park, with villages just outside the city limits, give for greater Detroit an estimated population of about 1,400,000.

In 1920 about 70% of the population was either of foreign birth or foreign parentage. Poles, Germans and Russians represented the largest numbers, though there were large accessions from southeastern Europe. In Dec. 1920, 55% of the pupils in the public schools were of American-born parentage, 50·5% being white, and 4·5% coloured. In the three years ending 1920, much work was done by the Board of Commerce, the Board of Education and leading manufacturers in teaching the English language and the elements of citizenship.

Manufactures.—The extraordinary growth of the city was mainly due to the expansion of its manufacturing industries. In 1914 it was surpassed only by New York, Chicago and Philadelphia, with a capital of $405,000,000; 141,188 employees; and products valued at $569,000,000. In 1919 the number of employees within the city limits had increased to 307,000 and the value of the product was $1,803,728,000. In 1923 the value of the product within the city limits was officially reported at $2,071,477,380. In 1924 the product in the metropolitan district, including Detroit and adjoining villages, was estimated at $2,500,000,000.

The most important of the manufacturing industries in this district is the making of motor-cars (*see* HENRY FORD). In 1926 there were 26 companies assembling cars and about 150 whose sole, or principal, business was the making of parts and accessories. They employed 200,000 persons, and in 1924 turned out 2,500,000 vehicles. Trucks and motor-buses constitute the most rapidly growing branches of this industry. During the period 1910–25 numerous changes took place in other industries. Freight-car building, for many years the largest of all, disappeared almost entirely. The carriage and furniture factories were for the most part changed to the making of automobile accessories, and clothing manufacture diminished. Meantime some of the metal industries, notably brass and aluminium, increased enormously. The city is in the front rank in the following lines: aluminium castings, adding machines, brass and bronze products, druggists' preparations, gas-engines, machine tools, soda ash and kindred alkalis, stoves, furnaces and varnishes.

Transport.—The industrial expansion necessitated a great enlargement of the transport system. The Michigan Central Railway Co. tunnelled Detroit river and built an immense new passenger station and office building. The same company made great additions to their freight yards, stations and sidings, as did also the Grand Trunk and the Père Marquette lines. The outer belt line was extended and the Pennsylvania lines were extended from Toledo to Detroit, with a belt line of their own round a portion of the city and ample freight and passenger facilities. The Detroit, Toledo and Ironton line, which was suffering from lack of capital and equipment, was purchased by Henry Ford, who greatly improved its service. The line has, since 1920, been practically rebuilt and in part electrified. There has also been a great development in motor-truck freight service which extends from 50 to 100 m. in all directions from the city. At the April election in 1920 a plan was approved for the municipal construction and operation of street railway lines. The city has since acquired the Detroit United Railway for $40,000,000 within the city limits, has added many more lines, and operates the whole system. The trolley service is supplemented by an extensive motor-bus system, both municipally and privately operated. A private air freight line is in operation between Detroit and Chicago.

Administration.—Under a charter adopted by popular vote, June 25 1918, the methods of municipal government were materially changed. In place of a board of education of one member from each ward, there was a board of seven members, elected two or three at a time on a general ticket and holding office for six years. The old board of estimates, consisting of two members from each ward and five at large, was abolished, leaving appropriations and bond issues to be determined by the mayor and common council. The mayor's final judgment was conclusive upon all appropriation items, unless reversed by a vote of seven out of the nine aldermen. The old common council of two aldermen from each ward was displaced by a council of nine members, all elected at one time on a general ticket. The mayor, city clerk and city treasurer were elected, but all other administrative officers and commissions were appointed by the mayor, without reference to the council, and were subject to dismissal by him without trial. Nominations, two for each office to be filled, were made at non-partisan primaries. Blanks for voting were also non-partisan, and the time of election was separated from that of the state and national contests. By special legislative enactment the police and recorders' courts were combined in one with seven judges, holding office for four years, and having jurisdiction of all criminal and ordinance cases. The judges were all chosen at one time on a non-partisan ticket. In 1925 legislation was secured to provide for the creation of a metropolitan district for administrative purposes to include Detroit and the adjacent villages; also for the creation of a port development area including Detroit and other towns bordering on the Detroit and Rouge rivers. (W. St.)

DE VALERA, EAMON (1882–), Irish politician, was born in New York City Oct. 14 1882. He was sent to his mother's home at Charleville, Co. Cork, as a child, and was educated at Blackrock College and the Royal University, Dublin. In 1913 he became an ardent supporter of the newly formed Irish volunteers and in the Easter rising of 1916 commanded a party of the insurgents. On April 30 he surrendered and was sentenced to death, but the sentence was commuted to penal servitude for life. On June 15 1917, however, he was released under the terms of the general amnesty.

In the same month he was elected to Parliament for East Clare, but in May 1918 he was rearrested in connection with another plot for a rising. Imprisoned in Lincoln, he escaped on Feb. 3 1919 and went to the United States. In 1920 he was elected for Co. Down in the Northern Parliament and in 1921 was nominated chancellor of the National University. In 1917 he was chosen president of the Irish Republic, but resigned in Jan. 1922 and led the Republican forces. In Aug. 1923 he was captured and once more imprisoned; being released in July 1924, he became in the same year president of Sinn Fein, but resigned in March 1926, after encountering strong opposition to his proposal that members of the Republican party might enter the Dail and the Northern Parliament if exempted from taking the oath.

DEVENTER, SIR JACOB LOUIS VAN (1874–1922), South African soldier, was born in the Orange Free State. Beginning life as a farmer, he achieved distinction in the South African War of 1899–1902, becoming second-in-command to Gen. Smuts during the latter's invasion of Cape Colony. A colonel on the permanent staff of the South African Defence Force, Van Deventer served in the campaign in German South West Africa, 1914–5, where he had a distinguished record in active service. His real gifts as a general, however, were not fully appreciated until he went to German East Africa, to fight in Gen. Smuts' campaign against the Germans. In 1917 he was appointed commander-in-chief of the forces in East Africa. He was then a major-general, and was given the temporary rank of lieutenant-general on becoming commander-in-chief. Shortly afterwards, he was created K.C.B. As commander-in-chief he showed the same qualities which had secured for him this high promotion and it was under his auspices that the campaign was brought to a successful end. He died Aug. 27 1922.

DE VILLIERS, JOHN HENRY, BARON (1842–1914), first Chief Justice of the Union of South Africa, was born at Paarl, Cape Colony, in June 1842. Descended from the Huguenots who settled in that part of the Cape, he was educated at the South African College, Cape Town, and went to Utrecht and Berlin universities. In 1865 he was called to the bar by the Inner Temple and in the same year returned to South Africa and began practice as an advocate of the Supreme Court of Cape Colony. Entering Cape politics in 1866, he was elected a member of the House of Assembly, became attorney-general of the Colony in 1872 and two years later was appointed Chief Justice of the Cape. In this capacity he succeeded, by his decisions, in adapting the Roman-Dutch law of the colony to modern requirements. De Villiers was knighted in 1880 and was created a

K.C.M.G. a year later. He was appointed President of the National Convention in 1908 and in 1910 was raised to the peerage on becoming Chief Justice of the Union of South Africa. He died Sept. 2 1914.

DEWAR, SIR JAMES (1842–1923), British scientist (*see* 8.137), died March 27 1923. He published (with G. D. Liveing) *Collected Papers on Spectroscopy* (1915). In 1916 he received the Copley Medal of the Royal Society; and in 1919 the Franklin Medal of the Franklin Institute of Philadelphia.

DE WET, CHRISTIAN (1854–1922), Boer general and politician (*see* 8.138), remained until 1914 a member of the Legislative Assembly and Minister of Agriculture in the Orange Free State. In 1912–3 he supported Gen. Hertzog in his separatist policy, seceded from the South African party and helped to form the Nationalist party. Soon after the outbreak of the World War, De Wet rebelled against the South African Govt., but after raiding a few towns in the Northern Free State was captured at Waterberg on Dec. 1 1914. On June 10 1915 his trial began on a charge of high treason and on June 21 he was found guilty on eight of the 10 counts. He was sentenced to six years imprisonment and fined £2,000, but in the following Dec. was released, on undertaking to abstain from political agitation. He died at Bloemfontein Feb. 3 1922.

DEWEY, GEORGE (1837–1917), American naval officer (*see* 8.139), died in Washington Jan. 16 1917, and three days later was buried in the Arlington National Cemetery. His body was transferred, on Mar. 28 1925, to the crypt of the Bethlehem Chapel of the National Episcopal Cathedral, Washington, D.C. By special provision Adm. Dewey was never retired, but continued in active service up to his death, being president of the General Board of the Navy for the last seven years of his life. To the end he continued to urge the building of large battleships, citing their superiority in the battle of Jutland. He published his *Autobiography* in 1913.

DEWEY, JOHN (1859–   ), American philosopher, was born at Burlington, Vt., Oct. 20 1859. He graduated from the University of Vermont, taking the degree of A.B., in 1879, and Johns Hopkins University, where he became Ph.D., in 1884. After teaching for four years at the University of Michigan he was appointed in 1888 professor of philosophy at the University of Minnesota, returning in a similar capacity the following year to the University of Michigan, where he was made head of the Department. In 1894 he was appointed head of the Department of Philosophy at the University of Chicago, and was, in addition, head of the school of education for two years (1902–4). In 1904 he became professor of philosophy at Columbia University. In the field of philosophy he is a pragmatist and as such has had a very great influence on the trend of modern thought. He was antagonistic to formalism of any kind. When at Chicago he developed a theory of education, embodied in his *School and Society* (1899), the aim of which is the utilisation, instead of suppression, of the impulses of childhood, and the substitution of practical experience in place of theoretical knowledge. In 1919 he visited Japan, where he lectured at the Imperial University of Tokio and other places, subsequently proceeding to China, where he made a prolonged stay and devoted his attention chiefly to educational problems.

Among his important works may be mentioned *Psychology* (1886); *A Critical Theory of Ethics* (1894); *How to Think* (1909); *German Philosophy and Politics* (1915); *Experimental Logic* (1916); *Democracy and Education* (1916); *Reconstruction in Philosophy* (1920); *Human Nature and Conduct* (1922); *Experience and Nature* (1925).

DIABETES (*see* 8.145).—The rapid accumulation of new facts which has increased our knowledge of diabetes mellitus makes it difficult to give a comprehensive definition of this disease. Diabetes is a condition in which the body is unable to metabolise sugars efficiently. It is believed that this condition is produced when there is insufficient available insulin in the body.

The first suggestion that the pancreas is necessary for the complete utilisation of carbohydrates in the animal body was made by Brunner in 1682. The relationship of the pancreas to diabetes was first suggested in 1788 by Cowley, an English physician. In 1889 Von Mering and Minkowski showed that the complete removal of the pancreas from animals resulted in a condition which is practically identical with diabetes mellitus in man. Although attempts were made to secure an anti-diabetic substance from the pancreas by scores of investigators, this substance was not proven to be present until 1921 (*see* INSULIN).

Diabetes mellitus is a very common disease. It has been stated that it occurs in 1% of the population of the United States. The cause of the disease is not definitely known. There are probably numerous factors which predispose to its development. It is not hereditary in the strict sense of the word. It is quite possible that certain children are born with insufficient insulin-producing tissue. Infection in the region of the pancreas seems to play a definite part in the aetiology of the condition. In elderly patients vascular sclerosis may be a factor. Obese individuals are more liable to develop diabetes than those whose weight is within the proper limits. In a few cases it appears probable that an injury in the region of the pancreas was the predisposing factor.

Symptoms.—The untreated diabetic patient suffers from extreme thirst, hunger, loss of weight and strength. He excretes abnormally large quantities of urine. He is very susceptible to infection and this condition, when established, is difficult to eliminate. The diabetic is unable to burn sugar. This sugar accumulates in the blood and is excreted in the urine. Not only are the sugars imperfectly metabolised, the fats are also not utilised in a normal manner and certain products of their abnormal or incomplete decomposition accumulate in the blood and produce the conditions of acidosis and coma.

The diabetic condition is suspected when a patient complains of one or more of the symptoms or signs mentioned above. An analysis of the urine for sugar should always be made. Diabetes may be present and sugar may be found in the urine when the patient is not aware of any of these symptoms. The routine analysis of the urine in life insurance examinations has resulted in the early diagnosis of many cases of diabetes. The prognosis of the early case is, of course, much better than the advanced case since treatment can be instituted earlier in the disease. The amount of sugar in the blood, under certain standard conditions, is a valuable indication of the severity of the disease. The presence in the urine of the acetone bodies formed from the abnormal breakdown of fats is a warning that acidosis or coma is imminent. The presence of these substances in the body can sometimes be suspected by the characteristic odour which they impart to the breath.

Treatment.—Patients suffering from diabetes mellitus are treated by dietetic measures, and if the condition is severe, by the administration of insulin. Before the discovery of insulin the methods of treatment introduced by Allen and Joslin of drastic restrictions in diet prolonged the lives of many severe diabetics. In many cases the necessary restriction in diet was so severe that marked under-nutrition was produced. Under-nutrition renders the patient more susceptible to other diseases.

Several important principles underlie the dietetic treatment of this disease. The diet must supply sufficient calories to the patient in order that his weight may be kept constant at the proper level. Protein, preferably as lean meat, eggs or milk, must not be reduced below a certain minimum value. If this substance is unduly reduced, the tissue protein of the patient's body is utilised. The carbohydrates and fats of the diet must be in a certain fixed proportion to each other. If the fats are present in excess of this proportion, there is danger of the production of the poisonous acetone bodies. In calculating the sugar in a diet, it is necessary to remember that sugar is formed from protein and to a lesser extent from fat, as well as from the carbohydrate of the diet. The diabetic patient is given as much sugar-forming food as he can utilise. Sugar in excess of what is utilised is excreted in the urine. The amount of excess sugar can therefore be determined by analysis.

Dietetic Measures.—The diabetic diet should consist as far as possible of easily available seasonable foods along the line of a normal diet. It is much more satisfactory for the patient to obtain the essentials of his diet from among these natural foods than to be dependent upon specially prepared diabetic foods. Patients have been known to discontinue treatment because of the monotony of their diet. The diabetic diet need not be monotonous.

Mild cases of diabetes can be successfully treated by dietetic measures. If a patient excretes sugar on a diet which is sufficient only for his needs insulin must be supplied. The amount necessary is proportional to the severity of the disease. Insulin, which is distributed as a sterile, watery solution, is administered hypodermically. It is not effective when given by mouth. Insulin is usually administered twice a day, 15 to 30 minutes before breakfast and again before the evening meal. However, there is considerable variation in the different clinics on this point. Some patients require only one dose per day, while in very severe cases three doses are necessary.

If the diabetic patient is using a diet which is too high in fats or too low in sugar, coma may develop. A large percentage of diabetics died of coma before insulin was discovered. The treatment of coma was to put the patient to bed, to supply fluids and alkalis, heat and stimulants and to give sugar by mouth or into a vein. These measures are still necessary. Insulin has proved a specific drug in the treatment of this condition and, when administered sufficiently early, and in large doses, the results have been very successful.

Insulin is a very powerful drug. A very serious condition may be produced by the administration of an overdose. This may be avoided on the physician's part by a very careful balancing of diet against dosage of insulin employed, and on the patient's part by a close and intelligent observance of the diet, together with a thorough understanding of the premonitory symptoms of a beginning hypoglycaemic reaction. These symptoms of slight hypoglycaemia are sudden hunger, fatigue, a peculiar restlessness often described by the patient as a feeling of "inward trembling," pallor or flushing of the face, and an increased pulse rate which is a valuable sign in children. If the overdose of insulin is large and corrective measures are not taken, the patient may show profuse perspiration, tremor, emotional disturbances, collapse and unconsciousness. The treatment of mild degrees of hypoglycaemia consists of the administration of carbohydrate in any convenient form, such as sugar candy. Should the more serious symptoms develop, orange juice with sugar added, or corn syrup, may be given by mouth. In the very severe cases, sterile dextrose is given intravenously.

In the past, less than 20% of patients suffering from severe diabetes lived more than 10 years. Children, who usually have the disease in a severe form, seldom lived for more than 6 years. The diabetes which develops in individuals over 50 years of age is usually mild and the patients may live their allotted span of years. It is not possible to state definitely as yet the exact effect of insulin on diabetic mortality. It is certain, however, that thousands are now alive who would have died had it not been for insulin. In some cases it appears that patients need less insulin than they required when treatment with the material was commenced. In the great majority of cases, however, the insulin requirement has not been markedly reduced. The severe diabetic receiving insulin is now able to live practically a normal life, but the insulin treatment cannot be discontinued.

(C. H. B.)

DIAGHILEV, SERGEI PAVLOVICH (1872–), Russian ballet producer, was born in the province of Novgorod, Russia, March 19 1872. After studying law and music, he organised art exhibitions in St. Petersburg (Leningrad). In 1899 he founded the review *Mir Tskusstra* (The World of Art), to which Somov and Bakst contributed, and which exercised a powerful influence on Russian art. From 1907 onwards he occupied himself with musical and theatrical productions and organised a number of Russian concerts in Paris; there he produced in 1908 and 1909 Russian operas (*Boris Godunov* and *The Maid of Pskof*) and ballets. Subsequently he organised successful ballet and opera seasons in London, Paris, Berlin, America and elsewhere, many of his productions being of amazing beauty. One of his most successful operatic productions was that of Moussorgsky's *Khovanshtchina.* In England the originality of his conceptions may be said to have effected a revolution in choreographic art, and further put new life into stage dancing, which by the end of the 19th century had degenerated into a spectacular show of little artistic significance. Among his numerous successful ballets may be mentioned *La boutique fantasque* (1919), a charming fantasy composed of oddments from Rossini's note books; choreographic versions of Stravinsky's *Le chant du Rossignol* (1920), and *Petroushka*; *Le Pavillon d'Armide* (with decoration by Alexandre Benoit); and *Scheherazade* by Rimsky-Korsakov (1910). In 1904 M. Diaghilev produced a valuable book on the painter Levitsky. A collection of photographs and drawings illustrating the ballet, *Les Biches*, was published in 1924 by B. Koshno.

DIAGNOSIS (Greek διάγνωσις, a means of distinguishing), or the process of identifying the disease by consideration of the history (*anamnesis*), symptoms, physical signs and examination in every way of the patient, includes differential diagnosis or its distinction from other diseases.

Importance in Treatment.—Diagnosis is essential for rational treatment, for without a knowledge of its cause treatment of a morbid symptom is merely empirical or, as it is often called, symptomatic, and, if beneficial, is so for the time being only and is not curative. The ideal of diagnosis is the discovery, as early as possible, of the disturbing factor at work, so that it may be removed or neutralised before structural damage results. In most diseases symptoms precede the signs or evidence of organic change in the body; but correlation of the earlier symptoms with the later physical signs indicating the presence of structural change has made it possible to predict the nature, course and proper treatment of the disease.

This knowledge is more advanced in acute than in chronic diseases, in which the processes are less obvious and may be more complicated. It is therefore important to study the earliest manifestations of disordered function and by keeping the patient under observation to collect data for the recognition of the beginnings of chronic disease. This was one of the objects of the St. Andrews Clinic inspired and opened by the late Sir James Mackenzie in 1919. Diagnosis is a logical process based on all the available data and is the outcome of their analysis in the light of knowledge gained by experience; diagnosis therefore leads to prognosis.

Methods and Symptoms.—Diagnostic methods include investigation of the patient's past history and of his environmental conditions, of the symptoms of which he complains, and methodical examination of the patient and of his organs and of the manner in which they are performing their functions. This examination is physical and physiological; an example of the physical signs is a tumour which can be felt; the physiological method is seen in the estimation of the functional efficiency of the heart or nervous system by means of exercises or special tests. Physical examination detects gross organic changes; functional tests reveal the disordered action of the organs, which is present in the earlier stage of symptoms without physical signs, namely before structural damage has been produced.

But it must be admitted that the sequence of symptoms first and bodily changes with physical signs later is not invariable; for a slow change in the organs or tissues of the body may be accompanied by compensatory processes so complete as to prevent any functional impairment; thus an innocent tumour may grow to considerable size before it produces any symptoms, which may then be mechanical. A patient's past history is important not only as regards bodily illnesses, but with reference to mental experiences which having become subconscious memories may be responsible for neurosis; Freud and his followers, by means of the method of psycho-analysis (*see* PSYCHO-ANALYSIS) have brought the trauma buried in the subconscious into the field of consciousness when other psychotherapeutic means can be employed.

Use of Physical Signs.—Physical signs, in contradistinction to subjective symptoms of which the patient complains, are observed by the medical man. First, inspection in a good light may give a shrewd idea of what is the matter—for example severe anaemia, the pigmentation of Addison's disease, the cachexia of advanced malignant disease, the bony changes in acromegaly, the swollen features of myxoedema and cretinism and the shrivelled, sharp-featured countenance of acute peritonitis (*facies Hippocratica*). Facial diagnosis without further examination is not without its fallacies, but an experienced practitioner may possess "clinical instinct" which, without a conscious logical process, at once tells him what is the matter, and is probably due to recognition by the subconscious mind of a similar condition seen years before but forgotten.

The use of vision in diagnosis has been greatly extended in recent years. The ophthalmoscope, invented by Charles Babbage (1792–1871) and modified by Helmholtz, enables the retina at the back of the eye, which is an expansion of the brain, to be seen in all its details; similarly the laryngoscope, and more recently the bronchoscope, oesophagoscope, sigmoidoscope, endoscope for lighting up and bringing before the observer's eye the interior of the bronchial tubes, the gullet, the lower part of the bowel, and of the urinary bladder, have greatly facilitated the detection of disease in these situations. Endoscopes have also been introduced into the chest (thoracoscopy) and into the abdomen (laparoscopy or coelioscopy).

Skiagraphy.—Skiagraphy or examination of the body by X-rays, discovered by Prof. W. K. Röntgen of Würzburg in Nov. 1895 (*see* ANATOMY; RÖNTGEN RAYS), has revolutionised diagnosis by rendering the greater part of the body translucent while the bony skeleton and certain abnormal formations remain opaque; X-rays provide a photograph or skiagram of great use in diagnosis; thus fractures can be shown, and similarly tumours, foreign bodies, certain morbid conditions, such as abscesses and collections of fluid, stones in the kidney and bismuth when introduced into the alimentary canal appear dark, while the surrounding parts are light. In this way malignant disease, aneurysms, tuberculosis and other diseases of the lungs and the condition of the alimentary canal can be recognised. Further by introducing air into the abdomen the picture produced is rendered much clearer; recently the ingestion of dyes (tetraiodophenolphthalein or tetrabromphenolphthalein) which are excreted by the liver into the bile have been found to show up the gall bladder (cholecystography).

Use of Instruments of Precision.—The well-established and obvious method of palpation or examination of the body by the hand has been greatly supplemented by the introduction of instruments of precision which record the movements of the heart, arteries and muscles; graphic records of the pulse by the polygraph, of blood pressure by the sphygmomanometer and of the heart by the electrocardiograph have added accuracy to the unaided but trained senses. The various forms of cardiac irregularity have thus become clearly unravelled, and fresh information about the condition of the heart muscle and its beats, such as the *pulsus alternans* and auricular fibrillation, has been secured. The electrocardiograph requires special technical skill (*see* HEART, DISEASES OF THE); but when once the existence of the underlying condition has been definitely established in diseases also accompanied by more obvious manifestations, the presence of the latter has now become sufficient to justify a diagnosis of the primary cause, and so to indicate its prognosis and appropriate treatment. This simplification of diagnosis by associated phenomena will, it is to be hoped, follow in many diseases in which the full explanation can originally be provided only by laboratory methods too elaborate or time-consuming for ordinary bedside practice. Percussion of the chest, initiated by Leopold Auenbrugger in 1761, did not receive due attention until his book was translated into French by J. N. Corvisart in 1808, when in conjunction with Laennec's method of auscultation (1819) it brought about a new epoch in the diagnosis of diseases of the lungs and heart.

Laboratory Tests.—These methods of physical diagnosis are clinical and have been increasingly supplemented by tests adopted from those carried out in laboratories. The distinction between the clinical and laboratory methods of diagnosis is one of degree, for some, such as the counting of blood corpuscles and the detection of various animal parasites, do not require the help of a specialised laboratory; hence clinical laboratories have now become an essential part of the equipment of a modern hospital or clinic. But other valuable tests are not possible in less favourable circumstances. The chemical examination of the blood for its content of sugar and non-protein nitrogen has an invaluable bearing on diabetes and renal disease; the examination of the blood for antibodies has enabled the diagnosis of infectious diseases to be made when ordinary clinical methods fail, for example the Wassermann reaction in the detection of syphilis, and the Widal (also a complement-fixation) test in the diagnosis of enteric fever. Bacteriological examination of discharges and excretions, such as swabs from the throat in diphtheria, of the expectoration in pulmonary consumption, of the urine and of the blood, of the cerebrospinal fluid and of the faecal excreta, has enormously advanced the exact diagnosis of infectious diseases. Thus to take an example, diseases which formerly were sometimes with difficulty distinguished by clinical examination (enteric fever, generalised tuberculosis, malaria and malignant endocarditis) can now be identified readily by examination of the blood. Chemical investigation of, and examination of the cells in, the blood, the fluids already mentioned and especially of the gastric juice by the method of fractional test meals have also rendered eminent service in the diagnosis of many diseases of the blood, nervous system, stomach and other organs.

Immunity Tests.—Immunology (*see* IMMUNITY) or the science of the reactions given by persons who are immune or susceptible to certain infections or poisons has made it possible to say whether a person is liable to contract certain infections; thus by the Widal complement-fixation test to determine whether or not an individual is protected against enteric fever, by the Schick test against diphtheria and by the Dick test against scarlet fever. In the two latter the diphtheria toxin or the scarlatinal haemolytic streptococcus toxin is injected between the layers of the skin; a local reaction shows that the individual is susceptible to the disease, against which he can then be protected by injections into his muscles of the corresponding toxin. This may be regarded as protective diagnosis, and no doubt will become more general in its application.

Individual Idiosyncrasies.—The exact cause of idiosyncrasies to certain foods, for example eggs, or to animal or vegetable substances, such as hair, feathers and pollen, can be determined by rubbing on the abraded skin extracts of substances likely to be the exciting cause of one of the "toxic idiopathies," such as asthma or nettlerash. If an individual suspected to be hypersensitive to, say, the dandruff of horses, is thus tested with such an extract, the appearance at the point inoculated of a red area or wheal, much larger and more prominent than that produced on a control area of skin similarly treated, except that saline solution is applied, strongly suggests that the disorder, such as asthma, is due to hypersensitiveness to this particular foreign protein.

General Disease.—General ill-health (dis-ease, want of ease), often of a vague character as shown by undue fatigue, but sometimes severe and prominent, such as pernicious anaemia or malignant endocarditis, and also local affections, such as arthritis, are commonly due to some primary condition often in a distant part of the body, such as disease of the tonsils, in connection with the teeth, the gall bladder or the vermiform appendix; the symptoms are frequently, especially in the examples first mentioned, due to some local infection providing micro-organisms or their poisons only, which when carried to other parts of the body, *e.g.*, the central nervous system, the blood-forming organs, the heart or the joints, set up changes and attract attention, while the *fons et origo* remains latent. In such cases, and they are numerous, of secondary disease, search for the primary infective focus is the scientific method of diagnosis, and may require expert advice from the laryngologist, dentist, the radiologist or other specialists. In other instances the primary cause sets up, through the nervous system, symptoms often in a comparatively remote part, which are described as due to disordered reflex action; just as a decayed tooth may cause headache, a blow on the ulnar nerve at the elbow (the "funny bone") tingling and pain in the little finger, so may a stone in the kidney show itself by pain in the testicle on the same side, or a chronically inflamed appendix or gall bladder be responsible for dyspepsia.

Conclusions.—The foregoing examples show that with the advance and necessary specialisation of medicine diagnosis may make demands which no one man can efficiently meet, and that in certain cases a satisfactory solution can be obtained only after examination and report by specialists. He is a wise man who knows enough to recognise his limitations and to call for such assistance, whereas the converse course leads to the empirical treatment of symptoms, the continued discomfort and dependence, if nothing worse, of the patient and eventually perhaps to the doctor's discredit. Recognising this, hospitals have long carried out the combined diagnostic method, and more recently, especially in America, groups of doctors, each proficient in some branch of the healing art, have amalgamated to form "diagnostic clinics" and to practise "group medicine." (H. Ro.)

DIAZ, ARMANDO (1861–), Italian general, was born in Naples Dec. 6 1861. He served in the Italo-Turkish War, and in 1914 was promoted to major-general. On Italy's entry into the World War he was chief of the operations department, and in 1916 became lieutenant-general in command of the 49th Division. In Nov. 1917, after Caporetto, Diaz became chief of the general staff, and under him the battle front was successfully reconstituted and the Austrian armies were destroyed by the battle of Vittorio Veneto (Oct.—Nov. 1918). In Nov. 1919 he was nominated army general, and later became vice-president of the army council. In 1921 he was created Duca della Vittorio. On the advent of the Fascist Govt. he was appointed Minister of War, and held that appointment until ill-health obliged him to resign in April 1924. On Nov. 4 1924 the newly created rank of marshal was conferred on him.

DIAZ, PORFIRIO (1830–1915), president of Mexico (*see* 8.172), died in Paris July 2 1915.

DIBELIUS, WILHELM (1876–), German scholar, was born in Berlin April 23 1876. He took up his residence as lecturer in Berlin in 1901, and in 1903 became professor at the Academy of Posen. He became professor of English at Hamburg in 1911, and in 1918 went to Bonn in the same capacity. In 1924 he was appointed professor of English language and literature at the University of Berlin. He published *John Capgrave und die englische Schriftsprache* (1901); *Charles Dickens* (1916); *England* (2 vol., 3rd ed., 1924).

DICEY, EDWARD (1832–1911), British jurist (*see* 8.178), died in London July 7 1911. His brother, Albert Venn Dicey, died April 7 1922.

DICTOGRAPH: *see* OFFICE APPLIANCES.

DIERX, LÉON (1838–1912), French poet (*see* 8.210), died in Paris June 11 1912. His *Poésies Posthumes* appeared in 1913.

DIESEL, RUDOLF (1858–1913), German engineer, was born in Paris March 18 1858. His principal achievement was the invention of the Diesel oil engine (*see* Internal Combustion Engine; Marine Engineering), though he did not live to see its possibilities fully exploited. He fell overboard the Antwerp-Harwich mail steamer on the night of Sept. 30 1913.

DILKE SIR CHARLES WENTWORTH (1843–1911), British politician (*see* 8.271), died in London Jan. 26 1911. He was succeeded as 3rd baronet by his son, Charles Wentworth Dilke (1874–1918), who died in London Dec. 7 1918, when the title passed to a cousin, Fisher Wentworth Dilke (b. 1877).

DILLON, JOHN (1851–), Irish politician (*see* 8.273), was prominent in 1902 in Parliament in his attacks on the Government for the revival of the Crimes Act, and in the following year he helped forward Mr. Wyndham's Land Purchase Act. With the return of a Liberal government to power, Mr. Dillon, with Mr. Devlin of Belfast, was associated with John Redmond in the leadership of the Nationalist Party. In this capacity, like other Irish members, he presented to Parliament the grievances of evicted tenants and of the small farmers whose desire for land led them to indulge in "cattle driving" on the larger holdings devoted to grazing. For the preparation of the Home Rule Bill of 1912, he was almost as responsible as were ministers themselves. Nor were his interests confined to Ireland. He spoke frequently in the House on foreign questions; and while his attitude was critical of what he considered to be the imperialism of Sir Edward Grey's foreign policy, he was heard with respect and attention. In July 1914, he was invited by King George V. to accompany Mr. Redmond to the Conference at Buckingham Palace which attempted to settle the Irish Controversy. When war broke out, he immediately placed his whole influence behind the British Govt., speaking in this sense at the meeting in the Dublin Mansion House on Sept. 25 1914. He took an active part, moreover, in recruiting and, with Mr. Redmond, consulted with the War Office as to the best way of adapting this campaign for volunteers to Irish susceptibilities. The progress of Sinn Fein in Ireland steadily undermined the Nationalist position and John Dillon suffered with the rest. He was convinced that the enforcement of conscription in Ireland would merely aggravate the disaffection. He was completely sceptical of the press campaign in favour of a munitions department and believed that the revolt against Mr. Asquith, as the Prime Minister responsible for conducting the War, was unfair and factious. He succeeded Redmond as leader of the Nationalist Party which by that time was *in extremis*. In his desire to maintain the constitutional party against Sinn Fein, he denounced the measures of repression which followed the Eastern Rebellion of 1915, and brought forward a resolution suggesting that this coercion, as he regarded it, was inconsistent with the principles on which the Allies were fighting the War. At the General Election of Dec. 1918, he shared the general obliteration which overwhelmed the Nationalist Party.

DIPHTHERIA: *see* INFECTIOUS FEVERS.

DIPLOMACY (*see* 8.294).—The events of the years 1910–25 have created in the popular mind some misconception of the true nature of diplomatic practice. In particular, the controversy between the defenders of the "old" diplomacy and the supporters of the "new" has suggested an academic, and to some extent a false, distinction, or even conflict, between professional diplomacy and democratic control.

A theory has gained wide acceptance that diplomacy possesses some detached or independent identity, parasitic and not organic to the living growth of the state. Such conceptions are misleading: the history of diplomacy shows no such dramatic break in continuity; it shows merely a constantly fluid or organic process of adjustment, a constant endeavour to reconcile the maximum of representation with the maximum of efficiency. By "representation" is meant the recurrent necessity of adjusting the methods and the personnel of negotiation in such a manner as to render them fully representative of the ultimate sovereign authority of their national state; by "efficiency" is meant a constant endeavour to ensure that international intercourse is so conducted as to minimise the risks of misunderstanding, uncertainty or hasty action. It is the interaction of the impulse toward exact representation and the impulse toward increased efficiency which has since the 14th century constituted the main influence formative of diplomatic practice; the conflict between the "old" and the "new" diplomacy is thus no sudden development but merely this age-long process of adjustment presented in an increasingly intricate form.

Diplomacy may therefore be defined as representing those methods of international procedure which commend themselves to sensible men as being at any given period the most representative and the most efficient for conducting negotiations between sovereign states. If viewed as the logical continuation of this unceasing process of adaptation and adjustment, the changes introduced during the period under review fall into a more reasonable perspective.

Ratification.—The most important of recent developments is the insistence of the Legislature on a right to refuse ratification. In the United States this right is explicitly accorded to the Senate by the constitution. In Great Britain, as in most European states, ratification is the prerogative of the sovereign, and treaties have not been submitted to the Legislature unless money clauses formed part of the instrument. It was generally assumed that the signature of a treaty by a fully accredited representative of a sovereign state implied as a merely formal corollary the ratification of that instrument, and it was only with the rejection by the United States Senate of the Treaty of Versailles that this assumption was seriously challenged in Europe. Since then the conception has become firmly established that no important treaty, whatever the wording of its ratification clause, can be considered to have been concluded until it has been ratified by the legislatures of the leading signatory states.

Clearly this is a great gain in the direction of exact representation, while the loss in efficiency may not ultimately prove so serious as might be supposed. It is unlikely on the one hand that any responsible modern Govt. would in any case authorise the signature of a treaty unless they had good cause to count on the eventual approval of the Legislature. On the other hand it must be admitted that this potential veto of the Legislature introduces what, in some circumstances, might prove a dangerous element of uncertainty and delay; that it may seriously hamper the free and rapid exercise of judgment on the part of the executive; and that negotiations may thereby be unduly and protractedly exposed to the influence of popular ignorance, electoral excitement, party manoeuvres or press misrepresentation.

Open Diplomacy.—It is not impossible that when once the Legislature's right of veto on an international commitment entered into by the executive is fully established and realised, the old agitation for "open diplomacy" will subside. The existence of this veto and the prohibition embodied in the Covenant of the League of Nations will in future render any secret treaties but a precarious instrument in which to embody international agreements; nor is it unreasonable to hope that when once modern democracies feel safe-guarded against the obligations of such secret treaties, they will recognise that the battle has been won, and that it is unnecessary and highly inconvenient to insist that open covenants should also be openly arrived at. The admirable balance between representation and efficiency, between publicity and discretion, achieved at the Conference of Locarno in Oct. 1925, is likely to serve as a model of how to adjust the requirements of modern democracies to the smooth working of international negotiation.

THE DEMOCRATIC CONTROL OF DIPLOMACY

Apart from the very effective control which can be exercised by the Legislature through its veto on treaties which have been already signed by the executive, there exists in many countries a strong body of opinion which demands some more continuous form of parliamentary supervision over the foreign policy of the Govt. and its servants. In Great Britain this movement has concentrated on the demand for a Foreign Affairs Committee of the House of Commons endowed with the same privileges and prestige as the Foreign Relations Committee of the Senate in the United States, or the analogous parliamentary committees in France and Germany. The advantages of such committees are that they enable the Foreign Secretary accurately to gauge parliamentary opinion, while they provide Parliament with a safety-valve for criticism or suggestion which might be unsuitable for public debate. The disadvantages are that they entail extra labour on the Foreign Secretary, that they often seem to emphasise difficulties and disagreements which might otherwise be solved automatically, that they introduce into the conduct of foreign affairs a party and sometimes a personal element, that they constitute a channel through which financial and commercial interests may endeavour unduly to influence policy, and that they lead invariably to indiscretions and disclosures.

Diplomacy and the Press.—One of the most delicate problems of modern diplomacy is that of publicity. Full publicity is inimical to negotiation, partial publicity is apt to cause misunderstanding. When editors and correspondents have some sense of responsibility the problem is comparatively simple: they can be told the whole story and informed exactly why certain portions thereof are unfitted for publication. Unfortunately in moments of international excitement the discretion and integrity of every journal cannot always be relied on; nor can all negotiators resist the dangerous temptation of utilising their own press in order to reinforce their arguments by the excitation of their national opinion. The dangers of misdirected publicity are especially apparent during international conferences, and the greatest difficulty is experienced in maintaining a united front of discretion as between the several delegations. The more recent tendency is to throw on the Press itself the responsibility of using with good sense and discretion the material with which it is provided: but in the case of sensational or violently prejudiced journals, the temptation to abuse this gesture of confidence is obviously very great.

Diplomacy and Commerce.—Great progress has been made during the last few years in bringing the diplomatic services into close contact with the commercial needs of the peoples whom they serve. So long as this tendency develops on the lines of justifiable support for reputable commercial enterprises, and of the provision of full trade statistics and information, nothing but good will result. The institution by the British Govt. of the Dept. of Overseas Trade, and the analogous creation by the U.S. Govt. of the Bureau of Foreign and Domestic Commerce, both with their representatives in foreign trading centres, are important steps in the right direction. On the other hand, a tendency has arisen in certain states to expect from their representatives abroad a greater measure of commercial activity and intervention than is wholly consonant, either with their own prestige and political interests, or with the maintenance of harmonious relations with other competing countries. This tendency, if pursued, cannot contribute to the amity of nations.

Democratisation of the Diplomatic Services.—An interesting commentary on the constant iteration upon diplomatic practice of the concurrent needs of representation and efficiency is furnished by the reforms which have since 1919 been introduced into the foreign services of the United States and the British Empire. In Great Britain the Foreign Service was found to be too professional and not sufficiently representative; in the United States of America the Foreign Service was found to be too representative and not sufficiently professional. In Great Britain the Royal Commissions of 1861, 1871, 1886 and 1914 successively made recommendations tending to give to the British diplomatic service a more representative and less exclusive character. The regulations adopted as a result of the 1914 recommendations are of particular importance in that admission to the British Foreign Service was thereby to all intents and purposes thrown open to public competition, the examination being assimilated to that of other branches of the Civil Service. The old property qualification, which had in practice restricted recruitment to the richer classes, was abolished, the salaries and foreign allowances were graduated with the object of enabling a diplomatist to be independent of private means, and the Board of Selection, which had been instituted in 1907 to select candidates for examination, was reconstituted on a more representative and democratic basis. In the United States, on the other hand, the tendency as shown by the Reorganisation Act of May 24 1924 has been to abandon the extreme representative or "spoils" system (under which the whole personnel of the Foreign Service were adherents of the political party in power), and to create in its place a professional or standing Foreign Service.

Diplomacy and the British Dominions.—The international status acquired since 1914 by the British self-governing Dominions has faced the British Empire with a new and highly complicated aspect of the old problem of reconciling representation with efficiency. This new issue, although it is engaging anxious thought, has as yet been dealt with primarily by the expedient of keeping the Dominion Govts. fully informed of any important diplomatic developments. Some machinery for rapid consultation, probably in the form of increased liaison, will doubtless be devised in the near future. For the moment it can only be said that the present system is unsatisfactory, and that it can only be regarded as provisional. (*See* BRITISH EMPIRE.)

In so far as the changes noted above render diplomatic practice more exactly representative of modern conditions, they clearly contribute to the greater efficiency of international intercourse. Nothing leads more surely to confusion and uncertainty than any failure on the part of the negotiator to identify himself with the ultimate sovereign authority in his own country. On the other hand, successful diplomatic negotiation necessitates a certain detachment from herd-emotion, and it has always, and will always, be found that diplomacy works most efficiently when conducted on the lines which the experience of generations has evolved as being the most convenient. It is for this reason that so few permanent changes have been introduced during the period under review into the actual formalities of diplomacy.

The perpetual servitudes and moral judgments introduced into the Treaty of Versailles will not form a precedent; the spasmodic revival of the old practice of direct personal correspondence between Foreign Ministers is a too dangerous method to become habitual; the attempt to render diplomacy bilingual will be maintained only with difficulty; the war habit of propaganda may well prove too invidious and expensive for continuance; the increased facilities of communication may well modify, but will certainly not diminish, the value of personality in diplomatic representatives abroad; the wholesale appointment to embassies and legations of men outside the profession is not, as the U.S. Govt. has found, a practice which contributes to general efficiency. Equally transitory may well prove the system of "diplomacy by conference," which has since 1915 become so frequent a feature of international intercourse. Such *ad hoc* conferences were essential during the War, and in the period of post-War liquidation. But when once the Concert of Europe is re-established, it will probably be found that these dramatic meetings will be abandoned and that personal contact between the various Foreign Ministers (a system which, if not exaggerated, is highly useful) will be maintained at the periodical meetings of the Council and the Assembly of the League of Nations.

It is too early as yet to estimate the effect upon diplomatic practice of the institution of the League of Nations (*q.v.*). Until 1925 that body, however admirable its ideals and intentions, was in essence representative only of the will of the Allied Coalition. With the entry of Germany it will approximate to the old Concert of Europe with these important differences, namely, that it will possess a trained international secretariat, and that it will hold periodical meetings. Diplomacy, therefore, which, whatever its critics may contend, is the art of preserving international peace, may well find in the League of Nations a highly efficient instrument for the attainment of its objectives.

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DIRECTOR FIRING: *see* GUNNERY.

DISARMAMENT.—The word disarmament is used to cover two distinct conceptions: first, the complete abolition of all military armament, desired by a certain school of advanced thinkers; second, the reduction and limitation of national armaments by a general international agreement accepted by all, or almost all, states. In the former sense of the word, disarmament cannot yet be said to be practical politics. In the second sense it is one of the great problems of the day.

Partial Disarmament by Treaty.—Some attempts to achieve a concrete reduction and limitation of armaments were made before the World War of 1914–9. In isolated instances, where agreements were made between countries geographically remote from the rest of the world, a measure of success was obtained. Thus some South American republics reduced their armaments in accordance with arrangements made by treaty, while in a number of cases two countries agreed to the demilitarisation and sometimes to the actual neutralisation of the zone surrounding the frontier between them. The most striking example of disarmament by friendly agreement is that of the 3,000 m. land frontier between Canada and the United States, which has been demilitarised since 1818. Another is the frontier between Norway and Sweden, which was neutralised when the two countries separated in 1905. Early in 1870 Britain proposed such disarmament to France and Germany, but Germany refused to discuss the matter.

But whenever any attempt was made to reach a general agreement on disarmament, as for example, at the Hague Conferences of 1899 and 1907, failure was immediate and complete. Owing to the attitude of Germany all definite plans were prevented; during the 20 years preceding 1914 all the more powerful governments spent an ever-increasing proportion of their national wealth and resources in building up greater and greater fleets and armies.

It was widely believed that as soon as the World War was over, and the German menace was removed, disarmament would be brought about almost by itself; but in fact the burden of armaments remained almost as oppressive as before. Nevertheless, although great armaments were still maintained after the War, disarmament in the second sense did become a matter of practical politics.

Disarmament under the Peace Treaties of 1919.—In the first place, the principle of disarmament was effectively applied to the states defeated in the War. Under the treaties of peace, Germany, Austria, Hungary and Bulgaria accepted an immense reduction and a rigid limitation of the armed forces which they respectively maintained. The treaty clauses relating to these armed forces were worked out in the greatest possible detail and laid down the number of men, the equipment, the transport and the armament which each of the four states was allowed to maintain, Germany's army being fixed at a total of 100,000 men. Moreover, conscription was abolished and both armies and navies were to be recruited on the basis of long-period voluntary service. The manufacture of arms in the ex-enemy countries was forbidden, and a rigid control by the victorious Allied Powers was established to see that the disarmament provisions were carried out. It was hoped that in this way the ex-enemy states would be bound down to a fixed scale of armament, and that they could be prevented from building up great secret reserves, either of man-power or material.

Although it was one-sided, this disarmament of the ex-enemy Powers was nevertheless a considerable factor in the general post-War situation and in itself did much to make general disarmament practically important. For, apart from its obvious political effect, it was expressly recognised in the peace treaties that the disarmament of the ex-enemy Powers was only preliminary to a general reduction and limitation of armaments by the world at large. The preamble to Part V. of the Treaty of Versailles, for example, says:—

> In order to render possible the initiation of a general limitation of the armaments of all nations, Germany undertakes strictly to observe the military, naval and air clauses which follow.

Provisions of the Covenant.—Secondly, specific obligations with regard to disarmament were imposed upon all the members of the League of Nations by Article 8 of the Covenant. In this article, recognised by the authors of the Covenant to be fundamental to the successful working of the League, the Members

> recognise that the maintainance of peace requires the reduction of national armaments to the lowest point consistent with national safety and the enforcement by common action of international obligations.

The article goes on to provide that the Council of the League

> shall formulate plans for such reduction for the consideration and action of the several governments. . . . After these plans shall have been adopted by the several governments the limits of armaments therein fixed shall not be exceeded without the concurrence of the Council.

To this must also be added the Final Act of the Conference of Locarno, in which new undertakings to carry out Article 8 were made by the Great Powers there assembled.

Third, these are not merely paper obligations. Since the end of the War it has been recognised more and more widely that Article 8 *must* be carried out if the League of Nations is to fulfil the purposes for which it was created. British statesmen have made the strongest possible declarations on the subject. Lord Grey, Lord Cecil, Mr. MacDonald, Mr. Baldwin, Mr. Austen Chamberlain, among others have declared that both in the interests of the British Empire and of the world at large it is necessary to secure a general and mutual reduction of armaments without delay. Lord Grey summed up their arguments in a single sentence by saying that "if civilisation cannot destroy armaments, armaments will destroy civilisation." He claimed to be expressing an almost universal conviction that armaments are not only a result, but also a cause of policy; that they not only arise from a sense of insecurity but that they increase that sense of insecurity and thus cause war among nations.

Article 8 of the Covenant is an undertaking by the Members of the League to co-operate in preparing a plan of disarmament and in making the treaty required to bring that plan into effect. In the fulfilment of this task the principal rôle is assigned to the Council, which has first to prepare a plan for the "consideration and action of the several governments," and which is subsequently to control its observance.

The Temporary Mixed Commission.—It was not the Council, however, but the Assembly of the League which took the first important step towards executing Article 8. At the First Assembly in 1920 a resolution was adopted calling for the creation (by the Council) of a special committee of experts of various kinds to study disarmaments and to draft a scheme. On this committee, the "Temporary Mixed Commission," there were appointed military, naval, air, economic and financial experts, and to them were added also some persons of political experience. It first met in 1921 and early in its discussions Lord Esher produced a scheme, restricted to the limitation of the land-armaments of Europe. Lord Esher's plan, to which perhaps no very great consideration had been given, was founded on the principle that equal proportionate reduction of the armaments maintained by different countries in time of peace would affect the different countries equally and, therefore, while affording them all relief from a considerable burden, would not alter their relative military strength. This, of course, is the classical argument for a general reduction of military forces; but, although at first sight it seems an obvious proposition, it was not agreed to by all the members of the Temporary Mixed Commission.

On the contrary, the European members of the Commission almost unanimously rejected it. They contended that, while it may once have been true that proportionately equal reductions of military armaments and forces by international agreement would leave countries relatively as strong as they were before, in modern conditions this would no longer necessarily be so. They maintained that the application of science to war had introduced such changes in methods and weapons that no disarmament agreement could now include and limit all the vital factors on which military strength depends, since many of these vital factors are important elements in the normal peace-time economic life of the nations of the world. After prolonged and difficult discussion of these arguments, it was recognised by the Temporary Mixed Commission that reduction of armaments could not come alone but that it must be accompanied by arrangements, supplementary to those of the Covenant, for ensuring the security of Members of the League against aggressive attack. This conclusion was summarised in four resolutions adopted by the Temporary Mixed Commission and subsequently by the Third Assembly in 1922, the gist of which was that disarmament to be effective must be general, and that "security" and disarmament must go together.

Security Negotiations.—On the foundation of these four important resolutions the Temporary Mixed Commission proceeded in the following year to draw up the Draft Treaty of Mutual Assistance. The purpose of this Draft Treaty was to provide a system of general security which would permit the calling of a disarmament conference. Disarmament was intimately linked to the general scheme by the provision that none of its undertakings of mutual guarantee would come into effect until a plan of disarmament had been actually adopted and carried out. The treaty of mutual assistance was not, in fact, adopted by the succeeding Assembly, but the Fifth Assembly in 1924 elaborated the Geneva Protocol, which was founded on the same principles, and in which again the coming into force of a security system was made conditional upon the previous adoption at a disarmament conference of a general plan for mutual reduction and limitation of national armaments by the important countries of the world (*see* SECURITY).

The Geneva Protocol, in its turn, failed to secure sufficient acceptance by leading governments to bring it into force, and instead, the method of regional pacts was attempted by the British Foreign Secretary, Mr. Chamberlain. Once again, when his negotiations ended in the conclusion of the Locarno agreements, the Final Act of the Conference contained a new pledge that the Security Pacts should be followed by the adoption of a general plan of reduction and limitation.

Thus the whole course of the discussions and negotiations on the subject between 1919 and 1926 proved conclusively the essential connection between security and disarmament. On the problem of security those years witnessed much progress. In other respects, however, less progress was made. Quite apart from the problem of security, disarmament itself in its technical and technical-political aspects is an extremely intricate matter. It can hardly be expected that other governments will freely accept the simple but drastic system imposed on Germany and her allies, desirable though it might be that they should do so.

Technical Difficulties.—But the technical difficulties of a more elastic system are very great. How is the total strength of one country to be compared with that of another, or the power of one weapon to be measured against the power of another? How are weapons to be limited at all? How can secret preparation and storing of arms be stopped? How can the ratio of strength between different Powers be settled? What arrangement can be made for the simultaneous carrying out of disarmament provisions when they have been accepted?

These are formidable questions and the complicated technical problems which they raise were hardly touched on in the earlier discussions on the subject. The success of the Washington Naval Conference (*see* WASHINGTON CONFERENCE) does not give any indication of the lines on which they could be solved, for not only is naval disarmament infinitely simpler than military and air disarmament, but even among naval units the Washington Treaties dealt with only two categories of fighting ships. At length, however, the Sixth Assembly of the League recognised the importance of this side of the matter and decided that its study should be begun in order that, when security had been obtained, the work of the disarmament conference might be rapidly carried through. It remains to be seen what success will attend the League commission, on which it should be noted, the United States has a seat.

In conclusion, it may be said that the negotiations on disarmament which have so far taken place have been based on the following accepted principles:—

1. That general security is a necessary condition of general disarmament;
2. that the organisation of a system of sanctions through League of Nations machinery is the only road to security;
3. that to this end the "gap" in the Covenant, by which recourse to aggressive war is in certain cases legitimate, must be abolished, and aggressive war in all cases made an international crime;
4. that no scheme of disarmament can succeed unless it is accepted by all or almost all governments and unless it covers every kind of weapon and military preparation;
5. that only through the permanent machinery of the League can the necessary preliminary preparation for a disarmament conference be carried out; and
6. that no plan for general disarmament will give confidence to

governments and peoples unless it is supported by an imperial international system of control and supervision, which again can only be organised through the machinery of the League.

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DISTRIBUTION OF ANIMALS (*see* 28.1002).—Just as the main interest of animal classification is not the framing of diagnoses but the tracing of relationships, so the modern study of geographical distribution is less concerned with the definition of regions and provinces than with finding out the meaning of faunistic resemblances and differences, to what extent they are due to present conditions, to what to past events.

I. LAND AND FRESHWATER ANIMALS

The importance of a group of animals in relation to problems of distribution depends on the extent to which the classification has been worked out, the palaeontological history discovered and the methods of dispersal ascertained. Especially valuable are animals for which the sea is generally an impassable barrier, such as the mammals and the freshwater fishes, and we propose to consider how the ideas as to former continental connections and ancient lines of severance that come from a study of mammalian distribution are confirmed or modified by the distribution of freshwater fishes. The statement that the distribution of freshwater fishes must be represented by a different scheme from that proposed by Wallace and Sclater for the mammals is incorrect; each of the great regions, Palaearctic, Nearctic, Neotropical, African, Indian and Australian, is well defined by its freshwater fish fauna.

Australia.—The distinctness of the Australian region, with its peculiar marsupial fauna, is well known; the placental mammals are almost entirely absent, being represented in Australia itself by a few small rodents, a group peculiarly liable to accidental transmission, and by a dog, which must have been introduced by man. The freshwater fishes emphasise this distinctness, for the Ostariophysi, an order comprising more than 4,000 species and dominant in the fresh waters of the rest of the world, are absent from the Australian region, except for two families of cat-fishes, Ariidae and Plotosidae, the only marine families of the order; these are represented by a number of freshwater genera and species in the rivers of Australia and New Guinea. It is evident that the Australian region was cut off from the rest of the world long ago, probably not later than the beginning of the Cretaceous, before placental mammals or Ostariophysi had developed.

Wallace's Line.—Wallace's Line, between Borneo and Celebes and Bali and Lombok, was long accepted as the boundary between the Indian and Australian regions, but some modern authorities minimise its importance and would place Celebes in the Indian region. Max Weber, indeed, asserted that the freshwater fish-fauna of Celebes is an impoverished Indian one, and, in support of this, listed five widely distributed Indian species that occur in the island. But the presence of the same species, if it were due to a land connection, would mean a connection between Borneo and Celebes as late as the Pliocene, or later, which is quite out of the question. And we find that one of these species (*Anabas scandens*) not only crosses Wallace's Line, but Weber's Line also, reaching the Moluccas, and another (*Symbranchus bengalensis*) extends to Western Australia and to New Guinea!

The explanation is that three of the five species are valued as food-fishes because they can live out of water and can be carried about alive in jars without any water; these must have been introduced into Celebes, and the others are not true freshwater fishes, but are characteristically estuarine and can cross the sea. The contrast between Borneo, with hundreds of species of carps, loaches, cat-fishes, labyrinthic fishes, etc., and Celebes, without a single indigenous true freshwater fish, is a striking one. It may be that Wallace's Line is the ancient line of severance between Asia and Australia, and that the animals that have crossed it since the separation occurred have special means of dispersal or have been able to take advantage of special circumstances.

Australia and South America.—Some authorities believe that in early Tertiary times Australia was connected with South America via Antarctica, but the evidence in favour of this conclusion is very slight, and that against it weighty. A family of frogs, Cystignathidae, was said to be peculiar to Australia and South America, but this family is now included by Noble in the Bufonidae, a cosmopolitan group, and it is certain that the Australian and South American genera are not at all closely related. *Thylacinus* is a typical member of the Australian family Dasyuridae and has nothing in common with the Sparassodonts of the Miocene of Patagonia, except the carnivorous dentition. The South American and Australian tortoises of the extinct family Miolaniidae may well be placed in different genera, and this family may be a very ancient one that had a wide range in secondary times. The long isolation of the Australian region may be regarded as established.

Madagascar and Africa.—Madagascar, like Australia, has no Ostariophysi (except a peculiar genus of Ariidae) nor indeed any true freshwater fishes. This reinforces the purely geological evidence that the separation of Madagascar from Africa may have taken place as long ago as that of Australia from Asia. The mammals of Madagascar are placentals, but are very peculiar and have evidently evolved in the island from a few ancestral types, which may have reached it from Africa in early Tertiary times, either by means of a temporary and narrow land connection which did not suffice for the passage of freshwater fishes, or more probably, as Matthew has suggested, across the sea, *e.g.*, on drifting timber or by swimming, perhaps at periods of elevation which brought the north end of the island nearer to Africa than it is at present.

Dispersal of Mammalia.—The importance of the mammalia for the study of geographical distribution resides in the fact that for many of the groups their evolution and migrations during the Tertiary period are well ascertained, and that for the majority of them the sea constitutes an impassable barrier. It is generally accepted that in the Eocene North America was separated from South America and from Eurasia, and that a wide sea extended from the Mediterranean eastwards, cutting off Africa from Europe and India from northern Asia. In other words, during the Eocene the continents were isolated, and each was able to develop its own peculiar mammalian fauna. Thus, taking the orders generally grouped together as Ungulates, we have evidence that during this period the Proboscidea, Sirenia and Hyracoidea became differentiated from each other in Africa, the Litopterna, Toxodontia and Typotheria in South America, the Artiodactyla and Perissodactyla in the north. At the end of the Eocene nearly the present relations of the continents became established, and in addition North America and Eurasia were united across the Bering Sea, and perhaps also via Greenland and either Iceland or Spitsbergen; thus extended migrations became possible, the elephants spread northwards and the northern groups entered Africa and South America; in the last-named, perhaps as a result of this invasion, many of the original native groups became extinct, or were reduced, *e.g.*, Edentata.

Dispersal of Freshwater Fishes.—True freshwater fishes, that is, those belonging to groups that have evolved in fresh water, resemble the mammalia in their inability to cross the sea, but differ from them in that their distribution is a relatively slow process, dependent on hydrographical changes, such as the union of rivers formerly distinct, the capture by one river of the tributaries of another, etc. It seems that for mammals migration is easy, but survival difficult, whereas for freshwater fishes migration may be difficult, survival relatively easy. Our knowledge of the Tertiary history of freshwater fishes is incomplete, but we know that species closely related to the modern pike, tench and dace inhabited Europe in Oligocene times, and that in the Eocene of North America are representatives of some of the families characteristic of that continent at the present day, namely Catostomidae, Amiuridae, Percopsidae, Percidae and Centrarchidae. Clearly the main distribution of freshwater fishes was already determined in early Eocene times.

South American Ostariophysi.—The distribution of the Ostariophysi, to which order the great majority of the freshwater fishes of the world belong, is full of interest. The South American Ostariophysi exhibit the greatest diversity, and must have evolved in that continent for a very long time; there are five families of Characins, the most generalised group of the order; four of these are restricted to South America, and one is found also in Africa. The Gymnotiformes (electric eels) are an endemic neotropical group, and the South American Siluroids, or catfishes, belong to nine families, all endemic.

There is no relationship whatever to North America, and the freshwater fish fauna of South America is as peculiar and distinctive as the mammal fauna would have been if the connection with North America had never been formed; this connection has not enabled a single Nearctic freshwater fish to reach South America, but the ancient Lepidosteus has got as far as Panama. Nor have the neotropical types been more successful in spreading northwards; a few families have entered Central America, but none has reached the Mexican plateau, although in the lowlands of the Atlantic slope one species of the Characinid genus *Astyanax* had got so far north as the Rio Grande.

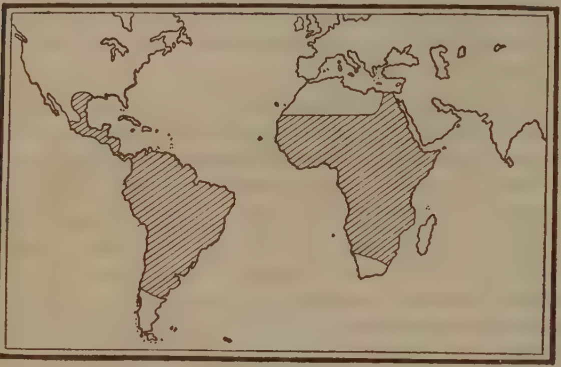

FIG. 1.—Distribution of Characins.

Africa and South America.—Although Africa and South America have no genera in common, there is a certain relationship. The Characins are restricted to these two continents, and of these the South American Brycon appears to be closely allied to the African Alestes. Also the Pimelodidae, the most generalised neotropical Siluroids, are very near to the Bargridae of Africa and India. These facts, added to the distribution of the Lepidosirenidae (Protopterus in Africa, Lepidosiren in South America), fishes specialised for freshwater life in the tropics, strongly suggest that in Cretaceous times South America and Africa formed one continent and that in it the Ostariophysi originated and evolved. Probably these continents became separated towards the end of the Cretaceous. The distribution of the Cichlid perches, a more modern group than the Ostariophysi, was at one time thought to support the view that this connection might have persisted into the Eocene; but it is now known that some Cichlids frequent brackish lagoons and estuaries, and two or three have even been found in the sea; moreover, the presence of fishes of this family in Madagascar, where none of the other freshwater families of Africa occur, is evidence that their distribution is not subject to the same restrictions as that of true freshwater fishes.

The Cypriniformes.—The Indian region, India and southeast Asia, is the headquarters of the Cypriniformes, a group more specialised than, and evidently derived from, the Characins. In this area, the Cyprinidae are represented by a great number of divergent genera, including those that most nearly approach the Characins in structure. The Characin ancestors of Cyprinidae must have come from Africa, and a direct Cretaceous connection between Africa and India may be inferred. In southern Asia the Cyprinidae gave rise to two families of loaches, fishes specialised for life in mountain streams, Homalopteridae and Cobitidae; of these the latter spread northwards. The Cyprinidae themselves must have extended northwards at an early date, for before the Eocene the ancestors of the Catostomidae had reached North America. The African Cyprinidae, although numerous enough, belong to a few Indian genera which have evidently reached Africa since the Eocene; most of the Palaearctic species are Leuciscines, a group that appears to have entered North America from Asia since the Eocene. The Indian region has six families of Siluroids, three endemic and three in common with Africa; of these the Bagridae must have reached it at an early date, for the Amiuridae, which are specialised Bagridae, were already present in North America in the Eocene.

Freshwater Fishes and Mammals Compared.—The freshwater fishes tell the same story as the mammalia, due allowance being made for their greater persistence and more limited powers of dispersal. The majority of the families characteristic of the great regions at the present day must have already been present in the same areas in Eocene times, and the connections established since the Eocene have produced but a small effect, in striking contrast to the rapid spread of the mammalia, the constant interchange between North America and Eurasia and the invasion of Africa and South America by groups of northern origin. Some authorities, impressed by the fact that the greater part of the present mammalian fauna of Africa and South America is derived from immigrants from the north, have accepted northern origin and southward migration as a general principle. But this generalisation, only partly true for the mammals of the Tertiary period, should not be applied to other groups and to other times without strong evidence to support it. The Ostariophysi entered North America from Asia, the Catostomidae and Amiuridae or their ancestors towards the end of the Cretaceous, the Leuciscines since the Eocene; the supposition that the ancestors of the completely different South American members of the order came from North America is unsupported by any evidence and is highly improbable. The conclusion that Africa and South America were connected in Cretaceous times, and that the Ostariophysi had a southern origin, is neither contradicted nor supported by the mammals; but it is at least as likely that the ancestors of the endemic South American orders came from Africa as from North America, that the Litopterna and Toxodontia, for example, may have evolved from the same southern group of primitive Ungulates as the Proboscidea and Sirenia.

Generalisation and Specialisation.—Matthew is responsible for another hypothesis, namely, that the most primitive living members of a group indicate the limits of its migration and the most advanced forms its original habitat. This appears to be true for certain groups of terrestrial animals, but not for others; it has no general value and cannot be applied to freshwater fishes, in which the most generalised types often persist in the region where the greatest diversity and specialisation are found.

Wegener's Hypothesis.—The bearing of Wegener's hypothesis on problems of geographical distribution has been much discussed in recent years. Wegener's main thesis, that the continents are masses of lighter and more solid material floating in a heavier and more fluid substratum, and that their present position is the result of " drift, " is a matter for geologists and geophysicists to pronounce on (*see* GEOLOGY). If his ideas as to the distribution of land and water in the past were a necessary consequence of his hypothesis, zoologists would have to reject it. It is evident, however, that these ideas are not an integral part of the hypothesis, but are the result of what Wegener has learnt about geographical distribution; his Eocene map, for example, shows Australia connected with South America by Antarctica and Madagascar united to India. The conclusion is that Wegener's hypothesis has at present nothing to do with geographical distribution. The zoogeographer who has reason to believe that South America and Africa were formerly united is indifferent whether they became separated by submergence of the intervening land, or by breaking and drifting apart.

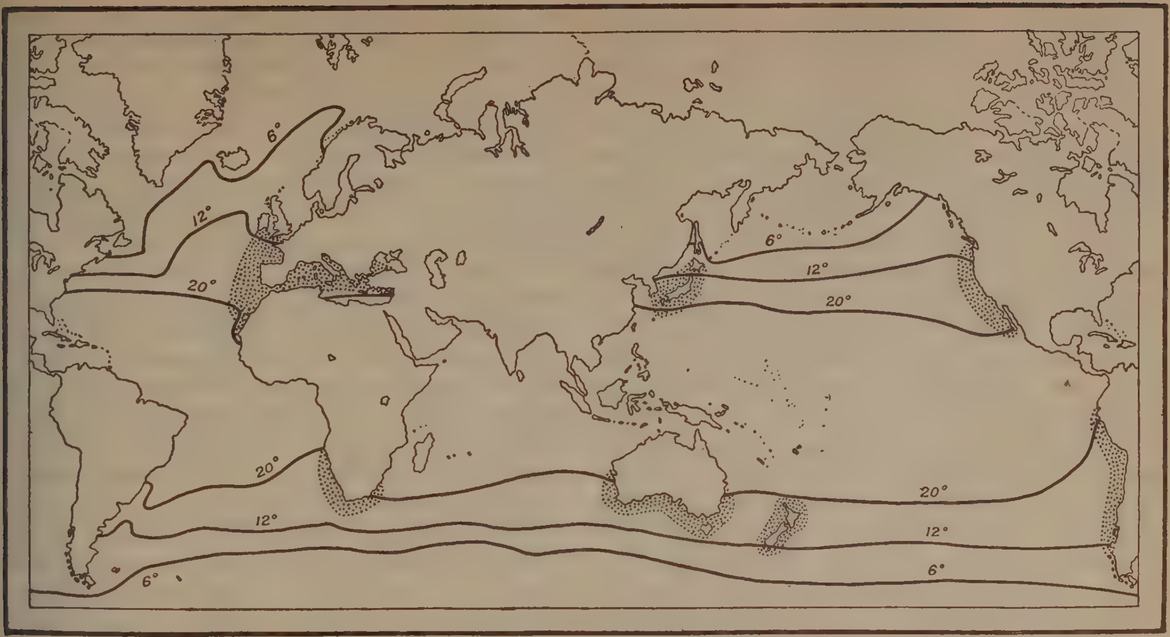

FIG. 2.—Mean annual surface isotherms of 6°, 12° and 20° C., approximating to boundaries of zones of marine distribution. The dotted areas show the distribution of pilchards (Sardinia).

II. MARINE DISTRIBUTION

Coastal.—During the present century the collections made by the British, French, German, Belgian and Swedish Antarctic expeditions have made known for the first time the marine fauna of the coasts of the Antarctic continent and the adjacent islands, with some results that were unexpected, for example the affinity, almost identity, of the South Georgia fauna with that of Graham Land, and its dissimilarity from that of the Magellan-Falklands area. It was found that nearly all the coastal fishes of Antarctica, South Georgia and other islands south of the mean annual surface isotherm of 6° C. belonged to a single group, Nototheniiformes, and that most of the genera and nearly all the species of this region were restricted to it. The Antarctic zone may be considered to be bounded by this isotherm and may be further subdivided into a glacial zone (Antarctica, South Georgia) within the limits of pack ice, and a periglacial zone (Kerguelen, Macquarie Is.) outside these limits. The peculiar and diverse Antarctic fish fauna must have taken a long time to evolve and justifies the belief that Antarctica has been surrounded by a cold sea for a long time, probably throughout the Tertiary.

Between the isotherms of 6° and 12° C. lies the subantarctic zone in which Nototheniiform fishes are represented by Bovichthyidae and species of Notothenia; there are two main areas, Magellan and Antipodes. The south temperate zone, between the isotherms of 12° and 20° C., has five districts, Chilean, Argentinian, South African, South Australian, New Zealand. South of the tropics the currents are not deflected by land masses to the extent that they are in the north, the isotherms are more nearly parallel and the zones of distribution are better defined. A remarkable example of the influence of temperature and currents on distribution is that two small islands, Tristan da cunha and St. Paul, some 4,000 m. apart, have species of fish in common that are found nowhere else in the world; these islands are on the same isotherm and the Antarctic Drift runs direct from one to the other. The Antarctic and Subantarctic coastal fishes are mostly quite unlike any found in northern regions, but there are a number of genera common to the north and south temperate zones, and the Cape fauna has many similarities to that of the Mediterranean.

Tropical Zone.—The tropical zone, bounded by the mean annual surface isotherms of 20° C., is far richer than any other; there are two main regions, American and Indo-Pacific. The similarity between the tropical fauna of the Atlantic and Pacific coasts is due to the Eocene connection of the Caribbean Sea with the Pacific; few species are identical on both coasts, but many Antillean species are represented by closely related forms on the Pacific side. West Africa has a mixture of Indian and Antillean types, but there is little that is distinctive in this district, perhaps because its area is relatively small and uniform, perhaps also from extinction in glacial times. Certain families and genera now restricted to the Indo-Pacific (*e.g.*, Triacanthidae, Amphisilidae, *Scatophagus*, *Mene*) have been found fossil in Eocene and Oligocene deposits in southern Europe and indicate that in early Tertiary times the Mediterranean, which then extended eastwards to the Pacific, had a tropical Indo-Pacific fauna, which would have ranged to West Africa also.

Northern Zones.—The greater seasonal variations make it more difficult to define the northern zones than those in the south, but the same isotherms may conveniently be used. These correspond very closely to P. Schmidt's faunal divisions of the east coast of Asia, and in the North Atlantic the isotherm of 12° C. runs to the mouth of the Channel, the region where the pilchard replaces the herring, the hake and the cod, and that of 6° marks the southern limit, as a marine fish, of such a typically Arctic species as the char and is near the northern boundary of many British species. The identity or near relationship of many subarctic species in the Atlantic and Pacific indicates their former continuous range along the northern coast of Eurasia under milder climatic conditions in the Arctic Ocean, and also establishes that the post-Eocene connection between North America and Asia must have been broken more than once since its formation.

In both the Atlantic and Pacific oceans the tropical zone is expanded on the western side and contracted on the eastern and in both oceans the north temperate and subarctic zones are narrow to the west and broad to the east. These facts may have an important bearing on distributional problems; off the Atlantic coast of America, for example, in the region where the Labrador current meets the Gulf Stream, there is an almost abrupt transition from subarctic to tropical conditions.

Bank, Coast and Continental Slope.—Under the heading "coastal" are included the pelagic animals that frequent the neighbourhood of the coasts as well as the benthic animals that live on the bottom, either near the shore or on the continental shelf, the edge of which corresponds to a depth of about 200 metres; it is within this depth that the greatest abundance and variety of life occurs. Hjort has shown that on the Atlantic slope of Europe and Africa the number of fishes decreases toward the abyssal plain and moreover that the fauna changes, the deepest part of the slope, from about 700 to 1,500 metres, having its own types, the uppermost part having also its own species, including some representatives of the fauna of the coast banks, or continental shelf. The zones and regions of distribution mentioned above apply especially to the surface-swimming fishes and to the bottom-living species within the 200 metres line; the fauna of the continental slope, particularly of its deeper parts, appears to be much more uniform over wide areas, as might be expected from what is known of temperature at these depths.

Oceanic Life.—Our knowledge of oceanic life has been greatly increased by the results of the German "Valdivia" expedition and especially by the "Michael Sars" expedition across the Atlantic under Hjort and the voyages of J. Schmidt in the Atlantic and Mediterranean in the "Thor" and "Dana." Hjort has put together his main results in a book *The Depths of the Ocean* (1912); he has come to the conclusion that the abyssal fauna is a poor one, and that the majority of the fishes recorded by the "Challenger" from great depths were taken in the nets on their way to the surface. He found that dark-coloured fishes, deep-red prawns and other organisms were bathypelagic, characteristic of a region extending downwards from a depth of about 500 metres below the surface, although in subarctic waters some of them may be found nearer the surface.

The region between 150 and 500 metres is inhabited by another association of organisms, small, silvery fishes with large eyes, and numerous small crustaceans, pteropods, etc.; with few exceptions the fishes of this region appear to be restricted to the tropical and temperate zones, and the few found in colder waters are generally specifically distinct. From the surface down to 150 metres are found large, swift, predacious fishes, tunny, sword-fish, etc., as well as smaller forms, of which the Myctophidae are typical and most abundant, with hosts of Foraminifera, Radiolaria, Copepoda, Pteropoda, Medusae, Siphonophora and Salpae. This fauna belongs mainly to the tropical and temperate zones, especially the former where both species and individuals are most numerous; the fishes are generally silvery, with blue backs, the invertebrates mostly transparent and colourless.

Eels.—Schmidt has not given a summary of his researches in book form; he has been concerned mainly with the influence of hydrographical conditions, temperature, salinity, currents, etc., on the distribution of pelagic organisms. As a typical example of his work we give that on the distribution of the eels (*Anguilla*), a research that has been carried on continuously since 1904 and is still in progress. Schmidt finds that there are five temperate and 16 tropical species of the genus *Anguilla;* these are littoral and freshwater fishes that migrate to the ocean to breed; the pelagic larvae are transparent and strongly compressed; on reaching the coastal waters these undergo a metamorphosis and become elvers, or young eels, which make their way into the bays and up the rivers. By collecting and comparing eel larvae from the North Atlantic and Mediterranean Schmidt has demonstrated that the European eel crosses the Atlantic to breed in an area to the south of Bermuda, and that the larvae travel eastwards, reaching the coastal waters of Europe when they are about 2½ years old and 3 in. long; here they change into elvers, those that enter our rivers in the spring being about 3 years old. Thus the distribution of the European eel, from Iceland and northern Norway to Morocco, and throughout the Mediterranean, represents the coasts reached by the larvae in their journey from the breeding area and those further regions to which the elvers can make their way.

The Gulf Stream is an important factor in bringing the larvae to Europe, but in this connection it is interesting to note that there are a number of fishes with pelagic larvae common to the Atlantic and Mediterranean, but, unlike the eel, these are divided into Atlantic and Mediterranean races, breeding in these areas; also there are Atlantic species not represented in the Mediterranean. Schmidt has found that although the larvae of the Atlantic species and races are abundant in the upper layers of the ocean in the neighbourhood of Gibraltar, and although there is a strong surface current eastwards through the Straits, none of these larvae enters the Mediterranean. He has expressed the opinion that the eel-larvae go into the Mediterranean because they want to, and the others do not because they do not want to.

The breeding place of the American eel overlaps that of the European eel, but is somewhat southwest of it. In the western Atlantic larvae of both species occur together, but Schmidt has found that the larval life of the American eel is relatively short, the elvers being only one year old, and he believes that this is true of the Japanese eel also; thus the long larval life of the European species is regarded as a special adaptation, related to the great distance of the breeding place from the coasts. There is reason to believe that eels breed at a depth of about 400 metres below the surface, and Schmidt has suggested that their breeding places are oceanic areas in which the temperature at this depth is high, above 13° C. This short summary of this fine piece of work will show that the anomalous distribution of the species of *Anguilla* on coasts and in rivers may be related to their life-history, to the temperature of the ocean at a particular depth and to the direction of the surface currents.

Micro-plankton.—The microscopic plants of the upper waters of the ocean obtain their food directly from inorganic substances dissolved in the water, building up their living substance from these, water and carbon dioxide. These minute plants form the food of the animal plankton, including small Crustacea, larval fishes, etc., which are eaten by pelagic fishes such as pilchards and mackerel, that form the prey of larger pelagic fishes. In coastal waters the plankton organisms form the food of many bottom-living invertebrates, which in turn are eaten by fishes. Thus it follows that the distribution of fishes may to a large extent depend on the microscopic plants floating in the surface waters, and the study of these, their distribution, quantity and the conditions of their existence has become of practical importance. One result that has been obtained is that these minute plants are generally abundant near the coast, but that in the open ocean they are far more plentiful in the colder waters than in the tropics; this is rather remarkable when it is considered that it is in the tropics that oceanic fishes are most abundant. It must be remembered, however, that a quantitative comparison of this sort, made at a season favourable to the colder waters, is no real index of annual production, that in the tropics growth is more rapid, and seasonal changes are less marked.

Detritus.—It is an open question whether the importance of the Phytoplankton as the basis of fish-life has not been overestimated, except for the pelagic fishes that are plankton-feeders and whether seaweeds, especially in the tropics, and organic detritus from the land are not equally valuable. Petersen especially has elucidated the part played by organic detritus from seaweeds and from the land as food for the bottom-living invertebrates that are eaten by bottom-living fishes of coastal banks.

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DIVING (*see* 8.326).—Several years before the World War, Gall of Württemberg invented a rigid copper armour, in which the diver, being exposed only to ordinary atmospheric pressure, could descend to depths hitherto unapproachable.

An Apparatus Described.—Messrs. Neufeldt & Kuhnke of Kiel, Germany, have developed a practical apparatus for commercial use, which consists mainly of an armour of steel and aluminium alloy which protects the diver against the pressure of the water. The body, joined at the hips, and held together by bolted flanges, affords the necessary resistance against mechanical or chemical destructive action. The upper part of the body, with observation windows at the front and at the sides, contains the signalling devices, the regulating valves, as well as the necessary instruments like depth gauge, pressure gauge, compass, etc. The lower part of the body affords space for the necessary balancing weights, and is provided with a seat like a bicycle saddle. The arm and leg coverings are so designed that the movements of the man's limbs may be as free as possible. Different sorts of artificial hands or tong-like devices are inserted in the arm stumps and operated by the diver from inside for all ordinary work like fixing or removing a shackle, placing a bolt in position, tying different knots, etc. The movable legs enable him to walk about, to lie down and get up, and perform every necessary movement. He can withdraw his arms from the armoured coverings and operate the different valves, the light, etc.

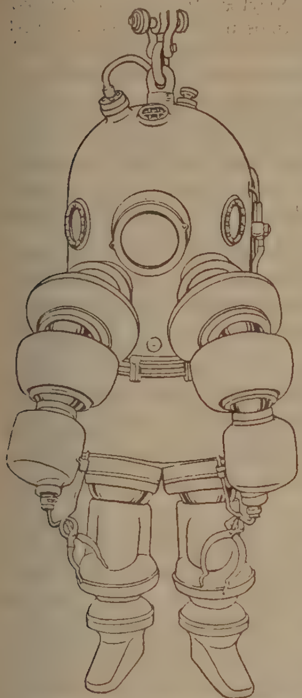
Fig. 1.—Deep sea diving apparatus, of steel armour and aluminium alloy.

Breathing Mechanism.—The breathing mechanism resembles that of a submarine. The diver does not depend on air pumped from above, as he has with him a sufficient quantity of oxygen stored in bottles, to last for about four hours. The carbonic acid exhaled is absorbed by special cartridges. As in a submarine, tanks are provided to enable the diver to rise or go down as he pleases. He is connected with the vessel, from which he descends by means of a steel cable sufficiently strong to lower him from the ship or raise him to it. The cable contains three independent telephone wires. If the connecting cable becomes entangled in some obstacle, and the diver is unable to clear it, he can detach the cable from inside the apparatus and rise to the surface independently by blowing out his tanks.

Behaviour Under Tests.—The whole apparatus, including the flexible joints, has been tested to stand a pressure of 25 atmospheres, corresponding to a depth of about 750 feet. At tests carried out in Lake Walchensee (Bavaria), the divers went down to a depth of 525 ft., and the ordinary diver's work was performed at the depth of 450 feet. No difficulty in breathing or manoeuvring was experienced in any of the tests.

Advantages.—For the diver working with this apparatus, depth is of no importance. As the increasing pressure of the water is borne by the apparatus, he feels no inconvenience whether he is working at a depth of 50 or 500 feet. The diver in the ordinary rubber suit requires about one hour to be raised or lowered in order to enable his body to adapt itself to the diminishing or increasing pressure. Any hurried movement in either direction would seriously affect, or even kill, him. With the new apparatus he can go down to a depth three times greater within a few minutes and come up at the same speed. As diving with this apparatus does not require any physical training such as divers have hitherto had to undergo, a supervising engineer or officer may go down at any time himself to inspect whatever may be the subject of inquiry.

Future Use.—The deep sea diving apparatus opens up new prospects for the exploration of the bottom of the sea. Scientific research formerly depended entirely on the results given by ground-nets, water and ground tests. Oceanographic and biological institutes will benefit by this addition to their equipment. Great economic importance attaches to this apparatus, for salvage, as well as pearl and sponge fishing. Work beyond a depth of 100–130 ft. was impossible with the ordinary rubber diving suits, but is now feasible. With the help of a new underwater oxygen cutting device, bullion from sunken ships lying at great depths can now be recovered, and pearl fishing is no longer limited to the almost exhausted grounds in shallow water.

Salvage of M1.—The first practical use of the apparatus for salvage work in the open sea was made by request of the British Admiralty in connection with the sinking of the ill-fated submarine M1 on Nov. 12 1925. As soon as it was certain that the submarine must have met with some accident, and most probably was lying at a depth of about 240 ft., the British Admiralty dispatched a destroyer to fetch from Messrs. Neufeldt & Kuhnke's works at Kiel two sets of diving apparatus, which, with the necessary crews, were immediately put at their disposal. The men and apparatus were hurried over to Portland and immediately transferred to the salvage ships "Moordale" and "Southdown," but on arrival at the scene of the disaster they encountered such rough weather and high seas that diving was out of the question. In the meantime, British destroyers and mine-sweepers were busy searching the water with dredging gear for any obstructions, and locating them.

In spite of heavy seas which would have absolutely prevented the use of ordinary divers irrespective of the depth, diving was begun on Nov. 20 and was continued until Dec. 2. During this time a considerable number of daring dives were made by different German divers, who stayed at the bottom as long as an hour and a half, and sometimes were able to search a considerable area by walking. As however the obstructions located by sweeping and on which diving took place were not the missing submarine, and as the salvage ship, "Moordale," encountered many difficulties owing to the bad weather in the Channel, the divers were not able to reach the sunken submarine. When it was established beyond doubt that the M1 had been rammed by the Swedish ship "Vida," and as the reason of the disaster was thus made clear and not the faintest hope of saving life could be entertained, the Admiralty decided to abandon the search for the time and to postpone it to a better season. It had been proved that the apparatus employed fulfilled all reasonable expectations, but failed to get definite results by reason of circumstances outside the control of the German expedition. (F. W. HA.*)

DIVORCE: *see* MARRIAGE LAWS.

DJEMAL PASHA, AHMED (1861–1922), Turkish politician, was born at Constantinople May 1 1861. He entered the army, and later became an influential member of the Committee of Union and Progress. In 1908 he was promoted lieutenant-colonel, and was appointed military governor of Adana. He was appointed governor-general of Baghdad in 1911, and commanded a division during the Balkan wars the following year. In 1913 he commanded the I. Army Corps, and was made Minister of Public Works. In 1914 he became Minister of Marine; in the same year he took over the II. Army, and was afterwards sent to Syria in command of the IV. Army. Owing to dissensions with Enver Pasha and von Falkenhayn he returned to Constantinople in 1917, where he retained the portfolio of the Marine until the Armistice. On the downfall of the Ministry in Oct. 1918 Djemal was forced, with other members of the Committee of Union and Progress, to seek refuge in Germany and Switzerland. Later he visited Russia, and thence proceeded to Afghanistan, where he exercised a powerful influence. He was assassinated by Russians at Tiflis July 22 1922. Djemal did much to awaken the spirit of nationalism in the Mahommedan countries of Central Asia. An able leader and an efficient organiser, many of his reforms were definitely constructive; but he was frequently cruel and tyrannical.

His writings include a volume in French, *Le Carnet de route du Colonel Djemal Bey*, and works in Turkish on Plevna and the Crimean Campaign. Another work, *Memories of a Turkish Statesman, 1913–9* (1922) appeared in English and in German.

DOBRUJA (*see* 8.351), a province of Rumania which is bounded east by the Black Sea, north and west by the Danube and south by Bulgaria. Its area, 8,993 sq. m., comprises the four districts of Tulcea, Constantsa, Bazargic and Durostor. Population 635,000. The Dobruja was assigned to Rumania by the Treaty of Berlin (1878), and soon radically changed its economic and ethnographical character. Part of the Turkish population voluntarily emigrated to Asia Minor, their place being taken by Rumanians who so developed these barren but fertile lands that to-day they form one of the most important wheat-growing regions of Rumania.

In 1911 the population numbered 338,267 inhabitants, of which 186,334 were Rumanians, the rest being composed of 48,963 Bulgarians, 10,836 Turks, 25,086 Tartars and 67,048 various other nationalities (Russians, Armenians, Greeks, Jews, etc.). The port of Constantsa (60,000 inhabitants) developed rapidly after the building of the bridge over the Danube and the opening of the railway line which links Dobruja with the rest of the country. Constantsa is to-day the principal port of export for the main products of Rumania (cereals, timber and oil), especially in winter when the Danubian ports are ice-bound. The oil is conveyed to the port through a pipe-line which connects Constantsa with the oil-fields in the Prahova district.

By the Treaty of Bucharest (Aug. 10 1913) Bulgaria ceded to Rumania two districts (Bazargic and Durostor) with an area of 2,877 sq. m. and a population of 289,131 inhabitants, of which, according to Bulgarian statistics, 134,731 were Bulgarians, the rest being composed of Turks, Rumanians, Greeks, Tartars, etc. The second Treaty of Bucharest (May 7 1918) deprived Rumania of the entire Dobruja. The southern part was to be ceded immediately to Bulgaria; the northern portion was, as a provisional measure, to be placed under the joint administration of Germany, Austria-Hungary, Bulgaria and Turkey. Rumania was to retain a commercial outlet to Constantsa. The Treaty of Neuilly (signed Nov. 27 1919) annulled these terms and by it the Bulgarian-Rumanian frontier was restored to the line of 1913 (*see* RUMANIA). (G. Bo.)

DOBSON, FRANK (1887–), British sculptor, was born in London on Nov. 18 1887. He received his early training with the sculptor W. Reynolds-Stephens, and later obtained a scholarship at Hospitalfield, Arbroath, New Brunswick. After further study in the City and Guilds Schools at Kennington, London, he lived in Cornwall and worked with the granite cutters. He was thus technically well equipped for a sculptor's career. His early works, both in painting and sculpture—few of which now exist—show definitely the attraction of the first Post-Impressionist Exhibition held in London in 1909. After war service he exhibited his first important work in stone "The Concertina Man" (1919), which was followed in 1921 by "Two Heads" in red Mansfield stone and the more complex Portland stone group "The Man Child." In 1923 he competed unsuccessfully for the Welsh National Memorial at Cardiff with his recumbent figure, "Cambria." To the next two years belong the white marble figure of a woman (1924), the seated nude "Susanna" and "Morning" (1925). His portraits include the bronze bust of the Earl of Oxford and Asquith (1921), the polished brass head of Osbert Sitwell (1923) and the plaster head of a young girl (1925)—the two last named in the National Gallery of British Art—the bronze half-length of Madame Lydia Lopokova (1924) and heads of L. H. Myers (1925), Robert McAlmond and Robin Sinclair. He was a founder of the X group, and in 1923 became president of the London group.

See Roger Fry in *The Burlington Magazine*, vol. 46, p. 171 (1925); Clive Bell in *The Architectural Review*, vol. 59, p. 41 (1926).

DOBSON, HENRY AUSTIN (1840–1921), British poet and man of letters (*see* 8.352), died at Ealing, London, Sept. 2 1921. His later work consisted of prose essays, notably *At Prior Park* (1912), *Rosalba's Journal* (1915) and *Later Essays* (1921), all studies of the 18th century; and *A Bookman's Budget* (1917).

DOCKS: *see* PORT ENGINEERING.

DODDS, ALFRED AMÉDÉE (1842–1922), French general (*see* 8.369), died in Paris July 18 1922.

DODECANESE (Twelve Islands), a term which first appears in the 9th century, was used in the Middle Ages for the Cyclades. Since the Italian occupation it has been applied to "the 13 Southern Sporades," consisting of the 13 (not 12) islands of Rhodes, Kos, Kalymnos, Leros, Nisyros, Tēlos, Symē, Khalkē, Astypalaia, Karpathos, Kasos, Patmos and Lipsos. The two first and the last were not included in the medieval "Dodecanese," which, however, comprised Nikaria and Castellorizo (Meyis). Turkish firmans from 1652 to 1835 conferred or confirmed their fiscal privileges, and local Greek authorities collected a lump annual sum as tribute to the Porte. These privileges, despite occasional infringements in 1869, 1886 and 1893, continued down to the Turkish revolution. The Young Turks, in 1909, abolished them, but in 1912, when the islands ceased to belong to Turkey, this decision had not yet been carried out.

In that year the Italians, then at war with Turkey and meeting with difficulties in Libya, occupied the 13 islands after a single battle at Psinthos in Rhodes, in which they were aided by the islanders, believing in the promises of General Ameglio and Admiral Presbitero, that "autonomy" would follow the abolition of Turkish rule. Indeed, an Insular Assembly met at Patmos, and proclaimed the "Autonomous State of the Aegean" with its own flag. The first Treaty of Lausanne, in Oct. 1912, pledged Italy to evacuate the islands as soon as the Turks had evacuated Libya. The Italian occupation was, therefore, to be provisional, but the French proverb tells us that *ce n'est que le provisoire qui reste*.

Signor Giolitti, when Premier, sincerely repudiated the idea of "annexing territories of Greek nationality" and Sir Edward Grey, in 1913, declared that their fate "interested all the Great Powers." Nevertheless, the 8th article of the secret Treaty of London of 1915, which secured Italy's entrance into the European War, gave her full sovereignty over the islands, which, had they been Turkish, during the first Balkan War, could all have been captured by the Greek fleet. Indeed it was only the Austrian veto which had prevented Italy from occupying Chios and Lesbos as well.

A convention was, however, made between M. Veniselos and Senator Tittoni (then Foreign Minister) on July 29 1919, which was to have simultaneous effect with the subsequent Treaty of Sèvres, and which ceded 12 of the islands to Greece, and provided that Rhodes, the thirteenth, should have "a wide local autonomy." A further treaty was signed on Aug. 10 1920 by M. Veniselos and Count Bonin at Sèvres. It confirmed the above, and added that Rhodes should, 15 years later, become Greek also if Great Britain should have ceded Cyprus to Greece, and a Rhodian plebiscite, held under the supervision of the League of Nations, should have decided for union. Meanwhile Italy pledged herself to give to the islands within two months a "wide local autonomy."

In 1922, however, Senator Tittoni's successor, Count Sforza, denounced these agreements on the ground that circumstances had changed, and the fall of M. Veniselos strengthened the determination of the Italians to remain, despite Lord Curzon's stiff note of Oct. 15 1922, intimating that the cession of Jubaland by Great Britain to Italy was conditional upon the Italian settlement of the question of the Dodecanese with Greece. This position was, however, abandoned by Mr. Ramsay MacDonald, Lord Curzon's successor. Meanwhile the Treaty of Sèvres had formally assigned the Dodecanese to Italy, which by article 15 of the second Treaty of Lausanne not only obtained the recognition by Turkey of her full sovereignty over "the 13 islands" but also the ratification of her occupation (during the World War) of Castellorizo.

The Metropolitan of Rhodes was expelled in 1921, and, after an exile of three years, was allowed to return and remain only on condition that he severed his connection with the Oecumenical Patriarch. The Italian plan was to create an autocephalous church for the Dodecanese on the mistaken precedent of Cyprus, which was ecclesiastically autocephalous many centuries before the British occupation. The death of the Patriarch, however, prevented the execution of this arrangement, which would have been uncanonical without his consent and contrary to the example of Protestant England in the Ionian Islands and of Catholic Austria in Bosnia and Hercegovina.

Another regulation in 1925 compelled all inhabitants of the Dodecanese to take Italian nationality, although, with the exceptions of the Moslems and Jews in Rhodes, they are all practically of Greek race. Latterly negotiations have gone on between the Italian Legation in Athens and a leading Dodecanesian, but with no result, whereas the fortification of Leros as a naval base and the establishment of a university at Rhodes point to the permanence of the Italian occupation, which is the chief obstacle to Greco-Italian friendship. The islands, with the exception of the sponge-fishing industry of Kalymnos and Symē, have small economic value, and the prohibition of sponge-fishing off the north coast of Africa by the Italians in 1916, since withdrawn, not only injured the islands economically but also diminished their population, now only about 80,000, by emigration. Besides, however, the strategic importance of Leros in view of possible Italian expansion in Asia Minor, Astypalaia has two harbours.

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(W. Mi.)

DOGGER BANK, BATTLE OF THE.—This naval action of the World War was fought near the Dogger Bank in the North Sea on Jan. 24 1915, between British and German battle-cruisers.

Reports from America at this time had led the Germans to think that a plan for blocking their harbours was afoot and Rear-Adml. Hipper was despatched at nightfall on Jan. 23 to reconnoitre off the Dogger Bank. His force consisted of four battle-cruisers of the 1st scouting group, "Seydlitz" (flag), "Derfflinger," "Moltke" and "Blücher," with four light cruisers and 19 destroyers. Before the ships left the Jade, their strength and intentions had been revealed by their own wireless and Vice-Adml. Beatty left the Forth to intercept them at 6 P.M. on the 23rd. With him were the five battle-cruisers of the 1st and 2nd Battle Cruiser Squadrons, the "Lion" (flag), "Tiger," "Princess Royal," "New Zealand" and "Indomitable," and the four light cruisers of the 1st Light Cruiser Squadron under Comm. W. E. Goodenough in the "Southampton." He was to proceed to a rendezvous in lat. 55 deg. 13 min. north, long. 3 deg. 12 min. east, 180 m. from Heligoland, where he was to meet Comm. Tyrwhitt with three light cruisers and 30 destroyers of the Harwich force. The 3rd Battle Squadron, of seven "King Edwards," left Rosyth and Admiral Jellicoe put to sea from Scapa with the battle-fleet at 9 P.M. In heavy guns Beatty's force was decidedly superior, mounting 24 13·5 in. and 16 12 in. against Hipper's 8 12 in., 20 11 in., and 16 8·2 in.

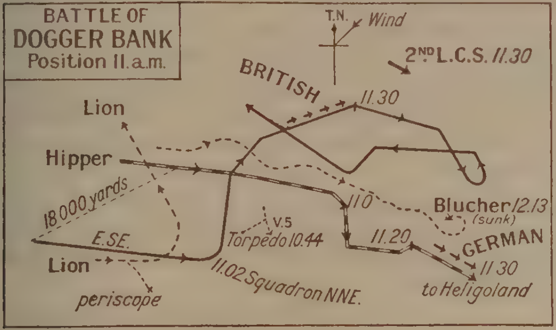

Fig. 1.

The Fight Begins.—Beatty reached the rendezvous at 7 A.M. It was a crisp winter morning with a calm sea and good visibility. The battle cruisers were in single line ahead with Goodenough's light cruisers two miles on the port bow. Course was then altered to south by west at 18 knots. Ten minutes later "Arethusa," Tyrwhitt's flagship, was sighted southeast about seven miles on the port bow. She had hardly been identified when the flash of guns was seen to the south-south-east. "Aurora," some 15 m. behind Tyrwhitt, had met and engaged the German light cruiser "Kolberg," on the port bow of Hipper's squadron coming from the southeast. Each received a couple of hits and "Kolberg" retired at 7.25 A.M.

At the sound of the guns, Beatty ordered the light cruisers to chase to south. "Southampton" had barely gone two miles when she sighted "Aurora" on her starboard bow and, a few minutes later, German battle-cruisers on the port bow to the southeast. Dense clouds of smoke were pouring from their funnels and they were evidently raising steam for full speed. It was then 7.50 A.M. Beatty's appearance had come on Hipper as a surprise and, turning to the southeast, the latter ran for home.

Pursuit of the Germans.—At 8.30 A.M. Beatty's position was lat. 54 deg. 50 min. north, long. 3 deg. 40 min. east, and the two had settled down to the long rush for Heligoland, 140 m. away. The British battle-cruisers were in single line ahead on a southeast by south course, working up to full speed. Hipper was 11 m. sharp on "Lion's" port bow, in full flight on a south-south-east course. In speed Beatty's squadron had a decided superiority. It was able to maintain a seagoing speed of 26 knots, while Hipper was limited at first to 23 or 24. At 8.52, when the range of "Blücher" had come down to 22,000 yd., "Lion" opened fire and at 9.05 hoisted the signal to engage. The German battle-cruisers were then forming a line of bearing to port. At 9.09 Hipper opened fire as "Lion" scored her first hit on "Blücher."

The action ran on to the southeast with the range gradually decreasing, but it was not till 9.28 that the Germans scored their first hit on "Lion," sending an 11-in. shell through her waterline aft. At 9.43 a 13·5-in. shell crashed through the quarter deck of "Seydlitz," penetrated the after turret and exploding inside set fire to the charges in the working chamber. The flames went roaring through the turret, passed through a small door into the adjoining one, set fire to the charges there and, wrapping both turrets in a sea of flame, slew at a stroke every man inside. "Blücher" was having trouble with her engines at this time and about 10 A.M. drew out of the line, going heavily.

At 10.22 Beatty, to bring the rear of his line into action, ordered the battle-cruisers to form on a line of bearing north-north-west and to proceed at utmost speed. "Lion" had eased to 24 knots to let the ships in the rear come up, and, as the enemy had turned slightly away, the range was increasing. At 10.30 a salvo fell on "Blücher"; a shell penetrated the central ammunition passage, set fire to the cartridges and sent a sheet of flame through the fore turrets. The main steam pipe was damaged, her speed came down to 17 knots and she gradually dropped behind, enveloped in smoke.

"Lion" out of Action.—But "Lion," too, had been badly hit at 10.35 at a range of 16,400 yd. and at 10.45 she was beginning to lose speed. Beatty then made a signal to close the enemy as rapidly as possible, keeping all guns bearing, but in the smoke of battle it failed to get through. About 10.50 she received a hit on the port side aft, which holed the feed tank and brought the port engines to a stop. The wash of what was thought to be a periscope was seen on the starboard bow, possibly a torpedo fired by V5 at 10.44, and Beatty made a signal to alter course eight points to port. This was hauled down at 11.02 and the squadron turned to north-north-east.

But "Lion" could no longer lead it. Her wireless was out of action, electric power had failed for a time and she had fallen out of the line. The squadron drew away to the northward, with Rear-Adml. Moore, the second in command, in "New Zealand" some distance in rear. To resume the chase Beatty ordered three signals to be made; the compass signal "course northeast"; "attack the rear of the enemy," and a third "keep nearer the enemy," but only the first two were received by Moore, and he unfortunately read them as an order to attack "Blücher," which was then bearing roughly northeast. Hipper at 11 A.M. turned to the southward with his broadside bearing for 12 min.

at a range of 16,500 yd. and obtained seven hits on "Tiger." He signalled to his destroyers to attack, but the British turn to the north had robbed them of any chance of success.

At 11:12 Hipper turned to east-south-east and drew rapidly out of range. The British battle-cruisers were then sending shot after shot into "Blücher" whose fate was sealed. At 11:38 "Arethusa" came up and fired two torpedoes into her. She ceased firing, listing heavily with fires raging fore and aft, and sank at 12:13. Hipper was already some 15 m. off and at 11:52 Moore made a signal to form single line ahead and steer west.

Beatty by this time had transferred his flag to "Attack" and was racing after his squadron. He reached "Princess Royal" at 12:30 and hoisted his flag, but pursuit was then hopeless. A warning was received of the approach of the High Sea Fleet, and at 12:45 P.M. the squadron turned back. Hipper made for home and got in touch with the High Sea Fleet about 2:30 P.M. "Blücher" had been lost, "Seydlitz" seriously damaged and "Derfflinger" hit. On the British side "Lion" had been put out of action and "Tiger" damaged.

Adml. Jellicoe with the battle-fleet met Beatty at 4:30 P.M. "Lion" was taken in tow by "Indomitable" and, screened by light cruisers and destroyers, reached Rosyth safely the next morning. On the British side the result was regarded as disappointing, but it must be remembered that, with the exception of "Blücher," the enemy's speed was not seriously diminished when the action was broken off.

The forces engaged were as follows:

BRITISH

1st Battle Cruiser Squadron.
"Lion" (flag), Vice-Adml. Sir David Beatty, Capt. Alfred Chatfield, 28 knots.
"Princess Royal," Capt. Osmond de B. Brock, 28 knots.
"Tiger," Capt. Henry B. Pelly, 30 knots.
Armament 8 13·5-in., 16 4-in. ("Tiger" 16 6-inch).
2nd Battle Cruiser Squadron.
"New Zealand" (flag), Rear-Adml. Sir Archibald Moore, Capt. Lionel Halsey, 25 knots.
"Indomitable," Capt. Francis W. Kennedy, 25 knots.
Armament 8 12-in., 16 4-inch.
1st Light Cruiser Squadron.
"Southampton," Comm. W. E. Goodenough, Comm. E. A. Rushton.
"Birmingham," Capt. Arthur A. Duff.
"Nottingham," Capt. Charles B. Miller.
"Lowestoft," Capt. Theobald W. Kennedy.
Armament 9 6-in., "Southampton" 8 6-in., 25·5 knots.
Harwich Flotillas.
"Arethusa," Comm. Reginald Tyrwhitt.
10th Flotilla: "Meteor" (Comm. Hon. Herbert Mead), "Miranda," "Milne," "Mentor," "Mastiff," "Minos," "Morris," speed 34 knots.
3rd Flotilla: "Undaunted" (Capt. Francis St. John), "Lookout," "Lysander," "Landrail," "Laurel," "Liberty," "Laertes," "Lucifer," "Lawford," "Lydia," "Louis," "Legion," "Lark," speed 29 knots.
1st Flotilla: "Aurora" (Capt. Wilmot S. Nicholson), "Acheron," "Attack," "Hydra," "Ariel," "Forester," "Defender," "Druid," "Hornet," "Tigress," "Sandfly," "Jackal," "Goshawk," "Phoenix," "Lapwing," speed 27 knots.

GERMAN

1st Scouting Group.
"Seydlitz," Rear-Adml. Hipper, 10 11-in., 12 5·9 in., 26·5 knots.
"Derfflinger," 8 12-in., 12 5·9-in., 26·5 knots.
"Moltke," 10 11-in., 12 5·9-in., 25 knots.
"Blücher," 12 8·2-in., 8 5·9-in., 24 knots.
2nd Scouting Group.
"Graudenz," "Stralsund," "Kolberg," "Rostock."

Casualties.—"Blücher," which sank, received about 40 hits and 2 torpedoes, had 792 of her crew killed, 45 wounded and 189 taken prisoner. "Seydlitz" sustained 3 hits, had 159 killed and 33 wounded. "Derfflinger" was only hit once, and "Kolberg" twice, the latter having 3 killed and 2 wounded.

On the British side "Lion" was put out of action with 12 hits; 1 killed and 20 wounded. "Tiger" received 7 hits, having 10 killed and 11 wounded; "Aurora" received 2 hits and "Meteor" sustained 1 hit, with 4 killed and 1 wounded. The British fired 1,154 rounds of heavy gun ammunition, of which 708 were armour-piercing shell, 77 common, 365 high explosive and 4 shrapnel. The Germans fired 976 rounds from their heavy guns.

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DOHERTY, CHARLES JOSEPH (1855–), Canadian politician, was born at Montreal May 11 1855 and educated at McGill University. Called to the Quebec bar in 1877, he became a Q.C. in 1887 and a puisne judge of the Superior Court of Quebec in 1891. He was first elected to the House of Commons as a Conservative member for the St. Anne's Division of Montreal in 1908 and became Minister of Justice in Sir Robert Borden's Govt. in 1911. He joined the Unionist Govt. in Dec. 1917 and, as acting Prime Minister and Minister of Justice, he had the difficult task of administering the Military Service Act. In 1918 he accompanied the Prime Minister to the Peace Conference at Paris, and in 1920 was one of the Canadian representatives at the League of Nations. He was appointed to the Privy Council, London, in the same year.

DOHNÁNYI, ERNST VON (1877–), Hungarian composer, pianist and conductor, was born at Bratislava (Pressburg) on July 27 1877. He studied at the Budapest Musical Academy, and was for some time a pupil of Eugen d'Albert. He attracted notice by his first piano quintette as early as 1895. He was appointed professor of piano at the state academies for music of Berlin and Budapest and was for a time director of the latter. He became conductor of the Philharmonic orchestra of Budapest, and conducted with notable success in the United States. The style of his compositions is conservative and carries on the romantic traditions of the 19th century. Among his principal works may be mentioned *The Veil of Pierrette* (pantomime); *Aunt Simona* (comic opera, 1912); *The Castle of Woijwoden* and *The Tenor* (operas); also orchestra and chamber music and songs.

DOLLAR STABILISATION.—Under the existing currency system, the so-called "level of prices" is largely at the mercy of monetary and credit conditions. The purchasing power of money has always been unstable, because a unit of money, as at present determined, is not a unit of purchasing power but only a unit containing a certain weight of gold or silver. Other units—the yard, pound, bushel, etc.—were once as unstable as monetary units, but, one after another, they have all been stabilised or standardised. Short weights and measures cheat the buyer; long weights, the seller. So a unit of money which changes in value or purchasing power is always playing havoc between contracting parties. The following table shows how the level of prices and the purchasing power of the dollar have fluctuated in the past half century, according to Prof. Irving Fisher's index number of wholesale prices.

	Index Number of Prices in % of pre-War, *i.e.*, 1913 = 100 %	Purchasing Power of the Dollar in pre-Warcents, *i.e.*, 1913 = 100 %
1860	96	105
1865 (high)	205	49
1896 (low)	66	152
1913	100	100
1920, May (high)	247	40·5
1922, Jan. (low)	138	72·5
1923, April (high)	167·0	59·9
Dec. (low)	150·6	66·4
1924, June (low)	143·1	69·9
Dec. (high)	155·9	64·1
1925, Feb. (high)	162·6	61·5
April (low)	156·4	63·9
1926, First quarter avg.	156·3	64·0
April avg.	150·9	66·3
May, 1st week	151·2	66·2
2nd week	152·3	65·7

An Unsatisfactory System.—When prices are rising, *i.e.*, when the purchasing power of the dollar is falling, creditors and recipients of fixed incomes suffer injustice. The sufferers include savings-bank depositors, bondholders and salaried classes. On the other hand, when prices fall, it is other classes, such as debtors, stockholders, farmers and independent business men generally, which suffer. The indirect effects of falling or rising prices, *i.e.*, of a rising or falling dollar, are equally bad. These indirect effects include industrial discontent, due either to the high cost of living or to unemployment and economic crises.

Hitherto there was ample excuse for the unstable monetary units of various countries, in that no instrument for measuring their aberrations had been devised. Likewise, until weighing scales were invented weights could not be standardised, and until instruments for measuring electrical magnitudes were invented, electrical units could not be standardised. But for some 10 years the index number of prices has provided a fairly accurate instrument for measuring the value of the dollar in terms of its power to purchase goods. An index number of prices is a figure which shows, for a specific period of time or on a specific date, the average percentage increase or decrease of prices. One of the most suggestive signs of the times is that this instrument for measuring changes in the purchasing power of money has been utilised in adjusting wages and salaries to the cost of living, and a number of industrial and financial concerns, and some private and official agencies, have amended wages on the basis of an index number of the prices of commodities. The principle was also employed in adjusting the terms of the Dawes Settlement for Germany, and in connection with at least one bond issue, that of the Rand Kardex Co., and one lease contract.

It has been contended by some economists that this principle may be utilised more generally in the future to safeguard the parties to agreements made at one date to pay money at another date. Such corrections would gradually break down the popular superstition that "a dollar is a dollar," for every time the dollar is corrected it is convicted of needing corrections; ultimately the correction might be applied, not, as at present, as a patch on the dollar from the outside, but by incorporating it in the dollar itself. Various methods for this have been proposed.

A Suggested Remedy.—The one perhaps best known is Prof. Irving Fisher's proposal to vary the weight of the gold dollar so as to keep its purchasing power invariable. Instead of a gold dollar of constant weight and fineness and varying purchasing power, what is needed, he contends, is a dollar of constant purchasing power, and, therefore, of varying weight. It is not proposed, of course, to remint gold coins, but simply to count an ounce of fine gold as being the equivalent, not always of $20·67 (as at present), but of as much more or less than that sum as is required from time to time to keep the purchasing power of the dollar constant. In other words, the proposal is to vary the price of gold according to its worth relative to other commodities, instead of, as at present, keeping it artificially constant at $20·67 an oz. pure, or £3 17s. 10½d. an oz. $^{11}/_{12}$ fine.

Thus, if Mexico should adopt the monetary unit of the United States, instead of its present unit containing half the weight of gold in the United States dollar, the price level in Mexico, other things being equal, would be halved. Again, if the United States should adopt the Mexican dollar as its monetary unit, the price level in the United States would be doubled—that is, the buying power of the dollar varies with the amount of gold in it. If this principle be admitted, Prof. Fisher contends that it follows that the dollar's buying power—that is, the level of prices—can be controlled. It can be kept from changing greatly just as easily as it could be made to change by periodical adjustments of the price of gold, each adjustment being made in accordance with the index numbers of prices. By this method, in conjunction with a sound banking system, Prof. Fisher contends that variations of more than one or two per cent could easily be prevented, except under the most extraordinary conditions.

It is also highly desirable that co-operation in the shape of credit control should exist in banking systems. This of itself can be an effective method of stabilising the dollar without any gold adjustments so long as there is a superabundant reserve of gold kept out of use. This method of control is already being practised by the Federal Reserve System and by the Bank of England, in accordance with the recommendations of the Genoa Economic Conference of 1922. This should prepare the way for a more complete stabilisation later. When a superabundance of gold no longer exists, deflation may become imminent unless the number of gold dollars can be increased by a reduction in the gold weight of the individual dollar. (*See* CURRENCY; INDEX NUMBERS.) (I. F.)

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DOMESTIC APPLIANCES: *see* HOUSEHOLD APPLIANCES.

DOMINICAN REPUBLIC: *see* SANTO DOMINGO.

DONALDSON, SIR JAMES (1831–1915), British scholar (*see* 8.406), died at St. Andrews, Scotland, March 9 1915.

DOUGHERTY, DENNIS J. (1865–), American Roman Catholic divine, was born at Girardville, Pa., Aug. 16 1865. He studied at St. Mary's College, Montreal, and the American College, Rome, and was ordained priest in 1890. After being connected with St. Charles' Seminary, Overbrook, Pa., for 12 years, he became Bishop of Nueva Segovia in the Philippine Is. in 1903, and later Bishop of Jaro. He was appointed Bishop of Buffalo, N.Y., in 1915 and in 1918 was made Archbishop of Philadelphia and metropolitan of Pennsylvania. He was created cardinal priest by Pope Benedict XV. in 1921, taking over the titular church of St. Nereus and Achilleus at Rome.

DOUGHERTY, PAUL (1877–), American painter, was born at Brooklyn, N. Y., Sept. 6 1877. He was educated at the Brooklyn Polytechnic Institute and the New York Law School, where he took the degree of LL.B. in 1898. He then spent five years in Europe, devoting himself to the study of art, and his first picture was exhibited at the Paris Salon in 1901. He was chiefly concerned with marine subjects, in which he achieved great success, being awarded the Osborne Prize (1905), the Innes Gold Medal and the Carnegie Prize, National Academy of Design (1913), the gold medal at the San Francisco Exposition (1915), and the Altman Prize (1918). Among his more important pictures are "October Seas," "The Road to Cayey," and "Lake Louise," in the Metropolitan Museum, New York City; "The Land and the Sea," in the Corcoran Gallery, Washington; "Flood Tide," in the Carnegie Institute, Pittsburgh; "Moonlight Cove," in the Toledo Museum; "Sun and Storm," in the National Gallery, Washington; and "A Freshening Gale," in the Albright Art Gallery, Buffalo.

DOUGHTY, CHARLES MONTAGU (1843–1926), British traveller and writer (*see* 2.257) younger son of Rev. C. M. Doughty of Theberton Hall, Suffolk, was born on Aug. 19 1843. Prevented by an impediment in speech from entering the navy, his education was continued at King's College, London, and at Caius and Downing Colleges, Cambridge, where he graduated in natural science in 1865. He turned then to independent travel and study, freely adventuring in his chosen fields of geology, archaeology and philology. And he did so in no half-hearted way: in Norway, Oxford, Leyden, Louvain, Italy, Spain, North Africa and Greece he served a long novitiate in wandering and scholarship which led him at last to Syria, Palestine and his adventures in Arabia.

In Nov. 1876 Doughty set out from Damascus with a pilgrim caravan. At Madâin Sâlih he left the Haj, and surveyed the Al Hajar monuments and inscriptions. He then decided to reach independently the oasis of Khaibar, and to this end attached himself to wandering Bedouins. Dependent on their movements, his dangers were now multiplied and his life was repeatedly endangered by the inevitable suspicion, fanaticism and treachery which on occasion broke through the respect and hospitality which Doughty's courageous personality compelled. He reached Khaibar from Taima in the summer of 1877, was sent back to Hail, thence to Al Qasim, Buraida and 'Anaiza. From there, after some months, he travelled southwards towards Mecca and reached safety at Jidda in Aug. 1878. The story of this great journey, which threw many fresh lights on the geology, hydrography and ethnology of Arabia, Doughty told in *Travels in Arabia Deserta*, published in 1888. The book was the fruit of a literary labour hardly less arduous than the journey whereof it treated. Doughty was less concerned to produce a chronicle or work of information than to create, out of his unique experience, an unique monument of what he considered pure English prose. To him, this meant the achievement of an Elizabethan directness of utterance and the renunciation of all post-Elizabethan growths in syntax and vocabulary. He succeeded. His profound literary sense had told him aright when it inspired him to treat his remote and lonely adventuring in this bare, majestic style.

The later years of Doughty's life, mostly spent in England, were given over to poetry. Essentially, indeed, he was always a poet, in his deep comprehension of the values of words no less than in his power of penetrating into the living past, whether of a country's physical structure or of its people and their life. Fourteen years' labour produced his epic, *The Dawn in Britain* (1907), his other long poems and poetic dramas including *The Cliffs* (1909), *The Clouds* (1912), *The Titans* (1916) and *Man-soul* (1920). Like *Arabia Deserta*, the poems he wrote reflect his Elizabethan predilections. He died at Sissinghurst, Kent, Jan. 20 1926. (H. Mi.)

DOUMER, PAUL (1857–), French politician, (*see* 8.450), returned to active politics in 1912 as Senator for Corsica. In 1917 he was a Secretary of State in the Painlevé Cabinet. In the Briand Cabinets of Jan. 1921—Jan. 1922 and Dec. 1925—March 1926, he was Minister of Finance.

DOUMERGUE, GASTON (1863–), French politician, was born at Aigues-Vives on Aug. 1 1863, and was educated at the lycée at Nîmes. He studied law, became a barrister, and, after holding magisterial appointments in Cochin China and Algiers, was elected deputy for Nîmes in 1893. In the Chamber he spoke with authority on colonial questions and from 1902 to 1905 was Minister for the Colonies in the Combes Government. When this administration fell, he was elected vice-president of the Chamber. In 1906 he was Minister of Commerce in the Sarrien Cabinet, retaining his portfolio in the succeeding Clemenceau Government. When M. Clemenceau reconstituted his Cabinet, M. Doumergue became Minister of Education and held the same post in the following Briand Ministry which lasted from July 1909 to Nov. 1910. In the latter year he became Senator for the Gard Department and attracted notice by his strong advocacy of the Three Years' Military Service Bill.

On the fall of M. Barthou's administration in Dec. 1913, M. Doumergue formed a Cabinet in which he himself took charge of Foreign Affairs. He was forced to resign, however, after the general elections of May 1914, which resulted in a majority in the Chamber opposed to the Three Years' Military Service law. On the outbreak of the World War he again became Minister for the Colonies in the Viviani Govt. of national defence. In 1917 he left the Government, and was sent on a mission of inquiry into conditions in Russia. On his return he re-entered the Senate. After the resignation of M. Léon Bourgeois on Feb. 22 1923, M. Doumergue was elected to succeed him as President of the Senate, and after his inauguration he made it clear that he supported the policy of M. Poincaré with regard to Germany and the Ruhr. On June 13 1924 he was elected President of the Republic by the French National Congress on the first ballot, securing 515 votes to M. Painlevé's 309.

DOVER, England (*see* 8.453), had a population in 1921 of 39,985, estimated in 1923 at 40,740. The municipal boundaries were extended in 1921, bringing the area of the borough up to 20,620 acres. Two new churches have been built, Charlton Church and St. Barnabas, and the remains of the tiny church of the Knights Templars on the western heights restored. Remains of a 12th-century church were found during alterations to the Shakespeare Hotel in 1924. In that year part of the ancient Archcliffe Fort was sold to the Southern Railway by the War Office. The Connaught Barracks near the Castle were finished in 1915. The War Memorial adjoins the old Maison Dieu, part of the municipal buildings, and an obelisk in memory of the Dover Patrol has been erected on the cliffs above St. Margaret's Bay. A bell taken from Antwerp by the Germans and used as an air-raid warning at Zeebrugge was presented to Dover by the King of the Belgians after the War and hung in a turret outside the Town Hall. Parliamentary sanction has been obtained for building a road up the East Cliff and along the cliffs to St. Margaret's Bay, with a light railway.

The Dover Harbour scheme, including the reclamation of about 11 ac. to the east of the Admiralty pier to provide a new marine station and a number of additional berths, was carried out in time to be of service during the World War. Silting has taken place in the harbour, primarily due to the sinking of a vessel during the War. This has prevented the calling of large liners sailing between Hamburg and America; but work in contemplation will enable these services to be resumed. In 1919 the naval base at Dover was given up, and in 1923 the Admiralty Harbour was transferred to the Harbour Board for commercial use. In 1925 plans were being considered for another large dock at the east end, and a landing stage the whole length of the Admiralty pier. The Channel-Tunnel scheme was vetoed by the Committee of Imperial Defence in 1924.

During the earlier part of the War numbers of barges were towed across the Channel from Dover, and taken by the French canals to depôts near the firing line. Some 180 bombs were dropped on Dover during the War, and in 1918 it was bombarded by a German submarine; 14 people were killed and about £30,000 of damage was done. (O. J. R. H.)

DOWDEN, EDWARD (1843–1913), British writer (*see* 8.456), died in Dublin April 4 1913. His *Letters*, edited by E. D. and H. M. Dowden, appeared in 1914.

DRAMA (*see* 8.475).—The period 1910–25 was one of paramount importance in the history of the drama and of the theatre, both in Europe and in America. In those 15 years the theatre passed through several grave vicissitudes. It rose and fell and rose again. The revolution made by Ibsen had become almost a convention, and a most diversified drama was everywhere being performed, except in France, where the theatre in every respect remained unaffected by the march of events.

A General Survey

Dramatists were tiring of old themes and were assiduously searching for new ones. They were not any longer content to repeat worn stories in worn words, but were striving to extend the range of their interest and thought. Old machinery was either being repaired or broken. The method of producing a play, whereby the actor was largely left to his own devices, was being replaced by a new method, whereby the actor was directed in every detail of his performance by a "producer," who professed to interpret the play in accordance with the intentions of the author. Attempts were made, with success, to obtain balanced performances by moderating the transports of the "star" system, under which balance and nearly everything else were sacrificed to the vanity of the principal performer. New sorts of scenery were invented, some of which were effective and beautiful, many of which were neither one nor the other, and "production" became, for a time, more important than the play itself or the performance.

Reformers were often excessively zealous, and in their impatience with obsolete machines were rash enough to destroy them before they had properly installed new ones or mastered their technicalities or, more important, perhaps, made the public accustomed to them. Audiences which had been nourished on *East Lynne* and *The Lights of London* and "actor-managered" Shakespeare suddenly found their diet changed to *The Tragedy of Nan* and *The Doctor's Dilemma* and Shakespeare done in his entirety before curtains of a dismal hue. Lovers of musical comedy and melodrama were invited to transfer their affections to Sophocles and Ibsen and Strindberg and John Galsworthy and Bernard Shaw. In the consequent confusion of mind, tempers and money were lost; the reformers became more scornfully didactic and educative and professorial; and the modest multitudes, obstinately resolved not to be improved by anybody, departed to the music-halls and the cinemas. Nevertheless, improvement was made. In England, the long and valuable dominion over the theatre held by Sir Arthur Pinero and Henry Arthur Jones yielded to the different dominion of George Bernard Shaw and John Galsworthy. Conservative managers received original work with less hesitation and hostility than had formerly been their habit. There even were managers who encouraged the revolutionaries.

The Influence of Moscow.—In Russia, the theatre had been reformed in a singular and successful manner. The activities of a band of amateur actors and actresses, performing at first in a barn on a country estate and afterwards in any available hall, culminated in the establishment of the Moscow Art Theatre by Constantin Stanislavsky and Vladimir Nemirovich-Danchenko, of which a most valuable account is given in Stanislavsky's book, *My Life in Art.* This theatre resembled many others that were widely influential—for example the Abbey Theatre in Dublin and the Theatre Guild of New York—in this respect, that it was founded by lovers of the theatre who were technically entitled to be called amateurs. There was not a professional man of the theatre among them. None of them had any "practical" experience of management or production, or acting. Their chief assets were enthusiasm and malleable minds. They had hardly any money and were often in danger of dissolution through debt. "Practical" men of the theatre openly derided them, but in the end it was the "practical" men who either were ruined or had to surrender to the inexperienced amateurs. The "practical" men were found to be living on the experience of others, whereas the amateurs were busy making experience for themselves.

The Moscow Art Theatre has profoundly influenced the theatre throughout the world. It changed the theatre in Russia. The old, rhetorical style of acting quickly gave place to the new and veracious style, called naturalistic acting. There was even a tendency to be over-natural: actors forgot that acting is not an exhibition of ordinary behaviour, but an intensified representation of ordinary behaviour—life, as it were, shown under a magnifying-glass. The old sin was excess: the new sin was insufficiency. Formerly the actor ranted and roared; now he mumbled and whispered. Over-emphasis was replaced by under-statement, and mechanically neat performances gave way to slovenly ones. These were faults which endangered the new theatre, but they were detected in time to be corrected. Producers still try to treat the actor as a puppet to be directed in every detail of his performance, but that, too, is a fault which is less common than it was in the first days of the revolution.

The Moscow Art Theatre had an indirect influence on the English theatre. It was in its turn brought under English influence. Acting in England became steadily more natural and easy until it was made into a nearly perfect instrument for the performance of polished comedy. Testimony everywhere was unanimous that English actors had an assurance in comedy far beyond that of any other actors. This ease, however, made them less capable of acting in tragic or poetic plays, and a result of it was that a demand for light and pleasant pieces dealing with the customs and manners of the upper classes was made by managers, and the note of the English theatre became in time predominantly that of agreeable and accomplished comedy. That was not the effect of naturalistic acting in Russia where the comedy, when there was any at all, became introspective and perturbed.

The Influence of Chekhov.—Out of the storm made by the Moscow Art Theatre came the figure of Anton Chekhov (*q.v.*) to be the master that others should follow; but his laughter was so acrid and his satire so terribly and uncompromisingly true that he is still considered to be pessimistic and gloomy. If naturalistic acting in England resolved itself more and more into a drawing-room entertainment in which expensively dressed people lived and ate and idled in an expensive manner, it resolved itself in Russia into a painful foreboding about the future until every realist seemed to be a prophet of woe and disaster. This bitter satire was, oddly enough, observable in Ireland where the dramatists became more and more acutely critical of their countrymen as their countrymen became more secure and prosperous until at last, after the establishment of the Irish Free State, a dramatist, Mr. Sean O'Casey, arose from the ranks of Dublin working-men and poured out the common feeling in profuse strains of premeditated bitterness and disillusionment. One could make a comparison between the Irish and the Russian people which would show them to be remarkably alike in many respects, and Mr. O'Casey's plays, *The Shadow of a Gunman* and *Juno and the Paycock*, would support the comparison. The manner of Mr. O'Casey, making allowance for differences of habit and local circumstances, resembles the manner of Chekhov. Each is a humorist who surveys the human scene with such fidelity to fact that he seems to be in irredeemable despair. There is laughter in their work, but it is laughter that is full of pain.

Reinhardt and Gordon Craig.—In America, the theatre was a cauldron wherein was boiled the drama of Europe in the hope that something American might emerge. In Germany, the drama was mainly a matter of grouping and lighting and experimental acting. People talked less of Gerhardt Hauptmann and Hermann Sudermann than they did of Max Reinhardt. Reinhardt, of whom there is an excellent account in *Reinhardt und seine Bühne*, by Ernst Stern and Heinz Herald (Berlin), derives, as indeed do nearly all the revolutionary producers and scenic artists, from Edward Gordon Craig, the son of Ellen Terry. Craig has been less fortunate in finding opportunities to work in the theatre than his followers, but he has profoundly affected the work of the theatre everywhere. Reinhardt is his greatest and best-known disciple. One of the most impressive productions made by the Moscow Art Theatre was Craig's production of *Hamlet* in 1911. It was full of the faults that seem to be associated with all Mr. Craig's work, due mainly to a wilful disregard of the limitations of material things, but it undoubtedly impressed all who saw it by its beauty. In England, Craig's influence is widely felt and acknowledged. Decorative artists, such as Norman Wilkinson, Claude Lovat Fraser (d. June 18 1921), Hugo Rumbold, Charles Ricketts, Albert Rutherston, George Sheringham, derive from him, as do producers such as Harley Granville-Barker, Nigel Playfair, James Bernard Fagan and Basil Dean. His authority is freely acknowledged in America, among others by Lee Simonson, Robert Edmond Jones and Rollo Peters, although in that country a later school of producers, infected by the opinions of the German Expressionists who rose to authority after the end of the World War has arisen. These may be called neo-Craigians. The work of these artists and producers will be considered later. It is now mentioned only because of the importance attached to it during the period under review in Germany.

GREAT BRITAIN AND IRELAND

In Great Britain, the period under survey was perhaps one of greater change than in any other country. Apart from the temporary, but substantial effect of the World War, other causes of wide influence profoundly affected both the drama as a part of literature and the theatre as a commercial organisation during that period. In the United Kingdom great changes in the constitution of theatrical enterprises were brought about abruptly and almost catastrophically. The government of the theatre by actor-managers ceased with dramatic suddenness and was replaced by the government of syndicates concerned primarily, if not exclusively, with the production of large profits quickly returned. In those theatres where the actor-manager was not replaced by a commercially minded syndicate, his place was taken by what may be called the producer-manager.

The three great actor-managers of the English theatre, Sir Herbert Beerbohm Tree, Sir George Alexander and Sir Charles Wyndham, did not outlive their reign; the era of the actor-manager ended simultaneously with their decease. Tree died July 2 1917; Alexander March 16 1918 and Wyndham Jan. 12 1919. In 18 months the actor-managerial system, which had been immensely powerful, was in ruins, and its chief protagonists, men of ability and taste, were dead, spared from the humiliation of neglect and supersession. It was a system undeniably disadvantageous to the drama as an art, since it tended to make the play subordinate to the player and restricted many dramatists to the production of plays with good parts for particular persons, but there is no doubt that the actor-managers, especially the three named, were possessed of ambition and much taste and that they worked successfully to restore dignity to the theatre. They were directly associated with many of the most interesting plays that were written during their reign, and Tree, Alexander and Wyndham could claim exemption from the charge so frequently and justly brought against Irving, of doing nothing whatever to encourage the work of meritable modern English dramatists. Sir Herbert Tree's annual Shakespearean festival held often at grave financial disadvantage to himself, was a real tribute to taste and culture, despite the serious complaints fairly made about his methods of production. Sir George Alexander, more than anyone else, made the way to the stage easy for the writer of distinguished comedy and was chiefly responsible for the career as a dramatist of Oscar Wilde. Sir Charles Wyndham, less consistently ambitious than his colleagues, followed an honourable tradition and was responsible for the redemption of farce from buffoonery.

The decline and fall of the actor-managerial system coincided with the disappearance from the centre of London of the older type of music-hall and with the great growth in popularity of the cinema, or picture-palace, or " movies." Almost all of the London suburban theatres and many of the provincial theatres, especially in small towns, became picture-palaces. A variety of reasons caused this change to take place, some of which were financial and others connected with altered taste. The cinemas were at once cheaper and more comfortable than the theatres and they offered a more consistently attractive programme. The inhabitants of a London suburb or a small provincial town were able to see as good a film at the local cinema as could be seen in a cinema in the centre of London, but they could not hope to see a play performed at the local theatre by a company as capable as that acting in the same play in the West End.

Adverse Effect of the War.—The situation, then, at the outbreak of the World War was one of extraordinary interest in the English theatre. The theatrical season 1913–4 had closed with considerable brilliance. Plays of merit had been extensively performed in London and in the provinces, and the repertory theatres were in a fairly healthy condition. A rich level of acting had been discovered. Production was on a genuinely artistic scale. The season of 1914–5 seemed likely to open still more brilliantly than the season just concluded. There was even talk of a national theatre at which the plays of Shakespeare would be permanently performed. On Aug. 4 1914 Great Britain declared war against Germany and immediately the great revival of the English theatre languished and seemed at first in danger of total collapse. Many of the repertory theatres soon ceased to exist. In 1921 the Gaiety Theatre, Manchester, passed from the hands of Miss Horniman to a cinema syndicate. A gallant effort to maintain a decent standard of plays was made by some managers; Sir Herbert Tree revived L. N. Parker's pageant piece, *Drake*, and Mr. (now Sir) Frank R. Benson revived *Henry the Fifth* in the laudable desire to satisfy patriotic cravings with something of value. Granville-Barker produced a number of scenes from Thomas Hardy's *The Dynasts* at the Kingsway. But these attempts to keep the theatre on a high level were not successful, and very soon began the process of degeneration which was maintained for the whole period of the War. Some of the managers gave up their efforts to save the tradition they had established: Sir Herbert Tree and Cyril Maude went to America. Others such as Gerald du Maurier remained in London and, with great courage, made a fight for decent drama. Among the plays produced by Gerald du Maurier during the War was a strange piece, very popular, entitled *Dear Brutus* by Sir James Barrie, and a revival of the same author's *A Kiss for Cinderella*. Du Maurier, more than anyone else during the War, kept faith with fine things finely done.

For the first two years of the War, the form of entertainment inaptly described as " revue " was very popular. Farces of a bold and even indecent character were next to the revues in popular esteem. Oddly enough, certain plays commonly called " highbrow " became popular during the War for reasons which were not concerned with literature. Brieux' banned play, *Les Avariés*, known in England as *Damaged Goods*, was licensed by the censor for public performance on the representations mainly of medical men and sociologists, and it was widely patronised in London and the provinces. The artistic value of *Damaged Goods* is slight, but its sociological value is indisputably great, and it brought a degree of publicity to the discussion of evils which would have been impossible in England prior to 1914. The success of this play led to the public performance of Brieux' play. *The Three Daughters of M. Dupont*, and of Ibsen's *Ghosts*, from which also the ban was removed by the censor. The latter play, however, is not, like *Damaged Goods*, a propaganda play and it received little support in spite of its being labelled " A Play for Adults only." The rule of the censor was considerably relaxed during the War and his ban was removed from Shaw's one-act play, *The Shewing-up of Blanco Posnet*, but attempts to obtain a licence for *Mrs. Warren's Profession* were unsuccessful. Since the conclusion of the War the censor's rule has been tightened again, but, as a result of the changes made on the recommendations of the Joint Select Committee on Stage Plays (censorship) 1909, the rule bears rather less arbitrarily on meritable work than it formerly did.

The end of the War found the stage in a chaotic condition. The demand for entertainment during the hostilities had been so great that theatre rents rose rapidly to absurd figures: a common rent at any time between 1915 and 1921 for a theatre in the centre of London was £400 to £500 per week. All other expenses, owing to the high cost of living, increased proportionately, but the price of admission, apart from the entertainment tax imposed during the War (which did not benefit, but rather harmed, the theatre manager) remained at the pre-War figure. Slight increases, after the Armistice, were made in one or two cases, but in 1921 the economic situation in the theatre was that the revenue remained at the pre-War figure while the expenditure was on the post-War scale. Such a situation as that is only endurable when the theatre is filled with an audience, each member of which has paid for his seat. The financial burden was too heavy to be borne; and for this reason many meritable pieces which might have been " nursed " into popularity were withdrawn almost immediately after production because they had not at once taken hold of popular fancy. The plays which suffer from this economic situation are undoubtedly the better kind of plays. Those which profit from it are the plays without merit other than that of a spectacular character. The best illustration of the effect of this situation on the drama is to be found in the remarkable popularity of *Chu Chin Chow*, an eastern spectacle written by Oscar Asche. This piece, a variant of the theme of *Ali Baba and the Forty Thieves*, was produced at His Majesty's Theatre, London—a theatre with a serious tradition—on Aug. 31 1916. It ran for nearly five years, creating a record of over 2,200 consecutive representations. Every device of colour and light and costume was used in this production. The appeal made was almost exclusively to the eye, very little to the ear and not at all to the mind. *Chu Chin Chow* broke all record for consecutive performances at one theatre and earned large fortunes for those who were concerned in its production.

In spite, however, of the difficult economic situation, of the change in tradition and government of the theatre, there was a remarkable recovery of quality on the English stage after the signing of the Armistice, and plays of quality began to appear, not timidly, but almost arrogantly. A play by Galsworthy, *The Skin Game*, dealing with the conflict between aristocracy and plutocracy (in which both sides are badly besmirched) and susceptible of allegorical application to the War and the treaty of peace, was performed with great success at the St. Martin's; and a political comedy, entitled *The Grain of Mustard Seed*, by H. M. Harwood, produced at the Ambassadors' had a singularly successful " run," singular because of the fact that political plays are rarely acceptable to English audiences. Sir James Barrie's *Mary Rose* was performed at the Haymarket with enormous success. In this play he treated the problem of life after death in a fashion which divided playgoers sharply into complete devotees or complete sceptics. *The Skin Game* was successfully produced in America, but *Mary Rose* hardly won the favour in New York that it had won in London. The most interesting post-War success was the popularity with which Gay's *The Beggar's Opera* was revived at the Lyric Opera House, Hammersmith. It was not, however, a success in America. Rostand's *Cyrano de Bergerac* was revived with notable success by Robert Loraine, and Bernard Shaw's *Arms and the Man*, also revived by Loraine, had astonishing success with ex-soldiers on account of its anti-romantic treatment of war.

Shakespeare's plays were extensively produced. A working-class theatre in the Waterloo road, London (popularly known as the "Old Vic."), had maintained the standard of good drama throughout the War, and this theatre, handicapped by lack of funds and rather amateurish acting, steadily built up an audience for good plays. After the Armistice its work was amply rewarded. The audiences steadily increased in size until at last the theatre was well occupied at every performance and, on many occasions, was full. The King and Queen made a formal visit to the theatre which draws its audience not only from the surrounding slums, but from every part of London. The whole of Shakespeare's plays, in their entirety, have been produced at the "Old Vic." before large audiences, in addition to a variety of classical plays, ranging from Greek tragedies to Goldsmith's *She Stoops to Conquer*. The activities of the theatre are not confined to the production of plays. Opera alternates with drama, so that its patrons are able to see not only the best plays, but to hear the best music. The production of Shakespearean plays in their entirety was begun soon after the outbreak of the World War in 1914 by the manager of the theatre, Miss Lilian Baylis, in face of the utmost discouragement from every person whom she consulted.

Her courage was signally rewarded. In 1923, the London County Council which had treated the theatre with great forbearance announced that it could no longer consent to let the "Old Vic." remain open unless certain necessary structural alterations and repairs were made. An appeal for £30,000 was made to the public by an influential committee, and about six or seven thousand pounds were soon raised, chiefly in small sums. Then the appeal was repeated in the London Sunday newspaper, *The Observer*, and as a result of it, Mr. George Dance, a well-known and successful theatre-manager, made a gift of £30,000 to the theatre, which was relieved of its structural troubles. Mr. Dance was knighted. In 1926, an attempt was made to establish another "Old Vic." on the north side of London in the theatre popularly known as Sadlers' Wells. The building was acquired, and a considerable sum of money raised.

Progress since 1921—The recovery of the theatre from the depression caused by the War did not continue without interruption. A relapse took place, for which profiteering in rent was mainly responsible. The cost of production was so high that only the most popular pieces had any hope of making money for their producers, none of whom was now in a position to "nurse" a play into success. Plays which were not profitable from the beginning of their "run" were almost immediately withdrawn. This state of indecision and uncertainty and bewilderment helped to intensify the misfortunes of the theatrical situation. Actors demanded larger salaries than they were formerly accustomed to receive, not because the cost of living had increased, but because the conditions of their employment were intolerably insecure. A player might rehearse without salary for as many as six weeks, only to find that the piece in which he was acting was withdrawn at the end of two or three weeks. There were a number of instances in which withdrawal took place after two or three performances. Dramatists, too, were discouraged from writing plays when they found that pieces drawing, perhaps, £1,000 per week to the box office had to be withdrawn because they were not making any profit for their producers. They turned their abilities to other ways of writing or abandoned all efforts to experiment in new forms. This set-back, however, was temporary so far as the quality of the plays and the playgoers were concerned, and a second time the process of recovery was begun, this time with more lasting effects. The profiteering in rent continued, making production of meritable plays difficult, but even the profiteers were obliged to consider the quality of their productions more carefully than they had done between 1914 and 1920.

In 1921 there was a perceptible improvement in the quality of the plays publicly performed. Mr. John Drinkwater's *Abraham Lincoln*, Mr. C. K. Munro's *At Mrs. Beam's*, Maeterlinck's *The Betrothal* (produced at the home of musical comedy, the Gaiety), Clemence Dane's *A Bill of Divorcement*, Bernard Shaw's *Heartbreak House*, Lord Dunsany's *If*, A. A. Milne's *The Truth About Blayds*, Clemence Dane's *Will Shakespeare* were all produced in this year, and most of them were very popular.

In 1922 the improvement was not so marked, but it continued. In that year, Shelley's *The Cenci* was released from the Censor's ban and performed by Sybil Thorndike for a fortnight at the New Theatre. The following meritable plays were also performed: A. A. Milne's *The Dover Road*, Somerset Maugham's *East of Suez*, Sir Arthur Pinero's *The Enchanted Cottage*, Gilda Varesi and Dolly Byrne's *Enter Madame*, Alfred Sutro's *The Great Well* and *The Laughing Lady*, Edward Percy's *If Four Walls Told*, Roland Pertwee's *I Serve*, St. John Ervine's *Jane Clegg*, John Galsworthy's *Loyalties*, John Drinkwater's *Mary Stuart*, John Galsworthy's *Windows*, and a number of uncommonly good musical plays, of which *Lilac Time* was the most notable.

In 1923 Eugene O'Neill, some of whose plays had been performed at the Everyman and in the provinces, reached the West End with *Anna Christie*. The play had much popularity at the beginning of its run, chiefly because of the admirable acting of Pauline Lord and George Marion, but its popularity did not last long. Frederick Lonsdale, who was previously known only as the author of musical comedies, began what proved to be a successful career as a writer of social comedies with *Aren't We All*. The play called *Back to Methuselah* by George Bernard Shaw, which had been done in New York by the Theatre Guild, was produced for the first time in England by the Birmingham Repertory Company in Birmingham and subsequently at the Court, London. Flecker's poetic play, *Hassan*, was a great success in London, but an immediate failure in New York. A play called *Havoc*, by Harry Wall was produced by the Repertory Players and transferred to the Haymarket. It was notable for the fact that it was the first play to deal seriously with the War, but it was marred by its story. *The Insect Play* and *R.U.R.* by the Brothers Capek, *The Green Goddess* by William Archer, *The Lie*, by Henry Arthur Jones, *The Likes of Her* by Charles M'Evoy, *The Lilies of the Field* by J. Hastings Turner, *Melloney Holtspur* by John Masefield, *Oliver Cromwell* by John Drinkwater, *Our Betters* by Somerset Maugham, *The Outsider* by Dorothy Brandon, *Outward Bound* by Sutton Vane, *Robert E. Lee* by John Drinkwater, *Taffy* by Caradoc Evans, and *The Young Idea* by Noel Coward were outstanding plays of this year.

The Shaw Revival.—In 1924 Miss Sybil Thorndike produced Bernard Shaw's five-act play, *Saint Joan*, at the New Theatre in London. The play, which had been successfully performed for the first time on any stage by the Theatre Guild of New York some months before this, was immediately successful and ran for a very long time. It was acclaimed as the greatest play Shaw had written and was said to be one of the masterpieces of English dramatic literature. *Saint Joan* has been translated into many languages and has been performed with great success in almost every European country. The very remarkable success of *Saint Joan* was followed by a "boom" in Shaw plays both in England and America, as well as in various foreign countries. A London theatre, The Regent, was devoted to the revival of them, one after the other, and here in 1925 *Mrs. Warren's Profession* was publicly performed for the first time in England. The play had lain under the censor's ban for more than a generation. It was found to be entirely innocuous and even old-fashioned.

The years 1924 and 1925 were undeniably Bernard Shaw's, but they were shared by Noel Coward, a young actor-dramatist who at the age of 25 had made himself an international figure by his power of portraying the shallow cleverness of neurotic Society people. Most of Coward's plays are short, slight pieces, so flimsily constructed that they seem almost to be charades. *Fallen Angels*, which caused some scandal on account of its main situation in which two women are shown drinking themselves into a state of intoxication, and *Hay Fever*, an immensely amusing play, brilliantly acted by Marie Tempest, are so slight that some critics saw in them no more than revue sketches hastily lengthened into three-acts.

Coward has remarkable facility in dialogue and a genuine sense of the theatre, but he seemed at first to lack depth and sincerity. These defects of his work, however, were no more than the immaturity of a young writer, for when *The Vortex* was performed his sternest critics were compelled to acknowledge that he could write sincerely and feelingly. This play was successful in London and New York.

Frederick Lonsdale was responsible for a very successful comedy, *Spring Cleaning* and, in 1925, for a still more successful one, entitled *The Last of Mrs. Cheney*. His plays are notable for the skill with which they are made and for the easiness of their dialogue. They sound no depths, nor are they intended to be more than they are, diverting pieces of the theatre. Other plays of quality done in 1924 were *The Comedy of Good and Evil* by Richard Hughes, *The Conquering Hero* by Allan Monkhouse (another war play), *The Fake* by Frederick Lonsdale, *The Farmer's Wife* by Eden Phillpots (which ran for more than two years), *Fata Morgana* by Ernest Vajda, *The Forest* by John Galsworthy, *Judas Iscariot* by E. Temple Thurston, *The Man with a Load of Mischief* by Ashley Dukes (originally produced by the Stage Society and afterwards transferred to the Haymarket, where it ran for seven months), *The Mask and the Face* by Luigi Chiarelli, *No Man's Land* by François de Curel, *Old English* by John Galsworthy, *The Pelican* by H. M. Harwood and F. Tennyson Jesse, *The Show-Off* by George Kelly (an American play which unaccountably failed in London), *Storm* by C. K. Munro, *Tiger Cats* by Karen Bramson, *To Have the Honour* by A. A. Milne, *The Way Things Happen* by Clemence Dane, *White Cargo* by Leon Gordon, and *Young Imeson* by J. R. Gregson.

There was also a remarkable production of *A Midsummer Night's Dream* at Drury Lane, done by Basil Dean who, for a short while, succeeded Arthur Collins at that theatre as director. The Birmingham Repertory Theatre, whose director, Barry Jackson, was knighted in 1925, transferred some of its activities to London where, among other pieces, an interesting production of *Romeo and Juliet* was done. This organisation was also responsible for the production in London of Rutland Boughton's opera, *The Immortal Hour.* Nigel Playfair at the Lyric Opera House, Hammersmith, revived Congreve's *The Way of the World* in which Edith Evans gave a distinguished performance, and developed his policy of reviving 18th century operettas, *The Duenna* and *Lionel and Clarissa* winning much of the popularity with which *The Beggar's Opera* and *Polly* had been received.

Repertory Theatres.—In addition to these productions, there was an immense amount of activity among private play-producing societies, which had increased in number to such an extent that there was almost a performance on every Sunday in the theatrical season. The repertory theatres, which had suffered severely in the War, began to revive, and "little theatres" of which the most successful was at Bristol, under the management of Rupert Harvey, were started all over the country. The Liverpool Repertory Theatre, which had courageously carried on its work throughout the War and the depressing period which followed it, entered into comparative prosperity under the management of William Armstrong.

In 1910 there were three repertory theatres in the British Isles, one in England (the Gaiety Theatre, Manchester, owned by Miss A. E. F. Horniman), one in Scotland (the Royalty, directed by Alfred Wareing) and one in Ireland (the Abbey, directed by Lady Gregory and W. B. Yeats). The last was the oldest as it has proved to be the most durable of the three. In addition to these three repertory theatres, there was a most ambitious attempt to establish one in London, at the Duke of York's theatre, where the late Charles Frohman (who was drowned in the "Lusitania" when it was torpedoed by the Germans May 7 1915) enlisted the services of Harley Granville-Barker and Dion Boucicault. The scheme was to establish a repertory theatre more nearly corresponding to the strict definition of one than any of those operating in the provinces, which were identical with what used to be called "stock" companies. Mr. Frohman's gallant enterprise failed. It lasted for 17 weeks, from Feb. 21 to June 17 1910, and during that period eight new plays and two old ones were produced. The names of the plays and their authors are as follows: *Justice* by John Galsworthy; *Misalliance* by Bernard Shaw; *Old Friends* by J. M. Barrie; *The Sentimentalists* by George Meredith; *The Twelve-Pound Look* by J. M. Barrie; *The Madras House* by H. Granville-Barker; *Helena's Path* by Anthony Hope and Cosmo Gordon-Lennox; *Chains* by Elizabeth Baker; *Trelawney of the Wells* by A. W. Pinero and *Prunella* by H. Granville-Barker and Laurence Housman. Three of these plays were in one act (the third, fourth and fifth in the list).

The original scheme, of a strictly repertory theatre similar to the Comédie Française, was not maintained, nor does the history of the repertory theatres in Great Britain and Ireland indicate that such a scheme is ever likely to succeed in a country where the people are disinclined to make the research through newspaper advertisements which a programme of irregular performances involves. For good or ill, the system of continuous performances has obtained a hold on the British theatre which will not easily be shaken off and may never be shaken off. *Trelawney of the Wells*, the most popular of the plays produced during the season, was performed 42 times in a season of 17 weeks, which clearly signifies that the promoters of the scheme had to revise their plan, partly to satisfy the public demand and partly to recoup themselves for the losses sustained on the unpopular pieces. A similar history has attended the establishment of other repertory theatres on Comédie Française lines in England, for example, the Everyman Theatre at Hampstead, established in 1920 by Norman MacDermott and carried on by him until 1926.

The repertory theatres steadily increased in number until, at the outbreak of the World War, there were seven of them operating regularly and a number of others operating for short periods during each year. None of these theatres earned large sums of money. Some of them, indeed, were constantly embarrassed by insufficient funds. But they performed a most valuable service to young actors and young dramatists: to the first, by giving them continuous and varied employment which, although not highly remunerated, enabled them to become accomplished in their craft; to the second, by giving them the greatest of all instruction to a dramatist, the public performance of his work, and by bringing before them the work of established dramatists, British and foreign, which otherwise they would not have known except in book form. Ibsen, Strindberg, Hauptmann, Schnitzler, Maeterlinck, Rostand, Verhaeren, Sudermann, Tolstoi, Chekhov, Shaw, Galsworthy, St. John Hankin, Granville-Barker, Arnold Bennett and John Masefield among the moderns; and Euripides, Shakespeare, Ben Jonson, Congreve, Beaumont and Fletcher, Goldsmith and Sheridan among the classics—the work, in quantity, of all these writers was brought to the knowledge and even to the intimacy of provincial playgoers who, but for the repertory theatres, would have had to subsist in the theatre on the more popular of the pieces produced in London and sent on tour. A similar service is performed in America by what are called "little" or "community" theatres.

Synge and the Abbey Theatre.—Out of these repertory theatres came a number of young dramatists, many of them resident in the city in which their plays were first performed, of whom at least one man was a genius, John Millington Synge (d. 1909) and three men of distinction, Stanley Houghton (d. 1913), John Drinkwater (b. 1882) and Lennox Robinson (b. Oct. 4 1886). Synge has been the subject of several biographies of which the principal and most authoritative one is *John Millington Synge and the Irish Theatre* by Maurice Bourgeois. He wrote six plays, a book of poems and translations and some impressionist articles of a newspaper character. Two of the plays are in one act, *In the Shadow of the Glen* and *Riders to the Sea.* The latter is commonly regarded as the best of his work. One of the plays, *Deirdre of the Sorrows*, is unfinished. Of the remaining three, *The Tinker's Wedding* (in 2 acts), *The Well of the Saints* (in 3 acts) and *The Playboy of the Western World* (in 3 acts), the last-named is the most widely known, partly because of its merits, but chiefly because of the anger which it aroused among the more sentimental of the Irish people who, accustomed to the romantic delusions in which subject or oppressed peoples live, could not endure the romantic realism of this play. A long succession of poets had insisted on one aspect of the Celtic character, its idealism and generosity and romance, with the result that people disbelieved in the other aspect of it, the cruelty and greed and treacherous materialism. Synge, a man without prepossessions or creed, set down what he saw in words of acrid beauty, and the Irish people, horribly shocked, pronounced him to be a liar, a degenerate and even a traitor. The violence of their anger against *The Playboy of the Western World* died down in time, especially as the play was performed as a farcical comedy, but Synge is a man of genius of whom his countrymen, when they take pride in him at all, remain reluctantly proud. He and Lennox Robinson are the principal products of the Abbey Theatre, Dublin, which includes among its minor dramatists Lady Gregory, the late William Boyle, T. C. Murray, Padraic Colum, the late Seumas O'Kelly and St. John Ervine. W. B. Yeats has written plays for the Abbey, but dramatic form is intractable in his hands.

The World War affected the Abbey, but not to as great an extent as it was affected by the internecine war in Ireland itself. Out of that welter of misery came a new dramatist, a working plasterer, Sean O'Casey, who wrote two plays, *The Shadow of a Gunman* and *Juno and the Paycock*, which despite their topical quality, have something of the universal in them. The second of the two plays was produced in London at the Royalty Theatre in 1925, and had a long run. A third play by O'Casey, called *The Plough and the Stars* was done at the Abbey in 1926, and resulted in a riot in the theatre caused by Irish Republicans who asserted that O'Casey had insulted their dead. The establishment of the Irish Free State considerably altered the status of the Abbey which began to be regarded, unofficially, as a national theatre; and in 1925 the Irish Govt. made an unconditional grant of £850 to the Abbey and of £600 to the Gaelic Players (An Comhar Drámuíochta). These grants are not annual, but will be considered each year. The grant to the Gaelic Players is officially described as a "Grant in Aid . . . towards the publication and production of plays in Irish." These grants are notable becuase they are the first governmental subsidies given to theatres in modern English-speaking communities

The Intellectual Drama.—The record of the English repertory theatres up to the time the World War began was honourable and promising. We have now to consider the record of the ordinary commercial theatre, and here we discover that the standard of plays produced had been greatly raised. The authority of Sir Arthur Pinero and Henry Arthur Jones, already diminished by the work of Oscar Wilde, was now yielding to that of Shaw and Sir James Matthew Barrie and John Galsworthy. A number of young dramatists of varying quality were appearing, whose allegiance was more definitely given to the school led by Shaw than to the school led by Sir Arthur Pinero, and these included Granville-Barker, the late St. John Hankin (d. 1909), Charles McEvoy, Arnold Bennett, John Masefield, Cicely Hamilton, Githa Sowerby and Elizabeth Baker. What was called the "intellectual" drama seemed to be established not on a broad basis, but on a basis sufficiently wide to make it steady. Shaw and Bennett were even able to obtain long "runs" for their plays, and Cicely Hamilton made a popular success with *Diana of Dobson's.* It is true that the "intellectual" drama did not make fortunes for its producers, but it is true also that it did not cause any bankruptcies, and probably, if an accurate statement of accounts could be prepared, the "intellectual" drama would be found to have caused less loss of money, relatively and absolutely, than the commercial drama. It might even be found to have paid its way. Following on the heels of the “intellectual” dramatists cited above came still younger dramatists, also of the school led by Shaw, whose intellectuality was perhaps less arid or severe, and these young dramatists contrived to write plays definitely of the “intellectual” school which made much profit for those who produced them. They have already been named in connection with the repertory theatres. Their lack of aridity is due, possibly, to the fact that the stage is their first concern, whereas most of the generation between them and Shaw came to the theatre from the novel and the sociological survey.

Outside the “intellectual” or “highbrow” school, in what is called the commercial theatre, there was observable a great increase in the quality of the plays produced. The younger dramatists who were without any intellectual pretensions were indirectly affected by the work of Shaw, even when it was repudiated by them. Plays by Hubert Henry Davies, Rudolf Besier, Alfred Sutro, Bernard Fagan, Somerset Maugham and J. E. Harold Terry were notably better in quality than plays written by their predecessors at any time during the century immediately preceding their appearance in the theatre. The work of Besier in *Don* and *Lady Patricia* had a flavour of letters and a technical excellence which made it appear almost equal to the best work of Sir Arthur Pinero and Henry Arthur Jones and superior to the best work of Sydney Grundy. Somerset Maugham, who began his career with a sombre play, *The Man of Honour*, changed his *métier* completely and very soon reached a high and profitable position as a writer of light comedy. He is the most skilful writer of the comedy of manners now working for the English theatre and his plays, *Home and Beauty* (re-named *Too Many Husbands* in America) and *The Circle*, put him in direct line of succession to Congreve. J. E. Harold Terry may be said to have been produced by the War. His plays are notably chiefly for their topical quality, but they are well done and are not without universal appeal. His first play, written in collaboration with Lechmere Worrall, was entitled *The Man Who Stayed At Home.* It was produced at the Royalty Theatre Dec. 10 1914, when the condition of theatrical enterprise was still sore from the effects of the War's beginning, and it was an immediate success. Terry wrote a second play with a war motive, entitled *General Post*, produced at the Haymarket Theatre March 14 1917. This play, slightly similar in theme to Meredith's *Evan Harrington*, was also a great popular success. In 1921 he produced a play entitled *The Fulfilling of the Law*, in which special appeal was less direct. A young American dramatist, Harold Chapin, who had settled in England, was killed in France while serving in the British Army. He was the author of a number of charming comedies and was expected to take a high place in the English theatre.

The United States

The New York Theatre Guild.—In America, the theatre, after the end of the War, was in a healthier state than in England. This is more true of New York perhaps, than of the rest of the country. Playgoers in that city seem more willing to patronise good things and to support new enterprises than playgoers anywhere else. A remarkable organisation entitled The Theatre Guild of New York has, in three years, raised itself from an obscure, impoverished and unknown position into that of the only first-class theatrical enterprise in the world which is a great financial success. The Theatre Guild grew out of the activities of a small group of enthusiasts who were known as the Provincetown Players and the Washington Square Players. These players gave performances, usually of one-act plays, in small theatres near Washington Square. They were akin to the movement, very widespread in America, known as the Little Theatre or Community Theatre movement—societies of amateurs producing plays primarily for their own entertainment rather than for profit. The Theatre Guild, when established, secured a long lease on an old theatre, the Garrick, in West 35th St., and began operations with the production of *Bonds of Interest*, translated from the Spanish of Jacinto Benavente. This play (*Los Intereses Creados*) has been done in England both under the American title and under that of *The Bias of the World.* It was not a financial success, and the capital of the Guild, about $500, was almost exhausted when the directors decided to produce *John Ferguson*, a four-act tragic Irish play by St. John Ervine. This play was not expected to be financially successful, but it falsified anticipation. It was performed in New York for nine months, and enabled the Guild to establish itself more securely.

Subsequent productions, including Masefield's *The Faithful*, were not quite so profitable, but the season ended with greater hope than it had begun. In the following season Tolstoy's *The Power of Darkness*, St. John Ervine's *Jane Clegg*, Strindberg's *The Dance of Death*, and other plays were performed, of which *Jane Clegg*, which ran for five months, was the most financially successful. The third season included the first production in English of Bernard Shaw's *Heartbreak House*, as well as of A. A. Milne's *Mr. Pim Passes By.* Both these plays made much profit for the Guild, the first-named running for 150 performances.

Eugene O'Neill.—The success of the Theatre Guild and of *John Ferguson* caused an immediate effect on theatrical entertainments in New York, and one interesting result of it was that a young American dramatist of Irish descent, Eugene G. O'Neill, was given an opportunity of producing his plays at a first-class theatre. He had already become known as the author of one-act plays when his six-act tragedy, *Beyond the Horizon*, was produced at the Morosco Theatre in New York. This play, most skilfully acted, had a great success, and those who are desirous of seeing a fine native drama grow up in America felt encouraged to maintain their hope when they contemplated O'Neill's work. In 1920 he produced a strange play in eight scenes, entitled *The Emperor Jones*, which is what may be called a one-part play, dealing with the journey of a negro into a West Indian forest where he lapses into primal terror. This play was produced by the Provincetown Players and the principal part was acted by a remarkable negro actor, Charles Gilpin. O'Neill has now written a great many plays, of which one, *Anna Christie*, was performed with some success in London. A number of his short sea-pieces have been acted in England, in addition to *The Emperor Jones* which was produced, but not with much success, at the Ambassadors in London in 1925. His most sensational play, *Desire Under the Elms*, was forbidden to be performed in England by the censor. It is less lyrical and more animal than the rest of his work. A play, entitled *All God's Chilluns Got Wings*, deals, not very deeply, with miscegenation. A better play, *The Hairy Ape*, showed O'Neill in the environment where he is at his best, among sailors in whom physical powers far exceed those of the spirit. O'Neill, who is almost commonplace when he steps out of this atmosphere, as for example in *Welded* and *The First Man*, has a deep, but unrestrained, lyrical sense which generally redeems the coarseness of his characters. But violence seems to increase in him, rather than to subside, and his development is being watched by his friends with anxiety.

Another American dramatist of quality, Susan Glaspell, suffers as O'Neill does from excess of nerves. She is less lyrical, but more intellectual, than O'Neill. She is also more prolix. One of her plays, *The Verge*, was performed for a special occasion in London by Miss Sybil Thorndike. Another and better one, *Inheritors*, was first acted in England by the Liverpool Repertory Company in 1925. Her work increases in strength, and it is possible that she may exceed O'Neill in quality.

Neither of these dramatists have ever had a play performed by the Theatre Guild, but they may be said to owe their opportunities to the fact that that organisation was so swiftly successful. What that success is may be gauged by the fact that in seven years from the date on which the guild was founded, it had not only established itself as a first-class theatrical body, but had built itself a new and very handsome theatre. It now controls two theatres in New York in which first performances of plays by English authors are often given.

Quality of American Drama.—American dramatists display great technical excellence in their work, together with a tendency towards sentimentalism of a curiously crude character. There is probably more mechanical ability among American dramatists to-day than among any other dramatists in the world, but this ability is seldom related to artistic power and it is frequently used to falsify life. There are signs, however, of discontent with slick sentimentality, and young writers throughout the country are endeavouring to relate technical excellence to plays in which life is truly treated. Dramatic craftsmanship is more closely studied in America than in England, and in many of the colleges and universities students take a course in dramaturgy. The most interesting experiment of this kind is that conducted by Prof. George P. Baker, formerly professor of dramatic literature at Harvard, who, in what is popularly known as “the 47 workshop,” instructs his pupils in the writing and production of plays from the point of view of author, producer, actor and critic. Many of his pupils have written competent one-act plays and several of them have successfully produced more ambitious pieces.

One of the ablest of American dramatists and, at the same time, the least prolific, is James Forbes, the author, among other plays, of *The Chorus Lady*, *The Show Shop* and *The Famous Mrs. Fair.* Forbes produces mainly satirical comedies of stage-life, but the last-named piece deals with ordinary life and is a very able bit of work. Other notable dramatists are Edward Sheldon whose *Romance*, with Doris Keane in the principal part, was extraordinarily successful in England; George Broadhurst—whose *Bought and Paid For* was described by Arnold Bennett as one of the best commercial plays he had ever seen; David Belasco; the late Clyde Fitch; Langdon Mitchell, the author of a brilliant comedy, *The New York Idea;* Augustus Thomas, whose *The Witching Hour*, *The Harvest Moon*, *As a Man Thinks* and *The Other Girl* are plays of uncommon quality; the late Charles Klein; Eugene Walter, author of two particularly able realistic plays, *Paid in Full* and *The Easiest Way;* Channing Pollock; A. E. Thomas; Booth Tarkington who, more popularly known, as a novelist achieved remarkable success in 1920 with a light comedy called *Clarence;* Zoë Akins; Sidney Howard, whose play *They Knew What They Wanted* had great success; George S. Kaufman and Marc Connelly, whose very interesting play, *Beggar on Horseback*, singularly failed to repeat in London the success it had in New York; and Maxwell Anderson and Laurence Stallings the authors of *What Price Glory?* The condition of the theatre in America at the end of 1920 was more hopeful than that in England because of the greater general interest in meritable plays and of the noticeable desire, especially in New York, to support original enterprises.

The standard of acting in America, so far as actresses are concerned, is higher than in England, but there is more all-around efficiency among English actors than there is among American actors. The latter excel in character-parts—a very admirable instance of this was the case of Frank Bacon in his own play *Lightnin'*—but are less capable in what are known as "straight" parts. With the exception of John Drew there are few American actors who can interpret characters such as were acted by Sir George Alexander. It is very difficult to discover either actors or actresses in America who can speak verse. These flaws in technique are remediable, however, and are slowly being rectified. One result of the War was to cause a distinct decline in the quality of acting among young players in England, and it is probably true to say that there was less acting ability among the younger members of the English theatrical profession at the end of 1920 than at any other period in the history of the English theatre. In America, on the contrary, there was a marked growth in technical skill among young actors and actresses.

THE DRAMA IN FRANCE

Conservatism of the French Stage.—In 1910, the theatre in France gave less occasion for satisfaction than the theatre either in England or in Germany. The traditions of decent drama were, of course, maintained at the Comédie Française, the Antoine and the Odéon, but, broadly speaking, plays of quality were few in number and "revues" of a very vulgar character were growing in popularity. That bad state of affairs could not last, and after 1910 until the outbreak of the World War, when the French theatre for obvious reasons completely collapsed, there was a revival of quality in French drama. The French theatre, too, which had not previously offered much hospitality to foreign plays, began to open its doors, not widely, indeed, but slightly to plays written by foreigners. Shakespeare suddenly came into fashion. *Hamlet* was produced at the Comédie Française, *King Lear* at the Antoine, *Julius Caesar* at the Orange Fêtes, and *Romeo and Juliet* at the Odéon. Camille de Saint-Croix organised single performances of many Shakespearean plays which were highly praised. One of Shaw's plays was performed in Paris, but without much favour. English musical comedy, produced on a more extravagant scale than is customary in France, became popular, and George Grossmith set the Parisians to singing "Ip-i-addy-i-ay-i-ay."

The most interesting play produced in Paris during the first five years of the decade was undoubtedly Edmond Rostand's *Chantecler*, which had been anticipated for seven years before it was performed for the first time at the Porte-Saint-Martin in 1910. It had not the great success of *Cyrano de Bergerac*, but it caused much discussion. Lucien Guitry played the part originally intended for the late Constant Coquelin, which part was played in New York by Maude Adams. Rostand, who was born in 1868, died in 1918. Another death of great importance to the French theatre was that of Jules Claretie, who, after controlling the Comédie Française for 28 years, died in 1913. Claretie conducted the difficult affairs of the national theatre with very great skill and diplomacy, and showed clearly that while a national theatre is not a forcing-house for genius, it is certainly a place in which the level of honourable drama is highly maintained. He was succeeded by Albert Carré, who remained in charge of the theatre until he was called up for military service during the War, when he was succeeded by Emile Fabre, a dramatist. Paul Hervieu, the dramatist, died Oct. 25 1915, and Mme. Réjane, the famous actress, June 14 1920.

Much useful, if not particularly significant, work was done by French dramatists from 1910 to 1915, but none of the disintegrating and insurgent influences detectable both in the English and the German theatres appeared to affect the French theatre. Stage *décor*, for example, is singularly poor in France, where, on the other hand, the standard of acting is very high. In addition to Rostand's play, notable pieces were produced by Henry Bataille (*Le Songe d'un Soir d'Amour* and *La Vierge Folle*—the first of which, done at the Comédie Française, was hardly so successful as the second, done at the Gymnase), by Pierre Wolff (*Ruisseau* and *Marionettes*), Henri Bernstein (*L'Assaut* and *Le Secret*), Georges Duhamel (*La Lumière*), Brieux (*La Femme Seule*, done in England under the title of *Woman on Her Own*), Maurice Donnay (*Les Eclaireuses*), Sacha Guitry (*Le Beau Mariage* and *La Prise de Berg-op-Zoom*), De Flers and de Caillavet (*Habit Vert*) and Tristran Bernard (*Jeanne Dore*—with Bernhardt in the cast).

After the outbreak of War, the French theatre for a considerable period practically ceased to exist. There were only two new plays produced in Paris in 1915—*Les Deux Vestales*, a farce of an old-fashioned broad character, done at the Gymnase and a translation, made by W. B. Perier, of the English play, *The Man Who Stayed at Home* by J. E. Harold Terry and Lechmere Worrall, which was done at the Théâtre des Bouffes Parisiennes under the title of *Kit*, with Max Dearly in the cast. Several war plays, not particularly good, were done in Paris towards the end of the War or immediately after the signing of the Armistice, and Sacha Guitry's play *Deburau* was also produced. A translation of this play, done into rhymed couplets, has been made by H. Granville Barker and was produced in New York in 1921 with great success. Edmond's *Saison d'Amour* was produced in 1919, and Sacha Guitry, rapidly acquiring a high place in France as a dramatist and an actor, was responsible for *Pasteur*, a farce entitled *Le Mari, La Femme et L'Amant* (a title which sufficiently indicates the character of the piece) and a comedy called *Mon Père avait Raison.* The Guitrys, father, son and daughter-in-law, gave a season of their plays in London in 1920 which was exceedingly successful.

Indications of Changing Taste.—But even the French theatre, the most conservative of all, began to feel the need for change as the effects of the War wore off. The theatre in Paris is largely dependent upon the patronage of foreigners. This dependence was increased by the fact that the permanent population of Paris now includes a very high proportion of immigrants from other countries, among whom Italians, Poles, Swiss and Russians predominate. The conventional French play of husband, wife and lover does not attract the foreigner now as it once did, and the French managers suddenly realised that their best customers were abstaining from the theatre altogether. A grave shock was sustained when the Opera House in Paris was let to the producers of a moving picture in 1924. The French mind does not easily adjust itself to change, and the managers, having recovered a little from their first fears, are contentedly waiting for the fruits of other men's labours to drop into their laps. Their audiences, however, continue to decline. The older playwriters, still pulling the same old, worn wires, find that a new generation of playgoers has grown up which is not content with stale repetitions of one dull story, and managers of enterprise are now casting about for new authors and new ideas.

Such managers as Georges Pitoeff, a Russian, and husband of Ludmilla Pitoeff, who played the title part in the French version of Bernard Shaw's *Saint Joan*, Gémier, Lugué-Poe, Jacques Copeau and Dullin have given opportunities for production to young dramatists, in addition to producing the work of foreigners.

The new authors include H. R. Lenormand, Jean Sarment, Jacques Natanson, J. J. Bernard, Jules Romain, Marcel Achard, Paul Vialar, Paul Raynal, Jacques Deval, Adolphe Orna and Zimmer. Most of these authors found production in small way theatres such as Le Vieux Colombier and L'Atelier, but some of them speedily found their way to more important and better-known theatres. The Comédie Française, slower to move in step with the times than the Boulevard theatres, managed to secure Paul Raynal's war-play *Le Tombeau sous l'Arc de Triomphe*, a piece which sharply divided playgoers into two classes, the younger generation which stoutly approved it, and the older generation which attempted to hiss it off the stage. It contained three characters and made unpleasant references to old men who lived in comfort while young men died in the trenches. Jules Romain, a doctor and a novelist, made reputation for himself with a piece called *Doctor Knock* at the Comédie des Champs-Elysées. This play has been translated into English by Harley Granville Barker, and was produced at the Royalty in April 1926 by Denis Eadie.

Zimmer's play, *Le Veau Gras*, an amusing, but ill-balanced piece, with a first act that has little relevance to the rest of it, was much liked because of its caricatures of provincial French life. Henri Bernstein had great success with his play, *La Galerie des Glaces*, which was produced at the Gymnase in Oct. 1924, and Lenormand, a dramatist of singular quality, wrote a play about Don Juan, entitled *L'Homme et ses Fantômes*, which Gémier produced at the Odéon in June 1924. Lenormand was also responsible for a play entitled *A L'Ombre du Mal*, a morbid play about colonial life, done at the Studio des Champs-Elysées. His striking piece, *Les Ratés* was done, but not with popularity, by the Theatre Guild in New York. French plays seem little to the American taste. Gémier gave performances of Bernard Shaw's *Arms and the Man* and Shakespeare's *The Merchant of Venice, A Midsummer Night's Dream* and *The Taming of the Shrew*. An attempt was made to hold a season of English plays at an out-of-the-way theatre, the Albert I., with an English cast. The play chosen to begin the season was A. A. Milne's *The Dover Road*, but it was a failure, and the attempt to perform English plays in English at that theatre collapsed. Success, however, attended the effort made by the Macdona Company to popularise the plays of Bernard Shaw in Paris, although the audience cannot be said to have included many French persons. The French theatre sustained heavy losses towards the end of the period in the deaths of Sarah Bernhardt, de Max (who was a Rumanian) and Lucien Guitry.

The Drama in Germany

Conditions Before the War.—The condition of the drama in Germany in 1910 was very odd—declining in Berlin, flourishing in the provinces. Metropolitan taste was fickle and vulgar; provincial taste was steadfast and of high quality. The result of this odd reversal of customary positions was that the German provinces absorbed almost the whole of the interest of dramatic students. More experiments were made outside Berlin than were made inside it, not only in the quality of the plays performed, but also in the methods of production and in the interior economy of the theatre. Volksbühnen (people's theatres) were organised in many places, at which performances of classical and modern pieces were given at very moderate prices. The two Freien Volksbühnen of Berlin, which were typical in most respects of all the other people's theatres, had between them a membership of 60,000 persons, of whom a considerable number were workingmen. These Freien Volksbühnen contracted with various theatre-managers for the performance of specified plays for their members, and the larger of the two, Die Neue Freie Volksbühne, was spending £25,000 per annum in 1910 on plays produced at 11 different theatres. This society even started a building fund, which in that year had reached £5,000, for the purpose of establishing a theatre of its own, to hold 2,000 persons. The members of this society paid one shilling for each performance witnessed, and seats were allotted by ballot.

A similar society, with a membership of 9,000 persons, existed in Vienna, under the direction of Stefan Grossmann, a dramatist. The Cologne Stadttheater organised performances on lines similar to those of the Volksbühnen, on Sunday afternoons before audiences drawn from workmen's societies which were allowed to nominate the play to be produced. In 1909 the trade unions of Cologne chose Galsworthy's *Strife* for performance, and this play was received with enormous enthusiasm. A Deutsches Volkstheater was in process of erection in 1919. Each subscriber to this society was to be admitted to one performance per week in a season of 40 weeks and to receive a theatrical paper, delivered free of charge, together with free admission to a number of lectures, for an annual subscription of 20 shillings! The number of Stadtbund theatres was increasing remarkably, and certain towns either subsidised or completely owned the local theatre. The following is a record of sums paid by German cities and towns for their own theatres: Cologne, £25,000; Frankfort, £13,000; Barmen, £6,000; Dortmund, £6,000; Essen, £4,000; Elberfeld, £4,000; Aachen, £3,500; Breslau, £3,000; Düsseldorf, £2,500; Magdeburg, £2,500; Kattowitz, £1,000; Thorn, £1,000.

The two great German dramatists, Gerhart Hauptmann and Hermann Sudermann, had reached the apex of their powers in 1910 and were beginning to yield place to new men, of whom the chief were Frank Wedekind, Arthur Schnitzler (an Austrian and, like Somerset Maugham and H. M. Harwood in England, a doctor of medicine) and Hermann Bahr. Problem and "tendency" plays were prolifically produced, and the drama of intellectual concepts rather than the drama of human emotions seemed to predominate. Just before the outbreak of the World War, a number of allegorical plays were being performed, such as *Haus am Meer* by Stefan Zweig and *Mutter* and *Gelebtes Leben* by W. von Molo. But, apart from the extraordinary experimental character of much of German drama and stage production during this time, the general range of theatrical entertainment was very catholic, extending from harshly realistic plays of the soil, such as Sudermann's *Strandkinder*, to purely poetic plays, such as *Medusa*, by a young dramatist of promise, Hans Kyser. In addition to the very diverse quality of native drama, the German theatre produced many foreign plays, equally diverse in character, ranging from Shaw's plays to plays by Jerome K. Jerome. Ibsen, Björnson and Strindberg (who died in 1912) had much popularity in Germany, and so had many French dramatists, but none of them had greater popularity than Shaw, Oscar Wilde and Galsworthy. Other English writers, Maugham, Sir James Barrie, Sutro, Arnold Bennett and Edward Knoblock, Monckton Hoffe, H. H. Davies, Sir Arthur Pinero, W. J. Locke and L. N. Parker, were freely and extensively admitted to the German theatre. Shakespeare, of course, had long been a popular author in Germany and this popularity did not decline during the War.

Hauptmann, who received the Nobel Prize on his 50th birthday in 1912, was fairly prolific during the five years preceding the War. *Griselda*, founded on Boccaccio's legend, was produced in 1909, and was followed in 1911 by *Die Ratten* (*The Rats*). *Gabriel Schillings Flucht* (*The Escape of Gabriel Schilling*) was produced in 1912, and in 1913 came the famous Festival Play commissioned by the city of Breslau to celebrate the war against Napoleon for freedom. This play was produced by Reinhardt in the new rotunda of the Breslau Centenary Exhibition, and its democratic sentiments were so displeasing to the Junkers that it provoked a great uproar. The then Crown Prince threatened to cancel his patronage of the exhibition unless the play were withdrawn—which was done. Another play, entitled *Der Bogenspanner Odysseus* (*Odysseus the Archer*), was written in 1913.

Hermann Sudermann was less prolific than Hauptmann. His *Strandkinder*, a play about people living on the shores of the Baltic Sea, was produced in 1909. This play had considerable affinity with the work of a dramatist who died in 1909, Ernst von Wildenbruch, two of whose plays, *Lieder des Euripides* and *Der Deutsche König*, were performed, after his death, in that year. *Strandkinder* was followed by an historical piece, entitled *Der Blinde von Syracus*, in 1911 and *Der Gute Ruf* in 1913.

Bahr, Wedekind and Schnitzler.—The ascending dramatists, Bahr, Wedekind and Schnitzler, produced many plays in the first half of the decade, as did another well-known, but peculiar and unsuccessful dramatist, Herbert Eulenberg. Bahr, whose gift is for human comedy, is known abroad by *Das Konzert* (*The Concert*), which was not notably successful in London, but was very popular in America as well as in Germany. Another play, *Kinder*, was produced simultaneously in 20 different German theatres in 1910. It was followed by *Das Prinzip* and *Das Tänzchen* in 1912 and by *Phantom* in 1913. Frank Wedekind, a dramatist of queer, undisciplined genius, was by far the most prolific of all the dramatists in Germany during the period under review and probably of all the dramatists in Europe. He produced nine plays in five years, four of which, indeed, were in one act. The plays were *Die Junge Welt*, *Die Zensur* (one act), *Der Liebestrank*, *Die Büchse der Pandora* and three one-act plays, *In Allen Satteln Gerecht*, *Mit Allen Hunden Gehetzt* and *In Allen Wassern Gewaschen*, which were combined in 1911 under the general title of *Schloss Wetterstein* and issued with the statement that they contained his views "on the inner necessity on which Marriage and the Family rest." These plays were followed by *Der Stein der Weisen* and *Franziska*, the latter, prohibited by the censor in Vienna, being produced in Munich. Arthur Schnitzler, a Viennese, known in England through the *Anatol* plays, translated by Granville Barker, and *Der grüne Kakadu* (*The Green Cockatoo*), had four plays performed in the first five years of the decade, *Komtesse Mizzi*, *Der junge Medardus* (which took five hours to perform), *Das Weite Land* and *Professor Bernhardi*, the latter of which was forbidden in Vienna. Herbert Eulenberg was responsible for six plays, *Der natürliche Vater*, *Anna Wolewska*, *Samson* (his most popular piece), *Alles um Geld*, *Alles um Liebe*, *Belinde* (which won the Volksschiller prize), *Zeitwinde* and a one-act play, *Paul und Paula*. Hans Kyser, in addition to the play already named, produced *Titus und die Jüdin* and *Erziehung zur Liebe*.

The list of meritable German dramatists is a very long one. It includes men such as Paul Ernst, Hans Franck, Otto Harnack, Carl Schönherr, whose Volksstück ("people's play") *Glaube und Heimat* was performed in more than 1,000 theatres in six months, Edward Stucken, Max Halbe, Ludwig Fulda, Ludwig Thoma, Franz Dulberg, Leo Birinski, Reinhard Sorge and Arno Holz. The records of the German theatre during the War indicate that a better standard of play was maintained there than elsewhere.

The Expressionists.—Since the end of the War, a new group of dramatists, known by the generic title of Expressionists, had grown up in Germany, of whom George Kaiser and Ernst Toller are the best known in the English-speaking world. Kaiser's play, *Von Morgens bis Mitternachts* (*From Morn to Midnight*) was acted in London before the Stage Society in 1919, and has been played elsewhere in England since then. His play, *Gas*, was produced by Sir Barry Jackson at the Birmingham Repertory Theatre in 1924. He, like all the Expressionists, experiments with new dramatic forms, but the principal characteristics of his work, which hardly merits the extravagant claims made for it, are violence and neurosis. In addition to the two plays named, he has written others, of which the more meritable are *Die Bürger von Calais* (*The Burghers of Calais*) and *Die Koralle* (*The Coral*). Toller's work, though it, too, has a neurotic note in it, which is not unnatural, considering that some of the plays were actually written in prison where he was confined after the War for his Communistic principles, is of more merit than that of Kaiser. His development is likely to be greater than Kaiser's. Two of his plays have been produced in London by the Stage Society, *Die Maschinenstürmer* (*The Machine-Wreckers*) and *Masse-Mensch* (*The Man and the Masses*), as well as in New York by the Theatre Guild. The latter play was revived at the Regent in London in 1926, but was not successful. Kaiser had considerable success with a play entitled *Nebeneinander* (*Parallel Paths*), but Toller was less fortunate with *Die Wandlung* (*Transformation*) which was a complete failure, and *Hinkemann* (*The Cripple*) which caused a riot in the theatre. Max Mohr, another modernist, wrote *Improvisation im Juni* (*Summer Charades*) which had much success.

A violence of sex interest has been manifested in much of the post-War German drama, and this was most plainly to be detected in Schnitzler's *Reigen* (*The Chain*). The temper of the German theatre, however, is calmer now than it was immediately after the Armistice, and there has been a notable increase in the number of English plays performed. The demand for spectacular pieces has abated in Germany as it has in England, and Herr Reinhardt, who, before the War, produced the *Miracle*, *Oedipus Rex* (with Sir John Martin Harvey and Lillah McCarthy in the principal parts) and *Sumurun* in London, found that his new theatre, Das Grosse Schauspielhaus (The Great Arena Theatre) built in 1919, with seating capacity for 3,000, was a failure.

The Drama in Austria

The theatre in Austria, which had existed in a prosperous, if unimpressive, manner up to the outbreak of the World War, suffered terribly after the Armistice. This was not due to any deficiency in the theatre itself, but to the break-up of the Austrian Empire. The depreciation of credit and currency and the decrease in population instantly brought the Vienna theatres to a state of ruin; and four of the most important of them, the Volksoper, the Carl, the Modernes and the Renaissance Bühne, were obliged to shut their doors and submit to drastic reorganisation. Actors' salaries steadily fell. Authors seemed to lose heart, and hardly any plays by Austrian authors were produced. Those that were done were chiefly of a Biblical character, such as Richard Beer-Hoffman's *Jaakob's Traum* (*Jacob's Dream*) and Anton Wildgans' *Kain* (*Cain*). Arthur Schnitzler wrote one exotic piece, *Komödie der Verführung* (*The Comedy of Seduction*) but Hermann Bahr remained silent.

Most of the plays done in Vienna, after the Armistice, were of foreign origin, German, Russian, English and Hungarian. Franz Molnar, the Hungarian dramatist, achieved remarkable popularity in America with various of his plays, as did another Hungarian dramatist, Ernest Vadja with *Fata Morgana*, though he was not so successful with any other play. *Fata Morgana* was very successfully produced in London. The Czechoslovakian dramatists, the brothers Capek, were also made popular in America by two plays, *R.U.R.* and *The Insect Play*, the first of which was fairly successful in London, the second being a failure. Neither of these plays was of the first importance. A third play by these authors entitled *The Makropulous Affair*, dealing with the elixir of life, was not a success in Vienna. The most popular dramatist in Austria after the War was Bernard Shaw, whose plays were almost perpetually performed.

The Drama in Italy

In Italy, the theatre developed along quite humdrum lines, except that the fastidious indelicacy of Gabriele d'Annunzio yielded place to the dubious metaphysics of Luigi Pirandello. The reformers appeared in Italy, too, but their reforms were chiefly concerned with details of acting. In Italy, the voice of the prompter incessantly is heard hissing throughout the performance. Italian actors, unlike all others, do not memorise their words. They are content to give impressions of them, a habit which reduces them to a state of hopeless dependence upon the prompter who steadily whispers the play, word by word, to them. This habit is said to stimulate the actor's spontaneity, but it also stimulates the anger of the audience in foreign countries when Italian actors play outside Italy, as Duse's company did in France, England and the United States in 1923, and Pirandello's company did in London in 1925. Pirandello's most notable play, *Sei Personaggi in cerco d'Autore* (*Six Characters in Search of an Author*) has been performed in English in London by the Stage Society, but has been forbidden public performance by the censor.

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(St. J. E.)

DREADNOUGHT.—The design of the original Dreadnought proved so satisfactory that from the date of her completion onwards the designs of British capital ships continued on the same lines without any essential departure from the principle of the Dreadnought type, namely, a ship carrying an all-big-gun armament, adequately protected, and of a speed equal to that of contemporary foreign capital ships. The other big naval Powers followed the fashion thus set and so the mixed armament vessel was definitely relegated to the past.

Armament.—The Dreadnought type itself, however, was very soon improved upon, the first break with the 12-in. gun armament being made in 1910 when the British "Orion" class of four vessels was laid down. The guns mounted were of 13·5-in. calibre, all mounted on the centre line in five turrets, the two turrets forward and aft being superposed so that one could fire over the other, giving a broadside fire of 10 guns and a forward and astern fire of four guns. This system, which had already been adopted in the United States capital ships, became the standard for future ships. Although foreign Powers followed the Dreadnought type they did not increase the calibre of their main armament for some little time after the British adoption of the heavier gun.

The foreign contemporaries of the "Orion" class were the "Arkansas," "Courbet," "Conte di Cavour," "Helgoland," "Viribus Unitis," "Settsu" and "Gangut" classes of the United States, French, Italian, German, Austrian, Japanese and Russian navies respectively, all of which carried 12-in. guns. The British ships following the "Orion" class continued to be armed with the 13·5-in. weapon, but in the meantime the United States laid down the "New York" and "Texas," mounting 10 14-in. weapons, and Japan the "Fuso" with 12. The British Navy again took the lead, however, in calibre of guns mounted, the "Queen Elizabeth" class of five vessels with eight 15-in. guns being laid down in 1912, followed the next year by the five vessels of the "Royal Sovereign" class, mounting the same main armament.

France had also gone to a higher calibre weapon for the main armament of the vessels "Bretagne," "Lorraine" and "Provence," but Italy, Germany and Austria remained faithful to the 12-in. weapon, and when the World War had been in progress for about two years, Germany completed the "Baden" class of two vessels, mounting eight 15-in. guns in four turrets, as in the British "Queen Elizabeth." In all the British battleships the main armament was mounted in twin mountings, but the foreign navies in this respect were somewhat less conservative. Triple gun mountings were adopted by France, Italy, Austria, Russia and United States, and the French began the construction of quadruple mountings, but neither these nor the ships for which they were intended were ever completed.

Machinery.—From the Dreadnought to the "Royal Sovereign" class the main machinery fitted was of the turbine type the only essential change made being that from the direct drive turbine to the geared turbine. Geared cruising turbines were first introduced into the British battleships in the "Queen Elizabeth" and the fitting of gearing was continued in all later vessels. The British example in regard to the complete adoption of turbines was not followed at once by other nations. A certain distrust for this new type of machinery seems to have been felt, since Japan and the United States, for example, built sister ships, one having turbine engines and the other having reciprocating engines.

The Japanese ships were the "Aki" and "Satsuma," completed in 1911 and 1910 respectively. The "Aki" had Curtis turbines, and the "Satsuma" triple expansion reciprocating engines, and although differing slightly in dimensions they were really vessels of a class. On trials the "Aki's" machinery developed 28,740 S.H.P., giving a speed of 20¼ knots and the "Satsuma's" developed 18,510 S.H.P., giving a speed of nearly 19 knots. All the later Japanese capital ships were fitted with turbine machinery as a result of experience with these two vessels.

The American vessels with which a similar experiment was conducted were the sister ships "Delaware" and "North Dakota," completed in 1910. The latter was the turbine vessel with machinery of Curtis type but this was afterwards replaced by Parsons type turbines. The next two classes of ships built for the United States, the "Utah" and "Florida" and the "Arkansas" and "Wyoming," completed in 1911 and 1912 respectively, had Parsons turbines, but the American experience with this type of machinery seems to have been inconclusive, for in the following class laid down, "New York" and "Texas," triple expansion reciprocating machinery was reintroduced.

The same cycle of changes commenced with the next class of vessel, the "Oklahoma" and "Nevada," the former having reciprocating machinery and the latter turbines, but ultimately turbines were once again adopted with gearing and a further change made in the "New Mexico," completed in 1918, of substituting electrical for mechanical gearing. This type of electric drive had become the standard for American capital ships.

The other big naval Powers adopted the turbine in turn, Germany completing the battle-cruiser "Von der Tann" in 1910, France the "Danton" class of battleship in 1911, Austria the "Viribus Unitis" class in 1912, Italy the "Dante Alighieri" in 1913, and Russia the "Gangut" class in 1914, all with turbine installation, and these countries continued to install this type of machinery in their later vessels.

Fuel.—The other great departure made in power production concerned the fuel. All the British battleships from the Dreadnought to the "Iron Duke" class had coal-fired boilers with oil as a subsidiary fuel. The oil was sprayed into the furnaces on top of the coal to maintain a burst of speed for a longer period than was possible when firing with coal only.

In the "Queen Elizabeth" class, however, as a result of experience in the light cruisers of the "Arethusa" type, oil was adopted as the fuel, coal being entirely dispensed with. This was a most important step to take in view of the supply of oil being comparatively insecure when compared with that of Welsh coal, but the advantages of oil as a fuel were so great that subsequent to this no British capital ship was built to use coal.

The "Royal Sovereign" class following the "Queen Elizabeths" was originally designed to be coal-fired, owing to a feeling that oil supplies would be insufficient, but during the design stage the advantages of oil fuel became so apparent in other vessels that all oil was ultimately adopted. All the battleships previous to the "Queen Elizabeth" had a speed of approximately 21 knots. This was increased in the "Queen Elizabeth" class to 25 and although the "Royal Sovereigns" were originally designed for 21 knots as coal-fired vessels, the great advantage of oil as fuel was shown by the fact that 23 knots would be obtained with the vessels oil-fired. The British lead in this respect was not followed by any other Power with the exception of the United States who first introduced all oil fuel in the "Nevada" and "Oklahoma" completed in 1916.

Armour and Protection.—The general arrangement of main belt armour, deck protection and underwater protection bulkheads continued on the same plan from the Dreadnought onwards, and the "Orion" class of the 1909–10 programme, completed in 1912, had a main belt varying from 12 in. to 8 in. in thickness, with protective decks varying from 1½ in. to 2 in. and underwater protection to magazines by isolated bulkheads varying from 1½ in. to 2 in. according to their distance from the ship's side.

In the "Royal Sovereign" class of the 1913–4 programme, completed in 1916, the main belt was 13 in. with protective decks varying from 1 in. to 3 in., and a continuous longitudinal bulkhead of 1½ in. in thickness to protect the vessel from underwater attack. This fore and aft protection had undergone various changes in the intermediate vessels, varying from isolated portions near the magazines to a continuous bulkhead, but the increasing power of torpedoes made it necessary finally to adopt the continuous protection. The efficiency of this system of protection was demonstrated at Jutland (torpedoing of "Marlborough"), but it was finally improved upon by the later forms of bulged protection, devised by Sir E. H. T. d'Eyncourt, whilst Director of Naval Construction, and the "Ramillies," the last vessel of the "Royal Sovereign" class to be completed, was built with a bulge, the other ships of the class being bulged later.

The foreign contemporaries of the "Royal Sovereign" class were very similarly protected except perhaps the German battleships which, with their generally greater beam and a sacrifice of such qualities as habitability and endurance, were able to carry somewhat thicker belt armour. It is a rather striking point that the foreign vessels completed about the time of the "Royal Sovereign" all had from 5 to 10 ft. more beam. The British designers were very seriously handicapped in this respect by the restricted width of the existing graving docks.

Battle Cruisers.—Concomitant with the design and construction of battleships the faster and more lightly protected type of capital ship called the battle-cruiser, was developed for the British Navy, and this lead was followed by Germany, Japan, Russia and America, but only the first three named completed any of these vessels.

Previous to 1910 three vessels of the "Invincible" class were completed for the British Navy, followed by three of the "Indefatigable" class completed in 1911–3, three of the "Lion" class in 1912–3, the "Tiger" in 1914 and the "Repulse" and "Renown" in 1916.

The main armament of the first of these battle-cruisers consisted of eight 12-in. guns, and the speed of the vessels was 25½ knots. The advance in armament followed a similar course to that in the battleships, increasing in calibre to 13½ in. in the "Lion" class and in the "Tiger," the speeds of the vessels being 28 and 30 knots respectively. The number of guns carried was still eight, but in the "Repulse" and "Renown," with a further advance in the calibre of the guns to 15 in. and an increase in speed to 32 knots, the number of guns carried was reduced to six in three twin turrets, two being mounted forward with one firing over the other and the third being mounted aft.

The essential differences between the battleship and the battle-cruiser are clearly shown in the comparison between the battleship of the "Royal Sovereign" class and the battle-cruisers of the "Renown" class and the "Tiger" in Table I.

TABLE I.

	"Royal Sovereign"	"Renown"	"Tiger"
Length extreme	624¼ ft.	794 ft.	704 ft.
Load displacement in tons	25,750	26,500	28,500
Shaft horsepower	40,000	120,000	108,000
Speed at load draft	23 knots	32 knots	30 knots
Main armament	8 15 in.	6 15 in.	8 13·5 in.
Distribution of weights as percentages of load displacement represented by symbols:			
Armament	1·4 a	a	a
Machinery	b	2·2 b	2·1 b
Armour and protection	1·73c	c	1·44c

The foreign battle-cruisers developed on very similar lines, but of those completed only the Japanese "Kongo" class mounted a heavier weapon than the 12-in., these vessels having a main armament of eight 14-in. guns and a speed of 27½ knots. The British battle-cruiser type in action was a great success in the battle of Falkland Is., in which the "Invincible" and "Inflexible," in company with smaller vessels, destroyed Von Spee's fleet, but later the losses of this type in the battle of Jutland brought out their weaknesses when in line of battle against battleships.

The "Hood" Design.—The experience thus gained led to additional horizontal protection being added over the magazines and other vital points of all capital ships and at the same time modified the design of the battle-cruiser "Hood." This vessel was designed by Sir E. H. T. d'Eyncourt early in 1916 and had only just been ordered when the battle of Jutland took place. Additional protection was incorporated without materially altering the essential features of the design, and the resulting vessel was a combination of the characteristic features of both the battleship and the battle-cruiser, since she carried a main armament of eight 15-in. guns, had a main belt of 12-in. armour and had a speed equal to that of any battle-cruiser, namely, 32 knots. Complete bulge protection was fitted in this vessel, and the section of the vessel shown in fig. 1 (*a*) in comparison with a section of the "Royal Sovereign" (*b*) as originally built without a bulge, shows what a great departure she was from the conventional ship form.

The "Hood," completed in 1920, is 860 ft. in length overall, 104 ft. in breadth, displaces at her load draught 41,200 tons and with a S.H.P. of 144,000 can be driven at 32 knots. She has the distinction of being the largest and at the same time the fastest capital ship in the world at present, and will probably hold that distinction for many years to come.

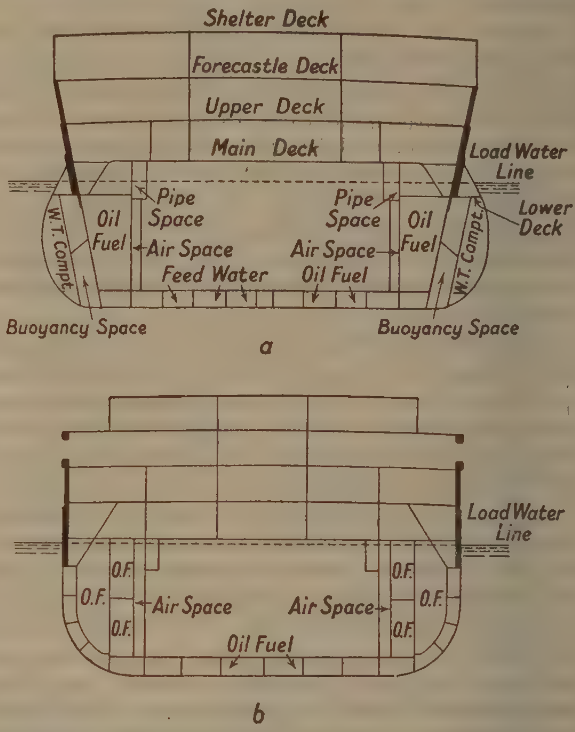


FIG. 1.—*a*. Section of H.M.S. "Hood." *b*. Section of H.M.S. "Royal Sovereign."

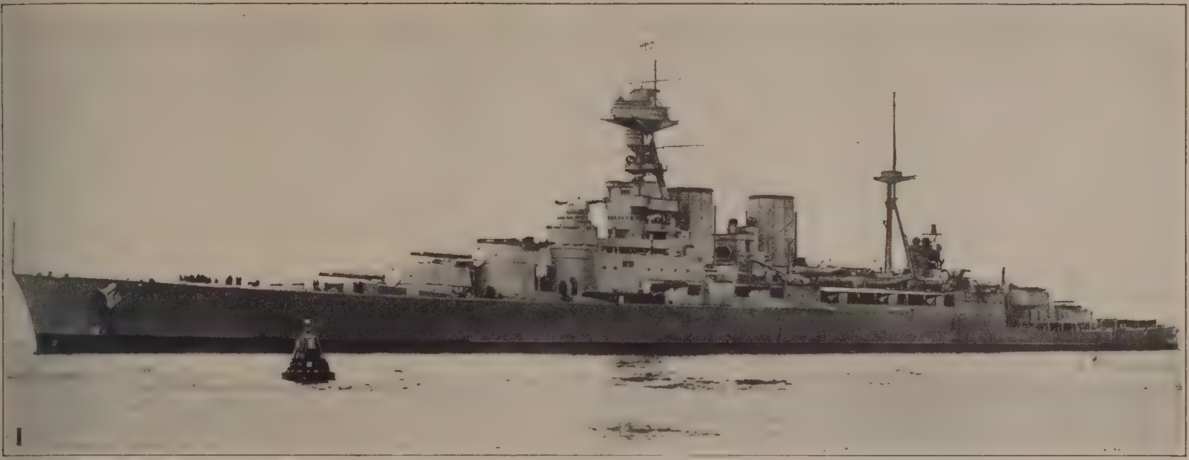
At the end of the World War and whilst the construction of the "Hood" was proceeding, warship design practically came to a standstill whilst the lessons of the War were being absorbed. Germany and Austria had practically ceased to exist as naval Powers, Russia was in a similar state, France and Italy had abandoned construction of capital ships some time previous in order to husband their resources and so it was left to the British, American and Japanese designers to continue the study of the design of capital ships.

NAVAL CONSTRUCTION, 1919–22

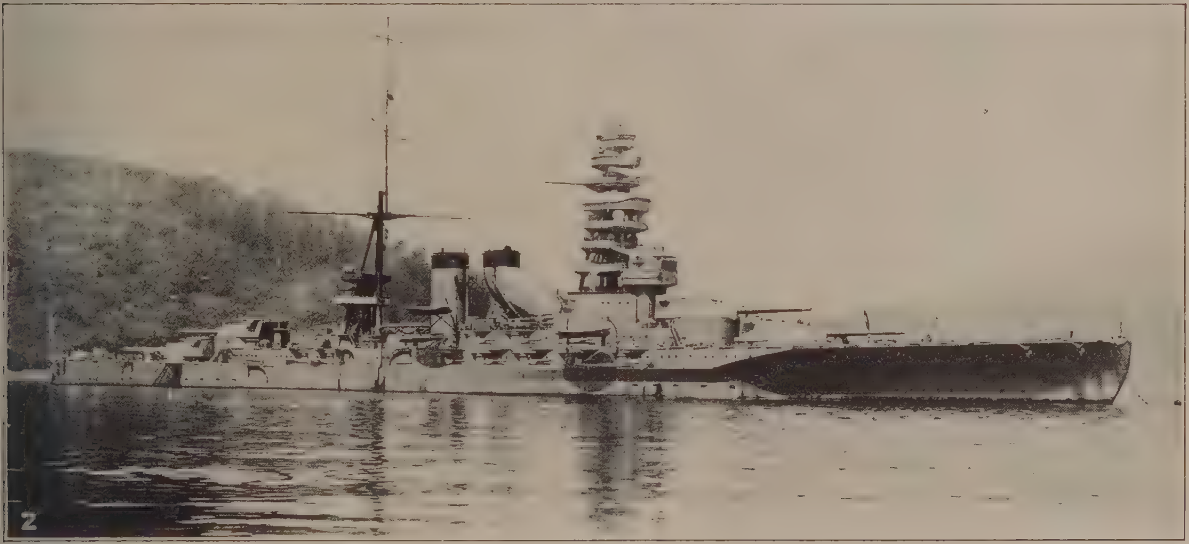
If we now consider the warship building programmes of these three nations during the year 1919 and up to the signing of the Washington Treaty on Feb. 6 1922, we shall obtain an idea of the trend of capital ship design before it was affected by the treaty.

The vessels built, building and projected, with the salient particulars, are shown in Table II., p. 878.

Once again the calibre of the main armament had increased, this time to 16 in. for both the foreign battleships and battle-cruisers, and the tendency was for both the displacement and speed to increase also. There is no doubt also that the British Admiralty were considering the design of vessels of still greater dimensions than the "Hood," and it was at the commencement of this new era of the building of colossal ships of war that the Washington Conference (*q.v.*) was convened, followed by the signing of the treaty early in the year 1922. Under this



1



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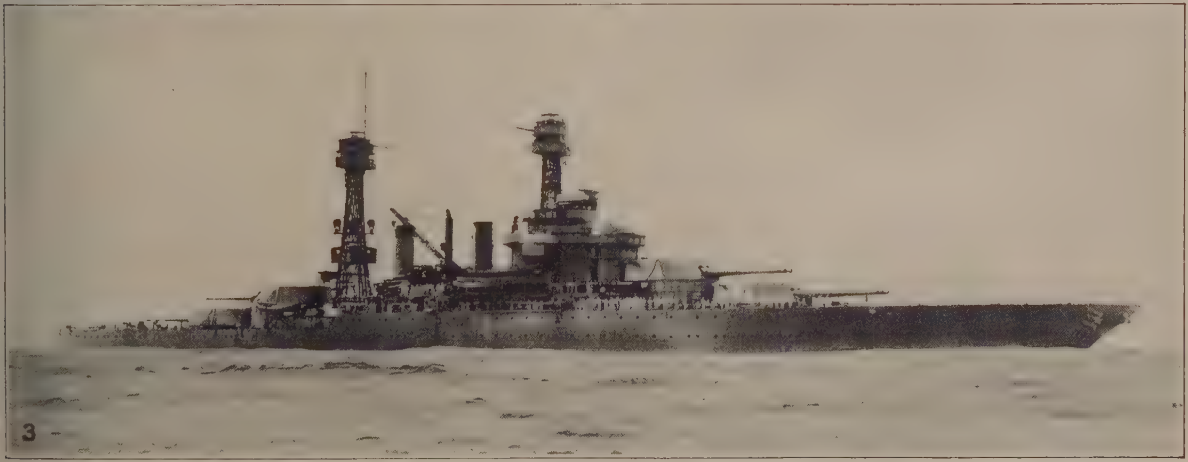

3

FIG. 1. BRITISH BATTLE CRUISER "HOOD," COMPLETED 1920. FIG. 2. JAPANESE BATTLESHIP "MUTSU," COMPLETED 1920. FIG. 3. U. S. BATTLESHIP "WEST VIRGINIA," COMPLETED 1923.

Fig. 1. Photo. Abrahams, Devonport. Fig. 2. From "Jane's Fighting Ships, 1925." Fig. 3. Courtesy of U. S. Navy Dept.

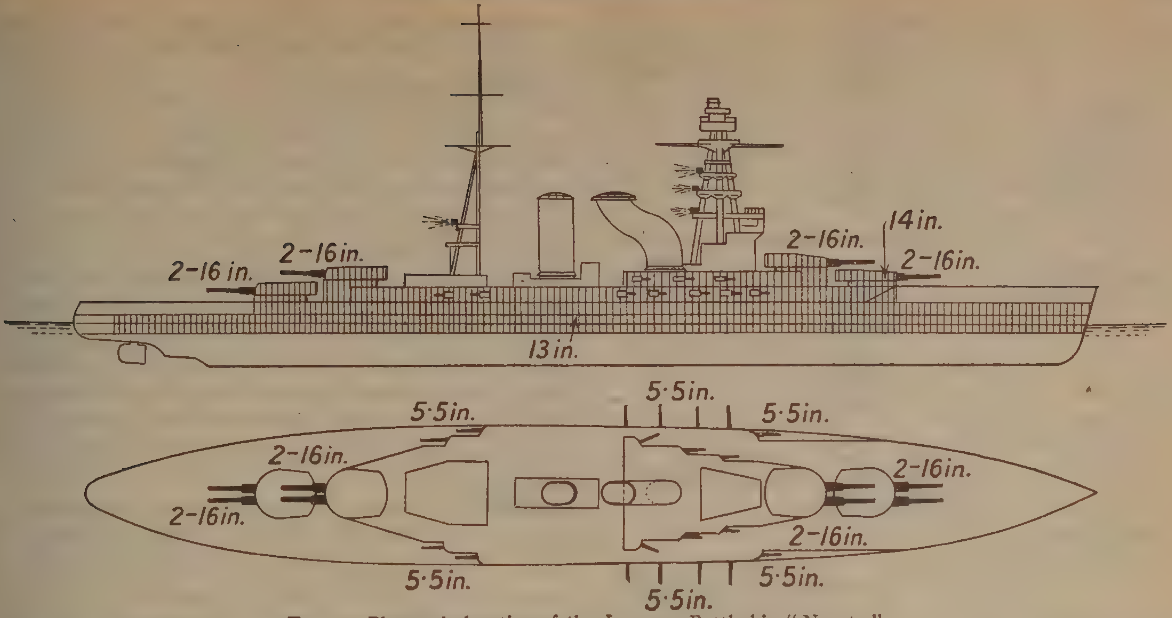
2-16 in.
2-16in.
14in.
2-16in.
2-16in.
13in.
5·5in.
5·5in.
5·5in.
2-16in.
2-16in.
2-16in.
2-16in.
5·5in.
5·5in.
5·5in.

FIG. 2.—Plan and elevation of the Japanese Battleship "Nagato."
Brassey's Naval and Shipping Annual

treaty Japan retained the battleships "Nagato" and "Mutsu," mentioned in the previous table, and was given the power to convert two of the remaining battle-cruisers or battleships then building to aircraft carriers; the rest were scrapped.

United States.—The United States retained the "Colorado," "Maryland" and "West Virginia" and retained also the power to convert two of the battle-cruisers to aircraft carriers. These retained vessels are of special importance, as to a certain extent they set the limits to the design of capital ships which were fixed by the Washington Treaty. They are in the region of 33,000 to 34,000 tons displacement and their main armament consists of 16-in. guns, and the specific terms laid down by the treaty limit the displacement to a maximum of 35,000 tons, the calibre of the main armament to be not greater than 16-inch.

Great Britain.—By the treaty the British Empire was allowed to lay down in 1922, for completion by about the end of 1925, two such capital ships to complete the necessary tonnage allowed and these, the "Nelson" and "Rodney," the first two post-War capital ships to be laid down for the British Navy, were designed by Sir E. H. T. d'Eyncourt previous to his retirement from the Admiralty. These are the only capital ships designed entirely since the Washington Treaty and therefore the only two vessels in which it has been possible to incorporate the lessons learned at Jutland. It is obvious, from a study of the previous table, that as long as the Washington limit prevails, the battle-cruiser type is dead, if it is desired to mount the maximum possible armament of 16-in. calibre and to give adequate armour protection to the vitals. The dimensions of the "Nelson" and "Rodney" have been published and are shown in Table III., p. 878, in comparison with the Japanese "Mutsu" class and the United States "Colorado" type.

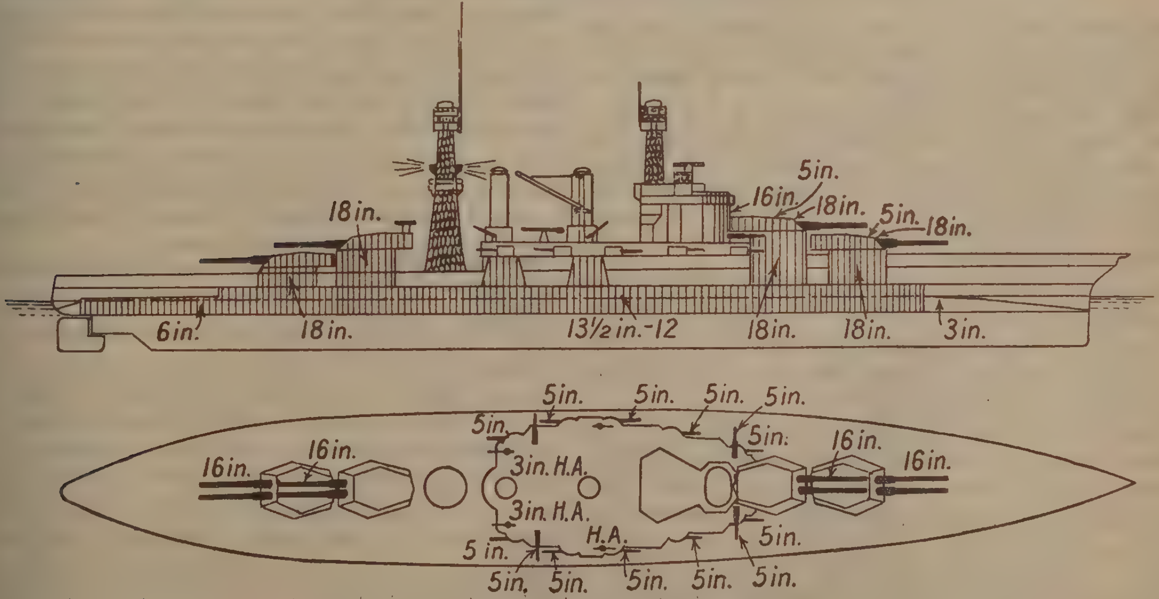
18in.
5in.
16in.
18in.
5in.
18in.
6in.
18in.
13½in.-12
18in.
18in.
3in.
5in.
5in.
5in.
5in.
5in.
5in.
16in.
16in.
16in.
16in.
3in. H.A.
3in. H.A.
H.A.
5in.
5 in.
5in.
5in.
5in.
5in.
5in.

FIG. 3.—Plan and elevation of U.S. Battleship "Colorado."
Brassey's Naval and Shipping Annual

TABLE II.

	Laid Down	Completed	Displ. Tons	Main Armt.	Speed Knots
UNITED STATES					
Battleships:—					
"Colorado" . .	1919	(1923)	32,600	8 16 in.	21
"Maryland" . .	1917	(1921)			
"West Virginia" . .	1919	(1923)			
"Washington" .	1919	Scrapped			
"Indiana" class, 6 vessels . .	Projected	Scrapped	43,200	12 16 in.	23
Battle-cruisers:—					
"Constellation" class, 6 vessels .	1919–20	Two being converted to aircraft carriers. Others scrapped	43,500	8 16 in.	33¼
JAPAN					
Battleships:—					
"Mutsu" . .	1917	1920	33,800	8 16 in.	23
"Nagato" . .	1918	1921			
"Kaga" . .	1918	Being converted to aircraft carrier			
"Tosa" . .	Projected	Scrapped			
Battle-cruisers:—					
"Amagi" class, 4 vessels . . .	1919–20	One being converted to aircraft carrier; others scrapped	40,000	8 16 in.	30
GREAT BRITAIN					
Battle-cruiser:—					
"Hood" . .	1916	1920	41,200	8 15 in.	32

TABLE III.

	Length on Water-line	Breadth Extr.	Displ. Tons	Main Armt.	Speed Knots
Great Britain "Nelson" and "Rodney" .	702	106	35,000	9 16 in. reported	..
United States "Colorado" class	600	97½	32,600	8 16 in.	21
Japan "Mutsu" class .	695 approx.	95	33,800	8 16 in.	23

Other particulars of the "Nelson" and "Rodney" are still withheld by the British Admiralty but they are credited with a main armament of nine 16-in. guns and very heavy armour and complete underwater protection.

Both these vessels were launched towards the end of 1925, the "Nelson" from the works of Messrs. Armstrong Whitworth & Co., Newcastle-on-Tyne, and the "Rodney" from Messrs. Cammell Laird & Co.'s works at Birkenhead. These will be the last two capital ships added to the British Navy for several years to come, as it will be 1931 before two further ships can be laid down for completion in 1934.

United States and Japan.—The same applies in the case of the United States and Japan, which can lay down two and one capital ships respectively also in 1931. Both Italy and France are allowed to lay down capital ship tonnage in 1927, but it seems very improbable at present that such a course will be taken owing to financial considerations.

Political Factors.—Another great factor in addition to the Washington Treaty affecting warship design is the change in the general tactical and strategical situation brought about by the almost complete eclipse of Germany as a naval Power. The centre of gravity as far as the naval situation is concerned has moved from the North Sea, and to a great extent also from the Mediterranean, to a much larger field of operations, namely, the Pacific. This means that British ships will have to traverse much wider areas than heretofore and the design of cruisers with a large endurance, not only to protect the ocean routes but to operate in the larger oceans, has assumed a relatively greater importance compared with capital ships than has been the case hitherto. (E. T. D'E.)

DREISER, THEODORE (1871–), American author, was born at Terre Haute, Ind., Aug. 27 1871 and received his education in the public schools at Warsaw, Ind., and at Indiana University. From 1892 to 1894 he was engaged in newspaper work in Chicago and St. Louis. In 1895 he became editor of *Every Month*, a literary and musical magazine. In 1905 he was editor of *Smith's Magazine*, becoming managing editor of *Broadway Magazine* in the following year. From 1907 to 1910 he was editor-in-chief of the Butterick publications, including *The Delineator.* He published his first novel *Sister Carrie* in 1900, followed by *Jennie Gerhardt* (1911) and *The Financier* (1912), the last of which established his reputation as a powerful writer of realistic fiction. His other novels include *The Titan* (1914) and *The Genius* (1915). He also wrote *Plays of the Natural and the Supernatural* (1916); *A Hoosier Holiday* (1916) and *The Hand of the Potter,* a tragedy (1918). His latest works were *A Book about Myself* (1922); *The Color of a Great City* (1923) and *An American Tragedy* (1925).

DRESDEN, Germany (*see* 8.574), had in 1919 a population of 587,748. In this figure are included Tolkewitz and Reich, incorporated in 1912, but not 23 suburban communes incorporated in 1921. A later estimate was 613,000. The newer industrial areas of the city lie to the south and southwest. The Diet of Saxony meets in the modern town hall, a Renaissance structure. New buildings include a theatre, a branch of the technical academy, an impressive crematorium and the Haus der Kaufmannschaft. During the World War the loss of foreign visitors and subsequently the dissolution of the court of the King of Saxony bore very hardly on the city. The revolution was followed in Dresden by disturbances and strikes; in 1919 sanguinary street fighting took place.

DRESS: *see* COSTUME.

DRINK TRAFFIC: *see* LIQUOR LAWS.

DRINKWATER, JOHN (1882–), British poet, playwright and critic, was born at Leytonstone, Essex, June 1 1882, and educated at the Oxford High school. After 12 years' work as an insurance clerk, he began to devote himself to theatrical enterprise, and became manager and producer to the Pilgrim Players, who developed into the Birmingham Repertory Theatre Co. His first volume of poems appeared in 1906 and his first play, *Cophetua* (in verse), in 1911. He subsequently published several volumes of verse, critical studies on *William Morris* (1912), *Swinburne* (1913) and others, and several plays, of which *Abraham Lincoln* (1918) was produced with great success both in London and in the United States. Among his later plays were *Oliver Cromwell* (1921), *Mary Stuart* (1922) and *Robert E. Lee* (1923), each of which was performed in London. These plays fall under the category of "chronicle dramas." In 1923 his *Collected Poems* (2 vol.) were published, and in 1925 *The Muse in Council*, a collection of essays, and his *Collected Plays* (2 vol.). In 1925 *The Pilgrim of Eternity: Byron—a Conflict*, his most important prose work, made its appearance.

DRIVER, SAMUEL ROLLES (1846–1914), British scholar (*see* 8.585), died at Oxford Feb. 26 1914.

DRIVING: *see* COACHING.

DROYSEN, GUSTAV (1838–1908), German historian (*see* 8.596), died at Halle Nov. 10 1908.

DRUSES (*see* 8.603).—Drūz or Darazīyah, so-called from the missionary Darazī, who founded the sect in the first quarter of the 11th Christian century. The Drūz community consists of Arabic-speaking mountaineers, estimated to number about 150,000 in the aggregate, who are scattered through different parts of Syria, principally in four districts: (*a*) the Southern Lebanon; (*b*) Hāsbeiyā and Rāsheiyā on the western slopes of Mount Hermon; (*c*) Jebel Haurān, an isolated block of mountains southeast of Damascus on the edge of the Syrian desert; (*d*) the northern part of the Hama district. The settlement in the Jebel Haurān is the most important, owing to the virtual independence which the Druses maintained here against the

Ottoman Govt. and which they sought to assert against the French mandate; but it is also the most recent. The migration of the Druses to the Haurān does not seem to have begun before the 18th century, and took place for the most part during the middle decades of the 19th century.

The autonomous vilayet of the Lebanon was constituted in 1864 under the guarantee of the Powers. In the Lebanon constitution the different religious sects into which the population of the vilayet was divided were represented proportionately in the Government. The system worked well until the constitution was suppressed by the Turks during the World War, and in that period trouble between the Druses and the Maronites in the Lebanon was rare. Meanwhile the Druse community had shifted its centre of gravity to the Haurān, where it was practically out of reach of the Ottoman Govt. and of the Powers. In the peace settlement after the World War the Haurān was included in the French mandated territory of Syria. After the French had conquered the interior of Syria in the campaign of Aug. 1920, they attached additional territory, including the Druse settlements in the Hāsbeiyā and Rāsheiyā districts, to the Lebanon province, and induced the Druses of the Haurān to receive a French resident political officer. Discontent with this territorial change and with the conduct of the French resident in the Haurān led to the Syrian rising of 1925, in which the Druses took the lead. (*See* DAMASCUS; SYRIA.)

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DRY CLEANING.—Dry cleaning is the removal of dirt and stains from materials by means of solvents, and of especially prepared soap. The process is known variously as dry, French and chemical cleaning. It is based on the fact that a considerable amount of the dirt and dust on wearing apparel, draperies, etc., is held in position by greasy substances. When the grease is removed by a suitable solvent, the dirt may be removed mechanically. The process was first employed in France about the middle of the 19th century. At first all the work was done by hand and the operations were very simple. Later machinery was introduced, thus providing the basis for a large industry that requires skill, a thorough knowledge of textiles, leather, etc., and elaborate equipment.

The term dry cleaning is used in contradistinction to cleaning with soap and water. The process involves immersion of articles in liquids other than water, which do not affect the physical properties of the materials treated. In a strict sense, the process is not "dry," but articles immersed in the liquids employed in dry cleaning are not wetted as they would be in water. Water causes textile fibres to become limp, and, in many cases, to alter in shape and size. Petroleum naphtha and other liquids employed in dry cleaning are inert as regards alterations of the fibre. The classes of materials which may best be dry cleaned include many kinds of clothing, millinery and house furnishings. The two cleaning agents used in largest quantities are dry-cleaner's soap and petroleum naphtha. These agents are supplemented by ethyl alcohol, acetone, carbon tetrachloride, acetic acid, etc., which are used in small quantities mostly for removing spots that do not respond to the ordinary treatment described below. Dry-cleaning soap is a superfatted soap, in which about one-half of the fatty acid has been saponified with caustic potash or caustic soda or ammonia. A soap of this nature is soluble in gasolene or naphtha and in similar solvents.

Articles made of strong materials are washed in mechanically driven revolving cylinder-type washers with petroleum naphtha and dry-cleaning soap, followed by rinses in fresh naphtha. The articles are removed from the washer and freed from as much solvent as possible in a centrifugal extractor, and finally transferred to a drying tumbler, where the last traces of the cleaning fluid are removed. The drying tumblers are of metal and are designed along somewhat the same lines as the washer. The drying is hastened by a current of heated air which is blown through the tumbler. The garments when dry go to the spotting table for attention to any spots that may not have been removed in the process just described.

Articles made of delicate materials are cleaned by hand on specially constructed tables, and for some of this cleaning considerable skill is required. The more delicate classes of work cannot be dried in drying tumblers, but must be hung in ventilated, heated, drying rooms. In all cases the used cleaning fluid is drained into reclaiming tanks. After proper renovation it is used over and over again, new solvent being added to make up evaporation and mechanical losses. Most dry-cleaning fluids are inflammable and precautions must be observed to prevent fires when using them. For this reason, dry cleaning can be practised with safety only in plants designed for the purpose.

There are approximately 3,000 power-cleaning establishments in the United States. The total number of persons engaged in the industry exceeds 35,000. Salaries and wages paid annually total approximately $48,000,000. The larger establishments employ from 200 to 600 people. The average number of employees is approximately 12 per plant. European dry-cleaning practice is similar to that of the United States but less machinery is used, particularly for finishing materials cleaned. There are fewer plants per unit of population, but the average size is larger. Some of them have several thousand employees. (Ll. J.)

DUBLIN (*see* 8.617) had in 1923 an estimated population of 431,000. The census figure for 1911 was 304,800. Its finest thoroughfare, Sackville (or O'Connell) Street, witnessed the fiercest fighting of the Easter rising of 1916 and the irregular revolt of 1922. The General Post Office was the revolutionary headquarters in 1916, and in the military operations the greater portion of the southern section of the street from Nelson Pillar to the Liffey was burned to the ground. Over 200 buildings were destroyed, including the General Post Office, of which only the shell remained, the Royal Hibernian Academy, the offices of *The Freeman's Journal*, several leading hotels and a large number of the principal shops and warehouses.

Destruction in 1922.—Rebuilding operations had not been completed when, in June 1922, forces opposed to the treaty with Great Britain seized the block of buildings in the northern section of Sackville Street between Cathedral Street and the Parnell Statue. This position was subjected to an artillery bombardment at close range and, as in the Easter rebellion, the buildings were destroyed by fire. Thus, with the exception of the block between Henry Street and Parnell Street, which suffered only partial damage, the whole of Sackville Street was reduced to rubble. While the southern portion of the thoroughfare has been reconstructed on modern lines, in 1926 little had been done, beyond clearing the sites, to make good the havoc wrought by the 1922 fighting. The heaviest architectural loss sustained was the destruction of the Custom House, and the four Courts. In May 1922 the Custom House, which under British rule was the headquarters of the Inland Revenue and the Local Government Board, was seized and set on fire by armed bands of the Irish Republican Army. Later, clearing operations were undertaken and it is the intention of the Free State Govt. to reconstruct the building.

In the assault of June 1922 on the Four Courts, the guns of the Provisional Govt. battered a breach in the walls, but the destruction of the building was due to the explosion of land mines by the irregular garrison. Rebuilding operations had made good progress in 1926. The pierced dome had been repaired and it is expected that by 1928 the law courts will again be housed in their former home. Meanwhile they are housed in Dublin Castle, which is no longer, as under the British régime, the headquarters of the executive.

Though the castle was handed over after the acceptance of the treaty by Dail Eireann, the Provisional Govt. decided to establish themselves in the College of Science, Merrion Street, which is now known as Government Buildings. This transferred the centre of administrative activity to a new quarter of the city, but the abnormal conditions created by the armed resistance of those opposed to the treaty, which kept ministers practically prisoners in Government Buildings, made it necessary to select a meeting place for the first Parliament of the Free State with an eye to the exigencies of the military situation. Leinster House, adjoining the College of Science, and the National Museum, which forms a connecting link with the College of Science, were commandeered for the use of the Dail and the Senate.

Little is heard now of the demand that the old Parliament House in College Green should be restored to its former dignity. Though architecturally more imposing than Leinster House, the building could not be converted to the needs of a modern representative assembly save by a heavy outlay for the purchase of adjoining property, while, under present conditions of Free State finance, the cost of providing alternative accommodation for the Bank of Ireland, now in occupation, would be prohibitive.

A few miniature building schemes have been carried out, but nothing has yet been done to deal with Dublin's terrible slum problem. At present in the city 20,000 families are herded into single rooms. The stoppage of building during the War has been relieved in a slight degree for the middle classes by the transformation into flats of the capacious Georgian houses which in former days were occupied by single families. (J. W. Go.)

DUBLIN, UNIVERSITY OF (*see* 8.619).—Trinity College, Dublin, which constitutes the University of Dublin, sent 3,042 members to the World War, of whom 456 were killed or died on active service. Italian, Spanish and Irish form new departments of study. In 1919 arrangements were made for the admission of primary teachers from the Church of Ireland training college. In 1923 arrangements were made with the Royal College of Science to provide teaching leading to the degrees of Sc.B. (Tech.), B.A.I. (Mech.) and B.A.I. (Elec.). In 1925 a school of commerce was founded. A department for the training of secondary teachers in Trinity College has been established. In 1920 the mode of election of fellows by examination was completely altered, and a new system was adopted by which fellows might be elected for proficiency in any branch of learning. Research prizes were instituted for honour graduates. The Lecky professorship of modern history and the professorships of pathology, bacteriology and preventive medicine were founded, as were professorships in general chemistry, plant biology, human anatomy and embryology and physiology.

Benefactions.—The principal benefactions received during the period 1910–26 were as follows: The historical library of W. E. H. Lecky, containing over 6,000 vol., presented by Mrs. Lecky; £3,500 from Sir J. P. Griffith for the extension of Trinity Hall for women students; £2,500 from Lord Iveagh for the equipment of Trinity Hall; £3,000 from Sir J. P. Griffith to help graduates to secure permanent positions; £3,000 from Sir J. P. Griffith to help undergraduates; £10,000 from Lord Iveagh for the school of geology; £20,000 from the same donor for a new bath house in college; landed property bequeathed by Mrs. Lecky to endow the Lecky chair of history; £10,000 from J. M. Purser, M.D., for the schools of physic, natural science and experimental science.

DUBOIS, FRANÇOIS CLÉMENT THÉODORE (1837–1924), French musical composer (*see* 8.623), died in Paris June 11 1924.

DUBOIS, LOUIS ERNEST (1856–), French ecclesiastic, was born at Saint Calais, France, Sept. 1 1856. He was educated at the seminaries of Précigne and Mons, being ordained priest in 1879. In 1885 he became curate of Notre Dame de la Couture at Le Mans, where he spent 10 years and occupied himself with ecclesiastical history. After he became vicar of Saint Benoit in 1895, Mgr. de Bonfils chose him as vicar-general on his appointment to the bishopric of Le Mans. In 1901 he was appointed bishop of Verdun where he was obliged to cope with the delicate situation which arose concerning the separation of Church and State, and accomplished the task with the minimum of friction. In 1909 he was made Archbishop of Bourges, and during the World War was indefatigable in organising charitable associations and relief work. After continuing his admirable work in the diocese of Rouen, to which he was appointed in 1916, he was made Cardinal of Santa Maria in Aquino, Rome, by Pope Benedict XV. in Dec. of the same year. On the death of Cardinal Amette in 1920, Cardinal Dubois was made Cardinal Archbishop of Paris.

DUCHESNE, LOUIS MARIE OLIVIER (1843–1922), French scholar and ecclesiastic (*see* 8.629), died in Rome April 21 1922.

DUCTLESS GLANDS: *see* ENDOCRINOLOGY.

DULUTH, Minn., U.S.A. (*see* 8.653), had a population in 1920 of 98,917, including 30,196 foreign-born, among whom Swedes, Norwegians, Canadians and Finns predominated; and in 1925, according to the census bureau estimate, of 110,502. The area was 62 sq. m. in 1925. The city adopted the commission form of government in 1912, a building code in 1918, a zoning ordinance in 1925, a programme of city planning to be completed in 1927, and enlarged and co-ordinated its fine system of parks, boulevards and playgrounds (over 2,000 ac. by 1925). The Duluth-Superior harbour handled its maximum tonnage in 1923 (59,274,812 short tons, 62% more than in 1910), ranking second among American ports. In 1925 there were 22 coal docks, nine iron ore docks and 27 grain elevators. There were also a cement elevator three shipyards and 43 wharves for general freight.

DUNAJEC-SAN, BATTLES OF THE.—The Dunajec and San rivers, which, rising in the Carpathians, flow northwards across Galicia to join the Vistula on the Polish border, mark the first two stages of the great Austro-German offensive of 1915.

Austro-German Plans.—By the end of March 1915 the Austrian armies in the Carpathians were on the verge of collapse under pressure of the persistent Russian attacks (*see* CARPATHIANS, BATTLES IN THE); and it became obvious to Falkenhayn, who directed German strategy, that the available reserves of Germany must be used in the East to bolster up her principal ally. He had no intention of dispersing these reserves in purely defensive measures, and judged the time opportune to deal Russia a blow which would paralyse her offensive power for many months, if not permanently. The Franco-British attacks during March had given him a gauge by which to measure the defensive strength required in the West. He decided that troops could safely be withdrawn for the Russian front. He had also arrived at a just appreciation of the seriousness of Russia's shortage of reinforcements and of munitions. Not only were all formations much under establishment, but there were no available reserves either of trained men or of rifles; the stock of shells was almost exhausted, the output of the home factories was entirely inadequate and munitions from abroad could only arrive slowly. Russia's situation invited attack.

Having decided on an offensive, Falkenhayn had to choose between enveloping operations from the flanks or a break-through attack. The poor railway communications to the Carpathians and the disorganisation existing in that region as a consequence of the long winter battle excluded an operation from that flank. An enveloping movement from the northern flank—Ludendorff's favourite project—would be too distant to influence immediately the critical situation in the Carpathians. Falkenhayn determined on a break-through attack east of Cracow between the Carpathians and the upper Vistula. This point of attack appears well chosen. No great obstacle would be met till the line of the San was reached; the Vistula would afford some protection to the left flank of the advance; and a success would immediately influence the Carpathian situation. Moreover, the enemy's line on the selected front of attack was weakly held.

Disposition of Forces.—The Russian III. Army, which in Jan. held from the Vistula-Dunajec junction to about Gorlice in the Carpathian foothills only, had extended its front during the Carpathians battle. It now reached to about Mezö Laborcz, southeast of the Dukla pass, a total front of over 100 miles. It comprised a fighting wing and a defensive wing. The left wing, which had been engaged in the last great offensive of the Carpathians battle, consisted of four corps, all somewhat exhausted. The right, the defensive wing, on which the blow was to fall, had been weakened by the withdrawal of one corps to the IX. Army in the Bukowina and by the transfer of another corps to the left, the fighting wing; it now contained two corps only, holding a front of 50 to 60 miles. The right corps, the IX., held the lower Dunajec, from its junction with the Vistula to south of Tarnów; the other, the X., extended between Tuchów and Gorlice.

These two corps had been sitting inactive opposite the Austrian IV. Army all winter; and the dispositions they had made were calculated for defence against Austrians, not Germans. Consequently there were neither sufficient rear lines nor alternative gun emplacements. The Army had only a single corps in reserve, the III. Caucasian. The Russian army commander was Radko-Dimitriev. He had some ability and was a gallant fighter, but seems to have distinguished himself more as a corps commander than as an army commander.

The German XI. Army, the spear point of the offensive, consisted of eight German divisions from the western Front, two Austrian divisions and a cavalry division. It was assembled with great secrecy behind the right of the Austrian IV. Army, opposite the Russian X. Corps. Its commander was Mackensen, who had led the Łódź offensive at the end of 1914 (*see* Łódź-Cracow) and was to win further fame by his victories in Serbia and Rumania. The Austrian IV. Army was placed under him in addition to his XI. Army. He himself was subordinate to the Austrian High Command.

Mackensen's Attack.—The preliminary bombardment began on May 1 and was continued during the forenoon of the 2nd. It was carried out by 1,500 guns of all calibres, and left the Russians powerless. Mackensen's army swept over the shattered trenches of the X. Corps, meeting with little resistance, and pressed forward in the direction of Rzeszów and Jarosław. The Austrian IV. Army forced the IX. Corps from its line on the lower Dunajec. The Austrian II. and III. Armies in the Carpathians also began a forward move. There followed five days of hard fighting, but the Russians were unable to stem the tide. Radko-Dimitriev's reserve corps attacked gallantly but fruitlessly; his left wing had to yield the Dukla pass and the hard-won gains of the April offensive. An attempt to stand on the line of the Wisłok river and the Lupków pass failed before renewed Austro-German attacks on May 8. Brusilov's VIII. Army was now also involved in the retreat; and a few days later the left wing of the IV. Army north of the Vistula had to retire from the line of the Nida.

The Russians now decided to check their foes on the strong line of the river San, with the fortress of Przemyśl to support their left centre, and the Dniester marshes to protect their left flank. Mackensen's army, however, reached Jarosław on May 14, stormed the bridge-head next day and established itself east of the San. It extended its gains to Sieniawa on the following days and threatened to jeopardise the whole Russian position on the San. But the impetus of the attack had spent itself for the moment and the Russians were given a breathing space. Strong reinforcements were being hurried up to them, but their losses had been enormous, over 170,000 in prisoners alone.

New Russian Line.—The Russian III. Army now held the line of the San (except for the breach made by Mackensen opposite Jarosław) as far south as Radymno; thence the VIII. Army continued the line past Przemyśl to the Dniester marshes near Sambor. The XI. Army was on a line northwest and southeast of Stryj. In the Bukowina the IX. Army had started a counter-offensive, but had made little progress. North of the Vistula on the right of the III. Army, the line of the IV. Army ran from the Pilica river by Radom-Iłża-Opatów.

Further Austro-German Attacks.—The second stage of the fighting began with an attack by Mackensen's forces on May 24, which forced the line of the San at and about Radymno and thrust southeast towards the Przemyśl-Lemberg railway. The Austrians simultaneously attacked Przemyśl from the south, but made little progress. The Russians now made a counter-stroke on Sieniawa, north of Jarosław, with the III. Caucasian Corps. This gallant corps stormed the Austrian positions and caused a temporary set-back to Mackensen's plans. At the same time heavy attacks were made on the Austrian IV. Army further north.

But the odds against the Russians were too heavy; they had little or no ammunition for their guns and practically no heavy artillery at all; their counter-attacks were made with little or no artillery preparation; even rifle ammunition was not plentiful. Before combined attacks of the German XI. and Austrian II. and III. Armies, Przemyśl fell on June 3; and the line here had to be withdrawn to about Gródek. The line of the lower San, north of Sieniawa, was held till June 11, when Mackensen, who had received reinforcements, attacked again and forced the whole of the San line, the Russians retiring to the last line of defence west of Lemberg. (*See* Lemberg, Battles of.)

Operations in the Southeast.—Meanwhile, during the last week of May and first two weeks of June, battles were being fought further to the east and south, opposite Stryj and along the lines of the Dniester and Prut. At Stryj the Russian XI. Army (Shcherbachev) faced Linsingen's Southern Army; on the Dniester and Prut Lechitski's IX. Army was opposed to Pflanzer-Baltin's group. The result of both battles was the same. In spite of their repeated counter-attacks the Russians had to give ground.

By the middle of June the Russian losses in Galicia since the beginning of Mackensen's offensive included nearly 400,000 prisoners, over 300 guns and much other material. Their losses in killed and wounded had also been exceedingly heavy, for they had counter-attacked repeatedly with little artillery support. The Russians were in fact paying in flesh and blood for their lack of modern equipment. The dominance of his heavy artillery was the chief factor in Mackensen's success; the Russians had none with which to oppose it. The lesson should have been clear enough, yet a year later the Rumanians entered the War to pass through the same bitter experience as the Russians. (*See* Eastern European Front.)

Bibliography.—E. von Falkenhayn, *General Headquarters 1914–16, and its Critical Decisions* (1919); Sir A. Knox, *With the Russian Army 1914–17* (1921). (*See* also World War: Bibliography.)

(A. P. W.)

DUNCAN, ISADORA (1878–), American dancer, was born in San Francisco, Cal., May 27 1878, and was educated there, receiving a special training in music. In 1890, she made her first public appearance as a dancer. In 1895 she went to Chicago, and subsequently joined Augustin Daly's company in New York, taking dancing rôles. In 1899 she went to London, where she was enthusiastically received, and made tours throughout the principal capitals and art centres of Europe. In 1904 she established a school for classical dancing near Berlin, where she commenced the training of the girls who later became known as the Duncan dancers. In 1923 she accepted an invitation of the Soviet Government to establish a school of dancing in Moscow. On her return she took up her residence in Paris (*see* Ballet).

DUNDEE, Scotland (*see* 8.674), with a population of 168,315 in 1921 and estimated at 169,600 in 1923, is the third largest city in Scotland. Broughty Ferry, a considerable town four miles to the east, was added to the borough in 1913. The large factory population, together with the number of high tenement buildings, has given rise to slum conditions with which the municipality was in 1925 endeavouring to cope by means of housing schemes. The area of the borough is 6,548 acres.

Ground containing the ruins of Mains Castle and part of the estate given by Sir James Caird in 1911 were opened as Caird Park in 1923. A Technical College was opened in 1910, and a Training College in 1920; and in 1915 the Central Reading Rooms and Sculpture Galleries in Ward street were finished. A City Hall has been built on the Green Market, a quadrangle containing the old Town House; the latter has been preserved, though the buildings on each side of it have been cleared away. A War Memorial in the shape of an obelisk has been erected on the top of Law Hill.

DUNSANY, EDWARD JOHN MORETON DRAX PLUNKETT, 18th Baron (1878–), Irish dramatist, was born in London on July 24 1878. He was educated at Eton and Sandhurst, and succeeded his father as 18th Baron Dunsany in 1899. Entering the Coldstream Guards, he served in the Boer War, and, in the Royal Inniskilling Fusiliers, in the World War. As a playwright, he first attracted attention with *The Glittering Gate*, produced in Dublin, 1909; the best of his other plays, which are inspired by an exotic fantasy and expressed in richly coloured language, are *The Gods of the Mountain* (1911), *A Night at an Inn* (1916), *If* (1921) and *Alexander and other Plays* (1925). He has also written numerous tales in similar style, to be found in, among other volumes: *The Gods of Pegana* (1905); *The Sword of Welleran* (1908); *Tales of Wonder* (1916); and the *Chronicles of Rodriguez* (1922); *Evil Kettle* (1926); *Old King's Tale* (1926).

DUPLICATING MACHINE: *see* OFFICE APPLIANCES.

DU PONT, THOMAS COLEMAN (1863–), American manufacturer and politician, was born at Louisville, Ky., Dec. 11 1863. Educated at the Massachusetts Institute of Technology, he entered the Kentucky coal and iron mining industries in 1883, operating on a large scale. In 1900 he removed to Wilmington, Del., being interested in the E. I. du Pont de Nemours Powder Co., of which corporation he was president 1902–15. Having been appointed Senator in July 1921, in place of Josiah O. Wolcott, who had resigned, he failed to secure election on the Republican ticket in 1922, but was successful in 1924. He built a concrete motor highway at a cost of $4,000,000 in the state of Delaware, and made a gift of it to the state.

His cousin, Pierre Samuel du Pont (1870–), having graduated from the Massachusetts Institute of Technology in 1890, engaged in manufacturing at Wilmington, becoming chairman of the board of the E. I. du Pont de Nemours Powder Co., and also chairman of the General Motors Corporation, an organisation consisting of 28 major manufacturing operations, 27 sales organisations and 8 miscellaneous companies, the principal business of which is the manufacture of motor cars, accessories and parts. The E. I. du Pont Co., the business of which was originally confined to the making of explosives, under his guidance, extended its activities to include the manufacture of artificial silk, motion picture films, paints and varnishes.

DUPUY, CHARLES ALEXANDRE (1851–1923), French statesman (*see* 8.690), died at Isle-sur-la-Tête July 23 1923.

DURBAN, Natal, South Africa (*see* 8.696).—In 1921 the population was 146,310, of whom 57,095 were whites and 47,811 Asiatics (nearly all Indians). In 1911 the population was 78,072 (whites 34,882). It is the most compact of South African cities, the borough covering only 12 square miles. Its prosperity depends upon its port (Port Natal); since 1910 it has become a manufacturing centre and a leading holiday resort.

Chief among modern buildings are the Town Hall, opened in 1910, and the Law Courts. The latter face the Victoria Embankment, a fine thoroughfare along Bay Beach, *i.e.*, the Bay of Natal. At the Point, overlooking the eastern entrance to the harbour, an equestrian statue of Dick King, commemorative of his great ride to seek help for the infant settlement, was erected in 1915. A memorial to Durban citizens who fell in the World War was unveiled in the Public Gardens in 1926. From Ocean Beach a semicircular pier, over 900 ft. long, encloses a bathing place free from sharks. Ocean Beach, with its esplanade and park and fine hotels, forms the chief attraction during the Durban winter season (May to Sept.) when the mean maximum temperature is 76° F. For horse-racing fixtures Durban ranks only second to Johannesburg among the cities of South Africa. A wireless station, the first in South Africa, was opened in 1910. In 1925 a site of 50 ac. was selected for a university for Natal.

Vessels are constantly engaged in dredging the bar at the entrance to the harbour; the lowest depth of water at the entrance is 36 ft. the minimum depth at the quayside varies from 23 to 34 feet. There were by 1925 three miles of wharfage and the harbour is equipped with every facility for the rapid loading and unloading of ships. Some 300 ac. of land have been reclaimed at Congella, at the northeast end of the harbour and here on June 4 1925 the Prince of Wales opened a new graving dock, the second largest in the world, being 1,159 ft. long and 138 ft. wide at the entrance.

Shipping.—The bunkering and export of coal, an industry made profitable by the nearness of the Natal coal-fields, made Durban by 1913 the chief cargo-handling port of South Africa. While the amount of coal bunkered, 1,395,000 tons in 1910 and 1,226,000 tons in 1924, tended to decrease, the coal exports rose steadily, being 57,000 tons in 1910 and 1,502,000 tons in 1924. In 1923 the cargo handled at Durban totalled 3,592,000 tons as against 1,907,000 tons for all the other ports of the Union combined. The tonnage of shipping entering Durban, 3,944,000 in 1913 was 3,959,000 in 1923. Owing to the scarcity of shipping there had been a sharp drop to 2,155,000 tons in 1918.

(F. R. C.)

DURHAM, UNIVERSITY OF (*see* 8.709).—By the University of Durham Act, 1908 (8 Edw. VII. c. 20), the university was reconstituted by commissioners appointed under the Act. It now consists of the Durham division and the Newcastle division. The latter is composed of the College of Medicine and Armstrong College, though each of these exists at present as a separate unit, with its own constitution and government. The Durham colleges, University College, Hatfield College, St. Chad's College, St. John's College, St. Mary's College (women) and three residential colleges form also a unit, controlled by the council of the Durham colleges. Certain professors are known as professors of the university, while others are known as professors in the university. Canonries in Durham Cathedral are attached to the professorships of divinity and Greek. The system and life in Durham are broadly similar to those of Oxford and Cambridge. The Newcastle division more closely resembles the modern urban universities. Proctorial administration is carried on by two proctors, one for each division, nominated annually by the senate and appointed by the chancellor.

Since 1908 the University of Durham has made great progress. The numbers of matriculated students has more than doubled. Seven new professorships and six readerships have been established in Durham, five new professorships in the College of Medicine, and seven professorships and four readerships in Armstrong College, while the number of lectureships in all subjects has been very greatly increased. Among other developments may be noted the well-equipped science laboratories, and a department of education in Durham, the bacteriological department in connection with the College of Medicine, and the school of law at Armstrong College. The Durham colleges possess an astronomical laboratory, while Armstrong College has a model farm at Cockle Park, and a marine biological institute at Cullercoats. A new library to contain 200,000 books is being built at Armstrong College. Among recent benefactions may be noted the Union buildings, the sports ground at Newcastle and scholarships.

DUSE, ELEONORA (1859–1924), Italian actress, belonged to a family of actors from Chioggia, near Venice. Her grandfather, Luigi Duse, a celebrated actor of Goldoni plays, created the 18th century Venetian masque of Giacometto, round which a whole dialect repertory turned. Born on a tour in Lombardy, Oct. 3 1859, Eleonora Duse was carried to her christening at Vigevano in a gilt theatrical property-box; some Austrian soldiers presented arms, thinking it was a reliquary. She acted the part of Cosette in *Les Misérables* at the age of four in a booth at Chioggia. At Verona she played Juliet when just 14, and drew public attention by her love of flowers and the use she made of them in her art. The incident is always referred to as "the device of the roses" (*la trovata delle rose*).

About this time her mother, to whom she was passionately attached, died, and thrown on her own resources, often in dire poverty, she passed from one travelling company to another, eventually reaching fame through sheer hard work no less than by genius and the exceptional beauty of her speaking voice. She acted in *Alcibiades* of Felice Cavallotti, in *Orfeo* of Alfieri, and took the part of Shakespeare's Ophelia with success. She gained wider recognition in 1878 when, one night at Naples, she was called upon suddenly to take the leading part in *Les Fourchambault* by Augier. In the following year, after securing a real triumph in the part of Zola's *Thérèse Raquin,* Cesare Rossi engaged her for his famous company as *prima diva* and she added *La Princesse de Bagdad* to her repertory. A memorable year was 1882: she saw Sarah Bernhardt act at Turin in *La Dame aux Camélias* of Dumas fils, and felt inspired to give her own interpretation of Marguerite Gautier—"fille galante, extrêmement distinguée," a character which both actresses idealised. The

Frenchwoman, less realistic and temperamental, possessed a more subtle style; but, in certain scenes, the passionate almost volcanic powers of the Duse admitted of no rival. The greatest riumph, perhaps, in her career was gained in this part, and she was induced to act it in Paris in 1897, when the Parisians were aken by storm, Sarah Bernhardt leading the applause. She also acted in *Frou Frou* and *La Femme de Claude*. Her *Magda*, in the opinion of Sudermann the author, was never surpassed. In the character of Mirandolina (*La Locandièra* of Goldoni) she also showed a remarkable gift for light comedy. She created the character of Santuzza in *La Cavalleria Rusticana*, given for the irst time in 1884, and such was her success that Verga said he play belonged as much to her as to him.

Her acting during all this period was characterised by realism devoid of any excess; hers was the highest kind of romantic ealism which had passed through the flame of intense feeling. Coquelin the elder said of her: " No one draws from humanity as he does; she is passionately beautiful and great." " O grande amatrice," exclaimed D'Annunzio after witnessing a love scene n *La Dame aux Camélias*. Her own words still further help to explain her vivid and varied personality: " How I have loved ife!" she wrote to a friend, and again: " There are a thousand women within me, and each one makes me suffer in turn." Although Duse was noted for her exceptional naturalness, spurning certain mechanical rules of the stage, and showing unerring artistic instinct, she was by no means guided only by impulse. Her pontaneous art was built upon a careful structure, and no actress had a greater capacity for taking pains. She brooded over her characters, which became so much part of herself that he could not act certain plays on two consecutive nights; and, during the run of a season, she withdrew herself entirely from riends and family.

Eleonora Duse was a woman of wide culture; her intellectual ife had been greatly influenced early in life through a close riendship with Arrigo Boito, the composer, whose sound criticism proved of considerable value to her art. The books she steeped herself in included the writings of Pascal; Keats; and Thomas à Kempis; *The Letters of St. Catherine of Siena; The Confessions of St. Augustine* and *L'Action* by Maurice Blondel. Essentially eligious by nature, she was untouched by organised religion. She travelled a great deal both for her profession and for pleasure: Matilde Serao called her " the impassioned pilgrim." She had no ixed home; the nearest approach to one was her summer house at Asolo. She lived simply but spent large sums on producing plays and in financing her company of actors whom she would ometimes keep idle for long spells on account of health. She made her first appearance in Paris in 1884; went to London and New York in 1893 and to Moscow in 1892 and 1897, and to Egypt. She always particularly liked acting in Vienna.

Her restless, soaring spirit eventually grew weary of Dumas and Augier, finding in *La Dame aux Camélias* alone " a thread of gold to hold together the string of false pearls "; and, towards middle age, the Duse turned definitely to poetry and " les oeuvres de pensée." In 1896 she commissioned Panzacchi to translate *L'Abbesse de Houarre*, which she acted in Rome with so much uccess that Renan wrote her a letter full of praise and gratitude. At this time she passed under the spell of the later works of Ibsen, o be closely followed by the aestheticism of D'Annunzio. In the Scandinavian dramatist she saw the poet more vividly than the courger of society. Ellida, *The Lady from the Sea*, with whom he felt some affinity, was her favourite heroine. Ibsen was not altogether satisfied with her interpretation of Hedda Gabler; he s reported to have said as he left the theatre: " She believes Hedda to be a neurotic, but she is absolutely wrong."

Her life-consuming friendship with D'Annunzio began in 1897; hey parted in 1902, only to meet 18 years later at a patriotic gathering in Milan. D'Annunzio immortalised their friendship n *Fuoco*, the novel of the lagoons, incorporating many of her etters and sayings. *La Città morta* he had dedicated to Sarah Bernhardt; *La Gioconda* he wrote for " Eleonora Duse of the beautiful hands," and wrote many other plays under her enthusiastic inspiration. She took up the cause of D'Annunzio as a dramatist with almost mystic exaltation, and threw all her energies into trying to found a theatre which was to be a D'Annunzio Bayreuth for the glory of a pure art. A site was offered to her on the shores of Lake Albano, near the Baths of Diana, but to her grief the scheme fell through, chiefly because the public did not recognise the real Duse in the drama of D'Annunzio. *La Gloria* was hissed at Naples in 1898 and no better success attended *Sogno di un mattino di primavera*, but she won some applause for *Francesca di Rimini* in 1902. Undaunted, the Duse insisted upon acting only the plays of D'Annunzio when she went to America in 1902–3 with Ermete Zacconi, and, in spite of financial losses, she refused to revive old favourites. Some people think that D'Annunzio had an enervating effect upon her art, and that her recitation tended towards monotony; while, in the opinion of others, her style lost rough edges and gained in classical grandeur, and her general culture was enriched.

At the height of her fame in 1909, Eleonora Duse definitely left the stage, mainly on account of health. She suffered from asthma and exhaustion. The last performance was given at Berlin in *The Lady from the Sea*, which she described as her swan song. She felt she had been a worthy interpreter of Ibsen that night, adding with characteristic modesty: " but I may be wrong." For twelve years she retired into private life. But, owing to pecuniary losses arising out of the World War, she had to face the necessity of returning to the stage. After much anxious thought she accepted collaboration once more with Ermete Zacconi, appearing at Turin in 1921 in *The Lady from the Sea*. " I only want to act the part of mothers," she said, " women without age, creatures of eternity, like Ellida and so many heroines of the great Ibsen . . . . No wigs, they must accept me with my white hair." They did, and Eleonora Duse found that she had conquered the world a second time. Apart from the question of money difficulties, it is clear from letters and published conversations with friends that a desire to do something for Italy acted as an incentive to work at this time. Animated by a passionate desire to participate in the joys and sorrows of her fellow creatures, she strove to teach " the good and beauty of life " to a world devastated by a spirit of violence, which was abhorrent to her nature. For the purpose of this spiritual crusade, and also for the benefit of young authors, she tried to found an Italian theatre—*Teatro dei Giovani*. She complained that her scheme was not supported by the Government, but her ideas were vague and perhaps, too, time was not ripe for the venture.

This, the last period in her career, was marked rather by a wonderful revival of her youthful genius, rather than by any new creations or change of style. She continued to play Ibsen, D'Annunzio and *La Porta Chiusa* of Marco Praga, and risked popularity, as well as loss of money, by producing a new play, *Così Sià* by Gallarati Scotti. It was killed on its first appearance in Rome in Jan. 1922, so far as Italy was concerned. The play was written round a mother's prayer and vow to the Madonna, a fine fragment which appealed to the Duse, who interpreted it as a symbol of enduring human love and sacrifice. After touring Italy she made her last appearance in London in June 1923 when she acted to far fuller houses than in the heyday of her glory.

She courageously accepted a tour in America the following spring, where she also received a triumphal reception. But her health was broken, and often she had to be revived with oxygen after a performance, though her vitality never gave out during the play. The long journeys and the cold proved too great a strain upon her small reserve of strength; the mild climate of California revived her and she wished to stay longer, but an inexorable theatrical agent urged her forward, and she died from the results of a chill at Pittsburgh on April 21 1924 at the age of 64. She was pitifully anxious not to die far away from Italy, and gave feverous orders, almost with her last breath, to pack up quickly so as to catch the boat home. Italian emigrants knelt on the quay as her coffin was lowered on to the battleship " Duilio " at New York, and national mourning was proclaimed in Italy. Her countrymen desired to see her laid at rest with other illustrious Italians in Santa Croce at Florence, but they respected her wishes to be quietly buried at Asolo.

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DUTCH LITERATURE (*see* 8.719).—The movement towards naturalism, begun in the eighties with the founding of *De Nieuwe Gids*, was succeeded towards the end of the century by a definitely democratic tendency, of which the delicate and consciously simple works of Adama van Scheltema and those of the fiery revolutionary Henriëtte Roland Holst were most representative. Soon, however, the influence of Albert Verwey, with his monthly *De Beweging*, made itself felt. Verwey, originally one of the men of the eighties, gradually developed a more balanced style, resulting at its best in symbolism, and in its less happy phases in extreme intellectualism. This movement gave rise to a number of poets who gave to the period under revision its special character. In the eyes of these younger men Verwey was regarded as the leader. It was more by virtue of his ideas—the exalting of imagination to the rank of the supreme function of the intellect, by whose light one can best learn to understand the soul and the world—than by his poetry, which only too often bears the marks of laborious creation.

Of the elder poets, Boutens, Henriëtte Roland Holst, Karel van de Woestijne and Verwey continued to produce work of merit—Boutens, full of thought and melody; Henriëtte Roland Holst, full of mysticism and ideas of the brotherhood of man—Karel van de Woestijne, the Fleming, voluptuous, sensual, reminiscent of the period of the renaissance. J. H. Leopold (d. 1925) wrote little, but nevertheless exercised a certain influence on the younger generation. Others worthy of mention are Geerten Gossaert, the central idea of whose work *Experimenten* (1919) is the consciousness of the ego, controlled, if not always successfully, by Christian faith; A. Roland Holst, a nephew of Henriëtte, who (with Jan Prins, the inspired poet of the sea and the Orient, and Martien Beversluis) was perhaps the most prominent poet of this time. He has—what is rare in the poems of Verwey's followers—a soft, easy flow of song, a yearning for some hidden beauty existing far away beyond sea horizons, and a deep feeling of mystery underlying the delicate description of some commonplace scene. The works of Jacob Israël de Haan (d. 1924), are, like those of Gossaert, permeated by a strong, sincere religious faith. He is more direct and passionate in his expression than Gossaert, and unlike the latter never lapses into rhetoric, but is terse and concise.

Although not fully appreciated by the leading critics in the *Beweging* circle, Martien Beversluis succeeds by means of an uncommonly delicate and vivid combination of wording and rhyme in giving a surprising and brilliant form to his visions of nature. Of the younger poets, constituting more or less a group, mention may be made of M. Nijhoff, the poet of child dreams robbed of their lustre by the realities of life; Werumeus Buning, whose small volume *In Memoriam* (1924), blooms as a flower of contemplation which has sprung up in a pale, still dawn on the grave of a dead love; van Schagen, who in formless recitatives rejoices in the gloriousness of every aspect of life; Besnard, who in apparently easy-flowing verse makes us feel the emptiness of modern life; Slauerhoff, whose conception of life is similar but more humane, and who therefore can afford to smile now and then. The Flemings, Wies Moens and Urbain van der Voorde, may also be included in this survey of post-War poetry and there are a number of others.

Fiction.—During this period the novel came to flower. The later works of the painter-novelist Jac. van Looy, who belongs to the older school, show a departure from his early plastic manner. In *Jaapje* (1917) and *Jaap*, reminiscences of his childhood, he shows a complete understanding of the mind of a child free from all sophisticated comments. With him may be coupled Ary Prins, who in 1913 completed his *Heilige Tocht*, in its impressionism a typical work of the eighties.

Couperus, up to the time of his death in 1923, wrote novels dealing with aristocratic life, brilliantly coloured stories of olden times, such as *Herakles* (1913), *De Komedianten* (1917) and *Iskander* (1920). In this latter period he also showed himself a master of the short story, frequently told in the first person. Herman Robbers in his later work never surpassed his *Roman van een Gezin*, a study in social psychology. J. De Meester followed up his masterpiece *Geertje* (1921) by many stories full of irony and hatred of respectability. Van Hulzen, after producing a number of striking sketches dealing with people living outside society, wrote various novels on the subject of love and marriage. Realism on the broad lines of Zola probably found its greatest representative in Is. Querido, who, in his romantic cycle *De Jordaan* (1914) drew a brutal picture of life in this typical quarter of Amsterdam, whilst in *De Oude Waereld* (1918) he attempted to resurrect the ancient civilisation of the Orient, and was on the whole successful. In the portrayal of times past, ancient civilisations, and in the modern historical novel (which differs from the romanticism of 1850–70 in that it makes deeper psychological investigations) he was preceded by Ary Prins and Couperus, by Adrian van Oort and Arthur van Schendel. The latter, however, was more individual in his treatment of these subjects. P. H. van Moerkerken also wrote a series of novels dealing especially with the past life of his country.

A great many women contributed towards the romantic literature of the period. In collaboration with her husband, Carel Scharten, Margo Antink, having given independent proof of a talent for vigorous naturalistic work, produced a series of large scale pictures of various phases of society, mostly Italian. The vigorous style of the woman was combined with the man's tendency towards *préciosité*. Mention may also be made of Top Naeff, who began her literary career with a number of books for girls, but later produced works dealing with subtle feminine psychology, including the great novel *Voor de Poort* (1914), a story dealing with the unreturned love of a woman.

Ina Boudier Bakker produced work widely divergent in character—symbolic stories, reminiscent of Norway, plays and a number of excellent sketches of children. Her talent, however, was shown to the best advantage in novels of family life, such as *Armoede* (1917) and *Het Spiegeltje* (1917), which were greatly admired and achieved great popularity. Augusta de Wit wrote admirable novels about the Dutch East Indies. Carry van Bruggen—whose husband, Kees van Bruggen, under her influence, developed into an important novelist of great imaginative power—in her novels is inclined to indulge in one-sided arguments. Her sketches, however, which frequently deal with children, are mostly masterpieces of observation, full of subtle humour. Jo van Ammers-Küller, author of several plays, wrote a number of novels dealing with theatrical life, such as *Het Huis der Vreugden* (1922) and *Jenny Heysten* (1923). Annie Salomons—who also wrote under the *nom-de-plume* of Ada van Gerlo—wrote a number of novels and sketches dealing with the aspirations of the modern woman. Nico van Suchtelen is the chief representative of symbolism in fiction.

Dramatic Literature.—The period is best represented by Heyermans, who in his later plays attempted symbolism, but was really more at home in realism. He wrote one extremely witty play, *De wijze Kater* (1920). Of Emants' later work, *Om de Mensen* is notable as a description of society life at The Hague. One of the best plays of Madame J. A. Simons-Mees is *Levensstroomingen*, which depicts the conflict between parents and children. Both sides are represented with strict impartiality. Jan Fabricius has given us a series of plays dealing with the tropics, but they are very unequal. *Eenzaam* and *De Meteoor* are perhaps the best. Madame Ranucci-Beckman and Dr. P. C. van Rossem wrote a number of witty drawing-room plays. Alph. Laudy's *De Paradijsvloek* was a partly successful attempt at a monumental work. The 20th compared with the 19th century shows a considerable improvement as regards the number of original plays produced, and on the whole interest in the stage has grown, the artistic standard has been raised, and a higher level of performance demanded and exercised. (*See* NETHERLANDS.)

See H. Robbers, *De Nederlandsche Litteratuur na 1880* (1922); Dirk Coster, *Nieuwe Geluiden* (1924). (J. Wa.*)

DUVENECK, FRANK (1848–1919), American painter (*see* 8.737), died in Cincinnati, O., Jan. 3 1919. He was awarded a special gold medal at the San Francisco Exposition in 1915, and in the same year he presented to the Cincinnati Museum a large collection of his own works.

DYEING (*see* 8.744).—Profound changes took place between 1910 and 1925, more in the field of industrial politics than in the technical side.

I. THE INDUSTRY IN GREAT BRITAIN

War Problems.—The War produced a period of chaos, and swept the industry into the centre of national politics owing to three main factors—(*A*) the colour users of the world, of whom textile manufacturers were the most important, had become largely dependent on Germany, who, in 1913, supplied three-quarters of the total world demand. Switzerland was the second important source, supplying 7%, Great Britain 6·5%, France 5·4% and the U.S.A. 3·3%. (*B*) On the outbreak of the War the nations of the world suddenly found their supplies cut off, and the important textile industries of Great Britain, France, Italy and the United States were in a most difficult position. (*C*) In addition, colour-chemistry produces a number of chemical experts, whose knowledge enables them to apply chemicals to war purposes in the production of high explosives, such as picric acid and T.N.T., and also in the manufacture of poison gas and the like. It is true to some extent that dye factories can be used for the making of high explosives, but what is more important is that this industry provides a reserve of highly qualified chemists whose services the Government can, if necessary, utilise for war purposes. Thus the nations at war with Germany found their national wellbeing threatened at two points: firstly, a whole group of basic industries, the textile, were jeopardised; while, secondly, the national existence itself was threatened by the superior skill of their opponents in chemical warfare (*q.v.*).

The various nations met the crisis in different ways, according to the national temperaments. In Great Britain, at the outbreak of war, there existed five important British firms making dyes and two German firms with works in Great Britain. The latter were sequestrated by the British Govt., and ultimately disposed of to British firms. The output of the British firms, even when supplemented by supplies from Switzerland, was totally inadequate to meet the requirements of the British textile manufacturers, on whom the demand was abnormally increased by the Government requirements for military and naval uniforms and the like. The average annual British import of dyes from abroad in pre-War years had amounted to nearly 18,000 tons, worth £2,000,000. Many important dyes, such as synthetic indigo, were German trade secrets and had never been made in this country.

British Dyes Ltd.—To meet these difficulties the Government, in close co-operation with the users of dyes, established a company named "British Dyes Ltd.," with a capital of £3,000,000, of which the Government supplied half. The new firm started by taking over one of the old works, that of Messrs. Read, Holliday & Co., at Huddersfield, but began to build new and enlarged works. The building went on during a period of continuously rising prices, and ultimately the huge size and enhanced cost of these buildings became a serious liability to the firm, or rather to its successor.

Meanwhile other works sprang into existence, encouraged by the large profits which for the time being were obtainable. During this period the chief difficulty was that of working out the formulae for the intermediate products, especially for the azo dyes, nearly all of which had previously come from Germany. In addition, British dye manufacturers found themselves faced with a shortage of certain needs, especially "oleum" and oil of vitriol, which necessitated the construction of new chambers and contact plant.

Government Action after the War.—Considerable progress was made, however, and at the conclusion of the War the Government recognised that the dyestuffs industry must be protected and helped to establish itself on a sufficiently firm basis to prevent the recurrence of such a crisis. It therefore recognised the production of dyes as a key industry, and extended to it a strong measure of protection against foreign competition; and secondly, it helped in the establishment of a new firm, which absorbed not only "British Dyes Ltd." but also its chief competitor, Levinstein Ltd., who had previously bought up another important firm, Messrs. Claus & Co.

During and immediately after the War the Government had restricted the importation of German dyes by proclamation; but when peace had been signed this procedure was challenged, and in a test case the courts decided that the proclamation was illegal. In consequence, a special Act of Parliament, the Dyestuffs (Import Regulation) Act 1920, 10 and 11 Geo. V., cap. 77, was passed, which came into force Jan. 15 1921. This Act is intended to protect the dye industry for 10 years, and under it no dyestuff may be imported which can be satisfactorily made in Great Britain, while, where imports are shown to be necessary, a licence must be obtained from a committee appointed by the Board of Trade.

Thus the new firm, "The British Dyestuffs Corporation Ltd.," practically constituted a monopoly, and in order to safeguard national industries in general, and particularly those of dye users, the Government insisted on retaining considerable control in the administration of the business. The shareholders of British Dyes and of Levinstein Ltd. exchanged the holdings they had in these concerns for shares in the new company. The Government, in lieu of the amount it had technically "loaned" to British Dyes, received £1,700,000 worth of shares, and subscriptions were invited for £5,000,000 new capital. These were taken up by the general public, mostly by people not interested in the business as colour users, thus creating an entirely different situation, for the new firm, the British Dyestuffs Corporation Ltd., had now to earn dividends to satisfy these shareholders, whereas "British Dyes" might have been able to satisfy its shareholders, the dye users, if it provided good and cheap dyes, even if its profits were negligible. The British Dyestuffs Corporation had therefore to satisfy its shareholders like any other business, while its hands were, to a considerable extent, tied by the Governmental control to which it had to submit, and the objects of the Government were obviously not precisely the same as those of the people who had subscribed money in the expectation of receiving good dividends.

The clauses in the articles of association which placed the Government in a peculiar position were three in number:—

(*a*) The allotment to Government nominees of a special share carrying special voting rights for the purpose of preventing any alteration in the company's articles of association.

(*b*) Restrictions on the allotment and transfer of shares to foreigners or persons under foreign control, and provisions under which it was necessary to secure the consent of the Board of Trade to any allotment or transfer of shares to such persons.

(*c*) The nomination of two directors by the Government, and the exercise by those directors of certain powers of veto and control over the company's affairs.

The nominal share capital of this new venture was fixed at £10,000,000.

Reconstruction.—It was hoped by these two measures to establish the manufacture of dyes in Great Britain on a firm basis; but by 1925 it had been found that although the licensing system worked fairly smoothly, despite a certain amount of complaint from the colour users, the British Dyestuffs Corporation itself was not a financial success. On Nov. 25 1925 it was reconstructed, the issued share capital of £9,197,112 was reduced to £4,775,000 and the articles amended.

The Government abandoned all claims to control the company and surrendered its shares, which then amounted to £1,700,000, for a cash payment of £600,000. The company agreed to keep in touch with the Board of Trade in all matters of technical information and research, and also undertook that not more than 25% of its shares should be held by foreigners. The partial failure of the corporation was largely caused by two other factors, firstly the cost of its vast new works at Huddersfield, built at a time of inflated prices; and, secondly, a changed economic situation. All other nations had established dyestuff factories of their own, and in 1925, while the output of the world was four times that of 1913, effective demand had not kept pace with this expansion, and there was not enough business to meet the overhead charges of all. (J. S. M. W.)

II. THE INDUSTRY IN THE UNITED STATES

The dyeing industry of the United States during the period 1910–26 grew commensurately with the textile industries. An important advance was made in the production of fast colours, especially on cotton goods. This was in keeping with the rapidly extended use of cotton in high-grade wearing apparel and with the increase of steam laundries, displacing household washing. Modern laundry methods or rapidly cleansing and whitening fabrics necessitated the use of strong chemicals, destructive of many of the colours formerly employed in dyeing cotton. The demand for laundry-fast colours was met by the introduction of the so-called " vat " dyes, of which indigo was long the only representative. The extended use of the dye known as sulphur black to take the place of aniline black for cotton hosiery and piece-goods was also worthy of note. The silk industry also grew largely, the United States consuming more raw silk in manufactures than any other country. This led to the great extension of silk-dyeing, chiefly in the industrial centres of South Manchester, Conn., Paterson, N.J., and Lancaster, Pennsylvania. Another branch of the textile industry which has developed to great proportions in the period 1920–6 is that of artificial silk or rayon fibre. This has required a corresponding development in the dyeing industry, as this new fibre requires special methods of dyeing, and in some cases new kinds of dyestuffs. At the present day there is even a larger amount of rayon fibre manufactured than there is of natural silk, and the industry is still growing rapidly.

The World War at first threw the dyeing industry in the United States into confusion, owing to the uncertainty of trade relations with Germany, the more so when the Allied blockade put a complete embargo on Germany's exports. It was then seen how dependent America had been on Germany for dyestuffs, and it was estimated that manufacturing industries with products valued at about $4,000,000,000 might soon be thrown completely out of gear by a lack of dyestuffs. In the confusion which resulted many expedients were adopted in the production of colours, with a consequent reduction in the fastness and quality of dyeing. Dyestuffs became so scarce that exorbitant prices stimulated the erection of many dyestuff factories in various parts of the United States. Large amounts of capital were freely invested in the new industry, and many chemists became engaged in dyestuff research and manufacturing.

Previous to the War the United States had a small dyestuff industry distributed among about five plants. The manufacturing operations, however, were limited chiefly to the assembling of the coal-tar intermediates imported from Germany for the production of the finished dyes, so that the new industry had to be built from the ground up. To the great credit of the American chemist and chemical manufacturer it may be said that in a very short time the more important dyes were successfully made in the United States in such quantity that practically no dye-consuming industry was forced to shut down by reason of a lack of dyes. In 1924 there were 193 firms in the United States engaged in the manufacture of coal-tar chemicals, and of these 78 firms were engaged particularly in the making of dyestuffs, producing 68,679,000 lb. of the various synthetic dyes. Of the dyes sold to consumers the value was $35,012,400, at an average price of 54c per pound. Of the total dyes consumed in the United States about 96% were produced by the domestic industry and only about 4% were imported dyestuffs, the latter coming chiefly from Germany and Switzerland. About 20,000,000 lb. of synthetic indigo were produced in the United States in 1924, about twice the pre-War importation, indicating a great extension in the use of indigo in dyeing. Sulphur black was also produced on a very large scale, as well as all of the required acid dyes for wool and silk, most of the basic dyes, a complete line of direct cotton dyes, and what was still more significant, a rather complete line of vat dyes as well as alizarine and mordant dyes for the fast colours. Associated with the making of dyestuffs there also grew up the many related branches of the coal-tar chemical industry, such as colour-lakes for paints; lithographic and printing inks; coal-tar pharmaceuticals; flavouring and perfume materials; photographic chemicals; and synthetic tannins and resins. The great growth of the industry created a constant demand for increasing quantities of coal-tar distillates, which form the raw materials of the dyestuff industry, and this led to a rapid increase in the number of by-product coke ovens. In 1924 the production of coke in by-product ovens amounted to nearly 78% of the total.

The great production of dyes in the United States during the post-War period led to the building up of a considerable export trade, particularly to South America and the Orient. The total dyes exported from the United States in the year 1924 amounted to 15,713,428 lb., with a value of $5,636,244. The dyes exported, in fact, were about five times the amount and about twice the value of those imported. The dyestuff industry in the United States was wisely protected and fostered by the government by suitable tariff and licensing regulations during the post-War period and has now been established on a firm and permanent basis, and this has greatly aided the stability and prosperity of the dyeing industry.

In the matter of natural dyestuffs America has always occupied a leading position. Many of the principal natural dyes are of American origin. Logwood, fustic, cochineal and the red-woods are all American products, discovered in and still obtained from Mexico, Central America and South America, as well as the West Indies. During the War a product very closely resembling fustic and known as osage orange was developed in the United States and was produced and consumed in large quantities. As the dyer at the present time usually employs the colouring matters of the dyewoods in the form of suitable extracts, there has long been developed in the United States a considerable industry in the manufacture of these extracts, generally produced in connection with the manufacture of tannin extracts. This industry is in no way associated with the coal-tar dyestuff business.

The scarcity of dyes during the early part of the War resulted in a great expansion of the dyewood extract industry, which, however, rapidly declined as the manufacture of synthetic coal-tar dyes increased. In former years natural indigo was extensively used in dyeing, and in early colonial days, large quantities of this dye were cultivated in the southern states. As the growing of cotton increased, that of indigo was neglected, so that most of the indigo used in the United States was imported, chiefly from the Far East. The advent of synthetic indigo, however, soon displaced the natural product, so that but very little of this vegetable dye is now used in America. With the exception of logwood, which is still employed in considerable amounts for the dyeing of silk and leather, the use of the natural dyewoods is fast decreasing. In the dyeing of woollen materials the use of logwood has been displaced by coal-tar dyes that give better and faster colours. Contrary to the belief of many unacquainted with the facts, the natural vegetable dyeing materials can in no wise equal in fastness and in purity of colour many of the recently introduced fast coal-tar dyestuffs comprised among the so-called " vat " dyes for cotton and silk, the alizarine and chrome dyeing colours for wool, and the naphthol coupled colours for cotton dyeing and calico printing. It is now possible to produce coloured fabrics which will stand sun and climatic exposure as well as bleaching and severe laundering in a manner a great deal better than could be obtained with the old-fashioned vegetable dyes. This has led to many innovations in the application of dyestuffs, and many new processes of dyeing have been devised that have greatly enlarged and enriched the art. Another recent development in the dyeing industry in the United States is that of fur dyeing. During the post-War period, owing to the shifting of the centres of trade, the United States became an important market for the sale and manufacture of furs. This has resulted in the building up of an extensive industry in the dyeing and finishing of furs, which will without doubt become firmly established as an important adjunct to the general dyeing industry of the United States. (J. M. M.*)

III. THE INDUSTRY IN GERMANY AND SWITZERLAND

Germany.—In Germany the industry was firmly established before the War, but it was confined to three main groups which during the War came together under a working agreement and pooling arrangement. In 1925 a financial amalgamation gave the new Farben Industrie Interessen-Gemeinschaft, or "I.G." as it is known, capital resources of about £40,000,000. The I.G., which is interested not only in actual dyestuff manufacture but in heavy chemical production, and also in making fine chemicals for pharmaceutical, medicinal, photographic, etc., purposes, still holds the premier position in the world's dyestuff trade; but the dominant and almost monopolistic position it held before the War has gone, chiefly through the loss of its former British and American markets and the increase of competition in the principal free dye markets of the world—India and China.

The output of the German factories was influenced considerably during the few years following the Armistice by the fact that they were situated for the most part in the occupied areas, and consequently were under the control of the Allied Army. In 1919 a military commission of inspection representing the different Allied countries visited the factories, and though their report was never published the commission indicated quite clearly that the resources of the German dye industry had been directed almost solely to the prosecution of the War, and had contributed in no mean degree to the extent and duration of the resistance which Germany had been able to offer. Definite connections were established between the dye factories and poison gas manufacture.

During the Peace Treaty negotiations there was a fear that Germany might endeavour to make use of her position in the chemical and dyestuffs industry to secure special terms, or alternatively that, by withholding supplies of such chemical products including dyes as were only available from Germany, attempt to hinder the economic recovery of the Allied countries during the period of reconstruction. Clauses were therefore inserted in the Treaty of Versailles (annex 6 to part VIII.) whereby an option was accorded to the Reparation Commission on one-half of the stocks of dyestuffs and chemical drugs in Germany at the time, and also on 25% of the German output of these products for a period of five years from Jan. 1920. This period was subsequently extended by the London agreement of Aug. 30 1924 to Aug. 28 1928. Under these arrangements large quantities both of dyes and drugs have been delivered by Germany on reparation account and, but for a temporary dislocation during the occupation of the Ruhr by the French, the arrangements laid down by the treaty have worked satisfactorily and smoothly. Some difficulty has, however, been occasioned, particularly to dye manufacturers, because certain countries requisitioned quantities in excess of their domestic requirements and re-exported these excess quantities at uneconomic prices.

France, Italy, Japan, Spain.—In France a national dye factory was started with government assistance, and the pre-War factories in France belonging to the German dye firms were taken over and developed by French concerns. Nevertheless, France is still dependent on foreign sources for the supply of about one-half of her requirements of dyes. The same is the case with Italy; whilst as regards Japan an attempt to create a national dye-making industry with a large measure of government financial assistance has not met with any marked success. In Spain a system of control of imports has been adopted, presumably with the object of protecting the one or two small dye-making factories in that country.

Switzerland.—The four factories which were in existence in Switzerland before the War have made considerable progress since that time. Whilst competition from Germany was suspended owing to the War the Swiss factories made large profits which enabled them to modernise and extend their works and to write off their plants. They made an arrangement with the British Govt. in 1915 whereby in return for supplies of raw materials and intermediates they supplied the British market with a large proportion of their output. As the Swiss factories are situated at Basle, close to the German frontier, and most of the materials supplied to them were of immense importance for war purposes, a system of control by British officials of the Swiss factories was instituted during the war period, but at no time was there any evidence of the misuse by the Swiss of the materials sent to them, they being most anxious to fulfil their arrangement with Great Britain not only to the letter but in the spirit. Since the War one of the Swiss firms—Durand Huguenin, S.A.—has been acquired by the German I.G., whilst the other three have formed a "community of interest," under which they are working together by means of a pooling arrangement for a period of 50 years. These three Swiss firms jointly own a factory in England—the Clayton Aniline Co. Ltd., Manchester—which has made great progress, especially in manufacturing a number of dyes formerly imported from Switzerland. Whether the Clayton factory would continue to be developed to the same extent under a system of free importation into England is open to some doubt.

The capacity for the production of dyestuffs throughout the world has increased enormously since the War, but it is doubtful if there has been any appreciable increase in the rate of consumption during this period. This excess of capacity over demand prevents manufacturers from producing dyes under the most efficient conditions, and in certain cases, as in the U.S.A., this has resulted in price-cutting campaigns. In others, as for example Germany, the efforts of the dye-makers have been directed to other and more remunerative channels, such as the development of products based on synthetic nitrogen and synthetic methyl alcohol. The experience of the war years has shown quite definitely that no country can, without grave risk to its national security and economic prosperity, allow itself to become dependent solely on foreign sources for its supply of dyestuffs and kindred products. (W. Gr.*)

Bibliography.—*Memorandum by the Board of Trade on the Scheme for the Allocation by Parliament for the Development of the Dye Industry, etc.*, Cd. 9, 194 (1918); *Dyestuffs (Import Regulations) Act 1920*, chap. 77; *Report from Standing Committee B on the Dyestuffs (Import Regulation) Bill* (242) 1920; *British Dyestuffs Corporation Ltd., Papers Relative to the Liquidation of the Government Interests in the British Dyestuffs Corporation Ltd.*, Cd. 2545 (1925).

IV. TECHNICAL ADVANCES SINCE 1910

Important advances in the application of dyes to fabrics from the scientific aspect since 1910 have been mainly concerned with a simplification of the dyeing process, and the production on the fibre of shades of extreme fastness. Experience now enables us to predict with some certainty how a dyestuff of known chemical constitution can be applied to this or that fibre; but, on the other hand, there is still no general agreement as to what happens as the result of the dyeing operation. Thus the artificial dyestuffs are classified for tinctorial purposes, by possessing certain special chemical groupings, rather than by their more exact structure, for these groupings determine their attraction for this or that fibre and as a consequence their method of application thereto.

New dyestuffs of importance have been discovered, and with few exceptions, they require no special dyeing processes. As a result the main principles of this art have remained unaltered. The advent in 1921 of the so-called Celanese silk (partially acetylated cellulose) provided the world with a fibre of distinct properties, for the dyeing of which, however, new methods and colouring matters have in part been found essential.

Sulphide Dyestuffs.—With regard to the employment of these colouring matters for the dyeing of cotton, their chief function, there is little new to be said. The dyeing process consists essentially in converting the insoluble colouring matter by means of sodium sulphide into the soluble sodium salt of its leuco-compound. This possesses an affinity for the cotton fibre, and by air oxidation passes thereon into the insoluble dyestuff.

The defect, that such dyed material, on keeping, is liable to become tender owing to a development of sulphuric acid, has been carefully studied, and it is now known that the formation of this acid is due not to the presence of sulphur in the free condition, but to an oxidation of a part of the sulphur which is in actual combination with the dye itself (W. Zanker, *Farber Zeitung*, 1914). Trouble due to this character is now rarely experienced. Though the sulphide dyestuffs are largely in use for cotton dyeing, their application to wool in a satisfactory manner was hardly feasible, because sodium sulphide is strongly alkaline, and readily attacks wool. This difficulty can be overcome by the Lodge Evans process (*Jour. Soc. Dyers and Colourists*, p. 252, 1915), based on the fact that sulphide dyestuffs are soluble in sodium sulphite solution. These solutions, however, are devoid of dyeing property because the colouring matter is not present therein as leuco-compound; but on adding sodium hydrosulphite or ammonium sulphide this change occurs and the bath is now ready for use. This process, which is of value for dyeing union material solid shades of black, is not of importance for all wool material, because other fast colours, more easily applied, are available for this purpose.

Insoluble Azo Dyestuffs.—The method for the application of these insoluble colouring matters to cotton consists in the actual formation by chemical means of the dyestuff on the fibre. Thus the material padded with the solution of one of the components of the reaction, generally the sodium salt of beta-naphthol, is dried, and then passed into a bath of the second component, invariably the salt of a diazotised aromatic base.

Reaction occurs almost instantaneously with formation of the azo colouring matter, and by employing the diazo compounds of different aromatic bases varied shades can be obtained by this process. The dyeing of cotton yarn and calico by this method is extensively practised, because these colours have good fastness to soap, and are fairly fast to light.

The diazo compounds of these bases are of an unstable character, and are thus prepared (in solution) shortly before use, (and preferably cooled by ice). It was, however, shown in 1894 that by simple methods these may be converted into stable inactive forms, which are now on the market, and can quickly be rendered ready for use as occasion requires (*Colour Index*, No. 44).

The application of beta-naphthol as sodium salt to cotton, for which it has no affinity, requires extreme care, for in case the dried material is not evenly impregnated therewith, the finished shade will be uneven. In 1912 a substitute for beta-naphthol was placed on the market by the Chemische Fabrik Griesheim Electron, and this, known as Naphthol A.S., is the anilide of beta-hydroxy-naphthoic acid (*Colour Index*, page 333). As sodium salt, it possesses a distinct affinity for the cotton fibre, and the treated material can thus be at once immersed in the diazo solution without previously drying.

The shades thus produced are both brilliant and fast, and, though more costly, it is much superior to beta-naphthol for this purpose. Again, in 1916 a further simplification of the process was announced and products known as " Rapid Fast Dyes " came on to the market. These consist of one or other of the stable diazo compound preparations referred to above, admixed with naphthol A.S. (*Colour Index*, page 364), and by merely padding the cotton in a solution of such a product, drying and steeping in a bath of hot dilute acetic acid, the colour is at once developed. Certain of the insoluble azo dyes (such as *Para Red*, which has been much used as a cheap substitute for Turkey Red), on account of their chemical nature, are capable, when dyed on cotton, of withstanding to some extent a mild bleaching operation, that is to say, a moderate kier boiling of the material with dilute alkali, and subsequent treatment with bleaching powder solution. Thus yarn dyed therewith can be interwoven with unbleached white cotton in the form of stripes and fancy patterns, and the goods subsequently bleached. For this type of process, which is much in vogue, the ordinary insoluble azo colours are markedly inferior to Turkey Red, Indigo, the vat and certain other dyes, but since 1921, faster members of this class have been prepared. These, which can be produced on the fibre according to the methods given above, are obtained by employing on the one hand new derivatives of beta-hydroxy-naphthoic acid anilide, and on the other of diazotised bases generally of a more complex character than those formerly in use. Much which is claimed for these new colours is correct, and the progress of their technical application both in dyeing and calico printing will be awaited with interest.[1]

Artificial Silks.—The so-called " artificial silks " (*q.v.*) which have come into increasing prominence during recent years are all obtained from cotton, wood-pulp or some other form of cellulose (*q.v.*), and until recently all the varieties on the market consisted in their essence of cellulose itself.

The processes applicable for dyeing these materials are generally identical with those available for cotton, though owing to their more fragile nature and a liability for the production of uneven shades, the operation requires special care.

Shortly after the conclusion of the War, a new variety, known as " acetyl silk " or " Celanese silk," came on to the market, which differs in a very interesting manner from other artificial silks in regard to its affinity for dyestuffs. It consists of cotton which has been partially acetylated by means of acetic anhydride, and thus contains acetyl groups which render it more acidic than cotton itself. As a result, it possesses, especially in the presence of certain inorganic salts, a marked attraction for basic dyestuffs, a group of colouring matters to which cotton is practically inert, but on the other hand has little or no affinity for the direct cotton colouring matters. The most important of the methods proposed to overcome this latter difficulty at the time was a conversion of the surface of the fibre into cellulose by the hydrolysing action of alkali (G. F. Briggs, *Jour. Soc. Dyers and Colourists*, p. 287, 1921). When cautiously treated in this manner, the lustre of the silk was not specially impaired but among other difficulties a loss in weight and in strength is liable to occur.

A second method is the use of ammonium thiocyanate (L. G. Lawrie, *ibid.*, vol. II, p. 69, 1924), which renders the Celanese silk capable of dyeing with cotton colouring matters. Much more valuable has been the discovery of dyestuffs and dye preparations especially adapted to the peculiarities of this fibre.

Acetyl silk possesses an attraction for insoluble colouring matters, generally of a basic character, in case these are in a highly dispersed or colloidal condition (G. H. Ellis, *ibid.*, p. 285, 1924) and the so-called Sulpho-Ricinoleic Acid colours are, at least in part, solutions of simple amino-azo compounds in sulpho-ricinoleic acid. The Duranol, Dispersol and Celatene colours again are dye preparations of a similar type (Lawrie, *loc. cit.*). The dyeing of the acetyl silk with these colours merely consists in immersion of the material in the dyebath at a temperature not exceeding 80° C.

The Ionamines of A. G. Green and K. H. Saunders (*Jour. Soc. Dyers and Colourists*, p. 10, 1923; p. 138, 1924), in their essence consist of insoluble basic compounds rendered soluble by a chemical addition of the ($CH_2{\cdot}OH{\cdot}SO_3H$) group. These (omega sulphonic acid) compounds, though comparatively stable in neutral solution, are readily converted (hydrolysed) by acids and alkalis with regeneration of the insoluble colouring matter, a reaction which accounts for their behaviour as dyestuffs. Thus in the dyeing operation, which is carried out at 65–75° C. in the presence of a little formic or sulphuric acid, the soluble ionamine, at first attracted by the acetate silk, is there decomposed, with deposition of the colouring matter on and in the fibre. The dyed colouring matters are basic, that is, contain a free amino group, and by diazotisation and coupling in the usual manner with a phenolic developer, such as beta-naphthol, beta-naphthoic acid anilide (Naphthol A.S.) or resorcin, various shades can be obtained.

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[1] For a detailed description of these compounds, the papers of F. M. Rowe and E. Levin (*Jour. Soc. Dyers and Colourists*, p. 204, 1921, and pp. 218, 230, 1924) should be consulted.

Though acetyl silk has little affinity for soluble dyes of the sulphonic acid class, the British Dyestuffs Corporation, Ltd. (British pat. 202,157, 1922), discovered that amino-azo and other insoluble basic dyes, on conversion into carboxylic acids, give soluble products suitable for dyeing acetate silk, and that these again can be converted into a new dye on the fibre by the diazotisation and coupling process.

Excellent shades of indigo blue can be dyed on acetyl silk by employing a vat containing a solution of indigo white, sodium hydrosulphite and ammonia together with a little glue. There is no real difficulty in dyeing mixtures of acetyl silk and cotton, as two distinct colours can be employed in the same bath, each having an affinity for one or other of these fibres. With mixtures of wool and acetyl silk the difficulties are greater, but by first dyeing the latter with a colloidal dye preparation, and subsequently the wool with suitable acid dyestuff, these can be avoided.

The cotton material known as "Immunised Cotton," altered by the action of sulphonic chlorides (Sandoz, Basle) (G. Tagliani, *Jour. Soc. Dyers and Colourists*, p. 165, 1925), resembles acetyl silk in dyeing property, in that it has no attraction for direct cotton colours, though a great affinity for basic dyes. As this "immunisation" of cotton can be carried out locally on either yarn or piece goods, many varied colour contrasts can be obtained by its use both in dyeing and calico printing.

Vat Dyes.—This group contains, in addition to indigo and its derivatives, numerous colours derived from anthraquinone, among which are the fastest dyes known. The use of many of these latter has until recently been mainly confined to cotton, because their usual method of application entails an amount of alkali in the dyebath (vat) which is injurious to wool. Wool, again, according to H. Kammerer (*Jour. Soc. Dyers and Colourists*, p. 68, 1913), shows much less affinity for these colouring matters as leuco-compounds than cotton, and dyeing as a rule with this fibre does not commence below 70° Centigrade. Employment of the minimum of alkali, and the addition also of glue to the vat hinders the injurious action of the alkali on the wool, and satisfactory results are thus possible.

A new method for the application of vat dyes to acetyl silk in admixture with cotton (British Celanese Co.) consists in replacing the harmful alkali of the hydrosulphite vat by sodium phenate (carbolate) and is more specially applicable to those colours which require but small amounts of alkali in the dyeing process. The vat may be set in the usual manner with alkali, and the excess of the latter may be neutralised with phenol (carbolic acid).

Indigo is prepared by the colourmakers in an easily soluble reduced form, and similar preparations of certain other of these vat dyes are on the market. These termed "anthre dyestuffs" are recommended as serviceable for wool dyeing, employing in the vat sodium hydrosulphite, ammonia and glue solution. For protecting wool from the action of the alkali (Actien G. f. Anilinfabrikation) sulphite cellulose liquor, obtained in the manufacture of wood-pulp, is recommended, and a preparation termed "Protectol," probably contains this (A. Edge, *Jour. Soc. Dyers and Colourists*, vol. 38, p. 136, 1922). According to Kollmann (*Jour. Textile Institute*, vol. 13, p. 16, 1922), vat colours can be dyed on wool from a bath containing hydrosulphite of soda and ground chalk or zinc oxide. "Indigosol" (*Colour Index* No. 1178) is a product prepared from indigo, which by acid oxidation is readily reconverted into this colouring matter (Hugenin) (*Jour. Soc. Dyers and Colourists*, p. 340, 1925).

This, which is a sodium compound of the disulphonic ester of indigo white, is readily soluble in water and thus can be used for the dyeing or printing of indigo on cotton, wool or silk. Woollen goods may be immersed in a bath of Indigosol containing sodium sulphate, together with a little acetic and formic acids. After washing, the blue is developed by steeping the material in dilute nitrous acid (sodium nitrite and dilute sulphuric acid) (Durand and Hugenin). Cotton can be dyed by a similar process, employing in the same way a mild oxidising agent, such as ferric chloride, acidified bichromate or nitrous acid.

Another product of a similar type, "Soledon Jade Green," derived from an anthraquinone vat dyestuff (Scottish Dyes, Ltd.), can be applied to fabrics in a similar way to Indigosol. Other anthraquinone dyestuffs of this type have been prepared, and a new process is thus now available for the use of these fast dyes on wool and silk, simple in its application, and avoiding the harmful use of alkali in the dyebath.

Basic Colours.—As these dyes possess little or no affinity for cotton, a tannin antimony, lake or mordant is usually first precipitated on the fibre by steeping the undyed material in a tannin solution and then in a bath of tartar emetic. New so-called mordants for this purpose (Bayer & Co.) consist of phenolic compounds containing sulphur and a preparation of this kind, termed "Katanol O," is on the market (*Colour Index*, 357) (*Jour. Soc. Chem. Ind.* 139A, 1922).

The operation of mordanting cotton with this preparation is much simpler than by the tannin method, and again the shades obtained are purer and of greater fastness to washing. The cotton is merely immersed in an alkaline solution of the Katanol containing common salt, and after rinsing is ready for the dyeing operation (see also R. Fischer, *Textile Berichte*, p. 119, 1924). A second preparation, termed "Katanol W," removes the affinity of the animal fibres for certain of the direct cotton colours. By its use in the case of mixed fabrics the cotton may be dyed a full shade, whereas the animal fibre remains unaffected.

Mordant Dyes yield coloured lakes with metallic oxides. The method of first mordanting the material and dyeing in a separate bath is still in vogue with certain of the phenolic dyestuffs, such as the alizarines, logwood, etc. The more simple procedure of mordanting during the dyeing operation, or at its close, in the same bath, with copper or chromium salts, employing acid mordant dyes largely of the azo class, is now far more generally employed. In addition to the older mordants employed in this one bath method, chromium oxalate or "chromosul" mordant (Sandoz) finds some service. The dyeing operation is again simplified by the use of colouring matters soluble in water and containing copper or chromium in combination, which, in the dyeing or printing operation, are fixed on the fibre as insoluble metallic lakes, such as the Neolan colours (Society of Chemical Industry, Basle) (H. Whitworth, *Jour. Soc. Dyers and Colourists*, vol. 40, p. 256, 1924), which are applied in the presence of sulphuric acid.

The chemical nature of the lakes contained by the combination of dyes with metallic mordants has been investigated from the point of view of the co-ordination theory of valency by G. T. Morgan and his pupils (see *Jour. Soc. Dyers and Colourists*, vol. 37, p. 43, 1921).

Theories of Dyeing.—Numerous theories have been proposed in the past to explain the dyeing operation, namely, the "mechanical," "solid solution," "absorption," "colloidal" and "electrical" theories, the latter being of the most recent date.

In regard to these theories of the dyeing process, it begins to be clear, as W. Ostwald himself indicated (*Outlines of General Chemistry*, p. 295, 1912), that no single theory can account for all dyeing processes. In any case, it seems probable that two stages occur, the first being due, it may be, to either adsorption or electrical attraction. This is then followed by fixation of the dye in or on the fibre by solid solution, colloid aggregation, or by chemical interaction, and these may come into play according to the nature of the fibre, the process and the character of the dyestuff involved.

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DYNAMO-ELECTRIC MACHINES (*see* 8.764).—The term dynamo-electric machine is used broadly to denote a machine for changing mechanical to electric power, or one for changing electric to mechanical power. The former is called an electric generator, the latter an electric motor.

ELECTRIC GENERATORS

Steam-Turbine Driven Generators.—In 1910 the largest generating sets were practically never of more than 10,000 kw. capacity.

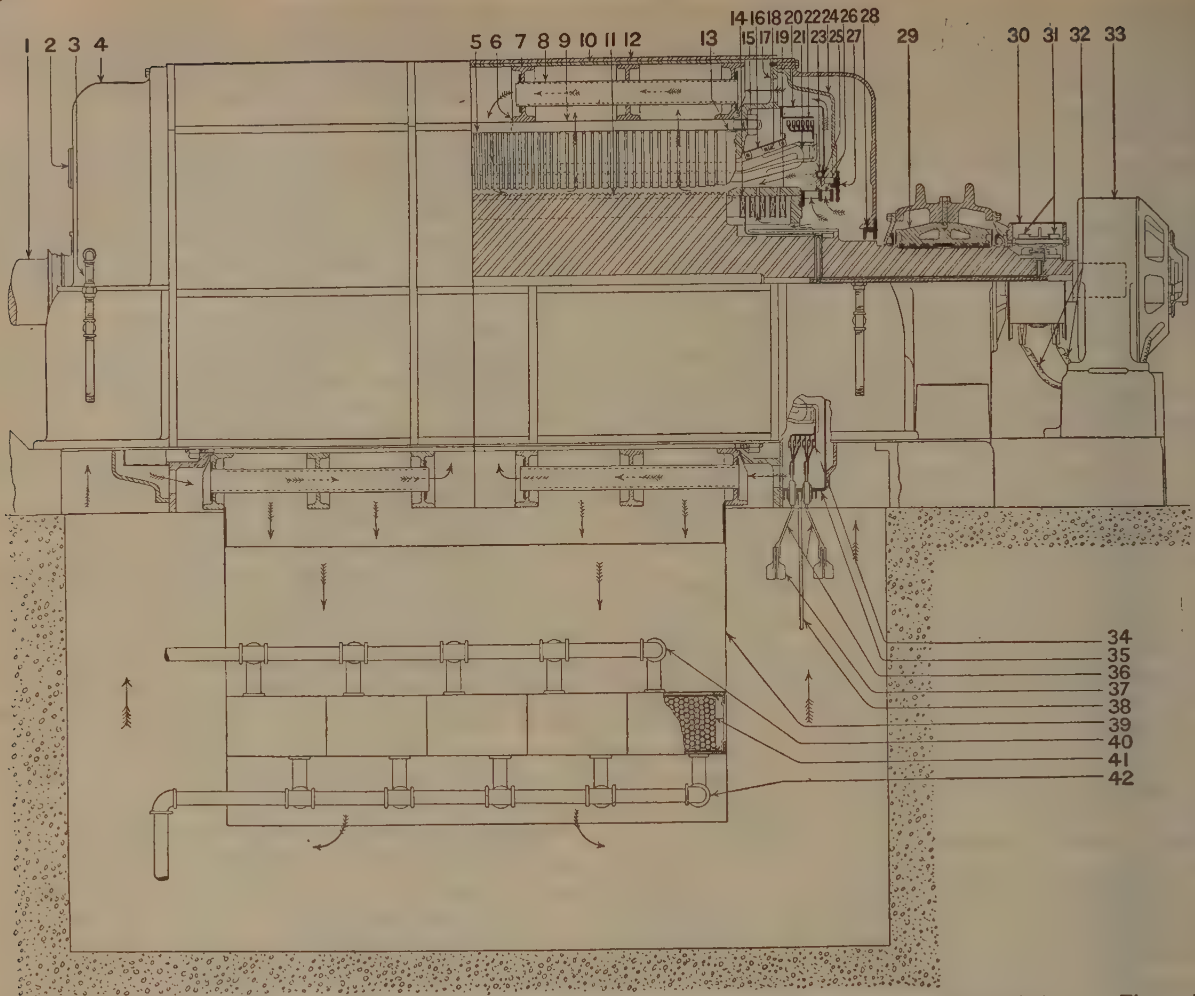


FIG. 1.—Design for closed circuit system of cooling for a turbo generator. 1. Generator shaft. 2. Observation window. 3. Fire extinguisher piping. 4. Outside end shield. 5. Armature punchings. 6. Air deflector. 7. Stator frame I-beam. 8. Air tube. 9. Punching rib. 10. Supporting plate. 11. Rotor. 12. Sheet iron cover plate. 13. Air deflector. 14. Rotor end windings. 15. Rib nut. 16. Binding band support. 17. Armature flange. 18. Binding band. 19. Nickel steel retaining bell. 20. Air deflector plate. 21. Armature coil. 22. End connection support. 23. Fire extinguisher sprinkler. 24. Inside end shield. 25. Air deflector ring. 26. Fans. 27. Air baffle. 28. Oil guard. 29. Bearing. 30. Brush-holder rigging and cover. 31. Collector. 32. Field cables. 33. Exciter. 34. Stator winding connections. 35. Terminal board. 36. Stator winding leads. 37. Stator winding terminal. 38. Barrier. 39. Air discharge duct. 40. Water cooler discharge pipe. 41. Air cooling coils. 42. Water cooler intake pipe.

Reciprocating steam-engines were still the most widely used for large generating sets. At present they are rarely built for driving large generators, whereas 60-cycle steam-turbine driven sets are now built with continuous ratings up to 50,000 kw. for 1,800 r.p.m. and still greater outputs for 1,200 revolutions per minute (*see* TURBINES, STEAM). Such 50,000 kw. single shaft sets are suitable for power factors down to 0·8 at rated load, corresponding to 62,500 kilovolt-amperes. In Europe 3,000 r.p.m. bi-polar 50-cycle turbine generators have been built in sizes up to 20,000 kilowatts. This is about eight times the capacity attained in 1910 for bi-polar 50-cycle generators.

Modern large turbo generators have peripheral speeds (at rated speed) of from 20,000 to 28,000 ft. per min. and are required to stand overspeed tests of 20% in excess of rated speed. In a typical 50,000 kw. (62,500 kv.a.), 1,800 r.p.m. machine, the rotor has a diameter of 49·5 in. (corresponding to a peripheral speed of 23,400 ft. per min.) and is constructed from a solid forging of carbon steel. The rotor slots, which are 8 in. deep, are milled out of the solid forging. The insulation and conductors are retained in position in the slots by steel and alloy wedges. The rotor must withstand the great centrifugal force which, at this peripheral speed, amounts to just over one metric ton for every pound at the periphery. The copper ends beyond the rotor core, and the insulation, are held very solidly against the slightest movement by retaining bells of nickel steel and by separators consisting of aluminium castings designed to provide passages for the cooling air. The heat generated in such a machine by the internal losses is removed by circulating through the machine some 110,000 cu. ft. of air (four metric tons) per minute. At present the most approved practice is to employ a completely closed circulating system for the cooling air which, after passing through the generator, is cooled by flowing over pipes through which water is circulated. To avoid carrying moisture into the generator it is necessary that in some one section of the cooling system the air speed be not over 600 ft. per minute. Consequently, such a circulating system for a 62,500 kv.a. generator must have a maximum cross section of 183 sq. feet. At other parts the cross section may be much less and the air speed higher. The air makes the complete circuit in a few seconds, thus being heated and cooled many times per minute. This is coming to be believed to constitute the most satisfactory way in which large generators can be kept clean and cool. As a generator costs over $500,000 the justification for such precautions is evident. Fig. 1 illustrates a design for a closed circuit system of cooling for a turbo-generator.

Friction Loss in Turbo-Generators.—The use of such high peripheral speeds as 20,000 to 28,000 ft. per min. and the circulation of such large quantities of cooling air as over 1,000 cu. ft. per sec. occasions very large friction losses. An 1,800 r.p.m., 62,500 kv.a. (50,000 kw.) machine will have at its rated load an efficiency of about 97·0%. The loss in the machine is thus 1,500 kilowatts. About 40% of this loss is due to friction. Experimental machines have been built running in hydrogen instead of in air. Because of the low density of hydrogen, the friction loss, if atmospheric pressure is used, is reduced to one-tenth. In the above example the total loss would be reduced from 1,500 kw. to about 960 kw. and the efficiency would be increased to about 98·1%. Moreover hydrogen has higher thermal conductivity and higher forced heat convection. The use of hydrogen also decreases the extent to which the insulation is deteriorated by corona.

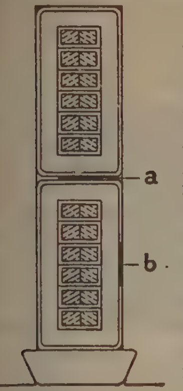


FIG. 2.—Cross section through stator slot showing embedded temperature detectors located at *a* and *b*.

An important feature in the design of the stator windings is the use of transposed conductors to eliminate wasteful circulating currents. The importance of such transposition in the construction of conductors had been pointed out prior to 1910 by A. B. Field, but the advent of these large modern generators has made their use imperative. The extremely great core length of the largest turbo-generators brings into prominence the matter of expansion and contraction as a cause of insulation deterioration and unbalancing. It is thus desirable to design such machines for the lowest practicable temperature rise.

Water-wheel Driven Generators (*see* DAMS; HYDROELECTRICAL ENGINEERING).—In the large scale generation of electricity, the importance of the water-wheel driven generator is (at any rate, in waterpower countries, such as Scandinavia, France, Italy, Switzerland and America) commensurate with that of the steam-turbine driven generator. While in 1910 the largest water-wheel driven generators in operation or being constructed had a rated output of only 15,000 kw., there are now some in operation with ratings of over 50,000 kilowatts. As the speeds of hydraulic turbines are low in comparison with those of steam turbines, such generators have more poles, larger diameter and relatively small core length and present a completely different appearance. In fig. 3 on plate is shown a vertical-shaft 72-pole, 60-cycle machine with a rated output of 20,000 kv.a. and a speed of 100 revolutions per minute. The design of these lower-speed machines presents less complex problems than that of steam-turbine driven generators. However, the mechanical design must be adequate for a runaway speed of approximately twice normal speed. This imposes a serious limitation on the peripheral speed at the rated shaft speed.

Stability of Generators.—Stable operation of large generators on the occurrence of sudden overloads is a matter to which much attention must be given. American designers observe as a conservative limitation a much larger ratio of field to armature magneto-motive forces than European designers think necessary.

Wave Form.—With high peripheral speeds and few poles as in steam-turbine generators, it is comparatively easy to obtain a good potential wave, since there are many slots per pole. But by the use of fractional pitch windings, suitably shaped gap contours, proper gap depths and slot opening dimensions and other means, an almost perfect potential wave may be obtained even where there are very few slots per pole and per phase. It is not sufficient that the resultant wave shall be within a specified percentage of sine form, but it is important that certain particular harmonics which adversely affect telephone systems shall be kept down to very small amplitudes at all loads.

Induction Generators.—In 1910 it was anticipated that induction generators were about to be employed on a considerable scale on systems employing sufficient synchronous machines or their equivalent, to supply the required magnetising current. Steam-turbine driven induction generators of 7,500 kw. rating at 750 r.p.m. were indeed placed in service in 1911 and quite a number of smaller induction generators are in use. But the synchronous type continues to be practically always employed. However, some induction motors are operated under conditions where they serve temporarily from time to time as induction generators, as, for example, in certain types of electric locomotives, where the axles are driven by induction motors; in Scherbius sets and in certain varieties of frequency converters.

Direct-Current Generators.—The rapid growth of the practice of providing electricity in the form of polyphase currents from large generating stations has nearly eliminated the direct-current generator driven by a prime mover as an original source of electricity, except relatively unimportant isolated installations.

Careful study, however, continues to be given to the possibilities of high-voltage transmission by direct current (*see* ELECTRICITY, TRANSMISSION OF). So far as relates to the transmission of large amounts of power over distances of hundreds of miles the cost of the transmission system decreases considerably with decrease in the periodicity employed. It is possible that the use of as low as five cycles for the periodicity during the transmission stage will be better than going to direct current (zero periodicity). If, however, direct current is employed, the present state of the art will not require the use of machines with commutators. Polyphase machines can be employed of whatever periodicity is consistent with economical design, the polyphase currents being converted into direct current in mercury arc or vacuum rectifiers, of which any required number may be placed in series to supply the high-voltage direct-current transmission line. Such outfits can be built in any desired large capacity and for steam-turbine or water-wheel speeds according to need.

A direct-current generator on the same shaft as the polyphase motor by which it is driven, constitutes, together with its driving motor, a motor generator set. These sets are extensively employed in substations in which high-voltage polyphase alternating current is received from a distant generating station. Where the conditions cannot be met by synchronous converters, such motor generator sets are widely used for supplying electric railways and also for supplying individual customers whose requirements are best met by direct current. It is probable that within a very few years the mercury arc rectifier will be widely employed in cases of this sort where motor generators and synchronous converters are at present being used. The mercury arc rectifier takes the place of the entire motor generator set or synchronous converter and has higher efficiency and other advantages.

Direct-Current Generators for Ward-Leonard Systems.—For special applications where a direct-current generator is used for the exclusive supply of a single motor or group of motors, the conditions of supply to the motor are controlled by adjustments of the excitation of the direct-current generator. This is the Ward-Leonard system of control and is used for applications where the load is constantly changing by large amounts. When such considerable fly-wheel capacity is provided on the generator shaft as to occasion a fairly constant input from the supply system with rapidly and widely varying output from the generator, the combination is known as an Ilgner system. Ilgner sets are widely employed for hoists and reversing rolls.

Electric Generators for Electrically Propelled Ships.—During the period from 1910 up to the present there have been installed on naval and merchant vessels a total of considerably over 500,000 kw. of electric generators supplying motors which drive the propellers. While most of these generators are of the steam-turbine driven polyphase type and often of many thousand kilowatts rated capacity each, the smaller ships are often driven by direct-current from generators directly connected to Diesel engines (*see* MARINE ENGINEERING).

Exciters.—There is a large production of small direct current generators employed to provide the excitation to alternating-current generators and synchronous motors. Such machines may also ultimately be rendered obsolete by the use of mercury arc or vacuum rectifiers for the purpose.

High-Frequency Generators.—Since 1918 a good many high-frequency generators have been built for radio work. The Alexanderson generator is of the inductor type and over 20 have been built in the 200 kw. size. The speed is generally about 2,500 r.p.m., the corresponding periodicity being of the order of 20,000 cycles per second. Other high-frequency machines which have been considerably used for radio work are the Goldschmidt alternator and the Latour alternator.

For induction furnace work increasing use is being made of generators supplying current at a frequency of about 500 cycles per sec., and higher frequencies up to 2,000 cycles per sec. are sometimes used. The rotor of a 480-cycle machine is shown in fig. 2, on plate.

Temperature Detectors in Large Generators.—In America there has developed since 1910 a general practice of equipping large electric generators with embedded temperature detectors, several located at various parts of the stator windings being provided. The knowledge thereby obtained of the amount and distribution of the temperature inside the machine has been of great value in improving designs. In America, where the usual design of stator winding provides two coil sides per slot, the highest observable temperature has generally been believed to be that disclosed by a detector located midway between the top and bottom coil sides as shown diagrammatically at *a* in fig. 2 and midway between the core ends. The temperature of the hottest places in the copper windings may be some five or more degrees greater. The original object of providing these temperature detectors was for the purposes of acceptance tests. They have, however, often proved very useful as a permanent feature to permit of guiding the operating staff in loading the generators, the internal temperatures being made at all times available from the readings of switchboard instruments. In a considerable number of large generators the highest temperature affecting the insulation, instead of being between the coil sides, will be on the core side of the slot insulation near the ends of the core. Consequently, detectors ought also to be located at these places, which are indicated by *b* in fig. 2.

ELECTRIC MOTORS

Most of the modern varieties of electric motors were already in use (or at any rate their principles were known) in 1910. All types have, however, undergone considerable modification and improvement. By standardisation and by mass production the cost has been notably decreased. The 1923 U.S. census of manufactures gives the production of electric motors for that year as just over 5,000,000 H.P., and gives the total number of motors built in the United States in 1923 as 2·4 million, of which 2,000,000 were fractional horse-power motors. These latter are used largely in homes to drive phonographs, hairdryers, egg-beaters, vibrators, coffee grinders, washing machines, ironing machines, sewing machines, dish washers, ventilating fans, vacuum-cleaners, floor-polishers, pumps, etc. (*see* HOUSEHOLD APPLIANCES). Aside from domestic uses may be mentioned small motors for automobile starters, automobile tire pumps, gasolene pumps, portable drills, lathes, bottle labellers, cream separators, etc. A considerable proportion of these small motors are of a class designated Universal Motors, the distinguishing feature of which is that, for a given circuit voltage and load, they run at substantially the same speed whether the supply be direct current or alternating current.

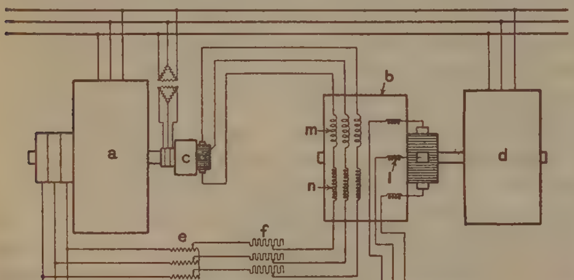


FIG. 3.—Diagram of the Scherbius system of speed control of induction motors. *a.* Main induction motor. *b.* Polyphase commutator motor. *c.* Ohmic drop exciter. *d.* Squirrel cage induction machine. *e.* Auto transformer for speed regulation. *f.* Variable resistor for speed regulation. *l.* Neutralizing winding of polyphase commutator machine. *m.* Main field winding of polyphase commutator machine. *n.* Interpole field winding of polyphase commutator machine.

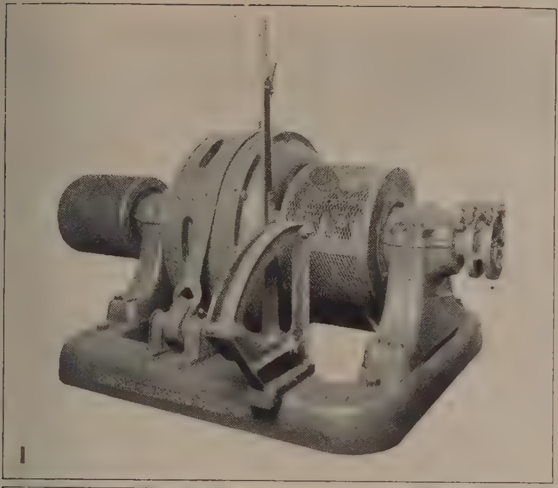
From 1 H.P. upwards, there has, since 1910, been a continuing rapid trend toward the use of the polyphase squirrel cage induction motor. The direct-current motor is relatively of far less importance now than in 1910. Where speed control is necessary, the direct-current motor is usually more suitable, but polyphase commutator motors which provide for speed control by brush shifting are available, although their cost is high. The notable tendency in 1926 is toward the much wider use of synchronous motors of all sizes in order to improve the system power factor. Static condensers are also being installed with induction motors for the same purpose. Synchronous motors are generally fitted with some auxiliary feature such as a squirrel cage winding to provide adequate starting torque. But it is sometimes arranged for the load to be applied through a clutch after the motor has acquired synchronous speed. Fig. 1 on plate shows a type of so-called super-synchronous motor in which the stator is permitted to revolve during the period of acceleration from rest up to synchronous speed and is then brought to rest with a band brake while the rotor runs up to synchronous speed.

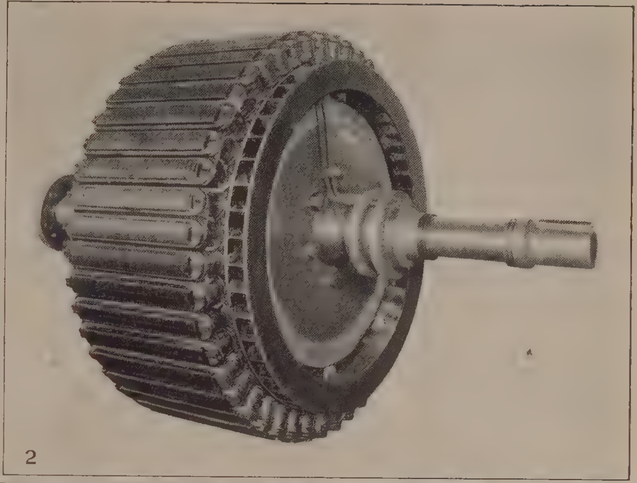
There have since 1910 been developments consisting in so designing transposed conductors as to increase the eddy current losses at starting. The squirrel cage system of an induction motor will provide more starting torque per ampere input to the motor, the greater the loss in the squirrel cage. Full periodicity occurs in the squirrel cage at starting, thus intensifying eddy current losses, while the periodicity at full speed is very low indeed. There are many ways of attaining the desired object. Some of these are modifications of Boucherot's proposals. Others, such as the Kierstead principle described in U.S. Patent No. 1188182 of 1916, are novel. The simple expedient of using radially deep squirrel cage conductors is also effective.

The multiplicity of devices and types of construction of all sorts at present widely used to endow electric motors with desirable characteristics as regards high starting, accelerating and stalling torque, speed control and other features, as also constructional characteristics such as being acid-resisting, dust-proof, gas-tight, moisture-resisting, splash-proof, submersible (*see* SALVAGING), weather-proof, drip-proof and explosion-proof, is too great for enumeration in this article.

Electric Railway Motors.—These are more effectively ventilated than the 1910 motors and are for this reason and owing to improved design features and materials much lighter per horse-power. Since 1910 hundreds of single-commutator direct-current railway motors have been built for 1,500 v., two in series being used in pairs on electric locomotives for 3,000 v. service. Several European countries have, since 1910, adopted as standard the high-voltage direct-current system of railway electrification. In Germany and Switzerland, where the standard periodicity for single-phase railway motors is 16⅔ cycles per sec., fairly satisfactory and not excessively heavy single-phase railway motors have been developed in large sizes, which are mounted above the trucks where the necessary space is available, the axles usually being driven through rather elaborate mechanical transmission systems. (*See* RAILWAYS.)

Electric Drive of Rolling Mills.—All new steel mills are invariably equipped with the electric drive, and the replacement of the steam drive in old mills is proceeding rapidly. During 1925 there were installed in America for driving the rolls 150 motors with an aggregate capacity of 275,000 horse-power. The total aggregate capacity of all motors at present installed in steel mills in America is 4,000,000 horse-power. Of this total there are 1,200 motors driving rolls, and their aggregate capacity is 1·5 million horse-power. Electrification has led to great increases





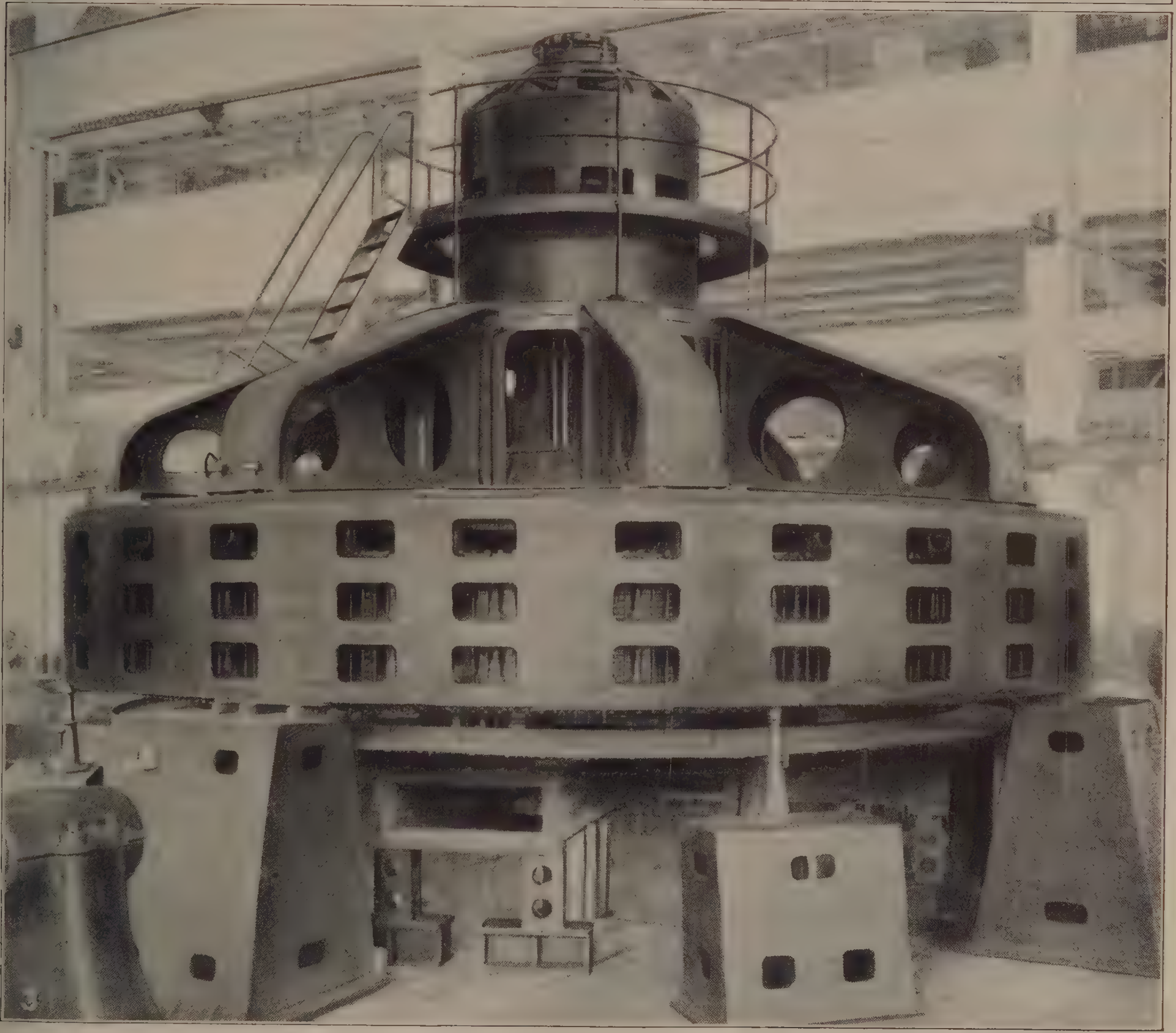


FIG. 1. 8 pole, 100 H.P., 900 r.p.m., 220 volt super synchronous motor. FIG. 2. 480 cycle rotor of a 48 pole, 600 k.v.a., 1,200 r.p.m. 1,875 volt generator for induction furnace work. FIG. 3. 72 pole, 20,000 k.v.a., 100 r.p.m., 6,600 volt, vertical shaft water wheel driven generator.

the output of steel mills through speeding up the rolls, has proved the product through the much greater exactness of ntrol and has decreased the manufacturing cost.

For reversing mills the Ilgner system with liquid slip regulator almost always used and the d.c. motor which drives the revers- g rolls is sometimes of very large capacity, such, for example, a continuous capacity of 8,000 H.P., and a capacity for mo- entary loads up to 22,000 horsepower. Reversing from full eed in one direction to full speed in the other direction is ac- mplished in from three to four seconds. For non-reversing nstant-speed mills induction motors are nearly always used. owever, a recent installation comprised a 9,000 H.P., 107 .m., 60-cycle synchronous motor. For non-reversing mills quiring adjustable speed, there are often employed induction otors with the Scherbius or the Krämer[1] direct current sys- n of speed control, although when close speed regulation is quired d.c. motors are employed.

Scherbius System of Speed Control of Induction Motors.—The herbius system is one of the systems developed and extensively ed since 1910, providing for the economical control of the eed of induction motors. It is shown diagrammatically in fig. in which *a* represents the induction motor whose speed is to controlled, *b* is a commutator regulating motor whose main and erpole stator windings are connected (1) to the slip rings of through a resistor *f* and an auto-transformer *e*, and (2) to the nmutator brushes of a small frequency converter *c*, which is unted on the shaft of *a*, and whose slip rings are connected the supply circuit through a small transformer. On the same ft as *b* is a squirrel cage induction machine *d*, whose stator ndings are connected to the supply circuit.

For speeds of *a* below synchronism, *d* is an induction generator urning energy to the supply circuit, while for speeds of *a* above nchronism it is an induction motor driving *b*, which then is a nerator. *c* is called an "ohmic drop exciter" and serves to pply the resistance drop of the excitation circuit at the proper quency to *b* and so supplies the whole excitation when *a* is at very close to synchronous speed. The speed control of *a* is ained by manipulation of the transformer *e* and the resistor *f*.

Reversing Drives.—Excavators (shovels), cranes, hoists, ersing planers and slotters, elevators (*see* ELEVATORS), con- vers, etc., constitute examples of motor applications requiring eated rapid acceleration and reversal. Often the reverse drive at a speed several times greater than the load drive. The oice between direct-current and alternating-current motors for se applications depends upon many circumstances. Often d systems are available with each type of motor.

Mining Applications.—Electric motors are very extensively d in both the coal and metal mining industries, there now ng approximately 2,750,000 H.P. installed in these fields in United States. Many steam drives have been converted to ctric power with remarkable savings in cost of operation, and ctric motors are used for practically all new undertakings.

At the mines proper (*see* MINING) electric motors are used for following purposes: (1) hoisting, (2) pumping, (3) ventilation l (4) haulage. For the driving of mine hoists there are used h geared reversible polyphase induction motors and direct- rent motors (usually without gears) operating on the Ward- nard or Ilgner systems. Many hundreds of hoist induction tors have been installed, ranging in capacity from 100 H.P. to 00 H.P., and direct-current hoist installations have been made capacities up to 5,000 horsepower. A notable example of a ge automatic electric hoist is that at the Inspiration Copper mine in Arizona, consisting of dual 580 H.P. direct-current ipments which have a combined maximum daily capacity of 00 tons of ore from a depth of 750 feet.

Wood and Metal Working Machinery.— It is often desirable wood-working machinery, that the driving motor should e extra high speed. Thousands of small squirrel cage induc- n motors with speeds up to 25,000 r.p.m. have been developed America for this class of machinery and are usually mounted directly on the shaft or spindle of the machine to be driven. They are of bipolar design and are operated from the high-frequency generators of motor generator sets or from the high-frequency circuits of frequency converters. At 420 cycles per second the speed of a small induction motor will usually be well above 20,000 revolutions per minute. These motors are also used for such purposes as (1) grinding small bearings and ball races (2) driving oil separators (3) driving wood shapers and wood-carving machinery. A type of motor which is built by a European firm for driving wood-working machinery and which avoids the need for a frequency converter is shown in fig. 4. The motor has two concentric rotors. If the windings are bipolar and if the stator and the outer rotor are each supplied with 50 cycles, the inner rotor will run at 6,000 r.p.m., or twice the speed associated with a single rotor 50-cycle bipolar motor. The driving of air compressors may be mentioned as a very important instance of requiring motors of large capacity and very high speed.

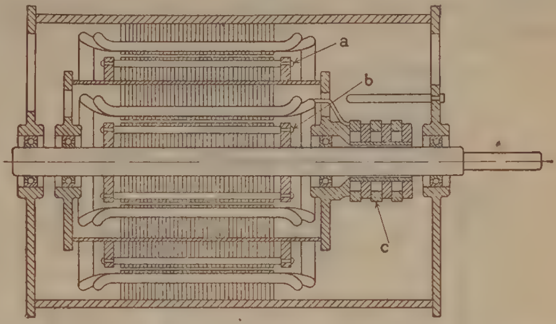


FIG. 4.—Cross section of a German high speed polyphase motor with two concentric rotors. *a*. Outer squirrel cage. *b*. Inner squirrel cage. *c*. Slip ring.

Extra-Low-Periodicity Motors.—Careful study has been given by the author to the design of extra-low-periodicity motors, such as 6 to 10 cycles per second. For low-speed applications such designs have characteristics as regards lower cost, higher efficiency and power factor, and capacity for carrying large overloads, which are much superior to 60-cycle and even to 25-cycle designs.

CONVERTERS

Synchronous Converters.—Reference has already been made to motor generator sets for transforming alternating current received in a motor into direct current delivered from a generator driven by the motor. While in 1910 synchronous converters which accomplish this purpose in a single machine and at higher efficiency than with motor generators had been widely used for years, they were of relatively low speed and consequently large and expensive. The synchronous converter of 1926 has, for a given capacity, voltage and periodicity, from 50% to 100% higher speed. Furthermore for 60-cycle circuits much larger capacities are now obtained in a single machine. In 1910 the 25-cycle converter was developed for quite large sizes up to 750 v. at the commutator, but the 60-cycle converter was limited to much smaller sizes and voltages. The improvements have been accomplished through more suitable interpole design, higher peripheral speeds of commutator, thinner commutator segments, improved brush-holder design, the use of flash barriers and other related devices, equaliser connections, amortisseur windings and other features. Improvements in very high speed circuit breakers have also contributed. The largest number of collector rings used in 1910 was six. At present 12-ring synchronous converters are being built. Fig. 5, an example of this, is a 12-phase, 4,200-kw., 285-v., 25-cycle, 16-pole synchronous converter, with its airblast transformers located integrally with the converter. This saves all the floor space formerly occupied by the transformer and also the long heavy-cross-section secondary cables from the transformers to the collector rings and the losses therein. For electric railway substations the modern synchronous converter is usually specified to carry 150% rated load for two hours and twice rated load momentarily. However, 300% rated load for five minutes is sometimes required and provided.

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[1] For a description of the Krämer system, see p. 576 of the 5th ion of the *Standard Handbook for Electrical Engineers*.

In America the practice followed in starting synchronous converters continues to be the use of low voltage transformer taps with the field circuit disconnected into sections and with the brushes raised from the commutator. In England the usual method consists in employing a small squirrel cage motor on the shaft and connecting its stator windings in series with the synchronous converter. When the converter has been brought up to speed, the stator windings of the starting motor are short-circuited.

Motor Converters.—In Great Britain motor converters are supplied by several manufacturers as an alternative to synchronous converters on the basis of there being an economic field for each. Motor converters are not used in America.

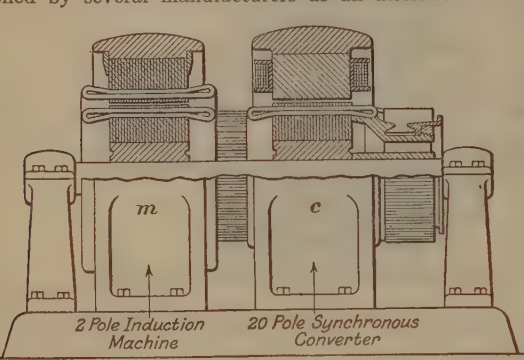

Fig. 5.—Synchronous converter system with transformer on shaft.

Transformer on Shaft of Synchronous Converter.—As an alternative, in saving floor space, an attractive proposition consists in mounting on the shaft of the synchronous converter the transformer, which steps down the voltage and multiplies the phases. Such an arrangement substitutes three small-current high-voltage slip rings for the six or 12 heavy-current slip rings otherwise required. It is still more attractive to have only the secondary half of the transformer on the shaft, the primary being on a stator. Then no slip rings are needed and the shaft is relieved of more than half of the weight of the transformer.

This ideal is nearly realised by the arrangement illustrated in fig. 5. The left-hand member is structurally a 2-pole induction machine, the right-hand member being, in the example, a 20-pole, 400 r.p.m. synchronous converter. A three-phase high-voltage 60-cycle source supplies the windings on the left-hand stator and establishes in the stator a magnetic field with a speed of 3,600 r.p.m. in a direction opposite to the shaft speed of 400 revolutions per minute. Consequently current of 66·7 cycles is induced in the windings of the left-hand rotor and delivered, at 12 or more phases, to the rotor windings of the synchronous converter. An analysis shows that the left-hand machine is nine-tenths transformer and one-tenth induction generator.

Frequency Converters.—These are now far more widely used and are built in sizes many times greater than in 1910. This increase in size has become necessary for interconnecting extensive transmission and distribution systems. A synchronous frequency converter for interconnecting 25-cycle and 60-cycle systems has been built with a speed of 300 r.p.m. and with a rated capacity of 35,000 kilowatts. It has an efficiency of 96·1%, or just over 98·0% for each machine. In the largest frequency converter yet built, one of the machines is of the induction type, so far as relates to its mechanical construction. This converter has a capacity of 40,000 kw. for the transfer of energy from a 60-cycle to a 25-cycle system and for 38,000 kw. when the energy is transferred in the opposite direction. The speed of the set is 300 revolutions per minute. The synchronous type member has 10 poles and the induction type member 14 poles. The necessity for having an exact relation between the frequencies of the two systems may be avoided by adding a Scherbius speed-regulating set to the induction type machine This plan has been employed in several recent frequency converters.

Synchronous Condensers.—With the growth in size and voltag of transmission lines, the problems of voltage regulation an power factor correction have become very important and hav led to the wide use of synchronous condensers located at suitabl points in the system. As an important instance may be mentione a synchronous condenser for 60 cycles, 11,000 v. and 25,000 kv.a running at 600 revolutions per minute. For some other purpose where it is desired to control the power factor, use is made other kinds of machines, which have come to be known as phas advancers. Amongst these may be mentioned those devised b Leblanc, Scherbius and Kapp. Descriptions of these are give at pp. 578 to 585 of the 5th ed. of the *Standard Handbook f Electrical Engineers.* No considerable need for such machine had developed in 1910.

Automatic and Supervisory Control.—Particularly with refer ence to converters, condensers and other apparatus in sub stations, but also as applying to generators in hydraulic station mention should be made of the wide use which is now made automatic switching and supervisory control. Such operatio was non-existent in 1910. But in America alone at the end 1925 a total of 5,000,000 kw. was thus controlled. Much quicke operation is secured and there is a complete avoidance of th mistakes made in manual operation. The first cost is greate but this is offset by operation savings and improved servic

Generators and Motors Wound for High Voltage.—While a fe machines have been wound for voltages of nearly 30,000 by usin considerable thicknesses of the best of slot insulation, it is sti usual to employ transformers for any voltage higher than 16,00 There are grounds for believing that stators of generators an motors could in many cases economically be wound for muc higher voltages by enclosing the stator windings in a space co taining oil. A system of pipes through which cooling water circulated could be located in the oil. Instead of oil the enclosu could contain air or suitable gas at high pressure. Such co structions would also decrease the deterioration of the insulatio through corona action.

Various constructions have been proposed to permit of a complishing these purposes. A sound basis when air is use would be to make the enclosure only reasonably airtight an have a small compressor supply of make-up air to maintain—sa —two or three times atmospheric pressure. Not only will th high-pressure air be a better insulator but it will conduce to much lower temperature rise just as there is a higher tempera ture rise when an air-cooled machine is operated at a high alt tude. By means of a suitable fan the high-pressure air can b drawn from the stator enclosure through a closed-circuit coolin system (such as that illustrated in fig. 1) and back to th stator enclosure.

Standard Specifications for Dynamo Electric Machines.—In th interval between 1910 and 1926 a vast amount of standardisatio work for dynamo-electric machinery has been accomplished i various countries. Some of the leading specifications employe in Great Britain, America and internationally are those adopte by the American Institute of Electrical Engineers, the Britis Engineering Standards Association and the Internationa Electrotechnical Commission. (H. M. H.*)

DYSENTERY (*see* 8.785).—The term now designates a clinica syndrome in man characterised by the passage of blood an mucus, the bloody flux of former times, consequent upon th pathogenic activities, primarily upon the large bowel, and leadin to superficial or deep ulceration, of certain microbic forms life, protozoal or bacterial. Though this character is pathog nomonic of the disease it is but one sign or symptom there and is not in itself a pathological entity. The syndrome arise from the habitual localisation of the micro-organism in the mu cous membrane of the lower bowel; and as dysentery may b due to diverse micro-organisms, the causal one or its family generic name is employed to specify the type of infection, thus— amoebic, bacillary, spirochaetic, ciliar and helminthic dysenter the first two being the most prevalent and of world-wide incidenc

Pseudo-dysentery.—The term pseudo-dysentery has been give to the passage of blood and mucus arising when there is ulcera ion of the lower bowel in other diseases in which the site of ctivity of the causal micro-organism is not a specifically se-ective one and confined to the lower bowel, but may occur in ther parts of the body, as in tubercle, syphilis or in typhoid or aratyphoid. Again this passage of blood and mucus may be ound associated with a pathological state of the kidney, heart r liver or with carcinoma of the bowel, the impaction of a foreign ody or mechanical irritation.

Clinical Dysentery.—The term clinical dysentery is applied to group of cases of a mild form of dysentery of short duration, een especially in natives in the tropics, the aetiology of which s not yet known. In all forms of dysentery there is frequently ssociated abdominal pain and tenesmus, or one only of these ymptoms; or, again, both may be absent, for they depend on the ite or extent of the ulceration.

Causal Organisms.—The causal micro-organisms have been rouped. Protozoa and bacteria found in the intestine of man ave been classified into pathogenic and non-pathogenic, and the arieties of form certain protozoal organisms undergo in their life istories in the intestines, or when, as some helminths do, they ass through a phase of existence in an invertebrate host, have een studied and made known.

The findings of Walker and Sellards in Manilla from experi-nents on condemned prisoners show that of the five amoebae ound in man only one, *Entamoeba histolytica*, is pathogenic to im. Later Darling, James and others at Panama differentiated from the non-pathogenic E-coli, an entamoeba commonly ound in the large bowel of man. Recently Cutler, Boeek and Dr. Bohlar have cultivated the *E. histolytica* in artificial media. n the Philippine Islands Vedder studied the specific action on moebae of emetine, an alkaloid from ipecacuanha, and its appli-ation with such beneficial results to man was first made by Sir eonard Rogers in India. A new species of bacillus dysenteriae, B. *dys. Schmitz*, was first found in Rumania in 1916.

Improvements in Technique.—Mechanical aids have been im-roved to obtain more precise clinical knowledge. The sigmoido-cope, by which one can see 20 cm. up the bowel, is now employed look for any ulceration and its character in this region and, present, specimens for laboratory examination can be taken irect therefrom, so that this instrument renders a double and ery valuable service. Skiagrams taken after a barium mixture, iven by mouth or injected per anum, have been very service-bly employed to determine the movements and the nature of the owel condition, and presence of any ulceration, filling defects, trictures or diverticula in its wall in subacute or chronic cases *see* RÖNTGEN RAYS).

In England and France the existence of bacteriophage has een determined. Regarding dysentery d'Hérelle found that if a ew drops of the filtrate from a broth culture of the faeces of a onvalescent case of *B. dys. Shiga* be placed in a broth culture of his bacillus, the micro-organisms are dissolved. The action is onsidered due to the development of an ultra-microscopic virus r to a ferment or lytic property which destroys the bacillus rganisms and this virus or property has been developed to xtend to other bacillary dysentery (*see* BACTERIOLOGY).

Amoebic Dysentery

This is also called amoebiasis, loeschiasis or tropical dysentery, he latter because of its early endemicity and greater incidence the tropical areas.

The causal organism *E. histolytica* (Loesch 1871), a species of the enus Entamoeba, affects man alone in nature, though the dog and at, and recently the guinea-pig and rat, have been infected experimen-ally. The *E. histolytica* in its life-cycle in man passes through three tages—a large vegetative stage when living within the tissues, giving ise to ulceration and passage of blood and mucus; a pre-cystic or minuta stage found in convalescents and in carriers, when the moebae are much smaller and live on the mucous membrane within he bowel, from which they may pass into the membrane and assume he larger vegetative form, and a cystic stage. The amoebae increase n numbers by division of the parent into two. In the pre-cystic, or minuta, stage they contract into a smaller, rounded or ovoid form, evelop a firm outer wall and become transformed into cysts with he characteristic one to four nuclei, and containing chromatoid rods which possibly act as food stores. It is by swallowing these cysts that man is infected. These cysts do not resist drying, but retain their vitality for two weeks if kept moist in the faeces or in water. They can therefore be transmitted by direct contamination with faeces, through handling soiled linen, by flies carrying them on to food, by soil or by drinking contaminated water; and prophylaxis must be directed accordingly.

Symptoms.—Clinically the disease is characterised by its chronicity with tendency to recrudescence of symptoms. The onset is insidious, the sufferer first noticing a feeling of debility and lassitude with an increase of stools soft in character, and with blood and mucus for several days. These may clear up and be the only signs noticed, or they may recur months later. Most often the initial stage is followed on by an acute exacerbation of symptoms, dependent in their degree upon the extent of the ulceration in the large bowel, the most markedly affected sites being the entire colon, the caecum, flexures and appendix, sigmoid and rectum. Stools become still more frequent, even up to 40 or 50 in 24 hours, and the ulceration gives rise to abdominal pain and, if at the rectum, to severe tenesmus. The patient takes to his bed exhausted. In uncomplicated cases there is but slight rise of temperature or other symptoms of toxaemia as the entamoeba produces no toxin.

The entamoebic cysts in cystic form pass through the stomach unchanged, and in the small intestines they germinate, and young amoebulae are set free. These increase in size, multiply by a process of division, and, by their lytic power, penetrate through the mucus membrane lining the large bowel, into the submucous layer, where they continue to proliferate and destroy the tissue, including the small blood-vessels, thus leading to the haemorrhage that accompanies the mucus produced by the irritation of the membrane, and impeding the circulation of blood and lymph at the site. A typical flask-shaped ulcer is formed, with roughened undermined edges at the orifice, and when situated approximately they are frequently joined by submucous tunnels.

Occasionally super-added infection with other bowel organisms supervenes, and gangrene may follow, or the amoebae may penetrate through the outer muscular walls of the large bowel, giving rise to perforation and accompanying peritonitis, or, by penetrating a blood-vessel, they may be carried off in the blood stream and give rise to an abscess in the liver, to which the blood first takes them, or, most exceptionally, an abscess in the brain or lung or elsewhere. Healing is brought about by the development of fibrous tissue at the sites of the ulcers.

Diagnosis.—Diagnosis is quickly made by examination of the stools. In the acute condition they may consist entirely of blood and mucus, or contain also a little faecal matter. The mucus is stained a brownish colour by degenerated blood cells and the blood is usually in the form of clots, not evenly mixed through it. Microscopically the *E. histolytica* is readily found and is distinguished by its rapid movement, ill-defined nucleus and greenish tinted ectoplasm and ingested red cells. White cells are not seen in great numbers, and they tend to break down and disintegrate as distinguished from the many pus cells which are present in bacillary dysentery, and which tend to become swollen and structureless. Charcot-Leyden crystals, seen in dysentery of the amoebic type, may be found.

Treatment.—The acute symptoms readily subside under appropriate treatment. The patient should be put to bed. The specific treatment is ipecacuanha, or an alkaloid extracted from it, emetine. Combined hypodermic injections of emetine hydrochloride with oral administration of ipecacuanha (Brazilian), or of bismuth subnitrate in large doses, to attack the amoebae from within and without, have given striking results. The toxic action of emetine on the heart must be watched. Added to the specific treatment in acute cases there is the general and symptomatic, which may include an early free flushing of the bowel by a dose of castor oil with tinct. opii. added; later followed by magnesium (or sodium) sulphate in hourly or two-hourly half or drachm doses for 12 or 24 hours. Morphia may be necessary to relieve the abdominal pain and straining. The diet must be light and easily assimilated, and raw food should be withheld.

The symptoms subside in one to three weeks, the patient regains his general health after suitable convalescence and no further trouble may follow. However, not infrequently the fibrous healing leads to the thickening of the bowel wall, partial loss of peristalsis or to constriction producing chronic constipation, or, what is rare, stenosis and blockage; or again the entamoeba may persist in the lumen of the bowel, ever ready to enter its wall and renew symptoms when conditions so favour. The usual medical and dietetic measures are taken when constipation supervenes, and liquid paraffin has proved a useful adjunct.

Therapy Notes.—Treatment to eliminate the entamoeba in its pre-cystic form from within the lumen of the bowel of the carrier is not yet on an equally satisfactory basis. Emetine hydrochloride injections, so effective in killing the entamoeba when in body tissues, have no effect upon it. An important measure to avoid recrudescence is to maintain the general health and avoid indiscretions in diet. There are several medicaments given to kill off the entamoeba and it may be necessary to vary or repeat courses of them; these are ipecacuanha, emetine alone or combined in an encapsuled pill, bismuth subnitrate, Ravaut's paste, Stovarsol, etc. Intravenous injections and colonic lavage with neosalvarsan have been much used to supplement oral treatment, by the French. Colonic lavage through an appendicostomy wound or by enemata has not given the good results anticipated. Amoebic hepatitis and small abscess of the liver respond well to injections of emetine hydrochloride, but a large abscess needs surgical intervention. A carrier should, if possible, live in the temperate zone.

Bacillary Dysentery

While sharing with the amoebic the clinical dysenteric syndrome above described, it differs therefrom in the shortness of the incubation period, generally 24 to 72 hours, by its sudden acute onset with elevation of temperature which may persist several days or more, and other symptoms of toxaemia; extreme contagiousness; seasonal prevalence (midsummer and autumn); epidemic character and incidence in temperate regions, where the amoebic type is practically limited to sporadic cases; higher death-rate and in the complications that may follow infection more especially with *Bacillus dys. Shiga*, namely: arthritis, fibrositis, conjunctivitis, muscular paralysis and myocarditis. Clinically it may assume forms varying in symptomatology from mild to severe, and occasionally be hypertoxic, typhoidal or ulcero-gangrenous in character. Outbreaks of dysentery in asylums, prisons, concentration camps and ships are generally bacillary in type.

The bacillary dysentery group comprises:—

1. The *B. dys. Shiga* (Chantmesse and Widal 1888, Shiga 1898, Kruse 1900), a well-defined homogeneous species, known as the true dysentery bacillus, since it alone contains endotoxins which are pathogenic to man and experimental animals.
2. *B. dys. Schmitz* (Schmitz 1916, Andrewes 1918, Broughton-Alcock 1918), another homogeneous species and a bacillus which contains endotoxins acting severely on rabbits but much less pathogenic to man. Its incidence is rare.
3. *B. dys. Flexner-Hiss* (Flexner 1900, Hiss and Russell 1903), a mildly toxic heterogeneous group of bacilli characterised by their power to ferment mannite, produce indol from peptone and containing many species recently distinguished by the agglutination and absorption reactions.
4. A further group which embraces bacilli rarely found and characterised by specific agglutination and absorption properties and power to ferment certain sugars, *e.g.*, *Bacillus of Strong, Castellani, Gay, d'Herelle* and others, each capable of producing a mild, clinically dysenteric syndrome in man.

Symptoms.—Clinical symptoms vary, as do the degree of the intestinal lesions and the toxicity of the causal bacillus. Infections with *B. dys. Shiga* are characteristically the most severe. The ulcerative lesions are not confined to the large bowel but extend one to two feet up into the small intestine. The bacilli pass through the stomach, multiply in the small intestine and produce at least two toxins which are absorbed into the blood, one acting on the nervous system and the other excreted into the large bowel, causing inflammation with coagulation of lymph, thrombosis of vessels and necrosis of the submucous layer and superimposed mucous membrane. The bacilli proliferate on the bowel wall, an exudative fibrinous diphtheritic-like membrane forms and separates off, leaving superficial ulcers with raised, red, oedematous edges. These may deepen by continued microbic action and even penetrate through into the peritoneum, leading to peritonitis, or gangrene may set up in the damaged necrosed tissue, and in either case death follows unless surgical intervention is early. Repair proceeds along the same lines as in amoebic cases, but, the ulcers being generally more superficial, the permanent damage is not so great.

The stools have a characteristic microscopic appearance, as numerous pus and epithelial cells and large, macrophage cells are present in the mucus. Microscopically the stool most often consists of mucus, like cloudy-grey jelly streaked or stained by bright red blood, or the mucus may be bile-stained in a diarrhoea-like stool, or, in very severe cases, there are shreds of necrosed mucosa.

Causation.—The causal bacillus is readily isolated by culture within the first days, but afterwards it becomes difficult as the microbic life in the necrotic tissue becomes a flora of proliferating organisms. The life of dysentery bacilli is prolonged by mixing the faeces with 30% glycerine in 0·6% sterile sodium chloride (Teague and Durman's solution), and the method is very useful when specimens are to be sent by post or transport to a laboratory. The *Bacillus dys. Shiga*, the only species isolated from the blood stream, has been found therein in only four or five cases. The bacilli dysenteriae pass to the mesenteric glands along the lymphatics, but are arrested there.

After the cessation of the symptoms the percentage of cases retaining the causal organism in the bowel is very small. If the patient becomes a carrier of *B. dys. Shiga* the stools will continue to be in part muco-purulent, even up to three or more years. The property of agglutinating the causal organism and other strains of the same race is present in the blood after the first week and may last for only eight or ten days in mild cases, but when the infection is prolonged this property of agglutination persists for a longer period. *B. dys. Shiga* infected cases generally agglutinate, also the *B. dys. Flexner-Hiss* in a lesser degree, but the converse does not hold. *B. dys. Flexner-Hiss* cases agglutinate several species of the group, rarely only the strain isolated from them. *B. dys. Schmitz* cases do not appear to develop agglutinins even for their own organism.

Treatment.—In bacillary dysentery the patient, especially if infected with *B. dys. Shiga*, is much more ill than in amoebic, and attention is given to neutralising the toxins which act strongly on the heart and other vital organs, besides general and symptomatic treatment and elimination of the microorganism from the intestines. Infections with *B. dys. Shiga* are outstandingly the most severe, and it is the anti-Shiga serum prepared by inoculating the bacilli with their endotoxin into the horse which is the most efficacious. It has also been used in severe cases due to *B. dys. Flexner-Hiss* with some success. A polyvalent horse serum prepared by inoculating strains of both these groups of microorganisms has been extensively given in cases of either infection, but the best results are gained from anti-Shiga serum in *B. dys. Shiga* infections where this specific line of treatment is most required. The injections should be given as early in the disease as possible and in large doses, dependent upon the severity of the case, *e.g.*, 60 c.c., 40 c.c., 20 c.c., on successive days in a severe case; saline aperients until the stools become faecal should be given frequently. Heart stimulants may be needed. Diet as above. Thereby amelioration is rapid, sequelae rare, the bacillus early eliminated and convalescent carriers much more rare than after amoebic dysentery, and the bowel wall is not so often permanently damaged. After an attack it is well to take care in building up the general health and adhere to a diet.

Prophylaxis.—The general prophylactic measures to be taken are comparable with those against infections with *E. histolytica*, but it should be remembered that bacilli are lower vegetable organisms and can proliferate in a suitable environment outside the body. Dependent on several factors, bacillary is more contagious than amoebic dysentery. Encouraged by successful results following inoculations of typhoid and paratyphoid vaccines, some series of inoculations with a vaccine of *B. dys. Shiga* were made in epidemic areas during the War, as this was the bacillary organism so prevalent and so toxic in epidemics during war conditions. Its contained toxins give rise to acute local reactions unless modified prior to inoculation by special methods, as by treating the heat-killed bacilli with normal serum (serum treated) or with specific horse anti-serum (sensitised), or by inoculating both specific anti-serum and bacillary emulsions on approximating days, or by giving an absorbed specific anti-erum and bacillary emulsion simultaneously, or by emulsifying he bacilli in oil. These series of inoculations made by various workers gave encouraging results. Vaccine-therapy employed o rid the convalescent carrier of *B. dys. Shiga* has not been uccessful. In striking contrast with *B. dys. Shiga* the killed and ntreated emulsions of the *B. dys. Flexner-Hiss* group give rise to o reaction, even in high doses.

Spirochaetic Dysentery.—This is due to *Spirochaeta eurygyrata* Le Dantec 1900, Werner 1910). To a considerable extent vidence is increasing that this spirochaeta is capable of giv-ng rise to an acute condition with passage of blood and mucus r of what is more frequent, maintaining a chronic or intermit-ent mild form of dysentery, or it may give rise to no symptoms. t is never found free in faecal matter but only in mucous shreds xcreted, in the detached crypts and occasionally within the lin-ng epithelial cells of the mucous membrane. Many observ-rs consider that it proliferates and gains a footing on a bowel damaged by the entamoeba. It is a rare form of dysentery but has a wide endemic distribution in tropical and subtropical coun-ries. Treatment of the very rare acute condition is by frequent aline aperients. In its chronic form best results have followed nemata containing oil of eucalyptus, or by calomel at night ollowed by a saline aperient next morning or by Slovarsol.

Helminthic Dysentery.—The chief helminths which give rise to dysentery are the bilharzia worms, *Schistosoma mansoni*, in Africa, South America, West Indies and *Schistosoma japonicum* in the Far East. Another trematode which may cause dysenteric symp-oms is *Fasciolopsis buski*, found in China, Assam and India. Thymol or beta-naphthol are used in treatment of this latter.

Infections with hookworm (*see* HOOKWORM), *Ankylostoma uodenale*, are widely distributed in tropical lands and extend to ubtropical regions. In such infections blood and mucus are ometimes passed in large quantities and these cases may be mistaken for true dysentery.

Ciliar dysentery due to *Balantidium coli* is a form of dysen-ery that has been found in Europe, Japan and the Philippine Is., but rarely elsewhere. An investigation of a number of habit-ants of Utuado, Porto Rico, led to the detection of many carriers without symptoms. The ciliar form of dysentery is rarely seen outside endemic regions and the causal organism is transported herefrom in sporadic cases that may arise elsewhere.

Carriers.—A certain number of cases of dysentery become convalescent carriers, harbouring the parasite in the intestine with r without obvious activities on the host. The contact or healthy arrier may have no signs past or present. Neither type of carrier s very common in the bacillary form, and there are more of B. *dys. Flexner-Hiss*, but both types are not very uncommon in amoebic dysentery.

The causal organism, bacillus or amoeba, can live in some humans, o all appearance as a harmless commensal within its host. The rst sign of the presence of the entamoeba may be an abscess in the body, generally in the right lobe of the liver, very rarely in the brain r the lung, though its transference from the bowel by the blood tream is a rare sequela outside tropical regions. Only by laboratory nvestigation of the stools, and finding of the amoeba or its cyst, can he contact or healthy carriers be detected. Lowering of resistance by debilitating illness, indiscretions of diet, poor feeding, crowding ogether, etc., may lead to activity of the organisms on the bowel wall, giving rise to symptoms. Carriers of dysenteric organisms hould always be looked for and treated and should not be employed on the preparation or distribution of foodstuffs which may ecome infected and spread infection to others. Helminthic and iliar dysentery carriers are practically limited to endemic regions nd to those arising from infections therein. Of 9,431 returned troops laiming State aid for disabilities following War dysenteries, 942 arboured the *E. histolytica* and four of these acquired a liver abscess n England; 10 carried *B. dys. Shiga*, 7 *B. dys. Flexner-Hiss*, 1 *B. dys. Shiga* and *E. histolytica*, 12 *Spirochaeta eurygyrata*, 10 *E. histolytica* and *S. eurygyrata*. Approximately half of those who were not ompletely freed of *E. histolytica* during early treatments after arrival n England have remained carriers, despite many forms of treatment since. The vast majority do not suffer from acute symptoms. A few persist in passing blood and mucus, others a catarrhal exudate with active amoeba.

Examinations of the faeces of groups of people who have never been in tropical lands, some leading normal lives, others in camps, prisons, asylums, etc., by various workers in temperate regions, including England, Europe, the United States, Northern China, have shewn a percentage of carriers of the amoeba of dysentery in a varying but definite percentage amongst apparently normal people living normal lives, as well as in subjects under conditions of confinement. The findings of the bacilli of dysentery were less frequent. When we consider that the spread of the disease is from the faeces of infected subjects, and that a distinct carrier rate is found under conditions of hygiene and sanitation, it will be appreciated that the very frequent lack of any such conditions amongst natives increases the risk of infection in tropical lands. Again the less healthy conditions of life in these parts tend to favour a lower resistance of the body and a higher number of cases with symptoms. Whenever people are confined or crowded together, as has happened formerly in asylums, prisons, etc., the risk of a spread of infection is great and an outbreak of dysentery not uncommon when rigid sanitary measures are not applied.

GENERAL CONCLUSION

Epidemiology.—Dysentery is markedly more frequent in hotter countries and tends to arise in subjects of lowered body resistance. This disease appears in its most devastating epidemic form in armies, fugitives, refugees and pioneers and vanishes before the comfort and prosperity of a well-fed and settled people, especially when living under favoured climatic and sanitary conditions. During the World War, its invaliding rôle was considerable in all armies, especially those fighting in tropical countries where the conditions favoured it, and in parts of eastern Europe where sanitary control was not scrupulously exercised. On the Gallipoli Peninsula, nearly every soldier who landed on the peninsula suffered from dysentery or diarrhoea, and few escaped the former disease. Severity of the climatic conditions, difficulties of obtaining adequate food and sterilised water, fly pests, fatigue, hastily improvised resting places and sanitary arrangements, prolonged periods in trenches, were the important factors conducive to infection. The comparatively small death roll was due to the knowledge that dysentery may be due to diverse organisms, each having a specific line of treatment. Most deaths were due to *B. dys. Shiga* infections.

Incidence.—In most temperate zones the incidence of dysentery is practically limited to occasional small outbreaks of the bacillary form, to sporadic cases of this or of the amoebic form due to infection from a patient or from a carrier of the organism, and to cases that have been infected in tropical or subtropical lands or under War and such like conditions of life; but in hot climates these forms of dysentery constitute one of the most prevalent diseases and claim a very high incidence and death rate, approximating that of malaria.

As a sequel to the inflowing of the white races and the development of agriculture, mining and other industries in tropical lands, there has been an appreciation of the economic value as well as of the maintenance of better health and social conditions that followed the investigations into tropical diseases, the care in health and disease of the native and application of fitting hygienic and sanitary measures on a large scale. To cite but two extensive beneficial issues in areas heavily infected with dysentery, the once so prevalent amoebic dysentery in the Panama Canal Zone is now uncommon there, while in the Malay States, where bacillary dysentery is the more frequent form, there has been an increasing fall in the number of cases and death rate during the last decade.

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DYSON, SIR FRANK WATSON (1868–), British astronomer, was born at Ashby-de-la-Zouch, Leicestershire, on Jan. 8 1868, and was educated at Bradford Grammar School and Trinity College, Cambridge, where he was second wrangler and Smith's Prizeman. In 1894 he became chief assistant at the Royal Observatory, Greenwich, and in 1905 was made astronomer royal of Scotland, a position which he held until his return to Greenwich in 1910 as astronomer royal of England. From 1899 to 1905 he was secretary of the Royal Astronomical

Society. He was elected F.R.S. in 1901, subsequently serving on the council, and was in 1921 awarded the royal medal for his numerous contributions to astronomy, and especially for his important investigations of the distribution and movements of stars and the bearing of these upon the structure of the stellar universe. He was conspicuously successful, too, in obtaining records of the spectrum of the corona and chromosphere during eclipses of the sun. He was knighted in 1915. His publications include papers on mathematical and astronomical subjects in *The Quarterly Journal of Mathematics*, and other periodicals.

DZERZHINSKY, FELIX EDMUNDOVICH (1877–), Russian politician of Polish descent, was born at Vilna. He joined the Social Democratic party of Lithuania in 1895, and two years later was arrested and banished to Siberia for political agitation. In 1899 he escaped, was rearrested in the following year and in 1902 again escaped. After he had taken part in the revolution of 1905 there followed further years of banishment until 1912, when he returned to Warsaw, was arrested again and sentenced to nine years hard labour. After the revolution of March 1917 he was released and became a member of the military revolutionary committee which organised the Bolshevik revolution. In Dec. 1917 he organised and became chairman of the Cheka, or secret police which fought the revolution. By his ruthless methods in this capacity Dzerzhinsky became one of the most feared men in Russia. He was appointed commissar of the home department in 1919. The organisation of the cheka was found to be so complete that it was possible to dispense with Dzerzhinsky's supervision and in 1921 he was transferred to the commissariat of transport, where he carried out an exhaustive reform of the railways. Under his rule bridges were rebuilt, lines and rolling-stock put in order, punctuality restored and pilfering and banditry stopped. In 1924, after the party dispute on policy at the time of Lenin's death, Dzerzhinsky was placed at the head of the supreme economic council.

EAKINS, THOMAS (1844–1916), American painter (*see* 8.791), died at Philadelphia June 25 1916.

EAR, NOSE AND THROAT, DISEASES OF THE (*see* 8.794, 20.79).—This article gives a short survey of the ain development of these branches of scientific medicine during e years since 1910.

I. DISEASES OF THE EAR

The researches of Arthur Cheatle into the anatomy of the mporal bone have shown that in 80% of cases the mastoid ocess is of the "pneumatic" or cellular type, *i.e.*, the process composed very largely of air cells. In the remaining 20% it of the "infantile" type in which the bone is dense or acellular. e same investigator also demonstrated that mastoid cells may velop in regions other than the mastoid process, *e.g.*, the floor the tympanic cavity, the root of the zygomatic process, in the pper and posterior wall of the bony meatus, around the poste- or vertical, semicircular canal, the wall of the sigmoid sinus and the apex of the petrous portion of the temporal bone. He has own that persistence or excessive development of certain all veins in the inner wall of the mastoid antrum may favour e spread of infection leading to intracranial complications.

These anatomical features may be the chief factors in es- blishing the nature of clinical symptoms and the line of treat- ent to be adopted when disease attacks the temporal bone, rticularly in inflammatory lesions brought about by invasion the middle ear by pathogenic organisms. During this period e attention of otologists has been more than ever concentrated the anatomy, physiology and pathology of the labyrinth, and rticularly on its vestibular component.

This activity followed on the publication in 1907 by R. árány (Vienna) of his classical treatise *The Physiology and athology of the Semicircular Canal Apparatus in Man* and later e brilliant work of R. Magnus and his assistants of the Utrecht niversity which may be regarded as parallel or supplementary that of Sir Charles Sherrington at Oxford. Albert Gray Glasgow) has added to our knowledge of the comparative atomy of the labyrinth and John S. Fraser (Edinburgh) to e microscopic anatomy of pathological lesions affecting it.

The internal ear or labyrinth comprises two essential struc- res, the cochlea which is to the ear what the retina is to the eye; e vestibular apparatus which subserves two important func- ons: (*a*) static (saccule and utricle) which has to do with the aintenance of equilibrium (*b*) kinetic (saccule, utricle and micircular canals) for the recognition and analysis of motion.

In conditions of health certain tests are employed which give efinite results indicating a normal condition of the vestibular pparatus, *e.g.*, the pointing tests, nystagmic movements of e eyes after rotation of the patient and the employment of the aloric and electrical tests. These reactions will be modified or bsent when the vestibule is diseased so that it is often possible determine the situation of the lesion.

With such information at his command the aural surgeon can ow explore the labyrinth and its immediate neighbourhood with success hitherto undreamt of. Consequently, certain types of ertigo intractable to treatment by constitutional measures, cute and chronic suppuration of the labyrinth with threatening ymptoms of meningitis, and tumours of the auditory nerve, are ften amenable to surgical intervention.

While little advance can be registered in the treatment of the ell-known types of insidious and slowly progressive forms of hronic deafness, it is more than probable that in future genera- ions there will be fewer suffering from deafness than at the resent time. This will be due to prevention rather than cure, ecause it is recognised that the so-called "chronic middle-ear eafness" is primarily due to infection passing from the naso- harynx by way of the Eustachian tubes into the middle-ear left and its adnexa.

From this point of view, no wiser social legislation has been instituted than that which provided for the establishment of school clinics, child welfare centres, etc., in which skilled examination and treatment of the ears, throats and teeth of children are carried out. Prophylactic measures of this kind will go far, not only toward the preservation of hearing, but also in the prevention of those serious and often fatal complications which are apt to result from neglected acute and chronic suppuration of the middle-ear cleft, *e.g.*, meningitis, abscess of the brain and certain types of septicaemia. In the diagnosis and treatment of such serious conditions mention must be made of the valuable assistance to be derived from an examination of the cerebrospinal fluid drawn from the lower end of the spinal canal by "lumbar puncture."

Lumbar Puncture.—A hollow needle is passed successively through the tissues between the arches of the 3rd and 4th lumbar vertebrae until it pierces the dura-arachnoid sheath of the spinal theca. The fluid then issues from the needle and about 5 to 10 c.c. is collected for examination. Normally this is a clear alkaline fluid with a trace of proteids, a slight amount of sugar and free from cell elements. These characteristics may be strikingly altered when infection spreads from the ear into the adjacent regions of the cranial cavity, *e.g.*, the fluid may be increased in amount, it may be turbid, its chemical constitution modified and leucocytes, lymphocytes and endothelial cells may be present together with one or more types of infective organisms.

Finally and in regard to treatment, A. R. Friel has demonstrated the value of zinc ionisation for certain cases of chronic suppuration in which the sepsis is confined to the tympanum and does not involve the "attic" nor the antrum, and where the perforation in the tympanic membrane is large enough to admit of the middle ear being filled with the ionising fluid. Suppurations intractable to other non-surgical measures, which had existed for many months, or even for years have been cured by one or two applications of this treatment.

II. DISEASES OF THE NOSE

During the decade 1915–25 the nasal cavities have received more attention from the general medical profession than formerly and for the following reasons:—

(*a*) Within these cavities or in the air cells or sinuses connected with them, foci of infection may exist which may give rise not only to local symptoms but to others in distant regions, such as the lungs, heart, gastro-intestinal tract, kidneys, muscles, joints, the central nervous system, the peripheral nerves and the special organs of the senses, especially those of the eye and the ear.

(*b*) Nasal symptoms are frequently a local manifestation of hypersensitiveness or anaphylaxis of the individual to certain proteids.

In regard to infection no organ or tissue of the body appears to be exempt from possible sub-infection by the organisms or their toxins if and when these are located in the antral, ethmoidal, frontal or sphenoidal sinuses. They gain entry into the system by inhalation into the lower air passages and thus bring about pulmonary symptoms or they may be swallowed and cause affections of the gastro-intestinal tract.

In other instances the organisms or the poisons produced by their growth find their way into the lymphatics or blood-vessels and are thereby disseminated to such distant regions as have already been indicated. It is therefore obvious that in the presence of symptoms which suggest absorption from a focus of chronic sepsis, the rôle played by the nasal sinuses should not be overlooked. This important subject has recently been emphasised and fully dealt with in the "Semon Lecture," University of London (1925), by Dr. Watson-Williams.

Treatment.—The most noticeable change in the surgical treatment of these infective foci has been in relation to the technique employed when chronic suppuration involves the frontal sinus. Hitherto an external operation was performed which involved some weeks of after-treatment, the infliction of a more or less noticeable scar in the region of the eyebrow and a radical procedure not free from considerable risk to life. To-day the sinus is approached through the corresponding nasal cavity and an attempt made to secure free and permanent drainage of the septic focus. The results are generally satisfactory, the patient is rarely confined to bed for more than a week, no deformity is produced and in skilled hands the risks of complications are small. It only remains to be said that the higher nasal sinuses are difficult of access and important structures lie in their immediate vicinity, *e.g.*, the eye and the intracranial structures. Consequently only those who have ample opportunities for acquiring the necessary manipulative skill should undertake operations in these regions.

One of the most intractable diseases of the nose is Foetid Atrophic Rhinitis (Ozaena). It is characterised by gradual wasting of the nasal mucous membranes and the bony structures which they cover. These atrophic changes are accompanied by the formation of foul-smelling crusts and not infrequently with a sinking in of the bony framework of the nose. Its cause has not been fully ascertained, and it is possible that constitutional and local factors may play their part in establishing the disease. Hitherto surgeons have depended chiefly on local antiseptic applications to affected areas and the daily use of cleansing washes.

More recently better results have been obtained by surgical measures which aim at narrowing the nasal cavities by forcing inwards the inner walls of the antral sinuses and maintaining them in that position. The literature on the subject records many cases which appear to have been cured or greatly benefited. Lupus of the nasal mucous membrane has proved to be amenable to radium therapy.

Hypersensitiveness or Anaphylaxis.—This term connotes an abnormal sensitiveness in certain individuals to protein substances, shown by the occurrence of phenomena mainly connected with the action of certain groups of involuntary muscles. These substances may gain access to the body from the atmosphere by microbial infection, by the ingestion of foodstuffs or be produced within the body by aberrant metabolism. Hay fever and asthma may be produced by the action of pollens and the hairs or dandruff of animals, such as horses, cats or dogs upon the conjunctiva or the mucous membrane of the nose. Vasomotor rhinitis and angio-neurotic oedema are also manifestations of this condition of hypersensitivity.

Research has shown that it is possible to identify these substances in any particular case by applying extracts of the suspected agents to minute abrasions of the skin, or to the conjunctiva in the case of air-borne pollens, and observing the local reaction to such extracts. Treatment must be directed toward putting the patient's tissues into what is known technically as a "refractory state" in which the organism no longer reacts abnormally to these protein substances and the method adopted must vary with the factors present in each individual case. By draining surgically a septic focus, such as an infected paranasal sinus, the absorption of microbial toxins is lessened, or by stimulating the production of antibodies in infections where surgical drainage is not applicable, we lessen the sensitivity of the organism to that infection and to other factors, such as foodstuffs or pollens, though these may have to be dealt with separately. Where neither of these methods applies we can treat the condition by the elimination from the diet of the foodstuffs shown by the skin tests to produce the abnormal state. Where the only feasible explanation is an error of metabolism the cause must be investigated by means of chemical and bacteriological examinations of the blood, the contents of the gastro-intestinal tract and the urinary excretion.

III. DISEASES OF THE THROAT

The Tonsils.—This term is popularly applied to compact masses of glandular or lymphatic tissue which are situated between the anterior and posterior faucial pillars which form the isthmus between the mouth and the pharynx. They are more correctly spoken of as the faucial or palatal tonsils, because similar collections of lymphoid tissue are present in the nasopharynx and in the base of the tongue. The complete circle of glandular tissue is known as Waldeyer's Ring. It is present in a children and while it tends to undergo a natural involution atrophy about the age of puberty, this change not infrequentl fails to take place.

Adenoids.—The term adenoids implies an overgrowth of th lymphoid mass in the nasopharynx which is sufficient in degre to produce symptoms. In conditions of health the collections lymphoid tissue comprising Waldeyer's Ring are supposed t possess a protective function in the earlier years of life, *e.g.*, i the acute specific fevers of childhood they often bear the first brun of the attack by infective organisms, and may thus be regarde as barriers to a generalised infection of more distant and important organs.

But when, as frequently happens, any or all of the component of the lymphoid ring become the seat of a chronic infection, o act as foci of sepsis, then their potency for evil is equal to or eve greater than that of the paranasal sinuses already referred to The faucial tonsils are peculiarly liable to act as centres o local and general infection because they are exposed to contaminated atmosphere, food and to the organisms associate with diseased conditions of the gums and teeth.

No facts in medicine have been more clearly established tha that the ring of tonsillar tissue in the upper air passages form an easy and open portal for infection by the micro-organisms o disease. It is only necessary to mention the initial inflammation of the tonsils and their immediate regions which herald a attack of scarlet fever, measles, diphtheria, influenza (frequently) and acute rheumatic fever. The symptoms which chronic septic conditions of the tonsils may cause are far-reaching and important and their cure or relief by enucleation of the tonsils is a matter of frequent experience. As the influence of chronic sepsis on the higher brain has hitherto received little notice it may be as well to give an illustration of the toll of diseased tonsils in this connection.

Chronic infective foci, by lessening the general resistance of the body and producing degenerative changes in the nervous and endocrine systems, dispose to and even determine mental disturbance. Without infection the chance of psychosis developing is very slight. At the New Jersey State Hospital (Trenton) the number of discharged patients increased from 37 to 85 % after removal of oral and tonsillar infections (H. A. Cotton, 1923). It is often forgotten that a small septic tonsil—especially in adults—frequently causes more definite symptoms in distant organs or tissues than large and prominent tonsils which are often only a cause of local discomfort. The modern practice of "enucleation" or complete rather than partial removal of the tonsils is based on the facts which are briefly outlined above.

Malignant Disease.—Two types are commonly met with, viz., sarcomata and carcinomata. If left untreated they prove fatal, but if recognised and dealt with in their earlier stages they may be cured or afforded long periods of immunity from recurrence. During the period under review experience has shown that radiotherapy alone or in conjunction with cutting operations of less radical nature than formerly, has produced equally good if not better results than extensive surgical procedures by themselves.

As a rule sarcomata respond more quickly to radium than is the case with carcinomata. Radium bromide, sulphate or emanations from the pure element are employed and carefully measured amounts are enclosed in suitably screened containers. These are inserted into the growth for a definite period of time while the neighbouring regions are at the same time submitted to radiation. The primary carcinomatous growths are treated in the same way, but usually after a "block dissection" of the glands in the neck has been made.

Diathermy.—When a high frequency current is led into the body by a narrow metal rod or needle, an intense heat is developed in the tissues around its point of entry, so that they are coagulated and can be removed easily. (*See* ELECTROTHERAPY.) The operation is practically bloodless, the patient suffers no shock, the scarring is slight and healing rapid. The coagulation by heat prevents dissemination of the cancer cells into the surrounding tissues which ordinary surgical manipulations may not be able to avoid. A dissection of the glands in the neck can be made before or after destruction of the primary growth.

Treatment by diathermy can only be carried out successfully when the growth is situated in readily accessible regions such as the mouth, soft palate, tonsillar regions, posterior wall of the pharynx and the epiglottis of the larynx. It will be contraindicated in the immediate neighbourhood of large blood-vessels, bone and cartilage. Whatever may be the value of "deep" X-ray therapy for malignant disease in other regions of the body, no results yet observed would recommend it for similar conditions in the throat or larynx.

Diseases of the Larynx.—Tuberculosis of the larynx is practically always secondary to a primary infection of the lungs, and its treatment has improved *pari passu* with that of the pulmonary lesion. Frequent inspection of the larynx, and the recognition of the earliest signs and symptoms of tuberculous laryngitis, followed by prolonged functional rest of the voice, have cured many patients whose general health and resistance have been maintained or improved by the régime of sanatorium treatment. In these circumstances and if prolonged functional rest of the vocal cords fails to cure small or limited tuberculous lesions in the larynx, the application to them of the galvano-cautery will often produce rapid healing. Severe surgical measures for the removal of infected laryngeal tissues are rarely called for. The value of tuberculin in the treatment of laryngeal tuberculosis is still a matter of opinion. It would be safe to state that its employment may be a useful accessory to general treatment in carefully selected cases. For fuller information on this subject see "the Mitchell Lecture" by Sir St. Clair Thomson (*Brit. Med. Journ.*, Nov. 8 1924).

Malignant Disease.—Here again the essential for successful treatment is early diagnosis. Any adult suffering from an alteration of the normal speaking voice of more than a few weeks' duration should be examined by an expert laryngologist. The treatment of the disease in its early stages is surgical and aims at its complete removal. The records of cure or many years of freedom from recurrence are probably better than those in any other region of the body.

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EARTHQUAKES (*see* 8.817).—Seismology originally meant that department of knowledge which deals with earthquakes. Up to about the end of the 19th century the meaning was almost unambiguous; the earthquake dealt with was the disturbance or quaking of the solid earth which could be felt and, when sufficiently severe, might cause damage or destruction. Toward the end of the century it was found that certain very severe earthquakes were accompanied by disturbances which could be registered, with suitable instruments, far beyond the region where the shock could be recognised without instrumental aid, and not infrequently these records could be obtained at great distances, even up to the antipodes of the origin.

It is, however, only a very small proportion of the shocks which can be felt, not more than one in 100, which give instrumental records at long distances from the origin; and it is probable, though not yet proved, that some of these long-distance records represent disturbances which nowhere were of a nature and severity that could be recognised except by delicate instruments.

From the study of these long-distance records of unfelt disturbances, a new department of knowledge arose, which, being new and giving rise to some remarkable and surprising results, has rapidly grown in importance till, at the present day, it has almost usurped the title to the name seismology, though a large part of it does not concern the earthquake, as that word was originally understood. Where the existence of the two branches is recognised, they have generally been distinguished as the old and the new seismology, but the new seismology is already an old and established subject of study and it seems better to distinguish them, when distinction is necessary, as *teleseismology* (τῆλε, distant) and *engysseismology* (ἐγγύς, near), the former being the study of the long-distance records, the latter the study of the shock which can be felt near by the place of origin. The two branches are, and must remain in practice, almost distinct sciences, for the method and character of observation are very different in each case.

Duplex Origin of Earthquakes.—The connecting link between these two branches of seismology is to be found in the recognition of the duplex origin of certain great and destructive earthquakes, in which the destructive surface shock is of shallow origin and a secondary effect of a more deep-seated disturbance, which gives rise to the distant records. These have been named bathyseism and episeism, the former being applied to the deep-seated origin and the latter to the secondary shock originated near the surface. Roughly, and with all the inaccuracy inevitable in a simile, they may be likened to the effect of the firing of a big gun; the explosion in the gun gives rise to a loud report which may be heard at long distances away, and may be taken to represent the bathyseism and long-distance records, while the explosion of the shell which falls some distance away from the gun and causes the destruction desired, is the analogue of the episeism, or destructive shock. Thus Prof. H. F. Reid, from a study of the destructive shock of the Californian earthquake of April 18 1906, concluded that it originated at a depth of about 20 km., and Dr. L. Pilgrim, of Stuttgart, studying the long-distance records, concluded that they originated at a depth of about 140 kilometres. These two very divergent estimates, obtained from different sets of data, by methods in each case sound and trustworthy, are easily reconcilable if the latter is regarded as referring to the bathyseism and the former to the episeism.

Depth of Origin.—The depth of origin of the long-distance records has been the subject of several studies, and depths of 50 km. to 1,300 km. have been deduced. Prof. H. H. Turner concludes that the bulk of them originate at about 200 km. below the surface, that a small number start from greater depths down to about 600 km., mainly grouped round a depth of 500 km., while a still smaller number originate at lesser depths up to 50 km., and these are mainly grouped round a depth of about 100 kilometres. On the other hand, from the record of earthquakes which occurred in Italy over a period of 14 years Mr. R. D. Oldham finds that out of a total number of 5,605 shocks, more than 90% originated at depths of less than 10 km., and only 1% at depths of over 30 kilometres.

Cause of the Episeism.—This strong contrast in depth is symptomatic of a difference in character of origin; the surface shocks which can be felt, or episeisms, are in some cases clearly due to the shock consequent on fracture of the rock composing the outer crust of the earth, and this is probably the usual cause of origin; but it is doubtful whether anything analogous to fracture, as we understand it, can take place under the great pressures and other conditions which must prevail at the depths where the bathyseism originates.

Cause of the Bathyseism.—The real nature of the bathyseism is still unknown, but in some cases, at any rate, and possibly, if not probably, in all, it is accompanied by a change of bulk, by which strains are set up resulting in distortion and fracture of the overlying rock near the surface. A possible cause is a regrouping of the chemical elements of a mass of deep-seated material, to form a new mixture of compounds, occupying a different volume from that which the original grouping required. Chemistry knows of many instances where an inert mixture of compounds may by change of temperature or pressure, or by some other external cause, change to a mixture of a new set of compounds, occupying a different volume. The most familiar instances of this are those known as explosives, in which the alteration of volume is very large and the change very rapid, but in other cases the action takes place more slowly, or the change of bulk may be much smaller. It is by no means impossible that similar changes take place in the interior of the earth, some slow and gradual, giving rise to elevation or subsidence of the land, others sufficiently abrupt to set up disturbances which are propagated as elastic waves, and may give rise either to earthquakes which can be felt, or to those which can only be registered by suitable instruments.

Interior of the Earth.—The study of the distant records has led to some interesting conclusions regarding the material of which our earth is composed. Any disturbance of the nature of a shock will set up two sorts of elastic waves which can be transmitted in a solid, one condensational and the other distortional, and these two forms of wave motion are distinctly recorded on all seismograms up to a distance of about 100° from the origin, beyond which the second phase of distortional waves can no longer be recognised. From the times at which the arrival of these waves are recorded at the stations now scattered over the globe, it is possible to calculate the paths followed through the substance of the earth; this problem has been attacked by different workers by different methods, and their conclusions, though differing in detail, are concordant in main features.

Successive Layers of Differing Material.—The outermost layer of the earth is composed of material which transmits the condensational wave at about 5½ km. per sec.; this extends downwards to a depth of some 50 to 60 km., and at that depth there is a rapid and great change to material of a very different character, in which the rate of transmission jumps to about 7½ km. per sec., increasing steadily and continuously as the wave path penetrates toward the centre of the earth, till a depth of about two-tenths to a quarter of the radius is reached. Here the steady increase is checked, indicating a change in the character of the material traversed, but the increase in rate of propagation is again resumed, at a slower rate, till a depth of a little over three-tenths of the radius is reached and the rate of propagation has risen to 13 km. per second. From this depth the rate of propagation does not vary much at first, but beyond about a half of the radius from the surface, the rate of propagation decreases with increase of depth and at the same time the material traversed ceases to be able to transmit the distortional waves.

Other Investigations.—These conclusions have an important bearing on, and receive confirmation from, the results of other lines of investigation. The depth of 50 km. corresponds very closely with the depth at which the lower limit of the outer shell of cooled and solid rock, known generally as the crust, has been placed by geologists on physical and petrological grounds; the depth of about a fifth to a quarter of the radius, is that which would separate the metallic, mainly iron, central core from the outer shell of stony matter; the innermost nucleus, consisting of matter which is unable to transmit the distortional wave, had not been suspected before it was revealed by study of the distant seismograms, but is in accordance with the conclusion which has been reached by Dr. H. Jeffreys, from a study of the tidal retardation of the earth's rotation, that the central part of the earth is devoid of rigidity.

Earthquake of Sept. 1 1923.—The Japanese earthquake of Sept. 1 1923 ranks as the most destructive on record. The roll of killed and injured is officially stated as 99,331 dead, 103,733 wounded and 43,476 missing; but an appreciable proportion of these casualties is attributable to the conflagration which followed on the earthquake, and was the cause of more than 95 % of the destruction of property, estimated as representing a loss of not far from £1,000,000,000. From the point of view of the maximum intensity of shock, or of the area affected by the earthquake, it ranks as a great, but by no means among the greatest on record; it is, however, of great scientific interest on account of the extent of the displacements of surface level which took place and the completeness with which these have been recorded.

Changes of Level.—The principal centre of the Tokyo earthquake was under Sagami bay to the south of Tokyo, and soundings taken some months after the earthquake showed that the sea bed had been raised over large areas and depressed over others; the uplift gave soundings ranging to 135 fathoms less than had been recorded at the previous survey, and in the depressed area the depths had increased by as much as 259 fathoms at one place. The bulk of the depression amounted to 50 cu. km. (12 cu. m.) and that of the elevated tracts 20 cu. km. (4.8 cu. m.). As the size of the sea waves, which accompanied the principal shock, was not very great, it is certain that only a small part of these changes took place at the time of the earthquake, the greater part being probably due to the more gradual change taking place during the period of great instability, accompanied by very numerous after-shocks, which followed on the great earthquake.

Along the shores of the bay the changes of level were much less; except along a short length of coast line, the level of the land rose at the time of the earthquake, but the initial rise was not permanent and, within a month, gradually sank till the remaining uplift was less than half of the original. The most detailed observations were from Misaki, where the original uplift reached the maximum recorded figure of 25 ft., and a small island off the shore became part of the mainland; no change took place for the first four days, and then the land began to sink, at first by more than 2 in. a day but afterwards more and more slowly, till on Sept. 26 the remaining uplift was only 4 ft. 7 inches. Changes of a similar character had been recorded in the cases of the Cutch earthquake of June 16 1819, and the Chilean of Feb. 20 1835, but the records lacked detail and completeness, and have not been universally accepted.

Periodicity of Earthquakes.—The periodicity of earthquakes has long been a subject of study. In general, the attempt has been to find some connection between the frequency of occurrence and some natural period such as the day, the year or the lunar month. With regard to the first two, the examination of the record from any region usually shows a distinct periodicity, the frequency of shocks reaching a maximum at some particular time of the day or year, and a minimum frequency at about half-way between the maxima, but when one district comes to be compared with another, and even when records separated by an interval of many years come to be compared with each other, no agreement can be found in the times of maximum and minimum frequency. Some of the most recent work on this subject suggests that the true periods are not the day or year, but differ slightly from them, so that, in the course of a few hundreds of years, the time of maximum frequency gradually works round the clock or calendar. If this suggestion should be borne out by further work, it would prove that the earthquake is a purely terrestrial phenomenon and is uninfluenced as to time of occurrence by any cause exterior to the earth.

Against this must be set one consideration which indicates that the gravitational attraction of the sun and moon, though in no way a cause of the occurrence of the earthquake, may, to a small extent, have an influence in determining the exact time of occurrence. If any record is examined, which contains a sufficient number of shocks to give a trustworthy average, it is found that the day shocks are slightly more frequent in summer, as compared with the general average for the year, and slightly less frequent in winter, while the reverse is the case with the shocks occurring during the night. As this is just what would be expected if the gravitational, tide-producing, stresses had some influence, and as the same relative disproportion has been found to be repeated, and to become more conspicuous, in those cases where the record has been discussed in terms of lunar hours and declination, it seems likely that the effect is in reality due to this cause. The smallness of the variation from average frequency, amounting to not more than 5 % in general, is a measure of the slightness of the effect of these extra terrestrial influences.

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EAST, SIR ALFRED (1849–1913), British painter (*see* 8.827), was knighted in 1910, and died in London Sept. 28 1913.

EAST AFRICA: *see* KENYA COLONY; TANGANYIKA TERRITORY.

EAST AFRICA, OPERATIONS IN.—When the World War broke out in 1914 the garrison of British East Africa, the territory immediately north of German East Africa, was scattered and engaged on punitive expeditions remote from the enemy frontier. In the case of each Protectorate the troops were native with

European officers. The German forces, some 5,000 strong, including 260 Europeans, lay ready to the hand of their commander, Von Lettow-Vorbeck, a capable and determined soldier well able to employ them to full advantage. If it is remembered how keenly sensitive the native soldier is to any shortcoming in his superior and that Von Lettow had only been with his command for six months when hostilities began and kept that command efficient and formidable through four years of steadily declining fortune, some idea may be formed of the resolute nature and soldierly qualities of the German commander-in-chief. His operations consistently bore the clear imprint of his skill and personality, and there were advantages, other than his professional capacity and steady courage, upon which he could rely.

I. EARLY OPERATIONS

The country—nearly double the size of Germany in 1914—which was the scene of operations, is for the most part covered by bush, dense as a rule, but occasionally thinning out to something like park land. High mountain ranges, thick with vegetation, rear themselves from bush and jungle which are fever stricken and liable to wholesale inundation during the rainy season. Rivers abound and malaria and dysentery of a malignant type, with other tropical diseases, combined to swell the casualty list of a European or Anglo-Indian force. Practically every animal imported into East Africa for the use of the British forces succumbed to the tsetse fly. The route of every British advance was marked by casualties due to diseases from which the rank and file of the enemy—askaris recruited from local tribes—were immune. Surprise by the attacker was as difficult as it was simple by the defender, who waited concealed and warned by the laborious approach of his adversary cutting roads and bridging rivers.

Supply and transport presented appalling difficulties to an advance through hundreds of miles of naturally impenetrable bush, while the defending force slowly fell back upon the magazines posted in its rear. Only an overwhelming preponderance in numbers made any advance possible, but a force starting with a strength adequate for an offensive enterprise constantly found itself reduced at best to an equality of strength on contact with the enemy. Many good cards were thus in the hand of the German commander; and he rarely failed to play them with full effect.

Naval Operations and German Advance.—On Aug. 8 1914 two British cruisers, "Astraea" and "Pegasus," arrived opposite Dar es Salaam from Zanzibar, and, being unable to leave a garrison, the naval commander covenanted with the German governor that the latter should forbear from any hostile action in Dar es Salaam itself. Parallel to the southern frontier of British East Africa and about 50 m. distant from it ran the Uganda railway from Mombasa to Lake Victoria. This tempting and exposed objective, for the protection of which the British troops at the outset were hopelessly inadequate, at once appealed to Von Lettow, who on Aug. 15 seized Taveta, which lay in British territory at the eastern end of the gap between the southern slopes of Mount Kilimanjaro and the northern end of the Pare mountains in the German Protectorate. An enemy force here was a standing menace to the British capital at Nairobi, and, constantly raiding the railway line, seriously hampered the British initiative.

In September the enemy cruiser "Königsberg" returned to Dar es Salaam and on Sept. 20 surprised and destroyed the "Pegasus" while undergoing repair in the Zanzibar roadstead. A combined enemy operation against Mombasa, for the execution of which the "Königsberg" was to attack the port in conjunction with a land force moving north along the coast, failed, as the "Königsberg" was driven by the ships of the Cape Squadron into the Rufiji delta, where she was run aground. The land force began its march along the coast on Sept. 20, was repulsed at Gazi, 25 m. from Mombasa, on Sept. 23, and retired to the frontier on Oct. 8. The crew of the "Königsberg," which was blown up in July 1915, after being set on fire by the monitors "Severn" and "Mersey," joined the enemy land forces, together with its armament of ten 4·1 guns.

German raids along the coast, on the Uganda Railway, and into the frontier districts of Uganda, Belgian Congo, Rhodesia and Nyasaland were constant in the opening months of the campaign. These small enterprises were much simplified by the central position of the enemy and the excellent lateral communication afforded by the central railway from Dar es Salaam to Kigoma, on Lake Tanganyika. This lake was under German control until Dec. 1915, when by the operations of motor boats specially brought from Capetown the enemy was deprived of the one lake which had not been in British hands since the earliest days of the campaign.

Reinforcements from India.—It soon became apparent that, unaided, the British Protectorate forces could not hold their own, and the Government of India consented to send an expedition. On Aug. 25 its leading unit reached Mombasa with Brig.-Gen. Stewart, who assumed command. The rest of the expeditionary force was directed on Tanga, the northernmost German port, at the southern extremity of the Usambara mountains, healthy highlands where the bulk of the German settlers resided. Coincident with an attack on Tanga an advance against Moshi by the north of Kilimanjaro was to be made by Stewart. The expeditionary force under Brig.-Gen. A. E. Aitken was about 7,000 strong and (except for the 2nd Loyal North Lancs.) composed of Indian troops.

Failure of British Offensive.—The transports reached Tanga on Nov. 2, when the local commissioner represented the place as an open and undefended port and bombardment was deferred. Meanwhile, Von Lettow, advised of the plan by captured Indian mails, was hurrying reinforcements to the coast. When one and a half British battalions landed two miles east of the town on the evening of the arrival, they met with strong opposition and fell back. Von Lettow arrived on the evening of the following day, when British reinforcements had been landed and fighting resumed, and on Nov. 4 heavily defeated his opponent, whose casualties were 795. On the same day Stewart, checked at Longido, was compelled to retire. The British force at Tanga re-embarked and reached Mombasa on Nov. 5. The first British offensive had thus failed completely. Von Lettow's success at Tanga put an end for the time being to any general offensive against him, and it was not until 1916 that the next British advance was set in train.

The intervening period was occupied in raiding by both forces, with occasional engagements of a more ambitious nature. A British force was compelled to surrender on Jan. 17 1915 at Jasin, in enemy territory, to a superior force, after 48 hours' fighting, which exhausted their ammunition and water. German losses, especially in officers, were serious, as was the shrinkage of ammunition. Maj.-Gen. M. I. Tighe assumed chief command in April 1915 and in June, Bukoba, on Lake Victoria, was successfully attacked.

Reinforcements Arrive.—Aid was now sought from a different quarter, for, with the conquest of German South West Africa by Gen. Louis Botha in July 1915, the resources of the Union of South Africa became disposable to an extent which was impossible till the disappearance of the enemy from her own border. During the latter half of 1915 there was continuous preparation in South Africa of troops, depôts, supplies, medical stores, transport, animals and material of all kinds for use in East Africa. By Feb. 1916 one mounted brigade, two infantry brigades and one field artillery brigade, complete with all their auxiliary units, had arrived from South Africa to join Tighe. A second mounted brigade followed, together with a battalion of the Cape Corps (coloured men from the Cape Province). Tighe also had the following European units: the Calcutta Volunteer Battery, the 2nd Loyal North Lancs., 25th Royal Fusiliers, 2nd Rhodesians and two local settlers' corps; India sent him from her native army 10 infantry regiments, one squadron of cavalry and two mountain batteries. The battalions of King's African Rifles were the original native Protectorate force. At the same time, Von Lettow's force had reached the highest limit which it attained in the campaign and was probably over 20,000. The exact combatant strength is difficult to estimate, for there were many carriers of whom a percentage were armed and many trained as askaris. The askari in his own country is a soldier of high value. Such a force, with a strong leaven of Europeans trained to arms, under a skilful and determined commander, was a formidable adversary in tropical bush country.

German Ammunition Supplies.—In April 1915 the mind of Von Lettow, which had been sorely exercised by his shortage of ammunition, was relieved in the following remarkable manner: A British ship, the "Rubens," seized at Hamburg, left that port loaded with arms and ammunition and appeared off Tanga on April 4, being sighted by H.M.S. "Hyacinth." Entering Manza Bay on fire and abandoned, she was boarded by bluejackets, who found her timbered up and battened down. After firing more rounds the "Hyacinth" steamed away on the assumption that her quarry would burn herself out. The Germans returned and salved almost the entire cargo, and a largely increased volume of enemy fire from the Mauser pattern 1898 rifles which the "Rubens" had brought was the result. A repetition of this operation a year later will be referred to.

II. OPERATIONS UNDER GENERAL SMUTS

The chief command in East Africa was assumed by Gen. Smuts in Feb. 1916. He had previously declined the post, but when Gen. Smith-Dorrien was compelled to relinquish the command in consequence of illness he accepted it. He reached Mombasa on Feb. 19 and found the railway completed from Voi to Serengeti, 5 m. from Salaita Hill, the German advanced position from Taveta. A week earlier an attack on Salaita had failed. The rainy season was at hand and movement would then become impossible, and Smuts telegraphed to Lord Kitchener that he was ready to carry out the occupation of the Kilimanjaro area at once. The proposal was agreed to and Smuts proceeded to initiate his first advance.

British Advance on Taveta.—An attack, designed primarily to hold the enemy, was to be delivered on Salaita by a force under Gen. Malleson, while Stewart was to repeat his attempt of 1914 to reach Moshi by the north of Kilimanjaro and thence to intercept any enemy retirement in his direction. Gen. van Deventer with a mounted brigade, moving by Malleson's right, was to cross the Lumi river, and by way of the foothills of Kilimanjaro cut the enemy line of retreat between Taveta and Moshi. The execution of this movement unobserved was the only chance of surprising the enemy, for it was apparent to Von Lettow, who had made all preparations for retirement, that Taveta was Smuts' objective. In the event it may be accepted that this surprise was effected. Van Deventer moved on March 8 and on the following day his troops were astride the Moshi-Taveta road. On the same day the Germans evacuated Salaita and took up new positions on two hills, Latema and Reata, covering the gap between the Pare mountains and Kilimanjaro. The main enemy force was posted at Himo, 5 m. from the gap, whence it could move in any direction to attack or retire. The progress of Stewart's force was so slow that his movement was without effect.

The new enemy position was attacked on March 11 and, after severe fighting all day and the succeeding night, was occupied on the morning of the 12th by a general advance in support of detachments which had won their way to the two crests during the night and caused a retirement by the enemy.

German Withdrawal.—Von Lettow now withdrew his entire force to a position (Kahe-Ruvu) which stretched south of the Taveta-Moshi road from Kahe railway station eastward along the northern end of the Pare mountains. He was followed up and attacked on March 18 from Latema Nek by Brig.-Gen. Sheppard, and on March 20 van Deventer was sent from Moshi to turn the enemy at Kahe. He seized Kahe on March 21 and on the following night, after a very severe action with Sheppard, the enemy withdrew to Lembeni, 20 m. south of Kahe. Von Lettow abandoned one 4·1 gun, and had expended ammunition to an extent which he could ill afford, but his force was intact and the timely arrival of the second blockade runner at this juncture with four 4·1 field howitzers, gun and small-arm ammunition, machine-guns, stores, provisions and clothing was an inestimable stroke of good fortune. Here the operations which Smuts had undertaken before the rainy season were successfully concluded and the British forces took up positions covering Taveta and Moshi and facing the enemy at Lembeni.

During the ensuing rains Smuts reorganised his force and prepared to resume the offensive at the earliest possible date. He could rely for assistance in his main operations upon the Belgians in the northwest and the British force under Maj.-Gen. Northey, operating from Nyasaland, to the southwest. For reasons fully recorded in his dispatches, Smuts decided at once to send van Deventer with a mounted force rapidly by Arusha to Kondoa Irangi and thence to the central railway and east along that line to Morogoro. His own force was to move south by the Pangani, and make for the same ultimate objective, Morogoro. It was hoped that Von Lettow would there be brought to bay by the two converging forces.

New British Offensive.—Van Deventer moved on April 3 and occupied Kondoa Irangi on April 19, capturing the enemy garrison at Lol Kisale en route. He reached Kondoa Irangi after heavy casualties in men and animals from disease and was there cut off and reduced to immobility as a consequence of his losses and the advent of the rainy season. Von Lettow concentrated a force against van Deventer and fighting ensued, but the German attacks, with one exception, lacked vigour and were all repulsed. Van Deventer's position was eased by the end of May, when Smuts began his advance down the Pangani and the Belgians moved on Tabora. Maj. Kraut was in command of the German force opposite Smuts when the latter set his troops in motion southwards from Moshi on May 18, Von Lettow having assumed direction of his concentration against van Deventer.

Systematically outflanked by his opponent, whose main advance along the Pangani was supplemented by flank movements by the Pare and Usambara ranges, Kraut found himself compelled to leave the Tanga railway and retire upon Handeni. This place was seized by Smuts on June 19, Korogwe having been occupied four days earlier. On June 24 the Germans were attacked simultaneously on three sides, but, after determined fighting, withdrew into the Nguru Hills. Smuts was now compelled to halt his force on the Msiha river. In a month 250 m. had been covered, but malaria had reduced the strength of all units, combatant and non-combatant, in some instances to 30% of their original numbers. The troops were on half rations, and the transport, which included a variety of types of motor vehicles, was much damaged. The coast region was now dealt with, and with the aid of the Navy, Tanga, Pangani, Sadani and Bagamoyo were successively occupied between July 17 and Aug. 15. The removal of the British base to Tanga saved 200 m. of rail transport. Dar es Salaam was occupied on Sept. 4, but three months elapsed from its capture before it could be used as the base.

German Retreat.—Von Lettow now moved the bulk of his force once more opposite Smuts, and on June 24 van Deventer resumed his advance and at the end of July held the central railway from Kilimatinde to Kikombo, about 100 miles. On Aug. 9 he was ready to move on Morogoro. The Belgians were at the same time advancing on Tabora against the German force under Maj.-Gen. Wahle, who was left to do his best unaided, though some reinforcements were sent southwest against Northey. Smuts moved again on Aug. 5, opposed by a detachment of the enemy whose main force was withdrawn to Kilosa, whence it proceeded south towards Mahenge, the eventual direction of the enemy retirement on all fronts. Von Lettow directed the remainder of his forces by a route through the Uluguru mountains, thus foiling the attempt to intercept him at Morogoro. Heavy fighting ensued in these mountains but Kisaki fell into British hands on Sept. 15 and Von Lettow retired to Mgeta river and there entrenched himself. On this front during the three last months of 1916, activity was confined to such minor affairs as are usual between opposite entrenched forces. Civil administration was instituted in the occupied area behind the British forces.

Belgian Operations.—The Belgian force (also native), under Maj.-Gen. Tombeur with European officers, was divided into two brigades, the Northern (Col. Molitor) and the Southern

Lt.-Col. Olsen) and operated in the northwest of German erritory, opposed by Wahle, who was instructed to avoid a ecisive action. The Belgian operations, well planned and uccessfully executed, were of prime importance to the general ampaign. Broadly described, they were as follows. Molitor ivaded Ruanda by the north of Lake Kivu while Olsen co-perated south of him by the north of Tanganyika. The moveents started on April 4, and by the end of May the Belgians ere in possession of Ruanda. Molitor then sent columns southest to join hands with Olsen and other columns southwest to ake Victoria, which was reached on June 27.

In the middle of July, on a front between Tanganyika and ictoria, Molitor and Olsen moved south on the respective bjectives of Tabora and Kigoma, the terminus of the central ilway on Tanganyika. Olsen occupied Kigoma on July 28 and jiji on Aug. 2, and then moved east on Tabora. Co-operating ith Molitor was a British column under Brig.-Gen. Sir C. P. rewe, who captured Mwanza on the southern shore of Lake ictoria on July 14. On Sept. 19 Molitor occupied Tabora hich Wahle had evacuated the previous day, leaving behind his ck with civilians and prisoners of war. Crewe reached the ntral railway a week later.

British Advance from Rhodesia.—By this time Northey had cceeded in interposing some of his forces, which were in three lumns under Lt.-Cols. Hawthorn, Murray and Rodgers (the st a South African unit), between Tabora and Mahenge. His lvance was on an original front between Lakes Nyasa and anganyika. Murray occupied Kasanga (Bismarckburg) at the uth end of Tanganyika on June 8. The Germans were defeated Malangali on July 24, and on Aug. 29 Iringa was occupied, ipembe having been seized 10 days earlier. Northey, ordered th van Deventer, now at Kilosa, to deal with the enemy in e Mahenge district, was much outnumbered by forces already touch with him and Wahle's columns approaching from the rth, and on the night of Oct. 21 most of Wahle's troops broke rough him. On the same day Kraut was heavily defeated at kapira. Hawthorn secured the surrender of an enemy column Ilembule. On Dec. 24 van Deventer and Northey attacked e Mahenge force. An enemy column surrendered to Northey, t the force engaged with van Deventer escaped him after hting from Dec. 25 to 28.

Position at End of 1916.—By the beginning of 1917 Smuts had acuated 12,000 to 15,000 white troops (South Africans), ostly victims to malaria, and they had been replaced by the gerian Brigade (Brig.-Gen. Cunliffe) and fresh battalions of e King's African Rifles. Kilwa and Lindi, south of Dar es laam, had been seized by the navy and a force under Maj.-en. Hoskins had been concentrated at Kilwa. On Jan. 1 1917 advance was made on the Mgeta position, but after heavy hting the enemy retired across the Rufiji at Kibambawe. nuts now went to England and Hoskins assumed the chief mmand. The rains ensued, and to clear the north bank of the fiji was all that could be barely accomplished before operans ceased perforce. Hoskins completely reorganised his mmand, but before operations were resumed he was ordered Palestine. His successor in East Africa was General van eventer, who assumed command of the forces there at the end May 1917.

III. VAN DEVENTER'S OPERATIONS

The enemy forces were disposed as follows: Von Lettow ar Kilwa, Wahle in the Lindi area, Tafel at Mahenge, detachents between Kilwa and Lindi, and near the Ruvuma. Northey south and west of Tafel with another British force at Iringa, rthwest of the enemy. The rest of van Deventer's troops were act against Von Lettow. In pursuance of this decision an vance was made by the Kilwa force under Brig.-Gen. Beves July 5 towards Liwale. The enemy fell back to Narungombe, ere a severe engagement took place on July 19. The enemy ired south, but the Kilwa force was unable to move again til mid-September. In Aug. the enemy was driven from the kuledi estuary to allow of an advance inland from Lindi. The Kilwa force (Hannyngton) was to move south and that at Lindi (Beves) west. These operations were marked by the hardest fighting of the whole campaign. Von Lettow fell back, under pressure by Hannyngton, towards Nyangao, 40 m. southwest of Lindi, Wahle doing the same before Beves. On Oct. 15 a four days' battle began between Beves' force and the enemy under Von Lettow joined by Wahle. The latter retained their position and it was 10 days before Beves' force under the command of Cunliffe could resume the offensive.

On Oct. 8 Tafel, pressed by Northey with Belgian co-operation from the north, had retired from Mahenge, and, breaking through two weak detachments on Nov. 16, moved southeast towards Von Lettow, whom he was debarred from joining by the Kilwa force. Vainly endeavouring to join the main body, Tafel reached the Ruvuma, but, unable to procure food, surrendered with his entire force on Nov. 28.

Germans Retire to Portuguese Territory.—On the night of Nov. 25–26 Von Lettow, having shed all weaklings, crossed the Ruvuma into Portuguese territory and thenceforward moved as the circumstances of his position, without bases and short of ammunition, dictated. Early successes in the new sphere of action, especially at Ngomano, gave the Germans food, ammunition, arms and clothing, and when the rainy season set in in Jan. 1918, they were able to rest for a short time.

The operations during 1918 were carried out almost entirely by natives, the King's African Rifles, and Von Lettow fell back upon guerilla tactics. Against him in Portuguese territory were sent columns from the east and south shores of Nyasa; and another (Brig.-Gen. Edwards) advanced west from Porto Amelia midway between the Ruvuma and Mozambique. After various engagements Von Lettow marched in May south to the Lurio river, 200 m. from German territory, captured Ille, and in June reached the coastal region near Quelimane. On July 1 he captured Nyamakura, 25 m. from Quelimane, and in the middle of Aug. at Chalana, eluded envelopment by converging columns. Turning northwest, he was engaged by Hawthorn (who had succeeded Northey) at Lioma, east of Lake Shirwa. After several encounters, the German force reached the Ruvuma again on Sept. 28 and, after resting at Ubena, where Wahle was left, set out for Rhodesia. On Nov. 1 Von Lettow made an unsuccessful attack on Fife and, turning southwest, took Kasama on Nov. 9. Advised on Nov. 13 of the Armistice, he accepted it the following day, and on Nov. 23 formally surrendered to Gen. Edwards at Abercorn. With him were Dr. Schnee, the Governor, and Maj. Kraut, together with a force of 30 officers and 125 other Europeans, 1,165 askaris and 2,891 other natives (including 819 women), 1 small field gun, 24 machine-guns and 14 Lewis guns.

Troops Engaged, Casualties, Etc.—The troops employed by the Allies in East Africa included 52,339 sent from India (5,403 British) and 43,477 South African whites. East African and Nyasaland settlers, Rhodesian volunteers and the 25th Fusiliers numbered about 3,000; African troops (King's African Rifles, Nigerians, Gold Coast Regiment, Gambia Company, Cape Corps) and West Indians about 15,000; an approximate total of 114,000 not reckoning Belgian native troops (about 12,000 in all), Portuguese and the naval force engaged. The greatest number in the field at any one time, May to Sept. 1916, was about 55,000; the lowest, in 1918, some 10,000, all African, save administrative services.

British and Indian casualties were returned at 17,823; of these 2,762 were in the South African Forces. These figures are exclusive of casualties among carriers and of deaths and invaliding through sickness, which among the South Africans alone exceeded 12,000. The cost of the campaign to Great Britain, inclusive of Indian and South African expenditure and that of the local protectorates to March 1919, was officially estimated at £72,000,000.

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(J. J. C.)

EASTER, FIXED (*see* 8.828).—The question of the date of Easter has vexed the Church for many centuries, and the difficulties which had arisen in determining the Easter date led directly to the introduction of the Gregorian Calendar. The ecclesiastical astronomers of the Middle Ages exercised their ingenuity upon it for centuries, and made many elaborate tables.

It is not proposed in this article to go into these very complicated matters, but to give a short summary of the more important considerations, and to present some account of the subject in its more modern aspects. The celebration of the great spring festival is consecrated by the Church to the commemoration of the central fact of the death and resurrection of our Lord. This occurred at the time of the Jewish Passover. The Jews celebrated their deliverance from Egypt by the Feast of the Passover. This was held on the 14th day of the first month of the Jewish ecclesiastical year, which commenced with the vernal equinox, at the time of the full moon. The Gospels record that our Lord celebrated the Passover on the Thursday, while Caiaphas and the Priesthood apparently celebrated it on the Friday, the day of the Crucifixion. As the Jewish day is counted from sunset to sunset there may be some explanation of the difference in this fact, but when the festival of Easter was established by the Church, there was a sharp controversy between those who celebrated the event on the 14th day and those who celebrated it on the 15th, the Quartadecimans, and the Quintadecimans, which led to much bloodshed.

The Council of Nicaea, held in A.D. 325, decided that Easter should be celebrated on a Sunday, but it was not till A.D. 716 that the English clergy submitted themselves to the Papal rule, and that feeling ran high at the time may be judged from the fact that Ethelfrith, King of Northumbria, massacred 1,200 monks at Bangor, who adhered to the heresy of the 14th day.

These acute religious controversies have long since died down, but the fact remains that we are left with a method of fixing the date of Easter by which it can vary from year to year by no less than 35 days, between March 22 and April 25 (*see* 4.997). The date is fixed in accordance with the tables prepared by Clavius for Pope Gregory XIII., when he reformed the calendar on Feb. 24 1582, and is an attempt to reconcile the solar with the lunar year, on the Metonic system, with all the complications of the week, the month, the epact and an inexact calendar. The tables occasionally produce strange results. In 1923 the full moon of the heavens fell on the Sunday given by the tables for the celebration of Easter; and the Resurrection, going by the real moon, was being celebrated before the Crucifixion.

Proposals for Fixing Easter.—The inconveniences of an oscillating Easter are felt by all sections of the community, as school terms, university terms, law terms and the great holidays of Easter and Whitsuntide are all affected by a moving Easter. Chambers of Commerce, national and international, have since 1900 year by year passed resolutions in favour of a fixed date for Easter. At the International Congress of Chambers of Commerce held in Rome in 1923 such a resolution was re-affirmed and addressed to the Holy See. Not long afterwards the matter was referred to the League of Nations, and a conference was summoned at which the Roman, the Eastern Orthodox and the Anglican churches were represented, and it was agreed that there was no insuperable objection, on dogmatic lines to the fixing of Easter, and it was abundantly proved that there was a practically unanimous wish among the nations concerned that Easter should be fixed.

The Movement in Great Britain.—On April 27 1921 Lord Desborough introduced a Fixed Easter bill in the House of Lords. Under this, Easter was always to be kept and observed on the second Sunday in April, which was the date in 1925. The three main arguments in favour of the date were: (1) That it is the nearest Sunday to the generally accepted date of the event which it commemorates; (2) that as the mean date of Easter for 100 years has been April 8·3, such a Sunday complies to the full with the requisition that any date selected should fall within the present limits of deviation, and (3) it divides the Christian year equally, and is a convenient date for the people.

As regards No. 1 it may be stated that, though the matter cannot be absolutely decided, the balance of opinion seems to be that the Crucifixion took place on Friday, April 7 A.D. 30, so calculating by Sundays, and in order to secure a date which can be very easily remembered, the second Sunday in April would appear to be an appropriate one, but it would be still more accurate to make Easter Sunday on April 9, if that day were a Sunday, or on the Sunday following April 9. Certain ecclesiastical difficulties would then be avoided and there would always be 24 Sundays after Trinity, and the whole ecclesiastical calendar would be admirably fixed. The Archbishop of Canterbury stated in the course of the debate in the House of Lords that as far as the Anglican Church was concerned it would be entirely acceptable to them that Easter Sunday should be a fixed Sunday and not a variable one, provided that, among other things, the Western Churches were agreed. This evidently points to the Holy See, which has admitted that no question of dogma is concerned. Indeed the Roman Catholic Bishop of Salford has pointed out in a letter published in *The Tablet*, that the dogmatic dangers and difficulties of the early centuries involved in a change of the Paschal calculation are no longer existent, and there can be no objection from the theological point of view. He also stated that it is a reform which has long been due, and that for the Catholic Church the Holy See could make the change with a stroke of the pen.

The supporters of the reform point out that the celebration of the Birth of our Lord was fixed in the 4th century by enactment for Dec. 25, thus consecrating the old Saturnalia of Rome to the new religion, and that, this having been done, there is no good reason why the celebration of the Death and Resurrection should vary 35 days in accordance with a fictitious moon. The date of the celebration of Easter is primarily a matter for the churches, and should be settled by them, but the inconveniences of a widely oscillating Easter are felt in so many departments of civil life that it is to be hoped that the matter may be taken in hand without further delay. The possible alternative of fixing the Easter and Whitsuntide holidays independently of the Church has been often mooted, but its use would be generally deplored. (D.)

EASTERN EUROPEAN FRONT CAMPAIGNS.—This heading covers the story of the operations on the main Russian front during the World War. It includes the campaigns in Rumania, but not the Serbian or Salonika campaigns nor the Russian campaigns in the Caucasus against Turkey. As the article is of such a general nature, its division into sections has been based on chronological sequence. The headings employed are therefore I. The Campaign of 1914; II. The Austro-German Advance into Russia, 1915; III. Rumania's Effort, 1916; and IV. The Russian Revolution, 1917.

I. THE CAMPAIGN OF 1914

Theatre of War.—The theatre of operations after Rumania, had joined in the War, extended from the Baltic to the Black Sea, a distance of some 800 m. in a direct line, or more than twice that distance if measured along the frontier lines between the opposing States. In Aug. 1914 the actual length of the frontier line along which the Russian and Austro-German hosts faced each other was over 1,000 m. from the Baltic to the northern frontier of Rumania, which was at this time neutral. This great length was due to the projection of Russian Poland as a huge salient between German East Prussia and Austrian Galicia. The shape of the frontier, the great distances, and the physical features and communications, combined to divide the Russian theatre into three "sub-theatres" until the Russian retreat out of Poland in 1915. Thus the operations in East Prussia, in the Polish salient and in Galicia, though they formed part of a combined whole, had each their own special characteristics.

The greater part of the huge area of operations was plain or gently undulating uplands. The only heights sufficient to constitute a serious military obstacle were the Carpathians, which extended in a semicircle from the south-west corner of the

Polish salient to the Iron Gate on the Danube, forming a protective barrier for the Hungarian plains on the north and east. Opposite Russia, they ran roughly parallel to the frontier and at 50 to 100 m. distant from it; opposite Rumania they actually marked the frontier. It was a constant aim of the Russians throughout the operations, and the objective of Rumania's single abortive offensive, to pierce this barrier and reach the plains below.

Though there is only this one mountain barrier, the water barriers in the theatre are numerous and formidable. The most serious from the strategical point of view is presented by the marshes of the Pripet (sometimes called the Pinsk Marshes or Polyesie), an area stretching east from near Brest-Litovsk, some 200 m. long by 100 m. broad, where communications are few and military movements on a large scale extremely difficult in consequence. Other water lines which had a considerable effect on operations are: in East Prussia, the line of the Masurian lakes; in the Polish salient, the rivers Vistula, Narew, Bobr, Niemen and Bug; in Galicia, the Dunajec, Wisłok, San and Dniester; in the Rumanian theatre, the Danube itself, the Oltu (Aluta) and the Siret (Sereth). Besides the rivers enumerated above, there were a number of lesser streams which influenced the course and direction of the operations. Strategy in this theatre was in fact largely determined by rivers. Rivers retard the movement of an advancing army but are seldom a permanent bar to its progress; though many of the principal river crossings had been fortified in peace, these fortifications had little influence on the course of operations, except, indeed, at Przemyśl. In East Prussia and in Poland were extensive stretches of forest, which had certain tactical consequences. The Carpathians also were thickly wooded.

The real key to the strategical moves on this Eastern European front lay, as ever, in the communications. In this respect the contrast between Russia and her western neighbours was striking. In both railway and road communication Russia was extremely backward, in spite of all her efforts in the years preceding the war to develop her strategical railways. The Russian general staff had of set purpose prevented road or railway construction in the north and in the south-east of the Polish salient in order to provide protection to a defensive position in the centre of the salient. This short-sighted policy seriously hampered Russian strategy when an offensive campaign from Poland was undertaken. Nor could Russia make much use of her great rivers as lines of supply owing to lack of previous development. Thus superior communications gave to her adversaries the inestimable advantage of greater mobility.

Characteristics of the Armies.—Of the Germans little need be said; their army of 1914 was probably the most powerful instrument of war yet forged. The raw material of the Russian army was in many ways excellent. The Russian peasant in physique and powers of endurance surpassed the rank and file of other Continental armies; he was easily disciplined and stoically brave. But his lack of individuality and want of education unfitted him for the strain of a long and unsuccessful war, and made him unduly dependent on good leading. This was not forthcoming once the original cadre of regular officers and N.C.O.s had fallen, since the Russian system did not produce an efficient type of reserve officer.

In organisation, the Russian army was very weak on the technical side; the proportion of guns to rifles was smaller than in other armies; there were large masses of cavalry, provision for which threw a great strain on the communications, but which accomplished little. In no way except by weight of numbers could a Russian army hope to gain the advantage over a German force. The Austrian army, only slightly, if at all, superior to the Russian on the technical side, was inferior to it in fighting quality. This was due to the heterogeneous nature of the Austrian personnel, many of whom fought unwillingly and surrendered freely. A Russian force was almost always the master of an Austrian force of similar size, but required a great numerical preponderance to meet a force of Germans with any hope of success.

The Plans of Campaign.—The German plan of 1914 was a development of that drawn up by Schlieffen many years previously. It provided for an offensive against France designed to obtain a rapid and decisive victory, and a defensive in the East against Russia until the decision had been obtained in the West. The choice of France for the initial offensive was actuated chiefly by the relative slowness of Russian mobilisation and by the impossibility of gaining a rapid decision against Russia owing to the great distances. The choice once made, Germany's problem in the East was to determine the minimum strength to be left for defensive purposes. This was eventually fixed at nine divisions, active and reserve, with one cavalry division, for the protection of East Prussia; and certain second line troops for the defence of the Eastern fortresses (such as Posen, Torún [Thorn], Danzig, Königsberg) and to watch the Polish frontier. The troops in East Prussia, organised into four corps, formed the VIII. Army under Prittwitz.

The chief of the Austrian General Staff, Conrad von Hötzendorf, of some ability and of sanguine temperament, had planned an offensive into south-east Poland between the Vistula and Bug rivers, directed on the line Chełm (Kholm)-Lublin. This was to be carried out by the I. and IV. Armies (Dankl and Auffenberg). To protect their right flank and rear, the II. and III. Armies (Kövess and von Brudermann) deployed east of Halicz and Lemberg. This offensive of Conrad's was originally designed as part of a combined Austro-German offensive, in which German forces from East Prussia were simultaneously to attack on the Narew line. Germans and Austrians were to meet about Siedlce and thus cut off the whole Polish salient. Conrad had repeatedly urged this plan on Moltke, but had failed to induce him to provide sufficient troops to take the offensive from East Prussia, before France had been disposed of.

In the absence of German co-operation, it is difficult to see what permanent success Conrad could have hoped for from his Chełm-Lublin offensive, since, as already pointed out, the Russians had neglected the communications in that area expressly to embarrass the operation he had chosen. From the German point of view, however, this Austrian offensive fitted in admirably with their strategic plan, since, whatever its outcome, it would keep the Russians fully engaged and thus safeguard the vital industrial areas of Silesia, till the campaign against France had been won.

The Russians had gauged accurately the intentions of both their adversaries. Their original plan was to take the offensive against the Austrian armies in Galicia and to act defensively in the Polish salient and against the Germans in East Prussia. They were, however, pledged to their French allies to assume the offensive against Germany at the earliest possible date. Six armies were initially deployed in front line. The I. Army (Rennenkampf) assembled on the east frontier of East Prussia, and the II. Army (Samsonov) at Warsaw. These two armies formed the North-Western front, under Jilinski. They were intended for action against the German forces in East Prussia. The South-Western front, under Ivanov, consisted of four armies, of which the IV. (Salza) and V. (Plehve) were to deploy on the Lublin-Chełm railway to meet the expected Austrian offensive; the III. Army (Ruzski) and VIII. Army (Brusilov) were to take the offensive at once from the eastern frontier of Galicia in the direction of Lemberg. It will be seen that the Austrian and Russian plans were almost the exact counterpart of each other. The Grand Duke Nicholas assumed chief command of the whole Russian armies. Though no great strategist, he was shrewd and had a strong personality. His chief of staff, Yanushkevich, was a man of no great ability or character. The Russian strategy is attributed mainly to Danilov, head of the operations branch of the General Staff.

In addition to the front line armies, the VI. Army was assembled at Petrograd for the protection of the capital and as a general reserve, the VII. Army at Odessa to watch the Black Sea coast, and an army in the Caucasus to watch Turkey. At the last moment, after mobilisation, a momentous change in the Russian dispositions was made. The I. and II. Armies were ordered to invade East Prussia at once, without waiting to complete their concentration. This change was made solely to assist Russia's allies in the West.

East Prussia: August–September 1914.—Rennenkampf's I. Army comprised 11 divisions and five cavalry divisions and Samsonov's II. Army nine divisions and three cavalry divisions. They had thus in combination an overwhelming superiority over Prittwitz's VIII. Army, which was defending East Prussia. Combination between them was, however, completely lacking and led to their defeat in detail. Jilinski, who was responsible for combining the action of the two armies, was a man of some administrative capacity but little aptitude for command. Samsonov's army had to move before its concentration was completed, and was deficient in transport. The arrangements for obtaining and recording intelligence were indifferent in spite of the large masses of cavalry available; and so defective were the means of intercommunication that the Russians were frequently forced to issue orders by wireless in clear, with the result that the Germans often had complete information of their enemy's moves and intentions.

The course of events was briefly as follows: Rennenkampf crossed the frontier on Aug. 17 driving back a German force at Stallupönen; and on the 19th and 20th, after a hard battle at Gumbinnen, defeated Prittwitz, who had concentrated against him the bulk of his army, leaving only one corps to observe the southern frontier. Meanwhile Samsonov, stumbling slowly forward by Mlawa, crossed into East Prussia on the 21st, causing Prittwitz in momentary panic to announce his intention of withdrawing behind the Vistula. He was promptly superseded by Hindenburg, with Ludendorff as chief of staff. Within a week the new commander had completely defeated the II. Army at the battle of Tannenberg, surrounding and capturing the greater portion of it. Receiving a reinforcement of two corps which had been hastily recalled from France, he then turned on Rennenkampf, who had remained inactive during the disaster to the II. Army, though faced by a small German detachment only. Between Sept. 7 and 13 he was attacked and driven out of East Prussia with very heavy casualties (*see* MASURIAN LAKES).

In these operations the Russians had suffered a total loss of some 250,000 men, a crippling loss in spite of Russia's immense reserves. Much war material had also been lost and this could not easily be replaced. On the other hand this invasion of East Prussia, by causing the recall of two corps from the West at the crisis of France's fate, had made possible the victory of the Marne.

Operations in Galicia, August–September 1914.—Meanwhile the Austrians in Galicia had suffered heavy defeat at the hands of Ivanov's south-western group of armies. The offensive of their I. and IV. Armies towards Lublin and Chelm at first made satisfactory progress, battles at Krasnik and Komarów ending in their favour. But their flank guard of the II. and III. Armies was unable to withstand the onslaught of the Russian III. and VIII. Armies. On Sept. 2 Lemberg was lost and the advance of the victorious left wing was consequently stayed. Two corps from the Russian IX. Army (which had been formed at Warsaw as a central reserve) now reinforced Ivanov's right wing, and the whole Austrian line was gradually pressed back. On Sept. 11 a retirement to the San was ordered by the Austrians; by the end of the month they had withdrawn to within 50m. of Cracow, leaving their fortress of Przemyśl to stand siege.

First and Second Invasions of Poland.—The Austrian defeat compelled the German Supreme Command to send direct assistance to her ally. This was done by the transfer of five and a half corps, formed into the IX. Army, from East Prussia to the front Cracow–Częstochowa, whence it advanced on Warsaw in the last days of Sept. in conjunction with a simultaneous advance along the whole Austrian front up to the Carpathians. The Russians had halted on the San after their defeat of the Austrians, and were in the process of transferring troops north to form a new front south of Warsaw. This re-grouping was carried out in safety behind the Vistula, only cavalry being left to oppose the German advance west of the river. By the middle of Oct. the German IX. Army was near Warsaw, but the Austrian advance had been held up on the San. The Russians now counter-attacked all along the line. In the south they drove the Austrians back to the Dunajec, in the centre they compelled the German IX. Army to fall back, and in the north the newly-constituted X. Army crossed the frontiers of East Prussia.

The intention of the Russian Commander-in-Chief was now to invade Silesia with his V., IV. and IX. Armies, in that order from the north. His right flank was to be protected by the X. Army in the east of East Prussia and by the I. and II. Armies north and west of Warsaw, his left flank by the advance of the III. and VIII. Armies in Galicia. But the Germans had thoroughly broken up communications in south-west Poland during their retreat, and the Russian advance was slow and halting.

Their more nimble opponents once again used the superior mobility given them by their highly developed network of railways to launch a telling counterstroke. A German Eastern Front Command was constituted under Hindenburg and Ludendorff, and the IX. Army, now under Mackensen, was withdrawn from south-west Poland and concentrated between Posen and Torún. It advanced on Nov. 11, with its left flank on the Vistula, against the right flank and rear of the Russian main armies. The Russian I. and II. Armies were severely mauled, and the latter was by Nov. 17 in a critical situation, almost completely surrounded at Łódź. It was saved by a skilful counterstroke of Plehve's V. Army; and the Germans in their turn were in danger of envelopment and disaster. Thanks to Rennenkampf's failure to act with energy they extricated themselves with credit. Four corps from the Western Front released by the conclusion of the Ypres battle now joined Mackensen, and enabled him again to advance and to capture Lowicz and Łódź by Dec. 12. In the south heavy fighting had taken place east of Cracow with no decisive result (*see* ŁÓDŹ-CRACOW).

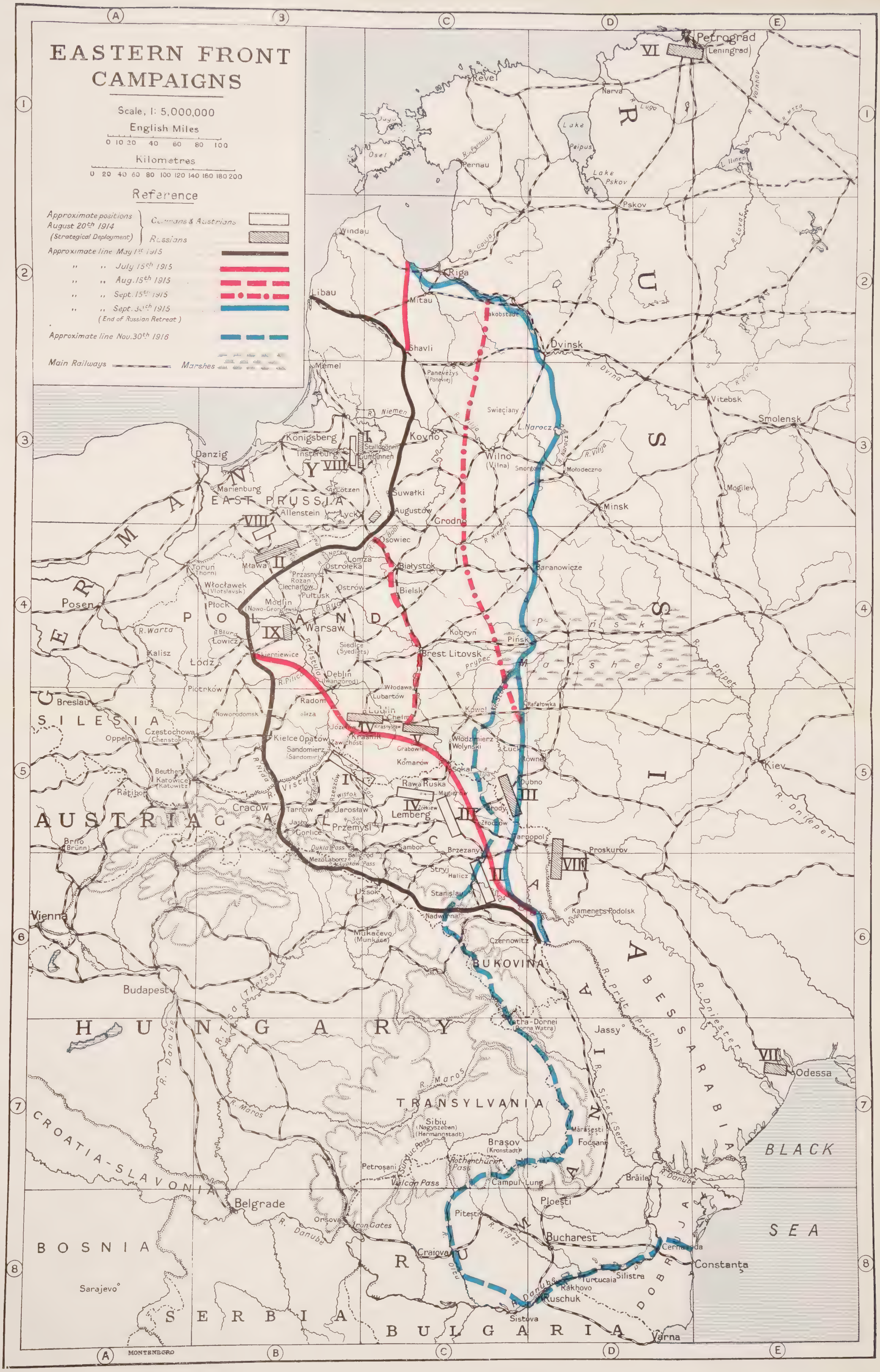
II. THE AUSTRO-GERMAN ADVANCE INTO RUSSIA

January–April.—The 1914 campaign had ended in stalemate both in East and West. The German plan of a swift overthrow of France, to be followed by an unhurried reckoning with Russia, had miscarried. And her Austrian allies were already perilously near to breaking under the strain. From now onwards German formations had to be interwoven into the Austrian battle line to stiffen its uncertain fabric. On the other side, the weaknesses already evident in the Russian army were increased by the deficiencies in munitions, especially rifles and shell, which now began to be seriously felt.

Even the severity of winter gave little check to the fighting. In the centre the front remained stable but furious battles on either flank marked the opening months of 1915. On the Russian side, the Grand Duke had realised that he must secure his flanks solidly before any further attempt to advance in the salient. The problem was on which flank to make the main effort; on this point Russian strategists were divided. The majority were for making an end of Austria; others urged, very reasonably, that the occupation of East Prussia would do more than anything else to solve Russia's strategical problem. In the end both were attempted and neither aim was accomplished.

Conflicting German Plans.—On the German side, there now became evident a fundamental difference of opinion between Falkenhayn at supreme command and Ludendorff, the guiding brain of the campaign on the Eastern front. The latter aimed at nothing less than decisive manoeuvre on the largest scale against the Russian armies, and now urged that all available resources should be put into a great effort from both flanks, which was to finish the Eastern campaign once for all. Falkenhayn judged the distance too great and the communications too sparse for manoeuvre on such a scale. He would admit only the limited offensive which sought tactical success; he hoped by a series of such successes to wear out the resisting powers of the Russian army.

On the southern flank, battle raged all along the Carpathians from Jan. to mid-April. The Russians sought to secure the crest of the mountains and to debouch on to the plains below.


EASTERN FRONT CAMPAIGNS
Scale, 1: 5,000,000
English Miles
0 10 20 40 60 80 100
Kilometres
0 20 40 60 80 100 120 140 160 180 200
Reference
Approximate positions August 20th 1914 (Strategical Deployment)
Germans & Austrians
Russians
Approximate line May 1st 1915
" " July 15th 1915
" " Aug. 15th 1915
" " Sept. 15th 1915
" " Sept. 30th 1915 (End of Russian Retreat)
Approximate line Nov. 30th 1916
Main Railways
Marshes
A
B
C
D
E
1
2
3
4
5
6
7
8
Petrograd (Leningrad)
VI
Revel
Narva
Lake Peipus
Lake Pskov
Pskov
R. Lugo
R. Volkhov
R. Msta
L. Ilmen
R. Lovat
Osel
Pernau
R. Pernau
Windau
Libau
Riga
Mitau
Jakobstadt
Dvinsk
R. Dvina
Shavli
Memel
Panevezys (Ponevej)
Swięciany
L. Narocz
R. Narocz
Vitebsk
Smolensk
R. Vilija
Wilno (Vilna)
Smorgonie
Molodeczno
Mogilev
Kovno
R. Niemen
Königsberg
Insterburg
Stallupönen
Gumbinnen
I
VIII
Lötzen
Lyck
Suwałki
Augustów
Grodno
Minsk
Danzig
Marienburg
EAST PRUSSIA
Allenstein
VIII
II
Osowiec
Łomża
Ostrołęka
Białystok
Bielsk
Baranowicze
Mława
Przasnysz
Rozan
Ciechanów
Pułtusk
Ostrów
Toruń (Thorn)
Włocławek (Vlotslavsk)
Płock
Modlin (Nowo-Georgievsk)
R. Bug
Warsaw
IX
R. Narew
R. Bobr
Posen
R. Warta
R. Bzura
Łowicz
Kalisz
Łódź
Skierniewice
Siedlce (Syedlets)
Brest Litovsk
Kobryn
Pinsk
R. Prypeć
Pripet Marshes
R. Pripet
Piotrków
R. Pilica
Dęblin (Iwangorod)
R. Vistula
Włodawa
Lubartów
Kowel
Rafałowka
Breslau
SILESIA
Noworadomsk
Radom
Iłża
Lublin
Chełm
Józefów
Krasnystaw
Kraśnik
IV
V
Zawichost
Włodzimierz Wołyński
Łuck
Równe
Czestochowa (Chenstokhov)
Oppeln
Kielce
Opatów
Sandomierz (Sandomir)
Grabowiec
Komarów
Sokal
Dubno
III
Beuthen
Katowice (Katowitz)
Ratibor
R. Nida
Rzeszów
Wisłok
I
Rawa Ruska
Magierów
Żółkiew
Lemberg
IV
III
Brody
Złoczów
Tarnopol
Proskurov
VIII
Cracow
Tarnów
Jarosław
R. San
Przemyśl
Jasło
Gorlice
AUSTRIA
GALICIA
Brno (Brünn)
Dukla Pass
Belgrod
Mezö Laborcz
Łupków Pass
Sambor
Brzezany
Stryj
Halicz
Stanisław
II
Uzsok
Nadwórna
Kamenets Podolsk
Vienna
Mukačevo (Munkács)
Czernowitz
BUKOVINA
Budapest
R. Theiss
R. Danube
HUNGARY
R. Maros
Vatra-Dornei (Dorna Watra)
Jassy
R. Prut (Pruth)
R. Dniester
R. Dnieper
Kiev
BESSARABIA
RUSSIA
VII
Odessa
BLACK SEA
TRANSYLVANIA
Sibiu (Nagyszeben) (Hermannstadt)
Brașov (Kronstadt)
Mărășești
Focșani
R. Siret (Sereth)
Petroșani
Surduc Pass
Rothenthurm Pass
Vulcan Pass
Câmpul Lung
Brăila
CROATIA-SLAVONIA
Belgrade
Orșova
Iron Gates
Ploești
Pitești
R. Argeș
Bucharest
ROUMANIA
Craiova
R. Oltu
Cernavoda
Constanța
DOBRUJA
Silistra
Turtucaia
Rakhovo
Ruschuk
Sistova
Varna
BOSNIA
Sarajevo
SERBIA
BULGARIA
MONTENEGRO
GERMANY

The Austrians, stiffened by Linsingen's German Southern Army, strove to drive them back and to relieve Przemyśl. The result was indecisive; the Russians captured Przemyśl, which fell on March 22, and gained some ground in the Carpathians, but only at the price of terrible losses.

In the north, the Grand Duke had intended to strike his main blow with the recently constituted XII. Army in much the same direction as Samsonov's ill-starred offensive. But Hindenburg and Ludendorff forestalled him. Falkenhayn had, with some reluctance, consented to reinforce the Eastern front with four newly-constituted corps. A X. Army was formed in East Prussia. With this, and with the VIII. Army, Hindenburg took the offensive against the Russian X. Army, which was stretched out over a wide front just inside the Eastern frontier of East Prussia. In a battle which lasted from Feb. 8 to 22, the Russians were completely surprised and heavily defeated, with the loss of 110,000 prisoners, four divisions being surrounded in the forests of Augustówo. The attack of the Russian XII. Army in the latter part of Feb. and the beginning of March was easily repulsed.

German Offensive: May–Sept.—During the latter half of March and in April, except in the Carpathians, there was a breathing space in the operations. Falkenhayn now decided on an offensive in the East on a large scale; his aim was to hammer the Russians into powerlessness so that he could then concentrate the main German forces in the West without fear for the collapse of Austria. The French and British offensives of March had enabled him to judge the extent to which he could safely weaken his Western front to provide the necessary forces. He determined on a break-through on the Dunajec between the Carpathians and the Vistula, and entrusted the operation to Mackensen with the newly-formed XI. Army, which contained eight divisions from the Western front. The concentration was carried out with great secrecy; and the attack, which fell on the Russian III. Army (Radko-Dimitriev) was preceded by artillery fire on a scale hitherto unknown on the Eastern front. Operations commenced on May 2 and had a great and immediate success. The Russians were driven back with heavy losses to the line of the San.

Meanwhile, the Franco-British attempts at relief offensives had shown Falkenhayn that the defence in the West could stand the strain; and he withdrew more divisions for a continuance of Mackensen's offensive. Italy had declared war on May 24; and Falkenhayn had some difficulty in dissuading the Austrian command from weakening their Galician forces. Mackensen forced the San, recaptured Przemyśl on June 3 and Lemberg on June 22. Large numbers of prisoners were captured and the whole Russian organisation was much shaken. Incidentally, the Turks, hard pressed in Gallipoli, were relieved from the menace of a Russian corps which had been training at Odessa for an attack on Constantinople. This and all other available Russian reinforcements were thrown pell-mell into Galicia. But the Russian powers of resistance were by no means broken, and they still counter-attacked vigorously.

Falkenhayn decided to continue the offensive, but now with an eye on the clock, for the Allies in the West were obviously preparing fresh attacks, which would probably develop not ater than September. There was once again a sharp conflict of opinion between him and Ludendorff as to the plan on which he offensive should be continued. Ludendorff urged a decisive attack on Kovno and towards Wilno (Vilna) and Minsk, with he object of cutting the main communications of the Russian orces. A German force had, at the end of April, crossed the north part of the East Prussian frontier and established itself t Libau and Spavli. It was thus well placed to facilitate Ludendorff's proposed operations by turning the line of the Niemen, provided it were made sufficiently strong to overcome the Russian forces which had been sent north to oppose it and proect Riga. But Falkenhayn would have nothing of this bold plan, which he feared would commit him too deeply into the nterior of Russia. He ordered instead a continuation of Macknsen's offensive northward between the Bug and Vistula towards Brest-Litovsk. Hindenburg was to co-operate by an attack through Przasnysz on the Narew line.

The Russian Retreat.—These July offensives were successful, but only after heavy fighting. Thus the Grand Duke was enabled to withdraw his forces from Warsaw and the salient while his line of retreat was still open. This embittered the controversy between Falkenhayn and the Eastern command (Hindenburg and Ludendorff). The former accused Hindenburg of not prosecuting the attack on the Narew with the full strength at his disposal—he had, in fact, kept certain formations in hand for his Kovno-Wilno scheme—and thus allowing the Russian forces to escape; while the latter retorted that his advance on Wilno, if permitted, would have cut off the whole Russian forces and ended the War in the East.

It was now the middle of August. Falkenhayn was compelled to return troops to the West to meet the impending French offensive in Champagne; he therefore ceased any further attempts on a large scale in the East. He had already accomplished his object; in prisoners alone the Russian losses amounted to 750,000, and the Russian armies would obviously be incapable of any offensive for many months. He left Hindenburg to continue the campaign, and withdrew the ban on the Wilno advance, should Ludendorff still judge it feasible. Mackensen was taken to hammer out a fresh victory in Serbia.

During the latter half of Aug. and all Sept. the Russian retreat continued, pressed by constant German and Austrian attacks. Ludendorff tried his Wilno manoeuvre; but, though Kovno, Grodno and Wilno fell, the Russians, by hard fighting, kept open their lines of retirement. At the end of Sept. the retreat was finally stayed on the general line Riga–Dvinsk–Baranovicze–Pinsk–Dubno–River Siret–Czernowitz. Early in Sept. the Tsar had taken over the chief command from the Grand Duke Nicholas. His chief of staff and the virtual commander-in-chief was Alexeyev (*q.v.*), a man of parts, but lacking in firmness of decision. The strength of the Russian armies at the front had by this time sunk to 650,000. Over 8,000,000 men had already been mobilised, but the losses had been enormous. The Russian morale was also low, and there was a feeling that their Allies in the West, by sitting inactive during Russia's trial, had ill repaid the sacrifices which Russia had made for them in 1914.

III. RUMANIA'S EFFORT

On the Eastern front, in the spring of 1916, the forces were organised as follows: on the German front, from Riga to the marshes of the Pripet, which formed the dividing line between the German and Austrian sectors, lay 42 German and 2 Austrian divisions; south of the Pripet were 38 Austrians and 4 German divisions. The Russian line was divided into three fronts, the Northern from Riga to Dvinsk, the Western from Dvinsk to the Pripet marshes, and the South-Western thence to the Rumanian frontier. The number of divisions allotted to these fronts was approximately 35, 60 and 35 respectively, and the total rifle strength was over 1,500,000.

Russian Offensive.—The battle of Verdun began in February. On March 18 the Russians started a relief offensive on their Western front. The point of attack chosen was on either side of Lake Naroch, east of Wilno. After a preliminary success the Russians persisted in attacks although a thaw had rendered the ground practically impassable. By the end of March they had lost 150,000 men and had little to show for their losses. They then commenced to prepare an offensive at Motodeczno, a little south of Lake Naroch, to take place in July, in combination with the Franco-British offensive in the West. Brusilov, who had succeeded Ivanov in command of the South-Western front, had been ordered to prepare such offensives as he could stage with his own resources, to serve as distractions to the enemy from the main Russian effort.

In the middle of May the Austrians—contrary to the wishes of the German Supreme Command—made an attack on Italy, which at first met with considerable success. Italy made an appeal to Russia to prevent the Austrian formations on her front from crossing over to Italy. Brusilov's offensive, loosed on June 4 in answer to this appeal, met with a sudden and surprising success. The Austrian front, from which the best troops had been withdrawn for the Italian attack, crumbled into collapse. But the Russians proved unable to take full advantage of their opportunity. The reserves were all in the north, and could not be moved down as fast as the Germans could produce divisions to fill the gaps.

During June, July and Aug. Brusilov's offensive continued with considerable success, but by the end of Aug. it had lost its impetus. The Bukovina and a large portion of Eastern Galicia had been occupied and nearly 400,000 prisoners taken (*see* LUCK). But the Russian losses had been enormous; by the end of the autumn they amounted to something over 1,000,000 on Brusilov's front alone. Holding offensives made on the Russian Western front at Baranovicze had also cost the Russians heavy losses with no gain. Outside Russia, Brusilov's success had two important results—the entry of Rumania into the War on Aug. 27, and Falkenhayn's replacement at Supreme Command by Hindenburg and Ludendorff.

Rumanian Campaign: Aug.–Dec. 1916.—Rumania had for some time been awaiting a favourable opportunity to throw in her lot with the Allies. In Aug. 1916 this seemed to have come. The Russian conquest of the Bukovina safeguarded the right flank of her intended advance into Transylvania; the German reserves seemed fully occupied in stemming Brusilov's attacks and the Franco-British offensive on the Somme; the Bulgarians were, it was hoped, well held by Sarrail's Salonika army, an attack by which was promised. Encouraged by France and Great Britain, Rumania took the plunge.

The prompt and united effort of the Central Powers against Rumania was in contrast to the lack of unity between the Allies, particularly between Russia and Rumania. Consequently Rumania's adherence to the Allied cause was to prove an embarrassment, rather than an addition of strength. The Rumanian strategical problem was not an easy one; the long narrow salient of Western Wallachia, projecting between Hungary and Bulgaria; the location of the capital within 30 m. of hostile territory; the exposed position of the Dobruja with no good natural defences; the great length of frontier line in proportion to the depth of the country; and the lack of lateral railways, were all obvious defensive weaknesses.

Only on the supposition that her enemies were too fully occupied to stage an offensive of any great weight against her, could Rumania have anticipated, as she undoubtedly did, an easy victory. The invasion of Transylvania as her main operation was clearly indicated. It would give her possession of the territory she claimed by right of common nationality; and it would open to the Russians the Carpathian passes. Moreover, the occupation of a line about the Maros valley, across the chord of the great re-entrant bend of the Carpathians, would shorten her front by over 100 miles. A further advance westward would, however, have far to go before threatening any area vital to the Central Powers.

The Rumanians advanced in three columns, each about four divisions strong. The IV. Northern Army seized the passes south of the Bukovina and was to act in co-operation with the Russian left; the II. Army in the centre moved on Braşov (Kronstadt), and the I. Army by the Rothenthurm and Vulcan passes on Sibiu (Hermannstadt) and Petroşani. A detachment of a division at Orsova on the Danube defended the left flank and rear. Three divisions were left in the Dobruja to face the Bulgarians; by a provision of the Convention under which Rumania entered the War, they were to be supported by a Russian force of two infantry divisions and one of cavalry. Other Rumanian detachments amounting to about three divisions held the line of the Danube. The whole southern front was under the III. Army command.

The plan of the Central Powers provided for a concentration in Transylvania behind the defensive line of the river Maros. This group was to make a counter-offensive against the Rumanian I. and II. Armies as soon as the concentration was complete. Meanwhile a Bulgarian army, assisted by a German detachment and Austrian bridging train, the whole under the command of Mackensen, was to carry out an immediate invasion of Rumania's "back door," the Dobruja.

Rumanian Offensive Stopped.—The Rumanian advance was slow, and the Austro-German concentration on the Maros was completed without interference. Meanwhile Mackensen's operations had been attended with success of far-reaching importance. He stormed the strongly fortified bridgehead of Turtucaia on Sept. 5, capturing almost the whole of two Rumanian divisions, while a third Rumanian division was defeated and driven northwards. Silistria fell on Sept. 9. The Russian forces which now came up succeeded in saving, for the time being, the Constantsa-Cernavoda railway. A counter-attack in the Dobruja and an attempt to cross the Danube at Rakhovo in Mackensen's rear were badly combined and executed, and failed completely. Operations in the Dobruja came to a temporary standstill early in October. Mackensen's intervention had had the desired effect of halting the main Rumanian offensive and of drawing the available reserves southward. The counter-offensive in Transylvania was now launched. The Rumanian I. Army was beaten at the battle of Sibiu between Sept. 26 and 28 and their II. Army at Braşov, 10 days later. The Rumanians were driven out of Transylvania and thrown on the defensive all along their frontier. Relations between the Russians and Rumanians, already strained, were not improved by Mackensen's defeat on Oct. 19 of the Russo-Rumanian Dobruja Army and occupation of the Rumanian port of Constantsa and the railway to Cernavoda.

Fall of Bucharest.—The Rumanians repulsed the enemy's attempts to cross the passes on the heels of their retreat from Transylvania and compelled him to pause and await fresh reinforcements. They also defeated the first attempt of Falkenhayn, who commanded the principal Austro-German army, to force the Vulcan and Surduc passes. But a second attack with fresh troops, made at the same spot from Nov. 10 to 17, broke their resistance. They fell back to the line of the river Oltu (Aluta). Falkenhayn had won his race against winter only by a few days, as snow would soon have made large-scale operations in the high passes almost impracticable.

As soon as Falkenhayn's army was across the mountains and within reach, Mackensen made the next move in the carefully concerted plan. Leaving a force to hold the narrowest part of the Dobruja north of the Constantsa railway, he had withdrawn the bulk of his forces to Sistova, where was his bridging train. On Nov. 23 he crossed the Danube, thus turning the line of the Oltu, which had already been crossed by German cavalry. Both armies now advanced on Bucharest, which fell on Dec. 6, after a hard-fought battle on the Arges river. This reflected great credit on Gen. Presan, who had now become Chief of the Rumanian General Staff. Tardy Russian attacks in the Carpathians and Dobruja had no effect, and Russians and Rumanians now withdrew to the Siret–Danube–Black Sea line.

Sarrail's offensive on the Salonika front had been made with little apparent determination and had brought no relief. The campaign had given the Central Powers control of the oil and wheat of Wallachia and had added 300 m. to the already overlong Russian front. On the Allied side, it had been a badly mismanaged affair. The plan of the Central Powers was boldly conceived and executed. The careful co-ordination of the moves by Mackensen and the Transylvanian group are worthy of study.

IV. THE RUSSIAN REVOLUTION

In the early spring of 1917 the initiative was definitely with the Allies, and a simultaneous offensive by all the Allies was planned, with the intention of preventing the Germans from transferring reserves from one front to another. This plan was ruined by the snapping of the weakest link in the Allied chain, Russia.

Collapse of the Army.—Though the Russian Army was now better armed, better equipped and probably better directed than ever before, the losses of the previous two and a half years had worn out the endurance of the rank and file, who were weary for peace. Still the army would have held but for the internal collapse. The Russian revolution broke out in the middle of March. The effect on the army was immediate. The Provisional Government, by its weakness, allowed the situation to pass out of its control into the hands of the subversive element. The notorious "Order No. 1" of the Workmen's and Soldiers' Soviet was the first and fatal step in the destruction of discipline. The poison spread rapidly throughout the uneducated, war-weary mass of the Russian soldiers; and the corps of officers, which had sadly deteriorated during the War, was powerless to check the evil.

Even as early as April, an Austro-German attack on the Stochód bridgehead found the Russians little inclined for fight; a few months later the bulk of the army was a harmless, demoralised mob. By great efforts a part was blandished into undertaking the attacks in Galicia known as "Kerensky's offensive" at the beginning of July. Thanks to the unwonted abundance of guns and shells, these at first met with some measure of success, especially in the region of Stanislau, and showed what might have been achieved had the army remained sound. But they speedily collapsed so soon as real resistance was met; and when the Germans on July 19 commenced a counter-offensive east of Lemberg, the front crumbled at once. By early Aug. the Russians had been driven out of Galicia and the Bukovina, and it was only policy which halted the Austro-German armies at the frontiers of Russia itself.

Armistice with the Central Powers.—The Central Powers had resolved early in Aug. to complete the occupation of Rumania and improve the defensive position by driving the Russo-Rumanian army behind the Prut. This intention was foiled by the fine fighting of the re-constituted Rumanian army, which fully held its own at the battle of Marasesti. At the beginning of Sept. the Germans captured Riga, meeting with little resistance. A month later the Bolshevists seized power, and at once began overtures for an armistice. This was concluded early in Dec., the Rumanians being forced to follow suit.

The Russian debacle gave the Central Powers a last chance to win the war in 1918, and for long rendered the Allied victory doubtful. But up to the final collapse of the nation, under the internal strain of its own disorganisation rather than under external pressure by its foes, Russian strategy towards her Western allies had been chivalrous in the extreme. Despite their deficiencies in equipment and consequent enormous losses, they never hesitated to attack when the pressure in the West was severe. This must always be remembered to Russia's credit in judging of her efforts in the World War.

For more detailed accounts of the individual battles fought in the Eastern European theatre, reference should be made to the following articles: BREST-LITOVSK, BATTLES OF; DUNAJEC-SAN, BATTLES OF THE; LEMBERG, BATTLES OF; ŁÓDŹ-CRACOW, BATTLES OF; LUCK (LUTSK), BATTLES OF; MASURIAN LAKES, BATTLES OF THE; NAREW, BATTLES OF THE; NAROCZ LAKE, BATTLE OF; PRZEMYŚL, SIEGES OF; TANNENBERG, BATTLE OF; VISTULA-SAN, BATTLES OF.

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EAST INDIES, NETHERLANDS (*see* 17.467).—Asiatic possessions of the Netherlands. Their area is 733,667 sq. m. and the population 49,350,834.

Political Development.—The economic and technical progress of the islands after 1900 did not at first affect the general organisation of the Government, but in the long run the extension of the European-conducted agriculture, mining and industry created a demand for skilled labour and accelerated the process of differentiation in the mass of the native population. This development, coupled with the tendencies commonly described as the awakening of the East, resulted in more or less popular movements of political character. The Chinese revolution of 1911 led some sections of the Chinese community to assume an overbearing attitude towards the natives, who retaliated by founding a society of politico-religious character, the *Sarekat Islam*, aiming in the first instance at breaking the Chinese ascendancy in inland trade, but soon developing into a numerous and influential political party.

Other associations of a distinctly political character appeared about the same time, such as *Budi Utomo* (1909), whose members belong to the native professional and intellectual class, and an Indian party under Eurasian leadership and with the avowed object of separation from Holland. The latter disappeared after some years of very lively agitation, the Eurasians (who are legally and socially treated as Europeans) having realised that their community would be the first to suffer by separation. The *Sarekat Islam* split into a communist or "red" wing and a relatively moderate reform party. Labour unions of the continental socialistic type have been formed among the industrial working class; after the Russian revolution many came under communistic influence. By an Act of 1916 a central representative body, called the *Volksraad* (national council), had been created at Batavia, one-half elected, the other nominated. Although its functions were advisory only, its powers of criticism and advice in matters of budget, legislation and administration were large enough to secure for it at once an influential position.

In 1922 the revision of the Dutch constitution was made the occasion for the further reform of colonial institutions in order to place the task of legislation and administration as much as possible in the hands of authorities and bodies resident in the colony, and ensure to the resident population as large a share in those bodies as would be found practicable. Under the new colonial constitution, which was worked out by an Act of 1925, the *Volksraad* becomes, in conjunction with the Governor-General, the regular legislature for all matters of internal policy, except in so far as the Imperial Parliament deems proper to legislate by Act or to empower the Crown to regulate on specified subjects by order in council. The reorganised *Volksraad* consists of a president, appointed by the Crown and 60 members, of whom 25 are to be natives (20 elected by native members of local councils and 5 nominated), at least 30 Netherlanders (15 elected) and three to five others (three elected). Officials may serve on the *Volksraad* as elected or nominated members, and in both cases are as free to speak and vote as non-officials.

Population.—The table following gives the population according to the census of Nov. 1920, with the figures of the census of Dec. 1905 in brackets.

	Java and Madura	Other islands	Total
Europeans (including half-castes, Americans and Japanese)	135,288 (65,535)	34,420 (15,375)	169,708 (80,910)[1]
Natives	34,433,476 (29,715,908)	13,871,144 (7,304,552)	48,304,620 (37,020,460)
Chinese	384,218 (295,193)	425,429 (268,256)	809,647 (563,449)
Arabs	27,806 (19,148)	17,115 (10,440)	44,921 (29,588)
Other foreign Orientals	3,383 (2,842)	18,555 (20,128)	21,983 (22,970)
Total	34,984,171 (30,098,626)	14,366,663 (7,618,751)	49,350,834 (37,717,377)

[1] The figures for 1905 do not include the Europeans serving in the army and navy, totalling 15,866.

The density for the colony as a whole is 67 per sq. m.; for Java (including Madura), 689; some districts of Java are seriously over-populated. The Government has tried, with some measure of success, to create a current of emigration to South Sumatra, and the plantations in the east coast district of Sumatra, the Straits Settlements, the Federated Malay States and Surinam employ Javanese as indentured labourers, but only part of them settle down in their new home. The average mortality is 21 per 1,000. In the crowded native and Chinese quarters of the old seaports it is much higher; among the coolies on modern plantations it has been brought down to 12 per 1,000.

Education.—The principal aims at which the educational policy of the period 1910–25 were directed were: (1) increase the number of vernacular schools for the mass of the people; (2) develop a type of school with Dutch as the medium for the higher classes (Dutch-Native and Dutch-Chinese schools); (3) create secondary schools adapted to the special requirements of the country (suitable for all races alike) in addition to the older secondary schools copied on the Holland model and (4) develop higher general, scientific, technical and professional education.

In 1920 a college for civil engineers was opened at Bandung. Batavia has a college for lawyers, opened in 1924, and medical schools exist at Batavia and Surabaya. A board of education was instituted in 1918.

Exports and Imports.—Notwithstanding the disturbance caused by the War, the history of the Netherlands East Indies (N. I.) in the first quarter of the 20th century was one of almost constant progress. Order was firmly established by 1900, and native and European production increased. Total imports and exports doubled in value between 1900 and 1911; in 1913 they were valued at 1,177 million guilders. Capital was attracted, not only from the Netherlands as before but also from other European countries, large sums being invested in rubber. Food crops were not extended at the same rate, and importation of rice became increasingly necessary; in Java, where little arable land was available for extension of food crops, the yearly rice imports in 1913 amounted to 258,000 metric tons.

Just before the War progress seemed to have come to a standstill owing to a general fall in prices of tropical products, and the outbreak of war paralysed all foreign trade for a while. But soon another tendency set in, and during some years colonial products were in great demand. Intercourse with Holland being hampered by war measures, the export trade had to seek other markets in Japan, China, British India, Australia, the United States, Chile and South Africa. Regular shipping lines to these countries were established, and for some time a good number of the imports that formerly came from Europe were supplied by them. The years 1917–8 were years of growing difficulties. The seagoing tonnage was diminished by the German submarine war and the seizure of many Dutch ships in American ports on a plea of angary; large quantities of produce could not be disposed of, and the importation of rice for consumption decreased. The Government had to step in and organise the collection and distribution of rice to prevent starvation in many districts. With the Armistice this crisis came to an end, and prices went up to fantastic heights (sugar rose from 5 guilders per picul in 1918 to 45 in 1919 and 72 in 1920), with the inevitable results of over-production, overtrading and speculation.

Finance.—The general rise of prices and wages and the pressing needs of increased transport and harbour accommodation made great demands on the public finances, and a period of deficits set in which reached a climax in 1921, when the revenue amounted to 756,000,000 guilders and expenditure to 1,060 million. The funded public debt rose from 83,000,000 guilders in 1913 to 1,176 million in 1923. Reaction set in by the middle of 1921, but the profits of the favourable years enabled most of the older firms to stand the strain. Public finances were set in order by a strong policy of retrenchment and the fiscal year 1924 showed a surplus, with revenue at 707,000,000 guilders and expenditure at 662,000,000. The monetary system had been maintained in sound condition, so that by April 1925 Netherlands India was able to return to the gold standard.

Production and Trade.—Native agriculture in 1925 was still mainly concerned with food crops; on Java and Madura the area of irrigated rice fields in 1924 was 7,800,000 ac., other crops (non-irrigated rice, maize, cassave, peanuts, etc.) covering 10,900,000 acres. As a result of the Government policy of education the natives are taking more and more to growing export products, in Java especially copra, tea, tobacco, kapok; in the other islands rubber, pepper and coffee. Still, the bulk of the exported products is grown on European-managed estates. The principal articles of export are given in the table in the preceding column, with quantities (when not otherwise indicated, in tons of 1,000 kilos) and values (in million guilders) for 1923.

	1910 (quantity)	1923 (quantity)	1923 (value)
Sugar . . .	1,179,576	1,827,518	499
Rubber	2,768	143,661	171
Kerosene, gasolene (1,000 litres)	801,434	889,518	118
Other petroleum products (value)	5·6	. .	61
Tobacco . . .	62,856	52,246	86
Copra	248,148	320,362	85
Tin and tin ore . .	5,713	30,277	60
Tea	15,338	48,114	76
Fibres (kapok, sisal-hemp, etc.) . .	19,718	44,422	31
Coffee	14,730	38,608	30
Cassava products .	11,719	111,451	20
Quinine . . .	119	251	11
Cinchona bark . .	7,235	7,058	7
Pepper . . .	26,189	28,618	11

In 1924 the total value of exports and imports, including coin, was 2,286 million guilders.

Rubber.—Rubber, which was first planted in 1876, increased in importance. The industry suffered heavily from the crisis of 1920–1, and the Government was asked to join in the working of the Stevenson scheme (*see* RUBBER). Dutch planters and Government alike refused to adopt this compulsory restriction policy, but the British owners of rubber plantations in Sumatra, many of them also owning estates in Malaya, for the greater part voluntarily adopted the restriction policy. The rubber boom that followed the rise in prices stimulated not only the European-conducted planting industry but also the native production, which in 1923 already supplied more than one-third of the total exports from Netherlands India. For 1924 the production of native rubber was estimated at 53,000 tons (of 1,000 kilos) as against 90,292 tons of plantation rubber; native production was still fast increasing. The capital invested in the rubber estates is supplied largely by non-Dutch countries; in 1924 31·9 % of the area under rubber in Netherlands India, 34·9 % of the estates in production and 30·9 % of the production were British.

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EAST LONDON, South Africa (*see* 8.836), had population (1921), including suburbs, of 34,673, of whom 20,374 were whites. East London, which ranks as the fourth port of the Union, has grown in importance as the entrepôt for an extensive agricultural district and it exports a large proportion of the wool produced in the province. Alterations at the harbour designed to secure a large enclosed space at the mouth of the Buffalo river were in progress in 1925. The tonnage of ships entering the port was 1,906,000 in 1913 and, after falling to 325,000 in 1919, had reached 2,043,000 in 1923. The average value of imports in 1910–4 was £4,261,000; in 1923 the value was £5,142,000. The average value of exports was £2,067,000 in 1910–4; in 1923 exports were valued at £5,517,000. Though eclipsed as a holiday resort by Cape Town, East London attracts many visitors, as does also the neighbouring municipality of Cambridge, whose population (4,890) is included in that of East London.

EASTMAN, GEORGE (1854–), American inventor (*see* 23.431), manufacturer and philanthropist, was born at Waterville, N.Y., July 12 1854. He was educated at Rochester and became interested in photography. In 1880 he began to manufacture dry plates, and four years later produced the first practicable roll film. In 1888 he invented the "kodak." He devoted the greater part of his fortune to the advancement of education, and had given by 1925 a total of over $58,000,000 for such purposes. Of this sum the University of Rochester received over $25,000,000 including upward of $5,500,000 for the medical school and $6,500,000 for the foundation and endowment of the Eastman school of music. He gave also $15,500,000 to the Massachusetts Institute of Technology and about $2,000,000 to the Hampton and Tuskegee Institutes (*See* PHOTOGRAPHY).

EBERT, FRIEDRICH (1870–1925), German politician, was born in Heidelberg Nov. 4 1870, the son of an impecunious tailor. He was an early recruit to the Socialist movement, becoming a fluent speaker and a first-class trade union organiser, suffering persecution and boycott for the cause. He moved to Hanover, and later on to Bremen where he joined the staff of the local paper of the party, and, having dropped his trade as a saddler, became labour secretary for Bremen. From 1905 Ebert played an important part in the direction of the Socialist party. He entered the Reichstag in 1912. A year later he became chairman of the party, which at that time was torn between the Orthodox and Revisionists; his common sense was considered a guarantee for keeping the party together.

At the outbreak of the World War, Ebert, deeply impressed by the danger of a Russian victory, voted, with his party, for the War credits. His common sense revolted against the optimistic pacificism of Haase and his followers, who later became the Independent Socialist party. He continued to strive, however, at home and abroad, especially at the Stockholm conference in June 1917, for a just peace. He became leader of the Majority Socialists in 1916 and chairman of the budget commission of the Reichstag in 1918. Though disapproving of the peace of Brest-Litovsk, he opposed strikes to bring about peace. In Feb. 1918 he tried hard and fairly successfully to put an end to the Berlin strike, which threatened to become a national calamity. For the part he played at that time he was attacked later on by the Independents as well as by the representatives of the old order.

After Ludendorff's collapse in Sept. 1918 Prince Max of Baden formed the first parliamentary Cabinet. Ebert induced his party to join at a time when Ludendorff's insistence on an immediate demand for an armistice was already known. The negotiations about the armistice continued over a month. The suffering working classes began to be restless. When the plans to force a great naval battle became known, a mutiny took place at Kiel. Acting on Ebert's advice, Prince Max sent Noske to Kiel who succeeded in re-establishing order.

Ebert, knowing the historical attachment of the German people to monarchy, wanted a parliamentary democratic government, on English lines, but no republic. When the organised working men began to follow the Independents inspired by the Russian example, Scheidemann intimated to Prince Max (Nov. 7) that the Socialists must withdraw from the Cabinet, and that if the Emperor did not abdicate by the 9th one of his sons, not the Crown Prince, should take his place. The Emperor vacillated. By the 9th the masses had got out of hand. The monarchy collapsed, but the knowledge of the abdication had not the desired effect. Scheidemann proclaimed the German republic, and Prince Max offered the chancellorship to Ebert, which he accepted. He formed a provisional government consisting of three Independents and two Majority Socialists besides himself.

From Nov. 1918 to Feb. 1919 it was touch and go whether Germany would be a democratic country or a soviet republic. The small group of German Bolshevists, the Spartacus Union, led by Karl Liebknecht and Rosa Luxemburg, insisted on following Russia's example, whilst the Independents did lip service to democracy, but wanted to postpone the elections. Ebert insisted on an early election for a Constituent assembly, to give Germany a democratic constitution. For nearly two months the Government had no power. The Spartacists had armed their adherents and repeatedly tried to imprison Ebert and his colleagues. Ebert called Noske to Berlin, who succeeded in quelling the Dec. and the Jan. risings by means of quickly organised volunteers. When the struggle was over, the elections to the National Assembly took place quite quietly. Democracy had won the day, thanks to Ebert and the Moderate Socialists. It was but fitting that the Assembly elected him the first provisional president of the German Republic. Ebert stuck to his post when the Treaty of Versailles had to be signed and later when, as early as 1920, a military rising, the Kapp Putsch, took place. He left Berlin with his Government to return when the general strike, had forced the leaders to surrender.

As President.—Ebert's term as president was provisional. He wanted to withdraw from office at the appointed time (1922) and to subject himself to a proper election. He bowed, probably unwisely from his point of view, to the wishes of the majority of the Reichstag, including the People's party, who asked him to accept office for a second term from their hands until 1925. When that term drew near its end, reactionary and radical forces had gained strength in Germany. This was shown by the result of the general election of May 1924. But by 1925, after stabilisation had done its work, the situation had improved considerably; there appeared to be quite a fair chance that Ebert, if he chose to stand, might be re-elected.

By that time Ebert had become a statesman; he had dropped the party leadership. He remained on friendly terms with his party, but he considered himself the representative of the German people as a whole. He wielded the great but rather veiled power of the German President with consummate tact. His attitude when forming cabinets, and when reaching decisions was correct, constitutional and wise. He had gained the confidence of all persons with whom he came in contact. He had made the office of the president influential, though not conspicuous. This artisan who had not had the academic training so greatly valued in Germany succeeded in getting a firm grasp on foreign affairs. He saw a point quickly and he knew how to deal with men. Singularly modest and unassuming, his was the dominant influence, nevertheless, in the many crises the German Republic had to pass through in the year that followed the peace.

But the fact that a plain man of the people was the head of the state did not commend itself to the reactionary elements of German society. A campaign of calumny was organised against him, accusing him of having fermented sedition and broken the back of the German Army. He was forced to bring an action for libel against Herr Rothard, who had published in the *Mitteldeutsche Zeitung* a letter and footnote accusing Ebert of treasonable conduct in connection with the munition workers' strike in Jan. 1918. Rothard was found technically guilty, but the judge's finding was unfavourable to Ebert. As the judge's political bias was scarcely denied, the public, including the Cabinet sided with Ebert. The Central Government and many state governments passed votes of confidence; the public assured him of their sympathy, but the strain practically killed Ebert, who had been suffering from repeated attacks of appendicitis. He did not wish to be operated upon before the case was over, and then it was too late. He died Feb. 28 1925 at Charlottenburg.

Ebert was a very fortunate combination of the light-hearted spirituality and sober shrewdness of the South German. He had faith in ideas and ideals, but he believed in action and in organisation as well. There was passion in him, but there was common sense; there was strength in him, and there was suavity. He was by no means a genius towering head and shoulders above his fellow men. He was rather one of them, sharing their feelings and their qualities, so that they could trust him completely, being just far enough ahead of them to make them follow him, the true leader for an incipient democracy.

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EBNER-ESCHENBACH, MARIE, FREIFRAU VON (1830–1916), Austrian novelist (*see* 8.843), died March 12 1916.

ECHEGARAY, JOSÉ (1833–1916), Spanish author and playwright (*see* 8.870), died at Madrid Sept. 16 1916.

ECOLOGY.—The period 1910–26 has witnessed extensive research along many lines. Descriptive ecology, which considers the vegetation of the earth as composed of static units and deals chiefly with the spatial relations of plant communities, their composition and construction, is a necessary preliminary to the more intensive studies by which alone the existing flora and fauna can be correlated with the conditions of the habitat.

Attempts to give greater precision to descriptive ecology led Raunkiaer(1) to elaborate a classification of growth forms mainly based on their adaptation to periods of adverse conditions. By comparison of the percentages of the different types of growth

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[1] The figures throughout the text refer to notes at the end of the article.

form (*e.g.*, trees, herbs, etc.) in any given region, numerical expression can be given to the biological differences of different areas, which are often very pronounced. Thus, whereas the flora of Spitzbergen contains only 2% of annual species that of the Libyan Desert contains 42%; similarly the proportion of annuals decreases with increasing altitude. Equally valuable is the distinction emphasised by Braun(2), between those species which are almost invariable constituents of a particular type of plant community (constants) and those which, even if rare, are more or less restricted to it (characteristic).

The Upsala School has attempted to define the plant community in statistical terms based upon the constancy of species in minimal areas chosen empirically(3). These methods, if still somewhat subjective have led to greater accuracy in description and the recognition of the distinction between the abundance of a species and the frequency of its occurrence.

Study of Climate.—It has been long recognised that temperature conditions chiefly determine the character of vegetation zones more or less parallel to the equator, whilst within each of these the interplay of temperature, precipitation, humidity, wind and sunshine, as they affect the water supply of the plant, determine the incidence of forest, natural grassland and desert. But though climatic conditions are largely responsible for the changes in the character of the vegetation as we proceed from the equator to the poles or, in the vertical direction, up a mountain slope, yet these climatic factors are profoundly modified by differences in soil and topography as when the altitudinal tree-limit rises on a dry calcareous soil or is depressed on smaller, as compared with larger mountain masses. The correlation of the broader vegetational and climatic features is well exemplified by the recent account of the plant communities of the United States by Livingstone and Shreve(4) who show that the plant communities of that region follow closely the changes in the ratio of precipitation to evaporation.

As an example of modern descriptive ecology applied to aquatic communities the account of Esthwaite Water may be cited. If, as the ecologist conceives, the plant community is but the "resultant" of the combined action of all the habitat conditions, it is apparent that its conception as a purely static assemblage disregards the importance of the historic factor and the sequence of changes through which the community passes. This change with time led Clements(5) to the assumption of a climatic climax community to which all the other plant communities of the same climatic area were related as stages in a succession, arrested, it may be, by natural or artificial causes. In temperate climates the succession in certain communities has been shown to follow a sequence of soil changes, due directly or indirectly to leaching and the accumulation of plant residues, and these soil changes may be the fundamental initiating factors of the plant succession, disturbing an equilibrium which might otherwise have remained relatively stable(6).

Habitat Factors.—In no direction has progress been more pronounced than in the study of the habitat factors. Of these, soil acidity plays an important rôle, due both to the direct effect of the hydrogen and hydroxyl ions and to the influence of the concentration of these on the solubility of toxic salts such as those of aluminium and iron. Not only do various species exhibit a definite range with respect to this factor but for each species there is an optimal reaction or reactions at which the maximum frequency and vigour is attained(7, 8). This applies not merely to the phanerogamic vegetation but also to such important micro-organisms as the nitrogen-fixing bacteria of the soil(9).

Soil Problems.—Research on soil problems has been chiefly carried out on agricultural soils(10) which differ in their disturbed character from the natural soils with which the ecologist is more concerned. These latter possess a definite structure with marked changes in the vertical direction(6), and with this structure can, to some extent, be correlated the depth and form of root systems. The underground organs of the plant have been investigated for prairie species by Weaver(11) who has moreover developed a nomenclature of root form.

Water Supply.—The early concept of available and non-available water has been given greater significance by the work of Briggs and Shantz on the percentage of water present in natural soils when permanent wilting sets in. This equilibrium represents the point at which the supplying power of the soil balances the demands of the plant and hence varies with the water content of the soil and the atmospheric conditions. This non-available water probably consists of combined water and some of the capillary-absorbed water and, though not constant in amount, varies only within narrow limits for a given species and soil type(12).

Methods have been devised for obtaining samples of the actual soil solution which show that its osmotic pressure varies both with the nature of the soil and its water-content, moreover the latter appears to influence the proportions in which the various soluble substances are present. The osmotic pressure of the plant is intimately related to that of the habitat both in space and time, and freezing-point-depression methods show that plants of similar habitat and growth-form tend to possess similar osmotic pressures and hence similar capacities for withdrawal of water from their immediate environment.

Light Factor.—With respect to the investigation of the light factor, one of the most important advances is the recognition of the relation between optimal illumination and habitat. Thus whilst the woodsorrel (*Oxalis acetosella*) attains its maximum rate of assimilation at about one-tenth the full intensity of sunlight, a sun-plant such as *Amaranthus* can utilise an intensity of over one-third(13).

The chief problem of ecology is to explain why plants grow where they do. Does a particular species inhabit a woodland or a mangrove swamp because the conditions here are most favourable to its physiological processes or because elsewhere it is suppressed by more vigorous competitors? The one view demands a general fitness for the special environment, the other a greater tolerance. Much of the recent work on individual species has emphasised their adaptation and there seems reason to believe that the habitat has effected a selection of the most favourable mutants(14).

Historical Ecology.—Historical ecology and palaeo-ecology have received comparatively little attention but the admirable summaries of Laurent and Seward(15, 16) of what is known respecting the floras of the past, the work of Mrs. Clement Reid on the pre-glacial floras of Britain(17) and of Erdtman on the vertical distribution of pollen in peat(18), have done much to shed light on the plant migrations of the past, of which a knowledge is essential to a correct appreciation of the distribution of the present.

Detailed Ecology.—Of the detailed ecology of individual species (autecology) little is known, except for a few habitats (19), although the experimental study of the characteristic species of the major plant communities is almost a pre-requisite for comprehending the causes of their occurrence. Similarly the relation of plants to one another and to the animals of the same environment is as yet an almost untouched field of research.

Economic Applications.—Economic applications of ecology have been mainly directed toward the control and utilisation of natural successions, as in the work of Cockayne on the grasslands of New Zealand and of Smith on mountain pasture(20, 21). The use of ecological methods in the control of erosion and accretion of maritime habitats developed by Oliver is especially noteworthy(22).

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ECONOMICS (*see* 8.899).—As the second half of the 19th century was marked in economic thought by the emergence of the historical sense, so the early decades of the 20th century have been marked by the impulse toward exact quantitative measurement. Abstract reasoning, proceeding by deduction from the assumption of self-interest, has by no means lost its value, as assisting, and sometimes greatly assisting, in the explanation of observed phenomena; even though there is a growing feeling that the classifications which it devises depend for their practical significance on the ascertained magnitude of the concrete facts which fall within them.

The historical study of economic conditions, which may be said to have completed its first stage in 1900–4 with the generalisations of Schmoller's masterly survey, continues to progress. Of late it has been turning its attention to one after another of the great industries of western Europe. In England a series of monographs on particular trades has illuminated the past and given added significance to the present. In France, the renaissance of historical studies in the universities is lifting the *ancien régime* and the economic effects of the Revolution out of the realm of controversy. American scholars are bringing fresh and unbiased minds to the examination of the society of the Old World.

It is evident, however, that it is in neither of these two directions, abstract reasoning or historical investigation, that the main tide of economic interest is now turning, but rather in the direction of statistics and accounting. And this is not for their own sake, nor even for their immediate value as tools in the hands of administrators; it is rather for ascertaining the magnitude of economic phenomena, for measuring the potency of economic forces, for indicating the requirements and limiting circumstances of national economic policy.

Modern Tendencies.—This was clear even before the World War. It arose from the organisation of business on the one side and from the enlarged functions of government on the other. For instance, the rapid conquest of the larger part of the field of modern business by the limited liability company, or corporation, necessitated in every country some procedure in the way of registration and annual returns or balance-sheets. At the end of the 19th century it occurred to Körösy, the statistician of Budapest, that it would be possible, on the basis of this material, to arrive at conclusions concerning the profitableness (or rentability) of joint-stock enterprise. The discussion his work provoked led to a whole series of attempts, especially by German statisticians, to measure the gainfulness of particular industries, and in 1909 the German Imperial Govt. undertook the task with its first annual report on "the business results of German joint-stock companies." Here, then, was a development arising out of existing official material, but forcing to the front important and difficult questions as to the meaning to be assigned both to capital and to profit.

A more general movement, arising out of the internal necessities of business undertakings themselves, was the extension and elaboration of cost accounts. With the multiplication and diversification of the products of manufacturing concerns, it was no longer sufficient to have the figures for total cost and total sales; it became necessary to ascertain the cost of each class of goods or components and to find how it was composed. It became requisite to distinguish between direct, or prime, cost and indirect, or general, cost. In a surprisingly few years the term overhead charges has displaced in business circles the various other terms by which the idea had been expressed, and it has now become part of the speech of the educated world. It is realised that overheads must largely determine price policy and employment policy; and since they are bound up with the scale and continuity of production and these with the size and character of the market, they must have a bearing on national tariff policy and the like. Closely parallel with the cost-account movement was the independent movement toward greater efficiency of labour, known for a time as scientific management (*q.v.*). The movement had several unfortunate defects, especially in its earlier phases; but it did at any rate increase the demand for an exact measurement of output in relation to remuneration and time.

Influences of the War.—The resort to statistics and accounting was vastly stimulated by the World War. Conscription, modern means of transport and blockade destroyed the distinction between enemy forces and non-combatant citizens. Governments, belligerent and neutral alike, were constrained to take control of all the economic activities of their peoples. For this purpose they found it necessary to acquire as exact information as was obtainable. Figures of food supply and cost of living from being the curiosities of science became instruments of government. With hundreds of factories owned or controlled by the State, with the political dangers of profiteering and with the financial requirements of Govt., not only had figures to be collected, but working definitions had to be arrived at of capital and profit. In order to do what was quite unavoidable with respect to primary commodities, viz., to fix prices, the public authorities had to feel their way to an assessment of "fairness" in profits and wages. Within the factories themselves the relation of output to working time and all the problems which came to be associated with the word fatigue had to be faced, not from a welfare point of view, nor from a profit-making point of view, but from a munition-producing point of view.

Commercial Education.—In the period since the War, the interest in the quantitative measurement of economic conditions has been greatly furthered by the remarkable extension of higher commercial education. This has been most marked in the United States and in Germany. In the United States there were already in existence, in certain of the universities, schools or departments of commerce or of business administration, most of an undergraduate, but one or two of a graduate, character. In Germany there were already a number of commercial high schools of university status (Handelshochschulen). Most of these were now turned into universities, while at the same time the economic departments of the older universities, under the pressure of incoming throngs of students, took on much of the character of commercial high schools. Even in England the University of London followed the example of Birmingham and Manchester, and established a faculty of commerce. Economics in all these countries, instead of being regarded as a study appropriate only to a future lawyer or official or journalist or professor or as a subsidiary element in a general education, now came to be regarded as professional education for an active business career. That being so, business economics or private economics, *i.e.*, the study of economic conditions from the point of view of the business interests of those in charge of particular undertakings, naturally came to claim a large share of the attention of the student, side by side with the political or national economy which interested the philosopher or statesman.

In the centre of economic study, viewed as professional preparation for a business career, necessarily appeared business administration or *Betriebslehre*. Considering the diversity in local needs and in the qualities of available teachers, it is not surprising that terms like these have been given very differing content in differing places. But almost everywhere the new purpose has led to increased attention to measurement by statistical and accounting methods. It has made use of the internal statistics which modern big business is driven to collect for its own guidance, and in return it has stimulated and criticised them. Nor has this been all; in several universities in the United States the teachers in the schools of commerce have organised bureaux of business research, obtaining both financial support and statistical material from business organisations in their several areas. Expenses, profits and losses in particular lines of business, distribution charges, wholesale and retail, the turnover of stock, the element of rent and allied problems have been subjected to scrutiny, with the help of the latest refinements of accounting practice and mathematical statistics. The results arrived at have not only been of direct value in actual business practice, but also throw light on the validity of some of the conceptions of current economic theory, such as those of the marginal producer or the representative firm.

Trade Forecasts.—Meanwhile some universities, not as a rule officially, but in effect through the activities of members of their staffs, have become interested in the wide-spread hope or longing in the business world which is associated with what is known as forecasting. This development, though not now limited to the United States, has taken place there on a larger scale. For some years before the War a number of independent agencies had made a business of furnishing clients with forecasts as to the future movement of trade. Whether the forecasts rested on an assumed equality of action and reaction, of prosperity and depression, or upon an assumed sequence of trade movements, they called for the collection and grouping, by approved statistical methods, of the masses of figures now regularly turned out by governments and trade organisations. Since the War this field of work has been entered upon by bodies of academically trained experts, associated with particular universities, though not formally authorised by them. The best known is the Harvard Economic Service, which has been followed by a London and a Cambridge Service.

Whatever may be the value of the services thus offered to the business world, there can be no doubt that the labours they involve have led to a more searching and continuous scrutiny of certain large classes of economic statistics than they have ever before received. During the same period, and under the stress of the abnormal currency and price fluctuation of the post-War years, the method of measuring the level of prices by index numbers has become widely familiar; and instead of the single *Economist* index, an almost perplexingly large choice of index numbers is now pressed upon the world's attention.

Agricultural Statistics.—The new interest in numerical measurement since the War has passed over from finance and merchanting and manufacture to the most conservative branch of economic activity, agriculture. Ever since the introduction of artificial manures and the creation of experimental stations, like that at Rothamsted, a stream of statistical calculations has been poured forth as to the effect of the application of varying doses of particular fertilisers and feeding stuffs on crops and cattle. On the chemico-biological side there has been abundant material for illustrating and confirming the principle implied by the law of decreasing returns. But until recently there have been far less adequate means of measuring the facts on the economic side, and of ascertaining exactly the ultimate return to the farmer under varying conditions of cost and sale.

Among the pioneers in agricultural book-keeping and in the effort to obtain results of general significance by the statistical grouping of the book-keeping results were the peasant farmers of Denmark. In Great Britain and America, in recent years, Institutes of Agricultural Economics, such as those attached in the one country to the universities of Oxford and Leeds, and in the other country to Northwestern University, have begun to deal seriously with the difficult problems of valuation and distribution of expenses and to stimulate the farming community to co-operate with them and to imitate. Here, as in some other of the directions in which more exact measurement is being aimed at, the general theory worked out by an earlier generation proves its usefulness in the preliminary analysis of the situation; it is sufficient to refer to the proposition that "rent does not enter into the cost of production." Moreover, there is an element of truth in the assertion that the new methods of measurement are, after all, simply ways of estimating the strength of the tendencies or, putting it the other way, the strength of the friction which economic theory has long been in the habit of affirming. But while this is so, it is also true that abstract reasoning tends to fall from a primary and antecedent position, where it asserted conclusions and then looked round for confirmatory examples, to a secondary and subsequent position in economic enquiry; *i.e.*, to be resorted to only after history and statistics have ascertained what are the facts to be explained (*see* FARM ORGANISATION).

Conclusions.—The number of persons professionally engaged in economic teaching or investigation in academic institutions had been growing in England and America before the War; it has been greatly enlarged since. The output of statistics by government offices is steadily growing, and the scientific standard, notably with respect to labour statistics, has been rising. Economists and statisticians are being engaged by the great banks and business concerns, especially in America and Germany. The accounting profession is gaining in professional status. Works management is being differentiated from engineering, and is calling for ampler and exacter records. It may be anticipated, therefore, that for some time to come the quantitative measurement of economic phenomena will secure increasing attention. The present accidental distinction between accounting and statistics will probably largely pass away in the higher work of measurement; for accounting is but the necessary means for arriving at the data which statistical science has to handle. And, with the present trend toward business consolidation, and the transference of particular branches of business to state (central or local) management or control, the need for measurement will make itself felt with growing force.

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(WM. A.)

ECUADOR (*see* 8.910), a republic of South America. Its area is 250,000 square miles. No systematic census has been taken, but the population in 1925 was estimated at 2,000,000. The capital, Quito, had 80,000 inhabitants, and the chief port, Guayaquil, 100,000; towns next in importance were Cuenca with 40,000 inhabitants, Azogues with 35,000 and Ambato with 25,000.

I. POLITICAL HISTORY

The Government candidate for the presidency, Dr. Emilio Estrada, was elected by a large majority in 1910 over Señor Alfredo Baquerizo Moreno to succeed Gen. Eloy Alfaro, whose term of office expired on Aug. 31 1911. On Dec. 21 1911 Estrada died, an event which was followed in a few days by Gen. Pedro Montero proclaiming himself supreme chief of the republic. The Government organised an army to remove him from this position, and early in Jan. 1912 the constitutional forces met the revolutionaries at Huigra, and later at Yaguachi when Montero's supporters were finally defeated. A formal convention was signed on Jan. 20 by Gen. Plaza for the Government, and by

Montero; but on the same day the people of Guayaquil rose and disarmed the revolutionaries, many of whom, including Montero, were arrested. Soon afterwards Montero was assassinated.

Meanwhile Dr. Carlos Freile, President of the Senate, had assumed the executive authority, and arrangements were made for the holding of presidential elections in the last four days of March. When the elections were held the Conservative party abstained from voting and the Liberal candidate, Gen. Leonidas Plaza, received a majority; but Dr. Francisco Andrade Marín, President of the Deputies, had already assumed office on March 6, which he held until Aug. 10, to be succeeded temporarily by Dr. Alfredo Baquerizo Moreno. Gen. Plaza, the constitutionally elected candidate, took office on Aug. 31 for the four years ending Aug. 31 1916. The stamping out of yellow fever and bubonic plague was attempted early in Plaza's presidency, and the efforts met with success; in later years these two maladies were practically non-existent as a result of the policy then decided upon.

The War Period.—In his message to Congress in 1914 the President raised the question of constitutional reform, and again in 1915, when he proposed the introduction of the parliamentary system by amending the fundamental law of the republic; on both occasions his proposals were rejected. Meanwhile, after the outbreak of the World War, the Government announced by decree that it would observe strict neutrality, would abide by the Hague Convention of 1907, and by the general principles of international law. As a result of the presidential elections held in Jan. 1916 Alfredo Baquerizo Moreno, the Liberal candidate, was elected and assumed office on Aug. 31, at a period when the economic strain caused by the World War overshadowed political events.

After the severance of diplomatic relations with Germany by Peru, the German ex-minister at Lima wished in Oct. 1917 to proceed to Ecuador, to which country he was also accredited; he was informed by the Ecuadorian Minister at Lima that his reception by Ecuador would be incompatible with American solidarity. On Dec. 8 following, Ecuador severed relations with Germany. The whole of Moreno's term of office was largely occupied with the economic problem and the less important fiscal problems that had long awaited a solution. Notwithstanding all his efforts to that end—relieved by the introduction in 1917 of laws regulating cabinet procedure and duties, and a decree in 1919 to transfer the administration of the province of Oriente and the Galapagos Is. to the Foreign Ministry—the situation did not improve.

Post-War Problems.—Dr. José L. Tamayo was inaugurated as President on Aug. 31 1920, for the term ending Sept. 1924. In his opening address to Congress he outlined the grave economic and financial problems facing the country, caused in the first instance by the World War and then by the delays in the sale of cocoa; and also because foreign capital was not coming in as formerly. During his administration laws and decrees were promulgated to regulate the exploitation of petroleum lands, to reserve for the country 6% of the total output of oil wells, to raise funds for aviation and for military education in higher schools, academies and universities. The year 1922 was uneventful but for the continued economic difficulties and for the centenary celebrations in May of the battle of Pichincha (*see* 8.919).

In 1923 a contract was signed by the President with a London syndicate for a loan of $18,000,000 gold, to be guaranteed by customs receipts: the proceeds were to be used for the liquidation of debts to Ecuadorian banks, the purchase of shares in the Guayaquil and Quito Railway and the payment of interest on the bonds of this line and public works. In the same year three severe earthquakes caused serious damage, the first in Machachi, the second in Quito, the third and most severe on Dec. 15 at Tulcán in the province of Carchi.

Señor Gonzalo S. Córdova, an experienced diplomat and presidential candidate of the Liberal Association, received in 1923 an overwhelming majority over Senator Intriago and Colonel Lasso for the term 1924–8. Two revolutionary movements followed this election; the first in Jan. 1924, organised by Lasso, the defeated Democratic candidate, and the second in Sept. 1924, organised by Señor Jacinto Jijón Caamaño in the centre and north of the country, shortly after the inauguration of the new President. Both movements failed, but during the remainder of the year much unrest prevailed in the capital and provinces.

Negotiations between Ecuador and Peru for an adjustment of their boundary dispute came to an end with the signature at Quito on June 21 1924 of a protocol agreeing to a "formula mixta" for a settlement; this dispute had existed to disturb the peace of both countries since 1830. Criticism was levied against the clause in the protocol which makes arbitration by the President of the United States dependent upon a prior settlement of the Tacna-Arica question; but notwithstanding this it was generally agreed that a step in the right direction had been taken. In Oct. the Government relinquished the control which, resulting from conditions caused by the World War, it had exercised over international exchange.

The political unrest which was manifested in 1924 again showed itself in 1925 when on July 9 a revolutionary movement unaccompanied by violence removed the President from office and caused him, with ex-President Plaza, to leave the republic. A military *junta* led by Gen. Gómez de la Torre took over the executive power and formed a Government with Señor Modesto Larrea Jojón as head of the Cabinet and Gen. de la Torre as Minister of War. With this *de facto* Government the United States maintained relations, but refused to recognise the new régime as a Government *de jure*. (*See* TACNA-ARICA.)

Defence.—Military service is compulsory between the ages of 18 and 50, but it is not enforced. In time of peace, the army, navy, air force and lighthouses are in the charge of the Ministry of War. In May 1922 a military mission from Italy arrived in Ecuador to reorganise the national army. In 1925 the standing army consisted of 558 officers, 1,300 non-commissioned officers and 3,108 men.

Education.—Primary education is compulsory and free. The control of public education is in the hands of a superior council over which the Minister of Public Instruction presides. In 1924 there were in Ecuador 1,488 primary schools, with an enrolment of 112,219 pupils. In 19 *colégios*, or academies, there were 2,218 students; in three normal institutes there were in attendance 431 students. At the Central University of Quito 638 students were enrolled. In addition to these educational institutions, there were agricultural, industrial and commercial schools and schools of arts and trades.

II. ECONOMIC HISTORY

Finance.—In Ecuador's budget for 1924 the receipts amounted to 30,473,236 sucres, while the expenditures aggregated 36,531,625 sucres, leaving a deficit of 6,058,389 sucres. The main items in the national revenues for 1924 were as follows, in sucres: import duties, 8,738,382; export duties, 2,824,214; internal revenue, 9,497,486; decentralised revenues for railways and public instruction, 5,831,094; and revenue derived from laws not considered in the budget, 3,217,609. The expenditures were distributed thus, in sucres: legislative and executive departments, 451,404; interior, 4,051,067; foreign relations, 1,350,899; public instruction, 5,299,331; war and navy, 6,709,679; treasury, 3,037,554; and public debt service, 9,174,951. The budget for 1925, promulgated on Oct. 16 1924, was estimated at 35,833,080 sucres. As Congress was not summoned during 1925, no budget for 1926 was promulgated.

Production and Industry.—The principal product of Ecuador is cocoa. The production in 1924, which was approximately 62,345,600 lb. showed a decrease over previous years, occasioned by the "witch broom" disease. The crop of cocoa for the first six months of 1925 at approximately 49,688,200 lb. showed an increase over that of the same period in 1924, which was 43,583,000 pounds. During 1924 67,470,900 lb. of cocoa were exported from the port of Guayaquil, of which 26,257,000 lb. were taken by the United States and 3,045,000 by the United Kingdom. Coffee is also produced, the production for 1924 being valued at 9,316,880 sucres. Ecuador produces about 80% of the total world production of *tagua* (ivory nuts), the crop for 1924 ranking after that in coffee in value at 8,544,460 sucres. Rubber plantations with more than a million trees showed a decline in production in 1924. Cotton production has increased, the crop for 1924 being valued at 2,374,680 sucres as against 2,292,919 sucres for 1923.

Under a decree of Congress 1921 oil deposits are declared state property. Operations of importance are carried out in the Santa Elena oil-fields. The estimated annual production of petroleum in the republic is 40,000 barrels. The principal manufacture of Ecuador is Panama hats, of which the estimated monthly production is 700 dozen. Exports of hats in 1923 were valued at 2,797,526 sucres, and in 1924 at 2,241,380 sucres. Eight textile factories were working in 1924, one of which produces cotton prints, an industry that has made rapid progress and has produced cotton and woollen cloths for export.

Foreign Commerce.—The total foreign trade of Ecuador in 1923 amounted to 85,159,563 sucres (1 sucre=$0.487). The imports amounted to 39,460,778 sucres, while the exports aggregated 45,698,785 sucres. The countries taking the largest amounts of exports were, in order: the United States, France, Great Britain, Germany, Spain and Chile; while the countries furnishing the largest amounts of the imports were the United States, Great Britain, Germany, France, Belgium, Peru and Spain. In 1923 the chief exports were cacao, ivory nuts, coffee, hides, rubber and cotton.

Communications.—During the post-War period steps were taken by the Government for the improvement of roads, most of which were merely trails or bridlepaths. Some internal traffic is carried on the rivers, especially on the Guayas river and the tributaries of the Amazon. In 1924 the railways of Ecuador aggregated about 420 miles. Besides extensions of the most important line in Ecuador, the Guayaquil and Quito railroad, a number of other short lines were under construction in 1925. The most important of these was the line from Esmeraldas to Quito, which, when completed, will furnish the shortest line from the seacoast to the capital. Contracts had been approved for a line from Manta to Santa Ana, passing through Montecresti and Portoviejo; for a line from Quito to Ibarra; from Huigra to Cuenca; for an electric line from Babahoyo to Balzapampa; a line from Ambato, on the Guayaquil and Quito railroad, to the Rio Arajuno in the east. In 1914 a radio station was officially opened at Quito, and wireless communication was established with a small station in Guayaquil.

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ECZEMA: *see* SKIN DISEASES.

EDDINGTON, ARTHUR STANLEY (1882–   ), British astronomer, was born at Kendal, England, Dec. 28 1882. He was educated at Owen's College, Manchester, and Trinity College, Cambridge, where he was Senior Wrangler in 1904 and Smith's Prizeman in 1907. In the latter year he was elected Fellow of his college. From 1906 to 1913 he held the post of chief assistant at the Royal Observatory at Greenwich; and in 1913 he became Plumian Professor of Astronomy at Cambridge. In 1914 he was made director of the observatory at Cambridge, and in the same year was elected Fellow of the Royal Society. His principal researches, in recognition of which he was made a member of many British and foreign scientific societies, were on the motions of the stars, stellar evolution, relativity and gravitation. He was president of the Royal Astronomical Society from 1921 to 1923. His published works include *Stellar Movement and the Structure of the Universe* (1914), *Report on the Relativity of Gravitation* (1918), *Space, Time, and Gravitation* (1920), *The Mathematical Theory of Relativity* (1923). (*See* ASTRONOMY.)

EDDY, MARY BAKER (1821–1910), the discoverer, founder and leader of Christian Science, was born July 16 1821, at Bow, near Concord, New Hampshire, U.S.A. She was the youngest of the six children of Mark Baker and Abigail Ambrose Baker. Her father was a man of local prominence, first at Bow and later at Tilton, New Hampshire; a farmer, a Justice of the Peace, a member of the committee having charge of the public schools and a deacon of the Congregational Church. Her mother was the daughter of Deacon Nathaniel Ambrose, of Pembroke, New Hampshire, who also represented the same type of citizenship. All of Mrs. Eddy's American ancestors were New England people of sturdy character and of English and Scotch descent.

Considering that educational facilities for women were limited when Mrs. Eddy was young, the education she obtained was exceptionally liberal. She graduated from the Academy at Tilton, besides which she had extensive training from two excellent tutors, her brother, Albert Baker, and her pastor at Tilton.

When Mary Baker was 22 years old (Dec. 1843) she married George W. Glover, a native of Concord, New Hampshire, who had established himself in business as a contractor and builder at Charleston, South Carolina. Six months later he died, a victim of yellow fever, at Wilmington, N.C., whither they had gone temporarily, pursuant to his business. Her only child (also named George W. Glover) was born in the following Sept. after she had returned to her father's home in Tilton. Thereafter, for nine years, Mrs. Glover lived at Tilton with her father or with her sister, Mrs. Abigail Tilton, and occupied herself to the extent allowed by delicate health in caring for her child and in teaching. For a time she conducted a private school for young children; at other times she was a substitute teacher in the New Hampshire Conference Seminary.

After Mrs. Glover had been a widow for nine years (in 1853) she married Dr. Daniel Patterson, a dentist, of Franklin, New Hampshire. She was reluctant to marry him, but consented largely because she wanted a home of her own in which her child would be welcome. When she had gone to live with her sister, the child had been put in the care of a nurse who had worked for the Baker family. Dr. Patterson, however, disappointed her expectation, for he was not willing that the boy should be in their home permanently. He even participated in a plot by which the boy was taken to a frontier state, so that she did not see him again for many years. Her marriage to Dr. Patterson proved to be extremely unfortunate. After a decade or more of alternate care and neglect, he finally deserted her at Lynn, Mass., whither they had removed from New Hampshire. Long afterward (in 1873) she obtained a divorce from him for desertion resulting from adultery. In 1877 Mrs. Glover (Mrs. Patterson having resumed this name) married Asa Gilbert Eddy, of Lynn, Mass., an ardent Christian Scientist and the first of her followers to engage in the public practice of Christian Science. This union was most happy, but he passed away at Lynn in 1882, at a time when she felt that his encouragement and support were of inestimable value to the great religious work in which she was then engaged.

Mrs. Eddy's religious history began by contact with her mother, Mrs. Baker being devout and spiritually minded as well as distinguished for her culture and intellectual power. Mrs. Eddy herself had the courage and independence to dispute a point in theology when she applied, at the age of 12, for membership in the Congregational Church at Bow. Afterward she became a member of the Congregational Church at Tilton, and continued her affiliation with this denomination until she became the founder of another. As a girl and young woman, she devoted more thought to religious subjects than was usual, even among the devout people of her class in the New England of her time. She was also driven by persistent ill health to ponder the cases of healing of disease related in the Bible.

In 1862, at the instance of her husband, Dr. Patterson, Mrs. Eddy went for treatment to Phineas P. Quimby, of Portland, Me., a magnetic healer. He was not religious; in fact, he was fond of arguing against religion to any and all who would listen. Nevertheless, Mrs. Eddy was disposed, by her previous course of thinking, to attribute to spiritual power the apparent benefits which resulted to many of his patients, including herself, from what she afterward recognised as a form of personal magnetism or mesmerism. The relief thus obtained by Mrs. Eddy did not last, but she continued until her discovery of Christian Science to regard him as a gifted man, whose practice could be explained in religious terms.

Mrs. Eddy regarded her discovery of Christian Science (*q.v.*) as a religious and scientific experience—an unfoldment of spiritual ideas—which continued and developed through many years. (See pages 24–9 of her autobiography entitled *Retrospection and Introspection.*) In particular she identified her discovery with her almost instantaneous recovery from a severe accident, a fall on an icy street at Lynn in Feb. 1866. As was related in the Lynn *Reporter* at the time, she was picked up in an insensible condition and carried to a nearby residence, where she was cared for during the night. A physician "found her injuries to be internal and of a severe nature." The next day she was removed to her home "although in a very critical condition." Mrs. Eddy has related the sequel as follows: "On the third day thereafter I called for my Bible, and opened it at Matthew ix. 2. As I read, the healing Truth dawned upon my sense; and the result was that I rose, dressed myself, and ever after was in better health than I had before enjoyed. That short experience included a glimpse of the great fact that I have since tried to make plain to others, namely, Life in and of Spirit; this Life being the sole reality of existence." (*Miscellaneous Writings*, p. 24.)

Speaking of her ensuing experience, Mrs. Eddy has said, "I knew the Principle of all harmonious Mind-action to be God, and that cures were produced in primitive Christian healing by holy, uplifting faith; but I must know the Science of this healing, and I won my way to absolute conclusions through divine revelation, reason and demonstration. The revelation of Truth in the understanding came to me gradually and apparently through divine power." (*Science and Health with Key to the Scriptures*, p. 109.)

From her girlhood, Mrs Eddy had been an accomplished writer of both poetry and prose. She had contributed extensively to newspapers and periodicals and had acquired a considerable reputation as an author. Thus, she had been offered a position, with a salary large for that time, as assistant editor of a magazine. As soon as Mrs. Eddy felt that she comprehended what she regarded as the restoration of primitive Christianity with its healing power, her ability as an author became particularly useful for the purpose to which she thenceforth devoted her life. She wrote and herself published (at Boston in 1875) the first edition of the Christian Science text-book, then called *Science and Health* but later entitled *Science and Health with Key to the Scriptures.* Beginning slowly, the demand for this book increased steadily, and still continues to increase. Aided at first only by a copyist and a printer, Mrs. Eddy was aided for subsequent revisions by critics (both friendly and hostile) and especially by the development of her own thought, but, as she has said, in the final edition, "I have revised *Science and Health* only to give a clearer and fuller expression of its original meaning." Other published works by Mrs. Eddy include *The People's Idea of God* (1886), *Christian Healing* (1886), *Unity of Good* (1891), *Rudimental Divine Science* (1891), *No and Yes* (1891), *Church Manual* (1895–1910), *Miscellaneous Writings* (1896), *Christ and Christmas* (1897), *Christian Science versus Pantheism* (1898), *Pulpit and Press* (1898), *Messages to the Mother Church* (1900; 1901; 1902), *The First Church of Christ, Scientist and Miscellany* (1913).

Naturally, Mrs. Eddy was the first Christian Science practitioner. Numerous and wonderful cases of healing resulted from her practice, until work which could not be left to others required all of her time. Likewise she taught Christian Science to pupils in classes, thus teaching about 4,000, until she was obliged to leave this work to those of her followers whom she authorised as teachers. In 1883 Mrs. Eddy founded *The Christian Science Journal*, a monthly periodical, which she edited for 11 years and again later for nearly a year. In 1898 she founded *The Christian Science Sentinel*, a weekly, and in 1908 she established *The Christian Science Monitor*, an international daily newspaper. Even after she left the office of editor, she continued to write for these publications, and maintained a close supervision of their contents. This she relaxed, as editors acquired qualifications, but did not discontinue until she passed away.

Mrs. Eddy began to organise the Christian Science movement by forming the Christian Science Assn. at Boston in 1876. At first it consisted of herself and six of her students. Three years later, also in Boston, she and a selected number of her students organised the Church of Christ, Scientist, into which the earlier association was merged. Again, in 1892, she and a selected number of her students organised the First Church of Christ, Scientist, in Boston, Mass., which succeeded the earlier church and is the present institution. In one aspect, it is a local congregation of Christian Scientists; in another aspect, it is The Mother Church of the Christian Science denomination. From 1881 to 1895 Mrs. Eddy was the pastor of her church. Then she introduced reading from the Bible and from the Christian Science text-book instead of personal preaching in the services of her denomination.

Next to what she did as the discoverer and founder of Christian Science, Mrs. Eddy's greatest work was as the leader of the Christian Science movement. Though living in a rather secluded manner (at Lynn until 1882; in Boston from then till 1889; at Pleasant View, near Concord, N.H., from then until 1908; and afterward at Chestnut Hill, a suburb of Boston), she initiated every important step by which her religion attained the position it held when she passed away on Dec. 3 1910; thus she laid the foundation for its later development and future progress. As has been remarked by intelligent observers, Mrs. Eddy's faith in God, her dependence on prayer, her obedience to Christ, her patience in adversity or opposition, and her combination of practical and spiritual wisdom were exceptional in the most extraordinary degree. Beyond cavil or question, her life was an illustration and a demonstration of her proposition that "prayer, watching and working, combined with self-immolation, are God's gracious means for accomplishing whatever has been successfully done for the Christianisation and health of mankind." (*Science and Health*, p. 1.) See *The Life of Mary Baker Eddy*, by Sibyl Wilbur, Boston (Christian Science Publishing Society, 1923). (C. P. S.)

EDINBURGH (*see* 8.937).—By the passage of the Edinburgh Boundaries Extension Act of 1920 Edinburgh became, as regards area, the second largest city in Great Britain. This was through an amalgamation with Leith, and the absorption of the suburban districts of Liberton, Colinton, Corstorphine and Cramond. The municipal area was increased from 10,597 to 32,402 ac., and the population in 1921 was 420,264. The number of municipal wards was increased from 16 to 23, and the number of members of the city council from 50 to 71, made up of three representatives of each ward in addition to the two *ex-officio* members, the dean of guild and the convener of the trades. The four Leith wards form the parliamentary division of Leith, and the four suburban wards are in the northern division of Midlothian and Peebles.

In 1917 the corporation agreed to purchase the plant of the Edinburgh Tramway Co. for £50,000, and the transfer took place in July 1919, at the expiry of the company's lease. The work of replacing the system of cable cars was begun in 1910. A tramway extension to South Queensferry and Port Edgar was sanctioned by the council in 1917. The most important addition to the public parks was the establishment, by the Zoological Society of Scotland, in conjunction with the town council, of a zoological park at Corstorphine Hill, opened in July 1913. The site, which extends to 74 ac., was purchased by the town council and leased to the Society. Large corporation markets and slaughter houses were opened in 1910, and in March 1914 the Usher Hall, bequeathed to the city in 1898 by Mr. Andrew Usher, was completed and opened.

Additions to the public memorials in the city include the Black Watch Memorial (1910); a statue of Dr. Guthrie (1910); a life-size statue of Thomas Carlyle, presented to the National Gallery by Lord Rosebery in 1916; the Gladstone Memorial (1917); and the Edward VII. Memorial in front of Holyrood Palace. In 1913 Lord Rosebery presented to the city the historic house in the Lawnmarket, known as Lady Stair's House; and in 1920 the birthplace of Robert Louis Stevenson, 8, Howard Place, was purchased as a memorial by the R. L. Stevenson Club. In 1911 the King and Queen dedicated the new chapel of the Order of the Thistle, in St. Giles' Cathedral. The new Freemasons' Hall was opened in the same year. The western spires of St. Mary's Cathedral, carrying out the original plan of Sir Gilbert Scott, were completed and dedicated in 1915 and 1917. The National Museum of Antiquities, which was used by the timber control during the World War, and the national portrait gallery have been reconstructed. A Scottish War Memorial will be erected at the castle. In 1924 a new wing of the university buildings was opened. A scheme for a new dock at Leith, to the north of the Edinburgh dock was prepared at the end of 1924, and a quay, 1,000 ft. long, was built in the outer harbour. Since the residence of the King and Queen at Holyrood in 1923 many decorative and domestic improvements have been made there.

During the World War the proximity of Edinburgh to Queensferry and Port Edgar and the great battle cruiser and destroyer base in the Firth of Forth gave it strategic importance in the naval operations, and its position as the headquarters of the Scottish command made it a centre of military organisation. Preparations for defence against an invasion by sea were made in its vicinity as in other coastal districts, but no serious anti-aircraft protection was given until after a Zeppelin raid, on April 2 1916, in which 10 people were killed and 11 seriously injured, and damage was done to warehouses, private houses and public buildings. (O. J. R. H.)

EDINBURGH, UNIVERSITY OF (*see* 8.941).—New chairs have been established since 1910 in bacteriology, clinical medicine, tuberculosis, French, chemistry in relation to medicine, German, therapeutics, psychiatry, forestry, zoology (second chair), accounting and business method, natural philosophy (second chair), mining and organisation of industry and commerce.

Lectureships have been founded in Italian, Spanish, Arabic, actuarial science, Indian and colonial history, technical chemistry, English law, physiology of the nervous system, genetics, venereal diseases, radiology, neuropathology, psychiatry. Diplomas have been instituted in social study, psychiatry, forestry, technical chemistry, public health, actuarial mathematics, geography. New degrees are granted in veterinary science, education, commerce, philosophy (doctor), mining and technical chemistry.

Women were admitted to classes in the faculty of medicine in 1916; before this date they attended special extramural classes which were recognised by the university. In 1922 an Act was passed—Universities (Scotland) Act 1922—granting powers to the universities to make ordinances: (1) to fix an age limit for principals and professors; (2) to institute a system of pensions or superannuation allowances for principals and professors, and (3) providing for the admission of lecturers or readers as members of the Senatus Academicus. The University of Edinburgh has exercised the powers granted under the Act. The age limit in the case of principals has been fixed at 75 and in the case of professors at 70.

In 1919 the university acquired 115 acres of land at Liberton, a suburb to the south of the city, and in July 1920 the King laid the foundation stone of new chemical laboratories. In Dec. 1924 this building was formally opened by the Prince of Wales, who thereafter received the honorary degree of doctor of laws. It is intended to erect additional buildings on the site for the use of other science departments. An ordinance of the University Court, No. 33, was passed enabling the university to appoint readers, a certain proportion of whom may be appointed to membership of the faculties.

In 1916 three hostels were built for the accommodation of women students attending the university or the provincial college for the training of teachers. A closer relationship has been established between the university and the Edinburgh provincial college for the training of teachers by a single appointment to the offices of the professorship of education in the university and the director of studies of the training college. Since 1913 the university has granted the use of rooms to the Workers' Educational Association for evening classes. The list of subjects taught has included, among others, English literature, economics, history, psychology, science and music, and the majority of the teachers are drawn from the university staff. The number of matriculated students was as follows:—

1910–4 (average)	3,420
1915–9 (average)	2,400
1920–4 (average)	4,533
1925	3,964

In 1924–5 the number of women students was 1,228.

EDISON, THOMAS ALVA (1847–), American inventor (*see* 8.946), after 1910 perfected a battery of large storage capacity for propelling vehicles. This proved of great service, for example, in moving baggage trucks at railway stations. He hoped to produce, with Henry Ford, an automobile so propelled. He was specially interested in the cinema, and early in 1913 displayed the first talking pictures, produced by synchronising the motion picture and the phonograph. Although as yet unperfected, the inventor believed that such pictures were destined largely to replace text-books in the schools. When in 1915, it appeared probable that the United States might be drawn into the World War, Secretary Daniels formed, Oct. 7, the United States Naval Consulting Board, of which Edison was made chairman. In Jan. 1917, placing his business affairs in charge of his officers, Edison devoted himself exclusively to naval problems. Among the previous matters with which he successfully dealt were the detection of submarines by sound from moving vessels, the quick turning of ships by means of sea-anchors, and the devising of a type of projectile which would enter water direct without ricochet. He also designed and took charge of plants for the manufacture of chemicals used in warfare which had previously been produced exclusively in Germany. In 1916 he announced a portable searchlight fed by a storage battery and more powerful than the acetylene lamp.

EDMONTON, Canada (*see* 8.946), the capital of the province of Alberta, had a population in 1921 of 58,821. Edmonton is one of the chief western points on the Canadian National Railways, and is the terminus of the Calgary and Edmonton branch of the Canadian Pacific Railway. The Parliament Building of the province of Alberta stands high above the north bank of the Saskatchewan river. Edmonton is the chief educational centre of the province, and here in addition to the University of Alberta, with beautiful buildings on the south side of the river, are Alberta and Robertson colleges, Westminster Ladies' College and a Presbyterian college. Edmonton has extensive live-stock, dairy, milling and packing industries, and many manufacturing establishments; it is the centre of a prosperous farming district, and the growing regions of the Peace and Mackenzie rivers bring it further importance as a distributing point. There are 30 coal-mines in and about the city; and gold, silver and oil are also found in the neighbourhood.

EDMUNDS, GEORGE FRANKLIN (1828–1919), American lawyer and political leader (*see* 8.949), died in Pasadena, Cal., Feb. 27 1919.

EDUCATION (*see* 8.951).—The recognised importance of education in the modern world justifies, indeed demands, an article dealing with it from various points of view. The following contribution, therefore, is divided into several sections, each from the pen of a recognised authority. These main sections are: I. General Introduction. II. Education in Western Europe. III. Education in the United States. IV. Educational Experiments. V. The Architecture of School Buildings. Section II. is followed by a carefully written bibliography of the literature of education, also from the pen of an expert.

I. GENERAL INTRODUCTION

Each year it is becoming more and more difficult to frame a satisfactory definition of education. The reason for this is twofold. The subject is, in the first place, an always developing one. If we speak of it in the way people did a generation ago, as the training of the mind of youth, we are brought up by the fact that the duty of educating is recognised to-day as extending to the minds of those who have passed beyond adolescence. Not only in the university, but in that growing system under which training of a university type is being extended extramurally to the working classes in industrial and other centres, we find education extending its scope to the adult. Even when the university has provided all the higher training it can for the student, it has only prepared him to develop his faculties by his own initiative in another fashion. He can, when fully trained, study books which were formerly sealed to him, and the library takes him further in that process of self-development for which the professor has prepared him. Education to-day therefore knows no limit but the grave.

Education and Biology.—But this is only one aspect of the larger significance which the word is receiving. There is a second illustration. In recent years biological science has made it impossible to draw any sharp line of demarcation between the individual as merely alive, with initiative and energy as such, and the individual as also intelligent. Life and mind unite in the formation of habitual activities which enable the individual to get rid of hindrances to freedom caused by his environment. Inherited qualities of life and its predispositions have to be taken into account if the development of mind is to be rendered intelligible and then guided. This is especially the case with young children who have not reached the stage of generalising their experience in any definite fashion.

The result is that biology and psychology are entering increasingly into the study of education, especially in its early stages, and are affecting its practice. The field of the teacher is thereby being extended, particularly as regards the study and fashioning of the lives of children. Education is therefore getting an extended significance at this end also, and the study of psychology, which enters into it throughout its field, is now playing an increasing part in it. But the part which it plays is not the main feature in education. It must never be forgotten that its chief concern is with the development of personality, and that this depends on intelligence and on a moral and religious training for which the limited growth of the mind of the young child affords no more than a preliminary preparation.

Continuity of Education.—Another modern principle which is adding to-day to the complication of the meaning of education is that it is being more fully recognised that the system must be treated as a whole, of which the earlier stages are indeed preparatory, but lead into those that come later. The individual continues identical through the growth of his personality. But in childhood he can take in only what is appropriate to the infantile stage and falls within his capacity at that stage, as in the nursery school. Later on, there comes to the child grown older what is stimulated further by something that we call primary education. This process prepares for secondary training, but there is no sharp line of demarcation between these later stages. The subjects of the earlier conduct to the subjects of those that come later, but the system is an entirety and has to be recognised as such. What any division implies is, in reality, that brain and personality can only absorb gradually, and by stages, but that what is absorbed belongs to a system which is not itself divisible into separate parts, but expands as its meaning and effect, by degrees, enter into and are absorbed by a developing mind. The subjects of instruction appropriate to the differing stages thus involve each other. Bearing these things in mind, the first object must be to give some view of what the educational system stands for to-day.

An examination of the records of 1925 shows that there has been a marked change in the directions just indicated. It will be convenient to take an actual instance, and the most obvious instance to select as supplying material for judgment is that of England. Scotland also affords evidence of a striking development of new tendencies in some respects of a different kind. Some reference must also be made to Germany, France and Italy, for in these countries the same sort of impelling force, arising from the effects of the War, is illustrated.

II. EDUCATION IN WESTERN EUROPE

Developments in Great Britain

The system of national education in England has advanced its scope since 1911 (*see* 8.971). Then the system was that established under the Education Act of 1902, which abolished parochial school boards and made the county councils the local authorities for all forms of education short of the university type. Secondary and primary education were no longer technically separated, so far as concerned powers to administer them, and a definite step had been taken towards unifying the national educational system. The voluntary public elementary schools, mostly Church schools, were brought, by the Act of 1902, under the local education authorities, and were assisted, so far as secular instruction was concerned, by contributions from rates, which were added ~~to~~ the public grants they already enjoyed. These schools were continued with most of the control, except as regards secular teaching, exercised before by managers established by the founders.

The new local authorities were given power to provide other schools, for technical and secondary education, and to levy rates for this purpose. But even under these powers, while elementary education went on developing, secondary education increased but slowly. The access to it from the elementary schools was hampered by the small provision of secondary school buildings. The task of providing these by the local authorities had begun, but progress was very slow. Even to-day the greater number of pupils passing from public elementary into secondary schools unfortunately leave the latter when still under 16 years of age. For all excepting a very small proportion of school children secondary education ends in practice two years before it should. There are over 5,000,000 children in the public elementary schools of England, and the number leaving these schools is probably about 600,000 in each year. But the provision for their further education is still wholly inadequate. England is in this respect behind Scotland, where the tradition has been different, in a very material degree.

Religious Controversy.—The religious controversy over the schools in England must not be passed over. The Act of 1902 had to be made a compromise on this question if the House of Lords were to pass it. Accordingly, that Act provided for the maintenance of the schools not provided by the local education authorities, *i.e.*, the voluntary schools, mostly of Church foundation. These were to be maintained by the authorities out of the rates. They were each to have, under the Act of 1902, six managers, of whom four were to be denominational foundation managers, and two were to be appointed by local authorities. The foundation managers were to be such that they would have regard to the ownership of the school building, and to the principles on which education had been given in the schools as managed in the past. These schools were to be maintained and kept efficient under the direction of the local education authorities, and, as regards secular instruction, their directions were to be carried out as regards the number and educational qualifications of the teachers, but the consent of these authorities to the action of the managers was not to be withheld except on educational grounds, and such consent was required for the dismissal of a teacher, unless the dismissal was on grounds connected with the giving of religious instruction. The managers were required to provide the school free of charge. The relation of the local educational authorities to these managers was defined in a judgment given by the House of Lords in 1912 (Gillow v. County Council of Durham, 1913, Appeal Cases 54).

The tendency has, not unnaturally, been for these non-provided, or voluntary, schools to diminish in number. One reason has been that in the areas, mostly rural, where there was only a single school, this school was denominational. But there has been at least as great a diminution in the urban areas. In 1903 there were 5,975 provided schools as against 14,238 non-provided. In 1924 there were 8,967 provided schools as against 11,776 non-provided. The difference in accommodation is still more striking: in 1903, there were places for 3,065,169 scholars in provided, as against 3,722,317 in non-provided; in 1924, there were places for 4,428,096 scholars in provided, as against 2,661,618 in non-provided schools.

Education in Scotland.—In Scotland the Scottish Education Act of 1918 made a clean sweep on this subject; all the schools, provided and non-provided, were brought under the control of the new education authorities as regards the rate aid and substantially as regards state aid and the authority had to be satisfied as to the qualifications of the teachers before the denominational authorities were allowed to appoint them. The novel spectacle was seen of nuns studying in the universities in order to secure the necessary qualifications for the higher appointments in schools controlled by the state.

Education Acts, 1918 and 1921.—The Education Act of 1918, which was carried through by Mr. H. A. L. Fisher, and which is now re-enacted, along with most of the earlier Acts, in consolidated form by the Education Act of 1921, made a determined attempt to improve the state of things in England and Wales. This new Act did not attempt to re-open the controversy over the Church schools. But it aimed at the establishment of "a national system of public education available for all persons capable of profiting thereby," and the local authorities were called on to prepare schemes setting out the provision which they had made and proposed to make to this end. The Act effects important changes in respect of elementary education (*see* ELEMENTARY EDUCATION) including the power to establish nursery schools for children between two and five years of age. It raises the compulsory school age for education from 12 to 14 with power to the local authority by by-law to extend that age to 15. It abolishes part-time attendance; it makes provision for central schools for the older and more intelligent children in the elementary schools, and it lays emphasis on physical training and the social side of education. The local authorities are to co-operate in providing for the preparation of children for further education in schools other than elementary, and for their transference at suitable ages to schools which give such further education. The Act also deals with the supply and training of teachers, and extends the duties and powers of the local authorities with reference to medical inspection and treatment to secondary and continuation schools. It removes the limit imposed on rating powers for education other than elementary.

Continuation Schools.—But perhaps the most novel feature of the statute was that which instituted a compulsory system of part-time continuation education after the close of the elementary school period. "Young persons" between the ages of 14 and 18 were required to attend a continuation school for 320 hours in the year, unless able to claim exemption under the Act. Unfortunately financial difficulties have prevented the nation from making this new system a general or efficient one. What has, however, emerged is not only a growth in the recognition of the necessity of secondary schools, but an increasing disposition in pupils, who are leaving the elementary schools, to attend technical and special schools, and also, when older, classes of a purely university tutorial character and those organised on an increasing scale by such bodies as the Workers' Educational Association. (*See* WORKERS' EDUCATION.)

Secondary Education.—Looking back over the history of education in England, we find that the backbone of secondary education used to be the local endowed grammar schools. These were often of great antiquity and owed their existence to the munificence of private founders, often ecclesiastical in character. It happened frequently that these grammar schools bore no relation to the needs which had sprung up amid a changed population. They might exist in remote and small towns, while the populous industrial centres were without them. Successive commissions did something to secure the due application of their revenues, but there was no general scheme of reform which was carried into effect.

Sometimes these endowed schools reached a high level of efficiency and prosperity, but at other times they merely languished on, often with inadequate resources. There were indeed higher grade schools, founded to promote the teaching of science and art, but the local authorities, school boards after the passing of the Education Act of 1870, were restrained by the state of the law from developing this side so as to make it follow on primary education. The famous Cockerton judgment gave the quietus to every such attempt. However, the Technical Instruction Act of 1889 enabled committees to be set up to develop technical instruction with the aid of certain moneys granted by Parliament out of the revenue from excise, and known as the "whisky" money. The teaching was mostly in the evening, but some of the ordinary schools were subsidised for this kind of teaching. Presently the subjects were so extended as to include English and modern languages.

These influences stimulated the desire for systematic secondary education, and this led to the recognition of the want of some method of training the teachers required for these and for the elementary schools. Pupil teacher centres had begun, with the commencement of the century, to come into existence. What was needed was a general system, with control both by the Board of Education and the local authorities. In 1904 the former body took a fresh step. It sent out regulations which defined a secondary school as one which could offer to the scholars up to and beyond the age of 16 a four years' course of general education of a wider scope and more advanced degree than that in the elementary school. English, geography, history, at least one language other than English, mathematics, science and drawing, manual work, physical exercises and, for girls, housewifery, were among the subjects included. Grants-in-aid were made, and the Education Dept. in Whitehall, although still hampered by the insufficiency of the money put at its disposal, was no longer interfered with by the independent organisation of the Science and Art Dept. which was now merged into it. Some good work was accomplished by this and subsequent efforts of the Education Dept., and a scholarship system for the benefit of children in elementary schools, who desired to proceed to secondary education, did much to render the new movement popular. (*See* SECONDARY SCHOOLS.)

The Report of a Royal Commission under the presidency of Lord Bryce appointed in 1894 had done a good deal to give definite shape to the movement. As the result of the report of that commission, the Board of Education Act of 1899 was passed. Under this Act the department of science and art had been incorporated into the department of education in a newly-organised Board of Education, with a president and a parliamentary secretary, and the powers of the Charity Commissioners in relation to educational endowments were also transferred to the new board. A consultative committee to advise the board was likewise set up, and, after the passing of the Education Act of 1902, the administrative work was divided, in accordance with the functions of the board, under the heads of elementary, secondary and technological.

University Development.—The machinery at Whitehall was now adequate to the task. Assistance was added from another source. The early part of the 20th century witnessed a great development in the provision for university education in England. London University had already, as the result of the London University Act of 1898, been developed, though very imperfectly, into a kind of teaching university, instead of being left as a university whose functions were confined to giving degrees on a mere external examination basis. Dissensions among those interested prevented the work from being completed, and it is even to-day far from completion. But the university colleges and schools in London received a great stimulus, and they have not only developed into an aggregate of powerful university colleges, but have increased in number.

The movement brought into being a desire on the part of the university colleges elsewhere than in London for the grant of full university status. As the result of an enquiry held by a special committee of the Privy Council on the application of the colleges at Liverpool and Manchester for charters, a committee, over which the late Duke of Devonshire presided, and on which Lord Rosebery and the late Lord Balfour of Burleigh sat, the request was found to be justified. There was a hearing of witnesses which lasted for several days in Dec. 1902. After deliberation the committee reported, and an order in council, of Feb. 10 1903, gave effect to the report.

The charters petitioned for were to be granted, but it was added that this step involved issues of great moment which must be kept in view, and for the solution of which due preparation should be made, especially in regard to those points on which, having regard to the importance of the matter and the effects of any changes upon the future of higher education in the north of England, co-operation was expedient between universities of a common type and with cognate aims. The date of this order in council is too little remembered, but it is a memorable one. It gave state recognition to a fresh development in higher education. The principle laid down was that the number of the English universities might usefully be increased, and that they were to include civic universities, with their headquarters in great cities, large enough and keen enough to ensure that the requisite local resources should be forthcoming for the maintenance and development of the new universities. It was considered, and as the event proved, rightly, that the civic university would make an appeal to the citizens greater than the old type of local university college had been able to do.

The movement thus started grew. Not only Liverpool and Manchester, but Birmingham, Leeds, Sheffield and Bristol founded universities. Durham was expanded and developed so as to take in Newcastle-upon-Tyne. With the inclusion of London, no fewer than eight teaching universities were thus added in the early part of the 20th century to the list in England. To these the most recent, Reading, must be now added. Besides this, two new universities were added in Ireland. These fresh influences on higher education came into action very rapidly. Their activities found a parallel in new activities of Oxford and Cambridge and there came into operation a new force, permeating from the top the whole educational system in England. Many of the teachers in the schools almost at once sought to qualify themselves by taking the degrees, based partly on record of work in the university, which the new provision made possible. There were other opportunities for further colleges of a university type, some of which seem to be on the road to the attainment of university status.

The result has been a substantial increase in the number of teachers passing through these new institutions and so gaining a university training, and also of special training colleges available to teachers. The Board of Education now assists teachers to follow approved full-time courses of advanced study at the universities. There are now also short courses at Oxford, Cambridge and elsewhere provided for teachers in secondary schools. (*See* TEACHING.)

Board of Education.—The Board of Education is concerned with the universities only indirectly. The grants to them are made under the advice of a wholly distinct body, the university grants committee of the Treasury, a body which contains individuals of high experience in university affairs. From the report of this committee for 1923–4, it appears that, in spite of financial pressure in the classes from which the university students are mainly drawn, and in spite of the rise in fees and in personal expenses, there are now 56·9% more full-time students of both sexes at the British universities and colleges than before the War. The committee estimate that a further increase is probable. They also point out that the basis of the university curriculum is being broadened in response to new requirements. It records with satisfaction that the Chancellor of the Exchequer has agreed to place on the estimates for 1925–6 an increased grant-in-aid for the universities of £1,550,000, in substitution for the £1,242,570 which was included in the vote for 1924–5.

Adult Education.—In yet another fashion the universities have undertaken a national duty. About 1875 Oxford began to interest itself in adult education (*see* ADULT EDUCATION) of an extramural type and Cambridge appointed a syndicate for local lectures, and so took the first official step in the movement for university extension (*see* UNIVERSITY EXTENSION). But the system of isolated local lectures has had to be supplemented. This is being increasingly done by tutorial classes, mainly organised by joint committees of the universities and the Workers' Educational Asssociation (*see* WORKERS' EDUCATION). Dr. Albert Mansbridge has taken a prominent part in the movement. The new tutorial class system already receives some financial aid from the Board of Education, given through the local education authorities.

Under this system courses of lectures are held wherever practicable by university tutors, who establish themselves in the industrial locality where the teaching is given. The lectures form a consecutive course, running to 12 or even 24 lectures. When practicable there are courses extending over successive years; where possible, three. The hours are in the evening, for the students are mainly of the classes that are engaged in manual labour in the mine, the factory or the field or are busied in clerical work in the counting-house during the day. So far they have been popular and have brought labour into a further relation with education. For the students are adults and the standard of teaching and the qualifications of the teacher are those of the university, and appropriate to adults with experience of life. Summer meetings and schools for the same kind of student are now organised by some of the universities, including Oxford and Cambridge (*see* SUMMER SCHOOLS). These are well attended and are popular with the working classes. Another body, the British Institute of Adult Education, is actively co-operating in developing the movement.

In this kind of extramural university education the most sought-after subjects for the moment appear to be those of economics and industrial history. But literature and languages, philosophy, including psychology, sociology, history, natural science and music are also being increasingly chosen. The system is spreading over England, and the new universities and the university colleges are active in extending it. But it is much dependent on access to libraries. The work of most of the counties in establishing libraries and the intervention, on an already considerable scale, of the Carnegie United Kingdom Trust, by providing central libraries from which those that are local can draw books, are helping to get over this difficulty (*see* LIBRARIES). A further question of growing importance is that of extending the availability to localities of the national museums. (*See* MUSEUMS.)

Altogether the adult education movement may be said to have opened up a new way in which higher education of the university type can be reached by the democracy, and it may well travel much further along that road, particularly if the state assists it financially in a larger measure than at present. The universities are thus becoming more of national institutions than they were before they took up the movement. The latest feature in the movement is that the trade unions have determined to take it up, and desire to have an active part in its direction. The question of the expediency of this may give rise to discussion, but it appears to be an advantage that the Trade Union Congress should now be interesting itself directly in the higher education of the working classes, in connection with the activities both of universities and local authorities and the Workers' Educational Assn., and of the labour colleges which have been established in various centres.

Special Organisations.—The system of education as it exists to-day in England has now been described. It has been shown how it extends in principle from the nursery school, through primary and secondary stages, to the higher education, given either within the universities or by them extramurally. There are other agencies, not organised in any way by the state, which co-operate in the work. For example, the Boy Scouts movement (*see* BOY SCOUTS), the industrial settlements, the Sunday-school organisations and the Women's Institutes, along with others, are contributing a good deal that is of special ethical value. The description given here has not been extended to them, partly for reasons of space, and partly because they are less directly connected with education in the strict sense than the recognised organisations already described.

The Board of Education is now not only assisting adult education and the tutorial class system by grants made to the local authorities for the purpose, but it has appointed special committees which have made valuable reports on the subject. One of these reported in 1924. The inspectors of the board now visit and report to it upon the university tutorial classes. What remains is to take the system of national education, look at it as a whole, and ascertain the nature of the mental treatment which characterises each stage in that whole.

THE PSYCHOLOGY OF EDUCATION

The earliest stage is concerned with the conduct of very young children. The conduct of the lower animals is largely guided by what is called instinct, and, in the case of the higher animals also, including man, instinct plays a great part. Waking and sleeping, much of what we reveal in our actions is due not to consciously formed purposes but to habits which are ours as members of our species, and which yet enter into the making up of our personalities (*see* PSYCHOLOGY). These habits are in many cases instinctive, the result of inheritance, and often, even when they have been originally formed by choice, they come to seem instinctive. In social, as well as individual, action much of what is done is not the outcome of conscious purpose. Mother and child, for example, are alike ruled by the unconscious promptings of the species.

But the fact that, especially in young children, instinctive habit plays a large part does not alter the necessity of regarding the child as a person by guiding its mind. The law extends to the child protection and even rights. In its behaviour there are premonitions of the higher rights of adolescence. Still, consciously formed purpose is only one among the aspects of nascent personality. The other aspects, those more nearly of the higher animal, have to be studied by methods which extend to phases with which the teacher in the primary school has to concern himself less.

In the nursery school the personality has to be developed by different means. (*See* MONTESSORI METHOD.) Here the insight of the modern psychologist becomes of most obvious value. He refuses to limit individuality to the mind. The biologically regarded organism enters into the constitution of personality, and, if the purpose of education be to develop the best forms of individuality, the body and what is bodily must not be ignored. Our organs are in large measure self-directing. We do not, for example, perform the function of digestion consciously, nor do we consciously control our steps when walking. Yet the life of the organism is a whole and if that life fails these processes cease. For physiologists and psychologists alike this is so. This whole life controls the parts and functions, sometimes unconsciously, sometimes consciously. Our conscious efforts as persons are what is called conative. They are guided and made possible by inherited instincts which do not always come into consciousness. When they do, and when action is consciously based on past experience, we have one form of memory.

Development of the Child.—As the physical individuality of the child develops into consciousness his conative and memoric capacity develops with it. Freedom of choice gives him new activities. These activities are the outcome of his self-directing energies and they have values which vary. What education has to do is to bring into his consciousness ever-increasing interests and values. The child has to be guided in the fashioning of his experience and to the most valuable forms of activity in fashioning it. His tendencies in conation are thus set in higher directions and his experience is enriched by the new memories which influence his choices. The ideas that often seemed most attractive are thus to be refashioned in the earliest form of school. The meanings of the things around are expanded and connected together. The original attitudes towards events are modified and further experience creates new dispositions. Here the teacher has his opportunities.

It is obvious that in this region there is much work for the psychologist, and much has been done by writers, such as the German biologist, Richard Semon, in providing theories and detailed explanations. At the stage of infancy in the development of the child the application of these is often of value. But there are other fields in which psychologists have been working which are concerned with young and old alike. One of these is the investigation made by physiological psychologists into the dependence of the mind on the nervous system. (*See* PSYCHIATRY.) So wide a subject only admits of mention; it is enough to say that it is to-day recognised as being an important one in the study of education and must not be neglected.

Another field is that of psycho-analysis. (*See* PSYCHO-ANALYSIS.) Freud and Jung have in different ways developed the view that there is in the self a region of which we are not conscious, but in which are buried "complexes" which are striving to break through and influence conscious action in ways which become intelligible only if we study the region of their genesis. This point of view has many adherents, and it is now entering into the studies by teachers of the minds of their pupils. The field which is thus opened up is, however, a somewhat controversial one.

It is obvious that psychology, in forms such as those alluded to, is an important subject in the theory of education. But it can never be relied on as containing the whole of the truth. Teaching, which is directed to the development in the best direction of individuality, must be primarily concerned with personality, that is with intelligence that is conscious of itself as such. Psychology has the value for education that physics and chemistry have for biology. But just as it is at least doubtful whether the former sciences, concerned as they are with mere order in externality, can furnish conceptions which adequately express the character of life, so it is doubtful whether psychological methods can really reach to developed personality. Direct study of the individual minds of his pupils is always necessary for the teacher. He may derive much subsidiary help from scientific observation, such as that afforded by "fatigue psychology," or in quite another form from the method of Dr. Maria Montessori, which is to throw on the child as much as possible the responsibility for its own education, and to reduce external interference with self-development to a minimum.

Still the teacher must influence the environment, and so direct development under its influence. The influence of his own personality counts for much, even in the infant school, and the example he sets, mental and moral, counts for certainly not less in the subsequent stages of education. The old psychological notions were insufficient in so far as they treated knowledge as a merely passive interpretation of external experience. We have learned that knowledge is an activity which changes even that experience for him who possesses it, and therefore requires adequate stimulus from within and direction from without. The giving of these is the work of the teacher throughout his whole career, and it depends primarily on his developed personality as well as on the individuality of his pupil. The school is the environment in which he works and the influence which he directs. Enough has been said to show the new scope and importance in the teaching of to-day of psychological ideas.

Science in Education.—The desire on the part of those concerned with education to apply scientific conceptions in the organisation of their work is to-day increasing. The stimulus to apply general science seems to have come to them from the searching methods forced on their notice by the World War. It is indeed since the War that in England much of the growth now described has taken place. The study of childhood and primary training has become more thorough; secondary education still remains the weak point, but its shortcomings are being closely scrutinised, and it is slowly being developed. The idea of the university type of education is laying hold of the people with greatly increased power. The advance in England has been accompanied by an advance in Scotland in kind, probably not relatively speaking as great, for there was less unbroken ground to be covered.

GERMANY, FRANCE AND ITALY

In the other countries of Europe analogous, though not wholly similar, advances have been made with not less zeal. In Germany there is a striking example of this. She had before the War a remarkable educational system, in advance in most respects of that of any other country, but it was a system which had been shaped unduly in the interests of the well-to-do classes, and did not fit the new constitution of the democratic republic. With the advent of a democratic form of government all this is being changed. Germany is struggling to establish a principle of unity (*Einheit*), under which the children of rich and poor shall be educated together, and she is also doing her best to develop the system of continuation schools which existed in her country before the War, and which she is now trying to make not only everywhere compulsory, but extended in scope.

In studying the voluminous literature which her new educational leaders are pouring out about the ideals of her new system, it is impossible not to realise that the old keenness about education still pervades the German people and makes it ready for sacrifices in order to preserve what has been one of her great advantages. The German universities do not appear to have thrown themselves into the work of spreading their influence extramurally to the people in the way the universities of England are doing. But this side of the work of levelling up the popular mind is not being overlooked. The teachers in the higher schools in the industrial centres, men who have been university trained, are giving a new sort of adult education to those round them. Altogether the effect of the War in imparting fresh stimulation to the growing demand for equality in education (the national poverty notwithstanding) appears to be not less striking than it is in England.

Education in France.—In France an analogous desire for equality in education is apparent. Like Germany she had before the War a splendid system of secondary schools. But the provision for those children in her elementary schools who could not hope to go there was deficient. An effort is being made to concentrate on improving primary education. The highly centralised system of state control renders the accomplishment of this task more difficult in the absence of local initiative. But French statesmen appear to be quite aware of its importance; a lesson which the War has driven home. They are still faced with difficulties caused by the highly centralised educational system established under Napoleon, and hardly less by the insistence of the Church on a religious character for the schools.

But, on the other hand, France has inherited a splendid tradition in her establishments for secondary education of lycées and colleges, in which ability to speak well and write well is developed in the scholars as it is almost nowhere else. Recent reforms, while leaving undiminished the classical tradition recommended as indispensable for this purpose, are introducing science also into these institutions. The recommendations of the Ribot Commission in 1899 about secondary education have been followed up by the proposals for widening the basis of the system made by M. Bérard in 1921. The purpose was to provide an *élite*, nurtured in the traditional culture of the French nation, but so extended as to reach poor and rich alike.

Under this scheme scholarships were to be given to enable the best pupils in the elementary schools to proceed to the reformed secondary schools. The Chamber of Deputies and the President of the Republic approved the plan, but it remains to be seen how the national financial necessities will permit of its being carried fully into effect. The position in France of her secondary schools is a great one. They have influenced the development there of primary education and appear likely to influence it still more. The War has stimulated the desire of the French for a much improved system of national education in which rich and poor shall both share.

Education in Italy.—Another and last example of the influence of the War, apparent also in many countries other than those here referred to, is the development of the national system of education in Italy. In that country education has always been a state monopoly. The schools were almost entirely state schools, and the educational machinery was by tradition highly centralised. The system was, however, good in many respects, although it was bureaucratic and lacked elasticity. The teachers were too tightly bound. The subjects prescribed were too numerous, and yet fine art and music and games were not taught. Primary education was compulsory, but the weak spot was the difficulty of enforcing the compulsion. This was partly due to the small interest taken by the nation in its system of education, notwithstanding that the schools were open to everyone.

The Spirit of Education.—It was plain that education had to be made more interesting, and, among others, Prof. Giovanni Gentile, the Minister of Education in 1923, set himself to accomplish this. He considered that his first task was to reform the spirit of the teachers. These must learn that education is no mere matter of empirical rules, or even of organisation, but is a spiritual activity, involving the continuous self-recreation of the individual teacher. The plan is to entrust him with a large amount of liberty in working out the purpose prescribed to him. This is accompanied by greater freedom given to the local education authorities, with which they can adapt the schools to the varying requirements of their neighbourhood. It is a new experience to read in an official decree such words as those with which the minister introduced the new scheme in 1923:—

> The schemes for study which are described here are intended more than anything as a guide. The teacher is informed of the result which the state expects from his work in each school year, leaving him free to use what he individually considers the most suitable ways for arriving at it. These, for several reasons, are always various and elastic; according to how the teacher is situated with regard to his scholastic surroundings, and according to his individual personal culture, and the particular character which he has succeeded in giving to the spirit of his teaching, by means of observation and personal experience. The following schemes are designed in such a way as to oblige the teacher continually to renew his personal culture; not only by means of the superficial little manuals in which he can gather the crumbs of knowledge, but from the living fountains of national culture. . . . These schemes forbid the commonplace platitudes which have so long dulled children's education, and demand pure genuine poetry, sincere searching for truth, energetic investigation of the popular spirit, restless and never satisfied, asking always the reason why; the rapture of contemplating pictures resplendent with art and life, the communion with great souls which speak through the mouth of the teacher.

Noble words these of the minister-philosopher in whose hands the cause of education in Italy was placed in 1923. It will be of interest to observe how far the new spirit is realised.

SOME CONCLUSIONS

Reviewing the state of education in England and in the other civilised countries referred to, it may be said to be this. The War brought about a remarkable advance, primarily through the fresh interest in education which has been awakened in the people. This interest has resulted in a desire for equality of educational opportunity, which is having its effect on the policy of governments. Democracy is coming to its own in the attainment of fresh chances for its hitherto less fortunate members. The spirit of scientific organisation is also becoming everywhere operative. Much remains to be accomplished, but a beginning has been made, and the process of development now initiated does not seem likely to stop. If wealth again accumulates, a good deal is likely to be asked for in order to give the people better chances than those hitherto attainable.

It is not only in the schools and universities that the new desire is making its influence felt. The chiefs of industry and commerce are asking for higher standards of knowledge in those whom they employ. They are recognising, too, the value in their undertakings of pure science, and in England the Govt. is co-operating, through the medium of committees under the President of the Council, in giving what is wanted. It is a new function of the President of the Council to organise and to stimulate industrial and scientific research. Public funds have been placed at his disposal. In the year 1925–6 some £380,000 was applied for these purposes. In 1925 the Govt. also added to its machinery a committee under the Cabinet analogous to the Committee of Imperial Defence, but devoted to problems of civil enquiry. This new committee, which has hardly as yet had time to get into its work, opens up new possibilities in the way of furnishing the Cabinet with exact knowledge for the disposal of civilian problems of every kind, at home and in relation to the Empire.

These changes bear closely on the growing demand for education, and especially for higher education. The strides made in organisation are great, and the spread of knowledge is more rapid as well as wider than was the case before the War. But the advances actually so far made are in outlook and organisation mainly, and until the financial stress of the time passes and the freer provision of public funds becomes practicable, the full advantages of what has been recently accomplished can hardly be reaped. Notwithstanding this, it is no exaggeration to say that the convulsion which shook the world in 1914 has produced a new stimulus to education of all kinds. (H.*)

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III. EDUCATION IN THE UNITED STATES

Each state has its own system of education, which includes elementary and secondary schools and institutions of higher learning. All the states have enacted compulsory school laws, but in standards and enforcement of them the states vary widely. School attendance is generally required of children between the ages of 8 and 14 (or 16) during from 6 to 8 months of the year, and many states further require attendance at part-time or evening classes by those who have not acquired a prescribed minimum of education or who cannot adequately speak, read and write the English language.

The national Govt., through Congress in 1916, notably reenforced the compulsory school laws of the states by an enactment prohibiting the shipment, in interstate commerce, of any articles in the manufacture of which children under 14 have been employed. In place of a nearly uniform curriculum and the almost universal requirement of 8 years in the elementary school, there is manifest a tendency to group together as a "junior high school" the seventh, eighth and ninth grades, which otherwise would constitute the last two years of the elementary school and the first year of the secondary school. The purpose of the rearrangement is to facilitate departmental teaching, to free the child from the rigid grade system of promotion (by which a failure in one subject necessitates the repetition of the whole year's work), and to permit earlier a choice of courses and thereby prepare the pupil for greater accomplishment in his chosen field during the later high-school years. The public secondary schools have grown rapidly in numbers and resources. Their enrolment doubled in the 10 years, 1908–18; from 1,564,152 in 1918 the enrolment rose to 2,160,861 in 1922. They are no longer essentially stepping stones to college; they represent the continuation of the common schools, and their function is to complete the formal education of that vast majority which will never enter institutions of higher learning.

Colleges and Universities

Throughout the country, but especially in the West and Middle West, so-called junior colleges are becoming numerous. Some of these institutions are derived from small colleges without support from taxation; some of these colleges, finding themselves financially unable to continue satisfactorily the full four-year course, limit themselves to two years; others, more significantly, form the upward extension of the vigorous public high schools. This type not only brings the opportunity for higher education within the reach of many who could not leave the immediate vicinity of their homes, but also reacts favourably on the pupils and teachers of the secondary schools. The college remains the most characteristic feature of education in the United States. In 1922 there were enrolled 414,806 collegiate students as compared with 341,082 in 1920 and 174,213 in 1910. While competition is displacing registration, the entrance requirements are, perhaps, less rigid. Even the conservative Association of New England Colleges recommends "a system of tests for admission, in which a certificate shall be taken for the quantity, and examination shall be held in a limited number of subjects for the quality, of school work."

The curriculum covers a very wide range of subjects, but experience has shown that it is unwise to permit the student to exercise untrammelled freedom in the choice of his studies, and most colleges now limit the selection of courses in such manner as to prevent too great concentration and too great dispersion as well. The universities, though not more numerous, have in recent years grown stronger. Their graduate departments, better manned, attract more students. In this respect the development of the state-supported institutions has been remarkable. A few years ago only three had achieved distinction on this field; by 1924, 13 had qualified for membership in the Association of American Universities, and constituted one-half of its members. The enrolment of graduate students in all universities in 1916 was 11,215; in 1920 it was 15,612; and in 1922, 22,061. So great has become the demand among women for higher education that the colleges exclusively for women are no longer able to provide for the rapidly increasing number of applicants for admission. Bryn Mawr, Vassar, Wellesley, Smith and Mount Holyoke have been forced to establish waiting lists. The doors of the universities for the most part stand open to women upon an equal footing with men. By 1922, 35% of the students, graduate and undergraduate, enrolled in the universities, colleges and technological schools were women, and it may confidently be predicted that women will soon outnumber men. The general admission of women to courses in medicine removes practically the last barrier discriminating between the sexes. (*See* Co-education.)

Professional Education

Schools for professional training have grown rapidly. Whereas early in the 19th century professional education comprised little more than preparation for the ministry, it now includes theology, medicine, law, the profession of engineering and two offshoots of medicine—dentistry and veterinary medicine. Pharmacy and nursing are sometimes regarded as professions because a specialised education is prescribed for those who would practise them.

Theology.—The colleges first founded in what is now the United States—Harvard, William and Mary, and Yale—were established to train men for the Christian ministry. As the colleges have developed into universities the original aim has been merged into the broader purpose of providing liberal education for all, while influential schools of theology have grown up, for the most part, as strictly denominational institutions independent of the universities. Methods of teaching and the content of the curriculum have been revised. Formal theology is emphasised less, a first-hand knowledge of human relationships more; Hebrew is not always obligatory, while the results of literary and historical criticism are fully discussed. Freedom of thought in some institutions has completely liberalised the training and greatly modified the traditional theology. During the years 1870–95 the number of theological students increased more rapidly than the general population. For the next 25 years the figures showed marked fluctuations, but for the period as a whole neither student enrolment nor the number of graduates kept pace with the increase in population.

Medicine.—The medical schools of the United States were slow to adjust themselves to the new conditions brought about by the growth of medical science. They followed the model of continental Europe rather than that of Great Britain, in that the teaching was almost exclusively by lectures and imposed no definite requirement as to the preliminary education. There was lacking also, for the most part, stimulating contact with colleges or universities of high academic ideals; and therefore there developed an organisation which lent itself readily to commercialism. Later, however, medical teaching has been revolutionised, and it now exemplifies the highest standards of professional education. The rapid development of physiology and physiological chemistry, bacteriology, pathology and hygiene necessitated the enlargement of the curriculum to include these subjects. Laboratory methods of teaching have been introduced, at very great cost for buildings and equipment. Teachers qualified by training and experience have superseded practising physicians as instructors in the fundamental sciences; in the clinical branches also pedagogical standards have been raised, and in many schools full-time clinical instructors are in charge. Satisfactory preliminary education is regarded as essential, and all recognised medical schools in 1926 require of candidates for admission the completion of the four-year secondary school course and at least two years of college work, including physics, chemistry and biology.

Cornell, Western Reserve and Leland Stanford require three years of college for entrance; Harvard a degree from, or two years of high rank in, a college or scientific school; Johns Hopkins and Chicago a Bachelor's degree or its equivalent. Most significant of all, the student is again brought into intimate contact with the patient; hospitals and dispensaries are used as laboratories where the prospective physician may acquire skill in examining patients and familiarity with the manifestations of disease. The degree of Doctor of Medicine is conferred on completion of the medical course, which in nearly all schools is four years in length. A few institutions require also, before granting the degree, a fifth year, spent as an *interne* in a hospital. Advancing educational requirements, the consequently greater cost of medical training, and the increasing knowledge and interest of the public in matters of public health combined to reduce the number of medical schools from its maximum of 162 in 1906 to 80 in 1925; of medical students from 28,142 in 1904 to 18,200 in 1925; of medical graduates from 5,747 in 1904 to 3,974 in 1925.

Engineering.—The beginnings of American technological training were made, not in the long-established colleges, but in a group of special schools, independently founded, such as the Massachusetts Institute of Technology in Boston and Stevens Institute in Hoboken, New Jersey. Later the universities eagerly took up education in engineering, developed elaborate departments and offered the greatest variety of courses. Another type of technical school is the state college of "Agriculture and Mechanic Arts," supported by land grants from the Federal Government. Engineering schools require of applicants for admission the completion of the four-year secondary school course. Instruction is largely by means of laboratory courses. The University of Cincinnati went a step further, and perfected an arrangement by which students spend half their time outside the college, actually employed in some form of engineering work; periods of two weeks of study alternate with like periods of practice in a shop. The degree of Bachelor of Science, with or without specification of the branch studied, is commonly conferred after four years of college work. The degrees of Civil Engineer, Mining Engineer and so forth are awarded for undergraduate work by some schools in place of the B.Sc., by others reserved for more advanced study.

Dentistry.—Since 1900 there has been increasing uniformity among dental schools until, in 1921, all recognised schools required for admission at least the completion of a four-year secondary school course, and many of them demanded an additional collegiate year of preliminary training, followed by four full years of professional training. The increasing recognition of the relation of dental pathology to health and disease in the body as a whole tends to make dentistry a branch of the study of medicine, and a leading group of dental schools decided to demand in 1927 the same two years of collegiate preliminary training now required of medical students, followed by four years of dental training. The growing appreciation of the value of dentistry is indicated by the increase in the ratio of the number of dentists to the total population. In 1850 this ratio was 12 for 100,000; in 1910 it was 43; in 1920, 56; in 1925, 68.

Veterinary Medicine.—In this, as in other professions, there has come a realisation of the necessity for a solid foundation of general education on which to base special training. The accepted standard in 1921 was the completion of a four-year secondary school course and three years in a college of veterinary medicine. In 1900, 13 schools enrolled 362 students and graduated 100 veterinarians. In 1916 the numbers had increased to 22 schools, 3,064 students and 759 graduates; but in 1921 the number of veterinary schools declined to 14 and the student enrolment to 849.

UNIVERSITY EXTENSION WORK

Under this head are grouped all those activities of institutions of higher learning which are carried on for the benefit of people unable, through lack of time or training, to matriculate in the regular college or university courses, but who still desire some form of higher education, and this extension of facilities is designed to include in its scope persons many years older than the ordinary undergraduate. Originally no more than a series of public lectures on topics of literary, historical or scientific interest, this extramural teaching has extended its range, diversified its method and multiplied its activities, until it has become, in some instances at least, an important function of the university.

The spirit of service to the community which it embodies was expressed by the late President Van Hise in these words: "So far as the University of Wisconsin is concerned, we propose to take up any line of education work within the state for which the university is the best fitted instrument"; and again: "It is my ideal of a state university that it should be a beneficent influence to every citizen of the state." In such a programme the whole realm of human knowledge is included, from sewing to Sanskrit and from plumbing to philosophy. Summer sessions, of from six to eight weeks' duration, provide valuable opportunities for those, chiefly teachers and students, whose work allows a long vacation. Varying standards prevail in the summer schools: in not a few the amount and quality of the work render it acceptable as part of the requirement for a degree. The University of Chicago has made its summer session the full equivalent of one of the winter terms, and operates on a four-quarter schedule. Teaching by mail is another method employed by some universities to widen their spheres of influence. Extension teaching is also carried on by local boards of education, especially in large cities. Much of it takes the form of part-time classes for children who have left school prematurely and for immigrants who lack command of the English language.

Private enterprise outside of academic circles has contributed to extension teaching along two distinct lines. The Chautauqua Assembly is the prototype of the summer school (*q.v.*), and has exerted a very wide influence through the thousands who each year attend its courses. Quite different in scope, but not less valuable, is the kind of work done by other institutions which provide opportunities and incentives for continuous and serious study as well as lecture courses and concerts having a wider appeal. Perhaps the most valuable extension teaching is that which reaches into the home, bringing to the mother such information as will aid her in solving her manifold and peculiar problems. The U.S. Govt. prepares and distributes upon request a comprehensive series of pamphlets containing instruction regarding the selection and preparation of food, infant feeding, child hygiene and many other subjects. Whenever possible, nurses and women trained in the household arts visit the homes and, by personal directions and demonstration, often succeed in promoting the welfare of the family where print alone would fail. Intellectual development is stimulated by courses of home reading. The recognition of the importance of home influences as factors in the child's success at school led to the formation of "parent-teacher associations," from which the teachers gain a knowledge of the home environment of their pupils and the parents learn how best to co-operate in the work of educating their children.

Vocational Training.—This term denotes training of less than college grade, designed to fit the individual to earn a livelihood. Its beginning in the form of manual training may be traced back as far as 1880, but except for a few isolated experiments it is a development of the 20th century. Phases in the progress toward an understanding of the problem have been: (1) attention was focused on "misfits"; the problem was stated in terms of what might be called a "niche" theory of society as that of finding the particular place or station in life that exists somewhere for each individual; (2) it was held to be the duty of society to regard with earnest concern and in some way to aid those that are defective; (3) then came the idea that the schools might prevent individual and perhaps unusual types from being spoiled in the making; (4) next came a shift in emphasis to the necessity for vocational training; and (5) finally came a recognition of the necessity for an educational survey of the community in order to determine what opportunities are already available and what its industrial needs really are.

The so-called Smith-Hughes Act passed by Congress in 1917 authorised appropriations aggregating $7,000,000 a year for promoting, in co-operation with the states, special training in schools designed to meet the needs of those preparing to enter agriculture or industry; provision being also made for training teachers for this work by industrial or commercial corporations. The teaching of domestic science was begun in the schools of Framingham, Mass., in 1898. The desirability of such training for every young girl has led to the inclusion of one or more courses in home economics in the curriculum of every girls' high school, and also in the upper grades of the better organised elementary schools.

Agricultural Education.—Training for agricultural pursuits more than any other branch of education has been fostered by the Federal Government. Its development manifests several stages, each characterised by a different method. The land grants of 1862 led to the establishment of state colleges of "Agriculture and Mechanic Arts," which, however, for a generation at least were predominantly schools of engineering. In 1887 Congress authorised subsidies to agricultural experiment stations under state control, a policy the wisdom of which was quickly demonstrated. In a few years these stations accumulated a wealth of exact knowledge relating to farm problems which would have been of inestimable value if it could have been applied. Then came the development of agricultural extension education, employing agencies such as lectures, bulletins, correspondence courses, reading courses, farmers' institutes, short courses in agricultural schools, travelling libraries, educational trains, demonstration farms, education exhibits at fairs and moving pictures. This phase culminated in the Smith-Lever Act of 1914, which appropriated more than $4,000,000 annually to be apportioned among the states for agricultural extension work. Such activity, creating a great demand for teachers and farm demonstrators, reacted beneficially upon the agricultural colleges. Meanwhile, another tendency was becoming manifest. The science of farming was being taught in the secondary schools. This plan possessed so many obvious advantages and showed such satisfactory results that in the decade following 1910 it was widely adopted. In 1922, 2,175 public secondary schools, with an enrolment of 59,276 pupils, provided vocational instruction in agriculture. In most schools the boy or girl is required to carry out, under supervision, some definite enterprise such as the cultivation of a small plot, the raising of pigs or poultry, or the conduct of a miniature dairy. A detailed record of the undertaking, including a financial statement, is required and forms a basis for grading the pupil's work.

Certain private corporations, not directly engaged in teaching, have influenced education in the United States. The General Education Board, for example, incorporated in 1903, employed the funds at its disposal in assisting institutions of higher learning throughout the country, and in the southern states it also promoted the development of the secondary schools and the teaching of agriculture. Later it entered the field of medical education. The Carnegie Foundation for the Advancement of Teaching, incorporated in 1906, starting with a programme of pensions for retiring college professors, has been led into the field of investigations and surveys. The published reports of its findings have contributed in large measure to educational progress. The Russell Sage Foundation performs similar service.

Statistics.—The magnitude of work in education may be indicated by figures from *The Statistical Survey of Education* for the school year 1921–2, published in 1925 by the United States Bureau of Education. The total enrolment in all schools (public and private, from kindergarten to university) was reported as 26,458,655; the total number of teachers, 871,131 (men 180,362; women 690,769); the total cost (including outlays) for the school year, $2,053,250,492; the value of all school property, $4,369,163,043. For the public schools of elementary and secondary grade the Bureau reported the following figures:—

Pupils enrolled	23,239,227
Average number of days schools were in session	164
Average number of days attended by each pupil enrolled	130·6
Number of teachers (men 118,085; women 604,891)	722,976
Percentage of men teachers	16·3
(Percentage in 1879–80, 42·8)	
Average annual salary of teachers	$1,166
Number of schoolhouses	270,574
Value of all school property	$3,008,563,033
Receipts	$1,444,241,920
From income of permanent funds and lands	$23,767,933
From county and local taxes and appropriations	$1,106,331,287
From state taxes and appropriations	210,707,514
From all other sources	103,435,186
Expenditures	$1,580,671,296
For sites, buildings and equipment	$305,940,965
For salaries of superintendents, supervisors, principals and teachers	$885,475,100
For all other purposes	$389,255,231
Total expenditure *per capita* of population	$14.47
Total expenditure per pupil in average attendance	$85.76
Average total expenditure per day for each pupil	$0.523

(A. S. D.; N. M. B.)

BIBLIOGRAPHY.—The United States Govt. publishes a *Biennial Survey of Education.* The Education Bureau has issued a *Report* annually from 1871, and a number of *Bulletins* covering the subjects of Agricultural Colleges and Education, Citizenship and Civics, City Schools, Colleges and Universities, Commercial Education, Health and Hygiene, High Schools, Home Economics, Industrial Education, Kindergarten, Rural Schools, Secondary Education, Teachers and Vocational Education. Valuable information is also contained in the annual *Reports* of the Depts. of Education of the various states, *e.g.*, Massachusetts, Pennsylvania and New York.

The following works deal with higher education: David Starr Jordan, *The Care and Culture of Men* (1910); H. M. Bennett, *Women and Work* (1917); H. W. Stuart, *Liberal and Vocational Studies in the College* (1918); Thorstein Veblen, *The Higher Learning in America* (1918); Le Baron Russell Briggs, *Men, Women, and Colleges* (1925).

On education in general the following are some of the more important books: A. T. Hadley, *The Education of the American Citizen* (1902); C. F. Thwing, *A History of Education in the United States since the Civil War* (1910); *Education in the United States*, a series of monographs, ed. Nicholas Murray Butler (1910); E. L. Thorndike, *Education: a First Book* (1912); F. P. Graves, *A Student's History of Education*, (1915); *New Possibilities in Education*, ed. A. L. Sahrie, The American Academy of Political and Social Science (1916); J. Dewey, *Democracy and Education* (1916); G. R. Twiss, *The Principles of Science Teaching* (1917); E. P. Cubberley, *Public Education in the United States* (1919); J. A. H. Keith and W. C. Bagley, *The Nation and the Schools* (1920); Ross L. Finney, *The American Public School* (1921); E. H. Reisner, *Nationalism and Education since 1789* (1922); J. L. Horn, *The American Elementary School: a Study in Fundamental Principles* (1923); H. C. Link, *Education and Industry* (1923); D. H. Smith, *The Bureau of Education: its History, Activities and Organisation* (1923); A. Gesell, *Mental Growth of the Pre-School Child* (1924); W. Goodsell, *The History of the Family as a Social and Educational Institution* (1925); W. H. Kilpatrick, *Foundations of Method* (1925); *Cyclopedia of Education*, ed. P. Monroe (1925); C. H. Judd, *Psychology of Social Institutions* (1926); Thomas Jesse Jones, *Four Essentials of Education*, pref. by F. H. Giddings (1926).

IV. EDUCATIONAL EXPERIMENTS

Educational experiments in England and Wales are usually suggested by the needs of the moment and not by a desire to test by experience a hypothesis formed beforehand. The persons who conduct them do so to overcome a recognised difficulty or to achieve a better way of teaching. In one department, that of intelligence testing, research experiments are tried and it is here that, in the strict sense of the term, experiment takes place. The importance of this subject led to its being referred to the Consultative Committee of the Board of Education which issued a report on it in 1924. Their findings are not conclusive, but in general recognise the importance of these tests while cautious as to the probable usefulness of the results.

Central Schools.—Of experiment in a wider sense there is a great deal. The Board of Education itself is encouraging an experiment on a very large scale in urging local education authorities and school managers to set up central schools, to which boys and girls in elementary schools are transferred at or about the age of 11 for a course of study specially designed to cover the years up to 14 or 15, selection being either by age alone, or through examination. Thus some central schools include all children from the schools which feed them, above 11 years of age, dull and clever alike; others, such as the London central schools, consist of picked scholars. This movement is dictated by various considerations, such as the growing demand for advanced instruction beyond the primary stage, consciousness that the ordinary elementary school, small or large, does not usually do full justice to its older scholars, and a desire for economy, since the concentration of specially qualified teachers in central schools is more economical of energy as well as of money than to spread them over ordinary schools with children from 7 to 14.

Many hold that the primary age ends or should end at 11, with a fair equipment in the tools of learning; and that all teaching beyond that age should be post-primary if not secondary in character. Where central schools are established, this principle holds the field, with the proviso that the best type of co-ordinated instruction beyond 11 is not necessarily that of the normal secondary school. Some central schools have an industrial bias and devote much attention to practical work; others have a commercial bias. This important experiment alters essentially the English conception of an elementary school, which, if the central schools become universal, will no longer be an "omnibus" school for children from babies up to 14. The change toward industrial and commercial studies in the central schools encounters the objection that it tends to lessen, rather than increase, the adaptability of pupils, to restrict them to fixed stations in life instead of broadening their opportunities as the older, less specialised, schooling was believed to do. The movement grows, however, if slowly; one obstacle prevents a general acceptance, the very large number of schools under voluntary, and usually denominational, management. Some Church of England schools are acquiescing in it; in other cases, Church central schools are set up; in some the Church schools refuse to participate. The Roman Catholic schools will not "decapitate" their own schools to send their children to non-Catholic central schools; here and there they found Catholic central schools. An effect, not unforeseen, of the change is that infant schools may tend to become absorbed in the new junior primary school and no longer be a separate entity.

Experiments in Infant Schools.—Apart from organisation, one of the most striking waves of experiment has taken place in infants' schools and classes. Where formerly the three R's in a dull form were the staple of instruction, modified by some artificial exercises denominated "Kindergarten," the school now tries to cultivate speech besides reading and leading "up to reading," activity instead of immobility, self-help instead of formal instruction. This new orientation in fact preceded the spread of Montessori doctrines, but it was strongly reinforced by them (*see* MONTESSORI SYSTEM), even where they were not accepted in full. The infants' school and class become now more of a social agency and a centre of education than a centre merely of instruction.

School Experiments.—Another movement has grown quietly without the support of a great name, but spreading by its own reasonableness. This is the "ruralising" of many schools, not only in the country but also in many towns. When this goes no further than nature study, it is a recognition that school lessons should be related to the child's surroundings. But gardening is very popular and a school often includes bee-keeping and even poultry-keeping. The Welsh Dept. of the Board of Education have stimulated the extension of the idea of suggesting that rural lore, including history, antiquities, architecture, folk-song and speech, should be cultivated in country schools. Connected with this trend is the tendency to localise the geography teaching on the one hand, by studying closely the geography of the town, village or region, and on the other to supplement the local study by school journeys. School journeys are not for all, since their management requires very special organising and personal care. In small numbers they preceded the Boy Scout movement (*see* BOY SCOUTS), but the proved practicability of school journeys reinforced the camping idea of the Scouts and camps grew in popularity. One annual camp under the patronage and the personal attention of the Duke of York, combining boys from the public schools and boys brought up in elementary schools, is a noteworthy example of an attempt to create a sympathy between classes brought up very differently. Both secondary and primary schools have even organised school journeys and school camps in other countries.

Handicraft Work.—The progress of instruction in handicrafts is on the whole slow, for this form of instruction is apt to be expensive. But the idea that handicraft for girls, as well as for boys, is an essential element in education undoubtedly grows and the stage is now reached where impatience is expressed at the lack of proper progress where formerly a missionary kind of advocacy was required to make the idea acceptable at all. Handicraft for boys means usually work in wood and metal; and for girls besides needlework and cookery, long established, laundry work, housecraft and the simpler beginnings of crafts like weaving, basketry, embroidery, lace making and pottery.

Cinema, Gramophone and Broadcasting.—These are perhaps past the stage of experiment. The schools are considering and trying experiments in new fields with results which are not yet firmly established, experiments with the gramophone, broadcasting and the cinema. The gramophone has practically won its way to a position of limited but decided usefulness. It becomes more and more used for music, and the introduction by its means of a wide variety of good music into the schools means an increase of music and the appreciation of it as a liberal factor in education. It is also used in the teaching of foreign languages. Broadcasting is on its trial (*see* BROADCASTING); every day at fixed hours in the afternoon lectures and talks are broadcast from the various studios and schools, and the teachers are asked to co-operate by giving the children who listen appropriate revision and appropriate exercises, talks on literature, history, simple science, especially natural history which in this way may regain the place in children's education it used to have and deserves to have, and, of course, music. The value of the cinema is more doubtful at present. It appears to be of use (where it can be used) chiefly as recreative, or as giving a pictorial summary of teaching, the mass of which has been communicated by word of mouth or acquired by reading.

The Dalton Plan.—Mention must also be made of experiments in teaching such as the well-known Dalton plan. In a few schools this is followed very thoroughly: in more, adaptations of it are made (in the usual English way), in part of a school, or in some subjects only. The experiments so far have hardly been crucial enough for a final verdict to be passed. The plan was started originally in secondary schools, but it has also been adopted experimentally in a few elementary schools. The direct method of teaching foreign languages is another example of a movement which has passed the stage of experimentation in one sense. Its principle is fairly well accepted; but it is carried out not always in its purist form but modified to suit the circumstances of the pupils. Dr. Rouse of the Perse School, Cambridge, continues to use it for Latin and Greek, though he has no great following (*see* CLASSICAL EDUCATION). The question of the training of teachers is being canvassed and the ultimate scope of the training, as well as the forms it will take, are too uncertain to admit of description. One result may be noted, that the idea of training for teachers in secondary schools gains ground. (H. WA.)

EXPERIMENTS IN THE UNITED STATES

In America experimentation has become a normal function not only of individual schools and colleges but of whole systems of education. The experimental movement has coincided with the rapid quantitative expansion of educational facilities which has marked the first quarter of the 20th century. It has spread with the growth of schools; especially has it accompanied the introduction of new types of schools. The movement owes its impetus primarily to the university schools devoted to the scientific study of education which prepare for professional service an ever-increasing number of school administrators. More recently normal schools and teachers' colleges, philanthropic foundations and special research bureaux maintained in connection with state and city systems have likewise made important contributions to the movement. Not only have these latter agencies extended the range and variety of experiments, but they have also done much to inoculate the whole teaching profession with the experimental point of view.

The most significant educational experiments may be classified for convenience as (1) experiments based on psychological investigations, (2) experiments dealing with the reconstruction of the curriculum and (3) experiments bearing on the reorganisation of the educational system. There is naturally some overlapping of these categories.

Experiments Based on Psychological Investigations.—Educational psychologists have been concerned with developing two kinds of measures: measures of native capacity and measures of intellectual achievement. The measures of native capacity, the so-called intelligence tests, appeared only sporadically in the schools before the World War, although a number of American psychologists, building on the work of Binet, had been endeavouring to adapt them to educational purposes. In 1917 and 1918 the opportunity presented itself to use intelligence tests on a large scale in classifying and assigning the personnel of the American draft army. The results obtained through subjecting 1,750,000 men to certain simple forms of these tests demonstrated their fundamental validity and attracted the attention of both educators and laymen. Since the War, intelligence tests have come into general use in schools of all grades. They have been steadily refined and improved, but are still regarded as in the experimental stage. In the classification of pupils and their selection for special treatment, in comparing the progress of different groups of children, and in a wide variety of studies of the educational process, the tests find constant application. They have been adopted by many colleges as part of the matriculation machinery.

The effort to invent objective measures of achievement in school subjects has produced a series of new devices called scales or standard tests. These are designed to estimate the results of the work done in the schools more reliably than is possible by means of the conventional examination. By the correlation of the scales and standard tests with the age of the pupils, tentative norms of achievement at different stages of school life are being established. Scales or standard tests and intelligence tests are now being used in conjunction, with a view to determining the respective rates of progress of children of different mental endowments. Scales and tests of proved reliability are already available in most of the school subjects. Those designed to measure achievement in handwriting, spelling and arithmetic have been longest in existence and have had widest application.

The whole testing movement has led teachers and administrators to appreciate more fully the essential importance of adapting school procedures to individual differences. Thus in spite of the great growth in the school population, devices for individualising instruction are becoming more numerous and more effective. The defective or sub-normal child was the first to receive special attention. In the last few years, however, the realisation has grown that the gifted child suffers quite as much from subjection to an inflexible régime designed for the mediocre and that society suffers still more from a training process that hampers the full development of the superior individual. Hence a variety of experiments are now in progress throughout the United States which have as their object the identification and the appropriate education of the gifted pupil. In these experiments colleges and universities are beginning to participate through the establishment of so-called honours courses and through devices for segregating and stimulating the superior student.

Experiments in the Reconstruction of the Curriculum.—For some years the conviction has been gathering momentum that the curricula of schools at all levels are not only out of harmony with the requirements of modern life, but that they are also at variance with the laws of mental growth and of learning which the psychologists have been discovering. Modern living conditions have transferred to the schools a multiplicity of tasks previously performed by other agencies. The social aims of education have also become more prominent at the same time that the necessity of recognising the idiosyncrasies of the individual has been revealed. The problem of reconstructing the curriculum is now the central problem of American education. It is being attacked in hundreds of schools. Certain experiments have seemed promising enough to be widely imitated, with some local modification. One of these is the Dalton plan and another is the platoon or work-study-play plan. Under this plan, conspicuously in operation in public-school systems of Gary, Detroit and certain other cities, half the children are in classrooms while the other half are at work or at play in school shops, laboratories, studios, on the playground or in the auditorium. Decreased classroom space and greatly increased facilities for work and play are features of the physical plants of schools that operate on this plan. The school day is lengthened and the school becomes responsible for the child during the major part of his waking hours.

Cutting across schemes like those just mentioned, which involve complete reorganisation of the school in the interests of a more vitalised curriculum, is the project method. This method focuses instruction around typical problems actually encountered in life outside the school. In the course of solving these problems, or working out the projects, principles are discovered and learned. The topical organisation of instruction largely disappears. The pupils actively seek the solution of the problem wherever the search may lead, even outside the confines of the school. Experiments with the project method are numerous. Some schools have applied it in a few subjects, some in practically all subjects. A considerable body of teaching material is already available as a basis for such experiments. Instruction in vocational subjects is now largely dominated by some form of the project method. The system of co-operative part-time instruction first developed in the engineering school of the University of Cincinnati and now followed in many other engineering schools and industrial schools is founded on the same underlying concept.

Experiments in the reconstruction of the curriculum are not confined to schools or school systems that are committed to some new departure in method or in organisation. In many institutions where the older type of school regimen has not been radically changed, the curriculum is being experimentally revised by the introduction of new material, the elimination of old material and the alteration of the order of presentation. This movement is officially fostered by the Dept. of Superintendence of the National Education Association.

Numerous private schools have lately sprung up which are frankly experimental. These have come to be known as progressive schools. For the most part they have been inspired by the educational philosophy of John Dewey. They have been quick to take up and test under the most favourable conditions any methods, materials or plans of organisation that muster substantial scientific support. Devices that have proved successful in the progressive schools constantly find their way into the more conservative public institutions.

Experiments in Reorganising the Educational System.—The typical organisation of the American system consisting of an eight-year elementary school, a four-year high school and a four-year college, with entrance upon professional study coming either at the end or in the middle of the college course, has long been criticised. The several institutional units are the product of diverse influences, mostly foreign. The welding of them into a system was largely accidental. It is generally believed that the period devoted to secondary education is too short, that it should begin earlier and that secondary education should embrace much of the present content of the college curriculum. Educators commonly hold that with a rational organisation of the system and with an altered and condensed curriculum, time can be saved and educational results improved.

Two experimental movements looking toward the accomplishment of these reforms are now well under way. One of these involves the reorganisation of the elementary and secondary schools and has come to be known as the junior high school movement, or the six-three-three plan. Where junior high schools have been established the elementary school course is generally reduced to six years. This is followed by a junior high school course of three years, which in turn is followed by a senior high school course of three years. In theory the junior high school curriculum includes algebra, geometry, foreign languages, the social sciences and vocational subjects which were formerly reserved for the four-year high school. The practical difficulty which junior high schools have faced has been the absence of teaching materials in these branches appropriate for younger pupils. In spite of this handicap the establishment of junior high schools proceeds apace and numerous experiments in the production of materials are in progress.

At the other end of the conventional secondary school period another new institution is evolving, the junior college. The typical junior college offers the first two years of the usual college course, with certain modifications dictated by its local environment. There are (1926) between 200 and 300 independent junior colleges in the United States; the majority are private institutions but a large minority are attached to city school systems. Whether the junior college as a separate institution is a transitory phenomenon it is too early to say. Its appearance has had one noteworthy effect upon universities, however. It has led a considerable number of them to divide their colleges of liberal arts into junior and senior colleges and to organise the programme of instruction so that the end of the junior college period marks the completion of general education of a secondary character and the beginning of university specialisation. This tendency, together with the multiplication of junior colleges as upward extensions of public school systems, seems to point to the ultimate assimilation of the work of the first two years of the American college of liberal arts into the scheme of secondary education. (S. P. C.)

V. THE ARCHITECTURE OF SCHOOL BUILDINGS

Recent years have seen a complete change in the school design. Compactness, ease of supervision and convenience for the rapid movement of large numbers were the governing factors of the older type of plan; by eliminating corridors and placing the classrooms on three, or all four sides of a central hall, off which the rooms opened, the maximum amount of concentration was secured, while the head of the school had, from the central hall, an eye upon the door of every room. This form became stereotyped as the normal, but between 1905 and 1910 doubts arose as to whether this type of building was really so satisfactory. Good ventilation could not be secured in rooms having only one external wall, and such a plan made it impossible to secure the proper aspect for more than a few rooms.

The M Type Condemned.—These objections were raised from the point of view of health. The central position of the hall, serving as the access to the classrooms, seriously interfered with full use being made of it. Not only was any occupation liable to interruption, but any noise there interfered with the work in the adjoining rooms, the result being that in practice the hall was used for little more than the opening and closing of the school, while a room of this kind ought to play an important part in the general work of the school, and in fact was so used in schools that happened to have a hall separated from the classrooms. Thus the type of plan that had so long held the field had to give way. The rapidly growing recognition of the value of sunlight and fresh air, and the strikingly successful result of the open-air schools accelerated the remarkably rapid adoption of the newer type of school building. The greatly extended duties now laid upon the local education authorities in Great Britain with regard to the health of the children, and the feeling that they are as responsible for the physical as for the mental needs of the school child, imply that the conditions under which the work is carried on are hardly less important than the work itself and that, where necessary, educational convenience must be subordinated to the demands of health.

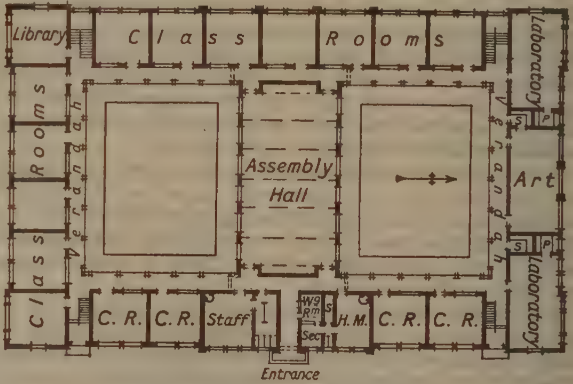

FIG. 1. Plan of a Model School.

The New Model.—In place of solid, compactly designed buildings of several storeys we find light, spreading, single-storey structures, often with radiating wings on the lines of a hospital, set to catch the greatest possible amount of sun, with every room cross-ventilated into the open air, windows opening so freely that practically the whole wall space can be cleared, or even so arranged that both sides can be thrown open; in short, the arrangement of the open-air school being adopted for the ordinary school.

In place of a common, stereotyped plan, schools are now built in an almost bewildering variety of arrangement. The essential features are the cross-ventilated classroom with a sunny aspect, usually approached by an open verandah or low corridor, with classrooms on one side only, and the hall, so placed as to be neither a passage to the classrooms nor likely to cause inconvenience, is used for any purpose involving noise.

The illustration (fig. 1) shows a quadrangular arrangement that is widely made use of for large schools. The open verandah on the inside secures direct sunlight at some period during the day to the rooms whose main windows have a northerly aspect. For a smaller school all the rooms are placed to the southeast with the hall well out of the way at the back, or are arranged with radiating wings with the usual cross-ventilated classrooms. These single-storey buildings require a larger area of ground, but, where possible, large sites are generally secured in order to make provision for games, and the fact of their being of one storey makes it feasible to lighten the construction, while subsequent alteration or addition is easy. (G. F. N. C.)

EDWARD, PRINCE OF WALES (1894–), eldest son of King George V. and Queen Mary, at that time duke and duchess of York, was born June 23 1894, at White Lodge, Richmond Park, and baptised 23 days later by the Archbishop of Canterbury as Edward Albert Christian George Andrew Patrick David. In 1902 Mr. H. P. Hansell was appointed his tutor, and remained with him from that time until Aug. 1914. During 1902–7 the Prince was prepared for the navy, and in the spring of 1907 he entered Osborne, where he remained for two years before going on to the Royal Naval College, Dartmouth. While a cadet at Dartmouth he performed his first public duty on March 29 1911, by presenting to the mayor and corporation of that town the silver oar which they had held formerly as a symbol of the rights associated with the bailiwick of the water of Dartmouth.

At the close of his Dartmouth training in June 1911, he was invested as a Knight of the Garter, and on July 13 1911 he was created Prince of Wales and Earl of Chester, his father having just become King. About the same time the duchy of Cornwall was bestowed upon him. He was shortly afterwards invested as Prince of Wales in Carnarvon Castle, and on this occasion for the first time an English prince addressed the Welsh people in their own tongue. Shortly after this event the Prince became a midshipman, and was appointed to H.M.S. "Hindustan," in which ship he served for three months. During the spring of 1912 the Prince spent five months in Paris as the guest of the Marquis de Breteuil, during which period he was coached by M. Maurice Escoffier in the language and history of the country. In Oct. 1912 the Prince entered Magdalen College, Oxford, with Maj. the Hon. William Cadogan (10th Hussars) as equerry. At Oxford the Prince took part in the corporate life of his college and the usual athletic amusements of the undergraduates. He resided in college rooms, dined in hall or at one of the university clubs, and mixed freely with his fellow undergraduates. Some of his vacations he spent in European travel, visiting Germany twice, in 1912 and 1913, and Denmark and Norway in 1914. The Prince's university career was ended by the outbreak of the World War in Aug. 1914. On Aug. 7 he was gazetted to the Grenadier Guards, and on the 11th he joined the 1st Battalion at Warley Barracks, Essex.

In Nov. 1914 the Prince, who had been appointed aide-de-camp to Sir John French, arrived in France and took up his new duties at British G.H.Q. at St. Omer. During the next 18 months he served with the Expeditionary Force in Flanders and in France in various parts of the line, being first attached to the 2nd Div. under Sir H.S. Horne, to the I. Corps under Sir Charles Monro, and later to the Guards Div. under the Earl of Cavan. In March 1916 he was appointed to the staff of the general officer commanding the Mediterranean Expeditionary Force, and proceeded at once to Egypt. He took the opportunity of seeing the troops in various parts of the line, and also went as far south as Khartum. On his return journey he paid a visit to the Italian headquarters at Udine, and by the middle of June had returned to the British armies in France. He was then attached to the XIV. Corps (Lord Cavan) in Flanders and France and subsequently proceeded with this corps, in Oct. 1917, to the Italian front, where he remained till Aug. 1918. In May 1918 the Prince paid a semi-official visit to Rome; he then returned to France and was attached to the Canadian Corps, with whom he was serving at the time of the Armistice. He was attached to the Australian Corps in Belgium till the beginning of 1919 after which he visited the Army of Occupation on the Rhine, spending a few days with the New Zealand division, and paying a short visit to Gen. Pershing at the American headquarters at Coblenz.

On his return journey to England at the end of Feb. 1919 the Prince almost immediately took up a number of public duties which had of necessity been deferred during the War, and on May 29 was admitted to the freedom of the City of London. On Aug. 5 1919 he left Portsmouth in H.M.S. "Renown" for Newfoundland and Canada, first setting foot on Canadian soil on Aug. 15 at St. John, New Brunswick. His tour extended through the entire Dominion from east to west, and five days after reaching Victoria on Sept. 23 the return journey began. The Canadian tour ended at Ottawa, and on Nov. 10 the Prince left for Washington to pay a short official visit to the President of the United States. New York was subsequently visited, and after a long series of official engagements, the Prince sailed for Halifax, where he bade good-bye to Canada, reaching Portsmouth Dec. 1.

After a short stay in England the Prince sailed again in H.M.S. "Renown" on March 16 1920 for New Zealand and Australia. The first port of call was Bridgetown, Barbados, and then, passing through the Panama Canal, the Prince paid short visits to San Diego (Cal.), Honolulu and Fiji, Auckland being reached on April 24 after a voyage of 14,000 miles. A month was spent in New Zealand, all parts of the North and South Is. were visited, and on May 26 the Prince landed at Melbourne. During his stay in Australia he visited all the states of the Commonwealth, and eventually sailed from Sydney on Aug. 19. On the return journey he stopped at Fiji, Samoa, Honolulu and Acapulco, and, after passing once again through the Panama Canal, the Prince spent three weeks in the West Indies. The last port of call was Bermuda, and H.M.S. "Renown" eventually reached Portsmouth Oct. 11 1920.

After a brief holiday, spent for the greater part in the hunting field, he resumed his public duties after Christmas 1920. During the first six months of 1921 he was occupied chiefly in London, but found time to visit, among other places, Oxford, Cambridge, Glasgow and the Clyde; his property in Devon, Cornwall and the Scilly Is.; Cardiff, Newport and Bristol. On Oct. 26 he sailed in the "Renown" on a state visit to India, visiting Gibraltar, Malta (where he opened the first Maltese Parliament) and Aden, landing at Bombay Nov. 17. After several weeks in India, he sailed from Calcutta for Rangoon (Jan. 2 1922) and proceeded to Mandalay, returning thence to Madras (Jan 13). There, as previously at Bombay, some rioting occurred in the native quarters on the day of his arrival; but on the whole he was splendidly received, even though attempts were made by the Swarajists, with occasional success, to persuade the population to remain indoors. At Delhi on Feb. 14 he received an address from the Indian Legislature. After visiting the northwest frontier he eventually embarked at Karachi on March 7, sailing thence to Japan, touching on the way at Colombo, Port Swettenham, Singapore and Hong Kong, and reaching Tokio April 12. He remained in Japan till May 9 and on the voyage home visited Manila, Borneo, Penang and Cairo, reaching Plymouth June 20.

In April 1923 he paid a visit to Brussels in order to dedicate the monument of British gratitude erected in that city and subsequently revisited the battlefields in Flanders and northern France. On Sept. 5 he sailed for Canada on a private visit to his ranch in Alberta, returning to England Oct. 20. On April 23 1924, as president of the British Empire Exhibition at Wembley, he received King George at the opening ceremony. He was also present at the close on Nov. 1. In the meanwhile he had again spent a short time on his ranch in Canada; on his way there he visited the United States in a private capacity, in order to witness the international polo matches, and took the opportunity of calling on President Coolidge, with whom he had luncheon at the White House. During 1923–4 he visited various industrial areas, including West Yorkshire, Birmingham, Newcastle-on-Tyne, Nottingham, Dundee, North Wales and the Potteries district.

On March 28 1925 he sailed in the "Repulse" for West and South Africa. Landing at Bathurst April 4 he visited in turn Gambia, Sierra Leone, The Gold Coast and Nigeria. Leaving Lagos on April 22, he reached Cape Town April 30, and after a short stay proceeded through the Cape Province and into the native territories of the Transkei. His journey was continued through the Orange Free State, and at Maseru he was greeted by 50,000 Basuto horsemen. During his stay in Natal he opened a new dock at Durban and was there welcomed by 23,000 Indians. He went through Zululand, Swaziland and thence to Pretoria and Johannesburg, where he opened the University of the Witwatersrand; then via Mafeking and the Bechuanaland Protectorate he travelled to Buluwayo and Salisbury.

On the return journey to Cape Town he visited Kimberley. After spending three months in South Africa he sailed July 29 for South America, having accepted an invitation conveyed to him in 1924 by the president of the Argentine Republic, to visit that country. Touching only at St. Helena for two days, he arrived at Montevideo Aug. 14. After three days spent in Uruguay, he reached Buenos Aires Aug. 17, stayed for a time in the capital, and made one or two tours in the country, including a journey of 1,500 miles to the cattle-raising districts in the provinces of Entre Rios and Corrientes. He crossed the Andes into Chile, visiting Santiago and Valparaiso, and after some delay, owing to avalanches of snow in the mountains, returned to Buenos Aires. Sailing from Mar del Plata for England Sept. 27, he touched at the Cape Verde Is. Oct. 8 and reached Portsmouth Oct. 16. In 1926 the Prince underwent a slight operation for ear trouble which temporarily interfered with his public duties.

EDWARDS, ALFRED GEORGE (1848–), first Archbishop of Wales, was born at Llanymawddwy Nov. 2 1848 and was educated at Jesus College, Oxford. He was ordained in 1874, and in 1875 became warden and headmaster of the college at Llandovery, holding this position until 1885, when he was appointed vicar of Carmarthen. In 1889 he was chosen Bishop of St. Asaph. In 1920, after the disestablishment of the Welsh Church, of which he had been one of the most active opponents, he was elected first Archbishop of Wales, and was enthroned by the Archbishop of Canterbury at St. Asaph's Cathedral, June 1.

Among his publications may be mentioned *The Church in Wales* (1888); *Common Sense Patriotism* (1894); and *Landmarks in Welsh Church History* (1912).

EGGLESTON, GEORGE CARY (1839–1911), American journalist and author (*see* 9.17), died in New York April 14 1911.

EGYPT (*see* 9.21), a kingdom of northeast Africa. The international boundaries of Egypt were completed in Dec. 1925, by an agreement between the Egyptian and Italian Govts. defining the western frontier. This starts from the Mediterranean 10 km. north of Sollum, takes a southwesterly and southerly direction, excluding the oasis of Jaghbub, and then in latitude 29° 21′ joins the 25th meridian, which it follows southward until it meets the 22nd parallel, this being the boundary between Egypt and the Anglo-Egyptian Sudan. The eastern land frontier approximates to a straight line, joining Rafah on the Mediterranean, to 'Aqaba on the gulf of that name. The total area of Egypt thus defined is 386,000 sq. miles. Population (1917) 12,750,918; (1925, estimated) 14,000,000.

I. POLITICAL HISTORY

The policy of entrusting the Egyptians with larger administrative responsibility was initiated under Sir Eldon Gorst, who succeeded Lord Cromer in 1907. The four years which elapsed before his premature death were too few for a fair trial of an experiment which stimulated rather than discouraged nationalist agitation. In Feb. 1910 Boutros Ghali Pasha, the first Copt to attain the rank of Prime Minister, was assassinated by a young member of the party. Nationalist influence also invaded the Assembly, which rejected a proposal to extend the concession of the Suez Canal Co. after its expiry in 1968. More drastic measures became necessary to check anti-British manifestations. Gorst, who had long been failing in health, requested to be relieved of his functions in July 1911 and died within the month. His knowledge of the country lends special importance to his report for 1910, in which he recognised that the new policy had failed.

Kitchener in Egypt.—It seemed doubtful whether the appointment of a former servant of the Egyptian Govt. to be British representative in Cairo was opportune, but an exception was justifiable in the case of Lord Kitchener, who enjoyed great prestige. He arrived in Sept. 1911. A fortnight later the Italian landing in Tripolitania followed a declaration of war with Turkey. The neutrality of Egypt was declared and strictly observed by the Egyptian people in spite of a natural sympathy with a Moslem belligerent. But Islamic sentiment was roused by the Libyan War, and early in 1912 a plot was detected to kill the Khedive, the Prime Minister and Lord Kitchener.

Kitchener's energies were first directed to the needs of the peasantry, and small holdings were exempted from distraint for debt. But the salient measure of his administration was a revision of the organic law of 1883 and the institution of a single Legislative Assembly on a broader basis than that of the old Legislative Council and General Assembly, both of which had practically the same functions. The new Assembly, with 55 members returned by indirect election, received extended powers, including that of initiating legislation. The president and one vice-president were appointed by the government. For the second elective vice-president Zaghlul Pasha, recently Minister of Education and acknowledged as leader of the Nationalists was chosen. He at once attacked his former chief, Mohammed Said, who had succeeded Boutros, and indirectly the British Agency in a Chamber which the Khedive encouraged to be hostile. Tension with the palace then led to the resignation of Mohammed Said. He was succeeded by Husein Rushdi Pasha, who remained in office till the end of 1918.

The War Period.—After the change in the status of Egypt which followed the outbreak of the World War, the sittings of the Assembly were suspended and not resumed before its mandate expired. Lord Kitchener was on leave when Great Britain became a belligerent, and having been appointed Secretary of State for War, he did not return to Egypt. Martial law was proclaimed in Egypt on Nov. 2 1914. This enabled administrative measures to be enforced without reference to the Assembly and, where foreign subjects were concerned, without obtaining the consent of foreign Powers. A further proclamation, notifying a state of war with Turkey, announced that Great Britain would not call upon the Egyptian people for aid. Units of the Egyptian artillery nevertheless volunteered to defend the Suez Canal, and Labour Battalions, voluntarily raised, played an important part in the War.

As the Egyptians were nominally subjects of the Sultan, the entry of Turkey into the War created an intolerable situation. Turkish suzerainty might have been terminated by a British annexation of Egypt, but that policy was rejected, and a proclamation issued on Dec. 17 1914 by the Secretary of State for Foreign Affairs announced that:—

> In view of the state of war arising out of the action of Turkey, Egypt is placed under the protection of His Majesty and will henceforth constitute a British Protectorate. The suzerainty of Turkey over Egypt is thus terminated and His Majesty's Government will adopt all measures necessary for the defence of Egypt and protect its inhabitants and interests.

A further proclamation issued the following day announced that the Khedive, Abbas Hilmi, who was in Constantinople, was deposed on the grounds of adherence to the King's enemies, and that his uncle, Prince Husein Kamel, had accepted the succession and would bear the title of Sultan of Egypt. The new status was introduced without disturbance if without enthusiasm under the direction of Sir Milne Cheetham, pending the arrival of Sir Henry McMahon, who had been appointed High Commissioner. The British Representative then took over the control of Egyp tian foreign affairs. After the abortive Turkish attack on the Suez Canal, the prestige of the Sultan increased, but the failure in the Dardanelles produced some reaction and in 1915 his life was twice attempted. The Egyptian people, however, bore with patience the disabilities and unwelcome requisitions which the War entailed, and thus laid Great Britain under obligations, both moral and financial, for which too little credit was given.

On the other hand the withdrawal of British officials for service elsewhere opened a wider field for Nationalist propaganda, which found ready listeners among the younger men who had not known the pre-occupation conditions. Nationalist sentiment had from the first received an anti-British impulse from rivalries among the western Powers, and it was at one time exploited by the Khedive for his own personal ends. A dissatisfied civil service regarded the growing number of British officials as a bar to promotion and Nationalist ranks were reinforced by the students, whose prospect of obtaining state employment was diminished by foreign competition. A professed intention to train Egyptians to manage their own affairs seemed inconsistent with a constant increase of British officials, disproportionate even to the expanding activities of the departments. These, moreover, had tended to absorb administrative functions and not merely to advise. As their number grew, they became a separate community living aloof from Egyptians, and with loss of contact their moral influence diminished. The strength acquired by the Nationalist movement during the War was not sufficiently realised.

At the end of 1916 Gen. Sir Reginald Wingate, Sirdar and Governor-General of the Sudan since Dec. 1899, replaced Sir H. McMahon as High Commissioner. The declining health of Sultan Husein made a settlement of the succession urgent. His only son, Prince Kemal ed Din, declined the position of heir-apparent, which was then offered to the sixth son of Ismail, Prince Fuad, who had been educated at the military school at Turin. Sultan Husein died in Oct. 1917. It was a misfortune for Egypt to lose a ruler remarkable for his character, public spirit and thorough knowledge of his own country.

End of the War.—The principles formulated by the President of the United States towards the close of the World War had a far-reaching effect on educated opinion in Egypt. Numerous disclaimers by British statesmen of any intention to occupy the country permanently were insistently recalled, and the acceptance of the principle of self-determination was represented as having given international sanction to the aspirations of Egyptians to govern themselves. Their attitude during the War was made a plea for special consideration. When in Nov. 1918, an Anglo-French declaration announced that the Allies contemplated the enfranchisement of the peoples oppressed by Turkish rule, Egyptians regarded their title to manage their own affairs to be even stronger than that of Syria, Mesopotamia or of Arabia, where an independent kingdom had already been established.

Public opinion was at the same time excited by the indiscreet publication of a document which was held to indicate the British attitude toward the re-organisation of the Legislative Assembly. Sir W. Brunyate, the judicial adviser who acted as financial adviser during the illness of Lord Edward Cecil, had mooted the question of the participation of the foreign colonies in legislation, if capitulations were abolished, in a memorandum submitted to the Prime Minister, which was only intended to serve as a basis for confidential discussion. It was represented as a British design for restricting the Assembly to consultative functions and for vesting legislative power in a Senate in which the officially nominated members with a group of elected foreigners would form a majority.

At the end of 1918 a Nationalist Committee was formed under the chairmanship of Zaghlul. His proposal to proceed to England with a programme of complete autonomy was inevitably rejected. At the same time Sir R. Wingate pleaded with insistence for the reception in London of Rushdi Pasha and Adly Pasha Yeghen, the Minister of Education. As the Foreign Secretary was about to start for the Peace Conference and unable to devote due attention to Egyptian internal affairs, the Ministers were begged to defer their visit. Rushdi and Adly, however, tendered their resignations and, though they were pressed to reconsider their decision, the crisis remained unsolved when Sir R. Wingate was summoned to London to make a personal report. By this time many Moderates had rallied to the Nationalists, who were receiving such general support that the Ministers were unwilling to remain in office or to go to London unless Zaghlul were also heard, a condition to which his defiant attitude made it difficult to accede. Meanwhile, the constitution of a "Delegation" with 12 members under Zaghlul's presidency was announced to the foreign representatives. The delegation forwarded to the Sultan, who had declined to receive them, a petition clearly designed to intimidate His Highness and prevent the formation of a new government. Zaghlul and three of his most important adherents were consequently arrested March 8 1919 and deported to Malta.

The Outbreak of March 1919.—The immediate effects of this measure revealed the gravity of the internal situation in Egypt, which had probably been under-estimated. Anti-British demonstrations in Cairo necessitated military intervention. There were disturbances at Tanta and in the Delta provinces where British soldiers and civilians were attacked. Railway lines were torn up, telegraph wires cut and by the middle of March, Cairo was isolated. Foreign colonies were blockaded in Upper Egypt, and at Dairut station a British inspector of prisons, two officers and five other ranks were brutally murdered in the train by a fanatical crowd. Mobile columns were rapidly despatched to disturbed areas, communications were re-established and before the end of March the situation was well in hand. The Nationalist leaders had probably not contemplated such a serious upheaval, which was nevertheless the direct result of their propaganda. The Egyptian Police behaved throughout in an exemplary manner. The Egyptian Army which, all but a few units, was in the Sudan, remained unaffected.

With these exceptions the agitation was supported by every class including the Copts, whose solidarity with the Mussulman was no doubt prompted by prudential considerations. If the movement was only partial among the peaceful unchanging fellaheen it was nevertheless perceptible that their experiences during the War had stirred a spirit of discontent even in the class which had benefited most from the British occupation. Recruiting for the Labour and Camel Corps had not been unpopular in the earlier volunteer stage. But when voluntary enlistment ceased to produce a sufficient number of men some administrative compulsion was exercised by unscrupulous mayors who, alleging British insistence, accepted bribes for exemptions and sent their enemies to serve. The requisition of domestic animals had pressed hardly on the small farmer and still more so that of cereals. Requisition rates, lower than market prices, tempted local officials to collect more than the quotum demanded and to sell the balance. Processes of verification and repayment were inevitably slow and offered opportunity for abuses. The cost of food, clothing and fuel rose in an unprecedented manner and the average wages of the labouring class did not expand correspondingly. Meanwhile the producer of cotton and the privileged foreigner were notoriously accumulating fortunes.

When the outbreak became serious, Lord Allenby, the commander-in-chief in Egypt, who had left for Paris, was directed to return at once as Special High Commissioner during the absence of Sir R. Wingate. After the restoration of law and order a phase of passive resistance succeeded that of aggression. A general strike was only maintained for a few days, but students, lawyers and a number of officials declined to resume their activities. Lord Allenby, however, adopted a policy of conciliation, and a removal of the embargo on the free movement of Egyptians entailed the liberation of Zaghlul and his associates. They left Malta for Paris, where their efforts to obtain a hearing at the Peace Conference were disappointed. Early in April Rushdi succeeded in reconstituting a Ministry with Adly at the Interior but, finding himself impotent to terminate the official strike, he resigned barely a fortnight later. Only a stern proclamation from the commander-in-chief, acting under the powers of martial law, which threatened with dismissal all officials who did not resume duty, had the desired effect.

The Milner Mission.—The British Govt. now decided to send a mission to Egypt under the chairmanship of Lord Milner, "to enquire into the causes of the recent disorders, and to report on the existing situation in the country and the form of the constitution which, under the protectorate will be best calculated to promote its peace and prosperity, the progressive development of self-governing institutions and the protection of foreign interests." It would have been well if the mission could have proceeded at once before the Nationalists had completed an organisation which was now receiving encouragement from sections of the Arab University of El Azhar. But circumstances rendered its departure before the autumn difficult. After some delay, Mohammed Said Pasha (Prime Minister 1910–3) formed an Administration. Changes in the British personnel were also regarded as opportune. Sir Paul Harvey, who had resigned the position of Financial Adviser under Lord Kitchener, returned. Sir W. Brunyate, who had acted in that capacity since the death of Lord Edward Cecil, also resigned his judicial advisership. Mr. Douglas Dunlop was replaced at the Ministry of Education by Mr. R. S. Patterson, Director-General of Accounts, and Brig. Gen. Sir J. F. Clayton became adviser to the Interior.

A period of drift followed during which the Nationalists zealously applied a boycott of the mission. Capital was also made out of an alleged intention to curtail the water supply of Egypt in favour of the Anglo-Egyptian Sudan. The project actually adopted contemplated the construction of barrages at Jebel Aulya and Sennar, on the White and Blue Niles respectively, to create a reservoir which would enable the waste lands of Egypt to be redeemed and extend perennial irrigation to some 1,200,000 ac., which under basin irrigation produced only one crop a year. The Sennar dam would feed a canal to irrigate the region south of Khartoum known as the Gezira, which was eminently suitable for cotton. Unjustified attacks by Sir W. Willcocks and Col. Kennedy on Sir Murdoch Macdonald, adviser to the Public Works Dept., gave encouragement to misrepresentation and rendered inevitable a prosecution for criminal libel which resulted in conviction. The proposal to boycott the mission moreover gained strength from the attitude of the Prime Minister, who resigned when his protest against its despatch before the signature of peace with Turkey was disregarded. Wahba Pasha, the Minister of Finance, courageously undertook to constitute a Ministry of Affairs.

The special mission which reached Cairo on Dec. 7 1919 was thus composed: Viscount Milner, Chairman; Sir J. Rennell Rodd, Gen. Sir John Maxwell, Brig. Gen. Sir Owen Thomas, Sir Cecil Hurst and Mr. J. A. Spender with A. T. Loyd and E. M. B. Ingram as secretaries. Special measures had been taken for their safety in view of an organised antagonism, in which even the Cairene ladies took a demonstrative part. Pickets of students watched their hotel, and individual members were followed into the provinces. A visit to Tanta provoked riots in that city. During the residence of the mission in Cairo, there were repeated assaults on British soldiers and no less than three attempts to assassinate Egyptian ministers with bombs. The chiefs of El Azhar now openly identified themselves with the Nationalists in a manifesto addressed to the High Commissioner. Innumerable letters and resolutions were received denouncing the protectorate.

A declaration issued on Dec. 29, in which the real objects of the mission were clearly stated, had some reassuring influence. But relations with Egyptians were restricted to informal discussions with individuals who had the courage to be independent. As time went on, however, such conversations became general and the mission found no difficulty in estimating the current feeling in the country. The chief British officials were consulted as well as representative members of the non-official community. The working of every department was thoroughly investigated, while Sir Cecil Hurst devoted much time to an examination of the judicial system and the reforms which new conditions might entail. Some days were spent in Alexandria, where the views of the foreign colonies were heard. Sir John Maxwell and Sir Owen Thomas also visited the Sudan. Before the departure of the mission, in March 1920, a large volume of material had been assembled, and certain proposals, unanimously adopted, were provisionally drafted pending the preparation of a final report in England.

Negotiations with Zaghlul.—Shortly after their return occasion was taken, through the good offices of Adly Pasha, to enter into relations with the Egyptian Delegation then established in Paris which, it could no longer be doubted, represented a majority of Egyptian opinion. Zaghlul, with seven other delegates, came to London in June. Meanwhile Wahba Pasha, whose health proved unequal to the strain of office, had resigned and was succeeded by Tewfik Pasha Nessim. After deliberations extending till the middle of Aug., in which Adly also took an unofficial conciliatory part, a memorandum which came to be known as the Milner-Zaghlul agreement, was drafted. It adopted the basis of settlement proposed by the special mission, a treaty of alliance in which Egypt contracted definite obligations in return for the recognition of independence, with certain additions such as the acceptance in principle of the rights of Egypt to foreign representation. Any reference to the Sudan was specifically excluded. As Zaghlul and his colleagues were not prepared to commit themselves to definite agreement without consulting their supporters, four members of the delegation proceeded to Cairo. The substance of the memorandum may be summarised as follows:—

> To establish the independence of Egypt on a secure and lasting basis it is essential to define precisely the relations between Great Britain and Egypt and to modify the privileges and immunities actually enjoyed by capitulatory Powers. Negotiations between accredited representatives of the two governments should contemplate: a treaty of alliance between Great Britain and Egypt under which Great Britain will recognise the independence of Egypt as a constitutional monarchy with representative institutions, and Egypt will confer upon Great Britain the rights necessary to safeguard her special interests and to enable her to give foreign Powers guarantees which will secure relinquishment of capitulatory rights: Great Britain will defend the integrity of Egyptian territory, and Egypt will, in case of war, render Great Britain all assistance in her power within her own borders. This treaty will stipulate that Egypt will enjoy right of representation in foreign countries, and in absence of an accredited representative confide her interests to the British representative; Egypt will not adopt an attitude inconsistent with the alliance, or enter into any agreement with a foreign Power prejudicial to British interests; Egypt will confer on Great Britain the right to maintain a military force on Egyptian soil for the maintenance of her Imperial communications; Egypt will appoint with the concurrence of H.M. Government a financial adviser, who will take over powers now administered by the Commissioners of Debt and will be generally available for consultation; Egypt will similarly appoint a British official in the Ministry of Justice, with access to the Minister, to have cognisance of all matters affecting foreigners and be available for consultation regarding maintenance of law and order; Egypt will recognise right of Great Britain to intervene should legislation operate inequitably against foreigners; the British representative will enjoy a special position and precedence; engagements of British or other foreign employees may be terminated by either party within two years after treaty comes into force with pension or compensation to be determined therein.
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> Further provisions dealt with maintenance of existing treaties, validation of measures taken under martial law, reorganisation of mixed tribunals, closing of consular courts, etc.

Zaghlul and his colleagues once more met the mission in Oct. 1920, after the return of the four delegates from Egypt. The latter reported that the proposed settlement had been well received At the same time they had been urged to invite modifications of certain points, including a restriction of the functions of the financial adviser and the official attached to the Ministry of Justice. The mission held that no good purpose could be served by further discussion at that stage. Zaghlul, whom several members of the delegation regarded as too intransigent, insisted that his efforts to promote a settlement might be compromised if he could give no undertaking regarding the abolition of the protectorate. The delegates then left England and the mission forwarded a report to the Secretary of State on Dec. 29 1920, which was presented to Parliament as Egypt No. 1 (1921).

At the beginning of 1921 Adly Pasha had a strong following in Egypt and Zaghlul's influence appeared to be diminishing. On the other hand the resignation of Lord Milner was regarded as an indication that H.M. Govt. might not endorse the recommendations of the mission, while a reference in a speech from the new Colonial Secretary to Egypt as included in the elastic circle of the British Empire, evoked a number of protesting telegrams.

When, however, the report was published in Arabic, the proposals were welcomed and the ascendancy of the Moderate party was re-established. The following invitation was then addressed to the Sultan of Egypt:—

> His Majesty's Govt. after a study of the proposals made by Lord Milner have arrived at the conclusion that the status of protectorate is not a satisfactory relation in which Egypt should continue to stand to Great Britain. While they have not reached final decisions with regard to Lord Milner's recommendations, they desire to confer regarding them with a delegation nominated by Your Highness, with a view, if possible, to substitute for the protectorate a relationship which would, while securing the special interests of Great Britain and enabling her to offer adequate guarantees to Foreign Powers, meet the legitimate aspirations of Egypt and the Egyptian people.

Adly Pasha then formed a Ministry with a programme designed to secure the co-operation of the Nationalists. He invited Zaghlul, who had remained in France, to collaborate in forming a delegation. But the claims which the latter advanced for his party, which included the presidency and a majority of the members, were quite unacceptable. Zaghlul returned on April 5 and was received with enthusiasm. He lost no time in attacking the new Government. His philippics, and the weakness of the Administration in dealing with mob violence at Tanta, led to outbreaks in Cairo and Alexandria, directed in the latter city chiefly against the Greeks. A military court of enquiry attributed responsibility to the Zaghlulist party. Sixteen of the rioters found guilty were executed and a large number were condemned to lighter sentences.

Negotiations with Adly Pasha, 1921.—Six months had elapsed since the presentation of the Milner report before a delegation under the presidency of Adly, pledged to demand the abolition of the protectorate and the maintenance of the reserves formulated, proceeded to London in July 1921 to negotiate with Lord Curzon of Kedleston. In the ensuing conversations, all reference to the Sudan was avoided as it had been in negotiations with the mission, and the Egyptians appeared to have disinterested themselves in the abolition of the capitulations. Certain divergencies seemed capable of adjustment on a basis of compromise, while others, such as the control of foreign affairs, presented greater difficulty. But the negotiations, which were adjourned for some weeks and resumed in Sept., broke down completely on the military issue. The British Govt. were unable to give the delegation an assurance that British troops would withdraw towards the Canal zone as soon as conditions in Egypt were stabilised. Adly, while ready to accept the permanent establishment of a British military force to protect imperial communications, claimed that it should be restricted to a defined area in peace time, and that there should be no interference in the internal affairs of Egypt. A draft treaty, embodying conditions accepted by H.M. Govt. but unhesitatingly rejected by the delegation, was published on Dec. 2 1921, together with the letter to the Sultan in which it was forwarded.

Having failed to achieve a settlement, Adly resigned. The problem of finding a successor under prevailing conditions proved insoluble. The administration, though fortified by a number of British assistants, could not be carried on without the machinery of an Egyptian Govt., in default of which no real co-operation could be expected from Egyptian officials. The assent of H.M. Govt. to the restoration of an Egyptian Minister for Foreign Affairs, the revival of whose office might legitimately be regarded as a preliminary step to the modification of the protectorate policy, encouraged Sarwat Pasha in his efforts to form a Ministry. But they were unavailing. There was in practice an administrative strike.

A visit to Egypt of some members of the Labour party, while the London negotiations were in process, was followed by, if it did not actually stimulate, renewed activity on the part of the extreme Nationalists. Zaghlul himself attempted a progress through Upper Egypt but encountered such a hostile reception at Assyut that he abandoned the project. He continued, however, to agitate in Lower Egypt, where demonstrations assumed a menacing character after the publication of the note to the Sultan, and two British soldiers were shot. In view of their defiant attitude, Zaghlul and his chief supporters were ordered to retire to their country estates; as they proved recalcitrant, he and five others were deported by the British authorities.

Egypt Declared Independent.—The disturbances, which had taken a serious form in Cairo, were vigorously suppressed and by the end of the year (1921) conditions were favourable for a further endeavour to terminate a situation which could not be allowed to continue. No progress could be made until some form of settlement assured co-operation from the Egyptian element. H.M. Govt. were concerned not to surrender a position of vital importance to the Empire without adequate guarantee for the future. On the other hand repeated postponements and abortive negotiations had produced an internal situation in Egypt from which there was no issue save on the one hand by Draconian measures, or on the other by a voluntary abandonment on the British side of non-essential points. Lord Allenby therefore proceeded to London to lay the situation before the Cabinet. The following declaration was sent the Sultan on Feb. 28 1922:—

> Whereas H.M. Govt. in accordance with their declared intentions desire to recognise Egypt as an independent sovereign state, and
>
> Whereas the relations between H.M. Govt. and Egypt are of vital importance to the British Empire, the following principles are hereby declared:—
>
> (1) The British Protectorate over Egypt is terminated and Egypt is declared to be an independent sovereign state.
>
> (2) So soon as the Govt. of His Highness shall pass an Act of Indemnity with application to all inhabitants of Egypt martial law as proclaimed on Nov. 2 1914, shall be withdrawn.
>
> (3) The following matters are absolutely reserved to the discretion of H.M. Govt. until such time as it may be possible by free discussion and friendly accommodation on both sides to conclude agreements in regard thereto between H.M. Govt. and the Govt. of Egypt: (*a*) the security of the communications of the British Empire in Egypt; (*b*) the defence of Egypt against all foreign aggression or interference direct or indirect; (*c*) the protection of foreign residents in Egypt and the protection of minorities; (*d*) the Sudan. Pending the conclusion of such agreements, the *status quo* in all these matters shall remain intact.

If the report of the special mission had convinced the British Govt. that the protectorate was not a relation which could be permanently maintained, the rejection of the general settlement then proposed had not rendered the situation more favourable. It had been established in the preliminary negotiations with the mission that agreement on the points reserved and certain others should be a condition of the recognition of Egyptian independence. The concession was now made unilaterally and the British postulates were to await an opportune time for discussion and solution. In the meanwhile, however, the *status quo* was maintained in so far as a British Army remained in occupation.

Sarwat Pasha was then able to form a Ministry with a programme contemplating a democratic constitution, ministerial responsibility and the revocation of martial law. After the British Parliament had approved the declaration of Feb. 1922, the Sultan assumed the title of King and proclaimed Egypt a monarchy. An Egyptian Minister for Foreign Affairs was once more appointed. The British Govt. informed the Powers that special relations between Great Britain and Egypt would always be maintained as an essential British interest. They could admit no question or discussion of those special relations, and any interference in the affairs of Egypt by any other Power would be regarded by them as an unfriendly act.

The constitution, drafted by a representative commission, was completed by Oct. 1922. H.M. Govt. took exception to the ascription to King Fuad in the draft of the title of "King of Egypt and the Sudan" as well as to other clauses referring to the latter region. Acute differences also arose between the Ministry and the King, whose views regarding the suitability of democratic institutions for Egypt seemed hardly consistent with his public utterances. Sarwat consequently resigned in Nov. and Tewfik Nessim became Prime Minister for the second time. A further obstacle to progress was presented by a series of outrages on British subjects, which culminated in the assassination in broad daylight of Prof. Newby Robson by three students. The Egyptian Govt. were informed that the continuance of these attacks would make impossible the abolition of martial law.

Events in 1923.—Tewfik Nessim was anxious to promulgate the constitution before announcing an Indemnity Act. But the King strenuously resisted a modification of his title, and a period of tension ensued which only ended after his signature of a document formally accepting the views of the British Government. Tewfik Pasha then resigned and an interregnum of five weeks followed, during which a recrudescence of murder and bomb-throwing rendered a severer application of martial law inevitable. Yehia Ibrahim Pasha finally formed an Administration which assumed office in March 1923. Shortly afterwards Zaghlul Pasha was released unconditionally from detention at Gibraltar to undergo a cure at Aix-les-Bains. Yehia's Govt. found themselves at once in conflict with the Sovereign, who had availed himself of the compliance of Tewfik Nessim to introduce modifications into the constitution, which would greatly have increased the authority and prerogatives of the Crown. The firmness of the Prime Minister secured their withdrawal and the constitution was promulgated on April 19 1923. The old Legislative Assembly ceased to exist and a new electoral law came into force.

The New Constitution.—A constitutional monarchy is thereby established with two Houses, a Senate and a Chamber of Deputies, and a Ministry responsible to the Lower Chamber. Deputies, 220 in number, are chosen by universal suffrage, under the old system of indirect election, for five years. The Senate cannot be dissolved. Two-fifths of its members are appointed by the Sovereign and three-fifths are elective, with a mandate for ten years. One half of each category are renewable every five years. A two-thirds' majority in each House is necessary for a revision of the constitution.

An Act of Indemnity prohibiting any process or plea calling in question acts under martial law was issued in July and that jurisdiction, continuously in force since Nov. 1914, was then terminated by a proclamation of the commander-in-chief and an exchange of notes between the British and Egyptian Governments. Yehia also carried through a law governing the retirement and compensation of foreign officials in the Egyptian service. After the abolition of martial law, Zaghlul and his associates were free to return to Egypt. Considerable enthusiasm was displayed on his landing at Alexandria and the coming elections proved that his influence was still predominant in the country.

The internal situation at the end of 1923 was not very reassuring. A revival of arbitrary action became manifest after the removal of direct British control, nepotism began to reassert itself and a general sense of insecurity prevailed. On the other hand the continual intrigues of the ex-Khedive Abbas Hilmi for the recovery of his throne had culminated in an attempted *coup d'état* which proved a complete fiasco. Vigorous efforts to repress the murder campaign had also been successful. A large number of students were arrested and three turned king's evidence. Of 14 who were tried, five were acquitted, three were sentenced to death, three to penal servitude and the remainder to lighter sentences.

Events of 1924.—When the elections to the Chamber of Deputies were completed in Jan. 1924, the return of 176 supporters gave Zaghlul an overwhelming majority. He was equally strong in the Senate. Yehia, who had deserved well of his country during the transitional period, resigned and Zaghlul formed a Ministry. The almost simultaneous advent to power of a Labour Govt. in England revived Egyptian hopes that the Sudan policy would be reconsidered. But a declaration made (June 25) in the House of Lords by Lord Parmoor that the British Govt. did not intend to evacuate the Sudan evoked violent protests from Zaghlul. Nor was the statement in the House of Commons by Mr. Ramsay MacDonald a few days later more encouraging, though he expressed the hope that the Egyptian Prime Minister would come to England to discuss the issue.

The latter, who was now completely master of the situation at Cairo, had repeatedly affirmed that he would only accept discussion on the basis of the incorporation of the Sudan in Egypt. In view of the unequivocal attitude of the British Govt. and Parliament, he tendered his resignation, which was, however, not accepted. When about to start for Alexandria, where the court was established for the summer, he was shot at and wounded by a young Egyptian who appeared to be of unbalanced mind and not closely connected with any political movement. He recovered quickly and proceeded to Europe to recruit his health.

Meanwhile Nationalist propaganda had transferred its activity to the Sudan, and disturbances, of which there had been some premonition a few weeks earlier, broke out (Aug. 9–11) at Khartoum, the Atbara post and Port Sudan. A proposal from Cairo for an Egyptian-Sudanese commission of enquiry elicited a firm reply from H.M. Government. The governor-general was alone responsible for order in the Sudan. Egyptian and other troops which were guilty of disaffection would be removed and replaced by such British troops as might be considered necessary.

After the recognition of independence, the Egyptian Govt. claimed an exclusive right of decision in certain international issues hitherto dealt with by the British Government. They declined to be bound by the result of negotiations undertaken in their behalf regarding the boundary of Cyrenaica and the possession of the oasis of Jaghbub, which the British Govt. proposed to regard as Italian territory in return for a rectification of frontier at Sollum.[1] Direct negotiations would therefore be opened with the Italian Government. They also contended that, having ceased to be a dependency of the Sultan, Egypt could no longer be held liable for the tribute to Turkey. As the tribute had been made the security for two Turkish loans, the disclaimer of liability presented serious difficulties. It was proposed that a conference of interested Powers should study the question or that it should be referred to the International Court at The Hague. After June 1924, moreover, the Egyptian Govt. ceased to make an annual contribution towards the cost of the army of occupation. This contribution had been fixed at £150,000 per annum by an exchange of notes in 1907.

Meeting of Prime Ministers.—A meeting between the British and Egyptian Prime Ministers eventually took place in London (Sept. 25–Oct. 3 1924), but it was fruitless in results owing to the inordinate pretensions of Zaghlul who, when once Egyptian independence became an accomplished fact, repudiated any obligation to reciprocal concessions. He was informed by Mr. Ramsay MacDonald that no British Govt. could divest itself of its interest in guarding the Suez Canal, for which security must be provided in any agreement between Great Britain and Egypt. Effective co-operation might have been established by a treaty of alliance. The British force to be maintained in Egypt would neither interfere with the functions of its Govt. nor encroach upon its sovereignty.

He adhered to the declaration made in the House of Commons that no arrangement which would jeopardise the administration and development of the Sudan could be contemplated. The British Govt. had the duty of maintaining order there, and there could be no question of abandoning the Sudan until the work of Great Britain was completed. At the same time the special interest of Egypt in the water supply was recognised as well as certain financial claims against the Sudan Government. These interests Great Britain was prepared to secure.[2]

The contrast between the two points of view was irreconcilable and Zaghlul's Govt. responded by replacing men of moderate opinions in the public service with uncompromising Nationalists. A phase of acute tension between Zaghlul and the Palace now became manifest and the King was openly accused of violating the constitution. At the same time a sense of preoccupation in Egypt at the indefinite prolongation of unsettled conditions was appreciable after the failure of negotiations with a Govt. the attitude of whose members in opposition had aroused unwarranted anticipations. The Minister of Finance, Tewfik Nessim, resigned, and Zaghlul himself, confident of evoking a renewed demonstration of popular support, also offered his resignation on the eve of the meeting of Parliament. The King, impressed by the unanimity of Parliament and popular opinion, refused to accept it.

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[1] The agreement for the rectification of the frontier between Egypt and Cyrenaica by which the oasis of Jaghbub was recognised as Italian territory was signed on Dec. 6 1925.

[2] The results of these conferences are summarised in a despatch (Oct. 7) from Mr. Ramsay MacDonald. (Cmd. 2269 of 1924.)

Murder of Sir Lee Stack.—On Nov. 19 1924 Sir Lee Stack, the Sirdar and governor-general of the Sudan, was shot in broad daylight while driving through the streets of Cairo and his aide-de-camp was wounded. The assassination roused a storm of indignation in Great Britain. Rigourous measures were called for. The demands put forward by Lord Allenby (British Note of Nov. 22) were tantamount to an ultimatum. They required:—

1. An ample apology for the crime.
2. An enquiry into the authorship of the crime with the utmost energy and without respect of persons, and the condign punishment of the criminals, whoever and whatever their age might be.
3. The prohibition and vigourous suppression of all popular political demonstrations.
4. The payment forthwith to the British Govt. of a fine of £500,000.
5. The withdrawal from the Sudan within 24 hours of all Egyptian officers and the purely Egyptian units of the Egyptian Army with the resulting changes to be specified later.
6. Notification to the competent department that the Sudan Govt. would increase the area to be irrigated at Gezira from 300,000 feddans to an unlimited figure as need might arise.
7. The withdrawal of all opposition in the respects to be specified later to the wishes of the British Govt. concerning the protection of foreign interests in Egypt.

If these demands were not immediately complied with, the British Govt. would at once take appropriate action to safeguard their interests in Egypt and the Sudan.

The 5th and 6th of these demands being declared unacceptable, while an evasive answer was returned to the 7th, the British authorities took immediate action. The Egyptian Govt. were informed of instructions sent to the Sudan Govt. to effect the removal of all Egyptian officers and of the purely Egyptian units. The restriction of the irrigable area of the Gezira to 300,000 feddans would be regarded as no longer binding. At the same time the customs at Alexandria were occupied by a British force. Certain individuals under suspicion of conspiracy were arrested by the British but handed at once to the Egyptian authority. These vigorous measures inevitably led to the resignation of Zaghlul, who was replaced by Ahmed Pasha Ziwar, the president of the Senate, with a Ministry of moderate views. They lost no time in negotiating a settlement with the British Govt. which secured the evacuation of the customs, after which they were joined by Ismail Sidky Pasha. A mutiny in a section of the Sudanese troops at Khartoum which broke out at this moment was rapidly suppressed. The Egyptian Parliament was adjourned and finally dissolved at the end of 1924. An appeal which it had addressed to the League of Nations and to the parliaments of other countries for intervention remained without response.

Events of 1925.—The elections which followed the dissolution left the political situation uncertain. A new Union party (*Ittihad*), formed under the inspiration of the Palace, had for its object to draw away from Zaghlul's party, the *Wafd*, many of those to whom his intransigence had become distasteful, and while a number of his former adherents adopted the Union programme, others who stood as Independents professed their intention if returned of joining either the Unionists or the Liberals. On the reassembling of Parliament, however, Zaghlul defeated the ministerial candidate for the presidency of the Chamber by a majority of 40, and it became evident that the Independents had repudiated their undertaking to separate themselves from the *Wafd*.

In view of the support thus openly given to the leader whose policy has led up to the British ultimatum, the Ministry could only recommend the King to dissolve the newly elected Parliament. A commission under the chairmanship of Ismail Sidky, in which the Liberal element predominated, was then appointed to revise the electoral law so as to restrict the suffrage to Egyptians whose education and interests would render them less amenable to popular agitation. The opposition appeared for the moment disconcerted and disarmed, and Ziwar Pasha, the Prime Minister, was able at length to contemplate a cure in Europe, leaving the Administration in the hands of Yehia Ibrahim Pasha, the Minister of Finance. Lord Allenby took advantage of this period to retire from the high commissionership.

Sir George Lloyd, afterwards Lord Lloyd, was appointed to succeed him. By the time he arrived to take up his post the political situation threatened once more to become critical. During the absence of the Prime Minister, the influence of Nashat Pasha, the head of the King's privy cabinet, his most trusted adviser, became paramount. In promoting the formation of the *Ittihad* party his object had been to eliminate from power the Liberals, who were strenuously opposed to any extension of the royal prerogative. A plausible pretext having been found for the dismissal of the Minister of Justice, the Liberal colleagues of the latter tendered their resignation, as also did Sidky Pasha who was at the time in Europe. The Liberal Party, in return for Zaghlul's promise that the selection of candidates for the coming election would be made on a basis of administrative capacity, now entered into intimate relationship with the *Wafd*. But the promise made was not fulfilled, and at the meeting of the coalition on Feb. 19 1926, the solidarity of the opposition was seriously endangered. Zaghlul lost no opportunity of impressing on the Liberals, as well as on the *Ittihad*, their dependence upon his support. The collapse of the latter was marked by the transfer of Nashat to a diplomatic post—the first indication of the influence exercised by Lord Lloyd..

The General Election.—Meanwhile the Prime Minister took the wind out of Zaghlul's sails by announcing that the revised electoral law had been withdrawn and that elections would be held under the law of 1924; namely, by direct democratic representation. The meeting of the opposition consequently confined itself to passing resolutions charging Ziwar's Govt. with having violated the constitution by dissolving Parliament, an accusation for which there was in fact no legal justification. Despite their tactics the Liberals soon found themselves in the position of having paid a heavy price for an alliance which benefitted them not at all. Nevertheless, every attempt to induce other Egyptians to join the Cabinet in their place proved abortive. But if the prestige of this body declined that of Ziwar remained high. At the instigation of the opposition a certain number of omdas had refused to draw up the electoral lists under the revised indirect suffrage law; they were dismissed by Ziwar who on this and on several occasions showed courage in standing by his policy. And when he agreed to return to the *Wafd* electoral law of 1924, his promise that the elections should be held under the fairest possible conditions, was duly carried out. The elections which took place in May 1926 resulted in an overwhelming majority for the Nationalists who were returned with some 150 candidates against about 30 Liberals, 5 Nationalists, 20 Independents and 10 Unionists.

The efforts of the police authorities and the support which they received from Ziwar had succeeded by the beginning of 1926 in bringing before the Egyptian courts the remainder of the culprits responsible for the political crimes which had occurred in Egypt since 1920. The miscreants who still remained to be accounted for were brought to trial in May 1926. Among them were two members of Zaghlul's Government, Ahmed Maher formerly minister of education, and Mahmud Nekrashi, undersecretary of the interior. After unsuccessfully attempting to place the blame for the murder of Sir Lee Stack and others on the shoulders of a revolutionary society of their own organisation which had its head quarters in Khartum, the *Wafd* had for some time past made efforts to secure the acquittal of these two personages. To the consternation of the more moderate Egyptians and all foreigners, the trial at the end of May 1926 ended in their acquittal, but the verdict also involved, as a protest, the resignation of Judge Kershaw, the British member of the tribunal on the grounds that it had been given by his two Egyptian colleagues in defiance of the evidence brought before the court.

Prior to the elections, Zaghlul Pasha had several times announced that it was not his intention to form a Government himself. But this wise policy, apparently dictated by the unfortunate consequences which his previous term of office had had, was soon abandoned when the result of the elections and of the acquittal of Ahmed Maher and Mahmud Nekrashi were announced. His *volte-face* received immediate attention in London. During the first week in June the High Commissioner announced that the British Govt. would take steps to secure that a similar miscarriage of justice was not repeated. Certain demands were presented, in this connection and upon sundry other points. They were made conditional upon Zaghlul assuming the premiership. But their effect was to induce him to return to his original decision, himself to remain in the background. So in his place Adly Pasha was requested by the King to form a cabinet in which three prominent Liberals and an Independent were included.

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II. EDUCATION AND PUBLIC HEALTH

Education.—The University Mosque of el Azhar is the largest and most important of seven well-endowed Moslem institutions in Egypt which provide instruction on traditional religious lines. There are also scattered throughout the country a large number of mosque schools conducted on the same basis. The teaching of Moslem religious law and the instruction of Sheikhs are carried on in two special schools. Steady effort has been directed to develop this indigenous structure without undermining it, not without success, particularly in the case of the last two schools. Upon it a modern system of education, with its primary, secondary and higher stages, and its provision for specialisation, has been imposed.

As elsewhere, the competing demands upon the taxpayer have restricted the funds available for purposes of national education. Until the change in 1922 of the status of the country the Govt's. consequent policy may be described as a general concentration upon the development and encouragement of mosque schools, and primary education and the maintenance of a few secondary schools in Cairo and Alexandria, intended to serve as nuclei and models for the conduct of secondary education by the local educational authorities (provincial councils), Moslem educational trusts and private enterprise. Since the school year 1922–3 there seems to have been a definite move towards taking over secondary schools and direct assumption of the development of secondary education by the state.

The provision of higher and general professional education has throughout been left to the state and effected in a series of separate schools under various Ministries. Some of these schools, notably the School of Medicine at Qasr el Aini, have acquired more than a local reputation; but the local demand for higher education is great and many Egyptian students go to Europe and America to obtain it.

The desirability of uniting the above institutions as faculties of a modern Egyptian university has long been under consideration, and was reported on favourably in detail by a special commission in 1921. Owing, however, largely to difficulties in securing suitable accommodation and to differences in regard to means of government and methods of teaching, the realisation of the project has been continuously delayed. Although these difficulties have only been partially overcome, the formal and administrative incorporation of the specified higher schools to constitute a university was enacted by royal decree in March 1925. (E. M. D.)

Public Health

All the capital towns of the muderias (provinces) have now been furnished with up-to-date water supplies, either of filtered or of deep well-water, besides many other of the larger towns. As efficient water supplies were installed, water-carriage drainage followed, and it was found that main drainage systems had to be undertaken in order to prevent the land becoming sewage-logged. Drainage systems have now been installed in Cairo, Alexandria, Port Said, Suez, Tanta, El Mansura and Kafr ez Zaiyat, and schemes are under consideration for Zagazig and Damietta. Establishments coming under the law dealing with "établissements insalubres, incommodes et dangereux," which corresponds roughly to the British Factory Acts, are now registered and are visited by special inspectors. A new "milk law," controlling the collection, distribution and sale of milk, and laying down standards for the fat-content, etc., has been drawn up. A "pure food law" is (1926) under consideration.

Very great progress has been made in the prevention and control of epidemic disease. Plague, both bubonic and pneumonic, has been reduced to practically negligible proportions, only a few hundred cases occurring annually over the whole country. The whole organisation for the prevention and combating of cholera epidemics has been remodelled and, although infection has frequently been brought into the country from infected areas, cholera has been prevented from developing into epidemic form, partly owing to an excellent system of port control, under which cases can be traced from the port of arrival and put under observation in their own homes. Typhus and relapsing fever have been combated on modern lines, and by means of careful delousing of patients and contacts the number of cases in the country have been enormously reduced. Systematic vaccination with revaccination in infected areas has now reduced smallpox to an almost negligible quantity.

In 1918 an Anti-Malaria Commission was instituted, on which the irrigation and main drainage and public health departments are represented, and a great deal of work in draining and filling in swamping areas has already been completed in districts known to be malarial. Active campaigns have now been started against ankylostomiasis and bilharzia, and travelling hospitals and dispensaries are at work throughout the country treating the infected peasants.

A large number of ophthalmic hospitals have been built and opened throughout the country, and there is now a permanent ophthalmic hospital in every provincial capital. The Imperial War Graves Commission have built an ophthalmic research laboratory as a memorial to the men of the Egyptian Labour Corps and Camel Transport Corps who gave their lives in the World War. A new general hospital of modern design has just been opened at Damietta. Dispensaries now exist in all the Markaz towns and free medical treatment is given to the poor. A new pharmacy law has been promulgated, as also a law controlling the importation and sale of stupefacient drugs. Under the new law, firms importing cocaine operate under licence, and are to all intents and purposes rationed.

A number of children's dispensaries (welfare centres) and maternity homes for the poor have been opened all over the country during the period under review. There is now a children's dispensary and maternity home in practically every muderia. The death-rate, though considerably reduced during the period under review, is still high. This is very largely owing to the high infantile mortality. (W. HA.*)

III. ECONOMIC AND FINANCIAL HISTORY

Area and Population (*see* 9.21).—The cultivable area, as now developed, covers some 12,000 sq. m., excluding the fringe of still unreclaimed maritime lakes. In addition to the navigable use of the main irrigation waterways, the cultivated area is well served by networks of broad- and narrow-gauge railways, of telegraphs, of telephones and of roads. The four former have been perfected, and the majority of the roads built since 1910. Except after unusual rain the road system, which includes the larger canal banks and is for the most part unmetalled, provides very serviceable ways for motor traffic, now fast extending in all forms.

It is, however, the development of the irrigation system and especially its steady extension of the margin of cultivation in the Delta, the completion of the conversion of some 40,000 feddans[1] south of Cairo from single to double crop production, and the reduction to a negligible figure of the 90,000 feddans previously in constant danger of being rendered entirely unproductive by a low flood, made possible by the construction (1902) and heightening (1912) of the Aswan reservoir and the building of the Asyut (1902) and Isna (1909) barrages, that more particularly mark the improvement in Egypt's economic resources during the period 1911 to 1925. Further improvement depends upon the execution of storage works on the upper reaches of the Nile now under construction or consideration.

But although Egypt's economic progress would have been impossible without these great developments of her natural advantages, it is the unremitting industry of her agricultural peasantry, stimulated by light and equitable taxation, by the establishment of a great measure of public security and economic freedom, and by care for the public health, that has been the motive force which has turned all these favourable conditions to such remarkable account since 1885. Private and public wealth was gradually built up thereby from impoverishment and bankruptcy, and provided funds which enabled the use of the cultivable area to be progressively extended and a greatly increased population to be supported. In 1882, when the first modern census was taken, the population was 6,800,000 or about 570 to the sq. m. for the most part living and regarded, in their own expressive phrase, as cattle. The population in 1925 was approximately 14,000,000 or about 1,170 to the sq. m.: and in spite of much squalor, difficult to remove under deltaic conditions, the general advance in independence and standard of life has been even more striking. With an area closely corresponding to that of Belgium, the cultivated area of Egypt now supports very nearly twice the population, and is probably the richest and most densely populated land of its size in the world.

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[1] By Law No. 9 of 1914 three measures of length, one of weight and one of capacity are defined in terms of the metric system. These are respectively the dira' baladi = 58 cm., used for textiles; the dira' ma'mari or pic = 75 cm., used by architects; the qasaba = 355 cm., used for agricultural land; the dirhem = 312 centigrammes; and the ardeb = 198 litres.

The derivatives most commonly used and quoted abroad are the feddan = 1·038 ac. and the qantar = 99·05 lb. Cotton prices are regularly quoted in Egyptian dollars of 200 millièmes, per qantar. These can be converted with close approximation into pence per lb. by halving. Otherwise the metric system is used and understood.

Owing to the absence of appreciable rainfall, except along the northern coastline, 98 % of Egypt's large territory is desert, supporting a population of under 100,000, and only of economic importance for the production of a certain amount of building stone, road metals and minerals. The camel still constitutes the essential means of desert travel; but the use of the motor-car is increasing and its employment may be expected to extend steadily as bad places are made passable. During the War railway connection with Palestine was effected across Northern Sinai and has since been maintained.

Mines.—During the 20th century a systematic effort has been made by the Egyptian Govt. to facilitate mineral discovery and development. The geological survey of the country, started in 1896, has been steadily pursued ever since; while some 10 years later, standard mining licences and leases were substituted for monopolistic concessions of mineral rights over extensive areas, which closed such areas to general prospecting and only involved tenuous obligations. The mineral output from 1907 to 1924 expressed in millions of metric tons includes 1·7 of petroleum, 1·1 of phosphate rock, 0·6 of manganese ore; while 58,000 oz. of fine gold and £E.55,000 worth of peridots were also extracted.

Currency.—Before the World War the monetary system of Egypt was on a gold monometallic basis, the nominal unit being the Egyptian pound subdivided into 100 piastres and 1,000 millièmes. The British sovereign was legal tender at the rate of 975 millièmes, and constituted the real basis of the system. The notes of the National Bank of Egypt were current to a limited extent, but were not legal tender, being payable in gold on demand. At the outbreak of War the international circulation of gold stopped, and it was found necessary to make these notes legal tender and relieve the bank of the obligation to pay them in gold on demand. It was, however, arranged that adjustments of cover to the note issue could be effected in gold or securities in London, while all the local banks were authorised to deposit or withdraw cash in London against deposit or withdrawal of notes in Cairo. The Govt. and the bank co-operated loyally and effectively, and the Egyptian public rapidly accustomed themselves to the use of notes and the disappearance of gold. The measures taken worked admirably and their effect is still operative. They stabilised the sterling exchange at par throughout the War and provided a steady currency which adjusted itself automatically and without any disturbance to all subsequent requirements. Egypt has now returned to a gold basis, but the notes of the National Bank of Egypt remain inconvertible for internal circulation.

Cotton and Foreign Trade.—The gross returns of Egyptian foreign trade since 1911 are given in Table I., and a comparison of its distribution in 1913 and 1924 among the principal countries concerned in Table II. With the exception of Turkey, those countries whose political boundaries have been radically altered in the interval have been excluded in the second table. Egypt's disposable wealth for purposes of foreign trade is predominantly represented by the value of her cotton exports, as reference to Table I. will show. Although these exports satisfy only about 4 % of the world's consumption, the length and strength of the best Egyptian fibre enables it to command a marked premium in price over practically all other cottons. It is this virtual monopoly of the finest cotton and the great rise in the price of cotton generally which have set the scale of Egypt's leap into prosperity. No reliable analysis can be given of the amount of the total payment annually remitted by other countries to Egypt for her cotton, which represents this premium: but its importance and the seriousness of the loss if Egyptian cotton did not possess the advantage mentioned can be gauged from Tables I. and III.

While the premiums quoted are simply indices of the relative demand for Egyptian and American standard cottons in the market of the most important outside purchaser, the maintenance of the higher quality of which they are the reflection is of outstanding importance to Egypt, as otherwise her cotton would become a satellite of American and follow its price levels. While Egypt's primary economic interest is thus the maintenance of the present pre-eminence in the quality of her cotton, the danger that this advantage may be discounted by a falling off in quantity also calls for serious attention. As Table III. illustrates, the general statistics of the crop have indicated for a long time past that there has been a steady diminution in the yield per feddan. But even assuming the dependability and equal weight of the statistics throughout, there have been important disturbing factors at work, which make it advisable to accept with caution as yet the deduction that the culture of the cotton plant is, for one or other reason, generally less successful than it used to be. Among such factors may be mentioned the extension of cotton culture into less fertile districts and the cultivation of varieties, such as Sakellarides, which appear to combine better quality lint with lower yield. (*See* COTTON.)

TABLE I. *Annual returns of value of imports and exports in millions of £E.*

Year	Imports	Exports	Exports Cotton, Cotton Products[1]	Year	Imports	Exports	Exports Cotton, Cotton Products[1]
1911	27·3	28·9	26·4	1919	47·4	75·9	69·1
1912	25·9	34·6	32·0	1920	101·9	85·5	79·4
1913	27·9	31·7	29·2	1921	55·5	36·4	31·5
1914	21·7	24·1	21·4	1922	43·3	48·7	43·7
1915	19·4	27·0	22·0	1923	45·3	58·4	54·3
1916	31·1	37·5	32·3	1924	50·7	65·7	61·4
1917	33·2	41·1	36·1	1925	58·2	59·2	55·2
1918	51·2	45·4	40·8				

[1]This includes cotton, raw cotton, cotton seed, cotton seed cake, cotton seed oil, cotton yarn, cotton waste and grey piece goods manufactured in Egypt. No re-exports are included.

Apart from raw cotton, the only other exports of importance are cottonseed, cottonseed oil and cake, manganese ore, phosphates, raw flax and wool, cigarettes and eggs. The chief imports in 1924, together with the value of each expressed in millions of £E., were cotton piece goods, 8·8; wheat flour, 2·3; coal, 1·6; woollen and worsted clothes, 1·0; and kerosene, 1·0.

General Review, 1910–25.—In response to world demand, approximately from 1902 onward the price of Egyptian cotton increased greatly, so that the country became rapidly and, so far as any effort of its own was concerned, fortuitously enriched. This fortuitous accession of wealth led to a speculative boom in Egyptian affairs, which was succeeded by a sudden and complete slump in 1907. The reaction was inevitable, and was in no way due to any setback in the yield or price of the staple product of the country; but it left the latter with a load of unproductive debt which constituted a new and heavy charge upon its production. During the next seven years two tendencies were in conflict. On the one hand a succession of abundant cotton crops realised at good prices tended to add steadily to the wealth of the country: on the other the pressure of indebtedness and the insidious practice of seeking relief in further debt operated to impoverish it.

The immediate effect of the outbreak of war was to reduce the price of cotton by a third and thus deprive the country at a stroke

TABLE II. *Distribution of foreign trade in 1913 and 1924 expressed in thousands of £E.*

Country	Imports from				Exports to			
	1913		1924		1913		1924	
	Value	%	Value	%	Value	%	Value	%
Belgium	1,100	4·0	1,898	3·8	100	0·3	285	0·4
France	2,300	8·3	4,689	9·2	2,800	8·9	8,614	13·1
Germany	1,500	5·4	2,947	5·8	4,000	12·6	3,972	6·4
Great Britain	7,700	27·6	13,994	27·6	13,500	42·4	31,956	48·6
Greece	500	1·8	922	1·8	50	0·2	405	0·6
India	500	1·8	1,781	3·5	30	0·1	216	0·3
Italy	1,400	5·0	5,231	10·3	1,000	3·2	4,069	6·1
Japan	. .	. .	973	1·9	. .		1,509	2·3
Russia	900	3·2	810	1·6	2,200	7·0	75	0·1
Switzerland	130	0·5	638	1·3	1,000	3·2	2,299	3·5
Turkey	1,900	6·8	827	1·6	500	1·6	142	0·2
United States of A.	500	1·8	1,799	3·6	2,500	7·9	7,086	10·7
Other countries	9,435	33·8	14,227	28·0	3,982	12·6	5,106	7·7
Totals	27,865	100·0	50,737	100·0	31,622	100·0	65,734	100·0

of the increased income it had enjoyed for some 12 years previously. The sudden diminution of the country's purchasing power reacted severely on economic activity, imports fell off heavily, many debts were left undischarged and even gold hoards were dispersed. As elsewhere, emergency measures were taken. A general moratorium was proclaimed, advances were extended to cultivators on their cotton and the notes of the National Bank of Egypt were decreed legal tender and inconvertible. These and other measures could, however, only be palliatives operating to reduce the shock of an economic setback which would have been very serious if it had continued.

TABLE III. *Average annual return of production and value of cotton crop for groups of seasons*

Group of Seasons	1895–6 to 1901–2	1902–3 to 1906–7	1907–8 to 1913–4	1914–5 to 1920–1	1921–2 to 1925–6
Planted area in millions of feddans	1·1	1·4	1·7	1·6	1·7
Crop in millions of qantars	5·9	6·3	7·0	5·6	6·5
Yield in qantars per feddan	5·2	4·4	4·2	3·6	3·8
Average price pence per lb.: American middling .	4·3	5·9	6·8	14·8	14·4
Egyptian[1] standard . .	5·8	8·8	10·0	27·0	22·0
Premium per cent of Egyptian	35	49	47	82	53
Value of crop in millions £E.	12·6	20·2	26·2	42·3	45·2

[1] Fully good fair Brown till 1916–7; fully good fair Sakellarides 1917–8 onwards.

Fortunately the price of cotton, stimulated by the demand for War purposes, gradually recovered until by the end of 1915 it again reached its pre-War level. The conversion of Egypt into a huge British military base for the Near Eastern theatre of war and the paradoxical political connection between the two countries, which characteristically gave Egypt the benefits of being on the winning side without the financial drain of actual belligerency, combined with the demand for Egyptian cotton, completed the economic rescue and converted it to prosperity.

Thus the maintenance of Egypt as a great base involved considerable expenditure on labour, military works, supplies and commodities of all kinds, which was defrayed by the British Govt. or by the troops themselves, and materially contributed to the financial recovery of the country. It caused the British Govt. to provide and ensure the import of the coal necessary for the working of the railways, of the water supply, lighting and sewage systems of the towns, and of the thousands of irrigation pumps on which the cotton, food and fodder harvests largely depend. It necessitated the protection of the maritime routes to Egypt and brought large volumes of shipping to her ports, which greatly facilitated the export of cotton and the import of food, fuel and other necessaries. These favourable conditions continued throughout the War, and were accompanied by a steady increase in cotton prices and a great growth in the wealth of the country.

In the middle of 1919 the prices of Egyptian cotton soared in response to a feverish post-War demand and early in 1920 stood at more than 10 times the pre-War figure. Soon after reaching this peak, prices, in response to an abrupt cessation of demand brought about by the contemporary world crisis in production, fell as precipitously as they had risen, till in March 1921, they stood at little more than their pre-War level. The combined effect of the abnormal expansion in wealth when cotton prices were soaring and of the contemporary relaxation of War-time restrictions on transport is reflected in the record import and export returns for 1920. The shock of the subsequent sudden contraction of the national income to the pre-War standard was felt most severely by the landholding population, which was in a good position to stand it, having been able to accumulate profits practically untouched by taxation during the previous years. On the other hand, the general fall in prices brought relief to the classes which had suffered from the continuous increase in the cost of living. For the growth of the national wealth since 1914 had been most unevenly distributed, and was accompanied by extreme contrasts of ease and want. The poorer classes in the towns, and large numbers of officials and others on small fixed salaries or purely money wages had suffered severely.

The sudden fall in prices also caught the Govt. with large stocks of depreciated coal and cereals in its possession. For, as in other countries, the obligation to ensure essential supplies and partially to redress depreciation of the pay of public servants led the Govt. during the War to adopt special measures of food and fuel supply and in supplement of salaries. The liquidation of practically all these special liabilities and the reaction on public finance of the heavy fall in cotton prices fell into the working of the financial year 1920–1, which accordingly may most fittingly be held to terminate the War period for Egypt. She emerged from it, as reference to Table IV. will show, at a net cost to her public finances of just over £E.2,500,000; with moderately increased taxation and with greatly increased national wealth.

TABLE IV. *Summary of Public Finance, 1910–25, in millions of £E. in the pre-War, War and post-War periods*

Date and Period	Total Revenue over each period	Total Expenditure over each period	Reserve Fund	Consol. Debt[1]
Jan. 1910 to March 1914 .	72·8	73·7	6·4 5·1	95·2 94·1
April 1914 to March 1921 .	184·0	187·6	5·1 1·5	94·1 93·0
April 1921 to March 1925 .	151·5	127·4	1·5 25·6	93·0 92·2[2]

[1] Excluding the Ottoman Tribute Loans.

[2] Of which the Govt. and the Caisse de la Dette held 8·5 in March 1924.

In the above table revenue and expenditure are totalled for each period, and the reserve fund and consolidated debt for first and last years of each period are given. In reading the totals the unequal lengths of the periods must of course be considered.

While there have been important private losses, notably owing to investments in, and speculative purchases of, depreciated currencies, Egypt's economic position has been greatly fortified both absolutely, and even more relatively, as a result of the War and of the post-War stabilisation and recovery that followed. This is established by many indices covering the period 1910–25, Among these may be mentioned a great growth in Egypt's foreign trade, a great increase in bank deposits, a notable transfer of the Egyptian debt from European to Egyptian holders, the high level of Egyptian securities, a marked discharge of agricultural debt. Table I. illustrates the first, Table V. the last.

TABLE V. *Mortgage debts due to four leading Banks in 1911 and 1925 expressed in millions of £E.*

Bank	1911	1925
Crédit Foncier Egyptien	27·9	18·7
Agricultural Bank of Egypt	8·2	2·7
Land Bank of Egypt	3·5	4·2
Mortgage Company of Egypt	2·0	3·1
Totals	41·6	28·7

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EHRLICH, PAUL (1854–1915), German bacteriologist, was born in Silesia March 14 1854, of Jewish parentage. He was educated at Breslau and Strasbourg, where he studied medicine, He was soon drawn toward research in chemistry, and in his earlier years carried out various important investigations in aniline dyes. He was at the same time winning fame as a bacteriologist, and in 1907 discovered a red dye, known as "trypan red," which effected the complete sterilisation of animals infected with trypanosomes, a work of enormous importance for the treatment of diseases caused by these parasites. He considerably improved the technique of serum preparation, and also discovered a method by which the potency of the anti-diphtheria toxin could be tested. He also investigated the problems of cancer. Ehrlich's most famous discovery, however, was made in connection with his researches into venereal diseases. It was announced in 1910 that he had prepared an arsenical compound, known as salvarsan or "606," which was a cure for syphilis. He lectured in London in 1907, and in 1913 attended the medical congress held there. In 1908 he, together with Mechnikov, was awarded the Nobel Prize for Medicine. He received many honours from his Government and marks of distinction from almost every university and scientific society. He died at Homburg Aug. 20 1915.

See *Paul Ehrlich: eine Darstellung seines wissenschaftlichen Wirkens*, Festschrift zum 60. Geburtstage des Forschers (1914).

EINSTEIN, ALBERT (1879–), German-Swiss physicist, was born of Jewish parents at Ulm, Württemberg, May 14 1879. His boyhood was spent at Munich where his father, who owned electro-technical works, had settled. The family migrated to Italy in 1894, whilst Albert Einstein went to a cantonal school at Aarau in Switzerland. He attended lectures while supporting himself by teaching mathematics and physics at the polytechnic school at Zürich until 1900 and finally, after a year as tutor at Schaffhausen, was appointed examiner of patents at the patent office at Berne, where, having become a Swiss citizen, he remained until 1909. It was during this period that he took his Ph.D. degree at the University of Zürich and published his first papers on physical subjects. These were so highly thought of that in 1909 he was appointed extraordinary professor of theoretical physics at the University of Zürich. In 1911 he accepted the chair of physics in Prague, only to be induced to return to his own polytechnic school at Zürich as full professor in the following year. In 1913 his pre-eminence had become so evident that a special position was created for him in Berlin, director of the Kaiser-Wilhelm Physical Institute. He was elected a member of the Royal Prussian Academy of Sciences and given a stipend sufficient to enable him to devote all his time to research without any restrictions or routine duties. He was elected a foreign member of the Royal Society in 1921, having also been made previously a member of the Amsterdam and Copenhagen Academies, while the universities of Geneva, Manchester, Rostock and Princeton conferred honorary degrees on him. In 1925 he received the Copley Medal of the Royal Society and in 1926 the gold medal of the Royal Astronomical Society in recognition of his theory of relativity. He received a Nobel Prize in 1921.

Einstein's work is so important and has proved fertile in so many various branches of physics that it is not possible to do more than enumerate a few of the most salient papers. The work by which he is best known, the theory of relativity, was begun in 1905 with the publication of the restricted principle with its consequences (*see* RELATIVITY: SPACE-TIME). Though considered fantastic by many, it had secured fairly general acceptance in Germany in 1912, and was followed by the generalised theory in 1915. But Einstein's work has been by no means confined to such abstract questions. One of his earliest publications gave the complete theory and formulae of the phenomenon known as Brownian motion, which had puzzled physicists for nearly 80 years. He showed that the heat motion of particles, which is too small to be perceptible when these particles are large, and which cannot be observed in molecules since these themselves are too small, must be perceptible when the particles are just large enough to be visible, and gave complete equations which enable the masses themselves to be deduced from the motions of these particles.

Much of his time again was spent on the obscure problems usually combined under the heading "quantum theory." The importance of these has become more and more evident, and the difficulty of reconciling the apparently inevitable discontinuities of the product of energy and time which experiment indicates, with our accepted habits of mind, always had a peculiar fascination for Einstein. Sooner, probably, than anybody else he realised the far-reaching implications of the theory propounded by Planck. His paper on the variation of the specific heat with temperature, which appeared in 1907, was the first extension of Planck's fundamental hypothesis, and its verification in essentials is one of the most convincing arguments in its favour. Numerous other papers on molecular physics, including an experimental research on magnetism, appeared in the *Proceedings* of the Russian Academy of Science, the *Physikalische Zeitschrift*, the *Proceedings* of the German Physical Society, the *Annalen der Physik*, etc. (F. A. L.)

EISNER, KURT (1867–1919), Bavarian politician and writer, was born in Berlin May 14 1867 He became a journalist, and at an early stage of his career had the first of his many experiences of imprisonment because of the socialist tendency of his writings. He was successively on the editorial staff of *Vorwärts* in Berlin (1898–1905) and of socialist newspapers at Nuremberg and Munich. After the outbreak of the World War he turned against his old allies, the Social Democrats, and attacked them for supporting the War. Convicted of treason in Jan. 1918, he was released on account of his candidature for the Reichstag, and was in time to organise the mass meeting which was held at Munich on Nov. 7 1918 and resulted in the overthrow of the Bavarian monarchy. A Bavarian revolutionary government, with Eisner as its president, was established. He was opposed to the re-establishment of the federal system of the German Reich and to the election of a National Constituent Assembly. His revelations regarding Germany's responsibility for the War increased his unpopularity with the Bavarian reactionaries; and on his way to open the Bavarian Assembly on Feb. 21 1919 he was shot dead in the street by Count Arco. Among Eisner's various written works are *Psychopathia Spiritualis* (1892); *Eine Junkerrevolte* (1899); *Wilhelm Liebknecht* (1900); *Feste der Festlosen* (1903); and *Die Neue Zeit* (1919).

ELBE (*see* 9.161), a river of Central Europe. Under Article 331 of the Treaty of Versailles the Elbe from its confluence with the Vltava (Moldau) was declared international. The administration of its system was entrusted to an international commission composed of four representatives of the German riparian states, two of Czechoslovakia, and one each of Great Britain, France, Italy and Belgium. This commission drew up the Navigation Act signed at Dresden Feb. 22 1922 (League of Nations Treaty Series, vol. 26, No. 649, 1924). The commission has to provide for freedom of navigation and equality of treatment; to take decisions on complaints arising out of the application of the Act; to see that the navigable waterway is kept in good condition and to supervise improvements. Its jurisdiction may be extended, subject to the unanimous consent of the commission, by decision of the riparian state or states concerned. A supplementary convention signed at Prague Jan. 27 1923 laid down detailed regulations for navigation tribunals and for appeal.

Railway Competition.—The question of railway competition has become important. The railway practically follows the same route as the river and thus naturally competes with river-traffic. Moreover, before the War the German railways had granted exceptionally favourable tariffs to encourage railway transport from Saxony and Bohemia to Hamburg, in competition with the transport to Trieste. At the same time Saxon railways assisted shipping by granting special tariffs to traffic to or from Elbe ports in Saxony. The Peace Treaties prohibited Germany for a time from granting special tariffs to seaports, while maintaining the favourable tariffs to Trieste; Czechoslovak traffic was thus diverted. In 1920 the German railways introduced low rates for long distance traffic, and recently re-established exceptionally favourable tariffs for seaports, but not for the fluvial Elbe ports. The shipping companies have formed a combine, which since Dec. 31 1923 has applied only to downstream traffic. In 1924 a new common fluvial tariff was introduced for both the German and the Czechoslovak sections of the river, which introduced bills of lading at flat rates, applicable to the chief ports above Teschen in respect of shipments consigned to Hamburg. The Elbe is divided into (1) the Czechoslovak zone, with fixed rates; (2) the Saxon zone, with rates varying according to whether the goods come from near the river or not; (3) the middle Elbe zone, with variable rates.

The results have been fairly satisfactory, and although the railways have captured part of the heavy goods traffic from the waterway, the waterway has secured the transport of certain classes of valuable goods. Statistics show that the proportion of shipments at Hamburg by rail to those by water in 1924 was approximately the same as before the War (1924: 64% by water, 36% by rail). Czechoslovakia has considerable interests in the Elbe navigation. The total quantity of goods exported from Czechoslovakia in 1924 amounted to 1,112,000 tons (321,550 tons of sugar). In addition 181,855 tons of timber were floated. The total tonnage entering the ports of Hamburg, Harburg and Altona from upstream was 3,023,833 tons. The total tonnage shipped upstream from these ports was 3,317,248 tons, of which 754,455 tons went to Czechoslovakia. (R. Rn.)

ELECTORAL LAWS, CHANGES IN (*see* 9.169).—A survey of the world's electoral laws since 1910 shows a steady democratic development, most marked since the end of the World War. The various implications of accepted democratic theory are swiftly on the way to complete legal consummation in almost every self-governing country in the world. The end, already in sight, is to make the franchise direct, equal, universal, with the minimum of property qualification, or none at all, to make the ballot secret, and registration simple. The universality of the franchise in any real sense has come to mean its extension to women. And further, in pursuit of the principle of equity of representation, the systems of proportional and minority representation have been adopted in many countries. The age at which the citizen is entitled to vote varies widely; in Soviet Russia and in modernised Turkey and in Argentina it is 18, in Germany and Switzerland 20, in Norway 23, in Italy and Denmark and Japan it is 25, in Great Britain a woman must be 30 before she is entitled to be registered.

Women's Suffrage.—The new European states, in whose composition the democratic doctrine was necessarily an essential ingredient, have given women the right to vote, with the exception of monarchial Yugoslavia. The European states which still deny the women the parliamentary franchise are Belgium, France, Greece, Portugal, Yugoslavia and Spain. It is curious to find France in this category, since she was the pioneer in the realisation of universal male suffrage. The many projects before the French Chambers have foundered against the Latin-Christian objection to women having aught to do but with domestic politics. In the United States the ratification, in 1920, of the 19th Amendment to the Constitution, put women on an equal footing with men. The amendment runs: "The right of the citizens of the United States to vote shall not be denied or abridged by the United States or by any state on account of sex. Congress shall have power to enforce this article by appropriate legislation." This clause has the more importance since the 17th Amendment, in 1913, commands the election of Senators by direct vote of the citizens. The Dominion Elections Act of 1920 gave women in Canada an equal right with men to vote. In Australia the female franchise is of date prior to 1910. South Africa has defeated several projects for women suffrage, in Argentina the Election law of 1912 gave the vote to males only of 18 years of age, and in Brazil political practice has excluded women from the franchise. Nor have women the suffrage in Japan. The Mexican constitution of 1917 gave the vote to all Mexican citizens: that is, to all over 21 if unmarried, and all over 18 if married.

Compulsory Voting.—The vote in Mexico is for all electors, not merely a prerogative, but a duty. If the duty is not fulfilled and that "without sufficient cause," then according to the constitution the right is suspended. This conception of the vote as a civic duty finds its counterpart in the recent enactments of compulsory voting for the Australian Commonwealth House of Representatives and Senate (1924), for the Queensland Legislative Assembly (1915) and in the Argentine Republic (1912) where the penalties are not strictly administered, and the Belgian compulsory vote enacted in 1896. The substance of the electoral laws of Great Britain, Germany, Japan and India have since 1910 undergone the most far-reaching alterations of all with the exception of Soviet Russia, whose system is based on a radically different principle, and Canada, where the Dominion Elections Act of 1920 laid down a Federal qualification overruling previous provincial legislation.

CHANGES IN VARIOUS COUNTRIES

Great Britain.—In Great Britain the Representation of the People Act, 1918, cleared away the diversity of franchises then existing. Occupation as owner or tenant for six months is the basis of the franchise for both men and women of 21 in local government elections. A woman may receive a vote not as occupier in her own right, but as wife of a local government elector. The parliamentary franchise is, for men, based upon a six months' residence in a constituency; or upon six months' occupation of land or premises of not less than £10 yearly value. Holders of university degrees have a further vote. Women are entitled to vote where they are over 30 and entitled to be local government electors as occupiers, but their occupancy must be of £5 annual value. They may also be registered if they are wives of local government electors, but here the occupancy, again, must be of £5 annual value. They also have a university vote. Plural voting was restricted to two votes, inclusive of the university vote. Receipt of poor relief is no longer a disqualification for the local government franchise. The shortening of the registration period to six months, and the institution of two registers per year substantially decreased the existing evil of disqualification through industrial migration. In 1917 there were 8,357,000 men on the registers. In 1923 there were 10,449,820 men and 7,831,583 women. The Act also regulated the maximum amount of election expenses allowable. In counties expenses are at the rate of 7d. per registered elector, in boroughs 5d.

Germany.—The German constitution of 1919 swept away the three-class and indirect systems of elections of the various German states and substituted a system of equal and direct suffrage throughout the entire Reich, for imperial, state and municipal elections. Proportional representation was also instituted, and, its execution necessitating large constituencies, resulted in a redistribution of seats which rectified the crying political injustice done since 1867 to the populous parts of the country. The system was enacted in detail in the law of April 1920.

Japan.—The growing potency of the democratic idea in Japan in the last quarter of a century, immensely quickened by the War, and marked by some 15 attempts at substantial electoral reform, gained a partial reward in 1920, when the direct-tax qualification was reduced from 12 to 3 yen. The electorate was thereby increased from about 1,500,000 to 2,800,000, and this had expanded to 3,500,000 by 1925. In that year an electoral law regulated the franchise with greater approach to completeness. Male suffrage was enacted for all over 25 resident in their constituency for six months prior to registration, and with their own means of subsistence. The electorate increased to over 14 million.

India.—The Indian constitutional reforms of 1919 worked a small revolution in the electoral system and franchise opportunities in that country. The rules under section 7 of the Reforms Act (electoral rules for provincial legislative councils) and under section 23 (electoral rules for the Indian Legislature) are too detailed to be summarised here with any pretence to exactitude.

PROPORTIONAL REPRESENTATION

During the War, the neutral nations of Denmark (1915), Holland (1917) and Switzerland (1918) adopted the system of proportional representation for the Lower House of Parliament; and after the War, the system favoured in some cases by the necessity of making provisions for racial minorities was adopted for parliamentary and generally also for local, relations by Germany and Austria (1919), Italy (this was abandoned in 1921 under the Fascist régime), Luxembourg and Poland (1919), Czechoslovakia, Estonia, Latvia, Lithuania, Norway and Jugoslavia (1920). A similar development has been taking place in English-speaking countries. In Great Britain the Speaker's Conference on Electoral Reform of 1916–7 recommended a partial adoption of proportional representation for the House of Commons, extending to about one-third of the seats. This recommendation was rejected by Parliament, but the principle of proportional representation applies in university elections. The system is provided for parliamentary elections under the constitution of the Irish Free State. South Africa (1909) instituted proportional representation for municipal elections, but has rejected the system for the national representative assembly. Proportional representation has been introduced in Canada for some municipalities and in one provincial constituency, *i.e.*, the ity of Winnipeg, but projects for its national application have een rejected.

The alternative vote has been adopted almost universally in ustralia. Argentina and Brazil have adopted systems of minory representation. France is not happy under its system instiuted in 1919, because an unfortunate compromise has resulted a hybrid régime of majority representation with a small and ccidental element of proportional representation. The German ystem puts the power of organising the lists of candidates into he hands of the party machine, and "star" candidates carry lists of mediocre colleagues.

Miscellaneous Matters

The Soviet Franchise.—The development of political repreentation so far indicated went along familiar paths. But the ussian system, as planned by the Bolshevik theorists, constiutes a startlingly new orientation. To the orthodox democratic heorists the vote itself was an abstract attribute of a theoretcally perfect body of citizens, between whom there could be no iscrimination at the polls. The integrated complex of material esults likely to be consequent upon the exercise of the vote was arely the impetus or the guide to reform. The granting of the ote was prior to the aim of the vote. The Bolshevik theory enies the validity of such political liberalism. It commences ith a definite conception of the kind of state it wants, and proeeds to arrange its electoral system to bring about the desired esult. The "non-workers" in Russia have not the franchise. his class includes all persons who hire others for profit-making urposes, those who have unearned incomes, merchants and iddlemen, the satellite helpers of the bourgeoisie, monks and inisters of religion, and former police officials. All "working" itizens over 18 may participate in the elections. The second oint in which the Soviet régime diverges from its contempoaries is in its denial of the principle of the direct representation f a constituency in the supreme legislative body. Popular conent in the Soviet system is attainable through the Councils, alled soviets, established in the smallest town and rural disricts; and thence by a process of pyramidical delegation, upards through various district and gubernial congresses or oviets, to the all-Russian congress of Soviets. Elections take lace annually, since short periods of election are deemed to ntensify political activity and increase the vividness of the epresentative quality.

Economic Councils.—Economic councils centring in the Fedral Economic Council (*das Reichswirtschaftsrat*), in Germany, mbodied in Article 165 of the constitution, constitutes a system f representation of the citizens on the basis of their vocations, ccupations or professions. It stands by the side of the Reichtag in an advisory capacity. It is the outcome of the idea of the epresentation of estates of the realm, and the acknowledgment f the importance of vocational groupings and the difficulty of btaining a true micro-mirror of the weal and knowledge of the itizens by the old orthodox method of territorial representation.

Secret Voting.—Almost all countries now make provision for ecret voting, with more or less careful regulations for ensuring heir object. Some, notably Great Britain, the Dominions, the nited States and Belgium, use the Australian ballot system, *e.*, ballots prepared by the state and distributed under proper upervision to the voter in the isolated booths. Others, like rgentina (1912), Italy (1912), France (1913–4) and Germany 1919) allow ballots, conforming to certain regulations to be disributed by the parties, and then a state-provided envelope is anded by the officials in the polling station to the voter in hich to enclose his completed ballot paper. Hungary and Russia re exceptions to the rule of secret voting. In the former, by the lectoral rules of April 1922, rural constituencies, numbering 200 ut of a total of 245, are subject to open voting. In Russia the onstitution and various decrees establish public voting, with a urious procedure. Voting takes place in specially convened works" and "institutional" assemblies, and there is a "genral" assembly for people outside these categories. Where the istrict is small there is a general meeting of all categories of voters. Here lists of candidates are publicly put forward by parties, trade unions or groups of electors. The electoral commissioners are not impartial. Being the agents of the Communist party, they invariably prepare and present the lists of candidates, and they are entitled to oppose the election of persons who have previously shown "incapacity" in office, and by order of the gubernial authorities may unseat those elected.

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ELECTRICITY: NATURE AND USES.—Reference should be made to the following articles: Atmospheric Electricity; Atom; Atomic Weights; Broadcasting; Chemistry; Dynamo; Conduction, Electric; Ether; Gases, Electrical Properties of; Isotopes; Magnetism; Matter; Photoelectricity; Quantum Theory; Rays; Relativity; Spectrum; Super-Power; Telegraphy; Wireless Telegraphy.

Remarkable progress has been made since 1910 both in the scientific study of electric and magnetic phenomena and also their application for technical purpose.

On the scientific side these advances have been closely connected with an increased insight into the nature of material atoms as electrical structures and our powers of interpretation of observed effects have been enhanced by the introduction into physics of a novel hypothesis called the Quantum Theory, originally suggested by Max Planck about 1900 to explain the distribution of energy in the spectrum but since found to have important applications in all atomic phenomena.

Electrons.—There is now but little doubt that the agency we call negative or resinous electricity exists in small, indivisible particles called electrons (*see* Electron) and that these are constituents of all material atoms. The mass of an electron is about 1/1800th of that of an atom of hydrogen and its electric charge (e) according to the careful determinations published by R. A. Millikan in 1913 is $(4{\cdot}774 \pm {\cdot}009) \times 10^{-10}$ electrostatic units. Thus 6·28 million billion electron charges are nearly equal to one coulomb or that quantity of electricity conveyed by one ampère in one second. The mass (m) of an electron is $0{\cdot}899 \times 10^{-27}$ of a gramme. The theory of atomic structure widely adopted at the present time is that an atom (*see* Atom,) comprises a central nucleus which is very small compared with its over-all dimensions and that round this circulate a number of electrons in various orbits. This view, originally suggested by Sir Ernest Rutherford in 1911, is called the nucleus theory of the atom and by the aid of the quantum theory has been developed of late years (in 1913) by Niels Bohr, Arnold Sommerfield and others in a manner which gives a plausible explanation of the properties of the atom in radiating and absorbing energy.

Protons.—The nucleus of the atom is assumed to be a structure built up of elements called protons, which are the units of positive electricity in the same sense that electrons are units of negative electricity. Since similar units repel each other the protons must be held together by electrons owing to the strong attraction between electrons and protons, but the protons outnumber the electrons in the nucleus and the total gravitative mass is almost entirely due to that of the protons, the electric charge on the proton being equal but opposite in sign to that of the electron but the mass nearly 1,800 times greater. On this theory the simplest atom is that of hydrogen, which consists of one electron and one proton revolving round their common centre of mass. In other words, the proton or unit of positive electricity is the nucleus of the hydrogen atom. In the nuclei of other atoms the number of protons in excess of the nuclear electrons is called the atomic number. In electrically neutral atoms the number of planetary electrons circulating round the nucleus in various orbits is also equal to the atomic number.

Isotopes.—The atomic weight of the atom is the sum of the weights of all the protons plus a small excess due to the electrons, The true atomic weight is therefore an integer multiple, or nearly so, of the weight of the hydrogen nucleus. If the mass of the nucleus is increased by adding an equal number of protons and electrons to it the atomic weight is increased but the atomic number remains unaltered. Atoms of equal atomic number but slightly different atomic weights are called isotopes (*see* ISOTOPES) and many of the elementary substances, for example chlorine and mercury, are mixtures of isotopes. Hence the resultant or mean atomic weight is not always an integer multiple of that of the proton. It has been shown that the chemical properties of an atom depend more upon its atomic number than upon its atomic weight. There are, for instance, two kinds of lithium atoms of atomic weights 6 and 7 respectively, and two kinds of chlorine atoms of atomic weights 35 and 37, and ordinary chlorine gas is a mixture of these two varieties. The search for isotopes has been conducted of late with great success by F. W. Aston, employing a method devised by Sir J. J. Thomson depending on the deflection of the so-called positive rays in a vacuum tube.

Quantum Theory.—The theory of atomic structure now in vogue is that the planetary electrons circulate round the nucleus in elliptic orbits arranged in different planes. Niels Bohr in 1913 introduced the novel idea that an electron cannot revolve round its nucleus at any and every distance but only in certain distinct orbits called Quantum paths or stationary states and that when rotating in these orbits it does not radiate its energy. Also there is a relation between the dimensions of the possible orbits and between these and the nuclear electric charge. If the orbits are circular the radii of the successive orbits would be in the ratio of the squares of the integers 1, 2, 3, etc.; or 1, 4, 9—and the size would be inversely as the atomic number or charge on the nucleus so that the orbits would be more compact the greater the nuclear charge. Bohr's second principle is that an atom radiates energy only when an electron jumps from one orbit to another or falls back into an orbit from outside. These orbits reckoned from the inmost one are called the K, L, M, etc., orbits. An electron can be expelled or moved from one orbit to another by the action of X-rays or of ultra-violet light rays. When this happens the energy of the atom changes suddenly from one value, say A_1, to another, say A_2. When an electron falls back into an orbit it vibrates in settling down into its Quantum path and sends out radiation (*see* ELECTRIC RADIATION) of a frequency (n). This frequency is fixed by the equation $hn = A_2 - A_1$, where h is Planck's unit of action, an extremely important constant in modern physics, the numerical value of which according to recent work is $(6 \cdot 55) \times 10^{-27}$ (*see* QUANTUM THEORY).

The Rydberg Constant.—When a neutral atom has lost one or more electrons it is said to be ionised and when it takes back an electron and emits radiation this last consists of vibrations of one or more definite frequencies. The radiation can be examined spectroscopically by a prism or diffraction grating or, if of very short wave length, by the use of a crystal section as a grating in the manner devised by Laue and Bragg. Bohr was able in 1913 by the aid of his postulates above mentioned to arrive at a formula which enabled him to predict exactly the wave length or frequency (n) of the radiations emitted by a hydrogen atom, which consist of a series of lines in the visible spectrum called the Balmer series and also a series in the ultra-violet part of the spectrum called the Lyman series and again a series in the infra-red part of the spectrum called the Paschen series, all of which are predetermined by a formula $n = \mathrm{R}\left(\frac{1}{n^{-1}_{2}} - \frac{1}{n^{-2}_{2}}\right)$, where n_{-1} has respectively the value 1, 2 or 3 and n_{-2} the values 3, 4, 5, etc.; or 2, 3, 4, etc.; or 4, 5, 6, etc.; and R is a constant called Rydberg's constant. Bohr deduced as a consequence of his theory of stationary or non-radiative orbits that the Rydberg constant should have the value $2\pi^2 e\frac{m}{h_3}$ where e and m are the charge and mass of the electron and h is Planck's unit of action. Taking the measured values of these constants, viz., $e = 4 \cdot 774 \times 10^{-10}$, $m = 0 \cdot 899 \times 10^{-27}$ and $h = 6 \cdot 55 \times 10^{-27}$, we have $\mathrm{R} = 3 \cdot 27 \times 10^{-15}$ which agrees closely with an observed value, viz., $3 \cdot 29 \times 10^{-15}$ of the Rydberg constant. This success of Bohr's theory is a strong indication that it has in it a large element of truth.

X-Rays.—Great attention has been given to the problem of the structure of the atomic nucleus. Röntgen discovered in 1895 the type of radiation called X-rays, and Ch. Barkla and others proved in 1904 that there are two kinds of X-rays, one consisting of pulses produced when electrons have their velocity suddenly changed and the other, called the characteristic radiation, produced when electrons strike a target of material substance and set some part of the atoms of that target vibrating very quickly, which radiation consists of two or more rays of short but definite wave lengths.

Spectrography.—H. G. J. Moseley, a young British scientific man who unhappily was killed in the World War in 1915, published in 1914 an account of a very important investigation in which he photographed the characteristic X-ray spectrum for various metallic elements by placing them as anticathodes in an X-ray bulb and employing a crystal as diffraction grating. He found that as the atomic number of the metal increased the wave lengths of the corresponding spectral lines decreased, so that the square root of the frequency is proportional to the atomic number or nuclear charge. This enables the position and atomic number of missing or undiscovered elements to be fixed and shows that the nuclear charge is an exact multiple of that of the hydrogen atom. This work, since Moseley's death, has been continued by M. Siegbahn and we therefore know the atomic number of all possible or known elements between hydrogen (=1) and uranium (=92) (*see* CHEMISTRY). R. A. Millikan has pointed out that the Lyman ultra-violet lines in the hydrogen spectrum are the X-ray radiations belonging to its innermost or K-orbit. The corresponding X-ray vibrations of uranium would have a frequency $92 \times 92 = 8{,}464$ times as great as hydrogen. We are therefore now acquainted with a range of X-ray radiation extending over about 6 octaves, using the term in its musical sense, below the shortest of the ultra-violet rays, of which last there are 5 octaves beyond the end of the visible spectrum. Beyond the X-rays there are 5 octaves of still shorter wave radiation commonly called the Gamma rays.

Infra-red Rays.—Extending beyond the red end of the visible spectrum there are 9 octaves of infra-red radiation overlapping with very short Hertzian waves, which last shade into the longer waves used in wireless telephony and telegraphy. The longer dark heat rays were isolated toward the end of the last century by H. Rubens and his co-workers by a method depending upon repeated reflection of heat by polished surfaces of certain materials, which reflection selects those rays which would be most strongly absorbed by the reflecting substance on transmission. Rubens called these the " Reststrahlen " or residual rays.

Hertzian (*Short*) *Waves.*—Up to the year 1911 such dark heat rays had been isolated and studied by Rubens, Nichols and R. W. Wood with wave lengths up to about $\frac{1}{3}$ mm. but there remained a considerable gap between these longest heat waves and the shortest Hertzian waves studied by Righi, Bose and others. In 1923 E. F. Nichols and J. D. Tear succeeded in creating by Hertzian methods electric waves only 1/100 in. or $\frac{1}{4}$ mm. in wave length and measured this wave length by a form of interferometer. The same appliances served to measure the wave lengths of Restsrahlen of 1/75 in. wave length. Hence Hertzian waves created by purely electrical methods have now been made of shorter wave length than known dark heat rays. More recently still A. Glacolewa-Arkadiewa in Russia (May 1924) has created Hertzian waves of only 0·082 mm. in wave length.

The Spectrum.—The work of the period 1910–26 has therefore filled in the gaps on the two sides of the visible spectrum (*see* SPECTRUM) and has made us familiar with a range of more than 60 octaves of radiation, extending from the shortest Gamma rays emitted by radium, which have a wave length near to one-fifteenth of a hundred millionth of a centimetre, up to the longest wireless waves of 20,000 metres or more in wave length. The evidence shows that all this radiation is electromagnetic in nature and it travels through space with identical velocity of $\times 10^8$ metres per second.

Ether.—A question which has been much discussed is the nature of this wave propagation. Scientific opinion until a few years ago, was almost unanimous in describing it as a vibration of some kind in an imponderable space-filling ether. The celebrated Michelson and Morley experiment first performed in 1887, which seemed to show that the velocity of light was the same in all directions, was considered by many to prove that as relative motion of the earth in its orbit (about 30 km. per sec.) and an assumed tagnant ether could not be detected by optical means, doubt was therefore thrown upon the existence of any such medium. As a matter of fact all that this experiment showed was that this relative motion of the earth and the assumed ether *at the surface of he earth* was, as far as could be judged by the experiment, not greater than 7·5 km. per second. That is to say, a greater relative velocity could have been detected but not a much less. Recent prolonged experiments of the same kind in 1921 to 1924 perormed at the Mount Wilson Observatory, U.S.A., by Prof. Dayton C. Miller and others show that there is at that elevation a difference in the velocity of light in different directions relative o the earth's orbital motion and ether of as much as 10 km. per sec. in certain directions. This suggests a partial drag of the ether by the earth which decreases with altitude. If, therefore, he experiment could be performed, say at the summit of Mount Everest, this difference might amount to much more than 10 km. per sec. and might even approximate to 30 km. per sec., and n such a case would demonstrate a motion of the earth relative o the ether.

Relativity.—Starting, however, from the assumption that relative motion of matter and ether cannot be detected and that he velocity of light is an absolute constant, independent of the motion of the observer or of the source of light, A. Einstein ounded on it in 1905 his special theory of Relativity (*see* RELATIVITY), and in 1915 he promulgated the general theory of relativity in which a new and radical departure was made in the mode of viewing physical phenomena. Space and time were no longer to be regarded as separate entities or concepts independent of each other, but merely as modes of division of a single entity called space-time having four dimensions just as the two-dimensional plan and elevation of a house are not separate realities but only modes of viewing a section of a single solid hing of three dimensions. The ether, at any rate by some relativists, was then dismissed as an unnecessary hypothesis and he Newtonian concept of force regarded as a mathematical fiction, the observed effects being simply due to a curvature or distortion of the space-time in proximity to material substances.

The hypothesis of an ether seems, however, essential as a starting point for logical thought (*see* ETHER). If there are undulations in space through which radiation is passing, then there must be something which undulates. We know that there are two periodic vectors or directed quantities in a ray, the electric and the magnetic vectors, and these have directions in space and make that space physically different from places where the ray does not exist. Moreover, the radiation conveys energy and this exists in the space after it has left the radiating atom and before t reaches the absorbing atom. We cannot attribute these properties to mere emptiness and to speak of space as having properties is to endow it with reality equivalent to the hypothesis of an ether.

On the other hand, we cannot rightly attribute to the ether such qualities as elasticity or inertia, or earmark a portion of it and consider it as retaining identity during displacement or distortion. If it is hypothecated to explain the properties of matter, it must be in essential nature different from and more fundamental than the material substance, the powers of which it is invoked to explain.

Photo Electrics.—The properties of short wave radiation in causing discharge of electricity from metals by liberating electrons from their atoms and also ionising gases, have been much studied during the last 15 years and are described as photo-electric phenomena (*see* PHOTOELECTRICITY). The first observation was made by H. Hertz in 1887, who noticed that when ultra-violet light fell upon spark bells it promoted electric discharge.

In 1888 Hallwachs made the discovery that a negatively charged conductor of zinc or aluminium rapidly loses its charge when ultra-violet light falls upon it. This effect is better exhibited in the high vacuum. P. Lenard discovered that the velocity of the electrons emitted is independent of the intensity of the light and other observers found that the number of electrons emitted per second is proportional to the intensity. The speed of ejection of the electron increases with the frequency of the light.

In 1905–6 A. Einstein suggested that Planck's quantum theory must be valid in connection with photo-electric effects and proposed the equation $\frac{1}{2}mv^2 = hn - P$ where m and v are the mass and velocity of the ejected electron, h is Planck's constant, n is the frequency of the incident light and P is the energy necessary to liberate the electron from the metal. Ten years later this relation was fully established experimentally by R. A. Millikan, who made use of it to determine the value of Planck's constant.

The equation shows that unless the light has a frequency exceeding a certain limit, no photo-electric effect can take place; also that the more electropositive the metal, the greater the wave length of the liberating light can be, thus ultra-violet light is effective in causing electronic emission in the case of zinc but ordinary visible light in the case of potassium.

Properties of Gases.—The ionising power of X-rays was noticed soon after their discovery by the fact that they make gases electrically conductive when sent through them (*see* GASES, ELECTRICAL PROPERTIES OF). The remarkable thing is that a beam of X-ray does not ionise every atom in a mass of gas through which it passes. This extraordinary fact has been held to prove that the energy of light is not uniformly distributed over the wave front but confined to certain places. This theory, however, is quite inconsistent with the facts of interference of light. Nevertheless it is evident from photo-electric phenomena that radiant energy must be concentrated in some way in certain parcels, or quanta as they are called, the unit of energy for any frequency n being hn where h is Planck's constant. The vibrating atom radiates and absorbs only in integer multiples of this unit. No one has yet been able to reconcile this quantum theory of radiation with the classical wave theory of uniform distribution of energy over the wave front.

Conduction Phenomena.—Another department of electric research which has claimed much attention is concerned with electric conductivity especially in metallic conductors. It has long been recognised that the conduction of electricity through gases and liquids depends upon the atoms or molecules being ionised. A gas composed of electrically neutral atoms is a nonconductor. If, however, exposed to X-rays or ultra-violet light, electrons are separated from the atoms by a photo-electric action the atomic residues being left positively charged. Under the action of an electric field, these ions move in opposite directions and constitute an electric current through the gas.

The theory was originally suggested by Riecke and P. Drude, that the conduction of electricity through metals is due to a drift, under the action of impressed electro-motive force, of free electrons which exist and are moving irregularly in the interspaces between the metallic atoms. These electrons may therefore be compared with the molecules of a gas. When set drifting by an E.M.F. they collide with the atoms of the conductor and give up energy acquired during the motion from atom to atom. If we make the supposition that the velocity of free motion is much greater than that of the drift motion, which is equivalent to assuming that the electrons are moving with the same average kinetic energy that the gas molecules would possess at the same temperature, we can show that Ohm's law is fulfilled in that the conductivity will be dependent on the E.M.F. or current. Also if we postulate that heat conduction consists in an equalisation of electronic energy in a metal in which electrons are moving more rapidly in one part than in another, we can show that the Wiedemann-Franz law is predicted, viz., that the ratio of electric to thermal conductivity is constant and is proportional to the absolute temperature. In spite of these confirmations of the theory there is the serious difficulty that the postulate of equi-partition of the heat energy between atoms and free electrons leads to a value of the specific heat which is much greater than that which is actually observed, and it would not decrease with temperature as the observed specific heat value does (*see* CONDUCTION, ELECTRIC).

Low Temperature Effects.—Very important experimental results have been obtained since 1911 by Kamerlingh Onnes at Leyden on the electric conductivity of metals at very low temperatures. Using liquid helium he was able to obtain temperatures down to about 1·5° K (absolute). It had long been known that the electric resistance of pure metals was greatly reduced by cooling in liquid air and hydrogen, but Onnes found that the resistance of a thread of pure mercury vanished completely at 4·1° K. Similarly, that of tin vanished at 3·78° K, lead at 7·2°K, thallium at 2·3°K. These metals became as he called it, "supra-conductive." Electric currents in such helium-cooled metals continue to flow without any impressed E.M.F. Thus in a lead ring, in which an E.M.F. has been created by drawing a magnet away from it, a current of 320 ampères flowed for 30 min. without 1 % reduction in strength and in a cooled lead wire of 1,000 turns the current did not decrease 1 % in an hour and would have been detectable for days.

Bridgman in the physical laboratory of Harvard University, U.S.A., has studied the effect of enormous pressures up to 12,000 atmospheres on the electric conductivity of metals. Usually, but not always, this great pressure increases electric conductivity by about 10%, but it is 40% for sodium, 70% for potassium and 25% for bismuth.

This electron theory of conduction has been chiefly developed by H. A. Lorentz and ably discussed by Sir J. J. Thompson, M. Planck, M. Wien and N. Bohr. Although it has much in it to commend it, there are many unsolved difficulties. If there are free electrons possessing inertia in the interspaces of the atoms of a metal, then if a rod of this metal is set moving longitudinally and suddenly stopped, the free electrons should lurch forward like passengers in a train when there is a collision. Experiments by R. C. Tolman and J. D. Stewart in the U.S.A. in 1916 have shown that there is an effect of this kind in a suddenly arrested moving coil of wire which is considered by H. A. Lorentz to give strong support to the electronic theory of electric conduction.

Atmospheric Electricity.—The ionisation of the earth's atmosphere by solar light or radiation or cosmic dust creates a state of electric conductivity in the upper air and gives rise to the effects of atmospheric electricity (*see* ATMOSPHERIC ELECTRICITY). These have been much studied of recent years as they are of great importance in long-distance wireless telegraphy. It is generally believed that the earth as a whole has normally a charge of negative electricity, though the source of this is obscure.

This charge is continually escaping or being neutralised by a downward flow of positive electricity from the air and it must therefore be renewed in some way. As we go up into the air, the positive potential increases at an initial rate of, roughly, 150 volts per metre rise but it varies very greatly with time and place. According to the measurements of Prof. C. T. R. Wilson this earth-air current is 2×10^{-16} ampères per sq. cm. or the total current for the whole earth is about 1,000 ampères and the total charge of the earth is some 700,000 coulombs. Rain brings down, in general, positive electricity, but sometimes negative. There is also a discharge of electricity between air and earth in the form of lightning. The nature of thunderstorms has been particularly studied of late years by Prof. C. T. R. Wilson. Although lightning is not frequent in temperate climates yet the number of thunderstorms taking place over the whole earth per day is very large and there is therefore a continual passage of electrons to and from the earth. The study of wireless telegraphy and also of aurorae has shown that there must be a highly ionised or conducting layer in the earth's atmosphere at a height, roughly, of 70 to 100 kilometres. There are, however, great differences in the state of ionisation on the sides of the earth turned toward or from the sun and great changes at places of sunset and sunrise and variations with the changes in the state of the solar surface. These cause corresponding differences in the facility with which wireless waves travel by day and night and in different directions. Also the incessant lightning discharges cause vagrant electric waves called "atmospherics" which are a source of great trouble in wireless telegraphy and telephony. (*See* BROADCASTING; WIRELESS TELEGRAPHY.)

Magnetism.—The subject of Magnetism has also engaged much attention since the year 1910. Even in spite of all the investigation which has taken place we are still in ignorance as to the true cause for the peculiar magnetic properties of three common metals, iron, nickel and cobalt. Remarkable alloys have been prepared of late years which are non-magnetic, though containing a considerable percentage of iron. In addition to the non-magnetic manganese steel (12 % of Mn.) produced by Sir Robert Hadfield in 1882, there is now a non-magnetic cast iron prepared in 1920 by S. E. Dawson and Messrs. Ferranti containing 85% of iron, 5% manganese and 10% nickel. Certain nickel-iron alloys such as the 25% Ni. alloy can exist in either of two states, magnetic or non-magnetic, according to the previous heat-treatment. Again alloys have been prepared which are magnetic and yet contain no iron, such as the Heusler alloys of manganese, copper and aluminium.

Permalloy.—Perhaps the most notable magnetic discovery of recent years is the nickel-iron alloy prepared in the laboratories of the American Telephone and Telegraph, and Western Electric Companies, United States of America. It consists of 78·5% nickel and 21·5% iron. It has a magnetic permeability of 13,000 for nearly zero magnetic force, whereas the best soft iron has not more than 100–200. For magnetic forces not exceeding 0·05 C.G.S. units its permeability may reach 160,000 or more. The meaning of this is that for very weak magnetising forces or in very feeble fields this alloy, called permalloy, can attain a magnetisation hundreds of times greater than that of the purest iron. This alloy is being used for the "loading" or overwinding of submarine telegraph cables and the result is to increase the speed of signalling through the cable to two or three times that in a similar unloaded cable.

Magnetic theory has also been revised in the last few years. In 1922 Sir Alfred Ewing, whose researches on magnetism are classical, published an important paper suggesting fresh ideas on the process of magnetisation.

Structure of Iron.—The methods of examining the arrangement of atoms in solids by X-ray spectrography devised by Sir William Bragg and his son, Prof. W. L. Bragg, have been applied in study of the molecular structure of the various types of iron. This metal is now recognised by metallurgists to exist in two phases at least: called alpha-iron and gamma-iron. The form of crystal lattice in each is different. Alpha-iron is magnetic but gamma-iron is non-magnetic. There is, however, no definite relation between magnetic properties and crystal lattice structures so far as at present known.

TECHNICAL ADVANCES

Hydroelectrical Progress.—The advances in the technical application of electrical science must next be noticed. In the period 1910–26 great progress has been made in the erection of stations for generating electric current on a very large scale. These stations are either hydroelectric, that is, derive their power from falling water, or are steam driven by boilers and engines consuming coal as fuel. In a few cases internal combustion (Diesel) engines are used. As regards type of current generated they are either direct current or else single-phase or three-phase alternating current supply. For large scale transmission of power for factory supply or traction, the generation and transmission are by three-phase current and it is then converted by rotary convertors or mercury arc rectifiers into direct current (*see* DYNAMO). In hydroelectric stations, power may be derived from a high fall of water, driving impulse turbines of the Pelton wheel type or else low fall of water in large volume actuating reaction or inward flow turbines. The dynamo or alternator is then coupled directly to it. Automatic arrangements are provided for controlling the water supply as the load on the dynamo varies. In typical cases a three-phase electric current is generated at a frequency of 50 periods per sec. and at a voltage of a few thousand volts, which pressure is raised by transformers to 100,000 or 220,000 volts for transmission and then reduced again in voltage by other transformers for utilisation. Similarly large hydroelectric stations exist for utilising either high or low falls of water from high level natural lakes or valleys dammed by barrages, or low falls from rivers by diverting a portion of the water into canals which short circuit bends of the river. A cubic metre of water falling in one second through a height of one metre is equivalent to 13 H.P. and about 70% of this can be captured and transformed into electric current power by modern machinery.

In the case of steam-engine and boiler electric stations the combustion of 1·25 lb. of coal under good modern boilers is capable of yielding one kilowatt-hour of electric energy at the dynamo terminals when employing the best types of steam turbine and direct-coupled dynamo. As the calorific power of coal varies much it is generally stated that 10 to 11 lb. of steam are required for producing one kilowatt-hour.

The economical production of electric power is, however, largely controlled by the scale on which it is carried out and by the load factor of the demand, that is, by the ratio of the total energy taken up in any time to the total quantity which would be taken if the plant were always working at full load.

Transmission Problems.—The problem of the economic generation of electric power involves also that of transmission from place of generation to that of consumption. The line is, generally speaking, the most costly part of the installation if the distance is at all large, say 20 m. or more. The power transmitted electrically is measured by the product of three factors, viz., current, voltage and the power factor of consumption, which may be anything between 0·7 and 1·0.

The use of large currents involves thick and therefore expensive copper conductors, hence for long distance working high voltages and aerial, overhead, relatively thin conductors are used. This requires high insulation which is achieved by supporting the wires by chains of porcelain insulators attached to the cross arms of wooden or steel lattice poles or masts. The current is generated at a pressure of a few thousand volts and raised in voltage by static transformers and reduced again for use. Great improvements have been made in these. The use of silicon steel for the transformer cores has greatly reduced the magnetic losses. The use of aluminium is increasing greatly and in spite of disadvantages is efficient as a material for conductors. Knowledge has been expensively acquired as to the best way to prepare and purify the insulating oil in which the transformers must be immersed and means have been devised for recording the temperature of this oil when the transformer is working. Alternating transformers up to 10,000 kilowatts (13,000 H.P.) are now made and used for electric pressures up to 100,000 volts (*see* ELECTRICITY, TRANSMISSION OF).

Corona Effect.—The means necessary to protect the transformers and alternators from damage by electric surges set up by lightning discharges striking an aerial line or those produced by flash-over discharges on the insulators have been much studied in Switzerland, Canada and the United States. In the case of high voltage aerial lines there is a notable loss of power due to the ionisation of the air. This is called the corona effect since it makes the lines appear luminous in the dark. It may amount to many kilowatts per mile. Its causes and variation have been very thoroughly studied in recent years. The damage done to aerial lines by lightning is no longer considered very serious.

Telegraphy.—The progress made in the arts of telegraphy and telephony must be very briefly mentioned. The direction of improvements in telegraphy of late years has been to abolish the necessity for skilled labour in sending or interpreting messages and substitute for it transmitting machines with keyboards like typewriters which prepare a strip of paper punched with holes in a certain way for each letter key depressed. This strip is then sent through another instrument which sends groups of electric currents into the line corresponding to each letter. By means of a distributor several messages can be sent at the same time, the letter signals being sandwiched in between each other so that the line is never idle. At the receiving end a machine employs these received currents to punch holes in a paper strip which are identical with those in the sending strip. This again passing through a second machine like a typewriter reproduces the message in type ready for sending out (*see* TELEGRAPHY).

Telephony.—In telephony the great advance in the last 15 years has been the extended use of "loaded" lines, that is, lines having inductance coils inserted at intervals of 1 to 10 or 12 m., the effect of which is to decrease the "distortion" of the electric waves sent along these lines when telephonic speech is transmitted. In some cases the loading is effected by iron wire closely coiled round the copper conductor and both the coil and this uniform loading have been applied with success to improve the speech through submarine telephone cables. The most important improvement has, however, come from the introduction of the thermionic repeater as a telephone relay. This appliance, which is the basis of modern wireless telegraphy and telephony, consists of a small incandescent lamp with glass bulb and a tungsten filament or else a platinum iridium wire coated with oxides of barium and strontium. The bulb is highly exhausted. The filament is surrounded by a spiral of wire called the grid and this again by a cylinder of metal called the plate; a battery of cells is connected between the filament and plate, and another circuit between the grid and filament. The filament when incandescent emits electrons copiously and any change in the potential or voltage of the grid is instantly followed by a corresponding change in the electron current. This instrument is also called a thermionic valve. It can be used to magnify electric currents. Telephone speech, electric currents flowing along a line, are weakened by its resistance but the thermionic repeater can be used to impart to them fresh energy and send them on their way reinvigorated. Hence the use of thermionic repeater stations enables smaller and cheaper trunk conductors to be used. Another great advance is in so-called carrier wave telephony in which high-frequency electric currents are transmitted along a line and thermionic valves and microphones used to modulate these currents so as to reproduce the speech sounds at a distance. Many currents of different frequencies can be transmitted along the same line and multiple telephony conducted. (*See* AMPLIFIERS.)

Wireless Telegraphy.—In the case of wireless telegraphy (*see* VACUUM TUBE; WIRELESS TELEGRAPHY) the thermionic valve (vacuum tube) is used not only to detect but to generate the high frequency currents and electric waves required. The most striking advance of recent years is the invention of the "beam" system by Marconi. Employing electric waves from 30 to 100 metres in wave length it is possible to use skeleton parabolic mirrors to project a beam of electric radiation in a given direction, which beam is concentrated along a rather narrow path. There is great economy in power, far less interference and much less obstruction by ionisation of the atmosphere. Marconi has in this way communicated not only signals but speech to the antipodes.

Broadcasting.—In wireless telephony the most wonderful advance during the period 1910–25 has been the creation of the new art of broadcasting music and speech (*see* BROADCASTING) which can be picked up anywhere by proper receiving appliances and telephones. Most large countries now possess many broadcasting stations at which there are powerful thermionic valve transmitters and from which music and speech are sent out. The manufacture and sale of appropriate receivers to be used by the public has created a vast new industry and the industry itself has added a new pleasure to life.

The uses of wireless telegraphy and telephony in aerial and marine navigation have been greatly improved and, without the use of directional wireless, aerial travel would be impossible in cloud or fog, but by its means the position of an aeroplane can be exactly located and given to it, and the same with a ship at sea. The improvements in thermionic valves themselves have been many and important. One of these is the dull-emitter filament made of tungsten in which thorium is incorporated, and this can give a large electron emission even when worked at only a dull red heat. (J. A. F.)

ELECTRICITY, TRANSMISSION OF (*see* 22.233) —Substantial progress was made during the years 1911–26 in the art of transmitting electricity. This progress was due distinctly to the stimulus of the World War and the imposed necessity for economy of fuel and other sources of energy. The development of the art during this period may be gauged from the fact that the maximum quantity of power transmitted over one circuit increased from 20,000 to nearly 200,000 kva., the maximum line voltage being raised from 110,000 to 220,000, and, while the longest distance covered by a straightaway transmission remains at approximately 250 miles, individual lines have been grouped and interconnected so as to form widespreading systems involving a number of generating and receiving stations electrically tied together (*see* SUPER-POWER).

PROGRESS IN VARIOUS COUNTRIES

Great Britain.—In this country the advances in the science of transmitting electricity have been significant but less spectacular than elsewhere. This is partially due to the reasonably wide distribution of the coalfields and to the early growth of a large number of steam-power stations, each serving its own limited area according to its own specific needs. Unfortunately, this has led to a serious diversity in the type of current, frequency and voltage employed; consequently, the desirability for interconnection is discounted by the difficulty attending its achievement. Early development of overhead power transmission in Great Britain was also hindered by two causes: (*a*) the difficulty of securing way-leaves from local authorities and property owners, and (*b*) the ultra-conservatism of the rules provided by the Electric Lighting Acts of 1882, *et seq.*, administered by the Board of Trade under which all overhead construction was regulated. To some extent these factors stimulated the use of underground high tension cables, but the cost of such installations is too high to permit of widespread transmission of electricity.

In 1922 a code of regulations was issued by the newly formed Electricity Commission, which superseded the Board of Trade in administering the various Electric Lighting Acts. This code calls for safe construction which may at the same time be entirely economical. Among other matters, it recognises aluminium as well as copper conductors, and specifies that overhead lines shall be designed to withstand a loading of ½ inch ice on the wires together with 8 lb. per sq. ft. wind pressure with a maximum stress in the wires of one-half the ultimate figure. For steel poles or towers the maximum working stress shall not exceed 40% and for wood or concrete poles 28% of the ultimate strength. Suitable rules are framed for the crossing of telephone lines and highways. Earthing devices are to be provided in case the wire fails at a crossing. Needless to say, this code of regulations distinctly encourages the increase of high-tension power transmission, and a number of installations have been constructed in England and Wales which would not have been economically possible under the earlier code.

Notable modern British transmission line construction is illustrated by a very extensive network in South Wales operating at 20,000 volts. This is built with both reinforced concrete and lattice steel poles using pin-type insulators with suspension units at tension positions. Another important system is that of the North Wales Power Co., operating at 35,000 volts using both wood pole and steel tower construction. The highest voltage employed is 66,000 on the overhead system of the County of Durham Electric Supply Company. This latter incorporates the use of heavy-type creosoted poles with steel cross-arms and suspension insulators, and both mechanically and electrically represents the highest grade of engineering.

United States and Canada.—These countries have shown the most rapid development and afford the most important illustrations of modern transmission practice. At the beginning of the period under review some five systems in the United States and Canada were operating at a voltage of 110,000. Earlier installations using pin-type insulators were virtually limited to 66,000 volts, but the introduction of the suspension design, in which a number of units are linked together according to the requirements of the operating voltage, opened a new field in the direction of high-tension working.

A characteristic 110,000-volt line incorporates the use of galvanised structural steel towers supporting two circuits on three cross-arms. One circuit is arranged on each side of the tower, usually with the centre conductor slightly offset out of the vertical plane to minimise possibility of short circuit. An average span is 600 ft., giving eight to nine towers per m., each tower being of the order of 70 ft. high and weighing from 5,000 to 7,000 pounds. At occasional intervals in the line it may be necessary to introduce an anchor or dead-end tower which would probably weigh 50% more. Conductors are generally of stranded copper 0·16 to 0·25 sq. in., or the equivalent aluminium. Along the top of the towers it has been customary to string a galvanised steel earth wire to increase the capacity of the line to ground and minimise inductive interference. Three-phase alternating current is universal with a frequency of 60 cycles predominating. Transformers are generally connected Y on the high tension side with the neutral point connected directly to earth, so as to ensure the quick operation of relays in the event of a short circuit.

Before long the limitations of 110,000 volts began to be felt, and in 1912, 140,000 volts was used by the Au Sable Power Co. in Michigan, followed a year later by the adoption of 150,000 volts for the Big Creek system transmitting to Los Angeles, 240 m. away. In this case single circuit towers were employed, each carrying the three conductors in a horizontal plane 17 ft. apart. A number of other systems were built of 130,000, 150,000 and 165,000 volts, this voltage being selected more with reference to the load to be carried than the distance of transmission. In the year 1923 the Big Creek system, after reinsulating the lines and raising some of the towers, changed to 220,000-volt operation. Shortly after this the Pacific Gas and Electric Co. began operation of a 220,000-volt line from Pit river to Vaca, California, 202 miles. In addition, two further 220,000-volt transmission lines were under construction in 1926: (*a*) Great Western Power Co., Brighton to Merced, California, 103 m., and (*b*) Pennsylvania Power and Light Co. from Wallenpaupack to Allentown, 60 miles. A fifth 220,000-volt line was planned in connection with the Conowingo development on the Susquehanna river, which would transmit to Philadelphia. In the United States and Canada there are not less than 30,000 m. of circuit operated at 110,000 volts or over, all of which has been put into operation since the year 1910.

Germany.—Since the adoption of 100,000-volt transmission constitutes such an important step in the art, it is interesting to note its successive introduction into countries where electric development is most fully advanced.

The first European 100,000-volt line was built from Lauchhammer to Riesa in Saxony in 1911, transmitting 15,000 kva. over 30 miles. Steel structures of the lattice type were used set in concrete foundations. By the use of extra long cross-arms each circuit was arranged in an equilateral triangle, while the relative position of the conductors was transposed 36 times in the length of the line. This careful method of balancing the reactances would seem to be quite unnecessary, and has probably been the cause of mechanical trouble on this line. Construction has been standardised in favour of lattice steel poles set in concrete carrying three cross-arms of heavy channel section. The conductors are for the most part of stranded aluminium 0·189 sq. in. or of steel core aluminium 0·11 sq. in. section. Suspension insulators are usual together with a steel earth wire.

Italy.—In the year 1912 the first 90,000-volt system was operated in Italy, followed by further installations at 100,000 to 135,000 volts, and the art became more fully developed in this country than anywhere else in Europe. All these lines are of the most modern design with steel construction. Notable installations are the following: Societa Interregionale from Brugherio to Reggio Emilio (95 m.), Societa Lombardo, Val Brembana to Lecco, Cislago, etc. (56 m.), Societa Adamello, Tema to San Polo (140 m.), Societa Piemontese, Ponte Tresa to Novaro (38 m.), Societa Tridentina, Meran to San Polo (168 miles). In addition to the foregoing a considerable further mileage of 125,000-volt transmission was already planned in 1926; and lastly the Societa Forze Idrauliche is constructing 600 m. of transmission to operate at 150,000 volts extending from Sila to Naples and across the Straits of Messina to Palermo.

India.—The year 1912 also saw the first 100,000-volt transmission in India, this being the double circuit line from the Tata hydro-electric plant at Khopoli to Bombay, a distance of 43 miles. This installation was the first of its type to be designed and carried out by British engineers, although in some of its characteristics it resembled the high-tension network in the Transvaal, which had been designed by the same group and put into operation about two years earlier at 88,000 volts. Some elements of the mechanical design in the Tata transmission are similar to those of the early German designs, especially in respect of the long cross-arms and equilateral conductor arrangement. These have not been repeated in later installations. In 1926 several systems were being constructed in India to operate at 110,000 volts.

Spain.—The Ebro Irrigation and Power Co. inaugurated in 1914 the first 100,000-volt transmission system in Spain from a plant on the Sagre river to Barcelona, 105 m. away. American engineers were responsible for the work, and the designs followed those employed on certain installations in Mexico. A somewhat unusual feature was the use of pedestal type insulators on the Ebro system, this being the only instance of their use on 110,000 volts. Subsequent experience has not confirmed this practice, and more recent extensions to the Ebro transmission network employ suspension strings. This transmission now comprises about 500 m. of 110,000-volt line, in addition to which two or three other systems have been built in Spain for the like voltage.

Japan.—The first 110,000-volt transmission in Japan was a double circuit steel tower line from Lake Inawashiro to Tokyo built in 1913, a distance of 144 miles. This line followed American engineering practice very closely. Conductors were of copper 0·155 sq. in. section with seven and eight unit suspension insulators. Towers were spaced 550 ft. apart on the level and the customary steel ground wire was strung. Since the year 1914 there have been built in Japan four important trunk transmissions operating at 150,000 volts, while a fifth is under construction. Each of these lines is from 150 to 200 m. in length. In addition, an interconnection line of 127 m. in length is planned for operation at 220,000 volts.

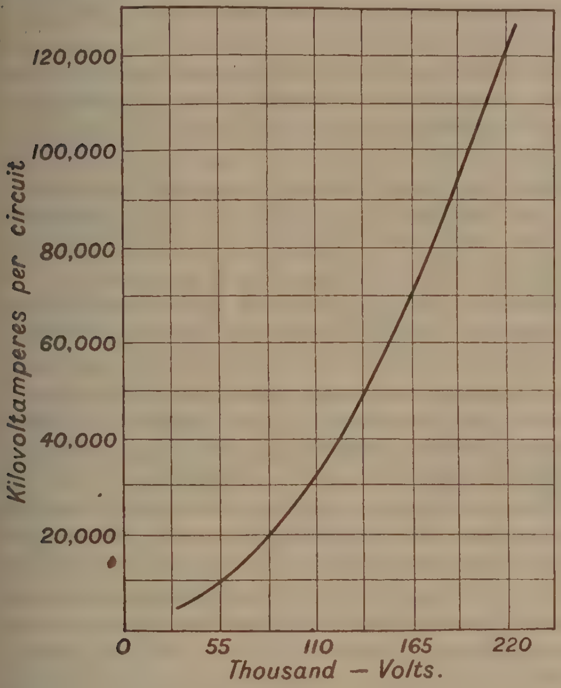

FIG. 1.—Diagram showing increased capacity per circuit, at higher voltages.

France.—In 1918 the first 100,000-volt transmission was built in France. Prior to this time industrial districts had been tied in with power plants (notably in the Pyrenees and the Mediterranean coast) with power lines of economical design but operating at much lower voltage. In the year mentioned a 110,000-volt steel-tower line carrying 15,000 kva. was constructed from Goesgen in Switzerland to Pouxeux in France, a distance of 115 m., of which one-half was in each country. Lattice steel, concrete-set poles were used of single circuit design carrying two conductors on one side and one on the other. The wires used are of stranded copper 0·12 sq. in. section suspended on 8-unit insulators with standard spans of 591 ft. and special crossings up to 1,600 feet. Subsequent to the reclamation of the war zone a series of transmission networks was developed under government control to supply energy for the work of reconstruction. These systems have since been extended and now connect Vincey, Nancy and Mohon with 120,000-volt lines, amounting to 135 m. in length in what is known as the Eastern system. Construction was being completed in 1926 on the northwest system of a 100,000-volt network connecting Labuissère, Beuvry, Bully, Abbéville, Amiens and Calais, a mileage of more than 300. It is estimated that the total circuit mileage of 100,000-volt line in France is not less than 2,500.

Sweden.—The waterfalls at Trollhättan have long provided a source of power for the southwestern peninsula of Sweden. The power was developed under government control prior to 1910, the energy being transmitted at 50,000 volts. In 1921, however, a power line was built across the entire width of the country from Trollhättan to Vesterås, a distance of 200 m., and this is being extended to Stockholm. This installation is designed for 132,000 volts with ultimate operation at 220,000 volts. Single circuit construction is used, the wires being hung from a horizontal cross-arm. For part of the route the twin structures supporting this cross-arm are of lattice steel, and for the other portion reinforced concrete poles are employed, the intention being at a later date to add a third pole to each support and extend the cross-arm sufficiently to accommodate a second circuit. This line is remarkable in respect of the economy and simplicity of its construction. A similar transmission line is planned which will extend from Stadforsen in the north to Vesterås, a distance of nearly 300 miles.

Australia.—From the great 125,000 kva. power station at Yallourn to Melbourne, a 112-m., 132,000-volt, double-circuit transmission line was constructed in the year 1922, this being the highest operating voltage in British territory. The design of the line was on American principles, but in some respects it marked a distinct advance. The average span employed was 1,056 ft., a procedure made possible by the use of steel-cored aluminium conductors of 0·264 sq. in. section. A further mileage is now being added to this system.

The foregoing summary is not to be regarded as complete, because it takes no account of the construction of 100,000-volt transmission in South Africa, Chile, Austria and Switzerland, as well as in other countries where the transmission of power is beginning its development.

CONDUCTORS, INSULATORS AND SUPPORTS

Conductors.—The most important element in overhead transmission is the conductor. Copper wire is the most widely used in the hard-drawn form, such wire having a density of 8·89 at 68° F. and a resistivity based on the international standard of 0·15328 ohms-metre-gramme. For practical purposes conductors are stranded to achieve maximum strength and flexibility, from 3 to 37 wires being laid up in spiral form, giving a sectional area of from ·025 to ·75 sq. in. (British Engineering Standard). In America it is usual to strand a smaller number of heavier wires. To allow for the twist it is customary to add 2% to the weight and resistance. Tensile strength of hard-drawn copper is from 51,000 to 65,000 lb. per sq. in. with an elongation of from 1 to 2½% on 10 in., depending upon the size of the wire. Aluminium wire is now very extensively used; it has 60% the conductivity of copper and about one-third the density; consequently the equivalent conductor will be only half the weight of copper with a diameter 30% greater. In most cases the aluminium is reinforced with a core of high tensile steel wires, thus forming a composite conductor.

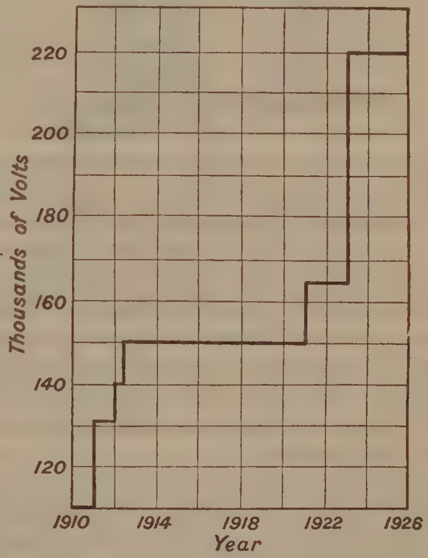

FIG. 2.—Diagram showing successive increase in maximum transmission-line voltage.

This development is one of the most important in the art, and it is estimated that since its commercial introduction in the year 1910 more than 150,000 m. of aluminium-steel conductor have been installed. The high ratio of tensile strength to weight makes it possible to erect with long spans and so economise construction cost. Being some 40% larger in diameter than the equivalent copper, the corona loss is minimised or eliminated entirely. Copper-steel and copper-bronze composite conductors are also coming into use for special purposes, notably for catenary wires on electric railways. Copper-clad wire is used as a conductor on special long-span construction as well as for earth wire. It is drawn down from a composite wire bar made by casting copper around a steel billet. Steel conductors have a limited use for long crossings, some of which are as long as 6,200 ft. between towers. In such a case the highest tensile strength is necessary; the steel must be thoroughly galvanised, and usually is painted periodically in addition. A variety of rope strands is used with such steel wire to secure the best combination of flexibility and strength.

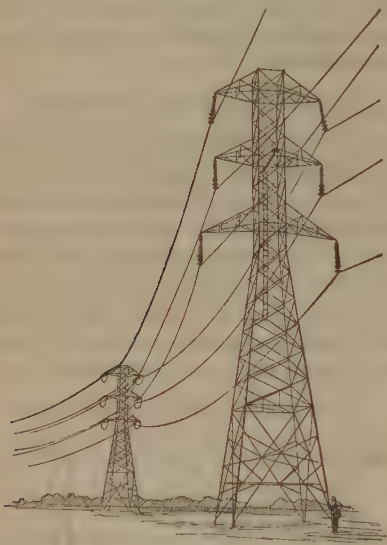

FIG. 3.—View of a modern 220,000-volt transmission line.

Insulators.—The modern high-tension line usually incorporates porcelain insulators of the suspension type. In most cases the unit consists of a disk with metal attachments such as a cap and pin, which are cemented to the porcelain element and provide a means of linking two or more units together. Certain designs have been brought out, especially in Germany, by which the attachments are fixed without the use of cement; in another design (the Hewlett insulator) two metal links engage in holes through the porcelain. Only the perfection of insulator porcelain has made 220,000-volt transmission possible, and although the ceramic art is an old one it has to be modified by the most careful precautions in this industry.

A mixture of clay (usually English ball clay and China clay) with potash feldspar and flint forms the basis of porcelain. The last two constituents are ground very finely and mixed with the clay in a digester or "blunger," next filter pressed, and the resulting "body" set aside to age. It is afterwards kneaded in a pug-mill, which extrudes the pug in a suitable form for moulding, which is done on a modification of the potter's wheel. The shells are then oven-dried, trimmed, glazed, kiln-fired, cemented, tested and issued as a complete insulator unit. Careful inspection follows almost every operation. Most of the earlier troubles with insulator porcelain have been eliminated. "Blebs" or air bubbles have been eradicated by ageing or by the use of vacuum pumps for handling the slip. Capillary holes have been traced to threads from the filter lawns; brittleness and porosity have been corrected by careful thermostatic control of firing temperatures. Cracking in service due to hydration and swelling of the cement has been prevented by setting the cement in an atmosphere of high pressure steam as well as by an admixture to provide elasticity. Insulator testing has also developed to an advanced stage. The customary porosity test on a batch of shells after firing is to break up a sample and immerse in an alcoholic solution of red fuchsine for 24 hours under a pressure of not less than 2,000 lb. per sq. in. (British Engineering Standard). Any porosity will be shown by permeation of the red dye. The above standard specification calls for a flash-over test of 300,000 volts dry and 220,000 volts wet on a 100,000-volt insulator, the same to withstand a voltage of 525,000 under oil without puncture. A mechanical load 2½ times that used in service is to be applied without failure of the insulator. The number of units per string is of course a function of the voltage, the usual practice varying from four or five on 66,000 volts up to 13 or 15 on 220,000 volts. For tensioning positions where the mechanical stress on the insulator is greater, the electrical stress is reduced by adding one or two extra elements to the string. The same applies to districts liable to considerable fog or smoke. For the highest voltage service it is customary to suspend a metal shield ring round the lowermost unit; this equalises the voltage drop across the various elements as well as protecting them by carrying any arc which may form.

Supports.—Steel construction is coming to be universal except in regions where suitable timber is unusually good and plentiful or steel is difficult to obtain. At 110,000 volts a spacing of 10 to 12 ft. between conductors becomes necessary; this requires very long cross-arms, and although twin poles would carry one circuit a simple design of steel structure will accommodate two with a greater factor of safety and probably double the life. In Europe such a support is generally designed as a pole or beam having a relatively narrow base three to six ft. square set in a block of concrete. The post is built up of four corner angles laced together, usually shop assembled by rivets. Three heavy channel cross-arms are used of graduated length, usually with the shortest at the top, which provides symmetry and reduces the torsional loading. Conductors are hung from suspension insulators at the extremities of the arms, and as they are in different vertical planes there is little risk of contact due to excessive sag.

This type of structure is virtually the standard in France, Germany and Italy; it will be seen that it requires a very heavy concrete block to resist overturning, and is not of the best design to resist torsional loads. The American type of double circuit tower overcomes these difficulties but occupies a much greater area, the base being from 15 to 25 ft. square, and each post is separately anchored to a steel footing buried in the ground or in a light concrete footing. Overturning moment is therefore converted into a thrust and pull. Actual design of the tower is that of an entirely determinate structure; it can therefore be laid out with economy. The same general rules apply to single circuit towers which support the three conductors in the same horizontal plane. They have the merit that "whipping" and short circuit due to ice load on the wire are precluded, and this type of structure is favoured for mountain regions where altitudes are high, snow and ice frequent and spans long. A double circuit tower in American practice may weigh from 5,000 to 9,000 lb. and a single circuit from 4,000 to 9,000 lb., including foundation steel. Heavy anchor or strain towers are used at important points along the line; these will probably weigh up to 50% more. In American practice, which is also followed in Japan, Australia, India and South Africa, the tower members are bolted together in the field. Galvanised sections are universal, but in Europe there is a tendency to paint the towers wholly or partially.

Mention should be made of reinforced concrete, which, although not widely used, appears on at least one very important installation—the transmission from Trollhättan to Vesterås in Sweden already referred to. Here a structure consists of two 60-ft. hollow concrete poles set 20 ft. apart and supporting a horizontal steel cross-arm from which the conductors are hung. Each pole is fully reinforced and made by the Schleuder centrifugal process; it tapers from 20 in. to 9 in. and weighs 8,000 pounds. A transverse load of 7,000 lb. applied at the top has been withstood with safety. The chief merits of the construction are its simplicity, small disturbance of the ground when setting, absence of painting or other protection and economy in first cost. The disadvantages are those attaching to the great weight, the high cost of transportation and the heavy tackle necessary in the field.

SOME SPECIAL PROBLEMS

Lightning.—Successive increase in the operating voltage of high-tension systems has eliminated some problems and introduced others. For example, lightning in its direct or indirect effects is no longer feared on the highest voltage lines because the quality of the insulation employed is so high. Ground wires and lightning arresters are therefore being eliminated on these systems. Flashover due to an induced surge will take place at one of the many arcing rings without damaging the insulators.

Current Difficulties.—Charging current is a most embarrassing problem, because the capacity of transmission lines has increased owing to the increased length and size of wire. Adding the effect of the extra high voltages employed, the charging current has become in many cases commensurate with the load current. In starting up the line, therefore, the generator must supply virtually full load amperes of leading current, with the result that it becomes self-exciting and a dangerous rise of voltage results. The solution of this and other difficulties has been found in the so-called synchronous condenser or motor permanently connected at the receiving end of the line with adjustable excitation by which the line current can be made to lag or lead or to run in phase. In starting up, the under-excited synchronous motor is brought up to speed with the generator, and it supplies approximately half the charging kilovolt-amperes.

Instability.—This is an effect of resonance or tuning by which a line of given frequency and physical characteristics may be liable to excessive rise in voltage and other abnormal conditions. At a frequency of 60 cycles a complete alternation occupies a distance of 3,000 miles, and one-fourth of this, or 750 miles, is occupied by a rise in voltage from zero to maximum amplitude. A line of this critical length is virtually impossible to charge. While such long distance lines have not yet been built, they have already been planned, and it has been made obvious that an entirely new set of conditions has to be met which will probably be by means of distributed synchronous condensers throughout a sectionalised line.

Corona.—This is an important phenomenon, especially at high altitudes; it connotes the breaking down of the insulating properties of air, and is shown by a purple glow surrounding the conductor. The voltage at which corona takes place is higher for large conductors and wide spacing, and it can therefore be kept under control by careful design, use of aluminium-steel or other large conductors. The actual loss will be proportional to the square of the difference between the operating voltage and the corona voltage if the former is the higher. For 220,000-volt operation at sea-level under good conditions it has been found that one inch is the minimum practicable diameter of conductor. According to F. W. Peek, who has made many years' research of this problem, for 1,000,000 volts a 6-in. diameter conductor would be necessary.

Underground Transmission.—The high engineering and economic status attained by the overhead transmission line will react against any very wide use of insulated cables. Nevertheless, there are occasions where the high cost of these may be justified and the gradual development of extra high-tension cables is promising. According to C. H. Merz, many miles of 33,000-volt underground cable are in use in England with satisfactory results, and not less than 8 m. of 66,000 volts. In Holland there is an important installation of 55,000-volt cable. All these examples are of three-core construction; although single-core cables have been made for much higher voltage, they cannot be regarded as a final development.

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ELECTRIC LIGHTING.—Progress in electric lighting since 1910 is chiefly a story of the development and application of the tungsten filament lamp and its accessories. *See* also ILLUMINATING ENGINEERING.

Filament Lamps.—From 1907 until 1911 the tungsten filament was extremely fragile, but in the latter year Coolidge developed ductile tungsten. The ductility of the tungsten wire made it possible to construct the filament in various forms, which greatly increased the application of the filament lamp. Extremely controllable light was now available, because point sources could be approximated and various optical principles could be taken advantage of in designing reflecting, refracting and transmitting accessories. In 1913 Langmuir developed the gas-filled lamp, in which the filament is wound into a fine helical coil, and the bulb is filled with nitrogen or argon instead of being completely exhausted, as in the case of the so-called "vacuum" lamp. This helical coil is in effect a thick filament, and it was found to lose a relatively smaller percentage of energy by conduction than a thin one for equal amounts of emitted light. The efficiencies of these gas-filled lamps are approximately twice those of the vacuum lamps.

The lumen has been introduced as a unit of quantity of light, and lamps are now rated in lumens per watt or in total lumens.[1] The temperature of the filaments of vacuum lamps is of the order of magnitude of 2050° C., and their average efficiency approximates 9 lumens per watt. The higher efficiencies of the gas-filled lamps (from 10 to 25 lumens per watt) are due to the higher temperatures (up to about 3,000° C.) at which the filaments can be operated satisfactorily when immersed in a gas. The blackening of tungsten filament lamps is due to the evaporation of the filament material, and this metallic vapour is deposited upon the relatively cool bulb. The function of the gas is to reduce this evaporation. Other improvements have been made which reduce the blackening by the insertion of chemicals that alter the metallic vapour to compounds which are less black. Filaments after a period of operation at incandescence used to sag considerably. This was undesirable in the vacuum lamps, and was very objectionable in the fine helical coils of the gas-filled lamps. Pacz developed a process which produced "non-sag" filaments, thereby removing a serious cause of lamp deterioration.

In earlier lamps it was necessary to use platinum for that part of the leading-in wire which was sealed into the glass of the bulb. A relatively inexpensive substitute has been developed by using a copper-sheathed nickel-iron wire of the proper proportions, so as to have the same expansion coefficient as platinum or glass. This equality of expansion coefficient is necessary in order that a leakage may not develop at the place where the wire is sealed into the glass. A later improvement was the introduction of the tipless bulb. This was achieved by exhausting the bulb through the tubular stem which supports the filament. A still later development was the evolution of "inside-frosted" bulbs, which were introduced in the smaller sizes up to 100 watts. This frosting diffuses the light and reduces the brightness of the lamp. It makes it possible to standardise lamps, thereby reducing the number of kinds through a reduction in the number of different finishes. Simultaneously various shapes of bulbs have been eliminated, with great resulting economies in manufacture. This development fits nicely into the programme of shaded light which better lighting demands. The filament lamp possesses the great advantage of divisibility, and this is evidenced by the extreme range of sizes which have been produced. The smallest is about the size of a grain of wheat, and the largest actually used by 1926 was 30,000 watts.

The increased efficiency of light production made it possible to produce lights of various quality. For example, by the use of a special blue-green bulb the so-called daylight lamp emitted a light approximating daylight in quality. By the application of a yellow-orange coating on the bulb the so-called "flametint" lamp was produced. This provided the "warm" light of flames.

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[1] A lumen is the amount of light that would fall on a surface so placed that all its parts are at a distance of 1 ft. from a light source of one-candle power.

The average luminous efficiency of all filament lamps sold in the United States in 1910 was 4·42 lumens per watt. This average steadily increased so that in 1924 it was about 12·5 lumens per watt. This great increase in luminous efficiency is responsible for almost the entire decrease in the cost of light during that period, and this decrease in cost greatly increased the amount of light used. However, the usual intensities of artificial illumination were still far below what is best for vision as evolved under natural light.

Consumption of Electric Lamps.—Inasmuch as the tungsten filament lamp is a good index of development of electric lighting, the following approximate statistics for 1922 are of interest:—

	Number of Lamps	% of Total
Entire world	706,000,000	100·0
United States	337,000,000	47·7
Europe	266,000,000	37·6
Germany	95,000,000	13·5
Japan	37,000,000	5·3
France	28,000,000	4·0
Great Britain	24,000,000	3·5
Italy	22,000,000	3·1

In 1922 the average consumption of filament lamps per person was as follows:

	Lamps per capita		Lamps per capita
Entire world	0·42	Norway	1·54
United States	3·10	Sweden	1·30
Switzerland	1·75	France	0·70
Canada	1·70	Great Britain	0·50
Germany	1·60		

From 1911 to 1922 the percentage increase in the *per capita* consumption of filament lamps for various countries was as follows: United States, 227; Germany, 220; Japan, 114; The Netherlands, 93; Sweden, 81; France, 67; Italy and Belgium, 60; Switzerland, 49; Great Britain, 18. The percentage increase for Europe was 49.

Other Light Sources.—The mercury vapour lamp was somewhat improved, but no radical developments took place. The gaseous-conductor lamp, employing various gases and producing light sources of various colours, was introduced to a slight degree in special fields. The use of the arc-lamp for lighting rapidly receded in the face of the invasion of the gas-filled tungsten lamp. Magnetite and flame arcs were still being installed to some extent in "whiteway" street lighting. The tungsten arc confined in a bulb was commercialised for very special purposes.

Fields of Lighting.—In all fields the intensities of illumination generally increased markedly, and with the introduction of better equipment great strides were made in controlling and diffusing light and in shading the light sources from the eyes. In street lighting arc-lamps were generally superseded by filament lamps; the watts per unit increased; and more attention was paid to ornamental equipment. Highway lighting outside the cities began to develop. In industrial lighting the tendency toward higher intensities of illumination became particularly marked. Intensities as high as 20 foot-candles were found in many factories and offices. Where, in 1910, three foot-candles were recommended, in 1926 10 foot-candles were commonly suggested. Industrial lighting equipment became gradually more or less standardised.

The tendency away from the earlier localised lighting to a general distribution of light became well established, although localised lighting became recognised as a desirable supplement to general lighting. Localised supplementary lighting was made practicable through filament lamps. In residence lighting the tendency moved toward more adequate wiring, the increased use of portable lamps, and the shading of light sources. In stores and schools the diffusing glass lighting unit became widely adopted, and improvements were marked throughout these fields. Sign lighting and electric signs developed very greatly after 1910. So it is with stage and show window lighting, where the filament lamps of higher efficiencies add greatly to the ease with which lighting effects may be produced. The use of light as an expressive medium has been extended enormously since 1914. By the use of spot-lights, of lamps concealed behind architectural details, of coloured accessories, etc., theatres and other public buildings have become palaces of light. Flood-lighting of exteriors almost entirely developed since 1910, not only for spectacular and artistic purposes but for utilitarian needs, such as the flood-lighting of railroad yards and the grounds of industrial plants. One of the most spectacular displays was the illumination of Niagara Falls. In headlighting for automobiles and locomotives, filament lamps very generally superseded the flame light sources. In signals and traffic control, filament lamps were responsible for most of the development. Electric lighting has been extensively developed for night-flying. In the projection of motion pictures the arc lamp has been dispensed with. It was apt to set fire to the easily combustible film and also to burn out in the middle of a reel.

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(M. L.)

ELECTRIC POWER, GENERATION OF.—A marked advance in the utilisation of electrical power has taken place since 1910, as is shown in the development of water-power resources in many countries and in the extent of high-pressure transmission covering vast distances; the electrification of main and suburban railways and the advance in the installed capacity of power stations and in the sizes of the units of plant contained in them.

Marked improvements have also been effected in fuel-fired stations by reason of the greater evaporation capacities of the boilers (*see* BOILERS), higher steam pressure, the admission of pre-heated air to the grates, the use of pulverised fuel and of oil fuel and the consequent progressive improvement in the thermal efficiencies of boiler house plant. For example, in Great Britain, while the average thermal efficiency of public power stations in 1924 was only 12·45%, the efficiency of the Barton generating station of the Manchester Corp., taken over a whole year's operation, was 20%, while recent records show an advance even on that figure and nearly 22% has been obtained on a 55% station load factor.

Developments are also being made in the processes for the low temperature carbonisation of coal (*see* FUEL PROBLEMS) enabling valuable by-products to be recovered, such as heavy oils and other derivatives from which dyes and other necessary products can be distilled, and by which smokeless fuel with valuable properties can be obtained for domestic use.

This process, combined with power station practice, would enable boilers to be gas-fired or fired with the by-product coke applied in a pulverised form and though, according to the latest report of the Fuel Research Board of Great Britain, no process has yet been evolved which can claim to be commercially successful, developments and improvements are continually taking place which may render this process of great utility, not only by reason of the valuable by-products resulting therefrom, but also in the application to steam raising in combination with electrical power stations.

The employment of large water-tube boilers working at high steam pressures, the usual figure nowadays being from 350 to 550 lb. per sq. in., but with experimental plants already working at pressures considerably in excess of these figures, viz., up to 1,200 lb.; the employment of super-heated steam at 750° F.; marine casings and settings which eliminate air leakage; the adoption of pre-heated air and of both induced and forced draught fans so as to obtain a balanced draught in the boiler grate; overhead economisers and steel stacks—enable a self-contained boiler unit to be designed which is of great value in the lay-out of the larger and more important stations.

To these advantages may be added the improved grates of the two main forms, namely, chain and underfeed types: the water-trough system of ash disposal and the closed system of feed water supply combined with the further de-aeration of the whole or the make-up portion only of the feed water, the conservation of heat from the condensate delivered from the main turbine condensers, supplemented by live steam "bleeding" from one or more of the stages of the turbine, and by exhaust steam taken from some of the steam-driven station auxiliaries, have all brought up the boiler house efficiency, so that figures well over 80% are now (1926) claimed. The most recent practice in feed water supply is to run constant speed motor-driven turbine pumps in parallel with variable speed steam pumps for easy regulation.

The instrument attachments which readily enable records of the draught and percentage of CO_2 to be obtained as well as temperatures at various points in the flue circuit and in the feed water circuit, super-heater temperatures, etc., are a recent addition contributing greatly to the increased efficiencies obtained during the last few years; in fact boiler house practice has been greatly improved and is now generally carried out in a thoroughly scientific way.

Reference should also be made to automatic control of boiler plants, a popular system being one which regulates both the pressure and proportion of CO_2.

In the engine-room, turbines are commonly constructed for speeds of 3,000 r.p.m. on a 50-cycle system, which is the adopted standard frequency in Europe, up to sizes of 20,000 kv.a., while for speeds of 1,500 r.p.m. units of 30,000 and 40,000 kv.a. are in use. In the United States single units and combination units with an aggregate output of 60,000 kv.a. or more are in vogue.

Improvements in the steel and alloys employed (*see* IRON AND STEEL; METALLURGY) have enabled these large machines to be constructed and a notable advance in design has been made in recent years. Turbines continue to be made of both the impulse and the reaction types and in some cases the combination of the impulse type for the H.P. end with reaction type for the L.P. end have been employed. In another design both the stator and rotor of the turbine revolve, and so double the relative velocity by which an increased efficiency has been obtained with a reduced steam consumption.

Generally speaking, a steam consumption well under 9 lb. per kw. hour can now be relied upon with the larger machines when running at full load. Improvements in the metals used and in balancing have brought about a great advance in the reliability, efficiency and cost of these large units.

Improvements have been made in the closed system of air ventilation of alternators which minimise the risk of serious combustion of the insulation of the machine in the event of faults developing. The "closed" system of circulating the air over or through coolers supplied with water in shunt to the main circulating water system is generally used to-day.

In the surface condensers and pump equipment the general practice now is to employ dry and wet air pumps (*see* PUMPS), generally of the rotary or injection type in conjunction with, or as an alternative to, a system of high- and low-pressure steam and water jets to deal with the incondensable gases, with a supplemental condensate wet pump to raise the condensed steam to the hot well and boiler feed system. From the turbine to the switchboard it is now general practice to introduce a buffer in the shape of reactance coils and thus to minimise the effect of a breakdown on any part of the distribution system or occurring in the power house. The most modern practice is to put the reactance into the machines themselves. Alternatively where, as is now quite common, step-up transformers are used, the necessary reactance is embodied in the latter.

In the switchroom the practice now is to provide a central control-room, from which not only can the boiler-house and engine-room plant be controlled by simple telegraph systems, but also, through remote control, effectively to command the various oil break switches controlling the various generators and outgoing feeders, and to sectionalise the station in emergencies or during special tests. It is the general practice to sectionalise the busbars, and to insert reactances between the sections so as to minimise fault disturbances. Switching is generally now confined to the stepped-up voltage and smaller currents. Much research has been made into the design of heavy oil break switches with valuable results upon their reliability. The American practice for extra high voltage is to install outdoor switches and transformers, indoor gear being now regarded as out of date.

The tendency in modern stations is to design them on big lines and to employ large units of plant. The self-contained boiler unit referred to enables simplicity of design to be made effective and reduces the cost of buildings while maintaining ample room for inspection and overhaul. The construction of large stations of 500,000 kw., or more, generally embodies the grouping of, say, five sections, each self-contained and equipped with 100,000 kw., with complete fuel handling, condensing and switchroom arrangements which, from economic and even military reasons, is an advantage in design and does not adversely affect the economic cost of the equipment.

Power stations of this size are under construction at Crawford avenue, Chicago; in the Philo Station of the Ohio Power Co.; East River, New York; at Barking Creek, London, and elsewhere. Briefly, the modern tendency is toward the establishment of larger generating stations ranging from 200,000 to 500,000 kw., properly situated with reference to economic fuel supplies and liberal supplies of circulating water and also to interconnect such stations with others by transmission lines working at high pressure (*see* SUPER-POWER).

The advance in design has resulted in a notable increase in the thermal efficiency of the equipment due (*a*) to boiler equipment improvements, (*b*) to turbine design at higher speeds consequent upon the improved materials available, (*c*) to the practice of extracting live steam from one or more of the later turbine stages for feed water heating, and thus reducing the volume of steam exhausted into the condenser—a matter of importance with the very large machines now employed and (*d*) the utilisation of the waste flue gases to pre-heat the air required for combustion.

The transverter has been evolved during the last few years, a machine consisting of fixed transformer and commutator with brushes revolving at synchronous speed, by which three-phase alternating current energy can be converted to direct current at one end of the line and re-converted at the terminal point, thus substituting two conductors for three and indeed only one conductor for three if the earth be used as a return, as in the Thury system. Two transverters may then be used to provide a link between two systems of differing frequencies. Experimental trials of a favourable character have been carried out, but the transverter can hardly be said to have yet emerged from the experimental stage, though giving great promise of success.

To sum up, it may be said that circumstances arising out of the World War and the economic disturbances which have followed have given a great impetus to electrical development in recent years in the utilisation of water power, in the transmission of energy over wide areas, in the increased use for railway traction and in the wider use for industrial and metallurgical requirements and domestic applications. All this has developed a tendency toward generation on a concentrated but greatly increased scale, coupled with schemes of inter-connection between widely separated centres of generation. It would appear that this constant expansion, bringing in its train cheaper and more efficient production and wider distribution, must inevitably greatly extend the use of electricity to meet the necessary requirements of civilisation in the immediate future. (J. SN.)

ELECTRIC RADIATION.—Radiation, in the most general sense of influences travelling with finite speeds along definite paths, has been concerned intimately in all the most striking discoveries of physics since 1910 with the exception of the general theory of relativity. But the word is generally used in one or two narrower senses. Radiation may mean the class of rays to which light belongs, distinguished from rays which consist of material particles by travelling with the same speed and by possessing a periodicity which is displayed in interference. Experimental knowledge of such radiation has been greatly extended by the definite proof that X-rays and γ-rays are forms of it, and differ from light only as light differs from Hertzian waves, namely in possessing a much greater frequency. Radiation in a still narrower sense may mean the form which is emitted from hot bodies and determined by their temperature.

Saha's Views.—This temperature radiation was the main subject of the earlier article (22.785); subsequent investigation has not added much. All doubts have been removed concerning the validity of Planck's formula, which has become the basis of all modern methods of measuring the highest temperatures (*see* THERMOMETRY, 26.821). The most important theoretical advance is due to Saha, who suggested that temperature radiation may contain part or the whole of the line spectrum of the elements from which it is emitted. He applies Gibbs' thermodynamical theory of chemical equilibrium to an assemblage of similar atoms, and supposes that the energy required to ionise an atom may be taken as analogous to the heat of dissociation of a chemical compound. In such an assemblage there will be a rate, increasing rapidly with the temperature, at which the atomic electrons are raised to higher states, including that of ionisation, and an equal rate of return; the lines of the spectrum will therefore appear with an intensity proportional to the rate of the corresponding transitions (*see* below). Temperatures attainable in the laboratory are generally so low that this spectrum is masked by the continuous spectrum; it was formerly believed that line spectra could not arise from pure temperature excitation. But a re-examination of the facts in the light of Saha's theory indicates that such excitation plays an important part in the high temperature arc and in "furnace" spectra. In the stars, conditions are much more favourable; there the theory has wide application (*see* ASTRONOMY; SPECTROSCOPY).

Origin of Spectra.—Concerning radiation in the sense of all rays similar to light, the chief question mentioned in the earlier article which has been the subject of later investigation is that of the origin of spectra. This question has been completely answered. According to Bohr's theory, which is the key to modern physics, line and band spectra arise from the transition of the emitting system between two stationary states of different energy content. If the transition takes place from a stationary state of higher energy W_1 to one of lower energy W_2, ν, the frequency of the line emitted, is given by $h\nu = W_1 - W_2$, where h is Planck's constant (*see* QUANTUM THEORY). Line spectra are emitted by atoms, the different stationary states of which are different orbits of the electrons about the nucleus; band spectra are emitted by molecules, the different states of which are different orbits of both the electrons and the nuclei. The problem of the interpretation of various spectra is simply that of determining the stationary states; it belongs to the study of the structure of the ATOM (*q.v.*).

Nature of Radiation.—The great modern problem of radiation in the wider sense had only just appeared when the earlier article was written; and a question which was thought to have been quite settled has arisen again. What is the fundamental nature of radiation? For two generations the work of Young and Fresnel had seemed to leave no doubt that light was a form of vibration; the only question that remained was what form. A mechanical theory was first attempted which assimilated the vibrations that constitute light to the transverse vibrations of an electric solid. By the end of the 19th century it was recognised that no aether could be devised, reacting to disturbances like any material medium and yet propagating these disturbances according to optical laws. The theory had been abandoned in favour of the electromagnetic theory which assimilated light vibrations to those originating from the oscillations of charged particles and consisting of alternations in the electric and magnetic fields at a distance from it. This theory was also in a sense "mechanical," although it did not refer radiation to the motions of material particles. For, by the time of its appearance, the principles of Newtonian mechanics had been generalised by Lagrange and Hamilton so as to cover a field much wider than that of the motion of material particles. The laws of electromagnetism were consistent with these general principles; and since mechanics had come to mean the wider field rather than the narrower, the electromagnetic theory of light was as mechanical as a theory of an elastic solid aether could have been.

The electromagnetic theory explained all those laws of the propagation of radiation through empty space that are explicable by any wave theory, and, unlike the electric solid theory, it related the speed of propagation to other natural constants. Further, in conjunction with the electric theory, it could explain many of the mutual reactions of radiation and matter. It covered qualitatively the whole and quantitatively a very great part of the known optical laws. But in the early years of the 20th century difficulties had already begun to attract attention.

Difficulties in Theory.—The first discrepancy was much less striking than those which appeared later and was disclosed only by somewhat abstruse arguments. It concerned temperature radiation. According to generalised mechanics, if any system is left undisturbed to reach a state of equilibrium, its energy will distribute itself equally on the average between all its "degrees of freedom," that is to say between the different independent ways in which the system can change. The degrees of freedom of radiation are plausibly identified with its different frequencies, for experiments seem to show that the energy associated with any one frequency can vary independently of that associated with any other. The number of degrees of freedom is infinite, but the ratio to the total number of those lying within a given range of frequency $d\nu$ increases with the frequency, being proportional to $\nu^2 d\nu$. It seemed therefore that when radiation is in equilibrium, as it must be in an undisturbed enclosure of uniform temperature, the energy of radiation between ν and $\nu + d\nu$ must be proportional to $\nu^2 d\nu$ and increase indefinitely with the frequency. But according to Planck's law, established by experiment, at any temperature T has a maximum at a finite frequency $\nu_{\max}$ given by $\nu_{\max}/T =$ constant.

Difficulties arose again in the study of spectra. Electronic theory indicated that the origin of spectra must be sought in the disturbance of the electrons of the atoms emitting the radiation. If the electrons vibrated under quasi-elastic forces after disturbance, the emission of radiation of definite frequency would be a direct consequence of the electromagnetic theory. But on this theory the series discovered in the spectra of a single element (*see* SPECTROSCOPY) must indicate the different modes of vibration possible to disturbed electrons in its atom. But all attempts failed to devise atomic models, subject to mechanical principles, which would actually possess these modes.

The third, simplest and most striking discrepancy arose from the study of photoelectrics *i.e.*, the ejection of electrons from material bodies under the influences of radiation. Electromagnetic theory could well explain how radiation might exert forces on electrons and thus eject them from their atoms; but no mechanical theory could explain why the energy of the ejected electron should be independent of the intensity of the radiation and dependent only on its frequency.

These discrepant or "unmechanical" phenomena can be related to each other by means of the Quantum Theory (*q.v.*). As applied to the photoelectric effect, the theory states little more than the experimental facts, namely that if an electron takes up energy from radiation of frequency ν, then whatever the intensity of the radiation, it will take up an amount of energy $h\nu$, neither more nor less; the intensity determines only the chance of its taking up any energy at all. As applied to the origin of spectra, it denies that the frequency of radiation is that of the system from which it is emitted. As applied to temperature radiation, it states again that energy of frequency ν can be gained or lost only in quanta $h\nu$, and therefore, since "equipartition of energy" follows only if energy is gained and lost by infinitesimal steps, that this doctrine must be abandoned. The equal distribution of energy among the degrees of freedom is replaced by an equal probability of the occurrence of certain distributions of energy among the radiators. As for the mechanism by which the equilibrium between matter and radiation is established, the theory of Einstein, departing somewhat from the original conceptions of Planck, supposes that a given radiator influenced by the radiation has a chance of gaining quanta and another chance of losing them, the first being wholly, the second partly, dependent on the intensity of the radiation; equilibrium is attained when the intensity is such that these chances are equal. By assigning suitable values to these chances Planck's law can be deduced very simply.

Common Explanation Impossible.—Thus all these unmechanical phenomena are explained in the sense that they, and many other phenomena having no direct connection with radiation, are deduced from a few simple and self-consistent principles. These principles have the same right as those of mechanics to be egarded as fundamental. If the mechanical or optical pheomena were explained by the quantum theory the discrepancy ould be solved as satisfactorily as if the unmechanical were xplained by the mechanical theory. But they are not; indeed long as the two classes of phenomena are described in terms f the concepts which have so far seemed appropriate to them, common explanation for both appears logically impossible.

For, consider a source of radiation surrounded by matter. If e are to explain how the matter produces regular reflection, efraction, diffraction, or interference of this radiation, we must ppose that the influence of the radiation on the matter is connuous both in space and time; we must imagine that at each stant the radiation is influencing all the matter; that between vo regions separated from each other there is a continuous eries of intermediate regions each differing infinitesimally om its neighbour; and that each elementary region of the atter undergoes a regular sequence of change passing from one ate to another through a continuous intermediate series. On e other hand, if we are to explain how the radiation produces e photoelectric effect and its associated phenomena, we must ppose that the influence is discontinuous both in space and me; we must imagine that at any instant all but a very small action of the matter is wholly uninfluenced by the radiation; at the isolated points at which influence is being exerted at ny instant are widely separated from each other by regions in hich there is no influence; and that the instants at which the diation influences a given region are separated by intervals of uch greater duration in which there is no influence. But if ese two sets of phenomena are aspects of the same process, is process must be either continuous or discontinuous; it canot be both.

Possible Reconciliation.—One way to reconciliation is yet pen. It is just possible that the whole process is really disontinuous and that the continuity is only apparent, or, conersely, the continuity real and the discontinuity apparent. uggestions have been made in both these directions. The first ossibility is represented by J. J. Thomson's theories of radiaon and by Einstein's light-quanta. Thomson proposes to ttribute physical reality to the " lines of force " which Faraday troduced as the mechanism of all electromagnetic actions. In e simplest form of Thomson's theory, the line of forces are pposed to consist of discrete strings which are attached to the ectric charges emitting the radiation and along which the virations are transmitted. The wave-front would consist of disontinuous specks at the points where it cut these strings; the ppearance of continuity is due to the large number of strings oncerned in radiation of ordinary intensity. Einstein's theory oes not profess to give so definite a mechanical picture, but it so assumes that the radiation is made of discrete bundles, parate in space, the energy associated with each bundle of equency ν being $h\nu$ and the momentum $h\nu/c$. On either of ese views, interference must arise from the interaction of two rings or bundles and should vanish if the intensity of the radiaon and the number of the bundles is sufficiently reduced, so at the chance of an encounter becomes small. No sign of such minution of interference can be detected experimentally.

The second possibility is represented by theories which supose that the action of radiation on matter appears discontinuous ecause atoms can store the effects of the action without obvious ange, until it ultimately produces instability; an analogy is to found in a striking clock, where the continuously progressive ange manifests itself only in discontinuous changes separated intervals very long compared with their duration. Here ain the direct experimental test fails; no evidence of any kind n be found that in the interval between the discontinuous anges the atom undergoes any alteration whatever, either ontaneously or as the result of radiation incident on it. Morever no theory of this kind is of much value unless it can suggest e mechanism by which the continuous changes are stored ntil the final catastrophe. Numerous mechanisms of this kind ave been invented, but they are all enormously elaborate, and one of them give any adequate account of the relatively simple laws, of which Bohr's quantum theory of atomic structure gives so strikingly successful an explanation.

The only remaining alternative is to deny that the continuous and discontinuous phenomena are really aspects of the same process. Continuity appears in the action of matter on radiation; discontinuity in the action of radiation on matter. It is not possible to divorce these processes quite completely from each other; for in all optical experiments what is immediately observed is an action of radiation on matter, which probably is always reducible ultimately to a photoelectric effect; and on the other hand, we cannot fully describe the influence of the quality of the radiation on its action on matter without the concept of frequency, derived from optical experiments. But if we agree to overlook the experimental methods by which our knowledge is attained and consider only theories to explain it, divorce may be possible.

Conservation of Energy and of Momentum.—One of the reasons why it has appeared necessary hitherto to regard the action of radiation on matter and that of matter on radiation as merely different aspects of the same process, lies in the doctrines of the conservation of energy and of momentum. If matter changes the energy or momentum of radiation, then, if these doctrines are true, there must be an exactly corresponding change of the energy or momentum of matter. Bohr, Kramers and Slater have proposed to deny these doctrines in their detailed applications and to regard them as merely statistically true. On this view the electromagnetic theory is true of radiation itself. Radiation consists of continuous waves, the frequency, intensity and distribution of which are determined, according to that theory, by the atoms from which it arises and with which it is in contact. Conversely, it determines changes in these atoms. But while a change in the state of the atoms immediately and definitely produces a change in the radiation, the converse is not true; a change in the nature of the radiation merely alters the chance that the atoms it encounters will undergo certain changes of state. If an atom A suffers a change of state such as is associated, by the quantum theory, with the emission of radiation of frequency ν, then there is established round this atom a field of radiation which confers on all atoms in it a definite chance of suffering the converse change; this field will endure until some atom B somewhere actually suffers this converse change. In the interval between the two changes, the energy lost by A and later acquired by B does not reside in the radiation; for, on the electromagnetic theory, the energy required to maintain a given field of radiation in a given region is proportional to the time that the field endures; this time is determined wholly by chance and may be infinite or infinitesimal. Energy is conserved only in so far as the energy lost by A is acquired sometime by B.

On this theory the complete divorce is effected. The action of matter on radiation is determined by one set of laws, definite and regular; the action of radiation on matter by another set in which chance is a fundamental factor. The concepts involved in the two sets are essentially different; and the only connection possible between them is that of numerical laws, formal and physically inexplicable, of which Planck's quantum relation is the chief and the type. The other laws necessary for a complete formulation of the theory may be derived from Bohr's " Principle of Correspondence " (*see* QUANTUM THEORY) which states roughly, that in certain limiting cases, when the discontinuities pass over into continuity, both sets of laws must become identical and the concepts in one set must correspond, term by term, with those in the other. It has proved possible, for example, to establish a " quantum theory of dispersion " in which the refractive index (a concept derived from the continuous laws) is related numerically to the chances and energy-differences of quantum states (concepts derived from the discontinuous laws); but it must be remembered that this is not a theory in the sense of suggesting a reason why this relation should hold or in reducing to common concepts the quantities between which it holds.

The Bohr-Kramers-Slater theory has aroused great interest, but unfortunately there is evidence against it. In the scattering of X-rays, there is known to be interchange of energy and momentum between the scattered ray and the scattering electron which recoils from it (*see* X-RAYS). On this theory the interchange should be merely statistical; recoil electrons on the whole should receive the energy and momentum lost by scattered rays on the whole; but in the scattering of any individual ray, there should be no constant relation either in time or in magnitude between the scattering of the ray and the recoil of the electron. Experiment has shown on the other hand that there is a correlation as close as would be expected if energy and momentum were conserved at each encounter. In view of these experiments Bohr is inclined to abandon theory in favour of the yet more revolutionary ideas of Heisenberg.

Since there cannot be contradiction between facts, Heisenberg suggests that our difficulties arise because we import into our description of the facts things that are not facts and quantities which are not actually observed. Thus we do not actually observe temporal periodicities in radiation; the frequency is measured by experiments in which there is no change with time; the conception of frequency must therefore be dismissed from our description. With it must go most of the spatio-temporal conceptions that dominate much of physical theory, including the conception of radiation. There are left a few conceptions, such as energy and the transition from one state to another, which do not necessarily involve either space or time. Heisenberg proposes to state in terms of such conceptions, general principles which shall cover the range of both quantum and mechanical theory, and to reject as meaningless the principles of narrower range but (so far at least) of deeper content which lead to nothing but inconsistency. His theory is too recent and as yet too incomplete for discussion here; but it becomes every day more likely that the difficulties which have so far beset the theory of radiation are to be overcome only by a fundamental reconstruction of physical theory far more sweeping even than that introduced by the general theory of relativity.

BIBLIOGRAPHY.—For Saha's theory see M. N. Saha, *Phil. Mag.*, vol. 40 (1920); it has been greatly developed by R. H. Fowler, *Phil. Mag.*, vol. 45 (1923), and R. H. Fowler and E. A. Milne, *Monthly Notices Roy. Astr. Soc.*, vol. 83 (1923), vol. 84 (1924). J. H. Jeans' *Report on Radiation and the Quantum Theory*, 2nd ed. (1923), is an admirable summary of the position at that date. For later developments, see an article by N. Bohr, *Nature*, vol. 116 (Dec. 5 1925), which gives full references to the most important papers.

(N. R. C.)

ELECTROCHEMISTRY (*see* 9.208).—Electrolytic alkali works are now operated in all the leading manufacturing countries where the raw materials of the industry are found; and those who controlled the operation of the old Le Blanc process of alkali manufacture in the United Kingdom found themselves in 1921 compelled, by the force of circumstances and by the changing conditions of the trade and industry, to adopt the newer method of decomposing salt.

The cells now being operated industrially may be classified either as diaphragm or non-diaphragm cells. In the former class, a porous diaphragm, composed of cement, asbestos or other material unacted upon by the electrolyte or by the ions produced by the electrolysis, is employed to separate the cell into two or more compartments; and in this way the chlorine liberated at the anode is to a large extent prevented from taking part in secondary reactions with the sodium hydrate or potassium hydrate formed at the cathode.

The "Elektron," Hargreaves-Bird, Outhenin-Chalandre, Basel, Billiter-Siemens, Nelson, Allen-Moore, Gibbs, Wheeler and Townsend cells are all of this type, the chief difference between them being in the construction or position of the diaphragm, and in the arrangements made for withdrawing the sodium-hydrate solution from the cathode compartment of the cell, before it has had time to be decomposed by the electric current. The defects of all diaphragm cells are the higher voltage required per cell, and the increased costs of maintenance, due to the non-durability of the diaphragm.

For these reasons non-diaphragm cells have always attracted the electrochemist. Many of these have been patented and tried, but only two types have survived industrial trial—namely (1) the Castner-Kellner, Whiting and Solvay cells, which employ a moving mercury electrode in the cathode compartment of the cell, and thus produce an amalgam of sodium which can be removed from the cell before it is decomposed with water to yield the hydrate; and (2) the "bell" type o gravity cell, which makes use of the different specific gravities of the brine, and of the newly formed sodium or potassium hydrate solution, in order to effect a separation of the two The Aussig "bell" cell and the Billiter-Leykam cell are now the only two representatives of this class in actual operation The attempts to use molten lead, in place of the more expensive mercury as the liquid or moving electrode, failed after tria upon an industrial scale in the United States of America.

The answer to the question as to which type of cell is the bes for the production of caustic soda or caustic potash, depends largely upon the relative costs of electric power and of fuel i the locality where the cell is to be operated.

The diaphragm cells with the highest efficiency, unfortunately give the weakest solution of sodium hydrate at the cathode; and i order to obtain a concentrated cathode liquor it is necessary to sacrifice to some extent the energy efficiency of the cell.

The Whiting, Castner-Kellner, and Wilderman types of mercury cell all yield cathode liquors of a fairly high degree of concentration namely, 200 to 240 grammes per litre of NaOH. But for the hig cost of mercury, the mercury type of cell would probably be generally adopted for the production of caustic hydrates, for this type yields specially pure product, both at the anode and the cathode.

The Billiter-Siemens, Billiter-Leykam, Townsend and Nelso cells all yield a liquor containing 120 to 160 grammes per litre NaOH and therefore come next to the mercury cells, as regards the concentration of the caustic liquor. The Gibbs and Wheeler cells produc a liquor containing 100 to 120 grammes per litre NaOH, but as compensating advantages have a very low capital cost and a low maintenance charge, due to their cylindrical shape and small size. At th present time (1925) these two types of cell are in extensive use bot in Great Britain and in the United States of America, and it is noteworthy that the United Alkali Co., after exhaustive enquiries i 1920–1 adopted one of these cells (the Gibbs) for the equipment o their new Electrolytic Alkali Works at Widnes.

The Aussig bell, Griesheim, and Outhenin-Chalandre cells on th other hand, yield a liquor containing only 60–80 grammes NaO (or under) per litre, and in view of the amount of fuel required t produce solid caustic from weak liquor, it is surprising that thes cells have attained such wide use on the continent of Europe.

The War caused a considerable increase in the number an capacity of the works for the electrolytic decomposition o brine, liquid chlorine being required in very large amounts b the military authorities, for gas warfare and for sterilising wate supplies.

Chlorates and Perchlorates.—The electrolytic method of manufacture of chlorates and perchlorates is now operated in a countries where cheap power is available, the most notab works being located at Chedde in the Haute Savoie, and a Mansboe and Trollhättan in Sweden. The cells in use at Chedd are constructed of cement, and are arranged in terraces so tha the electrolyte can flow through them by gravity. Very thi sheets of platinum foil fixed in ebonite frames are used in serie as bipolar electrodes; and the number of these in a cell, and th number of cells in a circuit, are arranged to suit the voltage o the generators.

When potassium chloride is employed as the electrolyte, th chlorate can be easily separated from the unaltered chloride b crystallisation. When sodium chlorate is to be produced, a different treatment is required to obtain separation of the chloride an chlorate, since the sodium salt is much more soluble than potassiu chlorate. The current efficiency, when producing either sodium o potassium chlorate can be raised, under the best conditions, to 90° and the conversion of the chloride into chlorate can be completed i one operation.

Perchlorates.—The conditions required in order to obtai perchlorates in an electrolytic cell are: (1) Insoluble electrode (2) A high current density at the anode; (3) The preventio of any reducing action by the hydrogen gas liberated at th cathode. This latter condition is obtained either by the use o a diaphragm, or by the employment of salts which suppres the cathodic reduction, chromates or cyanides being used fo this purpose.

Under normal conditions, the conversion of the chlorate into perchlorate takes place without evolution of ozone, and shows an average current efficiency of 85%. The power required to produce one kgm. of sodium perchlorate from sodium chlorate, is about $3\frac{1}{2}$ kw. hours; and as the sodium salt is deliquescent, it is usually at once converted into the potassium salt by treatment with potassium chloride or sulphate. Ammonium perchlorate, which is used largely in the manufacture of explosives, is prepared in a similar manner, by treating a sodium perchlorate solution, produced electrolytically, with ammonium sulphate. An alternative method of manufacturing the ammonium salt is to start with calcium chloride, and to convert this by successive stages of anodic oxidation into calcium perchlorate, which is finally decomposed by ammonium sulphate.

Sodium perborate.—This persalt is most easily produced by the electrolysis of solution of sodium borate. The process of manufacture employed is based on the use of a mixed electrolyte of sodium borate and of an alkaline carbonate. The latest theory of the conversion is that a percarbonate is formed first, and that this salt then reacts with the sodium borate.

Persulphates and Hydrogen Peroxide.—Persulphates are another class of highly oxidised salts which are finding wide application, especially in photography. Here again the electrolytic method of production is the cleanest, simplest and most efficient. As a rule, the desired persalt can be produced by one simple operation in an electrolytic cell or bath, an important factor in the production of what are usually known as "fine" chemicals. When comparing the merits of chemical and electrolytic methods for producing persalts, it is necessary to note also that the cost of electric current is not the main item in the total cost of production.

The method of producing persulphates in the electrolytic cell is based upon the discharge of SO_4 ions at the anode of the cell. The conditions required to effect this discharge are the same as in the production of perchlorates, namely, (1) a low temperature, (2) a high current density with a smooth platinum anode, (3) a neutral or acid solution. A concentrated solution of ammonium sulphate may be employed in the anode compartment of a diaphragm type of cell, with sulphuric acid of medium strength in the cathode compartment. Platinum must be employed as anode material, but lead can be employed for the cathodes, and these may be of much larger surface area than the anodes.

Hydrogen Peroxide.—Two methods have been employed for the electrolytic production of hydrogen peroxide, the first based upon the use of persulphuric acid as an intermediate product, and the other upon the use of potassium or ammonium persulphate. The density of the sulphuric acid in the first case should lie between 1·35 and 1·50, and the electrolysis should be carried out as rapidly as possible, with a current density of 950 amp. per sq. foot.

Hypochlorites.—Charles Watt, in his very remarkable Master Patent No. 13755 of 1851, clearly explained all the conditions which must be maintained in order to produce hypochlorites by the electrolytic decomposition of sodium or potassium chloride solutions.

The advance since then relates simply to the form and design of the cell used for carrying out the electrolytic method. The leading features of the cells now employed specially for hypochlorite production are, however, very similar. They possess graphite or platinum electrodes, placed so close together, that the chlorine liberated at the anode reacts at once with the alkaline hydrate formed at the cathode; and they possess also some means for promoting that rapid circulation and cooling of the electrolyte which is necessary in order to avoid the formation of chlorate.

The three leading types of electrolyser for the production of hypochlorite solutions are:—(1) the Haas and Oettel, (2) the Kellner and (3) the Mather and Platt.

In recent years, the electrolytic production of hypochlorites has suffered a set-back, owing to the large amount of low-priced chlorine in the liquid form which has been placed upon the market by the electrolytic alkali works. It has proved in many cases more economical for large bleaching firms to purchase this liquid chlorine in place of the usual bleaching powder, and to absorb the gas either in milk of lime, or in solutions of sodium hydrate in their own works. In the latter case, the absorption of the gas may take place in the actual bleaching vat, and numerous patents have been applied for, in connection with this application of liquid chlorine.

Oxygen and Hydrogen.—Cells for producing these two gases by the method of electrolytic decomposition of water, have been patented in very large numbers; and many have been operated upon a commercial scale, for production of the hydrogen required for oil hardening, for ammonia synthesis (*see* AMMONIA) and for metallurgical work. The Schoop, Schuckert and Schmidt (or Oerlikon) cells have been most widely employed in Europe, while the Knowles, the International Oxygen Company and the Levin types of cell, have found most favour in Great Britain and in the United States of America.

A remarkable expansion of the electrolytic process for hydrogen production occurred after Sabatier & Senderens' discovery in 1897–9 that, with the aid of a suitable catalyst, the hydrogen content of liquid vegetable fats could be raised and the fat thereby converted from a liquid to a solid form. This oil hardening process is adversely affected, however, by the presence of other gases as impurities of the hydrogen, even in very small amounts, and for this reason the very pure form of hydrogen obtained by the decomposition of water has been employed on an immense scale for the operation of the oil hardening plants which have been erected since the War, in all parts of the world.

It is stated on good authority that over 100,000,000 cu. ft. of hydrogen are being produced per annum for oil hardening, by an English type of electrolytic cell, and the aggregate annual production of electrolytic gases in this and other countries, by all the types of cell employed, must amount therefore to an inconceivable volume.

Ozone.—When a high-tension electric discharge is passed through dry air, ozone is produced, and as most of the early patents covering the apparatus used have lapsed, the essential details of construction of the general type of ozoniser have now become standardised. The apparatus consists usually of an inner cylinder of sheet copper or aluminium, connected to the high-tension side of the transformer; and of an outer metal cylinder connected to the casing of the ozoniser, and maintained at zero potential. The two cylinders are separated by a glass tube, through which the air is passed, and the silent electric discharge which produces condensation of the oxygen to ozone takes place in the annular air space between the two sheets of metal. Alternating current with frequencies up to 60 cycles is employed, and the practical limit for the E.M.F. used is found experimentally to lie between 10,000 and 12,000 volts.

Ozonised air is employed for bleaching purposes; for the sterilisation of air and food; for the acceleration of the drying and hardening processes in paints and varnishes, and the rapid oxidation of oils.

Organic Products.—The use of electrolytic methods for reducing and oxidising purposes is extending in the field of organic chemistry. All the best equipped works both in Germany and America, where synthetic dyes and drugs and other organic chemicals are produced, are now provided with special cells for this type of work.

Anodic oxygen is a most energetic oxidising agent, and electrolytic oxidation methods are used to produce saccharine, ethane, nitrobenzoic acid and other organic products. The electrolytic preparation of salicyl aldehyde is also practiced.

Miscellaneous Products.—Anhydrous aluminium chloride, lead arsenate, chromic acid, potassium ferricyanide and potassium permanganate, are now being produced by electrolysis.

(J. B. C. K.)

ELECTROMETALLURGY (*see* 9.232).—This article deals with the application of the science of electrometallurgy to the various metals.

Aluminium.—The mineral bauxite remains the chief raw material of the aluminium industry. The increased demand, however, has led to several new deposits of bauxite being discovered and worked, and the mineral has been found to be much more widely distributed than was supposed. Not one of the numerous attempts to dispense with the preliminary purification and to operate the baths with raw bauxite in place of the pure alumina, in order to reduce the cost of the metal, has proved successful. Weaver (Canadian patent, No. 190054 of 1919) has proposed to extract aluminium chloride from clay, with the aid of liquid chlorine. The pure aluminium chloride obtained from this source would then be fed into a bath containing molten sodium and aluminium chloride, and the process would be worked for the continuous production of aluminium and chlorine gas. An apparatus for carrying out this electrolysis was described in U.S. patent No. 1,297,946, for 1919, and a process of this kind may eventually solve the problem of providing a cheaper raw material for the industry.

The electrolytic process, by which the metal is produced at present, differs but little from that by which Heroult in Switzerland, and Hall in America, first carried on the manufacture in 1889. The metal now ranks fourth in the list of non-ferrous metals, both as regards production and consumption; for only copper, lead and zinc are produced and used in larger amounts in the arts and industries. During the War, aluminium was used largely in powdered form as an ingredient of an explosive known as "ammonal," and for pyrotechnical work, and, either as pure metal or in the alloyed state, for the construction of air-ships, aeroplanes, motor-cars, bombs, radiators and many forms of measuring instruments.

The increased demand for aluminium and its alloys in the domestic arts and industries since 1920, however, has now quite compensated for the loss of the special demand for war purposes. In the electrical trade, it is employed for transmission lines, busbars, field coils and armature windings. In the motor-car industry it is employed in sheet form for the body work of cars, for gear and crank casings, for engine cylinders, and for pistons and connecting rods. The metal is also being used to a rapidly increasing extent in the construction of vessels for the chemical, brewing, sugar refining, margarine, dyeing and soap industries, and the manufacture of domestic cooking utensils affords another large and rapidly growing outlet for the metal.

Aluminium can be efficiently protected against corrosion by air by a thin layer of hydrogenated cotton-seed oil. The local corrosion which often occurs, is due to minute traces of oxides and other impurities which are trapped in the metal when in the molten state before casting or rolling. Aluminium carbide, which forms at a comparatively low temperature, is one of these and its presence can be avoided by preventing the access of gases containing carbon to the metal when in the molten state.

Artificial Abrasives.—Carborundum, or silicon carbide, is formed by heating a pure form of sand and carbon to a very high temperature in an electric furnace of the resistance type. This manufacture has not undergone any technical changes since 1910, but the industry has developed considerably, and now that the limitations of the material are recognised, and the attempts to apply carborundum wheels to the grinding and finishing of fine steel goods have ceased, the industry is on a very sound footing. Silicon carbide is intensely hard and very brittle, and is most suitable for grinding and finishing similar materials, while artificial corundum (fused alumina) has taken the place of carborundum, for a variety of other grinding purposes.

Peters states that carborundum brick as a refractory lining for electric and other furnaces is highly resistant to the action of silicious slags, but is readily attacked by slags high in lime, lead or iron. The manufacture of corundum as an artificial abrasive is expanding, and has become one of great importance in Canada. It is carried out by heating bauxite, iron and coke, in an electric arc furnace, the proportions used being as follows: calcined bauxite, 1,750 parts; coke, 100 parts; iron borings, 350 parts.

Brass and Bronze.—In 1914 there were no electric furnaces in operation for melting brass, but by the end of 1919, 40 American firms were reported to be using or installing such furnaces in their brass foundries, and over 100 of these furnaces were in actual operation. By adopting electricity as the agent for heat production when melting brass, the losses occasioned by the volatilisation and oxidation of the zinc are avoided, and larger furnace units can be employed with greater uniformity in the melt, and lower labour costs. The electric furnace has therefore now almost entirely supplanted fuel-heated furnaces for brass-melting in all countries, and has been found the most economical way of melting brass, and also conducive to improvement in the health and safety of the workpeople engaged in the foundry.

The following types of furnace have been used successfully for brass-melting: (1) The direct arc furnace, of which the Snyder and Giolitti are the chief representatives. (2) The indirect arc furnace, of which the Rennerfelt and the G.E.C. or Detroit are the most successful examples. (3) The vertical ring induction furnace, of which the Ajax-Wyatt is the best known. (4) The granular resistance furnace, of which the Baily is the only example.

New furnaces of the induction type have been brought out recently by the General Electric Co. of U.S.A. and by the Compagnie Française de Métaux, the furnace of the latter being designed for use with three-phase current. The Ryan is another new resistance furnace, but in this case the heat is developed by means of a central graphite electrode, through which a strictly regulated current of electricity is passed.

The direct and indirect arc furnaces are quite unsuitable for the rolling mills which use yellow brass as the higher temperatures they produce lead to zinc volatilisation and loss. The induction type of furnace is also unsuited for foundries where alloys high in lead are produced, or where frequent changes in the composition of the brass are necessary. The type of furnace to be chosen therefore must be determined solely by the character of the alloy or metal which is to be melted. Brass founders should obtain expert and skilled advice in the selection of the furnace best suited to their needs and requirements before embarking upon any changes in their present methods or equipment.

Bullion.—Bullion is the technical name for alloys of the precious metals silver and gold, but the name is also applied to the commercial bars or ingots of these metals which are sold for minting purposes to the Governments of the various countries.

Chemical and metallurgical methods are still employed here and there for separating or "parting" silver and gold from one another (*see* CYANIDES), and from the baser metals with which they are often associated, but electrolytic methods of separation have been making steady progress since 1910 and a very large proportion of the silver and gold output of the world is now refined by electrolytic methods. The Moebius process, or some modification of it, is employed for silver refining, while the Wohlwill process is used for gold bullion.

The chief disadvantage of the electrolytic method is due to the large amount of gold and silver which is locked up as anodes and electrolyte in the vats used for the process. Improvements therefore have been directed chiefly towards reducing the volume of the solution, and the time required for the refining operation. One of the newer cells which has been devised for refining silver, is an improved form of the Moebius cell, and is in operation at the Ottawa Mint in Canada. The crude silver in this case contains from 10% to 16% of base metal, and by means of specially designed cathodes and multiple grouping of the anodes, the current which passes through the cell is made a pulsating one. This causes the silver to be deposited on the cathodes so loosely, that it can be easily removed, and the process is made thereby a continuous one. The cells are annular, 36 in. in diameter, and are provided with a hollow centre; the electrolyte is contained in the space between the inner and outer walls of the cells. A rotating cathode is employed, and the silver is stripped continuously from the cathode as it rotates and falls into the trays, which are removed and emptied at intervals of four hours.

Cadmium.—This metal was produced during the War, by electrolysis of acid solutions of the sulphate which had been previously freed by chemical treatment from all impurities. The electrolysis was carried out in semicircular lead-lined tanks, provided with rotating disc-shaped cathodes of aluminium sheet, $\frac{1}{3}$ in. in thickness. The output of the metal in the United States increased from 91,000 lb. in 1914 to double this amount in 1917. In Germany, also, large amounts of cadmium metal were produced during the War, and were used as a substitute for tin in the manufacture of solder. The production of cadmium is still carried on in the U.S.A. at works located at Kennett and at Midvale, the raw materials in each case being obtained from the refuse and waste products or fumes of the lead and zinc smelting works. At Midvale these residues contain 15% of cadmium, 20% of lead and 50% of arsenic; and the solutions obtained after roasting and leaching, are treated with lime, and the filtered liquor is then passed on to the electrolytic vats for electro-deposition of the metal.

Calcium Carbide and Cyanamide.—The applications of calcium carbide for generating acetylene gas for domestic or public lighting have not expanded during the period under review, but its use in the cyanamide process, for fixation of atmospheric nitrogen, has increased rapidly (*see* CYANAMIDES; NITROGEN, FIXATION OF). According to a recent estimate 900,000 tons of calcium cyanamide are now being manufactured yearly, more than half of this total (500,000 tons) being produced in Germany. The greater proportion of this output is applied directly to the soil as a fertiliser, and a small amount only is converted into the ammonium salt.

The tendency in recent years has been to reduce the costs of manufacture by the installation of very large furnaces, using from 5,000 to 10,000 kw. for the production of the carbide; the use of polyphase urrent also has greatly improved the efficiency of the process of anufacture. The latest American carbide furnaces are equipped ith nine electrodes, using triple three-phase current, and an output f 160 tons of carbide per 24 hours is obtained. These large furnaces re covered in and the carbon monoxide gas evolved by the operaion is collected and employed for preheating the raw materials r for other purposes. A continuous process for the manufacture of yanamide from carbide is also now being operated at Marignac in rance, by the Société d'Azote Française, where a yield of 85 to 90% s reported.

Copper.—The remarkable expansion of the electrolytic method f refining copper is due to the presence of small amounts of ilver, gold and other precious metals, in the original copper ore. hese impurities accumulate in the raw copper from the smelters, nd finally appear in the slimes from the electrolytic vats. In any cases the value of these slimes covers the whole cost of the efining operation.

The aggregate output of copper by all the mines in the world s approximately 1,000,000 tons p. a., of which 75 to 85% is now eing refined by the electrolytic process. The greater number of efineries are located in the U.S.A., for over half the world's outut of copper is still produced in that country. When judged by ere tonnage capacity, or by the capital sunk in the refineries, he electrolytic copper refining industry ranks first, therefore, mong the electro-metallurgical industries.

The latest improvement in the conduct of the technical side of the efining operations is based upon the use of colloidal (*see* COLLOIDS) nd other agents for improving the character of the deposit. At the orks of the Boston and Montana Refining Co., Ltd., Great Falls, ontana, gelatine is being employed in the vats for this purpose.

With regard to the use of electrolytic methods for the direct exraction of copper from its ores, dilute sulphuric acid is employed s leaching agent for the roasted ore, and the solution of copper ulphate is purified by chemical methods before passing it into he electrolytic vats. At the extraction works operated by the ornelia Copper Co. the solution obtained from the leaching operaion is treated with sulphur dioxide gas, in order to reduce the ferric ulphate to ferrous sulphate. The liquor is then electrolysed in the rdinary way, and the efficiency of the process depends on keeping own the percentage of ferric sulphate which is allowed to enter the ats. In the McKay extraction process now being operated in ustralia, a sulphide silicious ore, containing 4% of copper, is roasted a special type of furnace which enables the temperature of the air nd its rate of supply to be so regulated that the copper is obtained s soluble sulphate, while the iron and other impurities of the ore re converted into insoluble basic sulphates. The small amounts of on and aluminium which accumulate in the electrolyte, after being sed, are removed by means of a stream of air.

Graphite.—The production of artificial graphite by the electrohermal process has become one of the most flourishing of the inor electro-metallurgical industries. The original patent has ow lapsed, and there has been consequently a great expansion f the industry, which is carried on in practically every country here cheap power is available. The method described by cheson in his original patent is employed and has undergone ery few modifications since it was first operated on an industrial cale at Niagara Falls in the year 1897.

Artificial graphite can be employed for any of the purposes for hich natural graphite has been used, but its chief application is for he construction of electrodes for electrolytic and for electric furace work. Its electrical conductivity is high and it can be produced n large blocks, which may be sawed, tapped, screwed or turned in he lathe, to produce electrodes of any desired shape. Some graphite lectrodes manufactured for electric steel furnaces have been 24 in. n diameter and 72 in. in length, and could not have been produced rom natural graphite. It is also used for the manufacture of lubriants, paints, dry batteries, packings for engine glands, and of preentives for scale in steam boilers.

Electric Steel Furnaces.—During the year 1910–25 there has een a remarkable increase in the number and capacity of the lectric furnaces employed in steel works, and in steel foundries or melting and refining the higher grades of steel. In 1913 Germany produced more than one-half of the world's supplies, but before the end of the War the United States took the lead and has since retained it.

The electric furnace may be employed either alone or with the Bessemer or open-hearth furnace, and may be operated either with acid or basic slags. It can be employed also as an adjunct of the blast furnace or of the cupola furnace, for producing grey or malleable iron and for semi-steel castings, and the smaller sized furnaces are particularly advantageous when only small quantities of castings of a particular steel or iron are required.

Recent improvements have been confined chiefly to the mechanical and electrical equipment of the furnaces, such as better-fitting doors; water-cooled arches; improvement in the electrodes and holders, and automatic electrode control. As regards the holders, the tendency has been to substitute cast steel for the bronze holders which were formerly employed; and the mechanism for tilting the furnace has also been much improved, controllers of the reversing type now being used, with a motor brake which prevents overtravel of the furnace, and holds it stationary in any desired position.

With regard to electrical features, the transformers are now more strongly constructed, and only two main types are in use; namely, the Heroult, operated at 110 volts, and the Pittsburgh or "Lectromolt" with a voltage of nearly twice this amount. The transformers are placed as close to the furnace as possible, in order to improve the power-factor by shortening the leads. The majority of furnaces are now operated with three-phase connections, and the use of a bottom electrode is being discarded. As regards linings, the larger number of furnaces have silica brick walls; and silica brick is also generally employed for the roof, although carborundum brick has been employed. Another special refractory material, which has been tried with success, is fused magnesite which does not shrink and seems to have great possibilities.

The majority of the arc furnaces are built on the Heroult principle, and have capacities of from 1 to 40 tons, and in those, both arc and resistance heating is employed. The power expenditure for melting steel for casting ranges from 500 to 600 kw. hours per ton, and for refining the metal from 700 to 1,200 kw. hours per ton. Since the War, fine steel for castings is being produced. The two types of furnaces which are popular for foundry work are, the small furnace delivering from a half to one ton, and a larger one with a capacity of three to four tons. A wide field for the application of the electric furnace lies in the production of high-grade grey and white iron, since it is possible for the electric furnace to superheat the metal, both under acid and basic conditions.

In Great Britain the chief progress to be recorded is in the manufacture of high-grade steel. In the Sheffield district the old established crucible process of steel manufacture is being gradually displaced by the electric process. At the works of Messrs. E. Allen & Co., Sheffield, scrap steel is being melted and refined in two stages. The preliminary melting and oxidation is carried out in a 10-ton furnace, and from this the molten metal is transferred at short intervals to a smaller $3\frac{1}{2}$-ton furnace, in which the refining operation is finished.

In France the latest improvement in the Heroult type of furnace has been the use of copper tubing as conductor and as carrier for the cooling water required by the electrode holders. This plan saves two-thirds of the copper, and the current leads can be brought much closer together. In the latest design of Heroult furnace the superstructure, which carried the conductors and electrodes above the furnace, also has been dispensed with; and the electrode arms and holders are supported from below. The transformers and high-tension switch gear are now placed beneath the floor. Improvements have also been made in the density of carbon electrodes; but on account of the impossibility of producing these electrodes satisfactorily beyond a certain limit of size, Heroult furnaces of 40 tons capacity cannot be exceeded.

In Canada a new form of Heroult furnace has been applied to the melting of "monel-metal" at the works of the International Nickel Co. at Huntingdon. A basic lining is used for this furnace, and the desulphurisation and deoxidation are carried out under a basic slag. The latest form of Greaves-Etchells furnace adopted in the U.S.A. introduces two phases of the three-phase power supply, through two or more top electrodes, and the third phase through the furnace hearth. By the use of four or more electrodes with this furnace, considerable flexibility of operation is possible, as the top electrode and higher voltage can be employed when starting up a cold furnace, and the top and bottom electrodes when the bath is molten and the refining and superheating of the metal is in progress. Furnaces of this type, with capacities of from 60 to 80 tons, are reported to be under trial by the Ford Motor Co. at Detroit, U.S.A.

A multiple system of electric heating has been introduced into some American steel foundries, in order to diminish the interval between one heating and the next. The method is based upon the use of two furnaces, mounted on a movable turn-table, so that either furnace can be brought under the fixed furnace cover and electrodes. Where this method is adopted, the average time between successive heats is reduced to $3\frac{1}{2}$ min., and a load-factor of from 95 to 98% is obtained. The units employed are of $1\frac{1}{2}$-ton capacity, and these provide small batches of hot metal for light castings, ready for pouring at regular intervals of three-quarters of an hour. By the use of this system only one charging and pouring position is required, and continuity of operation is being obtained.

The largest electric furnaces employed in America for steel melting and refining are the 25-ton Heroult three-phase arc-type furnaces erected at the South Chicago works of the Illinois Steel Co. during the War. In 1918, these furnaces were producing steel at the rate of 16,500 tons per month, when operated under the triplex system of charging, referred to above. Other types of electric furnaces used in the American steel industry are the Booth-Hall, the Girod, the Greaves-Etchells, the Grönwall-Dixon, the Ludlum, the Snyder and the Von Baur.

Ferro-alloys.—The applications of ferro-alloys in the iron and steel industry have increased enormously since 1911, and the Sheffield steel trade is now dependent upon these alloys for some of its most valuable products. The discovery made many years ago, that very small percentages of chromium, nickel, manganese, vanadium and other rare metals, either separately or in combination, could produce great changes in the physical properties of steel, has, in fact, revolutionised modern steel manufacture, and the production of rustless or "stainless" steel (*see* RUSTLESS STEEL) was one of the most notable advances made during the war period. These special steels are known as binary, ternary or quaternary steels, according to the number of elements (other than impurities) which are present in the finished steel, and it is the quaternary steels, containing carbon and two other elements, which are now finding very wide application in the arts and industries.

The ferro-alloys used in the manufacture of these special steels came chiefly from the large electro-metallurgical works located in the French and Swiss Alps and dependent upon hydraulic power for their source of electricity and heat. During the War, ferro-alloys were produced in the United Kingdom, at Newcastle, Widnes and other places, the manufacture having been scheduled as a "key" industry. Since the return to peace conditions, the bulk of our supplies are once again being drawn from the more economically operated works abroad.

The furnaces used for the production of ferro-alloys are of the resistance, not of the arc, type, and their design is based on that of the furnaces employed for the manufacture of calcium carbide. They are generally constituted with a cylindrical receptacle of masonry or metal lined with a refractory metal, and equipped with one hearth-electrode and with two or more electrodes suspended above it. The chief difference between the various types is in the method of constructing the base electrode, which may be either a plate of steel embedded in the lining used to form a hearth, or a series of steel bars arranged in fan fashion above a similar lining. In the Keller furnace, a large water-cooled graphite electrode is employed, terminating above in a graphite hearth.

The older furnaces had open tops, and the gases produced during the reduction of the ore and production of the alloy, were allowed to escape with their heat unused. Modern furnaces are closed, and after recovering the dust, which may prove in certain cases to be valuable, from the gases, these latter are used for heating purposes. This improvement in the heat economy of process, together with the use of higher current densities and temperatures, has led to considerable economies in the operation of the furnaces, and it is now possible to produce ferro-alloys from low-grade ores, and thus to reduce their price to the consumer. The demand for ferro-alloys containing low percentages of carbon and silicon, has led also to considerable improvements in the refining operation, and it is now possible to obtain ferro-alloys containing under ·5% of carbon. As regards the size of furnace, the tendency is towards the use of larger units, and a recent paper contributed to the *Jour. Amer. Inst. Elec. Engineers*, described a furnace of 12,000 kv.a. capacity for the production of ferro-alloys.

Electric Iron Smelting.—Pig iron can be produced in an electric furnace, either by reduction of the iron ore with coke or charcoal by aid of electric heat, or by melting steel scrap. The latter method is termed the "synthetic" production of pig iron, and has been practised chiefly in France and Canada; while electric smelting is carried on only in Scandinavia and Italy, where very cheap electric power is available. The smelting furnaces now employed are an improved type of the shaft-furnace which was first tried in 1911 in Sweden.

Two types of furnace are now in use for electric smelting, namely, (*a*) those with a deep charge and shaft, as exemplified in furnaces of Grönwall, Linblad and Stalhane type, and (*b*) furnaces with a low charge and shaft, of which the Hilfenstein is the best known example. Furnaces with a deep shaft are adapted for use with charcoal as reducing agent, while coke is the fuel used with the Hilfenstein furnace. The latest improvements in electric smelting have been the recovery of the heat from the waste gases, automatic charging, the use of continuous electrodes, and progress in transformer construction.

Magnesium and Magnesium Alloys.—Magnesium and its alloys have come to the front as metals of considerable industrial value and importance in recent years, owing to the demands of the aeroplane and motor industries for a metal combining lightness, strength, toughness, and ability to resist the effects of vibration and shock. The alloys of magnesium and aluminium which contain from 5 to 30% of aluminium have approximately the same mechanical properties as brass, and can be employed for the manufacture of screws, nuts, wire, tubes and sheets. The hardness of these aluminium magnesium alloys increases with the proportion of the latter metal present in the alloy, and with 70% magnesium the hardness is equal to that of mild steel. An alloy containing 92% magnesium and 8% aluminium has been patented also by a German firm, and is stated to have a strength equal to that of gun metal, with a specific gravity of only 1·75.

In the manufacture of the magnesium-aluminium alloys, it is of great importance that the metals should be pure. The aluminium is first melted in a graphite crucible, and a small amount of cryolite is added as a flux. The magnesium in the required amount is then introduced and in order to prevent loss by oxidation it is held beneath the surface of the molten aluminium by tongs, until it is melted. As regards the best contents of magnesium for alloys designed for various uses, Klaudy states that a 2 to 5% magnesium alloy is best for wire drawing; 5 to 8% for rolling; 12 to 15% for casting, and that the average strength of a cast of 10% magnesium alloy is 20,000 lb. per square inch. An alloy he recommends for aeroplane construction work has the following composition: aluminium, 80 parts; magnesium, 12 parts; cadmium, 8 parts.

As regards the methods of manufacture, magnesium is being produced by the electrolysis of fused carnallite in Germany, carnallite being the naturally occurring chlorides of magnesium and potassium. In America the metal is produced from pure magnesia (MgO) by a process very similar to that used for the production of aluminium. In this case, however, the magnesium oxide is added continuously to a bath composed of chlorides of potash and magnesium, and the metal is removed from the fused electrolyte as it collects at the negative electrode. Details of the method used to prevent oxidation are lacking. At Wolverhampton the metal is reported to be manufactured by a two-stage process. An alloy with lead is first obtained by the electrolysis of magnesium chloride, and this lead-magnesium alloy is electrolysed in the molten state.

Quartz Glass.—Quartz is an impure form of silicic acid (SiO_2) and quartz glass is, therefore, a glass consisting chiefly of silicic acid; whereas ordinary glass contains silicic acid in combination with lime, soda, potash or lead. Quartz glass for chemical use as compared with ordinary glass has a much higher melting point, and is not fractured by sudden changes of temperature. It is neither hygroscopic nor soluble in acids, and alkalies affect it less then ordinary glass except at the higher temperatures. It is, therefore, of great value for chemical and research work of various kinds.

In the early days of its manufacture only tubes were made. The electro-thermal method of production was to embed a graphite rod in sand, and to heat this with a current of high amperage. A white opaque tube of quartz was obtained in this way, of much greater diameter than the graphite core. The opacity was due to the air entangled in the raw material, this air being imprisoned as minute air bubbles in the pasty mass, when it softened under the application of heat.

A new method for producing clear quartz in various forms is now in use in the U.S.A. Clean crystals of quartz are packed in a graphite crucible, and are melted under low pressure in a vacuum furnace, heated either by the oxyhydrogen blow-pipe flame or by electricity. A clear, transparent pellet of quartz, containing a few air bubbles is thus obtained. This is next placed in another graphite crucible suspended in a vertical carbon-tube electric furnace. A graphite piston which just fits the crucible and loaded with a weight on top, is placed above the quartz pellet which is again brought to its fusion point. The air bubbles in this way are caused to collapse, and the clear quartz is forced out below through openings, and is moulded as required, in the form of rods, tubes, ribbon, etc.

Sodium.—This metal is now produced almost entirely for commercial and industrial purposes by the electrolysis of fused sodium hydrate, using the type of cell and process originally patented by Castner. Danneel has recently stated that it can be more economically produced by electrolysis of the fused chloride, and that industrial trials of this method were made before the War at Chevres, near Geneva, and at Bozel, in the Haute-Savoie. The electrolyte used for this process is composed of a bath of mixed chlorides and fluorides of sodium and potassium, and the sodium chloride is fed into this bath at the same rate as that of its decomposition.

Tin.—Electrolytic methods for stripping tin from the waste cuttings of can factories and from the old tin cans collected from towns' refuse, were at one time operated in Germany, and also other countries, but have now been displaced by chemical ethods, depending upon the use of liquid chlorine. The electroeposition of tin is still employed, however, in some places for fining the metal, as at Perth Amboy, New Jersey.

Electrolysis is used here, to separate the tin from impurities such s antimony, arsenic, lead and bismuth, which cannot be successlly removed by any other process. The electrolyte used is a uosilicate of tin, which is prepared in the vats, and the cathodes e protected from its action by a porous vase. The electrolyte hould contain 20 % of hydrofluosilicic acid, and about 1 % of sulhuric acid; the latter is added to precipitate the lead. The current nsity employed is about 18 amp. per sq. ft., and the temperature the electrolyte must be kept below 20° Centigrade.

Zinc.—The electrolytic process for the recovery of zinc from e solutions obtained by leaching the roasted ore with dilute lphuric acid has made remarkable progress since 1910, and the tal output of electrolytic zinc is now estimated to lie between 25,000 and 150,000 tons per annum. The extraction of zinc, herefore, is now the most important electrolytic industry after hose of copper and aluminium, and its growth is explained by he fact that the electrolytic method is useful for treating complex res, which cannot be dealt with satisfactorily by the older dry ethods. Recent study of the conditions which yield the best esult have shown the necessity for producing a high percentage f soluble zinc during the preliminary roasting of the ore, and the est temperature for attaining a high sulphatising action is ound to be a dull red heat, 550° to 600° Centigrade.

The latest progress in the electrolytic recovery of zinc centres round the systems of purification, circulation and regeneration of he electrolyte, and one of the most recent of these improvements is o separate zinc ferrite from the roasted ore by passing it over a agnetic separator. Two products are thus obtained, a magnetic ne containing all the ferrite and some zinc oxide, and the other ontaining pure zinc oxide. The magnetic product is then leached ith 28 % sulphuric acid and on neutralising this with the zinc oxide rom the non-magnetic portion of the roasted ore, the iron is preipitated as dense ferric hydroxide, which carries down with it all the rsenic, antimony and silica present in the ore. The purified solution s then electrolysed with a current of 100 amp. per sq. ft., and during he electrolysis glue is added to the electrolyte, to the extent of 3 b. per ton of zinc produced. The zinc deposit obtained from this igh acid process is dense and smooth, and may be detached readily rom the aluminium sheet by a slight tap.

Electrolytic zinc works have been established in Italy and in he Pyrenees, one of the most recent being the works of the Société de la Vieille Montaigne at Viviez, where 4,000 H.P. is beng used, from a water power located 40 m. away. The largest plant in which electrolytic zinc is being produced is that erected n 1918 by the Anaconda Copper Co. at Great Falls, Mont., for recovery of the zinc from the complex zinc-lead ores of the Butte district, by a sulphate leaching process. The tankhouse of this plant contains 864 vats, each 10 ft. long by 3 ft. wide by 5 ft. deep; each vat holds 28 anodes and 27 cathodes. The latter are of rolled sheet aluminium, from which the deposited zinc can be stripped easily. The anodes are of chemical lead. The current for each unit of 144 cells is supplied by a rotary converter of 5,800 kw. output, 10,000 amp. at 580 v. being required to run this number of cells. At full load the current density employed is 30 amp. per sq. ft. of cathode area; but 22 to 25 amp. yields the most satisfactory deposit.

Electro-thermal processes of zinc extraction are practised in Scandinavia, resistance furnaces being used in Norway and arc furnaces in Sweden. The resistance furnaces employed in the former country are those designed by Thorledsen. In this type of furnace, the roasted ore and carbon form the resistance material for the passage of the current. The zinc condensed in the first part of the receiver contains 10 % of lead, further on in the receiver a deposit of 98 % of zinc is obtained, finally pure zinc and zinc mixed with a small amount of cadmium. The condensed metal, however, is not pure, but contains 35 % of zinc powder.

The Swedish process is used at Trollhättan, and the works there now employ 18,000 horsepower. The mineral is first roasted, and after mixture with coke and fluorspar is submitted to the action of the electric arc. Oxide of zinc and grey metal are recovered, and on submitting this to the process a second time, a metal containing 99·8 % of zinc is obtained.

Electrogalvanising.—The electrolytic deposition of a coating of zinc, from sulphate solutions upon iron articles is now a well-established industry in all the leading manufacturing countries.

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(J. B. C. K.)

ELECTRON (*see* 9.237).—The reader should consult the article Gases, Electrical Properties of, by Sir J. J. Thomson, for an account of the electron and its properties. The electrons are particles whose mass is about 1/1800 part of an atom of hydrogen. There is only one kind of electron, for all have the same mass and carry the same electric charge. (*See* also Electricity; Matter.)

ELECTROTHERAPY (*see* 9.249).—Four different types of electricity are employed in medicine:—

(1) The constant, continuous or galvanic current.

(2) The interrupted currents of low frequency (the interrupted galvanic current, the alternating and sinusoidal currents, the faradic current).

(3) The interrupted currents of high frequency (high frequency currents, and diathermy).

(4) The high voltage unidirectional currents derived from the static machine.

The Constant Current.—It is now generally accepted that the chief curative action of the constant current is due to the reflex action resulting from the stimulation of the cutaneous and subcutaneous nerves immediately beneath the area over which the pads conveying the current are applied. By this reflex stimulation, an increased blood supply with its valuable consecutive effects is obtained. This stimulation is very similar in nature to what has been termed "counter-irritation," with the great advantages that the amount of stimulation is capable of exact regulation, that it takes place within the epidermis, thus acting directly on the nerve endings and that it can be continued daily for a long period, improving the condition of the skin rather than destroying it, as the constant painting on of an irritant would do. The extent of this stimulation is dependent on the strength and duration of the current employed and the nature of the solutions with which the conducting pads are moistened.

When a positive pole of zinc or copper, or when salts of these metals in solution are employed, a caustic and destructive compound such as the chlorides or oxychlorides of zinc or copper [is formed in the submucous or subcutaneous area by the combination of the negatively charged atoms of zinc (zinc ions), proceeding from the positive pole to the tissues, with the positively charged chlorine atoms (chlorine ions) proceeding from the tissues toward the positive pole. In the process of combination the atoms get rid of their electrical charges, the process is therefore rather one of de-ionisation. This method is very valuable for the thorough and safe destruction of the diseased membranes of cavities, such as the unhealthy mucous membrane of the uterus or the lining of septic cavities.

Similarly, by the employment of less destructive solutions, a reflex stimulation of the tissues can be brought about. The amount of stimulation depends on (1) the nature of the solution, (2) the strength and duration of the current. In general the best results are obtained by a solution causing the minimum of irritation and the application of the maximum current which can be readily tolerated by the patient for at least 40 minutes.

This form of treatment is indicated when increased local nutrition or the re-absorption of fibrotic thickening is desired: such as in the local treatment of chronic rheumatics, neuritis, sprains and many other conditions. It is especially valuable in the treatment of tic douloureux, for which the employment of strong currents of from 40 to 80 milliamperes is necessary.

Interrupted Currents of Low Frequency.—The therapeutic effects obtainable from the employment of the interrupted currents of low frequency have been greatly increased by the methods recently introduced by Prof. Lapicque, Prof. Leduc and Dr. Morton Smart. In the method of Lapicque, by the interposition in parallel of condensers with capacities varying from 2 to 30 micro-farads, we obtain an interrupted current of such progressive onset and decline that we can excite contractions in paralysed muscles without exciting corresponding or overpowering contractions in the neighbouring healthy muscles, due to the physiological fact that the contraction excited in a paralysed muscle is less dependent on a sharp make and break than with a healthy muscle.

In the treatment of infantile paralysis objection has been raised to the electrical excitation of the paralysed muscles on account of the over-excitation of the opposing healthy muscles which accompanies such stimulation. By the method of Lapicque this objection is entirely overcome. The defined and isolated contraction elicited by this method has a valuable re-educative effect in cases of recovering motor-nerve lesions. Lapicque's technique is especially useful in the treatment of facial palsy.

The Leduc current consists in the interruption at a frequency of about 100 per sec. of the galvanic current at the very low intensity of from two to four milliamperes. Leduc claims that it is possible by employing these minute currents interrupted at such frequency to induce successively local anaesthesia and, if applied through the brain, general anaesthesia, electric sleep, coma and eventually death. Applied locally, avoiding the region of the brain, this treatment is perfectly safe and has proved valuable in the treatment of certain forms of neuritis and especially in that otherwise intractable condition, causalgia.

The advantages of the instrument and technique elaborated by Dr. Morton Smart for the application of faradism to muscles deficient in excitability and tone, which have very greatly enhanced the therapeutic value of the faradic current, are that the pain of the treatment is abolished or reduced to a minimum, the vigour and amplitude of the contractions are increased; and, above all, when employing this method, the operator can at once appreciate when the muscles are becoming fatigued and so can at once discontinue further stimulation before any of the bad effects which were liable to occur when employing the older methods, can take place.

High Frequency Currents and Diathermy.—Although the researches of D'Arsonval which led to his discovery of the high frequency currents and diathermy were commenced in 1888 and concluded in 1890, diathermy the most valuable result of his research, only began to be employed in Great Britain in 1911 or 1912. D'Arsonval, when experimenting with alternating currents in 1888, noticed that, with a constant strength of current, the more rapidly the interruptions occurred, the more vigorous were the resulting muscular contractions.

When, however, a frequency of from 2,500 to 5,000 excitations a second was reached, a decrease in the vigour of the contractions occurred and progressively decreased with the increased frequency of excitation. At this time, the instruments at D'Arsonval's disposal did not permit a further increase of frequency, but in 1890, by employing the wireless apparatus of Hertz, he obtained what he rather exaggeratingly termed "billions of oscillations a second." With these frequencies he found that he was able to pass a current of two or three amperes through the human body without producing any muscular contraction or other sensation than that of heat. He thus obtained the clinical high frequency currents. Diathermic currents were subsequently evolved from the high frequency currents by such modifications in the instruments as permitted currents of lower voltage, higher amperage and higher frequency to be obtained.

The main therapeutic effect of diathermy is the generation of heat deeply in the tissues by the friction from the oscillation of the electrically charged atoms. Any organ of the body, any limb or part of the body, or the whole body to any extent required, can be heated by this current. Before the advent of diathermy we were able to heat only the superficies or the accessible cavities of the body; even under such limitations the application of heat formed one of the oldest and most useful therapeutic measures. Moreover, the heat obtainable from diathermy admits of exact and easily regulated adjustment to a degree never before obtainable.

The consecutive effects of heat applied in this manner are an increased blood supply, relaxation of tension and spasm with consequent relief of pain, increased local drainage, increase local nutrition. The heat thus generated is an expression of th mechanical or dynamic force excercised by the oscillations of th ions within the tissues and this primary action (the so-calle "ionic massage") appears to be of value in aiding the dispersa of recent effusions. Some of the main indications for the application of diathermy are the relief of pain and spasm, the treatment of rheumatism, neuritis, sciatica, asthma and pneumonia

Diathermy in Surgery.—Apart from its medical application diathermy is of considerable value in surgical practice for th destruction of superficial morbid growths, such as rodent ulcers warts, naevi, etc. When applied for this purpose, in place of th two electrodes of large size employed in medical diathermy, on large (the indifferent electrode) and one small metal point (th active electrode) are substituted. In this way the heat, which i distributed and is only appreciated as a slight warmth over th large pad, is concentrated at the small metal point and almos immediately coagulates and destroys the tissue with which th point is brought in contact. Very satisfactory results have bee obtained from the treatment of haemorrhoids in this manner.

The point of a metal wire can be employed as the activ electrode and by inserting this wire through a cystoscope (a instrument for viewing the interior of the bladder) small growths can be readily destroyed and serious surgical operation avoided.

High Voltage Unidirectional Currents.—The therapeuti effects obtainable from the static machine were so exhaustively worked out towards the end of the 19th century, notably by Drs. W. J. Morton and Benham Snow of New York, that no important developments in the use of these machines have been made in recent years. Recent research, however, has enabled the therapeutic action of the currents derived from these instruments to be rationally explained on a physiological basis and the claims formerly put forward for this form of treatment have been fully justified. (W. T.)

ELEMENTARY EDUCATION (*see* 8.981).—The changes which have taken place in elementary schools since 1910 represent the natural development, perhaps accelerated, of the principle that elementary education is an integral part of a comprehensive national education which aims primarily at the all-round development of each human personality. (*See* EDUCATION.)

I. GREAT BRITAIN

In England and Wales the policy of the Board of Education[1] indicates clearly enough the official ideal of the responsible department of state during this period.

> The only uniformity of practice that the Board of Education desire to see in the teaching of public elementary schools is that each teacher shall think for himself, and work out for himself, such methods of teaching as may use his powers to the best advantage and be suited to the particular needs and conditions of the school. Uniformity in details of practice (except in the mere routine of school management) is not desirable even if it were attainable. But freedom implies a corresponding responsibility in its use.

The administration and inspection of public elementary education upon lines broad as these have combined with other influences to produce the variety which at the moment characterises English and Welsh elementary schools and which indeed makes it difficult to generalise about them with accuracy. Influences other than those directly exercised by the Board of Education are in the nature of things far less easy to trace, yet some of them require specific mention.

Influence of Psychological Science.—The study of psychology has exercised a powerful and widespread influence upon elementary school teaching, which shows no sign of waning. For example, the emphasis placed by W. MacDougall (*Social Psychology*, 1908) and his school upon the importance of the factor of "interest" in education has been almost universally reflected in school methods and schemes of work and has been largely although not entirely responsible for many attempts—often singularly original and successful—to co-ordinate the life of the child in school with his life at home and for the adoption of "imaginative methods," *e.g.*, free drawing, dramatisation, modelling, etc., in the teaching of subjects which have hitherto been taught almost entirely by oral instruction by the teacher.

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[1] See the Prefatory Memorandum of the *Suggestions for the Consideration of Teachers and Others concerned in the work of Public Elementary Schools* published in 1905 and re-affirmed in subsequent issues of this pamphlet. (Cd. 2638.)

Intelligence Tests.—Again, teachers everywhere have taken great interest in both the theory and practice of intelligence tests (*q.v.*). The recognition of the possibility that much ability may pass through the elementary school undetected by the traditional methods and content of teaching has led to much original experiment under both these heads. In particular it has led to a critical scrutiny of traditional examinations.

Physical Training.—The criticism of medical authorities (closely associated with the development of the school medical service) has checked any tendencies to regard education as an exclusively intellectual process. The modern elementary school has an equal regard for the physical as for the mental development of its pupils and, quite apart from the specifically remedial action of the school medical officers, now does much to improve the physique of its children (*see* PHYSICAL TRAINING). Considerable time and attention are devoted to suitable games (largely musical in character) in the infants' schools; and organised games, such as cricket, football, swimming, netball and folk dancing are practically universal in the senior schools. Steady progress has been made in the provision of special schools for blind, deaf, physically and mentally defective children, though much yet remains to be done.

Individual Methods.—The influence of Mme. Montessori's theories (*see* MONTESSORI SYSTEM) has been very marked, not indeed by any wholesale adoption of them, but in directing criticism against the traditional classroom methods of teaching and so leading on to a particularly fruitful experimentation in individual methods of instruction, which has been remarkably general and often remarkably successful in the infants' schools. Perhaps the great majority of English infants' schools now employ "individual methods" to a substantial extent, although seldom relying upon them to the entire exclusion of the more traditional classroom methods. Somewhat similar methods—such as those adopted under variations of the well-known "Dalton plan"—are now being largely applied to the case of older pupils, the broad aim being to train the children to use books and to work individually with self-reliance and effect.

Curiously enough, too, the elementary schools in their endeavour to increase the effective interest of school-life have found it worth while to take a leaf out of the book of the most traditional of English educational institutions—the English Public Schools. The house and team systems, now frequently adopted, covering both work and games, represent an attempt to cultivate the healthy spirit of group rivalry.

Teachers' Courses.—Some reference must be made to the growing importance of "Teachers' Courses" in the development of elementary school teaching. Year by year since the War the popularity of "refresher courses" for teachers already fully qualified has increased and these courses are now attended by thousands of teachers annually (*see* SUMMER SCHOOLS). The courses may be held during the school holidays or the school terms; they may take the shape of continuous fortnights of study or of weekly demonstrations and lectures; they may be conducted by a local education authority, the Board of Education or private enterprise; they may deal with the theory or practice of education or aim merely at deepening the teacher's knowledge of a particular subject. But whatever their system they have exerted a very beneficial influence upon elementary school teaching by helping to keep the teacher alive and interested in his work and in touch also with current developments in educational ideas and contemporary scholarship.

Special Developments.—Administrative action during the period 1910–25 has increasingly recognised the necessity for the unification of the system of public education and has made a steadily increasing provision for the advanced education of elementary school children who are capable of profiting by it. The brighter children are now drafted away in increasing numbers from the elementary schools at the age of 11–12 to continue by means of scholarships and free places their education in the secondary schools. Notwithstanding recent financial stringency, the action of the secondary schools in this respect has been considerably intensified by the establishment in a large number of areas of "Central Schools," "Central Classes," "Higher Tops" and distinctively vocational schools which also draw their pupils from contributory elementary schools, generally on a selective basis. Thus more and more the children remaining in the elementary schools beyond the age of 12 are those that are left after the cream has been drawn off. The process is inevitable and all to the good from the point of view of the individual child. But the elementary school is left with a new problem to solve, viz.: the evolution of a new type of education for children not of the first ability, who have only two or three years more of school life before them, but who have nevertheless outgrown the methods of the middle-school and now require to be prepared effectively for life as adolescents in trade or business. The present tendency is to favour the application of individual methods with an increasing amount of practical work of all kinds for these children. In conclusion it may be well to endeavour to characterise briefly, in so far as the variety of the schools makes this possible, the outstanding features of the public elementary school at the moment.

Relations with Parents.—First, the elementary school as a whole since 1910 has very definitely resisted any tendency to become an educational machine for the instilling of mere information into children. Year by year it has become more and more clearly an organ of general social welfare—with a particular function of its own, it is true, but none the less for that, part of the great general movement of the age making for social betterment. It has won general recognition among the parents; it has ceased to be the enemy of the family as it once often seemed, and has become instead a friend to be trusted and assisted. Few things are so significant as this changed relationship between the teachers and the parents, so strikingly exemplified since the War by the widespread popularity of the "Education Week"—a week set apart by a local authority in order to explain and exhibit its system of education to the public.

Infants' Schools.—As regards the infants' school, the special aim here is, not only to impart the rudiments of the 3 R's—and much ingenuity has gone since 1910 to the formulation of rapid and interesting methods of teaching these—but to develop interest and the natural activities, special weight being laid perhaps upon oral responsiveness. The lively, eager interested child, although with the powers of concentration proper to his age, is increasingly regarded as the typical product of the good infant school.

Senior Schools.—In the Senior schools the general aim is to train the child in habits of independent work and self-reliance and to cultivate in him an interest and ability in intelligent work—at least of some sort—which will stand him in good stead long after he has passed the age of compulsory attendance. In particular, it seems as though the position of arithmetic as the weightiest subject in the elementary school curriculum has now been severely shaken, if not definitely occupied by English—a subject which has made great advance during the last 10 or 15 years. In any case, the old multiplicity of subjects is now defining itself into two groups—the English group, including reading, spelling, compositions, the study of elementary literature, geography and history; and the mathematical-scientific group, including arithmetic, elementary mathematics and physical science. This process of definition with its accompanying simplification of the whole and co-ordination of parts is doing a great deal to liberalise both the content and method of teaching.

Handwork.—Handwork has established itself firmly as a teaching method; as a subject in the shape of laundry, cookery and housewifery for girls, and wood, metal and varied work for boys, its value is increasingly allowed, especially for the kind of children likely now to remain in the elementary schools until their school-life finishes; its development in these more specialised directions has, however, since the conclusion of the World War been unavoidably checked by financial considerations. Still more recently some reaction may be discerned against the more extravagant doctrines of self-expression and self-development. This reaction is likely perhaps to lead to an increasing emphasis upon the value of the more formal elements in education. *See* EDUCATION and the bibliography thereto.

(K. M. A.)

II. THE UNITED STATES

Progress in the development of elementary education has been made during the years 1910–25: (1) through the adoption of compulsory education laws by all of the states which did not have such laws; (2) through consolidation of rural schools; (3) through the enrichment of the curriculum, especially in the upper grades; (4) through the improvement of the training of teachers; (5) through the lengthening of the school year; and (6) through the erection of many modern school buildings with enlarged equipment.

Compulsory Laws.—Compulsory education laws were enacted in 1915 by Alabama, Florida, South Carolina and Texas; in 1916 by Georgia and in 1918 by Mississippi. The movement to make compulsory education universal in the United States, which began in 1852 in Massachusetts, was thus consummated by the Legislatures of the states mentioned. In these states public education developed slowly after the Civil War and the enactment of compulsory education was delayed by economic and social conditions. In 15 of the older states recent legislation has raised the age limit of compulsory school attendance from 14 to 16 years. There seems to be a tendency to carry the limit finally to 18, which limit is now set by Idaho. If this tendency is realised in legislation it will undoubtedly be accompanied, as was similar legislation in England, by provision for supervised entrance of a part of the school population upon industrial occupations (*see* CONTINUATION SCHOOLS).

Rural Schools.—Rural schools, which have always been meagre and ill-equipped as compared with urban schools, have been greatly improved, especially through the consolidation of several school districts and the transportation of pupils to a single central building, where better facilities are provided because of the type of organisation which can be adopted when larger numbers of pupils are grouped together in classes. The U.S. Commissioner of Education is authority for the statement that in 1924 approximately 1,000 school consolidations were made; about 5,000 one-room schools were absorbed into consolidated centres; and expenditures for the transportation of pupils increased in that year by $3,500,000.

Curriculum Changes.—The fact that modern life because of its complexity makes a broader education necessary for success, has led to an expansion of the curriculum by the introduction of new materials of instruction and by the great enlargement of some of the traditional subjects. Where pupils used to read one book a year they now read 10 to 20 books in the reading class. Nature study is common as an extension of geography and as a means of introducing pupils to the principles of science. Practical activities, such as cooking, sewing and manual training, are now very general. Health education has been enlarged as never before, and takes either the form of scientific teaching of hygiene and physiology or the form of practical exercises in the gymnasium or clinics. A general tendency has appeared to carry down into the elementary school certain courses which were formerly regarded as the exclusive property of the high schools. Such are courses in foreign languages and mathematics beyond arithmetic. This tendency to enlarge the work of the upper grades is directly related to the development of the junior high school (*see* SECONDARY SCHOOLS).

Training of Teachers.—Much agitation has in recent years led to a serious consideration of the very general lack of training on the part of teachers. It has been estimated that from 25% to 40% of the teachers in public schools, especially the one-room rural schools, are without a high-school training. Probably less than one quarter of the teaching staff of all schools is made up of normal school graduates. The agitation has resulted in legislation empowering state departments of education in the various states to raise the requirements for teachers' certificates and to compel communities to pay higher salaries. Twelve states increased the requirements for teachers' certificates in 1924.

Attendances.—The school year has been lengthened steadily during the period in which the U.S. Bureau of Education has collected statistics, as has also the average number of days of attendance of individual pupils. The following table gives details of these increases since 1900.

	1900	1905	1910	1915	1920	1922
Average No. of days schools were in session . . .	144·3	150·9	157·5	159·4	161·9	164·0
Average No. of days attended by each pupil enrolled .	99·0	105·2	113·0	121·2	121·2	130·6

New Buildings.—The erection of new school buildings has gone on at an unprecedented rate since the World War. In 1910 expenditures for sites, buildings and equipment were $69,978,370; in 1920 they were $153,542,852 and in 1922 $305,940,965. The buildings are better planned and more hygienic and include in many cases auditoria, gymnasia, science laboratories and shops, thus providing more adequately for the enriched programme of instruction, and also for the use of the buildings for many community purposes.

(C. H. J.)

ELEMENTS, TRANSMUTATION OF: *see* TRANSMUTATION OF ELEMENTS.

ELEVATORS AND ESCALATORS (*see* 9.263).—The chief advances in elevator design in the period 1910–26 have been initiated in the United States, where the increasing congestion in business districts has forced up land values and made it desirable to increase the height of buildings, a necessary condition to this change being an improved type of elevator. The famous skyline of New York is thus intimately dependent on the most notable improvement of the period, the perfecting of the gearless traction elevator.

Prior to 1906, when the first electric gearless traction elevator was installed, practically all electric elevators had been of the drum type. This type had inherent limitations, such as the available width of face of the drum upon which the hoisting cables were wound and a maximum car speed of 400 ft. per minute. These restricted the electric elevator to lower buildings, the higher ones being equipped with the geared vertical or horizontal hydraulic elevators, which provided car speeds up to 600 ft. per minute.

The Electric Elevator.—The advent of the electric elevator, which was evolved from the earlier drum type of electric elevator, provided 600-ft. car speeds without restrictions on the height of buildings. It substituted a traction driving sheave for the drum of the earlier type of electric machine and direct drive instead of the worm gearing. The first cost of such an installation was much less than the hydraulic elevator, with its steam pumping plant; the operating costs were less; the machines were easier to operate and required less space in the building, being placed over the hatchways and thus saving the valuable space in the basements formerly required for the pumping plants. These advantages speedily made the gearless traction elevators popular, and by 1910 installations of hydraulic elevators had practically ceased. From that time, improvement consisted largely of development and refinement of operation and control. Direct current only can be used with this machine.

The drum type of electric elevator, employed for slower speed service, is gradually being replaced by the geared (single wrap) traction types, except for special uses, such as mine or blast-furnace hoists, where it is still desirable to wind the ropes on a drum. Electric elevators having car speeds up to approximately 350 to 400 ft. are usually of this type. It differs from the old drum type merely in its use of a traction driving sheave, which is substituted for the drum. The change was prompted by the success of the traction drive on the gearless machines, its advantage lying in the safeguarding of the car or counterweight against being drawn into the overhead work. The driving sheave is mounted on a spider, or directly on the gear shaft, just as was

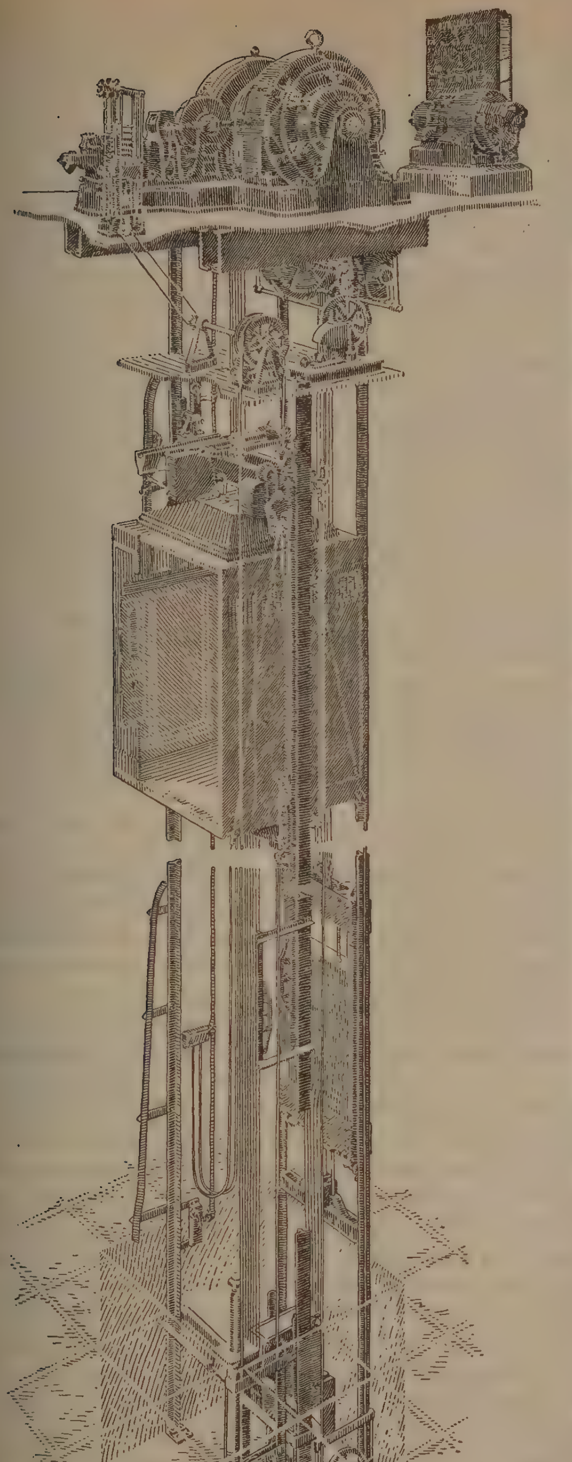

FIG. 1.—A Modern elevator with electric drive and signal control. (Otis Elevator Co.)

formerly done with the drum. The ropes are attached to the car, then pass up and over the driving sheave of the machine, which is usually mounted over the hatchway, and then, passing down, are attached to the counterweight. Thus, if by any chance the car should travel too far beyond the top landing, the counterweight will land in the pit and the tractive effort will at once be lessened so that the car cannot be drawn up further. This also applies to the drawing of the counterweight into the overhead. These machines are provided with hand-rope control for the very slow speeds and, for higher speeds, with car switch control or automatic push-button control. The hand-rope control is being displaced by the double-button controls, a feature of which is the providing of a contact and lock on hatchway doors or gates so that the elevator cannot be started until they are all closed. Both geared and gearless machines have been provided with two almost revolutionary improvements in control, the micro drive or self-levelling operation and the unit multi-voltage control or variable voltage operation.

The micro drive (self-levelling operation) is designed to bring the car platform automatically to rest on an exact level with the floor landing, this level being maintained irrespective of the stretch of ropes or change of load on the platform. The mechanism is brought into action by the operator, who centres the car switch to stop the car within the " micro zone " above or below a landing. A cam on the car then engages levelling switches in the hatchway and operates through the controller to bring the car automatically to an exact landing. The micro drive is particularly valuable in elevators used extensively by women and children, as in large stores, hotels and apartments, where it lessens the danger of stumbling. It is valuable also for heavy-duty freight elevators, assuring a level landing for trucks.

Unit Multi-Voltage Control.—Unit multi-voltage control provides much greater smoothness in starting and stopping the car, while increasing general operating efficiency, in comparison with the so-called resistance control. It produces the highest class of service for high-speed elevators of all types. It is also particularly valuable in locations where alternating current source of supply only is available, as it permits of the use of the highest class of direct current elevator machines operating through special motor generator sets provided for this purpose. Otherwise it would be necessary to use commercial motor generator sets, which are not satisfactory for this purpose, or else to use regular alternating current elevator machines, which cannot provide a high-speed service.

Signal Control.—A further development of elevator operation is known as Otis signal control. This is primarily intended for the highest class of elevator service in the tallest buildings, or indeed in others in which intensive service is required. The control is entirely automatic and is exercised by means of a series of buttons in the car, and "up" and " down " buttons at each floor landing. This adaptation of ordinary slow-speed push-button control is applicable to elevators travelling as fast as 800 ft. per min. or more. This machine is always provided with micro-drive operation and unit multi-voltage control.

The following brief description shows the kind of service possible with the Otis signal control operation. As the car is standing at the ground floor, each entering passenger calls the floor at which he wishes to alight. The attendant then presses the button in the panel numbered to correspond to that floor. When he receives the signal to start he merely releases the door, which closes automatically, the elevator starts automatically, and then, without further action on the part of the attendant, stops automatically at the first floor for which a button has been pressed. As the micro drive brings the platform exactly level, the doors open automatically. This course is repeated at each floor for which a button has been pressed. A waiting passenger at any floor merely presses the usual signal button, which call is then automatically registered on the controller of the first car travelling in the desired direction. This car automatically stops at the floor and the doors open automatically. Such stopping of the car to answer calls at the floors is entirely independent of the attendant and is indeed unknown to him until the car stops.

There is thus no possibility of an attendant neglecting to stop for a waiting passenger, although if his car is full he can transfer all calls to the next car. The adoption of the signal control with micro drive permits of car speeds being raised to 1,000 ft. per min. or more with perfect stopping at the floors, thus anticipating the requirements of still higher buildings in the future.

New Controls.—Two new forms of control, known as department store control and collective automatic push-button control, were being placed upon the market in 1926. These are both adaptations of the signal control and designed to provide automatic operation for slower-speed elevators. Department store control is intended primarily for use in that type of building and provides automatic operation, so that the attendant in the car may devote his entire attention to his passengers, and to announcing the departments on the floors. The elevator starts automatically as soon as the doors are closed at the first floor, and without the necessity of pressing any buttons in the car, stops automatically at each floor. As the car is slowed down with the micro drive the doors open automatically, and upon being released by the attendant they close automatically and the car immediately starts for the next floor. No hall buttons are necessary as the car stops at each landing.

Micro-drive operation and unit multi-voltage control are essential features of this machine as they are of the collective automatic push-button control. This latter type combines the advantage of requiring no regular operator and of attaining speeds impossible for the earlier slow-speed elevators with push-button control. The use of the earlier type was confined to private residences, small apartments or small office buildings, because the car could only serve one floor at a time and was restricted to speeds not exceeding 150 to 200 ft. per min. in order to make accurate landings. With this new control there is no restriction on car speed; the car will automatically pick up all calls registered from the hall buttons in the direction in which the car is travelling, and the system may be used in much larger buildings. A so-called operatorless elevator is designed for use in large warehouses where there are a number of elevators operating in banks, and so arranged with a telephone system at each floor that the elevators are operated entirely by one person at a central dispatch point, thereby effecting a great economy in operation. Such systems are provided with the micro drive and automatic push-button control.

Safety Devices.—In addition to minor improvements in the earlier devices underneath the platform to prevent falling of the car in case the ropes break, there has been developed a switch which acts to slow down the elevator if descending at excessive speed and which acts prior to the application of the safety device. Automatic stopping and limit switches also are provided on all high-speed cars, whereby the machines are automatically slowed down as the car approaches the terminal landings. If the car runs past the final limits of travel, the final limit switch cuts off all power from the machine and applies the brake. The governors are also provided with governor switches, which cut off current to the machine and apply the brake upon application of the safety devices. Buffers are provided in the bottom of the elevator pit, arranged to bring the car or counterweight to rest if they should overrun their travel. On high-speed elevators these buffers are usually of the oil type with telescope casing, in which the oil percolates through holes into the outer oil chambers at a predetermined rate so designed as to permit of the car's landing on the buffers at normal operating speed and being brought to rest without injury to the occupants. Building regulations frequently provide that elevator hatchway doors shall be so equipped that the elevator cannot be started until all doors are closed. The car also often has a door or gate provided with mechanisms to prevent the elevator from starting until the door is closed.

THE USES OF ESCALATORS

The escalator has greatly increased in popularity in places where it is necessary to transport large crowds of persons from one level to another, such as in stores, railway terminals and underground railways, the transfer being possible with perfect safety, greater rapidity and less crowding than by elevators. The first escalator was shown at the Paris Exposition in 1898. It was later taken down and is now used in a large store in Philadelphia. The earlier escalator has now been superseded by a simpler and more efficient type, in which the construction is more substantial, wearing parts are few and operating costs are low. There are two general designs—the flat step and the cleat step types. In the former the steps are perfectly flat, as in an ordinary stairway, and disappear under a shunt at the top or bottom. These shunts require considerable space on the floors, a disadvantage which is not found in the cleat step escalator, the principal superficial difference being that the steps have several cleats attached which pass through comb plates at the top or bottom of the runway. Since these new types were perfected, many escalators have been installed in department stores throughout the United States, England and Germany, as well as in Japan and Australia. (J. H. VAN A.)

ELGAR, SIR EDWARD (1857–), British composer (*see* 9.266), received the Order of Merit in 1911. His first symphony, produced at Manchester in 1908, created a furore and was played over 100 times in one year. This was followed by a violin concerto (1910); the second symphony in E flat (1911); *Falstaff* (1913); *The Carillon*, recitation with orchestra (1914); *Polonia*, symphonic poem (1915); *The Spirit of England*, choruses (1917); a quartet, quintet and violoncello concerto (1919); a transcription for orchestra of Bach's C-minor fugue (1921). In 1924 Sir Edward Elgar conducted the massed bands and choirs at the opening of the British Empire Exhibition, where his "Land of Hope and Glory" was performed before King George V., and 100,000 people; the same year he was appointed Master of the King's Musick. Among his other compositions may be mentioned: *The Crown of India*, a masque (1912); *The Music Makers*, for contralto, chorus and orchestra (1912); choral songs, anthems, etc.

See E. Newman, *Elgar* (1906); R. Buckley, *Sir Edward Elgar* (1904); and J. F. Porte, *Sir Edward Elgar* (1921).

ELGIN, VICTOR ALEXANDER BRUCE, 9th EARL OF (1849–1917), British politician (*see* 9.268), died at Broomhall, Fife, Jan. 18 1917. His son, Edward James Bruce (1881–), who then became the 10th earl, was made chairman of the Carnegie United Kingdom Trust. In 1925 he was lord high commissioner to the Church of Scotland.

ELIOT, SIR CHARLES NORTON EDGCUMBE (1864–), British diplomatist and writer, was educated at Cheltenham and Balliol College, Oxford, where he had a highly distinguished university career, being elected fellow of University College in 1885. He entered the diplomatic service in 1886 and acted as chargé d'affaires in Morocco in 1892–3, in Bulgaria, 1895 and in Serbia, 1897. He was created C.B. in 1898 and K.C.M.G. in 1900. In Jan. 1901 he was appointed high commissioner of the British East Africa Protectorate, but he resigned in Jan. 1904, being opposed to the grant of a concession to the East Africa Syndicate, which he held to be detrimental to genuine colonisation. For some years he abandoned public service, but in Aug. 1918 he was named high commissioner in Siberia, and in Nov. 1919 became ambassador to Japan, being thereupon sworn of the privy council. He was created G.C.M.G. in 1923. In Jan. 1926 he was appointed a member of the Japanese Imperial Academy, being the first foreigner to receive this honour.

In early life Eliot paid several visits to the Balkan Peninsula and under the pseudonym of "Odysseus" published in 1900 *Turkey in Europe*. He also travelled in Central Asia, China and Japan and is the author of *Letters from the Far East* (1907), and *Hinduism and Buddhism* (1921). He wrote also *The East Africa Protectorate* (1905), and compiled *A Finnish Grammar* (1890) and other linguistic books.

ELIOT, CHARLES WILLIAM (1834–), American educationalist (*see* 9.274), was offered the post of ambassador to England by President Taft in 1909, but preferred to serve his country in a private capacity at home. He received a similar invitation from President Wilson in 1913 but again declined.

He continued to take an active part, by writing and speaking, in all the important public questions of the day. His theories concerning necessary changes in education toward the concrete and practical had great influence upon American schools. The vocational movement, so marked after 1910, was without doubt accelerated by his continued insistence upon the training of the senses of sight, hearing and touch, as being the sources of the best part of knowledge. In 1914 he was elected president of the American Association for the Advancement of Science. In his educational writings he maintained that the traditional systems had dealt too exclusively with language and literature. In 1916, however, he was awarded a gold medal by the American Academy of Arts and Letters for his literary influence in his educational work.

In the field of religion he was an authoritative spokesman on the Unitarian faith. In his later books, *The Religion of the Future* (1909) and *Twentieth Century Christianity*, he rejected obscure dogma, emphasised freedom in place of authority, and held that the teaching of Christ had been "the undying root of all the best in human history since He lived," and that He would be the supreme teacher in the new religion, the outcome of which would be the brotherhood of man. Dr. Eliot gave much attention to labour problems and declared that "profit-sharing, combined with co-operative management, in which the employees take active and reasonable part, is the only road to industrial peace." He condemned limited output by labour as well as uniform hours and wages. The settling of industrial strife he considered to be second in importance only to the establishment of a league of nations.

Eliot was a strong supporter of President Wilson's administration, and approved his personal appeal to the country in 1918 to return a Democratic Congress. He favoured Prohibition as a War measure, and later as an amendment to the Constitution. He wrote in favour of military training after the Swiss method, but maintained that, after a league of nations was formed, no country should be allowed to have an army "whose officers have entered for life the profession of soldier." In 1920 Dr. Eliot was an active worker for the Democratic party because he regarded the immediate adoption of the Covenant of the League of Nations as a moral obligation. His 90th birthday, March 20 1924, was made the occasion of a striking demonstration of esteem in Sanders Theatre, Harvard University, Cambridge, Mass., on which occasion Chief Justice Taft, representing the President of the United States, testified to the great influence wielded by Dr. Eliot in the field of education.

ELIZABETH (1843–1916), QUEEN OF RUMANIA (*see* 9.286), died at Bucharest, Rumania, March 2 1916.

ELLIOTT, HOWARD (1860–), American railway manager, was born in New York City Dec. 6 1860. After graduating from the Lawrence Scientific School, Harvard, in 1881, he was for several years a clerk in various offices of the Chicago, Burlington and Quincy Railroad. Later he was appointed general freight agent and then general manager of several lines belonging to the Burlington system. In 1902 he became second vice-president of the company and the following year president of the Northern Pacific Railway. In 1913 he was made president of the New York, New Haven and Hartford Railroad and at the same time chairman of its board of directors. In 1917 he resigned and was made chairman of the committee on intercorporate relations of the New Haven system, a position which he retained until 1922. In the same year he was nominated by the American Railway Assn. one of the six members of the Railroads War Board. In 1917 he also became chairman of the executive committee of the Northern Pacific Railway Co., was president 1919–20 and then chairman of the board of directors. He took an active part in obtaining legislation from Congress for the protection of the railroads, urged higher freight rates and suggested the creation of a department of transportation, with a secretary in the Cabinet.

ELLIS, HENRY HAVELOCK (1859–), British psychologist, was born at Croydon, Surrey, on Feb. 2 1859. Both his father and his maternal grandfather were sea captains, and much of his childhood was spent on the Pacific. After teaching for four years in New South Wales, he proceeded to St. Thomas's Hospital, London, where he qualified for the medical profession. For a short time he was engaged in general practice but very soon he abandoned it for literary and scientific work. The more popular researches of the Freudian school have to a considerable extent overshadowed the methods of Ellis, in which more emphasis is laid on biology and less on clinical experience. In the last century, moreover, the extension of his fame beyond medical circles was impeded by the repugnance aroused in the ordinary reader by the subject matter of his studies. Only of late has it become possible to adjudge his work without prejudicial heat.

Yet Ellis has the unusual advantage of being able to expound his scientific theories in a clear and often beautiful style. The patience of a Darwin is combined with the literary brilliance of a Huxley, and even when he is unable to convince he is sure to amuse. Moreover, as is sufficiently proved by his occasional writings, both early and late, he brings to the totality of human experience a generous sympathy, a sharp intelligence and a daring wit. Whatever his studies had been, he would certainly have won a reputation as a literary artist. The curious may find in the first number of *The Savoy*, an illustrated quarterly of the 'nineties, together with an article by G. B. Shaw on "Going to Church" a study of Zola by Ellis. This calm and bold analysis of a French novelist is typical of Ellis' work. "And Zola pours out the stream of his pitiful, pitiless irony on the weak, erring children of men." Ellis has done much the same.

His works include: *Studies in Psychology of Sex*, 6 vol. (1898–1910); *Affirmations* (1898); *The World of Dreams* (1911); *Impressions and Comments*, 3 series (1914–24); the *Dance of Life* (1923). See also: D. Isaac Goldberg, *Havelock Ellis: a Biographical and Critical Survey* (1926). (H. C. HA.)

ELLIS, ROBINSON (1834–1913), British scholar (*see* 9.294), died at Oxford Oct. 9 1913. Among his later publications were a lecture on the *Amores* of Ovid (1912) and an edition of the second book of Ovid's *Tristia* (1913).

EL PASO, Tex., U.S.A. (*see* 9.298), almost doubled its population in the decade after 1910, reaching 77,560 in 1920, of whom 30,769 were natives of Mexico; and (census bureau estimate) 104,929 in 1925. About 30% do not speak English. Elephant Butte dam was completed in 1916 and by 1925 over 125,000 ac. of the rich valley land in the Rio Grande reclamation project, of which El Paso is the centre, was under cultivation, including 25,000 ac. in Mexico, producing a crop worth $12,000,000, of which $8,000,000 was cotton. The principal industry was still the smelting of copper and lead ores (500,000 tons annually), but cotton-growing brought in new industries, including a textile-mill, three cotton seed oil-mills, 35 gins and two compresses by 1925. The total value of manufactured products rose from $3,637,000 in 1909 to $16,650,000 in 1919. A high school and stadium were built in 1916, a county courthouse in 1917 and a scenic drive around Mt. Franklin in 1919. A memorial park of 43 ac. is the tribute to the soldiers and sailors who fell in the World War. In 1922 a city plan commission was appointed, and the budget system was introduced into the city government. A junior college was added to the public school system in 1920. The University of Texas school of mines and metallurgy, established in 1914, is located at El Paso.

EMBRYOLOGY (*see* 9.314).—It remains here to deal with the more recent discoveries as to the nature and meaning of the developmental processes.

The Cell.—We take for granted (*see* CYTOLOGY) a general acquaintance with the structure of the bodies of adult animals. It is now a matter of universal agreement to conceive the active living parts of these bodies, which are included under the general name protoplasm, as built up of a series of units termed cells, each normally containing a single nucleus and separated from one another by quasi-solid membranes termed cell-walls.

The doubts as to the validity of the concept of the cell, which were raised in the later years of the 19th century, have not been sustained by later discoveries. A more refined technique has enabled us to demonstrate a cell-wall in cases where it was supposed to be absent; and where it really is absent, as for instance in the ectoderm of the Nematode worms, it has been proved that this is a secondary state of affairs, due to the degeneration of a well-developed layer of cells, which in younger stages of the life-history are clearly and sharply delimited from each other. In many, perhaps in most, cases the cell-walls are perforated so that adjacent cells are connected by bars of protoplasm, but this circumstance in no way invalidates the idea of the cell as the unit of structure.

Scope of Embryology.—The lowest grade of animals, termed the Protozoa (*see* PROTOZOÖLOGY), do not exhibit cellular structure. Either their bodies are so small that they possess only one nucleus, and may be regarded as free-living cells; or they contain more than one nucleus and attain a greater size, and then their protoplasm is not divided into compartments in accordance with the distribution of these nuclei.

Some of the largest of the Protozoa, such as the extinct genus *Nummulites*, were disk-like in form and attained a size of an inch in diameter; the bodies of these animals were divided into thousands of compartments by calcareous septa. To judge from what we know of the structure of their nearest living representatives they must have possessed numerous nuclei; but these nuclei were not distributed in accordance with the divisions of the protoplasm. Some compartments contained several nuclei, some one nucleus only and many none; so that true cell-structure was absent.

In other cases the protozoön may be described as a colony of small uninucleate forms, connected together either by strings of protoplasm or by stalks springing from a common base. But all these more complex Protozoa are distinguished from the true higher animals or Metazoa by the fact that when reproduction takes place the whole body of the parent breaks up into germs, each containing a single nucleus, whereas in true Metazoa small portions only of the parent's body are set aside for reproductive purposes; in other words, in the Metazoa there is a persistent "soma" or body distinct from the germ-cells. Now of course the development of the Protozoa ought to form part of the subject matter of embryology, but in the case of the smaller species it is exceedingly difficult to say which stage corresponds to the adult condition of Metazoa, since reproduction by the division of the mother's body into two can take place at various periods in the life-cycle; therefore purely as a matter of convenience it is customary to confine the subject matter of embryology to the study of the life-histories of the higher animals which exhibit definite cellular structure, in a word, to the Metazoa.

Metazoa.—If we now examine the development of the Metazoa we find a few cases where, side by side with other methods, reproduction by *fission*, that is by the division of the mother's body, does actually take place.

Thus in the marine annelid *Procerastes* described by Allen[1] the mother worm breaks up into groups of one, two or three segments and each of these groups regenerates the missing parts and thus reconstitutes a new worm. In much more numerous cases an outgrowth of the mother's body, termed a "bud," is produced. The bud may consist from the beginning of one or of several tissues, and is slowly moulded into the likeness of the parent and when fully grown separates from it, or in the case of a colonial animal remains connected with it and helps to build up a compound organism. Such compound creatures are found amongst the sponges, the Coelenterata, the Polyzoa and the Ascidians, the last-named group being degenerate allies of the Vertebrata.

The Germ Cells.—The laws of bud-development have not been as clearly elucidated as those of the germ-cells. Development by germ-cells is universal amongst the Metazoa; and in all but two phyla the form in which they appear is remarkably constant. They are of two kinds, viz., male and female, and are normally incapable of development unless they have previously united in pairs to form what are called "zygotes" (Gr. ζυόγν, a yoke).

The male cell or spermatozoön consists of a head which is a condensed nucleus made up of a compact mass of chromatin, and a tail which is a vibratile filament. Amongst the nematode worms, however, the male cells are devoid of filaments and appear under the form of small amoeboid cells, whilst amongst the higher Crustacea (*i.e.*, the shrimps, lobsters and crabs) the tail is replaced by a peculiar open vesicle lined with chitin, which under certain circumstances absorbs water and becomes turned inside out, thus propelling the head forwards and bringing about the union of the two germ-cells.

The female cell or ovum (egg) is typically rounded and motionless but it is of very different sizes in different species of animals. These differences in size depend entirely on the varying amounts of food-yolk (*i.e.*, reserve material) deposited in the cytoplasm (extra-nuclear protoplasm). The food-yolk in turn differs in amount according to the extent to which the young organism must grow before it can obtain nourishment for itself. Thus the human egg is only about 0·1 mm. in diameter, since at a very early period of its development it becomes attached to the wall of the womb and subsequently draws all its nourishment from that source. The egg of the ostrich on the contrary is one of the largest known, being about 15 cm. in diameter, since it has to provide all the food necessary to build up a good-sized chick.

Eggs which have a very small amount of yolk and in which this is evenly distributed throughout the cytoplasm are termed "alecithal"; such are the eggs of Hydrozoa, Echinodermata, Brachiopoda and of Amphioxus and Mammalia amongst Vertebrata. Eggs in which the yolk is concentrated at one pole of the egg are termed "telolecithal"; this pole is termed the "vegetative pole," whilst the opposite pole, where the bulk of the cytoplasm is concentrated and where the polar bodies (see below) are given off is termed the "animal pole." The eggs of most Annelida and Mollusca and of Pisces, Amphibia, Reptilia and Aves amongst Vertebrata are telolecithal. Eggs in which the yolk is massed in the central part of the egg and is surrounded by a layer of cytoplasm almost free from yolk are termed "centrolecithal." In this class are the eggs of nearly all Arthropoda.

Both types of germ-cell before attaining maturity undergo two ripening (*maturation*) divisions, so that in each case four daughter cells are produced. Whereas in the case of the male germ-cell all four daughters become fully formed "spermatozoa," in the case of the female germ-cell only one daughter is converted into the ripe egg; the remaining three are small vestigial cells destined to perish, which are termed "polar bodies." During the maturation divisions the number of chromosomes in the nuclei of both male and female germ-cells is reduced by one-half (*see* CYTOLOGY).

When the spermatozoön enters the egg, the head, which is a condensed nucleus, swells up and assumes the ordinary nuclear structure and is termed the "male pronucleus"; behind it is situated a very active centrosome which produces a series of radiating rays termed the "spermaster." The nucleus of the ripe egg is termed the "female pronucleus." The male pronucleus approaches the female pronucleus, and becomes closely apposed to it; the spermaster then fades out, the centrosome which gave rise to it becomes divided into two which become connected by a so-called "spindle." New asters are then formed from the daughter centrosome at the poles of the spindle; this spindle initiates the development of the egg by bringing about the first division of the combined male and female pronuclei and of the fertilised egg (zygote) itself. The tail of the spermatozoön is either left outside when the head penetrates the egg, or if it penetrates the cytoplasm it degenerates there; its remnants can sometimes be detected in one cell of the embryo, up till the stage of 32 cells has been attained, but it takes no part in cell-division and no portion of it is transmitted to any other cell, the conclusion being that it plays no part in the transmission of hereditary qualities.

The nucleus of the zygote, as we have just seen, has double the number of chromosomes which are present in the nucleus of the ripe egg but half of these are of male origin. Every nucleus of the developing embryo therefore inherits from the zygote nucleus an equal number of male and female chromosomes, so that the body of the embryo has with justice been likened to a piece of cloth of which the warp is paternal and the woof maternal.

Parthenogenesis.—In the earlier article it was pointed out that the unfertilised egg could be induced to develop by a variety of agencies varying from the addition of a small quantity of butyric acid to the sea-water in which it is placed, followed by exposure to the action of hypertonic (*i.e.*, over-salted) sea-water in the case of echinoderm eggs, to the prick of a pin in the case of the eggs of Amphibia. This is termed *artificial parthenogenesis*.

In the case of the eggs of sea-urchins parthenogenesis has been minutely studied by Loeb[2] who has put forward various theories as to action of the agents which he employed. He imagined that the action of the butyric acid was to start cytolysis, one result of which was the formation of a definite egg membrane, but which if unchecked destroyed the egg, which became resolved into a mass of globules. The exposure to hypertonic sea-water was supposed to arrest this injurious action. This explanation was obviously not applicable to the parthenogenesis of the frog's egg.

The whole subject has been attacked from a new point of view by Herlant[3] and Brachet[4] who have pointed out that the agent employed to provoke parthenogenesis does not exercise a specific chemical action on the egg but merely acts as a stimulus to which the egg as a living organism responds. Whether butyric acid or a needle be employed the response is the same; the egg "wakes up" so to speak, the nucleus emits something which acts as a centrosome and from this is developed a great series of radiating rays traversing the cytoplasm, a huge " monaster " in fact. The chromatin of the nucleus becomes resolved into chromosomes which are split longitudinally and which become adherent to the rays of the " monaster." In the case of the egg of the sea-urchin it is only extremely rarely that the monaster becomes changed into an ordinary mitotic spindle by the division of the centrosome. In most cases after persisting for about an hour the monaster disappears; the nucleus returns to the resting condition and then after a short interval it passes through the same phases, a monaster being again formed. After this process has been repeated about six times over a period lasting twelve hours the egg dies and cytolysis supervenes.

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[1] E. J. Allen, "An Autotomy and Regeneration in the syllid worm Procerastes," *Phil. Trans. Roy. Soc. Lond.*, Series B, vol. 211 (1921).

[2] J. Loeb. Numerous papers summarised in his book, *Die chemische Entwicklung des tierischen Eies* (1909).

[3] M. Herlant, "Le Mécanisme de la Parthénogenèse Expérimentale," *Bull. Scientifique de la France et de la Belgique*, 7th series, vol. 50 (1917).

[4] A. Brachet, "L'Oeuf et les facteurs de l'Ontogenèse," *Encyclopédie Scientifique* (1916).

If, however, after the egg has been exposed to the action of the butyric acid and then washed in sea-water, it is placed in hypertonic sea-water, and then after a limited period of immersion in this fluid replaced in ordinary sea-water, additional asters are formed in the cytoplasm. When the egg forms a monaster this becomes connected with these other asters by longitudinal fibres so as to form a complex spindle. By properly choosing the period of immersion in hypertonic water it is possible to arrange that only one additional aster should be formed; the centrosome of this aster then joins with that of the monaster to form a normal mitotic spindle on to which the egg chromosomes migrate; a regular division of the nucleus follows and thereafter a division of the whole egg into two cells, and so parthenogenetic development is initiated.

These two cells are generally very unequal in size, whereas in normal development the first division of the egg results in the production of two cells of exactly the same size. This inequality results from the fact that the aster induced by the action of the hypertonic water is small in comparison with the size of the monaster produced by the butyric acid. The size of the cell produced at the division of the egg is therefore determined by the size of the aster at one pole of the mitotic spindle. The aster is a framework of semi-rigid gelatinised protoplasm, which becomes continuous with the viscous protoplasm forming the outer layer of the cytoplasm of the cell.

The course of events in the frog's egg is fundamentally similar to the process which we have just described, although there are differences in detail. A prick with a sterilised needle induces the formation of a huge monaster, the centrosome of which then divides into two, between which a short mitotic spindle is formed on to which the chromosomes of the egg migrate. Since, however, the length of the spindle stands in relation to the number of chromosomes in the nucleus and as these chromosomes are only present in half the number found in the nucleus of the fertilised egg, the spindle which is formed is only four-fifths of the length of the first spindle formed in the fertilised egg. The length of spindle in turn determines the length of the astral rays from its poles, and if these are too short to reach the periphery of the egg the spindle is unable to bring about the division of the egg into two cells. This is the case with the spindle formed in the parthenogenetic egg, and although abortive and transitory furrows on the egg's surface are formed no division into cells results; the nucleus, it is true, divides and a multiplication of nuclei follows in which the numerous short spindles formed interfere with one another and make orderly development impossible, and so after a short time the egg dies.

If, however, the needle be " infected " by being dipped into frog's blood before being used to prick the egg, then the foreign substance thus introduced produces additional asters in the cytoplasm just as did the hypertonic water in the sea-urchin's egg. These asters have a tendency, as their rays develop, to repel one another, and they push the mitotic spindle developed around the egg nucleus over to one side. *If this side happens to be the side of the egg at which the cytoplasm is concentrated*, then the spindle is able to start the formation of a furrow which cuts right through the egg and divides it into two cells, and so parthenogenetic development is begun. We see then that the difficulty of initiating parthenogenesis depends on two factors, viz.: (1) the quiescent condition of the egg and (2) the small amount of chromatin present in the nucleus. If we choose the unripe eggs of the sea-urchin as the subjects of our experiment, then it is sometimes possible to induce them to develop by the use of one reagent alone, such as hypertonic sea-water; since in these eggs the " reducing " division of the nucleus has not occurred and the chromatin is consequently present in undiminished quantity.

Parthenogenetic development is closely related to the problem of heterogeneous fertilisation. It has been shown that under certain circumstances it is possible to fertilise the eggs of the sea-urchin with the sperm of creatures so diverse in zoological affinity as an annelid worm (*Chaetopterus*) and the sea-mussel (*Mytilus*). In the first case the male and female pronuclei fuse, but the male chromatin falls out of the zygote nucleus before the first division takes place. In the second case the male pronucleus refuses to enter into union with the female pronucleus at all, but the spermaster brings about the division of the egg. When the eggs of the sea-urchin (*Echinus*) are fertilised with the sperm of the heart-urchin (*Echinocardium*), in the vast majority of cases cytolysis results exactly as it does after the exposure of the echinus eggs to the action of butyric acid, but in some few cases the egg develops and produces a hybrid. We conclude that in most cases the sperm of *Echinocardium* is so alien to the cytoplasm of the egg of *Echinus* that it is not even able to bring about the formation of a spermaster.

Under certain circumstances (slight staleness of the egg, excess of sperm, etc.) more than one spermatozoön may enter the egg. In large eggs such as those of cephalopods, reptiles and birds, this seems to be a normal occurrence; only one of these nuclei unites with the female pronucleus and forms the zygote nucleus from which begins the cell-division which initiates development; but the other spermatozoa also form centres for cell-division, which gives rise to the so-called free cells which are characteristic of these eggs. These free cells are gradually crushed out and destroyed by the developing cells produced by the activity of the zygote nucleus.

Brachet, however, has shown[1] that when the frog's egg is entered by spermatozoa in moderate numbers, whereas only one fuses with the female pronucleus, the others form centres for the formation of cells which are built up into the body of the embryo. As these sperm-heads, however, contain only half the quantity of chromatin contained in the zygote nucleus, the cells to which they give rise are markedly smaller than those which contain nuclei descended from the zygote nucleus, and so it is possible to distinguish in the growing tadpole the regions which contain cells which have nuclei derived from the zygote nucleus from those which contain cells having nuclei derived from the supernumerary spermatozoa.

Brachet's observations prove in the clearest manner that the differentiation of organs in the frog's egg is due to the differentiation of regions in the cytoplasm and not to the differentiation of the nuclei produced by the division of the zygote nucleus as Weismann[2] had supposed, for some of these nuclei can be replaced by sperm-nuclei, each of which carries in it the potentiality of producing the whole organism—not a mere region of it—and yet no dislocation of development results.

The entry of two or more spermatozoa into small eggs such as those of the sea-urchin usually produces abnormal development followed by early death. The reason is that the centrosomes which are carried into the egg by these spermatozoa are so near each other that instead of leading to the formation of separate spindles they give rise to three- (triaster) or four-poled (tetraster) spindles along which the chromosomes are arranged in an irregular manner. This causes the formation of abnormal nuclei incapable of properly fulfilling their functions and the embryo dies.

Development of the Egg.—If we now turn to consider the normal development of the egg we find that this can be divided into three stages which in primitive forms are sharply delimited, but which in more modified forms tend to overlap one another. These stages are (1) segmentation, or the division of the egg into a number of indifferent cells or blastomeres; (2) the formation of the so-called germ-layers, *i.e.*, the differentiation of the blastomeres into the primitive organs, viz.: (*a*) the ectoderm (or epiblast) which is the primitive skin, (*b*) the endoderm (or hypoblast) which is the primitive lining of the gut, and (*c*) the mesoderm (or mesoblast) which is the primitive peritoneum or lining of the body-cavity; (3) organogeny, *i.e.*, the formation of the separate organs of the body, such as brain, liver, kidneys, etc., from the germ-layers.

Segmentation of the Egg.—Considering first the process of segmentation, we find, as Balfour[3] pointed out long ago, that the effect of the accumulation of yolk in the egg is to impede cell-division. It acts exactly as if it were a dilutant of the cytoplasm in lowering surface tension. Cell-division is accompanied by partial gelatinisation as is obvious from the way each daughter cell rounds itself off from its sister. This is particularly evident in the segmentation of alecithal eggs, for in them, in the early stages of segmentation, all the blastomeres divide simultaneously, and just after each period of division these take on the appearance of a pile of balls only touching each other in points; whereas during the interval between two such periods the gelatinisation diminishes and the blastomeres become flattened out against each other.

In all alecithal and telolecithal eggs there is a pole (see above) from which the polar bodies are given off which is termed the animal pole of the egg. This pole is the region of the egg which contains least yolk; here cell-division is most rapid and the smallest blastomeres are produced, whereas as we pass towards the vegetative pole of the egg, where the yolk is concentrated, the blastomeres become fewer and larger.

When the yolk is very much increased in amount, the nuclei produced by the division of the zygote nucleus are unable to produce

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[1] Brachet, *loc. cit.*

[2] A. Weismann, *The Germ-Plasm. A Theory of Heredity* (1900).

[3] F. M. Balfour, *Comparative Embryology*, vol. 1, p. 95 (1880).

an amount of gelatinisation sufficient to divide the cytoplasm, and so we get a multiplication of nuclei without the formation of blastomeres. When this happens segmentation is confined to the animal pole of the egg and results in the formation of a thin disk of blastomeres termed the "blastoderm," resting on an unsegmented "yolk." Such eggs (for instance the hen's egg) are termed "meroblastic" (gr. μέρος, a part) in contradistinction to eggs, like those of the frog, which are completely divided and are termed "holoblastic."

In centrolecithal eggs, like those of the cray-fish, the egg appears to be completely divided into cells, but although division may at first be complete, when gelatinisation diminishes the inner yolky ends of the blastomeres flow together so as to form a common inner yolky mass. Such eggs are said to exhibit *superficial segmentation.* Later, the outer protoplasmic ends of these incomplete blastomeres become completely cut off, so as to form a skin of cells of blastoderm surrounding a central "yolk." A still further modification of this type is found in the eggs of insects in which the yolk is so abundant as to prevent all segmentation. The zygote nucleus alone divides and gives rise to daughter nuclei each surrounded by an island of protoplasm; these are at first dispersed throughout the "yolk," but they gradually migrate to the surface and here form a blastoderm.

In primitive alecithal eggs segmentation results in the formation of a hollow ball of cells one layer thick. This ball is termed the "blastula" and its cavity the "blastocoele," "segmentation-cavity" or "primary body-cavity." The formation of the blastula marks the accomplishment of an important step in development. Although typically formed only in alecithal eggs, it appears in a modified form in telolecithal eggs, even in those in which there is so much yolk that they have meroblastic segmentation. Thus in the case of the frog the blastula is a hollow ball of which the roof is two cells thick and the floor is many cells thick, whilst in the case of the pigeon the blastula is represented by a stage in which the blastoderm is one layer thick and forms the roof of the slit-like segmentation cavity, whilst the immense mass of the unsegmented yolk forms the floor of this cavity. This floor, in its uppermost layer, contains a few nuclei which are representatives of the cells which should constitute the vegetative pole of the blastula but these nuclei are utterly unable to cut the yolk up into cells.

Formation of Germ Layers.—As soon as the blastula stage has been attained, the "formation of layers" begins. The cells at the vegetative pole become turned inwards, forming a tube-like structure which projects into the blastocoele and partially obliterates it. This tube is the primitive gut or "archenteron" and the cells forming it are termed "endoderm," whereas the cells forming the outer wall of the blastula give rise to the primitive skin and are termed "ectoderm." Recently, von Übisch[1] has introduced an ingenious method of staining certain blastomeres during life. By the aid of this method he has been enabled to determine definitely not only the fate of individual blastomeres in normal development but also their powers of development (prospective potencies) when separated from their fellows. When in the 8-cell stage of the sea-urchin's egg the four upper cells are isolated, they will produce a blastula, but this blastula will neither produce "mesenchyme" (that is, wandering cells which migrate into the blastocoele) nor an archenteron, but the lower four cells will give rise to a blastula which will produce mesenchyme and an archenteron and which eventually grows into a perfect larva of reduced size. In normal development these four lower cells are entirely used up in the formation of archenteron and mesenchyme; whence von Übisch concludes that prospective ectoderm is unchangeable but that prospective endoderm retains all the primitive potencies of the egg and can be changed into ectoderm.

When the archenteron has been formed, the developing egg has assumed the shape of a double-walled cup, the opening into which is termed the "blastopore." This stage is clearly and sharply marked in the development of almost all eggs in which the yolk is small in amount, and it can be recognised in an obscured and altered form in the development of large yolky eggs. It is of equal importance with the blastula stage, and it is termed the "gastrula."

The primary body-cavity has now become reduced to the slit intervening between the wall of the archenteron and the outer wall of the gastrula and this slit becomes largely filled up by the development of the third germ layer, the "mesoderm." We have defined this layer as the primitive peritoneum or lining of the body-cavity, but the body-cavity now indicated is termed the "coelom" or "secondary body-cavity" in order to distinguish it from the primary body-cavity. In the eggs of primitive animals, where the yolk is small in amount, the coelom is always formed as a series of pouch-like outgrowths of the archenteron which become cut off from this tube. It follows that the mesoderm is differentiated from the primary endoderm. Driesch[2] has shown that if the front half of the gastrula of the starfish which includes the apex of the archenteron be cut off, the hinder half will heal up and will form a perfect larva, forming, of course, the coelom in the normal way. If, however, this operation be performed after a swelling of the tip of the archenteron (the first rudiment of the coelom) has appeared, then, although the hinder half will heal up and form a larva, it never forms a coelom.

Driesch concludes from this experiment that at first all parts of the archenteric wall have the power of giving rise to a coelom, that is of forming mesoderm, but that later a definite portion of this wall becomes set aside as the rudiment of the coelom and that then the rest of it becomes the definitive endoderm devoid of this coelom-forming power. In Echinodermata the coelom arises as a single pouch from the apex of the archenteron; in primitive Vertebrata it originates as five pouches of which one is apical and four are paired and lateral; in Chaetognatha and Brachiopoda as a lateral pair of pouches. The remnant of the primary body-cavity becomes almost filled up with cells budded from the wall of the coelom which are termed "mesenchyme." The primary "mesenchyme" of the developing echinoderm, however, is formed from that portion of the blastular wall which will later be converted into the archenteron. After the archenteron has been formed the production of mesenchyme continues but is now confined to its apex, *i.e.*, that portion which will be converted into the coelom. These cells may become joined to one another by their processes and thus constitute a network which becomes converted into connective tissue by the secretion of fibres; or they may remain separate from one another, and then they become developed into blood and lymph cells, the remnants of the primary body-cavity constituting the blood-spaces. In the Coelenterata, in which no coelom is formed, similar cells are budded from both ectoderm and endoderm; in Annelida and Mollusca, in addition to the mesenchyme given off the coelomic wall, some is likewise budded from the ectoderm, and to this the name "mesectoderm" has been given. In Vertebrata the most recent research indicates that no mesenchyme is given off from the ectoderm.

Organogeny.—Turning now to the third stage of development, viz., the formation of special organs, we find that from the ectoderm are derived the central nervous system and the sense organs, and also the lining of the mouth-cavity and of the terminal portion of the alimentary canal near the anus. The endoderm gives rise to the middle portion of the gut and to the glands which are developed from it, and in Vertebrata to the primitive elastic axis of the backbone or "notochord." From the mesoderm arise the majority of the muscles, the connective tissue and, in Vertebrata and Echinodermata, the internal calcareous skeleton which is derived from the connective tissue. The mesoderm also gives rise to the genital organs and their ducts in all Metozoa above the rank of Coelenterata, and in Mollusca and Vertebrata to the kidney tubules.

Now we have pointed out that, in telolecithal eggs, segmentation proceeds most rapidly at the animal pole; here the second stage of development rapidly supervenes, and the archenteron is begun before segmentation is even initiated at the vegetative pole. In meroblastic eggs the upper pole of the egg may become converted into an embryo in which all the important organs of the adult are mapped out before the lower pole is even invested with cells. Finally in Amniota (reptiles, birds and mammals) the lower pole of the egg, after all the yolk has been absorbed from it, is torn from the rest of the embryo at birth and cast off as a useless embryonic membrane.

In the earlier article doubts were expressed whether the primitive germ layers corresponded to one another in different eggs; in a word, whether the same name had not been given to different things. The result of the labours of embryologists has been to establish the universal homology of the germ layers on an ever firmer basis.

If, for instance, we define the mesoderm as the wall of the coelom then it is found that this organ originates in one of two ways, viz., either as a pouch or a mass of cells. The pouch (recognisable in Chaetognatha, Brachiopoda, Echinodermata, Enteropneusta and the lowest Vertebrata) quite clearly originates as an outgrowth from the endoderm; the mass of cells can be traced back to its source in one large cell, the mother mesoderm-cell. This cell, as was first shown by Shearer[3] in the annelid *Hydroides* and by Conklin[4] in the mollusc *Crepidula*, originally forms part of the wall of the archenteron, and its ejection from this wall is evidently a modification of the more primitive method of coelom-formation by the outgrowth of a gut-pouch. Meissenheimer[5] and Harms[6] stated that in certain Mollusca the coelomic pouches originated from cells budded from the ectoderm. Later workers have shown that in these very Mollusca the mother mesoderm cell gives rise to the pericardium which is representative of the coelom in these animals. The so-called "mesectoderm" of Annelida and Mollusca gives rise to some superficial muscles, but to confound this with the coelomic wall and its derivatives by calling both mesoderm and then to complain that the mesoderm is not an homologous structure in various groups of animals is to introduce a perfectly gratuitous confusion.

The gut epithelium of certain Arthropoda has been alleged to arise from the ectoderm. If we examine the embryo of the most primitive land Arthropoda *Peripatus* we find a large slit-like blastopore which later became divided by a constriction into mouth and anus. It has been suggested that a portion of the gut epithelium, viz., that forming the midventral portion, is formed from ectoderm turned in round the edges of the slit. Now in the primitive annelid *Polygordius* Woltereck[1] has described a similar slit-like blastopore and he has followed the process of its closure in great detail, describing the division of every cell involved. In this case the midventral epithelium of the gut is formed by the union of *endoderm* cells lying at the sides of the blastopore—whilst the *ectoderm* cells lying in the blastoporal lips by their union reconstitute the midventral skin. Doubtless a renewed investigation with a more modern technique would show that this is also true of *Peripatus*.

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[1] Von Übisch, "Entwicklungsphysiologische Studien an Seeigelkeimen," *Zeit. für Wiss. Zoologie*, vol. 124 (1925).

[2] H. Driesch, "Zur Analysis der Potenzen embryonalen Organzellen, *Arch. f. Entwicklungsmechanik*, vol. 2 (1896).

[3] C. Shearer, "On the development and structure of the Trochopore of Hydroides," *Quar. Jour. Micr. Sci.*, vol. 13 (N.S.) (1911).

[4] E. G. Conklin, "The Embryology of Crepidula," *Journal of Morphology*, vol. 13 (1897).

[5] J. Meissenheimer, "Entwicklungsgeschichte von Dreissensia polymorpha," *Zeitschrift f. wissenschaftliche Zoologie*, vol. 69 (1901).

[6] W. Harms, "Postembryonale Entwicklungsgeschichte der Unioniden," *Zool. Jahrbücher* (Abt. für Ontogenie), vol. 28 (1909).

Embryological research is based on a comparison of embryos of different ages with one another—not, as would be the ideal method, on a continuous observation of the progress of one and the same embryo. It follows that too large an age-difference between the embryos examined may give rise to a totally wrong conception of the process which is taking place. So is to be explained the statement by Heymons[2] that the mid-gut of the higher insects is entirely formed from ectoderm and that by Watase[3] who attributed a similar origin to the mid-gut of the cephalopod *Loligo*. Hirschler[4] has shown how the first error originated, and the second has been corrected by Faussek[5]; and should further statements of this kind occur the strong presumption is that they also are founded on mistakes.

Organ-forming Substances.—We have arrived at the conclusion that the establishment of the validity of the germ-layer theory is one of the great achievements of embryological research, and we now turn to the question of how the differences which distinguish the layers from one another are brought about. We have learned that in primitive alecithal eggs like those of echinoderms the lower portion of the blastula wall has the capacity of giving rise to a complete larva and that this capacity only becomes restricted when the first traces of gut-formation are visible. We have also learned that all parts of the primitive gut or archenteron are alike in their coelom-forming powers, and that the separation of endoderm from mesoderm only becomes apparent when the first indication of the coelom appears. But this progressive differentiation of the embryo might be due to a differentiation of the nuclei of various regions or of the cytoplasm or of both. We have, however, learned from the development of the polyspermic frog's egg that there is a strong presumption that the nuclei of the embryo are alike in their nature and that the differentiation of the layers must be due to the separation of organ-forming cytoplasmic substances from one another. This conclusion is confirmed by a large number of observations on many different kinds of eggs; a few of the more striking follow.

Hertwig[6] allowed frogs' eggs to develop under pressure between glass plates and in capillary tubes. Under these circumstances the divisions took place by planes normal to the pressure and flat plates and rows of cells were produced. When the pressure was removed, however, these deformed embryos recovered, multiplication of cells took place and the normal form was regained and normal development proceeded. It was easy to show that nuclei which under undisturbed conditions would have occupied certain definite regions of the embryo had been forced into quite other regions, and yet perfectly normal embryos resulted. Hertwig concludes that the nuclei could be juggled about like a handful of balls without affecting the formation of the embryo.

In many eggs the differentiation of the layers is indicated at a far earlier period than that at which it occurs in the egg of the Echinodermata or even of the lower Vertebrata like the frog. The egg of the ascidian *Cynthia partita* which has been studied in great detail by Conklin[7] may be adduced as an example. This egg when it develops becomes converted into an elongated blastula consisting of few cells: this blastula changes into a gastrula in the typical way and, though no distinct coelomic pouches are formed, large portions of the archenteric wall are directly converted into muscles which lie at the sides of the tail of the tadpole-like larva. In this species the nucleus of the unripe egg is, as usual, a vesicle filled with fluid (the so-called germinal vesicle). The cytoplasm contains numerous yolk globules of a slaty-blue colour and also larger yellowish globules which are concentrated in its superficial layer. When the maturation divisions of the nucleus occur the nuclear wall is dissolved and the fluid contents escape and form a cap of clear material at the animal pole of the egg.

When fertilisation takes place profound rearrangements of the substances in the cytoplasm are effected. The yellow globules stream downwards to meet the spermatozoön which enters at the vegetative pole, and they finally form a crescentic layer of yellow material round the lower pole of the egg. As the egg develops first into a blastula and then into a gastrula, and finally into the characteristic ascidian tadpole, it becomes evident that the clear substance forms the ectoderm, that the slaty-blue material is contained in the endoderm, whilst the yellow material is confined to the masses of mesoderm which give rise to the tail muscles. When the egg is in the four-cell stage the yellow material is confined to the two posterior cells; if one of these be killed the remainder of the egg will give rise to a larva with muscles on one side only of the tail. That the nuclei have nothing to do with this separation of substances is shown by what occurs at the lip of the blastopore. Here we find an arc of what Conklin calls "neurochordal" cells. Each of these has of course a single nucleus, but the cytoplasm of each consists of two zones, one clear and one slaty-blue. At the next division two daughter cells are produced from each neurochordal cell; one of these contains the clear substance and is added to the nerve plate which is a part of the ectoderm; the other is composed of the blue substance and forms part of the notochord which in *Cynthia* as in other Vertebrata is a derivative of the endoderm.

From this development we conclude that the *germinal layers owe their origin to the segregation of cytoplasmic substances in the growing egg;* that these substances assume their final arrangement under the influence of the spermatozoön which thus, on its path to meet the female pronucleus, *determines the symmetry of the embryo.* But it would be a mistake to conclude that in these visible yellow and blue materials we have the actual organ-forming substances themselves. The nature of these substances in the egg of *Cynthia* has not yet been determined but similar substances occur in the eggs of many mollusca and more particularly in those of *Limnaea Planorbis* and *Physa*. In these eggs, too, as development proceeds these substances are distributed to definite regions of the egg. Conklin[8] has centrifuged the eggs of these snails and produced thereby a completely abnormal distribution of these substances and yet the development of the egg proceeded in a perfectly normal manner to the formation of a healthy young snail. Brambell[9] has shown that the greyish or bluish material is in all probability Golgi yolk and the yellow substance swollen mitochondria (*see* CYTOLOGY). Brachet[10] has shown that there are also organ-forming regions in the frog's egg. It was for long a puzzle why competent observers like Roux[11] and Hertwig[12] should differ so profoundly on the results of killing one of the first two blastomeres of the frog's egg. Roux asserted that the surviving blastomere gave rise to a half blastula which developed into a half tadpole, whilst Hertwig maintained that it tended to form a normal tadpole, being only impeded in its development by the mass of dead material constituted by the other blastomere. Brachet has shown that both are right, for the plane separating the first two blastomeres need not by any means coincide with the future median plane of the embryo, but may make any angle up to a right angle with it. If it coincides with this plane by killing one blastomere Roux's result is obtained; if it is oblique the result accords with Hertwig's researches.

Thus the potency of each of the first two blastomeres of the frog's egg depends entirely on the cytoplasm which it happens to include and in no way on the nucleus. Brachet[13] has shown that the fixing of the median plane of symmetry in the frog's tadpole, as in the ascidian tadpole, is effected by the spermatozoön. As the spermatozoön penetrates the egg in its path towards the female pronucleus, it leaves behind a trail of pigment which persists for a considerable time and can be detected at a much later period in the development of the egg. On the opposite surface of the egg to that at which the spermatozoön enters it, there is formed the so-called "grey crescent." This is in reality the upper lip of the blastopore; it is here that the differentiation of ectoderm from endoderm begins. Therefore we conclude that the arrangement of the organ-forming substances in the frog's egg is caused by the spermatozoön.

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[1] Woltereck, "Beitrag zur praktischen Analyse der Polygordiusentwicklung," *Archiv. f. Entwicklungsmechanik*, vol. 18 (1903).

[2] R. Heymons, "Über die Bildung der Keimblätter bei den Insecten," *Sitzungsb. der Preussischen Akad. der Wiss.*, vol. 1 (1894).

[3] Watase, "Observations on the Development of Cephalopods," *Studies from the Biol. Lab. Johns Hopkins Univ., Baltimore*, vol. 6 (1888).

[4] J. Hirschler, "Embryonalentwicklung von *Donacia crassipes*," *Zeitsch. f. wiss. Zool.*, vol. 92 (1909).

[5] V. Faussek, "Untersuchungen über die Entwicklung der Cephalopoden," *Mitteilungen a. d. Zool. Station zu Neapel*, vol. 14, p. 83 (1901).

[6] O. Hertwig, "Ueber den Werth der ersten Furchungszellen für die Organbildung des Embryos," *Archiv f. mikr. Anatomie*, vol. 42 (1893).

[7] E. G. Conklin, "The Orientation and Cell-lineage of the Ascidian Egg," *Jour. Acad. Sciences, Philadelphia*, series 2, vol. 13 (1905).

[8] E. G. Conklin, "The effects of centrifugal force on the organisation and development of the eggs of fresh-water Pulmonates," *Jour. Exp. Zool.*, vol. 9 (1910).

[9] F. W. R. Brambell, "The Nature and Origin of Yolk," *British Jour. Exp. Biol.*, vol. 1 (1924).

[10] Brachet, *loc. cit.*

[11] W. Roux, "Über das entwicklungsmechanische Vermögen jeder der beiden ersten Furchungszellen des Eies," 6th. *Verhandl. der anat. Gesellschaft* (1892).

[12] O. Hertwig, "Über den Werth der ersten Furchungszellen für Organbildung des Embryos," *Arch. f. mikr. Anatomie*, vol. 42 (1893).

[13] Brachet, *loc. cit.*

In the mollusc Dentalium when the egg has reached the four-cell stage one of the blastomeres emits a protuberance termed the "yolk-lobe" or "polar lobe." This lobe is devoid of a nucleus and before the attainment of the eight-cell stage is reabsorbed into the blastomere. Nevertheless, if this lobe be cut off, the remainder of the egg develops into a larva which is fatally devoid of mesoderm.

That the materials which form the basis of the different substances embodied in the germinal layers are formed in the growing egg under the influence of emissions from the nucleus is rendered certain, first by the close relationship of the nucleus to assimilation and secondly by the fact (*see* CYTOLOGY) that the nucleolus of the unripe egg breaks up into fragments and is extruded into the cytoplasm. It is, however, a surprising fact that the nuclei of the segmenting egg are alike and apparently without influence on the differentiation of the primary organs. In fertilisation a second nucleus of alien origin is introduced and portions of this nucleus, as we have already seen, are incorporated in all these "segmentation" nuclei. Now it is common knowledge that the influence of the father is as potent as that of the mother in heredity and therefore there must arrive a period of development at which the nuclei again influence the cytoplasm.

An attempt to determine this period was made by MacBride[1] by fertilising the eggs of *Echinocardium* with the sperm of *Echinus*. The result of this cross is in most cases to produce cytolysis of the egg, but in a minority of cases a hybrid develops.

The egg of *Echinocardium* is oval whereas that of *Echinus* is spherical and the shape of the blastula of each species follows that of the egg. The blastula of the hybrid is oval, like the maternal blastula, and the gastrula is also like that of *Echinocardium*. But the typical larva (the four-armed echinopluteus) resembles in several points the larva of *Echinus*; in the vast majority of cases it is totally devoid of a large aboral club supported by a special skeleton which is characteristic of the larva of *Echinocardium*. It is clear therefore that at this stage the paternal nucleus is influencing the structure of the organism. When the eggs of *Echinus* are fertilised with sperm of a still more divergent character, such as that of the crinoid *Antedon*, a hybrid occasionally develops as far as the gastrula stage, but it always resembles the larva developed from the normally fertilised egg in every detail and shows no trace of paternal influence.

Nuclei and Cytoplasm.—We are thus led to the conception of an intermittent action of the nuclei on the cytoplasm, and in this it seems as if we had reached the deepest point to which analysis of development has so far led us. Perhaps it would be more accurate to speak of an intermittent reaction between cytoplasm and nucleus, for in some embryos there is evidence that the nuclei undergo alteration as development proceeds. It is on cases like these that Weismann's theory of development was founded.[2] According to this theory, as growth proceeds, differential division of the nuclei takes place, some becoming specialised as ectodermal nuclei, others as endodermal nuclei, and so on, whilst some retain the constitution of the original zygote nucleus. These last give rise by division to others like themselves which eventually engender the nuclei of the germ cells. The lineage or line of descent leading from these germ-cell nuclei back to their ancestors amongst the nuclei of the first blastomeres is termed the "germ-track." Now in the Nematode worm *Ascaris megalocephala* the zygote nucleus contains only four chromosomes, but as the egg divides into blastomeres the nucleus of one blastomere after another undergoes the change termed *diminution of the chromatin*. This change involves the nipping-off of the ends of the chromosomes, and these portions are ejected into the cytoplasm and are absorbed; the remainder of each chromosome becomes fragmented into a large number of minute granules. These granules act as chromosomes in the next nuclear division. The nucleus of one blastomere remains exempt from this change and this blastomere eventually gives rise to the genital organs.

Boveri[3] has shown that the fact that one nucleus undergoes diminution of the chromatin whilst another does not is not the consequence of a differential division of the mother nucleus of them both, but is due to the fact that one nucleus takes up its position in a region occupied by a particular cytoplasmic substance. This he proves in two ways, viz.: (1) by considering the case of eggs fertilised by two spermatozoa, and (2) by the results obtained by subjecting eggs about to segment to the action of strong centrifugal force.

In doubly fertilised eggs the extra spermatozoön forms an independent nucleus whilst the other fuses with the female pronucleus to form the zygote nucleus. The first division of the egg results in the formation of four nuclei and four blastomeres. In the development of the normally fertilised egg one of the two first nuclei undergoes diminution, and the cell containing it gives rise to a large part of the dorsal ectoderm; the other nucleus remains undiminished and amongst the progeny of the cell containing it are found the genital cells. Now amongst the four cells produced by the division of the doubly fertilised egg, three may contain nuclei which undergo diminution, and one may remain undiminished and in such cases the egg develops into a single embryo with an unusually abundant ectoderm. In other cases only two of the nuclei undergo diminution; such eggs form twin embryos of normal aspect; whereas in still other cases one nucleus alone may undergo diminution and in these cases a monstrous triple embryo is formed. These differences are accounted for on the assumption that one region of the egg contains a substance which induces diminution and one, two or three nuclei of the doubly fertilised egg may be in it.

When eggs about to segment are exposed to the action of long-continued and intense centrifugal force the plane separating the first two blastomeres will in some cases be found to lie along a radius of the circle of rotation, and in these cases a small mass of material will be found to be ejected from the egg which then becomes divided into two appreciably equal and similar blastomeres, the nucleus of neither of which undergoes reduction. This suppression of reduction must be attributed to the even distribution of the cytoplasmic materials under the stress of the centrifugal force, so that no region of the egg contains more of the peculiar substance than any other. Diminution of the chromatin apparently results from the action of an excess of this substance on any nucleus contained in it.

Regeneration.—In the phenomena of regeneration and of budding we meet with evidence of the renewed influence of the nuclei in causing the formation of cytoplasmic substances.

When one of the first two blastomeres into which a frog's egg divides is killed the survivor frequently develops into a half gastrula which may even grow into a half tadpole. Roux[4], however, has shown that if this half tadpole survives it becomes a whole tadpole by what he calls the "post-generation" of the missing half. This is effected by the multiplication of the cells lying at the edges of the half embryo. The nuclei increase in number and confer on the cytoplasm in their neighbourhood new powers. In this case it might be objected that each kind of tissue in the old half gives origin only to the same kind of tissue in the new half. But Morgan[5] has shown that if the head (including the pharynx) of the annelid *Nereis* be cut off, a new head with pharynx will be regenerated from the stump; whereas, however, the original pharynx was formed by an intucking of ectoderm, the new pharynx is formed by an outgrowth from the endodermal tube in the stump. The new powers thus conferred on the cytoplasm of the endodermal gut can only be explained as the result of the calling-forth of new potentialities in the nuclei lying in the cut edge. More remarkable evidence still has cropped up in connection with the regeneration of the lens of the eye of the newt. In the embryo the lens is formed as a thickening of the ectoderm on the side of the head. But if the original lens be torn out, a new lens is developed from the edge of the retinal portion of the iris—a tissue which has no connection with the skin of the head. Some try to meet this difficulty by the phrase that in these cases the organism acts as a whole, independently of the germ layers into which we analyse it. But what meaning can be attached to this phrase, except that the organism under different circumstances uses different means in order to effect a restoration of its integrity, it would be difficult to say. In fact we approach very closely to the celebrated "entelechy" of Driesch[6]; that is an indwelling "something" in an organism which strives to realise a purpose.

Vitalism and the Theory of an Entelechy.—It may be argued that such an idea is unscientific, because it introduces "vital force" and similar mystic ideas amongst our biological conceptions. It may be answered that in the last resort *all explanation is comparison*, and that those who reject vitalism seek to compare all the activities of living beings to phenomena which go on outside the body in test-tubes. But this is equivalent to referring all the phenomena of life to structure, in other words to the juxtaposition of definite chemical substances in a definite spatial arrangement; in regeneration, however, we encounter phenomena where structure appears to be irrelevant. If we are to do justice to such phenomena we must have some working hypothesis similar to that of Driesch. Whether the assumption of an "entelechy" is better or worse than the statement that all the nuclei in the body are totipotent and that varying potentialities are called forth in different cases seems to be a matter of taste.

Budding.—Regeneration is in many respects akin to budding, since buds in many cases may be regarded as portions of the mother organism restored after natural amputations.

In the growth of buds we often meet with a wide divergence between the materials used to build up certain organs and those used to construct similar organs in the embryo. To give an example—the bud of the ascidian *Botryllus* begins its existence as a little two-layered vesicle very similar to the gastrula of the same species. But in the embryo the central nervous system is developed from the outer layer as it is in all other Vertebrata. In the bud, on the contrary, it is formed as an outgrowth from the inner layer. Hjört,[1] who described this phenomenon, suggested as the explanation for it the fact that the outer layer of the bud is an outgrowth of the adult maternal ectoderm, which is specialised for the secretion of the cellulose "mantle" and not sufficiently plastic to be turned into nervous tissue. This is only another way of saying that the formative nuclei act differently in different cases and distribute the organ-forming cytoplasmic substances in a different manner in the bud from their arrangement in the egg.

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[1] E. W. MacBride, "Studies on the Development of Echinoidea: (II.) The early larva of *Echinocardium cordatum* and the result of crossing this species with *Echinus esculentus*," *Quar. Jour. Micr. Science*, vol. 58 (1912).

[2] A. Weismann, *The Germ-Plasm. A Theory of Heredity* (1900).

[3] Th. Boveri, "Die Potenzen der Ascaris-Blastomeren bei abgeänderter Furchung," *Festschrift zum 60sten Geburtstag Richard Hertwigs*, vol. 3, No. 8 (1910).

[4] Roux, *loc. cit.*

[5] T. H. Morgan, *Regeneration* (1901).

[6] H. Driesch, *Zwei Vorträge zur Naturphilosophie* (1910); see also Gifford lectures for 1907 and 1908.

One or Two Embryos.—The primary organs, *i.e.*, the germ layers, are the material out of which the higher organs are built up, and one of the most remarkable of recent discoveries in embryology is the fact that the question of whether this material shall be used to build up one embryo or two depends on the special relations which these primary cytoplasmic substances sustain to one another.

If the eggs of a frog be placed dry on the surface of a slide with their animal poles uppermost and fertilised in that position by the addition of small quantities of the fluid extracted from the seminal vesicles of a male; if then another slide be placed on top of them and the two slides clamped together by rubber bands; if when the eggs have divided into two blastomeres the whole preparation be inverted and left in water in a shallow dish for five or six days tadpoles with two heads or two tails will be developed. The materials in the unsegmented egg are of different specific gravities; the first furrow often (*see* above) divides them into two symmetrical halves; when the two-cell stage is inverted they tend to re-arrange themselves in *each cell* in the same manner as they would have done in the whole egg had it been inverted. Nothing has been added or taken away, yet the altered position of the materials in each cell has led to the formation of two organs where normally only one would have been formed. In the case of the newt's egg a similar procedure leads to the formation of two complete embryos, whilst if the blastula of the newt be constricted longitudinally by a hair a two-headed monster is formed. When a lizard's tail is broken off, if the little regenerating bud which forms at the wounded surface be indented the animal will regenerate two tails instead of one.

Internal Environment.—When the higher organs begin to develop we can in many cases prove that the whole course of their growth is governed by what may be called their internal environment, *i.e.*, by influence emitted by other organs.

This may be clearly seen in the development of the common sea-urchin *Echinus miliaris*. The "echinopluteus" larva of this species is a transparent bilaterally symmetrical free-swimming creature. It is provided with a complete alimentary canal consisting of oesophagus, stomach and rectum, and at the sides of the oesophagus are situated two flattened coelomic sacs. As development proceeds each sac becomes divided into anterior and posterior portions, and the latter move backwards so as to be pressed against the stomach. Still later from the posterior end of the left anterior sac a little bud termed the "hydrocoele" grows out. This is the rudiment of the water-vascular system of tubes in the adult. The ectoderm lying over this bud becomes depressed so as to form a sac (the "amniotic cavity") from the floor of which grow up the spines which will cover the test of the future sea-urchin.

The hydrocoele bud overlaps the front end of the left posterior sac, and from this part of the posterior sac there grow out five pockets from which will be developed the dental apparatus—the so-called "Aristotle's lantern." From the outer wall of the right posterior coelomic sac cells are given off from which are developed a pair of "pedicellariae" (pincer-organs) which will be situated on the upper surface of the future urchin. If we now allow[2] the young larvae at the time the coelom is being formed to grow in hypertonic water, then many of them will develop from the *right* anterior coelom a second hydrocoele bud. If this bud develops—and it does so if plentiful nourishment be supplied to the larva—then a right amniotic cavity is formed from the overlying ectoderm, whilst the right posterior coelom gives rise to a second Aristotle's lantern. If the development of the second hydrocoele bud be slow, then one or even two pedicellariae may be formed on the right side as in normal larvae, but if it be rapid the formation of pedicellariae may be inhibited altogether. If after the bud has appeared the larva is nearly starved for a time, both this abnormal bud and the normal hydrocoele may remain small and undeveloped and then pedicellariae may be formed on the left side as well as on the right.

We conclude from these facts that the hydrocoele bud tends to inhibit the formation of pedicellariae on its own side of the larva but to cause their production on the opposite side, and we see further that the right hydrocoele bud can totally alter the development of the right side of the larva, forcing the right ectoderm to form an amniotic cavity and the right posterior coelom a dental apparatus.

Another still more striking case of the influence of the internal environment is afforded by the results of experiments performed on the tadpole of the frog.[3] The vertebrate eye consists of two main parts, viz.: (*a*) the retina, formed as an outgrowth from the brain; and (*b*) the lens, formed as a thickening of the ectoderm of the side of the head. If before the lens is formed the skin of the head of a tadpole be slit open and the retina cut off from the brain and pushed back till it occupies a position in the region of the shoulder or even farther back, the slit in the skin will soon heal up and then the tadpole will recover; the cut-off retina will continue to live and grow in its new position, and it will force the ectoderm covering it to form a lens—although never in the history of the race has a lens been normally formed in this position. Numerous other similar instances could be adduced suggesting the conclusion that in many embryos *the primary organs are indifferent material and that the manner in which the secondary organs will develop out of them is fundamentally a matter of their spatial relations.* We shall, however, confine ourselves to citing one more case of this phenomenon, the most striking that has yet been discovered.

We have already mentioned the fact that the differentiation of organs in the frog's egg begins in the upper lip of the blastopore. This is also true of the eggs of newts and apparently of all other Amphibia. Spemann[4] removed a small piece of this upper lip from the gastrula of the newt *Triton taeniatus* which is deeply pigmented and implanted it in the midst of the lateral wall of the gastrula of the newt *Triton cristatus* which is devoid of pigment. The small dark piece of foreign tissue effected a complete union with its alien surroundings and as development proceeded a nerve cord was developed in front of it from the tissues of the host, entirely independent of and supplementary to the proper nerve cord of the host which developed in the usual way from the dorsal legs of the blastopore.

Here we have the clearest demonstration of the fact that all the potentialities of the development of the entire embryo slumber in each cell and can be awakened if the appropriate stimulus reaches them, a stimulus which in this case is produced by the tissue of another species.

External Environment.—We now approach the subject of the possible influence of the external environment on the course of development. In the earlier article attention was drawn to the fact that development presents itself under two principal aspects, viz., the embryonic and the larval. In the embryonic phase the young organism is sheltered from the external world, either within an egg-shell or in the mother's womb, whereas in the larval phase it leads a free life, using its larval organs to seek its own food and escape its enemies.

It was further pointed out that if we compare two nearly allied animals such as *Salamandra atra* and *Salamandra maculosa*, in the first of which development is mainly embryonic, whereas in the second it is largely larval, we arrive at the conclusion that the embryonic phase is secondarily derived from the larval phase, since the organs such as gills which are functionless in the embryo are functional in the larva. It was also pointed out that larval organs frequently resemble the adult organs of other animals of simpler and more primitive structure.

On these facts was founded the celebrated biogenetic law first enunciated by Haeckel[5] which affirms that "the embryo in its development recapitulates the ancestral history of the race." It is this law which provides a large part of the fascination of embryological research, though it was vigorously attacked in the earlier article when an effort was then made to show that it is not valid, since it was maintained that whilst it is true that larvae retain ancestral characters, the same is true of adults, and that larvae in their structure are not more reminiscent of the former history of the race than are adults.

Now the outcome of recent investigation has in large measure tended to reinstate the doctrine of recapitulation in its former position of pre-eminence, to show in fact that recapitulation forms the central thread in every life history, although it has been blurred and deflected by secondary influences, as indeed all believers in the biogenetic law have from the first admitted.

The first point to which we wish to direct the reader's attention is that larval and embryonic phases occur in all life histories. Every animal begins its existence as an egg which is quite incapable of feeding or of defending itself and this egg is always protected by an egg-shell although this shell may be very thin, and no animal upon leaving its early shelter and beginning to seek its own food attains at once the structure of the sexually ripe adult. Hence every animal in the course of its development may be said to pass first through an embryonic and then through a larval phase, although the latter phase may be very short and the difference in structure between the larva and the adult inconsiderable. Now, the larval phase being the later is the most recent addition to the life history, and therefore the least likely to be modified by secondary factors; if therefore the biogenetic law is valid, it is the larval phase which will possess most ancestral significance. But in the earlier article attention is called to the fact that the identification of a larva as the representative of an ancestor must always be hypothetical because we have no direct knowledge of what the ancestor of any living animal was like. It behoves us therefore to look a little more closely at the reasons which actually do induce us to regard a given stage as ancestral.

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[1] J. Hjört, "Germ-layer Studies Based on the Development of Ascidians," *Zool. Results Norwegian N. Atlantic Exped.* (1890).

[2] E. W. MacBride, "The Artificial Production of Echinoderm Larvae with Two Water Vascular Systems," *Proc. Roy. Soc. (London)*, series B, vol. 90 (1918).

[3] W. H. Lewis, "Studies on the Development of the Eye in Amphibia. 1. The Lens," *American Jour. Anat.*, vol. 3 (1904).

[4] H. Spemann, "Die Erzeugung tierischer Chimaeren durch heteroplastische embryonale Transplantation zwischen *Triton cristatus* und *taeniatus*," *Arch. f. Entwicklungsmech.* vol. 48 (1921).

[5] E. Haeckel, *Generelle Morphologie* (1866).

First, we may call attention to the fact that quite recently direct experimental proof of the validity of the biogenetic law has been obtained. Kämmerer[1] placed young specimens of *Salamandra maculosa* which had just completed their metamorphosis in cages the floors and walls of which were coloured differently in different cases. The larva of this species has a skin of a uniform dark-greyish tint but the skin of the adult is gaily coloured with bright yellow patches on a black background. The salamanders which were confined in cages having a floor of moist yellow loam and walls coloured yellow became yellower as they grew to maturity—a process which occupies between four and five years. The yellow patches increased in number and size and tended to become joined together in bands. Those confined in cages with blackened walls and a floor of black garden earth became darker since the yellow patches dwindled in size.

When the salamanders had attained sexual maturity and were allowed to pair, it was found that the offspring of two which had been reared in yellow surroundings, if they continued to live in the same environment, became still yellower than their parents until the black pigment had been almost entirely displaced; whilst the offspring of two which had become darker, if reared in cages with black walls and floor, became practically completely black by the time they reached maturity so that they came to resemble the mountain species *Salamandra atra*. If, however, the offspring of two salamanders reared in yellow surroundings were allowed to grow up under black surroundings, they nevertheless *for the first six months of their lives became progressively yellower;* then and only then did the influence of the black environment begin to tell—the yellow patches became invaded by numerous small black spots and grew smaller. In short, the young recapitulated the process of "yellowing" that their parents had undergone.

If these results are confirmed the doctrine of recapitulation will change its status from that of an hypothesis to that of a proved fact; and further proof will be furnished that changes acquired by the individual in response to the demands of the environment are to a certain extent at least inherited.

The Recapitulation Theory.—Once we have grasped the mutual relationship of the embryonic and larval phases of development, indirect proofs of the reality of recapitulation begin to crowd in on us. If we find, for instance, one or two aberrant forms in an order or even a family the majority of whose members have a uniform type of structure, no reasonable doubt can exist that the ancestors of these aberrant forms had the typical structure of the group. If this conclusion be admitted and we find that the younger stages of the aberrant species also show the typical structure, does any one seriously question that these young forms recapitulate the history of the race? Two very striking instances of this kind have come to light within the group Ctenophora.

The typical Ctenophora are ovoid organisms of a glassy transparence which swim in a vertical position in the sea. Their locomotor organs are eight vertical rows of vibratile combs, each comb consisting of a short horizontal row of powerful cilia fused together at their bases. A certain creeping organism resembling a flat worm, named *Coeloplana*, had been believed by some zoölogists to exhibit ctenophore affinities but its relationships were very obscure. Quite recently a Japanese zoölogist[2] has described its development. Its larva is a small typical ctenophore with eight rows of perfectly formed combs; these it discards after swimming for a few hours—it sinks to the bottom and flattens out and gradually assumes the adult structure. Another extraordinary organism, named by its discoverer Tjalfjella,[3] was discovered amongst dredgings collected in the Arctic Ocean. This creature superficially resembled a sponge or an ascidian. It was gelatinous and sessile and seemed to consist of a pair of upright tubes like towers whence proceeded smaller tubes which ramified in its substance. In pockets connected with these smaller tubes were discovered groups of the larvae. These were small ovoid creatures of typical ctenophore structure with the eight vertical rows of combs.

Change of Habits.—If recapitulation of ancestral history forms an unquestionable element in the life history of some animals, it is probable that it constitutes a factor in all life histories. What is, then, its meaning? The recapitulatory element is most obvious in the latest larval stage of development, the most recently added page of the life history. Now the organs of the larva are adapted to its environment; therefore this environment in its broad outlines at least must represent the ancestral environment of the race.

The present condition of the race both as regards structure and habits has been produced as a consequence of migration from the original haunts of the race. Change of habits therefore reveals itself as the great driving-force in evolution, and change in habits usually means the choice of a different type of food.

We may conclude that the period of life at which this change most frequently occurred was when the adult organs had developed but before sexual maturity had been attained—in a word, at the stage of what we may call the young adult. As one change of habits succeeds to another in the course of evolution, the life history is not lengthened in the same proportion, since the new phase takes the place of the sexual phase in the previous condition of the race. In some Crustacea, *e.g.*, in the shrimp *Penaeus*, at least four larval stages are passed through before the adult stage is attained, but in the majority of life histories when a new phase is added there is a tendency for some of the older phases to be pushed back into the embryonic period, so that as an animal passes from stage to stage in evolution it leaves behind a trail of stages at first larval and then becoming embryonic.

Secondary Modifying Factors.—The principal factors which modify and tend to obscure the recapitulatory factor can only be defined by a truly comparative embryology based on a wide survey.

One of these factors is "tachygenesis" or precocious development; that is to say, we find that organs originally developed as a response to the stimulus of a new environment come in course of time to be developed before the habits to which they correspond can be exercised—in fact *acquired habits tend to become innate.* Thus the young hermit crab when adult thrusts its abdomen into the cavity of a spirally coiled gastropod shell, and in this way imposes a twisted form on this part of its body. But if all such shells be removed from the hermit crab's neighbourhood at the time of its metamorphosis, it will still develop a curved abdomen, although the extent of the curvature will be less than that which occurs normally. When the tadpole of the frog acquires limbs, these do not develop in the form of fins, from which they have been undoubtedly evolved, but grow directly into the ordinary type of five-toed limbs, although weeks must elapse after their form is fully defined before they can function as the limbs of land animals. The tendency to hurry on development may be compared to the increasing facility with which a difficult operation is performed after long practice, but this tendency obviously obscures the distinctive features of early development.

A second powerful modifying factor is the change from the larval to the embryonic phase, so far as the development of a particular organ is concerned. This change of phase is sometimes caused by an unfavourable alteration in the environment of the larva. It was actually effected artificially in the development of *Salamandra maculosa* by Kämmerer.[4] This species is viviparous and normally gives birth to between 30 and 40 young which are provided with gill-slits and long gills and which live in the water for six weeks before they metamorphose into land animals. If the parents are exposed to successively colder and drier conditions, the number of young produced at a birth diminishes with each breeding period, and these young are born at a progressively more advanced stage of development. If these young are reared to maturity under similar conditions of coolness and dryness, they will in turn give birth to young which will be still fewer in number than those produced by their parents and which are born at a still more advanced stage of development. The process goes on till only three or four are born at one time and these are provided with the merest stumps of gills; such young never enter the water at all but at once take up the adult mode of life. This is the normal mode of development of *Salamandra atra.*

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[1] P. Kämmerer, "Vererbung erzwungener Farbveränderungen. IV. Das Farbkleid des Feuersalamanders (Salamandra maculosa) in seiner Abhängigkeit von der Umwelt," *Arch. f. Entwicklungsmech.*, vol. 36 (1913).

[2] Taku Komai, "Notes on *Coeloplana bocki* and its development," *Annotationes Zoologicales Japonenses*, vol. 9 (1920).

[3] Mortensen, "Ctenophora," *Danish Ingolf Expedition*, vol. 5, No. 2 (1912).

[4] P. Kämmerer, "Vererbung erzwungener Fortpflanzungsanpassungen. I. & II. Die Nachkommen der spätgeborenen *Salamandra maculosa* und der frühgeborenen *S. atra*," *Arch. f. Entwicklungsmech.*, vol. 25 (1908).

The change of phase from the larval to the embryonic type entails many other changes. The embryo must be fed and it obtains its food from one of three sources, (*a*) devouring its sisters; (*b*) secretions from the mother's womb; (*c*) inclusions of yolk in its own ectoplasm. When the embryo devours its own sisters, this, as in the case of *Salamandra atra,* may entail little change of structure because in this case the habit has been recently acquired; but where, as in the case of the platyhelminth worms, the habit is of old standing, then the embryo may be distorted out of all recognition. In these worms one viable egg is shut up in a capsule along with thousands of small sterile ones; and it is difficult to find in the embryo any vestige of resemblance to the larvae of those Platyhelminthes which lay their eggs singly.

When the embryo derives its nourishment from the mother's womb, then it frequently develops organs of adhesion to the wall of this. To this category belongs the placenta which profoundly distorts the ventral surface of the human embryo, so that this surface gives rise to a treelike outgrowth whilst the dorsal surface is moulded into a ludicrously exact copy of the early tadpole of the amphibian. When the embryo is fed by yolk, this, as we have already pointed out, modifies all the processes of development; cell division becomes slow and the cells produced few and large, and folding, which plays a large part in the development of small alecithal eggs, becomes impossible and is replaced by solid outgrowths of cells.

Still a third factor which tends to hide the recapitulatory element is the development of special larval adaptations. This occurs when the larva retains its free life but when its circumstances become changed, these special adaptations have been developed in thousands of insect larvae. So generally is this the case that Balfour[1] denied to these larvae any ancestral significance at all; but modern research has succeeded in revealing the original ancestral larval type beneath the secondary modifications.

All the evidence at our disposal points to the conclusion that the ancestors of insects were creeping myriapod forms—scavengers which fed on the débris of both animal and vegetable nature in the undergrowth of primeval forests. Such is in fact the life of the lowest insects known to-day, some of which, such as *Machilis,* nourish themselves on the decaying seaweed on the seashore, and retain throughout life vestigial limbs attached to the abdominal segments which aid them in their crawling movements. Now the myriapod or polypod larva survives as the caterpillar of the Lepidoptera and the primitive Hymenoptera. It is also found amongst the primitive Neuroptera and amongst the may-flies (Ephemeroptera). These last-named insects were supposed to possess a larva showing great secondary modifications, for it is provided with leaf-like gills attached to its abdominal segments; but Heymons[2] has shown that these gills are nothing but modified abdominal legs. It is a curious fact, however, that amongst the lower insects, such as the cockroach, this polypod stage is usually passed through during the embryonic phase of development. The reason for this change seems to be that these insects lay their eggs in situations where a grub-like larva would perish, whereas the higher insects, in which the stage is larval, are gifted with instincts which lead them to lay their eggs in situations where an abundance of easily procured and easily masticated food is available and a scavenging existence like that of the ancestor is possible.

A fourth factor which modifies development, and which is potent in its effect although it is usually overlooked, is *loss of size in the larva as compared with the ancestor which it represents.* As conditions change and the larval life becomes more dangerous there arises a tendency in which we may trace the influence of tachygenesis to pass quickly through the larval stage and to metamorphose at as early a period of growth as possible into the adult condition. Thus in the American lobster the adult stage is attained when the animal is 1½ in. long but this lobster eventually attains a length of from 18 in. to two feet. A consequence of this change is that the larva assumes a new relation to its environment, for many qualities of the surrounding medium, such as the viscosity and the supporting-power of water, acquire an altered importance as the organism decreases in size. If the ancestral organs were reduced in the same scale as is the whole body of the larva, this would often result in their becoming incapable of being used. As a consequence we find that in many cases where the ancestor had a series of organs, this series is represented in the larva by fewer members or only one member of larger relative size, and that where in the ancestor there was a pair of organs there is frequently only one in the larva, but this is on a larger scale than the rest of the body.

If we now select a few examples to illustrate this principle, we may consider the free-swimming larva of that most primitive of all vertebrates *Amphioxus.* This larva has only a single series of gill-slits which are so enlarged as to occupy the whole ventral surface of the body. If the double series of slits, which the ancestor in common with all other fish possessed, had been developed in the larva, they would necessarily have been of such minute size that the capillarity of the water would have prevented them from being functional. Similarly there is no doubt that the eyes of vertebrates were from the beginning paired structures, but they are represented in the ascidian tadpole by a cup-like outgrowth of one side of the brain. Again no serious doubt can be entertained that the primitive arthropod was evolved from a long many-segmented annelid with flexible parapodia. But the most primitive larval form of the Crustacea is the Nauplius which in most cases is a little, oval, unsegmented creature with but three pairs of legs. In some of the most primitive Crustacea, however, such as *Estheria* and *Chirocephalus,* the Nauplius possesses when hatched a comparatively long "abdomen" which though devoid of appendages is divided into a series of narrow ring-like segments. The ordinary type of Nauplius larva seemed to indicate that the Crustacea must have been derived from an unsegmented animal totally distinct from the ancestor of other Arthropoda, for the progenitor of these must have been long and segmented, since the embryos of all these Arthropoda have many segments.

But if we look at the Nauplius larva from the standpoint of function rather than of structure we have no difficulty in seeing in it the recapitulation of the first step in the "arthropodisation" of the annelid. This step was a change of habits which consisted in using the foremost parapodia as oars to propel the animal and as organs to seize food. As a consequence in the front of the body the cuticle was thickened and the "arthropodous" type of limb produced, whilst in the rest of the body the annelid condition of affairs persisted as indeed it may be almost said to do in the posterior portions of the bodies of this most primitive Crustacea, the long-bodied Phyllopoda such as *Artemia.* Once begun in front, this "arthropodous" modification was gradually propagated backwards so as to involve the hinder segments of the body and in this way the higher Crustacea were evolved. In the Nauplius larva, the anterior arthropodised portion of the ancestor with its appendages is alone represented; the hinder annelid portion in which function was less intense and less important is feebly or not at all developed.

One last instance of the principle may be adduced which we select from the embryology of the higher vertebrates. In the development of those types of Vertebrata in the life history of which there is a long larval phase (Cyclostomata, dipnoan, "ganoid" and teleostean fish, Amphibia), a larval excretory organ termed the *pronephros* makes its appearance. Its duct later becomes the duct of the permanent kidney, but the pronephros itself consists of very few tubules and these originate from the wall of the general body-cavity and not, as do the tubules of the permanent kidney, from special sacs (the malpighian capsules). The earlier workers regarded the pronephros as a last trace of a primeval excretory organ of quite different structure from the permanent kidney which later supersedes it. Hatta[3] working on the development of the lamprey and Kerr[4] on the development of Polypterus, have proved that the pronephros is nothing more than the foremost section of the permanent kidney, early called into action and enlarged whilst the hinder section of the metamerically repeated series of tubes of which the kidney consists remains undeveloped. Further, the portion of the general body-cavity from which the pronephric tubules arise is proved to consist of several malpighian capsules fused together and secondarily communicating with the general body-cavity.

Life History of Animals.—It might be supposed that with so many modifying factors at work it would be a hopeless task to attempt to disentangle the recapitulatory element from them and that therefore the ancestral history of animals, except in its latest and least modified chapters, would remain a closed book. But when we recollect that the life history of every species constitutes a separate edition of this history, and that the modifying factors have affected no two of them to the same extent, it becomes evident that comparative embryology built on a broad basis can attack the problem with a fair prospect of success.

Bearing in mind the priority of the larval over the embryonic phase, and beginning therefore our survey with the larvae of the simplest metazoa, we are able to recognise the first step in the evolution of the metazoa from the protozoa in the blastula, the hollow ball of cells which may be regarded as representing a colonial protozoön like the living Volvox. This stage was followed by the formation of a gut by the intucking of one side of the ball; and this second step is represented in the life histories of all the lower and simpler animals by the gastrula stage. Following on this stage came the formation of the coelom as a series of pouch-like outgrowths of the gut, and the change of the single opening of the gastrula, the blastopore, into two openings which became the mouth and the anus by the constriction of its middle portion.

It has been possible to show that two groups so utterly diverse in appearance as the Annelida and the Mollusca have originated from a single group of free-swimming ancestors represented by the trochophore larva, and since Arthropoda are admitted by all to be descended from Annelida, this conclusion involves the ancestry of four-fifths of the animal kingdom.

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[1] F. M. Balfour, *Comparative Embryology,* vol. 2, p. 365 (1881).

[2] R. Heymons, "Über die Lebensweise und Entwicklung von *Ephemera vulgata,*" *Sitzungsber. d. Gesells. d. Naturf. Berlin* (1896).

[3] Hatta, "The Development of the Renal Organs in the Lamprey," *Journ. Coll. Sci. Imp. Univ. Tokio* (1912).

[4] J. Graham Kerr, "Vertebrata with the exception of Mammalia," *Textbook of Embryology,* vol. 2 (1919).

We can form a very plausible guess as to the nature of the divergence of habits which led to the differentiation of the Annelida and Mollusca from one another. The original stock was free-swimming but both groups derived from it are typically bottom-dwellers. Two modes of seeking their food were open to them: they could either glide over the bottom by means of their cilia as young Gastropoda and Lamellibranchiata still do, or they could burrow into it. The first of these habits led to the evolution of Mollusca, the second to that of Annelida.

Two other groups of very diverse structure, which embryology has given strong reasons for believing to have been derived from a single race, are the Echinodermata and the Vertebrata. The lowest form which gives distinct evidence of the vertebrate affinities is the worm-like creature *Balanoglossus.* The larval form of *Balanoglossus* is a free-swimming organism called *tornaria* which shows the closest resemblance to the typical larva of Echinodermata, the *dipleurula.* The recognition of this affinity has assisted in the elucidation of a difficult subject to which considerable space was devoted in the 11th ed., viz., the origin of the central nervous system.

It is characteristic of the most primitive Annelida and Arthropoda that this system develops as a ring round the blastopore and an endeavour was made in the 11th ed. to prove that this was originally true of vertebrate embryos also. But it is a peculiarity of the vertebrate-echinoderm alliance which is still unexplained that in them the blastopore gives rise to the anus alone, whilst the mouth is formed as an apparently independent perforation at a considerably later period of development. A long succession of embryologists, with their eyes fixed only on the embryos of Annelida, Arthropoda and the higher vertebrates, have held that the vertebrate mouth is a new structure formed by the fusion of a pair of gill-slits and have prosecuted vain searches for traces of the old mouth.

Others have imagined that the mid-dorsal line of the vertebrate embryo along which the nerve-cord develops corresponds to the line joining mouth and anus in the arthropod, the line in fact which is occupied by the slit-like blastopore in *Peripatus.* They hold that the nervous system of the vertebrate originally extended round the front end of the embryo so as to include the mouth. There is, however, strong evidence that in Vertebrata the blastopore originally extended along the ventral surface. In Amphioxus the blastopore is at first a large wide opening beneath the nerve, the diameter of which is at right angles to the long axis of the nerve cord. As development proceeds this opening closes from below upwards and the blastopore is finally reduced to a small pore immediately posterior to the nerve cord. The anus arises as an apparently new perforation along the line of this closure. In the newt the lower part of the blastopore remains permanently open as the anus. In elasmobranch fish (sharks and rays) the blastopore is at first an enormous opening occupying the whole under surface of the egg which gradually closes by the approximation of its sides. As the anus can develop as an apparently independent opening along the line of the closed blastopore, it does not require a great stretch of the imagination to assume that this line really extends so far forward as to include the area where the mouth later develops. The independent and late development of the mouth is as marked a feature in the echinoderm larva as in the vertebrate embryo and there are no gill pouches in the echinoderm on which we could fall back to explain the phenomenon; and, further, in all four types of Echinoderm larvae develop a wide mouth leading into a shallow funnel-shaped gullet situated in the same position in the larval body and showing no relation whatever to the blastopore.

In two groups of Echinodermata (Ophiuroidea and Holothuroidea) as development proceeds this mouth moves to the left: its inner portion forms the adult mouth whilst its outer portion shallows out and forms the circular lip (peristome) surrounding the adult mouth. In two other groups (Asteroidea and Echinoidea) the larval mouth entirely disappears and the adult mouth is formed as an independent perforation on the left side—yet no one would question the homology of the mouth in all four groups. These facts afford conclusive proof that the shift of an organ from one position to another may be represented in embryology by its disappearance in one position and its apparent new formation in another. In the adult echinoderm the whole of the ectoderm is underlain by a nervous plexus of which the central nervous system is only a specialised and intensified portion, and the same thing is true of the anterior region of *Balanoglossus.* It is therefore futile to look for exact correspondence between the central nervous systems of two stocks which diverged from one another at such a primitive level as did the Vertebrata and the Annelida. In fact the descendants of the trochophore stock (Annelida, Arthropoda and Mollusca) on the one hand and the original Vertebrata on the other seem to have adopted two different modes of life which led to concentrations of the nervous system in different parts of the body. The trochophore stock took to crawling on their ventral surfaces and their locomotor organs were developed in this region of the body and in connection with them the motor ganglia which make up the ventral nerve-cord; whereas the vertebrate stock took to swimming by lateral blows of their blade-like bodies and this led to the concentration of the central nervous system in the mid-dorsal line.

Enough has been said to give evidence for our belief that the most recent research has tended to re-establish the recapitulatory element as the fundamental factor in life-history, and if this be admitted the study of comparative embryology opens up a means of investigating the early history of life at a stage long before it left evidence of its existence in the stratified rocks; and, further, the acceptance of recapitulation involves a conception of the laws of heredity entirely distinct from and supplementary to that suggested by Gregor Mendel and his followers.

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(E. W. MacB.)

EMIGRATION: *see* MIGRATION.

ENCEPHALITIS LETHARGICA.—The virus is unknown. Filtrable organisms have been described and also the transmission of the disease by injection of nervous tissues, but these experiments are at present inconclusive. The incubation period is uncertain but it is probably about two weeks. The degree of infectivity must be small. The duration of infectivity and of the persistence of the virus in the body are unknown. Apparently the virus may lie quiescent and return to activity after long periods since late manifestations have been known to develop after periods of two to four years, sometimes after apparent cure in the intervals. No age is immune to infection though the disease is not common in very young children.

Symptoms.—It is very difficult to classify the different cases. The best scheme provisionally is that of MacNalty which has been adopted by the Ministry of Health. This classifies the cases under the following main types:—

1. In which there is general disturbance of the functions of the central nervous system but without localisation.
2. In which, in addition to general disturbance, there are various localisations in the central nervous system. The most frequent of these are affections of the third pair of cranial nerves, but no portion of the nervous system is immune.
3. Mild or so-called abortive cases (*formes frustes*).

The clinical manifestations are very variable and complex, and are best classified, according to Walshe's scheme into general and nervous.

I. General: (1) negative, (2) positive.
II. Focal: (1) negative, (2) positive.

The positive symptoms denote exaltation of function which may be due either to irritation of nervous tissue or to a loss of the control exerted normally by the higher centres of the brain, while negative symptoms denote depression or loss of function due principally to destruction of nervous tissue.

The onset of the disease may be sudden or insidious. Occasionally the onset is extraordinarily sudden, the patient falling asleep almost without warning or sometimes becoming delirious. More frequently it is insidious either with the development of drowsiness or with more general symptoms. The general symptoms are not in themselves distinguishable from those of other conditions. Headache is common, and nausea and vomiting are frequent without being very severe. The temperature is very variable. It may be about 102° F. at the onset, falling after a few days, or it may be normal at the onset and rise later in the first week. A persistent rise is a serious sign. Some cases are apyrexial throughout. There is no characteristic eruption. In the mild and abortive types the general condition may suggest influenza and the nature of the illness only be recognised long subsequently by the development of characteristic late manifestations. Most cases undoubtedly commence with some grade of the characteristic symptoms of lethargy and double vision.

Lethargy.—The depth of this varies from apathy or drowsiness to deep sleep. The patient can usually be roused and may then answer questions with unexpected clearness. Occasionally the lethargy gradually deepens to stupor and fatal coma. Most commonly the lethargy lasts for two to three weeks, but it varies from a few days to several months. Rarely is it completely absent. Occasionally there may be somnolence by day and insomnia by night.

Double Vision.—Diplopia or double vision also occurs in the majority of cases, and is due to some form of paralysis of the ocular muscles. Other ocular manifestations may occur, such as ptosis or drooping of the eye-lids. The pupils may exhibit every possible variation from the normal in size, shape and reactions. Coarse nystagmoid movements are also common. Optic neuritis is never marked and a definite degree of swelling of the optic disk suggests an error in the diagnosis.

Nervous Symptoms.—Certain of the nervous manifestations which occur more commonly during convalescence or after the acute stages have passed will be referred to under the heading of "Residual" or "Late Manifestations," but any of them may occur at the onset or at any point in the course of the disease.

The positive symptoms are represented by restlessness, delirium, acute mania and various degrees of excitement. General convulsions are not common but are usually fatal. Negative symptoms are represented by the characteristic lethargy referred to above. Not uncommonly a patient may vary rapidly between a positive and a negative state.

Among the positive symptoms may be mentioned muscular pains which are occasionally severe and may simulate many diseases. In the positive group fall also the rigidity, Parkinsonism and the various involuntary movements which are referred to below among the late manifestations. The negative symptoms are represented by paralysis. The ocular manifestations have been mentioned above. Affection of the remaining cranial nerves may produce facial paralysis, difficulty in swallowing, rapid respiration and paralysis of the pharyngeal and laryngeal muscles. Aphasia and paralysis of the limbs may also occur. The deep reflexes are usually absent in the acute stages of severe cases, but there is no constant rule. The cerebro-spinal fluid may show a moderate increase in the number of lymphocytes but in at least one-third of the cases the fluid is normal.

Residual and Late Manifestations.—These are of the highest importance. The manifestations here referred to develop most frequently during convalescence, yet they may be present from the very outset of the disease, while in other cases long intervals, even of years, may elapse after the acute stages before their appearance. The initial attack may be so mild as to be overlooked at the time.

The most important of these manifestations are as follows:—

The Parkinsonian Syndrome.—This is characterised by the remarkable absence of facial expression which is termed the "Parkinsonian mask." There is also general muscular rigidity and a striking absence of slight and automatic movements. The general appearance resembles the condition known as paralysis agitans though the general effect is not quite identical. As mentioned above this state may be fully marked within a week or two of the onset. The progress is more rapid than in senile paralysis agitans, but on the other hand recovery may take place, especially in those cases in which it has developed early in the attack. Mental changes are not uncommonly associated with this complication especially in childhood.

Mental Changes.—These are of great importance from their frequency and character and are present to some extent in about 75% of cases. The changes may be of all grades from slight weakness of the intellectual powers to definite dementia and insanity. The development of certifiable insanity is, however, rare.

In adults the usual manifestation is a general weakness of the intellectual powers. The subject shows a marked lack of attention, concentration and initiative. Definite melancholia is not very common. There may be some irritability of temper but the excitement which occurs in children is not often seen in adults. Insomnia is a not infrequent symptom and may be very persistent. On the other hand there may be persistent drowsiness.

In children the mental changes are far more varied and of greater importance than in adults. As in adults the commonest effect is a weakening of the powers of concentration. This becomes very obvious during school life, since these children pay little attention either to their work or to their surroundings. Such a child makes but little progress and appears to remain at the age at which the illness began, but is seldom troublesome.

A second group, numerically smaller, is characterised by excitement. These children are usually under 10 years of age. They are restless, troublesome, noisy and uncontrollable. The excitement may be most marked during, or even be confined to the night. As the afternoon passes on these children become restless and excited and the entire night is spent in shouting and constant movements. For the time, they are quite beyond control.

This group merges into a third group in which there are definite alterations in the moral character. Most of the children are between the ages of 10 and 18 years. This group, though small, is important owing to the difficulty in dealing with the subjects. They become morally and sexually perverted. These changes are more common in children of families with a bad record mentally and criminally. There is a small group in which idiocy develops, usually in children under 5 years of age, and in a few cases there has been definite certifiable insanity. In addition to these mental changes Parkinsonism may be present and also the myoclonic and other movements described below. The treatment and especially the disposal of children in the second and third groups is a matter of great difficulty. Home surroundings are rarely suitable and the child will render ordinary family life impossible. The moral pervert may also lead to trouble with the law. Special institutions may need to be provided for these children.

Involuntary Movements.—This group of "excitomotor" symptoms includes numerous varieties of involuntary movements and muscular contractions. Though they are more common late in the disease many of them occasionally occur at the onset. The most definite type is myoclonus which is characterised by short, rapid, rhythmic contractions of the muscles: a single muscle such as the diaphragm, or even a part of a single muscle may be affected. There is generally no movement at the joints, but in some cases the contractions are of a slow rhythmic type and may lead to very complex movements. Various choreiform and athetoid movements are also met with. Tremors and tics of all types may also develop. Epidemic hiccough may be a variety, but this is at present uncertain.

Respiratory Abnormalities.—Rapid or deep breathing may be present, either continuously or in paroxysms at any period of the acuter stages. Violent spasmodic cough occasionally develops in in children or sniffing and various respiratory spasms.

Paralysis.—The persistence of these is relatively uncommon. Diplopia is rarely permanent. Many nervous diseases, however, are occasionally simulated such as disseminated sclerosis. Numerous other late manifestations are observed more rarely. Among these may be mentioned obesity which is occasionally associated with polyuria, suggesting disturbance of the pituitary gland.

Progress and Prognosis.—A. J. Hall states as a rough approximation that of 100 cases, 25 recover completely, 25 die, and 50 have various residua of which at least 25 exhibit Parkinsonism. It is impossible to give a good prognosis during the acute stages in any case of encephalitis lethargica, owing to the fact that serious late manifestations may develop after a mild initial attack. Further, long quiescent periods may occur with subsequent recrudescence of activity and fresh manifestations. Such intervals may be several years, but the limit is at present unknown.

In the acute stages the outlook for life is bad with severe general symptoms, with a rapid onset, with high temperature, with acute delirium or with mania. Slight early symptoms may, however, also progress to serious grades. Deep early lethargy is not necessarily a serious symptom. Early myoclonus and involuntary movements do not appear to be especially unfavourable. Most deaths occur within the first month and the prognosis for life improves after this.

With regard to special manifestations, the Parkinsonian syndrome may be recovered from partially or even completely when it develops early in the disease, but when it appears later it usually progresses and mental changes may also occur. The outlook in the cases with the severer mental changes is poor; recovery is rarely more than partial and relapses may follow.

The influence on pregnancy has been carefully studied by Hall. He considers that there is no evidence that pregnancy pre-disposes to infection with encephalitis lethargica, or that it is associated with a higher mortality or influences the course of the disease in any way. Residual manifestations, however, may be aggravated in a woman who has passed through an attack and become pregnant subsequently. No advantage is apparently gained from induction of labour.

Diagnosis.—The disease is often easily recognised from the combination of lethargy and double vision. The milder forms, however, are easily overlooked at the onset and may frequently be unavoidably mistaken for influenza. When the more complex nervous symptoms are present the diagnosis may be of great difficulty. The conditions with which confusion most often occurs are meningitis (especially tuberculous), cerebral tumour, cerebral vascular lesions and cerebral syphilis. The confusion with senile paralysis agitans is not common.

Treatment.—This is on the general lines of treatment of acute febrile disease. Unfortunately there are no specific measures. The administration of hexamine may be recommended. The withdrawal of cerebro-spinal fluid by lumbar puncture is frequently performed but there is no evidence that it is beneficial.

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(H. L. T.)

ENDOCRINOLOGY.—This science deals with the structure and function of the organs of internal secretion (*endocrine*, or *incretory organs*), in health and disease, and has been vigorously developed since 1910. Through observations upon man in private clinics and in university hospitals, and through experimentation upon animals in laboratories, many important new facts have been accumulated concerning these organs, their products (*increta*) and their functions during different periods of the life-cycle of individual organisms. Attempts are being made to co-ordinate these recent discoveries with what was known before, in order that knowledge in this domain may be better systematised and formulated and that the diagnosis and treatment of endocrine disturbances in man may find securer foundations than the speculative suppositions, often groundless, that have been advanced in a period of expanding research to eke out a store of facts that was felt to be lamentably meagre.

Limitation of the Field.—There is, as yet, no general agreement as to the limits to be set to the field of endocrinology(¹). Some would include all parts of the body in the category of organs of internal secretion, on the ground that all organs give off chemical substances to the blood and lymph; others would limit membership in the class to a few organs—(*a*) the ductless glands and (*b*) certain glands that, despite the possession of ducts and the production of an external secretion, yield to the blood directly (or through the lymph) materials that are of profound significance either for the growth and differentiation of distant parts or for the automatic regulation of the physiological functions of those parts. In this latter and more restricted sense, the endocrine organs include the thyroid gland, the parathyroid glands, the hypophysis cerebri (or pituitary gland), the suprarenal glands, the islands of Langerhans of the pancreas, and, perhaps, the endocrine portions of the sex gland or gonads. Organs, the products of which serve merely the nutrition of the body or are mere waste substances to be excreted from the body by other organs, would not be so included.

Even with this restriction there is doubt as to just how many organs should be classed as "incretory" and, particularly, as to whether the pineal gland, the posterior lobe of the hypophysis cerebri, the thymus, the liver and the chromaffin tissues should, or should not, be so classed. For practical reasons it would seem better to regard endocrinology, for the present at least, as limited in its field to the structure and functions of the organs of internal secretion in the narrower sense mentioned above rather than to extend its scope so as to include all the organs of the body whose products on entering the blood play any part in chemical regulation. The science which deals with the "hormones" or "chemical messengers" (*cf.* E. H. Starling) in general within the body has been called "hormonology"; endocrinology in the narrower sense would appear to represent an important part or domain of that more comprehensive subject.

Anatomy, Histology and Embryology of the Endocrine Organs.—The gross and microscopic appearances of the principal ductless glands are described in 8.633. Recent advances in the morphology of these glands have consisted (*a*) of intensive studies of their finer structure by means of more delicate histological technique and (*b*) of more accurate determinations of the mode of origin and the chronological development of these structures in the embryos. Systematic (and quantitative) statistical studies of the normal variations of these organs and their relations to the body as a whole have been undertaken for certain animal species (*e.g.*, the rat). An attempt is also being made to determine precisely the evolutionary processes responsible for the organogenesis and histogenesis of the structures that manufacture the internal secretions, a phase of research regarded as important by biologists and especially by embryologists(²).

General Physiology of the Endocrine Organs.—The increta produced by the endocrine organs and delivered to the blood, either directly, or by way of the lymph, appear to be of great importance for the organism as a whole in all phases of the life-cycle (evolution, maturity and involution). During the *period of evolution*, the progressive phases of the life-cycle (that is, during the development of the individual), these increta play a rôle in the processes of growth, of organ formation and of tissue differentiation(³). The endocrine substances that participate in the building of the bodily organs and are of significance in the initiation and the continuance of the metamorphoses that occur during growth have been called "harmozones." It is believed that they react with the autochthonous chromosomal substances of the cells of different regions of the body, perhaps in an enzyme-like way, and so form a part of the stimulative and assimilative processes concerned in normal growth and differentiation.

The endocrine organs themselves undergo changes during growth and development; the several organs appear at somewhat different times in the embryo, and vary somewhat in size in structure, and doubtless, too, in function, at different stages of an organism's unfolding. That the functions of these organs are correlatively connected is certain; and that there are individual, racial and generic variations in these correlations seems very probable. The different varieties of habitus (pyknic, asthenic, athletic) met with inside the limits of normal variation in a single human race, and the skeletal and other somatic peculiarities that characterise the different races of man (*e.g.*, Nordic, Mediterranean, negro, etc.,) or of any other animal, say the dog (*e.g.*, bulldog, dachshund, greyhound), though dependent in part on regional chromosomal specificities, are believed to be also in part determined by the differing endocrine "formulae" or "constellations" of their bearers, the hypophysis being dominant, perhaps in one, the thyroid in another, the gonads in a third and so forth. The different combinations and permutations of the incretory influences that are possible are interesting and at the same time appalling to the student of human and animal constitutions(⁴).

During the period of maturity the hormones from the incre-

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[1] The figures throughout the text refer to the bibliography at end of the article.

tory organs are believed to subserve many important functions, particularly those concerned with automatic adjustments within the organism when disturbances endanger equilibrium(5).

Thus a hormone from the thyroid gland participates in the control of the basal metabolic rate, one from the parathyroid in the control of calcium metabolism, and one from the islands of the pancreas in the control of sugar metabolism. These hormones may act, as is gradually being found out, through the utilisation of various mechanisms; sometimes they exert their influence through affecting other endocrine organs than those by which they are produced, sometimes through the vegetative nervous system and sometimes through direct attack upon the body cells in general. Ignorance here is as yet profound. Slowly, however, facts are emerging, as a result of clinical-pathological studies, of experimental removal of an endocrine organ and observing what follows, of transplantation experiments and of experiments in which substances derived from endocrine organs are fed to, or injected into, healthy or diseased organisms.

During the period of involution of an organism, the incretory organs change as do all the other parts of the body. In the ageing process of normal involution, there may be steady general decline through a long series of regressive phases to physiological death. But premature senescence, partial or general, may appear as a result of abnormalities of one or more endocrine organs (gonads, thyroid, etc.), for such abnormalities lead to disturbances of equilibrium of the correlating systems of the body. To a certain extent, " rejuvenescence " can be experimentally achieved by injection or transplantation of certain endocrine tissues (*see* REJUVENATION). It is possible that the appearance of certain malignant growths may come to be correlated with changes in the incretory glands, for in man, alterations in the thymus, thyroid, hypophysis and suprarenals have been found in association with neoplastic growths and, in experimental animals, definite influences of incretory conditions upon the " taking " and growth of neoplastic grafts, have been demonstrated(6). Adenocarcinomata, for example, are transplantable to certain normal mice but not to castrates of the same species, though if a young testis be also grafted into the castrate, the neoplastic graft can then be made to grow.

Physiological chemists have made progress in isolating various potent chemical substances from the organs of internal secretion. Among the more important of these may be mentioned *epinephrin* (or *adrenalin*) from chromaffin tissues, *thyroxin* from the thyroid gland, *pituitrin* and *antuitrin* from the hypophysis cerebri, *lutein* from corpora lutea of the ovary and insulin (*q.v.*) from the islets of the pancreas. Recently, from the parathyroid glands has been extracted a *parathyroid hormone* that will prevent or control tetany due to parathyroid insufficiency and will regulate the level of the calcium content of the blood; from pituitrin has been isolated an active principle of great potency that will in extremely dilute solutions cause contraction of uterine muscle; and from ovarian follicular fluid has been separated a hormone that will, on injection, induce a sexually mature condition in immature females(7).

Clinical Endocrinology.—Knowledge of clinical syndromes due to disorders of the endocrine organs has also made rapid strides since 1910, and the symptomatology of the endocrine disorders has been extended and made more precise. Thus the principal endocrine disturbances manifested as Graves' disease, myxoedema, tetany, acromegaly, adiposogenital dystrophy, eunuchism and eunuchoidism, Addison's disease, suprarenal virilism and hirsutism and diabetes mellitus are now far better understood than ever before. There has been a tendency, however, to attempt to push the clinical applications of the scientific advances in endocrinology further than is warranted, and much confusion has arisen both in the profession and among laymen because of failure to distinguish between mere speculations and well-established facts(8). Fortunately, warnings have been sounded, and more careful workers emphasise the necessity of a more rigidly critical approach to the solution of clinical endocrine problems. This is particularly true of endocrine therapy, which has recently almost run riot. The wishful thinking of unskilled practitioners and their uncontrolled impulses therapeutically to act by administering endocrine products singly and in the form of divers " polyglandular formulae " bade fair, for a time, to become scandalous, aided and abetted as such ill-founded therapy was by ignorant or unscrupulous vendors of endocrine products. Organotherapy and hormonotherapy have scored genuine triumphs; it is unfortunate that their reputation should be sullied by uncritical extravagances(9). The effects of thyroid extract or thyroxin in myxœdema, of iodine in the prevention of colloid goitre (*q.v.*), of surgical removal of part of the thyroid gland in exophthalmic goitre of insulin (*q.v.*) in diabetes (*q.v.*) are brilliant examples of therapeutic successes in endocrine domains. The utilisation of certain hormones for their pharmacodynamic effects in disorders not primarily of endocrine origin is proving profitable; the control of paroxysms of bronchial asthma by injections of epinephrin and the restriction of water-excretion through the kidneys in diabetes insipidus by injections of pituitrin, and the use of pituitrin in obstretrics and surgery, of adrenalin in local anaesthesia and of lutein in ovarian dysfunction are notable examples. Organotherapy and hormonotherapy undoubtedly have an important future, but genuine success in these fields can be achieved only by thoughtful, painstaking, rigidly controlled work; progress is only too likely to be retarded and science to be discredited by the rash enthusiast and the credulous ignoramus.

In the United States the Assn. for the study of Internal Secretions and its journal, *Endocrinology*, are doing much to foster the development of endocrine research.

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(1) *cf.* A. Kohn *Ueber den Begriff der inneren Sekretion*, Med. Klinik, Berl., 1924, 20, 1272–1274.

(2) For summaries of the morphological and developmental discoveries of recent years, the reader may consult E. A. Schäfer's *Endocrine Organs; an Introduction to the Study of Internal Secretion* (1916). Swale Vincent's *Internal Secretion and the Ductless Glands* (2nd ed., 1922), and the series of articles in the first two vol. of *Endocrinology* and *Metabolism* (1922).

(3) *cf.* Harms " Das Wesen der Inkretion und ihre Bedeutung für das normale und experimentell beeinflusste Geschehen innerhalb der Lebensphasen der Tiere," *Deutsche Med. Wchnschr.*, 1925, 51, 631–633.

(4) *cf.* G. Draper, *Human Constitution: a Consideration of Its Relation to Disease* (1924); also, J. Bauer, *Die konstitutionelle Disposition zu inneren Krankheiten* (3. Aufl. 1924).

(5) *cf.* W. B. Cannon and Associates " Studies on Conditions of Activity in Endocrine Glands," *Am. Jour. Physiol.*, 1924, 69, 46; 71, 153; 1925, 72, 283; 295; also G. N. Stewart, *Physiol. Rev.*, 1924, 4, 163–190.

(6) *cf.* Brown and Pearce " Malignant tumor of rabbit: results of miscellaneous methods of transplantation, with discussion of factors influencing transplantation in general." *J. Exper. Med.*, 1923, 37, 811; 38, 385, 1924, 40, 603.

(7) For references to some of these newer studies, the reader may consult A. C. Crawford's " Chemistry of the Suprarenal Glands," *Endocrinology and Metabolism* (1916), 2, 77–98; E. C. Kendall's " Isolation of Thyroxin," *J. Am. M. Assn.*, 1915, 64, 2042–2043; J. J. Abel's " Physiological, Chemical and Clinical Studies on Pituitary Principles," *Bull., Johns Hopkins Hosp.*, 1924, 35, 305–328; F. G. Banting and C. H. Best's " Internal Secretion of the Pancreas (insulin)" *J. Lab. & Clin. Med.*, 1922, 7, 251–464; J. J. R. McLeod and F. G. Banting's " Antidiabetic Functions of the Pancreas and the Successful Isolation of the Antidiabetic Hormone–Insulin," (1924); E. Allen and E. A. Doisy's " Ovarian Follicular Hormone," *Am. J. Physiol.*, 1924, 69, 577–588; *J. Biol. Chem.*, 1924, 61, 711–727; and J. B. Collip's " Parathyroid Hormone," *J. Biol. Chem.*, 1925, 63, 395–438.

(8) *cf.* H. A. Christian " The Use and Abuse of Endocrinology," *Canada M. Assn. J.*, 1924, 14, 102–106.

(9) *cf.* H. Lisser, " Organotherapy; Present Achievements and Future Prospects," *Endocrinology*, 1925, 9, 1–20. (L. F. B.)

ENGINE: *see* INTERNAL COMBUSTION ENGINE; STEAM ENGINE.

ENGINEERING: *see* BREAD MAKING; CELLULOSE; CHEMICAL ENGINEERING; DAMS; DYNAMO; ELECTRICITY; FACTORY DESIGN; FERRO-CONCRETE ENGINEERING; FUEL PROBLEMS; GAS, MANU-

FACTURE OF; HYDROELECTRIC ENGINEERING; INTERNAL COMBUSTION ENGINES; ILLUMINATING ENGINEERING; IRRIGATION ENGINEERING; MATERIALS, STRENGTH OF; PAPERMAKING; PUMPS; RESEARCH, INDUSTRIAL; RIVER AND CANAL ENGINEERING; STEAM ENGINE; TEXTILE MACHINERY; TURBINES, STEAM.

ENGINEERS, MILITARY (*see* 9.406).—In the ever-expanding application of engineering science to the ends of war, we note the evolution of a natural process, and a modern classification of engineer work. The former evidences itself in the tendency to fissiparism; that is to say, the separation from the parent body of specialised engineer branches.

Thus from the Royal Engineers arose the Signals Corps; the Tank Corps may be regarded as a specialised branch of the original Corps of Ordnance; the Royal Air Force had its origin in the balloon units of the Royal Engineers; and in the World War the Royal Engineers were required to father a special organisation of troops for gas warfare. When a nation expends its military forces and puts forth a serious military effort, this fissiparous tendency becomes more marked, as it becomes essential to form specialised branches for electrical and mechanical work, railway construction, inland water transport, road maintenance, quarry operation, forestry, etc. It is in these specialised units that full opportunity offers for the utilisation to the best advantage of the civil engineer expert.

I. THE EUROPEAN SERVICES

Engineer work in war is now classified under two heads (1) Field engineering and (2) Engineer services.

Field Engineering.—For this purpose, field engineer units (field companies and field squadrons, R.E. in the British Army) are incorporated in infantry and cavalry divisions as integral portions of these divisions, taking their orders only from the commander of the division, and entirely at his disposal. These constitute the true engineer arm. They may at any moment be required to execute works of very diverse natures, whether they are bridges or roads, or the development of water supply for the troops to facilitate an advance, or construction of works of defence or obstacles to assist in the holding of a position of defence, or demolitions to hamper a pursuing enemy.

The essential conditions are speed and the adaptation to the end in view of the materials available at the moment on the spot. For this purpose, the engineer officer must possess a thorough knowledge of the methods and psychology of troops of other arms; he must be able to grasp intuitively the intention or wishes of the commander of the force; whilst, technically, he must know the utmost limit to which he may risk stressing the available materials.

Engineer Services.—Apart from the field engineer units, however, there is a vast volume of engineering to be performed in the zones in rear of the fighting troops. For an army operating overseas, *i.e.*, for the normal wars of the British Army, it is necessary to provide, in the theatre of war, bases of supply from which radiate lines of supply: through these bases and along these channels flow all the reinforcements in men and animals and the munitions, food and innumerable stores required to maintain the army in the field. It is inevitably found that the volume of these supplies far exceeds that for which the available ports, railways, roads and waterways, have been developed for the purposes of commerce. The necessary development of the rear zones, for the purposes of the army, thus involves normally port, railway and road construction, as well as the provision of camps, electric power stations, waterworks, etc., on a scale which would be required to house the population of a large city. In addition, development of local resources and the provision of repair factories in order to ease the strain on sea transport demands the organisation of other specialised engineer activities. These services are, in the British Army, organised under and directed by engineer commanders, and require, in the case of a serious national effort, the mobilisation of civil engineer resources.

Engineers in European Armies.—In the case of European armies, whose serious efforts always are directed to the defence of their land frontiers, the problem of maintenance of these armies can be foreseen by provision of suitable rail communication in time of peace, so that, on the outbreak of war, the problem is reduced to that of diverting the manufacturing energy and the peace trade routes of the country to the purposes of war. In consequence, the function of their military engineers in effect begins and ends with field engineering. Even in this rôle the problem which confronted the staffs of Continental armies immediately before 1914 was essentially different from that of the British War Office. For the national armies of Continental Powers, it was not only possible, but desirable, to provide specialised units for separate branches of field engineering, *e.g.*, railway construction units, bridging units, etc. For several obvious reasons, this is not feasible in the case of the small British Army; nor is it normally essential in the first stage of war to provide engineer troops in the proportion which will be necessary after the first few months of war. During the first stage of intense mobility it may be possible to obtain effective help from engineering science with a 5% proportion of engineers; but this proportion must inevitably be increased to 10%, or even higher, if the war tends towards static conditions. The proportion of engineers in the British Armies in 1918 had risen to 12½%.

Training of Engineers.—The primary aim in the education of the engineer officer being to produce the field engineer, the cadet in the British Army is given an 18 months' course between the ages of 18 and 20 years at the Royal Military Academy, Woolwich, where elementary military knowledge is imparted and special attention is given to elementary sciences. From the Royal Military Academy he passes as a commissioned officer to a two years' course at the School of Military Engineering at Chatham and the University of Cambridge, where, in addition to the continuance of his military studies, he is specially and intensively trained in elementary engineering. Subsequently, after some years of practical experience with engineer units, a proportion are given courses of education in specialised subjects, *e.g.*, electrical and mechanical engineering, while another small proportion are put through the Staff College course. During their subsequent career a large number of engineer officers are employed on the supervision of construction of barracks, fortifications, roads, water supplies and other military works at home and abroad.

The rank and file of the Royal Engineers are obtained from two sources, (1) the enlistment of artisans and "mates" and (2) the apprenticeship of boys to trades at military technical schools. The objective of subsequent training in engineer units is to impart military training and improve the handiness of all ranks with a view to obtaining the versatility required for field engineering and the co-ordination of all ranks in a unit to effect field works, especially the construction of bridges, in the minimum possible time. (*See* BRIDGING.) (J. W. S. S.)

II. THE UNITED STATES

The engineer component of the Regular Army of the United States is the Corps of Engineers, which is charged with the engineering duties appropriate to the military establishment, and also certain public works functions mainly in connection with the improvement of rivers and harbours.

Prior to the National Defense Act of 1916 the maximum strength of the corps was 240 officers and 1,968 enlisted men forming three battalions of four companies each. Under the Act of 1916 the Corps of Engineers was to consist of 505 officers (including those assigned to public works), seven regiments (foot), two battalions (mounted) and one band. As the increase was to be made in five successive increments, the corps, on April 6 1917, when the United States decided to enter the World War, numbered 256 officers and 2,228 enlisted men, organised in three regiments and one mounted company. There were in existence a few companies of engineers in the National Guard, as also the rudiments of an organised reserve. During the War several changes were made in the organisation of the army, and many regiments of engineers were organised for special (non-divisional) purposes. However, under the system of recruitment, voluntary at first and later compulsory, craftsmen of all sorts were to be found in the combatant regiments of engineers attached to infantry divisions. The change from trench warfare to the war of manoeuvre eliminated the need for specialist troops, and all engineer regiments performed service as pioneers and sappers. At the Armistice the divisional regiment, with its train, had a strength of 49 officers and 1,695 enlisted men. During the War, 13,527 officers were commissioned as engineers, of which the maximum enlisted strength was approximately 285,000 men. Of this number 233,000 served in the theatre of operations.

Reorganisation.—Under the reorganisation Act of 1920 the Corps of Engineers was fixed at 602 officers and 12,000 enlisted men, to be formed into tactical units as the President might direct. Engineer troops were classified as general and special, the former including combatant regiments and mounted battalions for infantry and cavalry divisions, with general service regiments and auxiliary battalions (coloured) for the line of communications. Special engineer troops included bridge and motor-truck trains, topographical and camouflage troops, railway and other special units as might be needed. Lack of appropriations has necessitated certain reductions, and on Dec. 31 1925 there were actually in service 500 officers and 5,040 enlisted men including 330 native Philippine troops. A number of the units authorised by the Act of 1920 were, however, in an inactive skeletonised status.

Training of Officers.—The officers are obtained mainly from the U.S. Military Academy at West Point, a limited number of the most capable graduates at the Military Academy being appointed to the engineers. Inasmuch as the curriculum at the Military Academy is directed to general military fundamentals, the graduates require additional instruction to fit them for service as subalterns in the Corps of Engineers. For the special training of its younger officers, and for the development of enlisted specialists, a military engineering school is maintained at Fort Humphreys, Va., near Washington, D.C. The instruction embraces subjects of a general military nature, as well as those pertaining to the application of engineering to the functions of the Corps of Engineers both in war and in peace.

During the first three years of a young officer's career he is assigned for one year to duty with troops, and spends one year as student at a selected civilian technical institute, where he receives a degree in some branch of engineering, and one year at the Army Engineer school, where he pursues the "company officers' course." A few officers are appointed to the corps from civil technical institutions and these are assigned for two years with troops and then to the Army Engineer school to take the "company officers' course." Eventually the education of the appointees derived from the two sources is reduced to a common denominator, and no subsequent distinction is made between them in respect of duty or promotion. Their technical schooling is supplemented by assignment as junior assistants to officers engaged in public works, where their training is continued in accordance with programmes formulated in the office of the Chief of Engineers.

The practice of appointing the graduate of the Military Academy to civilian institutions for technical training has many advantages, in that it gives the young officer the benefit of the complete educational plant and specially trained staff found only at large institutions, and his professional education is attested by a scholastic degree of known merit; as a student he comes into competition with young men who will subsequently practise engineering in civil life, and he and his civilian fellows thus obtain a mutual knowledge of and respect for one another's ability. The young officers become members of the fraternal societies and alumni associations of the various institutions, which circumstance promotes a knowledge of the regular army and an interest in national defence on the part of the civilian practitioner. This is particularly advantageous in view of the traditional military policy of the United States which places its reliance on a citizen soldiery. (G. A. Y.)

ENGLISH HISTORY (*see* 9.466).—The history of England from 1910 falls obviously into three main divisions, the years before the outbreak of the World War, the years of the War, and the period that began with the armistice, 1918. For convenience the third period may be sub-divided, the end of the Lloyd George Ministry being taken as the line of demarcation.

I. FROM THE KING'S DEATH TO THE WAR

The truce which the death of Edward VII. (May 6 1910) imposed upon political warfare was not of long duration, and the conference in which the opposing parties sought a negotiated peace over the veto of the House of Lords broke up on Nov. 10 1910, with the announcement that it was unanimously of the opinion that no information could be given on the nature or causes of its disagreement. The general election which followed in Dec. was fought specifically over the Parliament Bill, Mr. Asquith having announced in the previous April that Ministers would not advise a dissolution except on such conditions as would enable them, if successful at the polls, to place that bill on the statute book, despite the resistance of the House of Lords.

Tariff Reform and the referendum were pressed on the other side as alternative issues; Mr. Redmond's return from America with $200,000 for Home Rule provoked the cry of "dollar dictation," and woman suffragists, in default of the vote, exercised some physical force against prominent ministerialists and public property. But these diversions, while attracting some votes and repelling others, hardly affected the main issue. It was generally expected that Ministers would be returned to office, but with a diminished majority, and it was contended that the loss of half a dozen seats on balance would be sufficient to deprive them of that "adequate" majority which they themselves regarded as an essential justification for invoking the royal prerogative of creating peers in order to pass the Parliament Bill. Even that modest hope was frustrated. The Government came back with a nominal following of 398 against 272 in opposition, having thus increased their majority by four.

The Parliament Bill.—The Parliament Bill was accordingly re-introduced on Feb. 22 1911. Objection to its preamble, which accepted the principle of a second chamber and foreshadowed a reform of the House of Lords, was taken by Labour members and some Radicals; but the Bill passed its third reading in the Commons on May 15, after a few modifications in committee, by 362 votes to 241. The House of Lords had meanwhile been seeking to ward off the blow by considering various plans for its own reformation. They all contemplated a drastic reduction of the number of hereditary peers and the reinforcement of the House by nominated or elected members, the proposed electoral bodies varying from the peerage itself to comparatively popular constituencies. But there was little agreement, and Lord Lansdowne's bill, which was given a second reading without a division on May 22, proceeded no farther.

More urgent than the reform of the House was the defeat of the Parliament Bill, and the proposal which commended itself most to the majority, but not all, of the Unionist peers and members of parliament was the adoption of the referendum. Mr. Balfour accepted it on behalf of the party and even, in response to inquiries from his free trade opponents, undertook to submit tariff reform to this "poll of the people." Advanced tariff reformers suspected this acceptance as a concession to free trade Unionists and resented it as an evasion of their attempts to pin their leader down to what they regarded as the most important and popular plank in their platform. Nor was it made at all clear in what form the referendum could be applied to such a question, nor how it could be reconciled with the financial control of the House of Commons; the more general opinion among tariff reformers was that finance must be excepted from its operation.

Meanwhile the Parliament Bill demanded the Lords' attention. Tactical reasons dictated a second reading without a division on May 29, and then the preparations for the coronation of the King and Queen (June 22) and the prolonged festivities connected therewith interposed a truce. Parliament reassembled on June 26 and Lord Lansdowne produced his amendments; if successful they would not only have wrecked the Bill, but have made it impossible for the Government to carry any other principal item in its programme without either a second, if not a third, general election, or the adoption of the referendum for any bill proposing a change in the constitution; the adoption of this change in the constitution would obviously itself have to be submitted to a referendum. On July 5 the principal amendment was accepted by 253 votes to 40, and of that minority 27 had been created peers by the existing Liberal Government. "The referendum," said Lord Selborne, "had come to stay."

On July 20 the Lords completed their remodelling of the Parliament Bill and sent it back to the Commons. On the same day Mr. Asquith wrote to Mr. Balfour informing him that "should the necessity arise, the Government will advise the King to exercise his prerogative to secure the passing into law of the Bill in substantially the same form in which it left the House of Commons, and his Majesty has been pleased to signify that he will consider it his duty to accept and act on that advice." This intimation produced a sharp division in a meeting of Unionist peers held on July 21 and in the party generally.

The advocates of resistance, "die-hards," as they were called, were in a minority, but were very determined; their figure-head was Lord Halsbury, but they were led by Lord Milner, Mr. Austen Chamberlain (with the full support of his father) and Sir E. Carson. They included the Duke of Bedford, the Marquess of Salisbury, the Earl of Selborne, Lord Willoughby de Broke, Sir Edward Carson and Mr. George Wyndham. The younger Cecils were more dubious in their attitude, while the responsible leaders of the party, Mr. Balfour, Lord Lansdowne, the Duke of Devonshire, Lord Curzon and Viscount St. Aldwyn, thought discretion the better part of valour. The "die-hards" themselves were firm in their convictions, but many believed that the threat to create 500 peers was little more than bluff. The discovery that the Government was in earnest and possessed the means to carry out its policy provoked a furious resentment; and when on July 24 the Prime Minister rose in the House of Commons to amplify and justify his communication to Mr. Balfour, he was greeted with 40 minutes' organised and premeditated uproar which even the Speaker was unable to check. Next day Lord Lansdowne and Mr. Balfour appealed to their respective followers in the two Houses to desist from further resistance to the Parliament Bill, but their advice was rejected by the "die-hards".

On Aug. 8 the Lords passed, by 282 votes to 68, a vote of censure on the Government which the Commons had rejected by 365 to 246 votes on Aug. 7; and on Aug. 9 and 10 they debated what they should do with the Parliament Bill once more sent up by the Commons with the Lords' amendments deleted. The division was taken on Aug. 10: 37 Unionist peers, the two archbishops and 11 bishops voted for the bill, while the majority abstained; it was carried by 131 to 114 votes, but eight "die-hards" were accidentally prevented from reducing the majority of 17 to even more exiguous dimensions.

The Position Analysed.—Probably the moderate Conservatives, by their action and inaction, conserved a good deal more than their extremer colleagues would have done had their resistance succeeded. Yet it is not so easy as it appears on the surface to strike a balance of ultimate advantage between the rival tactics. The rejection of the Parliament Bill would undoubtedly have been followed, as Lord Crewe had intimated, by the creation of enough peers to outnumber any possible opposition; but that vast creation would surely have hastened the reform of the House. No doubt the Government would see to it that the new peers were also sound on Home Rule, if not on Welsh Disestablishment as well; and that would have meant Home Rule in 1912 and Disestablishment in 1913 instead of two years later. Home Rule in 1912 might have involved a rebellion in Ulster, but it would surely in that case have prevented a Sinn Fein rebellion in 1916 and the civil war of 1920–2; the Home Rule Bill which was frustrated in 1913–4 was conservative compared with the Irish treaty adopted by the Coalition in 1922; and the implementing of the preamble to the Parliament Act, which the creation of 500 peers would have made feasible within the lifetime of the 1910 Parliament would, whatever its details, have seemed a conservative measure 10 years later.

National Insurance.—The Parliament Act was only the most striking legislative incident in a year singularly fertile in political sensations; and during the intervals in which the Lords were perpending the Parliament Bill, the Commons were engaged upon a vast and novel scheme of National Insurance. It was introduced by Mr. Lloyd George on May 4 amid a chorus of approval which might well have reminded him of the warning of woe when men speak well of apostles and prophets. The scheme touched many interests and classes, and the sections proceeded to discuss it in the light of how much each would put in and how little each would get out of the common welfare. The British Medical Association seemed to be the most class conscious; doctors, it said, would be ruined, or at least inadequately paid. The Friendly Societies took the view that they would be the principal sufferers. The Chancellor of the Exchequer at times implied that he was giving the people 9d. for 4d.; labour thought it should get the 9d. for nothing; other friends of the people contended that they would be paying 9d. for 4d.; and *The Daily Mail* collected 10,000 mistresses and maid servants in the Albert Hall, London, to protest against the prospect of "licking stamps" for the sake of Mr. Lloyd George.

The bill was taken in intermittent stages between May and Dec., by which time Unionist approval had turned mostly into violent condemnation, tempered mostly by conviction that the enormous burden the Act would put upon industry would create an imperious demand for tariff reform. Attempts were made to separate the parts dealing with invalidity from that dealing with unemployment, and a good many details were altered by Mr. Lloyd George himself as a result of his numerous conferences with the rival interests. The result showed a remarkable triumph of common sense over sectional clamour and political faction. Only 21 members voted against the third reading in the Commons; the Lords adopted the Bill without protest, and its main principles have been universally accepted as sound and beneficent, capable of modification and extension but not of repudiation.

Payment of Members.—Another change, almost equally resented in certain quarters but easily effected because it did not require legislation, was the adoption of payment of members by resolution of the House of Commons. Members had been paid from the days of Edward I. to the end of the 17th century; but while the Government fixed the rates, the wages were levied by the constituencies, which often paid less and sometimes more than the standard rates. The stipend was now made uniform and paid out of the national exchequer; the £400 a year at which each member's salary was fixed was, considering the greater length of sessions and the fall in the value of money, far below the rates which obtained in the Middle Ages. The Commons also rejected the old standing order which denied the right of peers to vote, or otherwise participate in elections to the House of Commons; it was not for the Commons to maintain, in the year of the Parliament Act, that any class should be unrepresented therein.

Other enactments affecting very different sections of the community were the Shops Act, restricting the hours of attendance of employees to 60 a week, and the Copyright Act extending protection for that form of property to 50 years after the author's death. A Trade Unions Bill designed to modify the effects of the Osborne judgment and to enable unions to raise voluntary levies for political purposes passed its second reading on May 30 by 219 to 18 votes. A limited Women's Enfranchisement Bill also passed its second reading in May by 255 to 88 votes. But enthusiasts for women's suffrage were infuriated by Mr. Asquith's announcement in Nov. of a bill to be introduced embodying the principle of adult male suffrage, and the close of the year was marked by an outburst of window breaking and other manifestations of suffragist militancy.

Resignation of Mr. Balfour.—These were the pin pricks of politics. More serious anxiety was caused by a series of railway and other strikes during the summer, for which its excessive heat and unusual length, the rise in prices and the unbending temper of employers were variously blamed. The strength of the Government's position seemed, however, hardly to be affected except by one or two by-election losses attributed to the Insurance Act, while on the other hand the Opposition was deeply divided by the die-hard schism and dissatisfied with its leadership. Tariff reformers resented Mr. Balfour's pledge to submit their policy to a referendum, and on Nov. 8 Mr. Austen Chamberlain said that a Unionist Government would embody it in a statutory form "without any further mandate, sanction or approbation." Mr. Balfour had resigned a few hours before, pleading advancing years and insufficient vigour to manage another administration.

The two most obvious candidates for the leadership were Mr. Austen Chamberlain and Mr. Walter Long, one representing the commercial and industrial elements in the party, the other its landed and aristocratic traditions. A contest was, however, avoided by the withdrawal of both in favour of Mr. Bonar Law, a Glasgow ironmaster whose membership of Parliament only went back to 1900 and whose experience of office was limited to the under-secretaryship to the Board of Trade from 1902 to 1906. Apart from his personal qualities, he probably owed his choice largely to his Canadian birth and education and to the fact that Canada's emphatic rejection of Laurier's Liberal Government and its tariff reciprocity with the United States at the general election in Sept. had given British tariff reformers greater cause to rejoice than any recent event in domestic politics.

Their other principal cause for satisfaction was the refusal of the House of Lords, by 145 to 53 votes, to give a second reading to the Naval Prize Bill, based on the Declaration of London. It had only passed the House of Commons by less than half the Government's normal majority (172 to 125), and although the Imperial Conference then sitting had, Australia dissenting, approved its principles, the proposal created great alarm as likely to endanger Great Britain's food supplies in time of war; and the action of the House of Lords saved the Government three years later from having to revoke a law in addition to acting against its principles.

The proposed reference to an international court at the Hague was in keeping with the movement towards arbitration expressed n treaties being negotiated with the United States; but these were eventually rejected by the Senate, and the omens were beginning in 1911 to point less towards the peaceful settlement of disputes than the arbitrament of war. In defending the naval estimates in March, Sir Edward Grey had deplored the increase n armaments which, if it went on, must in the end break down civilisation, though he thought it might be ended, not so much by war as by the revolt of the masses of men against taxation. He welcomed President Taft's pronouncements in favour of arbitration, and thought that public opinion might rise to it under the increasing pressure of armaments, that armies and navies might survive only as the police of the world, and that aw might take the place of force. But no one nation could stop the race for armaments by simply dropping out, which would give a spurt to expenditure somewhere else. The First Lord of the Admiralty, Mr. R. McKenna, opined that the new naval works at Rosyth might be completed by Sept. 1914, and the discussion turned on the probable distribution of naval strength about that time.

The Agadir Crisis.—The crisis threatened to come earlier. In May the disorder in Morocco induced the French to occupy Fez and on July 1, Germany announced the dispatch of a gunboat to Agadir. After a Cabinet meeting on May 5, Sir Edward Grey informed Count Metternich that the British Government could not disinterest itself in Morocco, and that until Germany's intentions were made known their attitude must remain one of reserve. There intervened "the period of silence" during which Germany said nothing to England but continued to bring great pressure to bear on France. On May 21 Mr. Lloyd George took the occasion of a speech at the bankers' annual dinner in London to make it plain, in diplomatic language, that if Germany meant war, she would find Great Britain on the side of France. Coming from the leader of the least imperialist section of the Cabinet, the speech produced a great impression. "The accession of Mr. Lloyd George," writes Mr. Churchill, "in foreign policy to the opposite wing of the Government was decisive. We were able immediately to pursue a firm and coherent policy." On May 25 Sir E. Grey received a communication from Germany "so stiff that the Fleet might be attacked at any moment;" the German Government refused to explain its intentions, and the British Mr. Lloyd George's speech. On Aug. 23, after Parliament had risen, the Prime Minister convened a secret and special meeting of the Committee of Imperial Defence. It sat all day and at its conclusion Mr. Haldane informed the Prime Minister that he could not continue to be responsible for the War Office without a new Board of Admiralty which would begin to organise a proper Naval War Staff and co-operate with the War Office. Mr. Churchill had already on May 13, while Home Secretary, drafted a sketch of the probable course of a war between Germany and Austria on the one side and France, Russia and Great Britain on the other which was accurate enough for him to reprint it in Sept. 1914; and in Oct. Mr. Asquith invited him to become First Lord of the Admiralty, Mr. McKenna taking his place at the Home Office.

Mr. Churchill was always a good barometer, though sometimes inclined to rise too fast. He subsequently admitted that probably Germany had no thought of war at that time; her Government made a "very friendly" communication to Sir Edward Grey on July 27 and considerable concessions to France during the Morocco negotiations. The incident, however, reverberated in war preparations, both naval and military, and in war scares throughout the autumn and provoked a good deal of criticism from the Labour and Radical benches when Parliament reassembled.

The critics found other, and perhaps more substantial, grounds for complaint in the effects of the Anglo-Russian agreement in Persia, where co-operation seemed to be turning into a dual control, destructive of that "integrity and independence" of Persia to which the two Powers were pledged by their agreement of 1907 and fraught with evil influence on the Mesopotamian campaigns of the World War. The atmosphere was not improved by Italy's sudden attack on Turkey and invasion of Tripoli which Turkey, having no navy, was in no position to defend; more pregnant with future problems was Italy's seizure of islands in the Aegean which the outbreak and consequences of the Balkan wars accidentally enabled her to retain. Meanwhile, in July, the Anglo-Japanese treaty was renewed till 1921, and Kitchener was appointed to succeed Sir Eldon Gorst in Egypt; and on Nov. 11 the King and Queen sailed to India to hold their coronation Durbar at Delhi in Dec. and there to announce the transference thither of the capital from Calcutta.

Early Events of 1912.—*Exit annus mirabilis* was *Punch's* legend on its last cartoon of 1911. Its first, in 1912, depicted the infant year being dragged into a dark wood haunted by goblins of Home Rule, Welsh Disestablishment, and Manhood Suffrage. It would have needed a more prophetic soul to descry the heroic tragedy of Captain R. F. Scott's Antarctic expedition, after discovering the South Pole on Jan. 18, the strike of coalminers in the spring, the "Titanic" disaster in April, the worst summer, from the climatic point of view, on record, and the outbreak of Balkan War in the autumn.

Mr. Bonar Law's Speech.—The new Unionist leader made his first appearance as such on the platform at the Albert Hall on Jan. 26, and signalised the occasion by what his opponents called "the new style" of political debate. His speech was a comprehensive denunciation of the Government, all its members and all its works. Mr. Churchill and Mr. McKenna had, he said, exchanged offices, probably to escape the consequences of failure. Mr. Haldane's army policy had been unsuccessful, and Mr. Lloyd George's speech on July 21 had roused enduring ill-will in Germany; the Government as a whole had introduced into England a "spoils system" from America, and the shock to public confidence was shown by the flight of capital. Uncompromising as the utterance was on domestic politics, the censure of Mr. Lloyd George's warning to Germany implied a desire for more friendly relations with that country, and the first few months of 1912 were marked by a reaction against the war talk which followed on Agadir.

Naval Rivalry.—This feeling was expressed by a meeting on Jan. 27, called by the Lord Provost of Glasgow, addressed by Sir Frank Lascelles, late ambassador to Germany, and blessed by Lord Rosebery. Similar sentiments were enunciated by the Bishop of Winchester at a diocesan conference on Jan. 31; and on Feb. 7 Mr. Haldane started on a mission to Germany on which he published a volume after the War. Two days later, Mr. Churchill, having, in defiance of threats which led to the concentration of 4,000 troops in Belfast, addressed a successful meeting in the Irish quarter of that city, crossed over to Glasgow and defined Anglo-German relations in terms which pleased his Unionist opponents as much as his Belfast speech had gratified his Home Rule friends.

Naval power was, he said, a luxury for them; to us it meant existence, to them it meant expansion. Great Britain could build ships faster, more cheaply and on a larger scale than any other Power. Whatever happened abroad there would be no signals of distress in Great Britain, but she would be the first Power to welcome and respond to any slackening of naval rivalry. The speech had not the remotest effect on Mr. Haldane's mission; this came to nothing, as he has explained, because the German Government demanded as the price of any agreement "a covenant of absolute neutrality" in case of war between Germany and France, from whatever cause it might arise; and all that he brought back on Feb. 12 was a confidential draft of a new German naval law containing a programme of construction and personnel far in excess of the rumours which had reached the British Cabinet.

The determining cause of this uncompromising attitude had been the German general election on Jan. 11, which had resulted in the return of the Socialists as by far the largest party in the Reichstag and in the first serious threat to the continuance of the form of government established in Germany by Bismarck. For, in spite of its manhood suffrage, Germany's administrations were responsible to the Kaiser and not to the Reichstag; and hitherto a bourgeois Reichstag had acquiesced in its subordinance. The effect of Socialist victories on the Government was therefore to cause it to react not to but against democratic opinion and to strive in the interests of self-preservation to improve its chances of success in war by which alone it thought it could postpone, if not avert, domestic revolution.

There was therefore no response to Mr. Churchill's suggestion for a slackening in naval armaments, and in introducing his naval estimates on March 18 while repeating his offer, he insisted upon the danger to the world of one nation adding a predominant fleet to an overwhelming army and upon the necessity to Great Britain of a fleet adequate for protection against the risk of defeat. His argument came in short to this; no naval superiority on the part of Great Britain could threaten Germany with invasion, while a German naval victory would paralyse the British Empire and expose Great Britain itself to conquest. It fell on deaf ears in a Germany which was not content with security, but regarded an overseas empire as its place in the sun.[1] In the same month, March 7, the Anglo-American and Franco-American treaties of arbitration were rejected by the Senate of the United States.

Strike of Miners.—Meanwhile the King and Queen had returned from India (Feb. 4), Sir Edward Grey had received the Order of the Garter, conferred on only four commoners before Feb. 13, and Parliament had been opened on the 15th. But it had barely disposed of the address when its attention was diverted from estimates and its legislative programme by a strike of coal miners which began on Feb. 27, and lasted for over six weeks. There had been a good deal of labour unrest for some time, due probably to the rise in prices, which itself was partly caused by additional taxation required to finance the Government's social reforms; the Chancellor had to budget for over £187,000,000 in 1912, double what it had been 20 years earlier.

The demand of the miners, now that hours of labour had been fixed at eight, was that wages should not fall below a minimum fixed by law. The coal owners adhered, on the other hand, to the principle of payment for work done, a principle which does not obtain in the Civil Service, the clerical and scholastic professions or even in most fields of labour. By March 4 about 1,000,000 miners had ceased work, and another 1,000,000 in other industries were threatened with consequential unemployment. On Feb. 28 the Government had proposed acceptance of the principle of minimum rates of wages varying according to districts and conditional upon safeguards against a diminution of output. Some of the coal owners still held out, while the inconvenience and, in some localities, distress increased; and on March 19 the Prime Minister introduced a Minimum Wage Bill on the lines he had already indicated. It was opposed as panic legislation and on a party division the second reading was carried by 348 to 225. A new conference failed; by the end of the month the Bill got through its remaining stages in both Houses without much opposition, and gradually the miners returned to their work.

The Suffragists.—The remedy of any grievance before their own was regarded by the militant suffragists as an additional grievance and insult; and the Government's acceptance of the minimum wage for miners on Feb. 28 was followed on March 1 by a feminine onslaught on the shop windows of the west end of London. Arrests and sentences to imprisonment were followed by further raids, and the raids by a weakening of support for the Conciliation Bill in Parliament. This was defeated on its second reading, March 28, by 222 votes to 208. Further outrages occurred, and on May 22 Mr. and Mrs. Pethick Lawrence and Mrs. Pankhurst were convicted at the Central Criminal Court of conspiracy and sentenced to nine months' imprisonment in the second division; they were, however, released in little more than a month on the ground of ill-health. The militant campaign continued in various forms, personal assaults on Ministers, attempts to burn churches and pose as martyrs and hunger strikes in prison; but its effect was to postpone the adoption by Parliament of any measure of women suffrage until towards the end of the War.

The Home Rule Bill.—Diverted by these episodes, it was not until after Easter that the first item in the Government's legislative programme, the Home Rule Bill, was introduced. Inasmuch as it never came into operation and, even as a proposal, was entirely superseded by the more radical Irish treaty of 1922, the third Home Rule Bill has merely a historical interest. Substantially the difference between it and the Irish treaty was that its constitutional arrangements were based on the relations between a Canadian province and the Dominion of Canada, whereas the treaty established between Southern Ireland and the United Kingdom the relations existing between the latter and the Dominion; in other words the Home Rule Bill treated the whole of Ireland as a province, while the treaty recognised part of Ireland as a Dominion. It was none the less fiercely resisted for that; and nothing would appear more irrational than the two years' turmoil over the bill contrasted with the ease and rapidity with which the treaty obtained Parliamentary sanction. The War and the Coalition, bitter experience and increasing wisdom do much to account for the contrast.

But there was a further reason inherent in the difference between the proposals. Ulster was excluded from the Ireland of the treaty, but included in the Ireland of the bill; and that attempt to force Ulster into a united Ireland was as fatal to the bill as it was illogical in a policy based on the impossibility of retaining Ireland within the United Kingdom. It was inconsistent with the Canadian precedents both for the bill and the treaty; the union of Upper and Lower Canada in 1841 had proved unworkable and had been abandoned, and no Canadian province that desired to keep outside the Dominion in 1867 was forced within its jurisdiction. The lesson was learnt in the end that Ulster, like Newfoundland, must be left, if she liked, to contract out of a Dominion; but the refusal to admit the force of the argument in 1912–4 brought a disunited Ireland and a dis-United Kingdom perilously near the argument of force.

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[1] *Cf.* B. Pascal, *Pensées* xxv., 34: "*Ce chien est à moi,*" *disaient ces pauvres enfants; "c'est là ma place au soleil." Voilà le commencement et l'image de l'usurpation de toute la terre.*"

Other Measures.—For eight months, on and off, sterile debate on the Bill occupied the time of Parliament and the energies of rival demonstrations in the country. Introduced on April 11 it was read a second time by 372 votes to 271 on May 9. It was not through committee until the second week in Dec., and the autumn session had to be prolonged into the new year for the report stage, third reading and rejection by the House of Lords. The intervals were partly occupied by discussion of the Welsh Disestablishment Bill, which had, at least, the merit of ultimately becoming law and causing less harm and friction than its critics had foretold. It was introduced by Mr. McKenna on April 23 and passed its second reading by 348 to 267 on May 16. The diminution in the Government's normal majority was due to the fact that, outside Wales, there was no great enthusiasm for it, and a number of Liberals disliked, not so much the disestablishment as the disendowment, of four dioceses of the church which assuredly were not rich. They had, however, little sympathy with the charge of sacrilege urged most vehemently by owners of lands which had once belonged to the church in England. The committee stage was not begun until Nov. 29 nor concluded till the following year. Similarly, the third Government bill of the session, proposing to abolish plural voting and university representation, was, after receiving a second reading on July 12, postponed with its committee stage and women suffrage amendments until 1913. Some days in July were also spent over Mr. Churchill's supplementary naval estimates, the foreign situation, and the causes of the "Titanic" disaster. Mr. Haldane meanwhile had left the War Office to become Lord Chancellor in succession to Lord Loreburn and had been created a viscount, while his under-secretary, Colonel J. E. B. Seely, succeeded to the headship of the department.

Outside Parliament a fusion was effected of the Conservative and Liberal Unionist organisations in May, and a serious strike of dockers began which lasted until August. Protests against the impending coming into force of the Insurance Act continue. The rank and file of the medical profession threatened to boycott it; the Albert Hall, London, was more than filled for a second time with indignant mistresses and maids on June 27; and the agitation only ceased when the agitators began to realise through practical experience what the Act was really like. The House rose on Aug. 8, and the vacation was principally marked by denunciation of the Home Rule Bill, and by the more impressive adoption of the Ulster Covenant in September. Mr. Bonar Law had justified resistance at a Unionist demonstration on July 27, and missiles were thrown by members in the House of Commons itself in a disorderly scene on Nov. 13. The pertinent comment was contained in a letter from Miss Christabel Pankhurst claiming that members could no longer deny to militant suffragists the right to assault Ministers and drown their utterances by vocal protests.

War in the Balkans.—But graver events than speeches or even missiles in the House of Commons disturbed the peace in the autumn. On Oct. 8, Montenegro suddenly declared war upon Turkey, which was still at war with Italy, and in a few days Serbia, Bulgaria and Greece followed suit. (*See* BALKAN WARS.) There had been careful premeditation, and in a rapid, combined and unexpectedly successful campaign the liberated Balkan peoples showed that they were masters of their fate, provided they were masters of their temper. The Turks were everywhere defeated until, in Nov., the Bulgars reached the Chatalja lines and confronted the problem of Constantinople and a forbidding concert of Europe. The Great Powers had helplessly threatened, before the Turks were beaten, to recognise none of the victors' accomplished facts.

They did not now propose to keep their word, but they proceeded, at the Conference of London in Dec., to inflame enmity among the victors lest their united advance should inflame it among the Great Powers themselves. None of them, with the possible exception of Great Britain and France, was prepared to see Constantinople in the hands of the Balkan League and the Adriatic dominated by Jugoslavs; and the restraint of these ambitions precipitated a conflict among the Balkan allies over the remnants of their spoils. It was a dubious credit to British diplomacy that it should, with Germany's hearty co-operation, have in London secured a brief prolongation of peace at the cost which was later paid in the course of the World War.

Domestic Politics Again.—New Year's day 1913 found the House of Commons engaged on the report stage of the Home Rule Bill. Sir Edward Carson's motion that Ulster be excluded from its operation was rejected by 294 to 197 and the third reading was carried on Jan. 16 by 367 to 257. On Jan. 27 its consideration was begun in the House of Lords, which rejected the motion for its second reading by 326 to 69 three days later. On the same day, by a singular coincidence, Londonderry city was won at a by-election by the Home Rulers from the Unionists, thus giving Home Rule 17 seats in the province of Ulster against 16 held by Unionists. Meanwhile, the Welsh Disestablishment Bill reached its report stage on Feb. 3 and passed its third reading by 347 to 240 on Feb. 5. It was discussed for three days Feb. 11–13 in the Lords and then rejected on its second reading by 252 to 51.

The Lords, however, passed the Trade Unions Bill, which had been for two sessions before the House of Commons; and, though the Scottish Temperance Bill was lost, it was rather through inadvertence than deliberate hostility. The Franchise Bill encountered a fiasco in the House of Commons; undertakings had been given that the Government as such would not resist amendments incorporating in the bill some form or other of women suffrage; but, when the first of these amendments came to be moved, the Speaker intimated on Jan. 27 that he must consider a bill so radically amended as a new measure, which could not be taken without a fresh introduction. The bill was accordingly withdrawn. The Commons adjourned on Feb. 14, and on March 7, Parliament was prorogued, to meet again for another session three days later.

Outside its walls the principal controversies related to Tariff reform, national service and woman's suffrage. On Jan. 2 a Lancashire deputation had pressed upon Mr. Bonar Law the Unionist objections, in that part of the country, to any taxes upon food, and after consultation with Lord Lansdowne he announced that it was not now the policy of the Unionist party to impose such duties "until they have been submitted to the people of this country at a general election." Tactically the decision was wise, but it was deplored by an influential section of the party, led by Mr. Austen Chamberlain, which regarded the taxation of food as the very foundation of any effective measure of Imperial preference, protection or relief from the burden of direct taxation; from that source, too, they looked for the revenue to promote social reform, which Conservatives would not support if it depended upon a heavy income tax.

This domestic controversy lasted throughout the year and materially impaired the power of the Unionist party to combat effectively the legislative proposals of the Government. Another topic on which Unionists were more divided than Liberals was national service, in the interests of which Earl Roberts conducted a six months' campaign. His great services and popularity neutralised to some extent the objections to his plan, namely that it contemplated only home defence, which necessarily depended upon the navy, and made no provision for expeditionary forces; Lord Roberts' own belief that an army, compulsorily raised for home defence, would volunteer for foreign service, could hardly be used as an argument without provoking the retort that his proposal was really to provide an army for foreign service out of the need for home defence.

The Suffragists Again.—The fiasco over the Franchise Bill not unnaturally infuriated the militant suffragists, who felt that they had been betrayed; and there followed at once a renewal of the campaign of outrage which grew more intense as time went on. It was logical enough as a retort to the arguments that women should not vote because they could not fight and that government in the last analysis rests on force as its foundation. The outrages on property and persons were followed by arrests and imprisonment; to this the militants responded by hunger striking, and the Government replied by forcible feeding, an expedient which disgusted a number of its supporters.

To meet the difficulty the Home Office devised what came to be known as the "cat and mouse" bill; prisoners whose health was impaired by hunger striking might be released on conditions by the Home Secretary, and then rearrested without further warrant or trial if they broke the conditions and resorted to outrage. The bill was passed by overwhelming majorities (296 to 43 on its second reading) in April, but it had apparently little effect in diminishing or even retarding the development of the campaign; and the day after the second reading Mrs. Pankhurst was sentenced to three years' penal servitude for inciting a bomb explosion which wrecked Mr. Lloyd George's unfurnished house at Walton Heath in Surrey.

A fresh impetus, indeed, was given it by the rejection on May 5, by 267 to 219 votes, of the Women's Suffrage Bill, which had been introduced as a separate measure to repair the fiasco of the amendments to the General Franchise Bill in January. It proposed to enfranchise 6,000,000 women, and its liberality was no doubt responsible for the fact that the minority in its favour consisted mainly of Liberal and Labour members, while the majority against contained twice as many Unionists as Liberals. The issue was really decided by the 54 Nationalists who voted against the Bill from motives quite unconnected with its merits. On the following afternoon one of the finest of South London churches, St. Catharine's, Hatcham, was destroyed by militant incendiarism, and a bomb was found under the bishop's throne in St. Paul's Cathedral.

Important Legislation.—Most of the legislation promoted in the session of 1913, which began on March 10, proved equally abortive. The Home Rule Bill was reintroduced on May 7 and read a second time, by 368 to 270 votes, on June 9. The committee and report stages were, in order to secure the benefit of the Parliament Act, reduced to mere formalities and the bill passed its third reading on July 7. The Lords debated its second reading for two days, and then declined, on July 15 by 302 to 64 votes, to proceed any further with the bill "until it has been submitted to the judgment of the country." The Welsh Disestablishment Bill followed it through the same ritual to the same sacrifice, a week later, July 22. The Plural Voting Bill was slaughtered on a somewhat different plea: after an attempt to preserve a second vote for university graduates had been defeated the bill was read a third time in the Commons on July 14 by 293 to 222 votes.

The House of Lords on July 24 refused by 166 to 42 votes to proceed with it, not until it was submitted to the judgment of the country, but on the ground that it dealt with only one electoral anomaly when there were so many others. The policy, if any, underlying this discrimination was not very obvious unless it implied a claim by the Lords to refer to the country whatever bill they thought might thus be defeated, and to defeat by their own authority whatever bill might pass the popular test. The Scottish Temperance Bill, however, which had also been reintroduced and passed by the Commons, was accepted, after some modifications, on July 31 on the ground that it was a local measure and was apparently desired by the Scottish people.

The Budget.—The Budget was slightly delayed by a judgment obtained from the Court of King's Bench to the effect that the resolution of the House of Commons, in virtue of which new duties were usually collected pending the passing of the Finance Act, was not sufficient authority for the collection of income tax; and a Provisional Collection of Taxes Bill, which did not, under the Parliament Act, require the assent of the House of Lords, had to be passed to remedy the defect before the Budget was introduced. It imposed no fresh taxation although the estimates had risen to £195,000,000. The past year, claimed Mr. Lloyd George, had been the most prosperous British trade had ever known, despite the coal strike, the bad harvest and the Balkan War; and he looked to a further increase in the revenue to counterbalance the increased expenditure.

The Marconi Episode.—The Budget provided little material for party warfare compared with the Marconi episode, which bulked so large in the public eye during the summer of 1913 that one of the most moderate of Unionist journals lamented that so much time had been spent over the insurance agitation which should have been devoted to the Marconi "scandal." The gist of the charges in some Unionist journals was that Ministers, notably the Attorney-General (Sir Rufus Isaacs) and the Chancellor of the Exchequer (Mr. Lloyd George) had been guilty of corrupt practices in connection with the Government contract with the British Marconi Co., the managing director of which was the Attorney-General's brother. The editor of *The New Witness* was condemned in an action for libel, but the legal proceedings covered but part of the ground occupied by the fertile weeds of suspicion; and a committee of the House of Commons spent many months examining witnesses and probing the charges, only to produce four more or less discrepant reports and some inconclusive debates in the House. One at least of the Ministers had indulged in a "flutter" which was indiscreet in a Chancellor of the Exchequer, but their dealings had been in the shares of the American Marconi Co. which had no connection with the British Company and no contract with the British Government. All the committee's reports declared that the charges of corruption were false, and none accused the Ministers of anything worse than indiscretion in act and reticence in speech, which they admitted themselves. The best answer lay perhaps in the subsequent careers of Sir Rufus Isaacs as Lord Chief Justice and Viceroy of India, and of Mr. Lloyd George as Prime Minister and head of a Coalition which included opponents who had viewed his conduct unfavourably in 1913.

National Insurance.—Both the Chancellor of the Exchequer and his critics might congratulate themselves on the comparative ease with which his National Insurance Act was amended before the end of the session. The amendment took the form of extension in two directions: full benefits for employed contributors were extended from 50 to 70 years of age and full medical benefits for all insured persons to the end of their lives; and additional grants were provided for medical service. These emollients hastened the decease of the medical boycott, and the amending bill, which had been referred to a standing committee, passed its report stage on Aug. 6 and was accepted by the House of Lords before Parliament was prorogued on Aug. 15.

A Proposed Naval Holiday.—In introducing the naval estimates in March Mr. Churchill had asked why all the Powers concerned should not take a "naval holiday" in construction for a year, but Germany regarded the suggestion as impracticable since Great Britain, being able to build a warship in two years while it took Germany three, could make up arrears a good deal faster; and in July Mr. Churchill announced an acceleration in British construction, attributing it, however, to the defeat in May of the Canadian Naval Aid Bill by the Canadian Senate, a Liberal second chamber which had not yet been affected by Mr. Borden's Conservative victory at the Canadian general election in the autumn of 1912.

Another of Mr. Churchill's announcements related to the substitution of oil for coal as the fuel for the British Navy, stimulated partly by the coal strike of 1912 and the determination of the Admiralty to become ultimately the independent owner and producer of its own supplies. For the time being it must rely to a large extent on Mexican oil, in which Lord Cowdray was largely interested and to which the chief Liberal whip (Lord Murray of Elibank), after resigning that office, devoted much of his attention. The policy subsequently had its reverberations in Mesopotamia.

Foreign Relations.—International relations were less strained apart from the Balkans, than they had been in 1911–2. In May the King and Queen visited Germany on the occasion of the reconciliation of the Guelph and Hohenzollern feud by the marriage of the Kaiser's only daughter to Prince Ernest Augustus of Cumberland, and in June President Poincaré had a notable reception in London. Lord Haldane's visit to Canada in Aug., to address the annual meeting of the American Bar Association at Montreal, necessitated the unusual step of putting the Great

Seal in commission and illustrated English speaking friendliness; but the visit in Nov. of the heir presumptive to the Austrian Empire, the Archduke Franz Ferdinand, and his morganatic wife, attracted less attention that it would have done had people known what the future had in store.

The Balkan situation was ominous enough, and it would have seemed more so had it been known that Austria sought the connivance, if not the co-operation, of Italy in an attack upon the too-triumphant Serbia. The Peace Conference of Balkan States in London broke down on Feb. 1, and the Balkan War began again. The Crown Prince of Greece occupied Yanina early in March and King George of Greece was assassinated at Salonika on March 18. The Bulgars got to Bulair, on the Sea of Marmora, early in Feb. and captured Adrianople, with 30,000 prisoners, on March 25. Scutari (Skodra) alone held out, and that was because it was neither Turkish nor Yugoslav but Albanian, and the Powers were bent on applying the doctrine of self-determination to the extent of creating an independent Albania. A naval demonstration gave point to their determination, but Scutari, nevertheless, capitulated to Montenegro on April 22.

A second London Conference opened on May 20, but it could not restrain the animosities which broke out among the Balkan victors. Bulgaria, threatened with the loss of much of her spoil, took the offensive against Serbia; Greece and Rumania took the Serbian side, and even Turkey rejoined the fray in July. Bulgaria was hopelessly outmatched and had to submit to a settlement by which she lost Adrianople and Macedonia and acquired a grievance which led her to intervene with disastrous results in a greater war two years later.

Trouble in Ireland.—War seemed to threaten nearer home than the Balkans in the autumn of 1913. Arms were being stealthily imported from Germany into Ulster, and a provisional government for that province was organised in September. The intention was not to resist the establishment of a Home Rule government in Dublin, but to resist its authority over Ulster, and the leaders of the movement had some grounds for their conviction that in such a conflict no British Government could coerce them. Lord Loreburn, the Liberal ex-Lord Chancellor, issued an appeal that month for a conference on Home Rule, and on Dec. 17 Sir Edward Grey said, at Alnwick, that the door was still open for a settlement by consent as regarded Ulster; behind the appearance of no-compromise on both sides, both parties came down in the following year to disputes over the frontier of the Ulster that was to be exempt from the Irish parliament. Mr. Lloyd George meanwhile was concentrating his energies on a fresh land campaign in view of the dissolution, which would normally come not later than the winter of 1914–5, and of the very mild proposals which Lord Lansdowne had put forward in July.

The session of 1914 did not, however, open until Feb. 10 and Jan. oratory had thrown cold water on the prospects of Irish accommodation, Mr. Redmond declaring that Ulster would make no concession and Mr. Bonar Law asserting that the conversations had come to nothing. The King's Speech, indeed, admitted that they had "so far not succeeded." An identical amendment to the Address was accordingly moved in both the Houses declaring that it would be disastrous to proceed further with the Home Rule Bill until it had been submitted to the judgment of the people; it was carried in the Lords by 243 to 55 and rejected in the Commons by 333 to 255. Five days later a similar amendment to the address was moved with reference to Welsh Disestablishment and defeated by 279 to 217.

On the second reading of the Home Rule Bill (third time of asking) Mr. Asquith explained the concessions the Government was prepared to make. Any Ulster county (Belfast and Londonderry being regarded as counties for this purpose) might, immediately after the enactment of Home Rule and before it came into operation, vote by ballot for its own exemption, such exemption to expire at the end of six years unless the Imperial Parliament otherwise determined. Mr. Redmond agreed to this proposal, but Mr. Bonar Law declined unless there were further concessions to follow, and Sir Edward Carson demurred to a reprieve which might last no longer than six years. Nevertheless, the difference between the two parties seemed to be reduced to a narrowness incommensurate with the agitation, anger and anxiety which followed; and it appeared, from the speeches on the vote of censure moved by Mr. Bonar Law on March 19, that the main concern was less to exclude the Ulster counties from a hypothetical future incorporation in a united Ireland than to exclude the accumulated legislation of the Government from the impending benefits of the Parliament Act, for his suggestion was once more that not only the new proposals but the bill should be submitted to a referendum; and it was obvious that, if this argument and the threat of forcible resistance were admitted with reference to Home Rule, it could and would be applied to the other bills awaiting enactment without the consent of the House of Lords. The motion was rejected by 345 to 252 votes; Sir Edward Carson went off to Belfast, and on March 21 the Chancellor of the Exchequer attacked at Huddersfield the whole idea of Ulster exclusion.

The Affair at the Curragh.—Two days later it was announced that a number of army officers stationed in Ireland at the Curragh had tendered their resignations rather than face the duty of executing orders which they feared might be given them. Measures, both naval and military, had in fact already been taken to protect military stores against possible raids by Ulster Volunteers, but the resignations seem to have been tendered under the impression that these measures were designed to initiate military operations against Ulster rather than to maintain order, a duty which the officers were prepared to accept. When they were reassured they returned to their posts.

But this reassurance alarmed the civilian mind. The Labour party at once pointed the moral by the syndicalist appeal to troops to refuse to obey orders to suppress a strike; and Mr. J. H. Thomas declared that, if the Opposition doctrine held good, it would be his duty to tell railwaymen to organise their forces and spend their capital in the purchase of arms and ammunition. The alarm was increased by the publication of a minute of the Army Council initialled by Col. Seely, Sir John French and Sir Spencer Ewart, implying a discretion invested in officers as to what orders they should obey. All three resigned, and Mr. Asquith evoked great enthusiasm from his supporters by taking upon himself the vacant Secretaryship for War and vindicating thus the subordination of the military to the civil power. His appointment vacated his seat, but he was returned without a contest by his constituents on April 8.

The Home Rule Bill.—The second reading of the Home Rule Bill was taken during Mr. Asquith's absence, and Sir Edward Grey, who led in his place, while refusing to go beyond the six years' exemption, suggested the possibility of a federal solution. The bill was read by 356 to 276 votes on April 6. After the Easter adjournment, the second reading of the Welsh Disestablishment Bill was taken on April 20–21 and carried by 349 to 265. During the next three days the King and Queen returned President Poincaré's visit and had an enthusiastic reception in Paris. The Plural Voting Bill was read a second time on April 27, and on April 28 the Unionists moved for an enquiry into "the plot to coerce Ulster."

The point of the motion was somewhat blunted by the news that 35,000 rifles and 3,000,000 cartridges had been landed at Larne on the night of April 24–25 and distributed by motor lorries and motor cars throughout Protestant Ulster. In spite of mutual recriminations about the rival "plots," conciliatory speeches were made by Mr. Churchill, Sir Edward Carson, Mr. Bonar Law and Mr. Asquith; but on May 12 Mr. Asquith announced that any settlement with Ulster must take the form of a separate amending bill; for, of course, the Home Rule Bill by amendment would lose the benefit of the Parliament Act; and, further, the idea was to make the government of Ulster "Home Rule within Home Rule," a subordinate and not a co-ordinate part of their scheme. The bill was reported on May 21 and read a third time by 351 to 274 on May 25.

The Lords gave it a first reading on June 7, but refused to proceed further until the amending bill was produced. This was introduced by Lord Crewe on June 23, and, no agreement having been yet reached, it simply embodied the Prime Minister's offer on March 9 of allowing Ulster counties to contract out. The Lords, however, gave it a second reading on July 2—the day on which Mr. Joseph Chamberlain died—and on July 8 began to amend it by excluding the whole of Ulster, without any ballot, from the operation of the Home Rule Bill; other amendments transformed the amending bill which was read a third time on the 14th. On July 20 Mr. Asquith announced that the King had summoned a conference of eight delegates, with the Speaker as chairman, at Buckingham Palace. The locality protected the Conference from the intrusion of the Press; nevertheless, after four meetings, the Speaker reported that it had been unable to agree either in detail or principle. The further prosecution of the quarrel was interrupted by Austria's declaration of war upon Serbia on July 28, which put into some sort of perspective the parochial nature of the Irish dispute.

Parliament in July 1914.—Meanwhile, the Welsh Disestablishment Bill passed the Commons for the third time on May 19, and on June 25 the House of Lords delivered its last blow at the measure; it took the interesting form of a refusal to proceed pending the report of a select committee into the historical question whether the constitution of the Convocations of the Church of England had ever been altered by Act of Parliament without their own consent; but the implication that Parliament was precluded from passing any measure which it had not passed before was not a convincing political argument. On July 15 the Plural Voting Bill came before the Lords: its second reading was postponed without any periphrasis, for, unlike the Home Rule and Welsh Disestablishment Bills, it had not yet come to its third time of asking.

The Budget of 1914.—The Budget was interesting as the last before the World War, and the lightest that generation was likely to see. That did not prevent some of its taxes from being heavier than ever before, nor preclude the taxpayers from lamenting, in *Punch's* words, that this was "not milking, but murder." The revenue had expanded beyond even the Chancellor's expectations, the increase amounting to over £9,000,000; but he had supplementary estimates to meet, and further demands would be made by the reforms he proposed. The total required was nearly £206,000,000, and increased taxation would be needed to relieve municipal rates of some of the burden in which municipal authorities were involved by the fresh duties Parliament had put upon them; the education grant was to be reconstituted on the principles recommended by the Kempe committee which had reported in March.

The tax on incomes between £1,000 and £1,500 was therefore to be raised to 10½d., on £1,500 to £2,000 to 1s., on £2,000 to £2,500 1s. 2d., and over £3,000, 1s. 4d.; the highest rate of super-tax was also raised to 1s. 4d., though reduced in committee to 1s. 3d. The Speaker, however, ruled on June 22 that a finance bill must be limited to the imposition of taxation, and the bill was therefore divided into two parts, with the result that the temporary grants to local authorities were not made that year. The Finance Bill passed on July 31; the Revenue Bill was postponed until the new session. The naval estimates had risen to £51,550,000, an increase of 70% during the Government's eight years' tenure of office; criticism of this expenditure was effectually silenced before the session ended.

II. THE WAR PERIOD

The Great War came as a thief in the night upon the country at large. The murder of the Archduke at Sarajevo on June 28 had not greatly disturbed men's minds, and even the Cabinet had no thoughts of immediate danger from that source until, at the conclusion of its meeting on Friday, July 24, news came of Austria's ultimatum. Sir E. Grey's efforts to promote a pacific settlement of the dispute belong to the history of Europe and of the World War (*see* EUROPE). The precaution was taken during the week-end by Mr. Churchill and his First Sea Lord, Prince Louis of Battenberg, of countermanding the dispersal of the fleet assembled for a great naval review at Spithead on July 18, and on July 27 it proceeded quietly to its war stations in the North Sea, the German fleet having withdrawn from the Norwegian fiords on the previous day.

But even after Austria's seizure of Belgrade on July 28 there was little idea in the popular mind that anything worse than another Balkan war was afoot, and the Russo-German declarations of war on Aug. 1 did not reveal to the British public the western implications of the conflict. That came with the crossing of the frontiers of France and Luxemburg by German troops on Sunday, Aug. 2, and the dispatch that afternoon of mobilisation orders to British naval reservists. The Cabinet itself was still undecided, a circumstance which might be alleged to prove that England's hands were still free. In point of fact no country's hands are free; its action depends upon that of others, and it was Germany's action which made up the mind of the British Cabinet and people and determined the issue of the War before it was begun.

Britain at War.—Late that evening Germany informed the Belgian Govt. of her intention to violate Belgian neutrality, and at 7 A.M., on Monday Aug. 3, Belgium appealed to Great Britain. There could be but one reply, and there never has been an answer to King George's question to Mr. W. H. Page, the American ambassador: "Good God, sir, what else could we do?" Whether Great Britain would have intervened in the War had Belgium been left at peace is another matter; but there can be little doubt that, had Germany confined her attack to Russia and stood on the defensive in the West, she would have won the War with comparative ease. If France had attacked her, Italy would have been bound by the Triple Alliance to side with Germany and assuredly would not have come into the War on the other side; nor would the United States, while Great Britain, if she intervened at all, would have done so under another Government and with a mind so divided as to destroy her best chance of success.

It was Germany's subordination of moral principle to military advantage that set the world against her from the start; and serious division in the British Cabinet was solved by her attack on Belgian neutrality, which she, as well as Great Britain, was pledged to observe. Lord Morley, whose retirement could not have been long delayed in any case, resigned, as did another Cabinet Minister, Mr. John Burns and Mr. C. P. Trevelyan, secretary to the Board of Education, for different reasons. Some Radicals and Labour M. P.'s remained unconvinced because they hated war in general; but that was no answer to the specific question put by the Belgian Govt., and Sir E. Grey, in a speech described by Lord Lansdowne as one of "rare courage," carried the vast majority of the House with him on Aug. 3. The Unionist leaders assured the Government of their whole-hearted support. Germany invaded Belgium on Aug. 4 and Great Britain declared war that night.

With the outbreak of war, party differences ceased and political history shrank to a tenuous stream. The truce was illustrated by the appointment, amid universal acclaim, of Lord Kitchener as Secretary of State for War; he could not be expected to commit himself on such questions as Home Rule and Welsh Disestablishment, and it would have been more in accordance with the fitness of things had the Government refrained from insisting on placing those measures on the statute book under the Parliament Act in September. Their execution was, however, postponed till the end of the War by a suspensory Act which simultaneously received the royal assent; and the World War was undisturbed by the domestic dissensions which had marked the war with revolutionary and even Napoleonic France a century earlier.

Early Days of the Struggle.—There was no organised British party pressing throughout for peace, and the pacifists were simply individuals, some of them distinguished, without an organ in the Press, or a platform in the country: even Mr. Ramsay MacDonald found little support in the party he had once led. Such agitation as arose was not for peace, but over the methods and means of carrying on the War. It might have been different had a gradually waning strength in the enemy produced an accommodating temper and afforded an opening for a negotiated peace. But Germany resembled Oliver Wendell Holmes's "one-hoss shay," which was so perfectly organised and its parts so equal in strength that none broke down until the whole collapsed into a heap of dust; and Germany's position remained imposing and her Government intractable until complete ruin overtook them between Aug. and Nov. in the fifth year of the War. The military efficiency which betrayed Germany into war betrayed her also into ultimate collapse. She, too, learnt that under modern conditions, Governments, however autocratic, can maintain themselves in war only so long as success commends them to their subjects.

The reaction to ill-success was more rapid in more democratic countries, all of which changed their governments once or more during the War, England twice and France half a dozen times. There was a natural tendency to attribute individual mishaps to espionage or treachery and the postponement of victory to the incompetence of the Government; and as time went on popular psychology accepted the view expressed by a comparatively sober journal that in the case of mistakes soldiers were never, generals sometimes, but Ministers always, wrong.

The first serious criticisms, however, which affected the course of political history related to the inadequacy of munitions and the policy of the Dardanelles expedition. Men had been the first need of the War, but in the autumn of 1914 they were volunteering faster than they could be clothed or armed, and the demand for conscription met with little response. Nor was it the lack of rifles that produced the crisis over munitions, but a need which arose from the change in the War, after the failure of the German invasion of France, from one of movement to one of positions.

On the Western Front the opposing forces had come to a deadlock of lines stretching from neutral Switzerland to the British-commanded sea; and the Germans, with a forethought characteristic of them, spent the winter in constructing defences, novel in their intricacy of barbed wire and trenches, which could only be overcome by high explosives and heavy guns. The French took naval guns from their ships to meet the need and even criticised the British for not following their example when every naval gun was needed to maintain that command of the sea on which the fortune of the Allies depended. The problem was brought home acutely by the failure at Neuve Chapelle (March 10–12 1915) of the first deliberately planned offensive by the British, and it was natural, even for the commander-in-chief, to subordinate its other causes to the lack of adequate artillery preparation and that in its turn to inadequacy of munitions. This explanation was communicated to others in England besides the authorities, and by April the first serious political agitation against the Government during the War was in full swing.

The Dardanelles Operation.—This coincided with another dissension of which, however, little was known outside the Cabinet, though it had reference to a divergence of opinion which lasted almost throughout the War. The stabilisation of an impregnable front from the Alps to the sea inevitably suggested to strategical minds the idea of at least exploring the possibility of turning that front by means of the British command of the sea. Lord Fisher, whom Mr. Churchill brought back to the Admiralty as First Sea Lord to replace Prince Louis, who had been the subject of a campaign of calumny, had ideas of outflanking the land front by a naval incursion into the Baltic. The entrance of Turkey into the War (Oct. 1914) suggested to Mr. Churchill the feasibility of an attempt on the Dardanelles, and in Jan. 1915 he was actively engaged in an effort to convert or commit the Cabinet to his point of view.

There is now little doubt that, if the Allies had put into the Dardanelles campaign the forces and the energy they wasted on ineffective offensives on the Western Front during 1915, the Dardanelles could have been forced, Russia relieved, the Balkans brought solidly into the Allied scale, and Central Europe beleaguered on all sides. But the Cabinet was committed inch by inch, first to a naval and then to a military attack without being really converted to either. The real obstacle to, and criticism of, the strategy lay in the fact that the eyes of France were naturally glued on a front which lay almost wholly in France and not many leagues from its capital; and nothing would persuade her to risk her own defence by turning the speculation in the Dardanelles into a major operation.

The First Coalition.—Lord Kitchener, naturally more in touch with French military opinion than Mr. Churchill, was impressed by this objection; but the breach came between the First Lord and his expert adviser, Lord Fisher, who felt that he was being dragged by a politician where as a seaman he did not want to go. He resigned on May 15, and his resignation, coupled not only with the outcry about munitions and journalistic attacks on Kitchener, who was rewarded with the Garter, but with the threat of formal Opposition censure, convinced Mr. Asquith that the Government could not go on without broadening its foundations.

From the party point of view it would have been more prudent to resign and leave to others the conduct of the War, which would not have been materially abbreviated thereby, and the consequent burden of discontent with its leaden progress. But vital interests demanded a Coalition, and Mr. Asquith succeeded in enlisting all parties, save the Irish Nationalists. He remained Prime Minister himself, and Sir E. Grey Foreign Secretary: but Lord Lansdowne entered the Cabinet without portfolio, Mr. Balfour succeeded Mr. Churchill, who was reduced to the civilian sinecure of the Chancellorship of the Duchy of Lancaster, Mr. Bonar Law became Secretary for the Colonies, Mr. Chamberlain for India, Mr. Long President of the Local Government Board, Lord Curzon Lord Privy Seal, Sir Edward Carson Attorney-General and Mr. F. E. Smith, afterwards Earl of Birkenhead, Solicitor-General. Labour was represented by Mr. Arthur Henderson at the Board of Education, and Mr. Lloyd George took over the new Ministry of Munitions. Lord Haldane was sacrificed to popular clamour arising from the conviction that anyone who could speak German could not be an Englishman at heart; with the exception of Lord Fisher, he had done more than any other single man to arm his country.

The Question of Men.—The new Government, by its comprehensiveness, disconcerted the making of party capital out of the greater disappointments which followed in the summer and autumn, the rout of Russia, the failure of the Dardanelles campaign and of the French and British offensives on the Western Front, the entrance of Bulgaria into the War on Germany's side and the consequent over-running of Serbia; and the principal topic of civil dissension was the question of conscription. The idea of universal compulsory military foreign service was a complete novelty in English history, medieval military service being limited to those who held land on that condition in lieu of rent or other service, and the more general obligation to assist in keeping the peace and repelling invasion being limited to shires in which men lived. Even on the European Continent conscription was supposed to be limited to home defence; in Australia, where service at home was compulsory, similar service outside the Commonwealth was twice rejected on a referendum during the War, and it remained limited to the same extent in the Channel Islands. The Territorials, whose obligation was similarly restricted, had, however, almost all volunteered and been employed for foreign service; and the exigencies of the War led to the use of such arguments as that home defence involved the defence of Belgium and France as well as any part of the British Empire, and that the obligation could even be read into medieval precedents. The former argument was later on used by the French as a plea for cancelling their debt to England on the ground that they supplied the bulk of the forces fighting in France for England's defence.

It was, however, wisely recognised that the thing, if done at all, must be done by Act of Parliament, and, before resorting to that, Lord Derby was employed to obtain the maximum output from voluntary recruiting. His campaign in the autumn left too large a residuum of unrecruited men whose best justification was that they had domestic claims of which they could judge, while only the Government could judge the number of men required for service abroad, and therefore it was for the Government to take the responsibility by introducing conscription.

Conscription.—The first bill, which excluded married men, was introduced on Jan. 5 1916. Sir John Simon, the Home Secretary, resigned the day before, the Labour Ministers also tendered their resignations, and the Irish Nationalists avowed their opposition, notwithstanding the exclusion of Ireland. But on the second reading Mr. Redmond announced that they would not continue their opposition, the Labour Ministers withdrew their resignations, and the bill was carried by 431 to 39. It became law on Jan. 27, but did not satisfy military demands, and after a good deal of ministerial disagreement a fresh bill was introduced and discussed in secret sessions of both Houses of Parliament. It, too, proved unacceptable as a mere instalment, and on May 3 the Prime Minister introduced a third bill making all men, married or single, between the ages of 18 and 41, subject to compulsory enlistment. It was read a second time by 328 to 36 on May 4, and a third by 250 to 35 on May 16 and passed by the House of Lords within a week. Local tribunals were set up to determine claims for exemption on medical grounds, for family reasons, or on account of the national importance of civil work; most of the exemptions were granted for workers on the land or in munition factories.

Causes for General Uneasiness.—Dissatisfaction with the progress of the War soon found other grounds of complaint, and candidates began to appear at by-elections with unofficial newspaper backing against the Coalition Government. The principal objection to a Coalition is that it releases critics from the restraint and responsibility which a front Opposition bench normally imposes on its followers, and the principal motive for criticism was the insular pride which could only account for German success by the poor quality of British leadership. Hopes for the long-expected offensive on the Somme tempered this discontent for a time; but the Irish Rebellion at Easter, ambiguity about the battle of Jutland (May 31), whence the German fleet escaped with losses inferior to those inflicted on the British Navy, the loss of the "Hampshire" with Lord Kitchener on board (June 5), disappointment with the apparently meagre effects, in spite of the tanks, of the sanguinary fighting on the Somme (July–Oct.), and official reticence about the casualities provoked doubts of ultimate victory, which were reflected in views believed to have been communicated by Lord Lansdowne to his colleagues but not published until a year later in a letter to *The Daily Telegraph.*

Their existence was presumably responsible for an interview given by Mr. Lloyd George to an American journalist in Oct., in which he declared that Britain had only begun and that "the fight must be to a finish—to a knock-out." But the next episode was the ruin of Rumania (Nov.), the third little ally to be overrun by the enemy. Mr. Lloyd George termed it a "blunder" two months later without specifying whose; but the British public, having no other Government which it could call to account than its own, ascribed to it the failure of Russia to help a neighbour from which the other Allies were completely cut off.

The Crisis of Dec. 1916.—It was not, however, the public nor even the House of Commons which precipitated the political crisis in December. On Dec. 1 Mr. Lloyd George, who had succeeded Lord Kitchener as Secretary for War, intimated to Mr. Asquith that he could not continue unless the supreme direction of the War was entrusted to a new War Committee consisting of himself, Sir Edward Carson, Mr. Bonar Law and a Labour member, but excluding the Prime Minister. Mr. Asquith demurred; on Dec. 5 Mr. Lloyd George resigned, Mr. Asquith followed suit, and the King sent for Mr. Bonar Law, who found himself unable to accept the task of forming a Ministry.

Mr, Lloyd George as Premier.—It therefore fell to Mr. Lloyd George, who had already secured the co-operation of the Unionist leaders, except Lord Lansdowne, and gained that of most of the Labour party and some of the Liberals, to undertake the task; none of the Liberal members of Mr. Asquith's cabinet, however, transferred their allegiance at that time to the new Prime Minister, though all gave a general support to the new Government. It was a novelty in various respects, though the Prime Minister, now changed, remained at the head of the War Committee, which was reduced in number from seven to four, and all the four were politicians, with the possible exception of Lord Milner, and one of them, Mr. Henderson, was selected for purely political reasons. The radical change consisted in the supersession of the Cabinet by its War Committee, which became the War Cabinet without any sort of responsibility to other Ministers, and was at times expanded into the Imperial War Cabinet. The other Ministers were reduced to the position of heads of departments. The novel situation was clearly expressed by Sir Robert Borden in a speech delivered in London on April 3 1917, and quoted by the War Cabinet in its *Report for the year 1917* (*Cd.* 9005, p. 8).

> For the first time, he said, in the Empire's history there are sitting in London two Cabinets. . . . Over each of them the Prime Minister of the United Kingdom presides. One of them is designated as the "War Cabinet," which chiefly devotes itself to such questions touching the prosecution of the War as primarily concern the United Kingdom. The other is designated as the "Imperial War Cabinet," which has a wider purpose, jurisdiction and personnel. To its deliberations have been summoned representatives of all the Empire's self-governing Dominions.

This "Imperial War Cabinet" held fourteen meetings between March 20 and May 2 1917, but was then reduced to meetings which Mr. Lloyd George hoped would be "annual" in peace as well as in war, and eventually subsided into the Imperial Conference. The "War Cabinet," on the other hand, held more than 300 meetings in 1917; and, as it states in its *Report* (no other was issued than that for 1917), "this fact in itself indicates the great change which has taken place in the work of the Cabinet": when it refers thenceforth to "the Cabinet," it means the War Cabinet, its expanded session being designated as the "Imperial War Cabinet," and no other being mentioned. Its chart, "showing the administrative organisation of the British Govt.," represents "the War Cabinet sitting as a permanent body, the Imperial Cabinet meeting periodically and the Ministers with portfolios." Lord Curzon, the leader of the House of Lords, was included, but there was only a sort of liaison officer between this War Cabinet and the House of Commons in the person of Mr. Bonar Law, who occasionally attended the War Cabinet and led the House, from which Mr. Lloyd George as a rule absented himself.

Other important innovations consisted in having a Prime Minister who was leader of neither House, and heads of great departments who were not members of Parliament at all. The old Cabinet system ceased in fact to exist; the War Cabinet was a dictatorship, other Ministers became too numerous for any collective responsibility or activity and had little voice in general policy. As heads of departments, some of them achieved conspicuous success, notably Mr. R. E. Prothero (afterwards Lord Ernle) at the Board of Agriculture, and Mr. H. A. L. Fisher at the Board of Education.

Changes in Personnel.—Changes in the personnel of the Ministry followed one another with bewildering rapidity. The War Cabinet itself was increased to the number (seven) of the War Committee under Mr. Asquith's régime by the addition of Sir Edward Carson and General Smuts and the regular inclusion of Mr. Bonar Law; Mr. Barnes succeeded Mr. Henderson in Aug. 1917, and Mr. Chamberlain Lord Milner in April 1918. In the previous Cabinet positions Mr. Montagu succeeded Mr. Austen Chamberlain at the India Office, Mr. Churchill succeeded Dr. Addison at the Ministry of Munitions, and Sir Eric Geddes followed Sir Edward Carson at the Admiralty in July. In Aug. Sir Auckland Geddes followed Mr. Neville Chamberlain as Director of National Service, Mr. Hodge followed Mr. Barnes as Pensions Minister, Mr. Roberts followed Mr. Hodge as Minister of Labour and Mr. Wardle followed Mr. Roberts at the Board of Trade.

Outside the Cabinet, Mr. Stanley Baldwin became joint Financial Secretary of the Treasury in Jan., and other ministerial changes took place in June. In 1918, Sir E. Carson resigned from the War Cabinet in Jan. and Lord Milner left it in April to succeed Lord Derby at the War Office, and there were a dozen other changes among less important ministers before the War came to an end. Nor were the soldiers immune. Sir William Robertson was succeeded as Chief of the Imperial General Staff by Sir Henry Wilson in Feb. 1918, General Trenchard resigned from the Air Staff, and Sir Douglas Haig was none too secure, there was not much stability in the strategy of the War until Foch's appointment as generalissimo of the French and British forces in April.

The War Narrative Again.—The public, however, thought, in Dec. 1916, that with the new British Ministry the Allies would not be long in winning the War. An emphatic refusal was given to the German invitation to enter a peace conference, and a Victory loan, calculated to last till about Aug., was successfully floated in January. For three months or so things went well enough; the fruits of earlier efforts were reaped in the German retreat from the Somme and Sir Stanley Maude's conquest of Baghdad in March. But the advance into Palestine was held up before Gaza; the Vimy campaign, after a striking initial success, subsided into trench warfare in April; the French attack on the Chemin des Dames was a ghastly failure and Russia was paralysed by the revolution of March.

The United States, indeed, declared war in April, but its intervention on the field of battle was delayed for more than a year, and the Allies were reduced to the defensive, modified by local gains by the French, a well-staged attack on the Messines Ridge in June, and a pitiless struggle for Passchendaele in the mud and the floods of Flanders.

Meanwhile, the battle of Jutland had been decisive enough to convince the Germans that their hopes lay not on but under the surface of the ocean. They concentrated on their submarines, which in April sank 25% of the merchant ships that put to sea, and bade fair to justify Mr. Prothero's anticipation, on taking office, that victory might be lost or won on the cornfields and potato lands of Great Britain. Then followed the Italian disaster at Caporetto and the Bolshevik revolution (Nov.); Russia went out of the War at the peace of Brest-Litovsk; "defeatism" made its appearance in France, and Mr. Lloyd George only escaped suspicion of a leaning towards the Stockholm Peace Conference by ejecting Mr. Henderson from his Government.

The German Offensive.—What seemed to some a crowning disaster came with the German offensive in March 1918, which swept away all and more than all the Allies had gained on the Western Front since the autumn of 1914. The British stood, as Haig said, with their backs to the wall, and their liaison with the French was nearly broken in front of Amiens. Things seemed far worse than they had been in Dec. 1916, and it looked as though another government might fall. The point of attack was the responsibility for the weakness of the extended front held by the V. Army under the command of General Hubert Gough, who was cashiered for his failure. It had been held at Versailles, in Jan., that the German offensive would fall on that front, and repeated demands for its reinforcement had been made and ignored. Mr. Lloyd George put the blame for the extension of Gough's front on the French Premier, M. Clemenceau; Sir Frederick Maurice, late Director of Military Operations, indicated, in a letter published on May 7, that the responsibility lay nearer home, and challenged the veracity of ministerial statements. He was placed on half-pay for his breach of discipline, but the Government offered a judicial enquiry into his charges. Mr. Asquith moved, on the other hand, for a select committee of the House of Commons, like that which inquired into the Dardanelles campaign. The Government treated this as a vote of censure, and it was defeated by 293 to 106 votes. The Liberal sheep who followed their leader were divided from the goats who supported the Coalition, and the party was rent in twain.

The United States in the War.—The War meanwhile had been won, not so much by the virtues of any particular British or other Ministry, as by the masses of troops which the United States, stirred at last by the threatened disaster to the common cause, poured into the Western Front during the next few months and by the unification of its command in the person of Marshal Foch. Two million American soldiers sailed before the end of the summer, relieving Foch of all anxiety about his reserves and middle-aged Britons of the military service imposed on all under 51 by the last of the Conscription Acts passed in May. With the prospect of an American army in France, larger than the British or the French, leadership in the diplomacy, which helped on the German surrender, passed to President Wilson, who had already, on Jan. 8 enunciated his famous "Fourteen Points"; and with Foch directing the strategy and Wilson the policy of the War, the Coalition Govt. entered smoother waters.

Electoral Reform and Education.—It had been far more happy in its projects of reform than in its conduct of the War; and in the spring of 1918 two measures of first-rate importance were placed upon the statute book. One related to electoral reform and the other to education. Before the fall of Mr. Asquith's Govt. the Speaker's Conference had been set up in Oct. 1916 to deal with the former problem, and on March 28 1917 Mr. Asquith moved for legislation on the lines of its report, indicating incidentally his own conversion to woman suffrage. The Prime Minister accepted the motion, subject to the qualification that proportional representation and woman suffrage would be left to the judgment of the House. Differences between members and between the two Houses turned mainly on these two points.

The chief proposals of the Representation of the People Bill, which was introduced on May 15 by Mr. Walter Long, were that no one should have more than two votes, one for his residence and the other for either his place of business or his university; that women entitled to the municipal franchise should also receive the Parliamentary vote on attaining the age of 30; that persons on war service should not be disqualified by non-residence; that all elections should be held on the same day and that there should be a redistribution of constituencies. The second reading was carried by 329 votes to 40; in committee, an amendment to omit the higher age limit for women was rejected by 385 to 55, and the clause adopted by 214 to 17. Proportional representation was rejected, except for universities, by 201 to 169 but the "alternative vote" accepted by 125 to 124.

The final stages in the Commons were deferred till the autumn session and the bill did not reach the Lords till Dec.; in Jan. 1918, an amendment against women suffrage was rejected by 134 to 71 and a proposal to submit it to a referendum by 90 to 62. The Lords then eliminated the "alternative vote" from the bill by 66 to 9 and inserted proportional representation by 132 to 42; and a brisk interchange of hostilities on these points ensued between the two Houses, each insisting on its own projects. A compromise eventually provided for a commission to set up a scheme by which not more than 100 members might be elected by proportional representation if constituencies desired it; no such desire has yet (1926) been expressed. The bill became law on Feb. 6.

The Education Bill.—Mr. Fisher introduced his Education Bill on Aug. 10 1917; but politics are always more urgent than education in the House of Commons because children cannot be educated as easily or as quickly as adults can be given votes, and the bill was deferred until March 1918. It proposed to abolish all exemptions between the ages of five and 14 and to require attendance at continuation schools until 18; no child under 12 was to be employed at all and none over 12 on school days except after school hours and before 8 P.M.; no fees were to be charged in public elementary or continuation schools; provision was made for nursery schools and various forms of physical training and recreation. Local education authorities were made responsible for the provision of all kinds of education in their areas, were released from the limit of their expenditure for higher education, and were guaranteed half the cost from the national exchequer. The bill was read a second time without a division, and the only hostile amendment in committee, aimed at the abolition of fees, was defeated by 157 to 51. The bill became law on Aug. 8.

The Budget of 1918.—Most of the time of Parliament was, however, devoted to legislation of a temporary character relating to the War, such as raising the military age, providing for the national service of civilians, the production and control of food and shipping, and war pensions; penalising aliens and conscientious objectors; and voting credits and taxation. The last budget of the war period was introduced by Mr. Bonar Law on

April 22. He estimated the year's expenditure at nearly £3,000,000,000 (£2,972,197,000) and the revenue at £774,250,000. The standard rate of income tax was raised to 6s. in the pound, the duty on spirits from 14s. 9d. to 30s. a gal., and on beer from 25s. to 50s. a bar., on tobacco from 6s. 5d. to 8s. 2d. a lb., and on sugar by an additional 11s. 8d. on the cwt.; an extra penny was put on cheques. The dead weight of the National Debt had risen from £651,000,000 on the eve of the War to nearly £5,000,000,000, and nearly another £1,000,000,000 was added during the year; the cost of its service, £22,000,000 a year in 1914, had risen to £189,000,000 by April 1918, and rose to £315,000,000 a year during the next 12 months.

End of the Long Parliament.—The first Parliament elected under George V. met for its last session on Oct. 15 1918. It should, under the Parliament Act passed by itself, have been dissolved in accordance with the five-year limitation, not later than 1915. But, just as the first Parliament of George I., elected under a Triennial Act, extended its own existence by its own authority to seven years, so this Parliament superseded its own Parliament Act in order to prolong its own existence from five years to eight; as if to atone for this excess it was before long dissolved without its consent in each of three successive years by the royal prerogative at the behest of three different Ministers. The autumn session of 1918 lasted for little over a month, and its chief decisions were to pass an Act qualifying women for election to Parliament and to reject a resolution moved by the Irish Nationalists demanding Home Rule before Great Britain entered a peace conference to settle Europe on a basis of "self-determination." The Chief Secretary (Mr. Shortt) resisted the motion, although he warned the House of the probability of another Irish rebellion; and Mr. Bonar Law declared that Ireland was purely a domestic question for the British Empire. Mr Asquith asked that it might not, "at this eleventh hour," be left as a standing reproach, but the resolution was rejected by 196 to 115 votes (Nov. 5) and the Irish settlement was left until very late in the eleventh hour of the Coalition and of the new Parliament, for which the election was already being prepared before the Armistice on Nov. 11.

The General Election of 1918.—Never had a government better excuses for taking its opponents at a disadvantage. The very fact that they were hardly in opposition, but had supported and served in the War, deprived them of putting before the electors any clear-cut alternative policy and any counter-attraction to the roseate prospect of homes fit for heroes, woes fit for Huns and indemnities to pay taxation, dangled before the popular gaze. The Independent Liberals, as they came to be called, demurred to an immediate general election; but, as the Prime Minister urged, Parliament had long outlasted its term, it had no mandate for peace and it was necessary that British Ministers should go into the peace conference with the confidence of the country at their back, although France, Italy and Belgium managed without general elections until peace had been signed.

A more acute and legitimate question was whether the Coalition, formed in and for the War, should prolong its existence for the purpose of peaceful reconstruction. Ministers had or expressed no doubts at the time, and Mr. Lloyd George was apparently convinced that Ministers who had won the War, or been in office when it ended, were entitled to build the temple and garner the fruits of peace; the "old mismanagement," if any in office were guilty, could be avoided by a general confession that all had made mistakes. The election test, he wrote to Mr. Bonar Law on Nov. 2, "must be not, as in the past, a pledge to support the Government in the prosecution of the War, but a definite pledge to support this Government." To what and how far Ministers pledged themselves, beyond mutual admiration, was prudently concealed.

The Results.—The Labour party refused to concur in this Napoleonic plebiscite, and to its decision in Nov. 1918 it owed its accession to office in Jan. 1924; it severed itself from the Coalition, though some Labour Ministers continued to support the Government and some became Coalition Liberals and one or two Conservatives. The Liberal party was incapable of action as a whole and followed the divergent lines drawn by the schism of Dec. 1916 and the division in the House on May 7 1918. The Independent Liberals refused the Coalition pledge, and a number of Unionists did the same. Parliament was prorogued on Nov. 21, dissolved on Nov. 25, and the election was fixed for Dec. 14, though the votes, for the sake of voters on active service abroad, were not counted till Dec. 28. The results exceeded the most optimistic hopes of the Coalition: 484 of its supporters were returned, made up of 338 Unionist, 136 Liberal and 10 National Democratic, and there were also 51 Independent Unionists. Labour secured 57, against 38 seats in the previous Parliament, but the Independent Liberals were reduced to 26 and all their leaders were defeated. The Irish Nationalists, however, suffered worst of all: they lost 70 out of 77 seats, while the Sinn Fein members rose from 7 to 73; but the latter were pledged to abstain from taking their seats at Westminster and their absence increased the colossal majority for the Coalition. Excluding them, and also the Independent Unionists, the Coalition had in the House 484 members to 85 Labour and Independent Liberal members combined, a majority of more than 5 to 1. It bore not the remotest relation to voting strength in the country, which gave just over 5,000,000 votes to the Coalition, but nearly 3,700,000 to Labour and the Independent Liberals, not to mention the Independent Unionists and Sinn Feiners. In view of the subsequent rise of the Labour party in Parliament it is well to note that in 1918 it polled almost as many votes as the Coalition Liberals and Independent Liberals combined and two-thirds as many as the Coalition Unionists.

The Lloyd George Programme.—It was impracticable to fight a general election on the principle of "least said, soonest mended," but rarely have Ministers been more embarrassed and impeded than was the Coalition by platform speeches and a programme which Mr. Lloyd George summed up on Dec. 10 as consisting of (1) trial of the Kaiser; (2) punishment of those responsible for atrocities; (3) fullest indemnities from Germany; (4) Britain for the British, socially and industrially; (5) rehabilitation of those broken in the War; and (6) a happier country for all (see *Annual Register*, 1918, p. 163).

There was, however, little novelty in the Cabinet burdened with these ambitions, and the arguments for the maintenance of the Coalition were not extended to the War Cabinet, which abandoned its war exclusiveness and resumed its previous distended size. It consisted of 21 members (Jan. 10); Mr. Chamberlain became Chancellor of the Exchequer, Mr. Churchill went to the War Office, Mr. Long to the Admiralty, Lord Milner to the Colonial Office and Mr. Shortt to the Home Office; Mr. Bonar Law continued to lead the Commons as Lord Privy Seal and Mr. Lloyd George, in view of the Peace Conference, retained his independence of departmental duties and of regular attendance in the House. Of the 77 Ministers, all but ten had been in the old Government, and the chief novelty was that Sir F. E. Smith became Lord Chancellor and Baron Birkenhead. The Labour party, as larger than the Liberal, claimed to be the official Opposition, and chose as its leader Mr. William Adamson, who had been a Perthshire miner, while the remnant of Independent Liberals chose Sir Donald Maclean.

III. FROM THE PEACE CONFERENCE TO THE FALL OF MR. LLOYD GEORGE

The Peace Conference.—The centre of interest, however, lay not in Parliament, which was opened on Feb. 11, but at Paris, where the Peace Conference gathered early in Jan. and held its first plenary session on Jan. 18. The delegates for the United Kingdom were Mr. Lloyd George, Mr. Balfour, Mr. Bonar Law and Mr. G. N. Barnes, all representing the Coalition, for which not much more than half of an electorate, already beginning to change its mind, had voted. It was felt in some quarters that the responsibility in England, as well as in the United States, might more wisely have been shared with parties not in power, and that there might in that case have been less of a burden to distribute. Mr. Lloyd George, however, was among the first to react from the mood of 1918, and on April 7 *The Times*, of which

Mr. Wickham Steed had succeeded Mr. Geoffrey Dawson as editor at the end of Feb., accused him at Paris of "thinking of his position at home all the time." On March 14 an Independent Liberal had won a seat from the Coalition by over 2,000 votes; another seat was lost by the Coalition on April 11 where the Coalition majority in Dec. had been over 10,000; and a third followed on the 30th.

Mr. Lloyd George was suspected of trimming his sails and of weakening on the question of German indemnities and the punishment of war criminals; and an indignant protest, originating in Lord Northcliffe's entourage, was eventually signed by 370 Members of Parliament. The Prime Minister replied that he would keep to his pledges, and an interview attributing to him more liberal sentiments was repudiated, but avowed and republished three years later as a vindication of his foresight. For the time he was tied by his immediate past, and the peace that was ultimately made (*see* PARIS, CONFERENCE OF) was dictated more by the sentiments of Dec. than by second thoughts in June. These were best expressed by General Smuts, who, while subscribing to the treaty, protested against its spirit and declared that real peace would be found not so much in its terms as in the means it provided for its own amendment when time had toned down the passions and products of war (*see* LEAGUE OF NATIONS). In presenting bills on July 3 for carrying out the treaty, Mr. Lloyd George announced that an Inter-Allied tribunal would sit in London for the trial of the ex-Kaiser, and that Germany had acknowledged her liability for all the costs of the War—some £30,000,000,000 sterling.

Russia.—The Government was still engaged in wars of sorts in Russia and in Ireland. In 1918 it was a nice question which of the two the average Briton hated more, the Germans or the Bolsheviks; in 1919 Moscow supplanted Potsdam as the root of all evil in ultra-British eyes, and forces intended to help Russia against Germany were perverted to the purpose of collecting British debts from Bolsheviks. It was a moot point, which continued to engage the attention of the United States, whether "self determination" entitles a people to determine how much of its debts it shall pay; but if there is anything that makes invasion unpopular it is the conviction that the invader comes in the guise of the sheriff's officer, and the half-hearted and surreptitious assistance given to Koltchak, Denikin and Judenitch did them far more harm than good, and incidentally weakened the Coalition in Great Britain. But only the failure of these successive efforts convinced the Government of the futility of attempting to impose upon Russia a policy borrowed from the Bourbon restoration.

Ireland.—Its task was formidable enough in Ireland, where on Jan. 21 a Sinn Fein congress adopted a Declaration of Independence after the fashion of the American colonies and established a provisional government modelled on that of Ulster in 1913; that such would be the result of an attempt to impose conscription on Ireland had been foretold when that Act was introduced (see *The Times*, April 11 1918). A fortnight later de Valera escaped from Lincoln gaol, and on April 5 was appointed president of the Sinn Fein executive; on May 9 Irish-American delegates were received in Dublin, and on July 12 Sir Edward Carson demanded the repeal of the Home Rule Act, which still remained an empty form on the statute book, and threatened to call out the Irish volunteers. Lord Birkenhead said that the Government had no sympathy with Sir Edward's attitude, Mr. Bonar Law that it had no ground for taking legal proceedings and Mr. Lloyd George that it had not prepared its plan for the settlement of Ireland; in Oct., however, a Cabinet committee began to draft a scheme.

Schemes of Reform.—Schemes were the order of the day, but Great Britain, like other countries, had incurred in the War debts too deep to be liquidated by Parliamentary bills, to be paid in a generation or to be redeemed by money transactions. "Homes fit for heroes" was but a symbolical expression of an aspiration which had been sincere enough in trenches and in hospitals where war had equalised mankind and almost abolished class distinctions; and millions at least had hoped that peace would no more revive those old inequalities than the old "mismanagement" which the Prime Minister deplored. The England for which they had fought was, as Mr. Kipling wrote of "The Return" from a smaller war, not "what England seems" but "the England of our dreams"; and the agitations of the first years of peace were efforts to realise dreams by Parliamentary statutes or action more direct.

Neither came up to expectation; Ministries of Transport and of Health were established by Acts passed in 1919; rents were restricted and evictions restrained; hours of labour in coal mines were reduced from eight to seven, and a commission, under Mr. Justice Sankey, was set up to consider nationalisation; a Housing Act was passed, and another to fix prices and check profiteering. But dreams cost much to realise, and Englishmen thought that no one but Germans should pay the cost. Prices continued to rise, in spite of Acts of Parliament; the nationalisation of coal was recommended by the casting vote of the chairman of the Sankey Commission which was equally divided between owners and men, but it was not adopted; and Housing Bills became hardy annuals which produced few houses but frequent defeats for ministers who proposed them. It was not until two or three years after peace had been signed that the Coalition realised the necessity of acting upon the truth that the only way of reducing a nation's debt is to raise its production above its consumption and to reduce its expenditure below its income.

The Budget of 1919.—Mr. Chamberlain's first peace budget was introduced on April 30. The national debt had risen during the year from £5,871,000,000 to £7,435,000,000; it had stood at £900,000,000 at the end of 22 years' war in 1815, and had been reduced in a century by about £240,000,000. The increase during 1918–9 had, however, been enhanced by loans to Allies and Dominions, whose indebtedness to Great Britain now amounted to £1,739,000,000. On the other hand, to this dead weight of national debt had to be added a floating debt of £1,412,000,000. The cost of its service amounted to £400,000,000 and the total expenditure for 1919–20 was estimated at £1,435,000,000, subsequently raised to £1,642,000,000, and the revenue at 1,201,000,000, afterwards reduced to £1,168,000,000. The death duties and duties on beer and spirits were largely increased; but the excess profits duty was reduced from 80% to 40%, the proposed luxury tax was not adopted, the duties on land values were abandoned as unworkable, and a beginning was made in Imperial Preference by reducing the duties on certain articles of colonial manufacture. With the income tax left at 6s., the deficit was estimated at £234,000,000 and afterwards raised to £473,000,000, and expenditure in the autumn still averaged over £4,000,000 a day, while it was calculated that the total debt would amount by the end of the financial year to over £8,000,000,000. It was little wonder that even Mr. Bonar Law began to consider the merits of a capital levy, or that opposition was raised to the bill prolonging conscription until April 30 1920.

England, declared the Prime Minister on the eve of the adjournment in August, was not paying her way: so far from reducing her debt, she was producing less and consuming more. Nevertheless, when Parliament reassembled in Oct. its attention was mainly devoted to a bill which provided that every former enemy alien should be deported unless licensed by the Home Secretary to remain. Old age pensions, in view of the rise in prices, were raised from 7s. 6d. to 10s. a week, and a bill establishing industrial courts was passed. The Government of India Bill, giving effect to the Montagu-Chelmsford reforms, received the royal assent on Dec. 23. Dr. Addison admitted that the actual amount of building under the recent Housing Act was trivial, and proposed to stimulate it by a subsidy of £130–£150 a house. Lady Astor, the first woman M.P., took her seat on Dec. 1, and a bill to remove the sex disqualification for the bar and the judicial bench was passed, the House of Lords debating a clause to open its doors equally wide. No less a novelty was the Act establishing a National Assembly for the Church of England, and enabling it to legislate within limits for itself: hitherto the highest church assemblies had been provincial, and they had possessed no independent right of legislation. The

Welsh church had earlier in the year received a more extensive independence in the form of disestablishment and disendowment (April 19); Lord Robert Cecil had resigned from the Government because of disagreement with the measure on Nov. 23 1918.

Thus passed one of the three measures which had created so much controversy in the years before the War. Another, the Plural Voting Bill, had been compromised in the Reform Act of 1918. Home Rule remained, and on Dec. 22 1919 the Prime Minister outlined his proposal for two Irish parliaments, one for Northeast Ulster at Belfast, the other for the rest of Ireland at Dublin. The bill was not introduced until the new session which began on Feb. 10 1920, after the remaining Labour Ministers, Messrs. Barnes, Roberts and Wardle, had resigned; it was debated for three days at the end of March. Mr. Clynes moved its rejection, and Mr. Asquith, who had returned to the House as member for Paisley on Feb. 25, declared that no one in Ireland wanted two Irish parliaments, and urged that Ireland should be given the status of a dominion—a step that was taken, after infinite troubles, three years later. Sir Edward Carson said that Ulster did not want the bill, and before it was passed the Government was asking for emergency powers to supersede the civil courts in Ireland and deal with a civil war (*see* IRELAND). The King's Speech had been optimistic in other respects; it promised bills to acquire mining royalties and reform the House of Lords, while the Prime Minister made the bold assertion that the Government was effecting the strictest and most relentless economy in every department of state.

Another Budget.—The budget, however, estimated expenditure for the second year of peace at £1,177,000,000. Revenue was, indeed, put at £1,341,000,000, leaving a surplus of £154,000,000 for the reduction of debt. This Mr. Chamberlain considered insufficient; and, the land taxes being definitely repealed as unproductive, the minimum cost of letters was raised to 2d. and of telegrams to 1s., the duty on spirits by a further 22s. 6d. a gallon, and that on beer by 30s. a barrel. The Excess Profits Duty, which had been reduced in 1919 from 80% to 40%, was raised again to 60%; and a corporation tax was imposed on limited liability companies. Mr. Clynes's motion for special taxation on war fortunes was, however, rejected by 244 to 81 votes on June 8. The Finance Act passed without difficulty in the House, but the loss of safe Unionist seats at by-elections to "anti-waste" candidates showed that electors wanted the reduction of expenditure rather than the increase of taxation.

Other measures dealt with rents, attempted to render the Profiteering Act more efficacious, and made further provision for health insurance. Instead of the nationalisation of the mines, Sir Robert Horne proposed a Ministry of Mines and the establishment of district boards to adjust the remuneration of miners to the profits of the industry in the different areas; the House of Lords reduced the minister to an under-secretary of the Board of Trade. The Indemnity Act, necessary after every war, was passed almost automatically. These measures seemed very inadequate to a public more impressed by 2d. postage, the increase of railway fares in Aug. by 25% in addition to the 50% of the War period, by the rise of the bank rate, which had been 5% during the War, to 6% in Nov. 1919 and 7% in April 1920, and by the steady mounting of prices which in Nov. were 176% above those of July 1914.

The Irish Bill.—The autumn session was mainly concerned with the Government of Ireland Bill, the problem of unemployment, emergency measures during strikes and agriculture. The condition of Ireland was going from bad to worse, and outrages were growing into raids and ambuscades and military operations hardly distinguishable from a state of war, or at least of revolution. Speaking in London at the Guild hall, Mr. Lloyd George declared that the Government "had murder by the throat," and two days later he said in the House of Commons that Great Britain could give to Ireland no powers which would endanger the integrity of the United Kingdom, of which Ireland was part. The latter remark referred to the proposal to give Ireland the status of a dominion, which had met with growing support since its suggestion by Mr. Asquith in March. Few seemed to have much confidence in the bill before Parliament as a solution of the problem; and, considering the size of the Coalition, the majorities by which it was passed, 131 in the Commons and 86 in the Lords, were small.

The problem of unemployment, due to demobilisation and trade union resistance to the dilution of labour by "hands" which were "unskilled" because of their service in war was hardly less disturbing than the Irish situation; and on Oct. 18 there were riots in Downing street, London, which led to its being barricaded against the public. The two bills passed to deal with the subject in Dec. only touched the surface of a fraction of the problem. The Agriculture Bill was more comprehensive; it aimed at guaranteeing prices for the farmer by perpetuating the corn production legislation of the War, and at insuring a minimum wage for the labourer; a further instalment of protection was effected by a bill to safeguard the manufacture of dyestuffs in the country.

Weakening of the Coalition.—The year 1921 marked the turning point in the history of the Coalition and the reversal by itself of the policy for which it existed. The first Coalition of May 1915 had been created in order that the nation might present an organised and co-ordinated front to the dangers with which it was beset. The second Coalition of Dec. 1916 had been called into existence to develop that organisation by increasing state activity and control over all the nation's powers of production, defence and attack; and the result was, in fact, though the phrase was eschewed, a gigantic experiment in state socialism. This was one of the subtle causes which made the Labour party more wholehearted as a rule than Liberals in support of the Coalition. In Nov. 1918, the leaders of the Coalition came, for various reasons, to the conclusion that reconstruction must be pursued by the methods which, it was thought, had led to success in the War; that is to say by the employment of supermen to exercise supercontrol of national energies, rather than by reliance upon the initiative, energy and productiveness of the individual.

There was much to be said for this view; millions of men drilled for military service, trained to look for orders, and accustomed to depend upon a sustenance that was provided for them by an industry to which they had never been accustomed, or from which conscription had cut them adrift, would not find it easy, without direction and assistance, to discover or resume their place in a community dislocated by the consequence of War. Ministers themselves found the transition from war to peace as difficult as that from peace to war, and the painful stages by which the nation worked up to efficiency in war were reproduced in the lagging steps by which it was brought back to normal conditions of peace. "Business as usual" had been the cry in the first few months of war; control, if not conscription, as usual, seemed the main business of the first few days of peace.

Finance and Decontrol.—The tax collector was, as ever, the main factor in the political education of the country, and the cost of control by supermen with Napoleonic ideas provoked in 1920–1 a movement which convinced even the supermen themselves of the evils of superfluity and converted them to the virtues of the economical axe. Decontrol became the order of the day; and railways, mines, food and drink, prices, agriculture, the Civil Service and other organised activities were subjected to the processes of pruning or liberation. In some the reversal of policy was distinctly precipitate, and the Minister, who in Dec. 1920 had secured an Act for guaranteeing prices for farmers and wages for agricultural labourers, obtained its repeal and the abandonment of its principles in July 1921.

The railways were decontrolled by another bill introduced by Sir Eric Geddes, and resisted by Mr. Clynes on the ground that it failed to provide for public ownership and control. The bill to decontrol mines was introduced on March 4 and passed with great rapidity three weeks later. The Labour protest against it took the form of a miners' strike at Easter, which provoked the powers granted by the Emergency Act of the previous session. The reserves were called out and a defence force was established in April; but on June 28 Mr. Lloyd George announced terms of settlement, which he claimed with inveterate optimism would open a new era of co-operation in the industry. Peace was bought by a subsidy of £10,000,000 out of the public purse. On the other hand, decontrol coincided with a steady fall in prices and a reduction in the bank rate from 7% to 6½% on April 28, to 6% on June 23, to 5½% on July 21 and to 5% on Nov. 3. Prices, which had averaged 176 points above the pre-War level in Nov. 1920, had fallen to 133 in April 1921, and fell as much again to 92 by the end of December.

Resignation of Mr. Bonar Law.—The new policy also coincided with important ministerial changes. Lord Milner resigned in Feb. 1922; Mr. Churchill took his place at the Colonial Office; and Sir L. Worthington-Evans followed Mr. Churchill at the War Office. Mr. Long simultaneously resigned the Admiralty and was created a peer, his place at the Admiralty being taken by Lord Lee of Fareham. A greater disturbance was caused on March 17 by the resignation of Mr. Bonar Law on the ground of ill-health. This created a vacancy in the leadership of the Unionist party and of the House of Commons. Mr. Chamberlain was unanimously elected to the leadership of the party, and the Prime Minister thereupon invited him to lead the House of Commons; he also took Mr. Bonar Law's post as Lord Privy Seal. Sir Robert Horne succeeded to Mr. Chamberlain as Chancellor of the Exchequer, and Mr. Baldwin to Sir R. Horne as President of the Board of Trade. Dr. Addison resigned the Ministry of Health in April because the axe had been laid at the root of his housing policy, and was succeeded by Sir Alfred Mond. In the same month Lord French resigned his lord-lieutenancy of Ireland and was succeeded by Lord Edmund Talbot, who was created Viscount FitzAlan; his chief secretary, Sir Hamar Greenwood, was included in the Cabinet, to which Sir. L. Worthington-Evans, Sir Alfred Mond and Sir A. Griffith Boscawen were also admitted in the place of Lord Milner, Lord Long and Dr. Addison. Minor official changes followed, and in Oct. Sir Eric Geddes retired from the Ministry of Transport and from politics. Politics, however, had nothing to do with the retirement of Mr. Lowther from the Speaker's chair in April; he had occupied it for the almost unprecedented period of 16 years. He was succeeded by Mr. J. H. Whitley, and was created Viscount Ullswater. Promotion, however, could be earned by other means than resignation, and in June Earl Curzon was made a marquis and Lord Birkenhead a viscount.

Political reasons may have had something to do with the elevation May 24 of Sir Edward Carson from Irish politics into the serener atmosphere of a judicial seat in the House of Lords. The substitution of Lord FitzAlan for Lord French, interviews between emissaries of the Prime Minister and Sinn Fein leaders in Mountjoy Prison at which Dominion Home Rule was discussed, and between Sir James Craig and Mr. de Valera, all indicated that the ideas of the Government were getting beyond the grasp of "murder by the throat" and following the lines of decontrol. The elections, a few days later, to the paper parliament for Southern Ireland provided a remarkable justification for this intelligent conversion; apart from the University of Dublin hardly a candidate, Nationalist or Unionist, was forthcoming to withstand the nominees of Sinn Fein, many of whom enjoyed the credentials of imprisonment; out of 128 seats they secured 120 without a contest. The approaching Imperial Conference in London eased the approach to conferences between General Smuts, Mr. de Valera, Sir James Craig and Mr. Lloyd George. In July a truce was arranged, and conversations led to a conference which, in the autumn, produced the Irish treaty and a far more radical solution of the problem than the Home Rule Bills of 1886, 1893 and 1912, which, backed by nothing but argument, had encountered an opposition which disturbed and dominated British politics for a generation.

The Budget of 1922.—Meanwhile the budget had been introduced on April 25 by Mr. Chamberlain, because his successor, Sir Robert Horne, was absorbed with the coal strike and industrial unrest. Comparison with previous budgets was complicated by the distinction now first made between ordinary and extraordinary revenue and expenditure. The ordinary revenue for 1921–2 was estimated at £1,058,000,000; the extraordinary, arising from the realisation of war assets, at £158,000,000. The ordinary expenditure was put at £974,000,000, and the extraordinary at £65,000,000, thus leaving a combined surplus of £176,000,000. The disconcerting facts were that the National Debt stood at £7,831,000,000, and that, while the total expenditure for 1921–2 was put at £138,000,000 less than in 1920–1, the revenue was also £125,000,000 less, even including £158,000,000 accruing from the disposal of war assets. There seemed therefore to be no justification for the abolition of the excess profits duty, except the assumption (fatal to the policy of its imposition) that the removal of this tax would enable trade to make up the deficiency through more ordinary taxes. The other changes in taxation were unimportant; the income tax was left at 6s., and presumably the Government was looking for relief to the prospect of extracting fresh revenue out of its plans for safeguarding British industries.

Resolutions to this effect were moved by Mr. Baldwin on May 9. Duties to the extent of 33⅓% of the value were to be imposed for five years on specified articles in key industries, and also upon imported articles sold below the cost of production in England. Other birds, it was hoped, might be killed with the same stone; the exchange with New York, which at the end of 1920 had sunk to $3.54 to the £, might be restored, dumping might be defeated and the figure of unemployment, which rose to 2,044,655—its highest point—on June 21, might be reduced. But food, drink and raw materials were exempt. The bill framed on these resolutions was actively resisted in the House of Commons, but was carried by 312 to 92 votes, and the Speaker ruled that it was a money bill within the terms of the Parliament Act and could therefore not be amended by the Lords; a motion for its rejection was nevertheless only defeated by 68 to 43. Something was also hoped from a bill passed in March to collect German reparations by taxing, up to 50% of their value, imported German goods.

The autumn session was the shortest in modern times. It began on Dec. 14 and ended five days later. Its sole purpose was to give parliamentary sanction to the articles of agreement concluded between the Government and the Sinn Fein delegation. Lord Morley emerged from his retirement to move the address in reply to the King's speech in the House of Lords, where the treaty, denounced by Lord Carson as treachery, was ratified by 166 to 47 votes, having passed the House of Commons by 401 to 58. The treaty, however, no more gave Ireland a constitution than the treaty of Vereeniging, in 1902, had given one to South Africa; and the first business of the new session, which began on Feb. 7 1922, was to pass a bill enabling the Provisional Government of South Ireland to convene a constituent assembly to frame a constitution. In moving the second reading on Feb. 16, Mr. Churchill declared that the Government would never recognise an Irish Republic. The bill met with some opposition from a small minority, but passed both Houses and received the royal assent by March 31. The final stage of giving the sanction of the Imperial Parliament to the constitution worked out by the Irish Assembly was not reached until the end of the year, when it had to be dealt with by a new British Govt. and a new British Parliament.

Troubles of the Coalition.—The Coalition, however, survived the session, and fell, as all British governments in the century had fallen, without any apparent or immediate reference to the confidence of the House of Commons. But the rift in the Coalition lute had produced audible discord from the earliest days of the year, and in Jan. the difference was over the date of the general election. The Prime Minister wanted it soon; the Unionists, or at least their expert tactician Sir George Younger, wished for delay until reform of the House of Lords had been achieved and there was some improvement in the industrial situation; the number of unemployed, after falling to about 1,500,000 in the autumn, had risen again to nearly 2,000,000. There was, moreover, serious doubt whether the two wings of the Coalition could present a united front to the enemy at a general election, and the preparations of the Unionists for standing alone were by no means complete.

Another grievance, which came out in public during the summer, created no little resentment. The distribution of rewards for political services was determined solely by the Prime Minister, though arranged by subordinates, some of whom exemplified the wisdom of the serpent even more strikingly than others did the innocence of the dove; and it was alleged, not without cause, that lavish benefactions to public and even to party funds earned little recognition unless they went into the particular party chest which Mr. Lloyd George controlled. Sir George Younger's objections were termed by the Lord Chancellor a mutiny of the cabin boy; but the election was postponed, and in July Lord Salisbury in the House of Lords and another Unionist in the Commons moved for a select committee of both houses to inquire into the actual methods of distributing honours. Lord Birkenhead and the Prime Minister moved and carried, after lively debates, in their respective houses, the circumlocutory substitution of a royal commission to advise on the procedure to be adopted in future to assist the Prime Minister in making his recommendations.

The Geddes Axe.—It was more difficult to evade pressure outside the tied Houses of Parliament, and the maintenance of taxes at a higher level in the fourth year of peace than they had reached during the War was producing a clamour for economy which would be fatal if it were side-tracked into mere inquiry. There was, indeed, little point in decontrol unless it led to economy; and in Aug. 1921, in response to representations by 170 Unionist members, a committee had been appointed, with Sir Eric Geddes as chairman, to assist the Treasury to discharge its proper function of containing expenditure within the limits of sound finance. The chairman was criticised on the ground that he had hitherto been concerned rather with spending than saving public money, but the report of his "super-axe" committee was found too drastic for the departments concerned, all of which resisted the reductions it recommended.

On its appointment, Sir Robert Horne, the Chancellor, had put the necessary economies at £130,000,000; the committee recommended £100,000,000; and on May 9 Sir Eric Geddes complained that the saving actually proposed in the estimates had been cut down to £52,000,000. The difficulty was that, while every one wanted economy, there was no agreement on the economies to be effected; the broad divergence was between those who wanted to cut down expenditure on the army, navy and air forces and those who wanted to reduce it on education and social services. The net result in the budget was an estimated revenue for 1922–3 of £910,775,000, against £1,216,000,000 in 1921–2, and an estimated expenditure of £910,069,000 against £1,039,000,000 in 1921–2, leaving a surplus of £706,000. Mr. Asquith criticised the remission of taxes out of so small a surplus, and Sir Donald Maclean the decision to suspend the reduction of debt. Some critics were placated by the reduction of income tax from 6s. to 5s., of letters from 2d. to 1½d. and postcards from 1½d. to 1d., and of the duties on coffee and cocoa.

Reform of the Lords.—The approach of a general election was also indicated by an attempt to reform the House of Lords. It was proposed to reduce its membership to 350 and to confine the strictly hereditary seats to peers of the royal family, though other peers could be elected by their fellow peers for a term of years; law lords and bishops were to sit as at present, but a considerable element, directly or indirectly elected, was to be introduced from outside. The proposals found little favour in the House of Lords, mainly because they assumed the permanence of the Parliament Act. The root of the difficulty was indicated by Lord Crawford when, replying for the Government, he remarked that there could be no repeal of the Parliament Act unless their lordships were prepared to accept an elected second chamber and the complete elimination of the hereditary principle, a dilemma which was long to defer the settlement of the question.

A Miscellany.—More serious differences of opinion in the Coalition cropped up from time to time. The indiscreet publication of a telegram by Mr. Montagu in March led to his compulsory resignation from the India Office, and to the revelation of strong Unionist dissatisfaction with the Indian policy of the Government. Affairs in Ireland caused greater disagreement, and Mr. Bonar Law declared in July that he would not now have given the vote he gave in Dec. for the Irish treaty. Lord Carson had already in March made a platform speech, for which he was rebuked by the Lord Chancellor, attacking the Coalition and saying it was time to return to the party system, and on April 5, Sir W. Joynson-Hicks moved in the House that in view of the Government's lack of coherent principle a new ministry should be formed upon that basis—he objected to the application of Liberal principles by a Government of which he was a supporter while Lord Hugh Cecil declared that no Prime Minister could be so bad as Mr. Lloyd George, and that the country had gone from bad to worse ever since the Armistice.

Members and even ministers were at loggerheads over the embargo on Canadian cattle, the mandates for Palestine and Mesopotamia, and the self-government of Egypt hardly less than over Ireland and India; while the failure in Aug. of the London conference on reparations and the increasing friction with France portended grave risk to the stability of European peace. A shock of a different kind was given by the murder of Sir Henry Wilson on his own doorstep near Belgrave Square, London, in mid-daylight on June 22; but more damaging to the Coalition was the buoyant speech of the Prime Minister at the adjournment of Parliament on Aug. 4[1].

Greece and Turkey.—The speech dealt principally with the situation in the Near East, which was afterwards described as being one of secret war between England and France openly waged by their respective pawns of Greece and Turkey. Mr. Lloyd George denied that Great Britain was giving Greece preferential treatment, but he said that the Greeks could take Constantinople in a few hours were it not for the allied occupation, and that he did not know of any other army that could have gone as far as the Greeks had gone in Asia Minor. The Greeks were wild with delight, and placarded the speech throughout their country. Within a month that army had been routed by Mustapha Kemal and driven helter-skelter to the sea; Smyrna was taken and pillaged, and the victorious Turks swarmed up to the limits of the neutral zone, where detachments of French and British troops guarded the approaches to the Bosporus and the Dardanelles. Mustapha denied all knowledge of a neutral zone, the French were friendly with the Turks, and their detachment withdrew across the Straits. At the end of September ministers believed that war was imminent; a semi-official manifesto was issued insisting on the necessity of defending the Straits and preventing a Turkish invasion of Europe, and the dominions were invited to send contingents to defend interests for which they had already made enormous sacrifices. But France remonstrated against the enunciation of an apparently bellicose policy without previous consultation; the dominions had similar cause for annoyance, and protests against a war which Great Britain might have to wage almost single-handed came from both the Labour and Liberal parties. Popular opinion was in this respect behind them, and the Government was constrained to rely, not on force, but on diplomatic suasion exerted by Lord Curzon on M. Poincaré in Paris, and on the tact and firmness employed by Sir C. Harington at the Dardanelles.

End of the Coalition.—The crisis passed with the convention which Mustapha Kemal signed at Mudania on Oct. 11, but it sounded the death knell of the Coalition and its Government. Mr. Chamberlain and Mr. Lloyd George strove manfully against the tide of disruption in speeches at Birmingham and Manchester on Oct. 13 and 14; but on Oct. 16 Lord Salisbury denounced what he called a new method of cabinet government and an exaltation of one-man rule which had proved to be disastrous, and declared that a Bolshevist bogey was the only excuse for maintaining the coalition. It foundered at a meeting of Conservatives held at the Carlton Club three days later. Mr. Chamberlain stoutly defended the coalition and its chief, but Lord Curzon stayed away, and the attack was led by Mr. Baldwin,

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[1] The total failure of the Genoa Conference, which was to "settle Europe," played a very important part (April-May 1922) in weakening Mr. Lloyd George's position. (Ed. *E. B.*)

President of the Board of Trade, who said that Mr. Lloyd George had destroyed the Liberal, and was in course of destroying the Conservative party. Behind him loomed the figure of Mr. Bonar Law, whose retirement 18 months before enabled him to maintain a sphinx-like attitude until the last.

While the meeting was in progress, news arrived of a Conservative victory at Newport in a triangular contest with Liberalism and Labour; Mr. Bonar Law declared his opposition to a combination with either. Lord Balfour, on whom an earldom had been conferred in April, held that it was a principle of the Conservative party to act on the advice of its leaders; but the resolution to fight the general election as an independent party with its own leader and programme was carried by 187 to 87 votes. Resignations were at once dispatched to the Prime Minister, and in the afternoon he tendered his own to the King, who sent for Mr. Bonar Law. On Oct. 23 the new Prime Minister was unanimously elected leader of the Unionist party at a meeting consisting both of peers and members of the House of Commons.

IV. THE COURSE OF EVENTS SINCE 1922

This was something of an innovation in Great Britain, where the invitation to form a ministry from the Crown and success in forming it had hitherto determined the leadership of parties. Only when in opposition had leaders been elected, and then only leaders of the respective oppositions in the Lords and Commons. But the practice had long been in vogue in the Labour party in Australia, and the political earthquake which produced a purely Conservative administration in Oct. was curiously democratic in its operation. The movement came from below. Lord Salisbury on Oct. 16 had expressed a firm belief in the people, and the party repudiated Lord Balfour's advice to follow its leaders. Nearly all the Conservative ex-Ministers or ex-Conservative ministers, Mr. Chamberlain, Lord Balfour, Lord Birkenhead, Sir Robert Horne, Lord Lee, Sir L. Worthington-Evans and Lord Crawford, adhered to the Coalition, and Lord Curzon was the only Minister with any cabinet experience worth mentioning who conveyed the benefit of that experience from Mr. Lloyd George to Mr. Bonar Law in October. Sir A. Griffith-Boscawen had attained cabinet rank in Feb., Mr. Baldwin in April 1921 and Lord Peel in March 1922, while Lord Derby had been a minister under Mr. Lloyd George's War cabinet in 1917–8. The other members of the new cabinet were all newcomers, largely recruited from the under-secretaries in the old.

The General Election.—This disability, if any, hardly counted in the general desire to be rid of the Coalition, and Sir George Younger, who was created a viscount for his services, had made a remarkably shrewd forecast of the results of the general election which followed in November. The Conservatives, now united under the leadership of Mr. Bonar Law, secured 347 seats by their independent efforts, against 338 they had won in 1918 with the assistance of the Coalition Liberals; those Liberals were reduced from 136 in 1918 to 59 in 1922, while the Independent Liberals increased from 26 to 59 or 60, and the Labour party from 59 to 142.

But the advantages of unity, under the existing electoral system, were most strikingly illustrated by the fact that a single united party with 5,000,000 votes won 347 seats against 268 obtained by the 8,000,000 votes cast for the three sections of the opposition. In the rout of the Coalition Mr. Lloyd George was returned unopposed for the first time in his career; but Mr. Churchill was heavily defeated at Dundee by unconventional Labour candidates, and five other Coalition Liberals who had been cabinet ministers lost their seats elsewhere. Sir John Simon returned to Parliament and Mr. Asquith retained his seat at Paisley; but Mr. Runciman and Sir Donald Maclean were defeated. So was Mr. Henderson, but Mr. Ramsay MacDonald and Mr. Snowden returned to the House, reinforced by Mr. Sidney Webb and other Labour leaders. Two women alone were elected, Lady Astor and Mrs. Wintringham, both of whom had succeeded their husbands at by-elections to the previous Parliament.

The new Parliament met on Nov. 20 and Mr. Ramsay MacDonald was chosen leader of the Labour party by a majority of five votes over Mr. Clynes. The party outnumbered both sections of the Liberals combined, and there could be no doubt about its title to the front opposition bench. Divided though the opposition was, its combined strength left the Government with a majority of only 79, and the return to normal conditions was generally recognised as an improvement upon the last House, in which there could be no effective opposition at all.

The Irish Treaty.—It was the first Parliament of Great Britain and Northern Ireland; its members had been reduced to 615 by the exclusion of Southern Ireland, and its most urgent task was to implement the constitution of the Free State. The King had been moved to impress this duty on Mr. Bonar Law, and he had impressed it upon his party on his election to the leadership before the general election. In these circumstances opposition was almost out of the question; and when on Nov. 24 Mr. Law introduced two bills, one to sanction the constitution of the Free State and the other to make consequential alterations in that of Northern Ireland, the only objections came from the two singular Communists in the House; both bills received the royal assent on Dec. 5.

Hardly more serious was the opposition to a bill removing the embargo on Canadian cattle, and there was none to another providing a loan of £6,500,000 to set Austria on her feet again. There was more searching of heart over the unemployed, the numbers of which had fallen from 1,900,000 in Jan. to 1,318,000 in Sept., but had risen again to 1,400,000 before the end of the year. A Labour amendment to the Address was moved on the subject; the Minister for Labour announced that the Government's programme included proposals for relief and general work, unemployment insurance, and trade facilities and export credits; and a reduction of 350,000 in the number of unemployed was effected during the year 1923.

Foreign Affairs.—A crisis of considerable magnitude, however, arose in foreign affairs before Parliament met again. Mr. Bonar Law had announced, on his acceptance of office, that his foreign policy would be based on cordial co-operation and friendship with France; and on Dec. 9 a conference of the British, French, Italian and Belgian Prime Ministers began in Downing street to resume the discussion of German reparations which had been interrupted by the breakdown of the conference in August. The German Govt. had submitted proposals in a note which was laid before the conference and promptly denounced as not worth discussing by M. Poincaré, who declared that nothing would move Germany but the occupation of the Ruhr or some similar form of coercion. Some such measure had been contemplated and threatened by Mr. Lloyd George on May 5 1921.

The conference came to no decision in Dec., but adjourned the discussion until Jan. 2 at Paris; and on a debate on the subject in the House of Lords Lord Grey remarked that, if the January conference failed, it might mean a further step towards the collapse of Europe and the breach of our friendship with France. He doubted the wisdom of refusing to remit our debts to European allies merely on the ground that the United States declined to remit what Great Britain owed; he thought, however, that the strong measures recommended by France were more likely to produce the collapse of Germany than the payment of reparations. In the House of Commons a general who had been stationed in Germany expressed the view that the object of French policy was to break up Germany into small states, beginning with the separation of the Rhineland from the Reich. The general situation was rendered all the more difficult by the fact that Lord Curzon was at Lausanne endeavouring to place on a permanent footing the precarious agreement made with the Turks at Mudania; and a serious difference with France would at least prolong the unrest in the East.

The Prime Minister saw Lord Curzon in Paris before the conference opened on Jan. 2. No middle course was found between the English desire to give Germany, "purely as a business proposition," in Mr. Bonar Law's words, breathing time to recover, and the French idea of compensating themselves for the absence of reparations and for the failure of the Anglo-American guarantee, proposed in 1919, by security through the dismemberment of Germany and the establishment of the Rhine as its frontier. The Entente Cordiale gave way to the "Rupture Cordiale," whatever that might mean, and France was left with a free hand to deal with a disarmed Germany without British assistance. Belgium supported France, but Italy's co-operation was purely formal.

Occupation of the Ruhr.—On Jan. 11 the occupation of the Ruhr began, many of the troops employed consisting of negroid auxiliaries which France had introduced into the heart of Europe to make up for her own declining birth rate. It required no little tact on the part of the British troops at Cologne to maintain the excellent relations which were said to exist between them and both the Germans and the French. If ever Great Britain was an arbiter, it was during 1923–4, but the arbitration had to be implemented by patience rather than by force; and it was by a year's patience and passive resistance that Germany convinced the French of the futility and folly of their enterprise.

The American Debt.—Meanwhile, Mr. Baldwin, the Chancellor of the Exchequer, had sailed for New York to negotiate terms for the funding of Great Britain's debt to the United States. This stood at some £963,000,000 sterling, all borrowed for the War, and some of it to be passed on to Allies to whom the United States had refused advances without a British guarantee. In Great Britain it was considered hard that she should pay interest, on that part of the debt especially, to the United States, which had profited enormously out of her neutrality during the greater part of the War, and where taxation was trivial compared with its burden in Great Britain, while Great Britain herself was receiving nothing from her European debtors. The ordinary citizen in the United States was, however, unacquainted with these facts, and more responsible persons to whom they were known were unfavourably impressed by the huge sums which the European debtors of the United States continued to spend on armaments. It was idle, they argued, to contend that these countries could not pay their debts while they lavished money on objects inconsistent with their professions as a League of Nations; and they felt that whatever they remitted as debt would go to increase armaments, which the United States had striven to restrict at the Washington Conference, and would have restricted further but for the opposition of their European debtors.

A partial reply to this reasoning was that European armaments were partly due to the refusal of the United States to implement President Wilson's proffered guarantee to France or to take its place in the League of Nations. But it was recognised that argument would not reconcile the conflicting points of view, and even British public opinion was fairly unanimous that any reasonable settlement, however onerous it might seem, would be better than none. Nor, regarded from a strictly business point of view, were the terms inequitable, and the city of London was strongly in favour of acceptance. Three per cent was to be paid for the first 10 years, and 3½% for the remainder of a period of 62 years, with an additional half of 1% as a sinking fund. The settlement materially added to Mr. Baldwin's reputation, and contributed to the restoration of British credit.

The Baldwin Budget.—The Chancellor's first budget, which he introduced on the April 16, was also well received. A revenue of £914,000,000 and an expenditure of £812,000,000 had produced a surplus of over £101,000,000 which went to the reduction of debt. Mr. Baldwin remarked that nothing would ease the finding of capital for industrial purposes so much as the steady redemption of public debt, and he proposed a sinking fund of £40,000,000, increasing to £45,000,000 the next year and to £50,000,000. The income tax was reduced from 5s. to 4s. 6d. and £1 a barrel was taken off beer. Mr. Asquith thought it should have been taken off sugar, Sir Alfred Mond preferred the lightening of taxation to the reduction of debt; Labour contended that taxation paid by the working classes should have been reduced rather than on income and property. But generally the Chancellor was thought to have been as wise in the disposal of his surplus as he had been fortunate in its inheritance.

The other legislation of the session was of a somewhat modest character. Mr. Neville Chamberlain did rather better than his predecessors with the annual Housing Bill, but modestly described it as being not a solution but the beginning of a solution of the problem. Some relief was also afforded to agriculture, and the Home Secretary had to be relieved of the legal responsibilities he had incurred under the Habeas Corpus Acts for deporting to Ireland prisoners over whom the Free State claimed jurisdiction.

Death of Mr. Bonar Law.—The great disaster to the Government was the resignation of May 20 of the Prime Minister, who died on Oct. 30 following. It was impossible to fill his place, and the choice of a successor caused his party anxious consideration. Lord Curzon had great claims and greater expectations; in ability and industry he had few equals and no superior. But his aloofness from the rank and file, his ambiguous attitude in the crisis of Oct., his friction with France, and his position in the House of Lords were serious obstacles to his selection; he attributed his failure to the last of these circumstances, and there was much significance in the fact that leadership of the House of Lords should be considered incompatible with the headship of what was almost a "die-hard" Government. Mr. Austen Chamberlain, who had been leader of the Unionists in the House of Commons, was ruled out by a Conservative clique for his fidelity to the Coalition; and that as well as advancing years and his peerage disqualified Lord Balfour.

Mr. Baldwin Becomes Premier.—This left Mr. Baldwin practically without a competitor, and no opposition was raised to his election as leader of the Party on May 28, six days after he had been entrusted by the King with the duty of forming an administration. He had, it is true, only two years cabinet experience, but Mr. Bonar Law had had none when he was elected leader of the Unionists in the Commons in 1911, and that experiment in novelty had been unusually successful. Mr. Baldwin had, moreover, taken a decisive part in demolishing the Coalition which, as he said in his first speech as Prime Minister, came only just in time to save the Conservative party from the disruption that had overtaken the Liberals. Other qualifications had been concealed by the absence of showier qualities; a man of sterling character and of more insight than was suspected, he had broad human sympathies not often associated with industrial capitalists, and he was the antithesis of the hard-faced profiteers who had compromised the Coalition by the fervour of their support.

A certain ambiguity, however, characterised the overture of his Government. He retained for the moment his Chancellorship of the Exchequer, but was known to be anxious to strengthen his Ministry and close the schism which excluded the Unionists, who had belonged to the Coalition. Mr. Chamberlain would have come to his assistance, but was barred from the Administration, as well as from the Premiership, and the only accession to the Cabinet was Lord Robert Cecil who became Lord Privy Seal. The Prime Minister, however, still hoped to secure as Chancellor of the Exchequer either Sir Robert Horne or Mr. R. McKenna, one of whom had held the office during the declining days of the Coalition while it had compromised the purity of its Free Trade principles, and the other under Mr. Asquith. The claims of business and of banking, respectively, given as reasons to the public for the refusal of both, were not exhaustive explanations; and it seems clear that Mr. Baldwin had not yet reached the conclusion that Protection afforded the only cure for unemployment.

Still, the financial orthodoxy of his Budget did not completely conceal or correct his leanings towards fiscal heresy; and it is possible that the alternatives of Sir Robert Horne or Mr. McKenna did not imply so much ambiguity as appeared on the surface. Conceivably Mr. Baldwin expected Mr. McKenna to take the same view as he did of certain duties which Tariff Reformers, in gentle retaliation for Mr. McKenna's refusal of office, insisted thenceforth on naming "the McKenna duties."

Those duties had been imposed while Mr. McKenna was Chancellor, after an Allied Conference at Paris in June 1916, and as an economic aspect of the war with Germany which some of their advocates hoped would outlive its other forms; and their idea was to provide for reconstruction and reparation after the War by means of tariffs, and also to provide against future wars by securing economic independence and control of key industries for the Allies by something like a Zollverein, the quaint assumption being made that enemies in the existing war would necessarily be enemies in the next. The immediate object of the duties was, however, to render Great Britain independent of enemy products during the War, and had nothing to do with unemployment which the War had practically extinguished; Mr. Long, indeed, declared in the House on July 11 1916 that it was non-existent.

Unemployment.—Unemployment was, however, a serious problem in 1923. The numbers had fallen during 1922 from nearly 2,000,000 on Jan. 1 to 1,695,000 at the end of the year, and a further reduction to 1,191,000 was effected by the end of June 1923; but in September they were rising again, and a change in the fiscal system might cure the evil, or alternatively might reap the credit for the amelioration in the industrial situation which some observers were beginning to anticipate as the result of slow but natural causes. While the figure rose to 1,246,000 on Oct. 1 it did in fact recede to 1,137,000 just before Christmas, its lowest point since demobilisation.

Imperial Conference.—Considerations other than the reduction of unemployment affected the imperialistic minds of some of Mr. Baldwin's younger colleagues. A tribunal of economists, appointed in Dec. 1922, reported in April in favour of "a cautious use of the power of the State to obtain for agriculture a somewhat greater measure of security than it had enjoyed for the past half century," and simultaneously the Prime Minister announced that, concurrently with the regular Imperial Conference, an Imperial Economic Conference would meet on Oct. 1. There was to be a great Exhibition of Imperial products at Wembley in 1924, and the Board of Education was to tune the schools to this imperial note; a circular was prepared requesting teachers to suspend their ordinary historical instruction in favour of a special six months' course devoted to the greatness of the British Empire. All this would provide an admirable setting while the House of Commons would be enacting a policy of Imperial Preference and Protection. The curtain was not to be raised at once; but before the end of July 1923 intelligent forecasts found their way into private conversations, and when Mr. Baldwin eventually divested himself of the Chancellorship it was announced on Aug. 28 that Mr. McKenna was unable to join the Government and that the mantle had fallen on Joseph Chamberlain's second son, Neville.

Relations with Russia.—Foreign affairs claimed attention before the *dénouement* of this domestic drama. In May Lord Curzon threatened a renewed breach with Russia, not so much on account of Bolshevik propaganda in the West as of its disturbing influence in Asia. It was dimly beginning to be perceived that Marxist Communism had proved a fiasco and made little appeal to any industrial community, but that the newer Bolshevik orientation was a far more serious and significant problem. Russia was, in fact, destroying the western façade which Peter the Great had imposed upon the country, and the Tartar in the Russian reverted to his original type. Bolshevik Russia lost all her western provinces, but easily recovered the Siberian conquests of the Tsars. The "war on heaven" was Russia's recantation of her whilom championship of the orthodox church against the Moslem and the Turk, and it paved the way for the Bolshevik assumption of the British part in Asia, which the Kaiser had challenged when he claimed to be the friend of Moslems all over the world.

But anything oriental was fish to the Bolshevik net: Chinese troops had been the most useful of their mercenaries, and Bolshevik influence overthrew the peace Lord Curzon dictated to Persia in 1919, penetrated into Afghanistan, played a large part in Chinese civil wars, and fostered discontent in India. But none of her new friends brought much grist to the economic mill of Russian destitution, and the "new economic policy" of 1922–3 recognised the need of western trade and capital and implied, perhaps, some doubt of the permanence of the new orientation. Krassin travelled by aeroplane to London in May to convey surprising acquiescence in Lord Curzon's somewhat dictatorial demands.

Relations with France.—With France relations were more and more strained as distrust of the wisdom of her Ruhr adventure grew into detestation of the methods employed, not so much to extort reparations as to dismember a disarmed country, to the integrity of which, as restricted by the Peace of Versailles, the Allies had pledged themselves. The worst was concealed by the Government out of consideration for French susceptibilities, but there was considerable indignation in Parliament and outside with the "wait and see" attitude of the Government and with the studied deliberation with which M. Poincaré, confident in his own methods, postponed the consideration of Britain's tardy efforts to find a practical solution.

The Cabinet was in fact divided, and the difference was somewhat strikingly illustrated by the discrepancy between Lord Curzon's note to France on Aug. 11 denying the legality of the occupation of the Ruhr, and the Prime Minister's statement, after an interview with M. Poincaré on Sept. 19, that there was no divergence between them in purpose or in principle with regard to Reparations. French intransigence was commonly attributed to M. Poincaré's knowledge of the support he enjoyed within the British Cabinet, but Mr. Baldwin did not expressly extend his approval of French purpose and principle to their methods, and in September there were extraneous reasons for avoiding disputes with France.

Greece and Italy.—A third crisis had been precipitated by M. Mussolini's hasty extension to other countries of the methods of the Fascisti. On Aug. 27 General Tellini and four members of his suite were murdered while engaged on a League of Nations commission to delimit the Greco-Albanian frontier. The outrage certainly occurred on soil that was claimed by Greece; but without waiting to ascertain whether the criminals were Greeks, M. Mussolini sent an ultimatum to Greece, and on Aug. 31 bombarded and seized Corfu. It was a repetition of Austria's action over the Serajevo murders, copied down to the phraseology used by the disputing parties, with this difference, that Tellini's mission was under the auspices, not of Italy, but of the League of Nations.

The incident produced a remarkably strong and unanimous expression of opinion by the League of Nations then in session at Geneva; but the Council of Ambassadors, which was still kept up, to temper with diplomatic caution the convictions of indiscreet humanity, intervened to secure the evacuation of Corfu, without compensation for its bombardment, and to impose a fine on Greece without waiting to ascertain who the murderers were. The credit of the League was thought to have suffered a shock; but Corfu was evacuated and it was the Conference of Ambassadors which disappeared. The general effect of the situation upon the prestige of the Government was indicated by Sir Robert Horne's assent to a remark by Mr. Asquith that Great Britain had almost ceased to count among the Great Powers of the world.

Mr. Baldwin and Protection.—Meanwhile, early in Oct., the British Dominions had met in conference and inspected the progress of the Wembley Exhibition; and on Oct. 9 Mr. Bruce, the Australian Premier, pleaded for a thorough Protectionist policy for England on the ground that it alone provided adequate scope for Colonial Preference. The Government at once indicated that it would go as far as it could within the limits of Mr. Bonar Law's pledge in Oct. 1922 not to introduce general protection during the lifetime of the Parliament then to be elected; and on Oct. 25 at Plymouth Mr. Baldwin announced that the only way of fighting unemployment was by protecting the home market, while his Chancellor of the Exchequer added that the Cabinet would have to seek release from Mr. Bonar Law's pledge.

The conversion of the Ministry and its announcement were hardly bolts from the blue to careful students of political meteorology. But the Prime Minister himself appears to have been surprised by the rapidity with which he was hustled towards a general election. He gave no hint of it in other speeches five and seven days later, and not until Parliament met on Nov. 13 did he announce that he had advised the King to dissolve it on Nov. 16. The wisdom of dissolution was not apparent, and a confession was read into his remark a year later that it was not often a man was given a second chance. He had an adequate majority over all other parties in the House; Parliament had still four years to run; unemployment, while serious enough, had been reduced by 25% or 30% in nine months without heroic measures, and Mr. Bonar Law had pleaded for a period of tranquillity. It seemed as though his successor was bent on throwing away substantial advantages for a delusive policy on which his party were not agreed.

To the feud between Coalition and anti-Coalition Unionists were added division between free traders and full protectionists and the alienation of both. Mr. Austen Chamberlain denounced the exclusion of wheat and meat from the proposed duties, and said it was a mistake to fight a great fight on a little issue, while Lord Derby and Lancashire inclined towards the view of *The Glasgow Herald* that Mr. Baldwin's policy was one in which the Unionist Party could not succeed without disaster to the country, nor fail without disaster to itself.

It succeeded, however, in averting one danger which Mr. Baldwin feared. He had remarked in his first speech as Prime Minister that the Coalition had been destroyed just in time to prevent the disruption of the Conservative Party; yet his succession to the Premiership had coincided with a vigorous effort, led by Mr. Churchill and Lord Birkenhead, to revive the Coalition under the name of a Centre Party in order to combat socialism. The revival of the free trade issue precipitated Liberal reunion, and enlisted the support of Mr. Churchill, who found his nearest approach to a Coalition among the Liberals. But while that reunion preserved Conservatism from the contamination of Coalition, it did not save the country from the experiment of a Socialist Government.

The General Election.—The general election took place on Dec. 6. Most Unionists had anticipated a reduced but still comfortable majority over all other parties. Their disappointment was due less to any great alteration in the distribution of the popular vote, than to the co-operation between the two Liberal sections and the restriction of contests between Liberal and Labour candidates to 52 seats. The Unionists lost about 75,000 votes, while Labour gained about 250,000 and the Liberals about 180,000 out of some 14,000,000 polled. But the Unionists lost on a balance 88 seats while Labour gained 47 and the Liberals 41. The result was that, instead of 346, there were only 258 Unionists in the new Parliament; instead of 144 there were 191 Labour M.P.'s; and instead of 117 there were 158 Liberals. Apart from eight Independents, Labour and Liberal members combined had a majority of 91 over the Government which had dissolved with a majority of 85.

Labour had again secured the place of the largest party in opposition, and would assuredly regard it as its duty to oppose; but it was not so clear that the Liberals would turn out Mr. Baldwin in order to install Mr. Ramsay MacDonald, nor, indeed, that the followers of Mr. Asquith and those of Mr. Lloyd George would take the same view of their duty in the matter. Mr. Baldwin, relying upon this ambiguity and upon the fact that he still had a bigger majority over Labour than Labour had over the Liberals, determined to wait in office and see what Parliament would do.

Historical Precedent.—The Christmas vacation was mainly occupied by a vigorous discussion of the political situation and its constitutional implications. There was no particular novelty in the existence of three parties in the House of Commons, no one of them possessing a majority over the other two combined. Daniel O'Connell held the balance of power between the Whigs and Tories in 1835 when his "Lichfield House compact" with the Whig Opposition turned out Peel and set "an evil precedent, pregnant with disastrous consequences." The Peelites themselves held the balance a few years later between Liberals and Conservatives. Liberals held office by virtue of Irish votes in 1886, 1892–5 and 1910–4, and a Conservative Government by Liberal Unionist votes, not represented, save by Mr. Goschen, in the cabinet, from 1886 to 1892.

The difference lay in the relative depth of the dividing lines; the stability of these recent Governments reposed upon the fact that one issue, Home Rule, overrode all others, and divided the Government from the Opposition more fundamentally than any division within their respective ranks. But in 1924 no two parties were bound together to pursue a specific policy. Nor was it easy to discover anything more fundamental in the division between a liberalism, not very clearly defined, and a socialism with many shades of meaning, than in that between liberalism and a tariff reform which might mean anything between a "whole hog" and a pork chop. To Sir John Simon's argument that the Socialist programme of nationalisation of the means of production, distribution and exchange meant the nationalisation of *all* these means, it might be replied that liberalism meant the nationalisation of none, and, therefore, implied the abolition of the Post Office, the repeal of a good deal of Liberal legislation, and the abandonment of several items in its programme. Free Trade was a clearer issue than most, and foreign policy came next; and the two together provided the basis upon which Mr. Baldwin was turned out and a Labour Government installed in office for the first time in English history.

The Position in Theory.—The constitutional argument turned on the question how far the leader of a party in a permanent minority could impose on the Crown an advice which depended for its authority upon the assumption that he enjoyed the confidence of a majority. Extreme doctrinaires held that the Crown must act on that advice even though it involved a dissolution of Parliament against the wishes of the Crown, the Commons, and the country, and envisaged a ministerial prerogative based on a purely Bolshevist theory of executive irresponsibility. But there were clearly practical objections to its adoption; according to it Mr. Baldwin might, instead of resigning on his defeat in the House, have plunged the country once more into another general election; Mr. MacDonald might, remaining in office after the general election of 1924, have done the same in Nov. or Dec. 1924; and a Government might theoretically maintain itself in office by a series of dissolutions. The best practical answer, however, to those who regarded absolute control over dissolutions as the sacred ark of ministerial prerogative, is perhaps the facts that no Prime Minister in the 20th century, except Mr. Asquith, has yet (1926) exercised it more than once, and that the more eager the claim to control the greater the penalty inflicted by the country for its exercise.

The first effect of the election was to provoke from timid minds an agitated appeal for another coalition of Conservatives and Liberals, and alternatively, either a Liberal agreement to support a Conservative Govt. or Conservative support for a Liberal Government. Mr. Asquith hastened to pour scorn upon this invocation of him as a saviour of society, and made no concealment of his intention to assist in the downfall of Mr. Baldwin's Government. Mr. Baldwin, whose supersession was one of the motives of the movement, could hardly have consented to a coalition in view of his action in Oct. 1922, and he somewhat easily weathered the attack on his position as Conservative leader.

Fall of the Baldwin Ministry.—He met Parliament on Jan. 8 1924 with a bold front and a programme shorn of Protection, but replete with proposals borrowed from Labour or the Liberals. The question was one of confidence, which a Labour amendment to the address denied in simple terms to Mr. Baldwin's administration. The amendment was supported by Mr. Asquith, who was the arbiter of the situation, and was accordingly heard with a respect which had not for nearly 10 years been paid to his words. Some of his nominal supporters did not relish his advice; 10 voted with the Government and six abstained; but the bulk of the Liberals, added to the Labour vote, gave a majority of 72 for the amendment on Jan. 21, and for the first time since Mr. Asquith's own amendment on Aug. 11 1892, the House of Commons enjoyed the sensation of ejecting a ministry from office by a direct vote of censure.

Labour in Office.—Mr. Baldwin resigned, and Mr. MacDonald accepted office on the following day. He had already prepared his colleagues. There was necessarily a good deal of inexperience in the cabinet of a party taking office for the first time, and only three of Mr. MacDonald's colleagues had been in one before—Lord Haldane, who returned to the woolsack, Mr. Henderson, and Mr. Clynes. But there was a general desire to give the new Government a "fair chance;" and one or two Ministers, Lord Chelmsford, and possibly Lords Olivier and Parmoor, accepted office rather on the ground that the King's Govt. must be carried on, than from any particular zeal for Labour politics. Lord Olivier had, however, long been a member of the Fabian Society; Lord Parmoor, a prominent churchman and a Conservative M.P. from 1895 to 1914, had been attracted by Labour's devotion to peace; and there was particular need at the Admiralty for some one of Lord Chelmsford's experience and tact to bridge the hiatus between the senior service and the youngest of political parties.

Mr. Walsh, however, got on excellently at the War Office, though finding it a little difficult to be properly superior to his subordinate, the Earl of Cavan, chief of the Imperial General Staff. Probably the most effective of Mr. MacDonald's colleagues were Mr. Philip Snowden, who became Chancellor of the Exchequer, and Mr. J. H. Thomas, who went to the Colonial Office. Mr. MacDonald himself took the Foreign Office, too heavy a burden to combine with the leadership of his party and of the House of Commons. He was justified by the success of his dealings with France and Germany, and by the very favourable impression he produced at home and abroad; but overwork and strained nerves had a good deal to do with the abbreviation of his term of office.

France and Russia.—The European situation had taken a slight turn for the better before Mr. Baldwin resigned, owing to President Coolidge's intimation, in Oct. 1923, of America's willingness to participate in an inquiry into Germany's capacity to pay reparations and to M. Poincaré's consent in Dec. to the appointment of committees for the purpose; and by a tactful letter to the French Prime Minister on Jan. 26 Mr. MacDonald established a friendliness in personal relations which had been impossible under the Curzon-Baldwin diarchy. In response to his suavity or in intelligent anticipation of the French general election, M. Poincaré showed himself more accommodating on the Rhine. With regard to Russia, however, Mr. MacDonald reversed his predecessor's policy, recognised the Soviet Govt. on Feb. 1 and invited it to send plenipotentiaries to London to discuss existing treaties and the settlement of existing claims between the two Governments and their individual subjects. The Liberals warmly supported this policy, and still more warmly the Government's decision to abandon the project of a great naval base at Singapore. It was different with Mr. MacDonald's acceptance of his predecessor's plan of laying down five fresh cruisers, albeit his reason was peaceful employment rather than warlike preparation. This did not meet the Liberal plea for economy, and the Government had to rely on Conservative votes to save them from defeat.

Housing and Unemployment.—The most singular failures of Labour in office related to those domestic problems for which it was thought to have specific cures, namely housing and unemployment. The number of unemployed, which had risen during the last fortnight in Dec. to 1,280,000, had, indeed, been reduced by the end of June to 1,009,500, the lowest point since demobilisation; but at the end of Sept. it was up again to 1,215,000, and before the end of the year to practically what it had been at the beginning. This was worse than the modest anticipation of Mr. Shaw, the Minister of Labour, in May, that the figure would remain at about 1,000,000 for the next two years and in the third would not sink below 800,000. The most plausible defence was that of Miss Bondfield, the first woman minister, to the effect that the Labour remedy was the nationalisation of land, mines, railways and main roads, which was impossible till Labour obtained power as well as office. Mr. Wheatley was no happier, as Minister of Health, with his housing policy, the fundamental trouble both with it and with unemployment being the reluctance of the majority of workers who were employed to risk reduction of wages and dilution of labour for the sake of those who were not.

The Labour Budget.—The Labour Govt. seemed doomed to prosper by its liberalism rather than its socialism; and Mr. Snowden came to the rescue on April 29 with a free trade budget, which pleased the Liberals a great deal more than it did some of his colleagues, including his own Prime Minister. The internal debt had been substantially reduced, and the external, save that to the United States, wiped out; and the Chancellor estimated his expenditure at £790,000,000 and his revenue at £828,000,000. He proposed, therefore, to halve the duties on tea, coffee, cocoa and chicory, and to reduce that on sugar from 25s. 8d. to 11s. 8d. per cwt., thus taking, he said, "the greatest step ever made towards the near realisation of the cherished Radical idea of a free breakfast table." He also proposed to abolish the inhabited house duty, and, after June 30, the corporation profits tax. He announced that the Government were unable to endorse the resolutions of the Imperial Conference in favour of Colonial Preference, but proposed to retain the existing ones. The McKenna duties, however, were to be abolished after Aug. 1. This last proposal provoked the most discussion, but Mr. Baldwin's motion regretting it was defeated on May 12 by 317 to 252. The effect of the Budget as a whole was to increase the gap between the Conservatives and the Government and to diminish that between the Government and the Liberals; and Mr. Thomas's interjection during the budget debates to the effect that the Government had many more budgets to introduce implied an expectation of continued co-operation between the two parties. The co-operation had to be active because mere abstention by the Liberals would insure the defeat of the Government.

The French Election.—Meanwhile another stroke of good fortune befell the Government in the French general election in May. The failure of the Ruhr adventure to produce financial fruits, coupled with its cost, had forced upon M. Poincaré the unpleasant necessities of taxation and retrenchment. These were not at all the results which France had expected, and her obvious reluctance to meet her obligations started the franc on the downward path of the German mark; not till it had fallen to nearly 130 was its progress checked by American and British intervention, dictated by fear of the effects on French external trade. This assistance did not save M. Poincaré, who had gone so far as to sanction a breach of the French law requiring annual budgets, from electoral resentment; but, as in England during the autumn, the success of the Radical and Socialist parties was due rather to increased co-operation than to any great turnover of votes. The result was the same, namely to give a majority to a combination of left centre and left parties, which enforced the retirement (June 11) of the French President, M. Millerand, on the ground that he had improperly identified himself with M. Poincaré's policy, and substituted M. Herriot as Premier for M. Poincaré.

A European Agreement.—Semi-Socialist governments in the two countries could now discuss the Dawes plan and the Ruhr with greater cordiality and better prospects of agreement. On June 21–2 M. Herriot paid a visit to Mr. MacDonald at Chequers and Mr. MacDonald returned it at Paris on July 8–9; as a result invitations were issued to a conference of the Allies in London which opened on July 16. Mr. MacDonald presided with a skill which materially contributed to its striking success; and on Aug. 16 a settlement was reached, embodying the Dawes plan and an agreement between French and German delegates for the liquidation of the Ruhr adventure, which was ratified by the French Chambers and the German Reichstag. This, claimed Mr. MacDonald with some justification, was the first real treaty of peace since the War, because it was made by agreement and not dictated by force.

Difficulties of the Government.—This was the climax of the Government's success, and already ominous signs were appearing of trouble in other directions. One was the refusal of Northern Ireland to appoint, as provided by the Irish treaty, a commissioner to assist in the delimitation of the Free State frontier; but this only caused a Conservative outburst, which the Government could afford to ignore so long as it retained Liberal support. It was, however, sore over the number of Liberal amendments it was forced to incorporate in its housing, unemployment insurance and agricultural wages bills; and on one occasion the Prime Minister angrily refused to "feed out of Mr. Asquith's hand."

The final breach, however, was imposed upon him by his left wing, inspired by Mr. Wheatley, whom it would have preferred as Prime Minister. The negotiations which the Government had initiated with Soviet Russia dragged on from April until Aug. 5, when an official announcement was made that the conference had broken down; late that night, however, some four or five members of the extreme Labour left succeeded, by secret diplomacy, in persuading the rival negotiators to meet once more,[1] and on Aug. 6 the Under-Secretary for Foreign Affairs informed the House that a treaty had been drafted and would be signed next day. The determining consideration was the suggestion of British capital to Communist Russia in return for an acknowledgment and partial satisfaction of British debts. Unofficial intervention of a secret character also determined the withdrawal on Aug. 12 of the Government's prosecution for seditious libel of Mr. Campbell, who was the acting editor of *The Worker's Weekly.*

The first of these incidents caused most of the political discussion in Sept., but it was the second on which the Government fell. The Conservatives had at once denounced the Russian treaty in the House, and Mr. Lloyd George joined in the attack on its loan proposal. He renewed his attack during the recess on Sept. 10, and defied the Government to proceed with its ratification. Lord Grey took similar objection in a milder way on Sept. 18, and on Sept. 20 Mr. Asquith followed suit in a letter, but not without a hint that some modification of the treaty might induce Liberals to acquiesce in its ratification. The cabinet met on Sept. 22, and seemed not altogether averse from the idea. On Sept. 27 the Prime Minister explained that the Government only proposed to guarantee so much to Russia as she could raise in the ordinary way in the money market, and that it would guarantee nothing until the conditions were fulfilled.

Simultaneously there appeared, in the second edition of his *Socialism, Critical and Constructive* (1924), a denunciation of Russian Bolshevism and British Communism. The path was still open to peace between Labour and enough Liberals to avert a defeat of the Government. Both parties were at one over the Irish Boundary Commission, and all parties concurred in Mr. MacDonald's prompt refusal of Zaghlul Pasha's demand that Great Britain should relinquish the Sudan to Egypt. The urgency of the Irish question, however, required the reassembly of Parliament on Sept. 30, instead of four weeks later. The Boundary Bill went through without opposition except from Conservatives who did not persist therein, but the meeting of Parliament provided facilities for a disruption which might have been postponed or avoided, had the combatants kept apart on their respective platforms instead of coming into contact in the House of Commons.

Defeat of the Government.—On Oct. 1 the Liberals put down a motion on the Russian Treaty, but that was not to come up until Nov. On Sept. 30 Mr. Baldwin asked for a day to discuss, when Parliament met again at the end of Oct. the Government's action over *The Worker's Weekly.* It is not easy to apportion the responsibility for the anticipation of the crisis, and it may have been inadvertence rather than the deliberate choice of an issue which led Mr. MacDonald, in replying to Mr. Baldwin, to suggest an immediate discussion of the Campbell case. When that motion appeared next day as a vote of censure, constitutional propriety required that it should not be left hanging over the Government for a month, and it would seem that the Conservatives, who were already convinced that they had most to gain by a dissolution, were least anxious to avoid it. Mr. Churchill had just come out as a Conservative candidate, and, apart from that accession of strength, he was ever the best indicator of the quarter from which the wind was going to blow. Conservative tactics were certainly on this occasion more skilful than those of other parties.

The Liberal motion on the Campbell case was for a select committee, which need not be treated as a vote of censure any more than were those for the Jameson Raid committee or the Marconi inquiry; and, put as an amendment to Mr. Baldwin's vote of censure, it would ensure the defeat of the latter. If Mr. Baldwin's contention had been correct that the Government wished to defeat his motion by means of Liberal votes and the Liberal amendment by Conservative votes or abstention, it would have absolved Mr. MacDonald from the charge of precipitancy which the Conservatives incurred by voting for the Liberal amendment to their own motion and thus defeating the Government on Oct. 8 by 364 to 198. It was difficult for Mr. MacDonald not to regard an amendment as a vote of censure when the majority, who voted for it, had a vote of censure in their minds and on the paper. Partly by accident and partly by design, the Liberals had been hoist with their own petard and made to appear as willing to wound but afraid to strike; and the dilemma in which they found themselves was prophetic of their disaster.

Another General Election.—The Government naturally preferred dissolution to resignation, though they forfeited the prospect of a year or two of office and of budgets by which they could have effected much, as well as the unpopularity of a third dissolution in two years. The Conservatives were even more willing, and a windfall helped them in the Zinovieff letter inciting British citizens to disorder in the interests of international communism. The Foreign Office regarded it as genuine, and Mr. MacDonald demanded an explanation from the Russian Govt., which denounced the letter as a forgery. The original had not been seen, but a copy had found its way into the offices of *The Daily Mail.* After the election a committee of the Labour Govt. was unable to come to a positive conclusion, but a subsequent committee of its Conservative successors thought the evidence for its authenticity conclusive.[2] The effect of the bombshell was more disastrous among half-hearted Liberals than wholehearted Labour voters, and the polling revealed a landslide in public opinion. It was a falling away from the Liberal party in both directions. It lost 1,250,000 votes: the Conservatives gained 2,000,000 but Labour also gained 1,000,000.

This result was, as usual, grossly exaggerated in the members returned; less than half the votes cast—7,864,402 out of 16,302,455—gave the Conservatives more than two-thirds out of the whole House—413 out of 615 seats; Labour, with just over a third of the votes, obtained 151 seats, less than a quarter of the House; and the Liberals with nearly a fifth of the votes obtained 40, or less than a fifteenth of the seats in the House. Mr. Asquith lost his seat at Paisley and was presently created Earl of Oxford, the latest, but, with the doubtful exception of Harley, easily the most distinguished holder of that historic title; and Mr. Lloyd George, Sir John Simon, Mr. Runciman, Mr. Fisher and Sir Alfred Mond were the chief survivors of a disaster which seemed to show that Liberalism had fulfilled its function in British politics. Labour, while driven from office, had succeeded in its more immediate object of defeating its rival for the succession.

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[1] Mr. MacDonald stigmatises as a "common error" the statement that "half a dozen unofficial members of Parliament reopened the negotiations and drafted the agreement" (*The Observer*, (London) March 21 1925). This does not, contradict the statement in the text.

[2] See the text and comment in A. J. Toynbee's *Survey for 1924* (1926), pp. 246–50, 492–6; the matter is still involved in obscurity due to the ambiguity of the relations between the Third International and the Soviet Government.

The Second Baldwin Ministry.—In a sense it had done so by converting both its rivals. The King's speech, which Mr. Baldwin had drafted in Jan. 1924, marked an enormous advance n Conservative thought; the Labour party had repudiated its Communist wing and definitely committed itself to the cause of orderly progress, and not a few Labour and Conservative leaders had called themselves Liberals and retained much of the faith n which they had been brought up. In the long run it might seem to make little difference to the country whether it took alternate doses of rival prescriptions, or adhered consistently to a compound of both. One thing was certain; the country would not remain always content with the same advisers, and the need for an opposition was only second to that for a Government.

Mr. Baldwin's second administration was a great improvement on his first; the Coalition feud was healed, and the new Cabinet included most of the able ministers who had been banned in 1922. Mr. Austen Chamberlain went to the Foreign Office, from which it was Mr. Baldwin's painful duty to exclude Lord Curzon; Lord Cave returned to the woolsack, but Lord Birkenhead was given the India Office; Lord Balfour succeeded Lord Curzon as President of the Council on Lord Curzon's death in March 1925; Sir L. Worthington-Evans returned to the War-Office; and Mr. Churchill received, in the Chancellorship of he Exchequer, the reward of intelligent anticipation. But the House was the poorer for the holocaust of Liberal critics, and Mr. Baldwin's huge majority deprived its proceedings of an essential stimulus to liveliness. The country did not exactly want to rest and be thankful; but it wanted to get along without being over-driven by supermen and without being governed by a perpetual series of general elections.

The Meeting of Parliament.—The new Parliament met on Dec. 2 to find some results of the general election already regisered in the Government's repudiation of the Russian treaties, he revival of the Singapore naval base, and the claim for excessive reparations from Egypt for the murder of the Sirdar, Sir Lee Stack; the Italian press approved of the British demands on the ground that they justified Italy's action the year before over the assassination of General Tellini. The Government, however, was continuing Mr. MacDonald's policy in rejecting Zaghlul's claim to Egyptian control of the Sudan and in bringing o a successful conclusion the negotiations for a commercial reaty with Germany. Another reversal of policy, indicated in Mr. Baldwin's declaration that in the view of this Government he late Government's instructions to the attorney-general to nstitute no political prosecutions without the sanction of the cabinet was unconstitutional, was modified a few days later by his statement that the attorney-general should in such cases inorm himself of the views of the Government or the appropriate minister before coming to any decision. The chief outstanding ambiguity related to the Government's tariff policy. Mr. Baldwin on Dec. 9 renewed his pledge not to introduce Protection nto the new Parliament, but on Dec. 17 he announced that a bill would be introduced next year to give any industry which could prove itself to be substantial and efficient general protecion against unfair competition from abroad. How far "efficiency" n an industry was compatible with failure to meet competition, and how far "unfair" was identical with successful competition were questions demanding careful consideration.

Mr. Churchill's Budget.—Before Parliament reassembled, on Feb. 10 1925, the Government had determined to drop the idea of a tariff bill, in order, said Mr. Baldwin, to restore the House of Commons to its constitutional position as the taxing authorty; and the Government's proposals were embodied in the budget which Mr. Churchill introduced on April 28. There were certain "sumptuary duties" on natural and artificial silk, and a "nakedly protective" duty on imported hops; the McKenna duties were reimposed, and the preferences recommended by the Imperial Economic Conference of 1923 were accorded so far as they did not involve new or additional duties upon food. These sumptuary, protective or preferential duties in the budget were subsequently supplemented by bills, introduced after reports by Board of Trade committees in favour of special measures of protection; and lace, gloves, gas mantles and certain kinds of cutlery were granted.

An application on behalf of the steel industry was rejected, not apparently on the ground that it was illogical, or that foreign competition was fair, but because steel involved so many particular industries that their sum might infringe the pledge against general protection; some of the parts must be left out lest they should make a whole. These concessions to the protective wing of the party were balanced by a new scheme for old age pensions at 65 and pensions for widowed mothers, by sixpence off the income tax and increased allowances for earned and smaller incomes. The fly in the ointment of the budget was an estimate of expenditure, amounting to nearly £800,000,000, and soon to be increased, until, at the end of the year, the Chancellor was faced with the dilemma of revoking his boons or imposing drastic and comprehensive economy.

The Gold Standard Restored.—The soundest of Mr. Churchill's achievements was, perhaps, the restoration of the gold standard, though its beneficence was disputed by some economists and it had little apparent effect upon trade or unemployment. Most progress was made with housing, but the 150,000 new houses owed their existence to private rather than to state or municipal enterprise; rent control was continued, and the total number of unemployed was only reduced during the year from 1,307,140 to 1,251,900. Coal mining threatened catastrophe, and at the end of June the owners intimated that they could not go on without a reduction in wages, which the men would not even discuss; a disastrous strike was only averted on July 31 by the dubious expedient of a subsidy, put at first by Mr. Baldwin at £10,000,000, but more than doubled by the end of the financial year. A commission sat throughout the autumn and into 1926 to deal with a problem for which none of the party creeds provided a solution. Owners could see salvation only in increased hours of labour and reduced wages and railway expenses, while the community paid for German indemnities by maintaining British miners and spent in the way of subsidies to coal what it saved by using other fuel.

The Pact of Locarno.—The need of retrenchment at home ingeminated peace abroad, and the spirit of Locarno pervaded the political atmosphere of the autumn. The Government had, in the spring, rejected the League protocol, conceived on Wilsonian lines and supported by the sentiment of labour and America, after it had been accepted by the great majority of the members of the League, and had turned to the more restricted but feasible ideas embodied in the security pact which was initialed at Locarno in Oct., ratified by the relevant parties in Nov., and signed in London on Dec. 1. By it Great Britain, France, Germany, Italy and Belgium bound themselves, collectively and severally, not merely, like the famous "scrap of paper," to respect but to guarantee the existing frontiers between Germany and France and between Germany and Belgium. The treaty was only to become effective on the day on which Germany entered the League of Nations. Whether this condition was inspired by fear lest Germany should decline to enter, or lest other Powers should shut the door, the universal anticipation was that it would be fulfilled.

Some ill-grounded apprehension had been felt in May over the election of the veteran Hindenburg as German President on Ebert's death; but that event belonged to the same harmless national psychology as that which made Marshal MacMahon President of the French Republic in 1873; and just as that was followed by the German evacuation of France, so Hindenburg's election was followed by the French evacuation of the Ruhr and the British evacuation of Cologne. For his services in the negotiations Mr. Chamberlain received the Garter and the gratitude of the world. The decision to proceed with Singapore was followed within a year by another to reduce Rosyth and Pembroke to a care-and-maintenance basis.

The spirit of peace spread to southeastern Europe; and after Greece and Bulgaria had been constrained by the League to forego a frontier war in Oct., even the Balkans began to talk of a security pact for their own particular cockpit. The League also decided at length in Dec., mainly in favour of Britain, the claim, disputed by Turkey, to Mosul, though the solatium which would induce the Angora Turks to acquiesce was left over until 1926 for arrangement between the parties.

The Irish Boundary.—How far peace was induced in Ireland by the threat of the Free State to refer its frontier problem to the League is a matter of speculation. The refusal of Ulster to appoint a boundary commissioner in 1924 had been followed by the appointment of a distinguished South African judge, and an unauthorised forecast of the commission's report in Nov. 1925 precipitated at first a revival of contention and then a settlement between the parties without recourse either to the commission's report or to the League of Nations. The existing frontier was maintained and consolation extracted from the British Exchequer in the form of relinquished British claims to indemnities for destruction during the hostilities of 1921–2. Whatever the friction between the north and the south, there was, it appeared, an Ireland united at least in this: no Irishman would obstruct another in any claim he might have against the British Treasury, and all would resist a peace enforced in Irish homes by intruders from outside.

Position at the End of 1925.—Great Britain was left at the end of 1925 freer than it had been for 15 years to contemplate its own domestic discontents; and, for the moment, there was even there an uncommon absence of violent disagreement. The evils were admitted, and the remedial principles only disputed on the ground that they did not go far enough. The complaint of the Liberals, as of the Whigs 60 years before, was that their clothes had been stolen while they were bathing or basking in a setting sun. Socialists echoed the refrain with the reservation that it was a rising sun in which they basked; and when a Conservative Govt., acquiesced in the Parliament Act and political levies by trade unions, cold-shouldered the reform of the House of Lords, maintained state control of rents and prices, proposed to hew a way through city slums, bestowed old age and other pensions on an unexampled scale, and lavished subsidies on coal and protection on efficient industries, it was difficult to discern a basic principle of differentiation between the parties.

Labour had in Sept. repeated and reinforced its repudiation of Communism; even Mr. Wheatley's left wing was all but excluded from the executive of the party, and Mr. MacDonald regained his restraining influence. The two major parties were, in fact, suffering or benefiting by a process from which no party and no cause is ever immune, namely a dilution of its principles inherent in the extension of its size and the increase of its popularity. Intensity is the perquisite of the few, dilution the property of the mass. Dilution had even to be imposed upon the land policy, which Mr. Lloyd George inaugurated in the autumn, before it commended itself to his party; and such loss of voting power as threatened the Government was mainly due to the intensification of its policies of protection and economy.

In the first half of 1926, what had been called "the Locarno spirit" was violently disappointed. Germany's expected entry into the League of Nations as a permanent member of the Council with the moral status of a Great Power was vetoed by Brazil. That country's action was disapproved too late by the British and French governments, but earlier they had countenanced opposition by Poland and Spain to Germany's unconditional admission. This sequel to the Locarno Pact was widely censured and nowhere more generally than in Great Britain. (A. F. P.)

The Coal Commission reported in March condemning the subsidy, but recommending an extensive reconstruction of the industry and some temporary reduction in wages. (*See* COAL.) Again negotiations between miners and owners broke down and government intervention failed. A general strike was then declared by Labour at the beginning of May. It was one of the greatest social crises by which any country had been shaken since the War but it only lasted nine days. Volunteers and motor-transport played a chief part in preventing the paralysis of communications by the Trade Unions. The struggle had been watched with breathless attention by the world. The calm firmness and competence of the British people as a whole raised them accordingly in the world's respect. The miners stood out alone and the coal strike dragged on into June 1926. In the early days of that month earnest efforts for a settlement were afoot. There were strong hopes that the "spirit of Locarno" would prevail after all, both in the industrial field and in foreign policy. (ED. *E.B.*)

BIBLIOGRAPHY.—The great bulk of the original material for English history during these 15 years is contained in Hansard's *Parliamentary Debates* and the even more numerous volumes of parliamentary and official papers, for which see H. B. Lees-Smith's useful *Guide to Parliamentary and Official Papers* (1924). One of the most important of these is *The War Cabinet: Report for the Year 1917*, Cd. 9005, published by H.M.S.O. (March 1918), which is valuable not only as a record of achievement but of the now forgotten ideas of that body; no other British Govt. has published a similar record of its work or revelation of its methods. These official sources have not yet been supplemented to any great extent by personal or private revelations: the interval is too short to have permitted the publication of the confidential papers, correspondence or memoranda of British statesmen, or of their biographies or memoirs. Such as have appeared have generally been fragmentary and partial, often eked out with gossip misleading in proportion to its indiscretion. Most of these volumes, moreover, relate to the War, and are dealt with elsewhere.

Pre-eminent among periodical publications are *The Times* for its fullness and general accuracy, and *Punch* for its happy and impartial reflection of the passing mood. A good deal of history can also be made out of or verified by such annuals as the *Statesman's Year Book* and *Whitaker's Almanack*, while the *Annual Register* provides a valuable half-way house between daily papers and history. The documents it contains, while important, are few, and its usefulness consists, so far as English history is concerned, mainly in the political summaries compiled from *Hansard*, *The Times*, and other periodical literature.

Some political history is contained in books dealing primarily with the genesis, history, or consequences of the War, such as Lord Haldane's *Before the War* (1920), an account of his mission to Germany in 1912; Mr. W. Churchill's *The World Crisis*, 2 vol. (1923), the first volume of which deals with the prelude to the War, and the second with its naval history until Mr. Churchill's resignation; Sir George Arthur's *Life of Lord Kitchener*, 3 vol. (1920); Mr. H. H. Asquith's *Genesis of the War* (1923), which is authoritative but scrupulously reticent; and, weightiest of all, Lord Grey's *Twenty-Five Years*, 2 vol. (1925). For the documents in any complete form we have, however, to wait for the completion of the task with which Dr. G. P. Gooch and Mr. H. W. V. Temperley were entrusted in 1925 when the Government consented to open its foreign archives for that purpose. Political history also intrudes to some extent into J. Buchan's *History of the War* (1921–2), published in 24 volumes during its course and re-written in four volumes after its conclusion, and also into A. F. Pollard's *Short History of the War* (1920).

Some English political history for the period after the War is to be found in Mr. H. W. V. Temperley's six-volume *History of the Peace Conference*, published under the auspices of the British Institute of International Affairs (1920–4), and in its even more valuable continuation in Professor A. J. Toynbee's *Survey of International Affairs 1920–3* (1925), *The World After the Peace Conference* (1925), and *Survey of International Affairs, 1924* (1926), all produced under the same auspices. But this is mainly international and diplomatic history. For domestic history we have to rely almost exclusively on parliamentary and official papers, periodical literature, and personal recollection or information. (A. F. P.)

ENGLISH LITERATURE (*see* 9.607).—It must remain for a remoter posterity to pass final judgment upon the English literature of 1911–26; to decide which (if any) of the authors then living were really great; to discern with certitude the trends and the characteristic colour of the age.

I. INTRODUCTION

Among those who lived through the period, it was a common opinion that it was not an age "of giants"; that the poets were not as great as Browning or Tennyson, nor any of the novelists as eminent as Dickens, Thackeray or Fielding. That opinion, as yet, can only be tentative; in the ultimate, reputations are decided by the permanent, as contrasted with the topical, appeal to the human mind and heart; and it may be that to posterity all the writers of the age will seem to have qualities and a tone in common which were not evident to themselves. It certainly does appear to us that there was a harmoniousness, a shared adventurousness, curiosity and delight, general in the Elizabethan age; that the Puritan, the Cavalier and the "metaphysical" groups may be clearly distinguished in the next age, all three having much in common; and that the reaction against religious, political and aesthetic excess produced in the 18th century a set of compromises and conventions on the basis of which men worked easily, confidently, with agreed assumptions and agreed aims. Yet we see these things more positively than our fathers did; and we cannot be sure.

Tendencies in Literature.—If there is foundation for the general view that there is a defect of passion in the most recent English literature and a lack of major achievements, the reasons must certainly be found in the state of thought and of what passes for thought. Men's views about the universe, the purpose of life and the nature and destiny of the soul must profoundly influence their works of art, as well as their other actions, however frequent may be the antinomy between their proclaimed theories and their obscure but obstinate impulses. There can be no doubt that the period under review was, at least in what are called "intellectual circles," a period of confusion and conflict, of doubt manifesting itself here in energetic pessimism, here in fatigue and apathy, here in blind hedonism, here in a desperate search for new creeds, sometimes brutally pagan.

The monstrous calamity of the War forced the perennial problem of evil upon the attention of those who would have been disturbed by no lesser, or less spectacular, shock; evolutionary science and comparative mythology had continued to sap the foundations of popular religion and were as yet imperfectly reconciled by contemporary thought in what a bishop has described as "the provisional correlation" of Christian truth with the latest developments of knowledge or hypothesis; the social reforming enthusiasm and the belief in automatic progress of the Victorian age had weakened and in the reaction the imagination brooded upon the prospect of an ice age and the imperfectibility of man. Meanwhile, the mass of questions asked ever since the feudal and Catholic system broke up were reinforced by a new chorus disputing the fundamentals of traditional morality. "Why should I?" was the dominant note, accompanied by a subtler "Why shouldn't I?"; and often neither awaited an answer.

Those who dislike what they regard as the "pollution of pure literature" by didacticism, propaganda, controversy may well find subject for complaint in modern English literature. When a whole set of dogmas is generally accepted both artist and audience may take them for granted, whether forgetting them, building on them or artistically embroidering them. Artists in such an age may sing like birds; where all are in disagreement, or at least perpetually worrying, harshness will creep into the song. At best, argument has its day; even the great genius of Voltaire and Rousseau cannot keep the bulk of their works alive; and those moderns whose plays and stories are coloured by argument, which is negative rather than positive, are handicapped, not merely by the ephemeral nature of the argument, but by the lowering effect of their views upon their general temperament, their capacity for ardent joy, fierce passion and acute grief.

II. FICTION

Conrad and George Moore.—Politics, popularised science, psycho-analysis and their results are powerfully present in a large proportion of the most intelligent modern novels, and the novel, grown polymorphous, is the characteristic medium of the age. Just as the Pre-Raphaelites segregated themselves behind the arras in flight from the smoke of the first industrial age, so certain modern novelists have declined to be affected by the smoke of modern controversy. Amongst novelists, since Meredith and Stevenson died, Joseph Conrad and George Moore were signal examples of the kind of artist who can build a raft for himself and escape from the topical welter. Conrad had his religion and his morality, "a few simple maxims," a code of honour and fidelity. He did not shrink from the major problems either; he was perennially occupied with the difficulties of conduct, the mystery of evil, the veil over the face of Destiny. Yet, as an artist, he did not primarily set out a sublimated journalist, to mingle art with conversion or subversion, to add his word to the babel of tongues discussing property, sex, the multiple self and spiritualism. His views were manifest and set; so were his doubts; he wrote to record what he saw of magnificence, even in the form and visage of tempest and terror, in the most beautiful language he could find; he was an artist in characterisation, in construction, in his treatment of the visible and invisible world.

Of Conrad's last works, *The Rover* (1923) was a prelude to the posthumous *Suspense* (1925), the torso of what might have been a great book, set in the Mediterranean, with Napoleon in Elba a shadow imminent over the action. He died in 1924, a Pole by birth, a seaman by training, who had achieved miracles in a tongue not his own and left a long series of tales, from *Almayer's Folly* (1895) to *Suspense*, mainly concerned with the sea, particularly the East Indian seas (with the psychology of conspirators as a strong secondary interest), written with such scrupulous art, such power of description and suggestion, such a march of sound, such chivalry of spirit, that it is difficult to conceive of them as tarnishing with time.

George Moore, in his latest years, modified his manner and took new materials. His Irish trilogy, *Ave, Salve, Vale* (1911–4), might be classed, by some of the friends whose words and deeds it records, with "fiction"; at least it does indicate his aims. Politics and religion may be and are touched on here, but they are raw material for art, for witty, graceful and tuneful writing; and the desire to create a finely shaped and phrased work is never subordinate to a desire to inform the reader. In *The Brook Kerith* (1916) and *Héloïse and Abélard* (1921), Moore took historical events and settings and made of them stories like tapestries, in the evenness of their flow and the carefulness of their execution. A touch of Pre-Raphaelitism may be detected in them, and some affinity with Pater's one long story; but few artists have owed less, in an obvious way, to their predecessors than Moore, and the ease and translucency of his English, in its latest developments, was unique in our time. The prose flowed like conversation, but no conversation was ever so well shaped and worded.

Other Leading Novelists.—Apart from these, the outstanding novelists of their generation were H. G. Wells, John Galsworthy and Arnold Bennett. Ultimately, Wells is not likely to be thought of primarily as a novelist, and he himself has stated that he has dedicated himself to journalism rather than art. He was the Rousseau, as Shaw was the Voltaire, of his time; he used a great variety of forms to communicate his opinions about the problems of the day and the morrow, to inculcate his enthusiasm for the physical sciences and to awaken the human race to the great possibilities before it, should it but be infected with his ardour for racial reconstruction, a more heroic (or alternatively more comfortable) life, and for the exploration of the worlds around and within us. As a workman and a poet in prose, he never excelled his early short stories and "scientific romances," in which extreme assumptions led up to ingenious and seemingly inevitable chains of consequence. Nor did any of his later novels, in which sexual romance, contemporary politics, satire and Utopian preaching are mingled, betray quite the same care or contain quite such fine sustained passages of description as *Tono-Bungay* (1909).

But *Mr. Britling Sees it Through* (1916) was a remarkable record of the effect of the War upon one man's mind, and *The Undying Fire* (1919), a very striking and successful modernisation of the arguments canvassed in the *Book of Job* and *In Memoriam*. He was tireless as a tractarian and amongst the most astonishing by-products of his great energy and zeal was an *Outline of History* (1919–20), unique among such compilations for the raciness of its narration and the ingenuity of its summary of all the world's annals since the ball of fire first began to cool. *The Salvaging of Civilisation* (1921) was one of his titles; a man who believes that to be his mission and the dissemination of opinion on a variety of subjects the best means to the end, is too preoccupied to write great novels or careful prose.

The reforming, or at least the protesting, bias was strong also in the novels of John Galsworthy. *The Forsyte Saga* (1922), a collection of novels, early and late, about one respectable family, was the crown of all his work. For all his air of detachment Galsworthy could not help presenting the respectable and complacent incompletely; more humour might have led to more truth; so even might a less acutely sensitive humanitarianism. But the achievement of his presentation of the *moeurs* of South Kensington and of country houses cannot be denied; much is there that must be recognised as very faithful record; his characters often lead an independent life, and his writing at its best, if uniformly quiet, is extremely good.

In Arnold Bennett the propagandist instinct was much weaker, though the reporting proclivity was strong. His later, like his earlier, novels varied greatly in importance. He was never slipshod and dull, but in some of his books the chief interest lay in brilliant journalistic descriptions of superficial aspects of "West-End life," some were light-hearted farces, and the best were long meditated and profoundly "understanding" stories about real human beings, stories in which all his talents were brought into play, but all kept subordinate to his genius. The chief of his later books, a worthy successor to *Clayhanger* (1910) and *The Old Wives' Tale* (1908) was *Riceyman Steps* (1923). In this book Mr. Bennett did for his physical and social background, Clerkenwell, what he had long ago done for the Five Towns. The place is known as a place long lived in; the pages are full of pictures ranging from the Hogarthian genre to the Whistlerian nocturne; yet all is seen through the eyes of the characters, the miserly bookseller and his wife and especially Elsie, the brave and lonely maid-of-all-work.

A Younger Group.—Among the younger novelists, Hugh Walpole, Compton Mackenzie, Rose Macaulay, E. M. Delafield, Sheila Kaye-Smith, Francis Brett-Young, Virginia Woolf and Margaret Kennedy were widely read. D. H. Lawrence, brooding like many of them over the mysteries of sex and expounding vaguely prophetic things, showed great descriptive power and a gift for sentences like lightnings. Walter de la Mare in *Memoirs of a Midget* (1921) wrote a long modern fairy tale, like a poet's wood, full of flowers and insects, with a candle-light window at the end of a path and the constellations glittering in the dark sky overhead. H. Belloc's *The Four Men* (1912) was remarkable for its Sussex walks, its gay dialogue and its songs. E. M. Forster's *A Passage to India* (1924) was the most notable book of a maturing and slowly-working novelist, a book in which the artist brooded over the whole surface of Indian and Anglo-Indian life, showing the general through the particular. David Garnett's *Lady into Fox* (1923) and Hugh de Selincourt's *The Cricket Match* (1925) were short books beautifully composed. Among short-story writers W. W. Jacobs lost none of his old cunning and Katherine Mansfield, cut off in her youth, came, in *Bliss* and *The Garden Party*, nearer to Tchekhov than any of his many disciples. May Sinclair, J. D. Beresford, E. F. Benson, Leo Myers, R. H. Mottram, Aldous Huxley, P. G. Wodehouse, Frank Swinnerton and many other names might be added to the list of the novelists who, during the period, produced novels competent or more than competent.

III. POETRY

It is conceivable that in later retrospect the War years and the years immediately preceding and following the War will be held in literature to be chiefly remarkable for their poetry. There may have been few long poems of great note, but a very large volume of good lyric poetry by a very large number of writers was produced.

Bridges and Hardy.—One of the most extraordinary phenomena of the period was the continued fertility of the older poets. When nearly eighty, the poet laureate, Robert Bridges, produced a new volume of poems, *October and Other Poems* (1920), a collection which showed no waning of his technical powers, experimental curiosity and gift of observation, and (more unusual still) no slackening of his emotional ardour. Perhaps the finest of all our landscape poets, and certainly one of the most careful and cunning artists who has ever worked with English words and English rhythms, he stands out conspicuously also by virtue of his perennial freshness and energy, an energy manifested, moreover, in these later years in the compilation of a noble wartime anthology, *The Spirit of Man* (1916), and of various papers on prosody and pure English.

As Dr. Bridges at Oxford, so Mr. Thomas Hardy at Dorchester continued to command the astonished admiration of his juniors. Mr. Hardy, turning to verse in his old age after a long, and nobly productive, servitude to the novel, did not attempt to emulate the vast enterprise of *The Dynasts* (1906), a panorama of the Napoleonic era, with the Fates and the Pities and the Ironies brooding over it. But he followed up his three earlier volumes of lyric and narrative poems, a series of volumes beginning with *Satires of Circumstance* (1914) and culminating in *Human Shows* (1925). Grim little tragedies, tender memories of the beloved dead and Wessex scenes long vanished, hard clear etchings of landscape, sea and shingle, down and puddled lane, bare tree and shivering bird; many of these written in extreme old age, surpassed the best of Mr. Hardy's previous work. These poems were marked by a great and seemingly spontaneous gift of metrical invention, a power of emotion which enabled the poet to incorporate the most unmanageable words in the movement of his music and a quick sensitiveness, a capacity for suffering and pure joy, rare in the old.

Doughty and Others.—Another prolific veteran was C. M. Doughty (d.1926), author of *Travels in Arabia Deserta* (1888), one of the greatest books of the kind in any language, who followed up his *Dawn in Britain* (1906), with a series of long poems. *The Clouds* (1912), *The Cliffs* (1909), *The Titans* (1916) and *Mansoul* (1920), epical dramas and dramatic epics in which archaism and topicality, naïveté and sublimity are strangely mingled, are interspersed with massive passages in which the imagination ranges over all time; and in which the tongue, albeit with something of the accents of Chaucer and Spenser, speaks with prophetic force of imagery; and with other passages which to any one but an idolator must seem bathetic.

Sir William Watson published one volume during, and one after, the War in which, whilst not equalling his major achievements, he showed that his talents for pithy yet magniloquent statement and for the careful polishing of verse remained unimpaired. Maurice Hewlett (d.1923) devoted his last years mainly to poetry. His *Song of the Plow* (1916), perhaps the finest of all his works and certainly one of the few memorable long poems of the period, was a racy, vigorous, picturesque summary of English history from the point of view of "Hodge." His *Village Wife's Lament* (1918), a very poignant ballad of the effect of the War on the same kind of community, was a pendant to it. Laurence Binyon, of the other poets of that generation, perhaps wrote the most impressive volume of War poetry, *The Four Years* (1919), in which the meditations and agonies and exaltations of the humanitarian and the patriot in face of the great calamity are expressed with power and dignity.

Noble poetry inspired by the War was also among the last work of Herbert Trench (d.1923) and Alice Meynell (d.1922), Mrs. Meynell's little book *A Father of Women* (1917) displaying rigid restraint, perfection of workmanship and concentrated emotion, which have been characteristics of her work, both in prose and verse, throughout her career. A similar frugality was manifest in A. E. Housman's *Last Poems* (1922), its author's first collection of poems since *A Shropshire Lad* (1896), of a generation before. A few of the new poems surpassed the finest of the old for beauty of imagery and cadence, and the book was received with enthusiasm by the larger public and with reverent admiration by Mr. Housman's fellow artists. Gilbert Murray continued to add to his beautiful translations from Euripides. One volume, which contained some excellent epigrams and some spirited poems of the War, was all that the period added to the poetical works of Rudyard Kipling.

There remain a large number of poets whose reputations were not fully established in 1911, or who emerged during or after the War. The most notable progress among the former was made by Walter de la Mare, whose early books were followed by *The Listeners* (1912), *Peacock Pie* (1913) and others, including a two-volume collection in 1920. This poet usually inhabits provinces which he has made his own: Woods haunted by fairies, midnight gardens and heaths haunted by ghosts, desolate shores haunted by memory. His imagination broods intensely over hese, making the least flutter, tap or bird's cry momentous; or t returns to the happy or unhappy places of childhood, to the unt's placid parlour, the cobwebbed shrubbery, the nursery, the opulous countries of Grimm and Andersen. The exquisite nelody and felicity of his most typical work would give him a igh place among English poets; yet what is called the "major" ote is not absent from his work, in which one suddenly encounters some profound allegory of man's bewilderment in the niversal struggle, or some casual flung phrase like:—

> When music sounds all that I was I am
> Ere to this haunt of brooding dust I came.

The slow, vivid, sunlit style of T. Sturge Moore was again seen t its best in *The Sea is Kind* (1914); G. K. Chesterton, with 'Lepanto," the songs in *The Flying Inn* (1914) and a few comic oems intensified his readers' regret that he should find so little ime for verse; Hilaire Belloc added a few beautiful lyrics, otably "Tarantella," to the small body of his serious verse; nd W. H. Davies almost annually delighted his admirers with a ittle collection of nature lyrics, of which the best achieved a imple perfection, and the worst had a certain peculiar charm. Alfred Noyes, with the two first volumes of *The Torch Bearers* (1922–5), opened an ambitious epic of human intellectual development. These two "covered" astronomy and geology; both vere very readable, no small merit in a long poem, and contained ine passages, as well as being permeated by a faith and resolution not common in these years.

Masefield and Brooke.—In 1911 there broke upon the world ohn Masefield's *The Everlasting Mercy*, a sensational story of conversion written in vigorous octosyllabics. It had, as lively narrative work usually has, a great success; and the author ollowed it up with a series of long poems on rural and marine ragedies. *Dauber* (1913) was probably the best of them, but here were good things in all, especially the *genre* pictures in *The Widow in the Bye Street* (1912). Of his shorter poems 'Biography," a series of vivid pictures from memory and 'August 1914," were notable.

Several of the best poets of their generation died in the War. Rupert Brooke (d.1915), by virtue of his beauty, radiant personality and talents, became, when his *1914 and other Poems* (1915) vere published, the general symbol of youth that went into the urnace. His maturer work showed grace, wit, intellectual curiosity and a growing perception of the chief goods of life; his five amous war sonnets, his manifesto and testament, remain intact n their brightness and nobility, though perpetually quoted and ven misapplied.

James Elroy Flecker (d.1915) died of consumption at Davos, cut off from home by a ring of battle-grounds. His *Collected Poems* (1916) show that he had outgrown early affectation and uncertainty, achieved a style, pictorial and euphonious, of his own, and secured his grasp upon his deepest loves and most personal dreams. The East, which fascinated and repelled him, inspired many of his best things; it was also the source of his posthumous drama *Hassan* (1922), which was produced at His Majesty's in 1923. This is an imperfectly constructed tale of Haroun and Baghdad, with elements of farce and romantic comedy interwoven with dreadful tragedy, against a gorgeously spectacular background of moonlight and minarets, Persian hangings, silver fountains, ballets and processions of torturers and troops. Wilfred Owen, killed in 1918, was unknown in life. His *Poems* (1920) were very interesting for their technical use of assonance; but his technical genius, however remarkable, was less so than the magnitude of his vision and the ardour of his spirit, which produced unforgettable pictures of physical battle and of the torture of man crucified in the trenches. Charles H. Sorley (d.1915) was another boy who was killed on the verge of greatness; and Julian Grenfell (d.1915), professional soldier and fine boxer, went to his death with the finest song of the War on his lips, *Into Battle* (1915).

Edward Thomas (d.1917) had had a strange career. Before 1914 he was known as a voluminous writer and journalist whose hackwork was scattered with fine descriptions of nature, but whom no one thought of as a poet. Under the stimulus of the American poet, Robert Frost, he turned, in his last two fertile years, to the making of poetry, nature poetry unique in its kind. He knew the south of England intimately; he had learned to love any sight a man may see leaning over a gate: trampled mud, a stack of sprouting swedes, a stone roller overgrown by nettles. Exact observation and record of landscape could go no farther than this; but his *Poems* (1920) would not be as fine as they are were it not for their faltering music and the positive, if quiet and melancholy, personality which suffuses them all.

Poets of the War Period.—Siegfried Sassoon, Robert Graves and Robert Nichols all came into notice during the War as writers of powerful and "realistic" poems describing it. Surviving, they all developed interestingly. Graves first wrote charming songs of a fanciful nature, then curious poems in which the ballad was (as it were) crossed by psycho-analysis; Nichols, in his later work, employed, on themes of nature and love, an eloquence from which most modern writers too fastidiously shrink; Sassoon, quietly experimenting, searching his own heart and noting the ugly, the pretty and the comic aspects of the human panoramas, actual and historic, prepared himself for what may prove a very interesting and significant future. Ralph Hodgson (*Poems*, 1917) was always a poet of slender production, but his "Song of Honour" (a successful competitor with C. Smart's *Song to David*, 1895), "The Bull" and "Eve" are among the best-loved poems of the time. Edmund Blunden, mainly a recorder of rural scenes in the tradition of Morland and Constable, showed a very individual talent, and John Freeman must be singled out for the beauty of his rhythms, his spiritual strength and his landscape;[1] D. H. Lawrence (especially *Birds, Beasts and Flowers*, 1923) for his hard graphic power and apprehension of the crude forces of nature. Amongst others who, in few poems or many, have beautifully registered moments and moods, have dreamed or reflected, are Lascelles Abercrombie, Gordon Bottomley, A. Y. Campbell, John Drinkwater, Edward Davison, Frank Kendon, Harold Monro, Edward Shanks, W. J. Turner, Dorothy Wellesley and Victoria Sackville-West.

The Irish poetical movement (*see* IRISH LITERATURE) begun in the previous generation by "AE" (George Russell) and W. B. Yeats, showed signs of exhaustion. "AE" wrote little; Mr. Yeats in his later poems escaped from "the Celtic twilight", abandoned the Celtic myths and discarded the languorous manner of his early triumphs for a hard, bare style in which, used for describing the outer world and the inner, he wrote poems often obscure but always full of thought, which many held to be his finest. Thomas Macdonagh and Joseph Plunkett, who died after the Easter Week rebellion of 1916, had written good lyrics; Joseph Campbell, Seumas O'Sullivan and a few others did as much; but the most notable "new" poet of the period was James Stephens, author of the delightful prose fantasy *The Crock of Gold* (1912).

It is impossible to close this survey, however, without a reference to certain deliberate "movements" conducted by poets who held a strong conviction that the main poetic tradition had petrified, as that of the 18th century petrified. It is doubtfully profitable for an artist to write in violent reaction against other artists; to determine to treat of "new" subjects because others are too conventional in their themes, or to produce something as unlike "regular" poetry as possible because others grind their organs too mechanically. Much of the "free verse" both in England and elsewhere has been marked by a cold-blooded intellectualism, a bookishness (though of a new kind) and an excessive preoccupation with the technique of expression that are adverse to the production of poetry. Great poets do not flaunt banners proclaiming themselves Imagists, Cubists, Vorticists or, for the matter of that, psycho-analysts; the technique of poetry is a means to an end, and propaganda or the conveying of information an incidental matter. Where such writers, undoubtedly gifted, as Richard Aldington, F. S. Flint and their American confrères succeed with their "free verse" there is nothing unorthodox about them: music is music, truth truth, accuracy accuracy, sincerity sincerity and some of *les jeunes* waste time throwing bricks at imaginary Aunt Sallies who maintain that poetry must rhyme, that line patterns must be "regular" and that aeroplanes and complexes are taboo in literature. It is not for us to decide which of our poets, if any, rank with the greatest. If there be a malady which prevents any of them from so ranking it will not be cured by taking thought, still less by incorporating chemical formulae into verse, or by innovations of technique or typography; as thinker, as religious or irreligious man, the poet is partly the child of his age; and whatever he be his strength must partly reside in the response that his age can give him.

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[1] Blunden and Freeman were awarded the Hawthornden Prize, founded by Miss Alice Warrender in 1919 for imaginative work by young writers, the other recipients during the period being Edward Shanks, Romer Wilson, David Garnett and R. H. Mottram.

IV. CRITICISM

The publication of works of pure scholarship, and new editions with critical apparatus, was seriously affected by the expenses of production during the War and post-War periods. Nevertheless, a considerable number of important standard editions, especially through the University Presses, were published, notably Prof. Grierson's *Donne* (Oxford, 1912), the first volumes of C. H. Herford's and Percy Simpson's *Ben Jonson* (1925), some volumes of the Cambridge *Shakespeare* (a new text embodying the results of the bibliographical researches of A. W. Pollard and J. Dover Wilson (1920) and R. W. Chapman's exhaustive *Jane Austen* (1923). The *Cambridge History of English Literature* (1907–16) was brought to a conclusion and Prof. Oliver Elton published his massive *Survey of Modern English Literature* (1912 and 1920). Prof. Caroline Spurgeon's *Five Hundred Years of Chaucer Criticism and Allusion* (1925), in three volumes, was an outstanding example of the specialised literary research work which is largely superseding the older kind of academic criticism.

Gosse and Saintsbury.—Among critical studies of a less encyclopaedic kind, the most substantial were done by the older men, notably Sir Edmund Gosse and George Saintsbury. Sir Edmund Gosse, enjoying an Indian summer, produced numerous volumes of collected papers in which he illuminated authors and movements, ancient and modern, English and foreign, incorporating anecdote and personal sidelights with incomparable ease and grace, and delighting his readers by the suppleness, wit and pictorial brightness of his clear and idiomatic style. Most memorable perhaps, were the essays in which, with consummate skill, he etched the appearances, manners and habits of thought of men and women, celebrities and oddities, whom he had known. The most important of his later publications was *The Life of Algernon Charles Swinburne* (1917), a model of brilliant portraiture, compact narrative and sane criticism.

Mr. George Saintsbury, who retired from his Edinburgh professorship in 1915, completed his edition of the *Minor Caroline Poets* (1905–21) added *A History of English Prose Rhythm* (1912), *A History of the French Novel* (1917–9) and the *Peace of the Augustans* (1916) to the prodigious pile of his historical works; and made delightful use of his vast erudition and full-stored memory in several miscellanies including two about wine. At Oxford Sir Walter Raleigh and at Cambridge Sir Arthur Quiller-Couch lectured brilliantly and published the best of their lectures. Standard lives of Keats and Byron were produced by Sir Sidney Colvin and Ethel Colburn Mayne; and theoretical treatises of a high order were Percy Lubbock's *The Craft of Fiction* (1921) and Geoffrey Scott's *The Architecture of Humanism* (1914). The death of Arthur Clutton-Brock, in 1924, prematurely removed one of the most luminous and sensible of the literary journalists, publishing short criticisms regularly in newspapers and periodicals, who abounded in the period. Others who did good critical work were Edward Garnett, a notable discoverer of talent, John Freeman, Lascelles Abercrombie, Harold Nicolson, Gerald Gould, R. Ellis Roberts, Arthur MacDowall, Robert Lynd, T. Sturge Moore, J. B. Priestley, Osbert Burdett, Lytton Strachey, Edward Shanks, Maurice Baring, Virginia Woolf; and, among critics of the drama, A. B. Walkley and Desmond MacCarthy.

V. MISCELLANEOUS LITERATURE

The essay flourished in the period, but mainly in a modern form. The old leisurely manner was practised with perfect success by Max Beerbohm in *Seven Men* (1919), *And Even Now* (1920) and other collections. A caricaturist and parodist of genius, Beerbohm wrote with an awareness that made him extremely careful to secure the last degree of accuracy and flavour in his language, to arrange the cadence of his sentences, to exhaust his subject as it presented itself to his mind, the mind of a humorous, witty and tender connoisseur of life and particularly of highly civilised urban life. Alice Meynell also wrote essays on the major scale, profound in thought, exquisite in phrasing, austere in temper yet iridescent in hue, which posterity cannot neglect. The majority of the essayists of the period entirely, or almost entirely, wrote under conditions which precluded a painstaking craftsmanship, free quotation, digression, amplitude of illustration and other qualities which are admired in the essays of Lamb and Hazlitt. The typical modern essayist wrote regularly every week to fill a column in a daily newspaper, or a page in a weekly: the remarkable thing is the merit of much of the writing done under these limitations of time and space by such men as G. K. Chesterton, Hilaire Belloc, E. V. Lucas and Robert Lynd, and, in his last years, Maurice Hewlett.

Vivid and powerful sketches of travel were written by R. B. Cunninghame Graham and H. M. Tomlinson; Francis Brett-Young, in *Marching on Tanga* (1919), wrote a narrative prose poem on the Africa he saw during the War. Works difficult to group are the *Earlham* (1922) of Percy Lubbock, a picture of childhood's memories of a place and people; L. Pearsall Smith's *Trivia* (1902–18), brief prose compositions full of wit, candour and pictures, and very melodious. *The Puppet Show of Memory* (1922) by Maurice Baring, one of the most versatile writers of his time, was an autobiographical work of great charm and interest, conspicuous among recent memoirs for its good manners. Max Beerbohm's *A Christmas Garland* (1912) was a masterly volume of parodies of modern prose writers. Among other parodists, Sir Owen Seaman having resigned the art, E. V. Knox (Evoe) was conspicuous; his work in *Punch*, together with that, both in prose and in verse, of A. P. Herbert, was a mainstay of the chief English humorous journal.

Historical Works.—Historical works, deserving the appellation of literature, were few in the period. G. M. Trevelyan completed his Garibaldian trilogy and Philip Guedalla wrote an amusing book about Napoleon III., *The Second Empire* (1922). John W. Fortescue's *History of the British Army*, concluded in 1920, more than 20 years after its inception, was a massive work written in excellent English. The most interesting work in biography was not to be found in the two or three volume political biographies, notably G. E. Buckle's continuation of W. F. Monypenny's *Disraeli*, excellent though several of these were, as in such works as Lytton Strachey's *Eminent Victorians* (1918) and *Queen Victoria* (1921), works tinged with irony and partial perhaps, but seminal books, because of their brevity, their concentration of the essentials of a great mass of material, the excellence of their portraiture and the impeccability of their epigrammatic and coloured prose. They reminded people that there was something possible in biography between the review-essay and the enormous repository of significant and insignificant facts.

Dramatic Literature.—The theatrical literature of the period is surveyed elsewhere (*see* DRAMA), but some reference may be permitted here to certain works which were widely read as well as acted. In 1911 the "realistic" movement in the drama, largely influenced by Ibsen, was in full swing. The word did not necessarily imply any approximation to reality, though it was meant to do so. What it really implied was the substitution of a novel set of conventions for a set of which people had grown tired. West-End drawing-rooms were replaced by the homes of suburban clerks; rosy sentimentalism was replaced by cynicism, a prophetic pessimism or a detached irony of presentation; speeches gave way to silences or pregnant ejaculations; "social problems" broke in upon a theatre which had ignored them. The public was invited to listen, not to the epigrams of marquesses, the lofty declamations of forgiving husbands, the sighs of a Romeo or the guitar of a Juan, but to the muttered resolutions of captains of industry, the subdued complaints of oppressed sempstresses, the exhortations of auctioneers, the speeches of strike leaders and the outbursts of Suffragist daughters crashing, blue book in hand, through the conversation of respectability, where they had been stifled by cant, convention, mahogany, plush and Tennyson's works in morocco.

The born dramatist could work within this convention as within another, assuming the fashionable trappings, but relying, as he must, for his effect upon the audience, on his ability to excite and amuse them by surprise, to charm them by the presentation of "humours," to exalt them with passion and courage, to "purge" them rather than depress by the display of failure and pain; and, where a play of this school succeeded, it was not because it was arguing for prison reform, votes for women, better housing or better drains. The restrictions, however, could not endure; humanity craves in the theatre for more splendid language than it ever uses and more splendid scenes than it habitually lives among; and the end of the period saw ample signs of a return to the stage of poetry and eloquence, vivid colour and symbolism, to the universal and the particular as contrasted with the mere mundane and temporal generalisation which obscures individual character without connoting anything eternal.

Shaw and Barrie.—Chief among living British dramatists, Mr. Bernard Shaw was perennially active, moved with the times and remained obstinately himself. His method in his early plays recalled now Sheridan, now Ibsen; the wit, the paradox, the irony, the odd "angle on life" were his own. Of his last eleven plays, long and short, the most interesting were the last three: *Heartbreak House* (1919), *Back to Methuselah* (1921) and *Saint Joan* (1924). In the first picture of social fecklessness, the influence of Tchekhov and the Russians was evident; in *Saint Joan* notable for the great trial scene of Jeanne d'Arc and the detachment with which both sides of the argument were presented, Mr. Shaw wrote a chronicle play, as John Drinkwater in *Abraham Lincoln* (1918), which ran for years at the Lyric Theatre, Hammersmith, had done before him. *Back to Methuselah*, a cycle taking five nights to play, was all his own; a prodigiously ambitious play which opens with Adam, Eve and the Serpent in the Garden and ends with human beings "as far as thought can reach," who live beautifully and very long and are born, mature, out of eggs. The earlier and later scenes contained fine, even poetical, passages; the middle was marred by political topicality.

Sir James Barrie in *Dear Brutus* (1917), *Mary Rose* (1920) and seven short plays continued to charm a large public with his peculiar vein of humour, sentiment and fantasy, and John Galsworthy, with *The Skin Game* (1920) and *Loyalties* (1922), also did effective work in his established manner. A greater development was noticeable in the work of W. Somerset Maugham, whose long series of witty social comedies culminated (1923) in *Our Betters*, the most effective, if the bitterest, of them all. Henry Arthur Jones and Sir Arthur Pinero, the dominant dramatists of the previous period, did little to modify their reputations; and H. Granville-Barker, who had shown great promise with *The Voysey Inheritance* (1909), was largely preoccupied, first with production and then with editing Shakespeare. Arnold Bennett's *The Great Adventure* (1913) was a delightful comedy; the comedies of A. A. Milne also had distinction. G. K. Chesterton's solitary dramatic work *Magic* (1913) was agreeably individual in manner.

The effort to restore the "poetic drama" to the stage from the "closet" was increasingly noticeable. Flecker's *Hassan* (1922) was written before the War; Rupert Brooke was making his first dramatic experiments when War broke out. A series of verse plays by Gordon Bottomley the best, perhaps, being *The Riding to Lithend* (1909) and *King Lear's Wife* (1915), though retaining traces of the "reading play" had considerable dramatic power; Herbert Trench's *Napoleon* (1919) was on the verge of greatness; and there was grace and charm in Clifford Bax's *Midsummer Madness* (1923), a ballad opera to which C. Armstrong Gibbs wrote music. Other dramatists conspicuous in the period were Noel Coward, Clemence Dane, St. John Ervine, "Ian Hay," John Masefield, Alfred Sutro and Israel Zangwill.

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(J. C. Sq.)

ENGLISH-SPEAKING PEOPLES, RELATIONS OF.—The preservation of good relations between the various sections of the English-speaking peoples and nations, not merely in Great Britain and the United States, but wherever the English tongue is the medium of social life and intercourse, is a great cause; perhaps the greatest of all causes at the present moment. But the greater the cause, the more necessary it is to take the utmost care in its development and maintenance. As was said by an English-speaking philosopher, "the greatest truths demand the greatest care and devotion in their handling."

Misunderstanding is the chief disintegrating force in human affairs. It is that which poisons and disturbs the body politic. It acts as sepsis does in the body natural. This is particularly the case with the cause of amity among the speakers of the English-speaking tongue. Misunderstandings, on both sides of the Atlantic, spring up like mushrooms, and with them arise distrust, suspicion, soreness and wounded pride. People with thoroughly good intentions use vague and infelicitous language. Their words are misrepresented, and have reactions, evil instead of good. They are suspected of selfish and sly propaganda! Yet, all the time, the supposed propaganda was launched in perfect good faith, and without a thought of taking advantage. But, naturally, the repelled well-wisher is deeply hurt to see himself what he calls "cruelly misunderstood." What is wanted is to make absolutely clear the aims of those who would improve the relations between the communities who speak the language of Shakespeare, Bacon and Milton, of Washington, Lincoln and Emerson.

The desires of those who in England and America have given themselves up to the cause are so simple and so entirely divested of mere national, and therefore selfish, interests that it is difficult for them to think that they can be misjudged. Yet misjudged they are, and will be, unless they use a discretion proportionate to their enthusiasm. They grow too zealously fierce in their good cause. But that is a sure way to create the friction of alarm.

THREE REASONS FOR MAINTAINING GOODWILL

Let one, who is a convinced and life-long supporter of Anglo-American amity and goodwill, set forth as lucidly as possible (1) what the true friends of good understanding between the English-speaking peoples want, (2) why they want it and (3) how they propose to get it.

(1) They want amity for no exclusive, or dominating, purpose. They do not want it in order to crush other races and to exalt their own. Their do not want to establish anything in the nature of an alliance, entangling or non-entangling, offensive and defensive, or purely defensive, between America and the British Empire. All they desire is to obtain so complete and so clear an

understanding between the Republic and the Union of free Commonwealths that the evil chance of war and all thoughts of aggression or of interference in each other's domestic concerns, shall be forever banished. In the link of language, and in that intellectual liaison which follows from it, they see a deeply moving opportunity for human betterment. That link is far safer, and far less likely to tempt a misuse of power than is the pride of unity of race and blood. Such unity involves the evil influences of privilege, repulsion and exclusiveness, and aristocratic pretension.

The unity of speech has no bad side of this kind, no barbed wire barrier which cannot be climbed. Birth and race have been described as "incommunicable things." That cannot be said of language. You can learn a language and attain its powers and inspirations as completely as if you had been "born-free" of its privileges. You cannot make yourself a New Englander, a Virginian, a Pennsylvanian, a Scot, an Irishman, an Englishman, a Cockney or a "native-born" member of any of the British Dominions. The inhabitants of Great Britain and Ireland, and the Dominions, have in them a score of racial and sectional strains. They are a mixed race. Yet they are all speakers of English, save for a few dwindling exceptions. The same fact is even more superlatively apparent in the United States. There came to the making of the American, not 20, but 100 different nationalities. They are more recently, but also more completely, mixed than those on the other side of the Atlantic. Further, the mixture is a different mixture. Yet all are either actual or potential speakers of English.

English-speaking peoples everywhere should be fully conscious of this awe-inspiring freemasonry. This should also realise the opportunity it affords and seize it. And they can, because both America and Britain have obeyed Bacon's wise apothegm and have been "liberal in nationalisation," *i.e.*, have freely admitted men of other nationalities into their community—have been comprehensive, not exclusive, in the matter of citizenship. Let it be always remembered that while both countries ask for a recognition of the tie formed by a common language, they are not ignoring, but recognising, the differences of blood and birth, and, instead, noting how they can be fused in one lingual culture. They do not ask only the men of Anglo-Saxon race and blood to get together, but all the men who themselves, or whose forebears, voluntarily adopted the English tongue. That is what they want.

(2) Why is it wanted? It is wanted for the reason that in an understanding between those who speak the English tongue is to be found the instrument that will save the civilisation which has been built up with so much toil and anguish, high hopes and high endeavour, from going the way of Egypt and Persia, of Athens and Rome and of a hundred noble races and mighty empires. If anyone thinks that this is tall talk, visionary and unpractical, let him consider for a moment how many fissiparous influences there are still at work, how many sources of war and conflict. We may quite conceivably abolish war or, at any rate, limit it to local scuffles, if there are enough people in the world determined that the final word shall be, not physical force, but justice. But if these people do not act together, then we may drift into a long series of wars which will sap the vitality of the white races and expose the civilised world, as we know it, to incursions from the barbarians of our epoch, which will be quite as devastating as those of Alaric, Attila and Genseric. A new Theodoric may overwhelm Rome and burn St. Peter's, or stable his horses in Westminster Abbey, and leave the Louvre a heap of calcined walls. In the last resort, then, all the English-speaking peoples must get together, and hold together, because they can save the rest of the civilised world by their help and goodwill. In Franklin's famous phrase, the civilised races have got to "hang together," or else they will hang separately. But the way to teach them to hang together is for the English-speakers to show the path, not by dominance or arrogant assertions of racial superiority, but by example.

(3) How to arrive at this goal? The answer here must necessarily be largely negative. In the first place, it is a question of what not to do. Nothing should be done and nothing should be said that will give any possible ground for alarm to those who should co-operate together. Just as zealous Englishmen have got to avoid the slightest appearance of wishing to catch and lead Americans, so zealous Americans must avoid the slightest appearance of wishing, as foolish people would say, "to drag John Bull chained at their chariot wheels." Similarly both must both make it clear to the whole world that they have no design to rule it, or protect it, or to do any of the other things which make men think that they are no longer to be their own masters. They must learn a system of propaganda different from that which made the French Jacobins liable to the taunt that they met other nations with the demand, "Be our brothers, or we will slay you!"

It is difficult to describe the exact methods by which this cause is to be spread, for admittedly it is a new thing, and to describe new things is the most difficult task in the world. Yet it can be done, and must be done. The river in front is not one which any man with a spark of spirit, or good feeling, can dare to say is unfordable. It can be crossed and it will be crossed if there is faith. Those who desire to improve the relations between the various sections of the English-speaking world must remember Tennyson's words, though they were applied to so different a subject,

> How pure at heart and sound in head,
> With what divine affections bold,

should be the men whose intent it is to make the English-speakers understand each other; not for their own glorification, but in order to get a similar and greater understanding throughout the human race. (J. St. L. S.)

ENNEKING, JOHN JOSEPH (1841–1916), American painter (*see* 9.647), died at Hyde Park, Mass., Nov. 17 1916.

ENTOMOLOGY, ECONOMIC.—Interest in the practical importance of insects in relation to agriculture, horticulture and forestry has increased quite considerably during the past few years, owing to several factors which are readily apparent on analysis. One of these lies in the increasing ease with which insect pests are distributed from one geographical region to another as commerce becomes more rapid and extensive. For reasons which we shall see in a moment, imported insects are almost invariably more destructive than native ones.

Another depends upon gradual changes in agricultural, horticultural and forest practice, which are continuously tending away from diversification and leading to the growing of some single crop. This is true not only of individual landholders, but extends over large areas which are devoted to the production of one of several crops in enormous quantities. Outside Europe this is particularly true; we need mention only a few cases as cotton, wheat, maize, apples and citrus fruits. Such conditions offer exceptionally favourable opportunities for insect pests to develop, on account of a practically unlimited and easily obtained food supply which is available without interruption. There seems every reason to believe that agriculture will never return to its primitive system of diversified farming, so that from this standpoint at least the annoyance and destruction caused by insects may be expected to increase rather than abate.

The most serious and extensive outbreaks of recently imported pests have occurred in the United States. The pink bollworm (*Gelechia gossypiella*) has become established in Texas, the European corn-borer (*Pyrausta nubilalis*) in several parts of the eastern states and a number of minor pests in various localities. Many tropical and subtropical countries have been invaded by a small fly, the Mediterranean fruit fly (*Ceratitis capitata*), which feeds within a great variety of tropical fruits, ruining them for human consumption.

This insect has attained an almost tropicopolitan distribution and has wrought great havoc in many of the warmer countries of both hemispheres. To prevent its appearance in the United States the importation of fruits from Hawaii and the Mediterranean region has been prohibited. To curb the spread of insect pests many countries have passed laws prohibiting the importation of living plants without rigid inspection at the port of entry, since the commonest way in which insects come is with the plants upon which they feed. By these means it is hoped greatly to lessen the rapidity with which such pests otherwise become disseminated.

In spite of the great advances that have been made in the methods of controlling injurious insects, it is probable that about one-tenth of the products of agriculture go to feed insects, and are thus an utter loss. In some cases this amount is greatly exceeded, as for example in the case of cotton in India and Egypt and particularly in the United States, where there are four insect pests of prime importance, two native and two introduced. One of the latter is so far very much restricted in its distribution. Once well established it is well-nigh impossible to eradicate completely any species of insect that feeds upon an extensively cultivated crop plant, and after a few years any one will spread over vast areas if not stopped by some natural barrier. In one case, however, it appears that an introduced insect, the gipsy moth, a general feeder on deciduous trees, will actually be wiped out in one section of the United States. It is now established beyond all hopes of eradication in New England, but a few years ago a second centre of infestation was discovered in New Jersey involving several hundred square miles. After several years of heroic and very expensive work, this area has actually been so nearly freed from this species that it now seems probable that it will soon be exterminated.

METHODS OF CONTROL

The present methods of controlling insect pests are of two general types. The first depends upon the application of insecticides. Some of these kill by their poisonous action when taken into the stomach with food, and others act by contact or by the effect of poisonous gases, which are applied directly or result from the decomposition of some non-gaseous material. Such methods are by no means new, but considerable advances have been made in their application and many new materials have come into use.

Heat and Fumigation.—The use of heat is a common method of destroying insects in granaries, flour-mills and similar places. Insects are readily killed by exposure for a short time, to a temperature of about 140° F., which may be easily obtained even in large warehouses by artificial heating during the warm season. The fumigation of plants and trees by means of hydrocyanic acid gas is extensively practised in greenhouses and in orchards where trees like citrus fruits are grown, which are too delicate for treatment with sprays for the destruction of scale insects. Hydrocyanic acid gas was formerly generated where needed by the action of an acid on sodium or potassium cyanide, but it is now marketed in liquid form for fumigation. By this method a number of loaded freight cars may be cleared of insects within a very brief space of time, and even bales of almost impermeable material like cotton may be successfully treated by subjecting them to a vacuum and then allowing the penetration of the poisonous gas.

Oil Sprays.—The use of oil sprays for the treatment of trees infested with scale insects has become very general. Heavy petroleum oils are emulsified by means of various agents such as soap or fish-oil soap treated with cresylic acid, and the resulting emulsions are sprayed in a finely divided state upon the trees, killing the insects by contact. These and other sucking forms cannot be destroyed by poisoning their food, since they obtain this as sap from the interior of plants, and no method is yet devised for rendering sap poisonous without injuring the plant.

Nicotine.—Highly-concentrated solutions of nicotine are now available for the destruction of many soft-bodied insects on foliage and even of small insect grubs that mine within the tissues of leaves. These may be poisoned by the application of nicotine solutions to the surface of the leaves. For this purpose the nicotine is applied as a spray in very dilute aqueous solution to which soap is added. Very recently nicotine has been combined with oleic acid to form nicotine oleate, a soapy compound that is used in water at high dilution.

Paradichlorbenzene.—The introduction of a new material, paradichlorbenzene, which is a very powerful contact insecticide, has made it possible to destroy insect larvae that bore in the roots of trees and those which feed in the wood. For insects like the apple-tree borer (*Saperda candida*) and the peach-tree borer (*Aegeria exitiosa*) this substance is sprinkled on the ground near the lower part of the trunk where the larvae develop. As it is non-poisonous to man under ordinary conditions it is particularly suitable for destroying clothes-moths.

Lead Arsenate.—In the spraying of foliage for the destruction of leaf-eating insects lead arsenate has come to replace almost entirely the other arsenical poisons such as Paris green. This is used in enormous quantities for the protection of agricultural crop plants and orchard trees and even in some places upon woodland and forest trees. Arsenate of lead is also used in dust form to a large extent, commonly diluted with some non-active dust and applied to plants by special blowers or dusting machines. Recently the dusting of extensive fields has been accomplished by aeroplanes fitted with large power dusters which operate as the planes pass and emit the poisonous powder, which settles upon the plants like fine volcanic ash. For the poisoning of certain insects, as the Japanese beetle (*Popillia japonica*), which will not readily eat plants coated with lead arsenate, a method has been devised of coating the minute insoluble particles of the arsenate with a film of an insoluble soap, such as lead oleate. This is more readily accepted and increases the toxicity of the poison. Calcium cyanide is now also applied in dust form as an insecticide. In the presence of water or moisture in the air this substance is decomposed into lime and the powerfully poisonous hydrocyanic acid gas.

X-rays; Mercury.—It has been found that light of very short wave length is a powerful insecticide, and exposure to X-rays forms a satisfactory method of destroying certain tobacco-beetles, the development of which is prevented in cigars that are treated by exposure to these rays. One of the most surprising discoveries relates to the vapour of metallic mercury, which appears to destroy some insects at least, such as bean weevils and clothes-moths, when present in infinitesimal amounts at ordinary temperatures. A small vial of mercury left uncorked in a container will prevent the development of the insect.

Machinery.—There have been no radical innovations in recent years in the machinery for applying sprays or dust insecticides, but much larger power machines are now in general use. Those, for example, used in New England for the spraying of woodlands infested with the gipsy moth or in the western United States to protect apple orchards from the codling moth ordinarily carry a tank holding 500 gal. and a gasolene motor powerful enough to supply simultaneously half a dozen lines of hose each delivering spray at pressure up to 200 lb. per square inch. It has been shown in several cases that insects show an increased immunity towards certain contact insecticides, such as sulphur-lime and oil emulsions after continued sprayings over a number of years. This is probably due to the more rapid eliminations of the more susceptible parts of the population and has necessitated the adoption of other materials. Just how far such changes may affect future entomological practice is not yet to be predicted.

Parasites and Natural Control.—From a biological standpoint there have been many advances leading both to a better understanding of the relations of insects one to another and of insect pests to the plants which they infest. One phase of this matter which has received much attention and assumed great practical importance relates to the effect of predatory and parasitic insects upon the abundance of insects destructive to plants. It was early realised that parasitic and predatory insect enemies were very important in regulating and holding in check the multiplication of vegetarian forms. Aside from a shortage of food, such enemies are the major factors that maintain the balance of nature and prevent the vegetarian species from becoming unduly abundant. When agricultural crops are planted continuously from year to year, shortage of food does not occur and consequently these enemies assume the major rôle. Further, when foreign pests are accidentally introduced into new regions they are very generally freed from this restraining influence, as practically all parasites do not select their hosts indiscriminately. Thus, the world over, the introduced pest soon becomes excessively abundant.

To counteract these conditions the parasites of imported insects are in turn imported to aid control work, and perhaps the most notable progress made in economic entomology during the past two decades relates to this method of "natural control." Among many projects of this kind the most extensive has been undertaken and carried on for the control of the European gipsy moth in the New England states. Investigations of this moth and other insects have shown that the natural control of any insect in its native land is due to a number of parasites and predatory insect enemies which feed at the expense of the several developmental stages of their hosts. Thus there are enemies that destroy the eggs of the gipsy moth, others that attack the larvae and still others that feed upon the pupae. Large numbers of a series of such enemies of this moth have been brought over from Europe, multiplied in the laboratory and put out or colonised in places where the gipsy moth is abundant. A number of species have become well established and have spread until they now greatly reduce the numbers of their hosts each season.

The same method is now being applied to many other pests with very considerable success, and it has the great advantage that, once under way, it continues without further expenditure of time or money, whereas spraying and other similar artificial measures must be repeated continuously. Incidentally these experiments have added much to our knowledge of the biology of insects and greatly stimulated research on parasitic insects.

Insect Carriers.—As in the case of insects which act as carriers of certain diseases of man and other animals (*see* ENTOMOLOGY, MEDICAL), some species have been shown to act as carriers of plant diseases. Some of these are due to fungi and bacteria, and a number, including the mosaic diseases, to filterable organisms (*see* FILTER PASSING MICROBES). Most of the insects concerned are aphids and leaf-hoppers, which feed upon the sap of the plants concerned.

Legislation.—Apart from its scientific aspects economic entomology has entered widely into the legislative field. Laws have been enacted by nearly all governments, most extensively by the Federal and State Governments in the United States, relating in various ways to insect pests, and agencies have been created to enforce these laws. Many relate to quarantine, and these aim at preventing the introduction of foreign insect pests. They provide for inspection of living plants, bulbs, seeds, etc., foodstuffs and the like, and usually convey the power to refuse entry, destroy or properly fumigate infested or suspected objects. In America the importation of certain kinds of plants is now forbidden except in very special cases of plants which cannot otherwise be secured. These regulations frequently work considerable hardship, but in the long run there seems to be no question that they will greatly delay the spread of destructive insects throughout the world. This is particularly evident from the vast numbers of harmful kinds that are continually intercepted where inspection is practised, and inspection for such small and secretive creatures can never be satisfactory or complete. As the proper enforcement of laws of this kind requires an expert knowledge of insects, a type of police duty has necessarily been imposed upon many official entomologists, making heavy demands upon their time and leading in some cases to the establishment of separate offices or laboratories for such routine work.

Research.—The establishment of a number of new bureaux and research institutions devoted entirely or in part to economic entomology has been a notable feature of the last few years, as well as the rapid growth and development of others already extant. In Great Britain the Imperial Bureau of Entomology is a large and efficient organisation correlating entomological work in all parts of the British Empire and aiding science throughout the world by the publication of a fine review which summarises each month the current literature of applied entomology. In the United States the Bureau of Entomology is the largest of its kind in the world. Its many workers are occupied in Washington and several subsidiary laboratories throughout the country, dealing with economically important insects, their behaviour, habits and practical control, as well as the application of established measures to eradicate or reduce the numbers of particularly serious pests, and to limit the spread of certain introduced species that enjoy so far only a limited distribution. On account of its wide agricultural interests and extensive forests, the Dominion of Canada has added an entomological bureau performing similar services in a less elaborate way.

In addition to the various governmental and public agencies throughout the world there are numerous semi-private or endowed institutions maintaining laboratories for research in economic entomology, often in connection with universities. In a number of these there are opportunities for students to secure special training in pure and applied entomology.

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(C. T. B.)

ENTOMOLOGY, MEDICAL.—Although medical entomology includes in its scope a number of venomous and parasitic arthropoda that inflict miscellaneous minor hurts upon the individual human body, its main concern is with those arthropoda which, either as the necessary intermediary hosts or as the fortuitous mechanical disseminators of other pathogenetic organisms, stand in the main line of causation of serious endemic and epidemic disease and so are a menace to the public health.

Manson's Discovery.—Such insect-borne disease, though from of old a topic of popular belief and even of rational speculation, was first clearly demonstrated by Manson, who discovered, in 1879, how the embryos of the worm that causes a common filarial disease of the tropics are extracted from one human host by a female mosquito and then pass through their larval development within that insect's body before they can find their way into another human host. The value of this discovery, however, was not generally appreciated until 1898, when Ross discovered how the parasites of the more formidable disease malaria, after an analogous dependence on the mosquito for transport and sustenance, are furthermore injected into their human host by the insect intermediary, it being, however, "Manson's theory, and no other, which actually solved the problem" of the mode of transmission of this disease.

In these and similar instances the insect is a go-between, safeguarding the transfer of a specifically "human" parasite from one human being to another. But many blood-making insects are normally infected with seemingly innocuous endoparasites of their own, and some maintain that such insects may inoculate their own parasites into the human body where they may not remain innocuous. This is within the bounds of possibility, but the evidence of its actual occurrence is not generally accepted. Surmise of the same still unsatisfied kind has been awakened by the recent discovery in the normal intestine of certain insects, particularly bugs and lice, of bodies similar to the minute Rickettsia-bodies isolated, in 1916, by Rocha Lima from typhus fever cases and regarded by him as specifically morbific.

Recent developments in medical entomology may be summarised thus:—

Diseases Specifically Attributable to Mosquito Agency.—To filariasis, malaria and yellow fever, the parasite of which last was in 1918 determined by Noguchi as a *Leptospira*, must be added dengue fever, shown to be transmitted in Australia (Cleland and others) by *Stegomyia fasciata* and in Syria (Graham) by *Culex fatigans.*

Diseases Specifically Attributable to Sandfly Agency.—In entomological company with phlebotomus fever will probably have to be placed oriental sore (Sergent brothers: Aragão), and also kala-azar, the natural history of which seems from studies now in progress in Calcutta to be definitely associated with *Phlebotomus argentipes* (*see* KALA-AZAR and SANDFLY FEVER).

Diseases Attributable to Gad-fly (Tabanidae).—The details of the post-embryonic development of *Filaria (Loa) loa* in the course of its transmission from man to man by *Chrysops dimidiata* and *salacea* were described in 1921 by Dr. and Mrs. Connal. (Tularaemia, a recently recognised septic fever of American rabbits, may be imparted from rabbits to man by *Chrysops discalis*, but merely mechanically, since the infection may also pass to man without any insect intervention.)

Diseases Specifically Attributable to Tsetse-fly Agency.—Besides the notorious *Glossina palpalis* and *morsitans* several other common species of *Glossina* are now known to be intermediary in the spread of the trypanosomes of African sleeping sickness.

Diseases Specifically Attributable to Flea Agency.—Hirst, in Ceylon, and Cragg, in India, have produced good evidence that not all the three species of rat-fleas of the *Xenopsylla* genus are equally formidable in spreading bubonic plague, and that plague does not rage as an epidemic in places where *Xenopsylla astia* is the only flea infesting the local rats. The evidence of the intermediation of the dog-flea in the transmission of infantile kala-azar is still obscure.

Diseases Attributable to Bugs (Rhynchota).—The parasite of South American trypanosomiasis (Chagas's disease) is now known to be transmissible by several species of reduviid bugs—and also, experimentally, by other bloodsucking insects—and is believed to be imparted to man in the insects' excrement. An original natural source of infection is said to exist in armadillos and opossums.

Diseases Attributable to Lice.—In company with typhus and relapsing fever the War disease "trench-fever" is to be included. In all three instances the virus is inoculated by contamination. The lousy person as he scratches himself rubs the infective juice or excrement of the infected insects into the abrasions of his skin.

Diseases Attributable to Ticks.—Several species of *Ornithodorus* are now suspected of transmitting the spirillum of relapsing fever, and *O. talaje* in tropical America has been shown to be as dangerous in this respect as the African *O. moubata*. The virus of Rocky Mountain spotted fever, conveyed to man by *Dermatocentor venustus*, is declared by Wolbach to be a *Rickettsia*. Another tick of this genus, *D. andersoni*, has been found infected with the bacillus of tularaemia. In these tick-borne infections the parent tick, becoming infected, transmits the infection to its offspring.

Diseases Specifically Attributable to the Agency of Harvest Mites (Trombidiid larvae).—Besides Japanese river fever, the virus of which is inoculated by the *akamushi* mite, there seem to be other local and seasonal epidemic fevers that have a similar causation. Among them is the pseudotyphus of Sumatra.

Diseases Specifically Attributable to Crustacean Agency.—Small freshwater copepods of the genus *Cyclops* have been known from the time of Fedshenko to be intermediary hosts of the guinea-worm (*Dracunculus medinensis*); and in 1917 Janicki and Rosen discovered, in *Cyclops strenuus* and the near-related *Diaptomus gracilis*, the long-sought first intermediary hosts of the larval ribbon worm (*Bothriocephalus latus*). Recently Japanese workers have shown that several species of river crabs play an intermediary part in the post-embryonic development of the lung-fluke. (In a logical system, however, all these passive crustacean infections should be classed with water-borne and food-borne diseases rather than with diseases due to the malign aggressions of insects.)

Diseases Attributable to Fortuitous Insect Agency.—Outside the range of the specific insects, ticks and mites that severally play their definite and *necessary* part as specific intermediary host for a particular morbific parasite of man, there has still to be considered the odious assistance lent by ubiquitous domestic insects—houseflies, cockroaches, cellar-beetles, ants, fish-insects and by the ubiquitous fauna—moth and beetle-larvae, booklice, food-mites—of granaries, provision stores, warehouses, etc., in the indiscriminate and mainly mechanical dissemination of morbific material of various kinds. Houseflies are the most assuredly dangerous of these disturbers of the public health. Sambon seems to regard the cockroach as equally, but more painfully, dangerous. Impressed mainly by the experiments of Fibiger, who found that in rats infected with a filarial worm of the genus *Gongylonema*, through feeding on infected cockroaches, cancerous growths started from the lesions caused in the rat by the worm, Sambon concludes that cockroaches, especially where they swarm in particular houses, are one of the main links in the causation of cancer in human beings. Evidence that cockroaches infect human beings with *Gongylonema*, or anything attributable to *Gongylonema*, is, however, still lacking.

Dangerous to the public health as all the insects here very briefly reviewed are, it is beginning to be realised that the danger is conditional. In an environment unmodified by sanitation, such as prevails in extensive areas in the tropics, where the villages and even the suburbs of the towns are still under the domination of the jungle, these insects are a constant danger, and, at the present time, must be attacked with energy, and with resource based upon a finished study of their life-history, seasons and habits. But in countries having settled standards of personal and domestic hygiene and an efficient sanitary administration these insects find no comfort in the reformed human environment and have ceased to be a standing menace to the public health, as is exemplified by the history of plague, typhus and malaria in England since the establishment of a sanitary régime. See A. Alcock, *Entomology for Medical Officers* (1920).

(A. W. A.)

ENVER PASHA (1881–), leader of the Young Turks, was born at Apana, on the Black Sea coast, where his father was a bridge keeper and his mother followed the despised profession of laying out the dead. His father was Turkish, his mother Albanian and he had a Circassian grandmother. He entered the Turkish Army as a subaltern without money or influence but gained admission to the staff college at Constantinople, and thence went to Salonika, the headquarters of the Young Turk movement. He fought with Bulgarian and Greek guerrilla bands, coming meanwhile in contact with the representatives of the new ideas, and finding in Talaat, the minor telegraph official, a politician after his own heart. In 1908 as aide-de-camp of Gen. Hussein Hilmi, he, with Niazi Bey, imported the flag of revolution into the Macedonian mountains, originally with the object of restoring the constitution of 1876, which had been disregarded by 'Abdul Hamid, but also to save himself from a threatened arrest. 'Abdul Hamid professed to yield and Enver entered Constantinople as a fêted hero. But he realised that his time was not yet come. He went to Berlin as major and military attaché, and there, from 1909 to 1911, he pursued his military studies and enjoyed a social career as a ladies' favourite. His stay was only once interrupted, when, in 1909, he hastened to Salonika, and with Mahmud Shevket undertook a brief and victorious campaign against the reactionaries, who hoped to regain unfettered power under 'Abdul Hamid.

After taking the capital and deposing 'Abdul Hamid, Enver returned to Berlin. Having learned to speak good German, he took command at Benghazi in the Italo-Turkish War. He also wrote a book called *Tripoli*, dealing with this period.[1] The Peace of Lausanne brought his work in Africa to an end, and he returned to Constantinople to find Turkey in the midst of the war with the Balkan States. During the Dec. armistice, Enver, then a lieutenant-colonel, was made chief-of-staff of the X. Army Corps, of which he soon was virtually in command. His attempt at a landing at Sharköi (in the east of the Gallipoli peninsula), on Feb. 8 1913, miscarried, as indeed did all Enver's military enterprises. During the peace negotiations, when Kiamil, as Grand Vizier, took the wise course of deferring to the wishes of the British, Enver with his friends arrived in front of the Sublime Porte, shot the War Minister, Nazim Pasha, turned out Kiamil, forced himself upon the Sultan, and in collusion with the Young Turk Committee filled all the offices with Young Turks.

The new Vizier, Mahmud Shevket, was assassinated in June 1913, and this further enraged the Committee against the Old Turks and the Union Libérale. The body of the state was purged of all elements which would not blindly carry out the policy of the Committee. More than 1,200 officers, among them 153 generals and colonels, were dismissed by Enver in one day. Enver put himself at the head of the troops, and in July 1913 made a triumphal entry into Adrianople, which had already been evacuated by the Bulgarians. On Jan. 3 1914 he promoted himself major-general and Minister of War.

When the World War broke out, Enver began to cherish strategical ambitions. In the winter of 1914–5 he led an entire Turkish Army in the disastrous offensive in the snow-covered mountains on the Russo-Turkish border. With Liman von Sanders, the chief of the German military mission, his relations were strained, and the situation was not improved by certain Germans who flattered Enver and intrigued against Liman von Sanders. He became a megalomaniac to whom no one dared offer a word of advice. He had no share in the Dardanelles defense, but took all the credit for it. In internal politics he became, by degrees, the absolute ruler of the country. When the Turkish collapse came, he fled by way of Odessa to Germany. In 1919 he was condemned to death at Constantinople *in contumaciam*. In the same year, after a brief exile among friends in Germany, he fled to Russia. There at first he helped Denikin to maintain the independence of the Caucasus, but when the latter made a political approach towards the Entente, Enver left him, stayed for a short time in Azerbaijan, and was mixed up in adventures in Asia Minor. He was reported in 1920–1 to have been employed at Moscow as director of the Asiatic department in the Soviet Govt., and to have posed at the Baku Congress of Oriental Peoples as the leader of a great Socialist movement in the Middle East and north Africa.

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[1] A German version was issued in 1918.

The last heard of him was that he had turned against the Soviet Govt. and was leading an insurrection against them in the mountains of Russian Turkistan—a revival of the "Pan-Turanian" ambitions which he cherished during the War. In this insurrection (which was unsuccessful) he appears to have met his death, though the circumstances of it are obscure.

EÖTVÖS, ROLAND, Baron (1848–1919), Hungarian physicist, son of Baron Josef Eötvös, was born in Budapest July 27 1848. In 1872 he was appointed professor of physics in the University of Budapest. In the following year he was elected member, and in 1889 president, of the Hungarian Academy of Sciences. From 1894–5 he was Minister of Public Instruction. His first scientific studies were connected with capillarity; in 1885 he published the result of these investigations, which is known as *Lex Eötvös*. From 1890 onwards he examined the phenomena connected with the problems of gravitation and of terrestral magnetism. He constructed a number of magnetic instruments and also an extremely delicate instrument with which the variations of gravity in space can be quickly and exactly determined both in the laboratory and in the open. In 1898 he completed his first single-armed variometer; later he constructed the double-armed torsion-balance. This so-called Eötvös-balance became an essential instrument for the location of subterranean materials.

To commemorate his researches, physicists express the result of the measurements with the torsion-balance in Eötvös units (*see* 12.388). In a treatise which won him the Benecke prize from Göttingen University in 1909, Eötvös demonstrated with great exactitude that the attraction of bodies is independent of the quality of the substance. Towards the end of his life he studied the variations of the gravitation of bodies moving on the earth. He demonstrated by experiments that if a body moves towards the east it loses in weight. He died in Budapest April 8 1919.

EPIDEMIOLOGY.—In recent years more study has been given to that branch of the science of medicine which, under the name of epidemiology, displays the general factors which operate upon populations or aggregates, and lead to the outbreak of a sickness affecting several persons within a short interval of time. The unit of the epidemiologist is a population, while the unit of a physician is an individual.

The Spread of Epidemics.—Modern epidemiology is based on the collections of statistics which began half way through the 19th century, and on the associated information which was obtained as to the causation and course of epidemics by careful local inquiry into all the conditions. Even before this some countries, such as Sweden, published the figures of the deaths from numerous infectious diseases for series of years; but, though very interesting, these figures reflect more or less special conditions. Since about 1840, especially in Europe, India and America, carefully collected information exists respecting many epidemics and epidemiological conditions. Sufficient evidence is now available to examine any theory which may be offered to account for the facts. Advance has been made on a number of lines: on the modes of spread of infection; on the theory of the course, recurrence and size of epidemics; on the relation of epidemics to climatic conditions and the cause of these relations; on the knowledge of the life history of the organisms which cause epidemics; on the conditions of living which favour the spread of infectious disease.

Aetiology.—With the discovery of the organisms (*see* Bacteriology; Filter Passing Microbes; Parasitology) which cause disease, and with careful observation in the field as to the manner in which disease spreads from person to person, many new points of view have emerged. It is no longer sufficient to talk vaguely of fomites. Most diseases have their special forms of spreading which account for practically all the cases. Thus measles (*see* Infectious Fevers) and smallpox (*q.v.*) are exceedingly infectious from person to person. Enteric fever is nearly always carried by contaminated water or contaminated food. Cholera (*q.v.*) is spread by water and flies. Other diseases have been found to be practically non-infectious from person to person unless by means of an intermediate parasite. Thus typhus (*see* Infectious Fevers) and trench fever are carried by lice, while yellow fever (*q.v.*) and malaria (*q.v.*) require the intervention of the mosquito. The mode of spread of some diseases, however, is still obscure. Among these scarlet fever must be placed. While direct infection undoubtedly takes place, a satisfactory elucidation of the problems of its dissemination has not yet been arrived at.

Infectivity and Virulence.—Disease-producing organisms possess two qualities: one, the power of causing the disease; and the second the power of producing a severe attack of disease. The first may be termed infectivity and the second virulence. These qualities must not be confused. In point of fact, they are not constantly associated. In certain diseases the height of the epidemic seems to be associated with severe disease, in others with that of milder type. The former at least holds for a certain number of large epidemics of measles of which the statistics have been investigated. The latter is the case both in Glasgow and London in regard to the autumnal prevalence of scarlet fever.

Incidence.—That an epidemic might possess a definite form capable of calculation seems to have been advanced first by Farr. In 1840 he graduated the decline of the great smallpox epidemic in England to the normal curve of error, and obtained a very close representation of the facts. He promised further discussion, but seems to have given none till 1867. In this year he returned to the subject in connection with the cattle plague, writing a letter to *The Daily News*, in which it was stated that though in the popular conception plague was advancing with such rapidity that all the cattle of the country might be destroyed, in reality the force of the epidemic was spent, and that if the form of the epidemic curve up to that point were taken as a basis of calculation the future course could be foretold. The prediction proved to be very near the truth.

The theory of the course of the epidemic, however, as a guide to the solution of the problem has unfortunately not proved so fertile as might have been hoped. Some facts are quite definite. The curve of the epidemic is often found to be symmetrical, the fall corresponding closely to the rise, though in some diseases the ascent is more rapid than the descent, and in some the reverse. The equation of the curve which describes the majority of epidemics, as found by trial apart from theory, is

$$y=\frac{a}{{1+\frac{t^2}{b^2}}^{n}}$$

where y is the number of cases at time t, t being measured from the centre of the epidemic.

Curves closely resembling that given by the above equation arise on a number of hypotheses, of which two are discussed. First, the organism may be assumed to possess at the beginning of the disease a high degree of infectivity, which decreases as the epidemic goes on. If the loss of infectivity is according to geometric law, the normal curve of error already used by Farr is the result. It is sufficient to state that on various probable hypotheses regarding exposure to infection, etc., the normal curve may be so modified as to take the form found by observation. Secondly, a similar type of curve arises if we consider an epidemic dies out from lack of susceptible persons. It is not possible to distinguish statistically these hypotheses from the consideration of the epidemic form alone. In one case, however, the second hypothesis can be tested. If the form of the epidemic be calculated by assuming different degrees of infectivity on the part of the organism, an infectivity which remains constant during the epidemic, it is found that this curve becomes flatter and flatter the smaller the degree of infectivity.

Now with regard to plague in India, among brown and black rats living more or less in the same circumstances, it is observed that many more brown rats are infected than black. In such circumstances the form of the epizoötic should be different in the two species if the decline is due to lack of susceptible individuals. As a matter of fact it is nearly identical: a fact which tells strongly in favour of the hypothesis that the epidemic ends because of oss of infectivity on the part of the organisms. This example vould be crucial but for the fact that the flea on which the spread f the epizoötic depends has a law of seasonal prevalence of its wn to which both the epizoötics must conform.

In many cases, however, the only feasible explanation of the ourse of an epidemic is that the organism loses the power of in- ecting as the epidemic proceeds. It is difficult to believe, for nstance, with regard to the great epidemic of smallpox in Lon- on in 1901–2, that there were only 8,000 people susceptible out f a population of 6,000,000. As the course of this epidemic was ypical, rising and falling in the manner found to be character- stic, it cannot be argued that the decline was due to the action f the health authorities; all they can have done was to limit the xtent of the epidemic, leaving its course unchanged.

Periodicity.—The next point requiring consideration is the eriodicity in the epidemics of infectious diseases. Taking neasles as an example, the common explanation is that each pidemic ends from the exhaustion of the number of susceptible ersons, and that it is only when a new population of susceptible hildren has accumulated that a further outbreak occurs. This xplanation fails to account for many of the facts. Even after ne very large epidemic of measles in Glasgow in 1906, it was ound that nearly half of the children admitted to the fever ospitals immediately thereafter suffering from other diseases ad not suffered from measles, so that there must have been, ith the high infectivity of the epidemic, plenty of susceptible naterial. The disease subject to the most extensive inquiry itherto has been measles. Using the method of the periodo- ram, the statistics of London and all the chief towns of the ritish Isles have been analysed. It is found that in almost no ase is there only one period to be discovered. In London there e several, the chief of which is 97 weeks.

Periodicity in other diseases is well known. Thus in the city Liverpool the epidemics of scarlet fever occurred at regular tervals of four years from 1850–78. On one occasion alone was ere an exception, when the interval between two epidemics as three years in place of four. A similar periodicity of five ears has been observed in Glasgow. There is one specially teresting example, namely, the occurrence of plague in Bom- ay. In many places, such as Hong Kong, the period between ch epidemic is rigidly a year. In such a case the influence of the ason of the year seems a sufficient explanation. But the case Bombay is different. The first epidemic in 1897 had its maxi- um about the 40th day of the year. From this point until the st year for which statistics are available (1918) the date of the aximum of the epidemic has steadily advanced into the year, lvancing about 80 days in 20 years, or an average of four days year. The conclusion must be arrived at that while some eriodicities of disease are strictly seasonal others are not so, and quire some further explanation.

A further important application of mathematics to epidemi- ogy has been made by Sir Ronald Ross in his studies on ma- ria (*q.v.*). Here the factors influencing the spread of the dis- se are numerous. Rainfall and temperature, the number of rsons carrying the organism in their blood, the number of osquitoes and the proximity of the breeding-places of the mos- iito to the abodes of men, are all capable of quantitative meas- ement, and of furnishing guidance in the adoption of suitable ministrative measures.

Climate and Weather.—The relationship of epidemics to climate s received much attention in recent years, though in many ses the cause of seasonal prevalence is elusive. Thus, why arlet fever should be so regularly an autumnal disease is not at clear. On many cases, however, much light has been thrown. ne discovery, for instance, that malaria was carried by the osquito elucidates the seasonal distribution of that disease. temperature of a certain height associated with pools of water necessary for the rapid development of the mosquito, and also certain degree of temperature for the development of the para- e in the mosquito. In the same way the zone to which sleeping kness is limited is a narrow region in which the climate and vironment are suitable to the life history of one particular tsetse fly. Much light has been thrown on the epidemiology of plague by the discovery that it was carried to man from the rat by means of the flea. Humidity is necessary for the growth of the flea, and consequently epidemics of plague can hardly occur at seasons of the year when it is warm and dry. Thus the epidemics of plague in Bombay, which have advanced progressively later and later into the year, now occur when the flea is no longer at its greatest prevalence. With this change the number of cases and deaths has greatly diminished.

Effect of Organisms.—As to the relation of epidemics to the organism which causes them, why an organism should be capable at one time of causing a great epidemic and at another only a few sporadic cases of a disease has not yet been found out. That organisms do vary in the power of infecting in this manner is a truism to anyone who has administered in the health departments of a large city. At one time the merest contact with a case of smallpox, for instance, will give rise to a large number of cases. At another time a patient suffering from smallpox may even attend a theatre without giving rise to a case of infection.

A considerable amount of evidence has been accumulated that an organism having found a suitable host or succession of hosts may have its virulence unusually exalted, and if the virulence can be exalted in this manner, it is probable that some similar conditions may give rise to a great increase in the power of infection.

Environment.—While an epidemic may in many cases be chiefly or even wholly due to the active condition of the causal organism, it is to be remembered that the vitality and environment of the persons affected must also play a part. Thus, for instance, typhus fever introduced into a crowded slum in which lice are plentiful will almost certainly cause considerable havoc, but even here the havoc will be determined to a certain extent by the season of the year. If the weather be cold the people are crowded together on account of the demand for warmth, and the chance of infection is increased. In addition, in the winter, food is often scarce, and consequently vitality is low. If, on the other hand, the invasion of the organism takes place during the summer, a large epidemic will be unlikely. But though these factors act, yet if an organism has an exalted state of activity an epidemic of the disease may occur at any season of the year, even the most unlikely. Plague, for instance, especially in temperate climates, is essentially a disease of the warmer part of the year, yet it has been known occasionally to occur in large epidemics in the middle of winter, while epidemics of typhus of considerable size have been recorded in the summer time. The great epidemic of influenza (*q.v.*) in the autumn of 1918 is a striking example, such a season being a very unusual one for an outbreak of this disease. What rôle special susceptibility on the part of the population, due to change in vitality, had in this case is not known.

Some other influences also act. There is some evidence that fatigue predisposes to enteric fever, an army on the march drinking polluted water tending to have a larger number stricken than a similarly conditioned civil population. Further, it cannot be doubted that the accumulated effect of seasons may tend to depress health and increase susceptibility to certain diseases. The cumulative effect of winter cold may be perhaps traced in children in relation to death from whooping-cough, the average minimum temperature in the winter preceding the maximum number of deaths from whooping-cough by about six weeks, while the form of the two curves is very much the same. The deaths from whooping-cough are due very largely to broncho-pneumonia, yet the seasonal distribution of whooping-cough is not identical with that of the latter disease. Thus scarlet fever, being an autumnal disease and following the hot summer, might in the same way be ascribed to depression produced by continued hot weather, making certain persons more susceptible to the disease. But as scarlet fever is a disease almost absent in warm climates this explanation can hardly be complete, and some other factor must be necessary. None of these questions, however, have at present been sufficiently investigated to allow any dogmatism.

Carriers.—Another point of importance requires special reference, and that is the problem of "carriers," as individuals infected with a disease and cured as regards themselves, but who yet continue to harbour and distribute the parasite, are called. Cholera follows the pilgrims' way, enteric fever the carrier cook, diphtheria the carrier school-teacher.

Experimental Verification.—Recently, investigators in several countries—Topley and his collaborators in England; Webster and others at the Rockefeller Institute, New York; Neufeld, Lange and others of the Robert Koch Institute in Berlin—have applied the experimental method to the study of epidemiological problems. The plan has been to study the course of an epidemic disease introduced into a herd of mice, its evolution under conditions better defined and more simple than obtain in nature. Greenwood and Topley, for instance, have watched the progress of a fatal infectious disease of mice due to an organism of the Pasteurella group in a population of mice replenished wholly by the addition of normal animals over a period of more than three and a quarter years—that is, through a period much longer than the length of an average generation of mice. They have shown that in these circumstances the prevalence of the disease exhibits wave-like movements, and that the intervals between successive exacerbations can be diminished merely by increasing the rate of immigration of normal animals. It has been demonstrated that in infections of this type the regular immigration of healthy animals is sufficient to maintain the disease indefinitely. In spite of the obvious objection that experimental work can only be used to explain the phenomena of naturally occurring epidemics in men with the help of analogical reasoning, there is little doubt this is a promising field of inquiry.

Prophylaxis.—In field epidemiology much work has been done in developing a method of prophylaxis against diphtheria, rendered possible by the discovery that certain persons exhibit a peculiar skin reaction (the so-called Schick reaction) after the injection within the skin of a small quantity of the toxin produced by the bacillus of diphtheria (*see* INFECTIOUS FEVERS). It is thought that such persons are especially liable to develop the disease when exposed to infection, and that an outbreak may be controlled or prevented by the immunisation of those who respond to this test. This immunisation is obtained by the injection of small doses of a mixture of toxin and anti-toxin. The method has now been employed on a large scale, particularly in America, and a majority of experts consider the results very satisfactory. It is, however, too early to express a decided opinion, since the statistical evidence which has been tendered has not always been free from ambiguity.

BIBLIOGRAPHY.—An excellent general account of the progress of knowledge is contained in Haeser's *Lehrbuch der Geschichte der Medizin und der epidemischen Krankheiten*, 3 vol., 3rd ed. (1882); English epidemiological history is fully related in Dr. Charles Creighton's *History of Epidemics in Britain*, 2 vol. (1894). A paper by M. Greenwood on the "Epidemiology of Plague in India," *Journal of Hygiene*, vol. 10, p. 349 (1910), gives examples of modern epidemiological methods; while his report "On the Rise, Spread, etc., of Epidemic Diseases," *Internat. Congress of Medicine*, Sec. 18, p. 49 (London, 1913), gives a full study with literature. Two papers by John Brownlee discussing "Theory of Epidemiology in Relation to Plague," *Proc. Roy. Soc. Med.*, vol. 11, p. 86 (1918), and the "Periodicities of Epidemics of Measles," *Proc. Roy. Soc. Med.*, vol. 12, p. 77 (1919), give an account of the statistical and mathematical methods which may be used. Sir R. Ross's *Prevention of Malaria* (1910) and Sir R. W. Boyce's *Yellow Fever and Its Prevention* (1911) discuss theory and practice in all their forms. For a summary of recent work on experimental epidemiology, see M. Greenwood and W. W. C. Topley's paper, *Journal of Hygiene*, vol. 24, p. 45 (1925). A complete account of recent work on diphtheria is given in *Diphtheria, Its Bacteriology, Pathology and Immunology*, issued by the Medical Research Council (1923).

(J. BRO.; M. G.*)

EPILEPSY (*see* 9.691), a disorder whose essential symptom is a recurring, abrupt loss or alteration of consciousness, includes many types of seizures, *e.g.*, convulsions, emotional explosions, irritable periods, vertigoes and psychic clouding. There are normal gradations of consciousness, as sleep, degrees of attentiveness or mental concentration, etc. Convulsions, because of their alarming appearance, early impressed mankind. This continued, preventing recognition of mental traits and important minor phenomena of the epilepsies. Symptomatic convulsions occur in other disorders, *e.g.*, uremia, diabetes, eclampsia, psychosis, and in infancy and childhood, especially at the onset of acute infections.

Facts pertaining to heredity are not established scientifically to formulate laws regarding transmission of epilepsies. Direct similar heredity in epilepsy is uncommon. Hereditary syphilis is infrequent, although it cannot be determined how much damage may be done to germ plasm by parental syphilis (*see* VENEREAL DISEASES). Infections and malnutrition during foetal life, infancy and childhood may damage vital systems and cause subsequent epilepsy. The relative value of assigned predisposing and exciting causes varies. The majority of epilepsies seem due to multiple factors. Injurious influences affecting the brain during early life may permit later of otherwise harmless influences exciting seizures. Without such predisposition, normal functioning of essential organs would withstand the influence which produces epilepsy. Paralytics surviving from birth injury usually become epileptic. Finer changes in the nervous system from birth injury often cause subsequent mental defect, epilepsy or both. In many epileptics the heart and large blood-vessels are abnormally small. There may be other organ inferiorities. Seemingly inhibition, not stimulation, of the cerebral cortex, resulting in loss of control over lower brain centres (decerebration) produces impairment or loss of consciousness with convulsive manifestations. In epilepsies there is faulty energy distribution. Regressive changes may result in lack of inhibitory control of the brain.

The gravity of a skull injury bears no relationship to development of traumatic epilepsy which sometimes follows comparatively slight head injuries. Only a small proportion of head injuries in children or adults result in epilepsy. In epileptics having frequent seizures, the brain at autopsy may appear quite normal, finer changes being found upon microscopic examination. In cases with marked abnormalities there may have been few seizures. Such brain changes are considered in some to have been predisposing, in others resultant or merely concomitant.

The immediate cause of epileptic phenomena is cerebral vascular disturbance with resulting nutritive upset and transitory oedema of parts of the brain. Such vasomotor disturbance in the brain cannot ordinarily be demonstrated in life nor found *post mortem*. It may be caused by insufficient or excessive activity of endocrines, protein sensitisation, passage from the intestines into the circulation of toxins which eventually reach the brain, toxic substances produced locally in the brain as a result of vascular disturbance in encephalitis, brain tumour, arteriosclerosis, brain scars with adhesions, etc. Faulty metabolism of foods may result in substances toxic to brain cells and cause seizures, although simple retention of ordinary waste products may not so act. Some investigators claim an acidosis, others an alkalosis, precipitates seizures. Attacks may be induced by excess or undue diminution of blood sugar, sudden lowering or increase of blood pressure, great loss of blood, increased intracranial pressure, etc. Some maintain a severe convulsion automatically adjusts faulty metabolism resulting in an interval of relatively normal health. Habit may act in causing recurrence of seizures. The importance of eyestrain, teething, worms, scars on extremities, abnormalities of sex organs, etc., as reflex causes, has been exaggerated. Apparently menstruation, pregnancy and menopause provoke some seizures. Up to 20 years of age the two sexes are equally affected, subsequently males exceed because of habits, occupation, etc.

Some describe the epileptic as one with inherited defect which causes various types of stress, ultimately psychic in character, producing reactions of unconsciousness, recurring periodically, which permits riddance of a particular, adaptive demand through regression to the unconscious, a state of peace and harmony, comparable to existence before reality had become part of the mental demand. Mentality of epileptics may range from normal to marked defectiveness. Deprivation, retardation and deterioration are factors acting in many. A number are highly intelligent, the majority living normally in their community, ver reaching institutions. In some, outstanding symptoms are o-centricity, supersensitiveness, emotional poverty, self- tisfaction, superficial religious manifestations and abnormal ctuation of attention.

Attacks may be classified as follows: motor seizures, with or thout apparent loss of consciousness; sensory seizures; psychic sturbances, acute or chronic. All symptoms considered part the disorder are modifications of one or all of these reactions. utomatism, a part of certain seizures, is frequently unrecog- sed, the individual unconsciously committing certain acts. edico-legally such periods as well as psychic phenomena of ilepsy are of importance. Many present "epileptic opti- sm," *i.e.*, failure to appreciate the necessity for avoiding dan- rous situations or assuming undue responsibilities. An ileptic may appreciate the onset of a seizure, but not recall by lack of memory fixation. Numerous factors seemingly vour occurrence of seizure, *e.g.*, circulatory changes accom- nying onset and cessation of sleep, puberty, dietary indiscre- ns, emotional reactions, atmospheric humidity, etc.

Minor attacks are often overlooked, as the person may not l; simply pauses for an instant, looks strange, then resumes nscious life. He may fall and immediately arise, such seizure ing mistaken for syncope, but distinguished by suddenness of set and recovery. Ramsay Hunt suggests such attacks are due sudden momentary loss of postural muscular control, associ- ed with transient unconsciousness. Recurring mild attacks in ldren may be a forerunner of epilepsy or cease without mental pairment.

Cerebral apoplexy seldom occurs in severe convulsions, al- ough minute haemorrhages without doubt do, causing recur- ce of symptoms. Study of the seizure itself does not with tainty differentiate those due to organic disease from those to psychic cause. Research has thus far failed to prove per- sions of function of organs peculiar to the epilepsies. No g is specific because essential epilepsy is not a disease, but a nptom complex resulting from unknown underlying condi- ns. The basis of treatment is to find and remove, at least nimise, factors that adversely influence the central nervous tem.

The epileptic should be placed under proper guidance early, necessarily public surveillance, but a physician or person npetent to advise. In effecting readjustment of life, it is cessary carefully to analyse symptoms and individualise treat- nt possible to carry out. The mode of living cannot be entirely nged, let alone environment; nevertheless, many circum- nces or habits which act injuriously may be diminished. The ient must be considered as a whole and not solely as presenting es of seizures. Reasonable restriction of diet, allowing for intenance of normal nutrition, with exclusion of articles diffi- t to digest will accomplish as much as extreme methods of longed starvation. Some are benefited with increase of fats, ne by other food groups, depending on chemical examina- ns of blood, urine, etc. Due care must be given to the elimina- of waste products. The pathology being unknown, surgery no specific place in the treatment. It is indicated in certain nptomatic epilepsies, *e.g.*, brain tumour and to relieve con- ions lowering general health.

The longer the freedom from seizures, and the better the ustment to ordinary environments, the better the prognosis. relessness in mode of life may result in recurrence of seizures. missions over more or less prolonged periods, irrespective of atment, are not uncommon. Spontaneous arrest seemingly urs in some. Expectation of life in epileptics is some 20 years than in others. To effect material improvement there must only disturbed function, not destruction, of portions of the tral nervous system and related organs. Psychic-mal-adjust- nts, lack of adaptation of organs and the individual as a le, *i.e.*, constitutional instability, the environment created neurotic relatives or associates, or the ordinary environment whose stresses the abnormal person cannot react properly are tors influencing epilepsy. An epileptic ordinarily presents reactions common to mankind, a fact to be remembered in prescribing for him. Salts of bromine have been used with more or less success for 70 years. Sodium or strontium salts produce least irritation in the gastro-intestinal tract. If bromides are used, particular care must be given to elimination and avoidance of deleterious influence on the mentality. Favourable results have followed the use of luminal (phenyl-barbital) in diminishing frequency of seizures, especially of the severer type, or holding them completely in abeyance. Alleged "cure-alls" often do much harm. Marriage of epileptics should be discouraged because of possibility of transmission of the condition to offspring, incompatibility of temperament and difficulty of assuming responsibility. Educational work among younger epileptics is beneficial, *e.g.*, discipline should be inculcated, interests aroused and self-control developed. Too solicitous care forces invalidism upon epileptic children. Responsibility begets confidence. The epileptic should be allowed to participate in activities of his circle, permitting energy outlets. The feeling that he is a person set apart from relatives and associates has a bad influence on mental functioning and metabolism. Occupation inducing normal healthy fatigue is most beneficial. (W. T. S.)

EPISTEMOLOGY: *see* KNOWLEDGE, THEORY OF.

EPSTEIN, JACOB (1880–), sculptor, was born in New York Nov. 10 1880, the son of Russian-Polish parents. He received his early training at the School of the Art Students' League of New York, and in 1902 he worked for a time at the Ecole des Beaux Arts in Paris. He went to London in 1905, and three years later obtained the commission to decorate the front of the British Medical Association building in the Strand, for which he made 18 large figures. In 1909 he carved the large sphinx for the Oscar Wilde memorial, placed in the Père Lachaise cemetery in Paris in 1912. His next works—the marble group "Two Doves" (1913), the marble Venus (1914) and his interesting carvings in flenite belong to his period of experiment in "abstract" sculpture. The life-sized bronze figure of Christ, on which he was working between 1917–9, roused a storm of opposition, which has signalised the appearance of each of the sculptor's most important works.

His series of bronze portraits, in which he may be said to have obtained his greatest success, began in 1907 with the portrait of Mrs. McEvoy. This was followed by the portrait of Lord Fisher in the Imperial War Museum (1915), mask of Mrs. Jacob Epstein (1916), the half-length "Meum with a Fan" and the Duchess of Marlborough (1917), bust of Mrs. Jacob Epstein (1918), Hélène (1919), the "Girl from Senegal" and "Kathleen" and "Jacob Kramer" in the National Gallery of British Art (1921), the "Weeping Woman" and "Dolores" (1922), Ferosa Rastourmji, R. B. Cunninghame Graham and "Old Pinager" (1923), Joseph Conrad (1924), "Sunita" and Sybil Thorndike (1925). His Hudson Memorial in Hyde Park—a panel carved with a figure of Rima—was unveiled in 1925. Exhibitions of the sculptor's works have been held at the Leicester Galleries, London, in 1917, 1920 and 1924. (*See* SCULPTURE.)

See also Bernard van Dieren, *Epstein* (1920) and the volume devoted to the sculptor in the *Contemporary British Artists* series (1925).

EQUATORIAL AFRICA, FRENCH (*l'Afrique Équatoriale française* or A.É.F.), formerly French Congo (*see* 11.99). Its area is approximately 982,000 sq. m. and the population was reckoned at 4,300,000 in 1911 and at under 3,000,000 in 1921. The inhabitants suffered greatly, especially in the Middle Congo colony, from sleeping sickness, dysentery and other diseases. Europeans numbered 2,932 in 1921.

By a decree issued on March 17 1920 the Chad territory, until then a dependency of the Ubangi-Shari colony, was made a separate colony. It extends from Lake Chad across the central Sudan to and including Wadai (*see* 28.225). The administrative system of A.É.F. is the same as in French West Africa. In 1911 more than 100,000 sq. m. of A.É.F. were ceded to Germany as compensation for the acknowledgment of a French protectorate in Morocco. This area was added to German Cameroons, but was restored to France in 1919 under the Treaty of Versailles and again incorporated in A.É.F. An Anglo-French agreement in 1919 settled the dispute as to the frontier between Wadai and Darfur and in 1923 a joint commission marked the frontier on the spot.

Transport and Communications.—Economically A.E.F. is the least developed of French African possessions, largely owing to lack of transport facilities. The Ogowe river system affords access to part of the Gabun colony and the port of Libreville on the Gabun estuary has periods of activity; but the trade of the Middle Congo and Ubangi has no outlet save along the (Belgian) Congo railway. River and lagoon feeder services are maintained by the Chargeurs Réunis. The construction of a railway, some 300 m. long, to connect Pointe Noire on the coast near Loango, with Brazzaville, on the Congo river at Stanley Pool, was begun in 1921, but the railway had not been more than half finished by 1926. The plans included the creation of a port at Pointe Noire and harbour works were in progress in 1926. Telegraph lines have been laid connecting Brazzaville with Bangi and Fort Lamy. The total length of line in operation in 1925 was about 2,366 miles.

Trade.—Timber, palm kernels and palm oil, rubber, ivory and cocoa are the leading exports. The system adopted of granting exclusive rights to concession companies was unsuccessful; the companies did, however, help to make known the natural riches of the country and assisted the organisation of transport on the Congo, Ubangi and Shari rivers. Cattle, sheep, camels, horses, asses and ostriches are raised in the Chad colony, which contained over 700,000 head of cattle in 1922, but facilities for exports are lacking. The value of external trade was approximately 57,840,000 fr. in 1913; it fell to insignificant proportions during the World War, but increased to 49,800,000 fr. in 1920 and 65,300,000 fr. in 1923. Between 1910 and 1920 French authority was made effective throughout the country, Tibesti and other Saharan regions being occupied. The slave trade was rigorously suppressed and, in view of the alarming decrease in the population, considerable attention was paid to hygiene. Educational facilities remained however very deficient.

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ERITREA, an Italian colony on the Red Sea (*see* 9.745), has an area of 45,734 sq. m. and a population (1924) of about 410,000, of whom 4,000 were Italians. Asmara, the capital, had (1921) 13,510 inhabitants (of whom 2,407 were Europeans), Massawa, the chief port, some 12,000 (of whom 360 were Europeans). Systematic efforts were made to develop the resources of Eritrea, though a project to settle large numbers of Italians as farmers in the highlands had to be abandoned as it was found that nearly all the suitable land was already occupied by the natives (Abyssinians). Means of communication were extended. The port of Massawa was greatly improved and the railway carried from it to the highlands. The section to Asmara, 75 m., completed in 1912, rises to 7,765 ft., the altitude of Asmara. An extension to Cheren, 65 m., was opened in 1922. Thence the railway was continued towards Agordat, a town on the Khor Baraka. A motor road was made to Aduwa in Tigré (Abyssinia). A Decauville railway was built (1917–8) from Port Fatima in the Danakil (Afar) country to serve the potash mine at Dolol, on the Abyssinian side of the frontier. From the port of Assab, further south, a road was built to tap the trade of central Abyssinia.

Trade and Industry.—Stock raising remained up to 1925 the principal and most valuable industry and skins and hides the chief export. There was, however, marked increase in the trade in vegetable ivory (the nut of the dum palms). Other leading exports were salt, potash, mother-of-pearl and linseed. The most promising new industry was the cultivation of cotton in the Khor Baraka and river Gash (Mareb) areas. Ginneries were built at Asmara and Massawa and a beginning was made with irrigation works in the Gash area in 1915. The Gash ends in an inland delta in the Kassala province of the Sudan and in 1925 an agreement with the Sudan Govt. regulated the use of its waters by the two countries. Owing to the World War the development of the cotton fields was at first slow, the crop in 1922 being little more than 1,000 quintals. By 1924, however, the crop had increased to over 20,000 quintals.

The trade returns of Massawa illustrate the progress made in industry. In 1911 the imports were valued at 17,100,000 lire, the exports at 8,800,000 lire and the transit trade at 3,350,000 lire. In 1924 the figures were imports 146,129,000 lire, exports 86,680,000 lire, transit 18,850,000 lire. In the same year (1924) the total trade of Assab was returned at 12,000,000 lire; in 1923 the imports by the land frontiers were valued at 38,000,000 lire and the exports at 29,470,000 lire.

Finance.—Although Eritrea had not become self-supporting the budget for 1924–5 showed that the colonial revenue (12,400,000 lire) approximated to ordinary expenditure (13,700,000 lire). The budget was balanced at 36,439,000 lire, the deficit being met by the Italian Treasury. The sum of 11,365,000 lire was debited to military expenditure. The Abyssinians of Eritrea make good soldiers and Eritrian troops were employed in the war in Tripoli (1911–2) and in the World War. Eritrian battalions are stationed in Tripolitania, Cyrenaica and Italian Somaliland. In 1919 the military force in Eritrea itself was 12,000 (including 3,000 Europeans). By 1924 it had been reduced to 134 Europeans and 5,000 natives.

The relations of Eritrea with its neighbours, Abyssinia and the Sudan, were of a friendly character and it was comparatively little affected by the World War. Its oversea trade is mainly with Italy, Aden and India. Economic development might have been more rapid had foreign capital been sought, but it was not, and Italian capitalists for many years showed a disinclination to invest money in the colony. Massawa is in wireless telegraphic communication with Italy and with Italian Somaliland.

See Tommaso Tittoni, *Italy's Foreign and Colonial Policy* (English trans. 1914); *Eritrea*, a British Foreign Office handbook with bibliography (1920); E. Vinassa de Regny, *Dancalia* (Rome, 1923); the *Rivista Coloniale* (Rome) and the *Bolletino della Societa Geografica italiana* (Rome). (F. R. C.)

ERNLE, ROWLAND EDMUND PROTHERO, 1st Baron (1852–), British agriculturist and writer, was born at Clifton-on-Teme Sept. 6 1852. He was educated at Marlborough and Balliol College, Oxford, where he took his degree in 1875. From 1894 to 1899 he was editor of *The Quarterly Review.* Twenty years as chief agent to the Duke of Bedford greatly extended his experience on agricultural questions. In 1913 he was a member of the royal commission on railways, and sat on the departmental committees on the home production of food (1914) and the increased price of commodities (1915). Having entered Parliament for Oxford University in 1914, he was President of the Board of Agriculture under Mr. Lloyd George from 1916 to Feb. 1919. He resigned his office in 1919 and was raised to the peerage.

Among his works are *Pioneers and Progress of English Farming* (1888); *Life and Correspondence of Dean Stanley* (1893); *Letters of Edward Gibbon* (1896); *Letters and Journals of Lord Byron* (1898–1901); *Psalms in Human Life* (1903); *The Pleasant Land of France* (1908); *English Farming, Past and Present* (1912); and *The Land and Its People* (1925).

ERZBERGER, MATTHIAS (1875–1921), was born on Sept. 20 1875, in Buttenhausen, in the Swabian Alp. Having entered the teaching profession, he soon became interested in politics. He joined the staff of the Stuttgart Catholic paper *Deutsches Volksblatt* and was elected member of the Reichstag at the age of 28. The Centre party, to which he belonged, came into existence as a mainly religious association during the "Kulturkampf" (Bismarck's quarrel with the Catholic Church.)

When this particular dispute had been settled the Centre party gradually assumed a political complexion. Erzberger, being rather anti-bureaucratic by temperament, began his career as a severe critic of the Colonial Office, whose chief spokesman, Dr. Helfferich, later on became his violent enemy. His party did not enjoy his impetuosity, which sometimes savoured of l form. The dissolution of the Reichstag by Prince Bülow, en the Centre party insisted on parliamentary responsibility colonial affairs, and the return of the party with undiminished nbers in 1907 rather justified Erzberger in his tactics. And en Prince Bülow's incongruous Conservative-Liberal coalin broke down and the Centre party again became a quasivernment party (1909), Erzberger had gained a leading sition in its councils.

)uring the World War Erzberger quickly realised the imporce of public opinion. He built up a big organisation to ighten neutral opinion, addressing himself primarily to Catho-. His influence on them was by no means inconspicuous, for ugh he was a fervent believer in the authority of his Church spiritual matters, in temporal affairs he was a democrat by ining and by temperament. He elaborated all sorts of plans the reconstruction of Europe, some rather illogically based the right of self-determination of the people.

Ie did not openly oppose submarine warfare, though he atly feared America's entrance into the war. In the summer 1917 he realised that Austria was collapsing. He knew the nous Czernin memorandum (April 12 1917) and has even en falsely accused of having brought it to light. His insight o the Austrian situation and his disillusion about the subrine warfare made him take the initiative in bringing about declaration of the Reichstag on July 19, which proclaimed rmany's intention to fight for a peace without annexations. succeeded by his impetuous methods in overthrowing Bethnn Hollweg, who sympathised with the movement, and nging in Michaelis, who was a supporter of the militarists l whose famous interpretation of the resolution destroyed h chances as the appeal might have had. Erzberger played art in the unsuccessful peace efforts of the Vatican, turning h a wonderful facility from one scheme to another, never unted by failure.

Erzberger's great political chance came in Sept. 1918, when nce Max of Baden formed a parliamentary government. zberger had outlined the programme for this coalition of tional-Liberals, Liberals, Centrists and Socialists. He bene Secretary of State without portfolio. He was asked to d the armistice commission when General Headquarters inted on an armistice. He did not succeed in getting terms, sed on the Wilson principles, which Germany had accepted. has been held up to obloquy for this failure, his carelessness, ignorance of French and his bad manners having been given reasons. It may well be doubted whether the most brilliant ners of such qualities would have fared better at the hands a victorious general.

When Erzberger came home, the old régime had gone. He nained head of the armistice commission but participated in e reorganisation of the Centre party, which gained 90 seats at e election of 1919. He entered the Cabinet, formed by Scheidenn, as minister without portfolio. When that government, luenced by Brockdorff-Rantzau and the German delegation, sired to reject the peace terms, Erzberger dissented, dissting the capacity of the German people to stand another olonged strain, and fearing greatly for German unity. He essed his point with his customary energy and perhaps, too, h that want of tact he occasionally exhibited. He is supposed have said quite openly that another government would sign e treaty, if Scheidemann refused, and it is quite possible that utterances may have reassured the Allies of the small risk they n when presenting an ultimatum (June 16). The government l resign, and Erzberger became Chancellor of the Exchequer the Bauer Government, formed by Socialists and Centrists, ich signed the peace.

Up to that time the individual States had owned the railways d drawn the direct taxes, especially the income tax; the Reich d to be satisfied mainly with indirect taxation. The wrangles tween the states and the central authority had filled the pages German history, the states always succeeding in holding eir own. Erzberger took the railways for the Reich and establhed its control over taxation. He succeeded where Otto von Bismarck had failed. He organised an Imperial inland revenue service and introduced a system of income and property taxes which, though somewhat socialistic in its main features, was the first real system of Imperial finance Germany has had.

His activities during the World War, his participation in the Armistice and the peace negotiations, and his financial policy made Erzberger the best hated man in Germany. His feud with the bureaucrats was of old standing; the capitalist classes hated him for his confiscatory financial legislation; and to the Prussian Protestant he was the international Catholic, who spoke with a broad Swabian accent. The federalists loathed him on account of his centralising tendencies, and the militarists tried to make him the scapegoat for their want of success. All the enemies of the new order of things realised, however, that whatever his faults might be, he was a man of action and not a dreamer.

Karl Helfferich, a former Secretary of State whose financial War policy Erzberger had strongly criticised, fathered these attacks in a pamphlet *Fort mit Erzberger*, in which Erzberger was accused of all sorts of petty underhand financial misdemeanors and even of having committed perjury. Erzberger sued Helfferich, but did not succeed in clearing himself as completely as the facts of the case probably warranted. He immediatedly resigned. The verdict assumed that he had committed perjury, but the same court, inquiring later on whether the facts established should lead to a public prosecution, came to a negative finding. It was then considered that in some way or other Erzberger would be completely rehabilitated. The feeling against him was so intense, however, that an abortive attempt upon his life was made during the proceedings. A few months after, when taking a holiday, he was foully murdered on Aug. 26 1921, by Schulz and Tillessen, two members of secret associations, who got safely to Hungary.

Erzberger was probably the most gifted man of action German democracy has so far produced. He acted with the light-hearted impetuosity of a child: there was no situation to which he did not consider himself equal. He quickly saw the main point, and when he saw it, he acted, being quite free from those mental impediments which so often paralyse intelligent men. He very often did not visualise the ultimate consequences of his actions, but this did not trouble him as he was quite sure that he could deal with them when they arose. His jaunty manner equally antagonised the deep thinker and the well-bred bureaucrat. He was often careless and inaccurate in details, for though details interested him greatly, he had not always a just sense of "value." Being rather insensitive himself, he often failed to consider other people's susceptibilities, and being simple though very shrewd, he was not a good judge of men and did not understand complicated minds, nor the impression he made upon them. He was a man of the people and he looked like it. As such he was loathed by all to whom a statesman must be "decorous." He was almost a genius. But he lacked the magnetism and charm indispensable to a really great leader.

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(M. Bo.*)

ESCALATOR: *see* ELEVATORS AND ESCALATORS.

ESENIN, SERGIUS (1895–1925), Russian poet, was born Oct. 4 1895 in Constantinovo, since his death officially renamed Esenino, in the Ryazan province. A peasant by birth, he lived in his native village until he was 17 when he moved to Moscow. His first poems (1915) met with immediate success. In 1919 he founded the Imagist group. Esenin travelled in Persia and also visited America and France. He was married first to the American dancer, Isadora Duncan, from whom he soon parted, and secondly to a grand-daughter of Count Leo Tolstoy. He died by his own hand on Dec. 28 1925. Although he was a staunch supporter of the Soviets, his meditative and purely lyrical talent was tragically out of touch with the active and matter-of-fact post-Revolutionary Russia.

Esenin has been considered the finest Russian poet of his generation and second only to Blok. His poetry reflects the mysticism of the old Russian peasantry with its ikons and its folklore, as in "Radunitza" (Day of the Dead), "Goluben" (Blueness); and in "Inonia" he depicts a religious Utopia and proclaims the advent of a "peasant Christ." All his poems reflect the same love for peasant Russia, its fields, thatched cottages, its trees and animals. He called himself "the last peasant poet" and deplores the invasion of the land by the town—"the iron guest." His town and tavern poems ("Moscow of the Taverns," "The Confessions of a Hooligan," etc.) telling the evil victory of the town and its allurements, are of a tragic and captivating sincerity. His poetic style is highly imaginative and his simple, transparent verse follows the classic Pushkin tradition.

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ESHER, REGINALD BALIOL BRETT, 2ND VISCOUNT (1852–), British politician and writer, eldest son of the 1st Viscount Esher (*see* 9.768), was born in London, June 30 1852, and educated at Eton and Trinity College, Cambridge. He entered politics, becoming private secretary to the Marquess of Hartington in 1878, and from 1880 to 1885 was Liberal member for Penrhyn and Falmouth. From 1895 to 1902 he was secretary to the Office of Works. He succeeded his father in 1899 and in 1901 was appointed deputy constable and lieutenant-governor of Windsor Castle. In 1902 he was appointed one of the commissioners who inquired into the conduct of the South African War. In 1904 he was chairman of the War Office Reconstitution Committee, and in 1905 became a permanent member of the Committee of Imperial Defence. He was chairman of the Territorial Force Assn. of the county of London 1909–13, and president, 1912–21. Lord Esher was selected by King Edward VII. as one of the editors of the *Letters of Queen Victoria*, which appeared in 1907, and he produced *The Girlhood of Queen Victoria* (1912). His other works include *The Influence of King Edward* (1915); *The Tragedy of Kitchener* (1921) and *Ionicus* (1923).

ESPERANTO: *see* UNIVERSAL LANGUAGE.

ESSEN (*see* 9.778), one of the largest towns in Prussia, Germany, had a population of 439,257 in 1919. A later estimate was 474,000. Alten Essen, Haarzopf, Bredenau and part of Vorbeck, with a total population of 114,000 were included in the city boundaries in 1915. Situated at the centre of great coalfields, Essen has developed rapidly. The Krupp works, to the west of the old town, now produce locomotives, agricultural machinery, etc., and were employing some 35,000 workers in 1925. The Exchange, opposite the railway station, was finished in 1924. In 1920 factories were occupied by Communists during revolutionary outbreaks, and were only retaken by Government troops after heavy fighting. Occupied by the French after the Armistice, Essen was evacuated by them on Aug. 1 1925.

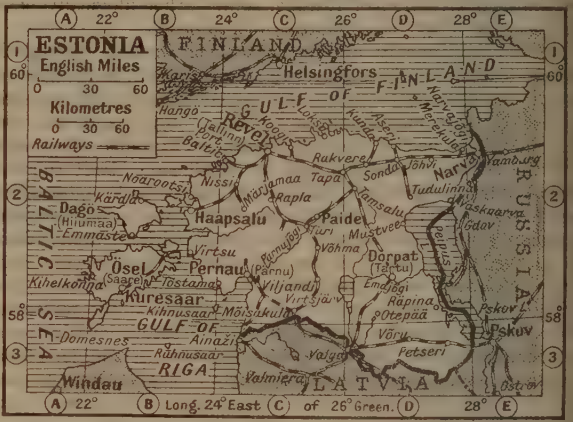
ESTONIA (*see* ESTHONIA, 9.797) an independent Baltic republic (Eesti), founded in 1918, its area is 16,955 sq. m. and the population (1922), 1,107,059. It is bounded on the north by the Gulf of Finland; on the west by the Baltic Sea; on the south by Latvia; and on the east by Soviet Russia, the boundary running through the middle of Lake Peipus. The republic comprises the former Russian government of Estland, the northern part of Livland, parts of two districts of the Pskov and Petrograd governments together with the islands of Dagö (Hiiu Maa), Öesel Saare, Muhu and other small islands in the Baltic Sea.

Constitution.—The constitution adopted by the Constituent Assembly on June 15 1920, provides for a republican government, with parliament (Riigikegu), consisting of 100 members elected by universal and secret ballot on the proportional representation system. Provision is made for a direct exercise of power by the people through initiative and referendum. The Prime Minister is the head and official representative of the Estonian Republic,

I. POLITICAL HISTORY

The Russian Revolution.—Acting on the proposal of the Union of Estonian organisations, the Russian provisional government, formed on March 12 1917, ruled that the northern districts of the Gubernia (government) of Livonia (inhabited by Estonians) and of Estonia should become one State and be given a democratic local self-government. Since the revolution of 1905 Estonia had, like the other small states on Russia's borders, been working for autonomy. When the Russian provisional government of 1917 had been declared this could only be granted by the All-Russian Constituent Assembly. When, therefore, the Estonian Diet met at Revel (Tallinn) on July 14 1917, its first task was to prepare a Bill for this purpose.

The Bolshevik *coup d'état* changed the course of events. On the fall of the Russian provisional government the Estonian Diet, on Nov. 15, declared its complete local independence. The Bolsheviks, however, dissolved the Diet; and although national regiments, amounting finally to a division, had been formed during the revolution, the fact that Revel was now being used by the Russian army as its sea base, and lay exposed to fire from Russian ships, made it expedient to avoid conflict. The "Baltic barons" of Estonia had meanwhile appealed to Germany for military assistance. Taking their stand on the Treaty of Nystad (1721), they declared themselves the authorised representatives of the country, and on Dec. 12 1917 formally broke away from Russia, and invoked the aid of German troops. In accordance with Germany's request the barons approached the Estonian Diet with the object of securing a joint appeal to Germany; but the Diet, well aware of their schemes for German colonisation and compulsory denationalisation of the country, decided, at the turn of the year 1917–8, to separate from Russia but at the same time to declare the independence of Estonia.



De Facto Recognition.—The resumption of hostilities by the Germans had disconcerted the Bolsheviks, and advantage was taken on this fact to overthrow the Bolshevik rule at Revel and proclaim Estonia an independent republic on Feb. 24 1918. The resolution of the Diet had been laid before the allied governments; favourable replies were received from France on March 1 1918 and from Great Britain on March 20, the *de facto* recognition of Estonia by Great Britain, France and Italy following on May 5 May 13 and May 29 respectively.

The German occupation which followed was designed to turn Estonia into a Baltic duchy in personal union with Prussia, in conformity with the wishes of the Baltic nobility. To create the appearance of a national movement it was desirable to gain the consent of certain sections of the Estonian people. The representatives of the peasant-proprietors, however, when summoned to the Riga Assembly on April 10 1918, by the authorities of the military occupation, refused their consent. Nevertheless, Baron Dellingshausen, the leader of the Baltic nobility, forwarded Estonia's request for union with Prussia to Berlin, and received the German Emperor's consent through his Chancellor on April 21 1918. After the peace of Brest-Litovsk, Germany held only tem-orary police powers in Estonia, and Soviet Russia renounced er sovereign rights over Estonia and Livonia by the supple- ientary agreement of Berlin on Aug. 27 1918. With the ollapse of Germany in the autumn of 1918 the Estonian provi- onal government, consisting of representatives of all parties, ncluding the Social Democrats, resumed its activities. K. Päts, ne former President of the Diet, released from imprisonment by ne Germans, became Prime Minister; and J. Poska, the former ommissar of the Russian provisional government, proceeded o the peace conference in Paris as Foreign Minister.

The Bolshevist Invasion.—The German troops had not been ompletely withdrawn before a new danger threatened from the ast. Narwa had been invested by the Bolshevists, who now be- an to penetrate into Estonia (Nov. 28) aided by landings on ne coast of the Gulf of Finland. Estonia's situation was ren- ered more difficult by the fact that the Germans had devastated ne country and removed or destroyed all arms. Thus a state ad to be created without money, a war begun without weapons. ut of the cadres of the Estonian regiments of 1917 Gen. aidoner had begun to organise an Estonian army, while Capt. Pitka created a marine force of volunteers and students, form- g shock-battalions and improvising armoured trains out of oods trucks. Assistance came first in the form of a loan amount- g to 20,000,000 Finnish marks, a consignment of arms and a ody of over 2,000 volunteers from Estonia's neighbour and sis- r-nation, Finland. On Dec. 12 1918, a British fleet under dmiral Sinclair arrived at Revel, which brought over a supply arms and took the Gulf of Finland under its protection. Sin- air also captured two Russian destroyers and handed them over Estonia. Later, some hundreds of volunteers from Sweden nd Denmark made their appearance. On Jan. 4 1919, when the olshevists held half Estonia in their grasp, their offensive was oken, and by the beginning of Feb. the whole country as freed from the enemy. The Constituent Assembly was now ected. Meeting on April 23 1919, it voted unanimously for the newed declaration of Estonia's independence, and formed a w coalition government from the bourgeois parties and the ocial Democrats.

Throughout the spring, from Feb. till May, Bolshevik at- cks continued. In May, however, the Estonians took the of- nsive and broke through the Bolshevik front, carrying opera- ons over into Russian territory. The "Northern Corps" of the ussian White Army under Gen. Rodzianko, which had re- red into Estonia from Pskov, now occupied Yamburg, the Es- nians taking Pskov. As the result of an attack to the south in ne direction of Marienburg-Jakobstadt along the Dvina, Nor- nern Latvia was freed from the Bolsheviks, while Latvia re- eived assistance in organising its regiments. In the neighbour- ood of Riga an encounter occurred with Gen. R. von der oltz's German volunteers, who had overthrown the Lettish emocratic government at Libau and were endeavouring to get ne whole of Latvia into their power. Gen. Sir H. Gough, as nief of the Allied military mission, had ruled, in support of the emand of the Estonians, that Gen. von der Goltz should not ad his troops northward against Estonia but eastward against ne Bolsheviks; in defiance of this, von der Goltz broke the armi- ice and began to advance. On June 21–2, at the battle of Wen- en-Ronneburg, his front was broken through and his army put flight and driven out of Northern Latvia. By the intervention the Allies a new armistice was concluded at Riga on July 3 919. Von der Goltz was forced to evacuate the town, and the ettish Govt. was again able to return to its functions.

Peace with Russia.—On Russian territory the Northern Corps the White Army had been organised as an independent north- estern army with Gen. Yudenich as commander-in-chief. he disputes between the various Russian generals went on eadily increasing until finally civil war broke out at Pskov. As either the White Russians nor the Paris peace conference of the llies would acknowledge her *de jure*, Estonia, on Aug. 31, ac- epted the peace proposals made by Chicherin on behalf of Soviet ussia. On Dec. 5 1919, peace negotiations were opened be- ween Estonia and Russia at Dorpat. In order to make their demands more impressive, the Russians concentrated their VII. and XV. Armies (upwards of 40,000 men) on the banks of the Narowa and threatened Narwa. An armistice was declared on Dec. 31, and peace was concluded on Feb. 2 1920. Russia agreed to acknowledge the independence of Estonia and to pay her 15,000,000 gold roubles (£1,500,000) from the Russian gold fund, but refused to return the funds, savings and money which had been removed. On the other hand, Estonia was released from any responsibility for Russia's debts abroad. Free transit to Estonian ports was conceded to Russia. This was the first peace treaty concluded between Soviet Russia and any of the border states.

Internal Legislation.—On Oct. 10 1919, while the War was still in progress, the Estonian Constituent Assembly had passed an Agrarian Reform Bill, by which manorial estates of more than 330 hectares, a type of holding which covered more than half of the whole agricultural area, were to be divided among those who had taken part in the war of independence in holdings averaging from 20 to 25 hectares. Thus the landless peasant population, which constituted one of the most important factors in the revolutionary movement, was satisfied. The last task of the Constituent Assembly before its dissolution was the adoption (June 15 1920) of a constitution which resembled in many respects the Swiss and the new German constitutions.

The two parliamentary elections of 1920 and 1923 showed a strong tendency towards the Right as compared with the Constituent Assembly. In the case of the Assembly, agrarian reform came first in importance, but in the new parliaments economic problems were predominant. The Conservative Agrarian Party was now the strongest; the Social Democrats, who had formed 40% of the Constituent Assembly, sank to 30% in the Riigikegu. Socialists rarely held office in the government.

When the civil war in Russia ended in victory for the Bolsheviks the Supreme Council of the Allies agreed to the *de jure* recognition of Estonia (Jan. 26 1921). On Sept. 22 of the same year Estonia was admitted to the League of Nations. Recognition by the United States followed on July 28 1922.

Foreign Policy.—Attempts to co-ordinate the foreign policy of the Baltic States had been made while they were still fighting for independence. At Warsaw, on March 17 1922, Estonia, Poland, Latvia and Finland signed a political agreement, which, however, did not come into force, Finland refusing to ratify it on the ground that it might be directed against Germany. That the Baltic states are working with a common aim is nevertheless evident from their attitude in the League of Nations and from the periodic conferences between the foreign ministers; at one of these conferences, in 1925, an agreement was reached for the establishment of a permanent court of arbitration. Estonia came to a final agreement with Latvia with regard to their common line of frontier on Nov. 1 1923, when a treaty of defensive alliance was concluded, war claims were settled and an economic agreement signed. The economic clauses, which established unified tariffs and duty-free transit of goods, marked the first step in the direction of a complete customs union. Other agreements in existence between Estonia, Latvia and Lithuania aim at rendering inter-communication between these countries easier by the elimination of passport visas and the introduction of an inland postal tariff.

Communist Agitation.—Communist agitation has been responsible for constant friction between Estonia and Russia. Estonian Communists have their headquarters in Russia, and their secret agents in Estonia are under Russian diplomatic protection; should anything happen to these agents, Estonians living in Russia are imprisoned as hostages and an exchange is then proposed between them and the Communists imprisoned in Estonia. But Communist agitation has obtained so small a hold in Estonia that no special measures have been taken with regard to it. Estonia was the last of the border states to declare the Communist party illegal; this was in the autumn of 1923, when, at the time of the riots in Germany, Communists in Estonia began to prepare for an armed rising there also. At Revel, a "putsch" was attempted early in the morning of Dec. 1 1924, when the proceedings against the imprisoned Communists had come to an end. About 300 conspirators, formed into shock troops and composed mainly of Russian red guards, had been smuggled over, and Russian transit workers in Revel, provided with arms secretly imported from Russia, made a sudden and simultaneous attack on the government and military institutions, but were immediately repulsed and soon after killed. The result of this revolutionary outburst was the closing of all Communist organisations and the founding of civil guards on the Finnish model, in which 30,000 men were enrolled.

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(E. L.)

II. SOCIAL AND ECONOMIC CONDITIONS

Population.—According to the census of 1922, Estonia's population of 1,107,059 included 87·7% Estonians, 8·2% Russians, 1·7% Germans, 0·7% Swedes, 0·4% Jews. The rights of minority nationalities were laid down by the Constituent Assembly, and on Feb. 5 1925 a special Act was passed which granted national and cultural autonomy to all minority nationalities with a minimum of 3,000 members, living in Estonian territory.

The principal towns are: the capital Revel (Tallinn), 130,000 inhabitants; the university town of Dorpat (Tartu), 50,000; Pernau (Pärnu) 18,500, on the gulf of Riga, and the manufacturing town of Narwa, 27,000.

Education.—The various national minorities have their own schools, where instruction is given in each mother tongue. Every individual, however, has to learn the Estonian language also. School attendance is compulsory by law, and Church and State are separated. Religious teaching in the State schools was established by Referendum in 1923. The proportion of illiterates (to be found chiefly on the Russian border) is 5·7%. Dorpat University was re-opened on Dec. 1 1919 as the Estonian national university. The number of students in 1922 was 2,398 men and 1,002 women. Revel has a Technicum (higher professional school) with 400 students. Lutheranism claims 78·6% of the population, and the Greek Church 19%.

Defence.—Military service is compulsory. The army is organised in three divisions, the peace strength in 1924 being 1,600 officers and 18,500 other ranks, and the full strength on mobilisation 90,000. The naval force consists of two destroyers, one gunboat, one torpedo boat and smaller craft.

The Problem of Reconstruction.—Before the War Estonia was one of the principal sources of St. Petersburg's food supply and Revel was one of Russia's main northern outlets to the sea. There had grown up at Revel in easy reach of foreign coal a considerable industry—shipbuilding, metallurgical shops, textile mills, etc.—designed to supply the Russian market and largely to meet the requirements of the Russian army and navy.

The problem of reconstruction with which the Government was faced after the Treaty of Dorpat was, therefore, extremely difficult. An agricultural revolution had been created by the expropriation law of Oct. 1919 and agriculture had lost its normal market. The big industries had no less lost their markets. They were destitute of floating capital after six years of inflation and proved at first rather an incubus to the State than an asset. During the previous years public expenditure had been covered largely by means of the issue of notes, and the whole machinery of Government and administration had to be built up from its foundations.

Agriculture.—The most essential task was the reorganisation of agriculture, the drainage, stocking, equipment and general capitalisation of the new small holdings, the training of the new peasant farmers and the establishment of agricultural co-operation societies, for the main source of Estonia's wealth is agriculture. About 40% of the total area consists of prairie and meadow, 23% is under plough and 15% under forest. With the assistance of these co-operative societies Estonian agriculture is now developing on the lines of specialising in cattle-breeding, dairy farming and flax productions. The export of butter is controlled by the State with a view to maintaining a definite standard of quality, and new markets have been found in England, Germany and elsewhere. The total exports of butter increased from 1,032 tons in 1922 to 6,443 tons in 1925, and the export of eggs at a not much inferior rate.

While material progress has thus been made in dairy farming and in the cultivation of forage crops which that system of husbandry necessitates in northern climates, the areas under cereals and average cereal crops are about the same as they were before the War, and Estonia remains a corn-importing country. The production of potatoes, on the other hand, for which the land is well suited, has greatly diminished (1910, 810,000 tons; 1925, 590,000 tons) owing to the lack of markets for potato spirit. The area under flax has grown steadily from year to year and is now nearly 20% greater than it was before the War.

Industrial Production.—In the first few years of Estonian history high hopes were still placed on the future of her larger industrial undertakings, and considerable sums were advanced by the State Bank, with the result that by 1923–4 the credit and banking situation of the country became highly critical and a considerable proportion of the gold reserve obtained from Russia under the Treaty of Dorpat was lost. Estonia, however, possesses certain raw materials, which may possibly constitute the basis of a new industrial development in the future. Of these, the most important are wood and oil shale. The shale, the deposits of which are roughly estimated at 3,500–5,000 million tons, is unusually rich in oil. It is already utilised to a growing extent in Estonian factories and on the railways in its crude state in place of coal, and a certain number of concessions for its more scientific exploitation have been granted to foreign firms.

The forests, which since the expropriation law of 1919 have remained under the direct control of the State, constitute an additional source of fuel and the raw material of the saw mills, three-ply, and paper industries. Since about 1921 the quantity of timber employed in the country by these three industries has steadily increased. Cement is another product the preparation of which is in no way dependent upon foreign raw materials. Of the industries which are dependent upon foreign raw materials cotton spinning has been the most successfully organised, the exports of cotton yarn having increased from 154 tons in 1922 to 758 in 1924 and 1,282 in 1925.

Trade.—The principal exports of the country in 1924 were:—

	Value in Estonian marks
Dairy produce and other foodstuffs of animal origin	1,191
Wood and wood products	1,752
Cotton fabrics	1,094
Flax, raw	1,690
Total exports	7,866

Although Estonia was the first "window into Europe" for Soviet Russia, neither Russian transit nor the traffic in goods attained the height reached before the War. Trade with Russia was heaviest after the great Russian famine of 1922, when, in consequence of the quantity of provisions sent into the country, Russian transit over Estonian railways amounted to 370,000 tons, providing one-fourth of the total revenue of those railways.

Currency.—The economic progress which the country has achieved may be judged from the growth of its total exports from 2,287 million Estonian marks in 1921 to 4,812 in 1922, to 5,712 in 1923, to 7,866 in 1924, to 9,665 in 1925. To some extent the increase in these figures is due to the depreciation of the Estonian mark and the rise of prices. Direct fiduciary inflation ceased in 1921, and the exchange improved slightly during the next two years. With the bank inflation of 1923–4 the exchange depreciated from about 340 to 460 (Aug. 1924) to the dollar. By the end of the year, however, the Central Bank, which is a Government institution, had succeeded in bringing down the rate to about 373 Estonian marks to the dollar, a rate which is equivalent to 100 Estonian marks to the Swedish crown. The exchanges were kept stable at this rate from Jan. 1925 onwards, and it is proposed to introduce a new currency, a Kroon, equivalent to 100 of the present Estonian marks. In June 1924 this Kroon was made a legal unit of account.

The measure of success with which Estonia has met her economic reconstruction, despite great initial difficulties, despite certain highly critical periods as in 1923, when the effects of a bad harvest and an unwise credit policy coincided, and despite inevitable errors, has been largely due to the fact that since 1921 she has managed to balance her budget. Indeed, not only has the budget been balanced, but the capital outlay incidental upon her economic reconstruction has been largely met out of current revenues. Her taxes have thus been to a considerable extent a form of forced savings. On the other hand, as indicated above, as a result of the losses incurred by the State Bank, this country has lived to some extent upon the gold received from Russia.

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ETCHING (*see* 9.804).—No feature of recent art history has been more remarkable than the extended practice of original etching and its widening appreciation among print collectors and the public seeking decoration for its home walls. To compare the art's present condition with that offered to the survey of Sir rederick Wedmore in the 11th Edition of *The Encyclopædia ritannica* is to realise that since 1911 etchers of importance ave arisen who must be ranked with the masters, while the verage standard of accomplishment is now so much higher, otwithstanding the great increase in the numbers practising e method, that changes in the comparative value of reputa- ons are inevitable.

While, therefore, etchers already of world-wide repute, such s Forain, Bauer, Zorn, Brangwyn, Bone and McBey are now entioned for the first time in these pages, there are names hich must disappear, necessarily giving place to others of more epresentative distinction. Since the volumes of the 11th dition were in the press, the three latest surviving pro- gonists of the modern revival of original etching have died; r Francis Seymour Haden in 1910, Alphonse Legros in 1911 nd Felix Bracquemond in 1914.

The Influence of Short.—Even greater and farther reaching han Haden's has been the influence of his successor in the pres- ency of the Royal Society of Painter-Etchers and Engravers, r Frank Short, R.A., for, during his long direction of the mous Engraving School of the Royal College of Art, he as trained two generations of British etchers in the tradition of embrandt's vital line, which he has held always as a sacred ust. A master of every method of the copperplate, with eshness of vision and sincerity of expression, Short long ago dded to the classics of the etcher's art, to name only such eautiful and masterly plates as "Low Tide and the Evening tar," and "A Wintry Blast on the Stourbridge Canal." His evival of pure aquatint, in other words, tone-etching, as an in- ependent expressive medium, with rich and subtle development f its capacity for tonal gradation, has enlarged the scope of the cher's pictorial utterance. This service to graphic art was carcely less important than Short's restoration of mezzotint to s purity of practice, first in his completion of J. M. W. Turner's *iber Studiorum,* and further in his own poetic plates, exem- lifying its value for original landscape.

Sir D. Y. Cameron, R.A., another veteran of the copper- late, won a distinctive place among eminent etchers before he ad established his fame as a painter. Always attracted by the omantic aspects of architecture and landscape, he gradually ound, through the just inspiration of the masters, a graciously istinctive style of his own to interpret with impressive chiaro- curo the significant beauties of buildings of character, and the es- ential poetry of his native scenery of loch and mountain. There re masterpieces among Cameron's architectural plates too fami- ar to need naming here, yet, remembering the beauty of "The Ieuse," "Ben Ledi," "Ben Lomond," "Strathearn," one ay believe that in landscape he finds his most distinctively ersonal expression on copper as on canvas.

Work of Brangwyn and Bone.—Another eminent painter who as made also a great reputation as an etcher is Frank Brangwyn, .A., though he has characteristically taken his independent ay with the method, adapting it with boldly bitten line to is pictorial designs, conceived deliberately on an unusually arge scale for wall decoration rather than for the collector's ortfolio.

Extraordinarily varied in pictorial interest, many of Brang- vyn's etchings are monumental in design and vigour of draughts- nanship, though the effect of their chiaroscuro often suffers rom over-emphasis in the printing. Muirhead Bone has long een one of the most potent personalities in British etching, hough it is with the dry-point rather than the etching-needle hat he has expressed his linear mastery in the interpretation of rchitecture as an integral factor of social life. Always he has ad a sympathetic eye for landscape, but it is with buildings in very variety of aspect and condition that his keen vision and nagnificent, searching draughtsmanship have been chiefly con- erned, and whether the structures are shown in progress, in ourse of demolition or actually functioning, the vital accent f human interest is never missing.

McBey and Other Masters.—Innately an etcher, with a viva- ious wizardry of line and originality of vision, James McBey was already a master of his expression when, in 1911, he came from Aberdeen to London and surprised and charmed the connoisseurs. With brilliant versatility, his progress has been extraordinary, and it may be traced through a succession of accepted masterpieces, such as "Ovation to the Matador," "Night in Ely Cathedral," "The Torpedoed *Sussex,*" "Dawn—Camel Patrol Setting Out," "Gale at Port Errol," and certain Venetian plates.

In England we have now, indeed, as never before, a number of authentic etchers, producing plates of genuine, sometimes even masterly quality, distinguished by original design, with a wide range of pictorial interest. In these, while fresh architectural and landscape conceptions are revealing their artistic superiority to the stale conventions of vision so long prevalent, aspects of human life and character are claiming a far more important share. This awakened consciousness among British etchers that human beings and their circumstances and activities may be even more emotionally interesting as subjects for etching than, say, cathedral doorways and old barns is one of the most notable and promising signs of the present condition of the art in the country.

No etcher is more distinctive in his treatment of the human subject than Edmund Blampied, who finds the happiest inspiration for his superb drawing in vividly suggestive line in the life and labours of the Jersey and Normandy peasants and their farm horses and cattle; E. S. Lumsden finds his in scenes of native Indian life, and some of his Benares, Rajputana and Tibet plates bear the hallmark of a master. Of etched portraiture Malcolm Osborne, A.R.A., is a masterly exponent, while few of his best landscapes and architectural etchings are not invested with human interest. Francis Dodd also is most distinguished in his portraiture, while a style all his own marks Gerald Brockhurst's strangely alluring studies of feminine personality.

In several wonderfully characteristic etchings, of chiefly portrait interest, the art of Augustus John, A.R.A., has expressed its vitality and simplicity of conception in a line of singular purity. F. L. Griggs, A.R.A., in exquisite etchings of elaborate accomplishment recalling somewhat the technical manner of Samuel Palmer, aims at an imaginative reconstruction of medieval England in its architectural aspect, as William Walcot's remarkable "Roman Compositions," with a very different technique and manner, revivify Imperial Rome. Henry Rushbury's brilliant architectural conceptions, on the other hand, depict with something of Bone's accent the actualities of places. Landscape etchers range far and wide, but the homely charm of English landscape with its bounty of trees has found no truer interpreter in latter days than W. P. Robins. Marine etching has been given a fresh impetus, with widened scope, by Arthur Briscoe's authentic visions of nautical activities on the high seas. The etchings of Walter Sickert, A.R.A., George Clausen, R.A., Oliver Hall, A.R.A. and E. J. Sullivan, although but side issues of their lives' work, are yet important enough to stand the test of time; while among the legion of contemporary British etchers are some notably sincere artists who show a "coming-on disposition" which stirs hopes.

French Etching.—The outstanding personality in modern French etching is J. L. Forain, and he is one of the world's great etchers. Whether depicting with dramatic irony scenes of Parisian life, in the law courts, the café, the studio or interpreting with pathetic beauty the religious emotion of the Lourdes pilgrimage or challenging Rembrandt himself in his great human conceptions of Christ's tragedy, with his magically expressive line and vital draughtsmanship, Forain has produced unforgettable masterpieces. Although Auguste Lepère won fame first as a wood engraver of excellence, his name in the story of French etching is of considerable importance. There was always a charming humanity about his work. With him in the orthodox school may be mentioned Steinlen, Besnard, Beaufrere, Beurdeley, Roussel, Béjot and Auguste Brouet; but the personalities of the *Indépendent* group of modernists may perhaps be more safely left to the time test.

Other European Etchers.—In the land of Rembrandt there has been one great etcher since the supreme master, and he is Marius A. J. Bauer. He has found all his inspiration in the Orient, Turkey, Egypt, Palestine, India and always a rich imagination with a magnificent sense of design has directed his pictorial vision. His genius is seen as expressively in the vitality and spontaneity of his early small plates as in such great impressive compositions as "The Holy Camel," "Benares" and "Elephants." In Anders Zorn, Sweden gave a master-etcher to the world. His line was thoroughly individual, and happily adapted to his preoccupation with light in his vivid pictorial conceptions of the human physiognomy or figure, especially in his studies of nude bathers. His "Renan" ranks with the great etched portraits of all time.

Etching. America.—In America, where interest in etching grows apace, the most distinctive personality is Frank W. Benson whose vital studies of water fowl in their native wilds, the great Canadian rivers or the Atlantic coast, in various aspects of flight chiefly, have given new motives to the art. The veteran Joseph Pennell was productive until his death, April 22 1926. Herman J. Webster has produced many accomplished plates. Donald Shaw MacLaughlan, a masterly etcher, is increasing his reputation, while among the younger men of promise are notably John W. Winkler, Louis C. Rosenberg, Arthur W. Heintzelman, Ernest D. Roth, and Roi Partridge.

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(M. C. S.*)

ETHER (*see* 1.292).—Whether space is a mere geometrical abstraction, or whether it has definite physical properties which can be investigated, is a question which in one form or another has often been debated. As to the parts which are occupied by matter, that is by a substance which appeals to the senses, there has never been any doubt; and the whole of science may be said to be an investigation of the properties of matter. But from time to time attention has been directed to the intervening portions of space from which sensible matter is absent; and this also has physical properties, of which the complete investigation has hardly begun.

These physical properties do not appeal directly to the senses, and are therefore comparatively obscure; but there is now no doubt of their existence, even among those who still prefer to use the term space. But a space endowed with physical properties is more than a geometrical abstraction, and is most conveniently thought of as a substantial reality, to which therefore some other name is appropriate. The term used is unimportant, but long ago the term ether was invented; it was adopted by Isaac Newton, and is good enough for us. The term ether therefore connotes a genuine entity filling all space, without any break or cavity anywhere, the one omnipresent physical reality, of which there is a growing tendency to perceive that everything in the material universe consists; matter itself being in all probability one of its modifications.

Many attempts have been made to state the properties of such a substance in terms of material analogies, and all these attempts have shown signs of weakness and may be said to have failed. The properties of the ether are too fundamental to be stated in terms of something else.

There have been tendencies at different times to invent ethers or effluvia with special qualities to account for specific phenomena. These attempts were long ago discarded, and are now regarded as absurd. But that space has physical properties is a definite fact of experience, provided experience is extended to include inferences and deductions and is not limited to direct sensual perception. What we perceive directly are length, breadth and height, modified here and there by a resistance or obstruction which we call matter, and combined with the element of time or duration, as exhibited and measured by the motion of matter, with speeds that can be directly apprehended.

But in addition to all that mass of common experience, the free unobstructed space is modified by the neighbourhood of matter; so that there exists everywhere a gravitational potential varying inversely with the distance from its appropriate portion of matter; the result of which is that matter tends to move from places of lower to places of higher potential, as if some force were driving the masses of matter together. Civil engineering is constantly concerned with this fact; and on this basis the whole of the older astronomy has been worked out in detail.

Atoms of Matter.—The atoms of matter are not quiescent, even when a mass appears stationary, but are in a state of rapid quivering motion; and these motions are not independent of each other, but are interrelated and connected by additional and special disturbances which they communicate to the space or medium in which they occur. And about these supplementary disturbances our sense organ, the eye, has given us a mass of indirect information. These disturbances, though generated by matter, are not conveyed or transmitted by matter. They travel at a rate depending on innate properties of space; or rather, as we feel bound to say, on the physical properties of the substantial reality which fills space; thereby telling us something definite about those properties, though in a form difficult of apprehension and one which is not fully expressible in terms of any of the familiar properties of matter.

Thus the different masses of matter, even though separated by great distances, are not isolated or independent of each other. They are connected gravitationally, and they are connected optically. The energies of the earth, of which we constantly make use, are derived from the sun, and have travelled across the intervening 92,000,000 m. of empty space at a perfectly known and definite rate, with which rate matter has nothing to do. There may be uncertainty as to what exactly it is that is travelling; but the fact that it is travelling energy is certain. All that matter does is to generate this radiant energy at one end and absorb it at the other.

Concerning the processes of generation and absorption a good deal is now known. Moreover not only is the speed of travel of the transmitted disturbance known, but also the fact that it is a periodic disturbance, expressible mathematically in exact analogy with a wave equation. Wherefore the disturbance may be spoken of without further hypothesis as ether "waves," the generic name for which is radiation, a small range of this radiation being visible light.

Radiation is generated by some cataclysm or collision or other violent and sudden disturbance in the atoms of matter. When radiation encounters matter (unless it be merely reflected or passed on) it can throw the multitude of atoms into the confused motion we call "heat," and produce other remarkable and chemical effects. Thus an ether is necessary for the purpose of transmitting what is called gravitational force between one piece of matter and another, and for the still more important and universal purpose of transmitting waves of radiation between one piece of matter and another however small and distant they be.

Electric and Magnetic Properties.—In addition to those two functions, other properties have been discovered, notably the properties called electric and magnetic. Atoms of matter are electrically constituted, and accordingly tend to attract each other with a force which is the source of chemical affinity; with the result that molecules and other aggregates are formed, of which the structure is studied in the science of chemistry. Moreover the molecules themselves attract each other by a residual affinity, giving the familiar shape of crystals and other solids, the particles of which are held together in regular packing across ultra-microscopic intervals by what is called cohesion, for which likewise the ether must be held responsible. For, as Newton forcefully said in other words, it is absurd to imagine one piece of matter acting mechanically on another at a distance, whether that distance be large or small, without some intervening mechanism. The continuous medium which fills space therefore is not only the vehicle of gravitation and light, but is also he instrument for cohesion and chemical affinity and for elec-ric and magnetic attractions and repulsions.

The intimate structure of the ether will probably be expressi-le and partially understood in terms of the phenomena of lectricity and magnetism: for electric and magnetic influences hich can be the subject of experiment are transmitted per-ectly through vacuum, that is, across space empty of matter. hey represent primarily properties of the ether, and are only nade manifest to our senses by means of matter. It was in erms of electricity and magnetism that Clerk Maxwell was ble to explain the phenomenon of light. A close study of elec-ro-magnetism, that is, of the interaction between electric and nagnetic disturbances, showed that they must combine into a ave equation, the waves being transmitted at a rate calculable rom purely electric and magnetic considerations. This velocity urned out to be the velocity of light; and so in 1865 the true heory of light was born.

Not that it is anything like complete. We know too little of he electric and magnetic properties of the ether to be able to icture them exactly. What we do know is that light is an ectro-magnetic phenomenon, and that it is entirely dependent n the properties of the ether. The ether involves or possesses roperties expressible by two fundamental constants; one of hem regulates the force of attraction between two electrified odies, and the other the force of attraction between two mag-ets. Neither constant by itself is as yet known. But the value the constants multiplied together is known: it was discovered y Clerk Maxwell, and is the reciprocal of the square of the elocity of light. In other words, the combination of the electric d magnetic properties of the ether enables it to transmit aves at a rate equal to the inverse geometric mean of its two onstants.

So far we have been dealing with things which have been nown for some time. But the subject is so fundamental and nportant that a recapitulation in other terms seemed advisa-e. It now remains to deal with the later progress which has een made in investigating the properties of this extraordinary on-material but physical substance. Perhaps "substance" hardly the right term, for, though exceedingly substantial in he sense, it makes no appeal to the senses and is therefore nlike any substance we know.

In the 9th Edition of the *Encyclopædia Britannica* an attempt as made to estimate the elasticity and the density of the ether, n the strength of a certain hypothesis made by Lord Kelvin. the 11th Edition (*see* 1.292) this estimate was repeated, and was hinted that the hypothesis might be erroneous and the alues obtained exceedingly wrong. Everything tends to confirm at conclusion. Strictly speaking the very terms elasticity and ensity, which are terms applicable to matter, may be inappli-ble to the ether without re-definition; if used they must be derstood in a formal sense. The properties of the ether are ot likely to be expressible in terms of matter; but, as we have better clue, we must proceed by analogy, and we may apolo-etically speak of the elasticity and density of the ether as presenting things which, if it were matter, would be called by ose names. What these terms really express we have not yet thomed; but if, as is now regarded as very probable, atomic atter is a structure in ether, there is every reason for saying at the ether must in some sense be far denser than any known aterial substance. The densest known matter, or matter of ghest inertia, is found in some of the stars; the barely visible mpanion of Sirius having been found, on converging grounds evidence, to be more than 1,000 times as dense as lead. The her must exceed even that startling amount; indeed there are und arguments for regarding it as a million times denser. he fundamental substance is not likely to be filmy and un-bstantial.

Recent discoveries have represented the atom of matter as mposed of minute electric charges, which fill hardly any of e space inside the atom, so that it is as porous as a solar system. he great bulk of an atom is occupied only by a few electrons; that it is by no means impenetrable to particles, which if they fly through it at sufficient speed, can escape being entangled and absorbed. Matter therefore is comparatively a gossamer structure, subsisting in a very substantial medium. An estimate of the substantiality of the medium can be made from its magnetic energies, and it comes out almost incredibly large. If it is right to express it in terms of material properties (which is doubtful) its inertia comes out as of the order of 1,000 tons per cubic millimetre. While as to the elasticity, that is still more enormous, since it is equal to the density multiplied by the square of the velocity of light.

These values are barely conceivable, being so much higher than anything of which we have sensual experience. But still they are definite and finite, and are capable of being measured and expressed; so the ether is a physical substance, with properties which can in time be ascertained; and if the estimate above given of the source of the vast energies involved is wrong (as it is sure to be inadequately and incompletely worded) subsequent investigation can correct it. Meanwhile we may assume that there is some truth underlying these modes of expression, a truth which we cannot at present formulate any better.

The constants embodying the physical properties of the ether though so huge are not infinite, and it seems to have certain very simple and perfect properties. It is perfectly transparent, it dissipates no energy; otherwise the stars and the spiral nebulae could not be seen at their gigantic distances across space. There is no friction between matter and ether, otherwise a portion of matter isolated from the rest would cool down, and the planets would not continue forever in their courses unperturbed. The ether has nothing of what we call in matter viscosity or fluid friction. There is no real heat in the ether, nor any sound; nothing but one simple type of propagation of effects by waves goes on in free space, and that with a definite unchangeable velocity which is known as the velocity of light, the one fundamental and so to say absolute velocity in the universe.

The Velocity of Light.—The question arises as to what that velocity can be due to. The most probable surmise or guess at present is that the ether is a perfectly incompressible continuous fluid, in a state of fine-grained vortex motion, circulating with that same enormous speed. For it has been partly, though as yet incompletely, shown that such a vortex fluid would transmit waves of the same general nature as light waves—*i.e.*, periodic disturbances across the line of propagation—and would transmit them at a rate of the same order of magnitude as the vortex or circulation speed. There remains indeed a question of stability to be safeguarded, but in these days of quanta (*see* QUANTUM THEORY) stability considerations are apt to be deferred. Thus it appears possible that some day an extended hydrodynamics of a perfect fluid will explain all the physical properties of the material universe.[1]

This motion of a structure due to vortex circulation in a perfect fluid may be regarded by some as too material an idea, and it may have to be discarded; but it is the nearest approach that can be suggested to a pictorial image of the etheric constitution. Certainly no *structureless* fluid could transmit actual radiation. And certainly the ether is continuous and without viscosity or any dissipation of energy, and so in many respects is like an ideal fluid. More than that we cannot say, except speculatively, about its constitution.

Meanwhile we must assume that the ether has a substantiality and a wave-conveying structure beyond our present clear imaginings, with parts of it modified in an unknown way into electrons and protons; that of these the atoms of matter are built up; and that the whole of material activity consists in the interactions of these minute electric charges, connected as they are by their lines of force and by radiation.

These electric charges, and the aggregates which they have built up are subject to what we experience or recognise as locomotion. The ether itself is stationary. Whether it is really infinite in extent or whether though boundless, like the surface of a sphere, it is nevertheless finite, are questions which we cannot at present answer. There is no doubt that it extends beyond the farthest visible stellar object, and for all practical purposes is infinite. There is very little doubt that matter is not an alien substance, but is essentially composed of it, being built up of the electrons and protons whose constitution has not yet been ascertained, but which must somehow be constituted of ether, perhaps in some sense analogous to that in which a knot in a piece of string is constructed of string, or a vortex in air is composed of air, or the fibre of a muscle is still essentially flesh.

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[1] Lord Kelvin, "The Vortex Theory of Ether," *Phil. Mag.* (1887) and *Math. and Phys. Papers*, vol. iv. and passim. G. F. FitzGerald, *Proc. Roy. Dub. Soc.* (1899), or *Collected Papers*, pp. 154, 238, 472.

Einstein's Theory.—The theory of Relativity (*see* RELATIVITY) has led some people—not many of the leaders of thought—to doubt if the ether can really exist. It may be useful therefore at the present time in this supplementary article to explain in what way the equations connected with that theory are to be understood physically. Newton expressed the laws binding the planets and suns together in terms of a hypothetical force acting between them, the same kind of force as we experience when a weight is supported above the earth; which force may therefore be taken as a fact of experience. But though the force is a fact, it is not explained: any expression in terms of action at a distance is necessarily incomplete.

Einstein was led by considerations of relativity to formulate a law of gravitation, not in terms of force or of action at a distance, but in terms of something in space, that is, in the ether, which results in a tendency of bodies to approach each other. It might be called a warp in space, or it might be called by other names: the names do not matter. The thing that has to be expressed is that the presence of matter modifies its whole neighbourhood, causing a gravitational potential, as has been previously said. And, until we know more about its intimate nature, the action of this modification is best expressed in terms of a differential equation which seeks to formulate abstractly, without physical hypothesis, the essence of what is really happening. None of the arguments which necessitate the existence of a medium are affected, but no name for it need be used, nor need the idea of a medium be introduced, for mathematical purposes. Mathematicians are quite able to work with abstract equations about quantities without physical implications or conceptions, as long as they remain purely mathematicians. They can reduce even geometry to arithmetic.

In a complete expression for the enlarged geometric interval between two points, the element of time must be introduced as well as the element of space, because they may be moving points. In other words geometry must be enlarged into kinematics, in order to express activities. The interval or line element between two neighbouring points may be expressed in polar co-ordinates π,θ,φ thus: $ds^2 = -dr^2 - (rd\theta)^2 - (r\sin\theta d\varphi)^2 + C^2dt^2$, a mode of expression devised by Minkowski, an enthusiast for this kind of four-dimensional treatment, where the fundamental etheric velocity c is introduced as a coefficient able to turn time into imaginary space, $icdt$. The emphasis on c, as an absolute geometric constant, is perhaps the most remarkable part of the Einstein-Minkowski conception, as a preparation for the building erected upon it.

But Einstein took a further step, introducing the gravitation potential as something which would modify the motions of matter, and introduced it not only into the element of time (as Newton might have done if he had used that notation) but into the element of radial distance also; so that if the points are in the field of a mass of matter m the Minkowski equation is:—

$$ds^2 = -\nu^{-1}(dr)^2 - (rd\theta)^2 - (r\sin\theta d\varphi)^2 + \nu c^2dt^2$$

where $\nu = 1 - 2P/c^2$, P being the gravitation potential at the place considered; which, if caused by a mass at a distance r, is $P = {}^{km}/_{r}$, with k as the Newtonian gravitation constant.

Here the coefficient ν occurs twice. If it occurred in the t term only it would be a mode of stating Newton's theory of astronomy, in differential instead of integral fashion; but this ν occurs in the r term also, as a result of the isotropy of the fourfold medium contemplated in this gravitational theory. This equation when elaborated gives, strangely enough, the outstanding progression of the perihelion of Mercury, and it also gives the double deflection for a ray of light passing near the Sun (doubled because the co-efficient ν occurs twice), which has since been perhaps confirmed quantitatively by observation. It likewise gives the shift of the spectral lines emanating from an exceedingly massive body, which has now been confirmed beyond the reach of reasonable controversy by observations on light coming from the companion of Sirius, which Eddington has astonishingly proved to be by far the most compact and densest material body at present known to science.

The beauty of these results is overwhelming; but the idea that any mathematical scheme is more than a powerful method of exploration, and that a universe can be thus constructed in which physical explanations can be dispensed with, involves too simple and anthropomorphic a view of nature. The things calculated, and the things observed, cannot exhaust reality; an explanation is bound to be sought, and ultimately attained, in terms of the partially recognised but largely unexplored properties of the entity which fills space.[1]

Locomotion of Matter.—The locomotion of matter is perhaps the commonest fact of experience, and it seems strange that it should be in need of explanation. But since the atom of matter is composed of electric charges, the locomotion of those charges has to be considered more in detail. An electric charge in motion constitutes an electric current, and the path of every electric current is surrounded by rings of magnetic force. This magnetic field confers inertia or momentum upon the moving charge; so that mechanical impulse is necessary to start it moving; and also to stop the motion. If not stopped it will continue to move uniformly in a straight line until it encounters some deflecting or retarding agency.

But though locomotion can thus be stated and worked out electromagnetically, that cannot be regarded as an ultimate explanation of so familiar and apparently simple a thing. Moving matter is known to have kinetic energy; and the familiar expression $\frac{1}{2}mv^2$ is the type of its measure. But when we come to analyse this expression there are difficulties about it which the Theory of Relativity has brought out and emphasised. For when we try to specify the velocity of a body, in order to calculate its energy, we find it difficult to say what that velocity really is: we can only specify it with reference to something else, commonly with reference to the earth. But the earth itself is moving. Hence $\frac{1}{2}mv^2$ does not give the absolute energy, but only the energy relative to the earth or other frame of reference, as Newton implicitly recognised. What the velocity of a body is in space we have no means at present of ascertaining, having no universal standard of reference; and accordingly the usual expressions, though practically useful, are by no means ultimately satisfactory. Nor can a statement in terms of electromagnetism be considered as ultimate.

The fact is that locomotion does not seem to be a property of the ether, which appears to be affected by one speed and one speed only, namely, what we suppose to be the speed of its internal circulation and are familiar with as the velocity of light. How then can a particle of ether, however modified, move from one place to another? The analogy of a loose knot slipping along a string may be helpful.

An electron even at rest has intrinsic energy, its electrostatic energy of constitution, which can be expressed in various ways, and which, when expressed in terms of mass and speed, is m_0c^2, m_0 being its inertia at rest. Its static energy is thus expressible as equivalent to that of a particle of certain mass m_0 or $2m_0$, moving with the speed c—the speed of light. To assist ideas, it might be thought of as a spinning motion; at any rate not locomotion.

When the particle is moved, the natural idea would be that this velocity c is increased, or that some addition is made to it. But according to the doctrine of relativity that is impossible: the velocity c is constant. The thing that changes is not c, but m. And the energy of a moving body is m_1c^2, where m_1 is greater than m_0. And as the speed of motion increases, m_1 increases too; until at high speeds it is very great, and, as the speed of light is approached, tends to become infinite. So that when an identified portion of ether is in locomotion, it is not the speed that is changed, but the amount of modified ether associated with that identified moving portion. And what we observe as the kinetic energy of the particle is $(m_1 - m_0)c^2$ or c^2dm. This is what we have hitherto recognised and called $\frac{1}{2}mv^2$, an expression which is relative, and which is not exactly applicable to great velocities, such as we encounter in vacuum tubes and in radioactivity generally.

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[1] To avoid any appearance of dogmatism on difficult subjects, it may be well to say that some eminent mathematicians are still of opinion that the Einstein formulation is not quite satisfactory. For instance, Larmor, *Phil. Mag.* (1923) claims that it only gives half values, and expects that some slight modification of Newtonian and Maxwellian theory will be found able to cover the above slight experimental deviations from what was previously known. The rest of this article must be treated as a tentative attempt to indicate ideas that cannot be thoroughly expressed at the present date except by symbols.

Thus when we try to look at locomotion absolutely, we have o admit that varying speed means varying amounts of subtance in the identified portion of matter we are attending to. f the earth were to move quicker it would be more massive: nd this increase of mass would appeal to us as locomotion. It s as if the normal constitutional circulation trended or drifted n one direction, so as to constitute perceptible or available nergy.

The same idea may be expressed magnetically by calling ttention to the magnetic field surrounding a moving charge. t high speeds the magnetic field is strong; more substance is nvolved in it: and the additional spin (if that is the right term, or magnetism is usually thought of as a kind of spin) accounts or the additional energy. Why it should appeal to us as loconotion, and what the real meaning of locomotion is, are not so lear. This is only an illustration of the difficulty we experience vhen we come to probe the simplest thing to its depths. We ave grown accustomed to certain aspects of the universe given s by our senses, but we do not fundamentally understand them. nd when we come to probe the meaning of things deeply enough, ve find ourselves up against difficulties of conception, toward he elucidation of which our senses give hardly any aid. What we re used to is mechanical movements; but the effort to explain hings ultimately in that way is not easy, and may turn out o be not possible.

Meanwhile we take refuge in expressing these things in terms f electricity and magnetism; which is a step toward an explanaion, and is useful in bringing out the difficulties which underlie very ultimate and absolute statement. The attempted absoute expression for static electric energy, mc^2 with the inertia m s the only variable, is a legitimate mathematical expression f electric facts. But the real meaning of c is, at present, a ypothesis: and what the real meaning of m is, must be regarded s still less known. Both these factors must have reference o the ether, and until we know more about the constitution of he ether we must be content to remain in a condition of proisional ignorance. We are led to regard the material universe s a substantial reality in various stages or varieties of internal ctivity. We may try to think of this activity as akin to a finerained vortex circulation in a continuous, incompressible, perect fluid: beyond that we cannot at present go; nor are we lear about the exact meaning of these terms when applied to a nedium of unknown constitution. When we understand the eal and ultimate nature of electricity and magnetism we may ope to proceed further. Till then we must be content with roximate explanations. (O. L.)

ETHICS (*see* 9.808).—Since 1911 little new or striking work has ppeared on the subject of moral philosophy. The more original nd prolific writers have devoted themselves mainly to metahysics, or especially to the theory of knowledge. This was peraps a natural result of the philosophical situation; but, while the onsequent progress in these studies has been valuable, the loss as also been serious. The temporary neglect of ethics, the branch nost attractive to the average educated reader, has tended to essen popular interest in philosophy and to make the style as vell as the subject of philosophical writers more technical. ttention to the facts of the moral consciousness has value even or the special problems of epistemology.

Perhaps in revenge for the neglect of genuine philosophical eflection on morality, a large part of the work professedly upon he subject has not been strictly philosophical at all, but either lidactic or anthropological. There has certainly been no decrease n the output of books aiming at edification by attempting to leduce particular practices, political, social or religious, from rbitrarily selected principles. In other words, during this peiod, between the stools of metaphysic and didactic casuistry, noral philosophy has fallen to the ground. In English H. Rashlall's work[1] still holds the field as the most adequate survey of he whole ground of ethical controversies, though the modified ationalist and altruistic utilitarianism of his own view would ertainly not be universally accepted.

English Idealism.—The traditional doctrine of English idealism, not yet affected by contemporary Italian idealists or by the revival of realism, is well represented by J. H. Muirhead.[2] The general character and difficulties of this view may be illustrated by a quotation: " There is no such thing as determination by pure reason. Apparent cases, as in the preference of duty to inclination, are cases of determination by a deeper inclination." Here the word " deeper " where, after " preference " we might have expected " stronger," seems ambiguous. " The humblest plant is free in a sense denied to the heavens. *A fortiori*, all this is true of beings who not only live but can make their life an object—who to adjustment to environment and to determination from within can add determination by the idea of self." A man is more free according as he " lives more habitually and consistently in his deepest purposes." He who sees what is reasonable must do it. " The essence of moral judgment is distinction of value between different forms of momentary and individual satisfaction."

A similar view is elaborated in greater detail and with a full discussion of objections by G. C. Field.[3] For him also the only possible motive to action is desire; and on this point he contrasts Aristotle favourably with Kant. A wise man's desires are directed towards an end which would fully and permanently satisfy him, and the only such end is love as embodied in Kant's *Kingdom of Ends.* Right action then is action which tends to produce such a state, or expresses such a state, or removes hindrances to it. It is hard to see that such theories really give any account of obligation, and particularly any real account of the obligation to justice.

The Realists.—The moral theory of a realist, S. Alexander,[4] is not so different from that of idealists as might have been expected. He describes goodness as being like truth and beauty, a " tertiary quality " or value which exists " in a physical fact " only " for a contemplating mind." " Good is the satisfaction of persons." But goodness is attributed to acts of will only when they possess " coherence," which is not their " quality " but a " property " belonging to them just " so far as the valuing subject appreciates it." " The reality which we produce is good in so far as it satisfies coherently the persons who bring it about." " Morality arises out of our human affections and desires which we seek to satisfy. Some of them are self-regarding, others are natural affections for others. . . . We sympathise or dissympathise . . . with certain impulses or tendencies of others. . . . The good wills are those which cohere with each other." " The good act is approved as pleasing the collective wills." " In so far as the individual is good he represents the collective wills of the society. His approbations whether of himself or others coincide with theirs. . . . So far as he is good he embodies the common judgment . . . he is the standardised man." " Self and others are claims which are antecedent to morality and are reconciled by the moral judgment itself. . . . Much suffering and heartburning may be endured in the social adjustment of claims and exaltation of what is approved of them into rights, till the individual has learned the difficult lesson of finding more pleasure in following the right than he loses from the sacrifice of his desires."

Idealism v. Realism.—The expected issue between idealistic and realistic ethics is, however, clearly raised by G. E. Moore[5] where he asks " Whether when we judge (either truly or falsely) that an action is a duty or a state of things good, *all* that we are thinking about the action or the state of things in question is simply and solely that (1) we ourselves or (2) others have or tend to have a certain feeling towards it when we contemplate or think of it." This question he inclines to answer negatively, on the grounds that (1) where two people differ in a moral judgment we cannot think both are right, and (2) in making a moral judgment we do not mean to assert that others agree to it.

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[1] *The Theory of Good and Evil* (Oxford, 1907).

[2] Author of *The Elements of Ethics* (1910), in his article " Ethics " in the *Encyclopaedia of Religion and Ethics*, vol. 5 (London, 1912).

[3] *Moral Theory* (1921).

[4] *Space, Time, and Deity* (1920).

[5] The last essay of his *Philosophical Studies* (1922).

Elsewhere the same writer,[1] after expanding this view, argues that what makes an action right is its consequences. He does not make clear whether he would consider there would be a difference of consequences if by my act an exactly similar satisfaction could be produced either in a stranger or in one to whom I was under some obligation. To the question of freedom he suggests the answer that we are free to do an act if we could do it if we willed it; but he is not decided whether it is ever true that we can will or not will an act.

H. A. Prichard[2] points out that nearly all moral philosophers from Plato downwards have taken for their function to prove that we ought to do what we take to be our duties (or what they take to be our duties) as against a reflective scepticism arising from our disinclination to do it. They have tried to demonstrate the obligation either of current morality or of some version of it amended in their own sense. The only ways of doing this were either (1) to argue with the hedonists of all types that such alleged duties were really our interest—which after all does not prove them our duty; or (2) to argue with Sidgwick and Rashdall that the alleged duties were really duties because they led to some end rationally judged to be good; but this cannot always be shown of an act of secret (and therefore not exemplary) justice; or (3) to base the obligation to the alleged duties on the goodness of the act itself. But in this last attempt "good" either means (*a*) right, and then we are only told that an act is right because it is right; or (*b*) moral, *i.e.*, done from a sense of duty, and then we are told that acts are right which are done because they are thought right; or (*c*) virtuous, *i.e.*, done from a good desire, and then we are told that acts are right if they spring from right desires; but to have a desire is not in our power. It would appear that there can be no such thing as moral philosophy if that means a proof of our immediate moral apprehensions. If these are subsequently questioned (on any ground other than ignorance of matters of fact) the only remedy is to replace oneself imaginatively in the situation and perform the moral judgment again. The only proper sphere of moral philosophy is to justify the immediacy of our moral judgments and so to defend them against the scepticism which may arise from the failure to find demonstration.

Influence of Croce.—Perhaps the strongest idealistic influence of an original character has been that of Benedetto Croce.[3] Unlike Rashdall, Croce would deny that the rightness of an act depends upon its being directed to an end rationally judged to be good. For him a good is merely the object of a desire. All rules of conduct are merely empirical generalisations from past moral acts. Every act has its utilitarian or, as he calls it, "economic" side; in order to be willed at all its doing must have satisfied the doer. Moral acts have this economic side; they satisfy the agent; but they, and they only, have also another side which he describes as "universal." They satisfy not merely the individual nature of the doer, but that universal spirit in which as an individual spirit he shares. To the question of freedom, whether it is in our power to choose to satisfy either the empirical individual self only or the universal spirit, Croce's answer is obscure. He denies determinism as being "the introduction of the methods of physical science into philosophy," but he also denies what he calls "arbitrary choice." On the whole, his view of freedom would appear similar to that of H. Bergson, whom he quotes with approval.[4] The *Pratica*, though brilliant in criticism, is too cursory and contemptuous in its treatment of difficult problems to be satisfactory. For instance, it is not clear whether the acts which are said to satisfy the universal spirit are right acts (perhaps not known to be so by the individual) or moral acts—*i.e.*, acts done because thought (perhaps falsely) to be right by the individual.

In spite of this, and of their very different starting-points, there are some remarkable points of agreement between Croce and Prichard, which, just because of that difference, may well be symptoms of the general trend of contemporary thought. They agree (1) that, as against Kant, we cannot think an act right unless we think it will originate some satisfaction; but yet (2) that, as against Sidgwick and Rashdall, the rightness of one of alternative acts cannot be determined by the greater satisfaction or greater good which it will originate; and indeed (3) that rightness cannot be determined by reference to any concept other than rightness itself. Further, consequently, they agree (4) that "the formula of means and end is irrelevant in morality" and (5) that what is called "proving the rightness of an act" is either (*a*) giving fuller information about the situation, or (*b*) giving fuller information about the act itself, *i.e.*, what we are originating. Croce's "universal act" or satisfaction of the universal self would perhaps be described by Prichard as originating the satisfactions which we ought to originate or which we think we ought to originate. (The ambiguity is Croce's.)

Pragmatist Theories.—Theories of morality in a pragmatist sense have been mainly developed in America by J. Dewey and others.[5] Much that is here insisted on would be accepted by moralists of other schools: that right conduct depends in part on a scientific knowledge of the results of action; that all action has social effects; that there is no one ascertainable "end of man" to which all right actions are directed as means; that rules of morality are only generalisations from the judgments passed on particular acts in definite situations. But some of the conclusions would be regarded as paradoxical by moralists of any school outside hedonism. For instance, along with other "ends" dismissed as fictitious, Dewey classes the principle of "obedience to rational consciousness of duty." "A remote goal of perfection, ideals that are contrary in a wholesale way to what is actual, a free will of arbitrary choice—all of these conceptions band themselves together with that of a non-empirical authority of Right and a non-empirical conscience which acknowledges it. . . . Why indeed acknowledge the authority of Right? That many persons do not acknowledge it in fact, in action, and that all persons ignore it at times, is assumed by the argument. Just what is the significance of an alleged recognition of a supremacy which is continually denied in fact? How much would be lost if it were dropped out and we were left face to face with actual facts? . . . We live in a world where other persons live too. Our acts affect them. They perceive these effects and react upon us in consequence. . . . They approve and condemn, not in abstract theory but in what they do to us. The answer to the question, 'Why not put your hand in the fire?' is the answer of fact. If you do, your hand will be burnt. The answer to the question, 'Why acknowledge the right?' is of the same sort . . . it signifies the totality of social pressures exercised upon us." The conclusion appears to be that the only meaning for "thinking an act right" is the doing it, from fear of punishment.

The most interesting endeavour to demonstrate the rightness of some particular kind of conduct from philosophical principles is made by V. Solovyof.[6] It is the most interesting both because the emphasis on asceticism is somewhat strange to the Western conscience and because of the psychological views involved. The basis of morality is said to be self-regarding, not social; it consists in the sense of shame, primarily sexual shame, peculiar to humanity, which is implicitly a sense of the duty to free ourselves from the dominion of "the body" and of its instinctive demands for racial or individual preservation. Closely connected with the shame of sex (or of subjection to racial preservation) is shame of fear (or of subjection to selfish preservation). Shame is developed by reason into conscience, which gradually extends its sphere of criticism from the self-regarding duties of chastity and courage (subjection of bodily impulses) to the social duty of pity for those similar but inferior to us and the religious duty of reverence for what is superior to us. These two duties are developed, unlike shame, from impulses natural to animals as well as men; since they begin in parental and filial affection. From these three impulses the writer develops an elaborate system of personal, political and religious ethics.

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[1] *Ethics* (1912).

[2] *Mind* (Jan. 1912) "Does Moral Philosophy Rest on a Mistake?"

[3] *Filosofia della Pratica*, written in 1908 and translated into English in 1913.

[4] *Les Données Immédiates de la Conscience* (1889).

[5] *Creative Intelligence* (1917) and by J. Dewey in *Reconstruction in Philosophy* (1921) and *Human Nature and Conduct* (1922).

[6] *The Justification of the Good*, translated from the Russian in 1918.

BIBLIOGRAPHY.—The following are among the more interesting elevant books of the period in addition to those cited above: I. Dealing mainly with Ethics: J. Ward, *The Realm of Ends* (Camridge, 1911); R. Eucken, *Present Day Ethics*, translated by M. on Legdewitz (1913); E. B, Holt, *The Freudian Wish and Its Place n Ethics* (1915); W. G. Everett, *Moral Values* (1920); F. Adler, *An Ethical Philosophy of Life* (1918); B. Bosanquet, *Some Suggestions in Ethics* (1918); W. E. Hocking, *Human Nature and Its Remaking* 1918); W. R. Sorley, *Moral Values and the Idea of God* (Camridge, 1918); A. K. Rogers, *The Theory of Ethics* (1922); W. McDougall, *Ethics and Some Modern World Problems* (1924). II. Dealing with Ethics as incidental to a philosophic system: B. Bosanquet, *The Principle of Individuality and Value* (1912), *The Value and Destiny of the Individual* (1913). (E. F. C.)

ETHYL CHLORIDE (C_2H_5Cl) (*see* 9.851), prepared from ydrochloric acid and ethyl alcohol, is a gas at room temperature, ut is stored and sold under pressure in glass bottles fitted with rigger-controlled spray nozzles, as a colourless, mobile liquid ith a characteristic ethereal smell and sweet, burning taste, hich boils at 12·5°C. The vapour burns with a green flame. Chloryl and Kelene are trade names. Anestile is a mixture of thyl and methyl chlorides.

Uses.—It is used (*a*) as a local anaesthetic for small incisions, ooth extractions and needle punctures, by spraying it on the urface of the skin or mucous membrane in a fine stream. Its apid evaporation causes local freezing (−35°C. can be obtained). This method is unsatisfactory for many reasons. Only a very mall area can be frozen at one time, it is difficult to puncture r cut the hard-frozen tissues, the freezing is very transitory, the hawing afterward is exceedingly painful, the frozen zone is so uperficial that the smallest incision penetrates beyond it and is lt by the patient, and lastly it is not good treatment to produce cute frost-bite in living tissues.

(*b*) As a general anaesthetic, it is usually given in doses of –5 cubic centimetres in a closed inhaler. An ordinary ether inhaler ill do perfectly well. As regards safety it is probably intermediate between nitrous oxide and ether. At one dental hospital has been given nearly 100,000 times without mishap. Short dministrations produce an anaesthesia similar in type to that nitrous oxide with an equally rapid loss of consciousness, a uick recovery and slight after-effects. Like gas, it can be afely given in the sitting position. It is more convenient than as, as the apparatus required is less bulky; it is more powerful nd more reliable, gives a longer period of anaesthesia for dental ork (90 seconds instead of 30), and does not cause cyanosis. Muscular relaxation cannot be guaranteed, especially in adult ales, but it is as a rule more satisfactory than with gas.

Longer administrations approximate more to the ether type of naesthesia, ethyl chloride being, like chloroform and ether and nlike gas, a lipoid solvent. For cases lasting more than a few inutes ether is preferable and cheaper. Ethyl chloride may also e used to precede ether anaesthesia by the open or closed methds and is more humane as quicker, less irritating with a less uneasant smell.

Clinically its effect on the circulatory and respiratory systems slightly stimulating, causing flushing of the face, acceleration the pulse rate by 10–20 beats per minute and a rise in systolic ood pressure of 10 to 20 millimetres, together with deeper and ore rapid breathing. (*See* ANAESTHETICS.) (W. S. S.)

ETHYLENE (*see* 9.851), when inhaled is a general anaesthetic nd was first used as such by Luckhardt and Carter in 1923. is still in the experimental stage, however. Like nitrous oxide is not a lipoid solvent. It is given with oxygen, of which 7–12% needed. Caution is necessary because of the explosive nature the mixture. Its efficiency is between that of gas oxygen and her. Ether may have to be used with it to deepen the anaeshesia. (*See* ANAESTHETICS.) (W. S. S.)

EUGENICS (*see* 9.885), a name for any plan to improve the born qualities of the human races. The idea that such imrovement might be made by deliberate selection of parents in ccordance with the practices of animal husbandry, has doubtss often occurred to man from the earliest times to the present. he earliest extant expression of it in literature is probably und in Plato's *Republic*, written about 375 B.C. Plato recommended that, for the improvement of the quality of the citizens, matings should be arranged by the magistrates between the best of both sexes.

Toward the close of the 19th century Sir Frances Galton, from studies described in *Natural Inheritance* (1889) and *Hereditary Genius* (1869) concluded that improvement of the human stock was not only conceivable but practicable. At his death he arranged for the continued study of the subject at the University of London, where Karl Pearson has since directed the work of the Galton Laboratory of National Eugenics. An important series of its publications deals with human heredity. (*See* HEREDITY.) Interest in that subject was further stimulated in 1900 by the rediscovery of Mendel's laws (*see* MENDELISM), now regarded as the fundamental laws of heredity in animals and plants as well as in man, though the laws were unknown to Galton himself, who formulated a different generalised law of heredity (Galton's law), a less accurate generalisation than Mendel's, as is now recognised.

Eugenics Record Office.—In the United States, the Eugenics Record Office was founded in 1910 by Dr. C. B. Davenport, at Cold Spring Harbour, N. Y., for collecting for study all data obtainable about family histories, with special reference to the inheritance of traits physical or mental. The public is invited to deposit at the Eugenics Record Office family records, whose privacy is guaranteed. By co-operation with the authorities, family histories are also obtained relating to the patients or inmates of institutions for the insane, epileptic and feeble-minded. Based on the study of such data, bulletins are from time to time published concerning the inheritance of traits such as insanity, epilepsy, feeble-mindedness, hair-colour, skin-colour, stature, body-build and hair-form.

Since the rediscovery of Mendelism occasioned the founding of the Eugenics Record Office, it is natural that results coming from this institution should have been formulated as far as possible in terms of Mendel's laws. Thus in certain of its early bulletins feeble-mindedness, insanity and epilepsy are described as recessive characters, while Huntington's chorea, fragility of bones associated with blue choroid of the eye, and violent temper are described as dominant characters. Possibly some of these and other results published by the Eugenics Record Office have been put into too simple and too rigid categories, and a strictly Mendelian statement of results has been adopted oftener than is justified by present knowledge of genetics.

Karl Pearson and his associates of the Galton Laboratory in London have gone to an opposite extreme in ignoring Mendelism in the interpretation of heredity. Both schools agree that insanity, for example, occurs oftener in some families than in others, and that the differences are too great to be due to chance. A predisposition to insanity must accordingly be an inherited character, but its manifestations in successive generations are too varied and erratic to be described as a case of simple Mendelian inheritance.

Developments in Various Countries.—The study of human heredity is being actively pursued at present in most countries where the genetics of other animals and of plants are being investigated. Britain, Germany, Sweden, Holland and the United States have journals, devoted to a greater or less extent, to publishing the results of studies of human heredity. A considerable portion of the published material is probably of small value, since it is uncontrolled by experiment and is based largely on uncritical data; nevertheless substantial progress is being made in our knowledge of human heredity. There is an inherited basis for differences between individuals, families, and races, as regards (*a*) colour of skin, hair and eyes; (*b*) stature; and (*c*) head-form; what a geneticist would call multiple factor differences, dependent upon more than one inheritance unit, as the results of racial crosses show. Cases of inheritance due to one-factor differences (simple Mendelian cases) are limited chiefly to physical abnormalities or peculiarities such as albinism, night-blindness, brachydactyly, syndactyly, and other digital malformations, colour-blindness, spontaneous bleeding or haemophilia, and alkaptonuria. Few of these are seriously harmful characters or recur with alarming frequency in a normally exogamous population.

Mental Traits.—It is generally believed that differences in intelligence are inherited, that the children of highly intelligent parents are more intelligent than the children of low-grade parents. But as the intellectual capacity of the child is determined only in part by inheritance and in part by the environment, it is difficult to devise intelligence tests (*q.v.*) which will discriminate between effects of the two agencies. Also not all the children of highly intelligent parents are of the same character. Nor are all children of exceptional intelligence born of highly intelligent parents.

Clearly then, neither high intelligence nor mediocre intelligence breeds true. While this will be generally admitted, some hold that the lowest grades of human intelligence do breed true, in the sense that feeble-minded parents have only feeble-minded offspring. Such in general is the finding of H. H. Goddard, who made a study of the families of pupils in the Vineland, N. J., Training School for the Feeble-Minded. To this it has been objected that the class feeble-minded cannot be clearly defined, since there are all grades of human intelligence between the lowest and the highest. Individuals of the very lowest grade (idiots) do not become parents, and it is only the "feeble-minded" of a fair amount of intelligence (comparable with that of anthropoid apes) who do leave offspring. Whether, when both parents are feeble-minded, the children are all as low in intelligence as their parents cannot be stated with any certainty until more reliable tests of intelligence have been devised than now exist.

Effect of Infection.—Another element of uncertainty is the part played by infection, especially with syphilis, in the production of feeble-mindedness and other nervous disorders. Admittedly it is considerable; its exact extent is unknown. A true-breeding feeble-minded strain may in some cases be only a fully infected syphilitic strain. A great majority of the feeble-minded are produced by matings in which one or both parents are not feeble minded, and a certain percentage of these cases are admittedly non-genetic, being due to accidents or infections occurring before, at, or subsequent to birth. But when more than one case occurs in the same family history, a genetic agency is at once suspected, though perhaps quite unjustly. Since, in the case of the higher grades and of average grades of intelligence, it is evident that differences, when genetic, are due to multiple factors, it is doubtful whether a low grade of intelligence is in general inherited as a unit-character either dominant or recessive, though in a particular isolated and inbred family group, this may well be true.

Heredity and Eugenics.—Human heredity forms the only rational basis of a programme of eugenics. Such programmes have been outlined and are being advocated by national societies in England, Germany, France, Italy, Sweden, Norway, the United States and several other countries. Two international congresses on eugenics have been held, the first in London, the second in New York in 1921. A permanent international committee on eugenics has been formed. A state-supported eugenic institute has been established in Sweden.

The Foundations.—The philosophy or logical foundation on which eugenic programmes explicitly or implicitly rest may be stated as follows:—

1. The present stratification of society is in part due to differences in ability between its constituent strata. The abler individuals rise to positions of influence and authority, enter the learned or professional classes, or become captains of industry and acquire wealth. The less able work with their hands rather than their heads, since the latter are inferior, and must content themselves with lesser economic rewards.

2. Each grade of ability has a *tendency* to breed true, though there are numerous exceptions. Thus the average ability of children produced by the professional classes and wealthier industrial and business classes is greater than the average for children of the poor and labouring classes.

3. In all civilised countries at the present time the professional and wealthy classes are producing fewer children per family than the poor and the labouring classes (*see* Birth Control). (This differential fertility of the classes appears to be a modern development; *e.g.*, in Britain it only originated shortly before 1850.)

4. As a consequence of 2 and 3 the average grade of intelligence o the populations in all civilised countries is at present declining, an this decline will continue until the differential character of the birth rate is abolished or reversed.

5. In addition, it has been maintained that physical and menta defects are increasing in all classes.

Measures Proposed.—The practical measures proposed by eugenists to correct the supposed declining quality of the population are of two sorts.

1. Measures designed to discourage, decrease or prevent reproduction by the inferior elements of the population—negative eugenics.

2. Measures designed to encourage or increase reproduction by the superior elements of the population—positive eugenics.

Negative eugenic measures include (1) the dissemination of information (popular education) concerning the racial consequences of unfit matings, which will result in voluntary abstention from marriage, or birth control, on the part of those likely to transmit bad physical or mental traits; (2) legal prohibition of marriage to persons unfit to be parents—for example, members of families with a hereditary taint of insanity, epilepsy, feeble-mindedness or the like; (3) segregation during the reproductive period, or sterilisation of mentally defective or otherwise seriously unfit persons. Measures of the first-mentioned sort are the aim in part of publications such as *The Eugenics Review* (London), *Eugenical News* (Cold Spring Harbor, N.Y.) and of the published proceedings of congresses and conferences on eugenics. Laws which fall into classes (2) and (3) have been enacted in certain of the United States, but most of these have been rendered ineffective by court decisions. In support of positive eugenics, proposals have been made to offer economic inducements to fit parents to have large families, but the practical difficulty of determining who are "fit" or of putting into effect class legislation for their benefit has hitherto prevented such suggestions from taking concrete form.

Criticisms.—Those who decry or look with disfavour on the modern eugenic movement suggest that the philosophy of eugenics is faulty, in that (*a*) the basic assumption that social status is in any degree due to inborn qualities of the individual, not to accidents of environment or opportunity, requires proof; (*b*) that the supposed greater average ability of the children of the professional and wealthier industrial classes is another unproved assumption, and that their superior attainments, if real, may be due to superior advantages made possible by greater economic resources or by the smaller number of children in the family; that (*c*) unless both assumptions (*a*) and (*b*) are established, there is no reason to think that the differential birth-rate is dysgenic; and (*d*) that such negative eugenic measures as refusing a marriage license to a person on the basis of his pedigree, or subjecting him to bodily mutilation against his will, are unwarranted interferences with his liberty and personal rights; that (*e*) the eugenists are wrong not only in the basic assumptions of their philosophy but also in their general conclusion that the human race is declining in ability, since at no time within the historic period has mankind been progressing faster than within the past century in physical, mental and moral achievements.

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EUGÉNIE (1826–1920), sometime Empress of the French (*see* 9.885), died in Madrid July 11 1920.

EUPEN AND MALMEDY (*see* 9.892), two districts acquired by Belgium from Rhenish Prussia in 1919, with the small district of Moresnet. The latter, by an oversight in the Treaty of Vienna in 1815, was not assigned to either Belgium or Prussia, and part of it therefore remained neutral territory between the two countries. It comprised little over 3,000 inhabitants (census of 1910).

Fupen and Malmédy comprise 60,924 persons, of whom less han one-sixth are Walloon and French-speaking, and five-sixths ,erman. It was contended, however, at the Peace Conference hat these inhabitants had been systematically Prussianised nce 1815. It seems true that the majority spoke French before hat date, and were, in origin, Walloons. The Peace Conference 1919 therefore declined to sanction a plebiscite, but the in- abitants were permitted to express their opinions in registers or six months after the ratification of the treaty Jan. 10 1920. he league, to whom the case was referred ultimately assigned the reas to Belgium.

The Allied Powers (reply to the German observations on the raft treaty, June 16 1919) based the fate of these areas on grounds her than those of self-determination. Eupen and Malmédy had een made a basis for German militarism, and had a close economic onnection with Belgium. Moresnet, which had valuable woods, was signed to Belgium "in partial compensation for the destruction of elgian forests."

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EURHYTHMICS is the term applied generally to the use of rmonious bodily movement as a form of artistic expression, d specifically to Dalcroze's system of musical education, hich is founded on a rhythmical discipline of bodily movements r the expression of time values. The present article is restricted the latter sense. (*See* DANCING.)

History.—Emile Jaques-Dalcroze (b. 1865) studied music at e Geneva Conservatoire and under Délibes in Paris and uckner and Fuchs in Vienna. In 1892 he was appointed ofessor of harmony at Geneva Conservatoire. His experience a teacher suggested to him that the conventional professional ining of musicians was radically wrong in that it ignored the ation of technical training to the inner consciousness of the dent. It was found that pupils, technically far advanced, er many years of study were unable to deal with the simplest blems in rhythm; that their sense of pitch, relative or ab- ute, was extremely defective; and that, while able to read urately and to play pieces memorised, they had not the slight- power of spontaneous musical expression. Dalcroze, starting m the position that technique is but a means to art, argued t the student should begin, not by specialising on any instru- nt, but by developing his musical faculties as a basis for cialised study. Such a training could only be secured by akening the sense—natural, though often latent—of the imate bases of music, viz.: tone and rhythm.

As the sense of tone can be developed only through the ear, lcroze gave special attention to vocal work; and then, notic- that when the students themselves beat time to their singing work became much more real, he wrote a series of "gesture gs," which were performed by his pupils with surprising e. This suggested the idea, which is the essence of the lcroze method, viz.: the training of the body in such a way as make movement not merely an accompaniment of music a means of expressing it. At first only the conventional movements of the conductor had been employed. The t step was to devise a series of arm movements that should rly mark all tempi from two beats in one bar to 12 beats, uding such forms as $\frac{5}{4}$ $\frac{7}{4}$ $\frac{9}{4}$ $\frac{11}{4}$, and a system of movements he body and lower limbs to represent note values from any nber of notes to the beat up to notes of 12 beats.

bout 1905 Dalcroze began to consider the possibility of lying his method not only to the special education of musi- s but as part of the general elementary education of children. ordingly he worked out a system of pedagogic eurhythmics ch has been widely adopted in schools throughout Europe America. In 1906 the first training courses for teachers e started at Geneva, but in 1910, on the invitation of the hers Wolf and Harald Dohrn, Dalcroze removed to Dresden, re a college for rhythmic training was established in the len suburb of Hellerau. The college made rapid progress did educational work of great value. Its activities, however, e abruptly terminated by the outbreak of the World War, since 1915 its place as the head-centre of eurhythmics has been taken by the Institut Jaques-Dalcroze at Geneva. Central schools were founded in London in 1913 and in Paris in 1924.

Outline of the Method.—The Dalcroze method consists of three parts: (*a*) rhythmic movement, (*b*) ear training and (*c*) improvisation (practical harmony). Of these the first is the essence of the Dalcroze method and is fundamentally new. The second is closely linked with the first and necessary to the pupil. The third is necessary to the teacher, who must have the power of free expression on some musical instrument, preferably the piano.

In the system of exercises upon which the method is based *time* is shown by movements of the arms, and *time-duration*, *i.e.*, note-values, by movements of the feet and body. In the early stages of the training this principle is clearly observed; later it may be varied in many ingenious ways—for instance, in what is known as plastic counterpoint the actual notes may be represented by movements of the arms, while the counterpoint in crotchets, quavers or semiquavers is given by the feet. The system of beating time with the arms provides for all tempi from $\frac{2}{4}$ to $\frac{12}{4}$ including $\frac{5}{4}$ $\frac{7}{4}$ $\frac{9}{4}$.

In the series of movements to represent note-values the crotchet is taken as the unit—this is represented by a step; higher values, from the minim to the note of 12 beats, are represented by a step with one foot and a movement or movements with the other foot or with the body, but without progression, *e.g.*, a minim by one step and a knee bend, a dotted minim by a step and two movements without progression, a note of 12 beats by a step and 11 movements. Thus for each note in the music there is one step, one progression in space, while at the same time the note, if of greater length than a crotchet, is analysed into crotchets. Notes of shorter duration than the crotchet, *i.e.*, quavers, triplets, etc., are expressed also by simple steps.

When the movements corresponding to the notes from the crotchet to the whole note of 12 beats have, with all their details, become a habit, the pupil need only make them mentally, contenting himself with one step forward. This step will have the time-duration of the note, which will be mentally analysed into its elements. The latter are not individually performed by the body, but their images in thought replace the movements.

The whole training aims at developing the power of rapid physical reaction to mental impressions. These latter are more commonly obtained through the ear, chiefly from the music played; naturally, however, the teacher needs at times to give commands during an exercise. For this purpose he generally uses the word "hopp," chosen for its clear incisiveness. Before each exercise it is clearly stated what the word is to represent in that particular case, *e.g.*, omit one beat, omit one bar, beat time twice as fast with the arms, etc.; often the word will be used in series in an exercise, each "hopp" meaning some additional change. As the command generally falls on the second half of the beat preceding the one in which the change is to be made, very rapid intellectual and physical response is necessary, especially if the music be at all quick. Exercises of this class soon give the power of rapid muscular innervation and inhibition, and are of extraordinary value in education, quite apart from their purely rhythmic side. The educational value of Dalcroze's method of eurhythmics is becoming widely recognised. There exist many centres in Great Britain and Europe, and trained teachers are working in America, South Africa, Australia and New Zealand. (P. B. I.)

EUROPE (*see* 9.922).—In dealing with the general European situation during the years which intervened between 1909 and the outbreak of the World War, the historian is faced with the fact that the importance of this period lies in the conclusion. Always there is before us the problem: was the War with which it terminated the inevitable outcome of deep-seated causes, or was it an avoidable result of demonstrable blunders and crimes? A consideration of this problem makes it necessary to revert briefly to previous events. Much which in 1910 was obscure has been elucidated by later publications; much which was then a conjecture or hypothesis has been verified; and much which could then only be tentatively suggested can now be frankly said.

I. THE ORIGIN OF THE WAR

The Triple Alliance.—The chief characteristic of the first years of the 20th century is the rivalry of the two political groups into which Europe was divided. As we can now see, the establishment of the Triple Entente (England, France, Russia) was a necessary and inevitable counterweight to the Triple Alliance (Germany, Austria and Italy); for this latter alliance, so long as it stood alone, gave to Germany a preponderance upon the continent of Europe so great as to be a permanent check on the free diplomatic activities of other states, and possibly a danger to their independence. It is true that the original alliance between Germany and Austria in 1879[1] had been a method of maintaining peace and securing the *status quo.* At that time Germany under Bismarck was, as he said, a "saturated" state; all that it required was time and peace for the development of its internal resources. In order to secure this he had built up a complicated system of alliances.

We have first among these the Austro-German Alliance, which was repeatedly renewed and remained in force until the outbreak of the World War. This treaty, which was published in 1881 in an incomplete form, bound the two empires to help each other in case either was attacked by Russia; if either was attacked by a third Power, the other was to observe at least a benevolent neutrality, and if the attacking Power was supported by Russia, then to come to the assistance of its ally. Side by side with this treaty of mutual defence against Russia, in 1881 Germany and Austria entered into an alliance with Russia, the chief point of which was a mutual engagement to act together in all Balkan matters. This treaty was renewed in 1884 for three years.[2] It lapsed in 1887, and for it was substituted the secret "Reinsurance Treaty" between Germany and Russia alone[3] by which each party agreed to maintain benevolent neutrality towards the other in case of a war with a third Power. This was not to apply in the case of a war against Austria or France if this resulted from an attack against one of these latter Powers by one of the parties to the treaty. In addition, Germany recognised the rights historically acquired by Russia in the Balkan Peninsula, and particularly the legitimacy of her preponderant and decisive influence in Bulgaria and in Eastern Rumelia. There was to be no modification of the territorial *status quo* in the Balkans without previous agreement and the principle of the closing of the Straits was reaffirmed. This elapsed in 1891; but just when a Russian envoy came to Berlin to arrange for a renewal, Bismarck was dismissed. Caprivi, on the advice of the Foreign Office, refused his consent; he is reported to have said that it was too complicated for him.

In 1882, the Triple Alliance was arranged between Austria, Germany and Italy[4] the essential point to which was that Germany and Austria were to come to the assistance of Italy if attacked by France, and similarly, Italy to come to the assistance of her allies if either of them was attacked or engaged in a war with two or more Great Powers; a special protocol stated that this treaty could not in any case be regarded as being directed against England. In 1883 Rumania, by a separate treaty[5] with Austria, to which afterwards Germany and Italy acceded became attached to the group, the allies binding themselves to defend Rumania if she was attacked. This treaty was kept strictly secret; it was a personal act of the King of Rumania, and was communicated to no one except the prime minister. In 1887 the Triple Alliance was renewed and extended[6] and included an undertaking to support Italy in any action that she might take to safeguard her position, even to war with France. In 1891 the third treaty of the Triple Alliance[7] reasserted in a strengthened form the Mediterranean obligations to Italy; a new clause (VII.) determined that every advantage, territorial or other, obtained either by Austria or by Italy in the Balkans should be based on the principle of reciprocal compensations.

These four Powers formed a coherent group, but to it other states were more loosely attached. In 1887, when there were cordial relations between the British and the German Govts., Lord Salisbury, by an exchange of notes, came to an agreement with Italy and Austria[8] to maintain the *status quo* in all the eastern waters of the Mediterranean, while Italy undertook to support Great Britain in Egypt; Great Britain on her side expressing her intention to support the action of Italy in North Africa. Lord Rosebery in taking office in 1892 refused to recognise the existence of this agreement. There was also an agreement between Italy and Spain as to Morocco, and at this time Serbia also was attached by a separate treaty to Austria.

We see that this very elaborate structure of treaties and agreements was really approximating to a general European system into which in one form or another there were brought Austria, Italy, Rumania, Spain, Serbia, Great Britain and even Russia; the whole object was the isolation of France, and it served its purpose of securing to Germany full and peaceful enjoyment of all that she had gained by the war of 1870–1. The extension of this system to the Mediterranean was advantageous to Great Britain in so far as it tended to strengthen her position in Egypt. The pivot was Germany and the centre of gravity was the German Army; this it was which held the whole together. It was a system in which Europe could acquiesce only so long as the policy of Germany was passive; a reaction must inevitably arise if Germany began a policy of active expansion. With the accession of a new emperor and the resignation of Bismarck, the Triple Alliance, while unchanged in form, acquired a new meaning. The period of rest and recuperation in Germany was over, and the new empire, conscious of its strength, began to stretch out with great ambitions towards the other quarters of the globe.

The immense growth of German wealth, the skill with which the mineral and agricultural resources were developed, and the expansion of manufactures naturally led to an extension of foreign trade. German agents, supported by German bankers, were to be found in every part of the world; there was a great development of maritime shipping, and this naturally led to the acquisition of extra-European dependencies and the extension of political interests. The first years of the new Emperor's reign appear a tentative experiment; with the appointment of Herr (afterwards Count and then Prince) von Bülow, first as Foreign Secretary and afterwards as Chancellor, the new tendencies became the deliberate and conscious policy of the German Government. It was inevitable, even with the best possible intentions, that numerous causes of friction should arise with other nations, and especially with Great Britain, for there was no part of the world in which the expansion of German influence did not touch British interests.

Franco-Russian Alliance.—Germany could embark with full confidence on this great policy of expansion just because her essential security at home was so well guarded; hers was the only alliance on the Continent. But ever since 1870 acute observers had foreseen that, some day or another, France and Russia would join together in order to redress the balance of the Continent. This event took place in Aug. 1891. The agreement (which was formulated in an exchange of notes) was based on "the renewal of the Triple Alliance and the more or less probable adhesion of Great Britain to the political views of this alliance."[9] It contained two clauses: one that the two Governments would agree together on any question of such a kind as to endanger the general peace; and the other that, in case either party was menaced by an attack, they would agree together on the measures to be taken. Two years later, however, after long negotiations in which many difficulties were encountered, this was supplemented by a military convention (Dec. 1893–Jan. 1894): if either France or Russia were attacked by Germany, France or

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[1] Pribram, *Die politischen Geheimverträge Oesterreich-Ungarns 1879–1914*, p. 6 (Vienna and Leipzig, 1920).

[2] Pribram, *op. cit.*, p. 11.

[3] *Die grosse Politik der Europäischen Kabinette, 1871–1914.* Vol. 5, p. 253.

[4] Pribram, *op. cit.*, pp. 24–8.

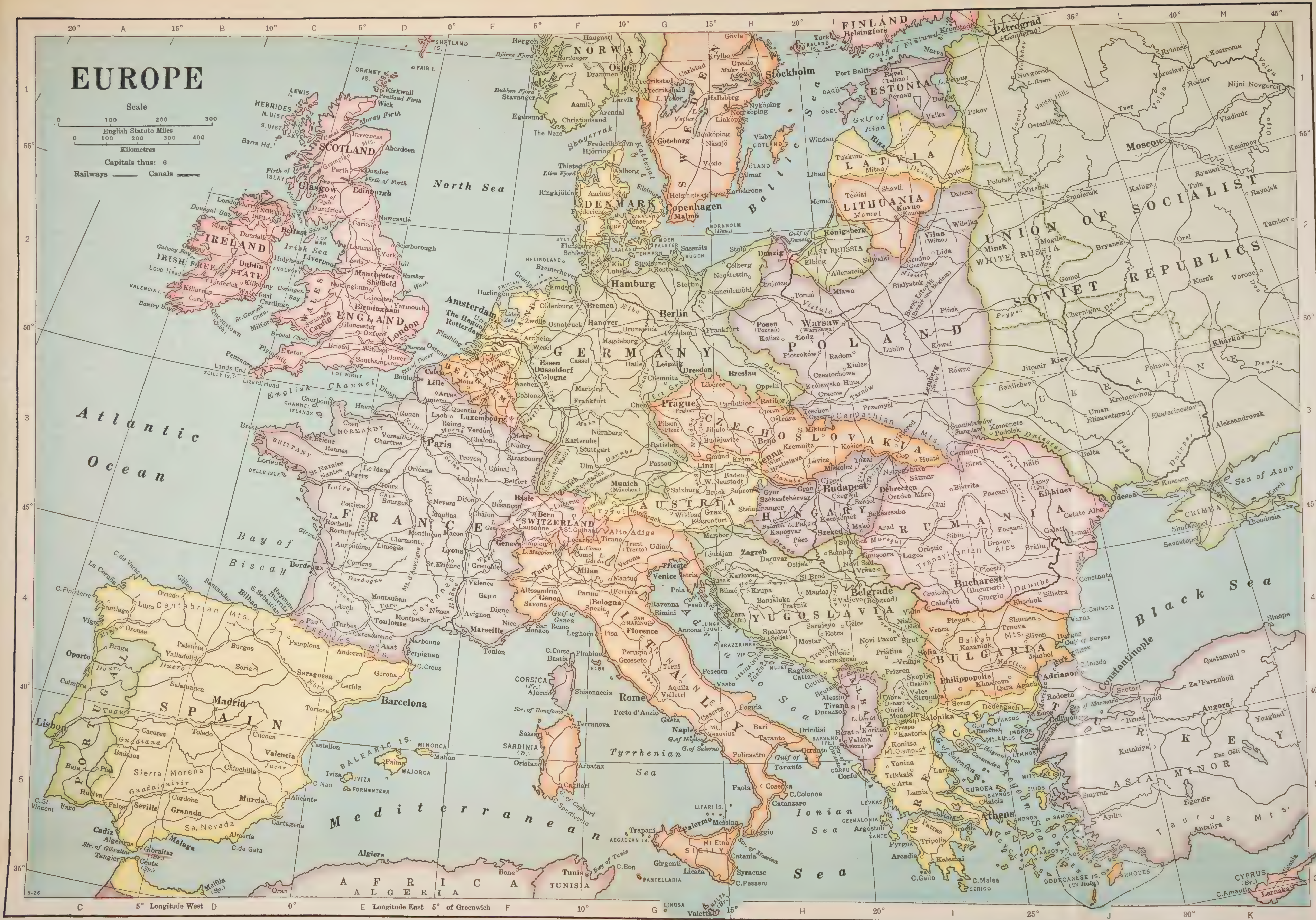
[5] Pribram, *op. cit.*, p. 29.

[6] Pribram, *op. cit.*, p. 42.

[7] Pribram, *op. cit.*, p. 64.

[8] Pribram, *op. cit.*, pp. 52–6.

[9] *Documents diplomatiques: L'Alliance Franco-Russe* (issued by Ministère des Affaires Étrangères, Paris, 1918).



EUROPE
Scale
0 100 200 300
English Statute Miles
0 100 200 300 400
Kilometres
Capitals thus: ⊙
Railways
Canals
Atlantic Ocean
North Sea
Bay of Biscay
Mediterranean Sea
Tyrrhenian Sea
Ionian Sea
Black Sea
Sea of Azov
Baltic Sea
English Channel
SCOTLAND
ENGLAND
WALES
IRELAND
IRISH FREE STATE
NORWAY
SWEDEN
FINLAND
ESTONIA
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LITHUANIA
DENMARK
GERMANY
POLAND
EAST PRUSSIA
CZECHOSLOVAKIA
AUSTRIA
HUNGARY
RUMANIA
YUGOSLAVIA
BULGARIA
ALBANIA
GREECE
TURKEY
ASIA MINOR
ITALY
SWITZERLAND
FRANCE
BELGIUM
SPAIN
PORTUGAL
UNION OF SOCIALIST SOVIET REPUBLICS
WHITE RUSSIA
UKRAINE
CRIMEA
CORSICA (Fr.)
SARDINIA (It.)
SICILY
AFRICA
ALGERIA
TUNISIA
CYPRUS (Br.)
Longitude West
Longitude East of Greenwich
5-26

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ussia respectively would apply all her forces to attack Ger- any.[1] If the forces of the Triple Alliance, or one of the Powers which it consisted, were mobilised, France and Russia would mmediately mobilise. The number of troops to be employed as specified, and it was agreed that there should be joint action etween the general staffs and interchange of all information lative to the armies of the Triple Alliance.

But even after this there was little real cordiality in the rela- ons between Russia and France. Russia, moreover, was occu- ed with Asiatic affairs, and had come to a friendly agreement ith Austria as to the Balkans which was confirmed by an ex- ange of notes on May 8 1897.[2] The internal dissensions of rance (it was the time of the Dreyfus trial) weakened the in- uence of that country abroad. France indeed was protected ainst the danger of a new attack from Germany, but received tle support from Russia in the normal discussion of diplomatic atters.

The essential change took place at the turn of the century. p to this period Great Britain had held herself aloof from e continental system. The British occupation of Egypt had sulted in a continued estrangement from France, and on the hole there was a tendency towards a close understanding with ermany and the other members of the Triple Alliance. This nderstanding was now broken. The first serious differences ose out of South African affairs. The Krüger telegram of 1896 s a flash of lightning; no storm followed, but this and the tense animosity against Great Britain shown during the Boer ar were symptoms that could not be neglected. By a large rty in Germany the consolidation of British power in South rica was regarded as the loss of a sphere which they had rked out for German expansion. Suggestions were made in rlin for a joint European action against England; these, how- er, broke down, for Germany made it a condition that there ould be a mutual guarantee of European territory. The French vt. would in this way recognise and confirm the cession of sace-Lorraine.

Equally important was the altered attitude of Germany wards the Near East. The great and legitimate expansion of rman commercial and economic interests was accompanied a growing cordiality with the Porte, and during his visit to mascus in 1897 the German Emperor proclaimed himself the otector of all Mahommedans throughout the world—an utter- ce which from anyone but him would have been justly regard- by France and Great Britain as an unparalleled provocation. ere was also a serious conflict of interests in the Far East. The dence which came from many sources was sufficient to make bvious to every British statesman that a continued political lation was dangerous. England must have friends, and friends whom she could rely.

From 1898 to 1901 advances were repeatedly made to Germany Great Britain, and the project of a definite understanding, y even of a defensive alliance, was ventilated.[3] The sugges- ns were accompanied by warnings that if an arrangement with rmany was not reached, then recourse would be had to the posed alliance. The offers were rejected; the warnings disre- ded. To the German Foreign Office, to Prince Bülow and to Emperor, it was an axiom that there could be no real friend- p, as they said, "between the whale and the bear." They red, or professed to fear, that an alliance with England would y mean that they would be used as a military advance post inst Russia; in the case of war the brunt of the fighting would upon them, while Great Britain would gather up the spoils Asia. "The danger was imminent that if Germany allied her- with England she would have to undertake the rôle against ssia that Japan assumed later single-handed." They be- ed that they could do better business by playing off the al empires against one another, by refusing to commit them- es either to Russia or to England, and by using the rivalry extend their own influence and possessions.

The German Navy.—But there was another influence at work. One of the chief tasks which the German Govt. had set itself was the building of a great war fleet. It was the considered opinion of German statesmen that, if they were to come to a friendly diplomatic arrangement with England, this would inevitably compel them to limit their naval development; they affected to think that a fleet built by a Germany friendly to England would be a fleet built under patronage and limited by the British insistence on superiority at sea. This they did not desire; they preferred, therefore, full freedom to build against England, trusting that it might be possible to avoid a serious conflict during what Prince Bülow calls the "danger period of construction." It was indeed the new naval ambitions, more even than the rejection of the British offer of an alliance, that conditioned the whole European situation. The building of the German fleet could only be compared to the similar work by which from 1857 onwards the Prussian army, after a period of comparative stagnation and inefficiency, was brought up to the highest point of perfection, and we know how this great instrument of war, when perfected, was used to further Prussian policy. There could be no doubt that the navy, when completed, would also be used for the same object, and in fact the responsible spokesmen of Germany took care to leave no doubt on this point. They wanted the fleet to support their diplomacy. In the memorandum which accompanied the great Navy bill of 1900[4] this was clearly stated. The navy must be such that, "even for the greatest sea Power, a war with it would involve such risks as to jeopardise its own supremacy."

It would be an error to suppose that the German Govt. were deliberately looking forward to forcing a war with England. Still more misleading to assume, as so many did in England, that the object was an invasion. The danger was of quite a different character, but it was none the less serious. The calculation was that if there was a fundamental difference between British and German policy, the possession of a great fleet would enable Germany to get her way, because England might be put in such a position that she would not dare to risk war. And what was the kind of point on which such a difference of policy might arise? It was the want of a fleet which, as he himself said, prevented the German Emperor intervening during the Boer War. It had become the avowed policy of the German Emperor to use his friendship with the Sultan as a means of winning the confidence of the Mahommedan world, and this—we have his own words for it—was an instrument which might in necessity be used to render impossible the position of England in Egypt or to arouse difficulties in Mesopotamia, in Persia, in India itself. It was the calculation that if any such controversy arose, Germany would not be alone; if she were allied to some other Great Power which possessed a formidable navy—Russia, France, Japan or the United States—the predominance at sea, on which the very existence of the British Empire depended, would be imperilled.

This menace was one which had to be met. No child could suppose that it would not affect the whole trend of British policy. The Germans themselves knew this well. What they feared was that England would attack while she still enjoyed her previous naval supremacy and before the German fleet had grown large enough to be dangerous. But this policy of a "preventive" war was never even seriously considered by responsible British statesmen. Their answer was the only possible one. In the first place the British fleet must be strengthened and its whole organisation altered. A fleet, like an army, must be found in the place where it is wanted. In the old days the North Sea had been empty of ships; it was in the Channel, in the Mediterranean, in the Atlantic, that the British fleet was placed. The centre of gravity was the Straits of Gibraltar. Circumstances were now changed, and so a great reorganisation was effected. Outlying stations were denuded of ships and the bulk of the fleet was in the North Sea.

The Mediterranean had also, however, to be guarded. Austria was increasing her fleet, and Italy was an ally of Germany. To meet this danger in 1912 it was agreed by England that France should concentrate the greater portion of her fleet in the Medit-

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Documents diplomatiques: L'Alliance Franco-Russe (issued by istère des Affaires Étrangères, Paris, 1918).

Pribram, *op. cit.*, pp. 73-82.

See *Die Grosse Politik*, vol. 17, chap. cix.

[4] Published by German Government.

erranean; in the event of a common war with Germany it would fall to the British Fleet to defend the northern and western coasts of France. In the same year a naval convention was concluded between France and Russia;[1] with the building of the Kiel Canal the importance of the Baltic in naval strategy had increased. In 1913 a further naval convention between the three Powers of the Triple Alliance was made[2] and in May 1914 proposals were made for naval conversations between Russia and Great Britain;[3] it is to be noted that at the end of June in the same year the enlargement of the Kiel Canal, by which the biggest ships could pass through it, was completed.

All this was not enough. The German plan was based on the assumption that Germany would be able to gain further allies in addition to those she already had. England also must have allies. Now that Germany was becoming the second naval Power, England could no longer afford to regard with equanimity German military predominance upon the continent of Europe. The success of the German schemes required one of two things,—either an alliance with other states against England, or such increase of German preponderance that they would become, for political purposes, subject to German will. It was necessary, for England to guard against either contingency, and she could do so only by entering into a firm understanding to join with them in resistance to any unprovoked act of German aggression.

These considerations were so weighty that alone they are sufficient to explain and justify the action of the British Government. The further information which has now become available completely substantiates them. We now know from the letters of the Kaiser to the Tsar[4] which were published after the Russian Revolution, that throughout the whole of the reign of Nicholas II. the German Emperor had been using the strongest personal pressure upon him to bring about an alliance between Germany and Russia, the point of which was avowedly directed against Great Britain, an alliance into which France would be forced to come; whatever the subject of the diplomatic negotiations at the moment might be—whether it was Armenia or Crete or South Africa or Egypt, neutrality during the Russo-Japanese War, or Morocco—always we see the same ambition. He hoped to create trouble in India by encouraging a Russian move on Afghanistan, and for this purpose to arouse the slumbering passions of Islam: " Remember what you and I agreed upon at Peterhof, never to forget that Mahommedans were a tremendous card in our game in case you or I were suddenly confronted by a war with a certain meddlesome Power." He encouraged Russia to give support to Turkey as against Great Britain in the Persian Gulf:—

> Last but not least, an excellent expedient to kill British insolence and overbearing would be to make some military demonstrations on the Perso-Afghan frontier . . . . Even should the forces at your disposal not suffice for a real attack on India itself, they would do for Persia.

All this culminated when on July 24 1905 he persuaded the Tsar to sign the Treaty of Björko,[5] a secret alliance against England which it was his hope would afterwards be joined by France. The treaty proved abortive, for the Russian Foreign Minister pointed out that it was inconsistent with the terms of the French Alliance, but it shows the method by which the Kaiser professed to be guarding the peace of Europe. The remark of King Edward made to a Danish diplomatist may be recalled: " I will admit this, that with a man of so impulsive a temperament as the German Emperor at the head of the greatest Power in Europe, anything may happen." This correspondence was secret, but in diplomacy there is no absolute secrecy, and the rumours of it must be taken into account if we are to understand the profound distrust felt for Germany during these years.

Franco-British Entente.—These were the circumstances in which a great change of policy took place. The first step was the British alliance with Japan.[6] In this it had originally been contemplated that Germany should be a partner. But Germany did not accept the opportunity offered her, and, in addition German action over the Manchurian agreement seemed to show that no confidence could be placed in any German engagement. The alliance therefore was one between Japan and Great Britain alone. In 1904 a colonial agreement was reached between England and France,[7] by which the numerous points o friction between the two countries were settled. The essence was that France recognised the British position in Egypt. To do so was a bitter blow to most cherished French traditions and ambitions. In return for this Great Britain recognised the special position of France in Morocco and gave up to France her claims and interests. This agreement in its original inception had, at any rate in England, no special point directed against Germany. It was probably due chiefly to Lord Cromer, but his efforts were supported by Lord Lansdowne and King Edward VII. The object was merely to clear away the outstanding causes of controversy with France, but it was destined to have far-reaching results.

This agreement was quite unexpected and very unwelcome in Berlin. The whole basis of German diplomacy was cut away. Europe at once took on a new aspect. In the ordinary diplomatic negotiations Germany must look forward to a situation in which she was confronted no longer by disunited and antagonistic states, but by great Powers, acting in union and co-operation. Even the Triple Alliance itself was shaken, for it was obvious that Italy could not be depended upon in any serious conflict with both France and England. It must therefore be the chief object of German diplomacy to drive a wedge between England and France. For this reason, from this time onwards, every diplomatic incident, even of minor importance, at once reverberated throughout the whole of Europe. This is illustrated by the Morocco affair. Morocco was of great importance to France and Spain; it was essential to England that no hostile Power should be established on the northwestern coast of Africa; apart from this, Morocco was merely of trivial importance to the rest of the world, including Germany. But Morocco was made the test of the Entente. Germany, taking advantage of the temporary crippling of Russia by her military and naval defeat in the Far East and the internal disturbances which followed, brought the full weight of her military superiority to bear upon France, and thereby forced her into a conference and brought about the resignation of Delcassé. This action defeated its own object. It cemented the union between France and Great Britain, and as soon as it became obvious that France, by entering into this union, exposed herself to the threat of war, it was inevitable that England should take steps, if necessary, to protect her new friend. It was the threats by Germany which gave a military side to what had at first been merely a diplomatic arrangement.

No doubt the French handling of the whole matter was open to criticism, but there was a peculiarity about the arrangement of 1904, which placed Great Britain in a delicate position. England, while she gained definite rights which France surrendered to her in Egypt, gave in exchange only eventual rights in Morocco; France, in return for a definite surrender, got nothing but hopes; England acquired Egypt, France merely the prospect of acquiring Morocco. In these circumstances there was obviously an obligation on Great Britain to see to it that her support of France in Morocco should not be half-hearted; had this support been withdrawn simply because some of the subsequent details of French action were open to criticism, then the worst possible construction might have been placed on the good faith of the British Govt.; it would have appeared that, after having secured themselves in Egypt, they had seized on a subterfuge so as to avoid carrying out their side of the agreement.

Anglo-Russian Entente.—Not only did the German attempt to separate Russia from France fail, but in 1907 an arrangement was made by which the outstanding points of difference between Great Britain and Russia and Tibet, Afghanistan and Persia were settled.[1] The prime motive as in the agreement with France was genuine desire to remove possible causes of war in Asia, but hough there was no definite agreement, it naturally brought about co-operation in Europe. The approximation between the wo empires, which had for so long been in a state of complete ivalry, was cemented by a meeting between King Edward VII. and the Tsar, which took place at Reval in June 1908. The chief nd almost only subject of discussion was the state of affairs in he Balkans, and it was agreed that there should be common ction for bringing about a reform in Macedonia.

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[1] *L'Alliance Franco-Russe: Documents Diplomatiques* (issued by Ministère des Affaires Étrangères, Paris, 1918).

[2] Pribram, *op. cit.*, pp. 308 seq.

[3] Grey, *Twenty-Five Years, 1892-1916*, vol. I. pp. 283 seq.

[4] *The Kaiser's letters to the Tsar*—edited by N. F. Grant (London, 1921).

[5] *Die Grosse Politik der Europäischen Kabinette.*

[6] *State Papers*, vol. 95, pp. 83 seq.

[7] *State Papers*, vol. 97, p. 39, 1903–4.

The Turkish Revolution and the Annexation Crisis of 1908.—This meeting was immediately followed by, and perhaps precipiated the outbreak of revolution in Turkey and the overthrow f Abdul Hamid by the Young Turks. This again was followed t the beginning of Oct. by the Declaration of Independence f Bulgaria and the annexation to Austria of the provinces of osnia and Hercegovina, which she had administered since 1879. These events produced an acute crisis. The British Govt. was stranged by the contrast between this action and the language sed shortly before by Aehrenthal, the Austro-Hungarian Forgn Minister, and the Austrian Emperor. Moreover, they foreaw how dangerous would be the effect upon public opinion in Turkey. Above all, they protested against the claim of a single ower to change the arrangements made by all the Great Powers the Treaty of Berlin. It brought to a head the animosity etween Christians and Moslems in the Balkans, to which all e wars which followed were due. M. Isvolsky, the Russian oreign Minister, was bitterly offended; negotiations were in ogress by which he hoped as a recompense for his assent to e annexation, to receive important concessions regarding the pening of the Straits, the main object of Russian policy, but ehrenthal acted before he had had time to consult France and ngland. Isvolsky felt, therefore, that he had been duped. It oused also most intense animosity in Serbia and the result as to ensure that henceforward the full support of Russia would given to Serbia against Austria and that the Balkans would ce more become the field for Russian diplomacy.

The annexation crisis is important, for in it is to be found the planation of much which happened in 1914. Just when it emed as though the very prolonged and acrimonious controrsy might be reaching a conclusion, Count Pourtalès, the German ambassador, delivered to M. Isvolsky "a peremptory deand" that Russia should without conditions agree to the abrotion of Article 25 of the Treaty of Berlin, that is, should recnise the annexation; and it was intimated that if the answer as unfavourable, Germany would "*lâcher l'Autriche sur la rbie.*" It is important to understand what this threat—for it as a threat—implied. A war between Austria and Serbia would ve placed Russia in a most disadvantageous position; weaked as she was, she could not have come to the help of Serbia, cause under the system of alliances Germany would, if necesy, come to the help of Austria. Before this, Russian resistance llapsed; they agreed to the German demand without even conting France and Great Britain. The success was a notable one, t it was dangerous. It was one which could not be repeated. ussia had given way to threats once; she could not afford to do a second time. It left an intense feeling of indignation in St. tersburg, which persisted, and became one of the most dangers factors in the European situation. Personally M. Isvolsky, o soon resigned the post of Foreign Minister and went to ris as Ambassador, henceforward became the active partisan an anti-Austrian policy, and was only anxious to revenge nself for the humiliation which had been placed upon him first Count Aehrenthal and secondly by Germany.

Agadir.—The annexation crisis had occurred at a moment en the relations between France and Germany were comratively friendly; an attempt had been made at establishing nomic and financial co-operation in Morocco. An awkward sode (the German consul at Casablanca was inducing soldiers the Foreign Legion to desert and was arrested) was settled by bitration. But this co-operation did not last long. The ambitions of the Colonial party in Germany could not be reconciled with the complete political control which France aimed at. A new and very serious crisis arose in 1911. The French, in consequence of a civil war in Morocco, followed by the abdication of the Sultan, advanced to Fez. This appeared to show a desire to disregard the obligations of the Convention of Algeciras. Germany, in order to support her claim to be consulted, took a step which, as so often happened, could be interpreted as a threat. She sent a small ship of war to Agadir. It was of course assumed, not only abroad but in Germany itself, that this action meant that the German Govt. proposed to claim part of the western coast of Morocco and were even intending to land troops in order to enforce this claim. It seems probable that the German Govt. themselves had not at the moment really made up their minds precisely what they wanted. The obvious answer to this German move would have been the dispatch of a French or British warship—a policy which was strongly pressed by some of the French.

Eventually separate conversations were begun between Germany and France on the basis that Germany would agree to disinterest herself in Morocco completely, receiving in return territorial concessions in other parts of Africa. There were many anxious moments, for some of the German demands were excessive, but eventually an agreement was reached by which France surrendered to Germany important parts of her possessions on the Congo.[2] As in the previous Morocco discussions, the importance of the episode lay not so much in the immediate question at issue as in the attempt of Germany to separate England and France and to intimidate France. As before, this had the natural result of strengthening the union between France and England, and taking a stage further the military and naval accompaniments of this agreement.

Great Britain and Germany, 1909–14.—The final settlement of the Moroccan question led to an improvement in the relations between Great Britain and Germany. One of the first acts of Bethmann-Hollweg, who on the resignation of Prince Bülow became Chancellor in 1909, had been to make proposals which might bring about an amelioration of the relations between Germany and England, and for the next four years conversations with this object continued. The negotiations turned on two points: (1) a naval arrangement, the object of which would be to prevent the two countries continuing on an unlimited rivalry of armaments; (2) a general political understanding by which each country should be assured that the other would not join in attacking it in case of war. From 1909 to 1911 the discussions took the form of conversations of the ordinary diplomatic nature, interspersed with public speeches in the two Parliaments. They were broken off in the summer of 1911 owing to the Agadir difficulty, but after that had been surmounted, were resumed at the beginning of 1912, when on Feb. 9 Lord Haldane was, in consequence of a suggestion from Germany, sent on a special mission to Berlin. On neither point did these negotiations lead to any definite result. As to the naval agreement it seems clear that Bethmann Hollweg would have welcomed it, but that his support was not strong enough against the opposition of Tirpitz and the Emperor.

The proposals for a general political agreement, however, broke down because, as soon as a precise formula was put forward, it appeared that Germany would not be satisfied with any arrangements except one which would be so worded as to imply that Great Britain would be debarred from coming to the assistance of France if she were attacked. Anything of this nature was of course out of the question, for, as Sir Edward Grey said on Nov. 27 1911, "one does not make new friendships worth having by deserting old ones." None the less, the very fact that this attempt had been made, though it failed, left the relations between the two Governments less unfriendly; even more important was the practical illustration afforded by the subsequent Balkan troubles as to the importance of co-operation between them. Everything tended to show that the peace of Europe could be maintained if Germany and Great Britain, while each maintaining full loyalty to its own associates, were willing, when any difficulty arose, to communicate frankly and freely with one another. By this means the two alliances might cease from their rivalry and gradually be merged in a general concert. This was a system which Sir Edward Grey deliberately adopted; his whole handling of political difficulties was based upon this, and so long as Germany acted in a similar spirit things went well. When the World War ultimately broke out, it was because Germany, in a very grave crisis, ceased this co-operation and in profound secrecy made herself the associate of schemes the success of which would have been most detrimental to one of the partners in the Triple Entente. Meanwhile, during 1913 and the first half of 1914, negotiations were begun and carried through to a successful issue by which the two chief outstanding points of controversy were in fact removed. A settlement was at last brought about with regard to the Baghdad railway and the reversion of the Portuguese colonies in Africa.

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[1] *State Papers*, vol. 100, p. 555.

[2] *State papers*, 1911, vol. 104, pp. 948–964.

The situation in Germany was, of course, the subject of the most careful study by those who were responsible for directing British policy. Opinions were much divided in England; there was a belief, which was probably well founded, that neither Herr von Bethmann Hollweg nor Herr von Jagow desired anything but the best relations. On the other hand, it must remain a matter of comparative indifference whether in any particular year the German administration then in office was well disposed, Their position was at the best very precarious. All information, both from public and confidential sources, showed that a very large section of educated German public opinion was animated by feelings of intense animosity against England, and, although this party was at the moment in opposition to the Government, at any time they might come into office, all the more because of the very unreliable character of the Emperor, of whom the only thing that could be said with certainty was that no one could foresee what he would do.

Moreover, there was another factor to be kept steadily in mind. Good relations between Great Britain and Germany might possibly be valued, not for their own sake, but merely as a device for separating Great Britain from her associates. It was an obvious policy to encourage a spirit of conciliation, so that if there was a serious conflict with Russia, English public opinion would refuse support to Russia. To put it brutally, Germany had no reasons to fear a war if England stood out; according to all instructed German expectations the crisis of any great European war would be over in the first two months. All that was necessary then was to secure that England should remain neutral during the first stage; if once the essential victory in France were secured, then nothing else really mattered. Germany would quite well be able to acquiesce in an interference of Great Britain at a later stage, for, though this might be used to moderate the claims of the victors, it would not eliminate the fact of the victory. It was the consciousness of this which made it absolutely necessary that every advance to Germany should be accompanied by the clearest and most public intimation that the union of the Entente was not thereby weakened. So we get the key to British policy: the maintenance of the two alliances, but the frank and friendly discussion between Great Britain and Germany on each point of difference as it arose. This was the state of things when a new and quite unforeseen evolution began in the Balkans. (*see* SERBIA.)

The Balkan Wars.—It had been long agreed that to Italy should fall the reversion of Tripoli. The increasing disorder of the Turkish Empire, the obvious failure of the Young Turks to establish an orderly and civilised Government, made it appear that the time for action had come. In Sept. 1911, at the very crisis of the Agadir incident, without previous warning the Italian Govt. presented an ultimatum to Turkey, and three days later, on Sept. 29, declared war. On Oct. 4 an Italian force landed in Tripoli, which, during the next months, was occupied with the very difficult task of subduing the resistance both of the Arab population and of the Turkish troops. The fighting which eventually extended to the Aegean raised among the Balkan States hopes of finally expelling the Turks from the Peninsula.

In Feb. 1912 negotiations were begun under, the deepest secrecy, between Serbia and Bulgaria, and on March 13 there was signed a treaty of friendship and alliance (*see* SERBIA), by which the two kingdoms mutually guaranteed to one another their political independence and the integrity of their territory, and agreed to support one another with all their forces if either were attacked by one or more states. More than this, they agreed to support one another if any of the Great Powers attempted to occupy any part of the Balkans which was at present under Turkish dominion, a clause which was obviously directed against Austria. This treaty was accompanied by a secret additional treaty and a military convention; the first of these was in fact in the nature of an offensive alliance against Turkey and was followed by detailed arrangements as to the disposal of any Turkish territory which might be acquired. The treaty was to be communicated to Russia, and all matters undetermined in the treaty were to be settled by the arbitrament of Russia. The military convention determined precisely the nature and character of the help to be given in the case of a war with Turkey or with Austria or Rumania. This treaty was in accordance with the agreement submitted to the Russian Govt., but they did not communicate it to their Allies. It was followed in May by a similar treaty between Greece and Bulgaria, the initiative to which was to a large extent given by Mr. J. D. Bourchier, the well-known correspondent of *The Times*.

The action prefigured in the treaties was hastened by the conclusion of the war between Turkey and Italy; negotiations were entered into during the month of August and were brought to a conclusion by the Treaty of Lausanne signed on Oct. 18,[1] by which Turkey surrendered Tripoli to Italy, the future of the Aegean Is. being reserved for later arbitration. It was necessary, if the attack on Turkey were to be made, that it should take place at once so as not to leave time for preparation. On Oct. 8 Montenegro declared war; on the 13th the three other Allied states presented an ultimatum demanding the immediate grant of autonomy to Macedonia; on the 14th the population of Crete declared themselves independent of Turkey, and formally joined Greece; and on the 17th the declaration of war was sent.

During the next three months the Turks were repeatedly defeated by the Allies; they evacuated the whole of Macedonia and Southern Albania, as well as Adrianople. It remained for Europe to determine its attitude towards these unexpected events. The danger was extreme that the Balkan might become a European war.

The Austrian Govt. was determined to put a barrier to Serbian ambition. The arrangements with Bulgaria were based on the assumption that Serbia should gain her reward by the annexation of the northern part of Albania and should thereby obtain access to the Adriatic. This Austria would not permit. She did not wish to see a Slavonic State having access to a sea which she looked upon as her own. In this matter she could depend upon Italian support. Austrian troops were mobilised; garrisons in Hercegovina were placed upon a war footing, and the situation was aggravated by numerous personal incidents, as for instance by stories which were put about that the Serbians had imprisoned and ill-treated an Austrian consul. War between Austria and Serbia was imminent, but if it broke out Serbia would be supported by Russia, and in answer to Austrian military preparations, Russian troops on the southwestern frontier were placed on a war footing. A war between Austria and Russia would, in consequence of the complicated system of alliances, inevitably bring in Germany and France, and thereby bring about the great struggle which everyone wished to avoid. The danger was averted by France, Great Britain and Germany, who worked together to bring about conciliation. It had been arranged that, side by side with the peace negotiations which were taking place in St. James's Palace, the ambassadors of the Great Powers in London should sit in conference under the presidency of Sir Edward Grey. It was agreed that France and Great Britain should give their support to Austria, and that Albania should be set up as an independent state. This removed the essential point f controversy, and in Feb. the Austrian Emperor sent Prince ohenlohe on a special mission with a letter to the Tsar. was agreed that the two Powers should demobilise, and from is time the extreme friction began to diminish. But the re- sal of Serbian access to the Adriatic was to have unexpected esults. It cut away the basis on which the division of the spoil d been arranged between the Balkan States.

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[1] R. B. Mowat, *Select Treaties and Documents* (Oxford Pamphlets, 1914–5).

The Serbian Govt. therefore demanded a larger portion of acedonia than had been originally assigned to her. They based is claim also on the point that Bulgaria had not provided her e share of forces to fight in the western area, while Serbia had ntributed more than she was bound in the struggle for Adri- ople. Under these circumstances an appeal to the Tsar to arbi- ate was enjoined. But before he had even received the appeal, catastrophe took place. The old animosity against Bulgaria, ich had been for so many hundreds of years traditional among e Greeks and Serbians, was again growing. The armies were Macedonia still in closely adjacent quarters. The Bulgarian ovt. determined on a sudden blow, and on June 29 an attack form was delivered by the Bulgarains against the Serbian rces. Immediately afterwards the Greeks in Salonika attacked e Bulgarians. This new fratricidal war had scarcely begun en two new champions entered the field. The Turks de- unced the armistice and a fortnight later retook Adrianople. July 18 Rumania, with a fresh army, entered the field, de- red war on Bulgaria, and occupied the Dobruja. Before this eat superiority of force the Bulgarians, who had lost so heavily the war—the dead alone were 30,000—had no course open but capitulate. On the demand of Rumania a conference was mmoned to Bucharest, which on July 30 arranged an armistice, d on Aug. 10 the Peace of Bucharest was signed.[1] By this Bul- ria had to surrender to Serbia the whole of Macedonia, to eece a large part of the northern shore of the Aegean, while to rkey she had to restore Adrianople and to Rumania to sur- nder the Dobruja.

The situation left by the Treaty of Bucharest was very ecarious. It was obvious that Bulgaria would not willingly quiesce in the loss of territory and prestige. The mutual ani- osity between Serbia and Austria continued, and the Prince Wied did not show himself capable of coping with the very ious difficulties in Albania. There were acute differences tween Turkey and Greece, and the renewal of war seemed im- nent. But these mere local complications could doubtless ve been overcome so long as no one of the Great Powers inter- ned; separate action by any one of them must almost inevi- ly bring about the great trial of strength between the rival alli- ces. It was the object of every responsible statesman to pre- t this arising. The immediate danger arose from Austria and ssia. Austrian policy was inclined towards Bulgaria and de- ed to see the Treaty of Bucharest overthrown. In the summer 1913 they proposed an immediate attack on Serbia; in this they not have the support of Berlin. The German Govt. was clearly satisfied with the Austrian handling of the Serbian diffi- ty, and also with the unnecessary harshness with which the ngarians treated the Rumanians. They rightly saw that an elioration of the position must be found in an internal reform the Dual Monarchy.

On the other hand, German ambitions were becoming a serious nger. Count Wangenheim, who had succeeded Marshall von eberstein as ambassador to the Porte, was with great assurance engthening the German control at Constantinople. This was evelopment which Russia could not regard with equanimity. crisis was reached during the winter, when Gen. Liman von nders was not only appointed to reorganise the Turkish Army, was given actual control over the army corps stationed in nstantinople. This led to a strong protest from Russia, and s followed by very violent press polemics between Germany Russia. It is clear that Russia was becoming impatient. It ked as though Germany, with the conclusion of the Baghdad reement, and in other ways, would gain complete control over rkey, military, political and economic. This, if achieved, would be a formidable impediment to the ultimate realisation of what had for so long been the permanent object of Russian policy—not only the opening of the Straits but the control of Constantinople. In Feb., as we now know, the situation was reviewed; it was agreed that these hopes could only be achieved as the result of a European war, and that it was necessary to prepare the scheme for landing troops on the Bosporus if the contingency arose. Russia did not take her Allies into her confidence. The most serious element in the situation was that more and more, the old rivalry between Austria and Russia, which had always been found manageable, was giving place to a direct conflict of interests between Russia and Germany herself. Moreover, the commercial treaty made between Russia and Germany in 1892 was running out; Germany had succeeded in imposing upon Russia conditions which subordinated Russian interests to those of Germany. Any negotiations for the renewal of the treaty must certainly react on the political situation. Already the anticipation of this had aroused all the strong national spirit in both empires. The Russians in particular were determined not to accept a renewal of the humiliating position in which they had so long been placed.

Meanwhile Russia was actively strengthening her diplomatic position and was working to build up a new Balkan alliance. The first step was to win over Rumania from the Central Powers; in this she was largely successful, being helped by the popular sympathy in Rumania for their fellow-countrymen in Transylvania. But the prospect of a new Balkan alliance necessarily aroused the greatest apprehension in Austria; it could have no *raison d'être* except hostility towards her, for a reconciliation between Bulgaria and Serbia would only be possible if Serbia relinquished part of the territory won in the late war and as a compensation was able to extend to the Adriatic. Her real ambitions were the annexation of Bosnia and Hercegovina and in the prospect of this she was encouraged by Russia. Moreover, the internal condition of the monarchy was becoming serious.

Apart from grave financial embarrassments the conflict of nationalities was growing. The German element, on the loyalty of which the very existence of the monarchy depended, was tending to fall under the influence of the pan-German party in the Empire; the chronic difficulties with the Czechs had reached such a stage that from March onwards it was necessary to suspend the meetings of the Reichsrat; there were constant disputes between the Rumanians in Transylvania and the Magyar Govt., and throughout the southern provinces the dissatisfaction of Serbs and Croats alike was growing; the gradually increased strength and reputation of Serbia was beginning to act as a dangerous magnet. Responsible statesmen in Europe were beginning to realise that now that the Turkish problem had been solved, they would soon be confronted by an Austrian problem. This again affected the political situation of Germany; she had now only one sure ally left; if there were to be a collapse of Austria-Hungary, she would be left alone. Confronted by the growing strength of Russia, her rulers began to look to the future with grave apprehension. The great danger to Europe lay in the rivalry of armaments.

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II. THE OUTBREAK OF WAR

The Murder of the Austrian Archduke.—The preceding pages of this article describe the state of Europe when, on Sunday, June 28, the Archduke Franz Ferdinand, the heir to the Austrian throne, and his wife, while on an official tour of inspection in Bosnia and Hercegovina, were murdered at Serajevo, the capital. The two assassins were young men of 20 years of age, natives of Bosnia and therefore Austrian subjects. Such evidence as is available seems to show that the motive for the crime must be traced to the intense racial animosity which had existed in Bosnia since the time of the annexation, increased as it was by the growing discontent in Croatia, and by the rising tide of aggressive nationalism in Serbia. But the preparations had been made under the auspices of a secret society in Serbia known as the "Black Hand," the leader of which was Demetrivich, an officer of the Serbian General Staff. The Serbian Govt. itself was in no way an accomplice in the act, which they deplored, for at the moment they desired peace and recuperation after two wars. There is, however, evidence that they had some knowledge of what was intended and they were very remiss in not giving a warning to the Austrian Government.

Elsewhere, except among the comparatively few who really understood how precarious was the position in the Balkans, it was the personal aspect of this event which attracted attention. The general feeling was one of deepest indignation, and of the warmest sympathy for Austria and for the aged Emperor, Francis Joseph, whose life had already been so full of tragedy. In Austria the crime, which was no isolated act, was looked on as a blow at the very existence of the monarchy. The relations with Serbia had for long been the cause of grave disquiet, internal as well as external. There had in fact just been drawn up a very important Austrian memorandum for communication to the German Govt.; in it the Balkan situation was discussed, and stress was laid on the scheme attributed to Russia of creating a new Balkan league, which was to include Rumania and be used as an offensive weapon against the Triple Alliance.

In this scheme the disaffection in Bosnia and Croatia, fermented by the agitation from Serbia, would be a dangerous instrument. Against this it had been intended to propose a pro-Austrian anti-Serbian alliance with Bulgaria and Turkey, which could be used also to check the pro-Russian influences in Rumania. Count Berchtold and his colleagues now determined immediately to use this new opportunity so as to rid themselves once and for all of the menace to the monarchy caused by the Yugoslav propaganda and at the same time to restore the waning prestige of the monarchy. In this they were influenced by the advice of Conrad von Hötzendorf, chief of the General Staff, who had long held the view that a successful war was the only means of stopping the disintegration at home and rehabilitating the Empire abroad.[1] For this purpose it was essential that there should be war with Serbia; no diplomatic success would be sufficient and the war must end in the diminution of Serbian territory and in bringing the kingdom into such a condition of dependence upon Austria that it would practically cease to be an independent state, or to exercise influence in the Balkans.

Austria could not take action of this kind unless assured befor hand of German support, for she would certainly be confronte by the opposition of Russia. Count Hoyos was therefore dispatched on a special mission to Berlin, taking with him both th memorandum written before the murder and an autograp letter of the Emperor in which the situation was explained.

The Decision in Berlin.—This letter was delivered personall by Count Szögyény, the Austrian ambassador, on July 5 to th German Emperor, who was due to leave for his annual holida in the North Sea on July 7. It was then that the decision o which so much was to depend was made. It was one for whic the Kaiser was immediately and personally responsible. Whil explaining that he must, of course, consult the Chancellor on matter of serious European importance, the Count was author ised to inform the Austrian Emperor that in this question h could "depend on the complete support of Germany." "Thi especially applied to Austrian action against Serbia." "In th Kaiser's opinion there must be no delay. Russia's attitude woul certainly be hostile, but he had for years past been prepared fo this; if it was to come to a war between Austria-Hungary an Russia she could be convinced that Germany would stand at he side with her usual fidelity. Moreover, Russia, as matters stood was in no way ready for war, and would certainly consider befor appealing to arms."

The Kaiser, after a brief and informal committee with hi naval and military advisers, left Berlin for his visit to Norway as arranged, on July 7. The official German answer, thoug more guarded, was in accordance with his language. In it the Chancellor explained that the view of the German Govt. wa that the relations between Austria and Serbia were a matte within the competence of Austria alone; Germany therefore di not propose to claim any right to interfere. What this, of course, meant was that Austria received a free hand to couch her demands on Serbia in such terms as she chose; Germany alread knew that they would be such as to make war very probable. But Austria had already been assured that, if this action led t war with Russia, Germany would be at her side. It is noticeable that no advice or warning was given that the demands on Serbi should be so modified as to avoid this danger. On the other han great attention was given to the diplomatic preparation; everything was to be done to secure for a war with Serbia the support or neutrality of the neighbouring states. With this object the Kaiser, though strongly against his own personal inclination, agreed that the King of Bulgaria should be asked to join the Triple Alliance, and, in view of the great German interests in Turkey, negotiations with the same object should be entered into with the Porte. What above all interested them was the positio of Rumania and Italy. The situation in Rumania caused muc anxiety, for King Charles let it be known that he would probabl not be able to bring the country with him into a war with Russi on the side of the Germanic Powers; all, however, was to be done to strengthen German influences in that country. As to Italy, it was agreed that its Government should not be informed beforehand as to the blow which was impending against Serbia, but Germany pressed very strongly that Austria should be prepared to offer to Italy suitable compensation for any gain in territory or influence in the Balkans which might accrue to her.

Analysis of the objects and motives of the German Govt. is all the more difficult because, in its political composition, it had no powerful personality such as Bismarck had once been, and its actions were the result of many conflicting influences, while decisions were always liable to be deflected by the impulsive and vacillating character of the Kaiser himself. There was in the first place genuine indignation at the crime of Serajevo, an indignation which in the Kaiser's mind took the characteristic form that there must be co-operation between all monarchical states against elements of disorder. This motive was one which, no doubt, it was hoped when the time came he would use with effect upon the Tsar. Politically there had long been dissatisfaction at Berlin with the conduct of affairs in Austria; the force and decision which were needed in an ally were wanting. It was hoped, therefore, that the opportunity would be used to remedy this defect.

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[1] Conrad, *Aus meiner Dienstzeit*, vol. 1 and 2 *passim.*

ut there were further and greater objects which would follow utomatically; if Russia could be persuaded to stand aside while erbia was overrun by the Austrian Army, it would become evi- ent that Russian protection was of no avail to Serbia; Serbia ould be pushed out of the way, and thereby the Germanic owers would gain in fact the control of the Balkans and the ad to the East.

It was an essential part of the scheme that Great Britain and rance should be urged to use their influence to keep Russia uiet; if they did not do so then the responsibility for any exten- on of the war which ensued would seem to attach to them; if ey did then the internal harmony of the Triple Entente would weakened; Russia would feel that she had been deserted by r Allies. It was hoped that these results might be obtained ithout a European war. If, however, Russia was determined meet the challenge and war resulted, it could be so arranged at the responsibility for the war should appear to fall on Russia d the Entente. The general condition of Europe was very reatening; it seemed probable that under any circumstances e "great war" must ensue shortly; it was believed that Russia ould be ready in about two years. If there was to be a war the mmer of 1914 seemed on the whole to be favourable to Ger- any. The Kiel Canal had been enlarged; the army was at the ight of efficiency; the diplomatic situation seemed favourable; ere were very serious labour troubles in Russia, serious par- mentary disputes in France, and it appeared as if there might on be open rebellion in Ireland, with possibly something ap- oaching mutiny in the British Army. It was indeed impossible depend on Italy; but if Bulgaria and Turkey could be won er this would counteract the uncertainty of Rumania's action.

German support having been secured, the Austrian Govt. oceeded to prepare the text of the demands to be presented to rbia. The great point was that they should be so drafted that ey would be unacceptable; the object was not a mere diplo- atic victory, but war; it was held that nothing would meet the uation and restore the authority and prestige of the monarchy ort of an effective display of military strength. It was agreed, wever, in consequence of the strong pressure used by Count sza, who alone was in opposition to the policy proposed, that e annexation of any part of Serbia, apart from a rectification the frontier, should be repudiated; on the other hand, as a sult of a successful war, portions of Serbia would be assigned to lgaria and Albania. On July 17, the final draft, having passed e Council of State, received the approval of the Emperor ancis Joseph, but it was determined to postpone its presenta- n till July 23; it would be better to delay until M. Poincaré, e French President, who was to visit the northern courts, had t St. Petersburg.

These arrangements were conducted in the greatest secrecy. l that was known outside was that Austria was contemplating me serious action against Serbia; this was naturally sufficient cause apprehension and anxiety, but, during the days of wait- g, the Austrian Govt. used its influence to damp down the ry violent denunciations of Serbia in the Viennese Press, and in her ways tried to still the vigilance of the other Powers. As e as July 19 they assured the Russian ambassador in Vienna at nothing dangerous to the peace of Europe was being under- ken, and in consequence he went on a holiday. The British vt. and nation, whose attention was preoccupied at the ment with the Irish problem, were inclined to regard the cal dispute between Serbia and Austria as not being one in ich they were vitally concerned. On July 16 the British am- ssador, Sir Maurice de Bunsen, was able to give Sir Edward ey a warning which was corroborated from unofficial sources. one the less, the belief that there would be a real danger of ropean war was slow in maturing in Great Britain, in spite the anxiety felt in a few well-informed quarters. This attitude s based on a belief that, after all, the German Govt. would not pport Austria in any reckless policy.

The Austrian Note.—The ultimatum was presented at 6 P.M. Thursday, July 23, by Baron de Giesl to Dr. Patchou, as Pasic, the Serbian prime minister, was absent from Belgrade. The note had been admirably drawn up to fulfil the avowed object that it should contain demands which could not possibly be complied with. It required that Serbia should first of all officially publish on the front page of the official journal a condemnation of the Serbian propaganda against Austria-Hungary, regret for the part taken by Serbian officers and officials in this propaganda, and a promise of amendment in the future. There were in addition 10 requirements, which included, among others, the dissolution of *Narodna Obrana*, the suppression of any publication which incited to hatred and contempt of the monarchy, the elimination from public instruction in Serbia (including the teaching body) of anything that served as propaganda against Austria-Hungary, the removal from the army and the administration of officers and officials guilty of such propaganda whose names might be communicated by the Austro-Hungarian Govt., the collaboration in Serbia of Austro-Hungarian representatives for the suppression of the movement against the territorial integrity of the monarchy, and that Austro-Hungarian representatives should take part in judicial proceedings against all the accessories to the plot of June 28 on Serbian territory. A reply was required by 6 o'clock on the evening of Saturday, July 25.

As was immediately pointed out by everyone who read this document, it would be impossible for the Serbian Govt. to accept all these demands; no such requirements had ever been directed to a fully sovereign state—in particular the requirement that unnamed officials should be dismissed on the request of the Austro-Hungarian Govt., and that Austro-Hungarian officials should take part both in police and judicial proceedings on Serbian soil, was clearly one impossible to be granted. There could be only one conclusion, that Austria intended to force a war with Serbia and that in doing this she had deliberately prepared to meet the opposition of Russia. But it was clear that Austria could not have taken this step without the previous consent of Germany. It was therefore at once concluded that the two Germanic Powers had determined immediately to challenge Russia, and with Russia, France, to a great trial of strength.

This view was supported by a note which on the following day was delivered at St. Petersburg, Paris and London, in which the German Govt. announced that they considered the procedure and demands of the Austrian Govt. to be both equitable and moderate. (It is now known that these words had been written at a time when the German Govt. did not precisely know what the demands of the Austrian Govt. would be. It did not occur to anyone outside that the Government of a great state could be guilty of such unparalleled levity; it was naturally assumed that they had seen and approved the text of the Austrian note beforehand, and all their disclaimers were received with incredulity.) The German Govt. also emphasised their opinion that the questions at issue between Austria and Serbia should be settled by these two states alone, and lastly they intimated that interference by any other Power would be followed by incalculable consequences. This could obviously mean nothing except that Germany was backing up Austria, would support her even in a war with Russia, and that a threat was intended to France and Great Britain that, unless they put themselves on the Austrian side and brought pressure to bear upon Russia to withdraw her support from Serbia, a European war would result.

The news reached St. Petersburg just after M. Poincaré had left. The secrecy with which the ultimatum had been engendered, the misleading assurances, the absence of any warning to or consultation with other states, all seemed to point to a deep-laid plot. The reaction was precisely what was to be anticipated. The greatest indignation was expressed and the indignation was genuine. M. Sazonov at once asked for assurance that he should have the full support of France and Great Britain against this unparalleled act of aggression; the only method of avoiding war with Germany was, he said, that Germany should know that she would be confronted by the united forces of the Entente. At the same time Russian military preparations were at once begun; it was decided at a meeting of the Russian Council of State on July 25 that all preliminary steps should be taken and that Sazonov should be authorised to give the signal for mobilisation as soon as it seemed to him necessary. Meanwhile, a public communiqué was issued that Russia could not remain indifferent to the fate of Serbia. Similar language was used in private and official interviews. From the beginning it was clear that Russia intended to resist the Austrian scheme, by war if necessary.

In these circumstances much depended on the action of Great Britain. During these days France could do little, for the President and the Foreign Minister were at sea. Russia and France both pressed Sir Edward Grey to declare himself. The situation was a difficult one. He clearly could not, as the Russians asked, give an unconditional promise to join with Russia if war ensued; by doing so he would incur the danger of increasing the influence of the war party which undoubtedly existed at St. Petersburg. Moreover, he would not have the full support of the Cabinet, nor apparently of the country. On the other hand, he could not give the promise of neutrality which Germany asked for, nor could he even press Russia too strongly to suspend her military preparations, for, by so doing, he would in fact be giving his support to an act of aggression against a State with which he was in the closest diplomatic agreement. He therefore saw from the beginning that the only possible means of avoiding a European war was to bring about some form of mediation or conciliation by which time would be gained; then some means might be found of settling the crisis in a peaceful way. For the next five days, supported by France, he pursued this path with energy and resource. In accordance with the practice of the last years he depended on the co-operation of Germany. To intervene directly between Austria and Serbia was out of the question; if Russia became involved the only remedy would be joint action of Great Britain and Germany. He knew that he had the support of Prince Lichnowsky, the German ambassador in London; he hoped for the co-operation of the German chancellor; he did not know how fundamental was the difference between the German ambassador and his Government.

His first suggestion was that Austria should give Serbia more time, and not, as was threatened, break off diplomatic relations if Serbia did not accept all the requirements of the ultimatum by 6 o'clock on Saturday, July 25. This proposal, which was supported by Russia, received no support in Germany, and in fact reached Vienna almost too late. It was at once rejected there. The Serbian answer was actually delivered at the appointed hour on July 25. It was very conciliatory. It went to the furthest possible extreme in compliance; every demand was granted with the exception of two, the dismissal of unspecified officials and officers and the co-operation on Serbian soil of Austrian officials. The Austrian minister, however, at once, in accordance with his instructions, left Belgrade. Sir Edward Grey now began to press for mediation, not between Austria and Serbia, but between Austria and Russia, by the four Powers, Great Britain, Germany, France and Italy. On July 26 he converted this into a firm proposal for submission of the points at issue between Austria and Russia to a conference of the ambassadors in London. This proposal was rejected by the Germans on the ground that they could not ask Austria to submit to what would in fact be an Areopagus of the Powers. They also would prefer separate conversations between Austria and Russia, which Sazonov had accepted.

The text of the Serbian answer to the Austrian note was received in London on July 27. Sir Edward Grey at once pointed out that this reply could surely be made the basis of negotiations, and pressed that, if Austria continued her intransigeant attitude, it would appear that she was deliberately aiming at war. These representations were fully reported to Berlin by Prince Lichnowsky, who warned the German Govt. that, if they continued their negative attitude, they would no longer be able to depend upon the neutrality of Great Britain. They were without effect. The German Govt. indeed on July 27 forwarded Sir Edward Grey's proposals to Vienna, but at the same time they informed Count Szgöyény, the Austrian ambassador, that they did so merely because they did not wish to alienate Great Britain, and in no way associated themselves with the proposals, which they did not wish to see adopted. The negative attitude of Berlin, the apparent refusal to do anything to restrain Austria, inevitably produced the conviction that Germany was no longer working for peace. If this were so there then remained only one means of avoiding war, that Great Britain should give a formal warning that in the event of war she would be found on the side of Russia and France. This was from the beginning strongly urged both at Paris and St. Petersburg; a first step in this direction was the order given to the British fleet (which had been assembled for manoeuvres) not to demobilise; this order was made public on July 28.

However, on the morning of July 28, some change became apparent in the German attitude. The Kaiser had returned to Potsdam from his North Sea cruise on the afternoon of July 27. There was at once laid before him the text of the Serbian answer, which, owing to very serious delay, for which the Austrians were responsible, had not reached Berlin until that day. He saw that it left to the Austrians no defensible ground for a declaration of war. "A brilliant achievement; this is more than could have been expected. A great moral success for Vienna, but with it every ground for war disappears, and Giesl ought to have remained quietly at Belgrade. I would never have ordered mobilisation." He therefore, on the morning of July 28, caused to be sent to Vienna a proposal that Austria should be satisfied with the occupation of Belgrade and a defined limit of territory, and should issue her demands from there. This would give to the military feeling of Austria that satisfaction which they might reasonably demand. As was pointed out: "If Austria continues her refusal to all proposals for mediation or arbitration, the odium of being responsible for a world war will in the eyes of the German people fall on the German Government. On such a basis, however, a successful war on three fronts cannot be started and carried through." The weakness of this proposal was that it was based on the assumption that war with Serbia would have begun; but as soon as war began, clearly Russia must mobilise. No settlement could be successful unless it provided for a mutual understanding as to the military measures to be taken on both sides. The Emperor's proposal assumed that while Austria began a war with Serbia, Russia should cease all military measures. This clearly was impossible.

Austrian Declaration of War against Serbia.—Russian mobilisation was in fact becoming imminent. The preliminary work had proceeded rapidly; reports came to Germany from all parts of the Russian Empire showing the activity of the preparations. The Russian position never changed. They would not proceed to the next stage until Austria took overt action either by a military advance or declaration of war. As soon as she took either of these steps, Russia would mobilise part of her forces. This contingency was realised on Tuesday, July 28. Austria had issued an order for the mobilisation of eight army corps on July 26, and now sent a declaration of war against Serbia in an open telegram to Belgrade. The Austrian Govt. had informed Germany of their intention to do this the day before, but no warning or suggestion that some delay would be useful was given. Germany in fact was now beginning to experience the results of the very ill-considered language used three weeks before; the Kaiser had insisted then on the necessity for rapid and vigorous action; to press now for moderation and delay would have exposed him to the charge of vacillation which on other occasions his actions had appeared to justify, and from which he had boasted that on this occasion he would be free.

As soon as the news of the declaration of war reached St. Petersburg it was decided that partial mobilisation must follow; the German and other Governments were immediately informed. This decision was confirmed when on the same day the Austrians broke off the separate conversations with Russia which Sazonov had suggested, giving as a reason the declaration of war with Serbia, an act for which they themselves were entirely responsible. Even now, however, there was a delay of 24 hours. The next morning news came that the Austrians had begun to attack and were bombarding Belgrade. Further delay seemed impossible. The military authorities, however, strongly urged that par-ial mobilisation against Austria alone would have fatal effects. f there was to be war, Russia would certainly have to meet Germany as well as Austria, but if partial mobilisation had once begun, the change to general mobilisation would for technical easons produce a complete state of disorganisation. The Tsar herefore apparently, on the morning of Wednesday, July 28, igned two orders, one for partial and one for general mobilisation. t was still left open which should be used. About 7 o'clock that vening Count Pourtalès called on Sazonov, and under instrucions from the German chancellor warned him that any further military preparations or mobilisation would involve German mobilisation, and that German mobilisation meant war. This message was so worded that it seemed to prohibit even partial mobilisation against Austria. The German explanation is that t was meant as a friendly warning, but it was taken, not unnaturally, as something in the nature of an ultimatum.

Meanwhile there was great anxiety in Berlin. The Government were not well informed as to the intentions of Austria, and nswers to telegrams were long delayed. There was also a serious divergence between the political and military authorities. The general staff were becoming very nervous. If there was to be war it was essential that it must begin at once in order that they might gain the advantage which came from their higher stage of military preparation. Every day that elapsed would have the esult of enabling Russia to enter the campaign sooner than had been anticipated. On the other hand, from the political point f view, especially having regard to the effect on public opinion n Germany and in Great Britain, it was most important to avoid ction which might appear provocative. Matters must be so rranged that the appearance of aggression would fall upon Russia. The whole situation appears to have been discussed in a ouncil which met at the palace at Potsdam on the evening of uly 29. There is no authentic record of the discussion, but it is lear that a demand was made by the general staff for immediate mobilisation, and was refused.

It was, however, determined to make a strong effort to avoid he danger, which was becoming more apparent, of active British ntervention in the war; with this object, that very evening etween 9 and 10 o'clock, the German chancellor sent for Sir Edward Goschen, the British ambassador, and made him a trong offer for British neutrality. In return for this Germany would be prepared to promise that in the event of a successful war no part of France would be annexed by Germany. This uggestion was, of course, the next day indignantly refused. Scarcely, however, was the interview over when a fresh telegram rom Prince Lichnowsky was received, containing a friendly warning from Sir Edward Grey that, if war resulted, England would probably not be able to keep out of it. This produced omething like consternation. The negotiations with Austria as o Italy had not been proceeding favourably, and all the information seemed to show that Italian support would *not* be orthcoming. The very same night three additional telegrams were dispatched to Vienna couched in the most pressing and rgent terms, exhorting the Austrian Govt. not to continue their efusal against all projects of mediation; if they did so they would be dragging Germany into a European war, in which Italy would not be on the side of the Triple Alliance and in which Great Britain would be among the enemies—a war, therefore, which would be fought under the most unfavourable conditions.

Russian and German Mobilisation.—Among the numerous other telegrams sent out from Berlin on this evening was one from he Kaiser to the Tsar, again impressing on him in the strongest erms the danger of mobilisation. In consequence the Tsar, about 9 o'clock, counter-ordered general mobilisation sent out about midnight. (The statement made in 1917 that the Tsar's orders were disobeyed by General Sukhomlinov, the Minister of War, was untrue.) This decision caused the most serious anxiety n military circles and at a meeting held the next day, July 30, after a long discussion they succeeded in persuading the Tsar, against his will, to reconfirm the decision of the previous evening hat general mobilisation was to be proceeded with. The notices were put up throughout the Russian Empire during the course of the night, and on the following morning the fact was public. There was, however, some delay in communicating it abroad; the news does not seem to have reached either Paris or London until very late in the afternoon. It reached Berlin shortly after midday. The Kaiser at once left Potsdam for Berlin and ordered the proclamation of *Kriegszustand*, the first step before mobilisation; a telegram was also sent to Pourtalès that he should immediately call on Sazonov and inform him that unless the order for general mobilisation was recalled within 24 hours Germany would consider herself at war with Russia. No answer was given; German mobilisation was proclaimed the next day, Saturday, Aug. 1, and war was declared at 5 o'clock in the afternoon.

The Russian order for general mobilisation seems on all grounds to have been ill-advised; from the military point of view delay was advantageous to Russia. Politically it provided the German Govt. with the pretext which was essential to them: for the moment it appeared as if Germany was defending herself against a Russian invasion; the solidarity of the nation was secured and even the Socialists ceased their criticism and opposition. It was this which made the Reichstag, which assembled on Aug. 3, almost unanimous in its support of the war measures laid before it. It also destroyed any slender possibility of still avoiding war. The decision seems to have been due not so much to any deliberate desire for war, as to the state of nervous panic which prevailed in the sinister situation by which Russia was suddenly confronted, owing to the provocative and menacing action of Austria and Germany; there was no cool and balanced judgment or strong hand to exercise control.

The extreme rapidity with which these events took place frustrated all the efforts at mediation which were in progress. Sir Edward Grey had put forward a new plan, very similar to the German Emperor's proposal that Austria should issue her terms from Belgrade, but he had accompanied it by conditions which if accepted would have got over the mobilisation difficulty. This had been communicated by Berlin to Vienna, but no answer had been received when Germany, by her ultimatum, broke through all the negotiations. None the less, even as late as Saturday, Aug. 1, this and other suggestions continued to be the subject of an interchange of telegrams. They had, however, no practical importance. There is indeed no indication that, so far as Austria was concerned, the postponement of the Russian general mobilisation would have had any effect upon the final issue. The order for general mobilisation was determined on the afternoon of July 30, and issued on July 31, before Russian mobilisation was known.

France and Germany.—In accordance with the terms of the Franco-Russian Alliance, an aggressive war declared by Germany against Russia inevitably entailed war with France. The French President, M. Poincaré, and the premier, M. Viviani, reached Paris on the evening of July 29; they at once telegraphed to Russia that France would fulfil the obligations of her alliance, while continuing her efforts to preserve peace. From the beginning of the crisis France had, like all other nations on the continent of Europe, immediately begun all the necessary military preparations. Even the smaller states, such as Holland, had from the beginning of the week been doing the same thing. The Austrian ultimatum to Serbia was an act of such a nature that, followed as it was by the rupture of diplomatic relations and the declaration of war, no responsible Government could afford to lose a moment in carrying through every measure short of the final act of calling up the reserves, to which the name of "mobilisation" is generally given. Suffice it to say that by July 31, the French and German covering troops on the frontier were both in position. The French, however, in order to avoid any untoward incident, took the precaution of keeping their troops 10 km. from the frontier.

This was not imitated by the Germans, and in fact could not be, for the great fortress of Metz was actually on the frontier, and there seems no doubt that before July 31, on several occasions, German troops had crossed the French frontier. The Russian mobilisation, the consequent German mobilisation, and the declaration of war against Russia, made it imperatively necessary for the German Govt. without any delay to settle the issue with France. The basis of their whole plan of operations was an instantaneous invasion of France. They therefore could not allow a day to pass unused; if there was to be war with France, it must come at once. Accordingly at 7 o'clock on July 31, Herr von Schoen, the German ambassador, called on M. Viviani and announced that he would come again the next day to learn what the attitude of France would be in case of a war between Germany and Russia. He came in consequence on Aug. 1, and was informed merely that "France would do that which her interest dictated." French general mobilisation was ordered on Aug. 1, at almost exactly the same time as that of Germany. It would have been natural that the actual declaration of war by Germany should immediately have followed; it was, however, delayed for two days, partly in consequence apparently of a misunderstanding which arose in London. Lichnowsky telegraphed that he had received an inquiry whether Germany would stand out if England secured the neutrality of France. What seems to have been meant was an idea that both France and Germany should remain neutral, leaving Austria and Russia alone at war; this was misinterpreted as a suggestion that France should remain neutral in a war between Germany and Russia. Nothing could have been more favourable to Germany than this, but subsequent revelations have shown that even French neutrality alone would not have been accepted by Germany. Herr von Schoen was instructed, if France promised to remain neutral, to demand that she should hand over the fortified cities of Toul and Verdun to Germany as a guarantee. That such a proposal should ever have been seriously entertained shows how abnormal was the mentality of Berlin. There was never the slightest doubt that France could not leave Russia unprotected against a combined attack from both Germany and Austria.

The situation at the end of the week was a very anxious one in Paris. War with Germany was now certain, and France might anticipate that within a few days the whole force of the German army would be thrown against the frontier. The future of France seemed to depend upon the action of Great Britain. But in London all seemed uncertain. The strongest representations were made by M. Cambon to Sir Edward Grey, and the President of the French Republic addressed an autograph letter to King George urging the vital necessity for help from England. No promise could be given. The British Cabinet were then divided. Neither they nor, as was thought, the country would have approved of the interference of Great Britain in a continental war in which her interests and honour were not immediately involved. Though Great Britain could not stand by and passively watch the defeat and dismemberment of France, this might be a reason for preparing to intervene if at any time it became necessary, but not for taking part as a principal from the beginning. There was indeed one point in which, admittedly, both British interests and British honour were closely concerned, viz.: the neutrality of Belgium.

Great Britain was bound by the Treaties of 1839 to intervene if either party to a war violated that neutrality. Following, therefore, the precedent of 1870 Sir Edward Grey, on July 30, addressed a message both to the French and the German Governments, drawing their attention to this point and asking for assurance that Belgian neutrality would be respected. The answer from France was quite satisfactory. The German Govt., on the other hand, said that they were unable to give any answer to the question. On Sunday, Aug. 2, Sir Edward Grey, on his own responsibility, without obtaining the consent of the Cabinet, took another step. He informed the French that if a German fleet attacked France in the Channel or the Atlantic, Great Britain would immediately intervene with her fleet. Apart from the Belgian question, it would still have been possible for Germany to keep Great Britain neutral by limiting the war against France to land operations, and it would clearly have been in her interests to do so.

All then seemed to depend on the Belgian question. On Monday, Aug. 3, the German Govt. formally declared war against France. The actual reasons given were statements that the French had violated German territory by dropping bombs from aeroplanes, and in other ways. The German Govt. has since acknowledged that these statements were untrue. Meanwhile it became known in London (Aug. 2) that German forces had crossed the Luxembourg frontier and occupied the Grand Duchy, the neutrality of which was guaranteed by the Great Powers, Germany herself included; and also that the German minister at Brussels (as Sir E. Grey told the House of Commons on Aug. 3) had delivered a note to the Belgian Govt. demanding free passage for their troops across Belgian territory; if this was granted they undertook to leave Belgium at the end of the war with her independence and territory unimpaired, and in fact held out hopes of increase of territory at the expense of France, either in Europe or in the colonies. If the request was refused, Belgium would be treated as an enemy. An answer was required within 12 hours. This action was excused by the statement that the German Govt. had reliable information that French forces intended to enter Belgium. But it is now known that the whole note, including this statement, had been drafted more than a week before by the general staff. After a midnight sitting of the Belgian Council of State, presided over by the King, a refusal was handed to Herr von Below. Before this happened German troops had already crossed the frontier, and in consequence Herr von Below received his passport and was requested to leave the country immediately.

These events were decisive for Great Britain. All the doubts by which the Cabinet and large sections of the country had been assailed during the previous week were at once swept aside. On the afternoon of Aug. 3, Sir Edward Grey explained the menacing nature of the situation to the House of Commons, and on the next day (after a further statement in Parliament by the Prime Minister) an ultimatum was dispatched to Berlin requiring the German Govt. to respect Belgian neutrality. This was presented by Sir E. Goschen to Herr von Jagow; as the request was refused, he demanded his passport, and war between Great Britain and Germany began at midnight (Aug. 4–5).

Bibliography.—The chief authority for the events dealt with above is the official correspondence published by the various Governments. A translation of the full text of all documents published at the beginning of the war will be found in *Collected Diplomatic Documents relating to the Outbreak of the European War*, printed by the Stationery Office (1915). Fuller publications have now been made by the British, German and Austrian Governments: *The Outbreak of War—Foreign Office Documents (June 28–August 4 1914)*, collected and arranged with introduction and notes by J. W. Headlam-Morley; *Die Deutschen Dokumente zum Kriegsausbruch*, collected by Karl Kautsky (4 vol., Berlin, 1919 *seq.*) English tr. "*Official German Documents relative to the World War*" (Carnegie Trust Endowment, Washington, 1923); *Diplomatische Aktenstücke zur Vorgeschichte des Krieges 1914* (Österreichisch-Ungarisches Rotbuch); Goos, *Das Wiener Kabinett und die Entstehung des Weltkrieges* (Vienna, 1919); Romberg, *The Falsifications of the Russian Orange-book* (English trans., London, 1923). In addition to the works referred to on pp. 1039–40, see Renouvin, *Les Origines immédiates de la Guerre* (1925); Montgelas, *The Case for the Central Powers* (London, 1925); Seton-Watson, Sarajevo, *A Study of the Origins of the War* (London, 1926). The very numerous works which appeared during the War are to a great extent superseded owing to the further information which is now available. (J. W. H.-M.)

III. THE WAR PERIOD

The Formation of the Alliances.—A month after the declaration of war by Austria-Hungary on Serbia (July 28 1914)—hostilities had already begun—France, Great Britain, Russia, Serbia, Montenegro and Japan (since Aug. 23) stood against Germany and Austria-Hungary. On Sept. 5 1914 the Entente between France, Britain and Russia was transformed in London into a treaty by which the signatories undertook the obligation, amongst others, to conclude no peace with the enemy except in concert.[1] Germany and Austria-Hungary were pledged to common action by the Treaty of Oct. 7 1879, which was still in force at the outbreak of the War, and by the Triple Alliance, which had been renewed for the fourth time on Dec. 7 1912.[2] Italy, ne third signatory to the latter Treaty, replied to the request of e Central Powers for her co-operation that no *casus foederis* ad arisen for her, since Austria-Hungary had taken the offensive gainst Serbia. When the conflict between Austria-Hungary and erbia developed into the World War, the Italian Govt. promised enevolent neutrality, leaving the question open whether Italy ould not range herself on the side of her Allies at some later ate. Italy made this support, however, contingent on conditions hich the persons in charge of Austro-Hungarian policy de- ared utterly impossible. The negotiations of the Central owers with their second Ally, Rumania, had been no more rtunate. The hopes which the Emperor William, in particular, ad entertained of King Charles were disappointed. The ma- ority of influential Rumanian politicians were too friendly to the ntente, the old differences with the Habsburg Monarchy too eep, for King Charles to be able to fulfil the obligations under- aken in the secret treaty of 1883 with the Central Powers, which ad been renewed for the fourth time in Feb. 1913.[1] Francis oseph I. and William II. themselves brought their personal in- uence to bear on King Charles at the beginning of Aug., and fered him, amongst other inducements, the acqusition of Bessa- abia after the successful termination of the War, in return for umania's active participation on the side of the Central Powers. was in vain; the Crown Council of Aug. 4 decided that no *sus foederis* had arisen for Rumania, and she therefore preserved eutrality for the time.

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[1] *Parliamentary Papers*, Cd. 7737.

[2] For texts, see Pribram, *Die Politischen Geheimverträge Oesterreich-Ungarns, 1879–1914* (Vienna-Leipzig, 1920), pp. 3–9, 101–106.

The Central Powers were rather more fortunate in their quest r new Allies. On Aug. 1 1914 the representatives of Germany nd Turkey signed a treaty whereby the latter undertook to emain neutral should the conflict confine itself to one between ustria-Hungary and Serbia, but to join the Central Powers as belligerent should war break out between them and Russia. oon after, when Russia's entry into the War was assured, the entral Powers increased their offers. They held out a promise the Sultan—not, indeed, in writing—that his participation in e War would be rewarded on its successful close by the abo- tion of the capitulations which were so unpopular in Turkey, a vourable rectification of Turkey's frontier, and a proportionate are in any war indemnity obtained from the Allies. Meanwhile e representatives of the Western Powers in Constantinople ere making every effort to prevent Turkey from joining their emies. They were prepared to guarantee the Sultan's territory nd to meet his wishes regarding the capitulations in return for his eutrality. The Sultan and the Grand Vizier returned cour- eous answers to these offers, but decided finally for the Central owers. At the end of Oct. Turkey commenced hostilities gainst Russia; Russia answered by declaring war; the Western owers followed suit.

The attitude of Bulgaria proved a great disappointment to e Central Powers. Austria-Hungary had long been engaged negotiations with Bulgaria, and these were so far advanced at e beginning of Aug. 1914 that she confidently expected the eaty to be concluded almost immediately. In return for his ctive assistance in the War the Central Powers were prepared ot merely to guarantee King Ferdinand his existing territories, ut also to satisfy his comprehensive ambition to establish Bul- aria's "ethno-historical frontiers" at the expense of such of the alkan States as did not ally themselves with the Central owers. But King Ferdinand and his Government refused to nter on a war with Serbia until they were sufficiently guaranteed y treaty that the opening of hostilities against Serbia would not volve them in an attack from their neighbours, Greece, Ru- ania and Turkey. The assurances offered by the Entente for ulgaria's alliance, or even her benevolent neutrality, contributed this attitude. In Aug. 1914, Noel Buxton, chairman of the alkan Committee, had semi-officially sounded the Bulgarian ovt. as to whether it would accept a revision of the Treaty of ucharest and a loan in return for armed neutrality. At the same me Sazonov urged Pasic, the Serbian Minister President, to ake Bulgaria territorial concessions in Macedonia if this would duce her to take the field against the Central Powers. Undoubtedly, however, the hesitations of the Sofia Govt. were largely due to the wish not to commit itself until one or the other group of combatants should have proved definitely superior in the field. Meanwhile, the Central Powers had been disappointed in their hopes of bringing the War to a speedy end by force of arms. Moreover, the consequences of the economic warfare to which the Allies, particularly Britain, had resorted were becoming felt. Germany had lost a great part of her overseas possessions, and the Central Powers had suffered considerable economic losses of the most varied nature.

The entry of Turkey into the War afforded them a very respectable addition to their fighting forces, and something even more important. The hand which commanded the Dardanelles controlled the sea route between the granaries of Russia and the industrial states of the West. An enemy in Mesopotamia and Mount Sinai could threaten Britain in India, Egypt and the Suez Canal. As suzerain of many Indian Mahommedans who revered the Sultan as their spiritual head, Britain, and France too, had to reckon with the solidarity and hostility of the Pan-Islamic movement. Britain at once took the necessary measures of precaution. She declared that she would annex Cyprus, proclaimed a protectorate over Egypt, declared the Khedive Abbas, who was the Sultan's partisan, deposed, and set the son of Ismail on the throne of Egypt in his stead.

Russia, unlike the Western Powers, found the idea of a war with Turkey not disagreeable. A victory held out prospect of rich spoils; above all, Constantinople and the Dardanelles. And the Western Powers showed themselves prepared to fulfil Russia's wishes. During the negotiations which occupied the succeeding months, Russia, encouraged by the success of her armies against those of Austria-Hungary, increased her demands. In a memorandum which she presented at the beginning of March 1915 she claimed as reward for a successful war Constantinople, the west coasts of the Bosporus, of the Sea of Marmora and of the Dardanelles, Thrace as far as the Enos-Midia line, the coast of Asia Minor between the Bosporus and the River Sakaria and the islands in the Sea of Marmora with Imbros and Tenedos. The British and French Govts. demanded in return that Constantinople be declared a free port for the transit of goods not originating from or bound for Russian ports, that free passage be guaranteed to their mercantile marine through the Straits, that their territorial claims to districts in Turkey in Asia, to be exactly defined later, be recognised. The holy places were to be put under independent Mahommedan rule, the north zone of Persia to be in the British sphere of influence. Russia agreed with all essential demands of the Western Powers, whereupon the latter gave their written consent on March 12 1915 to Russia's annexation of Constantinople and the Straits.[2]

Meanwhile hostilities had commenced between the Turks and their enemies, in which the former gave evidence of skill and endurance, but were hampered by shortage of arms and material of war. Their allies in Central Europe would have helped them here, but it was not easy, as they had no secure land route to Turkey; the countries in the way, especially Rumania, were by no means willing to conform to the wishes which the Central Powers expressed in this matter. It was therefore the more urgently necessary for the latter to persuade Rumania and Bulgaria, or one of them at least, to enter the War on their side. Negotiations to this effect had been in progress since the autumn of 1914, but remained without result as the reports which reached Sofia and Bucharest from the theatres of war ran unfavourably for the Central Powers. The representatives of the Entente Powers in Rumania gained ground. On Oct. 1 (Sept. 18 O.S.) an agreement had been concluded between Russia and Rumania, whereby Rumania pledged herself to benevolent neutrality towards Russia in return for a guarantee of her existing territory and the right to incorporate the Rumanian-speaking districts lying within Austro-Hungarian territory. On Sept. 23 the Rumanian statesmen made a compact with those of Italy to regulate their attitude to the belligerents in concert and unison only. At the same time they had carried the negotiations with the Central Powers further, but had increased their territorial demands. To these the Austro-Hungarian Govt. gave a firm refusal. So at the beginning of Oct. 1914 Rumania's entry into the camp of the Entente Powers, who had been lavish with their promises seemed imminent. Yet the fear of an attack from their neighbours, Bulgaria and Turkey, and the deathbed resistance of the old King, at last restrained the Government from declaring for war against the Central Powers, and determined it to abide by its neutrality for the time.

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[1] Pribram, *op. cit.*, pp. 107–111.

[2] For text of this Constantinople Agreement, see H. W. V. Temperley, *History of the Peace Conference at Paris*, vol. 6, pp. 4–9.

This attitude was preserved by Ferdinand, who succeeded to the throne when King Charles died on Oct. 10, although his personal sympathies were with the Entente and the influence of most of his ministers and of his wife pointed in the same direction. In the course of the winter 1914–5 the negotiations with the Central Powers were continued, but the Rumanian statesmen increased their demands, which now included, not merely the Bukovina, but Transylvania as well. In Feb. 1915 the agreement of Sept. with Italy was renewed and expanded; the two Powers now guaranteed each other mutual help in case of an unprovoked attack from Austria-Hungary. When the Government in Vienna rejected Rumania's comprehensive territorial demands, the outbreak of war seemed inevitable; but although Italy declared war on May 23rd 1915, the military revival of the Central Powers in Galicia just stopped Rumania from following her example.

As the prospects that the Central Powers would persuade Rumania to enter the World War on their side diminished, so their anxiety grew to secure Bulgaria as an ally. They needed her to secure a safe passage for the arms and materials of war which Germany had promised Turkey in the treaty of Jan. 11 1915, to which Austria-Hungary had adhered on March 21; to keep Rumania in check; and to take an active part in the coming campaign against Serbia. Throughout the spring Austria-Hungary had refused to grant Bulgaria's steadily increasing demands. But in the summer the views of Ferdinand and his advisers changed. They recognised the fact that the Central Powers—not to speak of the great improvement in their military situation—had nothing to prevent them from gratifying Bulgaria's territorial ambitions, especially those relating to Serb territory in Macedonia, while the Allies had always to fear that equal concessions on their part to Bulgaria must deeply offend their faithful ally Serbia. Their representatives in Sofia made the attempt all the same. As early as May, after the failure of the first attempts to force the Dardanelles, they had told Bulgaria that if she would attack Turkey she might occupy and retain Thrace up to the Enos-Midia line. Furthermore, they pledged themselves to bring pressure to bear on Greece to cede Kavalla, promised financial assistance, and were prepared to guarantee Bulgaria South Macedonia on condition that she only occupied it after the conclusion of peace and after Serbia had been previously compensated by Bosnia and Hercegovina and on the Adriatic coast.

This point far more than all the others brought their plan to nought. Under the pressure of the Western Powers, the Skuptchina declared itself ready on Aug. 16 1915 to cede Macedonian territory to Bulgaria, but insisted that it could only be handed over after Serbia was already in possession of those parts of the Habsburg Monarchy which the Allies had destined as compensation for her, while even in June Bulgaria had demanded from the Entente Powers that the Macedonian districts in Serbia's possession be handed over to her immediately. So the balance in Sofia inclined ever more towards the Central Powers. None the less, difficult negotiations were still to follow before the treaties were signed on Sept. 6 1915 which ranged Bulgaria definitely in the camp of the Central Powers and Turkey. Her reward was the guarantee of her independence and existing frontiers, a large loan and the assurance of the annexation of east Serbia and the greater part of Macedonia. In return she pledged herself to place at least four divisions at the service of the Central Powers in the offensive which was being planned against Serbia. In addition, Bulgaria was promised that if Rumania or Greece made an unprovoked attack on her, the districts which she had ceded to these Powers in 1913 by the Treaty of Bucharest should be restored to her. On the same day, the reconciliation between Bulgaria and Turkey, for which the Central Powers had worked so hard, was perfected, the Sultan having consented to a rectification of the frontier on both sides of the Maritsa in Bulgaria's favour. The line of communications between the Central Powers and Turkey was now open and the campaign against Serbia could commence.

The acquisition of Bulgaria was a success for the Central Powers, but could not compensate for the loss they had suffered some months previously when Italy passed over to their enemies. While both groups of combatants had vied for Italy's support since the outbreak of war, her statesmen had at first adopted an attitude of reserve towards both alike. They had assured their Allies of their intention to keep to the spirit and letter of the Triple Alliance, but at the same time they had nourished the hopes of the other side and meanwhile had armed busily. But the further their preparations for war had advanced, the larger were the demands which they made from both sides. From the Habsburg Monarchy they required territorial concessions which grew ever more extensive. They began with the Trentino; but as the negotiations went on, as the reluctance of the Austrian Govt. to give up home soil was overcome by the unfavourable military situation and the ceaseless pressure from Germany, Italy's claims grew enormous.

At the same time she negotiated with the Allies. They, too, especially Russia, found Italy's demands difficult of fulfilment, and saw that to grant them must lead in the future to complications with other allies, especially with Serbia. But the resistance of the Entente diplomats grew less as the course of the campaign showed ever more clearly that they could not dispense with Italy's help if the War was to be brought, as they hoped, to a speedy and successful conclusion. And as the Italian statesmen saw more and more hope that their demands, which were exactly formulated at the beginning of March 1915, would be accepted by the Allies, they increased their pretensions to Austrian territory. In April 1915 they demanded from the Court at Vienna as the price of their neutrality for the duration of the War—there was no more talk of active participation on the side of the Central Powers—not only South Tirol, Gorizia and Gradisca, a number of the most important Adriatic islands, complete sovereignty for Italy over Valona, Austria-Hungary's "désintéressement" in Albania and the proclamation of Trieste and its surroundings as a territory independent of Austria-Hungary, but also the immediate occupation by Italy of the Austrian districts.

The last-named demand was definately refused by the Vienna Cabinet, but in view of the dangerous military situation of the moment, and at the urgent request of the German statesmen and generals, who were even reinforced for the time by Conrad von Hötzendorf, then Austria-Hungary's leading military authority, the Cabinet continued the negotiations and made one concession after another. But the Italian Govt., strongly pressed by the representatives of the Allies, who finally agreed to all Italy's demands, but insisted on a quick decision, dragged on the negotiations with the Central Powers, and finally, on April 26, signed the Treaty of London, by which Italy pledged herself to enter the War on the side of the Allies within a month. Her reward was to include the Trentino, South Tirol up to the Brenner, Gorizia and Gradisca, Istria, the town and district of Trieste, North Dalmatia, numerous islands off the Adriatic coast, Valona, the twelve islands off the coast of Asia Minor, the protection of her interests in the Mediterranean and possibly the annexation of Adalia, the extension of her possessions in Eritrea, Somaliland and Libya; a loan of £50,000,000 on easy terms; in case of a successful end to the War a due proportion of the war indemnity and the promise that the Pope should have no say at the conclusion of peace or in any other question affecting the War.[1]

After the conclusion of this Treaty, Italy continued her ne-otiations with the Central Powers. Burian, who had succeeded erchtold as Austro-Hungarian Foreign Minister in Jan. 1915, vain increased his offers in the attempt to change the attitude the Italian Government. On May 3 Italy denounced her eaty with Austria-Hungary; three weeks later, on May 23, e declared war. Germany broke off diplomatic relations with aly, but war was not formally declared between these two owers, since a few days before Italy's declaration of war on ustria-Hungary they had made agreements directed to the aintenance of certain economic relations. Italy only declared ar on Germany on Aug. 27 1916, the day of Rumania's entry to the camp of the Allies.

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[1] For full text see Temperley, *op. cit.*, vol. 5, pp. 384–393. *See also* below, EUROPE: INTERALLIED DIPLOMACY.

After the conclusion of their treaty with Bulgaria on Sept. 6 915, the Central Powers reopened their campaign against erbia, whose situation now became most difficult. The state of fairs was such that the Western Powers, although prepared to nd help to their Ally, could do so only through the Greek egean port of Salonika. The attitude of Greece was therefore l-important. The Minister President in Athens, Veniselos, nce the outbreak of war, had worked tirelessly to make Greece de with the Western Powers. King Constantine, however, uner the influence of his wife, who was William II.'s sister, refused ost firmly to adopt his Minister President's policy, and disissed him in March 1915. But the new elections in the summer f 1915 brought a majority for the friends of the Allies; the King as obliged once more to entrust the new Ministry to the leaderhip of Veniselos, who made every effort to force Constantine to in the enemies of the Central Powers unreservedly. The King, ortified by the loyalty of his military party, succeeded in mainaining his policy of neutrality. Veniselos resigned a second time.

But meanwhile, he had conducted the negotiations with the llies so far that the first troops from the Dardanelles force could nd at Salonika on Oct. 5 1915, although Greece made a formal rotest. But they came too late. The campaign which the entral Powers and Bulgaria had conducted against Serbia nded in their complete victory, despite heroic resistance. Beore the end of 1915 the whole of Serbia was in their occupation. oon after the Austro-Hungarian troops conquered Montenegro nd northern Albania. The Central Powers had further great ictories to report on other theatres of war, especially against ussia; at the end of 1915 they had occupied Congress Poland, ithuania and Courland. Yet they had won no victory which ould determine the issue of the War, and both sides made the ost extensive preparations to resume hostilities in 1916. Great ritain succeeded in bringing about a breach between Portugal nd the Central Powers in Feb. 1916; but all the efforts of the entral Powers failed to persuade Rumania to abandon her eutrality in 1915, since Tisza's attitude made territorial conessions as a price impossible; although such concessions were rged by the German Govt. and Supreme Command and also by onrad von Hötzendorf.

In June 1916 the great success of the Russians over the Austroungarian troops at Luck and Okna had a deep effect on the umanian Government. The friends of the Allies now preonderated. The negotiations with the representatives of the llies were resumed, and led, especially after France had suceeded in smoothing over certain hesitations felt by Russia, o the conclusion of the Treaty of Aug. 17 1916. Rumania vas promised the acquisition of the Bukovina, Transylvaia, the Eastern Banat and a number of other Hungarian *omitates.* A military convention was concluded on the same day etween the Entente Powers and Rumania. Ten days later Rumania declared war on Austria-Hungary, and opened up hosilities immediately. The Central Powers took up the challenge vith such complete success that by the end of 1916 a very great part of the country was in their hands.

This was only one of the many successes gained by their roops in 1916; but the situation of the Quadruple Alliance developed less favourably in the non-European theatres of War, notably Turkey in Asia and German East Africa. Even more serious to the Central Powers were the growing economic privations, the consequences of which grew ever more apparent in the course of 1916. Shut off as they were from the world market, they began to feel the shortage of raw materials, which they needed urgently for rationing their armies and civilian populations, and procuring the necessary requisites of war. The shortage of foodstuffs, which was especially felt in the large towns, provoked discontent among those circles of the population which were most deeply affected. Internal difficulties found expression in Germany in conflicts between the politically and socially divided parties, while in the Habsburg Monarchy in addition they added strength to the national movements which endangered the unity of the state.

The First Peace Offers: The U.S.A. as a Neutral.—These internal troubles were an important factor in the decision of the Central Powers to join with their Allies at the end of 1916 in laying an offer of peace before the enemy.

The first step was taken by Baron Burian. He brought his proposal forward while Francis Joseph still lived. Francis Joseph had spoken in favour of a peace by understanding shortly after the outbreak of war, and had listened attentively to all proposals in this direction, but had never tolerated the idea of a separate peace. On Oct. 16 1916 Burian was at the German headquarters in Pless, and there propounded his plan. Bethmann Hollweg and the majority of German statesmen approved it, but demanded postponement till the close of the campaign against Rumania, and refused to communicate their conditions of peace at once. After negotiations, which countinued until after the death of Francis Joseph on Nov. 21 1916 and the fall of Bucharest it was agreed to proclaim the Quadruple Alliance's readiness for peace and to propose to the enemy a peace conference in the course of which the conditions of the Quadruple Alliance should be communicated. But it was soon apparent that the leading statesmen of the Allies had no intention of sitting down to confer with the Quadruple Alliance. Negotiations had been in progress between the Western Powers and Russia which led in March 1917 to an agreement whereby the "zones of influence and territorial acquisitions" of the three Powers on a possible dismemberment of Turkish possessions in Asia had been defined. Britain was to receive southern Mesopotamia, with Baghdad and two ports in Syria; France, Syria, the Vilayet of Adana and western Kurdistan; Russia, amongst other prizes, Trebizond, Erzerum, Van and districts in southern Kurdistan. Alexandretta was to become a free port, Palestine with the holy places to be taken away from Turkey and placed under a "special régime," the nature of which was to be determined by agreement between France, Russia and Britain.[1]

These plans by themselves, combined with the promises which had been held out by the Entente to Italy, Serbia and Rumania, could have afforded the Quadruple Alliance no fitting basis for negotiations, as they would have imposed the greatest sacrifices on three of its members, Austria-Hungary, Bulgaria and Turkey. Germany also would have had to submit to exceedingly hard conditions. After the "miracle on the Marne" it had become an article of faith among the people of France that Alsace-Lorraine must be restored to France. But the plans of France's leading statesmen went further. In the negotiations with Russia, which were already far advanced at the end of 1916 and led to the conclusion of a treaty on Feb. 12 1917, that Power not only recognised the claims of France to Alsace-Lorraine, the Saar district and Syria; she pledged herself further to support France's plan of erecting a buffer state on the left bank of the Rhine. This state was indeed to be neutral, but was to stand under French protection. Italy demanded a share in any territorial extensions in Asia. At the end of Nov. 1915 she had adhered, according to Article 16 of the treaty of April 26 1915, to the treaty of Sept. 4 1914 against a separate peace. At that time and throughout 1916 she had made it quite plain to her Allies that she would in no circumstances allow a peace to be concluded which involved her renunciation of any part of the territorial acquisitions promised her in the Treaty of London.

In Britain, too, both the home political situation and the attitude of the Colonies showed the greatest determination. The chief mouthpiece of the "will to win" was Lloyd George, who had become first Secretary of State for War, then Prime Minister. In Dec. 1916 he proclaimed the "knock-out blow" as the resolve not only of himself but also of the British Cabinet, their military advisers and their Allies. Among the last-named he included Russia where, since the fall of Stürmer and Protopopov, who would probably not have been averse from a separate peace with the Quadruple Alliance in Nov. 1916, the war party, vigorously supported by the ambassadors of Great Britain and France, had gained the upper hand. At the end of 1916, Trepov, Stürmer's successor, declared the Tsar's fixed resolution to continue the War at the side of the Allies and to abide by his resolve to incorporate Constantinople in his Empire. At the same time a promise was issued to establish an autonomous Great Poland under the guarantee of the whole Entente. This was done to neutralise the effect which the Central Powers had caused by the "Polish Manifesto" of Nov. 5 1916. As, however, the latter could not agree over the fate of Congress Poland, although they had been deliberating the subject since the fall of Warsaw on Aug. 5 1915, they had decided to postpone the final solution of the Polish question. To allay the anxiety of the Poles about their future, and to induce them to render effective military assistance, a proclamation had been issued on Nov. 5 1916 promising the restoration of an independent Congress Poland, which should yet be closely connected with the Central Powers as a constitutional monarchy. The effect of this step was, however, neutralised by the above-mentioned declaration by Russia and the Western Powers; the hopes which the Central Powers had entertained of vigorous support from the Poles were not fulfilled. The Poles continued to negotiate with both sides, always keeping in view their aim of erecting an independent state to embrace all Polish territory.

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[1] For text of this Agreement (Sykes-Picot), see Temperley, *op. cit.*, vol. 6, p. 16. *See* also below, EUROPE: INTERALLIED DIPLOMACY.

The Western Powers were less successful in their efforts to persuade their Ally outside Europe, Japan, to render them active assistance. After taking Tsingtao, Japan thought it unnecessary to carry on further active hostilities. She now contented herself with supplying her Allies with material of war, and in the case of Russia with artillery instructors, taking advantage meanwhile of the favourable opportunity to extend her sphere of influence in the Far East. In fact, China, weakened by internal unrest, concluded a treaty on Jan. 2 1915 whereby she recognised the political and economic suzerainty of Japan in parts of the Chinese Empire, and something over a year later, in July 1916, there followed a separate treaty between Russia and Japan which left the latter almost a free hand in the Far East. This expansion of the Japanese power was not welcome to the Western Powers, but they accepted it, although unwillingly. Japan had adhered in Oct. 1915 to the Pact of London against a separate peace, but this did not weigh heavily on her, nor prevent the Japanese Govt. from entrusting its minister in Stockholm with the charge of negotiations with the German minister there, aiming at the conclusion of a peace to include Russia.

This was the situation when the Central Powers made their peace offer in the middle of Dec. 1916. It was to be expected that it would meet with no friendly reception from the other side. The lack of any closer details regarding the conditions of peace and the somewhat disingenuous estimate of the military situation were factors which must weaken the impression of this peace pronouncement. In these circumstances nothing but strong pressure from a neutral quarter could have persuaded the Allied statesmen to enter on negotiations with the enemy.

Of the neutrals the President of the United States alone could hope that his intercession would be powerful enough to give matters a turn in favour of a peace by agreement. His position was very difficult. By far the greater part of the population of the U.S. had sympathised strongly from the beginning with Great Britain. France, too, was more popular there than Germany. Wilson certainly never thought of ranging himself with the Quadruple Alliance. But it long remained his intention to keep neutral, and then play the part of peace intermediary when the moment arrived. Soon after the outbreak of war he had called on the belligerent Powers to respect the Declaration of London and had replied to reservations made by Britain that he wished to see the rights and duties of the U.S. respected "in accordance with the accepted principles of international law and treaty obligations." The British blockade of the North Sea (Nov. 1914) had evoked a protest from the Government in Washington and led to negotiations, the course of which proved that Wilson was anxious to maintain the freedom of the seas. The question of submarine warfare and the use of floating mines and attacks on merchantmen again showed a wide difference of opinion between Britain and America. Even after a German submarine had torpedoed the "Lusitania" on May 7 1915, causing 124 American citizens to lose their lives, Wilson made every endeavour in face of the immense excitement prevailing among his countrymen to prevent the outbreak of war against Germany, and for a time was successful.

He promised that if Germany would abandon submarine warfare he would use every means of intervention with her enemies to have the hunger blockade raised, but made it clear at the same time that he would have to declare war on Germany if citizens of the U.S. lost their lives in this fashion. Germany had pleaded as justification that the "Lusitania" had been armed with guns and was carrying materials of war for the Allies. When the British passenger boat "Arabic" was torpedoed in Aug. and two Americans lost their lives, the German Govt. expressed its regret in Washington, and Count Bernstorff, its ambassador there, declared that the German submarines had already received orders not to attack passenger ships in the future. In spite of all this, the "Sussex" was torpedoed in March 1916, and several citizens of the U.S. perished with her. The U.S. now sent an ultimatum to the German Government. The latter gave a public declaration that merchant vessels should be sunk only in the future after warning given and after the crews had been saved. It demanded in return that the Govt. of the U.S. should intervene in London and make England "recognise the laws of humanity"; which Wilson refused to do. The Declaration of London which followed on July 7 1916 did not satisfy the German Govt.; nevertheless throughout 1916 it observed the assurances which it had given the United States.[1]

Thanks to this attitude, although the news of German torpedo attacks, the transportation of Belgian workmen into Germany and the anti-German propaganda of the Western Powers directed public opinion in America ever more towards active intervention against Germany, Wilson resolved to persevere in his pacific efforts. After his re-election as President in Nov. 1916 he approached the belligerents on Dec. 18 with an open offer of mediation. He called on them to publish their peace terms, giving expression at the same time to his favourite hope of securing lasting peace for the world by the formation of a League of Nations.[2] This pronouncement, although it followed only a few days after the offer of the Quadruple Alliance of Dec. 12, had been prepared long before and was not influenced by it. The German answer came quickly. It ran: "Germany considered that a lasting peace would be best attained through direct negotiations between the belligerent Powers in a neutral country. After the close of the present war Germany would gladly co-operate with the U.S. to prevent wars in the future."

Before Germany's answer had reached Wilson, the Entente Powers had published their reply, curtly declining the proposals of the Central Powers in favour of peace by agreement. Briand, the French Minister of Foreign Affairs, described the offer of the Quadruple Alliance as a war manoeuvre which must not be taken seriously. Pokrovsky, the Russian, declared that it must be rejected "with indignation"; Sonnino conjured his countrymen to stand solid with Italy's Allies in their attitude towards this "treacherous step"; and Lloyd George gave his opinion that to enter into a conference at Germany's invitation, and with Germany proclaiming herself victorious, and without any notion of the proposals she has to make, is "to put our heads into a hoose.” These verbal declarations by the leading statesmen of he four Great Powers were followed on Dec. 30 by the written nswer of the Allies. In this it was pointed out, not unjustly, hat the enemy had based their estimate of the military situa- ion exclusively on the European theatres of war. Their offer vas devoid of “all substance or precision.” The Central Powers vere described as the sole authors of the World War; expiation vas demanded from them and their Allies for the crimes which hey had committed and full reparation for all destruction aused by the war.[1] The meaning of this phrase was shown most iearly by the answer which its authors gave to the President of he U.S. on Jan. 10 1917 in reply to his declaration of Dec. 18 916. Germany was to suffer considerable territorial curtail- nents in the East and the West, the Habsburg Monarchy to be ismembered by the “liberation of the Italians, Slavs, Ruma- ians, Czechs and Serbs from foreign rule,” Turkey banished from Curope, the peoples smarting under her yoke to be delivered rom her tyrannies. The Poles were promised full autonomy in ccordance with the Tsar's manifesto. The Allies declared hemselves as agreeing “whole-heartedly with Wilson's ideal, the League of Nations.”[2]

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[1] For further information, see C. E. Seymour, *The Intimate Papers of Colonel House*, 2 vol., 1926.

[2] *Parliamentary Papers*. Cd. 8431 for text.

The negative answer returned by Germany, which Wilson ound too indefinite, contrasted with the approval shown by the llies of his favourite idea; and their definite proposals could not ut impress him and inevitably strengthen the influence of those ircles in his entourage which were working tirelessly to bring he U.S. into the War on the side of the Allies. None the less, Vilson did not yet abandon his plan of mediation. He negoti- ted further with the German Govt. and asked it to define its eace terms exactly. Moreover, he declared himself prepared o carry on confidential conversations. Germany gave no official nswer to these offers. Bernstorff was empowered to state in Vashington that Germany was gladly prepared to enter into iscussions aiming at preventing the outbreak of wars in the ture. At the present moment, however, Germany could not elcome Wilson's official mediation, as this must give the Allies he impression that the peace offer of the Quadruple Alliance ad been dictated by fear of the future. Germany's peace con- itions, Washington was informed, were very moderate. She id not wish to annex Belgium, but allowed no discussion what- ver on Alsace-Lorraine. These declarations impressed Wilson vourably, and he persevered in his efforts to advocate a peace y understanding. On Jan. 22 1917 he spoke in the Senate gainst a peace dictated by the victory of either group of bellig- rents, as this could not bring lasting peace. “Only peace etween equals can last.” He demanded freedom for the op- ressed peoples, freedom of the seas, reduction of armaments. he U.S. would be ready to “join in guaranteeing the perma- ence of a peace based on such foundations.”[3]

On the following day Wilson's confidant, Col. House, who had ready held conversations on the possibility of peace with the aders of both groups during journeys to Europe in 1915 and 916—although indeed without success—asked Bernstorff to ecommend his Government to communicate its peace terms the President, either publicly or confidentially, whereupon he latter would propose a Peace Conference. Soon after, Wil- n repeated his offer in person. Bernstorff urged his Govern- ent strongly to fall in with Wilson's wishes. But he had al- ady been informed by his Government that Germany had etermined to start unrestricted submarine warfare on Feb. 1 917. This resolution, the outcome in the main of the ever- creasing influence which the supreme military and naval thorities were gaining over the leading German statesmen d the Emperor William II., had in fact been taken on Jan. 9 917 in a Crown Council at Pless. The objections which had een raised in particular by the German Chancellor Bethmann ollweg, including the consideration of the almost certain entry the U.S. into the War, had been met by the statement of the German Admiralty that Britain would be forced to come to terms within five months of the commencement of the unrestricted submarine warfare, and by that of the Army Command that it could only guarantee the safety of the Western Front if the unrestricted submarine warfare were introduced.

A hard struggle was still necessary to win the consent of the Government in Vienna. The young Emperor Charles, who had only ascended the throne a few weeks previously, did not share the high expectations which the German Supreme Command based upon the unrestricted submarine warfare. The new Minister for Foreign Affairs, Count Czernin, shared the Emperor's views. Both declared that the direct result of the unrestricted submarine warfare would be the declaration of war by the U.S. and therefore the beginning of an unlucky end. Fully convinced that a victorious peace was now impossible for the Quadruple Alliance, they were working for a peace by agreement, and wished accordingly to avoid everything which would multiply their enemies and strengthen their determination. But their resistance was silenced by the increasing pressure from Germany and by the statements of Conrad von Hötzendorf and Admiral Haus that the introduction of unrestricted submarine warfare was necessary and promised good results.[4]

The U.S.A. as Belligerent: Weakening of Austria-Hungary.—On Jan. 31 1917 Bernstorff informed Wilson that Germany would begin the unrestricted submarine warfare on Feb. 1. This determined Wilson's attitude. On Feb. 3 the U.S. broke off diplomatic relations with Germany. Two months later, on April 6 1917—she had learnt meanwhile that Germany had offered the Mexican Govt. an alliance in case of a German-American war—she declared war on Germany; but on Austria-Hungary not till Dec. 4 1917. The other American states (except Mexico, Colombia, Venezuela, Paraguay, the Argentine and Chile) followed the example of the U.S.A. but did not go beyond giving the Allies their economic support. Britain had already succeeded in Feb. 1917 in overcoming Japan's resistance to China's joining the War against the Quadruple Alliance, and had induced Japan herself to furnish a squadron to protect British interests, especially in the Mediterranean. In return the British Govt. recognised Japan's claim to Germany's former rights in Shantung, and agreed that the former German South Sea Islands north of the Equator should be allotted to Japan, while those south of the equator should go to Australia. France adhered to this agreement at the beginning of March. China broke off diplomatic relations with Germany on March 14; her formal declaration of war on the Central Powers only followed on Aug. 14 1917, shortly before Siam, too, had resolved to join the Allies.

European neutrals, however, preserved their attitude. The sympathies of Denmark and Norway had always been with the Allies; in Sweden they moved in this direction under the influence of Branting, especially after the U.S. had entered the War. Holland was largely dependent, commercially, on Britain. Even in Spain, where the King favoured the Central Powers for family reasons and Dato's Conservative Govt. had supported this attitude, there was a period during 1916 and early 1917, while Romanones' Liberal Govt. was in power, when Spain might have joined the Allies but for the King's determined opposition. Switzerland remained strictly neutral. Only Greece grew ever more dependent on the Western Powers, although King Constantine resisted their encroachments with all vigour. In order to guard the rear of their army of the Orient, the Western Powers forced Greece to disarm her army in Oct. 1916, and soon after to hand over her fleet. Veniselos, who had been working for them tirelessly, proclaimed a revolutionary counter-government in Salonika and forced Constantine, whose life appeared in danger, to call on the representatives of the Central Powers on Nov. 11 to leave Athens. Under the circumstances Greece's entry into the Allied camp seemed only a question of time.[5]

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[1] For text, see, *Parliamentary Papers*, Cd. 8467.

[2] For text see *Parliamentary Papers*, Cd. 8468.

[3] See G. Lowes Dickinson, *Documents Relating to Peace Proposals d War Aims* (Dec. 1916–Nov. 1918), pp. 24–30.

[4] For further information, see Czernin, *In the World War, passim;* Conrad von Hötzendorf, *Aus meiner Dienstzeit*, vol. 4, *passim*.

[5] For Greek negotiations with both the Central and the Entente Powers, see Frangulis, *La Grèce et la crise mondiale*, vol. 1.

In order to increase the determination of the Porte, which was groaning under its increased war burden, the German Govt. had promised it on Sept. 28 1916 to conclude no separate peace with the common enemy, and to admit Turkey to a share in the conquered territory proportionate to her military efforts. Soon afterwards, on Jan. 11 1917, these two Powers arrived at a further agreement, in which the abolition of the oppressive "capitulations" was granted. The provisions of these two treaties were expanded in a manner favourable to Turkey on Nov. 27 1917. The Government in Vienna gave its adherence to these treaties, although only after long hesitation.

The Allies had planned a general offensive in the west, east and south of Europe for 1917, with further campaigns in the theatres of war outside Europe. Various circumstances delayed the opening of hostilities. Meanwhile something happened which gravely disturbed their plans. The Russian dynasty was overthrown. On March 15 Nicholas II. was forced to abdicate. Miljukov, the Minister of Foreign Affairs of the first Revolutionary Govt., assured his Allies that Russia would remain loyal to them; but it was soon obvious that there could be no hope of effective co-operation by the Russian armies in the proposed general offensive. Germany was therefore enabled to employ a considerable number of her troops from the East to strengthen her Western Front, and thus successfully to resist the violent offensive of the Western Powers which began in April.

This fact and the comparatively great successes gained by Germany's unrestricted submarine warfare in its first months had a certain reaction on opinion in Britain and France. Many French soldiers gave vent to their discontent and war weariness in grave excesses and mutinies. In England too the fear of food shortage grew with the increasing success of the German submarines. In April and May there were days when the men in authority in Paris and London reckoned with the possibility that the War would take a final turn in favour of the Quadruple Alliance. Now, if ever, was the moment when a decisive success for the enemy in any theatre of war whatever could have brought the Entente to open up negotiations for a peace by understanding. But the Central Powers did not achieve this decisive victory, and the leading French and British statesmen were soon able to take severe measures against the malcontents, to stimulate patriotic passions and to imbue their armies and civilian population with fresh confidence in ultimate victory. Not only were they able to point out how the entry of the U.S.A. into the War increased their strength, how Russia had resumed the battle against the enemy, but their masterly propaganda had its effect on friend and foe alike in many ways. Indeed, this propaganda fostered the old internal conflicts within the Central Powers.[1]

It grew ever more apparent how widely the views of the different parties inside and outside the German Reichstag differed on the ultimate goal of the War. On the one side was the will to dictate a peace through victory and to stand staunch by the old form of the state; on the other the cry for a peace by agreement and more influence for the Reichstag on home and foreign policy.

In the Habsburg Monarchy all these social differences were aggravated by national feuds. The enemies at home of the dualist system and of the hegemony of the Germans in Austria and the Magyars in Hungary pointed out with ever-increasing vehemence that the victory of the Central Powers could only bring the Slavs and Latins of the monarchy the continuance in aggravated form of their present oppression. The emigrés, led by the Czech Masaryk, worked from abroad with the same arguments. The Emperor Charles and his Foreign Minister Czernin had ample occasion to convince themselves of the growing war-weariness of the soldiers and of those circles of the Austrian civilian population which were especially hard hit by the hunger blockade. These considerations, as well as the increasing directness with which the Slav and Latin irredentas aimed at destroying the unity of the monarchy, necessarily confirmed Charles and Czernin in the resolution to abide by the idea enunciated in the peace offer of Dec. 12 1916.

Both thought that it was easier for them than for their Allies to pave the way towards a peace by understanding; both believed that the Western Powers were not aiming at that time at the complete destruction of the Habsburg Monarchy. They were at one, too, in the conviction that there was no time to be lost. They did not believe that the German U-boat warfare would bring a decisive success, and feared that once the United States had entered the War actively the Western Powers would refuse any proposal for a peace by understanding. They were resolved to aim at an universal peace, but they believed that this could not be achieved without strong pressure on the German Emperor and his Chancellor. And indeed William II., who was unduly influenced by his Army Command, still envisaged peace terms which could only have been achieved after a complete victory of the Quadruple Alliance. Charles and his minister, on the other hand, thought that the general situation imperatively required Germany to make a territorial sacrifice in Alsace-Lorraine, if peace negotiations with the enemy were to be conducted with any prospect of success.

In order to reconcile his allies to this sacrifice, Czernin had suggested to the Chancellor, when he visited Vienna in March 1917, that Germany might take Congress Poland as compensation for territorial sacrifices on her western frontier. Yet the pacifist feeling at the Vienna Court did not awaken the expected echo in Berlin. Czernin accordingly prepared a memorandum for the Emperor Charles on April 12, and had it communicated to William II.[2] In this the internal situation of the Habsburg Monarchy was painted in the blackest colours, and its collapse, involving a revolution and the downfall of the dynasty, was represented as imminent. A few days before, Czernin renewed in authoritative quarters in Germany his offer to compensate the German Empire for eventual losses in Alsace-Lorraine by the permanent acquisition of Congress Poland enlarged by the addition of Galicia. The Habsburg Monarchy should compensate herself at the expense of Rumania for this loss of territory.

But this attempt too met with failure. At first, indeed, the German Chancellor showed himself not entirely averse on principle from accepting Czernin's proposals; gradually, however, the plans of the Army Command prevailed, as expressed in the agreements made in Kreuznach on May 17 and 18. Here Germany proposed to annex the coal basins of Briey and Longwy, and to establish economic and military unity between Belgium and herself. There was no further mention of the cession of parts of Alsace-Lorraine, but Austria-Hungary stipulated, not only that her integrity should be guaranteed, but that she should receive some accessions of territory in the Balkans. Germany furthermore agreed, in the event of her being able to carry out "the territorial incorporation (Angliederung) of Courland and Lithuania together with the dependence (Anlehnung) of Poland contemplated on the German side, that Rumania so far as occupied, with the exception of the Dobruja (frontier anterior to 1913) and a border strip to the south of the Cerna-Voda-Constanta railway, falls as a separate state into the Austro-Hungarian sphere of interests, subject to a guarantee for Germany's economic interests in Rumania." On fulfilment of these conditions Austria-Hungary consented to renounce her condominium in Poland, and promised to declare her "désinteressement," political and military, in that country. On June 9 1917 William II. and Charles signed an agreement as to Poland's military forces, by which their organisation was placed entirely in the hands of Germany.

The attitude of the Emperor Charles and Czernin towards their ally is only comprehensible in conjunction with the negotiations which they had been conducting with the Western Powers since Feb. 1917 in the hope of attaining a peace by understanding. When Bethmann Hollweg visited Vienna in the middle of March 1917, Czernin had informed him that it looked as though France would not be averse from conversations; he stated at the same time that Italy had made an overture for peace. Bethmann-Hollweg pointed out in his answer that France would undoubtedly demand the cession of Alsace-Lorraine as a *condi-*

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[1] For further information as to the Entente propaganda, see Sir Campbell Stuart, *The Secrets of Crewe House.*

[2] For the text, see Czernin, *In the World War*, pp. 146–150.

tio sine qua non, and this he could neither propose to his Emperor nor justify before the German people. He also doubted the wisdom of evacuating the districts which Germany had occupied in France and Belgium before the conclusion of the negotiations, “ since this was the only means of forcing England to give back the conquered German colonies.” Yet he agreed n principle to the peace conversations proposed by Austria, but nsisted that the Austrian intermediary must adopt a passive attitude; he might only hint cautiously that an understanding between France and Germany seemed possible on the basis of an exchange of territory in Europe, a general colonial agreement and economic compensation; at the same time he was to ask the French what Britain's attitude to such an agreement would be. As for the East, negotiations had been opened up from a Russian quarter, shortly before the Tsar's abdication, in favour of a separate peace with the Central Powers; but these had now become rrelevant. Bethmann Hollweg therefore thought that the Cenral Powers should not evacuate the territories in their occupaion in Russia and the Balkans before the enemy had retired rom the occupied territory of Austria-Hungary. The proposed new acquisitions for Germany and Austria-Hungary should be partitioned on as fair a scale as possible.

The German Chancellor was not informed that Charles and Czernin had already opened up negotiations with France through he Emperor's brother-in-law, Prince Sixtus of Parma, on a quite different basis. Since, however, Bethmann Hollweg had conented on principle to open up these negotiations with the enemy, Charles and Czernin considered themselves justified in pursuing he course which they had adopted. A few days after the German Chancellor had left Vienna Prince Sixtus arrived there. He proffered proposals on the lines of his letter of March 16 to the Emperor Charles which were certainly irreconcilable with the reaty obligations of the monarchy. Czernin treated the Prince oolly, but had not the energy to shake him off. So it came that is proposal for the Imperial answer to be given to Prince Sixus' declarations was disregarded. Instead, a letter in the Emperor's own hand was given Sixtus on March 24 without Czernin's knowledge. This letter made, indeed, no mention of a separate armistice or of a separate peace, but contained an assurnce to Poincaré of the Emperor's readiness to support “ the ust claims of France to Alsace Lorraine ” in Berlin, and to work for the restoration of Belgium and Serbia as sovereign tates. Belgium was to receive suitable compensation for the osses she had incurred, Serbia to receive a natural outlet in the Adriatic and far-reaching economic concessions. In return for he concessions made to Serbia, the Emperor demanded a decaration from her, given under the guarantee of the Entente Powers, that she would abstain from and suppress any future olitical agitation against the Habsburg Monarchy.[1]

But the Prince's communications had not the effect for which Charles hoped. The enemy saw in them only a proof of the weakess of the Central Powers and of the incipient decay of the German-Austrian Alliance, and hoped in this way to impose a eace favourable to themselves on Germany, or to checkmate Germany through a separate peace with Austria-Hungary. Charles' letter to Sixtus made no mention of territorial concesons by the Habsburg Monarchy to Italy; on the contrary, it mphasised the fixed determination of all peoples of the Monrchy “ to defend the integrity of the monarchy, be it at the ost of the severest sacrifices.”[1] This point, more than any other, oomed Charles and Sixtus to failure. When Ribot and Lloyd George met Sonnino, the Italian Foreign Minister, at St. Jean de Maurienne on April 19 1917, and tried to persuade him to accept myrna in return for renouncing the acquisition of Trieste, Sonnino eclared that he could not even allow a discussion on the Italian spirations as recognised in the Treaty of London. French ttempts to persuade Sonnino to change his views remained ruitless; the plan of the Emperor Charles and his brother-in-aw had failed.

In Germany, meanwhile, the adherents of the circles which considered a peace by victory unattainable grew ever more numerous. Especially when it became clear that the hopes which the military and naval authorities had based on the unrestricted submarine warfare would probably not be justified, the cry that the Government should openly declare its war aims grew louder. On July 19 1917 the majority of the Reichstag voted, indeed, for a motion brought forward by Erzberger, the leader of the Centre, in favour of a peace by understanding, without forcible territorial acquisitions or political, financial or economic violation. “ The freedom of the seas must be made secure. So long, however, as the enemy governments threaten Germany and her Allies with conquests and oppression, the German nation will fight till its own and its allies' right to life and development is secured.” On the day on which this resolution was adopted by the Reichstag by a considerable majority, Bethmann Hollweg was no longer Chancellor. His successor Michaelis, who had been elected by agreement with the Supreme Command, immediately modified the effect of the Reichstag's resolution by declaring that his aims, including the inviolability of German territory and a guarantee against economic barriers, were attainable within the limits of the resolution “ as I understand it.”[2]

The consequence was that the Western Powers continued to doubt the good faith of the German Govt., to propose negotiations on a basis agreeable to themselves, and to see in the differences apparent inside and outside the Reichstag signs of weakness which confirmed them in their resolution to gather all their forces to carry the War to a victorious end. Under these circumstances, the efforts in which Czernin was fertile, even after the failure of Prince Sixtus' mission, to achieve a compromise with the enemy acceptable to both sides were unavailing. In Aug. two meetings were arranged in Switzerland, on the initiative of the French Govt., between the Austro-Hungarian diplomat Count Revertera and his relative, the French General Staff major, Count Armand. The negotiations broke down over the severity of the conditions which Germany was required to accept.[3]

The hopes of the Central Powers to find a compromise with Russia met also with disappointment. The Provisional Govt. in St. Petersburg was too deeply under the influence of the Western Powers to listen to the overtures which the Central Powers made for a separate peace. Efforts to stimulate the desire for peace among the war-weary Russian troops by direct propaganda across no man's land increased, indeed, the demoralisation among the Russian troops, but had no further result, since the commanders of the Russian army refused to conclude a formal armistice. Equally unsuccessful were the attempts of international Socialist circles to find a satisfactory solution of the peace question at a world congress at Stockholm,[4] and the effort made in Aug. by Pope Benedict XV. In accordance with the terms of the Treaty of London, France, Italy and Great Britain sent no reply to his invitation; President Wilson sent a formal refusal for himself, which was really intended to answer for his associates. At the same time Britain declared that any conversations must be preceded by an unequivocal declaration by the German Govt. that she would give up Belgium after the end of the War. The German Govt., however, refused to give such a declaration, especially since Ludendorff had spoken against it most decidedly in the Potsdam Crown Council of Sept. 14 1917. Germany answered the Pope without mentioning Belgium. So this attempt to bring about a *rapprochement* between the two groups of Powers broke down like the rest. The same fate attended efforts to pave the way towards peace conversations between France and Germany made by Lancken and Coppée—where Briand was also active—and between Germany and Britain by way of Brussels and Madrid.[5]

The Allied offensives in 1917 again brought no decisive victory, nor were the hopes of the Allies fulfilled in the Balkans.

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[1] The texts of Charles' letters and Sixtus' memoranda to the Allied Powers are in Manteyer's *Austria's Peace Offer* (1921).

[2] On this subject see Erzberger, *Erlebnisse;* Ludendorff, *The General Staff*, vol. 2.

[3] See Czernin, *op. cit.*, pp. 164 and 169.

[4] See below, EUROPE: INTERALLIED DIPLOMACY (Section IV. of this article).

[5] See Mermeix, *Les négociations secrètes et les quatre armistices* (chaps. vii. and xiii.).

King Constantine and his eldest son were forced to leave Greece, and the new ruler, Alexander, was obliged to appoint Veniselos, the champion of the Western Powers, Minister President. Under Veniselos' influence Greece broke off diplomatic relations with the Quadruple Alliance, and Greek troops joined the Army of the Orient which was awaiting battle in Macedonia. Greece was promised, as reward, Thrace and Smyrna. But the Allies were disappointed of the victory for which they looked. They were more successful outside Europe. Turkey lost Jerusalem, Germany East Africa. Yet the military situation in the late autumn of 1917 was such that the German military authorities were convinced of their ability to carry on a fresh successful campaign in 1918, so long as their allies did not leave them in the lurch. This danger was, however, imminent, since war-weariness grew ever more apparent in Austria-Hungary, and reports to a similar effect reached Germany from Sofia and Constantinople.

Then came an event calculated to revive the courage of the Quadruple Alliance. The prospect was revealed to them of concluding a favourable peace with their enemies in the East which would enable them to fall with their full strength upon their enemies in the West. Early in Nov. 1917, the second period of the Russian revolution, the "social revolutionary" phase, led by Kerensky, who had come ever more under the influence of the representatives of the Western Powers,[1] was succeeded by the third, that of the "Bolsheviks," under Lenin and Trotsky. As early as the end of Nov. the new government called on all the belligerent Powers to conclude an immediate armistice and begin negotiations for the conclusion of a general peace, which should assure to every nation freedom of economic and cultural development. When the Entente Powers refused to comply with this summons, the Russians on Dec. 3 entered on a suspension of hostilities with Germany and her allies, to last till Dec. 17 1917. On Dec. 15 the suspension of hostilities was succeeded by an armistice, to last till Jan. 14 1918, and then to be continued with the right to denounce it on seven days' notice. Rumania adhered to this armistice, albeit unwillingly.

Peace negotiations began on Dec. 22 at Brest-Litovsk. They were conducted in public. It was not easy for the representatives of the Quadruple Alliance to accept the conditions of the Russian peace programme. If the German and Bulgarian delegates found a peace "without annexations or indemnities" to involve great sacrifices, considering the general situation, the "right of self-determination" which the Russian delegates demanded for all nations endangered the future existence of the Habsburg Monarchy and Turkey. The upshot was that on Dec. 25 the Quadruple Alliance accepted the Russian proposals for the conclusion of a peace without annexations or indemnities as the basis of a general peace. This was, however, contingent on the acceptance of this basis by the Allies also. At the suggestion of the Russian delegates the negotiations were suspended for 10 days, and a request was addressed to the other enemies of the Quadruple Alliance that they should take part in further deliberations on the basis of the resolutions adopted on Dec. 25. But the Entente Powers refused. Thereupon negotiations began on Jan. 9 1918 for a separate peace between Russia and the Quadruple Alliance. But they did not run so smoothly as the German and Austro-Hungarian politicians hoped. Trotsky, now the chief of the Russian delegation, demanded full freedom for the plebiscites to be held in the Russian provinces occupied by the Central Powers, and with this object proposed that their troops should evacuate them. When the German and Austro-Hungarian delegates rejected this suggestion, Trotsky protracted the negotiations in order meanwhile to introduce Bolshevik ideas into the territory of the Quadruple Alliance. The progress of the negotiations was impeded by quarrels among the Russians and by the appearance at Brest-Litovsk of an Ukrainian delegation which pressed for the establishment of a Russian Federal Republic.

Since no agreement could be reached on this question, the representatives of the Ukraine announced the complete independence of the Ukrainian People's Republic on Jan. 24, and on Feb. 9 concluded a separate peace with the Quadruple Alliance. The Ukraine was promised the province of Cholm, which had been a bone of contention between her and Poland for centuries; further, Austro-Hungary undertook in a secret clause to make a separate crownland out of east Galicia, where the population was predominantly Ukrainian (Ruthenian). In return, the representatives of the Ukraine promised to deliver at least 1,000,000 tons of cereals to the Central Powers by Aug. 1 1918, a promise which, however, could not be fulfilled, since the *Rada* in power in the Ukraine at the time was overthrown immediately after by the Bolsheviks, who disregarded the obligations into which their predecessors had entered. The troops of the Central Powers thereupon occupied the Ukraine, and divided it into a German and an Austro-Hungarian administrative district. They were now able, although with difficulty, to secure a portion of the cereals, which were indispensable, especially for Austria. But as a result of the concessions to the Ukrainians a Cabinet crisis broke out in Congress Poland; those circles which had hitherto favoured Austria changed round; some of the Polish legions stationed in east Galicia went over to Russia, whence they were brought to France under the command of General Haller to be united with the Polish Legion which had existed there since the summer of 1917.

Meanwhile, the negotiations with Russia had gone on. Czernin, zealously seconded by the Emperor Charles, pressed for a conclusion, but met with determined opposition from the German negotiators. On Feb. 10 1918 Trotsky declared that Russia renounced a formal treaty of peace, but regarded the state of war against the Quadruple Alliance as ended, and would reduce her troops to a peace footing on all fronts. But since this solution did not meet with the whole-hearted consent of the Central Powers, Germany resumed the struggle. The Russians, defeated by Germany in the field, now changed their tactics and made ready to conclude a formal peace, which was signed on March 3 1918 at Brest-Litovsk.

Russia pledged herself to surrender Courland, Lithuania and Poland entirely to the influence of the Central Powers, to evacuate the occupied Turkish territories, to grant freedom to Finland, Estonia, Livland and the Ukraine, and to the Caucasian districts of Ardahan, Kars and Batum. The undeniable contradiction between the basis of peace which the Central Powers had at first accepted, if with reservations, and the terms of the Treaty of Brest-Litovsk was most skilfully exploited by the statesmen of the Entente and their Press to brand Germany's insatiability.[2]

The peace with Russia was succeeded by that with Rumania, but the necessary negotiations had been long and difficult. A quick conclusion was rendered impossible, not only by the refusal of the Rumanian Govt. to accept the terms of the victors, but also—perhaps even more—by the lack of unanimity among the Quadruple Alliance as to how the booty should be divided. The resistance of the Rumanians was overcome by an ultimatum; on March 3 the Averescu Ministry signed the preliminary Peace of Buftea. Soon after this Ministry was replaced by the Germanophil Marghiloman Ministry, which concluded the definite peace with the Quadruple Alliance on May 7 1918 in Bucharest. This peace was never ratified. Austria-Hungary received a favourable strategic frontier in the Carpathians and the promise of the immediate evacuation of the provinces of the Habsburg Monarchy still occupied by Rumania. The whole of the Dobruja was left to the victors. The southern half was allotted to Bulgaria on the spot; the northern half was to be taken over and administered by the Quadruple Alliance in concert until the differences between Turkey and Bulgaria should have been composed. As compensation Rumania was promised the succession to Bessarabia, which had broken off from Russia in Feb. 1917 by arrangement with Rumania.[3]

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[1] On the subject of Entente relations with Russia both before and after the revolution, see Sir G. Buchanan, *My Mission to Russia*, etc., 2 vol.; M. Paléologue, *La Russie pendant la Grande Guerre*, 3 vol.

[2] For the Brest-Litovsk negotiations, see Czernin, *op. cit.*, pp. 211–257; Gratz and Schüller, *Die Aeussere Wirtschaftspolitik Oesterreich-Ungarns*, pp. 115–169 (1925).

[3] See Czernin, *op. cit.*, pp. 258–270; Gratz and Schüller, *op. cit.*, pp. 177–255.

The appeal for peace which the Russian Govt. issued to all belligerent nations had given new voice to the old wish for an end to the War cherished among the peoples of the Quadruple Alliance, especially those of Austria-Hungary. It was intensified at the beginning of 1918, when Wilson published his Fourteen Points (*q. v.*) as the basis for the future world peace. These included, indeed, many conditions which imposed heavy sacrifices on the Powers of the Quadruple Alliance. The evacuation and restoration of Belgium, Northern France and the Russian border states, the cession of Alsace-Lorraine, the establishment of an independent Poland embracing all districts undoubtedly inhabited by the Poles—these were demands to which the German Govt., and especially the German Supreme Command, was unwilling to consent in the then military situation. The Austro-Hungarian statesmen, too, would find difficulty in allowing the frontier between Austria-Hungary and Italy to be drawn "on clearly recognisable national lines," Rumania, Serbia and Montenegro to be evacuated and restored, a free outlet for Serbia to the sea to be granted unconditionally—quite apart from the fact that Wilson's solution of the Polish question would have meant the loss of Galicia to the Habsburg Monarchy.

But the chief danger in the eyes of the Vienna Govt. was Wilson's demand for autonomy for the peoples of Austria-Hungary. It held its realisation—rightly, as later events proved—to mean the beginning of the end of the Habsburg Monarchy. Equally great were the sacrifices which Wilson thought to impose on Turkey by his demand for autonomy for her Christian peoples and internationalisation of the Straits. Even so, Wilson's territorial demands lagged far behind those to which his Allies had pledged themselves in secret treaties, some of them unknown to him offically. A favourable impression was made on the peoples of the Quadruple Alliance, especially those of the Central Powers, by the fact that Wilson had included in his programme the abolition of secret diplomacy, the freedom of the seas and of economic life, reduction of armaments, impartial settlement of colonial pretensions and the welding of the nations into a League of Nations, which should prevent future wars. Wilson's peace programme—which, indeed, imposed the brunt of the sacrifices exclusively on the States of the Quadruple Alliance—was, however, most skilfully exploited by the statesmen of the Western Powers against the Central Powers to strengthen, not only the peace parties, but also the subversive elements there. Disturbances broke out on a large scale in the most important industrial districts of Germany and Austria-Hungary, the forerunners of the social upheavals which were to convulse both states in the course of 1918.

Differences in Germany were accentuated by the weak attitude of Count Hertling, the leader of the Bavarian Centre, who had become Chancellor of the Reich in Nov. 1917. On principle he was not against a peace by understanding, but was not strong enough to carry his plans through in the teeth of the parties of the Right, which had been strongly reinforced by the *Vaterlandspartei* founded by Admiral Tirpitz in Sept. 1917. So it came about that the Supreme Command, of which Ludendorff was becoming ever more truly the ruling spirit, gained the upper hand when the decision was taken on the question "peace by compromise or continuation of the war." The Emperor William at heart was ready for peace, and inclined to make concessions in internal politics—general suffrage in Prussia and extension of the competencies of the Parliament had been demanded—yet he yielded to the advice of his military commanders and the pressure of the parties of the Right, and he decided for the continuation of the War.

Matters lay somewhat otherwise in the Habsburg Monarchy. Here the Emperor Charles and his Foreign Minister Czernin had never lost sight of their aim, a peace which should make the further existence of the monarchy possible, even if at the cost of heavy sacrifices at home and abroad. This ideal seemed ever more desirable as the dangers loomed more clearly which threatened the monarchy in its present form; the increasing war-weariness of the soldiers and the ever franker separatism of the different peoples of this polyglot state. Czechs, Southern Slavs and Poles grew ever more sweeping in their demands for unlimited autonomy. But a similar feeling had now infected the Magyars also. Despite the close connection between their fate and that of the other half of the realm, despite the predominating influence which they exercised on the general policy of the monarchy, many circles worked for full independence. In addition to all this, the German-Austrian Social Democrats began to believe that the disintegration of the monarchy could be only advantageous to the German-Austrian proletariat, since, if the monarchy fell into its component parts, its German-speaking districts would naturally become a part of Germany.

Under these circumstances, Charles and Czernin were anxious to miss no opportunity of resuming seriously the contact with the Governments of the Western Powers, which they had never quite given up. There was nothing to be done at this moment in France, since Clemenceau had taken over the Government after the fall of Ribot and Painlevé; his programme was "war, nothing but war," and he had taken strong measures against the "defeatists" and all advocates of a peace by understanding; so that it was improbable that he would listen to overtures. On the other hand, the Viennese Govt. imagined feeling in England, as expressed by Lord Lansdowne's letter to *The Daily Telegraph* at the end of Nov. 1917, to be such that negotiations here might have a chance of success. Lansdowne had, indeed, stated plainly that the aims of the Allies would be victorious in the long run. But he had pointed out at the same time that the continuation of the struggle must lead to the ruin of the civilised world, and had advocated a revision of the Allied war aims, in the hope of thus strengthening the peace party in Germany. In Dec. 1917 conversations took place between Gen. Smuts and Count Mensdorff. As the latter was authorised to work for a general peace between the belligerents while Smuts refused Mensdorff's proposal to discuss an agreement with Germany, and was only prepared to conduct negotiations aiming at a separate peace with Austria-Hungary, the conversations led to no result.

Soon after, at the beginning of 1918, Lloyd George communicated the conditions which he considered a basis for possible peace negotiations. They were much more moderate than those which the Allies had laid down a year previously. Britain, he declared, did not want the destruction or disruption of Germany and would not fight merely to alter or destroy the Imperial Constitution; yet military autocracy was a dangerous anachronism. The adoption of a really democratic constitution would be the most convincing evidence that the old spirit of military domination had died, and would make it easier to conclude a broad democratic peace. Among the conditions on which he was prepared to commence peace negotiations he mentioned the complete restoration, security and indemnification of Belgium for the losses and damage which she had suffered; the restoration of Serbia, Montenegro and the occupied parts of France, Italy and Rumania. As regards Alsace-Lorraine, nothing was said of an integral restoration of the Provinces; only: "We mean to stand by the French democracy to the death in the demand they make for a reconsideration of the great wrong of 1871." Britain would only safeguard Russia's interests if the present rulers of the Republic remained loyal to their Allies. "We believe, however, that an independent Poland comprising all those genuinely Polish elements who desire to form part of it is an urgent necessity for the stability of Eastern Europe."

As for the Habsburg Monarchy, Lloyd George declared: "The break-up of Austria-Hungary is no part of our war aims; but genuine self-government must be granted to those Austro-Hungarian nationalities which have long desired it." Only in the case of the Italians of the monarchy he regarded as vital "the satisfaction of the legitimate claims of the Italians for union with those of their own race and tongue." These demands were a great deal more modest than the previous ones, and could not be reconciled with the promises which had been made in the course of the war to the Italians, the Serbs and the Slav emigrés.[1]

This moderation was even more marked in the conditions laid down for Turkey. "We are not fighting" they ran now, "to deprive Turkey of her capital nor of the rich and renowned lands of Asia Minor or Thrace, which are predominantly Turkish by race." Only the Straits were to be internationalised and neutralised—Arabia, Armenia, Mesopotamia, Syria and Palestine—were entitled to a recognition of separate national conditions. For Wilson's benefit came the declaration: "finally, a great attempt must be made to establish by some international organisation an alternative to war as a means of settling international disputes." Three conditions were essential to permanent peace: "the re-establishment of the sanctity of treaties, territorial settlement based on the right of self-determination or the consent of the governed, and the creation of some international organisation to limit the burden of armaments and diminish the probability of war."[1]

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[1] Of Rumanians in the Dual Monarchy the Premier said, "We also mean to press that justice be done to men of Rumanian blood and speech in these legitimate aspirations."

Nevertheless, the German Chancellor found the military situation so favourable that he declared himself unable to open up peace negotiations on the basis proposed by Lloyd George and demanded a fresh revision of the enemy proposals. As he let it be understood at the same time that Germany entertained no idea of giving up either the whole or parts of Alsace-Lorraine, the Supreme Council in Versailles declared on Feb. 4 1918 that a suitable basis for making peace was not given. The War must, therefore, continue till its pressure should have brought about a change of temper in the enemy governments and peoples. The Vienna Govt. endeavoured indeed to bring about another meeting between Revertera and Armand in Feb. 1918, to pave the way for official conversations with the French Government. But it at once encountered insuperable difficulties. When Revertera asked whether France would be inclined to renounce the reacquisition of Alsace-Lorraine, Clemenceau answered at the beginning of March 1918 with a curt negative. This doomed to failure the attempt which the Emperor Charles had been making meanwhile to work for a peace by understanding by an appeal to Wilson through Spain; efforts which from the outset had had little chance of success.

Disintegration of the Central Powers.—Once again the decision lay with arms. The Germans achieved great successes in the first months; but the Allied troops in the West were now brought under a single command,[2] and were effectively reinforced from America. Moreover the hope of the Central Powers that the relief of their Eastern Front would enable them to concentrate their entire forces in the west and southwest had been only partly fulfilled. The state of war in the east appeared, indeed, to be at an end after the conclusion of the Treaties of Brest-Litovsk and Bucharest, and after Finland too had concluded peace with each of the Powers of the Quadruple Alliance separately between March and May 1918. As, however, the German Army Command and the civilian circles which worked in concert with it were aiming at extending Germany's frontiers and her political, military and economic sphere of influence in the east, not all the troops hitherto employed in the east could be transferred to the west. And this all the less since the Western Powers, in view of the great interests which they too had in the eastern question, made every effort to thwart Germany's plans. They had military detachments in various parts of Russia, and a strong reinforcement in the Czechoslovak legions, which had been raised with the greatest energy. These forces assisted the counter-revolutionaries in the numerous bloody battles in which they engaged the armies of the Soviet Government.

The danger thus presented to Germany induced the Berlin Govt. to approach that of Soviet Russia, although their tendencies were completely opposite and the Bolsheviks never relaxed their efforts to introduce their revolutionary ideas into the German ranks. The German Govt. refused the request of the Soviet Govt. to grant them support, if only unofficially, against the enemy in the Murmansk district and on the Don. But they signed a supplementary treaty to the Peace of Brest-Litovsk on Aug. 27 1918, whereby they promised neither to initiate nor assist the formation of any further independent states on the territory of Soviet Russia, nor to support the operations conducted against the Bolsheviks in the Caucasus and to prevent the attack which Turkey was planning on Baku. In return, Russia was to allow Livland and Estonia to be assigned, as Courland and Lithuania had already been, entirely to the German sphere of influence and to pay a large indemnity.

The advantageous results of this agreement for Soviet Russia were soon apparent. The Red Army was able to advance successfully against the enemy; a number of districts were conquered; its authority in its own territory strengthened. But this agreement, which Germany had concluded without the co-operation of her Allies, had evil consequences for her. Her Allies had long been discontented with the selfish attitude, as they saw it, of the German Govt., and this discontent was voiced ever more plainly when instead of the victory which Ludendorff had promised in the west, the Allied troops under Foch opened a most successful counter-offensive. A conference of the leading statesmen and generals was held at general headquarters in Spa on Aug. 14 under the Emperor William's presidency, to adopt a policy to meet the altered military situation. Ludendorff stated that the chances of victory were now gone, but he hoped to put up a successful defence which would increase the enemy's inclination for peace. Hintze, the new German Secretary of State for Foreign Affairs, strongly urged the opening up of peace negotiations, and carried his point. The Army Command agreed.

One of the chief factors which contributed to this decision were the statements of the Emperor Charles and Burian, who had arrived in Spa the same day and declared that Austria was unequal to a fifth winter campaign. The Governments in Sofia and Constantinople reported to the same effect. Furthermore, the relations between Germany and her Allies had become ever more strained during 1918. The Bulgarians complained that Berlin had paid too little attention to their requests for military assistance; the Turks that Germany wanted to stop them from taking advantage of the favourable opportunity to extend their frontiers in the Caucasus.

But the worst effect was produced by the increasing resentment felt by the Emperor Charles and his Government at Germany's attitude. For as their need of peace grew ever stronger, they felt more bitterly the refusal of the German Govt., which had become increasingly dependent on the military command, to make a general peace possible by sacrificing territory in the west of Germany. Their loyalty to the idea of a general peace and their rejection of their enemies' proposals for a separate peace had already involved them in great dangers. The Ministry of Propaganda, which had been formed in London, and was under Lord Northcliffe's direction had declared openly in Feb. 1918 that it was "impossible to renounce the liberation of the peoples oppressed by the House of Habsburg." The Congress, which met in Rome in the second week of April 1918, and was attended by emigrants from the Czechoslovak, Polish, Yugoslav, Italian and Rumanian-speaking districts of the Habsburg Monarchy, had shown how far the separatist ambitions of these circles had already advanced. At this Congress the Italians agreed to settle their territorial disputes by amicable arrangement with the Southern Slavs, who had already smoothed over differences in their own camp by the Pact of Corfu, July 20 1917. A joint commission consisting of representatives of Italy, Great Britain and France, was established at Italian Headquarters, which became the centre of the national propaganda directed against the Dual Monarchy, and increased the danger which threatened that State.

In order to enlighten the world on the difficulties which stood in the way of his efforts for a general peace, Count Czernin had stated in a public speech at the beginning of April 1918 that Clemenceau's refusal to renounce the restoration of Alsace-Lorraine to France was the decisive reason of the non-success of the peace idea advocated by the Vienna Govt.; and had been rash enough to refer here to the conversations of Feb. 1918 between Revertera and Armand, which had hitherto been kept secret. Clemenceau answered by publishing the Emperor's letter of March 24 1917, which had only recently come to his knowledge. Czernin, who did not wish to cover the Emperor—and could hardly have done so—fell.

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[1] For text see Lowes Dickinson, *op. cit.*, pp. 108–115.

[2] By the decision taken at Doullens on March 26 1918 to place the oversight of the Allied Armies in the hands of Marshal Foch.

In Germany the contents of the Imperial letter and Charles' attitude in the polemic which followed its publication aroused most violent and universal indignation. The affair was described as an act of treachery against an ally at whose expense Charles had wished to buy a separate peace on terms favourable to himself. In order to allay this excitement, Charles, accompanied by his new Foreign Minister, Burian, travelled to Spa, where he concluded an agreement on May 12 1918 which arranged for the closest possible connection between the two empires in all political, economic and military matters both during and after the War. Had this come into force, it would certainly have meant a great increase in the predominance of the stronger partner over the government and peoples of the Habsburg Monarchy. The Emperor Charles had, indeed, made this agreement contingent on the condition that the Polish question be first settled on the Austro-Polish lines, a solution which had, however, little chance of realisation in view of the general opposition to it in authoritative circles in Germany. The enemies of the Central Powers, however, saw in the meeting at Spa a step further along the road towards the dreaded "Mittel-Europa" on which much had been written and spoken in Germany and Austria and whose best-known exponent was Friedrich Naumann.

One of the consequences of this view was that the idea of thwarting these plans by dismembering Austria-Hungary gained more and more adherents in Paris and London. This consideration, together with the valuable help which the Czech legions in the East were rendering to the Entente Powers, induced the French Govt. on June 28 1918 to confirm the rights of the Czechs to independence and to recognise the Czechoslovak National Council in Paris as their supreme organ, the forerunner of a future Czechoslovak Government. These concessions were at once approved by France's allies and extended by the declarations made by Britain on Aug. 9 and the United States on Sept. 3—this was largely due to Masaryk, who had been in that country since May 1918—by which the status of an Allied army was conceded to the Czech troops in Siberia and their legions in France and Italy, and the National Council in Paris was allowed the rights of an Allied Government.

Meanwhile the failures of the Austro-Hungarian troops in Italy and the Germans in the West had reacted on internal conditions in the Dual Monarchy. The new Austrian Minister, President Hussarek, had produced a plan for a revision of the Constitution on federalist lines, but with little effect. The resolutions of the Congress of Laibach of Aug. 18 1918 showed that the non-German peoples of the western half of the monarchy were working for the establishment of independent states, and the central authority was no longer strong enough to check these endeavours, especially as the Magyars refused to release Croatia-Slavonia from the Hungarian body politic. Charles and his Foreign Minister, Burian, thought an immediate offer of peace the only way to save what was still to be saved. The resolutions of the Congress of Spa showed Burian the way to fresh conversations with Germany. He encountered no more absolute resistance.

Yet great differences presented themselves during the negotiations as to the course to be adopted. The Germans wanted to wait till the military situation in the west improved and then begin negotiations with the enemy through a neutral Power—Holland or Spain—while Burian advocated an immediate and open appeal to all the belligerent Powers. At the beginning of Sept. 1918 Hintze spent some time in Vienna in the endeavour to arrive at a concerted course of action. When, however, Ludendorff's promise of a successful military defensive was not fulfilled; when, on the contrary the German troops were forced to retire on to the "Siegfried lines," Burian, seeing no prospect of an agreement with Germany, decided on Sept. 14 to disregard her opposition and to issue an appeal to all belligerent States to open peace negotiations. This step was not attended by the success for which Burian had hoped. President Wilson answered, after a few days' interval, that he had repeatedly and in the plainest terms made known the conditions upon which he was prepared to consider the conclusion of peace; hence the Government of the United States could not and would not accept a proposal for a conference concerning a matter on which it had already clearly made known its attitude and aims. The Cabinets of London and Paris were equally cold.

The sole result of Burian's new effort for peace was to increase the Entente's confidence of victory. On Sept. 15 ensued a violent attack against the Bulgarian Army, in the ranks of which war-weariness had for some time made serious inroads. The Bulgarian troops offered but little resistance; great bodies of them laid down their arms and returned to their homes. The Sofia Govt., at the head of which Malinov, who was friendly to the Entente, had succeeded Radoslavov some months previously, resolved, since its appeals to the Central Powers had met with practically no response, to propose an armistice. This was granted on Sept. 29 upon conditions which, for the Central Powers, spelled the loss of the Balkans. King Ferdinand abdicated in favour of his son Boris.

These events and the great successes of the British troops in Palestine produced their effect upon Turkey. At the beginning of Oct. Enver and Talat, the chief advocates of the policy of the Central Powers in Constantinople, fell from power, and thus the way towards a separate peace lay open here also. The Entente concluded an armistice with Turkey on Oct. 31 which brought the Dardanelles and the Bosporus under its control, and pledged the Turks to break off all relations with the Central Powers.

Meanwhile the position of the Central Powers had likewise become untenable. Under the effect of the crushing defeat of the Turkish and Bulgarian troops and the new, most violent assault of the Entente troops on the "Siegfried line," Ludendorff demanded at the end of Sept. that an immediate request be addressed to Wilson for an armistice and the opening of peace negotiations. Prince Max of Baden, the new German Chancellor, agreed with the ideas of the Supreme Command, but advised that the first step should only concern the peace offer, which he too thought inevitable, while the request for an immediate armistice should be postponed, since the enemy would only look upon and utilise this as an indisputable proof of the complete breakdown of the German Army. Ludendorff, however, stood by his demand and forced it through. On Oct. 5 the Govts. of Germany, Austria-Hungary and Turkey appealed to Wilson for an armistice, to be followed by peace negotiations. Wilson answered that he could not consult his Allies about an armistice until the Central Powers had admitted defeat by evacuating the Allied territory still in their occupation. He refused to admit any discussion of his Fourteen Points; at the most he would allow conversations on the details of their application. Furthermore, he asked whether the German Chancellor still spoke in the name "of the persons responsible for the War."

A week later he produced further demands. He called for abandonment of the U-boat warfare and guarantees for the maintenance of the military superiority of the Entente Powers. In a third note (Oct. 23) he defined the last-named demand as follows—that "he and his Allies, before granting an armistice, must have the assurance that they could at any time impose the conditions of peace." At the same time he declared that he must demand "not peace negotiations but surrender" if he had to continue in the future to negotiate "with the military rulers and monarchist autocrats of Germany." The severity of these conditions of armistice evoked the most lively excitement in German military and civilian circles. In both the opinions were violently divided. Ludendorff demanded the breakoff of the negotiations, the continuance of the War and an appeal to the German people for a *levée en masse* to defend the Fatherland. Other military leaders, on the other hand, declared it useless to continue the War, since the superiority of the enemy became more obvious every week, while war-weariness among the German troops had much increased under the strong influence of extreme socialist and enemy propaganda. The new German Govt. pronounced on the same lines. It called for, and carried, subjection to the commands of the enemy. Ludendorff resigned (Oct. 27).

Meanwhile the catastrophe had taken place in Austria-Hungary. Encouraged by President Wilson's repeated pronouncements as to the right of nations to self-determination, the separatist ideas of those peoples of the monarchy which did not acknowledge German or Magyar nationality had become ever more articulate. There were disturbances in various parts of the Empire, and these disruptive influences had made it month by month increasingly difficult to keep the army efficient for war. The Viennese Govt., although recognising the dangers of the experiment, resolved to reorganise the monarchy on a new basis, in accordance with the 10th of Wilson's Fourteen Points. On Oct. 16 the Emperor Charles issued a manifesto in which he proclaimed that Austria, in accordance with the will of her peoples, was to be created into a Federal State in which every race would be free to establish its own form of body politic on the territory occupied by it. This was not, however, to anticipate the union of the Austrian Poles with an independent Polish State. The Imperial manifesto was to apply to Austria only. For Hungary, where forces were already at work for a personal union and for a complete separation from Austria, the manifesto affirmed the unity of the Kingdom of Hungary. It thus became clear to the Southern Slavs that they must no longer hope for a realisation of their national aspirations within the bounds of the monarchy. But the Emperor's hope of conciliating opinion among the Austrian Slavs with this manifesto was disappointed; the more so, as Wilson had informed Vienna that the United States had already recognised Czechoslovakia as a belligerent Power and the Czechoslovak National Council as a belligerent government, and had also recognised the justice of the national aspirations of the Southern Slavs; these peoples had therefore to decide for themselves which of the resolutions of the Austrian Govt. were acceptable to them.

In the last days of Oct. independent governments or other national authorities formed themselves in Prague, Agram, Laibach, Sarajevo, Cracow, Lemberg and Trieste. These internal movements led to the collapse of the armies; the governments of the several countries constituting the monarchy, Hungary leading the way, summoned their co-nationals to the defence of their particular frontiers or called them back home.

The Emperor Charles now attempted to achieve a separate peace; but his intermediaries hardly gained a hearing. At the end of Oct., after the revolution in Hungary, and after increasing numbers of the troops in Italy had started for home, the Austro-Hungarian Army Command asked an armistice from the Italians, who were advancing without meeting resistance. This was granted on Nov. 3 on conditions of pitiless severity. The negotiations for a separate peace were carried on even now, but without any result. The process of dissolution ran its course in the Dual Monarchy. On Nov. 11 1918 the Emperor Charles renounced all share in the business of government in Austria, on Nov. 13 in Hungary; he did not, however, renounce his crown. On Nov. 12 the Austrian National Assembly proclaimed a Republic, which was at first intended to form a component part of the new German Republic. On Nov. 16 Hungary inaugurated the Republican form of government. The ancient Austro-Hungarian Monarchy ceased to exist. The armistices with Bulgaria, Turkey and Austria-Hungary were granted on terms of unconditional surrender, and gave none of these Powers the legal right to claim self-determination on the Fourteen Points.

Wilson's offer to the fresh demand of Germany for definition of the conditions of an armistice and peace was different. It is stated in his communication of Nov. 5. All the Entente Great Powers agreed to the basis of the Fourteen Points, and addresses of President Wilson in 1916, being applied to Germany; but all reference to her allies was excluded. The Entente Powers "reserve to themselves complete freedom" (Point 2 relating to Freedom of the Seas) on this subject when they entered the Peace Conference. Further, in the conditions of peace laid down in his Address to Congress of Jan. 8 1918, the President had declared that the invaded territories must be restored as well as evacuated and freed, "and the Allied Govts. feel that no doubt ought to be allowed to exist as to what this provision implies." By it they understood "that compensation will be made by Germany for all damage done to the civilian population of the Allies and their property by the aggression of Germany by land, by sea and from the air."

Marshal Foch was empowered to communicate the conditions of armistice to suitable accredited military representatives. On Nov. 8 the German Delegation met Marshal Foch in the Forest of Compiègne. The conditions communicated to it were even harder than events in Bulgaria, Turkey and Austria-Hungary had led Germany to expect. A violent difference of opinion arose once more in Germany whether these conditions should be accepted or rejected and the struggle continued. In reality, there could be no doubt as to the course which must be adopted. For the enemy troops had been advancing unceasingly, and the "home front" had been broken by the revolution, which had begun with the mutiny of the sailors in Kiel and had quickly extended over wide districts of Germany. On Nov. 4 soldiers' and workmen's councils were formed on the Russian model. The cry that William II. should abdicate grew ever louder; but he hesitated to obey it. Thereupon Prince Max of Baden, the German Chancellor, under the continuous pressure of the Social Democrats and in view of the threatening attitude of the masses, proclaimed the abdication of William II. and his eldest son, without waiting for their consent (Nov. 9). His hope to save the monarchy by this means was disappointed. A few hours later the Republic was proclaimed. The Emperor William abandoned his resistance in the face of the accomplished fact and fled to Holland. The other German monarchs shared his fall. The new government declared itself prepared to accept the Armistice, which was signed for Germany by Erzberger, the leader of the Centre, and three others, with Hindenburg's approval, on Nov. 11 1918.

Thus ended the four years and more of the War. It had led to the fall of three Empires, to the complete dismemberment of the Habsburg Monarchy, to the formation of a number of independent states on the territory of the Dual Monarchy and of the former Empire of the Tsar, who had met with a violent end in 1918. The further fate of the conquered peoples depended on the decision of the victorious states, whose leading personalities immediately began to occupy themselves with the re-making of Europe.

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IV. INTER-ALLIED DIPLOMACY

Pact of London.—The legal consecration and the basis for the further development of the co-operation of the Allied and Associated Powers is to be found in the Pact of London[1] (Sept. 5 1914), in which Great Britain, France and Russia mutually engaged "not to conclude peace separately" and that no one of them should "demand conditions of peace without the previous agreement of the other allies."

The Treaty of London.—By the Treaty of London[2] (April 26 1915) Italy pledged her military assistance to the Entente in return for the realisation of her political and territorial ambitions at the close of the War. As recorded in the Treaty of London, the price paid by the Entente to Italy was a heavy one. The Entente was committed to the assignment of part of the territory of the Austro-Hungarian Empire to Italy. Italy's aspirations in the Adriatic were to be satisfied, and, still more important in view of subsequent controversies between the Allies, her position as a factor in the Mediterranean balance of power was acknowledged. Her interests in the Near East were to be safeguarded in the event of either a partition or a retention of the Turkish Empire. Although the treaty contains no hint of it, France and Great Britain had already made up their minds to a partition of Turkey.

The Constantinople Agreement.—In March they had signed with Russia an agreement, the so-called "Constantinople" agreement[3] (March 18 1915), by which they promised her Constantinople and all European Turkey east of the Enos-Midia line; Italy became a party to this agreement after her signature of the London Treaty.

The accession of Italy to the Entente opened up a new theatre of war, and revealed more than ever the need for co-ordination of military effort. Hitherto ordinary diplomatic channels had been made use of by the Allies in their communications with one another; but in a short time these were proved to be hopelessly inadequate. Early in 1915 the visits of M. Millerand to London and of Mr. Asquith to Sir John French's military headquarters, where he met M. Millerand and Generals Joffre and Foch, revealed the need for, and inaugurated, the long succession of inter-Allied conferences that took place during the next three years,[4] of which only those of outstanding political importance can be mentioned here. (For certain conferences not here mentioned see CONTROL, INTER-ALLIED.)

Inter-Allied Conferences July 1915–March 1916.—In July 1915 there met at Calais the first inter-Allied conference to be attended by the heads of the British and French governments. In addition to the French and British Prime Ministers, there were present Lord Kitchener, Lord Crewe, Mr. Balfour and MM. Millerand, Albert Thomas, Delcassé and Augagneur. At this conference certain decisions affecting war strategy were taken, and its success was demonstrated when matters that had been awaiting decision for weeks were dealt with in a single day.[5] So successful was it that only a few weeks elapsed before an even more important one was held at Paris (Nov. 17 1915) between the British and French Prime Ministers, Ministers of Foreign Affairs, War, Marine, etc.[1] Here matters of the greatest importance were discussed and decisions taken upon them: the position of Greece, Serbia (including the question of Salonika) and the Gallipoli Expeditionary Force; the general problem of the co-ordination of military efforts; the determination of reinforcements to be sent to Salonika. Most important of all, a decision was taken in principle to set up a committee to co-ordinate the action of the Allies in regard to the War, the task of making proposals for this purpose being placed in Mr. Asquith's hands. In this decision lies the germ of the organisation of the subsequent inter-Allied conferences. Salonika and Gallipoli loomed large at this conference, for events in those theatres of war had not favoured the Allies. Indeed, in Sept. a conference between the French and British War Ministers, commanders-in-chief, chiefs of the general staffs and other technical experts had been held at Calais to discuss the question of reinforcements for Gallipoli and the possibility of effecting a landing on the Asiatic side of the Straits.

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[1] For text see *Parliamentary Papers*, Cd. 7737.

[2] For full text see Temperley, *History of the Peace Conference*, vol. 5, pp. 384–93. The terms were, in brief, as follows: Italy promised to assist the Entente with her "entire resources." Military and naval conventions were to be drawn up to establish the assistance to be given to Italy by the Russian Army and the British and French fleets. Under the Treaty of Peace, Italy was to receive "the Trentino, Cis-Alpine Tirol with its geographical and natural frontier (the Brenner frontier), as well as Trieste, the counties of Gradisca and Gorizia, all Istria as far as the Quarnero," with the Istrian islands. Also "Dalmatia within its present administrative boundaries" down to Cape Planka, with the adjacent islands. Southern Dalmatia down to the Montenegrin frontier, to be neutralised. Southern Istria, "all the coast of Croatia with the port of Fiume" and some small islands, and the neutralised strip of Southern Dalmatia, were to be assigned to "Croatia, Serbia and Montenegro." Italy received Valona, and the foreign representation of Albania, but consented to a partition of Northern and Southern Albania between Montenegro, Serbia and Greece, should her Allies desire it. She received full sovereignty over the islands of the Dodecanese. It was recognised that Italy was "interested in the balance of power in the Mediterranean," and in the event of a "partial partition of Turkey in Asia" she was to receive a "just share" to be delimited later, in the Mediterranean region adjacent to Adalia. All rights and privileges of the Sultan in Libya were transferred to Italy. She was to receive a proportionate share of any war indemnity. She agreed that Arabia and the Moslem holy places should be left under an independent Moslem Power. If France and Great Britain increased their African colonies at Germany's expense, Italy was to receive "some equitable compensation," particularly on the frontiers of "the Italian colonies of Eritrea, Somaliland and Libya." Great Britain undertook "to facilitate the immediate conclusion, under equitable conditions, of a loan of at least £50,000,000." Her Allies would support her in opposing the introduction of a representative of the Holy See in the peace negotiations, etc.

[3] For text see Temperley, *op. cit.*, vol. 6, pp. 4–9. The main points were: Russia was to receive "the town of Constantinople, the western coast of the Bosporus, the Sea of Marmara and the Dardanelles; Southern Thrace as far as the Enos-Midia line; the coast of Asia Minor between the Bosporus and the River Sakaria and a point on the Gulf of Ismid to be defined later; the islands in the Sea of Marmara and the islands of Imbros and Tenedos." Constantinople was to be recognised as a free port for transit of goods not coming from nor proceeding to Russia. The sacred Mahommedan places to be protected and Arabia to be under an independent Mahommedan rule. The neutral zone in Persia established under the Anglo-Russian Agreement of 1907 to be "included in the English sphere of influence."

[4] See Sir M. A. P. Hankey, *Diplomacy by Conference*, p. 6.

[5] *Ibid.*

At a meeting between M. Briand and Mr. Asquith in London (Jan. 19 1916),[2] the constitution and rules for the proposed committee were agreed upon. In brief, it was to be an advisory body subject as to its conclusions to the approval of the governments. Its membership consisted of the Allied Prime Ministers and other such members of the Allied Govts. and their technical advisers as might be summoned to attend it. Underlying its creation was the idea of keeping the control of the military power in civil hands, for the meetings of the committee were to be preceded by meetings between the general staffs of the Allies, and it would be for the committee to decide upon the recommendations of the staffs in regard to naval, military and economic policy. All inter-Allied conferences held after 1915 at which the heads of the Allied Govts. were present were in reality meetings of this committee.

Its first meeting was the representative conference held in Paris on March 26 1916, at which were present the British, French, Belgian, Italian and Serbian Prime Ministers, the Russian and Japanese Ambassadors and the Portuguese Minister to the French Republic. As agreed, the conference was preceded by a meeting of the Allied general staffs, whose recommendations were subsequently reported to the conference by Marshal Joffre. Upon these the conference gave its decision; and upon certain economic and shipping questions, including that of the establishment of an Allied maritime transport council in London Opportunity was taken of the presence of so many members of the Alliance both to draft and pass a declaration of the unity of their aims in military, economic and diplomatic affairs, and to renew the decision contained in the Pact of London not separately to conclude peace.

In formal conference the Allied statesmen were preoccupied with the effectual prosecution of the War, yet speculation, even negotiation, as to the nature of the political settlement to follow an Allied victory was never far from their minds. When brought together, as by the conference in Paris, they informally canvassed one another as to the bases of a possible peace. The knowledge that "conversations" were taking place contributed to the reaffirmation of the Pact of London. Though bound not to negotiate peace separately, the Great Powers saw no reason why they should not predetermine among themselves the details of peace; and it was with the territorial settlement of the Near East that their minds were chiefly occupied in the early summer of 1916.

The Sykes-Picot Agreement.—Anxious to obtain Arab assistance against the Turks, Great Britain in 1915 had come to a secret and loosely defined arrangement with the Sherif of Mecca by which, in return for the armed assistance of the Arabs, she promised her support for the Sherif's plan for the creation of an independent Arab kingdom. The French, however, had for well-nigh a century entertained ambitions in regard to Syria and Cilicia—ambitions conflicting directly with those of the Sherif. The reconcilement was effected by the late Sir Mark Sykes and M. Georges Picot, without the knowledge of the Sherif of Mecca, in an agreement that has come to bear their names.[3] As the Sykes-Picot Agreement affected certain vital Russian interests in the Middle East, it was communicated to the Russian Govt., who assented to it in May 1916; but its provisions and even its existence were carefully concealed from Italy, with whose interests it might be expected to conflict. The full importance of this agreement in the history of inter-Allied relations became apparent in 1917 at the conference at St. Jean de Maurienne. It serves here to illustrate both the rifts that existed within the outward harmony of the Alliance, and the fact that not a few of the many subsequent disputes between the Allies had their origin in similar instances, where immediate military aid was purchased by promises, given by one or the other of the Powers, irreconcilable with the ambitions of some other member of the Alliance.

Negotiations with Bulgaria and Greece.—By winning Italy to their side the Entente had attacked the Triple Alliance in its Achilles-heel. The next step was to seek to place a barrier in the Balkans between the Central Empires and their Turkish ally. Geographically and politically, Bulgaria was obviously designed to act as barrier. Her ultimate refusal to do so, after protracted negotiations, was due as much to the inability of the Western Powers to induce Serbia to make concessions to Bulgarian aspirations in Macedonia as to the Germanophil feeling of her Coburg King. When Bulgaria finally threw in her lot with the Central Powers and invaded Serbia in Oct. 1915, the Allies turned to Serbia's ally, Greece, for help. Greece, too, was ruled by a Germanophil King and, despite the efforts of Veniselos and the bait of the possession of Cyprus held out by the British Govt., she proclaimed herself neutral in the conflict between Serbia and Bulgaria.

Political discussion remained in abeyance during the summer of 1916, until it was clear that the Allied offensive on the Somme would bring no decisive results; the attention of France and Great Britain, in particular, was again turned to wider problems. At a conference at Boulogne on Oct. 20 the British and French Prime Ministers, Ministers for Foreign Affairs, War, Marine, commanders-in-chief, chiefs-of-staffs, etc., discussed the question of Greek military co-operation against Bulgaria. In the previous Aug. Rumania had joined the Allies at a price which it had taken much negotiation to arrange, her demands conflicting dangerously with Serbian ideals. Now, after a few weeks' fighting, the total collapse of Rumania was imminent. The Boulogne conference found itself face to face with complete German domination in the Balkans; not only was Bulgaria an ally of the Central Powers, but Belgrade was, and Bucharest was about to become a German possession. Alone of the Balkan States Greece had not yet intervened in the struggle. At the end of Aug. an internecine struggle had broken out there between the King and his pro-German advisers and the pro-Ally Veniselos. When the Boulogne conference was assembling Veniselos had set up a provisional government at Salonika and declared war upon Bulgaria; but his government depended solely for its support upon the Greek islands. The mainland remained loyal to Constantine, whose deposition, desired by France and Great Britain, was opposed by the Tsar and by Italy.[4] At Boulogne the French and British Ministers found themselves called upon to arrange financial support for Veniselos, military co-operation with his forces against Bulgaria, transport of Allied troops to Salonika, the constitution of these troops, and, astly, whether or not Portuguese regiments should be included n their ranks.

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[1] See Sir M. A. P. Hankey, *Diplomacy by Conference*, p. 7.

[2] *Ibid.* p. 7.

[3] For text see Temperley, *op. cit.*, vol. 6, p. 16. The main terms were: Russia obtains "the provinces of Erzerum, Trebizond, Van and Bitlis" and part of Southern Kurdistan. France obtains "the coastal strip of Syria, the vilayet of Adana and the territory bounded on the south by a line Aintab-Mardin to the future Russian frontier, and on the north by a line Ala Dagh, Kaisariya, Ak-dagh, Sildiz-dagh, Zara and Egin, Kharput." Great Britain obtains Southern Mesopotamia with Baghdad and Haifa and Akka in Syria. The zone between the French and British territories forms an independent Arab state or states. Alexandretta becomes a free port. The holy places are put under a special régime.

[4] For valuable information as to the relations between Greece and the Entente Powers, see A. F. Frangulis, *La Grèce et la Crise mondiale*, vol. 1 (1926).

Conferences on Russian Situation.—In the meantime, the situation in Russia was growing more serious from day to day, and at a conference in Paris on Nov. 15 Russia formed the chief subject for discussion. In reality there were two conferences held on this day: the first, in the morning, was an Anglo-French conference; in the afternoon a second was held to which representatives of Russia and Italy were admitted. At the Anglo-French conference a frank interchange of views took place between Mr. Asquith and Mr. Lloyd George, representing Great Britain, and M. Briand and Admiral La Caze, the French representatives, on the subject of Russia and a political and military inter-Allied conference it was proposed to hold at Petrograd. It was agreed that, in addition to France, Great Britain and Russia, Italy should also take part, and that the conference should be composed solely of statesmen of the first rank with eminent soldiers and technical experts from each of he participating Powers.

In these circumstances Mr. Lloyd George attached so great mportance to the results likely to be obtained that he himself offered to be the British delegate.[1] Poland, in whose future France had a deep concern, and Greece, were also discussed; agreement was reached upon all these subjects. Great Britain nd France having thus arranged matters between themselves admitted Italy and Russia to the afternoon discussion. Russia was represented by her ambassador at Paris, M. Isvolsky; taly by Signori Tittoni and Carcano and the Italian Ambas- ador at Paris. The decisions arrived at in the morning were again debated, as well as the relations between the various governments and general staffs in regard to the conduct of the War. Already that need for unity of direction that was ultimately to result in the creation of the Supreme War Council was making itself felt. The discussion proving too long to be concluded the same day, the conference was resumed on Nov. 16. As regards Russia the work of this conference proved fruitless. The inter-Allied conference held at St. Petersburg (Leningrad) n the following Jan. found that, in the rapidity of their occur- ence, events in Russia had outstripped human power to control hem.

The Peace Proposals of the Central Powers, Dec. 12 1916.—British statesmen had frequently declared that the War ould be terminated for either side only by a "knock-out low." Shortly before he resigned the Premiership in Dec. 1916 Mr. Asquith defined the objects of the Allies as "adequate" eparation for the past and adequate security for the future."[2] Three days after the Boulogne Conference Sir Edward Grey delivered a speech (Oct. 23) in which he expressed his conviction hat the world must look to some league of nations as the preventive of future wars.[3] Bethmann Hollweg, the German Chancellor, seized upon this reference as opening the way to a possible peace negotiation, and dispatched (Dec. 12) a vaguely worded Note to the Allies in which he voiced his conviction that proposals Germany and her allies were prepared to bring forward "would be such as to serve as a basis for the restoration f a lasting peace."[4] The reception accorded this Note by the Allies showed that there was as yet no serious rift in the Entente, nor any weakening of the common determination to prosecute he War to a victorious termination. Allied statesmen denounced he Note as an endeavour to create discord within their anks,[5] while on Dec. 26 the heads of the French and British Govts. conferred in London over a reply to the German Note. In replying, the Allies rejected the German proposal as a manoeuvre, and reaffirmed their determination to carry on the War until assured of a peace that would secure "reparation of violated rights and liberties, recognition of the principle of nationalities and of the free existence of small States."[6]

President Wilson's Peace Proposals.—The reply to the German Note was only one among many subjects discussed and decided at this Anglo-French Conference. Another peace proposal—that of the American President—received a fuller reply. Deferring to the President's request for more detailed information as to the terms upon which the Allies were prepared to conclude a peace,[7] the French and British statesmen drafted in this conference the famous Reply that was returned to the President in the name of the Allied Powers on Jan. 10 1917. The Entente Powers committed themselves and their Allies to a peace programme that embraced the "reorganisation of Europe," including, as it did, "the liberation of the Italians, as also of the Slavs, Rumanians and Czechoslovaks from foreign domination . . . the setting free of the populations subject to the bloody tyranny of the Turks; and the turning out of Europe of the Ottoman Empire as decidedly foreign to Western civilisation."[8] Inspiring these phrases, unknown to the public and perhaps to certain of the statesmen agreeing to them, were the secret treaties and agreements, the Treaty of London and the Constantinople and Sykes-Picot Agreements. This conference also busied itself with the strategical problems in Palestine, with the Balkans and with the extension of the British front in France. Greece was again discussed, and Russia and the holding of the proposed conference at St. Petersburg. Arrangements were made for holding an Anglo-French-Italian conference in Rome at the New Year. Diplomacy by conference was again justified by its results: all these important matters were discussed and decided upon within three days.

Conference of Rome.—The conference at Rome on Jan. 5 was more representative, and occupied itself with matters no less important, than its predecessor in London. Italy and Russia were represented, as well as France and Great Britain. This was the second conference Mr. Lloyd George attended as Prime Minister (he had succeeded Mr. Asquith in that office in Dec.), and he had the French and Italian Prime Ministers as neighbours at the conference table, in addition to the chiefs of the staffs of the Allies, with a great number of technical advisers.[9] The proposed conference in Petrograd was again discussed, as also the possibility of affording some measure of military and economic assistance to Russia. Co-ordination had so justified itself by results in other departments of the War that a resolution was taken to hold a naval and shipping conference in London at an early date to take counsel regarding the submarine menace, maritime transport and other cognate matters.

So grave was the menace that a new line of communication with Salonika and the Allied forces in Macedonia was agreed upon by which, as it passed through Italy, a great shortening of the sea journey would be effected. Those forces were menaced by another danger; the opposition of King Constantine to the policy of the Allies. Hence the conference was led to decide what policy should be adopted towards the Royal Greek Govt., and what instructions should be given to General Sarrail, the commander-in-chief of the Allied forces at Salonika for his guidance in his relations with that Government and with the general officers commanding the Allied Armies in the Balkans. Greece and Russia were not the only causes for anxiety to the Allies; the military situation in Italy, as Mr. Lloyd George told the conference in a memorandum he circulated amongst its members, left much to be desired. Convinced that the collapse of Russia was imminent and inevitable, the Prime Minister believed that it would set free enemy forces sufficient to render an intensive attack upon the Italian front a feasible and probable operation on the part of the Central Empires. He therefore urged the desirability of preparation on the part of the Allies, so that in the event of the need arising large reinforcements could at once be dispatched to the Italian front. The Italian débâcle at Caporetto 10 months later demonstrated the truth of his warning; the fact that that debacle was stayed in time is testimony to the efficiency of the plans worked out by the conference in Rome.

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[1] Hankey, *op. cit.*, p. 9.

[2] Speech on Oct. 11.

[3] Speech to Foreign Press Association, Oct. 23.

[4] *Parliamentary Papers*, Cd. 8,406.

[5] On this subject generally, see *Cambridge History of British Foreign Policy*, vol. 3.

[6] *Parliamentary Papers*, Cd. 8,467.

[7] *Parliamentary Papers*, Cd. 8,431.

[8] *Parliamentary Papers*, Cd. 8,468.

[9] For information as to this conference, see Hankey, *op. cit.*, pp. 10–11; Sir W. Robertson, *From Private to Field-Marshal;* Temperley, *op. cit.*, among others.

Conference of St. Jean de Maurienne.—While the Rome conference was sitting another of some importance was taking place in London between Mr. Balfour, the French and Italian ambassadors and the Russian Chargé d'Affaires. The British Govt. again found themselves called upon to reconcile conflicting ambitions with regard to the post-War territorial settlement in the Near East. The Sykes-Picot Agreement had been kept secret from Italy and the Sherif of Mecca, but the fact of its existence and its terms, if not an actual copy of the agreement itself, had come into possession of the Italian Government. At once that Government sought from its Allies a very definite and binding interpretation of the admission in principle of Italian claims in Asia Minor contained in Article 9 of the Treaty of London. When these claims came to be discussed in conference in London, their irreconcilability with those of Russia, France and Great Britain became embarrassingly apparent. A way had to be found out of this tangle of diplomatic promises; but after some weeks of negotiation and discussion the Conference failed to secure complete unanimity. Italy continued to be insistent in her demands, and, as she was mistress of the new route to the Salonika front and any defection on her part from the Alliance would have entailed the most serious consequences, the French and British Prime Ministers met the Italian Prime Minister and Foreign Ministers at St. Jean de Maurienne on April 17 and achieved an agreement. The terms of this agreement have never been published; but it was intended that it should be a corollary to the Sykes-Picot Agreement. One fact alone is certain: that the Italian Prime Minister received a promise of Smyrna in answer to his demand for that town.[1]

Events in Greece were now steadily leading up to the crisis which culminated with Mr. Jonnart's mission and the deposition of King Constantine. The Allies, especially Great Britain, wished to reconcile the Veniselist and Royal factions, and when that became impossible to side with whichever party was most likely to further the Allied cause in the War. By April 1917 Constantine was the sole obstacle in the way of a Greek declaration of war on the Central Empires; therefore, at St. Jean de Maurienne, M. Ribot proposed that the Allies should demand his abdication. This proposal, if not unwelcome to the British Prime Minister, met with heated opposition from Baron Sonnino for the same reason that Italy in the previous year had refused to demand Constantine's deposition—that to place Veniselos in power would be to endanger Italy's Near Eastern and Mediterranean interests by rendering possible the creation of a Greater Greece. The conference rejected M. Ribot's proposal, and decided to postpone any demand for the King's abdication until popular movements or other causes at Athens should render it inevitable.[2] When that occurred the crown should pass to Constantine's eldest son. The conference resolved in the meantime to take certain measures that would virtually make them the masters of Greece.

The Sixtus Letters.—A final question still remained for decision. The Emperor Charles of Austria had transmitted a peace proposal to the Allies through his brother-in-law, Prince Sixtus of Bourbon-Parma. The Emperor consented to the restoration and indemnification of Belgium; to the restoration of Serbia with an outlet to the sea [through Albania]; and promised to support " the just claims of France to Alsace-Lorraine." He did not mention Italy.[3] When Lloyd George and Ribot, being inclined to treat with Austria, raised the question at St. Jean de Maurienne, Sonnino refused scornfully to listen to it. Italy, said Sonnino, could not conclude a " white peace "; her demands as stated and agreed to in the Treaty of London must be fulfilled to the letter.[4] Subsequently the Emperor agreed to certain minor concessions to Italy; but Sonnino's refusal at St. Jean de Maurienne had dealt the movement its deathblow.

The Greek Question: the Stockholm Conference.—The Allied Prime Ministers had no sooner returned to their capitals than Greek affairs once more claimed their attention. At an Anglo-French Conference, that met in London on May 28, it was resolved to address a demand to the Greek Govt. for the abdication of King Constantine, and within a fortnight that monarch had abdicated in favour of his second son Alexander. The Salonika front again came up for discussion, as also did a new subject at inter-Allied conferences—Socialism. The outbreak of revolution in Russia had inspired the Dutch Socialist, Troelstra, to propose a Labour conference in Stockholm to discuss the possibilities of peace. This idea was strongly supported by the Kerensky Govt. in Russia and by Mr. Henderson, the British Labour leader and Cabinet Minister, who had been on a mission to Russia with Vandervelde and Albert Thomas; more important still, it was favoured by Mr. Lloyd George.[5] The conference, however, decided against the Allied Powers being in any way represented at the proposed Labour conference, and even went so far as to agree that the Allied Govts. should refuse passports to their subjects desiring to attend its deliberations.

A few months later the Allies were confronted with the complete military collapse of Russia and her disappearance from among their ranks. In order to make arrangements for meeting the military, economic and political consequences of Russia's defection, a great inter-Allied conference assembled in Paris on July 25. At the first session Great Britain, France, Italy, Russia, Greece, Rumania and Serbia were represented, while at the final session on July 26 representatives of Belgium, Japan, Montenegro and Portugal were also invited to be present. The deposition of King Constantine had rendered it possible for Veniselos to bring Greece into the Alliance; but one of the chief problems before the conference was that of providing the financial sinews of war for the new Ally. The situation at Salonika gave rise to a discussion that finally embraced the general Balkan policy of the Allies. This conference also discussed the establishment of an Allied base at Corfu, the Italians in Epirus, the formation of an Arab legion, and the holding of a conference in London to effect co-ordination of transport arrangements.

The Russian collapse was speedily followed on the Italian front by the very consequence Mr. Lloyd George had foretold at the Rome conference in January. At the end of Oct. the Austro-German armies gained a great victory at Caporetto. At a conference at Rapallo on Nov. 7 the British, French and Italian Prime Ministers and chiefs of staff took measures that proved effective in stemming and eventually repulsing the danger. Always an advocate of unity of action and purpose among the Allies, Mr. Lloyd George found at Rapallo the strongest possible argument in the Caporetto disaster for urging upon them the establishment of some central directing organisation. His arguments prevailed, and resulted in the establishment of the Supreme War Council, composed of the Prime Minister and another representative of each of the Great Powers.[6]

The Supreme War Council.—At a great inter-Allied conference that met in Paris on Nov. 29 the decisions come to at Rapallo were endorsed; on Dec. 1 the Supreme War Council held its opening meeting. With its inception this record of inter-Allied conferences comes to a close. The Supreme War Council was indeed in one sense an inter-Allied conference *en permanence* in that it was a deliberative body composed primarily of the heads of the Allied Governments. But in another sense it was something less than a full inter-Allied conference, inasmuch as it was an advisory body whose recommendations could be put into practice only after they had been assented to by the Allied Governments. Certain it is that at times it tended to take on the aspect of a full inter-

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[1] For information as to this conference see G. P. Gooch, *Modern Europe;* Frangulis, *op. cit.*

[2] Frangulis, *op. cit.*, vol. 1, p. 519.

[3] See Manteyer, *The Austrian Peace Offer.*

[4] See Gooch, *op. cit.*, pp. 627–9.

[5] Gooch, *op. cit.*, p. 623.

[6] See on this conference Hankey, *op. cit.*, pp. 12–3; *War Cabinet Report*, 1917 (Cd. 9,005); P. Wright, *The Supreme War Council;* Robertson, *op. cit.*, among others.

Allied conference, as when, in addition to representatives of the British Colonies and of the Indian Empire, a great many of the Allied States were also represented. For the most part secrecy has been successfully maintained as to the actual proceedings at the meetings of the Supreme War Council.

From a few of these meetings, however, the veil has been lifted —the meeting at Versailles from Jan. 30 to Feb. 2 1918, at which the " creation of a general reserve for the whole of the armies on the Western, Italian and Balkan fronts " was decided upon, and the task of creation assigned " to an executive, composed of the permanent military representatives of Great Britain, Italy and the United States of America, with Marshal Foch for France."[1] Consequent upon the German offensive on March 21 a meeting was held at Doullens on March 26 at which the decision was taken to place the task of co-ordination of the British and French armies in the hands of Marshal Foch; following the repulse of the German offensive a meeting was held in Abbeville on May 1 at which it was decided to dissolve the military executive appointed the previous Jan., and a few days later the title of Commander-in-Chief of the Allied Armies was conferred upon Marshal Foch[2]; finally, from Oct. 31 to Nov. 4 a session was held at Paris at which were present the British, French and Italian Prime Ministers and Foreign Ministers, and at which two matters preliminary to the termination of the War were dealt with—the Austro-German request for an armistice, and the conditions of armistice to be granted to Turkey. At this conference man-power and that recurring subject on the agenda of inter-Allied conferences, military operations in the Balkans, were also discussed.

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(I. F. D. M.)

V. EUROPE AFTER THE WAR

The object of the following article is to give an account of the political condition of Europe during the six years from Jan. 1920 to the beginning of 1926. It does not include a formal narrative of the events which took place during this period; for that, reference must be made to the various special articles included n these volumes; the aim is to concentrate attention on those matters which affected the Continent as a whole and to point out the main characteristics in the general political development. The chief of these can be at once indicated for it gives a unity to he whole. The period is one of transition, a transition from the tate of war to a state of peace. It begins with the ratification of he Treaty of Versailles, followed shortly by that of the treaties of St. Germain, Trianon and Neuilly, by which the formal state of war on the continent of Europe ceased.

But even after the treaties had come into force it required ome years to liquidate the immediate effect of the War and to estore a normal political condition. The most important step n this direction was the adoption in 1924 of the Dawes scheme for he payment of reparation, by which what had been the chief ause both of economic and political trouble in Europe was to a great extent removed. This was followed in the autumn of 1925 by the Treaties of Locarno, but it was an essential part of these reaties that Germany should be admitted to the League of Nations. This, owing to unforeseen obstacles, was not realised in the spring of 1926 and in consequence the political situation still remained obscure and unsatisfactory.

The New Europe.—The settlement arranged in the Peace Conference of Paris had produced changes equal to if not greater in importance than those embodied in the former similar settlements, the Treaty of Westphalia, the Peace of Utrecht and the Congress of Vienna. The War, short as it had been, compared with the Thirty Years War—the War of the Spanish Succession or the Revolutionary and Napoleonic Wars—had in fact completely upset the existing political system. In the west indeed the changes were few and of minor importance. The Iberian Peninsula, Holland, Switzerland and the Scandinavian States, retained their old position and their old possessions almost unaltered, though Belgium was freed from the limitations on her full sovereignty implied in the guarantee of permanent neutrality. France had regained the provinces of Alsace and Lorraine which she had lost in 1870 and, at the same time, come back into the position of the first of the European nations which had so long been hers. In Central Europe it was very different. There the three great monarchies, which since the days of Catherine, Frederick the Great and Maria Theresa, had dominated so large a part of the Continent, had disappeared. In Petrograd, Berlin and Vienna, the old centres of monarchical authority, the Court had made way for republican government and the great armies by which Europe had been overawed had ceased to exist. But the character of the change in each case was very different. Germany had not only lost the military and political predominance which she had held since 1871, but she had been deprived of considerable territories: Alsace-Lorraine had been ceded to France; to Denmark the northern part of Slesvig; to Poland the greater part of the provinces of Posen and West Prussia, and, in addition, the heart of the great mining district of Upper Silesia; while the city of Danzig, commanding the mouth of the Vistula, was created a separate state in close association with Poland.

Perhaps even more important than the loss of territory, were the economic and financial disabilities imposed by the peace settlement, and the state of internal instability caused by the revolution. At the same time Germany was effectually crippled by the disarmament enforced on her, the establishment of control, and the occupation of the Rhineland. The general effect was that for the moment Germany was unable to take any active part in European politics; she had become a passive element in the continental system. The utmost she could do was to concentrate on the slow and arduous task of internal reconstruction, which at the best must take many years. None the less, she had come out of the War a united state. Subsequent projects for disruption, for instance in the Rhine provinces, Bavaria or East Prussia, failed, and she was still in population the largest country, except Russia, on the continent of Europe. It could be foreseen that sooner or later the time must come when she would be restored, not indeed to the old position of predominance, but to that of a Great Power.

Russia.—Very different was the change which had taken place in the relations of Russia to Europe. From the time of Peter the Great it had been the object of the Tsars to introduce European civilisation into their country and at the same time, by the Western extension of the Empire, to establish themselves as one of the European Powers. In this they had been successful, and ever since the Congress of Vienna they had taken an important and often a leading part in all the Conferences, and intervened even in matters which primarily concerned Western Europe alone, such as the establishment of the Kingdom of the Belgians. By the defeat of Russia in the War, followed as it was by the Bolshevik revolution, all this was changed. Russia lost the border territories from Finland to Bessarabia, and was now confined to the semi-Asiatic areas which had never come under the direct influence of European culture and the Western Church. She had in fact once more become not a European but an Asiatic Power.[3]

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[1] *War Cabinet Report*, 1918, Cmd. 325.

[2] *Ibid.*

[3] This may appear to be so if we look at territory alone, but the vast bulk of the Russian population speaks a great European language, possesses a great European literature and belongs mainly, in every way, to the European family system.—Ed. *E. B.*

More than this, the religious fervour with which her self-imposed governors adopted the principles of militant communism, set her in pronounced opposition to the whole established system of Western Europe. She became therefore, instead of an integral part of Europe, an alien state threatening Europe.[1] During 1919–20 the Soviet Govt. entertained hopes of imposing on the European states the new system which they had themselves adopted.

The first serious success was the establishment of a Communist Govt. in Hungary; there were hopes, which were not fulfilled, that this would be followed by a similar revolution in Germany. The crisis came in the summer of 1920. In the war which had broken out between Poland and Russia, the Russian troops advanced to the gates of Warsaw. The attempt failed; they were defeated and driven back in disorder, and this was quickly followed by treaties of peace in which the Soviet Govt. recognised the independence not only of Poland but also of the Baltic States and Finland. By this the immediate danger of Europe was stayed, but none the less the estrangement continued. The ill-advised attempts, which had been made in 1918 and 1919 to overthrow the Soviet Govt. by force of arms and the help of the Russian Whites, had failed.

The policy of the Soviet Govt. indeed gradually changed. Urged largely by the necessity of foreign capital for internal reconstruction, they aimed at negotiating treaties, both political and commercial, with individual states. Their first success was the Treaty of Rapallo with Germany, signed during the Conference of Genoa in April 1922, but it was not until the spring that formal *de jure* recognition was awarded by the British Labour Govt. under Mr. Ramsay MacDonald; this step was quickly followed by Italy, France and other states. From this time Russia has had diplomatic representation in the most important European capitals. But her efforts at closer relationship have in general not been successful, and her decisive refusal up to 1926 even to consider an application for admission to the League of Nations showed her unchanged opposition to the general principles by which the European States were governed. Meanwhile, in accordance with the old traditions of the Tsarist Govts., the new Russia aimed at extending her influence and authority on the continent of Asia. It was there—in Persia, in Afghanistan and in the Far East—that her power was most felt, and here the old rivalry between England and Russia reasserted itself.

The Succession States.—Germany was then temporarily in eclipse. Russia was alienated from Europe, but the third and oldest of the Great Powers—the one formerly though inaccurately known as the "Austrian Empire"—had been shattered never to rise again. The great Habsburg Monarchy, which since the days of Charles V. had played so important a part, had disappeared from the map of Europe. This is an event for which there is no parallel in modern European history. It is the first time that one of the Great Powers has, not by a slow and long delay, but by a sudden collapse, ceased to exist. It was not the result of any definite decision; the dissolution of the Empire had never been one of the avowed War-aims of the Allies: it was the spontaneous act of the population, an act which the Allies had not the power, even had they the will, to prevent.

As a consequence of these events the number of states comprising the European family of nations had been greatly increased. The new states were Finland, Estonia, Latvia, Lithuania, Poland, Czechoslovakia and Yugoslavia; and among them may also be included the Republics of Austria and Hungary. Of these the majority, though new from the point of view of the politician and the lawyer, to the historian were familiar. They were the recreation of states which had been absorbed in the two great monarchies of the Habsburgs and the Romanoffs. The Polish nation had regained the independence which it had lost in the partitions; Czechoslovakia, though with different frontiers, was really an incarnation of the ancient Kingdom of Bohemia; the new Austria and the new Hungary were parts of the hereditary dominions of the House of Habsburg and of the Hungarian Kingdom which, after a union of some four centuries, had now separated and regained the position, which they had had in the 15th century, of separate states. Serbia and Rumania had as a result of the series of wars increased in size. The fall of the Austrian Empire had in fact had results similar to those involved in the decay of the Turkish Empire: there too, the recognition as independent European states of Serbia, Bulgaria and Rumania, meant the restoration to independent life of nationalities which had for a time been submerged under the Ottoman conquest.

This comparison struck all observers and it led to the use of a phrase, the "Balkanisation of Europe," which formed a convenient catchword. In truth it might easily become dangerous and misleading. What had really happened was that the principle of the compact national state which after centuries of war had established itself in Western Europe, in the case, for instance, of Holland, Belgium, Denmark, Norway and Sweden, had now asserted itself in the more backward territories of Central Europe. That had been attained which had for 100 years been the ideal and the dream of liberal thought. Curiously enough it was just those parties who before the War had been most vociferous in the proclamation of the ideals of nationality and liberty who showed themselves after the War most ready to criticise the results when these ideals had been realised.[2] There was indeed legitimate cause for apprehension. These new states were confronted by the task of building up the whole of their national institutions and creating afresh a centre of authority.

At the best this is not easy. It was made more difficult in that it had to be undertaken at a time when economic resources had been wasted and destroyed by four years of war, and, in addition, by the fact that every one of these states made for itself a constitution in which were adopted the most extreme principles of democracy. It could only be expected that numerous mistakes would be made and that long years would be required before a fully satisfactory system of government had been established. Moreover, in most of these states there were inevitably incorporated very considerable minorities of population who were alien in language and religion or in nationality. Of the twenty millions of whom the new Republic of Poland consisted, there were two million Germans, four or five million Jews, and an undetermined number—Ukrainians and White Russians—who were more closely attached to the Russian than to the Polish branch of the Slavonic peoples. In Czechoslovakia there were some 3,500,000 Germans who felt their new position of inferiority all the more keenly, that up to 1914 they had belonged to the ruling caste of the Empire. In Rumania were incorporated large Slav, Magyar and German minorities.

With wise foresight the Allies, when determining the new frontiers of Europe, had imposed on these states in the east of Europe special treaties by which they bound themselves, under international guarantee, to give to these subject and unwilling populations full rights of citizenship and complete equality before the law, as well as the right of recognition of their own language and religion in the schools and courts of law. The enforcement of these stipulations was necessarily attended with much difficulty. In one case, at any rate, the proposal of the Polish Govt. to dispossess German farmers in the Grand Duchy of Posen, was prevented, and thereby a threatened act of injustice, which would have caused national enmity, was averted. It was of the highest importance that the new system of Europe should recognise the obligation to provide an international guarantee of justice and protection against the unjust administration of the laws in these new states. It was to the League of Nations that was entrusted by treaty the responsibility of watching over the execution of these new treaties. In fact, they only perpetuated a principle which by the Treaties of Berlin had already been adopted when the Great Powers of Europe had recognised the new independence of Rumania and Serbia.

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[1] Historically it is very important to note that Lenin and his colleagues believed themselves, however wrongly, to be the most European of Russians, the executors of the latest and best European ideas and the true spokesmen of the industrial masses throughout Europe. (*See* RUSSIA.)—Ed. *E. B.*

[2] Much of the criticism, however, was deeply reflective and guided by historical and ethnographical study. The new system was far from being animated by a pure principle of national liberty. Poland, Czechoslovakia and Rumania contain a mixture of peoples, with a dominant race, and corresponding minority problems.—Ed. *E. B.*

The Principal Allied Powers.—These political and territorial changes had radically altered the political balance of the continent. For the last 100 years, by common consent, the five—later six —Great Powers had exercised a general control and supervision over all European matters, and had in particular claimed the right of intervening when any important territorial change was proposed. This system, which at the best had only worked intermittently and had often failed owing to dissensions among the Great Powers, had now broken down. The three eastern monarchies were eliminated, and there remained only Great Britain, France and Italy. It was these three states, who, together with the United States of America and Japan, acting as the Principal Allied and Associated Powers, had determined he conditions of peace, and there naturally fell to them the responsibility of enforcing their observance. The United States, by their refusal to ratify the Treaty of Versailles, fell out. In regard to European matters, Japan had no direct interest and claimed none; on these the three European Powers in effect acted alone; to them fell also, as the only organised centre of authority in Europe, a general prerogative of control. It soon appeared, however, that their real powers were very limited. Notwithstanding the victory which they had achieved in the War, they were so exhausted by the effort that they had not the effective military power nor the financial resources to impose heir will throughout the great expanse of Central or Eastern Europe. Their position was very different from that of the allied monarchs who, after 1814, were in military occupation of large parts of the Continent and were able, almost without resistance, o carry into effect any resolution on which they jointly agreed. In 1919 the Allies found difficulty in exercising any effective conrol over the steps by which the new states, such as Poland and Czechoslovakia, came into existence, and they encountered serious obstacles when they attempted to supervise and limit the arge extensions of territory demanded by Poland, Yugoslavia and Rumania.

None the less, it was necessary for them to set up machinery or dealing with the very numerous and sometimes important problems arising out of the treaties which could be dealt with by hem alone. Almost every chapter of the treaties left important points, including the right of interpretation, to the Principal Allied and Associated Powers. Some of these, *e.g.*, reparation and he control of the occupied areas in Germany, were referred o special commissions. Matters of outstanding importance were dealt with by periodical meetings of the allied statesmen who continued, under the title of the Supreme Council, the work lone by the Council of Four at Paris. These meetings varied rom long and formal conferences, such as those of Spa in July 920 or of London in Feb. 1921, to brief and transitory conversaions between the Prime Ministers of Great Britain and France, astily summoned to deal with some special point or special mergency. They were similar in character and object to the onference of Aix-la-Chapelle and other conferences which folowed on the conclusion of the Napoleonic Wars.

Matters of less importance were referred to the Conference of Ambassadors, a body created in 1920, which sat in Paris. To it here reported, for instance, the territorial commissions which had been set up to mark the new frontiers; it had to frame the deisions arrived at after the various plebiscites ordained by the Peace treaties, had been held. Much of the work which came efore it was of an extremely subordinate character. It is a misake, which is not uncommon, to speak of the Conference of Ambassadors as a body with its own independent rights and duties. n itself it had no power or authority; it was merely a clearing ouse established to avoid the long delay involved in dealing with questions by the ordinary diplomatic channels. The memers of the conference were each directly responsible to the Government by which he was appointed. Its functions were also trictly limited to questions which arose out of the execution or nterpretation of the treaties; there does not seem any case in which it transcended them. As the years went on, the points referred to it, which at first had been very numerous and sometimes of considerable importance, naturally diminished.

The League of Nations.—Of greater importance was the institution of the League of Nations. This differed fundamentally from the older system of meetings of the Great Powers and, in fact was something quite new in the machinery of dealing with international affairs. The first point to be noted in its organisation was that it was a permanent body with a standing secretariat and regular meetings. By this alone it showed a great advance. Matters of a political nature could be referred to it and dealt with immediately before they had had time to become politically dangerous. When any local dispute arose, it was no longer necessary to create special machinery for dealing with it or to resort to the cumbrous method of calling a special conference; the machinery was there ready and able to get to work without delay. Moreover, it was found that an appreciable advantage was gained by transferring discussions from the more electric atmosphere prevailing in cities such as Paris, London or Rome, to the more neutral and impartial surroundings of Geneva.

Almost as important as the creation of the League itself was that of the Court of International Justice, which was set up in the year 1920–1 at The Hague; the settlement of international disputes was much facilitated by the existence of a permanent organ to which all questions of a judicial nature were automatically referred. Again, in the constitution of the League there was found a solution of a long-standing difficulty. The dominance of the Great Powers had during the 19th century been pushed so far as seriously to threaten the sovereignty and independence of the smaller states. In the Assembly of the League, however, every European State, except Germany and Russia, had a seat, and in the Council (which was for most purposes the executive organ) side by side with the permanent members, the Great Powers, there was an actual majority of elected representatives of the other states. All this gave to the smaller states an influence and importance of which they had long been deprived. Of this opportunity they were quick to avail themselves. Many of the representatives, for instance Mr. Branting of Sweden, M. Hymans of Belgium, M. Beneš of Czechoslovakia, M. Politis of Greece, M. Quinones of Spain, quickly won a high position in public esteem; they showed eloquence in debate and wisdom in counsel. It soon became apparent that in dealing with political matters one of the chief weapons of the League was publicity. The open discussion in the Assembly and the Council had a great effect in creating a general public opinion which no state could afford to ignore.

Naturally time was required before the League could undertake its political duties. It was fortunate that the major questions which were agitating Europe at this time, especially the continued conflicts between the Allies and Germany, did not fall within its sphere. They, like all other questions concerning the interpretation and enforcement of the treaties, had in the first place to be dealt with by the Allies. It was an important stage when, owing to continued differences of opinion in the Conference of Ambassadors as to the partition of Upper Silesia after the plebiscite, this question was referred to the League for decision. They were asked to adjudicate on the difference of opinion between Great Britain, France and Italy, all three Powers, having agreed beforehand to accept their verdict. The decision when given was at once adopted and enforced, and though the justice of it has often been criticised, the very fact that a decision was obtained in this manner was a good omen for the future. Other matters arising out of the treaties were by them definitely referred to the League and not to the Allies, as for instance the control of the Saar Valley, the adjudication between Poland and Danzig of disputed points which arose in great number owing to the anomalous position in which the free city of Danzig had been placed. These, and the working of the Minority Treaties, which also belonged to the League, gave valuable experience and materially helped to solidify the new institution. In some cases it was not so successful.

The League failed, as did the Allies, to bring about a satisfactory solution of the controversy which arose between Poland

and Lithuania after the lawless seizure of Vilna by General Zeligowski. When a similar problem arose out of a raid by the Lithuanians on the town of Memel, outstanding points were eventually referred to the League by the Conference of Ambassadors; here again a solution was arrived at, though in this case the terms of settlement were such that grave apprehension might be felt as to the feasibility of enforcing them. The most marked success which the League achieved was the settlement in June 1921 of the dispute between Sweden and Finland regarding the ownership of the Aaland Islands. But they also intervened effectively to determine awkward frontier questions between Albania and Yugoslavia, and they averted what would probably have been an outbreak of war between Greece and Bulgaria in 1925 over a serious frontier incident. In another sphere the League proved itself of great use, when its assistance was called upon to create a scheme for the financial rehabilitation of Austria, and, this having been done, in a similar way to bring about an international agreement for the restoration of Hungarian finances.

Great Britain and France.—Ultimately the peaceful progress of the Continent depended upon the mutual relations between the three Great Powers, Great Britain, France and Italy, and particularly on those between Great Britain and France. Not only in the more informal diplomatic discussions, but in the meetings of the Supreme Council, the Conference of Ambassadors, the Reparation Commission, and also the Council of the League of Nations, no satisfactory conclusion could be obtained unless an agreement had been arrived at between France and Great Britain. This agreement was often difficult. Even during the War there was constant evidence that the close understanding which had been temporarily brought about owing to the insistent pressure of the German danger, was fragile and uncertain. From the moment that this danger was over, divergence of policy began. It was present throughout all the discussions in Paris and increased after the peace treaties had been signed. There were many matters on which the two states were by their interests and traditions disposed to take conflicting views.

The French Govt. and people, naturally intent on future security desired to protect themselves by a new system of defensive alliances, in which the military superiority of the Allies should be made permanent. Great Britain, owing to her worldwide interests and the fact that her representatives had to speak not only for these islands but also for the Dominions, was forced to take a more detached view of purely European problems, and in particular, public opinion was very averse from any formal commitments which might force her on some future occasion to take part in a new European war. While the French aimed at a common guarantee for the maintenance of the new system among the states adjacent to Germany, especially with Poland and Czechoslovakia, the British wished to pursue a policy rather of reconciliation, and were very opposed to anything that would bind them to a formal guarantee of the new frontiers in the East of Europe. Throughout the long negotiations with Germany on military control, on reparation, on the occupation of the Rhineland, the British representatives always tended to take a more lenient view than the French; these differences led to something like an open conflict of policies, especially during the period when M. Poincaré held office as French Minister President. There was, for instance, definite British opposition to the occupation of the Ruhr and to the French attitude towards the Separatist movement in the Palatinate and the Rhine provinces.

The diplomatic situation created was often difficult, for however great the difference of opinion might be, no one could doubt the supreme importance of maintaining the closest touch between the two countries. Any definite severance or diplomatic opposition would necessarily have had the gravest consequences. Europe was full of inflammable material; there were many places where at any moment a conflagration might break out. If in any of these questions, as for instance the attempts of the Emperor Charles to recover his throne and the consequent mobilisation of the forces of the Little Entente, the constant causes of friction between Yugoslavia on the one hand, Italy, Greece and Bulgaria on the other, the two Great Powers, instead of using their common influence to damp down the growing excitement and enmity, had taken sides, each supporting one of the antagonists, there would have been, instead of a brief and unimportant local controversy, a formal division of interests which would have affected the whole Continent.

This period of strained relations came to an end in the spring of 1924, when the fall of M. Poincaré followed shortly after the establishment of the Labour Ministry in this country. From this time there took place a remarkable change in French policy. They had, as we have seen, concentrated their endeavours on procuring by alliances a permanent military superiority on the Continent; they now became keenly interested in the rival policy of producing security by disarmament. French representatives took a leading part in the drafting of the treaty for mutual security and also in advocating the adoption of the Geneva Protocol. In both matters the British Govt. was less accommodating. There was a curious change of position. The English representatives now found that they were quickly losing the position which they had hitherto occupied, of being the principal supporters of the methods of avoiding war, with which the League was especially associated. As a result it seemed for the time that the French would step into this position, and there is no doubt that thereby they would greatly increase the influence, always important, which they had exercised at Geneva.

Italy.—In this association of the Allies during the first years after the War, Italy, under successive weak and embarrassed Govts., hampered as she was by internal dissensions, took no permanent part and pursued on the whole a pacifist rôle. A great change ensued when in Oct. 1922, after the march on Rome, Signor Mussolini, with a firm hand, took over the control. There was some apprehension that as a consequence of the strong nationalist element in the Fascist movement, the Government might adopt an ambitious and aggressive policy. Support for this was given by the very vigorous action of Mussolini when, in consequence of the murder of Italian officers occupied in the delimitation of the Greco-Albanian frontiers, an Italian fleet was sent to Corfu and attacked and occupied the town. Confronted, however, by the strong expression of opinion at a meeting of the League of Nations, the Italian Govt. accepted the intervention and agreed to abide by the decisions of the Conference of Ambassadors, and what seemed for a moment a dangerous episode passed over (*see* CORFU; LEAGUE OF NATIONS). In other matters, as for instance the settlement of the prolonged Fiume controversy and the general amelioration of relations with Yugoslavia, the new Italian Govt., while effectively protecting the interests of its own country, showed a considerable amount of diplomatic skill and discretion.

The Little Entente.—In no part of Europe did it seem that the danger of continued unrest, both political and social, and then the outbreak of a fresh war, was so imminent as in the southeast. The disappearance of the Austro-Hungarian Monarchy had brought about a state of things which is often referred to as the Balkanisation of Europe. Instead of one of the Great Powers, which with all its faults and internal weaknesses, had maintained for many centuries settled order, there were a number of small states of which some had to start the work of government from the very beginning. It was feared by many that they would be unequal to the task, that they would fail in maintaining internal order and cohesion, and that consequently fresh wars might break out between them.

It was under these circumstances that the "Succession States" arranged with one another a network of defensive alliances. This new system, commonly known as the Little Entente is undoubtedly one of the most remarkable diplomatic and political developments in Europe since the War. Among other things it shows a determination on the part of these states boldly and vigorously to take their place in Europe; they refused to accept a position, which perhaps some had anticipated they would hold, as clients to the Great Powers; they appear indeed to have acted without consulting, and perhaps to some extent contrary to the wishes of the Principal Allied and Associated Powers. It was a significant and not unwholesome reminder that the smaller states of Europe proposed to make the fullest use of the position which they had won, and it was the fitting outcome of a war in which the cause of small nations played so large a part. A German victory would certainly have implied complete German predominance over the whole of Central Europe; the Allied victory had brought into existence new states of the second rank, but these were animated by the strongest assertion of their sovereign rights and influenced by a keen sense of national independence. In this the lead throughout was taken by Dr. Beneš, the Foreign Secretary of the Czechoslovak Republic.

The beginning of this system (*see* LITTLE ENTENTE) is to be found in a treaty between Czechoslovakia and Yugoslavia of Aug. 1920; this is in form a defensive alliance against an unprovoked attack from Hungary. In April 1921 a similar treaty was concluded between Czechoslovakia and Rumania: this, unlike the first, provided for a separate military convention to be eventually concluded. In June 1921 an identical treaty was signed between Rumania and Yugoslavia. It was the alliances between these three states by which the nucleus of the Little Entente was formed, and the basis of the alliance was mutual protection against the possibility of attack by Hungary. The reason of this is obvious; the territories of each of these states included large areas which had formerly belonged to Hungary, part of which were inhabited by a considerable Magyar population. The Hungarians, though they had been forced to sign the Treaty of Trianon, consistently refused to recognise the moral justice of the new frontiers, and it was the policy of the national parties to work for the restoration, at any rate of large parts of the territory which they had lost. Subsequently on March 3 1921 Poland concluded a treaty with Rumania in which, for obvious reasons, there was no specific mention of Hungary. It is an alliance for the defence of their existing frontiers. It becomes, therefore, a defensive alliance against Russia. In Dec. of the same year a treaty by which the two states mutually guaranteed each other's territories, was concluded between Czechoslovakia and Austria. This is of importance because it is the first case in which one of the states defeated in the War entered into a treaty of this nature with one of the victors, and thereby the Austrians formally gave up the claim which they had made in 1919 to those parts of Czechoslovakia in which there was a predominantly German population.

While the British Govt., though maintaining the most friendly relations with the different states concerned, and particularly with Czechoslovakia, held aloof from these arrangements, the French Govt., without any formal treaty, kept in close touch with the Government of Czechoslovakia and throughout assisted them by advice and the maintenance of a military mission, in building up their new army. With Poland, in Feb. 1921, they entered into a treaty by which the two Governments bound themselves to discuss together all questions of foreign policy in which they were mutually interested, and agreed, if necessary, to take steps for the mutual defence of their territory and the safeguarding of their legitimate interests. By an exchange of notes in 1921 the Italian and Czechoslovak Ministers declared that there was a complete identity between the views and aims of the two countries in the sphere of international politics, especially as regards the application of the treaties of peace and the policy to be followed towards the Successor States of the Austro-Hungarian Monarchy.

By the end of 1921, therefore, the new group of states had come into effective existence, and it was cemented by repeated meetings on each other's territory of the leading ministers. It acquired additional strength in 1924, when the prolonged difficulties between Italy and Yugoslavia, arising out of the Fiume question, had at length been settled, and in consequence a treaty of alliance was signed at Rome on Jan. 27 1924. In the same year a formal treaty of alliance was made by Czechoslovakia with both Italy and France. It must be noted that in all these treaties it is expressly stated that they were in accordance with the Covenant of the League of Nations, and were, of course, as required by the Covenant, published and deposited at Geneva. In this way they differ from previous systems, such as that of the Triple Alliance, which were to a large extent secret. This, however, does not apply to the military conventions by which some of the treaties were accompanied.

Politically the general result of these treaties seems to have been to maintain peace and security. Hungary, disarmed as she was and with her greatly reduced territory, was not in a position to take the offensive. That the treaties were effective and that action would be taken in accordance with them was shown on more than one occasion, especially when the ex-Emperor Charles, in Oct. 1921 suddenly appeared in Hungary with the object of regaining the throne which he had lost. On this occasion the Czechoslovak Army was mobilised and it was probably only the intervention of the Great Powers which prevented the occupation of Hungarian territory.

The problems and difficulties caused by the peace settlement were, however, not only political. The economic and financial results were equally important. The Empire had formed a unit, with a common railway system and common customs frontier, (Austria and Hungary, though technically distinct, had entered into a customs agreement) the financial centre being placed in Vienna, which was the headquarters of the great banks by which capital was distributed throughout the territories. From the moment of dissolution each of the successor states claimed and exercised the right to complete control of its own economic and financial policy. Animated by an intense spirit of nationality, they were above all anxious to assert their full sovereignty, and refused to consent to efforts which were made during 1919 to maintain in some form or another financial, if not political unity.

They were just as frightened of the maintenance of the economic superiority of Vienna as they were of its political control. Each of these states was animated by the desire to make itself economically sufficient, and with this object, set to work to impose very high tariffs in order to foster its own industries. The result was a sudden and complete severance of long standing commercial ties. Trade and industry were disorganised; moreover, pending the liquidation of the great railway companies and railway material, the whole system of communication was thrown out of joint, as was the trade on the Danube, which was in the hands of several competing states, who created new impediments to its commercial use. The results were especially disastrous for the city of Vienna, which had largely depended on the trade in articles of luxury to the less highly developed parts of the Empire, and also to the Balkans, but it seriously interfered with the prosperity of all the countries concerned. Under these circumstances many still maintained the hope of restoring in some form the old economic unity.

Immediately after the War there were indications that some similar system of mutual guarantee between the smaller states might be formed among the countries bordering on the Baltic, in particular, among the states which had been separated from Russia. It was perhaps hoped that the three Scandinavian states would be willing to lend their support to such an alliance. If so, the hopes were disappointed. Sweden, Norway and Denmark, which had established and maintained during the War co-operation on matters of common interest, preferred, when the immediate danger was over, to revert to their older condition of isolation. They were prepared to rest their security on the general guarantee given by the League of Nations. In the summer of 1921 a Conference was held at Warsaw, which was attended by representatives of Finland and the three Baltic states, with a view to a defensive alliance, which in effect would have been one against Russia. The people of Finland, however, were not unnaturally alarmed by the prospect of being entangled in a war with Russia arising out of questions connected with the Polish frontier. At that time the relations between Russia and Poland were still very strained. In consequence, Holsti, the Prime Minister, finding that he could not get support for his policy, had to resign, and from this time these larger schemes fell to the ground. All, therefore, that was achieved was an alliance between the two small states of Latvia and Estonia, the political and commercial interests of which were almost identical. From this alliance, Lithuania, chiefly occupied by her perennial struggle with Poland, and therefore to some extent tending to depend on Russian support, held aloof.

Guarantee Treaties.—It was the strength, but also the weakness of the League of Nations, that as its members were recruited from all continents, so also in its formal constitution it gave no recognition of, or method of dealing with, those matters which concerned peculiarly the continent of Europe. This was shown by the treatment of the whole question of disarmament in connection especially with the different schemes for treaties of mutual guarantee and disarmament, and for the further proposals contained in the Geneva Protocol of 1924. Quite apart from the fact that by the preamble to the disarmament clauses of the treaty, the Allies had formally bound themselves to the principle of disarmament, there was a general agreement that a great reduction of armaments was essential to the future peace and progress of the Continent. Whatever view might be held about the particular degree of responsibility for the War of 1914 which attached to each Power or each group of Powers, on one matter all were agreed—that the chief predisposing cause of the outbreak of war was the intense rivalry of armaments which had continued and increased ever since the war of 1870. It was a natural deduction that if this rivalry in armaments was to continue, it would at some future period almost inevitably result in a new outbreak.

It could probably be foreseen that whatever the terms of the treaty were, it would not be possible permanently to maintain the system by which Germany was compelled to almost complete disarmament if, after she had become a member of the League of Nations, other nations of Europe, by which she was surrounded, especially France and Poland, recognised no restriction of the preparations which they might make for war. There was also ground for legitimate apprehension that if the newly constituted states of southeastern Europe devoted a large part of their energies and other resources to the building up of general armaments, sooner or later temptation might become irresistible to use these armies, not necessarily against their old enemies, Hungary and Bulgaria, but in some quarrel between themselves. There were, for instance, causes of friction between Yugoslavia on the one side, Italy and Greece on the other. It was obviously very undesirable that in a time of general financial depression and economic embarrassment, the countries of Europe should squander an undue part of their resources in military preparation.

For this reason, various schemes were projected, the general object of which was to work out a system in which the nations should mutually bind themselves each to reduce its army and navy to a specified strength, while at the same time, by a general mutual guarantee, they should undertake to protect one another against aggression. As soon, however, as any attempt was made to reduce these schemes to a precise form, difficulties arose from the fact that if they were to be made generally binding on all the states, members of the League of Nations, the mutual guarantee would apply both to European, and to Asiatic and American States. This affected more particularly the British Dominions, which, while they acted as independent members of the League, were united in their refusal to enter into any binding engagement again to intervene in matters of purely local European importance. In truth, the problem of disarmament as it existed in Europe, owing to historical reasons, did not apply elsewhere. In South America there was no such great military tradition. In the Pacific the rivalry of armaments was naval rather than military, and it therefore was quite properly dealt with, not at Geneva, but at a special conference summoned for this purpose at Washington in Nov. 1921, a conference which was attended only by Great Britain and France among the European States, and in which a major part was taken by the United States of America, Japan and Great Britain, in her capacity as a Power specially interested in the affairs of the Far East.

What was wanted, however, was some special arrangement between the European States themselves; as M. Briand said: "Pour assurer la paix, c'est l'Europe qu'il s'agit d'organiser."[1] This became more evident in the discussions on the Treaty of Mutual Assurance and the Geneva Protocol. It could not be expected that the South American Republics would be ready to co-operate in enforcing sanctions arising out of a purely European conflict. This point of view was also expressed by the British Dominions; everything seemed to point to the necessity for some arrangement for special treatment of the affairs of each continent, but the more the matter was investigated, the clearer did it become that the European problem was too varied and too complex to allow the whole of it to be dealt with in a single instrument. This was the view put forward authoritatively by Mr. Austen Chamberlain when expounding the reasons why Great Britain was unable to accept the proposals of the Geneva Protocol; as he explained, it would be wiser to approach the question not from a general, but from a local, agreement.

On the continent of Europe there were three areas from which danger could be anticipated:—the Rhineland, which had so often been the cause of war between France and Germany during the last thousand years; the Eastern frontiers of Germany, where, as we have seen, the Germans refused to accept as a permanent solution the frontiers laid down in the Treaty of Versailles; and the southeast of Europe. Of these at the moment the Franco-German problem presented the smallest difficulty. No one really anticipated that the Germans, if they attempted at any future time to recover by force the position which they had lost, would begin upon the Rhine; there, they knew, the opposition they would have to meet would be strongest; the French Army was the largest in Europe, and though the draft treaties of mutual assurance by which Great Britain and the United States had in 1919 offered their help to France against a renewed war of aggression from Germany, had not come into force, the Germans would still fear that anything in the nature of an unprovoked attack on France would recreate the coalition by which they had been defeated. They were not likely in the future to hazard a new war against the combination of France and England.

Locarno.—From 1922 onwards constant discussions and negotiations had taken place with the object of bringing into existence some new treaty by which the security of France against invasion would be guaranteed. None of the proposals made had been successful. The chief reason for this was that the French now asked, what they had not asked in 1919, that any such treaty should apply not only to the western, but to all the frontiers of Germany. This the British Govt. was unable to accept. There was, moreover, a strong feeling in this country against continental commitments in general, and particularly against any treaty which would seem designed to perpetuate the division of Europe into victors and vanquished. But a solution was eventually found in a proposal which, in March 1925 was put forward by the German Govt.; they suggested a mutual pact of non-aggression between Germany on the one side, France, Belgium and Great Britain on the other. This was a very notable proposal because in effect it implied that Germany would voluntarily bind herself not to attempt by arms to recover Alsace-Lorraine. She relinquished the idea of a war of revenge. It was first made confidentially to the British Govt., and afterwards embodied in a formal note to France, and was made the basis of discussions which took place at Locarno during the month of Oct. 1925. The agreement arrived at was embodied in a series of treaties, all of which were signed in London on Dec. 1, of that year.

The essential points in these treaties were that Germany on the one side, France and Belgium on the other, agreed mutually to refrain from any act of aggression, to respect and keep inviolate the frontiers arranged in 1919: and, in addition to this, to submit all causes of dispute which might arise, to arbitration. These basic agreements were supplemented in the main treaty of Locarno by a mutual guarantee, in which Great Britain and Italy also joined. The result was that every cause of dispute was to be submitted to arbitration, and that if any one of the states violated this undertaking, all the other signatory Powers, including this country, would be compelled, if necessary, to come to the help in arms of the state whose territory had been attacked. It was a condition, moreover, that Germany should immediately apply for admission to the League of Nations. After some delay, owing to the internal weakness of the German Govt., formal permission was given by the Reichstag, and the application was presented at Geneva on Feb. 11 1926.

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[1] *Journal officiel*, Feb. 27 1926.

In addition to the treaties dealing with the western frontier of Germany, general arbitration treaties were concluded between Germany on the one side, Poland and Czechoslovakia on the other, and by a separate instrument France undertook in this case a unilateral obligation to Poland and Czechoslovakia to guarantee this treaty.

As soon as the treaties had been signed, the Allies, in accordance with the promise already made, hastened to carry out the evacuation of the northern part of the occupied Rhenish area which, by the Treaty of Versailles, was to have been concluded in Jan. 1925, and numerous other concessions were made to Germany in regard both to the number of troops maintained in the occupied area, and the exceptional measures introduced at the time of the occupation of the Ruhr were withdrawn. Outstanding points concerning the disarmament of Germany, and in particular aerial control, were also settled.

These two events mean that Germany signed the treaties of Locarno as an equal Power, on the same status as the Allies. By the fact that the British guarantee was given equally to her and to France, and by her prospective admission to the League of Nations, she regained her position as an equal member of the European family of nations. It was an act similar to that by which, at the Congress of Aix-la-Chapelle in 1818, France was welcomed into the Concert of Europe, which hitherto had been an association of the Allies against France. On the other hand, on some points the change was not complete. Germany was, and would remain, in an inferior position so long as part of her territory was still occupied by Allied troops, and so long as, in respect of her naval, military and aerial forces, she was subject to restrictions which did not apply to the other European states. Moreover, at the last moment an unexpected difficulty prevented the final conclusion of the arrangements made at Locarno. It was an essential part of the settlement that Germany should apply for and be admitted to the League of Nations, and should on admission to the League be granted the status of a permanent member of the Council, the position held by all the other Great Powers.

In March 1926 a special meeting of the Council and Assembly was summoned; unfortunately proposals were put forward that the opportunity should be used for far-reaching changes in the constitution of the Council, and in particular that Poland, Spain and Brazil should, at the same time as Germany, one or all of them, be made permanent members. Even more unfortunately it was publicly suggested that some step of this kind would be a protection to Europe against German influence. Inevitably, therefore, the German Govt. let it be known that she could not enter the League if any changes in the constitution of the Council were made prior to her admission. Before and after the meeting of the Assembly, prolonged negotiations took place; it appeared that they had reached a satisfactory conclusion, but eventually Brazil intimated that unless a permanent seat was accorded to her, she would refuse to vote for Germany's admission. As unanimity was required among members of the Council, her single veto would be effective. There was nothing left to be done but to postpone the consideration of the matter until the next regular meeting of the Assembly in Sept. 1926.

The result was most unsatisfactory. Germany was condemned o wait for nearly a year before she could be admitted to the League, and it was quite natural that in order to strengthen her own political position she should enter into a fresh treaty with he Soviet Govt. which in political inportance went very far beyond the Treaty of Rapallo. The text of the treaty raised serious questions of interpretation which might be used to prevent her admission to the League. In the spring of 1926 the whole situation was therefore most obscure and unsatisfactory.

See A. J. Toynbee, *Survey of International Affairs 1920–3, and 1924* (1925–6). Issued by Oxford Univ. Press under the auspices of the British Institute of International Affairs. "Post-War Political Alignments" in *World Peace Foundation Pamphlet. League of Nations* vol. vi. No. 2. (World Peace Foundation 1923). *See* also the articles on individual European states: FRANCE; GERMANY; GREAT BRITAIN; ITALY; RUSSIA; etc.; also, LEAGUE OF NATIONS, and the special articles on the subjects referred to in the second part of that article on the work of the League during the first six years of its existence.

(X.)

EVANS, SIR ARTHUR JOHN (1851–), British archaeologist was born at Nash Mills, Herts, July 8 1851, the eldest son of Sir John Evans, K.C.B. (*see* 10.2). Educated at Harrow, Brasenose College, Oxford and Göttingen, he was elected fellow of Brasenose, and in 1884 keeper of the Ashmolean Museum at Oxford, holding this post till 1908. He travelled in Finland and Lapland in 1873–4, and in 1875 made a special study of archaeology and ethnology in the Balkan States. In 1893 he began his investigations in Crete, which have resulted in discoveries of the utmost importance concerning the early history of Greece and the eastern Mediterranean (*see* 1.246, 7.421 and ARCHAEOLOGY: CRETE). In 1911 he was knighted.

His chief publications are: *Cretan Pictographs and Prae-Phoenician Script* (1896); *Further Discoveries of Cretan and Aegean Script* (1898); *The Mycenaean Tree and Pillar Cult* (1901); *Scripta Minoa* (1909); *Palace of Minos I.* (1922); and reports on the excavations at Knossos. He also edited, E. A. Freeman's *History of Sicily*, vol. iv.

EVEREST, MOUNT (*see* 10.7).—A description of the attempts to climb Mount Everest, the highest known summit in the world, may be divided under three headings, the reconnaissance expedition of 1921, the first attempt to ascend the mountain in 1922 and the second attempt in 1924.

Previous attempts had been made to obtain permission to travel in that part of Tibet and to explore and attempt to climb Mount Everest, but only the expeditions of 1921, 1922 and 1924 are dealt with here. The extraordinary advance in the relations between Tibet and the outside world were such that it was possible in 1920 to approach the Tibetan Govt. with every hope of success in obtaining from them permission to approach the mountain and explore its surroundings. As a preliminary, Col. Howard-Bury, in 1920, visited Phari Dzong. His negotiations were successful, and in the winter of that year the first expedition was organised to reconnoitre and explore all the approaches to the great group and to make preliminary climbs on the mountain to ascertain the conditions and favourable points of attack.

THE RECONNAISSANCE EXPEDITION OF 1921

This preliminary expedition carried out their work in the most complete manner the following summer. Roads and approaches to the Everest district, which are contained in the district of Shekar and Kharta Sheka, were thoroughly explored and mapped. The approaches to Mount Everest on all its northern faces were thoroughly examined. Relations were established with all the local authorities. This expedition was excellently constituted for the work in hand. Under the leadership of Lt.-Col. C. K. Howard-Bury, D.S.O., the climbing party consisted of Mr. C. H. Bullock, Dr. A. M. Kellas, Mr. G. L. Mallory and Mr. Harold Raeburn. Maj. H. T. Morshead, D.S.O., and Maj. O. E. Wheeler, M.C., went as surveyors and Dr. A. M. Heron as geologist. Mr. A. F. Wollaston was doctor, naturalist and botanist. Among them was one mountaineer and scientist whose name stands out pre-eminently in the exploration of the East Central Himalaya—Dr. Kellas. Unfortunately Dr. Kellas died during the progress of the expedition's march through Tibet, and now lies buried under the fort of Khampa Dzong. The expedition was accompanied by two officers of the Indian Survey in Maj. Morshead and Maj. Wheeler, as well as by Dr. Heron, a representative of the Geological Survey of India.

The Rongbuk Valley.—The first object was to explore the Rongbuk Valley beyond the great Rongbuk monastery. From there the mountaineering party pushed up the west Rongbuk glacier, which descends directly from the northern faces of Mount Everest, but failed to find the true approach to the mountain up the narrow mouth of the east Rongbuk glacier. This glacier was later on in the year surveyed by Wheeler and the true approach was established. Later, the expedition crossed over to the low-lying country to the east of Mount Everest at Kharta Sheka.

From there a pass was found named the Lhakpa La, 22,000 ft., which led to the head of the east Rongbuk glacier. From this point the mountaineering members of the party were able to trace the most likely line of attack on the mountain and actually mounted by difficult snow and ice slopes to a col on the main north ridge descending from Everest, which they named the Chang La or North Col. By this time the season was late, the weather was breaking and no more work could be effected. The reconnaissance expedition had collected an immense amount of information and had mapped the country to the north of Everest.

THE ATTEMPT OF 1922

On the information and experience of the reconnaissance expedition, the second expedition to Everest was organised, which was to complete the exploration of the group and to carry out the ascent of the great mountain. Brig.-Gen. the Hon. C. G. Bruce, C.B., M.V.O., was in command, with Col. E. L. Strutt as second-in-command. The climbing party consisted of Mr. G. L. Mallory, Maj. E. F. Norton, D.S.O., R.A., Dr. T. H. Somervell, Dr. A. W. Wakefield and Capt. G. I. Finch, who was oxygen officer to this party. Dr. T. G. Longstaff was doctor and naturalist. Mr. C. G. Crawford, Capt. J. G. Bruce, M.C., and Capt. C. J. Morris were the transport officers. Maj. H. T. Morshead, D.S.O., as surveyor and Capt. J. B. L. Noel as photographer completed the party forming the second expedition.

Choice of Season.—It had been found necessary to make the attempt early in the year, as giving a better chance of good weather and of finding the snow conditions on the mountain more favourable to an assault; but this early start also carried with it a great deal more exposure and, naturally, fatigue on the journey from Darjeeling to Everest; for on this route not only are the passes which cut off the southern Himalaya from the north to be crossed, but on the way a large number of high and exposed ridges have also to be negotiated. Naturally, too, the outfit was much greater; and for the first time in the exploration of the mountains experiments were to be made in the artificial administration of oxygen as an assistance in counteracting the effects of low atmospheric pressure. By the end of April 1922 the expedition was collected in the Rongbuk valley and the base camp established within two miles of the snout of the west Rongbuk glacier. An immense amount of stores of all descriptions had been transported to this spot, employing some 350 transport animals.

The Transport Problem.—It is necessary at this point to explain how great is the problem of attacking such a mountain as Everest. It differs immensely from an ordinary mountaineering expedition, and besides the pure mountaineering technique which is required, many of the methods necessary for polar exploration must be put in force. Besides, a large number of first-class porters are required owing to the immense amount of stores which must be moved to great altitudes. For them special clothing and food are necessary, which greatly adds to the difficulties of equipment. The expedition drew its porters mainly from subjects of Nepal, belonging to a tribe known as Sherpas. They are true Tibetans, who in the course of generations have settled on the southern slope of the Himalaya. They live in a steeper and slightly less elevated country than Tibet, and are thoroughly suitable for the work; but among them there were also certain true Tibetans of Tibet. These men have proved through all the expeditions a great success.

Importance of the Monsoon.—But the real problem is the race with the monsoon. This period of time, from May 1 to early June, is the only suitable time for the attack on the mountain, and even this is dominated by the approach of the monsoon. Up to the arrival of the south-west monsoon the whole northern slopes of the Himalaya are swept by an intensely dry and cold wind. While these conditions continue, the mountains are safe if human beings can stand the terrible cold, immense fatigue and the dominating factor of low atmospheric pressure. When once the humid and warm southwest monsoon is established, the mountains are unapproachable, snows thaw, avalanches fall and progress is impossible. Hence the great difficulty is an immense exertion to be undertaken in a short time.

Camps Established.—Up the east Rongbuk glacier camps were established, from the base camp at 16,500 ft. above sea level to camp 3, four stages higher up, which was placed near the foot of the slopes leading to the Chang La or North Col. At camp 3 the advanced base of the expedition was established, at a height of 21,000 ft., and here were accumulated stores of every description for the attack on the mountain, with food supplies sufficient to last 12 Europeans and 50 natives for one month. From here a high camp was pushed on up to the North Col, which was successfully established in good weather. From this camp the first attempt without the assistance of oxygen was made.

First Assault on the Mountain.—The four members of the party who were chosen for this effort, Maj. Norton, Dr. Somervell, Mallory and Morshead, set out from the North Col. With great difficulty they established a camp at about 25,000 ft. on the sheltered side of the great north ridge which descends from Everest. This camp was carried up for them and pitched by the special Sherpa porters. It is worthy of note that until this expedition only once in the whole history of mountain exploration has a camp been pitched as high as 23,000 ft., the height of the Chang La, and that was only for one night. The camp referred to was that of Mr. Meade's expedition on Kamet in Garhwal. This camp at 25,000 ft. was occupied on May 19. The following morning three of the climbers, Somervell, Norton and Mallory, continued their attempt on Everest, Morshead having to be left behind as he was suffering from frost-bite and exhaustion. The climbing party pushed on under trying conditions of wind and weather until they attained the height of 26,985 ft., the highest point yet reached by human beings.

At this point their strength was so far exhausted as to make further progress unsafe, and a retreat was made. Their descent was most toilsome and slow, but finally the camp at 25,000 ft. was reached, and Morshead had to be conducted back from this point in bad weather to the North Col. In traversing back from the gîte on the face of the mountain, an accident as nearly as possible occurred from a slip; but after a dramatic and exciting incident their laborious descent was continued, and finally, completely worn out, they reached the camp on the North Col at midnight. Morshead was badly frost-bitten, and each of the other members of the party in a lesser degree.

First Attempt with Oxygen.—Later, on May 25, a second attempt was made by Finch and J. G. Bruce, using the oxygen apparatus from as low down as camp 3. They were accompanied by Naik Tejbir Bura, a young Gurkha non-commissioned officer who belonged to Capt. Bruce's regiment, the 6th Gurkha Rifles. This party followed on the footsteps of the previous one, camping, however, some 500 ft. higher, at a height of 25,500 ft. on the main ridge itself, their porters thus surpassing the efforts of the previous party. The porters returned to the North Col, but the climbing party were caught that night in a furious hurricane and were camp-bound for two nights and a day. Their experiences were most trying, and it is lucky that they ever survived that terrible exposure.

The morning of the second day, the weather having calmed, they set out, using the full oxygen apparatus and employing the Gurkha non-commissioned officer to carry spare oxygen bottles. On reaching the height of 26,000 ft. this young man could proceed no farther. The two mountaineers continued alone from this point, and before being completely exhausted reached a height of some 27,300 feet.

Their return journey, still using oxygen and picking up reserve oxygen supplies on the way down, was in great contrast to the experiences of the first party. They not only descended the mountain at good speed but continued from the North Col or Chang La directly down to the advanced base camp at camp 3. The expedition then returned to the base camp for rest, all members of the party being greatly exhausted. From this camp certain members of the expedition, including Morshead, were obliged to return to India.

Third Assault.—A third attempt was organised, and the party left on June 3, consisting of Finch, Mallory, Somervell, Crawford and Wakefield. Finch shortly returned and joined the homing party. The remainder again pitched their camp at the advanced base, and on the morning of June 7 attempted to reach the North Col; but unfortunately they had been overtaken the previous three days by bad weather and heavy snow, and following the formerly used route to the North Col they were obliged to traverse the snow slopes rendered extremely dangerous by the accumulation of fresh snow.

They were caught in a great avalanche which swept down the face of the mountain side and carried down the whole of the party of 17 roped-in groups of four and five. Two of these groups, one of four and one of five men, were swept over an ice cliff some 60 ft. high, and only two out of the nine men thus carried away were saved. The leading rope, consisting of three climbers, Crawford, Mallory and Somervell, was carried down for some 150 ft. by the avalanche and stopped well above the danger point without injury to the climbers. This third attempt ended he expedition of 1922, which then, as a body, returned to India, having added immensely to the knowledge of the possibilities of urther acclimatisation at high altitudes.

The Attempt of 1924

The 1924 expedition consisted of Brig.-Gen. the Hon. C. G. Bruce, C.B., M.V.O., in command, and of Lt.-Col. E. F. Norton, D.S.O., R.A., second-in-command. The climbing party consisted of Mr. Bentley Beetham, Capt. J. G. Bruce, M.C., Mr. J. de V. Hazard, Mr. A. C. Irvine, Mr. G. L. Mallory, Mr. N. E. Odell and Dr. T. H. Somervell. Mr. E. O. Shebbeare was transport officer, Dr. R. W. J. Hingston, doctor and naturalist, and Capt. . B. L. Noel was again photographer. This expedition was able o profit in a great number of ways by the experience of the two previous expeditions. Leaving Darjeeling at about the same ime as before, it arrived a few days earlier at the same base amp at Rongbuk. Its transport had been improved and inreased. Unfortunately, during the march up, Gen. Bruce had been obliged to return to India owing to illness, and his place was lled by Norton.

Bad Weather at Base Camp.—On arrival at the base camp, very effort was made to establish a line of intermediary camps between the base camp and camp 3 with the greatest possible apidity; but the expedition was overtaken by hurricane after urricane during the month of May, at a time when fair weather s ordinarily to be expected. The temperatures experienced were ery much lower than in 1922, and it was very soon discovered hat a low temperature, high wind, hard work and a low atmospheric pressure together are enough to wear out the very strongest constitution in a very short period.

So for some three weeks the expedition struggled in a coninuous battle to establish not only the camps on the line of communication but also the Alpine base on the summit of the North Col. This terrible fight against the elements, occasioning several eturns for recuperation to the base camp, not only delayed the xpedition very much indeed but reduced their strength and that eserve of power which is necessary for the final great assault—he great test of all; nor at high altitudes can that lost strength e ever adequately regained.

New Route to North Col.—The route that it was necessary to tilise between camp 3 at 21,000 ft. and the North Col camp at 3,000 ft. was far steeper and more difficult than that of 1922; but it had the advantage of being safe from the avalanches, which render the easier slopes of the 1922 route most dangerous fter such weather as was experienced in this season. But it was on this route that another accident almost occurred. After he new difficult route to the North Col had been forced by Noron, Hazard led the first party of porters and established the amp on May 22. On the following day, on his descent from the North Col camp to camp 3 in bad weather, it was discovered that our porters had remained actually on the North Col itself. A urricane that night and the following day prevented communiation with them, but on the day succeeding, Norton, Somervell nd Mallory formed a rescue party to extricate these men from heir awkward position.

This they successfully accomplished after a most dramatic ncident, two of the porters, when crossing a dangerous face, slipping down and being brought up at the edge of an ice cliff. From this position they were rescued after a very severe struggle. All members of the party were at this time terribly worn by exposure to the low temperatures and gales, the temperatures registered even at camp 3 being as low as −23°F. After this, the expedition retired to the base camp for a complete rest.

The members of the party and porters were all completely worn out. Norton led his party down to the monastery at the mouth of the Rongbuk valley, presided over by a remarkable Lama or Buddhistic priest, a man in whom every Buddhist member of the party placed absolute faith. Here a service was held, the Lama blessed and encouraged the men, and then, when morale was established, Norton, reorganising his party, led the whole expedition back again to the advanced base camp 3.

Hopes were now raised by the splendour of the weather. With reorganised plans, on June 1 camp 4 was re-established on a greater basis than ever, and from this camp the climbing party started the real assault on the mountain. There were few porters left who were fit to make such an immense effort as was required of them, and therefore several attempts were made by parties of two climbers, assisted by whatever porters were available. Mallory and J. G. Bruce pitched camp 5 at 25,000 ft., but owing to the exhaustion of their porters were obliged to return.

They were followed on June 3 by Norton and Somervell, who, passing through them, actually pitched a camp at 26,800 ft. elevation, men having been found fit enough to carry loads without the assistance of oxygen to this great height. From this point, with the greatest pain and trouble, Somervell and Norton reached a height on the following day of 28,200 ft.; they again descended to the North Col. Somervell had been working under disadvantageous conditions, suffering terribly from a high altitude throat. So dry and parched does one's throat become in this intensely cold and dry air that it forms more than an inconvenience, even a danger. Norton had been fit and well, but the following morning awoke absolutely sightless from snow blindness. An unforgettable episode occurred the following morning when Norton, stone blind, was taken down that steep and difficult descent by Hingston and Hazard.

The Last Attempt.—There was still one more attempt to be made by Mallory and Irvine. There had been defects in the oxygen apparatus and but little oxygen was now available. They were assisted by a supporting party consisting of Odell and Hazard, who accompanied them to the 25,000 ft. camp. This point, on June 6, they left with porters, who again carried loads for them to 27,000 feet. On June 8 they left camp 6, the highest camp, for their attempt. Odell on that morning arrived, according to arrangements previously made with Mallory, at this highest camp, to watch their progress and report on it and to take such steps for their comfort as were considered necessary.

He caught a glimpse of the climbers high up on the mountain side for a short space of time; the mists blew across and he saw them no more. Returning to camp 4 he awaited their return, but on the following morning, seeing no signs of them, he searched with signal and magnesium flare the whole hillside without effect. On June 10, for the third time, he mounted the slopes to 27,000 ft.—in itself an unprecedented effort—but could find no signs of Mallory and Irvine, and, communicating with Norton, evacuated the mountain.

Thus stands the battle with Everest up to 1926. Unfortunately, the expedition also lost one young Gurkha non-commissioned officer from over-exposure, and one Tibetan follower from frostbite and pneumonia. At the base camp stands a monument to those who gave their lives in this great attempt.

Bibliography.—C. G. Bruce, *The Assault on Mount Everest, 1922* (1923); E. F. Norton, *The Fight for Everest, 1924* (1925). See also *The Alpine Journal* (1922–5) and *The Geographical Journal,* incl. *Proc. Roy. Geog. Soc.* (1924–5). (C. G. B.*)

EVOLUTION (*see* 10.22).—The topic of evolution is a very wide one. In its broadest sense it denotes little more than gradual change, as is indicated by the common French equivalent *transformisme.* In a somewhat more restricted sense it implies orderly change, while certain authors wish to combine it with orderly and progressive change. The two fields, however, in which it is most often applied are those of cosmic and of organic evolution, the former dealing with the development of stars and stellar systems, the latter with the changes undergone by life upon this planet. Here, only the topic of organic evolution will be discussed.

I. GENERAL SURVEY

Organic Evolution.—There are three quite distinct angles from which the subject can be treated. In the first place, there is the question of the *fact* of evolution: has organic evolution occurred or has it not occurred? Secondly, there is the *method* of evolution: by what mechanism has evolution been brought about? And thirdly, there is the *course* of evolution: granted that it has occurred, what were the main results of the process?

The Evidence

The evidences on the first point are well known. They are chiefly drawn from the facts of comparative anatomy, of embryology, of geographical distribution and of palaeontology.

Palaeontology.—The last, or the history of life as revealed by actual fossil remains of organisms in the sedimentary rocks, affords the most direct evidence, since we find that many past organisms are now extinct, and that there are frequently to be traced long evolutionary chains, leading up from primitive extinct forms to specialised modern types.

Embryology.—That of embryology is, however, equally important. The majority of animals run through, in the course of their development, stages which resemble other organisms. The fact that a fowl or a man passes through a stage in which its organisation is essentially like that of a fish is meaningless, save on the assumption that land vertebrates originally evolved from fish-like, aquatic ancestors.

Distribution of Animals.—The distribution of animals and plants over the earth's surface is, further, such that it cannot be explained except by assuming that evolution has occurred. If certain types have had their origins in certain areas, and have then spread thence, the facts are intelligible, but not otherwise. In the same way, the fact that oceanic islands contain but a very limited fauna and flora, and that, in oceanic archipelagoes, the types of animal life are often represented by different species on each different island, is readily explicable on the idea of chance spreading, followed by isolation and consequent evolutionary divergence.

Comparative Anatomy.—The evidence from comparative anatomy, though perhaps the most indirect, is equally strong, and was historically the first to attract attention. When we examine a series of, say, vertebrates, we soon perceive that a common general plan runs through them all, in spite of great differences in their various modes of life. The same is true for each particular organ. The hand and arm of man, the foreleg of a dog, the wing of a bird, the flipper of a whale—all these, and indeed the fore-limbs of all terrestrial vertebrates, show the same essential plan, though often much modified to suit the exigencies of the animal's particular mode of life. It must not be supposed that no other general ground-plan can exist: far from it. The insect or the crustacean is built on a wholly different general plan, and the special plan of its limbs is entirely different from that of the vertebrate limb. It is very difficult to explain these facts except on the theory of evolution.

Vestigial Organs.—The conclusion is strengthened by the existence of vestigial organs (often called rudimentary organs), which are useless to their possessor, although corresponding (homologous) organs in other species are of service. The vestigial hair on the surface of the human body affords one excellent example, while another is provided by the wholly useless remnants of limbs in various snakes. Often vestigial organs are recapitulatory as well, being better developed in the embryo or young than in the adult (hair and tail of man, teeth of certain whales, etc.).

Natural Selection.—The evidences for evolution having taken place were first cogently marshalled by Charles Darwin in the *Origin of Species* (1859). No satisfactory alternative explanation of the data he adduced has ever been advanced, and the fact of evolution has passed beyond the realm of discussion. Darwin, however, accomplished much more than this. He also advanced a theory as to the method of evolution, and one so reasonable that it could be and is still widely held by scientific men. This was the theory of natural selection. He assumed as a fact the existence of variation, showed the universal presence of a struggle for existence due to the invariable birth of more young than can come to maturity, and then pointed out that this would inevitably lead on the average to the survival of those that were best fitted to survive and so to evolutionary change and progress. By so doing at one stroke he cut the ground from under the feet of those who, like Paley, argued that organic adaptations were evidences of conscious design.

Sexual Selection.—He also advanced the subsidiary hypothesis of sexual selection to account for the development of special sexual adornments employed in courtship or display. Here the underlying idea of the automatic selection of some types and the failure of others remains the same, but the selective agency is now the mind of the opposite sex; and, further, the selection may be between rival males as concerning success in mating only, and the characters selected may not only have no utility in relation to the ordinary business of survival, but in extreme cases may handicap their possessor in the struggle for individual existence. However, the biological advantage gained by being selected as the father of offspring, especially in polygamous species, may be so great as to compensate for disadvantage in other directions. This theory has been much criticised, but has now, in somewhat modified form, been shown to rest on a firm basis.

Darwin also, in part, adopted the second main theory of the method of evolution, that of Lamarck, by assigning some weight to the direct effect of the environment and to the effects of use and disuse.

Three other main types of hypothesis to account for evolutionary change have also been advanced. The first has been styled Orthogenesis. It is frequently observed by palaeontologists that evolutionary trends in particular directions can be traced in series of fossils. The theory of orthogenesis assumes that the straight course pursued by such evolving types is due not to moulding, direct or indirect, from without, but to inner necessity, the hereditary constitution of the race unfolding and changing according to predetermined laws. Next, there is what may be called the crude theory of mutation, according to which species may enter upon a mutating period, and rapidly throw off a number of new and markedly distinct types, which may often be merely new without being better or worse suited to the environment. Finally, there is the view urged by Lotsy, that new types arise by recombination of characters after crossing. We know that when very distinct types are crossed and are fertile, there is (as demanded by the Mendelian theory) great diversity among their offspring from the second generation onward. Lotsy imagines that very wide crosses may occur, with enormous resultant variation, and that this variation is the sole raw material of evolutionary change. We may call this the recombination hypothesis, since it supposes that evolutionary novelty is due to new combinations of old characteristics.

The last three theories emphasise the force of inner variation as against that of outer environment. The mutation and the recombination theories think of the process as occasional and random, that of orthogenesis as continuous and directional. The other two lay greater stress upon the environment. But whereas the Lamarckian theory assumes a direct effect of the environment, the hereditary constitution responding like wax to outer changes, the effect in Darwin's theory of natural selection is only indirect. The source of variation is here in the hereditary constitution and it occurs in all directions; the environment is exerting a constant pressure and ensuring that only the "right" variations shall survive.

It cannot be said that the problem is yet by any means solved. In particular, the first origin of variations remains one of the great problems of biology. It would appear, however, that all heories can contribute something of value, although an adjustnent of the theory of natural selection to a modified mutation heory will probably account for the majority of the facts.

Heredity in the Light of Mendelism.—We must remember in ny case that any accurate knowledge of the processes of heredity vas denied to Darwin. Not until the rediscovery of Mendel's vork in 1900 was it possible to push forward along this path. Ve now know that the great majority of inherited characterstics are dependent upon the presence of definite units (factors r genes) present in the hereditary constitution; and that these re lodged in a definite proportion and definite arrangement in he chromosomes which are transmitted from parent to offspring n the gametes (*see* CYTOLOGY; GENETICS; MENDELISM). Nornally, these units remain constant, and resist change with exraordinary resistance. Occasionally, however, they have been ound to change apparently spontaneously (though this, of ourse, only means that we have not yet ascertained the cause), nd, once changed, to remain constant in their changed form. uch changes are now generally known by the name of mutaions. It is important to note that mutations of this type may e of any extent, some causing marked, others very slight, changes nd the generally accepted view now is that mutations of slight xtent afford the major part of the raw material of variation; atural selection may then act. It is a curious fact that the " mutations " of the evening primrose adduced by De Vries, in he earliest presentation of the pure mutation theory, have urned out to be, some of them, not mutations at all, others nutations of a different and rarer type (due to subtraction or ddition of whole chromosomes).

There is further evidence that in some apparently rare cases nutations may be caused directly by changes in external conitions; so that in respect of these, a modified Lamarckian theory vill hold.

Melanism in Moths.—The latest and most satisfactory evilence on this matter, the production of melanism in moths by reatment with the metallic salts found deposited by smoke n industrial areas (J. W. H. Harrison and F. C. Garrett, *Proc. Roy. Soc.*, 1926) indicates that the induced hereditary hange is not directly adaptive, and, once produced, remains onstant and is inherited according to Mendel's laws—in other vords, that such changes are induced Mendelian mutations. On he other hand, there is as yet no evidence which has satisfied he majority of biologists that the effects of use and disuse are ver directly inheritable. As regards orthogenesis, there is no oubt that beautiful series of fossil forms, each tending in a paricular direction towards specialisation for one particular mode f life, may be found. But there is no evidence whatever that hese are to be accounted for by some inner necessity for deterninate variation in a particular direction, and not rather by radual improvement at the hand of natural selection.

In addition, however, to such series (which obviously run ounter to Lotsy's theory of recombination) detailed studies of ariation among existing species bring to light numerous charcters which appear to be of no biological advantage or the reerse to their possessors, and are most readily to be accounted or as due to random mutations. Finally, in some cases, espeially among plants (as roses, willows, etc.) enormous variability s found combined with evidences of hybridity. Here it appears lmost certain that evolution by hybridisation and recombinaion has been effective. The most plausible view as to the mechnism of organic change (although it must again be emphasised hat there is as yet no unanimity on the matter) is therefore omewhat as follows:—

A Mechanism of Organic Change.—The raw material of evoluion is provided chiefly by variations in the form of factorial or oint mutations. Some of these may be directly caused by changes n the outer world; but even when this is the case, there is no eason that they should be adaptive—sometimes they may be, ometimes they may not. Others, probably the majority, are ot as yet to be traced to definite external causes; they are " sponaneous " (as in another field of science are the disintegration hanges suffered by the radioactive elements). Some of these come under the action of natural selection: the biologically favourable benefit their possessors and are preserved, the biologically unfavourable are weeded out. Still others appear to be neither favourable nor unfavourable; and their survival is a matter of accident. It is further clear that if an organic type possesses a hereditary constitution of a chemically definite nature, this will restrict the possible changes which it may undergo—in other words, will make variation, within certain wide limits, determinate. To this limited extent the principle of orthogenesis will be at work. Finally, we obtain evolution by recombination in the comparatively rare cases in which two or more distinct races or species can cross and produce normally fertile offspring.

One thing at least can be stated to-day with assurance, and that is that the mechanism of evolution is not simple, and that no single one of the various theories previously advanced will by itself prove to be sufficient.

Creative Evolution and Climatic Changes.—In considering the evidence bearing upon orthogenesis, biologists have been forced to take account of the geological evidence bearing upon past climates. As a result, opinion is inclining more and more to the view that the marked bursts of " creative " evolution, when new types are rapidly and abundantly produced, as with the mammals at the very beginning of the Caenozoic epoch, are to be correlated with pronounced changes in climatic conditions. When a single pond dries up, the species inhabiting it simply become dispersed to other neighbouring ponds. But when a whole area of the world's surface becomes progressively drier or colder, the life which inhabits it must either change or die. The detailed working out of this difficult subject of past climates will be of great importance for a study of evolution.

We now come to the third main heading under which we can study evolution. Taking for granted both the fact of its occurrence, and the existence of some sufficient mechanism, we can seek to discover what has actually happened, and whether any general principles or laws can be traced in the process.

The Fossil Record.—We are at the outset placed under a grave handicap, in that our most trustworthy and direct source of evidence—that from fossils—is only available for a limited part of evolutionary history. The earlier fossil-bearing rocks have in part been denuded away (to be carried down to the sea and deposited once more as rocks of a later age), or else so much altered by the heat and the pressure to which they have been subjected in the course of geological time, that they are completely *metamorphosed*, and their fossil record obliterated. Opinions differ as to the proportion of the geological record which has thus been destroyed, but at a very conservative estimate it comprises at least half the time during which life has existed upon the earth. As a result, when the earliest richly fossiliferous rocks are examined, they are found already to contain representatives of most of the main groups of animals. With regard to the vertebrates, however, this is luckily not the case. They evolved late; and the rocks provide us with an excellent record of the evolution of their main groups (*see* PALAEONTOLOGY). In addition, however, the indirect evidences of comparative anatomy and embryology do permit us to draw a number of broad conclusions concerning the other groups with a reasonable degree of certitude. When we assemble and analyse the evidences drawn from every possible source we find that we can obtain from them a body of important general principles concerning the direction which evolution has actually pursued. These principles appear to hold good equally well for all the main groups of animals in which they can be checked and not only for vertebrates.

Lower and Higher Types.—In the first place, when a higher type evolves from a lower, it is usually found that this does not involve the total disappearance of the lower type. Commonly, representatives of the lower type survive, but the total number of its species is reduced, and the survivors are often smaller in size and lead less conspicuous lives than when the type was in its prime. The classical example is afforded by the reptiles and the mammals. The former with their " cold blood " and absence of placenta and of milk are definitely of lower organisation than the latter. In the Mesozoic epoch, they became the dominant group of vertebrates, and branched out into various striking types—gigantic herbivores, carnivores of corresponding bulk, flying forms, marine fishlike types and so forth. By the onset of the Caenozoic period, the mammals had become dominant; the reptiles still survive but only in the shape of crocodiles, tortoises and turtles, snakes and lizards.

Similar survival of "lower" types, but in reduced numbers and reduced variety, alongside of "higher" types is also seen when we look at the evolution of human inventions, an obvious example being afforded by the survival of pack transport and horse-drawn wheeled vehicles after the introduction of mechanically-propelled vehicles. A consideration of the causes operating to produce such effects with human inventions often clarifies the causes of similar survivals in biological evolution.

Directional Change.—As a result, we find that at any given moment the organic world provides us with a selection, not merely of the latest-evolved types, but of most of the main types which have ever come into being. When, on the other hand, we consider the latest types only—in other words, the upper level reached by life instead of its whole range—we are enabled to trace a definite directional change in evolution. There has been a tendency to produce types which can respond with greater precision to changes in the environment, which have greater control over external objects, are increasingly independent of the environment, and more self-regulatory.

These tendencies are revealed in various concrete ways. The efficiency of the various organs of animals has become greater. Sense organs come to have greater range and greater accuracy; one has only to compare the nervous system—brain, spinal cord and nerves—of a mammal with the nerve-net of a jelly-fish and this with the nervelessness and almost total absence of co-ordination in a sponge to have the advance as regards conduction and co-ordination very forcibly brought home; and equally striking examples could be drawn from other systems, such as the locomotor, the skeletal, the blood-circulatory or the digestive. A very striking step was that taken by the birds and mammals alone among all organisms—the acquisition of special machinery permitting the body temperature to remain constant ("warm blood"); this permits the general activity of the organism to remain at the same level in spite of great changes in outer temperature, whereas that of all other organisms rises and falls with the temperature like an ordinary chemical reaction.

General and Special Organisation.—Efficiency of machinery for control and self-regulation may be improved in two main ways—in relation to the organisation as a whole, or in relation to a particular mode of life. For example, the general organisation of the mammalian type is an improvement upon the reptilian. On the other hand, the organisation of the horse is an improvement upon that of the early mammals when considered in relation to a cursorial and vegetarian existence, that of a whale in relation to a marine existence. But it cannot be said that in general organisation either horse or whale is superior to the other. This latter type of improvement we speak of as specialisation, the former as improvement of general organisation, or more succinctly as biological progress. Biological progress involves all-round advance; but specialisation, which is by definition specialisation in regard to one particular direction and mode of life, invariably involves a sacrifice of possibilities in other directions and for other modes of life. The horse, by the very fact of being adapted to grass-eating, is cut off from all carnivorous diets; the whale, through being so thoroughly adapted to life in water, is debarred from the possibility of life on land or in the air.

Sometimes the adaptation is such a limited mode of life that the sacrifices appear to outnumber the gains. We then speak of degenerative evolution. This is best seen in animals which have exchanged a free-swimming for a sessile existence, or those which have taken to parasitism. It should not, however, be forgotten that degeneration is always a form of specialisation. Even the most "degenerate" parasite is beautifully adapted to its mode of life in its mechanisms for passage from host to host and in its arrangements for maintaining itself unharmed within a particular part of its host's body.

Specialisation.—Further, the evidence seems clear on one important point—no highly-specialised form appears to retain the possibility of giving rise to types specialised in some quite other direction, or to a type which shows a general advance in organisation. It was among the most generalised fishes that the ancestors of land animals took their rise; and the ancestors of man are not to be sought among any of the specialised groups of mammals like ungulates, carnivores or the like, but in the humble and generalised insectivora. In other words, the sacrifice involved by specialisation is not only a morphological one; the special improvement involves also a sacrifice of general evolutionary possibility.

As each new type comes into being we find in general the following series of events. There is first a considerable period during which the new type is not fully perfected; its representatives remain small in size, few in numbers and in kinds, and of little importance as compared with the dominant type from among whose more primitive members they have sprung. Then, comparatively suddenly, the new type ousts the old from its position of dominance. This is well exemplified by the early mammals which existed during the Age of Reptiles and their sudden rise to supremacy at the close of the secondary period; or by the long period during which primitive man existed at a low stage of attainment, prior to his quick rise to biological dominance in the last 10,000 or 20,000 years, or—to utilise our example from human inventions once more—by the early decades in the history of the motor-car, when it was regarded as either a joke or a nuisance, before its sudden rise into general use.

Once the new type becomes well established, it usually evolves into a number of specialised branches, together with other branches which remain relatively primitive and generalised. This specialisation of a group into a number of adaptive lines is usually known by Osborn's term of adaptive radiation. It is beautifully illustrated in the fossil history both of the reptiles and of the mammals (and again in the origin of numerous divergent types of motor vehicle as soon as the motor type came into favour).

Progress from Lower to Higher.—It remains to ask whether one type can legitimately be called "higher" than another, whether the term "progress" can legitimately be used for any purely biological process, since such terms involve the idea of value. Types undoubtedly differ in regard to their degree of efficiency, self-regulative capacity, etc.; and there is also undoubtedly a general directional trend to be traced in the evolutionary history of life as a whole. It is further found, however, that this trend is in the general direction of producing qualities and characteristics which are regarded as valuable by us (control, efficiency, independence, etc.), and that the difference between what are customarily called lower and higher organisms does again correspond with a difference in regard to qualities which do seem valuable to us. In other words, the terms high and low as applied to organisms, and biological progress as applied to a certain direction of evolution are perfectly legitimate.

Conclusion.—In conclusion, it should be remembered that the fact of biological progress, of a steady trend of the upper level of life in an upward direction, by no means implies, as is sometimes stated, the existence of an internal "urge," or of a non-natural guiding force; nor need we assume any purpose in the process. The matter is on a par with the question of purpose in regard to specific adaptations, which were taken by Paley as definite proofs of purposeful design by a personal designer. Darwin, however, pointed out that the purpose here was only apparent, and that adaptations could be satisfactorily accounted for by the non-purposeful automatic working of natural forces. Precisely the same is true of the apparent purposefulness revealed in biological progress. On reflection, it, too, is seen to receive a satisfactory explanation on the same Darwinian principles. The struggle for existence being as keen as it is, any advance, whether specialisation along a restricted line, or progress in general organisation, will be a biological advantage.

Purpose is a purely psychological category, and the term should only be used when other explanations can be excluded. It is, however, important to notice that, with man, purpose has come to have evolutionary significance. Any future progressive evolution of the human species (*see* EUGENICS) or of human institutions must inevitably depend, in greater or lesser degree, upon true purpose; and this itself is a biological advance, for purposive planning is both more direct and less wasteful than the pseudo-teleological methods of natural selection. (J. S. H.)

II. EVOLUTION AND COMPARATIVE ANATOMY

The science which is concerned with the resemblances and differences which exist between the bodily structures of animals, was cultivated by the zoologists of the 19th century with such success that by 1870 the structure of representative members of all the greater groups of vertebrates was known, and even the invertebrate groups were well understood. The body of facts so brought together forms the foundation of the theory of organic evolution. It established that the whole series of living animals, some 2,000,000 in number, resembled one another in such a way that their organisation could be referred to a small number of fundamental types, sharply marked off from one another, and not connected by any animals of intermediate structure. The more important of these groups are the Protozoa, Porifera, Coelenterata, Platyhelmia, Chaetopoda, Arthropoda, Mollusca, Polyzoa and Chordata, whose characters and mutual relationships are well explained in the zoological articles of the *Encyclopædia* (*see* 28.1033 esp.).

The general acceptance of the truth of the doctrine of evolution led to a great deal of work on comparative anatomy, with the intention of displaying the steps by which the structure of the higher animals had arisen from that of lower forms. It was soon realised that a continuation of this work resulted merely n the accumulation of details, which although sometimes interesting, could not bring about any important changes in the conclusions which had already been reached. Two lines of research appeared open to the morphologists of 1870; they could add the nvestigations of function to that study of pure form which was their selected field, or they could determine the actual mode in which the structures they described came into existence during the embryological development of an animal.

Study of Embryology.—The problems raised by an attempt to relate the structure of an animal to the functions performed by ts organs are, except in specially simple cases, of great difficulty, requiring resources of physics and chemistry which were not available in 1870; thus it was to the study of embryology (*q.v.*) that the majority of morphologists turned. Their work soon led to results which revolutionised the whole subject, placing many homologies between the parts of different animals, which had previously been disputed, on a firm foundation and introducing the element of succession of events in time. But embryology n its turn has reached a stage in which the new work is concerned olely with detail, and no fundamental new facts are likely to be discovered by the old methods. There is however another way n which the time element can be brought into morphology; study f the remains of fossil animals has, of late, solved some outstanding problems amongst vertebrates and has revived interest n the whole subject.

Experimental Work.—The most promising mode of attack is, however, through experiment. It is possible to interfere with the development of an animal: by altering the rate at which it proceeds, by cooling or by chemical means; by the removal of the primordium of one of its organs; by transplanting a developing ye or ear into a new region of the body, or even by grafting alves of two different species together. Work of this kind s being very actively carried on, especially in the Unites States f America, and it has already revolutionised our outlook on morphology.

The study of evolution, and of the causes which have brought t about, is not now fashionable. All zoologists regard the truth f the doctrine as established more by the patent incredibility f other explanations than by direct evidence; indeed only the tudy of palaeontology (*q.v.*) leads to a vivid realisation of its ruth and of the details of the process. Thus zoologists, being no onger compelled to concern themselves with the truth of a fundamental principle, have been free to devote their attention to those problems which gave promise of rapid solution.

At present it is difficult to design and carry out experiments whose direct object is the establishment of the factors which bring about evolutionary changes, because the whole subject is overlain by a mass of theoretical conclusions based entirely on the examination of observed facts, whilst many aspects of the subject which are quite fundamental have never yet been adequately explored by an experimental method under controlled conditions.

Mendelism (*q.v.*).—The rediscovery in 1900 of Mendel's Principles of Heredity showed that the assumptions made by the earlier naturalists, and even the conclusions reached by statistical methods of investigation, might have no validity so far as the individual was concerned, and emphasised the necessity of a renewed and rigorous investigation of that heredity to which every animal owes its morphology. But this work, as it has been carried on, especially by the school of Morgan, is itself morphological, it relates the structure of an adult animal to that of the chromosomes contained in the nucleus of the zygote from which it arises. The problem which now confronts morphologists is to discover the mode in which the "genes" function, that is, the nature of the factors which so control development as to determine the final structure attained by the animal. This problem is being attacked by the methods of experimental embryology, which are leading to a better understanding of the meaning of the facts of comparative anatomy. Thus, by their early work, comparative anatomists established the prima facie case on which our belief in the reality of evolution rests, whilst by the work that they are now carrying on they hope in the end to come to an understanding of those forces which underlie the phenomenon of evolution.

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III. THE PALAEONTOLOGICAL ASPECT

The law of evolution, especially as applied to human origin, has again been challenged in the United States by adherents of religious bodies who are described as Fundamentalists as distinguished from Modernists (*see* FUNDAMENTALISM). The movement is based on a revival of the literal interpretation of Creation as described in the book of Genesis, largely under the eloquent leadership of the national politician, William Jennings Bryan. Evolution is characterised as an unfounded hypothesis, unsupported by evidence, subversive of youthful morals, and, therefore, a menace not only to religion but to the state.

Bryan and other lay and clerical opponents of evolution sustained their course by direct citations from Dr. William Bateson's Toronto address to the American Association for the Advancement of Science (1921), "Evolutionary Faith and Modern Doubts," which supported the law of evolution and, while completely negative as to the causes of the origin of species, served to clear the biologic atmosphere and to intensify research for veritable causes.

PALAEONTOLOGIC ASPECTS OF THE THEORY OF ORGANIC EVOLUTION

Zoological researches on variation, selection and the origin of species, up to the year 1926, have ended in a series of negative conclusions and opened the way to consider the new light thrown on the problem of adaptation by palaeontologic research. In such research we may sharply distinguish between the illumination of the law of evolution as a universal principle of plant and animal descent and the light which palaeontology throws upon the *causes* of evolution and, consequently, on the older theories of causation. (1) Palaeontology substantiates natural selection in its larger meaning but deprives it of its creative or originative power. (2) Palaeontology gives an equally strong negation to Lamarckism in its creative sense of immediate inheritance in course of present time. (3) Palaeontology presents an equally strong front against discontinuity and mutation, or sudden sal-tations in mechanical characters, and substitutes an absolute, unbroken continuity in secular evolution as in growth.

Material Observed.—In palaeontology, however, the field of observation is chiefly limited to the adaptations of the hard parts preserved in a fossil state, to the relations of function and form, to the adaptation and development of new proportions (allometrons) in mechanical structures—adaptations which are primarily biomechanical. Thus while palaeontology negatives both selection and Lamarckism in biomechanical evolution, it has its strict limitations, it throws no light on the possibility of discontinuity or mutation in biochemical or biophysical evolution. There are grounds for believing that saltation, mutation and other forms of discontinuity, such as may frequently occur in adaptations primarily biophysical and biochemical, immunity and non-immunity, fertility and non-fertility and interbreeding, physical reactions to temperature, atmospheric pressure, etc.

As the unique result of palaeontological research we perceive evolution as a *secular* phenomenon, a process of the ages which, measured either by geology or by the radium content of the rocks, is infinitely slower than either Lamarck or Darwin conceived. Lamarckism in part holds true as a cause of secular evolution, just as Darwinism (*i.e.*, survival of the fittest) holds true as a potent cause of secular evolution. On the other hand, palaeontology denies absolutely the origin of species according to the original conceptions and literal interpretations of either Lamarck or Darwin. In claiming that all that is acquired is transmitted, Lamarck was over-confident, as Darwin was over-confident in claiming that every variation, however slight, may favour the chance of survival.

The second unique result of palaeontological research is to transfer from the field of reason, imagination and speculation to the field of direct observation the whole question of the modes and methods of evolution and the whole problem of the manner in which new specific adaptations originate and of the details by which new biomechanical species are constantly created. We refer to such biomechanical adaptations as the elongated neck of the giraffe, the classic case cited by Lamarck and Darwin, the highly complicated mechanical evolution of the teeth, the origin and development of horns and of defensive armature.

The Record of the Rocks.—In the 60 years since 1865 some palaeontologists have been speculating, while others were quietly devoting themselves to gathering harvest after harvest of facts about the modes and methods of the origin of species. The palaeozoic rocks of eastern America afforded Hyatt (1866) opportunities similar to those enjoyed in Europe by Waagen (1869) and Neumayr (1871) of observing in closely successive and continuous stages (mutations of Waagen) that the old barriers between "species" as conceived by Lamarck and Darwin are entirely broken down and one specific stage merges into the next without a break; in this respect evolution appears exactly like growth. In vertebrate palaeontology finely successive fossil horizons in the arid western states of America yielded Osborn and others closely continuous stages in all the hard parts of many lines of mammalian descent, especially horses, rhinoceroses and titanotheres.

The Creative Origin of Species

Thus between 1859 and 1926 the "origin of species" has become an entirely different problem from that conceived of by Darwin or, in fact, by any other zoologist, because our knowledge of what constitutes a species is entirely different. As palaeontologists we are observing the initial and terminal phases of a *continuous creative evolution and adaptation of the germ plasm*, because palaeontology forces upon us this new creational definition and conception of evolution, namely, of a *continuous creative unfolding of life fitted to a continuously changing environment.* It is remarkable that through palaeontological research the original Latin word "evolution" becomes inadequate and the old Sanskrit word √*kar* reasserts itself.

> CREATE (Lat. *creatus*, make, create, akin to Gr. κραίνειν, complete, Skt. √*kar*, make.) 1. Trans. To bring into being; cause to exist. 2. Intrans. To originate; engage in originative action.

This new creative definition of evolution expresses the two new principles of evolution discovered in palaeontology, namely, the principle of continuity and the principle of rectigradation, the one a denial of *mutation* in biomechanical evolution, the other a denial of *fortuity* in biomechanical evolution.

Species and Adaptations.—It appears through the study of continuous series of invertebrate and vertebrate fossils that "species" and "adaptations" are synonymous terms, as may be clearly seen in the history of these two terms, from Aristotle to Linnaeus.[1] The origin of species and the origin of adaptations are phenomena of the same significance, for every "species" is an ensemble of countless "adaptations" in various stages of rise and decline. What Aristotle (300 B.C.) called an adaptation, Linnaeus in 1758 called a species. When Aristotle in his *History of Animals* and his *Physics* debated the natural causes of adaptations he had in mind the same structures and functions as those which Linnaeus used in defining his species. For example, the celebrated "survival of the fittest" passage in Aristotle's Physics (Taylor's translation):—

> What, then, hinders but that the parts in nature may also thus arise? For instance, that the teeth should arise from necessity, the front teeth sharp and adapted to divide the food, the grinders broad and adapted to breaking the food into pieces. . . . It is argued that where all things happened as if they were made for some purpose, being aptly united by chance, these were preserved, but such as were not aptly made, these were lost and still perish, according to what Empedocles says concerning the bull species with human heads. . . . . Nature produces those things which, being continually moved by a certain principle contained in themselves, arrive at a certain end.

For example, again, Linnaeus (1758) defines the anthropoid ape known as the orang:—

> SIMIA: *Dentes Primores* IV., approximati. *Laniarii* solitarii, longiores hinc remoti. *Molares* obtusi. *Cauda nulla: Simiae veterum.*

Seven Principles of Origin

Baldwin thus defines the word "principle" in its bearing on science in general:—

> PRINCIPLE (Lat. *principium*, commencement, beginning: trans. of Gr. ἀρχή, beginning, authority): Ger. *Princip;* Fr. *Principe;* Ital. *principio.* Scientifically, it is the law through which a diversity of facts, otherwise unrelated and unexplained, are classified and interpreted: opposed to datum, brute fact or "mere" fact. . . . Greek philosophy began with the search after the principle in the literal sense: that original reality (*a*) from which other things are derived, and (*b*) out of which they consist. In the sense (*a*) it was implicitly or explicitly dynamic, a force, a causal power; in the sense (*b*) it was static, an element of subsistence. The first meaning led up to Aristotle's form εἶδος as a principle; the second to his matter ὕλη.

The Seven Principles.—Briefly, the first of these subsidiary principles discovered and formulated in zoology as confirmed and amplified in palaeontology are five in number: First, the principle of individual adaptation or reaction to changes of motion or function which invariably precede changes of form, as first observed by Aristotle and finally confirmed by the experimental observations of Arbuthnot Lane and Felix Regnault; second, the Aristotle-Lamarck principle of development through use, of degeneration through disuse, of balance through unchanged or static function. These two principles were understood and expressed by Goethe in the pre-Lamarckian year 1784 when as a brilliant novitiate in human and comparative anatomy he was on the very threshold of evolution:—

> Thus by the animal's form is its manner of living determined;
> Likewise the manner of life affecteth every creature,
> Moulding its form.

Third, the ontogenetic principle by von Baer in embryology and Hyatt in palaeontology, of Acceleration or the hurrying forward of characters in development and in evolution, and of Retardation or the slowing down of characters, according to juvenile or adult needs in the struggle for existence; fourth, the Empedocles-Darwin principle of individual and racial struggle for existence and individual and racial survival of the fittest; fifth, the

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[1] There are, however, many specific characters to which no adaptive significance can yet be assigned.—Ed. *E.B.*

Lamarck-Darwin principle of *ébranchement*, of divergence, the adaptive radiation of Osborn, which permeates the diversity of the plant and animal world.

These five pioneer or zoologic principles, all alike discovered in zoology, have been confirmed and ratified in palaeontology as the principles of progression and of retrogression, manifested first only in the individual and finally in the race. They are the coefficients both of individual development and of racial evolution or phylogeny, as set forth in what Osborn has termed "tetraplasy" in ontogeny and "tetrakinesis" in phylogeny. To cite Baldwin again:—

COEFFICIENT. *a.* Co-operating; acting in union to the same end. *n.* That which unites in action with something else to produce a given effect; that which unites its action with the action of another.

The two remaining principles are palaeontologic, namely (VI.) *Continuity* and (VII.) *Rectigradation.* To the zoologist every minute mechanical part of every animal is still and dead; to the palaeontologist every detail is alive and moving, slowly unfolding in the original sense of the Latin *evolvere* (*evolutio*); to the vision of the embryologist, individual development is an unfolding of the potency of the germ.

In this creative movement the palaeontologist discovers his two new principles, a sixth and a seventh, namely the principle of continuity, of continuous and unbroken advance or recession of each character from invisibility into visibility, and, closely connected therewith, the principle of rectigradation, of the continuous orthogenetic rise of each new organ out of heredity, passing through stages of increasing mechanical perfection, then perhaps gradually subsiding again into the germplasm until it finally disappears.

These seven principles which govern the origin of species in mechanical adaptation also concern an enlarged heredity, for only through palaeontology can we broaden and clarify our vision of heredity and distinguish the ripples of "saltation" or "mutation" (De Vries) from the waves of "evolution," the local currents and vortices of "variation" from the rise and fall of the tide of great characters (*cf.* Scott, 1894). The minute fossilised tissues of the ivory tusks of the mastodon and the stupendous "thunder-saurian" *Brontosaurus* are alike mirrors and "phenotypes" of the evolving germ-plasm out of which they once developed. The stages in the evolution of the horse, camel, mastodon and elephant, in the largest and in the minutest detail, are mirrors of the evolution of the germ-plasm.

PALAEONTOLOGY AGAINST VITALISM OR "ENTELECHY"

The principles of rectigradation, that is, of the direct adaptive origin of new specific characters from the germ, presents the greatest theoretic difficulties; certain new specific characters arise adaptively, without antecedent use or function, and are therefore unexplainable on the original Lamarckian principles (Lamarck, Spencer, Cope). Nor is the cause of these orthogenetic characters traceable to an "entelechy" or internal perfecting principle, or to an *évolution créatrice* in Bergson's sense. New organs chiefly appear as *secular* reactions to new conditions of life. Entirely inexplicable as the reaction process is, all of the numerous rectigradations which have been closely observed in many lines of descent are responses to secular changes in environment or in habit. In this secular sense the Lamarckian principle of new needs of the organism inducing a change of function and the change of function inducing change of structure acquires a new significance. For example, the browsing horse (*Hypohippus*), remaining in a forested environment, retains an arrested dental mechanism, whereas the plains-living horse (*Hipparion*), finally contending with the grasses of an extremely arid environment, shows the most highly progressive and intricate dental structure; the browsing Pleistocene proboscidean (*Mastodon*) retains the same kind of grinder as its Oligocene ancestor (*Palaeomastodon*); the grazing mammoth (*E. primigenius*) rapidly evolves a grass-eating mechanism.

Such facts as these, however, do not justify a revival of Lamarckian confidence, because, taking biomechanical evolution as a whole as revealed in palaeolontogy, it is like a two-edged sword, equally damaging to the original Darwin and the original Lamarck hypotheses. It substitutes a firm and undeviating order in biomechanical adaptation, of which we have at present no conceivable explanation as to causes.[1]

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The definitions of "principle" and "coefficient" are taken from Baldwin's *Dictionary of Philosophy and Psychology*: that of "create" from *The Century Dictionary.* (H. F. O.)

IV. THEORY OF ORGANIC EVOLUTION

Two important advances in the study of evolution have taken place since 1859, when Darwin published his *Origin of Species.* The first of these was Mendel's discovery of the fundamental laws of heredity, announced in 1865 but lost sight of until 1900. The second advance was the discovery of the importance of discontinuous germinal variation, whose value in relation to evolution was foreshadowed by W. Bateson's work on *Materials for the Study of Variation* (1894), and brought prominently forward by H. de Vries in his *Mutation Theory* (1901). Even before Darwin's time it was known that new types, departing widely from the parent type, occasionally appear and that their characters may be inherited. The more extreme variations of this kind had been called sports. It was not realised, however, that many of the minute differences in individuals arise in the same way.

The writings of August Weismann between 1885–93, more especially his essays on *The Continuity of the Germ-plasm as the Foundation of a Theory of Heredity* (1885), *The Significance of Sexual Reproduction in the Theory of Natural Selection* (1886) and *The Germ Plasm* (1889) had shown that variations originate in changes that first take place in the germinal material. His discussion of the problem of variation gave a new trend to all later studies on variability. Twenty-four years later the penetrating analysis of W. Johannsen (1909), based on experimentally obtained data, furnished a secure basis for all later discussion relating to selection. These advances have furnished material for a scientific discussion of the evolution theory. The phylogenetic generalities formerly indulged in when questions of variation and heredity were discussed have to-day little more than historical interest; for it has become apparent that those discussions were lacking in a precise knowledge of the facts with which they dealt. A more detailed and systematic statement concerning those matters referred to above may now be made.

MENDELIAN THEORY OF HEREDITY

Mendel (*see* MENDELISM, 18.115) has shown that when two plants belonging to races with contrasted characters, such as peas with green seeds and peas with yellow seeds, are crossed the hybrid offspring may be like one of the parents with respect to the pair of characters involved in the cross. If the hybrids are next bred to each other (or when monoecious, self-fertilised) the next generation consists of the two kinds of individuals in the ratio of 3:1. Mendel explained this ratio by assuming that one of the original races carried an element for yellow seed, the other race an element for green. When these elements are brought together in the hybrid the influence of one *dominates* the influence of the other. If, at the time when the egg-cells and the pollen grains of the hybrid reach maturity, the elements separate so that half of the germ-cells come to contain the element for yellow and half the other element for green, then chance fertilisation of any egg by any pollen grain will give a three to one ratio. For when yellow meets yellow a pure yellow individual will result; when yellow meets green a yellow individual will be produced (yellow dominating); similarly when green meets yellow a yellow individual will result; and when green meets green a pure green individual will be formed. The outcome is three yellow to one green. Of these three kinds one is pure for yellow and breeds true to that character; one is pure for green and breeds true to green; while two are hybrids, and, if selfed, will give again three yellow to one green.

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[1] It is important to recall that the study of palaeontology cannot in the nature of things give information as to the kind of hereditary processes occurring in evolution. The important fact of gradual evolutionary change established by palaeontology could be quite well accounted for by the accumulation by selection of small mutations.—ED. *E.B.*

Mendel also discovered that when two pairs of contrasted characters enter a cross, *e.g.*, when a tall plant with coloured flowers is crossed to a short plant with white flowers, each pair behaves as above, and independently of the other, giving in consequence in the second generation four kinds of individuals in the ratio of 9:3:3:1. Two of these kinds are like the two original grandparents; the other two present new recombinations of their characters. The same independent assortment of pairs of characters is supposed to hold for any number of pairs, but later results have shown that this is true only to a certain point.

Thus the inheritance of characters can be explained by the theory that there are independent elements in the germinal materials (eggs and sperm-cells) to which, in a sense (see below), the differentials that distinguish individuals may be referred. Equally important is the demonstration that these elements do not fuse or blend when brought together in the hybrid, but separate there cleanly from each other, and half of the gametes come to contain one member of a pair and half the other member. When Mendel wrote, no mechanism was known to which an appeal could be made to account for this separation (technically called segregation) of the elements in the hybrid, but, later, the extensive work carried out on the ripening of the germ-cells made it evident that the chromosomes furnish a mechanism that fulfils all the requirements of Mendel's principles both for one pair and for more than one pair of elements. In the examples that Mendel chose to illustrate the fundamental laws of heredity, one character completely dominates the other; but, while this often happens, in many other cases the hybrid character is more or less intermediate between those of the parents. Thus when a white-flowered four o'clock is crossed to a red-flowered plant, the flowers of the hybrid are pink. Nevertheless, the results in the next generation (namely, 1 red; 2 pink; 1 white) show that the hereditary elements have not blended in the hybrid but separate as cleanly as do the elements for yellow and green peas. It is true that when a given character in one race differs from the contrasted character of the other race in many elements (as height, *e.g.*, tall *v.* short in man) the results are not simple but even here there is every reason to suppose that Mendel's laws also hold for the character pairs taken separately.

Each individual contains in every cell of its body as well as in the germ-cells two elements of each kind, one of which has come from the father, the other from the mother. In other words, it is not a characteristic of the hybrid alone to have pairs of elements, but all ordinary animals and plants also are " double " or duplex. When the germ-cells mature the members of all these pairs separate and each ripe cell comes to contain half of the entire number. At the time of fertilisation of the egg by the sperm the full number of elements is again restored.

The postulated elements in the germ-cells, now usually called genes, are not to be confused with the characters of the individuals for which, in a sense, they are responsible. Each character is not supposed to be the direct product of one particular gene. On the contrary, characters or organs, as realised, are complex in origin—the product of a great many genes—but a difference that distinguishes one kind of individual from another may be due to a difference in only one pair of genes that act, so to speak, as differentials. Moreover, there is much evidence to show that these differentials cause not only a single main difference but a great many other minor differences in all parts of the body. What is called a Mendelian " character " therefore is only the most conspicuous amongst these several effects, all of which, however, accompany one or the other differentiating gene.

Whenever dominance is complete the measure of a given character in the hybrid cannot serve as a measure either of the past history of the individual or of its potential progeny. For example, if a grey house mouse is bred to a tame white or albino mouse the hybrid is grey and is undistinguishable in colour from the house mouse, whose ancestry may never have contained a white mouse and whose offspring by other house mice would be always grey; while half of the gametes of the grey hybrid that has had one white parent will contain an element for white. Failure to recognise these simple facts made all the earlier work on heredity extremely difficult and inaccurate when applied to individual cases. In this respect Mendel's discovery has made possible a more accurate interpretation of heredity, and consequently has an important bearing on theories of evolution.

Since the elements in the gametes of the hybrid come out as they went in, the character of the individual is shown not to have any influence whatsoever on the elements in the germ-cells. It follows that Lamarck's theory of the inheritance of acquired characters is erroneous. That theory postulates that the character of the individual has a direct effect on the germ-cells, so that the offspring show the influence of the characters of the body of the parents. If this were true there could be no reappearance of clean-cut elements in the gametes of a hybrid as Mendel's law postulates and as the facts demonstrate. Since this law has been shown to hold, wherever tested, it follows that there is no influence of the sort postulated by Lamarck's hypothesis, although evidence is at hand to show that external agencies may, in rare cases, alter the gene, the alteration being then inherited in Mendelian fashion.

Applications of Mendelism

It thus follows that a theory of organic evolution must be in conformity with Mendel's principles, quite irrespective of the way in which the elements in the germ-material may be supposed to have arisen. There may be some dispute as to whether this or that character shown by domesticated animals and plants has arisen in the same way as have the contrasted characters in the wild forms from which they have been derived, but there can be no doubt that the elements or genes in both are inherited in precisely the same way.

Mutation Theory.—The mutation theory, as it is called to-day, postulates that new types arise by sudden changes in the constitution of the germinal material. The new type, if sufficiently equipped to survive, shows the same degree of stability as the original type, *i.e.*, it breeds true to its new characteristics. The mutation may involve one striking change or many changes of small or large degree. Whether the new mutant type is or is not to be called a new species is in part a question of definition, for it is true that new mutant types do not show for the most part, when bred to the parent stock, a peculiarity that has often been found to distinguish wild species when crossed, namely cross-infertility or sterility of the hybrids when such are produced. If this distinction is held as essential to the definition of new species, then it must be positively stated that most mutant types differing from the original type do not show this relation to the original type or to each other. There is, nevertheless, something further to be said before admitting this argument as the crucial test of the origin of types by mutation or by any other process.

The doctrine of the origin of new types by mutation owes its vogue to-day mainly to the work of Hugo de Vries, and to a large extent to his observations on an escaped variety of evening primrose (Oenothera Lamarckiana). He found that this plant produces in each generation a small percentage of new types that breed true to their kind. These new types he called elementary species. They cross freely with the parent and with each other. It has been objected many times, especially by the opponents of the mutation theory, that the appearance of the new types in this evening primrose is due to its hybrid origin, and in support of their contention they point out that O. Lamarckiana is not known to exist as a wild species. These who relied on this evidence failed to appreciate that the appearance of its mutants does not conform to the ordinary rules of hybrid splitting, and their arguments were rudely shaken by the fact that other wild species of Oenothera behave in this respect in the same way as does Lamarck's evening primrose.

More recent discoveries have shown, it is true, that a few of the more striking mutants of this plant owe their origin to processes some of which at least can scarcely be admitted as representing, in general, the way in which wild species arise. An example of this may be cited here: one mutant type, O. gigas, is due to a doubling of the number of chromosomes; several others to the addition of an extra chromosome to the chromosome group, and the latter process is one that can hardly be supposed to be a method by which new species arise. There remain still a few other types whose appearance is not yet clear, but some of them at least can be accounted for on the assumption of what is known as balanced lethal factors. Without attempting to discuss this technical question it may be said that the appearance of this last kind of new type does not represent the original act of mutating but rather the liberation of genes from their lethal connection. These genes may have arisen earlier by what is now known as point mutation. If so, some of De Vries' results fall into line with the results of more recent work on mutation. This work has shown that new characters arise from time to time as a result of a single change (point mutation) of an element of a germ-cell. The new element gives with the one from which it arose a contrasted pair of Mendelian units (called allelomorphs). If the new type is crossed to the parent type, the new and the old elements segregate in the hybrid as a characteristic pair of Mendelian differentials. The new mutant type breeds true to its kind as does the parent type. The only serious question that may arise is whether these mutant types furnish materials for evolution, or whether they represent no more than the materials from which many of our domesticated types of animals and plants have originated. There can be no doubt that a large number of domesticated types have arisen in this way, nevertheless it might still be true that the origin of such types has nothing in common with the process by which wild types and species originated. A further consideration of the situation may help to show which way probability lies.

1. Some of the mutant types are characterised by the loss of characters or parts present in the old type. The albino, for example, has no pigment in the eye, hair or skin. But evolution may be at times in the direction of simplification as with the eyes of many cave-dwelling forms.
2. New mutant types are often abnormal or defective. Because of their small chance of survival such new types cannot, of course, be supposed to contribute materials for evolution, unless the origin of variations has some mystical relation to their fitness—a supposition not uncommon in the latter part of the 19th century. But nothing in the theory of evolution requires that all new variations shall be in the direction of fitness. For the theory of evolution it is only necessary that some sorts of variations appear that have a chance for survival in the old or in a new environment.
3. Some of the new mutant types are less resistant (weaker) or are less fertile than the original type from which they arose. These under natural conditions would die out. In fact, many observations go to show that animals and plants under natural conditions are kept up to their top level of strength and fertility by the constant elimination of the less viable variations. Wild types have already been brought as near the upper-limits as their particular organisation is capable of, and it is not to be expected, therefore, that any particular departures from this type will be an improvement. The situation would not be very different if a change could be "purposely" brought about, for, as stated, the adjustment of most organisms to the varied conditions under which they live—an adjustment that has been reached after an immense interval of time—may be as nearly perfect as the materials of its organisation and the varying condition of its environment permit. In a new environment or in a new relation to its present surroundings the chance for a change in an adaptive direction may seem greater. The relation of domesticated types to human needs or fancy supplies such a novel situation; but human intelligence as an agent in evolution, while it may speed up the process or increase the chances of survival of a particular type, bears the same relation to variability which makes evolution possible as does any other environmental agency.

If the preceding discussion appears to weaken rather than enhance the value of mutant types as material for evolution, this is equally true for any other kind of material, unless there were kinds in which the response of the organism to a possible need takes place. Carefully controlled observations have discovered no adequate evidence of this latter sort of variation. The extravagant claims and speculations that have been advanced in support of such views rest on confused thinking or unwarranted assumptions or false deductions from insufficient evidence.

More specifically in support of the mutational origin of new types the following facts carry considerable weight: (1) The differences that distinguish wild variations and even wild species have been shown in a number of cases to depend on genetic elements that behave toward each as do Mendelian elements. (2) Genetic elements that modify common characters, making them a little more or a little less developed, are well known. They conform in every way to the laws regulating larger changes. Many of the individual differences that make organisms a little better or a little less well adapted depend on these modifying elements. Any theory of evolution based on observed facts, and not on imaginary suppositions, must appeal to these genetic elements as material out of which to construct a theory of evolution or descent through gradual modifications. As already stated, it does not follow that these modifying factors, which can generally be found when looked for, have arisen by mutations even though they obey Mendel's laws, but until some other origin can be discovered it seems better to construct a working hypothesis on this assumption than on one that appeals to purely fictitious agencies. (3) Darwin argued that since all degrees of infertility between types and all degrees of fertility of hybrids are known to exist, there is no need to suppose that these differences have had any origin than other kinds of differences. In fact, if evolution has taken place, we might expect to find just such an inconstant relation. Later work supports Darwin's contention. The attempt to set up artificial distinctions between the frequently observed infertility between wild "species" and the complete fertility of nearly all domesticated and mutant types does not appear to-day as a real difficulty in the path of the mutation theory of evolution.

Modern experimental research has brought to light an important distinction in relation to those individual differences that are always found to be present in any group (variety or species) of individuals. The individual differences, that are often called fluctuating variations, are due sometimes to environmental effects produced on the individual during its development. These are not transmitted to the offspring and can take, therefore, no part in evolution. Other individual differences are genetic differences due to elements or genes in the germinal materials. These differences are inherited according to Mendel's laws and may take part in evolution. At the time when Darwin wrote the *Origin of Species* (1859) these distinctions were not clearly understood, although, of course, it had been known long before that time that while some individual differences are transmitted others are not. Darwin's theory of natural selection was based on the occurrence of individual variations, which, under selection, furnish the materials by which progressive evolution takes place.

It was, however, not then sufficiently realised that selection of individual differences, even of those that are inherited, can not bring about an advance in the direction of selection to an indefinite extent. The changes due to selection come abruptly to a standstill unless new mutation occurs. The explanation of this is well understood to-day, owing more especially to the thorough examination of the problem by a Danish botanist, W. Johannsen.[1] The first advance that takes place under selection is due to the sorting out of the genetic differences present that modify this or that organ in one or another direction. When selection has brought together those genetic elements that modify a particular character in the direction of selection, further advance ceases. The selected type will still vary, it is true, due to the environmental influence acting on each individual during its development; but, since these are not inherited, no further advance in the selected group of individuals as a whole takes place. Only by the appearance of a new mutation or of some other sort of change is any further progress possible. The rather widespread popular fallacy that selection can go on changing a group as long as the process continues is now known to be erroneous. The selective process does not furnish a new base from which further progress may be made, but acts only in so far as genetic differences are already present and then comes to an end, or unless new differences arise by mutation. It is a creative process only in so far as it sorts out what is already given. On the other hand if mutations are constantly arising, selection will *guide* the resultant evolution.

Darwin's ideas concerning the nature of variation and the power of natural selection could not have been as precise as the ideas of the present time based on accurate experimental work, and there is nowhere to be found any statement in his writings to the effect that selection itself creates the possibility of further advance in the direction of selection. It could not have been as clear to him as to us that the power of selection to bring about a progressive change in a given material is extremely limited. Nevertheless, he took for granted that new variations are constantly occurring, and in all directions. If this were strictly true, selection would cause progress indefinitely. We realise that genetic variability is by no means such a common event as Darwin supposed. On the contrary, all the evidence indicates that it is a rather remarkably rare event in proportion to the individual environmental changes that are ever present. Compensating for the rarity of new genetic variations is the fact that when they do appear they are constant and not necessarily lost by the swamping effects of intercrossing. Thus what the theory of natural selection lost in one direction it gained in another, and the probability that evolution has taken place by the selection of chance variations is as great as at the time when Darwin advanced his theory of natural selection.

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V. EVOLUTION AND RESPONSE TO ENVIRONMENTAL CHANGE

The word evolution, literally translated, means unfolding or unrolling, and in Latin signified the opening up of the bud into the perfect flower or leaf-shoot. Its meaning was extended later by metaphor to denote the growth of an institution or a people. In the 18th century it was introduced into biology to denote one particular theory of the development of the individual. According to this theory all development was a mere unfolding or unrolling: the perfect individual complete in all its parts already existed in miniature in the germ; growth consisted in separating out and making evident what had been previously wrapped up together.

History of the Term.—The geologist, Lyell, employed it to denote the moulding of the earth by natural forces. Darwin, in 1859, did not employ the word evolution at all in his celebrated book on the *Origin of Species.* When Herbert Spencer, in his famous *First Principles*, attempted to show that the same process which had condensed nebulae into suns and planets had also produced life from lifeless matter and modern animals and plants from the first simple living things, he gave to this hypothetical process the name "evolution"; but his term "evolution" has come into general use to denote the Darwinian theory that the inexhaustible variety of living plants and animals have arisen by descent from a few or, perhaps, only one stock of simple ancestors.

Nature of Evidence.—Now since evolution is *ex hypothesi*, a process which required for its accomplishment millions of years, direct evidence of its occurrence is of course unobtainable, and the indirect evidence in its favour may be grouped under three heads, viz.: (1) deductions from the comparison of allied species with each other, (2) deductions from the comparison of fossil species with one another and with living species, (3) deductions from the comparison of the stages which the individual of one species passes through during its growth from the egg to the adult condition, with the adult stages of other species. Darwin relied mainly on the first category of evidence. He showed that those who contended for the fixity and independent creation of each species, nevertheless divided many species into local races which in their view had arisen through the modification of different portions of the mother species by exposure to different types of external conditions, but that in practice no sharp line could be drawn between such races and species which graded into each other. Huxley, however, relied chiefly on the second category of evidence, for at the time of his great fight for Darwin, series of closely related fossils deposited in immediately succeeding beds had been discovered, in which to his mind there was exhibited a veritable record of evolutionary change, the fossils in the lower beds being the remains of the ancestors of the animals preserved in the younger and succeeding beds. The comparison of the embryonic stages in the life history of one animal with the adult stages of another was brought into prominence by Haeckel, who interpreted the life history of the individual as a recapitulation of the history of the race: this interpretation is of course a great assumption: its validity has to be first established by arguments drawn from categories 1 and 2; but once its general truth is admitted it furnishes a splendid means of unravelling the actual course which evolution has pursued.

Present Position.—The present position of affairs may be summarised as follows: by arguments belonging to all three categories mentioned above, the educated mass of mankind have been convinced that evolution has actually taken place; that as time has flowed on a species has gradually changed its character and that one mother species has split up into local races which, by diverging more and more from one another, have gradually changed into distinct daughter species. But how this has been brought about is an extremely disputed question, for the constancy of specific characters within the span of observation afforded by a human life is the most familiar of all the facts of natural history.

Main Hypotheses.—Three main hypotheses as to how evolutionary change has been produced have been put forward, the Lamarckian, the Darwinian and de Vriesian respectively. Lamarck's hypothesis in its original form was that the direct cause of evolution is a change in the environment. Animals exposed to new conditions experience new needs, and the effort to satisfy these needs leads them to make greater use of certain organs and less use of others; greater use leads to greater growth and lesser use to diminished growth; and these tendencies to greater or less growth are transmitted by heredity to offspring.

Darwinian Hypothesis.—The Darwinian view is that change of conditions induces a tendency in animals to vary slightly in all directions; that many of these variations are inheritable, and that those that *happen* to suit the new environment are preserved and affect the character of subsequent generations, whilst the individuals which exhibit harmful variations are wiped out by natural selection. Darwin implicitly assumed that the descendants of each individual exhibiting a favourable variation might be expected to vary again in the same way as did their progenitor, and that so the character of the stock would be gradually modified in a given favourable direction.

Mutation Theory.—The theory of de Vries is founded on his experiments with the evening primrose *Oenothera lamarckiana.* He found that when thousands of this plant were cultivated in the botanical gardens at Amsterdam, in each generation a small number of individuals were produced which exhibited marked divergences in structure from the type, divergences which at the same time affected roots, leaves, stem, flowers and seeds. In nearly every case the divergent individual, when fertilised with its own pollen, transmitted its peculiarities to its offspring; so that new species were being produced from the mother species in each generation complete in all their characters.

The causes of this production of new species, however, were quite mysterious, and de Vries suggested that species underwent fits of variation. To very similar conclusions Morgan was led by his cultures of the fruit fly *Drosophila melanogaster*, of which he has bred several hundred thousand individuals. Here, too, small numbers of individuals, differing definitely, though to varying extents from the type, were encountered, and each such individual, when mated with its like, transmitted its peculiarities to its offspring. Morgan believed that in these aberrant individ-nals he had discovered the raw material of evolution, and is usually known as the "mutation theory."

Pure Lines.—The reason that the mutation theory has gained n favour whilst the pure Darwinian theory is less widely accepted than formerly is to be found in the results of what are called the pure-line experiments. Galton and Weldon had shown hat if the individuals of species are measured with respect o the development of a single character, they did exhibit variations on both sides of the mean of approximately the same extent and with very nearly equivalent frequency, but the question remained to be answered whether these variations were inheritable or not. This question was attacked by Johannsen, Agar and Jennings, each of whom investigated inheritance in a pure line—hat is, amongst the offspring of a single parent. Johannsen chose the bean-plant, in which the flowers can be fertilised with heir own pollen; Agar worked on the little crustacean *Simocephalus*, in which the eggs develop parthenogenetically, that is, without fertilisation; and Jennings chose the *protist Paramecium*, commonly known as the slipper animalcule, for his investigations. This animal is equivalent to a single cell and multiplies by division into two. In all three cases it was found that the progeny varied considerably amongst themselves, but that if a divergent ndividual were selected to carry on the strain, the progeny of uch an individual were exactly like those of a typical individual and that the possibility imagined by Darwin of continuously ncreasing or diminishing the size of an organ by continually electing in each generation for continued propagation those individuals which exhibited the largest or smallest developments of an organ did not in fact exist.

Difficulties and Criticisms of the Mutation Theory.—The objections to the mutation theory are of a different character. While "mutations" do appear suddenly and are in most cases nheritable, most of the mutations described by Morgan and the "sports" used to propagate fancy races in other species, differ trongly in their character from the diagnostic marks which disinguish allied species from one another. On this subject the udgment of leading systematic zoologists is decisive. Most muations are as Haecker has recently expressed it: "inhibitions of development" and correlated with diminished vital energy. As they never fail to make their appearance when plants are ultivated or animals bred in confinement there must be what Baur terms "idiokinetic factors" in environments of this kind which alter the hereditary tendencies. The nature of these facors has been investigated by Tornier in the case of goldfish. No domesticated race of animals exhibits such aberrant types as he goldfish; but all the divergences of structure from the normal are the secondary results of what Tornier calls "plasma-weakness" or the diminished vital energy of the protoplasmic part of the egg, in consequence of which this portion became crushed nd distorted by the swelling yolky portion. This weakness s due to the deprivation of the egg of sufficient oxygen during he critical period of its development immediately succeeding ertilisation; but once acquired, this weakness is transmitted rom one generation to another and produces similar results in ach: If Tornier's conclusions are accepted, "mutants" can ave played no part in the process of evolution, for owing to heir relatively feeble constitution they would be the first to be liminated by natural selection.

Lamarckian Hypothesis.—As to Lamarck's principle of "reponse to the environment" as the cause of evolution: that animals do respond to changes in the environment by slight changes n habits and consequent modifications of structure is admitted y all, so far as the life of the individual is concerned. The point n dispute and one that is vital for the evolution theory is whether uch modifications can be transmitted in any degree to subsequent generations. Thus, children who run about with bare legs cquire an abundant growth of hair on these members, profesional singers acquire enlarged chests and prize-fighters enormous muscles in their arms. It is obvious that if these changes ffect the children of such people the changes in structure will keep pace with changes in habits, or, as it is usually phrased, tructure will change with function.

Evolution of the Horse.—In the succession of fossil remains, which convinced Huxley of the truth of evolution, this slow concomitant change of structure and function is the salient fact which impresses itself on the observer. Thus, in the series which is apparently the record of the evolution of the horse, we start with animals with four toes on each foot. As we proceed upwards in the series the outer toe, corresponding to the human little toe, gradually diminishes in size and disappears first on the hind foot and then on the fore foot. The second and fourth toes then begin to diminish slowly and are ultimately reduced to mere vestiges concealed under the skin, in which condition they remain in the modern horse, leaving only the third toe active and functional. Whilst the toes are shortening the teeth are undergoing changes also. In the earlier four-toed forms the grinding teeth are studded with cusps—but as we ascend in the series the cusps become connected by ridges, and the valleys between the ridges become filled with cement and the crown is at the same time greatly increased in height. The changes both in teeth and feet are clearly related to the gradual changes of swampy plains into dry steppes, and the resultant modification of succulent soft marsh plants into dry harsh grasses.

Embryological Evidence.—But the study of comparative embryology leads also to the conclusion that evolution results from changes in habits. Whenever in an order, where the type of structure is fairly constant, one genus is met with which exhibits an aberrant type of structure, this aberrant genus, when young, almost invariably exhibits the structure characteristic of the other members of the order. The cat-fish, widely distributed over Europe and Asia, (*see* DISTRIBUTION OF ANIMALS) are fresh-water fish devoid of scales and with darkly pigmented skins. They have broad mouths adorned with long barbels, which have been fancifully compared to the whiskers of a cat. There is a cat-fish, however, which is a denizen of small ponds and tanks in India, belonging to the genus *Clarias*, which has learned to breathe air. This fish, when young, is exactly like other cat-fish, but as it grows a sac-like extension of the opercular cavity is formed above the gills and into this cavity peculiar tree-like organs extend. These organs are adapted to absorb oxygen from the air; they arise as little buds from the uppermost sections of the gill arches, and as they grow the fish begins to make excursions out of the tanks on to the swampy meadow and gardens round them in pursuit of earthworms. It is difficult to take seriously the suggestion that "accidental" mutations led to the production of the trees in fish which remained in the water and that then these aberrances enabled their happy possessors to extend their hunting grounds, whilst other simultaneous mutations inspired them with the instinct to do so.

Zoological Evidence.—The study of closely allied species or detailed systematic zoology has led Dr. Tate Regan, to exactly the same conclusion. Change of habits, he avers, has preceded and determined change of structure and so caused evolution. So in the case of the viviparous blenny Zoarces, which retains the young in the maternal body till they have acquired the structure of the parent and are ready to assume the parental habits, small colonies of this fish in different localities differ from one another slightly in the shape of the body. Those that live in the quiet headwaters of the Danish fjords have shorter and deeper bodies with a reduced number of vertebrae, while those that lead a more active life in the open sea have longer and more slender bodies with an increased number of vertebrae. Activities—habits—are here, as Lamarck phrased it, called forth by the demands of the situation in which the fish find themselves and become crystallised into changes of structure.

Transmission of Acquired or Adoptive Characters.—Most palaeontologists are supporters of the Lamarckian view, but so far the evidence adduced in favour of the Lamarckian view has been indirect; the question now arises: can we induce animals to adopt different habits from those to which they have been accustomed, and show that these changed habits and the modifications resulting therefrom are transmitted to their descendants? Weismann, who on theoretical grounds was strongly opposed to the theory of the inheritability of the effects of habit, endeavoured to give a negative answer to this question. He cut off the tails of mice and bred these mutilated specimens together and showed that their progeny were born with normal tails. These experiments, which betray ignorance on the part of the experimenter of what the Lamarckian doctrine was or what was meant by an "acquired character," have been cited for a generation as conclusive evidence against this doctrine.

Recent Experiments.—Of recent years, however, a series of carefully planned experiments have been carried out which give positive answers to the question. Thus, Kammerer took specimens of the common European Fire-salamander, (*Salamandra maculosa*) and reared them in cages the walls of which were coloured yellow or black. The skins of these animals are black diversified with patches of yellow pigment. This yellow pigment, however, only makes its appearance at the time of the metamorphosis of the gilled larva into the land-living adult. It varies in extent in different individuals. During larval life Kammerer kept his specimens in surroundings of a neutral grey tint; after metamorphosis he placed relatively black specimens in yellow cages and yellower specimens in black cages. In these cages they lived and grew till they reached maturity, a process which occupied between four and five years. At the end of this time the specimens in the yellow cages had amalgamated their yellow spots into two broad longitudinal dorsal bands; in those in the black cages, on the contrary, the spots had diminished to minute dots. When two yellowed specimens were mated together and their offspring reared to maturity in yellow boxes, the yellow increased so much in extent as almost to exclude the black pigment altogether: when on the contrary, these offspring were reared in black boxes *the yellow pigment still increased in quantity for the first year of their life owing to the influence of parental conditions;* then, and then only, did the black environment begin to exert its effect and the yellow pigment was ultimately reduced to small spots.

Durkhen enclosed the caterpillars of the common white butterfly (*Pierisbrassicae*) in boxes covered with lids of orange-coloured glass. In these boxes they pupated, and from the pupae the butterflies emerged and were used to propagate a second generation. The orange-coloured light inhibits the formation of the pigments (chalky white and minute dots of black) in the skin of the pupa and allows the green blood to shine through. In ordinary light about 4% of the pupae are green: of those reared in orange light 65% were green. When a second generation were reared under similar conditions 95% were green, and when this generation was exposed to the influence of ordinary daylight 34% were still green owing to the influences to which their parents were exposed.

MacBride once endeavoured to force the stick insect (*Carausius morosus*) to feed on leaves of the common ivy plant. The insects disliked this plant very much and took to it with reluctance—those that survived produced few eggs, but these eggs produced larvae which took to ivy with avidity when opportunity offered.

Time Factor.—Lamarck had expressly asserted that the influence of conditions in modifying structure only begins to be evident "after a long time," and all the evidence derivable from palaeontology bears out this conclusion. Pigmentation, however, is the most recently acquired and variable character which animals possess; and it was therefore to be expected that it would be this character which would yield results to experiments conducted over a relatively limited period of time. The objection sometimes raised that the changes induced in these experiments might not be permanent is due to a confusion of thought. The objector tacitly assumes that a change in hereditary tendency, once produced, should persist, whatever the nature of the subsequent environment may be.

But if hereditary potences are of such a nature that they can be deflected from their course by environmental change, a transference of the organism back to typical conditions must work in the opposed sense to the previous environmental change. The utmost that we could expect in such cases would be (1) an intensification of the effect when the environmental change is prolonged for several generations; (2) a trace of the effect, especially in earlier stages of life, when the organism in the second generation is removed to normal surroundings; these expectations are fulfilled by the results of Kammerer and Durkhen.

It appears therefore that the whole constitution of an animal can be expressed as a superposed series of adaptations or habits. This, indeed, has always been the basal assumption underlying comparative anatomy—and that these habits have produced corresponding structural modifications. Those most recently acquired are assumed to be most quickly affected by changes in conditions—long established habits acquire a kind of inertia, or are, so to say, more "deeply engrained" and only yield slowly to new stimuli.

Two *a priori* theoretical objections have been made to the Lamarckian doctrine by its opponents. These are: (1) that there are structures, such as the peculiar features of neuter insects and the phenomena of mimicry in insects, which could not have been evolved by the handing on to posterity of the results of changes of habits, and (2) that there is no conceivable mechanism by which changes in the body of the adult organism could be transmitted to the egg-cell.

The first objection may be at once countered by the reflection that in many cases where the evolutionary history has been clearly deciphered the dependence of change of structure or change of habit is obvious. If in these difficult cases alluded to above we knew the evolutionary history, the same explanation would be seen to apply to them. Elsewhere (*see* BIBLIOGRAPHY) suggestions have been made as to how these exceptional cases might be explained, but it is waste of time to discuss them until we know more of their history.

The Mechanism.—To the second objection we may reply that whether we can conceive it or not some means of transmitting the effects of changes in bodily structure to the egg must exist. Guyer and Smith made an emulsion of the lens of the eye of a rabbit in Ringer's solution and injected it into the blood of a fowl. After an interval of three weeks the serum of the fowl's blood had acquired the power of attacking and dissolving the lens of the rabbit's eye. If now this serum were injected into the veins of a pregnant rabbit some of the embryos were born with minute defective lenses. If these young were allowed to breed the defect could be transmitted through six generations without any further administration of serum, and was, moreover, transmitted through the male, so that any explanation of the transmission by a supposititious infection of the embryos of each generation through the placenta of the mother was excluded. Guyer was driven to the conclusion that the germ-cells of the rabbits originally injected had acquired the power of forming a "cytolysm" which destroyed the lens, and that this power was transmitted by heredity.

But it is really idle to raise the objection that there is no "mechanism" by which the properties of the body can be transmitted to the egg. No "mechanism" is yet discovered by which the growth of the adult body from the egg can be explained.

Evolution of Plants.—Does evolution as a result of the transmission of the effects of habit apply to plants also? As there is a strong fundamental similarity in the characters and reactions of living substance in both animals and plants, it is to be expected that plants, like animals, will inherit acquired qualities. But the life of the plant and all its reactions are much slower than those of an animal, and the period of a human life would probably be too short to demonstrate this inheritance. Some evidence, however, exists. In the 17th century the peach tree was introduced by the French colonists into the Island of Reunion. In France the peach is a deciduous tree, but those planted at sea-level in Reunion became evergreens, whilst those on the summits of the mountains remained deciduous. If now the seed of a tree living at sea-level is planted at a higher elevation, it remains an evergreen, so that this acquired habit has become hereditary.

To sum up, there is in every organism something which feels, reacts by striving, learns, remembers and transmits its memories to its posterity. Striving and memory are fundamental properties of life and give the only satisfactory explanation of evolution.

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(E. W. MacB.)

VI. EVOLUTION AND MIND

The word " evolution " has been used in many senses. Some of them may now be regarded as obsolete. But there is still diversity of usage. Traced to its source this is not merely a matter of verbal definition. It depends on the place that is assigned to mind in, or in relation to, the course of events. In what may be called an unrestricted usage of the word " evolution," mind s the outcome of the progressive differentiation and integration of world-events. In a specially restricted usage those world-events which are distinctive of organisms are the outcome of the directive activity of mind. This divergence of usage is based on he acceptance of this or that speculative hypothesis. On one ypothesis mind is the evolutionary *terminus ad quem:* on the other hypothesis mind is the creative *terminus a quo.* But the iologist within his province may reject both these hypotheses. For him evolution is neither more nor less than a doctrine of escent.

Take first the unrestricted use of the word. The noun stands for concept of very wide range, and needs adjectival qualification r referential completion to focus its meaning. Thus we read of osmic evolution, of mental evolution, of social evolution; of the volution of the atom, of the solar system, of scenery and so forth.

Those who accept this unrestricted usage must be prepared to tate that which is common to each several instances of the use f the noun, when they talk, for example, now of geological and ow of mental evolution, or turn from the evolution of a crystal o that of trial by jury. Herbert Spencer, who rendered current he unrestricted use of the word, enunciated a " law of evolution " tating certain criteria which he regarded as salient. But his ormulation is rarely quoted now save by those who seek to show he inadequacy of the concept he sought to express with such mphasis on redistribution of matter and motion as seemed to ave mental and social evolution interpretable only on a basis f questionable analogy.

Those who still use the word in an unrestricted sense mean by something comprehensible though necessarily expressible only very comprehensive form. They mean something like this: ny set of events or state of affairs, physical or mental, which emplifies evolution is a passing phase in an orderly sequence; nd it comes into existence in such wise that its place in the se- uence, and its relations to precedent and consequent phases, e interpretable under the accredited methods of scientific pro- dure. Otherwise stated: Evolution implies a determinate plan advance to which any given instance of advance may be re- rred, and as thus referred is susceptible of interpretation, such terpretation is commonly spoken of as natural. But it is com- only held that there are some phases of events or some states affairs of which no natural interpretation, evolutionary or her, can be given. These are said to be supernatural.

If we wish to understand why so many people regard evolu- on as a live issue we cannot disregard this antithesis between tural and supernatural. But though it is preserved in much ntroversial discussion, nay more, is widely regarded as essen- l, it has for long been subjected to criticism. Many urge, ghtly or wrongly, that it is a relic of primitive mythology. here are those who believe that some world-events demand pernatural intervention in order that the direction they take ay be explained, whereas other world-events do not. Hence e must ask: which do and which do not? But many eminent nkers believe that the concept of supernatural intervention, re, there or elsewhere, as directive of the current course of rld-events, should be ruled out as invalid. The supernatural, ey urge, is omnipresent. If they be right, the antithesis be- een " some " events and " others " lapses. The question then is: Are all world-events not only natural but in some valid sense supernatural also? We are not here concerned with this philosophical question. But we must not prejudge the issue. Hence we must be content to say: There are at any rate some events which occur in enchained sequence of which it may be affirmed that to all these events the concept of evolution in an unrestricted sense is applicable.

A further question then arises. Does every enchained sequence of natural events furnish an instance of evolutionary advance? Of course there is temporal sequence; and this may be called " advance in time." But this means only that in any sequence of phases, say *l*, *m*, *n*, *l* precedes *m*, which is succeeded by *n*. It tells nothing of the character of the group of events *l*, *m* or *n*. If there be evolution some change of character is implied. Now it was one of Herbert Spencer's noteworthy contributions to the discussion of enchained natural sequence that he sought to distinguish groups of events or states of affairs as in some sense " lower " and " higher." Progress is from lower to higher; regress is from higher to lower. Evolution is always progressive. Regressive change is not evolution but " dissolution."

The difficulty still remains how to characterise in some way " higher " and " lower." It may be that at present we can best deal with the question departmentally and say that *n* is higher (or lower) than *m*, as an organism, as a mind, as a social institution and so on. But to justify the concept of unrestricted evolution there must be some character or characters, which may be taken as distinctive of all instances of what we are to call " higher." Perhaps there is as yet no common agreement as to the criteria on which reliance can be placed. It has, however, been suggested that complexity in the constituents of any *l*, *m* or *n*, and comprehensiveness in their plan of going together as an integral whole may serve to distinguish higher from lower in any context of natural events.

So far we have taken the sequence of events, say *l*, *m*, *n*, as susceptible of observation or inferable from observation duly recorded. Let us assume that *l*, *m* and *n*, are integral entities wherein certain natural events as constituents go together in substantial unity in accordance with some determinate plan, as in an atom, a molecule, a crystal, an organism. Then *m* may be (1) a stage in progressive evolution, or it may be (2) a stage in regressive " dissolution." Let *m* be an atom of lead. It is admittedly in being. We seem to have evidence of its becoming or natural origin, in isotope form, by regressive dissolution of the uranium or the thorium atom. But we have as yet no evidence of its origin through progressive evolution. If, however, *m* be a molecule, say of water, there may be evidence of its origin (1) in this instance by evolution or (2) in that instance by dissolution. And if *m* be an organism its status in being may have been reached either by evolutionary progress from an organism which was lower than it is, or by regressive dissolution (degradation) from one which was higher than it is. Here we take it for granted that *l*, *m* and *n* are affiliated organisms. It may then be said that, since there is no affiliation in atoms or molecules or crystals, the words evolution or " dissolution " (in the biological sense of regressive degradation) are inapplicable. Furthermore, in biology, adaptation means changing attunement to changing external conditions and of such progressive or regressive adaptation there is no evidence in the inorganic world.

We thus pass from the unrestricted usage to one that is restricted to that province of inquiry in which *l*, *m* or *n* are living organisms. And here yet a further restriction is customary—namely, to that which is otherwise spoken of as the " doctrine of descent," where *l*, *m* and *n* are affiliated organisms, reserving the word " development " for the branch of inquiry which deals with *l*, *m* and *n* as stages in the life-history of the individual. The question then arises: In what way is the story of the individual development (ontogeny) connected with the story of racial or linear evolution (phylogeny)?

Now it is part of the business of the biologist to describe (1) the intrinsic nature of this or that organism, and (2) its extrinsic relations to the world in which it lives—its environment. In order that it may continue in being (survive) there must be adaptation to surrounding circumstances. The evidence of such adaptation must primarily be sought in the story of development in the course of individual life. But the story of l, of m and of n, as affiliated individuals, may have much in common in respect of their intrinsic nature and of their adaptation to environing conditions. In any evolutionary hypothesis, that which is common to the affiliated organisms l, m and n, is discussed under heredity (*see* HEREDITY). Apart from a doctrine of heredity there can be no doctrine of descent. And this applies to the intrinsic nature of the individuals, and to the adaptation of these individuals to their environment.

Such in brief—apart from contributory matters—is the concept of evolution in a restricted sense. It needs emphasis, however, that under intrinsic nature and adaptation there are commonly included such mental characters as may be attributed to the organism on presumptive evidence. This provides for mental evolution on a doctrine of descent.

We may now ask on what grounds one usage or the other is accepted. They may broadly be distinguished as practical and speculative. There seems to be a hierarchy of modes of being. And this hierarchy may be reducible to the three modes of being, physico-chemical, vital and mental. The unrestricted theory is that these three exemplify the evolutionary sequence l, m and n and are interpretable as successive stages of world-progress in one order of nature. The vital m has certain distinctive characters, such as hereditary adaptation, which are absent in l; the mental n has characters which are absent in m—let us say endeavour to reach a foreseen end. The presence of n implies that the stage m has already been reached; the presence of m implies that the stage l has already been reached. It does not necessarily follow that m can be interpreted in terms of l, or that n can be interpreted in terms of m. Nay rather it seems, on the evidence, that in passing from l to m, and from m to n, there is something really new. For this the word "emergent" has been suggested. Emergence labels the concept which may thus be expressed: When certain constituents with distinctive characterising properties go together in accordance with some determinate plan so as to form an integral whole, the properties of that whole are not the algebraical sum of the properties of the constituents as they exist (*a*) independently or (*b*) within some other and different whole. There are *new* properties which are said to be emergent.

Whether there be in nature instances of emergence in this sense is a matter of evidence. If so they may be found only in l—in the physico-chemical realm, or they may be found also in m and in n. Wherever they be found, we must loyally accept this finding, which implies that in these cases—not necessarily in all cases—evolutionary advance is by emergent steps with continuity of direction towards higher modes of being. Acceptance of some such evolutionary scheme for the interpretation of life and mind is admittedly on speculative grounds.

On practical grounds botanists and zoologists of the older school may say: We keep to known facts and work within our province. Of an enchained series of steps from the not-living to the living there is at present no evidence which carries conviction. We start, therefore, with organisms in being. We adduce evidence in favour of evolution, by which we mean a doctrine of descent. We adduce evidence from which we infer that, accompanying certain organic events, the physiological nature of which we seek to characterise, there is in some organisms, but not in all, and even in man in some but not all of his behaviour, conscious guidance which contributes to fuller life and to nicer and more delicate adaptation. This "mind" we accept where the evidence justifies its acceptance, just as we "accept" life on the evidence. We find it in being at a describable stage of individual development. It is then a factor in further development and on this wise, under heredity, a factor in organic evolution. It is not within our province to ask: Whence does life arise? or Whence does mind arise? When once they are in being (through what mode of becoming, sudden or gradual, is unknown) we trace their evolution under our doctrine of descent. We submit that all this is based on sound scientific method.

Let us grant that it is based on sound biological method, and that the botanist or zoologist is wise to keep within his own province. But there are border-land sub-provinces in which other specialists are busily at work, and the interconnection of provinces (physico-chemical, organic and mental) is itself worthy of serious discussion. We must set no barriers to scientific inquiry.

Unrestricted evolution is unquestionably speculative in the sense that it is a hypothesis to be accepted or rejected on evidential grounds. It includes in its purview the origin of living beings and the origin of conscious endeavour to attain foreseen ends. Under restricted evolution biologists of the older school exclude these questions of origin (that of life and of mind) either (1) as beyond the scope of their special inquiry, or (2) as one with which science has no concern. But in either case they commonly urge that conscious endeavour as distinctive of mind, comes into effective existence quite late in the developmental history of the individual and quite late in evolution under their doctrine of descent. And when it does come, so as to be a new factor in adaptation to environing circumstances, they commonly accept as an unexplained fact that it in some way "accompanies" certain highly differentiated physiological events the story of which falls within their province.

There is, however, a newer school of biologists, and among them the logically consistent extremists say: not late in the course of development or of evolution does mind appear, but at the very outset of life, which from first to last is but the organic expression of mind as endeavour to accomplish its ends in development and evolution. For them evolution assumes a radically different meaning. It is still restricted to the realm or order of life and mind as definitely contrasted with the utterly diverse order of matter and energy. Here only is endeavour in being, but here always. Even in the plant, even in the fertilised ovum, even in processes of cell-division, that endeavour which is distinctive of mind, and which is absent in the inorganic realm, intervenes as directive of the course of events. The word "supernatural" may not be used, but sufficient emphasis can be laid on the analogous concept—"wholly other than naturalistic or deterministic."

Endeavour belongs to a disparate order of being, that of the mind which animates the organism and uses the material provided by nature as a means to the accomplishment of its ends. However stereotyped the development of oak from acorn may be, it is none the less the expression of life which is one with mind and is utterly different from the forces concerned in any mechanical occurrence. It betokens a persistent and consistent aim directed to, and directive of the fulfilment of "oakly" being. It is this that is spoken of as endeavour; this that demands a concept which is inapplicable to atoms or molecules or crystals or the solar system. Such a form of restricted evolution is a speculative hypothesis to be accepted or rejected on evidential grounds. What is the evidence in support of the cardinal concept? That is the crucial question which must here be left *sub judice*.

In view of the rival claims of this special form of restricted evolution on the one hand, and of unrestricted evolution on the other hand, controversy, often embittered, arises, and there is talk of "obsession" by this or that "dogma." The issue is at the bottom the place and the status of mind in its relation to matter.

Dr. Broad has recently discussed no less than seventeen logically possible solutions of this vexed problem under certain definitions. They lie beyond our purview here. Much has been written—much remains to be written—on evolution. The careful reader should ask: Which of at least three different usages of the word is implied in this or that statement, in this context or that?

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(C. Ll. M.)

EXAMINATIONS (*see* 10.41; also INTELLIGENCE, HUMAN).—As far as Great Britain is concerned progress since 1911 has been made in three directions:—

(1) It is suggested that the following criteria applicable to physical tests should be applied as far as possible to examination tests:

(*a*) The test of a given characteristic should demonstrably yield a suitable measure of that characteristic; (*b*) in cases where the whole material under investigation cannot be tested, it should be shown that the sample tested is an average sample of the whole; (*c*) the test should be trustworthy, *i.e.*, when repeated a number of times by the same observer, or when repeated by different observers, it should yield approximately the same results; (*d*) the application of the test should not sensibly affect the characteristic tested, or injuriously affect the material as a whole; (*e*) the characteristic tested should be demonstrably of a permanent or semi-permanent nature.[1]

(2) The British Govt. has taken action with a view to the improvement of the most difficult civil service examinations in the country and of secondary school examinations. The report of the Treasury Committee on Civil Service, Class I. Examinations (1917), has led to important reforms in that examination, of which the chief are the introduction of a viva-voce examination and the modification of the examination in "English" so as to make it a real "capacity-test" of "the understanding of English and the workmanlike use of words." The test in this subject has now a definite purpose and is designed to meet that purpose; and the whole tendency of the examinations in other subjects is also to test capacity rather than mere memory.

The Secondary Schools Examination Council set up by the Board of Education in 1917 is making, with the help of expert investigators in each subject, periodical investigations of examinations and scripts with a view to correlating the standards of public examinations at the ages of 16 and 18 (approximately), conducted by universities and other public bodies, while avoiding the introduction of an educational dead-level which would block progress. This "continuous audit" of examinations is valuable, and probably the first of its kind. In regard to one point there has been no visible advance—the statistical investigation of the marking by different examiners, in which Edgeworth's important researches remain almost isolated. Starch and Elliott, in 1913, showed that the marks allotted independently to a single script by 115 mathematical teachers varied from 28 to 92, confirming Edgeworth's results.[2] Further investigation of this point is essential. In regard to "interview" and viva-voce examinations, there appears to be far greater uniformity of valuation.[3]

(3) The development of intelligence tests has introduced a new element into examinations. In the marking (or "scoring") of these tests, differences between different examiners are eliminated: the tests are "trustworthy" as defined under (1) above. Ballard (*loc. cit.*) points out that most ordinary examinations are incidentally tests of English composition, which is difficult to mark; whereas in "intelligence" tests writing is reduced to a minimum, the answer being often given by a mark or a number instead of by words. But much of the old difficulty remains as to the precise significance of the examination results in their bearing on the purpose of the examination. The fact remains hat in the emergency of the War the "group-tests," which are apid, were successfully applied in 1917-8 in the United States of America to nearly 2,000,000 men with the object of separating hem into various classes for military employment or registering hem as unemployable (*see* JOB ANALYSIS).[4] Ballard, who has xtended the new methods to such school subjects as history and eography, claims that there is a high degree of correlation etween the results and the estimates of teachers based on long experience. The Consultative Committee of the English Board of Education in their important *Report on Psychological Tests of Educable Capacity*, etc. (1924), state that

> "though in the present state of development of 'intelligence' tests it is hardly possible to explain simply what is measured or tested by them, it is tolerably well established that these tests . . . have shown themselves capable of giving a useful common measurement of what teachers generally call capacity or intelligence."

The committee think the new tests will probably exert an important influence on examinations of the ordinary type, and recommend especially that further research should be instituted into the use of individual "intelligence" tests in connection with oral examinations for all ages or types.

Although progress has been made, there is still much room for the improvement of examinations, it being especially necessary to define the exact purpose of each examination, and to ascertain by investigation how far it fulfils that purpose.

BIBLIOGRAPHY.—In addition to sources quoted, *Circular 996* of May 25 1917, of the *Board of Education*, London, re the Secondary Schools Examination Council; Publications of that Council; chapters on "Examinations" in the *Calcutta University Commission Report*, vol. 2, chap. 18; vol. 5, chap. 40; vol. 7, App. 18 (1919).

(P. J. H.)

THE UNITED STATES

Examinations in subject matter in school and college have been undergoing a very radical change during the period 1910-26. This change may be characterized as a turning away from the old-type question, which asked the candidate to "describe," "state" or "explain" in essay form a certain topic, to the new-type question, which calls for a specific response to an item, this response being made by underlining, checking or writing a word or at most a phrase. In an old-type examination[5] the candidate might be asked to write an essay in answer to the question, "Describe the secretion of gastric juice." In the new-type examination his knowledge about gastric juice would be tested by his responses to many short items. Such items may take several forms, as will be illustrated by items from different subjects:—

Analogy: Gastric juice is to the stomach as (saliva, adrenin, *tears*, bile) is to the lachrymal glands.

Completion: The part of a circle included between two—and an —is called a sector.

Recognition: Planets move around the sun in orbits that are circular, *elliptical*, hyperbolic, cylindrical.

True-False: T. F. The chief crop in Ohio is tobacco.

There are many different varieties and combinations of such forms, and those quoted above must be considered only as samples.

The reasons for this change from old- to new-type examinations may be ascribed to the unreliability of the old-type and the development of the new-type item in intelligence testing. The old-type question is difficult to score accurately and it fails to cover the whole field of the subject examined. The development of group intelligence tests led the way to a study of the technique of constructing the questions, arranging them in sub-tests and in standardising the whole test. The methods of scoring were also developed through the group intelligence test. The construction of an examination in a school subject for nation-wide use (generally called a standardised educational test) is now quite a technical matter.[6] There are such standardised subject-matter examinations or tests for practically every subject taught in the elementary and high schools of the country.

In addition to these standardised tests made by experts, teachers are everywhere using the new-type examinations in their class room work. Wood[7] describes such examinations at the university level and Russell[8] shows in detail how school teachers can construct such examinations in all subjects in the elementary school. He goes further and suggests how they may be used as effective teaching devices. None of these authorities advises the absolute abandonment of the old-type essay examination, but all of them believe it to be insufficient for the accurate examination of the pupil. All of them emphasise the necessity for a careful construction of the new-type examination, and they maintain that it can be made to measure the pupil's ability to reason. They deny that it merely tests the memory of the pupil.

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[1] P. J. Hartog, *Examinations and Their Relation to Culture and Efficiency* (1918).

[2] See P. B. Ballard, *The New Examiner*, p. 182 (1924).

[3] *Cf.* Sir Stanley Leathes on "The Qualifications . . . of Pubc Servants," *Jour. of Public Administration*, I, p. 356 (1923).

[4] C. S. Yoakum and R. M. Yerkes, *Mental Tests in the American Army* (1920).

[5] Examples taken from D. G. Paterson, *Preparation and Use of New-Type Examinations*, Yonkers, 1925.

[6] W. A. McCall, *How to Measure in Education* (New York, 1922).

[7] B. D. Wood, *Measurement in Higher Education* (Yonkers, 1923).

[8] C. Russell, *Classroom Tests* (Boston, 1926).

These new type examinations are now being used by such examining bodies as the College Entrance Examination Board and the Board of Examiners of the New York City Board of Education, and by many civil service commissions, both state and municipal. In *Public Personnel Studies*, a journal issued by the Bureau of Public Personnel Administration, Institute for Government Research at Washington, suggested examinations for a great many civil service positions have been published. Almost all of these examinations are of the new type. (R. Pi.)

EXCESS PROFITS DUTY.—This describes a tax on the excess of the actual profit of an accounting period over a standard of profit.

I. IN THE UNITED KINGDOM

Immediately after the outbreak of War in 1914 it was apparent, from the movement of the monthly index numbers of the wholesale prices of commodities, that profits of businesses, especially of those concerns whose products would immediately be in increased demand, would move upwards at a rate even greater than that shown by the index number. For instance, the Sauerbeck-Statist index number for July 1914 was 82·4, by Dec. it was 91·6 and in July 1915 it had reached 106·4, or an increase of over 25% in 12 months. When the results shown by accounts of trading concerns embracing part of the War period became available to the authorities, the figures which emerged more than confirmed this anticipation, and so the excess profits duty was born. It was imposed by Part 3 of the Finance (No. 2) Act 1915, which passed into law on Dec. 23 of that year.

Scope of the Duty.—The excess profits duty was a duty, where a chargeable amount of profit existed, on the profit of trades and businesses carried on in the United Kingdom, or owned or carried on in any other place by persons ordinarily resident in the United Kingdom. The duty did not extend to the profit derived from husbandry in the United Kingdom, or from the exercise of a profession or from offices or employments—though in certain cases the remuneration of directors and other persons concerned in the management of a business was indirectly made subject to the duty. The duty was imposed upon the profit of a business concern as an entity, and not by reference to the profit or income of individuals as such. A chargeable amount of profit was the excess of the actual profit of an accounting period over a standard of profit increased by certain free allowances. An accounting period was in general the period for which the accounts of the business are made up; it might cover any period not exceeding 12 months.

Both for the accounting period and for purposes of the standard, profit was determined, subject to the modifications set out in the statutes, on the same principles which determined profits under the Income Tax Acts. It was limited to the profit inuring to the proprietors of the business, exclusive (with certain exceptions) of interest received on investments. Interest paid upon loans and other charges upon the business was therefore deducted in arriving at profit.

Standard of Profit.—The standard of profit was represented in the normal case of a business which had been carried on for some years prior to the outbreak of War by either: (*a*) a profits standard, or (*b*) a percentage standard. A profits standard was normally the average profit of any two of the three years to the end of the last accounting period ended before the outbreak of War. In exceptional cases the profit of a different period of pre-War trading was adopted. A percentage standard was normally a statutory percentage (in the case of companies 6% and in other cases 7% for accounting periods ended on or before Dec. 31 1916, and 8% thereafter) on the amount of capital employed in the business at the end of the last accounting period ended before the outbreak of War. Provision was made for the increase of these percentages in the case of classes of trade or business which proved that the capital employed in the class of trade or business was subject to special circumstances (*e.g.*, special risk, etc.). Applications for any such increase of the statutory percentage was dealt with by a board of referees appointed for the purpose by the Treasury. A large number of such applications was made to that board, embracing many trading activities carried on abroad by British concerns, *e.g.*, mining, teaplanting, etc., and numerous awards were issued by the board increasing the statutory percentage.

Since the scheme of the duty involved a comparison of the profit of the accounting period with the standard of profit (the excess of the former over the standard being the amount on which the duty was charged), it was necessary that the basis of computation should be similar and comparable in both cases. Provision was therefore made for a reduction or increase of the profit of the accounting period, by reference to a statutory percentage upon the additional or reduced amount of capital employed in the accounting period as compared with the capital employed during the period or at the date to which the standard related. The statutory percentage here referred to was for cases where there was a decrease in the amount of capital employed, 6% in the case of companies and 7% in the case of other persons since the imposition of the duty. Where there had been an increase in the amount of capital the statutory percentage was at different times: in the case of companies, 6, 9 and 11%; in the case of other persons, 7, 11 and 13%.

Capital as computed for the purpose of the duty represented the proprietors' trading capital, and borrowed money was, therefore, excluded from the computation of capital. In general, capital of a business consisted of money; assets acquired by purchase at the price paid, subject to any deductions for wear and tear or replacement; debts due to the business and assets not acquired by purchase taken at their value when they became assets of the business. Accumulated profits employed in the business were treated as capital; any capital (the income of which was not taken into account in computing profits for the purposes of duty) and any borrowed money or debts were to be deducted in computing the capital. Assets paid for otherwise than in cash were to be taken at the value of the consideration when the asset was acquired, but if the business had been converted into a company so that the shares therein were held by the late owner, no value was to be attached to those shares so far as they were represented by good-will or otherwise than by material assets. For this purpose patents and secret processes were deemed material assets. The free allowance was in general £200 for an accounting period of a year. In certain cases of ex-soldier, etc., proprietors of businesses it was £500.

Relief under the Original Act.—Special provisions affording relief from the full weight of the duty were introduced as from Jan. 1 1917 in the case of small businesses. The relief was given either by reference to the deficiency of the profit of the accounting period below a prescribed sum (at first a sum of £2,000 for an accounting period of a year and subsequently £4,000), or by reference (as from Jan. 1 1920) to a substituted standard dependent upon the number of working proprietors and the capital employed during the period or at the date to which the original standard related.

A special and novel feature of the duty was found in a provision under which in the normal case a percentage—equal to the percentage rate of duty in force for the period concerned—of any deficiency of profit of a business below the standard in any accounting period was set off against the amount of duty applicable to an excess of profit over the standard in another period.

Special provisions were included in the statutes as regards businesses where there had been only two pre-War years or only one or part of one pre-War year, or where the business had been commenced since the outbreak of the War; as regards depreciation and obsolescence of assets, unremunerative capital, remuneration of directors, etc.; the businesses of local authorities, industrial and provident societies and of shipping; and other matters of detail.

In the case of an accounting period which commenced before and ended after any of the times stated, the excess profits were apportioned on a time basis between the relative parts of the accounting period and the apportioned parts of the profits were charged at the several appropriate rates of duty.

The duties imposed are shown in the following table:—

Rates of Duty on the amount by which the profits from any trade or business to which the law applied, in any accounting period which ended after Aug. 4 1914, exceeded by more than £200 the pre-War standard of profits

Excess profits arising:—	%
(*a*) Within a year from the commencement of the first accounting period[1]	50
(*b*) After the end of the period mentioned in (*a*) but before Jan. 1 1917[1]	60
(*c*) During the calendar years 1917 and 1918	80
(*d*) During the calendar year 1919	40
(*e*) On and after Jan. 1 1920, until Parliament otherwise determined	60

[1] In the case of trades or businesses commencing after Aug. 4 1914, the rate was 50%, if the accounting period ended on or before Aug. 4 1915, and 60% if it ended thereafter.

Munitions Levy.—For a time there existed side by side with the excess profits duty another duty known as munitions levy, or munitions Exchequer payments, which was imposed by the Muniions of War Act 1915. It applied only to certain concerns or parts of concerns engaged in the manufacture of munitions or War mateials which the Minister of Munitions "controlled" under the provisions of that Act.

The Act limited the profits of controlled establishments, as from he date of control, to a retainable amount, ascertained in accordance with the statute and rules made thereunder. Any excess of net profits of the establishment over such retainable amount was payable to the Exchequer in the form of munitions levy.

The retainable amount of profits was, broadly speaking, made up of:—

(*a*) The standard amount of profits,
(*b*) One-fifth of that standard,
(*c*) Special allowances for increased output or for increased apital, and
(*d*) Special allowances for exceptional services by the controlled wner or other exceptional circumstances.

Controlled establishments liable to the munitions levy were liable lso, like other trades and businesses, to the general excess-profits uty, but under Section 48 of the Finance Act 1916, it was provided n effect that the concern should be liable to pay for any period an mount equivalent to the higher of the two charges, but not both.

The operation of the munitions levy was terminated as from Dec. 31 1916 by the Finance Act 1917 (section 24). The ground for he repeal of the levy as from Dec. 31 1916, is to be found in the fact hat as from that date the rate of excess-profits duty was increased o 80%. At that rate the duty became, practically without excepion, the heavier charge, and the munitions levy would, if it had been ontinued, have been inoperative in its result.

Repeal of the Duty.—Excess-profits duty was abolished by the Finance Act 1921. As different businesses had become first subject o the duty at different dates, provision was made for them to cease o be liable to the duty at different dates in such a manner as to esult in every business which had commenced before the outbreak f War being subject to the duty for an aggregate period of seven ears and no longer. Businesses which had commenced after the outreak of War had their liability terminated at a fixed date of Dec. 31 920.

Refund of Relief.—It was a general principle that against the duty hargeable upon the excess profits of any accounting period there might be set off the duty applicable to any deficiency of profits susained in another accounting period. The various changes which ere enacted in the rate of duty made it possible for a taxpayer to be equired to pay an amount of duty in excess of his aggregate net xcess profits over the whole period for which the duty was in force. o obviate this anomalous result, provision was made that in such ases the excess should be remitted or repaid. In calculating the uty to be compared with the net aggregate excess profits, payments f munitions levy were to be counted as payments of excess-profits uty to the extent that duty would have been payable if munions levy had not existed.

Part of the productivity of the duty was due to the continuous rise f the price level, and as early as 1917 the trading community, nticipating that at some time this period of high prices might be ucceeded by a heavy fall in prices, urged upon the Government the ecessity of providing relief from excess-profits duty, in any cases in hich losses were incurred shortly after the duty came to an end, in onsequence of such a fall in value. Complex provisions to this end ere contained in the Finance Act 1921, granting three reliefs in onnection with trading stocks, two of which were alternative to ne another. A maximum period of four years from Aug. 31 1921, ithin which relief could operate, was allowed. During the four ears from 1921 to 1924, inclusive, £184,000,000 of excess-profits uty and munitions levy were repaid, and a large part of this epayment is to be ascribed to these reliefs. That the fears of ne trading community as respects the price level were justified, is nown by the movement of the Sauerbeck-Statist index number from s peak of 266·1 for April 1920 to 134·8 in April 1922.

The net amount of duty collected and retained in the Exchequer from the inception of the tax to March 31 1926 was £1,280,000,000. Even at that date a considerable volume of arrears was still outstanding, although the authorities anticipated that little more benefit to the Exchequer could be expected.

In order to expedite the clearing up of arrears, steps were taken in 1922 to charge simple interest at the rate of 4½% per annum without deduction for income tax on excess-profits duty outstanding as from the date at which the debt became payable, or, if it had become payable on or before Jan. 1 1922, as from that date.

In the earlier years of the debt the number of assessments made was about 50,000, but when prices were at their peak the number of concerns liable to the duty was round about 70,000.

Yield.—The approximate true excess profits arising in accounting periods classified in financial years were officially estimated to be as follows:—

Accounting Periods Ended in the Period or Year	Approximate True Excess Profits £
Aug. 5 1914 to March 31 1915	50,000,000
Year to March 31 1916	200,000,000
Year to March 31 1917	350,000,000
Year to March 31 1918	430,000,000
Year to March 31 1919	500,000,000
Year to March 31 1920	600,000,000[1]
Year to March 31 1921	200,000,000[1]

[1] Subject to revision in the light of assessments still being made for accounting periods ended in the year 1919–20, and 1920–1. The estimate for the latter year does not allow for the reduction in value of trading stocks arising after the end of the final accounting period under the relief provisions. (W. H. C.)

II. THE UNITED STATES

Although during the American Civil War the State of Georgia had adopted (1863) a tax on business profits in excess of 8% on the capital stock, at rates varying from 5% to 25% according to the amount of such excess profits, the first federal excess-profits tax was adopted in the Act of March 3 1917, for the purpose of creating a "special preparedness fund." After the United States entered the World War, this tax, at higher rates and in more complex form, was continued in the Acts of Oct. 3 1917, Feb. 24 1919 and Nov. 23 1921. In all these Acts, less use was made of pre-War profits as a base than in the British Acts. The American tax was aimed at "supernormal profits"—profits in excess of normal profits—rather than profits in excess of pre-War profits. The decision to subordinate pre-War profits was made deliberately by the framers of the law on the ground that a deduction based upon invested capital was simpler, better designed to serve as the basis of a permanent tax, and more equitable in that it prevented tax-payers from escaping the tax merely because they had been unusually prosperous before the World War. Under the American tax a business which had been unusually profitable before the War and merely maintained the former rate of profits during the War, was still subject to a heavy excess-profits tax. However, minor recognition of the War-profits idea was incorporated in the Act of Oct. 3 1917; and for the one year 1918 a dual or alternative tax was imposed, the taxpayer in effect paying an 80% War-profits tax or an excess-profits tax at progressive rates of 30% and 65%, whichever tax was larger. During the years 1919–21 only the excess profits tax was retained.

Provisions.—The 1917 law applied to all trades and businesses, including professions and occupations, but beginning with 1918 the tax was confined to corporations, excluding "personal-service corporations." The normal exemption or "excess-profits credit" consisted of a specific exemption of $3,000 plus 8% of the invested capital. Income in excess of this credit but not in excess of 20% of the invested capital was taxed (after the year 1918) at the rate of 20%, and the remaining income, if any, at the rate of 40%. The upper rate for the year 1917 rose to 60% and for 1918 to 65%. Under the Act of Oct. 3 1917 the specific exemption to individuals and partnerships was $6,000; but to corporations only, $3,000.

Yield.—Judged by the standard of productivity—the most important quality of a War tax—the excess-profits tax was conspicuously successful during the World War. The yield of the tax was as shown on following page.

The figures for 1918 represent possibly the largest annual amount ever produced in one country by a single tax. During the years 1917–9 the excess-profits tax produced more than 25% of the total ordinary receipts. But despite the high rates, the tax was collected without crippling industry, owing to the high level of profits and to the protective effect of the normal exemption, the relief provisions, and the large degree of administrative discretion authorised in the law.

Excess-Profits Tax Returned for Calendar Year

1917	Individuals, etc.	$101,249,781	
	Partnerships	103,887,984	
	Corporations	1,638,747,740	
	Total		$1,843,885,505
1918			2,505,565,939
1919			1,431,805,690
1920			988,726,351
1921			335,131,811

In accordance with the promises of both political parties, the tax was repealed, after stubborn opposition, as on Dec. 31 1921. The termination of the tax gave rise to no special problems such as arose in Great Britain, because under the American tax the liability of the taxpayer for any one year was not dependent in any important way upon his income for other years. The repeal of the tax was due mainly to the sharp decline in its productivity under peace conditions; its discrimination in favour of overcapitalised concerns and against conservatively financed corporations; the general belief that it was passed on, loaded with additions, to the general body of consumers; its capricious inequalities; and its great complexity. The complexity of the tax, which, in the words of one secretary of the Treasury, threatened to cause an administrative breakdown, is illustrated by the fact that the tax liability for the year 1917 of many of the large corporate consolidations had not been finally determined at the close of the year 1925.

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(T. S. A.)

EXCHANGES, FOREIGN (*see* 10.50).—The main reason why we pay anything for a foreign currency is of course that this currency represents in the foreign country a purchasing power which can be used for acquiring the goods or for paying for the services of that country. Thus, it is clear that the amount we can pay for the unit of the foreign currency must, broadly speaking, be in direct proportion to the internal purchasing power of that currency, *i.e.*, in inverse proportion to the country's general level of prices.

On the other hand, it is clear that we can afford to pay more in our own currency the more abundant this currency is, *i.e.*, the lower its internal purchasing power, and the higher the general level of home prices. This is easily seen if we reflect on the fact that the price paid for a foreign currency is ultimately a price for foreign commodities, a price which must stand in a certain relation to the prices of commodities on the home market. Thus we arrive at the conclusion that the rate of exchange between two currencies must depend essentially on the quotient of the internal purchasing powers of these currencies. Again, the internal purchasing power of a currency must essentially depend upon the supply of means of payment in that currency. By unlimited supply any price could be paid for goods and a currency could have no definite purchasing power. A certain restriction of the supply of means of payment is therefore necessary, and the scarcity of this supply determines the purchasing power of the currency. Thus the rate of exchange between two currencies is ultimately dependent upon the limitation of the supply of means of payment in both countries.

The fact that the rate of exchange is determined by the quotient of the purchasing powers of the currencies is most obvious in the case of independent paper standards, where no other basis can be found for the determination of the exchange. But the principle applies equally well to the exchange between gold standards. The essential reason why the pound sterling before the War was worth about 25 fr. in French currency was that the internal purchasing power of the pound was about 25 times as large as that of the French franc. It is true that the existence of a gold standard in both countries determines a certain gold parity. But it would be impossible to keep up the gold standard if the purchasing powers of the currencies were not maintained at a corresponding level and if the supply of means of payment in both countries were not regulated to that end.

If, however, we wish to apply our principle to exact calculations we are faced with the difficulty that the absolute purchasing power of a currency cannot strictly be compared with that of another currency. Of course, if all prices in the country B are 10 times as high as those in the country A, it is obvious that the purchasing power of the B currency is one tenth of that of the A currency. If some prices in B are somewhat more and some prices somewhat less than 10 times the corresponding prices in A, we may still say that the purchasing power of the B currency is, broadly speaking, one tenth of the A currency. But this formula will no longer be exact. Now this is precisely the case with which we always have to deal in making international comparisons. For an international exchange of goods can only exist if the constellation of relative prices in one country is different from that in the other country.

In the simple case of only two countries, A and B, exchanging goods with one another, their international trade will come to an equilibrium at a certain rate of exchange determined by the condition that there must be equality in value between A's imports from B and exports to B. This equilibrium rate is determined essentially by the internal purchasing powers of the two currencies and, in the second instance, by the constellation of relative prices in each country and by the conditions prevailing for the interchange of goods between them. Assuming the latter factors to be given, the equilibrium rate of exchange will be determined exclusively by the quotient of the internal purchasing powers of the currencies. If the internal purchasing power of one currency is doubled and that of the other remains constant, the value in exchange of the former currency will likewise be doubled. In order to emphasise this dominating influence of the internal purchasing power in fixing the equilibrium rate of exchange, we call this rate, as here defined, the purchasing power parity between the two currencies.

It is always possible to find such a rate of exchange as will establish equilibrium in the international trade. Thus a country can never be excluded from international trade by being handicapped with regard to costs of production. High prices will always be counteracted by a sufficiently low valuation of the country's currency, and the rate of exchange will always stabilise itself at a point where all disadvantages are counterbalanced and where, therefore, the country is able to export just as much as it imports. This observation is sufficient to show the usefulness of the purchasing power parity theory for a clear exposition of the theory of international trade.

The internal purchasing power of the two currencies contemplated determines only the equilibrium of the rate of exchange. The actual rate generally shows deviations from this equilibrium. When more is paid for a foreign currency than would correspond to its purchasing power parity, the currency is said to be over-valued. Again, when less is paid, the currency is under-valued. If a currency is over-valued, foreign currencies are under-valued in that currency. The result is that the export trade of the country is handicapped and that the import trade receives an artificial stimulus. In the case of an under-valued currency, the effect is of course the reverse.

After the outbreak of the World War, radical revolutions took place in the internal purchasing powers of all the currencies of the world. These revolutions were reflected in corresponding revolutions in the exchanges, which could naturally be explained only by a theory giving the internal purchasing power of the different currencies its due place as the fundamental factor in the formation of exchanges. In fact, the history of exchanges after 1914 affords the most complete illustration to the paramount rôle of the purchasing power parity in the determination of exchanges as well as to the deviations of actual exchanges from this equilibrium and the causes and effects of such deviations.

In order to finance the War, the belligerent countries had recourse to a creation of purchasing power by the aid of note-printing and book credits with central banks. Neutral countries soon followed suit, partly in order to finance extraordinary expenses in connection with the War, and partly in order to grant extensive credits to the belligerents. As nothing was produced to be set up against this extra purchasing power, the result was a rise in prices. At the higher level of prices a correspondingly greater supply of means of payment was required and was therefore retained by the public. The creation of fresh purchasing power, however, was continually repeated, and the result was a continual rise in prices and an equally continual increase in the amount of means of payment in use. These two quantities grew in proportion to one another, but the ultimate cause of this movement was the continual creation of fresh purchasing power. We call such a movement "inflation." Thus inflation is a rise in the general level of prices caused by creation of artificial purchasing power in the form of a superabundant supply of means of payment. A country may of course see its supply of commodities reduced and its general level of prices raised in consequence of such a scarcity of commodities. But if the supply of commodities is reduced, say to three-fourths—which means a very serious deprivation indeed—the corresponding rise in prices is only as 3 to 4, and this is not very much in comparison with the tremendous rise in prices which has taken place in so many countries since 1914. The essential cause of rising prices has, therefore, always been an inflation. Further, from a more rigorous point of view, we must say that a country which sees its supply of commodities diminishing, ought to reduce its supply of means of payment in the same proportion. If this is done, the scarcity of commodities can cause no general rise in prices and the price evel will remain intact. Therefore, strictly speaking, every rise in the general level of prices is a result of a too abundant supply of means of payment and may consequently be described as an "inflation" in a wider sense.

The most conspicuous case of inflation was that of Germany. The inflation in that country began on a small scale in the beginning of the War, and as it proceeded meant a continual deterioration of the German mark. This deterioration was, of ourse, according to the purchasing power parity theory, reflected in a corresponding fall of the German exchange in the nternational market. However, people in Germany were very eluctant to acknowledge that a real deterioration of their own urrency had taken place, and they resorted to all sorts of more popular explanations of the fall of the exchange. Particularly, t was held that the extraordinary difficulties of Germany's oreign trade were a sufficient explanation of the unfavourable development of the rate of exchange.

In this case, however, later events were to prove the complete ncapacity of the popular market-theory of exchanges to explain lterations in the exchanges brought about by a radical alteration f the internal value of the currency. German inflation, under he influence of the revolution and under the pressure of the reaty and particularly of the Ruhr occupation, surpassed all mits and ultimately brought down the value of the German mark to a millionth of a millionth of its pre-War value. This atastrophe opened the eyes of even the blindest, and people egan to realise both that the internal value of the mark had been eteriorated and that the external value as expressed in the xchanges essentially only reflected this internal deterioration.

What was truth in the case of Germany had gradually to be cknowledged as truth also with regard to other countries. In act, inflation has taken place in all countries, although not to uch a fantastic extent as in Germany. Generally people have een extremely unwilling to admit the existence of a deterioraon of their own currency. But statistical figures put the fact eyond all doubt. For most countries the maximum of inflation as reached in 1920, when such price index figures were atained as 366 for Sweden, 588 for France and 670 for Italy. In he United States the price level reached its highest point in May 1920 with 264 and in the same month the British price dex reached its maximum with 336. The two last figures are hose given by the Federal Reserve Board of the United States, hich calculates index numbers particularly for purposes of ternational comparison.

It is important to observe that inflation did not reach its aximum before 1920, whereas the War came to an end in Nov. 918. This shows that the enhancement of prices and the disturbances of the exchanges which took place during the War were not, as many people had believed, merely a result of the conditions of the War. Inflation went on as long as the false methods of finance and the unsound monetary policy originated during the War were continued. In most countries a deflation has since taken place and substantially lowered the general level of prices. Nevertheless, in all countries the general level of prices remains considerably above the pre-War level. This is so even where the pre-War gold standard has been restored, the price indexes of the United States and England being, for instance, for June 1925, 163 and 164 respectively. Thus value of gold in 1925 was only about 60% of the pre-War value.

What, now, has been the effect on the exchanges of all these revolutions of the internal values of the currencies? We may calculate the new equilibrium of the exchange between two currencies, if we start from their pre-War purchasing power parity and multiply it by the quotient of the degrees of inflation of both currencies. We thus arrive at a new purchasing power parity which represents the new equilibrium of the exchange. If, *e.g.*, inflation has brought the general level of prices in A up to six times the pre-War height, but in B only to four times that height, the new purchasing power parity between the A currency and the B currency will be two-thirds of the pre-War purchasing power parity, and therefore the equilibrium rate of exchange of the A currency as expressed in the B currency will be two-thirds of the normal rate of pre-War time. Strictly speaking, this new equilibrium can be expected to establish itself only when normal conditions of international commerce similar to those which existed before the War have been restored. However, experience seems to show that this requirement is in most cases already beginning to be fulfilled in a measure sufficient to make the application of the principle here enunciated possible, at least in a broad sense.

The calculation is most reliable in the case of England and the United States. In May 1920, when, as mentioned above, the price level of these countries reached their maximum with 336 and 264 respectively, the purchasing power parity between them could be calculated by multiplying the pre-War parity, $4.87 for £1 with the quotient of 264 and 336. We thus arrive at the result that in May 1920 the purchasing power parity of the pound sterling was $3.83. The mean actual rate of exchange for the month was almost exactly the same ($3.85). Consequently, at that time the depression of the Sterling-Dollar exchange was exclusively a result of alterations in the internal purchasing power of the currencies concerned. In June 1925, when the price indexes of both countries were practically equal, the exchange had also returned to practically the pre-War par.

Of course the actual exchanges do not always so closely coincide with the purchasing power parities. In the present case a particularly noteworthy deviation was caused during the War by the so-called "pegging" of the Sterling-Dollar exchange. This meant that the pound sterling was by a deliberate policy kept very nearly to its pre-War par, namely, at the constant value of about $4.76, and this result was obtained during a period when inflation in England had gone so much further than in the United States that the purchasing power parity of the pound was considerably lower. The possibility of stabilising an exchange at such an artificial height is explained by the fact that not only were the immense financial resources of the United States placed at disposal for the purpose in the form of almost unlimited credits to the British Govt. but also private trade between the countries was severely restricted. After the Armistice, it was soon found impossible to continue such a policy and the exchange was "unpegged" in March 1919, with the result that there was a considerable fall in the rate which for April 1919 showed a mean figure of $4.66. Since that time, the actual exchange has oscillated round the purchasing power parity. The deviations have seldom exceeded 10% and have usually been much smaller; for the whole period after March 1919 the mean deviation of the actual exchange from the purchasing power parity has been almost nil.

A closer study of the deviations, however, is of considerable interest. It reveals the fact that the main cause of such deviations has been the movement of capital between the countries. When dollar credits have been granted on a large scale and when the rate of interest in New York has been lower than that in London, this has created an abundance of dollars in England, which has exerted some pressure on the value of the dollar in terms of sterling. At such periods we can observe a clear under-valuation of the dollar. Again, in periods when America has restricted its credit-giving to Europe and when a comparatively high rate of interest has prevailed in the United States, a certain scarcity of dollars has made itself felt in Europe, resulting in an over-valuation of the dollar. After the Dawes Scheme for the reorganisation of the German currency and for the payment of reparations had been finally adopted and the Dawes loan had been floated in the autumn of 1924, America displayed her restored confidence in Europe by a very considerably increased grant of credits, resulting in an under-valuation of the dollar, which lasted for the first four months of 1925.

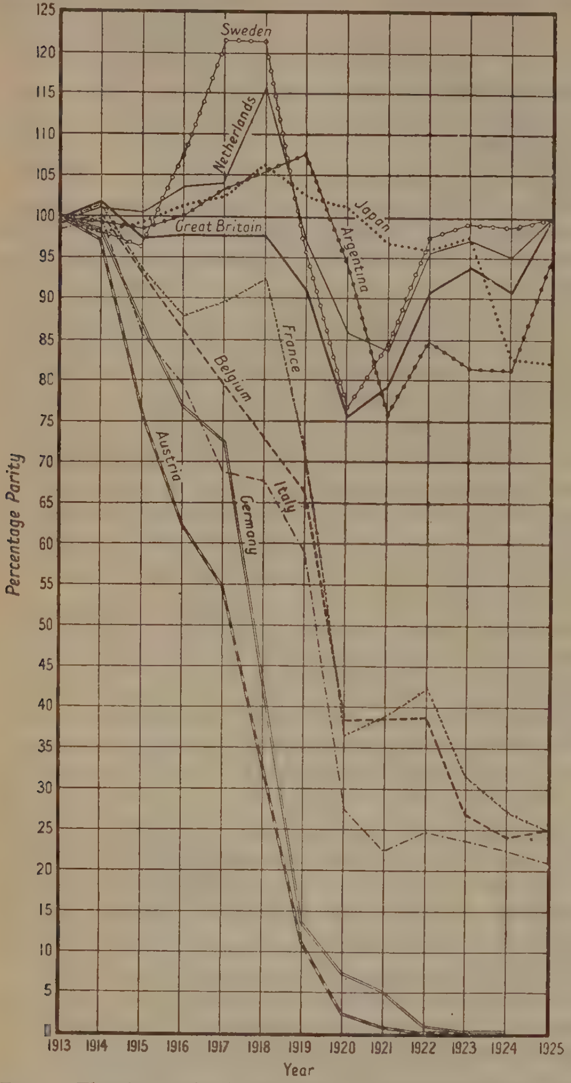

FIG. 1. The changes in the rates of exchange of the currencies of certain selected countries from 1913 to 1925, as compared with the dollar, are here shown as percentages above or below parity. The rate for each year is the daily average of cable transfer rates in New York: the rate in 1925 is therefore the average for the year, not the rate on December 31 1925. No figures are available for Belgium from 1914 to 1918 owing to the occupation of the country by the Germans: the average rate for 1914 is therefore linked up with that for 1919 by a straight line in order to make a continuous graph. Figures are not available for Germany and Austria for 1918, and the rates for 1917 and 1919 are similarly linked up. The most striking features are the appreciation of the currencies of Sweden, the Netherlands and Argentina during the war period, and the startling collapse of the Austrian and German currencies after the War. The rates for these two countries during 1925 are not shown, as new currencies, which remained practically at par during the year, were introduced. The chart is based on figures in "The Review of Economic Statistics" (Statistical Record 1924 Supplement) of the Harvard Economic Service, and in the United States Department of Commerce Survey of Current Statistics (Semiannual number, Feb. 1926).

This under-valuation, which may also be regarded as an over-valuation of the pound sterling in terms of dollars, was strengthened by the expectation of an early restoration of the gold standard in England, which of course would mean the raising of the pound to the old parity with the dollar. In fact, this restoration of the gold standard was carried through on April 29 1925, when the large gold resources of the Bank of England and huge dollar credits in the United States were placed at disposal for stabilising the Sterling-Dollar exchange in the neighbourhood of the old parity, $4.87. When this was done, however, the English currency was not yet in full parity with gold in regard to internal purchasing power. The dollar exchange, therefore, meant an over-valuation of the pound. Naturally, the gold standard could not be founded on such an over-valuation, but had to be built on the more solid basis of a raising of the internal purchasing power of the pound to the official parity with the dollar. This meant that prices in England had to be forced down by 4 or 5%. This was in fact what was done. During a time when the American price level stood nearly constant at 163, the English price level was brought down from 171 in April to 166 in May, and to 164 in June. Thus the internal purchasing power of the English currency had practically been brought to a level with that of the dollar.

In this case it seems clear enough that the artificial raising of the external value of the pound, which was accomplished by the restoration of the gold standard, has to some extent drawn the internal value of the pound with it. Clearly, the artificial depression of the exchange value of the dollar cheapened imports and had some depressing influence on the prices of British exports, and in both these ways helped to bring down the general level of prices in England. Such a process, however, is of an extraordinary nature, and is only possible when vast resources are at disposal for raising the currency's external value which is normally determined by the internal purchasing power. In the long run, an increase of this purchasing power is possible only when supported by a suitable restriction of the supply of means of payment. As a preliminary measure for the restoration of the gold standard, the Bank of England in fact raised its rate from 4 to 5% on March 5 1925. The effect showed itself immediately. The British price level, which had been rising from Sept. 1924 and which had attained a maximum of 178 for Jan. and Feb. 1925, was in March pressed down to 175, and, as has already been mentioned, right down to 164 for July. How far this fall in prices is to be ascribed to the raising of the international value of the pound and how far to the pressure of the higher rate of discount, it is hardly possible exactly to decide.

The artificial over-valuation of the pound, which was a result of the restoration of the gold standard in April, meant of course a handicap to British producers who had to face foreign competition without being able immediately to reduce their sterling costs of production in proportion to the increase in the international value of the pound. Some authors laid great stress on this disadvantage, and on that account not only opposed the restoration of the gold standard, but also, after the reform had been carried out, made it responsible for the prevailing unemployment and other economic difficulties. This argument was doubtless much exaggerated. The over-valuation of the pound caused by the restoration of the gold standard was, as our figures show, not very considerable, and, at any rate, as it disappeared as early as in July, it cannot reasonably be made responsible for more permanent economic difficulties.

In cases of continued inflation the deviations of exchanges from their purchasing power parities have been much greater. When, *e.g.*, the internal purchasing power of the German currency, in consequence of continued inflation, showed a regular fall, month after month, this fall was discounted on the international market, which generally paid a price considerably below the purchasing power parity of the German currency, but still a price corresponding to the internal purchasing power which that currency was to possess some months later. This under-valuation of the German currency made it possible for foreigners to buy goods in Germany at an unreasonably low price, or, what is the same, for German producers to sell their goods on foreign markets at prices ruinous for their foreign competitors. Both consequences called forth counteracting measures.

In Germany exports were prohibited except under licence, and every endeavour was made to force foreigners to pay more for German goods than the Germans did themselves. Of course, such measures diminished the value of the German mark for foreigners and the under-valuation grew still worse. In other countries the cheap German exports were regarded as a form of "dumping," and efforts were made to safeguard industries against competition from countries having a depreciated currency. Such measures, again, tended further to accentuate the under-valuation of the German currency, as its employment for the import of German goods was made more difficult. Thus, again, German competition was strengthened. It should also be observed that the exports of a country are artificially stimulated only by the under-valuation of its currency. The mere fact that the currency is depreciated gives no advantage to the exporter, provided the exchange value of the currency corresponds to its internal purchasing power.

A considerable over-valuation of a currency has sometimes taken place when it has been believed that the internal value of the currency was to be raised from a depreciated level to a pre-War gold parity. This was particularly the case with the Danish and Norwegian currencies during the second half of 1925. The over-valuation which in these cases has been supported by a strong international speculation has of course been a great drawback to the export trade of the countries concerned, and has also contributed to a general fall in prices within those countries and to a consequent serious economic depression.

The only way out of all these difficulties is, of course, to stabilise the internal values of the currencies and to bring back such normal conditions as will make exchanges correspond to these internal values. After the violent disturbances of its monetary systems which the world had witnessed the only practical possibility of attaining general stabilisation of currencies and a corresponding stability of exchanges was without doubt a return to the gold standard. Currencies which were very near to their pre-War gold parity could be restored to that parity, but for other currencies a new lower gold par had to be chosen, in conformity with the already existent purchasing power parity. A series of currencies have already been stabilised on this principle, and it seems certain that other countries which have hitherto been hesitating with regard to the ultimate aim of their monetary policy will soon come to a decision in favour of a similar stabilisation.

The adoption of the gold standard has the effect of compelling the purchasing power of the currency to be kept in a definite relation to that of gold and, therefore, the purchasing power parity between two gold standard currencies will always remain in the neighbourhood of the gold par. Still, smaller deviations of exchanges from the purchasing power parities are possible on account of fluctuations in the market. Such deviations, however, will always call forth an adjustment in the demand and supply of the currencies concerned, tending to restore the equilibrium of the market. The main factor in this adjustment is the movement of capital, which is made profitable by the abnormal rate of exchange. Of course, an over-valuation of the currency of a country also calls forth an increase in the imports to that country and hampers its exports. But these movements are much slower than the corresponding movements of securities and the transfers of short-term credits, and are, therefore, under normal conditions, of only secondary importance for the adjustment of the exchanges to their purchasing power parities. *See* also CURRENCY.

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EXHIBITION (*see* 10.67).—Following on the great exhibition of London, under the influence of Ruskin and Morris, the first tendencies towards the emancipation of decorative art made themselves evident. The movement took root in France, and led in 1863 to the creation of the Union Centrale des Arts Décoratifs, which was in time to achieve the formation, modelled on the South Kensington Museum, of the Musée des Arts Décoratifs. In the end the decorative artists won the right of citation in the artistic salons, in 1892 and 1895. They participated in the two great exhibitions of 1889 and 1900. In ceramics, in jewellery, in metal working, the creations of a Chapelet, a Lalique, a Brateau, and a Gallé met with the highest esteem.

The manufacture of furniture, characterised by the description "modern style," stirred the lively hostility of the public. This modern style was in its way a protest against the copying of the antique, and marked the break with all the secular traditions which had been the glory of furniture; and it created a fashion in reaction and in contrast rather than a style truly representative of contemporary life. Opposed by lovers of the antique, treated as suspect by the mass of the public, its vogue was brief.

The effort pursued since 1900 rests on a more solid basis and on more durable ideas. It strives to associate in one common work both the artist, the creator of models, and the commercial firm, the former contributing his original conception, the latter his capital, equipment and clientèle. This alliance, which was achieved in Germany by the foundation of the Werkbund in 1907, required more laborious efforts for its realisation in France. It is in a way the charter of modern decorative art. It was the guiding principle of the Paris exhibition of 1925.

The exhibitions which took place after 1900 in different capitals reserved space, restricted, no doubt, but still very significant, for modern decorators. They had their salon at Turin in 1902, at St. Louis in 1904, at Liége in 1905, at Milan in 1906, London in 1908, at Copenhagen in 1909, at Brussels in 1910, and at Turin in 1911, where the Union Centrale des Arts Décoratifs showed in its pavilion all the advances made up to then.

Important Exhibitions.—The Turin exhibition was to have been the overture of the Exposition des Arts Décoratifs Modernes. But the War delayed its realisation for 10 years. Various exhibitions in the interval called attention to the advances made in certain special branches. The Anglo-Latin exhibition in London in 1912 gave hospitality notably to France, Italy and the South American republics. The Ghent exhibition of 1913 renewed and surpassed the results already achieved at Liége and Brussels. Three groups were devoted to Letters, to Science and to Art, in a vast palace which covered an area of 20,000 sq. mètres. The urban exhibition at Lyon in 1914 covered the vast and complex problems which, in our day, are raised by the systematic expansion, and the life itself, of urban agglomerations: vital statistics, protection of childhood, home and school hygiene, organisation of labour, water supply, thoroughfares, transport and town amenities. All these aspects of life were set out, along a great avenue lined with 60 pavilions. Leipzig, in the same year, offered an exhibition of the advances made in the graphic arts and the book industry. In 1915, in the midst of war-time activities, France, Belgium and Italy accepted the invitation of the United States, which was then organising an exhibition at San Francisco to celebrate the opening of the Panama Canal. The French pavilion there reproduced the Palace of the Legion of Honour.

Post War Exhibitions.—The return of peace allowed the revival of regular exhibitions, national and international. Among the first may be mentioned the exhibition at Strasbourg in 1919, intended to re-establish the necessary contact between France and the restored provinces. In 1922, an international exhibition in celebration of the centenary of Brazilian independence was held at Rio de Janeiro. Two great Colonial exhibitions, French and British, took place in 1922 and 1924 respectively. The Marseilles exhibition made a survey of French colonial expansion. From 1870, onward it drew up, as it were, an economic inventory of France's overseas Empire. It paid tribute to the colonising methods of France, and to the attachment of the native races, who, in the course of the War, had sacrificed their lives in the common cause. The exhibition held at Wembley in 1924, and revived in 1925, was evidence of the vast extent and the great resources of the British Empire in all regions of the globe. In 1923 Italy inaugurated at the Monza Palace, the Versailles of Milan, an exhibition devoted to the art of housing. Made a biennial function, it was renewed with equal success, its scheme comprising furniture, bronzes, ironwork, jewellery, ceramics, glass and textiles. Every region of Italy had contributed to this effort of modern art, and a French section also took part.

In the same year a similar display was organised at Barcelona, on the Hill of Montjuich, destined to become the site of permanent palaces to house specialised exhibitions covering successively various aspects of modern life. The first was devoted to furnishing and interior decoration, and comprised three sections, one retrospective, the second for modern interiors, the third for special furnishings for offices, schools and public services. In 1925 France could show two great exhibitions. At Grenoble was held the exhibition of electric power and of touring facilities. One palace was reserved for the applied uses of electricity and the means of its conveyance. A dwelling-house was equipped to show its application to domestic life, and a farm exhibited its possibilities in rural communities. The touring section had two palaces, the first devoted to administrative organisations, the *Office du Tourisme*, the Touring Club, the local information bureaux, while the second displayed advances in the industries connected with the influx of tourists. The capital of the French Alps was thus combining in one exhibition the advance in the transportation of energy and its uses in modern life.

The Paris Exhibition.—At the same time Paris was exhibiting on both banks of the Seine, on the Champs-Elysées and on the Esplanade des Invalides, the creations of modern decorative art. This long-awaited exhibition, delayed for 10 years by the World War, covered all the *ensemble* of the background of our life. Architecture, furnishings, clothing, theatre, street and garden, education—the works displayed were all to be exclusively modern. No retrospective work was admitted. For the first time modern art was offered by itself to public judgment. The experiment was favourable and its success was fulfilled, and even surpassed what was hoped for. More than 16,000,000 visitors thronged enthusiastically the magical spectacle, to which a special character, at once alluring and impressive, was given by the waters of the Seine and the lighting effects. Objects were presented as much as possible in their proper settings. Special settings were designed so as to reproduce the actual conditions of life. Pavilions, separate rooms, shops and stores, rivalled each other in their realism. A great advance was achieved in the art of presentation. And the exhibition marked also, in a final manner, the alliance of art and industry in practice, an alliance adumbrated in 1900 towards which the movement had been working ever since.

This exhibition was international and specialised. It had not the vast extent of the old great exhibitions, but it was shown to be more sharply instructive in effect within the scope assigned to it. Specialisation tends to show itself, not only in restriction of programmes, but in that of geographical range also. All countries are returning to the old-fashioned formula of city fairs, annual or biennial. Paris, Lyon and Dijon in France have adopted these regular demonstrations. They take place likewise in London, Milan, Riga, Leipzig, Nijni Novgorod and many other cities, in various forms and under varying conditions. It seems as if here, as elsewhere, progress sometimes returns to old conceptions, modified to the ideas of our generation. An annual exhibition of national scope is the Canadian National Exhibition held each autumn on permanently equipped premises at Toronto, Canada.

International Co-operation.—The need for assuring a certain unity among institutions of such varied characters brought about the meeting at Berlin, in 1912, of a diplomatic conference in which 16 states took part. The conference defined and classified the various sorts of general or specialised exhibitions, official or private, national or international. It fixed the rules governing the participation of states and limiting the number of exhibitions and their duration, the modes of issuing invitations, the procedures for adjudicating bodies, the scale of awards. This work is continued by the international federation of the permanent committees of exhibitions.

Thus these great institutions have their regular place in the lives of the peoples. If they have lost the vastness and all-embracing range of former times, the limitation of their scope seems, on the other hand, to make for their increased efficacy, and for their becoming a permanent instrument of economic expansion and social progress. (*See* DECORATIVE ART.)

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EXHIBITION, BRITISH EMPIRE.—The British Empire Exhibition, held at Wembley, Middlesex, in 1924 and 1925, was the largest exhibition of its kind ever held in Great Britain. The site chosen lies about 10 m. west-north-west of the city, and is served by the Metropolitan, L.N.E. and L.M.S. railways.

The construction of the exhibition was begun in January 1922, and the exhibition was opened by the King on April 23 1924. The first season lasted till Nov. 1 1924; and at a banquet held at the Guildhall on Nov. 10 the Prime Minister indicated the intention of the Govt. to re-open the exhibition the following year. A second season was accordingly undertaken. This lasted from May 9 1925 to Oct. 31; and the buildings and other paraphernalia of the exhibition were shortly afterwards put in the hands of liquidators for sale.

The aims and objects of the exhibition, as set out in early exhibition literature, were as follows:—

> To find in the development and utilisation of the raw materials of the empire new sources of imperial wealth.
>
> To foster intra-imperial trade and open fresh world markets for Dominion and home products.
>
> To make the different races of the British Empire better known to each other and to demonstrate to the people of Britain the almost illimitable possibilities of the Dominions, Colonies and Dependencies overseas.

In the 1924 season Imperial exhibits came from Australia, Bermuda, British Guiana, Burmah, Canada, Ceylon, Cyprus, East Africa (Nyasaland, Seychelles and Zanzibar), Fiji, Hong Kong, India, Malaya, Malta, Newfoundland, New Zealand, Palestine, Sarawak, South Africa, West Africa (Nigeria, Gold Coast and Sierra Leone), West Indian and Atlantic group (Barbados, British Honduras, Falkland Is., Jamaica, Leeward Is., Saint Lucia, Trinidad and Tobago).

In addition to these exhibits, in each of which were displayed as far as possible the main characteristics of the life and potentialities of the dominion or dependency in question, there were various industrial and commercial exhibits of importance, such as the Palace of Industry, the Palace of Arts, and the Palace of Engineering, the last being changed in 1925 to the Palace of Housing and Transport.

The Pavilion of H. M. Govt. was an enterprise without precedent. In addition to its function of presenting some account of the nation's public services, its purpose was to illuminate and epitomise the imperial idea. The Pavilion was British civisation in microcosm. To that civilisation each of the countries rought its share and the function of the Pavilion was to illusrate the broad result.

Defence was represented by the navy, army and air force; ealth by the exhibits of the Tropical Health and Hygiene Comnittee, and the Ministry of Health; public services by such epartments as the Post Office, Royal Mint, Dept. of Overseas rade, Committee of Overseas Settlement, Ministry of Agriulture, Stationery Office, etc.

The following statistical records will be of interest:—

Total area	220 acres
Cost of construction	nearly £3,000,000
Total attendance, 1924	17,403,119
Total attendance, 1925	9,699,231
Cash paid for admission, 1924	£991,000
Cash paid for admission, 1925	£428,000
Labour employed on construction (in man weeks)	444,800
Approximate number of people employed daily, 1924	24,200
Approximate number of people employed daily, 1925	21,000

On Monday, Dec. 1 1925 the auditors to the British Empire xhibition issued a statement of accounts and an interim ertificate. According to their figures, it was estimated that the nancial loss on the exhibition for the two seasons would be 1,581,905. The various guarantors, of whom the British Govt. as by far the largest, were on Dec. 5 1925 officially called pon to pay as an immediate call 15s. in the £ on the amount of heir guarantees, the liquidators reserving the right to fix later he ultimate and final liability of the guarantors. (J. H. T.)

EXPLORATION.—The explorers of previous centuries had the oles to reach, great blank spaces on the maps to fill in, the source f the Nile to trace and other major topographical facts to deermine. The progress of exploration has brought the accomplishnent of one after another of these primary tasks, but has opened p many more, involving more intensive work. Detailed toporaphical surveys are still needed for many regions, even if the najor lines of mountain and valley and ocean abyss are known. nd from topography the explorer proceeds to structure and hysiography on the one hand, to climate and ecology of plants, nimals and man on the other. The progress of exploration is inolving a gradual change of emphasis in geographical research rom topographical work to an understanding of the earth as he scene of man's activities (*see* HUMAN GEOGRAPHY).

Polar Regions.—Some of the primary tasks relating to polar egions are still far from being achieved, and we need only renark that the exploration of the atmosphere in the polar regions s leading to valuable conclusions promoting a more satisfactory nowledge of the world's climates in general. The exploration of ub-polar regions has been pursued with some vigour, partly for conomic reasons. The coal and other possibilities of Spitsergen have received attention, and Stefansson has emphasised tock-raising potentialities of the prairies of Arctic America for eindeer and musk-ox, while he also claims to have shown the ossibility of entrusting oneself to the sea-ice of the frozen seas *see* ARCTIC REGIONS; POLAR EXPLORATION).

Asia.—The immense interior of Asia, though known in a broad ense, has large areas which lacked even topographical investiation until the present century, when explorations of these egions have been numerous. Stein's many-sided work has inluded much mapping, and Sven Hedin has also published a reat deal, chiefly for Southern Tibet. The courses of the great ivers from Eastern Tibet toward China, Further India and Asam, have been investigated and general lines on our maps are eplaced by far more accurate ones, especially as regards the sang-po and its continuation, the Brahmaputra. Structure and hysiography in this region have received much attention from he same explorers, as well as from Dainelli, who, in the reports of he Filippi expedition to the Himalaya, Karakorum, etc., brings orward important evidence for a series of extended glaciations of hose mountain ranges analogous with several of those of the lps.

Inner Asia.—The ecology and climate of Inner Asia have een the subject of much discussion. Huntington has advanced he view that the climate has long varied cyclically with alternating wetter and drier phases, but he thinks that successive wet phases have meant less and less moisture for the land (*see* CLIMATE; GEOLOGY). His opinions have been attacked by several explorers, who have pointed out the caprice of rivers in a dry region with loose soil, and the consequent liability to accident from which irrigation systems may have suffered in the past. There is at least much reason to suppose that decay of irrigation systems from both physical and human causes may account for many ruined cities of Central Asia, quite apart from possible increase of drought. Stein has advanced the very probable view that even after the passing away of the great Ice age large stores of water remained locked up as ice on the central Asiatic mountain ranges, and their melting gave supplies of moisture to the lowlands. The drought, in his view, would have become intensified when these supplies suffered marked reduction at some period not far removed from the beginning of the Christian era. From these references it will be seen that attention is turning increasingly toward investigation of the environment of man, though this type of work has long accompanied that of topographical surveying. Besides Stein's and Sven Hedin's works, we may mention among recent contributions, A. D. Carruthers' writings on Mongolia and Dzungaria, Baddeley's book on Russia, Mongolia and China, Dr. Legendre's work on the upper Yalung in Western China, Kingdon Ward's *From China to Hkamti Long* and among many others J. W. Gregory and Teichman on Eastern Tibet. Behind all these lies the great work of von Richthofen on China, which opened up to modern science many problems of Central and Eastern Asia. Younghusband's entry into Tibet must also be mentioned.

The Filippi expedition, as well as that of Stein, contributed fresh data concerning races and peoples in the regions visited and our knowledge of Central Asia is growing in all directions. The geological exploration of China, begun by von Richthofen, has been pursued under the aegis of the Japanese Geological Survey, and it seems likely that, with the growing discussion of new views of the history of the earth's surface, much re-examination of geological facts of Central Asia will be undertaken in the next generation. Expeditions are at work in Mongolia on both geological and ecological problems, and are also hunting for traces of early man. (*See* MONGOLIA, PALAEONTOLOGICAL DISCOVERIES IN.)

Western Asia.—The area between the Caspian Sea and the Sahara has long interested students as a home of ancient civilisation, and great military and political interest has turned scientific attention to it in the 20th century. Surveys and mapping in Mesopotamia have progressed a great deal, and numerous details have been gleaned concerning Arabia. H. St. J. Philby's *Heart of Arabia* is one of the most important books on the region since C. M. Doughty's *Arabia Deserta*, and it gives both direct knowledge of the oasis fortress towns of Central Arabia and information gleaned about the great southern desert. Besides this, there has been great activity in exploration of ancient sites at Susa, Kish, Ur of the Chaldees, in Palestine, and as always, in Egypt, resulting in new knowledge, especially of the developmental background of ancient Egypt and Babylonia. (*See* ARCHAEOLOGY.) Our knowledge of ancient Hittite civilisation has grown through explorations in Asia Minor and near the Upper Euphrates, and the beginnings of decipherment of Hittite writing show that it had Indo-European links, which had probably come into it from the Russian steppe via Thrace and the Bosporus. This idea of movements of influence from Europe to Asia in remote times is a rather new one.

The site of Anau, some distance from the southeastern corner of the Caspian Sea, has also yielded valued indications of very early settlement, and students of the finds have urged that probably nomad herdsmen of the great grasslands and deserts of Inner Asia are less the descendants of ancient nomad hunters than people who gradually cut adrift from a humble settled life as they acquired power over the herds of those grasslands. In Egypt, the exploration of ancient cultures in some of the oases and the opening of new tombs in the Valley of the Kings, leading to the rich finds in the tomb of Tutankhamun, have been the greatest achievements in this field. The long-continued discussion of the origins of elements of civilisation has by no means closed. On the whole, of late years, the view that Egypt originated civilisation has been heavily attacked, and evidence has come forward pointing to the importance of the fertile crescent from Syria round via Palmyra to Mesopotamia in the earliest stages. The region of ancient civilisations has been seized upon by modern man with the idea of re-creating its ancient wealth. Mesopotamia has been explored by irrigation engineers with a view to cotton planting, and schemes of the same kind are going forward in the Anglo-Egyptian Sudan (*see* IRRIGATION ENGINEERING). Explorations for oil have been made and widely discussed, and routes for motor-cars between Syria and Mesopotamia have been planned and established.

Europe.—The construction of detailed topographical maps in Europe is of too old standing for any notable addition to have been made in this respect yet. Explorations have been of more intensive kind for scientific, economic or social purposes. The re-examination of the Alps by Argand and Staub and their colleagues had led to the formulation of a new view of the origin of the chain (*see* GEOGRAPHY), and if these fresh theories are maintained there will be need to re-explore several other mountain lands of Europe. Engineering surveys have been conducted in several lands, and notably in Norway and Sweden, south Germany, Switzerland, north Italy and southeast France, to find and utilise sources of hydroelectric power (*see* HYDROELECTRIC ENGINEERING). North Italy, with its glacier-fed streams giving a good steady power supply in summer and its juxtaposed city sites on the plain, gains greatly from this combination of physical advantages with the possession of an able and industrious population in old, established cities.

Early Man in Europe.—There has been much exploration of Europe for traces of ancient man and the beginnings of our civilisation. The French caves have continued to yield traces of art of the Old Stone age, and the wealth of Spain in this respect has been further demonstrated, while the rock-drawings of eastern Spain have been shown to relate to another early culture of African origin. The evidences of the importance of Spain when metal was first coming into use have been explored, especially by Bosch-Gimpera and Obermaier. The re-exploration of Stonehenge has shown that the "foreign stones" which form a part of that monument were brought in prehistoric times from Pembrokeshire, probably by sea rather than by land, and this is one of many indications pointing to an antiquity of sea faring along the western shores of Europe much greater than had previously been supposed; this form of activity in our region is now thought to go back to 2,000 B.C. or earlier.

The exploration of the lake village at Glastonbury has brought much knowledge of the early Iron age in Britain; and caves in the Mendips, especially Aveline's Hole, have given information about life in Britain not long after the end of the great Ice age.

The finding of the Piltdown skull and of the skull under the new Lloyd's building in the City of London has shown that variant types existed already in very early periods, and skeletons found at Predmost in Czechoslovakia and near the Caucasus as well as in Galilee seem likely to give indications of the evolution of modern types of man. (*See* MAN, EVOLUTION OF.) Sir Arthur Evans continued the publication of his famous researches on ancient Crete, and intervals in war duties led officers to begin explorations in Macedonia, which were subsequently continued. Beginnings of promising re-explorations of ancient sites in the Danube basin and Transylvania are noteworthy.

North Africa.—In North Africa a number of detailed explorations have been made in Morocco, Algeria and Tunisia, and the site of ancient Carthage, for example, has been studied, but the less-known desert behind has been the scene of most important work. Augieras has described the intensely desert character of the western Sahara, with few oases save on the periphery and with extremes of temperature, because the land lies low and the dunes lose heat quickly. Tilho has explored Tibesti, Borkou and Ennedi. The first, as a belt of highland between Tunis and Darfur, probably played a great part in southward spreads of fauna and flora in Miocene and Pliocene times. Mrs. Rosita Forbes travelled across from the Cyrenaica to Kufara oasis, the Senuss headquarters; and Hassanein Bey gathered valuable geological, cartographical and other data for all this region and the desert toward Darfur. His accounts of two oases connected with a route from south-west Egypt into Darfur aroused much interest. In the west of the Sahara, experiments have been made towards the establishment of motor transport with caterpillar attachments to overcome the sand.

Central and South Africa.—Though equatorial and southern Africa have witnessed less of the primary type of exploration, that of major topographical features, in the last generation a great deal of more intensive work was done. It has been shown that there have been changes of level of Victoria and Albert Nyanza, changes concordant with the variations of sunspots. There have been numerous surveys of race-types and studies of native society. Explorers have examined parts of Africa for cotton soils and mineral products in several regions, and Uganda promises to yield a good cotton crop. The controversies concerning Natives, Indians and Whites in East Africa, especially in Kenya, led to inquiries culminating, officially, in a report of the East Africa Commission to the Colonial Office. Farther south, MacIver claimed that the famous Zimbabwe ruins are essentially African and not more than 400 years old. (*See* ARCHAEOLOGY: AFRICA, SOUTH AND CENTRAL). The finding of a very interesting skull of ancient type but possibly of relatively recent date at Broken Hill, Rhodesia, opened up a large problem.

North America.—Explorations in North America accompanied the delimitation of the boundary between Canada and Alaska, and there have been studies of geomorphology in Central America, contributing to establish the theory of the eastward folding of the Cordillera and to bring out its relation to the Antillean arcs. Of more general interest were Stefansson's explorations in Arctic Canada, leading to topographical mapping around the difficult ice-bound coasts and to arguments on his part in favour of using the Arctic for herds of reindeer and musk-ox. British Columbia has been explored for economic purposes, and especially for sources of hydroelectric power.

South America.—In South America there was exploration attendant upon the delimitation of Bolivia's frontiers 1911–3, and at about the same time some detailed studies were made in southern Peru and the Cordilleran fringe of Argentina. Topographical maps, geological and physiographical conclusions, and social studies have resulted from this work. Rice mapped in detail the unique Cassequaire stream which conducts water from the Upper Orinoco to the Rio Negro, a northern affluent of the Amazon. Koch Grünberg studied the same district. In economic exploration an important step was taken in the appointment of a British committee, which reported in 1920 upon the reserves of the dependencies of the Falkland Is., such as South Georgia and South Shetland.

Oceania.—In the Pacific, the mystery of Easter I. has been examined afresh by Mr. and Mrs. Routledge, and Galapagos has been studied by William Beebe. Haddon has added to his many explorations by examining Papuan peoples and their cultures and Wollaston and Chinnery have also contributed to knowledge of this part of the world, while both Dutch and British have made progress toward a better understanding of the corrugations of the sea-floor in the East Indies. The work of scientific exploration of the sea, which owes so much to the initiative and the help of the late Prince of Monaco, has been continued; and much work has been done in European waters by Fisheries Commissions (*see* OCEANOGRAPHY).

This brief survey of some of the better known work of the early part of the 20th century illustrates the point that surveying for major topographical features has largely given place to detailed work, with increasing attention and application of scientific methods to economic and social exploration. The increased dependence of the industrial areas of the world upon tropical products has made the latter types of work very important, and more and more effort is likely to be concentrated in this direction. Along with this goes medical exploration, such as that leading to delimitation of fly-belts and to the combating of fly-borne dis-cases, especially in Africa. The success of medical efforts during the cutting of the Panama Canal altered estimates of the white man's adaptability to the tropics, but it is generally admitted that the problem remains a serious one, even if parasitic diseases are conquered by medical science (*see* PARASITOLOGY; TROPICAL MEDICINE).

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EXPLOSIVES (*see* 10.81).—A very large number of explosives is now known, and apart from warlike purposes they are used extensively for mining, quarrying, tunnelling, road making, and like purposes..

The Nature of Explosion.—The phenomenon of explosion is accompanied usually by a loud report, and frequently by a destructive effect, due to the sudden liberation of a large volume of gas. Explosives are substances which are capable of resolving themselves, under suitable impulses, almost instantaneously into gases which occupy a very much larger volume than the original substances. The explosion is invariably accompanied by a considerable evolution of heat, which still further increases the expansion of the gases.

In general, explosion is akin to combustion, inasmuch as it depends in most cases upon the combination of carbon and hydrogen with oxygen. When a combustible material such as charcoal burns in the air, the combination of carbon with oxygen necessarily takes place slowly, since the spent air must be continuously swept away and replenished by fresh air. In a draught of air, the burning is accelerated. If we were to mix the charcoal with liquid oxygen there would be no such delay, and it would be possible for the combustion to take place almost instantaneously. This is the essential nature of explosion, the sudden release of energy accompanied by a large volume of gas. In gunpowder we have a mixture of charcoal and sulphur, both of which are combustible, with saltpetre (potassium nitrate), which contains an excess of oxygen, and thus on ignition the oxidation of the carbon and sulphur can take place very rapidly.

Modern Explosives.—The main advance in modern explosives lies in the discovery of substances in which each molecule contains, in addition to carbon and hydrogen, the oxygen necessary for its combustion. Gunpowder is merely a mechanical mixture and, although the ingredients are very finely powdered and closely mixed, they still form separate particles. The advantages of combining the oxygen with the combustible elements in one and the same substance are:—

1. Gunpowder contains a large proportion of useless potash, which is merely a vehicle for the oxygen. The self-contained explosives on the other hand do not contain any such waste mineral matter, and hence have a greater store of useful energy.
2. Gunpowder gives a cloud of smoke when fired from a gun in consequence of the potash which it contains. The use of explosives containing no mineral matter gives rise to "smokeless powders," which permit of much more rapid firing.
3. The closer contact of the oxygen with the combustible elements renders possible a much more rapid internal combustion, leading to a greater violence of explosion in the so-called "high explosives."

The compounds which are mainly used as explosives are those containing "nitro groups," in which the oxygen is attached, somewhat loosely, to nitrogen. For instance trinitrotoluene (TNT) is represented by the chemical formula $C_7H_5(NO_2)_3$. The oxygen may be considered to be in a state of strain, as it is striving to pass from the nitrogen to the carbon and hydrogen, to which it has a much greater affinity.

The question naturally arises: if the molecules of an explosive are in a state of internal strain, why do they not fall to pieces spontaneously? The explanation is that a certain amount of energy must be imparted to the molecules to detach the oxygen from the nitrogen, before it can unite with the carbon and hydrogen. When the reaction has once started, the much greater energy given out in the oxidation of the carbon and hydrogen loosens the oxygen of the nitro groups in the surrounding molecules, and so the explosion is propagated throughout the mass. The amount of energy which is necessary to loosen the atoms in the molecule differs greatly in different explosives, and this determines their chemical and mechanical stability, and the ease with which they can be brought to explode violently. Thus trinitrotoluene is very stable, whilst mercury fulminate is very sensitive, and requires only a slight shock to cause it to explode with great violence. If a small quantity of mercury fulminate be exploded in contact with a larger quantity of trinitrotoluene, the fulminate ensures that the explosion is effectively started, and thus overcomes the initial inertia of the trinitrotoluene. The explosion then propagates itself through the mass of the explosive with a very high velocity. This very rapid explosion is termed detonation, and its velocity may vary from about 3,000 to 8,000 metres (2 to 5 m.) per second.

Classification.—It is sometimes a matter for surprise that so many different explosives should be in use, and it may appear at first sight that the one aim in the study of explosives should be to obtain an explosive of the greatest possible power. In practice, however, the greatest explosive violence is not always desired. In firing a shot from a gun, for instance, a very violent explosive would shatter the gun. For this purpose a more gradual and sustained pressure is required. This leads to the first important classification into (*a*) propellants, which are used to drive the shot from a gun, and (*b*) high explosives, which are used for their shattering effect, *e.g.*, in bombs and shells, and for rock blasting, etc.

Among high explosives again, different degrees of violence are required. Thus in blasting soft materials, a relatively slow, heaving effect is required, whilst a shattering effect is required for hard rock. In some cases, the degrees of sensitiveness and stability on storage are of great importance, in others less important. Special conditions have to be met in certain cases; thus the danger of ignition of firedamp in coal mines has led to the creation of a distinct class of explosives which can safely be used in such mines. Economic considerations are naturally of importance, and in many cases cheapness has to be balanced against efficiency. Detonants such as mercury fulminate form a separate class of explosives. These are limited to a very few representatives, and are used in caps and detonators in conjunction with other explosives.

Manufacture.—The most important explosive compounds are made by the action of nitric acid on various organic compounds. Two main classes of chemical compounds come into consideration as explosives, namely nitric esters, that is nitrates of carbon compounds, and true nitro compounds. The chemical reactions, which are utilised in the preparation of these two classes of compounds, may be typified by the formation of glycerol trinitrate or nitroglycerine, a nitric ester, and trinitrotoluene, a true nitro-compound.

$$\begin{array}{llll} C_3H_5(OH)_3+3HNO_3 & = & C_3H_5(ONO_2)_3 & +3H_2O \\ \text{Glycerol} & & \text{Glycerol trinitrate} & \\ CH_3C_6H_5\ \ +3HNO_3 & = & CH_3C_6H_2(NO_2)_3 & +3H_2O \\ \text{Toluene} & & \text{Trinitrotoluene} & \end{array}$$

The process of conversion to a nitro compound or nitric ester is commonly called "nitration." In practice sulphuric acid is mixed with the nitric acid, to take up the water formed in the reaction.

Glycerol trinitrate or "nitroglycerine" is made by the nitration of glycerol (glycerine) and forms a heavy yellow oil. Glycerol dinitrate is also used to some extent. Cellulose nitrates or "nitrocelluloses" are made by the nitration of cellulose, generally in the form of cotton waste. The cotton retains its fibrous condition during nitration, but can be reduced to a gelatinous condition by solvents such as acetone, or a mixture of ether and alcohol. Advantage is taken of this in the preparation of smokeless powders. The viscous jelly is forced through an orifice, so as to form long sticks or cords, and the solvent is then dried off. Cordite contains both nitrocellulose and nitroglycerine, together with a little mineral jelly. Other nitric esters can be made by the nitration of starch and sugar, but have only a limited application.

The true nitro-compounds are all prepared by the nitration of coal-tar products of the benzene series. They are generally yellow solid compounds, and are used either as such, or mixed with nitrates, etc. The nitro-compounds chiefly used for explosive purposes are dinitrobenzene, di- and trinitrotoluene (TNT), trinitrophenol (picric acid or lyddite) and nitronaphthalenes. For war purposes, trinitroxylene, trinitroanisol, hexanitro-diphenylamine and others have also been used.

Mercury fulminate, $Hg(CNO)_2$, is not a nitro-compound, but is nevertheless made by the action of nitric acid on mercury and alcohol. In all cases, the explosives require careful purification, all traces of acid being carefully removed.

Mixed Explosives.—Most industrial explosives consist of mixtures of several constituents. As in gunpowder, the general principle is to mix substances containing an excess of oxygen with combustible materials. The choice of oxidising agents is very limited, the main ones being nitrates, chlorates and perchlorates. In many cases the mixtures are reinforced by admixture with explosives such as nitroglycerine, nitrocellulose or trinitrotoluene. A special type of mixed explosive, which has been increasingly used, is made by adding liquefied oxygen to carbonaceous materials. The oxygen evaporates very quickly, and the mixture must therefore be made on the spot, and exploded at once.

Properties and Testing.—Apart from ordinary chemical and analytical tests, the following characteristics are examined:—

1. Explosive properties. The power is measured by detonating the explosive in a cavity in a lead block and measuring the increase in the size of the cavity. The heat of explosion and volume of the explosion gases are measured in a calorimetric bomb. The velocity of detonation can be determined by means of an electric chronograph.
2. Sensitiveness to shock and friction. A falling weight machine serves to ascertain the sensitiveness to shock, and various friction devices are in use.
3. Chemical stability. This determines the safety on storage. Numerous tests are available, the general principle being to heat the explosive under carefully regulated conditions, and to ascertain the extent to which decomposition occurs, either by chemical reactions depending on the presence of oxides of nitrogen, by the evolution of gas or by the alteration in weight.

Other tests are carried out to ascertain the safety of explosives under special conditions. Thus the length of flash and its duration are determined photographically; the safety of explosives in presence of firedamp is examined in experimental galleries simulating the conditions in mines.

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(R. C. F.)

EXPLOSIVES, MILITARY (*see* 1.864).—For military purposes, explosives are divided into two main classes: (*a*) Propellants; (*b*) High explosives (disruptives). The difference in functioning of these two classes is obtained by regulating the rate of explosion, *i.e.*, the rapidity with which the explosive is converted into gases. In the case of a propellant, so as not to burst the gun, a relatively slow rate of transformation, corresponding to a prolonged push is required; whilst a very high rate (detonation) which is equivalent to a sudden blow, in order to cause fracture by shock, is necessitated in explosives used for disruptive purposes. It follows, therefore, that the rapidity of the explosion or burning of a propellant, must be strictly controlled and that of a disruptive enhanced as far as possible, so as to liberate almost instantaneously the whole of its potential energy, if the utmost violence is desired.

PROPELLANTS AND THEIR NATURE

It was found that the temperature developed by the explosion of Mark I. cordite (7.138) was unduly high, owing to its large content of nitro-glycerine. In order to lessen the wearing and scoring effect of the hot gases on the bore of a gun, known as erosion, it is essential to keep the temperature of explosion of the charge as low as possible and a "cooler" cordite of modified composition, designated cordite M.D., was introduced, and remains to this day the standard British propellant for naval and military uses.

The composition of cordite M.D. is:—

Nitro-glycerine,	30 %.
Guncotton,	65 %.
Mineral jelly,	5 %.

The so-called "nitro-cellulose powders" do not contain nitro-glycerine and find favour in France, Germany and America on account of their lower temperature of explosion, thereby decreasing the erosion of the gun barrel. They are made from soluble nitro-cellulose, which is gelatinised by a mixture of ether and alcohol and then dried in the form of sticks, cubes or flakes, as found most suitable for the particular ordnance intended.

High Explosives (Disruptives).—High explosives for naval and military purposes are required for the bursting charges of shell, mortar and aerial bombs, grenades, mines (land or sea), torpedoes and for general demolition purposes. For such uses, an extremely violent and disruptive effect (brisance) is necessary in their explosion, but at the same time a very high order of chemical stability and insensitiveness is called for, particularly in the fillings for shell, which are subjected to an extremely severe shock at the moment of discharge of the gun.

To bring about the effective explosion of such stable compounds requires the employment of a powerful initiatory impulse. This may be effected by means of a small quantity of a more sensitive explosive, which then acts as a detonating agent or detonator. A high explosive is said to "detonate" when its explosion is propagated at the maximum velocity possible for the particular substance in question. There is no definite line of demarcation between a "high" and what may for the want of a better term be called a "low" explosive, such as gunpowder; the term is purely relative. No intensity of initial impulse can cause gunpowder to explode at a greater velocity than about 350 ft. per second. In the recognised high explosives the velocity of detonation is at least 2,000 or 3,000 ft. per sec. and may reach to as much as 9,000 ft. per second. It is owing to this intensely sudden evolution of gases that the shattering and disruptive effect of high explosives is obtained.

In order to appreciate the function of the detonator in initiating explosion, it is necessary to consider that in an explosive substance each molecule in its decomposition gives out a surplus of energy, and so provides the initial impulse required to decompose the neighbouring molecules. When, however, a stable high explosive, for instance T.N.T., is merely ignited, the decomposition propagates itself slowly at first and may cease altogether owing to external cooling; in any case, the velocity of decomposition increases but gradually or may even die out, and it is only after a considerable quantity has decomposed that detonation may ensue. By employing a detonating agent to initiate the explosion, decomposition of sufficient of the stable explosive in contact with the detonator is ensured, so that the explosion wave is propagated throughout the whole mass with certainty.

The value of fulminate of mercury, discovered by Howard in 1800 as a detonating agent for more stable high explosives, was not recognised till a considerably later date. This sensitive chemical compound may be readily caused to detonate "*en masse*" by heat, friction or percussion, and the detonation is similarly imparted to any high explosive with which the fulminate is in contact. Another detonating agent, for similar purposes, which is now increasing in favour is lead azide, for which better keeping qualities, particularly in hot climates, are claimed. By reason of their sensitiveness, the quantities of such detonating agents employed are strictly limited—in the case of percussion fuses, for shell up to about 10 grains. A greater amount of an explosive such as tetryl, which is intermediate in sensitiveness between the detonator proper and the bulk filling, may, if necessary, be used to increase the "send off."

Shell Filling.—For shell filling, very insensitive high explosives are required, on account of the severe shock to which they are subjected at the moment of discharge. In fact it was the fear of premature explosion in the gun which militated for many years against the introduction of H.E. shell. The high explosives most suitable for shell filling are nitro-benzene derivatives, derived from coal tar. The first to be employed for this purpose was picric acid, tri-nitro-phenol (*see* 10.82) discovered by Woulffe in 1771, and used for many years as a dye without its explosive properties being recognised. It was first used in actual warfare by the British Army in the South African War of 1899–1902, under the name of lyddite. Picric acid is also the main or sole constituent of the French mélinite, the Japanese Shimosé powder and the Austrian ékrasit. It has now largely been superseded by Trinitrotoluene, which is known generally as T.N.T. It is very similar in its action and appearance to picric acid, over which it possesses certain advantages in ease of manufacture and facility of manipulation.

In the World War economic considerations played a large part in determining the types of explosives used and their methods of manufacture, and so led to the adoption of others hitherto untried and unproved for military purposes. For these reasons, the high explosive which was used in the greatest quantities by Great Britain was "Amatol," the name given to various mixtures of ammonium nitrate and T.N.T. The proportion most favoured was Amatol 80/20, which contains 80% of ammonium nitrate and 20% of T.N.T., these being approximately the proportions necessary for the complete combustion of the T.N.T., through the agency of the extra oxygen required, which is supplied by the ammonium nitrate constituent. Such an amatol can be compressed into the shell or other munition, in the form of a powder, or loaded in a plastic condition by heating it above the melting point of the T.N.T. This is a consideration of great importance, as it enables more rapid output to be obtained than in the melt process used with lyddite or T.N.T.

The high explosive fillings described for shell are equally applicable to the numerous other kinds of munitions, but in addition wet guncotton has been used for the filling of torpedo war heads and floating mines. For hasty demolitions in the field wet guncotton slabs packed in watertight boxes are convenient, the detonator being inserted before use in a disk or primer of dry guncotton which fits into a correspondingly shaped cavity in the wet slab and thereby brings the whole to detonation.

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EXPORT CREDITS, a post-War scheme adopted by the British Govt. to assist British export trade. The Export Credits Scheme was initiated by Mr. Lloyd George's Coalition Govt. in the autumn of 1919 as a means of facilitating the finance of export business and of promoting the restoration of British trade. Importers in many markets found it difficult at the time to pay cash or do business on short-term bills; and it was felt that trade could be secured if facilities were provided for financing transactions which owing to the length of credit required, or for other reasons would not be acceptable to the banks.

Power was also taken to insure goods against risks of an abnormal or exceptional nature, but this part of the scheme has remained inoperative. At first the application of the scheme was limited to business with certain European states, viz., Finland the Baltic States, Poland, Czechoslovakia, Yugoslavia, Rumania and others. This restriction was due in part to a concomitant policy of assisting in the economic reconstruction of countries which had been specially disorganised by the World War. In 1921 the sphere of operations was enlarged to include the whole world, subject to certain exceptions adopted in the actual administration of the scheme.

The legislation governing the scheme is contained in the Overseas Trade (Credit and Insurance) Act 1920; in an amending Act of 1921; and in the Trade Facilities Acts 1921–4. It is administered on behalf of the Board of Trade by the Export Credits Dept. of the Dept. of Overseas Trade, with the assistance of an advisory committee of business men. The aggregate amount outstanding in respect of credits at any given time may not exceed £26,000,000. Credits may only be given for British goods. The period within which new credits may be given expires in Sept. 1926, but legislation was introduced in 1926 to extend it for another three years.

Under the original scheme the Export Credits Dept. made advances to the exporter in cash up to 80% of the cost of the goods, but early in 1921 an important modification was introduced, the object of which was to bring the method of operation into closer correspondence with the normal machinery of trade. Instead of making advances the department was authorised to guarantee drafts drawn against the shipment of export goods. The advances system was in consequence discontinued, and the bulk of the business done under the scheme was effected under the guarantee plan.

The *modus operandi* is that the exporter makes application to the department through his bank (an arrangement introduced so as to preclude overlapping with the banks), and if the proposed credit is sanctioned, the government's guarantee is given usually in the form of a guarantee endorsed on the actual bills drawn by the exporter, but sometimes in the form of a letter of guarantee. An appropriate premium is charged. Bills may be guaranteed up to 100% of the invoice value if the length of the credit does not exceed one year, and up to 85% if the term is for more than one year. If adequate security is provided by the importer, usually in the form of a bank guarantee, there is no recourse on the exporter in event of loss; in other cases the department takes recourse up to $57\frac{1}{2}$% if 100% has been guaranteed, and up to $42\frac{1}{2}$% if 85% has been guaranteed. It will thus be seen that the exporter gets both assistance in his finance, since the guaranteed bills can be discounted or used as collateral security for a bank advance, and a measure of insurance against loss, since the department, in only taking partial recourse upon him, makes itself responsible for part of any loss which may arise. This is the broad outline of the scheme; there are variants in the actual facilities offered which need not be set out in detail.

The total amount of business done up to Dec. 1925 was about £1,750,000 under the advances scheme, and rather less than £6,000,000 under the guarantee scheme. As the limit fixed by the original Act was £26,000,000 it is clear that the scheme has not been taken advantage of to the extent expected. This may be due to various causes. The scheme probably has not been very widely known; business men have been perhaps sceptical about the handling of such matters by a government department; there may have been complications and rigidities of practice such as would discourage applicants. Published figures, however, show that very much larger amounts of credits have been sanctioned than have actually been taken up—presumably because the applicant eventually failed to secure the business for which the credit was required, or perhaps was ultimately able to finance it without assistance from the department. On the whole, the figures indicate that the scheme has been helpful to trade at a difficult juncture.

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(W. CL.)

EYE: *see* OPHTHALMOLOGY.

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A. Del R.	ARUNDELL DEL RE, O.B.E., M.A. Taylorian Lecturer in Italian, University of Oxford. Lecturer in Italian, King's College, University of London. Editor of *The Oxford Magazine.* Private Secretary to the Italian Military Attaché, London, 1916–8.	**Italian Literature.**
A. D. H.	SIR A. DANIEL HALL, K.C.B., F.R.S. Chief Scientific Adviser and Director General of the Intelligence Department, Ministry of Agriculture and Fisheries, London. Author of *The Soil; Fertilisers and Manures; A Pilgrimage of British Farming; Agriculture after the War;* etc.	**Farmers' Organisations** (*in part*).
A. D. N.	A. D. NOCK. Lecturer in Classics and Fellow of Clare College, Cambridge.	**Greek Religion.**

A. E. A.	Algernon Edward Aspinall, C.M.G., C.B.E. Secretary to the West India Committee and to the Imperial College of Tropical Agriculture. Author of *The British West Indies*; *The West Indies and Guiana*; etc.	**Jamaica.**
A. E. S.*	Addison Erwin Sheldon, A.M., Ph.D. Superintendent and Secretary of the Nebraska State Historical Society. Author of *History and Stories of Nebraska*; *Poems and Sketches of Nebraska*; *Nebraska Constitutional Conventions.* Editor of *The Nebraska Blue Book.*	**Nebraska.**
A. E. T.	Alonzo Englebert Taylor, M.D., LL.D. Director of the Food Research Institute, Stanford University, California. Formerly Professor of Pathology and of Physiological Chemistry, University of California. Author of *Digestion and Metabolism*, etc.	**Food Supply.**
A. F.*	Abraham Flexner, A.M. Secretary of the General Education Board, New York. Author of *Education in the United States and Canada.*	**Medical Education** (*in part*)
A. Fo.	Anna Foehringer. Senior Physicist of the Central Geophysical Observatory, Leningrad. Formerly Lecturer in physics at the University of Leningrad, and Professor of the history of physics.	**Golitzin, B. B.;** **Lebedev, Petr N.**
A. F. Pr.	Alfred Francis Pribram, Ph.D. Professor of Modern History in the University of Vienna.	**Francis Joseph I.**
A. G. D.	Arthur G. Doughty, C.M.G., Litt.D. (Laval), F.R.Hist.S., F.R.S.C. Keeper of Public Records and Director of War Trophies, Canada. Formerly Joint Librarian of Legislature, Province of Quebec. Member Geographic Board of Canada, 1909. Attached to Staff of Prince of Wales as historian of Canadian Tour, 1919. Author of *Quebec under Two Flags*; *The Cradle of New France*; *The Acadian Exiles*; etc.	**King, W. L. Mackenzie;** **Meighen, Arthur.**
A. G. G.*	Alfred G. Gardiner. Formerly Editor of *The Daily News*, London. Author of *Prophets, Priests and Kings*; *The Life of Sir William Harcourt*; *The Life of George Cadbury*; *Sir John Benn and the Progressive Movement*; and works under the pen name of "Alpha of the Plough."	**Oxford and Asquith, Earl o**
A. Gn.	Auguste Gauvain. Member of the Institute of France. Foreign editor of *Le Journal des Débats.* Author of *L'Europe avant la guerre*; *Les origines de la guerre européenne*; *L'Europe au jour le jour.*	**France:** *History.*
A. H. Gi.	Arnold Hartley Gibson, D.Sc., M.Inst.C.E., M.I.Mech.E. Professor of Engineering, University of Manchester; late Professor of Engineering, St. Andrew's University, Scotland. Member Board of Trade Water Power Committee; Member of the Air Ministry Engine Research Committee.	**Hydroelectric Engineering.**
A. Hi.	Alexander Hill, M.D., F.R.C.S. Secretary of the Universities Bureau of the British Empire. Master of Downing College, Cambridge, 1888–1907. Vice-Chancellor of Cambridge University, 1897–9. Principal of University College, Southampton, 1912–9. Author of *The Body at Work*, etc.	**Medical Education** (*in part*
A. Hn.*	Austin Harrison. Author of *Life of Frederic Harrison.* Late editor of *The English Review.*	**Harrison, Frederic.**
A. Hu.*	Archibald Hurd. Member of the editorial staff of *The Daily Telegraph*, London. Author of *Naval Efficiency*; *The British Fleet in the Great War*; *The Command of the Sea*; *The Merchant Navy*; etc.	**Navy.**
A. J. M.	Rt. Rev. Arthur John Maclean, D.D. Bishop of Moray, Ross and Caithness. Formerly Principal of the Scottish Episcopal Theological College, Edinburgh, and Pantonian Professor and Canon of Edinburgh Cathedral. Author of *Dictionary of Vernacular Syriac*; *The Ancient Church Orders*; etc. Joint author of *The Catholicos of the East and His People.*	**Orthodox Eastern Churche**
A. J. T.	Arnold Joseph Toynbee. Professor of International History, University of London. Member of Middle Eastern Section, British Delegation to the Peace Conference at Paris. Koraes Professor of Byzantine and Modern Greek Language, Literature and History at the University of London, 1919–24. Author of *Nationality and the War*; *A Survey of International Affairs, 1920–24*; etc.	**Genoa, Conference of;** **Lausanne, Conference of;** **London, Conference of;** **Memel;** **Mustafa Kemal.**
A. K.	Sir Arthur Keith, M.D., F.R.C.S., LL.D., F.R.S. Hunterian Professor and Conservator of the Museum, Royal College of Surgeons of England. Secretary and late Fullerian Professor of Physiology, Royal Institution of Great Britain. President of the Royal Anthropological Institute, London, 1912–4. Author of *Introduction to Study of Anthropoid Apes*; *Human Embryology and Morphology*; *Antiquity of Man*; *Religion of a Darwinist*; etc.	**Man, Evolution of.**
A. L.*	Arnold Lunn. Author of *The Englishman in the Alps*; *Cross Country Ski-ing*; *Alpine Ski-ing*; etc.	**Mountaineering.**

A. L. Bo.	Arthur Lyon Bowley, Sc.D., F.B.A. Professor of Statistics at the London School of Economics. Formerly Professor of Mathematics and Economics, University College, Reading. Author of *Elements of Statistics*; *An Elementary Manual of Statistics*; *Measurement of Social Phenomena*; etc.	**Index Numbers.**
A. L. J. S.	Arthur L. J. Smith. President and chief proprietor of *The Spectator* and of The Spectator Company, New York and Chicago. Director, Dime Savings Bank of Brooklyn. Director, Manhattan Bridge Three Cent Line. Member of the Chamber of Commerce of the State of New York.	**Insurance** (*U.S.A.*).
A. Ly.	A. Loveday. Member of the Economic and Financial Section, League of Nations, Geneva.	**Lithuania:** *Economic and Financial History.*
A. Mav.	A. Mavrogordato. Fellow in Industrial Hygiene, South African Institute for Medical Research, Johannesburg.	**Miners' Phthisis.**
A. M.-B.	A. Mendelssohn-Bartholdy. Professor of International Law in the University of Hamburg. Editor of *Europaische Gesprache*. Author of *Irland: Ein Beispiel der Machtpolitik*; part author of *Die Grosse Politik der Europaischen Kabinette 1871–1914*; etc.	**Germany:** *History* (*in part*).
A. M. C.-S.	Alexander Morris Carr-Saunders, M.A. Charles Booth Professor of Social Science in the University of Liverpool. Author of *The Population Problem*; etc.	**Great Britain:** *Population.*
A. Mey.	Adolf Meyer, M.D. Professor of Psychiatry, Johns Hopkins University, and Director of Henry Phipps Psychiatric Clinic, Johns Hopkins Hospital, Baltimore. Formerly Director of Pathological Institute, New York State Hospitals.	**Insanity.**
. My.	Gustaf Arthur Montgomery. Professor of Economics and Finance at the Abo Akademi (Swedish University), Finland.	**Finland:** *Financial and Economic History.*
. N. J. W.	A. Neville J. Whymant, Ph.D., Litt.D. Professor of Chinese and Oriental Philosophy in Hosei University, Tokyo. Member of Council of the Asiatic Society of Japan. Sometime Davis Chinese Scholar, University of Oxford. Author of *The Oceanic Theory of the Origin of the Japanese Language and People*; etc.	**Ishii, Viscount;** **Japanese Literature.**
. P.	Alexander Paul. Journalist and author.	**Leverhulme, Viscount.**
. P. W.	Colonel Archibald Percival Wavell, C.M.G., M.C. Late The Black Watch. General Staff Officer, War Office, London. British Military Attaché on the Caucasus Front, Nov. 1916–June 1917. General Staff Officer with Egyptian Expeditionary Force, July 1917 March 1918. Brigadier General, General Staff, with Egyptian Expeditionary Force, April 1918–20.	**Lemberg, Battles of;** **Lodz-Cracow, Battles of;** **Luck, Battles of;** **Narew, Battles of the;** **Narocz, Battle of Lake.**
. R.*	Athelstan Ridgway, LL.B. Barrister-at-Law. Formerly Deputy Director of Information, War Office and Colonial Office, London.	**Fiji Islands;** **Malay States, Federated;** **Malay States, Unfederated.**
. Sa.	A. Safrastian. Formerly British vice-consul at Bitlis, Kurdistan.	**Kurdistan.**
. S. G.	Albert Sydney Galtrey. "Hotspur" of *The Daily Telegraph*, London. Formerly Staff Captain to the Director of Remounts at the War Office. Author of *The Horse and the War*.	**Horse-Racing** (*in part*).
. Soe.	Albert Soergel, Ph.D. Director of the Book-Lovers Association, Chemnitz, Germany. Author of *Dichtung der Zeit*.	**German Literature.**
. Sr.	Sir James Arthur Salter, K.C.B. Director of the Economic and Finance section of the League of Nations. General Secretary to the Reparation Commission, 1920–2. Secretary of the British Department of the Supreme Economic Council, 1919. Secretary of the Allied Maritime Transport Council and Chairman of the Allied Maritime Transport Executive, 1918. Author of *Allied Shipping Control, an Experiment in International Administration.*	**League of Nations** (*in part*).
. St.	Anna Stancioff. Widow of late Dimitri Stancioff, formerly Bulgarian Minister in London.	**Ferdinand, King of Bulgaria.**
. Th.*	Albert Thomas. Director of the International Labour Office, Geneva. Minister of Munitions in French Government, 1916. Assistant Editor of *L'Humanité*, 1904. Author of *Le Syndicalisme allemand Histoire, anecdotique du Travail.*	**International Labour Office.**
. V. W.-H.	Major A. V. Wheeler-Holohan. King's Messenger. Formerly Sub-Editor of Debrett's *Peerage*. Author of *Divisional and Other Signs* and publications on Medals, Decorations and Heraldry.	**Knighthood;** **Medals and Decorations.**

A. W. F. K.	Major-General Sir Alfred William Fortescue Knox, K.C.B., C.M.G. M.P. for the Wycombe Division of Buckinghamshire. Chief of British Military Mission to Siberia, 1918–20. Formerly Military Attaché, British Embassy at Petrograd. Author of *With the Russian Army, 1914–17*.	**Nicholas, Grand Duke.**
A. W. K.	Arthur William Kiddy. City Editor of *The Morning Post* and of *The Spectator*, London. Financial Correspondent in London of *The New York Evening Post*. Editor of *The Bankers' Magazine*, London.	**Money Markets.**
A. Wo.	Abraham Wolf, M.A., D.Litt. Professor of Logic and Scientific Method in the University of London. Head of the Department of the History and Method of Science at University College, London, and of the Department of Logic and Philosophy at the London School of Economics, London University. Late Fellow of St. John's College, Cambridge. Author of *Studies in Logic*; *Exercises in Logic and Scientific Method*; *Essentials of Scientific Method*; etc.	**Logic.**
A. Wr.	Sir Almroth Edward Wright, K.B.E., M.D., F.R.S. Principal of the Institute of Pathology and Research, and Professor of Experimental Pathology, St. Mary's Hospital, London. Originator of the system of Anti-Typhoid Inoculation, the system of Therapeutic Inoculation for Bacterial Infections (Vaccinotherapy), and of methods for measuring the protective substances in human blood. Author of *System of Anti-Typhoid Inoculation*; *Principles of Microscopy*; *Studies in Immunisation*; etc.	**Immunity.**
B. A. W. R.	Hon. Bertrand Arthur William Russell, M.A., F.R.S. Late Lecturer and Fellow of Trinity College, Cambridge. Author of *Philosophical Essays*; *Mysticism and Logic*; *Introduction to Mathematical Philosophy*; *The Analysis of Mind*; etc.	**Knowledge, Theory of.**
B. B.	Bruce Bairnsfather. Author and Journalist. Author of *Fragments from France*; *The Better 'Ole*; etc.	**Illustration** (*in part*).
B. C. S.	Bernard Christian Steiner, M.A., Ph.D., Litt.D. Librarian, Enoch Pratt Free Library, Baltimore; Dean and Professor of Law, Baltimore Law School, 1900–4. Author of *Education in Maryland*; *Institutions and Civil Government of Maryland*; etc.	**Maryland.**
B. D.	Bernard Darwin. Golf Correspondent of *The Times*, London, and *Country Life*. Played golf for England *v.* Scotland and for Great Britain *v.* America. Author of *Golf Courses of Great Britain*; *Golf, some Hints and Suggestions*; *Tee Shots and Others*; etc.	**Golf.**
Be.	Count Stephen de Bethlen, LL.D. Prime Minister of Hungary since 1921.	**Hungary:** *Political History.*
B. E. P.	Barthelémy Edmond Palat. Formerly General of Brigade in the French Army. Commanded a Division 1915–6. Author of *La Grande Guerre sur le Front Occidental*; *Les Batailles d'Arras et de Champagne*; and, under the pseudonym "Pierre Lebautcourt," of *La Défense Nationale, 1870–1*.	**Frontiers, Battles of the** (*in part*).
B. H. L. H.	Captain B. H. Liddell Hart, F.R.Hist.S. Military Correspondent of *The Daily Telegraph* (London). Inventor of the Battle Drill and various tactical methods adopted by the British Army. Joint Author of the official manual, *Infantry Training*, and editor of *Small Arms Training*. Author of *Science of Infantry Tactics* (transl. for Bulgarian Army, 1925); *Paris, or the Future of War*; etc.	**Hamilton, Sir Ian, etc.**
B. M. B.	Bernhard Mannes Baruch, LL.D. Formerly member of the Supreme Economic Council and Chairman of its Raw Materials Division. Economic Adviser to the American Peace Commission. Author of *The Making of Economic and Reparation Sections of Peace Treaty*.	**Industry, War Control of** (*in part*).
B. S.	Bernard Serrigny. General of Division of the French Army, Secretary of the Committee of National Defence, Paris. Formerly Deputy Chief of the General Staff of the French Army. Author of *Reflexions sur l'art de la guerre*, etc.	**France:** *Defence.*
B. Z.	Bela Zolnai, Ph.D. Lecturer in Contemporary Literature, University of Budapest.	**Hungarian Literature.**
C. A. Br.	Charles Albert Browne, Ph.D. Chief of the Bureau of Chemistry, U.S. Department of Agriculture. Chemist in charge of the New York Sugar Trade Laboratory, 1907–23. Author of *Handbook of Sugar Analysis*; *Sugar Tables for Laboratory Use*; etc.	**Food, Pure.**
C. A. M.	Carlile Aylmer Macartney. H.B.M. Passport Control officer for Austria 1922–5. Author of *The Social Revolution in Austria*.	**Galicia, East;** **Germany** (*in part*); **Habsburg;** **Kun, Bela** (*in part*).
C. B. L.	Lieut.-Col. Cecil Bingham Levita, C.B.E., M.V.O., D.L., J.P. Member of the London County Council, and Chairman of its Housing Committee.	**Housing:** *Great Britain.*

C. Bre.	Cloudesley Brereton, M.A., **D.-ès-L.** Divisional Inspector (Modern Languages) to the London County Council. Corresponding Member of the National Educational Association (America). Author of *The Organisation of Modern Language Teaching*; *Studies in Foreign Education*; etc.	**Foreign Languages** (*in part*).
C. C. B.	Clarence Charles Burlingame, M.D. Executive officer, Joint Administrative Board, Columbia University, Presbyterian Hospital, New York. Director of the medical and surgical section, military affairs dept., 1918; Director of hospital administration; Director of the medical and surgical department of the American Red Cross in France, 1918–9.	**Hospitals** (*in part*); **Medical Service, Naval** (*in part*).
C. Ch.	Charles Chree, Sc.D., LL.D., F.R.S. Formerly Assistant Director of the Meteorological Office and Superintendent of the Observatory at Kew, London.	**Magnetism, Terrestrial.**
C. Ch.*	Cecil Chisholm. Chairman of Business Publications Ltd.; Editorial Director of *The Advertiser's Weekly*; Editor of *System*. Author of *Marketing and Merchandising*.	**Instalment Selling** (*in part*).
C. D. C.	Lieut.-Col. C. D. Crozier, R.A. (ret.). Director of Inspection of High Explosives, Ministry of Munitions, 1915–9.	**Grenades.**
C. D. Wi.	Curtis Dwight Wilbur, LL.D. Secretary of the United States Navy Department. Formerly Chief Justice of the Supreme Court of California.	**Navy Department** (*U.S.A.*).
C. E. C.	Major-General Sir Charles Edward Callwell, K.C.B. Director of Military Operations at the War Office, London, 1914–6. Author of *Small Wars*; *The Dardanelles*; etc.	**Mesopotamia, Operations in.**
C. E. Ch.	Charles Edward Chapman, A.M., Ph.D. Associate Professor of History, University of California. Author of *The Founding of Spanish California*; *A Californian in South America*; *A History of Spain*; *Catalogue of Materials in the Archivo General de Indias for the History of the Pacific Coast and the American Southwest*; *A History of California*; *History of the Cuban Republic*.	**Havana.**
C. E. D.	Charles Edward Dupuis, M.I.C.E., M.A. Formerly Adviser to the Egyptian Ministry of Public Works.	**Nile.**
C. E. K. M.	Charles Edward Kenneth Mees, D.Sc. Director of the Research Laboratory, Eastman Kodak Co., Rochester, New York. Author of *Photography of Colored Objects*; *The Atlas of Absorption Spectra*; *The Fundamentals of Photography*; etc.	**Motion Pictures:** *Technology*.
C. F. Cl.	Colonel Sir Charles Frederick Close, K.B.E., C.M.G., F.R.S. Vice-President of the Royal Geographical Society, London. General Secretary of the International Geographical Union. Director-General of the Ordnance Survey, 1911–22. Author of *Text Book of Topographical Surveying*.	**Map.**
C. F. G. M.	Right Hon. Charles Frederick Gurney Masterman. Under-Secretary of State, Home Department, 1909–12. Financial Secretary to Treasury 1912–4. Chancellor, Duchy of Lancaster, 1914–5. Sometime Literary Editor of *The Daily News*, London; and contributor to *The Nation*, *The Evening Standard* and other periodicals. Author of *The New Liberalism*; *How England is Governed*; *England after War*; etc.	**Liberal Party.**
C. G.*	Charles Gide. Professor at the College of France. Editor of *La Revue d'Economie Politique*. Author of *Political Economy*; etc.	**France:** *Economic and Industrial History*.
C. Ha.	C. Hambro. Chairman of the Norwegian Committee on Foreign Relations, Oslo. Formerly editor of *Morgenbladet*.	**Norway:** *Political History*.
C. H. B.	C. H. Best. Attached to National Medical Research Institute, London.	**Insulin.**
C. H. Bu.	Charles H. Burke. Second South Dakota District Commissioner of Indian Affairs. Formerly Member of Congress.	**Indians, North American.**
C. H. D.	Cecil Henry Desch, D.Sc., F.R.S. Professor of Metallurgy, University of Sheffield, England. Formerly Professor of Metallurgy, Royal Technical College, Glasgow. Author of *Metallography*; *Intermetallic Compounds*; etc.	**Metallography.**
C. H. J.	Charles Hubbard Judd, Ph.D., LL.D. Director of the School of Education, and Chairman of the Department of Psychology, University of Chicago. Author of *Psychology, General Introduction*; *Psychology of High School Subjects*; etc. Editor of *The Supplementary School Journal*; *The School Review*; etc.	**Industrial Education.**
C. H. M.	Clifford Herschel Moore, Ph.D., Litt.D. Professor of Latin at Harvard University. Author of *Religious Thought of the Greeks*; *Pagan Ideas of Immortality*; etc.	**Harvard University.**
C. J. M.*	Charles James Martin, C.M.G., D.Sc., F.R.S. Director, Lister Institute of Preventive Medicine, London. Professor of Experimental Pathology, University of London. Late Consulting Pathologist, Australian Infantry Force.	**Filter-Passing Microbes.**

C. K. E.	Charles Keyser Edmunds, Ph.D. Provost, Johns Hopkins University, Baltimore. Formerly President of Canton Christian College.	**Hwang-ho.**
C. La.	Lieut.-Col. Clayton Lane, M.D. Indian Medical Service (retired).	**Hookworm.**
C. L. R.	Captain C. Lestock Reid.	**Fox-Hunting.**
C. Ma.	Cuthbert Maughan. Insurance and Shipping Editor, *The Times*, London. Contributor on Finance, Shipping and Insurance to *The Annual Register*, etc. Representative of Admiralty Section of the British Ministry of Information in North America, 1918.	**Insurance** (*in part*).
C. M. J.	Charles Michael Jacobs, A.B., D.D. Professor of Church History and Director of the Graduate School, Lutheran Theological Seminary, Philadelphia. Editor of *Luther's Correspondence*.	**Lutherans.**
C. M. L.	Charles Mostyn Lloyd, M.A. Barrister-at-Law. Lecturer and Head of the Department of Social Science and Administration in the London School of Economics, University of London. Assistant Editor of *The New Statesman*.	**Great Britain:** *Local Government.*
C. M. P.*	Charles Max Page, D.S.O., F.R.C.S. Hunterian Professor, Royal College of Surgeons, England. Senior Surgeon to out-patients, St. Thomas' Hospital, London. Author of *The Treatment of Fractures in General Practice*; etc.	**Fractures.**
C. My.	Christopher Morley. Formerly editor of *The New York Evening Post*. Author of *The Haunted Book Shop*; *Chimney Smoke*; *Inward Ho*; *Thunder on the Left*; etc.	**Henry, O.**
C. of C.	Right Hon. Viscount Cecil of Chelwood, K.C. Chancellor of the Duchy of Lancaster. Under-Secretary of State for Foreign Affairs, 1915–8, and Assistant Secretary of State, 1918–9. Minister of Blockade, 1916–8. Lord Privy Seal, 1923–4. Representative of Great Britain on the League of Nations Commission at the Peace Conference, 1919. Representative of South Africa at the Assembly of the League of Nations at Geneva, 1920; Vice-Chairman of the League of Nations Union.	**League of Nations** (*in part*).
C. O. L.	C. O. Lee. Honorary Secretary of the English Lacrosse Union.	**Lacrosse.**
C. O. R.	C. O. Reed. Professor of Agricultural Engineering, Ohio State University.	**Farm Machinery.**
C. P. C.	C. P. Curran, M.A. Irish Correspondent of *The Nation* and *The Athenaeum* 1916–21; of *The Nation and Athenaeum*, 1921–3.	**Irish Literature,** *English*.
C. Sey.	Charles Seymour, M.A., Ph.D., Litt.D. Sterling Professor of History in Yale University. Technical Delegate at the Paris Peace Conference, 1919. Author of *The Diplomatic Background of the War*; *Woodrow Wilson and the World War*; etc.	**Harding, W. G.;** **House, Edward M.;** **Lodge, H. C.**
C. Si.	Charles Singer, D.M., D.Litt., F.R.C.P. Lecturer in the History of Medicine, University College, University of London. Author of *Greek Biology and Greek Medicine*; *History of the Discovery of the Circulation of the Blood*; etc.	**Medicine, Pre-Scientific.**
C. S. O.	Charles Stewart Orwin. Fellow of Balliol College and Director of the Institute for Research in Agricultural Economics, Oxford University. Agricultural Assessor on the Agricultural Tribunal of Investigation, 1922–4. Editor of *The Journal of the Royal Agricultural Society*, London. Author of *Farm Accounts*; etc.	**Farm Organisation.**
C. Sp.	Charles E. Spearman, Ph.D., F.R.S. Grote Professor of Mind and Logic, University College, University of London. Author of *An Economic Theory of Spatial Perception*; *Principles of Cognition*; etc.	**Intelligence, Human.**
C. T.	Charles B. L. Tennyson, C.M.G. Deputy Director of the Federation of British Industries. Formerly Legal Adviser to the Colonial Office, London.	**Great Britain:** *Production and Industry; Communications.*
C. T. A.	C. T. Atkinson, M.A. Fellow of Exeter College, Oxford. Formerly of the Historical Section, Committee of Imperial Defence.	**Loos, Battle of;** **Neuve Chapelle, Battle of.**
C. W. G.*	Claude W. Guillebaud. Lecturer in Economics at the University of Cambridge; formerly Fellow of St. John's College, Cambridge. Served in the Supreme Economic Council in Paris, 1919–20.	**Industry, War Control of** (*in part*).
D. A. MacG.	D. A. MacGibbon, Ph.D. Professor of Political Economy at the University of Alberta, Canada. Author of *Railway Rates and the Canadian Railway Commission*.	**Manitoba;** **Northwest Territory.**
D. Ca.	Donald Carswell, M.A. Barrister-at-law of the Middle Temple, London.	**Naturalisation** (*in part*).
D. C. J.	D. Caradog Jones. Senior Lecturer in Social Statistics, University of Liverpool.	**Illegitimacy.**

D. F. T.	DONALD FRANCIS TOVEY, MUS.DOC. Reid Professor of Music, Edinburgh University.	Music.
D. G. H.	DAVID GEORGE HOGARTH, C.M.G., D.LITT., F.B.A. Keeper of the Ashmolean Museum, Oxford. President of the Royal Geographical Society, London, 1925. Fellow of Magdalen College, Oxford. Author of *The Ancient East*; *Arabia*; *The Wandering Scholar*; etc.	Lawrence, T. E.
D. Hy.	DOUGLAS HYDE, LL.D., D.LITT. Professor of Modern Irish Language and Literature, University College, Dublin. Founder of the Gaelic League and President thereof, 1893–1915. President of the Irish Texts Society. Author of *A Literary History of Ireland*; *The Love Songs of Connacht*; *The Religious Songs of Connacht*; etc.	Irish Language; Irish Literature, *Gaelic*.
D. L.	COLONEL DAVID LYELL, C.M.G., D.S.O., M.INST.C.E. Director of Pauling & Co. Ltd., London. Chief Railway Construction Engineer to the British Army in France during the World War.	Light Railways, Military.
D. McC.	D. MCCANDLISH, M.SC. Professor of Leather Industries in the University of Leeds.	Leather (*in part*).
D. W.*	DION WILLIAMS. Brigadier General, United States Marine Corps.	Marines (*U.S.A.*).
E. A.*	CAPTAIN EDWARD ALTHAM, C.B., R.N. (RET.). Editor of *The Journal of the United Service Institution*, London. Commanded H.M.S. "General Crawford" in operations at Zeebrugge and Ostend, April 1918.	Jellicoe, Earl; Jutland, Battle of.
E. A. B.	EDWARD ALGERNON BAUGHAN. Dramatic and Film Critic of *The Daily News*, London, and *The Sunday Chronicle*. Formerly editor of *The Musical Standard*. Author of *Music and Musicians*.	Musical Comedy.
E. A. W.	CAPTAIN E. A. WOODS, R.A.	Ordnance (*in part*).
E. Be.	EDUARD BENEŠ. Minister of Foreign Affairs of the Czechoslovak Republic. Prime Minister of Czechoslovakia, 1921–2. Professor of Sociology at the University of Prague, 1922. Author of *Political Partisanship*; *Problems of New Europe and the Foreign Policy of Czechoslovakia*; *Difficulties of Democracy*; etc.	Little Entente.
. B. Ph.	EARLE BERNARD PHELPS. Professor in the College of Physicians and Surgeons, New York City. Formerly Professor of Chemistry in the Hygienic Laboratories, U.S. Public Health Service.	Milk (*in part*).
. Ca.*	EMILE CAMMAERTS. Professor of French Literature at Queen's College, London. Author of *Belgian Poems*; *New Belgian Poems*; *The Treasure House of Belgium*; *Belgium* (The Story of the Nations); etc.	Mercier, Cardinal.
. C. Sn.	ERNEST CHARLES SNOW, M.A., D.SC. Manager, United Tanners' Federation, London. Author of *Leather* in "The Resources of the Empire" series.	Leather (*in part*).
. D. G.	ELMER D. GRAPER, PH.D. Instructor in Government, Columbia University, New York. Author of *American Police Administration*.	New York State.
d. He.	EDOUARD HERRIOT. Prime Minister of the French Republic, 1924 and 1926. Senator 1912–9. Minister of Public Works, 1916–7. Formerly Professor of Rhetoric in the Lycée at Lyons. Author of *Madame Recamier et ses amis*; etc.	Jaurès, Jean.
. E. F. D'A.	EDMUND EDWARD FOURNIER D'ALBE, D.SC. Inventor of the Optophone. Vice-President of the Radio Association. Formerly Lecturer in Physics in the Punjab University. Author of *The Electron Theory*; *Two New Worlds*; *Contemporary Chemistry*; etc.	Optophone.
. E. MacM.	EMILY E. MACMANUS. Matron of the Royal Infirmary, Bristol.	Nursing: *Science and Technique*.
. Ev.	EDWIN EVANS. Formerly musical critic of *The Pall Mall Gazette*, London. Author of *Tchaikovsky*; *The Margin of Music*; etc.	Orchestration.
. Fo.	EVELYN FOX. Hon. Secretary, Central Association for Mental Welfare, London.	Mental Deficiency.
. F. S.	LIEUT.-COL. EDWARD FAIRBROTHER STRANGE, C.B.E. Late Keeper of Woodwork, Victoria and Albert Museum, London. Author of *Alphabets, A Handbook of Lettering*; *Japanese Illustration*; *The Colour Prints of Japan*; *Flowers and Plants for Designers and Schools*; etc.	Handicrafts, Artistic (*in part*).
. G. L.	ERNEST GRAHAM LITTLE, M.D., F.R.C.P., M.R.C.S. M.P. for the University of London. Physician in charge of the Skin Department of St. Mary's Hospital; University of London Lecturer on Dermatology, St. Mary's Hospital Medical School.	London, University of.
. G. S.	EMMA GURNEY SALTER. Formerly of the Geographical section of the Naval Intelligence Department.	Morocco (*in part*).
. J. B.	EDWIN JULIUS BARTLETT, A.M., M.D., D.SC. Emeritus Professor of Chemistry, Dartmouth College, Hanover, New Hampshire, U.S.A.	New Hampshire.

E. J. B.*	Elbert Jay Benton, Ph.D. Professor of History in Western Reserve University, Cleveland, U.S.A. Author of *The Wabash Trade Route*; *International Law and Diplomacy of the Spanish-American War*. Joint author of *Introductory American History*; *History of the United States*.	Ohio.
E. J. C.	Lieut.-Col. E. J. Cummins, D.S.O., R.A. Instructor at the Artillery College, Woolwich.	Ordnance, Military.
E. J. Di.	Emile Joseph Dillon. Foreign Correspondent of *The Daily Telegraph* (London). Author of *Russian Characteristics*; *Maxim Gorky*; *From the Triple to the Quadruple Alliance*; *The Eclipse of Russia*; etc.	Isvolsky, A. P.
E. L. B.*	Edward Leslie Burgin, LL.D. Principal and Director of Legal Studies to the Law Society, London. Member of the General Council of the League of Nations Union. Author of *Administration of Foreign Estates*.	Legal Education (*in part*).
E. L. C.	Edgar Leigh Collis, M.D., M.R.C.P., M.R.C.S. Talbot Professor of Preventive Medicine, Welsh National School of Medicine, Cardiff. Late Director of Health, Ministry of Munitions. H.M. Medical Inspector of Factories, 1908–17.	Industrial Welfare.
E. L. T.	Edward Lee Thorndike, A.M., Ph.D., Sc.D., LL.D. Professor of Psychology, Teachers' College, Columbia University, New York. Author of *Educational Psychology*; *Mental and Social Measurements*; *Animal Intelligence*; *The Original Nature of Man*; etc.	Intelligence Tests.
E. M.*	Elie Moroy.	Hospitals (*in part*).
E. Mi.	Emile Mireaux. Director of the Society for Economic Studies and Information, Paris. Associate Professor at the University of Paris. Author of *La France et les huit heures*; *Les nouvelles formules d'organisation economique*; etc.	France: *Finance*.
E. M. M.	Sir Edward Mortimer Mountain, Bart. Managing Director of the Eagle, Star and British Dominions Insurance Company, London.	Fire Prevention (*in part*).
E. O. J.	Edwin Oakes Jordan, B.S., Ph.D. Professor of Bacteriology and Chairman of the Department of Hygiene and Bacteriology, University of Chicago. Joint editor of *The Journal of Infectious Diseases*. Author of *General Bacteriology*; *Food Poisoning*; etc.	Food Poisoning.
E. R.	Colonel E. Réquin. Military Representative of France on the League of Nations.	Marne, Second Battle of the.
E. Ra.	Eleanor Rathbone, M.A., J.P. Member of the Liverpool City Council. President, National Union of Societies for Equal Citizenship. Author of *The Disinherited Family*; *A Plea for Family Endowment*.	Family Allowances.
E. R. B.*	Edward Richards Bolton, F.I.C., F.C.S. Vice-President of the Institute of Chemistry of Great Britain and Ireland. President of the Society of Public Analysts. Managing Director, Technical Research Works, Ltd., and Director of Loders and Nucoline, Ltd. Author of *Oils, Fats, Waxes and Resins* (with R. G. Pelly).	Margarine (*in part*); Oils and Fats (*in part*).
E. R. J.	Emory Richard Johnson, M.L., Ph.D., Sc.D. Professor of Transportation and Commerce, and Dean of the Wharton School of Finance and Commerce, University of Pennsylvania. Author of *Principles of Railroad Transportation*; *Principles of Ocean Transportation*; etc.	Interstate Commerce.
E. Ru.	Sir Ernest Rutherford, O.M., D.Sc., F.R.S. Cavendish Professor of Experimental Physics and Director of the Cavendish Laboratory, Cambridge University. Professor of Natural Philosophy, Royal Institution, London. Nobel Prizeman for Chemistry, 1908. President of the British Association, 1923. Author of *Radioactivity*; *Radioactive Transformations*; *Radioactive Substances and Their Radiations*; etc.	Matter.
E. S. H.	Elizabeth Sanderson Haldane, C.H., LL.D., J.P. Vice-chairman, Territorial Nursing Service. Deputy President of the Perthshire Branch, British Red Cross Society. Author of *The British Nurse in Peace and War*; *The Life of Descartes*; etc.	Nursing (*in part*).
E. S. R.	Edward Stuart Russell, M.A., D.Sc., F.L.S., F.Z.S. Director of Fishery Investigations, Ministry of Agriculture and Fisheries, London. Author of *Form and Function*; *The Study of Living Things*.	Intelligence, Animal.
E. T.*	Edward Tuthill, M.A., Ph.D. Professor of History, University of Kentucky. Author of *Government of Kentucky*.	Kentucky.
E. T. D'E.	Sir Eustace Henry William Tennyson-D'Eyncourt, K.C.B., F.R.S., M.I.C.E. Managing Director, Armstrong Whitworth and Co., Ltd. Director of Naval Construction at the Admiralty, 1912–24.	Monitor.

E. U.	Evelyn Underhill (Mrs. Stuart Moore). Upton Lecturer on Religion, Manchester New College, Oxford, 1921–2. Hon. Fellow of King's College for Women, University of London. Author of *Mysticism, a Study in the Nature and Development of Man's Spiritual Consciousness*; *Practical Mysticism*; *The Essentials of Mysticism*; etc.	**Mysticism.**
F. A. Cl.	Frederick Albert Cleveland, Ph.B., Ph.D., LL.D. Formerly Professor of United States Citizenship, Maxwell Foundation, Boston University. Author of *Organized Democracy*; *First Lessons in Finance*; etc.	**Massachusetts.**
F. B. M.	Major-General Sir Frederick Barton Maurice, K.C.M.G. Director of Military Operations, Imperial General Staff, 1915–8. Author of *The Russo-Turkish War, 1877–8*: *Forty Days in 1914*; *The Last Four Months*; etc. Contributor to *The Cambridge Modern History.*	**Haig, Earl.**
F. Bo.	Ferrucio Bonavia. Assistant musical critic of *The Daily Telegraph*, London.	**Opera.**
F. D. L.	Rt. Hon. Sir Frederick John Dealtry Lugard, G.C.M.G., C.B., D.S.O. British Member of Permanent Mandates Commission, League of Nations. Governor-General of Nigeria, 1914–9. Governor of Hong Kong, 1907–12. Author of *Our East African Empire*; *The Dual Mandate in British Tropical Africa*; etc.	**Mandates.**
F. E. W.*	Lieut.-Col. Frederick Ernest Whitton, C.M.G. Formerly Secretary, Historical Section, Committee of Imperial Defence, London. Editor of *The Fighting Forces.* Author of *The Marne Campaign*; *The Decisive Battles of Modern Times*; etc.	**Frontiers, Battles of the** (*in part*); **German Offensive** (*in part*); **Marne, First Battle of the.**
F. Fi.	Franz Fischer. Director of Kaiser Wilhelm Institute for Coal Research, Mulheim-on-the-Ruhr. Professor at the Technical High School, Berlin. Member of the Reich Coal Council. Author of *The Conversion of Coal into Oils.*	**Fuel Problems.**
F. Fo.	Ferdinand Foch, O.M., G.C.B. Marshal of France and British Field-Marshal. Commander-in-Chief of the Allied Armies in France, 1918. Member of the *Académie Française* and of the *Académie des Sciences.* Author of *Les Principles de la Guerre.*	**Morale in War.**
F. G. C.	Frederick Gardner Cottrell, Ph.D. Director of the Fixed Nitrogen Research Laboratory, U.S. Department of Agriculture. Inventor of the Fume Precipitation Process.	**Fume Precipitation.**
F. G. K.*	Rt. Hon. Frederick George Kellaway. Managing Director, Marconi's Wireless Telegraph Co., Ltd., and the Marconi International Marine Communication Co., London. Postmaster-General 1921-2.	**Marconi, Guglielmo.**
F. G. Ke.	Sir Frederick George Kenyon, G.B.E., K.C.B., D.Litt. Director and Principal Librarian, British Museum. President of the Bibliographical Society, London, 1924. Honorary Fellow of Magdalen College and of New College, Oxford. Author of *The Buildings of the British Museum.*	**Museums.**
F. G. Y.	Frederick George Young. Dean of the School of Sociology and Professor of Sociology in the University of Oregon. Editor of the *Quarterly Journal* of the Oregon Historical Society. Author of *Financial History of Oregon.*	**Oregon.**
F. H. C.	Fred H. Colvin. Editor of *The American Machinist*, New York.	**Machine Tools.**
F. H. H.	Franklin Henry Hooper. American Editor of *The Encyclopædia Britannica.* Formerly Assistant Editor of *The Century Dictionary.*	**Liberty Loans.**
F. H. H.*	Frank Heywood Hodder, Ph.M. Professor of American History in the University of Kansas. Author of *Civil Government of Kansas*; *Outlines of American History*; etc.	**Kansas.**
F. H. W.	Franklin Harcourt Wentworth. Editor of the quarterly magazine of the American Fire Protection Association. Author of *Factories and Their Fire Prevention*; etc.	**Fire Prevention** (*in part*).
F. J. D.	Engineer-Captain F. J. Drover, R.N. Author of *Marine Engineering Practice*; *Coal and Oil Fired Boilers*; *Marine Engineering Repairs*; etc.	**Flettner Rudder;** **Marine Engineering.**
F. J. Se.	F. J. Sellicks. Football Correspondent to *The Illustrated Sporting and Dramatic News*, London. Joint Editor of *The Blue Magazine*, London.	**Football, Rugby.**
F. Kle.	Fritz Klein, Ph.D. Member of the staff of the *Deutsche Allgemeine Zeitung.*	**Luther, Hans.**
F. L. L.	Lady Lugard, D.B.E. (Flora Shaw). Formerly Head of the Colonial Department of *The Times*, London. Author of *A Tropical Dependency*; etc.	**Nigeria.**
F. P. R.	Frank Plumpton Ramsey. Fellow and Lecturer, King's College, Cambridge.	**Mathematics:** *Logic.*

F. R. C.	Frank Richardson Cana, F.R.G.S. Editorial staff of *The Times* (London). Author of *South Africa from the Great Trek to the Union*; etc. Member of the editorial staff of the *Encyclopædia Britannica*, 11th edition.	**Gambia; Kenya; Liberia; Madagascar; Mozambique; Natal; Nyasaland.**
F. W. A.	Francis William Aston, Sc.D., F.R.S. Fellow of Trinity College, Cambridge; Nobel Prizeman for Chemistry. Author of *Isotopes.*	**Isotopes.**
F. W. Th.	Frederick William Thomas, M.A. Librarian to the India Office, London. Lecturer in Comparative Philology and Reader in Tibetan, University College, University of London. Late Fellow of Trinity College, Cambridge. Hon. Secretary of Royal Asiatic Society and Director, 1921–2. Formerly Editor of *Epigraphia India.*	**Indian Literature.**
G. Ab.	Grace Abbott, M.A. Chief of the Children's Bureau, U.S. Department of Labor. Author of *The Immigrant and the Community.*	**Maternity and Infant Wel- fare** (*in part*).
G. A. Bu.	George Arthur Burls, M.Inst.C.E. Author and joint author with Sir Dugald Clerk, of works on internal combustion engines.	**Internal Combustion Engine.**
G. Ar.	Sir George Compton Archibald Arthur, Bart. Formerly Private Secretary to Earl Kitchener. Author of *The Life of Lord Kitchener of Khartoum.*	**Kitchener, Earl.**
G. B. D.	George Bucknam Dorr, M.A. Founder and Superintendent, under the U.S. Government, of Lafayette National Park, Maine. Author of U.S. Government bulletins on the national parks.	**National Parks and Game Preserves.**
G. Be.	Gertrude Margaret Lowthian Bell, C.B.E. Late Oriental Secretary to the British High Commissioner of 'Iraq. Author of *Review of the Civil Administration of Mesopotamia.*	**'Iraq:** *Political History.*
G. Bo.	George Boncescu. Rumanian correspondent of *The Times* (London).	**Ferdinand, King of Rumania.**
G. C. D.	G. C. Dixon. Literary Editor, *The Daily Mail* (London). Author of *From Melbourne to Moscow.*	**Hughes, W. Morris.**
G. E. B.	George Earle Buckle, M.A., LL.D. Editor of *The Times* (London) 1884–1912. Formerly Fellow of All Souls College, Oxford. Author of *Life of Disraeli* (vol. III., IV., V. and VI).	**Grey of Fallodon, Viscount; Henderson, A.; Lansdowne, Marquess of; Law, A. Bonar; Long, Viscount; Lyttelton, Alfred; McKenna, Reginald; Milner, Viscount, etc.**
G. G. A.	Major-General Sir George Grey Aston, K.C.B. Lecturer on Military History, University College, University of London. Formerly Professor of Fortification at the Royal Naval College, Greenwich. Author of *Sea, Land and Air Strategy*; *Memories of a Marine*; etc.	**Great Britain:** *Defence.*
G. G. A. M.	George Gilbert Aimé Murray, D.Litt., LL.D., F.B.A. Regius Professor of Greek, Oxford University. President of the League of Nations Union. Author of *History of Ancient Greek Literature*; *Rise of the Greek Epic*; *Euripides and his Age*; etc.	**Greek Literature:** *Ancient.*
G. Gl.	George Glasgow. Author and Publicist. Author of *The Minoans*; *Ronald Burrows: a Memoir*; etc.	**Masaryk, T. G.**
G. H. Ga.	George Henry Gater, C.M.G., D.S.O. Education Officer, London County Council. Formerly Director of Education, Lancashire County Council.	**Industrial Schools.**
G. H. H.	Godfrey Harold Hardy, D.Sc., LL.D., F.R.S. Savilian Professor of Geometry, Oxford University; Fellow of New College, Oxford. President of the Mathematical Association, London, and Hon. Secretary, the Mathematical Society. Author of *A Course of Pure Mathematics*; etc.	**Mathematics** (*in part*).
G. L. B.	Guy Leslie Buckeridge, M.R.C.S., L.R.C.P. Surgeon Commander in the R.N.	**Medical Service, Naval** (*in part*).
G. M. G.-H.	Geoffrey Malcolm Gathorne-Hardy, M.C. Barrister-at-Law. Hon. Secretary, British Institute of International Affairs.	**Faeroe Islands.**
G. O'B.	George O'Brien. Author of *Economic History in the 17th Century*; *Economic History of Ireland (1800–47)*; etc.	**Irish Free State:** *Financial and Economic History.*
G. R.*	Lieutenant-Colonel Guido Romanelli. Commandant of the Artillery Headquarters at Messina. Formerly Chief of the Italian Military Mission to Hungary for the Armistice. Commendatore of the Crown of Italy.	**Kun, Bela** (*in part*).

G. S.*	George Sampson, M.A. Inspector of Schools, London County Council. Member of the Departmental Committee on English Studies. Author of *English for the English.* Editor of *Nineteenth Century Essays*; *Cambridge Readings in Literature*; *The Cambridge Book of Verse and Prose*; *etc.*	**Kipling, Rudyard.**
G. Se.	Gilbert Seldes. Author of *The Seven Lively Arts.*	**Motion Pictures:** ***Art.***
G. Sl.	Gilbert Slater, M.A., D.Sc. Formerly Professor of Indian Economics in the University of Madras, and Publicity Officer for Madras, 1921–2. Author of *The Davidian Element in Indian Culture.*	**India (*in part*).**
G. St.	Gustav Stresemann. Minister for Foreign Affairs, Germany. Formerly Chancellor of the Reich. Signed the Pact of Locarno on behalf of Germany, December 1925. Author of *Macht und Freiheit*, etc.	**Locarno, Pact of.**
G. St.*	Sir Gerald Strickland, G.C.M.G., LL.B. M.P. for the Lancaster Division. Member of the Malta Legislative Assembly. Owner and Director of Progress Printing Co., and *The Times* of Malta. Governor of Western Australia 1909–13, and of New South Wales 1914–7. Author of *Correspondence and Remarks on the Constitution of Malta*, etc.	**Malta.**
G. W. K.*	George Washington Kirchwey, LL.D. Head of the Department of Criminology, New York School of Social Work. Formerly Warden of Sing Sing Prison. Author of *Readings in the Law of Real Property*, etc.	**Habitual Offenders.**
G. W. T. B.	G. W. T. Bruins. Professor of Economics at the Rotterdam School of Commerce. Author of the Memorandum prepared for the International Financial Conference at Brussels, 1920.	**Netherlands:** *Financial and Economic History.*
H. A. G.*	Harold Atheling Grimshaw, M.Sc. (Econ.). Lecturer in Public Administration at the London School of Economics, London University. Member of the International Labour Section of the League of Nations.	**Hours of Labour.**
H. B.*	Sir Herbert Atkinson Barker. Specialist in manipulative surgery.	**Manipulative Surgery.**
H. B. Br.	Henry Britten Brackenbury, M.R.C.S., L.R.C.P. Member of the Council of the British Medical Association. Chairman of the Insurance Acts Committee, London.	**Insect Bites and Stings;** **Insurance, Social (*in part*).**
H. B. C. P.	Hugh B. C. Pollard. Late Editor of *Discovery*, London. Author of *A History of Firearms*, etc.	**Microscopy.**
H. Bi.*	Henri Bidou. Member of the staff of *Le Journal des Débats* (Paris). Chevalier of the Legion of Honour.	**Galliéni, General;** **Joffre, Marshal;** **Lanrezac, General.**
H. B. M.	H. B. Meek. Professor in charge of Hotel Courses at the New York State College of Home Economics, Cornell University.	**Food Service.**
H. Br.*	Henri Brenier. Director-General of the Chamber of Commerce, Marseilles. General Secretary to the National Colonial Exhibition at Marseilles, 1922, and to the Colonial Organisation Congress, 1922.	**Indo China, French;** **Morocco (*in part*).**
H. Bra.	Herbert Brande. Advertising Manager, New York. Formerly editorial writer on *The Chicago Tribune.*	**Instalment Selling (*in part*).**
H. C. D.	Harrison Clifford Dale, A.M. Professor of Economics and Political Science, University of Idaho. Author of *The Ashley-Smith Exploration and the Discovery of a Central Route to the Pacific: 1822–1829*, etc.	**Idaho.**
H. Ch.	Hugh Chisholm, M.A. Editor of the 11th and 12th editions of *The Encyclopædia Britannica.*	**George V. (*in part*);** **Montessori System.**
H. C. P.*	Rt. Hon. Sir Horace Curzon Plunkett, K.C.V.O., F.R.S. Vice-President of the Department of Agriculture and Technical Instruction for Ireland, 1899–1907. Founder of the Irish Agricultural Organisation Society, 1894. Commissioner, Congested Districts Board, Ireland, 1891–1918. Chairman of the Irish Convention, 1917–8. Author of *Ireland in the New Century*, etc.	**Ireland:** *Agriculture.*
H. C. Wa.	H. C. Watts.	**Mauritius.**
H. D. K.	Harry Dexter Kitson, A.M., Ph.D. Professor of Psychology, University of Indiana. Author of *Scientific Study of the College Student*; *Manual for the Study of the Psychology of Advertising and Selling*; *The Mind of the Buyer*; etc.	**Job Analysis.**

H. F.	Henry Ford. Organiser and President of the Ford Motor Co. Author (with Samuel Crowther) of *My Life and Work* (1922).	**Mass Production.**
H. F. Ba.	Henry Frederick Baker, Sc.D., F.R.S. Lowndean Professor of Astronomy and Geometry, Cambridge University. Fellow of St. John's College, Cambridge. Senior Wrangler (equal), 1887, and first Smith's Prizeman, 1889.	**Geometry.**
H. F. O.	Henry Fairfield Osborn, D.Sc., LL.D., Ph.D. Honorary Curator of the Department of Vertebrate Palaeontology of the American Museum of Natural History. Senior Geologist, United States Geological Survey. Research Professor of Zoology, Columbia University, New York. Author of *Age of Mammals*; *Men of the Old Stone Age*; *Origin and Evolution of Life*; etc.	**Mongolia, Palaeontologic Discoveries in** (*in part*).
H. Gu.	Hugh Gunn, M.A. Director of Education and Member of the Legislative Council, Orange River Colony, 1902–10. Editor of *The British Empire*.	**Hertzog, General.**
H. H.*	Harry Hansen. Literary Editor of *The Daily News*, Chicago. Book critic for *Harper's Magazine*. Author of *The Adventures of the Fourteen Points*.	**Lawson, Victor.**
H. H. L. B.	Hugh Hale Leigh Bellot, H.A., D.C.L. Barrister-at-Law. Honorary secretary of the International Law Association. Formerly Acting Professor of Constitutional Law in the University of London. Author of *The Law of Children and Young Persons*. Editor of Pitt Cobbett's *Leading Cases on International Law*; etc.	**Marriage Laws.**
H. H. M.	Henry Herman Meyer, A.M., D.D. Editor of Sunday School Publications of the Methodist Episcopal Church, U.S.A. Author of *The Lesson Handbook* (annual); *The Graded Sunday School in Principle and Practice*.	**Methodism** (*in part*).
H. I. P.	Herbert Ingram Priestley, M.A., Ph.D. Professor of Mexican History and Librarian of the Bancroft Library, University of California. Author of *The Mexican Nation*; etc.	**Guatemala; Honduras; Mexico; Nicaragua.**
H. J. F.	Herbert John Fleure, D.Sc. Professor of Geography and Anthropology, University College of Wales Aberystwyth. Hon. Secretary, Geographical Association; and Hon. Editor of *The Geographical Teacher*. Author of *Human Geography in Western Europe*, etc.	**Geography; Human Geography.**
H. J. G.	Sir Henry Gauvain, M.D., M.Ch. Medical Superintendent, Lord Mayor Treloar Cripples' Hospital and College, Alton and Hayling Island, Hants. Hon. Consulting Surgeon to the Welsh National Memorial Association for the treatment of Tuberculosis. Consultant in Surgical Tuberculosis to the London, Essex and Hampshire County Councils.	**Heliotherapy.**
H. J. G.*	Hippolyte Jean Giraudoux. Chevalier of the Legion of Honour. Author of *Amica America*; *La Prière sur la Tour Eiffel*; etc.	**France:** *Colonies*.
H. J. Go.	Herman John Gough. Of the National Physical Laboratory, Teddington, Middlesex.	**Fatigue of Metals.**
H. J. R.	Capt. H. J. Round, M.C. Of the Marconi Wireless Telegraph Co., Ltd.	**Microphone.**
H. L. C.	Hugh Longbourne Callendar, M.A., LL.D., F.R.S. Professor of Physics at the Imperial College of Science, South Kensington, London. Formerly Fellow of Trinity College, Cambridge. Author of *Properties of Steam*; *Thermodynamic Theory of Turbines*.	**Heat.**
H. M. P.	Rt. Hon. Hugh McDowell Pollock. M.P. for South Belfast. Minister of Finance, Northern Ireland. Late Chairman, Belfast Chamber of Commerce.	**Ireland, Northern:** *Financial and Economic History*.
H. P. M.	H. P. Macomber. Secretary and Treasurer, Society of Arts and Crafts, Boston, Massachusetts.	**Handicrafts, Artistic** (*in part*).
H. R. A.	Hon. Herbert R. Atkinson. Instructor at the Artillery College, Woolwich. Formerly Experimental Officer at the Small Arms School, Hythe, Kent.	**Machine Guns.**
H. Ro.	Sir Humphry Davy Rolleston, Bart., K.C.B., M.D., D.Sc., D.C.L. Regius Professor of Physic, Cambridge University. Physician in Ordinary to His Majesty King George V. President of the Royal College of Physicians of London. Author of *Diseases of the Liver*; etc.	**Goitre; Medicine.**
H. Sa.	Hirosi Saito, M.A. Secretary of Embassy and Consul in the Japanese Diplomatic and Consular Service. Member of the Japanese Delegation to the Peace Conference in Paris, 1919, and to other Inter-Allied and International Conferences in Europe, 1919–21.	**Formosa** (*in part*); **Japan** (*in part*); **Korea** (*in part*).
H. S. G.	Henry Solon Graves, LL.D. Provost, Dean of the School of Forestry and Sterling Professor of Forestry, Yale University.	**Natural Resources, Conservation of.**

H. Sp.	E. Harold Spender, LL.D. Formerly on the staff of *The Pall Mall Gazette*, *The Westminister Gazette*, *The Daily Chronicle*, *The Manchester Guardian*, and *The Daily News*. Author of *A Briton in America*; *David Lloyd George*; *Herbert Henry Asquith*; *The Cauldron of Europe*; etc.	**George, David Lloyd.**
H. St. J. B. P.	Harry St. John Bridger Philby, C.I.E. Chief British Representative in Transjordan, 1921–4. Commander, British Political Mission to Central Arabia, 1917–8. Author of *The Heart of Arabia.*	**Hejaz.**
H. T.*	Harry Taylor, D.S.M. General in United States Army. Chief of Engineers, United States War Department.	**Great Lakes and St. Lawrence;** **Mississippi** (*River*).
H. W.*	Harold W. T. Wager, D.Sc., F.R.S. H.M. Inspector of Schools, Secondary Branch, Board of Education, London. Hon. Lecturer in Botany in the University of Leeds. Author of *Physiology of Plants*; *Teaching of Botany*; etc.	**Mycology.**
H. W. H. K.	Henry William Howard Knott. Barrister-at-Law. Formerly Lecturer at the Law School of the University of Manitoba, Winnipeg.	**Hughes, Charles E.**
H. W. V. T.	Harold William Vazeille Temperley, M.A., Litt.D., O.B.E. University Reader in Modern History and Fellow of Peterhouse, Cambridge. British Representative on the Albanian Frontiers Commission, 1921. Military Adviser at the Peace Conference, Paris, 1919. Editor of *A History of the Peace Conference of Paris.* Contributor to *The Cambridge Modern History* and *The Cambridge History of Foreign Policy.*	**Neuilly, Treaty of, etc.**
H. W. W.	Herbert Wrigley Wilson, M.A. Chief Leader Writer on *The Daily Mail*, London. Author of *Ironclads in Action.* Contributor to *The Cambridge Modern History.*	**Northcliffe, Viscount.**
. Fi.	Imre Ferenczi. Member of the Diplomatic Division of the International Labour Office, Geneva.	**Migration.**
. G.	Sir Israel Gollancz, Litt.D., F.B.A. Secretary of the British Academy. University Professor of English Language and Literature, King's College, London. Fellow of King's College. President of the Philological Society, London, 1919–22.	**Learned Societies.**
. Max.	Sir Ivor Maxse, K.C.B., D.S.O. General Officer Commanding 19th Division 1914–7 and XVIII. Corps 1917–8. Inspector-General of Training to the British Armies in France, 1918–9. Commander-in-Chief, Northern Command, England, 1919–23. Author of *Seymour Vandeleur.*	**Infantry.**
. A. H. C.	James A. H. Catton. Editor of *The Athletic News*, Manchester, 1900–24. Contributor on athletic subjects to *The Observer* (London) and *The Evening Standard* (London).	**Football, Association.**
. A. J.	James Alton James, B.L., Ph.D. Professor of History and Dean of Graduate School, Northwestern University, Illinois. Author of *George Rogers Clark.*	**Illinois.**
. Al.	Sir James Allen, G.C.M.G. Formerly High Commissioner in London for New Zealand; Minister of Finance, Minister of Education and Minister of Defence, New Zealand.	**New Zealand:** *Political History.*
. A. Ro.	James Alexander Robertson, Ph.B., L.H.D. Research Professor of American History, John B. Stetson University, Deland, Florida. Formerly Chief of the Near Eastern Division Bureau of Foreign and Domestic Commerce, Department of Commerce, Washington, D.C. Co-Editor of Blair and Robertson's *The Philippine Islands, 1493–1898.*	**Guam.**
. A. T.	John Arthur Thomson, M.A., LL.D. Regius Professor of Natural History in the University of Aberdeen. Gifford Lecturer, St. Andrew's, 1915. Terry Lecturer, Yale University, 1924. Author of *The Study of Animal Life*; *Outlines of Zoology*; *Heredity*; *Darwinism and Human Life*; *What is Man? Concerning Evolution.* Joint Author (with Professor Patrick Geddes) of *Evolution*; *Sex*; *Biology.*	**Heredity.**
. A. W.	James Albert Woodburn, Ph.D., LL.D. Professor of American History, Indiana University. Author of *The American Republic and its Government*; etc.	**Indiana.**
. B. S.	James Brown Scott, A.M., J.U.D. President of the American Institute of International Law. Editor-in-Chief of *The American Journal of International Law.* Trustee and Secretary of the Carnegie Endowment for International Peace. Author of *An International Court of Justice*; etc.	**Naturalisation** (*in part*).
. Ci.	Jaroslav Cisar, Ph.D. Secretary on Special Mission, Czechoslovakian Legation, London. Author of *The Czecho-Slovak Republic.*	**Jebavy, V.**
. C. K.	J. C. Kielstra. Professor of Colonial Economics in the School of Agriculture, Wageningen, Holland.	**Guiana, Dutch.**

J. C. McL.	John Cunningham McLennan, LL.D., D.Sc., F.R.S. Professor of Physics and Director of the Physical Laboratory, University of Toronto. Formerly President, Royal Canadian Institute and Royal Society of Canada. Scientific Adviser to the British Admiralty, 1919. Author of numerous papers on radioactivity, the production and liquefaction of helium, and spectroscopy.	**Helium.**
J. Co.	Joseph L. Cohen, M.A. Lecturer in Economics, Cambridge University. Member of the Advisory Committee on Social Insurance of the International Labour Office. Author of *Insurance against Unemployment*; *Insurance by Industry Examined*; *Workmen's Compensation in Great Britain*; *Social Insurance Unified*; etc.	**Insurance, Social** (*in part*).
J. de G. H.	J. de Graaff Hunter, M.A., Sc.D. Mathematical Adviser to the Survey of India. Author of *Formulae for Atmospheric Refraction and their Application to Terrestrial Refraction and Geodesy*; etc.	**Geodesy.**
J. D. Ro.	John Davy Rolleston, M.A., M.D. Medical Superintendent, Western Fever Hospital, Metropolitan Asylums Board, London. Formerly Senior Assistant Medical Officer, Grove Hospital, London. Editor *The British Journal of Children's Diseases.*	**Infectious Fevers.**
J. Du.	Major-General John Duncan, C.M.G., D.S.O. Commanded the 11th Division in Gallipoli, 1915, and the 22nd Division in Macedonia.	**Italy:** *Defence.*
J. E.*	Rev. John Elsworth. Minister of the Wesleyan Methodist Church. Member of Committees for arranging the details of Methodist Reunion.	**Methodism** (*in part*).
J. E. C.	Janet Elizabeth Courtney, O.B.E. J.P. (Mrs. W. L. Courtney). Author of *Free Thinkers of the Nineteenth Century*; *Recollected in Tranquillity.* Joint-author of *Pillars of Empire.* Joint-author of Index to the 11th Edition of *The Encyclopædia Britannica.*	**George V.** (*in part*), **etc.**
J. E. H. R.	James Ernest Helme Roberts, M.B., B.S., F.R.C.S. Surgeon with charge of out-patients, St. Bartholomew's Hospital, London. Senior Surgeon, Brompton Hospital for Consumption and Diseases of the Chest, London.	**Heart and Lung Surgery.**
J. E. S. B.	John Edward Spencer Brind, C.B., C.M.G., D.S.O. Deputy Director of Military Operations and Intelligence at the War Office, London, 1923. Temporary Colonel Commandant attached to the Aldershot Command Staff.	**German Offensive:** *Battle of the Lys.*
J. E. Se.	John Edward Sears, C.B.E., M.A., M.I.Mech.E., A.M.Inst.C.E. Deputy Warden of the Standards, Board of Trade, London, and Superintendent of the Metrology Department, National Physical Laboratory, Teddington, Middlesex.	**Measurements;** **Measuring Instruments.**
J. E. T. H.	John Ernest Troyte Harper, M.V.O., C.B. Rear Admiral R.N. Director of Navigation at the Admiralty, 1919–21. Commanded His Majesty's yacht "Victoria and Albert," 1911–4. Compiler of a special report on the Battle of Jutland.	**Navigation.**
J. E. W.*	Jeanne Elizabeth Wier. Professor of History and Political Science in the University of Nevada. Executive Secretary of the Nevada Historical Society.	**Nevada.**
J. F.	James Ford, Ph.D. Associate Professor of Social Ethics in Harvard University. Sometime Division Manager, U.S. Housing Corporation. Editor of the *Report* of the U.S. Housing Corporation. Author of *Co-operation in New England*; and *Social Problems and Social Policy.*	**Housing:** *United States.*
J. F. C. F.	John Frederic Charles Fuller, D.S.O. Military Assistant to the Chief of the Imperial General Staff. Chief General Staff Officer, Tank Corps, 1917–8. Formerly Chief Instructor, Staff College, Camberley. Author of *Tanks in the Great War*; *The Reformation of War*; *Sir John Moore's System of Training*; etc.	**German Offensive:** *St. Quentin.*
J. F. N.	Rev. Joseph Fort Newton. Formerly Pastor of the Church of the Divine Paternity, New York City. Editor of *The Master Mason.*	**Freemasonry** (*in part*).
J. G. B.	Sir Joseph Guinness Broodbank. Chairman of the Dock and Warehouse Committee of the Port of London Authority, 1909–20. President of the Institute of Transport, 1923–4. Author of *History of the Port of London.*	**London, Port of.**
J. G. C.*	Hon. Joseph Gordon Coates, M.C. Prime Minister of New Zealand. Formerly Postmaster-General and Minister of Public Works, Railways, Telegraphs, Roads and Public Buildings, and Native Affairs.	**New Zealand:** *Economic and Financial History.*
J. G. D.	James G. Douglas. Vice-Chairman of the Senate of the Irish Free State, 1925. Chairman of the Board of the National Land Bank, Ltd.	**Irish Free State:** *Constitution.*

G. de R. H.	Joseph Gregoire de Roulhac Hamilton, Ph.D. Kenan Professor of History and Government in the University of North Carolina. Author of *Reconstruction in North Carolina*; *North Carolina since 1880*; etc.	**North Carolina.**
G. Sm.	John George Smith, M.A., M.Com. Mitsui Professor of Finance, University of Birmingham. Member of the Warwickshire Agricultural Wages Committee. Author of *Organised Produce Markets*; etc.	**Marketing** (*in part*).
H.*	Julius Hirsch, Ph.D. Formerly Minister of Public Works in the German Reich.	**Germany:** *Finance.*
H. Go.	John Henry Gorvin, C.B.E. General Secretary to the International Relief Credits Committee, Paris, 1921. Representative in Russia of the High Commissioner for Russian Relief, 1922–3, and of the Refugee Section of League of Nations, 1923–5.	**Nansen, Fridtjof.**
H. H.*	Very Rev. Joseph Herman Hertz, Ph.D., Litt.D. Chief Rabbi of the United Hebrew Congregations of the British Empire. Chairman of the Administrative Board, Institute of Jewish Studies, University of Jerusalem. President of the Jews' College, London. Author of *The Jew in South Africa*; *A Book of Jewish Thoughts*; etc.	**Judaism.**
H. Ho.	Jacob H. Hollander, Ph.D. Professor of Political Economy in Johns Hopkins University, Baltimore. Treasurer of Porto Rico, 1900–1. Financial Adviser of the Dominican Republic, 1908–10. Author of *The Abolition of Poverty*; *War Borrowing*; etc.	**Haiti.**
H. Hu.	John H. Hubback. International Institute of Agriculture, Rome. Formerly President of the Liverpool Corn Trade Association.	**Grain Trade** (*in part*).
H. Mo.	John Hartman Morgan, K.C., M.A. Barrister-at-Law; Professor of Constitutional Law, University College, University of London. Deputy-Adjutant-General, Interallied Military Commission of Control in Germany, 1919–23. Author of *The Place of a Second Chamber in the Constitution*; *The New Irish Constitution*; etc.	**Great Britain:** *Constitution.*
H. O.	Joseph Houldsworth Oldham, M.A. Secretary, International Missionary Council, London. Editor, *The International Review of Missions*. Author of *The World and the Gospel*; *Christianity and the Race Problem*; etc.	**Missions.**
H. S.	J. H. Sutcliffe, O.B.E. Secretary of the British Optical Association.	**Optical Glass.**
H. W.	J. H. Walker. Superintendent of Central Heating, Detroit Edison Company. Joint Author of *Heating and Ventilation* (1918). Past President of the *National District Heating Association*.	**Heating and Ventilation.**
J.	James Johnstone, D.Sc. Professor of Oceanography, University of Liverpool. Author of *Conditions of Life in the Sea*; *British Fisheries*; etc.	**Oceanography.**
J. D.	James John Davis. United States Secretary of Labor.	**Labor, Department of.**
J. T.	Sir Joseph John Thomson, O.M., C.M., Sc.D., F.R.S. Master of Trinity College, Cambridge. Hon. Professor of Physics, Cambridge University and Royal Institution, London. President of the Royal Society, London, 1916–20. Nobel Prizeman for Physics, 1906. Author of *Conduction of Electricity through Gases*; *The Structure of Light*; etc.	**Gases, Electrical Properties of.**
K.	Joseph Kitchin, F.S.S. London Manager of the Union Corporation, Ltd.	**Gold.**
La.	James Laver. Department of Engraving, Illustration and Design, Victoria and Albert Museum, South Kensington, London.	**Illustration** (*in part*).
. L.*	John Livingston Lowes, Ph.D. Professor of English and formerly Dean of the Graduate School of Arts and Sciences, Harvard University. Author of *Convention and Revolt in Poetry*.	**Amy Lowell.**
u.	Julien Luchaire. Director of the Bureau of Intellectual Co-operation, Paris. Honorary Professor, University of Grenoble; late Inspector-General of Public Instruction in France.	**Intellectual Co-operation.**
M. L.	James Miller Leake, Ph.D. Professor of History and Political Science in the University of Florida. Author of *The Virginia Committee System and the American Revolution*; etc.	**Florida.**
M. L.*	James Melvin Lee, Litt.D. Director of the Department of Journalism, New York University. Literary editor of *The Editor and Publisher*. Author of *A History of American Journalism*; etc.	**Newspapers** (*in part*).

J. M. M.	John Malcolm Mitchell, M.C., F.S.A. (Scot.). Secretary, Carnegie United Kingdom Trust. Vice-President, Library Association. Author of *The Public Library System of Great Britain and Ireland.* Editor of *The Rural Libraries Handbook* (1922), etc.	**Libraries.**
J. N. M.*	John Nicholas Mavrogordato. Author of *Cassandra in Troy*; *Letters from Greece*; *The World in Chains*; etc.	**Greece** (*in part*).
Jo. B.	Joshua Bloch. Chief of the Jewish Division, New York Public Library.	**Hebrew Literature.**
J. P. V.-S.	John Patrick Villiers-Stuart, C.B., D.S.O. Colonel, Indian Army (ret.). Served N.W. Frontier, India, 1901–2; East Africa 1903–4; European War 1914–8.	**Mountain Warfare.**
J. R. M.	Rt. Hon. James Ramsay MacDonald, M.P. Prime Minister of Great Britain, 1923–4. Chairman of the Parliamentary Labour Party and Leader of His Majesty's Opposition. Author of *Socialism and Society*; *Labour and the Empire*; *The Social Unrest*; *Parliament and Revolution*; etc.	**Labour Party.**
J. S. Fa.	John Shields Fairbairn, M.B., B.Ch., F.R.C.S., F.R.C.P. Obstetric Physician and Lecturer on Midwifery and Diseases of Women, St. Thomas's Hospital, and Physician, General Lying-in Hospital, London. Author of *A Textbook for Midwives*; *Gynaecology with Obstetrics*; etc.	**Obstetrics.**
J. S. G.*	John Stanley Gardiner, F.R.S., F.L. Professor of Zoology and Comparative Anatomy, Cambridge University. Director of Scientific Investigations, Ministry of Agriculture and Fisheries, London.	**Fisheries.**
J. Sh.	John Shapley. Morse Professor of the Literature of the Arts of Design, New York University. President of the College Art Association of America. Editor of *The Art Bulletin.* Associate Editor of *The American Journal of Archaeology.*	**Mural Painting.**
J. S. M. W.	John Sebastian Marlow Ward, M.A., F.S.S.S. Head of the Intelligence Department of the Federation of British Industries. Author of *Textile Fibres and Yarns of the British Empire*; *An Outline History of Freemasonry*; etc.	**Fibres;** **Freemasonry** (*in part*).
J. T. H.	John Theodore Hewitt, M.A., D.Sc., Ph.D., F.R.S. Formerly Professor of Chemistry, East London College, University of London. Author of *Synthetic Colouring Matters*, etc.	**Nitrogen, Fixation of.**
J. Vi.	Jonas Viles, Ph.D. Professor of American History in the University of Missouri. Author of *History of Missouri*; *Outline of American History*; etc.	**Missouri.**
J. We.*	Joseph Wells. Vice-Chancellor of Oxford University and Warden of Wadham College. Formerly Fellow and Tutor of Wadham College. Author of *Oxford and its Colleges*; *Wadham College*; *The Charm of Oxford*; etc.	**Oxford.**
J. W. G.	John Walter Gregory, D.Sc., F.R.S. Professor of Geology in the University of Glasgow. Author of *The Great Rift Valley*; *The Dead Heart of Australia*; *The Menace of Colour*; etc.	**Geology.**
J. W. Go.	James Winder Good. Assistant Editor, *The Irish Statesman.* Irish Correspondent of *The New Statesman* and *The Manchester Guardian.* Author of *Ulster and Ireland*; *Irish Unionism.*	**Irish Free State:** *Defence.*
J. Wi.	James Williamson, M.I.C.E. Member of the firm of Sir Alexander Gibb and Partners, Engineers, London.	**Ferro-Concrete Engineering.**
J. Wi.*	Sir James Glenny Wilson. Formerly President of the New Zealand Farmers' Union.	**Grain Trade** (*in part*).
J. W. P.	J. W. Pearson. Managing Director, British Oil and Cake Mills, Ltd., London.	**Oils and Fats** (*in part*).
J. W. T.	John Wilson Taylor, A.M., Ph.D. Assistant to the American Editor of *The Encyclopædia Britannica.* Formerly Professor of Greek, Ohio University.	**Herbert C. Hoover.**
K. B.	Karl Ballod. Professor of Economics, University of Riga.	**Latvia:** *Financial and Economic History.*
K. C. M. S.	Kenneth Charles Morton Sills, M.A., LL.D. President of Bowdoin College, Brunswick, Maine. President of the Board of Visitors to the Naval Academy at Annapolis, 1920–1.	**Maine.**
K. M.	Kengo Mori. Financial Commissioner of Japan in London, Paris and New York.	**Formosa** (*in part*); **Japan** (*in part*); **Korea** (*in part*).
K. No.	Karl Nordhoff. Of the statistical section of the Reichsbank, Berlin.	**Germany:** *Currency.*
K. P.	Karl Pribram. Director of the Investigation Department, International Labour Office, Geneva. Professor of Political Economy and Statistics, University of Vienna.	**Housing** (*in part*).

. S. L.	Kenneth Scott Latourette, M.A., Ph.D., D.D. Professor of Missions, Yale University. Formerly Professor of History, Denison University, Granville, Ohio. Author of *The Development of China*; *History of Early Relations Between the United States and China, 1784–1844*; etc.	**Manchuria; Mongolia.**
. von O.	Karlludwig von Oertzen. Chief of the Intelligence branch of the personal staff of the Ministry of Defence, Berlin.	**Germany:** ***Defence.***
. Ab.	Lascelles Abercrombie, M.A. Professor of English Literature, University of Leeds. Formerly Lecturer in Poetry, University of Liverpool. Author of *Thomas Hardy, A Critical Study*; *Theory of Art*; *Theory of Poetry*; *Idea of Great Poetry*; etc.	**Hardy, Thomas.**
C. H.	L. Coke Hill, M.E.I.C. Chief Engineer for John S. Metcalf Co. Ltd., Montreal.	**Grain Elevators.**
D. W.	Lilian D. Wald. President of the Henry Street Settlement and of the Social Halls Association, New York City. Vice-President of the New York Association for Parks and Playgrounds, etc. Author of *The House on Henry Street.*	**Nursing** (*U.S.A.*).
E.	Luigi Einaudi. Professor of Finance in the University of Turin and in the Commercial University Luigi Bocconi of Milan. Senator of the Kingdom of Italy. Editor of *La Reforma Sociale.* Author of *Corso de Scienza della Finanza*; *La guerra e il systema tributario italiano*; etc.	**Italy:** *Financial and Economic History.*
E. H.	Leonard Erskine Hill, F.R.S. Director of the Department of Applied Physiology, National Institute of Medical Research, Hampstead, London. Formerly Professor of Physiology, London Hospital. Author of *Manual of Physiology*; etc.	**Kata Thermometer.**
F. R.	L. F. Richardson, F.R.S. Lecturer in Physics, Westminster Training College, London.	**Meteorology** (*in part*).
F. Sh.	L. F. Sheppick. Assistant Editor of *Milling*, London.	**Flour Milling.**
G.*	Leon Gaster. Hon. Secretary of the Illuminating Engineering Society, London.	**Illumination Engineering.**
G. R.	Leander Gaspard Roussin, C.M.G. British Delegate on the International Financial Commission, Athens. Formerly Financial Secretary to the Ministry of Finance, Cairo.	**Greece** (*in part*).
J. S.	Leonard James Spencer, Sc.D., F.R.S. Assistant Keeper, Mineral Department, Natural History Museum, London. Editor of *The Mineralogical Magazine.* Author of *The World's Minerals.*	**Mineralogy.**
L.	Louis Loucheur. Minister of Finance in the French Cabinet, and Minister for the Liberated Regions of France in the Briand Cabinet, 1921–2. Minister of Munitions in the Clemenceau Cabinet, 1917–20.	**France:** *Invaded Regions.*
M.	Emile Marie Louis Madelin, D. ès L. Chairman of the French Alliance of the United States and of Canada, 1907–8. Chevalier of the Legion of Honour. Author of *La bataille de France*; *Les Heures merveilleuses d'Alsace et de Lorraine*; *L'expansion française*; etc.	**Foch, Marshal.**
McC. N.	Louis McCoy Nulton. Rear Admiral, U.S. Navy, and Superintendent, U.S. Naval Academy.	**Naval Academy** (*U.S.A.*).
M. F.	Leonard M. Fanning. Director of Publicity and Statistics, American Petroleum Institute. Editor of *The Oil Trade Journal.*	**Gasolene.**
.	Right Hon. the Marquess of Londonderry, K.G. Formerly Minister of Education, Northern Ireland. Chancellor of Queen's University, Belfast.	**Ireland, Northern:** *Political History.*
Pr.	Lionel George Preston, C.B. Rear-Admiral R.N. Commanded the Patrol, Minesweeping, Training and Fishing Protection Flotilla, 1919–20. Director of the Minesweeping Division, Admiralty, London, 1917–9.	**Minelaying and Minesweeping.**
R. B.	Lydia Ray Balderston, B.S., M.A. Instructor in Household Arts, Teachers College, Columbia University, New York. Author of *Laundering*; *Housewifery.*	**Laundry Work.**
Ri.	Louis Ripault. Private Secretary to the President of the Chamber of Deputies, France. Author of *Histoire du Canada*; *Histoire des Etats-Unis*; etc.	**Herriot, Edouard.**
Ro.	Sir Leonard Rogers, C.I.E., M.D., F.R.S., F.R.C.P., F.R.C.S. Member of Medical Board, India Office, London. Physician and Lecturer, London School of Tropical Medicine. Late Professor of Pathology, Medical College, Calcutta.	**Kala-Azar; Leprosy.**

L. St.	LEONARD STEIN. Of the Zionist Organisation, London.	**Jews.**
Lt.	RIGHT HON. LORD LOVAT (Simon J. Fraser), K.T., K.C.M.G., K.C.V.O., D.S.O. Formerly Director of Forestry, British Expeditionary Force in France. Chief Commissioner, Forestry Commission of Great Britain.	**Forestry.**
L. T.	LEV DAVIDOVICH TROTSKY. Head of the Central Committee for Concessions, Union of Soviet Republics. Formerly People's Commissar for Foreign Affairs, and Commissar for War, Moscow.	**Lenin, Nikolai.**
L. V.*	LUIGI VILLARI. Member of the Staff of the League of Nations, 1920–3. Subsequently attached to the Emigration Department of the Italian Foreign Office. Commendatore of the Crown of Italy. Author of *Italian Life in Town and Country*; *The Awakening of Italy*; etc.	**Fascism;** **Italy:** *Political History*; **Mussolini, B.;** **Nitti, Francesco.**
L. Wi.	LOUIS WILEY, LL.D. Business Manager of *The New York Times.*	**Ochs, Adolf.**
M. A. C.*	MAURICE ALAN CASSIDY, M.D., F.R.C.P. Physician in charge of Out-Patients and of Electro-Cardiographic Department, St. Thomas's Hospital, London. Physician to the Metropolitan Police and to the Lord Mayor Treloar Cripples' Hospital, Alton.	**Heart Diseases.**
M. A. H.	MARY AGNES HAMILTON. Member of the Balfour Committee on British Trade and Industry. Member of the staff of *The Economist*, London, etc. Under the pen name of "Iconoclast" wrote *The Man of Tomorrow*; *J. Ramsay MacDonald*; etc.	**MacDonald, J. R.**
M. A. Van G.	M. A. VAN GENNEP. Editor, *Revue de Folklore.* Author of *Totémisme*, etc.	**Folklore.**
M. Bo.	MARGARET GRACE BONDFIELD. M.P. for the Wallsend Division. Parliamentary Secretary to the British Ministry of Labour, 1924. Labour adviser to Labour Convention at Washington, 1919. Hon. Secretary of the National Federation of Women Workers. Chairman, General Council of the Trade Union Congress, 1923.	**Maternity and Infant Welfare** (*in part*).
M. Bo.*	MORITZ JULIUS BONN. Professor of Economics at the School of Commerce, Berlin. Author of *Die englische Kolonisation in Irland*; *Amerika als Feind*; etc.	**Germany:** *Economic and Financial History.*
M. C. M.	MAX CORNILS MANGELS. Legal member of the department for administering the Kiel Canal.	**Kiel Canal.**
Me.	RIGHT HON. LORD MESTON, K.C.S.I., LL.D. Secretary to Finance Department, Government of India, 1906–12. Formerly Lieut.-Governor, United Provinces of Agra and Oudh. Represented India on the Imperial War Cabinet, and at the Imperial Conference, 1917. Finance Minister on Executive Council of the Governor-General of India, 1919.	**Gandhi, M. K.;** **India** (*in part*).
M. Gu.	M. GUILLAUME. Managing director of *Le Petit Journal*, Paris.	**Lyautey, General;** **Mangin, General;** **Nivelle, General.**
M. L. R.	MCKENDREE LLEWELLYN RANEY. Librarian of Johns Hopkins University, Baltimore.	**Johns Hopkins University.**
M. Mac.	SIR MURDOCH MACDONALD, K.C.M.G., M.INST.C.E. M.P. for Inverness. Consulting Civil Engineer. Late Adviser and Under-Secretary of State for Public Works in Egypt. Civil Engineer, Assuan Dam Protective and Heightening operations, and Isna Barrage Construction.	**Irrigation Engineering.**
M. Mo.	MURIEL MONTGOMERY. General Secretary, Girl Guides Association, London.	**Girl Guides.**
M. N.	MARION I. NEWBIGIN, D.SC. Editor of *The Scottish Geographical Magazine.* Author of *A Geographical Study of the Peace Terms*; *Mediterranean Lands*; etc.	**Mediterranean Sea.**
M. N. T.	M. N. TCHERKINSKY. Chief Editor in the Bureau of Economic and Social Intelligence of the International Institute of Agriculture, Rome.	**Land Tenure.**
M. of B.	RIGHT HON. LORD MONTAGU OF BEAULIEU. Adviser on Mechanical Transport Services to the Government of India, 1915–9. Vice-President of the Royal Automobile Club, London. Founder and former editor of *The Car* (London).	**Motoring.**
M. S.	MAY SMITH, M.A. Senior Investigator to the Industrial Fatigue Research Board, Medical Research Council, London.	**Industrial Psychology.**
N. M. Pe.	NORMAN MOSLEY PENZER, M.A., F.R.G.S., F.G.S. Author of *Cotton in British West Africa*; *The Tin Resources of the British Empire*; *The Mineral Resources of Burma*; *Non-Ferrous Metals and other Minerals*; etc.	**Lead;** **Manganese;** **Mica;** **Nickel.**

G. L.	ORIN GRANT LIBBY, PH.D. Professor of American History, University of North Dakota. Secretary of the North Dakota State Historical Society. Editor of *Collections of State Historical Society of North Dakota* (vol. i.–iv. and vi.).	**North Dakota.**
J. R. H.	OSBERT JOHN RADCLIFFE HOWARTH, O.B.E., M.A. Secretary of the British Association. Member of the Geographical Section, Naval Intelligence Department, London, 1915–9. Author of *Commercial Geography of the World*, etc. Joint-editor of *The Oxford Survey of the British Empire.*	**Liverpool;** **Manchester;** **Oceania; etc.**
W. R.	OWEN WILLANS RICHARDSON, D.SC., F.R.S. Yarrow Research Professor of the Royal Society, London. Director of Research in Physics, King's College, University of London. Late Fellow of Trinity College, Cambridge, and Professor of Physics, Princeton University, U.S.A.	**Magnetism.**
B.	PIERRE FRANCIS BERNUS. Foreign editor of *Le Journal des Débats*, Paris correspondent of *Le Journal de Genève*; Chevalier of the Legion of Honour.	**Millerand, A.**
C. P.	PAUL CHRISLER PHILLIPS, M.A., PH.D. Professor of History in the University of Montana. Joint author of *The West in the Diplomacy of the American Revolution.* Author of *The Story of Columbus*; etc.	**Montana.**
E. L.	P. EVANS LEWIN, M.B.E., F.R.HIST.S. Librarian of the Royal Colonial Institute, London. Author of *The Germans in Africa*; *A Geography of Africa.*	**Gold Coast.**
G.*	PIETER GEYL, LITT.D. Professor of Dutch History, University College, University of London. Author of *Holland and Belgium*; etc.	**Netherlands:** *Political History.*
H. N.	PAUL HENRY NYSTROM, PH.D. Director of the Retail Research Association, New York. Formerly Professor of Economics in the universities of Wisconsin and Minnesota. Author of *Economics and Retailing*; *Retail Selling and Store Management*; *Textiles*; etc.	**Marketing** (*in part*).
J.	PAUL EMILE JAVARY. Chief Engineer for the development of the Chemin de fer du Nord, France.	**France:** *Communications.*
L.	PAUL LAMBOTTE. Director of Fine Arts for Belgium. Government Commissioner for Fine Art Exhibitions. Author of two volumes in the *Collection des artistes belges contemporains.*	**Laermans, Eugène.**
La.	PHILIP LAKE, M.A. University Reader in Geography, Cambridge.	**Geology:** *New Theories.*
Le.	PHILEAS LEBERGUE. Greek correspondent of *Le Mercure de France* under the name of Demetrius Asteriotis.	**Greek Literature:** *Modern.*
Lo.	PERRY LONGHURST. Author of *Wrestling.*	**Gymnastics.**
M. H.	PETER MARTIN HELDT. Engineering Editor of *Automotive Industries.* Author of *The Gasoline Automobile*; etc.	**Motor Vehicles.**
N.	SIR PHILIP ARTHUR MANLEY NASH, K.C.M.G., D.S.M., M.INST.C.E. Chairman of Metropolitan-Vickers Electrical Co. Ltd. Director of National Filling Factories, Ministry of Munitions, 1915–6. Inspector-General of Transportation, Western Front, 1918. Director-General of Traffic, Ministry of Transport, 1919–21.	**Factory Design.**
T. M.	SIR PATRICK THOMAS MCGRATH, K.B.E., LL.D. President, Legislative Council, Newfoundland. Managing Director and Editor of *The Evening Herald.* Newfoundland Correspondent of *The Times*, London. Author of *Newfoundland in 1911*; *From Ocean to Ocean*; etc.	**Labrador;** **Newfoundland.**
Vi.	SIR PAUL VINOGRADOFF, F.B.A., D.C.L., LL.D. Formerly Corpus Professor of Jurisprudence, Oxford University. Fellow of the Russian Academy, Petrograd. Member of International Academy of Comparative Law, Geneva. Author of *Villainage in England*; *The Growth of the Manor*; *Outlines of Historical Jurisprudence*; *Self-Government in Russia*; etc.	**Nicholas II.** (*Tsar*).
W. L.	PERCY W. LOVELL. Hon. Secretary of The London Society.	**London.**
B. F.	RAYMOND BLAINE FOSDICK, M.A. Formerly Commissioner of Accounts, City of New York. Author of *American Police Systems*; *European Police Systems*; *Keeping our Fighters Fit*; etc.	**New York City.**
C. A.	ROY CHAPMAN ANDREWS. Chief of Division of Asiatic Exploration, American Museum of Natural History, New York, Leader of Expeditions to Tibet, China, Mongolia, etc. Author of *Camps and Trails in China*; etc.	**Mongolia, Paleontological Discoveries in** (*in part*).

R. C. B.	Robert Clarkson Brooks, Ph.D. Professor of Political Science, Swarthmore College, Pennsylvania. Author of *Corruption in American Politics and Life*; *Political Parties and Electoral Problems*; etc.	**Initiative.**
R. C. F.	R. C. Farmer, O.B.E., D.Sc., Ph.D., F.I.C. Late Chief Chemist, Explosives Department, Ministry of Munitions. Author of *The Manufacture and Uses of Explosives*; *Industrial and Power Alcohol*; various scientific papers on explosives and general chemical subjects.	**Filtration.**
R. Cr.	Dame Rachel Eleanor Crowdy, D.B.E. Chief of Social Questions and Opium Traffic Section, Secretariat League of Nations. Principal Commandant of V.A.D.'s in France and Belgium, 1914–9.	**Opium, Traffic in.**
R. D.	Sir Robert Donald, G.B.E., LL.D. Late Chairman, Empire Press Union. Formerly Managing Director of United Newspapers, Ltd. Chairman, Publicity Committee, British Empire Exhibition, 1924.	**Newspapers** (*in part*).
R. D. O.	Richard Dixon Oldham, F.R.S. Formerly President of the Geological Society, London. Author of various papers on Geology and kindred subjects.	**Isostasy.**
R. F. M.	Robert Foster Moore, O.B.E., F.R.C.S. Ophthalmic Surgeon, St. Bartholomew's Hospital. Surgeon, Moorfields Eye Hospital. Consulting Ophthalmic Surgeon, Maudesley Hospital, London. Secretary Ophthalmological Society of the United Kingdom. Author of *Medical Ophthalmology*; etc.	**Ophthalmology.**
R. Gi.	Roy Gittinger, Ph.D. Dean of Undergraduates and Professor of English History in the University of Oklahoma. Author of *The Formation of the State of Oklahoma*; etc.	**Oklahoma.**
R. G. H.	Ralph George Hawtrey. Assistant Secretary to the Treasury, London. Author of *Currency and Credit*; etc.	**Great Britain:** *Finance.*
R. G. H.*	Robert G. Hodgson. Editor of the *Fur Trade Journal of Canada*. Author of *Fur Farming in Canada*; *Trapping in Northern Canada*; etc.	**Fur Trade.**
R. G. P.	Russell G. Pelly, F.I.C. Joint Author of *Oils, Fats, Waxes and Resins*.	**Margarine** (*in part*).
R. Hd.	Sir Robert Erskine Holland, K.C.I.E., C.S.I., C.V.O. Member of the Council of India. Agent to the Governor-General in Rajputana, 1920–5.	**India** (*in part*).
R. Jo.	Sir Robert Jones, K.B.E., D.S.M., F.R.C.S. President, Association of Surgeons of Great Britain; Lecturer in Orthopaedic Surgery, University of Liverpool. Director of Orthopaedic Surgery, St. Thomas's Hospital, London. English Editor of *The International Journal of Orthopaedic Surgery*. Author of *Surgery of Joints*; etc.	**Orthopaedic Surgery.**
R. J. T.	Robert John Thompson, C.B., O.B.E. Assistant Secretary, Ministry of Agriculture and Fisheries, London.	**Great Britain:** *Agriculture.*
R. L. W.	Ray Lyman Wilbur, A.M., M.D., LL.D. President and Formerly Dean of the Medical School, Leland Stanford Jr. University, California.	**Leland Stanford Jr. University.**
R. Ma.*	René Maran. Novelist. Awarded the *Prix Goncourt* in 1921 for his novel *Batouala*. Author of *Le visage calme*; etc.	**French African Literature.**
R. Mac.	Robert Machray. Contributor to magazines and journals especially on subjects connected with the Middle and Far East, the Baltic states; etc.	**Gdynia.**
R. M. H.	Robert Mitchell Henry, M.A. Professor of Latin and secretary of the Academic Council, Queen's University of Belfast, Ireland. Chairman of Trade Boards of Northern Ireland. Author of *The Evolution of Sinn Fein*; etc.	**Ireland:** *Political History.*
R. P.*	Robert Peele, E.M. Professor of Mining in the School of Mines, Columbia University, New York. Author of *Compressed Air Plant*. Editor-in-chief of *Peele's Mining Engineer's Handbook*; etc.	**Mining.**
R. P. B.	Robert Preston Brooks, Ph.D. Dean of the School of Commerce, University of Georgia; formerly Professor of History. Author of *A History of Georgia*; *The Agrarian Revolution in Georgia*; etc.	**Georgia** (*U.S.A.*).
R. Po.*	Roscoe Pound, A.M., Ph.D., LL.D. Carter Professor of Jurisprudence and Dean of the Faculty of Law in Harvard University. Sometime Commissioner of Appeals of the Supreme Court of Nebraska. Author of *Readings on Roman Law*; *The Spirit of the Common Law*; *Interpretation of Legal History*; etc.	**Legal Education.**

Rn.	R. Romein. Member of Transit Section, League of Nations, Geneva.	Inland Water Transport; Oder.
Ro.	Sir Ronald Ross, K.C.B., K.C.M.G., M.D., D.Sc., F.R.S., F.R.S. (Edin.). Director in Chief, Ross Institute and Hospital for Tropical Diseases, Putney Heath, London. Consultant in Malaria, British Ministry of Pensions. Formerly Consultant in Malaria to the War Office, London. Nobel Prizeman for Medicine, 1902. Former Vice-President and Royal Medallist of the Royal Society, London. Author of *The Prevention of Malaria*	Malaria (*in part*).
S.*	Reinhard Scheer. Admiral and Commander-in-Chief, German High Seas Fleet, 1916–8, and Chief of German Admiralty Staff till 1919. Author of *Deutschlands Hochseeflotte im Weltkriege.*	Germany: *Naval Policy.*
Sc.	Robert Scott, M.B., Ch.B. Barrister-at-Law. Formerly Major in the R.A.M.C.	Medical Legislation.
S. C.	Robert Seymour Conway, Litt.D., F.B.A. Hulme Professor of Classics, Victoria University of Manchester. Author of *The Restored Pronunciation of Greek and Latin*; *The Italic Dialects*; *New Studies of a Great Inheritance*; *The Making of Latin*; etc.	Latin Literature.
S.-D.	Richard Storry-Deans, LL.B. M.P. for the Park Division of Sheffield. Barrister-at-Law. Author of *Parent and Child*; *Students' Legal History*; *Notable Trials*; *Trials of Five Queens*; etc.	Hogg, Sir Douglas.
V. S.	Richard Vynne Southwell, M.A., F.R.S. Fellow and Lecturer in Mathematics, Trinity College, Cambridge. In charge of Non-Rigid Airships Design at R.N. Air Station, Kingsnorth, 1915–8, and of Aerodynamic and Structural Experiments at the Royal Aircraft Establishment, Farnborough, 1918–9. Late Superintendent of the Aerodynamics Department, National Physical Laboratory, Teddington.	Materials, Strength of.
V. V.	Roland Venables Vernon, C.B. Financial Adviser to Government of 'Iraq. Assistant Secretary, Ministry of Munitions, 1915–8. Deputy Accountant-General, Board of Education, 1920–1. Appointed on financial mission to 'Iraq for British and 'Iraq Governments, 1925.	'Iraq: *Financial and Economic History.*
We.*	Raymond Weeks, A.M., Ph.D. Professor of Romance Languages, Columbia University, New York. Inventor of instruments for the study of phonetics.	Foreign Languages (*in part*).
W. P.*	Sir Robert William Perks, Bart. Chairman of the Metropolitan District Railway, 1902–6. Treasurer, Wesleyan Methodist Twentieth Century Million Fund. M.P. for the Louth Division of Lincolnshire, 1892–1910.	Methodism (*in part*).
W. S.-W.	Robert William Seton-Watson, Litt. D. Masaryk Professor of Central European History at King's College, London. Founder and joint editor, 1916–20, of *The New Europe.* Joint editor of *The Slavonic Review.* Author of *The Rise of Nationality in the Balkans*; etc.	Montenegro.
A. K. W.	Samuel Alexander Kinnier Wilson, B.Sc., M.D., F.R.C.P. Junior Neurologist, King's College Hospital, London. Consulting Neurologist, Metropolitan Asylums Board. Croonian Lecturer, Royal College of Physicians, London. Editor of *The Journal of Neurology and Psychopathology.*	Neuro-Muscular System.
C. H.	S. C. Hammer, M.A. Oslo Correspondent of *The Times*, London. Editor of *The Norway Year Book.*	Norway: *Financial and Economic History*; Norwegian Literature.
Cr.	Samuel Crowther, B.S., LL.D. Author of *Common Sense and Labour*; *Life of George W. Perkins*; *My Life and Work* (with Henry Ford).	Henry Ford.
G.	Stephen Lucius Gwynn. Irish Correspondent of *The Observer* (London). Member of the Irish Convention 1917–8. Author of *Irish Books and Irish People*; *The Irish Situation*; *The History of Ireland*; etc.	Griffith, Arthur; Irish Free State: *Political History*; Healy, T. M.
H. S.	S. H. Shoveller. Vice-President of the English Hockey Association. Captain of the English team, 1909–14, and 1920–1. Author of *Hockey.*	Hockey (*in part*).
H. W.	Captain Stanley H. Wilton, R.N. (ret.). Late Assistant Director of Naval Ordnance, Admiralty, London.	Gunnery, Naval; Ordnance (*in part*).
J. B.	Solon Justus Buck. Superintendent of the Minnesota Historical Society. Professor of History in the University of Minnesota. Author of *The Granger Movement*; *Illinois in 1818*; *The Agrarian Crusade*; etc.	Minnesota.
L.	Suzanne Lenglen. Winner of the Ladies' Singles, Ladies' Doubles and Mixed Doubles Lawn Tennis Championships at Wimbledon, London, 1925 and earlier years.	Lawn Tennis.
L. C.	Stevenson Lyle Cummins, C.M.G., M.D., LL.D. Colonel, Army Medical Service (retired). David Davies Professor of Tuberculosis, University College of South Wales and Monmouthshire, Cardiff.	Influenza.

S. Le.	Stephen Butler Leacock, Ph.D., Litt. D., F.R.S. (Can.). William Dow Professor of Political Economy, McGill University, Montreal. Author of *The Elements of Political Science*; and of many literary satires including *Nonsense Novels*; *The Hohenzollerns in America*; *The Garden of Folly*; etc.	**New Brunswick;** **Nova Scotia;** **Ontario.**
S. McC. L.	Samuel McCune Lindsay, Ph.D., LL.D. Professor of Social Legislation in Columbia University, New York. President of New York Academy of Political Science, New York. Author of *Railway Labor in the United States*; *Financial Administration of Great Britain*; etc.	**Liquor Laws, *United States.***
S. R.	Samuel Rosenbaum. Formerly Assistant U.S. Attorney and Assistant City Solicitor, Philadelphia. Author of *Commercial Arbitration in England* and *The English County Courts.*	**Judicial Reform.**
S. S.	Sophy Sanger. Chief of section in the International Labour Office of the League of Nations, Geneva, 1920–4; Secretary of British Section, International Association for Labour Legislation, 1906–19, and Editor of the English Edition of the *Bulletin* of the International Labour office (Basle).	**Factory and Workshop Law.**
S. Sp.	Sigmund Spaeth, Ph.D. Formerly member of the Editorial Staff of *The New York Times*, and Musical Correspondent of *The Boston Transcript.* Author of *Milton's Knowledge of Music*; *The Common Sense of Music.*	**Musical Instruments.**
T. Co.	Sir Theodore Andrea Cook. Editor-in-chief of *The Field* (London). Author of *A History of the English Turf*; *The Art and Science of the Oar*; *The Fencer's Song*; etc.	**Fencing;** **Olympic Games.**
T. E. G.	T. E. Gregory, D.Sc. Cassel Reader in Banking and Currency, London School of Economics. Author of *Tariffs: a Study in Method*; etc.	**Great Britain: *Banking.***
T. E. L.	Thomas East Lones, M.A., LL.D. Formerly Senior Examiner in H.M. Patent Office, London. Author of *Aristotle's Researches in Natural Science*; *Zinc and Its Alloys.*	**Gas, Manufacture of;** **Gyroscope;** **Inventions;** **Liquid Air;** **Meter.**
T. G. G. H.	Lieut.-Col. T. G. G. Heywood. General Staff Officer, British Territorial Army Air Defence Formations.	**Intelligence, Naval and Military.**
T. Ho.	Thomas A. Howard. Of Messrs. A. G. Spalding & Bros., Sports Outfitters, London and New York.	**Hockey (*in part*).**
Th. R.	Th. Ruyssen. Professor of the History of Philosophy, University of Bordeaux. General Secretary, International League of Nations Union, Brussels.	**Minorities.**
T. N. C.	Thomas Nixon Carver, Ph.D., LL.D. Professor of Political Economy, Harvard University. Author of *The Distribution of Wealth*; *Principles of Rural Economics*; *Principles of Political Economy*; etc.	**Federal Farm Loan System.**
T. R.	Terry Ramsaye. Editor of film productions and writer on motion picture subjects. Author of *A History of the Motion Picture.*	**Motion Pictures: *History.***
T. S. A.	Thomas Sewall Adams, Ph.D. Professor of Political Economy in Yale University. Adviser on Taxation, U.S. Treasury Department. Author of *Taxation in Maryland*; etc.	**Income Tax (*in part*).**
T. W. Ho.	Sir Thomas William Holderness, Bart., G.C.B., K.C.S.I. Late Permanent Under-Secretary of State for India. Author of *Peoples and Problems of India*; *Narrative of the Indian Famine, 1896–97.*	**India (*in part*).**
U. B. P.	Ulrich Bonnell Phillips, Ph.D. Professor of American History in the University of Michigan. Author of *The Life of Robert Toombs*; *American Negro Slavery*; etc.	**Michigan.**
V. G.	Valtyr Gudmundsson, M.A., D.Ph. Professor of Icelandic Language and Literature in the University of Copenhagen. Member of the Icelandic Parliament, 1894–1914.	**Iceland.**
V. L. E. C.	Victor Louis Emilien Cordonnier. General commanding the French Army in the East under General Sarrail. Author of *The Japanese in Manchuria.*	**Frontiers, Battles of the (*in part*).**
W. A. B.	William Adams Brown, A.B., Ph.D. Roosevelt Professor of Systematic Theology, Union Theological Seminary, New York. Author of *The Essence of Christianity*; *The Church in America.*	**Fundamentalism and Modernism.**
W. B.-A.	W. Broughton-Alcock, M.D. Director of the Central Laboratory, Ministry of Pensions, London.	**Malaria (*in part*).**
W. B. H.	Walter B. Harris, F.S.A. Moroccan Correspondent of *The Times* (London). Author of *The Land of an African Sultan*; *Travels in Morocco 1888–9*; *Morocco that Was*; etc.	**Morocco, Campaigns in.**

. Bn.	William Bateson, M.A., F.R.S. Late Director of the John Innes Horticultural Institution, Merton Park, Surrey, and Professor of Biology, Cambridge University. Author of *Mendel's Principles of Heredity*; *Problems of Genetics*; etc.	**Genetics;** **Mendelism.**
. B. S.*	Wilfred B. Shaw. General Secretary, Alumni Association, University of Michigan. Author of *History of University of Michigan.*	**Michigan, University of.**
. D. L.	William Draper Lewis, Ph.D., LL.D. Director of the American Law Institute. Formerly Dean of the Law Department, University of Pennsylvania. Author of *Restraint of Infringement of Incorporeal Rights*; *Life of Theodore Roosevelt*; etc.	**Judicial Reform.**
. E. El.	Walter Elliot Elliot, M.C., D.Sc., M.B., Ch.B. M.P. for the Kelvingrove Division of Glasgow. Parliamentary Under-Secretary of Health for Scotland.	**Health, Ministry of.**
. E. I.	Major-General Sir William Edmund Ironside, K.C.B., C.M.G., D.S.O. Commandant, Staff College, Camberley, Surrey. Commander-in-Chief, British Forces in Russia, 1918–9. Author of *Tannenberg: the first thirty days in East Prussia.*	**Masurian Lakes, Battles of the.**
. F.	Lieut.-Col. Wolfgang Foerster. Late General Staff, German Army. Keeper of Public Records, Potsdam. Formerly member of the Historical Section of the General Staff. Chief of the General Staff of the XI. Corps, 1915. Author of *Prinz Friedrich Karl von Preussen*; *Graf Schlieffen und der Weltkrieg.*	**Hindenburg, Paul von;** **Ludendorff, Erich.**
F. B.	William F. T. Butler, M.A. Assistant Commissioner of Intermediate Education, Ireland. Formerly Professor of Modern Languages in Queen's College, Cork. Member of the Royal Irish Academy.	**Irish Free State:** *Education.*
F. F.	Walter Francis Frear, LL.D. Formerly Chief Justice and late Governor of Hawaii. Chairman of the Hawaiian Code Commission, 1903–5. Author of *The Evolution of the Hawaiian Judiciary.*	**Hawaii.**
F. O'C.	Lieut.-Col. Sir William Frederick Travers O'Connor, C.S.I., C.I.E. Formerly Resident in Nepal and British Envoy in Nepal. Signatory of Treaty between Great Britain and Nepal, 1925. Author of *Folk Tales from Tibet*; etc.	**Nepal.**
F. W.	Walter Francis Willcox, Ph.D., LL.D. Professor of Economics and Statistics, Cornell University. Author of *The Divorce Problem—A Study in Statistics*; etc.	**Negro.**
G. Ma.	Sir William Grant Macpherson, K.C.M.G., M.B., D.P.H. Major-General, Army Medical Service. Editor-in-Chief, *Medical History of the War.* Served at the War Office as Deputy Assistant and Deputy Director-General of the Army Medical Service, and as a Member of the Advisory Board for Medical Services, and of the Army Sanitary Committee. Director of Medical Services, British Force in Macedonia, 1915–6.	**Medical Service, Army.**
Go.*	Sir William A. M. Goode, K.B.E. Unofficial Adviser to the Hungarian Government. President of, and British Representative on, the Austrian Section of the Reparation Commission, Vienna, 1920–1. Author of *Economic Conditions in Central Europe*; etc.	**Horthy, Admiral;** **Hungary** (*in part*); **Karolyi, Count.**
Gr.	Walter Gravell, Ph.D. *Ober Regierungsrat* in the Statistical Offices of the Reich, Berlin. Member of the German Statistical Society. Author of *Abhandlungen über Bevolkerungs- Berufs- und Betriebsstatistik*; etc.	**Germany:** *Area and Population.*
G. S. A.	William George Stewart Adams, M.A. Gladstone Professor of Political Theory and Institutions, Oxford University. Fellow of All Souls College. Member of the British Development Commission.	**Government.**
H. C.	W. H. Coates, LL.B. Secretary of Nobel Industries, Ltd. (London).	**Income Tax** (*in part*).
H. Di.	William Henry Dines, F.R.S., F.R.Met.Soc. Author of *Characteristics of Free Atmosphere* and of numerous scientific articles in the *Proceedings* of the Royal Society, *The Journal of the Royal Aeronautical Society*; etc.	**Meteorology** (*in part*).
H. L.*	W. H. Leffingwell. Management Engineer. Author of *Office Management*; etc.	**Office Appliances;** **Office Management.**
K. McC.	William Kidston McClure, C.B.E. Correspondent of *The Times* (London) in Rome. War Correspondent of *The Times* on the Italian Front, 1915–7. Author of *Italy's Part in the War*; *Italy in North Africa*; etc.	**Italian Campaigns;** **Italo-Turkish War.**
L. B.	William Lewis Blennerhasset, D.S.O., O.B.E. Formerly acting British Vice-Counsul at Kovno, Lithuania. Member of the London Stock Exchange.	**Finland:** *Political History;* **Lithuania:** *Political History.*
. A.	Sir William James Ashley, Ph.D., M.A., M.Com. Formerly Vice-Principal and Professor of Commerce of the University of Birmingham. Member of numerous British Committees on Economic Questions. Author of *Introduction to English Economic History and Theory*; *The Rise in Prices*; *The Economic Organisation of England*; etc.	**Imperial Preference.**

W. Me.	Wilfred Meynell. Editor of the Collected Works of Francis Thompson. Author of *Life of Benjamin Disraeli*; etc.	**Meynell, Alice.**
W. Mi.	William Miller. Correspondent of *The Morning Post* (London) in Athens and Rome. Author of *The Latins in the Levant*; *The Ottoman Empire and its Successors*; *A History of the Greek People (1821–1921)*; etc.	**Fiume;** **Macedonia.**
W. M. J.	William M. Jardine, B.S., LL.D. United States Secretary of Agriculture. Formerly President of Experiment Station, Kansas State Agricultural College.	**Farmers' Organisations** (*in part*).
W. N. R.	William Nelson Runyon, A.B., LL.B. Judge, U.S. District Court, District of New Jersey. Instructor in New Jersey Law School. Formerly Acting Governor of New Jersey.	**New Jersey.**
W. O. S.	William Oscar Scroggs, A.M., Ph.D. Financial Writer on *The New York Evening Post*. Formerly Professor of Economics and Sociology. Louisiana State University. Author of *Filibusters and Financiers*.	**Louisiana.**
W. P. P.*	Wolf Pocklington Pond. Editor of *The Spur*, New York. Correspondent of *The Sporting Chronicle*, Manchester.	**Horse-Racing** (*in part*).
W. Rn.	Walter Rosenhain, F.R.S., D.Sc. Superintendent of the Department of Metallurgy in the National Physical Laboratory, Teddington, Middlesex. Member of International Committee on Nomenclature of Iron and Steel. Author of *Introduction to the Study of Physical Metallurgy*; etc.	**Metallurgy.**
W. S. B.	Air Vice-Marshal Sir William Sefton Brancker, K.C.B. Director of Civil Aviation at the Air Ministry, London. British Representative on the International Commission of Air Navigation.	**Flying.**
W. S. L.-B.	Walter Sydney Lazarus-Barlow, M.D., F.R.C.P. Member of Cancer Committee, Ministry of Health, London. Late Professor of Experimental Pathology and Director of Cancer Research Laboratories, Middlesex Hospital, London. Author of *A Manual of General Pathology*.	**Medical Research.**
W. S. N.	Hon. William S. Nosworthy. Minister of Finance, Stamp Duties, Agriculture and Immigration; and Minister in charge of Land and Income Tax, State Allowances, Valuation, Tourist and Health Resorts and Legislative Department, New Zealand.	**New Zealand:** *Population and Settlement.*
W. W. M.	William Watts Macon. Editor of *The Iron Age*, New York.	**Iron and Steel.**
Y. H.	Yrjo Hirn. Professor of Modern Literature, University of Helsingfors, Finland. Author of *Det heliga skrinet*, *Studier i den Katolska Kyrkans Poesi ock Konst*; etc.	**Finnish Literature.**

THE
ENCYCLOPÆDIA BRITANNICA

VOLUME 30

THE SECOND OF THE THREE NEW VOLUMES

FABRE TO OYAMA

FABRE, JEAN HENRI (1823–1915), French entomologist, as born at St. Léons in Aveyron Dec. 21 1823. He received e elements of a classical education at Rodez, continuing it rther at the école normale of Vaucluse. But his whole bent as for science, and after he had become a teacher at Carpentras, worked in his spare hours at physics and mathematics, and came interested in insects, the study of whose habits was to rm his life-work (*see* 3.626, 6.672, 14.180). His observations ere published in *Annales des sciences naturelles* (1855–8), fol- wed by *Souvenirs entomologiques* (1879–1907). He died at rignan, Provence, Oct. 11 1915.

FACTORY AND WORKSHOP LAW (*see* 16.7).—Factory and rkshop law forms part of the mass of modern legislation erred to as "industrial law" or "labour legislation" (*see* .7). The limited term "factory and workshop law" arose m the way in which the British Parliament defined workplaces the purposes of regulation. The line of demarcation thus awn between manufacturing and other occupations and the rticular grouping of subjects regulated by the British Factory d Workshop Acts are more or less arbitrary and are not cessarily found in the laws of other countries. Nor is it ssible, in a practical study of British legislation, to adhere ictly to Factory and Workshop Acts properly so-called. ere are many statutes of recent years which affect the health, ety and welfare of workers in factories and workshops without ing in to the general scheme of the Factory and Workshop ts. A list of Acts since the beginning of 1911, amending se Acts or having an important bearing upon conditions of rk in factories and workshops is appended. In addition, a ge number of Orders have been issued both under the Act 1901 and under the later Acts, which have given important powers of regulation to the Home Secretary. Indeed it is gely by Orders that the factory and workshop law of Great itain has been kept up to date.

I. GREAT BRITAIN

Taking the matters regulated by the Consolidating Factory d Workshop Act of 1901, as a basis, we may consider recent velopments under the following six headings:—

. *Health and Safety.*—The formerly important provisions for tecting children from risk of accident or injury to health came obsolete, when "children" as defined by the Act of 01, were excluded from work of all kinds in factories and rkshops. On the other hand, certain general provisions the Employment of Children Act, 1903, apply, in Scotland only, to girls and boys of 14 years of age employed in factories and workshops, since the Scottish Education Act of 1918 raised to 15 the age of children affected by them. The provisions of the Act of 1901 relating to humidity and ventilation in cotton-weaving sheds were modified by regulations substituted for them under powers given by the Cotton Cloth Factories Act of 1911. The conditions under which accidents must be notified have been changed both as regards the nature of the accidents notifiable and as regards procedure.

Under sections included in the Workmen's Compensation Act, 1923, any accident occurring in a factory or workshop causing death or disabling a worker for three days must be notified, and notice is given to the inspectors of factories only, the former duties of certifying surgeons in this connection having been abolished by the Police, Factories, etc. Act, 1916. However, the duties of certifying surgeons in connection with health remain, and have been extended both by Orders making several further diseases compulsorily notifiable, and also by the Lead Processes Act of 1920, which prescribes the periodical medical examination of all women and young persons employed in lead processes (a rule which previously existed only in those lead trades for which it had been prescribed by regulations). This Act contains, in addition, some general rules of hygiene to be observed whenever any woman or young person is employed in contact with lead compounds. It is, however, chiefly important in having been adopted in order to give legal confirmation to a recommendation of the International Labour Organisation (I.L.O.), since nearly all the ground was already covered by regulations under section seventy-nine of the Act of 1901.

Great progress has been made with regulations under that section. Between 30 and 40 codes of regulations are in force, mostly very detailed and highly technical. By means of this system of regulations, the British law for the protection of workers in trades involving special risks is kept fully abreast of medical knowledge and scientific discovery. Many other countries have, especially in recent years, adopted a similar system. But none can show regulations more carefully and scientifically prepared or better observed in practice. The regulations are aimed at every kind of special industrial risk—risk of poisoning, risk of infection, risk from injurious fumes and from excessive and injurious dust, risk of accident, risk of overstrain. The regulations of 1925 restricting the lifting of weights in the woollen or worsted industry relate exclusively to the last-named risk. One of the most interesting sets of regulations, and quite the most elaborate, is the code for the pottery industry drawn up in 1913 after an exhaustive investigation by a departmental committee. Every process and branch of this complicated industry is dealt with in detail.

Interesting examples of technical rules for the prevention of accidents are to be found in the regulations of 1922 for woodworking and in the revised regulations for dock work issued in 1925. Occupations less ostensibly dangerous than those regulated under section 79 of the Act of 1901 may be made the subject of so-called Welfare Orders under section 7 of the Police, Factories, etc. Act of 1916. Welfare orders may deal with facilities for preparing and taking meals, with the supplying of drinking water, protective clothing, ambulances and appliances for first-aid, seats in work-rooms, washing facilities and accommodation for clothing, with the supervision of workers and (a later addition, by Order) with the provision of restrooms. Many of the subjects thus relegated in the British system to Orders are to be found in the statutes of other countries and will no doubt be included in some future consolidating British Act. Meantime these Orders provide a practical, if gradual, means of bringing the British law of a quarter of a century ago up to date as far as the health and well-being of the workers is concerned. Arrangements for "first-aid" (or ambulance rooms) were later prescribed for all "factories," namely by section 29 of the Workmen's Compensation Act, 1923. This section also gave the Home Secretary wider powers in the matter of accident prevention. For instance, sub-section (3) gives powers so defined as to enable him to require employers to put into operation modern safety methods (inspired largely by American practice and adopted of recent years by many British firms on their own initiative), such as the appointment of safety engineers or representative safety committees, whose business it is to check the human as well as the mechanical element in accidents (*see* SAFETY FIRST). The Anthrax Prevention Act, 1919, was adopted in order to enable practical use to be made of a newly discovered method of disinfecting raw wool and hair likely to be infected with anthrax.

2. *Hours of Work.*—The provisions of the Factory and Workshop Acts relating to hours of work have been only slightly altered during the period under review. Consequently they have grown out of date, and are in practice largely obsolete. The restrictions placed upon the night work of women and boys by the Act of 1901 were supplemented by the Employment of Women, Young Persons and Children Act, 1920, adopted so as to embody in law the provisions of the Conventions on that subject. As far as concerns women the Act made no practical difference. But as regards male young persons it allows fewer exceptions to the general prohibition of night work than the old law and never allows boys under 16 to work at night. It therefore overrules or modifies many of the special exceptions formerly allowed both as regards employment in night shifts and as regards encroachments on the rigidly prescribed period of 11 hours night's rest.

The Act introduced another important change, permitting the employment of women and boys over 16 in two day-shifts of eight hours. This necessitated an extension of the strict outside limits for employment under the Act of 1901, since the two shifts could not be fitted in unless the second shift could continue at work up to 10 o'clock at night. The clause aroused considerable opposition and was eventually adopted in a guarded form. In the first place, it was of only temporary operation, and from 1925 needed to be annually extended. In the second place, the Home Secretary may only allow the two shifts in any undertaking on the joint application of the employer and a majority of the workers concerned, and the Act enables an organised trade as a whole to resist the introduction of the two-shift system by means of a kind of veto. The Home Secretary may attach conditions to the permission, such as the adoption of various "welfare" arrangements, including, for instance, the provision of special transport facilities for women and young persons having to travel to or from work at an unusually early or late hour. The indirect effect of the Trade Boards Acts on hours in factories and workshops may well be noted. Although the trade boards cannot directly regulate hours of work, they influence actual hours by fixing a standard week (usually about 48 hours) beyond which higher rates of wages must be paid.

3. *Exclusions from Industrial Work.*—As regards the exclusion of persons from industrial work, the most important recent change has been the raising to 14 of the age limit for young workers to enter upon such employment. This rule was applied by the Employment of Women, etc. Act of 1920 to "industrial undertakings," so defined as to cover all "factories and workshops." The same result had already been attained by the two Education Acts of 1918, which are still relied on for controlling the admission of children to domestic workshops. The Scottish Education Act of 1918 excludes children from factories and workshops up to the age of 15 unless they have procured exemption from school attendance. Both under the Education Act of 1921 and the Scottish Act of 1918, employers may be required to allow young persons over 14 time off from their work for attendance at continuation classes. The Lead Processes Act, 1920 (see 1 above) out of deference to a recommendation of the International Labour Organisation, excluded women and young persons by law from certain lead processes in which, in practice, they were not employed at all.

4. *Home Work.*—Home Work Orders were issued in 1911, 1912 and 1913, extending to a number of trades the provisions of the Act of 1901 relating to lists of outworkers and the prohibition of work in unwholesome or infected premises.

5. *Particulars of Work and Wages.*—Part VII. of the Act of 1901, relating to particulars of work and wages, has been extended by Order to a large number of additional trades.

6. *Enforcement of the Law.*—The factory inspectorate was entirely reorganised after the War. For this no legislation was necessary. One result of the reorganisation was the abolition of the special women's branch and the admission of the women inspectors to all grades with the same duties as the men inspectors. The enforcement of the sections of the Act of 1901 relating to the employment of women after childbirth and to bakehouses have been transferred to the Ministry of Health and the Scottish Board of Health.

II. THE BRITISH DOMINIONS

Both in Northern Ireland and in the Irish Free State the British factory and workshop law existing at the time when the recent constitutional changes were introduced remains in operation for the time being. The Parliament of Northern Ireland can now amend or develop the law, subject to the possible intervention of the British Parliament. The Irish Free State, like all other self-governing Dominions, is free to legislate on this matter quite independently of the British Parliament, but up to March 1926, had made no changes beyond issuing two sets of regulations under section 79 of the Act of 1901. The other British Dominions have steadily developed their industrial legislation. In Australia factory and workshop law of old standing and often amended has in many cases been consolidated more or less recently. It is important to note that industrial arbitration awards and the determinations of wages boards form an essential part of the law in Australia and New Zealand and represent a type of regulation not to be found in so fully developed a form in any other country, though South Africa has recently adopted a somewhat similar method suited to her industrial conditions. In Canada, the most interesting recent legislation from the point of view of factory and workshop law is that of British Columbia putting into operation the proposals of the I.L.O. on hours of work and the employment of women before and after confinement. In India, likewise, certain proposals of that body have been put into force by an Act which made many important amendments in the Factory Act.

III. EUROPEAN COUNTRIES

Both in the years immediately preceding and during the War, nearly all the countries of Europe were gradually developing or consolidating their industrial law. France began the codification f her labour laws in 1910, and Book II. of the Code of Labour, vhich covers most of the subjects here considered, was issued n 1912. All existing Industrial Codes have been amended more r less since 1910 and new and improved Factory Acts, super-eding older laws, were adopted in Sweden in 1912, Denmark n 1913, Switzerland in 1914 and Norway in 1915. Special laws rotecting women and young workers only were newly adopted r amended in Austria, the Netherlands and Portugal in 1911, n Greece and Spain in 1912 and in Belgium in 1914, while evelopments in legislation concerned with industrial hygiene nd safety may be noted in Finland (1914), Germany (the Home Vork Law of 1911), Greece (1911, and a bakeries law of 1912) nd the Netherlands (a special law for the protection of dock bourers, 1914; and an amendment of the Safety Act, 1915). inland issued an ordinance in 1917 covering nearly all the round of factory and workshop law.

Since 1918 there has been a still more remarkable activity in bour legislation, due in large measure to the industrial ferment aused by the War. As the process of legislation goes on, we an continually trace the influence of the I.L.O., tending to nake the laws approximate broadly in aim, but not preventing hem from differing widely in form and detail. The newly reated or enlarged countries have the task of adapting the laws lready existing in newly acquired territory. Of these, only the erb-Croat-Slovene Kingdom has as yet fully co-ordinated and odified her industrial law (by the Workers' Protection Act of 922). Poland has incorporated certain principles of industrial gulation in her Constitution.

The most striking part of post-War labour legislation is that hich restricts the hours of labour of adult men (as well as of omen and boys) to approximately eight a day (*see* Hours of abour). Many countries have, in addition, amended their law as to conform to various proposals of the I.L.O. relating to e employment of women and boys at night and in lead proc-ses, the protection of women workers before and after child-rth and the age limit for the employment of children. It ould be noted that night-work for adult men is prohibited in neral, subject to special exceptions, in several European coun-ies (Belgium, Czechoslovakia, Netherlands, Norway, Poland d Switzerland) and may be restricted by order in Hungary d the Serb-Croat-Slovene Kingdom. Home-work laws, deal-g with hygiene as well as wages, were adopted in 1918 in ustria and Norway, and in 1919 in Czechoslovakia. The ndency for compensation laws to deal also with accident pre-ention should not be overlooked. A new departure may be ticed in recent laws giving workers the right to a period of nual leave with pay. Laws have been adopted in a number countries to establish or reorganise systems of inspection, and e influence which works councils (*q.v.*) may have upon the servance of factory and workshop law should be noted. viet Russia has produced a comprehensive labour code and arge number of detailed regulations for health and safety.

IV. THE UNITED STATES AND SOUTH AMERICA

In the United States, labour legislation has been checked to me extent by the lack of a uniform standard among the ates, and by the rigid application by the courts of constitu-nal principles now out of harmony with public opinion. But, spite of this, factory and workshop law has steadily developed most of the States during the period under review, and some ates have now advanced labour codes. The problem of child bour has been receiving much attention and a constitutional nendment is being considered to enable Congress to regulate e employment of children. In some States great improvement accident prevention and hygiene have been brought about rough the action of industrial commissions or boards, with de powers of investigation into, and regulation of, trades. An ginal plan has been adopted to provide for the rehabilitation workers permanently injured by their work, on the analogy those injured by war (Vocational Rehabilitation Act, 1920). In the republics of Central and South America, a considerable nount of factory and workshop law is to be found, in some cases embodied in elaborate codes. In Mexico, the Labour Codes of the various States are based on general principles laid down in an amendment to the federal Constitution of 1917.

V. ASIATIC COUNTRIES

Factory and workshop law made a start in Japan with the Factory Act of 1911, which was amended in 1923 and supplemented by an Act on the minimum age for industrial employment in order to put into operation certain of the standards specially recommended for Japan by the I.L.O. The only other Asiatic country where factory legislation is, as yet, at all advanced, is India, to which reference has already been made. But, in 1923, a Factories Act emerged in China, and Persia issued a decree for the protection of workers in carpet factories.

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(3) *International Sources.* (*a*) Most of the world's factory and workshop law of recent years can be found in one or other of the following collections of translations of labour laws: I. *The Bulletin of the International Labour Office* (*of Basle*), which ceased with the year 1919 (vol. 14 of the English edition, corresponding to vol. 18 of the German and French editions; *Bulletins des Internationalen Arbeitsamtes* [Jena]; *Bulletin de l'Office International du Travail*, Berger Levrault). II. *The Legislative Series of the International Labour Office*, Geneva (German edition: *Gesetzreihe*; French edition: *Série Législative*) appearing annually, the laws being issued first in a series of advance brochures, referred to by abbreviated names of countries and numbered under each country. The brochure edition began in English for the year 1919 and covers the same ground as the *Bulletin of Basle* for that year. The annual volumes began with the year 1920. The volume for 1921 was issued in two parts. III. The *Annuaire de la Législation du Travail* (in French only, but giving the original texts also in some years) published annually by the Belgian Govt. up to the year 1913 and closing with a collection of labour laws in several volumes covering the War period. (*b*) *Factory Inspection, historical development and present organisation in certain countries*, I.L.O., Geneva, 1923; *International Labour Review* (monthly), articles on the labour laws of various countries, and summaries of official reports of factory inspectors.

(4) *National Sources.* France: *Code du Travail et de la Prévoyance Sociale*, editions by Berger Levrault or Dalloz.

Great Britain: *Redgrave's Factory Acts*, 13th edition by C. F. Lloyd (Butterworth, 1924); *Factory and Workshop Orders*, issued every few years by the Home Office (H. M. Stationery Office); *Annual Reports of the Chief Inspector of Factories.*

United States of America: *Labor laws of the United States with decisions of courts relating thereto*, Bulletin of the Bureau of Labor Statistics, No. 370, 1925 (see also list of other *Bulletins* on labor legislation and court decisions, appended to No. 370). (S. S.)

FACTORY DESIGN.—The selection of the site and the design of factory buildings are most important economic factors in manufacture because they may contribute very seriously to the cost of production, not only on account of the initial outlay of capital required, but because of their influence on efficient production. The elimination of waste, whether of material, time or effort, is the chief feature of all manufacturing, and the design of factory buildings plays its part in this elimination.

The haphazard methods of erecting factory buildings are passing, and more systematic consideration is being given to their planning and erection, though even at the present time more effort is devoted to providing good machinery than good, suitable buildings. The factors most largely influencing the design of factory buildings are large scale and standardised production; factory legislation, both government and local; building by-laws; insurance conditions, and the welfare of the employees.

Regarding the actual design and building of factories, the determining factor is naturally the character of the product, but certain general considerations apply whatever the product. The architect of every new factory should make himself thoroughly familiar with the processes and products of the factory before attempting his design, which should be made with a view to meeting adequately the future needs of the industry which, under favourable conditions, will naturally expand, especially as the present-day tendency is towards amalgamations and the formation of large corporations. One of the best ways of providing for this contingency is to design all buildings on the principle of suitable standardised units which can be increased as necessity arises. These standardised units should represent a complete organisation, but should be so arranged as to make future extensions possible without interfering with the existing business.

SELECTION OF SITE

The effect of location is common to all factory design, and in selecting a site all the following should be taken into account:—

Nearness to raw material supply is an important factor where raw materials are bulky and cheap, but as the bulk decreases and the value increases this factor becomes less important. It is necessary to study the convenience of existing railway lines, freightage, etc. Proximity to a canal is not the important feature it was formerly. The contour of the land should be studied, not only in so far as it presents a suitably level site for building purposes, but also in relation to canals, railways and other means of transport.

The supplies of electricity, gas and water are all important considerations, especially where, as in the case of some industries, enormous quantities of any one are needed, as, for example, in the pulp and paper industry, which requires a vast amount of water; or where the cost of power represents a large part of the ultimate cost of the product. The climate is an important factor in certain industries, as for example, in the textile industry where a humid atmosphere is necessary, though in this case it is becoming less important than formerly because the humidity can be controlled artificially.

Suitable Labour Supply.—Where the necessary labour supply is of the unskilled type this is not an important factor, but where skilled labour is essential, it is necessary to locate the industry in a district where training and heredity have developed the required type. Skilled labour is not so migratory as unskilled on account of social and family attachments, etc.

Room for Expansion.—It would, of course, be futile to place a factory in a crowded and congested area where there is no space for expansion. The present tendency is for factories to be built on the outskirts of existing industrial areas because here (providing transport facilities are satisfactory, which is not always the case) land is usually cheaper, taxation lower and working conditions better than in the towns. It is, however, difficult to induce labour that is accustomed to town life to migrate to country districts and this, coupled with the housing question (*see* HOUSING) may be an important factor operating against an otherwise ideal site. Further, some industries may be dangerous or offensive, and these must be located well away from congested areas.

Other Factors.—Capital available for investment, laws affecting the tenancy of land, sewage, floods, drinking water supply, etc., are all important points to consider in the selection of a site.

TYPES OF FACTORY BUILDING

The type of building erected for a factory depends entirely on the product to be manufactured, and the architectural form is dominated by this factor, and, in the majority of cases, by the great need for economy, but an attractive looking plant has a marked effect on employees, and has an advertising value.

Main Types.—There are, in general, three main types of factory building:—

1. The single story building of the weaving-shed type, having a saw-toothed roof consisting of a series of unequally inclined ridges, glazed usually only on the north side which permits of uniform lighting without shadows. In the single story type when the site does not permit of north lighting, the ridges, which must be equally inclined, can be glazed on both sides. This type (see fig. 1 on plate) is not well adapted for overhead shafting, cranes, etc.

2. The one-story building with large truss spans, provided with accommodation for travelling cranes, etc. This is the foundry, forge and machine shop type and is suitable for medium and heavy work (see fig. 2 on plate).

3. Multi-story buildings for all kinds of manufacture and storage, except in the case of the heaviest industries (see fig. 1 on plate).

Naturally, each type has its advantages and disadvantages and must be considered in relation to the product of the factory, but generally, when cost of land is not prohibitive, and the product is bulky, the natural choice would be towards a one-story building. Each of these three types of building permits of a construction of any one of the following kinds:—

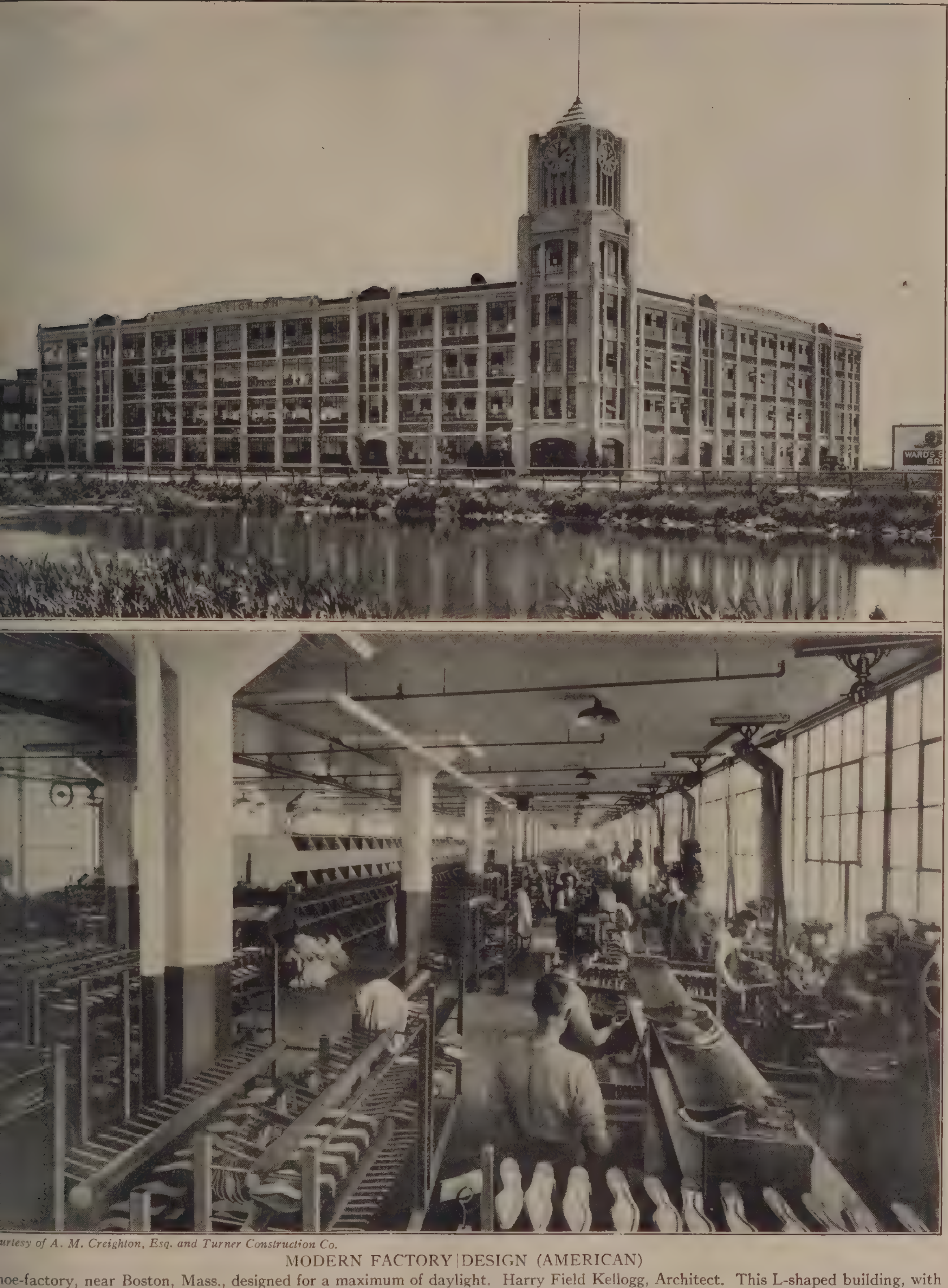
(*a*) Timber and masonry, known as "Mill construction."
(*b*) Steel framework.
(*c*) Reinforced concrete.

Whatever type of construction is employed, the predominating necessity is "fireproofness." In the event of a fire, although the actual amount of material damage is recoverable by insurance, the loss through disorganisation is not recoverable, and frequently is so overwhelming as to prevent ultimate reorganisation.

Mill Construction.—Mill construction is of various types, but in the main, the outside walls are of masonry, the floors of wood, and the roofs, posts, joists and girders of wood or metal. Where much timber is involved the great disadvantage of this type, which for other than heavy work is in other respects satisfactory, is that for fire-resisting purposes it cannot be recommended. This type of building is seldom used for heights of more than six floors on account of its lack of lateral stability, which is chiefly dependent on the masonry of the walls, and which, if developed to any height, would require to be supported by excessive-sized pillars and increased thickness in the lower stories. The adoption of this type of building is getting less and less.

Steel Framework.—Buildings of this type were made possible by the introduction of the Bessemer process of steel manufacture. Here rolled steel structural members are used and filled in with walls, floor and roof, etc. The steel members are riveted, or bolted together. Where long spans without support are necessary, steel framework is essential, and it is also necessary in the case of high walls exposed to wind pressure and to the lateral forces of moving cranes. Steel framework buildings are not fireproof because exposed steelwork twists and buckles when subject to intense heat, thus wrecking the building more quickly than the fire itself. If the structural steel framework is encased in fire-resisting material such as concrete, it is admirably suitable for the interior of a factory (*see* FERRO-CONCRETE).

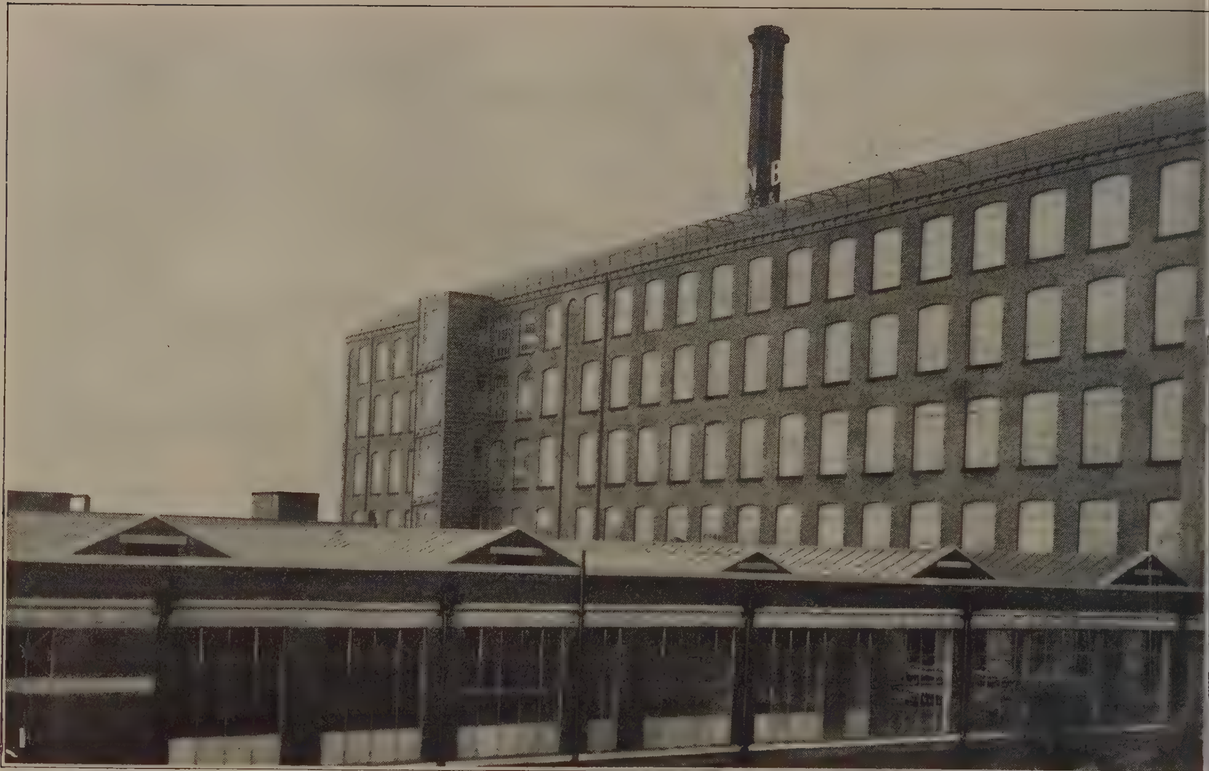
Reinforced Concrete.—Buildings of this material have come to be recognised as one of the standard types for industry. The material is classed as "fireproof" and will stand the destructive effects of fire as well as any material. It is not usually damaged beyond repair by fire, and seldom, if ever, destroyed. It is a particularly durable material, and its durability improves with age. It is particularly well suited for multi-story buildings containing vibrating machinery or machines with heavy reciprocating parts. "Daylight factories" giving the maximum of natural lighting have come into vogue with reinforced concrete

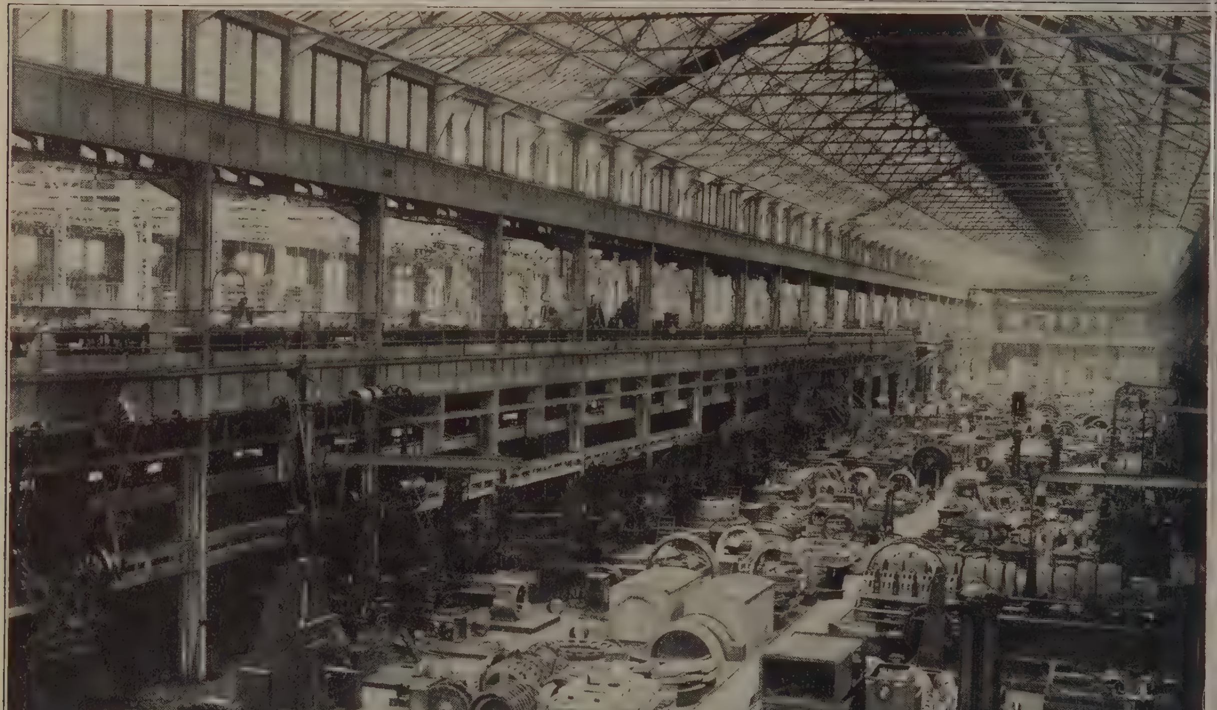


urtesy of A. M. Creighton, Esq. and Turner Construction Co.

MODERN FACTORY DESIGN (AMERICAN)

noe-factory, near Boston, Mass., designed for a maximum of daylight. Harry Field Kellogg, Architect. This L-shaped building, with
ombined clock and sprinkler-tank tower at its western angle, is built of reinforced concrete throughout. The piers are between 16 and
ft. apart, with glass in metal sashes extending from pier to pier. The brick curtain walls, of no structural function, lend a touch of
lour to the building; being only the height of a work-bench, they do not decrease the effective lighting of the factory. The floors are
of flat slab construction.





MODERN FACTORY DESIGN

FIG. 1. Single-storey weaving shed and multi-storey spinning mill of unit construction.
FIG. 2. Interior of single-storey engineering shop.

ecause columns or pillars may be more slender and the steel amework windows used give an increased lighting area. In cases here the floor load is higher than 200 lb. per sq. ft., reinforced ncrete buildings are cheaper than those of mill construction. Reinforced concrete buildings have developed almost entirely nce 1910. The first line of development was along the form of am and girder construction, but now the flat slab method of oring is used, especially in cases where the live load is 150 lb. or ore per square foot. For lighter loads, the development has been wards the long span joist construction with a filler of metal, e, terra-cotta or gypsum block, which reduces dead load and ves concrete.

DETAILS OF CONSTRUCTION

Foundations.—In choosing a site an important point is that of levels, and a site poor in this respect purchased at a low figure ay eventually prove a most costly one. It is also important to ve full knowledge of any mineral workings going on, or likely go on, as these might cause subsidence. The foundations of ildings which are to house heavy machinery must be ample ough to absorb vibration, and in the case of such implements as e steam and power hammer, or jarring machinery for foundries, e foundations should be entirely separate from all building uctures or their foundations. It is important to choose a site ere there exists a good subsoil of clay or rock, otherwise the pense of piling or rafting might make the cost of the buildings y high or even prohibitive.

Floors.—These should be designed to provide facilities for ure changes, especially if they are of reinforced concrete, and cts should be arranged to accommodate pipes, etc. Conduits uld be properly placed and openings provided for belts, fting and other accessories, properly protected. Where paratus must be taken through floors, ample openings and p doors or removable floor slabs are essential. Floors formed concrete and merely spade-finished are unsuitable, and their rability should be increased by some form of floor-hardener by the application of paving. Pavings are of many kinds, tallic, granolithic, cemented, of fir boarding laid on battens, chpine boarding, bricking, maple boarding, rock asphalt, od blocks, etc. Each of these types has its advantages and advantages, some being unsuitable on account of dust, others account of the discomfort to workers, and every building uires separate consideration. Floor areas must be laid out s to avoid the conflict of travel in opposite directions and to mit of easy transport.

ighting.—Windows, while no more expensive in initial outlay n walls, are an expensive item in upkeep, and with a large a of glazing the size of glass forming a unit should be of the er of 1 ft. 4 in. by 2 ft. or even larger, if of the roughcast or rismatic" type. It is not usually essential that all parts uld be made to open. Steel sashing, although difficult to n and a source of lost heat, is preferable to wooden sashing t provides increased lighting facilities, giving 80% to 90% t area as against 50% to 70% for wooden sashes and frames. e-story saw-toothed buildings should have roof windows ng north to avoid direct sunlight.

alls.—The thickness of building walls is dictated by Building Acts and by-laws, and in most countries there is no possiy of erecting such walls of less thickness than 9 in. or 14 in., ending on the height and length of the wall and whether steel nework is used. As already stated in connection with the ious types of building construction, various materials are d for walls such as brick, concrete, stone, etc. Where hoists cranes are fitted these must be provided with ample support.

oofs.—Roofs are one of the large items in building construc-. Their particular form is dependent upon the intended pose of the building; a high pitched gabled roof is the best forges, foundries and other shops engaged in hot processes hich large quantities of heat require to be dissipated, and in r cases where a level ceiling is not required; the glazed sawhed form of roof provides the best condition of steady, unin, natural lighting; the flat roof is the natural type for buildings with interior columns. Whatever the type the essential features are water- and fire-proofness. For general purposes the best material is mineral rock asphalt, which is unaffected by heat or cold and requires no yearly treatment, and is also capable of withstanding traffic without damage. Where sloping roofs are used, steel or reinforced concrete roof principals are employed, and this method of support is now as cheap as steel. Slates as a covering are high in first cost and heavy for long span roofs, but if of good quality are very durable. Bituminous felts and other compositions in sheet form are low in first cost, but require special treatment every few years.

Heating and Ventilation.—Of these two subjects the latter is the more important. In an ordinary factory the air should be changed three to five times per hour, while under some circumstances it should be changed as many as 20 times per hour. The temperature also varies with the nature of the work carried on, but a good average is 57° F., though for heavy manual labour a lower temperature should prevail, and for sedentary work, a higher. Various systems of ventilation and heating are employed, but the most suitable for the particular case must be selected, care being taken to economise space and avoid interference with cranes, conveyors, etc. (*see* PUBLIC HEALTH).

Stairways, Lifts, Elevators, etc.—Stairways should be ample for emergencies, and give passengers the least inconvenience, a $6\frac{1}{2}$ in. rise being considered good practice. Lifts should be encased with brick walls to prevent the spread of fire, and the openings should be fitted with doors of fire-resisting material made to close automatically in case of fire.

Power Supplies.—Where power is generated on the site, the plant should be located at a point most convenient for the handling of fuel and ashes, and all boiler and engine-room equipment should be capable of extension. Where live steam is used in the manufacturing processes, the power plant should be situated centrally in order to avoid the necessity of long lengths of piping and excessive loss of heat.

Fire Protection.—The installation of apparatus to deal with outbreaks of fire is a necessity in all industrial buildings. The most usual form is by the sprinkler system in which pipes are fixed horizontally along the ceiling, and supplied with water which is not released until the temperature in the building is sufficiently high to melt the solder which holds the automatic valve of the sprinklers in position. When this is released the water is discharged over the affected area. Where sprinklers are not used, hydrants with lengths of hose should be fixed near stairs and in easily accessible positions and fire buckets and chemical fire extinguishers should be placed within the reach of anyone in the building. In the case of some trades, buckets of sand are more useful than water. Lightning-conductors should be fixed to all buildings.

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FAEROE ISLANDS (*see* 10.123).—A group of 21 islands belonging to Denmark, situated in the North Sea, 7° east, 62° north. The area is 511 sq. m. and the population (1921) 21,532. Since 1910 the development of an active movement in favour of self-government has been the most prominent feature of politics in the Faeroes. Though the *Sjálvstýrisflokkur*, or Home Rule party, was first organized as lately as 1906, it is true that some points in the nationalist programme have an earlier origin.

Rise of Nationalism.—The endeavour to secure for the national speech of the inhabitants a position of equality with the official Danish may be said, indeed, to date from the middle of last century, when V. U. Hammershaimb, by systematising the local language, adapted it to literary use. The encouragement of this language was a main plank in the programme of the *Föroyingafelag*, a society instituted in 1889. The addition, however, to such comparatively innocent expressions of nationalism, of claims for complete political autonomy and even independence, is doubtless largely due to the stimulus of recent events. The success of a similar movement in Iceland (*q.v.*), which secured for that colony, in 1918, a status of sovereign independence, has no doubt played its part, and it is significant that it was in the same year—1918—that the Home Rule party of the Faeroes first obtained a majority in the local Lagting. To this stimulus was added, at about the same time, the prominence given to self-determination during and after the World War.

But above all, the dispute between Denmark and Norway over the question of Greenland revived old complaints as to the methods whereby the Danish negotiators, at the Treaty of Kiel in 1814, managed to retain possession of the ancient Norwegian colonies, Iceland, Greenland and the Faeroes, while the separatist tendencies of the Home Rulers were encouraged by certain sections of the Norwegian press and by private individuals in Norway. Under these influences the nationalist leader in the Faeroes, Johannes Patursson, went so far, in 1923, as to suggest the possibility of complete separation from Denmark and an ultimate union with Norway. This, however, is no part of the official programme of his party, the political aims of which do not seem to go much further than an effort to secure autonomy by giving to the Lagting legislative instead of, as at present, merely advisory powers.

With regard to the language question, some progress has been made, and since 1912 the use of the local as well as the Danish language in education and in the conduct of religious services has, to some extent, been authorized. The claims of extreme nationalists in this respect are, however, not yet satisfied. The complaints of Danish misrule made by Home Rulers seem, as is usual in such cases, based more on the events of the past than the present. The Danish Govt. has voted considerable sums towards the construction of roads and harbour works, as well as to the support of education. The large increase in the population, which has nearly doubled since the beginning of the century, indicates a considerable measure of prosperity.

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(G. M. G.-H.)

FAGUET, ÉMILE (1847–1916), French critic and man of letters (*see* 10.125), published in his later years *Rousseau penseur* (1910); *Madame de Sévigné* (1910); a study of *Rostand* (1911); *Vie de Rousseau* (1911); *Les amies de Rousseau* (1912); *Rousseau artiste*, etc. (1912); *En lisant Molière* (1914) and *Mgr. Dupanloup* (1914). He died in Paris June 7 1916.

FAIRBAIRN, ANDREW MARTIN (1838–1912), British divine (*see* 10.129), died in London Feb. 9 1912.

FAIRBANKS, CHARLES WARREN (1852–1918), American politician, was born near Unionville, O., May 11 1852. Graduating from Ohio Wesleyan University in 1872, he was admitted to the bar in 1874, and began practice at Indianapolis, Ind., where he became a railway financier. He was chairman of the Republican State Convention in 1892, 1898 and 1914, and in 1896 was elected to the U.S. Senate. He was chairman of the U.S. representatives on the British-American Joint High Commission for dealing with Canadian questions in 1898 and 1903, being re-elected to the Senate in the latter year. In 1904 he was elected Vice-President as a Republican with Theodore Roosevelt. In 1916 he was again nominated for the vice-presidency, but was defeated. He died at Indianapolis June 4 1918.

FAIRBANKS, DOUGLAS (1883–   ), motion picture actor and producer, was born at Denver, Colo., May 23 1883. He studied at the Colorado School of Mines and later attended Harvard University, but left the university to enter a brokerage firm in Wall Street. In 1901 he abandoned finance and took up the stage as a career, eventually starring in several plays, among them *The Man of the Hour* and *The Gentleman from Mississippi*. Leaving the stage in 1915, he devoted himself to the screen and achieved success in *The Lamb*, his first picture. In 1917 he became head of his own producing company. His pictures have been distinguished by the wholesomeness of their themes and the extraordinary amount of action displayed. His later productions, such as *The Thief of Bagdad*, exhibit great mechanical ingenuity and a genius for picturesque background. His other pictures include, *The Mark of Zorro*, *The Three Musketeers*, *Robin Hood*, *Don Q* and *The Black Pirate*. He married, March 28 1920, as his second wife, Mary Pickford.

FAISAL AL HUSAIN (1885–   ), King of ʻIrāq, was born at Taif, the third son of the Sharif Husain. Faisal traced his descent from Fatimah, only surviving child of the Prophet, through Hasan, her eldest son by marriage with ʻAli Ibn Abi Talib, fourth Amir Al Muninin. After the custom of his house, Faisal was sent when only seven days old, to Rahab Palace, the country seat of the Al ʻAun family, in the territory of his clan, Beni ʻAbadiyah and their confederates the ʻAtaibah. Here the boy was raised among the tribesmen, and remained until he was seven. In 1893, when Husain was ordered to Constantinople, Faisal accompanied him and was educated privately in that city. In 1905 he married his cousin, and returned to the Hejāz in 1909, when his father was appointed Sharif.

In 1913 Faisal became deputy for Jiddah and proceeded to identify himself with the Arab National movement. He commanded his father's forces in ʻAsir in 1914, and was at Mecca on the outbreak of the World War. He was posted with the Turkish Governor of Syria in 1915, but escaped to the Hejāz early in the following year, and there played a leading part in the Arab revolt, commanding the Arab forces with Gen. Allenby's army until the capture of Aleppo in Oct. 1918. His influence with the tribes did much to keep Husain's tribal levies in the field. As Commander-in-Chief of the Arab Army under the Allied Commander-in-Chief he then undertook the administration of the newly-constituted Syrian State, and after attending the Peace Conference in Paris returned to Syria in April 1919. In Sept. he again visited Europe and remained until Feb. 1920; in the following month he was proclaimed King of Syria, but being unable to come to terms with the French Mandatory power he left Damascus in July 1920. After spending the winter in England he proceeded to ʻIrāq as candidate for the throne in June 1921, and was elected king by a plebiscite in which he received 96% of the votes cast (*see* ʻIRĀQ).

FALKENHAYN, ERICH VON (1861–1922), Prussian general, was born Sept. 11 1861 at Burg Belchau in the district of Thorn (Torun). He took part in the China expedition of 1900 and remained in China with a brigade of occupation till 1903. In 1906 he was appointed chief-of-staff of the XVI. and afterwards of the IV. Army Corps; in 1913 he became general and was appointed Prussian minister of war. He succeeded Gen. von Moltke in Dec. 1914 as chief of the general staff of the army, was advanced to the rank of general of the infantry, and helped to plan the summer offensive of 1915 against Russia and the operations by which in the winter of 1915–6 Serbia was overrun. He was made responsible, however, for the ill-success of the German attacks of 1916 at Verdun, and was replaced as chief of the general staff by Hindenburg in Aug. of that year. He was then assigned the leadership of the IX. Army against Rumania. In 1917 he took command of the so-called Asiatic Corps, for operations in the Caucasus, and in 1918 and 1919 was at the head of the X. Army. Falkenhayn wrote *Die Oberste Heeresleitung 1914–6 in ihren wichtigsten Entschliessungen* (1920) and *Der Feldzug der 9. Armee gegen die Rumänen und Russen 1916* (2 vol., 1921). He died April 8 1922 at the castle of Lindstet, near Wildpark.

FALKLAND ISLANDS, BATTLE OF THE.—One of the principal naval actions of the World War was fought on Dec. 8 1914, to the southeast of the Falkland Is. between a British battle-cruiser squadron under Vice-Adml. Sir Doveton Sturdee and the German squadron under Vice-Adml. Graf von Spee. The table on p. 7 shows the details of the respective forces

Fleet at Port William.—Adml. Sturdee arrived at Port William (adjoining Port Stanley) in the Falklands in the forenoon of Monday, Dec. 7. The "Canopus," an old battleship, was already there, moored in Port Stanley and waiting with the local volunteers to resist any attack. The squadron was ordered to keep steam for 12 knots at two hours' notice; the "Macedonia ook the guard, and coaling started. Adml. Sturdee's own colliers ad not arrived: there were only three in harbour and the coal one had deteriorated. The "Carnarvon" finished coaling 4 A.M. Dec. 8; the "Invincible" started at 6 A.M., and the Inflexible" at 7:20 A.M. The "Bristol" had drawn fires to medy defects and the "Cornwall" had opened up one engine. his was the situation when at 8 A.M. the "Glasgow" fired a gun.

BRITISH			
Type	Ships	Guns	Speed
Battle-Cruisers	"Invincible" "Inflexible"	8 12-in. 8 12-in.	25 knots 25 knots
Armoured Cruisers	"Carnarvon" "Cornwall" "Kent"	4 7·5-in., 6 6-in. 14 6-in. 14 6-in.	22·5 knots 23 knots 23 knots
Light Cruisers	"Glasgow" "Bristol"	2 6-in., 10 4-in. 2 6-in., 10 4-in.	25 knots 24 knots
rmed Merchant Cruiser	"Macedonia"	..	..
GERMAN			
rmoured Cruisers	"Scharnhorst" "Gneisenau"	8 8·2-in., 6 5·9-in. 8 8·2-in., 6 5·9-in.	22·5 knots 22·5 knots
ight Cruisers	"Leipzig" "Nürnberg" "Dresden"	10 4·1-in. 10 4·1-in. 10 4·1-in.	22 knots 23 knots 24 knots
upply Ships	"Seydlitz" "Baden" "Santa Isabel"	..	..

German Fleet Sighted.—A signal was flying at the look-out tion on Sapper's Hill above the harbour. It reported two ange ships in sight. A scene of bustle and commotion ensued. 8:14 A.M. the signal was made to prepare to weigh and raise am for full speed. Colliers were cast off, guns cleared away l great clouds of smoke began to pour from the funnels as the os raised steam. The ships which had appeared so unexpect- y were the "Gneisenau" and "Nürnberg," which Von Spee l sent in advance to effect a landing. They were not visible n the "Canopus," but with the help of a fire control station the hill she opened fire on them with her 12-in. guns at 9 A.M. e range was over 14,000 yd. and the shots fell short, but they le the "Gneisenau" turn away.

he "Scharnhorst" was still some 15 m. off but the clouds of ke rising over the hills had made Von Spee uneasy. From "Gneisenau" came a report of six warships in the harbour, the German admiral, confirmed in his misgivings, ordered to steer east and not to accept battle. By 10 A.M. the "In- cible," "Inflexible" and "Cornwall" were under way and ing harbour. Huge clouds of smoke hid them for a time, but cleared away, revealing the tripod masts of battle-cruisers Von Spee knew that his hour had come.

ursuit of German Fleet.—By 10:30 A.M. Sturdee was clear of harbour; the Germans were hull down to the southeast about n. off, and the admiral hoisted the "general chase," a signal each ship to steam as hard as she could in pursuit. It was a ect day with a blue sky and calm sea. A light wind was blow- rom the northwest. The day may be resolved into two phases e pursuit from 10:20 A.M. to 1:20 P.M., and the action from P.M. to 6 P.M. At 10:50 A.M. Sturdee ordered the "Inflex- " to take station on his port quarter, thereby annulling the al to chase. By 11 A.M. the Germans were showing above the zon and the battle-cruisers eased to 24 knots. The "Glas- " was on the "Invincible's" port bow, the "Kent" on her beam. The "Carnarvon" and "Cornwall" were 5 m. astern. he crews were piped to dinner and, to give the "Carnarvon" ance to get up, the admiral reduced to 19 knots. Meanwhile Spee's colliers had been sighted to the westward off Port sant (20 m. west of Port William) and the "Bristol," which just leaving harbour, was sent after them with the "Mace- a" at 11:30 A.M. By this time the chase was gradually coming round to southeast by east. The "Carnarvon's" efforts to get up were unavailing and Sturdee increased to full speed. By 12:50 P.M. the battle-cruisers were going 25 knots, overhauling the Germans fast.

The "Leipzig" soon felt the pace and began to drop behind. At 12:55 P.M. her range had fallen to 16,000 yd. and the "Inflexible" opened fire on her. Von Spee, to save his light cruisers, ordered them to scatter at 1:20 P.M. and they broke away to the southward, but the British cruisers were ready, and without waiting for orders, the "Glasgow," "Cornwall" and "Kent" went off in hot pursuit (see fig. 1).

Conflict of Battle-Cruisers.—Von Spee, as his light cruisers left him, turned at 1:25 P.M. to the eastward to accept battle, and took station ahead of the "Gneisenau," while Sturdee's battle-cruisers to the northward turned into line ahead on an easterly course. At 1:30 Von Spee opened fire at 14,000 yd. but the range was too great for the 8·2 in. guns and he led round to the northeast. The range fell to 12,500 yd. and about 1:45 P.M. the "Invincible" was hit, and Sturdee turned away to open the range and take advantage of his heavier guns. The windward position was a severe handicap. Dense clouds of smoke were pouring from the battle-cruisers shrouding the ships and smothering the range. By 2 P.M. the range had increased to 16,000 yd. and the guns ceased fire. No serious damage had been done, the "Gneisenau" had received only two hits, and one of her 8·2 in. casemates had been temporarily disabled.

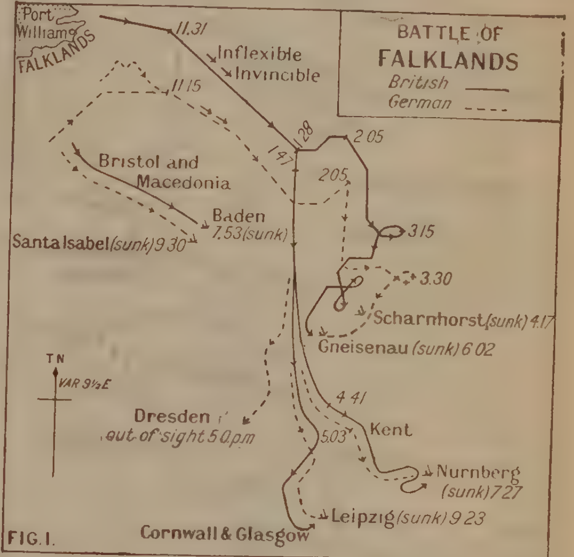

FIG. 1.

At 2:05 P.M. Von Spee turned right away to the southward, bringing the battle-cruisers right astern, and some minutes elapsed before the movement was seen; then Sturdee turned after him to the southward, increasing speed, and the chase began again (see fig. 2). It continued for nearly 40 min., while Sturdee crept gradually up on von Spee's port quarter. At 2:50 P.M. the range was down again to 14,000 yd., and turning two points to port, Sturdee opened fire again. Von Spee again accepted action and turning to the east opened fire at 2:55 P.M. (see fig. 2). The action ran to the eastward till 3:15 P.M. with the range falling gradually to 11,000 yards. The British guns were now establishing a mastery. The "Scharnhorst" was burning, her fire had slowed down and she sheered to starboard for a time with a damaged rudder.

But again the smother of smoke made spotting difficult, and at 3:15 P.M., to escape from it, Sturdee turned the battle-cruisers right round to port together, so that the "Inflexible" was now leading to the westward. Von Spee in reply at 3:27 P.M. led round to port, in succession bringing his starboard guns into action. The action now ran to the south-westward with the

British battle-cruisers circling round the Germans at a range of 11,000 to 12,000 yards. By 4 P.M. the "Scharnhorst" was blazing from stem to stern, her guns were silent, her superstructure was a mass of ruins; she was listing heavily to port and barely making 12 knots. Smoke was again obscuring the range and the "Inflexible," to get rid of it, circled round to starboard at 4:10 P.M. engaging the "Gneisenau" on a northeasterly course (see fig. 2).

End of the "Scharnhorst."—The "Invincible" ran on a little farther to the southward and then circled round to the northeast. The "Scharnhorst's" end was now near. She turned to starboard a mass of smoke and flame, then at 4:17 P.M. heeled completely over to port and sank with her flag flying. Not a soul was saved. The "Invincible" and "Inflexible" were now engaging the "Gneisenau" on an opposite course; at 4:30 P.M. Sturdee, then on a northeasterly course, circled round to starboard, and ordering the "Inflexible" to form single line ahead shaped course to the westward. The "Gneisenau" was some 13,000 yd. to the southeast, struggling desperately along on a southwest course.

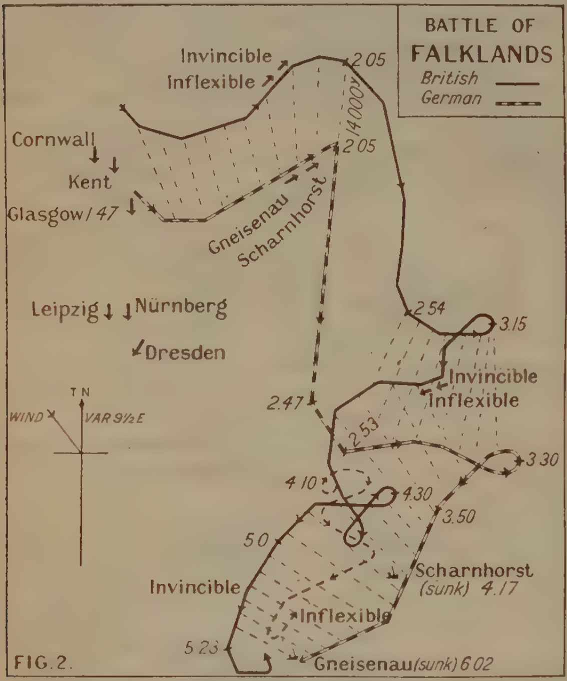

FIG. 2.

The "Gneisenau" Sunk.—At 4:45 P.M. the "Inflexible," again hampered by the smoke, turned to port, and, leaving the flagship, ran to the eastward, opening on the "Gneisenau" with her starboard guns, and turning southwest again at 4:55 P.M. kept the "Gneisenau" at about 12,000 yards. By 5:15 P.M. the latter was in a sorry plight. Her foremost funnel had toppled over; she was listing heavily to starboard and barely making headway. The sunshine had gone and a drizzling rain had commenced to fall. Her fore turret still fired fitfully. At 5:45 P.M. she fired her last shot and at 6:02 P.M. heeled slowly over to starboard and sank. The British rescued 187 survivors from the icy water.

Pursuit of Light Cruisers.—Meanwhile the German light cruisers were heading to the southward with the "Glasgow," "Kent" and "Cornwall" at their heels. The actual speeds are doubtful. On the British side, the "Glasgow" could probably go 25 knots, and the "Cornwall" and "Kent" can be credited with at least 22½ and 22 knots. The "Dresden" could probably go 25 knots, the "Nürnberg" 22, while the "Leipzig," whose engines and boilers were in bad condition, could barely do 20 to 21. The German ships, which had been cruising continuously for four months, found it hard to maintain their speeds. When the chase began the British cruisers were some 10 to 11 m. behind. The "Glasgow" soon forged ahead and at 2:53 P.M., in spite of the efforts of the "Dresden" to divert her by sheering off to the southwest, opened fire on the "Leipzig" and obtained a hit on her which reduced her speed.

Light Cruiser Action.—By 4:15 P.M. the "Cornwall" was coming up and opened fire on the "Leipzig" at 12,000 yd., but the range in the failing light was too great, and it was not till 4:25 P.M. that her shots were falling close. The "Glasgow" had received one or two hits and, forsaking any attempt to overtake the "Dresden," circled to starboard at 4:27 P.M. and passed behind the "Cornwall." The chase continued to the southeastward till 4:55 P.M., when the "Leipzig" turned to the southwestward, and the "Cornwall," following suit, engaged her with the port guns (see fig. 1). The "Glasgow" came into action again, the "Leipzig's" speed gradually sank and the British cruisers kept her under continuous fire at 9,000 to 10,000 yards. By 6 P.M. a drizzling rain had begun to fall and the "Glasgow" signalled to close. The "Cornwall" crept up and Capt. Ellerton began to fire lyddite with terrible effect.

The "Leipzig" Sunk.—By 7 P.M. the "Leipzig's" speed was reduced to 15 knots, but she was still firing fitfully. The whole of her stern was wrapped in flame and the main mast, melting in the heat, had collapsed. The British cruisers ceased fire and closed, but her flag was still flying defiantly and, at 7:50 P.M., they reopened fire for a quarter of an hour. Boats were lowered to rescue the crew. She was heeling heavily to port and at 9:23 P.M. turned over and sank (53° 55′ S., 55° 55′ W.). Only five officers and 13 men were saved.

"Nürnberg" in Action.—The "Kent," to the eastward all this time, had been vigorously pursuing the "Nürnberg" and by feeding the fires with all the spare wood in the ship, from hen coops to capstan bars, had brought the range down to 12,000 yd. by 5 P.M. The "Nürnberg" opened fire and was sending her 4·1 rounds right over the "Kent," when the latter's 6-in. guns were still falling 1,000 yd. short, but the weather was growing thick and it was becoming difficult to spot. Then came a change: the "Nürnberg's" boiler tubes gave out; her speed sank to 18 knots and the "Kent" overhauled her rapidly. At 5:45 P.M. the "Kent" was on her port quarter 7,000 yd. off, and the "Nürnberg" turned to northeast to engage her (see fig. 1).

The light was failing and Capt. Allen forced the pace and closed to 3,000 yards. The "Nürnberg" could not stand the fire and turned away to the southward at 6:02 P.M., but the "Kent" followed her round. By 6:10 P.M., the "Nürnberg" was blazing with only two guns in action, and the "Kent" circling round raked her at 3,500 yards. By 6:25 P.M. she was merely a burning wreck, listing heavily, but with her flag still flying, and the "Kent" opened fire again. Just before 7:30 P.M. the "Nürnberg" turned over and sank, but though the boats were searching up till 9 P.M., only seven survivors were found.

The following table shows the casualties of the British and German forces:—

	Ship	Hits Received	Casualties	Rounds Fired
British	"Invincible" .	22	0 k. 1 w.	573 12-in.
	"Inflexible" .	3	1 k. 2 w.	661 12-in.
	"Glasgow" .	2	1 k. 4 w.	316 6-in.
	"Cornwall" .	18	0 k. 0 w.	1,000 6-in.
	"Kent" . .	36	4 k. 12 w.	646 6-in.
	"Carnarvon" .	0	0 k. 0 w.	. .
German	"Scharnhorst"	Sunk	All	. .
	"Gneisenau" .	Sunk	187 saved	. .
	"Leipzig" .	Sunk	18 saved	. .
	"Nürnberg" .	Sunk	7 saved	. .
	"Dresden" .	Escaped	. .	. .

k. = killed. w. = wounded.

German Colliers Captured.—Meanwhile the German colliers "Santa Isabel" (Hamburg-South America) and "Baden" (Hamburg-America) had been found by the "Bristol" and "Macedonia," chased to the southeast and captured about 4 P.M. (see fig. 1). Sturdee had given the order to sink all transports, and, though they were not transports, but colliers full of valuable coal, they were sunk. The "Seydlitz" (Norddeutscher

oyd) escaped to the southward and found safety amongst the
bergs of the Antarctic. The “ Dresden ” had disappeared to
e southwest about 5 P.M. and reached Magellan Straits on Dec.
. Three long months elapsed before she was hunted down and
nk by the “ Glasgow ” and “Kent ” on March 14.

Conclusion.—This was the end of the engagement known as
e Battle of the Falklands, the end of Von Spee's squadron, of
n Spee and both his sons. It marked the end, too, of a definite
ase of the struggle at sea. The German cruiser warfare col-
sed, and outside the North Sea and the Baltic, England held
unchallenged command of the sea.

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PHY. (A. C. D.)

FALL RIVER, Mass., U.S.A. (*see* 10.155), was outranked in
19 by New Bedford (*q.v.*) in the value of cotton goods pro-
ced. In 1920 it ranked first in the proportion of children
ployed, 18·5% of all 10–15 years of age; second in illiteracy,
9% of the population 10 years of age and over being unable
write; third in the proportion of women at work, 41·6% of
females 10 years of age and over, and had a high infant mor-
ity. The total value of its manufactured products was $64,-
,000 in 1909; $163,246,000 in 1919; $133,407,969 in 1921;
72,395,700 in 1923. The average number of wage-earners in
factories was practically the same in 1909 and 1919 (37,139
37,015 respectively), and after a drop in 1921, rose to 37,018
1923. Fall River was seriously affected by the general de-
ssion of 1920–1 and by the growing competition of southern
ton-mills. At times, after the close of the World War, the
mber of unemployed was estimated at 20,000 or 30,000, or
n more. In 1922 a fuel-oil refinery, with a monthly capacity
1,000,000 barrels, was added to the industries of the city.
e construction of an electric super-power plant on the Taun-
river was begun in 1925. A city plan was adopted in 1923.

AMILY ALLOWANCES.—The custom of paying, in addition
wages, allowances for children and sometimes for wives, grew
out of the economic conditions during and after the World
r, though before that vestiges of it existed here and there
few occupations, notably in agriculture, where payments in
d varying with the size of the labourer's family have long
n general in most countries. During the War all the bel-
rent States paid allowances for the wives and children of the
in the fighting services, and in the public services of most
opean countries, the war bonuses made necessary by the rise
prices were proportioned in some way to the size of the
ker's family, or at least differed for married and unmarried.
bably these two war customs prepared the way for the rapid
elopment which has followed in some countries.

n the services of the State and of local authorities the pay-
nt of allowances for children has become established in
nce, Germany, Belgium, Holland, Switzerland, Italy,
choslovakia, Jugoslavia, Norway (municipal services only)
den, Finland and Poland. In several of these (*e.g.*, Switzer-
d and Italy), attempts have been made, so far unsuccessfully,
rop the payment as conditions became more normal. In most
ntries, a distinction is made between the children of salaried
cials and those of weekly wage-earners, the allowances for the
ner being at a higher rate and continuing during the years
niversity education, while those of the latter terminate at
or 14. Otherwise the allowances do not vary with the re-
neration of the worker, except in Holland, where they are
ressed as a percentage of his salary, with a minimum and a
imum. In Switzerland, allowances are confined to the lower
officials. Everywhere the allowances represent only a small
of the cost of a child; being on a flat rate they are more
ortant to the lower paid than to the higher paid officials.
s in Germany, where the allowances in the public services
relatively more important than in most countries, and where
include an allowance for the wife, it is reckoned that the
age income of a married official is raised by this means
from 15 to 30%, according to his grade, above that of an unmarried official. For a man with a large family the value is of course considerably more than this. The Federal Govt. of Australia gives the children of its employees an allowance of 5s. a week until the age of 14.

Next to the public services, mining is the occupation where the system is most widely established. It is practically universal in the mining industry of Germany, France, Belgium, Austria and Yugoslavia and in some of the mining districts of Holland, Czechoslovakia, Poland and Sweden. Here, as elsewhere, the allowance represents only a contribution towards child maintenance. It is reckoned that in the Ruhr a workman with three children receives by this aid about 16% more than a single man. In Germany and France the cost of the allowances to the employers is equivalent to about 6 or 7% of the wage bill. In most countries the married workers' privileges include coal and in some a house free or at a low rate.

THE SYSTEM AT WORK

In other industries, the family allowance system is widely extended only in France, Belgium, Germany and Austria, though there are instances of it in other countries.

The French System.—In France its development has been greatly helped by the device of the equalisation fund (*Caisse de Compensation pour allocations familiales*), which guards successfully against the danger that family allowances paid for by employers might prejudice men with families in obtaining employment. Such funds were first proposed in 1918 by M. Romanet, a benevolent Roman Catholic employer of the metallurgic industry of Grenoble. The idea spread rapidly, and by the end of 1925 there were in France 180 equalisation funds, covering over 10,000 firms. The method is simple:—The fund may be either “ professional,” *i.e.*, confined to a single industry or kind of occupation, or “ regional and interprofessional ” *i.e.*, open to all employers who desire to join within a given area. The scale of allowances (which varies considerably in different funds) having been fixed, the number of children covered is ascertained at fixed periods, and each adherent employer is assessed for his share of the cost, the assessment being based either on the amount of his wage-bill, the number of his workers or the number of hours worked. When the number of workers is the basis, some funds fix a lower scale for women and youths than for adult male workers. Some funds actually pay the allowances to the parents; in others the employer pays and subsequently claims from the fund the excess, or pays into the fund the deficiency of his payment over the sum due from him.

The allowances are usually paid monthly and, in an increasing proportion of funds, not to the workman but to the children's mother. It is found that this method is not only more certain to benefit the children, but less apt to arouse the jealousy of the single man, who is thus led to regard the allowances, not as an addition to wages, and thus an infraction of the principle of equal pay for equal work, but as a recognition of the separate service of parenthood. The desire for an increased population is shown by the grading of the allowances upwards, *e.g.*, in May 1924 the average of the scale in all the funds was per month 19 fr. for one child, 46 for two children, 81 for three, 124 for four. At this date the average monthly wage of an adult labourer was 500 francs. Many funds also pay bonuses at childbirth (*primes de naissance*) and during the period of lactation (*primes d'allaitement*). Many maintain subsidiary health services, such as health visitors, day nurseries, convalescent homes, etc.

The cost of the allowances to employers varies from 1 to 7% of the wage bill. Including the public services, mines, railways and other large enterprises, which pay allowances directly, the number of workers covered in 1925 was reckoned at 3,500,000 and the annual cost of allowances at over 1,000 million francs.

The system is increasingly popular with employers, who find their reward in the increased well-being and contentment of their workers. The attitude of the trade unions has changed from one of suspicion to a definite and cordial acceptance of the principle, coupled with resentment of employers' control and demand that it shall be made universal, compulsory and collectively controlled.

Other European Countries.—In Belgium, the methods adopted are modelled closely on those of France. Progress began several years later, but has been rapid; and the system appears equally destined to become a permanent part of industrial life, welcomed both by employer and employed. In his report for 1925, the British commercial secretary attributed the freedom of the country from industrial strife partly to this cause and says:—

> It is almost generally admitted now that the family bonus system is of real economic value, and that by improving the present and future conditions of the working class it is capable of exerting a direct and beneficial influence on the prosperity and producing capacity of the country.

In Germany, during the five years following the World War the payment of family allowances was probably as common as in France, but much less generally popular. Employers tended to regard the allowances as a temporary addition to wages which could be dropped when conditions became more normal. Hence few equalisation funds were started, and the allowances being paid to the worker with his wage was apt to excite the single man's jealousy, while the married man feared to be prejudiced in seeking work. In 1925 the number of collective agreements containing family allowances showed a falling off. It is not yet certain whether the tendency will be permanent.

In Austria, the payment of children's allowances through equalisation funds was, in 1921, made compulsory on all employers, as a kind of compensation to the workers for the removal of the bread subsidy. The amounts, however, were exceedingly small, and at the end of the period stipulated by the law, the system, to a great extent, lapsed, except in the public services and in the mining industry.

Australia.—In Australia, since 1907, wages have been subject to a legal minimum, settled by the Courts and supposed to be roughly based on the needs of the "normal" family of five persons (four persons in New South Wales). In 1919, owing to the discontent caused by rising prices, a Royal Commission on the basis wage, composed of equal numbers of representatives of employers and employed with an impartial chairman, was set up to determine what was the actual cost of maintenance of a five-member family at a standard of reasonable comfort. The sum fixed for each of the five States averaged £5 16s., the existing basic wage being then £4. The Commonwealth statistician promptly reported that the whole produced wealth of the country, if equally divided, would not yield the necessary amount. The chairman of the commission, Mr. A. D. Piddington, then submitted the proposal that the basic wage should be based on the needs of man and wife and supplemented by an allowance of 12s. per week for each child, paid out of a State fund to which each employer should contribute 10s. 9 p. per week per employee. He pointed out that the ordinary conception of the basic wage postulated 2,100,000 non-existent children, the total number of actual children (under 14) of employees being 900,000. The only actual fruit of this proposal, up to 1926, has been the aforesaid 5s. allowance paid for each child of a Commonwealth employee. But child endowment has figured largely in the programme of Australian politicians. A Bill embodying Mr. Piddington's proposal passed the Lower House of New South Wales in 1920; a Bill for the State endowment of children was introduced by the succeeding Labour Govt. of New South Wales. The South Australian Labour Govt. in 1925 promised, but failed, to introduce a similar measure. The Federal Govt. has also played with the question.

Great Britain.—Although Great Britain possesses the earliest equalisation fund in existence (in fact though not in name) in that established about a century ago by the Wesleyan community for children of ministers, the family allowance system has so far not taken much root in the country, except in the fighting services. The subject, however, has been widely discussed since the development of the foreign schemes. It is significant of its growing hold on public opinion that during 1925 the London School of Economics introduced substantial educational allowances for the children of its professorial staff, the Independent Labour Party adopted as part of its programme a state scheme of children's allowances, and the Coal Commission report recommended such allowances as "one of the most valuable measures that could be adopted for increasing the well-being and contentment of the mining population."

Conclusions.—Advocates of the principle contend that as the national income or dividend is an uncomfortably tight fit, it will be impossible to satisfy the general demand for a reasonably high standard of life so long as the needs of the family during the years of its greatest dependency are only met through a wage paid equally to the childless man. They further argue that the value of children to the community, as its future citizens and workers, is not adequately recognised by a system which assigns to the family unit an income no larger than that enjoyed by the single individual; that as a result the more thoughtful and ambitious workers are tending drastically to restrict their families, while the less thoughtful and less ambitious practise no such restriction. To this is added the plea that the maximum production of wealth will only be achieved when competition between men and women workers is at once free and fair; that this is impossible without "equal pay for equal work," and that this again is impracticable until family responsibilities are met by family allowances.

There is a division of opinion among advocates of family allowances in Great Britain between those who prefer the foreign system of equalisation funds paid for by employers, those who would like to see family allowances provided through contributory insurance, and those who believe that the whole cos should be met by the State.

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FARINA, SALVATORE (1846–1918), Italian novelist (se 10.179), died at Milan Dec. 15 1918. His best-known work i *La piu bella fancuilla dell' universo* (1911). See V. Dendi, *U Romanzo dimenticato, S. Farina* (1921).

FARINACCI, ROBERTO (1892–), Italian politician, wa born Oct. 16 1892 at Isernia, in the province of Campobasso Educated at Cremona, he entered the railway administration becoming station-master at Cremona. While still a very youn man he took to politics, and on the outbreak of the World Wa conducted an active interventionist propaganda. As soon a Italy went to war he volunteered for active service, but r months later was ordered to resume his civilian duties. After th Armistice he was one of the first to join Mussolini's Fasci c Combattimento and he organised the movement in Cremona In 1921 he was returned to the Legislature as member for Mantova Cremona, but was unable to take his seat in the Chamber, bein under age. He had now become the leading figure in Cremona and through the daily paper founded by him, *Cremona Nuov* acquired an increasing influence in the Fascist party. He als found time to complete his studies and secured a universit degree in law. When Mussolini came into power, although n given office, Farinacci continued to be one of the Premier's mos trusted advisers. In 1924 he was again returned to the Legislature and in March 1925 he became, on Mussolini's nominatio general secretary of the Fascist party.

FARMERS' ORGANISATIONS (*see* 10.181).—The wholesal intervention of various Governments in agricultural productio and the regulation of prices which was necessary during th World War have provided great stimulus to the organisatio of farmers into associations capable of negotiating with th Governments of their respective countries. The growth of th Federation of Farm Bureaus in the United States and of th National Farmers' Union in Great Britain are but examples o associations not called into existence by the War but which hav strengthened their position and learned to play a representativ part during these critical years.

It has become evident, however, that any national movemen for the stabilisation of the prices of agricultural produce at level that will be remunerative to the farmer must be severel limited by international competition in the world's marke Consequently a widespread feeling has grown up that an international combination between producers is necessary in order t secure some common action among the farmers of all countrie whereby their interests may be protected.

The International Institute of Agriculture at Rome i however, organised on an official basis. There is no direct representation of farmers, and the line of work taken up by the Institute has been mainly confined to the collection and disseminatio of information. The constitution of the Institute which is define by treaty provides no machinery for enabling farmers' associations to formulate an international expression of agricultura opinion, but the question is still under consideration. Ther exists an International Commission of Agriculture with its sea in Paris, which from time to time (1923 in Paris, 1925 in Warsaw) convenes an International Congress of Agriculture. It under consideration whether this organisation cannot be give a character more directly representative of the associations o farmers in various countries.

The same basic idea has been earnestly advocated by the writings and personal influence of Dr. E. Laur, the Director of th Swiss Farmers' Union. In Sept. 1925, Dr. Laur summoned a international conference of representatives of agricultural associations which met at Berne and was largely attended by delegates of farmers' organisations in Europe and the United State

America. The Conference affirmed the need for an interna- onal organisation that could promote common action amongst gricultural producers all the world over and decided to take eps to secure the support of the properly constituted bodies the various countries. A meeting was convoked in Rome for pril 1926 on the occasion of the meeting of the General Assem- y of the International Institute of Agriculture. (A. D. H.)

ORGANISATIONS IN THE UNITED STATES

The following article deals with the development of Farmers' rganisations in the United States, where the movement has own more rapidly and attained greater dimensions than in any her part of the world. For similar organisations in other agri- ltural countries, the articles thereon should be consulted. *ee* also AGRICULTURE; CO-OPERATION, AGRICULTURAL; MAR- CTING.)

The organisations in the United States fall into two general asses: (1) organisations interested in the general problems of riculture, *i.e.*, education, legislation, credit, transportation, c.; and (2) co-operative organisations of farmers formed for e purpose of marketing farm products or purchasing farm pplies. This classification does not include the various state d Federal institutions engaged in agricultural teaching, re- arch and service.

Principal Organisations.—Prominent among the general rmers' organisations are the Grange or Patrons of Husbandry, e American Farm Bureau Federation, the Farmers' Educational d Co-operative Union, and the Equity. Other organisations at restrict their activities to a special industry or phase of riculture are the National Co-operative Milk Producers' Feder- on and the National Council of Farmers' Co-operative Market- Associations. A number of local or regional organisations ve the interests of farmers and shippers of farm products. e organisation of the Grange comprises subordinate (or local) nty and state granges. The state organisations make up National Grange. The work of the local granges is chiefly ternal, educational, social and recreational, while the state ganisations and the National Grange give attention to broad estions of agricultural policy, education and legislation. The al units of the American Farm Bureau Federation are county ganisations, which were formed originally to employ and co- erate with an agricultural adviser for the county, who was o a state and Federal employee. In most states the county ricultural adviser was in 1926 paid wholly from public funds, ough he might work in close co-operation with the county n bureau or other farm organisation. County farm bureaus re first federated in state organisations, and in 1919 the ional organisation, the American Farm Bureau Federation, s formed. This organisation obtained a membership of over 00,000 farmers the first year of its existence. Since 1920 it taken an active part in the formation of large-scale, co- erative marketing agencies for grain, live stock and fruits vegetables. Some state farm bureaus have a close affilia- n with co-operative marketing associations which they have tered.

arketing.—The organisation of farmers for business pur- es has been mainly in the field of co-operative marketing. e most reliable estimates placed the total business of co- erative marketing associations at $2,500,000,000 for the year 5. This business was conducted by approximately 12,000 ociations, whose membership totalled over 2,700,000, more n one-third of the total number of farmers in the United tes. The number of farmers who were members of co-opera- e associations was divided by commodities as follows: grain, ,000; dairy products, 460,000; cotton, 300,000; tobacco, ,000; live stock, 400,000; fruits and vegetables, 180,000; eggs poultry, 50,000; wool, 50,000; nuts, 20,000; all other, 420,000.

he first nation-wide survey of the extent of co-operation among ners was begun in 1913. Data for the years 1912, 1913, 1914 and 5 were collected and tabulated. The most complete information secured for the year 1915. Reports were received from 5,424 operative associations with an estimated membership of 651,186 an estimated volume of business amounting to $635,838,684. The largest volume of business, $289,689,200, was credited to the farmers' grain elevators. Fruit and vegetable associations with $201,542,600 were second, and associations marketing dairy products were third with $89,061,300. The second survey was made in connection with the taking of the 1919 census. Sales through farmers' marketing organisations at this time were reported as $721,983,639 and 511,383 farms reported sales through such organisations. At the same time 329,449 farms reported purchases through farmers' buying associations totalling $84,615,669. The third survey was undertaken by the U.S. Dept. of Agriculture in 1921. Reports had been received from 10,500 associations up to 1925, and it is on these reports that the estimate of total business, already given, is based. The interesting feature as regards these figures as compared with those given for 1915 is the increase in the amount of business done by cotton, tobacco and live-stock marketing associations. In fact, large-scale co-operation in the South has developed entirely since 1920.

Local Associations.—In Jan. 1926 there were approximately 11,500 active local co-operative associations—independent organisations and units of federations—whose members were for the most part limited to farmers using the same shipping point. The local association is the earliest form of co-operation among farmers in the United States. It performs, as a rule, the services of a country dealer. Fruit and vegetables are assembled, packed and stored by local associations; milk is manufactured into butter and cheese; grain is bought; live stock is assembled and shipped and supplies are purchased and distributed by this type of organisation. Most of them handle only one commodity or a group of related commodities, such as several vegetables, or butter and eggs. Approximately 9,500 of the local associations operate independently. They sell their products to local dealers or through commission merchants in the terminal markets. In some cases they employ the services of private distributing firms, or more rarely sell direct to wholesalers.

About 2,000 local organisations, however, are member units of federations formed for the purpose of performing the selling services which the small independent local associations cannot handle to the best advantage. The federation is an organisation in which the local units are the members and own the stock of the organisation, if it is incorporated with capital stock. Over 450 creameries in Minnesota, for example, have affiliated to form a federation to sell the butter manufactured by them. Two hundred local citrus packing associations in California sell their products through a co-operative central agency which they own and control. In this manner the group of local units are adequately represented in the markets at a reasonable cost. Approximately 50 federations were in operation in 1925. The annual sales aggregated $400,000,000, and over 220,000 farmers were members of the local units that affiliated to form these federations.

Regional Associations.—A third type of co-operative organisation is the centralised regional association. The first co-operative organisation of this type was formed in 1912. Since 1920, associations for the marketing of tobacco, cotton, fluid milk and dried fruit have been formed according to the centralised plan. A centralised regional association usually extends over a large area, frequently an entire state, or a producing region including portions of several states. It combines the functions of the independent local association and the federation. All members affiliate directly with the organisation, it owns the local warehouses and other necessary local facilities, and performs the local functions of assembling, storing, grading, or processing the product in addition to the marketing functions of distributing and selling. The number of members in associations of this kind exceed 60,000 in some instances. About 75 associations of this kind have been formed. They have approximately 900,000 members, and their total sales in 1925 were approximately $600,000,000. It will be noted, therefore, that approximately one-third of the co-operative marketing business was carried on in 1925 by 125 centralised regional and federated regional organisations. Sales agencies for the co-operative handling of live stock have been established at 20 of the terminal markets. During 1925 these agencies received live stock which sold for more than $280,000,000. Co-operative terminal market agencies have also been formed in a few markets for the sale of grain.

Capper-Volstead Act.—The rapid growth of large-scale co-operative organisation, which began in 1920, created a demand for state laws providing for the incorporation of the co-operative associations. In 1925, 46 of the states had laws permitting co-operative organisations to incorporate, with or without capital stock, and to incorporate in their articles of incorporation and by-laws provisions that would ensure the co-operative nature of the enterprise. Many of these laws also define the status of co-operative associations with reference to state anti-trust laws. In 1922 Congress enacted the Capper-Volstead Act which, in effect, sets forth the right of producers of agricultural products to act together in associations, and prescribes certain conditions which organisations of agriculture producers must meet in order to be considered co-operative for the purposes of the Act. The second section of the Capper-Volstead Act provides that the

Secretary of Agriculture may take steps to prevent the undue enhancement of prices of agricultural products by co-operative organisations.

The steady growth of co-operative marketing among farmers in the United States indicates that it has become established as a permanent method of marketing farm products. Since 1924 the development of new co-operative enterprises has been comparatively slow. More effort is being directed toward strengthening existing organisations and introducing more efficient methods of marketing farm products.

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FARM MACHINERY.—The increased demand for food supplies is met in two ways, by increasing the yields and by increasing the acreage, both of which require more labour in agriculture. To increase or even to maintain the efficiency of farm labour, and to keep down production costs in countries where labour is scarce, farm machinery is a necessity. It is sure to be in the future, as in the past, a factor of increasing importance in the agricultural, social and industrial structure of all civilised countries. In the United States the value of farm machinery manufactured yearly has increased approximately 250% since 1910, and the inventory value of machinery on farms has more than trebled. Progress may be classified under four headings: (1) new implements; (2) changes in design to adapt well-established implements to mechanical power; (3) changes in sizes of implements to meet changes in farm practice; and (4) refinements, standardisation, improved materials and research in farm machinery. Of the mechanical changes, those under items (2) and (3) have been the most extensive and have had the most influence in countries which have long used farm machinery.

Some New Implements Described

Corn Picker.—The mechanical corn (maize) picker, although not a new idea, is being increasingly adopted by the farming public. This machine snaps the ears from the standing stalks, then husks and elevates the ears to a wagon drawn at the side of the picker. It is fast becoming a necessity in economical production in the great maize areas where hand labour is scarce.

Ensilage Cutter.—The field ensilage cutter may also be classed as new since 1910. As an attachment to a tractor this device cuts the maize into ensilage lengths directly from the standing stalk, and loads the finely cut material on a wagon hauled at the side. The material is then drawn to the silo and blown into it by a blower. Although this method may not always lessen the cost of ensiling maize, it eliminates much hard hand labour and frees the farmer somewhat from the obligations of exchanging labour with his neighbours. Not long ago it was said that shocking grain and loading manure were the only big jobs left on the farm for hand labour. But since then the grain shocker and the manure loader have been developed sufficiently to be listed as distinctly new devices. Each of these, however, still presents some difficulties.

Cotton Picker and Beet Topper.—Neither the mechanical cotton picker nor the sugar-beet topper has been perfected sufficiently to go into general use. When the cotton picker is widely used it will undoubtedly revolutionise the agriculture of the more highly developed cotton areas; its influence socially and industrially is hard to predict.

Sugar-cane Harvester.—A new machine displacing much hand labour in the sugar-cane industry is the mechanical harvester which cuts, strips and bunches the cane in one operation. The successful application of a large, expensive machine of this kind to a specialised industry suggests the future use in general agriculture of large machines which combine operations and save labour and cost. The attention which farmers in humid regions are giving to the combination grain harvester and thresher illustrates this progressive tendency. It is only by recent investigations that the grain combine has been found to have possibilities outside of the semi-arid sections of the United States. Another example of "combine" machinery is a machine that will cut, dry and bale alfalfa hay in one trip over the field.

Adaptation to Requirements of Small Farms

Tractors.—The introduction of the tractor (*q.v.*) as a new form of power effected many changes in the older farm implements. About 1916 the light four-wheeled tractor appeared, soon to create somewhat of a revolution in the farm machinery field. The light tractor, costing less than its predecessors, has carried power farming to thousands of farms which perhaps could not have otherwise afforded it. This demanded an accompaniment of lighter and less costly implement units, leading to the introduction of the light, rigid hitch, two-wheeled tractor plough, and to the two-three-wheeled plough which uses three wheels while ploughing and only two while turning or being transported. The latter is equipped with a semi-floating hitch instead of the full floating hitch of its predecessors or the rigid hitch common in the typical two-wheeled tractor ploughs. These light ploughs, while not distinctly new implements, embody radical changes in plough design. They accompanied the light tractor into all countries into which the latter has penetrated, and have helped introduce power farming and have had a great influence in agriculture—they are one of the outstanding developments in farm machinery.

Implements Adapted to Tractors.—As the economy of the tractor on the average farm depends to some extent upon the number of uses to which it can profitably be put, manufacturers have tried to adapt to the tractor as many existing types of implements as possible. Grain drills equipped with tractor hitch and power-lift, so that the operator can control the lifting and dropping of the furrow openers from the tractor seat, have appeared during the last few years. If the farmer wishes to use his light, four-wheeled tractor for cultivating, he can secure a tractor hitch for a two-row cultivator; then by using an extension control, a comparatively new development, he can control and guide the tractor from the cultivator seat.

A special tractor mower is on the market. This machine is like the standard mower, but is built heavier and carries the control levers and lifting mechanisms which can be operated from the tractor seat. Potato and beet machinery is now furnished with either tractor or horse hitches. Some tractors now carry a "power take-off," through which power to propel the mechanism of the implement attached is taken directly from the tractor motor. This arrangement has caused some changes, especially in grain binders and corn pickers, and may prove revolutionary in general implement design. The grain binder so driven is lower and more compact, since the main wheel need not be used to develop power.

General Purpose Tractor.—Another tractor development that bids fair to influence farm machinery design widely is the idea of a general-purpose tractor. Attempts to make the tractor itself the base to which implement elements can be attached are beginning to be successful. A mower bar as an attachment to a light tractor was developed about 1918, but in a more recent tractor of special design four cultivator rigs can be attached to accomplish double-row cultivating. When the same power base is needed for mowing hay, the cultivator attachment is removed and a mowing attachment is set upon the tractor's draw-bar. Undoubtedly the designers of such a general-purpose tractor contemplate for use with it a four-row planting attachment and perhaps a raking attachment. Thus the same power unit will perform the ploughing, harrowing, grain seeding and grain harvesting operations of its predecessors, and will be able to work in row crops and in the hay field where the conventional type of tractor is somewhat handicapped. The essential part of the implement as an attachment for the tractor will be less expensive than the complete independent unit designed to be hauled. Hence, the tractor has greatly influenced existing design, and may influence future developments even more.

Size of Implements.—Increased attention has been given to e size of implement units which would prove most economical to capacity, power and labour requirement and investment. e two-row cultivator has recently increased in popularity, cause with it one man can cultivate 90% more acreage a day n with the single-row machine, with an increase of only 50% power. Within the past few years 10-ft. grain binders have peared for use with tractors. The tendency, however, is not ard larger sizes of all kinds of machines. The reduction of combined harvester and thresher to a more economical size the smaller grain farms is bringing this machine into quite eral use in the principal wheat sections of the world.

he advent of mechanical power on farms of medium size makes it sible for the farmer to accomplish independently some belt-er jobs which formerly he had to hire to have done. As a result e is increasing demand for the small grain-thresher and for the ll sizes of ensilage-cutters, huskers, shredders and shellers. In e countries the "custom" thresherman seems doomed. This sent tendency toward small sizes of some belt machines to mpany the small tractor is not as fundamental as, nor should it n contradictory to, the previously mentioned tendency of farmers hink about larger, faster, cheaper ways of producing food. At sent the popular sizes of implement units depend upon the popular s of farms; and the size of farm has been determined largely by er than the machinery factors. The implement size, therefore, been a result rather than a cause. But one must not overlook the sibility of modern agricultural thought and vision leading to machinery changes in both type and size that may reverse the status. Farm machinery development may point the way to er pronounced changes in agricultural organisation, and com-tion may be the direct cause for the transition. There seems to enewed interest in the possibilities of corporate farming. Rather inent claims are made concerning the possibility of carrying to farm more of the manufacturing process, allowing the larger, in-rialised farm to deliver its product in more fabricated form. If economics involved dictate such procedure, farm machinery will f paramount importance.

efinements in Design.—Refinement in farm machinery design manufacture has continued during the past decade. Imple-ts are now of neater design or are more trim; their parts are e accessible; fast-wearing parts can be replaced at minimum ; weight has been reduced where possible; the operator's iency has been increased by changes in design which con-r his problems and convenience; greater efficiency in the lement itself is sought constantly; and closer inspection at factory assures the purchaser of a more reliable product. use of better materials has resulted in increased strength less weight, in better soil-working surfaces and in greater bility. Improved types of ball and roller bearings have ntly found a definite field in farm machinery. Simplification mplement types as well as standardisation of implement s is in progress.

esearch.—Studies of the trend and application of farm ma-ery, research in its design and behaviour, and investigations he necessary requirements are approaching the funda-tals in the Americas as well as in England and in con-tal Europe. To illustrate with one of many examples, devel-ent in soil-working machinery is handicapped to some extent bsence of adequate information on some phases of soil amics. Highly scientific analyses have been made of the ematics and mechanics of some machine parts designed to he soil, but the application of such information cannot be realised until more is known about the causes for certain viours in soils. There is not even a world accepted standard hich the efficiency of tillage machines can be measured or pared. The agricultural engineer comes face to face with s and soils problems heretofore unsolved and sometimes en by the agronomist. The emergency is forcing co-opera-effort in basic research. The field is not only a wide one, also a promising one for the scientist. Agricultural, engi-ing and other scientific societies are beginning to foster such rch, even on an international basis. (C. O. R.)

ARM ORGANISATION AND EQUIPMENT.—The study of organisation of the farm is a comparatively recent develop-t of modern agricultural research. In its earlier stages the investigation of the farmer's problems was confined to matters arising out of the application of the physical sciences to the production of crops and the feeding and breeding of live stock. The basis of the organisation of agricultural research was that the practice of farming was, in its essentials, the application of the knowledge of the chemist, the botanist, the zoologist and so forth.

More recently it has come to be recognised that important as this aspect of agricultural development undoubtedly is, farming is also a business, the successful conduct of which can be determined only by a study of its economic structure. The production of crops and stock is in many respects an art, but is an art by which the farmer has to live, and maximum productivity secured by the uncontrolled application of scientific knowledge concerning the properties of feeding stuffs and manures is not always synonymous with maximum profit.

Law of Diminishing Returns.—So long ago as 1879 Sir John Lawes drew the attention of farmers to this question. He showed that there was no connection between maximum production and economic production; on the contrary, over-stimulation of the crop might bring the scientific farmer to economic disaster. In other words, agricultural production conforms to the law of diminishing returns.[1] The point at which increased production becomes unprofitable depends upon the price of the commodity, other things being equal; in a rising market this point will rise and the farmer will be justified in farming for a higher output; but in a falling market the man who has to live by the land must reduce his capital outlay notwithstanding the facilities for higher production which science has placed at his disposal (*see* AGRICULTURE).

An illustration of the importance of the study of organisation is to be found in the comparisons which are often instituted between the intensity of farming in England and in certain Continental countries, notably Denmark. The case of Denmark is cited as an example of what can be done to develop production from the land without the artificial stimulus applied in certain other European countries. It is pointed out that, notwithstanding a fiscal policy which admits of free imports of agricultural produce, Danish agriculture has flourished during a period in which the industry in England has been stationary; the extent of arable land, and, with this, the agricultural population, has been maintained whilst the land of England has been going back to grass to the accompaniment of an exodus of the rural population; that the yield of the soil of Denmark has steadily increased until it has reached a point considerably in excess of that of this country (*see* DENMARK: AGRICULTURE).

In their crude form these statements appear to be justified, but a study of the organisation of farming in the two countries goes far to disprove the crude conclusions so often drawn to the detriment of the business acumen and technical capacity of the English farmer. The economic circumstances which give rise to the differences in agricultural progress in England and on the Continent may be classed under two heads: (*a*) the proportion of small farmers, and (*b*) the competition of urban industries. (*See* LAND TENURE; TARIFF.)

Only by the study of farm organisation, both at home and abroad, can a proper interpretation be placed upon crude statistics of agricultural production, which are apt to prove dangerous weapons without it.

Size and Efficiency as a Productive Unit.—The maintenance of a high standard of production is very generally associated in Continental agriculture with farming in small units, and the advocates of the extension of the small-holding movement in this country base their case very largely on this fact. Figures collected in the course of investigations of farm organisation go to show that this extra production is apparent rather than real, and that it is purchased by the expenditure of capital and labour which would be more productively employed on larger areas Here is a table showing the manual labour and the horse labour requirements of farms in three agricultural districts, grouped by size; it will be seen that in each of them the labour required in production, whether manual or horse, varies inversely with the size of the holding, or, alternatively, that the efficiency of labour varies directly with the size of the holding:—

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[1] *Is Higher Farming a Remedy for Lower Prices?* J. B. Lawes. A Lecture delivered before the East Berwickshire Agricultural Association, May 3 1879. *Rothamsted Memoirs*, vol. 5.

Size Group	Persons Employed per 100 Acres	Draught Horses Employed per 100 Acres
Acres	No.	No.
District 1		
Under 50	7·1	4·4
50–100	5·0	3·7
100–150	4·0	3·0
Over 150	2·4	2·5
District 2		
Under 50	7·1	5·1
50–100	6·4	3·7
100–150	4·2	3·5
150–250	3·3	2·5
Over 250	2·6	2·1
District 3		
Under 100	4·1	5·3
100–300	3·0	3·7
300–500	2·3	2·6
500–700	2·5	2·3
700–1,000	2·3	2·3

It might be argued, however, that the higher labour requirements on the smaller farms are the measure of their greater productivity, and the following table, showing the extent to which the production per unit of land and per unit of labour is affected by the size of the holding, supplies some confirmation of this. The sales per acre in the group shown here (which corresponds to District No. 2 in the above table) show that the total production varies inversely with the size of the farm. The economic effect of this, however, is considerably discounted by the next column, showing the sales per person employed, when once more the greater advantage of the larger holdings is clearly indicated:—

District 2 Size Group	Sales per Acre			Sales per Person Employed		
Acres	£	s.	d.	£	s.	d.
Under 50	11	19	9	168	19	0
50–100	9	19	2	156	2	0
100–150	7	19	1	189	0	0
150–250	7	5	8	222	12	0
Over 250	8	4	4	316	19	0

To consider, now, the capitalisation of the farm, evidence of the influence of size is afforded by the table below, in which is shown the value of the implement equipment, per 100 acres, on farms in three other districts. Here, again, it is apparent that the capital cost of the implements per unit of land falls as the size of the holding increases.

District A		District B		District C	
Size Group	Value of Equipment	Size Group	Value of Equipment	Size Group	Value of Equipment
Acres	£	Acres	£	Acres	£
Under 100	446	Under 100	374	0–49	328
101– 300	286	101–180	266	50–99	294
301– 500	192	181–300	212	100–149	269
501– 700	164	Over 300	157	150–199	234
701–1000	173	..	..	200–299	213
..	..			300–499	179
..	..	..	..	Over 500	139

The question at once suggests itself—" What is the economic unit of production? " The answer will not be forthcoming until more work on the study of farm organisation and equipment has been carried out. In some of these tables it will be observed that the rate of variation slows down as the size of the holdings increases; in fact, if curves were plotted they would rise or fall steeply through the smaller size groups and then tend to flatten out from about the 300–400 acre farm upwards. In other words there is evidence that the " economic unit " of farming, in the districts used for the purposes of illustration, does not occu until this size group is reached, and that it continues for some considerable period above it. Evidence is not yet complete o the question of a top limit, but there are certain indications tha one-man management does not continue its efficiency beyond a certain point. Thus, in a certain district, which contained a good many holdings extending to 1,000 acres and over, the efficienc curve rises sharply from the " under 100 acres " size group up t the " 300 acres—500 acres " group, flattens out from this poin up to the " 500 acres—700 acres " group, and then shows a distinct tendency to fall. This is illustrated in the following table showing the production per man employed (*i.e.*, sales less cost of raw materials) according to size of holding:—

Size Group	Value of Production per Man Employed
Acres	£
Under 100	181·1
100–300	211·6
300–500	254·2
500–700	283·2
Over 700	245·1

This result is no more than an indication of what may be expected to emerge in future work, but the point is worth studying For American conditions, *see* UNITED STATES: AGRICULTURE.

However, the study of farm organisation according to the siz of the holding gives other results besides evidence of efficienc The next table shows the influence of size on the nature of th farmer's business. In the district chosen it is clear to what a extent dairying is the concern of the small farmer, whereas shee and corn growing become intensified as the size of the farm increases. It is interesting to note that as regards meat the siz has very little influence on the quantity produced, but an examination of the data shows that it is mainly pork and veal in th case of the smaller groups, and beef and mutton in the case o the larger ones.

Production per Acre

Size Group	Meat	Dairy Produce[1]	Per Acre		Potatoes	Hay	Stra
			Wool	Grain and Pulse			
Acres	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.	Lb.
Under 100	56	638	..	353	46	163	7
100–300	46	340	0·9	355	15	140	49
300–500	42	128	1·0	498	31	219	166
500–700	50	148	1·2	451	358[2]	202	78
700–1,000	50	72	2·0	484	25	178	110

[1] In terms of milk.

[2] This high figure is due to the influence of one farm in the gro which specialized entirely in potatoes.

Economic Research.—On the continent of Europe investigation has been conducted mainly by the aid of book-keeping, directed towards the determination of the cost of the main products of the farm, the capitalisation of different farming systems the rental value of the land, the labour income of the peasan and so forth. In particular, the work of Dr. Ernst Laur amongs the Swiss peasant farmers and that of Dr. O. H. Larsen, in Denmark, may be cited. In America a great development of economic study of the agricultural industry has been witnesse during the present century. About the year 1905 " farm management " became definitely a subject of study at the hands of th technical staffs of the agricultural colleges. As on the continen of Europe, book-keeping afforded the principal instrument o study, and cost investigations were conducted in most of th clearly defined crop areas. Following the formation of the American Farm Management Association, a few years later, by thos engaged in this work, the attention of economists as well as c agriculturists was attracted to this subject. The number o workers in the field increased rapidly, methods of study wer rapidly developed and the Association was reconstituted as th American Farm Economic Association with a membershi which now runs into hundreds, and a quarterly Journal (se FARMERS' ORGANISATIONS). The importance with which th economic study of farm organisation is regarded in the States to-day was foreshadowed by the Secretary of Agriculture in his Foreword to the *Year Book* of the United States Department of Agriculture for 1921:—

> The *Year Book* for 1921 emphasises the economic side of our agriculture because help in their economic problems is now the most urgent need of our farmers. That is not to say that the Department s losing sight of production matters. The farmer needs all the help in his production problems that the Department of Agriculture, colleges and experimental stations can give him; but the need of the nost importance now is the development of an entirely new realm of organised knowledge bearing upon the economic factors of agriculture looking forward toward cheaper production, improved methods of distribution and enlargement of markets, in order that prices the armer receives shall be more fairly related to his cost of production.

The agricultural work of the colleges and experimental stalions is now largely directed to serving the ends indicated in the oregoing quotation, and a significant fact is the institution of he new Bureau of Agricultural Economics in the Department f Agriculture at Washington.

In England, the study of farm organisation and equipment on systematic basis dates from the establishment of the Agricultural Economics Research Institute in 1913, as a result of an pplication by the University of Oxford to the Ministry of Agriulture for a grant in aid of economic research in agriculture. As n other countries the Institute started its work by the costing nethod, and allowing for the interruption caused by the War it as continued with it as one line of investigation ever since. Costing is, of course, only the means, it is not the end itself and may be useful to those who have not studied the process to ive a few examples illustrating the kind of information got from his rather complicated exercise.

First, there is the evidence it supplies on the efficiency of farm nanagement in all its aspects. To take one of these for example, he use of manual labour. One object of any system of farming hould be to give employment to a regular staff of men at all easons of the year. Few systems do this better than the ordiary four-course rotation and some of the modifications of it, ut many rotations make the farmer dependent to a large measre on casual seasonal labour. The results of costing show that ependence on casual seasonal labour has the effect of raising nit labour costs, and though systems of farming involving much easonal labour are often justified on account of the usually rofitable nature of the crops grown (as in the case of potatoes), may well be that in certain cases the relative costliness of the bour involved may lead the farmer to consider whether after l it gives him an adequate return for the extra working capital d trouble involved. The introduction of silage or of the sugar et crop into the rotation can have a very upsetting effect on bour organisation, unless plentiful supplies of casual labour e available at the right seasons, and cost records are the only eans by which to confirm or correct the farm-manager's genal ideas of the economic value of these and other new crops.

To take, as a second example, the organisation of the horse bour on the farm. It costs so much to keep a horse for the year, d on the great majority of farms the figure does not vary very preciably. But it does not follow that there is little variation the cost of horse labour, for the cost of a day's work depends t only on the cost of keeping the horse, but on the number days during which it is effectively employed. Allowing for ndays and Christmas Day and for Saturday half-days, the aximum number of working days is 286 in the year, and every y less than this number worked by horses adds proportionately the cost of the labour performed. Figures collected recently om seven farms showed that the percentage of idle days varied om 13% up to 39%, and it will be realised how seriously the st of horse labour mounts up in proportion as the number idle days increase. This is a typical example of the way in ich costing may direct the attention of the farmer to possible aknesses in his management. It may be simply that he has many horses, in which case results such as these will make n consider the possibility of their reduction. It may be that system of cropping is such that he needs an abnormal equipment of horses at certain seasons of the year, in which case he will be led to consider whether his system is so profitable as to make the idle horses at other seasons worth while, or whether he could not modify it in some way which would enable him to keep his horses more regularly employed.

A third example of the use of costing is the compilation of comparative labour costs, to establish measures of individual efficiency in the use of manual labour. The figures in the following table, compiled by Mr. A. Bridges, represent the normal utilisation of labour for crops and live stock on a series of farms in the eastern counties of England; similar figures have been published by Dr. A. G. Ruston, of Leeds, and various tests of a like character can be devised which serve as standards of efficiency for other aspects of farm management.

Average Labour Requirements of Farm Crops and Stock
Arable Land

Cereal Crops	Man days per Acre
Winter Wheat	6·85
Spring Wheat	6·58
Winter Oats	7·58
Spring Oats	6·21
Barley	7·13
Beans	6·50
Peas	10·23
Root Crops	
Turnips and Swedes (eaten off)	8·31
Mangolds	16·73
Potatoes	33·80
Carrots	61·42
Seeds	
Mown	2·18
Grazed	0·71
Grass	
Meadow Hay	2·09
Pasture	0·09
Live Stock	
Cows	23·00
Other Cattle	7·13
Pigs	1·90
Sheep (Arable Breeds)	1·29

In the absence of data such as these nothing is more baffling than the attempt to trace leakages in farm management which cannot be located by any other means and which are often most surely responsible for the difference between profit and loss in farming. In a great number of cases the partial failure of the farmer is due to faulty organisation of labour or to some similar cause which defies detection by any process of inspection. As the practice extends of recording daily the operations on the farm it will be possible to establish, district by district, certain efficiency standards by which to test individual farm management. A good example of what has been done already in this direction is afforded in the case of milk-recording where, by careful observation and record, the farmer is provided with the means of weeding out the unprofitable elements in his dairy herd. The case provides an illustration of that which will be possible in many other directions when full records of the various matters arising in farm management are available, and similar weaknesses in the organisation of production can be detected.

Although the costing method was thus the first line of attack on the problems of agricultural economics it was always realised that it would not be sufficient in itself, and it was suggested that valuable information could be collected by means of economic surveys of farming districts. The evidence to be got in this way is less complete than that furnished by the more intensive costing method; on the other hand, a much greater mass of it can be collected by the expenditure of an equal amount of time and energy. At the outset, these surveys were planned to deal with particular problems; thus, Mr. A. W. Ashby conducted a survey of allotments and small-holdings in Oxfordshire, as the basis for a study of the rural allotments and the small-holding problems, and similarly, Mr. J. Orr conducted surveys of the systems of farm management in the counties of Oxfordshire and Berkshire, and considered the problems arising therefrom. But this method was found to be incomplete, for although it may happen that special problems will arise for investigation, the study of farm economics as a whole cannot best be pursued by the examination of particular questions. It was decided, therefore, to inaugurate general surveys, designed to collect all the information of any kind whatever which can be got by inquiry on the farm, for tabulation in a variety of ways, and then to study the tables in order to see what information they afforded. The method has been made familiar by the work of American farm economists. This work has formed a part of the activities of the Oxford Institute, and data have been collected from nearly 1,500 farms.

A more recent investigation undertaken by the Institute, and one likely to be developed in the near future, is the study of the organisation of agricultural marketing. The economic weakness of the existing marketing methods has often been a subject of comment, and particular attention has been attracted to it recently by the Report of the Departmental Committee on Distribution and Prices of Agricultural Produce. It was felt that it should be possible to organise an advisory service for farmers in marketing problems, in fact, that such a thing should be an essential part of the general advisory services available to them (*see* AGRICULTURE: ECONOMICS and MARKETING).

Since 1922 arrangements have been completed by the Ministry of Agriculture for the local study of farm organisation and equipment throughout England and Wales, to supplement the work carried on by the Agricultural Economics Research Institute at Oxford and with this body as a co-ordinating centre. For the purpose of advisory work among farmers the country was mapped out, some years ago, into provinces, each of which is equipped with an advisory staff of experts in the various branches of agricultural science. These staffs have now been strengthened by the inclusion in each of an advisory economist, who is occupied with the study of farm management problems arising within his particular province. Their function is mainly to assist the farmers of their districts to greater efficiency in the control of farm management, whilst, at the same time, the information and data accumulated by them in the course of their work is available for the use of the central institute at Oxford for co-ordination and review upon a national basis.

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(C. S. O.)

FARNELL, LEWIS RICHARD (1856–), British scholar, was born in Salisbury Jan. 19 1856. Educated at the City of London School and Exeter College, Oxford, in 1880 he won a fellowship at Exeter College. After studying classical archaeology in Berlin and Munich and travelling in Greece and Asia Minor, he became classical lecturer at Exeter College in 1883, and the following year sub-rector. Later he became university lecturer in classical archaeology. In 1893 he was appointed senior tutor of Exeter College and in 1894 proctor of the university. In 1909 he was elected first Wilde lecturer in comparative religion and in 1911 Hibbert lecturer. He was appointed rector of Exeter College in 1913 and from 1920 to 1923 was vice-chancellor of Oxford University. Among his written works are *Cults of the Greek States*, 5 vol. (1896); *The Evolution of Religion* (1903); *Greece and Babylon* (1911); *The Higher Aspects of Greek Religion* (1912); and *Outline History of Greek Religion* (1920).

FAROE ISLANDS: *see* FAEROE ISLANDS.

FARRAND, LIVINGSTON (1867–), American educationalist, was born at Newark, N.J., June 14 1867. After graduating from Princeton University in 1888, he studied medicine at the College of Physicians and Surgeons, New York (M.D., 1891). During the next two years he studied at Cambridge, England, and at Berlin. From 1893 to 1903 he was an instructor and, from 1901, adjunct professor in psychology at Columbia University; from 1903 to 1914 he was professor of anthropology. In 1897 he accompanied the Jesup North Pacific Expedition, which visited the Indians of British Columbia. From 1912 to 1914 he was treasurer of the American Health Assn. and editor of *The American Journal of Public Health*. From 1914 to 1919 he was president of the University of Colorado, but in 1917 was granted leave of absence, following his appointment by the International Health Board of the Rockefeller Foundation to direct the work against tuberculosis in France. In 1919 he was made chairman of the central committee of the American Red Cross. In 1921 he was elected to succeed Jacob Gould Schurman as president of Cornell University. He wrote *The Basis of American History* (1904) and various articles on psychology and anthropology.

FASCISM.—The Italian Fascist movement dates officially from the foundation in March 1919 by Benito Mussolini (*q.v.*), then editor of *Il Popolo d'Italia*, of the first *Fascio di Combattimento* at Milan, although many of its ideas had been inspired by the Nationalist movement dating from 1910, and by Syndicalism, of which Mussolini himself had been a leader. This first Fascio was composed of some 150 of Mussolini's friends who had supported his interventionist action at the beginning of the World War, mostly ex-socialists of the Syndicalist wing, and nearly all ex-combatants. The first Fascist programme was confused, demagogic and had a Republican trend, but the national patriotic note was conspicuous, and proper recognition was demanded for the men who had fought and won the War. The word *Fascio* means a bundle or bunch, and was taken to define the close union of the adherents of the movement; as an emblem, the *fasces* of the Roman lictors on a tricolor shield was adopted.

At first the Milan Fascio only attracted a fraction of the people who opposed Bolshevik Socialism, and it still savoured too much of Mussolini's revolutionary past to secure general support. Fascism was also inspired by a sense of exasperation at the foreign policy of the Government, which did not, the Fascists believed, defend Italian interests at the Peace Conference with sufficient firmness and dignity. This aspect of Fascism was largely the outcome of nationalism, which had first given the Italian people a sense of the importance of foreign affairs and of the necessity for colonial expansion. After D'Annunzio's evacuation of Fiume at the beginning of 1921 many of his *legionari* joined Fascism, some of whose outward manifestations and the semi-mystical character, as well as the Roman reminiscences and ritual, they inspired.

The Squadre.—At the elections of 1919 none of the Fascist candidates were returned. During the troubles of 1919 and most of 1920 Fascism as an organisation played but a small part. But the Fascist idea was spreading all over Italy, and during the municipal elections held in many cities in the late autumn of 1920 the Fascists collaborated with the other anti-Socialist parties, and in several instances formed with them national blocs, which defeated the Reds. In the Bologna riots (Nov. 1920), which broke out on the occasion of the inauguration of the Socialist-Communist town council, it was the Fascists who, although only 200 strong, organised the reaction of the majority of the citizens and brought about the rapid collapse of the Red organisations, first in that city and subsequently throughout the Po valley. The first armed Fascist *squadre* were now formed for the defence of the nation against what amounted in many places to revolutionary tyranny. These *squadre* consisted of young men, mostly ex-combatants, many of them decorated for valour and adorned with wound badges, of others too young to have served and of not a few older men, exasperated at the spectacle of their country, victorious in the War, but fallen into a slough of despond and browbeaten by a factious minority. There was as yet no real Fascist doctrine beyond this vague sense of outraged patriotism. The *squadristi* were mostly ırmed with cudgels, although many possessed revolvers and arbines, for at that time a large number of ex-service men had rought back arms of some sort from the War. Another weapon, novelty in partisan conflicts, was castor oil, large doses of vhich were administered to recalcitrant Socialists and Communists, and sometimes even to other opponents of Fascism. During 1921 and 1922 encounters between Fascists and the Reds were of almost daily occurrence. In that period over 1,000 ascists fell victims to their opponents, and in most cases were nurdered by treachery for no other reason than that they were ascists; but their comrades were not slow to avenge these utrages. When early in 1921 the Communists broke away rom the Maximalist Socialist party and indulged in a series of nurderous outbreaks in the hope of terrorising the masses into oining them, the Fascist reprisals were ruthless.

What attracted the sympathy of public opinion towards ascism was the extraordinary bravery and devotion to an ideal f the *squadristi*. At a time when armed Communists were ing in wait at street corners or behind closed shutters to ttack anyone wearing the Black Shirt or the Fascist badge, nese youths marched on regardless of danger, ready to sacrifice neir lives for the national cause. Even orthodox Liberals, atholics and others supported Fascism, in which they saw the nly hope for the salvation of the country from chaos. Many dhered to the movement for selfish reasons—landlords and anufacturers who simply regarded it as a form of protection r the rights of property which the Government allowed the ditious elements to violate with impunity, and others became ascists out of a spirit of adventure, to secure positions for nemselves or for other personal reasons.

A Mass Movement.—In its early days the movement was unonnected with any particular labour policy, although Syndicalists ere among its founders; later, individual workmen, peasantoprietors and farm hands joined it individually; but, with the ccess of the Fascist campaign against the Red organisations the Po valley at the end of 1920 masses of workers became scists, and often whole unions came over in a body. This velopment changed the character of Fascism, and converted from a minority to a mass movement. At the elections of ay 1921, held under the auspices of Sig. Giolitti, 38 Fascists ere returned, including Sig. Mussolini himself, and 10 Nationsts. In the new Chamber the Fascists and Nationalists rmed a fighting band of vigorous youths strenuously opposed to e Reds—a nucleus which gathered around its standard embers of other patriotic parties. At the Fascist congress in me in Nov. 1921 a review of the Fascist forces was held, and scism was constituted as a regular political party, the *Partito zionale Fascista*, and its statutes were then drafted.

The Programme of the Fascists

The programme of the Fascists differs from that of other pars, as it represents for its members not only a rule of political nduct, but also a moral code. The programme states that

> ne nation is not merely the sum total of living individuals, nor instrument of parties for their own ends, but an organism comsing the unlimited series of generations of which individuals are rely transient elements; it is the synthesis of all the material and n-material values of the race."

e state must be reduced to its essential functions as a legal d political organ, the powers of parliament limited to questions ncerning the individual as a citizen and the state as the organ realising the interests of the nation, whereas the activities of lividuals as producers should be dealt with by technical uncils. Trade unions must be encouraged as a means of veloping production, but they should not arbitrarily level all pacities. The prestige of the state must be restored at all ts. The national finances must be placed on a sound basis, e from all traces of demagogy. Fascism recognises the social ctions of private property, proposes a system of State cipline over class conflicts, and demands that both employers' l workmen's organisations shall be legally recognised and ested with responsibility; no strikes in the public services are to be tolerated. The state should restore to private enterprise all industrial undertakings which it has proved incapable of running. In foreign affairs Italy must "reaffirm her right to complete historic and geographic unity, and fulfil her mission as the bulwark of Latin civilisation in the Mediterranean." The party is indissolubly bound up with its *squadre*—the volunteer militia at the service of the state. It was this congress that declared that Fascism would substitute itself for the State whenever the state should prove incapable of suppressing the elements of disorder and disintegration.

The organs of the party are: the Directorate—the executive organ, composed of the general secretary and 10 other members elected by the national council, the central committee, composed of the various district delegates and the members of the Directorate, elected by the national council for a year and entrusted with the conduct of the political and administrative action of the Fasci and with disciplinary authority; the national council, composed of the members of the central committee and the provincial secretaries, and invested with controlling authority over the Fasci; the general secretariat, nominated by the national council; the Fasci, or local sections of the party, all the Fasci of a province constituting a provincial federation; *the squadre di combattimento;* entrusted with the duty of repelling the violence of adversaries, which should hold themselves in readiness to act at the bidding of the leaders of the party for the defence of the national interests; the parliamentary group, composed of the Fascist members of Parliament; the various auxiliary groups, such as *the Women's Fasci, the Avanguardie, the Balilla, etc.;* the congress, composed of delegates of the provinces, which meets at irregular intervals to express the views of Fascism as a whole.

Attitude to Monarchy.—Fascism had been gradually shedding its demagogic elements, and at Udine, on Sept. 29 1922, Mussolini expressed his adherence to the monarchy, thereby securing widespread support for Fascism among many who had hesitated on account of its "implicit republican tendency." Fascism has ended by becoming the strongest bulwark of the monarchy, because, unlike other monarchical parties, it had no need to conciliate the revolutionary elements. The whole conception of Fascism is based on rigid hierarchy.

Italy under the Fascists

When Fascism came into power (Oct. 28 1922), Sig. Mussolini, although rejecting alliances with other parties, accepted their collaboration, and admitted several of their members into his first Cabinet. Nationalism was absorbed by Fascism early in 1923, but as the Opposition became more violent in its attacks, especially after the Matteotti murder, the party tended to concentrate more and more on itself, satisfied with its own strength and the general approval of public opinion, not attached to any party; and it still has millions of supporters who are not Fascists. The party underwent certain changes in its constitution, among which the most important were the fusion with nationalism and the creation of the Fascist grand council. This body, which sums up, co-ordinates and directs all the activities of the party, is composed of the Prime Minister as chairman, all the Fascist members of the Government, the general secretary of the party and certain other party officers both central and local. At its meetings the opinion of Fascism in the direction of various legislative reforms is manifested, and the proposals voted are then submitted to the Cabinet. Although party and Government are separate, the connection between the two is very close, as Sig. Mussolini is at once the head of the Government and the leader of the party.

Relations with the Vatican.—Fascism, since it has become the Government of Italy, has shown a marked sympathy for Catholicism, which as the religion of the vast mass of the Italian people is regarded to some extent as a national institution. Relations between Fascism and the Vatican have become very friendly, and the anti-Fascist tendencies of the *Partito Popolare* are by no means approved of in Vatican circles. Occasional minor disagreements with the Vatican in no way affect the general policy of the party.

Fascist Aims.—The Fascist tendency to isolate itself and reject alliances with other parties was steadily advocated by Roberto Farinacci (*q.v.*) after his appointment as general secretary early in 1925. After the Matteotti trial in March 1926, he resigned his appointment, having accomplished the task of reorganising the party, and was succeeded by Auguste Turati. The party directorate was also changed. But the general character of Fascism remains unaltered. Its aim is to get its main principles generally accepted by the nation and embodied in a series of legislative reforms which shall make of Italy an essentially National State, as opposed to the pre-existing Liberal State, wherein the seditious elements were free to conspire against the general welfare in the interests of class or clique. These reforms comprise the restoration of national finance, the reorganisation of the bureaucracy in the interests of efficiency, the reform of education, the peaceable regulation of labour conflicts, the re-establishment of discipline in every department of the state and every aspect of national life, the improvement of agriculture and the progress of industry. Many of these reforms have already been carried out, and others are in progress. Opponents accuse Fascism of crushing liberty; but the Fascists reply that if the freedom of the Press is limited, and parties, other than the Fascist, are reduced to inactivity, the essential liberty of the people has been secured as never before—the freedom to work and produce for the common good—and that only a strong Government like that of Sig. Mussolini could achieve such a series of necessary and far-reaching reforms, which Liberal Governments may have desired, and even attempted, but had always failed to carry out owing to the tyranny of parliamentary obstruction. The people, he said in July 1924, never asked him to free them from a tyranny which did not exist, but asked for railways, houses, roads, bridges, drains, water and light.

Fascist Doctrine.—Fascist doctrine, as it has been evolved during the last years, was authoritatively set forth by Prof. Alfredo Rocco, Minister of Justice, in a speech at Perugia on Aug. 31 1925. After rejecting the liberal, socialist and democratic theories of the state, he declared that, according to Fascism, society does not exist for the individual, but the individual for society; although Fascism does not annul the individual as the individuals annulled society under certain older doctrines, but merely subordinates him to society, while securing his right to develop his personality. Economic progress is a social interest, but Fascism considers it best to leave the production and distribution of wealth to individual enterprise in order to secure the maximum results in the interests of the community. The social problem is not solved, however, by merely rejecting the socialist doctrine; Fascism wishes to secure justice between classes, but class warfare must be eliminated, as it is the state which must establish justice between classes just as it does between individuals. Sig. Mussolini in an article in *Gerarchia* (Oct. 1925) compares " the incessant and fertile activity of the Government with the paralysis of all the opposition parties within the Chamber and without. Everyone, explicitly or otherwise, is convinced that in the Italy of 1925 Fascism alone towers like a giant." The defects of Fascism are the general defects of the Italian character: the tendency to rhetoric, *arrivismo* (excessive pushfulness of men on the make), which has been accentuated by the creation of the many party offices and appointments, often filled not by the worthiest but by the most pushful and ambitious. Of the deeds of violence occasionally committed by Fascists, usually reprisals for similar deeds committed by adversaries, Sig. Mussolini wrote in the above-quoted article: " This violence does not facilitate the work of the Government, but compromises it."

Fascist Labour Organisation.—Labour syndicalism has become one of the most important aspects of Fascism. The first statute of the party, drafted in Dec. 1921, defined the Fascist labour corporations. Labour is declared to be the basis of human welfare and progress, and all who devote themselves to productive work are regarded as workers. Fascist syndicalism, unlike the Socialist unions, accepts the patriotic idea, recognises the importance of capital, and considers the fate of the worker as bound up with that of the whole nation. There are now 21 corporations, each of them representing " the union of the various trades, arts or professions related to or dependent on the same kind of labour or industry," and comprising separate unions of manual workers, engineers and experts, and managers and employees. It was not found possible to unite both employers and employed in the same corporations, but there are many joint committees for various purposes. All corporations and syndicates are united under the confederation of corporations, which is the supreme organ of Fascist syndicalism, entrusted with the task of reconciling the interests of the various categories and classes, securing equitable labour contracts with the employers and promoting social legislation. The whole idea of class war is rejected, as classes cannot be allowed to take justice into their own hands any more than private individuals. Fascist syndicalism is gradually coming to monopolise labour, as the older Socialist and Popolare unions are losing all influence over the masses, and the Fascist corporations have become the sole representatives of the working classes in their dealings with the employers. Time will show whether the system will work out satisfactorily, but there is no doubt that the development of Fascist syndicalism has reduced strikes to negligible proportions, increased production and improved the conditions of the working classes by progressive social legislation and in other ways. In Dec. 1925 a law was enacted granting the syndicates legal recognition, and creating the labour tribunals to which all labour conflicts must be referred; strikes and lock-outs are therefore illegal. This is the most far-reaching reform of the Fascist Government. The president of the Fascist federation is the deputy Edmondo Rossoni, elected by the national council. The whole organisation is strictly centralised and hierarchical.

The National Milizia.—Before Fascism came into power its action was largely that of the armed *squadre*, and it was the 200,000 Black Shirts[1] who effected the " March on Rome," enabling Fascism to become the government of the country. But once this was achieved, the existence of irregular Fascist forces was incompatible with Sig. Mussolini's intention of constitutionalising the Fascist movement. To have disbanded them would have savoured of ingratitude, while their constituent elements might still be useful to overawe the revolutionary and anti-national parties and to consolidate the Fascist *régime*. At a Cabinet Council on Dec. 28 1922 it was decided to disband all the *squadre—Fascist, Nationalist, Arditi* and *Legionari fiumani*, and by royal decree of Jan. 14 1923 the *Milizia volontaria per la sicurezza nazionale* was created in their place. The force was voluntarily recruited from among the *squadristi*, the men appointed by the Prime Minister or the authorities delegated by him, and the officers by royal decree on the proposal of the Ministers of War and of the Interior. Neither officers nor men are paid, except those on permanent duty at the general or territorial headquarters (700 in all), while those who are temporarily called out for service outside their place of residence receive a daily allowance.

The total budget comes to 35,000,000 lire annually, although certain special detachments, such as the railway *milizia*, are paid for by other departments. The force, which comprises some 190,000 men, is " at the service of God and the Italian Fatherland, and takes orders from the head of the government." Its duties are " to assist, together with the armed forces for the public safety and the army, in the maintenance of internal order and to prepare citizens for the defence of Italian interests in the world." It has relieved the army of many troublesome services, and although it has never been necessary to employ it to put down revolutionary outbreaks, its mere existence has sufficed to deter the seditious elements from such action. The organisation of the *milizia* was subsequently brought into closer harmony with existing institutions; the royal decree of Aug. 4 1924 provides that its members shall take the oath of allegiance to the King, and that the officers shall be recruited from among the reserve officers of the Army, Navy and Air Force. The force is also entrusted with the pre-military training of youths under 20; the object of this measure is to give a large part of the nation a military education without involving the country in too heavy expenditure. Three legions of the *milizia* have served with distinction in Libya.

In 1926 the party comprised 9,000 Fasci, with about 742,978 registered members (April 21). The party directorate decided at this time not to accept any more members to the Fascist party, all new applications for admission being held on until 1927. There were also

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[1] Estimates of their number vary considerably, owing to the fact that while 200,000 or more men were mobilised not all of them actually entered Rome.

590 *Women's Fasci* with 25,000 members, 16 *Legioni Avanguardisti* youths from 15 to 18 years old) and 18 *Legioni Balilla* composed of oys under 15. In addition the Fascist labour syndicates comprised bout 2,150,000 members not counting the Fascist railwaymen's yndicate (80,000 members), the maritime federation and certain ther special unions.

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(*b*) *Italian Works Against the Movement:* Carlo Avarna di Gualtieri, *Fascismo* (Turin, 1925); Ivanoe Bonomi, *Dal socialismo al scismo* (Rome, 1924), also published in England; *From Socialism to ascism* (1924); G. Ferrero, *Da Fiume a Roma* (Milan, 1923), so published in English; *Four Years of Fascism* (1924); G. atteotti, *Un anno di domino fascista* (Rome, 1923), English trans.; *he Fascisti Exposed* (1924); Luigi Sturzo, *Pensiero antifascista* urin, 1925).

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FASHION: *see* COSTUME.

FATIGUE OF METALS.—This is a generic term denoting all enomena associated with the behaviour of metals subjected to etitions of a range of stress. The term, however, is more gen- ally applied to the progressive deterioration, leading to ulti- ate fracture, caused by repetitions of a cycle of stress, the maxi- um stress of the cycle being numerically less than that stress ich causes failure on a single application. Fracture by fatigue n be caused by repeated cycles of direct, bending, torsional or mbined stresses, and is accelerated by the presence of shock nditions or surface defects, sudden discontinuities of section, c., which create local concentrations of stress.

Three Types of Stresses.—Cyclical variations of stress can be ided into three main types: *Alternating stresses* (maximum d minimum stress of cycle differ in sign), *pulsating stresses* resses vary from zero to maximum value) and *fluctuating esses* (vary in magnitude but not in sign). *Any* stress cycle defined numerically by the expression, $M \pm \frac{1}{2}R$, where M is average stress, and R is the range of stress (algebraic differ- e of maximum and minimum stresses). Fatigue range or iting range (R) is the greatest range of stress which can be lied for an indefinitely great number of repetitions without sing fracture. *Endurance*, under a given range of stress, is number of repetitions necessary to cause fracture.

n 1849 Jones and Galton investigated the behaviour of cast- n bars subjected to pulsating bending strains. Fracture urred in less than 100,000 strainings when the range of strain eeded one-third of the static ultimate deflection. The endur- e decreased at an increasing rate with increased ranges of in. Bars which had been partially fatigued suffered no loss tatic ultimate strength. Somewhat similar tests, on a wrought- built-up girder, were made by Fairbairn in 1860–1. The ling was applied with shock. Fairbairn's conclusions con- ed those of the earlier workers and also pointed to the exist- e of a definite fatigue range for metals. These conclusions ived further support from the experiments of Wohler (1871), hich, for the first time, strict attention was paid to the *mag- de* of the applied stresses. Wohler used iron and steel sub- ed to cycles of direct, bending and torsional stresses.

ubsequent to these early classical investigations, the fatigue of als has formed the subject of several hundreds of independent researches. The main objects of these investigations and the conclusions drawn from the results are briefly summarised below.[1]

Evidence of a Limiting Range of Stress.—The results of a series of endurance tests, where any one type of straining action and a constant value of the mean stress of the cycle are employed, show that the endurance (N) to fracture increases at an increasing rate as the range of stress (S) decreases. A curve connecting S and N tends to become parallel to the N axis. It is regarded as established that, in the case of ferrous metals, the S/N curve, has become parallel to the N axis at values of N of 10^7 or 2×10^7 reversals, and remains so for the maximum endurances investigated (10^8 to 10^9 cycles). This is also true for some of the pure metals and non-ferrous alloys. Tests on *some* non-ferrous metals and alloys, however, have shown fractures to occur after several hundred millions of reversals, although, at these endurances, the slope of the S/N curve is very small. In general, *sound metals appear to possess a definite limiting range of stress* (R_L).

Two relations have been suggested both of which can be expressed by the formula $R_L = R_{LR}(1 - \frac{M}{f})^x$ where R_L is the limiting range when M is the corresponding value of the mean stress, R_{LR} is the limiting range when $M = 0$, f is the static ultimate strength of the metal, and x has the value of 1 or 2. Some experimental results agree with one of these relations, others conform to neither. For cycles of direct stresses, the linear relation is generally a safe rule between the limits of $M = 0$ and $M = \frac{1}{2}R$. Some experiments employing torsional stresses have shown that the value of R_L is not altered appreciably by wide variations in the value of M.

Effect of Frequency of Cycle (F) on Limiting Range (R_L).—It is now established that a constant value of R_L is obtained at frequencies up to 5,000 cycles per minute. Tests made on copper, iron and mild steel at frequencies of 3,000, 30,000 and 60,000 cycles per minute gave progressively greater values of R_L at the higher frequencies.

Under repetitions of the limiting range, or a numerically inferior range, a state is ultimately reached when no further plastic strain occurs; approximate elasticity only results as strain hysteresis can be detected. These *natural* elastic limits are not related to the *primitive*, or original, elastic limits of the material. When the applied range of stress exceeds the limiting range, plastic deformation occurs until the cracking stage is reached.

Effect on Limiting Range of Temperature of Test.—Available data relate only to reversed stresses ($M = 0$). The limiting range (R_L) is largely unaffected in value until temperatures of about 400° C. are reached. At higher temperatures R_L decreases, the rate of decrease varying with different metals. The effect of elevated temperatures on R_L is not, in general, as marked as on the static ultimate strength under prolonged loading; *e.g.*, the values of $\frac{1}{2}R_L$ for 4 steels and 1 non-ferrous alloy, at various temperatures between 550° C. and 750° C., has been found to be *equal to*, or *greater than*, the static strength (under prolonged loading) at the same temperatures.

Effect of Repeated Stresses on Microstructure of Metals.—Repeated stresses applied to *crystalline aggregates* cause slip bands to appear on the surfaces of favourably orientated crystals. If R_L is not exceeded, this local action ceases after a certain number of repetitions and the metal becomes strain-hardened. Under repetitions of greater stress ranges, microscopic cracks are initiated in the regions of maximum slip, and fracture is caused by propagation of these cracks throughout the metal. Even in ductile materials, the process of initiation and propagation of these cracks may be so highly localised that the appearance of fracture is one usually associated with that of brittle materials. Precisely similar surface phenomena are exhibited by single metallic crystals subjected to repeated stresses, suggesting that fatigue failure is essentially a process of deterioration of crystalline material and that the chief effect of the inter-crystal boundaries in aggregates is to inhibit slip due to the change in orientation of neighbouring crystals.

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[1] Except where otherwise stated, the remarks apply only to tests conducted at air temperature.

A fundamental theory of fatigue has yet to be advanced. The attrition theory (Ewing and Humfrey) is not supported by the results of recent research. A number of theories have been based on the assumption (Beilby) that plastic strain in metals causes a change from the crystalline to the amorphous state on the surfaces of slip. The manner in which the fatigue crack is initiated has not been explained satisfactorily. The results of experiments on single crystals (Gough, Hanson and Wright) suggest that the effect of slip is to produce local distortions within the crystal, thus setting up internal stresses which, under repetitions of stress ranges, lead to the disruption of inter-atomic bonds and the initiation of cracks. The breaking-up, under strain, of a crystal grain into a number of crystallites of slightly varying orientations, is an alternative hypothesis which is consistent with observed facts. Little doubt exists that, in some manner, fatigue failure is the direct result of local plastic deformation, and it seems highly improbable that fatigue would occur in a material which is truly elastic.

The importance of an understanding of fatigue phenomena in its relation to industry cannot be over-estimated. Those machine and structural components whose working conditions can be so adjusted as to exclude the possibility of fatigue failure constitute a very small minority. The whole trend of development of modern engineering lies in the direction of the employment of higher working stresses, speeds and temperatures. These considerations, together with the necessities of eliminating unnecessary material —to reduce first cost—and the reduction of the weight power factor—which has become of prime importance since the advent of aircraft—tend to make the static strength properties of metals (except at elevated temperatures) of less relative importance than their fatigue properties. A conservative estimate of failures in modern engineering practice attributes 80% of such failures to fatigue. As fatigue failures are usually unaccompanied by any marked preliminary warnings, a deplorable loss of life has often resulted. *See* METALLOGRAPHY; METALLURGY; MATERIALS, STRENGTH OF.

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FAURÉ, GABRIEL (1845–1924), French musical composer (*see* 10.209), died at Passy Nov. 4 1924.

FAUVISM: *see* PAINTING.

FAWCETT, MILLICENT GARRETT (1847–), British writer and political worker, was born at Aldeburgh, Suffolk, June 11 1847. In 1867 she married the economist, Henry Fawcett (*see* 10.215). She herself produced various works on economics, including *Political Economy for Beginners* (1870), *Tales in Political Economy* (1874) and, with her husband, a volume of *Essays and Lectures* (1872). Mrs. Fawcett was one of the early workers for women's suffrage, and in 1907 became President of the National Union of Women's Suffrage Societies. She was strongly opposed to the tactics of the militant suffragists, and expressly dissociated the N.U.W.S.S. from any sympathy with such methods. The constitutional methods adopted by the body included an alliance formed with the Labour party (1912) by which the society agreed to support Labour candidates in preference to Liberal when the latter proved unsatisfactory on the suffrage question. Her later books include *Life of Queen Victoria* (1895); *Life of Sir William Molesworth* (1901); *Five Famous French Women* (1906); *Women's Suffrage* (1912); and *What I Remember* (1924). She was created G.B.E. in 1925.

FAYOLLE, MARIE ÉMILE (1852–), French soldier, was born at Puy (Haute-Loire) May 14 1852. He entered the École Polytechnique in 1873, and joined the 16th regiment of artillery in 1875. Captain in 1882, he entered the École de Guerre in 1889, and returned there as professor (of the artillery course) in 1897; in 1900 he was made titular professor and remained there till 1907. In the face of the orthodox doctrine he urged the importance of concentration of fire and the obstacle it offered to an attacker; this view he expressed in an admirable brochure entitled *Concentration des feux et concentration des moyens* (1912). On Aug. 13 1914 Fayolle who had been made a general of brigade in 1910 was given the command of the 70th reserve division. He distinguished himself at the battle of le grand Couronné and afterwards in Artois. The 70th division together with the 77th formed under Gen. Pétain the III. Army Corps which played a brilliant part in the offensive of May 9 1915. Gen. Fayolle succeeded Gen. Pétain on June 21 in command of the XXXIII. Corps, which he directed during the attack at Souchez and Vimy of Sept. 1915.

On Feb. 26 1916 Gen. Fayolle was given the command of the VI. Army which took part in the battle of the Somme; in the beginning of May 1917 he succeeded Gen. Pétain at the head of the Centre Group of armies (holding the Champagne and Verdun fronts). On Nov. 18 1917 he was sent to Italy but was recalled on Feb. 8 of the following year in expectation of the German offensive, which came on March 21; two days later he took command of all the forces engaged between Péronne and Barisis—which formed the Reserve Army Group. By March 31 the German attempt to break through was definitely checked, as also a fresh effort between June 9 and 13. In July the Reserve Army Group comprised the I., III., X. and VI. Armies which carried out the two great offensives of July 18 and Aug. 8 1918. After the armistice Fayolle's Army Group was entrusted with the occupation of the Rhine provinces; he entered Mainz on Dec. 14 1918, making Kaiserslautern his headquarters. He was made a marshal of France on Feb. 21 1921.

FEBVRE, ALEXANDRE FRÉDÉRIC (1835–1916), French actor (*see* 10.231), died in Paris Dec. 14 1916.

FEDERAL FARM LOAN SYSTEM.—The Federal Farm Loan Act of 1916 was adopted in the United States at a time when the increasing use of costly equipment and the rising price of farm land had combined to make the problem of financing the American farmer a difficult one.

His need for short-time credit, generally, had been met in various ways; his chief difficulty was to find long-time or mortgage credit. When the farmer must make a heavy investment, he needs a long loan. The only satisfactory security he can offer is a mortgage, and the market for farm mortgages is limited. Local mortgage brokers or bankers having the necessary expertness could lend on a limited number of mortgages and, after adding their own endorsements, discount the loans with eastern investors. In other cases, some of the large insurance companies sent their own experts into selected regions to place loans secured by mortgages. Again, a number of large corporations, commonly called mortgage banks, were organised to lend on mortgage security and to sell their own bonds to the investing public. Such a corporation, having bought a number of mortgage notes aggregating $100,000, would deposit them with a trustee as security for its own bonds to the same amount. These bonds were then sold to the general investing public, but sold on the general reputation of the corporation issuing them, and not on the buyer's expert knowledge of the individual mortgages.

The Act of 1916.—The Federal Farm Loan Act of 1916 was passed to extend this principle and enable it to meet the need for mortgage credit throughout the country. This Act created a Federal Farm Loan Board, consisting of the Secretary of the Treasury and four others to be appointed by the President, to have general administrative control. Under this board there were created 12 farm land banks, located in the 12 districts into which the country was divided; in each district there are organised, under its farm land bank, an indefinite number of farm loan associations, composed wholly of farmers desiring to borrow money on mortgage; and they borrow from the farm land bank of their district.

The 12 Federal farm land banks are located in the following cities:—Springfield, Mass.; Baltimore, Md.; Columbia, S.C.; Louisville, Ky.; New Orleans, La.; St. Louis, Mo.; St. Paul, Minn.; Omaha, Neb.; Wichita, Kan.; Houston, Tex.; Berkeley, Cal.; Spokane, Wash.

The Act permits joint stock land banks to come in under the Federal Farm Loan system. Sixty-nine had done so before Feb. 28 1925, with capital stock of $35,307,085, with bond issues aggregating

54,540,200, and with loans to farmers aggregating $464,873,770. ery Federal farm land bank was required to have, before beginning siness, a subscribed capital stock of not less than $750,000, from ich to purchase the first batch of mortgages from the farm loan ociations. Additional funds were to be raised through the sale bonds to the investing public. Each issue of bonds was to be sed upon a batch of mortgages previously purchased and deposited security under the direction of the farm loan board. If the total 50,000 of capital stock of any Federal farm land bank was not oscribed within 30 days after the opening of the books, it became duty of the Secretary of the Treasury "to subscribe the balance reof on behalf of the United States," and amendments were sed (Jan. 18 1918 and May 26 1920) authorising the Secretary the Treasury to purchase $200,000,000 of such bonds during 8–21.

On Feb. 28 1925 the U.S. Govt. held $1,513,045 of the capital ck of the farm land banks. The total bonds authorised and issued them was $949,130,492. The total capital stock of the 12 farm nks amounted to $50,390,330, held as follows:—

By the U.S. Govt.	$ 1,513,045
By National Farm Loan Assns.	48,471,970
By borrowers through agents	403,730
By individual subscribers	1,585

e total amounts loaned by the 12 Federal land banks, as recorded 1920 and 1925, are as follows:—

	To Nov. 30 1920.	To Feb. 28 1925.
pringfield	$13,550,345	$ 35,930,637
altimore	14,732,783	51,142,223
olumbia	20,406,515	57,481,504
ouisville	27,691,200	92,287,466
lew Orleans	25,811,705	93,063,031
t. Louis	30,951,675	66,280,807
t. Paul	49,554,700	113,430,039
maha	48,905,890	114,387,435
ichita	31,531,300	83,282,745
ouston	40,754,766	104,651,436
erkeley	18,645,900	39,531,815
pokane	46,084,535	93,520,832
Total	$368,621,314	$944,989,970

he course of the money is as follows: first, from the investor he farm land bank in exchange for bonds; second, from the n land bank to the farm loan association in exchange for a ch of mortgages; third, from the farm loan association to individual farmer in exchange for an individual mortgage. securities, however, proceed in the opposite direction; first, ortgage is given by the individual to his local farm loan ciation in exchange for money; second, this and other similar tgages are transferred from the farm loan association to the n land bank in exchange for money; third, the farm land k deposits these mortgages under the direction of the Federal n Loan Board and, on that security, issues its own bonds sells them to investors.

nder the Farm Loan Act the bonds of the farm land banks exempt from taxation, in order to make such bonds so attrac- to the general investor as to compensate for a low rate of rest, and thus to enable the farmer to borrow at a lower than would otherwise be possible. Bonds issued prior to 1 1920 paid 4½%. Subsequent issues pay 5%. This provision bitterly attacked on the ground that it was class legislation, iminating in favour of farmers as against other classes. matter was under litigation for many months, but finally in uary 1921 the Supreme Court decided in favour of the titutionality of the Act. (T. N. C.)

EDERAL RESERVE BANKING SYSTEM: *see* BANKING: ED STATES.

EDERAL TRADE COMMISSION.—This American commission created by Act of the U.S. Congress, approved Sept. 26 , for the prevention of unfair methods of competition in merce and for the collection of information respecting cor- tions engaged in interstate commerce and respecting export e associations and conditions. It is composed of five mem- appointed by the President, and confirmed by the Senate; more than three members may be of the same political y. The commission elects its own chairman. It entered its official duties March 16 1915. With it was merged Bureau of Corporations, previously under the jurisdiction ne Department of Commerce.

Powers.—If the commission has reason to believe that a "person, partnership or corporation" practises any unfair method to the prejudice of the public interest, it shall serve a notice upon such party, submit a statement of the charges and set a date for a hearing. The party complained of has the right to appear and show cause why the commission should not require the cessation of practices alleged to be in violation of the law. If the party refuses to obey the orders of the commission, the commission may apply to the U.S. Circuit Court of Appeals. Banks and common carriers are excepted, they being under other Federal supervision. The commission is empowered to investigate from time to time "the organisation, business, conduct, practices and management" of any commercial corporation excepting banks and common carriers, and its relation to any other corporation, and to make recommendations for a readjustment of its business alleged to be violating the anti-trust laws, including those relating to price discriminations, intercorporate stock-holdings and interlocking directorates. The purpose of the commission is to advise and regulate. It is also empowered to investigate trade conditions of foreign countries as affecting the foreign commerce of the United States, and to report to Congress with recommendations. The commission comprises three departments: administrative; economic, in charge of investigations; and legal, whose duty it is to conduct investigations in connection with applications for the issue of notices, gather evidence for use in trials, and furnish examiners and lawyers to represent the commission in proceedings before the commission and in court.

Methods.—The activities of the commission are (*a*) quasi judicial, (*b*) economic. Under the first heading comes the prevention of unfair methods of competition. On its economic side the commission investigates (i) on its own initiative any corporation engaged in interstate commerce; (ii) on the direction of the President or either House of Congress any corporation alleged to be violating the anti-trust Acts; (iii) either on its own initiative or that of the Attorney-General the manner in which a court decree dissolving a trust is being carried out. It can also, at the instance of the Attorney-General, recommend the readjustment of the business of any corporation alleged to be violating the anti-trust Acts so as to conform to the law.

Another Act of the U.S. Congress, approved Oct. 15 1914 (commonly called the Clayton Act), specifically declared certain practices illegal and gave the Federal Trade Commission jurisdiction to prevent them. (*See* also INTER-STATE COMMERCE; TRUSTS.)

FEDERZONI, LUIGI (1878–), Italian politician and journalist, was born at Bologna Sept. 17 1878. Educated at the university there, he took to journalism and literature, and for several years was on the staff of the *Giornale d'Italia*, Rome. In politics he was a Conservative, and became a warm supporter of the Nationalist movement. After the Florence Nationalist congress in Dec. 1910, he helped to found the *Idea Nazionale*, at first the weekly and subsequently the daily organ of the Nationalist movement. At the elections of 1913 Federzoni was elected for one of the divisions of Rome. In the Chamber he never missed an opportunity to combat the Socialists, Republicans and Democrats. As soon as Italy intervened in the World War he joined the army as a lieutenant of artillery; he afterwards joined a trench mortar battery and was awarded a medal for valour. Federzoni supported Mussolini when the latter issued his manifesto of Oct. 26 1922 announcing the march on Rome. In the Cabinet formed by Mussolini five days later Federzoni was Minister for the Colonies. In this capacity he provided for the reconquest of all the Libyan territories evacuated during the War, and proceeded to reorganise the whole colonial administration. After the Matteotti murder in June 1924 Mussolini selected Federzoni for the post of Minister of the Interior.

FÉLIX, LIA (1830–1908), French actress (*see* 10.239), died in Paris Jan. 15 1908.

FENCING (*see* 10.247).—The period from 1910 to 1926 was a very critical one for British fencing. Up till 1914 it was increasing in popularity and rising in its general standard when, with the outbreak of the World War, its activities came to an abrupt end. When, in 1919, more normal conditions had returned, the outlook was not of the best. The experienced fencers were suffering from their long period of inaction and there were no young fencers ready to step into their places; for fencing, above all other sports, demands a long period of apprenticeship. It is a wonderful tribute to the fascination of the art, that in 1925 fencing had become more popular than ever, that its general standard is considerably higher than in the years before the War and that its appeal is far more general.

Fencing in the Services.—A marked feature of this improvement is to be seen in the Royal Navy, the Army and the Royal Air Force. In the past the leading civilian fencers regarded the fencing of army and navy officers with scant respect, but in the six years from 1920 to 1925 inclusive, 5 out of the 18 amateur championships held with the three weapons, foil, épée and sabre, were gained by officers on the active list of the services. This improved standard is to be noted also at the universities and at the public schools, though naturally not to the same extent.

Fencing Clubs.—The most hopeful development for the future, however, lies in the more general appeal of fencing. In addition to the established salles, the London Fencing Club with Prof. Mimiague, the Salle Bertrand, Salle Tassart, Salle Alibert, Salle Gravé, the Royal Automobile Club with Prof. Volland, other fencing clubs have been recently formed which extend the pleasures of fencing to a class which in pre-War days never thought of it. Such are the Grosvenor Club, the Lensbury Club and the Tom Hughes Club, among others, and the members of these clubs are rapidly attaining a marked proficiency with foil and épée. Outside London, in the provinces, at Birmingham especially, and in Scotland, the popularity of fencing is increasing.

Two features of present-day fencing are to be regretted. In the first place the introduction of épée methods into foil play has become marked in recent years, and as long as the foil is regarded as a competitive weapon these methods will no doubt continue. In the two competitions for the Thompson trophy, between American and British representatives, the former easily defeated the more stylish British foil-fencers by using the weapon as a fighting rather than as a fencing implement, and their victories no doubt had an effect on the younger generation of foil-fencers.

The second indictment refers to épée fencing. Assaults with that weapon are now decided in international events by two hits out of three instead of by a single hit. There appear to be three good and sufficient arguments against this practice: (*a*) Where the target is the whole body, so great concentration is required that a single hit is quite sufficient to determine the issue: (*b*) the knowledge that a single hit is not fatal tends to carelessness over the first hit; (*c*) a fencer who has won the first hit can win the encounter equally with a good second hit or a coup double, and anything which tends to exploit the coup double is much to be deprecated.

The Olympic Games.—In the Olympic Games of 1912, the British team did not make a great show, but in the International Fencing Tournament, held at Earl's Court, London, Comm. E. W. H. Brookfield, R.N., tied for first place with the sabre. In 1914 that fine fencer, R. Montgomerie, by his victory in the épée championship, brought up the number of his individual championship successes to eight, a record for a British fencer. In the Olympic Games of 1920 Capt. R. Dalglish, R.N., was placed sixth in the final sabre pool and also awarded a special prize for "good sportsmanship."

Anglo-American Contests.—This Olympiad, with its apparently inevitable squabbles and bickerings, resulted in a special rapprochement between the teams of the United States and Great Britain and started the competition between the two nations for the Thompson trophy. The first meeting was held in America during Nov. 1921, and resulted in a victory for the United States by 25 points to 21, but Great Britain turned the tables in the summer of 1923. In 1923 E. Seligman won the sabre championship, a feat which he repeated in 1924, and so became the first British fencer to gain a championship with all three weapons, and he further distinguished himself by reaching the final pool of the foil championship in the Olympic Games of 1924 in Paris, when he had to retire owing to a strain, after beating the winner. He also qualified for the second round of the sabre championship and Capt. R. Dalglish, R.N., also did well; while C. H. Biscoe reached the semi-final pool of the épée championship. In these same Olympic events, the United States were well represented by Bloomer, Boyce, Calnan, Jeter, Breed, Milner, Gignoux, Macpherson, Lyon and Costner.

In 1923 two Grands Assauts d'Armes were held at the Hotel Cecil and the Grocers' Hall, London, and one in 1924 at the Royal Automobile Club, London. In these many of the most distinguished continental fencers took part, both amateur and professional, including A. Massard, M.C., L. Gaudin, R. L. Heldé, C. Lafontan, A. Pope, Aldo Nadi, E. Tack, F. de Smedt, J. Rossignol and many others. Fencing among women has developed extraordinary popularity. In 1925 the three outstanding women fencers in Great Britain were Miss Gladys Davis, Miss Gladys Daniell and Mrs. Freeman.

Winners of the Amateur Championships

	Foil	Épée	Sabre
1910	R. Montgomerie	E. M. Amphlett	A. Ridley-Martin
1911	E. M. Amphlett	J. P. Blake	W. Hammond
1912	P. G. Doyne	R. Montgomerie	Capt. C. F. Van-der Byl
1913	G. R. Alexander	G. G. M. Vereker	A. Ridley-Martin
1914	R. M. P. Willoughby	R. Montgomerie	W. Hammond
1920	P. G. Doyne	M. D. V. Holt	Lieut. C. A. Kershaw, R.N.
1921	R. Sutton	Capt. H. F. S. Huntington	W. Hammond
1922	R. Sutton	G. M. Burt	A. H. Corble
1923	Maj. Stenson Cooke	M. D. V. Holt	E. Seligman
1924	Flight-Lieut. F. G. Sheriff	C. H. Biscoe	E. Seligman
1925	Flight-Lieut. F. G. Sheriff	Maj. C. B. Notley	Lieut.-Comm. C. A. Kershaw, R.N.

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FENG YU-HSIANG, Chinese soldier, and the so-called "Christian general" first came into prominence when, on Aug. 25 1921, he was appointed tuchun, or military governor, of Shansi. In 1922 he was transferred to Peking and played a decisive part in the Chihli-Fengtien war of that year. During 1923 his troops were stationed at Nan-Yüan, near Peking, and it was inevitable, in view of the doubtful authority of the President and his Ministry, that he should play an important part in the political intrigues of the capital. These manoeuvres culminated in his resignation, the flight of President Li and the *coup d'état* which resulted in the assumption of office by Tsao-Kun. Feng retired to the northwest frontier, where he became director of defence, but returned to aid Chang-Tso-lin against Wu Pei-fu in 1924. After Wu's defeat, Feng turned against his ally and seized Peking, thus forcing Chang to retreat to Mukden. He dominated the capital throughout 1925 and at the end of the year captured Tientsin. Chang's victory at Mukden, however, led to Feng's retirement to Mongolia. Feng earned his sobriquet by embracing Christianity after witnessing, it is said, the heroism displayed by missionaries during the Boxer outrages.

FERDINAND (1861–), EX-KING OF BULGARIA (*see* 10.269).—King Ferdinand in 1911 was the instigator of the Balkan League between Bulgaria, Serbia, Greece and Montenegro, which was formed in 1912 and enabled these four states to declare war against Turkey that same year. This pact provided for the future division of the Balkan Peninsula, reserving to the arbitration of the Emperor of Russia the solution of any doubtful claims. The war started in Oct. 1912, before the conclusion of the Treaty of Ouchy, which put an end to the Italo-Turkish War (Oct. 15). Under the command of King Ferdinand, the Bulgarian Army dealt the most rapid and decisive blows to the enemy; victorious on the battlefields of Kirk Kilisse and Lule Burgas, and having conquered most of Macedonia and Thrace, it started on the open road to Constantinople. Europe grew alarmed; the Great Powers brought about the armistice of Dec.

1912, and the London Conference, which started on Dec. 13.
These discussions, however, ceased abruptly, and military
erations were resumed on Feb. 3 1913. The Bulgarian armies
tacked at Gallipoli and Chatalja, and after a gallant siege
tered Adrianople on March 26 1913. However, the Treaty of
ondon which followed did not sanction these victories, and its
cisions instead of inaugurating peace, provoked a war between
e Balkan States, which began on June 30 1913, by a simulta-
ous attack of the Serbs and Bulgarians. The former allies be-
me bitter rivals, Rumania and Turkey joining Montenegro,
reece and Serbia against Bulgaria, who, finding herself closed
by four enemies at once, was forced, after a few weeks of
ave but useless resistance, to submit unconditionally to the
ctors' terms. The Treaty of Bucharest, signed on Aug. 10 1913,
nihilated in one stroke the brilliant results obtained through
e heroism of the Bulgarian armies in 1912–3. It deprived Bul-
ria of all her conquests including the town of Silistra and part of
e Dobruja and gave to the Serbians and Greeks the province
Macedonia for which Bulgaria had made all the sacrifices of
e first Balkan War. This treaty was the principal cause of
lgaria's participation in the World War on the side of Ger-
ny. It explains the resentment of King Ferdinand and his
vt. against the other Balkan States. Had the Allied Powers
1914 guaranteed the revision of the Treaty of Bucharest,
lgaria would have co-operated with them; but as they failed
do so, Germany was able, by illusory promises, to induce
lgaria, who felt she had been unjustly treated, to fight for
e German cause. These German manoeuvres did not succeed
once, for King Ferdinand began by proclaiming the neutrality
Bulgaria in Nov. 1914.

During May 1915 the Bulgarian Govt. sounded the four
eat Powers, with regard to the fulfilment of Bulgaria's legiti-
te claims in Macedonia. As no concrete answer was re-
ned, King Ferdinand turned to Germany, where his applica-
n was received with great cordiality. Berlin made lavish
mises at once. German envoys hurried to Bulgaria, with a
w to persuading the King and the Govt. to conclude a mili-
y alliance with Germany. The desire for revenge against
bia, Greece and Rumania inspired Ferdinand to bind Bulgaria
the Central Powers. On Sept. 21 1915 he gave the order for
eral mobilisation, though his Govt. advised armed neutrality.
view of this equivocal situation Russia sent an ultimatum to
lgaria on Oct. 4 1915, which was succeeded by formal declara-
ns of war against Bulgaria on the part of Serbia, France,
eat Britain and Italy. Bulgaria was definitely in the German
np; under Gen. Gekoff, commander-in-chief, her armies were
torious on most of the battlefields of Macedonia, Thrace and
mania, in 1915, 1916 and 1917, against the Serbs, and against
Rumanians. The Kaiser, the King of Saxony and the King
Würtemberg all paid official visits to King Ferdinand at
a. However, in Sept. 1918, the Bulgarian Army, discouraged
innumerable hardships, was defeated at Dobropole, Mace-
ia, by the Allied troops. This was the sign for a general
eat. An armistice was signed at Salonika on Sept. 30 which
ed the war between Bulgaria and the Allies. After this
astrophe King Ferdinand abdicated in favour of his son
is on Oct. 4 1918 and left Sofia the same evening for Coburg
ere he has lived since in retirement. (A. St.)

ERDINAND I. (1865–), King of Rumania, was born
. 24 1865 at Sigmaringen, Prussia, the second son of Prince
pold of Hohenzollern-Sigmaringen. As King Charles had no
it was decided that the succession should be continued in
family of Prince Leopold, and Prince Ferdinand, Charles's
hew, became Crown Prince of Rumania and heir presumptive
he Rumanian throne in March 1889. Prince Ferdinand took
eat interest in military questions and the organisation of the
manian Army on modern lines was in no small measure due to
energy and enlightened advice. He was commander-in-chief
he Rumanian armies during the Bulgarian campaign of 1913.
Jan. 10 1893 he married Princess Marie, eldest daughter of the
ke of Edinburgh, Duke of Saxe-Coburg-Gotha. Six children
e born of the marriage.

When Ferdinand ascended the throne on Oct. 11 1914, Rumania was passing through one of the most critical periods of her history. At the Crown Council held under King Charles at Sinaia soon after the outbreak of the World War, the members of the Cabinet who were in favour of intervention on the side of the Central Powers were greatly outnumbered and in spite of Charles's support of the minority, it was almost unanimously decided that Rumania should remain neutral. Later King Ferdinand, who had in the meantime succeeded to the throne, found himself in an extraordinarily painful situation when he realised that an armed intervention in the cause of Rumania's national unity was unavoidable. He, however, conquered his feelings as a German and a Hohenzollern, and when the moment came, he did not hesitate to declare war on his native country. As a consequence he was disowned by the Hohenzollern family.

When Bucharest was occupied by General Mackensen, King Ferdinand and the Royal family withdrew with the Government and the army into Moldavia. There he endured with the rest of the population a most appalling period of anxiety, sickness and want. The Bolshevist revolution and the collapse of the Russian armies came as a crowning misery. Fortunately however, the Rumanian Army, headed by King Ferdinand, repulsed the German attack at Mărăşeşti, thus saving the rest of the country from invasion. In 1918 the provinces of Bessarabia, Bucowina, Transylvania and the Banat had become united with Rumania, and on Oct. 15 1922 King Ferdinand was crowned at Alba Julia King of all Rumanians.

Two most important reforms, the agrarian reform and the inauguration of universal suffrage, were enacted under Ferdinand's reign. The expropriation of large estates and their conversion into small holdings did much to guarantee the peaceful development of an agricultural country such as Rumania. King Ferdinand was the first landlord to hand over his estates to his peasant-soldiers. It was also due to his initiative that the thorny Jewish question was solved by the grant of full civil and military rights to the Rumanian-born Jews. In Dec. 1925 Ferdinand's eldest son, Charles, renounced his claims to the throne, and Charles's son, Michael, became heir apparent. (G. Bo.)

FERRERO, GUGLIELMO (1871–), Italian journalist and author, was born at Portici, near Naples, July 31 1871. At an early age he joined the staff of the Radical semi-republican *Secolo* of Milan. He travelled abroad considerably, and made a certain reputation by his books *L'Europa giovane* (1897) and *Il Militarismo* (1898); Engl. tr., 1902. Later he studied Roman History, and in 1902 published his *Grandezza e decadenza di Roma*, which established his fame as historian among the general public rather than among scholars. He, in fact, applied the methods of journalism to history. In politics a Radical Democrat, on the outbreak of the World War he was an ardent supporter of the Allied cause, which he identified with that of democracy, and advocated Italian intervention. After the War he published numerous articles and several books in Italy and abroad, inspired by the most gloomy forebodings of imminent catastrophe for Italy, Europe and the world's civilisation. Among these later works is *Da Fiume a Roma* (Milan, 1923), also published in English under the title *Four Years of Fascism* (1924).

FERRIER, PAUL (1843–1920), French dramatist (*see* 10.288), died at Nouan-le-Fuzelier Sept. 11 1920.

FERRO-CONCRETE ENGINEERING (*see* also Bridges; Dams; Factory; Road Construction).—Owing to a combination of circumstances, technical, economic and manufacturing, great developments in reinforced concrete have taken place since 1910, and as a structural system it is now widely appreciated for many purposes on account of its adaptability, lightness and economy of first cost and maintenance. The scarcity of steel during the World War caused reinforced concrete to be used for many structural purposes for which steel had hitherto been considered the most suitable material. Another factor in the development has been the progressive improvement in the strength and reliability of Portland cement as evidenced by the latest revision of the British standard specification for Portland cement, 1925, which calls for a neat cement tensile strength at 7 days of 600 lb. per sq. in. as compared with 450 lb. for the previous specification, 1912.

Rapid progress has also been made with a new type of aluminous cement ("ciment fondu"), originating in France, but now also made elsewhere, which, while setting initially no quicker than Portland cement, nevertheless attains or exceeds in 24 hours the strength of Portland cement at seven days, so that concrete made with such cement can be brought into service, if need be, in a day or two. It is claimed also that the cement resists the action of sea water, and that owing to the heat generated in setting, it can be used in frosty weather.

Along with the improvements in cements much progress has been made in the subject of proper grading, proportioning and mixing of aggregates, sands, cement and water in order to attain the densest, strongest and most watertight concrete. It is well recognised now that, with aggregate and sand of a given material, that mixture of graded material (large, medium and fine) which has the smallest proportion of voids, and which consequently weighs most per unit volume, will be capable, when mixed without excess of water, of furnishing the strongest concrete.

Technical Studies.—On the technical side, much work has been done in the theoretical analysis of the moments and stresses in arches and continuous framed constructions of varied forms, and the results are available for use in the more accurate determination of stresses and sections. Considerable study has also been given to the elastic properties of concrete in relation to the secondary stresses arising from temperature variations and shrinkage of the concrete.

Foundations.—Reinforced concrete construction is adapted to varied uses in foundation work. Thus, retaining walls of ample strength can be readily constructed in places where there is no room for a gravity wall of mass concrete. Heavy columns can be supported on a relatively thin but widespread foundation of reinforced concrete with great saving in weight, volume and depth of construction, as compared with mass concrete. On weak ground, a complete layer of light reinforced concrete in the shape of a plain or ribbed slab may be provided to distribute the entire load over the whole basement area of a structure in an economical and efficient manner unattainable with other methods of construction.

Caissons and Floating Craft.—An important development in subaqueous foundation work, such as dock walls, breakwaters and bridge piers (*see* PORT ENGINEERING) consists in the use of reinforced concrete caissons of rectangular, cylindrical or other form, which may be constructed in dry dock or on a staging on dry land, then launched or floated out, towed to the site, and deposited in position on a bed prepared by dredging or by divers. Such caissons form a permanent part of the construction and are generally used as a working base for further operations of sinking downwards and building upwards, the top being kept always above water. Sinking downwards through suitable materials may be effected by grabbing through open wells in the interior of the caisson, while for difficult cases the excavation may be carried on by men working under compressed air. Large concrete caissons have been applied in the construction of the upper portions of breakwaters as at Valparaiso[1] and elsewhere. In the Oswald Street Bridge at Glasgow,[2] cylindrical caissons 20 ft. diameter were used for the foundations of the piers. These caissons were constructed on a staging ashore, fitted with a false bottom, lowered into the water, floated out to position, deposited on the prepared bed, and after removal of the temporary bottom, sunk to the necessary depth by grabbing and excavation inside, the pier on top of a group of caissons being built up as the sinking proceeded.

Concrete Ships.—The results of the construction of reinforced concrete cargo vessels were satisfactory and indeed surprising as regards watertightness, main longitudinal and transverse strength and lightness of construction. The hull weight in careful designs was less than that of a wooden vessel, though somewhat greater than that of a steel hull. The principal disadvantage lay in the relative tenderness of the thin skin construction under the bumping and rubbing to which a vessel is often subject when in port and when touching the ground. The results were instructive as regards the possibilities of carrying out light watertight concrete constructions with rich concrete of small aggregate without the addition of any special waterproofing material and with very fine limits of cover of concrete and spacing of bars. In Great Britain, in addition to numerous barges and steam tugs, a few self-propelled cargo vessels were also constructed, the principal being the "Armistice"[3] of about 1,100 tons dead-weight capacity.

Flat Floors.—There has been a continued tendency toward simplification of structure with a view to speeding up and cheapening construction, culminating in the extensive use in the United States of the flat slab floor. In this type main and subsidiary beams are dispensed with and a floor of constant thickness with a flat under surface is supported directly on the columns, which have enlarged heads of square or moulded shape. The floor reinforcement consists of several systems of rods mainly radiating from the columns and placed near the upper surface over the columns and near the lower surface in the interior of panels.

The design of such floors is based on very approximate theory controlled by the results of stress measurements in tests of actual floors. The method has hitherto found but little application in Britain, where much more use had been made of light flat ceilinged floors having in their lower part rows of hollow tile blocks set so as to leave intermediate spaces for the formation of narrow reinforced beams, the floor being completed by a continuous concrete layer placed over the tiles and beams. Floors of this type are well adapted for filling in the panels between the main floor beams of structural steel-framed buildings, and have the advantages of lightness and good insulating qualities, while a plaster ceiling can be applied to the grooved soffits of the tiles.

Rich Concrete.—Greater recognition is now being given to the value of the cement element in concrete as affecting the strength, watertightness and endurance of the material. Starting from 1:2:4 mixture, the one most commonly used in reinforced construction, which is seldom quite watertight and on that account may in certain circumstances fail to protect the rods sufficiently, it is found that up to a 2:2:4 mixture the addition of cement is accompanied by a roughly proportionate increase in the compressive strength as well as by enhanced reliability, watertightness and protecting properties, to the extent that porosity in a 2:2:4 mixture is quite exceptional. The richest mixtures are required for sea construction, such as jetties, especially for the parts above low water, also for tanks, conduits and floating craft which have to withstand water pressure, and for piles which have to undergo severe hammering. Pressure conduits have been constructed of 20 ft. diameter for 50 ft. head and in smaller sizes for a maximum pressure of 180 ft. head. (*See* AQUEDUCTS.)

Long Span Arch Construction.—Wherever abutment and headroom conditions are suitable and the span is not small, arch construction compels consideration, as thereby a single main truss member (the arch) serves to carry the load as compared with two main members and a web system in the case of a beam or truss. Further, the arch has the economical advantage that the thrust is principally taken by concrete, which is cheaper for this purpose than steel, and in large arches only a relatively small proportion of reinforcement is required to take care of such tensile stresses as may develop due to live-load variations and the effects of shrinkage, temperature and rib-shortening in the concrete. The arch form, in addition, lends itself to the attainment of good appearance. The largest arch bridge completed in 1926 is the 432 ft. span road bridge across the Seine at St. Pierre du Vauvray, France. Whereas formerly 400 ft. was looked on as being near the practicable limit for a concrete arch, recent developments have greatly extended the limits and completely worked-out projects are now in existence for more than one bridge with spans of about 600 ft., and spans of well over 1,000 ft. do not appear to be unattainable.

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[1] *Proceedings of the Institution of Civil Engineers*, vol. 214.

[2] *Engineering News Record*, Oct. 1925.

[3] *Proceeds of Inst. of Naval Architects*, 1918.

Aesthetic Appearance.—Surfaces of concrete do not lend themselves very readily to satisfactory architectural treatment, so that in many fine buildings the supporting framework of reinforced concrete is entirely hidden behind facework of masonry or other material. Good effects in buildings can be attained when the visible concrete is well finished and confined to well-proportioned and suitably lined vertical and horizontal bands of he framework, the rest of the elevation being formed of panelling and facework of other materials. In bridges, principal reliance must be placed on satisfactory form and proportions combined with very careful work in constructing and setting the moulds which form the exposed surfaces. Parapets and pillars of good inish and appearance may be precast in small pieces in carefully inished moulds, preferably of metal.

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FERTILISERS: *see* AGRICULTURE: SCIENTIFIC DEVELOPMENTS.

FEZ, Morocco (*see* 10.306), has been since 1912 under the French Protectorate. The population in 1921 was 70,540, includng 2,218 Europeans. The city has still an active native industrial ife and prosperous trade, while European industries, such as oil and soap manufacture, have been established. The town is it by electric light derived from the falls of Wadi Fez. The municipal services have been reorganised by the French under he native pasha and his council, and an office of native industries has been set up to conserve the ancient handicrafts. The erecion of the new European town of Fez has been begun near Dar Debi Bagh. Fez is connected with Rabat and Ujda by narrow-gauge lines, and the line to Tangier is finished as far as the Spansh frontier. There are some 30 native olive oil factories round he Bab-el-Ghisa, and the manufacture of silk textiles occupies about 30,000 people. There are good roads to Taza, Meknes and Qnitra. The new port at Qnitra is the nearest to Fez.

FIBRES (*see* 10.309).—No fundamental changes have taken place in the technology of fibres since 1910, although there have been many minor developments, including an increased use of he lesser fibres for industrial purposes. It is rather in the employment of substitutes and in the evolution of processes which have produced practically new substances such as "artificial ilk" (*q.v.*) that the most striking changes have taken place.

War Substitutes.—During the World War period interesting echnical experiments were made, particularly in Germany and Austria, with various substitutes. These were caused by the hortage of cotton and wool, due partly to the blockade and partly to the huge demand for these fibres for military purposes. Cotton was required for explosives and wool for uniforms and he like. Early in the War, German experts began to examine he possibilities of other fibres, hoping thereby to supplement heir inadequate supplies of cotton and wool. From the standpoint of fibre technology, these experiments are undoubtedly mportant but so far have not been of much industrial use.

Experiments were made with nettles and with twisted paper yarns. The substitution of wood cellulose for cotton cellulose proved of the greatest immediate value to Germany. To a large extent she was thereby enabled to eke out her supplies of cotton cellulose and produced considerable quantities of nitro-cellulose propellant explosives from wood pulp. The wood cellulose was prepared from the bisulphite pulps of the paper industry by hydrolytic treatments and the result was a cottonisation of the pulp. This material is usually known as "Supersulfit" and has proved of considerable value during the post-War period for he making of paper. (*q.v.*).

Paper Yarn.—The "paper yarn" industry developed under the pressure of the War to an annual output of 200,000 tons. These yarns were used to quite a considerable extent for textiles, even complete suits being made from "paper cloth," but were characterised by the defects of short fibre length and failed to establish themselves as serious competitors with the older fibres such as cotton and wool.

Nettle Fibre.—Valuable experiments were made with nettle fibre, resulting in indications that it is almost a total failure. The common nettle or *Urticaceae* contains a rough fibre, and since the plant belongs to the same order as Ramie or Rhea fibre, high but illusory hopes were entertained that from it might be obtained a fibre of similar or even better quality, which could be used in the textile industry. Nettle fibre has great length of bast, and great variability in dimensions and has to be prepared by chemical methods of separation. The crop-weight is low and it is difficult to cultivate on a commercial basis. While stout plants can be gathered wild, when transferred to cultivated soil and planted in regular rows, they tend to deteriorate and become thin and weak. These difficulties may be surmounted, but so soon as the War ended fibre users quickly returned to the older and more satisfactory raw materials.

Jute.—Long before the War it was known among fibre experts that by treating jute with caustic soda a "woollenising" effect is produced. The structure of the fibre is altered, has many resemblances to wool, can be "carded," and mixes well with wool. This process was revived in Germany and Austria during the War and mixtures containing as much as 60% of this vegetable fibre were worked up and spun into serviceable yarns.

Sisal.—In the post-War period, so far as the old series of hard fibres are concerned, the most important developments have been in the direction of increasing their output by opening up new areas in which they are being grown on a commercial scale and in developing alternative plants, such as the expansion of the sisal industry in the British colony of Kenya. The sisal is an agave which is indigenous in Florida, the West Indies and Yucatan, and from its leaves sisal hemp is produced. The plant has, however, been transported to distant areas, and at Kenya it is now one of the chief exports of the country. In 1912 only 2,500 cwt. were exported; in 1919 the quantity had risen to 126,937. In 1924 Kenya and Uganda together exported 218,740 cwt. of sisal fibre and 9,720 cwt. of sisal tow.

The demand for sisal is due to the increasing demands for binder twine, needed by the mechanical reapers which are being employed in ever increased quantities by the great grain producing countries such as the United States, Canada, the Argentine and Australia, particularly for those machines which reap and at the same time bind into sheaves. Sisal hemp, a substitute for the original hemp, *Cannabis sativa*, is itself threatened by new competitors such as Mauritius hemp, Manila hemp and New Zealand hemp or *Phormium tenax*, which were well known and widely used before the War.

Bowstring Hemp.—This plant flourishes in the shade of old rubber and may therefore prove a valuable crop in old rubber clearings. It is propagated by seed, division or leaf cutting, the latter method being the most satisfactory. The distance of planting is two feet apart each way and the average yield is 1½ tons per acre. The plant produces a fine, tough, white and elastic fibre, which is extracted from the leaf by methods similar to those employed in the preparation of sisal. It is usually shipped in bales of four to five hundred-weights. Although much valuable scientific information has been acquired concerning this plant—and it undoubtedly has considerable possibilities—its production is still in the experimental stage.

Roselle Fibre.—This is obtained from an annual shrub which belongs to the order of the hibiscus. The fibre is obtained from the branches and main stem, but the latter is of inferior quality. The fibre is suitable for making rope and good quality string, and it is claimed that it can be spun like jute but, so far, it is not certain that it can be produced on a commercial scale. The plant grows to a height of 10 or 12 ft. and therefore must not be planted within a radius of 5 ft. of young rubber trees. It is prepared by retting in stagnant or slow moving water for 8 or 9 days, and all the work can be done by native hand labour and requires no elaborate machinery. It must, however, be bale-pressed for export.

Arghan.—This fibre stands half-way between the hard and soft fibres and appears to have some of the characteristics of each. It was originally discovered by Sir Henry Wickham in South America, but attempts are now being made to develop it on a commercial scale in Malaya. It was first considered as a material for twine and cordage but it possesses a tensile strength which gives a breaking strain of 50% above that of the finest Italian hemp or even the best flax. Moreover, it can be spun to a much finer lea than is required for twine. A firm cloth which bleaches and dyes well has been woven from it. Till recently it could only be spun on a flax machine but it now seems possible to use ordinary cotton machinery. It is a lance-leafed plant, similar to a pineapple, and the long leaves contain more than 20% of pure fibre. It is easily split up into long fibres, 7 feet or more in length, which are almost as delicate as silk. Specific leaves on each plant produce a softer and finer fibre than the others, and planters are concentrating attention on these. Arghan still is more of scientific than of commercial interest but possesses considerable possibilities.

Kapok.—This soft fibre is obtained from the pods of the Kapok or cotton tree, indigenous to Malaya, Java and the Philippines. Considerable and increasing quantities are being exported chiefly to Australia, America and Great Britain. The chief distributing centre in Europe is Amsterdam. It is non-absorbent and lighter than water. When stuffed into life-saving apparatus or into cushions, etc., it will sustain a heavy weight in water for many hours. In consequence it has largely replaced cork-lined appliances. The fibre is as buoyant as cork and can be compressed *en masse.* The peculiar property of the fibre is due to its structure. The fibre canal holds a large amount of air, and the smooth contour of the fibre and the resilience of the air-filled tube give a large air volume to the mass, even when compressed. The fibre is short, light and brittle, and despite much experiment so far, attempts to spin it on a large scale have not been successful. It has a fine lustre and great elasticity.

Flax.—Special efforts have been made to develop the production of flax in various parts of the British Empire in order to replace Russia who, in pre-War days, produced annually 525,000 tons of flax and exported at least half of it to Europe. Flax from the new Baltic States and from Soviet Russia has again begun to appear on the markets. The Belfast linen industry, in conjunction with the government, have in recent years devoted special attention to increasing the supply of fibre. In particular, efforts are being made to develop flax growing in England. A special committee was set up in Oct. 1924 to consider anew the whole matter, and in the *Journal of the Ministry of Agriculture* (1925, 32, 310) it was stated that the government had adopted the recommendation of this committee and had acquired two factories and constituted a society, not trading for profit. This society is The Flax Industry Development Society and its primary object is the supply of seed of good quality. It is believed this society will be able to supply a far better type of seed than that at present obtainable by flax growers and so lead to a great extension of flax growing of the finest quality within the British Isles and throughout the Empire. (*See* CELLULOSE.)

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FIJI ISLANDS (*see* 10.335) have an area of 7,425 sq. m. and a population of 139,541 (1911). The dominant feature of Fijian history during the years 1915–25 was the celebration at Levuka, on Oct. 10 1924, of the islands' jubilee as a Crown Colony. After 50 years of British rule the same "lali" or native drum was beaten at the same hour and place by the old chief who beat it at the cession of 1874, announcing the ceremonies arranged in honour of the occasion. Peace was the object of the cession, and the Fijian fully appreciates the peace that for nearly 50 years has remained unbroken. A large tabua (whale's tooth), presented on the occasion of the jubilee, was accepted by King George as a token of the loyalty and affection of his Fijian subjects.

Population.—The census of 1911 shows that the population in that year was 139,541; in 1921 there were 88,464 males and 68,802 females, total, 157,266. Of this total, Europeans number 2·4%, Fijians 53%, Indians 38%; the rest are mainly half castes, Polynesians, Rotumans and Chinese.

Constitution and Administration.—The present Constitution is regulated by Letters Patent of Jan. 31 1914 (amended in July 1916). It provides for an Executive Council to advise the Governor, and a Legislative Council; the former now consists of four official and two nominated unofficial members, and the latter consists of the Governor, not more than 12 nominated, 7 elected and 2 native members. The natives, however, retain a large share of self-government, and in the remote districts, where little commercial development has taken place, there is but slight modification in the old communal methods of native society. Younger natives, who through a certain amount of education have come under the influence of a European social system, are disposed to secure release from communal obligations and to support themselves on their own land or become wage-earners for varying periods in industrial centres or on plantations. Many are now engaged in the sugar-mills, and a considerable number as clerks, sailors, carpenters, boat builders and domestic servants. The vast majority, however, remain agriculturists living in native villages and cultivating their tribal lands. Educational administration was completely changed in 1916, when a board of education replaced the school boards, an education department was formed and ordinances passed to allow grants to be made to primary and vernacular schools. European education in the colony has made considerable progress, in spite of the fact that the problem is rendered more complex by the numerous races now domiciled in the islands. Facilities for primary education are good, and those for vocational training constantly improving.

Land Tenure.—The sale of native lands, except to the Government for specific purposes, was prohibited by an ordinance of 1912. The standard tenure is leasehold up to 99 years, with security to the tenant for permanent and unexhausted improvements. A native lands commission, comprising a European officer and three native chiefs, has been established to survey and register all native lands.

Trade and Industry.—The total trade in 1924 was £2,565,528, as against £1,999,004 for 1912, £2,329,908 for 1913 and £2,301,139 for 1914—a steady increase which has since been well maintained. There is a preferential tariff in favour of the products and manufactures of the British Empire; and of the total trade of the colony over 60% is with British Possessions, and about 11% with the United Kingdom, the balance, about 25%, being with Europe and the United States of America. The main agricultural industries have for long been the production of sugar, copra and bananas. The sugar industry has been hampered by inadequate labour and by a great increase in the world's production; copra has suffered from a restricted market, the banana industry from plant disease and a protective customs tariff in Australia. Hence the Government continues to make efforts to develop the new rice industry, which is important to the Colony with its large East Indian population. The cultivation of cotton, which had ceased in 1900, was resumed in 1922 and is almost entirely in the hands of East Indians. Other developing industries are dairying, sawmilling and the growing and canning of pineapples.

Communications.—There is regular monthly communication to and from Sydney via Auckland or directly, and also to and from Vancouver via Honolulu. The Colonial Sugar Refining Company has a narrow gauge railway extending from Tavua to Na Singatoka, a distance of 120 m. over which passengers are carried on specified days. The first section of the main trunk road, which ends at Sawani, was completed and opened to traffic in 1924, and, though the total length of metalled roads is less than 100 m., there is a good length of gravelled roads and of communally-maintained bridle tracks.

Finance.—The revenue for 1924 amounted to £484,834 as against £283,947 in 1912. Notwithstanding fluctuations the revenue has been steadily expanding for years, and though expenditure in the last 10 years has frequently exceeded it, there was a surplus of £50,316 in 1923 and of £33,764 in 1924. (A. R.*)

FILDES, SIR LUKE (1844–), British painter (*see* 8.339), was born at Liverpool and educated privately at Chester. He studied at the art schools of Warrington, South Kensington and he Royal Academy, and exhibited his first Academy painting n 1872. Introduced to Dickens by Millais, Fildes was illustrating *Edwin Drood* at the time of the novelist's death. "The Casuals" 1874) showed him as a genre painter of power, and a series of Venetian pictures were very popular. He was made A.R.A. in 879, and R.A. in 1887. "The Village Wedding" (1883) and, nore especially, "The Doctor" (1892) is probably the most videly famous of his works. In later years he painted many ortraits, among them state portraits of Edward VII. (1902), Queen Alexandra (1905), and George V. (1912). Knighted in 906, Sir Luke Fildes became K.C.V.O. in 1918.

FILING SYSTEMS: *see* OFFICE APPLIANCES.

FILM: *see* MOTION PICTURES; PHOTOGRAPHY.

FILON, PIERRE MARIE AUGUSTIN (1841–1916), French man f letters (*see* 10.345), died at Croydon, England, May 13 1916. n 1910 he published a short biography, *Marie Stuart*, and in 911 *L'Angleterre d'Edouard VII.*, and a dramatic poem, *hakespeare amoureux*. His *Souvenirs et documents*, relating to is former pupil, the Prince Imperial, appeared in 1912.

FILTER-PASSING MICROBES.—These organisms are those hich are small enough to pass through a "bacterial" filter. acterial filters are made of unglazed porcelain or compressed nfusorial earth. The grains of the china clay or infusorial earth sed for their manufacture are sufficiently small and uniform to eave insterstices, the cross section of which is 0·2 to 0·8 μ in iameter. If a liquid containing microbes whose smallest diameter exceeds 0.2 μ be pressed through the filter, the microbes remain impacted in the smaller crevices. As 0·2 μ is also the limit f size of a particle which can be resolved by the best microscopes ee MICROSCOPY) when white light is used, filter-passing organisms are either invisible or on the margin of visibility. Hence, ost of them have been classed as "ultravisible viruses."

Discovery.—The first discovery, that an ultramicroscopic or iterable virus was the cause of an animal disease, was made by oeffler in 1898 in the course of some experiments upon foot-nd-mouth disease, in which a filter of infusorial earth was used remove ordinary recognisable bacteria from the diluted contents of the superficial vesicles which are characteristic of this isease. The filtrate was free from any particles visible by the icroscope and no bacteria developed in it on cultivation. Nevertheless, injection of this filtrate into animals caused disease. laterial removed from the vesicles of the animal so infected nd filtered again reproduced the disease in a fresh animal. milar experiments were carried out through a number of generations of animals, so that there was no doubt that a virus apable of propagation in the animal body was contained in the ltrates. In the next few years the filterability of the virus was tablished in the case of infectious pleuro-pneumonia of cattle, outh African horse-sickness and fowl plague.

Yellow Fever.—The cause of yellow fever has been shown by oguchi to be a spirochaete which, owing to its thinness and otility, can pass through a bacterial filter.

Human Diseases.—Up to 1925 the virus of about 40 diseases of an and domestic animals had been found to pass through a acterial filter by some reliable observer. The more important these are the following: foot-and-mouth disease, contagious vine pleuro-pneumonia, African horse-sickness, fowl plague, llow fever, cattle plague, sheep-pox, *epithelioma contagiosum* birds, swine fever, rabies, cow-pox (vaccinia), *molluscum ntagiosum* of man, equine infectious pernicious anaemia, canine stemper, "blue tongue" of sheep, dengue fever, papataci or nd-fly fever, smallpox, trachoma, poliomyelitis, measles, phus fever, trench fever, mumps, Rocky Mountain spotted ver and *herpes labialis*.

Influenza.—Recently, Olitzky has succeeded in propagating special culture media seven varieties of small microbes from e filtrates through a "bacteria proof" filter of washings of the roats of individuals suffering from catarrhal diseases. One of em is credited, on substantial grounds, with being the cause pandemic influenza (*q.v.*), another is supposed by its discoverer to be responsible for our common colds. The others do ot appear to be of pathological significance.

Cancer Research.—There is now reason to suppose that filterable viruses play some part in the origin of cancer (*q.v.*). When a fragment of a malignant tumour is implanted in the tissues of an animal of the same species it generally grows and ultimately kills the animal. The animal cells of which the cancer is composed are endowed with a faculty for growth, uncontrolled by those factors which determine normal tissue equilibrium. The possibility that this property was due to infection of the cells by a microbe has, in the past, occupied the attention of investigators, but no experimental basis for this view was afforded till 1911, when Peyton Rous described a sarcoma of the fowl which differed from mammalian tumours in that it was transmissible from chicken to chicken by means of a filtrate from a filter which kept back all of the malignant cells (much too large to traverse its pores) and also any bacteria of ordinary dimensions. This filtrate could be dried at a low temperature and the powder retained its activity for years. It had no effect when injected into animals other than chickens, and it always produced the same type of tumour.

As the same result could not be obtained with a filtered extract of other malignant growths, this very important discovery was interpreted to mean that this fowl-sarcoma was a thing apart, although in structure and behaviour it closely resembled the mammalian sarcomata. Subsequently, its discoverer found that two other malignant tumours of fowls possessed similar properties, and quite recently Carrel has recorded the formation of malignant tumours in fowls following local irritation of the tissues with tar or arsenic, filtrates from which were also infective for chickens. Rous believed that the filterable agent which caused the tumours he studied was, probably, an extremely small microbe, but as he did not succeed in propagating it outside the body its nature remained undetermined. The nature of the infective agent in the filtrate of Rous's tumour has recently been disclosed by Gye, who has succeeded in growing it in test tubes in a special medium. The culture has been carried on through several generations of transplantations. By this means the virus has been purified from the other constituents of the original implant. The inoculation of this purified virus alone did not give rise to a tumour, but if mixed with an extract of the fresh tumour, in which the virus had been killed by chemical agents and which alone was innocuous, a tumour occurred. In other words, the conjunction of two factors, living virus and some non-living chemical substance or substances, is necessary to provoke the cells of the animal to that anarchical development which is characteristic of malignant growth.

Gye's Experiments.—Gye has also succeeded in showing that chicken sarcoma is not peculiar, as hitherto believed, and that a particular mouse sarcoma will sometimes yield an infective filtrate. In this case, however, a special technique had to be employed, the original method of Rous proving unsuccessful. This is a discovery of much significance and it seems probable that an extrinsic origin may be found in the case of other cancers in the near future.

The virus of Rous sarcoma has been presumed to be particulate as it is held back by the finer grades of filter, and recently Barnard, using ultra-violet light, has obtained photographs of small globoid bodies about 0·1 μ in diameter from cultures of the virus. These small bodies occurred in masses, suggesting colonies. They were not discovered in the medium before inoculation or when the cultivation of the virus proved unsuccessful. Whether they represent the microbes or aggregations of colloidal particles produced from the proteins of the medium by chemical changes associated with the growth of the virus occurring therein, is not at present determined.

Plant Diseases.—Filterable organisms are also responsible for many diseases of plants (*see* PLANT PATHOLOGY). In fact, their existence was first brought to light by Iwanowski in 1892 in connection with the mosaic disease of the tobacco plant. Iwanowski's discovery was lost sight of and the fact was rediscovered by Beijerinck in 1898. Many varieties of plants, including potatoes, tomatoes, beans, peaches, clover, peas, cucumbers, turnips, spinach, *datura*, *hyoscyamus*, *capsicum*, sugar-cane, maize, sorghum and various grasses suffer from mosaic diseases. In most mosaic diseases the only obvious lesion is bleaching of the leaves in patches of varying extent, but sometimes, as in "leaf roll" of potatoes, "curly top" of beet and "spike" disease of sandalwood trees, definite destruction of tissue leading to malformation occurs. The loss of chlorophyll interferes with the nutrition of the plant by limiting the leaf area capable of utilising the radiant energy of the sun for the building up of carbohydrate from carbonic acid and water. To this handicap local necrosis of portions of the leaf and stalk is in some varieties superadded. The economic effect of these diseases may be, as in the case of the mosaic of sugar-cane, almost negligible or, as in the case of "peach yellows" and the "spike" of sandalwood, serious, as it destroys these trees.

Between these extreme instances, the infection results in more or less diminution of crop. Only the growing leaves are affected. Nevertheless the virus extends throughout the plant and sometimes to the seeds. Mosaic diseases are very infectious. Mere handling of a healthy plant after touching an infected one is, in some instances, sufficient to transmit infection. The disease is spread by leaf flies or beetles and by grafting (*see* ENTOMOLOGY, ECONOMIC). The virus is not capable of maintaining itself in the soil. There is a large number of different viruses which produce mosaic diseases. Some of them infect more than one species of plant. They can also inhabit resistant species of plants without these manifesting any symptoms, but the disease can be transferred from resistant plants to susceptible species by insects or grafting. Many attempts have been made to propagate these plant viruses in the laboratory upon plant-juices without success, but the virus of one of the mosaic diseases of the potato appears to have been recently cultivated by Olitzky.

Properties of Micro-organisms.—Little is known about most of these filterable viruses. They appear to be of various natures, and the only property common to them is minuteness. The parasite responsible for yellow fever is a small spirochaete, those occasioning bovine pleuro-pneumonia and human poliomyelitis are globoid in shape and just on the margin of visibility with the best microscopes.

It is not improbable that many of them flourish only inside the cells of animals and plants, which may explain the difficulty in cultivating them in artificial media. In some cases, small bodies of definite size, shape and staining characteristics are always to be seen in the cells at the seat of the lesion (trachoma, *molluscum contagiosum*, variola, vaccinia, bird-pox, typhus and Rocky Mountain spotted fevers). Whether these represent the microbe or granules in the cell contents produced under the influence of the virus is a matter of opinion. Until cultivation outside the body is achieved this controversy will not be settled.

Definite Results.—At present only the viruses of pleuro-pneumonia, poliomyelitis, yellow fever, chicken sarcoma and the microbe probably responsible for influenza have been certainly cultivated, although many claims to have accomplished this with other viruses have been made. Some of these viruses occur in the blood of the patient during the acute stage of the illness and are transported to a fresh host by the bite of blood-sucking insects.

Transmission of Infection.—The infections of yellow fever (*q.v.*) and dengue are conveyed by the mosquito (*Stegomyia fasciata*). That of papataci fever is transmitted by the sandfly (*Phlebotomus papatasii*) (*see* SANDFLY FEVER) and that of typhus and trench fevers by lice (*see* INFECTIOUS FEVERS). With these three fevers and also in the case of some of the mosaic diseases of plants which are transferred by leaf flies, some days elapse before the insect is capable of handing on the infection, indicating that an interval for the multiplication of the parasite is necessary. It is possible that a stage in the life-history of the parasite can only occur in the body of the insect host. Some filterable viruses, such as smallpox, cow-pox, foot-and-mouth disease and *molluscum contagiosum* give rise to superficial lesions, and are spread by contact; others occasion catarrh of the respiratory passages and are distributed by coughing and intimate contact, as in distemper, measles and pleuro-pneumonia.

Conclusion.—Most filter-passing microbes which have been discovered hitherto cause disease of plants or animals. It would be strange if only parasitic forms existed, for the majority of the larger microbes are not pathogenic but are concerned with the multifarious putrefactive and fermentative changes in organic matter on the surface of the earth. Accordingly, it would be natural to suppose that sub-microscopic germs with similar activities would be ubiquitous. The indications, at present, are, however, against this supposition, and sub-microscopic dimensions seem to be an attribute, more especially, of germs which are parasitic upon animals and plants. (C. J. M.*)

FILTRATION.—In many industrial processes it is necessary to separate finely divided solid materials from liquids. The process of filtration consists in passing the liquid through a porous medium, which retains the solid particles. In some cases this is done for the sake of purifying the liquid; in others the recovery of the solid is the main object. Many different types of filter are in use, and it is necessary to consider (1) the various porous materials which are available for filtration, and (2) the construction of the apparatus in which these are applied.

Filter Materials.—The following are the main types of material which are in use:

1. Sheets of woven or felted material. These comprise porous filter paper, cotton, woollen or linen cloth, felt and woven metal.
2. Unwoven fibrous material, such as cotton wool, linen fibre, cellulose pulp, metal fibres, sponge.
3. Granular or powdered materials, such as gravel, sand, earth, coke, sawdust, cork.
4. Porous plates of stone, porcelain, carbon, silica, etc.

The choice of material depends upon (*a*) the fineness of the substances to be filtered, (*b*) the chemical nature of the liquid, (*c*) convenience in collecting the solid material after filtration.

Laboratory Filtration.—Porous paper is generally used as the filter medium, being resistant to most of the liquids which require filtration. The commonest method of filtration is to fold a circular filter paper twice at right angles, and open it out to a cone with three thicknesses of paper at one side and one at the other. This is placed in a conical glass funnel, and the liquid is poured into it. In some cases, the filter funnel is provided with a hot-water jacket to keep the liquid warm during filtration. Filter paper is also manufactured in the form of thimbles, for extractions with solvents, such as alcohol and ether, in special apparatus.

The Buchner funnel is made of porcelain and has a flat, perforated bottom on which a circular filter paper is placed. This form of filter has the advantage that the filtration may be assisted by the application of suction below the filter.

The Gooch crucible is a porcelain cup with a perforated bottom. A thin layer of asbestos serves as the filter, and the crucible can be weighed, after drying, to ascertain the weight of solid material collected.

A recent advance in laboratory filters consists in the use of discs made up of a fritted mass of hard glass, which has been ground and sieved to a definite degree of fineness. These are fused into various types of glass apparatus, and are resistant to almost all chemical reagents.

Filtration of Drinking Water.—Domestic filters are usually supplied in the form of earthenware vessels with a filter bed of charcoal; in some cases filters of paper, asbestos or stone are used. It was originally thought that charcoal filters would unfailingly remove micro-organisms, but the action was subsequently found to be less complete than had been believed. Indeed, if the filter material be not removed at intervals, it may become the seat of organic growths. Large-scale filtration of town supplies of water is generally effected in sand filters.

Industrial Filtration.—When possible, it is advantageous to allow the solid precipitate to settle in the liquor for some time, and to run off as much as possible of the clear liquid. The sediment may then be stirred up with water, allowed to settle, and the liquid again decanted, so as to minimise the bulk of liquor to be filtered, and to facilitate the subsequent washing. The design of industrial filters varies according to the requirements. The chief considerations are that the filter shall present a maximum available surface without occupying too much factory space, that it shall withstand the required pressures, that it shall not be easily clogged, but shall be readily cleaned and easily controlled at all points. In some cases, continuous working is desirable.

Simplicity and economy of construction often outweigh all other considerations, and for many purposes it is sufficient to filter through a bed of sand, or through a simple sheet of cloth resting on a flat, perforated support. Suspended bags of cloth are also frequently used, and have the advantage that the bag can be squeezed or wrung out after filtration to remove as much liquor as possible from the solid material.

Vacuum Filters.—As in laboratory filtration, suction is frequently applied to accelerate the flow of liquid. A filter cloth s spread on a perforated plate of earthenware or other material, and the receiver into which the filtrate flows is connected with a vacuum pump. Conversely, pressure may be applied to the surface of the liquid in the filter. In place of cloth filters, porous plates are sometimes used; these may be either flat plates or cylindrical " candles " of porous material, presenting an increased ilter area.

Leaf filters may be used either for suction or pressure. A ypical form of leaf consists of a rectangular frame of perforated pipes to which is attached a stiff, corrugated surface of coco-nut matting or other material, and the whole enveloped by a cloth bag. The liquid passes from the exterior to the interior of the eaf, and is assisted either by external pressure or by internal uction. A filtering unit consists of a number of parallel leaves, and thus presents a large filtering surface.

Filter presses are somewhat similar in principle. In one form, a number of recessed plates are supported on a framework, so hat they can be firmly pressed together by a screw press. Sheets f cloth are placed between the plates, and thus, when the filter press is assembled, it forms a series of narrow partitions separated by cloth filters. Channels are provided so that the sludge to be filtered can be forced under pressure between the cloth sheets, and the filtered liquid is collected from taps at the bottom of the plates. After filtration, the plates are separated, and the cake f solid material is removed. In place of recessed plates, some ilter presses have alternate plates and distance frames.

In centrifuges the filtration is assisted by the rapid rotation f a circular pan. The periphery of the pan is perforated, and provided on its inner side with a filter cloth, supported by a asket of metal. The rapid rotation (up to about 1,000 revoluions per minute) whizzes the liquid through the filter, with a orce several hundred times greater than in gravity filtration.

In the above-mentioned filters, the solid material has to be ollected at intervals, and this necessitates stopping the filtering peration. Continuous filtration can be effected by rotary lters. A hollow drum is supported in such a way that it can e rotated on a horizontal axis. The periphery of the drum is overed with a filter cloth, and the drum dips into the liquid to e filtered. By suction, the liquid is drawn through the filter loth to the interior of the drum, and the solid remains on the utside. The drum rotates slowly, and a scraper is fixed in such position that it scrapes off the solid material continuously.

A recent advance in filtration methods is the stream-line filter, which permits of the separation of extremely finely divided olid matter, which would pass through ordinary filter cloths. A arge number of sheets of paper are pressed together, and the iquid is forced through the edge of the pack by the application f pressure. The channels between the sheets are so minute that he finest precipitates are retained. The filter is made in various orms to permit of continuous filtration, etc.

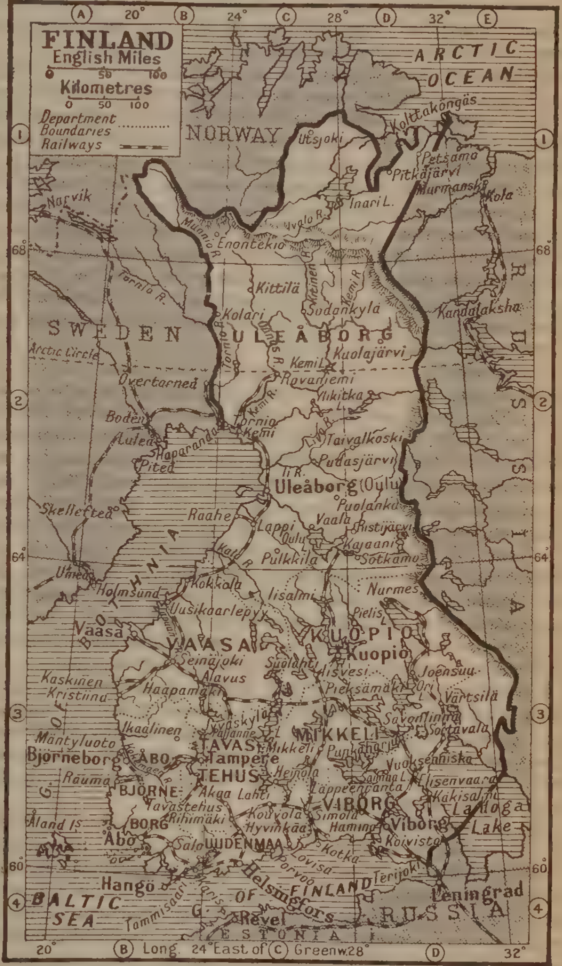
Aids to Filtration.—The greatest difficulties in filtration are resented by slimy substances, which clog the filter. Applicaon of increased pressure only accentuates the difficulty, and onsiderable importance attaches to methods whereby the imy material may be caused to clot together and settle out. This can be effected by the addition of kieselguhr, fuller's earth, ay, talc, silica-gel and various carbonates. Another procedure to coat the filter with a layer of finely divided kieselguhr, boneblack, sawdust or other finely porous material, which retains the slime and prevents it from penetrating into the filter material. (R. C. F.)

FINANCE: *see* BANKING; CURRENCY; and the sections on national finance in FRANCE; GERMANY; GREAT BRITAIN; UNITED STATES, etc.

FINLAND (*see* 10.383).—A republic of northern Europe and a member of the League of Nations, in Finnish it is Suomen Tasavolta. Its area is 132,550 sq. m. and the population 3,435,249.

I. POLITICAL HISTORY

In the closing decades of the 19th century there was a remarkable development of Finnish nationalism, primarily directed against the Swedish language and Finno-Swedish cultural domination.


FINLAND
English Miles
0 50 100
Kilometres
0 50 100
Department Boundaries
Railways
A B C D E
20° 24° 28° 32°
1 2 3 4
68° 64° 60°
ARCTIC OCEAN
NORWAY
Kolttakongäs
Utsjoki
Petsamo
Pitkäjärvi
Murmansk
Kola
Inari L.
Narvik
Ivalo R.
Muonio R.
Enontekiö
Tornio R.
Kittilä
Kitinen R.
Kemi R.
Sodankylä
Kandalaksha
SWEDEN
Kolari
ULEÅBORG
Kuolajärvi
Arctic Circle
Tornio R.
Ounas R.
Kemi L.
Övertorned
Rovaniemi
Ylikitka L.
Boden
Kemi R.
Tornio
Kemi
Luleå
Haparanda
Iiva R.
Taivalkoski
Piteå
Pudasjärvi
Ii R.
Uleåborg (Oulu)
Puolanka
Skellefteå
Raahe
Vaala
Ristijärvi
Lappi
Oulu L.
Kajaani
Kalo R.
Pulkkila
Sotkamo
Umeå
Holmsund
Kokkola
Iisalmi
Nurmes
Uusikaarlepyy
Lapua R.
Pielis L.
BOTHNIA
Vaasa
VAASA
KUOPIO
Kuopio
Seinäjoki
Suolahti
Iisvesi
Joensuu
Kaskinen
Kristiina
Alavus
Haapamäki
Pieksämäki
Orí L.
Värtsilä
Jyväskylä
Päijänne L.
Savonlinna
Sortavala
Ikaalinen
MIKKELI
Mäntyluoto
TAVASTEHUS
Mikkeli
Punkaharju
Björneborg
ÅBO
Tampere
Kokemäen R.
Vuoksenniska
Rauma
Heinola
Saimaa L.
Elisenvaara
G.
BJÖRNEBORG
Akaa
Lahti
Lappeenranta
Kakisalmi
Tavastehus
VIBORG
Ladoga Lake
Åland Is.
Riihimäki
Kouvola
Simola
Hyvinkää
Hamina
Viborg
Åbo
Salo
UUDENMAA
Kotka
Koivisto
Lovisa
Porvoo
Terijoki
Hangö
Karis
Helsingfors
GULF OF FINLAND
Leningrad
BALTIC SEA
Tammisaari
Revel
RUSSIA
ESTONIA
Long. 24° East of Greenw. 28°

Second Period of Russification 1908–14.—The successive governors of Russia, however, regarded the democratic, almost self-governing grand duchy as infringing the principle of the autocratic state, and delivered their first attack upon the liberties of Finland (1899–1905). The policy of repression was arrested by the Russian revolution of 1905, the manifesto of the Emperor-Grand Duke of Nov. 4 (Oct. 22) annulling all unconstitutional interferences. But after two years of peace, internal progress and political development, the same pan-Slav conception of a great homogeneous Russia stretching from the warm-water ports of Scandinavia to the Pacific, which had caused the conflict between Finland and the Tsar, involved her in fresh collisions with the Duma.

New and provocative interference with Finland's constitutional rights began. The Tsar peremptorily fixed an annual contribution in lieu of military service (Ukase of Oct. 7 1909) and the Imperial Duma approved of the principle (imp. law of Jan. 23 (U.S.) 1912). The Finnish Diet, though ready to compromise, was twice dissolved, and all the large measures of domestic reform which it passed were never heard of again. Such was the fate of the bill for the prohibition of alcohol, of measures relating to the care of children, insurance, old-age pensions, education, public health and the betterment of the landless worker upon the soil. Civil marriages, however, were instituted, illegitimate children placed upon a better basis, and the principle of "equal pay for equal work" was applied in teaching, the printing trade and, in 1913, in the state service. The Duma considered itself competent to decide what questions affected the interests of the Russian Empire, and for that reason did not fall within the competence of the Finnish Diet. The law, known as "Imperial Legislation Act," was passed on June 30 (17th) 1910, amid shouts of "Finis Finlandiae."

Immediately two imperial laws were laid before the Diet, which refused them both, and was thereupon dissolved. In one, already referred to, the Duma affirmed the principle of an annual Finnish indemnity in lieu of service, in the other full citizen rights were accorded to temporary Russian residents in Finland. The consequence of the last-named measure, apart from its injustice, was the overlapping of two different codes of law. Judges resigned rather than be a party to it; high officials suffered exile or imprisonment; every single provisional governor left voluntarily or under compulsion. The country was ruled by a packed Senate, the Diet was capriciously summoned and dismissed, the press censored. The Russification inflicted by the Duma was as oppressive as that of the Tsar.

The World War 1914–8.—It was left to Lt.-Gen. F. Seyn, the governor-general, to supervise the harassing restrictions of liberty which the World War brought with it. Though Finland escaped foreign invasion, two systems of fortified lines were constructed to protect the chief railways and the long sea border. The mercantile marine, exposed to destruction in the Baltic Sea, remained locked in the harbours of the Bothnian gulf, and, there being no leaks—as in Sweden and Denmark—in the Allied blockade, the price of living gradually rose by 25%. On the other hand, industries connected with military supply, as also iron, leather, glass, chemical and paper-manufacturing concerns, attained unexampled prosperity. The Russians, sporadically anxious to please, remitted the annual military indemnity, and merely imposed a 5% tax on property and mortgage.

Finland naturally feared that Russia, if she emerged victorious, would again turn oppressor. A strong party was anxious for a German victory, from patriotic motives. Only some 2,000 Finns volunteered for the Russian Army. About the same number enlisted on the German side, though ostensibly only for service on the eastern front.

The Russian Revolution, March–Nov. 1917.—The Tsar Nicholas II. abdicated on March 15 1917 and the new Provisional Govt. of Russia restored representative government in Finland. The Russianised Senate was disbanded and a temporary body of 12, half of whom were Social Democrats and the remainder representatives of the bourgeoisie, assumed executive power. Stakovich became governor-general and Rodichev, a tried friend, Secretary of State for Finland. The Socialist speaker of the Diet, M. Tokoi, was nominated president of the Senate; Kullervo Manner, of the same party, Speaker of the Diet. But in view of the anarchical conditions in Russia, the propertied classes of Finland quailed before the rising power of the Social Democratic party, which was politically orientated towards Russia. The intense industrial development of the last three years had strengthened hooliganism, and the War had brought to Finland some 40,000 Russian refugees from food shortage and the incipient riot. The Swedo-Finns aimed at complete independence, and the Finnish Govt. proclaimed that such was its policy.

The struggle between the Provisional Russian Govt. and the Finnish Diet crystallised around the law of July 18 1917 by which the Diet resolved that it alone decided, confirmed and put into practice all laws of Finland relating to home affairs, taxation and customs. This law reflected the standpoint of the Social Democratic majority, which demanded complete internal freedom but was ready to recognise Russia's supremacy in military matters and in foreign policy. Upon this issue a deadlock ensued, which the dilatory Russian Provisional Govt. never succeeded in settling. The Finnish Diet passed *en bloc* all reform bills previously held up by the Tsar, including the total prohibition of alcohol and the eight-hour day. Yet it passed no effective measure to avert the food-shortage, which was the inevitable result of the industrial effort of recent years and the neglect of agriculture. Prices soared ever higher, and from March 1917 to Feb. 1918 a veritable strike mania threatened the existence of the nation.

Meanwhile, the Bolshevik advent to power in Russia in Nov. 1917 created fundamental social and economic differences between the political parties in Finland. The pro-Russian sympathies of the Social Democrats deepened; on the other hand, the propertied classes—primarily the Swedo-Finn and Finno-Finn bourgeoisie—sought to cut adrift from a Russia which had no settled government. Accordingly, on Dec. 6 1917 the Diet and the now bourgeois Senate drew up an old-fashioned declaration of independence, which is held to mark the birth of Finnish freedom. The Bolsheviks on Jan. 4 1918 declared that the step taken conformed with their policy, whereupon the Swedish Govt. and the other Scandinavian countries acknowledged the independence of Finland. France did likewise and was followed by Germany. Immediately after their declaration of independence, the Finnish Govt. entered into negotiations with Germany. The Treaty of Brest Litovsk (March 3 1918) confirmed Finland's independence, and four days later she concluded a treaty with Germany which made her Germany's commercial ally and vassal.

The Bolsheviks, however, were bent on precipitating civil war. The Finnish Social Democrats were almost all Maximalists and anti-militarists, and, as such, averse even to the formation of a citizen army for the maintenance of order. They pinned their faith on the Muscovite connection to save their country from invasion—oblivious of the fact that the Russian revolutionary *soldateska* (reinforced from Russia), without restraint of discipline, starving and unpaid, was, to say the least, an uncertain factor. Soon so-called "Red Guards" began to ransack the country, while the White Guards, hurriedly organised by reactionaries, together with doubtful elements of the disbanded gendarmerie, resisted. The White Army, under Baron Carl Gustav Emil Mannerheim, a former Russian general of cavalry, proved insufficient to maintain order. Foreign intervention was sought, but while Sweden refused help, the Germans did not hesitate.

A German composite division, initially some 12,000 men strong under the Prussian General Count Rüdiger von der Goltz, landed in the rear of the Red forces and held these in a successful action near Karis on April 6. This enabled General Mannerheim to win the battle of Tammerfors, whereupon Goltz freed Helsingfors, entering this capital officially on April 14. Finally, the German victory over the Reds (April 30—May 2) at Lahti-Tavastehus contributed to Mannerheim's decisive victory near Viborg (April 28–29). The remnants of the Red Army were forced into Russia, but the cruelty of the Red insurrectionaries led to a White counter-terror. Some 15,000 men, women and children were slaughtered and, by June 27 1918, 73,915 Red rebels, including 4,600 women, were prisoners of war.

The Diet, which met in June 1918, was moderate in colour, since the Socialists, who formed 46% of the electorate, were excluded from the register. It authorised the Germanophil senator, Pehr Evind Svinhufud, to exercise the supreme power in so far as it had not already been conferred on the Senate, which was offering the crown to Prince Frederick Charles of Hesse, brother-in-law of the German Emperor.[1]

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[1] Prince Charles accepted the crown, but never proceeded to Finland and the question of the Finnish monarchy was allowed to lapse.

ut the Germans pursued the ulterior object of securing Fin- n military co-operation against the Murman railway, which guarded by a British expeditionary force. The claim of the rators upon the gratitude of the Finns was assuming the st peremptory forms known to diplomacy when, on July 18, Allied offensive in the west diverted Germany's forces. Thus uable time was gained until the Armistice of Nov. 11 1918 ght Finnish reaction between wind and water. Svinhufud succeeded on Dec. 12 by General Mannerheim as Regent, formed a Coalition Govt. composed of six Republicans six Monarchists. The most prominent pro-Germans were nissed; Finland turned definitely towards the Entente and monarchical period of German influence gave way to the nocratic régime associated with England and America. The man troops, in part mutinous, were conveyed back to many in December. General Mannerheim, who was a narchist, but not a pro-German, wielded the power of a si-dictator.

estoration of Order.—In 1919 Mannerheim organised the yddskorps" of 100,000 men to maintain order. The general tion of March 1 showed the following division of parties: al Democrats 80, Agrarians 42, Coalitionists 28, Progres- s 26, Swedish 22, Christian Labour 2. The tendency towards epublican form of government was outlined by the Agrarian y composed of small land-owners hostile to the Swedish- king monarchist section. The Social Democrats lost 12 s, largely owing to the disfranchisement of 40,000 voters for icipation in the Red revolt.

Iannerheim's popularity with the Right and the army pted him to exploit the military impotence of Soviet Russia. n, at the end of May 1919, the Entente intervention on the rmansk front brought the 237th Brigade (of the expedition- force under the British Major-General Maynard) to the l of Lake Onega, the Finnish Govt. offered co-operation in rn for the possession of Petrozavodsk. The offer being de- d, a Finnish volunteer force nevertheless assaulted the town pendently, but without success. Again, at the close of the , when the White Russian General Yudenitch was marching etrograd, Mannerheim sounded the Allies on proposed Fin- intervention. He received no encouragement from Paris ondon, nor from the Moderates at home.

stablishment of the Republic.—On June 17 1919 the Finnish resolved to establish a republic. The new constitution e into force on July 17. There is a single chamber, the Diet, hich the sovereign power of the people is embodied. The utive power is in the hands of a president, who is elected ix years by 300 presidential electors elected by the citizens. atifies new laws or withholds consent, dissolves the Diet, rs new elections and conducts foreign affairs. All his powers exercisable through the ministers and his decisions have to aken in the Council of State (Cabinet) consisting of 10 sters, who are legally and politically responsible. There are departments for local government, closely following the istic distribution. Both Finnish and Swedish are official uages. On July 25 Professor Kaarlo Juho Ståhlberg was en as first president by 143 votes against 50 recorded for nerheim. A Coalition anti-socialist government under M. n held office till April 9 1921. The Vennola Govt., a coalition rogressive and Agrarian parties, then came into power. manding only 64 out of 200 seats in the Diet, it introduced Amnesty bill which, after a chequered career, was passed on 18 by 165 votes to 68. On May 6 1919 Great Britain recog- l the independence of Finland and the existing Govt. *de jure.* peace treaty was signed with Soviet Russia at Dorpat on 14 1920. Pechenga was ceded to Finland, which thus ob- d an outlet on the Arctic Ocean, although Russia retained ern Karelia, where, after the collapse of General Skobel- s White Russian Army, fighting had occurred with Bolshe- troops with results satisfactory to Finnish arms. The treaty approved on Dec. 1 by the Diet with only 27 dissentient es and ratified on Dec. 11 by the President. On Dec. 16 Finland was admitted as a member of the League of Nations. As such it claimed sovereignty over the Aaland Is. (*q.v.*) which was disputed by Sweden. In June 1921 the League of Nations gave its decision in favour of Finland.

Despite the Treaty of Dorpat, relations with Soviet Russia did not improve. In Oct. 1921 the native Karelian population, racially allied to the Finns, broke out into open revolt against Moscow. After initial success, this "war of independence" was crushed by a Soviet army. But the Karelian question remained, and, at the instance of Finland, occupied the League of Nations all through 1923. The Permanent Court of International Justice, to which the legal aspect of the question was referred, decided in July not to deal with this matter, as Soviet Russia was not a member of the League and might not recognise its competence. The Council of the League, however, determined that this view of the Permanent Court should not hinder an attempt at a settlement, which resolve the Assembly of the League of Nations strongly supported. But the Soviet Commissar for Foreign Affairs, M. Chicherin, protested against the intervention of the League and declared Karelia part of Soviet Russia. His argument had the support of the Red battalions, which, after completely discomfiting the insurrectionaries, held the trump card of power. This rendered all diplomatic negotiation nugatory.

In these years, the guidance of Finnish foreign policy remained in the hands of Dr. R. Holsti, under successive administrations. In March 1922, this statesman met at Warsaw the Foreign Ministers of Estonia, Latvia and Poland, and signed an agreement by which the parties undertook "to observe benevolent neutrality towards any of the signatory states which might be attacked without provocation and to consult immediately with regard to subsequent steps to be taken." The Finnish Diet, in its spring session, refused to ratify this agreement, and Dr. Holsti relinquished office. The principle of policy enunciated upon this occasion by the Diet—the avoidance of treaty commitments of a military nature, continued to rule Finland's Baltic policy. On June 27 1924 Finland signed bilateral conventions with Sweden, Norway and Denmark for compulsory arbitration in the event of disputes.

Internal Policy.—The Karelian dispute with Soviet Russia reacted on Finnish internal politics. The long land-frontier to the East made it impossible to keep out Russian propagandists, and the discontent, thus fomented, threatened to imperil the economic recovery of the country. In May 1922 the Vennola administration resigned, but the new "Government of Officials", formed by Professor Cajander, did not long outlive the general election, which was held in July. The Social Democrats retained only 53 seats, while the Agrarians, with 45 and the Union party with 35, showed small gains, and the Progressives with 15 and the Swedish party with 25, small losses. The true victory lay with the Communists, who made their first appearance in the Diet with 27 seats. In Nov. 1922, therefore, the Agrarians, who had held their ground, formed a Centre Govt. under M. Kyösti Kaalio.

This administration passed the Religious Liberty Act, the Military Service bill and the "Lex Kaalio," which made provision for the landless population. In Oct. 1923 the Communist party was suddenly dissolved, its newspapers were suppressed, and 25 of its parliamentary representatives imprisoned. But this stroke reduced the Diet to a rump, and new elections became necessary in April 1924. The Kaalio Govt. resigned on the eve of the poll, being superseded by Professor Cajander's (second) "Government of Officials." The Social Democrats obtained 60 seats (+7), Communists 18 (−9), Agrarians 44 (−1), Union party 38 (+3), Progressives 17 (+2), Swedish party 23 (−2). On May 31 the Cajander Govt. made way for the non-Socialist Coalition Govt. formed by Professor Lauri Ingman (Union party).

M. Lauri Relander was elected President on Feb. 16 1925. The candidate of the Agrarians, he was elected by their votes and by those of the Finnish coalition and the Swedish party, which supported him when it was clear that their own candidates had no chance of success. He was president of the Diet in

1919 and was appointed Governor of the Viborg district in 1920, a position which he still occupied at the time of his election. He is a landed proprietor who has always taken great interest in agricultural questions and has published works on forestry in Swedish, Danish and German. His political views are moderate.

The Government of Professor Tulenheimo, in which the Union party and the Agrarian Union were represented, took office on March 31 1925. The chief political question it had to face was that of the military and naval estimates, which the parties of the Right desired to maintain at a comparatively high figure, while those of the Left desired a reduction. This left the cost of defence by land and by sea within reasonable bounds—at approximately 17% of the national expenditure.

In Dec. a new Government was formed by M. Kyösti Kaalio (Agrarian) in which again the Agrarian Union and the Union party were represented. (W. L. B.)

II. FINANCIAL AND ECONOMIC HISTORY

All through the War Finnish export trade, shut off from a large part of its foreign outlets, had to struggle with great difficulties. Until 1917, Russia remained a very considerable buyer of Finnish goods, but the revolution brought about a complete reversal of conditions, and trade with Finland became insignificant. At the close of the War, Finland, accordingly, had to shoulder the task not only of regaining her old markets in the West, but also of creating new markets to set off the loss of Russian trade. Similar difficulties were met in the import trade.

Imports and Exports.—The adjustment to the changed conditions was achieved with surprising rapidity, in spite of the unfavourable business conditions which prevailed on the leading markets. It was temporarily helped by the declining tendency of the Finnish exchange, which in the autumn of 1921 brought quotations down to a bottom level.

	Exports		Imports	
	Value Mill. Finnish marks	Percentage of volume of 1913	Value Mill. Finnish marks	Percentage of volume of 1913
1913	404·8	100·0	495·4	100·0
1919	880·4	47·6	2,509·9	77·8
1920	2,926·4	68·6	3,626·5	52·8
1921	3,389·4	69·0	3,585·7	54·5
1922	4,467·6	93·5	3,969·9	74·7
1923	4,392·5	94·8	4,600·3	101·5
1924	4,970·6	112·7	4,715·5	99·3

Great Britain took about 40% of Finnish exports in 1924. In the import trade the part played by Great Britain (19% in 1924), though considerable, is inferior to that of Germany (30% in 1924). The trade with Great Britain during recent years has gained ground when compared with pre-War conditions, but trade with Russia has not yet recovered. Timber products have long been of paramount importance in Finnish export trade, and timber exports after the War reached, and even exceeded, the record level of 1913. In 1924 the timber industry contributed close upon 60% of the total exports. The paper and pulp exports are second in importance only to the timber exports, the share of this industry in total exports amounting in 1924 to about 28%. Agricultural exports gradually revived, but the import of cereals, a very large item in Finnish foreign trade, was temporarily reduced. As a whole, Finnish agriculture showed some advance in comparison with pre-War conditions.

Currency.—The outbreak of war opened a period of serious monetary disturbance. The depreciation of the Finnish mark was, at first, largely due to the strain which Russian war finance put on the Finnish banking system. When, at the end of 1917, Finland gained her independence, she had to cover the increased expenditure imposed by her new position as an independent state, and that incurred in the suppression of the Red rebellion in the spring of 1918. As, in the disturbed state of the country, the taxes could not be punctually collected, the Government resorted to increased borrowing. Part of this demand for credit was met by means of new note issues which were made by the State Bank.

During the course of the years 1919, 1920, and 1921 the Finnish exchange declined seriously. In the latter part of 1922 the Bank of Finland embarked on a policy of stabilising the Finnish exchange in relation to the dollar, and since that date variations have been slight. At the end of 1925 the Finnish monetary system was put on a gold basis, the level of parity being approximately 193·23 Finnish marks to the £ sterling.

Finnish Monetary Statistics

	Rates of exchange on New York quoted by the Bank of Finland. Par 5·18 mks. = 1 dollar		Index of Wholesale Prices
	Highest	Lowest	Annual Average Base 1913 = 100
1921	80·50	28·00	1263
1922	54·50	35·25	1219
1923	40·75	35·85	1095
1924	40·44	39·70	1100
1925	39·70	39·70	1129

Banks.—The leading banking institutes are at present Nordiska Föreningsbanken, Kansallis Osake-Pankki, Helsingfors Aktiebank and Unionbanken, which at the end of 1924 held about 80% of the total home deposits of the 19 joint stock banks in existence. The note circulation of Finland's Bank, the bank of issue, at the end of 1925 amounted to 1,309,000,000 gold Finnish marks, backed by a gold reserve of 331,000,000 gold marks and foreign assets exceeding 1,000,000,000 gold marks.

National Budget.—The improved conditions of production and trade formed a firm basis for financial reorganisation. Before the War the bulk of the Finnish State revenue was derived from customs duties and other indirect taxes and from the earnings of Government enterprises, mainly the railways. The chief change in national finance since the War has been the introduction of an income and property tax. The customs duties still form the main part of the state revenue, but direct taxes now yield about a quarter of the total tax revenue. The income from state enterprises is relatively less than before the War. The public debt, foreign and internal, in Sept. 1925, was estimated at a sum equivalent to $94,300,000. The debt is balanced by state forests, railways and other state property. There has also been a reorganisation of municipal taxation.

Tariff Policy.—The pre-War tariff might be characterised as a Protectionist one, but it granted practically no protection to grain-growing. Post-War legislation has provided agricultural protection and, with the elimination of the special facilities formerly existing between Russia and Finland, the grain duties now established may be expected sensibly to influence agricultural conditions. The new policy made no radical change in the tariff on manufactured goods, but sought to promote a more scientific distribution of duties and to secure as large an income as possible to the state. But the revision of the tariff was not completed in 1925. Commercial agreements have been concluded with France (July 13 1921), Great Britain (Dec. 14 1923), the United States (May 2 1925) and several other countries during the post-War period. Finland's prohibitory legislation in regard to wines and alcoholic liquors in some cases made the task of negotiation a difficult one. To Estonia Finland granted (Oct. 29 1921) considerable fiscal concessions not granted to any other Power, but Estonia plays a very small part, about 1% in Finnish trade.

Social Legislation.—An active policy aiming at improving the position of the numerous landless agricultural population had been set on foot some time before the War. After gaining her independence Finland adopted laws which with certain limitations gave tenants the opportunity of purchasing their holdings at a price below their value in the open market, and a large number of tenants have been turned into small owners. Recent social legislation further includes the adoption of an eight-hour day. Financial considerations have limited the scope of actual legislation for social insurance, but workmen's compensation for accidents has been put on a new and more comprehensive basis by legislation of 1917 and 1925.

The co-operative movement has made considerable progress in Finland. This holds true of consumers' co-operation as well as of several branches of agricultural co-operation. The central co-operative butter export association "Valio" has carried on by far the greater part of the total exports of butter and has, no doubt, been of great service in improving and standardising the quality of dairy produce. The butter exports mainly consist of high grade ware, and the grading takes place under state control. (A. My.)

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INLAY, ROBERT BANNATYNE FINLAY, 1ST VISCOUNT, 42–), British lawyer and politician, was born at Edingh July 11 1842. He was educated at Edinburgh Academy University, and graduated in medicine. In 1867 he was ed to the bar, in 1882 becoming a Q.C. and a bencher of the ddle Temple. He was elected as Conservative member for erness Burghs in 1885, and held this seat until 1892. In 1895 regained the seat, and was made Solicitor-General in Lord sbury's Govt., when he was knighted. In 1900 he became orney-General, remaining in the Govt. until the Conserve defeat of 1906. In 1910 he was elected M.P. for Edingh and St. Andrews universities, and in 1916, on the forma of Mr. Lloyd George's Govt., became Lord Chancellor and e peer. He retired in 1918, and in 1919 was created a visnt. In 1920 he was appointed British member of the Perent Court of Arbitration at The Hague, and in 1921 became a nber of the Permanent Court of International Justice established by the League of Nations. From 1902 to 1903 he was lord or of Edinburgh University.

INNISH LITERATURE (*see* 10.386).—Several of the writers innish mentioned in the earlier article have since died. P. ander died in 1913, after having completed his translation of kespeare's plays in the previous year. Karl Bergbom, who e the Finnish National Theatre and was its first manager, in 1906. Of lyric poets, J. H. Erkko died in 1906 and Arvi es in 1915. The old peasant writer, P. Päivärinta, died in , and his younger colleagues, Kauppis Heikki, in 1920 and eijonen, in 1924. S. Ingman later took the name of "Ivalo" abandoned the realistic description of present-day life for historical novel. S. Alkio became a politician and leader of Agrarian party, being several times a Cabinet Minister. d Järnfelt, in his works published during this period, man to shake off the preponderating influence of Tolstoy.

rose.—The greatest writer of Finnish prose literature, Ju Aho, died in 1921. Amongst his later works mention may nade of *Rauhan erakko* (1916), in which the writer protests nst militarism, *Muistatko* (1920), an autobiographical study ildhood, and *Lastuja VIII.*, a collection of essays on salmon salmon fishing, dating from the year 1921.

he most notable of the younger writers were Johannes Linkoski (1869–1913) and F. E. Sillanpää (b. 1888). Linnani achieved European renown by his novel *Laulu tulipunai kukasta* (1905)—"The Song of the Blood-Red Flower"— h has been translated into a number of languages. His best from an artistic point of view is *Pakolaiset* (1908). Sillanpää written several collections of short stories dealing with peaslife, and one great novel dealing with the time of the Red rrection, which is an important document of social history. strength lies in psychological descriptions of subconscious es. No other Finnish writer has been so successful in depicting the atmosphere in which the peasant lives his everyday life. Teuvo Pakkala (1862–1925) made his name by realistic studies of proletarian life, short stories and plays about the peasantry, and studies of children, which show great psychological insight. Joel Lehtonen (b. 1881), like Sillanpää, wrote novels inspired by the Red insurrection. The novels of Ilmari Kianto (b. 1874) on the peasantry are flavoured with satire. Kyösti Vilkuna (1879–1922) produced novels, short stories and plays. Among other things, he described the part which he himself played in the legal struggle against Russia and in the events leading up to the war of independence.

Of the numerous women writers, the following deserve mention: Aino Kallas (b. 1878), short story writer, one of her volumes, *The White Ship*, being published in English in 1924. The wife of an Estonian scientist and diplomat, she obtained an intimate knowledge of Estonian life, which forms the subject of many of her stories. Mailo Talvio (b. 1871) wrote numerous novels concerning life among the peasants and higher ranks of society. Maria Jotuni (b. 1880) possesses a realistic power and a robust humour which inform all her stories, novels and comedies. L. Onerva (b. 1882) is best known for her lyric poetry, but also wrote fiction and plays.

Poetry.—Among the poets writing in Finnish, Eino Leino (1878–1925) was unusually productive. He published dramas in prose and verse, novels, short stories, literary studies and numerous volumes of lyric poetry. His most successful works are his *Helkavirsiä*, historic poems in ballad form of a strongly national colour. Leino has also translated Dante's Divine Comedy into Finnish blank verse. Larin Kyösti (b. 1873) was another prolific writer, who achieved a well-deserved popularity by his popular poetry. The lyrical poetry of Otto Manninen (b. 1872) is highly esteemed by connoisseurs. Manninen did invaluable work as translator of the Iliad, Odyssey, Molière's metric comedies and other works. V. A. Koskenniemi (b. 1885), professor of literature at the Finnish University of Turku (Åbo) published numerous volumes of poetry. He lacks the spontaneity of Leino and Larin Kyösti, but is unsurpassed in Finnish literature as the creator of a lofty style, his favourite verse forms being the sonnet and the elegy.

Literature in Swedish.—The Swedish literature of Finland includes a number of poets who have gained reputations both in their own country and in Scandinavia. Mikael Lybeck (1864–1925) achieved his first successes with lyric poetry, but abandoned verse for prose during the last 20 years of his life. His short stories, novels and dramas are highly esteemed by literary critics, though they have not achieved any widespread popularity. Bertel Gripenberg (b. 1878) is the chief master of form among the poets writing in Swedish. He has handled many different kinds of verse with great skill, but specially favours the sonnet. The characteristics of his first volumes were dark passion, sensualism, pessimism and an aristocratic romanticism, but he has also found words to sing of the Finnish wildernesses, and has written patriotic lyrics, inspired by the Red insurrection and the War of Independence, in which an echo of Runeberg's heroism may be heard. Jakob Tegengren (b. 1875) writes in an elegiac key, and descriptions of nature occupy a large part of his works. In his later volumes a religious tendency is visible. Hjalmar Procopé (b. 1868) has written a few dramas, but is best known as a lyric poet. Arvid Mörne (b. 1878) sings of the archipelago, peasant life and the scenery of the Swedish-speaking districts in the south of Finland. He is the poet of the sea, more than any other of the writers in Swedish. But Mörne's writings also reflect his deep, radical opinions. He was ardently interested in social reform and the movement for popular education. In his later works, however, this spirit has given place to a subdued resignation. Mörne also achieved success as a dramatist and novelist.

Emil Zilliacus (b. 1878) published some highly appreciated collections of lyrical poetry. Jarl Hemmer (b. 1893) is the most lyrical and spontaneous of the Swedish poets of Finland. His poetry still preserves something of the melodiousness characteristic of Topelius's lyrics. Hemmer's verse has a winning, youthful charm which yet does not preclude the expression of loftiness of thought. He also wrote a play, short stories and a novel dealing with the time of the War of Independence.

Runar Schildt (1888–1925) was the most eminent writer of Swedish prose in Finland. His short stories are characterised by a highly developed style, penetrating psychological insight and a humane, tolerant view of life. The subjects of some of them were taken from the War of Independence and the Red insurrection. Schildt was also a very successful dramatist. Vers libres and expressionist prose also found enthusiastic, and in some cases, gifted champions among the writers of Finland, both Swedish and Finnish.

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FIRE CONTROL: *see* GUNNERY, NAVAL.

FIRE PREVENTION (*see* 10.401).—Steadily mounting fire losses, particularly in North America, have greatly stimulated efforts looking toward fire prevention. Fire losses of created resources in the United States increased from $447,886,677 in 1920 to $548,810,639 in 1924. The latter figure exceeds the loss in 1906, the year of the San Francisco earthquake and fire, although in 1924 there was no great single conflagration. In Canada, the destruction of created resources increased in the same period from $27,600,000 to $33,300,000.

I. IN NORTH AMERICA

In forest fires, also, similarly excessive losses are sustained by the United States and Canada. In 1924 (U.S.A. Forest Service estimate) 29,000,000 ac. of forested land in the United States were swept by fires, numbering 92,000 in all and entailing an actual money damage of $38,000,000, a figure exceeding by $18,000,000 the previous nine-year average. Owing to different statistical methods in use, an exact comparison with European experience is at present impossible. In general, however, it may be stated that a stricter surveillance is observed in the State forests in Europe, made possible in part by the smaller areas to be watched. The State forests of Finland, in the period 1911–21, were damaged to the extent of less than 1/20th of 1% annually. In Norway, during the period 1913–23, the average yearly damage amounted to about $24,000, the area burned being about 1,770 ac. each year. In the Prussian State forests, 1901–10, the average forest area devastated annually by fire was about 1620 acres. In the Bavarian State forests, 1900–12, an average of 103 fires burned about 380 ac. annually, which was less than 1/50th of 1% of the total forest land.

Prevention of Forest Fires.—The chief causes of forest fires are lightning, incendiarism, sparks from locomotives and carelessness of campers and of lumbermen. To check the operation of these factors the supervision of forest areas, particularly in the United States and Canada, has been instituted by governmental action. Fire lanes are cut through the forest to act as breaks and are kept open by fire rangers in the employ of the Government. Other duties with which fire rangers are charged include an oversight of lumbermen, campers and other visitors in forest areas with a view of inculcating carefulness. They are expected also to take immediate action in the event of fire. Watch towers and airplanes are used in detecting any incipient conflagration.

Buildings and Stock.—The causes of fires in buildings and stock are chiefly defective chimneys; carelessness in handling fire and inflammable material; defects in electrical installations, and exposure, that is, ignition from fires in adjacent property. The use of wooden shingles on roofs and, in mercantile districts, wooden window trim in otherwise fire-resistant buildings facilitates the spread of flames. Some of the more recent conflagrations (1910–25) in the United States have been those of Paris, Tex. (1,440 buildings, loss $11,000,000); Nashville, Tenn. (648 buildings, loss $1,450,000); Augusta, Ga. (680 buildings, loss $4,500,000); Atlanta, Ga. (1,938 buildings, loss $5,500,000); Berkeley, Cal. (584 buildings, loss $10,000,000); and Chicago, Ill. (loss $8,000,000). To reduce fire risk, automatic fire alarm systems, automatic sprinklers and chemical fire extinguishers have been installed in the larger buildings and to some extent, in private houses. Conveniently hung coils of garden hose with means for attachment to the water tap are also of value.

In order to educate the public to the importance of such measures, fire prevention is taught in the schools of many of the United States and a " fire prevention week " has been instituted to call attention to this form of preventable waste. Among the agencies in promoting fire prevention in North America is the National Fire Protection Association, which formulates standards of fire protection appliances, and co-operates with local associations in lessening fire risks, such as furthering the use of safe electrical installations. The National Board of Fire Underwriters maintains laboratories for the testing of materials and devices falling within the scope of its services, makes civic surveys covering elements entering into fire risks, and furnishes a model building code for the guidance of cities desiring one. The U.S. Chamber of Commerce, also, acting through a committee on fire waste, promotes special studies of fire-risk conditions in individual communities and urges such action as appears desirable. In most cities, desirability of action along the following lines has been indicated: (*a*) Competent inspection by the fire department; (*b*) a more general use of fire-resistive roof coverings, protected window and door openings and automatic sprinklers; (*c*) adequate ordinances governing the storage and use of explosives and inflammable substances; (*d*) adequate means for the conviction of incendiaries; (*e*) public education in the transmission of fire alarms and use of first-aid extinguishing devices. (F. H. W.)

II. IN GREAT BRITAIN

With the growth of cities and consequent risk of conflagration, fire prevention is a subject which has received much attention since 1910. Societies have been formed for the special consideration of the matter, and public bodies and insurance companies have given every possible assistance in devising means and methods for the prevention of fire. Great Britain is much behind in the matter of official regulation for fire prevention, and insurance companies have done more than the authorities by encouraging improvements in construction and the introduction of appliances such as automatic sprinklers, automatic alarms, fire doors, etc.

A large proportion of fires is due to carelessness. There is the thoughtless individual who throws away a match before the spark is out, without looking where it falls, and the careless smoker who leaves cigarette ends in close proximity to combustible material. The " no smoking " sign in factory and warehouse is often ignored, and the guilty individual fails to realise how his act is a menace to life and property. If notices prohibiting smoking in factories or other buildings are posted up, they should be rigorously enforced. Smoking should be prohibited in all factories, and the growing tendency to allow smoking in theatres and music halls should be strongly deprecated.

There has been a large increase in the use of highly inflammable liquids and material, and public attention should be called to the danger, both in the use and in the storage of these. Many hazardous processes in manufacture from a fire hazard point of view can be rendered innocuous by the precautions recommended by insurance companies. Apart from individual carelessness, fires are often caused through defective building construction, such as wooden joists or beams under hearths and entering flues, etc., insecure heating apparatus and defective lighting systems.

Precautions.—In large cities, building by-laws are fairly strict, but insurance companies have done more than the authorities to encourage improvements in construction. Party walls through and above the roof and fireproof doors, where communications exist between buildings, often keep a fire from spreading. Insecure stoves and flue pipes should never be allowed and proper fenders and guards for fireplaces are amongst the simplest preventatives. Electric light installations should be overhauled by experts from time to time, and fuse boxes should not be tampered with by people ignorant of their use. Gas brackets and all

ings should be securely fixed. It is the duty of each occupier
a building to watch for signs of defects, and either to report
m or have the defects remedied.

Many devices are in use for detecting fire, known as automatic
alarms. The general principle is that the heat generated by
re causes a metal to expand, making electric connection and
ing an alarm bell in motion. Automatic fire alarms may be
nected up direct with fire brigade stations, thus securing an
nediate turn-out to a fire. In spite of precautions, fires will
ur, and every means should be taken to summon assistance
extinguish the outbreak. Fire precaution is a natural step
r fire prevention. Every occupier of a building should know
exact position of the nearest fire alarm, so that the fire brigade
reach the scene without delay.

t is often said that the first five minutes at a fire is worth more
n the next four hours, and water should be at hand to put out
flames. Buckets of water or chemical extinguishers should be
very building. There are many extinguishers on the market,
e containing liquids, others powdered chemicals, but no class
ire extinguisher is a cure for all fires. The extinguishing agent
st have either the property of allaying heat or a blanketing
ct or a combination of both of these. Fire in ordinary com-
tible materials can be put out with water, but fires in oils,
ases, etc., must be put out with a blanketing agent. Certain
micals put a film or thin blanket over the liquid or material,
s excluding the oxygen long enough to allow the mass to
l below its burning point.

ireproof buildings, efficient fire brigades and adequate water
plies have all contributed to reduce fire waste, but special
ntion should be made of the protection offered by auto-
tic sprinkler installations. The installation of these is becom-
quite common, and they have proved in practice to be won-
fully effective. Automatic sprinklers consist of a head or
er-jet connected with water pipes, in which a pressure of
er is maintained, the head being released by the melting of
ler when there is sufficient heat generated by an outbreak of
and the water automatically plays upon the fire, quickly
duing it. In connection with the installation there is also a
gong, which automatically works with the opening of a
inkler head, and assistance is thereby summoned at once.

(E. M. M.)

ISCHER, EMIL (1852–1919), German chemist (*see* 10.426),
in Berlin July 15 1919.

ISHER, JOHN ARBUTHNOT FISHER, 1st Baron (1841–
o), British sailor (*see* 10.428). From 1910 until Oct. 1914
d Fisher remained in retirement, although Mr. Churchill,
at the Admiralty, constantly consulted him and it was on
her's advice that Jellicoe was designated admiral of the
nd Fleet in the event of war. (At the time of the Agadir
is, however, Fisher had expressed to Lord Esher and others
ng disapproval of the War Office plans engaging us in ex-
sive land operations in France.)

isher was recalled as First Sea Lord in place of Prince Louis
Battenberg in the critical days at the end of Oct. 1914. The
udacious" had been sunk, Cradock heavily defeated off
onel, German submarines were active and there was no
ctive blockade of Germany. Fisher took the responsibility
weakening the British fleet in home waters and detached
"Invincible" and "Inflexible" to engage von Spee, with
result that a complete victory was gained in the battle of the
kland Islands. To Fisher's boldness and realism again were
the new blockade policy and the laying of extensive mine
ls. The association between Churchill and Fisher was most
py until it was broken by the Dardanelles enterprise. Fisher
never liked it; his own preference was for a landing on the
st of Prussia and the employment of Russian troops against
heart of Germany. But he was persuaded by Churchill into
iescence.

hen, however, the first attempt to force the straits had
ed, and German submarines had made their appearance in
kish waters, and it seemed doubtful whether the demands of
French campaign would allow the British to send the necessary reinforcements to the army in Gallipoli, Fisher felt that he could no longer continue to countenance the project of forcing the Dardanelles. At the War Council of May 14 1915 he had declared that "he was against the Dardanelles and had been all along." Churchill afterwards told him that it was not fair to obstruct necessary measures at the Dardanelles and then when things went wrong to turn round and say "I told you so, I was always against it." Fisher replied "I think you are right—it isn't fair." That night Mr. Churchill in order to encourage the entry of Italy into the War on the side of the Allies gave instructions that four cruisers should go to the Mediterranean 48 hours before the time arranged, and the minute was signed "First Sea Lord to see after action." That was the first document seen by Fisher on beginning work as usual at four o'clock next morning. He resigned and never entered the Admiralty again. His resignation coinciding with the crisis about high explosive shells, brought down the already shaken Liberal Govt., and led to the formation of the first Coalition. The manner of his leaving the Admiralty became Fisher less than anything in his life, but his motives were neither personal nor unworthy. He felt that as things were he had lost his power of service; that he could only hamper the Dardanelles and be "unfair" to Churchill without influencing events in the direction which he felt was right.

Fisher did useful work later in the War as Chairman of the Inventions Board, and when he died on July 10 1920 and was buried in Westminster Abbey, the crowds felt that they were mourning the greatest British sailor since Nelson. Their reverence was the more remarkable because Fisher never commanded a fleet in action, nor, except the Falkland Islands, is any great victory at sea traceable to his direct inspiration. His enemies accused him of exaggerating the material side of naval power at the expense of the moral and intellectual. He was not good in the logical presentation of an argument; he thought pictorially and the sequence of his ideas expressed themselves in a series of verbal explosions. But his prescience amounted at times almost to second-sight, and he had a genius for the burning phrase that lights up the truth from within. The most amazing quality of the man was that as he grew older he became more radical and revolutionary in his ideas. To the old man in 1919 his own Dreadnought of 13 years was a symbol of effete tradition; his slogan "Sack the lot" was not the prosecution of a personal vendetta against the Admiralty chiefs, but expressed his conviction that though the spirit was eternal, its forms were only made to be broken. He wrote two volumes of memoirs: *Memories* (1919) and *Records* (1919), before his death; somewhat scrappy and disorderly in composition but full of his glowing vitality. Fisher married, in 1866, Miss Kate Broughton, by whom he had one son, Cecil, and three daughters.

FISHER, ANDREW (1862–   ), Australian politician, was born at Crosshouse, Kilmarnock, Aug. 29 1862, and began life as a coal miner. He emigrated to Queensland at the age of 23, and eight years later was elected to the Queensland legislature. He was elected to the Commonwealth Parliament in 1901, joined Mr. Watson's Labour Cabinet of 1904 as Minister of Trade and Customs, and became leader of the Labour party in 1907 on Mr. Watson's resignation. In 1908 he became Prime Minister, but his administration lasted only six months. At the general election in 1910, however, his party was returned with a sweeping majority, and he was Prime Minister for three years, during which period he tackled the question of imperial defence, adopted Lord Kitchener's report of 1909 and passed a measure establishing universal military training. His Ministry fell in 1913, but at the election of Aug. 1914 he was again returned to power and gave Australia a vigorous lead in the early days of the World War. At the end of 1915 he resigned and took up the high commissionership vacated by Sir George Reid. This office he held until 1921.

FISHER, HERBERT ALBERT LAURENS (1865–   ), British man of letters and politician, was born in London March 21 1865. He was educated at Winchester and New College, Oxford, being elected in 1888 to a fellowship at the latter college, where he lectured for some years. He earned recognition as a scholarly historian, and in 1911–2 was appointed Chichele lecturer in modern history at Oxford. He was also a member of the royal commission on the public services of India (1912–5). In 1912 he was appointed vice-chancellor of Sheffield University. In 1916, Mr. Fisher accepted the invitation to become Minister of Education in Mr. Lloyd George's Cabinet and was elected to Parliament for the Hallam division of Sheffield. In 1918 he was elected Liberal member for the English universities. An Education bill was introduced by him in Aug. 1917, which contained many important reforms (*see* EDUCATION). In Jan. 1925 he was elected warden of New College, Oxford, and he resigned his seat as member for the combined universities in Feb. 1926.

Among his books are *The Mediaeval Empire* (1898); *Studies in Napoleonic Statesmanship* (1903); *A Political History of England* (1906); *Bonapartism* (1908); *Life of F. W. Maitland* (1910); *The Republican Tradition in Europe* (1911); *Political Unions* (1911); *Napoleon Bonaparte* (1913); *The Common Weal* (1924), besides essays and review articles.

FISHER, IRVING (1867–), American economist, was born at Saugerties, N.Y., Feb. 27 1867. He studied at Yale (A.B., 1888), Berlin and Paris. At first he taught mathematics at Yale; but in 1895 was made assistant professor of political economy, and, in 1898, professor. He was editor of *The Yale Review*, 1896–1910. He served as chairman of many commissions dealing with public health, prohibition and labour. An authority on money inflation, he proposed that the purchasing power of the dollar be stabilised (*see* DOLLAR STABILISATION).

His writings include: *Mathematical Investigations in the Theory of Value and Prices* (1892); *A Brief Introduction to the Infinitesimal Calculus* (1897); *The Nature of Capital and Income* (1906); *National Vitality* (1910); *The Purchasing Power of Money* (1911); *Stabilising the Dollar in Purchasing Power* (1919).

FISHERIES (*see* 10.429).—Dealing first with British fisheries, it may be said that during the 20th century development has been rather slow, having been directed rather to the perfection of existing classes of boats and nets than to new inventions.

The otter is still the chief net for trawling from steam vessels. Its mouth must be given as wide a gape as possible, so that floats and other devices are being employed to prevent its upper rope from sagging so as to close its aperture; a third otter board is sometimes used in this position. The same trawl, but with reduced mesh, is also dragged to catch fish swimming near the bottom, particularly herrings; further development in midwater fishing in the deeper oceanic areas seems probable. Seining, or the surrounding of areas by netting so as to enclose the fish, a method extended by the Danes, is now generally pursued in all the shallower waters of the North Sea; it results in large catches, particularly of haddock and plaice, the fish arriving in less bruised condition than after the long haul of the sac-like trawl.

Surface Fishing.—Surface fishing methods show little change; they are now mainly practised by steam drifters, which follow the successive shoaling of herrings from the northwest coasts of Scotland in Jan. to the Shetlands and, down the east coast of Great Britain, to Lowestoft in October.

Trawling.—Steam trawlers varying up to 145 ft. in length have still further replaced sailing vessels, fleets of the latter only being maintained at Lowestoft (136 vessels), Brixham (90), Ramsgate (25), and Plymouth (12). Experiments in the utilisation of oil fuel are now proceeding. These changes mean the further concentration of the industry in large ports and under companies or big firms. The hake is now generally recognised as a table fish and is trawled as far south as the Moroccan coast to depths of 250 fathoms; this fishery, in association also with that of soles and skate, has resulted in important fishery developments in Milford Haven, Swansea and Cardiff. To the north, trawlers regularly fish in the Barents Sea and off Iceland, and trial voyages have been made from Hull to the Greenland banks (1925); otherwise there is little increase in the fishing area. The Norway haddock (*Sebastes*) is now regularly marketed at Aberdeen, and the sea bream and skate have generally found favour. In recent years the inshore fisheries have been greatly helped by a loan scheme of the Development Commissioners for the installation of motors in the smaller sailing craft; a further scheme on business lines for the insurance of inshore fishing craft has also been financed by the commissioners, thus giving the inshore industry the power to secure its capital. On other sides the production of sterilised ice is a development of importance, and an entirely efficient method of preservation by freezing in brine has been perfected, but not yet applied in Great Britain. The use of fish waste to form nutritive fish meals has been undertaken in the greater ports, and on the retail side fish-frying shops have so immensely increased that they form an important factor in the feeding of town populations.

EUROPEAN FISHERIES

European countries, bordering on the Atlantic, show in their high-sea fisheries similar changes to those of Great Britain and are serious competitors on most fishing grounds. Norway, in particular, has developed all its fisheries; its export trade of salt cod and other fish products is of importance. Russia, the oceanic fisheries of which have to some degree retrograded, has interfered on several occasions with British trawlers working off her northern coasts; here, as also off Iceland, Spain, Norway and Morocco the maintenance of the territorial limit of three miles is regarded by the British fishing industry as of vital interest. France shows development in all the fisheries of the Bay of Biscay, especially in sardines and tunny; her trawling fleet has increased and her larger boats still proceed on regular annual voyages to the Newfoundland banks and to Ireland. Spain and Portugal are more organised and have extended the catching power of their fisheries, but still confine their voyages to adjacent waters.

AMERICAN, ASIATIC AND AFRICAN FISHERIES

With increase of population the importance of fisheries is more widely realised, and, in North America, the United States and Canada have pursued an active policy of development in both fresh and salt waters; they export large quantities of canned and frozen salmon to Europe. Newfoundland is still mainly exporting salt-dried cod, not having as yet adequately exploited her large shoals of herring and her salmon.

Asia.—Japan shows advance in every direction, and New Zealand and various states of the Commonwealth of Australia are concerned with the exploitation of their fishing grounds.

Africa.—South Africa, which has extensive areas of suitable depths to the south and west, maintains a trawler fleet, while a crayfish fishery has been opened off Natal. Many trawlers were sold after the War to go to tropical countries, but so far systematic fishing in such waters by large power vessels has not proved profitable. The largest areas of suitable depths still almost unfished are between the Falklands and Patagonia and in that great bay to the east of the Malay peninsula. The "Discovery" expedition to south Georgia should throw light on the possibility of southern grounds, while the Malay Govt. has a research steamer on the stocks (1926).

THE INDUSTRY IN GREAT BRITAIN DURING THE WAR

In 1914 there were about 100,000 fishermen of all classes in Great Britain. Practically 40% of these at once joined the navy, while over 10% quickly responded to the urgent appeals of the military authorities. About 3,000 steam fishing vessels, trawlers and drifters in about equal numbers, were requisitioned for service, and many more were built for the same purpose. They were largely manned by fishermen recruited from those still fishing; often a requisitioned vessel carried her whole crew with her. They were employed in the Auxiliary Patrol, in mine-sweeping from the White Sea to the Straits of Marmora and in all operations necessary to keep the seas open for the operations of the British fleet, for the transport of troops and material to France, for the advent of forces from overseas colonies and the United States, and, above all, for the due arrival of food from every part of the world. The few vessels left continued fishing, and a system of fleets fishing in selected areas under the protection of their own guns and those of the navy was devised. The success of this was seen in the fourth year of the War, only 4 steam trawlers being sunk by enemy submarines as compared with 156 in the previous year. By the middle of 1917 there were only about 14,000 men still fishing, of whom over 10,000 were over age or unfit for service. Yet in the same year about 8 million cwts. of fish were landed; about 40% of the average annual catch for the 20 years preceding the War; the value, however, was nearly the same.

Arrangements were made whereby Belgian and Dutch fishing vessels were based on British ports. The shell-fish industry was fostered and developed. The deficiency in fish was further reduced by importation, particularly from Norway and Holland.

Reconstruction Problems.—The reconstruction of the industry after the War presented problems of peculiar difficulty owing to the rapid fall in the price of fish, while all commodities used in the industry remained at over double pre-War costs. The greatest difficulty of all was to preserve the herring fishery, which depended for its existence on the export of about 80% of its catch to Germany and Russia as brine-cured herring, thus differing from the trawl fishery, the output of which is absorbed by the home market. The fishermen concerned had taken an essential and vital part in national defence, and their industry was threatened with complete annihilation, the loss of its skilled craftsmen and the rotting of its boats. The government took over the finance, and thus practically the management of this fishery by the "herring guarantees" of 1919 and 1920. The cost of this bold and unprecedented action amounted to £1,712,675. It was eminently successful, for the industry, thus re-established, survived a disastrous seasonal fluctuation in 1921 and now again flourishes, aided by good subsequent years and a new export trade of fresh herrings to the Continent.

Administration.—The interests of the fishing industry are cared for by the fisheries department of the Ministry of Agriculture and Fisheries, by the Fishery Board for Scotland and by corresponding departments in Ulster and the Irish Free State. There is a series of local county Sea Fisheries Committees around the coasts of England and of Boards of Conservators of certain salmon rivers; they are responsible for local by-laws for their territorial waters and rivers, but any such can be disallowed by the central authority. There are practically no restrictive regulations to administer, the central departments being maintained to help and foster the industry in the interests of the state. The high seas outside territorial waters are open to the fishermen of all countries and supply about 96% of the British catch, the larger trawlers and drifters not being allowed to fish within territorial waters. Under powers sanctioned by Parliament in 1889, the Moray Firth was closed to British trawlers, but this regulation is not enforceable against the trawlers of other nations outside the three-mile limit. For the most part the government departments act as expert intermediaries in the interests of the industry with all the government offices concerned (Admiralty, Board of Trade, Foreign Office, etc.), with market authorities and with railways. Officers are stationed in all the larger ports to help and advise the fishermen and to keep the Ministry informed of current fishery matters. The organisation of the statistics relating to the industry has been mainly the work of the English Ministry, difficulties due to the necessarily rapid handling of the fish on arrival in ports having to be overcome by the devising of unobjectionable tests and checks of all sorts.

Scientific Investigations.—The Fishery Departments of England, Scotland and the Irish Free State have each a scientific division, and each has its own research vessel with headquarters respectively at Lowestoft, Aberdeen and Dublin. The Irish vessel is also used for local policing purposes, as also is a further vessel under the Lancashire and North Western Sea Fisheries Committee. Fisheries protection on the high seas is a function of the navy. Great Britain also maintains a staff of fish measurers, who go to sea on commercial fishing vessels. Something of the kind is done by other countries.

INTERNATIONAL INVESTIGATIONS

In 1902 the International Council for the Exploration of the Sea was organised, Denmark, Germany, England, Finland, the Netherlands, Norway, Russia and Sweden being signatories to an agreement for the pursuit of scientific research into all the waters off northern Europe. It naturally became inactive during the War, but was reconstructed in 1920, France then giving her adhesion. It now includes all the countries of western Europe except Germany and Russia. Each country according to its means maintains research vessels, and each works on a determinate scheme, settled at the annual meeting, at which the facts collected are discussed. The departments of Scotland and Ireland organised scientific divisions to carry on their share of the work, but that of England was managed until 1910 by the Marine Biological Association.

The International Council is divided into Statistical, Hydrographical, Limnological and Plankton committees, together with committees for the following areas: North Sea, Baltic Sea, Atlantic Slope, North Western (Iceland, Faroes, etc.), North Eastern (off Norway and Arctic), with, as their first care, to consider the practical fishery problems arising, or likely to arise, in their own areas. Its greatest accomplishment of recent years has been the organisation of the collection of statistics of all countries concerned on a uniform basis, the form adopted being largely that of the statistical branch of the Ministry of Agriculture and Fisheries.

Problems Investigated.—The main problem before the council is to trace to their causes the fluctuations to which statistics show that all the great fisheries are subject. To this end the council has organised a general programme of biological work for all its members, co-operative research, the results of which are generally published nationally. In Great Britain there was a fear that the areas of the principal fisheries were being overfished; the fish supposed of most importance here was the plaice, as to which there were no reliable statistics, while its life-history was little known. Consequently a large part of the research power of England and Scotland has been concentrated on this fish, and the depletion of the plaice fishery of the North Sea by overfishing almost to the limits of safety has been established.

Various remedies have been suggested and carefully examined, such as regulating the size of the mesh of nets employed, prohibiting the sale of undersized fish, and completely or partially enclosing some of the nursery grounds. The first, so far, has been found to be impracticable, as the trawl has to catch round as well as flat fishes, but experiments with a view to overcoming the difficulties are being made. The second would entail undesirable regulations and costly inspection. In respect to the third, the closure of the North Sea during the War formed a gigantic experiment, the catch by English vessels in this sea increasing from 24,000 tons in 1913 to 33,000 in 1920, but falling to 22,000 tons in 1923. The fall was clearly due to overfishing, as shown by steam trawler average daily catches of 2·1, 3·4 and 1·9 cwts. of plaice in the three years respectively. The difficulty of closing areas lies in the necessity of negotiating international agreements, as all desirable areas to be closed are outside the limits of territorial waters to the east of the North Sea.

Other notable reports of the International Council, which has its headquarters at Copenhagen, and of the British Fishery Departments deal with the natural history and growth of the herring, of the plaice and of the cod, the determination of the water movements of the North Atlantic, the deposits of the North Sea, the movements of certain fish as shown by marking experiments, and the transplantation of plaice to the Dogger Bank. A report of the English Ministry describes the gear employed in 1923 and a Report of a Treasury Committee published in 1908 in the evidence recorded gives a full account of nearly every aspect of the fishing industry as it then existed. The annual administrative reports of the English and Scotch departments should also be consulted.

The researches of the government departments concerned are also largely aided by the work of the staffs of scientific marine laboratories situated at Plymouth, Cullercoats, Millport and Port Erin, each of which has its public aquarium. These, while founded by private enterprise, are materially assisted by grants from the Development Commission, on the recognition of the well-known fact that economic results usually follow scientific researches. Of these the largest is Plymouth with special departments for zoology, physiology and fisheries; it is the property of the Marine Biological Assn., which in its *Journal*, by agreement, publishes the result of research from all the British marine laboratories.

STATISTICS OF THE INDUSTRY

The approximate total value of the sea fisheries catch of the countries of western Europe in 1922 amounted to £48,000,000 (British Is., 39·5%; France, 17·6%; Spain, 15·5%; Norway, 7·5%; Denmark, 5%; Holland, 4%; Portugal, 3·4%; Germany, 3·3%). Canadian fisheries in 1924 were $44,500,000 (Provinces: Atlantic, $17,500,000, Inland, $5,500,000 and Pacific $21,500,000); Pacific salmon, $13,000,000 and Atlantic lobsters, $4,000,000; over 60% was exported. The recorded values for the United States in 1923 were about the same, but the inland fisheries were $13,000,000; exports were $12,000,000.

Great Britain

	Catches		Craft Employed		Employment	
	Demersal fish cwts.	Principal Pelagic fish cwts.	1st Class	2nd Class	Regular	Irregular
1909–13 average	11,613,066	10,769,178	6,602	5,203	67,962	13,150
1920 .	12,573,805	8,333,991	5,581	6,227	61,683	10,925
1924 .	10,880,251	9,800,481	4,921	5,777	54,610	8,947

This table shows vividly the modifications which have taken place in the Fishing Industry of Great Britain during the period under review. The type of fishing-boat has also changed greatly. In 1913, 3,233 steam-boats (3,222 1st class and 11 2nd class boats) were employed. In 1924, the number was 3,087, of which 3,078 were 1st class. Motor-craft, however, increased from 842 in 1913 (335 1st class and 507 2nd class) to 4,311 in 1924 (1,192 1st class and 3,119 2nd class). Sailing craft in 1913 were 7,730 (3,045 1st class and 4,685 2nd class), while in 1924 they were 3,300 (651 1st class and 2,649 2nd class). Corresponding figures are not available from other countries where statistics are based on different data and collected by different methods.

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FISHING: *see* ANGLING.

FITZMAURICE-KELLY, JAMES (1857–1923), British man of letters, was born in Glasgow June 20 1857. Educated at St. Charles's College, London, he became Taylorian lecturer in Spanish at Oxford in 1902. From 1909 to 1916 he was Gilmour professor of Spanish language and literature at the University of Liverpool; and in 1908 and 1912 Norman MacColl lecturer at Cambridge University. During 1907 and 1908 he lectured for the Hispanic Society of America at various American universities and at London University. In 1916 he was appointed Cervantes professor of Spanish language and literature at the University of London, a post he held till his resignation in 1920. Among his numerous published works should be mentioned *The Life of Miguel de Cervantes Saavedra* (1892); an introduction to the editio princeps of *Don Quixote* (1898–9); a *History of Spanish Literature* (1898); *Cervantes in England* (1905); *Miguel de Cervantes: a memoir* (1913); *Cervantes and Shakespeare* (1916); *Góngora* (1918); and *Fray Luis de Leon* (1921). He edited among other publications, the *Oxford Book of Spanish Verse* (1913) and the complete works of Miguel de Cervantes Saavedra (1901–). He died at Sydenham, London, Nov. 30 1923.

FIUME (Slav "Rijeka" both meaning "the river"), a port on the Adriatic (*see* 10.449). As the only port of Hungary, Fiume had had little history, but the city sprang into world-wide notoriety and became a burning question after the World War. The question of Fiume even threatened to become the cause of a further war between Italy and Yugoslavia. The "secret" treaty of London of April 26 1915, which contained Italy's terms for entering into the War, assigned Fiume to Croatia, and Senator Tittoni (subsequently Minister of Foreign Affairs) informed the writer that Baron Sonnino who negotiated that treaty for Italy, never once asked for Fiume; had he done so at that time, he could have had it for the asking. This point is important, because the Italian Press afterwards blamed the Allies for "refusing" Fiume to Italy.

The Italian Claims.—The first Italian claim to Fiume was made by Sig. Bissolati immediately after his resignation from the Cabinet at the end of 1918. Baron Sonnino's inaction in this matter was due to the fact that in 1915 he had neither anticipated, nor desired, the total breakup of the Dual Monarchy, but wished, while annexing the purely Italian provinces of Austria, to leave Fiume to Hungary, instead of including it, as a future rival to Trieste and Venice, among the Italian ports at the head of the Adriatic. But in 1919 the official Italians demanded Fiume on the principle of "self-determination," because the majority of its inhabitants was Italian, and largely so if Fiume proper were separated from its Yugoslav suburb of Sušak on the opposite side of the rivulet, which had given to Fiume its name, and which the Slavs called simply Rečina, and the Italians "Eneo"—a poetical title for so prosaic a stream. That Fiume was in 1919 predominantly Italian is true, but the Italian element had immigrated within comparatively recent years; the very detailed description of Fiume about 1855 by Charles Lever (the British consul at Trieste) in his novel, *That Boy of Norcott's*, mentions Slavs and Hungarians but never Italians there.

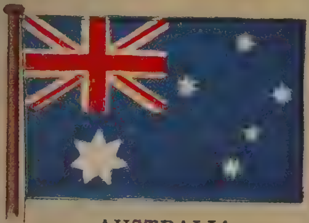
Meanwhile, on Oct. 23 1918, Croat troops had seized Fiume and in Nov. there was a dual occupation, against which the Yugoslav national council protested, by Italian and Serbian troops, while Italian naval forces entered the harbour. The Serbian troops were, however, withdrawn and replaced by Americans, pending the decision of the Fiume question by the Peace Conference. The Italians' position was similar to that known in English law as "pleading inconsistent defences." They claimed North Dalmatia, overwhelmingly Slav by race, in virtue of the Treaty of London, which President Wilson repudiated, and Fiume in virtue of the Wilson principle of "self-determination."

The D'Annunzio Adventure.—They ultimately obtained Fiume, thanks to the raid made by Gabriele D'Annunzio, who mustered a body of men at Ronchi near Trieste, and on Sept. 12 1919 occupied the contested town. There despite official notes, he remained as "commandant," offering to a prosaic age the spectacle of a poet as governor, and surrounding a commonplace town with the glamour of his dithyrambic speeches. He drew up a constitution for the "Carnaro," as he called his miniature state, and soon Fiuman divorces became the fashion for Italians unable to dissolve their marriages at home. He delivered frequent speeches, and represented the oppressed nationalities of the whole world as looking to Fiume, "the holocaust city," for consolation in their affliction. He descended with his "legionaries" upon Zara and meditated an extension of his territories still farther southward. While successive Italian Governments gave him no official support, he received considerable sympathy from the Nationalist elements in Italy and was regarded with corresponding aversion by the Yugoslavs, whose prowess in the Middle Ages he had sung in a poem of encyclopaedic erudition at the outset of the War.

But when Signor Giolitti in 1920 became for the last time Premier and concluded the treaty of Rapallo with the Yugoslavs, he resolved to turn the poet out of Fiume, and that eminently common-sense politician did so by force. The "commandant's" official residence was bombarded by the "Andrea Doria," and he narrowly escaped the martyrdom which he had proclaimed for himself and his followers, a "holocaust" for his country. After the "heroic age" of his rule there came the prosaic interlude of his local rival, Sig. Zanella, who represented the autonomous, as opposed to the Italian National, party, and aimed at bringing about a good understanding with Yugoslavia. A *coup d'état* by *Fascisti* and "legionaries" took place in 1922; the Government offices were stormed; Sig. Zanella abdicated in favour of a "government of national defence," and was escorted over the frontier in an armoured car; Sig. Prodan, a local engineer, succeeded him, and annexation to Italy was proclaimed. Official Italy, however, acted with caution and persuaded Sig. Giurati, a *Fascistà* deputy, to decline the proffered post of "Civil Commissioner," while D'Annunzio from his retreat on the lake of Garda denounced the dissensions of Fiume, and refused to return and lead the Fiuman movement.

Negotiations between Italy and Yugoslavia.—Finally General Giardino became Governor, and Signor Mussolini made a serious attempt to come to terms with the Yugoslavs. The river had in the course of generations changed its course, forming a

FLAGS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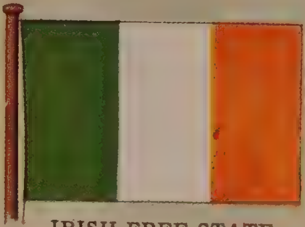
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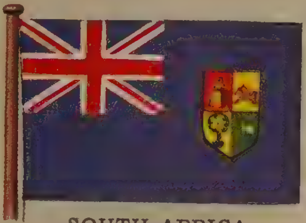
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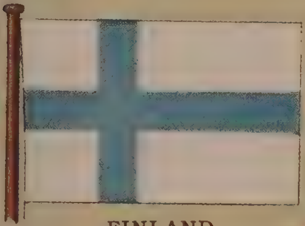
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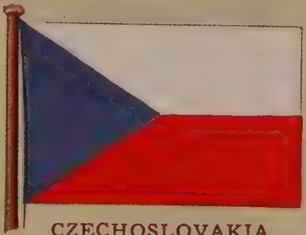
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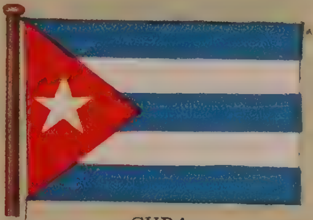
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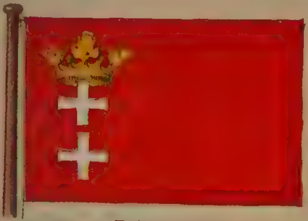
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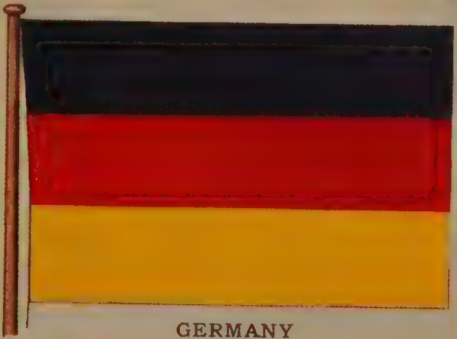
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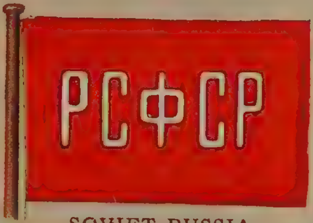

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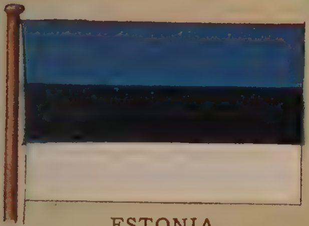
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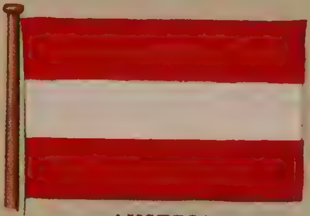
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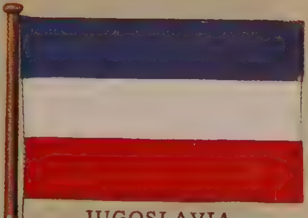
JUGOSLAVIA
Kingdom of the Serbs,
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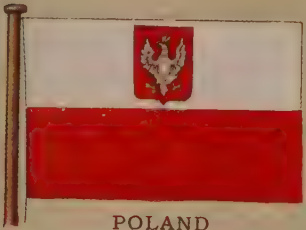
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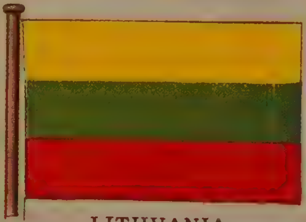
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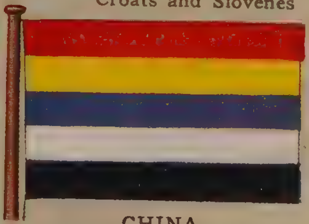
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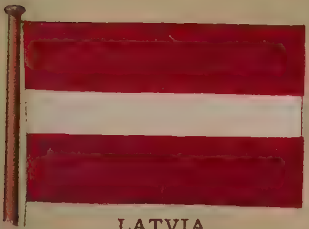
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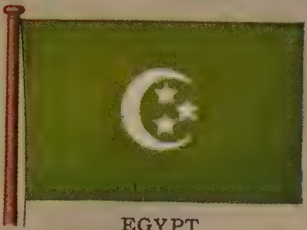
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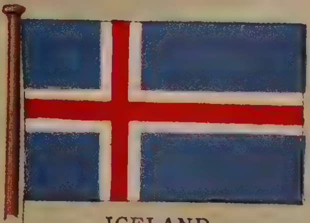
ICELAND

Delta," as it was called, and thus rendering doubtful the boundary of Fiume towards Sušak. Both Italians and Yugoslavs laimed the "Delta." The smaller harbour, too, called in Hunarian times "Port Baross" after a former governor, but rehristened by the Italians "Porto Nazario Sauro" after one of he heroes of the War, was a matter of dispute, but by a letter written by Count Sforza, then Italian Minister of Foreign Afairs, a few hours after the signature of the treaty of Rapallo in Nov. 1920 it was ceded to Yugoslavia.

Even after the refusal of D'Annunzio (afterwards created by the Fascisto Government "Principe di Monte Nevoso"), bickerings till continued and the two rival races did their best to give one another economic pin-pricks and thereby nearly ruined the trade of the once flourishing port of Hungary. Thus, the Italian ailway time-table was so arranged that the trains did not connect at the frontier-station of Postumia, while the Yugoslavs topped their through railway service to Fiume altogether, so hat the traveller from Fiume into Yugoslavia had to drive across he wooden bridge into Sušak and thence a mile or more to a oadside station on the line to Zagreb. Grass grew in the dockyards of the port and there were at one time only two steamers in he harbour. Just before the Corfu incident, Sig. Mussolini sent an ultimatum to Yugoslavia, and the fleet which bombarded the Greek island is said to have been originally intended or Fiume. But milder counsels prevailed, and at last a series of arrangements was concluded at Florence between the Italian and Yugoslav Govts. on Jan. 27 1924. Fiume with the larger harbour was definitely recognised as Italian; Port Baross and "the Delta" became Yugoslav, and through railway traffic, after several years' intermission, was renewed.

In 1925 the trade of the town improved; and the passage across the bridge to Sušak was no longer impeded by formalities. But he Fiuman frontier towards the north is fantastic, for a mere corridor, through which the road and railway run, connects the town with Abbazia, and is commanded by the old Roman ortress of Castua, high on the hills which dominate the Quarnero. Superficial peace reigns at Fiume; but Italy does not need three ports in the northern Adriatic and the opening (in Aug. 1925) of the last link in the Lika railway connecting Spalato with the Yugoslav hinterland is a fresh blow to Fiume, while the old Hungarian-Croatian steamship line now rechristened "Jadranska Plovidba" ("Adriatic Steamship Co.") starts from Port Baross and boycotts Italian Zara. The delimitation of the frontier by the Italo-Yugoslav commission has just been concluded. Population of the town of Fiume (1921), 45,000.

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(W. Mi.)

FIVES (*see* 10.450).—In Great Britain the forms most usually met with are known as Eton Fives and Rugby Fives. There are also Winchester Fives and other less-known varieties. A few rules of an older form of the game as played about 1825 still existed in 1925. Both the main games are played chiefly at the great public schools, but there are also a number of courts in various parts of the country, and the game is played in the north of England by working men. In 1924 a Fives Assn. was formed and two open competitions, one at Eton Fives and one at Rugby Fives, were instituted.

FLAG (*see* 10.454).—As one of the international attributes of a state or a sovereign, a flag has in modern times been liable to assume a new form or disappear, according to the vicissitudes of the individual political entity to which it is appurtenant. The years since 1910 witnessed greater transformations in the flags of the world than were occasioned even by the Napoleonic wars and the Congress of Vienna. As a result of the World War three imperial houses came to an end, some European states ceased o exist as such, new states emerged and old states assumed new forms. A necessary consequence of this was that historic banners such as the standards of the Hohenzollerns, the Habsburgs and the Czars ceased to exist or became obsolete, new national flags appeared and the blazonry of some of the old flags was materially changed.

Most of the states brought into existence by the Treaty of Versailles adopted flags which, though varying in design, embodied heraldic features of older banners. For example, the republic of Austria adopted the former flag of the Austro-Hungarian imperial navy without the charge, whereas the new flag of Hungary is that of the former Kingdom of Hungary. The new flag of the German Republic substitutes the national colours, black, red and gold, in place of the black, white and red which had been the distinguishing colours of the German mercantile marine. On the other hand, the former Russian national colours gave place to a new design, which departed from all traditions of heraldic law, *i.e.*, a flag bearing the letters PCΦCP (Russian Socialist Federation of Soviet Republics) imposed on a red ground. Of the new Baltic States, Finland, Latvia and Lithuania adopted flags devised in historic affinity with mediaeval banners associated with their respective localities. Estonia, however, brought into existence a new flag of no heraldic value, bearing three horizontal bars, blue, black and white, signifying respectively the blue sky, the black earth and the white shirt of the peasant. The port of Danzig adopted with modifications the flag of the city when it was an independent member of the Hanseatic League. The historic flag of Poland—before the partition—consisted of a scarlet field with a white eagle in the centre, but the flag of the new republic is of scarlet and white, the eagle being discarded. The former design is used, however, as a badge in the shape of a shield when necessary. The flag of the Kingdom of the Serbs, Croats and Slovenes is a combination of the old Serbian royal flag with that of Croatia, both these older flags having red, blue and white in differing orders, and the Montenegrin flag has disappeared.

Outside of Europe the changes have not been so marked. Egypt, as a sign of release from Turkish suzerainty, has in her flag discarded the red ground and substituted green, the design otherwise remaining intact. The Republic of China has rejected the historic dragon on a yellow ground, replacing it with a flag of five horizontal bars of different colours representing her five racial elements, *i.e.*, Mongol, Chinese, Manchu, Mahomedan and Tibetan. The flag of Morocco, as an acknowledgment of French suzerainty, now carries a tricolour canton. An entirely new flag is that of the Kingdoms of the Hejaz and 'Iraq, whilst the flags of Portugal, Panama, Turkey and Siam have undergone changes of varying importance.

See the plate of flags here given; also *Admiralty Book of Flags of All Nations*, printed for H.M. Stationery Office, London, 1916, kept up to date by the publication periodically of *Errata* officially issued.

FLAGG, ERNEST (1857–   ), American architect, was born at Brooklyn, N.Y., Feb. 6 1857. He studied at the École des Beaux-Arts, Paris, and in 1891 began to practise as an architect in New York City. He designed St. Luke's Hospital and the Singer Building, New York City, the tower of the latter (612 ft.) being the highest commercial structure in America at the time of its erection (1908). Other public buildings designed by him include the Corcoran Art Gallery, Washington, D.C., and the U.S. Naval Academy, Annapolis, Maryland. He also designed many private residences and wrote *Small Houses—Their Economic Design and Construction* (1922).

FLAMETHROWER (Ger.: *Flammenwerfer*).—This weapon was first used by the Germans in the winter of 1914–5, and with marked success in the Bois d'Avocourt (Verdun) on Feb. 26 1915. The French followed in their use. The British used them on the Somme and in the Zeebrugge attack, St. George's Day, 1918. The American Expeditionary Force did not use them at all.

Structure.—A flamethrower consists of (*a*) the container filled with some mixture of heavy and light oils, (*b*) the strong walled vessel filled with air, nitrogen, CO_2, etc., under high pressure, and (*c*) a discharge tube, with nozzle and, in most cases, an ignition device. Between (*a*) and (*b*) is a reducing valve, and between (*b*) and the nozzle a firing valve or trigger. Flamethrowers were short-range weapons, and were of two types, the heavy and the portable. The heavy type attained an extreme range of 134 yd. (British model), while with the portable British model a range of 45 yd. was attained, and maintained some 15 to 18 shots from a single filling of three gallons. The most satisfactory propellant was found to be nitrogen—either the pure product or a "deoxygenated air" produced in one field by a mobile plant.

Ignition was effected in the British types by two sparking plugs mounted in a cup containing petrol and fired by a magneto generator. The French fixed to the nozzle a tubular magazine which held a long stick of alumino-thermic composition kept up by a coiled spring and primarily ignited by a cerium steel briquet. The Germans used a double-walled cylinder, attached to the nozzle and charged with an alumino-thermic composition open to the air at the top. Inside the hollow of the cylinder and in prolongation of the bore of the nozzle tube were a piston, a spring, a striker needle, mounted on a pellet, and a cap with powder-relay. Between the cap and the needle was a fixed disk of cardboard. On release the impact of the jet on the piston compressed the spring and the striker against the cardboard disk, the needle penetrated the disk, and the spring, depressing itself, forced it on to the cap and fired the powder-relay which ignited the composition.

It is not possible to formulate any definite opinion as to the tactical value of heavy flamethrowers of the battery type. The portable type was found on occasions to be more useful than other close range auxiliaries of the infantryman.

FLATS: *see* ARCHITECTURE.

FLECKER, JAMES ELROY (1884–1915), British poet, was born at Lewisham, London, on Nov. 5 1884. He was educated at Dean Close School, Cheltenham, of which his father, W. H. Flecker, was headmaster; at Uppingham School; Trinity College, Oxford (1902–6), and Caius College, Cambridge (1908–10). He then entered the British consular service and went to Constantinople in 1910, in the same year issuing his *Thirty-six Poems*, reissued in 1911 as *Forty-two Poems*. *The Golden Journey to Samarkand*, with its notable preface summing up Flecker's Parnassian theory of poetry, appeared in 1913, after he had been compelled by consumption to leave his post at Beirut for treatment in Switzerland. He died at Davos-Platz Jan. 3 1915 and was buried at Cheltenham. Later in 1915 appeared *The Old Ships*. His spectacular Oriental drama, *Hassan*, was published in 1922 and produced in 1923, and an earlier play, *Don Juan*, appeared in 1925. His *Collected Poems* were issued in 1916. The most interesting of his few prose works was a novel, *The King of Alsander* (1914). See *Life* by Geraldine Hodgson (1925).

FLEMING, SIR SANDFORD (1827–1915), Canadian engineer and publicist (*see* 10.494), died at Halifax, N.S., July 22 1915.

FLETTNER RUDDER.—The design of this rudder constituted a radical departure from the design which for so long remained unaltered. All rudders may be said to be current-operated, but in this type the current is also used for altering the position of the rudder. The forces necessary to move the rudder of a big ship against the action of the current are very great; and a ship's steering engine requires to be of considerable horse-power, and of very robust construction. The gearing attached is heavy and more or less complicated. Such powerful steering gears should no longer be necessary. With the current-operated rudder, large ships can be steered direct by hand by the utilisation of the variations in pressure of the current on the rudder.

The principle of the invention is that of inducing negative pressure by moving the after-portion of the blade of the rudder, and of using the lateral effect thus caused by the difference of pressures on its after-part to move the rudder itself. For ships up to about 10,000 tons the Flettner rudder requires no engine to operate it, whilst in larger vessels the only additional effort necessary is that to overcome the friction in the transmission gear. The saving in effort is round about 95%. Instead of the large rudder it is only necessary to move a small one, having superficial area equal to about one-twentieth of that of the large rudder. Again, the small secondary rudder can never be placed in a position relative to the current which would cause the centre of pressure to move backwards at high speeds of ship. Manoeuvring power is greatly increased, because the rudder adjusts itself to the stream. The rudders are made either single or three-bladed, the most favoured design being the single-bladed spade type of more or less square form, which will be described in some detail.

Description of the Rudder.—The partially balanced main rudder, which is free to rotate about its axis, is steered by the secondary rudder, also balanced, hung at its after-edge. Movement by the secondary rudder is effected by the operating gear contained in a housing fixed to the main rudder.

A vertical shaft leads downwards from the operating gear through the hollow rudder stock, and terminates in a yoke which is coupled to a similar yoke on the secondary rudder by a pair of connecting rods. The operating gear is driven direct through a system of shafts and bevel wheels from alternative steering positions situated respectively on the bridge and the poop deck. In addition to the hand wheel, automatic steering is also provided by a gyroscopic compass gear, working through a ½-H.P. electric motor coupled to the steering wheel on the bridge by a chain.

The horizontal section of the rudder is of stream-line form. This shape avoids the disturbance in the even flow of water over the surface of the rudder which would otherwise be caused by the protrusion of the thick rudder-stock. It also adds to the stability of the rudder in the midship position. Moreover, this shape gives room for the protection of the connecting rods operating the secondary rudder except at the after-end, where an additional sheet-steel covering is built on as previously stated. The main rudder, which is free to rotate about its axis, is steered by the secondary rudder on its after-edge. When the latter is moved by its connecting rods, relatively to the main rudder during movement of the ship or in the slipstream of the propeller, the resulting deviation of the slipstream causes a different balance of pressures as between main and secondary rudders, *i.e.*, the main rudder being free to move, is deflected by the current through a certain angle. In going astern the balance of pressures is reversed through 180 degrees so at the moment when change of direction of the slipstream occurs the rudder automatically *turns* round through half a circle. The operating gear on the rudder-head determines the movements of the secondary rudder with relation to the steering wheel, the main rudder and the ship. (F. J. D.)

FLEXNER, SIMON (1863–), American pathologist, was born at Louisville, Ky., March 25 1863. Graduating from the University of Louisville in 1889, he pursued his studies further at Johns Hopkins University and the universities of Strasbourg, Berlin and Prague, and at the Pasteur Institute, Paris. He was associate professor and later professor of pathological anatomy at Johns Hopkins during 1889–99, becoming in the latter year professor of pathology at the University of Pennsylvania. In 1903 he was appointed director of the laboratories of the Rockefeller Institute for Medical Research, New York. Dr. Flexner became widely known in 1905 for his successful treatment of cerebrospinal fever by the use of a serum, the administration of which reduced the mortality rate from 90% in untreated cases to 46·3% in cases where the serum was used. He has published numerous monographs, including *The Pathology of Toxalbumin Intoxication* and *Mode of Infection, Means of Prevention and Specific Treatment of Epidemic Meningitis* (1917).

His brother Abraham Flexner (b. 1866) became, in 1917, secretary of the General Education Board. His views on education as set forth in *A Modern School* (1916) and *A Modern College* (1923) occasioned much discussion. He wrote also *Prostitution in Europe* (1914) and works on medical education. (*See* SPINAL MENINGITIS.)

FLINT, ROBERT (1838–1910), British divine and philosopher (*see* 10.521), died in Edinburgh Nov. 25 1910.

FLINT, Mich., U.S.A. (*see* 10.521), had a population in 1910 of 38,550, and in 1920 of 91,599, of whom 15,213 were foreign born; in 1925 the Census Bureau estimated the population at 130,316. The area in 1910 was 8,120 ac.; in 1925, 19,115 acres

e manufacture of motors and trucks, and of such contribu-
y articles as sparking plugs, carburetters, motor axles, paints
d colours, and malleable iron castings is the backbone of its
osperity. Postal receipts increased fourfold between 1910 and
24. Industrial development was paralleled in the building
homes, including noteworthy projects by some of the large
tor companies; street paving and lighting; and the construc-
n of hotels, banks, department stores, theatres and office build-
gs. A city-planning board was created in 1917. The park area
s increased to 882 ac. by 1925. Schools were built rapidly and
es acquired to provide for future expansion. In 1923 a belt-
e railway was opened.

FLORIDA (*see* 10.540).—The population of the state in 1920
s 968,470, a gain of 215,851 in the decade 1910–20. During
e five years 1920–5 the increase of population has been even
re remarkable, the state census for 1925 showing an increase
295,079, or 30.4% since 1920, the total population being given
1,263,549. In 1925 there were 21 cities with a population of
er 5,000; those then exceeding 10,000 were: Jacksonville
5,206), Tampa (94,808), Miami (69,754), St. Petersburg
6,706), Pensacola (24,958), Orlando (22,273), West Palm
ach (19,122), Key West (13,533) and St. Augustine (10,190).
e rapid development of Florida cities and towns is giving
e state a larger proportion of urban population than any other
uthern state. However, Florida's population is still pre-
minantly rural. In 1920 only 36.7% of the entire population
s urban (living in cities or towns of over 2,500). During the
nter months the population is largely augmented by thou-
nds of tourists and winter residents, quite a number of whom
come permanent residents or invest in Florida property.
r many years the coast resorts were the chief objectives, but
any of the inland towns and cities are now attracting out-of-
ate visitors. Far larger numbers of pleasure seekers have
sited Florida in the two years 1924–5 than ever before, and
is movement is certain to grow.

Industries and Commerce.—Florida's most extensive industry
agriculture. According to figures of the Florida Experiment
ation there were approximately 5,940,000 ac. of land in farms
1925, not including open or fenced range lands. Of this,
400,000 ac. were in crops, and 618,000 ac. of crop lands were
le; 275,000 ac. were in fruit; 1,500,000 ac. were in pasture; and
147,000 ac. in woodland. On approximately one-third of the
ltivated acreage crops were produced by intertillage (the
owing of two or more crops on the same land at one time) and
succession planting (where two or more crops follow each other
the same land in one year). The number of farms in Florida,
as 50,016 in 1910, 54,005 in 1920 and 59,817 in 1925. Fruit is
lorida's most important crop. The citrus industry has pros-
ered despite the fact that some of the groves in the more north-
n part of the state have suffered from heavy frosts in severe
inters. In 1920 the production of oranges was 8,500,000 boxes,
d of grape fruit 5,000,000 boxes. In 1925 the production was
,700,000 boxes of oranges and 6,300,000 boxes of grape fruit.
the sub-tropical part of the state pineapples, lemons, guavas,
d avacadoes are grown profitably on a commercial scale.
ther fruits produced are peaches, pears, bananas, grapes, figs
d limes. The more important crops with their 1925 acreage
elds and values, are tabulated in the next column.

There was a falling off in the production of cotton during the
ecade 1910–20; however, a good cotton season during 1925,
d the use of short staple cotton which is more resistant to the
oll weevil, more than doubled the state's production over the
op of 1920. The tobacco-growing section of western Florida
oduces profitably a shaded leaf, grown from Cuban and Suma-
an seed, which is in great demand in cigar manufacturing. The
ecan industry is comparatively new, most of the commercial
oves having been planted since 1905. It is believed that in the
rthern part of the state the pecan crop may soon compete
osely with the citrus crop of the southern part. The production
early vegetables for the northern markets is developing
pidly, and the Florida producer can put vegetables on the
arkets earlier than any of his competitors. The chief obstacles are costly rates and inadequate railway freight and express service. Much attention was formerly paid to stock-raising, but with the taking up and development of much of what was formerly open-range land, the figures for 1925 show a decided shrinkage in the production of livestock since 1920. In 1925 there were 662,000 cattle, including milch cows, valued at $13,240,000; 61,000 sheep, valued at $200,000; 506,000 swine, valued at $3,289,000; 31,000 horses, valued at $3,000,000 and 43,000 mules, valued at $5,934,000. These livestock statistics include only farm animals.

	Acres	Production	Value
Staple Crops:			
Corn	580,000	8,700,000 bu.	$ 8,700,000
Cotton	106,000	40,000 bales	3,541,000
Hay	82,000	57,000 tons	1,296,000
Sugar-cane	9,000	2,100,000 gal.	2,205,000
Sweet Potatoes	29,000	2,465,000 bu.	4,060,000
Tobacco	7,000	5,460,000 lb.	1,693,000
Truck Crops:			
Irish Potatoes	23,000	2,599,000 bu.	6,757,000
Snap Beans	20,530	1,663,000 hmprs.	2,494,000
Celery	4,320	2,000,000 crates	3,700,000
Cucumbers	10,830	1,256,000 hmprs.	1,520,000
Lettuce	3,400	765,000 crates	1,170,000
Peppers	3,400	1,115,000 bu.	2,787,000
Strawberries	3,170	6,023,000 qt.	1,807,000
Tomatoes	33,470	2,811,000 bu.	6,325,000
Watermelons	20,910	7,841 cars	2,352,000
Fruit and Nuts:			
Grape fruit	..	6,300,000 crates	11,340,000
Oranges	..	10,700,000 crates	26,750,000
Peaches	..	115,000 bu.	190,000
Pecans	..	1,340,000 lb.	348,000

In 1925 Florida produced mineral products to the value of $10,908,000, the more important of which were phosphates, lime, limestone, brick, tile, kaolin and fuller's earth, of which latter Florida produces about three-fourths of the entire U.S. output. In 1924 the production of phosphate was: land pebble, 2,348,137 long tons, valued at $7,987,752; and hard rock, 199,516 long tons, valued at $1,071,675. Florida's lumber production, due to exploitation, shows a decline since 1916, when an output of 1,425,000,000 ft. was reached; the 1924 production, mainly cypress and yellow pine, was 980,014,000 feet. Considerable hard wood (chiefly hickory) is produced. Naval stores are produced from the pine forests, where the sap of the trees is collected and distilled, yielding turpentine and resin. In 1923 Florida produced 9,747,000 gal. of turpentine valued at $10,000,000 and 660,000 bbl. of resin valued at $4,000,000.

In 1924 Florida manufactured 546,799,000 cigars, valued at $35,000,000; and 2,767,000 cigarettes, valued at $55,000. A rapidly developing manufacture is that of commercial fertilisers, large amounts of phosphate mined in the state being used for this purpose. Some index of Florida's recent business growth can be gained from the following banking statistics: deposits in National banks in Jan. 1920, $187,286,267; in Jan. 1925, $375,042,947; in state banks and trust companies in Jan. 1920, $197,809,947; in Jan. 1925, $287,636,588.

History.—The outbreak of the World War in 1914 interrupted two of Florida's more important exports to Europe, *i.e.*, naval stores and phosphates, thus creating a temporary business depression. In the naval-stores industry the recovery was comparatively rapid, owing to the high prices of and increased domestic demand for the products, after the first few months of the War. The phosphate industry was more seriously affected, as Germany had been a large purchaser. Many phosphate mines closed down, to resume operations only after the signing of the Armistice.

The political history of the state during the years 1910–25 was uneventful. The question of Prohibition played a large part in state politics until the ratification of the Eighteenth Federal (Prohibition) Amendment by the Florida Legislature

Dec. 14 1918. Since 1876 Florida has been uniformly Democratic and, except in 1916, when a contested primary election in the Democratic party resulted in the nomination of Sidney J. Catts as a prohibitionist and in his election as governor, all of the state's executives have been Democrats. The governors since 1910 were: Albert W. Gilchrist (1909–13); Park Trammell (1913–7); Sidney J. Catts (1917–21); Cary A. Hardee (1921–5), and John W. Martin, (1925–). In 1924 Florida adopted an amendment to the state constitution forbidding the Legislature to levy an income or inheritance tax. (J. M. L.)

FLOUR MILLING (*see* 10.548).—Profound changes have occurred during the period covered by our work (1910–26) in the geographical distribution of the flour-milling industry. The great increase that took place in the production of wheat in the U.S.A., Canada, Australia and Argentina, the relatively low cost of production in those countries, and the cheapness of transportation, together with the universal drift of the population from the rural to the urban districts, brought about the building of large flour-mills at the principal ports of Great Britain and other countries, and the gradual extinction of many small rural mills.

American Milling.—In the three Canadian provinces of Manitoba, Saskatchewan and Alberta, alone, in less than a quarter of a century the quantity of wheat grown was increased from 23,000,000 to 446,000,000 bu., and the export flour trade rose from 306,339 bar. (196 lb.) in the season 1871 to over 11,000,000 barrels in the season 1924–5. As wheat production increased, so also did the number of flour-mills, which were built regardless of domestic requirements in the United States, Canada and Australia. This was based on the assumption that flour could be most economically milled in the countries in which the wheat was grown.

European Milling.—In Europe, Germany and France, in particular, aimed at growing sufficient cereals for their own use, and heavy duties were levied on imported grain and flour to aid the process; in these cases, also, there was an increase in the capacity of the flour-mills to correspond with requirements. Great Britain and a few other countries placed their reliance on imported wheat, which was more suitable for breadmaking purposes than the native varieties; but here, again, they increased their capacity for the manufacture of flour, notwithstanding the same tendency in the wheat growing countries.

Active Competition.—Thus a situation arose in which the capacity of the mills in several countries exceeded the requirements of the population. Millers began to seek hungrily for trade farther afield. American, Canadian and Australian mills made unremitting efforts to supply Europe and the Far East with flour, entering alike overloaded and deficient countries. This current of trade in Europe was met by other currents flowing from England, Germany, France and other countries, the result being a swirl of competition that, however beneficial to the consuming public, engendered a certain amount of anxiety in the trade.

In the years which immediately preceded the War, a world-wide scramble for trade had begun. From 1914 to 1918, however, the feeding of the armies and the civil population was under the control of the respective governments concerned, and with the redistribution of supplies all the mills were kept going at full speed. In Great Britain additions were made to some of the plants, the aggregate peacetime capacity of which already exceeded requirements. The millers of England and Wales found themselves at the end of the War in possession of a potential manufacturing capacity of 40,000,000 sacks (280 lb.) of flour per annum, or an excess of 10,000,000 sacks over requirements. Scotland and Ireland were and had remained under-milled, but the English mills can supply their deficiency and still have several million sacks to spare.

After the state had liberated the industry from control in March 1921, British millers were compelled more than once by stress of circumstances to impose voluntary control upon their business, notably in 1921, when there was a record slump in the price of wheat, values declining by more than 40s. a quarter in a brief period.

For several years the situation was relieved by the demand for breadstuffs on the European continent. Shattered as these countries were by the four years of war, they could not, as formerly grow or grind sufficient wheat for themselves, and one after another they relaxed or abolished their tariffs on imported cereal and flour. During this period the exports of flour from Great Britain rose to the unprecedented height of over 3,000,000 sacks.

But so soon as the grain-growers on the Continent had succeeded in increasing their production more nearly to correspond with national requirements, both they and the flour millers exerted themselves to secure the re-imposition of tariffs. In Germany there was resistance from the urban element, but in Oct. 1925 grain and flour imported to Germany were again subject to customs duties. In France, millers were compelled by law to mix rice and other cheaper flour with their wheaten flour, and these regulations were finally removed in 1925.

The growing Chinese and Japanese demand for wheaten products was met partly by American and Canadian mills. But in these Far East as in other countries at present under-milled, new flour-mills were erected to meet the increasing demands, so that further readjustments in distribution appear to be inevitable. In the U.S.A., Canada, Australia and England, the mills were unable to work at their full capacity. In New South Wales (Australia) the quantity of flour required by the population of 2,250,000 people was 225,000 tons per annum, and the mills of this State could produce exactly double that quantity. The U.S.A. and Canadian mills shared the same difficulties. In Minneapolis, the largest flour-milling centre in the world, the mills were not able to work to anything like their full capacity for several years. In Great Britain, whilst the excess capacity amounted to 10,000,000 sacks per annum, on an average 4,000,000 sacks of flour came into this country from the U.S.A., Canada, Australia and elsewhere, so that the problem in this case is intensified by imports.

The tendency generally is towards large scale production. It is estimated that 50% of the flour required by the population of Great Britain is milled at the principal ports, approximately 17% at mills in large inland centres of population, and 33% at mills in country areas. The flour-milling industry has encountered inexorable economic laws, from the authority of which there is no escape, and, unless there is a voluntary arrangement to produce flour to conform with requirements, the fittest only will survive the stress of competition.

Bibliography.—Royal Commission on Wheat Supplies, *First Report*, Cmd. 2462 (1921); *Second Report*, Cmd. 1544 (1925); Departmental Committee on Distribution and Prices of Agricultural Produce—*Interim Report on Cereals, Flour and Bread*, Cmd. 1971 (1923); Royal Commission on Food Prices, Cmd. 2390 (1925).

(L. F. Sh.)

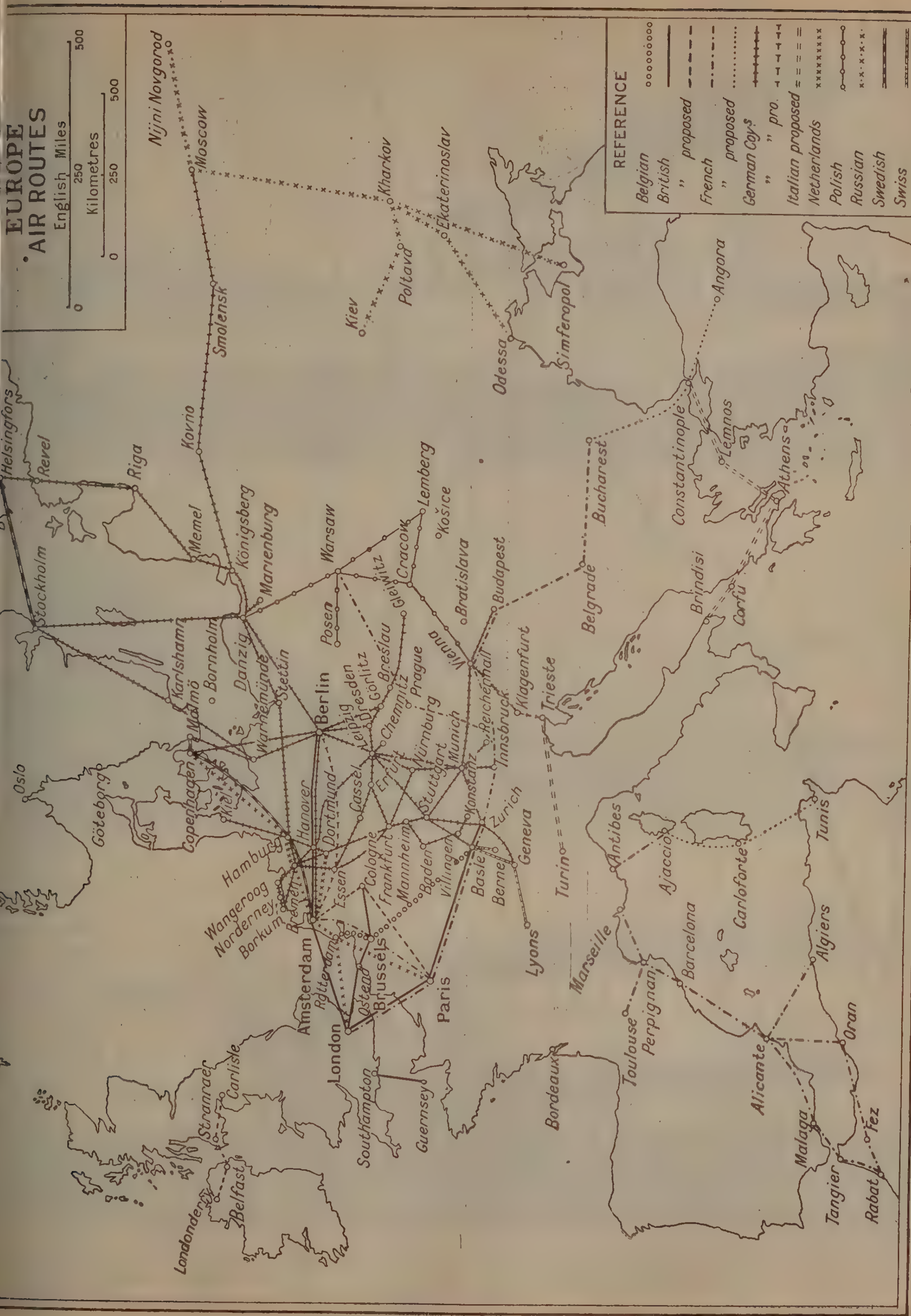
FLYING, COMMERCIAL (*see* also Aerial Navigation; Aeronautics; Aeroplane; Airship; etc.).—Commercial aviation may be said to embrace all forms of flying other than that carried out by the fighting forces and may be divided into the following categories: (1) Air transport; (2) Aerial survey; (3) General flying; (4) Flying schools; (5) Air racing.

I. AIR TRANSPORT

This section is confined to that particular branch of aeronautical activity described as air transport.

Air transport is an entirely modern innovation. Balloons were employed for the carriage of messages from Paris during the siege of 1870, a war measure for evading the besieging army which, in other circumstances, could not have claimed to be a practical method of carrying mails. Between 1909 and 1914 various demonstrations were made to prove the suitability of the aeroplane as a rapid conveyance for mail matter, and a considerable number of journeys by air were accomplished by private individuals; but none of these enterprises, though interesting and daring, could fairly be described as the real beginning of air transport.

That air transport would become a practical proposition was, however, recognised, and in 1910 a conference was held in Paris at which an International Convention in regard to aerial navigation was drafted. The credit for the first genuine commercial air service lies with Germany; from March 1912 until Nov. 1913, the rigid airships "Victoria Luise," "Hansa" and "Sachsen" plied regularly between Berlin and Friedrichs-


EUROPE
AIR ROUTES
English Miles
0
250
500
Kilometres
0
250
500
REFERENCE
Belgian
British
" proposed
French
" proposed
German Coy.s
" " pro.
Italian proposed
Netherlands
Polish
Russian
Swedish
Swiss
Nijni Novgorod
Moscow
Smolensk
Kharkov
Ekaterinoslav
Poltava
Kiev
Odessa
Simferopol
Angora
Helsingfors
Revel
Riga
Kovno
Memel
Königsberg
Marienburg
Stockholm
Warsaw
Lemberg
Košice
Cracow
Gleiwitz
Posen
Breslau
Bratislava
Budapest
Bucharest
Constantinople
Lemnos
Athens
Belgrade
Brindisi
Corfu
Karlshamn
Bornholm
Danzig
Stettin
Warnemünde
Malmö
Copenhagen
Kiel
Oslo
Göteborg
Berlin
Leipzig
Dresden
Görlitz
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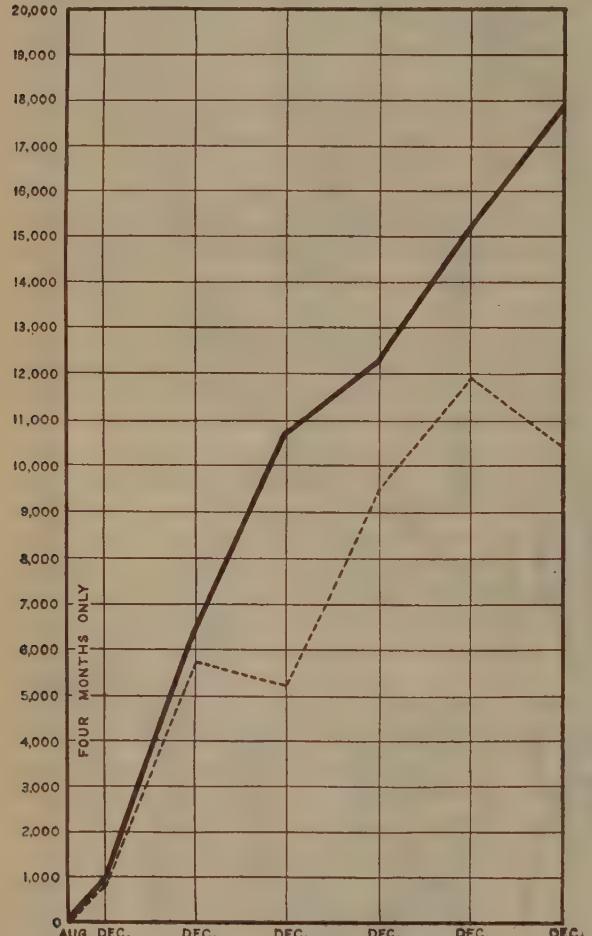
Nürnburg
Munich
Erfurt
Cassel
Stuttgart
Konstanz
Zurich
Geneva
Hanover
Dortmund
Hamburg
Bremen
Wangeroog
Norderney
Borkum
Essen
Cologne
Frankfurt
Mannheim
Baden
Villingen
Basle
Berne
Lyons
Turin
Antibes
Ajaccio
Carloforte
Tunis
Marseille
Amsterdam
Rotterdam
Ostend
Brussels
Paris
London
Southampton
Guernsey
Carlisle
Stranraer
Belfast
Londonderry
Bordeaux
Toulouse
Perpignan
Barcelona
Algiers
Alicante
Oran
Malaga
Tangier
Rabat
Fez

hafen, and in 881 flights, totalling 65,500 m., carried 19,105 passengers without injury and in considerable comfort.

HISTORY IN GREAT BRITAIN

The British Government can claim to be the first government to study the possibilities of air transport seriously. On May 22 1917 a Civil Aerial Transport Committee was appointed to advise the Air Board on the steps that should be taken for the development and regulation of aviation for civil and commercial purposes. This committee examined the possibilities of air transport from every point of view, and eventually submitted a report to the Air Council on May 11 1918.[1]



Graph showing annual air traffic on London-Continent routes. Total passengers (continuous line), and passengers carried by British aircraft (broken line).

Aeroplanes and Seaplanes.—At the conclusion of the War, the whole world began to turn its attention to the possibilities of aviation as a commercial activity. Five years of forced technical progress and intensive production had left a great heritage in aerial resources; practically every combatant nation possessed large numbers of pilots and mechanics and vast stores of surplus war aircraft. Military aircraft had been used for purely communication purposes with complete success; and the operations of war had proved clearly that flying under peace conditions should be both safe and comfortable. It was obvious that, if air transport was to accomplish even a small proportion of that which enthusiasts claimed for it, international regulations must be put into force as soon as possible, and the necessary steps were taken at the Peace Conference in Paris during 1919.

International Convention.—The Treaty of Versailles brought into being an International Convention for the Regulation o Aerial Navigation in which all the Allies participated; unde the terms of this convention a permanent commission for Ai Navigation was to be set up and placed under the direction o the League of Nations. In Great Britain, except for a brie period during Easter Week 1919, post-War civil aviation did no commence officially until May 1 1919. On Aug. 26 1919 international civil flying from Great Britain was first started unde temporary air navigation regulations.

The International Air Convention by June 1922 had been ratified by a sufficient number of signatory states to make th introduction of its regulations practicable. It was brought int force in Great Britain by the Air Navigation Order dated June 2 1922. Accordingly the first meeting of the International Commission for Air Navigation was opened in Paris on July 11 1922

The Start of the Service.—Air transport began its career unde somewhat evil auspices. On the one hand, a large body o enthusiasts claimed the certainty of immediate commercia success, and consequent financial profits; on the other, conservative scepticism pooh-poohed the idea that aeroplane could ever be a safe and economical means of transport, an cynically supported financial subsidies to the new industry England led the way in accomplishment. On Aug. 25 1919 th Aircraft Transport and Travel Co. despatched the first aircraf to fly on a regular commercial service to Paris and on Nov. 1 1919 an aeroplane belonging to the same company carried th first regularly established air mail to the same destination. Th British Handley-Page Air Transport Co. and the French Messageries Aériennes were quick to follow and by Jan. 1 1920 there were three British and two French companies operating on regular time-table across the Channel. These operations were nearly all carried out by military aircraft, or by military aircraf modified to carry passengers in some degree of comfort.

Need for State Aid.—From the first it was obvious that suc aircraft could not pay their way. It was, therefore, clear that air transport could not at once become self-supporting anc would need some financial assistance from the state, until experience was gained and aircraft specially designed for commercia purposes were produced with the aid of that experience.

The French Government had already realised the vast possibilities of air transport and a costly and ambitious polic of financial assistance was inaugurated in 1919 and has been continued until the present day. To some extent this polic was inspired by its potential political and military influence o the countries flown over, but its ultimate object was to attai rapid communication between Paris and the French Colonie in Africa and Asia.

In England, on the other hand, there was not sufficient mone allotted for even a very low standard of aerial defence, and ai transport was therefore relegated to the background as a enterprise which the nation could not afford. In fact, th British Empire had as much to gain from its developmen as any other country in the world. Consequently the pioneers, and with them the public who had supported thei new enterprises financially, walked towards inevitable ruin The general financial crisis of the autumn of 1920 brought matters to a head, and the Aircraft Transport and Travel Compan went into liquidation in Dec., whilst in Feb. 1921 the Handley Page Transport Company suspended operations, leaving th French in unchallenged occupation of the cross-Channel routes This disaster brought about a parliamentary and press agitatio which galvanised the Government into facing facts and doin something; and from March 1921 the cross-Channel servic have been subsidised in varying degrees.

Governmental Committees.—The following are the variou committees and boards which were set up by the British Government from 1917 to 1923 to consider the possibilities of ai transport and to make recommendations as to how it could bes be supported and developed:—

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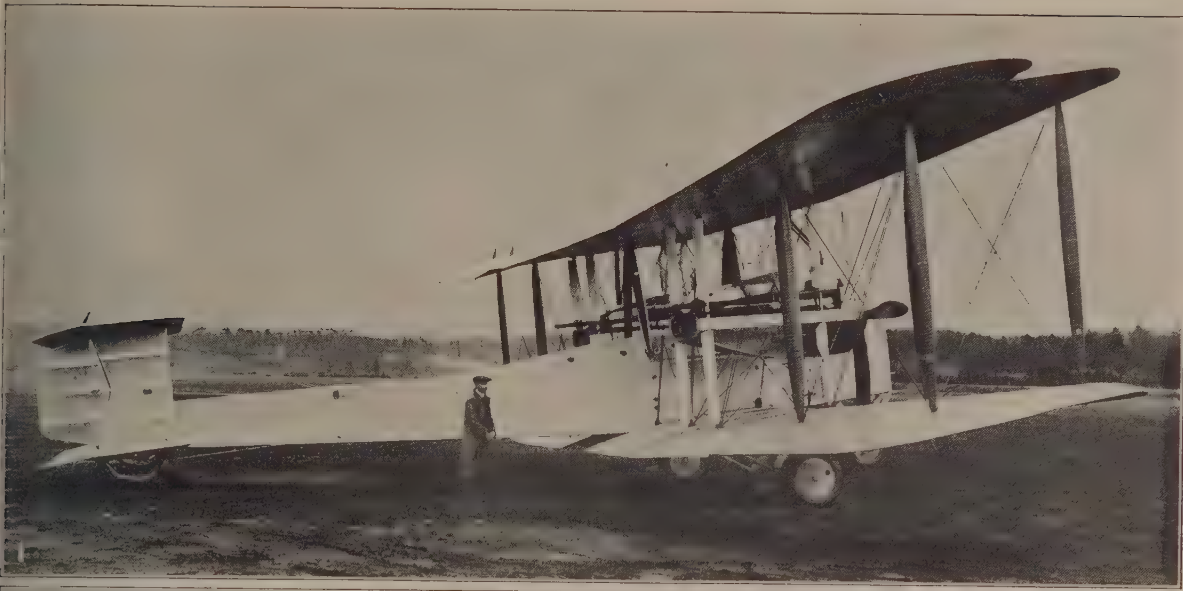
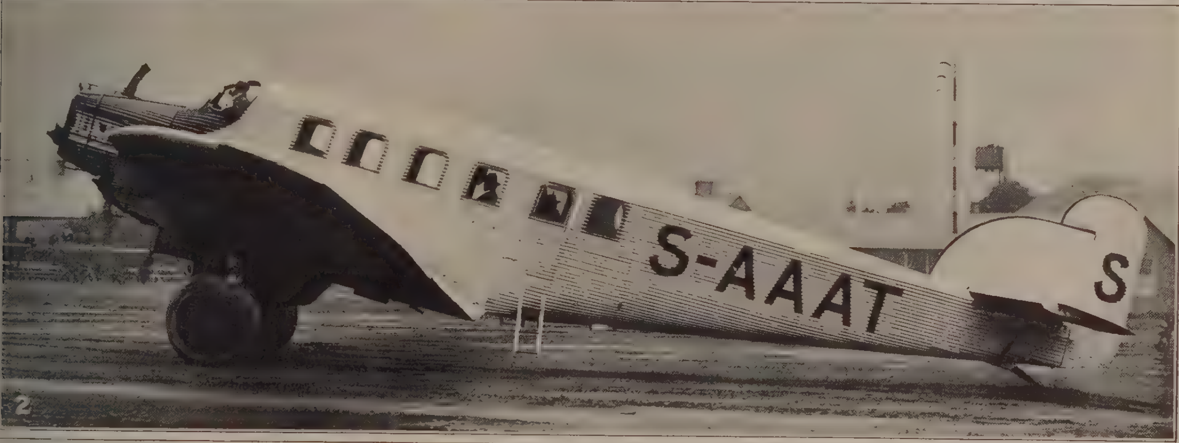
[1] *Reports of Civil Aerial Transport Committee*, pub. by H.M. S.O., Cd. 9218 (1918).





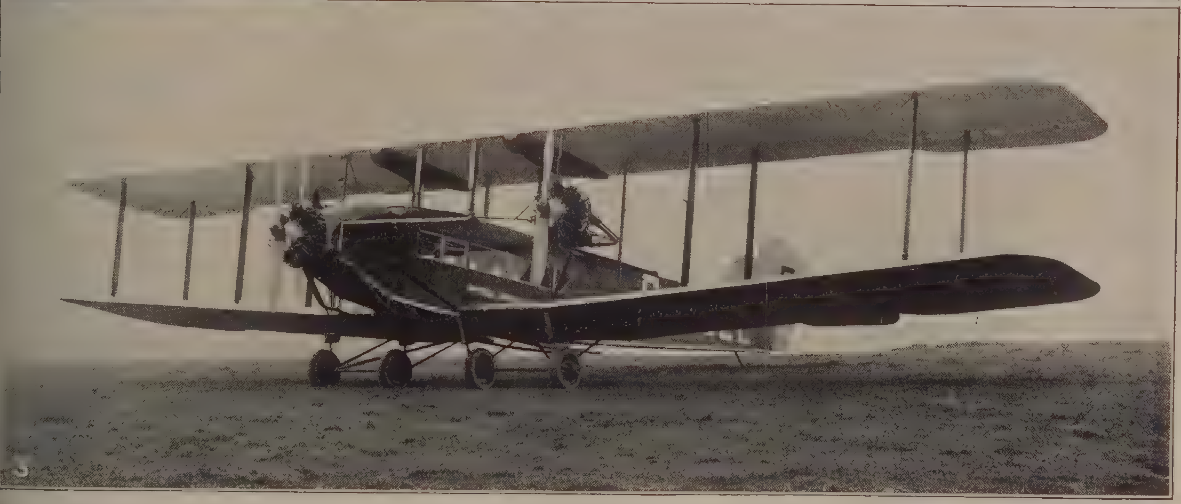


FIG. 1. Vickers-Vimy Rolls-Royce Transatlantic Biplane, which, piloted by Sir John Alcock, crossed the Atlantic in June 1919 in 16 hr. 12 min. FIG. 2. Junkers 3-engined all-metal monoplane. FIG. 3. Handley-Page "Hampstead" 3-engined commercial aeroplane.

(*Photos. Fig. 1, Science Museum, London. Fig. 2, Topical Press.*)

TABLE I.

Name of Committee	Date of Appointment	Date of Demise	Reports
vil Aerial Transport Committee	May 22 1917	Feb. 7 1918	"Reports of the Civil Aerial Transport Committee with Appendices," 1918. (Cd. 9218, price 9d.)
lvisory Committee on Civil Aviation (Weir Committee)	June 8 1919	Feb. 1922	1st Report: "Report on Imperial Air Routes," dated Oct. 30 1919 (Cd. 449, price 1d.). 2nd Report: "Report on Government Assistance for the Development of Civil Aviation," dated April 19 1920. (Cd. 770, price 2d.)
ommercial Airships Committee	May 5 1920	June 1 1920	Only Report dated June 1 1920. (Report not presented to Parliament.)
ross-Channel Subsidies Committee ("Londonderry Committee")	March 2 1921	April 1921	Only Report dated April 1921. (Report not presented to Parliament.)
onference of Prime Ministers and Representatives of the United Kingdom, the Dominions and India, held in June, July and August 1921	Conference opened June 20 1921	Conference closed Aug. 5 1921	Appendix III. to Report: "Report of the Imperial Air Communications Committee" dealing with Airships. (Cd. 1474, price 9d.)
ivil Aviation Advisory Board	Feb. 1922	July 8 1924	1st Report: "Report on Imperial Air Mail Services," dated July 25 1922. (Cd. 1739, price 1s.) 2nd Report: "Report on Aerodrome Facilities of London," dated Jan. 29 1923. (Cd. 1816, price 3d.)
ivil Air Transport Subsidies Committee ("Hambling Committee")	Jan. 2 1923	Feb. 15 1923	"Report on Government Financial Assistance to Civil Air Transport Companies," dated Feb. 15 1923. (Cd. 1811, price 6d.)
ir Mails Committee	June 1923		"Interim Report of the Air Mails Committee," dated Jan. 19 1924. (Cd. 2038, price 6d.)

From March 1921 until March 31 1922 two British com- nies continued limited operations between London and Paris der a system of government financial support which guaran- d them a 10% profit on the receipts obtained for traffic ried. Whilst this temporary and admittedly extravagant asure was in force, the Londonderry Committee put forward a w scheme which was accepted by the Government, and was in eration from April to Sept. 1922.

overnment Aid: the Londonderry Scheme.—This new scheme nprised the provision of half the fleet of each company by the vernment on a hire purchase system, and a subsidy based rtly on the load carried and partly on the gross earnings of the mpanies. Three companies, the Handley-Page Air Transport, Instone Air Line, and Daimler Airways, operated to Paris, d one company, the Instone Air Line, flew to Brussels. It s very soon found that the hire purchase scheme was im- acticable. Moreover, the traffic available between London and ris was not sufficient for five competing companies (three itish and two French), and it was obviously unsound that itish companies should be subsidised to compete against one other.

Modified Scheme.—On Oct. 1 1922, therefore, this scheme was odified on the basis of avoiding competition between British mpanies and extending British air transport into Europe as as possible with the money available. On this system the proved services in operation from this date until March 31 1924 given in table in next column.

Meanwhile, owing to the various difficulties which had arisen d the apparent wastefulness of maintaining four separate ganisations for a comparatively small volume of traffic, the mbling Committee was assembled in Jan. 1923. This mmittee definitely recommended the amalgamation of the r existing companies into a single national company with eat freedom of action. They indicated that the company must provided with a substantial capital, and be guaranteed a nopoly of subsidy for a term of years.

"*Imperial Airways" Founded.*—As a result, in March 1924, a tional company, Imperial Airways, Ltd., was brought into ing with a guarantee of a total subsidy of £1,000,000 spread er a period of 10 years, for regular flying carried out within Europe, the contract with the Government permitting liberty of action as to the services actually operated. The frequent modifications of system and changes of policy had naturally militated against serious progress, and when at length this new organisation came into being it encountered many setbacks and difficulties in its first 18 months of operation, but it now promises to bring air transport on to a definitely self-supporting basis before any other similar enterprise receiving a subsidy from its Government.

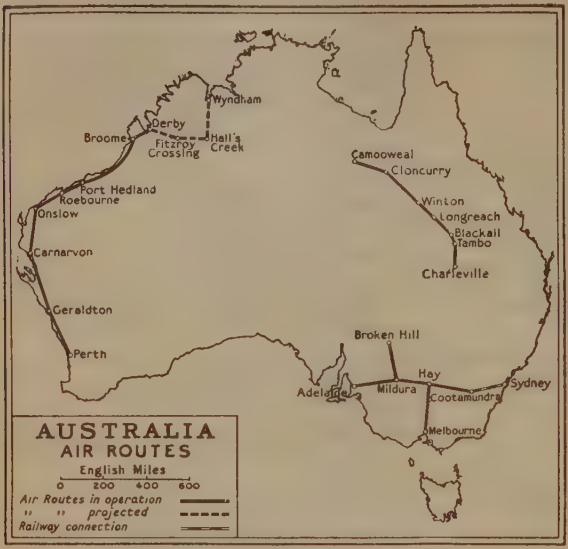
Firm	Service	Annual Minimum Services in Each Direction	Annual Minimum Total Mileage	Annual Maximum Subsidy
Handley-Page Transport, Ltd.	London, Paris	300	....	£ 15,000
Instone Air Line, Ltd.	London, Brussels, Cologne	300	....	25,000
Daimler Hire, Ltd.	Manchester, London, Amsterdam, Hamburg, Berlin	....	253,846	55,000
British Marine Air Navigation Co., Ltd.	Southampton, Cherbourg, Havre, and Channel Islands	....	60,000	10,000

History in Other Countries

In other parts of the British Empire, air transport generally made little progress, with the exception of Australia, where a good deal has been done.

Australian Development.—Australia has subsidised three important air lines—Western Australian Airways, Ltd., operating once a week from Perth to Derby (1,442 m.); Queensland and

Northern Territory Aerial Services, Ltd., Cloncurry to Camooweal; and the Larkin Aircraft Supply Co., Ltd., Adelaide to Cootamundra, with two branches, one from Mildura to Broken Hill and one from Hay to Melbourne.


Wyndham
Derby
Broome
Fitzroy Crossing
Hall's Creek
Port Hedland
Roebourne
Onslow
Carnarvon
Geraldton
Perth
Camooweal
Cloncurry
Winton
Longreach
Blackall
Tambo
Charleville
Broken Hill
Hay
Adelaide
Mildura
Cootamundra
Sydney
Melbourne
AUSTRALIA
AIR ROUTES
English Miles
0 200 400 600
Air Routes in operation
" " projected
Railway connection

German Activity.—Germany had entered the lists as soon as the conditions of peace permitted her and, to encourage private enterprise, offered a simple subsidy on a kilometric basis. As a result there are to-day two substantial German air transport companies—the Deutscher Aero Lloyd A.G. and the Junkers Luftverkehr A.G. in operation. The former is supported by some of the leading banks and shipping companies and utilises various types of aircraft. The latter is the property of the great Junkers engineering firm and is equipped entirely with all-metal Junkers aircraft.

The Junkers Co. has created a world-wide reputation by means of a comprehensive scheme of standardisation in manufacture. Endeavours have been made to establish subsidiary companies in various countries in Europe and in other parts of the world, over which control has been obtained by the provision of the initial fleet in exchange for shares. A scheme for the economical overhaul of all these aircraft at a flat rate at the Junkers works has also been evolved. Junkers companies exist in Switzerland, Denmark, Sweden, Austria, Hungary, Finland, Estonia, Latvia, Russia, Trans-Caucasia, Colombia and Argentina, in addition to which Junkers have created numerous subsidiary companies within Germany itself. This bold scheme is almost identical with that on which the British Air Transport and Travel Co. was embarking when it came to an untimely end through lack of Government support in 1920. Its progress has been remarkable, but its eventual success must depend on the power of the Junkers Co. to bear the heavy capital charges involved in the provision and maintenance of these fleets until such time as the subsidiary companies' shares attain a serious financial value.

French Progress.—France meanwhile has put her house in order and now has three main companies operating in different zones:—

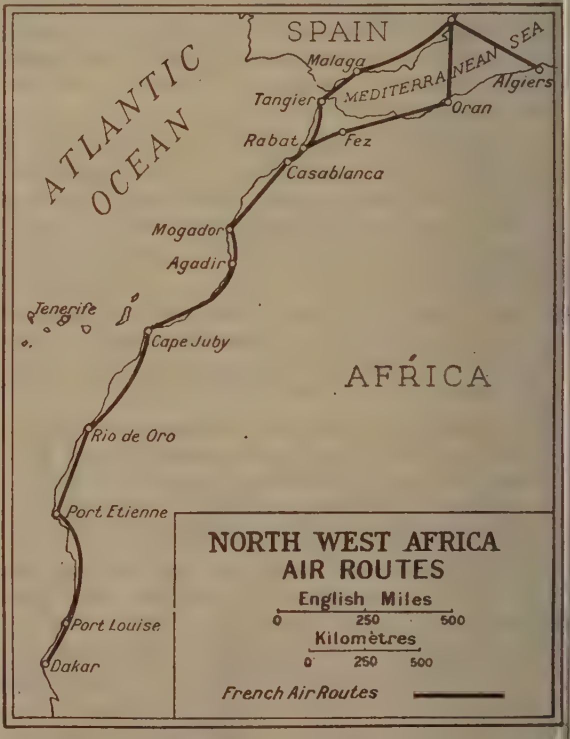
Air Union, Paris–London.
Compagnie Internationale de Navigation Aérienne (late Franco-Roumaine), Paris–Constantinople.
Compagnie Générale d'Entreprises Aéronautiques (late Latécoère), Toulouse–Dakar.

All these companies are generously subsidised by the French Govt. and in addition Czechoslovakia, Yugoslavia and Rumania give financial support to the C.I.D.N.A., whilst the C.G.E.A. is assisted by French Morocco.

American Policy.—America did not participate in the International Commission for Air Navigation and has adopted an entirely different line of policy from the European nations. S refused all assistance to private enterprise and even neglect to bring any form of air navigation regulations into force. the same time, she started and operated a most efficient b somewhat extravagant air mail service between New York a San Francisco. This service was equipped with old war aircra of British design and Liberty engines, and was administered the Post Office. Its operations were remarkable for their ef ciency and regularity, and in 1924 the first regular night flyi service in the world was carried out on the central sectio between Chicago and Cheyenne.

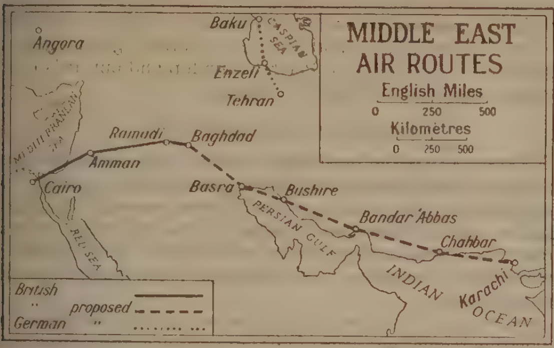
In 1925 America opened negotiations with a view to handi over the mail route to private enterprise, and is endeavouring persuade private operating companies to undertake mail servic on the other routes on a letter surcharge basis. Air Navigati Regulations have also been finally approved and prepared f promulgation. During the above period other nations we coming into the field of air transport.

Air Transportation in other Countries.—The Dutch created subsidised company called the Koninklijke Luchtvaart Maa schappij voor Nederland en Kolonien towards the end of 19 which has operated to London and Paris with great efficienc equipped with Fokker aircraft and British engines. Belgium h organised a national company called the Société Anonym Belge pour l'Exploitation de la Navigation Aérienne. Europe it operates during the summer between Brussels a Basel, and in Africa it has established a very successful service the Belgian Congo from near Leopoldville to Luebo and Eli abethville. Spain, Sweden, Poland, Switzerland, Denmar Austria, Hungary, Finland, Estonia, Latvia, Norway a Russia have all established air transport companies and p them into operation. Czechoslovakia, Italy and Yugoslav have companies which in 1926 were about to commence operatio on a fairly extensive scale.


SPAIN
MEDITERRANEAN SEA
Malaga
Algiers
Tangier
Oran
Rabat
Fez
Casablanca
ATLANTIC OCEAN
Mogador
Agadir
Tenerife
Cape Juby
AFRICA
Rio de Oro
Port Etienne
Port Louise
Dakar
NORTH WEST AFRICA
AIR ROUTES
English Miles
0 250 500
Kilometres
0 250 500
French Air Routes

Air Service to India.—The British Govt. is at prese establishing an air service operating aeroplanes between Cai and Karachi. The section between Cairo and Baghdad has alrea been flown once a fortnight by military aircraft belonging to t Royal Air Force for the carriage of mails and official passenge t is now proposed to hand this section over to Imperial Airways nd to extend it to Karachi via Basra and the coast of the ersian Gulf.

The preliminary reconnaissance of the route has been carried ut and the necessary arrangements made with the governments f Egypt, Palestine, 'Iraq, Persia and India. A contract involving he payment of a subsidy for five years has been signed, a lump um being given for each completed stage between Cairo and Basra and between Basra and Karachi. It is probable that this ervice will commence operations in Nov. 1926 with aircraft f the latest type equipped with three air-cooled engines.



Construction, Cost and Service

During the years that elapsed between 1918–26 many lessons were learned and certain facts established.

Safety.—First, it has been proved that air transport when roperly administered and operated is a safe means of travel.

In the British air service between May 1919 and March 1925 here were six fatal accidents, only four of which involved the eath of passengers, for 3,698,000 m. flown, the equivalent of 48 times round the equator. In Australia there was only one atal accident[1] and 570,000 m. were flown between the starting of perations in Dec. 1921 and the end of 1924.

Reliability.—A very high standard of efficiency has been eached and a standard of as much as 97% and 98% regularity n flying to a published time-table is claimed for certain air lines perating during summer weather. Three quarters of the ailures to maintain perfect regularity are due to weather and ailure of power-plant, 66% being due to weather and 34% to mechanical defects throughout the year. This high standard of regularity and safety in British air transport was obtained very largely through the skill and determination of the pilots; and throughout Europe it may be said that good piloting has usually been the greatest factor in any success obtained. Thus it can be claimed that by the end of 1925 much valuable experience had been gained, and a very creditable standard of security and regularity had been attained; this standard was certainly as high as could be expected with the equipment available.

Economy.—On the other hand, although some progress was made during these six years towards economical operation, air transport is still far from arriving at a point at which it can be counted on to operate commercially without artificial financial assistance.

Cost of Operating.—There are two main reasons for the high cost of air transport as compared to other means of locomotion. First, an aeroplane expends a considerable proportion of its horse-power in climbing into the air and on maintaining itself at a safe height without regard to forward speed; in all other forms of transport the vehicle can remain at a fixed level on or in its particular element without expenditure of power. Secondly, in order to obtain as great a disposable load as possible for any given horse-power, the structure of both engine and aircraft must be extremely light. Consequently the air transport vehicle is costly to construct, and through its comparative fragility involves a high rate of maintenance. The cost of operation per hour depends to a great extent on the horse-power employed; thus every endeavour is being made, not only to increase the total weight per horse-power carried, but also to ensure that the greatest possible proportion of this total load is devoted to disposable load at the expense of structural weight. Progress in this direction, however, has received certain setbacks by the proved necessity of carrying extra instruments, safety devices, heating and ventilating apparatus, etc.

As indicated above, a considerable measure of reliability and safety has already been attained, and steady progress is being made towards increasing this standard to a basis of equality with other forms of transport.[2] The problem of reducing the operating cost to really commercial rates is more difficult, and represents the most important question before the designers of commercial aircraft to-day. Progress is being made on broadly two main lines, the reduction of maintenance costs, and the increase of paying load per horse-power. Air-cooled engines are just coming into use; all-metal construction is beginning to replace wood and fabric; and a robust engine burning crude oil is promised in the near future. Each and all these innovations will appreciably reduce the cost of operation.

Design, Cost and Carrying Capacity.—England leads the way in the development of air-cooled engines and Germany in metal construction. On the other line, various mechanical developments are being applied to increase the disposable load without adding to the weight and size of the aircraft itself. The greatest load which an aircraft can carry is that with which it can take off and land safely. Once at a safe height in the air, the normal aircraft has plenty of lifting power in hand. The planes are being fitted with adjustable slots and flaps which permit of a greater load being lifted from the ground in safety, and which lower the landing speed of heavily loaded aircraft which otherwise might be dangerous. Considerable increase in horse-power is being obtained without serious additional weight by means of various systems of supercharging and "boosting" aircraft engines. Variable-pitch propellers are just emerging from the experimental stage, by the use of which much more efficient application of the horse-power available will be attained. The newly invented de la Cierva autogiro promises to be a very valuable factor in progress towards carrying greater loads.

Data regarding costs per ton-mile are not at present available from foreign nations, and in England, owing to constant changes of policy and administration, it is difficult to obtain reliable figures. It is claimed, however, that with existing aircraft it is possible to operate at a speed of 85 m. an hour at 5s. a ton-mile, of which 3s. a ton-mile represent operating costs and 2s. overhead charges, including maintenance and depreciation.

By means of various steps in technical progress, including those mentioned above, it should be possible to reduce these costs to less than 1s. a ton-mile for operating costs, and as safety and reliability are enhanced, traffic will increase and overhead charges will drop to a rate which may also be estimated at 1s. a ton-mile. With a total cost of 2s. a ton-mile, air transport should be able to pay its way on many lines of communication between the great centres of the world's commercial activity.

Summary of Conclusions.—To sum up it may be stated that by the end of 1925 air transport operated by means of aeroplanes and seaplanes has proved to be safe, and under European summer conditions very reliable. This new means of communication cannot function, however, without artificial financial assistance. Great progress is being made towards evolving aircraft which will be able to earn their costs of operation. As the receipts for traffic approximate more and more to the expense of flying, air transport activities will rapidly increase; and when air transport with aeroplanes and seaplanes eventually reaches a paying basis, it must inevitably become one of the most important means of communication between the various parts of the world.

Airships.—Since the early Zeppelin enterprise in Germany during 1912 and 1913, no regular commercial airship service has been put into operation, with the exception of the experimental service with the "Bodensee" run by the Zeppelin Company from Aug. to Dec. 1919. Germany, the chief user and most experienced designer of rigid airships, lost practically the whole of her airship organisation under the terms of the Treaty of Versailles; the ships which were handed over by her to the Allies were not suited for commercial work; England and France had not the necessary faith in the future of airships to justify the expenditure necessary for their further development; and it was only in America that progress was continued. This general stagnation was further justified in the minds of unbelievers by the disasters which overtook the British ship R38 in Aug. 1921 and the French "Dixmude" in Dec. 1923. The finest performance by an airship since 1918 was the flight of the British-built ship R34 from England to New York and back during the summer of 1919. (Left England July 2 1919, arrived America July 6 1919: 108 hours. Left America July 10 1919, arrived England July 13 1919: 75 hours).

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[1] At inaugural flight of Western Airways' operations.

[2] Lee, "The Lessons of Six Years' Experience in Air Transport" in *Jour. of the Royal Aeronautical Society,* No. 179, vol. 29 (Nov. 1925).

Airship Service.—Although America led the way by the construction of the "Shenandoah" and the demand that the ZR3, later the "Los Angeles," should be built in Germany as part of her war reparation, it was England that made the first serious step towards establishing a genuine commercial airship service.

This policy was initiated during 1923. After much discussion, towards the end of 1924 the construction of two large airships was put in hand, one to be built by Government and the other by private enterprise. In the design of these airships the orthodox type of Zeppelin girder has been departed from, and many improvements, the result of practical scientific research, will be incorporated in the structure. In connection with this scheme the existing airship station at Cardington near Bedford is being enlarged and a terminal airship station is being erected in India at Karachi. A temporary refuelling station has been established at Ismailia on the Suez Canal. The contract for the privately built ship includes a satisfactory flight to India along this route.

The following data are given to indicate the progress in rigid airship construction attained during the last few years:—

	Description	Horse-power	Speed m.p.h.	Extreme radius at this speed (without paying load)	Disposable load
				Miles	Tons
R34	Old British ship built in England during the War . .	1,250	Max. 63·5 = Cruising 45 =	3,286 4,905	26·55
ZR3	Zeppelin ship built in Germany for U.S.A. . . .	2,000	Max. 79 = Cruising 68 =	5,490 7,937	46
R101	Ship under construction by British Govt.	3,500	Max. 78 = Cruising 65 =	7,900 13,000	85

Use of Helium.—America has introduced helium gas to replace hydrogen as a lifting agent. Helium (*q.v.*) has the advantage over hydrogen that it is totally non-inflammable, but its production is extremely costly, and its lifting power 15% less than that of hydrogen, which facts will prove a very serious handicap in the commercial development of the airship in America, if this policy is continued. In England, it is the intention to fit crude oil engines to the big ships and so eliminate the element of danger incurred by carrying petrol. No dependable data exist from which the cost of operating an airship can be estimated, but there is little doubt that if the constructional and handling difficulties which have been connected with airships up to date can be overcome, the operating cost per ton-mile will be very much less than in heavier-than-air craft, although the initial capital cost involved is very much greater. The possibilities of the airship as a means of communication over long distances and across the great oceans are therefore enormous.

Co-operation with Aeroplanes.—It seems certain that in the future airships and aeroplanes will work in co-operation. As existing schemes develop, traffic for 'Iraq will reach Egypt by airship and proceed thence by aeroplane to Baghdad; for India, to Colombo by airship and thence to various great cities by aeroplane; for Australia, to Perth by airship and onwards to the northern and eastern cities by aeroplane.

INTERNATIONAL AGREEMENTS

Air transport is the most truly international of the transport industries; international laws and regulations are necessary for the operation of ships at sea and of trains across great continents. But the scope of these two activities is strictly limited, whereas aircraft can penetrate anywhere and fly over the territories of several different nations in a journey of a few hours' duration (*see* AERIAL LAW).

It has always been evident, therefore, that international air navigation regulations were of vital importance, and during 1922, on ratification of the International Air Convention, to which reference has already been made, the International Commission for Air Navigation (known as the I.C.A.N. in England and as the C.I.N.A. on the continent of Europe) came into being. The following states are parties to the convention and send representatives to this Commission:—

1. Belgium.
2. Great Britain and Northern Ireland.
3. Canada.
4. Australia.
5. Union of South Africa.
6. New Zealand.
7. Irish Free State.
8. India.
9. Bulgaria.
10. Chile.
11. France.
12. Greece.
13. Italy.
14. Japan.
15. Persia.
16. Poland.
17. Portugal.
18. Rumania.
19. Kingdom of the Serbs, Croats and Slovenes.
20. Siam.
21. Czechoslovakia.
22. Uruguay.

The general principles laid down by the Convention are as follows:—

1. Innocent passage of commercial aircraft of the members over the territories of all.
2. Designation of customs aerodromes at suitable points at which aircraft must land.
3. Issue of licences to all members of the crew and airworthy certificates to all aircraft engaged in international commerce. The forms of these licences and certificates and the qualifications and tests to be demanded have been agreed by the Commission.
4. The establishment of a wireless and meteorological organisation and a lighting system along air routes authorised by the nation over whose territory they lie.

The full Commission now meets twice every year, the place of meeting being decided on the invitation of one of the Governments represented. Meetings have taken place, so far, during 1922 in Paris and London; during 1923 in Brussels, London and Rome; during 1924 two meetings in Paris, and during 1925 in London and Brussels. The Commission has appointed standing subcommissions for the detailed study of operational, technical, medical and legal problems, and these meet as convenient at various dates between the meetings of the full Commission. Most European nations who are not members of the International Commission have drawn up regulations of their own, approximating to those of the International Commission, and many of them have entered into agreements of various classes and duration with one another and with members of the International Commission in order to facilitate the operation of international air transport.

Since its creation the Commission has taken steps to modify two articles of the Convention which were unacceptable to certain ex-neutral and ex-enemy countries. These modifications will come into force in the near future on the completion of ratification, when it is likely that several other European nations will join the Convention. As already stated, America, hough a signatory to the Convention originally, has never posited her ratification and is considering Federal legislation the administration of inter-state air transport.

Each country through its national legislature gives effect to International Air Convention and to the decisions of the ternational Commission. In Great Britain this is done by the Navigation Act, 1920, and by the air navigation orders and navigation directions issued by the authorities from time to ne thereunder.

II. AERIAL SURVEYS

Aerial survey came into existence during the World War. ie necessity of photographing trench-lines and hostile positions came more and more vital as operations progressed, and by 18, military aerial photography had reached a high pitch efficiency. It was only in a few cases, however, that it was cessary to employ aerial photography as a means of measuring stances on the ground; as a rule, comparatively accurate maps re available, and the photographs were required for filling in tails of natural features, buildings, roads, etc., and for dis- osing the dispositions of the enemy.

At the end of the War, it was clear that aerial photography ust provide a very valuable aid to ordinary survey, and from at date onwards aerial survey has been very successfully veloped in various parts of the world.

Aerial Survey Problems.—The greatest problems of aerial rvey activities are:—

1. To correct for the errors which must obviously result from otographing tracts of country in which considerably different ight levels exist.
2. To ensure that photographs are taken with the camera axis as ar as possible vertical and to correct the results of deviations from is ideal.
3. To fly straight and level and at a constant height so as to ensure gular overlap of all negatives obtained, and as near as may be a nstant scale.
4. To reduce operation costs to a standard at which aerial survey n compete financially with other forms of survey.

Canadian Progress.—Canada has been the pioneer of this new dustry. Her vast and comparatively flat northern regions fered an ideal field for the young enterprise to prove its com- ercial value. Operations have for the most part been carried t by flying boats working from the numerous lakes and water- ys which intersect large expanses of unsurveyed and unex- oited forest land.

Two systems have been employed; vertical photography aided certain points previously fixed by triangulation; and oblique otography along a line already traversed by means of ground rvey.

Combined with aerial survey, a system of forest fire patrol has en established. During the forest fire seasons, constant air trols are maintained over important areas, and all fires ported by wireless to fire-fighting stations; in some cases, the e-fighting parties and apparatus are actually carried to the e of the fire in aircraft. Enormous tracts of timber have been ved by this means. In 1923, it was calculated that 2,120,000 res of forest were destroyed in Ontario; in 1924 the total struction was reduced to 140,000 acres, and the saving in bour totalled 50,000 man-days. The *United States* has followed nada in aerial survey progress. Her operations have included surveys, coast-line and river surveys, the alignment of new ads and railways, and municipal surveys and town planning.

France and Germany.—In France, a new law demanding curate plans of all fair-sized municipalities has led to much tivity in the survey of towns. In Germany, forest survey has en carried out extensively and successfully, and great progress s been made in solving the scientific problems connected with ereoscopic plotting and the aerial photography of mountain icts.

English Experience.—In England, owing to the fact that very curate surveys everywhere exist, operations have been con- ed to experimental work and research, together with a great al of commercial photography of estates, factories, etc. British aerial survey expeditions have, however, carried out most successful work in British Guiana, Burma and Borneo. Experience has enabled fairly reliable estimates of cost to be prepared, and it seems certain that complete and accurate aerial photographs of any normal area can be produced for from £3 to £10 a square mile, depending on the position and extent of the area to be surveyed. Triangulation on the ground is necessary for both air and ground surveys, but this price compares very favourably with any other method of filling in the topography of all except the most open type of country, while at the same time it gives considerably greater details with all necessary accuracy. It is likely that aerial survey operations will develop rapidly in the near future. One of the difficulties of the operator at present is that a single aeroplane can cover large areas so quickly that it is almost impossible to find employment for an aerial survey unit throughout the year, and so be able to distribute overhead charges over a really large area of operations.

III. GENERAL FLYING

Immediately after the World War, a large number of very cheap aircraft were thrown on the market. In several countries, but particularly in Great Britain and America, demobilised pilots purchased one or two aeroplanes and set out to make their living by giving the general public short flights in the neighbourhood of their landing place. The following figures show the measure of this activity in Great Britain:—

	Flights	Passengers		Flights	Passengers
1919–20	37,067	66,785	1922–3	13,578	25,253
1920– 1	23,513	36,694	1923–4	22,842	39,227
1921– 2	21,767	36,048	1924–5	23,519	43,766

This purely local flying was in some cases extended to the maintenance of aircraft plying for hire to carry passengers at a mileage rate to any required destination. The demand for this useful activity has proved small in England, but is likely to increase as operational costs are reduced. Joy-riding has served a useful purpose both in England and America in educating the public as to the possibilities of aviation.

In England an original use for aviation was devised in the introduction of sky-writing. A British company was formed shortly after the War and proceeded to advertise various commodities by means of writing their titles with smoke at a height of about 12,000 ft. in the air. This British company also obtained a large contract for advertising in the United States during 1922 and 1923.

IV. CIVIL FLYING SCHOOLS

Owing to the heavy cost involved, flying instruction to the general public has been very limited. In most of the greater countries, however, civil flying schools exist which depend largely on government assistance for their existence. In England there are five civil flying schools which undertake the annual training of officers. At these schools a private individual can obtain a very good grounding in the art of flying for about £100.

In France there are 11 civil flying training schools at Buc, Le Crotoy, Mourmelun, Orly, Angers, Nîmes, Orléans, Bordeaux Lyon, Clermont-Ferrand, Châlon-sur-Seine.

Pilots are trained for military purposes in these schools and it is from those who have had that military training that the civil aviation companies draw for their pilots.

In Germany there are three types of schools where the training of civil pilots is carried out:—

(1) Schools conducted by aircraft constructors; (2) schools conducted as an independent enterprise; (3) schools conducted by associations. In addition, there is an organisation known as the " Sportsflug " which has started six of its own schools.

In England a movement has just been started which will also give the private individual an opportunity of learning to fly. Private flying clubs have been formed which charge entrance fees and annual subscriptions to all members; at these clubs tuition on small aeroplanes can be obtained at low rates. The Government has guaranteed a certain measure of financial assistance to five of these clubs.

V. AIR RACING

The first form of air racing to come into being consisted of competitions between free balloons, the prize being given to the balloon which eventually landed at the greatest distance from the starting point.

The first recorded race of this class was the Grand Prix which took place in France in 1905. In 1906 the Gordon Bennett Challenge Cup was instituted and has been competed for ever since, with the following results:—

GORDON BENNETT BALLOON CUP WINNERS

PARIS—1906. Sept. 30—Oct. 1 1906.—*America*, Frank S. Lahm. Balloon, "United States" (2,080 cm.). Paris—Fylingdales, Yorkshire. Distance, 647·098 km. Duration, 22 hr. 5 minutes.

ST. LOUIS, U.S.A.—1907. Oct. 21–23 1907.—*Germany*, Oscar Erbsloh. Balloon, "Pommern" (2,200 cm.). St. Louis—Bradley Beach, New Jersey. Distance, 1,403·559 km. Duration, 40 hours.

BERLIN—1908. Oct. 11–14 1908.—*Switzerland.* Col. Schaeck. Balloon, "Helvetia" (2,200 cm.). Berlin—Bergest, nr. Bud. Norway. Distance, 1,212 km. Duration, 73 hours.

ZURICH—1909. Oct. 3–4 1909.—*America*, E. W. Mix. Balloon, "America II." Zurich—Ostrolenka, Poland. Distance, 1,121·110 km. Duration, 35 hours.

ST. LOUIS—1910. Oct. 17–19 1910.—*America*, Alan R. Hawley. Balloon "America II." St. Louis—Peribonka River, nr. Chicoutimi, Quebec, Canada. Distance, 1,884 km. Duration, 44 hr. 25 minutes.

KANSAS CITY, U.S.A.—1911. Oct. 9 1911.—*Germany*, Lieut. Hans Gericke. Balloon, "Berlin II." (2,200 cm.). Kansas City—Halcombe, Wis. Distance, 758 km. Duration, 12 hr. 28 minutes.

STUTTGART—1912. Oct. 27–29 1912.—*France*, Maurice Bienaime. Balloon, "Picardie" (2,200 cm.). Stuttgart—Riga. Distance, 2,191 km. Duration, 46 hours.

PARIS—1913. Oct. 12–14 1913.—*America*, Ralph H. Upson, Balloon, "Goodyear" (2,200 cm.). Paris—Bempton, nr. Bridlington. Distance, 618 km. Duration, 43 hr. 10 minutes.

1914 to 1919, inclusive—No contest.

BIRMINGHAM, U.S.A.—1920. Oct. 23 1920.—*Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Birmingham—North Hero Island, Vermont, U.S.A. Distance, 1,760 km. Duration, 40 hr. 15 minutes.

BRUSSELS—1921. Sept. 18–19 1921.—*Switzerland*, Capt. Paul Armbruster. Balloon, "Zurich" (2,200 cm.). Brussels—Lambay Island, Ireland. Distance, 766 km. Duration, 27 hr. 23 minutes.

GENEVA—1922. Aug. 6–7 1922.—*Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Brussels—Skollersta., Sweden. Distance, 1,115 km. Duration, 21 hours.

BRUSSELS—1924. June 15–17 1924. *Belgium*, Ernest Demuyter. Balloon, "Belgica" (2,200 cm.). Brussels—St. Abbs Head, Berwickshire. Distance, 714 km. Duration, 43 hr. 16 minutes.

Won outright by Belgium; replaced by *second* Gordon Bennett Balloon Cup.

SECOND GORDON BENNETT BALLOON CUP

BRUSSELS—1925. June 7–9 1925.—*Belgium*, A. Veenstra. Balloon, "Prince Leopold." Brussels—Cap Torrina, Spain. Distance, 1,345 km. (840 m.). Duration, 47 hr. 30 minutes.

In 1905, the French Aero Club founded the Fédération Aéronautique Internationale to control all international sporting aviation. This body has laid down and published a code of rules for air racing. The aero club of each country appoints delegates to the Fédération, which meets once a year, discusses modifications to the regulations, decides on conditions for current international competitions and investigates and ratifies claims for world's records.

The first aeroplane races ever held took place at an international meeting at Reims in Aug. 1909. At this meeting an international challenge cup for speed was presented by Mr. Gordon Bennett to be won outright by the country which was victorious three times running. Below are given the principal international competitions for aeroplanes and seaplanes with the results up to date:—

GORDON BENNETT AVIATION CUP

(Speed Contest)

REIMS—1909.—*America* (Representative, G. H. Curtiss). Distance 20 km. (12·4 m.). Time, 15 min. 50⅗ sec. Curtiss biplane, 30 H.P. Curtiss engine.

BELMONT PARK, NEW YORK—1910.—*United Kingdom* (Representative, C. Grahame-White). Distance 100 km. (62·1 m.). Time, 1 hr. 1 min. 4·74 sec. Bleriot monoplane, 50 H.P. Gnome engine.

EASTCHURCH, SHEPPEY, ENGLAND—1911.—*America* (Representative C. T. Weyman). Distance, 150 km. (94 m.). Time, 1 hr. 1 min. 36⅕ sec. Nieuport monoplane, 100 H.P. Gnome engine.

CHICAGO, U.S.A.—1912.—*France* (Representative, J. Vedrines) Distance, 200 km. (124·8 m.). Time, 1 hr. 10 min. 56 sec. Deperdussin monoplane, 140 H.P. Gnome engine.

REIMS—1913.—*France* (Representative M. Prevost). Distance 200 km. (124·8 m.). Time, 59 min. 45 sec. Deperdussin monopla 160 H.P. Gnome engine.

1914 to 1919, inclusive—No contest.

ÉTAMPES—1920.—*France* (Representative, Sadi Lecointe). Distance, 300 km. (186·5 m.). Time, 1 hr. 6 min. 17⅕ sec. Nieupor biplane, 300 H.P. Hispano-Suiza engine.

Won outright by France; replaced by Deutsch de la Meurthe Cup

HENRY DEUTSCH DE LA MEURTHE CUP

(To be won outright after two victories running)

1921—*France.*—Société Nieuport-Astra. Pilot: Georges Kirsch Villesauvage, Oct. 1 1921. Nieuport-Delage, 300 H.P. Hispano Suiza engine. Distance, 300 km. Time, 1 hr. 11 min. 39⅕ seconds.

1922—*France.*—Société Nieuport-Astra. Pilot: Fernand Lasne Villesauvage. Sept. 30 1922. Nieuport-Delage, 300 H.P. Hispano Suiza engine. Distance, 300 km. Time, 1 hr. 2 min. 11⅘ seconds.

Won outright by France; replaced by Beaumont Cup.

BEAUMONT CUP

(To be won outright by two victories running)

1923—No contest.

1924—*Istres.* June 22 1924.—Sadi Lacointe. Nieuport-Delag monoplane, 450 H.P. Hispano-Suiza engine. Distance, 300 km Time, 57 min. 50 sec. Speed, 311 km. (193·2 m.) per hour.

1925—*Istres.* Oct. 18 1925.—Sadi Lacointe. Nieuport-Delag monoplane, 600 H.P. Hispano-Suiza engine. Distance, 300 km Time, 57 min. 36⅖ sec. Speed, 312·5 km. (194 m.) per hour.

Won outright by France.

PULITZER TROPHY

(Speed Contest)

1920—*Mineola, Long Island.* Nov. 25 1920.—Lieut. C. C. Mosley U.S. Army. Verville machine, 600 H.P. Packard engine, Course 132 m. Time, 44 min. 29·57 seconds.

1921—*Omaha.* Nov. 3 1921.—N. Acosta, Curtiss Navy biplane 400 H.P. Curtiss C.D. 12 engine. Speed, 176·7 m. per hour.

1922—*Detroit.* Oct. 14 1922.—Lieut. R. L. Maugham, U.S. Army Army Curtiss Racer, 375 H.P. Curtiss D. 12 engine. Triangular course of 160 m. Speed, 206 m. per hour.

1923—*St. Louis.* Oct. 6 1923.—Lieut. J. A. Williams, U.S. Navy Curtiss R.2.C.1, 460 H.P. Curtiss D. 12 engine. Course, 124·28 m Time, 30 min. 36 sec. Speed, 243·67 m. per hour.

1924—*Dayton, Ohio.* Oct. 4 1924.—Lieut. H. H. Mills, U.S Army. Verville-Sperry cantilever monoplane, 500 H.P. Curtiss D 12 A. engine. Course, 124·7 m. Speed, 215·72 m. per hour.

1925—*Mitchel Field, Long Island.* Oct. 12 1925. Lieut. Cyrus Bettis, U.S. Army Air Service. Army Curtiss Racer, 619 H.P Curtiss V. 1,400 engine. Course, 124·27 m. (200 km.). Time, 2 min. 56·9 sec. Speed, 248·99 m. per hour.

THE JACQUES SCHNEIDER MARITIME CUP

(List of Winners)

Monaco, 1913.—M. Prevost (France) on a Deperdussin float seaplane, 160 H.P. Gnome. 150 nautical m. in 3 hr. 48 min. 22 sec (45·25 land m. per hour).

Monaco, 1914.—Mr. Howard Pixton (Great Britain) on Sopwith float seaplane, 100 H.P. Monosoupape Gnome. 150 nautical m. in 2 hr. 0 min. 16 sec. (86 land m. per hour).

1915 to 1918, inclusive.—No contest.

Bournemouth, 1919.—Race annulled because, owing to fog, no competitor covered the correct course; but as the Italian aviator Signor Janello, on a Savoia flying boat came nearest to covering the correct course, the competition was held the following year in Italy.

Venice, 1920.—Signor Luigi Bologna (Italy) on a Savoia S. 19 flying boat with 550 H.P. Ansaldo engine. 202 nautical m. in 2 hr. 10 min. 35 sec. (106·7 land m. per hour).

No English machines competed.

Venice, 1921.—Signor Giovanni de Briganti (Italy) on a Macchi 7 flying boat with 260 H.P. Isotta-Fraschini engine. 200 nautical m. in 2 hr. 4 min. 29 sec. (110·9 land m. per hour).

Naples, 1922.—Mr. H. C. Biard (Great Britain) on Supermarine Sea Lion flying boat with 450 Napier Lion engine. 200·2 nautical m. in 1 hr. 34 min. 51⅘ sec. (145·7 land m. per hour).

Cowes, 1923.—Lieut. David Rittenhouse (U.S. Navy) on Curtiss float seaplane C.R.3 with 465 H.P. Curtiss D.R.A. engine. 186 nautical m. in 1 hr. 12 min. 24⅘ sec. (177·38 land m. per hour).

1924.—British and Italian machines entered for the competition which should have been held at Baltimore. Italian entry did not mature and British machine crashed just before it was due to leave for U.S.A. Thus, if the American competitor had simply flown over the course, he could have claimed a win. As it was, the Americans declared "no competition."

Baltimore, 1925.—Lieut. Doolittle (U.S. Army) on Curtiss R.3 2 with Curtiss V. 400 engine, 191·4 nautical m. in 56 min. 6·37 :. (232·57 land m. per hour).

Air racing has done much as an incentive towards attaining ry high speeds, and although the actual racing machines are ually of small practical use, it has proved comparatively easy develop from them aircraft of great military value.

BIBLIOGRAPHY.—Very little literature exists which deals seriously th commercial aviation, but the following publications touch on various aspects and cover the details of most of its early history: dré Beaumont, *My Three Big Flights* (1912); C. Grahame-White d H. Harper, *Air Power* (1917); L. Hirschauer, *L'aviation de Transrt* (1920); H. B. Pratt, *Commercial Airships* (1920); G. Holt Thom- *Aerial Transport* (1920); Sir Walter Raleigh, *The War in the r*, vol. 1 (1922, etc.); Sir Ross Smith, *14,000 Miles thro' the Air* 922); C. G. Grey, *Aircraft Yearbook* (1923, etc.); Aero Chamber of mmerce of America, *Aircraft Year Book* (1925); Fred T. Jane . G. Grey), *All the World's Aircraft* (1925); E. H. Lewitt, *The gid Airship*, a Treatise on Design and Performance (1925).

(W. S. B.)

FLYING CORPS: *see* AIR FORCES.

FOCH, FERDINAND (1851–), French marshal, was born Tarbes Oct. 2 1851. His father's family had long been settled the south of France, leaving the district of Ariège in the 17th ntury to establish themselves as woollen manufacturers in e small town of Valentine where they took a prominent part municipal affairs. On his mother's side, Marshal Foch came a race of soldiers, his maternal grandfather having been a llant officer of the Grand Army. His father was a lawyer at rbes (Hautes-Pyrénées) who later became a revenue official; d he was frequently transferred from place to place, taking son with him. The future marshal thus received his education successively at the Lycées at Tarbes and Rodez, the semiry at Polignan and the Jesuit college at St. Etienne.

It was not long before his teachers were struck with his geometrical mind" and it was decided that he should enter e École Polytechnique, to prepare for which he was sent to . Clément's College at Metz. After a few months there, hower, the war of 1870 interrupted his studies. He enlisted in the antry but the armistice came before he saw any fighting, and returned to Metz to finish preparing for his examination. ne of his fellow-students has described how, in the midst of a sson, they learned, on March 11 1871, by the booming of the rman guns, that the treaty of peace had made Metz a city the German empire. None could foresee that the young udent was destined, as marshal, to restore the city to France. He sat for his examinations at Nancy, which was still occupied Manteuffel's troops, and was admitted to the École Polychnique, where he made his mark. In 1873 he was commisoned, and served successively at Fontainebleau, Tarbes and ennes. He then passed into the École Supérieure de Guerre here, after a tour of duty on the general staff, he was appointed professor on Oct. 31 1894. His lectures soon made a sensation, th by the evident soundness of the matter and the originality the form. Even thus soon his pupils bore witness to the excelnt qualities of their professor, who presently became one of e leaders in military doctrine. The lessons given between 1894 d 1900, collected in volumes, constitute the chapters of Foch's eat works: *De la conduite de la guerre* and *Des principes de la erre*, which appeared in 1897 and 1899.

In teaching six batches of staff college students Foch fortified s own military science as well; his years of Paris were in fact capital importance in the higher development of his intellect. hen he vacated his post no one doubted that he would return long in another capacity. After holding two regimental comands of artillery and spending a year on the staff of the V. rps, he was, so to say, imposed on the Government by the inion of the whole army as the fittest selection for the comand of the École de Guerre that he had made famous. It was emenceau—at that time Prime Minister—who made the pointment, giving him the rank of general, and from that y began the cordial relations between the great statesman d the great soldier which were to be revived later under memable conditions.

The general held his post as head of the École for four years, during which time he threw himself with untiring zeal into the work of this famous centre for military study, giving it a permanent stamp and forming a whole new generation of picked officers. When, in 1911, he was nominated to the command of the 13th Div. at Chaumont, Foch was one of the very few outstanding figures of the army and it was not surprising that, after a brief period in command of the VIII. Corps, the wish of everyone acquainted with the higher military personnel brought him to the head of the splendid XX. Corps, stationed about Nancy, which was accounted one of the best elements of the "Couverture." Thus, in 1913, he entered, to the sound of trumpets, the town where he had passed his examinations to the tune of the German army fifes and whence, before long, he was to march out for the War.

General Foch, who had married Mademoiselle Julie Bienvenue, had at that time three children—two married daughters and a young son who was destined to be one of the first to fall in the War. Although still attached to his Pyrenean home, the general spent his holidays on a small estate that he had acquired at Trofeunteniou in Brittany. In the summer of 1914 France was so far removed from any idea of attacking Germany that Foch had left Nancy to spend a month in far-away Brittany. A week later events led to his recall and he went into harness.

The Outbreak of War.—He was then a man of 63, but his rare moral, intellectual and physical vigour kept him singularly young. Foch was a man of thought and also, above all, a man of action. Gifted with an intelligence which was never allowed to be idle, ever widening the scope of his knowledge, reflective and delighting—to use his own striking phrase—to "phosphoresce," the great soldier is even stronger in will than in intellect. "Victory=*Will* . . . Victory goes always to those who deserve it by the greater force of *will* . . . A battle won is a battle in which one *will* not acknowledge oneself beaten"—these are but a few of the maxims found in his books, in which the word *will* occurs on every page. And in truth, although his grey eyes sparkle with intelligence, the forehead and, even more, the mouth reveal that will which he was able to communicate to all those who came in contact with him in the course of war. It is this will which gives such solidity to his character and protects it from all weaknesses. What is more, it stimulates both conscience and intelligence. He speaks of "these natures, hungry for responsibility, which alone turn out great men," and his own is one of these natures, that no sentimental considerations can either divert or check. For the rest, his clarity of mind translates itself by a realist and somewhat ironic common sense. "What is it about?" is a favourite phrase of his in all circumstances, for he believes in clear vision before direct action.

The XX. Corps formed part of the II. Army and Foch was therefore one of the commanders of Castelnau's army, which, on Aug. 19 1914, was thrown into annexed Lorraine. It will be remembered that this army, after some successes, came up against a formidable resistance in the region of Morhange and failed with heavy losses. Foch had had no part in forming the plan, which met with so cruel a check; he was but one of the executants. He had thrown his army corps resolutely at Morhange and, when repulsed, was still able to organise with perfect coolness its retreat on the solid positions of the Couronné de Nancy. Not content to await the enemy there, he resumed the offensive and, on Aug. 20, threw himself on the German regiments which were waiting to attack in the "gap of Charmes," and in overthrowing them prepared the victory in Lorraine. He was preparing to take his part there when he was called to the Grand Quartier Général, where Joffre entrusted him with the command of an army.

At that time the French were retiring in good order from Belgium and the Ardennes towards the region of the Marne. As a gap tended to open between the IV. and V. Armies, Joffre gave Foch the mission of forming a new army (the IX.) between them, co-ordinating his action with theirs. He was on the ground before the corps entrusted to him had arrived. In a few days he forged out of them a solid and supple little army which was already well in hand when the celebrated order of Sept. 4 arrested the retreat and prescribed the battle which was to lead to the victory of the Marne.

Foch, after passing the marshes of St. Gond, established himself on the heights which dominate the Petit Morin and of which Fère Champenoise marks the crest. It was thought that his rôle would be limited to supporting Franchet d'Esperey's army on his left. But when the German armies, which, instead of turning the left of the French armies as they had expected, were themselves turned on the right, they tried to penetrate the allied centre precisely in this region of Fère Champenoise and Foch had therefore suddenly to support the main strain of the battle, and that with troops inferior in number. The heights were for a moment carried by the Germans from Mondemont to Fère Champenoise. It was then that, by a clever manoeuvre, Foch rapidly transferred the 42nd Div. from his left to his centre and thus was able to gain the upper hand and force the enemy back. The extreme fatigue of his troops prevented him from pushing his successes, but he hung on to the retreating Germans and entered Châlons-sur-Marne behind them. His part in the victory of the Marne was capital and it was recognised by a glorious citation in general orders.

His reputation was so increased after this great crisis that Joffre immediately entrusted him with a new mission—this time one without parallel. Scarcely had the operations of the Marne terminated when, the two armies mutually trying to outflank one another, the "race to the sea" set in from the Oise to the Flemish coast which was only to be closed by the arrival of the Belgian Army and the formation of a continuous front right to Nieuport. The British corps, for their part, had been moved into the region of Ypres, while Joffre detached from the now stable front between the Oise and the Vosges all the forces that he could spare to meet a great attack between the Oise and the sea.

To co-ordinate the action of the heterogeneous troops hurriedly thrown into these regions, a leader of great authority was wanted at once to take the higher direction of the operations of the French armies and to co-operate harmoniously with the Allied armies so as to assure the co-ordination necessary to victory. On Oct. 4 Foch was sent to the Nord to fulfil this mission with the title of "deputy to the commander-in-chief."

He did not limit himself to giving the French armies, from Picardy to Flanders, the most energetic orders but put himself in close and cordial relations with Field-Marshal Sir John French and King Albert I., and established the essential liaison between the Allied armies. Ceaselessly finding the necessary reinforcements and dispatching them to the aid of the hard-pressed British and Belgian corps, he was able by his friendly and generous activity to impose his own resolute ideas and so make himself the soul of the battle of Flanders that, after the fierce fighting of the Yser and of Ypres, ended in mid-Nov. by the definitive check of the German invasion for the year 1914. In all this Foch had not merely confirmed his prestige as a strategist, but had won for himself the friendly admiration of his Allies so completely that, even then, it could be foreseen that if, one day, circumstances required unity of command there could be no better choice for it than Foch. Did not Mr. Lloyd George say: "He could not have done more for us had he been one of our own generals."

Foch was left therefore in contact with the British and Belgian corps in the capacity of general commanding the Group of Armies of the North. He held the post for two years and thus presided over the two Artois offensives of May and Sept. 1915 and the battle of the Somme in the summer of 1916 which the German attack on Verdun prevented from assuming the amplitude and decisive character that had been intended.

After brilliant initial successes the Somme battle seemed to sink in the autumn mud. The disappointment that it caused led to a movement of dissatisfaction with the higher leaders who had presided over it. Joffre having been relieved of his command, Foch was deprived of his also and relegated to Senlis for a mission of inspection. The story was that he was fatigued. This was hardly the case, but he accepted this semi-disgrace with resignation and his valuable advice was always at the disposal of General Lyautey, who had become Minister of War.

When, in May 1917, Gen. Pétain was called to the chief command, he himself suggested to the Government that Foch could be usefully employed in the post of chief of the general staff. Having been sent into Italy on the morrow of Caporetto to establish a much-needed understanding with Gen. Cadorna's headquarters, and having remained in constant and cordial relations with Field-Marshal Haig, there was little doubt that when the time came Foch would appear as the single commander that so many people desired by the end of 1917. When, in March 1918, the Germans launched their first grand offensive and the Allied line threatened to break, the necessity of this command became obvious to everybody. It was at Doullens that Foch, on March 29, received from the representatives of the French and British Govts. that mission of higher co-ordination that on April 14 became more precise in the form of the chief command of all the Allied armies fighting in France. Already he had grasped this command with a firm hand. Thanks to the close co-operation of the Allies he stopped the Germans at the gates of Amiens, and thereby brought about the final failure of their attempt to break the Anglo-French front and penetrate to the Channel.

Henceforward his whole energies were directed towards assuring this fruitful co-operation. Thus he brought strong French reinforcements to help the British armies, attacked in March and April, and engaged British and American divisions in the battle of the Aisne in May, thus twice checking German offen sives that, for a moment, were triumphant. And when th Germans came to a standstill in the pockets that they had drive into our front, he prepared the counter-offensives which, whe the hour struck, were to shake and crumple the German front.

The counter-offensive was on the point of being launche against the flanks of these pockets, from the Aisne to the Marne when, on July 15, a new German offensive took place. This met with a partial check which, as we know, had the effect o deepening the pocket in which Foch intended to grip the enemy The victorious attack of July 18 on the enemy's flanks force him to retire and gave the signal for the grand Allied offensives

Foch was now determined to halt no more. He realised tha the German armies were beginning to be exhausted but that i they were to be overthrown, the blows must fall thick and fas The great offensive of Aug. 8 in the region of the Somme whic as it gradually spread and became more violent, forced th Germans to retire on to the Hindenburg Line, was almost im mediately followed by the new offensive against that stron position where French and English vied with each other i valour. Once the line had been forced, Foch launched his famou "directive" of Sept. 3 which was in fact the programme of th general attack. The stages of this semi-concentric attack a well known. It stretched from the Meuse into Flanders an was designed to draw the enemy from all parts back on to th region of the Ardennes, where Foch hoped to pin them an grasp them. The "directives," which issued from the hea quarters of Bombon (and later, Senlis) are clear, resolute an pitiless. At this point Pétain, Haig and Pershing worked closest harmony with their French colleague. The directives Oct. 10 and 19 were followed by successes—hard won and u equal, it is true, but which on Nov. 5 culminated in the gener retreat of the beaten and exhausted German armies.

Foch, following them closely, had already prepared an oper tion on a large scale to make an end of them. While the Germa were to be thrown back into the difficult Ardennes region, a hu group of armies under the orders of Castelnau with Mangin principal executant, were to attack on the Moselle and the Sar and, reaching the Rhine, were to bar the line of retreat from t encircled Germans. It was at this point that the Germans ask for the Armistice. On Nov. 8 Foch, who had been engaged drawing up the conditions for three weeks past, received t German plenipotentiaries at Rethondes and, by his master attitude, brought them to accept all conditions on Nov. 1

taining with the occupation of the left bank of the Rhine the ults which he had expected to gain from the supreme battle.

The career of Foch was not at an end. Europe acclaimed him as e leader who had secured the victory. Marshal of France since ig. 7, he now became a British field-marshal and later a marshal Poland. He was elected a member of the *Académie française*, iich body, emulating the *Académie des sciences*, gave him a nderful reception, and at Paris, on July 14 1919, he passed der the *Arc de triomphe de l'Etoile* at the head of the victorious ops. From New York to London and from Brussels to Warsaw passed from triumph to triumph. He was not, however, con- nt with a parade rôle, and, as president of the Inter-Allied ilitary commission, he was repeatedly called upon to take easures in support of the action of the Allied Governments. is presidency he still retains—the last vestige of that single mmand of the armies led by him to the common triumph, the umph which was the outcome of that "will" always regarded him as the great and essential mainspring of victory.

BIBLIOGRAPHY.—Marshal Foch's own works are *Des principes la guerre* (1903), with English translation by Hilaire Belloc (1918); *la conduite de la guerre*, 3rd ed. (1915); *Préceptes et jugements du aréchal Foch extraits de ses oeuvres, précédés d'une étude sur la vie ilitaire du maréchal par A. Casset* (Nancy, 1919); with English anslation by Hilaire Belloc (1919). See also A. H. Atteridge, *arshal Ferdinand Foch* (1919); A. L. Grasset, *Le Maréchal Foch* 919); H. de Lacroix, *Le Maréchal Foch* (1921); P. Painlevé, *Com- ent j'ai nommé Foch* (1923). See also the Marshal's article on ORALE in this *Encyclopaedia*. (L. M.)

FOERSTER, JOSEF BOHUSLAV (1859–), Czech com- ser, was born Dec. 30 1859 in Prague, and studied under ibich. He became an organist and a writer on musical subjects; ter he was appointed professor at the Conservatoire in Ham- irg and eventually, in 1918, professor at the Conservatoire in rague. As a composer he developed from symphonic and amber music to opera, which formed the most important part his work. Foerster was a type of cultured musician, deeply notional in his resources, who replaced the vagueness of ex- ression which marked his early period by purity and technical erfection. His operas *Deborah* (1891), *Eve* (1897), *Jessica* 904), *The Unconquered* (1906), *The Heart* (1922) are dis- nguished by psychological depth and by the subjectivity of eir artistic understanding. Of his other compositions, the ost important are a symphony entitled *From my Youth* and a umber of suites.

FOGAZZARO, ANTONIO (1842–1911), Italian novelist and oet (*see* 10.590), died at Vicenza March 7 1911.

See Eugenio Donadoni, *Antonio Fogazzaro* (1913); L. Gennari, *ogazzaro* (1918); and F. Crispolti, *Antonio Fogazzaro; Discorso ommemorativo* (1911).

FOKKER, ANTHONY HERMAN GERARD (1890–), Dutch eronaut and aeroplane constructor, was born April 6 1890 at ediri, Java. He obtained his international pilot certificate in 911 and in the following year he established an aeroplane factory Johannesthal, near Berlin. In 1913 he founded another factory Schwerin in Mecklenburg and during the World War supplied e German Army with flying material, notably the Fokker bi- lane. After the War he returned to Holland and established the okker Aircraft Works in that country. In 1924 the Atlantic ircraft Corporation was founded in the United States, Mr. okker being a director; and a factory was started at Hasbrouck eights, New Jersey. Meanwhile he had set up a plant in Mad- d, which was already producing machines for the Spanish overnment. He devoted much of his time to researches in the eld of commercial aircraft development, one of his latest designs eing the Fokker triplane. His early experiments with regard gliding with motorless machines, of which he gave a demonstra- on in England in 1922, did not meet with very much success.

FOLKESTONE, England (*see* 10.600b), with a population of 7,511, has been improved as a seaport. Before the World War e harbour pier was lengthened to 1,480 ft., so that it now has erths for eight steamers, a railway platform and raised prom- nade along the whole length, and a lighthouse at the end. The area of the inner and outer harbours is a little over 12 acres. In 1915 there was a large landslip in the Warren; the railway line between Folkestone and Dover, which was buried or damaged for a distance of nearly two miles, was closed and was not reopened until Aug. 1919. In 1920 the Earl of Radnor presented the Warren and East Cliff to the town. A zigzag path has been built between the Undercliff and the Leas. In 1921 the foundation stone of an addition to the Royal Victoria Hospital was laid. In 1924 remains of a large Roman villa were excavated near the East Cliff, and the corporation undertook the roofing of a portion of the site, which contains a mosaic pavement.

Folkestone was an important embarkation point during the World War and one of the ports permitted to civilians. Many Belgian refugees passed through in the early days; it was estimated that 64,500 destitute Belgians arrived between Sept. 1914 and March 1915, besides about 44,600 who had sufficient money to pay railway fares for themselves. There were later large numbers of Canadian troops at Shorncliffe Camp near the town and also camps for American troops and for Chinese and Zulu labourers. On May 25 1917, during an air raid, a bomb fell in a crowded street, killing 33 people.

FOLKLORE (*see* 10.601).—Folklore, the science of popular beliefs, traditions and customs, has made great progress since 1910, especially in countries which till then remained more or less outside general scientific movements. Unfortunately scholars in countries like the Balkan States, Finland, Czechoslovakia, Yugoslavia, now publish the results of their work in their national language, thus adding to the difficulties of comparative study. This scientific decentralisation may perhaps culminate in concentration and standardisation, as has been effected in physical anthropology. The need for some such measures is evident. The scope of folklore needs to be defined. Its methods must be organised and, where necessary, renovated.

Scope of the Science.—Early students of folklore limited their studies to beliefs, tales, legends, myths, songs and games—that is to a great extent to "literary traditions." Early in the 20th century folklore was only a section of comparative literary history and of comparative mythology. But in some countries, as those under Habsburg rule and Slavonic areas, investigations covered the details of dress and ornaments, of houses and villages, of arts and crafts, as well as literary material. In these countries folklore was thus inevitably associated directly with ethnography.

While such conditions obtained, it was true that folklore was the ethnography of European peoples, and ethnography the folklore of the non-European peoples. Such indeed, but only as regards beliefs and popular literature, was the attitude of the Folklore Society of London, which in its publications has always granted equality of place to "primitive or half-civilised" savages, as to the peasants of Europe. Again, Sir James Frazer in his *Golden Bough* and in *Folklore of the Old Testament* has included all popular documents without geographical or chronological distinction. For him, as for the majority of folklorists of the older school, the term folklore referred only to intellectual, not to material, culture. Obviously the variations of dress, houses and implements have not, in Great Britain and the Central States of Europe, the same importance as in eastern and southern Europe, although certain areas, such as Scotland, the Alps, the Pyrenees and parts of Germany, have preserved vestiges of very ancient cultures.

Rütimeyer has discovered in Switzerland many prehistoric survivals, instruments, decorations, even modes of life. The Spanish Anthropological Society has started investigations in Spain into local fashions of dress, which have already yielded interesting results. In eastern and northern Europe the varieties of material culture and survivals of the Stone, Bronze and Iron ages are even more numerous and better preserved. In these countries, therefore, folklore has gathered in more such data than in those where it was first organised. The scope of folklore needs enlargement, so as to include the study of varieties of types of houses, villages, utensils of every sort, furniture, jewels, dress and every expression of popular art. Since the War, a movement in this direction has been started in England and in France by the publication of numerous monographs on country houses, too often in a purely utilitarian, rather than in a scientific spirit, because conditioned by the exodus of people in towns towards the country. But the investigations of Bancalari, Meringer and the school of students in Finland, Russia, Bulgaria, Rumania, Serbo-Croatia and Czechoslovakia into the material culture of those areas have been undertaken in strict accordance with the scientific rules of folklore.

Methods of Investigation.—The ampler the scope of folklore and the wider its domain, the more rigorously must its rules be determined. No single method of approach is adequate. The historical method is necessary—so also is the comparative method necessary; for in distinction from the historical method it does not put chronology into the first place, but compares the data according to their intrinsic nature, according to their technique and their external forms, without note of conditions of time and place. Frazer, Lang, Hartland and Westermarck in England, de Basset, Sebillot, Cosquin, Gaidoz in France, Mannhardt and his followers in Germany used this method, which had the advantage of bringing to light the gaps in the historical method of which the older philological method was but a secondary variation. A new philological method was founded by Edmond and Gilliéron, who published the great linguistic Atlas of France. Their study of words such as *Scier* forced them and their fellow workers to investigate things as well, such as *faux, faucille, segue, scie,* etc. Thus came into being a new scientific department, in which folklore and linguistics were united. So great was its success in Germany that Meringer and his pupils founded a review, *Wörter und Sachen,* in order to exhibit the scientific advantages of this combination. And so useful is it that modern folklorists are obliged to give heed to this class of investigations.

Human Geography.—Under the name of anthropo-geography or human geography (*q.v.*), the science of geography lends valuable aid to folklore. While the comparative method eliminated all conditions of place, geography regards them as essential. The union of the two has produced a new method which, so long as it holds a just balance, will continue to produce valuable results. As in modern linguistics, distribution maps are now essential in folklore studies. By this means the easy generalisations of the comparative school can be rectified, as has been done by Van Gennep for the Savoy area, where more than 630 parishes were examined, with the result that the generalisations of Mannhardt and Frazer, etc., were found to be not valid in the areas studied. There are local variations, and even disappearances of customs, which the older, comparative method failed to explain.

Not only must the data be strictly localised but they must also be related to all their concomitant conditions. In addition to the historical, linguistic and geographic qualities already mentioned, note has to be made of the psychological, economic and political conditions. In short, to make due progress, folklore must adapt the psychological method to its needs, as well as the sociological method, by which all elements in the social life are classified. Folklore is concerned with social and collective, not individual and isolated, phenomena—its very derivation proves this. A tale, a myth, a ritual act, a dance, a ballad, a mode of dress, a type of house, are collective expressions.

The Individual in Invention.—This does not mean that these are collective inventions. Every study of the growth of an element of this nature reveals an individual act as the origin or moment of borrowing—never the act of a large group. A small and limited group behaves as an individual just as the admirers of a popular poet, the followers of a prophet or the pupils of a painter or a sculptor form a school. Thus a new end is given to folklore. The comparative method has disclosed to us the dominant and constant elements for all mankind. This was necessary to ascertain the conditions in which these dominant and constant elements came into existence, by whom, how and why, variations in them are effected in distribution of place and time. In short, it is its business to discover the action of individuals, or of small groups of individuals, as well as the mental and material evolution of collectivities.

Collection and Preservation of Data.—The wider the scope of folklore, the more delicate become its methods of interpretation and the more necessary is it to gather its data in a strictly scientific manner. At the outset, complicated questionnaires were used almost at random. They are now prepared on a less ambitious scale and with more precise terminology. Personal experience goes to show that questionnaires are useful only if used by an investigator who has an adequate general knowledge of manuals and comparative studies.

Folklore Material.—The data of folklore fall into two series, intellectual and material. No great dictionary or encyclopaedia as yet exists to cover the first group of topics, as has been accomplished for other sciences. The only attempt in this direction in Europe is the *Folklore of France* by Paul Sebillot, in four volumes, which, but for the untimely death of this great pioneer, would have been followed by four other volumes; and in America the two volumes of the *Handbook of the American Indians* by Hodge (Bureau of Ethnology). In most countries recourse must be had to collections of monographs, such as those published by the Folklore Society of London, by Pitre in Italy, and by Machado y Alvárez in Spain. The work that has to be done in this direction could, and should, be accomplished by international co-operation. The Finnish authority, Antti Aarne, has drawn up a list of catch-words which, with items supplied by his co-adjutators, contains more than 3,000 items concerning specially the themes of tales and legends.

Museums.—The material data, implements, dress, etc., find their place in museums. But it is still rare to find a museum specially devoted to folklore, properly termed. Such are the Nordic Museum at Stockholm, the finest of all, then the Museum of Völkerkunde at Berlin; the folklore museums at Hamburg and Basel, the Museum of Popular Traditions at Paris (Trocadero), the national museums at Prague, at Bucharest, Cluj Klausenburg at Zakopane, at Warsaw and Cracow and at Budapest. In almost all big towns where there is an archaeological museum, there is a section set apart in it for folklore material, specially of historical and artistic nature. Of peculiar interest are sections of this kind at South Kensington, at the German Museum in Nuremberg, at the Landes Museum at Zurich, the Natural History Museum, Vienna, the Polytechnic Museum, Moscow, and the Alsatian Museum, Strasbourg. In most large provincial towns in England, France, Germany, Switzerland and Austria there are local museums which contain folklore objects, such as exhibits of ancient costumes, as well as coins, pictures and historic objects of every kind.

Nevertheless, the scientific organisation of folklore museums has not yet been founded. We are still at the simple stage of curiosity and rarity. The historical point of view in general overrules the special aspect of folklore interest according to which specimens should be collected and classified in technological and evolutionary series. The folklore material of non-European peoples is naturally much better represented, for it is ethnography pure and simple. The number of ethnographic museums has increased greatly in this period and their organisation improved, notably in the United States, Switzerland and The Netherlands.

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(*c*) Periodicals and Collections. *Portugal.—Revista Lusitana*, the view of the Geographical Society of Lisbon and the Reports of porto University, edited by Mendes Correa.

Spain.—Acts and *Memoirs* of the Spanish Society for Anthro- logy, Ethnography and Prehistory, with a bibliography of works in panish dealing with all humanistic science, including folklore.

Basque Folklore.—Revue des Études Basques (Bayonne), the annual view and monthly bulletin of *Notes and Queries* by the Society of uske-Folklore founded by José Miguel de Baran in 1921 at Vittoria: so memoirs on the Basques by C. Schuchardt of Graz, N. Densu- anu of Bucharest, and M. Haberlandt of Vienna.

France.—On the death of Paul Sebillot, in 1918, the Société des raditions populaires was amalgamated with the Société française Ethnographie et des Traditions populaires which has published a view since 1919. The review *Melusine* has not appeared regularly nce the death of Eugène Rolland. Volume 13 appeared in 1912. egional reviews and the publications of academies and local arned societies contain much material. In the *Revue de folklore*, appear in 1926 under the direction of A. Van Gennep, provincial searches will be centralised.

The folklore of Northern Africa is dealt with in the *Revue tuni- enne*, and the *Revue africaine;* Western African folklore in the *Bulle- ns* published at St. Louis and at Brazzaville. In the *Revue indo- inoise* and the *Bulletin de l'École française d'Extrème-Orient* will be und material dealing with the folklore of India and China. The *ulletin de la Société des Études océaniennes* has articles on folklore.

British Empire.—Folklore, published by the Folklore Society of ondon, is both comparative and descriptive. The society also ublishes a collection of monographs dealing with the folklore of ngland under various headings. There are no special folklore re- ews for Scotland or Ireland, or, for the most part, of the Domin- ns; Canadian folklore finds a place in the *Journal of American olklore;* Asiatic folklore, especially Indian, is dealt with in the *ournal of the Asiatic Society of Bengal;* and Chinese folklore is also corded in the *Journal* of the North China Branch. The Chinese ociety also deals with such material from time to time. There are so local reviews and publications in the African territories which e not, however, centralised. As regards Australia, the publications the local geographic societies must be consulted.

Belgium.—The publication of *la revue Volkskund*, interrupted by e War, has now been resumed under the direction of A. de Cock, ictor de Meijère and J. Vercoulie. In Walloon Belgium *Folklore ubançon* has now commenced to appear in both languages under e direction of A. Marinus. The Belgian Folklore Society proposes publish a centralised bulletin dealing with folklore in both por- ons of Belgium.

Switzerland.—In spite of the War, La Société Suisse des Traditions opulaires has continued the publication of archives and separate emoirs and monthly bulletins dealing with Swiss folklore. Much formation has been collected and classified in the *Glossaire des atois de la Suisse romande* now appearing in instalments. The ictionary of patois suisse-italien has commenced publication, and cludes a description of material, objects, customs, etc., and dis- ibution maps covering northern Italy as well.

Italy.—For central and southern Italy, and especially Sicily, see e *Archivio italiano Tradizioni popolari* and the review, *Il Folklore aliano.* The review *Augusta Praetoria* deals with the valley of osta and neighbouring regions, and, from time to time, local or neral papers publish folklore material.

Germany.—All German folklore societies are united in the Verband eutscher Vereine für Volkskunde which publishes *Mitteilungen* eports). The Swiss society is a member, and the Scandinavian, utch and Czech-German societies also form part of this league. s reports deal with the activities of various societies under the rious headings of folklore. The best folklore reviews are:— erlin, *Zeitschrift für Volkskunde;* Munich, two reviews, *Bayerische efte* and *Bayerische Blätter für Volkskunde;* Giessen, *Hessische lätter für Volkskunde;* Leipzig, *Mitteilungen des Ver. für sächische olkskunde;* Breslau, *Mitteilungen der Schlesischen Gesellschaft r Volkskunde.* Further folklore articles, essays and bibliographies ill be found in *Anzeiger für deutsches Altertum; Archiv für dâs udium der neueren Sprachen; Archiv für Religionswissenschaft; örter und Sachen; Zeitschrift für Ethnologie.* The German output of folklore is by far the most important in the whole world because it is recognised to constitute an element in German nationality, and because the German country people are very conservative in their manners and customs.

Scandinavian Countries.—Most periodicals in Scandinavian countries publish folklore articles, such as, the *Danske Studier a Copenhague, Ymer* at Stockholm, etc. There are special reviews, such as, *Norsk Folkekultur* at Christiania; *Folkminnen och Folktankar* at Stockholm, and for Finnish Swedes *Folkloristiska och etnografiska.*

Finland and the Baltic Countries.—The Finnish-Ugrian Society publishes an excellent journal. The academy of Helsingfors publishes memoirs relating to the Ugrians, the Mongols, the Manchus, the Votiaks Voguls, the Tcheremisses and the Estonians. The Society of Folklore Fellows publishes at Helsingfors the well-known *Communications comparatives*, under the editorship of Antti Aarne. There are also folklore societies at Dorpat, in Latvia and in Lithuania.

Russia.—Nearly all periodical publications came to an end during the War and the revolution. Among them were *Zhiva 'ia Starina*, published by the Geographical Society of St. Petersburg, and *Etnografitcheskoye Obozrienie*, published by the Polytechnic Museum of Moscow. At Kieff, however, a laboratory of Anthropology and Ethnology has been founded by the Academy of Science of the Ukraine, which publishes a bulletin in Ukrainian, in which folklore is dealt with. In Manchuria a periodical appears, published by the local historical and archaeological society, and deals with Russian, Mongol, Manchu and Chinese folklore.

Poland.—While the review, *Wisla*, has ceased to appear, the Academy of Science at Cracow continues the publication of much material. The principal centre of activity is, however, at Lemberg, the headquarters of the Polish Society for Ethnology and Folklore. Its publication, *Lud*, is in its 23rd year, and appears simultaneously at Warsaw, Cracow, Posen and Vilna under the editorship of A. Fischer.

Czechoslovakia.—On the death of Zibert, the review, *Cesky Lid*, ceased to appear, but the *Narodopisny Vestnik Cesko-Slovansky* is still published under the editorship of G. Polivka. Other local reviews, notably in Slovakia, deal with folklore.

Austria.—On the break-up of the Habsburg Empire the scope of the Societies which publish journals of folklore has diminished; each element in the population prefers its own language as a means of publication so that there are local reviews in the Tirol, Styria, etc. Much folklore material is published by the Museum of Volkskunde and the Anthropological Institute in their publications.

Hungary.—Folklore material is centralised by the Academy of Science at Budapest, by the *Revue Ethnographique*, and in the reports of the Ethnographic Museum.

Bulgaria.—The Academy of Science publishes an important series of volumes on the popular manners and customs of Bulgaria.

Rumania.—The Bucharest Academy has already published some 50 vol. on Rumanian manners and customs. Then N. Densusianu has founded the review, *Grai si Suflet*, devoted to linguistics and to folklore. Local material is also published by the Universities of Jassy and Klausenburg.

Yugoslavia.—There are three important centres for folklore work in the country; the first at Belgrade where the Academy of Science and the university publish important memoirs from time to time; secondly, at Zagreb, where the review *Narodna Starina* (National Antiquities) is published under the editorship of Josip Matasovic; and thirdly, at Lubljana, where *Carniola* and *Mitteilungen des Museum-Vereines für Krain* are published. It may be indeed that Yugoslavia is one of the countries richest in folklore materials.

Greece.—The Hellenic Folklore Society founded by Politis at Athens, in 1910, publishes a review *Laographia*, to which also it has published as supplementary a collection of the complete works of Politis himself.

America.—In North America a distinct division of labour is observable. Indian folklore is centralised with the Bureau of Ethnology and the Smithsonian Institution and the *American Anthropologist.* The folklore of peoples of European and African origin falls to the *Journal of American Folklore* on behalf of the American Folklore Society, which also publishes memoirs. This society deals only with popular literature, tales, legends, songs, and not with popular material culture. Mention must be made here of the important investigations of Marius Barbeau on French Canada, and of Elsie Clews Parsons on the Bahamas.

Central America.—Gamio, in Mexico, deals with the folklore of the Indians in the publications of the Ministerio del Fomento. In Cuba, Fernando Ortiz has commenced publication of *Archivos del Folklore Cubano* (San Ignacio del Habana). Venezuela, Brazil and Chile are commencing publication of their folklore material, both of Indian and European origin. An annual bibliography of a complete nature, dealing with the folklore of North, Central and South America, has been published since 1917 by G. Rivet, of the Society of Americanists of Paris. (M. A. Van G.)

FOLKSONG: *see* SINGING.

FOOCHOW, China (*see* 11.271), a treaty port, had an estimated population, according to the Chinese maritime customs; of 320,900 in 1923. The streets have been widened and paved, the steps leading to the Long Bridge have been removed, and the road between it and the city planted with trees. Electric light has been installed, and also an ice-making plant to supply the fishing boats. In 1921 the Fukien Christian University was established on a site of 50 ac. below Kushan Point. The trade of Foochow has declined with the decline of the tea trade. The timber resources of the country are waning, and the trade in camphor is small. The demand for and the output of lacquer ware has increased. Ships discharge and load at the Pagoda anchorage, 10 m. below Foochow, since above this the Min river, divided into a number of channels, is obstructed by shoals and bars. A conservancy board was formed in 1919, and plans were worked out for directing the river into one channel, and permitting navigation by vessels drawing 17 ft. up to Nantai, the harbour of Foochow. The work was almost completed in the first and third sections in 1925, and the second section only required improvement by dredging.

FOOD, PURE (*see* ADULTERATION, 1.218).—It is only within recent years that the transfer of the manufacture of food from the home to the factory, and the transportation of food for greater and greater distances, have made it necessary for governments to promote systematically and scientifically the purity and truthful labelling of food products.

The purity of foods, drugs and other commodities was everywhere adversely affected by the conditions prevailing during the World War. There was a great increase in the practice of adulteration, and a marked falling off in the quality of manufactured foods. The use of substitutes and inferior products in times of shortage is a necessity; the subsequent restoration of higher standards is slow. Borax, formaldehyde and other food preservatives were tolerated to an almost unlimited extent in some European countries during the troubled period attending the War, and the users of these substances, after a few years of unmolested privilege, have been unwilling to give way.

Scientific Developments.—One phase of the movement for pure food was a proposal by the newly organised International Union of Pure and Applied Chemistry to study the practice of conserving foods by chemical means—a subject extensively investigated in the United States between 1904 and 1912. A report upon the laws governing the use of chemical preservatives in foods was presented at the fourth meeting of the International Union of Pure and Applied Chemistry at Cambridge, England, in June 1923 (Comptes-rendus de la quatrième Conférence Internationale de la Chimie, p. 133–6). The trend of public and scientific opinion at the present time is toward the complete elimination of chemical preservatives from foods. In addition to their own injurious action, food preservatives disguise the effects of putrefaction, and their use in many cases has put a premium upon the unsanitary handling of foods. Certain advocates, notably Prof. E. Paterno of the University of Rome, have defended the use of preservatives. It has been asserted that the extensive consumption of meats, preserved by boric acid or formaldehyde, as an exigency of war, produced no injurious effects. The lack of cold-storage facilities, such as are everywhere provided in the United States, has been advanced in many countries as an argument for the use of chemicals in preserving perishable foods. Legislation to exclude completely all foreign chemicals from foods has been held to be inconsistent so long as copper compounds, arsenates and other substances are permitted in agriculture as insecticides, fungicides and disinfectants, since traces of these nearly always occur in the fruits and vegetables so treated. Nevertheless opinion among hygienists, manufacturers and the general public is decidedly adverse to the use of chemical preservatives. It has been suggested that an important factor in the increase of certain diseases is the presence of chemical preservatives and metallic poisons in foods.

British Committee on Preservatives.—In England the Minister of Health appointed on July 7 1923 a Committee on the Use of Preservatives and Colouring Matters in Food. In accordance with their recommendations the Minister of Health announced on Feb. 17 1925 a Draft of Rules and Orders that completely excludes from foods boric acid, salicylic acid, formaldehyde, fluorides and all other chemical preservatives except benzoic acid and sulphur dioxide, which are permitted in minimum amounts for preserving a limited number of foods and beverages. According to these regulations a food preservative is defined as:—

> any substance which is capable of inhibiting, retarding or arresting the process of fermentation, acidification, or other decomposition of food or of masking any of the evidences of any such process or of neutralising the acid generated by any such process; but does not include common salt (sodium chloride), saltpetre (sodium or potassium nitrate), sugars, acetic acid or vinegar, alcohol or potable spirits, spices, essential oils or any substance added to food by the process of curing known as smoking.

It was objected that the new rules would operate to the detriment of both the trade and the general public on account of storage difficulties and of the increased price at which it would be necessary to sell food under the changed conditions. The new British Public Health (Preservatives, etc., in Food) Regulations of 1925 are to come into operation on Jan. 1 1927 with slight extensions of this date in the case of butter, cream and a few other products.

Standardisation.—A basic requirement in pure food control is the establishment of official standards of purity. The differences of opinion which prevail with regard to what constitutes pure sausage, marmalade, chocolate, catsup, ice cream and numerous other foods would make the task of the analyst an impossible one unless he had available certain recognised standards which are accepted as just by the trade and by regulatory officials. In Germany, Great Britain and the British colonies much valuable pioneer work has been done by the public analysts toward establishing standards of composition for many articles of food. In the United States a joint committee of nine experts selected equally from the U.S. Bureau of Chemistry, the Association of Official Agricultural Chemists and the Association of Dairy, Food and Drug Officials, by joint conferences with the trade, has established definitions and standards for a large variety of foods.

FOOD LAWS IN THE UNITED STATES

In the United States the control of foods is exercised by the Federal Govt. of the United States under the Federal Food and Drugs Act, the Meat Inspection Act, the Tea Inspection Act and certain Acts relating to specific products such as filled cheese, filled milk, butter and mixed flour. Forty-seven of the 48 states of the Union have some form of food control legislation. A number of states have laws which follow the general principles of the Federal Food and Drugs Act, but other states have laws differing very materially from that Act. In some states foods are controlled under the general provisions of one Act, in other states they are controlled under a number of Acts relating to specific food products. Each state has complete control of the foods produced and consumed within that state. The Federal Govt. has control of foods shipped into interstate or foreign commerce.

The Federal Food and Drugs Act, approved on June 30 1906 and amended in 1912, 1913 and 1919, provides in general that all foods coming within its jurisdiction be prepared in a cleanly manner from pure and wholesome materials; free from any added substances which might render them injurious to health; not labelled or sold under representations which are in any manner deceptive. Food packages must bear a plain and conspicuous statement of the quantity of the contents.

The Meat Inspection Act, approved on June 30 1906, provides that every establishment in which cattle, sheep, swine or goats are slaughtered or their carcasses are wholly or in part canned, cured, smoked, salted, packed, rendered or otherwise prepared, for transportation or sale as articles of interstate or foreign commerce, shall be inspected under the Act. The inspection begins when live animals are received for slaughter, and includes a thorough ante-mortem and post-mortem examination, a rigid inspection of products such as smoked or cured meats, lard and by-products, and a final inspection when meats and their products leave the inspected establishments.

The Tea Inspection Act of March 2 1897, amended on May 16 1908, provides that all shipments of tea offered for entry into the United States shall be inspected to see that they comply with the standards of quality and purity adopted each year by a board of tea experts appointed by the Secretary of Agriculture. Every consignment of tea offered for entry into the United States is inspected, and only such tea admitted as complies with the standards.

The Bureau of Chemistry in the enforcement of the Federal Food d Drugs Act endeavours to see that out of the great volume and riety of foods coming from other countries only such as comply th the Act are allowed to enter the United States. Shipments in olation of the Food and Drugs Act are denied entry into the iited States, and if not exported within three months are destroyed. the violation is a form of misbranding that can be entirely cor- ted by relabelling, the importer is permitted to relabel the ship- nt, after which it may be admitted to the country, if the relabel- g is correct. Foods that are harmful to health, however, are not mitted to the United States and must be exported or destroyed.

For the control of interstate commerce two forms of action are ovided by the Federal Food and Drugs Act—criminal prosecution ainst the party responsible for the violation, and seizure of any pments of adulterated or misbranded foods or drugs found in erstate or foreign commerce. Both actions may be invoked when cessary. Under the Federal Food and Drugs Act more than 000 cases, including both criminal prosecutions and seizures, have en terminated in the Federal courts and the results published in form of notices of judgment. This number represents only those tances of flagrant misbranding or adulteration in which court ion was necessary to check the practice. Countless minor viola- ns have been corrected by serving notices on the firm's responsible thout recourse to formal legal action.

Most of the grosser forms of adulteration and misbranding iich prevailed at the time of the enactment of the Federal od and Drugs Act and Meat Inspection Act in 1906 have been minated as general trade practices. Occasional sporadic in- ances on the part of widely scattered dealers to adulterate d misbrand in the old way are still detected at intervals, but ch practices are no longer general. New and more subtle rms of adulteration, however, are being detected. As a result the effects of pure food legislation by the Federal and State vernments, and by the application of the principles of sanitary ence in the food industries, very great improvement was made the purity of food in the markets of the United States between 10 and 1925. No other classes of merchandise are to-day, on whole, so free from adulteration and misbranding as foods.

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FOOD POISONING (*see* 18.29).—The term food poisoning as ed by public-health workers and bacteriologists does not in- de the deliberate addition to food of poisonous substances th criminal intent, nor yet individual idiosyncrasy or sensiti- tion to certain proteins such as those contained in strawberries, gs, milk or shellfish. Food idiosyncrasy depends primarily a peculiar condition of the human body rather than on any ngerous quality in the food itself. The various "deficiency eases," such as *beri-beri* (*see* 3.774d), *scurvy* (*see* 24.517b) and chaps *pellagra* (*see* 21.69b) and *goitre* (*see* 12.191d), which are e to the lack of some essential element in the diet, are also not ially considered as types of food poisoning.

The manifestations ordinarily grouped as food poisoning at present time are those due to:—(1) the presence of poison- s substances in healthy, untreated plant or animal tissues; the introduction into food by accident, or design, of more less familiar organic and inorganic poisons; (3) the presence the food of living pathogenic bacteria or other parasites; (4) the esence in the food of poisonous substances elaborated by the owth of various micro-organisms.

Poisons in Plants and Animals.—Certain normal plant and animal tissues contain substances poisonous to man, and when eaten may cause illness and death; such are poisonous mushrooms and certain fish found in tropical waters. Fatal cases of oxalic poisoning from eating the leaves of the common rhubarb have occurred. Horses and cattle grazing free on the western ranges are frequently poisoned when forage is scanty and they resort to weeds and plants generally left untouched, such as the larkspur, the lupins, the water hemlock and the death Camas. Poisonous weeds eaten by cattle may indirectly produce poisoning in man. The disease known to the pioneer settlers in parts of the United States as *milk sickness* was early recognised to be connected with the occurrence of *trembles* in milch cows, but its origin long remained obscure. It is now believed that both *trembles* and *milk sickness* were due to a poisonous substance in the white snakeroot (*Eupatorium*) which was eaten by the cows when other pasturage failed.

Mineral Poisons.—Occasionally mineral poisons like arsenic and lead find their way by accident into food in the process of manufacture, as in the famous outbreak of *peripheral neuritis* (*see* 2.654) in several of the Midland countries in England in 1900, involving at least 6,000 persons and causing about 70 deaths. This was traced to the presence of considerable quantities of arsenic in the beer coming from certain breweries; it was found that the brewing sugars had been impregnated with arsenic by the sulphuric acid used in their preparation, the arsenic itself being derived from the iron pyrites used in making the sulphuric acid. More recently the cocoa sold by an English firm contained a small amount of arsenic derived from the potassium carbonate employed in its manufacture.

Long-continued action of food on containers may dissolve harmful metals such as lead, copper or tin. Tin poisoning from canned foods, although theoretically possible, is so rare as to have little practical significance, doubtless partly because such tin as is dissolved is largely fixed in an insoluble form by the solid portions of the canned food and eliminated directly from the body. Copper, although not a violent irritant, may have a highly injurious effect when absorbed during many years, as in the constant use of distilled liquors containing copper derived from the copper worm of the condenser; cirrhosis of the liver (*see* 16.803) may be caused in this way. Lead, owing to its well-known cumulative effect on the human body, is an undesirable substance to come in contact with food or drink. As long ago as 1767 the local malady of *Devonshire colic* was shown by Baker to be due to the action of cider on lead vessels. Lead poisoning has also resulted from the frequent use of acid beverages in bottles with lead stoppers. When lead was generally used in glazes and enamels for cooking vessels, recognised poisoning from these sources sometimes occurred; the enamelled ware at present in common use in England and the United States is lead-free.

Food Preservatives.—The use of food preservatives constitutes a very difficult and important phase of the problem of the addition of poisonous substances to food. Numerous substances have been added to food intentionally for the purpose of preventing the growth of micro-organisms and consequent spoiling. Some food preservatives (*see* 10.612) once widely used are now known to be poisonous for man as well as antiseptic for microbes and have been generally discarded or prohibited. Such are formaldehyde and hydrofluoric acid and their derivatives. Regarding some other preservative substances there is great diversity of opinion among those who have given the matter most study. The use of boron and salicylic acid compounds is generally, but not universally, disapproved. Benzoic acid, sulphurous acid and sulphites are regarded by many hygienists as permissible in certain foods under controlled conditions. The differences of opinion emphasise the insufficiency of our knowledge. Until information commanding the respect of all competent experts is available, it is well to err on the side of caution and minimise the use of preservatives.

The practice of adding poisonous substances to food merely for the sake of altering colour or appearance has nothing to recommend it. At the present time any danger of actual poisoning from colouring matter added to candy, pastries and the like is slight. In most countries the health authorities maintain a list of the substances, such as certain coal-tar dyes, which are permitted, and prohibitory regulation is strictly enforced. In the United States no colours and no preservatives in foods are permitted unless they are deemed harmless. (*See* FOOD, PURE.)

Bacterial Poisoning.—Food may serve as the vehicle for certain kinds of disease-producing bacteria and other parasites. In some instances the bacteria are exclusively of human origin and occur in or upon the food as the result of contact with sewage-contaminated water or through handling by a *carrier* of disease germs, *e.g.*, the contamination of oysters with typhoid bacilli present in polluted water and the contamination of milk by a typhoid carrier on a dairy farm. In other instances the bacteria present in the food are derived from an infection of the food animal. This second class of infections is especially important in any survey of food poisoning since the gastro-intestinal symptoms produced are often sudden and violent; many of the most typical and best known mass outbreaks of food poisoning belong to this group. The nausea, vomiting and diarrhoea that characterise these attacks usually attract attention to some article of food eaten shortly before. An attack of this kind rarely terminates fatally, and the symptoms pass off within 24 to 48 hours, having little after effect. Often a history of illness in the slaughtered animal can be secured. Some of the most extensive outbreaks of meat poisoning in European countries have been traced to the use of meat from an animal noticed to be ailing and promptly killed by the thrifty peasant as an emergency measure.

The bacteria that cause this typical form of food poisoning belong for the most part to the group of *paratyphoid* bacilli, organisms closely related biologically to the typhoid bacillus, but distinguishable by laboratory tests. Within the group of paratyphoid bacilli there are several different species (*e. g.*, *B. enteritidis*, *B. aertrycke*, *B. suipestifer*) that primarily cause disease in various domestic animals, but secondarily and occasionally give rise to food poisoning in man. Food poisoning from paratyphoid bacilli would probably be much more common than it is if foods were not usually cooked. These bacteria are killed by boiling, and the history of many attacks shows that, while parts of an animal eaten raw or partly cooked have given rise to illness, other portions cooked before being eaten have been quite innocuous. Sausages made from uncooked meat or internal organs (liver sausage, blood sausage, etc.) have been the cause of food poisoning in a disproportionately large number of cases. Unfortunately inspection of the meat before sale may fail to reveal any evidence of infection, so that protection against this form of food poisoning depends chiefly on (*a*) the selection of healthy animals for slaughter and (*b*) thorough cooking of all foods of animal origin.

Foods may be also contaminated with paratyphoid bacilli by the agency of rats and mice. These rodents suffer from natural infections with these bacteria and can become carriers. Rodent contamination must always be reckoned a possibility in investigating outbreaks of this type.

Certain of the higher animal parasites occasionally enter the human body in contaminated food. The small roundworm (*Trichinella*) that causes trichinosis is one of the best known. Thorough cooking is an effective safeguard.

Ergotism.—One of the earliest established instances of poisoning due to the products formed by the growth of micro-organisms in food substances is the disease of *ergotism* (*St. Anthony's Fire*) (*see* 9.738) so prevalent in the Middle Ages. Ergot is the poison formed by a fungus that grows on rye; in times of famine the enforced use of rye that would not otherwise have been eaten led to much suffering and many thousands of deaths.

Ptomaines.—It was long believed that many instances of gastro-intestinal disturbance—the typical food poisoning of the layman—were due to the products of various micro-organisms found in partly spoiled or decomposed food. Definite chemical substances—*ptomaines* (*see* 3.174)—were incriminated, and the expression *ptomaine poisoning* (*see* 22.629) came for a time to play as large a part in popular self-diagnosis as "influenza" or "the grip." In point of fact ptomaine poisoning, if it occurs at all, must be exceedingly rare. Ptomaines appear in food substances in the later stages only of putrefaction—after about a week! Alleged instances of "ptomaine poisoning" when investigated by modern methods may almost always be traced with greater plausibility to some other form of food poisoning. "Ptomaine poisoning" may be a convenient refuge from aetiological uncertainty; it is not a satisfactory diagnosis for illness or death.

The products of paratyphoid bacilli that have grown in food may in some instances be the cause of food poisoning, even when the bacteria themselves have been killed. The determination of this question presents great technical difficulties and has not yet been settled.

Botulism.—The most conspicuous and definite example of poisoning from a microbic product formed in food is *botulism* (*see* 18.30). The chief symptoms of botulism are nervous rather than gastro-intestinal. Disturbance of vision (double vision), great weakness and difficulty in swallowing, are common signs; there is little or no fever and the temperature may be subnormal; there is rarely any pain and the mentality remains clear; the disease is always serious, over 60% of the cases resulting fatally. From 1899 to 1924 in the United States 129 outbreaks occurred, affecting 435 people and causing 290 deaths. In the only outbreak known to have occurred in Great Britain (Loch Maree, 1922), eight persons were affected and all died. Botulism is due to a specific germ (*Clostridium botulinum*) which has great heat resistance and is also able to grow in the absence of oxygen. Under favourable conditions it elaborates a toxin which is one of the most poisonous substances known. Although the germ is widely distributed in soil in many parts of the world, the conditions necessary for its development in foodstuffs are so seldom present that botulism is one of the rarest of human affections. The lack of a suitable temperature, a certain degree of acidity of the culture medium, an over-abundant supply of oxygen, the presence of certain other micro-organisms are factors that may interfere with the growth of this organism and prevent toxin formation. Nevertheless scattered cases of botulism have occurred at intervals in Europe and America for over 100 years. The first cases to be described were caused by sausage, hence the name botulism. Meat pickled in brine has also been known to contain botulism toxin. In recent years canned foods of various kinds, vegetables as well as meats, have been implicated.

The majority of the cells of *Cl. botulinum* are killed by temperatures slightly above boiling, but a very small number may survive prolonged exposure to 115° C. or even higher.

The most obvious mode of protection against this form of food poisoning is to ensure cleanliness in all foods subjected to preservative processes and, in the case of heat-preserved foods, to use so far as practicable temperatures high enough to destroy the most resistant spores of *Cl. botulinum*.[1] The majority of canned foods proved to contain botulism toxin give sensible evidence of spoilage. The botulism toxin, unlike the organism that produces it, is readily destroyed by boiling. The immediate rejection, without tasting, of any food showing signs of spoilage and the re-cooking of canned foods before serving, constitute a second line of defence. If these precautions are followed, botulism already rare should become practically unknown.

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[1] Temperature and time of exposure must be considered and also the difference in heat penetration, the degree of acidity of the food substance, the extent to which the appearance, and consequent marketability, is affected by the treatment, and other factors

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FOOD PRESERVING: *see* CANNING.

FOOD SERVICE.—In the United States there has been, since 10, an increasing tendency on the part of Americans to take eir meals outside of their homes, *i.e.*, the growth of the community kitchen and its corollary the community dining room.

Community Kitchens and Dining Rooms.—Many reasons may assigned for this movement. In the first place it was a natural ep in view of the changes in the home itself: the urban home d become smaller, for every square inch of floor area, every bic inch of space, cost money in rent, and consequently the nctions of the home were limited so as to effect a reduction of ace. The home kitchen shrank first to the kitchenette and is w in process of vanishing entirely. Even where the space for elaborate kitchen is available, the problem of getting suitable rvants is so troublesome as to induce many to get along with minimum of domestic service, and, as the mistress of the house herself less willing to be a kitchen drudge than formerly, many eals are taken outside the home, particularly those of an borate nature. Private hospitality is more and more offered hired hotel space in preference to the home. Banquets and her special functions are easily handled in public dining rooms d involve little responsibility on the part of the host and hostess. he emancipation of women is another factor. Many women ve succeeded in establishing themselves, professionally or mmercially, before marriage. They prefer financial independce to keeping house. The small, compact, efficiently arranged artment is the result, with meals away from the home.

These factors are intensified by the constantly rising standards living and by the greatly improved marketing technique ich has stimulated a demand for many possessions previously n-existent or rare. Demands upon the family income have lvanced, encroaching upon the former budget allotment for nt and servants. Small and servantless homes come as a tural sequence. If even then the income is too meagre, the odern woman has no hesitation in aiding her husband to uble it by taking a position herself. Another blow to the home the chief or sole source of prepared food has been dealt by the tomobile and touring habit. It is estimated that in 1910 there ere in the United States less than 350,000 automobiles; in 25 over 17,000,000 were registered. Such an increase in the e of a personal means of conveyance with a day's travel radius say, 200 m. could not but have its effect on the food habits the nation. "Automobile" business is considered a substantial rt of the total business of hotels and restaurants.

The hotel kitchen, like its domestic counterpart, has had its oubles with its personnel, and for similar reasons. Working, wever, on a larger scale and increasingly on standardised oducts, it can make readier use of machines as a substitute for bour. The modern quantity kitchen is thinly staffed but splendly equipped. Washing-machines for dishes, glassware and ver, each adapted to the task in hand, enable two men to do e work of ten and to do it better. There is less breakage, the ver bears an enhanced sheen, and the bacteria count is reduced per cent. Dirt and filth, once the bugbears of any but the ost expensive dining places, are now perhaps more rare in tels than in the home. There are also the great mixers which, r example, beat up a bushel of mashed potatoes or a gallon of eam with equal facility, the steam-cookers, the potato-peelers d a host of smaller indispensables that save time, labour and ace where food is cooked on a wholesale scale. Electricity s helped in cookery and is now applied to refrigeration.

The Cafeteria System.—The service side of the problem has so advanced. The use of the steam-table has solved one of the oblems of public service by keeping dishes hot and food tasty ring the minutes or even hours that elapse between preparation d eating. The modern coffee-urn makes possible the preparaon of five gallons at one time, a difficult feat under the old ocedure. The newer methods of service bring the consumer and his food together without delay. The cafeteria system, under which all the dishes in the menu are displayed before the customer, who helps himself, has made quick service possible and cheap. Whatever losses there may be aesthetically, and these need be few, are broadly balanced by the pleasure of being able to make a direct selection of food. Incidentally, the cafeteria system has placed a premium on attractive, neatly arranged dishes. Another development, exclusively metropolitan, for those who want only a little food quickly, is that of the sandwich shop, luncheonette or expanded soda-fountain counter, where light refreshments are dispensed under conditions that permit high speed. Frequently these places are operated in chains, so that large numbers of sandwiches, for instance, are prepared in a locality where rent is low and trucked to small luncheon counters crowded into nooks that tap main streams of city workers. Such places appeal to the clerical worker or office girl who has little to spend and who seeks only a light lunch.

A closely related development is the delicatessen store, which sells prepared food but does not serve it. These, located in territories of concentrated population, present still another solution to the consumer's problems of limited space and few and high-priced servants. They eliminate much of the work and annoyance of cooking food in small, ill-ventilated apartments, while permitting the enjoyment of family privacy in consuming it. Similarly, in the large apartment hotels recently erected in the big cities, provision is usually made for extensive "room service." The kitchens of the hotel make it a part of their business to prepare meals which will be served in the rooms of the apartment dwellers. Special elevators and floor pantries assist, and special dishes and equipment have been devised to help keep the food in its best condition. Such a combination of wholesale cookery with individual service is practicable only in large, high-grade apartment hotels, but it has distinct advantages where conditions permit its use.

The conditions described are evident to all observers. Accurate statistics on the subject are lacking, however. Difficulties in the definitions of hotels, restaurants, boarding-houses and other eating places make current figures unreliable, and even less reliable the figures of 1910. Two estimates may be mentioned. The *Hotel Monthly* calculates that nearly 5,000,000 persons in the United States take a majority of their meals in public eating places and that they spend therein over 1,250 million dollars a year for a total of 4,000 million meals. *Hotel Management*, on the other hand, estimates that about 8,000 million meals per year are served outside homes and, taking a somewhat higher average amount spent (50 cents as compared with 35), reaches a figure of 4,000 million dollars of annual expenditure in public dining-rooms. This wide divergence between two competent authorities illustrates the difficulty of accurate estimate in hotel and restaurant statistics. It is evident, however, that the nation's restaurant bill might conservatively be estimated at over 1,000 million dollars a year. If the value of the food eaten by the employees and managers themselves and that sold for immediate consumption is included, but the canned and package-prepared foods omitted, a figure of 2,000 millions was probably too low rather than too high in 1925. (H. B. M.)

FOOD SUPPLY.—War influences the food supply in belligerent countries directly, and in neutral countries indirectly, through deterioration or distortion of agriculture, disorganisation of shipping, disintegration of finance and changes in consumption. During post-war reconstruction the abnormalities persist in modified form, broadly proportional to the severity and duration of the struggle, often attended by new disturbances contingent on inherent developments or proceeding from misdirected efforts at restoration of the *status quo ante bellum*. Sooner or later, a new equilibrium is established between agriculture, industry, transportation and finance.

During a war of large extent and long duration, agriculture suffers heavily in the belligerent countries and prospers seemingly in unadjacent neutral countries. After the war, agriculture recovers in the belligerent countries, but in the neutral countries undergoes liquidation. The governmental restraint of competition, effectual during war, is likely to be followed by excessive competition. It is from this panoramic viewpoint that a scrutiny of the results of the World War on the food supply of the world is to be undertaken.

I. THE WAR AND AGRICULTURE

Shortage of Men, Horses and Fertilisers.—No matter how categorically agriculture is classified as an essential industry in a country at war, the labouring forces of the land are drawn on by the military authorities. Landowners, tenants and hired workers are mobilised for military service. Horses are requisitioned. In the World War this recruiting of rural workers continued intermittently until the farm work was done largely by males past middle age and under 16, and by women. The working forces suffered in number, in skill and experience. Some replacement was effected by stationing prisoners of war on the land, but the agricultural result was everywhere inconsiderable. The requisitioning of horses made it necessary to use cattle as work animals, to the direct injury of the milk supply.

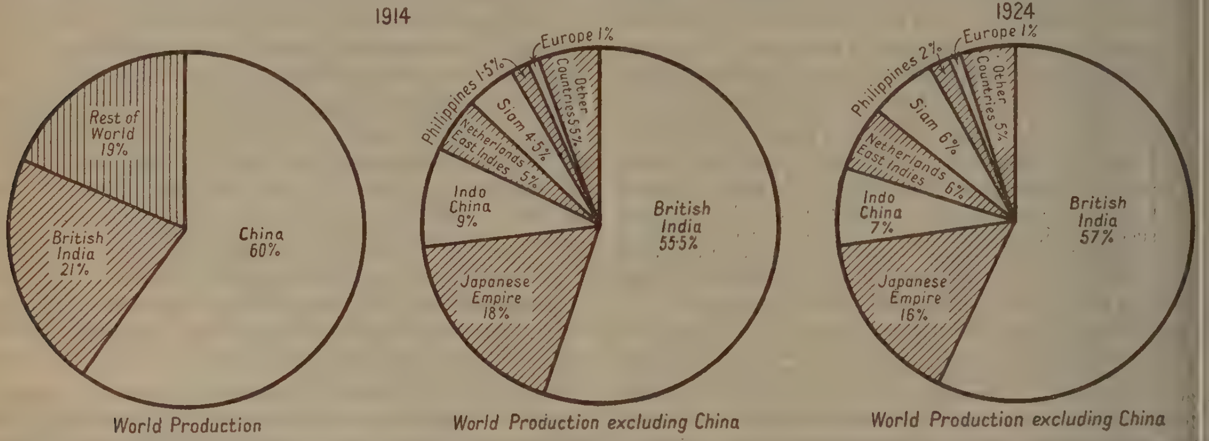


FIG. 1.—The total world production of rice in 1914 was estimated at 2,000,000,000 quintals. The total annual production of countries for which returns were obtained averaged 769,496,000 quintals for the period 1909-10 to 1913-4, and 849,415,000 quintals for 1924-5. The world's total production in 1924–5 was estimated at 1,300,000,000 quintals. (NOTE.—Percentages are necessarily approximate owing to incomplete data. No data is available for China after 1914.)

Only a partial picture of the effect of military recruiting is obtained by contrasting with the rural population the number of soldiers drawn from the land. The effect was more than the numerical ratio, and worsened progressively as the War continued. It was only by the redoubled and heroic efforts of old men, women and children that agriculture was kept going. Not alone human and animal forces were reduced, but material forces also. After the second year of the War there was practically no upkeep of implements. Deterioration of equipment rendered cultivation of the soil ineffective and imposed undue hardship on the workers, and agricultural practice became primitive and manual.

Pre-War European agriculture was heavily dependent on the use of chemical fertilisers, the supply of which declined rapidly. The United Kingdom drew saltpetre from Chile, phosphates from the United States and potash from Germany; under scarcity of tonnage and the munition demand for nitrogen, Chile saltpetre as a fertiliser became practically as scarce in the United Kingdom as was potash from Germany, and imports of phosphate declined. Despite huge domestic deposits of potash, Germany was unable to maintain the pre-War use of potash, though large amounts were applied to certain areas for particular crops in the vain hope of making good the lack of nitrate and phosphate. Since no imported phosphate rock was available to Germany, a grossly inadequate volume of Thomas slag remained her only source of phosphate. In France, the use of phosphate rock, saltpetre and potash declined to insignificant amounts.

In all belligerent countries, the by-product ammonia, previously largely used as fertiliser, went into munitions. Deprived of German potash, the agriculture of the United States was limited to the petty amounts of potash produced in War-born plants. Phosphate the United States had in abundance, until transportation became too congested to permit of normal movement. Saltpetre continued to be used on the soil in that country, though to a reduced extent. Sugar-producing areas, such as the West Indies, the Hawaiian Is. and Java, found their supplies of nitrate and ammonia greatly reduced. The neutral countries of Europe were little better off than the belligerents. Germany did, indeed, furnish potash to Holland and Scandinavia, as deliveries in blockade bargainings, but the amounts were small. Everywhere in Europe the prices of nitrate, ammonia, phosphate and potash became excessive for agriculture, when contrasted with the returned increments in crop yields.

The cumulative results of withdrawal of men and horses, deterioration of farm implements and lack of fertilisers operated in belligerent countries, so far as field crops were concerned, in four directions, mainly: (1) Acreage was reduced. (2) Yields per acre were lowered. (3) Weeds, pests and diseases had free run with corresponding deterioration of farm products. (4) The losses attending unfavourable weather were accentuated.

In general, the same situation held to some extent in the neutral countries of Europe. Men left the farms to take advantage of higher wages in industries. Horses were taken from the farms to be used in urban work or sold to belligerents. Farm implements were allowed to deteriorate, because the factories found it more profitable to manufacture war tools than to make replacement parts. Fertilisers were unavailable or expensive. Finally the agriculture of neutral countries suffered inordinately from disorganisation of natural markets through the operations of blockades. For the reduction in acreage and yield of the principal crops and the reduction in cattle, sheep and horses (*see* AGRICULTURE; GRAIN PRODUCTION AND TRADE).

Preference to Primary Foodstuffs.—It became a necessary War policy of agriculture in belligerent countries to use land for primary foodstuffs in place of raising feeding stuffs out of which meat and dairy products might be produced. According to common European practice, an acre of land devoted to bread grains would produce more than four times as many calories for human food in the form of flour as could be secured in the form of meat and dairy products if the land were devoted to animal husbandry. In the case of potatoes the economy in land was still greater. Contrasting beef cattle, hogs and dairy cows, the greatest waste of land occurred in the production of beef, the ratio of return being much greater in the form of pork or milk. On the other hand, cattle subsisted largely on forage not suitable for human food, while hogs were raised to a considerable extent on cereals adapted to human use or on special fodders grown on land that could produce cereals, potatoes or sugar. In order to make the best use of the land in terms of human nutrients, belligerent countries were compelled to reduce heavily the herds of swine and beef cattle. The count of dairy cattle was somewhat reduced, though efforts were made to conserve the milk supply.

As a result of these operations, some performed voluntarily by the easants and others executed under governmental orders, the count f cattle in Europe was reduced probably by 20–25% and of swine 0–40%. Despite the fact that sheep stood somewhat apart from attle and swine, the general result was much the same, though some ountries like Germany increased the number of sheep and goats. heep competed little with human beings for products of the soil or n the use of acreage, subsisting largely on feeding stuffs inappropriate to human use and grown on terrain unadapted to cultivation. n addition, wool was highly valuable; nevertheless, some countries howed a heavy reduction in the count of sheep.

The yield of meat and fat per animal was reduced owing to scarcity f feeding stuffs and to an abnormally high percentage of slaughter f immature animals. On the other hand, peasants concealed animals from the authorities, reporting fewer animals than they had nd delivering less of products that they produced. This duplicity n the part of the peasants was due partly to predilection for animal usbandry, partly to the greater profits of animal products as against ereals or other primary foodstuffs. The evasion thus described as least in evidence in Great Britain. In every country one found ter the War widely contrasting areas, some in which animal husbandry was most deplorably reduced, while in others the conditions ere practically normal.

It is difficult to compare estimates of acreage under cultivation nd counts of domesticated animals with those of the pre-War eriod on account of the changes in the map of Europe. It seems robable, regarding Europe (excluding Russia) as a whole, that the creage under cultivation and the count of domesticated animals as been restored generally to the pre-War level. The restoration of ultivated acreage has not been accompanied by restoration of pre-War yields, since there is still shortage of fertilisers. Also, the yield f meat and dairy products per head of animals is below the pre-War vel, due to shortage of imported feeding stuffs. It is difficult to ccomplish a restoration of animal husbandry in Europe until feeding uffs from Russia are again freely available. Broadly considered, the ecovery of European agriculture in the seven years after the World War was more rapid than was to have been expected, in consideration the extent and duration of the struggle.

Adaptive Devices of Agriculture.—Efforts were quite generally made the belligerent countries, following agricultural policies that aried in accordance with the characteristics of the region, to raise e maximum volume of foodstuffs in terms of calories. The agrarian ass everywhere had two motives: patriotism and price, though atriotism was perhaps less effective than price as a stimulant to roduction. In many countries peasants would give their sons without question, but not their crops, particularly not their animals. In der to stimulate production, farm prices were advanced, costs of stribution were reduced by establishing control of middlemen, and rices to consumers fixed at the lowest relative level possible; but the stems adopted worked out less well in some countries than in hers. As the burdens and costs of agriculture rose, the price demands of peasants increased. In every country the rural population elieved there was profiteering by urban industries, a belief which d to reprisals by agrarian classes in the form of pressing demands r higher prices for farm products. Governments everywhere were ying to satisfy the city with lower prices and the country with gher prices, usually failing in both directions. In some countries, rm prices of produce rose to four or five times pre-War figures.

In the neutral countries of Europe the situation was much the me. These countries were exporting farm produce to the belligerents. Usually the warring groups were bidding against each other. ach belligerent group used the power of the blockade to coerce the eutral countries of northwestern Europe. The governments of ese neutral countries were concerned with keeping the urban cost living down; but they had an interest in permitting the peasants to ploit the belligerents as much as possible. The peasants in neutral ountries had valid grounds for high prices, since the costs of agriculture and of consumers' goods had risen. They demanded coverage ices, then still more. Under these circumstances, in the neutral untries of Europe, as well as in belligerent countries, wherever ansportation permitted movements of foodstuffs and feeding uffs, there was a continuous trend towards higher prices for farm oducts, restrained or directed by governmental control, though actically unrestrained by competition between producers.

All growers of cane sugar were at the mercy of the Allies, and gar prices were definitely restrained; nevertheless, War prices were bstantially higher than those prevalent before the War. In belligerent Canada and Australasia, prices of essential foodstuffs rose adually throughout the War, particularly those destined for shipment to Europe. The neutral countries of South America were able secure relatively higher prices for essential foodstuffs, though the ices of some unessential foodstuffs declined. Raising wheat in gentina was a better business than raising coffee and chocolate in opical America.

The markets of the Central Powers were closed to neutral overseas countries by blockade; shipments from neutral overseas countries to the markets of neutral European countries were restricted by ocations by the Allies. Entrance to the markets of the Allies was stricted by governmental control over imports, attempting to parate essentials from non-essentials (*see* CONTROL), with the result that necessaries were able to command higher prices, while the prices of non-essentials declined heavily in the countries of origin.

II. EFFECT OF THE WAR ON CONSUMPTION

The *per-capita* intake of food was relatively reduced all over Europe, and absolutely reduced in the belligerent countries. Nevertheless, the *per-capita* food needs were higher in war than in peace; Europeans worked harder, wore poorer clothing, and heated their houses sparingly, all of which meant increase in food requirements.

In many belligerent countries it was impossible to secure a balanced diet with the requisite quantities of proteins and vitamins, and the situation became worse with each year of the War. With increased heat requirements, *per-capita* shortage of calories resulted in loss of body weight. Scarcity in the indispensable factors of the diet, together with a low intake of protein, resulted in retardation of growth of children, and in the development of marasmus and dyscrasias. Despite a quite general lowering of the birth-rate, in many countries morbidity and mortality were increased in children below the 10th year. Stunted growth was frequently observed between the 10th and 15th years; and the physical structure of many European children has been permanently injured by the nutritional disturbances of the War diet. The course of tuberculosis was intensified and the decline of the aged accelerated. Mere loss in body weight, quite generally observed in healthy adults in the countries of the Central Powers, was probably on the whole not an injury.

The pre-War level of consumption of food, in quality and in quantity, was not restored with peace. Indeed, in many parts of Europe, despite extensive relief operations conducted by the American Relief Administration (extending practically through three years following the Armistice), malnutrition and subnutrition persisted for years. Even in Jan. 1926 the diet of Europe in the comparative pre-War sense was, perhaps, normal only in Scandinavia, Spain, Portugal and Holland. The *per-capita* diet of the former belligerent countries is still probably somewhat subnormal in quantity and abnormal in respect of certain components, especially the relations of primary and secondary foodstuffs. Europe, as a continent, has to-day a notably heavier vegetarian diet than before the War, and this may be expected to persist for some time to come.

The diet of Europe is still probably deficient in fats. The supply of animal fats was reduced by slaughter of animals. Furthermore, the animals were insufficiently fed, and gave less milk-fat and less carcass-fat. Before the War Europe imported large supplies of vegetable oils. Russian export of vegetable oils ceased in 1915, and the blockade prevented edible oils from reaching the Central Powers from overseas. Scarcity of tonnage and marine warfare reduced the importation of edible vegetable oils to the allied countries. Importations into the neutral countries of Europe were reduced by blockade rationing. The effect was to lower the ratio between the fat and starch components of the diet of each country. Shortage of fat was more severely felt than shortage of sugar, and intensified the effects of shortage of milk.

The War induced modifications of the diet in many countries in Europe as the result of peasant reactions to governmental control. Illicit trade in foodstuffs, inevitable under any system of war control, became worse as the War continued and the technique of evasion was developed. (National pyschologies differed; there was comparatively little illicit food trade in England; in Germany it was rampant.) Food smuggling became a profession. As the War proceeded and the difference in price-returns between cereals and animal products became more extreme, the peasants concealed animals, delivered to market at the fixed price as little of animals and animal products as possible, sold as much as possible at high prices through illicit traffic, and increased the farm-household consumption. Milk, the most important single food for the urban population, suffered most because butter was the favourite article of illicit traffic. There was in most countries, therefore, a substantial degree of justice in the contention of urban Socialists, that the country districts were treasonably enriching the rural diet at the expense of the urban working classes.

This situation did not terminate with the War. Even after seven years of peace in many countries of Europe, of which perhaps Russia is the most notable illustration, the diet of the rural classes is richer in animal products than it was before the War; the diet of the urban classes is poorer. With deterioration of the buying power of urban workers since the War, this has had the result of increasing rural consumption of animal products; the town diet has become more vegetarian.

III. LIQUIDATION OF WAR CONDITIONS

The abnormalities in the production, marketing and consumption of foodstuffs during the reconstruction period were due to a variety of factors. Manufacturers who enlarged plants, making goods usable during peace as well as war, but subject to particular wastage during war, foresaw the dangers of such war expansion as would represent over-extension after the War, and in a variety of ways sought to evade the losses of post-War liquidations. The world still has unliquidated War expansions in flour-milling, sugar-refining, milk-condensing, food-canning, copper-smelting and leather-making, to mention only a few illustrations. Agriculture was generally urged to expand, with the result (naturally with exceptions in different countries and to different extents in different regions) that at the close of the War agriculture was over-extended by comparison with the pre-War position, and particularly with respect to the purchasing power of the world.

Over Europe the emphasis on the extension of primary foodstuffs, the reduction in the herds of domesticated animals, the scarcity of fertilisers and the deterioration of farm implements, together with the pressure to produce food stuffs to the maximum extent, led to the ploughing up of grass lands, to be used for the raising of primary foodstuffs. Agricultural authorities foresaw clearly the inevitable future repercussion of this movement. The policy of turning pasture to tillage reached its highest expression in the United Kingdom, and the deplorable post-War results are most clearly seen there, though observed to a lesser extent on the Continent.

Since the War, the agriculture of the United Kingdom has experienced a crisis as severe as that which characterised the period of agitation over the Corn Laws. British farmers have found that the enlarged area of tillage cannot be remuneratively cultivated; operative costs have been high, and the country has been deluged by agricultural produce flowing from overseas countries also suffering from War-expansion of agriculture. Throughout Europe, one of the results of agrarian distress, proceeding more or less from War over-expansion in the different countries, has been the revival of agrarian protectionist movements. This is not to be interpreted to suggest that Europe contemplates de-industrialisation in favour of agriculture; it represents merely a grasping at what seems to be an instrument of first aid. In part, it is a beggar-your-neighbour movement.

Cereals.—Europe may be expected slowly to recover her pre-War output of primary and secondary foodstuffs. This has been practically attained for cereals, and will soon be accomplished for sugar. In Russia, the recovery of agriculture has been most delayed, and the period of reconstruction may be notably prolonged. The recovery of agriculture is more rapid in western Europe than in the central countries between the Baltic and the Adriatic seas, on account of the higher natural position of agriculture, better railways, sounder fiscal policies and superior governments. Since the World War, western Europe has been compelled to secure a larger proportion of her imports of cereals from overseas, so that overseas countries have temporarily replaced Russia and the Danubian and Balkan States.

Sooner or later (probably sooner for the Danubian and Balkan States and later for Russia), these States will return to their natural position as preferred primary sources of supply of cereals for western Europe—for the one main reason, in addition to others, that these exporting countries must pay for necessary manufactured goods from western Europe with exports of cereals. During this time of readjustment the over-extended surplus-producing countries of North America, South America and Australasia face a gradual reduction in the scale of this agriculture, in so far as they may not be able to find new markets in the expanding population of the world.

The average acreage of the staple cereals in the United States during the years 1918, 1919 and 1920, was 230,000,000; the acreage in 1924 was 218,000,000. But for wheat the extent of liquidation represents a reduction of something near 20,000,000 acres. In the case of Canada, Argentina and Australia, there has been no such decline in wheat-growing. Indeed, the combined acreage in these three countries suggests continued expansion rather than contraction. When the definitive restoration of wheat-growing occurs in Eastern Europe, wheat-growers in Canada, Argentina and Australia will face liquidation with the development of a diversified agriculture, as has happened in the United States, or new markets for wheat must be acquired. The outcome will depend, among other things, upon development in the standard of living in the world, the penetration of industrialisation into Russia and Asia, and the competition between wheat, rice, millet and maize.

Sugar.—A good illustration of the disturbance in a staple foodstuff as a result of war is to be observed in sugar. Before the War, beet sugar and cane sugar competed internationally. Beet sugar was grown little outside Europe and Russia; cane sugar was grown in practically all tropical countries, and could readily be expanded. The production of beet sugar was greatly reduced during the War. The countries of western Europe replaced the beet sugar they had previously purchased from central and eastern Europe in part with cane sugar from overseas. A widespread expansion of sugar-cane growing followed. In some of the sugar-cane countries the planting is annual; in others the cane is cut, without replanting, over a number of years. When a new stand of sugar cane has been set and provided with transportation and refinery, this culture tends to persist, since sugar-growing is a form of agriculture associated with large capital.

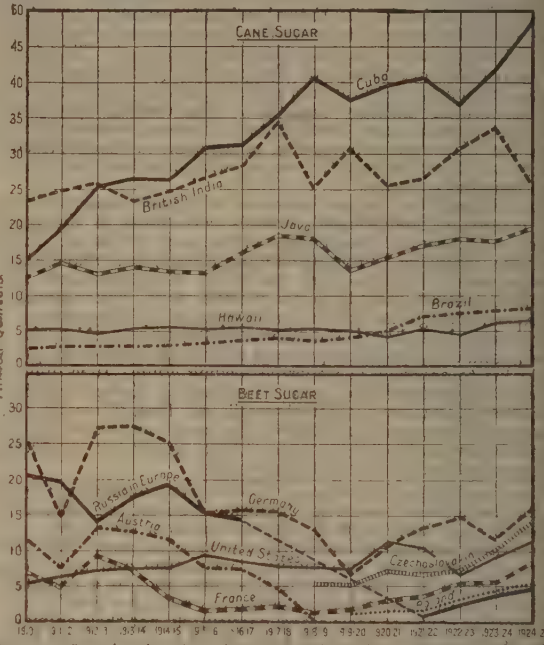


Fig. 2. -Graphs showing the production of raw sugar in the chief sugar-producing countries, for each year from 1910–1 to 1924–5.

In 1909–13 the world crop of beet sugar was about 8,000,000 short tons and of cane sugar about 10,000,000 short tons. In 1920–1 the world crop of cane sugar was over 13,000,000 short tons and of beet sugar only 5,000,000 short tons. Since then the production of cane sugar has continued to increase; at the same time, the beet-sugar areas are being restored. The sugar crop of the present season is over 17,000,000 short tons of cane sugar and over 9,000,000 short tons of beet sugar. When beet-sugar cultivation in Europe and Russia has been fully restored, unless there is some diminution in the output of cane sugar, the whole crop will be something like 18,000,000 short tons of cane sugar and 10,000,000 short tons of beet sugar. Can the world absorb this sugar? Certainly—at a price. Whether, with the restoration of the beet-sugar yields, the expanded cane-sugar acreage can be maintained or must be reduced, remains to be seen. In the meantime, the result for the world is a large supply of sugar at a beneficent price. Recent complicating developments are governmental restriction of cane-sugar production in Cuba and governmental bounty on beet-sugar production in Great Britain.

Other illustrations of agricultural expansions that became ansformed into problems of liquidation are cattle-raising in the nited States and Argentina and sheep-raising in Australasia. he expansion in cattle-raising in the United States was relative ther than absolute; none the less, the difficulties of American ttlemen have been due in good part to an increase in export of ef products from something like 150,000,000 lb. per annum st before the War to over half a billion lb. in 1918–9, with bsequent recession to the pre-War level. This restriction of tlet, together with other factors, has necessitated a heavy quidation. In the case of Argentina, the volume of the War arket for chilled, frozen and packed meats resulted in over-pansion of the industry, followed by a post-War crisis so severe to have prompted governmental action in price-fixing and bsidy. This also holds true of animal husbandry in Australasia, hich, despite the distance, was led to over-expansion as a re-lt of heavy demand for chilled and frozen meats during the ar. In Australia also, the crisis of liquidation found expression the use of public funds for the purpose of stabilising prices d minimising losses.

There is scarcely a country in the world in which some par-cular form of agricultural production was not over-stimulated uring the War. Hence, post-War problems of liquidation of rying extent and severity have everywhere arisen—writing-f of inventories and absorption of losses, liquidations imperative r the safe conduct of future business. Students of world agri-lture may agree that producers exploited the belligerent coun-ies during the War. They will also probably agree, a decade om now, that the gains of such profiteering have already been st, or more than lost, to the agriculturists as a whole, if not to articular individuals. And high food prices imposed on con-mers between 1915 and 1920 have since been requited by umping foodstuffs at less than the cost of production.

In particular countries, certain crops did not share in the World ar expansion but have nevertheless suffered in the post-War quidation. Of these, illustrations are wheat-growing in Aus-alia and sugar-raising in Java. Australia was too far from urope to have much call on ocean tonnage for shipment of heat, and wheat accumulated in Australia during the War. hese accumulations were exposed to heavy losses; grain is arketed in Australia in bags, storage capacity is limited, and rge amounts of grain were exposed to vermin and the elements. ustralia had no opportunity remuneratively to unload wheat n the world before the collapse of the wheat price in 1920. The tuation thus created was one of unusual gravity for the small opulation of the Commonwealth, and has found expression in ore or less continuous pooling and price regulation. In the se of Java, western European needs for sugar could be covered ith sugar purchased on money borrowed from the United States nd with a much shorter ocean haul. Thus the sugar industry f Java was stagnant during the War, and although it enjoyed short period of high prosperity just after the War, this was soon rminated by the collapse of sugar prices.

The history of sugar prices during and since the War furnishes good illustration of the contrast between correct statistics and correct opinions. Following decontrol of sugar, with the failure f purchase of the Cuban crop for the season 1919–20, the public, cluding sugar-producers, American importers, refiners, whole-lers, fruit-packers and candy-makers, assumed that the sup-lies available to the United States were short and inadequate her needs, that demand for sugar in that country would prove be quite inelastic, that sugar-hungry Europe would expand her nportations, and that the rest of the world contained no isible or invisible stocks of moment. On the basis of these ssumptions, a veritable trade hysteria resulted, culminating nally in a sugar price of some 23 cents. These stated assump-ons were all more or less unfounded, and as the facts became vealed the price of sugar declined precipitously. The Cuban pply proved larger than anticipated; consumers' demand in e United States was found to be relatively elastic; sugar-ungry Europe did not demand more sugar at high prices. In-ead of a shortage of sugar stocks throughout the world, sugar oured in from every conceivable direction. Hoarding was replaced by dumping. The huge gains in the spectacular rise of price (some realised, but mostly paper profits) were replaced by huge real losses that fell on producers, refiners and traders. Since sugar-beet growing in Europe is a long-view proposition, the recovery of this branch of agriculture was aided little by the price rise and has been retarded little by the price decline.

IV. CONSIDERATIONS BEARING ON MOVEMENT OF FOODSTUFFS

Despite the fact that the food supply is classed as the prime necessity of society, demand for foodstuffs is somewhat elastic and there is considerable variability contingent on adaptations and substitutions provoked by price relations. To a considerable extent, also, the distribution of foodstuffs is contingent on fluidity of finance; abundance or scarcity of credits has exerted considerable influence on the distribution of staples since the War. Credits from the United States, as well as the foreign investments of American nationals, tourist expenditures and immigrant remittances, have directly and indirectly facilitated the export of surplus agricultural produce from the United States, to some extent to the detriment of corresponding exports from Canada, Australia and Argentina. Public money has been used in Argentina and Australia in furtherance of the marketing of agricultural produce, and this, we may infer, to the injury of exportable produce from the United States. If surplus-producing countries employ public funds in furtherance of exports, the international movement of foodstuffs will be different from what would be expected if purely competitive relations obtain. It is difficult in surplus-producing countries to resist the political influence of agrarian blocs in their insistence on some form of relief through the use of public funds.

One post-War difficulty of agriculture, more or less general the world over, that finds expression in the food supply, has been the increased cost of labour. Without entering into the reasons for this advance in wages, it is sufficient to state that in most countries, both importing and exporting, the level of wages has risen substantially above the pre-War plane. To a considerable extent also labour costs have risen, since in many directions the efficiency of labour has not increased proportionately to the increase in the wage scale.

For many countries the position has been accentuated by the trend of movement of workers from country to city. Enlargement of wages of farm workers has resulted in increase in cost of production of farm produce. Since increase in wages of industrial workers has, at least to some extent, and in many directions, resulted in notable elevation in prices of industrial goods, this has had the effect of lowering the purchasing power of agricultural products in terms of goods and services. The measure for each year since the War in the different producing countries of the world of the purchasing power of staple foodstuffs—for example: wheat, corn, sugar, cattle, hogs, wool and coffee—amply confirms the broad fact. Only under special circumstances has the purchasing power of agricultural produce been raised relatively above the pre-War level. There is considerable readjustment in this direction to be expected the world over, since if such readjustment does not occur, this would imply a lower standard of living on the farm than in the town. This readjustment may be expected to include, from the side of agriculture, the elimination of submarginal areas and increase in efficiency of cultivation and management over the remainder; and, on the part of industry, increase in the efficiency of labour and improvement in mechanical operations, with resulting lowering of production costs.

A survey of the total commerce of the world in successive years since the War shows a relative overproduction of agricultural produce and a relative underproduction of industrial goods, though the margin is being gradually reduced. This has had the effect of lowering the purchasing power of agricultural produce in terms of industrial goods, which was relatively low at the beginning of the century and notably higher just before the War. After the War this relationship again became comparable to that existing at the beginning of the century.

The food supply of the world is modified by conditions of transportation, since both fluidity and cost of movement have influence on distribution and marketing. Transportation has been a limiting factor in the export of grains and oil seeds from Russia since the War. The railways of western Europe have been largely restored to their pre-War efficiency, except in the Danubian and Balkan States, whose crippled facilities still impose limitations on the movement of farm produce. The effective service of railways has been one of the outstanding features of the post-War situation in the United States and Canada. Ocean shipping rates have been low since the War, and this has facilitated movement to importing countries of surplus supplies from exporting countries the world over.

V. PROSPECTS OF THE NEAR FUTURE

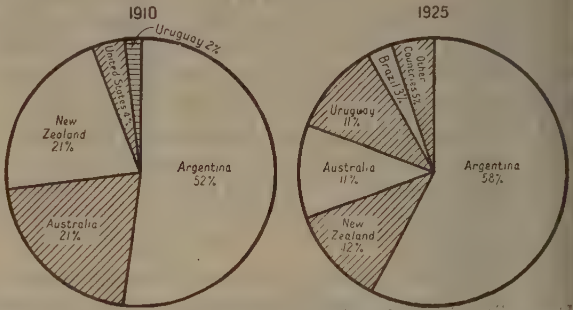
Changes in the food supply of the world will depend to some extent upon developments in industry as well as in agriculture. During the period 1915 to 1925 numerous backward countries of the world increased their manufacturing facilities and thus rendered themselves less dependent on European goods. If these new industries maintain themselves, the retardation of recovery of European industries (whose output as a whole is still considerably below normal) will be prolonged, unless new markets and a higher standard of living in the world result in a general expansion of demand for manufactured goods. A point of particular importance is Russia. If the present low standard of living is continued in Russia, this will have an indirect effect on the food supply and manufacturing activity of Europe. The degree to which goods from manufacturing industries in India, China and the British dominions are able to supplant the products of corresponding industries in the United Kingdom, is another point of importance.

It is probable that the food supply of the world during the next 10 years (1926–36) will be relatively below the pre-War level and more vegetarian. It would be an error to expect the world to direct the first energies solely toward the restoration of the pre-War food supply, leaving the restoration of the standard of living in the matter of other goods and services to be deferred. Various groups of demands will compete in their claims on income, and the demand for food will not be able to secure a proportion of the income so large as to insure in the near future the restoration of the pre-War diet. The best that can be hoped for, so far as Europe is concerned, is to secure a diet competent in the nutritional sense; but a cheaper diet, less diversified, and less luxurious than was the case before the War. The agriculture of the surplus-producing countries will necessarily have to adapt itself to these developments.

We are accustomed in world trade to view manufactures from the standpoint of the international division of labour. If the food supply of the world is to be correctly appraised, it must be considered from the same standpoint. The world faces during the next decade the necessity of establishing a new equilibrium in the demand and supply of foodstuffs, representing a new equation between effective demand and remuneratively produced supply, a revised international distribution of labour in agriculture and manufacture, distorted, however, to an unforeseeable extent, by artificial controls, bounties and protective tariffs.

Since the War, Europe has been financing the importation of foodstuffs largely with borrowed money, credits, tourist expenditures and immigrant remittances. Before the War, Russia was a borrowing country; but, with Russia excluded, Europe was a lending continent. Outside of the United Kingdom, which remains a lending country, Europe, as a result of the War, has become a borrowing continent. With each year since the War, European governments, industries and even agricultures contract new loans at relatively high interest rates. Disregarding entirely European payments of War debts to the United States, the service charges on post-War European borrowings will represent a growing burden on the continent, a burden certain to be reflected in international trade, since the difficulties of transfers of international payments find their ultimate expression in the commerce of goods and services.

Ultimately, Europe must pay her international obligations with goods and services; but this is not to be expected during the next five or 10 years, during which time we expect adjustments to occur largely through the invisible items in the international accounts. But the time approaches when Europe must raise a larger proportion of her food supply or pay for a larger proportion of it with goods and services. The necessary adjustments contingent on these developments form part of the new equilibrium between demand and supply of foodstuffs toward which the world is inevitably trending. (A. E. T.)



Courtesy of Weddell & Co. Ltd.

FIG. 3.—World exports of refrigerated Beef, Mutton and Lamb. The increasing importance of South America in the supply of meat products is clearly seen by these diagrams, in which exports for 1910 and 1925 from each country are shown as a percentage of total world exports. (See Table.) The chief importing country is Great Britain, which takes some 60% of the world's available supply.

BIBLIOGRAPHY.—International Labour Office, *Enquête sur la Production* (1923); International Institute of Agriculture, *International Yearbook of Agricultural Statistics* (Annual); United States Department of Agriculture, *Agricultural Yearbook* (Annual); see also Reports of Ministry of Agriculture of Great Britain, etc.

The accompanying diagrams and tables illustrate the principal sources of food supplies, except wheat, maize, oats, rye and barley, which are dealt with in the article on GRAIN PRODUCTION AND TRADE, during the period 1910 to 1925.

Sugar.—The production of both cane and beet sugar greatly increased after 1910. The following table gives the exports of sugar in *short tons* from the chief exporting countries for the average of the period 1909–13 and for 1922.

Country	Average 1909–13	1922
Cane Sugar		
Cuba	2,009,899	5,581,376
Dutch East Indies	1,412,555	1,582,691
Mauritius	226,255	322,692
Brazil	38,284	277,903
Peru	146,736	302,447
Philippine Islands	179,432	399,112
Dominican Republic	92,351	189,195
Beet Sugar		
Germany	873,161	13,915
Austria-Hungary	848,830	..
Czechoslovakia	..	350,366
Netherlands	200,490	219,477
Russia	293,514	..
Poland	..	65,344
Belgium	154,476	177,594

The production of sugar in the chief producing countries for each year from 1910–1 to 1924–5 is shown in the chart below, based on figures given in *The International Year-book of Agricultural Statistics*. The total world production in the pre-War period and in 1924–5 was:

	Beet Sugar quintals	Cane Sugar quintals
Average 1909–10 to 1913–4	83,990,000	95,668,000
1924–5	81,690,000	150,845,000

Meat Products.—The table below shows world exports of refrigerated beef, mutton and lamb for 1910, 1913, 1917 and for each year from 1920 to 1925. Of particular interest is the great increase in exports owing to war demands, the growing importance of Argentina

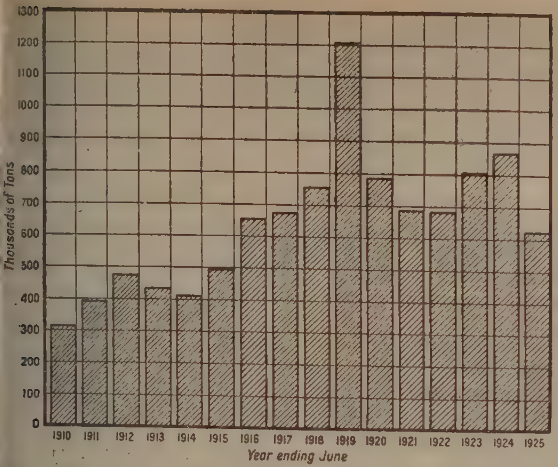


FIG. 4.—Exports of Pork and Pork Products from the United ates. The United States is the source of over two-thirds of the orld supply of pork products. This diagram shows the export of ɛsh, canned and pickled pork, cured hams and shoulders, bacon, d and neutral lard for each year from 1909–10 to 1924–5. The ief importing countries are the United Kingdom and Germany.

azil and Uruguay, and the decline in exports from the United ates. Exports from the chief exporting countries are shown in . 3 as a percentage of the total. The importance of the United ates as a source of pork products is clearly shown in fig. 4.

Exports, in Tons, of Refrigerated Beef, Mutton and Lamb, 1910 to 1925

Year	Australia	New Zealand	Canada	South Africa	Argentine	Uruguay	Brazil	U.S.A.	Other Countries	Total
910 . .	134,300	132,200	nil	nil	328,800	9,900	nil	23,900	nil	629,100
913 . .	178,500	122,400	nil	nil	412,200	30,100	nil	100	21,600	764,900
917 . .	116,500	120,100	55,000	21,100	448,700	72,300	66,400	97,900	37,500	1,035,500
920 . .	109,400	228,200	6,100	5,600	480,800	110,000	63,600	42,000	31,000	1,076,700
921 . .	95,200	212,200	4,300	1,000	456,400	82,700	61,000	12,500	45,000	970,300
922 . .	134,800	172,600	4,200	300	493,200	85,200	32,900	3,300	22,100	948,600
923 . .	114,200	149,200	4,000	400	683,800	115,200	39,500	4,100	30,400	1,140,800
924 . .	95,900	156,300	3,200	3,800	831,300	141,500	63,800	4,000	28,300	1,328,100
925 . .	148,800	165,300	4,700	9,700	775,900	147,400	44,800	700	42,600	1,339,900

Dairy Produce.—The exportable surplus of butter, cheese and ndensed milk for the average pre-War year and 1921 and 1924 is own below:—

Exports of Dairy Produce
(In metric tons of 2,204 lb.)

Country	Average 1909–13	1921	1924
Butter			
Denmark . . .	88,692	92,059	123,193
New Zealand . .	17,582	45,644	64,491
Netherlands . .	34,080	20,198	34,732
Russia . . .	68,172	. .	22,436[1]
Australia . . .	35,175	41,921	29,683
Argentina . . .	3,145	25,812	29,682
Hungary . . .	3,472[2]	. .	23,232
Canada . . .	1,720	4,142	10,135
Cheese			
New Zealand . .	25,202	69,537	81,003
Netherlands . .	57,779	52,280	77,271
Canada . . .	75,867	62,224	61,707
witzerland . .	31,912	4,806	19,856
taly . . .	27,470	7,559	33,616
Condensed Milk			
Netherlands[3] . .	. .	77,225	113,549
United States . .	7,349	131,416	93,446
Denmark[4] . . .	2,143	17,020	32,696
Switzerland[4] . .	36,532	21,239	26,411
Canada . . .	2,075	17,020	20,448

[1] Through European boundaries.
[2] Surplus mainly absorbed in former Austrian Empire.
[3] Average 1910–3.
[4] Including sterilised milk.

FOOT AND MOUTH DISEASE: *see* VETERINARY SCIENCE.

FOOTBALL, ASSOCIATION (*see* 10.621).—The Football Assn. of England, having helped materially in the development of the game in Europe, made a departure in 1910 when, at the invitation of the South African Assn., a team of amateurs and professionals was sent in May to that Dominion. A successful tour carried forward the work of the Corinthians, who visited South Africa in 1897, 1903 and 1907. In 1920 another mixed team was dispatched to Cape Town. After years of preparation the Commonwealth Football Assn. of Australia arranged with the English Football Assn. to send out in 1925 a party of players, who were mostly professionals. The results of these excursions may be tabulated thus:—

	Matches	Won	Goals For	Goals Against
1910. South Africa . .	23	23	143	16
1920. South Africa . .	14	14	64	10
1925. Australia . .	25	25	139	13

Such enterprises were a continuation of the policy of the Football Assn. to popularise the game, the Dominion organisations paying the expenses and retaining all revenue. In 1917 the parent body in England presented a shield to Japan to foster the game in the schools of that country, and in the years immediately following the World War it gave challenge cups for competition to South Africa, Australia, New Zealand and Canada. To stimulate the game and to encourage English amateurism, the Assn. also entered teams for the Assn. football tournaments at the Olympic Games of 1908, 1912 and 1920, but withdrew from participation after the Antwerp Olympiad, as the definition of an amateur in England and the practice in some other competing countries were not in unison.

In 1910 the Football Assn. took another important step, as in April the rule regulating the maximum wages which could be paid to professionals by English clubs was removed. Such financial matters were deputed to the executives of the leagues, which thus became the controllers of all payments to professionals. The Football Assn. celebrated the jubilee of its existence in Oct. 1913 by a banquet, and to mark the occasion endowed a benevolent fund with £5,000.

During the season of 1913–4 a schism which had afflicted the game was brought to an end. As amateurs declined to co-operate in the government of all football, including professional clubs, a rupture had occurred in 1907–8. The Amateur Football Assn. was established and carried on a separate organisation until Feb. 2 1914, when representatives of the older universities and the Corinthians met the Football Assn. in conference and settled the dispute. The Amateur Football Assn. became affiliated to the Football Assn. under the same conditions as the Army Football Assn. and other auxiliary bodies. A momentous season was closed, King George V. attending the final match for the Assn. Cup at the Crystal Palace, London, on April 25 1914 and presenting the trophy to Burnley, who had beaten Liverpool.

Effect of the War.—In spite of the outbreak of the World War, the season of 1914–5 was carried through by league clubs employing professionals and therefore having legal contracts and commitments, but all the national associations cancelled their international matches, and in the spring of 1915 the Football Assn. took powers to suspend professionalism and all its cup competitions, although local tournaments for amateurs, for munition workers and soldiers on leave, were arranged by the

Football League. The Football Assn. imposed rigid conditions, and monetary inducements for men to play football were strictly forbidden. The Football Assn. and the league did much to assist the Red Cross Society, to provide comforts for the troops, and to help refugees in England. A football national war fund was founded in Dec. 1917 to relieve those connected with the game who had been stricken by the misfortunes of war, either on active service or in munition work.

Post-War Progress.—In the spring of 1919 the work of reorganisation was commenced and victory international matches were played. The season was lengthened by the addition of the last Saturday in Aug. in one year and the first Saturday in May of the year following, and a boom in the game was experienced in 1919–20. King George V. attended a league match for the first time at the Manchester City ground on March 27 1920 and witnessed the final match for the Assn. Cup at Chelsea, on April 23 1921, presenting the trophy to Tottenham Hotspur. In the next month the Football Assn. entered into an agreement with the British Empire Exhibition to play the final tie for a term of years in the stadium at Wembley.

The cup competition of 1922–3 is memorable for the first entry of the Corinthians and the first final played at Wembley. This match between Bolton Wanderers, who won the cup, and West Ham United attracted at least 150,000 people, the receipts being £27,776. The Football Assn. has also a cup which is restricted to amateur teams, and each year plays a charity shield match, which is quite apart from the £20,000 per annum that the clubs contribute to local charities. Receipts from the practice matches in Aug. are earmarked for this purpose by the Football Association.

Changes in Laws.—The International Football Assn. Board, which was established in June 1886 by the Football Assn., the Scottish Football Assn., the Football Assn. of Wales and the Irish Football Assn., have continuously revised the laws of the game at their annual meeting in June of each year. Gradually, but surely, forwards have been given more scope. In 1907 the board decided that a player is not out of play "when he himself is within his own half of the field of play at the moment the ball is played, or thrown in from touch by any player of the same side." At the meeting in 1920 it was resolved that "no one shall be offside when a throw-in is taken." In 1925 the board relaxed the fundamental law relating to off-side so that a player would be on-side if only two opponents were nearer their own goal than himself when the ball was last played by one of his own side. The board determined, in 1924, that a goal may be scored from a corner kick, and a year later the player, throwing-in from touch, was ordered to stand with both feet on the ground outside the touch line and facing the field of play, so as to throw the ball in over his head with both hands in any direction.

Football Leagues.—The Football League, founded by 12 clubs in 1888, expanded greatly after the World War. When the league considered the revival of the two competitions, on March 10 1919, the clubs in divisions I. and II. were increased to 22 in each section. On May 31 1920 the Southern League was, at its own request, absorbed by the Football League and became division III. in associate membership but without the right to vote at the annual general meetings of the league. On the same day a projected northern group, a part of division III., was sanctioned, but its formation was deferred until March 8 1921, so as to give clubs the opportunity to strengthen their playing power and secure financial stability. Thus the league had, for the season 1921–2, not only divisions I. and II., but both sections of division III., north and south each with 22 clubs. Thus the original membership of 12 clubs had increased to 88 clubs—a powerful alliance with authority to devise rules for their domestic affairs, although these must be in conformity with the rules and bylaws of the Football Assn. and sanctioned by the supreme body.

A Welsh National League, with northern and southern groups, was inaugurated in 1921–2. The Scottish League, which remained active during the War, had a moribund second division, but in 1923–4 this was galvanised into life by the adoption of the system of promotion and relegation. The first division was therefore no longer a closed corporation. The invigorated secon division was supplemented by a third division, so that the club of England, Scotland and Wales became classified into groups f the first time. The Irish Football Assn. had not the same oppo tunity, being limited to Northern Ireland. The Irish Free Stat founded a governing association body and created its own cu and league competitions.

INTERNATIONAL FOOTBALL ASSOCIATIONS

La Fédération Internationale de Football Association, whi is composed solely of the governing body of each country pla ing the game, was formed at Paris on May 21 1904, with th object of developing and controlling association internationa football. It grew so rapidly that, in 1910, the members includ Austria, Belgium, Denmark, England, Finland, France, Ge many, Hungary, Italy, Luxemburg, Sweden and Switzerlan During 1911, Ireland, Wales and Scotland joined, and the secre tary's report stated that all European countries with a governi body were members except Rumania. In 1912, with the Argenti Football Assn., and the pan-Russian Football Assn. include the Federation was recognised officially by the Internationa Olympic Committee, although Spain, Portugal and the Balka states were not properly organised. In this year, English becam the official language for minutes and correspondence, and it wa decided to adhere to the laws of the game as passed by th International Board of Great Britain. The Federation was ac mitted to this board with the right to send two delegates. Du ing 1913, Canada and Chile were affiliated, and when the Worl War broke out the Federation had 26 members, including th United States.

The Federation was dormant during hostilities, and when i was restored to activity the British nations withdrew from mem bership, as they declined to sit with the representatives of thos countries which had been their enemies. In 1924 they rejoin on their own conditions, which were that the articles of th Federation should not affect the inter-relations of the vario parts of the British Isles and their own autonomy. By Aug. 2 1925 the Federation had affiliated the governing bodies of th following: Argentina, Austria, Belgium, Brazil, Bulgaria, Can ada, Chile, Czechoslovakia, Denmark, Dutch East Indies, Ecua dor, Egypt, England, Estonia, Finland, France, Germany, Hun gary, Ireland, Irish Free State, Italy, Latvia, Lithuania, Luxem burg, Netherlands, Norway, Paraguay, Peru, Poland, Portuga Rumania, Russia, Scotland, Siam, South Africa, Spain, Swede Switzerland, Turkey, Uruguay, United States, Wales and Yugo slavia, with headquarters at Amsterdam. At a congress held i Prague in May 1925 the following resolution was passed: "Th congress of the Fédération Internationale de Football Assn. de clares that it considers the Fédération Internationale de Foot ball Assn. the highest authority on all football matters, and tha it cannot accept the interference or guidance of anybody else i such matters." At a conference between representatives of th four associations of the British Isles at Liverpool on Sept. 5 192 it was decided that the Fédération be informed that if this re lution were confirmed the conference would have no alternative bu to advise the associations of the United Kingdom to withdra from the Fédération. In Nov. the president and secretary of th Fédération officially explained that by Article 34 of its Consti tution the authority and competence of the International Boar were recognised and that the resolution applied only to "som powers strangers to football."

It is clear that association football has become a world gam In 1906 South Africa visited South America, and in 1923 a 1924 Chinese University students and a Canadian combinatio went to Australia. At the Olympiad of 1908 in London and 1912 in Stockholm, England won the international tournamen In 1920, at Antwerp, England was defeated and Belgium wo while in 1924, at Paris, the representatives of Uruguay were th victors. It has been difficult to organise comprehensive gove ment in countries of large area, but South Africa founded a association in 1892, Canada in 1912, the United States in 191 and the Commonwealth of Australia in 1921.

In the United States there has been much activity to make his code pre-eminent as the fall and winter game. During 1920 n American-born team from St. Louis visited Scandinavia, hile a Scottish set of players, under the auspices of the Third anark Club of Glasgow, toured in Canada and the United States n 1920-1. The sequel in the United States was the formation f the American Soccer League with a higher standard of play han had previously obtained in that country.

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FOOTBALL, RUGBY (*see* 10.618).—The history of the game f Rugby since 1910, not only in Great Britain and Ireland, but n the British Dominions overseas and also in France, has been ne of steady development. Rugby is the national game in New Zealand and in South Africa, and to a less extent in Australia, while in a somewhat different way it is played in America. In France it has obtained the official recognition of the overnment, so that it is now played over the entire country. France possesses more clubs and more players than any other ation. In England many public schools, which have for years een devoted to the Assn. game, now play Rugby. Since the World War there has been a marked increase in the number f Rugby clubs in England, and the game is now played in many districts where at one time its very name was almost unknown. n the northern counties, which suffered so severely from the nroads of professionalism, Rugby is rapidly regaining its old opularity and prestige, and for some years now they have been ble to provide valuable members of the English team. The umber of old boy clubs, particularly in London, has been reatly increased.

I. THE BRITISH EMPIRE AND FRANCE

The year 1910 was an *annus mirabilis* for England, since t saw the opening of the national ground at Twickenham, Middlesex, with a brilliant victory over Wales. The revival of English Rugby may fairly be said to date from this year, for England won the championship for the first time since 1892, and rom then till 1925 has won it outright on five occasions, besides dividing the honours twice. The visit of the All Blacks in 1905 had demonstrated the weakness of the game in England, and or some seasons players had been endeavouring to improve both their tactics and their physical condition.

Much of the credit must go to A. D. Stoop, who persevered mid much discouragement in developing the open style of play, and who without doubt had his reward. He gathered ound him a band of brilliant halves and three-quarters, and fter a few years had the satisfaction of seeing his principles generally adopted and England gaining victory after victory. Next in importance to these tactics was the improvement in English forward play. For many years now the English selectors have aimed at discovering an all-round type of forward, clever with hands and feet and able to hold his own in the rough and umble of international matches. Forwards are no longer content to be mere pushing machines, their duties do not nowadays inish with the breaking up of the scrummage, rather do they hen begin. From 1910 to the end of 1925 England won 9 out f 11 matches with Scotland; 9 out of 11 with Ireland, the other being drawn; 8 out of 11 with Wales; and 10 out of 11 with France. That is to say, out of 44 matches England won 36, drew 3 and lost 5, a record probably without parallel.

Scottish Rugby.—In Scotland Rugby continues to flourish, new clubs are springing up and old ones are showing a decided ncrease in power and in the standard of their play. The national ide has achieved a very fair record since the World War, though t had to wait a long time for its first victory over England and or its first actual championship triumph since 1907. During he last few seasons Scotland has had to come south, especially to Oxford, for her three-quarters. Scottish forwards are as formidable as ever, the halves are sound, and, unlike England, Scotland has been fortunate in the possession of a succession of really first-class full-backs. The chief blots on the Scottish escutcheon since the World War are the three defeats by France, one of which was inflicted at Inverleith, where in 1921 France won by a try to nil. There are signs that Scottish Rugby is now at the beginning of a new era of prosperity.

Irish Rugby.—Irish Rugby naturally suffered severely during the World War, and also after it, owing to the disturbed state of the country generally. Indeed the wonder is, not that Irish teams have been defeated, but that they have been able to exist at all. But now old-established clubs are regaining their normal strength, and new ones are making good. During the last few seasons several international matches have been won, and the prospects for the future are bright. A number of young and promising players have been discovered, and Irish back play is developing well. The forwards too are recovering their old dash and are again a force to be reckoned with.

Welsh Rugby.—In 1910 Wales lost a sensational match to England, the first English victory since 1898, but they were still a formidable side, and in 1911 secured the international championship once more. Gradually Welsh Rugby began to lose its force, and triumph no longer automatically followed triumph. The World War dealt Welsh Rugby a very heavy blow, and although Wales gained a brilliant victory over England at Swansea in 1920, and carried off the championship in 1922, the Welsh game has not been up to its former standard. The curious point is that Welsh club football is practically as good as ever, or at any rate is still superior to English club Rugby, and Saxon victories over the great Welsh organisations are still few and far between. Yet the national side is no longer the force it once was, and the natural conclusion is that something is wrong with the principle of selection. Defections to the professional game now and again deprive Wales of potential international players, but not to an extent sufficient to explain the decadence of the Welsh fifteen.

French Rugby.—In France the game prospers amazingly. Reference has already been made to the three victories gained over Scotland. Ireland has also been beaten three times, but England and Wales have so far escaped defeat. England, it is true, had a very narrow escape in 1922, when the match at Twickenham ended in a draw, of which it is only fair to say that France had very much the better and were unlucky not to win. Tours in France are very popular nowadays with British clubs and they do an immense amount of good in more ways than one. French Rugby has suffered a good deal from the indiscriminate praise lavished on it in the early days, when it really needed constructive criticism, but the French authorities themselves were never misled, and always recognised the necessity of interchanging visits with British clubs and also of strict and adequate refereeing.

South African Rugby.—Since 1910 only two teams from the Colonies have visited this country. In 1912 a South African side, under W. A. Millar's captaincy, paid a visit which was remarkably successful. Of the 27 matches played, 24 were won and only three lost. A record was set up by their defeat of all the five countries, a feat no other touring side has rivalled. The matches lost were with Newport, London and Swansea. The strength of the team lay in the forwards, who were exceptionally powerful and fast, but the backs, if not as effective as those of the 1906 contingent, were by no means negligible.

In 1910 Dr. T. Smith, an Irish international, captained a British side in South Africa. It met with moderate success, winning 13 matches out of 24, and losing eight. Of the three test matches one was won and two were lost. About 12 international players took part, but the team was, of course, very far from representative of the full strength of Great Britain and Ireland. R. Cove-Smith led the fifth British team to tour in South Africa, but with rather unsatisfactory results. Of the 21 matches played nine were won and nine lost. Three of the four test matches ended in defeat, the other being drawn.

Persistent ill-luck followed the team in the matter of casualties, and the side, none too powerful to start with, was hardly ever at full strength. Indeed, toward the end it was difficult to find fifteen men sound enough to play. Most of the defeats were by comparatively moderate margins, but there is little doubt that the team was not strong enough for the task it undertook.

New Zealand Rugby.—In Sept. 1924 the second New Zealand team, captained by C. G. Porter, began a wonderfully successful tour. They actually won all their 28 matches in England, Ireland and Wales, no fixtures having been arranged in Scotland. Their triumphs were due to their splendid physical condition, and to their marvellous and intensive combination. Nothing finer has ever been seen in Rugby than the way in which the men supported one another; there was always somebody at hand to carry on and drive home an attack. They were naturally hardly at home in their first few matches, and they had a very narrow escape from defeat by Newport. But they steadily improved and in due course developed into a very fine side indeed, though in the opinion of many they were never quite the equals of Gallaher's men.

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II. THE GAME IN THE UNITED STATES

The rules that govern American Rugby football were drastically changed in the winter of 1906 by a combined Rules Committee, six of whom represented the newly formed National Collegiate Athletic Assn., the other six being members of the old Rules Committee. This amalgamated committee was the outgrowth of a conference of representatives of a large number of colleges and universities which, because of the large and increasing number of deaths and serious injuries, was called for the purpose of doing away with football, or of radically changing the rules. This conference was a direct result of the football season of 1905 which had been marked by 21 deaths and by many serious injuries.

Changes in the Rules.—Vital changes in the rules were made at the meeting of this combined committee, these being on the following lines: (1) Doing away with heavy mass play, (*a*) by making it impossible for tackles and guards to be used as battering rams to precede the runner with the ball; (*b*) by doing away with "chain interference" and (*c*) by abolishing pushing and pulling of the runner with the ball. (2) Encouraging attempts to advance by throwing the ball forward, provided it was thrown across the line of scrimmage not nearer than five yards to the point where it was put in play. (This has since been changed to allow the ball to be thrown anywhere over the line of scrimmage.) (3) Stimulating kicking by making all players on the kicking side, except the centre, eligible to receive the ball as soon as it touched the ground. (This rule has since been rescinded.) (4) Encouraging the offensive team to take chances in free running, forward passing and on side kicking, by compelling the offensive team to make 10 yards instead of five in three trials. (5) Shortening the playing period of each half from 35 min. to 30 min., thereby reducing the strain. In 1912, each half was divided into two 15-min. periods, with a 2-min. interval to permit time to change goals. The above changes proved to be effective in doing away with serious injuries; also in opening up the game. Since then, comparatively few changes of importance have been made in the rules.

One of the most important changes occurred when the forward pass was allowed to be thrown anywhere over the line of scrimmage and at any time, provided the passer was at least five yards behind the line. This change, together with one allowing the man who first received the ball from centre to cross the lines of scrimmage at any point, permitted the doing away with the checker-board marking of the field, thereby reverting to the gridiron or cross marking that was in vogue preceding 1903. Another important change adopted in 1910 required seven men of the offensive side to be on the line of scrimmage. The development of the forward pass brought about a change in the shortening of the field between the goal lines from 330 ft. to 300 ft., with end zones of 30 ft. beyond each goal line in which forward passes could be completed. With the shortening of the field, the kick-off was moved from the centre of the field to the 40-yd. line of the kicking side. The value of a touch-down has gone through a series of changes, in which it has counted four, five and finally six points. In the same way, a goal from the field, whether from a drop kick or a place kick, has had a similar variation, but downward from five to four and finally to three points. Four trials instead of three are now allowed to gain 10 yards.

Development of the Game.—The game itself has developed in a most interesting way. Previous to 1915, it was rare to see a team which did not play its quarter-back close up behind centre to receive the ball and pass it to the runner, or carry the ball himself. Nowadays, however, none of the men in the backfield need play in specified positions all the time. The quarter-back calls the signals, but arranges the backfield in one of a variety of formations from which the center makes a direct pass to one of the backs. Probably the most common arrangement of the linemen is to have four on one side of the centre and two on the other, creating what is called the "unbalanced" line with a strong and a weak side. Some coaches instruct their players to assume these positions deliberately, the strong side being on the right or left according to the signal. Others have a preliminary arrangement of the guards or tackles lined up behind the centre and jump into position either to the right or left, thus forming a strong side.

A favourite backfield formation is to line one back, known as the wing back, slightly outside and a yard behind the end man on the strong side, while the other three men form a diagonal tandem, the back man assuming a position four to five yards behind centre. Sometimes one of the other two men forms a wing back in a similar position on the short side. Some teams play a "solid line"; others direct the end man on the long side to play out from one to two yards, while the end on the short side lines out from two to four feet, in which case the wing back on the strong side usually lines behind the opening. Another favourite formation is known as the punt formation, in which two backs usually arrange themselves in tandem from three to four yards back of the line of scrimmage on the right, while a single man stands about three yards back in a corresponding position on the left, and the fourth man from six to ten yards directly back of centre.

This formation lends itself peculiarly well to what is termed the "triple threat" style of play, in which the man farthest back may run, make a forward pass or punt. Shift plays are being used by many coaches; in these usually four line men assume a preliminary position from one to two yards behind the line of scrimmage and then jump into balanced lines or into lines with one man over or two men over, while the four men in the backfield adjust themselves in various ways according to the plan of the coach. Owing to the tremendous noise attending games, at some of which there are as many as 80,000, or 90,000 spectators, some of the teams use what is called the "huddle system." Instead of the quarter-back calling out a string of numbers with the players in their regular positions, he gathers the team around him and tells them the play. The team then quickly springs into position, and the play begins, either with or without a further signal.

Offence and Defence.—The offence in football has now reached a certain degree of standardisation after many years of experimentation of the widest divergence. Fortunately, offensive football will never be completely standardised, because the possibilities of manoeuvring the players are so many that coaches of inventive genius are constantly lured into the multifarious forms of strategy always possible to the clever tactician.

In defence, the general usage is to employ either a six or seven man line. If a six man line is used, the centre and four other men are arranged in what is called the 2–2–1 formation;

it is, two men backing up the line two or three yards behind it l separated from each other by three or four yards, while two ers line up about 10 yards back of the defensive ends, and safety man plays from 15 to 30 yards back. Another favour- style is known as the "box" defence, in which seven men y in the line with two men backing up the line from two to r yards back and three to five yards apart, while two other n play at points from 12 to 18 yards back and behind their pective ends. Many coaches still favour the "diamond" ence, in which seven men play on the line of scrimmage, ile one man plays from three to five yards behind centre and backs line up 10 to 12 yards behind the defensive ends, the ety man lining up 20 to 30 yards from the scrimmage. The ove three defensive formations have become quite standard- d. Some teams employ all three kinds, according to the part the field they are in and according to the number of the lown," the number of yards to be gained, also the type of mation the opponents are using.

Until 1926, the use of the forward pass has been encouraged ause it has made possible the playing of games between all and large institutions. In 1926 a new rule came into effect t a penalty of five yards is to be inflicted for every uncom- ted forward pass, after the first one.

Formerly, all school and college teams were coached by duates without salary. Later, paid seasonal coaches were ployed. In 1925, most coaches were members of the athletic partment. Since the World War, football in the United States had an unprecedented public interest. An era of stadia ilding has swept over the country, most colleges and univer- ies having built or planned to build one. Many high schools o have them, and several cities have erected stadia holding ,000 people. (A. A. St.)

FORAKER, JOSEPH BENSON (1846–1917), American poli- ian (*see* 10.628), died in Cincinnati May 10 1917. In 1916 he blished *Notes of a Busy Life.*

FORCED LABOUR: *see* SLAVERY AND FORCED LABOUR.

FORD, HENRY (1863–), American manufacturer, was rn on a farm near Dearborn, Mich., nine miles west of De- it, of William and Mary Litogot Ford. William Ford was of glish descent but born near Cork, Ireland, whence the Ford nily emigrated to America in 1847, settling near Dearborn. ary Litogot was born in the United States of Dutch parents. rs. Ford died when her son was 12. Henry Ford went to school til he was about 15, but worked on the farm after school hours d during vacations. He began early to develop an intense erest in mechanics. He was attracted first to watches, and at he took a watch apart and put it together again. In a little ile he was repairing watches and clocks throughout the sur- unding country, not for pay but because he had a burning riosity to see how watches and clocks were made. His only ls were a screwdriver made from a knitting needle and a pair tweezers fashioned from an old watch spring. All this work was ne at night; later it was done secretly, because William Ford jected to the son giving his services free. Also, he wanted boy to be a farmer, while the boy wanted to be a mechanic. At 16 Henry could no longer tolerate farm work. He left home, lked to Detroit, and apprenticed himself in a machine shop a weekly wage of $2.50, working 10 hours a day. His board d lodging cost him $3.50 a week. In order to make up the ficit he took employment with a jeweler from 7 to 11 in the ening, for which he received $2.00 a week. In about a year he rned from machine shop to an engine shop to learn something the building of engines. There he stayed two years. A com- ny manufacturing small steam engines for farm use needed man to install them; Ford took the place and for two years ore set up and repaired these engines. He had gone back to farm to live; there he spent all of his spare time in a little rkshop trying to build a farm tractor—for his experience with portable engines, as well as his own farm experience, had nvinced him that power should be put to work on the farm l that it was a waste to keep horses.

Eventually he built a single-cylinder engine steam tractor, but he could not devise a boiler to provide pressure enough to keep the tractor at work ploughing and yet be light enough for his requirements. For the time being he gave up his tractor until he could discover a more suitable boiler. Large steam tractors were already in use, but Ford's thought even then was in the direction of inexpensive, simple apparatus which could be bought by everyone.

In 1884 Ford's father offered him 40 ac. of land in order to draw him away from his mechanics. The land was mostly wooded. Henry cut the timber, set up a sawmill and sold lumber. In the summer he repaired farm engines. In 1887 he married Clara Bryant, who lived in the neighbourhood. He sawed the lumber for his house, which he built himself on his plot of ground, and having done this he moved his workshop from his father's farm to his new home.

Securing a job with the Detroit Edison Co. as an engineer and machinist he moved from the farm to Detroit, where he set up his shop in a shed at the back of his house. After hours he worked on the building of a gasolene motor car. In 1892 he completed it—although it did not run properly until the following year. This, his first car, had two cylinders with a 2½-in. bore and a 6-in. stroke, set side by side over the rear axle, and developed about 4 H.P., which was transmitted from the motor to the countershaft by a belt and from the countershaft to the rear wheel by a chain. He ran this car about 1,000 m. and then sold it for $200, in order to start the building of another car which would be lighter and stronger.

In 1899, feeling that he had the experience he needed, Ford left his job with the electric light company and went into the making of automobiles as a business, with a company, of which he was the chief engineer, known as the Detroit Automobile Company. He held only a small portion of the stock, and the company would not follow the lines of manufacturing to which he had committed himself. The directors wanted to make cars to order only; Ford had in his mind a universal car which could be made in quantities. In 1902 he resigned in order to go into business for himself—when the opportunity arose. In the meantime he rented a one-story brick shed and continued his experiments. He built several cars, two of them solely for speed. One he called the "999" and the other the "Arrow." Each had a four-cylinder engine giving 80 horsepower. The "999" won every race it entered, and in 1903, on the reputation of this speed car, Ford formed the Ford Motor Co., with a capitalisation of $100,000. Actually only $28,000 in stock was ever subscribed, and of this only about one-half was in actual cash. The company in 1926 had assets of about $1,000,000,000. It is the largest motor car company in the world and the third largest industry in the United States, comprising in itself about 50 other industries and employing some 200,000 people directly and an equal number indirectly. It has been built up entirely by turning back profits into construction. The company has never issued bonds or borrowed money; nor has it issued stock otherwise than to enlarge the original capitalisation so as to have it more nearly correspond with values.

The company is entirely owned by Henry Ford and his son, Edsel B. Ford, they having bought out the minority stockholders in 1919 for $70,000,000.

During its first year the company built a two-cylinder, 8 H.P. car with a chain drive, and of these 1,708 were produced and sold. In the second year the company made three models and for five years the company made various models of four-and six-cylinder cars. The automobile at that time was considered a pleasure vehicle, but Ford had conceived of it as a universal method of individual transportation and he was working to produce a light car of great strength, which would require a minimum of care and cost in upkeep. What delayed him was finding a steel sufficiently strong for his purpose, and it was quite by accident that he came upon a piece of vanadium steel, which was not then made in the United States. With that steel he designed Model T—which is what is known today as the "Ford car." In 1909 Mr. Ford announced that thereafter the company would build only one type of chassis, that it would be Model T, and that "Any customer can have a car painted any colour that he wants, so long as it is black."

The principles upon which the Ford industries are founded, as Mr. Ford has stated them, are:—

1. An absence of fear of the future or veneration for the past. One who fears the future, who fears failure, limits his activities. Failure is only the opportunity more intelligently to begin again. There is no disgrace in honest failure; there is disgrace in fearing to fail. What is past is useful only as it suggests ways and means for progress.

2. A disregard of competition. Whoever does a thing best ought to be the one to do it. It is criminal to try to get business away from another man—criminal because one is then trying to lower for personal gain the condition of one's fellowmen—to rule by force instead of by intelligence.

3. The putting of service before profit. Without a profit, business cannot extend. There is nothing inherently wrong about making a profit. Well-conducted business enterprise cannot fail to return a profit, but profit must and inevitably will come as a reward for good service. It cannot be the basis—it must be the result of service.

4. Manufacturing is not buying low and selling high. It is the process of buying materials fairly and, with the smallest possible addition of cost, transforming those materials into a consumable product and giving it to the consumer. Gambling, speculating and sharp dealing tend only to clog this progression.

In the Ford practice the cycle of production starts with the consumer. Mr. Ford holds that a commodity must first of all be designed to fit the needs of the largest possible number of consumers both in quality and price, and that the number of consumers will be continuously increased by constantly lowering the price of the article. At the same time, by paying the highest possible wages to those engaged in the production and distribution of the article, he creates a high buying power. In Jan. 1914 Mr. Ford raised all wages in his industries to a minimum of $5.00 for an eight-hour day. The average wage throughout his industries at that time was $2.40 for a nine-hour day. The minimum wage in 1926 was $6.00 a day, with an average of $8.00. Model T (the touring car), which in the beginning cost $850, in 1926, with the average wage about four times larger than then and with materials costing at least double, sold for $310, with a self-starter and many improvements. From the introduction of Model T on Oct. 1 1908 it took the company until Dec. 10 1915 to produce 1,000,000 cars, but under the new wage programme and the constant lowering of prices the company was in 1926 producing at the rate of 2,000,000 cars a year.

The general theory of production in the Ford plants is that everything must be kept moving and that the work must go to the man instead of the man to the work. For example, the cylinder block is cast on a moving platform in a mould made on a moving platform. Thereafter it passes, without stopping, through a series of machines which perform all the necessary operations, and then, still moving, it passes into assembly, where to it are added, one by one, the hundreds of parts to create a complete motor. Then it moves into the final assembly, where it is joined by other parts until eventually an automobile leaves the final assembly line under its own power. Every part of the motor car has a similar train of construction and assembly, all converging either into the final assembly or into boxes or freight cars for shipment. No man uses more than one tool, all the work comes waist high, a man never has to stoop or to move his feet to get anything, and the speed of the work is controlled not by the worker's will but by the pace of the conveyer.

The Ford industries have been steadily reaching back to sources in order to cut out intermediate profits. The industries have their own iron mines, coal mines and forests, their own railway, and an extensive fleet of lake- and ocean-going steamships, all of which are operated on the principle of high wages, high production and low cost. In the forests no tree is permitted to be cut under 10 inches. The logs are taken directly to the sawmill and, instead of being first converted into lumber and the parts sawed from the lumber, the parts are sawed directly from the log. All the wood-working is done at the forest mill, the waste goes to a wood distillation plant, and there is no waste whatsoever in shipment. At the River Rouge plant, the iron from the furnace goes directly into the foundries and is poured without reheating. The slag from the furnaces goes to a cement plant. A combination of electric furnaces and a large rolling mill converts all of the steel scrap. In every direction the pressure is toward preventing the waste of time, men or material.

As the business developed, it became apparent that it was a waste to assemble the cars at the factory and ship them complete. The manufacturing plants then ceased in effect to manufacture automobiles; instead, they make parts, and these are shipped to 35 branches in the United States, where they are assembled into complete motor cars. Similar branches or associated companies are located in nearly every part of the world and these branches also manufacture if the costs permit. Foreign branches, under the theory of building consumption, employ only natives of the country in which they are located. All the branches use the same methods and pay the same wages as the home plants. The industry does not use a single warehouse—everything is in transit.

The centre of the industry is at Detroit, Mich., and at River Rouge, Mich., on the outskirts of Detroit; but with the method of assembling cars at the point of use, a decentralising of manufacturing is taking place and comparatively small plants are being located out in the country wherever proper water-power sites are available. Each of these plants makes only a single part; the thought behind their establishment is to strike a balance between industry and agriculture. None of these plants employs more than 500 men, and in most cases the men divide their time between agriculture and industry. This is one of the most important developments.

Mr. Ford is firmly against paternalism in any form. He believes charity greatly harms those who receive it. Carrying out this thought, he has a trade school for the education of boys with dependents, in which the boys make useful articles. They earn an average of about $15 a week while receiving their education. The Henry Ford hospital in Detroit, which is open to any one, is conceived on the theory that a hospital should be self supporting. All its rooms are precisely alike, all have baths attached, all the fees and services are at a scheduled rate, which is the same to everyone, and all the surgeons, physicians and nurses are on salary and have no financial relations with the patients. The Ford Motor Co. also builds a light farm tractor under the same methods and principles as the motor car, and in 1926 was building experimentally all-metal airplanes and maintaining for experimental purposes a number of air routes with the eventual aim of putting the Ford principles into aeronautics.

Henry Ford has taken no active part in politics, although he was nominated in 1918 for United States Senator from Michigan; at the election he was defeated by a small margin. He took no part whatsoever in the campaign. In 1915 he was convinced by certain peace advocates of foreign extraction that it might be possible to end the World War if a sufficient gesture were made. He thereupon chartered a ship and proceeded to Christiania, Norway. Then, convinced that the mission was futile, he returned home. Mr. Ford does not believe in war, but he is not an active pacificist. For this *Encyclopaedia* he wrote the article MASS PRODUCTION.

A full account of the origins, theories and practices of the Ford industries is contained in *My Life and Work* (1922), and *Today and Tomorrow* (1926), both by Henry Ford in collaboration with Samuel Crowther. (S. CR.)

FOREIGN LANGUAGES, TEACHING OF.—The revolution that has taken place in the methods of teaching modern languages may be said to date from Viëtor's pamphlet *Der Sprachunterricht muss umkehren* (1886). His doctrines were largely adopted in the Frankfurter Reformschulen, but it was not till after 1900 that the movement became widespread in England and France. Broadly speaking, the idea of the reformers was to substitute direct comprehension and acquisition of the foreign language for mere knowledge attained through the medium of the mother tongue.

They insisted on oral study at the outset of the language, involving explanations in the foreign tongue itself, on inductive ethods of learning grammar and on the use of reading and of ee composition in place of formal grammar and translation om or into the foreign language. Hence the introduction of ie phonetic script and chart; the employment of gesture; the ilisation of pictures, postcards, coins and other *Realien;* and ie stress laid on the teacher and not the text-book being the ntre of the instruction—the whole idea being to render the assroom a sort of French or German *enclave*, and to make the ipil think as far as possible in the language.

Some of these doctrines were pushed to excess. Certain achers attempted to exclude the mother tongue entirely from ie classroom; others devoted an inordinate time to phonetics conversation on pictures, and exalted the oral side as the goal all teaching. Others again neglected the grammar or inter-eted their new-won liberty as a right to teach as they pleased, respective of their colleagues. To-day, while phonetics (*q.v.*) ive been generally accepted in England (though not in France), is seen that the extent of their use (apart from the chart) may left to the choice of the teacher. Again, new grammar points iould be learnt inductively, but the grammar must be systemised and codified. With most pupils grammatical points are iore safely explained in English. Due co-ordination of method in usually be secured by the appointment of a head of depart-ient. Translation from or into the foreign language is often egun two years before the final examination and not often irlier. As regards the exclusion of the mother tongue, we may ike it as an axiom that the cleverer the child the more direct ie teaching. Hence with the duller child the aim should robably be to concentrate rather on reading and translation ian on composition (free or otherwise). At the extreme end of ie scale there are, in the opinion of some experts, a few non-nguistic pupils who would be more profitably engaged in con-ning themselves to the mother tongue.

It is probable that the earlier reformers laid insufficient stress n the rapid acquisition of vocabulary, possibly from their dread f rote-work. To-day there is a fruitful tendency to learn by eart, not merely poems but duly prepared prose passages, a ractice that is at the back of much of the mastery attained by ie French in their own language. Of course such passages need casional revision. Again, the principle of private reading, hich has made such strides in English, has been promoted by ie formation of class and school libraries, and the practice is been further fostered by the introduction of free study eriods in certain schools. Such are the main features of the aching in English secondary schools, up to the first school xamination.

In the central schools, which often prepare their fifth-year upils for similar examinations, the methods are largely the ime, except that in the first year the classes, which are larger, re sometimes divided for conversation, with excellent results. n the advanced courses of the secondary schools, the methods f reading and *lecture expliquée* without translation are largely ollowed, and essays on literature are written in the foreign inguage. A burning point is that the universities which con-uct the higher certificate examinations appear to prefer an-wers in English in the literature papers. A possible solution ould be the award of extra marks for one question to be an-wered in the foreign tongue. In the evening schools methods ave been modernised, but the need of covering the ground more uickly necessarily limits the employment of the more leisurely ractices of the direct method. (C. Bre.)

In the United States

The attempt to make general the employment of the "di-ect method" in the teaching of the foreign modern languages the United States had begun to subside before 1909, when it ecame clear that the method was looked on askance in the best igh schools and preparatory schools, and especially in the col-eges and universities. Many teachers were well acquainted ith foreign languages by ancestry and study abroad; but some ould not speak such languages with ease. Also, the increasing esire for travel in Europe, now so manifest, was only beginning to develop. In the universities and colleges, the professors laughed the method out of court. An anecdote is told about a professor of French in a certain university, who, when asked if he spoke French, answered: "I don't speak French, I teach it." When we consider, however, that at present no teacher of French in the United States would answer in this way, we see that the agitation over the direct method has borne fruit. Indeed, nearly all the text-books in modern languages bear an imprint, however faint, of the direct method, whose influence has been beneficial. It is true, furthermore, that the War gave a strong and perhaps lasting impulse to the study of the spoken language. It is said that when the United States entered the War, the accredited newspaper reporters sent to Europe were remarkable in only one regard: their inability to say the slightest thing in French. This would no longer be the case.

Much of the improvement in the teaching of the modern languages came from another source: the introduction of Phonetics. This study made its way under two forms: formal or theoretical Phonetics and experimental Phonetics. The first came from both France and Germany, as well as from the English school of Bell and Sweet; the latter came from France. The French influence was seen in the steady extension through the universities and high schools of the International Phonetic Alphabet, which is now the only one used in teaching the foreign spoken languages. This alphabet was contrived by Paul Passy (who took hints from Ellis, Bell, Sweet and others) and commenced to be known in the early 'nineties. Its use has become so general that it forms the basis of instruction in diction, music and phonetics, as is seen in the brilliant work being done in New York by such teachers and authors as Adele Baldwin, Marguerite DeWitt, May Laird-Brown and William Tilly.

Experimental Phonetics came from the indefatigable zeal of its founder, the Abbé Rousselot, whose laboratory at first was in the Institut Catholique, Paris, then in the Collège de France. Two or three Americans had begun experimental research at about the same time as Rousselot, but they did not have laboratories at their disposal. None the less, their example prepared the way for the introduction of Rousselot's methods, which have left a permanent impress on the teaching of the modern languages in the United States.

The War favoured the extension of French. Combined reports from about 76% of the elementary schools, public and private, and the high schools and academies and from about 89% of the colleges and universities indicate an enrolment during the year 1923-4 of 629,000 students of French, 392,000 of Spanish, and 65,000 of German. (R. We.*)

FORESTRY (*see* 10.645).—No summary of the timber resources of the world can be described in any sense as accurate or reliable. The facts available are insufficient, the statistics on which estimates are based are often incomparable and even the sources of information are not always above suspicion; overstatements by government departments to attract capital or to justify increased exploitation are as common as understatements by foresters or traders to insure conservation of resources or enhanced prices.

The British Empire contains not less than 1,100 million acres of woodlands, but has under 1,100 forest officers—that is to say, taking the Empire as a whole, less than an average of one forest officer for every 1,000,000 acres. Brazil with 1,000 million acres of tropical and semi-tropical forests has in the European sense no organised forest service at all. The information about the Russian forests, said to be 1,200 to 1,500 million acres in extent, even before the War, was unsatisfactory, especially as regards the virgin softwood forests in Asia and northern Europe. Since the War little authoritative information is obtainable, and such information as there is, is, therefore, for the most part, too old to be of any real utility.

The World's Timber Resources

For purposes of comparison the timber resources of the world may be divided into hardwoods and softwoods, the former being, generally speaking, broad-leaved and, in the temperate zone, deciduous trees; the latter coniferous and non-deciduous. The hardwoods themselves fall naturally into two classes—hardwoods of the temperate zone, some 1,200 million acres in extent, and tropical hardwoods, estimated at 3,600 million acres. The softwoods of the world cover a much smaller area, just over 2,500 million acres. These forests, with the exception of the Paraná pine forests of Brazil, Chile, India and Australasia, are situated in the Northern Hemisphere, over 80% of the total being found between the 45th and 70th parallel north. The more important commercial timbers of the world, the softwoods and temperate hardwoods (calculated on an acreage basis), are situated to the extent of 95% and 89% respectively in the Northern Hemisphere, where 75% of the population exists. While, as a means of estimating timber resources, a calculation by acreage is unsatisfactory, the stand of timber to the acre varying with species, soil and climatic conditions, no unit of measurement can be given which more accurately gives a picture of forest wealth.

Only about 10 to 15% of the world's forests are worked under systematic management, and about these forests alone is reliable information available as to stocks, annual growth, fellings or losses by pests, etc. Of the other forests, 15 to 20% may be classed as commercial forests either in process of exploitation or about to be exploited. About these forests some general trade information is usually available. The balance 65 to 75%, is virgin forest not utilised for commercial purposes, and about which information is non-existent or unreliable. The estimates of acreage have, in the main, been taken from the work of Messrs. Zon and Sparhawk entitled *Forest Resources of the World*. These two distinguished members of the United States Forest Service have succeeded in making a more or less coherent picture of the available data about the forests of the world, supplemented by personal investigations and inquiry where full information was not previously available.

HARDWOOD SUPPLIES

The hardwood timber supply of the world need give little real cause for anxiety. There will be in the future, as in the past, shortages of supplies of individual species. The hardwood forests, however, are so vast in extent, and include so many different types of timber, that the increase of information about recently developed countries, and the advance in the science of timber testing, seasoning and wood technology, should make the substitution of new species for old a more simple and certain proceeding than has formerly been the case. The solution of the hardwood supply question would therefore appear to lie not only in the conservation of existing resources, but also in the ordered investigation of new sources of supply, together with the initiation of such steps as are necessary to make such supplies available as and when they are found in quantities that make their exploitation commercially possible.

United States.—The United States has taken the lead in this matter. Owing to the wholesale clearances of their more accessible hardwood forests by uncontrolled felling, and the almost complete destruction of their valuable chestnut forests by the chestnut bark disease (*Endothia parasitica*), the Federal U.S. Department of Agriculture has for some time been inquiring through its Forest Products Laboratory, Madison, Wis., about the potential supplies of hardwood timber outside the States. Important results have already been obtained in Central and South America.

British Empire.—Inside the British Empire equally good work has been and is being done; at Dehra Dūn in India, at Montreal in Canada and in England under the aegis of the Forest Products Research Board, at Kew, as well as at the Imperial Institute, timbers are being tested and new species identified. In this section of Imperial development it is necessary to insist on one point that has been passed over, viz., that it is not only necessary to educate and indeed to persuade the consumer by scientific and practical tests of the possibilities of a given substitute species, it is also necessary to prove to the satisfaction of wood merchants that that substitute is available on a commercial scale and that the forests in which it is found are suitably situated for exploitation. An Imperial Forestry Bureau advocated by two consecutive Imperial Forestry Conferences is a necessary link between the consumer and the merchant on the one hand, and the systematic botanist, the timber testing centre and the producing units of the Empire overseas on the other.

SOFTWOOD SUPPLIES

The future supply of softwood timber is disquieting, the most unsatisfactory feature being the rapidity with which the accessible virgin forests are being destroyed. In the more progressive and industrially developed countries timber, other than firewood, is used in the proportion of 80% of softwood to 20% of hardwood. Great Britain, the greatest importing country in the world, brings in softwood in the proportion of nine to one hardwood. According to the latest figure available, Finland and Siberia are the only two "net" exporting countries in the world where the resources of softwood timber are not being reduced by annual felling at a greater rate than is made good by annual growth.

United States.—The United States, which consumes nearly one-half the converted timber of the world, is using up its softwood timber reserves at about four times their rate of growth. Only 137,000,000 ac. of virgin forest remain. These are being felled at the rate of 5,500,000 ac. per annum. The situation has caused such general anxiety that the President himself made the following statement in 1924: "Expressed roughly we have left about 745 billion cu. ft. of timber. From this the annual drain is 25 billion cu. feet. This total drain is most significant when we reflect that towards offsetting it we have an annual growth of only six billion cu. ft., and even in our young forests where this growth is taking place cutting has already outstripped growth. We must face the situation that at this rate we are not far from timber exhaustion."

The course of timber denudation in the United States is interesting. First the New England states, then the Lake states and now the South Atlantic states have been cut out in rapid succession. In the Southern states the departmental report of 1920 states that of the 5,400 mills owning or controlling practically the entire remaining virgin stand in the South, 4,410 mills will be cut out in five years or less, and that a further 800 mills will cut out their timber in the next ten years, *i.e.*, by the end of 1930 or thereabouts.

When this last forest reserve on the eastern freeboard is exhausted, the export trade of softwood timber will be concentrated almost entirely in the Pacific states, distant from the main commercial centres by 2,000 m. of railroad or 4,000 m. by sea. This fact is important from two points of view—(*a*) the price of timber must rise very considerably in the Eastern states, where four-fifths of the population are centred; (*b*) that, consequent on a rise in prices due to the lack of local supplies, sea freight and canal charges, America may come into the European market for construction timber, just as she does to-day into the Canadian and European markets for her pulp-wood. In a statement made by Col. W. B. Greeley, Chief of the United States Forest Service, at the British Empire Forestry Conference in 1923, the virgin softwood forests of the United States at the then rate of destruction would be cut out in 25 years, and after that date the industry would have to depend on "cut-over" woods and the less accessible of the Federal reserves.

Canada.—The position in Canada is but little more satisfactory. According to Mr. Craig, the Canadian statistical officer (report of 1923), the total amount of softwood in Canada amounts to 198,000 million cu. ft., one-half of which can be profitably operated under existing conditions. The amount of softwood used annually for all purposes is about 900,000,000 cu. ft., but owing to the method of exploitation this entails the destruction of 1,700,000,000 cu. ft. of standing timber. In five years the annual loss of merchantable timber from fire had amounted to 790,000,000 cu. ft., and in 10 years destruction by the spruce bud worm had averaged 1,300,000,000 cu. feet. Other insects and forest diseases have also caused serious loss in the forest, so that the annual drain on the resources of the Dominion is probably ot less than 4,000,000,000 cu. feet. At this rate the accessible ands of virgin forest would last 25 years.

Europe.—In Europe the softwood position is by no means tisfactory. The demand of industrial life for an adequate mber supply increases in volume much more quickly than the owth of the population, yet there is no margin for increased oduction outside Russia, and the estimates of Russian reserves e founded on quite insufficient data.

Three of the principal softwood exporting countries in Europe e Norway, Sweden and Finland. Norway has been living on her rest capital for many years, and her softwood timber con-umption exceeds growth by about 51,000,000 cu. feet. Sweden ntil recently was supposed to be living well within her forest eans. A recent survey has shown that the annual growth, pecially in the north, is less than was previously calculated, and nsumption exceeds growth by 100,000,000 cu. feet. Finland is ported to be using 140,000,000 cu. ft., less than the annual owth. Two facts must be borne in mind—(*a*) that her calcula-on of annual growth will probably have to be revised, (*b*) that e extension of her saw-milling industry is rapid.

Russia.—To what extent the virgin forests of Russia can come the aid of Europe and America is difficult to estimate. Apart om political questions there are certain limiting factors which e bound to affect continuous production.

1. The main group of softwood forests is situated north of the th parallel. The rate of growth is necessarily slow; on the Finnish d Swedish analogy, probably not more than 20 cu. ft. per ac. per num. In the extreme north the rate of growth is probably only lf that rate, while owing to the infrequency of seed years restocking ust necessarily be a slow process.

2. The extent of land over which Russian forests are spread is so eat and the communications so poor that only a relatively small rtion is accessible under existing conditions and at present day mber prices.

Mr. Fraser Story in his review of the softwood resources of urope estimates that 90,000,000 ac. of the Russian forests are erchantable as opposed to 243,000,000 ac. unmerchantable. e includes as unmerchantable all woods in which the cost of traction is prohibitive, or on which the land is so poorly ocked or the timber of such a character of growth as to be un-itable for commercial use. The merchantable area includes the eas which before the War could have been exploited without due commercial risk with the means of extraction and utilisa-on then available.

3. Russia has a population nearly as large as the United States. e is already an importer of timber in her southern states. Her nsumption of hardwoods and softwoods before the War was cal-lated at only 66 cu. ft. per capita per annum. It is not improbable at with the relaxation of forest regulations her per capita consump-on has materially increased and may approach that of Norway and weden, 130 cu. ft. per annum.

4. It is calculated that before the War Russia was living on her pital, *i.e.*, that her consumption exceeded her annual growth by 851 million cu. ft. per annum.

Siberia.—The productive Russian forests in Asia probably mount to 500 to 600,000,000 acres. Only one-fifth of this area s ever been surveyed. The Pacific slopes and the forests ibutary to the Amur and other small coastal rivers are the only eas capable of exploitation under existing trade conditions, d may amount to 40,000,000 acres of softwood and hardwood rests, only one-tenth of which has been surveyed. The main pplies of Central Siberia will only be available when political nditions are such as to permit of the investment of capital, e creation of railways and the establishment of banks and edit institutions. Even in the more easily developed area an port trade will have to be built up from its very foundations. efore the War there were said to be only 74 producing saw-ills in Siberia; since the War exports of timber to Japan and hina have increased; but even to-day, considering the size the country, they are relatively unimportant.

Other Areas.—The remaining virgin softwood forests of the orld can be dismissed in a very few words. In Japan consump-on is rapidly overtaking production. Japan has for long been axious about future supplies, and has embarked on the largest planting programme of any country in the world. The recent survey by the United States Forest Service in Alaska has proved disappointing. While the hinterland contains important reserves of pulp wood, the milling timber is confined to a strip of land on the coast averaging, it is said, only a few miles in width. Australia and New Zealand, despite their softwood supplies, are importing countries. The Paraná pine forests of Brazil, once considered as an important timber reserve for the southern hemisphere, are being rapidly cut out and no system of reforestation has yet been adopted.

Conclusion.—It would appear that while information about the softwood forests of the world leaves much to be desired, there are sufficient data to warrant certain conclusions:—

1. That except in Russia—an unknown quantity—the main softwood virgin timber reserves will be exhausted before very long, and producers will have to depend more and more on "cut-over" forests or woods raised or restocked by the agency of man.

2. That the United States shortage is likely to come more quickly than the European one.

3. That the more the American supply becomes centred in the Pacific Coast States the greater is the probability of the industrial States of North-eastern America coming into the European market for saw-timber in the same way as they do now for pulp of wood.

4. That as the United States consumes 13,750 million cu. ft. of softwoods as opposed to a total European consumption of 9,120 million cu. ft., the United States advent into European markets will have an important bearing on European prices.

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FORMOSA (*see* 10.669).—The island of Formosa (Taiwan) has an area of 13,839 sq. m. and on Oct. 1 1920 the population was 3,655,308, representing a density per sq. m. of 264 inhabitants. The population was estimated at 3,758,900 on Oct. 1 1923. The chief towns are Taihoku, Tainan, Kagi and Taichu. The Hokoto Is. (Pescadores) are included in Taiwan.

Administration and Finance.—Taiwan was placed under a civil administration in April 1896, and legislative steps were taken in the following year to put the finances of the island on an independent footing. Meanwhile a grant was made from the Imperial Treasury, but the subvention was withdrawn in 1906 owing to the satisfactory financial condition of the island. Furthermore, with the development of its industry and the increase of various public establishments, finance was greatly expanded and the total revenue and expenditure in the Budget for 1924–5 are put at 91,553,193 yen (excluding the extraordinary budget).

Government Monopolies.—The Government monopoly undertakings on the island are opium, salt, camphor and tobacco, the importation of opium and the manufacture and smoking of the drug being strictly prohibited since 1896, except by licence in the case of confirmed smokers. The number of licensed smokers had decreased from 117,000 in 1900 to 38,673 at the end of 1923.

In May 1899 the Government took steps to improve the quality and increase the quantity of salt produced, which had hitherto suffered from the fluctuations due to irregular and sporadic private enterprise. The total area of the salt-fields is now over 2,348 kō (about 4,500 ac.); the quality of the salt has decidedly improved, and the annual output has been steadily increasing, having risen to 404,090,000 kin (242,400 metric tons) in 1923, sufficient to satisfy local requirements and also for export to Japan, Chosen, Karafuto, etc. In 1899 the production of camphor was also controlled, and in 1905 the monopoly system was extended to Taiwan-cut tobacco, in both cases with beneficial results.

Trade.—The chief commodities exported from Taiwan are tea, rice, sugar, camphor, turmeric, flax, hemp, jute and coal. Foreign trade, consisting of oversea trade and trade with the homeland (Japan proper), has grown year by year. The development of Taiwan trade with foreign countries was affected adversely by the duties which have been increased frequently since the revision of customs tariffs in 1899, but its trade with the homeland has made steady progress with the development of various industries, stimulated by the growing perfection of banking and communication facilities in the island.

In 1907 the volume of trade with Japan and overseas trade was 58,340,000 yen, while in 1910 it was 108,880,000 yen (largely owing to the development of the sugar industry). In 1923 the total trade reached 308,720,000 yen. Of this the exports to foreign countries were valued at 29,150,000 yen, and the exports to Japan proper at 169,440,000 yen, a total of 198,590,000 yen. The imports amounted to 39,110,000 yen from foreign countries, and 71,010,000 yen from the homeland, totalling 110,120,000 yen. Thus the excess of total exports over total imports for 1923 amounted to 88,460,000 yen.

Agriculture and Industry.—Almost the whole of Taiwan is a rice-growing country, yielding two crops a year. In 1923 the rice crops amounted to 4,866,087 koku (24,102,639 bu.), though in that year they suffered from the worst drought ever known. The oolong and souchong teas, produced in the north of the island, are important exports to foreign countries; the value of the oolong exported abroad in 1923 was 5,160,965 yen.

The sugar industry enjoyed great prosperity in 1916 and 1917, the value of exports being 11,317,643 yen and 15,775,205 yen respectively. The area under sugar-cane cultivation in 1923 was 114,710 kō (1 kō = 2·45 ac.) which, owing to the satisfactory growth of the plant, yielded raw sugar amounting to 6,192,040,773 kin (1 kin = 1·323 lb.). There were operating 44 plants of the latest style with a capacity of 34,650 English tons, 11 improved-style factories with a capacity of 820 English tons and 101 old-style factories, which altogether produced 521,501,144 kin of centrifugals, 59,878,831 kin of refined sugar and 10,860,026 kin of brown sugar, aggregating 592,240,001 kin.

Gold, alluvial gold, silver, copper, coal, petroleum and sulphur are all found in the northern part of the island. The total value of mineral products in 1923 was 12,915,908 yen, being an increase of a little over 210% over the 1913 figure. The gold produced in 1923 was 411,649 grammes; placer gold, 8,306 grammes; silver, 569,576 grammes; coal, 1,445,000 metric tons; and petroleum, 25,289 hectolitres.

The fishing industry of Taiwan owes much of its present prosperity to Government encouragement, although owing to the favourable ocean currents, fishing can be carried on all around the island. Artificial rearing of oysters, prawns, carp, etc., is accomplished both in salt and brackish waters, and it is a characteristic of the Formosan fisheries that whilst the natural produce is valued at about 4,000,000 yen, the value of the products of fish culture is 2,000,000 yen.

Banking.—The Bank of Taiwan (est. 1897) is the central bank of the island, and has an authorised capital of 45,000,000 yen and a paid-up capital of 39,375,000 yen. The bank is empowered to issue bank-notes, and to transact ordinary banking and foreign exchange business. There are several ordinary banks and many credit associations.

A great increase in the business of the Post-Office Savings Bank took place during 1910–23, the number of depositors having risen from 90,893 in 1909–10 to 457,869 in 1922–3, the deposits increasing from 1,900,700 yen to 8,171,201 yen.

In 1899 the Government commenced planning out a trunk line from north to south of the island, connecting the ports of Keelung and Taku and passing through Taihoku, Taichu and Tainan. Branch lines, further opening up the rice, sugar, tea and mining districts, were gradually completed, so that at the end of the financial year 1922–3 there were 468·70 m. of railway open to traffic. In the same year over 13,000,000 passengers and more than 3,000,000 tons of goods were carried, the receipts being over 12,000,000 yen. In addition to the state railways, there were at the end of 1922 1,242 m. of railway belonging principally to sugar factories and 547 m. of track for hand-propelled cars, an important means of local transport peculiar to the island. (H. SA.; K. M.)

FORREST, JOHN FORREST, 1ST BARON (1847–1918), Australian statesman and explorer (*see* 10.672), was acting premier of Australia in 1907 during the absence of Mr. Deakin in London. He took office again as treasurer in Mr. Hughes's "National" Cabinet of 1917, but resigned owing to ill-health early in 1918, when he was raised to the peerage, being the first Australian to be so honoured. He died at sea on his way to London to take his seat in the House of Lords, Sept. 3 1918.

FORSTER, EDWARD MORGAN (1879–), British novelist, was educated at Tonbridge School and King's College, Cambridge. His first novel, *Where Angels Fear to Tread* (1905) was followed by *The Longest Journey* (1907) and *A Room with a View* (1908). Wider attention was won by *Howards End* (1910), but thereafter, except for some short stories, *The Celestial Omnibus* (1911), he published little until 1924, when *A Passage to India* appeared. This was a fruit of first hand observation of modern Indian life and with it Forster entered into a fuller public recognition of his powers as a writer with a gift for keen analysis of social character and relationships. Wartime work in Egypt enabled him to write a useful book on *Alexandria: A History and a Guide* (1922), from which came the material for the short studies of Alexandrian history, ancient and modern, in *Pharos and Pharillon* (1923).

FORSYTH, PETER TAYLOR (1848–1921), British Nonconformist divine (*see* 10.677), died in London Nov. 11 1921. Among his later works were *The Person and Place of Christ* (1909); *The Principle of Authority* (1912) and *This Life and the Next* (1918).

FORTIFICATION: *see* SIEGECRAFT.

FORT WORTH, Tex., U.S.A. (*see* 10.728), entered on a period of rapid development after the establishment of Camp Bowie (1917) and three flying fields for the training of Canadian and American aviators, and the erection (1918) of the army and navy helium plant. With the discovery of the Ranger and Burkburnett and other important new oilfields, it became the geographical centre of the oil-producing region of the southwest, and by 1925 was the greatest petroleum pipe-line centre in the world. Its refineries had a daily crude capacity of 75,000 barrels. Natural gas was brought in from 15 fields. Beginning about 1920, the transition in western Texas from ranching to stock-farming and diversified agriculture (especially cotton, wheat and feed crops) added a large and prosperous population to Fort Worth's trading territory, supplied raw materials for new industries, stimulated meat-packing and flour-and-feed-mills and enlarged its grain and livestock markets. A textile mill was established in 1924; a cement plant in 1925. Bank deposits were $15,425,000 in 1910; $78,540,000 in 1925. The value of manufactured products was $8,661,000 in 1909; $38,160,000 in 1919; $75,163,236 in 1923. In 1922 the area of the city was more than doubled by the annexation of 22 sq. m., including Niles Polytechnic, and a large suburban territory. The population in 1920 was 106,482, of whom 15,896 were negroes and 7,50 foreign-born; in 1925, 185,000 according to a local estimate, taking into account the suburban territory annexed in 1922.

A new charter, adopted in April 1925, established the Council manager form of government and created a city plan board. Plans were under way (1925) for the construction of a Union passenger station and an interchange belt railway, and for a great project of water conservation, flood control and irrigation by Tarrant County Water Improvement District Number 1. The leading educational institutions include Texas Christian University, Southwestern Baptist Theological Seminary and Texas Woman's College, established in 1914, with which the older Polytechnic College was merged.

FOSDICK, HARRY EMERSON (1878–), American divine, was born at Buffalo, N.Y., May 24 1878. He graduated from Colgate University in 1900, proceeding thence to Union Theological Seminary, New York City. Ordained into the Baptist ministry in 1903, he was pastor of the First Baptist Church, Montclair, N.J., 1904–15. He rapidly acquired a high reputation as a preacher, especially among the universities. Becoming instructor in homiletics at Union Theological Seminary in 1908, he was appointed Morris K. Jesup professor of practical theology in 1915. In 1918 the First Presbyterian Church of New York City was founded by amalgamation of The Old First, Madison Square and University Place churches, and Dr. Fosdick became its associate minister and permanent preacher Dec. 29 1918.

On May 21 1922 he preached a sermon entitled "Shall the Fundamentalists Win?" making a wide plea for tolerance in religion and asking that the door of Christian fellowship be left open to all who sincerely desired to follow Christ, regardless of specific credal belief. The Presbytery of Philadelphia formally brought the matter of Dr. Fosdick's teaching before the General Assembly of the Presbyterian Church at Indianapolis in 1923, stigmatising it as heretical and demanding action. The New ork Presbytery, acting on the request of the Assembly, apointed an investigating committee which reported to the Genral Assembly of 1924 that they found Dr. Fosdick's teaching nd preaching to be in accordance with Presbyterian standrds. This report was vehemently attacked by the Fundamenalist element in the Assembly and was referred to the Judicial Commission of the church, which, after hearing evidence, deided that Dr. Fosdick must take the vows of a Presbyterian minister (implying acceptance of the Westminster Confession) r vacate his pulpit. He thereupon tendered his resignation, ct. 6 1924, which was accepted and took effect March 1 1925. mmediately thereafter the Park Avenue Baptist Church of New York called Dr. Fosdick to its pastorate, agreeing to open s membership to all Christians without insisting on its tradional ordinance of baptism and also to remove from its present te and build an amply equipped church on Morningside Heights—the educational centre of the city.

His works include *The Second Mile* (1909); *The Manhood of the Master* (1913); *The Assurance of Immortality* (1913); *The Meaning f Prayer* (1915); *The Challenge of the Present Crisis* (1917); *The Meaning of Faith* (1918); *The Meaning of Service* (1920); *Christianity nd Progress* (1922); *The Modern Use of the Bible* (Yale lectures, 1924).

FOSTER, SIR GEORGE EULAS (1847–), Canadian statesman, was born in New Brunswick Sept. 3 1847. Educated in New Brunswick, Edinburgh and Heidelberg, he took up teaching in Canada. In 1882 he became Conservative member in the Canadian Parliament, representing New Brunswick, and in 885 became Minister of Marine and Fisheries. From 1888–1896 e was Minister of Finance. In the Borden Administration of 911 he was Minister of Trade and Commerce, retaining the ortfolio in the Union Govt. of 1917. In 1917 Foster was summoned to the Senate of Canada. He was a great advocate of referential trade within the Empire, and in 1903 he made a eries of speeches in England in support of Mr. Chamberlain's olicy. Sworn of the Imperial Privy Council in 1916, he was n the same year appointed one of Great Britain's four repreentatives at the Economic Conference at Paris. In 1918 Foser was created K.C.M.G., and he represented Canada at the Peace Conference, 1919, and at the first assembly of the League f Nations in 1921. He was later elected a vice-president of the ssembly.

FOUILLÉE, ALFRED JULES ÉMILE (1838–1912), French hilosopher (*see* 10.737 and 18.250), died at Lyons July 16 1912.

FOURTEEN POINTS, THE.—During the winter of 1917–8 talk f peace was prevalent throughout the world. Between Russia nd Germany actual peace negotiations were in progress during he opening months of 1918; and on Jan. 5 1918 the British Premier outlined the terms upon which Great Britain and her Allies ould be prepared to negotiate for peace.

On Jan. 8, three days after Lloyd George's speech, President Woodrow Wilson, in his address to the joint session of Congress, ormulated under 14 separate heads his ideas as to the essential ature of a post-War settlement. Before the delivery of his adress he had received from a committee of inquiry, set up by Col. House in Sept. 1917, a report upon the territorial settlement that hould follow the conclusion of the War. It has been stated that o fewer than six, and these the territorial points, of Wilson's Fourteen Points were "directly framed" upon the recommendations contained in the report. It has also been stated that he report was drawn up by Dr. S. Mezes, D. H. Miller, and Walter Lippmann.[1]

In any consideration of the Fourteen Points it must be borne n mind that in drafting the Points, especially the first five, egard was had not merely to the future, but also to the fact that hey could be used as a diplomatic weapon in the present.[2] In rafting Point 4 the President was probably inspired by the exmple of the United States, where each State has only a militia or the preservation of internal order; the safety of all from external attack being guarded by the Federal Army.

The Fourteen Points were:—

1. Open covenants of peace openly arrived at, after which there shall be no private international understandings of any kind, but diplomacy shall proceed always frankly and in the public view.
2. Absolute freedom of navigation upon the seas outside territorial waters alike in peace and in war, except as the seas may be closed in whole or in part by international action for the enforcement of international covenants.
3. The removal, so far as possible, of all economic barriers and the establishment of an equality of trade conditions among all the nations consenting to the peace and associating themselves for its maintenance.
4. Adequate guarantees given and taken that national armaments will be reduced to the lowest point consistent with domestic safety.
5. A free, open-minded and absolutely impartial adjustment of all colonial claims based upon a strict observance of the principle that in determining all such questions of sovereignty the interests of the populations concerned must have equal weight with the equitable claims of the Government whose title is to be determined.
6. The evacuation of all Russian territory, and such a settlement of all questions affecting Russia as will secure the best and freest co-operation of the other nations of the world in obtaining for her an unhampered and unembarrassed opportunity for the independent determination of her own political development and national policy, and assure her of a sincere welcome into the society of free nations under institutions of her own choosing, and more than a welcome, assistance also of every kind that she may need and may herself desire. The treatment accorded Russia by her sister nations in the months to come will be the acid test of their goodwill, of their comprehension of her needs as distinguished from their own interests, and of their intelligent and unselfish sympathy.
7. Belgium, the whole world will agree, must be evacuated and restored without any attempt to limit the sovereignty which she enjoys in common with all other free nations. No other single act will serve as this will serve to restore confidence among the nations in the laws which they have themselves set and determined for the government of their relations with one another. Without this healing act the whole structure and validity of international law is forever impaired.
8. All French territory should be freed, and the invaded portions restored, and the wrong done to France by Prussia in 1871 in the matter of Alsace-Lorraine, which has unsettled the peace of the world for nearly 50 years, should be righted in order that peace may once more be made secure in the interest of all.
9. A readjustment of the frontiers of Italy should be effected along clearly recognisable lines of nationality.
10. The peoples of Austria-Hungary, whose place among the nations we wish to see safeguarded and assured, should be accorded the freest opportunity of autonomous development.
11. Rumania, Serbia and Montenegro should be evacuated, occupied territories restored, Serbia accorded free and secure access to the sea, and the relations of the several Balkan States to one another determined by friendly counsel along historically established lines of allegiance and nationality, and international guarantees of the political and economic independence and territorial integrity of the several Balkan States should be entered into.
12. The Turkish portions of the present Ottoman Empire should be assured a secure sovereignty, but the other nationalities which are now under Turkish rule should be assured an undoubted security of life and an absolutely unmolested opportunity of autonomous development, and the Dardanelles should be permanently opened as a free passage to the ships and commerce of all nations under international guarantees.
13. An independent Polish State should be erected which should include the territories inhabited by indisputably Polish populations, which should be assured a free and secure access to the sea, and whose political and economic independence and territorial integrity should be guaranteed by international covenant.
14. A general association of nations must be formed under specific covenants for the purpose of affording mutual guarantees of political independence and territorial integrity to great and small States alike.

President Wilson developed his theories during 1918 in a series of speeches, to which reference was subsequently made during the Armistice negotiations. These are as follows:—

The Four Principles.—In the "Four Principles" speech in Congress, Feb. 11 1918, he declared:—

1. That each part of the final settlement must be based upon the essential justice of that particular case and upon such adjustments as are most likely to bring a peace that will be permanent;
2. That peoples and provinces are not to be bartered about from sovereignty to sovereignty as if they were chattels or pawns in a game, even the great game, now forever discredited, of the balance of power; but that
3. Every territorial settlement involved in this War must be made in the interest and for the benefit of the populations concerned, and not as a part of any mere adjustment or compromise of claims amongst rival States; and

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[1] R. S. Baker, *Woodrow Wilson*, vol. 1, pp. 110–1.
[2] C. Seymour, *Woodrow Wilson*, pp. 235 *seq.*

> 4. That all well-defined national aspirations shall be accorded the utmost satisfaction that can be accorded them without introducing new or perpetuating old elements of discord and antagonism that would be likely in time to break the peace of Europe, and consequently of the world.

The Four Ends.—In the " Four Ends " speech of July 4 1918 occurs the following passage:—

> These are the ends for which the associated peoples of the world are fighting and which must be conceded them before there can be peace:—
>
> 1. The destruction of every arbitrary power anywhere that can separately, secretly, and of its single choice disturb the peace of the world, or, if it cannot be presently destroyed, at the least its reduction to virtual impotence.
>
> 2. The settlement of every question, whether of territory or sovereighty, of economic arrangement, or of political relationship, upon the basis of the free acceptance of that settlement by the people immediately concerned, and not upon the basis of the material interest or advantage of any other nation or people which may desire a different settlement for the sake of its own exterior influence or mastery.
>
> 3. The consent of all nations to be governed in their conduct towards each other by the same principles of honour and of respect for the common law of civilised society that govern the individual citizens of all modern States, and in their relations with one another, to the end that all promises and covenants may be sacredly observed, no private plots or conspiracies hatched, no selfish injuries wrought with impunity, and a mutual trust established upon the handsome foundation of a mutual respect for right.
>
> 4. The establishment of an organisation of peace which shall make it certain that the combined power of free nations will check every invasion of right and serve to make peace and justice the more secure by affording a definite tribunal of opinion to which all must submit and by which every international readjustment that cannot be amicably agreed upon by the peoples directly concerned shall be sanctioned. These great objects can be put into a single sentence. *What we seek is the reign of law, based upon the consent of the governed and sustained by the organised opinion of mankind.*

The Five Particulars.—The " Five Particulars " (speech of Sept. 27 1918) were:—

> 1. The impartial justice meted out must involve no discrimination between those to whom we wish to be just and those to whom we do not wish to be just. It must be a justice that plays no favourites and knows no standards but the equal rights of the several peoples concerned.
>
> 2. No special or separate interest of any single nation or any group of nations can be made the basis of any part of the settlement which is not consistent with the common interest of all.
>
> 3. There can be no leagues or alliances or special covenants and understandings within the general and common family of the League of Nations.
>
> 4. And, more specifically, there can be no special selfish economic combinations within the League and no employment of any form of economic boycott or exclusion, except as the power of economic penalty, by exclusion from the markets of the world, may be vested in the League of Nations itself as a means of discipline and control.
>
> 5. All international agreements and treaties of every kind must be made known in their entirety to the rest of the world. Special alliances and economic rivalries and hostilities have been the prolific source in the modern world of the plans and passions that produce war. It would be an insincere as well as an insecure peace that did not exclude them in definite and binding terms. (*See* also EUROPE.)

BIBLIOGRAPHY.—The text of the Fourteen Points will be found in C. Seymour, *Woodrow Wilson and The World War*, vol. 3, pp. 42–5 (1921). See also R. S. Baker, *Woodrow Wilson and World Settlement*, 3 vol. (1923); H. W. V. Temperley, *History of the Peace Conference of Paris*, vol. 1, pp. 431–5 (London, 1920).

FOX-HUNTING (*see* 13.947).—The years immediately preceding the World War were in many ways the Golden Age of this great English sport. Money was plentiful and it was noticeable that newcomers to the country-side were inclined to favour hunting rather than shooting. Increased facilities for transport enabled people to hunt from towns. Horse-breeding and hound-breeding had been placed on a sound basis, and hunting, generally, had been organised and stabilised under the supreme authority of the Masters of Foxhounds Association.

War Difficulties.—Then came the War. The drain on horses was tremendous; subscription lists dropped to practically nothing; and, worst of all, at the height of the submarine menace, the feeding of hounds became an almost insoluble problem. The expense was enormous and there was a considerable outcry to the effect that hounds should be suppressed altogether as useless animals which consumed useful food. In 1917–8 hunting very nearly ceased altogether, and had it once come to an end it is extremely improbable that it would ever have been revived. The Association of M. F. H., however, in collaboration with Sir William Buxton, tackled the problem. All over the country the number of hounds was reduced, the reduction being effected partly by killing off hounds, but mainly by drafting large numbers out of the country, notably to America, and by breeding fewer.

These drastic measures had their reward. Not only was hunting saved, but it was far easier for the staffs, greatly depleted by the War, to deal efficiently with these reduced packs. Further, half a century of hound shows had given the general breeder a very sound idea at what to aim; so that, in spite of these reductions, not only was the total number of hounds in England in 1925 very nearly up to the pre-War strength, but the quality of English hounds was as high as ever. Not a single well-known hunt ceased to exist. In 1926 there were over 200 packs of foxhounds in the British Is. and 86 in the United States and the British Dominions.

Post-War Developments.—The end of the War by no means put an end to the difficulties which faced hunting. Judicious reductions, compensated for by breeding on sound lines, settled the hound difficulty. The question of horses largely answered itself by the release of an enormous number of animals from the army. After the War, too, whether as a direct result or not it is impossible to say, there was a decided improvement in the quality of the horses; this has been accentuated by the judgments given at horse shows. Before the War the showing animal and the hunter were two distinct types; the animal that won prizes was not likely to prove of much use across country and vice versa. But after the War the show animal was displaced by the real hunter, who is quite capable of winning a prize in the show ring in the summer and a point-to-point in the spring, the ideal at which to aim. The subscriber difficulty was also automatically solved by the return of the armies and, at any rate immediately after the Armistice, there were more people hunting than before the War.

Speaking generally, then, fox-hunting recovered in a surprising way from the direct consequences of the War. But an indirect consequence still had a great and adverse effect on the sport, namely, the change in the social and territorial conditions of rural England. This began before 1914, but was enormously accentuated by the War. In the old days rural England was largely in the hands of the great landowners, who were probably hunting men themselves, or at any rate supporters of hunting, and their tenant farmers, who took their cue from their landlord. Then came the extensive sales of landed property, due to the heavy taxation of the War period and after with its adverse effects on the sport. (C. L. R.)

FRACTURES.—The treatment of fractures has received considerable attention during the 15 years 1910–25, with a corresponding improvement in the general level of results. The development of radiography (*see* RADIOTHERAPY) and its more general application have produced a greater knowledge of the displacements which occur and may remain after a fracture, and a more critical spirit toward the results of these injuries has developed.

Normal Form.—The restoration of the normal form of the broken bone is an important factor if the best result is to be obtained. After the fracture of a long bone of the lower extremity, correctness of alignment is undoubtedly of the greatest importance; in the upper extremity, however, good functional results may be obtained when the position of the bone deviates considerably from the normal. The demand for accurate reposition of fragments has been met by wider use of open operations, whereby replacements of the fragments can be carried out under the eye of the surgeon, and fixation secured by the insertion of metal or bone plates, or suture material. With the precision of modern surgical technique, such intervention is possible without the risk of infection which held back the older surgeons from undertaking such procedures save in exceptional cases.

Function.—The restoration of function in the injured limb after a bone has been broken has received increasing notice. The oblem is recognised as a complicated one, each aspect of which ust receive consideration. Restoration of the normal line of the ne is of the first importance, but the repair of the soft structures erlying the fracture has an equal influence on the final result. oreover, stiffness in joints near the fracture may develop in ses immobilised for too long, and, if persistent, is a source of rious disability. These complications have been avoided or inimised by modified splint treatment, early massage and conolled movements. Various forms of electrical treatment have so been found helpful.

War Experience:—The intensive experience in the treatment of actures afforded by the World War came during the development of methods on the above lines, and yielded a store of imrovements in technique, while it tended to crystallise opinion the relative value of various methods of treatment for the dividual case. The general introduction of splints, which allow action to be made on the injured limb, facilitated the control bone alignment without open operation. Other mechanical nprovements elaborated enable direct traction to be made on one fragments. The transfixion of the bone with pins, and the se of metal calipers to grip the fragments, are examples of such ocedures.

Present Tendency.—In general at the present time the tenency to carry out open operations on all fractures of long bones less in evidence. This is due partly to the advance in methods splintage, but also to the fact that operations of this character, oupled with rigid fixation by means of metal plates, delay the rocess of union, and may be the source of subsequent adhesions etween bones and the subjacent soft structures. In America ere has been a movement to employ slips of the patient's own one for the purpose of fixation at open operations. This produre involves a more elaborate technique, but certainly overomes some of the disadvantages of plating with metal.

Compound or Open Fractures.—The introduction of infection ito a fracture has always been a bugbear of surgeons, as, once ippuration is established in bones, it runs a slow course and is able to lead to sequestration, or death, of some part of the bone, nd slow union. War experience has shown clearly that antiptics are of little value in the disinfection of a lacerated wound. he best method of eradicating infection in connection with ounds of this kind was found to be the excision of the track nd the removal of all contaminated tissues. The application of is process of wound excision or *débridement* to the more severe ypes of compound fracture has greatly improved the results. nce the infection has been avoided or overcome, a compound acture offers no more serious problem in treatment than does a mple one.

Un-united Fractures.—Though delay in the process of union is ommon enough for several reasons, failure of bones to unite rmly in healthy individuals is rare. It is, however, met with in hose cases in which a large part of the bone substance has been estroyed or damaged by the primary injury or subsequent fection. These cases are now treated with a high measure of iccess by bone grafting. Fresh bone taken from the patient imself gives the most reliable results. In cases in which the riginal broken bone ends can actually be brought together, a eef bone and preserved human bone have been employed with ome measure of success. As to the degree to which the grafted one replaces normal bone, the consensus of opinion is that ne graft acts as a scaffold along which new bone grows, rather an that it becomes a part of the host skeleton. At any rate it rms a firm bond about which, under suitable conditions, new one formation takes place. (C. M. P.*)

FRANCE, ANATOLE (1844–1924), French man of letters (*see* .775).—For 30 years French literature was dominated in the yes of all the world by the fame of Anatole France. Although is influence declined in the last period of his life the value of his t was still widely recognised. His ideas were questioned, but ot his style nor the services rendered by him to the language. n his old age he was revered as a genius and a patriarch. No eputation since Voltaire's has been found comparable with his.

The son of a bookseller called Thibault, this youth who was to make illustrious the pseudonym of Anatole France started his career quite humbly. He was fond of literature, he was studious and erudite, but negligently preferred reading to writing. He composed publishers' puffs and contributed a weekly article signed "Gérôme" to the *Univers Illustré.* For his own amusement he wrote verse, *Les poèmes dorés* (1875) and *Les noces Corinthiennes* (1876), which showed learning, charm and taste. In 1879 he published his first volume of stories, *Jocaste et le chat maigre*, and in 1881 his first novel, *Le crime de Sylvestre Bonnard*, which was acclaimed by the discriminating as delightful.

In 1883 he first met Madame Arman de Caillavet, with results that profoundly influenced his career. Mme. de Caillavet became his life-long friend. She was clever and active; she had a host of acquaintances and her receptions were attended by the leading figures of literature and politics. She laboured for the fame of Anatole France, and she forced him out of his inertia into composition. The extracts from her correspondence with him prove the important share she took in his writings, and in the dedication of *Crainquebille* (1904) Anatole France could say: "To Madame de Caillavet, this book which I should not have written without her help, for without her help I should write no books."

For 40 years Anatole France poured out a series of lively, solid, graceful and profound works. There are the pungent and mischievous short stories, *Balthazar* (1889), *L'étui de nacre* (1892), *Le puits de Sainte-Claire* (1895); the meditative and critical books, *Les opinions de Jérôme Coignard* (1893), *La vie littéraire* (4 vol. 1883–92); a philosophical novel, *La rôtisserie de la Reine Pédauque* (1893); an historico-philosophic novel, *Thaïs* (1890), describing Alexandria at the beginning of our era and contrasting the ideals of dying paganism with those of nascent Christianity; an admirable novel on the French Revolution and the Terror, *Les dieux ont soif* (1912); a society novel, *Le lys rouge* (1894), a powerful study of jealousy set amid the artistic treasures and lovely vistas of Florence; then the series of political satires, the four volumes of *L'histoire contemporaine—L'orme du mail* (1897), *Le mannequin d'osier* (1897), *L'anneau d'améthyste* (1899), *M. Bergeret à Paris* (1901), where Anatole France creates the legendary figure of M. Bergeret and portrays society before and during the Dreyfus affair; novels of a revolutionary tendency, *Sur la pierre blanche* (1903), *L'île des Pingouins* (1908), *La révolte des anges* (1914), a biography of Joan of Arc (1909–10); lastly the reminiscences, *Le petit Pierre* (1918), *La vie en fleur* (1922). Such is the sum of this work admirable in its wealth and variety.

The philosophy of Anatole France developed during the course of his career. Until 1900 he was primarily a sceptic. As Voltaire's spiritual son, he delighted in the play of ideas and observed without pity the stupidity and the silliness of men. He probed the past and the present and spared no example of human inconsistency, error or weakness. *Les opinions de Jérôme Coignard* gives the reader much pleasure, so witty and mischievous is the author, and gives him, too, a complete lesson in scepticism. The same remark may be passed on *Les dieux ont soif*, where Anatole France considers almost exclusively the failures of the French Revolution. At this time the author seems to have kept respect for beauty alone, the beauty of natural or artistic forms or of such superior intelligence as was shown in the great Greek and Latin writers. Meanwhile he beamed indulgently upon an imperfect universe. As he believed in nothing, he did not believe in a better or a worse. In the writings prior to 1900 may even be found conservative and aristocratic maxims. A supreme indifference inclined him to accept what is rather than risk what might be.

On the outbreak of the political crisis of 1900, his temper changed. He was then seen to show a preference for the progressive parties, and little by little went on to the revolutionary parties which became honoured by his support. He was no orator; words came slowly, and neither his mind nor his phrases were of the kind likely to be popular. The part taken by him at public meetings was undistinguished, being limited to signing manifestos and applauding resolutions, especially those with an international objective. He was more powerful with his pen. An opponent of Church and State, he seemed to put his faith in the people and to expect the world to be renewed by some kind of revolution. On this point his ideas remained rather vague. In one of his books, *Sur la pierre blanche*, he ends the description of future society with a dreadful cataclysm that destroys everything, and here he is nearer to nihilism than to socialism. The World War changed the trend of his thoughts. As he was too old to serve in the field he wanted at least to show his good will and asked to be employed in a Tours office. This great upheaval left him uncertain concerning the destinies of humanity. Perhaps extreme scepticism is not for long tolerable, and Anatole France felt the need of escape into a revolutionary faith which he refused to define, leaving it a mere aspiration.

What is indisputable is the quality of Anatole France's art. The younger generations, tried by war, and witnessing the consequent political difficulties, ill comprehend the detachment of dilettante M. Bergeret. They need more moral discipline, they believe more in virtue and action. But they do not deny the master who charmed their elders with his graceful wit and magic phrases. As a storyteller, in lucidity of thought and form, Anatole France is incomparable. In his style, too, there is a sweetness, an almost voluptuous grace, which distinguishes his phrases from those of any other writer. He owed much to Voltaire, much to Renan, much to the old French romances, to memoirs and to chronicles. He had read and remembered much; but what he borrowed he made his own; all was changed, and for the better, by his style and interpretation. He translated into a pungent idiom all that could delight or stimulate the intelligence of his cultured contemporaries. He was a deep admirer of classicism, and to the end of his life, when he mentioned Molière, Racine or Stendhal his conversation or his writing attained their richest substance and most pleasant harmonies.

He makes another strong claim on the attention of posterity. He was the finest flower of the Latin genius. His knowledge of antiquity was great, and his work contained the essentials of Greek and Latin wisdom. He portrayed in *Thaïs* characters who distil the philosophy of the ancients. He put into the mouth of Jérôme Coignard maxims which likewise represent the sum of the meditations and arguments common to antiquity. If all the works of the Hellenic and Roman periods were lost their shadow and purpose might be found in the works of Anatole France. He knew what he owed them, and paid them the most splendid homage.

Lastly, in all periods of his career, whatever his theories, he was a deep student of human nature. He expressed in tuneful sentences most of the wisdom that may be acquired from the observation of life and the reading of history. He created characters who persist in the memory: Jérôme Coignard, Jacques Tournebroche, M. Bergeret, Madame Martin Bellême, Catherine, the lace worker, Paphmuce, Nicias, Evariste Gamelin. He described what was comic and evil in mortals. He described, too, what was august in man, sacred in man's labours and sufferings. Though he lacked enthusiasm and ardour, his critical intelligence did not prevent him from brooding over human misery, and in the story of Crainquebille he showed his heart. While humbling himself before the invincible forces of fate and lust, he dedicated his work now to irony—which brought brightness into his life—and now to pity—which at other times reminded him that life deserves a serious, a solemn attention. And so he became twice fortunate, for he was at once a subtle artist acclaimed by the critics and a universally respected publicist who influenced the simple-minded. He died at Tours, Oct. 13 1924.

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FRANCE (*see* 10.775), a republic of Western Europe and member of the League of Nations. The area of France, increased on Nov. 11 1918 by the addition of Alsace-Lorraine, is now 212,73 sq. miles. Her domiciled population (1921) was 39,209,518.

I. POLITICAL HISTORY

The situation of France at the beginning of 1911 was difficult enough, though no acute trouble was manifest at any point to account for the general uneasiness everywhere apparent. In Nov. 1910 M. Briand, after breaking the great railway strike, reconstructed the Ministry, over which he had presided since the fall of M. Clemenceau in July 1909, to include a larger proportion of Moderate elements. As is usual in such cases, the reconstruction had disintegrated the governmental majority instead of strengthening it. The Chamber elected in 1910 leaned further to the Left than the Prime Minister, and showed its dissatisfaction by reducing the majority to 16 on a vote of confidence on the application of the Congregation Laws. M. Briand might still have remained in power had he really wished, but he preferred to resign (Feb. 20 1911) with honour rather than cling to office. Although himself sprung from the Socialist ranks, he felt the necessity of preserving public order against subversive elements, and saw that the deputies were more and more inclined to force the issue, and moreover, he saw no way of extricating himself satisfactorily from the very delicate negotiations with Germany.

The Years Before the War

The Conflict over Morocco.—Since the Algeciras Conference in 1909 French diplomacy had alternated between two courses. Confident in the Russian alliance and the Entente of April 8 1904 with England, she had effectively resisted German pressure. But she saw on all sides evidence that Germany intended to obtain by indirect means what she had failed to win by intimidation—a footing in Morocco and the disruption of the Triple Entente. The Berlin Cabinet took every opportunity of thwarting the organisation of a French protectorate in the Shereefian Empire; moreover, acting in conjunction with Vienna, they persistently insinuated in political and journalistic circles in Paris that France would enjoy greater facilities in Morocco in return for complaisance towards German expansion in the East. This alluring propaganda had its effect upon the Radicals and Socialists, while the Russian Alliance and the Entente Cordiale found favour mainly among the Conservatives, Progressives and Liberals. To the Left of these parties—whom the pacifists accused of militarism—hopes were entertained of an understanding with Germany which, by removing the risk of war, would permit of the normal development of democratic institutions. M. Pichon, Foreign Minister in the Clemenceau and Briand cabinets, did not share this view; but, inspired with a great desire for conciliation, he gave certain confidential assurances to Berlin, supplementing the Franco-German declaration of Feb. 9 1909, under which nationals of both countries were to be associated in Morocco in any transactions for which they could obtain contracts. But at the beginning of 1911 the cabinets of Paris and Berlin were in fact in complete disagreement on the application of the 1909 declaration, and it was therefore without regret that Pichon left the Quai d'Orsay.

Monis, a senator from La Gironde, formed (March 2) a Radical Ministry, giving Caillaux Finance, Berteaux War, Steeg Public Instruction, Delcassé the Navy, Messimy the Colonies and Paul-Boncour Labour. He immediately found himself in difficulties of various kinds. Himself opposed to proportional representation, he had to deal with a Chamber which favoured this method; and although he yielded to Socialist pressure on social questions he was unable to calm the effervescence of the extreme Left. In the department of Aube he was eatened by a quasi-revolt of the vine-growers, whose right sell their wine under the name of champagne had been dis- ted. The Moroccan question was again disquieting. The ongest personality in the Ministry was Caillaux, who, though stood for better relations with Germany, cherished the ambi- n of "giving" Morocco to France—that is to say, releasing protectorate in Morocco from the obligations of Algeciras by angement with Berlin. With the concurrence of Berteaux pressed forward the Morocco campaign. His Foreign Min- er, the lawyer Cruppi, failed to realise the risk of military tiative without diplomatic preparation. In April, when the ench troops entered Fez, Germany formulated reservations, d Spain claimed her right to similar military occupations, tably at Larache. The question of calling a second conference once arose; at the moment of this diplomatic crisis a tragic cident put an end to the Monis Ministry, for Berteaux was led and Monis seriously wounded (May 20) by the fall of an roplane on the aerodrome at Issy-les-Moulineaux. For a nth the Govt. struggled on. The Senate settled the Aube ne question by removing the strict definition of champagne. June 23 the Govt. was defeated in the Chamber, and resigned.

Invited to form a ministry, Caillaux took the Interior himself, signed Finance to Klotz, left Steeg and Delcassé at Public struction and the Navy, gave Messimy War and entrusted reign Affairs to de Selves, a senator and a successful prefect of e Seine. Caillaux's programme included a project for the eorganisation of Africa." This scheme, previously worked out th Messimy, had formed the subject of secret negotiation th the German Govt. in the spring. At that time the proposals tailed the cession to Germany of the political administration of ench Equatorial Africa under the form of railway exploitation. document, which was to remain secret, stipulated that: "if the nstruction of the railway is authorised, Germany may be prac- ally assured that sooner or later Cameroon will be able to annex e Sanga, Ubangi and Shari basins. The economic preponder- ce of Germany in these countries will in effect inevitably entail r political ascendancy."[1] This move, which meant disguised nexation, failed; but the German Govt., disillusioned by the lure of the agreements made with the Briand Ministry, pro- ded with a definite plan. Jules Cambon, French ambassador Berlin, went to Kissingen during the ministerial crisis to talk er matters with Kiderlen-Waechter.

The Agadir Incident.—On July 1, the day after the reading of e ministerial declaration in Parliament, the reply came. Ger- nv's representatives abroad notified all the Powers signatory the Act of Algeciras that in response to the appeal of German mmercial firms and of German protégés for the protection of gadir, their Government had sent a warship, the "Panther," to e Moroccan port. This brusque announcement, which meant that ance must either forego the military protectorate of Morocco or mpensate Germany, was made two days before the date fixed r the embarkation of the President, M. Fallières, and the For- gn Minister, M. de Selves, on a visit to the Queen of Holland. or four months the new Ministry was absorbed in extremely licate negotiations. Confronted with the uncompromising titude of Great Britain and Russia, Germany, whose military d naval equipment was not yet complete, did not persist in r original claims on the Congo. To hasten the issue, Caillaux ntured, unknown to de Selves, to make to Berlin secret pro- sals exceeding the limits conceived possible by the Foreign inister. Disagreeable complications ensued. Finally, on Nov. a treaty was signed ceding to Germany territory which gave cess to the Ubangi and the Congo and organising an economic otectorate in Morocco.

The bill for the ratification of the treaty provoked stormy bates in the Chamber. It was passed at the end of Dec.; but ien, some days later, M. Caillaux's secret offers were disclosed the Commission on Foreign Affairs of the Senate, at which on Bourgeois presided, there was a dramatic scene which led de Selves's resignation. Caillaux offered the Foreign Office to M. Delcassé, who hesitated; the Marine successively to Poincaré, Admiral Germinet and Pierre Baudin, who refused. Finding it impossible to complete his Cabinet, the Prime Minister resigned on Jan. 10.

The replacement of a third of the Senate on the first Sunday in Jan. 1912 produced no sensible modification in either the spirit or the composition of the Upper Chamber.

At the request of Fallières, Raymond Poincaré now quickly formed a ministry. Taking the Foreign Office himself, he made Briand Minister of Justice, gave Léon Bourgeois Labour, Steeg the Interior and Delcassé the Navy. In his declaration on Jan. 16 he announced as his programme the prompt ratification of the treaty of Nov. 4, an *entente loyale* with Spain, courteous and frank relations with Germany, loyalty to alliances and friendships, the restoration of the principle of authority, rigid repression of crime and of offences against persons or property and electoral reform. Under the influence of the Prime Minister moderate ideas began to find favour. When Henri Brisson died, Paul Deschanel was elected to succeed him as president of the Chamber. The municipal elections in May were in favour of the Moderates. A rather complicated franchise Act embodying proportional representation was passed by the Chamber. But, as in the previous year, attention was riveted primarily upon foreign affairs.

A treaty providing for the protectorate was signed by the Sultan of Morocco on March 30, and Gen. Lyautey was appointed Resident-General. There followed disturbances at Fez, negotiations with Spain and long discussions in Parliament. The Sultan Moulai-Hafid abdicated, and was replaced by Moulai-Youssef. The liquidation of the Moroccan affair was attended by a series of complications.

The Balkan Crisis.—Italy had thought it necessary to undertake a parallel enterprise in Tripoli, thus involving herself in a war with Turkey. Certain questions of neutrality arising out of this led to unpleasant incidents, one of which—that of the "Carthage" and the "Manouba"—caused acute tension between Paris and Rome. Here arbitration prevented actual conflict. But the annexation pure and simple of the whole of Libya by Italy, the closing of the Dardanelles and various other incidents aroused such excitement and such hopes in the Balkans that a Balkan League was formed for the purpose of liberating the Christian races on the peninsula. Poincaré was briefly informed of this by Izvolski on April 1, and of the details only in Aug. on the occasion of his visit to Nicholas II. at St. Petersburg. He attempted to intervene as a moderator, but the German and Austrian cabinets which had had warning from secret sources at the beginning of April, allowed events to take their course in the hope that Serbia might be crushed. During the Balkan wars Poincaré continued to urge the localisation of the conflict and the maintenance by the Great Powers of a disinterested attitude in respect of territory. At the London Conference, which opened in Dec., his thesis was: "The Balkans for the Balkan States."

The diplomatic crisis had become serious over the question of Scutari and of Serbia's access to the sea when, Fallières's tenure of office having expired, Poincaré was elected President of the Republic (Jan. 17 1913) by 483 votes against Pams with 269. He carried the day in spite of Clemenceau and the preliminary nomination of Pams by a majority of the Left groups. In his presidential address to the Chambers he made clear his intention to take a more active part than his predecessors had done in the politics of his country. "Weakening of the executive power" he said, "is no part of the creed of Chamber or Country." He insisted further on the necessity of maintaining the military power of France at its highest level, for "it is not possible for a nation to have an effectively pacific policy unless it be always prepared for war."

Briand's Cabinet of Jan. 1913 was formed in accordance with these ideas. Taking the Interior himself, he gave Foreign Affairs to Jonnart and Justice to Barthou, leaving most of the other ministers in their offices. He demanded extraordinary credits for material of war, and put forward a bill for the re-establishment of three years' service, proposing thus to counterbalance the military measures of the German Govt., which had asked for a special grant of a milliard marks for the reorganisation of the army (*see* Germany). Meanwhile he was placed in a minority in the Senate on the question of proportional representation and, on March 18, gave in his resignation.

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[1] *Documents secrets*, published by A.G. Journal des Débats Jan. 11 12.

Barthou, who now became Prime Minister, with Pichon as his Foreign Minister, set himself to secure the passing of the Three Years' Service bill, considered indispensable for national security by the French general staff. Meanwhile he decided to retain with the colours the class whose term of service would expire in October. It was only after a hard struggle and in the face of violent opposition from the Socialists throughout the country that the bill was passed by the Chamber, and then only with an amendment made by Painlevé which placed recruitment a year earlier, at 20 instead of 21, so that the 1912 and 1913 classes were called up together, allowing the 1910 class to be released at the appointed time. The Senate passed the bill almost unanimously.

Barthou's ultimate success was due to the ever-growing menace of a European war. In April a petty dispute between German travellers at Nancy and the inhabitants nearly led to a diplomatic quarrel. Even when the peace of Bucharest (Aug. 10 1913) ended the second Balkan War, the air was still charged with electricity, both in Europe and the East. In France anxiety increased with the rapid growth of pan-Germanism and the concentrated pressure exercised on the Quai d'Orsay by the cabinets of Vienna and Berlin with the object of raising loans to drain French savings invested in those countries which were under the influence of the two empires. In the beginning of Nov. Pichon learned through Jules Cambon, who had been confidentially charged by the King of the Belgians to convey the warning to the French Govt., that the Kaiser had said to King Albert at his official visit to Potsdam: "War with France is inevitable and imminent. . . . . This time it must be decisive. Your Majesty can have no conception of the irresistible enthusiasm that will sweep over the entire German nation when that day comes." Other remarks, of no less grave import, were made by von Moltke, chief of the German general staff, who was in attendance.

Vigorously attacked by the Left, Barthou had to contend with strong opposition from the Radicals, led by Caillaux, and the Socialists. After the parliamentary vacation his majority collapsed on a question of finance. The floating debt, which had been increased by the expenses in Morocco, made it necessary to raise a loan. The loan proposed by Dumont, Minister of Finance, was defeated by 290 to 265. The objection to the extension of the guarantee of fiscal immunity enjoyed by the existing *rentes* to the new *rente* demanded by the minister was, however, only the nominal pretext; the real opposition of the Left was due to Dumont's refusal to impose an income tax.

Ribot and Jean Dupuy failed successively in their attempts to form a Moderate cabinet on account of Radical opposition of which Caillaux was the rallying point. Poincaré, mindful of Caillaux's diplomatic activities in 1911, was unwilling to put him into power. He therefore instructed Doumergue to form a Radical ministry in which that statesman would take Foreign Affairs. Doumergue entrusted Caillaux with Finance, René Renoult with the Interior and Viviani with Public Instruction. He obtained a vote of confidence from the Chamber (302 votes against 141) for "a policy of democratic reforms, based on republican opinion and supported by an exclusively republican majority." This new Govt. indicated a reversion to the sectarian policy known as "Combisme." It was in favour of a tax on income, which was adopted by the Chamber. The reform of the franchise was definitely rejected by the Senate in March, and the approaching elections were therefore to be on the old basis of the *scrutin d'arrondissement.*

The Menace of "Preventive" War.—Although the Ministry had promised the loyal application of the Three Years' Service law, it was known to dislike the system. But the external situation became more and more disquieting. German militarism entered upon a provocative phase. The Zabern incident (*see* Alsace-Lorraine) produced a deep impression throughout the country. In March the *Kölnische Zeitung* stated that the "legend" of historical Russo-German friendship had been finally exploded. The question of the "preventive" war was openly discussed in the principal Berlin papers. The *Kreuzzeitung* expressed regret that Germany, in 1905, had missed the opportunity of demanding a decisive explanation from France when the conditions were most favourable. The *Berliner Tageblatt* held the view that "in certain cases, a state surrounded by too powerful neighbours owed it to herself not to wait for the knock-out blow to be delivered." It and other papers declared that Germany must make haste to act before the Habsburg Empire fell to pieces. For several weeks the newspapers harped on this theme. The cordial sentiments exchanged at the Elysée on April 21, when the King and Queen of England visited Paris, reassured the public for a time; but fresh signs of trouble soon disturbed its peace. A noisy campaign was organised in Germany against the Foreign Legion, and complications arose at various points in the East.

The Assassination of Gaston Calmette, and the Elections.—A sensation was caused on the eve of the elections by the assassination of Gaston Calmette, editor of the *Figaro*, by Madame Caillaux. On Caillaux's resignation Renoult became Minister of Finance, and Malvy Minister of the Interior. The elections took place a month later (April 26 and May 10). The re-election of Deschanel by 401 votes as president of the Chamber made a majority for the Radicals and Socialists seem unlikely. All the vice-presidents too were chosen from among the partisans of the Three Years' Service bill. Nevertheless the Unified Socialists carried 102 seats, and the Radicals were reinforced; their combined strength was such that no Cabinet could dispense with their support. Doumergue, deferring to custom, had resigned after the elections, and the President of the Republic appointed Viviani with instructions to maintain the Three Years' Service law. But Viviani, confronted with the opposition of the Radical-Socialists, who demanded a return to two years' service, resigned. Poincaré then called on Ribot, who completed on June 9 a Cabinet composed of Moderates and of friendly Radicals, such as Léon Bourgeois and Jean Dupuy. But this Cabinet fell at the first meeting of the Chamber on June 12, when a majority of 306 against 26 announced the resolve: "to give a vote of confidence only to a government capable of bringing about the union of the Left groups." Ribot had drawn the attention of the Chamber to the gravity of the general situation and the increase in German armaments; but the Socialist deputies, absorbed in their own affairs, maintained that these armaments were not directed against France. Viviani, summoned once more by Poincaré, now found the Radicals more accommodating, and succeeded in his task. He took Foreign Affairs himself; gave Justice to Bienvenu-Martin, the Interior to Malvy, War to Messimy and the Navy to Augagneur. The ministerial declaration announced the Government's intention of applying the Three Years' law until further notice and of carrying into effect the income-tax proposals so long held up by the Senate. The Ministry secured a vote of confidence by 370 against 137 votes.

The European Crisis

On June 28 the Archduke Francis Ferdinand and his wife were assassinated at Sarajevo by two Bosnians who were Austro-Hungarian subjects. While diplomatic and military preparations for a war of aggression were being carried on in the greatest secrecy in Vienna and Berlin, President Poincaré and Viviani were embarking for Russia on a visit to the Tsar, while the French people were passionately absorbed in the proceedings against Madame Caillaux (July 20–8) at the Seine assizes. The verdict of acquittal produced a great sensation, but at this very moment the designs of Austria and Germany were revealed in a flash. Poincaré had scarcely left Russia, on July 23, when—at a moment chosen by Vienna and Berlin to prevent the President and the Tsar from coming to any agreement—the Austro-Hungarian Foreign Minister sent Serbia an ultimatum couched in terms which were intended to make it unacceptable. In Paris, the Austrian and German ambassadors declared to Bienvenu-Martin ting Premier and Foreign Minister, that the conflict was be localised to Austria and Serbia. M. de Schoen added that any intervention by another Power would, automatically, der the existing alliances, produce incalculable results." A reless message led Poincaré and Viviani to cut short their pro-sed stay in Stockholm and cancel their visits to Christiania d Copenhagen; they arrived at Dunkirk on July 29.

On resuming the direction of affairs on the night of the 29–th, Viviani found the situation desperate On the night of e 25th Austria had broken off diplomatic relations with Serbia, d declared war on the 28th. At the Quai d'Orsay Schoen in-tently demanded from Bienvenu-Martin and Philippe Berthe- a public declaration of the "political solidarity of France d Germany"—that is to say, the abandonment of Russia by ance. On the 31st Graf Lichtenfeld, Bavarian Charge d'Af-res in Berlin, informed Munich that "the Prussian great neral staff face war against France with the most complete nfidence and count upon the complete defeat of France in ur weeks."

During the presidential voyage anxious French Socialists had t in touch with German Socialists at Brussels. Jouhaux, gen-al secretary of the *Confédération générale du travail*, inquired tegorically of Legien, the Social-democrat representative, ether his party would allow themselves to be mobilised in se of aggression on the part of Germany. He received no reply. the morning of the 31st the German Govt. declared a "state emergency" (Kriegsgefahrzustand) preliminary to general obilisation. On the same day the Austrian and Russian gov-nments simultaneously ordered a general mobilisation. At 30 P.M., Bethmann Hollweg desired Schoen to inform Viviani at the German mobilisation inevitably meant war, and to ask m whether in a war between Russia and Germany France uld remain neutral. His concluding instructions—marked secret"—to Schoen were:

> If, as there is no reason to suppose, the French Govt. should clare that they will remain neutral, I beg your Excellency to orm the French Govt. that we should require, as pledges of their utrality, the handing-over of the fortresses of Toul and Verdun; ese we should occupy and return after the war. The reply to this estion should be in our hands before 4 P.M. to-morrow.

At 7 o'clock Schoen fulfilled his mission to the Quai d'Orsay. few minutes later, Jean Jaurès, leader of the French Socialist rty, who had returned, greatly disheartened, from Brussels, s assassinated by a fanatic in a restaurant. During the day ree councils were held at the Elysée. Poincaré sent King eorge an urgent letter, insisting on the importance of unity of plomatic action on the part of the Triple Entente and on the oderating effect that could not fail to be produced in Vienna d Berlin by the certainty "that the Entente Cordiale would affirmed, in case of need, even to the extent of taking the field le by side." In spite of the extreme gravity of the situation viani had not yet ordered general mobilisation, but only the mpletion of the second defence line. No moderating influence uld now alter the course of events, determined by the two ntral Powers. The French Govt. had concurred in all the itish and Russian proposals for the prevention of a general nflagration, whether by the summoning of a conference, by bitration by the Hague Court, or by mediation. In spite of me wavering between Vienna and Berlin at the eleventh hour e situation was so well defined that Schoen made his prepara-ons for departure on the evening of the 31st, without waiting the reply that Viviani was to give him the next day. With e "punishment" of Serbia as the initial pretext, the conflict sensibly assumed the form desired by the German general aff. From Austro-Serbian and Austro-Russian it became Ger-an-French, without a mistake or even the slightest imprudence ving been committed at any point by the French Government.

The Declarations of War.—On Aug. 1, without awaiting replies om France and Russia, William II. approved the text of the clarations of war against these two Powers. The Federal ouncil assembled in Berlin took note of the two documents, d agreed to their dispatch in case the expccted replies should prove unsatisfactory. At 11 A.M. Viviani replied to Schoen that France would do what her interests demanded. There was no mention of Toul and Verdun by Schoen. At 3:40 P.M. France ordered a general mobilisation. At the same hour, and before the arrival in Berlin of Schoen's telegram relating his interview with Viviani, the order for general mobilisation was given in Berlin, the public announcement following at 5 o'clock. At 5:30 Schoen went again to the Quai d'Orsay, where Viviani expressed to him his hope that, in spite of the mobilisation, negotiations would be continued on the basis of the most recent proposal put forward by England, which had the warm support of the French Cabinet. At 7 P.M. Count Pourtalès delivered Germany's declaration of war to Sazonov. At midnight Izvolski appeared at the Elysée, where a Cabinet meeting was in progress, to ask what France intended to do. The Cabinet decision was to fulfil all the obligations of the Alliance, but that France should not take the initiative in breaking off relations nor declare war. A state of siege was proclaimed, and the Chambers were convoked for the following Tuesday. During the night German detachments invaded French territory at four different points.

On the morning of Aug. 2 a French corporal was killed on the Delle road by a German lieutenant who had entered France at the head of a patrol. In Berlin the expediency of an immediate invasion of France was being discussed. After consulting the war ministers and the general staff, the Chancellor decided in the negative. "We hope," he reported to the Kaiser, "that the French will attack us." But this hope was not realised, the French troops having orders not to respond to provocation. The German Cabinet then ordered the German Minister at Brussels to carry out the instructions contained in a sealed note that had been sent with a telegram on July 29; these instructions were that the Belgian Govt. be summoned to allow the passage of the German Army. At the same time the chief of the German Admiralty informed the commander of the fleet that hostilities against France would probably commence on Aug. 3. The Belgian Govt. rejected the German summons, as also the proposal of H. Klobukowski, the French Minister, to send five French army corps to defend Belgium's neutrality. In London assurances were made to M. Cambon by Sir Edward Grey that if the German Fleet came into the Channel or through the North Sea to undertake military operations against the French coast or shipping, the British Fleet would give all the protection in its power, and that the British Govt. were considering whether they would declare in Parliament the next day that the violation of Belgium should be regarded as a *casus belli*.

On Aug. 3, France having nowhere furnished any pretext for aggression, the German authorities spread false reports of supposed invasions of German soil or German skies by French soldiers. Bethmann Hollweg telegraphed to all the European capitals that "France's action was the most serious violation of neutrality imaginable." Between 1 and 2 o'clock he ordered Schoen to deliver to the French Govt. at 6 P.M. the same day a declaration of war couched in these terms:—

> The German administrative and military authorities have established a certain number of flagrantly hostile acts committed on German territory by French military aviators. Several of these have openly violated the neutrality of Belgium by flying over the territory of that country. One has attempted to destroy buildings near Wesel; others have been seen in the district of the Eifel, one has thrown bombs on the railway near Karlsruhe and Nürnberg. I am instructed, and I have the honour to inform your Excellency that, in the presence of these acts of aggression, the German Empire considers itself in a state of war with France in consequence of the acts of this latter Power.

Viviani made vigorous protests both to Schoen and in a note sent to the representatives of the Powers in Paris. There was some brawling in the streets of the capital where German or Austro-Hungarian subjects owned shops and some of these were pillaged. But order once being restored by Viviani, no further disturbance took place in the following days. That evening he reconstructed his Cabinet to suit the circumstances, himself remaining president of the council but relinquishing Foreign Affairs, which passed to Doumergue. Augagneur succeeded Gauthier for the Navy.

On Aug. 4, amid general excitement but without disturbance anywhere, Parliament reassembled to hear the Government's communication. In his message the President of the Republic recalled the fact that for over 40 years France, resolutely putting aside her desire for legitimate reparation, had used her rejuvenated energy solely in the interest of progress and for the good of humanity; that she might be justly proud of having made supreme efforts to avert the war which had just broken out, the crushing responsibility of which would be laid upon the German Empire by history. The message, to which the two Assemblies, greatly moved, listened standing, proclaimed the "*union sacrée*" of all sons of France. Viviani then explained at length the events and negotiations that had taken place, concluding with these words: "We are without fear, we shall be without reproach." Thus invoked, the "sacred union" became a reality. Even as the army mobilisation proceeded throughout the country in perfect order, so the mobilisation of the spirit, which prepared the population to endure long and terrible trials, was effected with a quiet dignity. Parties ceased to exist. Bowing to the evidence of German aggression the Socialists stood loyally by the Government. They sought no vengeance for the murder of Jaurès, and the Viviani Cabinet, confident in their patriotism, refrained from using their discretionary powers of preventive arrest even on the most suspect in their ranks—those whose names were on "List B." The whole country, moved by one will, rose with the same enthusiasm against the invader.

By a succession of laws, passed without debate, the country was organised for a state of war. The state of siege was to be maintained for the duration of the War; commercial settlements were postponed and credits prolonged; legal proceedings against citizens called up for service were suspended, and a moratorium was decreed for bank deposits. Allowances were voted for necessitous families whose breadwinners were in the army; the Govt. was authorised to open by decree credits for the requirements of national defence. Notes on the Banque de France became compulsory currency, and the limit of emission was raised to 12 milliards. Measures were taken against alcoholism, in particular the sale of absinthe was forbidden. To avoid press indiscretions it was forbidden, under penalty of imprisonment, to publish any information regarding national defence apart from that given in official communications, or any military or any diplomatic article of a nature "favourable to the enemy or calculated to depress the minds of the army and the population." No preventive censorship was established, but a Press bureau installed at the Ministry of War received the damp proof-sheets of the newspapers and marked such passages as were not to be printed. Any paper which failed to comply was liable to be warned, and, in case of a second offence, suspended. The passages suppressed were represented by blank spaces as it was impossible to replace them at the last moment; these were known as "caviare."

In a few days the conflagration had spread from one end of Europe to the other. Austria, however—the original instigator—affected a sort of ignorance of events in her relation to France. Her ambassador continued his functions in Paris. Under pressure of public opinion, infuriated by this cynical attitude, Doumergue sent Graf Szecsen his passports on Aug. 10 and instructed Dumaine to ask for his. The British Cabinet followed the same course with regard to Count Mensdorff.

The War Period

After the loss of the battle of the frontiers (Aug. 20–4) the Ministry realised the need of reconstruction or—as Viviani phrased it—of broadening its basis. On Aug. 26 the government of National Defence was constituted, containing representatives of the Republican parties, and including for the first time two Socialists, Guesde and Sembat. Viviani remained as Prime Minister without portfolio; with Briand, Delcassé, Malvy, Millerand, Ribot, Sarraut and Doumergue. At the same time Jouhaux, together with the Archbishop of Paris, Cardinal Amette, was appointed to the National Aid committee (*Comité de l'oeuvre du secours national*), created for the assistance of refugees from the invaded departments and presided over by the head of the Paris Faculty of Science, M. Appel. No sooner was the new Govt. formed than it departed to Bordeaux (Sept. 3) unwilling to risk being shut up in Paris as in 1870. The capital was left in the hands of a military governor, Gen. Galliéni, whose short proclamation became famous: "Inhabitants of Paris, the members of the Govt. of the Republic have left Paris in order to give a new impulse to National Defence. I have received a mandate to defend Paris against the invader; this mandate I shall carry out to the end" (Sept. 3). Nevertheless more than a third of the population left the city. German aeroplanes flew over Paris daily.

The installation at Bordeaux of the Govt., the foreign missions, the principal departments of state, the most important Paris newspapers, and a multitude of pusillanimous or curious persons was not effected without some disorder at first, and even some scandals. But life in the provisional capital rapidly attained the necessary dignity. On the side of the Govt. it showed great activity. On Sept. 5 M. Delcassé obtained through M. Cambon a declaration signed in London by which the British, French and Russian governments mutually agreed to conclude no separate peace during the existing War, nor, when peace terms came to be discussed, to propose conditions without first coming to an agreement with each of the other Allies.

The victory of the Marne (Sept. 6–10) brought relief, and, indeed, gave rise to exaggerated hopes; but disillusionment was to follow. On Aug. 2 a German-Turkish alliance had been concluded, unknown to the ambassadors of the Triple Entente duped by the triumvirate Talaat-Enver-Djemal; there followed the disaster of Tannenberg, the penetration of the "Goeben" and the "Breslau" into the Sea of Marmara, and Turkey's entry into the War on the side of Germany at the end of October. Munitions became exhausted and the line of trenches now extended continuously from the Vosges to the sea. Paris was no longer in danger, but six departments had been invaded, and none could say when they would be liberated. The situation being thus stabilised, the Govt. was reinstalled in Paris in the latter half of December. The Chambers which had not sat at Bordeaux, although assembly rooms had been reserved for them, met again on Dec. 22. Thenceforward they were to be permanently in session with but few interruptions. The experience of the preceding months had shown that there were serious objections to the suppression of Parliament and of the Press. An outside stimulus was needed to correct the errors of judgment and fatal imprudences that had been committed. In the Chamber the criticisms were many and vigorous; notably these formulated with asperity by Clemenceau in his paper *l'Homme Libre* which, after being suppressed by the censor, reappeared as *l'Homme Enchaîné*. But Viviani was able to curb excessive recriminations in the Chamber and to insist on the maintenance of the *union sacrée*. He consented to the formation of big parliamentary commissions, which were to prove discreet and very useful collaborators of the Government. Certain deputies and senators were sent on missions to the armies.

Annual budgets were dispensed with. All credits were voted by douzièmes described as provisional. As taxes were not coming in well and it was considered impolitic to raise them at a time when the nation's whole resources were being strained to restrict invasion, resort was had to loans. The most successful financial resource was the issue of National Defence bonds, which had been Ribot's idea. These were actually Treasury bonds in the form of coupons bearing a fixed rate of interest, payable in advance, which could be realised at three, six or 12 months and were negotiable at sight.

The Ministry was vigorously attacked on the subject of the men—named *embusqués*—mobilised or liable to be mobilised, who shirked service at the front. In the hurry to produce munitions many factories had to be set working again and authority was given to their directors to recall such of their workpeople or staff as seemed to them indispensable. Similarly, members of the universities and specialists whose technical knowledge was indispensable to different services, had to be allotted to non-combatant corps. As a result the trenches had been held, since the middle of 1915, mainly by peasants and employees. On the itiative of Dalbiez, therefore, the Chamber passed a rigorous w (June 26), which did not however entirely remove the *em*- *ısqués* scandal. In July two under-secretaryships were created: oseph Thierry for supply and Justin Godard for the medical rvices. The discussion aroused by all these complicated ques- ons weakened Millerand's position. In the Senate, Clemenceau, s president of the Army Commission, carried on a ruthless cam- ıign for the adaptation of the services to the needs revealed by ıe War.

The Intervention of Italy.—In the field of foreign politics the ɔring was a period of great promise followed by great disappoint- .ent. In the Dardanelles the naval expedition sent to force the traits failed (March 18) with heavy losses. In May there was y on hearing of Italy's intervention on the side of the Allies. A eaty between the Triple Entente and Italy, of which the tenor mained a secret for the whole of the War, had been signed on pril 26 in London. Although the clauses relating to the pro- ɔsed cession to Italy of territory inhabited by Slavs were not vulged, they were known in substance to the Slav peoples and eated great indignation, thus strengthening Austro-Hungarian sistance. Then, too, in defiance of a formal stipulation in the reaty of London, Sonnino declared war on Austria only. It was ɔt until Aug. of the following year that he declared war on Ger- .any, who benefited meanwhile by Italy's neutrality. Then gain, England and France, who were already providing military ıaterial for Russia, had now to manufacture it for Italy also, though they had not enough for themselves. The crowning umiliation was Rumania's failure to come in till over a year ter instead of with Italy, as the Allies had expected.

The Intervention of Bulgaria.—Yet another intervention was follow, disconcerting the Allied Ministers and precipitating ıe fall of Viviani's Cabinet. When Bulgaria ordered a general obilisation on Sept. 22, the Allies flattered themselves that it as directed against Turkey. For three days Delcassé and Mil- rand denied the evidence. When the truth came out, Delcassé, being questioned in the Chamber, was subjected to such vere criticism that he had to retire. Viviani then took over ıe portfolio of Foreign Affairs (Oct. 13). He was still able to otain a vote of confidence of 372 to 9; but, by the abstention the Socialists and a large number of Radicals, the *union sacrée* as broken. Viviani was a victim of the general uneasiness used by successive disappointments and by the non-success of ıe great offensive in Champagne (Sept. 15). Sensible of the saffection of the majority, who were opposed to the secret ommittees instituted by the Chamber, Viviani handed in his signation on Oct. 28.

Briand rapidly formed a new Cabinet, keeping Foreign Affairs mself. The Ministry of Justice fell to Viviani, War to Gen. alliéni, Navy to Adm. Lacaze, Public Instruction and Invention Painlevé; Ribot retained Finance and Malvy the Interior. ive seats in the Cabinet without portfolio were created for de reycinet, Léon Bourgeois, Combes, Guesde and Denys Cachin, ıd an Under-Secretariat for Munitions for Albert Thomas, the oung Socialist deputy. The Ministry, which embraced political eterans of all parties and some new men in addition, was unusu- ly well received. Briand's speech, taking as its motto: "peace rough victory," was followed by a vote of confidence in the hamber of 516 to 1. The *union sacrée* seemed to be restored in ite of the sympathy shown by a considerable and energetic ocialist minority with the pacifist resolutions passed at the In- rnational Socialist conference at Zimmerwald early in Septem- er. This minority grew gradually bolder. At the second Interna- onal Socialist Conference, held also in Switzerland at Kienthal April 1916, three French deputies presented themselves.

Restrictions and Finance.—In spite of goodwill the Briand abinet had some hard knocks at home and abroad. In the ope of preventing a rise in the price of essential foods and of owing down the increase in the cost of living, the Govt. pro- ded the bakers with flour (at a loss) and fixed maximum prices r certain commodities. They had eventually to proceed to ricter measures and to ration each family for bread, coal and gar. Summer time, introduced in June for the sake of economising coal, was maintained in spite of the dislike of the rural population. The prolongation of the War made it more difficult to enforce extraordinary regulations which had been accepted originally as temporary. The restrictions on the consumption of alcohol, to which the trade raised strong objections, and the prohibitions laid down by the military authorities aroused complaints which reverberated unpleasantly in the Chamber. On Feb. 1, 1916 Galliéni, having been rudely interrupted, left the tribune and even the hall. Although he was brought back it was only to complain, "You force me to do work for which I am not fitted." It was not for long. Galliéni, being exhausted and threatened with appendicitis, resigned on March 16. On May 26 he died as the result of an operation. His funeral was made a national event. He was succeeded by Gen. Roques, who was thus the fourth War Minister in 20 months.

The necessity of providing the Treasury with other resources than those raised by loans compelled the Govt. to demand new sacrifices. A tax on income, passed by the Chamber before the War, but laid aside by the Senate, had already been imposed; but owing to the respite granted to mobilised men only 133,000 were found to have an income over 5,000 fr. (the minimum taxable figure), and as their total income was under three milliards, only half the expected sum was realised. Ribot hoped at least to cover the interest on new loans by the tax. He therefore proposed to double the tax on land, the tax on income, and to increase the duties on tobacco, sugar and alcohol; also to suppress the rights of vineyard proprietors to distil without paying duty on the yield of their vintage. On this latter point in particular Ribot met much opposition, and exemption on 10 litres of pure alcohol per family was conceded. The Senate accepted this condition, though objecting to the distillers' privileges. The doubling of direct taxes was rejected in favour of a tax on war profits, which from this time onward often appeared excessive. The Socialists took advantage of the national unrest to promote their cause, and internationalism made some headway in the National Council of French Socialists. Late in Aug. a vote was passed protesting against the doctrine which denied that a country had the right to defend itself when attacked, and calling for a durable peace based upon reparation of the wrong done in 1871 and the restoration of independence to oppressed nations. But the minority continued to grow and, by Dec. 28, had 1,081 votes against 1,836. Only by 1,637 votes against 1,372 was Thomas authorised by the party to return to Munitions.

Verdun and the Somme.—During the whole of 1916 military interest was concentrated on the siege of Verdun (*q.v.*). By June the general anxiety had reached such a pitch that Viviani consented to let the Chamber sit in secret committee (June 16–22). After animated discussion a resolution was passed, by 440 against 97, expressing at the same time confidence in the Govt. and the Chamber's desire "to exercise effective control of all services engaged in providing for the requirements of the army . . . while strictly abstaining from interference with the conception, direction or execution of military operations." Actually this control was carried out without serious hitches, and the committee continued to sit in secret whenever the situation was felt by the deputies to be too serious to be discussed at a public sitting.

On July 1 a Franco-British massed attack was launched against the line of the Somme. It was a brilliant performance, with heavy losses on both sides, but the result was negative; for after weeks of struggle the Allied line had only advanced some kilometres to the East. On the second anniversary of the War efforts were made to sustain the morale of the army and the population by proclamations from the President of the Republic, the Prime Minister and the army chiefs. The Govt. urged private individuals to put their gold into the Banque de France and place their realisable foreign securities at the disposal of the state. In response to these appeals some three milliards were collected, making it possible to limit depreciation of the franc to 10 or 12%.

The Eastern Campaigns.—But events in the East took a disastrous turn. The second Dardanelles expedition—no more successful than the first—was abandoned in the autumn, and the troops thus released were sent to Salonika and placed under Gen. Sarrail, who had instructions to go to the aid of Serbia. But Sarrail, lacking adequate means and thwarted by the opposition of King Constantine, was unable to get into touch with the Serbs, whose army retreated under terrible conditions across Albania to the Adriatic. In vain did the British and French governments urge Constantine to range himself on the side of the Allies; he dismissed Veniselos and the Chamber, and persisted in an unfriendly neutrality. Briand opened negotiations with the Greek Govt., which produced nothing but irritation and disappointment to France. On Aug. 17 1916 a treaty of alliance with Rumania brought the Allies renewed hopes of an early victory. But after some success there came a fresh disaster. Rumania was attacked by Bulgaria, on whose neutrality she had relied; the Russian contingents promised to her were delayed, the promised offensive by Sarrail's army was not launched and her territory was finally invaded and occupied by the enemy as far as Moldavia. Encouraged by these events and urged on by Berlin, Constantine went so far as to attack some detachments of French marines on the outskirts of Athens and a number of Veniselists in the streets of the city. French residents had to take refuge with the fleet.

Briand and Adm. Dartige du Fourmet, commanding in Greek waters, had been doubtfully advised in their later negotiations with the Cabinet in Athens. They had in fact speculated on Constantine's goodwill. In France, where the Rumanian catastrophe had come as a surprise, these latest events made a painful impression. A secret committee of the Chamber (Nov. 28–Dec. 7) passed a resolution "taking note of the Government's declarations on the reorganisation of the command and approving its resolution to concentrate on the conduct of the War and its economic organisation." Briand thereupon reconstituted his Cabinet. He suppressed the five ministers of state, made Gen. Lyautey War Minister (replacing him in Morocco by Gen. Gouraud), promoted Thomas to be Minister of Munitions, and gave Herriot Supplies. Loucheur was made Under-Secretary of Munitions. A war committee of five ministers was formed and, at the end of the month, the reform of the high command, so long desired by the many who had lost confidence in Joffre's methods, was timidly brought about. Joffre was attached to the War Committee as technical adviser, and was made a Marshal of France. His successor was neither Foch nor Pétain, but Gen. Nivelle, who was appointed commander of the armies of the north and northeast. But Briand's authority was now seriously impaired. In the Chamber he was subjected to wearisome criticism and recrimination, and the deputies refused him the necessary powers to deal by administrative order with questions affecting national defence. Even the Senate's vote of confidence was only passed by 190 votes against 37. With each successive vote his majority decreased while the number of abstentions steadily increased. At last, during a session in which certain deputies demanded a secret committee on military questions, Gen. Lyautey retorted bluntly that there were some things which could not be said even in secret committee. This suggestion of possible indiscretions—there had been leakages—was greeted with angry murmurs, and Lyautey decided to resign. As Painlevé refused to take his place, Briand tendered the resignation of the whole Cabinet on March 17 1917.

Peace Offers.—One of the last acts of the Cabinet had been the rejection of a disputable offer from the four enemy governments "to enter upon peace negotiations." This proposition, couched in grandiloquent phrases and enhanced by sensational addresses from the heads of the governments in Berlin, Vienna and Sofia, lacked precision. As M. Briand said, speaking on Dec. 1 1916, it was a proposition to "*d'avoir a négocier la paix.*" The Russian, Italian and British ministers denounced its insincerity. About the same time, too, a note from Mr. Lansing invited the belligerents in the name of President Wilson to "take soundings." It was a profound shock to France to see all the belligerents—aggressors and victims—put thus on the same footing. Two days later the Swiss Govt. made a similar move. On Dec. 23 the French Senate announced its determination "to carry on the War which has been imposed upon us to a victorious conclusion." The governments of the other Allies expressed their determination with equal force. On Dec. 30 they sent collective and identical notes to the neutral states charged with the protection of their interests in enemy countries, stating that the conclusion of peace was contingent upon the restoration of rights and liberties that had been violated and recognition of the complete independence of the small states. Wilson still pleaded for "peace without victory" at the Senate on Jan. 22; but, Germany having declared for unrestricted submarine warfare, (Feb. 1) he broke off diplomatic relations with that country on Feb. 3.

Paul Deschanel, the president of the Chamber, having declined to undertake to form the new Ministry, it fell to Ribot to accomplish this task in 24 hours. Taking Foreign Affairs himself, he gave War to Painlevé, Labour to Léon Bourgeois, and retained several of the former Ministers—notably Malvy as Minister of the Interior. Lyautey returned to Morocco. The ministerial declaration, of considerable substance and detail, was approved by 440 votes against 61 abstentions. Ribot was confronted with some extremely important problems. The Russian Revolution, the forced abdication of the Tsar, and the installation of the weak provisional Govt.—soon to be succeeded by the Bolsheviks—upset all the military combinations of the Allies on the eve of a great offensive for which minute preparations had been in progress for months. At the same moment (March 17–24) the Germans effected a strategic retreat on the Somme front, leaving a desert behind them. A formidable problem presented itself: should the offensive, prepared in conjunction with the British, be carried out in spite of the modification in the general conditions unfavourable to the Allies? To what extent should the Govt. interfere in the direction of military operations? Intimate discussions took place between the ministers and Gen. Nivelle. The declaration of war on Germany by the United States (April 6) served, it is true, to restore the equilibrium destroyed by the Russian Revolution, but it would be many months before it could have any effect on the military situation. As the Govt. still hesitated Nivelle offered his resignation, but withdrew it on receiving definite assurance that the offensive would take place as arranged. On April 16 the French troops, who had been magnificent in launching their attack, were brought up against insurmountable obstacles and came to a standstill after heavy losses. The depression felt by the army and the public led, among other changes, to the replacement of Nivelle by Pétain, with Foch as chief of the general staff.

Side by side with military operations, secret negotiations were proceeding between Paris and Vienna. In Jan. and Feb. the Emperor Charles I. commissioned his brother-in-law Prince Sixtus of Bourbon to communicate his desire for peace to President Poincaré. After several journeys Prince Sixtus of Bourbon presented Austria's peace conditions (May 5) at the Elysée. They were the conditions of a conqueror, and the alliance with Germany, Bulgaria and Turkey was again affirmed. After another journey to Vienna, Prince Sixtus returned to the Elysée with a personal letter from the Emperor, who expressed his willingness "to forward in every possible way the just claims of France to Alsace-Lorraine and to use his personal influence with his Allies to that end." Although these conditions were unacceptable to the Allies of France, Poincaré and Ribot did not reject them offhand. On April 19 Ribot went to St. Jean-de-Maurienne with Lloyd George, who had been fully informed, to meet Sonnino. Lloyd George offered Sonnino Smyrna if he would give up Trieste; but the Italian Minister insisted that the conditions of the Treaty of London had represented a minimum and that any concession would provoke risings in Italy which would place the Govt. in danger. Subsequent conversations only attested the impotent vacillation of the Austro-Hungarian Government. Other secret proposals were exchanged during the summer at Fribourg in Switzerland between Count Revertera, for Austria, and Count Armand for the French general staff. But these emphasized the inconsistency of proposals which proved abortive.

French Action in Athens.—It was thought that only by force f arms could the enemy be checkmated. Ribot therefore de- ded, after consulting the British Govt. in London, to settle he Greek question by expelling Constantine and freeing the alonika Expeditionary Force from the risk of attack by the ermanophil Greek forces. He gave full powers to Senator Jon- art, appointed High Commissioner of the Allied Powers for the ccasion. Jonnart left for Brindisi on June 2 and appeared before he Piraeus at the head of a fleet on the 5th. In spite of strong rotests from the British, Italian and Russian Ministers at thens, all of whom were opposed to the expulsion of the King, onnart demanded and obtained Constantine's capitulation, fter having had Thessaly and the Isthmus of Corinth occupied y Allied troops. On June 13 King Constantine left Athens with is family. Jonnart then recalled Veniselos, who had consti- uted a provisional government at Salonika, and the King's econd son, Prince Alexander, was called to the throne with the itle of King Alexander I., his elder brother George being passed ver because of his German sympathies.

The Socialist Movement.—This success was warmly approved n Paris inside and outside Parliament. It helped to consolidate he Cabinet, which, however, was soon to be shaken by the ocialist manoeuvres. At a plenary session of the party held in May, the Socialists had decided to attend the International Congress at Stockholm which had been called with the object of topping the War. The Govt. refused their passports, and the hamber, after a secret session, passed a resolution of approval y 467 votes against 52, and with a further resolution on the onditions of peace that:—

> The Chamber, while countersigning the unanimous protest made o the National Assembly in 1871 by the representatives of Alsace- orraine, forcibly torn from France, announces that it expects, as he result of the War imposed upon Europe by the aggression of mperialist Germany, not only the liberation of invaded territory, ut the restoration of Alsace-Lorraine to the mother-country and ust reparation for damages.

The Chamber further declared itself to be "far from any idea f conquest or of the subjection of foreign populations," and efined the goal towards which the armies of the republic were triving as "the laying down of permanent guarantees of peace nd independence for great and little nations by an organisation f which the basis is now being prepared by the League of Na- ions." On June 7 a similar motion was passed unanimously in he Senate, which in addition requested the Govt. to take all ecessary precautions at home and abroad for the safety of the ation, in view of the number of recent strikes of a suspicious ature in which undesirable foreigners had taken part.

These transient troubles, which yielded to firm handling, coincided with a peace move staged in Berlin (*see* EUROPE), and rumours on the subject of a journey to Leningrad (Petrograd) undertaken by Doumergue and Castelnau under the late Ministry. As regards the latter, Ribot stated in the Chamber on July 31 that Doumergue had made a note of the Tsar's promise to support the re-annexation of Alsace-Lorraine to France and "to leave France free to seek guarantees against renewed aggression, not by annexing the territories on the left bank of the Rhine, but by creating if necessary an autonomous state out of these territories, which would protect us, as well as Belgium, from invasion from beyond the Rhine." Meanwhile disturbances stirred up by Teutonic influences with the aim of depressing French opinion and bringing into power in Paris men who would be willing to take the initiative in peace proposals, provoked a governmental crisis. In view of the anti-patriotic propaganda that was being carried on by means of pamphlets and the revolutionary paper *Le Bonnet Rouge*, the Senate held a secret committee (July 19–20). Clemenceau took Malvy, Minister of the Interior, vigorously to task on the matter of his relations with Almereyda, an adventurer who edited *Le Bonnet Rouge*. This episode marks an epoch in the internal history of France during the War, for it created the schism between the Socialists and the Government.

The Senate and the Chamber successively passed votes of confidence, in spite of the resignation of Adm. Lacaze and Denys Cochin. The Socialist group allowed Albert Thomas to remain in the Cabinet; but the rupture took place, following on the action brought against *Le Bonnet Rouge*. Almereyda, who had been arrested on Aug. 6, was found dead in his cell on the 14th. He had been strangled with one of his bootlaces. The official experts gave a verdict of suicide, but such a suicide was at lowest a singular reflection on the supervision exercised, and public opinion was up in arms. Malvy had been away a few days for his health, but he now resumed his functions. Meanwhile it was learnt that a cheque of suspicious origin which had been seized at the frontier from the director of *Le Bonnet Rouge* had been restored to him by the favour of Leymarie, Director of Public Safety, and at the same time director of the bureau of the minister. Leymarie declared he had acted without consulting the minister, and resigned. On Aug. 31 Malvy, accused of having relations with Almereyda, resigned. It was first thought that the Ministry might be simply reconstituted, but the attempt failed, and the Cabinet resigned on Sept. 7. Ribot, charged with the task of forming a new Ministry, failed, because the Socialists refused to collaborate with him, while Painlevé refused to remain in the Cabinet unless the Socialists came back. The Socialists could not forgive Ribot for refusing passports to Stockholm, and Painlevé was being pushed into power by friends who regarded him as the man of the hour.

Thus it fell to Painlevé to form a Cabinet which, by a curious contradiction, did not include a single Socialist. He was his own War Minister; Ribot retained Foreign Affairs, and Loucheur became Minister of Munitions. On Sept. 18 Painlevé secured a vote of confidence, unanimous but for the abstention of the Socialists and some Radicals (among them Caillaux). The Ministerial Declaration contained nothing new in general policy, but promised that justice would take its course, unhesitatingly and without any respect of persons, in the judicial inquiries then proceeding or about to be opened. This promise the Ministry was almost immediately called upon to fulfil. On Oct. 7 Turmel, a deputy, was arrested for having received money of suspicious origin. Then came the Bolo scandal. It was discovered that Bolo—known as Bolo Pasha, that title having been conferred on him by the former Khedive, now dethroned and an instrument of the Central Powers—had received 10,000,000 fr. in the United States from Von Bernstorff, the German ambassador. With this sum he had bought 1,100 shares in the *Journal*, the editor of which, Senator Charles Humbert, had made himself known by a noisy campaign demanding "guns and munitions." Bolo was arrested on Sept. 29. On Oct. 4 Malvy himself appeared in the dock. The former Minister of the Interior was accused of treason by Léon Daudet, editor of the *Action Française*, in a letter addressed to the President of the Republic, which was read out in the Chamber. After a judicial inquiry the Govt. announced, on Oct. 15, that there was no foundation for Daudet's accusations. The Govt. obtained only 246 votes against 89 in the Chamber on an interpellation on the subject. It was shaken; an outside incident brought about its fall.

The Lancken-Briand Incident.—Meanwhile the Berlin Cabinet, itself torn by internal dissensions, was trying to implicate certain Frenchmen in its *défaitist* negotiations. M. de Lancken, German civil commissioner in Brussels, conveyed proposals to Briand by means of Belgian intermediaries—notably Baron Coppée and his son. He told him that William II. was ready to make peace and to send a qualified personage to Switzerland to confer with the former Prime Minister. Briand wrote to inform Ribot, and suggested the conditions under which conversations might be initiated; but Ribot strongly opposed conversations which might be exploited by the Germans. Lancken therefore waited in vain for Briand at Ouchy, and the matter dropped. But a legend grew in the lobbies of the Chamber to the effect that Ribot had turned down peace feelers which held some promise of the return of Alsace-Lorraine to France. On Oct. 12, when Georges Leygues made an interpellation in the Chamber on the personnel and action of the diplomatic body, Ribot took the opportunity to denounce in veiled language Austria's manoeuvre to separate France from Italy and the pitfalls laid by Germany, "who only the other day, caused perfidious suggestions to be whispered in the ear of a man of high standing." The concluding words of this sentence caused a commotion at the Palais Bourbon, and were therefore suppressed in the official records. On the 16th, the Socialist deputy Mayeras moved to discuss the discrepancy between the words spoken in Parliament and the text as printed. The motion was discussed in a stormy secret committee which gave the Govt. a small majority. Briand's friends, displeased with the allusion of Oct. 12, voted with the Socialists, who were still full of resentment over the refusal of the Stockholm passports. The Cabinet were so badly hit that Painlevé contemplated resignation. Poincaré would not accept his resignation, but Ribot and his other colleagues handed in theirs collectively so as to give the Prime Minister a free hand to reconstruct his Cabinet. On Oct. 28 the Ministry was reconstituted, Painlevé contenting himself with replacing Ribot by Barthou; but far from consolidating the Govt. the substitution only weakened it. The ministerial majority, which had stood at 362 on the 12th and 316 on the 19th, fell to 288 after Painlevé's and Barthou's speeches on the 25th.

Nevertheless, Painlevé took the same attitude as Ribot towards Stockholm, and refused passports for the Congress then in progress. He hoped to appease the Socialists by an investigation of the *Action Française* affair, but the Court found no cause to prosecute. Meanwhile *Le Bonnet Rouge* and the *Journal* scandals grew more serious, and Caillaux himself was attacked in *l'Homme Enchaîné* for his conduct when travelling in Italy. Then came the Italian disaster of Caporetto and the advent of the Bolsheviks in Russia, which made it necessary to hold an inter-Allied conference at Rapallo for the co-ordination of military effort.

The Rapallo conference over, a troubled period set in for France. M. Paix-Séailles, who had formerly been attached to Painlevé's bureau, was accused of divulging information from documents dealing with national defence. Caillaux was brought before the juge d'instruction to give an account of his relations with Bolo Pasha, and had an exchange of letters with Clemenceau which caused a sensation. On Nov. 13 Painlevé announced in the Chamber the results of the Rapallo conference. These were, an extension of the British front, Franco-British economic co-operation, the strengthening of the blockade and the creation of an Inter-Allied Supreme War Council. Only 250 votes were recorded in approval against 192, a further diminution of the Government majority. This was speedily transformed into a minority when the Prime Minister demanded the postponement of motions relating to internal order until after the Inter-Allied Conference to be held at the Quai d'Orsay at the end of the month. The Chamber voted against the postponement by 277 against 186, and at the close of the sitting Painlevé handed his resignation to Poincaré: his authority in Parliament was at an end.

The Clemenceau Ministry.—Public opinion indicated Clemenceau as Prime Minister, the Senate supported the choice, and the Chamber was prepared to acquiesce, little as it liked the remorseless controversialist who criticised ministers and even the President of the Republic so fiercely in *l'Homme Enchaîné*. In spite of his 76 years, Clemenceau was universally regarded as the incarnation of the determination to "fight to a finish," to punish weakness or faltering, whatever their origin, and to subordinate everything to the pursuit of final victory. The great majority of Frenchmen felt that such a man was needed at the head of the Government. Ignoring all other considerations, Poincaré therefore called upon Clemenceau (Nov. 15) to form the new Cabinet. Clemenceau accepted, and completed his mission the next day. He took War himself, confiding Foreign Affairs to Pichon, the Interior to Pams, Navy to Leygues, Munitions to Loucheur, Finance to Klotz; and divided the war services between five under-secretaries. The Ministerial Declaration announced the intention—

> to carry on the War, to punish crime and faltering: weakness would be complicity. Accused persons to be tried by court-martial. No more pacifist campaigns, no more German conspiracies; neither treason nor demi-treason; but the War and nothing but the War. Our armies shall not be caught between two fires. Law shall prevail. The country shall know that its defence is sure.

In the debate on the declaration Clemenceau spoke in the same tone. There were to be no more party men, himself not excepted.

> Who has been more of a party man than I? I have been only too much of one, as I see to-day. . . I shared—and perhaps still share—many of your prejudices, but where I differ from you, deputies of the extreme Left, is that you want to introduce purely intellectual conceptions into the domain of realities—and that is impossible.

The vote of confidence was passed by 418 against 65. Clemenceau was as good as his word. Turmel, a deputy, was tried by court-martial on Nov. 22; parliamentary impunity was suspended by the Senate in the case of Humbert; and Malvy asked the Chamber to appoint a commission to inquire into the grounds for his accusation. Although the accusation had no legal basis, and the rules of the Chamber did not prescribe the procedure in such a case, the Chamber, greatly embarrassed, sent him before the Senate, which, having reinstituted a procedure in disuse since 1875, constituted itself a high court and ordered a supplementary inquiry (Jan. 28). On Dec. 22, at the request of Gen. Dubail, military governor of Paris, the Chamber voted for the suspension of parliamentary immunity for Caillaux by 396 against two votes and 100 abstentions. The accusation of intelligence with the enemy and of a criminal attempt against national security was founded on documents seized during the Bolo case, indicating a singular intimacy between Caillaux and Bolo and Almereyda. The official reports of the French naval and military attachés in Rome also drew attention to the attitude and the defeatist proposals of the former Prime Minister.

On Jan. 14 Caillaux was arrested. Inquiry conducted in the United States had revealed relations with the German Legation at Buenos Aires, at the time of his mission in the Argentine; and from various telegrams sent by Von Bernstorff, German ambassador in Washington (deciphered by the State Cryptographic Dept.) it seemed that Caillaux had spoken contemptuously of the members of the Govt.—Briand excepted. When reporting Caillaux's remarks to Berlin, Von Bernstorff asked his Govt. to instruct the German cruisers to take precautions with regard to the ship on which the French statesman was returning. Finally, in the safe of a Florentine bank rented by Caillaux there was found among the securities a packet labelled "Rubicon," which contained the outline of a scheme to be carried out when Caillaux should again become Prime Minister. This scheme resembles the constitution of the consulate.

These events were discussed in the Chamber, together with the royalist escapades of the *Action Française*, and the resolution passed stigmatised "all proceedings, royalist or other, which tend to divide the country in the face of the enemy." The Socialists and Caillautists voted against the words "or other," assuming that they referred to the "Rubicon." Bolo's trial by court-martial (Feb. 4-14) ended in sentence of death for the ex-pasha for his dealings with the enemy, which included relations with the former Khedive, transactions in America with Von Bernstorff and the payment of German moneys intended for the purchase of French newspapers. He was executed at Vincennes on April 17. To all attacks, direct or indirect, by the Socialists, Clemenceau presented an unmoved front, and claims of every kind—economic, financial and military—were met with the same imperturbability. By a bill passed on Dec. 24 the election was postponed on account of the mobilisation of several million electors. A loan of 10 milliards was liberally supported. Very severe restrictions on the consumption of bread were imposed, and the 1919 class was called up prematurely.

The Russian Defection.—This last measure was necessitated by the defection of the Russians and by Austrian arrogance. Count Czernin, in his elation over Caporetto, boasted that he was fighting as much for the defence of Germany as for the Austro-Hungarian frontiers—"We are fighting for Alsace-Lorraine just as Germany fought for Lemberg and Trieste. I make no distinction between Trieste and Strasbourg." At Brest-Litovsk the Bolsheviks concluded an armistice with Germany.

spite of Russia's undertaking, on Sept. 4 1914, not to nego- ite or conclude a separate peace; they also intimated their tention not to honour the financial engagements of the Tsarist vernment. The French Govt. sent a note of protest, stating at "financial engagements entered into previously in the me of Russia were independent of the changes of government hich had occurred since and might occur again in that country, d that, consequently, they were and would continue to be nding upon those by whom Russia was represented." The cialists now asked for passports for Leningrad (Petrograd) to tempt to dissuade Russia from making a separate peace; but emenceau refused them, because he regarded such a step as seless, dangerous and even unseemly. The signing of the reaty of Brest-Litovsk on March 3 definitely broke the Russian liance.

From the end of Jan. 1918 the bombing of Paris by aero- anes ("Gothas," as they were called) recommenced with fresh igour after a long respite. The raid of Jan. 31 took a toll of 45 lled (31 in Paris and 14 in the suburbs) and 207 wounded; that n March 9, carried out by a dozen squadrons, left 13 dead and 0 wounded. Life in Paris was seriously inconvenienced by the recautions imposed—as the reduction of street lighting, closed utters and the warnings given by sirens. But it was quite nother matter when, on March 23, shell, fired from colossal uns more than 100 km. distant, fell direct on Paris, without ere being at first any clue to their place of origin. Monuments tuated in the danger zones had to be protected by sandbags. n March 29 (Good Friday) a shell fell on the church of St. ervais, at 4 P.M., just as a sacred concert was beginning, killing 5 people and wounding 90 others, of whom several afterward ccumbed. Terrible bombardments at Dunkirk, Calais and heims simultaneously drove the inhabitants into the cellars. he motive behind these attacks was that of terrorising the untry at the moment when the German general staff was unching (March 21) a mass offensive against the British front hich was intended to be decisive. But the morale of the coun- ry was not shaken, any more than was the spirit of the high ommand. Although there were days of acute strain in March nd April Clemenceau never faltered. At the end of March he btained consent from the Allies for Foch's nomination as gen- ralissimo of the armies on the Western Front. He then pro- eeded to tighten food restrictions, ordered three meatless days week, reduced the consumption of paper, etc.

The Czernin Incident.—During these troubled times Teutonic trigues followed fast upon each other. The most sensational f these was that launched by Czernin (April 2), when he boldly sserted in a speech delivered to the municipal representatives in ienna that Clemenceau had asked him, shortly before the eginning of the Western offensive, if he were "prepared to nter into negotiations and on what basis." He went on to in- ist on Austria's loyalty to Germany, and vowed "a terrible engeance" upon the enemies of the Central Powers. Clemen- eau's reply was simply, "Count Czernin lied." By way of etort Czernin recalled the *pourparlers* between Count Nicholas evertera and Count Armand in Feb. 1918. On April 8 Clemen- eau exposed Revertera's "attempt to decoy us into a German eace," and announced "another attempt of the same sort by a erson of much higher rank." Czernin in reply accused Clemen- eau of having wrecked this effort by refusing to enter into nego- iations based on the renunciation of the re-annexation of Alsace- orraine. Clemenceau thereupon disclosed the fact that the ustrian Emperor had with his own hand recorded his willing- ess to agree to "the just claims of France on Alsace-Lorraine."

At this point the Emperor Charles himself intervened with a elegram to William II., in which he declared Clemenceau's tatement to be untrue and proclaimed the "perfect solidarity" etween the two Central Empires. An official communiqué from ienna followed, emphasising this denial. On April 12 Clemen- eau published the Emperor Charles' letter to Prince Sixtus. fter some sharp dispute with the Emperor and Empress, zernin announced that the text of the letter, which had been ntirely private and personal, had been published in Paris in a garbled version. He maintained that the Emperor had written: "I would have used all my personal influence in favour of the French claims with respect to Alsace-Lorraine had they been just claims; but this they are not." Clemenceau again stated the facts, and denounced "les consciences pourris." An embarrassed note from the Ballhansplatz on the 15th then declared the incident closed.

The Decisive Days.—A fortnight later the *Bonnet Rouge* trial opened before the court-martial. Although Almereyda, the principal conspirator, was dead, the evidence revealed by the inquiry was sufficiently serious for sentence of death to be passed on Duval—who had received over 1,000,000 fr. from a Mannheim banker named Marx—and for several of his associates to be sent to penal servitude. The Socialist party, of which the anti-war section had won a majority in the national council of the party, agitated in vain for a "white peace"; the threat to refuse military credits left Clemenceau unmoved. Only for an instant at the end of May, when a new offensive brought the Germans up to the Marne from Château-Thierry to Dormans, did he consider the idea of evacuating the Government and a portion of the population from Paris. He had become as military-minded as—if not more so than—the soldiers themselves. Paris was a city like any other, and it seemed to him a wise precaution to abandon the capital as in 1914. But the circumstances were very different. After four years of fierce fighting the occupation of Paris by the enemy would have appeared as a German triumph in the eyes of the world at large, and the consequences, both material and moral, would have been incalculable. The evacuation project, which had been kept secret, was therefore opposed by the President of the Republic and the presidents of both Chambers. In a special council at the Elysée, at which other persons besides ministers were present, it was finally decided that the Govt. should stay in Paris and that the decisive battles should take place in front of and not behind the capital. On June 11 a successful counter-attack by Mangin's army threw back the Germans some kilometres, and, on July 18, Foch opened the great offensive which was to continue until the Armistice. Czechoslovak and Polish legions, formed of deserters and volunteers, fought side by side with French troops.

On July 16, before the Senate, sitting as a high court, Malvy was accused of complicity "in treason which threatened the very existence of the country." The Senate, however, rejected the charge of treason, on Aug. 6, unanimously but for two votes, and that of complicity in communicating with the enemy by 125 votes against 36. Senator Etienne Flandin then made the subsidiary charge: "Is Malvy guilty of having committed the crime of *forfaiture* while residing in the territory of the Republic and during the discharge of his ministerial functions within the last 10 years?" At the following session this accusation was definitely formulated. It was directed against the minister's attitude towards Almereyda and certain other anarchists. On Aug. 6 the Senate declared Malvy guilty of *forfaiture* by 101 votes against 81, and condemned him to five years' banishment, but without civic degradation. There remained the Caillaux affair—by far the most serious. Was Caillaux to come before a court-martial or the High Court? The Govt. decided that if the case were one of intelligence with the enemy the court-martial should deal with it, but if it were that of crime against the security of the state it should come before the High Court. The latter solution was adopted, and the Senate met for the purpose on Oct. 29 and found that there were grounds for instituting an "instruction," the affair being thereby indefinitely adjourned.

The Armistices.—Beaten by the Govt., the Socialists confined themselves to protests. At their National Congress in Oct. the advanced group, headed by Longuet, carried the day by 1,528 votes against 1,212 and 181. Cachin was made editor of *l'Humanité* in place of Renaudel. But the people remained indifferent, being concerned only with the retreat of the German armies, the crumbling of the Bulgarian front, the abdication and flight of the Tsar Ferdinand, the progressive reoccupation of the devastated departments and the entry of the Belgian Army into Bruges. Under these auspices was launched on Oct. 20 the fourth great loan, the Liberation Loan, which realised 22 milliards. On the night of Oct. 30–31 Turkish plenipotentiaries signed an armistice with Adm. Calthrop at Mudros; on Nov. 3 the Austro-Hungarian armies signed an armistice; the break-up of the old Dual Monarchy was already far advanced.

A far-reaching problem now confronted the Allies. Was it wiser to conclude with Germany the Armistice which her desperate Govt. had asked from President Wilson, or to force the German armies to capitulate, and so enter Berlin? French ruling spirits were divided. Foch held that "war is only waged for its results, and, if these results are obtained by the Armistice, no one has the right—the aim being achieved—to cause one more drop of blood to be shed." The generalissimo knowing nothing of the developments of the revolution overshadowing Germany believed that it would still take several months to throw back the enemy across the Rhine. The conditions of the Armistice were therefore discussed, first at Senlis by the military delegates, then in Paris and Versailles among the heads of the Govt. and the foreign ministers of the Allied and Associated Powers, the discussions being based exclusively on military considerations. The statesmen agreed unreservedly to the proposals of the military council at Versailles. Many of them, at that moment, were so far from thinking the proposed conditions too mild that they feared the German plenipotentiaries would refuse certain exceptionally severe clauses, such as the surrender of the fleet and the fortresses of Alsace-Lorraine. The Germans, however, terrified by the prospect of invading enemy armies who would be tempted to avenge themselves for the abominations committed in Belgium and France, signed all the conditions on Nov. 11.

The proclamation of the Armistice, accompanied by the ringing of bells, led to scenes of enthusiasm that day in the streets and in Parliament. The two Chambers proclaimed that "Citizen Clemenceau and Marshal Foch have deserved well of their country." On the following day Foch was elected a member of the Academy of Sciences, and on the 21st the *Académie Française* elected Foch and Clemenceau, having previously elected Joffre (Feb. 14). Clemenceau, a doctor of medicine, was elected a member of the Academy of Medicine on Dec. 3. Finally the *Académie des Sciences Morales* opened its doors to Marshal Pétain, and the Beaux Arts elected Gen. Castelnau. Only the Socialists, while joining in the general rejoicings, professed an interest in the Russian revolution which was hardly justified in view of Russia's behaviour at the end of the War. The motion drawn up by the "Permanent Administrative Commission" of the party was disavowed by members of the minority, who announced their determination not to allow the methods even of revolutionary socialism to be confounded with Bolshevik practices, which did not allow universal suffrage to function. The French authorities now took possession of Alsace-Lorraine. On Nov. 17, in front of the statue of Strasbourg on the Place de La Concorde, from which the emblems of mourning had at last been removed, a magnificent ceremony was staged. At Metz Pétain was presented with his marshal's bâton, and on Nov. 25 the victorious troops entered Strasbourg amid scenes of frenzied enthusiasm. The War was over; it remained to "win the peace."

THE PEACE

The Armistice of Nov. 11 contained no political clause. It was assumed that, as was customary, some of the essential political conditions would be settled in peace preliminaries before the final treaty was signed. Had preliminaries been so arranged as to coincide with one of the three renewals of the Armistice, it should have been possible to take immediate measures for ensuring the position of those regions whose lot was to be changed—notably Poland, Upper Silesia and the Baltic States—where such measures were of the first importance. Certain opinion in France urged that this should be done. But for reasons that are still unexplained, no steps were taken to arrange such preliminaries, which, if arranged a few weeks after the military capitulation—so it was agreed—would have enabled the Allies to insist on all the points that seemed to them advisable. The end of the year was spent in rejoicings. The King of the Belgians and the King of England paid official visits to Paris, and President Wilson, before settling in Paris for the conference, visited England and Italy. When the conference opened on Jan. 18, Germany was more or less reassured, and on vital points Clemenceau was no longer in position to impose his views. He had to consult with President Wilson and Lloyd George. Indeed, in consenting to the form of procedure—Council of Ten, Council of Five, Council of Four, absolute secrecy, rigorous censorhsip of diplomatic indiscretions—he automatically forfeited the support which would have been gladly accorded to him by the representatives of the smaller powers, by Parliament and by influential publicists. Although both the President of the Republic and the presidents of the two Chambers disapproved of these "cellar negotiations," the system was maintained till the end. The conference only met in full open session to register preconcerted decisions. Thus Clemenceau, although he made spasmodic attempts at resistance, saw himself forced to concur in certain solutions that were contrary to his intentions.

This was particularly the case with the Rhine frontier. In common with the military authorities, many university men and several publicists, Clemenceau would have constituted the Rhine France's military frontier and formed the German countries lying between that river and the political frontier into an autonomous state. He was not even able to obtain the restitution of Saarlouis and Landau which had been severed from France by the Allies of 1815, in spite of their formal engagement (signed on March 13 1815, after Napoleon's return from Elba) to preserve intact France's frontiers of May 30 1814. He committed the imprudence of offending President Wilson by scoffing at the projected League of Nations, and prevented M. Bourgeois from bringing forward the plan of a league drawn up by French specialists. Surrounded by colleagues chosen from among his immediate circle, he was not amenable to any advice or suggestion and was neither wise enough to limit his original demands to what might be accepted nor to exact effective compensation for his successive concessions. To crown his misfortunes, he was wounded (Feb. 18) by three shots from a revolver by an anarchist named Cottin. When negotiations were resumed on March 14, after his recovery, decisions, contrary to his wishes, had been taken. France was only to have Alsace-Lorraine; the Inter-Allied military occupation of the left bank of the Rhine was fixed for 5, 10 or 15 years according to the zone; Germany was to renounce all rights in Morocco; power was taken to regulate the zones of Savoy; and Great Britain and the United States were to give a military guarantee against unprovoked German aggression, Britain's guarantee being dependent upon the ratification of that of the United States by the Senate in Washington.

The amount to be exacted for reparations for the terrible damages caused by the enemy was not fixed; a Reparations Committee was set up to settle it and to draw up the conditions of payment. Germany was to pay down on reparations account a sum of 20 milliard gold marks before May 1 1921. It was assumed in France—and Mr. Lloyd George's speeches in England appeared to justify the assumption—that Germany would pay for everything. Clemenceau and Klotz were under that illusion, for they brought in a bill passed on April 17 1919 by which those who had suffered damages were enabled not only to claim the price of their possessions at a pre-War valuation, but also the cost of reinstalment or reconstruction, taking into account the rise in prices since 1914. This arrangement was fated to bring about a financial catastrophe. Some hundred milliards had to be paid out on this score, and (in the event) Germany was to go bankrupt to evade payment. It was the same with similarly lavish promises of demobilisation premiums, pensions and allowances to the military victims of the War and their dependants; these had been made on the conviction that Germany would pay, but they made another deep hole in the budget. Other holes were made by the extravagant decision to y in at the rate of 1·25 fr. all German marks left in Alsace-raine (quoted then at 0·70 fr.) and buy back in dollars a large sum the American war stores which, if sold direct by American stores department, could have been usefully sorbed by the population without involving the Treasury. ese rash measures were to react disastrously on the whole of national life.

The Socialist Movement.—The propaganda carried on by rman Socialists infected their French comrades, who had n roused by the acquittal of the assassin of Jaurès on March 1919 at the assize court of the Seine, and were to be appeased ther by the passing of the Eight-hours' Day bill by both ambers at the end of April nor by the maintenance of the ce of bread below cost price. On May 1 they proclaimed a ike, and proceeded to demonstrations which led to the dis-ssal of several Socialist leaders holding government posts. e disturbances lasted all through the spring. The *confédéra-n Générale du travail* itself was powerless to maintain dis-line among its adherents; it alternately curbed their turbulence d yielded to their demands. When the peace treaty was being cussed with the German plenipotentiaries and the Allied mili-y intervention against the Bolsheviks was proceeding, labour ubles became more marked. But the public faced the situa-n with such firmness that the general strike arranged for ly 21 miscarried. Clemenceau was nevertheless awkwardly uated in the Chamber and had to replace the Food Controller ret by Noulens.

The Versailles Treaty.—After several crises, particularly with spect to the question of the Adriatic and Danzig, the peace nditions, comprising 440 articles and numerous annexes, were remoniously presented to Graf von Brockdorff-Rantzau, the rman plenipotentiary. The counter-proposals made by the rman delegation provoked lively discussion among the Allies, veral important modifications being supported by the British vernment. Towards the middle of June the Allies at last me to an agreement to maintain almost in its integrity the xt of May 7, the only really significant modification being the bstitution of a plebiscite in Upper Silesia for the annexation re and simple of that province to Poland. On June 16 the ial text was submitted to Brockdorff-Rantzau with the warn-g that it must be accepted without reservation within five ys. He resigned, and an extension of two days was granted. the 23rd a new German Cabinet with Gustav Bauer at its ad declared itself willing to sign, and on the 28th—the anni-rsary of the Serajevo murders—MM. Hermann Müller, Bell d von Haniel, the German plenipotentiaries, in the Hall of irrors at Versailles in which the German Empire had been pro-aimed in 1871, signed the treaty of peace which established the rritorial integrity of France, celebrated the triumph of right er might and destroyed Germany's supreme effort to achieve world hegemony. The treaty by which England and the nited States agreed to assist France in case of unprovoked attack as signed by Lloyd George and President Wilson the same day.

The treaties, taken as a whole, certainly were imposing, and arked an epoch in history. All the same, the French nation perienced a shiver when the clauses became known in detail. was realised, as Poincaré said, that the peace was to be *une éation continue.* Many serious problems were left unsettled. everal plebiscites, which would normally have been taken be-een peace preliminaries and the conclusion of the treaty, were ljourned until a time when—the demobilisation of the Allied mies having been effected—there would be no means of en-ring a true ballot. No precise sanctions had been stipulated the event of the non-execution of the treaty by Germany. he League of Nations Covenant, was held by French opinion be vague as to the principal obligations of its members. The rms were drawn in language permitting the contracting Gov-nments to interpret it in favour of evading liabilities. In short, became plain to the French that the Versailles Treaty would be rried out to their advantage only if the Allies, especially reat Britain, wished it. Except for Alsace-Lorraine they had received nothing but promises; their right to exact the fulfilment of Germany's engagements without the assent of all the Allies, was contested. The ratification of the treaty (Aug.-Sept.) therefore aroused violent opposition in the Chamber. Men like Louis Marin and Franklin-Bouillon called for its rejection. To reassure the deputies the Finance Minister announced, on Sept. 5, that Germany would put down a round sum of 450 milliards. In the end the ratification was agreed by only 372 votes against 52, with 73 abstentions. By the Senate, in Oct., it was approved without difficulty. But very soon it became known that the American Senate refused to ratify the Treaty of Versailles and the Treaty of Guarantee, and that, in consequence, the British guarantee disappeared. The most stupefying discovery was, however, that during the peace year of 1919 military expenditure exceeded that of 1918 with its fierce fighting, and that the National Debt had risen during the 12 months of peace from 170 to 218 millards. Under the shock of these affairs the country embarked on the election.

The Elections.—It was indeed time to return to normal constitutional life. All the elective assemblies had to be renewed, having outlived their legal term. The parliamentary elections took place on Nov. 16 according to the system adopted by the Act of July 12 1919: *scrutin de liste* according to department, with proportional representation in cases where none of the lists showed an absolute majority, together with the support of 25% of the electors on the roll. It was at first intended to maintain the political *union sacrée* by including Clemencistes, Liberal, Radical, Radical-Socialist and Moderate Socialist candidates on the same list; but the unified Socialists repudiated the union, and the Moderates—such as Herriot, Viviani, and Painlevé—separated from the Coalition after agreeing to it. Lists were accordingly framed as follows: the *Bloc national* including all moderate candidates—as, for instance, from Millerand to Maurice Barrès in Paris; and lists for the Unified Socialists, Radical Socialists and Independents of different categories.

The *Bloc national* had as its programme Millerand's Paris speech of Nov. 7 at the Ba-ta-clan hall. This speech denounced the class struggles, indicated the need of strengthening the Executive, of adopting a broader basis for the nomination of the President of the Republic, and for the constitution of the Senate. Clemenceau for his part made a great anti-Bolshevist speech at Strasbourg. At that moment, when demobilisation was complete and the opinions of the soldiers an unknown quantity, Bolshevism was thought to be the chief danger. In the beginning of Nov. a general strike was attempted. The newspapers were especially affected and, from Nov. 11, they ceased to appear; but they agreed between themselves to publish one organ in common, the *Presse de Paris*, in which space was reserved for a brief political article from each paper. This expedient was well received by the public. Soon the *Presse de Paris* appeared twice a day, corresponding to the morning and evening issues. The *Bloc* won the elections, and the new Chamber was made up of 56 Unified Socialists, 5 dissenting Socialists, 28 Republican Socialists, 129 Radicals and Radical-Socialists, 114 Republicans of the Left, 138 Progressives, 15 Liberals, 74 Conservatives and 3 adherents of the *Action Française*. The Bolshevist candidates were swept away; even in a suburb of Paris the list containing the names of Longuet and Sadoul was lost.

The municipal elections of Nov. 30 gave the same results. From the outset the Moderate elements carried all before them, not only in Paris but in many towns where they had formerly been in a minority as, for instance, at Toulouse. The check to the revolutionary parties was emphasized by the end of the newspaper strike on the same day. On Dec. 14 *conseils généraux* and *conseils d'arrondissement* were elected. Here the Left was more successful in holding its seats, based as it was on solid local organisations, and was able to recover lost ground on the senatorial elections (Jan 12), in which the prefects exercise considerable influence. Only 26 seats were lost by the Radicals, and Léon Bourgeois was elected president of the Senate by 147 votes against Antonin Dubost (with 125), the retiring president, of much the same political tendency.

The Presidency of the Republic.—Opening on Dec. 8, the Chamber had no important affairs to deal with before proceeding to elect a successor to Poincaré, whose seven years' tenure expired on Feb. 17 1920. The only outstanding event of its short session was the declaration of the Alsace-Lorraine deputies, whose entry into the Palais-Bourbon had been made an impressive ceremony. After recalling the protests of their ancestors against the Treaty of Frankfurt the representatives of the two reannexed provinces recorded the fact that no protest had been raised during the elections against the Treaty of Versailles. "France," they said, "has obtained a unanimous vote at the genuinely plebiscitary elections of Nov. 16."

On the choice of the future President of the Republic opinion was divided. Though he desired election, Clemenceau had not come forward openly. Deschanel stood as candidate. In spite of Clemenceau's disturbing antecedents, his popularity as victor was so great that the choice would have fallen upon him out of gratitude rather than from confidence in his political wisdom, had he not wounded the sensibilities of a large number of the *bloc national*. He had steadily refused them the satisfaction of re-establishing diplomatic relations with the Vatican, although they had pledged themselves to their constituencies to demand it. Moreover, while declaring that he would in no case remain Prime Minister, he showed a marked preference for former ministers ousted by the *bloc*. He also retained among his most intimate colleagues certain men who inspired justifiable suspicion. Unmoved by the insistence of the deputies, who were bent on seeing him rewarded by the supreme magistrature of the state, he refused to make any concession. Indeed, he openly announced his intention of reigning at the Elysée as the head of the Govt. and not as the Constitutional head of the state, and thus alienated many of the electors. On the eve of the Congress at a preliminary meeting, Clemenceau obtained only 389 votes against Deschanel's 408. Consequently he refused to stand, and Deschanel was elected by 734 votes out of 888 (Jan. 17 1920). The Cabinet resigned next day.

As leader of the *bloc national* Millerand was called upon to form the new Cabinet, which was constituted (Jan. 19) as follows: Millerand, Foreign Affairs; Interior, Steeg; Public Works, Le Trocquer; François-Marsal (a banker, not a member of Parliament), Finance. Poincaré was appointed President of the Reparations Commission. On Jan. 22 the Chamber passed a vote of confidence by only 272 votes against 23, half the members having abstained from voting in token of their resentment at having a Radical (Steeg) appointed to the Interior. But the majority rose to 481 against 70 on the 30th, after explanations by the Prime Minister.

Strikes and the Caillaux Case.—The internal situation did not realise the expectations inspired by the happy ending of the War. The *confédération générale du travail*, carried away by the masses it was supposed to control, instigated a strike of railwaymen in the spring, which was followed by miners', dockers' and seamen's strikes. None of these were successful, but they served to aggravate the industrial crisis caused by the rise in prices. That communist ideas were gaining ground in the Labour world was apparent at the Socialist Federal Congress of the Seine (Feb. 22), when the extremist motion put by Loriot, after an exchange of recriminations, was carried by an enormous majority. It looked as if the wave of revolution would sweep all before it. The disturbances coincided, not fortuitously, with the Caillaux case, which took its course before the Senate, constituted a high court, from Feb. 20 to April 23. Caillaux was condemned to three years' imprisonment and ten years' loss of civic rights; for five years his place of residence would be strictly that indicated by the Govt., and he was ordered to pay the costs of the trial. He was found guilty of corresponding with the subjects of an enemy country since the declaration of war, and notably in 1914, 1915, 1916 and 1917, both in France (especially in Paris) and abroad, the said correspondence having furnished the enemies of France with information detrimental to the military or political situation of France or her Allies—(Article 78 of the Penal Code). The high court admitted extenuating circumstances, and dismissed the charge of high treason. A Caillaux had already been detained in preventive arrest for two years and four months, he was released.

Relations with the Vatican.—Relations with the Vatican which had been suspended since 1904, were now re-established in accordance with the wishes of the majority in the Chamber and in the country, by a bill granting the necessary credit for setting up an embassy to the Holy See. Without waiting for the passage of the bill Millerand sent a *chargé d'affaires* to the Vatican to prepare for the resumption of relations (March 1920). The bill was not actually passed until Nov. 30 by the Chamber (379 votes against 109) and not until Dec. 16 1921 by the Senate (174 against 129). The Senate, with its Radical majority and anti-clerical traditions, bristled instinctively at any projects which looked like an infringement of laicisation, and the situation was further complicated by the problem of voluntary parochial corporations (*cultuelles*), which dated from the Act of Separation between Church and State (1905). The Holy See, having refused to acknowledge the separation, had forbidden the creation of *cultuelles*. Even the simple mutual ecclesiastical associations which several of the bishops desired to found as retreats for aged priests came under the ban.

The position of the French Church was therefore ill-defined and precarious, and Benedict XV. was as anxious to put an end to it as was the French Government. Since 1905, however, all the bishops had been nominated in Rome from among candidates intransigent towards the civil power, and the Pope was surprised to find, on the occasion of the Joan of Arc canonisation festival (May 16 1920) when Hanotaux represented the French Govt., that they were strongly opposed to the bill. Those of them who had come to Rome delivered a collective letter to this effect to the Pope. But as Jonnart had been appointed ambassador to the Vatican on May 16 1921, the papacy responded by the appointment of a Nuncio, Mgr. Cerretti, who arrived in Paris on Aug. 6. In spite of all efforts on both sides the question was still unsettled at the time of the Pope's death (Jan. 23 1922). Two years later, Pius XI., his successor, promulgated the Encyclical of Jan. 18 1924, by which permission was given to organise, by way of an experiment, "diocesan" corporations—that being the name chosen in place of *cultuelle*, as placing emphasis on the absolute power of the bishop over the corporation.

Execution of the Versailles Treaty.—The application of the treaty, both at home and abroad, was the chief concern of Millerand's Cabinet. The reconstruction of the devastated regions swallowed up vast sums which Germany—contrary to public expectation—failed to produce. Considerable sums also went in restocking the country with essential materials, above all, coal. The British Govt. exacted payment for British coal at a decidedly higher rate than the home prices. Since 1919, too, it had done away with common accounts. During 1920 France had to borrow nearly 38 milliard francs, thus raising the budget to close on 20 milliard (as against 5 milliards in 1913). These sacrifices were not compensated by other facilities from the Allies. In successive conferences—held in London in Feb., at San Remo in April, at Hythe in May and at Spain in July—Millerand obtained nothing but verbal expressions of sympathy although he gave way on some points of the treaty to the advantage of Germany. At San Remo, in return for the definite abandonment of Mosul, which came into the sphere of French influence as defined by the convention of May 16 1916 (Sykes-Picot Agreement, *see* EUROPE; INTER-ALLIED DIPLOMACY), France was presented with those shares in the Turkish Petroleum Co. (25%), which had formerly belonged to the German Government. Lloyd George felt obliged to devote himself principally to the economic recovery of Germany, which he assumed to be a necessary condition for the development of English markets in that country, and for the maintenance of European peace. Millerand had to fight some hard diplomatic battles on this subject with the Cabinet in London. He found himself in collision with Lloyd George on the Polish question when the Bolsheviks invaded the young republic in August. Lloyd George wanted the Polish Govt. to abandon Warsaw;

llerand retaliated by recognising Gen. Wrangel's government South Russia, and by sending a group of French officers to ırsaw under Gen. Weygand's orders. The friction thus caused s not dispelled by the retreat of the Bolshevik armies, for ile London was pessimistic as to Poland's future, Paris re- ded Poland's independence as the keystone of the new Europe. ance complained that, in taking up her mandate over Syria ording to agreement, she was thwarted by British agents.

A deplorable accident occurred to complicate the situation. the night of May 24, when making an official journey, the sident of the Republic fell from his sleeping-car on to the ıway line. Although not seriously injured he was so badly ıken that he was forced to rest from his work, and resigned on ot. 16, bidding farewell to the Chamber in a moving speech. Sept. 23 Millerand was elected President of the Republic by ; out of 892 votes. In offering himself as a candidate he had ıounced his intention of making more effective use than his decessors had done of the prerogative assigned to the head the state by the constitution. After election he defined his ws with greater emphasis, and, once installed at the Elysée, acted in conformity with his programme.

The Leygues Cabinet.—The changes in the Ministry necessi- ed by Millerand's election as First Magistrate were reduced a minimum. Georges Leygues became president of the Coun- and Minister of Foreign Affairs and the other Ministers re- ned their portfolios. This Cabinet had a brief and troubled . The *Bloc national* adopted an even more exacting and fiant attitude towards it than towards the preceding one. ıdré Lefèvre, Minister of War, resigned on Dec. 6 because he s not allowed a free hand in securing German disarmament. Jan. 12 1921, on the eve of a London conference and in con- uence of an interpellation by Bonnevay, the Chamber over- rew Leygues by 447 votes against 116 on the pretext that it nted no "negotiations in the dark." Nevertheless Leygues s in no way to blame; on the contrary, he had re-established friendly relations with the states of the Little Entente which d been upset by the action of the Quai d'Orsay the year before.

Briand's Cabinet.—Briand now formed a Cabinet in which he ld Foreign Affairs, giving Justice to Bonnevay, War to Bar- ou, Finance to Doumer and the Liberated Provinces to ucheur. He was well received by the Chamber on Jan. 20 d obtained a vote of confidence by 462 votes against 77. The ter-Allied conference for the settlement of reparations, which d been planned in London, was held in Paris on Jan. 24–8. was with difficulty that an agreement was reached; Germany's yments were spread over a period of 42 years, the sanctions be applied in case of non-payment being left vague.

They were to be as those securing German disarmament—*i.e.*, olongation if necessary of the occupation of the Rhineland; e seizure of German customs; the occupation of new territory, cluding the Ruhr; the application in Rhineland of customs ities or others. In any case, as these sanctions were not to nction automatically, negotiations would be necessary each ne they were to be applied. From Feb. 3 to 9 these questions ere discussed by the Chamber which finally approved the overnment's action by 363 against 114. Germany having by is time announced her inability to meet her immediate obliga- ons, a conference was held in London on Feb. 20, as the result which an ultimatum was sent to Germany (March 3) stipulat- g for: the occupation of Duisburg, Ruhrort and Düsseldorf, levy on the sales of German goods in the Allied countries and e establishment of a customs frontier on the Rhine if Germany ould persist in her opposition. These sanctions were to be plied automatically if Germany did not send a favourable ply by March 7. The reply was not forthcoming, and the lied troops proceeded to a joint occupation of the three wns named. These events were discussed in the Chamber on arch 15–7 and a vote of confidence was passed by 490 votes ainst 69. Meanwhile, the vote on the budget of 1921 had at st been taken, on April 30, after four *douzièmes provisoires.* is time the budget exceeded 21 milliard francs.

On April 30 a new conference was called in London to study "the situation created by the total failure of Germany to fulfil the dispositions of the Versailles Treaty as regards disarmament, the punishment of guilty persons and the reparations." The Reparations Commission had fixed Germany's total payment at 132 milliards of gold marks. A sum of 12 milliards was due and could be exacted on May 1. It was not paid. The conference agreed to warn Germany to meet the obligations named by the commission within 12 days, failing which the Ruhr would be occupied. There was nevertheless great opposition to this form of sanction in England; the French Govt., on the contrary, was acting under the pressure of public opinion. It was decided, on May 3, to mobilise the 1919 class, recently authorised, and the *Conseils généraux*, then sitting, voted for the most part in approval of this attitude. On May 5 there appeared the official text of the Allied declaration, which announced the occupation of the Ruhr on the 12th, failing the submission of Germany. But on the 11th Germany capitulated. The Chamber, on its return from recess on May 10, held a debate on this whole affair, the upshot of which was a fresh vote of confidence (390 votes against 162). The governmental majority was even larger on June 3, when a debate was held on the advances made for damages in the liberated regions (457 votes against 67). When the Chambers rose on July 12 the Inter-Allied Conversations were resumed, taking place in Paris (Aug. 16) for the settlement of Belgian priority and the costs of occupation and at Wiesbaden (Aug. 27) on deliveries in kind. The Conversations coincided with important negotiations of another description.

The Angora Convention.—With respect to Turkey, Briand held views which were not shared by observers of the Eastern question. He believed Turkey to be both powerful and sympathetic to France, and instead of endeavouring to consolidate the Treaty of Sèvres (Aug. 10 1920), by which Eastern affairs had been settled with due regard to the just claims of the Christian populations affected, he listened to the Kemalists. Acting under the influence of the Hellenophobes and of the unfavourable impression he had formed of British agents, whether in Syria or the neighbouring provinces, he sent out Franklin Bouillon—a pro-Turk and anti-English deputy—to Angora with instructions to make a special convention designed to put an end to disputes on the Turco-Syrian frontier. On Oct. 20 Bouillon signed an agreement at Angora which made exorbitant territorial and political concessions to the Turks, and contained additional clauses which were even more questionable. The text was kept secret. It leaked out nevertheless that France stood committed by one of the annexed clauses "to endeavour to solve in a friendly spirit (*esprit de cordiale entente*) all questions dealing with the independence and sovereignty of Turkey." Yielding to his Turcophil obsession, Bouillon had concluded something in the nature of an alliance rather than agreement of liquidation. He had even promised the Turks war material, which he requested the high commissioner in Syria to deliver to them; but this called forth such vigorous protests from those who were *au fait* with Eastern affairs in Paris that the material was stopped. Briand hastened to have the Angora agreement ratified by the President of the Republic without submitting it to the Chambers, which had met again on Oct. 18. On Oct. 28 he left for the conference on naval disarmament that was about to open in Washington.

The Washington Conference.—In spite of repeated warnings from well-informed personages, Briand insisted on going himself to Washington as France's representative, his idea being to act as arbitrator between Britain and the United States—assumed to be divided on the question of reducing naval armaments. He made one great public speech which for a moment gave him the illusion of success; but, as might have been foreseen, the British delegation came to an agreement with the American Govt. without considering French interests and even using arguments against them which were strongly challenged.

By the Washington Convention the French Navy, reduced by the War to a position in the third rank, was condemned to be placed on a still lower level. Although the state of her shattered finances prevented France from resuming her former position as a naval power, public opinion was hurt by an agreement which gave an official seal to the naval preponderance of friendly Powers which had profited by circumstances to assert their dominion over the seas. Briand's authority was undermined, and it was not long before another negotiation compromised it still more.

The Cannes Conference.—Returning from Washington in Dec., Briand departed almost immediately for London, where he was to confer with Lloyd George on the subject of the payments due on Jan. 15 and Feb. 15 1922 which Germany declared herself unable to meet in full. But instead of insisting on the settlement of this particular matter he allowed himself to be persuaded into calling a meeting of the Supreme Council at Cannes for Jan. 6. In the interval he found himself placed in an awkward position in the Chamber with regard to the Industrial Bank of China, a concern which was in difficulties and had been guilty of irregular transactions. One of the administrators, Senator André Berthelot, was the brother of Philippe Berthelot, secretary-general of the Ministry for Foreign Affairs. At first Briand tried to exonerate Philippe Berthelot, who was accused of having improperly used his influence to shield the bank; but he finally gave up the attempt and, on Dec. 27 1921, accepted his resignation. On the following day his majority in the Chamber was only 361 against 238.

His fall was brought about by differences over the conference at Cannes. As Premier, Briand was aware that President Millerand, with a majority of the public behind him, was profoundly opposed to the recognition of the Soviet Republic and to the modification of the French claim on Russia for the repayment of loans. But at Cannes, Briand agreed to a European Conference at Genoa, with a wide programme, to which Russian representatives were invited. Simultaneously, he was negotiating with Lloyd George the scheme for a pact designed to replace the stillborn convention of June 28 1919, which had been made void by nonratification in the United States. In Paris, the British guarantee, though almost identical with the former treaty, was regarded with suspicion because first, it contained no military convention, and secondly, it was accompanied by a memorandum which laid down a common policy for Britain and France, so limiting French liberty of action in Europe. Briand was bitterly accused of yielding to Lloyd George's persuasions and his policy was denounced as "cinematographic." The treaty made Great Britain responsible for resisting, with France, any violation by Germany of the military and naval safeguards of the treaty of Versailles but it was held that these guarantees were insufficient. Feeling ran high, in the Senate particularly. The Commission on Foreign Affairs, over which Poincaré presided, dispatched a telegram to Briand, reminding him of the indispensable conditions of an agreement, and the President of the Republic took the further step of requesting his urgent return to Paris. After a conversation at the Elysée and without waiting for a motion by the Chamber, to which he offered vague explanations, he gave in his resignation on Jan. 12 1922.

The Poincaré Ministry

In response to an almost universal public demand President Millerand appealed to Mr. Raymond Poincaré to deal with the crisis. He formed a Ministry on the 15th. He took Foreign Affairs, giving Justice to Barthou, Finance to de Lasteyrie, War to Maginot and Public Works to Le Trocquer. The heads of the Radical party had refused to join the new Ministry. Warmly welcomed by the public, Poincaré gained a vote of 434 against 84 in the Chamber on his ministerial declaration which was unusually firm in tone. He had to take a firm stand at Genoa without delay. He might have stopped the meetings and dissociated himself from the policy agreed upon by his predecessor without the government's consent. This would have meant a quarrel with Lloyd George. He preferred, however, to let the meetings fixed for the 10th April proceed, and went over to Boulogne for a talk with Lloyd George on Feb. 25. The only result of this somewhat chilly interview was a banal communiqué affirming the Entente between the two Governments.

The Genoa Conference.—At Genoa, where Barthou was i charge of the French delegation the Entente was only preserve with difficulty. Lloyd George who had, at the time of the Peac Conference, talked of inviting the Bolshevik delegates to Prinkipo, now made marked advances to them on the pretext tha Russia's collaboration was necessary to the restoration of norma life in Europe. But the inopportune publication of a Russo German treaty, concluded at Rapallo under the very nose of th conference, made it plain to all that the Germans and the Bolsheviks were also concerned with their own interests, whateve the rest of the world might think about it. At the Genera Council of the Meuse, Poincaré, who was president, made speech in which he reiterated his intention to allow no reductio or limitation of the claims and guarantees of France recognise by the Treaty of Versailles. The Genoa Conference, which ha been marked by various tragic-comic incidents, ended its futil existence on May 19. The Chamber signified its approval of th Government by 436 votes against 96. During the Conference th President of the Republic had made an extended tour in Morocc and Algeria.

Meanwhile the Chamber had been working at the reorganisation of military service to meet post-War conditions. Afte lengthy debates a bill was passed (June 29) by 365 votes agains 205, reducing the period of active service to 18 months and prescribing the incorporation of the 20-year-old recruits in two contingents so that there would always be at least two half-classe with the colours. This bill was not passed by the Senate unti the following winter. It came into force on April 1 1923.

The Eastern Conflict and Reparations.—In Aug. a fresh conference held in London failed to reconcile the English view tha Germany should be allowed a moratorium without correspondin compensation, and the French view that this should only b granted in return for a share of 60% in certain German industries, the establishment of customs depôts at the exits from th Ruhr, the collection of taxes in the occupied territories and th exploitation of forests, and of the Ruhr mines. At this momen an Eastern tragedy broke in upon the situation. The reorganise Turkish Army, set free on the Syrian side, broke the exhauste and badly led Greek Army on the Afiun Qarahisar front o Aug. 26, reconquered Asia Minor, took Smyrna on Sept. 8 and advanced on the Straits, occupied at Chanaq by Anglo-French contingents. Poincaré, unwilling to expose the French contingen to conflict with the Turks, gave orders for it to cross to th European side—to the surprise and indignation of many Frenchmen. A sharp crisis with Lloyd George ensued; he had sympathized with the desire of Greece to achieve a national destiny in the near east.

Lord Curzon went to Paris Sept. 19 to smooth the trouble. On Sept. 23 the lines of a new treaty of peace with Turkey were agreed, with the participation of Count Sforza, and after a second visit to Paris by Lord Curzon an armistice was signed a Mudanya (Oct. 11), when it was agreed that the plenipotentiaries authorised to settle the Eastern question should meet a the end of November. But the differences of opinion betwee the Cabinets of Paris and London, both on the measures to b adopted with regard to Turkey and on the subject of reparations persisted in spite of the resignation of Lloyd George and th advent of the Bonar Law Cabinet at the end of October.

French politics were at this time entirely dominated by th question of reparations, that is to say the execution of th "scale of payments" fixed in London in May 1921. Opinio became more and more irritated at seeing Germany devote th sums which she was under obligation to pay to the Reparations Commission to the completion of her industrial equipment, th extension and improvement of her communications, and extravagant domestic expenditure. Poincaré's protests were formally approved by the Chamber (with nearly 500 votes) and by a almost unanimous Senate. In London, on the contrary, th first consideration was that Germany's internal economy shoul not be disturbed. Bonar Law's attitude towards France was more amicable than that of Lloyd George, but the solutions which he proposed were hardly more favourable. In short, he ught rather to pursuade Poincaré to renounce for an indefinite eriod his claim for payment than to force Germany to pay. hen again the old spirit of rivalry between the chancelleries ersisted, diplomacy being untouched by the fraternity of arms. rance's efforts to secure the execution of the peace treaties were t down to imperialism. The London proposals were impreg- ted with distrust of France. Thus, at the Lausanne negotia- ons as in the Paris meetings, friction continued.

The Ruhr.—On Nov. 14 Wirth, the German Chancellor, nounced Germany's inability to pay for an indefinite period, a eclaration repeated by his successor Dr. Cuno. Outrages were ommitted at Stettin, Passau and Ingolstadt against Allied ficers. On Dec. 9 Bonar Law, Poincaré, Theunis and Mussolini et in London to discuss a new note from Cuno, while Lloyd eorge, at the same moment, made a violent attack on France in e United Press. Unable to reach agreement, the Conference oke up, and another meeting was arranged for Jan. 2 in Paris. oincaré secured the approval of the Chamber on Dec. 15 by 52 votes against 76, and of the Senate (carried unanimously) Dec. 21. On the 27th the Reparations Commission[1] took note two intentional defaults by Germany, and notified the Powers oncerned. The Inter-Allied Conference opened at the Quai 'Orsay on Jan. 2 1923 when Bonar Law submitted the following cheme: a four years' moratorium; the Reparations Commission be replaced by a Foreign Council for German finance, a erman Minister presiding; the reduction of deliveries in kind; eduction of the German debt to 30 milliard gold marks; com- ensation for Inter-Allied European debts by allotting to Eng- nd the milliard of French gold and the Italian bonds held as a uarantee by Great Britain; the first series of German bonds to e allotted to France by priority. This somewhat complicated cheme deviated completely from those of France, Belgium and taly. If it abolished Inter-Allied debts it did away with any erious expectation of payments except to Great Britain.

On Jan. 3 after a ministerial council and consultation with heunis and Della Torretta, Poincaré declared Bonar Law's cheme to be quite unacceptable. The conference closed down n the 4th, in view of the impossibility of agreement. While efusing to subscribe to the French propositions, the British elegates declared that the friendly sentiments of the British ovt. and people remained unchanged. On the 9th the Repara- ions Commission, having heard the German delegates, made a tatement (Great Britian dissenting) that Germany had "de- iberately failed" to deliver coke and coal. Poincaré then in- ormed the German Govt. (Jan. 10) of the sanctions which he as going to apply, viz.: control of industrial production in the uhr by French engineers under the protection of an adequate ilitary force. President Ebert protested, and the industrial orkers in the Ruhr refused to carry out the deliveries of coal by rder of their Government. The Franco-Belgian occupation as accordingly established from Essen to Bochum and Dort- und. On the German side passive resistance was organised.

Such were the facts, the consequences of which were to be felt hroughout the year. In proportion as passive resistance became ore stubborn French control became firmer and more extended. ith Poincaré, everything else was subordinated to the success f the undertaking. Disturbing incidents followed in quick uccession. On Jan. 18 for instance, the Chamber passed a reso- ution by 371 votes against 143 for the suspension of parlia- entary immunity for Marcel Cachin who had been charged efore the High Court with conspiring against the security of the tate. But the Senate declined on May 24, and the Cabinet endered its resignation to the President of the Republic, who efused to accept it. On this occasion (June 14) Poincaré fur- ished explanations on his internal policy long awaited by the *loc national*, who supported him consistently without having ny share in the administration. "Leave the extreme parties solated," he said; "republicans who wish to belong to the ajority should not risk their alliances and their friendships mong them." His majority was only 376 against 207, neither adical-Socialists nor Socialists being included in it. Poincaré did not change his methods, however, but relied on the Right for his foreign and on the Left for his home policy. He kept the Chamber busy by devoting over 20 sittings to academical debates on teaching reforms, particularly on the reintroduction of compulsory Latin.

Meanwhile the Lausanne negotiations were concluded. To the great regret of many of their compatriots the French plenipotentiaries missed the opportunity of joining hands with Lord Curzon on the Eastern question. They showed considerable complaisance to the Turks, and sacrificed the interests of Christian populations and of institutions under the traditional protection of France. A portion of the Paris Press expressed disapproval of the treaty, which was finally signed on July 24.

In Aug. a change took place in Germany. In face of the slow but sure effect of the measures taken in the Rhineland, the Cuno Cabinet had to resign and was replaced by a Stresemann Govt. more inclined to submission. On Sept. 24 passive resistance came to an end, announced by President Ebert in a proclamation which called the people to submit, while indulging in violent recriminations against France. At this point Poincaré, under the influence of the more extreme Nationalists, took the serious step of acquiescing in, if not encouraging, a separatist movement in the Rhineland, whereas he had, up till then, proclaimed himself in favour of pure autonomy. German opinion was once more exasperated. Mr. Baldwin, who had been assured of Poincaré's moderate views when visiting Paris on his way from Aix-les-Bains, was taken by surprise, and foreign opinion in general, at first favourably impressed by French success in the Ruhr move, now turned against France. The franc fell, and the cost of living rose. Poincaré then withdrew his support from a movement palpably artificial; but the harm was done. The opportunity of exploiting the Ruhr victory had been lost. The anger of the separatists, the disappointment of the public and the accusations of the extreme Left disturbed opinion. Poincaré now accepted the idea of having a new scale of payments drawn up by outside experts in accordance with Germany's real capacity. On Nov. 30 the Reparations Commission decided to send two committees of experts to seek means of balancing the budget, to decide upon the measures to be taken for stabilising German currency and to "seek means of evaluating and bringing back exported capital." The execution of the Treaty of Versailles had taken a new turning.

THE FINANCIAL AND INTERNAL CRISIS

In vain did Poincaré defend his policy in impassioned speeches on all occasions—and particularly on Sundays; public confidence was shaken, loans became impossible, the exploitation of the franc by speculators had to be countered by a mass manoeuvre in dollars, cost of living increased and the claims of wage-earners and officials grew in proportion. On Jan. 6 1924 one-third of the Senate was replaced, but without any serious change in the composition of that Assembly. On the other hand, the elections in the Chamber, fixed for May 11, became the focus of a fierce struggle. The government scheme for straightening out the financial situation so as to avert the fall of the franc met with decisive opposition from the Left. The augmentation of taxes, particularly the *double décime* was passed with difficulty. The proposal to authorise the Government to proceed by decree with administrative reforms estimated to save a milliard was only adopted by 333 votes against 205 in the Chamber (Feb. 7) and came near being thrown out by the Senate which had approved the general financial scheme by only 151 votes (March 18). The parliamentary horizon was overcast. On March 26 the Cabinet was put in a minority in the Chamber (271 against 264) on the question of pensions, and resigned. Poincaré was charged to re-form the Ministry, which he did by giving François-Marsal Finance, de Selves the Interior, Loucheur Commerce and Henri de Jouvenal Public Instruction. Thus many radical Ministers were replaced by Moderates. The electoral law of 1919 was slightly modified to do away with certain inconsistencies and to reduce the number of deputies to 584. On Jan. 25 Poincaré had signed a Franco-Czechoslovakian alliance with Dr. Beneš.

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[1] The British member dissenting (Ed. *E.B.*).

The election campaign was a heated one. Millerand's sensational speech at Evreux on Oct. 14 had really been the starting-point. The President of the Republic insisted on the necessity of confining legislative power to its proper function and of strengthening the prerogative of the head of the state. During April Poincaré made several important speeches in which he drew nearer to the *Bloc national*. The Radicals, Radical-Socialists and Socialists formed a Cartel, taking as their motto opposition to financial retrenchment and anti-Poincaréism. In several divisoins the Cartel included the Communists. When May 11 came, more than 9,000,000 voted out of 11,000,000 electors—a proportion never before attained. The results gave 277 seats to the Cartel, 267 to the *Bloc National*, 29 to the Communists and 11 to the candidates who belonged to no group. Of the Cartelist deputies 139 were Radicals and Radical-Socialists, 36 Republican-Socialists and 102 Unified Socialists. Taking the number of votes over the whole country, about half had gone to the *Bloc national*; the Republican Entente group alone accounted for 3,200,000 voters while the whole Cartel had only 3,400,000 to its credit.

Doumergue's Election.—Poincaré handed in his resignation at once, but carried on with current affairs until the opening of the new Chamber. On June 2 the Socialist Congress came to the unanimous decision not to take part in the new government, though supporting the Radical Socialists. Painlevé was elected President by the Chamber on June 4 by 296 votes against Maginot's 209. On the 5th Millerand offered to put Herriot in power, but Herriot refused to form a Cabinet so long as Millerand remained President of the Republic. He and his partisans could not forgive Millerand for having opposed them under the last Legislature. After turning in vain to friends such as Steeg, Millerand had at last to give in. He formed an interim Cabinet on June 8, under François-Marsal, for the purpose of laying before Parliament a memorandum in which he set forth his claim, to the effect that he had always respected the constitution and was still abiding by it in refusing to surrender his office without a definite vote from both Houses. The Senate refused to take action. The Chamber flatly refused to enter into relations with a government "which by reason of its composition, is the negation of parliamentary rights." On June 11 Millerand therefore resigned. The Cartel candidate for the Presidency was Painlevé, but at a preliminary meeting of the Congress 149 votes were given to Doumergue, president of the Senate, and it was he who was elected on June 13, by 515 votes against 309 for Painlevé.

Herriot's Ministry.—Herriot now proceeded to form the new Ministry, which was complete by June 14. Taking Foreign Affairs himself, he entrusted René Renoult with Justice, Clémentel with Finance and filled the remaining departments with other Radicals. The ministerial declaration marked a return to anticlericalism by announcing the suppression of the embassy to the Vatican and the intention of bringing Alsace and Lorraine within the scheme of French legislation as soon as possible, including secular education. The Chamber approved it by 313 votes against 234 (June 19); but on the same day the Senate elected de Selves as president, in place of Doumergue, by 151 votes against 134 for Bienvenu-Martin, the Cartel candidate. The two Assemblies, both Radical, were not of the same school.

The new majority made a point of reversing the work of their predecessors in every point and expressed the intention to secure for their own party "all the appointments, and that at once," as their principal organ the *Quotidien* phrased it. Some measures have therefore a symbolic importance. Gen. Sarrail was recalled for service without age-limit; the review of July 14 at Longchamps was cancelled; university reforms were dismissed with a stroke of the pen; the monopoly on matches was reinstituted; the economic and military evacuation of the Ruhr was brought under consideration; the Moscow Govt. was recognised *de jure* (Oct. 28) without any condition or guarantee for the Russian debt; an amnesty was proposed to be applicable to fiscal offences, events connected with strikes, desertion, cases of intelligence with the enemy and cases of *forfaiture*—the last two named categories including the cases of Caillaux, Malvy and the *Bonnet Rouge*! Not until the end of the year (Dec. 16) did the Senate pass this Act of Amnesty, voted by the Chamber as early as July. The anti-clerical policy of the Government produced considerable agitation. A letter was sent to the president of the council from the French cardinals denouncing the lay laws as "persecuting laws," and a "National Catholic Federation," presided over by Gen. Castelnau, was formed, which had a large following in the west and also in Alsace and Lorraine, where church schools are traditional, whereas French law recognises only lay and neutral schools. A National Republican League on parallel lines was formed by Millerand on Nov. 7 to combat "demagogy, revolution and anarchy."

The Dawes Plan.—Herriot's attitude with regard to Reparations was the reverse of Poincaré's. Instead of merely changing methods of negotiation which were open to criticism, he abandoned without resistance the positions held by his predecessors. On a visit to Ramsay MacDonald at "Chequers," he associated together the three problems, reparations, inter-allied debts and security. As a result, MacDonald felt authorised to issue a programme for the Inter-Allied Conference which allowed for concessions, hitherto regarded as inadmissible, on the part of Germany's creditors. Feeling ran so high in France that Mr. MacDonald hurried over to Paris on July 8 in order to draw up a fresh programme. It was in fact a question of accepting and applying the Dawes Plan which had been put before the Reparations Commission on April 9.

At the London Conference of July 16–Aug. 16, at which German delegates were present from Aug. 5 onward, conditions—very favourable to Germany—were adopted; attenuation of the debt; limitation of the Reparations Commissions powers; a loan of 800,000,000 gold marks; suppression of coercive measures and of Franco-Belgian *régie* in the Rhineland; a promise to evacuate the Ruhr before Aug. 15 1925; while Mr. Ramsay MacDonald undertook to seek a solution of the Inter-Allied debt problem, bearing in mind all these points. On his return to Paris Herriot was vigorously criticised in Parliament. In the Chamber, after six sittings devoted to debate, he obtained a vote of confidence by 336 votes against 204 (Aug. 23). In the Senate on the 26th, he secured 181 votes. His task was not made easier by Ramsay MacDonald's rejection of the Treaty of Mutua Assistance which had been elaborated in agreement with Lord Cecil by a commission appointed by the League of Nations. At the fifth meeting of the League Herriot succeeded, however, in regaining a portion of his prestige, by proposing the principles of "arbitration, security, disarmament," which became the basis of the Geneva Protocol. A few weeks later, on Oct. 30, he was able to settle by arbitration the dispute over the free zones of Savoy with Switzerland (*see* SWITZERLAND).

On the reopening of the Parliament the Radicals and Socialists continued their policy of supporting the Government, with the approval of their party Congresses. The Communists adopted a hostile attitude to the Socialists. On Nov. 23, when the ashes of Jaurès were transferred to the Panthéon, they gave the ceremony the appearance of a *revue* of Communist forces in the streets of Paris, entailing an accusation of weakness against the Government. Great difficulty attached also to the preparation and discussion of the budget in view of the promises made during the election period and the demands of the Socialists. Clémentel, who represented the moderate element in the Cartel, had retained the taxes voted by his predecessors; but no sooner was the equilibrium within sight of accomplishment than it was upset by a new revision of the scale of officials' salaries. From the expected figure of 32,800 millions the budget rose to 36 milliards and the pound sterling, which stood at 70 francs during the elections, was now at 91. The programme of the Socialist Conference at Grenoble in Feb. 1925, the Communist strike (accompanied by bloodshed) at Douarnenez, the fracas on Feb. 8 at Marseilles, which resulted in the death of three and wounding of 20 people at the close of a Catholic meeting—combined to bring discredit to the Government. No less grave and significant was the Quartier Latin affair in March. An immense majority of the students protested against the nomination of an ill-qualified ndidate as lecturer in the faculty of law in Paris. The dean the faculty was suspended by the Ministry for having refused allow the police to enter the premises. The whole Press rang th the consequent disturbances.

The suppression of the embassy to the Vatican and the threat lay-teaching in Alsace and Lorraine threw those two provinces to a state of growing unrest. On April 2 Clémentel resigned account of his bad reception by the Senate. He was replaced Monzie, who demanded of Herriot the retention of the em- ssy to the Vatican; but this patching up could not save the abinet, and on April 10 the Senate, exasperated by an infla- on of four milliards concealed in the balance-sheet of the anque de France in despite of solemn promises, threw the Gov- nment out. In February, following on a German note suggest- g a pact of security in the West, confidential negotiations were ened between the Cabinets concerned. These were continued semi-secrecy until autumn.

The Painlevé Ministry.—This particular crisis was difficult to olve, as the Socialists refused to accept portfolios, but Pain- vé finally succeeded on April 17 1925. He took War and the residency of the council, giving Foreign Affairs to Briand and inance to Caillaux. This last appointment caused a great nsation, but as the public had, after all, faith in Caillaux's chnical ability and desired principally to see the financial roblem settled, his war antecedents were overlooked. The inisterial declaration was manifestly designed to relieve the trained situation. It proclaimed the retention of the embassy t the Vatican in a new form, and reassured Alsace-Lorraine gainst any too precipitate assimilation. The Government had a ajority of 304 against 217 votes. The agitation in the Latin Quarter was allayed by the reinstallation of the dean in the aculty of law. Unfortunately, the Communist agitation ended n the shooting of four partisans of the Youthful Patriots *jeunesses patriotes*) in the rue Damrémont at the close of a meeting. The Prime Minister and the Minister of the Interior attended heir funeral at Notre-Dame. To prevent the recurrence of like ncidents, May Day processions in the open street were forbidden nd May 1 therefore passed in perfect calm. The Government ikewise forbade all street processions on May 10, the fête of oan of Arc, but the usual delegations made their pilgrimage to he statues of the saint, and the Prime Minister deposited a wreath in person. Herriot had been re-elected president of he Chamber by 266 votes only. On April 5 Millerand was lected Senator of the Seine by 520 out of 1,025 votes. The municipal elections (May 3 and 10) showed a slight progress owards the Left as compared with those of 1918, and at the ame time a striking set-back for the Communists.

Abroad the outlook was still uncertain. The Conference of Ambassadors had decided, in conformity with the Versailles Treaty, that the Cologne zone should be evacuated only after Germany had completed her disarmament. An Inter-Allied financial conference, that was held in Paris on Jan. 14, had settled the distribution of payments to be made under the Dawes scheme and that of the profits accruing from the occupation of the Ruhr. The election of Hindenburg to the presidency of the Reich (April 26) on the sudden death of Ebert had aroused great uneasiness among the Allies. In May a considerable financial and military effort was entailed by 'Abdel-Krim's attack on the Moroccan front. Painlevé flew over to Morocco by aeroplane to review the situation. He then sent Malvy to Madrid to arrange a plan for collaborating with Spain, and Marshal Pétain to Morocco to direct the military operations. In October, after the Riffs had been thrown back on their old front, Marshal Lyautey was replaced as Résident-Général by Steeg. Monzie became Minister of Justice and Yvon Delbos took the Ministry of Public Instruction. This first reconstitution of the Ministry had no political significance, but this could not be said for the next.

Dislocation of the Cartel.—July 12 saw a rift in the Cartel. For the first time, on the subject of the budget and the sales tax, the Socialists, Radical-Socialists and a certain number of Radicals voted against the Ministry, which was saved by the votes of the Opposition who were anxious above all to find a way out of the financial predicament. The *Conseils généraux* elections (July 19 and 26) showed a slight leaning to the Left and the intransigeance of the Socialists became more marked. On Aug. 15 the Socialist Congress in Paris began by excluding Deputy Varenne from the party because of his acceptance of the post of Governor-General of Indo-China. A motion was then passed (by 2,210 against 559) against Blum's proposal to censure any support of Painlevé's Cabinet but permitted the support of a Ministry "determined to bring about the reforms demanded by the proletariat." Inclusion in the Ministry remained forbidden in any case. The ever-increasing financial difficulties intensified the dissension. Caillaux failed to justify the hopes reposed in him. Instead of holding fast to a general financial scheme he became involved in party politics. To clear up the situation by the settlement of Inter-Allied debts he left for the United States in September, but only to return in October empty-handed. The consolidated 4% gold loan, which he had launched during the summer and by which he hoped to realise some 20 milliards produced barely six. Confidence was gone. At the end of Oct. misunderstandings in the majority ranks found expression at the Radical Congress at Nice, the speeches of Herriot and Caillaux revealed a fundamental difference, and Painlevé's long speech rather served to add to the confusion. Finally the Congress, unable to decide between the levy on capital and the more practicable taxes, adopted a vague formula recommending a "special contribution payable on all kinds of income and capital."

The Second Painlevé Ministry.—The brief credit enjoyed by the Government on the conclusion of the agreements signed on Oct. 16 at Locarno—for which Briand had paved the way during the 6th meeting of the League of Nations by agreement with Chamberlain, Benes and Skrzynski—did not help them for long. For one thing, French opinion was by no means unanimous in its approval of the agreements which were designed to replace both the Geneva Protocol (never ratified), the Security Pact of June 28 1919 and certain guarantees of the Versailles Treaty. On returning from Nice, Caillaux was unable to secure his colleagues' approval of his financial projects. To get rid of him Painlevé handed in the resignation of the Cabinet collectively on the 28th, and formed a new Ministry in which he took Finance himself. But in the Chamber he obtained a majority of only 221 votes against 189, owing to the abstention of the Socialists. The Socialist National Council, for its part, voted against him by 1,431 against 1,228. At the same time Gen. Sarrail's anticlerical sectarianism, Turkish sympathies, presumption and blunders in Syria brought about sanguinary encounters in the Jebel Druz and later in Damascus, which amounted to local disasters. Painlevé was at last obliged to recall him. When he put his financial schemes—badly conceived and co-ordinated—before the Chamber, he was already discredited. On Nov. 22 he was thrown out by 277 votes against 249. The Treasury was so hard pressed that he had to pass an emergency vote for an advance of 1,500 million francs from the Banque de France.

Another Briand Ministry.—Entrusted with the construction of a new Cabinet, Briand failed at first through the non-collaboration of the Socialists. Doumer, and after him Herriot, met with no greater success. Then, as the Socialists were meditating a *coup de force*, Briand yielded to the pressure of the President of the Republic and tried once more. He succeeded on Nov. 28, taking Foreign Affairs himself, sending Painlevé back to the War Office and, in spite of his objections, gave Finance to Loucheur who imagined he could straighten out the situation. The Ministry was still Cartellist, although Georges Leygues (Navy) and François Jourdain (Pensions) represented the Moderate elements. A change of policy was now perceptible, the developments of which appeared in December. Loucheur's scheme, once published, proved so great a disappointment that the Finance Minister had to resign. After groping a while pursued by the clamour of the extreme Left, Briand replaced Loucheur by Doumer. Several Cartellist ministers talked of resigning, but Briand unmoved stood by Doumer and gained the approval of the entire Cabinet for his schemes. The pound sterling oscillated at about 130 and the dollar at about 26 to 27 francs.

As soon as his Ministry was formed Briand went to London to sign the Locarno agreements (Dec. 1). By the end of the year foreign affairs looked more promising. The Dawes scheme functioned accurately, and the Cologne area was evacuated without incidents. In Morocco the vanquished ʽAbdel-Krim saw himself abandoned by the tribes; in Syria Henry de Jouvenel, appointed high commissioner, began to restore order and confidence; in central Europe, Poland and the Little Entente (*q.v.*) were following a policy parallel to that of France. Relations with England were cordial. The one great remaining problem remained the settlement of Inter-Allied debts, the shadow of which darkened a financial horizon already heavy with clouds. (A. Gn.)

The Locarno treaties were ratified by the French Chamber on Nov. 2 1925. The chief preoccupation of ministers in the new year was the financial crisis, the solution of which was rendered more difficult by the lack of an absolute majority in the Chamber. The Govt. made the tax on payments, M. Doumer's most important proposal, a matter of confidence. They were defeated by 274 votes to 221. Their resignation (March 6) took place two days before the opening of the special session of the Assembly called to arrange for the admission of Germany to the League.

The fall of M. Briand was a calamity at this moment, and, after a fruitless invitation to M. Herriot to form a cabinet, M. Briand assembled a ministry, with M. Raoul Peret at the Finance Ministry. A Finance Bill, providing for new or increased taxation, was passed (April 29), but the franc still fell. At the end of April it stood at 147 to the pound. Money was required for Morocco, where the new offensive was begun early in May. On May 19, on M. Peret's return from London without having settled the debt, the franc fell to 171. In June M. Peret resigned, and then the whole Government. After a delay of a week, during which M. Herriot had failed to form a ministry, M Briand, again took office, with M. Caillaux at the Ministry of Finance, and the latter was faced at once with the problem of protecting the franc. (Ed. *E.B.*)

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II. ECONOMIC AND SOCIAL HISTORY

In the course of the negotiations for the payment of France's debts to her Allies it has been persistently said, in particular by Americans, that France is the richest country in Europe, or at least in continental Europe. This opinion, very flattering to the French, is in some respects well founded; for since the fall or the amputation of the great empires of central Europe, France is, after Russia, the most extensive European country. Her soil is fertile. She owns the richest iron deposits in Europe, and, if her coal does not suffice for home consumption, she has by way of compensation more water power than any other European country except Norway. In addition she has a colonial empire, the second in the world and 20 times the size of the mother country. It is true that her population places her fifth in order of countries, but it is by her own choice that its increase is limited.

But the formidable damages inflicted by the War are not taken sufficiently into account. The world still remembers France's rapid recovery after the war of 1870–1, and supposes that this is a similar case. But the two situations are not in any real sense comparable.

If the national wealth of France were evaluated in gold currency or, to be exact, in the currency of 1914 (which is not the same thing, for we know that gold has lost a great deal of its value), we should arrive at a figure far below that of 1914. It is difficult to make a definite statement, but, speaking generally, the accepted pre-War figure was 300 milliard gold fr. whereas the present figure would not, we believe, reach 200 milliards, in spite of the restoration of Alsace-Lorraine.[1]

But leaving aside these general considerations let us examine, in two successive sections: (1) agriculture, mines, industry and commerce, with a comparison under each heading of the present situation with that of 1911–3; (2) the changes that have taken place in respect of workers' legislation, the social movement and population.

Production

Agriculture.—French agriculture suffered cruelly in the War; (*a*) in consequence of the occupation and of the destruction of part of its area; for certain portions of the ground—the part since known as the Red Zone (about 30,000 hectares)—were laid waste by shell to such an extent that they could no longer be cultivated in any way; (*b*) in consequence of scarcity of labour, live stock and manure, which had the effect of bringing cultivation to a standstill or of greatly impoverishing the crops for a long time after the War; (*c*) by the destruction of forests (several hundred thousand hectares) which must take 20 to 50 years or even longer, to grow again.

The area under cultivation is smaller to-day, whether we take the absolute or the relative figures, than it was before the War. From 1904 to 1913 its extent was 23,000,000 hectares (cereals, fodder, leguminous crops, vines, etc.), which represented in relation to France's total area of 52,952,000 hectares 47%. In 1923 it was only 20,432,000 hectares, although the area of France, aggrandised by Alsace-Lorraine, amounts to 54,400,000 hectares. The proportion is therefore now only 37·5%. This reduction of the cultivated areas is explained by the diminution and the high cost of agricultural labour, as the result of which landowners find it more profitable to convert their land into pasture.

It may be argued that the decrease in the areas matters little if there is a compensating increase in yield. Unfortunately this is not the case. There is certainly a general improvement in the yield per hectare, but not enough to compensate for the decrease in area. The result is that production is decreasing in the case of almost all agricultural products. The following are the figures for certain products, taken from a paper by M. Augé Laribé in the *Revue d'Economie politique*, March–April 1925.

		1904–13	1923–4
Cereals	Million quintals	88	76
Potatoes	Million quintals	133	127
Beetroot	Million quintals	58	44
Milk	Million litres	128	117
Wool	Million kilogrammes	34	20

It is only in the case of vines and fodder that production shows a small increase.

The live stock of the country, greatly reduced by the War, is still below pre-War numbers. It is evident from the following figures (*Annuaire statistique de la France*) that the deficit is still very considerable.

	1913	1924	Decrease
			%
Horses, mules, donkeys	3,222,000	2,859,000	11
Oxen and cows	14,788,000	14,025,000	5
Sheep and goats	16,131,000	10,172,000	37
Pigs	7,036,000	5,802,000	18

Nevertheless, in some directions, progress has been made. Manure is being more largely used, thanks to the work of the agricultural syndicates, but France is still far behind other countries in this respect, although she possesses very abundant supplies of phosphates in Northern Africa and, since the restoration of Alsace, a rich deposit of potash also. The employment of electric power, whether derived m waterfalls or from coal, is beginning to spread in country dis-ts owing to the formation of co-operative societies of consumers power. The state has voted a credit of 600,000,000 fr. for this pose. The shortage of labour is being compensated by the im-gration of foreign workers who are mainly Italian and Spanish in south, Polish and Belgian in the north. The southern region ich lies along the Garonne had become a deserted country in con-uence of the decrease in the local population, but is now being tored by the Italians, who come not merely as labourers, farmers métayers, but also to buy land and settle on it. It is undoubtedly anomaly, this colonisation of so ancient a country as France, and results may be dangerous from a national point of view. But n if it be an evil, it is at the same time a remedy for that greater l which has proved fatal to other countries, viz.: desertion of the d for lack of men to work it. The depreciation of the currency has n a blessing in so far as it has enabled most small holders to pay their mortgages and many farmers to buy their farms outright.

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[1] Mr. Harvey E. Fisk of the Bankers Trust Co., New York, concludes his exhaustive analysis of French public finance (1922) in these terms: "We believe that, notwithstanding the losses occasioned by the War, the wealth of France today, estimated on a specie basis, closely approximates or perhaps equals her pre-War wealth. This is partly due to the repatriation of Alsace and Lorraine, but it is also due to the fact that the War apparently served to intensify the normal saving habits of the people, and thus enabled them to meet the burden which it brought without seriously impairing the pre-War national fortune." (Ed. *E. B.*)

Mines and Water-power.—The invaded regions were the very es richest in mines. They produced half of France's total out-t of coal and three-quarters of that of iron. The coal-mines re systematically destroyed by the Germans; during the War 2 shafts and 1,910 kilometres of galleries were demolished or rnt out, and have had to be not merely repaired, but entirely onstructed. In 1925, by dint of immense efforts, production d been brought back to the pre-War figure, but the output 12 whole years had been lost.

It is true that, through the recovery of the Lorraine mines, ance—already a large producer of iron ores—has come into e front rank among European nations in that capacity. Her oduction of coal, however, was always much below her con-mption, and the restoration of Alsace-Lorraine has not altered is state of things.

The figures of coal production and consumption are as follows:—

Year	Production	Consumption
	tons	tons
911	39,280,000	59,500,000
913	40,844,000	64,800,000
924	44,955,000	76,900,000

At first sight there would seem to have been a considerable crease both in production and consumption, but this is an illu-n. As regards production, of the 45,000,000 tons produced in 24, more than 5,000,000 are from the restored Lorraine region; ducting this amount, it will be seen that from the rest of France e output is slightly below the pre-War figure, so that there s been no progress at all in the 12 years. Similarly, as regards al consumption, Alsace alone consumes 11,000,000 tons, so at in 1924 the consumption of France without that province s only 66,000,000, or about the same as in 1913. The deficit s in fact been augmented, for while in 1911 it amounted to ,000,000 tons only, in 1924 it had risen to 32,000,000 tons. is made up by the import of coal, which comes mainly from e Saar, Germany and England. If the Saar basin were to be-me permanently French, it would go far in redressing the in-fficiency of coal; but this question is to be settled by a plebi-ite in 1935, and it is probable that the decision will be in favour Germany. In that case, however, Germany would have to y France the value of the Saar mines, which has been fixed at 0,000,000 gold marks.

There is, however, a real and considerable increase in the pro-ction of iron and its derivatives; production is in fact nearly ubled, as may be seen from the following figures:—

Year	Iron Ore	Pig Iron	Steel
	tons	tons	tons
1911	16,600,000	4,470,000	3,837,000
1913	22,000,000	5,207,000	4,687,000
1924	29,000,000	7,693,000	6,900,000

Consumption, however, lags far behind production; even be-re the recovery of Lorraine, France was unable to absorb all r production, and is less able to do so now. The reason is that e produces very little coke, and coke is indispensable in the oduction of pig-iron. She has, therefore, no alternative but export her surplus of ore and of manufactured iron, and even is is a matter of difficulty as, since the War, the metallurgic industry has been in a state of depression marked by underselling and falling prices. In the matter of her metallurgical wealth, therefore, France has less cause for satisfaction than is generally supposed.

As to petroleum, France had formerly none at all, but with Alsace she has now acquired a few small wells. An oil-field has just been found in the Mediterranean region (department of Hérault) but it is not yet known what the yield will be.

The insufficiency of coal-mines is to some extent counterbalanced by the abundance of waterfalls which can be used for motor power. With the Pyrenees, the Alps, and the mountains of the centre, France is at least as well equipped as Switzerland and Norway. Before the War the amount of power utilised was valued at no more than 480,000 kilowatts (640,000 H.P.). In 1924 the figure was over 1,000,000 kilowatts. Plans for the utilisation of 4,000,000 additional kilowatts are in progress, and the total utilisable energy is calculated at 8,000,000 or 10,000,000. The increase, however, though extremely rapid after the War, is now tending to diminish owing to the great rise in the cost of installation, so that coal-power once more becomes the cheaper of the two. Nevertheless, France has already found in water-power a source of considerable wealth, for in addition to the amount employed for lighting and for running railways and tramways, a large number of industries, both metallurgical and chemical, have arisen as a consequence of this new motor power.

Industry.—French industry was hit even more directly than agriculture by the War. Those regions which were invaded, and in great part devastated, represented, it is true, only 5% of the total area of France, but they accounted for more than 10% of the population, 14% of the total number of industrial workers, 29% of the textile and 53% of the metallurgical production. They were in short the focus of the nation's industrial activity. Reparation of the damage done has cost the state 84 milliard fr., and 20 milliards have still to be paid. From the financial standpoint the losses are irreparable. We are not, however, concerned here with the financial situation, but with the question of whether, from the industrial point of view, a complete recovery has been made. The answer is yes, and no.

In certain respects undoubtedly, French industry gained through the terrible experience of war. Factories reconstructed in the devastated areas made good use of the enormous indemnities that they received from the state. They are reported to have had the use of extravagant sums, but they justify their case by saying that the money was spent on installing the latest improvements and that those installations would probably not have been made but for the War. In like manner factories have learnt to renew their stock of tools and to adapt themselves to new requirements by manufacturing at home articles for which France had formerly sent abroad, particularly to Germany; these included, for instance, chemical products, dyes, magnetos for motors, Diesel engines, electrical apparatus for wireless telegraphy, optical and photographic lenses and all the industrial requirements of aviation. The motor industry has made immense strides; the pre-War figure of about 100,000 cars in use has been increased to over 450,000 in 1925. Even the oldest industries received a new impetus through the War. In the bakery trade, for instance, only half of the establishments used a mechanical kneader; and after the War it was used by 88%. It must be said that the general adoption of the eight-hour day hastened the introduction of mechanical contrivances but this itself was a result of the War.

But while admitting these points, it is none the less true that French industry, taken as a whole, has not yet recovered from the shock of war. Certainly, the losses among industrial workers —(267,000 killed and about 130,000 disabled)—were less heavy than among agricultural labourers, because the greater number of skilled workmen were withdrawn from the front to work in munition factories. The deficit was more than covered, too, by the immigration of foreign workers. Every year, since 1922 especially, there is a contingent of 200,000 to 300,000 of whom two-thirds are industrial and one-third agricultural workers. In the mines to-day, something like one-third of the personnel is made up of foreigners.

But if there is no diminution in numbers, there is nevertheless diminution of output. Not only does the foreigner, who is often inexperienced in his particular branch of employment, produce less than the Frenchman of earlier days, but the Frenchman himself produces less than before the War. It is difficult to say whether this is the result of a limited working day or of discontent connected with Socialistic ideas; in either case, the facts are incontrovertible. To take one example only, the quantity of coal produced per head in 1913 was about 660 kilogrammes; in 1925 it is 510 kilogrammes. The diminution is rather less if the calculation is based upon the underground workers who extract the coal, but even in their case the quantity extracted shows a diminution of 5%, the present figure being 568 kilogrammes as against the earlier 595.

Then again, although the technical advance in industry has just been demonstrated, the total of horse-power used in industry, excluding transport, has not risen to any great extent (1911, 3,141,000 H.P.; 1913, 3,539,000 H.P.; 1922, 4,800,000 H.P.).

But Alsace-Lorraine accounts for a large share in the last of these figures and, if we deduct that share, the augmentation for pre-War France remains inconsiderable. It is a different matter with water-power, but that we have already discussed.

Taking the principal industries, we shall see that production has diminished, notwithstanding assertions to the contrary. The following are the figures for silk, which is pre-eminently a French industry:—

	Weight of Cocoons	Weight of Silk Yarns	Value of Silk Piece Goods
	kilos	kilos	francs
1911	5,109,000	411,000,000	414,000,000
1922	2,585,000	209,000,000	2,229,000,000
1923	4,180,000		2,812,000,000

It is evident that production has greatly diminished, the quantity produced being almost halved. The third column figures, taken alone, show on the contrary a septuple augmentation; but on what does it rest? Merely on the fact that the price of raw silk has been multiplied by 8, mounting from 35 fr. a kilo in 1911 to 278 fr. in 1923. We have therefore only to divide this nominal figure of 2,812,000,000 by 8 and we have left 350,000,000 gold fr., that is, a figure smaller than that of 1911.

In the case of sugar refineries the diminution amounts to one-third, as these figures show:—

1911–3	average 671,000,000 kilogrammes
1922–4	average 446,000,000 kilogrammes

Lastly, there is the building industry, that industry which supports so many others—as the French proverb has it: "When building goes well, all goes well." In the War years, it was practically non-existent; in 1924 and 1925 it was coming to life again, but only slowly. In Paris in 1911 there were 1,792 applications for permits to build houses, in 1919 only 173—not even one-tenth! But in 1925 building was resumed on a considerable scale in the capital.

Commerce.—Internal commerce has suffered but little, even during the War; it recovered immediately after the War, gaining a fresh impetus from the rise in prices caused by the depreciation of the franc, and profiting also by the influx of foreigners attracted precisely by that depreciation, which set a premium on their dollars, pounds or florins as the case might be. We have an indication of the fluctuation of the internal commerce in the special tax on sales. This tax brings in round figures 4 milliards of paper francs. As it is established at a fixed rate of 1·30%, it assumes an annual sales figure of 300 milliards—one might safely say, 400 to 500 milliards, *i.e.*, about 120 milliards of gold fr. on the basis of the exchange in 1924, for the declarations are assuredly much below the real figures. But unfortunately this tax did not exist before the War and we have therefore no basis of comparison.

Progress on the railways is, however, easier to assess; there is considerable increase in passenger traffic (35%) but less in goods (13%):—

	Goods	Passengers
1911	184,000,000 tons	511,000,000
1923	208,000,000 tons	689,000,000

In spite of a large increase in gross receipts the railway companies are losing money at the rate of 1,000,000,000 fr. a year. This is because the French charges, though they have been frequently raised, are still (on a gold basis) lower than they are in other countries.

The total length of the railway system has not been increased since the War (40,615 km. in 1911; 41,853 km. in 1923; but of these 1,250 were for Alsace), because the cost of construction is so heavy that even the old tracks have to go unrepaired. The system is, however, practically large enough to meet requirements.

In the mercantile marine, there has been a considerable increase: 1911, 1,413,000 tonnage net; 1913, 1,582,000 tonnage net; 1923, 2,145,000 tonnage net.

Sailing vessels account for only 386,000 of the total tonnage of 2,145,000. The increase since 1913 is therefore more than a third (35·6%). France lost nearly half of her merchant fleet during the War (700,000 net tonnage), but Germany was made to hand over to her an equivalent fleet. Besides, the enormous rise in freight after the War (now a thing of the past) was a great incentive t construction.

As regards international commerce, it is generally held tha the position of France is excellent, better indeed than before the War. This is true, but only in part; the figures need more careful inspection. The following are the statistics of values and quantities:—

	Imports		Exports	
	Value in Millions of Francs	Weight in Millions of Quintals	Value in Millions of Francs	Weight in Millions of Quintals
1912	8,231	397	6,712	203
1913	8,421	442	6,880	221
1924	40,132	565	41,454	294
1925	43,980	474	45,413	302

It will be seen that a comparison of the mean of the years 1912 and 1913 with that of the years 1924 and 1925 shows an enormous increase in values, the imports being more than five times, the exports more than six times larger. At the mean rate of exchange in 1924 and 1925 the import figures would be 12 and 11 milliards of gold fr respectively; the export figures 12·2 and 11·2 milliards respectively. The increase in quantities has been less: 24% on the imports, 40% on exports. It is not to be denied, moreover, that this increase is due to the depreciation of the franc to which we just now attributed the influx of foreign visitors, for this is why, despite the rise of prices in France, actual prices (gold prices), costs of production, and wage are lower in France than in foreign countries.

But the greater increase in exports and the smaller increase in imports has in fact served to turn the trade balance in favour of France. For while in 1911 and 1913 the export figures remained lower by nearly 2 millards of fr. than the average import figures, in 1924 on the contrary they exceeded the import figures by more than 1,300,000,000 (300,000,000 gold francs).

It would seem, therefore, that this favourable balance ought to improve the exchange and bring about a rise in the franc, all the more as the unknown, but considerable figure (probably more than 1 milliard gold fr.) of what are called invisible exports—that is, purchases made by passing visitors—may be added. On the other hand it must be remembered that France has almost entirely lost her credits held abroad in the shape of shares debentures and state loans. Of this wealth, which amounted to 40 or 50 milliard gold fr., a large portion was diverted during the War. Another part, comprising Russian, Austrian and Turkish bonds, has practically melted away; and this magnificent holding of foreign credits cannot unfortunately be restored, or at least can only be restored by secret methods, because an unintelligent fiscal policy prohibits or at least handicaps heavily all kinds of investments abroad. The figures of French commerce include those of the trade done between the mother country and her colonies and these can have no effect on the exchange, the currency being the same on both sides.

It is not our intention to discuss the immense question of protection. We will only say that the War, far from having shaken Protectionism, has fortified it, not only because fiscal necessities call for the imposition of duties, but because fear of blockade leads each nation to think that she ought to be self-sufficing; and if, in those countries which appeared to be converted for good to free trade, such as England, Holland, Denmark and Switzerland, protection is gaining ground, with how much more justification will it become rooted in France? The only hope is that the breath of internationalism, which has created the League of Nations, may also bring into being economic unions between several countries. No serious progress has yet been made with those economic understandings between France and Germany which have many times been proposed on both sides of the Rhine.

SOCIAL ECONOMY

Labour Legislation.—During the War, social questions naturally lost their interest for the public. Even the application of laws for the protection of men and women workers was set aside in the interests of national defence. Workers mobilised in muni-n factories, worked day and night without protest, stimulated th by the incredibly enhanced rate of pay and by the fear of ing sent to the front.

Even when the War was over, the opinion of business men and onomists held that this intensive labour should continue, at ast until the day when the ravages of war should have been paired on the ground that the work of restoring the devas- ted areas was no less urgent than that of national defence. ut the workers were deaf to this appeal; indeed they clamoured r the adoption of the eight-hour day awaited for 20 years, d celebrated in anticipation on each May Day. Parliament red not resist this pressure; and the Act of April 19 1919 estab- hed in principle the eight-hour day, leaving, however, the plication of the law to be adapted to the special conditions individual industries by technical commissions. This was a fficult task, not yet satisfactorily solved. So far the eight-hour y is only applied to some 5,000,000 workers distributed among trades. The trades unions protest violently against these lays; but all business men and a fair number of economists rsistently oppose the Act, in which they see one of the principal ctors in the rise of prices. Its partisans argue that in the case a number of industries productivity has been maintained nd even augmented, notwithstanding the eight-hour day.

Several other laws, on the same lines as this general law, ve been promulgated to secure the weekly holiday for trades- ople by compulsory closing of the shops and to forbid night ork in the bakeries. These laws meet with violent opposition the part of small traders or small bakers who, as they employ paid labour, claim the right to work themselves when and w they please. There is also a law of June 10 1915 ensuring a inimum wage to women working at home. This is in imitation the similar law in England. The insurance benefits against cidents, which had only been granted to industrial workers, ere extended to agricultural labourers by a law of Nov. 15 22. Another law of 1916 concerns economic life; it prohibits illicit speculation," that is, the extravagant raising of prices. his law was, it is true, repealed in 1922, but there is an agita- on for its renewal. The question leads to passionate arguments, r it opposes the idea of equitable prices to the classic law of upply and demand. There are numerous laws by which loans state funds are granted to co-operative societies, concerned ith credits, consumption or production; also to societies of tisans employed in small industry and of agricultural workers r the acquisition of land, special advantage being given to dis- led ex-soldiers. We may also mention the creation of a Na- onal Economic Council composed of members elected by all e great national organisations. It has no legislative powers ut aims at enlightening the Government and preparing draft gislation.

In addition there are numerous important measures under onsideration, vigorously demanded by the *Confédération Géné- le du Travail* and by the Socialist party. The following are e principal demands:—

(*a*) The establishment of a *general social insurance*, covering all e risks in life: illness, old age, disablement, unemployment, aternity, etc. This project likewise arouses lively opposition, on count of the enormous charge entailed on industry and on the ational budget at a time when the financial situation is in itself itical. Neither is it favourably regarded by the Mutual Insurance ocieties, corresponding to English Friendly Societies, who depend the voluntary contributions of their members and see themselves danger of being eliminated by a compulsory insurance scheme. evertheless, it is certain that the bill will be passed, in a more or ss modified form, for the Radical Socialist party has declared its tention to side with the Socialist party in supporting it.

(*b*) The establishment of a *contrôle ouvrier* which would authorise e workers—or rather the trades unions—in every factory to inter- ne in all questions of labour organisation, such as the workshop gulations, engagement, dismissals, discipline and so on.

(*c*) The workers' right to claim a certain number of days as olidays: this would give legal sanction to a custom which is becom- g general to-day.

(*d*) The right to receive a minimum wage, increased by allowances roportionate to the number of children. Here again it is a case of gal sanction for a custom of family allowances which, though of cent introduction, is already in use in many establishments. But these allowances are at present paid actually by the employers, and the trades unions will not accept this, seeing in it a means of binding the worker on the pretext of assisting him. They claim family allowances, but on a compulsory basis.

The Social Movement.—As long as the War lasted we had, if not social peace, at least a truce from social strife as from political strife. The middle class and the working class had fraternised in the same trenches. But this truce did not last. The working classes returned from the War disappointed and irritated. They had been laden with laurels for saving their country, promised a new world, and when they had to go into harness again, life seemed harder and the wage system more intolerable than ever. The rise in prices, due to a factor of which for years the public remained ignorant, viz.: depreciation of the currency, increased that irritation. Undoubtedly a rise in wages followed the rise in prices; in the first years of the War it anticipated it indeed, but after the War, the advance in wages fell behind the advance in prices, and adjustment was frequently obtained only through fighting and strikes. The index number of wages which had (almost) caught up with the index number of prices, again lagged behind on account of the fall in the value of the franc at the end of 1925.

The two columns below show the index numbers of retail prices and those of wages at corresponding dates. The parallelism of the two ascending lines would be still clearer if shown in a graph. It should be remembered, however, that index numbers of wages are far more difficult to determine than those of prices. Instead of taking more or less arbitrary averages, we have chosen to take wages in a single industry, that for which the most definite statistics are obtainable, namely the coal-mining industry (taking underground and surface workers together) as indicative of the wage movement in general.

	1914	1920	1921	1924	1925
Retail Prices . .	100	390	352	401	435
Wages . .	100	360	349	423	437

The same parallel movement is found in the salaries of minor employees and officials, but not at all in the case of higher officials whose salaries have often not even been doubled.

It must be admitted that when the worker does obtain wages proportionate to the rise in prices, he is not satisfied, for he does not see why, with his wages quadrupled, he cannot satisfy his requirements better than before the War. He feels that he is being duped and it irritates him. Then, too, the worker's requirements—particularly those of the agricultural worker—are much greater since the War. This is due to the lavish distribution of meat, coffee, tobacco and alcohol to the soldiers, the taste for which has survived and the desire for which is stimulated by the spectacle of the scandalous fortunes that are acquired through the rise in prices and through speculation.

The people's saving-banks have had their deposits greatly augmented, but not in proportion to the rise in prices, as the following figures show:—

	National Savings Bank	Municipal or Private Savings Banks	Total
	Fr.	Fr.	Fr.
1913 . . .	1,818,000,000	4,011,000,000	5,829,000,000
1914 . . .	1,904,000,000	3,909,000,000	5,813,000,000
1924 . . .	3,306,000,000	8,814,000,000	12,120,000,000

If we convert the actual total (12 milliards) to pre-War francs on the basis of the mean exchange in 1924 it becomes less than 3 milliard fr., that is, to a figure below that of 1911. The savings-bank deposits are influenced by the degree of confidence inspired by the national credit at any given time. This applies even to the municipal or private banks, for these also put nearly all their deposits into state funds. Among the lower classes confidence is greatly shaken by the fall in value of state bonds.

It might be supposed that, given the discontent prevailing among the working class, trade unionism would show a great increase, and a study of the official statistics appears to confirm that supposition; 1911, 1,029,000 trade unionists; 1925, 1,846,000 trade unionists.

But these figures are of little value because most of the trade unionists figure only on paper, and also, since the Moscow revolution, trade unionism has been disorganised. Actually it is represented by three organisations more or less hostile to each other.

1. The oldest of all (dating from 1895)—the *Confédération Générale du Travail*, the famous C.G.T., whose secretary Jouhaux is well known. Its effective membership rose from 1,000,000 before the War to nearly 2,000,000 in 1920. As the result of an attempted general strike provoked by unemployment, of which the C.G.T. did not approve, although it dare not disavow it, and especially of the withdrawal of the Communists in 1921 which was inspired from Moscow, the number of its members fell to 400,000. It has recovered since then, mainly through the adhesion of intellectual workers and officials (among whom are 110,000 teachers) and is said to have 700,000 members at the present time. Although it was declared illegal by a legal decision, never put into execution, its programme is reformist rather than revolutionary.

2. In consequence of the schism just mentioned, another *Confédération Générale du Travail* was formed which qualified its title by the additional word *unitaire*, a strange term for dissentients. Its programme is that of Moscow: the dictatorship of the proletariat. This organisation is known as the C.G.T.U. It has not succeeded in rallying more than 200,000 to 300,000 members and will probably return before long to the older organisation.

3. Finally there is the *Fédération des syndicats catholiques* which is not much in the public eye, but is said to be growing since the War.

The co-operative movement, more favourably situated, has grown steadily since the War in France, as indeed in all countries, particularly as regards consumers' co-operation. The reason for this lies not only in the rise in prices, which has forced the middle class as well as the working class to seek means of reducing the cost of living; there is also a psychological reason—reaction against the existing economic organisation. The classic laws of political economy are no longer accepted, and there is therefore a sympathetic public for a new doctrine such as this, which claims to replace competition by co-operation, the law of supply and demand by fair prices, production for profit by production for service, thus abolishing the profiteer.

The following figures show the progress that has been made:—

	Number of Societies	Number of Members	Sales Figures
			fr.
1918	3,280	865,000	317,000,000
1922	4,300	2,330,000	1,747,000,000

It will be seen that the increase in the sales is much less than it appears, for in 1922 the franc had already fallen to 0·27; the 1,747,000,000 therefore represent only 576,000,000 of 1913 francs. But the progress of the movement is shown above all in the development of central organisations and in the growing part which co-operatives play in national and international economic life. The importance of the movement received official acknowledgment at the end of the War in 1918 when the Conseil Supérieur de la Coopération was created and its advice asked on all questions of interest not only to co-operatives, but to consumers generally, just as the Conseil Supérieur du Travail is called in to advise on questions which concern workers.

Agricultural co-operative societies for mutual credit, have also been greatly multiplied:—

1911	3,946 societies	185,000 members
1923	5,212 societies	284,000 members

but their development is to a large extent artificial, being due as it is principally to the loans granted by the state (about 600,000,000 (150,000,000 gold fr.) up to date in 1924). These funds are not taken from the budget, but from the immense profits which the state draws from its partnership in the Banque de France.

As to the industrial producers' societies, the oldest and most typical of all co-operation in France, they comprise within a small ring some 500 societies in all with 30,000 members. The most celebrated, and one which has been visited by co-operators from all countries is the *Familistère de Guise*. The friendly societies, which in their day were the elementary schools of social solidarity, are now rather out of date. Their field of activity, hedged in on the one hand by employers' institutions, on the other by the extension of compulsory state insurance, is becoming more and more limited.

POPULATION

The demographical position of France was already bad before the War, and was bound to be aggravated by a war which robbed the country of the flower of its population. In 1911 the population was 39,605,000; in 1921 it was 39,240,000.

Thus the population has diminished in the course of these 10 years, but the diminution is even greater than it seems; for Alsace and Lorraine, which did not figure in the 1911 returns, are included in the census of 1921. Now these provinces account for 1,719,000 inhabitants, and if we deduct these from the figure of 39,209,518 we are left with a population of 37,521,000 for France as it was before the War. There is therefore a diminution of more than 2,000,000 and this diminution is only too easily explained:—(1) by the number of men killed in the War (1,400,000) and (2) by the fall of the birth-rate during the War.

The sudden rise in the number of births immediately after the War—a familiar phenomenon—was succeeded by a quick drop to the pre-War figure. Fortunately, the death-rate has sensibly diminished, with the result that the annual excess of births over deaths is greater than before the War:—

	Births	Deaths	Excess of Births over Deaths
1911–3 (3 years average)	746,000	724,000	22,000
1922–4 (3 years average)	758,000	679,000	79,000

It is clear that even could this natural increase be maintained over a period, it would take 26 years to replace the 2,000,000 dead or the unborn of the War. The state endeavours to stimulate the birth-rate by grants to families in proportion to the number of children. But it is hard to believe that these premiums will cause many children to be born; they are only a means of giving material aid to the parents of large families.

Happily foreign immigration goes far towards restoring the balance, for the number of immigrants is now far greater than the number of births in excess of deaths. The annual number of immigrants, taking the average over the three years 1922, 1923, 1924 is 290,000. We may suppose then that the coming census of 1926 will give France a population of 40,600,000 inhabitants. This places her fifth among the great European powers. But she has also a population—black, yellow and white—of 50,000,000 to 60,000,000 in her colonies.

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(C. G.*)

III. NATIONAL FINANCE

On the eve of the World War the public finances of France were in a relatively poor condition, a circumstance which has influenced the whole evolution of French finance since Aug. 1914, and was due solely to the indifferent way in which the finances had been handled.

The Budgetary Deficit.—For the three years 1908–10 the national budget showed a total deficit of 147,000,000 francs. In 1911, it is true, there was a surplus of 141,000,000 fr., but in the following year the deficit reappeared. Although the accounts of the year 1912 show an apparent surplus of 112,500,000 fr., this was only obtained by including 153,000,000 fr. which were extraordinary resources of the Treasury arising from the "Compte provisionnel." In reality this apparent surplus masked a deficit of 40,500,000 francs. For 1913 the budget showed the following results:—

	fr.
Receipts	5,066,900,000
Expenditure	5,038,100,000
Surplus	28,800,000

But the receipts included 172,000,000 fr. again coming for the "Compte Provisionnel," so that the real deficit on the budget was 143,000,000 francs. When the budget for 1914 was under discussion the deficit was estimated at 800,000,000 francs. In reality these deficits were even larger, as a number of items of expenditure which should have been included were withdrawn from the budget by accounting devices. A bad example had been set by the law of Feb. 17 1898, which instituted the special Treasury account for the improvement of military equipment.

Jan. 1 1914 there were still 173,000,000 fr. of short-term ıds issued in virtue of this law, of which 11,000,000 fell due in 4, 124,000,000 in 1915 and 38,000,000 in 1916. A subsequent of March 30 1912 created the account for the improvement naval equipment and, although annual sums were allotted m the budget for this purpose, the expenditure over the five rs 1912–6 exceeded the allocation by 139,293,000 francs.

These extra-budget expenditures, which had become to some ent both regular and normal, were not the only ones. The lomatic tension at the time of the Agadir incident in 1911 l drawn the attention of the French Govt. to the inadequacy the military equipment of France, and caused it to embark very considerable expenditure without the formal authorisa- n of Parliament. In 1912, 22,000,000 fr. were spent in this y but in 1913, owing to the passing of the three-year military vice law, the figures rose to 300,000,000 fr., and in 1914, 488,- ,000 fr. extra-budget credits were estimated for the army d 128,000,000 for the navy.

The "Compte Provisionnel."—In order to hide, at least in part, deficit, the "Compte Provisionnel" was created by the law Feb. 20 1912. This was a treasury device which enabled any plus to be carried over from one financial year to the next; us violating the fundamental rule of an annual budget. Dur- the first year, in 1912, a sum of 159,000,000 fr. was paid into "Compte Provisionnel," arising from the anticipated repay- ent by the Compagnie des Chemins de Fer de l'Est of advances ide to it by the state as a guarantee of interest. In the follow- year it was credited with 141,000,000 fr., the surplus of the ancial year 1911 and with a further 31,000,000 fr. from non- urring sources. In 1914 it received 112,500,000 fr., the surplus the financial year 1912.

The Reform of the Tax System.—Treasury expedients of this pe, besides being inadequate, did not provide a solution, which is clear could only be found by voting the necessary taxes, as as demanded by M. Poincaré when Minister of Finance in 1906. iere were two obstacles in the way of this solution: firstly, the ual unwillingness of all politicians to impose new burdens their electors—an unwillingness which from 1904 to 1914 evented the French Parliament from voting more than 6,000,000 fr. of new taxes as against additional expenditure of 777,000,000 fr.; secondly, the political battle which raged round e question of reform of direct taxation. After prolonged con- oversy, which dated from the reform proposals of M. Caillaux 1907, the law of March 29 1914 was passed, which provided r the reorganisation of the tax on property not built over and r the increase of the tax on income from securities. But this did t bring in any additional revenue, because at the same time e former tax was lowered by an amount equivalent to the eld of the new taxes on securities. On the eve of the declara- on of War, however, a decisive step towards fiscal reform was ken by the creation of the general income tax. This was a ghtly progressive supplementary tax on incomes levied on at part of the total income in excess of 5,000 francs. This new tax ly came into force in 1915, and therefore could not help to eet the deficit at the moment it was voted.

The Treasury and the Loan of July 1914.—The whole of the rrent and accumulated deficits were covered by an increase of e floating debt, which amounted to about 2,100,000,000 fr. Dec. 31 1913. While the necessity of issuing a loan to fund rt of the floating debt was realised as early as 1913, the measure as delayed by a controversy over the question whether or no e interest on the new rente should be exempt from taxation. nally, in June 1914, a law was passed authorising the issue of loan of 805,000,000 fr. of 3½% redeemable rente subject to xation and issued at 182 fr. for each 7 fr. of rente. The sub- ribers were only required to pay down 20 fr. on allotment of a minal 200 fr. of loan, the balance being payable in three sub- quent instalments. As a result of this mode of subscription e loan was chiefly subscribed by the banks, who hoped later dispose of the shares at a profit to the public. To sum up, e following was the financial situation in July 1914, on the e of the War: a considerable budget deficit; a relatively large floating debt; a loan recently issued and taken up by the banks but not placed with the public and involving a heavy burden on all credit institutions on the declaration of War.

FRENCH FINANCE DURING THE WAR (1914–8)

The Declaration of War and the Credit Crisis.—The outbreak of War brought with it a very grave credit crisis, of which the first manifestation was a panic on the Stock Exchange in the last days of July 1914. The settlement of future transactions was suspended for the time being, and on Sept. 3 the Bourse was closed. Hence the funds advanced to speculators to support their forward transactions were locked up, and ceased to be available for industry and commerce. The banks were forced to rediscount bills with the Bank of France, whose holdings of commercial bills rose from 1,554,000,000 fr. on July 25 to 4,000,000,000 fr. on Aug. 4. The Bank of France raised its discount rate from 3½ % to 6 %, and its rate for advances from 4½ % to 7 %. On July 31 the settlement of all commercial liabilities was postponed, and on Aug. 1 a moratorium was proclaimed for the deposits of the banks except for small sums not exceeding 250 francs. The Bank of France never refused to rediscount bills; therefore it seems questionable whether the moratorium was really unavoidable for the other banks. The crisis, though very acute during the first weeks of the War, was not of long duration. The Bourse was reopened on Sept. 27 for spot transactions, and, with the aid of a loan of 200,000,000 fr. from the Bank of France, it proved possible by Sept. 30 1915 to liquidate all commitments carried over during the moratorium, including the loan of 805,000,000 fr. of July 1914. The commercial moratorium was of longer duration. Most of the bills of exchange, etc., maturity of which had been prolonged were taken up by the Bank of France, whose holdings of these securities reached their maximum of 3,977,000,000 fr. on Dec. 24 1914. Many of these bills were relatively quickly absorbed, and their total fell to 1,938,000,000 fr. by the end of 1915. Owing to this credit crisis it was necessary to wait till the end of 1915 before the first big consolidated loan could be issued.

War Expenditure.—The following table summarises the growth of French expenditure for the War:—

Expenditure (Millions of Francs)

	Military Charges	Public Debt	Civil Services	Recoverable Expenditure	Special Accounts	Total
1914	6,526	1,360	2,005	372	108	10,371
1915	14,712	1,818	2,479	1,914	1,197	22,120
1916	23,853	3,327	2,817	2,947	3,904	36,848
1917	28,662	4,816	4,119	4,081	2,983	44,661
1918	36,120	7,021	5,443	5,952	2,113	56,649
	109,873	18,342	16,863	15,266	10,305	170,649

The item "recoverable expenditure" covers that expenditure for which Germany was rendered liable by the Treaty of Versailles. The item "special accounts" comprises the deficits of the special services of the Treasury which were created during the War, and which include extra-budget expenditure, advances to Allied Governments, cession of material to foreign Governments, feeding of the civilian population, etc.

Taxation.—The budget revenue raised during the War amounted to 26,200 million fr., or about 15 % of the total expenditure. When France is reproached with not having made a more considerable fiscal effort it must be remembered that she was deprived by invasion of about one-fifth of her tax revenue. Mobilisation caused the greater part of her labour to be called up, and withdrew many of the financial officials. Further, it is untrue to say that fresh taxes were not voted during the War; the general income tax was increased on three occasions, in 1916, 1917 and 1918, and carried from 2 % to 20 %; in 1917 the old direct taxes were replaced by the new system of income-tax schedules; taxes on succession, stamp duties and taxes on insurance were increased; finally, in 1916, an extraordinary tax on exceptional War profits was imposed. Additional taxation brought in about 2,800 million fr. during the War, and tax revenue rose from 4,100 million fr. in 1915 to 6,800 million fr. in 1918.

Advances of the Bank of France.—The following table shows the total of advances authorised to be made by the Bank of France and of advances actually given:—

	Total Advances Authorised (000,000 omitted)	Total Advances Made (000,000 omitted)
	fr.	fr.
Dec. 31 1914	6,000	3,900
Dec. 31 1915	9,000	5,000
Dec. 31 1916	9,000	7,400
Dec. 31 1917	15,000	12,500
Dec. 31 1918	21,000	17,150

To this total 3,750 million fr. must be added for loans granted by the French Govt. to foreign governments.

The French Exchange and Foreign Loans.—Prior to Aug. 1915 the French exchange, in spite of a deficit in the balance of trade amounting for eight months to 1,600 million fr., was kept at or very near par, thanks to the falling due of foreign coupons, to the export of small quantities of gold, to the placing of £12,000,000 of Treasury bills on the London market, and to an American advance of $10,000,000. Between April 1915 and April 1917 the total deficit of the French balance of trade rose to 27,000 million francs. This deficit was covered partly by expenditure incurred by the British Expeditionary Force in France, partly by the sale of a portion of the French holdings of foreign securities, but chiefly by British and American credits. France sent gold to London to the value of 2,840 million fr. and obtained credits in exchange to the value of 9,000 million francs. At the same time she procured credits amounting to $650,500,000 from the United States. By these means the depreciation of the franc was kept within reasonable limits. On March 31 1917 the franc was 11 % below par in relation to the dollar, 13·5 % in relation to the Swiss franc, and 21 % in relation to the peseta and the Swedish krone.

In April 1917 the United States entered the War, and from then onwards its financial assistance was very great. Between April 1 1917 and Dec. 31 1918 the French balance of trade showed a deficit of 32,000 million fr. which was mainly covered by credit operations; £290,000,000 were placed at the disposal of France by the British Treasury, and $2,500 million by the American Treasury. Smaller loans were also contracted in other countries, *e.g.*, 100,000,000 gold pesos in Argentina, 350,000,000 pesetas in Spain, 100,000,000 yen in Japan, etc. As a result of this assistance the French exchange at its worst never fell more than 44·7 % below par in relation to the Swedish kroner and 39·1 % in relation to the peseta, while on Dec. 31 1918 the depreciation was not more than 9·5 % and 7 % respectively.

Internal Loans.—The principal medium for the transfer of funds to the Govt. for War purposes was the National Defence Bills devised by M. Ribot and issued in virtue of the decree of Sept. 13 1914. These bills were Treasury securities with a currency of one year, six months, three months and even one month after April 1918. They were repayable at par, and could be discounted at the Bank of France within three months of maturity. They could be crossed like cheques. In fact, they acted as deposits with the Treasury which could very easily be mobilised. In view of their convenience and elasticity they quickly proved a great success, and the Treasury succeeded by this means in mobilising a considerable part of the available funds of the nation for its requirements. The National Defence Bills had, however, one danger—the abnormal expansion of the floating debt. To retard the increase of the floating debt the French Treasury made successive issues of National Defence Bonds with a currency of 10, 6 and 5 years.

Finally, when the credit crisis referred to above had been overcome, the state decided to issue a series of irredeemable loans—the 5 % loan of 1915 (real rate 5·73 %); the 5 % loan of 1916 (real rate 5·71 %); the 4 % loan of 1917 (real rate 5·83 %); and the 4 % loan of 118 (real rate 5·68 %).

Table Showing Loans Raised by France
(In millions of francs)

	1914	1915	1916	1917	1918
Irredeemable Loans (net yield)	..	6,265	5,425	5,174	7,246
Short Term Loans	465	...	..	...	..
National Defence Bills and Bonds	1,858	10,487	12,955	13,054	16,611
Funds deposited at the Treasury	..	...	53	360	436
Total	2,323	16,752	18,433	18,588	24,293

French Finances from 1919 to 1926

At the end of the War France was faced with three very grave financial problems—the liquidation of the War; the reconstruction of the devastated regions; and the reorganisation of her fiscal system on an entirely new basis. The liquidation of the War involved heavy outgoings in respect of unexpired contracts, extraordinary civil expenditure, the progressive liquidation of the special accounts of the Treasury, etc., which were not completed till the end of 1921, and may be estimated at about 36 or 37,000 million francs. The reconstruction of the devastated regions was regulated by the law of April 17 1919. This law, which was voted at a time when everyone believed that Germany would make good the whole of the damage in accordance with the provisions of the Treaty of Versailles, was conceived in a very liberal spirit. It laid down that all those who had suffered loss were entitled to an indemnity fixed by a special *ad hoc* body, and equivalent to the pre-War value of the property. If, further, the victim undertook to reconstruct his destroyed property he had a right to the refund of additional expenses caused by the rise in prices. The total cost of reparation thus calculated is e mated at 82,000 million francs. In addition to this there must added the permanent increase in expenditure resulting from hi prices and salaries and the service of the debt.

The story of the French financial effort since 1918 falls natura into four periods: (1) the year 1919; (2) 1920–1; (3) 1922–Ju 1924; (4) June 1924–Jan. 1926.

1919 and the Period of Inflation.—The events of the year 19 weigh heavily on the financial destiny of France. At the end Dec. 1918 the English pound stood at 29·97 fr. and the dollar 5·45 francs. At the end of Dec. 1919 the pound sterling was valu at 41·48 fr. and the dollar at 11 francs. This fall was due to t persistent deficit in the balance of trade (24,000 million fr. in 191 The deficit was again met in part, as in previous years, by forei credits. But on Jan. 3 1919 the British Treasury announced that would make no further advances to the French Treasury, and Dec. the American Treasury followed suit. Nevertheless, the ext nal debt of France increased in 1919 by about 11,000 million fran The expenditure of the state, swollen by the accompanying inflati amounted to 54,200 million fr. scarcely less than in the last year the War. This total included 15,500 million fr. of "recoveral expenditure," comprising costs of reconstruction and War pensio Budget revenue, on the other hand only amounted to 11,600 milli francs. The Chamber of Deputies elected in 1914 could not make its mind to impose new and heavy taxes on the eve of a new electio As a result the floating debt increased in 12 months by 27,653 milli francs. The Crédit National, created specially for the finance of t devastated regions, raised a loan at the end of 1919 which brought 3,960 million francs. Finally the Treasury borrowed 8,370 milli fr. from the Bank of France—a larger sum than in any year of t War. It was this wholesale inflation which put the seal on the d preciation of the franc.

During the year 1919, which could and should have been the fir year of financial reconstruction, the financial methods of the W were merely perpetuated, under the direction of the Finan Minister, M. Klotz. Financially the War did not finish till the e of 1919. In six years the Treasury had spent 224,000 million f which were raised in the following way:—

	fr.
Taxation	38,000,000,000
Internal Loans	112,000,000,000
Foreign Loans	44,000,000,000
Advances from the Bank of France	30,000,000,000
Total	224,000,000,000

Deflation (1920–1).—During 1920 and 1921, when MM. Françoi Marsal and Doumer were at the Ministry of Finance, there was a effective reaction against the methods of the preceding years. O Jan. 13 1920 the estimates for the current year were laid before th newly elected Chamber. The estimates provided for 17,861 millio fr. of ordinary and 7,568 million fr. of extraordinary expenditur the former was only covered by normal revenue to the extent 9,368 million fr. and the latter to the extent of 3,000 million f yielded by the sale of War stocks. To this budget deficit of 13,00 million fr. must be added the final deficits of the special accounts the Treasury (which in 1920 amounted to 5,092 million fr.) and further 22,000 million fr. of credits for "recoverable expenditure, which after July 1920 appeared under the heading "Special Budg of Recoverable Expenditure," and continued till 1925. In actu fact the expenditure was greater than had been anticipated, an amounted to 58,100 million francs. In June 1920 additional taxe to bring in 7,752 million fr. were voted to balance the ordinar budget, the normal revenue being thereby increased to 20,10 million francs. There still remained, however, a deficit of 38,00 million fr. which was covered by loans. A 5% long-term loan wa issued in Feb. March 1920, and a 6% loan in Oct.–November. Th total subscriptions to these two loans were 43,000 million fr., o which more than 18,000 million fr. were new money, the rest consisting of conversions of former loans or of floating debt. In 1921 th financial situation was further improved. The total expenditur was reduced from 58,100 million fr. in 1920 to 51,000 million fr., an revenue rose to 23,100 million francs. The deficit fell to 28,00 million francs.

The following table summarises the Treasury operations durin these two years:—

I. *Expenditure*
(In millions of francs)

	Military Charges	Debt	Civil Service	Recoverable Expenditure	Special Accounts	Refunds to Bank	Total
1920	7,600	11,700	11,400	22,300	5,100	..	58,100
1921	6,000	11,100	9,900	21,400	2,700	2,100	53,200

II. *Receipts*
(In millions of francs)

	Budget Revenue	Internal Loans	Advances from the Bank of France	Total
1920 . . .	20,100	38,400	500	59,000
1921 . . .	23,100	29,700	..	52,800

In the years 1920 and 1921, despite the very large deficit, the financial situation was easier. It proved possible not merely to stop inflation, but to inaugurate a systematic policy of deflation. The chief author of this courageous policy was M. François Marsal, who was Minister of Finance in 1920, and who in June 1920 carried through he imposition of 8,000 million fr. of new taxation; in addition he consolidated more than 12,000 million fr. of floating debt, and in Dec. made the agreement with the Bank of France by which he state undertook to repay 2,000 million fr. annually. The exchange also benefited by this policy. The dollar, which had risen to 7 francs in 1920, fell to 12·50 francs in June 1921, and even as low as 11 francs in April 1922. Wholesale prices fell more than 40% as compared with the spring of 1920.

The Budget Deficit and the Exchange Crisis of 1924 (Jan. 1922–May 1924).—Throughout 1922 and 1923 the franc depreciated in value, and at the end of 1923 the dollar was worth more than 19 rancs. This was due to several causes, and undoubtedly questions of foreign policy—the discords amongst the Allies on the subject of reparations and the Franco-Belgian occupation of the Ruhr—played heir part. But the basic reason is to be sought above all in the inancial situation of France herself. State expenditure, which, hough slowly decreasing, remained very large, was divided into hree big groups—the general budget, to be met out of taxation; the special budget of "recoverable expenditure" (pensions and interest on reparations debt), which in theory should be met by Germany; and the costs of reconstruction, which quite properly were covered by loans. The results are shown by the following figures:—

	General Budget (in millions of francs)		Special Budget (in millions of francs)	
	1922	1923	1922	1923
Expenditure . . .	24,688	24,163	9,905	10,382
Revenue	23,382	24,202	160	109
Balance	−1,306	+39	−9,745	−10,273

Hence the total budget deficit amounted in 1922 to 11,051 million fr. and in 1923 to 10,234 million francs. These deficits were covered by loan operations, and the state was even able to reduce the total of the advances from the Bank of France from 24,150 million fr. to 23,100 million francs. It was, however, becoming increasingly difficult to raise long-term loans. The Crédit National was alone in being able to place a loan with the public of 5,000 million francs. The rest of the expenditure was covered by an increase in the floating and short term debt. This situation was soon reflected in the movement of the foreign exchanges. There was a violent crisis at the beginning of 1924, and the pound sterling rose from 85 fr. to 117 fr. and the dollar from 19·60 fr. to 27·20 fr. on March 11. This crisis was the result of intensive speculative selling which developed in continental centres such as Vienna, Berlin, Milan, Basle and Amsterdam, and was in a large measure artificial. None the less it revealed how precarious was the financial situation of France. Under the energetic direction of M. Poincaré, the Prime Minister, a great effort was made to retrieve the position. The Govt. asked Parliament to vote 6,000 million fr. of taxes in order to cover the expenditure of the special as well as of the general budget, and it asked for powers to cut down expenditure by 1,000 million fr. by administrative decree. These measures were voted by the end of March 1924. At the same time exchange credits were raised in London and New York, and on April 20 the pound had fallen to 65 fr. and the dollar to 14·80 francs.

The Elections of May 11 1924 and the Return of Inflation.—The new elections resulted in the victory of the parties of the Left, which had refused to vote the last fiscal measures proposed by M. Poincaré. The Socialist party had a good deal of influence in the new Govt., and its revolutionary programme disquieted the propertied classes of the country. The budgetary equilibrium which had only just been restored was again destroyed, for the new Chamber voted 1,700 million fr. of supplementary credits, and suspended the realisation of the 1,000 million fr. of economies adopted by the preceding Chamber. There was thus a deficit of 3,000 million fr. on the budget of 1924. This deficit was enhanced in 1925 by the increase of 1,405 million fr. in War pensions, by the increase of the salaries of officials, and by expenditure in Morocco and Syria. The situation was aggravated by the falling due of quantities of bills and short-term bonds, of which about 8,000 million fr. had to be paid off in 1925. To this figure must be added the deficit in the subscriptions to the National Defence Bills, the amount of which reached 9,000 million francs. To meet these liabilities the Treasury issued, in Nov.–Dec. 1924, 5% Treasury bills at 150 repayable in 10 years (effective rate 9·20%), and in July–Oct. 1925 an irredeemable 4% loan with an exchange guarantee. These two loans brought into the Treasury a nominal sum of 11,000 million fr., but in fact very much less, because the greater part of the subscriptions only represented the consolidation of the floating debt.

It was under these conditions that France returned in 1925 to the *régime* of inflation, for the first time since 1919. In April 1925 the state asked the Bank of France for 4,000 million fr. of new advances, in June for a further 6,000 million fr., in Nov. for 1,500 million fr., and in Dec. 1925 for 6,000 million francs. All these credits were not in fact exhausted. Nevertheless, at the beginning of 1926 the advances from the bank to the state had risen from 22,000 to 36,000 million fr., and the total of notes in circulation from 40,500 to 52,000 million francs. Parallel with this the French exchange continued to fall, and the pound sterling, which was worth 88 fr. in Dec. 1924, exceeded 130 fr. in Dec. 1925. At the beginning of 1926 the position was as follows. The budget, with a total expenditure of 37,200 million fr. (the general budget and the special budget were amalgamated in 1925), shows a deficit of 4,500 million francs. Part of this deficit was covered by 3,000 million fr. of new exceptional revenue voted on Dec. 4 1925. All parties were agreed as to the necessity of creating a sinking fund to consolidate the floating debt. Successive Ministers of Finance, M. Doumer and M. Raoul Péret, proposed new taxes amounting to nearly 5,000 million francs.[1]

The French Debt and the Work of Reconstruction.—To have a sound understanding of the financial situation and its handling since 1918 it is desirable to relate the debt to the effort made for the reconstruction of the devastated regions. The two following tables show—(1) the situation of the French internal debt on April 30 1925; (2) the expenses devoted to the reparation of War damage to Dec. 31 1924.

I. *French Internal Debt*

	Annual Charge	Capital Debt
Perpetual and Long-term Debt	7,451,232,802	155,252,268,681
Short-term **Debt**	2,692,869,140	44,274,769,000
Floating **Debt**	2,762,584,000	86,646,656,500
Total	12,906,685,942	286,173,694,181

II. *Expenses Resulting from Reparation of War Damage*
(In millions of francs)

Damage to Persons	Private Property	Railways, Public Property, and Costs of Administration	Interest paid on Indemnities	Interest on Loans Contracted	Total
36,436	59,283	12,760	2,594	19,000	130,073

In conclusion, 45% of the internal debt of France comes from expenditure for the reparation of War damage, and one-sixth of the French budget was devoted in 1926 to the service of this debt.

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[1] The crisis in the franc was due to a loss of confidence, which showed itself in a reluctance on the part of the public to invest in the floating debt. M. Loucheur, while Minister of Finance in Dec. 1925, obtained a measure imposing a special additional income tax (non-recurrent); and steps were taken to hasten the collection of the ordinary income tax. The "heavy revenue collections" thus obtained were sufficient to meet all needs in the opening months of 1926. The At last, M. Raoul Péret, procured the passage of a budget which balanced at 37½ milliards, with a surplus of 250 millions, additional taxation to the amount of 4¼ milliards being imposed.

But meanwhile the exceptional revenue receipts of Dec. and Jan. could not continue, and a further block of three milliards of maturing bonds had to be met early in May. The exchange began to give way and rose above 140. The outbreak of the general strike in England at the beginning of May was the signal for something like an exchange panic, and after wild fluctuations, in the course of which the exchange reached 176, the French Govt. intervened with support, and brought it back for the moment almost to 140. At the beginning of June M. Péret appointed a committee of French financial experts to make recommendations for the future. (Ed. *E.B.*)

IV. DEFENCE

National defence in France underwent some material modifications after the World War. The reforms were based on the somewhat conflicting demands of national economy and of national security against aggression. In practice they resolved themselves as follows:—

(1) army and navy, in time of peace, to be limited strictly to the scale necessary for covering national mobilisation in case of aggression and allowing that mobilisation to be carried out at a speed compatible with that of the said aggression; the colonies and the communications with overseas possessions to be safeguarded; and

(2) the general organisation of the nation in war time to be minutely worked out.

Conscription.—Compulsory personal service was therefore maintained, but the duration was reduced to 18 months (Act of April 1 1923). The following tables show the effectives and the budgets of 1925 compared with those of the preceding years:—

	Aug. 1 1914 Pre-War	Aug. 15 1914 after Mobilisation	Nov. 1918 Armistice	1925
Army				
Effectives (French and Colonial)	947,000	3,850,000	4,200,000	695,000
Inf. Divs	44	87	112	32
Cav. Divs	10	10	6	5
Field Guns	2,800	4,044	5,000	1,350
Heavy Guns	250	308	5,100	1,000
Air Force				
Number of Aeroplanes	120	120	4,700	1,850
Navy				
Effectives	69,000	100,000	174,000	56,000
Battleships	26	26	10	9
Cruisers	31	31	15	18
Aeroplane-carriers	..	..	..	1
Destroyers	..	..	2	8
Torpedo-boats	83	83	51	63
Submarines	72	72	33	66

National Defence budgets (including gendarmerie, military, naval and colonial aviation, and certain expenses connected with public works undertaken in the interests of the army):—

In Millions of Gold Francs

Year	Army	Navy	Colonies	Total
1914	1,720	513	92	2,325
1925	955	308	50	1,313

General Organisation of National Defence.—The lessons of the War showed the necessity of a general organisation of the nation in readiness for war-time, the object of which should be to prepare in advance the mobilisation of civil and military forces alike to organise the nation's entire economic and industrial resources, etc. A bill to this effect was laid before Parliament on July 7 1925.

The general direction of a war devolves upon the Government. To assist the Govt. in their task, consultative and research bodies are placed at their disposal in war-time and also, for the purpose of advising upon the necessary precautions to be taken in peacetime. These are: the *Conseil Supérieur de la Défense Nationale,* composed of the appropriate ministers; the *Commission d'Études* of that council (composed of the highest functionaries of the various ministries), and the General Permanent Secretariat. The actual conduct of operations remains the exclusive province of the commanders-in-chief of the military and naval forces.

The Army

The army proper is formed by calling up the reserves. The permanent army is but the nucleus; its functions are: to train contingents as they are called up; to protect overseas possessions; to prepare for mobilisation and, in case of aggression, to protect the frontier while mobilisation is proceeding.

The recruiting Act of April 1 1923 provides for:—

(1) an active army, formed by:—

the calling-up of recruits, all young men who have reached the age of 20 being obliged to serve for 18 months; half of the contingent is called up in May, half in November;

voluntary enlistment (engagements, re-engagements, commissions) by which lower professional cadres, necessary both in peace and in war, are formed; and

auxiliary or reserve cadres.

(2) a first reinforcement (*disponibilité*) in which the citizen is reckoned for a period of two years following his term of active service; in case of need he is liable to be recalled;

(3) a first reserve, for use also on active service in which the citizen serves 16½ years, and a second reserve to which he is posted for 8 years; this reserve is designed for local services and work in industrial mobilisation.

The duration of service is reduced to one year for eldest sons of large families (minimum of 5 children). Special advantages are accorded to prospective reserve officers who have followed the military training course with success.

The 695,000 men of the fighting troops (France, countries of occupation, colonies) which constitute the army are thus distributed:—

French (1½ contingents of conscripts and professional soldiers)	457,000
Foreign Legion	14,000
North-African natives	97,000
Native colonials	62,000
Irregulars and auxiliaries	16,000
Gendarmerie and Republican Guard	29,000
	695,000

Out of this total of 695,000 men, only 395,000 are serving in France; the remainder—some 300,000 men—are engaged on the Rhine, in Algeria, Morocco, the Levant and the various colonies.

Organisation of the Army.—The Act dealing with the constitution of cadres and strengths which had passed the Chamber of Deputies but has not, at the end of 1925, been discussed by the Senate, distributed these effectives between the various arms and services. Pending the final passing of the Act, the Minister of War was authorised to proceed with re-groupings by which the army was reconstituted as follows:—

Large Units, 32 divisions of infantry of which 5 are on the Rhine; 5 divisions of cavalry of which 1 is on the Rhine.

Redistribution of Troops.—The following table gives the proportionate distribution between the various arms on mobilisation in 1914, at the Armistice, and in the army of today:—

Arms and Services	Aug. 1 1914	Nov. 1918	1925
	%	%	%
Infantry	65·6	43·7	53·8
Tanks	·0	0·6	1·8
Cavalry	9·0	3·5	8·0
Artillery	16·1	27·4	16·6
Engineers	3·0	8·0	5·2
Air Force	0·3	3·3	4·1
Transport	1·3	7·7	3·4
Administrative Services	2·3	5·2	3·0
Gendarmerie	2·4	0·6	4·1

This table shows the extent to which those arms employing principally mechanical weapons (tanks, artillery) have developed.

In accordance with the experience gained from the War, the army is being organised and trained on the basis of an increase in all arms of fire-power.

The Navy

During the War.—While hostilities were proceeding, the French Navy underwent a considerable reduction, both on account of War losses and of the obligation under which it stood to devote the greater number of its arsenals and private workshops to satisfying the needs of the army.

The tonnage of 1914 and that of 1919 are as follows: 1914, 816,000; 1919, 590,000.

The falling-off is therefore considerable and it becomes more striking if the heavy wear of the ships still in service—particularly the small vessels—be taken into account.

ince the War.—From the end of the War up to 1921 the French ry has had to pay for a great many special expenses of its , inevitably arising out of War-time necessities. Thus bur- ed, its budget rose to 1,962,000,000 gold francs in 1919 as nst 515,000,000 in 1914 and a yearly average of 813,000,000 ng the War. As it was impossible to put any further strain he exchequer, the reconstruction of the fleet, which continued lecline in tonnage (falling, in 1924, to 394,000), had to be yed. At Washington, in 1922, France consented to the pro- d reductions, according to which the total tonnage of her tal ships might not exceed 175,000 tons.

'he building of battleships was postponed. With a view to ecting the country's vital communications, particularly in Mediterranean and the North Atlantic, the French Navy ied its attention to the use of submarines, aeroplanes and t vessels with protected bases. Light cruisers and submarines e laid down as follows: in 1922, 3 cruisers of 8,000 tons, 6 royers, 12 torpedo-boats, 12 submarines, 1 aeroplane-carrier se units are nearly ready); in 1923, 9 submarines; in 1924, 2 sers of 10,000 tons, 6 torpedo-boats, 2 submarines; 1 cruiser o,000 tons, 3 destroyers, 4 torpedo-boats, 9 submarines (of ch two are mine-layers), 1 surface mine-layer and 1 aircraft sport are to be proceeded with at once. This represents an emely modest effort; the naval budget has not exceeded a l of 330,000,000 gold francs on an average, from 1921 925.

'he Future.—The schemes for the future of the French Navy e been dealt with in three bills which are still (1926) under sideration. The high-seas fleet, exclusive of special vessels, ld consist of: battleships up to 175,000 tonnage, aeroplane- rying vessels up to 60,000 tonnage, in conformity with the shington Treaty; in addition, 360,000 tons of light vessels isers, destroyers and torpedo-boats) and 90,000 tons of sub- rines. Age-limit: battleships and aeroplane-carriers 20 years; isers 17 years; destroyers and torpedo-boats 15 years; sub- rines 12 years. The naval air force would be composed of 50 hts of aeroplanes, of which 35 are fully equipped and aircraft various kinds (dirigibles, captive balloons, etc.) varying in nber.

'or coast defence there would be coast flotillas of submarines, st patrols, mine-sweepers, mine-layers, etc.; artillery, obstacles, ection systems, aeroplane service and, finally, troops and er means, controlled by the War Office, which will be placed the disposal of the navy. Although no term has been fixed the execution of this programme, the Dept. of Marine intends nave it completed within 20 years.

THE AIR FORCE

There is in France no organisation analogous to the British Ministry. A certain amount of centralisation has been ieved however as regards technical research, which is under authority of the Under-Secretary of State, who is also respon- le for preparing the mobilisation of aircraft industries.

A comparison of the numbers in 1914 and in 1918 shows the effort that was made in the War. During the 4 years 40,000 new aeroplanes and 92,000 engines were constructed.

Evolution of the Air Force, 1914–25

eronautic Section	Aug. 1 1914		Nov. 1918		1925			
	Army	Navy	Army	Navy	Army	Navy	Colonies	Civil Aviation
viation								
No. of flights	23	0	322	0	130	11	3	
No. of machines	120	8	3,430	1,264	1,500	389	30	700[1]
alloon Service								
o. of captive balloons	12	0	77	190	18	21	..	..
o. of dirigibles	8	0	0	37	..	13	..	..

200 are for training purposes.

The increase in the total of the four budgets (military, naval, colonial and civil), which rises from 367,000,000 fr. in 1920 to 791,000,000 fr. in 1925, may be put down to the necessity for replacing *matériel* (some of which dates back to the War) and above all to the expenses connected with building and preparation of the aerodromes and landing grounds. This budget would, if expressed in pounds (at 120 francs) amount to £6,600,000.

Organisation of Military Air Force.—The 130 squadrons of the military air force are distributed in 14 regiments and five autonomous groups. Two regiments of the balloon service deal with captive balloons. Nine of those regiments are formed in division and constitute the two air divisions.

Organisation of the Naval Air Force.—The naval air force, a War creation, is undergoing reorganisation. Its final status is defined by a bill which was still under consideration at the end of 1925. The 11 squadrons of the naval air force were at that time distributed between different centres (Cherbourg, Brest, Saint-Raphaël, etc.).

France was spending, in 1925, 44%[1] less on national defence than in 1914. The national defence budget, in which certain expenses figure, which in many countries fall upon budgets other than those of the army and navy, represented in 1914 44% of the general budget; in 1925 it represented only 17% of it. In her deep desire for peace France reduced her military expenses to the utmost extent and only hopes to effect still greater reductions. In that spirit she has made every effort to assure safety by putting into practice the pact of the League of Nations and furthering the development of arbitration and ideas of international solidarity. See *Armaments Year Book* (League of Nations, 1926) where the references to decrees on national defence are given. (B. S.)

V. INVADED REGIONS

In 1917 and 1918 when French ministers visited the Front they often wondered if it would ever prove possible to repair the dreadful ruin accumulated under their eyes. At Lens, for instance, the magnitude of the disaster was overwhelming. Not a house standing, 101 great pithead super-structures overthrown, their iron carcasses lying twisted on the ground, everywhere a terrible confusion of bricks, tiles, remnants of furniture—in one word, chaos. In the coal-mines, all the galleries flooded, the apparatus removed, the efforts of three generations completely annihilated. To-day there is hardly a trace of ruin, Lens is a city of wide streets and comfortable houses, the new arrangements of its mines are excellent; and the production of coal is equal to and even greater than that before the War. How could all this be brought about?

Extent of the Losses.—First, a few figures. When the damage was catalogued at the time of the Armistice, it was discovered that 289,000 houses had been completely destroyed and over 400,000 more or less damaged. Nearly 2,000,000 hectares of land had to be restored for cultivation. More than 6,000 factories had been destroyed or emptied of their machinery. The monetary value of these losses was about £1½ milliard; to reconstruct them (assuming the work to cost 3 times as much as before the War) 110 milliard gold francs would be required. Immediately after hostilities had ceased, M. Clemenceau abolished the Ministry of Munitions, replacing it by the Ministry of Reconstruction, of which the present writer was in charge. The new ministry first dealt as quickly as possible with those factories where the buildings and part of the machinery still remained and hastened to equip them to employ the industrial population. There were 500,000 unemployed; a year later unemployment had practically disappeared; the workmen had restored the factories, which had been hurriedly got going and were clearing away ruins and beginning reconstruction. The industrial districts thus received the first attention. This is one of the matters for which the Government has been most severely criticised; but it was the logical course, and as events showed, the right one.

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[1] This figure is based on the changed value of the franc.

In restoring the soil itself, in rebuilding the farms and enabling those fertile lands to resume the production of the wheat urgently required by the rest of France, the inhabitants themselves assisted in an amazing degree. The French peasant is deeply attached to the soil; he returned to it as soon as he could. He found it covered with shells, with strands of barbed wire, with block-houses. He found his home and farm buildings in ruins. Not for a moment did he lose heart. He set to work at once, surrounded by difficulties which would have daunted many a brave heart, even by grave dangers; so many unexploded shells remained that between 1919–24 more than one person a day, on an average, was killed in unearthing them. Nothing could stop the French peasant. The state helped by granting him little by little, as needed, financial assistance—the sums necessary to rebuild his dwelling and his farm buildings—and found him labour to clear his fields.

A year later, some 90% of the Département du Nord had been restored to cultivation, and in 1923 France's production of wheat had reached its pre-War figures, and of sugar very nearly so. The industrialists too, faced with empty or ruined factories, went bravely to work; but the farmers whose efforts saved France were even more admirable. To-day at least 90% of the farms have been reconstructed. Everywhere, thanks to the good harvests of recent years, prosperity has returned, and the zones where the havoc has so far defied restoration are growing daily smaller, and we may hope that, with rare exceptions, they will disappear altogether. Some reservation is necessary: the surroundings of Verdun are a frightful example of what is meant. As Minister of the Liberated Regions the present writer had to sign the act recording the final disappearance off the map of France of 11 villages of which nothing, hardly a heap of stones, remained. On every square metre there were so many fragments of shells that the whole of this territory might really have been exploited as an iron-mine, but it was useless to think of putting it under the plough. The signature of the act consecrated to death beyond repeal these villages where so many generations had lived, in whose defence so many good men had died.

Building Reconstruction.—The rebuilding of dwellings was a much longer task. Dr. Rathenau, with whom the reparations question was discussed at Wiesbaden, was surprised that the Ministry had not decided to rebuild the towns, not on the old sites, but near by, on virgin fields, constructing regular rows of houses and laying out the plans in the American style. Dr. Rathenau displayed ignorance of the French spirit in supposing that Frenchmen, with their profound individualism, could have adapted themselves to such a system. Each man has chosen the site of his house, he wishes to keep it, to rebuild it in its old place, different in size and shape from that of his neighbours, on his own plan, in his own style. To-day the city of Rheims, which was so completely ruined, is almost entirely restored. It has retained the mark of its old architecture, the houses are on the same spots as before. Some districts, however, of the devastated regions wanted to follow the ideas explained by Dr. Rathenau. The experiment was unsuccessful. Thus there are some large villages with roads which are too straight and too broad, which have not re-assumed their pre-War life. It is a grievous error to attempt to do violence to the psychology of a nation. The reconstruction of landed property is far advanced. In each village so-called "reconstruction co-operative societies" have been established, through which a few devoted men have set themselves to restore the homes of their fellow-citizens. They have lacked means, the parsimony of the last three annual budgets has complicated their task, but little by little, assisted by local loans, their efforts have made headway.

Finance of Reconstruction.—How has all this been paid for? From 1919–22 by loans from the state; but after 1922, financial difficulties grew more pressing and the sufferers from the devastation have been paid to a large extent by state loans redeemable in 10 years, which they have had to get taken up as they could; this has resulted in a serious fall of these bonds. To-day, since the Dawes plan has come into force, it has been possible to spread out the effort over three or four years, and should be about completed by the end of 1928. In 1926 a s equal to about £100,000,000 still remained to be spent. T sum was not large in comparison with what had been spent to date, but it represented a great effort.

Such are the broad outlines of the work of reconstruction the liberated districts. It was successful, thanks above all the united effort of French citizens and thanks to the fact th for several years the whole of France consented to burden h self in order to pay unassisted for the restoration of her rui for it must be admitted with regret—except in a few individ instances, France and France alone has had to shoulder expenditure. The writer does not forget the assistance grant by various British municipalities. In many French villages a towns one may see public rooms or fountains paid for by generosity of British towns. (L. L.)

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VI. THE COLONIAL EMPIRE

Description.—The French colonial domain appears at fi sight extremely various and scattered, since there is no contin in which France cannot count her colonies. In fact, it consi of two very different parts. First the remains of the old coloni Saint Pierre and Miquelon, on the Canadian coast; Martiniq and Gaudeloupe in the West Indies, near New Orleans; Guia in South America; five enclaves in British East India, Pon cherry being the most important; Réunion I. in the Indian Oce near Mauritius, a relic of the match between Bougainville a Cook; a series of islands, of which the most important are N Caledonia, Tahiti and the New Hebrides, held in common wi Great Britain. These are, if one likes to call them so, the arist cratic colonies. The American and Indian colonies and Réuni have their deputies and senators in the French Parliame They are united with France by old bonds of affection. Th have given her scholars, administrators and great men of l ters. In certain cases they derive special importance from th situation on the great international routes, or their great r sources. But, above all, their value for France is sentiment and historic; they are the outline of the first empire lost in t 18th century. The colonies of the 19th century on the oth hand, form a homogeneous system. They are divided into t groups, African and Asiatic, both closely concentrated—wi the exception in Africa of Jibuti and Madagascar.

The following table shows the respective importance of t three groups:—

Colony	Area in sq. km.	Population census 1920 1
I. America and Australasia (group of old colonies)	129,491	652,300
II. African group	11,516,224	35,919,405
III. Asiatic group	879,355	22,250,333
	12,525,070	58,822,038
France (for comparison)	550,985	40,000,000

The African group consists of Northern Africa (Alger Tunisia, Morocco); French West Africa (Senegal, Guinea, t Ivory Coast, Dahomey, Niger); French Central Africa, whi stretches from the Congo to Lake Chad and the Nile Basi Madagascar, the third largest island in the world; and the Fren Somali Coast, at the mouth of the Red Sea. In addition, Fran has mandates in Togo and Cameroons. This group, by i proximity, seems specially destined to act as an extension of t mother-country. It is naturally commanded by Northe Africa, which is only 750 km. distant from France, 20 hour journey by sea, or six hours by air. From Northern Africa t railroads and aerial routes spread out towards the tropical a equatorial territories; it links the mother-country and the oth African colonies. Algeria, lying as it does between Morocco a Tunisia, is the pivot of this system, and is rightly consider he key position, whether judged by the number of French hich inhabit it (600,000 out of 800,000 Europeans, against ,000,000 natives) or by the loyalty of its population and their eady acceptance of French culture. Owing to its Mediterranean ituation, Syria, administered by France under mandate, may also be included in this group, although lying in Asia. The Governor of Algeria and the Residents-General in Morocco and Tunisia meet every year in conference in one of the hree capitals in Northern Africa alternately. In 1926, for the first time, the Governor of French West Africa attended this meeting.

The Asiatic group consists of French Indo-China, or the Indo-Chinese Union, including six colonies or protectorates—Cochin-China, Cambodia, Annam, Tongking, Laos and the territory of Kwangchow. This union was organised in 1887. A series of reaties with Siam (the most recent dated 1926) and with China have now regularised its relations with all its neighbours. Indo-China has become the base of French policy in the Far East.

Administration.—The administrative ties which unite these French colonies with the mother-country are very various. There is no central colonial body in Paris. The Conseil Supérieur des Colonies, which consists of a number of persons distinguished in politics, commerce and the arts who are competent o speak on colonial affairs, is merely an advisory body. Plans for uniting under the control of a single body all the different colonies of North Africa, or of Indo-China and the Australasian possessions, have not been realised. Algeria is administered by the Ministry of the Interior; it is divided into departments administered by prefects and sub-prefects appointed by this Ministry and belonging to the home civil service. The protectorates of Tunisia and Morocco and the mandated territory of Syria are under the Ministry of Foreign Affairs, which appoints to them sub-agents from the diplomatic or consular lists, or from a service special to these three countries. The Colonial Ministry is in charge of the other colonies, and the École Coloniale in Paris furnishes their administrators and colonial governors. In fact, even the countries directly subordinate to the Colonial Ministry enjoy a degree of autonomy, and the governors have very full discretionary powers. The reason for this liberal system of administration lies as much in the conditions under which the French colonial empire grew up as in the French temperament. At the moment when explorers or soldiers conquered these domains for France, France did not need them. She had no surplus population requiring an outlet. Agriculturally, she was self-sufficing; industrially, her commerce, which was principally one of luxury articles, found its market in the more highly developed countries. The colonies were therefore subjected to no exploitation, and were often administered by soldiers—that is to say, by the class of ruler who is least interested in economic production. The relations between the administration and the natives were consequently marked by a particularly liberal character. Moreover, the colonies were granted financial autonomy as early as possible. The French colonial estimates have always been meagre—in 1925 only 270,000,000 francs. The financial administration of the colonies did not, therefore, concern French political life, which is essentially parliamentary. Nor was there any rivalry between the careers of the Frenchman—as soldier, official or great landowner or merchant—and the native. Things were different, for example, in Tunis, where the Italian and the native compete with one another. The colonial governors, apt, like all Frenchmen, to apply parliamentary formulae to life, and often themselves parliamentarians, were anxious to develop local councils and local assemblies, even with the power of voting taxes, in the countries which they were charged to administer. Finally, the Frenchman has little race or colour prejudice. All this contributes to give French colonisation the aspect of a friendly collaboration not dissimilar from the method of mandates.

French emigration is not due to the need for economic expansion or to divert a surplus population, but to the need of moral expansion. Missionaries, professors and soldiers form the largest contingent of emigrants. The colonies replace for them fields of action closed to them in Europe or America. Whether in India, China, Madagascar, Tunisia or Morocco, even in the Sudan, the effort of the French administrator has awakened national sentiment in these countries, after putting an end to the civil wars with which they were all torn. Certain races—for example, those of Cambodia—have been saved from a fatal torpor. Archaeologists, painters, and men of letters constitute a relatively high proportion of the French element, and in Indo-China and Morocco, for example, the artistic and intellectual regeneration of the colonised people cannot but strengthen their vitality. The colonial exhibition at Marseilles in 1922 illustrated this method. These considerations explain why France has sometimes been reproached with not having thoroughly exploited her colonial possessions.

Resources in Men and Wealth.—The War led French statesmen to take account of colonial resources in men and material wealth. First, it supported the theories of those who considered that France's military expenses might be reduced by enlisting native troops. The colonies contributed 545,000 combatant soldiers to the French Army. The strength (about 180,000) of the colonial army in 1925 rested mainly on native recruiting. The colonies are also a reservoir for the manual labour in which France is deficient. Many of the 183,928 colonial workmen brought to France during the War remained, and this immigration continues.

The various plans for exploiting colonial resources, the most complete being that put forward in the Chamber of Deputies by M. Albert Sarraut in 1921, have been inspired by a desire to lessen the dependence by France on foreign countries for raw materials. The French colonies are especially rich in minerals (phosphates, iron, coal). The production of phosphates in North Africa reached 2,600,000 tons in 1922; that of iron ore 1,800,000; Indo-China supplied Southern China with coal (900,000 tons); New Caledonia is the greatest producer of nickel after Canada, and her deposits of chrome are second only to those of Rhodesia. As regards agriculture, the production of cereals in Northern Africa in 1922 was 19,400,000 quintals of wheat, 19,200,000 quintals of barley; the production of wine was 10,900,000 hectolitres. There are 28,000,000 olive trees in Algeria and Tunisia alone; the exportation of fruits exceeded 300,000 quintals in 1922; that of early vegetables, 400,000 quintals. The live stock includes 17,650,000 sheep and 475,000 horses. French West Africa exported 153,000,000 fr. worth of ground nuts in 1922. Indo-China is the second exporting country in the world in rice—1,440,000 tons in 1922. The live stock comprises 4,000,000 oxen and buffaloes. The total area of colonial forests is 600,000,000 hectares, that is, about twice the total surface of France.

The private capital invested by France in colonial enterprises, exclusive of banks and railways, and of the milliards of francs spent by the state to pacify, organise and protect the colonies, exceeded 2,000 million fr. in 1924. The trade which France did with her colonies was 9,366 million fr. out of a total trade of 81,600 million francs. The public debt of the colonies is only three milliards. The colonies contribute a share to the central budget; in 1925 they paid 33,000,000 fr. as a contribution to military expenses, upkeep of the Ecole Coloniale, the Institute of Colonial Agriculture, the general agency of the colonies and the colonial air service. This share is very small, but shows the assistance which they can render France.

Such are the general characteristics of this colonial domain, the possession of which has had its effect on the traditional aspect of French policy. The French colonies have 15,086 km. of railways, 49,968 km. of roads, which are excellent in Northern Africa and Indo-China; and, although the Empire has not yet found its Kipling, French imagination has succumbed to that rosary of names, so exotically appealing to the tourists, Tunis, Algeria, Fez, Marrakesh, Damas, Angkor or Timgad, which envelop with a magnetic circle the central core of France. The French mercantile marine has found its true base in the colonies. The quickest routes between South America and Europe, will eventually lie across French Africa. This is mainly due to the railway between Algeria and Dakar, which has already been traced, and the air routes or motor roads already in use. French statesmen, thanks to this fact and also to the fact that many of them have already occupied high posts as governors in Africa or Asia, are gradually recovering the habit of thinking not merely nationally but geographically, and while the first place in their watchful eye is always the security of France, they have been led to play a practical part in world problems, where their predecessors confined themselves to theory.

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VII. RAILWAYS

In 1911 the French railways consisted of five great private-owned and one state-owned line, with a combined mileage open to public traffic of 40,615 km. and a capital value of about 17 milliard francs. After the War acquisition of the Alsace-Lorraine lines, with mileage of 2,255 km., brought the total mileage up to 42,870 km., while owing to this increase and the large amount of reconstruction effected after the War on the Nord and Est lines, their total capital value rose to about 39 milliard francs.

In 1911 the French railways carried 511,000,000 passengers, in 1924, 776,000,000; the mean annual increase has risen from 3 % to 6 %. In 1911 184,000,000 tons were carried by goods train; in 1924, 265,000,000, an increase of 37 % in three years.

The commercial development of the railways was arrested by the War; not so their technical activity. Between 1914–8 they bore 41 % more traffic than in peace time—the lines near the front, 200 %. 15,400 trains were used during the period of mobilisation and concentration; between Sept. 1914 and Nov. 1918 about 100,000 troop trains carried some 6,000,000 men; besides returning empties, rations trains, munitions trains, leave trains, ambulances and a daily average of 200 trains carrying engineering material. Between March 21 and Nov. 11 1918, when traffic was densest, 50,000 military trains of all sorts were moved; counting returning empties, the traffic on the Nord system reached about 900 trains in 24 hours.

Most of this traffic fell on those parts of the Nord and Est lines not in enemy occupation; here important works had to be carried out during the campaigns. In Sept. 1914 bridges, etc., destroyed during the retreat from Belgium were reconstructed and lines and stations adapted to permit the extension of the Allied front to the Belgian coast, an operation which required 2,169 trains for the movement of troops alone. During the subsequent period of stationary warfare, single lines were doubled, railheads constructed, engineers and munitions dumps formed, whole new lines built; 13,500 km. of line were built, nearly 6,000 being behind the British front, and 28,000,000 cu. m. of embankment erected. These works, serving purely military purposes, were generally dismantled after the War.

The German Army in its retreat destroyed 2,047 km. of line (about half being double line), 600 stations, 1,100 bridges, 24 tunnels and all workshops and watering stations in its area. When these lines were reconstructed, the opportunity was seized to enlarge and improve the stations, lay the permanent way more rationally and introduce the latest electric, pneumatic or hydraulic points and signals. Especial attention was paid to the great goods yards in view of their importance for the reconstruction of the devastated areas. Lille-Délivrance station, for example, which dominates the goods traffic of Northern France, was constructed to clear 4,500 trucks daily. Its tracks are so arranged that it functions by the force of gravity, and requires only a small staff; it acts like a filter, all traffic, being passed in the same direction.

Locomotives and rolling-stock have increased in numbers and power, especially on the Nord and Est systems. There were 20,383 locomotives in 1924, compared with 13,434 in 1911; the load of the fastest passenger trains rose from 400 tons to 550 tons. Between 1920–4 the number of passenger carriages increased by 11 %, of goods trucks by 20 %; they are also much stronger and of increased capacity. The new all-steel one-piece carriages on the Nord line deserve especial mention. Examples of the carriages used on other lines were shown at the Exhibition of Modern Decorative Arts in 1925. Most goods trucks before the War carried a maximum load of 10 tons, few of over 20 tons. In 1925, of 525,000 goods trucks, 254,500 carried 10–20 tons; 227,000, 20–30 tons; 41,000, 30–40 tons; 2,500, 40 tons or over. The average carrying capacity of trains, especially on the main lines, has greatly increased. Many take 80 trucks, and 1,500 tons.

In the devastated areas, the railways were reconstructed earlier than the dwellings; so that the companies had to provide accommodation for their workmen on a large scale. The Nord built 11,141 houses of modern types, sometimes constructing regular towns, besides providing their employees with 6,300 other dwellings.

The problem of electrification only became urgent after the War when the altered economic conditions compelled France to utilise all her natural resources. A scheme was drawn up involving an expenditure of five milliard francs on the construction of power stations and the electrification of about 9,000 km., including 3,350 km., or nearly half, of the Paris-Orléans line; 2,300 km., or a quarter, of the P.L.M. line, and 3,200, or over three-quarters, of the Midi line.

An agreement between the state and the railway companies, made on June 28 1921, established a close financial and technical connection between the state lines of the Etat and Alsace-Lorraine and the group of the five great private companies. After satisfaction of the claims of shareholders and personnel, all proceeds are pooled; a deficit on one line is thus compensated by a surplus on another, the tariffs are fixed high enough to avoid a general deficit. Tariffs are uniform and common throughout France; rolling-stock is pooled; important purchases, as those of rails, sleepers, etc., are made in common; common are all arrangements regarding pay, promotion, employment, etc., of the 500,000 employees. All important questions of management are discussed in a committee composed of the Presidents and Directors of the seven lines; all matters affecting the employees or national interests are discussed in the Conseil Supérieur des Chemins de Fer, in which the above committee is reinforced by elected representatives of all grades of the personnel, the presidents of Chambers of Commerce and representatives of the principal national industries and of the state. The workings of this innovation have proved most satisfactory. See *Statistiques des Chemins de* *français* (annuel). (P. J.

FRANCHET D'ESPEREY, LOUIS (1856–), French soldi was born at Mostaganem in Algeria May 25 1856. Comm sioned to the infantry in 1876, he early saw active service Tunisia, Tongking and N. China. In 1908 he became gene of brigade, and the same year a tour of the Balkans and published studies thereon worked the beginning of an inter in that region which was to have important results. In 19 as general of division, he carried out a vigorous campaign Morocco, after which he was appointed to the I. Army Corps Lille. This corps he commanded during the battle of the Fr tiers, Aug. 1914, and on the eve of the battle of the Marne succeeded Gen. Lanrezac as commander of the V. Army. March 1916 he was advanced to command the eastern group armies, and later the northern group. On the recall of Gu laumat in June 1918, Franchet d'Esperey was sent out to repla him as Commander-in-chief at Salonika. Adopting and dev oping his predecessor's plan for an offensive in the Balka Franchet d'Esperey ensured the success of his break-through the skill with which he denuded the rest of the front to conce trate an overwhelming preponderence on the narrow Sok Dobropolye sector, west of the Vardar. Success beyond anti pation crowned the stroke; with their reserves pinned down vigorous pressure elsewhere the Bulgarians were unable to rep the breach, and as the Serbian spearhead drove in deeper, whole Bulgarian front collapsed, and on Sept. 29 Bulgaria c pitulated—the first defection among the Central Powers. If owed much to his predecessor, to Franchet d'Esperey was glory of execution and realisation. Exploiting this victory, cleared Serbia of the Austrian troops and later, on Jan. 5 19 took prisoner the German Marshal von Mackensen, in Hungar He afterwards commanded the Allied forces in Turkey un Nov. 1920 and was created a marshal of France on Feb. 21 19

FRANCIS FERDINAND (1863–1914), Archduke of Austri was born at Graz Dec. 18 1863. The eldest son of the Archduk Charles Louis and a nephew of the Emperor Francis Joseph, became, after the death of the Crown Prince Rudolph, the heir the Austro-Hungarian monarchy. In 1875 he took the title Archduke of Austria-Este, as heir to his uncle the Duke Modena, with whose death the male line of this branch of th house became extinct, and to his possessions in Austria-Hunga and Italy.

Until the death on Jan. 30 1889 of the Crown Prince Rudolp Francis Ferdinand was only known in limited circles and eve then he was not invited by the Emperor Francis Joseph to tak part in state affairs, although the Emperor frequently commis sioned him to represent him abroad. On July 1 1900 he marrie Countess Sophie Chotek (1868–1914), after having overcome, b tenacious persistence, the obstacle due to the fact that the la was not of royal family, and renounced a few days before th ceremony the succession rights of any children of the union. Thi renunciation was not only inscribed in the records of the imperia family, but ratified in the Austrian and Hungarian Parliament and sanctioned by a law of Dec. 4 1900.

After that time the Emperor gradually allotted to him respon sibilities of his own, not only in military matters but occasionally in questions of domestic politics. The difference of outlook o the two men, however, became more and more marked; for with advancing age Francis Joseph was less and less willing to consid far-reaching reforms, was anxious to avoid any conflict with the nationalities, and preferred advisers who knew how to untie a knot gently instead of hacking through it. Francis Ferdinan was convinced that the Magyar preponderance in the affairs o the dual monarchy must be broken in the interests of the monarchy and the dynasty. For some time he held that Federalism was the best solution. At another period he inclined to "Trial ism." Later, influenced by the Hungarian minister Kristoffy, he inclined to strengthen unity by changing the Delegations into a Central Parliament and attaching the annexed provinces Bosnia and Hercegovina, with a state organisation of their own, to the Empire. The opposition which he met on all sides from the ruling

y in Hungary strengthened his conviction that here lay the
ntial obstacle to the healthy recovery of the monarchy. In
severe conflicts between the Magyars and the Crown from the
nning of the 20th century onwards he, therefore, maintained
opinion that no concession must be made, and that there
ıld be no shrinking even from the use of armed force for the
nce of the rights of the monarchy and the dynasty.

he zeal with which he sought the solution of domestic politi-
problems by strengthening the central power is explained by
firm conviction that this was the indispensable condition of
monarchy as a Great Power, which he desired to maintain
to increase. Francis Ferdinand was not an unconditional
erent of the group which thought his aim would only be at-
ed by force of arms. But he was firmly determined to tread
path if it was the only one by which the goal could be reached.
considered that friendly relations with Great Britain were
rable, but towards France, and still more towards Italy, his
tude was cool and negative. He was convinced that there
st inevitably be a day of reckoning between the monarchy and
y. He never adopted an anti-Slav policy. He wished to
id conflicts with the principal representatives of the Slav
ionalities, and recognised in the Tsar of Russia the strongest
port against revolutionary movements in monarchical states.
the same time he expressed the decided opinion that the en-
achments of the Greater Serbia movement of Austro-Hun-
ian soil should be resisted with all the forces of the monarchy.
stood by Germany, yet was determined that the monarchy
uld not fall into dependence on her powerful ally.

rancis Ferdinand was a man of more than average ability.
would immediately recognise the essential point in any busi-
s in which he was engaged. What he lacked was knowledge
nen and calmness and constancy in his relations with the men
had been placed in high offices of state by his influence. He
ed from the citizens of the monarchy not affection, but sub-
sion to the will of the ruler. To him the state was identified
h the divinely appointed person of the monarch. He was shot
ıe 28 1914, with his wife, by Bosnians of Serbian nationality at
ajevo. (*See* EUROPE.)

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RANCIS JOSEPH I. (1830–1916), Emperor of Austria and
ng of Hungary (*see* 10.942).—In the last years of his reign
ncis Joseph continued to strive to preserve peace for his realm,
ile maintaining the prestige of Austria-Hungary and her
ition as a Great Power. Perceiving that this aim was threat-
ed by the confusion reigning in the Balkans, he agreed to the
n of his Foreign Minister, Aehrenthal, to take advantage of
Young Turk movement to annex the territories of Bosnia
l Hercegovina occupied in 1878, and to embody them per-
nently in the monarchy. During the serious crisis following
the annexation Francis Joseph backed Aehrenthal with the
ole weight of his influence, and subsequently supported him in
endeavours to restore friendly relations with the Great
wers which had been signally disturbed by the annexation,
l to put an end to the risk of international conflicts. By his
sonal intervention he in fact repeatedly succeeded during the
rs 1908 to 1914 in averting dangers threatening the peace of
rope. When in 1912 the Balkan wars, which he had untiringly
unsuccessfully striven to avert, began, he thought they were
gale before the hurricane, and when, in Aug. 1913, the Peace
Bucharest provided a provisional settlement he expressed the
nion that this peace was only the breathing space before a
sh war.

The behaviour of the Serbs filled him with the greatest
iety. When the murder of the heir to the throne, the Arch-
ke Francis Ferdinand (June 28 1914), led the Vienna Govt. to take energetic measures against Serbia, Francis Joseph hesitated to follow, and it was with a heavy heart that he gave his consent to the dispatch of the severe ultimatum to Serbia, and, after its rejection, to the declaration of war. He did not believe that the war could be localised, as he would have wished it to be, and was pessimistic about the chances of a world war. Even then he was of the opinion that "war is beyond our strength," and said he would be glad if the monarchy escaped "with a black eye." The attitude of the rulers of Italy and Rumania offended him deeply, and strengthened his doubt of a favourable outcome of a war against an ever-increasing number of adversaries. Francis Joseph stood immovably by the alliance with Germany, to whose ruler he was bound by a friendship based on reciprocal liking; it never occurred to him to separate from his ally. He would never have agreed to a separate peace; yet he favoured and supported every endeavour to put an end to the War by a peace which should safeguard the interests of all his allies and the position of Austria-Hungary as a Great Power.

In all questions affecting the constitution of the monarchy, and in particular the relations between Austria and Hungary, Francis Joseph continued in the later years of his reign to stand by the principles of the *Ausgleich* of 1867. He would not consider the federalisation of the Empire, but stood unmoved on the basis of dualism. He went a long way to meet the efforts of the Hungarian Govt. for independence, but refused energetically during this period demands tending towards the severing of the remaining bonds between the two halves of the monarchy, especially that of the united army. In the increasingly violent conflicts between the different nationalities inhabiting the Cis-Leithan territories Francis Joseph stood above party. This was all the easier for him on account of his indifference towards all the nationalities of his vast realm, even towards the Germans, although to the end of his life he felt himself to be a German prince. As in the earlier part of his reign, so in the last decade, the separate nationalities were favoured or neglected, but always played off one against the other. The meaning of *viribus unitis* for Francis Joseph was to use all in the interests of the dynasty.

But national consciousness had grown so strong that this policy had no success. The concessions which he granted in the years just before the War to the Slav peoples increased their self-confidence, and led them to make ever greater demands, the non-fulfilment of which caused a weakening of their sentiment for the dynasty. As the differences between the national parties represented in the Austrian Parliament became in the course of years so great that there was no prospect of effective co-operation, Francis Joseph ignored parliamentary activity from 1914 onwards. Experience of the World War led the old Emperor to recognise that he had done the Austrian-Germans an injustice; but isolated attempts to alter the trend of affairs had no lasting effect, and in the end he let things take their course. When he died, severe inroads had been made on the affection of the Austrian peoples; what remained was only just sufficient to disguise the disappearance of loyalty to the dynasty.

As years went on the Emperor became more and more lonely. His son had committed suicide in 1889, his wife had been murdered in 1898; of his brothers only the youngest was still alive, and he resided at a distance and in the strictest seclusion. There had never been any cordial relationship with the heir to the throne, Francis Ferdinand; and with the years, especially after Francis Ferdinand had married Countess Sophie Chotek, the estrangement between the two men increased, so that personal intercourse became rare. Among the remaining members of the Imperial House Francis Joseph only cared to frequent the circles of his two daughters, Gisela and Marie Valerie, and their children. He was bound by ties of true friendship to Katharina Schratt, formerly an actress at the Burgtheater, and in her society he spent his sparingly measured hours of recreation. The summer he usually spent at the watering place of Ischl, and there he devoted himself to the chase, the only pleasure for which he cared passionately to the end of his life.

The Emperor had long enjoyed excellent health. It was not until he had passed his 75th year that disease of the respiratory organs began. In 1911 this became so serious that a catastrophe was feared. All the preparations for Francis Ferdinand's accession were made. But the old Emperor recovered; and his physical as well as his mental energy improved from year to year, so that he was able in the first two years of the World War to transact fully all the business of government. It was only in the year 1916 that his faculties began to fail. He died peacefully of a fresh attack of his old malady on Nov. 21 1916.

Francis Joseph was not one of those of whom contemporaries, especially those at a distance, form any definite impression. The reserve which he observed even towards the great majority of his advisers made it more difficult to penetrate his real nature. He had a deep sense of his exalted position as a ruler. To the end of his days he remained profoundly convinced that the Empire over which he ruled was *his* empire, and the peoples *his* peoples. This conception of the majesty of the office bestowed on him by God found expression in his bearing. He always maintained a regal attitude. He showed kindliness and winning courtesy to everyone. Nothing was farther from him than posing, and no one ever heard him utter sonorous phrases; but he avoided any kind of intimacy even in his intercourse with members of the Imperial House, and, even with them, knew how to maintain his distance. His intellectual gifts were not remarkable, but he possessed sound common sense and wit. He had a strikingly good memory for persons and events. As a ruler he was a model of the sense of duty. From early morning to evening he attended to business with clocklike regularity, and dealt with all the documents laid before him with the greatest punctuality. This industry and his exact memory made him one of the best authorities in all Government affairs. He sometimes startled his ministers by his intimate knowledge of the details of the business in hand, and occasionally embarrassed them. But he went no further than details, and lacked the power of surveying the whole.

The Emperor also lacked, especially in his later years, the ability to take the initiative in important questions, to form independent resolutions and to carry them to their logical conclusions. In an ever-increasing degree he left the decision to his responsible ministers. He was not without skill in the choice of his advisers, but had an instinctive dislike for men whom he felt to be his intellectual superiors. He also disliked people of proud and upright character, and even within the family circle he preferred those who were more subservient. He was essentially cold in temperament, with great self-control increased by practice. Among the European rulers he enjoyed, during the last decades of his reign, great respect, which he owed to his age, experience, personal amiability, blameless conduct, and above all the fact that his word could always be relied upon. He was a faithful son of the Catholic Church, and looked up with reverence to the Holy Father; but, quite in the spirit of the traditions of his House, he guarded the rights of the dynasty and of the State with the utmost tenacity, even against the Pope. He took no interest in the arts and sciences, being in this respect more of a Lorrainer than a Habsburg; but whenever he expressed an opinion on these subjects, he showed a decided aversion from the modern tendencies. (A. F. Pr.)

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FRANKFORT-ON-MAIN, GERMANY (*see* 11.17), has changed little outwardly since 1910, though the area of the city is now 33,277 ac., and the population according to the census of 1919 is 433,002. The life of the place still centres in the ancient and picturesque city, though in recent years blocks of old buildings round the cathedral have been swept away, and garden cities have arisen on the outskirts.

Frankfort is now an important inland port; heavy barges can navigate the Main as far as Aschaffenburg, and canalisation is being carried as far as Würzburg. The Rhine-Main-Danube canal is under construction, and a scheme has been prepared for a waterway to the Weser, which will link Frankfort with Bremen. Considering the difficulties of the process, the famous ban houses weathered the period of inflation well, and have lec way to the restoration of Germany's economic position in world. The metal, chemical and electrical industries of district are improving, and the old trade fair was revive 1919. In 1914 a university was founded, and in connection it is an academy of labour, designed to provide a new cla leaders for the labour movement. During the World War Fr fort was several times bombed, and it was occupied for a s time by the French in 1920 during the invasion of the Ruhr by German militarists.

FRASER, ALEXANDER CAMPBELL (1819–1914), Br philosopher (*see* 11.38), died at Edinburgh, Dec. 2 1914.

FRASER, CLAUD LOVAT (1890–1921), British artist and signer, was born in London, May 15 1890, and was educate Brighton and Charterhouse. He began to follow his fatl profession as a solicitor in 1908, but abandoned this three y later for art. After working with Walter Sickert for a tim exhibited in 1913, being responsible in the same year for decoration of the *Flying Fame* chapbooks and broadsheets served in France with the Durham Light Infantry during 191 but was gassed and invalided home. His gift for spirited de and lively colour, based to a great extent on 18th century ventions, developed rapidly, and he not only illustrated suc fully many books, but exercised a rejuvenating influence on lish stage designs by his production of *The Beggar's Opera* (1 *As You Like It* (1920) and *If* (1921). A career of great pro was cut short by his death, June 18 1921, at Sandgate, K See John Drinkwater and Albert Rutherston, *Claud L Fraser* (1923).

FRAZER, SIR JAMES GEORGE (1854–   ), British ant pologist, was born at Glasgow, Jan. 1 1854. Educated at Hel burgh, Glasgow University and Trinity College, Cambridge was elected a fellow of the latter college in 1879 and called to Bar in the same year. He was knighted in 1914, received O.M. in 1925 and became Commander of the Legion of Ho in 1926. A prolific writer, he is famous as the author of *Golden Bough*, first published in 1890 and re-issued in 12 volu under seven titles between 1907 and 1915. In 1922 appeare abridged edition under the original title. This work is an el rate study of ancient cults and folk lore and covers a vast of anthropological research. In 1926 he issued vol. 1 of *Worship of Nature*, dealing with the worship of the sky an the earth. Among his many other publications are: *Totem* (1887); *Adonis, Attis, Osiris, Studies in the History of Ori Religion* (1906, 2nd ed. 1907, 3rd ed. 1914); *Totemism Exogamy* (1910).

FREDERICK VIII. (1843–1912), king of Denmark (*see* 11. died at Hamburg May 14 1912.

FREEMASONRY (*see* 11.78).—The total membership has least doubled since 1910 and, according to the Masonic Book, Chicago, is (1926) about 3,922,318. In addition there at least 1,000,000 "unrecognised" masons, the most import group being the "Negro" masons of the United States America. Of the "regular" masons, all save 208,388 belong to various Grand Lodges of the U.S.A. and of the British Emp which indicates that freemasonry is essentially an Anglo-Sa institution.

Social Work.—In the U.S.A. and Holland the most notice change has been a tendency to take an active part in the so betterment of the nation. While avoiding controversial politi questions, the aim is to increase the interest of members in well-being of their fellow citizens outside the door of the lod This tendency is less marked in the British Grand Lodges, ow to their anxiety to avoid any appearance of interfering *as Mas* in politics, although in the field of charity they are particula active.

Anthropological School of Research.—Among British masons one the most notable changes has been the rise of a new school masonic research, which aims at tracing the history of Freemaso anterior to 1717. Faced by the paucity of documentary eviden due to the nature of the obligations taken by medieval masons, school has adopted the principles used in the study of anthropol and of comparative religions. It has discovered that figures carv or painted, by medieval masons, are often depicted making certain signs still known to Freemasons, and that in the scenes represented these clearly convey the same inner meaning as to-day.

Examples of such secret messages have been found in medieval and Comacine work and also in that done by members of the Roman Collegia. There also exists documentary evidence connecting these three groups of builders. A similar use of signs in Ancient Egypt, in the Hung Society of China and among savage races when initiating a boy into manhood, has also been demonstrated. On the basis of these facts, which are unquestionable, the theory is being developed that Speculative Freemasonry is descended via the Comacines, the Roman Collegia and the Mysteries from primitive rites, once universal in the dawn of history, survivals of which are to be found to this day in Central Africa and Australia. Concurrent with this work has been the careful study of the modern rituals, and the comparison of certain peculiar features in them with similar incidents in the ancient mysteries and in savage rites. The facts so far disclosed suggest that in modern freemasonry we may have an intellectualised survival of the cult of the Dying God and of the Fertility rites. Although this school has produced much interesting data, its conclusions are not yet universally accepted by the older or "documentary" school, the members of which consider that coincidence may explain the similarities to which their attention has been directed. If, however, the views of the Anthropological School are ultimately accepted, the result will be that the origin of freemasonry will be pushed back thousands of years.

The Mystical School.—Quite as important has been the rise of a distinctly spiritual school of thought, which endeavours to interpret the meaning of the ceremonies, and considers that in the rituals of the various degrees we have an allegory of the quest of the soul after mystic union with the Supreme Being. While often differing in detail, since they approach the subject from different angles, all the exponents of this school agree in the main principles, although in historical research they are often sharply divided, some belonging to the documentary school and others to the anthropological. Perhaps, however, the most important fact is the ever increasing interest among the rank and file in a subject which, even a few years ago, would have been treated with complete indifference.

Masonic Relations.—Since 1910 events have proved that the breach between Latin and Anglo-Saxon masonry was based on a fundamental divergence of opinion as to the basic principles on which the order rests, and this breach tends to grow wider year by year. The disastrous results of interfering in politics has been shown by the fact that the Italian and Hungarian Govts. have declared Freemasonry to be a danger to the State, and have suppressed it within their jurisdictions. In France opposition to the political activities of the Grand Orient culminated in 1914 in the formation of a new body, "Grande Loge Nationale Indépendante et Regulière pour la France," which avoids politics, and insists on belief in God. This body, which has increased rapidly in numbers, is recognised by the Grand Lodge of England. At the same time, one by one, most of the American Grand Lodges which were still in fraternal relations with the Grand Orient have felt compelled to sever relations.

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(J. S. M. W.)

United States.—Since 1920 freemasonry in the United States has grown with amazing rapidity, and in 1926 had a membership of nearly 4,000,000 men, organised in 50 grand lodges. While in many ways gratifying, the influx of new members raised many problems, to meet which two movements were started.

First, the National Masonic Research Society was organised in 1914, under the sanction of the Grand Lodge of Iowa, to encourage the education of Freemasons in the history, symbolism and philosophy of freemasonry. Its headquarters are in St. Louis, where its journal, *The Builder*, is edited. Second, the Masonic Service Assn. of the United States organised in 1919 more than 30 grand lodges—the first great co-operative movement in American freemasonry. It grew out of the service of the fraternity in the War, and had two objects, as stated in its constitution; firstly relief in time of nation-wide calamity, whether it be war, pestilence or other disaster; secondly education—the teaching of freemasonry as it has to do with the daily lives of citizens and the problems of the nation.

The educational programme of the association is based upon the doctrines of the fatherhood of God and the brotherhood of man, under five heads: religious liberty, equality before the law, equality of opportunity, the dignity of labour and charity. Its work is carried on by means of short talk bulletins read in the lodges of member jurisdictions, speaker's bulletins, lectures illustrated by films and moving pictures, books, and its journal *The Master Mason*, edited from its headquarters in Washington. The association is managed by an executive commission, composed of one member from each group of states into which the country is divided. As a result of these movements a better kind of masonic literature has been created, at once more accurate and more popular—a national masonic library of nine volumes, and a little masonic library of 20 volumes. The whole intent of the movement is to know more about freemasonry and to do more with freemasonry for the service of mankind.

Recent years have witnessed the building of great temples of freemasonry in many of the chief cities of the country, and also a remarkable growth of philanthropic activity—the building of homes for the aged and indigent, orphanages and hospitals and the organisation of the national masonic tubercular sanitoria association. Since the World War there have been tentative attempts to form an International Masonic Assn. but they have been largely abortive, so far as American freemasons are concerned, owing to the refusal of freemasons in the United States to affiliate with foreign bodies which remove the Bible from the lodge and do not require faith in a supreme being as a requisite of membership.

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(J. F. N.)

FRÉMIET, EMMANUEL (1824–1910), French sculptor (*see* 11.96), died Sept. 11 1910.

FRENCH, DANIEL CHESTER (1850–), American sculptor (*see* 11.98), numbers among his more notable recent works the four groups representing Europe, America, Asia and Africa for the New York Custom House; the Melvin Memorial at Concord, Mass. (1916); the 1st Division War Memorial, Washington, D.C. (1924), and the statue "Memory" (1911), which was purchased by Henry Walters and given to the Metropolitan Museum of Art. His statue of Abraham Lincoln, executed for the Lincoln Memorial, Washington, D.C. (1920), portraying Lincoln seated and in a meditative mood, occupies a superb though simple setting and is considered the crowning work of French's life.

FRENCH AFRICAN LITERATURE.—The enormous continent, of Africa on account of its geographical configuration, is apt to appear as a single unit. But this could only be if all negroes were of the same race; whereas, ethnically speaking, owing to the intermingling of blood and the differences of latitude and longitude, there are as many races of negroes as there are African tribes. An Englishman differs less from a Russian than an Ourlaf from a Haoussa, and a Haoussa from a Kaffir.

The outbreak of the World War brought home to France her need for man power, and she then began to turn her attention towards a race which sent her its men by thousands. In the midst of the madness and destruction that overwhelmed Europe, she realised that she had to do with men who were like children and whose virgin minds required cultivation. She was forced to recognise that, in spite of solid, imposing and well-documented volumes, the theories with regard to the natural superiority of the Aryan races, set forth by Count Gobineau in his *Essai sur l'inégalité des races humaines* (1853–5), had received an unpleasant shock. Moreover, the ideas which Dr. Cureau, a former Governor of French Equatorial Africa, and a follower of Gobineau, expressed in his learned and interesting *Sociétés primitives de l'Afrique equatoriale* (1912) have, after much discussion, been strongly attacked, first by Jean Finot, whose work *Le préjugé des races* (1905) has attained world circulation, and later by Doctor Huot, in "L'âme noire."[1]

The soul of the negro, as compared with that of the white man, is emotional, unstable, variable and incomprehensible. It cannot be fathomed either in the tales of the old navigators—they dealt too much in fable and fantasy—or in the journals of contemporary explorers. Those who have lived long enough with the negro have learned to hold him in affection, which, according to Stendhal, is nothing but the crystallisation of feelings and inclinations.

We cannot number among the initiated either Pierre Loti, impassioned admirer of the exotic—the poet and magician who was inclined to bewitch himself with his own incantations—or even Fromentin, whose *Un été dans le Sahara* (1874) and *Une année dans le Sahel* (1859) conjure up before us burning sand and blinding light; but we must include Isabelle Eberhardt, the *bonne nomade*, whose whole work is a glorification of Islam; and a group of other writers of whom the most outstanding are Robert Randau, whose novels *Les Colons* (1907), *Les Algérianistes* (1912) and *Cassard le Berbère* are powerful and vivid; F. Duchene with *Au pas lent des caravanes* (1922), *Thamil'la* (1923) and *Le roman du Meddah* (1924); Maximilienne Heller with *La mer rouge* (1923) and many others. These works, however, have been inspired less by the influence of Africa than by that of the Mediterranean. In spite of such works as *Terres de soleil et de sommeil* (1916) and *Le voyage du centurion* (1916) by Lucien Psichari, *Visions congolaises* by Louis de Raulin and *Les explorateurs* (1909) and *Le commandant et les Foulbé* (1910) by Robert Randau the true African influence has only prevailed since 1919.

Since that time there has been a harvest of such literature, including the remarkable *Visage de la Brousse* by Pierre Bonardi (1920) and *l'isolement* by Dominique Combatte, which exude the stifling atmosphere of a tropical forest. *Des inconnus chez moi* (1920), by Lucie Cousturier, is a work profoundly true, profoundly human as well as infinitely pathetic. *Batouala* by René Maran (1921), *La randonnée de Samba Diouf* (1922) by the brothers Tharaud, *Koffi* (1922) by Gaston Joseph, *Diato*, a mine of Mandingo folk-lore, by André Demaison (1923), *Métempsycose* by Madeleine de Valcombe (1923), *Pellobellé, gentilhomme soudanais*, by Oswald Durand, *Ulyse, cafre* (1924) by the brothers Marius-Ary Lebland, *Les Chansons de Kou-Singa* by Jean Marville have also contributed to the researches of such men as Delafosse, Bruel and missionaries of all classes, lay, military, commercial and religious. These works may not perhaps have the lyric character which runs through *A travers l'Afrique* (1910) by Captain Baratier, nor the humour of that caustic adventurer to whom Pierre Mille, the French Kipling, has given the name Barnavaux. They are, however, a valuable contribution to the study of the negro mind, and as such increase our knowledge of humanity. (R. MA.*)

FRENCH LITERATURE (*see* 11.110)—The 15 years between 1911 and 1925 were overshadowed historically by the events which preceded the War of 1914, by the War itself and by post-War preoccupations and difficulties. If the course of literature was not entirely determined by this concurrence of great events, it at least responded to them, and bears deep traces of their influence. These marks can be found in the writings of practically all those who were at work during this period. Two literary generations occupied these 15 years; one, the older, that of the writers who belonged to the preceding period, already famous or recognised in 1911, who were only continuing their work; the other, a younger generation, that of the writers who made their first appearance in 1914 or after 1918.

I. THE PRE-WAR GENERATION

The most important writers of 1911 and succeeding years have already been accounted for in the preceding period. It will suffice here then merely to recall their names and the books which they published after 1911. It will be more interesting to note the general tendency of literature at this point.

The peculiar characteristic of French literature in 1911 in the fact that the great movement of reaction against the cesses of naturalism which had started 20 years before reached its culmination, and with entire success. About 18 the doctrine of naturalism was still triumphant, and had i posed a general conception of things which was affirmed by t scientific spirit. It was material, subject to reason, in no w sentimental. It had invaded the novel with Zola, the theat and even made its way into philosophy. It claimed to make u of the discoveries of savants, of Berthelot in chemistry a Darwin in biology. It was fatalistic, pessimistic, setting its against religious beliefs and even against the tradition of t things of the spirit. It claimed to reduce all life, even the life the soul itself, to a mechanism of causes and effects, to a pure physiological basis.

It was about the year 1889 that new tendencies were ma fested simultaneously in poetry, in philosophy, in criticism a in the novel. While keeping as a fundamental principle t recognition of the fact, that is to say the method of observatio the newcomers insisted upon their observation being complet upon its taking into account the whole of reality, not mere facts, but also all the stuff of feeling, aspiration, of the impuls of the soul, of spiritual energy. As a result of all this, thoug became re-invigorated, took a new lease of life. Such was t accomplishment of men very different in their inspiration a their convictions. Paul Bourget and Barrès among the novelist Henri de Régnier among the poets, Rémy de Gourmont, Charl Maurras and André Gide among the critics, played a great pa in this change. Groups like those of the *Mercure de France*, t *Nouvelle Revue Française*, the *Cahiers de la Quinzaine*, under t leadership of Charles Péguy, did their capable share.

It may be said that in 1911 the distinction had been clearl made between science, which establishes laws and fundament causes and sets them forth in abstract terms, and art, whic manifests these causes sympathetically by appealing at one a the same time to the reason, the heart and the senses. Th works of a mathematician of genius, like Jules Henri Poincar had made for the development of a more exact conception science and the scientific method. The books of Henri Bergso especially the one which appeared in 1907 (*L'évolution créatric* had created a new spiritual awakening. Everything thus co tributed towards liberating the spirit from the narrow boun aries of naturalism. A literary outburst was the result, th main characteristic of which is that each work reflects the te perament and the tastes of the author, without dependence any school. Certain writers remain faithful to their concepti of the novel (Gustave Geffroy, *Cécile Pommier*, 1922), and th Académie Goncourt continue the tradition of objectivity an naturalism. But the brilliant group of psychological writer that followed Paul Bourget and Maurice Barrès goes back t Benjamin Constant and Stendhal, indeed even invokes Balzac and attempts to make of the novel a complete representation life, of the spiritual life as well as the social and material.

During the 15 years (1910–25) there appeared a brilliant serie of psychological studies. Writers already famous continue their work. Paul Bourget produced *Le Démon de Midi* (1914) *Némésis* (1918). Maurice Barrès wrote *Greco, ou Le secret d Tolède* (1912), *La colline inspirée* (1913), and just before hi death published that *Enquête aux pays du Levant* (1923), whic unites in itself all his peculiar qualities of thought and expressio and which remains one of his finest books. René Bazin (*Le nouveaux Oberlé*, 1919); Henry Bordeaux (*La maison*, 1913, and *La résurrection de la chair*, 1920); René Boylesve (*Tu n'es plus rien*, 1914, *Elise*, 1921); Louis Bertrand (*Jean Serbal*, 1924); Edouard Estaunié (*Les choses voient*, 1913, *L'ascension de M. Baslèvre*, 1920), attest the vitality of a *genre* which was trie with success also by Emile Clermont (1878–1915), author o *Laure* (1913); Louis Codet (1877–1918), author of *La petite Chiquette* (1911), *César Capéran* (1918), *La fortune de Bécot* (1919); and Roger Martin du Gard, of a more philosophical turn (*Jean Barois*, 1914, and *Les Thibault*, 1922).

The analytic and descriptive novel of manners continued with enri Lavedan, *Irène Olette, Le chemin du salut*, 1920–3); Abel ermant *Les Renards* (1912), *L'aube ardente* (1919), *La journée ève* (1920); with Gaston Chérau (*La prison de verre*, 1912, *monstre*, 1913). Jérôme and Jean Tharaud (*L'ombre de la oix*, 1917, and *Un royaume de Dieu*, 1920); Gilbert de Voisins *'enfant qui prit peur*, 1912); the tales of Henri Duvernois *e veau gras*, 1912, *Edgar*, 1912); Edmond Jaloux, Marcel oulenger, Eugène Montfort, Claude Anet, Charles Géniaux. n offshoot of the symbolist movement, the poetic novel of ntasy has its most illustrious exponents in the poet Henri de égnier (*La pêcheresse*, 1920, *Le divertissement provincial*, 1923); the poet Francis Jammes (*M. le Curé d'Ozeron*, 1918, *Le poète stique*, 1920); and in the young Alain Fournier (1886–1914), atched away too soon from letters by the War, whose book *grand Meaulnes* (1914) remains a charming and impressive ork. Finally, exotic literature, dominated by the great name Pierre Loti, finds brilliant expression in Claude Farrère *a Bataille*, 1911, *Dix-sept histoires de Marins*, 1914); Jérôme d Jean Tharaud (*La fête Arabe*, 1912); Pierre Mille, Marius-ry Leblond, and in the posthumous book of Louis Hémon on anada, *Maria Chapdelaine* (1916), which had a prodigious ccess.

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[1] *Mercure de France* (Sept. 1921).

Women have always excelled in the literature of imagination. hree writers occupy the first rank in this respect—Colette, who s added to her already famous list of works *La vagabonde* 910), *L'entrave* (1914), *Chéri* (1920), *La maison de Claudine* 922) and *La fin de Chéri* (1926); Gérard d'Houville, daughter the great poet J. M. de Heredia, wife of Henri de Régnier, ho has a rare poetic gift and who tells in the most fluid style rose stories of charming and often profound imagination, *e séducteur*, 1914, *Jeune fille*, 1916, *Tant pis pour toi*, 1920), nd who has written in *L'enfant* (1926) a little masterpiece; and omtesse de Noailles, a poet of passionate and inspired quality well, who in 1923 under the title of *Les innocentes* published series of novelettes and meditations in which lyricism is made e vehicle of a daring frankness. Mme. Marcelle Tinayre pub-shed in 1920 *Perséphone* and in 1922 *Priscille Séverac*. Mme. ucie Delarue-Mardrus, a very gifted story-teller, observant nd poetic, wrote *L'âme aux trois visages* in 1919 and *Graine au nt* in 1925. Mme. Andrée Corthés received in 1920 the novel rize of the Académie française for her book entitled *Pour moi ule*.

At the theatre that most personal of writers, François de urel, produced *Terre inhumaine* (1923), *La viveuse* and *e moribond* (1925). G. de Porto-Riche pursued his vigourous udies of passion with *Le vieil homme* (1911) and *Le marchand 'Estampes* (1918). Maurice Donnay, so charming, and, at the me time, so melancholy and whimsical, has continued his social udies in *Les éclaireuses* (1913) and *La chasse à l'homme* (1920). lfred Capus, a lucid realist, ironical and with a gift for natural ialogue, produced *Hélène Ardouin* in 1913 and *L'institut de auté* in 1914. Henry Bataille (1872–1922), hypersensitive, ightly involved and exotic, brought out *Le Phalène* in 1914 and *'homme à la rose* in 1922. Henry Bernstein after a series of ramatic and violent plays (*L'assaut*, 1922), brought out *Le cret* (1917), in which his effects are drawn from psychology nd character. Comedy has owed its greatest successes to obert de Flers (*L'habit vert*, 1913, *M. Brotanneau*, 1914, *es nouveaux messieurs*, 1925); to Tristan Bernard (*Les etites curieuses*, 1920); to Francis de Croisset (*Le coeur dispose*, 912); and to Sacha Guitry, whose vivacity and wit find trium-hant expression in *Le veilleur de nuit* (1911), *L'illusionniste* 921) and *L'amour masqué* (1924). The most interesting tempts in the way of original work have been made by Fran-ois Porché, who in *Les butors et la Finette* (1918) and *Le Cheva-er de Colomb* (1922) combines in a curious way the relics of ncient traditions with an entirely modern feeling for symbolism; nd by P. Claudel, author of *L'otage* (1911), *L'annonce faite à arie* (1912), *Le père humilié* (1920) and *Le pain dur* (1918), orks sometimes obscure, but freighted with purpose of an in-ontestable quality, and with austere emotion.

In the domain of poetry all the squabbles of the schools had already been silenced by 1911. Symbolism had done its work. Its most illustrious representative, Henri de Régnier, had returned to traditional forms. Master of rhythm and of rhyme, connoisseur of language, sumptuous and self-contained, he has amplitude and richness. Cultured, a great reader of history and old books, he knows the past. He has at his command all the images supplied by legend, history, nature and art. The outcome of this is a magnificent and lordly poetry which is the mirror of the passions, the adventures, the glories and all the multiple forms of human destiny (*Poésies*, 1907, *Vestigia Flammae*, 1921). Much nearer symbolism, Francis Vielé-Griffin has studied the ancient myths and has attempted to interpret their eternal significance (*Voix d'Ionie*, 1914). Francis Jammes is the poet of nature and divinity. He knows the country well, and he speaks of it with a charming simplicity and freshness (*Les Géorgiques chrétiennes*, 1911–2). He shows the same ingenuousness, the same healthy realism, the same humility in his poetry of religious inspirations; he has in him something at once bucolic and Christian (*La Vierge et les sonnets*, 1919). Comtesse de Noailles is on the contrary pantheistic and pagan. Impetuous and consciously unrestrained, heavy with doom like a priestess of old time, she has sung in eloquent and remarkably rhythmical verse of youth, love, the beauty of the universe, and also of human unhappiness, implacable destiny and death (*Les vivants et les morts*, 1913, *Les forces éternelles*, 1920). In her last verses (*Poème de l'amour*, 1924) she has adopted a deliberately simple and bare style, in which is traceable a growing melancholy, a strange lassitude in her ardent work, and, by way of substitute for resignation, a courage full of serenity. Paul Claudel, a vigorous personality, penetrated by a faith which, unlike the tenderness of Francis Jammes, is austere and sometimes sombre, and has written poems (*La cantate à trois voix*, 1914, *Trois poèmes de guerre*, 1915, *La messe là-bas*, 1919), which present a mixture of rather obscure metaphysics, rather self-conscious simplicity, and vivid and powerful imagery.

Charles Péguy, ardent, sophisticated and simple, Socialist and patriot, has shown in his poems *Le mystère de la Charité de Jeanne d'Arc* (1910), *Le mystère des Saints Innocents* (1912), *Eve* (1914) a fluency which is slightly wearing because of his repetition of the same themes, but at the same time a real power due to sincerity, tenderness and the human need for faith and piety. Finally, Paul Valéry, who had made his appearance between 1889 and 1898 in reviews of poetry and letters, *La Conque* and *Le Centaure*, after having kept silence for a long while, published in 1917 *Le jeune Parque*, and in 1922 *Charmes*. These two extremely slender collections contained much substance under an unpretentious form, and established his reputation. Mathematician and philosopher, a subtle and experienced artist, a disciple of Mallarmé, to whom he owes much, he gives expression to an abstract and intellectual life which though slightly arid is still passionate, and his work has a deep full note. The tendency to return to simple, pure and classical sources is found also with Paul Fort, whose *Ballades françaises* are full of colour and imagination; with J. P. Toulet, Fernand Gregh, Abel Bonnard, Franc-Nohain, whose *Fables* (1921) are delightfully humorous; with Alfred Droin and Pierre Camo; while symbolistic description is the more natural vehicle for Jean Royère.

If one were obliged, in spite of this diversity of temperaments, to characterise the period between 1911 and 1914, one might make two observations. One is that in matters of form pre-War writers went back almost without exception to classical traditions, to proportion, simplicity, clearness. The other is, that as far as guiding principles went they were for the most part occupied with furnishing a moral discipline to their contemporaries, and that in the wake of dilettantism and naturalistic pessimism they laboured to restore notions of order, of decorum, of hierarchy, which to them seemed useful to the national life. Whatever may have been the glory of Anatole France, it was not he who was then a leader, and who exercised an influence over men's souls; it was Paul Bourget and Maurice Barrès. There appeared at the approach of that danger constituted by the War a phenomenon worthy of remark by historians of the future. The grandson of Renan, Ernest Psichari, wrote in 1913 *L'appel des armes*, and shortly afterwards *Le voyage du centurion* (1916). Political crises and intellectual visionings had brought about a state of uncertainty that might prove a cause of weakness. Under the pressure of national exigencies that were apparent to all thoughtful minds, French literature in 1911 was mainly inspired by the attempt, which has been justified by the facts, to assure the future of the threatened country, to make readers acquainted with the strenuous life and the fundamental principles of the social and moral worlds.

II. THE POST-WAR GENERATION

The War abruptly ended the literary careers of many young men, who were killed on the field of battle, men who in all branches of literary activity gave high promise—novelists like Alain Fournier and Emile Clermont, poets like Paul Drouot and J. M. Bernard, essayists like Dufresnoy and Pierre Gilbert. But with those who survived it and had passed through its fires it only stimulated the desire for expression. During the course of the War there appeared a series of brilliant books of diverse character, but sincere and passionate, retracing the heroic years. It is impossible to mention all, but we must at least set down here *Le songe* (1922), by Henry de Montherlant; *Les croix de bois* (1919), by Roland Dorgelès; *Le feu* (1916), by Henri Barbusse; *La flamme au poing* (1917), by H. Malherbe; *Gaspard* (1916), by René Benjamin; *Civilisation* (1918) and *La vie des martyrs* (1917), by Georges Duhamel; *Sous Verdun* (1916), by Maurice Genevoix; *La guerre à vingt ans* (1924), by Philippe Barrès; *Fond de Cantine* (1920), by Pierre Drieu la Rochelle, and *Les récits de guerre dits à une femme*, by Camille Mayran. None of these books pretends to give a summary or to describe the whole of the War. It will be a long time before these great events will find their poet to synthesise and express them; Bonaparte had to wait for Victor Hugo. But all these works powerfully represent direct impressions and strong emotions; they have a meaning, and our grandchildren will find in them one day a sincerely moving record of a period that was shaken by a terrible storm.

This interesting and noble outburst necessarily faded as the events moved further away. The current of life which had been interrupted for four years took up its course again. All countries had to repair the consequences of the conflict. New problems arose. Difficulties mounted. The combined effect of all these causes was that there was no longer a collective effort. Everyone returned to his own preoccupations, to the world of his own imagination and fancy. More or less indifferent to the heritage of their elders, the young writers appeared to be under the impression of existing in a new world where they had to recreate everything. But nevertheless they remained under the influence of the past, sometimes without suspecting it themselves. They discovered, by the very fact that they lived in a predetermined epoch, the result of the labours of their elders. Tendencies, varieties of talent and aspirations are very diverse. There is little unity in the literature of the younger generation. Everyone follows the inclinations of his own temperament. The situation viewed as a whole gives the impression of a melting pot in which everything is in a state of fusion but out of which one day something new and unforeseen will spring. Let us try, in so far as we can to-day, to discern what this may be.

The dominating form in modern literature is always the novel, and it will serve as a type. It is not distinctively, in spite of the definition, a narrative representing life, but often consists of recollections like a book of memoirs or of reflections like a book of essays. The strongest influence to appear has been that of Marcel Proust (1873–1923). According to the date of his birth he belongs to the pre-War generation; but one finds that his work appeared almost entirely during or since the War. Only the first volume of his great novel *A la recherche du temps perdu*, namely *Du côté de Chez Swann*, had appeared by the end of the year 1913. All the others appeared in sequence down to 1925. Marcel Proust is remarkable for the depth and daring
of his analysis. Gifted with an acute, morbid sensitivity,
probed deeply into the motives of the heart and soul. W
an extraordinary delicacy and detail, he succeeded in expr
ing new and original nuances of thought in sinuous and o
interminable sentences. The bold analysis of the emotion
French literature had begun some years before Marcel Pro
by Anatole France but with discretion, and later with m
freedom by the female writers; but Marcel Proust has g
much further. He has carried the taste and feeling for in
spection to the extreme limits. By this one can say he
enlarged the scope of the novel, and that is the reason for
great prestige and influence among post-War writers.

This preoccupation with analysis is found in a series of w
the most characteristic of which are: Jacques Rivière's *A*
(1921), Jacques de Lacretelle's *Silbermann* (1922) and
Bonifas (1925), and Drieu la Rochelle's *Etat civil* (1921).
reality a gift as personal and exceptional as that of Ma
Proust encourages tendencies more than it provokes imitat
Psychological introspection is part of our period. It appe
in the course of the War more acutely and frequently than e
Carried to the extreme, it has resulted in the formation of
super-realist (*sur-réaliste*) school, which in essentials exi
already before the War, but which has been revivified by you
enthusiasts. The object of literature in the opinion of
school is to seize upon the pure thought itself, in its barely
scious stage. The outcome of this is a series of jottings, o
obscure, or at least unintelligible according to the ordi
processes of the understanding, and a series of images which
certain associations with the art of the cinema and which
lects traditional logic. At this extreme point the work of an
sis is entirely occupied with the subjective, and hardly t
into account at all the exterior world. Although there
been young men of talent like Aragon among the follower
this school, it has as yet produced no work which has tou
the world outside the literary cliques. Those who appea
have the most individual temperaments have detached th
selves from the group, like J. Cocteau (*Thomas l'impos*
1923) and Drieu la Rochelle (*Plainte contre inconnu*, 1924);
they are little by little returning to the classical forms.
attempt has had, however, up to the time of writing one resu
it has rid literature of all trace of rhetoric. In spite of a ma
tendency towards simplicity and brevity for many years, t
still remained traces of a declamation whose origin went
far back. The prestige of the sublimities of Hugo and o
Michelet was very great, and it nourished a love of the ph
With all its excesses, the development in the direction of ske
notations, suppression of logical associations and extrava
simplification has been made at the cost of a classic
sober art.

The writers who have been most successful in these last y
escape any attempt at classification. Each follows his
temperament and inclination. Recourse to the past is neces
to distinguish influences, forerunners, schools. In contempo
literature the only thing that can be distinguished is the i
vidual. The choir of young poets protest their personal fre
(Tristan Derême, Charles Derennes, Géraldy, Roger Al
Chabaneix). The novelists do the same; M. Pierre Benoît
master of the novel of adventure; he knows how to const
he knows how to tell a story; and addressing himself to a p
which, as after every period of upheaval, is in need of dis
tion, he has been able to captivate the attention in a seri
well-made novels (*Koenigsmark*, 1918; *L'Atlantide*, 1919;
de la Ferté, 1923; *Le puits de Jacob*, 1924)—in which he sho
remarkable facility in employing imaginary or historical e
and in keeping the reader breathless with suspense over
turns of his stories.

It is only necessary to recall *Le kilomètre 83*, by Henry
guerches (1913), to show that since before the War the tas
the novel of adventure had been revived. The influen
Anglo-Saxon literature, and particularly that of Kipling,
been a powerful stimulant in this development. The
naturally only accentuated this tendency. A proof of th

nd in the books of Pierre MacOrlan (*La cavalière Elsa*, 1921), Louis Chadourne (*Terre de Chanaan*, 1921) of Jean d'Esmé *s Barbères*, 1925), of Roland Dorgelès (*Le reveil des morts*, 3), of René Bizet (*La sirène hurle*, 1921) and of J. Kessil *Steppe rouge*, 1922, *L'Equipage*, 1924). All of these appeared ween 1918 and 1925. Actually, however, it does not seem t this form of literature is capable of much further develop- nt, except in the case of the exotic, historical or colonial el. French literature is traditionally psychological. It is racteristic that the best book of Pierre Benoît, the most ular writer of novels of adventure, is a novel of manners, *v. de la Ferté* (1923).

rancis Careo is a painter of the lower depths of society, of world of the apaches and of the outer boulevards. He deals, did Francois Villon in his day, with the world of thieves. Has handled this difficult subject with a great deal of tact *s innocents*, 1916, *L'homme traqué*, 1922, *Perversités*). Francis rco is a true artist with a quick sensitivity. He has made a dy of those who take no count of laws nor of social conven- ns; he has caught human beings with all their passions and their energies. He has shown how they live beyond the law l current morality; how they have made their own laws, ated their own code of honour and conventions. There are his work many amusing, picturesque and curious scenes, but re is more. He has analysed, often with profound sympathy, se creatures of an outcast world and their imagination, ams and miseries.

ean Giraudoux is also a subtle analyst. He has a capricious agination and a very individual, if somewhat complicated, tic manner, which makes him difficult reading; but he is pro- cative. There is in him much humour, often of an unexpected d, difficult to understand. The world of images has no secrets m him. Unusual comparisons and strange associations of as abound in his books. The most successful of these is *anne et le Pacifique* (1921), the story of a shipwrecked young l who lives alone on a desert island. She has to reorganise her , and by a series of chances and deductions she discovers that War, of which she knew nothing when she left, is going on. ychology in this book takes precedence over adventure, for author primarily wished to portray the reactions of an iso- ed human being in face of the vast world.

Henry de Montherlant is one of the most gifted among the ung writers. He has a sense of style, and is capable of vigorous ntal activity. After *Le Songe* (1922) he wrote about Verdun, d about sports (*Les onze devant la porte dorée*, 1924), books ich disclose his national and moral preoccupations. He is erested in the disciplines which make a human being master himself, permit him to live under the best conditions, and e the greatest possible value to his acts. He is very modern, d at the same time deeply attached to tradition; his works filled with youthful ardour, strength of will, and an impetu- ty which express themselves in vivid and poetic language.

François Mauriac is a harsh and powerful novelist. His books *e baiser au lépreux*, 1922, *Genitrix*, 1923, *Le désert de l'amour*, 25) have placed him among the most notable writers of his neration. Brought up in the Catholic tradition and attached his faith, François Mauriac is aware both of the demands posed by a Christian life and of the weaknesses of most man beings. All his work, which incidentally is open-minded, ems dominated by the idea of sin, by the necessary artifices in ich egotism and passion entangle human beings, by the thingness of their desires and the need for discipline. He mbines realism, austerity and even daring. Just as in cathe- als, where bold sculpture representing vice and demoniac in- irations are adjacent to sacred architectural motives, so he s put into his work scenes that are sordid enough, side by side th aspirations towards purity.

André Maurois, who during the War was interpreter with the itish Army, made his début with an impressionistic book, titled *Les silences du Colonel Bramble* (1918), which had a eat success. He published in 1923 *Ariel, ou la vie de Shelley*, ich had great charm, and *Des dialogues sur le Commandement* (1924). He is less a novelist than an essayist. He has a penetrating, highly cultivated mind and loves the play of ideas; he excels in delicate analyses, in the nuances of the emotions and in psychological insight.

Valéry Larbaud is interested in the manifestations of the international mind, and has written fascinating novels. *Fermina Marquez* is an original study of the life of young people in South American schools. *Le journal d'A.O. Barnabooth*, which followed, is a novel in which satire is mingled with poetic fancy. In it he amuses himself with drawing the life of a millionaire who can see everything, buy everything, and almost do what he pleases, and yet is stifled with boredom and doubt, finding pleasure only in doing everything that runs counter to the conventions of his social position. This story of the weariness of one of the inheritors of the earth is written with a vivacity which is one of the most curious characteristics of modern art.

Paul Morand represents the impressionist school at its acme of success. His short stories *Ouvert la nuit* (1922), and his novel *Lewis et Irène* (1924) are certainly among the most entertaining studies of the present time. Paul Morand has a keen feeling for the feverishness and instability of contemporary life. He is also keenly aware of the international aspect of post-War cities—the mingling in all countries in the same places, restaurants and hotels of people belonging to every race and nation. He has caught finally the elementary flashes which these cosmopolitans have in common by way of certain instincts and manifestations. His pictures are alive and chaotic. The author contents himself with incisive characterisations and brief formulas. He is full of verbal coinages. He reduces the recital to the bare essential. There is something acrobatic and artificial in this art, but the feat is always successful and entertaining.

A great number of other writers and books should be added to this summary. There is much diversity of literary activity. Works like *Les métiers blessés* (1919), by Pierre Hamp, and *Les entretiens dans le tumulte* (1919) and *La confession de minuit* (1920), by G. Duhamel, are a combination of social study and meditation; others, like those of Jean Rostand (*De la Vanité*), revive the tradition of the writers of maxims and of the moralists; others, like those of Alexandre Arnoux (*La nuit de Saint Barnabé*), constitute in the form of a narrative an interesting attempt to represent material civilisation and to give a picture of the modern industrial and mechanical world.

The attempts at a revival of the theatre, undertaken by the "Théâtre du Vieux Colombier," are continued chiefly by the "Atelier." While plays with Deval and Natanson were rather psychological, with Zimmer rather sombre, with Marcel Achard rather fantastic, with Géraldy rather sentimental, the modern play is sketchy, containing little action, and above all else designed to portray character. So it at least appears among the last comers, J. J. Bernard, Obey, Amiel, Steve Passeur. The construction is loose, without complications. The young dramatic authors seem to desire chiefly directness; they have no ambition to uphold theses, and wish only to amuse and to provoke reflection.

This article does not pretend to give a complete survey of present-day literature. It is being made, and there is no history at present. All that is possible is to indicate general characteristics; the appearance of men of talent may change everything to-morrow; the appearance of a genius may accentuate current tendencies or transform them. If one wished to summarise the various comments which have been made, one might say that literature in 1926 is still dominated by pre-War writers After the activity which showed itself in the years 1918–20, it seems there should have been a sort of fruition. Many talents with a certain ingenuity have been revealed, many young writers with distinctive personal qualities have published their books. But no single work dominates recent years or seems capable of exercising a determining influence.

It is then towards the masters of yesterday, who are still living to-day (except Barrès and Marcel Proust) and who are still exercising their influence, that little by little the younger men are turning their attention. The names of Paul Bourget, Maurice Barrès and Henri de Régnier, and those of Colette, Marcel Proust and Charles Maurras are dominating our period. Even when they know them only slightly or when they try to free themselves from them, the newcomers live in a society the ideas of which have in some way been fashioned by their elders. They breathe in air which is that of their time. One notices that the psychological analysis of Marcel Proust has strongly influenced some, that the impressionistic realism of Colette has attracted others, while the disciplines formulated by Bourget and Barrès form the mainstay of a great number. It is significant that a young writer like Drieu la Rochelle should leave his particular set and return to the Barrès tradition, and that after years of charming unconformity Jean Cocteau should entitle a book of essays, *Rappel à l'ordre.*

Thus after a detour of 10 years, violently disturbed by the War and its aftermaths, one can say that in 1925 French literature again took up the road which was foreshadowed in 1914. All the schools, after their trials and struggles, have achieved their work and have transmitted the best that was in them. The quarrels between romanticism and naturalism, between the Parnassians and the Symbolists have come to an end. The opposition between scientific rationalism and the world of the spirit has become less acute. It was a long struggle, bearing witness to the vitality of literature; of all the doctrines nothing is left but the trace of whatever in them was useful and true. Present-day French literature seems to be going in the direction of a classic revival in which certain other elements are mingled.

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FREUD, SIGMUND (1856–), Austrian physician and psychoanalyst, was born on May 6 1856, at Freiburg in Moravia, and studied medicine and psychology at Vienna, being strongly influenced by Brücke in the latter subject. After working in Paris under Charcot from 1885–6, he devoted himself, in co-operation with the Viennese physician, Josef Breuer, to the study of nerve cases. The results of their joint investigations were published in 1895 as *Studien über Hysterie*, expounding a new treatment, the so-called *catharsis.* This consisted in putting the patient in a hypnotic state, and the examination by the physician, while under this condition, of the forgotten original circumstances under which the symptoms first appeared. Subsequently Freud pursued a path of his own, and developed a special technique (*see* PSYCHO ANALYSIS). The technique and the results of this research work are explained in Freud's most important works: *Die Traumdeutung*, 6th ed. (1921); *Zur Psychopathologie des Alltagslebens*, 7th ed. (1920); *Drei Abhandlungen zur Sexualtheorie*, 4th ed. (1920). Freud's shorter works were collected in four volumes under the title, *Kleinere Beiträge zur Neurosenlehre.*

Freud also published two general sketches of his theory: a shorter one, *Fünf Vorlesungen über Psychoanalyse* (delivered at Worcester, Mass., in 1909) and a comprehensive one in *Vorlesungen zur Einführung in die Psychoanalyse* (1917). These medical-psychological studies yielded surprising results in relation to other subjects, and in the possibilities of their adaptation in other branches of knowledge, *e.g.*, mythology and the history of religion, civilisation and literature. The principal works in this connection are *Totem und Tabu*, 2nd ed. (1920); *Der Witz*, 3rd ed. (1921); *Eine Kindheitserinnerung: Leonardo da Vinci* (1916); *Jenseits des Lustprinzips* (1920); *Massenpsychologie und Ichanalyse* (1921). Freud's works have been translated into English.

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FREYCINET, CHARLES LOUIS DE SAULCES DE (1828–19
French statesman (*see* 11.211) died in Paris May 14 1923.

FRICK, HENRY CLAY (1849–1919), American manufact
and philanthropist, was born at West Overton, Pa., June 17 1
As a boy he was clerk for his grandfather, who was a distiller
flour merchant; but he early became interested in the coke b
ness. In 1871 he organised the firm of Frick & Co., which
mately acquired large coal deposits and ran 12,000 coke ov
He was chairman of the board of Carnegie Bros., from 188
1892, and in the latter year, during the Homestead strike,
shot and stabbed by Alexander Berkman, an anarchist. He w
director of the Pennsylvania, the Santa Fé and other railw
and of the U.S. Steel Corporation. He died in New York
2 1919.

Besides large sums left to his family and friends, he left to
city of Pittsburgh land for a park, together with an endowm
of $2,000,000. His New York mansion, with its collectio
paintings, bronzes and enamels, he bequeathed to the city on
death of his wife, with an endowment of $15,000,000. He
vided his residuary estate, estimated at $50,000,000, betw
various hospitals and educational and charitable instituti
The value of his New York mansion and its art collection
estimated in 1920, to be $50,000,000. Among the chief treas
are the Fragonard panels, Bellini's "St. Francis in the Dese
Velasquez' "Philip IV.," Van Dyck's "Paola Adorno," Re
brandt's "Portrait of Himself," Gainsborough's "The Mall,"
"The Hon. Anna Duncan." It includes also fine examples of Ti
Vermeer, Frans Hals, Ruysdael, Cuyp, Rubens, El Greco, Go
Sir Thomas Lawrence, Millet, Raeburn, Reynolds, Romney
Turner.

FRIEDJUNG, HEINRICH (1851–1920), Austrian historian,
born at Roštìn, Moravia, Jan. 18 1851 of Jewish parents. Fri
jung spent much of his career in political journalism; he wa
pronounced German nationalist, and the chief author of
nationalist *Unser Programme* of 1885. At the same time
devoted himself to historical research, especially over the per
1848–66, which he covered brilliantly and exhaustively
the three works *Oesterreich von 1849–60* (1908–12); *Der K*
krieg und die oesterreichische Politik (1907); and *Der Kampf*
die Vorherrschaft in Deutschland, 10th ed. (1917). His o
chief works are the volume *Historische Aufsätze* (1919) and
monumental review of modern times *Das Zeitalter des Imper*
ismus (1919–22), which was finished by Professor A. F. Přibr
after Friedjung's death in 1920.

Friedjung was a conscientious and an attractive histori
whose works cover all aspects of life during the period w
which they deal. The point of view expressed in them is, ho
ever, pronouncedly liberal, patriotic and anti-Catholic, a
shows little sympathy for the Slav and Magyar nationa
movements in the Dual Monarchy. His last excursion into p
itics was most unlucky, and undeservedly clouded his name;
March 24 1909 when the conflict between Austria-Hungary a
Serbia over the annexation of Bosnia-Herzegovina was at
height, he published an article in the *Neue Freie Presse*, accusi
the Serbo-Croat politicians in the Monarchy of treasonable pr
tices with the Government of Serbia, and violently attacki
conditions in Serbia. Fifty-two deputies of the Croato-Se
coalition and their leader Supilo separately, sued Friedjung
libel. It was disclosed that Friedjung had received the doc
ments on which his article was based from the Austro-Hungari
Foreign Office, that he had accepted them in good faith
after most insufficient scrutiny and that some at least w
blatant forgeries. The affair ended at last in a compromise,
not until it had assumed the proportions of a European *ca*
célèbre. Friedjung died in Vienna July 14 1920.

See Dr. R. W. Seton-Watson, *The Southern Slav Question and*
Habsburg Monarchy (London, 1911).

FRIEDRICH, JOHANN (1836–1917), German theologian
11.216), died in Munich, Aug. 19 1917.

FROHMAN, CHARLES (1860–1915), American theatri
manager, was born at Sandusky, O., June 17 1860. At the a
of 12 he started to work at night in the office of *The New Y*

ibune, attending school by day. In 1874 he began work for *e Daily Graphic*. In 1877 he entered the theatrical business, ng for a time associated with his brother Daniel in managing Madison Square Theatre, New York. In 1890 he organised Charles Frohman Stock Company. On Jan. 25 1893 he ened his Empire Theatre, New York. Other New York thea- s with which he was at various times connected were the terion, Garrick, Knickerbocker, Lyceum and Savoy. He was adept in developing talent. Among his successful players re Maude Adams, Ethel Barrymore, Blanche Bates, Billie rke, William Gillette and Otis Skinner. During 1905–6 presented E. H. Sothern and Julia Marlowe in Shakespearean ys. He was one of the organisers of the syndicate which for eral years controlled the American theatres. Beginning in 97 he presented many plays in London, leasing at different nes such houses as the Duke of York's, Globe, Comedy, Vaudele and Adelphi. He perished when the "Lusitania" was sunk a German submarine May 7 1915.

FRONTIERS, BATTLES OF THE.—The generic name of " bat- s of the frontiers " covers the whole of the actions fought at e opening of the World War in Aug. 1914, on or near the French ntiers. For convenience these are here divided into six sec- ns, each of which deals with a more or less distinct part of the ies of operations. These are: I. Early operations in Upper sace; II. First battles in Lorraine; III. Battle of the Ardennes; . Charleroi and Mons; V. Le Cateau; and VI. Guise.

I. EARLY OPERATIONS IN UPPER ALSACE

At the beginning of the World War the French higher com- nd was governed by two ideas. One was to avoid posing as the gressors, and consequently the covering troops were with- awn 10 km. behind the frontier. The other idea was to plant e flag in the lost provinces as quickly as possible. Not only, erefore, were strategy and politics not in harmony, but politics ntained a double element, the one pacific, the other aggressive.

First French Advance.—Immediately on the order for mobilisa- n, an advance on Mulhouse was ordered. The offensive began the morning of Aug. 7. Its start was promising. Mulhouse is reached and occupied in the evening of the 8th. The news the approach of large German forces then became known. e French commander feared being caught in a trap, and after eight-hour occupation the town was evacuated, a position rear being occupied. During the evening of Aug. 9, the Ger- ns attacked with superior force and drove back the French. e success was not followed up, since German supreme head- arters had prepared for a massed attack on Luxembourg and lgium, which postulated a strict defensive in the south.

The retreat from Mulhouse was likely to have a prejudicial ect upon the French. To counteract it Joffre formed a special my of Alsace. Early on Aug. 19 the Germans in front of Mul- use were attacked and defeated, and at 4 P.M., for the second ne in a fortnight, the victorious French entered the town. t though fortune seemed here for the moment to smile upon e French, reverses elsewhere extended their influence to Alsace. ders were issued for the break-up of the Army of Alsace and e dispersion of its units. Mulhouse was again evacuated on ig. 25. The fortress of Belfort was thus exposed and open to stile attack.

Belfort and Dannemarie.—Belfort had two rôles to play, the e permanent and foreseen, the other thrust upon it very early the War. In the first place, the fortress was designed to close e gap existing between the Vosges and the Jura. It was a tally important rôle, for if the Germans secured the gap they ight penetrate into the heart of France. The other rôle was to rm a pivot for the bending back of the whole French line, from e Swiss frontier to Belgium. A vast amount of work had been ne during the preceding 40 years to convert the small fortress 1870 into the immense stronghold of 1914. Much, however, mained to be completed. The completion of the task was nec- sarily impeded by the fighting in which part of the garrison is engaged during August. Nevertheless, by the time that the my of Alsace was broken up the enormous undertaking was achieved. The armament of the forts had been completed; numerous batteries had been constructed and armed; centres of resistance had been organised; and inundations in front had strengthened the zone of defence.

On the other hand, the German heavy artillery had introduced a new factor into war. The crushing of the resistance of Liége and Namur was disconcerting. By Aug. 25 there could be no possible doubt that if the Germans were allowed to plant their guns 8 km. from the forts the heart of the place would be bombarded and the forts themselves smashed before the artillery of the defence could fire a shot. Furthermore, by Aug. 25 the Allies were withdrawing all along the line. Clearly the Germans might make a special effort to seize the pivot on which this withdrawal hinged.

In these circumstances, and knowing that he had only his own resources to count upon, Gen. Thévenet, Governor of Belfort, decided not to await the enemy's attack, but at once to assume the offensive. The plan was quickly put into operation. The offensive reconnaissances in front of the fortress began on Aug. 28, and from that date were pursued without interruption. So successful was the operation that by Sept. 10 the advanced guards were over the frontier and 11 m. from the fortress. Eight days later the headquarters of the 57th Div., whose daily reconnaissances had been carried on uninterruptedly in advance of its front, was transferred from Foussemagne to Dannemarie. This transfer made a great impression in France, as also in Alsace, and had all the importance of a victory. It was indeed a considerable success, for the occupation of Dannemarie had been carried out with such precision and solidity that it had now to become definite. From Sept. 18 1914 onward, the French flag never ceased to fly over the little Alsatian town thus reconquered.

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II. FIRST BATTLES IN LORRAINE

The first French plan (General Instructions No. 1 of Aug. 8 1914) was purely offensive. It proposed to seek action with all forces united with the right on the Rhine. The two armies of Lorraine (I. and II.) were to lead, the I. in the direction of Saarburg, after having thrown back the German VII. Army towards Strasbourg and lower Alsace, while an isolated corps, the VII., would make a diversion to the east of the Vosges. The II. Army, covering itself from Metz, was to attack in the direction of Saarbrück, pivoting on the I. in the neighbourhood of Étangs. The two left corps were situated to the west of the Moselle, with a view to their eventual employment in the north.

Disposition of Forces.—In front of the I. and II. Armies the Germans had approximately equal strength (VI. and VII. Armies). They would at first keep to the defensive, acting as a pivot to the huge wheel being made by their centre and right. The rapidity of the invasion of Belgium determined the French to hasten the operations in the east in order to make a diversion. On Aug. 13, the I. Army had two corps on the Meurthe (VIII. and XIII.). Gen. Dubail, commanding the I. army, counted besides on the co-operation of the two right corps of the II. Army and on that of the XXI. Corps descending from the Vosges on his right. On Aug. 16 the II. Cavalry Corps was placed under his orders. The final concentration of the complete fighting force, however, could not be complete until the 18th. Nevertheless, the XIII. and VIII. Corps moved on the 14th, and on the 15th entered Cirey and Blamont, pushing back the I. Bavarian Corps, which retired toward Saarburg.

By the evening of the 17th the two French corps had reached the line Vasperveiller-Aspach-St. Georges, and the XXI. extended the line toward the Vosges. The II. Cavalry Corps had orders to go ahead on the 18th towards Saarburg, which was entered after a skirmish. The XXI. Corps pushed to the northeast as far as Walscheid; the XIII. held the heights north and east of Saarburg; the VIII., marching on Heming, seized the passage of the Marne-Rhine Canal and entered Saarburg. The II. Cavalry Corps bivouacked toward Diane-Capelle, in liaison with the II. Army, which had reached the line Bisping-Château Salins. The Germans held entrenched positions on a front of 40 m., from the neighbourhood of Dobbenheim to Biberkirch.

French Offensives.—It was decided that the I. Army should attack with its left northwest of Saarburg, its centre and right standing fast to repulse an eventual counter-attack in the Vosges. The II. Cavalry Corps was to move on Saar-Union in order to operate south of the Saar. On Aug. 19 the VIII. Corps commenced the attack before dawn, gained the terrain northwest of Saarburg and repulsed a counter-attack. On the 20th it resumed the offensive, but during the morning it became evident that it was incapable of opening a passage for the Cavalry Corps; indeed it was necessary to bring back a division on the canal with heavy losses. In the centre and on the right the French were more fortunate. The XXI. Corps met no resistance on the 19th, and the XIII. had not yet been engaged.

On Aug. 20, the XXI. Corps, attacked by the German XIV. Corps, inflicted on it a serious check near Walscheid; the XIII. Corps, coming into line, attacked to the northeast of Saarburg, disengaging the right of the VIII. Corps, which held the town till nightfall. Dubail's intention was to entrench on the front Kerprich-Soldatenkopf, and to undertake afterwards a methodical advance; but the check to the II. Army led Joffre to direct a retreat in Lorraine. On the morning of Aug. 21 the I. Army retired slowly towards Blamont. Afterwards it was necessary to accelerate the movement on account of the rapidity of the retreat of the II. Army. On the evening of the 23rd, the I. Army extended from Dames-aux-Bois to the Col du Bonhomme. It had suffered heavy losses, the casualties in the VIII. Corps amounting to more than 50 per cent.

The offensive of the II. Army (de Castelnau) had been still less fortunate. On Aug. 14 the XVI. and XV. Corps moved in the direction of Avricourt, with the bulk of the XX., the remainder covering the front to the north. In the evening, it faced to the northeast on the high ground at Gondrexon, the XV. Corps alone having been stopped by the enemy at Moncourt. On the 15th the advance was still checked by the condition of the XV. Corps, which had suffered heavily; the XVI. Corps reached Igney-Avricourt, the XX. Bezauge-la-Petite and Xanrey. The IX. Corps remained on the Grande Couronne east of Nancy and sent out detachments toward the northeast.

On Aug. 16 the Germans continued their retreat and the French followed rapidly as far as Morhange, northwest of Donnelay. On the 17th the army was to swing round to the northwest toward Delme-Chateau Salins-Dieuze. The XVI. Corps progressed without difficulty; the XV. occupied Marsal, but could not bring its main body beyond the Seille; the XX. Corps, in possession of Château Salins, reconnoitred toward the north. Rearguard fights only were expected, but on the 18th the XVI. Corps from the early morning met the enemy in strength. The German artillery held the XV. Corps in the valley of the Seille and prevented it from occupying Dieuze. The XVI. Corps had to fall back on Angviller, and only the XX. advanced to the north of Morville-les-Vic and Château Salins. In spite of the loss of the IX. Corps, sent to the IV. Army on Aug. 18, de Castelnau ordered for the 19th the continuation of the offensive in the direction of Loudrefing, Bensdorf and Morhange.

French Retreat: Aug. 19–20.—From the morning of Aug. 19 the XVI. Corps was stopped on the Salines canal; the XV. could not pass Zommange and Vergaville; and only the XX. could make a real advance, pushing a brigade as far as Morhange. The 68th Res. Div., which had relieved the IX. Corps, insufficiently covered the left of the XX. Corps. De Castelnau ordered for Aug. 20 a combined attack by the two other corps on the line Cutting-Dommon-Bassing; the XX. was to consolidate its positions, ready to march to the north or northeast. On the 20th the corps on the right, instead of progressing, was attacked and even thrown back. The XX. having attacked and not having improved its positions was stopped by de Castelnau, but the Germans, taking the offensive, threw the left back on Château Salins. The right followed this movement on Lidrequin and the 68th Div. resumed its position of the previous day. At 4 P.M. the general ordered a retirement, which began during the night and co tinued through Aug. 21 under the protection of the XX. Cor and the 68th Division. In spite of the arrival of two new reser divisions and the II. Cavalry Corps, the II. Army had to ret to the west of the Meurthe, the left to St. Nicholas. To the nort three divisions held the Grande Couronne.

French I. Army Action.—On Aug. 23, the I. Army commenc a three weeks' battle destined to stop the enemy and support t strongly attacked II. Army. To effect this, it took the offensi on the 24th and 25th, while the II. Army threw back the G mans to the northeast. From the 28th to the 31st the Germ stopped the advance of the I. Army, and their VI. and V Armies even aimed at forcing "the gap of Charmes," in such manner as to carry out an enveloping movement to the west the Vosges. This action was helped by ordering the XXI. Cor to take part in the battle of the Marne.

From these circumstances there resulted a series of very co fused fights extending over a large front between the Grande Co ronne and the Vosges. On Sept. 6, the German VII. Army, faci Dubail, was broken up, divided between the VI. Army and t German right then engaged on the Ourcq against Gen. Ma oury. But Dubail's army was also enfeebled by the remova the XIII. Corps to the west of the Oise; and at the same time t II. Army lost to the west the 18th Div. and the XV. Cor Evidently both sides had given up the idea of striking serious in Lorraine. After having gloriously held its positions to the e of Nancy and on the Meurthe, the II. Army was itself to broken up, to be reconstituted on the left of the French Armi in the "race to the sea."

Thus, after checks resulting from an inopportune offensiv the I. and II. Armies had been first able to stop the Germ progress; then to throw the enemy back to the frontier. M over, their merit was all the greater since they had been c stantly weakened by the withdrawal of their best units. Du ing the battle of the Marne they provided the unshakable pi of the vast movement undertaken by the Allies. It was than to their efforts that that movement succeeded. But they h paid the price. A single reserve division between Aug. 24 a Sept. 12 lost 140 officers and more than 5,000 men.

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(B. E. P.)

III. BATTLE OF THE ARDENNES

On the outbreak of the World War, the III., IV. and French Armies concentrated towards the frontier, west of Meuse, covered by the VI. Corps in front of Verdun, and the Corps in front of Stenay. On hearing of the German attack Liége, Gen. Joffre decided to post the V. Army (Gen. Lanrez toward the Sambre and to direct the IV. Army, which he h grouped between Vitry-le-Français and Sainte-Menehould, the region of Stenay. The concentration, which had scarc begun on Aug. 8, was nearly finished on the 14th. Until t commander-in-chief had all his forces at hand, no one w allowed to be drawn into an important action.

The German high command had made a similar decisio hence the battle of the Ardennes was the "battle of the t blind men." However, on Aug. 10, a German mixed brig arrived near Mangiennes and was launched into a mad front attack against the advanced posts of the IV. Corps (III. Arm While all its attention was taken up with the attack in front brigade of the II. Corps (under Gen. Cordonnier, IV. Arm took it in the rear, and the German brigade was destroyed. Af this adventure, no German force made any further attem against the French covering troops.

French Plan of Attack.—The German plan of operatio placed the V. Army between Thionville and Tintigny, the IV between Tintigny and the Meuse de Dinant,[1] the III. Army b tween Dinant and the Sambre, the II. on the Sambre and the in the neighbourhood of Mons. The III. Army was still in th

[1] Name given to the Meuse between Mezières and Namur.

ennes behind the IV. and the I. Army was hastening towards ssels and Antwerp, when on Aug. 22 Joffre decided to attack. was certainly a strategic success to bring about a battle with is forces in the Ardennes, while the German III. Army was ble to take part in it. Joffre had disposed his III. and IV. ies in échelon, the left in front, so that he could face the h or east as he wished. On Aug. 16 he decided to attack to- ds the north with these two armies forming a rigid block, e the 7th Cavalry Div. reconnoitred towards Thionville, and 4th and 9th Cavalry Divs. to the north towards the Meuse. result was that in front, and almost everywhere, the Army ps had only weak and insufficient cavalry for reconnoitring poses. The liaison between the two armies was to be kept on axis Marville-Virton-Étalle.

uring the night of Aug. 20-1 the whole block moved for- d. The only instructions given by G.H.Q. were “ to attack enemy wherever met.” G.H.Q. estimated that the IV. y would have almost nothing in front of it, and yet it was isely there that the Germans had their IV. and III. Armies, III. being behind the IV. The Lorraine Army, which con- ed of the reserve divisions, groups under Gens. Pol Durand de Lamaze, was placed under the command of Gen. Maun- y with orders to defend the Hauts de Meuse, or eventually, he event of the advance of the III. Army, to besiege Metz Thionville. These reserve divisions were mobilised after active forces, the men were elderly, they had few officers, their staffs were inexperienced, so that the III. Army could little help from them.

n the evening of Aug. 21, after a long period, during which patrols had been encountered, the block arrived on the line a-Lagranville (VI. Corps), Tellancourt (V. Corps), Virton . Corps). At Virton the IV. Corps tried to get in touch the II., which formed the right of the IV. Army. The line of le continued by Villers-la-Loue (II. Corps), Geronville lonial Corps), Florenville (XII. Corps) and the Semoy (XVII. XI. Corps). The IX Corps had just arrived from the neigh- rhood of Nancy with the 17th Div. (Dumas); the Morocean . (Humbert) was not yet in line. The IV. Army (de Langle de y) was to push on towards the north, while the III. Army was over the right of the IV. Army against any attack coming n the north or east. Everywhere the advance was made in sions, except in the case of the II. Corps, which marched re on a single road.

n Aug. 22, all the columns started in a fog at a very early r for a long march with the idea of “ attacking the enemy erever met.” To march quickly rather than to take precautions the order of the day and almost everywhere the presence of Germans was only discovered by receiving shell fire. In the Army, the V. Corps sent its infantry to the attack without support of artillery, and it suffered such terrible losses that leaders became completely unnerved, and Gen. Grossetti, ef of the staff, had to intervene to prevent a precipitate re- at. In the IV. Army the Colonial Corps exposed a division in umn-of-route to the German guns. The XVII. Corps also ered from a sanguinary surprise. But the most serious danger se on the right wing of the IV. Army, uncovered by the pre- ture check of the IV. Corps at Virton; and on the right wing the III. Army, which was not covered either by the 7th valry Div. or the Pol Durand group of divisions.

ortunately the II. Corps was in a single column so that the division was able to make up for the absence of the IV. ps. On the right of the III. Army there was a leader, Gen. che, who with his heroic division gained the necessary time the other divisions to fall back. The Germans did not exploit r tactical success, but remained practically stationary in r positions. This battle of the Ardennes taught the French necessity for co-operation of all arms in the field of battle.

attle of the Meuse.—On Aug. 23, 24 and 25 the III. and IV. ies retired slowly without being disturbed. On the evening ug. 23 the front of the IV. Army was the line Montherme euse)-Montmédy; and that of the III. Army Montmédy- ncourt. On Aug. 24 they were a little farther to the rear, but not pushed by the Germans. A German staff commander, killed in his motor in front of Avioth, was found to have on him the orders given to the German IV. Army for the forcing of the Chiers and Meuse crossings on Aug. 26 and 27. The III. Army had obtained in a similar way information to the effect that the German 33rd Div. was to leave Metz and attack at Étain. A trap was set, but the Lorraine Army (reserve troops) was not equal to the task and the Germans escaped.

Lorraine Army Dissolved.—On the morning of Aug. 25, the right of the IV. Army retired between the Chiers and the Meuse; the III. Army also approached the Meuse facing eastwards. Thus the two armies practically became one, and it is regrettable that from this time they were not placed under one leader. On the same day, the IV. Corps (III. Army) suffered a severe check at Marville and they feared they would lose their corps artillery, but the II. Corps came to their assistance and convoyed this artillery to Stenay, where they crossed the Meuse. This shows how intimate was the co-operation between the two armies. It was on Aug. 25 also that Joffre gave the first orders which contained the real beginnings of the battle of the Marne. He decided to reinforce the left of the Allied Armies and to lose ground in order to gain the necessary time for his strategic plans. The Lorraine Army was dissolved; the Pol Durand group was to defend the Hauts-de-Meuse; Verdun and Toul were to have their respective mobile forces returned to them; the 55th and 56th Divs. were entrained for Montdidier. Gen. Maunoury had in these two divisions the nucleus of that VI. Army which appeared on the Ourcq and determined the victory of the Marne.

On the morning of Aug. 26 the entire IV. Army was on the left bank of the Meuse, protected on its left flank by the IX. Corps and the 4th and 9th Cavalry Divs. between Mezières-Rocroi and Signy-l'Abbaye, and forming the connection between the IV. and V. Armies. On its right flank it was in immediate contact with the III. Army, which was concentrated on the left bank of the Meuse with the exception of the 42nd Division. So much feared was the envelopment of the III. Army's right, that the 7th Cavalry Div. was sent to the rear to Dombasle, between Verdun and Clermont, as if an extensive enemy movement was expected to take place south of Verdun. The III. Army took no part in the battle of the Meuse; its 7th Div. was summoned to Beauclair in order to help the II. Corps on Aug. 27, but it was not engaged. On the same day the 42nd Div. was taken from the III. Army, reached Varennes, and then served as part of Foch's Army.

Defence of the Meuse.—On Aug. 26, the orders for the IV. Army ran: “ From to-morrow the IV. Army will fight a decisive battle on the Meuse. . . . The corps will make every effort to prevent any attempt of the enemy to cross the river.”

Generally speaking, the IV. Army was some distance from the left bank. Its object was to carry out vigorous counter-attacks against German infantry who had passed the river before its artillery could come to its support. The Colonial Corps was somewhat driven back by the Germans, who had crossed the Meuse at Inor and Pouilly, but the arrival of reinforcements from the II. Corps soon checked this. The struggle was severe on the whole front. On the right wing the II. Corps had decided successes, three times throwing the Germans back into the river at Cesse and Luzy. On the left wing, the success was still more marked. There the XI. Corps, reinforced by the 52nd and 60th Res. Divs., gained the battle of la Marfée. The German 16th Div., making the same mistake as did the French at the battle of the Ardennes, advanced in massed formation without artillery support and were crushed, leaving in French hands the flag of the 68th Prussian Regiment.

On the evening of Aug. 27 Gen. de Langle de Cary gave the following order: “ At all costs the Germans must be thrown back into the river Meuse. The successes gained by the offensive to-day make us hopeful that to-morrow will be equally successful.” However, Aug. 28 was not so active as the previous day; the Germans scarcely attacked at all, and the orders given by Joffre for the coming retirement to the Aisne kept the IV. Army to its ground. On Aug. 28 Gen. de Langle de Cary, in a general order, said: "The army inflicted heavy losses on the enemy, yesterday and to-day. It returns to the Aisne line, in accordance with orders received, to prepare for the offensive in a new direction." On the 29th the movements towards the Aisne commenced—the battle of the Meuse was ended. The French IV. Army had beaten the German IV. Army—a victory without a to-morrow, but certainly a victory.

Battle of Signy-l'Abbaye.—The French V. Army, having been beaten by the German II. Army on Aug. 22 and 23, had to retreat, leaving a gap 25 m. wide between the IV. and V. Armies. The Germans poured into this open space. The only known units were the advanced troops of the XII. Corps—it was really the III. Army commanded by Von Hausen. Gen. Dubois was ordered to fill up this gap and to cover the left of the IV. Army, and was given command of the IX. Corps, composed of the 17th Div. (Dumas), the Moroccan Div. (Humbert), and the 9th Cavalry Div. (de l'Espée). The 4th Cavalry Div. had been given up to the V. Army. Two roads led to the region occupied by the Germans at Rethel. The road Mezières-Rethel was barred by the 17th Div. and the 9th Cavalry Div. at Guignicourt, the road from Rocroi to Rethel by the Moroccan Div. at Signy l'Abbaye Launois.

On Aug. 28, the 17th Div., hearing the guns from la Marfée, had its attention drawn in that direction. On the same day, at 3 A.M., the advanced posts of the Moroccan Div. were attacked by the XII. (Saxon) Corps. At 11 A.M. the Moroccan Div. was turned in the west by the enemy, who seized Signy l'Abbaye and so opened up the way to Rethel. But the Germans did not exploit their success and allowed themselves to be checked at Novion-Porcien. The battle manoeuvres lasted through Aug. 29 and 30. Dubois, by clever movements, brought his forces to the north of Rethel, having thus accomplished his difficult mission. Again German strategy had not made the best use of its superior strength.

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IV. CHARLEROI AND MONS

Charleroi and Mons are the names given to the battles fought by the French V. Army and the British Army respectively in the latter part of Aug. 1914, against the right and right centre of the Germans.

The French Position.—Inasmuch as the British did not come up into line until Aug. 22, it will be necessary to deal with the purely French situation first. Germany had declared war on France on Aug. 2 and the right wing had crossed the Belgian frontier on the 5th. By Aug. 20 1914 the forward movement of the German right-wing armies into Belgium, and the failure of the offensive of the French I. and II. Armies, had caused a modification in Gen. Joffre's original plan of campaign. Broadly speaking the intention now was to attack through Luxembourg and Belgian Luxembourg with the object of threatening the communications of such German forces as had crossed the Meuse between Namur and the Dutch frontier. This duty devolved primarily on the III. and IV.—*i.e.*, the centre—Armies of the French. In the south the I. and II. Armies were to make a secondary offensive between Metz and the Vosges to hold the enemy, who might otherwise be able to take in flank the French advancing through Luxembourg; and the French V. Army and the British Army were to act upon the offensive, though this offensive would depend almost entirely on success by the III. and IV. Armies to their right.

On the evening of Aug. 20 the French V. Army was either actually within, or entering, the area bounded by the river Sambre on the north and the river Meuse on the east. The junction of these two rivers formed a very marked salient; but so far from being a point of weakness this locality was at the moment of great strength. It was sealed by the strong Belgian fortress of Namur which was to be the pivot of an Allied right wheel in the projected offensive. On the 20th there arrived from G.H.Q. the orders for Gen. Joffre's new offensive. The ord were to the effect that all information pointed to the intent of the Germans to carry out an outflanking movement in north. The French III. and IV. Armies had been ordered march against the line Neufchâteau-Arlon. As for the V. Ar its task was to pivot on Namur and the Meuse, and to seek the main enemy mass in the north. On the left of the V. Ar the British Army would advance towards Soignies in the direct of Nivelles.

British Expeditionary Force.—When England declared war Germany during the night of Aug. 4–5 her forces available take the field consisted of a cavalry division, six infantry divisi and some battalions of line-of-communication troops, the wh forming the Expeditionary Force for service overseas. T Govt. decided to retain two divisions temporarily in the Uni Kingdom and to transport the rest of the Expeditionary Force France. The first ships sailed on Aug. 9 and, thanks to the p fection of the arrangements for mobilisation and transportati the operation was completed without a hitch by Aug. 18. John French, the British commander-in-chief, had reached headquarters at Le Cateau on the previous day; and his ar consisted of the I. Corps (1st and 2nd Divs.), Lt.-Gen. Douglas Haig; II. Corps (3rd and 5th Divs.), Lt.-Gen. Sir H ace Smith-Dorrien; and the cavalry division under Maj.-G Allenby, as well as line-of-communication troops. Concentrat was completed by the 20th, south of Maubeuge; and the p assigned to the British was on the left of the French V. Ar preparatory to the advance north of the Sambre towards Soign referred to above.

While his army was concentrating, Sir John French visi Gen. Joffre at Vitry-le-François on the 16th and discussed p sible alternatives of action depending on information of enemy's plans and dispositions. The main intention was, ho ever, to attack. Next day, French visited Gen. Lanrezac Rethel and there conferred with the commander of the V. Arm Lanrezac considered that it was not possible to carry out at o the order to attack, so far as it affected his V. Army. The wh of his troops had not yet come to hand. Then it had to be bor in mind that the British had not yet come up on the left, a that the action of the V. Army would also depend upon the su cess of the French IV. Army on the right. Lanrezac therefo confined himself for the moment to issuing orders for the occ pation of a defensive position by the X. and III. Corps, south the Sambre.

German Offensive Plan.—On this same day (Aug. 20), on t side of the Germans, a combined attack had been arranged which the II. and III. Armies were simultaneously to attack t French V. Army, from the north and east respectively. T German I. and II. Armies were to close up to the line reach on that day, and an offensive against the enemy west of Nam was to be carried out in co-operation with an attack by the I Army against the line of the Meuse between Meuse and Giv details being left for decision by the Army headquarters co cerned. As regards the British, the German Intelligence De was woefully at fault, for it was stated that a "disembarkati of the British forces at Boulogne and the neighbourhood mu be taken into account. It is the opinion here, however, that landing on a large scale has not yet taken place." At the tim two-thirds of the British force was within 30 m. of Gen. v Bülow.

During the day the Germans attacked the French detachmen on the Sambre. The events of the day had resulted in dislocati Lanrezac's preparations for the offensive, and at 12:30 P.M. wrote to Joffre as follows: "I consider it dangerous to let t V. Army cross the Sambre during the 22nd, minus, on the o hand, the I. Corps, which must hold the Meuse until the I Army has made sufficient progress north of Semoy, and minu on the other hand, the English who on the 22nd will not be ab to get farther than Mons." During the evening a reply came fro Joffre to say that Lanrezac could choose his own time for th offensive, and he accordingly decided that it would be launche on the twenty-third.

Early on the 22nd, fighting was resumed all along the French nt on the Sambre. The X. Corps was forced back, and during afternoon the road from Fosse to St. Gerard was crowded h artillery, infantry and transport moving southward. Fosse s occupied by the Germans about 8 P.M. Farther west the . Corps had likewise to give ground. Severe fighting took ce early in the afternoon round Chatelet, and both divisions d to retire, the 5th toward Tarcienne and the 6th to Nalinnes. 1 P.M. the III. Corps had definitely to renounce its grip on the thern outskirts of Charleroi.

As for the XVIII. Corps, it came upon the field, but was ith of the Sambre between Thuin and Malines instead of be-, as Lanrezac had hoped, on the Mons–Charleroi road in ich with the British. The Cavalry Corps of Gen. Sordet had len back during the night to Solre, and in the afternoon was it to guard the crossings from Jeumont to Thuin, and also hold the cross-roads at Merbes Ste. Marie on the far side of river. The night march following on long and arduous work Belgium had been fatiguing to the horses, and the cavalry ps was in need of rest. Joffre had prescribed that it was to ve to the British left, but Lanrezac considered that it was not a fit state to move until the twenty-third. It was not, how-er, until the evening of Aug. 25 that it arrived behind the t flank of the British.

To Lanrezac on the evening of the 22nd, the situation of the Army seemed grave, but by no means desperate. Only two of corps, the X. and III., had been engaged, and if these had fered heavily they had also made the enemy pay the price. thdrawn to more open terrain, where their artillery could der better support, they could re-form and, so he hoped, in ir turn take the offensive. Further, the I. Corps was intact and w becoming available on the right, as was also the XVIII. rps on the other flank; and the reserve divisions of Gen. labregue were coming up to support it. The British were now iving in position on the left, round Mons. In one way Lan-ac was much more fortunate than he knew. Von Bülow had acked prematurely by forcing the Sambre on the 22nd instead waiting for the attack of the III. Army against the Namur-vet section of the Meuse to take effect, and the retirement of V. Army during the 22nd had seriously discounted the German ances of enveloping it.

The British Army in Position.—The British Army had prac-lly completed its concentration on Aug. 21 and on the lowing day took up a position from Condé to Mons and nce southwest of that town, so as to be able to co-operate the forward movement, pivoting on Namur, as ordered by fre. As a matter of fact Namur had been attacked by the rmans and during this day was *in extremis*. This fact was, wever, unknown to French, who motored early in the morning m his headquarters at Le Cateau to visit Lanrezac at Phil-eville. To his dismay French, on entering the area of the nch V. Army, witnessed columns of infantry and artillery ving south. A British liaison officer reported that the Germans d forced the passage of the Sambre and were also making a le turning movement through Belgium.

French at once decided to give up the attempt to find Lan-ac and returned to Le Cateau. From there he despatched a ssage to Lanrezac to say that he was waiting for the French valry Corps to be posted on his left, as had been promised, and t he was prepared to fill the rôle allotted to him when the Army advanced to the attack. He also pointed out that his ition was much in advance of the line now held by that army d hinted that although prepared to carry out his rôle he could begin to do so until the French V. Army should recover ne of the ground already lost. Late at night a French staff cer from Lanrezac's headquarters confirmed the news of the ting which French had heard of during the day and asked if nch, by striking at the right flank of the German columns, ld thus relieve the pressure on the V. Army. The British nmander-in-chief considered that this was quite impracticable agreed to hold on to his position for 24 hours.

ituation on Aug. 23.—On the morning of Aug. 23—the day on which the battle of Mons was fought—the general situation of French and British was as follows: The French V. Army faced in two directions, east and north. The I. Corps was on or behind the Meuse, where all bridges had been destroyed except those at Dinant and Hastière. The X. Corps had its right on the high ground south of Fosse and Vitrivel, its left at Scry. The III. Corps (reinforced by a brigade from the XVIII. Corps) was deployed on the line Gerpinnes-Nalinnes-Claquedent. The XVIII. Corps was on the line Ham-Thuin, with detachments on the Sambre as far as Merbes-le-Château. The French Cavalry Corps was holding the passages of the Sambre from the left of the XVIII. Corps to Maubeuge. The 53rd and 69th Reserve Divs. (Gen. Valabregue) were about Solre le Château, and were to relieve the Cavalry Corps, which was to make for Maubeuge with the object of emerging eventually on the left flank of the British Army.

The British right flank was north of the Sambre between Erquelinne and Peissant. From here was the I. Corps—looking northeast—with its left near Mons. In front of the line, about Binche, was the 5th Cavalry Bde., which was subsequently withdrawn. The II. Corps carried on this line, from and including Mons, west of which there was a French division of territorials. The main body of the cavalry was in rear of the British left.

In this position of the theatre of war the I., II and III. German Armies were concerned. The German plan had been that the II. Army was to attack south across the Sambre, while the III. Army was to co-operate by attacking west across the Meuse, sending a strong force across the Meuse towards Rocroi to bar the French line of retreat. During Aug. 23, the I. Army (von Kluck) was to conform to this offensive movement. Gen. von Bülow had, however, made the mistake of attacking prematurely with his II. Army; the combined movement with the III. Army was unsuccessful, and consequently the trend of the fighting drifted westwards to where the advanced guards of the I. Army were coming into contact with the British on the Mons-Condé canal.

Battle of Charleroi.—In his published account of the battle of Charleroi, Lanrezac divides it into two distinct phases, the first from daybreak until 4 P.M., and the second from that hour until nightfall. In the first phase the course of the battle was as follows: The right wing of the X. Corps was driven back, and it reformed between Scry and St. Gerard; the I. Corps deployed on the high ground round St. Gerard with its right about Sart-St. Laurent. This operation was completed about midday, and the I. Corps was then well placed to act against the flank of the German Guard Corps, which was then attacking the X. Corps sharply. Gen. Franchet d'Espérey, commanding the I. Corps, instantly resolved to seize the opportunity and to attack *au fond*. His artillery prepared the way by an intense fire, and the Germans, apparently taken by surprise, suspended their attack to deal with this new danger.

It was now about 1 P.M. and Franchet d'Espérey was about to launch his infantry when disquieting news reached him from his right rear. The 51st Reserve Div., which had relieved the I. Corps on the Meuse, had failed in its task, and had allowed troops of the German III. Army to cross the river. The report went on to say that the reserve battalions had fallen back in disorder and that a detachment of the enemy had occupied Onhaye behind the V. Army. Franchet d'Espérey had no alternative but to suspend his attack and to send a division and a brigade to deal with the peril behind. Emboldened by the enforced inaction of the French, the Guard Corps again pressed on, its artillery maintaining a very severe fire. The French X. Corps and the fraction left of the I. Corps resisted energetically, with the result that in this portion of the field but little ground was lost, and connection was still maintained with the fortress of Namur.

While such was the state of affairs on the right wing, little was, in this first phase, taking place on the left wing. But after 4 P.M. a change for the worse set in, in that portion of the field. The left wing of the III. Corps was taken by surprise and driven back by a sharp attack, with the result that the whole III. Corps fell back in confusion, while the XVIII. Corps, with its right now uncovered by the retirement of the III. Corps, was forced to withdraw to the stream which runs from Thuilles to Thuin. The reserve divisions of Gen. Valabregue, however, had come up to Bousignies and Thirlemont. On the right wing, in this second phase of the battle, the X. Corps had been forced to admit a loss of ground, but it was only slight. As for the I. Corps, the portion left at St. Gerard was holding its ground.

During Aug. 23 Gen. Franchet d'Espérey had been called upon to deal with the presence of a detachment of the German III. Army which had forced its way over the river. Some sharp fighting took place, and about 10 P.M. the French infantry carried Onhaye with the bayonet. This attack by the French came upon the Germans somewhat by surprise, and the units of the III. Army on the right bank of the Meuse were in consequence retained there for the moment.

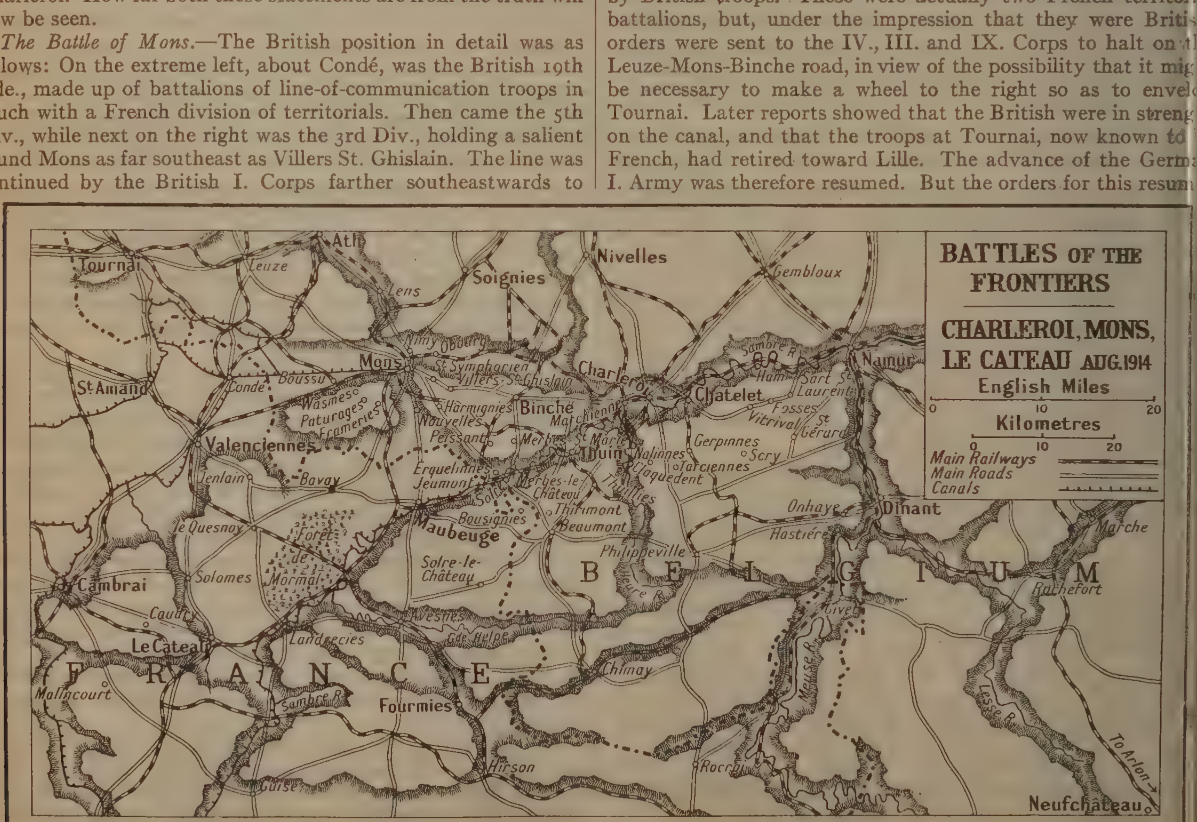
At the end of Aug. 23 Lanrezac came to the conclusion that immediate retreat was called for on the part of the V. Army. The chief causes of his decision are given by himself as follows: In the first place he had learnt definitely that the offensive of the IV. Army had failed and that the beaten troops were falling back to the Meuse with the left of the army on Mézières. The line of the river between that place and Givet was guarded by but a few battalions of reserve troops. The rear of the V. Army was thus threatened once again. In the second place Namur had fallen; in addition the roads on the right flank of the V. Army, already encumbered with thousands of civilian refugees, would be further blocked by the retreating Belgian troops from the fortress. Thirdly, the British Army was checked, and would in all probability be compelled to retire. Lanrezac, therefore, issued orders for the V. Army to retire on Aug. 24 to the line Givet-Philippeville-Beaumont-Maubeuge. Lanrezac's statement that his action was in part due to the conviction that the British would be forced to retire is a variant upon a previously held French opinion that such retirement actually preceded the retreat from Charleroi. How far both these statements are from the truth will now be seen.

The Battle of Mons.—The British position in detail was as follows: On the extreme left, about Condé, was the British 19th Bde., made up of battalions of line-of-communication troops in touch with a French division of territorials. Then came the 5th Div., while next on the right was the 3rd Div., holding a salient round Mons as far southeast as Villers St. Ghislain. The line was continued by the British I. Corps farther southeastwards to Peissant. The cavalry division was in rear of the British lef except the 5th Cavalry Bde., which was posted in advance of th right flank, but later withdrawn.

The British position was thus in shape somewhat like a broa arrow, with the two army corps practically at right angles to o another and facing, generally speaking, north and northea respectively. As matters turned out, the German attack w directed almost entirely against the II. Corps, and here on t left the situation was not unfavourable to the British, for t canal made a valuable defensive line, while the terrain on the f ther side held numerous difficulties for the attackers. Mud ditches and barbed-wire fences impeded their movement, a though, on the other hand, groups of trees and bushes gave cov from view and were of service for the enemy's machine-guns

South of the canal the crests of the high ground afforded t British useful sites for artillery, but the slag heaps of the num ous mines limited observation to some extent. The line of t canal, however, had one very disadvantageous feature: after ru ning from Condé to Mons in a mathematically straight line, forms a loop round Mons, thus constituting a marked salien Such a position might easily be found to be untenable, and S Horace Smith-Dorrien had prepared another and more defensi line in rear running through Frameries-Paturages-Wasme Boussu.

When day broke on Aug. 23 Von Kluck had three active cor and Von Bülow one, or about 150,000 men and 600 guns, with striking distance of the British force of some 75,000 men and 3 guns. The German I. Army was to march in a southeaste direction. The British II. Corps on the Mons canal was faci north. Consequently the left of Von Kluck's army must coll with the II. Corps in the neighbourhood of Mons. As a matt of fact the German commander was in ignorance of the positi of the British force. The march of the German I. Army, on t 23rd, was therefore shrouded in the fog of war, and, quite ear in the day, delay was caused by a report that Tournai was he by British troops. These were actually two French territori battalions, but, under the impression that they were Britis orders were sent to the IV., III. and IX. Corps to halt on t Leuze-Mons-Binche road, in view of the possibility that it mig be necessary to make a wheel to the right so as to envel Tournai. Later reports showed that the British were in streng on the canal, and that the troops at Tournai, now known to French, had retired toward Lille. The advance of the Germa I. Army was therefore resumed. But the orders for this resum


BATTLES OF THE FRONTIERS
CHARLEROI, MONS, LE CATEAU AUG. 1914
English Miles
0 10 20
Kilometres
0 10 20
Main Railways
Main Roads
Canals
Tournai
Leuze
Ath
Lens
Soignies
Nivelles
Gembloux
Namur
Mons
Obourg
St Symphorien
Villers St Ghislain
Charleroi
Chatelet
Sambre R.
Ham
Sart St Laurent
Fosses
Vitrival
St Gérard
St Amand
Condé
Boussu
Wasmes
Paturages
Frameries
Harmignies
Binche
Nouvelles
Peissant
Merbes
Marchienne
Mont St Vincent
Thuin
Nalinnes
Gerpinnes
Scry
Jamioulx
Ham
Florennes
Jarciennes
Valenciennes
Jenlain
Bavay
Erquelinnes
Jeumont
Sol
Merbes-le-Château
Thuillies
Thirimont
Beaumont
Bousignies
Maubeuge
Le Quesnoy
Forêt de Mormal
Solre-le-Château
Philippeville
Onhaye
Dinant
Hastière
Marche
Cambrai
Solomes
Caudry
Le Cateau
Landrecies
Avesnes
Gde Helpe
Chimay
Givet
Meuse R.
Rochefort
Lesse R.
B E L G I U M
F R A N C E
Malincourt
Sambre R.
Fourmies
Hirson
Guise
Rocroi
To Arlon
Neufchâteau

ion of the march were late in reaching the III. and IV. Corps, vith results that reacted on the German chances in the battle.

The left column of Von Kluck's army was the 17th Div. of the X. Corps, and its march was directed towards St. Symphorien nd Villers St. Ghislain. On the British side the I. Corps was on he line, generally, Harmignies-Peissant, and as it faced a gap etween the German I. and II. Armies its share in the battle of Ions was destined to be very small. It was shelled by German rtillery, covered in its advance by the 16th Dragoons, but the ritish casualties were slight. Of active fighting there was none ave for some spirited minor actions between the British divi- onal cavalry and cyclists on the one hand and German patrols n the other. The bulk of the day's fighting fell upon the salient ormed by the canal loop round Mons. So soon as Von Kluck ad grasped the real state of affairs his plan appears to have een to envelop both the British flanks while bombarding the ont heavily with his guns. The envelopment of the British left id not succeed, owing chiefly to the delay referred to above.

The battle opened in earnest about 10:30 A.M. with a bombard- ient by some batteries of the German IX. Corps which came ito action on a ridge to the north of Orbourg, and from that me onward the guns were gradually extended westwards as attery after battery, first of the IX. and then of the III. Corps, ime into action. At 1 P.M. the Germans had established a great iperiority of artillery against the front of the British II. Corps. he actual loop of the canal was held by the 4th Royal Fusiliers id the 4th Middlesex Regt., the former being responsible for ie bridge at Nimy while the right of the latter regiment held the ossing at Orbourg. At both these places the fighting was very vere, but the British musketry proved a terrible surprise to the ermans, who came on in masses which it was impossible to iss, and the British guns, though outnumbered by the German tillery, gave most effective support. Finally, however, the ermans were able through their superiority in numbers to ake a converging attack against the salient from the north and st, and the British were gradually forced back east and south- st of Mons. But the Germans were cautious about pushing to the town, and it was not until after 7 P.M. that the 84th egt. of the 18th Div. of the IX. Corps entered Mons, where it as thrown for a time into confusion by heavy fire. The British d Div. fell back to a line running east and west through ouvelles.

West of Mons the left division of the German III. Corps at- cked the left of the British 3rd Div.; and still farther west ong the canal the right division of the III. Corps, and later wards evening, the advanced guards of the IV. Corps, attacked e 5th Div. of the British. The retirement of the 3rd Div. from e salient round Mons inevitably led to a slight withdrawal of e 5th Div., and by nightfall the II. Corps was on a line which owed an average retirement of some three miles from the canal.

The Retreat Begins.—During the late afternoon and evening ench had been receiving disquieting news as to the situation the French V. Army on his right. At 11:30 P.M. a telegram rived confirming the reports, to the following effect: Namur d fallen during the day; the French V. Army had been heavily acked, and was falling back to the line Givet-Philippeville- aubeuge; Hastière had been captured by the Germans; the euse was falling rapidly and had added to the difficulty of ence. In these circumstances not only was the original offen- e out of the question, but the British line was now untenable. ench, therefore, decided to retreat to a previously reconnoitred e from Jerlain eastwards to Maubeuge, and orders were issued ordingly in the early hours of Aug. 24. The withdrawal was ected without serious loss, and for a moment French thought aking advantage of the fortifications of Maubeuge; but recol- ions of the fatal attraction of Metz for Bazaine induced him ass the fortress, and orders were issued at 3 P.M. on the 24th the retreat to be continued to the line Le Cateau-Cambrai.

BIBLIOGRAPHY.—A. Corbett-Smith, *The Retreat from Mons* 16); G. Hanotaux, *L'Enigme de Charleroi* (1917); R. von Gleichen- sswurm and E. Zurborn, *Schlacht bei Mons* (1919). (*See* also RLD WAR: BIBLIOGRAPHY.)

V. BATTLE OF LE CATEAU

The battle of Le Cateau was fought by the left wing of the British Army on Aug. 26 1914, during the retreat from Mons. After Bavai the retreat was handicapped by the Forêt de Mormâl, which compelled the British Army during the 25th to march in two separated portions, the I. Corps east of the forest and the II. on the west. During the previous night the detrainment of the 4th Div. from England was almost completed; and it moved to its position towards Solesmes.

Meanwhile reports showed that the French were retiring all along the line, and Sir John French had now to decide whether to stand and fight on the line Le Cateau-Cambrai, or to continue the retreat at daybreak on the 26th. He decided that the retreat should be continued, and orders to that effect were accordingly issued. The order was complied with by the I. Corps, and after some delay caused by a violent attack by the Germans on Landrecies, the retirement was continued on the 25th in the direction of Guise. In the II. Corps, however, shortly after midnight Sir Horace Smith-Dorrien came to the conclusion that, in view of the fact that many of his troops had just completed over 20 hours of heavy and continuous work, and that the enemy were close along his front, it was out of the question to continue his retirement at dawn. He therefore issued orders to fight on the ridge just south of the Le Cateau-Cambrai road.

Disposition of the Forces.—The force at Smith-Dorrien's disposal was as follows, from right to left: The greater part of the cavalry was between Le Cateau and the Sambre; later it moved to the left flank to get in touch with the French I. Cavalry Corps, which was in the neighbourhood of Malincourt. Then came the 5th Division. The 3rd Div. held the centre as far as Caudry, and on the left lay the 4th Division. Thence to Cambrai was a gap filled by the 4th Cavalry Bde., and later by the French I. Cavalry Corps. The French 84th Territorial Div. was retiring slowly through Cambrai. Each British division had a front of approximately three miles. The 4th Div. was incomplete, lacking divisional cavalry, signal company, ambulances, ammunition columns and heavy artillery. The 19th Bde. was the general reserve.

The German force on the heels of the British was the I. Army whose commander, Gen. von Kluck, was the victim of faulty conclusions before, during and after the battle. He believed that the whole of the B.E.F. was opposite him; he thought that it was holding a position running north and south, whereas the line of the II. Corps was almost due east and west, and he was sure that it was either retreating or about to retreat in a westerly direction. His plan was similar to that which had been tried at Mons, a frontal attack mainly with artillery followed by enveloping movements against both flanks. The cavalry was to pin the British left until the German infantry should arrive.

The German Attack.—Soon after daybreak the British were engaged upon both flanks. On the right some German troops entered Le Cateau and confused fighting ensued, while on the left the 4th Div. became engaged with the enemy. Here the 4th Div., after defending an advanced position for some time, fell back slowly to a second line and brought the enemy advance to a standstill. These events were but preliminaries, and the battle of Le Cateau proper opened with a heavy bombardment, which grew in intensity as the artillery of four German corps came into action. The British artillery made a spirited reply, though heavily outmatched in numbers and weight of metal, and dealt severely with attempts of the German infantry to push forward. These attempts were, however, practically limited to the ground near Le Cateau on the British right, and to the village of Caudry, which now formed a salient in the centre of the line. Throughout the forenoon constant infantry attacks, varied by bouts of heavy shelling, were made against the latter village, from which about noon the defenders were forced out by artillery fire; but a counter-attack at once regained part of it and the German infantry advance was held up.

Until 1 P.M. the line of the II. Corps was everywhere intact in spite of the superior numbers arrayed against it. But on the right the situation was becoming grave, for the 5th Div., with its right flank uncovered by the retirement of the I. Corps, was being threatened by more and more German columns converging upon the field. Smith-Dorrien realised that at all costs the fight must be broken off if his force was to be saved. Orders were sent to break off the fight and to continue the retirement of the previous days. Before the orders for retreat had reached all concerned the British right had given way before overwhelming numerical superiority. But the Germans failed to exploit this success, and the withdrawal of the II. Corps, thanks largely to the devotion of the British artillery and to the arrival of the French I. Cavalry Corps on the left, was effected with less difficulty than had been expected. Smith-Dorrien successfully withdrew his columns and marched them swiftly to the Somme at and near Ham. By Aug. 28 the II. Corps was safely across the river.

The losses of the British had been severe, 38 guns had been lost, and the casualties were over 7,800, the 4th Div. suffering particularly. The retreat was practically unmolested, for Von Kluck hurried southwest instead of south, and thus missed a chance not likely often to occur in war.

BIBLIOGRAPHY.—A. F. Becke, *The Royal Regiment of Artillery at Le Cateau* (1919). *See* also WORLD WAR: BIBLIOGRAPHY.

VI. BATTLE OF GUISE

By Aug. 25 the succession of victories achieved in Lorraine, the Ardennes and on the Sambre had produced an atmosphere of optimism at German general headquarters. It was thought that forces might be safely diverted to East Prussia to deal with the Russian invasion. Accordingly, on the 26th, two corps and a cavalry division received orders to proceed to the Eastern Front. On the side of the Allies, on the other hand, it was imperative to take immediate steps to check the onrush of the German right wing. During the night of Aug. 25–6 Joffre issued a new directive concerning a "new mass of manoeuvre" to be formed on the left flank to carry out an offensive and to consist of the French IV. and V. Armies, plus the British as well as a new French army—the VI.—to be made up of units moved by rail from other sections, chiefly from the right.

On Aug. 26 Joffre and French had a conference on this proposed offensive at St. Quentin, at which the commander of the French V. Army, Gen. Lanrezac, was also present. British co-operation was, however, impossible, for on this day half of French's army was engaged at Le Cateau, where it was very roughly handled. On the following day Joffre promised that the French V. Army would be immediately directed to take the pressure off the British. Accordingly at 1 P.M. on this day an officer arrived at Lanrezac's headquarters with verbal instructions to attack at once and with vigour toward St. Quentin. The French V. Army was at this time retiring over the Oise above Guise, and the attack it was called upon to carry out was with the object of following on the left flank of the German I. Army in order to delay the German onrush.

French Support for the British Army.—Nightfall on Aug. 27 found the French V. Army behind the Oise with its left below Guise and its right about Rumigny, the whole facing generally northeast. Lanrezac's task was a difficult one. He had to suspend a retirement toward the south and convert it into an attack toward the west. At noon on Aug. 28 Joffre came to see Lanrezac at the latter's headquarters at Marle. Lanrezac pointed out his difficulties and explained that his right flank would be considerably exposed in the operation enjoined upon him; but Joffre peremptorily ordered Lanrezac to proceed with the offensive and even threatened to relieve him of his command.

The German Advance Delayed.—At daybreak on Aug. 29 the main body of the V. Army began to cross the Oise above and below Origny, but the plan had to be modified owing to an attack made upon the right east of Guise by two corps of the German II. Army. Accordingly Lanrezac decided to postpone the attack toward St. Quentin and to deal with the threat against his right flank first. It was, however, impossible to carry out this new plan and it was now decided merely to mask St. Quentin and to devote every effort to dealing with the German attack east of Guise. The main body of the V. Army, assisted by a cavalry division, carried out its task with vigour and about 5 P.M. general offensive took place along the 18 m. front from Origny Vervins towards Guise. During the night the two German corp fell back across the Oise. This success was somewhat neutralise by events between the Oise and St. Quentin, where the situatio took an unfavourable turn for the French.

Having carried out its task of delaying the Germans; th French V. army fell back during the evening of Aug. 30. Th operation had been skilfully carried out, but Lanrezac was n in favour with French general headquarters and within a fe days he was relieved of his command.

BIBLIOGRAPHY.—Viscount French, *1914* (1919), and *Despatche* April 1914–July 1916 (1917); Marshal Joffre, *1914–15: preparati* *et conduite* (1920). *See* also WORLD WAR: BIBLIOGRAPHY.

(F. E. W.*)

FROST, ROBERT (1875–), American writer, was born San Francisco, March 26 1875. His father was a New England and his mother was born in Edinburgh. In 1885 he moved wi his parents to Lawrence, Mass., studied in the public school and entered Dartmouth College in 1892, remaining there o year. From 1897–9 he was a student at Harvard, and from 190 11 taught English in the Pinkerton Academy, Derry, N. H., a then for a year taught psychology at the N. H. Normal Sch at Plymouth. In 1912 he went to England, where he remain three years and published his first two volumes of verse. On h return to America he retired to a farm at Derry and gave mu time to active farming. During 1916–20 he was professor English at Amherst College, Mass., a position which he resum in 1923. His poems portray in realistic fashion everyday count life in New England. Some of the work of his first volume h been denied publication for 20 years, and some of the second 10 years. He is the author of *A Boy's Will* (1915); *North* *Boston* (1915); *Mountain Interval* (1916); *A Way Out*, a pl (1917); *New Hampshire* (1923).

FRUNZE, MIKHAIL VASSILIEVICH (1885–1925), Russian s dier, was the son of a peasant who had settled in Turkistān and b come a surgeon. While at school he came in contact wi socialists, and on entering the Polytechnical Institute at Petersburg (Leningrad) he joined the Bolshevik group in t social democratic organisation. In 1905 he worked in the dustrial district of Ivanovo-Voznesensk and helped to organi the big textile strike of that year. He was frequently arrest and in 1907 was sentenced to four years penal servitude, and a subsequent six years on the grounds that he had offered arm resistance to the police.

At the end of 1914 his penal servitude was exchanged banishment to Siberia, where he was arrested for revolutiona activities in the following year, but soon afterwards escap from prison and the March revolution of 1917 found him Minsk at the head of an illegal organisation in the army. became president of a Front Committee, and later president Soviet in the provinces, and at the time of the Nov. Revoluti came to Moscow with a detachment of 2,000 men, with which took part in the fighting in that city. After the revolt in Ja slaw he became military commissar of that district, and in D 1918, commander of an army on the Eastern Front. He la became commander in chief of four armies and directed t operations against Admiral Kolchak. When the Eastern Fr was divided, Frunze became commander on the Turkistān s tion of it, where he surrounded and destroyed Kolchak's sou ern army. He afterwards took part in minor operations Central Asia, returning to Russia in Sept. 1920 when he to command of the troops that eventually drove General Wran out of the Crimea. For this he was rewarded with a swor honour and a portrait of Karl Marx. He then commanded military forces in the Ukraine. In 1924 he became vice-presid of the Revolutionary Military Council, and, in the absence Trotsky, the actual head of the Red Army. He became presid of this council and People's Commissar for Military and Na Affairs in Jan. 1925, but died before the end of the year.

FRY, SIR EDWARD (1827–1918), English judge (*see* 11.27 died at Failand, near Bristol, Oct. 19 1918.

FRY, ROGER ELLIOT (1866-   ), British painter and art itic, son of Sir Edward Fry, was born in London, and educated Clifton and King's College, Cambridge. He studied painting ıder Francis Bate and then in Paris, and exhibited at the Car-x Gallery, London, in 1903. His work, notably in his land-apes, is marked by deep feeling for form and a scholarly sense design and technical means. An active member and exhibitor the London Group, he gave an exhibition of his own paintings 1920. As a critic, with his wide knowledge and acute sensibil-, Fry became recognised in England and abroad as a leading pert. He published a study of *Bellini* (1899) and edited *ynold's Discourses* (1905), but is best known by his champion-ip through much opposition and prejudice, of Cézanne and the st-impressionists. Among other publications are *Vision and sign* (1920); *Architectural Heresies of a Painter* (1921), and a ok of travel impressions, *A Sampler of Castile* (1923). He was so joint editor of *The Burlington Magazine*.

FRYATT, CHARLES (1872–1916), British seaman, was born Parkeston, Essex, Dec. 2 1872. He entered the service of the eat Eastern Railway Co., and in 1904 became chief officer in eir service of vessels plying between Harwich and Rotterdam. 1913 he was promoted captain. At the end of July 1916, it ıs announced that his ship, "Brussels" had been captured d the captain himself arrested and tried by court martial, a charge of having attempted, on March 28 1916, to ram a erman submarine. The German authorities stated that Cap-in Fryatt had confessed that he had acted under orders from e British Admiralty; but the trial was hurried and secret, no ervention on the part of neutrals being allowed. The captain ıs condemned to death and shot at Bruges, July 27 1916. ıe body was, on July 7 1919, brought from Belgium to England d was buried at Dovercourt, near Harwich.

FUAD I. (1868–   ), King of Egypt, was born at the palace Gizeh, March 26 1868, the youngest son of the Khedive Ismail sha. After his father's débâcle Prince Ahmed Fuad, as he en was, went to Italy where his youth was spent. He returned Egypt in the 'nineties and was appointed aide-de-camp to Khedive Abbas Hilmi. He found outlet for his energies by esiding over charitable and educational institutions and was gely responsible for the foundation of the Egyptian Univer-y, of which he became president. In 1917 his elder brother, Sultan Hussein Kiamil died, and as the latter's son, Prince mal ed Din, renounced the rights of succession, Prince Fuad ame Sultan. After the termination of the British protec-ate on Feb. 28 1922, he was proclaimed King of Egypt arch 16). He had married on May 25 1919 the Princess Nazli, ughter of Abdel Rehim Sabri Pasha, a former governor of iro, and his heir, Prince Faruk, was born on Feb. 11 1920.

FUEL PROBLEMS (*see* 11.274).—The wood of our forests is r natural fuel. If we were restricted to that material, the ormous fuel demands of our industrial age would long since e razed our forests. As the dearth of wood made itself felt in lustrial districts, recourse was had to the fossil fuels which ture has stored up, coal and peat, and natural oil and natural s. Bituminous coal was the most important of these fuels, and iron industry required in particular those coals which gave a tallurgical coke suitable for replacing the wood charcoal in blast furnace. In some countries, for instance in Germany, own coal has of late almost broken the predominance of bitu-nous coal; brown coal is more easily mined and offers advan-es as household fuel when briquetted.

urther, modern industry and transport, established on the l-fuel basis, have recognised the advantages of liquid fuels their necessity for certain purposes. Oceanic navigation kes an increasing use of crude oils; automobile and aerial tors are no longer to be thought of without gasoline fuel. ain, the cleanliness and precision attainable with gaseous ls in furnaces and in the preparation of valuable products, e secured to these fuels a preferential position in the produc-n of steel and in the manufacture of glass and of ceramic ects. Extensive systems of gas-pipes distribute gas through ns and industrial centres, even across states.

But the natural fuels, solid, liquid and gaseous, are by no means evenly distributed over our globe. Consequently we are forced to produce the required fuel from other sources, to meet local conditions, unless we are satisfied to depend upon imported fuel. The chemist and engineer are hence confronted with the problem of converting fuels of locally lesser value into fuels for which there is a greater demand. Thus arise many problems, the most important of which is the conversion of coal into oils.

I. GASEOUS FUELS AND THEIR PRODUCTION

From Solid Fuels.—The constitution of the gaseous fossil fuels is easily determined; for the molecules of gaseous substances are generally the smallest and the least complex. The combustible constituents of natural gases, exhaled as natural gas or fire-damp, are almost exclusively represented by methane, CH_4. The methane may have originated from residues of a fossil flora or fauna. The biological processes which resulted in the formation of petroleum took place under scission of methane, which was also produced during the formation of coal and during its natural ageing. Natural gas is therefore found in association with oil-fields and coal seams. As, however, natural gas is not replenished at the rate at which it is consumed in some industrial districts (*e.g.*, Pennsylvania), many works which originally relied upon natural gas have been obliged to adopt producer gas as their fuel. The chemical constitution of gaseous fuels is easily ascertained, and also the production of gaseous fuels from liquid and solid fuels offers no particular difficulties.

Dry Distillation.—For the preparation of gaseous from solid fuels two chief methods are now available. The so-called dry or destructive distillation of coal is historically the first. The gas formed by the thermal decomposition of the coal consists, when the temperature is kept as low as possible, essentially of methane and other hydrocarbons. When the coal is discharged into glowing retorts, as in gas and coke-oven works, the gas liberated will be the richer in hydrogen the higher the temperature. This method of coal distillation furnishes a gas of relatively high calorific value. With low temperature carbonisation, the calorific value may rise to 9,000 calories per cu. metre; at higher temperatures, the figure will lie between 4,000 and 5,000 calories. But the volumes of gas are comparatively limited; only a small portion of the coal substance is gasified, the bulk being transformed into coke. The yield is about 60 to 70 cu. metres of low temperature gas per ton of gas coal, and some 200 or 300 cu. metres of coke per ton. The complete gasification of coal cannot be effected by heat alone. The coke produced by the distillation must be gasified by chemical reactions. This can be done in three ways.

Chemical Reactions.—The reaction of air with white-hot coke yields a gas, theoretically consisting of two parts of carbon monoxide and four parts of nitrogen; this gas is of low calorific value. The reaction $2C+O_2=2CO$ proceeding under considerable liberation of heat, the manufacture of such a gas—air-gas—can be easily carried out continuously in shaft furnaces. The best material is coke; coal may be used provided it does not cake; brown coal briquettes are also suitable. From the standpoint of gas production, the ordinary pig-iron blast furnace may be regarded as a huge air-gas producer, with the difference that the oxygen required for the production of carbon monoxide is taken not only from the blast, but also from the iron ores. This process of coal gasification, the air-gas process, is associated with a pronounced liberation of heat.

Water-Gas Process.—In the water-gas process, however, the reaction $C+H_2O=H_2+CO$, heat is consumed and has to be replenished to sustain the process. The water-gas process can therefore not be carried out continuously in a shaft furnace unless external heat be supplied. The process is hence worked discontinuously. During the first hot run the coke charge is raised by the air blast to a temperature of about 1,000°C.; steam is then admitted, heat is absorbed and water-gas is produced, while the temperature of the layer of glowing coke sinks gradually. When the temperature has fallen a few hundred degrees, the hot-air blast is again turned on.

Mixed Gas Process.—Since the air-gas process liberates heat whilst the water-gas process absorbs heat, technical practice began to combine the two processes before the theory of the reactions was understood. Gas generators were worked with air and steam. Numerous advances have been made during the last decade in the domain of fuel gasification, particularly with regard to the difficulties caused by the use of coal instead of coke in the generation of both mixed gas and water-gas.

By the use of considerable additions of steam we have, in the mixed gas process, further learnt to recover the bulk of the nitrogen contained in the coal, in the form of ammonia (*see* AMMONIA). Success has also been achieved in the perfection of gas producers as economical apparatus for the manufacture of primary tar. The total gasification of the coal and coke has so far laboured under the disadvantage that, as the daily throughputs of gas producers were relatively small, a good many furnacemen and a good deal of stoking were required. Recently gas generators have been built for daily throughputs of 100 tons. This working in large units is one of the most important problems of coal gasification.

From Liquid Fuels.—Further substitutes for natural gaseous fuel can be obtained by the thermal decomposition of liquid fuels, such as crude oils or certain fractions of these oils, gas oil, tars or tar-fractions. The carburation of water-gas is a case in point. Water-gas does not burn with a luminous flame and its calorific power is low; it is therefore carburated by the injection of crude oil or tar oil into incandescent chambers. At temperatures above red glow the oils are decomposed, to a large extent, into gases, some tar and coke. The gases consist of very diverse hydrocarbons of higher calorific values than the water-gas. By mixing the two kinds of gases the water-gas is therefore enriched. In the early days the gas was carburated also for the purpose of rendering it luminous. With the invention of the Welsbach incandescent burners this application has lost its importance; but carburation for the sake of increasing the calorific value still remains important.

The thermal decomposition of oils is practised for the general purpose of obtaining gases of high calorific power. Thus tar or oil gas is manufactured by the decomposition of so-called gas oil. It served chiefly for lighting railway carriages, but is being replaced by electric illumination. The gasification of liquid, relatively inferior fuels, by the aid of steam might become valuable under certain conditions for the preparation of a water-gas rich in hydrogen, by a kind of water-gas process. Thus, petroleum vapours mixed with steam and heated to 1,000° in the presence of bauxite as catalyst can be converted into a mixture of carbon monoxide and hydrogen, which high-pressure catalysis further transforms into synthol and similar products.

From Other Gaseous Fuels.—It may happen that natural gas is available, but that hydrogen is needed. The conversion of methane into hydrogen may be effected catalytically by passing methane through tubes or kilns at the high temperature of 1,000°, when methane is decomposed into hydrogen and carbon. At lower temperatures the decomposition is incomplete. When shaft furnaces are used the carbon deposited can subsequently be burnt out again by blowing hot air into the furnace; the heat liberated is re-utilised to raise the furnace again to the high temperature and to decompose more methane. Like the vapours of liquid fuels (though less easily, owing to its high stability) methane can also be converted, by means of water vapour in the presence of bauxite as catalyst at about 1,000°, into a mixture of carbon monoxide and hydrogen.

The reversed process should finally be mentioned. If desired, the carbon monoxide contained in some available fuel gas mixture can be removed by transforming the carbon monoxide catalytically, at low temperature, into methane, with the aid of the hydrogen in the mixture. This was done experimentally about 1915. The process has not been adopted, however, although the elimination of the monoxide from illuminating gas seemed hygienically advantageous. The catalytic preparation of pure methane from water-gas, tried on an industrial scale some years ago, still remains in the preliminary stage, because the purification of the gas (of sulphur) and the partial remo of the carbon monoxide proved too expensive. Such a proce moreover, involves a loss of about 25% in calorific value, becau the proportion of methane, represented by the theoretical m ture of carbon monoxide and hydrogen, possesses only thr quarters of the heat value of the four times larger volume $(CO+3H_2)$ which it replaces. The reason is that this metha formation is a strongly endothermic process.

Purification of Gaseous Fuels.—For many purposes the a ficial gaseous fuels require careful purification. Thus, the escaping in large volumes from the mouth of a blast furna has to be freed of all the dust it carries before it can be fed i internal combustion engines. The object is attained by mecha cal cleaning and dust separation, by means of filters, centrifu machinery or sprinkling with water. The electric dust preci tation by the Cottrell process should especially be mention (*see* FUME PRECIPITATION). The removal from the gases of sulphur compounds is frequently a difficult problem. It is chie required in the case of illuminating gas, and the sulphur can recovered in a utilisable condition. The old-established meth purifies the gas by means of iron ore (bog ore). Activated bon has recently been experimented with for the same purpo The gas is mixed with a sufficient amount of air to oxidise sulphuretted hydrogen in the gas into sulphur; the sulphur retained by the carbon, and the process is accelerated if ammo is present in the gas. The activated carbon impregnated sulphur is then extracted with ammonium sulphide; the eva rated solution leaves the sulphur as a marketable residue. most of the catalytic processes removal of hydrogen sulph alone from the gas is, however, insufficient. The other sulp compounds, notably carbon disulphide, must also be eliminat

II. LIQUID FUELS AND THEIR PRODUCTION

The natural liquid fuels, natural oils or petroleums, occur widely-diverging compositions, and are partly aliphatic, pa naphthenic in character; aromatic compounds are found in so kinds of petroleum. The natural oils are also classified acco ing to the nature, asphaltic or paraffinic, of their high-boil residues.

As regards the origin of petroleum, the biological hypoth of Engler has found general support. According to this, pe leum was formed in the course of time by the decomposition the fatty constituents of small and large organisms. The opti activity of certain petroleum fractions is regarded as afford a strong argument in favour of this view. That, however, liq hydrocarbons, with which we are essentially concerned, may prepared artificially in other ways and might naturally h been produced in such ways under certain conditions, has b established within this century, by chemical research in vari cases. There are, *e.g.*, carbides, such as uranium carbide, w liberate liquid hydrocarbons when decomposed. It is furt known that acetylene and hydrogen may catalytically be c bined to form petroleum-like products; and within the last years it has been shown that the high-pressure synthesis water-gas leads to the formation first of synthol and furt when this synthol is heated under pressure, of an artif petroleum. Whether or not petroleum has been formed in s localities by inorganic reactions of cognate nature, cannot proved, but the possibility cannot be excluded.

From Solid Fuels.—Heating of geologically recent coals un exclusion of air seems to be the simplest method for the pro tion of liquid fuels from solid fuels. Destructive distilla yields, in addition to the gases mentioned and to the resi coke, a tar which, when formed at low temperature, cont constituents of petroleum character. The proportions of s tar obtainable are considerable. Gas coals of more recent logical periods (ordinary coal) yield up to 12% of the tar, ca coals still more. Certain lignites and oil shales are like suitable materials for the manufacture of the tar by distillat The Scottish shale-oil industry and the brown coal carbo tion works of central Germany operate on these lines.

The large bulk of the tar which comes from our coal gas

ke works is of a different composition. Owing to the high
mperatures which are used in gas-works and especially in coke-
ens, in order to secure high yields of both gas and a firm coke,
tars are essentially aromatic in character and rich in ben-
e, naphthalene, anthracene, etc. By weight the chief product
n either case semi-coke or coke. The tar yield referred to the
ght of coal, lies in general between 12 and 3% (*see* Coal Tar
oducts).

Bergius Process.—Since coal contains only 5% of hydrogen
average, whilst petroleum contains more than twice as much,
increase in the oil yield from coal seems dependent upon a
ply of hydrogen. In the Bergius process for the liquefaction
coal, hydrogen is made to react with coal at a pressure of
re than 100 atmospheres and at temperatures of about 450°.
e coal is ground and kneaded with 30% of tar into a paste;
s paste is continuously pressed into the high-pressure auto-
ve. We may imagine that the coal is first carbonised, the
mperature being sufficiently high for this purpose; the prod-
s are primary tar and semi-coke. The semi-coke is further
drogenated and half of it, by weight, is converted into oil.
at the reaction may proceed in this way has quite recently
en established by experiments in which the carbonisation
s effected at ordinary pressure, and only the hydrogenation
the semi-coke was carried out at high pressure. This "ber-
nnisation" is not equally applicable to all types of coal.
table materials are particularly coal of comparatively recent
iods, rich in volatile constituents, but not inclined to cake.
ch coals which are popular as fuel for gas generators, but in
neral unsuitable for coking, yield about 50% of oil by the
gius treatment, whilst low-temperature carbonisation would
the best give 10 to 12% of oil. The oil of the Bergius process
ot equal in value to natural oil. It contains, it is true, ample
portions of gasolene, but it also contains about 20% of
nolic constituents, and is hence more closely related in con-
ution to the primary tars than to petroleum. The Bergius
cess, which is expensive owing to the high-pressure apparatus
uired, offers advantages in localities in which there is no
rket for semi-coke, neither as domestic fuel nor for gasifica-
or the manufacture of powdered fuel. Under other con-
ons, improved methods of low-temperature carbonisation
l be serious competitors.

rom Other Liquid Fuels.—Natural, as well as artificial liquid
ls contain in general fractions of almost all boiling points,
ging from ordinary temperature up to 400°. Not all these
ctions are, however, in equal demand. In the 19th century
ip and illuminating oils, boiling between 150 and 250°, were
most valuable petroleum constituents. Since then electric
l incandescent lighting on the one hand, and the develop-
nt of automobiles, flying machines and industry generally
the other, have increased the values of the low-boiling ben-
es and of the lubricating oils in petroleum, so that the evalua-
of the various petroleum fractions has altogether changed.
present the supply of benzene from petroleum is not sufficient
satisfy the demand. Fortunately the high-boiling constitu-
s of petroleum can be converted by cracking processes into
-boiling motor spirits. One-third of the gasolene wanted in
erica for automobiles is said to be now produced by cracking.
e the oil-gas production mentioned above, cracking involves
ting of high-boiling oil fractions up to incipient decomposi-
. The cracking process is, however, conducted at lower
peratures, in the neighbourhood of 500°, and under pressure,
ause less gas and more vapours of gasolene type are formed
n the pressure is raised. This heating up to partial thermal
omposition of oils of high boiling points is important in other
pects. In the Diesel motor (*see* Internal Combustion
GINE), it is believed, the air is first heated by the compression
ke to cracking temperatures; the oil injected into this hot
is then thermally decomposed and burns in the compressed
separate ignition of the fuel can be dispensed with.

he dearth of low-boiling gasolene has induced designers of
omobile internal combustion engines to use fuels con-
ing high-boiling constituents. These constituents, however, are apt to ignite by the heat due to compression toward the end of the compression stroke and before the dead point is passed. The piston is then forced back and "knocking" occurs. This pre-ignition of gasolene-air mixtures seems to be favoured, if not caused, by the fact that the carbon deposited on the engine cylinder always carries some iron. The tendency to knocking is suppressed by adding to the motor spirit substances such as lead tetra-ethyl which, it is assumed, act by being adsorbed by the ferriferous carbon in the cylinder; the carbon is thus catalytically poisoned and cannot produce knocking. The anti-knocking reagents are, however, dangerous to the human system, and not likely to find favour. The best way of stopping the knocking trouble would be to return exclusively to motor fuels of low boiling points. The world's production of benzene is insufficient for the demand. Synthetic preparation of benzenes may bring the desired solution of this problem.

Some artificial liquid fuels can or should be improved or modified, wholly or partly, before utilisation. Half of the oil fraction of primary coal-tar consists of phenols for which there is little demand. By means of hydrogen at 700 to 800° they can be reduced to the more valuable benzene and toluene. Certain hydrocarbon fractions of primary tars are highly unsaturated; they can be hydrogenated and rendered more valuable in similar ways. The naphthalene of coke-oven tar can be converted into a liquid fuel, tetrahydronaphthalene, commercial tetralin. For this purpose the solid naphthalene is fused, purified by crystallisation and freed of the last traces of sulphur by treatment with metallic sodium. The naphthalene thus purified is then submitted to hydrogenation by means of hydrogen under pressure in the presence of nickel as catalyst, somewhat as in oil hardening; but the product, tetralin, is liquid.

Attempts have also been made to convert high-boiling liquid fuels and also tar and pitch into low-boiling motor spirit by the Bergius process, analogous to cracking but combined with hydrogenation. The process has not found industrial application, apparently because the American cracking processes attain the same object by less expensive means.

From Gaseous Fuels.—Gaseous fuels frequently contain vapours of liquid fuels of low boiling points. Natural gas, for example, very frequently, though not always, carries higher homologues of methane. There are benzene vapours in coke-oven gas, and the gases of low-temperature carbonisation retorts contain vapours of benzene character. These vapours can be removed and recovered by physical methods, scrubbing the gas with oil or treatment with adsorbents, such as activated carbon and recently also silicagel; the use of the latter reagent is so far largely experimental. These vapours are further condensed by cooling or by compression, or by a combination of the two methods. Both methods yield the liquid directly; in the former cases the oil or activated carbon used for the scrubbing or adsorption must afterwards be submitted to steam blowing in order to obtain the liquids.

The object of these processes is simply the recovery of fuels of low boiling point already present. Methods for the synthetic preparation of such fuels have been developed within the past few years. The process is a high-pressure catalysis, starting with carbon monoxide, utilised suitably in the form of a mixture of monoxide and hydrogen, a water-gas containing an excess of hydrogen. A mixture of one part of carbon monoxide and two parts of hydrogen is first carefully purified, especially of all sulphur compounds, and then compressed to about 150 atmospheres. At this pressure and a temperature of about 400°, the mixture is passed over the catalyst, for instance, zinc oxide or chromium oxide. The hydrogen is bound by the carbon monoxide and the reaction $CO+2H_2=CH_3OH$ yields almost pure methyl alcohol. Provided disturbing metals, particularly iron which would form iron carbonyl, be absent, no undesirable secondary reactions likely to diminish the alcohol yield seem to take place. Formation of methane, an undesirable reaction, would be aided by the presence of iron.

This synthesis of methyl alcohol hardly concerns the fuel problem. The alcohol contains almost 50% of oxygen, its calorific value is about half that of benzene or gasolene, and it is not a motor fuel.

Higher Alcohols.—In the case of the higher alcohols, it is possible to prepare mixtures of those alcohols and ketones by high-pressure catalysis, starting with the same raw materials, carbon monoxide and hydrogen, but resorting to other catalysts. These alcohol mixtures of oily character (*i.e.*, little soluble in water) which may be designated by the general term "synthol," can, for instance, be produced with the aid of iron impregnated with potassium carbonate as catalyst. Ninety percent of this synthol boils below 200°, and it forms an excellent motor fuel, at least equal in value to benzene and gasolene. For the present the synthol process is too expensive. But in the future synthetic motor fuels must be prepared in this or similar ways. Water-gas can be produced from all types of coal and peat. It is therefore possible to manufacture synthetic motor fuels in all districts where some coal but not petroleum is available. This source of fuel would provide for the time when petroleum and petroleum products fail. We have more reliable knowledge as to the occurrence of coal than about oil-fields. The coal resources of the globe will probably hold out for many centuries.

III. SOLID FUELS AND THEIR PRODUCTION

So far man essentially relies on fossil, chiefly solid, fuels for obtaining heat and power. Chronologically these fuels may be classified as peat, brown coal and coal. A discussion of their genetic interrelations is unnecessary. The earlier view which traced the genesis of coal to cellulose is giving way. Microscopical examination of coal indicates that coal is the decay-product of wood. Decay of wood, biological researches teach us, is due to certain fungi; they work by destroying the cellulose, which is transformed into gaseous and water-soluble products, whilst they leave the lignin essentially intact. Chemists have proved that the lignin and the carbon constituents proper of brown coal and coal possess a similar chemical constitution, that is to say, a cyclic structure.

The assumption is, then, that the main constituents of our fossil fuels have been formed by a slow decay of lignin, during which the essential chemical character of the lignin was preserved. Cognate interesting conclusions have been arrived at concerning the bitumen in coal. It would appear that the bitumen of the highly diverse brown coals consists mainly of fatty acids of high molecular weights and of odd numbers of carbon atoms, whilst the biologically easily digested fatty acids, which predominate in the fats of plants and animals, contain an even number of carbon atoms. We may hence assume that the fatty acids of the mother substance of coal, which are easily destroyed in a living organism, have disappeared, whilst the more resistant fatty acids of odd carbon-atom numbers have survived and have been utilised in the formation of bitumen.

The solid fuels—coal, for example—cannot always be used in the form in which they are won. According to requirements solid blocks are broken up and sifted into the desired sizes, or ground up and atomised to yield convenient powdered fuels. Conversely, small coal is rendered more marketable by briquetting; this applies particularly to the lignites, whose moisture of 50% is first reduced to 15%.

Apart from these mechanical modifications, other methods of improving solid fuels have of late acquired importance. Metallurgical coke was first made in coke ovens merely as a substitute for charcoal. The enlargement and perfection of the blast furnace called for a firm, little breakable and friable coke. Then the quality of the coke had to meet higher claims. What is wanted is absence of sulphur compounds. To a slight extent the sulphur is removed with the pyrites when the coal is washed. A complete elimination of the sulphur has been attempted by treating glowing coal with hydrogen; the process has not yet been adopted, chiefly, perhaps, because the purification is not complete, in spite of its high cost. Meanwhile, however, ways have been discovered of controlling the combustibility of the coke. The blast furnace requires an easily combustible coke, the cupola a coke which burns slowly. The former coke can, in general, be obtained by accelerating the coking process and by avoi subsequent heating, whilst high coking temperatures and coking periods favour the formation of a sluggishly burning c

The semi-coke obtained when temperatures of 500 to are not exceeded in its production is readily combustible. in a handy, dense and little friable condition, this semi-c the so-called smokeless coal, would represent an ideal fuel. produce such a semi-coke which will not require subsequent quetting is one of the most important problems of the fut considerable progress has been made in the solution of this p lem during the past few years.

The production of solid from liquid fuels is, as a fuel probl a matter of secondary importance. Retort graphite is produ by decomposing the tar vapours and the hydrocarbons of in gas retorts. Petrol coke, so-called, is obtained by cok petroleum pitch. Both these cokes are products of consider value for the manufacture, *e.g.*, of carbon electrodes; but t do not count as fuels. The soot prepared by the decomposit of vapours of liquid fuels, a high-priced form of carbon, is utilised in the manufacture of electrodes.

Reference should finally be made to the preparation of s from gaseous fuels. Here again a soot process should be m tioned in the first instance. Carbon black is obtained by incomplete combustion of natural gas; the process is waste however, and is only applied when the gas cannot be utili in other ways. Better results can be secured by the catal decomposition of carbon monoxide. This method has not found any serious industrial application, but it deserves att tion in cases where a carbon absolutely free of sulphur is wan The process might be developed in promising directions, si the decomposition of the monoxide $2CO=C+CO_2$ yields bon dioxide which cyclically can be reduced to monoxide ag The essence of the process is therefore an intermediate gasi tion of impure coke for the preparation of pure carbon.

See "Fuel and Power Generation," in *Rogers' Manual of dustrial Chemistry* (4th ed., 1925). (F. F

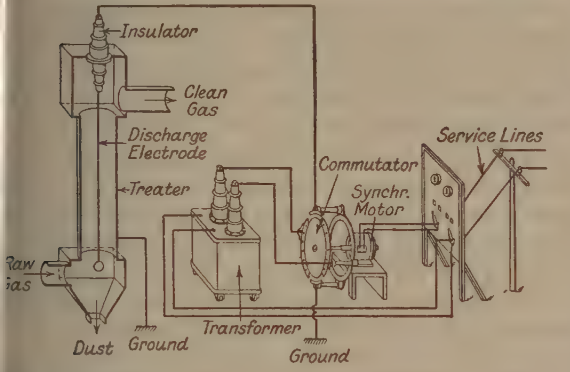
FULLER, JOHN FREDERICK CHARLES (1878–), B ish soldier, was born Sept. 1 1878 and gained a commissio the Oxfordshire and Buckinghamshire Light Infantry After active service in the South African War, he relieved tedium of peace-time soldiering by extensive scientific and ph sophical studies, and gained a considerable reputation as authority on Hindu mysticism and the Hebrew Kabbalah. Th studies provided an unusual groundwork and mental eq ment for his military researches later. In the World War, holding a variety of staff appointments, he became chief ge staff officer of the Tank Corps in April 1917. He had a resp ble share in the project for the great tank surprise at Cam in Nov. 1917, and in the tank successes later, until in July he was brought back to the War Office to organise the vast expansion then contemplated for 1919, had the war contin

Developing his ideas after the Armistice and preaching new gospel of war, Colonel Fuller was for a time criticised tank extremist, an unpractical visionary. Abroad, however, views were acclaimed, by the French general staff, who tra lated and circulated them throughout their army, as "an ex vision of the future." Gradually, however, his prophecies his teaching permeated the army, gaining power from his pointment, in 1922, as chief instructor at the Staff College, still more when, in 1926, he was appointed military assistant the new chief of the Imperial General Staff. The result of researches into the science of war is incorporated in his *Foun tions of a Science of War* (1926), and among numerous ot books, his *Tanks in the Great War* (1920), *The Reformation War* (1923), and *Sir John Moore's System of Training* (19 attracted wide attention (*see* STRATEGY).

FUME PRECIPITATION, ELECTRICAL.—The precipita of smoke by electricity was described in 1824 by Hohlfel teacher of mathematics in Leipzig, but only after it was in pendently rediscovered and critically studied by Sir Oli Lodge about 1884 did it attract general attention and lead attempts at industrial applications. At the time, howe

;e proved unsuccessful due to the lack of modern equipment. 'as not until 1906, following experiments at the University California, that the process was commercially successful. 'he first installation was at the Selby Smelting Works, near Francisco, where it was used for the removal of sulphuric l mist from about 5,000 cu. ft. of gases per min.; it was still peration there in 1926. By 1910 a plant to remove dry dust fume from 250,000 cu. ft. of gas per min. was built at an-er smelter, and in 1912 the process was successfully extended he removal of cement dust at nearly a red heat from 250,000 ft. of gas per min. at the Riverside Portland Cement Com-y. This mill, of 2,500 bbls. daily capacity, situated in the rt of the Californian orange groves, had been threatened with ıl closure as a nuisance because of the dust emitted.

'he electrical method as there installed removed 98% of the t, the daily catch being about 100 tons, aggregating for these years of operation over 350,000 tons, equivalent to a train of y loaded freight cars 100 kilometres long. Although first applied mitigate nuisances, the demand for the process to-day is marily based on a greater profit to be derived from the gases ıned or the material removed. At one time during the World ır, even the Riverside plant was making more profit from ash incidentally recovered in its dust than from its cement.



'IG. 1.—Apparatus for the electrical precipitation of dust or ›ke from gases.

Research Corporation.—Another circumstance aiding the de-opment through friendly public interest was the creation in 2, under the auspices of the Smithsonian Institution, of the search Corp. in New York City, to hold and administer as an lowment for research most of the United States patent rights the process. The corporation besides supervising construc-n and development of this particular process, also serves in ıeral as a clearing house for information and as an intermedi- and trustee between inventors, the industries and the public.

The Process.—Technically the process consists in securing a iform, copious but non-disruptive discharge of electricity m small electrode surfaces of one polarity into a stream of udy gas. The fine solid or liquid particles composing the dust, ne or smoke are immediately attracted to, and deposited on, ge electrode surfaces of opposite polarity, the particles having ome charged from the condensation on their surfaces of a ction of the electricity passing between the electrodes. The ›cess is diagrammatically illustrated in fig. 1. Alternating rent from service lines is stepped up in a transformer to a h voltage and then converted to a direct, or rather a pulsating directional, current by a commutator or "rectifier" driven a synchronous motor. One side of the line is grounded and ınected to a pipe or "treater" carrying the fume-laden gases. is pipe serves as the collecting electrode. The other side of the terminates in a wire serving as the discharge electrode, which ıung axially within the pipe. Voltage is regulated to secure as ong a glow as corona discharge from the wire electrode as ssible without passing over into a disruptive discharge, *i.e.*, spark or arc. This adjustment is easier when the discharge ctrode is the negative, though either polarity may be used.

The gas treaters now in general use consist either of a multiplicity of pipes similar to that in the figure, or of plates hung vertically in a flue, the wires being stretched parallel between them. The materials of construction, including the collecting electrodes, vary from iron and lead to reinforced concrete and vitrified earthenware, depending on the composition and temperature of the gas stream to be treated.

Factors in Design.—Most plants are designed with electrodes of opposite sign 2 to 6 in. apart and operating at 30,000 to 80,000 volts. The size of installation is determined primarily by the volume of gas to be treated and the percentage of suspended matter to be removed, the amount, kind and size of particle of the latter being of minor importance. If P is the ratio of outgoing to incoming suspended matter, t the average time in seconds that the gas remains between the electrodes, and K, a constant depending upon the apparatus, voltage, temperature and kind of raw gas, then $P=K^t$. In most commercial practice t averages about 2 seconds and K varies from 0·2 to 0·7, the gases travelling from 10 to 40 ft. through the electric field of linear rates of 3 to 15 ft. per second. Removal of 90% to 99% of the suspended matter is usually aimed at, and the energy required is 1 to 3 kw. hours per 100,000 cu. ft. of gas treated.

Industrial Uses.—The earliest applications of the process were to the smelting and sulphuric acid industries. Installations in such plants in 1926 still outnumbered those in all other industries, and amounted to several hundred scattered throughout the world. Equipments at cement mills were fewer in number but handled a large volume of gas and a large tonnage of precipitate. Other important applications are to the detarring of coke-oven gases, the cleaning of producer and iron blast-furnace gas, the cleaning of ventilating air in crushing, grinding and polishing mills (especially where cost of heating in winter makes recirculation of air important), the recovery of sludge acid fumes in petroleum refineries, the recovery of dust from brown-coal dryers, and the removal of ash from the stack gases of large power-plants burning powdered coal. On a laboratory scale the process has also been applied successfully to sanitary atmospheric analysis and to gas masks, including the removal of bacteria from air, but suitable standard equipment for these small-scale uses is apparently not yet on the market.

The process in itself precipitates only suspended solid or liquid particles and makes no separation between gases. It has, however, an important indirect application to problems in this latter field, involving the recollecting of solid or liquid absorbents which have been dusted or sprayed into gas mixtures. The electrical demulsification or dehydration of crude petroleum and transformer oils, the separation of fine suspensions, such as clays in pure water and other poorly conducting liquids (electrical osmose or electrophoresis) and electrostatic concentration of ores, though dependent on some of the same natural phenomena, differ to such an extent, in principle and equipment required, from the process here described as to preclude their discussion under this heading.

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FUNDAMENTALISM AND MODERNISM.—Fundamentalism is the name given to a religious movement which, appearing independently in different denominations in the United States during the period after the World War, steadily gathered momentum until in 1925 it became a subject of national, as distinct from denominational, interest through the trial and conviction of John T. Scopes, teacher of science in Rhea High School, Dayton, Tenn., on a charge of violating the Tennessee law prohibiting the teaching of evolution in the state public schools.

The trial began on July 10 1925, and was concluded on July 21 1925, by the conviction of the defendant and his sentence to pay a fine of $100. The immediate issue was as to whether the defendant had or had not violated the provisions of the state law as to the subjects to be taught in public schools, but the wider issue was as to the extent to which the state, in its control of public education, may determine the nature of the religious instruction given to the students in its schools. The trial itself was the culmination of a movement which had been going on for some years. Alarmed by the steady growth of liberal tendencies, the conservatives of the different churches had banded themselves together to stay what seemed to them the rising tide of negation. The form of the movement differed in the different communions according to the particular issue which was in question at the time, but common to all the Fundamentalist groups was, first, the acceptance of a view of the supernatural which insists that God manifests His presence in nature and history through exceptional and extraordinary activities, transcending the laws of nature; and secondly, the determination to use this conception of religion as a test to limit the freedom of teaching hitherto enjoyed by the ministers of the denomination. In all this there is nothing new. In every age conservatives and liberals have carried on their conflict over some form of this issue. What is new is the wide-spread character of the movement, the missionary enthusiasm which has been brought to it by its advocates and the consciousness on their part of interests transcending denominational lines and calling for a new alignment, with the Fundamentalists of all denominations on one side and the liberals on the other.

The Presbyterian Church.—In the Presbyterian Church the controversy centred about the case of Dr. Harry Emerson Fosdick, a Baptist clergyman who had been invited to act as stated supply for the First Presbyterian Church in New York City. Dr. Fosdick, who is also a professor in Union Theological Seminary in that city and a man of moderate liberal tendencies, made it his condition of accepting the call that he should be allowed to retain his membership in the Baptist Church. A sermon preached in May 1922, entitled "Shall the Fundamentalists Win?" was the occasion of an attack upon his theology by conservative Presbyterians, which led the General Assembly of 1923 to direct the Presbytery of New York to take such action as would require the preaching in the First Presbyterian Church to conform with the Confession of Faith. The Presbytery, after full conference with Dr. Fosdick and the Church, reported that such was now the case, whereupon the Assembly of 1924, without passing any judgment on Dr. Fosdick's theological views, expressed the opinion that if he were to remain longer in the pulpit of the Church, he should accept the standards of doctrine required of other ministers. On this issue Dr. Fosdick withdrew, declaring that "Creedal subscription to ancient confessions of faith is a practice dangerous to the welfare of the Church and to the integrity of the individual conscience."

In connection with this controversy the General Assembly in 1923 reasserted the so-called "Five Points," a declaration originally made in 1910, setting forth as essential doctrines of the Christian faith, the Virgin Birth, the physical Resurrection, the inerrancy of Scripture, the substitutionary Atonement and belief in the Miracles. In reliance upon this statement the judicial commission of the Assembly, in May 1925, declared that the Presbytery of New York had erred in licensing a student refused to affirm the Virgin Birth. The liberals attacked procedure as an unconstitutional limitation of the liberty interpretation accorded to every minister by the terms of scription, and to the Presbyteries by the historic precedents the Church. (*Cf.* Auburn Affirmation of May 1924, signed 1,283 members.)

The Baptist Church.—In the Baptist Church the controve has taken the form of an effort on the part of the conservati to secure the adoption by the Annual Conference of a creed wh should be used as a test of ministerial fellowship. This atten failed at repeated conferences, but the conservatives, defea at this point, have sought to secure their ends by instructi given to their Board of Home Missions as to the conditions to observed in the administration of their funds. One large beq was actually accepted by the board on conditions which see to some of its critics unduly to limit its freedom. A para effort to secure control over the teaching of the seminaries thus far failed of success.

Not the least important feature in the Fundamentalist mo ment is its bearing upon foreign missions. In general the poli of the different missionary boards has been to put the resp sibility for determining the doctrinal qualifications of candida upon the home church; and in the work on the foreign field c servatives and liberals have co-operated successfully in vari union enterprises. Fundamentalists have challenged this rangement and attacked the theology of liberal missionari On the whole this attack has been unsuccessful, and the un won on the field has thus far been maintained; but the battle by no means over or the danger at an end. A case in point is action of the General Convention of the Disciples at Oklaho City, Okla., on Oct. 6 1925, in reaffirming the principle of c communion which has been departed from by some of t missionaries in the interest of wider co-operation.

The Episcopal Church.—In the Episcopal Church the c troversy has centred about the literal observance of the cree On Oct. 5 1923 Bishop Lawrence of Massachusetts made address (afterwards published in pamphlet form) entitled *F Years*, in which he pleaded for a liberal interpretation of creeds. On Nov. 14 1923 at Dallas, Tex., the Bishops of Episcopal Church met this challenge by issuing a Pastoral sisting upon literal acceptance of the creeds and questioning good faith of those ministers who gave their historic stateme a symbolic interpretation. This Pastoral was attacked by liberals of the Church who were organised in a body known as Modern Churchman's Union. Sermons were preached by lead liberals, like Dr. Leighton Parks of St. Bartholomew's Churc New York, and Dr. William Russell Bowie of Grace Church the same city, and manifestoes were issued by theologians li the volume of essays entitled *Creeds and Loyalty* by seven me bers of the faculty of the Episcopal Theological School Cambridge, Mass. (1924). As a result of this agitation a tri for heresy begun against the Rev. Lee. W. Heaton for denying Virgin Birth was abandoned, and for the moment a truce has be declared.

The Bible Institutes.—One of the main sources of popul conservative propaganda is the so-called Bible institutes, which the most important are the Moody Bible Institute Chicago and the Bible Institute of Los Angeles. These school interdenominational in character, recruiting their scholars fro young people without college, and many of them without hig school education, insist upon the inerrancy of the Scriptur which they interpret commonly in the pre-millennarian sens They are carrying on an extensive propaganda partly throug periodicals of interdenominational character and partly throug conventions (the so-called prophetic conferences), which bri together large numbers of people. While not primarily designe as theological seminaries, many of their pupils are finding the way into the churches and are reinforcing the conservativ elements which are already there.

It is against the background of these influences that one mus interpret the Tennessee trial. Under the leadership of Willia nnings Bryan, the conservatives had been carrying on an ive campaign throughout the country, attacking the views of eral Christians as fundamentally irreligious and unchristian l insisting not only upon rigid measures on the part of the ividual churches, but also upon such a stiffening of the laws the states as to prevent what they regard as the insidious paganda of modernism in the schools. The storm-centre of debate was the doctrine of evolution which, as interpreted Mr. Bryan, involves a denial of the Biblical doctrine of ation and the surrender on the part of the teacher to an all-vouring materialism. In view of the fact that similar legislation either been passed or attempted in other states, it is not ely that a final decision will be reached upon this larger issue til the U.S. Supreme Court has passed judgment upon the tter. (W. A. B.)

FUNGUS: *see* MYCOLOGY.

FURNACE: *see* ELECTRO-METALLURGY.

FURNESS, HORACE HOWARD (1833–1912), American Shake-earian scholar (*see* 11.362c), died at Wallingford, Pa., Aug. 1912. His Variorum edition of *Cymbeline* was ready for the nter and appeared in 1913.

FUR TRADE (*see* 11.346).—The most important development this field in the period 1910–26 has been the rise of fur farming, de possible through the domestication of the silver fox and ner fur-bearing animals. This industry had its inception in ince Edward Island, Canada, those chiefly responsible for successful development there being R. J. Oulton, Charles ulton, J. S. Gordon, Robert Tuplin and B. J. and Silas Rayner. the silver fox pelt is the most valuable skin produced in orth America, these men were able to accumulate great alth for themselves as well as opening the door to similar portunities for others. Domesticated silver foxes sold at st for as high as $35,000 a pair. Prices have since fallen, with e stabilisation of the industry, to less than $1,000.

Development of the Industry—The Governments of Canada d of the United States have taken cognisance of the new dustry by the establishment of experimental ranches and formation bureaux. Yearly exhibitions also have been stituted for the comparison and judging of the animals. The dustry has since spread widely, ranches having been established Great Britain, Norway, Sweden, Germany, France and other untries. The domestication of the silver fox has encouraged nilar experiments with other animals and these have led to the ccessful rearing of minks, red foxes, blue foxes, raccoons, rakul sheep (persian lambs), martens and fishers. Muskrats d beavers have also been raised in confinement for the sake of eir pelts and require a much larger territory in which natural nditions are maintained and enemies excluded. Under such nditions these animals multiply very rapidly.

Markets and Production.—Prior to the World War London d Leipzig were the two largest fur markets in the world, more an half the total supply being sold at these places. Most of the essing and dyeing was done in Germany. It is estimated that 1910 North America and Europe each produced furs valued at $24,000,000, Asia $26,000,000, Australia $6,000,000, South America $2,000,000, and Africa and Oceania $2,000,000. The annual production has, since that time, more than doubled in value, Canada producing the greatest amount and exporting in 1925 pelts valued at $17,119,981 (about $22,000,000 in 1919–20). This increase is to be accounted for in large part by the rise in value of furs, occasioned in the first instance by the scarcity of pelts following the War. Muskrat pelts, the staple fur of North America, which had formerly been sold for from 10 to 30 cents apiece, frequently brought a price of $5.00. The interruption in trade caused by the War resulted also in the rise of a number of new fur markets, notably in St. Louis, New York and Montreal. The combined offerings of muskrat pelts at these three cities in the years 1920–3 amounted on the average to 3,366,516 pelts. The combined offerings of all auctions for these skins held in North America for 1924–5 averaged 4,594,446 pelts per year.

Manufacture in America.—Before 1914 approximately 65% of the furs secured in North America were exported abroad for manufacture and sale. The difficulties of export during the War, however, resulted in a large increase in fur manufacturing in America and particularly in the United States, where it is largely concentrated in New York City. The total imports into the United States from Canada and other countries in 1924 were valued at $87,705,582. About 20,000 concerns in the United States were handling furs in 1924. Of these, New York City alone had 2,000 wholesale manufacturers, who disposed of 80% of the manufactured furs sold in the wholesale trade. The fur-manufacturing establishments in the United States increased from 1,300 in 1914, employing 9,000 people, to 1,700 in 1923, with 19,000 employees. The wages paid increased from $6,000,000 in 1914 to $28,000,000 in 1923. The estimated retail value of furs and fur trimmings sold annually in the United States is $500,000,000.

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FURTWÄNGLER, WILHELM (1886–), German conductor, was born in Berlin Jan. 25 1886, the son of the famous archaeologist and university professor, Adolf Furtwängler (1853–1907). He received his musical education in Munich from Beer-Walbrun, Rheinberger and Schillings, and then acted as conductor at Zürich. Later he occupied similar positions at Strasbourg, Lübeck, Mannheim, Vienna and Frankfort-on-Main. In 1922, on the death of Arthur Nikisch, he became director of the Berlin Philharmonic Orchestra and of the Gewandhaus concerts at Leipzig. Ranked among the finest conductors in Germany, Furtwängler also gained an international reputation, which was considerably enhanced by his annual concerts in New York.

FUSE: *see* AMMUNITION.

FUTURISM: *see* PAINTING.

GAELIC LITERATURE: *see* IRISH LITERATURE, GAELIC; SCOTTISH-GAELIC LITERATURE.

GAIRDNER, JAMES (1828–1912), British historian (*see* 11.390), died at Pinner, Middlesex, Nov. 4 1912. A third volume of his *Lollardy and the Reformation in England* appeared in 1911.

GALATZ or GALATI, Rumania (*see* 11.396), saw considerable industrial development before the World War. The population, 73,512 in 1914, was estimated in 1919 at 60,000. The export of grain and timber has revived, and there are grain- and flour-mills in the town. The port has been improved, and vessels of 5,000 tons can reach it since dredging on the Danube has been resumed; there is now from 20½ to 23 ft. at low water. The docks accommodate 10 steamers and 20 barges. The communications by road and rail, however, are unsatisfactory, and are liable to be interrupted altogether in winter. Galatz is the seat of the Rumanian naval school. The Rumanian naval base is at Sulina. (*See* DANUBE.)

GALE, ZONA (1874–), American author, was born at Portage, Wis., Aug. 26 1874. Having graduated from the University of Wisconsin, she engaged in newspaper work in Milwaukee, and in 1901 joined the staff of *The World* (New York). After 1904 she devoted herself to fiction, verse and plays, producing among other works, *The Loves of Pelleas and Ettarre* (1907); *Friendship Village Stories* (5 vol., 1908–19); *Birth* (1918); *Miss Lulu Bett* (1920); *The Secret Way*, verse (1921); and *Faint Perfume* (1923). She was awarded a Pulitzer Prize for her dramatisation of *Miss Lulu Bett*, produced in New York, 1920.

GALICIA, EAST (*see* GALICIA, 11.401), a district assigned to Poland in 1923. Its oil-fields are of great value. The province of Galicia, finally assigned to Austria in 1815, fell into two well-defined ethnographical parts. East of Przemysl, some 72% of the population was Ruthenian (Ukrainian), the minority being mainly composed of Poles and Jews, who are extraordinarily numerous in the towns. It was usually contended by the Poles of Galicia that Ruthenes do not exist; and the Austrian Govt. long accepted this theory in order to ensure the loyalty of the Poles. The Russian Govt. also supported this view in order to discourage the nationalist movement in the Ukraine; and the Ruthenes themselves were divided—one party feeling itself Russian, the other Ruthenian-Ukrainian. About 1910, when the Neo-Slav movement partly reconciled the Poles with the Russians, thus shaking their loyalty to Austria, Austria began to encourage the particularist Ruthenian movement as a counterblast to Panslavonic ideas.

During the War East Galicia was the scene of heavy and continuous fighting. During 1916–7, in view of the importance of Poland for the Central Powers, it was proposed to unite all Galicia with Russian Poland in a Kingdom of Poland more or less closely attached to Austria-Hungary. But after the collapse of Russia, the Central Powers concluded a peace with the Ukraine at Brest-Litovsk (Feb. 9 1918) and Austria-Hungary promised to erect East Galicia, with the Bukovina, into a separate Austrian territory (Kronland).

The Ruthenes Claim Independence.—While the claims of the Poles to autonomy were universally recognised, those of the Ruthenes were forgotten. In Oct. 1918 the Austrian Govt. having promised to introduce a federal system, the Polish leaders claimed for themselves all Galicia. The Ruthenes replied that they would rather "fight and die than let themselves be annexed by Poland." They summoned a conference of representatives of all Ruthenes of Austria-Hungary to meet at Lemberg (Lvov, Lwow, Léopol) on Oct. 18. The Socialist party pressed for immediate union with the Ukraine; but the bourgeois parties formed a National Council which determined to form an independent state, inviting the Polish and Jewish minorities to co-operate. On Nov. 1 the Council occupied the government buildings in Lemberg with the help of Ruthenian regiments, and assumed the government of East Galicia within its ethnographical limi The Poles refused their co-operation, and fighting began betwe Poles and Ruthenes. The Austrian Govt. recognised the Ruth nian Govt. which was now formed under Dr. Eugen Petrushiewic and handed him over a share of the old Imperial assets; but t Poles immediately invaded East Galicia, occupying Lemberg Nov. 5. The Ruthenian Govt. retired to Vienna, and its activ ties now became very platonic, being chiefly concerned wi propaganda, in which it developed prodigious activity.

Meanwhile on Jan. 3 1919 the Hetman Petlura, who at th time had established his authority in the Ukraine, proclaim the union of Russian Ukraine and West Ukraine (East Galici in a republic. The Ruthenian troops joined the Ukrainian Arn with the consent of the East Galician Govt., which recognise Petlura's authority on Jan. 20. Fighting continued throughou 1919, during which time Polish troops occupied East Galicia, in d fiance of the efforts of the Supreme Council to arrange a truce an settle the problem. On May 8 the Supreme Council assigned We Galicia to Poland; but on June 24 it decided to give East Galic the right of self-determination, although authorising Poland proceed with her military occupation of the district. The Eas Galician Govt. revoked its recognition of Ukrainian authorit on Aug. 28 1919, and continued to assert the legality of its ow position and the right of East Galicia to self-determination.

In Dec. 1919 the Allied and Associated Powers announce that East Galicia would be granted autonomy for 25 years unde a Polish protectorate, after which time the League of Nation would decide on its future. This remarkable arrangemen evoked vehement protests from the Ruthenes. It also caused crisis in Poland, which desired unconditional possession of th district, and resulted in the fall of Paderewski. Petrushiewicz' Govt. was, however, powerless, and the numerous Ukrainia governments which existed simultaneously or consecutively wer fully occupied in war with each other, the Poles, the Bolsheviks o the White Russians. In April 1920 Petlura abandoned his clai to East Galicia in return for recognition by Poland; Petlura' and the Polish armies captured Kiev from the Bolsheviks o May 8; but by Nov. the Bolsheviks had driven Petlura out o the Ukraine and established themselves there firmly. In Galicia however, the Poles held their own, and the Treaties of Riga Oct. 12 1920 and March 18 1921, re-established the old frontie of Galicia with the Ukraine.

Petrushiewicz's Govt. was in a disastrous position. It was ignored by everyone; its funds were running out; its choice o allies lay between its hereditary racial enemies, the Poles, and Bolshevik Ukraine. The Poles meanwhile treated the district as their own; held elections to the Polish Diet in it in the autumn of 1922—although practically the whole Ukrainian population abstained from voting—and even pressed Ruthenes into the Polish Army. On March 14 1923 the Conference of Ambassadors recognised Poland's *de facto* eastern, northern and southeastern frontier.

The Polish Régime.—Political activity in East Galicia di not lose its customary complexity after this date. Many poliical leaders, including Petrushiewicz, came to terms with the Soviet authorities. The great bulk of these unfortunates were unable to return to their homes. A small minority accepted the situation, and attempted to combine with the other racial minorities in Poland. A general law passed by the Polish Diet on Sept. 26 1922, which established local government bodies to deal with purely local affairs, contained the proviso that in the East Galician provinces these bodies should consist of two chambers, of which one should be Ruthenian. This "autonomy," as it was described, was to be introduced within two years; the language rights of minorities in Poland were to be respected, and colonisation forbidden. But in fact, although a language law was passed on July 10 1924, providing that Ukrainian, White Russian or Lithuanian should be the language of administration, w-courts and schools in districts where the majority of the pulation speaks one of these languages, and Count Skrzynski owed a not illiberal attitude towards the minorities generally, olish policy in general was not hampered by an excess of scruples wards the Ruthenes. (C. A. M.)

GALLI-CURCI, AMELITA (1889–), Italo-American singer, as born at Milan, Italy, Nov. 18 1889. As a vocalist she was lf-taught. Gifted with a singularly pure soprano voice, she ade her début as Gilda in *Rigoletto* at the Constanzi Theatre, ome, in 1909, and subsequently visited Spain and South Amera. She made her first appearance in the United States at the uditorium, Chicago, Nov. 18 1916, where she remained four asons. She was engaged by the Metropolitan Opera Company, ew York, in 1921 and from that date constantly appeared in rand opera and concerts. Among her chief rôles were Buttery, Juliette, Lucia, Mimi, Rosine, Violetta and Manon Lescaut. he made a concert tour through Great Britain in 1924–5.

GALLIÉNI, JOSEPH SIMON (1849–1916), French general and atesman (*see* 11.418), reached the age limit for retirement on pril 24 1914, but was retained on the active list without duty, nd on July 31 1914 was officially confirmed as the eventual successor of the commander-in-chief. On Aug. 26 he was appointed overnor of Paris and general commanding the armies of Paris. Ie took energetic steps for the defence of the capital, and on ept. 3 issued the following order: "To the Army of Paris and he Population of Paris: The Members of the Government of he Republic have left Paris in order to give a new impulse to ational defence. I have been ordered to defend Paris against he invader. This order I shall fulfil to the end."

After Sept. 2 the armed forces in Paris had been placed under he orders of Joffre, who could thus in case of need use the garison for his operations; consequently, on Sept. 3 Galliéni wrote o Joffre asking for instructions. From information received luring the day, however, Galliéni concluded that the German orces marching on Paris were inclined southeast, thus offering im an exposed flank. Joffre's answer to Galliéni's messages rrived on the 4th a little before 3 P.M. and contemplated an ttack south of the Marne. Galliéni held that to gain the fullest ossible advantage from the situation by enveloping Von Kluck nd breaking his lines of communication the attack ought to be nade on the line of the Ourcq north of the Marne, and made at nce. Galliéni spoke to Joffre on the telephone on the 4th at ; P.M. and obtained authority to move on the 5th north of the Marne for the attack on the 6th. The VI. Army under Maunoury vas placed under Galliéni's command. Maunoury was given all he troops available and ordered to move on the 5th to the eights of the Ourcq, to attack on the 6th. But, while executing his movement, Maunoury was himself attacked on the 5th y the German IV. Reserve Corps, which covered Von Kluck. The two armies were almost equal; six divisions against six. But luring the night of the 7th–8th Galliéni sent up the 7th division in taxis from Paris to Nanteuil-le-Haudouin. The Germans retreated and the French armies moved out of the zone over which Galliéni held command.

On Oct. 29 1915 Galliéni became Minister of War in Briand's Cabinet. His period of office was made notable by endeavours to create unity of command and by changes in the position of Gen. Joffre. He resigned for reasons of ill-health on March 16 1916 and died at Versailles, after undergoing two operations, on May 27. His body was given a state funeral, and lay for a time under the dome of the Invalides. He was buried at St. Raphael. On April 21 1921 the dignity of marshal of France was conferred on him posthumously.

GALLIPOLI: *see* DARDANELLES CAMPAIGN.

GALSWORTHY, JOHN (1867–), British playwright and novelist, was born at Coombe, Surrey, Aug. 14 1867. Educated at Harrow and New College, Oxford, he was called to the bar in 1890, but devoted himself to literature. His first novel, *Jocelyn*, appeared in 1898, but he attracted wider attention in 1904 with *The Island Pharisees*, and *The Man of Property* (1906). The latter was the first novel of the sequence to be known later as *The Forsyte Saga*, the others being *The Indian Summer of a Forsyte* (1918); *In Chancery* (1920); *Awakening* (1920); and *To Let* (1921). As a detailed picture of upper middle-class society during the later Victorian and Edwardian eras, the sequence is a remarkable achievement. That picture was supplemented by the greater number of Galsworthy's other novels, of which it is the characteristic social setting, among them *The Country House* (1907); *Fraternity* (1909); *The Patrician* (1911); *The Freelands* (1915); *The White Monkey* (1924). Galsworthy also wrote *The Dark Flower*, 1913, and many short stories, of varying merit, but often worthy of his best work, collected as *Caravan* (1925), essays on current social and moral questions, marked by liberal and humane feeling, and a commentary on the extravagances of war time, *The Burning Spear*.

As a dramatist also, Galsworthy enjoyed a deserved fame. His plays, for the most part, are based on ethical or social problems and are marked by a scrupulously judicial fairness in displaying the opposing points of view typified by his characters. Some have partaken too much of this scrupulousness to be counted as having an essentially dramatic quality, but at their best Galsworthy's plays reflect not only his finest powers as a literary craftsman—for their diction is natural and serious without becoming loose or facile—but also a keen sense of dramatic values. Among them should be noted *The Silver Box* (1906); *Joy* (1907); *Strife* (1909); *Justice* (1910); *The Pigeon* (1912); *The Eldest Son* (1912); *The Fugitive* (1913); *The Skin Game* (1920); *Loyalties* (1922); *The Forest* (1924).

See S. Kaye-Smith, *John Galsworthy* (1916); André Chevrillon, *Trois Études Anglaises* (1924).

GALTON, SIR FRANCIS (1822–1911), British anthropologist (*see* 11.427), died at Haslemere Jan. 17 1911.

GALVANAUSKAS, ERNEST (1882–), Lithuanian statesman, was born Nov. 7 1882 at Vabalninkai. He studied as a mining engineer at Leningrad (St. Petersburg) and Liége, and his activities in the Lithuanian national movement date from his student days. In 1906 he was imprisoned for his attempts to free the country from the Russian yoke. He escaped to Belgium in 1908, where he continued in touch with the Lithuanian liberation movement. The outbreak of the World War found him in Belgrade, and after the enemy occupation of that city, Galvanauskas left with the Serbian Army and shared all the privations of the retreat. He subsequently proceeded to France and volunteered for military service. On the recovery of Lithuanian independence in 1918, Galvanauskas served as a member of the Lithuanian Delegation to the Versailles Peace Conference. He was several times Prime Minister and Minister for Foreign Affairs, and also held the portfolios of Finance and Communications. He became president of the Lithuanian Delegation to the League of Nations and in Aug. 1924 was appointed Lithuania's first envoy extraordinary and minister plenipotentiary to London and simultaneously envoy extraordinary and minister plenipotentiary to The Hague. In Nov. 1925, for services to the Serbian cause in the World War, he received from the King of Yugoslavia, the high military order "Albarrakom Spozeincom."

GAMBIA (*see* 11.437a), a British colony and protectorate in West Africa. Its population was 210,530 in 1921, an increase of 60,000 in 10 years. Bathurst, the capital, had 9,227 inhabitants, of whom Europeans numbered 265 (130 British). Hemmed in landward by French territories, which make but little use of its magnificent waterway, Gambia depends upon its own resources.

The cultivation of the ground nut, entirely a native industry, is the chief occupation of the people. Up to 1915 the nuts (the oil from which is a main ingredient of margarine) went mostly to France, which in 1914 took 78% of the crop. Changes caused by the World War led to over 91% of the export going to England in 1919. France subsequently in part recovered the market. In 1924 England took 54% and France 33% of the crop, which represented some 95% of the total exports. The economic crisis caused by the War was safely weathered and 1920 was a year of trade activity. Imports are mostly cotton piece goods, rice and sugar and, from Sierra Leone, kola nuts. Great Britain's share of the imports averaged over 50% in the years 1914–24; France, Germany (since 1920) and the United States supply most of the other imports. In 1922 it became necessary to demonetise the French five franc piece, the favourite coin of the natives, and this involved the administration in a loss of £187,000.

Taking 1914 and 1924 as normal years the revenue rose from £86,000 to £208,000, the expenditure from £120,000 to £203,000. The tonnage of shipping entered and cleared was 1,100,000 in 1924 compared with 571,000 in 1914. British shipping predominated, but from 1921 Germany became a keen competitor and in 1924 was second, with 158,000 tons as against 643,000 British, 93,000 American and 92,000 French. Since 1901 Gambia has enjoyed political tranquillity, and education and Christianity made progress, if slowly. Most of the natives are Moslems. The Gambia Co. of the West African Frontier Force served with credit in the campaigns in the Cameroons and German East Africa. Bathurst was the first place visited by the Prince of Wales in his 1925 tour.

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(F. R. C.)

GAME PRESERVES: *see* NATIONAL PARKS.

GANDHI, MOHANDAS KARAMCHAND (1869–), Hindu nationalist leader, was born at Porbandar (Kathiawar, India) of a Bania family with official traditions. At the age of 19 he went to London, studied for a time at University College, and was called to the bar by the Inner Temple. Soon after starting practice in the Bombay High Court he was called, in 1893, on professional business, to South Africa, where he threw himself at once into a long and bitter struggle for the liberties of the Indian settlers in that country. He became leader of the opposition to a variety of measures taken by the local authorities to discourage Asiatic immigration and to limit the rights of citizenship available to Asiatics already resident.

It was in the course of this movement that his conception of resistance without violence developed; he relinquished his large income as an advocate, and founded a colony for his compatriots on Tolstoian lines near Durban. As the price he paid for his championship of the Indians' grievances, besides being more than once arrested and imprisoned he suffered frequent indignities at the hands of angry mobs. This neither checked his energies nor deterred him from rendering service of marked loyalty to the Government on three occasions; for he raised and commanded a Red Cross unit in the Boer War, he organised a plague hospital when the epidemic broke out in Johannesburg, and he led a stretcher-bearer party in the suppression of the Natal revolt of 1908. At last in 1914 a commission of inquiry into the Indian discontent recommended the removal of several of the worst injustices against which Gandhi had striven; and he felt justified in closing down his activities in South Africa and returning to India. There a wider field of political protest awaited him; and he was soon at work organising, in connection with the home-rule movement, resistance to the British Government by "soul force" and nonco-operation.

In Jan. 1919 there were published two bills (subsequently known as the Rowlatt Acts) giving the Government emergency powers for dealing with revolutionary crimes and conspiracies; these had followed the proposals of a responsible commission which had investigated the subject, and the powers they conferred were safeguarded by elaborate protections against abuse. But Gandhi declared them to be an insult, intended to discredit the Indian people on the eve of ostensible political reforms, and he denounced the bills as instruments of oppression. He instituted a campaign of Satyagraha (literally, insistance on truth) or nonviolent disobedience to unjust laws in the first instance, enlarging if necessary into disobedience to any law and complete nonco-operation with the Government. Spreading rapidly, the agitation burst into violence in the Punjab and elsewhere, with results which shocked Gandhi into a temporary suspension of his civil disobedience. Later in the year, he formed common cause with the Indian Moslems of the Khilāfat party, aggrieved by the terms of peace which Great Britain was offering t Turkey; and in July 1920 he proclaimed a general campaign "non-violent nonco-operation." Its points were the bo cott of Government service, of the new legislatures and of th courts of law; the surrender of all public offices; and the wit drawal of children from Government schools; to which we subsequently added boycott of foreign goods and the adoptio of the spinning-wheel as an emblem of economic independenc

The agitation spread rapidly. The unlettered people w saw his earnestness and asceticism, and heard his simple el quence, regarded him as a saint, and invested him with the tit of Mahatma, or Great Soul. By 1921 Gandhi was at the zeni of his power. The national congress, sitting at Christmas that year, delegated its full authority to him, and empower him to appoint his own successor. But signs of change were no appearing. The unrest into which the non-co-operation mov ment had plunged the country culminated in a series of gra outrages, some of a racial character, of which the Mopla outbreak was the worst, and others directed against the agenci of law and order. Gandhi met them by personal penances, an by repeated postponements of the date on which he had for told that India would be liberated from British rule. But h had generated forces which he had no power to recall or contro and plain people were getting alarmed at the consequence Moslem support was being deflected from him by the encou agement which Lord Reading's Government was giving t Islamic sentiment over Turkey; and his closest adherents we embarrassed by his frequent changes of policy. Consequentl when he was arrested in March 1922 and put on trial for co spiring to spread disaffection with a view to overthrowing th government of the country, the *coup* evoked little excitemen Gandhi pleaded guilty, accepted responsibility for all that ha happened and invited "the highest penalty that can be i flicted upon me for what in law is a deliberate crime and wha appears to me to be the highest duty of a citizen."

Condemned to six years' simple imprisonment, he was re leased in Jan 1924 after an operation in gaol for appendiciti and the rest of his sentence was unconditionally remitted. H came back to a party which had chosen other leaders, and wa soon to reverse his policy of boycotting the administration Esteemed and consulted though he continued to be by his ol followers, he was no longer a power to sway the masses, and a the end of 1925 he announced his intentions of retiring from th world for a year. The nationalist movement was switched o to lines more familiar to western constitutional usage. To th Oriental mind Gandhi symbolised self-sacrifice and high ideal ism; western enthusiasts were not wanting who, like M. Romai Rolland, compared him with the Founder of Christianity; an the transparency of his character commanded the persona liking of even strong opponents. But he expected too much o human nature, he played recklessly with inflammable material his economic nostrums were unpractical and he gave way t unexpected bursts of intolerance, as when he described th British government of India as "satanic." His endeavour t unite Hindus and Moslems lacked sincerity; but his endurin legacy to Indian politics will be the part he has taken in consolidating Hindu nationalism.

See Romain Rolland, *Mahatma Gandhi* (Paris, 1924); Eng. trans by C. D. Groth, 1924. (Me.)

GARDEN, MARY (1877–), American operatic singer, was born at Aberdeen, Scotland, Feb. 20 1877. At the age of six sh was brought to the United States. In 1888 her family settled i Chicago, where her early musical training was received. She went to Paris in 1896, and studied under Trabadello, Chevallie and Fougère. She made her début at the Opéra Comique, Paris April 3 1900 in the title rôle of *Louise*, taking the place, at a few days' notice, of Mlle. Riotou, who had fallen ill. Her first appearance in the United States was at New York in the title rôle o *Thais* Nov. 25 1907. In 1910 she became a member of the Chicago Grand Opera Company, assuming, among others, the parts of Salome, Thais, Mélisande and Louise. She was appointed general director of the Chicago Opera Association Jan 13 1921.

GARDEN CITY: *see* CITY PLANNING.

GARIBALDI, GIUSEPPE (1879–), Italian general, eldest m of Gen. Ricciotti Garibaldi and grandson of the Liberator, as born at Melbourne July 29 1879. He fought under his father . the Greco-Turkish War in 1897, and served in the South frican War, subsequently leading an adventurous life in outh and Central America and in the Balkans. On the outreak of the World War he raised an Italian Legion of 14,000 ien, which fought on the side of France in the Argonne. In 15 Garibaldi returned to Italy, and on Italy's entry into the Var he enlisted as a volunteer. He was soon afterwards comissioned, being given command of a battalion, and served with istinction in the IV. Army. He returned to the French front in Iarch 1918 in command of the famous Brigata Alpi, and in une was promoted brigadier-general. He resigned his command June 1919 and gave up his commission in Feb. 1920. He beame opposed to the Fascist Govt. and in the autumn of 1924 as involved in an anti-Fascist agitation organised by the *Italia bera* Association. Deciding, however, that the movement had o chance of success, he departed for New York to devote himself o business.

GARLAND, HAMLIN (1860–), American writer, was born t West Salem, Wis., Sept 16 1860. He graduated from the Cedar Valley Seminary, Osage, Ia., at the age of 21. After teaching in Illinois and taking up a claim in South Dakota (then Dakota territory), he went to Boston in 1884 and engaged in terary work. The drudgery of farm life in the Middle West and he adventurous life of the mountains furnished him with abunant material for his realistic tales. His works, all based on the fe of the northwest states, include *Main Travelled Roads* (1890–); *Ulysses S. Grant: His Life and Character* (1898); *Boy Life on he Prairie* (1907); *The Long Trail* (1907); *Money Magic* (1907); *Cavanagh* (1909); *Other Main Travelled Roads* (1913); *The Tyranny of the Dark* (1905); *A Son of the Middle Border* (1917); *A Daughter of the Middle Border* (1921); *The Book of the American ndian* (1923). He was made a member of the American Academy f Arts and Letters in 1918.

GARSTIN, SIR WILLIAM EDMUND (1849–1925), British engineer, was born in India Jan. 29 1849. He was educated at Cheltenham and King's College, London, and in 1872 entered he Indian Public Works Department. In 1885 he was transferred o Egypt and in 1892 became inspector-general of irrigation and Under-secretary of State for Public Works. He proved himself an indefatigable worker, and by his efforts extensive areas were reclaimed in Egypt and the Sudan. Among his greatest works were the Asyut barrage and the Aswan reservoir. In addition, it was due to him that the White Nile was cleared of sudd, thus rendering possible free navigation between Khartoum and Gondokoro. He was created K.C.M.G. in 1897 and G.C.M.G. n 1902. In 1907 he was appointed British Govt. director of the Suez Canal Company. During the World War he devoted himself to Red Cross Work in England, being created G.B.E. in 1918. He died in London Jan. 8 1925.

GARVIN, JAMES LOUIS (1868–), British publicist, and editor-in-chief of the present volumes of *The Encyclopædia Britannica*, was born at Birkenhead, Ches., April 12 1868. A political writer from the age of 17, he joined *The Newcastle Chronicle*, where from 1891 to 1899 he was leader-writer, literary critic and aide-de-camp to its proprietor, the celebrated orator, Joseph Cowen. From the age of 26 for many years he was a chief contributor to *The Fortnightly Review*, and later to *The National Review* and *The Quarterly*. In 1899 he went to London, joining the staff of *The Daily Telegraph*, which gave him unusual scope. When Mr. Joseph Chamberlain started his historic campaign for tariff reform and Imperial unity, Mr. Garvin became nationally known as that statesman's most powerful lieutenant in the Press. Editor in 1905–6 of the weekly review *The Outlook*, he passed in 1908 to the editorial chair of *The Observer*. He raised that oldest of great Sunday journals to the highest position it had ever reached, and made it quoted throughout the world. Simultaneously from 1912 to 1915 his editorship gave new life to the evening *Pall Mall Gazette*. Steeped in German studies, his articles on foreign affairs, anticipating the World War from as early as 1901, had a deep public influence. In the War his articles were famous; but, equally the advocate of "absolute victory" and a wise peace, he was a searching and damaging critic of the Treaty of Versailles. To promote international reconciliation and co-operation he wrote in six weeks during the Paris conference (1919) his elaborate book *The Economic Foundations of Peace*. His only son, Gerard, who had justified high hopes, was killed at the age of 20 in the battle of the Somme, gallantly leading two companies of the South Lancashire Regiment in a night action. Behind all Mr. Garvin's politics there is a deep background of history and literature. In 1926 he was chosen chairman of the Empire Press Union.

GARY, ELBERT HENRY (1846–), American jurist and business man, was born near Wheaton, Ill., Oct. 8 1846. He attended Wheaton College and then, after studying law for a time in an office, he continued his legal studies at the University of Chicago, and took the degree of LL.B. in 1867. In 1871 he began practice in Chicago, where he became a noted corporation lawyer. In 1874 he organised the Gary-Wheaton Bank, of which he was president. He was elected judge of Du Page Co. in 1882 and again in 1886; was three times elected president of the town of Wheaton, and on its becoming a city in 1892 served as mayor for two terms. He was president of the Chicago Bar Association 1893–4. He early saw the advantages of combination in business and in 1891 was one of the organisers of the Consolidated Steel & Wire Co. In 1898, upon the organisation of the Federal Steel Corporation, with a capital stock of $200,000,000, he became its head and retired from legal practice. This company was merged in the United States Steel Corporation in 1901 with a capital stock exceeding $1,000,000,000 and he was elected chairman of the board of directors and of the finance committee. He continues to fill these offices after twenty-five years of remarkable development of the steel industry, and growth of the corporation. The town of Gary, Ind., laid out in 1906 as a model home for steel workmen, was named in his honour. In 1914 he was made chairman of the committee appointed by Mr. Mitchel, mayor of New York, to study the question of unemployment and its relief.

When America entered the World War in 1917, Gary was appointed chairman of the committee on steel of the council of national defence. Through his own connection with a business essential for munitions of war he exerted great influence in bringing about co-operation between the Government and industry. He was interested in a strengthening the friendship between America and Japan. In 1919 he was invited by President Wilson to attend the Industrial Conference in Washington, and took a prominent part in it as a firm upholder of the "open shop," of which he was always a strong advocate. He also opposed the drastic restriction of immigration effected by the "Quota" law. Miss Ida M. Tarbell's *Life of Judge Gary* concludes with these words: "He has made a lasting contribution to our difficult and often baffling problem of substituting, in American business, balance for instability, mutual interest for militarism, co-operation for defiance, frankness for secrecy, goodwill for distrust. No man in contemporary affairs has more honestly earned the high title of industrial statesman."

GARY, Ind., U.S.A. (*see* 11.480), had become in 1920 a city with 55,378 inhabitants of whom 5,299 were negroes and 16,460 foreign-born. In 1925, the 20th year of its existence, its population was 81,888 (school census); it had an area of 40·83 sq. m., 155·35 m. of improved and 178·45 m. of unimproved streets, 15 m. of boulevards, 45 m. of street railway track, a fleet of motor-buses and 94 m. of water-mains. The assessed valuation of taxable property was $131,006,810. There were over 1,000 retail stores. During the nation-wide strike of the steel workers in 1919, Gary was occupied by Federal troops from Oct. 7 until the strike was called off on Jan. 7 1920. A city-planning commission was appointed in 1919 and a comprehensive zoning ordinance was adopted in 1925. The "Gary Gateway and Railway Developement," which was adopted in 1924, provided for improved freight and passenger facilities and for beautifying a large section.

The public schools of Gary offer academic instruction 48 weeks in the year and physical training for 52 weeks of 6½ days each week. The first superintendent of schools, William A. Wirt, worked out a system with the following features: (1) an enriched curriculum; (2) a school plant adapted to such curriculum, with playground, gymnasium, swimming-pool, shops, laboratories and auditorium; and (3) organisation of classes on a "platoon" system, by which each feature of the plant is in use all the time, thus providing for the most economical utilisation of both plant and teaching force. This administrative scheme (3) became known among educators as the "Gary Plan" and was adopted, with more or less modification, in many cities.

See F. P. Bachman and R. Bowman, *The Gary Public Schools*, a Study by the General Education Board in eight parts (New York, 1918).

GAS IN WARFARE: *see* CHEMICAL WARFARE.

GAS, MANUFACTURE OF (*see* 11.483)—In the period 1910–25 the work done on gas retorts, coke ovens, gas generators, the complete gasification of coal, low temperature carbonisation and other operations in the gas industry has been considerable. During the War, gas-retort and coke-oven plants were worked to their full capacity; repairs and renewals were often unavoidably deferred or effected under difficult conditions. Gas and coke manufacturers have studied nearly every branch of the industry, and therefore many important changes have taken place.

Therms.—In Great Britain the provisions of the Gas Regulation Act of 1920 impose an obligation on the suppliers to charge for gas at a price based on the calorific value of the gas and specified the use of a recording calorimeter for determining this value. The calorific unit selected, the therm, is equal to 100,000 B.T.U.'s or British Thermal Units. Each gas undertaking formally declares the calorific value of the gas it proposes to supply; this is called its "declared calorific value" and is usually from 450 to 500 B.T.U.'s per cubic foot of gas.

The method of reading the gas meter remains the same, but the gas account is made out in therms at so much per therm. The number of therms is easily computed, for, suppose that the meter readings show that 10,800 cu. ft. of gas have been supplied and that 500 is the declared calorific value, then 10,800×500÷100,000=54 therms. At tenpence per therm, the gas bill would be £2·5·0.

The Act allows a gas undertaking to declare any calorific value it chooses. Therefore, subject to the requirements of gas purification, the company is free to adopt gas-making processes which will yield the maximum number of therms for every ton of coal treated. Clearly, it may be most profitable to supply a mixed gas, or to leave in the gas constituents which, like benzol, have a high thermal value; with gas and benzol at their present prices, benzol is usually left in the gas.

Calorimeters.—Among the recording calorimeters used by gas undertakings are the Simmance Total Heat, the Fairweather, and the Boys, in all of which the heat of combustion of known quantities of gas to be tested is imparted to a flow of water; the Thomas, in which the heat is imparted to air; and the Beasley, in which a differential thermometer filled with oil is employed. At large gasworks, several calorimeters are used, one in connection with the town's gas supply and the others with the separate gas-making plants.

Refractory Materials.—In Great Britain, siliceous clays containing 80 to 92% of silica and silica clays with more than 92% of silica have been used to an increasing extent in the gas industry and carborundum has also been tried. For the hotter parts of vertical retorts, siliceous and silica clays are commonly used and silica clays have been employed largely in constructing the coke-oven plant of the Consett Iron Co., Ltd., and other companies. In America the use of silica clays is the standard practice, not only for the hotter parts of vertical retorts and for the chamber ovens of the Koppers and other types for supplying gas, but also for horizontal retorts.

Silica bricks are more fragile, and have a coefficient of expansion greater than that of firebricks. Their greater heat conductivity facilitates rapid carbonisation; they sustain high temperatures and keep their shape in a satisfactory way. It is probable that the life of silica is greater than that of fireclay retorts a ovens. At St. Helens, eight Glover-West retorts, in which Frid silica was used, had an average working life of 1,694 days. Son of the American chamber ovens, constructed by Messrs. Ko pers, have worked continuously for 15 years and are said not have needed repairs (*see* ELECTRO-METALLURGY).

Carborundum is very refractory, hard and strong; its coef cient of expansion is very small; its heat conductivity is abou five times that of fireclay. The future of this valuable refracto material will depend largely on its initial cost, and on its beha iour in an oxidising atmosphere at high temperatures. Willian son, Cliff, Ltd., of Stamford, have constructed a horizont retort with a tile of carborundum extending along the centr part of the retort sole. In the United States, carborundum ha been used in both retort and gas generator construction.

The Retort Controversy.—The question of the best type of ga retort has been decided to a large extent by the selections mad by numerous gas engineers when erecting new installations of retorts. There are installations of inclined retorts working satisfactorily and numerous installations of horizontal retorts provided with efficient charging and discharging machines, but the tendency is clearly in the direction of using continuously operated vertical retorts.

Horizontal Retorts.—The improvements made since 1910 in these retorts and their settings have been mainly in details. Some continuously operated horizontal retorts erected by West's Gas Improvement Co., Ltd., at Blackpool and Middleton, did not show any advantages over the Glover-West vertical retort, and were abandoned.

Vertical Retorts.—The chief improvements in vertical retorts have been in connection with those of the continuously operated type, in which coal is fed into the top of the retort and coke discharged from the bottom in a continuous and regular manner, the retort increasing in area downward to facilitate descent of the charge. The Glover-West and the Woodall-Duckham vertical retorts are the chief examples.

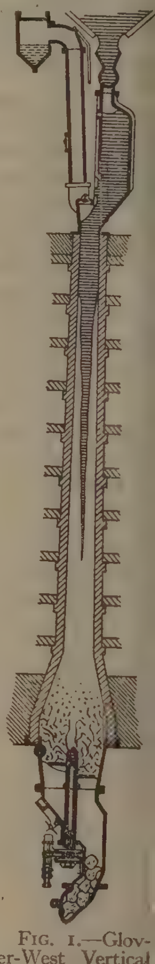


FIG. 1.—Glover-West Vertical Retort.

The Glover-West continuous vertical retort was originally developed on principles deduced from the practice with Scotch shale retorts. In its most approved form, the 40-in. new model, the cross-section is a flattened ellipse, the major axis of the mean section being 40 inches. Vertically, the retort enlarges regularly until the steaming chamber or "bell-bottom," clearly shown in fig. 1, is reached. This chamber opens up the core of coke and permits the exposure of a large surface of coke to the action of steam injected for making water gas. A powerful helix mounted on a vertical shaft, shown in fig. 1, supports the full weight of the coke; it is driven by worm gearing and, as it revolves, the coke is lowered continuously and regularly into the coke chamber, with a minimum of breakage. A step-grate producer generates gas which is led to combustion chambers arranged horizontally across the lines of retorts. The temperature distribution can be readily varied over the whole length, about 25 ft., of the retort, according to the carbonisation requirements of the coal treated. The Glover-West was successfully worked at the St. Helens gasworks in 1909. Since then, more than 135 gas undertakings in all parts of the world have adopted it; the new model has been installed recently at Oldbury, Nine Elms (Gas Light and Coke Co.), Dudley Leicester, Toronto and Malden, United States of America.

In the Woodall-Duckham continuous vertical retort the ntinuous and regular discharge of the coke is effected by an tractor roller formed of a series of stars set on a horizontal aft slightly in advance of each other, so as to form helical ades. The shaft is mounted in a gas-tight hopper, having one de curved so as not to prevent descent of the coke by gravita- on while supporting the greater part of its weight.

Heating of the retort is effected by means of a regenerative s producer. There are two very hot combustion chambers, ne at the top of the retort and another lower down for ensuring at the charge is hot enough for obtaining good water gas by e action of steam admitted to the retort. The Woodall- uckham retorts were installed at the Bournemouth gasworks, 03 -5; since then, numerous installations have been set up in l parts of the world. Among the most recent are those at Dun- rmline, Glasgow, Edinburgh, Warrington and Bergen.

Coke Ovens.—The course of development in coke-oven practice is been chiefly in the utilisation of surplus gas for town supply, nd in the installation of very large ovens of known types. Great Britain parliamentary sanction was first given in 1910 r the supply of coke-oven gas. The Board of Trade returns r 1924 gave 16 towns taking gas from colliery and other coke- ven plants, Chesterfield, Sheffield, Leeds, Middlesborough and ontypridd being included. Most coke ovens in Great Britain not take a charge exceeding 8 tons, but ovens of the Piette pe, of nearly 18 tons capacity, have been built at Stoke-on- rent by the Semet-Solvay and Piette Co. of Sheffield. In the nited States, it is common practice to use coke ovens of about tons capacity.

Charging and Discharging.—The introduction during recent years efficient charging and discharging apparatus has done much to able horizontal retorts to compete with other types of retort. any charging machines, *e.g.*, the Arrol-Foulis hydraulic charger d the de Brouwer, which projects the coal into the retort, are orked in association with a separate discharger. Drake's projector d pusher is a combination of a pusher made up of large, jointed ctions, adapted to fold over a rotary, polygonal drum and a rapidly tating wheel with vanes for projecting coal into the retort; the isher discharges the retort and is withdrawn, and then the pro- tor comes into operation. A further development is a type of paratus called a discharging charger, of which Guest and Gibbons' scharging charger is an example; it is described in British Patent ecification No. 103143/1916. A sectional, jointed trough which, it travels forward from its supporting wheel, discharges the coke, s mounted within it rollers supporting and guiding an endless drag- r chain. During the withdrawal of the trough, this chain is driven dependently and carries coal into the retort so as to fill it com- etely.

Steaming Practice.—Steam has been used, especially in the essau intermittent retorts, to increase the yield of ammonia. uring recent years, however, the practice has been greatly ex- nded, especially in working continuous vertical retorts, which are lmirably adapted for steaming. The method admits of numerous sy variations; usually superheated steam under a pressure of 10 40 lb. per sq. in. through a $\frac{1}{8}$-in. nozzle. As long as the steaming is t excessive, it increases the yield of gas, ammonia (*q.v.*) and tar, d also the total thermal yield, although the calorific value per . ft. of gas is lowered.

Coal Blending.—The blending of different kinds of coal has long en practised, especially in America, to obtain suitable charges for e in coke ovens. Coal blending has recently attracted attention, pecially in connection with smokeless fuel production. It has been oposed to mix several kinds of coal so as to obtain a blend having predetermined resinic content or yielding a predetermined amount volatile matter when heated. By this blending, it is sought to inimise the expansion of the coal when carbonised at low tem- erature, to facilitate discharge by preventing the coke from sticking the retort, and to obtain a coke of good quality. Processes of this nd are described in British Patent Specifications Nos. 164104 and 6085 (Illingworth) and 187336 (Roberts).

Coal Cleaning.—The removal of clay, shale, pyrites and other purities from coal by washing processes is important, especially in eparing charges for ovens used in making metallurgical coke, and connection with smokeless fuel production to facilitate the making a good quality fuel. The catalytic action of some of the inorganic nstituents during carbonising processes, is also receiving attention.

Carburetted Water Gas.—During recent years, increasing quan- ties of water gas, especially carburetted water gas, have been ade in Great Britain. In America, more than one-half of the s manufactured is carburetted water gas; Philadelphia is sup- ied almost entirely with this gas.

In the self-clinkering, self-steaming generator of Humphreys and Glasgow, Ltd., an annular water jacket forms the lower part of the generator and supports an upper firebrick part; the jacket is high enough to prevent adhesion of clinkers to the generator wall. A steam reservoir communicates with the jacket by pipes, and serves as a source of steam supply for the generator. A mechanically operated grate, having an upper conical part, formed with air passages, and a lower cylindrical part, is mounted eccentrically on the base of a rotary water pan. A central conduit conducts the air blast or steam or carries away the down-run gas, when the run is downward, for the run may be upward or downward as desired. During its rotation, the grate crushes and expels the clinker and ash, the carbon content of which has been reduced as much as possible. The speed of the grate is regulated automatically; this regulation may be effected by electric means, the action of which is controlled by the temperature beneath the grate. When carburetted water gas is to be produced, the gas is led from the generator to a carburettor supplied with a spray of heavy oil and thence to a super-heater in which the cracked oil-vapour is fixed.

Many of these generators are working in association with batteries of horizontal or vertical retorts, the whole representing a very advanced development of gas-making plant. The coke from the retorts, in a cold, clean state, is charged into the producers and the operation of the whole installation effects a substantially complete gasification of the coal. The loss of heat of the incandescent coke is of comparatively small importance, for the clean, cold coke is rapidly brought to an incandescent state in the generator and there is no expensive handling of hot coke. A self-steaming, self-contained, blue water-gas plant, erected by Humphreys and Glasgow, Ltd., comprises (*a*) a generator, (*b*) a recuperator, (*c*) a waste-heat boiler and (*d*) a washer-scrubber (see fig. 2). This firm has brought into commercial use a means for automatically operating a generator plant, in which a series of valves governing the interdependent operations necessary in working, *e.g.*, coke feed, air supply, steam supply, duration of blow, etc., is operated by hydraulic power in an order correct in time and sequence. The order of operation, determined by the conditions of temperature, pressure, etc., in, or connected with, the generator, is set once for all by adjusting the indicators of a series of dials corresponding respectively with the various valves. If any valve fails to respond in its turn, the cycle of operations is stopped automatically by the action of electric circuits; this prevents explosions or other accidents.

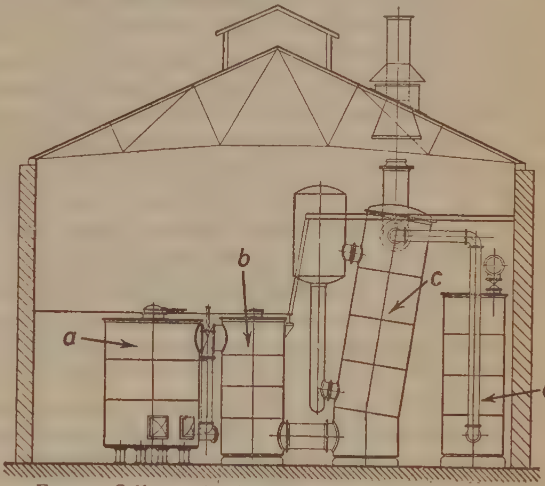


FIG. 2.—Self-steaming blue water-gas plant. (See text.)

Complete Gasification of Coal.—Complete gasification of coal in two steps is commercially successful. Numerous attempts have been made to effect complete gasification in one operation, but none appears to have been successful commercially. One of the earliest attempts was made many years ago by Fahnehjelm in the U.S.A.; his apparatus was a compact structure comprising a vertical conical retort, surrounded by heating flues and supported by a generator below. One of the many difficulties of this apparently simple process was that of obtaining in the generator a regular supply from the retort of incandescent coke suitable for yielding gas. A great deal has been achieved in Germany by extensive trials of Strache's apparatus, which is generally similar to Fahnehjelm's. The problem is, in fact, receiving careful attention and complete success may be achieved.

Low Temperature Carbonisation (*see* FUEL PROBLEMS).—This is a process for the partial destructive distillation of coal at temperatures which are low compared with those of an ordinary gas retort or coke oven; an important aim of the process is to obtain a smokeless fuel suitable for burning in ordinary grates. About 1865, experiments on partial destructive distillation of coal were made by Mr. Scott-Moncrieff, but the process which has led to a more intensive study of the subject is that patented by Mr. Thomas Parker (British Specification No. 14,365 of 1906), for subjecting bituminous coal to destructive distillation at a temperature of about 800° F., until illuminating gases cease to be evolved, then stopping the distillation and quenching the charge. This process, usually carried out in tubular iron retorts, was tried repeatedly and many improvements were made, especially by Low Temperature Carbonising, Ltd., whose retort plant, set up near Barnsley, operates at a temperature between 600° C. and 800° C.

Other investigators have worked processes of this kind. The South Metropolitan Gas Co. (London) has made experiments on low temperature carbonisation with a view to obtain a good quality smokeless fuel. An installation of rotary, inclined retorts, developed by Mr. Nielsen, has also been worked near Barnsley, the temperature of working being about 675° C. By these processes, a smokeless fuel, burning freely with a clear flame, and almost odourless, has been obtained, together with a moderately large quantity of a rich gas, and good yields of tar and ammonia. No plant, however, has been working, on a commercial scale, long enough to justify an assertion that the process is a success. Any plant for which it is claimed that the problem of low temperature carbonisation has been solved may be tested, free of cost, by the Fuel Research Board, so that the possibilities of the process are still being considered.

Bergius Process.—A process which has attracted a great deal of attention, especially in Germany, is the Bergius process, elaborated by Prof. Bergius. Experiments have been made at Mannheim and recently efforts have been made to carry out the process commercially. The chief aim of the process is to obtain oil from coal and it is claimed that coal of poor quality can be used advantageously. The coal is pulverised, mixed with oil residues from a previous operation, and heated to a temperature of about 450° C. in an atmosphere of hydrogen under a pressure of about 150 atmospheres. The product is a viscous mass from which the oils can be separated.

Gas Purification.—During the 15 years under review numerous improvements in the details of construction of gas purifying apparatus have been made, especially in connection with the grids and valves of purifier boxes. In modern gasworks water-cooled tubular condensers, bubble washers of the Livesey type, the Pelouze and Audouin type of tar extractors, and rotary brush scrubbers of the Holmes type are largely in use.

Attempts to introduce new purifying processes have been made. In Birkheiser's process, two rather small oxide purifiers, working together, are used, the crude gas being passed through one for removal of SH_2 while a blast of air is passed through the other to revivify the oxide by converting its absorbed SH_2 into SO_2; this SO_2 is used to recover ammonia. This process and a later modification were tried at the Tegel gasworks, Berlin, and also at Bournemouth, but, apparently, not with complete success.

Processes have been introduced by W. Feld, all ingenious, but most of them too complicated for commercial use. In one, used with success in Germany, the reagents employed are a solution of $FeSO_4$ for washing the crude gas and, in later steps of the cycle of operations, a mixture of SO_2 and air. Both SH_2 and NH_3 are eliminated from the gas, the ultimate products being ammonium sulphate and sulphur, which is filtered off, and thus recovered in solid form.

Gasholders.—Some exceptionally large gasholders have be erected during recent years. The largest gasholders in the wor appear to be those of the Astoria Gasworks, New York. T gasholders in course of erection at Birmingham are intended have five lifts and a total capacity of 20,000,000 cubic feet. A wat less, or tankless, gasholder recently erected in Michigan, is chamber of polygonal cross section with a capacity of 1,000,0 cubic feet. The chamber is closed by a piston, which moves up a down within it. A tar seal forms a gas-tight joint between t chamber and its piston and is a very important part of the wh construction. In countries where the winters are severe, a wat less gasholder offers advantages. (T.E.L.)

GASES, ELECTRICAL PROPERTIES OF (*see* 6.864). These va very greatly with the conditions to which the gas is exposed. gas in its normal condition is practically à non-conductor electricity even though it be the vapour of a good conductor li mercury. On the other hand, when it is exposed to such i fluences as cathode rays, Röntgen rays, intense electrical forc or the radiation from radioactive substances, it becomes a co ductor of electricity. The very delicate methods now at our d posal reveal however a trace of conductivity in gases where pr cautions have been taken to shield off the effects just mentione

The most important electrical property of a gas in a norm state is its specific inductive capacity. The significance of th property is best illustrated from the relation $(K-1)/$ $=NM$, between K, the specific inductive capacity; N, t number of molecules per unit volume, and M, the electrostat moment which a molecule acquires under unit electric force. we know N, we can if we know the value of K deduce the val of M, and this will tell us a good deal about the shape and si of the molecule. For example, if we regard the molecules solid conducting spheres, $M=r^3$ where r is the radius of t sphere. Thus, on this hypothesis we can find the radius of t molecule if we know the value of K, and though the hypothes itself does not throw much light on the structure of the atom, is probable that the radius of a conducting sphere which wou produce the same electrical moment would be of the same ord of magnitude as the linear dimensions of the molecule: the ra of metallic spheres which would give the specific inducti capacities possessed by hydrogen, nitrogen, oxygen and chlorin are respectively $1{\cdot}19\times10^{-8}$, $1{\cdot}60\times10^{-8}$, $1{\cdot}48\times10^{-8}$, $2{\cdot}04\times10$ centimetres. On the more probable hypothesis that the aton and molecules consist of electrons arranged round centres positive electricity, the electric force will displace the electro relatively to the positive centres and thus cause the molecule have a finite electrical moment. The more rigidly the electro are connected to the positive charge, the smaller will be th moment and the smaller the specific inductive capacity of the ga

The values of $K-1$ for the elements belonging to the sa family are connected by a remarkably simple and interesting r lation, which was discovered by Cuthbertson (*Phil. Trans.* A.20 p.135). It is shown in Table I. where the numbers under the sym bols denoting the elements are the values of $\frac{1}{2}(K-1)\times10^6$:—

TABLE I.

			He 144×½
N 297	O 270	F 192	Ne 137
P 1197 =299×4	S 1101 =275×4	Cl 768 =192×4	Ar 568 =142×4
As 1550 =258×6	Se 1565 =261×6	Br. 1125 =187×6	Kr 850 =142×6
	Te 2495 =249×10	I 1920 =192×10	X 1378 =138×10

Thus the values of $K-1$ for successive elements of the sam family—(N, P, As): (O, S, Se, Te): (F, Cl, Br I): (Ne, Ar, K X)—are in all cases very nearly in the proportion 1, 4, 6, 10. I the simple theory, where the molecules are regarded as condu tors, this would indicate that the volumes of the molecules of th uccessive elements in the same family are in the proportion 1, , 6, 10, for each of these types of elements. On the theory which egards the atom as built up of electrons arranged round positive entres, the configuration of the outer layer of electrons for different members of the same family would be similar, and it is asy to show that for similar configurations of electrons the alue of $K-1$ would be proportional to the cube of the linear imensions, *i.e.*, to the volume enclosed by the outer layer of lectrons; so that again on this theory Cuthbertson's result hows that volumes of successive elements in the same family are n the same ratio whether the family be that of the inert gases, he halogens, or the oxygen or nitrogen groups.

W. L. Bragg (*Phil. Mag.*, 40, p.169) using the method of Röntgen ray crystal analysis has measured directly the diameters f the atoms of many of the elements. He finds that the cubes f the diameters of F, Cl, Br, and I are proportional to 1, 3·72, ·45 and 8 respectively; those of O, S, Se to 1, 3·9 and 6, and hose of C and Si to 1, 3·6. Thus for these electronegative elements the ratio of the volumes of corresponding elements in two ifferent periods is approximately constant. This, however, is ot true for electropositive elements, where the sizes of the toms in one period increase much more slowly from one element o the next than they do for the electronegative elements.

Another example of the information as to the nature of the molecule afforded by determinations of the specific inductive apacity is that, while the specific inductive capacity of many ases, *e.g.*, H_2, N_2, O_2, CO, CO_2, Cl_2, is equal (as Maxwell's Electromagnetic Theory of Light suggests) to the square of the efractive index, there are, as Bädeker (*Zeitschrift Physik. Chem.*, 6, p.305) has shown, others, such as NH_3, HCl, SO_2, and the apours of water and the alcohols, whose specific inductive apacity is far in excess of the value given by this rule, and morever the specific inductive capacity of these gases diminishes much more rapidly as the temperature increases than that of ases of the first type. The difference can be accounted for by upposing that the molecules of gases of the first type have no lectrical moment when they are free from the action of an xternal electrical force, while those of the second type have an ntrinsic electrical moment apart from that which may be produced by the external force. When there is no electrical field, he collisions between the molecules will cause the axes of electrical moments of the different molecules to be uniformly distributed, so that the average effect will be zero. An electric orce will tend to drag the axes of the different molecules into lignment, and the assemblage of molecules will have a finite lectrical moment which will be a measure of the specific inductive capacity. Inasmuch as the collisions between the molecules end to knock their axes out of line and diminish the specific nductive capacity, the latter will diminish as the temperature nd with it the vigour of the encounters increases. The substances which have an intrinsic electrical moment have exceptionally active chemical properties and are good solvents, dissociating the salts dissolved in them.

If the distribution of electrons in a molecule were not symmetrical about three axes at right angles to each other, the pecific inductive capacity of a single molecule would vary with he direction of the electric force, but as the molecules in a gas are orientated in equal numbers in all directions we should not detect his by direct measurements of the specific inductive capacity. We can however detect this effect in another way; for if the molecules have different specific inductive capacities in different directions the light scattered by the molecules at right angles to he incident unpolarised light will not be plane polarised as it vould be if the molecule were symmetrical (J. J. Thomson, *Phil. Mag.*, 40, p. 393), and if the incident light is plane polarised he scattered light will not vanish in any direction. Strutt (now Lord Rayleigh) (*Proc. Roy. Soc.*, 98A, 57) has measured the departure from plane polarisation for different gases with the esults shown in Table II.

This shows that the molecule of argon is very symmetrical, while the nitrogen molecule is more symmetrical than that of oxygen, and this again more symmetrical than that of CO_2.

TABLE II.

Argon	0·46%
Hydrogen	3·83%
Nitrogen	4·06%
Air	5·00%
Oxygen	9·40%
Carbon dioxide	11·70%
Nitrous oxide	15·40%

Ionised Gases.—Gases may in various ways be put into a state in which they conduct electricity on an altogether different scale from the normal gas. They acquire this conductivity when Röntgen rays or the rays from radioactive substances pass through them, or when they are traversed by cathode or positive rays. Ultra-violet light of very short wave length can impart this property to a gas, while gases recently driven from flames or from near arcs or sparks or bubbled through certain liquids or passed slowly over phosphorus also possess this property.

The conductivity of gases possesses interesting characteristics. In the first place it persists for some time after the agent which made the gas a conductor has ceased to act; it always however diminishes after the agent is removed, in some cases very rapidly, and finally disappears. The conducting gas loses its conductivity if it is sucked through glass-wool, or made to bubble through water. The conductivity may also be removed by making the gas traverse a strong electric field so that a current of electricity passes through it. The removal of the conductivity by filtering the gas through glass-wool or water shows that the conductivity is due to something mixed with the gas which can be removed by filtration, while the removal of the conductivity by the electrical field shows that this something is charged with electricity and moves under the action of the electric force. Since the gas when in the conducting state shows as a whole no charge of electricity the charges mixed with the gas must be both positive and negative. We conclude that the conductivity of the gas is due to the presence of electrified particles; some of these particles are positively, others negatively, electrified. These electrified particles are called ions, and the process by which they are produced ionisation.

The passage of electricity through a conducting gas does not follow the same laws as the flow through metals and liquid electrolytes; in these the current is proportional to the electromotive force, while for gases the relation is represented by a graph like fig. 1, where the ordinates are proportional to the current and the abscissae to the electromotive forces. We see that when the electromotive force is small, the current is proportional to the electromotive force, as in the case of metallic conduction; as the electromotive force increases, the current after a time does not increase nearly so rapidly, and a stage is reached where the current remains constant in spite of the increase in the electromotive force. There is a further stage, which we shall consider later, where the current again increases with the electromotive force, and does so much more rapidly than at any previous stage. The current in the stage when it does not depend upon the electromotive force is said to be saturated. The reason for this saturation is that the passage of a current of electricity through the gas involves the removal of a number of ions proportional to the quantity of electricity passing through the gas. Thus the gas is losing ions at a rate proportional to the current; it cannot go on losing more ions than are produced, so that the current cannot increase beyond a critical value which is proportional to the rate of production of ions. This sometimes

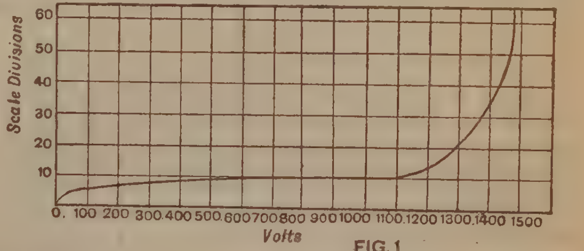


FIG. 1

produces a state of things which seems anomalous to those accustomed to look at conduction of electricity exclusively from the point of Ohm's law. For example, when gases are exposed to Röntgen rays, the number of ions produced per second is proportional to the volume of the gas, so that, if two parallel plates are immersed in such a gas and a current sent from one to the other, when the distance between the plates is increased the number of ions available for carrying the current and therefore the saturation current will be increased also. Thus the apparent " resistance " will diminish as the length of the gaseous conductor is increased.

The Nature of the Ions.—The question arises, what is the nature of the particles which carry the charges of electricity? Are they the atoms or molecules of the gas, or, for the negative charges, electrons? Information on these points is afforded by measuring the velocity with which the ions move through the gas under given electric forces.

The ion under the action of the electric force will soon attain a steady velocity which will be determined by the condition that the momentum communicated to the ion by the electric force in unit time is equal to the momentum lost by the ion in the same time by its collisions with the molecules of gas through which it is moving. Suppose that the average momentum lost by the ion per collision is qmu where m is the mass of the ion, u its velocity and q a quantity which will depend on the relative masses of the ion and the molecule and also on the force between the ion and the molecules, *e.g.*, if the ions and molecules behaved like elastice spheres q would not be the same as if they acted upon each other with forces varying inversely as the fifth power of the distance between them. The value of q will also depend on the electric charge on the ion. The number of collisions made by an ion with the molecules of the gas in time δt may be written as $\delta t/T$. Where T is the average interval between two collisions, T will vary inversely as the number of molecules in unit volume, *i.e.*, inversely as the density of the gas and will also depend upon the temperature and the masses of the ions and molecules. When the loss of momentum by collisions balances the gain from the electric force F

$$Fe\delta t = \frac{qmu\delta t}{T} \qquad (1)$$

$$\text{or } u = \frac{FeT}{mq}$$

we can determine by experiment the value of u/F and hence the value of T/mq. This will give us information as to the nature of the ions, *e.g.*, we can by the kinetic theory of gases calculate the values of T and q when the ion is a molecule of the gas and when the collision between an ion and a molecule is the same as that between two molecules; on these suppositions the calculated mobility is for most gases considerably greater than that found by experiment. The difference is to be explained by the effect of the electric charge on the collision and also the clustering of other molecules round the charged one to form a more complex ion. These two effects are not independent for it can be shown that if the effect of the charge is large enough seriously to affect the mobility, it follows by the Laws of Thermodynamics that the forces between the ions and the molecules must be great enough to lead to considerable aggregation at room temperatures. The effects to be expected from the formation of such aggregates may be illustrated from the expression for k, the mobility of the ion, *i.e.*, the velocity of the ion under unit force, deduced on the assumption that the force between the ion and the molecule varies inversely as the fifth power of the distance between them, this expression is

$$k = \frac{e}{2\pi N}\left\{\frac{M_1+M_2}{M_1\times M_2}\right\}^{\frac{1}{2}}\left\{1\cdot 1e\sqrt{(\mu^2-1)/N\pi}+\frac{s^2}{2}\sqrt{2\beta\theta}\right\}^{-\frac{1}{2}} \qquad (2)$$

where M_1, M_2 are the masses of the molecule and ion respectively, N the number of molecules per unit volume, μ the refractive index of the gas, s the sum of the radii of an ion and a molecule and $\beta\theta$ the energy of a molecule due to thermal agitation when θ is the absolute temperature of the gas. For most gases the effect of the term $s^2\sqrt{2\beta\theta}$ is insignificant. When this is so the effect of th complexity of the ion is represented by the term

$$\left(\frac{M_1+M_2}{M_1M_2}\right)^{\frac{1}{2}}.$$

This varies but slowly with the complexity, for when the ion co sists of a single molecule $M_2=M_1$ and the expression is $\sqrt{2/M}$ while when the ion consists of an infinite number of molecul the value is $\sqrt{1/M_1}$ thus this great increase in mass only reduce the mobility in the proportion of 1 to $\sqrt{2}$. The formula give above for k may be used to find the value of M_2/M_1 and f positive ions in most cases this ratio is found to be greater tha one. This indicates the formation of complex ions; these und the impact of the molecules break up and new aggregates a formed around the simple ions. This constant change of partne by the ions explains the very remarkable fact that in a mixture different gases all the ions appear to move with the same velocit Thus in a mixture of a light gas like hydrogen with a heavy o like methyl iodide we do not find ions of great mobility co responding to the hydrogen and others of smaller mobility co responding to the methyl iodide. Wellisch has shown that a the ions in the mixture move with the same velocity. If there ha been stable ions with masses comparable with the hydroge molecules and others comparable with the methyl iodide molecul they could easily have been differentiated. If however the io form aggregates and the partners of the ions in these aggregate are constantly changing so that during the life of the ion passes backwards and forwards through a great number different phases, then though at any particular instant one io might have a different mobility from another, yet the averag mobility taken over a finite time would be the same for all th ions. To detect the different kinds of ions it would be necessar to observe not their average behaviour over a long time but t make the measurements so quickly that the ion had not time t pass from one state to another whilst it was under observatio The life of an ion in a particular phase is, at atmospheric pressur probably considerably less than the millionth of a second; th length of life will vary inversely as the pressure so that the chanc of detecting the different kinds of ions would be much greater a low pressures than at high ones.

Lately Erikson has detected a case when the velocity of th ion changes even though the gas through which it is movin remains the same; he has shown that the mobility of the positiv ions in air at atmospheric pressure is, in the first second or so o their existence, about 1·89 but as the ions get older the mobilit falls to 1·35, the ratio of these numbers is nearly equal to √ which is the ratio of the mobility of an ion consisting of on molecule to that of one consisting of a very large number. I would thus seem that the old ions are much more complex tha the young ones. The surprising thing about Erikson's result i that he found the ions to retain their youthful properties for th best part of a second at atmospheric pressure; during this tim the ion will have collided with many million molecules of ai and so might have been expected to form partners in a very smal fraction of a second. The results are consistent with the ide that the ion forms a stable connection with the molecules of som very heavy gas present in very small quantities as an impurity The addition to the gas of small quantities of the vapours o water or alcohol whose molecules have a finite electrical momen produces a marked diminution in the mobility, indicating tha they give rise to aggregates of exceptional permanence. Formul (2) is obtained on the assumption that the force between the io and the molecule is due to electrostatic induction alone and s varies inversely as the fifth power of the distance; if the ga were one like water vapour or ammonia whose molecules ar polar, the force between the ion and the molecule would var inversely as the fourth instead of the fifth power of the distanc and the mobility would not be given by formula (2).

We see from this formula that unless M_2/M_1 depends upon th pressure the mobility is inversely proportional to N, *i.e.*, to th pressure of the gas. This law has been verified for positive ions own to pressures less than 1 mm. of mercury. As however the robability of forming complex aggregates is greater at high than t low pressures, we should expect M_2/M_1 to diminish as the ressure diminishes; this diminution in M_2/M_1 would produce a nall increase in the mobility so that the formula would indicate hat the mobility would increase just a little more quickly than he reciprocal of the pressure.

The behaviour of negative ions is in many respects quite ifferent from that of the positive ones. In the first place the obility of the negative ions is for the permanent gases greater han that of the positive; thus, for example, in dry hydrogen the elocities of the negative and positive ions, when the electric rce is one volt per cm., are 7·95 and 6·7 respectively, and for r 1·87 and 1·36. The difference is less for moist gases than for ry, while for complex vapours which have comparatively small obilities Wellisch found that there was very little difference etween the mobilities of the positive and negative ions.

For the permanent gases the ratio of the mobilities of the egative and positive ions varies but little with the pressure, un-l the pressure is reduced below that represented by about 10 n. of mercury. For lower pressures than this, the mobility of he negative ion increases, as Langevin showed, more rapidly han that of the positive; at the pressure of a millimetre or so the obility of the negative ion in air may be three or four times that f the positive.

An even more interesting result was discovered by Franck nd Hertz, who, when they experimented with very carefully urified nitrogen or argon, found that the mobility of the egative ion was more than 100 times that of the positive. The obilities in these gases are extremely sensitive to traces of oxy-en, and a fraction of 1% of oxygen added to the pure gas will duce the mobility of the negative ion to less than one-tenth f its maximum value. The enormous mobility of the negative n in nitrogen and argon as compared with that of the positive hows that in them the negative electricity must be carried by ectrons and not by atoms or molecules, while the effect of troducing traces of oxygen shows that these electrons readily tach themselves to the molecules of oxygen though they are nable to adhere to molecules of nitrogen or argon. The same fect has also been observed in helium and hydrogen.

These properties of the negative ion are of great importance connection with the mechanism of ionisation in gases and the ructure of atoms and molecules. In the first place, they rnish strong evidence in support of the view that the first stage the ionisation of a gas is the ejection of an electron from the olecule of the gas rather than the separation of the molecule to atoms of which some are charged with positive and others ith negative electricity. On this view the negative ion begins s career as an electron and not as an atom, while the positive n from the beginning is of molecular dimensions. As an elec-ron has much greater mobility than a molecule the mobility of e negative ion will at first be much greater than that of the ositive. In some gases, such as oxygen, the electron soon gets tached to a molecule, and its mass and mobility become com-rable with those of the positive ion. The mobility we measure the average mobility of the negative ion during its life; part the time its mobility, being that of an electron, is very much rger than that of the positive ion, while in the other part the o mobilities will be much the same. The excess of mobility of e negative over the positive ion will depend upon the fraction its life which the negative ion spends as a free electron—a action which would tend to increase as the pressure of the gas minished.

The mobility of the electron may be estimated by formula); if the gas is nitrogen we must in that formula put $M_2/M_1=$ 28×1800 which is the ratio of the mass of an electron to that a nitrogen molecule. Using this value for M_2/M_1 we find at the mobility of the electron is about 220 times that of e positive ion, a result which is confirmed by experiment. irect experiments on the mobility of negative ions do not give y indication of the existence of two kinds of these ions. This ay be regarded as a confirmation of the explanation of the similar result for the positive ions, viz.: that our methods only give the average mobility of the ion through a comparatively long life; for there can be but little doubt that in all but a very few gases the negative ion can exist in two phases, one of them being the electron. The mobility in the electron phase is so exceptional that anything which prolongs the duration of this phase in comparison with that of the other phases must have a great effect upon the mobility. Some observations by Loeb (*Phys. Review*, 17, p.89) give us some information about the time an electron in oxygen requires to unite with the molecule and form a negative ion. He found that the electron made about 50,000 collisions with an oxygen molecule before combining with it and that this number is independent of the pressure. The time taken to make these collisions, taking the velocity of the electron at 0° C. as 10^7 and the free path as 10^{-5} at 760 mm., is 5×10^{-8} sec. and this will measure the life of the free electron. It is evident that, even allowing for the great mobility of the electron, it could not appreciably affect the mobility in experiments lasting for a time comparable with ·01 sec., and the mobility would be practically that of the negative ion, unless the electron were able to break away again from a molecule after it had united with it. The mobility of the carriers of negative electricity as compared with that of the positive one is evidence that the electron is continually changing partners. If k_1 be the mobility of the electron, k_2 that of the negative ion, T_1 the life of the electron, T_2 that of the negative ion, the average mobility will be

$$\frac{k_1T_1 + k_2T_2}{T_1 + T_2}$$

If p is the pressure of the gas, k_1 and k_2 vary inversely as the pressure, let them equal K_1/p, K_2/p, then the mobility is equal to

$$\frac{1}{p}\left\{\frac{K_1T_1 + K_2T_2}{T_1 + T_2}\right\} \quad . \quad (3)$$

Since Loeb's experiments show that the electron makes the same number of collisions before uniting with the molecule whatever be the pressure, and since the interval between each collision is inversely proportional to the pressure, T_1 varies as $1/p$, if the breaking up of the negative ions were due to collisions with the molecules T_2 would also vary as $1/p$ and the ratio of T_1 to T_2 would be independent of the pressure. This from equation (3) would make the mobility of the negative ion like that of the positive vary inversely as the pressure and would not explain the abnormal increase of the negative carriers at low pressures. Hence we conclude that the breaking up of the negative ions is not due to collisions. If T_2 is independent of p, while T_1 increases as p diminishes the product of the mobility and pressure will by (3), since k_1 is greater than k_2, increase as p diminishes, which is in accordance with the results observed by Langevin and others.

The difference between the behaviour of the electron in nitrogen or argon and in oxygen discovered by Franck and Hertz is of great importance in connection with the structure of the atom and molecule, for it indicates that, while a molecule of oxygen can accommodate another electron in addition to those already present, the molecules of nitrogen and argon are unable to do so. It is instructive therefore to consider the results obtained by the study of the positive rays as to the power of the atoms and molecules of the different elements to acquire a negative charge. These show that, while the atoms of hydrogen, carbon, oxygen, fluorine or chlorine readily acquire a negative charge, those of helium, nitrogen, neon and argon do not; and again that, while it is very exceptional for a molecule whether of a compound or an elementary gas to acquire a negative charge, the molecule of oxygen is able to do so. We see that this result is in accordance with the behaviour of the carrier of the negative charge in an ionised gas. Since the atoms in the positive rays show so much greater affinity for the electrons than the molecules, it follows that if the agent producing ionisation were to dissociate some of the molecules of the gas into neutral atoms (and to do this would require the expenditure of much less energy than to ionise the gas), these atoms would be much more effective traps for the electrons than the undissociated molecules. Loeb has shown that even in oxygen an electron collides on the average with about 50,000 molecules of oxygen before it is captured; thus if the oxygen *atom* could capture an electron at the first encounter, if only one molecule in 50,000 were dissociated into atoms, the effect of the atoms would be as efficacious as that of the molecules in capturing the electrons. When this dissociation into atoms takes place the abnormal velocity of the negative ion will only occur in gases like nitrogen and the inert gases whose *atoms* cannot receive an electron.

Recombination of the Ions.—Even when the ions are not removed from a gas by sending a current of electricity through it, their number will not increase indefinitely with the time of exposure of the gas to the ionising agent. This is due to the recombination which takes place between the positive and negative ions; these ions as they move about in the gas sometimes come into collision with each other, and by forming electrically neutral systems cease to act as ions. The gas will reach a steady state with regard to ionisation when the number of ions which disappear in one second as the result of the collisions is equal to the number produced in the same time by the ionising agent.

If there are n ions of either kind per cu. cm., the number of collisions between the positive and negative ions in one second in a cu. cm. of the gas will be proportional to n^2; hence the number of ions of either sign which are lost by recombination in one second may be represented by αn^2 when α is called the coefficient of recombination. If the ionising agent produces q ions per cu. cm. per sec., then

$$\frac{dn}{dt} = q - \alpha n^2.$$

The solution of this equation, if we reckon t from the instant the ionising agent begins to act, so that $n=0$ when $t=0$, is $k^2=q/\alpha$

$$n = \frac{k(\epsilon^{2k\alpha t}-1)}{\epsilon^{2k\alpha t}+1}.$$

We see that, when the gas reaches a steady state, $n=k=\sqrt{q/\alpha}$, and that the gas will not approximate to this state until t is large compared with $1/2k\alpha$, *i.e.*, to $1/2\, n_0\alpha$ where n_0 is the value of n in the steady state. Thus when the ionisation is very weak it may take a considerable time for the gas to reach a steady state.

When the ionising agent is removed, the ions do not disappear at once, but decay at the rate given by the equation

$$\frac{dn}{dt} = -\alpha n^2.$$

The solution of this, when t is the time which has elapsed since the removal of the ionising agents, and n_0 the number of ions when $t=0$, is

$$n = n_0/(1+n_0\alpha t).$$

Thus the number of ions will be reduced to one-half their initial value after a time $1/\alpha n_0$. We may therefore take $1/\alpha n$ as the measure of the life of an ion when there are n ions per cubic centimetre. The values of α/e, where e is the charge on an ion, have been measured by various experimenters; the results are given in the following table: the agent used to ionise the gas is given in the second row.

TABLE III.

Values of α/e for Various Gases at Atmospheric Pressure and Ordinary Temperature

Gas	Townsend	McClung	Langevin	Thirkill	Hendren	Retschinsky	Rumelin	
	Röntgen rays	Röntgen rays	Röntgen rays	Röntgen rays	α rays	α rays	α rays	β rays
Air	3,420	3,380	3,200	3,580	3,300	4,200	4,240	5,820
CO_2	3,520	3,490	3,400	3,500	..	..	..	..
H_2	3,020	2,940	..	..	..	..	..	..
O_2	3,380	..	..	..	..	..	..	..
SO_2	..	..	..	3,000	..	..	..	..
N_2O	..	..	..	2,960	..	..	..	..
CO	..	..	..	1,780	..	..	..	..

The results ascribed to Thirkill were obtained by extrapolati from experiments made at lower pressures. Since e, in electr static measure, is $4{\cdot}8\times10^{-10}$, the value of α for air is about $1{\cdot}6$ 10^{-6}, so that, when there are n positive and n negative ions p cu. cm., the number of ions which recombine per second

$$1{\cdot}6\times10^{-6}n^2.$$

This shows very markedly the influence of the electric charg in increasing the number of collisions between the particles, f the number of collisions in a second between $2n$, uncharge molecules in a cu. cm. of air is

$$4\times10^{-10}n^2.$$

which is only about 1/4,000 of the number of recombinatio between the same number of ions.

The ions like the molecules of the gas will in consequence thermal agitation be moving with high velocities, and unless th distance between them is less than a certain value will drift apa and not combine. The condition that they should not separat if they are a distance d apart is that the kinetic energy due t their relative motion should be less than e^2/d the work require to separate the ions to an infinite distance. The average kineti energy due to their relative motion is equal to $\beta\theta$ where $\beta\theta$ the average kinetic energy of a molecule at the absolute te perature θ; β is equal to $2{\cdot}02\times10^{-16}$. Hence the ions will separat unless

$$2{\cdot}02\times10^{-16}\theta < e^2/d.$$

At 0° C, $\theta=273$ and since $e=4{\cdot}8\times10^{-10}$ this condition shows tha they will separate at this temperature unless d is less than $4{\cdot}1$ $\times10^{-6}$ centimetres. This is on the supposition that they are n subject to any influence other than their mutual attraction. A they move through the gas they may, if one or other of the when they are close together comes into collision with a molecul of the gas, lose some of the kinetic energy which would enabl them to separate. Assuming that collision with a molecule r duces the kinetic energy due to relative motion to $\beta\theta$, the valu it has for thermal equilibrium, it follows that to ensure combin tion the collision with the molecules must occur when d, th distance between the ions, is less than $e^2/\beta\theta$ and that every su collision leads to recombination. To find the rate at which th ions recombine we have to find the number of collisions betwee ions and molecules which occur in one second, only those co lisions to be counted when an ion is within a distance d of one opposite sign at the time of collision. It can be shown (s J. J. Thomson, *Phil. Mag.*, 47, p. 337) that this number is equal t

$$\pi d^2\rho\rho^1\sqrt{U^2+U_1^2}(1-\omega\omega^1)$$

where $$\omega = \frac{\lambda^2}{2d^2}\left(1-\epsilon^{\frac{-2d}{\lambda}}\left[1+\frac{2d}{\lambda}\right]\right)$$

$$\omega^1 = \frac{\lambda_1^2}{2d^2}\left(1-\epsilon^{\frac{-2d}{\lambda_1}}\left[1+\frac{2d}{\lambda_1}\right]\right)$$

where λ and λ_1 are respectively the mean free paths of th positive and negative ion through the gas, U and U_1 the mea velocities of these ions due to their thermal agitation, ρ and ρ the number of positive and negative ions per unit volume a $d=e^2/\beta\theta$.

It follows from the definition that α the coefficient of recom bination is given by the equation

$$\alpha = \pi d^2\sqrt{U^2+U_1^2}\,(1-\omega\omega^1).$$

When the pressure is low enough to make $2d/\lambda$ and $2d/$ small, then $1-\omega\omega^1 = \frac{4}{3}d\left(\frac{1}{\lambda}+\frac{1}{\lambda_1}\right)$ approximately,

so that $\alpha \doteq \frac{4}{3}\pi d^3\sqrt{U^2+U_1^2}\left(\frac{1}{\lambda}+\frac{1}{\lambda_1}\right).$

Both $1/\lambda$ and $1/\lambda_1$ are proportional to the pressure, so that at lo pressures α varies as the pressure, which agrees with the result of Thirkill's experiments. When the pressure is so high tha λ/d and λ_1/d are small, ω and ω^1 are small and

$$\alpha = \pi d^2\sqrt{U^2+U_1^2}$$

approximately, so that α is independent of the pressure.

When the density is constant the value of α diminishes as the mperature increases. The connection between α and the ablute temperature T seems to be expressed with fair accuracy by e equation

$$\alpha = c\mathrm{T}^{-n}$$

cording to Erikson, n is equal to 2·3, 2·42, 2·35 for hydrogen, and CO_2 respectively, while Phillips's experiments gave $n=2$.

Diffusion of Ions.—In addition to the loss of ions by recomnation, there will be a loss due to the diffusion of the ions to e side of the vessel in which they are contained; when the ions ike against the walls they may lose their charges and thus ase to be ions. The loss of ions from this cause will be prortional to the surface of the vessel, while that due to recomnation will be proportional to the volume, thus the ratio of the ss by diffusion to that by recombination will be greater in small ssels than in large. Again the rate of diffusion is inversely oportional to the pressure while that of recombination is dictly proportional to it, thus the loss by diffusion will be relavely more important at low pressures than at high.

Large Ions.—The ions we have been considering are those proced in dust-free gases by Röntgen or cathode rays. In some ses, however, ions with very much lower mobilities are to be und in gases. Thus Langevin found in air from the top of the iffel Tower two types of ions, one consisting of ions of the kind e have been considering, with a mobility of about 1·5 cm./sec., e other of ions with a mobility of 1/3,000 cm./second. Ions ith mobilities of the same order as this second type may be oduced by bubbling air through water, by passing air over osphorus or by drawing air from the neighbourhood of flames. hey are probably charged particles of dust of various kinds, held suspension in gas which is exposed to some kind of ionising gent which gives a supply of ions of the first type; these settle the particles of dust and form the slow ions. The number of ese slow ions, when the gas is in a steady state, will depend only the number of dust particles in the gas and will not be affected the strength of the ionising agent. This follows from the inciple that in the steady state the number of dust particles hich acquire a positive charge must equal the number which se such a charge. A positively electrified dust particle might se its charge by meeting and coalescing with a negative small n or by coalescing with a negatively electrified dust particle. hese dust particles are, however, so sluggish in their moveents that, unless the dust particles are enormously more merous than the small ions, we may neglect the second source loss in comparison with the first.

Thus if U is the number of uncharged dust particles in a cu. n. of the gas, P and N the number of those with positive and egative charges respectively and p, n, the number of positive nd negative small ions, then the number of dust particles which quire per second a positive charge will be $\alpha \mathrm{U} p$ and the number sing such a charge by coalescing with a negative ion $\beta \mathrm{P} n$, here α and β are constants; hence for equilibrium

$$\alpha \mathrm{U} p = \beta \mathrm{P} n$$

Similarly by considering the negatively charged particles we et

$$\alpha' \mathrm{U} n = \beta' \mathrm{N} p$$

ence we see that the proportion between the charged and unharged particles of dust depends only upon the ratio of p to n, nd not upon the absolute magnitude of either of these quanties. Thus, though it would take much longer to reach the eady state with a feeble source of ionisation than with a strong ne, when that state was reached there would be as much dust ectrified in one case as in the other. De Broglie estimates that this state about one-tenth of the particles would be electrified.

Relation Between the Potential Difference and the Current hrough an Ionised Gas.—We shall take the case of two infinite arallel metal plates maintained at different potentials and imersed in an ionised gas; the line at right angles to these plates e shall take as the axis of x, it being evidently parallel to the irection of the electric force X. Let n_1, n_2 be respectively the umber of positive and negative ions at the place fixed by the co-ordinate x; u_1 and u_2 the velocities of these ions. The volume density of the electrification in the gas, if it is entirely due to the ions, is $(n_1-n_2)e$ when e is the charge on an ion, hence

$$\frac{d\mathrm{X}}{dx} = 4\pi(n_1-n_2)e \qquad (1)$$

If ι is the current through a unit area of the gas

$$\iota = e(n_1u_1+n_2u_2) \qquad (2)$$

Hence from (1) and (2) we have

$$n_1e = \frac{\iota}{u_1+u_2}+\frac{1}{4\pi}\frac{u_2}{u_1+u_2}\frac{d\mathrm{X}}{dx} \qquad (3)$$

$$n_2e = \frac{\iota}{u_1+u_2}-\frac{1}{4\pi}\frac{u_1}{u_1+u_2}\frac{d\mathrm{X}}{dx} \qquad (4)$$

When things are in a steady state, neglecting any loss of ions by diffusion we have

$$\frac{d}{dx}(n_1u_2) = q-\alpha n_1n_2 \qquad (5)$$

$$-\frac{d}{dx}(n_2u_2) = q-\alpha n_1n_2 \qquad (6)$$

where q is the number of ions produced per second in a cu. cm. of gas, and α is the coefficient of recombination; if k_1, k_2 are the mobilities of the positive and negative ions respectively, then

$$u_1=k_1\mathrm{X} \qquad u_2=k_2\mathrm{X}$$

From equations (1), (5) and (6) we get

$$\frac{d^2\mathrm{X}^2}{dx^2} = 8\pi e(q-\alpha n_1n_2)\left(\frac{1}{k_1}+\frac{1}{k_2}\right)$$

and, substituting the values of n_1 and n_2, we get

$$\frac{d^2\mathrm{X}^2}{dx^2} = 8\pi e\left(\frac{1}{k_1}+\frac{1}{k_2}\right)\left\{q-\frac{\alpha}{e^2\mathrm{X}^2(k_1+k_2)^2}\left(\iota+\frac{k_2}{8\pi}\frac{d\mathrm{X}^2}{dx}\right)\left(\iota-\frac{k_1}{8\pi}\frac{d\mathrm{X}^2}{dx}\right)\right\} \qquad (7)$$

No general solution of this equation has been obtained, but when ι is small compared with the saturation current qle, l being the distance between the plates, an approximate solution is represented by the graph in fig. 2.

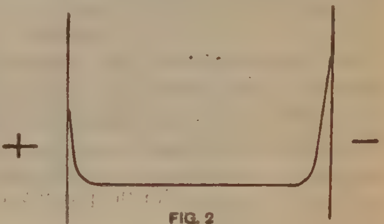


FIG. 2

The force is practically constant, and equal to

$$\left(\frac{\alpha}{q}\right)^{\frac{1}{2}}\frac{\iota}{e(k_1+k_2)}$$

except close to the electrode, where it increases; and as the mobility of the negative ion is greater than that of the positive the increase in the force will be greater at the cathode than at the anode. As the potential difference between the electrode increases, and the current approaches more nearly the saturation value, the flat part of the graph diminishes, and the graph for X takes the form given in fig. 3. When the potential difference is so large that the current is nearly saturated, X is very approximately constant from one electrode to another.

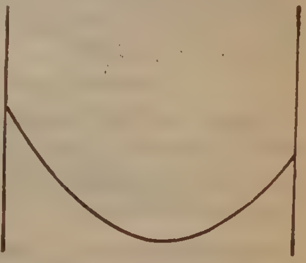


FIG. 3

In one extremely important case, that in which the negative ions are electrons and have a mobility which may be regarded as infinite in comparison with that of the positive ions, equation (7) admits of integration: for by putting $k_1/k_2=0$ in equation (8) it becomes

$$\frac{d\mathrm{X}^2}{dx}+\frac{8\pi e^2k_2q\mathrm{X}^2}{\alpha\iota} = \frac{8\pi\iota}{k_2} \qquad (8)$$

The solution of this is

$$\mathrm{X}^2 = \frac{\alpha\iota^2}{qk_2^2e^2}\left(1+\frac{k_2}{k_1}\frac{\iota-\iota_0}{\iota}\epsilon^{\frac{-8\pi e^2k_2q\mathrm{X}}{\alpha\iota}}\right) \qquad (9)$$

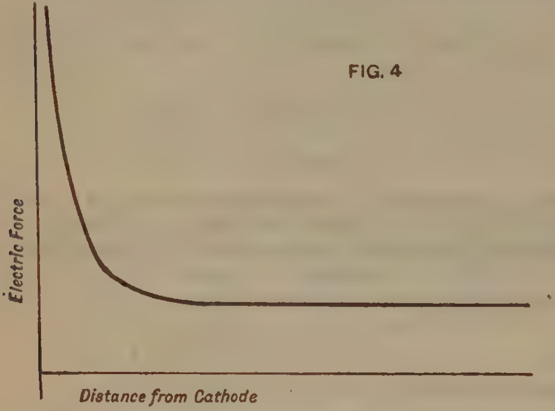
when x is the distance from the cathode and ι_0 the amount of negative electricity emitted by unit area of the cathode per unit time.

This distribution of force is represented by the graph in fig. 4; the force at some distance from the cathode is equal to

$$\frac{\iota}{k_2}\left(\frac{a}{q}\right)^{\frac{1}{2}}$$

and is thus proportional to the current; the force at the cathode itself is $\left\{1+k_2(\iota-\iota_0)/k_1\iota\right\}^{\frac{1}{2}}$ times greater than this. The fall of potential between the electrodes is made up of two parts, one arising from the constant force; as this force is proportional to ι this part of the potential fall will be proportional to ιl when l is the distance between the electrodes, and may be represented by $A\iota l$ when A is a constant; the other part of the potential fall is that which occurs close to the cathode. We find from equation (9) that this is proportional to ι^2 and does not depend upon l. Thus, if V is the potential difference between the electrodes when A and B are constants

FIG. 4



$$V = A\iota l+B\iota^2. \qquad (10)$$

H. A. Wilson has shown that an equation of this type represents the relation between the current and potential difference for conduction through flames. In many cases the drop of potential at the cathode is much greater than the fall in the rest of the circuit; when this is so we see that the current is proportional to the square root of the potential difference. The value of B increases with the pressure and decreases with the amount of the ionisation.

Current from Hot Wires.—A case of great importance from its industrial application in hot wire valves is one where all the ions are negative and are emitted from the cathode. Metal wires or plates raised to incandescence emit electrons, and if they are used as cathodes can transmit across a vacuum or gas at a low pressure very considerable currents.

Let the hot cathode be the plate $x=0$ and let V be the potential at the point x, n the density of the negative ions at this point, and ι the current through unit area. If u is the velocity of the negative ion, we have

$$nue = \iota \quad \text{and} \quad \frac{d^2V}{dx^2} = 4\pi ne.$$

There are two cases to be considered; the first is when the hot plate is surrounded by gas of sufficient density to make the velocity of the ions proportional to the electric force; the second is when it is surrounded by a vacuum, and the motion of the ions is not affected by the gas.

In the first case $u=k_2\dfrac{dV}{dx}$, when k_2 is the mobility of the negative ion, and the equation $nue=\iota$ is equivalent to

$$\frac{k_2}{4\pi}\frac{dV}{dx}\frac{d^2V}{dx^2} = \iota. \qquad (11)$$

The solution of this is

$$\left(\frac{dV}{dx}\right)^2 = \frac{8\pi\iota}{k_2}x+C.$$

Therefore if V is the difference of potential between the ano and cathode, and l the distance between them

$$V = \frac{k}{12\pi\iota}\left[\left(\frac{8\pi\iota l}{k}+C\right)^{\frac{3}{2}}-C^{\frac{3}{2}}\right] \qquad (1$$

where C is the constant of integration.

In consequence of thermal agitation some of the electrons ne the plate will diffuse backwards and hit the plate; if n_0 is t density of the electrons near the plate it follows from the Kine Theory of Gases that the number hitting the plate in unit tir is $n_0c/\sqrt{6\pi}$, where c is the velocity of mean square, *i.e.*, $\frac{1}{2}m$ $=\frac{3}{2}R\theta$; m is the mass of an electron, θ the absolute temperatu of the electrons and R the gas constant $1{\cdot}35+10^{-16}$.

If I is the current per unit area emitted by the plate, then consequence of the diffusion there is a backward curre $en_0c/\sqrt{6\pi}$, so that ι, the current going through the gas is given the equation

$$I-\frac{en_0c}{\sqrt{6\pi}} = \iota.$$

If u_0 is the velocity acquired by the electrons near the pla under the electric force, $\iota=en_0u$, hence

$$\frac{\iota}{I-\iota} = \frac{u_0}{c}\sqrt{6\pi}. \qquad (1$$

So that, unless ι is small compared with I, u_0 will be comparab with c; in this case, however, the velocity of the ion is no long proportional to the electric force so that equation (11) no long holds. Again, when the current approaches saturation, $\iota/(I-$ is large and therefore by (13) u_0 will be large compared with For the negative ion to acquire a velocity of this magnitude th electric field would have to be so strong that sparks would pa through the gas unless the pressure were very low. Thus satura tion currents from hot bodies are only obtainable at very lo pressures.

Since the electric force when $x=0$ is $\sqrt{C}$, $u_0=k\sqrt{C}$, an therefore by (13)

$$C = \frac{c^2}{6\pi k^2}\frac{\iota^2}{(I-\iota)^2}.$$

Thus if the current is far from saturation, C will be negligib compared with $8\pi\iota l/k$. When C can be neglected, equatio (12) gives

$$\iota = \frac{9k}{32\pi}\frac{V^2}{l^3}. \qquad (14$$

Thus the current is proportional to the square of the potenti difference. A remarkable thing about this expression is that fo these very small currents the intensity of the current is ind pendent of the temperature of the plate, although, of course, th range of currents over which this formula is applicable is wid the higher the temperature.

When the hot body is in a vacuum, we have, if the ions have n initial velocity,

$$\tfrac{1}{2}mu^2 = Ve$$

where m is the mass and e the charge on an ion; hence th equation $nue=\iota$ is equivalent to

$$\frac{d^2V}{dx^2}V^{\frac{1}{2}} = 4\pi\iota\sqrt{m/2e} \qquad (15$$

a solution of which is

$$V = (9\pi\iota)^{\frac{2}{3}}(m/2e)^{\frac{1}{3}}x^{\frac{4}{3}}. \qquad (16$$

Hence, if V is the potential difference and l the distance betwee the electrodes

$$\iota = \frac{l}{9\pi l^2}\left(\frac{2e}{m}\right)^{\frac{1}{2}}V^{\frac{3}{2}}. \qquad (17$$

We see from equation (16) that the electric force vanishes a the cathode, and that the density of the negative electrificatio is as $x^{-\frac{2}{3}}$; thus it is infinite when close to the cathode and diminishes as the distance from the anode diminishes. The total quantity of electricity between the anode and cathode is proportional to $(l\iota^2)^{\frac{1}{3}}$. We see again that for a given potential ifference the current does not depend on the temperature of the ot wire; this law only holds when the currents are less than the aximum currents which can pass between the electrodes. Vhen the current approaches this value, the current instead of icreasing as $V^{\frac{3}{2}}$ becomes independent of V, and the negative ectricity between the electrodes diminishes as V increases. angmuir, who has made a very complete investigation of the urrents from hot wires, finds that the expression (17) represents, ith considerable accuracy, the relation between the current and otential over a wide range in the values of the currents. The urves in fig. 5, given by him, represent the relation between the urrent and potential for wires at different temperatures. They lustrate the point that a colder wire, until it is approaching the tage of saturation, gives as large a current as a hotter one, hough the hotter one, of course, has a wider range of currents.

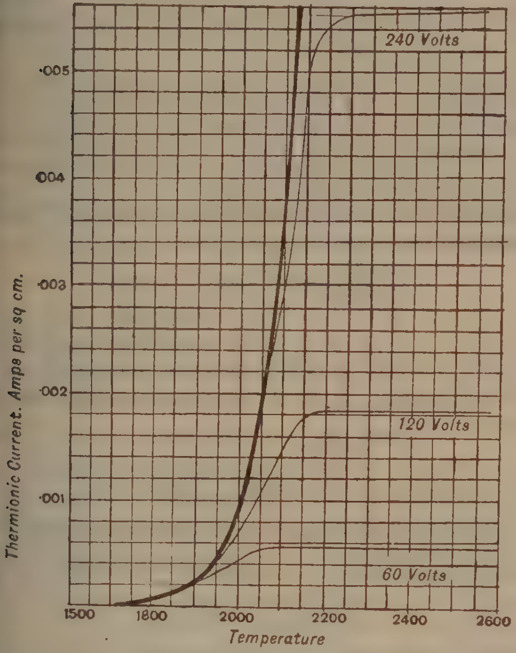


FIG. 5

Ionisation by Collision.—The curve representing the relation etween the currents through a gas ionised (say) by Röntgen ays and the difference of a potential between the electrodes is ound to be of the form already shown in fig. 1, where the orinates represent the currents and the abscissae the potential ifference. The flat part represents the state of saturation when he potential difference is large enough to send all the ions prouced by the rays to the electrodes before they can recombine. Vhen the potential difference is still further increased we see hat a stage is reached when the current begins to increase with reat rapidity with the potential difference, and reaches values uch greater than could be attained by the ions produced by he Röntgen rays. Thus in addition to the ions produced by the ays there must be other ions, and some other source of ionisation ssociated with the strong electric fields. Now the processes oing on in a gas while it is conveying an electric current are:—) the ionisation of the gas by the external agent—in this an lectron is liberated from the molecule and the residue forms a ositive ion; (2) the electron and the positive ion acquire energy nder the action of the electric forces; (3) in many gases the lectron finally unites with an uncharged molecule to form a egative ion. As the most noticeable change in the conditions hen the intensity of the electric field increases is in the energy f the electrons and ions, it is natural to look to these as the ource of the additional ionisation. We have, moreover, direct xperimental evidence that rapidly moving electrons and ions re able to ionise a gas through which they are passing. Hot wires and metals exposed to ultra-violet light yield a supply of electrons which when they leave the metal have very little energy; by applying suitable electric fields these electrons can be endowed with definite amounts of energy and can then be sent through a gas from which all extraneous ionising agencies are shielded off. When this is done it is found that, when the energy of the electrons exceeds a certain critical value, depending upon the nature of the gas, the gas is ionised by the electrons, but no ionisation occurs when the energy of the electron falls below this limit. It is convenient to measure the energy of the electron in terms of the difference of electrical potential through which the electron has to fall in order to acquire this energy. The potential difference which would give to the electron the energy at which it begins to ionise the gas is called the ionising potential. The values of the ionising potential have been found for several gases, as will be seen from Table IV. There is, however, considerable discrepancy between the results obtained by different observers.

TABLE IV. *Ionising Potentials in Volts.*

Gas	Stead & Gosling	Franck & Hertz	Davis & Goucher	Horton & Davies	Tate & Foote	Hughes & Dixon
H_2 .	15	11	11 & 15	..	..	10·2
He .	20·8	20·5	..	25·6	..	..
O_2 .	..	9	..	..	..	9·2
N_2 .	17·2	7·5	17	..	..	7·7
CO .	15	..	..	..	..	7·2
Arg. .	12·5	12	..	15	..	..
Ne .	..	..	..	16·7 & 20 & 22·8	..	..
Hg .	10·8	..	..	..	..	10·2
Cd .	..	..	..	..	8·9	..
Na .	..	..	..	..	5·1	..
K .	..	..	..	..	4·1	..
Zn .	..	..	..	..	9·5	..

The most obvious view to take of this ionisation by moving electrons is that the moving electron comes so near to an electron in a molecule of the gas that the latter receives from the collision enough energy to enable it to escape from the molecule and start as a free electron. If the electrons repel each other with forces varying inversely as the square of the distance between them, and if T is the energy of the moving electron, and d the length of the perpendicular from the electron in the molecule on the initial direction of motion of the moving electron, then the energy communicated to the electron in the molecule by its collision with the moving electron is equal to

$$\frac{T}{1+\frac{d^2T^2}{e^4}}$$

where e is the charge of electricity on an electron. This is on the supposition that the electron is moving so rapidly that the time while it is in close proximity to the electron in the molecule is small compared with the time of vibration of that electron; if this time is comparable with the duration of the collision, the energy taken from the moving electron will be considerably less, and it will become vanishingly small when the duration of the collision is large compared with the time of vibration. The energy given to the electron in the molecule does not increase indefinitely with that of the moving electron, for it vanishes when T is infinite as well as when T is zero; it has the maximum value when $T=e^2/d$. In order that the electron in the molecule should receive an amount of energy Q

$$Q=\frac{T}{1+\frac{d^2}{e^4}T^2}, \quad \text{or} \quad d^2=\frac{e^4(T/Q-1)}{T^2}$$

If Q is the ionising potential, d^2 must be less than the value given by this expression. If n is the number of *electrons* in unit volume of the gas, and if the spheres with radius d described round the different electrons do not overlap, the probability that the moving electrons should come within this distance of one of them, when moving through a distance Δx, is $n\pi d^2\Delta x$, or

$$\frac{n\pi e^4(T/Q-1)}{T^2}\Delta x$$

The coefficient of Δx is the number of ions made per unit path by a moving electron with energy T. The maximum is when $T=2Q$.

Experiments on ionisation by moving electrons have been made by Kössel (*Ann. der Phys.* 37, p. 406) and by Mayer (*ibid.* 45, p. 1), who found that the maximum ionisation per unit path occurred when the energy of the moving electron was in the neighbourhood of 200 volts. Mayer's results are 125 for hydrogen, 130 for air, and 140 for carbon dioxide. These numbers are much greater than twice the potential at which the ionisation begins, as this potential is of the order of 11 volts. It must be remembered, however, that though there may be some electrons in the atom which can be ejected by 11-volt electrons, there may be other electrons of different types which require more energy for their expulsion, so that, as the energy of the moving electrons increases beyond the energy required to liberate these electrons, fresh sources of detachable electrons will be trapped, and these may more than counterbalance the falling off in the ionisation of the more easily detached electrons. Again, some of the electrons ejected by the primary electrons may have enough energy to ionise on their own account; the total ionisation may thus be increased by ionisation due to the secondary electrons, and also by radiation excited by the impact of the primary electrons against the molecules of the gas.

When, as in the case of cathode rays in highly exhausted tubes or in that of the β rays from radioactive substances, T is very large compared with Q, the number of ions produced per unit path is $n\pi e^4/QT$, and so varies inversely as the energy of the moving electrons. The experiments of Glasson on ionisation by cathode rays, and of Durack on that by β-particles, seem to be in accordance with this result.

Scattering of Electrons.—The researches of Lenard and Ramsauer on the scattering of electrons in their passage through gases, have shown that the relation between the scattering produced by different gases depends to a great extent upon the velocity of the electrons which are scattered. If this velocity is small the scattering by most gases is approximately that which would be produced by impenetrable atoms of the size indicated by the Kinetic Theory of Gases and derived from the measurements of viscosity of gases and so on, there is no clear connection between the scattering produced by a gas and the number of electrons in its atoms. With high speed electrons the laws are much simpler and show proportionality between the scattering and the number of electrons in the atom. We should expect these results on the theory just given. For if 2θ is the angle through which the relative velocity of the electron and the atom is deflected by the collision

$$\sin^2\theta = \frac{1}{1+\dfrac{d^2}{e^4}T^2}$$

when T is the kinetic energy due to the relative motion of the electron and the atom.

Let us put $T = \dfrac{e^2}{C}$

then if T is expressed as V volts

$$C = 14{\cdot}4\times10^{-8}/V$$

and $\sin^2\theta = \dfrac{1}{1+\dfrac{d^2}{C^2}}$.

We see from this that θ will not be small unless d is considerably greater than C. Thus we may regard each electron in the atom as deflecting through considerable angles all electrons which pass within a distance C. They may, as far as collisions are concerned, be regarded as producing much the same effect as solid spheres of radius C. Now when the energy of the electrons is represented by 1 v., C is $14{\cdot}4\times10^{-8}$ centimetres. This is much greater than the distance between the electrons in the atom; thus the fields of influence of the different electrons in an atom will overlap, so that an increase in the number of electrons in the atom will not produce much effect on the scattering. On the other hand when T the energy of the electrons is so large that C, which is inverse proportional to T, becomes less than the distance between t electrons in the atom, the fields of influence of the differe electrons will not overlap and each electron will provide an add tional source of scattering, so that in this case the scattering w be proportional to the number of electrons in the atom.

With very slow electrons the scattering in most gases is i dependent of the speed but for argon and the heavier inert gas Ramsauer has made the very interesting discovery that very slo electrons are not scattered so much as those moving somewha faster, it is as if the atoms of these elements were more permeab to slow electrons than to fast.

Ionisation by Moving Ions.—When the moving systems are ion instead of electrons, the collision between them and the electron are collisions between masses of very different magnitudes, an in consequence a very much smaller fraction of the energy of th moving body becomes transferred to the electron than whe the colliding bodies have equal masses.

The amount of energy transferred to the electron when th moving body has a mass M_1 is equal to:—

$$\frac{4M_1M_2}{(M_1+M_2)^2}\times\frac{T}{1+\dfrac{4d^2T^2}{e^2E^2}\left(\dfrac{M_2}{M_1+M_2}\right)^2},$$

when M_2 is the mass of the electron and E the charge on th moving body. When, as in the case of the collision between a ion and an electron, M_2 is very small compared with M_1, thi becomes

$$\frac{4M_2}{M_1}\frac{T}{1+\dfrac{4d^2T^2}{e^2E^2}\dfrac{M_2^2}{M_1^2}}.$$

Thus, if Q is the ionising potential, the minimum value of T which will communicate this energy to the electron, is $\frac{1}{4}\frac{M_1}{M_2}$

For the smallest possible ion, an atom of hydrogen, $M_1/M_2=$ 1,700, so that the minimum energy that will enable an ion t ionise a gas by knocking out an electron from a molecule is equa to 425Q. Q for many gases is about 10 v.; thus a positive ion mus have at least energy represented by 4,250 v. to ionise the gas With more massive ions the energy required for ionisation woul be still greater.

An ion with a mass equal to that of a molecule of oxyge would not ionise unless its energy were greater than 136,000 volts Thus any ionisation by ions taking place in discharge tube where the potential difference is in general much less than thi value must be due to ions of the lighter elements, hydrogen o helium.

If the ion came into collision with the atom instead of with on of its electrons, it could, since its mass is comparable with tha of the atom, give up to this a large fraction of its energy, a ver much larger fraction than it is able to give to an electron. Inasmuch as it requires less work to dissociate a molecule into neutral atoms than to dissociate it into positively and negativel electrified ions, the result of such a collision is more likely to b the production of neutral atoms than of electrified ions.

An ion is, however, a much more complex thing than th simple charge of electricity which has, in the preceding considerations, been taken to represent the forces it exerts; and it may b that some strongly electronegative ions have such a strong attraction for an electron that when they pass through th molecule of a more electropositive element they are able t capture one of its electrons and carry it away with them. This type of ionisation would differ from the ordinary type, inasmuch as in it the electron is never free; this type produces negative ions, the other type negative electrons.

It is evident from the preceding considerations that except in very intense fields it must be the electrons and not the ions which produce ionisation by collision. Let us consider what are the chances of an electron acquiring sufficient energy in a uniform electric field; if the electron moved freely under the electric force X for a distance l it would acquire Xel units of energy.

e electron in its course through the gas will come into collision th other bodies; its path will be deflected, possibly reversed, d in moving against the electric field it may lose all the energy had previously acquired. Thus a collision of this type may stroy any ionising power given to the electron by the electric ld before the collision.

Let λ be the average distance passed over by an electron tween two collisions; then the chance of an electron moving rough a distance l without a collision is $\epsilon^{-\frac{l}{\lambda}}$, but if it moves rough a distance l it will acquire energy $=\mathrm{X}el$, hence the chance an electron acquiring energy equal to or greater than T is $\frac{\mathrm{T}}{\mathrm{X}e\lambda}$, and the chance that it should acquire energy between T d T+dT is $\frac{d}{d\mathrm{T}}\left(\epsilon^{-\frac{\mathrm{T}}{\mathrm{X}e\lambda}}\right)d\mathrm{T}$. If it possess this amount of energy e chance that it makes one ion per centimetre of path is $\frac{e^4}{\mathrm{T}^2}(\mathrm{T}/\mathrm{Q}-1)$; hence a, the chance that an electron should make e pair of ions per centimetre of path, is given by the equation

$$a = n\pi e^4\int_{\mathrm{Q}}^{\infty}\frac{d}{d\mathrm{T}}\left(\epsilon^{-\frac{\mathrm{T}}{\mathrm{X}e\lambda}}\right)(\mathrm{T}/\mathrm{Q}-1)\frac{d\mathrm{T}}{\mathrm{T}^2}$$

This may be written

$$a = \frac{n\pi e^4}{\mathrm{Q}^2}\mathrm{F}(\theta)$$

where $\theta = \mathrm{Q}/\mathrm{X}e\lambda$

and $$\mathrm{F}(\theta) = \theta\int_{\theta}^{\infty}\epsilon^{-x}\left(\frac{1}{x}-\frac{\theta}{x^2}\right)dx$$

Since λ for the same gas is inversely proportioned to the presre p, a will be of the form $nf(\mathrm{X}/p)$ where $f(\mathrm{X}/p)$ denotes a nction of X/p; and since n is proportional to the number of olecules per unit volume, a may be written as $pf(\mathrm{X}/p)$. hen the spheres described round the electrons with radius d

$$\text{where } d^2=\frac{l^4}{\mathrm{T}^2}\left(\frac{\mathrm{T}}{\mathrm{Q}}-1\right)$$

not overlap, n will also be proportional to the number of elecons in the molecule. The greatest value of d is $e^2/2\mathrm{Q}$; hence if , the distance between two electrons, is greater than $e^2/2\mathrm{Q}$ ere can be no overlapping; if D is less than this quantity, there ay be overlapping; since the value of d diminishes as the netic energy of the electron increases, n for very fast electrons ill be proportional to the number of electrons in the molecule.

Some of the electrons will by adhesion to a neutral molecule come negative ions. Let the chance of an electron doing so hile passing over 1 cm. be γp. If N be the number of electrons er c.c. at a place fixed by the co-ordinate x, then $\frac{d\mathrm{N}}{dt}+\frac{d}{dx}(\mathrm{NU})=$ te of increase of number of electrons per c.c., where U is the elocity of the electron parallel to x.

The number of electrons passing through the unit of area in nit time is NU. The new electrons produced by the passage of em through the unit volume is NUa, while NUγp will disapear; hence:—

$$\frac{d\mathrm{N}}{dt}+\frac{d}{dx}(\mathrm{NU})=\mathrm{NU}(a-\gamma p)+q \qquad (19)$$

here q is the ionisation due to external sources; when things are a steady state $d\mathrm{N}/dt=0$, and the solution of the equation, hen the electric field may be taken as constant from one elecode to another, is:—

$$\mathrm{NU} = \mathrm{C}\epsilon^{(a-\gamma p)x}-\frac{q}{a-\gamma p}$$

Most of the experiments on this subject have been made witht external ionisation; a supply of electrons has been obtained om the cathode, either by raising it to incandescence or by exsing it to ultra-violet light. In such cases $q=0$, and

$$\mathrm{NU} = \iota_0\epsilon^{(a-\gamma p)x} \qquad (20)$$

here ι_0 is the number of electrons emitted in unit time from the thode. Townsend, and Townsend and Kirby have determined the value of $a-\gamma p$ for various gases and over a considerable range of pressure. A series of these values for air are given in Table V.

TABLE V.

X = volts per cm.	Pressure (mm.)				
	·17	·38	1·10	2·1	4·1
20	·24	..	..	..	..
40	·65	·34	..	..	..
80	1·35	1·3	·45	·13	..
120	1·8	2·0	1·1	·42	·13
160	2·1	2·8	2·0	·9	·28
200	..	3·4	2·8	1·6	·5
240	2·45	3·8	4·0	2·35	·99
320	2·7	4·5	5·5	4·0	2·1
400	..	5·0	6·8	6·0	3·6
480	3·15	5·4	8·0	7·8	5·3
560	..	5·8	9·3	9·4	7·1
640	3·25	6·2	10·6	10·8	8·9

It will be seen that, when X is given, the increase in the number of electrons reaches a maximum for a particular pressure. From general reasoning this must be so, for if $p=0$ there will be no collisions to make fresh electrons, and if p is infinite the free path of the electrons will be so small that they cannot acquire sufficient energy to ionise the gas. Since a is of the form $pf\left(\frac{\mathrm{X}}{p}\right)$, and γ does not depend upon p, $a-\gamma p$ will be a maximum when

$$f\left(\frac{\mathrm{X}}{p}\right)-\gamma-pf^1\left(\frac{\mathrm{X}}{p}\right)\cdot\frac{\mathrm{X}}{p^2} = 0$$

or when $f\left(\frac{\mathrm{X}}{p}\right)-\gamma = f^1\left(\frac{\mathrm{X}}{p}\right)\frac{\mathrm{X}}{p}$ where $f^1(\mathrm{X}/p)$ denotes the differential coefficient of $f(\mathrm{X}/p)$ with respect to X/p. This equation determines X/p; hence the critical pressure will be proportional to the electric force. At this critical pressure $\mathrm{X}e\lambda$ bears to Q a ratio which depends upon the way in which the chance of an electron ionising by a collision depends upon the energy of the electron. If, for example, the chance were independent of this energy, provided the energy were greater than Q, the maximum current would be when $\mathrm{X}e\lambda=\mathrm{Q}$; this relation would not hold for other and more probable laws connecting ionising power with the energy, but we should expect that for any such law the ratio of $\mathrm{X}e\lambda$ to Q would neither be very large nor very small.

Since the electrons cannot begin to ionise until their energy is equal to Q, and to attain this energy they must pass through a distance $\mathrm{Q}/\mathrm{X}e$, it is clear that we ought in such an equation as (20) to write $x-\mathrm{Q}/\mathrm{X}e$ in place of x. If V is the potential difference between the plates, $\mathrm{X}=\mathrm{V}/d$, so that $x-\mathrm{Q}/\mathrm{X}e=x-d\mathrm{Q}/\mathrm{V}$ if Q is measured in volts. Thus in finding the current between two electrodes we must, if we use equation (20), write $d\left(1-\frac{\mathrm{Q}}{\mathrm{V}}\right)$ instead of d. Partsch (*Verh. d. Deutsch. Phys. Gesell.*, 14, p. 60) has shown that theory and experiment agree better by this change.

Ionisation Due to Radiation.—When rays of ultra-violet light of very small wave length or Röntgen rays which are vibrations with yet smaller wave length pass through a gas, the gas is ionised. The application of C. T. R. Wilson's expansion method (supra) to this case shows that the effect of the radiation is to expel from some of the gas an electron moving at a high speed. This electron ionises by collision the gas through which it passes and the majority of the ions are produced in this way. This is proved by the fact that on the Wilson photographs (*see* fig. 18) the drops of water which denote the presence of the ions are found to be arranged on lines starting from a molecule of the gas. For the ionisation to take place there must be some process going on by which the energy of the radiation can be concentrated on the minute volume occupied by an electron. The energy with which the electron is expelled from the molecule depends on the frequency of the radiation but not upon its intensity. Thus if the source of radiation be moved further away from the gas the number of high speed electrons ejected is diminished but the speed of those which are ejected is not affected. This result has led to the quantum theory of radiation, which supposes that radiant energy is made up into units, or at any rate is only communicable by such units, the unit of energy is proportional to ν the frequency of the radiation and equal to $h\nu$ where h is a constant called Planck's constant. On the C.G.S. system of units it is equal to $6{\cdot}55\times10^{-27}$. Since to expel an electron from a molecule requires the expenditure of Ve units of work when V is the ionising potential, if the electron is expelled by the radiation the energy available must be greater than Ve, hence ν the frequency of the light must be greater than the value V given by the equation

$$h\nu = Ve.$$

For example if the ionising potential of helium is 22·7 volts, helium will not be ionised by radiation unless the wave length of the radiation is less than 540 Ångstrom units.

It has been shown by Barkla that when the radiation is wholly absorbed in a gas the number of high speed electrons ejected is independent of the nature of the gas. Thus we may regard the production of a high speed electron as involving the destruction of a unit of radiant energy.

The connection between the wave length of the radiation and the amount of ionisation produced in gases of definitely chemical constitution is a most vital and important one which unfortunately has not received the attention it deserves. One most important question is whether the ionisation is an additive property, or not. If the chemical composition of the gas is represented by $A_xB_yC_z$ where A, B, C, are symbols representing chemical elements, and x, y, z, are the number of atoms of A, B, C, in the molecule, can the ionisation per molecule, when radiation of known frequency passes through the gas, be represented by

$$x(A)+y(B)+z(C)$$

where (A), (B), (C), are constants appertaining to the elements A, B, C, respectively? The evidence on the whole seems to be in favour of such a connection but the tests have not been very severe. The amount of ionisation due to radiation varies enormously with the nature of the gas. Thus the ionisation in hydrogen is so small that some observers consider that such as is observed is due to a trace of impurity. It is not comparable with that which occurs in gases like chlorine, sulphur, bromine, iodine and mercury vapours. It has been found that μ the absorption of radiation of wave-length λ estimated per molecule of the absorbing substance can be represented by formulae of the type

$$\mu = CN^p\lambda^q$$

where N is the atomic number of the absorbing substance and C a constant. The values of p given by different observers range from 2·5 to 4 and of q from 2·5 to 3. Values such as these indicate that the absorption and presumably the ionisation increase rapidly with the molecular weight. Thus if we take $p=3$ the absorption of the rays by an atom of iodine would be about 1,000 times that by an atom of carbon. For the same substance and different kinds of radiation, the ionisation increases as the cube of the wave length. Formulae of the type $CN^p\lambda^q$ hold over only a limited range of frequencies; the values of p and q appear to change when the wave length of the radiation passes through a value corresponding to that of a characteristic radiation of the absorbing substance. The graph representing the relation between the wave length and the absorption is of the type shown in fig. 6.

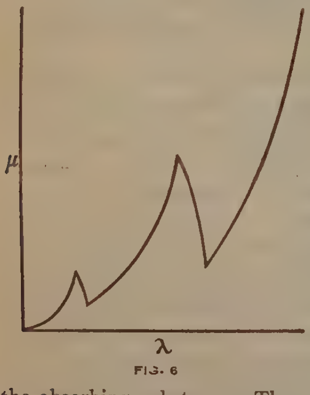


FIG. 6

It will be noticed that this curve differs very materially from the graph corresponding to the visible part of the spectrum. this part of the spectrum we may have very intense absorpti of light of a particular wave length, for example, the absorpti by mercury vapour of the line 2536 is so strong that the lig cannot pass through more than a few millimetres of the vapo at the pressure of one hundredth of a millimetre of mercury, a yet there is practically no absorption for lines whose wa length is either greater or less than 2536 by 1 Ångstrom un With radiation of the ionising type, on the other hand, thou the absorption comes in abruptly when the wave length fa below a critical value, it does not fall away abruptly when t wave length is still further diminished but decays according the λ^3 law. The application of this law leads us to expect th radiation between a certain range of wave lengths say from to 250 Ångstrom units would be exceedingly powerful ionisi agents. For the characteristic radiation given out by zi whose wave length is 1·4 Å, μ has been found to have the valu given in the second column of Table VI., the value of μ calc lated by the λ^3 law for radiation of the wave length 248 Å, f which the quantum is 50 v., is given in the third column.

TABLE VI. *Values of μ by the λ^3 law.*

Substance	$\lambda=1{\cdot}4$ Å	$\lambda=248$ Å
Carbon	4·26	$1{\cdot}8\times10^7$
Air at 0° C. & 760 mm.	$9{\cdot}1\times10^{-3}$	$4{\cdot}0\times10^4$
Mg	59	$2{\cdot}6\times10^8$
Al	105	$4{\cdot}6\times10^8$
Fe	1723	$7{\cdot}6\times10^9$
Cu	490	$2{\cdot}2\times10^9$

Since the radiation falls to $1/\epsilon$ of its value after passing throug a distance equal to $1/\mu$ we see that the radiation with the longe wave length would be practically completely absorbed by a laye of Al or Mg one molecule thick or by a layer of air one centimet thick at a pressure considerably less than that due to a tenth a millimetre of mercury. J. J. Thomson has shown by measurin the photo-electric effects produced inside the discharge tube b the radiation produced by the passage of the electric discharg through the tube that this radiation includes not only th visible part of the spectrum where the energy in the quantu is only some two or three volts, but soft Röntgen rays havin quanta between 20 and 100 volts. These rays as we have just see will be greedily absorbed by the gas and produce intense ionisa tion. A large part of the ionisation in the tube is probably du to these rays which are excited by the passage of cathode an positive rays through the gas and by their incidence on the ele trodes and on the walls of the discharge tube.

Spark Discharge.—The production of ions by moving electro will not by itself explain why a current of electricity can b maintained through a gas by an electric field when all oth sources of ionisation are excluded. The electrons are continuall being driven towards the anode, and unless there is some sourc of supply near the cathode the ionisation and therefore th current will rapidly come to an end. One way in which th electrons could be supplied by the action of the electric fiel would be by the positive ions which strike against the cathod communicating so much energy to the electrode that it is raise to incandescence. Since an incandescent metal gives out larg quantities of electrons there will be a continuous supply o electrons from the cathode, which will ionise the gas and produc fresh positive ions to strike against the cathode and keep it hot This is what happens in the arc discharge when the cathode is kept in a state of incandescence by the discharge. In this case there is a large amount of energy put into the arc. There are however, other forms of continuous discharge where the cathode does not become incandescent, so that there must be other ways in which the supply of electrons is maintained. From what we know about ions there are several ways in which this might occur

It has been found by experiment—[Füchtbauer, *Ann. der Phys.*, 23, p. 301 (1907); Saxen, *Ann. der Phys.*, 38, p. 319 (1912); Baerwald, *Ann. der Phys.*, 41, p. 643 (1913); 42, p. 1207 (1913)]— that electrons are emitted from metals when these are bombarded by high speed positive ions even though the metal is not raised to

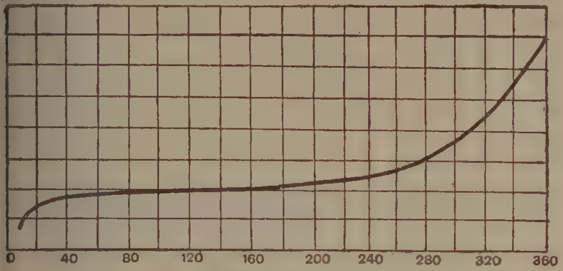
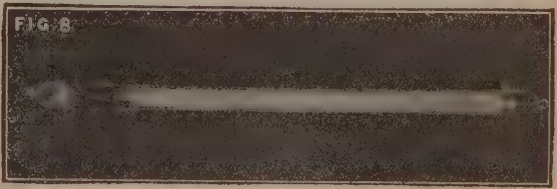


FIG. 7

ncandescence. According to Baerwald the emission of electrons from metals bombarded by positive hydrogen atoms does not become appreciable until these have an amount of energy exceeding that represented by 900 volts. Again positive ions ionise gas through which they pass. This was shown by McClelland, who found that the relation between the potential difference and the current from a hot wire anode surrounded by gas at low pressure was represented by a curve like that shown in fig. 7. The hot wire furnishes positive ions as well as negative ones, and he curve shows that fresh ions are formed when the potential difference is greater than about 200 volts. This is a much greater potential difference than that needed to produce ionisation by electrons, but it is smaller than would be expected by the considerations given above. As it requires less work to eject an electron from a metal than from a molecule, we should expect that f 200 v. ions could eject electrons from a gas through which they pass they would be able to do so from a metal against which they strike, but from Baerwald's experiments much more energy than 200 v. is required for this purpose. In McClelland's experiments the ionisation might have been into positive and negative ons rather than into positive ions and electrons; before the negative ions could be efficient for ionisation by collision they would have to undergo further dissociation into electrons and uncharged molecules. Curves similar to that in fig. 6 have also been obtained by O. W. Richardson. Pawlow (*Proc. Roy. Soc.*, A. 90, p. 398) and also Franck and E. v. Bahr (*Verh. d. Deutsch. Phys. Ges.*, 16, p. 57, 1914) came to the conclusion from their experiments, that ionisation was produced by positive ions even when their energy did not exceed a few volts; indeed they could not get any evidence of a minimum to the ionising voltage. Horton and Davies (*Proc. Roy. Soc.*, 95, p. 333) could not detect any ionisation in a gas by positive helium ions when the energy was due to 200 volts. They ascribe the ionisation observed by Pawlow, Bahr and Franck to photo-electric effects; they consider, however, that positive helium ions can liberate electrons from a metal against which they strike if their energy exceeds 20 volts. Baerwald considers that it requires an energy measured by 900 v. before positive ions can liberate electrons from metals.

There are thus at least four methods by which the supply of electrons near the cathode necessary to maintain the discharge can be obtained. The gas near the cathode may be ionised by positive ions or by radiation, or the cathode itself may emit electrons under the impact of positive ions or by the incidence of radiation.

When the gas is at a low pressure, the appearance of the discharge has well-marked characteristics which may throw light on the method by which the electrons are produced and the place from which they start. The discharge near the cathode is represented in fig. 8; in contact with the cathode there is a velvety glow, then a space comparatively dark called the cathode dark space; this joins on to a brightly luminous region called the negative glow; passing through this region, and making themselves evident by the luminosity they excite when they strike against the glass wall of the vessel in which the gas is contained, are the cathode rays. These have been shown to be electrons moving with high velocity. These electrons have been liberated by the action of the electric field and have acquired their velocity under the action of that field. The velocity of the cathode rays has been measured, and it has been found that the majority of them have the same velocity. This shows that they must have all fallen through the same potential. They would do this if they all started from the cathode itself, but if they had originated by the ionisation of the gas in the dark space in front of the cathode some would have started from one place and some from another, and they would have acquired different velocities. This is strong evidence in favour of the cathode itself being the primary source of the electrons which maintain the discharge. When a supply of electrons is produced by processes taking place at the cathode, ionisation by collisions of electrons with the molecules of the gas is sufficient to maintain the discharge through the interval between the negative glow and the anode. This interval, as will be seen from fig. 8, is made up of a short part next the negative glow in which there is comparatively little light, called the Faraday dark space, and then a long uniform portion reaching right up to the anode. Unless the pressure is very low or the spark very short this portion, which is called the positive column, forms by far the larger part of the discharge. The discharge here will be maintained if the rate at which electrons are produced by collision is equal to the number lost by recombination. When this is the case, equation (19) gives $\alpha=\gamma p$, or, since α is of the form $pf\left(\frac{Q}{Xe\lambda}\right)$



$$f\left(\frac{Q}{Xe\lambda}\right)=\gamma$$

thus $Xe\lambda=cQ$ where c is a quantity which does not depend upon the pressure or strength of the field; as λ is inversely proportional to the pressure, this equation is equivalent to $X=c_1p$, when c_1 is a quantity which will depend on the nature of the gas and possibly on the intensity of the current. If l is the length of the positive column the difference in potential between the anode and the end of the positive column next the cathode is lX, *i.e.*, c_1pl.

Between the cathode itself and the negative glow there is a fall of potential, called the cathode potential fall, which, when the current carried by the discharge is not large, is independent of the current and the pressure of the gas; it depends upon the nature of the gas and the material of which the electrodes are made. If V_0 is the cathode fall, then (neglecting the change in potential in the negative glow and the Faraday dark space, which has been found by experiments to be very small) V, the potential difference between the anode and cathode, will be given by the equation

$$V = V_0+c_1lp \qquad (21)$$

It is assumed that the length of the spark is greater than that of the dark space D; at pressures comparable with that of the atmosphere, D is a very small fraction of a millimetre, but at the low pressures which can easily be obtained in highly exhausted vessels D may be several centimetres. It is to be noticed that V is a linear function of lp, and lp is proportional to the mass of gas between the electrodes; hence as long as the mass of gas between the electrodes remains unaltered the potential difference required to maintain the spark will be constant. This law, which was discovered by Paschen in 1889 as the result of a long series of experiments, is known as "Paschen's law." It has been found to be in agreement with the very numerous investigations which have been made on the potential difference required to produce a discharge in an approximately uniform electric field such as that which exists between two slightly curved electrodes.

The relation (21) does not give any indication of the relation between the potential difference and the spark length when the latter is exceedingly small. When the spark length falls below a critical value which is inversely proportional to the pressure, and which in air at atmospheric pressure is about ·01 mm., the spark potential increases rapidly as the spark length diminishes; this was first observed by Peace. A simple way of demonstrating it is to use slightly curved electrodes and to observe the path of the spark as these are brought closer together. Until the electrodes get very close together the spark passes along the shortest line between them, but as they approach each other a stage is reached where the spark no longer passes along the shortest line but goes to one side, taking a longer path, showing that it is easier to produce a long spark than a short one. The relation between the potential difference and the spark length for several gases has been determined by Carr, who finds that Paschen's law that the potential difference depends only on *pl* is also true for very short sparks; Paschen's own experiments were made with sparks considerably longer than the critical value. Fig. 9 represents Carr's results for the relation between V and *pl*. The results of Carr's and Strutt's (Lord Rayleigh's) experiments for the minimum spark potential, and the value of *pl*, at which it occurs, are given in the following table:—

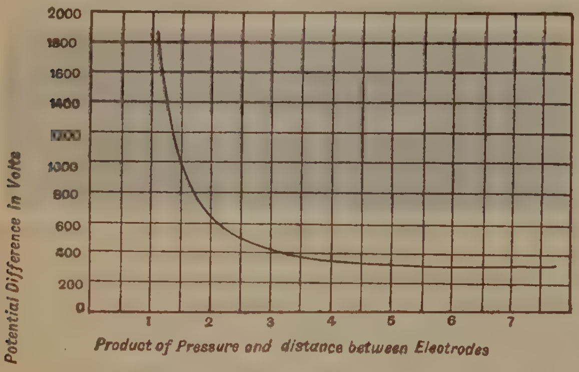


FIG. 9

TABLE VII.

Gas	Minimum Spark Potential in volts	*pl*
Air	341 S[1]	5·7
Nitrogen	251 S	6·7
Oxygen	455 C	..
Hydrogen	302–308 S 278 C	14·4
Carbonic acid	419 C	5·1
Sulphur dioxide	457 C	3·3
Nitrous oxide	418 C	5
Sulphuretted hydrogen	414 C	6
Acetylene	468 C	..
Helium	261 S	35

[1] S = by Strutt; C = by Carr.

The curves are very flat in the neighbourhood of the minima, so that the critical values of *pl* may be subject to considerable errors. Strutt found that even very small traces of impurity produced very large increases in the values of the minimum spark potential in nitrogen and helium; these are gases where, as we have seen, such traces produce large diminutions in the mobility of the negative ion. The existence of a minimum for the spark potential and a critical spark length follows from the view that the self-sustained discharge is maintained by radiation produced by electrons or positive particles. The condition for the self-sustained discharge is that an electron in its passage between the electrodes exerts some ionisation effect which produces another electron to succeed it. If V is the potential between the plates, the energy given to the electron is Ve. Let the amount of this converted into radiation be βVe; if μ is the coefficient of absorption, d the distance between the plates, then when d is small the number of ions produced by the electron will be $\beta\mu dVe$. If the electron is to provide a succession this must be equal to unity that

$$V = \frac{1}{\beta\mu e d},$$

so that the potential difference varies inversely as $1/d$ and infinite when d vanishes. Since μ is proportional to the pressu of the gas we see that V will depend upon pd so that Pasche law is fulfilled.

The mechanism we have hitherto considered involves t ionisation of the gas between the electrodes, and no spark cou pass across a vacuum. There are, however, other methods which a discharge might do this. For suppose there was a str electron between two parallel electrodes in a vacuum; then und the action of the electric field it would be driven against t anode; by the impact Röntgen radiation would be generate which would fall on the cathode, and if it were intense enou to liberate one electron from the cathode the original electr would be replaced and the passage of negative electricity fro the cathode to the anode would be repeated. From these co siderations it is probable that even the highest vacuum would n act as a perfect insulator for very intense fields.

The linear relation $V=V_0+c_1lp$ has been obtained on t assumption that the direction of the electric force was the sam in all parts of the field; this is only true when the dimensions the electrodes are large compared with the distance betwe them. The potential difference required to produce a spark a particular length depends upon the size of the electrod between which the spark passes, and is not a linear function of l where p is the pressure and l the spark length, unless l is sma compared with the linear dimensions of the electrodes. If the are spheres, the spark potential will depend upon their radi and for small spheres may be considerably less than for larg ones. Thus, for example, the spark potential in air for a fiv centimetre spark is 26,000 v. for electrodes ·5 cm. in diamete and 105,000 v. when the diameter of the electrodes is 5 cent metres.

In this connection it may be noted that, if the electric field sufficiently intense at any place to produce there a local supply ions, these may redistribute themselves between the electrode and by their electrostatic action produce a change in the distribution of the electric force more favourable to the passage the spark than that prior to the production of the ions. T illustrate this, take the very simple case when the electrodes ar two parallel plates: if there are any ions available these ma distribute themselves so that the force between the plates is n longer uniform. Thus let us suppose that there are enoug positive ions to congregate round the cathode in sufficient numbers to produce within the distance of the "critical spark length" or thickness of the cathode dark space, a difference of potentia equal to the minimum spark potential. This would ensur a continual emission of electrons from a place in front of th cathode, and even though the electric field from this place to th anode were too feeble to give an electron enough energy to ionis the gas, the electrons coming from the cathode would be able t carry a small current, though this part of the discharge migh not be luminous. The ions here would be all of one sign, so tha the electric force will increase up to the anode. If the curren is gradually increased, the place where the electric force wil first rise to the value necessary to make the electrons ionise wil be close to the anode. When this occurs a supply of positive ion will start from the anode and move towards the cathode, accompanied by luminosity close to the anode and very faint luminosit through the rest of the tube. The introduction of the positiv ions into the region between the anode and cathode will diminish the retarding effect of the negative space charge which existe in this region, so that the current will increase. This increase i current will again increase the ionisation at the anode, and thus the supply of positive ions. In this way there might be a supply of electrons coming from the cathode, and of positive ions from close to the anode, which will maintain the current in spite of the fact that between these places there is a region where the electric rce is below that required to produce ionisation by collision, and ie potential difference between the electrodes less than that lculated on the supposition that the electric force was uniform om one to the other. We should expect from these considera- ons that, if the electric force at any point were intense enough produce ionisation by collision, some discharge would take ace.

Russell (*Phil. Mag.*, 6, xi., p. 237) states that the results of the fferent experiments made on the potential difference required to roduce sparks of various lengths between spherical electrodes of arious radii are in good agreement with the rule that the dis- narge takes place in air at atmospheric pressure if the electric rce at any point in the field before discharge begins is as great 37,000 v. per centimetre. This value agrees well with that quired to make electrons produce, in air at atmospheric pressure, ther ions by collisions.

The curious lag observed by Warburg between the application f the potential difference and the passage of the spark, which hen the applied potential is only a very little greater than that quired to produce the spark may amount to several seconds, naturally explained as the time needed by the ions to dis- ribute themselves so as to produce the distribution of potential quired for the discharge.

The discharge of electricity from points affords a good illus- ration of the preceding considerations. Suppose that the elec- rodes are a needle point and a plane. When the discharge first egins the only place where any light is to be seen is close to the oint; the current between the electrodes is very small; as the otential difference increases a stage is reached where light begins o appear close to the plate, the space between the point and plate eing quite dark. This stage is marked by a large increase in the current. With further increase in current the luminosity extends nto the gas and ultimately stretches from one electrode to nother.

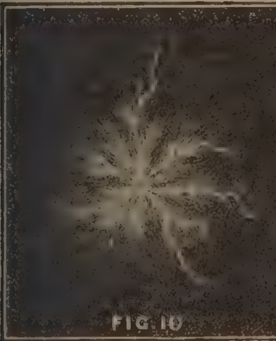


FIG. 10

FIG. 11

The potential required to start the discharge is less where the oint is negative than when it is positive. This is what might e expected, for to maintain the discharge from the negative oint there must be (1) ionisation of the gas by the outgoing elec- rons, and (2) liberation of electrons by the incoming positive ons, while when the point is positive there must be (1) ionisation f the gas by outgoing positive ions, and (2) liberation of positive ons by the impact of incoming electrons; as the process is not he same as for the negative point we should expect that there would be a difference between the potentials. It is not only the otential difference which is affected but the type of discharge. This can be shown by allowing the point discharge to pass in the neighbourhood of a photographic plate. Beautiful figures are found on developing the plate, and the character of these is different according as the point is positive or negative. Figures 10 and 11 represent discharges from positive and negative points respectively.

The discharge from a negative point is in some gases very much influenced by the purity of the gas; thus Warburg found that the discharge from a negative point in nitrogen increased about 50 times by removing the last trace of oxygen from the nitrogen, though this had little or no effect upon the discharge from a positive point. This can be accounted for by the discovery of Franck and Hertz that in very pure nitrogen the electron does not unite with the molecule and become a negative ion and has therefore a very high mobility. This is true for the inert gases as well as for nitrogen, and Przibram has shown that the difference between the discharges from positive and negative points is exceptionally large in these gases.

Electrical Wind.—The electrified ions' starting from the point in a point discharge sets the gas in the neighbourhood of the point in motion producing a current of air, called the "electrical wind." The momentum gained by the air is lost by the point, so that there is a backward force acting on the point, which has often been measured. This force, as well as the electrical wind, is smaller when the point is negative than when it is positive; this difference is especially marked at pressures low enough to make the negative ion have an abnormally large mobility.

Relation between Potential Difference and Current.—The potential difference required to maintain a discharge will depend upon the current passing in the discharge. The relation between the current and the potential difference for discharge through gases is often a very complicated one. We should expect that this would be so, for in the spark discharge, for example, the potential difference is made up of the cathode fall of potential (this increases with the current when the current is large) and a uniform force along the rest of the discharge, and this force in many cases diminishes as the current increases. Thus whether increases of current produce an increase or decrease in the potential difference will depend on the relative contributions of these two parts.

A curve whose ordinates are the potential difference between the electrodes and the abscissae the current through the gas, is called the "characteristic curve" for the discharge (see fig. 12). From such a curve it is possible to find the current sent through a gas by a given external electromotive force. Suppose that the current sent through a gas by a battery of cells of electromotive force E_0 is required. If R is the resistance of the curves connecting the battery with the electrodes in the gas, then $E_0-R\iota$ is the potential difference between the electrodes in the gas, and one relation between this potential V and the current is represented by the straight line $V=E_0-R\iota$. The other relation is that represented by the characteristic curve; the values of the current through the gas and the potential difference between the electrodes will be determined by the points of intersection of this straight line and the characteristic curve. Unless the straight line cuts the curve there can be no discharge through the gas; on the other hand, the straight line may cut the characteristic curve in more than one point, indicating that there is more than one type of discharge. Some of these types may, however, be unstable and thus impossible to realise. Thus, for example, if the current is increased by $\delta\iota$ the difference of potential given by the battery between the electrodes is diminished by $R\delta\iota$;

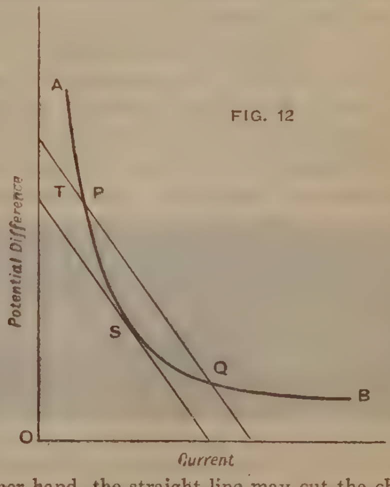
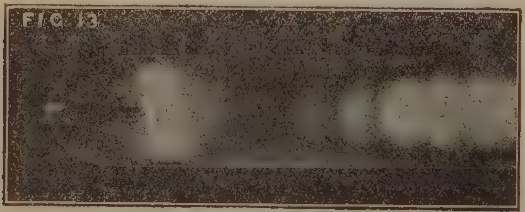


FIG. 12

if V is the potential difference between the electrodes required to send a current ι through the gas, then when the current is increased by $\delta\iota$, the increase in the potential required is $\frac{dV}{d\iota}\delta\iota$; thus unless $\frac{dV}{d\iota}\delta\iota$ is less than $-R\delta\iota$, or $-\left(\frac{dV}{d\iota}+R\right)\delta\iota$ be positive, the diminished potential supplied by the battery will not be sufficient to maintain the increase in the current; this increase will stop, the current will return to its original value, and the discharge will be stable; thus if $R+\frac{dV}{d\iota}$ is positive the discharge will be stable. If, however, $R+\frac{dV}{d\iota}$ is negative the fall in potential required to maintain the increased current is so great that, in spite of the diminution of the potential difference supplied by the battery, the residue is great enough to maintain the increased current, the increase in the current will continue, and the discharge will be unstable. Thus the condition for stability is that $R+\frac{dV}{d\iota}$ should be positive, a result first given by Kaufman. This result is equivalent to the condition that for stability the straight line must, at the point where it cuts the characteristic curve, fall more steeply than the tangent to the curve at that point. Thus if APQB, fig. 12, the characteristic curve and the right line cut at PQ, the type of discharge represented by P is unstable, and that by Q stable. Keeping the electromotive force at the battery constant and increasing the resistance will make the straight line steeper, and Q will move to the left and the current through the tube will decrease; when the line gets so steep that it touches the curve at S, the minimum value of the current consistent with the maintenance of this type of discharge by the electromotive force supplied by the battery will be reached, and any further diminution of the current will result in the extinction of this type of discharge. It is a well-known fact that the existence of most types of luminous discharges requires the current to be above a certain critical value which depends upon the external force. The electric arc is perhaps the most familiar example of this. As the characteristic curve for the arc discharge is a rectangular hyperbola represented by the equation $V=a+\frac{b}{\iota}$; we can easily show that if the external electric force is E, the maximum resistance which can be introduced into the circuit without extinguishing the arc is $(E-a)^2/4b$, and the smallest current compatible with the existence of the arc $2b/(E-a)$. For any stable type of discharge we see that an increase in the external electromotive force will result in an increase of current; at a point corresponding to an unstable condition it produces a diminution.

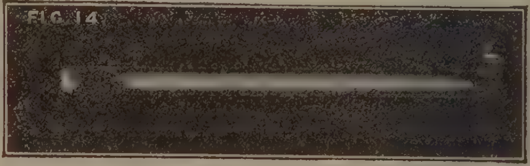
Structure of the Discharge.—The structure of the discharge at atmospheric pressure is on so fine a scale that its details can only be made out with difficulty; as the pressure is reduced the scale gets larger and larger, until, when the pressure is reduced to that due to a millimetre or so of mercury, the details of the structure become very conspicuous. The appearance of the discharge at such a pressure is shown in fig. 13, and we see that it is built up of several constituents of very different types. We have already, when considering the spark discharge, given a general description of some of them; there are, however, some features which require further discussion.

FIG. 13



Starting from the cathode, we find a thin layer of luminous gas, the colour of which depends on the kind of gas through which the discharge is passing. In most gases the light appears to reach right up to the cathode, but in hélium Aston has shown it separated from it by an exceedingly thin dark space. This minous layer is sometimes called “ Goldstein's first layer ”; n to this we have a region where there is comparatively lit luminosity called “ Crookes' dark space,” the boundary of t space being approximately the surface traced out by normals the surface of the cathode of constant length. The thickness the dark space, which is of the order of the critical spark leng depends upon the pressure of the gas, varying approximately the reciprocal of the pressure; for air at the pressure of 1 mm. mercury the thickness of the dark space is about 2 mm. so th at atmospheric pressure the thickness would not be much mo than about 1/400 of a millimetre. If the pressure remains co stant and the current through the tube is increased, the thickn of the dark space remains unaltered until the current is lar enough to cover the whole of the cathode with the luminous glo after this stage is reached any further increase in the curre causes a diminution in the thickness of the dark space. Starti from the boundary of the dark space there is a brightly lumino region called “ the negative glow.” The function of the par of the discharge from the cathode to the negative glow is produce the supply of electrons from the neighbourhood of t cathode necessary to keep the discharge going. The dimensio of this part of the discharge are independent of the distan between the cathode and anode; at very low pressures this pa may occupy a length of several centimetres, but at atmospher pressure they are crowded into a very small fraction of a mil metre and as far as length goes occupy a negligible portion of t sparks at such pressures. The Crookes' dark space, though appears dark in contrast to the negative glow, is not devo of luminosity; indeed Seeliger, who has made a spectroscop examination of the dark space, finds that there are some line such as the Balmer series lines, which are almost as bright in t dark space as in the negative glow. But many lines are muc stronger in the negative glow than in the dark space.

FIG. 14



Beyond the negative glow there is another comparatively dar region called the “ Faraday dark space”; the length of this very variable even when the pressure is constant, as it is sensiti to any change in current. Beyond this and reaching right up t the anode is a luminous column called the positive column. Th luminosity in some cases is fairly uniform in intensity, but whe the pressure and current are between certain limits this colum may exhibit remarkable alternations of dark and bright space called striations, such as are shown in fig. 14. Under some ci cumstances a dark space round the anode has been detected b several observers.

When the distance between the electrodes is considerable an the pressure not very low, the positive column forms by far th greater part of the discharge; thus at atmospheric pressures al but a fraction of a millimetre of the discharge next the cathod will consist of the positive column.

Distribution of the Electric Force Along the Discharge.—Th electric force is very large indeed in the part of the dark spac next the cathode, but diminishes rapidly towards the negativ glow. In the negative glow itself it is smaller than in any othe part of the discharge; passing the negative glow, the electric force increases in the Faraday dark space, until the positive column is reached. When the positive column is of uniform luminosity the electric force in the column is constant until quite close to the anode, when there is an abrupt change of potential of about 20 volts, called the anode fall of potential. When the positive column is striated, the alternations of luminosity in the positive column are accompanied by alternations in the intensity of the electric force, the maxima of the electric force occurring the bright parts of the striae; the minima at the dark. From equation $\frac{dX}{dx} = 4\pi\rho$, where X is the electric force in the direc- n of x and ρ the density of the electrification, we see that there n excess of positive electricity in the cathode dark space and of gative in the Faraday dark space; in a uniform positive column re is no appreciable excess of electricity of one sign over that the opposite, while in the striated positive column there is an ess of negative electricity on the cathode side of a bright t of a striation and of positive on the anode side.

athode Fall of Potential.—Until the glow next the cathode vers the whole of the electrode the difference of potential be- een the cathode and the negative glow is constant, depending the gas and the material of which the cathode is made, but ng independent of the pressure of the gas and the strength the current. This constant difference of potential is called " cathode fall of potential," and there is evidence to show t it is equal to the minimum potential that can produce a ark through the gas. Its value, for different gases and different ctrodes is given in the following table, due to Günther- aulze:—

TABLE VIII.

	K	Na	Mg	Al	Zn	Fe	Pb	Cu	Ag	Aa	Pt
Ie .	68	80	125	153	143	161	177	177	162	165	163
Ne .	68	75	122	145	136	153	172	221	154	158	152
rg .	71	78	158	150	155	166	166	155	156	157	162
N .	170	178	210	215	252	256	227	244	254	250	233
I .	172	185	171	192	233	250	316	299	301	330	300
ir .	181	198	240	242	292	281	306	282	305	297	324
	−2·92	−2·72	−1·55	−1·28	−0·76	−0·43	−·12	..	..	..	..

Further light is thrown on the origin of ionisation in gases by the dy of the distribution of electric force in the neighbourhood the cathode. Aston has shown that at low pressures the force the neighbourhood of the cathode is a linear function of the stance from the cathode, so that if V be the electrostatic point a point distant x from the cathode

$$\frac{dV}{dx} = C(d-x) \tag{22}$$

en C and d are constants. If ρ is the density of the electrifica- n at the point x: $4\pi\rho = d^2V/dx^2$, hence for this law of force s constant. We have to consider what law of ionisation is com- tible with this result. It can be shown that to make ρ constant e ionisation must be independent of the distance from the thode, a result which seems much more probable if the ionisa- n is due to radiation than if it were mainly due to ionisation collision. We see from equation (22) that dV/dx vanishes en $x = d$. This is the place where the negative glow begins. e potential difference between the cathode and the boundary the negative glow is called the cathode fall of potential and is a antity of great importance, of which many measurements ve been made which are given in Table VIII. The cathode fall potential depends on the nature of the gas and of the electrodes t is independent of the pressure.

The consequences of the hypothesis of ionisation by radiation e in fair agreement with the results of experiments; they are as lows:—

The normal cathode fall of potential is independent of the essure of the gas.

The thickness, d, of the dark space is inversely proportional to e pressure.

The cathode fall of potential V is connected with I the density the current carried by the positive ions by the relation:—

$$V^{\frac{3}{2}} = \left(\frac{M}{2e}\right)^{\frac{1}{2}} \pi^2 I d^2 \tag{23}$$

ere M is the mass of a molecule of the gas.

The cathode fall of potential is on this view equal to the allest potential difference that can produce a spark through e gas and the thickness of the dark space at any pressure is the gth of the spark which at that pressure passes with the nimum potential difference.

We see from equation (23) that in order to produce the discharge a definite current density as well as a definite potential difference is required. This density, for a flat electrode, is as we see from equation (23) inversely proportional to d^2 and therefore directly proportional to the square of the pressure.

The values of V and I at a pressure of 1 mm. of Hg for plane cathodes (1) of aluminium, (2) of iron, for different gases have been determined by Günther-Schulze (*Zeit. für Physik*, 20.1).

TABLE IX.

Gas	Aluminium		Iron	
	I(am/cm²)	V. volts	I(am/cm²)	V. volts
He .	1·07	153	1·187	161
Ne .	1·81	145	2·000	153
Ar .	14·07	150	15·5	166
N .	38·4	215	42·3	256
H .	9·0	192	9·96	250
O .	54·7	250	60·6	326

V depends on the nature of the electrode as well as upon the gas. Günther-Schulze's experiments indicate that V can be expressed approximately in the form:—

$$V = 35{\cdot}5\epsilon + a$$

where a is a quantity depending on the gas and ϵ, a quantity called the electrochemical normal equivalent, which is given in the last row of Table VIII.

The values of a in volts for different gases are He, 175; Ne, 169; Ar, 174; N, 265; H, 290; O, 350. The preceding values refer to what are called the normal values when the current flowing through the tube is not large enough to cover the whole cathode with glow, so that an increase in the current may occur through an increase in the area over which the current is spread and not from an increase in the mean density of the current.

Günther-Schulze gives the following empirical expression for the dark space, d

$$pd = (\text{constant})\,\lambda V_1$$

when p is the pressure, λ the free path of the molecule at atmospheric pressure, and V_1 the ionising potential of the gas. When the current is so great that the whole electrode is covered with glow V, I and d are no longer constant; the cathode potential fall increases and the dark space diminishes as the current I increases. According to Aston's experiments (*Proc. Roy. Soc.*, 86, p. 178), the following relations exist between these quantities:—

$$d = \frac{A}{p} + \frac{B}{\sqrt{I}}$$

$$V = E + \frac{F\sqrt{I}}{p}$$

Here p is the pressure and A, B, E, F constants.

As the current increases the values of V may increase to many thousand volts and thus be hundreds of times the normal value. According to Aston there is no sudden jump in potential at the cathode itself, some observers (*e.g.*, Westphal) have thought that such a drop occurred and that it amounted to a considerable fraction of the whole potential fall.

Though in many gases and especially in oxygen there is a very sharply defined boundary to the dark space, it must not be thought that no radiation comes from the dark space; it is only for certain types of radiation that the radiation from the dark space is absent. Thus for the type of radiation which is instrumental in producing ionisation, there is no discontinuity in the radiation as we pass across the boundary of the dark space, and Seeliger and his co-workers have shown that even for visible radiation the change in intensity on crossing the boundary depends to a great extent on the wave-length of the light. The electrical conditions inside the dark space differ very much from those outside; inside we have a great preponderance of positive ions over electrons, while outside the two are equal; again outside the density both of free electrons and of positive ions is much greater than inside, and there is recombination of electrons and positive ions outside and not inside. It is not surprising therefore that radiation produced outside the dark space should differ substantially from that produced inside.

Anode Fall of Potential.—Unlike the cathode fall of potential which is spread out through a length equal to the thickness of the dark space, the anode fall as Skinner has shown occurs quite abruptly so far as it can be tested by experiment. If this fall took place in molecular distances the electric attraction might be sufficient to drag positive ions out of the electrode itself. By using a cathode heated to incandescence, and therefore emitting a plentiful supply of electrons, we can reduce the cathode fall of potential to a small fraction of its normal value; we cannot, however, with a luminous discharge get rid of the anode fall; thus in the arc discharge the anode fall of potential is greater than the cathode fall. Matthies has shown that, in chlorine, bromine and iodine, the anode fall of potential may rise to hundreds of volts, that in air or hydrogen being only about 18 volts. Reichenheim and Gehrke utilised this fact to get positive ions of sodium and potassium projected with great velocity. They made the anode of a mixture of the halogen salts of these metals and graphite, and worked at a very low pressure; under the action of the discharge the halogens were liberated from the anode, and the large anode fall they produced was sufficient to project sodium and potassium ions from the anode with great velocity; this stream of positive ions constitutes what is known as "anode rays."

The electric force in the positive column is a linear function of the pressure; it depends slightly on the diameter of the tube through which the discharge is passing; it also depends on the current through the tube; in most cases, though not invariably, an increase of current produces a decrease in the electric force. The condition determining the electric force in the positive column is that it should give to an electron during its free path the amount of energy that will enable the electrons to produce by collisions as many ions per second as are lost during the same time by recombination.

Striated Discharge.—The form of discharge when the positive column is striated is so beautiful and remarkable that it has attracted a great deal of attention. To get this type of discharge the current and pressure must be within certain limits. The striations are developed more readily in mixtures of gases than in a pure gas; in fact some physicists have advanced the view that they could not be obtained in an absolutely pure gas. There is no doubt, however, about their occurrence in gases in which great attention has been paid to purification. Nörbeck could not get them in pure nitrogen or pure helium, though they were conspicuous as soon as a trace of impurity was admitted. Nitrogen and helium are gases in which, when pure, the carrier of negative electricity is always an electron; in these gases the electron does not join on to a molecule and become a negative ion. Spottiswoode found that, in some cases when the positive column showed no signs of striation when observed in the usual way, striations moving rapidly down the tube could be seen when the discharge was observed after reflection in a rapidly rotating mirror. Aston and Kikuchi, who have studied this effect in neon and helium, are of opinion that the striations are moving in these gases with the velocity of sound; it must be remembered, however, that the velocity of sound in many gases is of the same order as the velocity of a positive ion under the electric forces in the positive column, so that this result does not necessarily prove that the moving striations are analogous to sound waves.

The distance between the striations increases as the pressure diminishes (in hydrogen the distance is inversely proportional to the square root of the pressure); it depends upon the size of the tube: the striations are nearer together in narrow tubes than they are in wide. The distance between the striations also depends upon the current. When several gases are in the tube, spectroscopic observation of the bright parts of the different striations shows that we may have one set of striations corresponding to one gas, another to another, and so on. Thus Crookes observed in a tube containing hydrogen three sets of striations, one set red, another blue and a third grey; the spectroscope showed that the first was due to hydrogen, the second to mercury vapour and the third to hydrocarbons. The striations are often curved their concavities turned to the anode.

To get a general idea of the causes which might give ri stratifications, let us consider a case where the current is ca entirely by electrons, the positive ions being regarded as movable in comparison with the electrons. Let us consid stream of electrons emerging from the negative glow; t electrons will have very little energy and will be unable to io the gas. The electrification beyond the negative glow on anode side will be due to electrons and will be negative so the electric force will increase towards the anode. As the ele force increases the energy of the electrons also increases, unt is sufficient to enable the electron to ionise the gas and proc positive ions and electrons; the increase in the number of will check the rate of increase in the electric force. The con tion between the ionisation and this rate of increase is in the we are considering represented by a very simple equation. if n and m represent respectively the number of negative positive ions per unit volume, X the electric force, and x distance from the cathode

$$\frac{dX}{dx} = 4\pi(n-m)e \qquad ($$

If the current ι is carried, as we have supposed, by the electro $neu = \iota$, where u is the velocity of the electron. If we neglect current carried by the positive ions, then when things h reached a steady state the number of positive ions produced any region per second must equal the number which disapp owing to recombination. Hence, if q is the rate of ionisation the coefficient of recombination, $q=\alpha mn$ or $m=q/\alpha n$; and (24 equivalent to

$$\frac{dX}{dx} = \frac{4\pi\iota}{eu} - \frac{4\pi qeu}{\alpha\iota} \qquad ($$

Thus as long as q vanishes, dX/dx is positive, but as soon a becomes finite the rate of increase of X will be retarded; X increases q increases, and when $e^2qu^2=\alpha\iota^2$, dX/dx will vanis but though X reaches its greatest value at this point, the valu of u and q, which depend on the energy acquired by the electro will continue to increase beyond it. For the energy acquired an electron depends on $\int Xdx$, taken over a distance measur by the free path of the electron; at low pressures this may be centimetre or more, and the place where $\int Xdx$ is a maximu will be beyond that where X is a maximum by a length of th order. Thus after X has reached its maximum u and q will i crease and dX/dx will become negative, so that X will diminis the diminution in X will ultimately produce a diminution $\int Xdx$ and also in u and q; the rate of decrease will slow down; will attain a minimum, and begin to increase again when simil changes will be repeated. Thus the curve which represents th relation between X and x will resemble fig. 15, where the cathode is on the left, giving alternate maxima and minima for the value of X; and $\int Xdx$, the energy acquired by an electron, will vary periodically along the path of the discharge. Ther are two values of this energy which are of special importance i connection with discharge through gases, one the ionising potenti we have already referred to, the other, sometimes called th "radiation potential," is the energy which the electron must pos sess to make the gas luminous. The radiation potential is les than the ionising potential, and electrons with energy betwee these potentials will make the gas luminous but will not ionis it. Thus the molecules of the gas will give out light but will no be charged. When the energy of the gas exceeds the ionising po tential the luminous molecules are or have been charged. If th

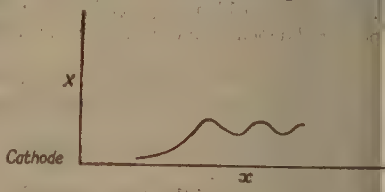


FIG. 15

ations in the energy along the line of discharge are large ugh to make it sink below the radiation potential, then along discharge we shall have: (1) places where the energy is be- the radiation potential,—these will be dark; (2) places where potential is between the radiation potential and the ionising ential,—the molecules here will be luminous and uncharged will, therefore, not move under the electric field; (3) places re the molecules are luminous and charged,—these molecules move down the tube towards the cathode with the velocity ch the positive ion acquires under the electric field. This ocity, when the pressure is low and the field several volts a timetre, as it is in the positive column, may be many thousand timetres per second. Place (1) corresponds to the dark parts he striations, (2) to the stationary luminous parts, while (3) he origin of the striations moving down the tube observed Wulner, Spottiswoode, Aston and Kikuchi.

athode Rays and the Discovery of the Electron.—In 1859 cker observed on the glass of a highly exhausted tube in the ghbourhood of the cathode a bright greenish yellow phosphor- ence, which changed its position when a magnet was ught near to it. About 10 years afterwards Hittorf showed t a solid body placed between a pointed electrode and the walls he tube cast a well-defined shadow of such a shape as to show t the agent producing the phosphorescence travels in straight s at right angles to the surface of the cathode. The name athode rays" for the cause of the phosphorescence was in- duced by Goldstein, who made many important investiga- s on their properties. The opinion held by Goldstein and erally in Germany was that cathode rays were waves in the er. Varley and Crookes advanced the view that they were trified molecules shot off at right angles to the cathode. The covery by Hertz that the cathode rays could pass through thin ers of gold leaf was difficult to reconcile with this view.

he evidence in favour of the cathode rays being electrified par- es was increased by Perrin's discovery that when a pencil of rays entered the opening in a Faraday cylinder they gave it a charge of negative electricity. One difficulty which had n urged against the rays being negatively electrified, viz., t, though they were deflected by a magnetic force, an electric ce produced no effect upon their path—was removed by J. Thomson, who showed that the absence of deflection was to the gas in the tube acting as a screen and protecting the ticles from the electric force. As the gas in the vacuum tube conductor of electricity the rays move inside a conductor of ctricity, and so will not be affected by an external electrified ly. Thomson showed that when the vacuum was very high, that there was but little gas in the tube, the cathode rays re deflected by an electric and magnetic field, and that the ection of the deflection indicated a negative charge on the rticles. His measurement of the deflection by known electric d magnetic forces led to a determination of the mass of the rticles which carried the charge, and showed that these par- les were not atoms or molecules but something with a mass t one-thousandth part of the mass of the lightest atom known, at of hydrogen.

The deflection due to electric and magnetic forces can be cal- lated as follows. Suppose that the particles are travelling rizontally between two parallel horizontal metal plates A, B, intained at a constant difference of potential, there will be vertical electric force F acting between the plates, and if the s of y is vertical the equation of motion of the electrified rticle when it is between the plates is

$$m\frac{d^2y}{dt^2} = Fe$$

y and $\frac{dy}{dt}$ are both zero when the particle enters the region tween the plates, then, when it leaves this region, after a time

$$y = \tfrac{1}{2}\frac{Fe}{m}t^2 \text{ and } \frac{dy}{dt} = \frac{Fe}{m}t$$

ce the electric force is at right angles to the direction of motion the particles, v the velocity of the particles will not alter, and if the deflection is small, $t=l/v$ where l is the length of the plates. Thus

$$y = \tfrac{1}{2}\frac{Fe}{m}\frac{l^2}{v^2} \text{ and } \frac{dy}{dt} = \frac{Fe}{m}\frac{l}{v}$$

Suppose the particles strike a photographic plate or a screen covered with a phosphorescent substance at a distance L from the end of the plates, the y displacement at this place produced by the electric force, is given by the expression

$$y = \tfrac{1}{2}\frac{Fel^2}{mv^2}+\frac{FelL}{mv^2} = \frac{Fel}{mv^2}\left(\frac{l}{2}+L\right)$$

Magnetic Deflection of the Rays.—If the rays go through a uniform magnetic field of length l and strength H, then if the magnetic force is vertical the force acting on the moving particles will be Hev, and will be at right angles to the magnetic force and also to the direction of motion of the rays; *i.e.*, it will be at right angles to the plane of the paper; if z is the displacement of the particle in this direction

$$m\frac{d^2z}{dt^2} = Hev.$$

From this we see that the value of z at the screen is given by

$$z = \frac{Hel}{mv}\left(\frac{l}{2}+L\right)$$

Hence
$$\frac{e}{m} = \frac{z^2}{y}\frac{F}{H^2l\left(\frac{l}{2}+L\right)} \qquad (26)$$

and
$$v = \frac{z}{y}\frac{F}{H} \qquad (27)$$

Thus the measurements of y and z, the electric and magnetic deflections, give the values of e/m and v.

The expressions for y and z have been obtained on the supposition that the electric and magnetic fields acted one at a time and not simultaneously. If, however, y and z are small, their values will not to a first approximation be altered if the electric and magnetic deflections occur simultaneously. Thus by making the cathode rays pass through superposed electric and magnetic fields, e/m and v can be got with one exposure by measuring y and z on the screen or photographic plate.

Since from equation (26) above z^2/y is constant as long as e/m is constant, we see that all the particles of the same kind, whatever their velocity, would strike the screen or plate on a parabola, and that if the rays were a mixture of particles of different kinds each kind of particles would trace out a different parabola. Since z/y only depends upon v, all the particles moving with the same velocity will strike the screen in a straight line.

The determination of e/m for the cathode rays led to results of fundamental and far-reaching importance, for it was found that all the cathode rays had the same value for e/m, and that moreover while for a charged atom of hydrogen in liquid electrolytes e/m was equal to 10^4, when e was measured in electromagnetic units, the value of e/m for the particles in the cathode rays was considerably more than one thousand times this value. Thus if e were the same for the particle as for the hydrogen atom (and we shall see later that this is the case) the mass of the cathode particle is only $\frac{1}{1800}$ of that of an atom of hydrogen, the smallest mass which hitherto had been recognised. Again it was found that whatever metal might be used for the cathode, or whatever might be the gas in the discharge tube, the value of e/m was unaltered. As those particles must have come either from the electrode or the gas, it follows that the particles of the cathode rays are a constituent of the atoms of all the chemical elements. These particles are called "electrons."

After the electrons had once been detected in the cathode rays they were very soon detected under many other conditions and found to be of very widespread occurrence. Thus, for example, it was found that streams of electrons are given out by incandescent metals, the rate of emission increasing very rapidly with the temperature. This has received a very important industrial application in what are known as "hot wire valves," at which a current from a hot cathode passes through a vessel in which the vacuum is so high that the gas takes no part in the discharge; the current, in some cases amounting to several amperes, is carried entirely by electrons. Lenard found that they were emitted by metals exposed to ultra-violet light. They are emitted when Röntgen rays strike against matter and by radio-active substances. The speed of the electrons ejected either by ultra-violet light or by Röntgen rays does not depend upon the intensity of the radiation but only upon the wave length. The energy acquired by the electrons is $=h\nu$, where ν is the frequency of the radiation and h Planck's constant.

Since the cathode rays are deflected by electric and magnetic forces proportionally to the magnitude of these forces, we can use the deflection of the rays as a measure for electric and magnetic forces. As these rays have practically no inertia they are especially adapted to measure very rapidly alternating forces which could not be detected by any index having an appreciable mass. The cathode ray oscillograph, an instrument by which electric and magnetic forces are measured by the deflection of cathode rays, has already been used in many investigations, and is a very important aid to research. Another property of cathode rays is that when they strike against matter they generate Röntgen rays, the hardness of the latter increasing with the speed of the former. The mass of an electron depends upon its velocity; this effect is not appreciable unless the velocity is comparable with that of light but the increase in mass becomes very marked when as in the case of the β rays from radio-active subjects the velocity exceeds 10^{10} cm./seconds. On the theory of Relativity the relation between m_v the mass of an electron moving with the velocity V and m_0 the mass of an electron at rest is

$$m_v = \frac{m_0}{\sqrt{1-v^2/c^2}},$$

where c is the velocity of light. This relation seems to be in agreement with the measurements which have been made on the masses of the β particles.

If the electron is regarded as a small sphere of radius a then it follows from the laws of electromagnetic action that $m_0 = \frac{2}{3}\frac{e^2}{c^2a}$ where e is the charge on an electron in electrostatic measure. The value of e/m_0 found by experiment is $1{\cdot}78\times10^7\times c$, the value of e is $4{\cdot}8\times10^{-10}$, and $c=3\times10^{10}$, hence the value of a from the preceding equation is equal to $1{\cdot}9\times10^{-13}$ cm.

Positive Rays.—Goldstein discovered in 1886 that, if the cathode in a highly exhausted tube was perforated, bundles of a luminous discharge streamed through the aperture into the space behind the cathode. The colour of this discharge depends upon the gas in the tube; thus in hydrogen it is rose colour; in air, yellowish. The colour of the light due to these rays is not the same as that produced when cathode rays pass through the gas. In some gases the difference is very striking; thus in neon the light due to the cathode rays is pale blue, while the discharge which streams through the cathode is a gorgeous red. Goldstein called the rays which stream through the hole in the cathode *Kanalstrahlen;* but as they have been proved to consist of positively charged particles it seems more natural to call them "positive rays." These rays produce phosphorescence when they strike against glass and many other substances, though the phosphorescence is generally of a different colour from that produced by cathode rays. They also affect a photographic plate. It was at first thought that the positive rays were not deflected by a magnet, as magnetic forces which produced large deflections of cathode rays had no appreciable effect upon positive ones. Wien showed, however, by using very strong magnetic fields, that they could be deflected and that the direction of the deflection indicated that they carried a charge of positive electricity; they can also be deflected by electric forces.

By measuring the deflection provided by electric and magnetic fields we can determine by using equations (26) and (27) the value of e/m for the particles which constitute the rays. The result is of great interest. Instead of, as in the cathode rays, e/m having the same
value for all the carriers, we find that e/m has many diffe
values separated by finite intervals; and instead of e/m b
equal to $1{\cdot}78\times10^7$, as in the cathode rays, we find the grea
value of e/m is 10^4, which is the same as its value for a cha
hydrogen atom. The values found for e/m depend on the g
in the discharge tube; the outstanding result is that all t
values of m correspond to masses of atoms or molecules of
chemical elements or compounds. Thus while the determina
of e/m for the cathode rays shows that in a gas at a very
pressure the carriers of the negative electricity are all of the
type, being electrons whose mass is exceedingly small compa
with that of any atom, the determination of e/m for the posi
rays shows that the carriers of the positive electricity are of m
different types; and that all these types correspond to atom
molecules of the chemical elements or compounds. It has alre
been shown that if charged particles, after passing thro
electric and magnetic fields, are received on a screen or ph
graphic plate, all particles, for which e/m is the same, strike

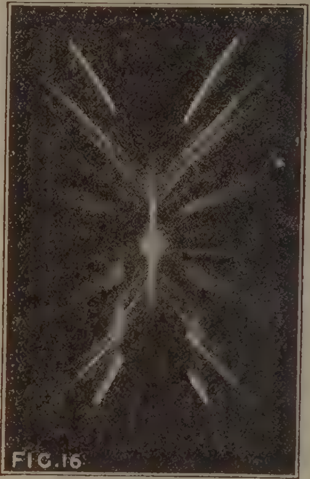


FIG. 16

plate on a parabola, and that for each different value of
there is a separate parabola.

These parabolas are shown in fig. 16, which is a reproduction
a photograph made by allowing the positive rays in a tube c
taining gases liberated by heating a certain mineral to str
against a photographic plate; taken from the top downwa
they correspond respectively to the atom of hydrogen,
molecule of hydrogen, the atom of helium, the atom of carb
with two charges, the atom of nitrogen with two charges,
atom of oxygen with two charges, the atom of carbon with
charge, the atom of nitrogen, the atom of oxygen, the molecule
water, the molecule of CO and that of N_2 (these form one para
ola), the molecule of oxygen, the molecule of CO_2 and the at
of mercury. We find that many of the atoms can carry more th
one charge, for when we find a parabola corresponding to o
value of e/m we frequently find another corresponding to tw
this value; thus carbon, nitrogen and oxygen occur very f
quently with two charges, other atoms such as argon with t
and three charges, while mercury atoms have been detected wi
1, 2, 3, 4, 5, 6, 7 charges. It is significant that the atom of h
drogen never occurs with more than one charge. Multi
charges generally occur on atoms but not on molecules; the
are, however, some molecules such as CO on which double charg
have been found. Some of the positive particles, after passi
through the hole in the cathode, lose their positive charge a
become uncharged, and some of these neutral particles acqui
a negative charge; thus mixed with the positively electrifi
particles there are some negatively electrified ones. This pow
of acquiring a negative charge is confined to certain atoms; th
while the atoms of hydrogen, carbon, oxygen, fluorine occur wi
a negative charge, the atoms of nitrogen, helium, argon and ne
do not. It is exceptional for a molecule to acquire a negati
charge—the molecules of oxygen and carbon, however, can do s

e equation of a parabola formed by a particle on the photo-phic plate has already been given

$$z^2 = \frac{e}{m} yC$$

ere z is measured parallel to the displacement due to the gnetic field and y to that due to the electrostatic. C is a antity which depends on the strength of the electric and gnetic fields and on the position of the photographic plate. If, in fig. 17, we draw a line parallel to the axis of z, the inter-ot made by a parabola on this line will be proportional to $m)^{\frac{1}{2}}$; thus, if the top parabola is due to the atom of hydrogen, next to the molecule of hydrogen, the third to the atom elium and the fourth to that of oxygen, the intercepts AH, AH_2, Ie, AO are in the proportion of 1, $1/\sqrt{2}$, 1/4. Thus by com-ring the intercept made by any parabola X with that made by e parabola due to the hydrogen atom we can find the molecular ight of the substance producing the parabola X.

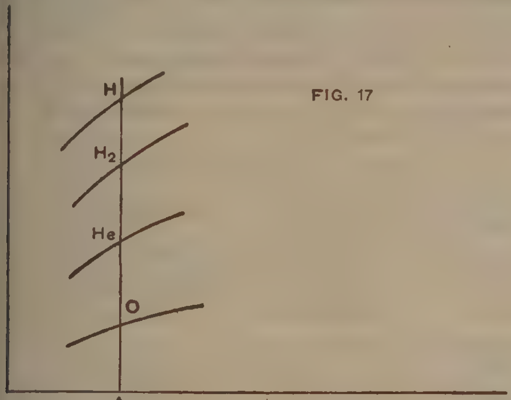


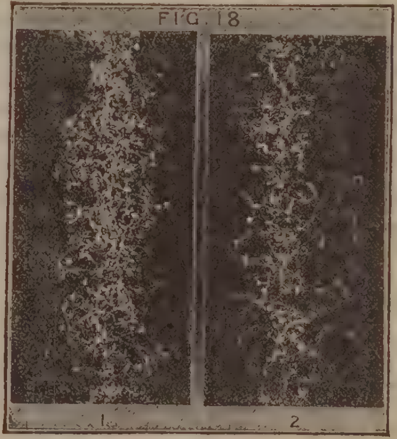
FIG. 17

Positive Rays as a Method of Chemical Analysis.—Since from e measurement of the positive ray photographs we can deter-ine the molecular weight of the gases in the discharge tube, we n analyse a gas by putting a small quantity of it in a discharge be and taking a photograph of the positive rays. It is thus a ethod of chemical analysis, and its application has already led the detection of several new substances. In fact, though it s only recently been introduced, more substances have been scovered by this method than have ever been discovered by ectrum analysis. The method has many advantages. In the st place only a very minute quantity of the gas is required; a all fraction of a cubic centimetre of gas at atmospheric pres-re is all that is required to fill the discharge tube at the pressure which the positive rays are produced. Again, the method is ry sensitive, as it will detect the presence of a gas which only rms a small percentage of the gas in the tube. The method not ly detects the presence of the gas, but at the same time termines its molecular weight. It indicates, if the gas is an ement, whether it is monatomic or diatomic; for if it is diatomic will give rise to two parabolas, one due to the atom, the other the molecule. The absence of double or negative charges will ggest that it is a compound and not an elementary gas. The ly ambiguity is that it does not distinguish between two sub-ances of the same molecular weight; thus CO_2, and N_2O give e same parabolas, as also do CO and N_2: we can often, however, move this ambiguity by putting substances in the tube which uld absorb one gas and not the other, and testing whether or t this has removed the parabola.

Use of Positive Rays to Determine Atomic Weight.—The meas-ement of the parabolas give, as we have seen, the atomic ight of the elements producing them; they can therefore be ed to determine the atomic weight of elements which can be roduced in a gaseous state into the discharge tube. This ethod has the great advantage that the presence of impurities es not affect the result. Mr. Aston has lately, by the use of a sitive-ray method for determining atomic weights (*see* ATOMIC WEIGHTS), found the very important fact that, if oxygen is taken as 16, the atomic weights of the elements with the exception of hydrogen are represented by whole numbers. Thus in working with chlorine he found no substance with an atomic weight of 35·4, but two substances with atomic weight of 35 and 37 respectively; he regards these substances as identical in chemical properties and inseparable by chemical reactions, and ordinary chlorine as a mixture of about 3 parts of (35^2) and one part of (37^1). Mr. Aston, by the method of positive-ray analysis, has discovered and measured the masses of the isotopes (*see* ISOTOPES) of most of the chemical elements.

The Charges of Electricity Carried by Gaseous Ions and Electrons.—The deflection of cathode and positive rays by electric and magnetic forces supplies a method for finding the value of e/m; for the determination of e, the charge of an ion, other methods have to be employed. One such method used by J. J. Thomson is based on the important investigation of C. T. R. Wilson on the effect of ions on the deposition of clouds and fogs from supersaturated air. If dust-free air saturated with water vapour is suddenly cooled by expansion, no cloud or fog is deposited unless the supersaturation due to the cooling is very large. C. T. R. Wilson found that if ions are present in the gas they act as nuclei round which drops of water are deposited with a supersaturation much below that required for gas free from ions. A beautiful application of this is the detection of the path of an α particle from a radioactive substance. The α particle produces by collision ions all along its path; if the damp gas through which the particle is passing is suddenly cooled by expansion, drops of water will deposit on the ions and thus mark out the path of the particle. One of Mr. Wilson's photographs of such a path is shown in fig. 18. Mr. Wilson found that less supersaturation is required to deposit water on negative than on positive ions. This result can be applied to find the number of ions in a moist gas, for if the gas is suddenly expanded by an amount sufficient to deposit drops on ions, but not sufficient to produce condensation in their absence, then each ion may be made the centre of a drop, and the problem of counting the ions is reduced to that of counting the drops.

FIG. 18



We can calculate the amount of water that will be deposited by any given expansion of the air: hence since we know the volume of the water we can determine the number of drops if we know the volume of a single drop. Observation of the rate at which a drop falls under gravity will give the size of the drop, for Stokes long ago showed that the velocity of a rain drop falling under gravity is given by the equation $v = \frac{2}{9} g \frac{a^2 \rho}{\mu}$; when v is the velocity of the drop, a its radius, μ the viscosity of the gas, g the acceleration due to gravity, and ρ the density of the gas. It has been found that, with the exceedingly fine drops formed round ions where the radius of the drop is comparable with the free path of the molecules of the gas, the velocity is $\left(1 + \frac{C}{pa}\right)$ times that given by the above equation when C is a constant, and p the pressure. But though this correction makes the relation between a and v a little more complicated, it still enables us to determine a when v is known. Thus the radius, and therefore the volume, of the drop can be determined, and from this, as we have seen, we can deduce the number of ions.

Let n be this number per unit volume; then if a current of electricity is sent through the gas by an electric force X, the current passing through unit area will be neU when U is the mean velocity of the positive and negative ions under the force X. We know that it is proportional to the force and for a force of one volt per cm. is 1·5 cm./second; and hence when X is known U is known, the current neU can be measured, and hence ne deduced; as n has been found by the drops, the value of e can be determined immediately. This was the method used by J. J. Thomson; a simpler method used afterwards by H. A. Wilson was to get drops round the negative ions alone by using an expansion that would deposit moisture on negative but not on positive ions. He then showed the rate of fall of these drops, first under gravity alone, and then under a vertical electrical force X, acting on the drop in the same direction as gravity. Thus, when the electric field is acting, the force on the drop is

$$Xe+\tfrac{4}{3}\pi\rho a^3g,$$

and when it is off the force is only $\frac{4}{3}\pi\rho a^3g$. Thus, if v_1, v are respectively the velocities of the drop when the field is on and off,

$$\frac{Xe+\frac{4}{3}\pi\rho a^3g}{\frac{4}{3}\pi\rho a^3g}=\frac{v_1}{v}$$

or

$$Xe=\tfrac{4}{3}\pi\rho a^3g\frac{(v_1-v)}{v}$$

From v, the rate of fall when the field is off, we can calculate as before the radius of the drop, and from the preceding equation we can determine e. Millikan (*Phil. Mag.*, 34, p.1), who has made most extensive and accurate investigations on the value of e, used a modification of the preceding method. Instead of producing water drops by expansion on the ions, he obtained, by means of a sprayer, minute drops of oil; he observed the motion of one of these under an electric field in a gas which was subject to some ionising agent, and from time to time an ion would strike against the drop and alter the charge; this would alter the velocity, and from the alteration of the velocity he could by a formula similar to that just given calculate the charge communicated to the drop by the ion. The value obtained for e by this method is, in electrostatic units,

$$e=4{\cdot}77\times10^{-10}$$

If M is the mass of an atom of hydrogen the value of E/M can be determined by the positive-ray method, so that as E is known M can be determined. When M is known Avogadro's constant and the number of molecules of hydrogen in a cubic centimetre of gas at standard temperature and pressure are at once determined.

Thus the study of the electrical property of gases gives the most accurate values available of two of the most important constants connected with the constitution of matter. By studying electrified atoms and molecules, we are able to determine their masses and their properties with an accuracy far beyond that attainable by any method which can be used when they are in the normal state. See Sir J. J. Thomson, *Conduction of Electricity Through Gases* (1926) (J. J. T.)

GASOLENE, commonly known in Great Britain as PETROL, is a motor fuel particularly suitable for use in motor vehicles. It has been officially defined by the American Society for Testing Materials as a refined petroleum naphtha which, by its composition, is suitable for use as a carburant in internal-combustion engines. Petroleum naphtha, as understood in the above definition, is any product of petroleum of which not less than 10% distils below 347° F. (175° C.) and not less than 95% below 464° F. (240° C.) when subjected to distillation according to the current tests of the American Society for Testing Materials. The term gasolene (natural gasolene) is applied also to a liq product of natural gas, which, however, in order to be mark able, must be blended with light grades of petroleum gasol On the other hand, among other motor fuels derived from pe leum, which, even in its crude form, is sometimes used for purpose, are kerosene, which is suitable for tractors, and distillate fuel oil employed in the semi-Diesel type of engi Besides serving as fuel in motor-vehicle engines, gasolene is u for aeroplanes, motor-boats, motor rail cars and many kinds stationary engines.

The increase in the use of motor vehicles, particularly in United States, has made the question of gasolene supply a m ter of vital concern. The consumption in the United States d ing 1924 was approximately 7,750,000,000 gal., nearly 500 for each of the 16,000,000 cars then in service. The largest c suming countries outside of the United States are, in ord Great Britain, France, Canada, Argentina, Belgium, Austra and Italy. The European consumption for 1924 is estimated 1,300,000,000 U. S. gal. (⅚ of the imperial gallon). The foll ing tabulation, based on figures supplied by the U.S. Dept. Commerce, shows the production and consumption in the imp tant countries in typical years.

Production and Consumption of Gasolene

Country and Year	Production	Consumption (in U.S. gal.)	
		Gross	Per Capit
United States	U.S. Gal.		
1914	1,460,038,200	1,255,218,538	..
1923	7,555,945,143	6,685,035,280	..
1924	8,959,690,220	7,780,625,085	69·3
Great Britain	Imperial Gal.		
1914	5,140,364	141,029,305	..
1923	71,000,000	417,027,593	..
1924	95,000,000	549,600,000	11·6
France	Metric Tons		
1913	..	63,113,000	
1923	3,848	261,011,000	..
1924	4,000	297,234,000	..
Canada	Imperial Gal.		
1924	170,000,000	260,252,000	29·0
Argentina	Liters		
1924	50,900,000	68,200,000	8·0
Belgium			
1923	..	35,155,185	..
1924	..	57,272,142	7·6
Australia			
1922–3	Metric Tons	46,800,000	8·6
Italy			
1913	2,800	12,046,900	..
1923	898	48,226,700	1·3
Germany			
1913	..	88,483,000	
1922		70,214,000	..
1923	..	43,704,000	0·7
Rumania			
1913	422,019	10,889,000	..
1922	285,097	27,089,000	..
1923	300,847	31,655,000	1·9
Russia	Poods		
1923–4	12,748,800	14,750,000	0·2

Gasolene Supply.—The supply of gasolene depends on th available petroleum reserve (*see* PETROLEUM 21.316), efficienc in refining methods, and economic utilisation. The increase i the yield of gasolene from a given amount of petroleum is to b expected chiefly from more careful fractionation, improve cracking methods, and raising the upper distillation limits in th production of straight run gasolene by straight distillation. Ac cording to an estimate made by the United States Burea of Mines, the gasolene produced from crude oil amounts t ut 33% of the oil entering the refineries. This percentage ht be increased to 55, in the opinion of the Committee of ven on Conservation, American Petroleum Institute. Of ater promise are possible improvements in engine design, as sult of which the energy available from a given amount of olene may be greatly increased (*see* INTERNAL COMBUSTION GINE). It is estimated by C. F. Kettering, president of the eral Motors Research Corporation, that the percentage of rgy in gasolene transformed into work is, on the average, 5, but that this might be increased to 10 through structural hanical changes, thereby almost doubling the transportation iency of a gallon of gasolene.

arketing Methods.—Highly specialised methods for the mar- ing of gasolene have been developed, particularly in the ted States. The gasolene is shipped from refineries in tank s or ships (tankers) to large storage terminals and thence to ller storage tanks along railways. From these it is taken by tor tank truck to "service stations," garages and curb pumps, ere it is pumped into motor vehicles. It is estimated that re are about 100,000 "service stations" in the United States, le innumerable curb pumps are to be found on the city ets and along country highways. Similar marketing methods employed in Canada. In Great Britain and France the dis- ution of petrol was largely effected by tins but the gasolene np has come into wide use. Public service stations for auto- biles are now to be seen also in the principal cities of Germany, gium, northern Italy and other European countries.

nti-knock Fuels.—A significant recent development has been production of a gasolene designed to eliminate or reduce the nock" of an engine. There are also substances on the market ertised to effect the same result if added to ordinary gaso- es. One such compound, known as ethyl gasolene, consists of nmercial gasolene to which has been added a small fraction of of a synthetic oil containing tetraethyl lead. Anti-knock ls are said to increase the mileage per gallon, to reduce carbon osits in the motor, to facilitate starting and to improve en- e efficiency in cold weather. Of greater importance, however, he fact that the elimination of "knock" removes the barrier the introduction of an automobile engine which would greatly rease the mileage per gallon and otherwise compare favoura- with the performance of engines now in use.

asolene Substitutes.—Benzol, derived as a by-product from ing coal, is used to a limited extent as a blend with gasolene the United States, the limitation being due to the relatively all production of benzol. The substitutes for gasolene which mise the greatest usefulness are oil derived from shale and ecially liquid fuel derived from coal. The use of alcohol (*q.v.*) a fuel for internal combustion engines is growing in Great itain, where extraordinary measures have been taken to en- rage research and production of this fuel. The French Govt. o has undertaken research to this end and has encouraged development of a local alcohol industry, the product of ich can be used as fuel. The use of alcohol as a motor fuel Germany was tried some years ago; more recently benzol, pared by the carbonisation of coal and lignite, has been used a motor fuel. Methanol, also, produced on a commercial scale m carbon monoxide and hydrogen by the so-called Bergius thod for the liquefaction of coal, has attained importance a substitute for gasolene. (*See* COAL; FUEL PROBLEMS.)

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GASQUET, FRANCIS AIDAN (1846–), English Roman tholic divine and historian, was born in London Oct. 5 1846. was educated at Downside College, Bath, afterward becoming perior of the Downside Benedictine monastery (1878–84). eated cardinal in 1914, in 1918 he was appointed prefect of Vatican archives. He has produced various works on mediae- church history and liturgies, among them being *Henry VIII. and the English Monasteries* (1888–9); *A Short History of the Catholic Church in England* (1903); *Parish Life in Mediaeval England* (1906); *The Bosworth Psalter* (1908); *Monastic Life in the Middle Ages* (1922); *His Holiness Pope Pius XI.* (1922).

GAUL, GILBERT WILLIAM (1855–1919), American painter (*see* 11.532), died in New York Dec. 21 1919. He was awarded a gold medal at the Appalachian Exposition, Knoxville, in 1910.

GAUVAIN, AUGUSTE (1861–), French journalist and diplomat, was born at Vesoul Oct. 6 1861. From 1889 to 1892 he was on the staff of *Le Journal des Débats* and in 1893 became general secretary to the European Commission of the Danube. In 1904 he was appointed French secretary to the Central Office of International Transport at Berne. In 1908 he returned to the staff of *Le Journal des Débats* and from that time directed its foreign policy. By the continuity and clearness of his views, his freedom from bias and, above all, by his exceptional talent as a writer, M. Gauvain came to exercise considerable influence. He gave early warning of the menace of German imperialism, and more especially of the danger threatened to Europe by the condition and policy of Austria-Hungary. He was an unceasing advocate of energetic action and moderation in aim on the part of the Allies in the World War. Gauvain, who became a member of the Academy of Moral and Political Sciences, published verbatim in 14 volumes all his articles in *Le Journal des Débats* from 1908 to 1920. (*See* FRANCE: HISTORY)

Among his other works are: *Les origines de la guerre européenne* (1915); *L'Europe avant la guerre* (1917); *L'affaire grecque* (1917); *La question Yougoslave* (1918); *L'encerclement de l'Allemagne* (1919).

GDYNIA or GDINGEN.—This Polish seaport and naval base is situated on the small bay of Gdynia, opening out into Danzig Bay, on the Baltic. It is 12 m. northwest of Danzig, with which it is connected by the railway running westerly from that city to Stolp and Stettin. The Polish Govt., in building a railway to the port which will pass over territory entirely Polish, has also a scheme for a canal to the port from a convenient point on the Vistula, thus tapping the whole waterway system of Poland.

During the struggle with Soviet Russia in 1920, the Poles were unable to utilise Danzig for naval or military purposes, and this led them to build a port of their own. A suitable site was found at Gdynia, where a fishing village of about 200 souls already existed. The depth of water near the shore varies from 10 to 20 metres; the bed of the bay gives firm anchorage; and the entrance is sheltered by the peninsula of Hela. The Polish Govt. began the construction of the port in 1921, and by the summer of 1924 had built the southern mole, 550 metres in length, and a breakwater 175 metres long, forming part of the northern mole, together with a landing stage 150 metres long, a narrow gauge railway along the southern mole, an electric power station, water supply and other equipment. A contract for further construction was signed on July 4 1924 by a Franco-Polish syndicate, the date for the completion of the contract being Dec. 31 1930.

Its main provisions are (1) the making of an entrance canal, 11 metres deep, to the harbour, (2) the construction of the harbour with a water area of about 400 ac. and 1,060 metres of quays, together with a basin eight metres deep and a pier for passenger vessels, the depth of water at the quays being from eight to 10 metres and (3) the digging of an inner basin or dock on the foreshore, with a water area of about 100 ac. and a depth of water at the quays of 10 metres. In 1924–5 the northern mole was extended to a length of 700 metres, and considerable dredging and excavation work was done. In addition the Polish Govt. proposes to spend a large sum on the equipment of the port, comprising large warehouses, a grain elevator, powerful cranes, railway sidings and paved roads. In 1930 the port will have quayage for 30 large steamers and a handling capacity annually of 2,500,000 tons, but it will be constructed so as to permit of a great increase in its size and capacity. In 1925, 85 vessels, of 73,351 net tonnage, entered, and 79 vessels, of 69,981 net tonnage, cleared the port, exclusive of coastal shipping.

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GEDDES, SIR AUCKLAND CAMPBELL (1879–   ), British politician, was born June 21 1879, the son of Auckland Campbell Geddes of Edinburgh and the younger brother of Sir Eric Geddes, and was educated at George Watson's College, Edinburgh, and Edinburgh University. He studied medicine, qualified as a practitioner, was at the London hospital for a time and later studied at Freiburg. He was a demonstrator and professor of anatomy first at Edinburgh, then at the Royal College of Surgeons, Dublin, and afterwards at McGill University, Montreal. He also had some military experience in the South African War and afterwards in the World War 1914–6.

In 1916 Geddes became director of recruiting, and in Aug. 1917 Minister of National Service. A seat in Parliament was found for him at Basingstoke and he had little difficulty in accommodating himself to parliamentary life. After the Armistice, Sir Auckland, who had been made a K.C.B. in 1917, became President of the Local Govt. Board and Minister of Reconstruction, and in May 1919 President of the Board of Trade. In this latter capacity he began the removal of the barriers to British Trade which the War had necessarily set up, and he had to deal with the difficulties which immediately arose in the coal industry. In this delicate task he was at least temporarily successful, and managed materially to reduce the price of domestic coal. In the same year an opportunity was afforded him to return to academic life by his election as principal of McGill University. He accepted the appointment, subject to its not being operative till the abatement of the coal crisis allowed of his leaving the Board of Trade. But during the delay the Government prevailed on him to accept instead the post of British Ambassador in Washington. His tenure of the Embassy only lasted three and a half years (1920–3), but the time was crowded with important negotiations in which he showed himself a successful diplomatist. On quitting Washington, Sir Auckland, who had been made G.C.M.G. in 1922, left the public service and became chairman of the Rio Tinto Company. He married in 1906 Isabella Gamble, daughter of W. A. Ross of New York.

GEDDES, SIR ERIC CAMPBELL (1875–   ), British man of business and administrator, born in India Sept. 26 1875, was the son of Auckland Campbell Geddes of Edinburgh, and the elder brother of Sir Auckland Geddes. He was educated at the Oxford Military College and Merchiston Castle School, Edinburgh. He gained some business experience at lumbering in the United States, and was afterwards connected with railways—first, the Baltimore and Ohio system, and then the Rohilkhand and Kumaton in India. Returning to England he joined the North Eastern Railway Co. under Sir George Gibb, and, having succeeded him in 1906, was himself the general manager of this line when the World War broke out.

Geddes was one of the business men whom Mr. Lloyd George, on becoming Minister of Munitions, enlisted in Government employ. He became deputy director general of munitions supply, 1915–6, and was then appointed, though a civilian, director general of transportation, and succeeded in bringing the British lines of communication in France into a high state of efficiency. He was knighted in 1916, and in 1917 he was created K.C.B. and G.B.E., being transferred to the Admiralty in May of that year as controller, in order to develop and utilise the whole of the shipbuilding resources of the country and concentrate them under one authority. A month or two later, in spite of having no parliamentary experience, he was appointed First Lord of the Admiralty, and was returned to the House of Commons as M.P. for the borough of Cambridge.

After the Armistice Mr. Lloyd George made use of Sir Eric's powers as an organiser by commissioning him to co-ordinate Government departments in regard to demobilisation. His success in these varied tasks was rewarded in Jan. 1919 by the G.C.B. When the Government was reconstructed in that month, he left the Admiralty in order to organise and preside over a new Ministry of Transport. But in the autumn of 1920 there came the sudden break in trade, and it became evident that the country could not afford a department on the proposed scale. In 1921 a bill introduced by Sir Eric for the re-grouping of the railways was passed; he then resigned office in Oct., and the ministry was
duced in personnel and importance. Sir Eric himself was
pointed in Aug. 1921 chairman of a small committee, la
known as the "Geddes Axe," to recommend public economies
the Government. In various reports in the winter of 1921–2
committee recommended savings amounting to £86,000,000; b
Sir Eric complained that only £52,000,000 of this amount w
actually saved. In 1922 he left Parliament and returned to
business career, becoming chairman of the Dunlop Rubber C
and of Imperial Airways, Ltd. He married in 1900 Gwendol
daughter of the Rev. A. Stokes, and had three sons.

GEDDES, PATRICK (1854–   ), British biologist and socio
gist, was born at Perth Oct. 20 1854. He was educated at Per
Academy, and in London and France, and became demonstrat
in physiology at University College, London, in zoology at Ab
deen and in botany at Edinburgh. In 1883 he was appointed pr
fessor of botany at University College, Dundee (St. Andrew
University) and in 1919 he became professor of sociology a
civics in Bombay University. As a biologist, in collaborati
with James Arthur Thomson, he wrote *The Evolution of S*
(1889; revised ed. 1901); *Evolution* (1911); *Problems of S*
(1912); and *Biology* (1925), tending towards a new Lamarcki
position. Interested in the synthetisation of science with a
and history and its application to the conditions of modern li
especially in the direction of town-planning and housing,
travelled extensively, established a publishing house and pr
moted civic museums and industrial exhibitions. He was o
of the leading members of the Sociological Society founded
1904. His views are embodied in the papers of this society a
in *City Development*, a report to the Carnegie Dunfermli
Trust (1904), and *Cities in Evolution* (1915). He also wro
Chapters in Modern Botany (1893) and *Life and Work of S*
Jagadis C. Bose (1920). In collaboration with Victor Branfo
he edited the series, (*The Making of the Future*, himself contribu
ing volumes, *The Coming Polity* and, with G. Slater, *Ideas at W*

GEIGER, WILHELM (1856–   ), German scholar, was bo
in Nuremberg July 21 1856. He qualified as an academic le
turer in 1886 in Munich and became professor at Erlangen
1891. In 1920 he was appointed professor of Indian and Irania
philology at Munich. He became the publisher of the *Zei*
schrift für Indologie und Iranistik, the *Zeitschrift für Buddhism*
and the *Grundriss der Iranischen Philologie*. His chief works ar
Handbuch der Avestasprache (1879); *Ostiranische Kultur i*
Altertum (1882); *Ceylon, Tagebuchblätter und Reiseerinnerunge*
(1898); *Litteratur und Sprache der Singhalesen* (1900); *Dipavams*
und Mahavamsa und die Entwicklung der geschichtlichen Ueb
lieferung in Ceylon (edited 1905); *Pāli, Litteratur und Spra*
(1916); *Pāli Dhamma* (1921); *Elementarbuch des Sanskrit* (3r
ed., 1923); *Samyutta Nikāya* (Eng. trans., 1924).

GEIKIE, SIR ARCHIBALD (1835–1924), Scottish geologi
(*see* 11.552), received the O.M. in 1914. He died at his residenc
near Haslemere, Surrey, on Nov. 10 1924.

GEIKIE, JAMES (1839–1915), British geologist (*see* 11.55
died in Edinburgh March 1 1915.

GENERATOR: *see* DYNAMO.

GENETICS (*Greek* γένεσις, origin or creation).—This ter
was proposed at the third International conference on hy
bridisation, London, 1906, to denote the study of heredity an
variation. In that sense it has been generally adopted, and b
extension is understood to include the physiology of reproductio
and the art of breeding. Though such inquiries have been pu
sued from the earliest times, the development of a special branc
of science relating to them is recent. The primary incentive wa
the hope that by applying accurate methods of observation an
experiment to the course of heredity and variation a more precis
knowledge of evolutionary processes might be acquired.

Modern theories of evolution are based on the assumption tha
species have arisen by descent with modification, and that th
constancy and diversity which living things manifest in thei
reproduction provide a sufficient basis for that conception. I
is significant that as a result of the preliminary work done unde
the new inspiration, attention has been largely diverted fro

se more philosophical aims. Beliefs current among naturalists,
ecially as to the nature and incidence of variability, were at
e found to be widely incorrect. The scope and character of
se discoveries are referred to below. Their immediate conse-
nce has been that the development of evolutionary theory is
tly suspended or postponed, and activity is concentrated on
exploration of genetical physiology, the theoretical evalua-
of the knowledge thus gained being relegated to the future.

n these researches several methods of investigation are avail-
e. Modern genetics began with an attempt to observe em-
cally the course of contemporary variation from type; but
ugh observations of this class have proved valuable in a pre-
inary survey, and have often been of use as indicating ma-
al for more prolonged investigation, the main advances have
n accomplished by either (1) experimental breeding or (2)
ology. Important sidelights on genetical problems have also
n obtained through the study of developmental mechanics
ntwicklungsmechanik) by experimental methods.

Experimental Breeding

he great stimulus to this method of research was given by the
iscovery in 1900 of Mendel's paper (*see* 18.115). Heredity,
g regarded as a fortuitous and seemingly lawless phenomenon,
s proved to follow regular principles which could in great
asure be ascertained by experiments properly planned. A vast
d was at once thrown open for investigation. Mendel's success
s made possible by his genius for simplification. Working with
s, he made crosses between distinct varieties and watched the
cent of their numerous characteristics, fixing his attention on
h separately, and disregarding other differences. He then
nd that numerous distinctive features behaved in descent as
hey were transmitted as units.

hese determining elements or units are referred to as *factors*
"genes" (a term especially used by American writers, the
ivalent of Johannsen's *Genen*). The differences determined
these factors can commonly be shown to be treated in hered-
as pairs of alternatives or opposites, such as tall and short,
oured and colourless, hairy and smooth, each germ-cell being
ally pure in respect of one or other of the contrasted char-
eristics. This is the principle of *allelomorphism*, and the
mbers of such pairs are called *allelomorphs*. The zygote,
med by two germ-cells united in fertilisation, may be made
of two germ-cells alike in respect of any given pair, in which
se it is said to be *homozygous* in that respect, or it may be a
erozygote if the uniting pair of cells are unlike. Before the
rm-cells of the heterozygote are formed a process of *segrega-*
n occurs, and there is a dissociation between the opposing
ments introduced at fertilisation, such that the resulting germ-
lls are again in normal cases pure in regard to each allelomorph.

In respect of any such pair of differences the character of the
terozygote is sometimes intermediate, but it most often ap-
oaches more nearly to one of the parental types. Not infre-
ently the approach is so close that the pure homozygote cannot
distinguished with certainty from the heterozygote. In
endel's terminology the character thus prevailing is a *dominant*,
e other being *recessive*. The distinction is of importance and is
e basis of certain suggestions as to the possible nature of al-
omorphism.

After the rediscovery of Mendel's work progress was rapid,
d it was soon found that similar principles of descent apply to
great range of characteristics by which living things are dis-
nguished. The number of forms of life studied is now very
rge, and includes most of the kinds of plants and animals which
e readily amenable to experiment or observation. Man is
idently no exception, and we already know that certain
atures of human colouration, especially of hair and eyes, and
veral congenital abnormalities are transmitted according to the
endelian scheme, some being dominant and others recessive.

Scarcely any satisfactory opportunities for studying the
netics of the lower plants (ferns, mosses, algae, etc.) have yet
curred, but one example has been described in a unicellular
ga (Pascher). Of the features by which animals and plants are distinguished most have now been shown to be dependent on segregable elements. Reservation must be made in regard to differences which are simply quantitative, for there is a good deal of evidence suggesting that the elements by which size and weight are determined do not often form themselves into simple allelomorphic pairs. A similar doubt exists in regard to numerical or meristic distinctions.

Abnormalities.—Differences in instinct and other characters dependent on nervous mechanism are not, as such, distinct in their genetical behaviour, and some have been proved to depend on segregable factors or elements. In several breeds of fowls the hens are devoid of maternal instincts, and do not sit on eggs. This characteristic is recessive to the normal instinct, and segregation takes place in regard to it. The same is true of the pacing habit in horses as opposed to the trotting habit. The "waltzing" habit of certain Japanese mice is recessive to the normal, segregates from it and breeds true when it reappears. This example is interesting, since the abnormality is almost certainly a consequence of deformity in the semicircular canals of the ear.

Descent in Man.—As to the descent of the normal mental attributes of man little is known with accuracy, but several abnormalities of the nervous system are known to follow modes of descent which prove them to be subject to segregation. Feeblemindedness is a recessive condition which breeds true. Paralysis agitans is also a recessive. Hereditary chorea descends as a dominant; colour-blindness and a form of night-blindness may also be termed recessive (*see* Sex). In heterozygous combination with the normal there is segregation, but the descent of these conditions is complicated by sex.

It will readily be understood that though the determining factors may be transmitted as units, the distinguishing characters of animals and plants often must be due to the association of many independent units. Of these, some produce their effects separately, but not rarely, though, independently transmitted, two or more unit-factors may be complementary to each other and combine to produce a joint effect or "compound character," as it is sometimes called. Such complementary factors, if separately present in the organism without their complement, need not manifest their presence at all, and it is then only by breeding tests that their existence can be demonstrated.

Organisms may now be represented as aggregates of units which confer upon them their various attributes. The degree to which an organism may be thus resolved is as yet undetermined, but there is presumably a limit to the process, and it is natural to suppose that the detachable elements are implanted on a *basis*, which for a given type is irreducible.

Reversion.—Conceptions, formerly vague, now acquire an exact meaning. For example, reversion or "throwing back" to an ancestral form, previously regarded as a mere caprice of nature, can at once be perceived to be due to one of two definite causes which operate with regularity. The reversion is either (*a*) the reappearance of a recessive characteristic, or (*b*) it is the consequence of the reunion of complementary factors which, though both present together in the ancestor, had been separated by variation and transmitted in distinct strains. For example, when a red-haired child is born to dark-haired parents the fact proves that the two parents are heterozygous in respect of the recessive red, which reappears when two germ-cells carrying it unite in fertilisation. Moreover, if the statistics of a considerable number of such families of children were collected and added together it would be found that the proportion of red-haired was approximately a quarter of the whole. The mere fact that one or both of the parents traces descent from a red-haired ancestor is not the cause of the reversion—for if either of the parents were homozygous in dark hair the red would not have reappeared.

The reversion to an actual or supposed ancestral form consequent on the meeting of complementary factors is less common in the ordinary practice of breeders, but is frequently seen in experimental crossing. When two white orchids crossed together give a coloured flower in F_1, or when a rose-combed fowl bred with a pea-combed bird gives chickens with the walnut comb of the Malay fowl, the production of the unexpected colour or structure is due to complementary action of two independent factors. But the old interpretation of the phenomenon as a consequence of such an ancestor having occurred in the pedigree is illogical and misleading. In the case of the walnut comb, for instance, it is quite possible that either or both of the parent breeds never had a Malay ancestor. The production of a new form by the meeting of complements should be regarded, like the properties of a chemical compound, simply as the empirical consequence of a certain combination of units, without reference to the previous history of those units.

Purity of Type.—Of greater importance, both theoretical and practical, is the fact that it is now possible to assign a precise meaning to this expression. To the pre-Mendelian evolutionist purity was always a matter of degree, which might be gradually and, as it were, asymptotically approached in successive generations of selection, but never actually attained. The practical breeder also has always regarded purity as a property necessarily dependent on a long course of selection. Purity is now seen to be the condition of the animal or plant which is formed by the union of gametes bearing identical units. In respect of any allelomorphic pair purity may thus be conferred, though in respect of other pairs of units the same organism may be impure, *i.e.*, heterozygous, or, in ordinary parlance, cross-bred. This is the central fact of Mendelism, and on it Genetics is based.

The question of purity must therefore be considered separately for each pair of units. A thoroughbred horse, for example, may be pure in a number of characteristics which go to the making of the breed, but it may be impure in, say, colour. A chestnut horse, however, of whatever parentage, is pure-bred in colour, since that colour is the lowest of the series of horse colours, and chestnuts bred together give chestnuts only. By selection, the likelihood of producing purity is increased, but, as will subsequently appear, no amount of selection can ensure purity. On the other hand, purity in respect of any character may be attained at once in any mating by which gametes of similar factorial composition happen to be brought together in fertilisation. From this proposition the corollary follows that the combination of two strains pure in any given respect will give a family uniform as regards the character considered, and the uniformity of such cross-bred families, especially when one of the parents contains few dominant factors, is in practice one of the simplest and most convincing tests of purity.

Genetic Analysis.—By the institution of a series of crosses with varieties and study of the composition of the succeeding generations an *analysis* of the factorial constitution of a given type can be made. The numerical proportions or ratios in which the several combinations of characters are represented, the number of these terms in the series, and their respective genetical powers of transmission furnish the data from which the nature and number of the factors comprising the parental type may be determined. In the earlier article on Mendelism (*see* 18.115) some of the simpler ratios and their significance are explained, but examples of a much higher order of complexity are often encountered. The unravelling of these complications has led to some important discoveries. The many ways in which it may come to pass that two or more terms in a series of factorial combinations may be indistinguishable from each other cannot be enumerated here, but a knowledge of some of the more significant causes of disturbance of what may be called the normal ratios (9:3; 3:1; 9:3:4; 27:9:9:9:3:3:3:1, etc.) is essential to a proper comprehension of Genetics.

Cumulative Factors.—From certain crosses (especially of cereals) into which only one pair of differences had apparently been introduced it was observed (Nilsson-Ehle; East) that the recessives reappearing in F_2 were only 1:1:5 instead of the usual 1:3. Investigation proved that from the dominant side *two* factors with identical functions, though belonging to distinct pairs, had been introduced. Consequently, among the dominants in F_2 were some containing both these factors and others having one only. Various results suggest that this multiplication, or better, *accumulation*, of similar factors is a common occurrence, and that the process may be extended in special cases.

Inhibiting and Lethal Factors.—Many factors act by produc
a negative result, inhibiting the development of some charac
the determining elements of which are present though their act
is not perceptible or largely diminished. Of these the most ea
demonstrable operate by inhibiting the formation of colour.
white pigment of the coats of animals and the feathers of birds
of flowers, for example, is commonly due to the absence of
elements necessary for the formation of colour, but both
animals and in plants varieties have been found which are wh
or nearly so, not through absence of pigment, but through
presence of factors which, in some way not yet defined, inhi
the production of the coloured pigments. From some mating
mixture of white individuals may be obtained, which to the
look alike or nearly so, though they represent various facto
terms and are genetically dissimilar. The process of inhibit
may be carried much further, and there are well-establish
instances in which the animal or the plant cannot live if it
homozygous (containing two "doses," in popular terms) fo
given factor.

The classical instance of such *lethal* factors, as Morgan
called them, was met with in the breeding of yellow mice (Cuén
F. M. Durham). Mice with yellow coats, bred together, giv
majority of yellow, but always throw a proportion of some ot
colour—for example, chocolate or black. Since in mice yell
is a dominant, it is clearly caused by a factor which the game
can carry. But the union of two gametes, both carrying t
factor, does not give rise to a viable animal. It was suggest
that two such gametes could not unite in fertilisation, but la
work has practically proved that these fertilisations occur a
that the resulting embryo perishes at an early stage (Ibse
The physiological action of the yellow factor in causing death
not known. In plants the "golden"-leaved varieties are co
parable. They cannot breed true, but throw 2 yellow: 1 gre
The purely yellow term is missing, and is clearly not viable (Ba
The suggestion has been made that the yellow factor acts
merely negatively by diluting the amount of chlorophyll, but
inhibiting its formation, probably producing a body with t
specific power. This is the more likely since golden varieties
dull weather turn almost a full green, whereas in sunlight th
bleach to a full yellow, a fact indicating that the production
the inhibiting body is promoted by sunlight. Two doses of t
factor kill the plant altogether, probably during embryonic li

Linkage.—At an early stage in these inquiries it was observ
that factorial units belonging to separate allelomorphic pairs
not always distributed independently among the gametes o
heterozygote, but that some combinations occur regularly wit
greater frequency than others. The next step was the discove
that this *linkage* depends on the association of the linked fact
in the parent from which the heterozygote was formed. F
example, if a form *AB* is crossed with *ab* the normal expectati
is that the double heterozygote *AaBb* will form gametes *A*
Ab, *aB*, *ab* in equal numbers; but if there is linkage between
and *B*, then the parental combinations *AB* and *ab* will be mo
frequently represented in the gametic series than the other,
"cross-over" combinations, *Ab* and *aB*. But if the original cro
were in the form *Ab* x *aB*, then the most frequent gametes w
be *Ab* and *aB*, the cross-overs, *AB* and *ab* being the rarer. Th
observation forms the starting-point from which modern genetic
theory has been very largely developed.

The terminology followed above is that introduced by T.
Morgan, to whom progress has been especially due. It is som
times convenient to distinguish the case in which the two dom
nants (*AB* x *ab*) are introduced together by the parent as *cou*
ling, and the converse (*Ab* x *aB*) as *repulsion*, but the physi
logical process is now recognised as being clearly the same in bot
cases, and there is no difference in the numerical proportions
which the parental combinations respectively reappear.
should be observed that the factors thus linked have plainly
connection with each other as regards the effects which they pr
duce in the zygote, but may concern the most dissimilar chara
ters. For instance, in the example first observed the linkage w
that between the factor which makes the flower of the sweet p

e or purple (as distinguished from red) and that which makes
, pollen grains long (as distinguished from round). According
the proportion of cross-overs is small or large the linkage is
re or less complete. If both parental and cross-over terms are
ially common there is no linkage. The most satisfactory test
he linkage-ratio is obviously provided by breeding the double
erozygote (*Aa–Bb*) with the double recessive (*aabb*), and this
ting should be carried out reciprocally since it is known that
plants (*e.g.*, *Primula sinensis*) male and female sides of the
ne plant may show different degrees of linkage (R. P. Gregory),
l that in animals (*e.g.*, *Drosophila* and the silkworm) crossing-
er may be absent in one sex though occurring in the other.

Allelomorphism: Multiple Allelomorphs.—Apart from linkage,
regation is always a separation of units affecting the same
racter, and from a very large range of observations it is possi-
to represent the distinction between the allelomorphic pair
one in which a *positive* element separates from a *negative*. In
ier words, allelomorphism may commonly be conceived as a
ference which consists in the *presence* of something on the one
e and its *absence* on the other. This conception is applicable
enever there is definitely pronounced dominance. It is
tural that the characteristic which possesses dominance should
looked upon as due to the positive or present element, the
essive being the consequence of its absence. Nevertheless,
ere is as yet no strict proof that this representation is physio-
gically correct. For since we know that many factors may
erate by inhibition it is always possible to *invert* the con-
ntional representation and by putting negative for positive, to
ike a factorial scheme which equally agrees with the observed
sults. Conventionally, for instance, the tall pea is represented
either *TT* (homozygous) or *Tt* (heterozygous), the dwarf
ing *tt*, from which the positive element *T* tallness is absent.
But we cannot positively declare that the dwarfs may not be
homozygous in the presence of an inhibitor *I*, whereas the tall
ints might be either *Ii* heterozygous, or *ii* homozygous in re-
ect of the absence of this inhibitor. The significance of this
ernative mode of representation will be apparent when the
plication of factorial systems to evolutionary theory is at-
mpted (*see* MENDELISM). But when the heterozygote is inter-
ediate between the two homozygous forms the "presence-and-
sence" method of representation cannot be applied with any
nfidence. From the existence of such cases and from certain
her considerations it has been urged, especially by American
neticists, that the method of representation by presence-and-
sence is incorrect, and that a negative allelomorph should be
eated as a real entity. There is no valid means of deciding this
estion as yet. The probability is perhaps that the absence
ould always be regarded as relative only. As a mode of sym-
lic expression the representation of the two allelomorphs as
ffering quantitatively is often convenient, though perhaps not
iversally applicable.

Types of Allelomorphs.—Allelomorphism is, as the term
plies, a relation between two alternatives, and in any one
gote there can be no more than two. Nevertheless, there are
stances in which the same unit-factor enters into heterozygous
mbination with various alternatives in different zygotes, and
ch of these may thus be in allelomorphic relation with it.
ternatives composing such a group of possibilities have been
rmed by Morgan *multiple allelomorphs*, and this expression is
mmonly adopted. Its use, however, makes the application of
e term "multiple" to "factors" in a totally different sense
probable source of confusion, and for this reason the word
mulative or some equivalent is there to be preferred as suggested
ove. The distinctions which together make up a set of multiple
elomorphs may commonly be recognised as a series of *quanti-
ive* differences, the character affected being throughout the
ies the same.

Albinism in Rabbits.—One of the most familiar illustrations
provided by the degree of albinism in rabbits. The fully albino
rm is white with pink eyes, but there is a variety called Hima-
yan, which, though born white with pink eyes, acquires some
gment in certain parts. Himalayan is dominant to albino but recessive to the ordinary coloured types. If a coloured type is bred with Himalayan the heterozygotes so raised cannot, when interbred, throw albinos, nor can heterozygotes raised from coloured x albinos throw Himalayans, even though the albino used as their parent had itself been extracted from Himalayans. The degree of albinism put in by the parents comes out in F_2 and in the same degree. Hence it is not possible from similar parents to breed all three kinds, but on the other hand, each family can contain at most two of them.

This phenomenon can be interpreted in either of two ways. The Himalayan pattern may be regarded simply as a quantitative diminution or fraction of the sum total of colour needed to make the self-coloured type. The real albino is thus produced by the absence of the whole unit needed for colour, and the Himalayan by the absence of part of this total. It is then obvious that the heterozygote, coloured x albino, could never produce a Himalayan unless the colour-complex broke up again *de novo*. But on the analogy of the behaviour of other colour patterns the self and the Himalayan might be conceived as each consisting of two units: one for colour and one a factor determining its pattern, intensity or distribution. If there were a very close linkage between each "pattern," factor and colour the observed facts could then be represented; but by continued breeding the supporters of this view would expect the missing cross-over to appear eventually as either a Himalayan associated with recessive albinos or an albino associated with recessive Himalayan. On the ground of simplicity the former view seems preferable. The significance of these two alternatives will presently appear.

Study of Grasshoppers.—More complex illustrations of these possibilities have been described by Nabours in certain grasshoppers (*Paratettix*). The species studied presents a long series of colour forms, and experimental breeding showed that with certain exceptions all the pure forms behaved as if allelomorphic to each other. In other words, whichever two pure forms *A* and *B* were crossed together, the F_1 generation was *A B*, giving in F_2 a family approximating to $1AA{:}2AB{:}1BB$. The whole series of colours is thus often described as a vast set of multiple allelomorphs. Nevertheless, there are curious features in this case which raise a doubt whether this account is really correct. Many of the distinctions are plainly *quantitative* degrees in development of some one type of coloration whch are, as might be expected, allelomorphic to each other (*cf.* the Himalayan rabbit): but among the elements comprising the total colouration of these grasshoppers there are several in which both the pigments and the positions they occupy are so distinct that the characters cannot easily be represented as determined by factors allelomorphic to each other. Only by a very loose application of the term 'colour' can the distinctions be said to apply to the same character. Hence, in this hitherto generally accepted illustration it seems probable that, in so far as the distinctions are actually quantitative differences in one respect, true allelomorphism may be recognised, but that the appearance of an allelomorphism between factors of differing scope is more probably spurious and referable to close linkage (*cf.* Haldane). No decision on this question can yet be made with any confidence.

Allelomorphic Complexes.—Among modern extensions of genetical theory none is more remarkable than the discovery that large and apparently miscellaneous groups of characters are sometimes governed by elements capable of segregating collectively as a single complex. Nevertheless, in the case of sex, we have long been familiar with one example. Since the distinction between the two sexes in many animals is known to behave in segregation as if it depended on a single Mendelian factor, we have to recognise that a number of distinctions of all kinds, structural and functional, may be treated in segregation as factorially single. In the special case of sex we know further that particular genetic elements may be detached from the complex (*e.g.*, the elements governing spur and broodiness in fowls, the beard in man, etc.), though the possible limits of such disintegration are unknown.

Oenotheras.—Renner's experiments have shown that the inheritance of the protean variations of several Oenotheras is largely effected by the transmission of similar complexes. Each of these large composite factors or groups of factors (in so far as they prove to be divisible) may govern many characters of form, colour, habit, etc., and the whole group is transmitted as a single heritable entity. Similar discoveries will probably be made in regard to other forms. The details are beyond the scope of this article, but it may be remarked that these complexes in Oenothera supply one of the most striking illustrations of the phenomenon which may be called *anisogeny* (see " Somatic Segregation," *inf.*) or the relegation of a factor or factors exclusively to one sex-side of a plant. For instance, whereas *Oenothera Lamarckiana*, the species which provided de Vries with his most celebrated but unsound evidence of mutation, can be proved to be a permanently heterozygous form having two complexes equally distributed in segregation to both the male and the female gametes, the species *biennis* and many more, though similarly heterozygotes of two complexes, in segregation pass the whole of the one complex into the male gametes and the whole of the other into the female gametes.

The question whether the apparently simple factors which commonly behave as Mendelian units are capable of further resolution is of much theoretical importance in its bearing on the problem of the nature of variation. Such a complex factor as that which determines sex may evidently break up into simpler components, but for various reasons some geneticists incline to the belief that factors in general are permanent and irresoluble. Whenever a series in F_2 derived from two clearly distinct and true-breeding types, consists of a number of intergrading forms, it is possible to interpret this result as due to the operation of a multitude of *originally* distinct factors, or to the fractionation of some one or more of them. Not very rarely in such series an extreme parental type fails to reappear at all [*e.g.*, the many-feathered tail of the fan-tail pigeon (Morgan), or the long glumes of Polish wheat from crosses with ordinary types. It is difficult to interpret the absence of the extremes simply as an indication of their statistical infrequency. The production of an innumerable series of colour-forms, as in the sweet pea, is almost certainly due to the fractionation of the colour-complex. Until systematic crossing was undertaken, the extremes existed, but the intergrades did not. So also in *Drosophila*, of which the normal eye is red, a profusion of intergrades ranging to the white eye, which was discovered first, has now appeared. Though " mutation " is involved, the essential change is probably the disintegration or fractionation of the originally integral complex.

CYTOLOGICAL INTERPRETATIONS OF GENETIC PHENOMENA

Soon after the rediscovery of Mendelian analysis the plausible suggestion was made that the behaviour of the chromosomes in the course of the maturation divisions was consistent with what might be expected if they were actually the bearers of segregable factors. Since, however, the number of segregating factors in many forms far exceeds the number of chromosomes possessed by those forms, it is clear that if the chromosomes are the carriers of factors they must be capable of carrying many. The discovery of linkage, and especially of the fact that linkage was determined by the parental associations of the factors, pointed in the same direction, for, as hinted (by Punnett) in the earlier article on Mendelism (*see* 18.115), linkage or " gametic coupling " as it was then called might not unreasonably be supposed to be based on chromosomal association. The first development of this conception was made by T. H. Morgan, whose investigations relating mainly to the fruit-fly *Drosophila*, have inaugurated a new phase in the development of genetical theory. This insect is a subject unusally favourable for experiment inasmuch as it offers a profusion of variations or " mutations," and reproduces itself with great rapidity under laboratory conditions.

The work began with the observation that the eyes, normally red, may be white, and that this variation is sex-linked, behaving genetically precisely as colour-blindness does in man. The white-eyed male mated with normal females produces offspring all normal. Of these the sons cannot transmit the abnormality at all, whereas the daughters mated with normal males transmit the white eye to half their sons. White-eyed females can only produced as daughters of white-eyed fathers and all the sons such females are white-eyed. Supposing the male to possess X-chromosome, this system of descent would be represente it were assumed that in the normal the X-chromosome carri the dominant factor for red eye (*see* SEX). The linkage with s is thus found to be an expression of the association of the t determining factors for sex and red eye in the same ch mosome.

Numerous other sex-linked characters were soon after d covered, to which the same considerations apply, all collective composing one linkage-group. The other factors identified *Drosophila*, amounting to more than a hundred, can all represented as grouped in three separate linkage-systems whi with the sex-linked group, make four; and since from cytologi observations the haploid number of chromosomes in this ani is also 4 the inference is drawn that the factors composing ea linkage-group are borne in one chromosome. Developing t conception, Morgan suggests that the factors are arranged in t chromosomes as beads on a string, each having a position norma ly fixed in relation to the rest. Crossing-over is thus represent as the consequence of an exchange of material between hom ogous pairs of chromosomes in synapsis. (*See* CYTOLOGY.)

The pairs of chromosomes which then conjugate are with mu probability regarded as respectively of maternal and patern origin. The conjugating pairs seem to twist round each othe and occasionally there is (especially in Amphibia) an appearan of anastomosis between them which is regarded as providing an exchange of material between the homologous pairs, and th for the formation of cross-overs. According as the linkage b tween two factors is more or less complete it is supposed that t distance between the position of the two factors in the chr mosome is smaller or greater, and in proportion as factors a placed close together the probability of their being separated the process of twisting and anastomosis is regarded as diminishe

The proportion of cross-overs is thus taken as a measure of t position of two factors in the chromosome. If A, B and C a three factors in the linkage group, and the closeness of the linkag between A and B and between B and C respectively be det mined experimentally, then from these two the linkage betwe A and C can be calculated, and the result of the calculation commonly found to agree with the value found experimenta for that linkage. In this way the relative " loci " of numero factors have been determined with fair consistency, and the fa that this can be done forms a strong argument for the belief th in some way at least the factors must be disposed in linear sy tems. That these systems are actually arranged along the lin of the chromosomes is as yet a matter of inference.

Attention must be called to the curious fact that in *Drosophi* crossing-over never occurs in the males in any of the four linkag systems. As in most examples of sex-linkage studies, the linka with the sex-factor is always complete; but all the other fact are liable to crossing-over in the female, though among the ma gametes the original parental combinations reappear unchange Conversely Tanaka, examining linkages in the silkworm, o served that a pair of linked factors show crossing-over in the mal but not in the female, and the two facts together suggest som limitation of crossing-over to the sex which is homozygous in s the female in Diptera, the male in Lepidoptera. The develo ment of the idea here outlined has become the subject of ve active research and is described in a copious but somewh esoteric literature, which can be followed only with difficulty b those not personally engaged in the work. That the outcome o these researches has led to a valuable codification of geneti principles is not in dispute; but until the main thesis, that th number of independent factors or of linkage-systems is neve greater than the haploid number of chromosomes, has bee shown to hold generally for animals and plants, this account o the nature of linkage, though probable, cannot be regarded a proved. The defect of the theory at the present time is that i rests on many subordinate hypotheses which are not all capabl of independent verification.

he position of the factors, for example, is believed to be liable changes due to the action of other factors, the effects of age l miscellaneous influences difficult to distinguish. Errors of -division long regarded as the most probable source of varia- n, may also cause disturbance. In two very remarkable in- nces it has been found possible to connect a disturbance in the mal course of heredity with a visible cytological irregularity— ied by Bridges "non-disjunction." In a certain family he ob- ved that a sex-linked character failed to follow its normal dis- ution to the sexes, and he was able to find that in this family sex-chromosomes showed corresponding irregularities. In he obtained similar evidence in regard to the fourth chromo- ne and the group of genes attributed to it. Thus a definite ociation between particular chromosomes and the transferable tors must certainly exist.

iant Forms.—The interrelation of genetical and cytological enomena is further illustrated by the behaviour of "Giant ms." This name is applied to certain varieties (chiefly of nts) in which the haploid and diploid numbers of chromo- nes are double those of normal forms. R. P. Gregory bred h varieties of *Primula sinensis* and found that in respect of ious allelomorphs they might be quadripartite and not merely artite as the normals are. A plant, for example, might be *RR* in colour or leaf-shape, and in consequence of the extra essive elements, not distinguishable from the ordinary re- sive, though in fact capable of throwing a small proportion of minants. Since recent cytological studies have shown that ies of allied forms may contain various multiples of the lowest ploid number (Chrysanthemum, for instance, having 9, 18, 27, or 45) various extensions on these lines may be expected.

omatic Segregation.—In the genetics of plants a number of enomena have been encountered which are difficult to reconcile h the view, otherwise not unacceptable, that the distribution the factors occurs exclusively in the maturation processes of germ-cells. Apart from certain special conditions best known variegated plants (which are sometimes irregular mosaics and netimes consist of an outer "skin" and an inner "core," similar in their genetical potentialities) there are many plants which the distribution of factors must have been laid down ore the formation of germ-cells. E. R. Saunders's results proved t in certain stocks (*Matthiola*) the pollen all carried double- s though the ovules were mixed in character, single and double. Pellew showed that in the hermaphrodite *Campanula car- ica* "pelviformis" the pollen bore exclusively femaleness and ponderantly white flower-colour (the plant being hetero- gous for blue). The pollen of *Begonia Davisii* (a wild species th single flowers) carries doubleness exclusively, and several nilar examples are known, in all of which the segregation of aracters must precede the maturation of the germ-cells. Thus, ile it is not a question that segregation depends on some cell- ision, and very possibly on a differentiation of the chromo- nes, there is evidence that the cell-division in which this dif- entiation occurs must at least sometimes precede germ-forma- n. As mentioned, in *Oenothera* this "anisogenous" distribu- n is exceptionally frequent.

Bearing on Evolutionary Theory.—This aspect of genetics can ly be briefly treated here (*see* also MENDELISM). Genetic alysis has shown that the appearance of variability as a con- nporary and widespread phenomenon is largely illusory. On dying a variable species critically it is found that the various ms cannot all produce each other as was formerly assumed, t that they stand in a regular descending order, being terms in series of combinations of definite factors. Such series are no idence of contemporary variability. Many of the terms can separated in the homozygous condition, and thereafter may ed perfectly true. Even such an appearance of variability as at seen in polymorphic species is frequently not above sus- ion of being the consequences of a cross, more or less remote. ntemporary variation certainly may occur; but of the con- nporary origination of new species, or of the occurrence of etic changes which can be colourably interpreted as likely to d to the production of incipient species in a strict sense, no indication has been found. That the forms of life have been evolved from dissimilar precedent forms we know from the geological record, but as to the process by which this evolution has come to pass we are still in ignorance. All that can be said at present is that variation most commonly arises as an error of cell-division, and that it is quite conceivable that new species have so arisen.

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GENEVA, Switzerland (*see* 11.587), had in 1920 a population of 135,059, including suburban districts. In the city proper it was 56,292. Geneva has been much changed in recent years, a large number of public and private buildings having been erected. The manufacture of motor-cars is a new industry, but it is as much an educational and intellectual centre as in the past. An historical and art museum was opened in the Boulevard Helvetique in 1919, and various collections of arms, pottery, coins, pictures, etc., including those from the Arsenal and the Musée Rath, have been brought together there. The Musée Rath, which was the International Prisoners of War Bureau during the World War, is now used for exhibitions. The imposing Electoral Palace was rebuilt with a large hall in 1913–6. A bridge to carry a loop line between the two railway stations has been thrown across the Rhone below the junction with the Arve. A Reformation monument, begun in 1909 on the 400th anniversary of Calvin's birth, was unveiled in 1917; it represents a stretch of rampart, the wall of Geneva with a narrow moat in front. In the centre are colossal figures of Calvin and others, with statues on each side of eminent champions of the Reformation, and bas-reliefs and monumental inscriptions between.

Geneva was chosen in 1919 as the seat of the League of Nations. The Assembly met first in 1920 in the Hall of the Reformation, built by public subscription in memory of Calvin, near the Grand Quay. The league secretariat is housed in the Palace of the Nations, formerly a hotel, beyond the Jetée des Pâques. In Dec. 1925 this building was put up for sale, but as there were no buyers it was decided to retain it for the use of the league. A tablet in memory of President Wilson was placed on the terrace wall in 1924. The International Labour Organisation was housed at first near the Ariana Museum, but for it a new building has been erected near Parc Mon Répos. The office of the International Red Cross is in the Rue de la Promenade du Pin, in the southeast part of Geneva.

GENOA (*see* 11.597), the chief port of Italy and capital of the province of Genoa, had a population of 316,217 in the municipal area of about 12 sq. m. in 1921. The industrial quarter of San Pier d'Arena on the west is now joined to Genoa, and there is a growing residential quarter beyond the Torente Bisagno to the southeast, to which the Via Venti Settembre gives direct access. Large buildings include the imposing Banca d'Italia in the Via Dante, and a building containing the bourse, the post office and a theatre in Piazza de Ferrari. The improvement of this piazza, the central square, was begun in 1913; blocks of houses have been demolished, and the area opened up. The historic Palazzo San Giorgio has undergone complete restoration, and is now the headquarters of the harbour board. A fine new sea front, the Corso d'Italia, adds considerably to the attractiveness of the new residential quarter. During the present century suburbs have arisen on the higher ground, and the Via di Circomvallazione a Monte has been laid out over the hills behind the city.

The tonnage of the port is growing, and is considerably higher than that of any other in Italy, representing almost one-fifth of the total tonnage of the country. Exports are on an average hardly an eighth of the imports, which are chiefly coal and cereals, and the marked drop which began in 1917 was due mainly to the decrease in coal. The doubling of the railway track to Pisa and the development of the stations at San Pier d'Arena and at Genoa Brignole, about two m. east of the principal station, with the extension of electric power to the main line towards Turin and along the coastal line, have improved the port's facilities. A scheme for the extension of the harbour, taken in hand in 1922, included the new Vittorio Emanuele and San Pier d'Arena basins. Shipbuilding is increasing in importance, and there is a considerable motor car industry; the manufacture of hats is also a growing trade.

GENOA, CONFERENCE OF, (April 10–May 19 1922,) a meeting of representatives of the British self-governing Dominions and of 29 European states, including not only the Allies and ex-neutrals, but all the ex-enemy Powers except Turkey (who was excluded on the ground that she was an Asiatic country). Above all, the conference was attended by representatives of Soviet Russia, and the dominant issue was the renewal of relations between Russia and the countries of Europe. The principal result achieved, however, was one which the organisers of the conference had not intended, namely, the signature at Rapallo, on April 16 1922, of a separate treaty between Soviet Russia and Germany.

The prospects of the Genoa conference had been somewhat clouded, before it assembled, by the wave of anti-Liberal feeling in France, which declared itself politically in the superseding of M. Briand by M. Poincaré as Prime Minister. Since the project of the Genoa conference had already been accepted by the Supreme Council, including the representative of France, before M. Poincaré came into power, he could not reject it altogether, but he took every possible step to interpret the agreed programme in the narrowest sense, and to hedge the participation of Russia with the fullest possible restrictions. He refrained from attending the conference but enforced his policy by giving detailed and stringent instructions to his representative, M. Barthou.

The general conference was preceded by a meeting between M. Poincaré and Mr. Lloyd George at Boulogne on Feb. 25, a meeting of Allied economic experts in London from March 20 to 28 which drew up detailed agenda for Genoa, and two other preliminary meetings of a regional character, one between the members of the Little Entente at Belgrade, and another at Warsaw between Poland, Latvia, Estonia and Finland. The parties represented at Warsaw subsequently conferred at Riga with representatives of Soviet Russia. The invitation to Genoa was accepted by the Soviet Govt. with alacrity, but was declined by the United States.

Adverse Influence of the Rapallo Treaty.—At its first plenary session the conference set up four commissions, the first to examine methods of putting into practice the principles of the Cannes' resolution of Jan. 6 1922 (*see* CANNES, CONFERENCE OF), while the other three were to deal respectively with financial subjects, economic and commercial subjects and transport. These th latter commissions, which were concerned with technical qu tions, all reported before the conference came to an end; but th reports were bound to remain academic unless the first co mission achieved positive results. The task of the first comn sion was more difficult, because it was general and politica character, and its work was soon suspended in favour of infor discussions between the three principal Allied Powers a Belgium on the one side, and the Russians on the other. T Germans, who felt themselves left out in the cold, retorted negotiating their separate treaty with the Russians at Rapa in which, at least on paper, the objects of the Genoa confere were achieved as between these two parties by a mutual nunciation of reparation claims and a resumption of normal c sular and diplomatic relations.

However, this separate Russo-German treaty damaged t general prospects of the conference by the shock which it ga to the Allies, and especially to Belgium and France, who, e since the Armistice, had been oppressed by the nightmare o military alliance between Germany and Russia. The Rapa treaty seemed like a first step in this direction, even though t published text contained no military clauses, and the All addressed a series of acrimonious though ineffective notes on t subject to the German delegation. In these circumstances the was little prospect of success for a general pact of non-aggressi which Mr. Lloyd George suggested on April 25. Meanwhile the very first session, M. Barthou had had a hostile encount with the principal Russian delegate, M. Chicherin; but the co ference actually broke down through the intransigence of B gium. When an attempt was made to secure a common draft proposals to be presented by the European delegates to t Russians, the Belgians insisted upon the integral restitution foreign-owned private property in Russia. M. Barthou su ported the Belgian contention, and was himself supported in th attitude by M. Poincaré. Eventually a formula on the Briti lines was carried over M. Barthou's head, even Belgium final giving way, but it was so evident that, with Great Britain a France divided, no positive result could be achieved, that t Genoa conference was quietly wound up by remitting its agen to a mixed commission of experts. This conference of exper duly met at the Hague from June 26 to July 20 1922, but foundered, like the Genoa conference, on the rock of foreig owned private property in Russia, in regard to which the Russia and the Franco-Belgian views again proved incompatible.

The Reconstruction Standpoint.—Although the Genoa confe ence led to no positive results, it was interesting as the first ge eral European conference after the War of 1914–8, and becau economic and financial problems were approached from the poi of view of reconstruction, and not of reparation. It was als interesting as the first attempt at a settlement between th European governments and Soviet Russia. At Genoa the diff culties which proved crucial on later occasions were alread encountered. (A. J. T.)

GENTILE, GIOVANNI (1875–), Italian philosopher an politician, was born at Castelvetrano (Trapani) May 29 187 He studied literature and philosophy at the University of Pa lermo, and after a series of university appointments became i 1918 professor of the history of philosophy in the University o Rome where he founded and became director of the school o philosophy. Two years later he founded the *Giornale critico dell filosofia italiana.* Created a Senator in 1918, he supported th Fascist movement from its beginnings, and when Mussolini Govt. came into power, Gentile was appointed Minister of Edu cation. He was then a Liberal, but subsequently joined th Fascist party, of which he became a prominent member. As Min ister of Education he carried out an organic reform of the Italia educational system, abolished the traditional shibboleths positivist and materialist teaching, and suppressed many inve erate abuses. He introduced the system of state examination and also the teaching of religion into the elementary schools The universities wholly maintained by the State were limited t 10, while others, maintained privately or by local administra ns. received state subsidies if they complied with certain ndards. Among Gentile's numerous works are: *Il modernismo rapporti tra religione e filosofia* (1909), *I problemi della scol- ca e il pensiero italiano* (1913), *I fondamenti della filosofia diritto* (1917), *Le origini della filosofia contemporanea in Italia* vol., 1917–23), *Il Problema scolastico del dopo guerra* (1920), *Riforma dell' educazione* (1920), *Il Fascismo al governo della ola* (1924), *Che cosa e il fascismo* (1925), etc.

EODESY (*see* 11.607 and 8.801).—The geoid is the surface which ncides with the ocean surfaces and their hypothetical continu- ons inland in imaginary channels; all tidal movement being sidered suppressed. The study of the form of the geoid, fre- ently referred to as the "Figure of the Earth," is a main ob- t of geodesy. It has been prosecuted by various agencies in arated portions of the land areas. Even in 1926 only a small ction of the total area of the globe has been examined.

uch results as have been obtained may be co-ordinated by assumption that the geoid does not differ greatly from a eroid (ellipsoid of revolution); and the assumption of an ellip- d of three unequal axes is not at present considered useful. etermination of the Figure of the Earth" may be used con- iently in the restricted sense of determination of the elements the most suitable spheroid; while the science of geodesy em- ces further the study of the actual geoidal form in detail, l even the explanation of this form.

igures of the Earth.—During the progress of the science and growth of observation results, various figures of the earth ve been obtained. Each Survey department has made use of t figure which at the time seemed best. A variety of spheroids now in use as reference figures, on which the calculations of corresponding surveys are based. There is growing inconven- ce in this, and it would be ideal if all the separate geodetic veys could express their results in terms of a single spheroid. hough there are technical difficulties in the relation of the gins of separate surveys to any unique spheroid, it was none less decided at the meeting of the International Union of odesy and Geophysics at Madrid in 1924 that one spheroid uld be internationalised and that, so far as practicable, results uld be expressed in terms of it. The International Spheroid hat determined by J. F. Hayford in 1909.[1]

quatorial radius	6,378,388 ± 18 metres
eciprocal of flattening	297·0 ± 0·5
olar semi-diameter	6,356,909 metres

he above figures were derived from observations made in the .A. only; and the introduction of the principle of isostasy (*q.v.*) the novel feature of the work. Remembering that the entire .A. area of 3,026,789 sq. m. is but 1/66th of the entire earth's a, 197,000,000 sq. m., some doubt might be felt as to their univer- applicability and their stated probable errors. An independent sideration by Helmert[2] of Hayford's figures yielded probable ors ± 35 metres and ± 0·8. Further, Helmert[3] in 1915, from a cussion of numerous gravity results from places scattered over globe found 1/296·7 ± 0·6 for the flattening, which is a very strong roboration of Hayford's value.

The Reference Spheroid.—That the geoid should be a spheroid s a very plausible conjecture; for a spheroid is a possible indary for a rotating gravitating fluid mass—the flattening ending on the internal density distribution. When a solid ss is considered in place of a fluid mass some modification the resultant form may be expected; at the same time the elopment of isostasy supports the view that the earth be- ves in many respects as though it were viscous, tending to the m it would assume if fluid. However, long before such evi- ice became available, it was tacitly assumed that the geoid s actually a spheroid. Nineteenth century observations were uced by Clarke and others, treating any discrepancies from eroidal form as due to observation error. This was justifiable en data were scant, and the instruments, with which they had n obtained, were of poor precision.

More recent data from greatly improved instruments, how- r, leave no room for doubt that there are measurable differences between the geoid and any adopted spheroid. Geodesists study the actual form of the geoid, expressing it with reference to a spheroid, which is accordingly named the "reference spheroid." When the reference spheroid is in close correspondence with the geoid, the mutual separation is small at all points. This facilitates many computations: for some purposes observed horizontal angles, which are geoidal angles, may be treated as spheroidal angles: as has practically always been done, though in a few cases small correction was really necessary.

The General Origin.—Suppose that the geoidal form were known throughout, and apply to this the international (or any other) spheroid. How is the latter to be orientated? The minor axis of the spheroid may be set parallel to the actual axis of rotation of the earth, whose direction is known unequivocally to the precision of astronomical telescopes. This answers the question of orientation. The location of the spheroid remains at choice. Any point on the spheroid may be brought into coincidence with corresponding point on the geoid; but *only one point can be so treated*, which may be called the "general origin." When this has been done, some portions of the geoid will lie without the spheroid, and other portions will lie within. The two surfaces will intersect in a number of closed curves, on one of which will lie the general origin. The normals to the geoid—verticals—will not coincide with the corresponding normals to the spheroid except at points along certain closed curves, quite distinct from the curves of intersection of the two surfaces. The form of these curves will change if the general origin is changed. The inclination of geoidal and spheroidal normals at corresponding points is what has generally been called the "deflection of the plumb-line." It will be clear now that the deflection of the plumb-line at a point depends on the choice of spheroid of reference and of general origin. It is not an absolute quantity, but dependent on the reference system. When this latter has been selected, there is a unique value of the deflection at any point which has been geodetically connected with the origin. In practice, however, it is necessary to assume separate origins for each detached survey, and accordingly the deflections of surveys on separate origins cannot be regarded as absolute quantities. In this respect the international spheroid cannot be considered as unique as yet.

The Selected Figure.—Meanwhile the study of the geoid in each detached survey may be continued. At any point of the earth's surface, astronomical observations combined with W.T. signals enable both latitude and longitude to be uniquely determined, independently of any assumed reference figure. A number of such points are connected by linear measure and triangulation, and values, called geodetic, of latitude and longitude are computed *on the selected figure*. The differences of astronomic and geodetic values are the deflection components. If these are sufficiently numerous—which may be judged by the smoothness of deflection variation—the separation of the geoid and spheroid can be integrated.

An alternative method of finding this separation is based on the measurement of vertical angles between the triangulation stations combined with spirit levelling and deflection results.

The observed vertical angles are reduced to the spheroidal vertical by application of the appropriate deflections. If the terrestrial refraction[4, 9b], of each ray is computed, it becomes merely a geometrical problem to calculate the differential *spheroidal* heights. Spirit levelling, which with its short rays intimately follows the geoidal surface, yields the *geoidal* heights. Both spheroidal and geoidal heights are thus known, and hence the separation of geoid from spheroid.

Ordinary triangulated heights, uncorrected for the deflection, are not the same as spirit levelled heights, apart from the question of precision; and they certainly are not geoidal heights. Geoidal heights are what enter into practical problems; but from the geodesist's point of view they do not mean much until the form of the geoid, to which they refer, has been determined.

Base Line Measurements.—Modern bases are measured with wires hanging in catenary under constant tension, a system introduced by E. Jäderin of Stockholm. His original plan was to use two wires having different expansion coefficients, whence the temperature could be determined and the necessary corrections applied. With Guillaume's invention of "Invar" this became unnecessary.

A bright wire of small gauge (1·65 mm. is the usual diameter) is not much affected by the sun's radiant heat, and so its temperature does not differ much from that of the air. With the low expansion coefficient of invar, $4\text{x}10^{-7}$ per degree Centigrade, an error of 2°·5 causes an error in length of only 1 in 10^6. The method of using invar

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Figures throughout the text refer to notes at the end of the cle.

wires has been closely studied by Benoit and Guillaume[5] and their procedure may be confidently followed. It is vastly simpler than the old methods with compensated bars and is also much more accurate; further, much rougher country can be negotiated and so, longer bases become possible.

For the standardisation of wires at the observatory, before and after the measurement of the base, different methods of laying out a length of 24 metres, which is the usual length of the wires, have been employed. An apparatus designed by Sir David Gill for India was fully described in *Engineering* 1915. The ultimate standard of length in this is a nickel bar of H section, one metre long. Standards for ordinary use are H bars of invar, one metre and four metres in length. Invar has been observed to undergo a secular change in length which continues for many years. Investigating this, Guillaume found that the instability is due to the presence of carbon which gradually forms cementite, Fe_3C, with the iron. The addition of chromium, which has a greater affinity for carbon than iron has, prevents this and an invar with ten-fold increased stability has been produced.

Triangulation.—Theodolites with circles of 12 or 10 in. are usually employed for the highest class geodetic triangulation. Mr. Connolly of the India Stores Department considers even that the fullest instrumental accuracy can be incorporated in an 8-in. theodolite fitted with a large objective telescope. Luminous signals, heliotropes by day and lamps by night, are essential. Vertical angles should be taken between 1 and 3:30 P.M., when the refraction is usually a minimum and most regular. None the less there is frequently at this time poor definition, and horizontal angles should be observed at night or by day within three hours of sunrise or sunset.

Control.—Triangulation emanating from a fixed point with observed base and azimuth yields positions of all stations and lengths and azimuths of all sides. Errors are unavoidably generated. Their probable amounts are given by the formulae of de Graaff Hunter[6] now indicated.

These involve the quantity $M=(1+f)m\sqrt{18/l}$, in which l is the average length of side; m (Ferrero's error of mean square of an angle) $=\sqrt{\Sigma(\Delta^2/3n)}$, where Δ is the triangular error and n is the number of triangles; and f, which lies between 0 and 1/6, depends on the type of figures in the series. Further, if O is the starting point and A the station at which errors are sought: R=OA and S=curved distance, OA measured medially through the series, both expressed in units of 100 miles, then P.E. in seconds of azimuth at $A=1\cdot''575\sqrt{\Sigma M^2S}$, P. E. in 7th figure of log. side at $A=33\cdot2\sqrt{\Sigma M^2S}$, P. E. in feet in northing or easting at $A=4\cdot03\sqrt{\Sigma(M^2\int R^2dS)}$.
The summation Σ is in each case for a set of series for which values of M differ.

The first two of these formulae give the means of determining at what intervals control of triangulation is desirable. Clearly an extra base will control the error developed in side length: to control the azimuth it is necessary to form a Laplace point, at which azimuth and longitude are determined astronomically. A numerical example will illustrate the method. It is desirable to introduce a control when the P.E. attains 3 times the error of the control. Two bases are involved, one at each end. If the P.E. of a base is 1 in 10^6 then the P.E. of the control is $\sqrt{2}$ in 10^6. The P.E. of side reaches thrice this amount when $33\cdot2M\sqrt{S}=3\sqrt{2}\cdot10^7\log.(1+10^{-6})$. Taking $M=0\cdot2$, corresponding to very high class triangulation, we find S is 772 miles.

Next, if ΔA, ΔA_o are differences astronomic minus geodetic azimuths; L, L_o, λ, λ_o triangulated values of longitude and latitude of A and O, and T the difference between the local times at A and O, then Laplace's equation is

$$\Delta A_o\text{cosec}\lambda_o-\Delta A\text{cosec}\lambda=(L-L_o)-15T$$

which serves to determine ΔA, a quantity to be subtracted from the astronomic azimuth to give the correct geodetic azimuth. The P.E. of an astronomic azimuth is taken as $0''\cdot2$ for high class work; that of T as $0^s\cdot03$. Hence the P.E. in azimuth determined from Laplace's equation is

$$\sqrt{[(0\cdot2\sin\lambda\ \text{cosec}\ \lambda_o)^2+(0\cdot2)^2+(0\cdot45\sin\lambda)^2]}$$

If we take $\lambda=\lambda_o=45°$ this become $0''\cdot42$ and $1\cdot575\times0\cdot2\sqrt{S}=3\times0\cdot42$, whence S is 1600 miles. If the time error could be reduced to $0^s\cdot01$ the value of S would be almost halved and the precision of azimuth would be about the same as that of side control. It is to be pointed out that there is little gain in controlling the side length with great accuracy while the equally important azimuth control is much less precise. Hitherto the ruling criterion has been that of azimuth. The conclusion is that until time observations are more precise, the highest class triangulation is not likely to be much improved by the controls available unless its extent is considerably greater than 1,000 miles.

Determinations of Height.—The precision of spirit levelli is so great as to justify the recognition of the lack of parallelis of the various level surfaces, each of which is approximat spheroidal. It is nowadays customary in levelling of high p cision to apply to the observed differences of height the corr tion[7,8], for the convergence of these surfaces, that is to sa the orthometric correction; and to publish the orthomet heights. As regards differences of height found by triangulati much improvement is called for. Observed vertical angles are ferred to the local geoidal vertical; they require correction to t reference spheroid vertical, as well as for refraction, after whi the height differences can easily be calculated.

Refraction.—When reciprocal observations have been made two points A_1, A_2, if E_1, ω_1, δ_1 are respectively the angle of elev tion, the refraction and the deflection at A_1 towards A_2, a similarly with changed suffixes for A_2, then

$$E_1+\delta_1-\omega_1+E_2+\delta_2-\omega_2+C=0,$$

C being the angle between spheroidal verticals at A_1, A_2, co puted from the triangulation. The ordinary practice is to igno δ_1 and δ_2 and to assume that $\omega_1=\omega_2=\Omega$; whence $2\Omega=E_1+E_2+$ The ratio $\Omega/C=k$ has been called the coefficient of refractio and as $k=\frac{1}{2}\left(1+\frac{E_1+E_2}{C}\right)$ it can be computed when a ray h been observed at both ends.

There are cases when $\delta_1+\delta_2$ is by no means negligible in co parison with $\omega_1+\omega_2$; moreover there is little justification for t assumption $\omega_1=\omega_2$, unless the two stations are at the same heigh

Refraction has a diurnal change, falling to a minimum about t time of maximum temperature, moreover the value of the minimu is pretty constant from day to day. It is in this constancy that l the value of observing vertical angles between the hours of 1 a 3:30 P.M. Consideration[4,9b] of the physical laws leads to a formu which represents the refraction usually met with at these hour At other hours the refraction is ordinarily larger by an amount whi varies as the defect of temperature from maximum and as the cos cant of the angle of elevation of the ray. The physical cause[10] is t the temperature lapse-rate is nearly constant within the hei limits of the ray, and does not vary much during the day exce comparatively close to the ground. The refractive effect of a pla stratum of air close to the ground can be expressed in terms of t air densities of its upper and lower surfaces. Some confirmation this view is obtained by considering barometric height reading Further research is required, and more observations, with f particulars of local deflection, are needed for investigation. In cas where the data are complete, the refraction does not appear so i tractable as has generally been supposed.

Astronomical Latitudes.—For the observation for latitu the zenith telescope and the Talcott-Horrebow method seem to have superseded all others (*see* 11.610); but the method equal altitudes is worthy of attention. Several special instruments have been designed for this observation, all of whi determine latitude and time simultaneously; whereby in association with wireless time signals, deflection in both meridian a prime vertical can be found.

The prismatic astrolabe of MM. Claude and Driencourt,[11, 12,] which is made in two sizes, has a horizontal telescope with equilateral prism mounted in front of the objective. The edges the prism are horizontal, and one face, that nearest to the objecti is vertical. A mercury bath is suitably placed below and slightly front of the prism. Light from a star of approximately 60° altitu falls normally on the upper face of the prism, and is reflected internally at the lower face towards the lower half of the objective. the same time light from the same star falls on the mercury, is flected into the prism through the lower face, then internally at t upper face, and so to the upper half of the objective. In both cas after reaching the objective, the light is brought to a focus and t images of the star are formed. These approach one another, and t instant at which they pass is timed—this instant corresponding t fixed altitude depending on the angle of the prism, imperfection i the focus of the telescope and the refraction. The actual altitude usually regarded as an unknown; corrected for refraction it should b a constant for one instrument.

Provisional values for this, for the latitude and for the time bein assumed, the result of one observation can be plotted as a straight lin on a chart with time and $\lambda\sec\lambda$ as co-ordinates. Four stars, on in each quadrant, form a set of observations and yield four such line which should touch a circle of radius equal to the discrepancy of th altitude from that provisionally assumed, both multiplied by cos λ. The co-ordinates of the centre of this circle represent the time an latitude sought, and the constancy of its radius is a measure of pre-of the observation. If there is too much wind the partially ed mercury surface is disturbed, and observation becomes im- le. The adjustments are very simple, as is also the observation the observer is practised; and there is practically no recording. utations and preparation of star programme are not excessive. lent results have been obtained with this instrument. In iscussion of a paper[14] Jackson stated that the images are ated, being in reality short spectra; so that stars of different r would give different results. Other users of the astrolabe have und this to be appreciable. Practical drawbacks are that each ields only one observation and that the time estimate is bur- by personality. To overcome the latter L. Favé[15] described ment to measure the personal equation, but up to 1925 this t proved completely successful.

alternative instrument, free from two of the above noted tions is the Circumzenithal Apparatus of MM. Nusl and Fric.[16] is the light from the star enters the instrument through llel plate of glass and falls on a half silvered mirror, being split wo portions. One portion proceeds to a mercury bath, and reflection there and at a second mirror passes again through the ilvered mirror. Thence both portions enter the observing tele- . The mercury is completely screened from the wind. By s of an achromatic reversible prism placed in front of the plate ich light enters the instrument, a star can be observed at three ly different altitudes. An additional interior prism in front of bjective, which causes the formation of four images, allows 7 vations to be made on the same star at each altitude.

imple bent telescope, in which reflection occurs at a mercury has been designed and used by de la Baume Pluvinal. Ob- g 10 stars on the same evening at the Paris Observatory, he ob- values of latitude and longitude differing by $0''\cdot2$ and $0^s\cdot03$ the well established observatory values.

Egypt, Wade has employed a simple method[17] of finding ential latitudes at places a few hundred metres apart.

ngitudes.—Several of the large wireless stations send out al time signals, which can be picked up at very great dis- s by suitable apparatus. These provide a basis for longitude mination when the local time has been observed.

e very powerful station at Bordeaux is an example; and the e times of the signals are determined by the "Service Horaire bservatoire de Paris." The signals are of the "rhythmic" in which 300 dots are sent out uniformly spaced over 293 ds. At the end of the set the precise times of those of the us day are signalled. Very precise comparison can be made by at what exact seconds the incoming signals coincide with the of the observer's clock: alternatively, when a recording er is used, all the 300 dots are recorded and subsequently red. Owing to the time of duration of the signals and of the beats not being precisely equal, there is some personality in timate of instant of coincidence. To obviate this Thrum[18] d a method in which the incoming signals and those of the extinguish one another in the telephone when they overlap. ence of opinion exists as to whether the registration or the on method is the more precise.

ne signals have been picked up at several of the larger observa- day by day for years. Sampson[19] pointed out and dis- serious discrepancies of the order of $0^s\cdot1$ in the relative times. omplete explanation is still to be found. On the other hand ude circuits recently formed by the U.S.C. and G.S. are stated ve closing errors of the order of $0^s\cdot01$, suggesting that field in- ents and conditions are superior to the large instruments and tions at the fixed observatories.

orld project of longitude was put forward by General Ferrié in A mixed commission of the International Unions of Astronomy f Geodesy and Geophysics was formed, and the project has discussed at Rome, 1922, Madrid, 1924, and Cambridge, 1925. ls have been advanced sufficiently for a decision to execute the e in 1926 to be arrived at. It is hoped to fix very accurately ngitude of numerous points over the earth, thus helping to dinate geodetic surveys. At the same time much experience in ghest precision work of this nature will be obtained. A com- nsive account of clock and wireless installations for this pur- s given by the Bureau des Longitudes.[20]

vity.—The absence of means of measuring the "sway" xure of the stand of pendulum apparatus was perhaps the pal cause of uncertainty in the older pendulum observa- Two methods have been devised and used for a number rs; and a further advance in eliminating the effect of sway een made by Vening Meinesz.

he two methods referred to, one is in vogue in the U.S. and ts in actually measuring the movement of the stand by aid of terferometer.[20a] It is claimed that the error in "g" from termination rarely exceeds 2 in 10^7. The other method, due to ann,[21] provides a means of mounting a second pendulum same stand. The first pendulum is set swinging, and from time to time the amplitude of the second pendulum, originally at rest, is noted. Formulae expressing the effect of sway in terms of oscillations are given. The precision appears to be much the same as that of the first method. Both of these methods regard the sway as a constant during the course of the observations at a station, lasting perhaps three days.

Vening Meinesz[22, 23, 24], solves the problem more completely, and also overcomes the effects of earth movements by always employing simultaneously two isochronous pendulums. These are mounted on one stand so that the distance between their points of support is invariable, and are set swinging in different phases. Denoting the angles of elongation by θ_1, θ_2 then the angle $\theta_1-\theta_2$ may be regarded as the angle of elongation of a hypothetical pendulum which is free from the effects of sway; as also of various irregular perturbations. So far is this the case that apparatus so arranged has been used for determining gravity at sea in a submarine; and determinations have been made in Holland in places where the ground is very unstable. Observation is much as usual in pendulum work, the ray of light passing from the mirror of the first pendulum to that of the second and thereby recording the differential angular movement of the two.

In consideration of its success at sea, Vening Meinesz's method supersedes the earlier work of Hecker and Duffield[25] with hypsometers and barometers. The possibilities opened up are very extensive. Helmert's formula of 1901 has been used widely in pendulum work. It is

$$g_0=978\cdot030\,(1+0\cdot005302\sin^2\lambda-0\cdot000007\sin^2 2\lambda),$$

λ being the latitude. Bowie,[26] p. 196, taking isostasy into account, found 978·039 as the equatorial value, and ·005294 as the coefficient of $\sin^2\lambda$, while Couchman[27] found Helmert's value too small by ·011 in the case of Indian stations.

In 1915 Helmert[3] gave a formula involving the longitude L,

$$=978\cdot052\,(1+\cdot005285\pm7\sin^2\lambda-\cdot000007\sin^2 2\lambda$$
$$+\cdot000018\pm4\cos^2\lambda\cos 2(L+17^\circ\pm6)$$

This is based on 3,000 stations reduced by Borass. It implies an elliptic equator with major axis in 17° W. longitude, whose half length is 230 metres greater than the semi-minor axis—compare Clarke's 3-axial figure results, with 8° 15′ W. as the longitude and 465 metres excess length of the semi-major axis.

The Eötvos Gravity Torsion Balance[28] measures the rate of change of gravity. The change per cm. along meridian given by the formula is $8\cdot1\times10^9$ C.G.S. units in latitude 45°; and as the instrument is incredibly sensitive, it is capable of measuring 1×10^9 and less, and easily detects irregularities. Nowadays it is used in prospecting for oil. (*See* GEOLOGY; ISOSTASY.)

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GEOGRAPHY (*see* 11.619).—The advance of geography as a subject of scientific study and research in fields other than that of exploration of untrodden ways is largely due to a change in the spirit of the times, which, from a vivid realisation of man's power over nature through his invention of mechanical power-schemes, has swung across to a deep sense of the play of dimly apprehended physical and social influences, which need study for men's sakes.

Within the scientific geographical field special credit must be given to the pioneering work of Réclus in France, to Ratzel and von Richthofen among others in Germany, to Vidal de la Blache and E. de Margerie and their schools in France, to W. M. Davis and others in the United States of America and to A. J. Herbertson in England. The geographer explores the earth and hands over to many specialists the tasks of analyses of geological, meteorological and other data, but he keeps the duty of building up more and more synthetic pictures of the various regions of the world, and he does this especially by studies of the conclusions of structural, physiographical, climatological and biological specialists, and by institution of comparisons of the interrelations of these conclusions as they affect every part of the world. Alongside of this he seeks "exact and organised knowledge of the distribution of phenomena on the earth's surface."

Natural Regions.—He is thus concerned to gain on the one hand general distributional knowledge, and on the other hand synthetic regional vision, the view of interrelations of specialist conclusions with reference to a region. The latter task involves the former, for it is through an appreciation of coincidences of distribution that we are able, scientifically, to recognise a region in geography. Herbertson gave notable service in this direction, for he saw the world as composed of a number of major natural regions within each of which there reigned, for him, partial uniformities of structure, drainage, climate and ecology. Though the progress of knowledge may well alter the relative weights given to different groups of facts, and may thus lead to schemes of natural regions that diverge from Herbertson's, the basic idea, for which he was largely responsible, maintains and develops itself. His major natural regions are, inevitably, almost entirely climatic, and here the problem is relatively simple if we allow enough for transition zones. When the subdivision of major regions is discussed, divergence of view is usually developed, as so much depends on the subjects of election of the disputants.

Physical Geography.—The older form of study of physical features of the earth's surface reviewed matters such as denudation by rain and rivers, coast erosion and deposition of materials, and endeavoured to find types of various natural processes. This type of work has continued, and Dr. Vaughan Cornish has contributed especially to the study of waves. Another physical study has received a great impetus from the publication of E. Suess' masterpiece *Das Antlitz der Erde* (1883–1909). This work, made possible by the researches on mountain structure pioneered for Britain by C. Lapworth, Peach and Horne, gave a glimpse of order, of pattern, in the physique of a country, and turned studies of physical geography in a regional direction, for it was now possible in a far more real sense than previously to see how physical features had come to be as they are. The trend in this direction was encouraged by the prevalence of evolutionary thought at the time. Few fields of research have yielded such harvests in the last generation as have been reaped by the geomorphologists, students of the regional history of the earth's physical features, and advance continues rapid for Wegener's views; and Argand's ideas on the evolution of the mou systems of the northern hemisphere through northward dr Africa, Arabia and the Deccan are valuable as aids to tho whether they themselves stand or fall (*see* GEOLOGY).

Geomorphology.—To geographers, whose business is the thetic picture of a region, the conclusions of geomorpholog of the first importance, for in no other way, save by the stu geomorphology, is it practicable to gain a vivid and underst ing view of the physical features of a region studied. Wit help of geomorphology the physical map becomes a palim in which we decipher numerous superposed patterns of hil valley lines, of basins and domes, of scarps and plains, an superposition of patterns indicates the course of their evolu

Mention should be made, incidentally, of the progre knowledge as to the general factors of the surface history o earth since Fisher's *Physics of the Earth's Crust* appeared in The recent outstanding contributions have been Hayf theory of isostasy (*q.v.*) and Joly's boldly interesting speculat These researches are bringing with them a vision of law order in the formation and evolution of characters of the n regions of the earth's surface of both land and water.

To the work of Suess are naturally related the studies of reefs and their origins initiated by Darwin, and continue many workers. Deperet has studied the ordering of coastal races around the Mediterranean, and a body of knowled coastal plateaus and of their relation to fluvial and fluviogl terraces is growing up, especially for Europe and North Ame It still needs more detailed comparisons to be made, but alr promises to spread the idea of orderly changes as a key t interpretation, on evolutionary lines, of a large range of su features most important in the landscape.

We note also the continuation of the work of Penck an followers on glaciers and moraines in the Alpine regions, of of de Geer and his students in Scandinavia, and of the exten of this work by Dainelli to the Himalaya and by Renngart the Caucasus. The effects of the phases of the last great ic on the landscapes of the northern hemisphere are thus beco known, especially as American workers have brought out pa studies for their continent. This work may be said to have a from the pioneer studies of James Geikie.

Oceanography (*q.v.*).—Studies of physical conditions in oc and seas have progressed largely owing to the efforts of com sions investigating fisheries. Schmidt's description of th history and migrations of the eel was an outstanding advance. DISTRIBUTION OF ANIMALS.) As an example of some bea of this work on geographical synthesis may be mentioned work of O. Pettersson on the hydrography of fiords and part enclosed seas around Scandinavia, in which he suggests se variations of tidal power as factors of changes of climate time to time.

Meteorology (*q.v.*).—In climatic study we note J. G. Bartholo and A. J. Herbertson's *Atlas of Meteorology* (1899), the wo Lyons and others in Egypt, and that of the British Met logical Office in preparing tables of normal figures for cli facts, and Dr. G. C. Simpson's theory of the Indian summer soon published in 1921 are notable. The study of the genera tribution of barometric pressure and of its changes in cyc systems is associated in England with the name of Napier S and there has been a great increase of knowledge of the lay of the atmosphere and of its more detailed conditions at diffe levels connected with the development of flying-machines the mapping of air-routes. The many new facts and views tained are modifying very seriously our expositions of fa of the climates of the earth's regions, and here again a s position has by no means been reached.

Climatology.—Climatological researches in polar regions been of great value for better understanding of climate where. C. E. P. Brooks, Berg, Murgoci and others have tri argue from the present to the climatic conditions of the past, have thus contributed factors of interpretation of variou and other features of the present day; von Richthofen pione in this direction with his classic work on Loess. (*See* CLIM

:ology.—Ecological study of plants (*see* Ecology), animals
man is both geographical and biological, the former in so
:s it works out features of the place inhabited, and it is indeed
:times argued that geography is essentially human ecology.
ıis field there has been increasing recognition of the fact that
lora and fauna of a region represent no more response to pres-
:onditions, but result from accumulation and interference of
t of a long series of past changes. In many cases, such as that
ıe virgin equatorial forest, a complex and delicate balance
'e has been established through the course of ages, and these
ıts will probably not regrow in anything like their present
. if cut down. The work of de la Bathie on Madagascar
ght this out specially. Several opinions concerning plant
animal distributions need adjustment if newer views on
inental drifts and on climates of the past are established.

:gional Studies.—Another generation saw the appearance of
ge number of studies of regions based upon scientific data.
Richthofen's *China* is rather old in parts, but its influence has
widely extended. Vidal de la Blache's *Tableau de la Géo-*
hie de la France (1903), like F. von Richthofen's *China* (1887–
), emphasises the facts of structure most of all. J. Dantin
:ceda's work on Spain, in turn, emphasises rather the facts of
ate and ecology. The volumes of the Filippi expedition to
Himalaya are conceived in an encyclopaedic spirit, but as
t is too early to say whether much effort will be made to-
ls synthesis. The American Geographic Society began a
s of scientific studies chiefly on Latin America. Sir M. A.
ı's *Serindia* (1921) is another encyclopaedic work with the
hasis largely on cultural distributions. A. Philippson's *Mit-*
:ergebiet (1914) may be used as an example of a less ency-
ıedic type of work which nevertheless effects with some suc-
a synthesis of a large number of scientific facts. The Atlas
inlande is another type of the collection, and to some extent
synthesis of scientific data, this time concerning a state.
ıughout these works it will be seen that the geographer's
ial part is to correlate specialist data and to synthesise the
into a picture of the region.

eat services have been rendered to the science of geography
vriters on various regions whose main object is a somewhat
rent one. H. W. Bates' "Naturalist on the Amazon" (1892),
son's works on La Plata (1892) and C. M. Doughty's
ıbia Deserta" (1888) are typical examples in this connection.

aps.—The map (*q.v.*) is the geographer's special instrument
he must work at its improvement, both as a representation
rger or smaller parts of the earth's surface and as a record
ecial types of data. The War provided enormous oppor-
:ies for surveying and cartography, and remarkable results
also attained by mapping from aerial photographs (*see*
veying). Different tints in turf brought out unsuspected
on development of the negative and led to interesting dis-
ries. (*See* Archaeology: Air Survey.) The mathematical
ry of map projections has been advanced especially by A. E.
ıg in England and Adams and Deetz in America. The "One
Million" map, on the other hand, met some difficulties on
ay towards the goal of world-wide unity; political reasons
o the crowding of some sheets with names while others
left nearly blank. Sheets including frontiers led to troubles
een states in some cases, and the wave of nationalism after
War thus harmfully affected for the time what promised to
great step forward in scientific geography. The Italian
raphers issued an interesting collection of map sheets
ing typical examples both of physical features and of
ın occupation of the surface.

mography.—The mapping of various types of data has en-
l much attention. General poverty after the War largely
ed improvement of the topographical map. The demo-
ıic map, fundamentally giving distribution of population is
n a state of flux. It is generally felt that density of popula-
cannot be adequately marked by contours, and, both in this
er and in that of mapping commercial production, the meth-
stippling with fine dots has been tried, while Sten de Geer
ıcted experiments utilising large circles, etc., for the purpose of indicating agglomerates. The mapping of data has spread remarkably as an auxiliary in many fields of study, such as ethnography (*see* Folklore), archaeology, anthropology, history and commerce. In most of these cases the stipple and contour methods of representation are rivals, while new methods tend as much towards insuring graphical power as towards accuracy of detail. The growing tendency to display on any one map only appropriately related facts is a testimony to the acceptance of the map as an instrument of research. The maps in C. Fox's *Archaeology of the Cambridge Region* (1923) illustrate the development of this point of view. (*See* Map.)

Place Names.—On the border line of geography is to be noted especially the development of the study of place names under Longnon in France, the English Place Name Society in Britain, and the effort of the British Permanent Committee on Geographical Names towards standardisation. (*See* Philology.)

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GEOLOGY (*see* 11.638).—The progress of geology suffered from a four years' break, which provided, however, a stimulus to economic geology by the compilations on mineral resources required during the peace negotiations, and to monographs on little-known areas such as the war fields (*Die Kriegsschauplätze 1914–1918 geologisch dargestellt*, Berlin, 1923–5).

The accumulation of geological evidence has increased apace owing to the foundation of new universities, the fuller educational employment of research work and the wider recognition of the economic value of geology. Its literature has become overwhelming, while its bibliographies and indexes are less efficient owing to the increasing bulk of material and cost of publication. One of the urgent needs in geological development is co-operation between the agencies which publish synopses of literature to secure prompter and fuller references and less serious omissions.

In the progress of geological philosophy since 1910 three features have been especially remarkable. First, the lessened over-emphasis on the geological conditions of northwestern Europe and the eastern states of North America, with the consequent abandonment (*cf. e.g.*, G. A. J. Cole, *Rep. Brit. Assoc.*, 1915) of that ultra-uniformitarianism which had developed in those countries. Second, release from the restricted range of geological time that had been declared necessary from physical and mathematical data. Instead of a possible maximum of ten million years, as maintained by Tait, geologists are at liberty to assume 8 to 10 thousand million years, and need not discard hypotheses which demand prolonged time for minor geological phenomena. Third, recognition of the plasticity of the earth's crust, and of the world-wide effect of earth movements on the relations of land and water. The physical evidence has been found to afford a more precise correlation at some dates than that based on fossils. The belief in the plasticity of the crust and the lateral movement of the land masses has led to the study of mountain ranges and crustal movements with renewed zeal, and to a flood of speculative hypotheses which are perhaps a reaction from the mental strain of the War.

Origin and Constitution of the Earth

The discussions on the origin of the earth have marked the steady wane of the nebular hypothesis of Laplace. The hypotheses which are replacing it agree in accepting the solar system as derived from one aggregation of matter; but they attribute its start to the tidal disruption of the parent mass by a passing star. This theory has been put forward in various forms. Its modern development is based upon the planetesimal hypothesis, which has been restated by T. C. Chamberlin in his *Origin of the Earth*, 1916 (and in *Jour. Geol.*,[1] Chicago, 21–29); it has been adopted by J. H. Jeans, *Problems of Cosmogony and Stellar Dynamics*, 1919, and Harold Jeffreys, *The Earth*, 1924.

According to Jeans the parent mass extended throughout the range of the solar system, while according to Jeffreys it was restricted to the inner part. The material of the earth on each of the theories was once loose and was welded by heat due to collisions or pressure. That the original material was gaseous is urged by Eddington, since so many stars have the size appropriate to a gaseous body; but that the earth was constituted by the aggregation of solid meteoritic material agrees with the well-established facts of the earth's high internal heat, zonal structure, and composition. The planetesimal theory has undergone important developments and modifications in recent memoirs by its founder, T. C. Chamberlin. He calls attention (*J.G.*, 28, 1920, pp. 144–6) to the possibility of the planets still receiving matter from the sun, in consequence of such solar explosions as those which in May and July 1919 hurled material to the height of at least 475,000 m. above the sun's surface, and probably outward to the orbits of some planets.

The planetesimals, according to Chamberlin's estimates of 1920 (*J. G.*, 28, pp. 672, 681; 29, pp. 407–8) were originally very minute, and weighed about one-fiftieth of a pound apiece; amongst other phenomena he attributes to them the zodiacal light and Saturn's rings. He compares them (*J. G.*, 29, 1921, pp.407–9) with the chrondrules, the rounded grains found in meteorites, rather than with the meteorites themselves. They therefore approximate to the meteoritic dust, which, according to T. J. J. See, was once spread throughout space. In spite of the small size of the planetesimals Chamberlin regards them as having contributed two-thirds of the mass of the earth by their fall from space as rain upon the original core (*J. G.*, 28, p. 681). Jeffreys, however, denies the possibility of any great accretion of such material, and dismisses the planetesimal hypothesis as no solution of any of the main problems of geophysics, and as quite unacceptable on cosmogonic grounds. He has brought it forward in a modified form, which, according to Chamberlin (*J. G.*, 32, 1924, p.713), accepts all the essential doctrines of the planetesimal hypothesis.

Meteoritic Theory.—Lockyer, the founder of the meteoritic theory, recognised that many of the meteorites which formed the earth had planetary orbits, and that they came from a single source or zone is supported by the work of Sir William Crookes (*Phil. Trans.*, 1918, vol. 217A, pp. 427–30). According to Crookes the stony meteorites consist of the elements which form the bulk of the earth's crust, and he suggests, from the striking simil in the proportions of their four chief constituents, that they all derived from the disruption of a planet that once existe tween Mars and Jupiter; the nickel-iron meteorites may have derived from the core of the same planet, or may have come a different source. The chemical similarity of the core of the e to the iron meteorites is asserted by L. H. Barnett (*J. G.*, 32, pp. 615–35) as according to him the core consists of 90% 7% nickel, cobalt and copper, and 3% of the other eleme The elementary constitution of the earth has been recalcul and its agreement with a meteoritic composition follows Tamman's (1924) estimate that 98% is composed of 7 elem in the following order of abundance—iron, oxygen, sili magnesium, nickel, calcium and aluminium; four othe sulphur, sodium, chromium and potassium, constitute ano 1.6%; all the other elements together amount to only four p per 1,000 of the substance of the earth.

The stony meteorites, so far as is known, correspond onl the basic igneous rocks. The occurrence of acid meteorites been claimed from the obsidianites of Australia, but microscopic structure indicates their formation as aerial gurites by the fusion of dust by lightning during dust storm

Zonal Structure of the Earth.—The earth consists of a serie layers, and much light has been thrown on their constitution thickness. The bulk of the earth consists of a nickel-iron m the barysphere, which is enclosed by a rocky crust, the li sphere. Within the barysphere is a core, 1,600 m. in diame which, according to the late C. G. Knott, is fluid, as it does transmit distortional waves. In spite, therefore, of the repeated conclusion that the whole earth is solid, seismol proves this large central core to be fluid. Between the barysp and the lithosphere, moreover, according to various authorit is a weak plastic layer, the asthenosphere of Barrell (*J. G.*, 1914), or the fluid layer of basalt glass which, according to (*Amer. Jour. Sci.*, 1923, pp. 347–71), lies below a holocrystal rigid shell 25 m. in thickness.

The lithosphere has been subdivided into various zo Suess adopted two: the basic Sima, composed predominantl silica and magnesia, and the lighter, more acid Sial, compo predominantly of silica and alumina. V. M. Goldschm (*Geochemische Verteilungsgesetz der Elemente, Vid. Selsk. S Math.-Nat. Kl., Kristiania, 1923–24*) considers that the nickel- core is surrounded by a sulphide and oxide zone which is c parable in metallurgical operations to a matte; above that zone is a stony zone which is comparable to a slag, and is divided into a lower layer of dense silicates, and an upper la of light silicates and silica. E. D. Williamson and L. H. Ada (*Jour. Washington Acad. Sci.*, vol. 13, 1923, pp. 413–28) div the lithosphere into three zones; the lowest consists of hea silicates mixed with nickel-iron and is comparable to the mete ites of the Pallasite type; this layer passes down into the ba sphere and upward into heavy silicates, which are covered b shell of light silicates and silica.

That the barysphere is composed of nickel-iron was affirmed Milne from the acceleration of earthquake waves, toward wh it behaves as a rigid material; but under the influence of intense heat and pressure, the material must at that depth capable of flow into any cavities like a fluid, so that it been described as elastico-rigid, or 'fluidible.' The work of F. Adams (*J. G.*, 20, 1912, pp. 97–118) has shown that the e mates of Van Hise as to the depth at which all rock mate would be fluidible must be extended; for Adams, by an exp ment suggested by Sir Charles Parsons, found that small cavi remained open for months in a granite cylinder which was la ally supported at conditions comparable to those in the ear at a depth of 11 miles. These experiments, however, deal o with a short period and small cores in a rigid case; they do represent the conditions of large masses acted upon by imme pressure at a high temperature for long periods. The h rigidity of the surface of the earth against tidal deformati was supported (*J. G.*, 27, 1919, pp. 585–601) by the observati of Michaelson and Gale on a horizontal waterpipe 502 ft. lo he limited depth of the lithosphere and the constitution of barysphere of nickel-iron have been supported by the evi-ce of radioactivity, for the earth's activity is of a strength ch can be explained by the restriction of radioactive ma-als to a depth of about 40 miles. The material of the nickel- meteorites is the only non-radioactive substance that is ly to form a considerable part of the earth. The inner earth ssigned a more moderate temperature than formerly; that he primitive sun, according to Jeffreys, cannot have been than 3,000° C., but within the earth the maximum may be h lower, for the temperature may be nearly uniform in such a conductor of heat as the nickel-iron core.

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[1] This journal is referred to in subsequent parts of the article as J. G.

The Depth of Earthquake Origins

nowledge of the physical nature of the earth's interior has e most progress from investigation of earthquakes, most which have been attributed to a depth of 5 or 6 m.; Dr. ham (*Quar. Jour. Geol. Soc.*, 78, 1922, p. 57) concludes that great majority arise less than 10 m. from the surface. Lately, ever, physicists have assigned their origin to much greater ths. The late G. W. Walker (*Rep. Brit. Assn.*, 1917, pp. 13–4 *Phil. Trans.* A.222, 1922, pp. 45–56), from the angle of rgence of earthquakes recorded by the Galitzin seismographs ulkova, inferred that some originate at least 800 m. deep. s deep-seated source has been supported by Prof. Turner *p. Brit. Assn.*, 1923, pp. 283–6) who assigns the majority to a e bounded below at a depth of 145 m., and some to a depth oo m., such as the Formosa earthquake of April 14 1906, at miles.

arthquakes.—The word earthquake originally meant a shaking uaking of the earth which could be felt, might cause damage and occasionally accompanied by changes in the aspect of the sur- of the earth. Seismology was the department of science which t with these disturbances, and was naturally regarded as a minor ion of geology; with improved methods of observation and the ntion of special instruments the scope of this subject has been rged, and it has come to include much that does not belong to hquakes in the original sense of the word, or to geology, yet ot be entirely separated. Recent developments in the study of earthquake, which might be dealt with here, are, therefore, sferred to the article EARTHQUAKE.

he shallow origin of some earthquakes was concluded by ne from the twisting and breaking of telegraph cables by slips aterial down submarine slopes. It has been found that such ks are not recorded on seismographs, so that they cause no espread vibration in the underlying rocks. The main claim the superficial origin of a world-shaking shock, other than se due to volcanic explosions, is that by the late Prince itzin, who referred an earthquake, on Feb. 18 1911, to a land- in the Pamir. A mass of earth weighing 7,500,000,000 tons into the valley, buried a village and all its inhabitants, and ned a bank over 3 m. long and 2 m. wide, and a lake 15 m. and 900 ft. deep. Dr. Oldham in a rediscussion of the lence (*Quar. Jour. Geol. Soc.*, 79, 1923, pp. 237–45) has shown the landslip was a result of the earthquake and not its se, for it was not above the centre of the disturbance, which ssigns to a depth of 30 miles.

Volcanic Action

olcanic studies have been greatly advanced by work at the ervatory on Kilauea in the Hawaiian Islands under the ction of T. A. Jaggar. His weekly letter enables geologists ll parts of the world to follow the changes in that instructive ano. Its cauldron was enlarged by huge subsidences in 1919, and 1924, the last being associated with powerful ex-ions.

he destructive eruption of Vesuvius of 1906 has been de-bed by Perrett (*Publ. Carnegie Institute*, No. 339, 1924), shows that the weight of the lava in the throat of the vol- broke through the wall, and the relief of pressure on the en rock enabled its superheated water to explode; the ex-ion threw up a column of vapour 7 m. high and produced anches of hot volcanic sand like that from Mt. Pelée, which whelmed St. Pierre, the capital of Martinique, in 1902. The Pelean eruption has been further brought into line with ordinary volcanic phenomena by the eruption of Katmai, at the base of the Alaska Peninsula, in June 1912—the most notable volcanic event of recent years. Katmai is an old volcano of basic andesite resting upon Jurassic sandstones. The eruption was of the paroxysmal explosive type. It scattered 5 cu. m. of pumice and scoria over the district, depositing a layer a foot thick even 100 m. away. The eruption left a great hollow with numerous steam vents on its floor; the summit of the mountain was replaced by a pit 2½ m. wide, and from 2,000 to 3,700 ft. deep. This crater was at first attributed to the explosion, but C. Fenner (*J.G.*, 28, pp. 569–606, 1920) shows that it was due to subsidence, aided by the solution of the older andesites by the 1912 lava.

The eruption is explained as due to the intrusion of a sheet of rhyolite under the volcano. The intrusion shattered the overlying rocks and the rhyolite rose through the fractures. The Katmai obsidian, when heated, froths up to pumice, and when it reached the surface it was blown into fragments by its superheated steam. This eruption has explained two phenomena of the West Indian eruptions of 1902 that had appeared unique. Part of the Katmai area was covered with beds of sand, composed of pumice that had been pulverized by the explosive escape of the steam. This sand is of the same nature as the incandescent dust which fell in an avalanche upon St. Pierre. A new secondary peak named Nova Rupta was formed at Katmai by the forcing of a dome of rhyolite into the overlying rocks; it is similar to the lava spine which was pushed up through the vent of Mt. Pélée.

Volcanic Cauldrons.—The first report that the great cauldron at Katmai was due to an explosion, threw doubt on the origin of some volcanic basins that had been attributed to subsidence. J. S. Diller (*J. G.*, 31, pp. 226–7, 1923) has restated the evidence proving that "Crater Lake" in Oregon lies in a basin due to subsidence. It is therefore a cauldron. This origin has been attributed to some huge volcanic basins in East Africa, such as Menengai in Kenya Colony, and Ngorongoro which has been further described by Barns in his *Across the Great Crater Land* (1923). Mount Aso in Japan remains by a little the largest known cauldron, being 14 m. long by 10 m. wide (Anderson, *J. G.*, 16, p. 499, 1908). Still larger subsidences form sunklands in some of which, such as the Riessenkessel in southern Bavaria, the sunken rock, there a shattered granite, is surrounded by a ring of lava. The ring-shaped intrusion of syenite, 16 m. in diameter, at Pilansberg in the Transvaal, described by W. A. Humphrey (1914), represents the deeper part of such a formation. The importance of such ring-dikes in volcanoes has been shown in the island of Mull in western Scotland. Its central mountains are the deeply dissected foundation of a volcano of the first order; and the tendency of lavas to rise along circular fractures is there well displayed and has been described in *Geological Survey Memoir* (by E. B. Bailey and others), which confirms the view of Judd that the ancient volcanoes of the Western Isles were separate volcanic vents.

Plateau Eruptions.—That some of the Mull lavas were ejected by fissure eruptions is still advocated, but this origin is not shown for any lava left on the island.

Knowledge of the vast lava fields that have been attributed to fissure eruptions has been extended for those in South Africa and South America. Those in South Africa have been described by Du Toit, "Karroo Dolerites of South Africa" (*Trans. Geol. Soc. South Africa*, 22, pp. 1–42), who shows that the Stormberg lavas (of which the age is Rhaetic or Liassic) cover an area around Basutoland 350 m. long by 150 m. wide. A surrounding area of some 320,000 sq. m. is seamed by dolerite dikes, so that the volcanic area was doubtless more extensive than it is now. C. L. Baker, "The Lava Field of the Barana Basin, South America" (*J.G.*, 31, 1923 pp. 66–79), points out that the basalt flows there cover an area of 300,000 sq. m. with an average thickness of 1,000 ft.; and the surrounding country, to the extent of 75,000 sq. m., is penetrated by innumerable sills and dikes of dolerite. These South American eruptions are of the same or of approximately the same age as those of South Africa—namely, at the very beginning of the Jurassic.

Meteoritic Impact Crater.—The view that Coon Butte or Meteor Crater in Arizona was due to the impact of a great meteorite has failed of further support by the explorations of D. M. Barringer. It was suggested that the crater was made by the nucleus of a comet instead of by a single meteorite. Recognition that this body struck the earth obliquely led to a fresh search for the meteorite under the southern rim of the crater and not, where previous borings were made, under the centre. Recent boring found only country rock.

ISOSTASY

The most significant discussion of the period has been upon the extent of isostasy, *e.g.*, *Bull. Geol. Soc. Amer.*, 33, 1922, pp. 275–410 (*see* ISOSTASY). The evidence for the greater density of the rocks below the oceans has been strengthened by pendulum observations in a submarine. This high density, according to F. P. Shephard (*J. G.*, 31, 1923) may be due to compression. The view generally adopted is, however, that the rocks below the oceans consist of denser material—the sima. Since the ocean floor must consist in places of sunken continental rocks, the existence of sima so near the sea bed appears uncertain.

Isostasy explains how large areas of the earth's crust may be uniformly uplifted, though the possibility of such a movement was denied by Suess. Burrard (*Prof. Pap. Survey of India*, No. 12, 1912, p. 6) has, however, supplied an instance in which 5,000 sq. m. of country between Saharanpore and Mussurie in northern India were upraised 5 inches during an earthquake. This fact was proved by re-levelling a line that had been surveyed shortly before the earthquake.

AREAS OF TENSION

Areas that are being slowly upraised are torn by tension clefts and broken by normal faults. Faults so weaken the rocks they traverse that the side left upstanding is usually reduced to a gentle slope; nevertheless some recent faults in areas of hard rock are marked by fault-scarps which bound sunklands and rift valleys. Of the latter the greatest extends from Palestine across East Africa, and as shown by Teale and Wilson (1915) south of the Zambezi. Its geology has been described by Gregory (*Geology and Rift Valleys of East Africa*, 1921) and Krenkel (*Bruchzonen Ost-Afrikas*, 1922). That this valley had a longer history than was originally recognised by Suess is now admitted. E. Lehmann (*Zeit. Vulkan.*, Erg. 4, 1924) has described the volcanic area in the Rift Valley north of lake Nyasa and shown that its rocks are alkalic in composition. The tectonic origin of the Gulf of Suez, a branch of the Great Rift Valley, has been proved by the Petroleum Bulletins of the Geological Survey of Egypt, and Prof. Brock has confirmed that view for the Dead Sea (*Quar. Jour. Geol. Soc.*, 75, 1919).

Abendanon, as a corollary to his view of the radial contraction of the earth, considers that some parts are forced upward by the subsidence of others, and that tension in the rising parts gives rise to rift valleys. W. H. Bucher, (*J. G.*, 32, 1924) has illustrated the importance of tensional structures by model shells in which the plan of the crumpled bands of the earth are produced by tension and not by compression.

The deformation of the earth leads to wide areas of subsidence and uplift. Thus the subsidence of an ocean floor, by forcing the material below it to flow outward, may uplift its borders. Where the uplifted area consists of hard rocks, the surface will be torn by a network of tension clefts forming fiords and fiord-valleys (J. W. Gregory, *The Origin and Nature of Fiords*, 1913). The upheaval of these areas accompanied great subsidences that followed the crumpling of the earth's surface during the mountain formation which culminated in the Miocene. Where the surface consists of soft rocks the rupture may control the topography, as in the rectangular valley system of north-eastern France, and S. W. Wooldridge (*Proc. Geol. Assoc.*, 34, 1923, pp. 175–92) suggests that many topographic features of the London Basin were determined by intersecting fractures in the underlying platform of old rocks. The tectonic origin of the Greenland fiords has been supported by L. Koch (*J. G.*, 31, 1923, pp. 42–65) who points out that some of the fiord valleys are pre-glacial, w others are of very late origin and have been but slightly fluenced by denudation. These fiords he calls fracture-fiord they were formed by the cleavage of gneiss along plane fracture.

AREAS OF COMPRESSION AND FOLD MOUNTAIN CHAINS

Alpine Structure.—Intense compression of the crust prod fold mountains, the study of which has been especially acti the Alps. It has long been known that some of the northern consist of blocks of old rock resting on younger beds. T "Klippe," or "mountains without roots" have been pu sideways on to their present foundations, a process demonstr in the north-western Highlands of Scotland. There, in s cases, the rocks were broken into short slabs which were fo one over another, giving rise to the "imbricate" structure, as would be produced if a row of slates on a roof were pressed a shorter space. In Switzerland the process has taken place great scale, and successive slabs of rocks have been thrust over another as *Decken* or overthrust-sheets.

In some parts of the Alps this structure is indisputable, bu others the evidence depends on an uncertain identification of rocks. Thus Monte Rosa and the Matterhorn have been in preted as pinnacles of old rock thrust northward over the T The Triassic age of the underlying rocks is uncertain; and tradition dating from the time when many of the Alpine sc were regarded as Jurassic. Bonney's work in the Lepontine showed that the so-called Jurassic schists, like the Carbonife "fossiliferous gneiss," were beds composed of schist debris; were infolded amongst the ancient rocks. The pre-Palaeo age of the crystalline schists of the Alps is now generally adop and the Triassic age of the base of Monte Rosa and the Ma horn is uncertain. The supposed overthrust parts of those m tains have no similar rocks to the south, so that they must h been transported from afar; and some advocates of the extr Decken theory regard parts of the overthrust sheets or "napp as African in origin. This view is dismissed as fantastic "U nappismus" by some Alpine geologists, and has led Heritsc describe the Decken theory as a fantasy.

The distance to which sheets of rock can be thrust is lim by their crushing strength. According to A. C. Lawson mechanical limit of overthrusting must be between 20 and 3 and Oldham has adopted a limit of about 5 miles. An overth of 150 m. has been claimed in Scandinavia but appears impos and is unnecessary on a more probable correlation of the ro The Decken theory in its extreme form may prove untena Amongst the voluminous literature on the theory reference be made to Albert Heim's work, *Geologie der Schweiz* (1918– to the case for it by R. Staub, *Der Bau der Alpen* (1924); f critical view to F. Heritsch, *Die Grundlagen der alpinen T tonik* (1923).

The investigation of Alpine movements has shown that t began earlier than was realised. The movements culmin in the Oligocene and Miocene; but the preliminary buckling gan early in the Mesozoic. Increasing importance is attache the younger granites of the Alps, to which fresh attention been directed by Steinmann. Movements of the Decken typ the southern and eastern Highlands of Scotland have been vocated by E. B. Bailey (1910–25); but his interpretation not been generally accepted.

The Decken theory of the Alps agrees in one respect Suess's interpretation, by attributing the main folding to pres from the south. That direction of movement has been reje by L. Kober, *Bau und Entstehung der Alpen* (Berlin, 1923), denies the asymmetry essential to Suess's view that the Alp belt has been pushed northward and buckled against the resist masses of Central France, the Black Forest, Bohemia and Russian Platform. Kober regards the Alps as symmetrical; explains Alpine mountains as due to a belt of the crust be crushed between the continental coigns, as they are forced gether by the earth's contraction. He regards the Mediterran basin as one mountain block or "orogen," which has be

mpled between northern Europe and North Africa, the move-
nts being outward from the compressed belt and therefore
thward in the Alps and southward in the Atlas. In the Atlas
pre-Alpine folds are southward; but those of the Alpine
iod, according to Gentil, are northward. That direction is in-
isistent with Kober's requirements. Longwall has pointed
that the structure of the Sierra Nevada of California is also
onsistent with Kober's explanation of the Rocky Mountains;
l Hobbs has rejected the theory for the Asiatic Arcs, which he
ributes to deep-seated pressure from the rear or concave side.

he Contraction of the Earth.—The view that mountain folding
lue to the compression of a contracting earth has been further
cussed; arguments against it have been stated by Sandberg
24) and Keith (*Bull. Geol. Soc. Amer.*, 34, 1923); but it has
n more widely adopted owing to the recognition of the fallacy
some objections. It was claimed that the utmost possible
inkage of the earth was inadequate for the observed com-
ssion; that view was based on the limited age of the earth, but
h the multiplication of its age 10 or 20 times that argument
become invalid. Jeffreys has pointed out that shrinkage by
ling would be sufficient, and there are other even more
ent factors of contraction. T. C. Chamberlin has supported
shrinkage of the earth's crust from the greater density of the
th as compared with the moon. If both originally consisted
similar material, the higher specific gravity of the earth is due
condensation, and to the shrinkage of its circumference by
55 miles.

The number of mountain chains in which overthrusting is rec-
nised has been increased, as by the work of Deprat in Tonkin
l southwestern China (*Mem. Geol. Serv. Indo-China*); his con-
sions in this respect have been confirmed by Jakob. Over-
usting has been recognised in the areas between Indo-China
l the eastern end of the Himalayas in northwestern Yunnan
hil. Trans., vol. 213B, pp. 171–298, 1925). Other mountains,
vever, though folded, show but slight overthrusting. Thus the
des, though gently folded in the Upper Cretaceous and
cene, have subsequently undergone block faulting without
ust planes, as shown by Steinmann (*Geol. Rundsch.*, 1922)
sworth (*Geol. North-West Peru*, 1922), Douglas (*Quar. Jour.*
l. Soc., 1914, 1920, 1921) and H. Backlund (1923). Different
ts of one mountain system may have been affected by both
es of movement; thus the northern Rocky Mountains are
wn by Mansfield (1923) to have undergone intense lateral
npression, while Lee (1923) and R. T. Chamberlin (1919)
wed that the movements in the southern Rockies were vertical.

Varrow U-shaped Fold-lines.—Suess explained some important
ographic features by the fold-lines having been diverted in a
rpin-bend, in Assam, the Caribbean Islands, the South
orgia arc in the South Atlantic, and the Moluccas to the west
New Guinea. This view has been adopted by Hobbs (1925)
l extended for the Moluccan Arcuate fold by G. A. F. Molen-
aff and H. A. Brouwer (1921); but the evidence for these
rrow U-shaped bends is inadequate, as the main Himalayan
e of Assam continues eastward into South China; the rocks of
ith Georgia are fundamentally different from those of the
des; in the West Indies the contorted foundation of Barbados
ikes west to east almost at right angles to the supposed arcuate
l; and in the Moluccan islands the essential strike is across the
ection of the chain, and the depression to the west may be due
a foundered block.

gneous Rocks and Earth Movements.—That distinctive series
igneous rocks are associated with different types of earth
vement has been reaffirmed by Harker (*Address, Geol. Soc.*,
7), but has not been generally confirmed (see for example
ewinsson-Lessing, *Bull. Geol. Soc. France* (4), 23) from the
ssian evidence, and for the Australasian area (*cf.*, *Scientia*,
1912, pp. 56–63).

The nature of the intrusions of the great plutonic masses has
n discussed by Daly in his *Igneous Rocks and their Origin*
14), with many luminous suggestions. Hans Cloos of Breslau,
n work in southwest Africa and Silesia (*Der Mechanismus
vulkanischer Vorgänge*, 1–21, and *Abh. Preuss. Geol. Landesanstalt*, n.f. 89, 1923), rejects Daly's theory that the granite masses eat their way into the crust by assimilating the material they replace. Cloos, agreeing thereby with Suess, concludes that intrusive granite either forces the rocks apart or occupies spaces made during the subsidence of blocks of the crust. Some assimilation naturally occurs on the margin, but Cloos regards it as only a minor incident. According to him the direction of pressure during the intrusion and consolidation of the granite may be inferred from the rifts, joints and dikes in the granite, which are parallel to the general grain of the country. The foliation in the granite he regards as less important, as it expresses only the local pressure.

STRATIGRAPHICAL GEOLOGY

In stratigraphical geology the national Geological Surveys and private workers in all countries have been collecting an immense accumulation of new data. The most notable addition to the Geological Surveys is that of China, which, with the new Geological Society of China, have together made a great contribution to knowledge of that country. Among the principles of stratigraphy the problem whether geological evolution has been even and continuous, or periodic by alternate rapid developments and long intervals of repose, has been further discussed. Shepard (1923) insists that the rate of progress has been on the whole regular; but advance by periodic spurts has received wide support, as from T. C. Chamberlin (1921, etc.), R. T. Chamberlin (1914, 1921), G. Stille, *Die Schrumpfung der Erde* (1923) and Prof. J. Joly (*Phil. Mag.*, 1923, pp. 1167–88) and *Surface History of the Earth* (1925) from his theory of the periodic re-melting of the foundations of the crust by radioactive heat; and also from the distribution of land and water by tetrahedral deformation of the crust and its spheroidal recovery.

The classification of the pre-Cambrian rocks has made much progress, especially in Canada, though there is no general agreement in the nomenclature. The tendency is to subdivide the pre-Palaeozoic rocks into a lower division of gneisses and coarse schists, an intermediate division of strongly metamorphosed sediments, and an upper division of sandstones, which are but little altered and may contain traces of organic remains. Some of the pre-Cambrian limestones, which are especially abundant in the middle division, are often attributed to an organic origin; but the extensive chemical precipitation of carbonate of lime has become more apparent, and some oölitic structure is inorganic as shown by its artificial formation (*e.g.*, Johnston and Williamson, *J. G.*, 24, 1916) and the crystalline structure of some recently formed oölite; Van Tuyl (*ibid.*; pp. 792–7) on the other hand shows how oölites with an organic structure may lose all traces of it.

In stratigraphical geology the process has been especially important in regard to the pre-Palaeozoic and the Palaeozoic. Much work has been done by many British geologists on the Lower Palaeozoic rocks of Wales and the Welsh border country, and on the zonal study of the Carboniferous Limestone, in papers published mainly by the Geological Society of London.

Important proposals for the reclassification of the Lower Palaeozoic have been made by E. O. Ulrich of the U. S. Geological Survey, in a paper which, owing to the extreme changes proposed, has been issued in the Bulletin of the Geological Society of America (23, 1912, pp. 261–680) with a note by the Director of the Survey disclaiming responsibility for its views. Ulrich classifies the Lower Palaeozoic into five systems instead of three, adding the Ozarkian and the Canadian systems between the Cambrian and Ordovician. Neither system is likely to be welcomed by British geologists, for there is little evidence for them in the British Isles. The Ozarkian system is either absent or is represented only by the Upper Lingula Flags; the Canadian system includes the British Tremadoc and Arenig Series. The proposed systems have not been widely accepted in America. The better American representation of this part of the geological record has enabled Dr. Grabau to settle an old problem in the northwest of Scotland; he confirms Salter's view that the Durness Limestone is Ordovician, and not Lower Cambrian, to which it was transferred from its superposition on the Lower Cambrian quartzites with *Olenellus*.

Much light has been thrown on some stratigraphical problems by the separation and identification of the heavy constituents of rocks—a method especially advanced by the work of Boswell. The Kainozoic classification of many areas has been put on a firmer basis by detailed palaeontological work, which has permitted the correlation of different sequences of beds in independent basins, as in California (for example, by B. L. Clark, 1921), and in Australia and New Zealand, largely by F. C. Chapman. Man has been traced back into the Pliocene by the rostrocarinate implements found in the Red Crag by Moir (*see* Archaeology), which, however, like the early Palaeolithic implements from the Forest Bed of Cromer, are not universally accepted. A great stimulus to the study of the geological history of man followed the description of the Piltdown skull (Eoanthropus) by Sir A. S. Woodward (*Quar. Jour. Geol. Soc.*, 69, 1913), and important skulls have been found in Queensland, South Africa and Palestine (*see* Man, Evolution of). Claims have again been made for the occurrence of early man in America, but without carrying conviction. The reports published by various Antarctic expeditions have thrown much light on glacial processes, strengthening doubt as to the extent to which ice erodes hard rocks, attaching increased importance to the shattering action of frost, and supporting the subaqueous origin of boulder clay from its absence on the Antarctic lands and its formation on the floor of the Ross Sea. (*See* Palaeontology.)

Palaeogeography

The steady advance of stratigraphical geology enables palaeogeography to be placed on a firmer footing and its data have been summarised in a series of works by Theodor Arldt, *Handbuch der Palaeogeographie* (1919). Eduard Suess's great work, *Das Antlitz der Erde* was completed in 1909, but the comprehension of his views has been much aided by the French translation edited by Prof. E. de Margerie (completed 1918), with its invaluable collection of maps and supplementary material. Suess's teaching has led to increased recognition of the fundamentally different arrangement of ocean and continent in former times, combined with the stability of some areas and the weakness of others. E. Haug in his *Traité* (completed 1911) has laid stress on the importance of the geosynclinals as mobile bands. C. Schuchert (1923) in several luminous contributions to the palaeogeography of North America has also shown the continuous influence of the geosynclinals and has organised symposia which have collected on various problems expert opinion which might otherwise not have been expressed.

Ruedemann (1923) believes that in spite of the many changes in the earth's geography three archi-continents have persisted throughout geological time. This view has, however, been criticised by W. J. Miller, who considers that it is impossible to distinguish between the pre- and post-Cambrian folding.

L. Kober has extended his theory of the Alpine structure to the world in general; he explains the distribution of land and water as due to the massive resistant coigns having been surrounded by weak belts, which sink in geosynclinals, are then crumpled into fold mountains, and on refoundering may carry down with them adjacent parts of the continental blocks.

Climatic Changes.—In connection with stratigraphy a good deal of attention has been devoted to former variations in climate (*see* Climate), which many authorities refer to changes in the heat emitted from the sun, leading at times to universal refrigeration. This view has been strongly advocated by Huntington and Visher (*Climatic Changes*, 1922) and some change of this nature is regarded as probable by Jeffreys. Prof. Coleman (*Amer. Jour. Sci.*, 1924, pp. 298–404) has called attention to the world-wide nature of the refrigeration during the Pleistocene glaciation. The leading alternative explanation rests on geographical changes in the arrangement of ocean and continent or in the relief of the land. Prof. William Ramsay of Helsingfors (*Geol. Mag.*, 1924) points out that a period of high relief produces a cold climate and that the wearing down of the land into extensive peneplains produces a milder climate. C. E. P. Brooks, *Evolution of Clim* (1922), gives important help to this line of explanation by c culating the quantitative effects of changes in the position land and water. Of the former glacial periods, the known ran of that in the Upper Carboniferous and Permian has been grea extended, especially in America, in Brazil, Paraguay and t Argentine, and in the eastern United States, where Quayle h shown that the till at Squantum near Boston is a boulder clay this period. There has been a tendency to attribute all coa boulder beds to glacial action, though some have now receiv other explanations. The glaciation in South Australia a Central China is generally regarded as belonging to the upp part of the pre-Palaeozoic instead of Cambrian.

Darwin's theory of coral reefs has gained general acceptan and the main interest in connection with them has been fr Daly's view that their up-growth was due to the rise of sea-le owing to the release of water by the melting of the glacial i sheets. This argument is largely based on many of the co reefs rising from banks at the depth of 100 fathoms; but th banks and platforms are probably cut down to that level, as is the lower limit of wave action. The numerous variations level of raised coral reefs and beaches do not support a unifo world-wide rise of the oceans. The irregularity in the rise a fall of coral reefs has been explained by Molengraaff as due the isostatic subsidence of volcanic areas by the weight of t volcanic materials being favourable to the growth of coral ree

Economic Geology

Perhaps the most marked change since 1910 has been the i proved status of economic geology, due to recognition of its i creasing practical service, and to the value of its contributions academic science. The further study of coals has strengthen the view that anthracite is formed from the same vegetation bituminous coal, the difference being due to subsequent change The enormous increase of output of oil, which has been mag fied more than threefold in the past 14 years, has roused anxiet as to the duration of the supplies. Oil geology attaches less valu than formerly to anticlinal structure as indispensable to a pro itable oil field. Oil prospecting has revealed the form a structure of the salt domes, and the oil fields in Persia have b come the most important under British control.

The extensive boring stimulated by the high prices of 1916– led to energetic well drilling from 1917–22, and to a sensationa increase in oil production in California. It is doubtful whethe the oil output can be extended to meet the growing deman or even be maintained, although improved methods of extracti of oil from beds will lengthen the life of many fields. The ind cations of a decline in some of the leading sources of supply hav led to increased attention being paid to oil shale, in the expectation that before the end of the century it will be the main sourc of mineral oil. Discussion on ores of magmatic origin indicate that they are relatively unimportant, unless the term be s defined that practically all primary ore deposits are regarded a magmatic. There has also been increasing recognition of th importance of magmatic water—as in the series of papers by American authors (*J. G.*, 32, 1921, pp. 177–225, 292–310, 373– 449–71), who agree that part of the water from the hot spring of the United States is of deep-seated origin.

The deep flowing wells of east-central Australia have con tinued to decrease in volume, supporting the view that the flow is due partly to the plutonic water which rises from bel and mixes with the water stored in the stratified beds. No sing chemical distinction has been found by which the proportion the plutonic to the meteoric waters in a deep-seated supply ca be determined; but, with the prolonged age now accepted for th world, a small annual supply of plutonic water would, in th course of geological time, make an important addition to th volume of the oceans.

Bibliography.—See in addition to the works cited in the text J. W. Gregory, *Geology of To-Day* (1919); J. Geikie, *Structural a* *Field Geology* (1920); P. Lake and R. H. Rastall, *A Text Book o* *Geology*, 3rd. ed. (1920); Sir A. Geikie, *Class Book of Geology*, 6th ed (1921).

(J. W. G.)

GEOLOGY: NEW THEORIES (*see* 11.638).—In considering the gin of continents and oceans it is important to have a clear a of the magnitudes concerned. If we imagine a globe a foot diameter to represent the earth, with all its features in their ie proportions, by far the greater part of the ocean will be less an $\frac{1}{200}$ in. deep and only its extreme depths will reach $\frac{1}{100}$ h. Almost the whole of the land will rise less than $\frac{1}{1000}$ in. ove the sea and even Mt. Everest will have an altitude of s than $\frac{1}{100}$ inch.

Leaving out of consideration exceptional heights and depths e difference in level between the surface of the land and the or of the deep oceans will be less than $\frac{1}{200}$ inch. These are e features for which we are trying to account. Of the 12-in. be all that lies more than an inch beneath the surface is der conditions of temperature and pressure which cannot be proached in our laboratories, and we have no experimental owledge of the behaviour of materials under such conditions. oreover, time is an important factor, and our experiments give t little indication of what may happen under stresses acting thousands or millions of years. It is not surprising that there no general agreement as to the causes that have produced the esent distribution of land and sea.

Earlier Ideas.—Throughout the greater part of the last century geologists in general believed that our present continents d oceans were only temporary features of the globe. It was sy to prove that much of the land had once been beneath the a, it was not possible to show that any part had always been nd. It was reasonable to suppose that much of the ocean had ce been land, it was not unreasonable to imagine that no part d always been sea. In the last quarter of the 19th century, wever, the idea of the permanence of the ocean basins began gain ground. It cannot be said that there is any universal reement upon the question even yet. Many geologists are w inclined to ascribe a high antiquity to the Pacific Ocean it to look upon the Atlantic and Indian oceans as comparavely modern. Haug and others still suspect the former existce of a Pacific continent.

If continents and oceans are not permanent the present stribution of land and sea is only an episode in the history of e globe and has no more significance than the distributions in e past. It was not geologists therefore who first endeavoured formulate general theories to account for the present shapes continents and oceans. Those who made such attempts nored the changes in the past and their speculations were ceived with little favour by geologists.

The Tetrahedral Theory.—By far the most suggestive of these eculations was the tetrahedral theory of Lowthian Green. It as to some extent foreshadowed by him in *The Edinburgh New hilosophical Journal* in 1857 and was fully elaborated in his *estiges of the Molten Globe* in 1875. Following the widely accepted notions of the time, he assumed that the earth is cooling, ie interior contracting more rapidly than the exterior, and nder the force of gravity the outer crust collapses. Fairbairn's periments on the crushing of wrought-iron tubes led him to beeve that the collapsing sphere will tend to approach a tetraheral form. The corners of the tetrahedron will rise above the ater, forming triangular masses of land; the faces of the tetraedron will remain covered and will form the oceans. He places ie of the corners at the South Pole and the other three in the orthern Hemisphere. The corner at the South Pole is the ntarctic Continent and the opposite face of the tetrahedron is vered by the Arctic Ocean. The triangular masses of land rmed by the other three corners are represented respectively y North and South America, Europe and Africa, Asia and ustralia, all of them wide toward the north and tapering toward ie south. The two last are united in the north, but the Caspian epression is below sea-level and the plain of the Obi but little ove it. Between these three land-masses lie the Atlantic, dian and Pacific oceans, all narrowing toward the north and, the south, where the tetrahedral edges are lowest, uniting to a continuous belt around the globe.

The actual form which Lowthian Green believes the earth to have reached is the hexakis-tetrahedron (*see* 7.575, fig. 29), and he supposes that all the faces are much rounded so that the departure from the spheroidal form is only slight. Lowthian Green's theory was entirely neglected in England for many years, but was more favourably received in France. De Lapparent seems to have been the first to recognise it as a probable hypothesis and at a later date both Michel Lévy and Marcel Bertrand adopted it in a modified form. Since the closing years of the last century a tetrahedral theory in some shape or other has been accepted by many writers in England, Germany and America.

Modifications of the Tetrahedral Theory.—That the lithosphere shows some approximation to the tetrahedral form is matter of observation and not of theory. But that the approximation is only rough is indicated by the fact that the writers who support the theory do not all place the tetrahedron in the same position. Michel Lévy's tetrahedron, for example, is not the same as Lowthian Green's. The question naturally arises whether so ill-defined an approach to the form is due to some general cause such as Lowthian Green imagined, or to the accidental concourse of a number of minor causes. If the form is due to a general cause, then, since three of the corners of the tetrahedron are placed symmetrically with respect to the axis of the earth, the three land-masses which represent them should have a similar geological history. In particular it might be expected that their coasts should show some uniformity of type. But, as has been pointed out by Suess, the Pacific and Atlantic coasts differ fundamentally in character. The former runs parallel to the folds that have affected the surrounding land, and it is clear that the cause that produced the folds also determined the coast. The Atlantic coast, on the other hand, in general cuts right across the folds that have affected the neighbouring land and must owe its origin to another cause. The difference is too great to be accounted for by later modifications of coasts which were originally of similar origin. Further, if the differences are due to later modifications, the approximation to the tetrahedron should have been closer in the past than it is now. All the available evidence goes to show that the tetrahedron which fits best to the present distribution of land and sea will not fit at all to the distributions in past times.

On physical grounds objection has been raised that the tetrahedron is not a figure of equilibrium for a rotating earth, and even a slight approximation to it cannot be retained. Gregory has suggested that there may have been periods of collapse with an approach to the tetrahedral form, and in the intervening periods the spheroidal form was resumed. Moreover, in these periods of collapse the tetrahedron may not always have been in the same position, and thus we get the different distributions of land and sea in the past. Other writers also place the tetrahedron differently for different periods, but the geological evidence in favour of these views is not convincing.

Suess's Theories.—A great advance in our knowledge of the history of the globe was made by Suess in his *Das Antlitz der Erde.* He showed that there are large areas where even the oldest fossiliferous beds still lie horizontal. Here the crust of the earth has been rigid, in the ordinary sense of the term, since Cambrian times. It has broken, but it has never crumpled. Between these areas lie broad belts in which the strata are often folded. Here the crust has been weaker and has yielded to tangential pressures by crumpling and overthrusting. The crumpling was not a continuous process. There were well-defined periods of folding separated by intervals during which the whole earth was free, or almost free, from such disturbances. During these intervals, however, fracturing of the resistant areas took place and large blocks sank; and there were also wide extensions or " transgressions " of the sea over the land. Some of these transgressions seem to have been nearly simultaneous throughout the world and the whole land-surface must have been greatly reduced. The most extensive of them, so far as positive evidence can be adduced, occurred in the middle and later parts of the Cretaceous period.

In the Northern Hemisphere there are three areas in which the Cambrian beds remain unfolded. These are: (1) " Laurentia," which includes most of Canada east of the Rockies and probably stretched to the Western Is. of Scotland, (2) the "Baltic Shield" and "Russian Platform," (3) "Angaraland," which includes a great part, but not the whole, of Eastern Siberia. In all these areas, except upon the Russian Platform, no marine beds of Mesozoic age have been found, and during the Mesozoic era they were land. Probably by that time Laurentia and the Baltic Shield had been united by the folding of the intervening belt that took place at an earlier date.

In the Southern Hemisphere Cambrian fossils have only been found at one or two localities, but there are areas in which the oldest fossiliferous beds known show no folding. The most extensive of these is "Gondwana-land," which includes the greater part of South America east of the Andes, most of Africa between the Atlas and the mountains of the Cape, Arabia, Syria and the Peninsula of India. Strictly speaking, perhaps, the whole of this region should not be called Gondwana-land, for the Cretaceous sea extended far over it and even marine Jurassic beds are found in places. But much the larger part was land throughout the Mesozoic era. A similar remark applies to a great part of Australia. Between the Mesozoic land-areas of the north and those of the south lies a belt in which the Mesozoic beds are for the most part marine. This is the "Tethys" of Suess.

Between the rigid masses of the north and those of the south the more yielding crust beneath the sea of Tethys was crushed, and the great series of mountain ranges which run from west to east across the Old World was elevated. Tethys was much reduced in size and is now represented chiefly by the Mediterranean Sea. About the same time Laurentia and Gondwana-land broke up, large portions sinking beneath the sea, and thus the present Atlantic came into existence.

Such are some of the more important events in the history of the globe according to the researches of Suess, and it is impossible here to enter into further detail or examine the evidence more closely. The Pacific appears to have been sea throughout the Mesozoic era at least, but nevertheless it has functioned as a rigid area.

Suess imagines that the interior of the earth is contracting and the crust settling down upon it. The settling is accomplished partly by the fracturing of the more rigid portions, partly by the crumpling of the more yielding parts between them. Sometimes one portion of the crust is pushed over another and thus there must have been changes in the relative positions of different points upon the surface, but in comparison with the size of the globe these changes are small.

The Wegener Hypothesis.—Wegener introduces an entirely different conception, according to which the relative positions even of whole continents have altered greatly in quite recent times. The idea is not altogether new, for Schwarz had already suggested that Africa and South America were once nearer to each other; and other writers, on less solid ground, have made somewhat similar suggestions. But Wegener goes further than his predecessors and brings forward a much greater body of evidence.

Sial, Sima and Nife.—It has long been known to geologists that the visible part of the earth's crust consists chiefly of the lighter and more acid rocks, and beneath this it has been commonly supposed that there lies a layer of the denser and more basic rocks. The interior core must be denser still. In formulating these ideas Suess proposed the names Sal, Sima and Nife for the three concentric regions respectively. The term Sal is now usually replaced by Sial, and with this modification Suess's nomenclature is widely adopted. It has generally been supposed that the sial covers the whole globe. It may be thinner under the oceans and thicker on the continents, but it is present everywhere. Wegener believes that the sial is discontinuous. The floor of the ocean is formed of sima and the continents are sheets of sial floating in the sima. Because the sial is of smaller density its surface rises above the surface of the sima. The sima is not liquid in the ordinary sense of the word; but there is no perfect solid, and the sheets of sial, supposed to be about 100 km. thick, could not lie upon the sima without the force of gravity pressing them in until they floated
like a cork in water. This is quite in accordance with the
servations of geodesists, which indicate that the earth is
nearly in a state of isostatic equilibrium.

It was long ago shown by Pratt that there must be an exc
of density beneath the oceans and a deficiency beneath
elevated regions; and Airy suggested that all elevated mas
must be supported by a downward protuberance of the ligh
rock of which they are formed, into a denser layer below—
fact by flotation. It should be noted, however, that all
observations are equally consistent with the notion of a c
tinuous sial thinner in oceanic areas and thicker in elevated
gions, the downward extension into the sima bearing such
relation to the protruding portion that the whole is in hyd
static equilibrium.

Wegener's view is that the sheets of sial are not only separ
and floating in the sima but also moving laterally, and that th
positions relatively to one another have altered in the past a
are altering still. There are certain forces arising from
rotation of the earth and the attraction of the moon which wo
tend to cause lateral movements. Whether they are sufficie
to produce such movement through so resistant a medium
the sima is open to question; but it is conceivable that th
may be.

Wegener says that if we take the edge of the continental sh
as the edge of the sial sheets and allow for the effects of Tertia
folding, the pieces of sial can be fitted together into one c
tinuous sheet covering about a third of the globe. This,
thinks, was the condition at the close of the Palaeozoic era.
brings Africa and South America together and both into cont
with the Antarctic continent. Australia also is placed agai
Antarctica, and Madagascar and the end of an elongated Ind
are wedged between Africa and Australia. In the north, Gree
land, Canada and north-western Europe come together but
wide gap is left between the rest of North America and t
continents of Europe and Africa.

Criticisms of the Theory.—There is far too much scope for t
imagination in this process. Wegener does not follow the edge
the continental shelf with any precision, and the allowance th
he makes for the Tertiary folding is purely fanciful. Moreov
in his fitting he has introduced great distortion. If we keep t
masses rigid and fit South America into the Gulf of Guine
Canada will not come within 1,000 m. of the position it occup
in his scheme. Indeed, if his theory rested solely on the eviden
of fitting, it might be dismissed at once. But there is mu
stronger evidence than this. He says that with his fitting t
geological structures on the eastern side of the Atlantic beco
the direct continuation of the structures on the western si
The argument is weakened by the great amount of distorti
that he has introduced to make them fit, it is almost entire
destroyed by the real facts. Several of his statements are qu
at variance with those of the actual observers, and others r
on a very imperfect basis.

It is in the Southern Hemisphere that the geological eviden
for a former union of the continental masses is strongest, and it
perhaps significant that the nearest approach to a fit is th
between Africa and South America. The close similarity betwe
the rocks and fossils of these two areas has led most geologis
to assume a former land connection. Both regions are cha
acterised by the occurrence of the fossil *Glossopteris* flora, whi
differs considerably from the contemporaneous flora of Europ
The same flora has also been found in India and Australia. A
these are brought together in Wegener's scheme and the si
ilarity in rocks and fossils is at once explained. But the arg
ment is considerably weakened by the fact that the *Glossopter*
flora is also found in Siberia and northern Russia, which in h
reconstruction become farther away from the presumed home
Glossopteris than they are at present. In view of our very i
perfect knowledge of the geology of Asia, and the discovery of th
Glossopteris flora in a few other Asiatic localities, it seems pro
able that it had a wide distribution and was far from confine
to the regions that Wegener brings together.

Associated with the *Glossopteris* beds in South America, Afric a and Australia there is a boulder bed containing glaciated ders, which has long been a puzzle to geologists. On the most urable supposition with regard to the position of the South the ice that carried the boulders must have extended nearly he tropics, and it seems improbable that any glacial period d have reached the required intensity. In Wegener's re- struction of the period all these areas come together and ld lie within a reasonable distance of a suitably placed pole. here again there are difficulties. A similar boulder bed, also ciated with beds containing a *Glossopteris* flora, has been d in Afghanistan, which, with Wegener's fitting, must have within thirty degrees of the equator when the other areas e centred about the pole. The Afghanistan boulder bed was down near sea-level, for it is associated with an alternation arine and terrestrial deposits.

general it may be said that Wegener's theory removes cer- difficulties, but in removing them it introduces others of al magnitude. By far the most suggestive point in his ur is the resemblance between the African and South erican rocks and fossils. Even here Coleman, who has ex- ned the South American boulder bed, states that the ice ch deposited it reached the sea on the eastern side of South erica.

oly and Radio-activity.—Joly's theory is based on the effects adio-activity. Like Wegener he thinks that the continents are ets of sial floating in the sima, which forms the floor of the an. Relative displacements of the continents may have taken ce, but only at certain periods.

he sial and the sima are both radio-active and the radio- ive elements in them are continually generating heat. Unless heat can escape the temperature must rise. The melting nt of the sial rocks is known to be much higher than that he sima, which is basaltic in composition.

uppose that at a certain period the whole of the sial is solid the sima also is solid down to a considerable depth. Heat can y escape by the slow process of conduction. Beneath the sial re will be no escape from the sima, because the base of the sial lf, owing to its own radio-activity, must be nearly at the lting point of sima.

ince the escape of heat is so slow the temperature rises and sima melts to within some 20 m. of the surface. Tidal movements in the molten sima acting upon the downward projections the sial move the whole crust so that the local accumulations heat originally formed beneath the sial come to lie under the n layer of solid sima beneath the ocean. This is quickly nned still further, and molten sima escapes through fractures. e loss of heat now becomes more rapid and an era of cooling d consolidation begins..

We must suppose, then, that there are periods during which the a layer melts more or less completely and periods during which olidifies down to a considerable depth. It has been shown ex- imentally that basalt, and most other rocks that have been ed, expand on melting and decrease in density. As the sima lts it expands, and therefore the general level of the earth's face is raised. But because the density of the sima is de- ased the masses of sial which are floating in it sink more ply into the layer. Their surfaces, owing to the general rise, ome farther from the earth's centre, but, relatively to the face of the sima they are depressed. In this way the wide- ead transgressions characteristic of certain geological periods explained. As the sima cools again and becomes denser the face falls, but the sial masses rise relatively to the sima.

When the sima begins to cool, the crust upon it, if not already mplete, is soon completed by the consolidation of molten ma- ial in its fissures. Together with the sial masses it now covers whole globe. But the sima continues to contract further, and covering becomes too large. And now begins a period of ding and other earth movements to enable the crust to descend th the sima.

It is not possible here to enter further into the consequences of theory. Its great merit, from the geological point of view is at it seems to offer a clear explanation of the most remarkable features in the history of the globe, the periodicity of earth-folding and sea-transgressions and their widespread character.

Conclusion.—In view of our ignorance of what goes on in by far the greater part of the interior of the globe it remains improbable that any theory founded on examination of a thin external skin can be wholly true. The old hypothesis of a contracting core fits the observed facts of geology as well as any other. It has been urged that the possible amount of contraction is insufficient, but on this point it is unsafe to dogmatise. Recent astronomical observations show that the companion star of Sirius consists of gas and yet is denser than any material upon the earth's surface. A discovery so unexpected leads us to revise our ideas and, though the conditions are very different, renews interest in the suggestion of Arrhenius that the interior of the earth is gaseous.

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(P. LA.)

GEOMETRY (*see* 11.675).—The usual history of the development of the ideas of a student of geometry in England to-day is somewhat as follows: After a more or less prolonged (and highly desirable) course of experimental geometry, very largely (and undesirably) limited to a plane, in which a line is a mark made on paper, and a straight line is a mark which agrees with a physical object (a ruler), the student passes through a course in which he is shown that there is a logical connection between the geometrical conceptions his experience may have led him to form.

I. FOUNDATIONS

At first, and for a long time, often permanently, lines and circles are regarded as objects of perception and, for instance, there is no hesitation in accepting the idea of two lines being in the same direction, and it appears intuitive that two points must have a certain distance, a result of familiarity with the rigid bodies which the student has had put before him. This teaching, after a certain knowledge has been obtained of the detailed relations of circles and lines, often painfully acquired and difficult to remember, is continued on the same plan, for the so-called geometrical properties of conic sections, though these are apt to appear at first as much less concrete than circles.

After this, as soon as some facility with algebraical computation is acquired, the student learns that a straight line has an *equation*, and that, *e.g.*, the common points of two circles depend on the solution of a quadratic equation, while the common points of two conics depend on a quartic equation. If his instruction is pursued far enough, he learns, with the expenditure of much time and energy, a vast number of algebraical devices, and is now, if apt in using them, capable of proving algebraically almost any question that his usual examinations are likely to require of him.

For his further efficiency to this end he is probably taught towards the close of his career something about harmonic relations, about homography, and about projections. In particular, for example, he may be taught that the equations which give the foci of a conic are obtainable by applying the analytical conditions for a circle to the equation of the pair of tangents to the conic from any point. If he is fortunate it may be pointed out to him, near the end of his laborious drilling in detail, that a circle behaves as if it were a conic with two definite (albeit imaginary) points; and if he must in any case know the properties of conics he may, for economy of memory, seize hold of this remark, and come also to a geometrical description of the property of foci just referred to—and pursuing this course, if circumstances allow, he may finally reach a framework of hypothetical constructions including the so-called circular points and the circle at infinity, from which, looking back, as from a hill-top, he sees the whole country of geometrical fact, with which he has so laboriously become acquainted, shrink into a landscape dominated by very few main routes.

He may now be at the stage of the third year university student. With continued consideration he may be led finally, even if only with the purpose of summarising his geometrical outlook in the fewest possible ideas, to regard as working hypotheses such as the following: (*a*) there is no fundamental difference between points at infinity and those not at infinity; (*b*) there is no difference in reality between real and imaginary points; (*c*) there is no gain but great loss in refusing to consider space of more than three dimensions; (*d*) distance, as a fundamental conception is unnecessary. And with these will come a recognition that the so-called non-Euclidean geometries are logically prior to the Euclidean geometry.

Leaving aside now the tempting pedagogic question of whether he has been justly treated in being so long denied the synthesis which, if he could have appreciated it, would so much have lightened his task of becoming familiar with the details, we remark that he finally works with a conceptual scheme which includes the perceptual experiences by which it has been suggested —but discards many ideas which at earlier stages his perceptions seemed to suggest as necessary. For instance, the points of a line are not now in (linear) order, and lines have lost their straightness, the lines of threefold space being for many purposes better regarded as points of a quadric in five dimensions.

Questions then arise such as: is geometry unique in thus replacing the first crude ideas of physical experience by a conceptual scheme of entities, whose properties are determined logically, not from a set of *definitions* which tell us what these entities are, but from a set of fundamental propositions or statements of relations between them? And connected therewith: are the ideal entities of such a conceptual scheme less *real* than those, for example, which the physicist employs, say the aether or electrons, to explain his conceptions? May the statement that distance is not necessary as a fundamental conception be fairly replaced by the statement that distance in the abstract is an illusion? It would seem that the difference is one only of the degree of abstractness of the conceptual scheme employed. We may in geometry itself have different levels of abstractness; for example, we may in the first instance regard the points of a line as conforming to our idea of an abstract order of such a kind that the so-called Dedekind's axiom is applicable, although finally when we allow the so-called imaginary points we discard this notion of order and use the word line in a still more abstract sense. It would seem that every science as it advances in comprehensiveness must similarly evolve for itself a conceptual scheme of ideal entities; and that in strict logic, no proposition can be asserted to be true or false except in reference to entities whose fundamental relations have been made explicit.

Such questions as these arise when it is assumed that it ought to be possible to ascertain by observation whether the world is finite, or still more whether space (in the abstract) is Euclidean or non-Euclidean. If the attitude which has been suggested is sound, the most that can be done is to inquire what would be the modifications in our statements of perceptual regularity which would follow if we adopted a particular scheme of conceptions in regard to the extent of the world, or the character of space.

Of such conceptions, those which have reference to a method of measurement are of fundamental importance. And if measurement is possible at all, it must presumably be based upon a scheme for assigning identification numbers to the points of bodies which are to be measured. This is not the same as assigning numbers to points of space, nor, even if this could be done, would the method of measurement be determined uniquely thereby. A way of assigning identification numbers to the points of a figure must be conditioned (*a*) by the fundamental theorems of incidence of the elements of the figure (as that a line is determined by two points, or that two planes meet in a line); (*b*) by the nature of the numbers to be used (whether they allow commutative multiplication, for example); (*c*) by the freedom of the assignment, that is the number of points of the figure for which the corresponding numbers may be assigned arbitrarily, the numbers belonging to any other point being then determinate; (*d*) which is in fact included under (*a*), by the character of
the "infinity" of the figure (as whether the space of the figu
open or closed); and even then (*e*) it appears to be necessary
assume one or more definite limiting theorems of incidence.

In the way which has been studied most in detail, as being
which is most naturally suggested by the Euclidean scheme in w
geometrical thought has developed, the numbers being taken t
those of ordinary arithmetic, it is possible to assume arbitrarily
numbers for three points of a line, so long as this is considered
itself, the numbers of four points of a plane regarded as isolated,
the numbers of five points of a three-dimensional space; this spa
regarded as closed, the numbers belonging to a point are regar
as ratios of numbers, and infinite values of numbers are thereby
cluded from consideration—and the assumption is made that
lines of which no two intersect have two common transversals.
is shown that the introduction of this assumption is equivalent (ot
things being equal) to assuming that the numbers used are commu
tive in multiplication. The number space of Descartes, in which e
point is represented by three ordinary numbers, one or more of wh
may be infinite, may be regarded as a particular case of the so-ca
projective space thus described.

In his famous *Habilitationsschrift* (1854), when 28 years old,
Riemann considered a Cartesian space in which each point is speci
not by three but by n numbers or co-ordinates, and proposed
measure the distance between two neighbouring points by means
a quadratic function of the small differences of their correspond
co-ordinates. He remarked then that such a space has not nec
sarily any rigid bodies capable of movement without change
linear dimensions. For this to be possible it is necessary and su
cient that certain functions of the co-efficients in the quadra
form and their differential coefficients should be constant. T
number of these functions is $n^2(n^2-1)/12$; for instance, for $n=$
this number is 1, and for $n=3$, it is 6. When these conditions
satisfied the space is said to be of constant curvature. But it is
be remarked that a Cartesian space of n dimensions, such as th
considered by Riemann, is in reversible, point-to-point correspo
ence with a quadratic manifold (also of n dimensions), in a p
jective space of $n+1$ dimensions. In such a space of $n+1$ dimensio
as was first remarked by Cayley, we can set up a measurement
distance between any two points by taking, quite arbitrarily,
quadric manifold of reference. It is then the case that Rieman
definition of distance, when his space is of constant curvature a
allows rigid bodies capable of movement, is so obtainable af
Cayley's manner.

These details appear to bring out very clearly that even when t
difficult step has been made of passing from the descriptive pro
erties of a geometrical figure to the assignment of co-ordinates,
is a further step of much artificiality to introduce a measure of t
distance between any two points.

In recent years, under the stimulus of A. Einstein, H. Mi
kowski, H. Weyl and others, Riemann's dearest dream of a u
form formulation of all phenomena of physics, has, it would see
been brought appreciably nearer to realisation, in what is know
as a Theory of Relativity. An event, occurring in a defini
place at a definite time, is regarded as depending on three co-or
nates for its position, and one for its time, and these four togeth
are spoken of as its co-ordinates in a Cartesian space of fo
dimensions. As formulated by Einstein, there is an interv
between two neighbouring events, given by a quadratic in th
differences of their corresponding co-ordinates; this quadratic wi
then have 10 co-efficients. (*See* RELATIVITY; SPACE-TIME.)

It can be shown that there exist functions of these coefficients an
of their derivatives in regard to the point co-ordinates, which are u
changed in value if calculated for the quadratic form into which th
given one is transformed by any transformation of the co-ordinates
for instance, the 20 functions which, as has been stated, arise in th
consideration of what is called the curvature, are such functions
It is clear that the vanishing of such an invariantive function ex
presses a fact which is not altered by any simplification that may b
possible in the form of the quadratic expression. For instance, if th
20 functions above referred to all vanish, the quadratic expressio
has a form the same as in Cartesian Euclidean geometry; and
they are all equal to the same quantity independent of co-ordinates
the quadratic expression has the form considered by Riemann.

In Riemann's theory, following Gauss, account is taken of curves
called geodesics, which satisfy the condition that the integral $\int d$
taken along such a curve, shall be stationary according to th
ordinary rules of Lagrange's *Calculus of Variations*, where ds is th
square root of the quadratic expression referred to. Einstein's sug
gestion is that the path of a particle under the influence of what w
call gravitating masses may be represented as such a geodesic, pro
vided the coefficients in the quadratic form are chosen to depend
suitably upon these masses; and this has proved capable of verifica
tion in the case of the planet Mercury, and in the case of a ray o
light passing near to the sun.

An analogous suggestion has led Weyl not only to the equations
belonging to the theory of gravitation, but also to those which

ess the phenomena of electromagnetism (and light). And it is interesting from our present point of view to see the character e modifications which Weyl has been led to make in Einstein's ematical formulation in order to attain this end. For our ent purpose we may state this in a twofold manner without ring into the logical connections. In the first place, in Weyl's ry, instead of the quadratic form ds^2 being regarded as definite wo specified neighbouring events, a product ϕds^2 is regarded as ite, where ϕ is a function variable from point to point, whose vatives in regard to the co-ordinates are utilized to represent romagnetic phenomena.

s Weyl writes (*Math. Zeitschrift*, ii., p. 397, 1918), "Riemann hte die . . . Annahme, dass sich Linienelemente nicht nur an elben Stelle, sondern auch an zwei endlich entfernten Stellen Länge nach miteinander vergleichen lassen. Die Möglichkeit r solchen ferngeometrischen Vergleichung kann aber . . . nicht standen werden." This is precisely in the spirit which has ed geometers increasingly since the publication of G. K. C. von dt's *Geometrie der Lage* (1847). It introduces however evidently de arbitrariness which Weyl limits by adopting as a datum the ibility of the translation of a vector given at one point to her neighbouring point *without change of direction.* This conception adopted from T. Levi-Cività (see Levi-Cività, *Palermo, Rendi-i*, xlii., 1917, pp. 173–205, and F. Severi, *ibid.*, p. 254), is as ws: The two elements of direction defined by (*a*) the vector he first point P and (*b*) the displacement from P to the neighing point P′, define a family of geodesic directions through P, ing a surface; the parallel vector at P′ is that whose direction *his surface* makes with the direction PP′ the same angle as that le by the vector at P. Evidently the assumption of the possibility his determination of unchanged direction is fraught with large sequences or conditions. A suggestion subsequent to Weyl's S. Eddington, *Proc. Roy. Soc.*, xcix., 1921, pp. 104–122), ns with Levi-Cività's differential equations for parallel displace-t of a vector, but working backwards towards the quadratic rential form leads to a generalisation of Weyl's formulation.

o much of detail in regard to these remarkable contemporary culations seems necessary in order to compare the geometrical ects with those of older conceptions. In the so-called space of stein, still less in Weyl's space, there exist neither bodies, nor vement; and what are the fundamental geometrical condi-s assumed prior to the establishment of the system of co-inates is as yet undetermined. The latter fact, which is ally true of any Cartesian space, may provisionally be evaded regarding the space as being in point to point correspondence h a quadric manifold in a projective space of five dimensions; former fact, which relates to the consideration of a quadratic erential expression, is most probably, if it proves finally to be sible to put the phenomena of physics into exact correspon-ce with geometrical considerations, suggestive of a physical ory which, given some fundamental relations of experience, ll be developed not by computation, but by descriptive hods. For the aim of geometry, towards which since Von udt's time, much progress has been made, is such a descrip-e conception of the relations of figures in space as may render nputation unnecessary.

II. GENERAL THEORY OF SURFACES

he older theory of circles and conics, or of rational curves in eral, as also the theory of quadric surfaces, of cubic surfaces f rational surfaces in general, can be placed in (1, 1) correspon-ce with the geometry of lines, or of planes, respectively; it ls ultimately with linear equations when viewed analytically. onsideration of cubic curves on a plane, or of the curve of rsection of two quadric surfaces, soon shows that these do depend upon linear equations ultimately—or more precisely t the points of a plane cubic curve cannot be put into (1, 1) respondence with the points of a line. And it further ap-rs that a quartic curve in a plane is again of a higher category, cannot be put into (1, 1) correspondence with a cubic curve. his fact first emerges clearly in Abel's great paper on the inte-ls of algebraic functions. The general theory of the so-called her Curves was then historically subsequent to the theory of ebraic functions and the integrals of these; though, when theory had received a sufficient development, it proved pos-e to elaborate a descriptive theory of these curves embodying results obtained by the earlier analytical methods. In geom-y, entities which can be put into exact (1, 1) correspondence equivalent for geometrical purposes, and conversely, for purposes of a general theory, it is vital to know whether two entities have this equivalence or not. It is one of the most important recent developments of geometry to have made it clear that criteria can be given by which to determine whether two surfaces have this (1, 1) correspondence.

And it is interesting to remark that historically the development in this case has been on similar lines to that by which the corresponding result was obtained for curves; in the first place, over many years, Picard developed the theory of algebraic integrals associated with surfaces on lines as far as possible analogous to those which had been followed in the case of curves, therein in part carrying out a suggestion due to Klebsch and Noether, though the integrals which have proved most effective hitherto were not those suggested by Klebsch; after this the geometrical aspect of the matter was investigated by Italian geometers, more especially Enriques, Castelnuovo and Severi, who have succeeded in surpassing in beauty and generality even the distinguished contributions of their own countrymen to the theory of curves. It is impossible indeed to convey to a non-geometrical reader any idea of the interval which separates the development of geometry in Italy to-day from the development reached in England.

The new theory is under the disadvantage that an appreciation of it is impossible without sympathy and acquaintance with the theory of algebraic functions and their integrals, and it may be some time before detailed applications of it become the common property of mathematicians. But it offers a limitless scope for new work, its importance cannot be doubted and its permanence is assured.

Bibliography.—For the question suggested by the Einstein-Minkowski work, ample material arises in attempting to sift into logical coherence many of the current writings on Relativity. An ample bibliography of these concludes the work of Hermann Weyl, *Raum-Zeit-Materie*, Vierte erweiterte Auflage (Berlin, 1921). The English reader will find much stimulus to geometrical consideration in Eddington's volumes, *Space, Time and Gravitation* (Cambridge, 1920) and *The Mathematical Theory of Relativity* (2nd ed., Cambridge, 1924); and should consult E. Cunningham's two fundamental volumes on *Relativity*, and A. A. Robb, *A Theory of Time and Space* (Cambridge, 1914). Emile Picard's work is summarised in his book, *Théorie des fonctions algébriques de deux variables indépendentes* (Paris, 1897–1906), which concludes with a summary by MM. Castelnuovo and Enriques (t.ii., pp. 485–522) of the results obtained by the Italian geometers up to 1906. The reader may also consult the article by Severi in vol. II of Pascal's *Repertorium of Higher Mathematics* (German Edition, pp. 741–782, 1922). Subsequent progress is recorded (and scattered) in the various mathematical journals, mainly of Italy. (H. F. Ba.)

GEORGE V. (1865–), King of Great Britain and Ireland (*see* 11.745), succeeded to the British throne on the death of his father, King Edward VII., May 6 1910. By the Regency Act, 1910 (a temporary constitutional necessity in view of the fact that King George's eldest son, Prince Edward, was then not 16) his consort Queen Mary was at once nominated regent in the event of a demise of the Crown while the heir to the throne was under age. A new civil list fixed at £470,000 a year, was approved by Parliament in 1910. An important change in the King's accession declaration was also embodied in an Act of that year, the following short and simple formula being substituted for the old manifesto:—

> I do solemnly and sincerely in the presence of God profess, testify and declare, that I am a faithful Protestant, and that I will, according to the true intent of the enactments which secure the Protestant succession to the Throne of my Realm, uphold and maintain the said enactments to the best of my power according to law.

The coronation at Westminster Abbey, on June 22 1911, was attended by representatives from all parts of the Empire and other countries and, in order to complete the public assumption of royal authority throughout the United Kingdom, the King and Queen, with the Prince of Wales and Princess Mary made state visits to Ireland, Wales and Scotland during July. Later in the year Their Majesties visited India, and coronation ceremonies took place at the ancient capital of Delhi (Dec. 12 1911).

From the very first King George and Queen Mary showed in all their actions their earnest desire to use their royal position in the most public spirited manner. Great Britain was fortunate in the fact that so much had already been done, by Queen Victoria and King Edward VII., to establish the Throne in the hearts of the people as a central and unifying national and Imperial force, distinct from sectional interests of party or class. Under King George this tradition was steadily maintained. He and Queen Mary devoted themselves to the task of making the influence of the court a pure, useful and kindly one in the life of the country; they mingled with different classes of society and were ever active in accepting new opportunities of service. The personal tastes of both were known to lie in characteristically domestic directions. The royal stamp collection is the most complete in existence, and in 1920 the King assured the Junior Philatelic Society of his "unabated interest in stamp-collecting."

The War Period.—The value of the influence of the Crown, as standing above and outside domestic party politics, was emphasised by the Buckingham Palace conference of 1914 on the Irish deadlock; and by the conduct during the World War of the King and Royal Family who in various ways strengthened their hold on the affections of the British people. From the opening of the World War in Aug. 1914 the King and Queen jointly and severally set themselves to make the royal influence an encouragement to every form of national activity in aid of the fighting forces. The King and Queen regularly went in state to prorogue and open Parliament in successive sessions and on frequent occasions during the War royal visits were paid to important factories and workshops at the munitions centres throughout Great Britain, as well as to shipbuilding yards, hospitals and other institutions engaged in war-work of one kind or another. The King's inspections of provincial industrial establishments included visits to Glasgow and the Clyde, Coventry and Birmingham, Leeds and Sheffield, Nottingham, Liverpool, Manchester, Barrow and Gretna, Newcastle-on-Tyne, Hull and Rosyth, Bristol, Bradford and Huddersfield. Moreover, periodical visits were made by him to the Grand Fleet. In 1917 Queen Mary accompanied the King to France. Finally, after the Armistice, the King made another visit to Paris and to the battle-fields, Nov. 27–Dec. 10 1918, and had an enthusiastic reception in the French capital (Nov. 28–30).

In other directions during the war period, the King's desire to set an example of patriotic self-abnegation was frequently apparent. The long record of royal attendances at notable ceremonies included such occasions as the funeral services at St. Paul's for Lord Roberts (Nov. 19 1914) and Lord Kitchener (June 13 1916); the commemoration service there on the entry of the United States into the War (April 20 1917); the Albert Hall commemoration of the first Seven Divisions (Dec. 15 1917); the thanksgiving at St. Paul's on Their Majesties' silver wedding (July 6 1918); the presentation to the King at Buckingham Palace by the special Japanese mission of the sword and badge of a Japanese field-marshal (Oct. 29 1918); and other events. On the occasion of Their Majesties' silver wedding, the King and Queen were received at the Guildhall (July 6 1918) and were presented with a cheque for £53,000, subscribed by the citizens of London, to be devoted to charities by Their Majesties' wish, together with a silver tankard once owned by Charles II.

On July 17 1917 it was announced that King George V. had abandoned all German titles for himself and his family. At the same time a proclamation was issued to the effect that henceforth the royal house of Great Britain and Ireland would be known, not as the house of Saxe-Coburg-Gotha, but as the house of Windsor. It had previously been announced (June 20 1917) that the King had decided that those princes of his family who were British subjects but bore German titles should relinquish those titles in favour of British names.

Post-War Incidents.—With the return of peace it was possible for the more normal activities of court life to be resumed, but in the long list of later royal functions some stand out as worthy of record for their special appeal to contemporary public interest. Immediately after the Armistice in 1918, the King and Queen on successive days made popular progresses through different sections of London, and received general ovations, in carriage drives through the city (Nov. 11), to a special thanksgivin St. Paul's (Nov. 12), through the East End (Nov. 13), the s (Nov. 14), the north (Nov. 15), the northwest (Nov. 18) an southwest (Nov. 22). On Dec. 27 a banquet was given in our of President Wilson at Buckingham Palace, where he Mrs. Wilson were staying with the King and Queen.

On June 21–2 1921 the King and Queen visited Belfast, w His Majesty inaugurated the new Parliament of Northern land. The King, in his speech on that occasion, made an ap to all Irishmen to pause and stretch out the hand of forbeara to forgive and forget and to make for the land they loved a era of peace, contentment and good-will. When, in the follo Dec., an agreement was at last reached with the Irish State, the King in his telegram of congratulation to Lloyd George, ventured to hope that his own speech at Bel might have contributed to bring it about.

On Feb. 28 1922 the King's only daughter, Princess Mary, married in Westminster Abbey to Viscount Lascelles (eldest son of the Earl of Harewood. The King and Queen a state visit to Belgium on May 8. Early in the following (Feb. 7) a son was born to Princess Mary and on April 26 Duke of York was married to Lady Elizabeth Bowes-L fourth daughter of the Earl of Strathmore and Kinghorne. days later the King inaugurated the new Stadium at Wemb Middlesex, constructed in connection with the projected Bri Empire Exhibition, by attending the final cup tie of the Eng Football Association. On May 5 the King and Queen pai state visit to the King and Queen of Italy, remaining in Ro for some days. They were received by the Pope at the Vati on May 9, and on May 12 the King visited Montecchio inspect the graves of British soldiers, who had fallen in Italy.

The outstanding event of 1924 was the opening by the K on April 23 of the British Empire Exhibition at Wembley. and the Queen made frequent subsequent visits to the Exhibiti both privately and accompanied by their royal guests, the K and Queen of Rumania and the King and Queen of Italy, made state visits to London during May. On Sunday, May an Empire Thanksgiving Service was held in the Stadium, c ducted by the Archbishop of Canterbury and attended by King and Queen. On July 19 the King and Queen visited Liv pool and were present at the dedication of the new Cathed On Aug. 21 a second son was born to Princess Mary. Nearer throne was the daughter born to the Duke and Duchess of Y on April 21 1926 and named Elizabeth Alexandra Mary. May 9 1925 the King and Queen opened the second year of Wembley exhibition. (H. Ch.; J. E. C.)

GEORGE I. (1845–1913), King of Greece (*see* 11.746).—In 19 King George promptly recognised Veniselos' rare ability a gave him his whole-hearted support, though the latter had lo denounced the royal policy of *laissez faire.* Internal polit played only a secondary part in King George's reign; the Pa hellenic idea had absorbed the thoughts and resources of t Greek people ever since the recognition of the independence Greece. The King consistently strove to restrain the patriot exuberance of his subjects on the one hand, while endeavourin on the other, to use his great personal influence and family co nections abroad in favour of the aspirations of the Greek peopl His policy was consistently pacific. Even in Oct. 1912, whe Greece was preparing to declare war against Turkey, King Geor made it clear to Veniselos that he only consented to the ventu because of his obedience to the constitutional principle. He wa about to celebrate his jubilee when he was assassinated by Greek named Schinas at Salonika on March 18 1913. He wa succeeded by his eldest son, Constantine I. *See* Capt. Walt Christmas, *King George of Greece* (1914).

GEORGE II. (1890–   ), ex-King of the Hellenes, eldest so of King Constantine, was born on July 20 1890 at Tatoi, the roya villa near Athens. On account of his supposed Germanoph tendencies during the World War, he was excluded from th succession by the Allies in favour of his younger brother, Ale ander, upon the deposition of his father by the ultimatum

e 11 1917. After his father's restoration to the throne in 1920,
narried on Feb. 27 1921, Princess Elizabeth, elder daughter of
g Ferdinand and Queen Marie of Rumania. Upon the second
osition of his father by the revolution of Gen. Plasteras, his
nger brother Alexander I. having died in 1920 he succeeded
he throne on Sept. 27 1922. After the unsuccessful counter-
olution of Oct. 1923, his position became more difficult, al-
igh there was no proof that he had been a party to that rising.
ublican feeling grew under the leadership of M. Papanasta-
and others, and, despite M. Veniselos' advice to await the
sion of the National Assembly, a number of military and na-
officers demanded the deposition of the Glücksburg dynasty.
Dec. 19 1923 the King and Queen left Greece. Next day,
niral Condouriotes, for the second time, became regent. On
rch 25 1924 the Assembly deposed the dynasty and forbade
members to reside in Greece; and the plebiscite of April 13
firmed the vote of the Assembly (*see* Greece).

EORGE, DAVID LLOYD (1863–   ), British statesman (*see*
32). The 1910 conference of British party leaders lasted from
e till November. It was a strange pause of calm in the midst
he stormy events of that period. It is not true to say that
conference was a failure. The conferring leaders, on the con-
y, nearly arrived at a very comprehensive and far-reaching
eme of agreement, affecting all the disputed issues—the House
ords, Home Rule, tariffs and conscription. But the six months
ecrecy ended in detaching the leaders from their followers.
haps the secrecy was overdone, because very few whispers
ne from behind the closed doors of the conference room to
pare the party followers for the agreements which required
e ratified by the parties before they could become valid. The
ilt was that when the party leaders on both sides emerged
n the conference room they found their followers quite unpre-
ed to grant the concessions required from them. While the
lers had passed into a mood of conciliation, the followers were
l living in an atmosphere of party warfare. On both sides the
posals put forward were regarded as surrenders.

Mr. Balfour (later Lord Balfour) and Mr. (later Sir) Austen
amberlain found themselves in peril of being isolated, and Mr.
yd George was immediately denounced as an opportunist.
ng party leaders themselves they were compelled to bow to
storm. Yet it is a fit reflection now that, but for the World
r, this conference presented to Great Britain at that moment
last solid alternative to the civil war which even then loomed
ad. It is also interesting to observe that most of the confer-
e proposals were adopted later, during the War or after. Mr.
yd George was among those who took a sanguine view of the
spects of the conference, and afterwards he always regretted
failure. He took a long view. He was ready to come to very
d settlements if they would save the country from civil strife.
and Mr. Balfour agreed in this attitude. But public opinion
s not ready for compromise. Party tides still ran too strong.

Schemes of Social Reform

National Insurance.—The political conflict was resumed. In
cember there took place the second of the two 1910 general
ctions. It was, in effect, a test election on the Parliament bill.
e Liberal Govt. had refused to go to the polls until they ob-
ned the promise of the King that, if they were successful, he
uld consent to employ his prerogative of peer-making in order
carry the Parliament bill. That promise was reluctantly given
King George V. Mr. Lloyd George was returned for Car-
rvon Boroughs for the seventh time with an enhanced majority
208). But a second national campaign within one year proved
much for his strength, and he was struck down by serious
roat trouble for some months. During this compulsory retire-
nt he prepared the National Insurance bill of 1911. This was
e first of a series of measures for improving the condition of
e British working class by the method of social insurance. The
a was first applied by Bismarck in Germany in 1893, and Mr.
oyd George had made a study of the German insurance sys-
n during a holiday visit to Central Europe in the autumn of
08. Old age pensions had been already passed into law before that visit; and thus it was that the British system of old age pensions originally took a non-contributory form.

Mr. Lloyd George's first general application of the contributory insurance principle was to sickness and invalidity, and the proposal produced a formidable social and political crisis in the autumn of 1911. Mr. Lloyd George was proposing a new habit to the British people, and at the first shock it was profoundly unpopular. All classes rose against it. There followed a succession of political revolts; and it seemed as if the combination of forces—of the Conservatives—of the Press and the public—opposed to the bill would be sufficient to swamp it. By-election after by-election was lost by the Liberal Government. The party managers were in favour of postponement; but Mr. Lloyd George held on. He eased the passage of the bill by a series of conferences with all the disturbed parties. Early in the year he won over the insurance societies. The trade unions were never definitely hostile. The doctors, after a series of protests and defiances, were finally appeased by a combination of firmness and concession. So at last, pushing the bill through the House of Commons with the aid of a strong closure time-table, Mr. Lloyd George achieved its third reading early in Dec. 1911. The House of Lords, tired of conflict with the House of Commons, allowed Mr. Lloyd George's insurance scheme to pass into law without serious amendment. This was followed by Mr. Lloyd George with an Unemployment Insurance bill which broke new ground. It was extended in subsequent years over the whole working class, and did much to carry the country through the dark years of unemployment which followed the World War.

The "Marconi" Affair.—In 1912 Mr. Lloyd George approached the reform of the English land system by way of a land committee, of which Sir Arthur Acland was the chairman. Two reports were published, one on the rural and the other on the urban side of the existing system; and Mr. Lloyd George had already announced his intention of bringing forward a series of bills in the House of Commons to carry out the proposals of his land committee. He sketched the main lines of his policy in a series of speeches throughout 1912 and 1913. But just as he approached this venture his way was barred by two events—one personal, and the other national. The first was known as the "Marconi Affair," which produced a grave crisis in Mr. Lloyd George's career. He had been persuaded by his friend Sir Rufus Isaacs (later Lord Reading) to take £1,000 worth of shares in the American branch of the great Marconi company at a moment when the British Post Office was discussing the terms of a contract with the British company. The two companies were separate, and there could in fairness be no accusation of anything beyond carelessness. But Mr. Lloyd George—at that moment Chancellor of the Exchequer—was too formidable a political figure to be let off lightly. The proceedings became the subject of an inquiry by a committee of the House of Commons, and he was gravely censured in the report of the chairman, Sir Albert Spicer, a prominent Liberal member of Parliament, although the majority of the committee acquitted him of serious blame. A majority of the House of Commons replied to the opposition attacks by a vote of confidence in Mr. Lloyd George. But for the moment his position was shaken.

The Curragh Revolt.—Already overshadowed by these events, the land proposals were now effectively blocked by the far greater crisis of Irish civil war. Mr. Lloyd George always took a mediating attitude in regard to the relations of Ulster and Southern Ireland, but he was now acutely involved in the coming passage of the Home Rule bill with its proposal of a single Irish Parliament under the Parliament Act. Ulster, organised by Sir Edward Carson (later Lord Carson), threatened an armed defiance of the Government. This defiance had now its first effect in the revolt of the officers at the Curragh against the orders issued for carrying out the prospective Home Rule policy. Faced with the possibility of a military revolt both at the Curragh and at Aldershot, Mr. Lloyd George took a very grave view of the situation and devoted all his energies to preserving civil peace. But at this moment, at the very heart of this Irish crisis, there came the vaster and more momentous challenge of the World War.

THE FIRST WAR YEARS

Mr. Lloyd George's Position.—Lord Grey of Fallodon in his memoir, *Twenty-Five Years, 1892–1916* (1925), gives a vivid account of the state of division that prevailed in the Liberal Cabinet in the fortnight before the outbreak of War. During that period the attitude of Mr. Lloyd George was deeply affected by his position as Chancellor of the Exchequer. On the Saturday before the declaration of war—Aug. 1 1914—the Governor of the Bank of England headed a deputation to 11, Downing Street, urging the policy of neutrality upon the Government. The same governor on Monday, Aug. 3, when the Germans invaded Belgium, telephoned to Downing street withdrawing the opposition of the City, and declaring that they were now in favour of war. This change of opinion in the City was highly dramatic, but it reflected the attitude of the Chancellor of the Exchequer. Mr. Lloyd George at first was not in favour of Great Britain being drawn into a contest between the two great warring groups of Europe unless some British interest or some British obligation were clearly involved. Accordingly during the previous week he did not take up the decisive attitude against Germany which he adopted in 1911, when he held the view that the claim of Germany to go to war with France over Morocco clearly involved a British guarantee (under the Entente). Once Belgium was invaded, however, and the neutrality treaty of 1839 defied, all hesitation left him; and never from that moment forward did he doubt that the military machine of the Central European Powers must be destroyed. Thus it was that Mr. Lloyd George entered upon a new phase of his career—that of war statesman.

The first great civilian duty of the War fell on Mr. Lloyd George. As Chancellor of the Exchequer, he had to secure the finances of the country. While Lord Kitchener at the War Office was organising the armies, Mr. Lloyd George had to see that the credit of the country did not collapse. At the very opening of the War he called together the governors of the leading banks and arranged a moratorium which prevented a panic. All the gloomy forecasts of the breakdown of finance so freely indulged in by the opponents of the War were in a moment dissolved into thin air. British finance, thus rallied at the start of the struggle, remained steady throughout; and the good faith thus engendered enabled the Government to borrow the immense sums which alone made it possible to endure and achieve victory. As long as he was Chancellor of the Exchequer, Mr. Lloyd George gave steady attention to this aspect of the war struggle. He knew that war, to be successful, depended, in Milton's phrase, on " two main nerves—iron and gold." His first attention was given to gold. During the first 10 months of the War he remained Chancellor of the Exchequer; and thus on him fell the main financial responsibility. By common agreement of all parties he placed British finance on an impregnable foundation.

The Ministry of Munitions.—It was in June 1915 that Mr. Lloyd George passed from the nerve of gold to the nerve of iron. It was brought to his knowledge that the insufficient supply of shells and guns at the front was exposing our armies to an intolerable inequality of loss. The crisis which followed on the general realisation of this fact in England broke up the Liberal Govt., May 19 1915, and substituted for it the first Coalition administration, of Mr. Asquith and Mr. Bonar Law. The Govt. was entirely reconstituted. Perhaps the most important change was the creation of a Ministry of Munitions—offered to and accepted by Mr. Lloyd George. This ministry was boldly entrusted with the whole function of providing war armaments, hitherto part and parcel of the duties of the War Office. It was natural that the War Office should resent this subtraction from their powers. But it was now quite clear that, in so great a war, the supply of munitions would be a function on a scale so large as to require a separate department. The new enterprise was rather a national movement than an ordinary office of state. The government workshops at Woolwich and elsewhere had been modelled to supply arms for a small peace army. Now that Lord Kitchener was calling forth from the nation by his magnetic appeal an army of 2,000,000 there had to be a corresponding effort to supply them with weapons. In order to achieve this, Mr. Lloyd George put forth all his powers as a democratic o and organiser. He first called on the private armament fir make a new and gigantic combined effort; and they gave splendid support. But this was not enough. He was comp to create a vast network of new factories and workshops, a rally to his effort a huge army of workers, both men and wo He set out to supply the army not only with sufficient shells also with the great guns and explosives rendered necessar Germany's extensive preparations. Above all, he had to c the machine-guns, hand grenades, trench mortars, and equipments which were now absolutely necessary for the effi conduct of a war which was from day to day taking on new t and forms.

Iron and gold were not, however, the only nerves destine be necessary for the winning of the World War. It soon bec evident that it was also to be a struggle of brains. As the spread from end to end of Europe, and afterwards to Asia Africa, it became clear that in this vast struggle statesman was just as urgently requisite as strategy for the full achi ment of victory. Strategy on so vast a scale passed into sphere of statesmanship. Much depended, for instance, on moral appeal to the world against the aggression of Germ There Mr. Lloyd George, with his golden gift of oratory, a leading part from the beginning. He helped gradually detach Italy, and widely affected opinion in all the neutral c tries. It was one thing to raise so gigantic an army. It another thing to apply it to its full use and value. On all t questions Mr. Lloyd George in 1915–6 held vigorous views. was not content to confine himself to the function of crea guns and shells. In the beginning of 1915 he began to pour to the Cabinet a succession of memoranda, in which he end oured to put before them the full seriousness of the military ation following upon the collapse of the Russian attack in spring and summer of 1915. The theory of the " Russian st roller " had proved very comforting to depressed English during the winter and spring of 1914–5. But when the Ger advance swallowed up Warsaw and Brest-Litovsk, it bec clear that the " steam roller " was not even a good sickle; that Great Britain would have to rely upon herself. The fai of the Gallipoli attack in the latter part of 1915 only emphas the same point. It began to look as if victory would depend so much on numbers as on skill; and all Britain's great ar and splendid armaments might only increase the magnitud her defeat if such enterprises were repeated.

Mr. Lloyd George and the Eastern Front.—The policy strategy laid before the Cabinet in the Lloyd George memora in the year 1915 were never fully adopted. In the language the time, the Cabinet was divided between " Westerners " " Easterners "—those who looked for a decision only on Western Front, and those who believed that victory could quickened by transferring part of our effort to the Near E It all ended in a compromise which resulted in the expediti to Salonika. But Mr. Lloyd George aimed at something larger—nothing less than a considerable diversion of armies fr the West to the East of Europe. He proposed and contempla the diversion of an army of at least 1,000,000 from the West to the Eastern Front. With the development of the Germ submarine warfare Mr. Lloyd George's Eastern idea became l and less practicable; and with the increase of the German arm the danger of a German break-through on the West finally h the British armies to their task. But in early 1915 these fa had not been fully disclosed.

As the year 1915 advanced, Mr. Lloyd George's general d content with the conduct of the War grew stronger with ev month. It extended to home policy as well as foreign. He sa for instance, that if the generals were to have their way and sta the whole issue on a break-through in the West they would requ to be provided with an incessant flow of men. The first respon to Lord Kitchener's appeal had been magnificent, and so 2,000,000 volunteers had flocked to the colours. But then ca a pause in the recruiting; and yet the fearful wastage continued and grew worse. The policy of frontal attacks begun at Ne

ıpelle clearly meant a continual supply of vast armies. Such
ıies, Mr. Lloyd George now began to perceive, could not be
ıred by the voluntary principle alone. Having once made up
mind on that point, he became a vehement advocate of con-
ption in the autumn of 1915. But Liberal sentiment was
inst it, and Mr. Asquith hesitated. A series of experiments,
wn at the time as the "Derby Schemes"—distinguishing
ween married men and single—were attempted from month
nonth. Mr. Lloyd George advocated the American ballot.
the military councils were not in favour of it. Then came
er plans—such as "starring" and "unstarring" of men
ording to their callings and occupations.

ut all these makeshifts ended in leaving a sense of inequality
unfairness which could only be removed by a more compre-
sive policy. So at last Mr. Lloyd George swung the Cabinet
conscription; and only one minister—Sir John Simon—
gned. Everything possible had now been done to supply the
erals both with men and with munitions. But the question
olicy remained, and there Mr. Lloyd George's discontent
tinued to grow. The tragic death of Lord Kitchener by the
ing of the cruiser H.M.S. "Hampshire" on June 5 1916
ted a vacancy at the War Office which could only be filled
ne way. So in that month Mr. Lloyd George passed from the
istry of Munitions to the War Office. In this new position
ower he obtained a firmer grip on the military machine at
front, and in particular he carried out a drastic reform of
munications in France.

rom these lesser tasks his mind was diverted to the main
e of victory or defeat by the tremendous tragedy that befell
Allied cause in the autumn of 1916. Rumania, tempted by
sia into the War on the side of the Allies at an unseasonable
nent, was violently attacked by the great German general
ckensen and dramatically crushed before the eyes of her dis-
and helpless Allies. In vain Mr. Lloyd George appealed to
Cabinet to make some effort to save Rumania. Italy had
red the War in the previous year, and the Russian armies
still in being—could nothing be done? Nothing was done;
for the moment Rumania was blotted out. But the event
a profound effect on the mind of Mr. Lloyd George. It
ght him to the parting of the ways. "Is it necessary," he
to say, "that a little nation should be laid on the altar of
war every Christmas? It was Serbia in 1915, now it is
nania. What nation will come next?" Possessed with this
d, he decided to raise the issue in a definite form, and on
ay, Dec. 1 1916, he laid his views before Mr. Asquith.

ollapse of the Asquith Govt.—His main contention was that
rge a War Committee as then existed could not conduct the
to victory. He proposed a smaller and more efficient body
ree or four men, solely devoted to this one object of winning
War. What was wanted was unified and unsleeping control.
he proposed—and here was the crux of the political situa-
—that the existing Prime Minister should not be chairman
e committee. That was where the dividing line came. For
kly and definitely Mr. Lloyd George had ceased to believe
r. Asquith as war leader. Mr. Asquith's pride was touched
e quick; and it was quite clear that he profoundly resented
proposal, although he himself had first named Mr. Lloyd
ge as chairman of the new War Committee. On Saturday,
2, Mr. Lloyd George was under the impression that his
osal had been accepted. But friends intervened on both
: the Northcliffe Press in favour of Mr. Lloyd George, and
Asquith's friends in favour of a chief whose loyalty has
ys commanded a fit return of personal devotion. On Mon-
Dec. 4 1916, *The Times* published a leading article display-
xultation over Mr. Asquith's defeat, and immediately Mr.
ith wrote to Mr. Lloyd George breaking off the agreement.
e afternoon of that day Mr. Asquith resigned office. He
ved authority from the King to form a new Ministry. He
to Mr. Lloyd George asking him to join on condition that
Mr. Asquith—as Prime Minister must be chairman of the
War Committee. Mr. Lloyd George refused that condition,
laced his office at the disposal of Mr. Asquith.

Already, on Sunday, Dec. 3, the Conservative rank and file had met. They had decided at first against following Mr. Lloyd George, whereupon Mr. Bonar Law had emphatically said that, in that case, they could not count on his leadership. He and his friends refused to join the new Ministry, and so Mr. Asquith's efforts to reform his Coalition without Mr. Lloyd George broke down. The King then sent for Mr. Bonar Law. But as some of the Liberals and the Labour party refused to support him, he too failed to form a government, although Mr. Lloyd George offered to serve under him. The King then called a conference at Buckingham Palace and tried to form a new Coalition Ministry under Mr. Bonar Law, with the offer of the Woolsack to Mr. Asquith. Mr. Asquith refused. Thereupon the King sent for Mr. Lloyd George, as he was clearly the only possible Premier.

MR. LLOYD GEORGE AS PREMIER

The New War Policy.—There was nothing left for Mr. Lloyd George but to accept the call. He attempted to rally all parties behind him. He succeeded with the Conservatives and the Labour party, and a certain number of Liberals. But the bulk of the Liberal ex-ministers stood aside and began to form a group known as the Independent Liberal party. Mr. Lloyd George was now in sole command of his own war policy. The small war committee which he instantly appointed fully carried out the hopes of its founders. It sat from day to day, and very often twice a day. It practically took the place of the Cabinet. Records were kept of its meetings, and Mr. Lloyd George formed a small Downing Street secretariat in order to keep in close touch with the various Ministries. The result was a general quickening up of war decisions and a more decisive control of the whole machine of government.

During the year 1917 Mr. Lloyd George pressed forward his idea of unified command of the Allied armies. He was now completely convinced that the War could only be won if the Allies were to face Germany with the same concentrated authority that Germany had established over her own partners. He was faced, however, with a very steady resistance from the high military command, now from time to time supported by the Independent Liberal party. There was a strong national sentiment against subordinating our armies to the control of foreigners, and there was a firm belief among the soldiers that they could win the War alone by pounding harder at the Western Front. But as the year advanced the sanguine expectations frankly thrown out in interviews in the spring by Sir Douglas (later Earl) Haig were not fulfilled. The Aug. fighting round Lens; the Sept. onslaughts on the east and north of Ypres; finally the assault on Passchendaele—all these battles displayed fully the inexhaustible valour of British, Australian and Canadian troops. But there was no break-through. The British armies were checked by the mud and rain of the Flanders autumn, and in too many cases heroism was literally choked in slime. Mr. Lloyd George contemplated this wastage of Brittish manhood with increased impatience, and on many occasions protested against the sacrifice of volunteers and conscripts.

On Oct. 24 1917 there occurred an event which finally decided him to force the matter of unified control to a decision. On that day the Austro-German armies under Von Bülow broke through the lines of the Italian armies dangerously stretched out between the Eastern Alps and the Adriatic Sea, and drove them back to the line of the Tagliamento with the loss of 300,000 men and 2,000 guns. Italy stood for the moment in peril of a defeat equal to that of Serbia and Rumania in the preceding years. Mr. Lloyd George was determined that this defeat should not take place. He himself journeyed immediately to Italy. By infusing new courage into the Italians he helped to check the confusion and flight of their armies. He compelled the Western commands to send an army of infantry and artillery, English and French, under Gen. Plumer through the Mont Cenis tunnel to northern Italy. These reinforcements arrived in the nick of time, checked the collapse of Italy, and aided greatly to save her from defeat.

The End of the War.—Having achieved this task, Mr. Lloyd George, with characteristic swiftness, determined to press on with the matter of unified control. On his journey back to England he stopped in Paris on Nov. 12 1917 to make a speech in which he plainly announced that divided control meant defeat. But that speech for the moment only aroused fresh opposition, and when he returned to Parliament he had to face the vehement criticism of the Independent Liberals led by Mr. Asquith. Yet, later, in May 1918, when Sir F. Maurice, challenged his authority in a letter to *The Times*, the consequent vote of confidence in the Commons secured him a decisive majority of 187. But full unity of control was not really achieved until the terrible events of March 1918 brought home to all parties in England the nearness of the peril. During the winter the Germans brought across Europe a fresh army of 2,000,000 men released by the collapse of Russia after the Bolshevik revolution of Oct. 1917. This gigantic new army created a fresh situation in the West, and the first blow fell on March 21, when 40 German divisions attacked and broke through the British line west of St. Quentin. On the following days the British line withdrew 15 m., and the military struggle that followed lasted through five terrible months. Mr. Lloyd George threw into the fighting line all those youthful regiments which he had hoped to keep for home defence. Even so, the German pressure very nearly crashed through to the sea. There was a tense moment when some high military authorities were in favour of bringing the British armies back to England. But Mr. Lloyd George always strenuously refused to face such a possibility. He averted defeat by two principal steps of policy. One was the assertion of full unity of control, and the other was the bringing over of the American armies.

President Wilson had not contemplated sending his armies to Europe until they were fully trained and brigaded. But that process could not have been finished till 1919 at the earliest, and it was now clear that in that case the American armies would be too late. Mr. Lloyd George therefore made a definite appeal to President Wilson to send all he could immediately, and the President instantly responded by a promise to do so on condition that Great Britain provided the transport. Thus with the combined effort of the American command and the British Navy and Marine no less than 2,000,000 American soldiers were carried across the Atlantic, in spite of the submarines, during the months of April and May 1918. Those numbers now enabled the Allies to meet the Germans with a greater sense of numerical equality. But mere numbers were still useless without unity. Visiting France in the first week of May 1918, Mr. Lloyd George held a decisive combined meeting of the military and civil powers, in which, supported by Lord Milner and M. Clemenceau, he was at last able to persuade the British generals to accept the supreme command of the great French soldier Marshal Foch. During the final months of the War the British armies fought loyally under that command. It was by the combined attacks of British and French troops, storming the German lines east of Amiens, that the tide was turned on Aug. 8 1918. Seven great battles were fought after this event, but from Aug. till Nov. the German armies were steadily driven back. Finally, on Nov. 11, came the collapse of the German resistance and the acceptance of armistice terms of defeat by the new German Government. "Germany is doomed," cried Mr. Lloyd George, speaking at the Mansion House on Nov. 9 1918, and he proved a true prophet. The Allies had won the War.

The Peace Conference.—Victory having been achieved, it now remained to make peace. There were inevitable delays. Mr. Lloyd George deemed it necessary first to strengthen his position by an appeal to the country. The polls took place on Dec. 14 1918, and the results were declared on Dec. 28. The effect was an overwhelming victory for Mr. Lloyd George, he being returned to power by a majority of 249 over all the independent groups. He himself was returned for the eighth time as member for Carnarvon Boroughs with a majority of 12,898. These events filled up the pause rendered inevitable by the waiting of Europe for the arrival of President Wilson, who had decided to attend the Peace Conference as American representative. The next step was the choice of the capital in which to hold the Peace Conference. Paris was selected, the intention being to move on to Geneva after the first stage. But once settled in Paris it
found impossible to move so vast an assembly of nations.
first meeting of the conference took place on Jan. 18 1919 a
Palace of Versailles, and it proved an impressive gatheri
the representatives of all the 30 countries who had taken pa
the defeat of the Central Powers. Mr. Lloyd George took
him from England a joint delegation representing all pa
including Mr. Bonar Law, Mr. Balfour, Lord Milner and
George Barnes. A powerful delegation came from the Do
ions, including Mr. Hughes, Premier of Australia, Sir R
Borden and Gen. Botha. Thus the whole British Empire
represented at Paris among the colleagues of Mr. Lloyd Ge

It soon became obvious that so big an assembly coul
really arrive at peace. There were too many conflicting v
there was no possibility of secrecy. The allied negotiators g
ally narrowed to an inner council of ten, which was soon red
to five; then from five to four; and finally from four to th
Mr. Lloyd George, President Wilson and M. Clemenceau.
them fell the full burden of making the peace. This num
narrowing of the peace negotiators, together with the inc
of secrecy, created widespread discontent among those wh
been led to expect a peace by open diplomacy. What happ
behind the scenes was this: roughly speaking, the position
that Mr. Lloyd George and President Wilson worked for a
of conciliation, while M. Clemenceau worked for a peace o
tory. The French started with a claim to extend their fro
up to the left bank of the Rhine. Wilson and Lloyd G
together succeeded in moderating this claim. But they
compelled to hand over the Saar Valley for 15 years as pa
the compromise. Smaller compromises took place in rega
Silesia and the Polish corridor. No one was completely satis
but every country had its say. President Wilson's unique
tribution to the settlement was the League of Nations Cove
Though Mr. Lloyd George took great interest in the frami
the Covenant, he left the chief British share in its mouldi
Lord Robert (later Viscount) Cecil, who sat on the League
mittee as the British representative. But when the crisis
and President Wilson threatened to leave the conference
the Covenant was placed first in the treaty, Mr. Lloyd G
supported the view of President Wilson.

The Treaty of Versailles.—Mr. Lloyd George's freedom
much hampered by Press attacks from home, and at one mo
Lord Northcliffe organised a mandatory telegram from ove
members of Parliament rebuking him for a tendency to we
on the demands to Germany. Mr. Lloyd George returne
London to face his critics in Parliament and secured a
majority. There can be no doubt, however, that these symp
of discontent at home diminished his authority and weak
his resistance to the military policy of France. At this
for instance, he agreed to the French claim to occupy the
bank of the Rhine for 15 years, which he had hitherto attem
to limit to a much shorter period. On May 6 a draft of the t
was completed, and was presented to the German Foreign
ister, Count Brockdorff-Rantzau on the following day. Ger
instantly pleaded for various important modifications. D
the six weeks of parley with Germany that followed Mr.
George played the part of conciliator. President Wilson
ened against Germany, and took the view that he was ple
to the treaty as it stood. Mr. Lloyd George secured the softe
of many harsh terms, and in that way prepared the groun
the return of the spirit of conciliation to Europe. A poli
crisis in Germany followed, but on June 22 the National asse
authorised the signing of the treaty, and on June 28 it was s
at Versailles by the German envoys. Mr. Lloyd George retu
to England and defended the treaty before Parliament, w
unanimously ratified it on July 3. Shortly after he was awa
the Order of Merit.

Domestic Discontents.—Having made peace abroad, Mr.
George returned to restore peace at home, which was jus
much in peril. The long strain of the World War and the
rible losses of men and material had left Great Britain gra
wounded and weakened. The impulse of patriotism pa

av; and the idea seemed to spread that every class was to be abled to "get rich quickly" by the achievement of victory. ie result was a series of industrial struggles, beginning with the ndon railway strike in Feb. 1919, followed a few weeks later the first of the coal crises. Mr. Lloyd George averted a strike the coal-fields by appointing a royal commission with Mr. stice Sankey as chairman, with a promise that the commission ould report on wages and hours by March 20. The Sankey nmission reported on that day, recommending a two-shillings' rease in wage and an immediate seven-hours' day. The consions were granted and a strike was averted. But when the jority of the commission went on to recommend nationalisa- of the mines, Mr. Lloyd George refused to adopt the sugtion. In Oct. 1919 the railwaymen precipitated a national ke; and once more Mr. Lloyd George had to play the part of ional conciliator. He brought the strike to an end by a commised settlement fixing wages according to the scale of living. uring the next two years the Lloyd George Coalition Govt. sed a series of agreed measures on housing, suffrage and land. as time went on it became clear that the country was finanly more exhausted than had been supposed. The first afterr "boom" gradually passed into a "slump," and there arose n the whole country a cry for economy which expressed itself n "Anti-Waste" campaign of the utmost vigour. By-elec after by-election was lost to the Government, and the counwas swept by financial panic. Mr. Lloyd George met it by rastic measure. He appointed a small committee, with Sir Geddes as chairman, to revise the whole of our national nce. As a result of its sweeping report—the "Geddes Axe" idespread economies were effected in all departments. The cultural subsidy was withdrawn and the agricultural wages rds were suspended. The housing scheme was held up: and rogress in education was checked.

all of the Ministry.—Those concessions weakened the Radical ort of the Coalition. In the autumn of 1922 a similar weakg occurred on the Unionist wing of the Conservative party g to the policy to which Mr. Lloyd George was driven in nd by the course of events. The Sinn Fein trouble which broken out in the later period of the War worked up in 1920–1 n actual rebellion. All Mr. Lloyd George's efforts to effect mpromise between Northern and Southern Ireland proved . In the spring and summer of 1921 the condition of Iregrew rapidly worse. Murder and outrage were rampant. Coalition Govt. initiated a special force, who received the name "Black and Tans," to deal with the violent methods he Sinn Feiners by vigorous reprisals. This produced in land a divided feeling as to the equity of the struggle. In autumn of 1921 peace overtures began to pass from one to the other. Mr. Lloyd George decided to make a real t after a settlement. A truce was declared, and the picked ers of Sinn Fein came to Downing street, where, after several s of discussion, a settlement was reached, at midnight, Dec. 21. This great concession to Ireland was followed by resist- to the Turks at Chanak on the Dardanelles (Sept. 1922), the two events produced the downfall of the Lloyd George ition. The Unionist party, created on the principle of rence to Home Rule, was riven asunder by so great a concession at of Dominion Home Rule to Southern Ireland. The t of renewed war with Turkey was profoundly unpopular, presented the enemies of the Govt. with an opportunity. Bonar Law, who had retired from the Govt., returned to eting of the Conservative party at the Carlton Club on Oct. 22, at which it was decided that the Conservative party d leave the Coalition. Mr. Lloyd George instantly red, and in the election that followed (1922) Mr. Baldwin— succeeded on the death of Mr. Bonar Law—obtained a rity. (*See* English History.)

An Opposition Leader.

roughout the vicissitudes of the general elections which ed in the autumns of the following years (1923 and 1924) loyd George remained a leader of opposition. He reunited his followers with the Independent Liberals after the election of 1922, and devoted his energies to identifying the Liberal party with a policy of economic reconstruction. In 1924 he published *Coal and Power*, which outlined a comprehensive scheme for the more efficient utilisation of the natural resources of the country. Nevertheless the reunited Liberal party failed to gain strength and in the General Election of 1924 its numbers in the House of Commons, controlled by Mr. Asquith and Mr. Lloyd George, sank to 40 members. Mr. Lloyd George continued his active efforts to rouse the country to the need of further domestic reform to meet the home crisis: and in the early autumn of 1925 he issued a big land programme which he proceeded to advocate throughout the country.

By the elevation of Mr. Asquith to the peerage as the Earl of Oxford and Asquith (1925) Mr. Lloyd George earned the succession to the Liberal leadership in the House of Commons, and was elected to that office in the sessions of 1925 and 1926. In Feb. 1926 he carried his land proposals, with few modifications, through a Liberal Convention assembled at the Kingsway Hall in London. But the Liberal party still showed no signs of revival in the country, and in the by-elections of Jan. and March 1926 some of the Liberal candidates lost their deposits to the returning officer. Still, the personal position of Mr. Lloyd George in the country was growing steadily stronger: and his criticism of Sir Austen Chamberlain's new Locarno policy in the House of Commons in March 1926 created a profound impression. His national and parliamentary position was in strange contrast to the size of his following; and that created a strange diversity of opinion in the forecasts of his future. In May, during the course of the general strike, Mr. Lloyd George expressed opinions that were not in accord with those of Lord Oxford and the other Liberal leaders. His idea was that the Government should negotiate with the strike leaders without delay, instead of declining to do so until the strike had been called off. He ridiculed the view that the general strike was aimed at the constitution. A somewhat acrimonious correspondence between him and Lord Oxford followed, and the party, both in and out of the House of Commons, was acutely divided upon the question. (*See* Liberal Party.)

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GEORGE, STEFAN (1868–), German poet, was born at Büdesheim, Hesse, on July 12 1868. After attending the grammar school at Darmstadt, he studied philosophy and the history of art in Paris, Munich and Berlin. He travelled extensively in Italy, France, England, Spain, Holland and Belgium and became associated with the Baudelaire and Mallarmé School in Paris and the disciples of the Pre-Raphaelites in London. His early poems were first published privately for a select circle of friends, for whom in 1892 he founded the *Blätter für die Kunst*. George's poetry which is non-realistic, reflects a heroic and aesthetic world-philosophy; and possesses great beauty of form and an austere power. Among his works are *Hymen* (1890); *Algabal* (1892); *Die Bücher der Hirten* (1895); *Jahr der Seele* (1897); *Die Teppich des Lebens* (1899); *Tage und Taten* (1900); *Die Fibel* (1901); *Der siebente Ring* (1907); *Stern des Bundes* (1914); *Der Krieg* (1917); *Drei Gesänge* (1921). He also translated Baudelaire, Dante and the sonnets of Shakespeare.

See L. Klage, *Stefan George* (1902); F. Düberg, *Stefan George* (1908).

GEORGIA, U.S.A. (*see* 11.751).—The population of Georgia in 1925 was 3,058,260, as against 2,895,832 in 1920 and 2,609,121 in 1910, an increase of 17·2% for the 15 years. During 1910–20 negroes increased from 1,176,987 to 1,206,365, but relatively they decreased from 45·1% of the total population to 41·7%. The urban population was 25·1% as compared with 20·6% in 1910. The density of population in 1920 was 49·3 per sq. m. as against 44·4 in 1910. The census of 1920 revealed an important movement of population from the mountain counties of the northern portion of the state and from central Georgia to south-central and southeastern Georgia, due to the presence of large areas of undeveloped and fertile land in the southern half of the state. The highest density of population, however, was still to be found in the northern half.

Agriculture.—Although scarcely perceptible in 1914, by 1916 the boll weevil had spread over the coastal plain of Georgia, and in the following years covered the entire state. The growing of long-staple cotton was abandoned and the production of the short-staple was sharply curtailed, falling from 2,718,037 bales in 1914, the largest crop in the history of the state, to an average of 30% less in the four years following. This situation gave a powerful impetus to diversified farming, the movement being aided by the high prices of foodstuffs due to the World War. The most important of the new crops is tobacco. Beginning with a production of 1,088,000 lb. in 1910, this crop in 1925 had grown to 47,880,000 pounds. Meanwhile there have been tremendous increases in the production of hogs, sweet potatoes, peanuts, melons and fruits, particularly peaches and apples, and pecans.

Education.—In 1910 the total enrolment in the public schools was 555,794; in 1924, 709,760; the state appropriation for elementary schools in 1910 was $2,237,000; in 1925, $4,500,000; there was raised by local taxation in 1910, $1,307,000; in 1924, $8,732,923. The total amount spent from all sources for elementary schools in 1924 was $22,701,973. Laws were enacted 1910–20 for the modernising of the educational system. A constitutional clause limiting the taxing power of the counties to taxation for elementary schools only was removed (1910). The state Board of Education, hitherto composed of state officials, was made a professional board (1911), and a uniform text-book law passed, the duty of selecting the books being placed upon the board. Compulsory education dates from 1916. The law, as amended by the new School Code of 1919 required attendance through the seventh grade. Provision was made for attendance officers. A training school for negro teachers was authorised in 1922. The Federal Smith-Lever Act of 1914, and the Smith-Hughes Act of 1917, both accepted by Georgia, provided for extension work in agriculture and home economics, and for the teaching of vocational subjects in the schools.

In 1919 the policy was adopted of setting apart one-half of the total income of the state for the schools. In the same year a constitutional amendment was adopted, by which the counties were required to levy local taxation of not less than one mill nor more than five mills for the support of elementary schools as a supplement to the state appropriation. To encourage the consolidation of small schools, the Legislature appropriated (1919) $100,000 from which the state offered to pay annually a bonus of $500 to any county which combined small schools into larger ones and where a four-year high school was provided, an additional bonus of $1,000 was authorised. This bonus fund was increased to $200,000 in 1924. An illiteracy commission was established (1919) to make a study of adult illiteracy and in 1920 local taxation for the support of schools for adult illiterates was authorised. Noteworthy progress was being made in the eradication of illiteracy. White illiteracy declined from 7·8 to 5·4%; negro from 36·5 to 29·1%. During the period 1905–25 the number of four-year high schools increased from 7 to 275. The total state appropriations for higher institutions, including the district agricultural schools, the academies for the blind and deaf, and various training schools for defective classes, was in 1910 $436,500; in 1924 $1,284,450.

Government.—The period 1910–25 in Georgia was characterised by legislation designed to further social progress and economic improvement. The standard of medical education was materially raised (1913); only four-year medical colleges were recognised and the requirements for entrance were increased. A new Board of Health was established (1914) to exercise control over the county boards of health. Provision was made for paid sanitary commissioners in all sanitary districts, which consist of one or more counties. A Vital Statistics law of 1914 provided for the registration of births and deaths and the publication of statistics.
The employment of children under 14 years of age was
hibited (1914), and factory inspectors were provided in
A Training School for Mental Defectives was established
and a state Board of Public Welfare (1919) was set up, char
primarily with the duty of inspecting all state institutions
the dependent, defective, delinquent and criminal classes.
Act of 1920 provided for rehabilitation of persons disable
industry or otherwise, assented to the Federal Vocational
and pledged the state to equal appropriations made by
United States. A state Board of Vocational Education
created (1917), charged with the administration of the reha
tation training. In 1922 a Commission was created to st
the laws of this and other states and propose legislation
safeguard the welfare of children within the state.

A Dept. of Commerce and Labour was created (1911)
which was later (1917) included a free employment bu
The Dept. of Insurance dates from 1912. The State High
Dept. (1916) was reconstituted in 1919 to bring the state sys
into harmony with national legislation providing aid in
construction of rural post roads. A Bureau of Markets
was created to gather and disseminate information of valu
producers and consumers of agricultural products; and, in
an Act was passed to encourage co-operative marketin
agricultural products, their storage, canning, packing, etc.,
supplying of agricultural machinery, and the financing of
operations. To further the erection of modern warehouse
the weighing, grading and storage of lint cotton, a Wareh
Commission was authorised in 1918. A new banking
(1920), modelled on the National Bank Act, corrected
defects in the old banking system and provided for adeq
inspection. An Employers' Liability Act (1920) set aside
common law defence of contributory negligence of fe
employees and provided for compensation for industrial
dents, a commission being created to administer the Act.
Uniform Negotiable Instruments law was adopted in 1924.

Finances.—The assessed value of the taxable propert
Georgia in 1910 was $766,000,000 and in 1924, $1,213,423
The yield of taxes in 1924 was $16,765,264. The prin
source of revenue was the general property tax. In recent
two special tax commissions appointed by the governor
made reports urging the classification of property for tax
purposes, the adoption of the income tax, and other chang
the system; but the Legislature had up to 1925 failed to
The bonded indebtedness of Georgia was reduced from $6,94
in 1910 to $5,284,202 in 1924.

History.—The governors of the state during the period
26 were: Hoke Smith (Dem.), 1911–2 (shortly after his inau
tion Smith was elected by the Legislature to succeed
Terrell as U.S. Senator); Joseph M. Brown (Dem.),
(elected at a special election to fill Smith's unexpired
John M. Slaton (Dem.), 1913–5; Nathaniel E. Harris
1915–7; Hugh M. Dorsey, 1917–21; Thomas W. Har
(Dem.), 1921–3; Clifford M. Walker (Dem.), 1923–. (R. P.

GEORGIA (*see* 11.758), a Soviet republic forming part
Transcaucasian Federation of Soviet Republics. The cap
Tiflis (*see* TRANSCAUCASIA).

GERARD, JAMES WATSON (1867–   ), American lawy
diplomat, was born at Geneseo, N.Y., Aug. 25 1867. Ed
at Columbia University and at the New York Law Sch
was admitted to the bar in 1892 and began to practise
York City. In 1908 he became associate justice of the Su
Court of New York, resigning in 1913, on being app
ambassador to Germany. At the outbreak of the World
1914 he assumed the care of British, Japanese, Ruman
Serbian interests in Germany, later visiting the camps
British and other prisoners were confined and doing
alleviate their condition. His responsibilities were furt
creased by the fact that German interests in France,
Britain and Russia were placed in the care of the A
embassies in those countries, the American embassy in
thus becoming a sort of clearing house. After the sinkin
"Lusitania" with many Americans on board, on May

e American ambassador's position became more difficult, and ally, on Feb. 3 1917, diplomatic relations were broken off by nerica and he was recalled. While in Germany in 1914 he was mocratic nominee in New York for the U.S. Senate, but with- t success. On his return to America he resumed the practice of v in New York City. He received the vote of several states in Democratic National Convention of 1920 and 1924 and was airman of the Finance Committee of the National Demo- tic Campaign in 1920 and Treasurer in 1924. In 1917 he pub- ed *My Four Years in Germany* and in 1918 *Face to Face with iserism.* For his services to England he was decorated with G.C.B.

ÉRAULT-RICHARD, ALFRED LÉON (1860–1911), French rnalist and politician (*see* 11.766), died Dec. 6 1911.

ERMAN LITERATURE (*see* 11.783), like every form of spirit- activity in Germany, experienced between 1910 and 1920 p alterations in thought, feeling, values and form. Charac- istic of the older generation was its pleasure in the external ture of the world. Man, with joy and confidence, felt himself art of this picture. The younger generation seeks to reveal inner meanings of the world. A time of suffering leads towards nite horizons. Former standards of measurement are replaced a sense of the immeasurable. We no longer tread our bit of world as a solid piece of reality, but long for escape into the nite. Its symbol is the horizon always receding, never attained.

he Forerunners of Expressionism.—But what appears at first it to be a bridgeless gap made by disruption is really only the stage of a continuous development already begun between o and 1910. During those two decades the point of view had ted, gradually but steadily, until by 1915 it already had come -circle. All typical writers of the "impressionist" period turned symbolists in their later works; Stefan George and circle, or Rainer Maria Rilke, Gerhart Hauptmann himself is later work (*Und Pippa tanzt, Emanuel Quint*) are only to understood from this angle. Even when "impressionism" at its height there were writers whose work was strange to r age, and only later became quite intelligible when they e seen as the forerunners of an age of "expressionism." In on, Hermann Conradi, Johannes Schlaf, Hermann Stehr and ob Wassermann looked towards new life and personality; le Julius Hast, Paul Scheerbart and Gustav Meyrink strove new form and shape; and Heinrich Mann's evolution from aissance poet to Central European democrat meant increas- sympathy with the New Youth. Dramatists had already mpted to create a new drama of style to break the suprem- of the old naturalistic drama of situations or the neo-ro- tic drama of sentiment. Herbert Eulenberg and Wilhelm midtbonn had dared to make a new drama out of passion or tement; Paul Ernst in a hard struggle for dramatic form ght to create a new classical drama, and thereby was first in far-reaching fight against the dominant relativist and psy- logical cult. Frank Wedekind had broken with every tradi- and spoken with the voice of primitive impulse. While lyric poets, Peter Hille, Alfred Mombert, Christian Morgen- n, had one foot in the field of the new art, others from 1900 ards took their full stand on that ground. Instance the poets *haron*, particularly Otto zur Linde (b. 1873, *Collected Works*, *seq.*), Karl Rottger and Rudolf Paunwitz.

he Expressionist Movement.—The term "expressionism" pplied to the theory and practice of this new art came into ral use between 1910 and 1920. The word is, on the whole, itous. It shows clearly how the new art contrasts with nat- istic impressionism which was all facts and feelings; as lly with aesthetic, neo-romantic fantasy; opposed thus to and Hoffmansthal alike. Instead of the Impression received without we have now Expression of the inward self. In- d of transcribing some trait of nature that awakens a certain of feeling, we have relief of the spiritual tension that con- es all concrete things as signs and symbols devoid of separate ning and even of incidental help towards the better recogni- of the outward world. Instead of being the humble inter- er of any outer thing, the artist's idea now absorbs the object in order that he may free himself from its tyranny and find his own salvation in the Idea. Instead of pleasure in the object, pleasure that enlightens or transfigures, there is now torment from which respite must be won if life is to be borne. Eternal circumstance yields to the eternal act; the cool observer to the ardent believer and worker in a holy cause; the poet to the political leader; description and eloquence to pathetic appeal, even to the stream of pain. Earth and nature yield to Spirit, to the All, to God; positivism to metaphysics and rationalism to the irrational; logic to mysticism, understanding to use, potential ability to active will and decided opinion; form to matter; society to community, the logical and psychological man to the inspired. In short "I" yields to "You" and "One Another;" the mistrusting mood to the trustful. For: "Man is good;" "Man is the centre of his world;" "With man the world begins."

In the history of ideas the new sweep of tendency is thus a variety of those foaming, overflowing movements known in Germany as "Sturm und Drang" or "romanticism." Chronologically, it is the expression of the inevitable change from one generation to another. This new art had, indeed, leaders older than itself; but in the main it manifests the spirit of the New Youth—its will to live, its urge towards artistic creation.

The generation born between 1880 and 1890 or later breaks clean away from its predecessors born in the 'sixties or thereabouts. But what this fresh generation feels, and means to prove, is that its break with the immediate past is something fundamentally different from the new departures of 1880 or 1840 or 1800. This artistic revolution stands out against the world's more profoundly significant background. It begins with a far different spiritual atmosphere—itself only one aspect of a whole world's violent moral crises. Before this, the revolts of Youth against Age were familiar enough, but really meant bolder advance on lines marked out by the fathers, and by the forebears for 400 years. This time the standpoint is quite changed. It is impossible, says youth now, to link up with our predecessors. Their past is worthless; the present is a disgrace; our task to-day is to "break all bridges and begin again." The naturalistic revolution of its fathers is regarded as a false development by their sons who overthrow it. To them it seems merely the last stage of a process set up a century ago or even four centuries ago, when the epoch of Humanism began to make the world "measurable and ponderable." Now, the aim is to make a new beginning.

The former phase displayed the victorious advance of the natural sciences, their processional entry, as it were, into human life, their permeation of all its knowledge, feeling, thought, activity. The resultant rise of machine-industry and technical resources gave an unparalleled command of nature by man. The young generation proclaims the end of this era in a Europe that went to pieces in the World War. It mocks the so-called mighty achievements which only led to unexampled violations of the spirit. This is why they reject and execrate the idols of science and repudiate its votaries, the brain, the head. This is why they acclaim as prophets the idol-breakers Strindberg and Claudel. This is why they reject the "law of causality" in literature, together with the materialist theory of the soul, and the correspondent psychology. Hence, from their language, they banish logic and sweep away the parts of speech like articles and copulatives, which merely serve logical uses. They rather look to children and savages for instruction in the principles of true and direct existence.

Simple as these principles appear on the one hand, not all the young talents are fully able to adapt them, but, on the other hand, they lend themselves to many varieties of imaginative and reflective creation. There is room not only for the despisers of culture and civilisation, but also for those who, like the "futurists," hope to create a new art by the enhanced employment of all new technical possibilities; room no less for a leading expressionist writer of fiction like Alfred Döblin, who answers the almost fashionable derision of modern science by protesting that the need is for "more and more natural science." Besides expressionism of the Western types there is an Eastern cult; while one school is actively political another is mystical and abstract;

while an international school calls for a new humanity, a German school demands a new German type of humanity. These groups are not susceptible to such clear local distinctions as in painting, where the Munich set of the "Blauer Reiter" stands apart from the Dresden "Brücke" set. The Prague group, with Meyrink, Brod, Kafka and Werfel, is perhaps more Eastern and mystical, the group assembled in the *Aktion* in Berlin more "activist" and political. But Berlin is also the home of the poets of the *Charon* and of the *Sturm*, the one an essentially Nordic-Germanic cult of metaphysical "expressionism" while the other bears the stamp of abstract internationalism.

The First Phase of Expressionism.—In point of time, the new literary movement falls mainly within the decade 1910–20. It broke through in two main thrusts. With "manifestos" and "radical strophes" the "apocalyptic striplings" led the onset. Kurt Hiller in Berlin gathered adherents into the "Neuer Klub," the "Gnu" and similar associations; he collected their verses in the *Condor* in 1912. Franz Pfemfert welcomed them in the *Aktion*, Alfred Richard Meyer in the *Bücherei Maiandros* and in his *Lyrische Flugblätter*. So Paul Zech in *Das neue Pathos*, Ernst Blass, in Heidelberg, in *Die Argonauten*, Herman Meister in *Saturn*, and he also published in the *Flut* collection a first *Anthology of the Most Recent Belles Lettres*. In Munich two of F. S. Bachmair's periodicals were entitled *Die Revolution* and *Neue Kunst* respectively. But this poetry, especially at first, often betrayed the influence of George and Rilke in form, and still more in rhythm; although, straining out beyond it. Not for nothing were the new periodicals which Dauer began to issue in Berlin in 1910 and 1911, called *Der Sturm* and *Die Aktion*. After these two, the most important periodical of the new school was the Leipzig *Weisse Blätter*, which first appeared in the autumn of 1913. The many-voiced yearnings of the time, their yeas and nays, find their most emphatic, clearest and purest artistic utterance in Theodore Däubler's three-volume epic *Das Nordlicht* (1910), Otto zur Linde's *Collected Works* (1910 *seq.*), Franz Werfel's poems (*Wir Sind*, 1913), the verses of Georg Heym, Georg Trakl, Ernst Stadler, Gottfried Benn, August Stramm, Carl Sternheim's dramatic work, Reinhard Johannes Sorge's *Bettler* (1912) and George Kaiser's *Die Bürger von Calais* (1914). Already at this time, just before the War, a new publishing house on a large scale (Kurt Wolff) was founded in the interests of the new movement; and its collection, *The Newest Day*, gave a first survey of the new art and its chief authors.

The Second Phase.—The second main offensive, opened in 1914 with Walter Hasenclever's play *Der Sohn*, was held up at first by the War. The radical ideas of the new movement suffered under a rigorous government censorship. The *Aktion*, originally a "periodical for liberal politics and literature," became perforce for years a purely literary affair; the *Weisse Blätter*, of which René Schickele became editor in 1915, was issued outside Germany, in Zürich, where it served as a mouthpiece for young writers such as Johannes R. Becker, Albert Ehrenstein, Leonhard Frank, Rudolph Leonhard, Alfred Wolfenstein, Walter Hasenclever, Ludwig Rubiner. The more revolutionary ideas gained ground as the War dragged on, the more violently did the whole movement break through the dams, until the highest flood-mark was reached in 1918 and 1919. The breakthrough was signalled by a host of periodicals, usually shortlived, whose very titles flamed like beacons; and by new publishing firms. Besides the *Jüngster Tag* series, the *Neue Reihe* appeared, containing old and new names. From 1914 on, the breakthrough had visible effect on artistic forms. In lyrical poetry the change comes with J. R. Becker's *Verfall und Triumph* and August Stramm's *Gedichte*. The "analytic" drama of the immediate past gives way more and more to the new form of a "synthetic" series of pictures. Strindberg set the example. Originally lyrical and ecstatic, given to dramatic monologue—for monologue gives relief from the sober, practical methods or crude psychology of the preceding decades—the movement at the same time invaded prose-fiction. So, by the side of the new lyric and dramatic poets —Fritz von Unruh, Reinhard Goering, Paul Kornfeld—we find new novelists like Leonhard Frank, Gottfried Benn, Franz Kafka, Kasimir Edschmid, Alfred Döblin. The years 1919 and 192 mark the close of an old period and the beginning of a new on What real progress had been made was shown in the excellen anthologies and collections of this time. In the *Symphon* *jüngster Dichtung—Menschheitsdämmerung*, put together b Kurt Pinthus in 1920, the *Anthologie junger Lyrik—Verkünd* *gung*, issued by Rudolf Kayser in 1921; in Ludwig Rubiner collections of poems *Weltrevolution—Kameraden der Menschhe* (1919) and in the *Novellen an die Zeit—Die Entfaltung* issued b Max Krell in 1921—in all these works an effort is made to asse the real value of the new achievements. A periodical such a *Der Genius*, which attempted to be for the expressionist era wha *Pan* had been for the impressionist; such also as the two yea books of new creative and critical literature issued by Alfre Wolfenstein in 1919 and 1920 under the title of *Die Erhebung*— these were partly retrospective. Dramatic pictures like Alfre Brust's play *Die Schlacht der Heilande* or Arnolt Bronnen *Vatermord* already indicated new developments, as did Wo Przygode's series, *Die Dich*.[1]

In the period of naturalism, theory and criticism were th creative and directing forces; they created the novel of experienc and frank "realism." Now it is otherwise; theory does not dire the work of art, but develops with it. *Charon* poetry precede the theory of Charonism. Edschmid's famous discussions o poetic expressionism came after the early works which decide him. Kornfeld's studies of inspired man and psychological ma appeared after his *Verführung*. The order is only reversed i the eccentricities of the movement, in the purely intellectu experiments. Yet here, as everywhere, will and deed fertilis each other. The most illuminating of the early books dealin with the movement are really those which treat of it in paintin and sculpture; as Kandiusky's book on *Das Geistige in der Kuns* Wilhelm Worringer's *Beitrag zur Stylpsychologie, Abstraktion un* *Einfühlung* and his *Formprobleme der Gotik*. Bergson, with hi doctrine of creative development, takes the place of Taine. Sie mund Freud's teaching is greedily devoured; his psycho-analysi the first real investigation of the soul, replaces the old dogma tism. Others are influenced by one who stands at the opposit pole from Hiller and Rubiner—the Zionist Martin Buber, th champion of every kind of belief in the vitality of myth and th redeeming strength of the soul. Rudolph Steiner's anthropo sophic writings also have their effect. And if the new artist ask his hearer to rise to his level, to take a creative part in his wor yet two Austrian philosophers of the older generation, born i 1860—Alexius Meinong and Edmund Husserl—had alrea laid a scientific basis for these emotional demands in their *Unte* *suchungen zur Gegenstandstheorie und Psychologie*, in which the exploded the "Empiric bases of our knowledge," their *Ideen* *einer reinen Phänomenologie und phänomenologischen Philosoph* and their doctrine of pure "Wesensschau." Then between 19 and 1920 appeared the publications which summed up what ha gone before and laid down definite aims: Ludwig Rubiner's co lection of fiery appeals, *Der Mensch in der Mitte* and his *Doku* *mente der geistigen Weltwende*, known as *Die Gemeinschaft*, Ku Hiller's year-books of spiritual policy, *Das Ziel* and Kasimi Edschmid's voluminous collection *Tribüne der Kunst und Zei*

The New Lyric.—In the period of naturalism prose-fictio predominated, but in the decade 1910–20, the lyric. The dram is lyrical, and even the novel is steeped in lyricism; despite itsel the influence of the lyric gives it something of the ballad in thi decade. As every realist drama bore the marks of its derivatio from the story or sketch, so every drama of this period bears th marks of its lyrical origin, down to the very stage directions. Th lyric poem itself in this period is generally an endless flow melody; it is also characterised by a wealth of interjections; relieves its emotions by an excess of O's, Ah's and How's, sug gesting an elemental outburst of dark, shapeless, chaotic force

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[1] Expressionism apparently began as a secret language for th initiated, but within a few years it had become the fashion, the cu rent jargon of the literary market. Its divine fire, its exaltation an ecstasy were made ludicrous by the "Dada" movement; the artis the prophet, the creator of values were succeeded by mounteban who denied all values.

t first calmer, more harmoniously restrained temperaments
elieved fervently in evolution without end, in a new art not
eeding to renounce a noble heritage. This faith inspires the
ork of Ernst Lissauer (b. 1882), Leo Sternberg (b. 1876) and
eorg Hadwiger. It is significant that these authors are closely
ound up with the ballad and the ballad-mind, that when the
Var affects them it does so as the fate of the German world,
erman humanity, as a German war—not as a World War, as
e murder of man's image as a whole.

But the thought that a new art can only be won at the price
a frightful world catastrophe, darkly foreshadowing itself in
rt, breaking in advance all moral laws before shaking the world
the past into chaos—this foreboding it is—shown in images,
notions, rhythms, not yet degraded into lyrics of war or revo-
tion—that gives the poems of George Haym (1887–1912),
eorg Trakl (1887–1914) or Ernst Stadler (1883–1914) their
eculiar position. These are as yet no agitators; they are still
ure poets, prophets; they were broken before the War began,
they broke in its first months. Only a happier star preserved
aul Zech (b. 1881) and Armin T. Wegner (b. 1886) from a
milar fate; they too might have been broken by the irreconcil-
ble antagonisms of their experience, pit and forest, country
nd town, had not a new consciousness of community preserved
em. It is this same feeling of community, or the longing for it,
at gives the analytic "brain poetry" of Hoddis, Lichtenstein,
oldt, Benn, Lotz and Klemm the strength and light which
ines through the verses of the *Aufbruch der Jugend*. The same
eling in the poems of Franz Werfel, who as regards form is by
means always a "new" lyricist, accounts for their effect on
whole young generation, which gives him secure significance by
king him for a model. This is the feeling, enhanced by war and
volution, which fills the verses of Alfred Wolfenstein (b. 1888)
d René Schickerle (b. 1883), till in the hymns of Johannes R.
ecker (b. 1891), the poet of Utopias, it rises to boiling-point
d evaporates. Yet it would be a mistake to suppose that this
eling of community, this creed of "Thou and One Another,"
the only element in the poetry of the time. There are lonely
ooders, like Else Lasker (b. 1876), Theodor Däubler (b. 1876),
bert Ehrenstein (b. 1886), whose poetry springs from quite
er sources. Herwarth Walden's *Sturm* united all lyric poets
o repudiate any continuity of thought as inartistic and wish
weld the lyric into a pure linguistic form of vowels and con-
nants, a pattern of "associated" sounds.

The New Drama.—German expressionist drama does not
eak quite such new ground as expressionist poetry. It has two
odels, Franz Wedekind and August Strindberg, and it rings
ntinual changes on their themes. In their works they present
new problems, and at the same time solve these problems in
exemplary manner, whether as spectacular or interpretative
matists. They create the new acting and the new staging.
indberg and Wedekind are accepted as masters by many
hout tradition who cherish a confessed or unavowed longing
moorings and firm anchorage. These are lonely bearers of the
ssage of community; the defeated who yet must seek to save
er the world or themselves; the godless who yearn after God;
es of impulse whose instincts are unsure; beast-men in the
of dark forces, brain-men who have experienced in their own
s the curse of a purely intellectual estimate of all life; those
essed by a sense of the meaninglessness of many a life, or of
life, who yet long to find a meaning. The votaries of this
ld, those who adore flesh and blood, live on Wedekind; those
he world beyond, who worship the spirit, live on Strindberg;
both alike are unredeemed victims following a way of the
ss. Whether calling themselves saints or penitents, they are
by a torment which drives them through "heaven and hell."
s no mere chance that these latter words are the title of an
ntially important work of this time, a play, by Paul Kornfeld.
ut besides Wedekind and Strindberg there is a third origi-
ng ancestor and an earlier—Georg Büchner (1813–1851),
creator of *Woyzek*, that drama which is nothing but a Way
e Cross, nothing but a view of the world through the soul of
pless martyr. There is hardly one expressionist drama without the Woyzek frame of mind, the Woyzek characterisation, the Woyzek life-blood. These outlines may suffice to show how inadequate is the term "expressionist dramatists;" how varied can be the world which an "expressionist" dramatist reflects. Halfway between the two periods stands Carl Sternheim (b. 1881). In his hatred of the bourgeois which inspired the comedies *Aus dem bürgerlichen Heldenleben* he is akin to Wedekind; but he despises the doctrine of brotherliness and love of mankind, he is dry and cold, crystal-clear, free from mist, a virtuoso of form, his every word plain and unmistakable. Georg Kaiser (b. 1878), the "cubist" of drama, is as true to form, but you cannot grasp him; the man is an enigma like each of his works.

They seem to come out of some other age than ours and to pass into yet another—creations of impassioned suffering or of pleasure in the "game of thinking," as Kaiser once termed his ideal of drama. What have Sternheim and Kaiser in common, beyond the joy in solid construction? Not even that connection exists between them and another pair, the poet of the blessed ego and him of the accursed ego, the poet of *Bettler* and the poet of *Himmel und Hölle*, Reinhardt Johannes Sorge (1891–1916), that pious disciple of Christianity; and Paul Kornfeld (b. 1889), the young apostle of an all-believing orientalism. Or what have these "philosophic politicians" in common with the real politicians, with Ludwig Rubiner (1888–1920) and Ernst Toller (b. 1893), the author of *Masse Mensch*, or with Reinhard Goering, author of *Seeschlacht* and *Scapa Flow*, or with Fritz von Unruh, the writer of *Louis Ferdinand* and *Ein Geschlecht*, whose whole work is inspired by the desire to show the symbolic meaning of the sorrows of mankind to-day in a myth of mankind future? The young humanity of Walter Hasenclever (b. 1890) revealed in his *Der Sohn*, what has it in common with the other young humanity of Hans Johst (b. 1890) in his *Der junge Mensch?* Or that other again of Anton Wildgans (b. 1881) in his *Dies Irae?* What is the link between the two artists from the sister realm of painting and sculpture, the terrified dreamer Oskar Kokoschka (b. 1886) and "Ernst Barlach" (b. 1870), that seeker after God? Or between legend-writers like Dietzenschmidt (b. 1893) on the one hand and Rolf Lauckner (b. 1887) or Alfred Brust (b. 1891) on the other? We see that expressionist drama, almost more even than the expressionist lyric, is the utterance of an age of confusion: it reflects the death-pangs of one world, the birth-pangs of another.

The New Prose-fiction.—The picture that we gain of expressionist prose-fiction is quieter. The reason is not far to seek; for if "the substance of the age"—all it "holds" of the past, present and future—is more clearly shown here than anywhere else, yet the novel seems alien to the "form of the age," the expressionist style. Expressionism is lyrical compulsion, dramatic impulsion, not epic propulsion. The longing of the age for the images of a new humanity and a new community offers many-sided satisfactions to the novelist. He is tempted to bring Utopias nearer our reach. But in conjuring up the picture of a future world, he forsakes to-day's world of chaos; out of its wreckage he makes a new world by new laws; but, above all, he sees one thing: that the spirit can create no world unless it begs Nature to assist it. Many a modern catchword is shattered by the restrictions of tale-telling art: among them phrases like "pure spirit" or "metaphysical space." There have been only isolated attempts to create pure "brain work." In fact, novelists like Gustav Sack, Kasimir Edschmid, Alfred Döblin, have proved, both by their work itself and by their own pronouncements on it, that they will have nothing to do with narrow-minded antagonism to nature. Certainly their work is no mere passive reflection of nature. Prose fiction of to-day requires scenic description, where life and its circumstances must be represented as in the historical or exotic novel; yet this is not now done at a leisurely length unbroken by action, but by a more concentrated method seizing on the decisive moments when significance springs out of circumstance.

Similarly, the outward and surrounding world is always being absorbed into the world within us; each man creates for himself a new outer world, which is nothing but his own soul projected into external form, the representation of all its impulses, the laying bare of its inmost secrets. The manner of narration, too, with its terse words and concise sentences, the accents of unrest and agitation—this is the very opposite of the old descriptive mode. The impression which all this gives is heightened by an avalanche of incidents. Events come thick and fast to match the hurrying giddy frivolity of life to-day, a whirling vortex chafing nerve and spirit. The long-starved appetite for material is glutted. We have a variegated cinema-world shown often by a cinematic method in novel-writing—jerky, abrupt, tempestuous, with flickering lights. We may pass by the hangers-on and imitators of the true expressionist movement.

The weary search of this age after a meaning in existence is tragically uttered in the works of the best novelists of Expressionism. Metaphysicians and believers like Max Brod (b. 1884), unbelievers like Gustav Sack (1885–1916) and Gottfried Benn (b. 1886), exhaust themselves in struggles of joy or despair. Kasimir Edschmid (b. 1890) flies to adventure for a firm foothold and plain idea; "Klabund" (Alfred Henschke, b. 1892) ceaselessly changes his phases; Leonhard Frank (b. 1882), author of *Der Mensch ist gut* (a collection of short stories), believes that he can find salvation in a renewed feeling of community. Another, Franz Kafka (d. 1924) sees that in this world there is no salvation, that all we can do is to gain a glimpse of the heaven of another world through the artistry of pure literature. Others again, as "Mynona" (Salomo Friedländer, b. 1871), construct a fabulous realm of new forces and seek to prove that nothing is more fantastical, more like a Utopia than nature. The work of Alfred Döblin (b. 1878) is inspired by the same feeling and leads him to the same conclusion in his romance of the future, *Berge Meere Giganten*, which describes titanic battles between mankind and nature.

The Reaction.—As indicated above, the wave of expressionism reached its height in 1920 and then suddenly broke altogether. After the boundless over-conceit which every revolution brings came a moment when the artist paused to reflect while the public was sobered. Will and deed, claim and achievement, promise and performance had been taken as one. In expressionism men had seen the revolt of the spirit against matter, of liberty against mechanical slavery, of creative force against the receptive mood and formal reason. All this was regarded as a vision of the future illuminating the background of a shattered past. But the course of the political revolution, in particular, showed that new humanity, after all, was subject to the original sin of all existence, the luckless children of a luckless age which lets no man be without devouring him again as a victim. Expressionism, in its latest phase, is usually the tortured outcry of the mangled victims of an age who yet believe themselves its saviours.

It is thus not surprising that literature once more seeks and finds contact again with powers and forces to which artistic teaching just before had denied any importance whether for substance or form. In our survey of the development of prose-fiction we have mentioned the return to nature. In literature, as in all art, there was talk of a "new reality," a "new objectivity," a new kind of literal naturalism. This new realism was termed "Magianism," to signify that it had borrowed essential characteristics from expressionism, and like it satisfied metaphysical needs. The name "Verism" means much the same. Hand in hand with a new reverence for nature goes a new regard for science, even for technique where it is creative. A novelist like Josef Ponten (b. 1883) is struggling, consciously or unconsciously, towards a marriage of science and art. The new task appears to be to spiritualise, elevate, to mythify everything belonging to science and mechanism, and all the characteristic factors of civilisation in our time. In the same way re-arises respect for tradition. The consciousness of a culture, nourished by all ages and peoples, comes to its own again; it finds its highest expression in the writings of Albrecht Schaeffer (b. 1885) whose comprehensive three-volume *Helianth* (1920) is one of those romances of education peculiarly significant in German literature, while his *Parzival* (1920) is one of the equally typical poems of deliverance. But another part of German literature took new blood
from new spiritual experience. The all-embracing internatio
love which poets and playwrights, especially of Jewish orig
had proclaimed with particular fervour, was ruthlessly destroy
after the War by the events of foreign and domestic polit
Then writers began again to think of the elemental forces of r
and nationality, out of which the super-national, super-tempo
always sprang. Finally, a German neo-Catholic school of lett
is undeniably growing up (R. J. Sorge, 1891–1916; Dietz
schmidt, b. 1893; Leo Weismantel, b. 1888).

This renewal of substance is accompanied by a revision
form. Here, too, faith in the tranquillising, uniting forces te
to gain the upper hand over faith in revolutionary and disrupt
forces. Idiom is becoming fixed; dramatic and epic struct
more coherent; the form of the lyric more crystallised. In c
connection with the new thinking there is a fresh appreciatio
workmanship, of ability, of technical mastery—things laug
at by a yesterday which had forgotten the "how" in its conc
with the "what." The development of the novel and the dra
show most clearly why the art of the most recent years is tend
towards a compromise between naturalism and impression
on the one side, expressionism on the other. How varied ca
the forms of this compromise is shown by the work of novel
like Albrecht Schaeffer, Josef Ponten, Wilhelm Lehmann
1882), Rudolf G. Binding (b. 1867), Otto Flake (b. 1882), Fr
Thiess (b. 1890), Arnold Ulitz (b. 1888). A good survey of
modern art of prose-fiction may be obtained from the "Libra
of modern stories *Der Falke*, which has been appearing si
1923. In drama the tendency to get lost in Utopian ideals,
the vagueness which often accompanied it, has given way
method that comes nearer to earth with more sureness and f
ness of outline. Where the dramas of Arnold Bronnen (b. 18
Bertolt Brecht (b. 1894), Max Mohr (b. 1891), Otto Brües
1897), Friedrich Griese (b. 1890), Rolf Lauckner (b. 1887), H
W. Fischer (b. 1876), Paul Gurk (b. 1880) are in advance of
dramas of the pure expressionists is in their genuine feeling
the theatre itself. In lyric poetry the new purpose and the
faculty are seen in the work of Oskar Loerke (b. 1889), Fried
Schnack (b. 1888), Anton Schnack (b. 1892), Fritz Walter
choff (b. 1896), Ina Seidel (b. 1885 and Ludwig Strauss (b. 18
The word *World-Inwardness* (*Weltinnigkeit*), chosen by
Seidel as the title of a volume of poems, well defines the spiri
the new poetry.

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(A. Soe

GERMAN OFFENSIVE (March–June 1918).—After the
of the battle of the Marne, in Sept. 1914, and the abor
operations which followed it on the Aisne and in Flanders,
German higher command changed the idea which unde
their strategy. In Aug. 1914 their main blow was to be d
against their strongest adversary, and France was to be crus
before Russia could develop her strength. The deci
victory of Tannenberg had, however, opened their eyes to
rottenness of the Russian Army, and from Oct. 1914 onwa
until March 1918 the aim of the German General staff wa
hit at weakness in order to isolate their strongest advers
namely, the French. The series of battles carried out du
the first six months of 1916 in the neighbourhood of Verdun
no exception to this crucial strategical idea, since its aim
defensive—that is, its intentions was not to gain a dec
victory in the West, but to dislocate the impending French
British operations and gain time wherein to defeat Russia.

The campaign in Russia, however, dragged on, the same
ditions appearing as in 1812—climate, lack of communicat
and distance rendering every tactical victory abortive. To m
up for this delay, in the autumn of 1916 Rumania is selected as
weakest point of attack, and is overrun. A year later Ital
selected, and the result is the Italian débâcle at Capore

nultaneously Russia, to all intents and purposes, disappears as ıostile power, so that by the end of 1917 Germany could once ıin turn to the task she had abandoned in the autumn of 1914, mely, the defeat of the French now so strongly supported by British Empire.

The political situation which faced the Imperial Govt. in rlin was one which demanded a rapid conclusion of the War. t only had unrestricted submarine warfare failed to produce attrition expected, but the stranglehold of the British vy was daily reducing the morale of the German people. Of allies, Turkey was the only one who seemed to be in earnest. lgaria's interest in the War was waning, and Austria and ıngary were worn out, having lost nearly 2,000,000 men in soners alone. These conditions demanded immediate and isive action if the War was to be won before America could elop her strength.

Whilst the Central Powers had been striking at weakness, eat Britain had been engaged in a similar strategy. The lemate which had been established on the Western Front, and abortive campaigns which had followed this stalemate, had ced her into seeking a line of least resistance by means of her vy, with the result that, by the end of 1917, a serious dispersion fighting force had taken place, extensive operations being in ogress in Palestine, Macedonia and Mesopotamia, without ınting minor campaigns in Africa. Further, the British ces in France had been bled white, the Arras, Messines, Ypres d Cambrai battles having alone accounted for 650,000 men. e general situation was that whilst France had been recover- her strength the British forces had grown steadily weaker. e offensive initiated by Germany on the Western Front in arch 1918 is here described as three main battles, namely, St. Quentin; II. The Lys; and III. Soissons-Reims.

I. THE BATTLE OF ST. QUENTIN

General Ludendorff, who by now had become the directing nius of the German war brain, was faced by the problem of ere the decisive blow should be struck, and determining strike at weakness he selected the British front for the de- ive attack. This front may be divided into three sectors Flanders, the Bruay area and the country southeast of it tween Cambrai and St. Quentin. The first of these was viously unsuited for offensive action of a decisive nature, as British operations of 1917 had clearly shown. The second ered an opportunity of striking at the French coal supply, a al factor, but the front of attack was restricted and difficult. e third included good offensive country, as it consisted of en field land and led to the valley of the Oise, a natural avenue ding to Paris.

Ludendorff's Opinion.—Though Ludendorff writes that actics had to be considered before purely strategical objects ich it is futile to pursue unless tactical success is possible," uccessful attack in this direction would not only isolate the itish forces by severing their connection with the French, but, if shed towards Paris, would jeopardise the line of communi- tions of all the French forces situated east of Soissons. The ategical possibilities of such an attack are therefore closely nparable with those of the original plan of campaign worked t by Schlieffen long before the War. To deliver this blow dendorff proposed to muster every available man and gun d further to accentuate the force of numbers by surprise, for tank attack at Cambrai and Hutier's gas attack at Riga had monstrated the overwhelming power of an unexpected assault. saw clearly that the forthcoming struggle would be no light e, and in an audience at Homburg with the Kaiser and the ancellor he said:—

'The battle in the West is the greatest military task that s ever been imposed upon an army. . . . It cannot be success- ly accomplished unless the authorities who conduct the War relieved of all intolerable shackles, unless the very last man employed in the decisive conflict, and is animated, not only love for his emperor and his native land, but by confidence in strength of the military leadership and the greatness of our country. These spiritual forces must not be underestimated, they are the foundations of the greatest deeds. . . . We must not imagine that this offensive will be like those in Galicia or Italy; it will be an immense struggle that will begin at one point, continue at another, and take a long time; it is difficult, but it will be victorious."

The Opposing Forces.—Between Nov. 1 1917 and March 21 1918 the German divisions on the Western Front were increased from 146 to 192, troops being withdrawn from Russia, Galicia, Italy and the East. By these means the German armies in the West were reinforced by no less than 18,492 officers and 553,794 other ranks. Finally it was decided to make available 62 divisions and 1,706 batteries for the main attack. These troops were carefully trained for mobile warfare on any sector of the French and British fronts, the greatest secrecy being maintained as to the actual area of attack, which extended from the south of Lens in the north to a little south of La Fère.

On the side of the Allies, except for a few miles in the north, this front was held by the III. and V. British Armies respectively, commanded by Sir Julian Byng and Sir Hubert Gough. The front of the III. Army extended from just south of the village of Gavrelle to half a mile north of Gouzeaucourt (26½ m.), and on March 21 was held by 10 divisions in line and seven in reserve. The V. Army front (42 m.) ran from the right of the III. Army to the village of Barisis, a little south of the river Oise, between the forests of Coucy and St. Gobain. On this extended front there were 11 divisions in line and three in reserve.

German Plans.—The plans of attack were issued by the Supreme Command on Jan. 24 1918. The attack was to be carried out by four armies:—

(*a*) XVII. Army (Below), comprising 17 divisions, was to attack on the frontage Gavrelle-Moeuvres.

(*b*) II. Army (Marwitz), comprising 18 divisions, was to attack from Moeuvres to Pontru (north of St. Quentin).

(*c*) XVIII. Army (Hutier), comprising 24 divisions, was to attack from Pontru to Vendeuil (south of St. Quentin).

(*d*) VII. Army (Gayl) was to demonstrate with three divisions against La Fère.

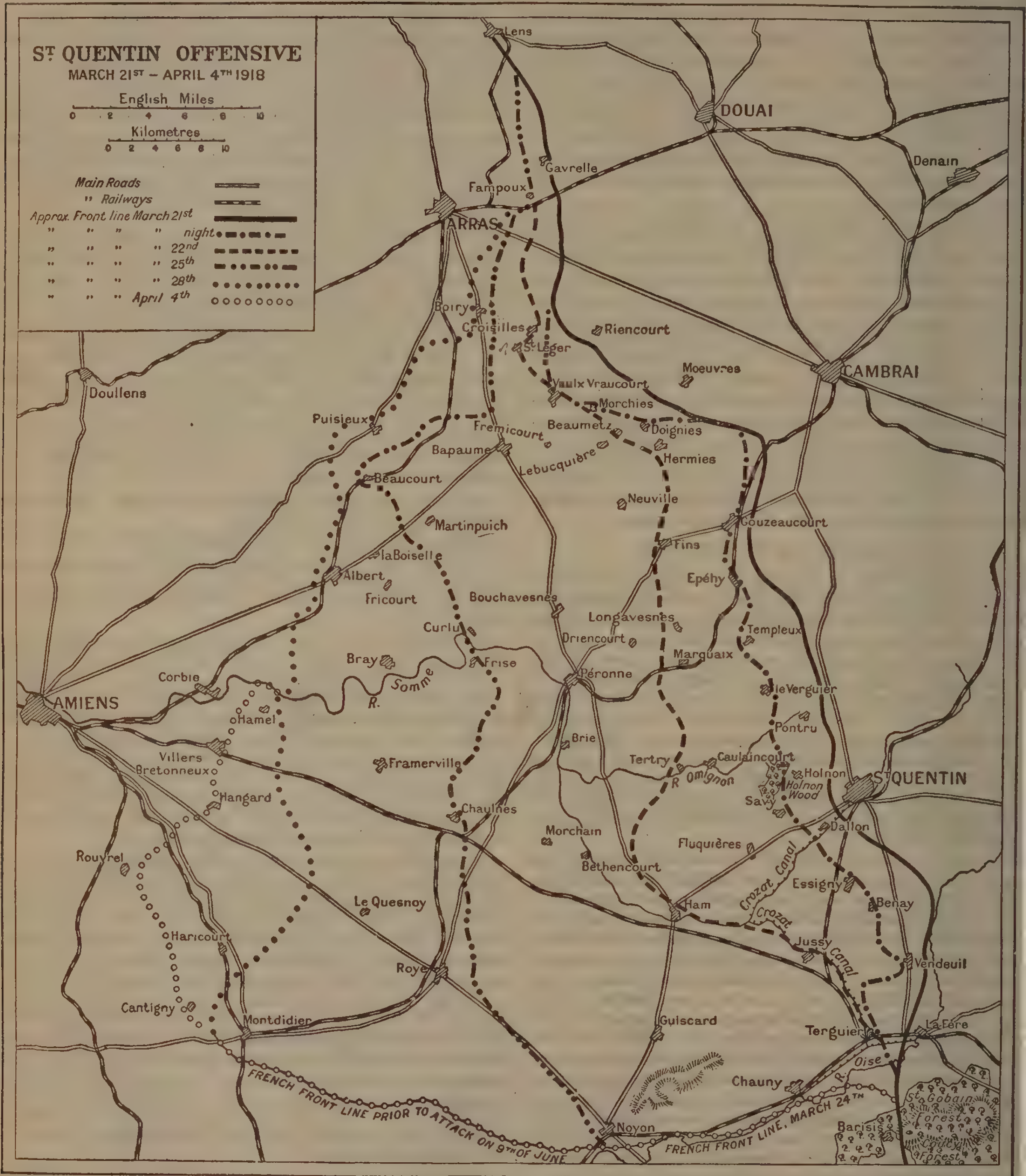
The various attacks were named as follows: XVII. Army, left wing attack "Mars" (south of Bapaume), right wing "Michael I." (north of Bapaume); II. Army, "Michael II.," to the north of the Omignon brook; XVIII. Army, "Michael III.," north and south of St. Quentin; VII. Army, "Archangel," south of the river Oise. The "Michael" attacks were to be delivered on the first day of the battle, followed a day or two later by the "Mars" and "Archangel" attacks. The object of the "Michael" attacks was to penetrate the enemy's front, and then, supported by the "Mars" attack, both were to push on through Peronne-Arras and Peronne-La Fère.

To bewilder the enemy as to the frontage selected for the main attack, subsidiary operations were prepared all along the Allied front, at Ypres-La Bassée, Reims, the Argonne and in Champagne. From March 14 onwards the crown prince was to bombard the enemy's headquarters on his front and make a show of bringing up reinforcements, and Gallwitz was to carry out an attack on Verdun up to the point of engaging his infantry.

Preparations for the Attack.—The forming up for deployment of the attacking armies was begun on March 10, the divisions being organised in groups normally in a depth of three lines. The first or assault line was made the strongest, and was moved close up to the front on March 20. The second line of divisions was some three to five km. in rear, and the third seven to ten km. behind the second line; this third line was to be held in reserve under the higher command, and was only to be used as the operations developed.

On March 20 all was in readiness for the attack, which was to be preceded by a three hours' hurricane bombardment in which gas was to be employed extensively by the artillery and minenwerfers. By this means it was hoped to paralyse the enemy. On the 20th, however, the wind was at first unfavourable, but by midday conditions had sufficiently improved to permit of the bombardment taking place. It was opened at 3:30 A.M. on the 21st, the Allied batteries being first gassed.

The infantry attack did not, however, take place until 9:40 A.M., when a general move forward was made under a creeping barrage supplemented by low-flying aeroplanes.


ST QUENTIN OFFENSIVE
MARCH 21ST – APRIL 4TH 1918
English Miles
0 2 4 6 8 10
Kilometres
0 2 4 6 8 10
Main Roads
" Railways
Approx. Front line March 21st
" " " " night
" " " " 22nd
" " " " 25th
" " " " 28th
" " " April 4th
Lens
DOUAI
Denain
Gavrelle
Fampoux
ARRAS
Boiry
Croisilles
St Léger
Riencourt
Moeuvres
CAMBRAI
Doullens
Vaulx Vraucourt
Morchies
Puisieux
Fremicourt
Beaumetz
Doignies
Bapaume
Lebucquière
Hermies
Beaucourt
Neuville
Gouzeaucourt
Martinpuich
Fins
laBoiselle
Albert
Epéhy
Fricourt
Bouchavesnes
Longavesnes
Templeux
Curlu
Driencourt
Marquaix
Bray
Frise
Somme R.
Corbie
Péronne
leVerguier
AMIENS
Hamel
Pontru
Brie
Villers Bretonneux
Framerville
Tertry
Caulaincourt
Holnon
R. Omignon
Holnon Wood
ST QUENTIN
Hangard
Savy
Chaulnes
Dallon
Morchain
Rouvrel
Fluquières
Bethencourt
Crozat Canal
Essigny
Le Quesnoy
Ham
Benay
Haricourt
Jussy
Vendeuil
Roye
Cantigny
Montdidier
Guiscard
Terguier
La Fère
Oise R.
Chauny
St Gobain Forest
Barisis
Noyon
FRENCH FRONT LINE PRIOR TO ATTACK ON 9TH OF JUNE
FRENCH FRONT LINE, MARCH 24TH

March 21.—The attack of the XVII. Army was met by strong opposition, which was accentuated by the fact that the infantry were unable to keep up with the barrage. At Vaulx-Vraucourt and Doignies strong counter-attacks were launched against them, and by nightfall the German divisions had to be reinforced by second line troops. The II. Army advanced to the line Gouzeaucourt-Epéhy-Templeux-Le Verguier, a fierce struggle taking place at Epéhy, which throughout the day remained in British hands. The XVIII. Army was more successful. Its right captured Holnon and Holnon wood; its centre got to Sa and Dallon, and its left captured a part of Essigny and Bena but was checked a little west of Vendeuil.

On the 22nd the attack was continued with vigour. T XVIII. Army was reinforced and was ordered to advance Tertry to facilitate the operations of the II. Army, which ha outrun its artillery support. The brunt of the fighting fell o the XVII. Army, which attacked the British second line o defence again and again, only to be met by vigorous counter attacks supported by tanks. Towards the close of the day, bu only after having been reinforced by third line units, it succeeded in capturing Croiselles, Vaulx-Vraucourt, Morchies an

Hermies. The II. Army pushed forward to Fins-Longavesnes-Marquaix-Caulaincourt, and the XVIII. Army captured Fluquières and crossed the Crozat Canal between Jussy and Terguier.

From the positions held on the 22nd the XVII. Army advanced n Bapaume and captured Driencourt, St. Léger, Beaumetz and Lebucquière. The II. Army reached the line Neuville-Bouchavesnes-Brie, and the XVIII. Army crossed the Somme at Bethencourt and captured the town Ham.

Between the 24th and the 26th the advance was steadily ontinued, and on these three days the German front was advanced to the following lines respectively: (*a*) 24th, Chauny—Guiscard—Morchain—west of Peronne—Curlu—Fremincourt—ampoux; (*b*) 25th, Noyon—east of Roye—east of Chaulnes—Frise—Beaucourt—Boiry; (*c*) 26th, west of Noyon—Le Quesoy—Framerville—Bray—east of Albert—Pusieux—Boiry.

Ludendorff's Second Plan.—The first great stage of the attack ow drew to a close, for not only had British resistance stiffened, but the difficulties of supplying the advancing armies over the ld Somme battlefield were so great that it was found impossible o maintain the leading troops. The result of this was that on he evening of the 26th Ludendorff determined on a change in lan. He now decided to separate the British and French forces by wheeling the II. and XVIII. Armies against the latter. The difficulty of supply was, however, too great for this change f front to succeed, consequently on the 27th Ludendorff made further change. He ordered the XVII. Army to close down he attack, and the XVIII. Army and left of the II. Army to ttack the French between the Oise and the Somme. By March 0 this attack advanced the huge pocket which had been found in the Allied front from a little south of Noyon to west of Montdidier, thence through Haricourt and Hangard to the omme north of Hamel.

Between this date and April 4, further attacks, mostly of a minor nature, extended the pocket from west of Montdidier to ast of Rouvrel, thence through Hangard east of Villers-Bretonneux to east of Corbie on the Somme. On April 4 the reat battle to all intents and purposes came to an end. The initial success had been great; since March 21 from a base of 4 m. a penetration of no less than 38 m. had been effected; the round lost in 1916 and abandoned in 1917 had been more than made good, and enormous booty as well as 90,000 prisoners and ,200 guns had been captured. The British Armies had been seriously defeated, and 20 French divisions had been drawn into the battle; yet, in spite of the fact that 90 German divisions ad been engaged, neither the transition to a war of movement or the separation of the British and French forces had been chieved.

Causes of German Success.—The initial successes of this reat battle were due to the length of front attacked; the comarative weakness of the British forces when compared with the ngth of line held by them; the rawness of these forces due to the losses suffered during 1917 which had been made good by astily trained troops; and the surprise of the attack itself, for though the British higher command suspected an attack on the onts of the V. and III. Armies, when the attack was launched many of the reserve divisions were still in the Flanders area. The ilure of the battle was due to well ascertainable causes, the wo most important being the comparative narrowness of the ont when compared with the depth of penetration required in order to obtain a decisive result, and the insuperable difficulty of keeping an advancing front of many divisions supplied. The German front of attack on March 21 stretched from three m. south of a Fère to three m. south of Lens, a distance of about 74 m. and by April 4 the depth of the penetration effected was some 38 miles.

A study of the various pockets formed by frontal attacks roughout the War will show that the depth of penetration was approximately half the length of the front attacked. Conquently, if it was necessary to reach Abbeville, which is about m. from the original German front, in order to effect a separaon of the British and French forces, so as to enable a change front on the line Abbeville-Soissons being made towards Paris, the initial front of attack should have been as least 120 m. in width. Though the German forces were insufficient to attack on such a frontage, had they been sufficient the second factor, namely, difficulty of supply, would in all probability have wrecked their plan.

We thus see that any attempt on the part of the Germans to win the War by an immense frontal attack before the Americans could develop their strength was, as long as the Allies resisted stubbornly, virtually an impossible operation. This by April 4 was realised by the German higher command, for the battle on the Amiens-Noyon front was closed down, save for minor operations south of La Fère, and other fronts of attack were sought, namely, those west of Lille, south of Laon and north of Compiègne, which were attacked on April 9, May 27 and June 9 respectively.

Bibliography.—Sir F. B. Maurice, *The Last Four Months* (1919), L. Madelin, *La Bataille de France, 21 Mars—11 Nov. 1918* (1920); C. M. E. Mangin, *Comment finit la Guerre* (1920); R. Recouly, *La Bataille de Foch* (1920). (*See* also World War: Bibliography.)

(J. F. C. F.)

II. THE BATTLE OF THE LYS

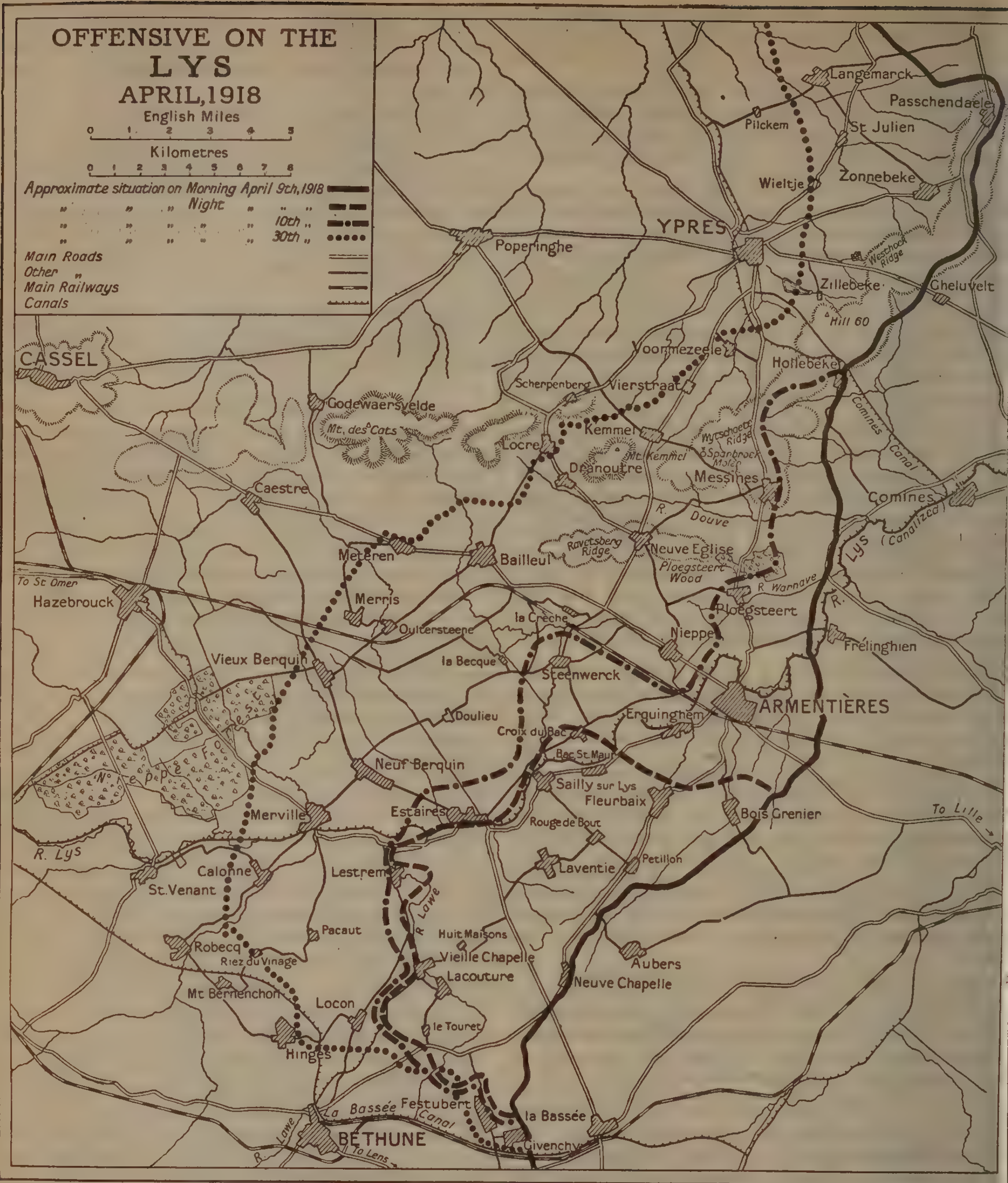
In the general scheme of the great German offensive of 1918, the idea of breaking through the British-Portuguese front in French Flanders was considered by the German High Command. Although this scheme became secondary to the great offensive further south, the preparations for it were carried out, firstly in order to mislead the British and Allied headquarters, and secondly that the Germans might be able to revert quickly to it in case the Somme offensive should come to a standstill.

When on March 30 it became obvious that no further progress was possible in the southern battle area, the German Supreme Command decided to put into effect the Flanders attack, the preparations for which were nearly complete. Although they did not anticipate that they would be able to force a decision in this area, there were certain definite advantages to be obtained from a successful blow in the direction of St. Omer-Hazebrouck and the local situation favoured, in their opinion, the prospect of success. This was to be the second blow struck against the British Army, a great proportion of which had already been employed on the southern front. The main weight of the initial blow was to fall on the Portuguese division, known to be less experienced and of less fighting value than British formations.

The abnormally dry weather gave good grounds for hope that the Lys valley would be practicable, a state of affairs which was not the case till much later in the spring in a normal year. The only lateral lines of communication in this sector of the British zone, other than the coast railway, ran through St. Pol-Lillers-Hazebrouck, and if the use of this could be denied to the British, problems of supply and reinforcement would be immeasurably complicated. It was above all important, in the view of the German Supreme Command, to retain the initiative, and to strike a second blow before the French could organise a counter-attack against the somewhat vulnerable southern flank of the salient which had been created by the success of the Somme offensive.

Plan of Attack.—The general plan of attack was that the main blow should be struck by Quast's VI. Army on the front between Armentières and the La Bassée Canal, in the direction of Hazebrouck. If the VI. Army's attack met with sufficient success, the IV. Army under Arnim was to advance north of Armentières, which was to be made to fall by envelopment, with the eventual object of securing the heights stretching from Kemmel to Mt. des Cats, south of the Ypres-Poperinghe road. If this were achieved the British and Belgian positions in the Ypres salient and on the Yser would be threatened from the rear. The extension of the attack southwards was a secondary consideration, but it was hoped that at least the destruction of the important mining area south of Bethune might be achieved.

Forces Engaged.—The forces available for the operation of the German VI. Army were four corps, from north to south, the Bavarian II. and German XIX., LV. and IV., to which were allotted nine divisions in the first line and five in corps reserve. Three more divisions were retained in army reserve. The sub-


OFFENSIVE ON THE LYS APRIL, 1918
English Miles
0 1 2 3 4 5
Kilometres
0 1 2 3 4 5 6 7 8
Approximate situation on Morning April 9th, 1918
" " " Night "
" " " 10th "
" " " 30th "
Main Roads
Other "
Main Railways
Canals
Langemarck
Passchendaele
Pilckem
St Julien
Wieltje
Zonnebeke
YPRES
Poperinghe
Westhoek Ridge
Zillebeke
Gheluvelt
Hill 60
Voormezeele
Hollebeke
CASSEL
Scherpenberg
Vierstraat
Godewaersvelde
Mt. des Cats
Kemmel
Locre
Wytschaete Ridge
Mt. Kemmel
Spanbroek Molen
Dranoutre
Messines
Comines Canal
Caestre
R. Douve
Comines
Lys (Canalized)
Ravetsberg Ridge
Neuve Eglise
Ploegsteert Wood
Meteren
Bailleul
To St Omer
Hazebrouck
R. Warnave
Merris
Ploegsteert
R. Lys
Outtersteene
la Creche
Nieppe
Frelinghien
Vieux Berquin
la Becque
Steenwerck
ARMENTIÈRES
Doulieu
Erquinghem
Croix du Bac
Bac St. Maur
Neuf Berquin
Forêt de Nieppe
Sailly sur Lys
Fleurbaix
Merville
Estaires
Bois Grenier
To Lille
Rouge de Bout
R. Lys
Calonne
St. Venant
Lestrem
Laventie
Petillon
R. Lawe
Pacaut
Huit Maisons
Robecq
Vieille Chapelle
Aubers
Riez du Vinage
Lacouture
Neuve Chapelle
Mt Bernenchon
Locon
le Touret
Hinges
La Bassée Canal
Festubert
la Bassée
R. Lawe
BETHUNE
Givenchy
To Lens

sidiary attack of the German IV. Army was to be delivered by the X. and XVIII. Res. Corps, with three divisions in the first and one in the second line.

The initial blow fell on the left of the I. and right of the II. British Armies, under Sir Henry Horne and Sir Herbert Plumer, the point of junction between which was, on April 9, the Lys, east of Armentières. The XI. Corps (British 55th and Portuguese 2nd Divs.) and the XV. Corps (40th and 34th Divs.) held the front from the La Bassée Canal to the Lys, while the IX. Corps (25th, 19th and 9th Divs.) continued the line from the Lys to the Ypres-Comines Canal. With the exception of the 55th, all these British divisions had already taken part in the southern battle and had been rapidly made up with reinfor ments from home. Three more battle-worn divisions were corps reserve.

The Battle Opens.—At about 4 A.M. on April 9 the battle oper with an intense bombardment of the whole front from Lens Armentières, with both gas and high-explosive shell. The fr trenches were subjected to a rain of high explosive, while batt positions, cross roads, headquarters and railheads far in r were treated with both gas and high explosive. Armentiè itself and the British position south of the La Bassée Canal w deluged with mustard gas. The foggy morning made obser tion difficult, and, according to German accounts, the count mbardment was ineffective. Between 8 and 9 A.M. nine Ger- an divisions, with ample reserves at hand, were launched ainst the two British and one Portuguese divisions. In the ntre the weight of the attack of the German XIX. and LV. rps overwhelmed the Portuguese 2nd Div., and both corps vanced steadily towards their objectives. The right of the avarian II. Corps was held firmly by the 40th Div., but the t of the Bavarians succeeded in advancing past the right flank that division. On the British right the 55th Div. held stoutly to Givenchy and north of that place withdrew slowly from e outpost position to the main line of resistance which ran just st of Festubert.

All available British reserves were hurried up; the reserve igade of the 55th Div. was employed to form a defensive flank cing north, from Festubert, south of Le Touret to the Lawe. e 11th Cyclist Bn. and King Edward's Horse were rushed up Lacouture, Vieille-Chapelle and Huit Maisons and by their roic resistance effectually prevented any extension of the break rough to the south. The 51st and 50th Divs. were moved up m the back areas to the river Lawe and the neighbourhood Estaires respectively. Meanwhile the 55th Div. continued to ld its position at Givenchy and Festubert throughout the day d in counter-attacks against elements of the enemy, which had netrated into their position, captured over 750 prisoners. he magnificent fight put up by this division completely broke e attack of the Prussian IV. Corps.

On the northern flank of the battle, the Bavarian II. Corps suc- eeded eventually in occupying the forward posts of the right ttalion of the 40th Div., and gradually worked their way north- ards. By 10:15 A.M. on April 9 the Bavarians were in Rouge De out, some 2,000 yd. in rear of the headquarters of the right ttalion of the 40th Div., which was still holding out in Petillon. y noon the division was forced back by pressure in front and nk to a position facing south from Bois Grenier through Fleur- ix to Sailly-sur-Lys. Owing to the rapid advance of the Ger- an centre the 50th Div. was unable to gain touch with the 40th, e right flank of which withdrew across the Lys at Bac St. Maur rly in the afternoon. The remainder of this division, reinforced y troops of the 34th Div., successfully maintained their line vering the approaches to Erquinghem and Armentières from e south, till the evening.

The Saxon XIX. Corps had rapidly followed up the right of e 40th Div. and about 3 P.M. succeeded in passing small bodies troops across the Lys at Bac St. Maur. During the remainder the afternoon and evening the strength of the German force orth of the river steadily increased, and they eventually reached roix du Bac, where they were successfully counter-attacked nd driven back by a brigade of the 25th Division. During the ight the Germans established themselves firmly on the north ank, in the gap between the 40th and 50th British Divisions.

Renewal of the Attack.—On April 10 the attacks were renewed ll along the line. Practically no progress was made by the IV. orps on the left. It was only just before nightfall that the LV. orps succeeded in gaining a footing on the west bank of the awe between Lestrem and Vieille-Chapelle, and at Lestrem it- elf. At Estaires the 50th Div. defended itself with great gal- ntry and inflicted very heavy casualties on the enemy in the treet fighting which continued all day. It was only at nightfall hat this division was forced to withdraw to a prepared position orth and west of the town. East of Estaires the German Corps, hich had now got up artillery in support of its infantry and achine guns, pushed back the thin British line to a position orth of Steenwerck, where the arrival of reinforcements for a ime effectually held up the German advance.

Meanwhile, after an intense preliminary bombardment of he British positions between Frélinghien and Hill 60 north of he Ypres-Comines Canal, the German IV. Army about 5:30 .M. attacked the British VIII. Corps. The outposts of the 25th nd 19th Divs. were driven in and under cover of mist the Ger- an X. and XVIII. Res. Corps worked their way up the valleys f the Warnave and Douve rivers on the flanks of the British ositions in Ploegsteert Wood and Messines. By midday the village of Ploegsteert, the southeast corner of the wood and Messines had been captured. During the afternoon the German attack succeeded in capturing the outpost position as far north as the Ypres-Comines Canal, but was held up on the crest of the Wytschaete Ridge and in front of Hollebeke by the 9th Division. The South African brigade of the same division retook Messines during the afternoon. This further success of the Germans, combined with the progress made by the right flank of the German VI. Army, gravely imperilled the situation of the 34th Div. which was holding the original line east of Armentières and had not been attacked. A withdrawal to the north bank of the Lys was therefore decided on, and was completed by 9:30 P.M. when the Lys bridges were destroyed.

On April 11 the attack was continued. The German IV. Corps again failed to make any progress between Givenchy and the Lawe river. North of Locon the British 51st and 50th Divs., weakened by continuous fighting, were slowly pushed back by the German LV. and XIX. Corps. The British divisions fought with the greatest gallantry and inflicted very heavy casualties, but bodies of German infantry worked their way through gaps in the attenuated line and by nightfall they had reached Neuf-Berquin and were in occupation of Merville. Further east progress was checked by a counter-attack of the 31st Div., which had arrived from the southern battlefield, but the Bavarian II. Corps pushed forward through Nieppe to Steenwerck. Slight progress was made by the German IV. Army between Nieppe and Messines.

Renewed Attacks.—During April 12 the arrival of reinforcements, mostly from the southern battle front, began to have its effect. The right flank of the British still held firm, but the German LV. Corps, attacking before dawn in the mist, broke through the left centre of the 51st Div., and reached Pacaut and Riez du Vinage, where their progress was checked by two batteries of artillery. The British 3rd Div. had come into action about Locon, which village was lost to the German LV. Corps, but the German advance was checked and their troops suffered heavy casualties. The right flank of the same German Corps was checked in Calonne by the 61st Div., which, like the 3rd, had arrived from the Somme battle area.

Meantime the Bavarian II. and German XIX. Corps attacked in great strength between Vieux Berquin and Steenwerck. In spite of the gallant defence put up by the 29th and 31st Divs. they succeeded in occupying Doulieu and La Becque, forming a gap southwest of Bailleul, which enabled the Germans to seize the villages of Outtersteene and Merris. This gap was eventually blocked by a brigade of the 33rd Div. reinforced by a party of cyclists, a pioneer battalion and by every available man from the local schools and reinforcement camps. Further to the left the 25th, 34th and 49th Divs. maintained their positions against all attacks. During April 12 headquarters of Prince Rupert's group of armies issued orders for the continuance of the attack by the inner wings of the two armies, with the dual objectives of Hazebrouck and the range of hills north of Bailleul. The VI. Army was also to prepare to continue the pressure of their left wing towards Bethune. On April 13 the German attacks north of the Lys were continued with great vigour. On the left, elements of the LV. Corps, which had penetrated into the outskirts of the Nieppe Forest, were driven back by the British 5th Div., which, advancing by two roads south of and through the forest, soon established themselves on a firm line clear of the woods, and finally checked the German advance in this area.

The German XIX. Corps continued to attack the 29th and 31st British Divs., now greatly diminished in strength by continuous fighting, but these formations, reinforced by the 4th Guards Bde., held on with the greatest heroism to their extended lines of nearly 10,000 yards. Except at Vieux Berquin, which was captured by the Germans, who brought up guns to point blank range, those divisions carried out their instructions to hold their positions at all costs and cover the detrainment of the Australian 1st Division. The arrival of the Australians in the evening definitely closed the approach to Hazebrouck. Further northeast a succession of heavy attacks was driven off by the 33rd and 34th Divs. about Meteren and La Creche. In the early morning the German 36th Res. Div. penetrated with heavy loss into Neuve Église, but before noon they were driven out by the British 33rd and 49th Divisions.

Early on the morning of April 14 the British troops withdrew without interference to a new line in front of the Ravelsburg heights between Bailleul and Neuve Église. The latter village, after intense fighting all day, was finally captured by the Germans by midnight on the 14th. Elsewhere all attacks were repulsed, and the British 4th Div., coming up east of Robecq, between the 61st and 3rd Divs., recaptured Riez Du Vinage with a number of prisoners. On April 15 the German attacks were renewed. By this time their troops had been reinforced by the Guard Res. Corps on the left wing of the IV. Army. The IX. Res. Corps had come in on the right of the IV. Corps, and the Bavarian III. Corps had replaced the Bavarian II. Corps. Heavy attacks developed during the day culminated in the capture of Bailleul and the Ravelsburg Ridge.

British Withdrawal.—On the night of April 15–16 a withdrawal of the British troops from the Ypres salient to a line east of Ypres through St. Julien and along the Westhoek and Wytschaete Ridges was completed without interference. This move had been commenced on the night of the 12–13 by direction of British G.H.Q. in order to set free additional troops, and to forestall any plans the Germans might be entertaining for the extension of the battle front to the north. The withdrawal was well timed, as the Germans were preparing an offensive from the Houthulst Forest, and the preparations were almost complete when the British withdrawal took place.

On April 16 strong local attacks were made at various points on the Metheren-Wytschaete front, all of which were repulsed by the 25th, 34th and 49th Divs., except on the extreme flanks, where both villages, after intense fighting, eventually fell into German hands. On the following day determined efforts to take Mt. Kemmel and to advance on the Meteren-Merris front were repulsed, and the Belgian Army achieved a notable success in defeating a powerful assault against their right flank about the Ypres-Staden railway, in which they captured over 700 prisoners.

Meantime the Germans had been preparing to renew the attack on the British right flank, and on the 18th, after a very intense bombardment, the IV. and IX. Res. Corps advanced to the assault of the British positions about Givenchy-Festubert and Mt. Bernenchon-Hinges. On the British right they penetrated at certain points, but were thrown back by the 1st Div. which had relieved the 55th. Everywhere else they failed to obtain even an initial success, and were driven back with great loss by the 4th and 61st Divisions. For nearly a week the battle died down. On the British right minor operations were successfully undertaken to improve the position of the 4th and 61st Divs., northeast of Robecq, which resulted in the capture of numerous prisoners. In the left centre of the British front French troops, which had been brought up from the south, relieved some of the wearied British divisions, and by the morning of the 21st had taken over the sector between Metheren and Spanbroekmolen.

New German Plans.—During this pause the German Higher Command readjusted their plans. On the 18th the Army Group suggested that the main operations should be abandoned, and it was finally decided on the 20th that further operations should be limited to the capture of Mt. Kemmel on the north, and the villages of Givenchy and Festubert on the south. No success whatever was obtained on the southern flank, but the attacks about Mt. Kemmel led to further bitter fighting.

At 3:30 A.M. on April 25 an intense bombardment was opened on the French and British positions extending from Bailleul to the Ypres-Comines Canal. The main object of the attack was the capture of Kemmel Hill by direct assault on the French, combined with an attack on the British right south of Wytschaete, intended to separate it from the French. The attack was entrusted to the XVIII. Res., Alpine and X. Res. Corps, to which were allotted nine divisions, five of which were fresh. Between 6 and 7 A.M. the German infantry advanced, supported by large numbers of squadrons of battle planes and bombers. After intense fighting they succeeded by 10 A.M. in wresting Kemmel Hill and village from the French, detachments of whom, however, though surrounded, held out till late in the day. The weight of the initial attack on the British front fell on the 9th Div., who inflicted very heavy casualties on their enemy but by midday were forced back to Vierstraat. Further north the 21st Div., after a gallant resistance, was in the afternoon compelled to withdraw to a line Hill 60-Vormezeele. On April 26 the attack was renewed, and many counter-attacks were carried out both by British and French troops, the latter recapturing Locre.

On April 27 and 28 local fighting continued without substantial alteration in the situation. During the night of April 26–27 the salient east of Ypres was further reduced by a withdrawal without interference to the line Pilkem-Zillebeke-Lake-Voormezeele.

Final Attack.—The German final effort took place on April 29. The action started with a bombardment of exceptional intensity at 3:10 A.M. At 5 A.M. powerful attacks commenced against the French and British troops from west of Dranoutre to Voormezeele. After very heavy fighting the Germans gained a temporary success north of Locre, but were driven back by the French troops holding the sector. On the British front the positions held by the 21st, 49th and 25th Divs. were again and again attacked by German infantry, which advanced with great courage in massed formation. The assaulting troops suffered the heaviest losses, but their valour was of no avail. The British artillery and infantry fought with magnificent bravery and this final German effort was repulsed with practically no loss of ground.

Results of the Battle.—Thus ended the battle of the Lys. The second great German offensive had succeeded in penetrating the British front on a front of about 20 m. to an extreme depth of about 12 miles. A large number of towns and villages had been taken and nearly 30,000 Allied prisoners and 450 guns had been captured. But the attack had failed to gain its main objects. The lateral railway communication between St. Pol and Hazebrouck was still intact, the mining area south of Bethune was safe. Except for the detached hill of Kemmel, the high ground dominating the Poperinghe-Ypres road still remained in Allied hands. A pronounced salient had been formed in the German front which was to cost them dear in the succeeding months. On the other hand, the British had been forced to abandon the almost equally pronounced salient east of Ypres, and with it all the ground which had been gained at so great a cost in the battle of Passchendaele the previous year. The losses on both sides had been very heavy. To achieve these results the Germans had employed 42 divisions, of which 33 were fresh; 25 British divisions were employed, of which only eight had not been engaged in the battle of the Somme.

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(J. E. S. B.)

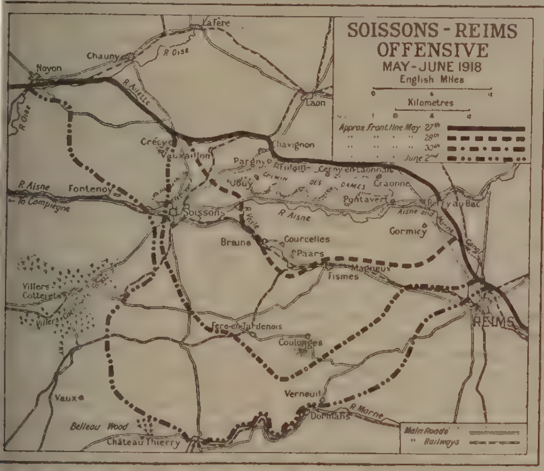
III. THE BATTLE OF SOISSONS-REIMS

After the relative failure of the German offensives of March and April it was incumbent upon the Germans, if they wished to preserve the initiative, to deliver another powerful blow without delay. The choice of the front of attack and the battle-ground fell on the oft-contested chain of heights between the Ailette and the Aisne, the Chemin-des-Dames.

Dispositions for the German Attack.—The German Supreme Command had decided to attack with the VII. and I. armies from the district southwestward of Laon—southwards of Berry-au-Bac in the direction Soissons-Fismes-Reims. If this attack proceeded favourably it was to be prolonged on the right over the Ailette to the Oise and on the left as far as Reims. Simultaneously an attack by the XVIII. Army was to be prepared westwards of the Oise with its centre of gravity in the direction

Compiègne. The German Supreme Command hoped that the h southward would succeed in reaching the neighbourhood of ssons and Fismes, and by this means attract strong forces n Flanders, so that it might be possible to continue the attack re according to plan. The army group under the Crown Prince pprecht was to remain purely on the defensive. On this front, on other sections of the Western Front where attack was not nded, feigned preparations for attack were to be made.

'reparations began about the middle of May. The VII. Army ler Böhm was charged with the main attack across the Chem- les-Dames, the I. Army under Below with the neighbouring ack on the left, and the XVIII. Army under Hutier with the ack in the direction of Compiègne. The right wing of the main ack, the LIV. Corps and the VIII. Res. Corps, had the task of hing forward in a southwesterly direction on both sides of ssons. The XXV. Res. Corps was to make its way on both es of Cerny-en-Laonnais direct towards Braisne, and on the t to take as much country as possible towards the south; the Res. Corps was to attack the " Winterberg " (*i.e.*, the height the eastern end of the Chemin-des-Dames; immediately north Craonne) with the main force and advance farther in the eral direction of Fismes; in concert with this on the left the V. Corps was to occupy with its left wing the river bend north Berry-au-Bac. Of the I. Army at first only one corps, ad- ncing simultaneously with the VII. Army, was to throw the posing forces over the Aisne-Marne canal. The corps was to vide itself with bridgeheads in order to take the heights of rmicy if the attack of the VII. Army proceeded favourably. urther attack to the right of the main attack was prepared by VII. Corps of the VII. Army, which was to push forward over Ailette, making its way in a southwesterly direction towards Oise. The number of divisions taking part in the attack was 41.



For success there were two essentials: the first, surprise; and second, effective artillery preparation. Most elaborate and rough precautions were taken to secure secrecy. As regards illery preparation the ascent of the steep slopes on the heights the Chemin-des-Dames was only possible if the Germans uld succeed in silencing the bulk of the opposing guns. All istration was to be abandoned in order to surprise the enemy much as possible. The first aim was to be a thorough gassing he Allied position right down into the Aisne valley. Prepara- ns were completed by the evening of May 26 1918.

n the night of May 26–7 at 2 A.M. the German artillery bom- dment began, completely surprising the French and English. whole valley of the Ailette, the steep slopes of the Chemin- -Dames, the Chemin-des-Dames itself, and the country lying behind down to the Aisne, were in a short time thoroughly sed. After an hour and a half's bombardment, the opposing ntry and artillery were sufficiently subdued to enable the rman infantry to venture the assault.

The Infantry Attack.—At 4:40 A.M., while it was still dark, the German infantry advanced to the attack. Without difficulty or delay they crossed the Ailette valley, which was covered with bushes in some places and marshy in others; during the ascent to the Chemin-des-Dames serious infantry fights only developed at Chavignon, Pargny and Fillain; on the other sections of the front the German infantry pushed forward almost without resistance on to the heights of the Chemin-des-Dames. Here the remarkable effect of the artillery preparations was already apparent; the steep slopes had been surmounted and the first lines were taken almost without firing a shot. By 7 A.M. the I. Army had already reached the canal, and part had crossed it. Since they were to await the left wing of the VII. Army before further advance, a halt had to be made there, and the opposing army gained time to reform their units and to rally, while those in front of the VII. Army were overrun by the advance of the attacking divisions so long as they felt the effect of overwhelming German artillery fire. This was an essential difference between the attack of the I. and VII. armies, and was to be of decisive importance. By 9 A.M. the German infantry had reached the line Vauxaillon-Jouy-Pontavert-Berry-au-Bac.

Soon after 11 A.M. the first German companies crossed over to the southern bank of the Aisne on bridges mostly intact. A vast and unexpected success had been gained. A wide and apparently impassable stretch of country, which had been for years the scene of the heaviest fighting, had been captured within a few hours after a short artillery preparation. Of the divisions of the defenders two English and three French had almost ceased to exist. The survivors streamed into the prisoners' collecting stations, while countless guns stood abandoned in their positions, some of them undamaged. In the afternoon and evening the attack on the principal fighting front of the VII. Army went forward without a pause farther in the direction of the Vesle valley. Engineering and road-making troops worked with the utmost effort to level a path for the columns following through the enemy positions and over the steep way up to and down from the Chemin-des-Dames. On the two wings the advance was considerably slower. The Vesle was reached by the XXV. and IV. Res. Corps, and sections of the XXV. Res. Corps passed southwards of Courcelles and Paars, while sections of the IV. Res. Corps occupied the steep slopes at Fismes and Magneux. On this very first day of fighting the Germans had penetrated the enemy positions over a front of about 60 km. to a depth of about 20 kilometers. Over 15,000 prisoners and vast army supplies had been taken. The German losses were proportionately small.

Allied Resistance Increases.—The second day of the battle, May 28, saw the first violent counter-attack of the opposing army against the right flank of the German attacking troops. Nevertheless the speed of the German advance was not lessened on this day. On the right wing the LIV. Corps, after repulsing French counter-attacks, captured the heights north and northeast of Soissons. On the left the German divisions pressed forward until midday, over the whole sector of the Vesle, as far as the northwestern fort of the fortress of Reims. The objective was thus reached after a day and a half's fighting. But in the ardour of the pursuit the troops stormed on without orders, though in agreement with the intentions of the Higher Command, in order to improve their success by determined pursuit. The order given by the Supreme Army Command at noon of the 28th to continue the attack as far as the line of heights southwest of Soissons-Fère-en-Tardenois—the heights south of Coulonges—reached the troops when they were already storming forwards. On the right wing of the VII. Army, the VII. Corps had already joined the attack on May 28 without waiting for the completion of the preparations begun at this point. Here, however, the resistance was so obstinate that it was only in the course of May 29 that the dominating heights at Creçy-au-Mont were captured.

On the following days the VII. Army pushed on with its centre in a southern direction as far as the Marne. The right wing of the I. Army, which had extended the attack towards Reims on the left, pressed forward between the Marne and the Vesle against the wooded hills of Reims, but soon met here with unconquerable resistance. The right wing of the VII. Army took Soissons, and between the Aisne and the Marne gained ground towards the heights southwest of Soissons, and up to the eastern edge of the Forest of Villers-Cotterêts. On the 29th the occupation of the important road and rail centre of Soissons as well as of Fère-en-Tardenois was of tactical importance. In both places immense masses of material fell into the hands of the Germans. On the left wing all the roads and railways leading from Reims to the Marne lay under German fire.

French Counter-attacks.—On May 30 violent counter-thrusts by the French had held up the advance of the German right wing, while the German centre in a rapid advance had by midday reached the heights of the northern bank of the Marne between Château-Thierry and Dormans. On both days the pursuing German troops had passed beyond the objectives fixed by the Supreme Army Command, so that they reached the Marne earlier than had been thought possible. A further advance of the centre, pushed out southward like a wedge, beyond the Marne, seemed to involve great risk so long as the German wings on the east and west had not won further ground and thus been able to broaden the base of attack.

On May 31 instructions went out from the Supreme Army Command not to penetrate farther south over the Marne, but to extend the successes against the wooded heights of Reims and up the Marne towards the west in the direction of Villers-Cotterêts. On May 30–1, and particularly in the first days of June, strong counter-attacks were made by the French and later by the Americans. In the first days of June the fighting became steadily more severe, as the Allied resistance grew more obstinate and the counter-attacks progressively more violent and extended. The Germans therefore succeeded in gaining only little ground. The powerful impetus of the German attack had come to an end. On June 17 the German armies stood with their right wing and centre roughly on the line Noyon-Fontenoy, the eastern edge of the Forest of Villers-Cotterêts, Château-Thierry, and up the Marne to Verneuil; the left wing had penetrated to the outlying woods west of the wooded heights of Reims, and close to the west, north and east front of Reims, which was closely encircled.

Results of the Battle.—The tactical result of the battle of Soissons-Reims for the Germans was great beyond all expectation. Over 65,000 prisoners fell into their hands. The booty included about 700 guns and 2,500 machine-guns; in addition, the French and English losses in *matériel* were enormous. But there was a reverse side to the shield. The battle had brought home to the Germans that not only were there American troops now on the Western Front but that they possessed a fighting capacity and quality not hitherto suspected by them. The first notable appearance of American troops was at Cantigny on May 28. Here the American 1st Div., in taking and holding the village against the best efforts the Germans could make, had proved itself absolutely dependable. And within a few days the 2nd Div. had shown itself, in front of Château-Thierry, at Belleau wood and Vaux, to be a first class fighting unit. The conduct of these two divisions did much to hearten the Allies, whose morale had been somewhat depressed by the series of German successes since March.

The extent to which the fighting of the Americans impressed the Allied generals can be gauged from the change of opinion as to how best these reinforcements might be employed. For a time it had been thought that it would be too much to expect that America could produce, without a long probationary period, commanders and staffs capable of handling large bodies of troops in action under modern war conditions. By the end of June it was clear that American commanders and staffs were eminently competent to direct divisions in any battle. Early in July the American I. Corps took over a sector from the French VI. Army, a step amply justified by the resistance offered by the Americans at Château-Thierry in the middle of that month.

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(F. E. W.*)

GERMANY (*see* 11.804), a Republic of Central Europe (Das Deutsche Reich). The German Empire, formed in 1871, included 26 states: the states of the North German Confederation, the South German states and Alsace-Lorraine. Until 1918 Germany retained this form unchanged, having an area of about 208,830 sq. m. and a population (1910) of 64,925,993 (estimated population, July 1914, 67,800,000).

I. AREA AND POPULATION

In Nov. 1918 Germany became a republic, and her states free states and, later, under the Constitution of Aug. 11 1919, territories of the German Reich. There are now 18 of these territories in the Reich, viz.: Prussia, Bavaria, Saxony, Württemberg, Baden, Thuringia, Hesse, Hamburg, Mecklenburg-Schwerin, Oldenburg, Brunswick, Anhalt, Bremen, Lippe, Lübeck, Mecklenburg-Strelitz, Waldeck and Schaumburg-Lippe. Under the Treaty of Versailles (Jan. 10 1920), Alsace-Lorraine was returned to France with validity from Nov. 11 1918; large areas in West and East Prussia, Pomerania, Posen and Silesia fell to Poland; portions of Schleswig-Holstein to Denmark; a small province of Upper Silesia to Czechoslovakia; Eupen and Malmédy to Belgium; the town and area of Danzig became a free state, and the Memel region was allotted to Lithuania. Germany's outline was thus changed, particularly in the east. Part of Germany, consisting mainly of East Prussia, was severed from the remainder by the "Polish Corridor" to the Baltic. The Rhine became to some extent the Franco-German frontier. Direct communication with Russia was cut off by Poland and the border states. Germany's present area is 186,517 sq. m.; it is bounded, W. by Holland, Belgium, Luxembourg and France; S. by Switzerland, Austria and Czechoslovakia; and E. by Poland and Lithuania.

This area had a population of 59,800,000 in 1919. On June 16 1925 the population was 63,250,000 (including the Saar valley, where however the census was not taken). There has been a steady increase in the density of population in Germany from 123·1 to the sq. km. in 1910 to 133·2 in 1925. Apart from the three city states of Hamburg, Bremen and Lübeck, Saxony is the most densely populated area (332 persons to the sq. km.); then Hesse and Baden. The least densely populated are the agricultural territories of Mecklenburg, Waldeck, Oldenburg and Bavaria (97 persons to the square kilometre). Prussia, with 120, is not far below the average for the Reich.

Increase of Urban Population.—In 1871 17·4% of the population lived in towns of more than 10,000 inhabitants; in 1925, 46·1%. The 45 towns with over 100,000 inhabitants absorb 16,500,000 or one quarter of the total population of Germany. The trend towards the towns is identical with the trend towards the workshops. This was specially noticeable during the years 1914–8, when internal migration assumed enormous proportions, being directed away from those places where the conditions of war had restricted production towards the centres of increased production arising out of war requirements. After the signature of the Armistice, there were extensive movements of population, still governed by prospects of production and therefore of wage-earning. At the same time rural districts experienced a not inconsiderable increase in population, as did also the coal-mining districts, the region of the Ruhr, Upper Silesia and the lignite districts, on account of the coal famine and consequent increase in production. In 1926 Germany was in the midst of a new shifting of the population, caused by the excess of coal and the attempt to put industry on a sound footing; this movement would be more pronounced but for the housing shortage.

The proportion of foreigners speaking their own language is now very small. There are many Germans outside the boundaries of the Reich. The contiguous wholly or partly German-speaking areas of Europe cover 15 states and include over 80 million Germans. The present area of the German Reich contained 38·1 million Evangelicals and 19·3 million Catholics in 1910. For figures of emigration and immigration *see* MIGRATION.

The birth-rate from 1870 to 1900 was consistently high (36·8 to 42·6 per 1,000). About 1·8 million children were born alive each year. The average annual surplus of births over deaths was approximately 600,000. The death-rate was also high, fluctuating during 1870–1900 between 21·7 and 31·0 per thousand. From 1900 onwards the birth-rate steadily decreased, and in 1914 it was only 26·8 per 1,000 of the average population. The death-rate declined from 23·2 per 1,000 in 1900 to 15·8 in 1913, and infant mortality from 207 per 1,000 infants born alive fell to 151. From the middle of 1915 the birth-rate dropped rapidly, and reached its lowest point in 1917, namely 14·4 per 1,000 of the population. In this year only 912,109 children were born alive. The rate of mortality rose during the same period owing to the War and the blockade. The highest death-rate was in 1918, when it rose to 25·2, assisted by the influenza epidemic. After the Armistice, the birth-rate began to recover. In 1920 it stood at 26·7, but then fell steadily until in 1924 it reached 21·1. The rate of mortality improved, once the blockade had been removed and the population were again able to obtain adequate nourishment. In 1921 the death-rate stood at 15·6 and sank again to 12·9 in 1924. The year 1925 brought further improvement.

The rate of births and deaths was as follows:—

ear	Total Births (inclusiv bi	Deaths e of still-rths)	Still-births	Per 1,000 of the population	
				Births (inclusiv bir	Deaths e of still-ths)
900	2,060,657	1,300,900	64,518	36·8	23·2
910	1,982,836	1,103,723	58,058	30·7	17·1
924	1,311,044	802,166	42,502	21·1	12·9

nfant mortality, which in 1913 was 151 per 1,000 born alive, was in 1920 and 108 in 1924. See *Statistisches Jahrbuch des Deutschen* *chs* (Berlin, annual). (W. Gr.)

II. CONSTITUTION

rom the Old Reich to the New.[1]—In the German Empire eich) the supreme authority was vested in the King of Prussia German Emperor, the Imperial Chancellor (appointed by the iser) as president of the Government, the Federal Council *undesrat*) representing the individual states, and the National presentative Assembly (*Reichstag*) representing the nation. e states—kingdoms, duchies, principalities and free states— l retained their sovereign rights, which they exercised in a ofold manner: first, in internal politics, by maintaining their n diets or councils, and secondly through the Bundesrat, ich, both in accordance with the rules of the Constitution l in practice, had a greater influence on the policy of the Reich n the Reichstag. Prussian hegemony in the Reich was not l down as a principle of the constitution but was a natural isequence of the disparity in size of the states.

Vhen the new Germany was constituted in 1919, the union of rman-Austria and Germany was made impossible by the aties of peace. This being so, Prussia's natural hegemony in rmany could be avoided only by the formation of a unified Reich by the division of Prussia into a number of provinces equal in to the other territories. But when the Constituent National sembly was elected on Jan. 19 1919 the question of a unified a federal constitution was overshadowed by other problems. e Communist party and a section of the Left Socialists re- ded this election and the demand for a constitution by the er political parties as bourgeois opposition to a dictatorship the Councils, and the Communists refrained from voting. e 185 Socialist deputies, who, like the Communists, stood for ntralism, were the strongest party, but could only form a jority with the help of the 75 Democrats, and, even so, they uld have opposed to them the German Nationals (44 deputies), German People's Party (19), the Catholic Centre (91) and seven deputies of the small Agrarian parties. The Socialists l Democrats were obliged to join hands with the third great publican party, the Catholic Centre, and thus there arose the called "Weimar coalition," supported by 329 deputies and er 23,000,000 votes, leaving out of account the Left Socialists, o still cherished hopes of a dictatorship.

The scheme for the new constitution was drafted by Dr. Hugo euss, former Secretary of State and at that time Minister of Interior. It was then reconstituted, by a commission ap- nted by the territorial Governments (*Staatenausschuss*), in such nanner as to strengthen the position of the individual terri- ies in relation to Preuss's unified Reich. In a special com- tee of the National Assembly, Erzberger, the actual leader of Centre, went over to the side of those who advocated a strong tral power for the Reich, and a resolution was passed which e to the Reich the financial authority which had hitherto ed principally with the territories (art. 8). On Aug. 11 1919 sident Ebert proclaimed the Weimar Constitution.

he Democratic Republic.—The preamble to the constitution s stress on the fact that the German people has given itself s constitution as by sovereign right:—

> The German nation, united in its peoples (*Stämme*) and inspired by the determination to renew and to establish its Reich in freedom and justice, to promote peace at home and abroad, and to further social progress, has given itself this constitution.

Between a monarchy and a republic there was no longer any choice. The choice lay rather between "direct" and "indirect" democracy.

"Direct" democracy is seen in the election of the president of the Reich by the most extended form of franchise in which "the whole German nation" takes part,[2] and in the Referendum which, however, is only admissible in the case of an adverse vote by the whole nation on a draft or a bill passed by the Reichstag [Initiative or Demand of the People (*Volksbegehren*), and Decision of the People (*Volksentscheid*), art. 73–6].[3]

"Indirect" democracy, on the other hand, is seen in the Reichstag, which has only one chamber, elected by the people entirely on the basis of proportional representation and with *scrutin de liste*,[4] that is, according to the party lists. No by-election takes place during the legislative period. The men at the head of the party list are replaced, when they go, by the men below them (art. 53, 54). The Ministry, which is nominated by the President of the Reich, must possess the confidence of the Reichstag; and, as the Reichstag is elected for a term of four years, and as a presidential election a national vote of censure or dissolution of the Reichstag only rarely occurs, German democracy is far more directly parliamentary than the Swiss or North American, both of which are frequently named as its models.

The President of the Reich may, after obtaining the countersignature of the Chancellor or other competent minister, dissolve the Reichstag, though such an expedient would of course only be resorted to in exceptional cases. Not only can the Reichstag force the Ministry to retire by a vote of no-confidence but, with a two-thirds majority, can submit to the nation a proposal for the deposition of the President (art. 43). A hundred members of the Reichstag can impeach president, chancellor or minister for having culpably violated the constitution or a law of the Reich. Judgment is then given after regular proceedings at law by a special Supreme Court (*Staatsgerichtshof*) (art. 59), not to be confused with the Supreme Court which sits at Leipzig.

The Reich and the Territories.—Of the 26 states which constituted the old Reich, 18 now (1926) remain and are called territories (Länder). The constitution prescribes a republican form of Government, but in other aspects the territories determine their own constitution, some of them having their own presidents. In their Parliaments the majority lies frequently with those parties who belong to the Opposition in the Reichstag. This is particularly the case in Bavaria where, since 1919, the Bavarian National party, belonging to the Right, has had a majority and forms the Government—and temporarily in Saxony and Thuringia, where in 1926 the Left Socialists and Communists held the majority.

The territories are represented in the central Government by the Council of the Reich (Reichsrat), to which their Governments (not their Parliaments as the Preuss scheme prescribed) send representatives. Each territory has at least one vote, but no one territory can have more than two-fifths of the total votes. In any case the number of votes is regulated according to the population (art. 61). Out of the 26 Prussian votes half are assigned to the Prussian provinces (of which Berlin is one) which are thus placed on the same footing as the other territories. On account of the peculiar majority regulations[5] in the provincial diets, these provinces sometimes vote against the policy of the Prussian territorial Government.

Unlike the old Federal Council (*Bundesrat*), the Reichsrat has no direct part in legislation.[6] The Government of the Reich lays its

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The words *Das Deutsche Reich* were, before the revolution of Nov. 8, invariably translated "German Empire." But the word *ch* has, for historical reasons, been retained by the German Re- lican Commonwealth as its official territorial and political desig- ion. *Reich* is an old Germanic word found in Early and Middle glish, and surviving in composition in the word bishopric. (Ed. *E.B.*)

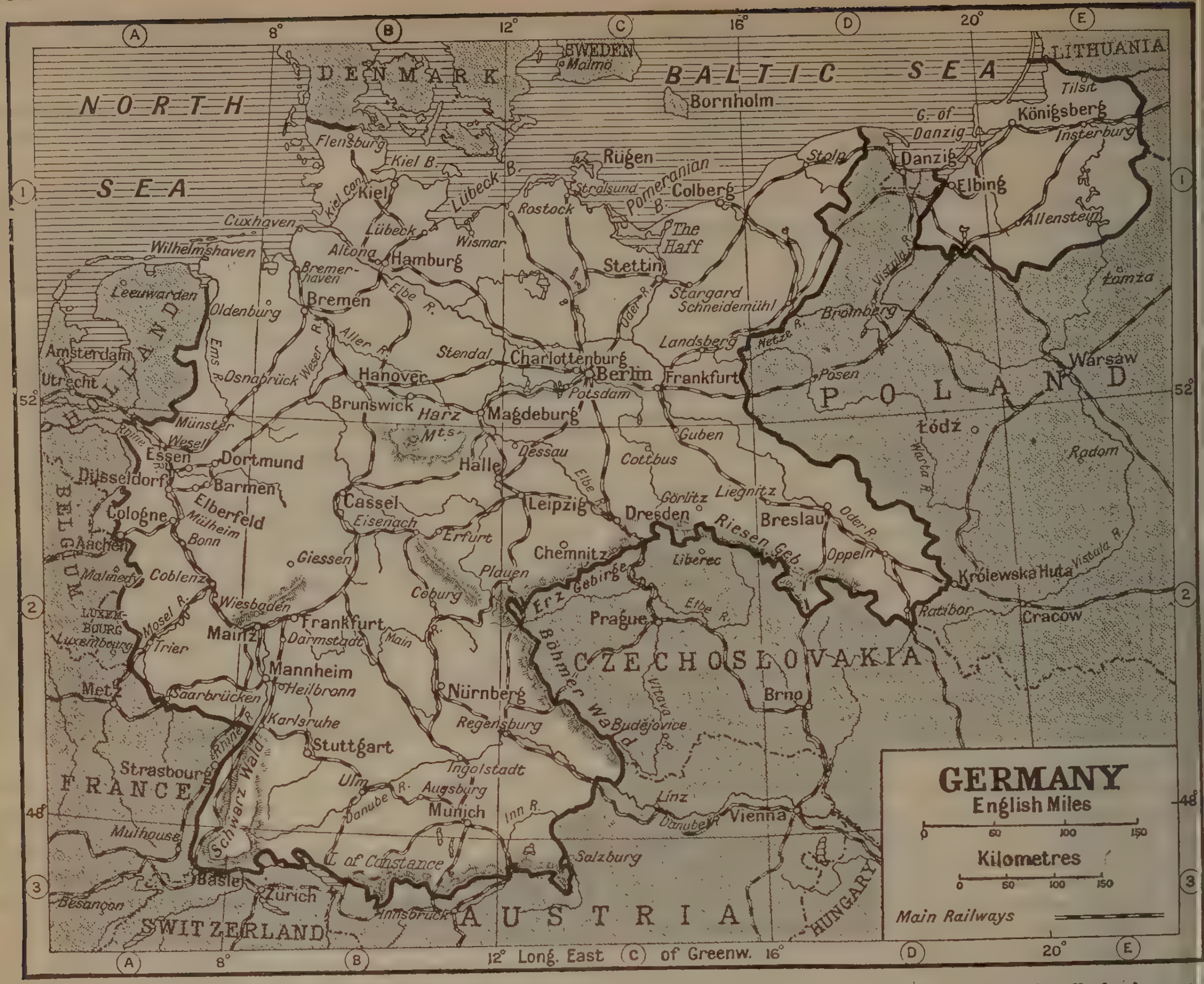
[2] Hence the expression "plebiscitary president."

[3] President and people may also work hand-in-hand, as when the president lays a bill that has been passed by the Reichstag before the people's referendum (*Volksentscheid*).

[4] The list is chosen, not the single deputy. In each electoral district as many seats are allotted to the list as the number of times by which the number of votes cast for that list is divisible by 60,000. Remainders are worked out in two ways: either by associating the lists within the electoral districts or by crediting the remainder to the Reich list of the party; here again 60,000 votes are necessary to elect a deputy.

[5] A candidate, in order to be elected, must have received one more than half of the number of votes cast.

[6] Still less does the Economic Council of the Reich (*Reichswirtschaftsrat*) possess legislative powers. It consists of representatives of the employers' and workers' organisations and of economists. The Government is obliged to consult the Council before placing social and economic bills of fundamental importance before the Reichstag. The Council can itself prepare such measures and bring them before that body (art. 165).


GERMANY
English Miles
Kilometres
Main Railways
NORTH SEA
BALTIC SEA
DENMARK
SWEDEN
Malmö
LITHUANIA
Bornholm
G. of Danzig
Königsberg
Tilsit
Insterburg
Danzig
Elbing
Allenstein
Łomża
Stolp
Flensburg
Kiel B.
Kiel
Kiel Can.
Lübeck B.
Lübeck
Rügen
Stralsund
Pomeranian B.
Colberg
Rostock
Wismar
The Haff
Stettin
Cuxhaven
Wilhelmshaven
Altona
Hamburg
Bremerhaven
Bremen
Elbe R.
Leeuwarden
Oldenburg
Stargard
Schneidemühl
Bromberg
Netze R.
Landsberg
Vistula R.
Amsterdam
Utrecht
HOLLAND
Ems R.
Osnabrück
Weser R.
Aller R.
Stendal
Charlottenburg
Hanover
Berlin
Potsdam
Frankfurt
Posen
Warsaw
POLAND
Brunswick
Harz Mts.
Magdeburg
Oder R.
Münster
Wesel
Essen
Dortmund
Düsseldorf
Barmen
Elberfeld
Mülheim
Cologne
Bonn
Aachen
BELGIUM
Halle
Dessau
Guben
Cottbus
Łódź
Warta R.
Radom
Cassel
Eisenach
Erfurt
Leipzig
Görlitz
Liegnitz
Dresden
Breslau
Riesen Geb.
Giessen
Chemnitz
Liberec
Oppeln
Królewska Huta
Malmedy
Coblenz
Plauen
Erz Gebirge
Coburg
Elbe R.
Ratibor
Cracow
LUXEMBOURG
Luxembourg
Mosel R.
Wiesbaden
Mainz
Frankfurt
Main
Darmstadt
Prague
CZECHOSLOVAKIA
Trier
Mannheim
Heilbronn
Metz
Saarbrücken
Nürnberg
Vltava
Brno
Karlsruhe
Böhmer Wald
Budějovice
Regensburg
Stuttgart
Rhine R.
Strasbourg
FRANCE
Ingolstadt
Ulm
Danube R.
Augsburg
Munich
Inn R.
Linz
Danube R.
Vienna
Mulhouse
Schwarz Wald
L. of Constance
Salzburg
Basle
Zürich
Besançon
SWITZERLAND
Innsbruck
AUSTRIA
HUNGARY
12° Long. East of Greenw. 16°
8°
12°
16°
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52°
48°
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3

bills before it in the first instance, but if the Council reject them they can still be taken to the Reichstag. The Council also has the right to veto bills passed by the Reichstag, but this, again, can be overridden by a two-thirds majority in the Reichstag.

In respect of legislation, the competence of the Reich *ipso facto* excludes the competence of the territories in such important spheres as foreign affairs, migration, the army, commerce and communications (art. 7). Taxation is almost entirely administered by the Reich: citizenship, penal laws and legal rights were administered by the old Reich for all Germany, likewise the social laws. Of these, education alone was left to the territories, but now the Reich is concerning itself with that also.

In administration the territories take a larger part. Their Governments are still allowed to nominate the greater number of the officials of the so-called interior administration. The appointment of the revenue officials has, however, been taken from them since Erzberger's reform of the finance department of the Reich, and the Reich has also taken over railway administration, while the post office officials were, with the exception of Bavaria, already under the Reich.

The Reich has power to coerce the territories (art. 48). If they fail in their duties to the Reich or endanger its safety by disturbances in their areas, the President has power to take up arms against them and temporarily to suspend their territorial constitutional rights ("Federal execution"). The Reichstag may insist on the repeal of such measures if it disapproves of them.

The Constitution and Foreign Affairs.—Accepted principles of international law have in Germany the force of laws of the Reich (art. 4). Decisions on war and peace can only be taken subject to a law of the Reich. Alliances and treaties with foreign states require the consent of the Reichstag (art. 45, sections 2, 3). The president of the Reich appoints the officials of the Foreign Office, in the same manner as other officials, with the countersignature of the Chancellor or the Foreign Minister. In the case of ambassadors and attachés the President may claim a personal right of choice. Thus President Ebert associated himself in the selection of new candidates for nearly all the importa diplomatic posts after the World War. The Reichstag Co mittee for Foreign Affairs is permanent (art. 35).

The First Five Years of the Constitution.—The constitut stood the test of its difficult early years well. It gained in general esteem by the effective use that was made of armed fo (placed in the hands of the Government by the constitution) various emergencies. Its reputation was further enhanced by stabilisation of the currency, and by the fact that the pr mover in this—Dr. Schacht, president of the Reichsbank—was avowed partisan of the Republic. It was realised that such a constitution the economic life of the nation could be vived, in spite of the alarming art. 156, giving "authority the socialisation of the Reich." The article which is most verely criticised, in North Germany especially, is art. 3, wh orders that the colours of the Reich shall be black-red-gold is significant, however, that the majority of those who cling the old Reich colours would be willing to accept black-white as the colours of the Republic.

The territories demand greater independence in relation the Reich, particularly as regards the right to levy their taxes. This demand was definitely formulated in the memor dum of the Bavarian Govt. on the revision of the constitu (Jan. 5 1924).[1] But even Bavaria, the ancient stronghold federalism, only asks for the revision and not for the suppres of the constitution.

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[1] A change in the constitution can only be made by a two-th majority in the Reichstag with two-thirds of the deputies presen the Reichsrat a two-thirds majority is required, and in a referen or people's decision a majority of the whole electorate, not only of actual voters.

Two attempts made in the Prussian provinces to create indendent territories by means of a plebiscite were defeated by e people themselves (Upper Silesia Nov. 3 1922; Hanover ay 5 1924). On the other hand, Saxe-Weimar, Saxe-Meiningen, xe-Gotha, Saxe-Altenburg and four small mid-German states ve united to form the free State of Thuringia; Coburg has ned Bavaria and Waldeck Prussia.[1]

The franchise and the one-chamber system have been widely ticised. The first presidential election showed that a candite who had not figured in the first ballot at all might be elected a relative majority in the second. But this President, ough elected by a minority, had after a year in office gained e confidence of an overwhelming majority of the people, ough losing, on the other hand, that of a portion of his electors. nilarly, President Ebert, who was elected by the Reichstag d not by the people, owed the strength of his position, even th the parliamentary parties, to the confidence with which his rsonality inspired large masses of the people. The franchise t only excludes strong action on the part of the people—a andslide "—but returns the same parties again and again with ly a slight alteration in the mandate, with the result that elecs become weary and indifferent. By-elections would serve the rpose of indicating to some extent the political feeling that tains among the people; and, further, as there is no upper use or senate, independent statesmen have no opportunity of icing the public opinion of the country. Neither is this want oplied by the big newspapers, which are almost all in the emoy of definite parties or definite economic groups.

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(A. M.-B.)

III. POLITICAL HISTORY

The Domestic Situation 1910–2.—When Th. von Bethmann llweg, the fifth Imperial German Chancellor, presented himf to Parliament as Prime Minister of Prussia[2] in Jan. 1910, he oyed the confidence of the Conservatives, while the Socialists, erals and Catholic centre all opposed him. His bill for the eration of the Prussian franchise of Feb. 4 1910, which upheld " three class voting system " and open ballot, was rejected en by the National Liberals, while the Left Wing Liberals unded it as an insult to the very principle of franchise, and it s rejected in May, a coalition of all the non-Conservative rties in the Chamber of Deputies having decided to vote for secret ballot, while the Upper House rejected it.

In the Reichstag the opposition to the Chancellor was simily composed of the Centre, Liberals and Socialists. The Cath- Centre was the great patron in Germany of the Polish tholic minorities in the eastern provinces of Prussia. It there- joined with the Left in embittered protests when disciplinary ion was taken against certain non-political government offils (of the the postal and railway services) who had supported Greater Poland party in the municipal elections in Kattoz. The antagonism was the more violent since the Chanor himself belonged to the Prussian Protestant official class ich had used its social status to establish an unwritten monop- over the higher administrative posts.

f Bethmann Hollweg, later in 1917, was the champion of the reat coalition," extending from the National Liberals to the ial Democrats, and the particular *bête noire* of the Conservas, it was not he but the situation and the parties that had changed since 1910. He remained throughout a perfectly loyal and devoted public official, but stubborn and dogmatic, and contemptuous of the counsels of the outer world.

Bethmann's position, both at home and abroad, was difficult. The differences over the internal shipping dues had been laboriously composed, but the struggle still troubled the harmony of the confederated Governments. Saxony and Baden, in particular, as the two states lying on the upper courses of the Rhine and the Elbe, felt themselves overreached by Prussia, which, situated at the mouth, sought to abolish the traffic-dues on the great rivers in the interests of her schemes for canal construction. In Bavaria under the new Regent, subsequently King Ludwig III., the Government guarded the particularist rights and the parity of the state with Prussia far more jealously than it had done under King Ludwig II. or the Regent, Prince Luitpold. In the Reichstag, on the other hand, there was already a considerable majority which demanded stronger powers for the Imperial Govt. in its dealings with individual states. It called for the removal of the remaining restrictions imposed upon the Catholic Church in predominantly Lutheran states, and urged the Imperial Chancellor to take action in virtue of his imperial powers to abolish the old constitution of estates still in force in Mecklenburg, which entailed the domination of the great landed proprietors, and to establish a Diet with universal suffrage.

The question of framing a constitution for Alsace-Lorraine was particularly difficult. Those sections in the " Reichsland " most anxious for a permanent association with Germany—the German-speaking Old Alsatians and German Lorrainers, the industrialists and traders, the Centre party, official and university circles—demanded a " Home Rule " under which the Reichsland should become a federal state with full parity of rights, with powers to frame a state constitution by means of a Constituent Assembly, and representation in the Bundesrat proportionate to the population, the people electing deputies to the Reichstag and to the local Diet. This involved the question of the future position of the German Emperor, who had hitherto ruled as *de facto* sovereign, without a Diet, indeed often against the wishes of the Alsace-Lorraine deputies as expressed in the Reichstag. In any case, his powers as Supreme War Lord in a frontier and fortified region remained very effective even against the civil administration, and would outshadow those of another territorial ruler. Moreover, the mutual jealousies of the reigning houses made it hard to appoint a member of one of them to rule in Alsace-Lorraine. Yet if the Emperor, who was also King of Prussia, retained his position, with the right to appoint the Statthalter, the new state constitution would of itself entitle him to instruct the delegates of Alsace-Lorraine to the Bundesrat, so that their votes would simply strengthen the Prussian vote in that council. Finally, on May 26 1911, the Act embodying the constitution of Alsace-Lorraine was adopted as a compromise.

The territory was now to rank as a federal state; its constitution, however, was fixed by a decision of the legislative body of the Empire. Of the two Houses of Parliament, one was chosen by universal suffrage, while the other was in part nominated by the Government, in part composed of high officials. The Emperor remained reigning Prince, the votes in the Bundesrat thus deriving from his Government; but where a Prussian majority in the Bundesrat depended on the votes of Alsace-Lorraine the latter were not to be counted. Such an intricate constitutional instrument would probably never have been popular. It increased the confidence of the moderate middle-class parties in the Chancellor's domestic policy; but the Right and Left were equally dissatisfied. The Conservatives regarded any step towards constitutional Government in the Reichsland as unsound, and many of them would have preferred the continuance of rigid military rule in the " conquered " territory. Indeed, the hostility of the extreme Conservatives and of the Pan-Germans towards Bethmann Hollweg dates from this period. The Radical Left wing were alienated because they had hoped that the Constitution would do away with the dominance of the Prussian bureaucracy in Alsace-Lorraine and lead to parliamentary Government similar to that of the three South German States.

[1] Other small states will probably later join their greater neighbour es.

[2] He assumed that position in July 1909.

In other directions, also, in domestic politics the parties of the two wings began to move towards extremes. This process, at first interrupted by the War, was renewed with great violence afterwards, and still hampers the formation of anything like a two-party system, or, indeed, of parliamentary government at all. For the Right wing of the group of moderate parties which lies between these extremes cannot sit in the same cabinet with the extreme Left, whilst their Left wing cannot co-operate with the extreme Right. The Conservative party associated themselves with the agrarians, whose organisation, the Farmers Union (*Bund der Landwirte*), from the outset adopted demagogic tactics and appealed frankly to the power of the producers of indispensable foodstuffs. Heavy industry moved away from Liberalism and joined the agrarians; and the Pan-Germans, formerly recruited from the National Liberals, and the Anti semites drew closer to the parties of the Right, voting with them in questions of foreign policy and defence and collaborating with them at elections. In 1914 two of these Right parties, the German Party of Reform and the German Social Party, combined under an Anti semite to form the new Deutschvölkische Partei.

On Dec. 7 1911 the Reichstag was dissolved, the elections being fixed for Jan. 12 1912. The Government called for an alliance of the middle-class parties against the Socialists to "continue our present policy of commercial treaties and protection to German labour," and to "maintain our Army and Navy permanently in a state of the highest efficiency, and to fill up any gaps in our armament." The Association for combating Social Democracy issued the same message, which was indeed the same as had been used in the last elections by the Conservatives and National Liberals, but then against the Centre, to-day on behalf of the "blue and black bloc" of the Centre and Conservatives. The message was unconvincing, and in fact the elections brought the Social Democrats unexpected success. With 110 members they formed the strongest single party in the Reichstag, even as they had proved the largest single party in the electorate. They had gained 69 seats and lost 12. The three Conservative parties between them had gained 14 seats and lost 49, and even if with the Centre they still commanded about 170 votes, to 152 votes of the left, the decision upon tariff and fiscal policy now lay with the 45 National Liberal deputies.

The strength of the parties was tested in the elections of the President and Vice-Presidents of the Chamber. A Socialist—and that Scheidemann, particularly hated by the Conservatives on account of his speech in the Reichstag two years earlier, when he had said, "I am too well acquainted with Prussian history not to know that broken promises belong, so to speak, to the most exalted traditions of the ruling house of Prussia"—was for the first time elected first Vice-President. The President and second Vice-President resigned rather than work with him; in the end, after much juggling, the Progressives (who numbered only 41 deputies) secured the offices of President and first Vice-President, the second Vice-President being a National Liberal. Thus party intrigues perpetuated the curse of German political life, the exclusion of the Social Democrats from all positions of public responsibility; while the Centre, the second strongest party, was also excluded from presidential office. Another grave symptom was the fact that during these elections and in the work of the Reichstag organised commercial interests became an open political force. A vehement protest was made during the elections by an honest and uncompromising deputy, Count Posadowsky.

Foreign Policy before the War.—In foreign policy, too, Bethmann Hollweg had found a much more difficult situation than appeared on the surface. The secret documents of the Foreign Office, published as regards the years 1871–1912 in 30 volumes at the beginning of 1926, show where the key to the policy of the European Powers lay since the beginning of the 20th century, and why the Western Powers could consider themselves endangered by a threat of German hegemony at the same time that Germany could complain of isolation and "encirclement." The key lay in the unreality of the Triple Alliance, the southern partner of which could now only be considered an ally as a matter of form, not in reality. When Bismarck, after long hesitation an consideration, concluded the first treaty of the Triple Allianc in 1882 at Italy's request, relations between Italy and Franc in the Mediterranean were so strained that war between Franc and Italy was more probable than a French attack on German The Triple Alliance therefore gave security for immediate mutu help in case of a French attack on Germany or Italy; it afford Italy security and lent the necessary weight to its claims t the north coast of Africa and to equality of rights with Franc and Great Britain in all Mediterranean questions. When, however, Italy had come to an agreement with France on the delimitation of her spheres of influence in Tunis, Algiers and Morocc on the one hand and Tripoli on the other, and when the Egypt Morocco agreement between France and Great Britain (1904 had drawn Britain also into this Mediterranean entente, a danger for Italy of a French attack vanished, and thus any support from Germany became superfluous.

It was remembered also in Italy that it was precisely the fo eign ministers who had been true to the Triple Alliance who ha complained that Germany was holding Italy back from her natural expansion in North Africa out of fear of being drawn into Mediterranean conflict. This complaint over the passivity the Triple Alliance policy, which was especially clearly put b Baron Blanc in his great "Aide-Mémoire" of July 14 1895 t Lord Salisbury and to the other two Powers of the Triple Entent is the direct origin of Italy's *rapprochement* with France at th end of the 19th century. Since 1901 the German Foreign Offi and General Staff fully realised that even in case of unconceale French aggression, if it took place on the Rhine, Germany coul not reckon on the military assistance which Italy had promis to send her over the Brenner and through the Tirol and Sout Germany, and that no Italian Govt. would be able to let Ital fight with Germany against France, in the face of public opinio It is clear from a communication of Von Schlieffen, chief of th German general staff,[1] that public admission of this fact wa only prevented by fear that Austria-Hungary would lose all co fidence in the Triple Alliance, and even in the alliance with Ge many, if she learnt that in no circumstances could reliance b placed upon Italy's military assistance.

Even Prince Bülow, the most loyal friend of the Italian all ance deliberated whether it would not be better, in view of the re situation, to let the Triple Alliance lapse and openly admit Ge many's isolation. He believed, however, that the agitation whic such open dealing would at first provoke in Europe would brin such a great danger for peace that again and again he plaster over the rent. Consequently, whenever Germany was confront with a proposal for conference of the Great Powers, her Forei Office sought to avoid her participation. Such proposals alwa looked as though they would lead to an unbiased adjustment views between two equally strong groups of which neith could outvote the other; for in every issue between the Gre Powers, whether it arose over Morocco, the Near East, the Ba kans or the Far East, a State of the Triple Alliance and a State the Entente always at first appeared as adversaries. Their par ners played the rôle of mediating powers, two against two, an their parity seemed specially to fit them to bring about a compromise. Such was the apparent position. But the German Forei Office knew that Italy could not and would not stand by Austr in a German encounter with Great Britain or France, nor b Germany in a conflict between Austria and Russia, but that sh would always have closer diplomatic contact with France an Britain, and even with Russia, than with her Allies, who on the side did not usually consult her before negotiating on Balka questions with one another or with the Entente Powers.

When Germany did take part in the Algeciras Conferen (Jan. 10–April 17 1910), in fact insisted against the wishes France that this conference be held—the reason was that Ge many believed that she would be supported outside Europ

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[1] It may be explained that Von Schlieffen retired towards the e of 1905. For the history of "the plan" up to the outbreak of Wa see the official record *Der Weltkrieg*, compiled from the archives the Reich, vol. 1, pp. 6–19 (Berlin, 1925). Ed. *E.B.*

Thanks to the ties which had been formed between the Emperor nd President Roosevelt by the German Ambassador Speck von Sternburg, Germany expected that the United States would dvocate the principle of the "open door" in the Moroccan question, and would join Germany in opposing the grant of a preferential mandate for France. Therefore Bülow did not then hink that Germany's isolation in Europe was an obstacle to the onference. All the greater was the disillusionment when Germany and Austria-Hungary stood alone at Algeciras as elsewhere. Bethmann Hollweg directly experienced not onlv this disappointment but the effects of Bülow's subsequent procedure in the Bosnian annexation crisis of 1908–9.

The Agadir Incident and the Settlement in Africa.—Since the rst Moroccan crisis the Emperor had acquiesced, though unwillingly, in the policy of the Chancellor and of the Foreign Office, articularly in Morocco and the Near East, and therefore the Foreign Office had always to strive to confront him with a *fait ccompli*. The Chancellor, who was naturally extremely pruent, took the responsibility for the sensational "Panther leap" to Agadir (July 1 1911). If a conference was to be avoided beause Germany was doomed to isolation (shared, at the very est, with Austria), an understanding made directly with France was essential. The Secretary of State, Von Kiderlen-Wächter, hought that this could be appropriately initiated by sending a warship to protect German commercial interests in Southern Morocco. He subsequently secured the Franco-German African Convention of Nov. 4 1911 after negotiations with the French mbassador Jules Cambon.

Kiderlen was neither a Junker nor a Prussian; he came from Württemberg, home of the South German spirit of independence nd democracy. He was, moreover, no militarist. He entertained keen, even personal hostility towards Admiral von Tirpitz nd the Emperor's military entourage, and was convinced that Germany could and must maintain her position by diplomatic means and without war. He claims for himself the credit of avertng the danger of hostilities between Austria-Hungary and Russia ver the annexation of Bosnia and Serbia's demand for compenation in Novi-Pazar. The Note of March 21 1909, in which ülow informed the Russian Govt. that Germany would "let hings take their course" if Russia did not accept her proposal or mediation, was drafted by Kiderlen; he had made its tone hat of an ultimatum in demanding from Isvolsky "a clear and ategoric answer, a precise answer—yes or no."[1] Kiderlen was t the time Ambassador at Bucharest, but in the interval he ssumed office as Foreign Secretary, in spite of the Emperor's ersonal dislike of him. He was the more inclined to a repetition f surprise tactics in diplomacy as they enabled him to exclude he Emperor himself from the direction of policy. Incidentally, Kiderlen treated Parliament even more brusquely, if possible, han he did his Sovereign and his military advisers.

The dispatch of the "Panther" to Agadir became known on uly 1 1911. On July 9 Kiderlen resumed his conversations with ules Cambon. At the end of the month the press of the Right nd Right Centre began to attack Bethmann Hollweg and the mperor himself for weakness towards France in Morocco. Kiderlen, in order to conciliate nationalist opposition to negoations with France, had created the belief that France would cede the French Congo entire to Germany; there was therefore eep disappointment when it became clear that Germany would nly receive a strip of territory securing her trade communicaons with the Congo river and the Belgian Congo. Bethmann Hollweg and Kiderlen, however, continued the negotiations. he Morocco-Congo Agreement was signed on Nov. 4 and pubshed on Nov. 7. Germany accorded a material recognition of he French protectorate over Morocco; France promised only eedom of trade and equality of treatment to the nationals of he European Powers, particularly as regards concessions for ublic works; but ceded to Germany 275,000 sq. km. in the north nd northwest of the French Congo, receiving in exchange 12,000 q. km. in the region of Lake Chad. Germany obtained access to the Congo river, while France acquired the right to construct military roads and a railway through the territory ceded to Germany, to connect the coast with the interior.

The Morocco agreement was, in general, welcomed by the Left but censured by the Right. The critics designated the newly acquired strip of southern Cameroon as worthless, and qualified the recognition of French predominance in Morocco as a feeble withdrawal before England's menaces, as expressed in particular in Lloyd George's Mansion House speech (July 21). The Chancellor defended the agreement in a great speech before the Reichstag on Nov. 9, in which he dealt in particular with the charge of irresolute policy:—

> From the very beginning our programme has been: to accord increased political rights to France only in return for increased security for our commercial interests in Morocco, and for the acquisition of colonial territory. We have not at any moment sought for territorial acquisition in Morocco itself. Negotiations between ourselves and France *alone*, not before an international congress, nor with the inclusion of a third party—this is the programme which we have laid down, and we have carried it out.

Diplomatic representations had been made in London respecting Lloyd George's speech. In the meantime, the British Govt. itself had held back, not desiring to intervene in the Franco-German negotiations. A "vigorous policy," such as the Right wing critics demanded, was only possible for Germany if she were strong on the Continent and avoided untenable positions outside Europe. Morocco had proved a festering sore not only in Franco-German but also in Anglo-German relations. The cause of peace was served by closing the wound. And finally:—

> Others, gentlemen, would favour a preventive war, against France, or against England, or against both together. But preventive war was a mistake, war must be avoided whenever possible. No one can tell whether hereafter Germany may be called upon to carry on war with her neighbours. The responsibility to-day is mine, and I say that it is my duty to conduct affairs in such a way that a war which might be avoided, a war which is not demanded by Germany's honour, is indeed avoided.

The Conservative opposition was directed by Heydebrand, known as the "uncrowned King of Prussia," and it was observed that the Crown Prince applauded him from the tribune in Parliament. The Crown Prince's criticism was really personal to the Emperor, and so William II. took it; he transferred his son from Danzig, where he was commanding a cavalry regiment, to work on the general staff.

This agreement had removed Morocco from among the direct political causes of a European war, even as the Franco-British Mediterranean agreement had removed Egypt. It was to be expected that new unrest would now break out elsewhere, and since the termination of the Russo-Japanese War the Balkans and the Near East seemed destined for this part.

German foreign policy was now concentrated upon the peaceful settlement of the Baghdad railway question, first by means of the agreement with Russia of Aug. 19 1911, and then on the negotiations which resulted in the agreement with Great Britain concluded in July 1914. The death of Von Kiderlen, on Dec. 30 1912, and of Marschall von Bieberstein, ambassador in London, (Sept. 24) were serious losses to the German diplomatic service. The death of Marschall dangerously reinforced Austrian influence in Berlin. As the most energetic promoter of friendship between Germany and Turkey, Marschall, from his post at Constantinople, had strongly opposed all Austrian encroachments in the Balkans, particularly before and during the Bosnian crisis of 1908–9. Unlike Count Aehrenthal, he never allowed himself to be influenced by prejudices of domestic policy in his idea of the necessary co-operation between the three Empires. As Ambassador in London, a post which he had hardly assumed when he died, Marschall would probably also have easily found the right attitude towards English Parliamentary policy.

The Turco-Italian War, for which Emperor and people alike strongly condemned the Italians, would probably have injured the Triple Alliance more if any illusions had been entertained in Berlin. It was only because nobody expected Italy to have any regard for her Allies that Germany was content to look on while Turkey, the only Power with which she was in close and friendly relations, was deprived of one of her provinces and suffered heavily from the war. During the war, on the occasion of the Emperor's visit to Venice in March 1912, the stability of the Triple Alliance was affirmed. In Dec. 1912 the Alliance was renewed without comment, its renewal on each previous occasion having been preceded by protracted negotiations. When the first Balkan War (1912) gave rise to a new and acute danger, and mobilisation seemed imminent on the Austro-Russian frontier, with all the results which it entailed in the summer of 1914, German policy, in close co-operation with that of Sir Edward Grey, brought pressure on Vienna, whilst the Emperor used his influence with the Archduke Francis Ferdinand, during the latter's visit to Springe (Nov. 22–3 1912), to dissuade Austria from threatening Serbia, and Russia from emphasising her rôle of Serbia's protector. The supporters of the policy of preventive wars were bitterly disappointed, and they spread broadcast an utterance attributed to the Emperor, in which he was said to have insisted that " the Austrians must not rattle the German sword."[1]

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[1] *Grosse Politik*, No. 9,460.

Home Politics 1912–4.—In the two years preceding the outbreak of the War, however, the foreign political situation was much less acute than the domestic. In the former field may be mentioned the characteristic incident of the Emperor's visit to Switzerland, with the sincere good feelings which it aroused, and his energetic commendation of the Swiss citizen army (Sept. 3–5 1912). The year 1912 brought the first ominous symptoms: the plans for strengthening the army and navy (the latter unhappily coinciding with the visit of Lord Haldane to Berlin); the resignation of Wermuth, Secretary to the Imperial Treasury, in March 1912, which was interpreted as an abandonment of the death duties; the miners' strike of March 1912, and the much more serious and enduring phenomenon of the rise in meat prices in the autumn and winter of 1912–3—a powerful weapon of agitation in the hands of the Left, for the Agrarians of the Right and Centre opposed the import of cheap foreign meat; the even more threatening insecurity of the Parliamentary majority, for a violent contest had arisen between the two Protectionist parties of the " blue and black " bloc since the campaign opened by the Centre (originating in Bavaria) to secure the abrogation of the Jesuit law. On that question the National Liberals voted with the Conservatives; the Left wing Liberals and Socialists, as opposed in principle to all exceptional legislation, with the Centre.

But, above all, the Emperor and the Prussian Court and military authorities were finding great difficulty in accommodating themselves to the new conditions in Alsace. Almost all the conflicts of this period arose among the German-speaking and German-bred Alsatians and not in predominantly French Lorraine. When the administration of Alsace withheld Government orders from a factory in Grafenstaden on account of the alleged provocative and anti-German conduct of the manager, it had the Landtag against it (unanimous vote of censure by the second Chamber on May 7 1912). At a dinner given by the Governor in Strasbourg the Emperor had expressed the intention of destroying the Alsatian Constitution and converting Alsace-Lorraine into a Prussian province if matters went on like this. This was not taken very seriously by the Alsatians themselves. The Alsatian papers even admitted that it was comprehensible that the Emperor should feel the opposition of the Landtag as ingratitude. In the Reichstag, however, Scheidemann seized upon the Emperor's pronouncement to remark that in any case to become Prussian was the harshest punishment Germany could inflict. The Chancellor and the Ministers walked out, and the President afterwards called the speaker to order. But the Social Democrats had moved a stage further Left.

Social Legislation.—The principal sufferers from stringent conditions in the German Reich were the numerous Government administrative officials (members of the post-office, railways, revenue office, clerks), although their loyalty made them slow to voice their grievances. The manual workers vented upon the big stores, the chief of which were in the hands of Jews, their anger at the high prices of necessaries and became anti-Semites. The workers who were organised in trade unions were materially not badly off. State insurance for disabled persons and dependants of the deceased, for the victims of accidents and for the sick, was now established on a uniform basis for the Empire (Imperial Insurance Act of July 19 1911). Considerable power was assured to the operatives, particularly in the establishment of the local sickness funds, so much so that the doctors constantly complained that they were at the mercy of the local officials concerned with the funds, who were almost all Social Democrats. For a time the doctors even threatened to strike on this issue. A new chapter of jurisprudence of great importance was opened: the " Labour Laws." This summed up in a comprehensive code the regulation of conditions of labour under public and civil law. There was also talk of establishing " labour courts " in which civil cases between workers and employers were to be decided. The court was to consist, on the model of the industrial and mercantile courts, of a lawyer as president and two assessors (one an employer and one a worker), elected by the employers and workers of the district. In these elections the principle of proportional representation was tried for the first time in Germany on a considerable scale. The formation of chambers of labour was also planned. These were to have the same standing in economic life as the chambers of commerce and of agriculture. They were, however, to be formed on a footing of equality—that is to say, workers' representatives were also to be included.

On July 1 1912 persons in receipt of disablement pay numbered 953, 057; in receipt of sickness benefit 15,866. Old age pensioners numbered 91,331; and the total pensions paid since Jan. 1 1900, 510,838. Under the provision for pensions for the widows and orphans of insured persons in the Act of 1911, 4,562 pensions had been paid by June 30 1912 and 1,059 single grants.

The Centenary Commemorations, 1913.—The year 1913 opened with festivals commemorating 1813, and what to the German people was the great war of liberation of its history. It was a genuine celebration of freedom and a national festival. The German dynasties, the governments and the political parties showed themselves ready to allay old quarrels. The betrothal of the Emperor's daughter to Prince Ernest Augustus of Brunswick, the grandson and heir of the last Guelph King of Hanover, brought about a reconciliation with the Duke of Cumberland, whose son ascended the throne of the federal state of Brunswick. It was announced on the Emperor's 25th jubilee (June 16) that he had destroyed a secret testament of Frederick William IV. in which the latter had enjoined upon all his successors to abolish the Prussian Constitution before assuming rule. On the occasion of the Emperor's jubilee, for which almost all the federal Princes assembled in Berlin, the Prince Regent of Bavaria, Ludwig, who in Nov. 1913 was empowered by law to assume the royal office in view of the persistence of King Otto's incurable mental ailment, pledged the loyalty of the states to the Empire. In reply, the Emperor styled the sovereigns of the German states and the burgomasters of the free towns his " allies," and declared that in their independence, as guaranteed by the Constitution, lay the strength of the Empire itself. In the Reichstag the motion of the Centre on the Jesuits was adopted on Feb. 19 1913, after a peaceful discussion. During the debates on the colonial budget, Erzberger, formerly the keenest critic of the abuses existing in certain colonies, supported the colonial policy of the Government.

Passing of the Army Reform Bill.—Even the Army bill, officially announced on March 1, encountered no very bitter opposition. The bill increased the peace strength from 544,271 men to 661,176, entailing the creation of 84 new battalions and squadrons. The total cost was to amount to an initial outlay of 1,050 million marks, and subsequently of 180,000,000 to 190,000,000 marks annually. The initial costs were to be covered by a capital impost for one year only, and in the case of high incomes by a single levy on income (" contribution towards national defence ") both non-recurring. The current expenses were to be met by an increase of the quota contributed towards the Imperial finances by the federal states, which those states levied through their own taxation upon capital or income. The discussions in the Reichstag turned less upon the strengthening of the Army than upon the means of meeting the cost. The Left wing parties demanded, and in part secured, that property, particularly unearned increment, should bear the chief burden of the single levy, and further the introduction of a steep, progressive graduation of the rates of taxation. Apart from the fact that they were in general favourable to the Army bill, the parties of the Right found satisfaction in the abandonment, at any rate for the time, of the plan of permanent death duties. On the death on Aug. 13 of Bebel, the venerable leader of German Social Democracy, all parties united in a tribute of respect to his character, and integrity and none denied that he was a "good German."

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[1] The official records of the conversations in politics between the Emperor and the Archduke at this meeting, and at the Emperor's subsequent visit to Konopischt in June 1914, will be published in volumes 32 and 35 of the collection of German archives: *Die Grosse Politik der Europäischen Kabinette.* Until their appearance it is wiser to suspend judgment.

The Zabern Incident.—Yet how delusive was this tranquility was manifested by the Zabern incident of Nov. 1913 (*see* ALSACE-LORRAINE); an incident so trivial in itself that its prodigious consequences can only be explained by the existence of a general state of political tension. The Government's position was weakened, for its attitude over the incident was censured by 293 votes against 54 in the Reichstag, unanimously in the lower Chamber of the Alsatian Landtag and by 33 votes against three in the upper Chamber. At the same time the Imperial Chancellor had incurred the definite hostility of the military party. In an important debate in the Prussian Upper House on Jan. 10 1914 Bethmann Hollweg developed his whole policy in a discussion with the spokesman of the Conservatives, Count Yorck zu Wartenburg. Zabern was not discussed, but it was present in the thoughts of every speaker. Bethmann defended the constitution of Alsace-Lorraine. He vindicated his right, disputed by Count Yorck, of calling a commission of inquiry with the co-operation of deputies of the Reichstag to report on the conditions and abuses in the army contracts' department. But he, on the other hand, admitted that precisely in the Empire with its universal and free suffrage and the social tendencies of its legislation a Prussia with a different "internal structure," that is without universal suffrage and without responsible parliamentary government and with a "firm military foundation," seemed essential.

The Government aimed at compromises between the Emperor and Parliament and between Prussia and the Empire. But the parties and the politically minded section of the nation all felt that alike in domestic and foreign politics the Government was lacking in decision. How little, however, the professional politicians knew of the reality may be seen from the fact that the appointment of Herr von Loebell, who during and after the War proved himself a leader of the reactionaries, as Prussian Minister of the Interior was characterised as a concession to Liberalism.

THE WAR PERIOD

The Sarajevo Murder.—When the news of the murder at Sarajevo on June 28 1914 became known in Germany, the horror generally felt was mingled in pacifist circles with a certain silent relief. Rumour had assigned the murdered man to the war party. From the new heir to the Austro-Hungarian throne a peaceful policy might be expected. It was anticipated that Austria-Hungary would take speedy action against Serbia, as far as possible in agreement with Russia. It was thought that the sympathies of the world were on Austria's side, even if she should undertake a short punitive expedition against Serbia.

The most recent and very meticulous examination of all the archives and the utterances of all witnesses have made it clear hat in the early days of July the Emperor and his entourage had no thoughts whatever of a European war, and that neither a Crown Council, still less a Council of War—as the American Ambassador Morgenthau claimed to have heard from the German Ambassador in Constantinople—was held in Potsdam or Berlin, But when Von Tschirschky, the German Ambassador in Vienna, eported on June 30 that Vienna desired to use the opportunity o settle accounts with the Serbs thoroughly, but that he himself eized every occasion to "issue calm but very emphatic and seri-us warnings against precipitate action," the Emperor commented: "Who has authorised him to do so? It is very stupid. It is no business of his. What Austria thinks of doing is solely her affair." Thenceforward the Ambassador let the Austrians go their own way, and as on July 5 the Emperor had received a letter from the Emperor Francis Joseph and a memorandum drawn up by Count Berchtold, and the Chancellor had declared that in harmony with his obligations as an ally the Emperor would stand loyally by the side of Austria-Hungary (July 5 and 6), Vienna felt that it could rely on German aid in its Balkan plans. But the Emperor and the Chancellor merely intended that Austria should demand satisfaction from Serbia as speedily and energetically as possible, before the murder of the heir became a European question. It, therefore, implied no change of view that the Emperor received the Serbian answer to the Austrian ultimatum of July 23 with the comment:—

> A brilliant achievement for a grace of 48 hours. It is more than could have been expected. A great moral triumph for Vienna. But every reason for war now disappears, and Giesl ought to have remained quietly at Belgrade. On the strength of this I would never have ordered mobilisation.

When Austria rejected the Serbian reply, and on July 28 declared war on Serbia without having previously consulted Berlin, the Chancellor and the Secretary of State, Von Jagow, realised the danger of the position—no doubt much too late. On July 29 Bethmann telegraphed to Vienna:—

> I view the attitude of the Government in Vienna and its inconsistent attitude towards the different Cabinets with increasing discomfort. In St. Petersburg it asserts its territorial disinterestedness, it leaves us entirely in the dark as to its programme, feeds Rome with meaningless phrases regarding the compensation question, whilst in London Count Mensdorff gives away portions of Serbia to Bulgaria and Albania and proceeds to contradict the solemn declarations in St. Petersburg. From these contradictions I must draw the conclusions that . . . the Viennese Government harbours plans which it deems it wise to conceal from us, to assure itself in any event of German support and not by an open avowal to run the risk of a possible refusal.

For a conference, however, as proposed in particular by Grey, Berlin was equally disinclined, as conferences had always been unwelcome to her since Algeciras. The last hope, therefore, lay in successful direct negotiations between Vienna and St. Petersburg. When these broke down on July 30, Germany supported in Vienna (July 30) the final British proposal for mediation to the effect that after the capture of Belgrade, Austria should announce her intention of advancing no further until the Powers should have mediated between herself and Russia. Count Berchtold's temporising defeated this proposal. With the general mobilisations of Russia and Austria on July 31 and that of Germany on Aug. 1 a state of war was actually in being, although the declarations of war followed later. For in the three states immediately involved the chiefs of the general staffs were now unanimous in asserting that any further delay would endanger the prospects of success in the field, and no civilian Chancellor could take the responsibility of opposing this view. Moreover, the executive power had now passed in accordance with the Constitution to the supreme military authority. (*See* also EUROPE.)

The Invasion of Belgium.—The German plan of campaign for a war on two fronts, as framed by the elder Von Moltke, had envisaged defensive action on the west, offensive on the east. Subsequently for a short time there were two alternative plans. The official account of the War by the German general staff proves that in 1892 under Count Schlieffen the plan of an eastern offensive was abandoned, the offensive on the western front with the march through Belgium being retained as the sole plan. The Foreign Office was not consulted.[1] The Emperor made a single allusion to the plan in a personal letter to Prince Bülow, who returned a dilatory answer. Bethmann Hollweg and his Secretary of State for Foreign Affairs, Von Jagow, were never asked whether they approved of the military plan which contemplated an offensive against France and the violation of Belgian neutrality. According to the Constitution, the Emperor, as Supreme War Lord, had to decide during war time in cases of differences of opinion between the civil and military authorities. But once set in motion, the machine of mobilisation revolved so rapidly that even the Emperor could no longer have interposed. Bethmann Hollweg declared in the Reichstag on Aug. 4 1914:—

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[1] It is necessary, however, for the understanding of the Schlieffen plan, which originally contemplated the violation of Dutch as well as Belgian neutrality, to read *Graf von Schlieffen*, by Freytag-Loringhoven (Berlin, 1920), and also *Erinnerungen, Briefe, Dokumente 1877–1916*, by the second Von Moltke, especially pp. 429, 430 (Stuttgart, 1922). From before the end of the 19th century the manoeuvres were obviously based on the principle of a turning movement through Belgium and Luxembourg (Reichsarchiv, *Der Weltkrieg*, vol. 1, Berlin, 1925); the Kaiser's statesmen were aware that strategical railway facilities were continually developed in the same direction and provided for in the Budget. There is no doubt that the Schlieffen plan was officially regarded as a life-and-death necessity of German policy in case of war.—Ed. *E.B.*

> We are now acting in self-defence, and necessity knows no law. Our troops have occupied Luxembourg and have perhaps already entered Belgian territory. This is in contravention of the behests of international law. It is true that the French Government stated in Brussels its intention of respecting the neutrality of Belgium, as long as the enemy respects it. We knew, however, that France was ready to march in. France could wait, we could not. A French flank attack on the lower Rhine might have proved fatal. We were thus compelled to disregard the justified protests of the Governments of Luxembourg and Belgium. The wrong that we are thereby inflicting —I speak openly—we will strive to repair as soon as our military objective is attained.

Early Stages of the War.—The parties concluded a truce, and the Social Democrats voted credits for the War, which they regarded as a defensive war against Tsarist Russia. The people everywhere accepted the situation very gravely. The immediate summons to the colours of the whole Landsturm up to 45 brought home the danger to all. The general nervous feeling during the first weeks was betrayed in the hunts after spies and transports of Russian gold. When the first prisoners of war arrived, the military authorities feared that the people would fraternize with them, and strictly forbade any intercourse. The civil authority at home was transferred to the Generals commanding Army Corps Areas in Germany, whose staffs consisted usually of superannuated and not always very intelligent officers, who were entrusted with all emergency defence measures and with censorship of the press and all other printed matter. Thanks to the censorship, the defeat on the Marne could at first be kept almost entirely secret. The war for positions was declared to be the deliberate plan of the general staff. Although Von Moltke was dismissed, and although it was already determined that the High Seas Fleet should not risk itself in open battle, General Headquarters still hoped for victory. The fatal effects for Austria of the failure to give her speedy help against the Russian army were not realised, especially in view of Hindenburg's striking success in the East.

It thus seemed clear that the prolongation of the War and all the accompanying distress was solely due to the blockade. This blockade, initiated by Great Britain, was regarded, like the sequestration of enemy property, as a violation of international law. Since the Anglo-American conception, which treated individual nationals of enemy states as "alien enemies," was new to Germany the opinion arose that it was the specific English mode of warfare—as distinct from the French or the Russian—which was inhumane and contrary to international law, particularly as the indignation aroused in Europe, and especially in France by the application of the same methods in the Boer War was not forgotten, while of course the decisions in British and American courts on which the blockade rested were unknown.[1] In the first year of the War the conviction had already arisen that the German army was invincible, and that the sole source of danger lay in the "war of hunger" which threatened women and children. If the population at home could "hold out," in the end the War must be won.

As the War dragged on questions of internal politics and economics revived. The people considered that their sacrifices in human lives—volunteers, officers of the reserve, substitutes as well as those on active service—and the privations which they had borne in meeting the costs of the War and in the internal loans, which had been in the first instance subscribed by the holders of small savings-funds, entitled them to claim full political rights. The Reichstag voiced this opinion and the rights of the civil authority with increasing firmness. The civil administration, however, was powerless against the military authorities. Since General Ludendorff had become Quartermaster-General, and a number of his personal adherents had converted the War Press Bureau, and later the "patriotic instruction" given to the troops, into an instrument of political propaganda, the Zabern episode was re-enacted on a large scale. The military authorities thought the Chancellor and the Foreign Office too weak in their attitude towards foreign countries and towards the Reichstag, and that when the civilian authority broke down the military must take over their duties.

The real test of strength came on the question of submarine warfare, to which the Chancellor, the Foreign Office and, of the other ministers in particular, Helfferich, the influential Secretary to the Imperial Treasury, stood opposed, when General Headquarters demanded it again in 1917 after the conferences at Pless of Aug. 30 1916 and Jan. 9 1917.[2] The supreme military authorities, supported by the chief of the naval staff, pointed out that the exchange of Notes between the German and the Entente Govts. with the United States and the other neutral Governments between Dec. 12 1916 and Jan. 12 1917 had proved that peace offers could not be negotiated through diplomatic channels.

The German Peace Offer, Dec. 1916.—That might be true, but the intrinsic weakness of the German Notes (*see* EUROPE) had resided in the fact that public opinion, the Reichstag, and possibly the Government itself, falsely informed by General Headquarters on the military position, considered the offers contained in them to be quite acceptable and even generous. In particular, no plain admission of a duty of reparation towards Belgium was made, because General Headquarters insisted that if Germany was to renounce territorial aggrandisement she must receive guarantees in the West and East. Moreover, heavy industry, at that time closely allied with General Headquarters, desired to see the economic predominance of Germany in Belgium and northeastern France established by the conditions of peace. Bethmann himself and after him Helfferich at length gave way to the military authorities Jan. 9 1917, and the Emperor issued orders to begin unrestricted U-boat warfare on Feb. 1. When on Jan. 23 1917 President Wilson proposed mediation to Count Bernstorff through Colonel House, and inquired the German terms of peace, the Chancellor, who received the communication on the 28th, lacked the strength to stop unrestricted U-boat warfare, and thereby destroyed his own position. He remained in office long enough to issue the so-called Easter message of April 7 1917 from the Emperor as King of Prussia, in which the abolition of the Prussian three-class franchise was promised, in order to reconcile the Social Democrats. But the new "Fatherland party" ("Vaterlandspartei"), which enjoyed the support of General Headquarters, and in particular its co-founder Kapp, attacked the Chancellor without mercy. When he fell at last, this was partly due to Erzberger's attack in the Main Committee of the Reichstag on July 6 1917 (recording the complete failure of U-boat warfare); partly to the military leaders who had come to Berlin on July 7 and, above all, to Ludendorff's *alter ego*, Colonel Bauer; finally, Ludendorff and Hindenburg extorted the resignation of the Chancellor from the Emperor by threatening their own resignation (July 13).

His successor, Michaelis, was nominated at the instance of the Emperor's entourage, without negotiations with the Reichstag. His restrictive interpretation of the peace resolution of the Reichstag, adopted on July 19 1917, deprived it of all value abroad (*see* EUROPE). His ambiguous attitude, moreover, was partly responsible for the failure of the pacific activities of Pope Benedict XV. in Aug. 1917. The Vice-Chancellor Helfferich was the most influential member of the Government. He en-oyed the special confidence of the Supreme Command, whose views he regularly imposed on the civilian authorities.

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[1] For the general case *see* BLOCKADE.

[2] The first occasion was Feb. 4 1915, when the Government—this time against the advice of Tirpitz—declared the British territorial waters to be a war-area as from Feb. 18. Mr. Wilson's mediatory proposal, that Germany should recognise the rules in force for cruiser warfare as applying to U-boat warfare, and that in return England should permit the passage of American provisions, failed. When the "Lusitania" was sunk, the protest of the United States of May 15 resulted in the suspension of the U-boat war (July 8 1915; finally on May 4 1916).

Economic Measures.—In the meantime, the economic structure of the German Empire had undergone a complete change. On Aug. 8 1914 Walter Rathenau founded the department dealing with raw materials for war industries in the Prussian War Office (“ Kriegsrohstoffabteilung des preussischen Kriegsministeriums ”), which for a considerable time met the demand for the chief imported raw materials of war industries, particularly metals, cotton, grease, india-rubber and glycerine, by economic handling of home supplies, organising imports from neutral countries (“ compensation trade ”) and by stimulating the discovery of substitutes (nitrogen from the atmosphere, raw material for textiles from nettles and wood, etc.). Foodstuffs were early rationed. The yield of the soil declined owing to the lack of manure and skilled labour. Ration cards were introduced, first for bread, then fats, sugar, milk, eggs, meat and potatoes. From the winter of 1916–7 onwards, the quantities allowed no longer sufficed to nourish children and young people. The home producers were also, in principle, limited to these rations; but watertight control was impossible, and smuggling and illicit sales became habitual. The sequestration of brass and copper articles in the smallest households excited much bitterness, since it was suspected that the treasures of the rich were being spared, those of the poor taken.

While the economic capacity of the individual, particularly of the lower middle-classes and officials, was thus physically and morally undermined and the mass of the population compulsorily socialised, on the basis of a bare subsistence rate, the economic capacity of individual industries expanded enormously, and the workers employed in them demanded a higher standard of living. The so-called “ Hindenburg Programme ” (Hindenburg's only in name) carried out by the War Department (*Kriegsamt*) founded on Nov. 1 1916 in accordance with the law of auxiliary services (*Hilfsdienstgesetz*), was a prime cause of the economic collapse. By an economically unjustifiable increase in munition workers' wages it disorganised other industries, in some cases brought about a stoppage and constructed at enormous expense blast furnaces which stood idle for lack of fuel. The “ conscription of labour ” provided welcome material for radical agitators, while the melting down of church bells offended the devout. War expenditure rose from two milliard marks a month in Aug. 1916 to more than three milliards in Dec. 1916, and to almost five milliards by Nov. 1918. Moreover, this programme laid the foundations of the political power of the great Rhineland-Westphalian industrials.

In the autumn of 1917 the civil authority reasserted itself. Helfferich was replaced by the Democrat Payer, from Württemberg. From Nov. 1917 the “ Interparty Commission ” of the Reichstag, in which Erzberger and Scheidemann were the chief figures, sat in permanence. On Jan. 24 1918 the Emperor stated to Hindenburg and Ludendorff that he himself and the Chancellor bore the sole responsibility for the direction of political issues. In reality, however, particularly since General Headquarters had forced on him a new Chief of Cabinet, the Emperor was entirely subservient to the military authorities. The Supreme Command took its revenge in 1918; the Peace of Brest Litovsk with Russia (March 3 1918) and of Bucharest with Rumania (May 7 1918) were purely military dictates, bringing no lasting goodwill; although it is true that only a dictated peace could bring Finland and the border states freedom and self-determination.

General Headquarters regarded the spring offensive of 1918 as the last chance of securing a peace “ which should strengthen the monarchy and extend Germany's power.” When it broke down, the War was lost from a military standpoint; even Ludendorff recognised this on the “ black day ” of the breakthrough at Villiers-Bretonneux (Aug. 8 1918). In Sept. and Oct. the Bulgarian, Turkish and Austrian fronts collapsed.

On Sept. 24 the Main Committee of the Reichstag brought Social Democrats into the Government as Secretaries of State, reformed the Prussian franchise and proposed full autonomy for Alsace-Lorraine. Prince Max of Baden became Chancellor; but General Headquarters retained their influence, especially as the Emperor always retired to their shelter at any decisive moments. The Supreme Army Command determined the specific character of the notes sent by the German Govt. to President Wilson in Oct. 1918, and demanded that the note asking for an armistice should be sent out on the night of Oct. 3–4 at the latest, in view of the threatened collapse of the German front; and were also responsible for the second note of Oct. 12, dictated by the necessities of the military situation. Only when Wilson's note of Oct. 14 had to be answered did the Cabinet withstand the views of Ludendorff, who now again asserted that the front line could be held, and themselves continue the exchange of notes with President Wilson.

On Oct. 26 the Cabinet obtained Ludendorff's resignation,[1] and Hindenburg thereby regained the simple and honourable position, free from the taint of politics, which had won him the people's confidence in the early years of the War, and now enabled him to lead the army home, in the face of the pursuing enemy, without the occurrence of mutiny or plunder. Ludendorff did not, indeed, leave his post as Quartermaster-General without first disseminating the contention later known as the “ legend of the stab in the back,” that it had been the slackening of resistance at home which had made it impossible to the army to continue fighting.

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THE REVOLUTION AND THE REPUBLIC

The fall of Ludendorff was deeply significant. The essence of Prussian tradition had always been the subordination of the civilian to the military power. In the first successful years of the War this tradition had naturally been fortified, and the military had assumed even more complete control over the conduct of politics. The Emperor and his entourage were entirely dominated by the Supreme Command, as was much of what ought to have been sensible Conservative opinion. When military defeat approached, the Vaterlandspartei and similar circles, like the Emperor, attributed it, not to errors or weakness of the Supreme Command, but to the fact that civilian authority and opinion had not yet been entirely stifled.

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[1] For a fuller explanation of the circumstances *see* LUDENDORFF.

In moderate liberal and democratic circles exactly the opposite process took place. Their leaders were driven by the intransigent and imperialist attitude of the extreme Right into strong sympathy with the Left. The great party of the Left was Social Democracy; but now when events seemed to be laying the future in its hands German Social Democracy found itself fatally disunited. Hampered by the undemocratic Prussian franchise and much frank repression, the German Socialist party had yet grown rapidly during the years of stress and rising prices which preceded the War. It had achieved a stake in the country, a complex organisation and considerable funds. Fear of losing these acquisitions, combined with natural patriotism and the dread of Russian autocracy, determined the attitude of the party leaders towards the War. On the crucial Aug. 4 1914 they abandoned the International; voted unanimously for the War credits in the Reichstag and concluded a "truce" with the other political parties. In return the Emperor, under pressure from the Government removed the restrictions on Socialist literature and admitted organised workmen into the state railway and other services. On Sept. 9 the Socialist leaders protested against the anti-German attitude of the International Socialist Bureau; and their spokesmen vigorously defended their national cause in the already vexed question of War guilt.

The moderate Socialists had really moved towards the left centre. A small fraction, however, dissented. In May 1915 one voice—that of Liebknecht—voted against a fresh War credit; and a group under Liebknecht and Rosa Luxemburg began to agitate for refusal of credits and a general strike to stop the War. In Nov. 1915, 18 Socialist deputies voted against the credits. The opposition now grew rapidly, but was itself divided. The larger group, under Haase, Kautsky, Ledebour and Bernstein, split definitely from the majority in March 1916 over the question of submarine warfare, and formed a separate group which at Easter 1917 took the title of the "Independent Social Democrat Party of Germany," with a programme of early peace without annexations. The extreme Left under Liebknecht (which in 1916 had begun to issue a secret paper named *Spartacus*) was already in touch with Lenin, Trotsky and Radek in Switzerland, and had adopted the programme of the Zimmerwald Congress. Both these parties were still largely heads without bodies, while the extremists were weakened by the imprisonment of Liebknecht in 1916. The Majority Socialists commanded the prestige and the organisation. But although the Russian revolution of March 1917 emboldened them, and at the International Socialist Conference at Stockholm in June 1917 they made a declaration against annexations and indemnities; and although the Emperor found it wise in his "Easter Message" of 1917 to promise a reform of the franchise, they might have been ignored had not Erzberger obtained and communicated to his colleagues of the Centre on July 6 a copy of Count Czernin's famous memoir in which he described Austria-Hungary as being on the verge of revolution, and victory as impossible.

Erzberger now propounded a resolution in favour of "peace by understanding," and the Centre and the Majority Socialists were definitely allied against the Imperialist aims of the Government and the Supreme Command. The latter were not yet ready for concessions; Bethmann Hollweg's successor, Michaelis, was their nominee. Only when Hertling succeeded him was a bill introduced which provided for a really democratic reform of the franchise; and the discussions on it outlasted the fall of the Empire. Certain concessions were, however, introduced; a minor electoral reform was carried on June 8 1918.

The Bolshevik revolution in Russia (Nov. 1917) widened the split in the Socialist camp. The Majority condemned Bolshevik methods in Russia, the Independent Socialists looked on them with much sympathy, and their following was strongly reinforced by unorganised labour, whose imagination was fired by the example of Russia and by the prisoners of war who began to return after the peace of Brest-Litovsk. The Spartacists were frankly out for the establishment of a dictatorship of the proletariat in Germany, and began to organise with the arms and money which the Russian agitators transmitted to them. All three groups, however, were alike emboldened by events in Russia; in Jan. and Feb. 1918 a series of munition strikes broke out in Germany which almost reached the scale of a revolution, their extent and order showing the vast power of the Majority Socialists, who, although they had not organised the strike, put themselves at its head to gain control of it.

The great munitions strikes, which were largely spontaneous, were symptomatic of an almost universal state of feeling. The almost intolerable strain and privations resulting from nearly four years of continuous war and blockade had affected practically the whole population. Hardly one man in a hundred saw in events in Russia the triumph of a new doctrine, the establishment of a new system, but those were innumerable who saw in it the end of a tyranny, of a driving of men beyond their powers, above all, of war and slaughter. The active policy of the Socialist leaders drew its strength from the great passivity of the over-driven masses; revolution was becoming the line of least resistance. The main motive in the German revolution, which substituted a Socialist for a monarchical Government, was to be anything but Socialist; it was the longing of workman and soldier to relieve themselves of the tyranny of the State in army and workshop.

In Sept. 1918 the general staff at last admitted the probability of defeat, and the Government prepared to make concessions to the moderates. Prince Max of Baden, the new Chancellor, asked the Majority Socialists to enter the Government. They made their acceptance conditional on far-reaching internal reforms; the liberation of Belgium; the evacuation of all occupied territory; and the abandonment of the treaties of Brest-Litovsk and Bucharest. Prince Max accepted the conditions, and took Scheidemann and Gustav Bauer, and later other Majority Socialists, into his Cabinet. The party then appealed to the Independents to re-unite; but the latter, who rejected all co-operation with bourgeois parties and demanded an immediate peace, refused brusquely.

The Outbreak of Revolution.—Prince Max filled the remainder of his Cabinet with liberals and democrats, including Erzberger. On Oct. 5 he propounded a programme containing a decided profession of democracy, with self-determination of nations. On Oct. 28, when Germany's allies had already failed her, he introduced a number of measures to democratise the Constitution and control the prerogatives of the Emperor, and especially to reduce the power of the military authorities. Meanwhile, however, Germany's own fighting forces had become infected. On Oct. 28 the fleet received orders to put out to sea "for manoeuvres." The crews, rightly suspecting that the real object was a last and desperate attack, refused to weigh anchor. Their ringleaders were arrested. On Nov. 5 a great meeting demanded their liberation. It was refused, and the demonstrators fired on. The next day the whole fleet was in uproar. There had been a naval mutiny in 1917, and a connection had been traced between the mutineers and the Independent leaders Haase and Dittmann. The situation was obviously critical. Noske, a Majority Socialist leader, was sent to Kiel to negotiate; he arrived to find a Sailors' Council in full control. He recommended that all their requests be granted, and remained in Kiel, where he was joined by Haase and Ledebour. Further Councils were formed. On the 6th the dock labourers in Hamburg revolted; a dictatorship of the proletariat was formed in Lübeck and demanded "immediate armistice and peace." Bremen joined on the same day; Hanover, Brunswick and Cologne on the 7th. The movement spread towards Berlin; revolutionary bodies took possession of Magdeburg, Leipzig and Dresden.

Thanks to the lamentable Socialist split, the whole of these movements were very confused. The Majority Socialists had still far the strongest organisation, but the movements in Northern Germany were largely spontaneous, the work of the unorganised proletariat. It was the outcome of a deep craving for peace and a reaction against authority. Many concerned in it followed the lead of the Independent Socialists, who were not compromised by their connection with the Government, many that of the Spartacists, whose leader Liebknecht had been released from prison and was conducting a violent extremist agitation. The Spartarcists, numerically the smallest group, had the great advantage of a fixed programme, although, an unattainable one.

The most urgent question, in view of Germany's defeat, was how far continuity with the previous régime should be preserved. The parties of the Centre and Left Centre had not in the main gone further than the idea of a constitutional republic; and the Emperor had subscribed to the Constitution of Oct. 28, and on Nov. 2 had declared that the old order was destroyed and that the Emperor was the "servant of the people." But this declaration was issued from Spa, whither William had fled on Oct. 29. The servant of the people had made an unfortunate beginning in sheltering himself from them behind the bayonets of his soldiers in a town on occupied foreign territory. His conduct disheartened the monarchists and thinned their ranks, besides making it almost impossible for his loyal adherents to concert their policy, with its object away at the safe end of a long telephone wire. The republican movement received a great impetus.

The Majority Socialists were anxious not to break with the bourgeois parties, which enjoyed the confidence of the peasants and middle classes and commanded practically all administrative talent; while the Independents believed that a complete break with the past would ensure Germany better conditions of armistice. The Majority Socialists, carried forward on the tide of events, moved almost daily further Left, since to stand still would have meant losing their adherents to the Independents. On Nov. 4 they made up their minds in favour of a republic; and on Nov. 7 the rapid march of events outside Berlin determined them to present an ultimatum to the Government, demanding the abdication of the Emperor and the Crown Prince, under threat of withdrawing their members from the Government and proclaiming a general strike. The Emperor was still debating whether he could not lead the army back to restore order at home. The new Quartermaster-General, Groener, and Hindenburg pronounced this impossible on Nov. 9. The Emperor therefore telegraphed his abdication as German Emperor. On the 10th he fled to Holland.

Proclamation of the Republic.—Events had outrun him. Prince Max had announced the abdication on the morning of the 9th. His telephone conversations with William had given him the impression that the latter abdicated both as German Emperor and King of Prussia, and he still hoped to save the throne to the dynasty; but republics had already been declared on the 8th in Munich and Brunswick. The general strike was proclaimed; and Prince Max formally appointed Ebert, the leader of the Majority Socialists, as his successor, and retired. Almost his last act was to order the troops not to shoot on the vast processions already filling the streets of Berlin.

The power had thus devolved on the Majority Socialists, who made great efforts at once to preserve order—for which the collaboration of bourgeois parties was necessary—and to restore the unity of the Labour front. In Bavaria and some of the smaller states—every state in Germany, without an exception, was proclaiming the republic and forming more or less revolutionary Governments—this was effected without friction. In Berlin and the Government of the Reich it was more difficult. The Independent Socialists agreed to enter a Government, on condition that the Cabinet be purely Socialist. The heads of non-political ministries were allowed to belong to other parties, but each was "controlled" by a Majority and an Independent Socialist. The Government proper entitled itself a "Council of Commissioners of the People" and was composed of Ebert, Scheidemann and Landsberg for the Majority Socialists and Haase, Dittmann and Barth for the Independents. It exercised dictatorial powers. Scheidemann proclaimed the republic from the buildings of the Reichstag on Nov. 9. The new Government hurriedly passed a series of decrees abolishing the state of siege, with the various restrictions on freedom in force and proclaiming a general amnesty, but affirming the right to private property. Its chief task, however, was to conclude the Armistice; and Erzberger, who had remained in office as Secretary of State, had on behalf of the German Govt. received the conditions of Armistice from the Allies in the Forest of Compiègne on Nov. 8. The conditions made the resumption of hostilities by Germany impossible. As President Wilson had demanded, they laid down the evacuation of the left bank of the Rhine, the occupation of the bridgeheads of Cologne, Mainz and Coblenz, the restitution of prisoners of war without reciprocity and the continuance of the blockade. An answer was required by Nov. 11, and on that morning the Government was obliged to accept the terms without modification. At the same time they asked that peace negotiations should be initiated.

The Struggle Against the Extreme Left.—The severity of the terms was a blow to the Moderates and encouraged the extreme Left. Workmen's and soldiers' councils were already springing into existence everywhere; a last order of the Supreme Command had been to allow their formation unimpeded. Some were quite spontaneous, others organised by the Independents and Spartacists. Liebknecht had refused a generous offer to join the Government, and he and Rosa Luxemburg, assisted by Radek, representing Bolshevik Russia, worked furiously to proclaim a Soviet dictatorship on the spot. The Majority Socialists, on the other hand, considered themselves only mandatories till the real will of the people should have been ascertained by a Constituent Assembly. It was a struggle between dictatorship and democracy, and the issue hung in the balance. On Dec. 1 a "National Executive Committee of Workmen's and Soldiers' Councils" was formed under the Independent Daümig. The extremists in it regarded it as the supreme authority of Germany, which, since the Councils system *ipso facto* excludes the bourgeoisie, involved the dictatorship of the proletariat. On Dec. 16 the Committee met in Berlin. After a stormy debate lasting three days, the views of the Majority Socialists prevailed. The powers of the Committee were limited to summoning and dissolving the Council of Representatives, which received both executive and legislative powers. Elections for a Constituent Assembly to determine the future form of the German State were fixed for Jan. 19. The Independents condemned this decision as "social treachery," and a few days later the Spartacists appealed to arms. The Council called out troops against them, defeating the Spartacists, after heavy fighting, on Dec. 24. The Independents, in consequence, seceded from the Government on Dec. 29.

The Spartacists, who had adopted the name of "Communist Party of Germany" on Jan. 1 1919, prepared to renew the struggle. Meanwhile, however, Noske, who had been appointed Minister of National Defence, had hurriedly organised a force which again defeated the Spartacists after fighting which lasted from Jan. 5–13. Liebknecht and Rosa Luxemburg were arrested and murdered by their escorts, apparently in cold blood. During the next few months, Noske was probably the most powerful man in Germany. He was entirely ruthless. "Somebody," he remarked "must be the bloodhound." Till now, the change of system had been almost bloodless, and had indeed been accomplished with remarkable smoothness. No member of a ruling house was injured, some indeed were genuinely regretted by their subjects. The administration continued to function; the soldiers dispersed to their homes in order, largely thanks to the irreproachable conduct of Hindenburg. The Spartacists alone appealed to arms; and it is probable that in putting them down without mercy, Noske saved his country from much anarchy. But he did it by dangerous methods—although, indeed, these were the only methods open to him; he employed the old corps of officers to serve a republic which most of them loved but little. Thus only a few weeks after the revolution, officers of the former army were appearing as saviours of society against Socialists; and a revival of German militarism so obnoxious both to the Allies and to liberal and Socialist Germany was thus provoked.

The Constituent Assembly and the Treaty of Versailles.—The non-Socialist parties reorganised hurriedly. The Conservatives founded the German National People's party (Deutschnationale Volkspartei) and announced their readiness to co-operate in "any form of Government in which justice and order held sway." Certain of the National Liberals under Stresemann formed the German People's party. The German Democratic party represented the middle-class electors, but was largely an organisation of leaders, with less backing from the electorate. The Centre styled itself the Christian Democratic People's party. The elections for the Constituent Assembly on Jan. 19 gave the Majority Socialists 163 votes, the Independent Socialists 22, the German Nationalists 44, the German People's party 14, the Centre 91, the Democrats, with the Peasants' League, 81. The Communists abstained from voting. The National Assembly opened its sitting in Weimar on Feb. 6. The Independents refused to enter a coalition with non-Socialist parties; a coalition was therefore formed of the Majority Socialists, the Centre and the Democrats. Scheidemann became Chancellor; and Ebert was elected President of the Reich. A chief task of the Constituent Assembly was the elaboration of the Constitution, which was proclaimed on Aug. 11 1919. Elections in the principal states took place shortly after those for the Constituent Assembly. In Prussia the results were very similar to those for the Reich, Berlin and the industrial districts voting strongly Socialist. In Saxony the two Socialist parties had a majority over all others combined. In Bavaria, on the other hand, the clerical "Christian People's party" formed the strongest group.

The spring of 1919 was accompanied by continued trouble from the Left. The Berlin Spartacists made a fresh attempt to set up a Soviet Govt. in March. It decreed a general strike throughout Germany, which reached considerable dimensions in Berlin. It was quelled with bloodshed in Berlin, Halle, Leipzig, Stuttgart, Hamburg and other cities. In Bavaria the Minister President, an Independent Socialist, Kurt Eisner, was murdered by a Nationalist officer. A violent struggle ensued, and a Soviet Republic was proclaimed in Munich and ruled there till May 1. Much of this unrest was due to the uncontrollable effects of the aftermath of the War, the continuance of the blockade, universal underfeeding and unemployment; some to foreign agitation and some to irresponsibility. The Weimar coalition had undertaken a far harder task than that of opposition; but it struggled manfully to preserve the unity of Germany, to prevent bloodshed and, by disarming and respecting the Armistice conditions, to allow the Allies no excuse for applying sanctions. Exaggerated rumours were current as to the prevalence of democratic feeling and brotherly love in Great Britain and elsewhere, and the Government hoped that the peace terms, when they came, would strengthen their hand. The publication of the terms aroused deep consternation in Germany. Scheidemann resigned, saying "let the hand wither that signs this treaty." The Democrats left the Government. The Majority Socialists and Catholic Centre alone, and they with dissentient voices, agreed to take the responsibility of signing, under threat of the continuance of blockade, an Allied march into Germany and possibly the loss of the country's unity. Germany signed the Treaty of Versailles on June 28 1919 (*see* VERSAILLES, TREATY OF), the National Assembly giving its assent to the signature on July 9 by 208 votes to 115.

The Policy of Fulfilment.—Even while signing Germany refused to admit the sole responsibility for the War, and made every effort to prove by history that the charge was unjust, in the hope that this would lead to a revision of the treaty. The Government hoped and long believed that such a revision would come. Immediately after the ratification of the treaty, on Jan. 10 1920, President Ebert circulated a message that "we shall honestly endeavour to fulfil our engagements towards the Entente according to the Peace Treaty, but if there are clauses which prove to be absolutely unrealisable, we must hope that the Entente will understand this and be able to meet us in our difficulties."

For the time, however, the Government saw no course but to make the best of a bad job, and meanwhile strengthen republican and democratic elements at home. Its position was dangerous. The extreme Left had relapsed into comparative quiescence after the failure of the spring disturbances, but the opposition of the Right now began to rally. They saw that Great Britain and America had favoured more moderate terms in the Treaty of Versailles, but that the die had really been cast against them by the presence of the great French Army. They declared that Germany had only been forced to accept the treaty by her own action in disarming; that the treaty was imposed by *force majeure* and involved no moral obligation; that any attempt to fulfil its terms was high treason; and that the duty of a patriotic German was sabotage of the treaty, to resist disarmament, indeed to re-arm and to repudiate the treaty at the earliest moment when Germany's military power allowed it. Anyone connected with the "policy of fulfilment" was a traitor, and in the views of the extreme secret organisations which rapidly sprang into being, it was a patriotic duty to murder such a person. The advocacy of assassination, disguised as patriotism, became common; and was responsible for the murder, first of Erzberger, then of Rathenau.

Owing to the number of Jews among the Democratic and especially Socialist politicians, this Nationalist agitation was also preached as the struggle of the pure-bred German against the "hidden hand" of Jewry. Finally, and in reality most essentially, it soon took the form of a conflict of Social Democracy against the anti-Socialist forces of the rural districts and capitalism. Unfortunately for the Socialists, they had been obliged to take almost the sole responsibility for signing the treaty; although refusal to sign had been out of the question. The association of Socialism with national treachery was thus as easy as it was unjust. The industrialists financed the Nationalist movement heavily; the influence of the Roman Catholic Church was generally anti-Socialist and no doubt helped to detach from Socialism the peasants and small tradesmen whose republican sympathies had led them into the enemy camp.

In the autumn the National Assembly returned to Berlin. The Democrats re-entered the Cabinet. The Right was already agitating for new general elections, on the ground that the Constituent Assembly had finished its task by passing the Constitution. The demand was unwelcome to the Social Democrats, who were losing ground in the constituencies; and they hastened to pass what legislation they could. The eight-hour day had already been decreed. A bill, providing for the formation of Works Councils, was now introduced. A Socialisation law laid down in principle the transference of the whole mining industry to state ownership; but the committees of inquiry had not finished their investigations as to how this was to be done before the opportunity passed. Moreover, the fear that the Allied and Associated Powers might take over the nationalised properties acted as a deterrent on the Socialists. Erzberger, as Minister of Finance, introduced some drastic measures of taxation on War increases of income and an emergency contribution which contemplated the sequestration of a considerable percentage of private fortunes. (*See* INDUSTRIAL RELATIONS; WORKS COUNCILS.)

Reactionary and Communist Outbreaks.—On Jan. 10 1920 the Treaty of Versailles came into force. Very soon afterward Germany had to face her first and most serious attempt at a monarchist reaction. What is known as the *Kapp Putsch* was short-lived, and in some aspects almost ridiculous; but it was inevitable that it should be made, and the fact that it failed was momentous. Only now was the German republic firmly established and the unsettled elements left stranded by the end of the War were forced to see that the new order was not merely provisional. Henceforward, gradually, and with an ill-will which is not incomprehensible considering their circumstance and traditions, they adapted themselves and began to look on the new Republican Reich as an established fact. The movers in the *Kapp Putsch* were the old officers who, their occupation gone, comprised a dangerous and unabsorbed element, which at this moment was reinforced by the return of General von der Goltz's formations from the Baltic States. The treaty had provided for the reduction of Germany's army to 100,000 by March 31 1920. This reduction had not been made. Germany desired permission to keep a permanent force of 200,000; but the Allies granted only a fur-er grace of three months in which to complete the full reduction. The officers were faced with starvation and ready for any lventure. Kapp, a founder of the "Vaterlandspartei" seized e pretext to agitate against Ebert's position as unconstitutional. n March 13 Kapp, Von Lüttwitz, Erhardt and Colonel Bauer, rmerly Ludendorff's chief of staff, seized the public buildings Berlin with the aid of the marine troops quartered at Döberitz, nd proclaimed a "government of order, liberty and action" nsisting mainly of themselves. The real Government fled to resden and thence to Stuttgart, the Socialists of Berlin proaimed a general strike. The movement collapsed in a few days. ne leaders alone were punished, but most of them made their cape.

The strike had been completely successful; but it soon got out hand. The threat of a reaction infuriated the workmen; Rusan propaganda accused the Majority Socialists of complicity. nstead of returning to work, the workmen formed Soviets. The ommunist element had long been secretly organising a Red rmy. It now came into action in many parts of Germany. In eipzig the Government had to use aeroplanes against the city. Berlin, Württemberg and Bavaria the troops put down the oters easily, but in the Saxon Vogtland a Communist government aintained power for some weeks. In the Ruhr a Red Army 0,000 strong conducted regular operations. This was a demilirised zone, into which German troops beyond a small permaent garrison might not enter; and when, after some hesitation, force of the Reichswehr actually entered the zone, French oops immediately marched in and occupied Frankfurt, armstadt and Homburg, remaining until May 17, by which ate the German troops had left.

Reorganisation of the Reichswehr.—As a sequel to this incident oske retired. His place was taken by the Bavarian Democrat essler, who together with General von Seeckt reorganised e Reichswehr. Many reactionary elements were eliminated om the Reichswehr (and simultaneously from the civil rvice), and it was henceforward a sufficiently trustworthy m of the civil government, although strongly conservave in feeling. Von Seeckt engaged in a prolonged if unacknowllged duel with the Inter-Allied Commissions of Control, which mained in the country for some years. Technically, few viotions of the treaty were proved. Great masses of war material ere actually surrendered and destroyed; only in July 1920 as Germany admittedly and demonstrably in arrears in this spect. On the other hand, it is scarcely denied that much mained concealed; that a very high proportion of the men of ilitary age and youths of Germany received what was military aining in all but name from their respective political party oranisations; that Germany was at no time without the nucleus of a ighly-trained army, and could at any time have put into the eld a formidable force; while her rifles and artillery were short, er chemists and scientists were working hard to discover new ffensive and defensive methods which the Treaty of Versailles ad not anticipated.

The First Reichstag.—After the collapse of the Communist sing, the National Assembly considered its work as finished. The ections for the first Reichstag (June 6 1920) followed hard on ose stormy events. The moderates of each wing feared the iolence of the other, and voted in self defence for their own xtremists. The Independent Socialists increased their votes o 81, the German People's party to 62, the German Nationals to 6. The Democrats were reduced to 45, the Majority Socialists o 112, the Centre to 70.

To avert the danger from the left, the People's party agreed o enter a coalition with the Centre and the Democrats. The Iajority Socialists supported the Government without entering . Herr Fehrenbach became Premier, Dr. Wirth Minister of inance and Dr. Simons Foreign Minister. The Government ollowed the policy of its predecessor. Almost its first action as to meet the Allies at Spa (July 5), a somewhat stormy eeting, chiefly concerned—outside the question of German oal-deliveries and the Inter-Allied arrangements regarding e distribution of reparations—with Germany's failure to disarm. During the remainder of the year, however, Germany enjoyed comparative quiet, and really began to disarm. A number of minor questions arising out of the Peace Treaty were settled during this period. The plebiscites in Schleswig (*q.v.*) had been held on Feb. 10 and March 14; those in Eupen and Malmédy (*see* EUPEN) on July 24; those in East and West Prussia on July 11. The only important territorial arrangement outstanding was that of Upper Silesia.

The question of the trial and punishment of the "war criminals" aroused much ill-feeling. Holland's refusal in Jan., Feb. and March 1920 to extradite the ex-Emperor William probably robbed international law of many interesting decisions. The Allies had demanded the arrest and delivery of many hundreds of war criminals; but in face of German protests, the Allies agreed (Feb. 16 1920) to allow trial before German Courts. Twelve persons were finally tried at Leipzig (May 23—July 16 1921), six being convicted.

The year 1921 saw renewed trouble. A militia known as the Einwohnerwehr had been organised in Bavaria, and Von Kahr, the Bavarian Premier, declared himself unable to dissolve it in view of the Bolshevik danger. Already all the elements of reaction were concentrating in Bavaria. Von Escherich, the prime mover in the Einwohnerwehr, had also formed a second organisation, the "Orgesch" (Organisation Escherich) obscurely connected with the Einwohnerwehr but receiving no official recognition. The Orgesch was spreading throughout Germany and assuming the proportions of a secret army, while the Government professed itself unable to control it in view of its own weakness. The Allied ultimatum of May 5 1921 at last decided Von Kahr, the Bavarian Premier, nominally to disband the Einwohnerwehr under threat of an occupation of the Ruhr.

The Bolshevik danger was real enough. The Majority Socialists had adhered to the Second International at Geneva in Aug. 1920; the Independents had joined the Third International (a minority dissenting) and coalesced with the Communists as the "United Communist party of Germany" (V.K.P.D.). A small and even more radical group formed a section of the Fourth International as the "Communist Labour Part of Germany" (K.A.P.D.). In March 1921 Moscow considered Germany "ripe for revolution" and a widespread rising broke out in Central Germany. The V.K.P.D. maintained a Communist régime in Halle, Mansfeld and Eisleben for several weeks. The insurrection, which spread as far as Hamburg, was put down with great difficulty.

The Reparations Problem.—Meanwhile the question of reparations was assuming the overwhelming importance which it was to retain for four years. Germany's financial situation was curious. Apart from the effects of war and blockade, she had been permanently weakened by the losses of large portions of territory. Nevertheless, her currency was low and her exports cheap, her territory unravaged, her population industrious. The middle-classes and officials were suffering severely, and districts such as Saxony, where industry depended on imported raw material and coal, were badly hit, so that in Germany there were now some 2,000,000 unemployed and at least 4,000,000 working half-time. In other places, however, where raw material was available, industry was flourishing. Notably the great industrial centres of Westphalia were reorganising and expanding most rapidly. Here Germany's chief wealth was concentrating and accumulating, especially in the hands of a few enormous combines, the most sensational of which was that which was founded and directed by Hugo Stinnes.

So long as complete uncertainty reigned as to what sum Germany would have to pay in reparations, the industrialists, who were strongly opposed to any "policy of fulfilment" made no attempt to relieve the financial distress of their country as a whole; they concentrated on maintaining their own prosperity and that of the districts under their own control, transferring capital abroad, speculating *à la baisse* on the mark, and paying their taxes in arrears and incompletely. It must be admitted that by their policy the industrialists did not only amass fortunes for themselves, but also saved the workmen in their concerns from otherwise inevitable unemployment, which would have had incalculable economic and political consequences. The Reichsbank, by granting the industrialists almost unlimited credit, encouraged this policy.

Enormous wealth had thus accumulated in Germany in a few private hands, while the Government was almost bankrupt. When the Allies, by Jan. 1921, had at last decided on the bill to be presented to Germany and its allotment among themselves, the difference between the wealth obviously present in Germany and that at the disposal of the Government was glaring. The essential problem was that of tapping the wealth of Westphalia. When the German Govt. declared the conditions of the Allied note of Jan. 29 1921 (*see* Reparations) impossible of fulfilment, and Dr. Simons, on a visit to London, was unable to come to any financial terms with the Allies, besides arousing their hostility by again repudiating Germany's war guilt, the Allies occupied Duisburg, Ruhrort and Düsseldorf on March 8 as "sanctions" and drew a customs cordon between occupied and unoccupied territory. It was this move which made possible the later occupation of the Ruhr district and opinion in Germany did not doubt that it was deliberately taken with a view to such later occupation.

The Fehrenbach Cabinet resigned. The Allies threatened to occupy the Ruhr and apply other sanctions. The "policy of fulfilment" became again a burning question; but in order "to save the German Reich and its unity, to save German territory from invasion and to retain German freedom" a new coalition Government under Wirth, composed of the Centre, the Majority Socialists and the Democrats was formed on May 10 and accepted the Allied ultimatum. Germany, by exertions which jeopardised the stability of the mark, paid the first milliard of gold marks on Aug. 31.

An early result of the Nationalist agitation against the "policy of fulfilment," which broke out with renewed violence, was the assassination of Erzberger (whose financial policy was particularly unpopular with the moneyed classes) on Aug. 25. The Independent Socialist Gartis was murdered in Munich, and the publicist Maximilian Harden wounded in Berlin, and an attempt made to poison Stresemann. A monarchist demonstration took place in Berlin; but although monarchist feeling was reviving, it lacked unity owing to the personal unpopularity of the members of the Hohenzollern family.

The Plebiscite in Upper Silesia.—The murder of Erzberger was followed by a further fall of the mark, which grew more pronounced in the autumn. The plebiscite in Upper Silesia had been taken on March 20, and had given 717,122 votes for Germany, 483,514 to Poland. The Polish High Commissioner, Korfanty, had thereupon raised an armed revolt, and the French troops stationed in the district were less successful in dealing with him than with the German defence force raised by General Hofer. As the Supreme Council was unable to agree on the fate of Upper Silesia, it turned the question over to the League of Nations, which awarded practically all the important industrial districts to Poland on grounds which were recondite in the eyes of many. This decision, which was taken in Oct., caused a crisis, more especially as it came at a moment when the "Reichswirtschaftsrat" had just evolved a plan under which the rich landowners and industrialists at last consented to make heavy sacrifices in order to stabilise the financial situation. These offers were now withdrawn.

The Second and Third Wirth Governments.—Wirth resigned, but formed a second Cabinet against the opposition of the extreme Right and Left. All other questions were now dominated by that of reparations, which in its turn brought fresh conflicts between Left and Right. The burden of reparations was being borne almost solely by the wage-earning and salaried classes, from whose pay the taxes were deducted on payment. As the fall of the mark accelerated, the proviso under which industry and agriculture were allowed to pay their taxes in arrears reduced their burdens to a trifle, while they were able to pay off debts and mortgages at a fraction of their real value. The reactionary agitation increased daily; but owing to emergency legislation passed in Aug. 1921 the year passed off without disturban In 1922, however, the state deficit increased enormously. T Government was obliged to beg for moratoria and to allow t Reparations Commission the right of scrutiny over Germa financial measures. On June 24 Rathenau, Germany's greate statesman, was murdered by Nationalists. He was the one ma in Germany who had shown himself capable of a positive polic In June 1921 he had come to a direct agreement with M. Lo cheur regarding the reconstruction of the devastated regions Northern France. On April 16 1922, as one of the German repr sentatives at the conference of Genoa, he had signed the Trea of Rapallo with Russia. The treaty had slightly eased Germany financial situation and had opened up a new field of activity her industry, but by proving her unwillingness to remain a c pher in foreign policy it deeply irritated the Allies.

In Aug. Poincaré came to the conclusion that Germa could only yield reparations if "productive pledges" we seized; that is, if the Allies actually took the Ruhr districts a managed them for their own profit. France's Allies were unwilli to consent to this, but the threat overshadowed the situatio The financial distress and continued fall of the mark made stabi sation the most urgent necessity. But the Allies rejected Ge many's suggestion to make this possible by reducing reparation the Reichsbank was unwilling to risk its last gold reserves; t Socialists refused to increase production by allowing hours labour to be lengthened, maintaining that the profit would go in the pockets of the capitalists. Thus Germany remained polit cally disunited.

On Sept. 24 1922 the Majority Socialists, who had revise their programme at Görlitz on Sept. 18 1921, re-united with t Independents.[1] As a counterpoise, the moderate bourgeois pa ties formed a "working agreement" with the People's Part The Social Democrats having refused to enter a Governme with the People's Party, Dr. Wirth resigned and on Nov. 23 192 formed a minority "business government" of middle-class re resentatives and permanent officials. It carried on the financi policy of its predecessor, stabilisation through reduction of rep rations.

The Occupation of the Ruhr.—On Dec. 26 1922 and Jan. 9 192 the Reparations Commission, the British member dissenting, d clared an "intentional default" on the part of Germany. O Jan. 11 French and Belgian troops occupied the territory of th Ruhr. The history of this struggle is told elsewhere (*see* Ruh The population of the Ruhr adopted an attitude of "passive r sistance" which was supported by the Government. For eig months the Government maintained as a charge on its financ the population which ordinarily yielded its chief source of reve nue. It could only meet this expenditure by unlimited inflatio which was aggravated by singularly incompetent administra tion of the Reichsbank. By June the mark was quoted at 150,00 to the dollar; on July 30 at 1,000,000; Nov. 20 at 4·2 billion Austria's financial collapse paled before conditions in German starvation for the working and middle-classes, mushroom fo tunes won by speculation, the rise of prices marked by a mult plication so that people entered a shop with a considerable sum i paper and found it too little to buy a crust of bread by the tim they reached the counter.

In view of the growing unrest, the Social Democrats agreed t enter a Government on a broad basis, with Stresemann, know to be a strong man, as Chancellor and Foreign Minister. Th "Grand Coalition" was at last formed in Aug. 1923. Hilferdin a Social Democrat, became Minister of Finance. An attempt t stabilise the currency under existing conditions broke down. O Sept. 26 the Government proclaimed the abandonment of passiv resistance in the Ruhr, and relieved itself of the financial expen iture involved. On the following day, it announced its inte tion to use all means to put down any attempt to create distur ances, and proclaimed martial law throughout the Reich.

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[1] The United Socialists joined the Second International at th Congress of Hamburg May 21-7, 1923, when the "2½ (Vienna International" of the German Independents, the Austrian Socia Democrats and the British I.L.P. ceased to exist (*see* Socialism).

Political Unrest.—The appalling financial catastrophe had pro-
ed a most dangerous political situation. In the Rhineland
l the Bavarian Palatinate (*see* RHINELAND), the French were
rking to create a separatist movement. In Bavaria proper the
tation was less artificial. There were two great movements in
varia. Von Kahr, who had been Premier in 1920 and 1921,
ed his power on the Bavarian People's party. He wished to
nsfer the "centre of gravity" of Germany to the Catholic
th, and while he denied any aim further than revising the
imar Constitution in the favour of federalism, he was an
wed monarchist—the Bavarian dynasty occupied a position
Bavaria little inferior to that which it had enjoyed up to 1918—
party had been compromised by revelations of their relations
h the French, and he had involved himself in various schemes
create a Catholic Danube monarchy of the South to include
ts of Austria. A second party was led by Hitler, an immi-
nt workman from Austria, and Gen. Ludendorff, supported by
nerous refugees from the Kapp Putsch. Its adherents styled
mselves "National Socialists" but were in fact not Socialists
ll. The programme was to "regenerate the Reich through
varia." These two groups were constantly intriguing with each
er and with various reactionary and Catholic parties outside
varia and outside Germany. A dangerous situation had been
ated in the summer of 1922, when Bavaria refused to recog-
the legislation and tribunals of the Reich. It was smoothed
r, and Von Knilling had since acted as Premier, with an un-
r policy. Throughout 1923 the agitation of Hitler's "Völ-
he" party grew so rapidly that a coup was almost daily expected,
ich would have been accompanied by military reaction in
rth Germany. The Government considered the monarchists
lesser danger; on Sept. 26 civil law was suspended in Bavaria,
Von Kahr appointed General Commissary with dictatorial
vers. He instantaneously consolidated his position by lower-
the price of beer.

he state of Saxony and Thuringia were no less disturbed. A
Bolshevik centre had been established in Dresden and the
mier, an extraordinary figure named Zeigner, was ruling at
head of a coalition of Communists and Left Wing Socialists.
ed Army had been formed, and was only waiting for a reac-
ary outbreak in Bavaria, which would give it the sympathy
the workmen in Berlin, to establish a Soviet Govt. and
terror. In addition, quite apart from the separatist move-
t, there were grave Communist disturbances among the un-
loyed in the Ruhr. The plans of the Third International,
ch was directing this movement, regarded Saxony only as a
mping off place" and envisaged a general rising with the
tre in West Germany. The Government had, however,
rched the offices of the Russian Trade Delegation in Berlin
May 3; and although relations between Germany and Russia
e in consequence very strained throughout the summer, the
man Govt. had obtained valuable information on the plans
he Communists.

he proclamation of martial law by the Government was an-
red by defiant demonstrations by all the malcontents and an
al outbreak by the Separatists in Düsseldorf on Sept. 30.
Saxon Finance Minister, Böttcher, called on the proletariat
rm. Fortunately, each side waited for the other to move
le the Government of the Reich passed through a fresh crisis.
he German People's party were alarmed at the presence in
Cabinet of Hilferding, who was known to be a champion of
onalisation. They desired legislation for increasing produc-
without regard to the eight-hour day, and that the Govern-
t should receive dictatorial powers to issue orders of this
re with the force of law without consulting the Reichstag. The
alists were determined to oppose any tampering with the
t-hour day. The parties finally agreed on the principle of a
w regulation of laws regarding hours of work, with retention
rinciple of the eight-hour day." The Stresemann Cabinet
reconstructed in early October. Hilferding left it, and Dr.
her became Finance Minister. The Cabinet received the de-
l emergency powers on Oct. 13. It was now able to deal suc-
fully with the Communists. The Military Commander in
Saxony called on Zeigner to repudiate Böttcher's speech. Zeigner refused; troops of the Reichswehr then entered Saxony on Oct. 22, forced Zeigner to resign and restored order. Other troops occupied Thuringia and disbanded the Red Army, and a rising in Hamburg was put down.

In Bavaria the military commander, Von Lossow, sided with the Bavarian Govt., refused Von Seeckt's order to resign, and allowed the Bavarian authorities to appoint him Provincial commander. The Bavarian Govt., in defiance of the law, exacted a special oath of allegiance from the Bavarian troops. Many officers of the Reichswehr openly sympathised with Ludendorff against the government of the Reich, and Hitler and Ludendorff were encouraged to believe their hour had come. On Nov. 8 they seized Von Kahr and Von Lossow and proclaimed a government, consisting of themselves. Von Kahr at first appeared to fall in with their plans and announced himself as "viceroy of the King of Bavaria." But as soon as he saw that the Reichswehr would act against the insurgents, he called in troops, which fired on the revolutionaries. Ludendorff fell on the pavement and shammed dead till all was over. His much-enduring reputation could not stand this strain.

His fellow conspirators were arrested, and the pricked bubble of the "Völkische" collapsed. In the following spring the chief participants were tried. Ludendorff was acquitted. Hitler and other leaders imprisoned. The trial aroused great excitement on both sides. The separatist movement in the occupied territory reached its climax about the same time. The "Rhineland Republic" was proclaimed at Aachen on Oct. 31; at Coblenz on Oct. 25; and in other Rhineland towns at the same time. The movement then gradually decayed, and had disappeared by Feb. 11 1924, except in the Bavarian Palatinate. The official birthday of this Government was Nov. 11, and French support of it was more than usually tenacious. It finally vanished at the end of Feb. 1924.

Financial Reconstruction.—This proved to be the climax of Germany's troubles; but her internal political situation was still uncertain. The Socialists withdrew their support from the Government on account of the different treatment of the insurgents in Saxony and in Bavaria. Stresemann failed to secure a fresh vote of confidence and a new emergency powers Act, and resigned on Nov. 23. On Dec. 1, Marx formed a minority "middle-class" Government with Stresemann as Foreign Minister and Luther as Minister of Finance. The Government received a new emergency powers Act to carry through the work of stabilisation and reconstruction during a limited period. By the appointed date (Feb. 15 1924) the budget was balanced by means of these emergency decrees. The first reduced the number of officials, readjusted taxation and ordained pre-payment of taxes. The second stabilised the mark, introducing a strictly limited issue of "Rentenmarks," each equivalent to one billion paper marks, and limiting credits. The third carried through the principle of valorisation of public and private debts which had been inaugurated before the inflation period set in. At the same time the Ruhr industries reached an agreement with the M.I.C.U.M. (*Mission interalliée de contrôle des usines et des mines*) regarding deliveries in kind on reparation account which formed the transition to a new settlement of reparation obligations.

The Dawes Plan.—On Jan. 14 1924 the Committee of Experts for the examination of Germany's capacity to pay met in Paris under Gen. Dawes. Its relations with Germany were not unhappy, and it frequently consulted Schacht, the new President of the Reichsbank. A British Labour Ministry entered office on Jan. 22, and Poincaré gave way to Herriot in France in May. Germany's internal and foreign position now improved very rapidly. On Feb. 5 the British Prime Minister expressed the hope that Germany would join the League of Nations. Soon after, a German Ambassador was appointed to France, for the first time since the War. Von Kahr and Von Lossow retired on Feb. 18, and the powers of the Bavarian general commissariat came to an end. The state of siege in Saxony and Thuringia lapsed on March 1. The Dawes Plan (*see* REPARATIONS) was accepted in principle by the Governments of the Reich and of the Territories on April

14, and by the Association of Industrialists on April 24; but the new elections for the Reichstag had been fixed for May 4, and were fought almost solely on the Dawes Plan as an issue.

In view of the great distress following the sudden deflation, restriction of credit and rise of prices, the extreme parties of both wings gained votes at the elections. All the Government parties lost heavily, while the Communists secured 62 votes, the "Völkische" 32 and the German Nationals 96. Nevertheless a vote of non-confidence in the old Ministry, which had remained in office, was defeated on June 6 by 239 votes to 194 and Marx and Stresemann left for London on Aug. 4 as the representatives of Germany. The decisions of the Conference of London were initialled on Aug. 16. They provided for the restoration of Germany's fiscal and economic unity; the military evacuation of the Ruhr by Aug. 16 1925 (by separate agreement between Marx and Herriot); the issue of a banker's loan to Germany of £40,000,000; and the continuance of reparations deliveries in hand. The Dawes scheme was to come into full operation by Oct. 5.

The Government was just able to carry the acceptance of the Dawes Plan. The German Nationalists consented to allow its members to vote independently. The essential laws (the denationalisation of the state railways, the Bank law, the private Banknote law, the law liquidating the Rentenbank and the coinage law) were passed and the agreement on the Dawes Plan was ratified on Aug. 29. The laws in question came into force on Oct. 12.

The complaisancy of the Nationalists had been bought at a considerable price. They regarded their concessions purely as business arrangements, as facilitating the influx of foreign capital and reducing the danger of fresh Communist disturbances. But they were growing ever less ready to accept Germany's position as an outcast; and demanded from Stresemann a statement repudiating Germany's war guilt, as well as a place in the Ministry. A statement in accordance with the first demand was made in the Reichstag, while in the autumn Stresemann began to sound the ground regarding Germany's entry into the League of Nations. On Sept. 23 the Cabinet arrived at a decision in principle to seek the speedy entry of Germany into the League. As, however, the British and French Govts. could not give a definite answer to the memorandum which she addressed to them on Sept. 29 asking "whether the guarantees requisite for an application for membership and the status of Germany within the League, and also other definite and inseparable questions, were forthcoming," the matter was left temporarily in suspense.

The second Nationalist condition led to the dissolution of the Reichstag on Oct. 20, as it proved impossible to induce the Social Democrats and Nationalists to sit together. The general elections were held on Dec. 7. But by this time the general situation had grown much easier. The Régie railways and mines in the west, and the customs, were again in German hands. The customs barrier between occupied and unoccupied territory had vanished. The M.I.C.U.M. agreement had become void. There were general symptoms of a revival in trade. The extremists lost votes again; the Communists were reduced to 45, the "Völkische" to 14, while the Socialists rose to 131. The numerous parties of the Right Centre formed the strongest Parliamentary group. A Luther Cabinet, including four German Nationalists, held a precarious tenure in which it endeavoured to compromise between the demands of various interests. Protective tariffs for agriculture were introduced, the sales tax lowered, restrictions on deals in foreign currency for commercial purposes abolished, official salaries raised, the goods tariff and certain postal dues reduced, the tax-free limit of income raised to 60 marks a month, and old claims valorised in July 1925 by a law of the Reich. The middle-class Government of the Reich, was, however, confronted by the incessant hostility of the Prussian Govt., where the parties of the Weimar coalition were in power. Although her Parliament was a mass of small, jealous parties, Germany at large was divided into two broad groups of the Right and Left which attacked each other bitterly. Each raked up a series of scandals against the other; this unsavoury process culminated when a judge, in his summing up on a small case, stated that the President of the Reich had been guilty of high treason to the Reich by his part in directing the munitions strike in 1918. The Nation ist Press broke out into violent invective against Ebert; t whole legend of the "stab in the back" was revived. The ca paign was the more cruel that it was directed against a sick m He died after an operation on Feb. 28 1925. Few men h served their country so well.

Von Hindenburg's Presidency.—Seven parties chose to forward candidates for Ebert's vacant post, and these includ such names as Ludendorff and the Communist Thälmann. T first poll gave no candidate a sufficient majority. The Right th united to bring Hindenburg forward; the Left proposed Ma the Communists stood apart.

On April 26 Hindenburg was elected by 14,639,000 vo against 13,740,000 cast for Marx and 4,900,000 for Thälma Many Socialist votes had been withheld from Marx on accou of his Catholic tenets. Hindenburg's election aroused gre apprehension outside Germany, but in point of fact the field marshal preserved his dignity and his common sense perfectly as he had throughout the War and the revolution.

Foreign Relations.—With the balance thus held evenly tween Left and Right, the extremists discredited and the uni of the Reich established, the interest in German politics w now almost confined to foreign affairs. If little has been sa hitherto on this topic, it is because the course of events in 19 had assigned Germany an almost purely passive rôle. Of all h old friends or sympathisers, the only one which did not diso her in her defeat (if we except the small minority of die-ha generals in other defeated countries who dreamed of reversi the results of the War with fantastically inadequate mea was the little republic of Austria. The peace treaties forba the union of Germany and Austria. The decision was a bitt one for Austria, but hardly awoke equal sorrow in Germa Not only was Austria economically a heavily passive factor, the inclusion of her would have made it impossible to centra the Reich as was done by the Weimar Constitution, and t constitution would certainly have to be revised should Aust join Germany at some later date. For the rest, Allied a Associated Powers of older or more recent standing surround Germany as soon as the Armistice was signed.

With the Treaty of Versailles, which assigned the whole gu of the War to Germany, was incorporated the Covenant of League of Nations, which built up a great structure for maintenance of the peace of Europe, which Germany was invited to join. At first, indeed, she showed no anxiety to j Hostility to the League was almost universal owing to its as ciation with the Treaty of Versailles which even the advoca of the "policy of fulfilment" denounced as unjust in ma respects. The feeling was aggravated by doubts as to the imp tiality of the League's administration of the Saar basin a reached its climax when the decision of the Council of the Leag sanctioned arrangements in Upper Silesia which German opini resented violently. Nor was it confined to the Nationali Soviet Russia repudiated the League as a capitalist institut The German Communists followed the lead of Moscow, a the Socialists saw far more hope in a revival of the Internatio

After the first passions had cooled, Germany began to d tinguish between the various territorial provisions of the Trea of Versailles. The cessions to Denmark and Czechoslovak aroused little resentment; those to Belgium were small. T justice of the loss of parts of Alsace-Lorraine was not grea disputed. The three most important questions remained th of the Rhineland, of the frontier with Poland and of the Germ colonies.

The problem of Germany's western frontier differed fr others, both by its urgent economic importance and by the fa that Germany could claim that here she was only defending h rights within the treaty. She contended that the occupation the Ruhr was illegal, but so long as the threat of it, or its act ality, was not removed, it was impossible for her to initiate active policy; it was equally unthinkable for either party th Germany and France could meet as colleagues within the Cou cil of the League of Nations.

Thus up to 1924 Germany's foreign policy was almost entirely ensive. A number of minor treaties and agreements, mainly commercial character, were concluded; the most important ng the Treaty of Arbitration with Switzerland (Dec. 3 1921). t the only treaty of outstanding importance was that con- ded with Russia on April 16 1922. The text of this Treaty of pallo (*q.v.*) was not in itself such as to justify the protests h which it was greeted. These were rather due to the fear at the treaty contained secret clauses of a political nature, d especially clauses aimed against the integrity of Poland. e existence of such clauses was denied and, in fact, no polit- l developments could be traced as arising out of the treaty ring 1923 or 1924. It was a tactical error in so far as it increased ance's and Poland's nervous instinct; it certainly looked as ough Germany was drawing her conclusions from the Treaty Versailles with too much logic in associating herself with the cond Great Power which remained by mutual consent outside e European concert. Germany, however, claimed that she d no quarrel with Russia.

With the advent to power of M. Herriot in France in 1924 e situation changed. Moderate opinion in Germany was will- g to accept the permanent loss of Alsace-Lorraine in return r security on the demilitarised western frontiers. If Ger- any could become a member of the Council of the League, ere was some hope that readjustments on her eastern frontier ight prove possible at some future date, and this position ould also give her a chance of acquiring some day a colonial andate. The general improvement of relations between ance and Germany made their collaboration within the ague possible, while Germany was rapidly freeing herself om the restrictions imposed on her national sovereignty. sudden shock was given to the improving relations by the port of the Commission of Control on June 29, that Germany d not yet fulfilled the disarmament conditions, and that the logne zone could consequently not be evacuated in Jan. 1925. uring the year, however, the commission finished its work d the Cologne zone was evacuated on Jan. 31 1926. In July 25 the troops had been withdrawn from the Ruhr, and in g. from the districts occupied in 1921. The question of ving Germany her proper place in Europe now became gent.

The Pact of Locarno.—On March 4 1925 was published resemann's offer of a guarantee pact in respect of Germany's ntiers with France and Belgium and an undertaking to frain from military means of revision of her Polish frontier. his policy occupied the attention of Europe throughout 1925, d was finally embodied in the Pact of Locarno, after discus- ons between the European diplomats which lasted from Oct. 16. At Locarno Germany concluded a number of treaties hich practically guaranteed peace between her and her neigh- ours (*see* LOCARNO; SECURITY). The Pact was to come into fect on Germany's admission as a member of the Council of e League of Nations.

Stresemann's policy was not easily accepted in Germany. he widespread distrust of the League could not vanish in a y. The Nationalists objected violently to the permanent nunciation of Alsace and Lorraine involved in the Pact. But ey had not gained in strength so much as they had hoped ring 1925; in particular, Hindenburg's sensible attitude had eply disappointed them. The Pact was ratified on Nov. 27 25 and duly signed in London on Dec. 1. Luther's Cabinet en resigned, but after a prolonged crisis Luther formed a esh minority Cabinet of the Centre on Jan. 19 1926. The Social- ts promised him their support on condition that he pursued a publican policy and carried out the terms of Locarno. The ationalists opened a violent campaign against him, while feeling tween Right and Left was further embittered by revelations garding the naval mutiny of 1918.

It was the more disastrous that, when Germany's application r admission came before the League of Nations in March 1926, razil vetoed her admission unless she herself were also given seat on the Council. Speaking in the Reichstag, on March 22, Stresemann declared that Germany had received "moral rehabilitation" in Geneva, and that the policy of Locarno must not be allowed to lapse. Most of the German parties agreed to support him. The Nationalist spokesman found it easy to revile the League and Germany's attempts at reconciliation.

The Russo-German Treaty, April 24 1926.—Considerable excitement was aroused shortly after, when it was announced that Germany and Russia were again in negotiation for a treaty. This new treaty was signed in Berlin on April 24 1926 and published, together with an exchange of notes between the signatories (Stresemann and Krestinsky) on April 26. The basis of relations between Germany and Russia was stated to be the Treaty of Rapallo. The two Governments promised to remain in friendly touch with one another. Article 2 ran "Should one of the contracting parties in despite of its peaceful attitude be attacked by a third party or by several third parties the other contracting party will observe neutrality during the entire duration of the conflict." By Article 3 each party promised not to participate in any "economic or financial boycott" imposed on the other in times of war or peace. The treaty was to be valid for five years.

The third paragraph of the note for which Stresemann was responsible declared explicitly that "this fundamental attitude of German policy towards the U.S.S.R. cannot be adversely influenced by the loyal observation of the obligations (arising out of Articles 16 and 17 of the Covenant of the League and relating to the application of sanctions) which would come into existence for Germany as the consequence of her entry into the League of Nations," as such sanctions could only come into force if Russia were the aggressor, in Germany's own view, the views of other Powers not being binding on her. Whether Germany would take part in the application of sanctions at all, and to what extent, depended on the interpretation of the note of Dec. 1 1925 on the interpretation of Article 16 addressed to the German Govt. on the signature of the treaty complex of Locarno (the gist of this note being that no state could be held to undertakings manifestly beyond its powers). Germany maintained that this treaty was a necessary and proper adaptation of the situation under the Treaty of Rapallo to that created by the Pact of Locarno. Opinion in France and Czechoslovakia was inclined to question this view.[1]

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(C. A. M.)

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[1] On May 5 the Luther Cabinet decided that a flag bearing the imperial colours, black, white and red, should be flown over the legations and missions of Germany, alongside with the black, red and gold of the Republic. The Democrats, dissatisfied with the attitude of Luther on this question, carried a motion against him on May 12 by 176 votes to 46. Herr Luther thereupon resigned, and Herr Marx succeeded him as Chancellor.

A serious difference of opinion arose over the proposal to confiscate the property of the former ruling houses, including the Hohenzollerns. Their large properties should, it was suggested, be devoted to benefiting the unemployed, war widows and other necessitous classes, while their castles and palaces should be used for welfare and educational purposes. The measure, which was opposed by President Hindenburg, was submitted to a referendum which took place on June 20. The total vote polled was 15,026,312, of which 14,441,590 were cast for confiscation, and 584,722 against. As, however, the constitution provides that more than one-half of the total votes—at that time 39,690,559—are necessary for success, the proposal failed. (ED. *E. B.*)

General Survey

The chronicler must not aspire to be a prophet. He may, however, reach a point from which he can survey the crowd of personalities and events grouped about him. How fares the Germany of 1925 in comparison with the Germany of 1910?

No such comparison can apply to economic life, since the inroads of the War have been too formidable and the consequences of the false economic policy which accompanied it could only gradually be surmounted. But it may be asserted that Germany has made a relatively rapid recovery from the unsound experiment of forming "vertical" trusts (liquidation of the Stinnes concern in Aug. 1925), and is striving by an energetic concentration of the operations of cognate industries to simplify the official organisation, to effect economies and to strengthen every enterprise included in the combine in its own capacity for output.[1] It is also a good sign that the influence of the most inventive and generally beneficent industry, the chemical industry, particularly the dyes branch (medicines, tropical therapeutics), has increased in industry as a whole.

Education and Justice.—As regards popular education, the arts and science, comparison is easier. For in these realms, where the War and revolution—which even in Germany party-life have strictly speaking only resulted in a change of nomenclature, produced a stagnation, a species of stupor, lasting indeed for years—development has been resumed at the point at which it broke off in 1914. One evil omen for the state is that popular confidence in the law has been shattered (in some cases through no fault of the judges) because during the period of inflation procedure in civil cases became farcical. There are others. The control of industry, which took the place of competition, benefited no one but the profiteers. In political trials the impartiality ofthe judges was often doubtful; in other trials, owing to the introduction of special courts, erroneous verdicts were laid to the charge of the law itself; young people only 14 or 15 years old, with unformed opinions, become members of contending political associations which do not subsist by their own strength but upon the funds of the adult party organisations. Finally, despite the diminished consumption of alcohol, popular amusements have become less harmless and "sociable." This is due in the great towns to the "revues," and in the medium-sized and smaller towns to the cinematograph, which before the most diverse audiences produces the same pieces and films, thereby destroying a healthy individual attitude towards art and recreation.

The relations between the German citizen and the state remain the same. He continues to regard himself as something distinct from the collective body. Just as during childhood he sees an enemy in the school and the teacher, so as a grown man he regards the State and the Government as an adversary rather than as something in which he himself bears a part and for which he is responsible. If "fiscal" morality is no worse, it is equally no better. The great problem of the schools has, moreover, not yet been solved, although attempts have been made in the Constitution itself and in a law of the Reich. It is sought to establish standard schools (Einheitsschule) providing an uniform education for the children of all classes up to the age of 10, and to give more instruction in German at the expense of the ancient tongues. But the problem of clerical influence in the school is still unsolved, and the process of converting purely scientific teaching into moral training for the young has been barely begun. The "movement of youth," which in the years before the War was making very great strides and led its members to the adoption of a simpler, more natural mode of life, to a greater readiness to help others, and, in many cases too, to a greater love of home, has split up into numerous sects. It has been ruined or impeded by the nee for earning a livelihood at an early age by work in the towns

In many respects, however, improvement is manifest. Afte the complete ruin of all means of communication in the las year of the War, order and punctuality have been restored withi the services with astonishing rapidity. The credit for this belongs to a great extent to the minister for transport, Groene The system of communications, so important an index for th modern state, is once more as efficient as before the War, an zealous efforts are being made to improve it. The police fee that they are there not so much to command as to render hel to the public. Many old officers serve the state honourably a members of the force. The great mass of the official class ha remained intact, and performs as much or more work for a salar which commands a purchasing power only equal to about hal that of pre-War salaries.

The Arts.—Parallel with the progress made in the chemica industry, in products demanding accuracy of workmanship an in the construction of machinery, taste and the sense of for have undergone a universal improvement. Photography an its application to open-air subjects produce excellent films Applied art, in which, however, German Austria holds the firs place, besides producing masterpieces in the luxury trades an in the form of efficient advertisements, has once more called genuine popular art into existence. Moreover, although in itsel unimportant it is of excellent omen that Germany to-day possesses not only toys but also children's picture-books (E. Kreidolf, Else Wenz, Wanda Ebel, Elsa Eisgruber) such as no othe country has. Since the death of Max Reger, Germany has n longer any composer to carry on the tale of her greatest creativ minds. The musical tradition is, however, kept alive by distinguished conductors and performers.

Germany has found a new and more serious rendering of musi than she possessed at the beginning of the century. In literatur the books that are read are of more significance than those tha are written. Side by side with Dostoievsky and the Scandinavians, the early German Romantics, Hölderlin and Novalis, are most read, but also Jean Paul, the object of enthusiastic admiration by the young. The writings alike of Goethe and Heine, treating of political and social topics, continue to exercise a powerful influence. The great national poet of German Switzerland, Jeremias Gotthelf, whom Ruskin admired, has been revived; and while young dramatists—Unruh, Toller, Brecht, Bronnen—in part powerfully influenced by Wedekind, espouse an exuberant "activism," Thomas Mann, taking up Theodore Fontane's subtle and genuinely realistic portrayal of North German society, has become, particularly by his last novel of contemporary life, *Der Zauberberg*, the undisputed master of prose narrative. The principal characters in this book, even if to some extent endowed with foreign traits, embody the whole of intellectual Germany in the same sense in which the spirit of English society lived and moved in the greatest novels of George Meredith. The clearest indication, however, of a turn for the better in Germany is given by town-planning and architecture. Even the terrible material stress of the War and post-War period has been unable to hold this in check. Examples may be found in Schumacher's town-planning scheme for Cologne, the railway station by Bonatz at Stuttgart and the Chile House in Hamburg.

(A. M.-B.)

IV. GERMANY'S NAVAL POLICY[2]

It has been frequently asserted that the creation of the German Navy was the main cause of the World War. Such an assertion implies not only that it was admittedly constructed on the right lines from a technical point of view—for no one would plunge into war for the sake of a negligible quantity—but also the admission that Germany's sea power was to be forcibly kept down. From the German standpoint a firm protest must be entered inst the view that as a political factor the German Navy con- uted a menace to foreign interests which could apparently be oved only by warlike methods.

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[1] *E.g.*, the amalgamations effected since Feb. 1925: association of locomotive builders, of steelworks, of spirituous industries, the syndicate of Ruhr coal and mid-German brown-coal industries, of dealers in tubing, of wire-rolling mills, of dye industries, of aerial and shipping communications. In the autumn of 1925 an agreement was reached between the amalgamated German and the Belgian wire industries regulating the conditions of export on lines similar to the earlier Franco-German agreement respecting potash (*see* CARTELS).

[2] Admiral von Scheer's article is full of disputable propositions, but is published unchanged in accordance with the principle of the Thirteenth Edition of *The Encyclopædia Britannica*—to allow each nation to state its own case through recognized spokesmen.—Ed. *E.B.*

The tendency which emerges from the German naval laws, as ried into effect, is that of aiming only at the preservation of tifiable self-interests without encroaching too much on the ritime interests of other nations. "Defence is one of the most pressive and visible expressions of the State's will to independ- e." This pronouncement was made in 1922 by the Bundes- of Switzerland, a country which can in no wise be accused of rishing schemes for attacking its neighbours.

The preservation of independence is the predominant principle tate for civilised nations to whom the conception of liberty is ir very life element, and Germany cannot be reproached for lertaking the construction of a navy proportionate to her nomic requirements. For impotence at sea is an intolerable idition of weakness for a seafaring people, let their land ence be what it will. So much was made plain by the German- nish war of 1848–9, when Prussia, with ten times more inhabit s than Denmark, was forced to yield for lack of a fleet to se the Danish blockade of the Baltic ports, the economic losses tained by her sea-trade being greater than the advantages ob- nable by a land war against Denmark. It was with a view to djusting the situation that the Prussian Navy came into exist- ce. Founded in 1853, it passed in 1867 into the possession of North German federation, established after the separation of Habsburg dual monarchy from Germany.

This perfectly natural aspiration to escape from the German all state powerlessness and form a national state such as other ples (England and France) had long since secured for them- ves, had its origin in the progressive tendency of the age. The at state-making forces which gripped Europe in the beginning the 19th century after the Napoleonic wars of conquest were direct consequence of the overthrow, with British aid, of the ench domination of that continent.

Although Germany's expectations of securing State unity by y of reward for her share in the war of liberation were, for the e being, dashed by the ruling of the Vienna Congress of 1815, ambition, once aroused, left her no peace until she had se- ed the establishment of the Reich after the war of 1870–1 inst France, who stood in the way of a united German state. th the reannexation at the peace treaty of Alsace-Lorraine, Imperial provinces seized by Louis XIV., the German Em- e became—in Bismarck's words—saturated. Territorial ex- nsion in Europe was no part of the programme. Its efforts re directed towards keeping the peace in Europe so that its full ength might be devoted to building up the Reich. The produc- e capacity of the concentrated and greatly enlarged economic ea represented by the Reich grew to considerable importance voured by the progress of technical methods. International nmerce provided goods in bulk, in particular raw material an enormously expanding industry, and foodstuffs for the pidly increasing populations of the civilised states. Some of ese were utterly unable to supply the needs of life from their n resources, for example England, and also Germany, whose pulation of over 40,000,000 had risen within a few decades to er 60 millions.

The former large migration of Germany's surplus population overseas had now ceased. The German colonies by reason of eir inadequate development and geographical situation were suited to absorb any numbers worth considering. The growing lustrialisation of the country, on the other hand, offered new ssibilities of livelihood to the increasing population. As early the 'eighties, the annual emigration figures fell from 200,000 one-tenth of that figure. At the same time Germany's depend- ce on other countries increased, as may be seen from the trade urns. The relations of the new state structure with foreign ntries brought about the naval foundation-plan of 1873, ich aimed at creating a sea power of the second rank within the ce of 10 years. It was not until the close of the 19th century t the possibility of grave conflicts with other European Pow- arising out of trade competition became a serious factor.

England, with a technical equipment decades in advance of the German and a predominant position in world commerce, could watch the new competitor the more coolly, in that the opening up of the world offered so many new sources of trade that she alone could never control them. In addition, her established commercial connections, large mercantile marine and colossal colonial possessions placed her in so favourable a position that the development of new trading enterprise could not but be welcome. Germany became almost her best customer, and English exports to that country always exceeded in value the imports therefrom, to which, by her free trade principles, she opposed no obstacle prejudicial to mutual relations.

Now while the great territorial Powers, with their armies pretty evenly balanced, at a time when those armies count millions of men not lightly to be unleashed, it becomes more important to be able to throw the power of a big fleet into the scales. For the personnel needed is small, the country will not be directly plunged into suffering and the population is able to go about its daily task almost unheeding, while the silent pressure of sea power can exercise a definite influence. It was on these grounds that England's influential position in the European concert was founded.

Her rôle emerged the more clearly after two definite groups of powers had been formed in Europe, which, while approximately well balanced, persisted in a state of intent hostility. It therefore became necessary to keep England from throwing her weight against Germany. The construction of the German fleet was a political move against this possibility in that it would prevent a shifting of the European balance to the detriment of the Central Powers.

After the carrying out of the naval programme of 1873 the German Navy had, between 1883 and 1897, fallen completely behind and become obsolete. This stagnation set in with the appointment of General Caprivi to the admiralty. Under his rule coast defence filled the picture. Obsolete ironclads were not replaced because no one had any clear views on naval tactics. The same uncertainty prevailed in other navies continually experimenting to find the best type of battleship. This state of things was brought to an end by the English Admiralty with the Naval Defence Act of 1889.

In Germany, too, it was realised that a coast defence consisting of fortifications and torpedo boats was but an incomplete form of armament, useless for any far-ranging operations at sea. From the time of Kaiser Wilhelm II.'s accession (1888), efforts to modernise the fleet were made, though with small success. Four battleships of the "Brandenburg" class with 10,000 tons displacement were authorised by the Reichstag in 1890, but after that construction again came to a standstill. In spite, however, of the bad quality and insufficiency of building material during those years, the time was well spent in the navy, for definite tactical and strategical conclusions were reached as to the manner of using a fleet.

On these conclusions was based the first navy law introduced after Admiral Tirpitz's appointment as Secretary of State for the Imperial Navy in 1897. This committed the Government as to the number of ships and the Reichstag to the necessary expenditure. The programme was to be spread over six years at an expenditure of 409,000,000 marks (about £21,000,000 sterling). England had thus an advantage of almost 10 years, and was building onto an existing fleet, whereas Germany lacked a working basis.

According to the new scheme the number of ships demanded was based upon their tactical division into two squadrons, each containing eight battleships (16), in addition to which there were to be a fleet flag ship and two reserve battleships, making in all 19 battleships. Besides, 12 large and 30 small cruisers, to serve as scouts for the home battle fleet and for service abroad, were asked for. A navy law in this sense was passed in 1898. The preamble declared that "as opposed to the greater naval powers the battle fleet will have importance solely in sorties." This was evident, both from the limitation in the number of vessels and from the circumstance that 12 of the old battleships were to be included in the figure to be reached in the course of six years.

The conflict of battleships now came to the fore as the strategic task of the fleet. This alone, according to the teaching of naval history, was the means by which command of the sea could be maintained. The limitation of the said control to Germany's home waters, the Baltic and the North Sea, was imposed by the relative strength of the German Navy to other navies. For a time, it is true, Germany was influenced by the young French school, which set forth the destruction of the enemy's sea-trade as the main task of a navy, but the principles were not only never applied but in the end definitely rejected in favour of the decision to build a battle fleet.

Adherence to this decision was the principle underlying the further upbuilding of the German Fleet, a measure that could no longer be delayed in face of the developments in foreign politics at the turn of the century. England's attitude towards Germany had become definitely hostile. The Franco-Russian alliance was obviously directed against Germany, and the clash between France and England over the Fashoda incident was smoothed out of existence by England's vigorous action. The pressure exercised by England through her Fleet on this occasion might well be regarded as a hint of what Germany might expect one day, especially as her interests at sea were definitely on the up-grade owing to the increase in trade. A comparison of the figures showing the rate of this increase for the two countries affords convincing proof of the possibility of peaceful parallel development.

The total foreign trade returns (export and import) amounted in millions of marks (20·4 M.=£1) to:—

	1890	1900	1910	1912	1913
Great Britain	15,300	17,900	24,733	27,409·5	28,632·5
Germany	8,195	11,089	17,615	21,256·6	22,546·6

The increase over 20 years from 1890 to 1910 was thus 9,433 million marks for England and 9,420 for Germany. But the increase in England's population from 38,000,000 to 46,000,000 during the same period was only half that of Germany's, which rose from 50,000,000 to 66,000,000. In proportion to the population, the increase in England's trade returns was therefore twice that of Germany's.

The total foreign trade returns of the more important countries were as follows:—

	Milliard marks
In 1890 roughly	73
In 1900 roughly	92
In 1910 roughly	147
In 1912 roughly	169

Between 1890 and 1910 an increase of 100% is shown. Increase of population over the same period in England=20%. As these 20% achieved a trade increase of 62% there could hardly be any serious question of Germany's crowding out England.

In Germany, the growing volume of trade was more and more sea-borne trade; the maritime proportion became 70% of the whole. In view of this development Germany had necessarily to think of the better protection of her sea connections. Accordin after taking the first step (in 1897) of modernising her out date fleet, she took (in 1899) the second step of doubling battleship squadrons from two to four on the basis of the decla tion: "Germany must possess a battle fleet so strong that with it would involve even the mightiest naval power in peril such a kind as to jeopardise its own supremacy." Those who sist in regarding this extended naval programme and its basis a proof of hostility to English supremacy at sea have misund stood the development of Germany's economic position a ignored the change which had taken place in the internatio political situation.

At the time of the great colonial wars of the 17th and 1 centuries, England had to deal with only *one* sea-trade rival a time—Spain, Holland or France.[1] The commercial centre gravity in the course of centuries had been shifted by Englan historic interventions from Cadiz, Lisbon and Amsterdam to L don. But London was no longer all-important. New Yo Antwerp and Hamburg were centres also. The trend of circu stances was towards the establishment of a sort of internatio balance of power. A struggle between England and one of h commercial rivals for the possession of the world's mark would no doubt have ended in her favour, thanks to the ov whelming superiority of British sea power; but the remaini competitors for the world's trade would have taken advantage England in her inevitable exhaustion after victory to aim blo at her commerce which even she would have difficulty in repellin

No one will deny that Great Britain, with her divisions empire scattered all over the globe, with her leading position international trade, with her dependence upon oversea commu cations arising from her insular situation and extensive industri and finally with her strong hold on international commerce, h the right and the duty of maintaining a fleet considerably larg and more powerful than those of other nations. This suprema is ungrudgingly allowed her. But should it lead to the preve tion of free commercial competition, all the other nations inte ested in international commerce would presumably unite safeguard themselves. This is the idea which found expression the German navy law; in adopting it Germany only followed t example of other states.

The table below shows the battleships of over 10,000 to and armoured cruisers of over 5,000 tons, not more than 20 yea old, possessed by various countries in 1900.

1900	Germany		England		United States		France		Japan	
	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement
Battleships	7	73,300	40	543,800	9	110,550	17	105,920	5	71,030
Armoured cruisers	1	10,690	10	75,580	2	19,270	5	35,910	3	29,720
Total	8	83,990	50	619,380	11	129,820	22	141,830	8	100,750

In 1910 the comparative strengths are shown by the following figures:—

1910	Germany		England		United States		France		Japan	
	No.	Displacement	No.	Displacement	No.	Displacement	No.	Displacement.	No.	Displacement
Battleships	28	360,990	56	859,990	29	451,320	16	207,430	12	174,630
Armoured cruisers	9	95,590	38	475,880	15	208,980	17	172,320	12	125,000
Total	37	456,580	94	1,335,870	44	660,300	33	379,750	24	299,630

With the respective strengths of the fleets thus distribute England had no need to fear that she would be ousted from h position; but it was necessary for Germany to protect hers against the eventuality of England's weight being thrown on th side of the group opposing the Central European Powers. Th England would supposedly risk little or nothing in so doing indicated in Churchill's slogan "Business as usual"[2] at th ning of the War; whether or not he was mistaken those in nd can best judge.

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[1] In the 18th century and just after England usually had to figh France and Spain together, and had always to reckon with th probability of their combination.—Ed. *E.B.*

[2] This phrase was not Mr. Churchill's.—Ed. *E.B.*

e long duration of the War and the unexpected capacity for ance displayed by the Central Powers affected the tech- of the War, on sea as on land, to an extent that could not been foreseen. Submarines, flying and the use of gas are nd terrible phenomena of great possibilities, still in their cy. In future, technical power in these respects must play at a part that insular security will be a thing of the past. uestion whether a true insight into such changes in the con- s of power and security might have suggested a less light- ed view of the consequences of the War is not for discussion; neither can we discuss the possible results of a different e of English policy. None the less, one is tempted to imag- e reply of the Delphic Oracle if consulted by British states- efore entering into the War: “ If you cross the North Sea ill destroy a great empire ”—not the German empire only meant.

e growth of the fleet by no means represented merely mili- ivalry at sea; rather ought that development to be regarded insurance premium for the great increase in trade interests g the same period, and as one aspect of a general forward ment in all countries chiefly concerned in international erce. The increase in Germany's naval establishment was bly the most steady and uniform, for the plan laid down in was strictly adhered to and no surprises were sprung upon ther sea powers. No essential alteration was made in the ard of strength which, up till 1917, was aimed at, viz.: a of two double squadrons and 20 first-class cruisers (58 capi- ips). It was also Germany's policy to refrain from such vements in the ship types as would initiate a process of ing. On the contrary, England was invariably allowed dence in this respect, although Germany was obliged to guard st any inferiority in her material, especially after 1905 the new type of super-battleship was ushered in by the ng of the “ Dreadnought.” This event had the effect of rating the fixed rate of German construction (in 1900 we ight ships; in 1910, 37, representing an increase of some 30 in 10 years), from three capital ships a year at the outset to per year between 1908 and 1911, in order that, after the of the new building phase, Germany should not lag too far d. That England, annoyed by her mistake, should vent her mour on Germany is only another example of the common ncy to make others responsible. To reach the standard set 917 (58 capital ships against England's 94 in 1910) it was sary to lay down three ships yearly, the statutory life of a being fixed at 20 years.

e scheme by which the German Fleet was to be brought up e required standard by 1917, providing for the gradual elim- on of obsolete units, was known to all the world. On economic ds alone, and also because the lines of construction had the first been on a small scale, all over-haste was avoided. atest addition to the navy law in 1912 provided for an addi- of not more than three ships to the nominal strength. Its aim was to place the navy in a better state of readiness, an which the threatening political situation of 1911 appeared to y. It is not to be denied that it was disagreeable to Eng- s supremacy to watch the growth across the North Sea of a naval power, whose strength she by no means underesti- d. Whether the suppression of this navy has repaid Eng- for her active participation in the World War, when she he alternative of *not* placing the mighty power of her own at the disposal of Germany's enemies on land, thereby in obability preserving peace, must remain an open question. as Germany has fallen, she can still look back with pride on ct that the glorious British Fleet did not beat the German open fight at sea.

e very regrettable enmity which exists between two racially nations who, during centuries of history, have been found y side, but never as embittered enemies, will, it is hoped, e softened when an unprejudiced appreciation of the cir- tances governing Germany's struggle for sea power has been shown; when time and a recognition of the common interest of these “ two white nations ”[1] have done their work.

(C. Ho.)

V. DEFENCE

The constitution of the armed forces of Germany has not been determined by the nation itself; on the contrary, its size, organisation and armament are fixed by the provisions of the Versailles Treaty.[2]

Army.—The enlistment must be voluntary, not on the basis of compulsory service. The recruit must bind himself to serve for 12 years or—if he wishes to become an officer—for 25 years. The strength of the army allowed is as follows: 3,797 officers, 20,297 N.C.O.'s, 74,499 privates, 1,407 administrative officers; in addition there are 300 medical and 200 veterinary staff. Of these (including N.C.O.'s) 51,506 are infantry, 15,767 cavalry, 10,644 artillery, 2,838 pioneers, 2,079 signalling troops, 5,572 communication troops and 2,800 medical service. The army is divided into seven Infantry and three Cav. Div., which are formed into two group commands.

Territorial Divisions.—Germany is divided into military regions, in each of which one infantry division is stationed. The seven regions are as follows:—

Region I. embraces the countries east of the Vistula (headquarters: Königsberg).

Region II. includes Pomerania, Mecklenburg, Schleswig-Holstein (headquarters: Stettin).

Region III. includes Brandenburg and Silesia (headquarters: Berlin).

Region IV. includes the country and the province of Saxony (headquarters: Dresden).

Region V. includes Thuringia, Hesse-Nassau, Hesse, Württemberg, Baden (headquarters: Stuttgart).

Region VI. includes Hanover and Westphalia (headquarters: Münster).

Region VII. includes Bavaria (headquarters: Munich).

The cavalry regiments are distributed over the whole Reich. The headquarters of the I. Cav. Div. is at Frankfurt-on-Oder, that of the II. Cav. Div. at Breslau, and that of the III. at Weimar.

Each divisional staff includes an infantry commander and an artillery commander. The pioneer battalions are under the infantry commander and the transport under the artillery commander.

Army Units.—There are 63 battalions with 189 infantry companies, 63 machine-gun companies and 21 trench mortar companies; 79 squadrons, of which 72 belong to cavalry divisions and 7 to infantry divisions; 72 batteries, of which 9 go to form the horse artillery brigades of the cavalry divisions; 14 pioneer companies; 14 signalling companies; 28 horse transport squadrons; 21 motor transport companies, and 7 divisional medical detachments. The infantry is armed with the 1898 rifle. It also carries 1,134 light and 756 heavy machine-guns, and 126 light and 42 medium trench mortars. The artillery is armed with 204 field-guns (7·7 cm.) and 84 light field howitzers (10·5 cm.). In addition, the fortress of Königsberg in East Prussia has 22 pieces of heavier calibre. Heavy artillery, tanks and aircraft are non-existent.

Administration.—The Minister of Defence is the highest authority for command and administration. At its head is a political minister, who is assisted in matters of military technique by the *Chef der Heeresleitung*, who, according to the Defence law, is a general and the superior of all soldiers. For training officer candidates there are one infantry, one cavalry, one artillery and one pioneer school. Enlistment is managed by the smallest units (company, squadron, battery). The proviso that soldiers may not leave the army until after 12 years' service is a great obstacle to maintaining the full strength. The Versailles Treaty directs that only 5% shall receive their discharge before the appointed time in any one year, and in practice this percentage hardly covers the discharges for sickness, incompetence and undesirability. An appeal for premature discharge can therefore only be granted in the rarest cases. This naturally deters many young men from joining, as they are alarmed at the idea of being forced to remain 12 years in the army whether promoted to the higher ranks or not.

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[1] “ The two white nations ” was the toast whispered in the ear of the captain of the “ Breslau ” by the English admiral when dining on board his vessel, together with other commanders of all nationalities, off the coast of Albania in June 1913. (See Preface, *Kiel and Jutland*, Commander Georg von Hase, London,—*Author's note.*

[2] Part V. *Military, Naval and Air Clauses Articles 159–211.*

Recruiting and Training.—Recruiting is, in fact, influenced by the economic conditions of the moment; under present conditions (1926) recruiting is adequate. Recruits first spend six months at the depôts, one of which is provided for each regiment. Only after this half-year's training are they admitted to their companies, etc. Cadets receive at least four years' training before becoming lieutenants; of these, two years at least are spent with the troops and at least two in schools for the different arms. Anyone who has passed the prescribed cadet examination can become an officer. Soldiers who hold a school-leaving certificate can enter for this examination at the end of $1\frac{1}{4}$ years, others at the end of $3\frac{1}{4}$ years; that is to say, after they have acquired the necessary knowledge for passing a preliminary examination. Every cadet is promoted to officer's rank, irrespective of his origin and purely on the merits of his service, knowledge and his abilities.

The men are trained during their period of service for the calling which they intend to follow on discharge. They are assured of a post in the public service at the conclusion of their 12 years unless they prefer an independent career. In every unit some of the soldiers are elected by their comrades as proxies for economic affairs. A soldier takes no part in politics, but is allowed to join economic and non-political societies. The Defence law provides power, however, to forbid his association with such societies should they be subversive of military discipline and order in the army. For the protection of army interests there is an Army Chamber, which is elected by direct voting and is summoned from time to time by the Minister for Defence. Members of the army are under civil law, and only in case of war may courts-martial be appointed.

In view of the historical development of Germany and her army the Defence law takes specially into consideration the interests of the several states, and too rigorous an application of the centralising principle is not allowed to disturb the territorial constitution of the regiment. Regiments are required to draw their recruits from the inhabitants in the neighbourhood of their stations. Bavaria is allowed a special influence in respect of appointments to commands in the VII. Infantry Div., which is stationed entirely in Bavaria. The supreme authority is, however, vested only in the President of the Reich, who nominates, removes, promotes and releases both officers and administrative officials of the army.

On leaving the army the men receive—according to the Defence Forces Pensions law of Aug. 4 1921—a gratuity on which to live until they find other employment and, further, a civil service certificate which entitles them to apply for an official post in the imperial, state or municipal services. In addition, they receive outfit expenses and, on request, government security to assist them in settling on the land. Officers receive retired pay, which may also be commuted as a lump sum.

The Defence Problem.—The Versailles Treaty declares the aim of the German Army to be the preservation of order in the interior and the "control of the frontiers." In the first of these tasks the German Army has until now been successful; the attacks made by the Right and Left Radical parties on the Government at the time of the financial and economic crash of 1923 were defeated and greater disturbances nipped in the bud. The second task is not easy to carry out with the German Army of 100,000 men. Germany's frontiers are 5,000 km. long, exclusive of coastline; one province is cut off by the so-called Polish Corridor; on the west, the country on the bank left of the Rhine and a stretch of 50 km. east of that river may not be entered by German troops—and it is in this unprotected zone that the West German industrial district lies. Beyond Germany's frontiers lie, on the west, the French Army, with a war strength of some 5,000,000 and the allied Belgian Army, with a war strength of about 800,000; on the east the ring is closed by the Czech Army (war strength, 1,000,000) and the Polish Army, with a war strength of 2,000,000 men. All these armies are provided with excellent modern equipment, and are uniformly trained on the French model. The German frontiers are exposed, and have no protection from natural barriers. In the west, fortresses no longer exist, those in the east are out-of-date and without arma
The eastern frontier is only 170 km. from Berlin. The G
Army has no possibilities of expansion, since all preparatio
mobilisation are forbidden by the terms of the Versailles T
Germany's military inferiority must therefore become g
after the outbreak of hostilities, for the losses could not be
good as fast as they occurred, owing to the absence of any
organisation, and could in the case of a prolonged war h
be made good at all; for the German Empire would sp
become the theatre of war and any possible sources from
reserves might be drawn would accordingly be blocked.

Navy.—By the terms of the Versailles Treaty, the Ge
Fleet was allowed to retain 6 battleships not exceeding
tons, 6 light cruisers not exceeding 6,000 tons, 12 destroye
exceeding 800 tons and 12 torpedo-boats not exceeding 200
Battleships may be replaced 20 years after being lau
destroyers and torpedo-boats after 15 years. The mate
now very much out of date; the battleships were launch
1902–6 and the cruisers in 1899–1903. One light cruis
replacement was laid down in 1920 and finished in 1925. In
the first replacement destroyer was authorised, and in 192
second replacement cruiser and 5 replacement destroyers.
total personnel of the navy numbers 15,000 men. The co
of the navy is vested in the Ministry of Defence (Reichs
ministerium). Under it are placed (1) The Fleet Comma
Wilhelmshaven, with the "Braunschweig" as fleet flag
the commander of the fleet also commands the battleship
sion, and has under him both the commander of the Nort
naval forces at Wilhelmshaven (battleships: "Braunschw
"Hannover"; cruisers: "Amazone," "Emden" and the
torpedo-boat flotilla) and the commander of the Baltic
forces at Kiel (battleships: "Elsass," "Hessen"; cruis
"Nymphe"; surveying-ship "Panther"; 1st torpedo
flotilla and 1st mine-sweeper half-flotilla); (2) the naval sta
in the Baltic and the North Sea; (3) the inspection of traini
Kiel with the naval schools at Flensburg-Mürwik for tra
the supply of naval executive officers and quartermasters,
at Kiel-Wik for training technical and non-commissioned of
and also the training ships "Berlin" and "Hamburg" (crui
and the "Niobe" (sailing-ship); (4) the inspection of the tor
and mines department at Kiel; (5) the inspection of the
artillery at Wilhelmshaven, with the coast defence arti
school (Wilhelmshaven) and the naval gunnery school at
Wik; (6) the inspection of the naval depôts at Wilhelmsha
Technical institutes are the naval dockyard at Wilhelmsh
and the naval arsenal at Kiel. Thus Germany has now at
disposal only the navy of a small Power.

Air.—Article 198 of the Treaty of Versailles prohibited
many from maintaining any military or naval air forces.
inter-Allied aeronautical commission of control, paid by
German Govt. on Reparations account, took charge of th
struction of German aircraft, parts and apparatus. This
mission was disbanded on May 5 1922. As civil aviatio
allowed to Germany, an agreement was reached with the
man Govt. by which certain technical points were enumer
as qualifying aeroplanes for use in warfare, and the posse
of aircraft possessing these characteristics was forbidden
new inter-Allied aeronautical committee of guarantee
established by agreement with the German Govt. (May 1 1
It is paid by the Governments concerned, has branches in Be
France and Great Britain, receives lists of all German works
in which flying material is manufactured, of machines an
pilots and sees that the provisions of the agreement are
infringed. (K. von C

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VI. NATIONAL FINANCE

Financial Situation before the War.—The central problem
German Finance since 1871 had always been the difficult

ting the limits of the respective powers of taxation of the
and the states (the "Länder" of the Constitution of Aug.
9). The financial policy of Bismarck had solved that
m, not formally but in actual practice, by allotting to the
l Govt. the customs and excise duties, and to the states
wer of direct taxation, which were also the main sources
me of local and municipal government. The income of
rman Empire from indirect taxation was never adequate;
re Bismarck made the Reich "a boarder of the states."
tter had to make good the deficiency by contributions
kularbeiträge). Before the World War, this system failed
n 1913, when the requirements of pre-War armaments
itated a larger revenue for the Reich, and the great defence
oution (*Reichswehrbeitrag*) of that year for the first time
he Reich unprecedented powers in the field of direct taxa-
One milliard of gold marks was raised by a non-recurring
n all property.

rt from this distinction of federal and state income by the
of their respective sources, there was a further significant
stance in the pre-War financial situation. While the
administered the postal service except in a few states, the
ys belonged to the states; thus Prussia had a revenue of
20,000,000 to 240,000,000 marks annually from the rail-
amounting to from one-third to one-quarter of the total
e of the state from taxation and state-owned property.
venue of the Reich derived about 70,000,000 marks annu-
om the postal service, and every year a large amount of
t revenue of the state undertakings was reinvested. With
to the railways, the real actual annual excess of revenue
xpenditure for the whole of the German systems immedi-
before the War was estimated at not far below a milliard
.

total revenue of the Reich, the states and the municipal
ations from taxation amounted to about 4½ milliards of
in 1913. The total public expenditure was considerably
, since the states and municipalities also drew considerable
e from state and municipal land property, from water, gas,
city, etc., works. Of the revenue from taxation about
fths went to the Imperial Govt., which, in 1913, failed to
e the budget, and had to carry over a deficit of more than
illions. This deficit would have been covered in normal
either by the states or probably by a loan. The total
t of the indebtedness of the Government of the Reich at
ginning of the War was about 4,900,000,000 marks. Thus,
eich entered the War with a financial system which com-
unfavourably with the high degree of economic develop-
of the country at large.

War Period.—No wonder that the strain of War expendi-
roke down the whole system. The optimism, common to
e belligerents, based on the idea that "the others would
" stimulated the policy of war loans and therefore of some
ion. The latter, tripling the amount of pre-War mark
supply, did not exceed the similar procedure in most of the
erent nations. By the end of the War, the debt of the Reich
een swollen by 150 milliards of new debts, of which about
alf had been funded; the other half was floating debt in the
of Treasury bills, which after the peace, could only be met
due by printing new mark notes. The revolutionary period
19-20 favoured inflation, and the facts indeed made it
imes even a necessity, the purchasing power of the mark
one of the expedients for the restoration and maintenance
blic order under enormously difficult conditions. The
ements of demobilisation, the occupation payments and
merous kinds of tribute demanded by the Allies added to
ancial difficulties of the Reich.

Erzberger Reforms.—Nevertheless, the whole system of
e was in 1919–20 remodelled by Minister Erzberger, whose
remains the basis of the present financial system. While
ederal constitution of 1919 weakened the power of the
dual "Länder" and strengthened the Federal Govt., the
financial reform of 1920 fundamentally changed the finan-
ystem of Germany, applying the new constitutional principle of unitarism in the field of taxation. Practically the Länder (Territories) became now the "boarders" of the Reich, the exact opposite of the pre-War position.

The first intention of the German republican government was to increase income and property taxes as much as possible. But after a short interval in 1920 inflation was renewed, as heavy reparation payments due under the London ultimatum spoiled any chance of balancing the budget. The bases of the German budget, in addition to the customs duties, which immediately after the War gave very low results, were: the income tax, and, especially, the taxation of wages and the turnover tax. The turnover tax began at the rate of ½%, and was raised steadily until it reached 2½% on any sale made in Germany, and in the occupied territories in 1923 even 3½%. This tax proved to be an enormous burden on consumption, since any commodity on the average changes hands four times in Germany before reaching the consumer. But under a policy of inflation any such burden, heavy at the moment when it fell due, became light at the time of payment, because in the meantime inflation had depressed the purchasing power of money and especially of delayed taxes.

For a time certain taxes based upon the difference of the purchasing power which was high in Germany and lower abroad gave considerable revenues; *e.g.*, the coal tax, which was reckoned at 40% on the price of coal, and from 1920 onwards the newly created export tax which yielded in the most difficult times nearly one-sixth of all state revenues. Both were obviously only transitory in character, the difference between the interior purchasing power of a currency and its value in foreign markets being large during that slow development of a depreciation of currency; if the depreciation becomes rapid, internal prices tend to rise to a gold basis and the gap disappears. The difficulties of German finance were aggravated in the most unhappy manner by the first attempts to finance reparation payments (*see* the other sections of this article on CURRENCY and on ECONOMIC HISTORY). But far more important than the purely financial process of stabilisation was the energy of the Finance Minister, Dr. Luther, who stabilised the budget by strict refusal to pay anything else in other way than by raising taxes. The "miracle of the Rentenmark" is more due to this obstinate determination than to any technical means of stabilisation. Thus Germany entered on her new period of financial and economic life with a very severe taxation.

The mark was stabilised in Nov.–Dec. 1923, and in the beginning of Dec. 1923 the Finance Minister issued two tax decrees, introducing the gold basis for all tax payments and reorganising the whole system of direct taxation. The sales tax was placed on a 2½% basis; income tax was to be paid by all business people on the basis of their turnover, and the tax-free minimum for wage-earners was fixed at 50 marks (£2 10s.) per month. The customs and liquor taxes were completed by a property tax and about a dozen taxes of minor importance. The bulk of the income of the Reich for 1924–5, *e.g.*, about 70% of all, was covered by wages taxes, turnover taxes, customs and indirect taxation of articles of mass consumption. It was a very crude system of taxation which was thus established, though the coal tax necessarily had disappeared with the vanishing difference between interior and world market prices. But it served its purpose. Revenue and expenditure were balanced, and in 1924–5 an unexpected excess of revenue over expenditure became visible. When the Dawes Plan was finally adopted (Sept. 1924) the financial situation of Germany was reasonably sound. The plan brought about two important changes. The railways, which had been forced by the Minister of Finance in 1924 to balance their accounts, were handed over to the Reich's railway company and burdened with a yearly payment for interest and sinking fund of about 660 millions of gold marks for reparations. The customs duties and most of the indirect taxes were to serve as a guarantee for the regular fulfilment of its obligations by the Reich.

Readjustment of 1924.—From Nov. 1924 a period of tax reductions began. Especially the limit of exemption from income tax was raised, and the sales tax rate was lowered, in addition to minor tax reductions. In spite of the reductions, the financial year 1924–5 closed with a large surplus of about two milliards of gold marks (£100,000,000). In July 1925, accordingly, the whole system of taxation was again revised. Income tax rates were lowered, and are now on a progressive scale ranging from 10 to 40%. The tax-free minimum of wage-earners was raised first to 80 marks per month in addition to certain family allowances, then, from Jan. 1926 to 100 marks (£5). The sales tax rate was lowered to 1 % on Oct. 1, and in March 1926 to 0·75 %. The so-called luxury tax almost disappeared. At the same time consumption taxes on tobacco and beer were raised.

Simultaneously the financial relationship between the Reich and the Länder (Territories) was ordered anew. The Territories receive a fixed amount of the revenue from the income tax and the sales tax, at least 2,300 millions. The most important taxes levied by themselves are the land and rent taxes; this latter tax is practically the only important remainder of a far-reaching price control system established during the War. Rents are fixed by the state Governments; about 50 % of the rent goes to the owner of the house, while the states raise the remainder as rental tax; the total receipts are shared between the local authorities for these expenses under this head and the provision of capital for the building of new houses, which is still largely carried out with the help of subsidies financed by the rental tax.

The system of taxation of the Reich draws its most important resources from the income tax (2,200,000,000 marks), the sales tax (1,300,000,000 marks), the customs duties and consumption taxes (1,700,000,000 marks), amounting to about four-fifths of the total tax revenue of the Reich and to about one-half of the total of taxes paid by the German nation.

It is much more difficult to give accurate data with regard to expenditure. The most important change is the reduction of expenditure for the army and navy, which is, however, more than balanced by war pensions and the payments under the peace treaty amounting at present to about 600,000,000 marks annually, but ascending to 1,650 millions in the year 1926–7. The payments to be effected in the "normal year" of the Dawes Plan (*e.g.*, 1928–9) should be covered in the following way:—

	Gold marks
Railways debentures interest and sinking fund	660,000,000
Interest and sinking fund of debentures of industrial and commercial enterprises given to the reparation commission	300,000,000
Budget	1,540,000,000
Total	2,500,000,000

The total expenditure of the Reich, the Territories and the local authorities for 1926–7 is summed up in the following approximate figures:—

	Gold marks
Expenditure of the Reich	4,000,000,000
Reparation payments	1,000,000,000
Expenditure of the Territories:—	
(a) derived from the Reich	2,250,000,000
(b) raised by themselves	1,000,000,000
	8,250,000,000
Local authorities	3,000,000,000
Total	11,250,000,000

In the normal year of the Dawes Plan, *e.g.*, after Oct. 1928, this burden will be about 1,500,000,000 marks higher. Very probably additional expenditure will be incurred on account of unemployment. (J. H.*)

VII. ECONOMIC HISTORY

The dominating note of Germany's economic development before the War was the growth of industrialism. Her population had increased rapidly. It had grown since the foundation of the Empire from 41 millions to 67·8 millions in 1914. The density per sq. m. had increased from 196.6 to 333.1. Emigration had fallen from about 142,000 in 1880–5 to scarcely 26,000 in 1913; Germany had even become a country of immigrants. Apart from the seasonal labourers who went there regularly mostly from Russia and Austria, returning at Christmas, there was a foreign resident population in 1910 of almost 1·3 millions. In 1882 42·5 % of the people had been engaged in agriculture; this percentage had fallen to 27·1 in 1907. The growth of industrialism was accompanied by urbanisation. In 1910 over one third of the German people lived in cities above 20,000, nearly a quarter in cities over 100,000, and the drift to the towns was renewed after the War.

Industrialisation.—Industrialisation had become possible by the growing economic expansion of the world, in which Germany participated through her foreign trade. Her own but recently acquired colonies did not count for much in the actual gr
Though developing at great speed they were rather a reser
the future than a present source of wealth. Notwithsta
tariffs, the growing development of North and South Am
of the African countries and of the Far East, brought abo
the great efflux of men, the export of capital and the applic
of the methods of capitalistic organisation to backward
tries, enlarged the markets of the world.

Germany's import trade, which had averaged 19 million
1880–5, had risen to 72½ million tons in 1908–13, whils
exports had grown from 20·8 to 64·9 million tons. Her pr
was mainly due to the application of scientific discover
industrial purposes, to a very carefully planned out syst
industrial and commercial organisation and to the intelli
and adaptability of the German working men. Her comm
policy favouring trusts and combines in industry facili
exports at the cost of the home consumers who, having t
under a system of agricultural protection as well, would
fared badly if the general development of the world ha
lowered the cost of living all round in comparison with days
by, though after the beginning of the new century an up
tendency in the movement of prices was visible.

The Post-War Crisis

Treaty of Versailles.—The Treaty of Versailles caused
reaching disintegration of Germany's economic life. She
10 % of her population, but over 13 % of her territory in Eu
Large agricultural areas were cut off in the east; in the
important industries like the iron industry were deprived of
raw material. The 1913 home supply of iron ore had amou
to 35 million tons; it had fallen to 5·1 million tons in 1923,
for the great importance of scrap iron in after-War days,
many would have been almost totally dependent on ore im
from abroad. A large part of the metallurgical industry dom
in Lorraine and Upper Silesia was lost (26·7 % of the blast fur
and 15·8 % of the rolling mills), also the important textile i
try (5,866 works) mostly in Upper Alsace were lost. Ge
owners were forcibly expropriated in the ceded territories;
had to be compensated by the German Government. The
principle of confiscation of private property was applied to
man-owned bonds and shares and to German-owned ships,
total proceeds of these confiscations to the Allies have
valued at 6 milliards gold marks, whilst the actual loss
Germany have been figured at about 30 milliards. The
established relations between the producers of raw materia
the manufacturers of finished goods were cut asunder, espe
in Lorraine and in Upper Silesia. The German industri
whose property had been confiscated were bound to use
money they received as compensation in rebuilding new
in Germany. They owned the coal needed for running
whilst their French competitors had to rely on reparation
delivered to them under the Treaty of Versailles from the
of the same rivals, whose works they had bought cheaply.
productive capacity of the iron and the steel industry o
European continent was thus artificially expanded at a
when markets were contracting. The exchange of iron and
ceased to be a natural process, and became part of interna
high politics.

The Allied Powers at Versailles assumed that Germany
quickly rebuild her economic life, as little physical destru
had taken place within her boundaries. To even up their
chances, Germany was to be handicapped. She was bou
grant the Allies most-favoured nation treatment for five
she had to admit during that period the produce of the
territories, especially of Alsace-Lorraine and of Poland duty
in such quantities as she had drawn from them formerly,
herself was denied the most-favoured nation treatment, an
nationals were excluded or subject to severe discrimination
was not allowed a moratorium. Though the total sum o
obligations was not settled owing to the inability of the
to agree amongst themselves, she had to pay within two
a milliard sterling.

he had to hand over a considerable part of her implements duction (ships, mines, cables, etc.) and most of her foreign ments, her future capacity to make payments abroad was d by the excess of exports over her imports as shown by lance of trade. Not knowing her total liabilities Germany o inducement to pay the first instalment as quickly as le; her capacity to do so would have resulted in an increased n two years later, when the definite settlement had to lace.

cts of the War.—German economics were permanently nced by the War. The cutting off of supplies, the loss of ts, the scarcity of labour due to the demands of the army, he wear and tear to which the industrial plant had been ted had forced a system of control on Germany which ore severe than that existing in other belligerent countries. and many raw materials was rationed, and the production ny industrial commodities was supervised by centralised rities. In a country traditionally run by a bureaucratic chy who considered themselves the born rulers of men, s eager for new activities, and where democracy was y represented by socialists, imbued with the idea of state ention in business affairs, that situation was bound to ce lasting effects. Though generally speaking the control nomics during the War was not oversuccessful the idea of socialism appeared to be greatly strengthened.

e collapse of the old régime seemed to clear the way for its t. But the internecine struggle between the small bolshelement, who wanted to follow the Russian example and ass of the organised working men who wanted to bring socialism in a peaceful orderly way, occupied the revolury Government which ruled Germany from Nov. 1918 to 1919. They succeeded in defeating Bolshevism and in g Germany (and with it Western Europe) from its ravages. were very eager for "nationalisation," at least for the isation of monopolistic industries. Two commissions were nted to inquire into this problem, especially into the nationion of mines. They issued some very interesting reports ould not agree upon a practical policy.

e Coalition Govt. which came into power early in 1919 ot very keen on nationalisation. They realised that it was enough to take over a smoothly running concern and man- by Government officials; but it was extremely difficult to anise a broken-down plant. The more energetic part of orking class demanded nationalisation without compensathey wanted syndicalised industries rather than Govern--run concerns. In these circumstances very little was done. the object of paying-lip service to the principle of nationaln and to the council schemes lately imported from Russia, nal councils for coal mining and potash mining were set up, e masters and men, producers and consumers, were allowed , to talk and to vote, without being in a position to wrench ol from the owners. The Weimar Constitution provides he creation of a Central Economic Council (Reichswirttsrat), provincial economic councils and works councils for idual concerns. These latter were to send two of their bers into the board of the company so as to give the workers al control of the business—a provision the only effect of h has been to deprive most boards of directors of their er influence, which was concentrated in the hands of some emely uncommunicative executive officers working hand in with a few big shareholders.

me kind of socialistic tradition survived however. Food s were controlled for quite a considerable time. Rents even are still being fixed; in the days of inflation they amounted ext to nothing when calculated in gold. The entire houseng class was despoiled. Wages were lowered *pro tanto*, as did not enter into them, and the cost of production was ced. In many cases foreign consumers of German exports thus given the rent taken from the German house-owner.

e failure of socialism to bring about the nationalisation of opolistic concerns and its success in despoiling the middle and in irritating the farmers redounded to the advantage of industrial capitalism. Socialists had not dared to take over the broken down industries; industrial owners were quite willing to reconstruct them. They had to make concessions to the working class. They had accepted the eight-hour working day, collective bargaining, greatly improved wages for unskilled labour, the temporary abolition of piece work and the works councils. They did not mind this as long as they could keep the control of prices to themselves. Treaty clauses for delivering coal had put the execution of important peace terms into their hands; they had acquired a place on the international stage. With the continuation of inflation they seemed to wax rich, whilst the state got weaker and poorer. They embarked on a policy of industrial aggregation; whilst formerly there had been a tendency to horizontal trusts, they now aimed at vertical combines to create self-sufficing enterprises, where raw materials, semi-manufactured and manufactured goods were in the same hand.

As time went on economic power became separated from political power. A Coalition Govt. of Socialists, Democrats and Centrists ruled the state. They were held responsible for the humiliations inflicted on Germany, whilst the real power, the economic power, was in the hands of the industrialists and the slowly recovering landed interest, impeded but little by organised labour. As inflation progressed labour became less and less powerful, and when the infuriated middle class turned away from the coalition parties, the weight of political power was turned into the same direction into which economic power had gone before. The state was broken; big business seemed to rule.

Depreciation of the Mark.—From the summer of 1919 to the end of 1923 German economic life was mainly dominated by the depreciation of the mark. The dollar had risen from par (4·2 marks), to about 14 marks after the signing of the Peace in the summer of 1919. It went up continuously until it bought 100 marks by the end of Feb. 1920. After that it fell to 40 in May. Owing to the loan contracted at Spa it remained between 50–70 until early in 1921. The beginning of the Reparations payment under the London plan (May 1921) forced the mark down to 80 by the end of July. It stood at 100 late in September. Its downward movement was greatly accelerated in Oct. of that year, when the news of the partial loss of Upper Silesia became known. Before the Genoa conference the mark hovered round 300 to the dollar, to go down considerably after its failure, its downward course gathering speed after the murder of Rathenau (June 24 1922). The demand for a moratorium and the abortive conferences about it brought it down to 4,000 in Oct. and 8,000 in Nov., where it remained through the rest of the autumn of 1922. On the day after the occupation of the Ruhr (Jan. 11 1923), it quickly fell to 30,000, reaching 49,000 on Jan. 31. At that time the Reichsbank intervened, bringing down the dollar to 20,000 and keeping it there until April 18. But the dislocation of economic life and the great strain on the finances caused by the struggle of the Ruhr forced the Government to use the printing press at a formerly unheard of rate. The stabilised mark collapsed. By the end of Aug. the dollar had risen to 10·3 millions. And when currency reform was under way, just before the issue of the new Rentenmark, the price of the dollar was practically settled at 2·5 billion marks. No depreciation on such a scale had ever been known, save in Russia.

The primary cause of the decline of the mark was faulty Government finance. At the end of the War the funded debt was estimated at 103 milliards gold marks. Current expenditure had been met by treasury bills, which the Reichsbank was allowed to discount and to use as cover for its notes. From time to time the outstanding Treasury Bills were converted into a funded loan, nine different issues of which were placed amongst the public, bringing in a total of 98·5 milliards.

The War was followed by a revolution. Demobilisation had to be carried out under very difficult conditions. The revenue went down almost to nothing. So most of the expenditure had to be met by Treasury Bills. The Reichsbank became the chief support of the Government, issuing notes against such Treasury Bills as were not taken up by the public. Retrenchment was impossible. When armed insurrection is threatening the foundations of the State, extravagance may be wise and saving may be foolish.

As soon as the worst danger was over, financial reform was undertaken. But the chances for its success were small. The organised working class who were the main support of the Government and on whose co-operation the maintenance of order depended were rather disillusioned. There was a great deal of privation all over Germany. The millennium which they had dreamed of had not come. They had not succeeded in wrenching the control of capital from the capitalistic classes. The least they could do to meet their supporters was to claim for them an enlarged share of the nation's income by way of increased wages. The revolution, it has been said, degenerated into a struggle for higher wages, short working hours, and overemployment in works and Government departments, so as to avoid dismissals. This meant increased Government expenditure, which could not be met by taxation of the working class. In a country where prices are rising rapidly and where there is an actual scarcity of commodities indirect taxation cannot be resorted to by a Government mainly dependent on the masses, the support of which is by no means certain. Taxation was bound to fall on the propertied classes.

As long as the socialistic movement was in the ascendant—even at the election of 1919 socialists failed to get a majority—the capitalist classes, including the landed interest kept quiet. They did not openly fight against taxation. But they naturally tried to save as much as they could. Notwithstanding all sorts of severe regulations a great deal of movable property left Germany in the revolutionary days 1918–9. The so-called " flight of capital " started—a movement quite legitimate in early days, when violent confiscation seemed imminent. Later on it developed into an effort to save property from the severe taxation involved in the financial reform proposed by Erzberger.

The Erzberger Reforms.—In Feb. 1919 a Coalition Govt. had been formed by the Majority Socialists, the Centre party and the Democrats. Differences of opinion about signing the treaty of Versailles led to the withdrawal of the Democratic party. The Majority Socialists and the Centre, who counted 253 in a house of 423 formed a new Government. And Erzberger, who up to now had been Minister without portfolio became Chancellor of the Exchequer. Being dependent on the Socialist vote and having been all his life the representative of a small, rather anti-capitalistic group in the Centre party, his scheme of taxation was bound to weigh heavily on the propertied classes. He introduced a capital levy originally devised to wipe out the deadweight debt and a thorough going taxation of War profits, which nearly wiped them out. He clearly saw that the Treaty of Versailles, which put a crushing burden on the Reich, necessitated the creation of a central Exchequer to which the individual States must be made subservient. All through German history the states have jealously guarded their rights of financial sovereignty. Even Prince Bismarck in the hey-day of his power had not been strong enough to make the central Treasury independent of their control. Erzberger made the Reich the dominant partner in finance. He deprived the states of the main sources of taxation, such as the income tax. He organised an imperial service for their collection and their administration, superseding the old state services. He amalgamated the railways, which hitherto had been the property of the individual states, into the imperial railways. Under the shadow of the Treaty of Versailles he succeeded where Prince Bismarck had failed.

Though part of this legislation was watered down while passing through parliament, it would have weighed heavily on the propertied classes, if the taxes had been paid immediately in stable money, with no interval for the further depreciation of money. But this was plainly impossible, as the new imperial inland revenue service could not start immediately. If properties were valued in marks at a time when the value of the mark was fairly high, and if taxes assessed on this value were paid at a later time when values were low, the burden of taxation could be easily shifted. At the same time the burden of the government debt would decrease automatically.

Reparations.—As the Treaty of Peace had not fixed Ger
total obligations before May 1921, the Budget did no
tain proper estimates for reparation payments. This w
merely a grave technical hindrance to reform, it put a pre
on financial procrastination. For it was clear that a c
whose finances were sound and solid would be charged
heavier indemnity than a country on the verge of bankr
Balancing a budget after a long spell of inflation is always
cult and very unpopular undertaking. If by balancing it
the total obligations are likely to be increased in the inte
hostile foreign creditors, the impetus to reform will be
weakened. And the same holds good of the taxpaying m
the individual taxpayer. What good is it, he was bound to
himself, to strain every nerve so as to enable the exchequ
square all its liabilities, if by doing so I am merely throwin
new indefinite liabilities?

The London Ultimatum (May 6 1921) enormously stre
ened this attitude. The total demands on Germany amoun
132 milliards of gold marks; the yearly payments might easil
to eight milliards, or twice the German exports and about d
the total revenue of the Empire before the War. The outlo
financial reform became hopeless. Inflation proceeded, an
business world began to realise that the public's loss mig
their private gain. They began to look upon the further d
ciation of the mark as upon a fateful destiny and, being una
able, as quite a legitimate means for getting rid of their de

The Budget.—Some courageous efforts to balance the b
were made nevertheless. A plan of either valorising the ta
revaluing the amount of taxes payable on the day on which
fell due was discussed in 1921. But as it was unwisely
" taxation of real values " and imbued with a certain am
of socialistic acerbity it could not be carried. It was transfo
much later into a forced loan, levied from all property o
but in such a stupid way that the owners could take u
loan in paper marks at a time when it cost next to not
When the loan was passed in July 1922 the owner of a pro
worth 100,000 gold marks, had to subscribe 1%, which a
then rate would have come to about 150,000 paper mark
he did not pay in time he was subject to a fine. But if he di
the fine and settled at the end of the year he had reduce
liability from 1,000 gold marks to 90 gold marks.

So the issue of Treasury Bills against which notes were pri
remained the chief prop of Government finance. As time we
and as the public became more sceptical the proportio
the bills taken up by the Reichsbank and those taken u
the public changed considerably. In Jan. 1921 the bank
50.6 milliards and the public 104·9; in Oct. 1922 the figures
reversed: the bank held 477.2 milliards and the public
Moreover, political events continually upset the balancing o
budget. The equilibrium established at the rate of 300 mar
the dollar, would immediately be upset if, in consequenc
some political action, the mark went down and prices wen

There was no immediate parallel movement between
amount of notes issued and the depreciation of the mark,
there was a very distinct connection between political events
the fall of the exchange. The loss of Upper Silesia, the acts o
Reparation Commission, the murder of Rathenau, the occupa
of the Ruhr, the speeches of Poincaré are the outstanding
at which the mark took a headlong downward flight. Each
political crisis brought about a huge demand for foreign excha
in Germany. As the German business world had to get raw
terials, or the means to pay for raw materials, or the chance
keeping part of their stock intact, they had to buy foreign
change, whilst foreign purchasers of marks got frightened
sold out at any price. Notwithstanding stringent regulations
ital fled from Germany in many forms.

In the autumn of 1922 the situation had become almost h
less. The German Government had been asking for a mora
rium. The Reparation Commission might have been willing
grant it, but the French Government proved recalcitrant.
conference of neutral experts was called to Berlin to consider
possibilities of stabilising the mark. It agreed with a small gr

man economists that the mark could be stabilised provi-
y with the gold of the Reichsbank, and that an effort in
rection might be made the basis for a reasonable repara-
ttlement. Public opinion, however, greatly influenced by
ss interests, considered a previous agreement on repara-
conditional to stabilisation. Nothing could be done; the
ance for bold action was missed.

pation of the Ruhr.—A few months later the Ruhr was
ed. The mark immediately responded by falling to 49,000
to the dollar. A tardy stabilisation effort was made in
hich succeeded for about eight weeks. But the Gov-
nt expenditure for the support of the people in the Ruhr.
works had come to a complete standstill, was enormous,
end of July the total note issue had reached 43·6 billions
t two billions at the end of Jan., the amount of Treasury
utstanding 57·8 billions, whilst private bills discounted
Bank had risen to 18·7 billion marks. Selling bills to the
had become a very profitable business. Debts were con-
d in marks when the dollar was 30,000 and paid back three
s afterwards when it had risen to 1,100,000; even a bank
18% was of no avail. By the end of May the bank's gold
ad fallen from one milliard to 758 millions; on Dec. 1923 it
own to 467 million marks.

he summer of 1923 social disorganisation had become im-
t. The farmers refused to sell goods against depreciating
; the big industrial works revised and paid wages bi-weekly,
ng from a kind of dollar basis. But if the money received
ot spent before the new quotations from New York had
d the shops its purchasing power might be halved. Whilst
untry was drowned in a flood of paper money a scarcity in
notes was frequent, for the printing press could not keep
vith the rise of prices.

a long time wages had been below the level of the world
t, as home prices had been rising more slowly than prices
d. It was expected that this advantage in the cost of pro-
n would enable Germany to produce more cheaply than
countries and to flood the world market. Nothing of the
ook place. For 1922 German export reached 6·2 milliard
narks and for 1923 5·4 milliard gold marks, against 10·2
rd in 1913. Though the accuracy of these figures may well
ubted in some respects, there is no evidence whatsoever to
e a flooding of foreign markets, the total weight of German
ts having dwindled from 74 million tons in 1913 to 22 mil-
ons in 1922. As foreign trade was controlled by all sorts of
fficial syndicates, exports were often restricted with the
of keeping the home customer quiet. And as German ex-
depended on imported raw materials, the scope for expan-
f industrial exports was small indeed, as imports were im-
by the fall of the mark. The fear of further depreciation
ed the German exporters to keep part of their revenues
d rather than return them to Germany. The McKenna
valued German assets outside Germany at about seven mil-
gold marks. Such people as were unable to invest their sav-
a foreign country bought dollar or pound notes; and though
rdinary citizen was forbidden by law to purchase these
they circulated quite freely though, of course, clandestinely,
er Germany.

e Rentenmark.—At midsummer 1923 the mark as medium
culation was doomed. An emergency currency such as
certificates" was suggested. To stave off the crisis, whilst
ncy discussion went on, taxation was put on a gold basis;
e first time for many years the landed interest had to bear
are. The plan of the reformers of Oct. 1922 to stabilise first
o settle the reparation business later on was taken up by its
dam opponents. But the obstacles to reform had grown
nously. The Reichsbank, which had not been willing to risk
ld in 1922 when there was a fair chance of success, had
n away half of its holdings in the hopeless endeavour to
the course of the mark at a time when the printing of
s proceeded at fantastical speed. A foreign loan, to ensure
ss, could not be had; a home loan, it was supposed, was out
e question.

A plan for the issue of a new money, to be guaranteed by mortgage bonds, inscribed on real estate, was broached. These notes—they were later called the Rentenmark—were to be secured by interest-bearing bonds; they could automatically be converted into them. The interest was to be a first charge on real estate. The total issue of the new money was to be limited to 4·2 millards, 2·3 of which were to be lent to the Government; the rest to private concerns. The plan which was to provide the Government with funds to carry on the struggle in the Ruhr would have failed lamentably if the Stresemann Govt. had not had the courage to stop the fight, thus doing away with the main cause for unlimited expenditure. It cut down the total issue to 3·2 milliards, and greatly modified the whole scheme. The Government succeeded, against all expectations, in floating a gold loan, which gave it a breathing space; it was echeloned in such small points that it could be used as stable currency during the period of transition. When Luther became chancellor of the exchequer the new currency, the Rentenmark, was issued, and the work of stabilisation began. It succeeded completely.

The cessation of passive resistance in the Ruhr was followed by the ruthless cutting down of expenditure, especially of salaries in Government offices, at a rate probably never heard of before in a civilised country. This brought about the equilibrium of the budget, the gold loan and the loan from the Rentenmark issue bridging over the temporary gap. The new president of the Reichsbank, Dr. Schacht, restricted the bank's credit facilities, thus cutting off business from their accustomed supply of cheap money. They had to rely on their own savings which they had invested in foreign exchange. These hoards played the part of a foreign loan usually contracted for stabilisation purposes. They constituted the foreign currency fund on which the bank could draw for maintaining the mark exchange. German business needing cash had to sell foreign exchange, against which the bank issued its notes, which thus became gold exchange covered. The flight from the mark, which originally had destroyed the German currency, later on provided Germany with the means of stabilising it. After the first quarter of 1924 the foundations for monetary reform had been safely laid. And on this basis negotiations for a reasonable settlement of the reparation problem were started which ended in the acceptance of the Dawes Plan.

The Dawes Plan.—As her economic life was at a low ebb, Germany could not be made liable for a lump sum anywhere within reach of French expectations. The experts had to fix Germany's obligations in such a way as not to sap her energy by incertitude, and at the same time give the Allies a chance of participation in her growing wealth in case she made a quick recovery. To do this Germany's obligations were, so to speak, divided in two halves; the one was to consist of 11 milliard gold mark bonds secured on the German Govt. railways and of five milliards bonds registered as obligations on German industrial property. At a rate of 5% interest and 1% sinking fund these bonds yielded 960 million marks a year, which were to come from the proceeds of the mortgaged properties. These 960 million constituted the minimum annuity to which Germany was liable. If these bonds could be sold at par their total value would be 16 milliard gold marks; the value of two milliard gold marks preference shares of the German railways might be added. This capital sum of nominally 18 milliard gold marks would be paid off within 37 to 38 years by means of a sinking fund of 1%.

The other half was an annuity not yet capitalised, the proceeds of the railway tax and of customs and excise yielding about 1,250 million gold marks a year. The administration of these revenues has to be supervised. An additional surplus was to be paid, in case Germany's capacity to pay increased, which was to be deducted from a carefully constructed index. If the contrary movement took place and if its transfer abroad affected the exchange unfavourably these revenues were to accumulate up to five milliard marks. When this figure was reached payments from these sources would be stopped, until an improved economic situation could permit the resumption of payments abroad. A transitional régime, including a kind of a diluted moratorium, was to be in force from 1924–7 when the yearly payments were to be 1,000, 1,200, 1,220, 1,750 million gold marks, part of them to be defrayed from loans or from sales of railway shares.

The first result of the Dawes Plan was the flotation of a German loan of 800 million marks in the financial centres of the world, which enabled Germany to pay most of the reparation payments of the first year and to put the Reichsbank on a sound basis. Reorganisation was to furnish amongst other things the mechanism for the gradual disappearance of the Rentenmark.

THE COUNTRY'S RECOVERY

After inflation Germany was an empty shell. The middle class, the owners of mortgages, of state, municipal and industrial bonds were practically ruined; so were the house-owners who had received scarcely any rent. A tardy restoration was enforced by public opinion 1924–5: private debentures, especially mortgages, were to be valorised at 25% of their original value, the payment to be postponed until 1932. The owners of public securities were to receive but scanty compensation, owing to the prior lien of reparation claims. The loss of the creditors has not benefited the debtors. States and municipalities were, no doubt, relieved of their burdens, but the ruin of well-to-do tax-payers was a very heavy burden to them.

Agriculture.—As far as agriculture is concerned, no fundamental changes have taken place. The big estates have not been split up, though under the different closer settlement schemes 7,300 new holdings have been created in Prussia. Big entails (Fideikommiss) have been broken up. But until lately land has not come into the market in great quantities. It is only now, when an agrarian crisis is setting in, that estates, especially big estates, can be had for a song. Whilst inflation lasted agriculturists had a good time. They saved the money due on their mortgages; some of them may have relaxed their efforts and produced less; others raised their standard of living. The wiser ones—and there were many of them—spent largely on permanent improvements. The great progress in the chemical industry, especially the production of artificial nitrates, enabled them to intensify their production. With a good harvest prices were bound to fall. Working capital, especially for big owners, was rather scarce. As the rate of interest had risen considerably, the number of years' purchase to be given for an estate had considerably diminished, and the total assets capable of being mortgaged had shrunk, whilst the total interest remained the same. Moreover, mortgages were very difficult to get. So financing was done by bills of exchange, which fell due after the harvest and forced the owners to sell at low prices. The agricultural crisis imminent in the summer of 1925 was aggravated by an embargo on grain; its abolition brought prices to the level of the world market, a rise which has not been considered sufficient, inasmuch as a good world harvest depressed the general level. New corn duties of three marks per doppelzentner and a refund for exportation were clamoured for and granted; so far they have been a failure as a remedy for the crisis.

Industry.—The bonded debt of industry, from which inflation freed it, has been estimated at about five milliards of gold marks. Apart from that, the bank had granted huge credits to industrialists, which were paid back in valueless money and cost them very little. Many enterprises used these savings for purposes of expansion, thus increasing their productive capacity; though this is by no means true of all enterprises. Many works, not having been subject to competition for a long time, want modernisation badly; entire trades, like the textile trade, have greatly shrunk. The number of spindles in cotton mills fell from 11,186,000 in 1913 to 9,464,000 in 1924; the consumption of cotton from 486,000 tons to 271,000.

Changes all over the world have greatly affected the position of German industry. The production of bituminous coal is suffering from the competition of lignite, of electricity and of oil. The iron industry, quite apart from the structural changes brought about through loss of territory, has lost the armament market as well as the building market; the construction of houses is far below the pre-War output of 200,000 dwellings a year. The great use of scrap iron has diminished for the time the importance of iron ores.

Inflation greatly facilitated the concentration of industri a few hands by all sorts of combines. Shrewd business borrowed money from the banks to buy shares and plants, repaid the loans in valueless paper money. Some of the combines were mere amorphous aggregations which fell to p immediately when credit became dear. Others chose the so-c vertical combination, trying to concentrate in one hand w representing the different stages of production. This wa type which has been closely identified with the name of Sti The home market was secure, as, owing to falling excha foreign goods could not compete. Wages reckoned in gold low, trading conditions profitable.

After the mark was stabilised, it was quite clear that indu as well as agriculture was a loser. The middle class, having ruined, had no purchasing power. Wages, though consider higher than during inflation days, were below the peace l The average weekly wages of a skilled metal worker had 36·36 marks in pre-War days; they were 31·27 marks in 1924. As the cost of living index had risen to 111 (rent incluc wages represented a good deal less purchasing power than be

Foreign Trade.—Exports could not make good the defici purchasing power at home. Germany's total exports fallen to 6·5 milliard gold marks, 1923–5, against 10·2 mill gold marks in 1913, not making allowance for the rise of pr As the purchasing power of neither the home market nor foreign market equalled the productive capacity of incre plants, many works were running at half speed. And as o head cost added an increasing proportion to costs when output was small, prices needs must be comparatively h Given the small purchasing power of the home market prices were bound to lead to reduced sales, and reduced sal their turn must bring about rising costs. Adjustment was slow as for a long time there was no real free competitio Germany. Foreign competition was kept out by tariffs as as by the use of import licenses (a practice which has al disappeared by now). The sheltered home market was trolled by cartels whose policy was to give a chance of livin the most inefficient member-works. All this really mea reversal of the old German business policy, which had insiste a big turn-over and a small profit; the new policy aimed at profits and small turn-overs. As the political power in econo affairs remained in the hands of the highly organised produ of raw materials and half-finished goods who insist on high pri the general price level was driven up. By the end of 1925 cost of living index had reacted, and nominal wages were ab the pre-War level. The average for the metal workers in 1925 was 46·24 gold marks (skilled) and 31·16 gold marks (skilled). In the midst of a crisis Germany had high prices rising wages.

Most of the legal obstacles to exportation had disappeare 1925. Germany was admitted to the most favoured-nat treatment, and the licence system was on the wane. hostile tariffs and decreased international purchasing po have remained, affecting German foreign trade in a pecu way. Whilst English exports have risen from 284 marks head 1913 to 385 marks 1923, Germany's quota has fallen fr 149 gold marks to 139·6 gold marks 1925. German indus clamoured for a tariff, with the double object of fighting hos customs barriers and of enabling her to recoup herself on home market whilst exporting cheaply abroad. The tariff carried by a combination of the landed interest and the p ducers of raw materials and half-finished goods. It came i force on Oct. 1 1925.

Credit Position.—Generally speaking it has not achieved mu It may have facilitated the conclusion of minor commer treaties. But the poverty of the consumer who can either b goods or keep his money in the bank, but who is unable to both as he did in days gone by, has deprived industry of working capital, though the valuation of the plants is rather hi Capital is scarce, and rates of interest (long term) at 12% a more are even now by no means the exception. The Reichsba was bound to restrict credit, as it had to protect the currency a

STATISTICS OF GERMANY'S PRODUCTION, INDUSTRY AND TRADE

	1913[1]	1913[2]	1920[2]	1921[2]	1922[2]	1923[2]	1924[2]	1925[2]
riculture:—								
Total area under cultivation (in thousands of hectares)	34,814	29,850[3]	..	..	..	..	..	..
ea (in thousands of hectares) under:—								
Wheat	1,974	1,676	1,375	1,441	1,374	1,478	1,466	1,552
Rye	6,414	5,259	4,285	4,265	4,142	4,366	4,260	4,709
)ats	4,438	3,924	3,213	3,162	3,202	3,345	3,525	3,452
Sugar beet	569	467	326	389	417	384	394	403
Potatoes	3,412	2,802	2,422	2,647	2,721	2,727	2,761	2,809
Grass	5,992	5,361[3]	..	..	..	..	..	..
tal production (in thousands of metric tons):—								
Wheat	4,656	4,036	2,247	2,933	1,958	2,897	2,428	3,218
Rye	12,222	10,130	4,934	6,798	5,234	6,682	5,730	8,063
)ats	9,714	8,615	4,826	5,004	4,015	6,107	5,654	5,585
Sugar beet	16,919	13,986	7,935	7,980	10,790	8,696	10,267	10,326
Potatoes	54,121	44,013	27,874	26,149	40,661	32,580	36,402	41,718
vestock (000's omitted):—								
Cattle	20,994	18,474	16,806	16,791	16,316	16,691	17,326	17,183
Horses	4,558[4]	3,807[4]	3,588	3,666	3,650	..	3,855	3,915
Sheep	5,521	4,988	6,150	5,891	5,566	6,105	5,735	4,742
Pigs	25,659	22,533	14,178	15,818	14,678	17,308	16,895	16,160
dustry:—								
Production (in millions of metric tons):—								
Coal	190·1	140·8	107·5	113·9	119·2	62·3	118·8	132·7
Lignite	87·2	87·2	111·9	123·1	137·2	118·8	124·6	139·8
Steel	18·3[5]	11·8	8·4	9·9	11·2	6·3	9·3	12·2
Tonnage launched (in thousands of reg. tons)	465·2	..	..	509·1	525·8	345·1	175·1	406·4
New Capital issues (in mill. marks) (Stock Exchanges)	2,351	..	..	..	..	..	14,927	2,321
Savings bank deposits (Dec. 31) (in mill. marks)	19,689	..	..	..	..	..	600	1,612
Unemployment (total) (excluding short-time workers (Dec. 31) (000's omitted)	..	..	410	165	85[6]	1,533[6]	536	1,488
Wages. Miners (hewers per shift. Dec. (black coal) (marks)	R.M. 6·51 (average)	..	..	..	..	..	7·51	8·30
Cost of living (Dec.) (marks)	100	..	1,158	1,928	68,506	1,247 milliards	122·6	141·2[7]
Wholesale prices (in gold marks)	100	..	105·8	82·7	82·0	95·1	122·5	130·4
ade								
Railways:—								
Goods traffic carried (in millions of tons)	501·1	445·0	337·1	354·0	374·4	246·3[9]	271·3[9]	..
Waterways:—								
Goods traffic carried (in millions of tons)	99·6	..	43·3	41·6	58·8	34·3	70·9	..
Shipping clearances (in thousands of reg. tons) Arr.	34,772	..	12,545	19,169	26,488	30,860	29,692[8]	33,193[8]
Dep.	34,922	..	12,360	19,114	26,450	30,899	29,677[8]	33,516[8]
Special Trade:—								
Imports (home consumption) quantity (in thousands of tons)	72,832	..	18,842	25,663	45,868	46,685	38,647	51,982
Values (in mill. marks)	10,770	..	3,939[10]	5,732[10]	6,290[10]	6,150	9,083	12,428
Exports (Domestic produce) quantity (in thousands of tons)	73,714	..	19,838	13,804	21,650	12,740	15,841	38,325
Values (in mill. marks)	10,097	..	3,709[10]	2,991[10]	6,187[10]	6,102	6,555	8,798

The pre-War area. [2] The present area excluding the Saar. [3] Including Saar. [4] Including army horses. [5] Including Luxemburg. [6] Unupied territory. [7] According to new basis. [8] 19 ports only. [9] Returns incomplete owing to occupation of Ruhr. [10] 1913 values. All the ve figures are obtained from official German sources.

(W. Gr.)

nted to force down prices. Government increased the ngency by overtaxing the people from fear of failing in their igations under the Dawes scheme. The surplus in the Treasury either gone to States or municipalities which not always d it wisely, or lent it out directly or through the banks in her an indiscriminate way. Foreign credits have been re- ted to on a considerable scale. They have been estimated at milliard marks, which accounts of course for Germany's avourable balance of trade (imports 12·5 milliard gold marks, orts 8·8 milliards gold marks). The lending capacity of the ks is very limited. The total capital of the four big Berlin ks before the War (reserves included) amounted to 1,059 lion marks, their deposits to 2 milliards. At the end of 1925 ital and reserves have shrunk to 546 million marks and osits to 1·76 milliards. The savings bank deposits have en from 18 milliards gold marks to 2·3 milliards.

The result of this scarcity of credit, which is really due to fficiency of income, has been a crisis which is now at its height. Amorphous aggregations like those of the Barmats have long ago gone to pieces, but even vertical combines, like the Stinnes concern, had to be dissolved. And the typically German form of the horizontal combine, the cartel, which is an organisation of works producing the same class of goods with the object of getting a monopoly price high enough to keep the weakest partner going, has broken down. There is a tendency already materialised in the chemical trade, and on the way to materialisation in the steel trade, to form a real trust with its advantages of large scale production. Germany is on the way to recovery. But the transition is slow and painful. Owners are naturally unwilling to write down capital on the necessary scale, as indicated perhaps too pessimistically by the valuation of shares on the stock exchange. Bankruptcy is rampant. In Dec. 1925 commercial failures, which were as low as 30 a month in Jan. 1924, have gone up to 1,660, thus greatly surpassing the monthly average of 815 in 1913. Unemployment is spreading. Whilst during the hey-days of inflation (second half of 1922) less than 50,000 people received unemployment benefit, their number had grown to 1,485,931 at the end of Dec. 1925. Emigration is starting again, notwithstanding all sorts of obstacles; 58,714 emigrants left Germany in 1925. Fortunately, trade unionism has regained its strength. The problem lying ahead of Germany is, how can she become a country with a low level of prices and a comparatively high level of wages.

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VIII. CURRENCY.

The New Bank Amendment Act.—On Jan. 1 1911 the provisions of the Bank Amendment Act of June 1 1909 came in force. By this Act the note issue privileges of the Reichsbank were extended for a further 10 years, and the tax-free portion of the issue was again increased (from 450,000,000 marks to 550,000,000 marks; at the end of each quarter to 750,000,000 marks). The note circulation was permitted to exceed the cash reserves by those sums without the Bank having to pay the 5 % note tax. This measure was partly due to the severe economic and financial crisis of 1906–7, which had led to abnormally high official discount rates, and to the institution of a thorough inquiry into the working of the Central Bank and of the whole German banking and credit system. The committee of investigation, of which Dr. Havenstein, the president of the Reichsbank, was chairman, had recommended, firstly, that the gold holdings of the Reichsbank should be increased by a larger issue of small notes, by encouraging payments which did not involve the use of cash, and by corresponding measures in regard to foreign payments; secondly, that measures should be taken to diminish the demands for credit from the Reichsbank on the part of public and private bodies, and to strengthen the security and liquidity of the deposits in the banks. The new Bank Act gave effect to most of these recommendations. Bi-monthly balance sheets of the banks were published in the *Reichsanzeiger* from 1912 to Aug. 1914 and again from the beginning of 1925. The liquidity of the German banking and currency system was improved.

The average annual gold holdings of the Reichsbank rose from 827,600,000 marks in 1911 to 1,067,600,000 marks in 1913, the note circulation of the Bank from 1,663,600,000 marks to 1,958,200,000 marks, the gold cover from 49·7 % to 54·5 %, the holding of bills from 1,077,800,000 to 1,136,000,000 marks, and the total turnover from 377,500,000,000 to 422,300,000,000 marks.

The official discount rate was fairly high during the years immediately preceding the War owing to expanding trade and to the tension on foreign relations, the average rate for 1911 being 4·397 %, for 1912 4·946 % and for 1913 5·885 %. Credit transactions both at home and abroad were regulated by the gold standard, and fluctuations were lessened by the intervention of the Reichsbank. The supply of and demand for capital were harmoniously adjusted, and the markets for short and long term loans were adapted to varying needs by the automatic operation of interest rates. The Reichsbank acted as the bankers' bank and as the ultimate source of credit in country. The whole credit and currency system stood in the clos relation to the economic organisation of Germany and to its devel ment as a great industrial and international trading centre. Thou the balance of trade was adverse, as in other advanced indust countries, the invisible exports were sufficiently large to enabl steadily increasing volume of capital investment abroad.

The War Period.—When the World War broke out the Reichsba was faced with new tasks of unexampled magnitude. It also to over the management of the loan offices (Reichsdarlehnskass which were set up in 1914 to facilitate borrowing against goo stocks, shares, etc. It was able to meet the tremendous demands cash and loans during the mobilisation period and in the early sta of the War without any appreciable rise in its discount rate and wi out the necessity for a general moratorium. It is true that on Aug 1914 its notes were declared irredeemable in gold, and the liabil to pay note tax on excess issues was abolished. Loan office not were recognised as a cover for Reichsbank notes, and Treasury Bi with not more than three months to run were admitted for discou at the Reichsbank, and accepted as cover for the note issue. T disregard of well-established currency principles would probably have had very serious results if, as was at first assumed, the War h been of short duration.

As the Reich acquired control over an ever larger proportion of t economic system for War purposes its demands for credit beca predominant, and the requirements of private industry and co merce, which at first were very great, fell increasingly into the ba ground. The necessary sums were in the first instance made ava able by the Reichsbank in the form of Treasury Bill credits, and th converted almost completely into long-term war loans. By a su cessful collection of gold from the hands of the public, a fund w created for external purposes which proved of the greatest imp tance, both in the War and in the difficult post-War period, as means of payment for vital imports. The Reichsbank discount rat which at the outbreak of the War was raised to 6 %, was reduced the middle of Dec. 1914 to 5 % and kept at that figure till the mid of 1922. But owing to the lack of a free gold market it lost a gre part of its normal influence as a regulator of the economic syste The circulation of Reichsbank notes rose from an average 1,958,000,000 marks in 1913 to 5,409,000,000 in 1915, to 9,010,000,0 marks in 1917 and to 13,682,000,000 marks in 1918.[1] The avera gold holdings of the Reichsbank rose from 1,068,000,000 marks 1913 to 2,387,000,000 marks in 1918. The highest figure reach was 2,550,000,000 marks on Nov. 7 1918 (including gold handed ov by Russia under the Brest-Litovsk Treaty). The average gold cov of the note circulation fell from 54·5 % in 1913 to 17·5 % in 191 The value of the mark remained near to parity during the first tw years of the War, and even at the end of the War had only fallen about half its pre-War value.

Legal Changes.—The most important changes in the legal provisions affecting the Reichsbank after the War were (1) the reductio in the minimum cover for the notes, by the Act of May 9 192 (2) the authorisation of the Reichsbank to undertake forward exchange business, by the Act of Dec. 16 1919; (3) the inclusion of gol stocks held by the Reichsbank in foreign central banks as prima cover for its notes, by the Act of March 4 1922; (4) the so-call autonomy law of May 26 1922, which made the management of th Reichsbank independent of the Government of the Reich and e trusted it solely to the managing board of the Reichsbank, thoug this did not appreciably affect the policy of the Bank.

Inflation.—During the years following the World War the economic life of Germany declined, reaching its nadir in 1923. Al attempts to stabilise the falling currency were unsuccessful in vie of the various burdens imposed on Germany by the Allies. Th value of the gold mark in terms of paper marks, as measured by th exchanges on countries with the gold standard, was 2·08 paper marks in Dec. 1918, 10·8 in Dec. 1919, 17·39 in Dec. 1920, 45·72 i Dec. 1921, 1,750 at the end of 1922 and after Nov. 20 1923 a million million, Since the printing press could not keep pace with the depreciation, emergency money was issued without proper control and utter confusion ensued. The money and capital market came to a complete standstill; interest rates rose to fantastic heights; the accumulation of capital ceased. There was a feverish chase after goods and foreign securities. The finances of the state lost all basis. The last phases of this evolution suddenly became catastrophic; the mark became useless as a medium of payment, for in many cases it was no longer accepted, and had already been largely rejected by the business community as either a measure of value or a basis of calculation.

The Rentenmark.—In the chaos of inflation there appeared the beginnings of the transition to a stable currency in the form of loans with a fixed value based on gold or commodities; mortgages, credit and insurance transactions, savings bank deposits, commercial contracts, etc., being reckoned in terms of gold or some other commodity standard. Finally, the Rentenbank was created by the Order of Oct. 15 1923 and was astonishingly successful in leading the way to the stabilisation of the currency. While the convening of the wes Committee was still under discussion Germany succeeded, in cumstances of the greatest stress, in stabilising her currency un- ed, and in resuming control over her finances. The success of the ntenbank was largely due to the fact that with its help the ances of the Reich were supported until the collection of the enue in terms of the new currency, and energetic measures of nomy had enabled the budget to be balanced. The Reichsbank s able, on account of its credit policy, without legal regulation, to intain the value of the Rentenmark at the equivalence of 1 ntenmark = 1 billion paper marks = 1 gold mark, until the final rency reform was introduced.

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[1] *Cf.* the figures for the end of each year on pp. 120–1 of *Memorandum on Currency and Central Banks, 1923–4* (Geneva, 1925).

n order to support the value of the currency in the meantime, the rman Gold Discount Bank was created (April 1924) for the pur- e of providing industry and commerce with gold credits, chiefly export purposes. The unity of currency and credit policy was ured by entrusting to the Reichsbank the management of the ld Discount Bank and the granting of Rentenbank credits for iness purposes.

Acts Regulating the Reform.—The adoption of the Dawes Plan led the passing on Aug. 30 1924 of four Acts—the new Bank Act, the nt Act, the Private Issue Bank Act and the Act for the redemption the notes in circulation of the Rentenbank. These Acts came into ce on Oct. 11 1924 after the floating of the German foreign loan of ,000,000 reichsmarks, in accordance with the proposals of the erts. The Rentenbank and the Gold Discount Bank were put o liquidation, but the latter subsequently resumed its activity as a dit institution in the guise of a department of the Reichsbank. e further issue of Rentenbank notes was prohibited, and the ichsbank was required to withdraw Rentenbank notes in circula- n, within a period of 10 years.

By the Mint Act the gold standard was again proclaimed with the chsmark as the currency unit, and with the same gold equivalence the pre-War gold mark, *i.e.*, 1 km. of fine gold = 2,790 reichsmarks. e old gold coins retained their validity and also the silver coins nted under the Act of March 20 1924, the rentenpfennigs and the pper pfennigs issued under the law of July 9 1873. All other coins viously minted of silver, nickel, aluminium, iron and zinc, lost ir validity. The minting of silver coins to the value of 1–5 reichs- rks was authorised by the new Mint law. Apart from the Reichs- nk notes only the gold coins were given unlimited legal tender. ver coins were legal tender up to 20 reichsmarks and smaller en coins up to 5 reichsmarks.

Under the new Bank Act the essential features of the Reichsbank e retained, but important modifications were made in accordance h the principles of the Dawes Plan, one of which was the introduc- n of an element of foreign co-operation exercised through the neral Council and the Commissioner of the Note Issue, who is a eign member of the General Council. The management and ministration of the Reichsbank was placed, as under the old Bank , in the hands of the Managing Board of the Reichsbank which sists exclusively of German nationals. The original capital of the nk was contracted from 180,000,000 marks to 90,000,000 reichs- rks. The new Bank Act provides for a capital of at least ,000,000 reichsmarks.

The functions of the Reichsbank, resulting from its position as the tral bank of issue, were laid down in the same terms as in the old nk Act, but the provisions in regard to credit were made more ngent. The power of the Bank to grant credit to the Reich, the leral States and the municipalities were narrowly limited or bidden altogether. The Reichsbank was also given the new func- n of holding on deposit the sums paid in reparations, for the ount of the agent for reparation payments. The exclusive right of ing notes was granted to the Reichsbank for 50 years. While on one hand the note circulation was subjected to more severe condi- ns with regard to its cover, it was also made more elastic, and greater edom of action was secured by the admission of foreign bills of hange as cover for the notes in addition to gold. The obligation the Reichsbank to redeem its notes in gold was for the time being pended, and its reintroduction was made dependent on the proval of both the Managing Board and the General Council.

Quantity in Circulation.—During 1925 gold coins were not in cir- ation. The following tables show the volume and composition of money in circulation in Germany at the end of 1913 and 1925:—

1913
(In Millions of Marks)

Gold Coins	Token Coins	Treasury Notes	Reichsbank Notes	Private Bank Notes	Total Circulation
2,750	850	100	2,593	160	6,453

1925
(In Millions of Reichsmarks)

Token Coins	Reichsbank Notes	Private Bank Notes	Rentenbank Notes	Total Circulation
582	2,961	190	1,476	5,209

Reichsbank Policy.—The Reichsbank was faced with very great difficulties in carrying out its economic functions after the stabilisation of the currency owing to the inevitable crisis of economic reconstruction, to the reparation payments and to the flood of foreign credits which came into the country following on the Dawes loan. Although the new Bank Act had re-established sound principles of banking policy it was not possible for them to be applied in the same way as before the War. As a result of the disrupting effects of war and inflation upon circulating capital there arose a grave discrepancy between the supply of and demand for capital, which only by degrees became less acute. The mechanism of the money and capital market, which had completely broken down, was at the beginning of 1926 still by no means normal, and the automatic regulation of the markets for short and long term loan capital was not yet restored. Under such abnormal conditions the Reichsbank (from April 1914 onwards) found itself compelled to put into force a drastic rationing of credit in addition to a cautious adjustment of its discount rate. It was not till the end of 1925 that it was able to modify in a tentative way the severity of its credit rationing. The discount rate was fixed at 10% after the stabilisation, but was then much below the rates of the private banks. Even when it was lowered in Feb. 1925 to 9%, in Jan. 1926 to 8% and in March 1926 to 7%, there remained an abnormal divergence between the official rate and the rates for private bank credits. By degrees, however, these rates have tended to come closer together.

The difficulties in the way of credit policy are enhanced by the restriction of the pre-War freedom of the Reichsbank in the control of its note issue, since the public funds, the reparation account and the foreign credits are more or less outside the direct influence of the Reichsbank, and are liable to lead to the withdrawal of considerable quantities of notes. The requirements of modern currency policy therefore compel the Reichsbank to watch most carefully the movement of the whole volume of purchasing power and its influence on prices, wages and other economic indices. It is incumbent on it to take or initiate the necessary measures to organise the money and capital market on sound lines, to encourage the formation of capital, and to secure the most economic use of all the available capital, including credits raised in foreign countries.

The Reichsbank augmented its gold holdings from less than 500,000,000 marks in 1923 to about 1,500,000,000 reichsmarks at the end of April 1926. The holdings of gold and liquid assets available for cover amount to 60% of the Reichsbank notes in circulation, but this proportion is not a decisive basis for credit policy as the circulation of Rentenbank notes has to be taken into consideration as well. From the middle of 1925 the total money circulation at the end of each month was in the neighbourhood of 5,000,000,000 marks. The total volume of private credit given by the Reichsbank, the private note banks, the Rentenbank, and the Gold Discount Bank, and including bills rediscounted by the Reichsbank to other bodies amounted in 1925 to about 3,000,000,000 reichsmarks.

After the stabilising of the currency German industry and commerce passed through a severe crisis, and thus heavy burdens were imposed on the Reichsbank as the guardian of the currency. In spite of these difficulties, it proved possible to maintain the value of the reichsmark, and from the beginning of June 1924 onwards all demands for foreign exchange were fully satisfied. It is not yet possible to foresee when the existing restriction on a free gold currency in Germany will be removed. In any case the fact that foreign exchange is available without limitation in exchange for Reichsbank notes is equivalent to the effective redemption of Reichsbank notes in gold. (K. No.)

GHENT, Belgium (*see* 11.919), had a population in 1923 of 163,877, and including the suburbs of Ledeberg, Ghentbrugge and St. Amand of 212,096. The city measures some 16 m. in circumference, much room being taken up by nurseries and gardens, for Ghent has become an important horticultural centre, especially for the cultivation of flowers under glass. Linen weaving has greatly developed, and schools of industry and mechanics have been established. A great international exhibition was held in 1913 in a Palais des Fêtes, specially built in the Parc de la Citadelle. The old cast-iron steeple of the belfry was rebuilt in 1913; subsequently most of the copper work from the new one was removed by the Germans. The hospital and almshouses for old men have been removed from the ancient Byloke, which has been fitted up to house the archaeological museum, previously in the old Carmelite church. The panels of the famous "Worship of the Lamb" by Hubert and Jan Van Eyk, dispersed since 1816, were brought together again in 1920 under the provisions of the Treaty of Versailles. A plaque in memory of Edith Cavell has been fixed on an inn, De Stad Ouden Aerde, where she stayed shortly before her arrest, and a memorial to the inter-Allied dead was unveiled in the cemetery in Oct. 1924. A new lock at Terneuzen enables vessels up to 26 ft. draught to pass at any tide into or out of the canal between that port and Ghent.

Ghent was in the hands of the Germans from Oct. 1914 till Armistice Day, Nov. 11 1918. The west part of the town suffered some damage in the final operations. The Germans published there the *Vlaamsche Post*, an organ professing Flemish sympathies and advocating the partition of Belgium, and made determined efforts to transform the University of Ghent into a purely Flemish institution, in order to widen the breach between the Flemish and Walloon elements. The university was reopened in Oct. 1923.

GIARDINO, GAETANO (1864–), Italian soldier, was born at Montemagno, Italy, Jan. 24 1864. He joined the army in 1882 and saw service in Eritréa (1889–94) and in Tripoli (1911–2). On Italy's intervention in the World War he was appointed chief of staff to the II. Army and was promoted brigadier-general in Aug. 1915. In June 1916 he was given command of the 48th Brigade and played an important part in the attack on Gorizia. In June 1917 he was promoted lieutenant-general but a few days later was chosen Minister of War and made a senator. He held office until after Caporetto, when he was appointed assistant chief of staff to the new commander-in-chief, Gen. Diaz. In April 1918 he was given the command of the IV. Army in the Grappa sector. At the battle of Vittorio Veneto (Oct. 24–Nov. 3 1918) he delivered a general attack on the Austrian lines and after a hard struggle forced the enemy to retreat. In 1919 he was promoted *generel d'esercito*. In Sept. 1923 as the Govt. of Fiume was unable to carry on, Giardino was sent to take charge of the town, where he remained until its annexation by Italy under the terms of the treaty between Italy and Yugoslavia in Jan. 1924.

GIBBONS, JAMES (1834–1921), American Roman Catholic cardinal (*see* 11.936), in 1916 published *A Retrospect of Fifty Years*. He died in Baltimore March 24 1921.

GIBRALTAR (*see* 11.938) has been largely increased in strength as a naval base; with the extension of the mole the deep harbour has an area of 260 ac. and affords anchorage for the largest ships. It was of great importance during the World War as a coaling station and port of call.

In 1922 an executive council was established, but all legislative power remains with the governor. A city council has replaced the board of sanitary commissioners, and currency notes have been issued by the local authority since 1913. Gibraltar is one of the most closely populated places in the world (9,888 to the sq. m. in 1921), but it is not unhealthy, the death-rate in 1921 being 17 per thousand. The population in 1924 was 20,638: 17,160 civilian, 2,932 military and 546 naval. There is a regular motor-omnibus service to La Linea, which has grown considerably and has a population of 63,000. A cross of sacrifice, in memory of those who died and were buried at Gibraltar during the World War, was unveiled in 1922, and a War Memorial in 1923. In 1915 a second reservoir was excavated, and the construction of another is contemplated. The Exchange in Commercial Square, which was burnt down in 1919, was rebuilt and opened in 1922. A public recreation ground was opened above the military school in 1920. The signal station on the summit of the rock has been dismantled. Since 1910 Gibraltar has been a Roman Catholic bishopric, independent of the Spanish hierarchy and subject directly to the Vatican.

GIDE, ANDRÉ (1869–), French essayist and novelist, was born in Paris Nov. 21 1869. Educated at the École Alsacienne and the Lycée Henri IV., he began his literary career with the *Cahiers* and the *Poésies d'André Walter* (1891–2). His first success was followed by a series of works resembling philosophical *causeries* in which an introspective method and great delicacy of expression were combined in an original manner. His dramatic works and criticism are characterised by the same sureness of touch and individual grace. He is considered one of the finest stylists in contemporary French literature, and exercised considerable influence outside his own country. As a novelist, however (as in *Les caves du Vatican*), he was less successful; he is more at home in the easy, discoursing flow of an essay.

Gide's works include: *Le voyage d'Urien* (1893); *Paludes* (1895); *Les nourritures terrestres* (1897); *Le traité du Narcisse* (1899); *Le Prométhée mal enchaîné* (1899); *L'immoraliste* (1902). Criticism: *Lettres à Angèle* (1900); *Prétextes* (1905). Drama: *Saul* (18 *Le roi Candaule* (1898); *Les caves du Vatican* (1911); *Isabelle* (19 *La symphonie pastorale* (1919); *Dostoievsky* (1923, tr. 1925); *Les f Monnayeurs* (1926).

GIDE, CHARLES (1847–), French economist, was b June 29 1847 at Uzès (Gard). Educated at the Collège d'U he entered the faculty of law of the University of Paris. He ea took up the study of economics and became professor of politi economy, first at Bordeaux, then at Montpellier, and from 1 to 1920 at the University of Paris. He is the author of one of best introductory treatises on political economy, *Princi d'Economie Politique*, first published in 1884 and since transla into English and other languages, and is joint author with fessor Rist of an excellent work on the history of economic theo *Histoire des Doctrines Economiques* (3rd ed. 1920). Gide devo a great deal of time and energy to the encouragement and therance of the co-operative movement in France, and wr largely on this question. Professor Gide enjoys a wide meas of esteem amongst scholars in other countries, not only as eminent economist, but also on account of his unremitting deavours to maintain and promote harmonious internatio relations and especially to preserve co-operation amongst int lectual workers in different countries. (*See* FRANCE.)

GILBERT, CASS (1859–), American architect, was b at Zanesville, O., Nov. 24 1859. He studied at the Massach setts Institute of Technology and in 1883 began his career as architect in St. Paul, but subsequently moved to New Yo He became perhaps most widely known as the architect of Woolworth building in New York, which has 57 stories and 760 ft. in height, and, with the exception of the Eiffel Tower Paris, the tallest structure in the world. Other buildings signed by him include the Minnesota State Capitol, St. Pa the Endicott building, the Dayton avenue church and St. Cl ent's Episcopal church, in St. Paul; the United States Cust House and the Union Club, New York; the Brazer building the Suffolk Savings Bank, Boston; Art building and Festi Hall (for the Louisiana Purchase Exposition), and the Cen Public Library, St. Louis; Ives Memorial Library, New Hav Conn.; Public Library, Detroit. He also drew the plans for university of Minnesota and for the university of Texas. was appointed by President Roosevelt a member of the Cou of the Fine Arts; and by President Taft a member of the tional Commission of Fine Arts, being reappointed by Preside Wilson. In 1926 he was appointed design architect for the posed bridge over the Hudson river at New York City.

GILBERT, GROVE KARL (1843–1918), American geolog (*see* 12.7), died at Jackson, Mich., May 1 1918.

GILBERT, SEYMOUR PARKER (1892–), American law and financial expert, was born in Bloomfield, N.J., Oct. 13 1 He graduated from Rutgers College in 1912, and in the same ye entered the Harvard Law School, obtaining the LL.B. degre 1915. After admission to the New York Bar, he practised New York City from 1915 to 1918. In the latter year, on the tiative of R. C. Leffingwood, a former Associate Secretary the Treasury, he joined the War Loan Staff as counsel. In J 1920 he became assistant secretary (later under-secretary) the Treasury in charge of fiscal affairs. He resigned Nov 1923, and became agent-general for Reparation payments un the Dawes plan Oct. 31 1924.

GILBERT, SIR WILLIAM SCHWENK (1836–1911), Brit playwright and humorist (*see* 12.9), was drowned at Har Weald, Middlesex, May 29 1911. His play, *The Hooligan*, produced a short time before his death.

GILBEY, SIR WALTER (1831–1914), British wine merch (*see* 12.11), died at Elsenham Hall, Essex, Nov. 12 1914.

GILDERSLEEVE, BASIL LANNEAU (1831–1924), Ameri scholar (*see* 12.12), died at Baltimore, Md., Jan. 9 1924.

GINER DE LOS RIOS, FRANCISCO (1840–1915), Spanish ph osopher and jurist, was born in Ronda (Andalusia) Oct. 10 184 He graduated in Granada, and in 1867 went to the Universi of Madrid as a professor of jurisprudence and there came un the influence of Prof. Sanz del Rio, Krause's famous discipl cordance with his belief that philosophy should have a con- influence on practical life, he devoted himself to the educa- question. Twice Giner resigned his chair, together with l of his colleagues, in a stand for liberty of thought in the rsity against a reactionary government, and was twice ated. He helped to found the Institucion Libre de Ense- ., an educational institution which did much to improve ing methods in Spain, by the application of philosophical ht to the problems of education. He many times refused on to the Cortes, and in 1873 declined a post in the Gov- ent. His greatest influence was personal and direct, for he born teacher, a man of refined sensibility, pure in his life his ideals.

er published several volumes of essays—literary, educational, ophical and religious—as well as *Lecciones Sumarias de ogia* (1871); *Psicologia; Idea del Derecho*, with Alfredo Calderon, from the German of Röder (1885); *Resumen de Filosofia del io*, with Alfredo Calderon (1898); and other works. A complete n of his numerous works was undertaken a year after his death. S. de Madariaga, *The Genius of Spain* (1923).

ISBURG, CHRISTIAN DAVID (1831–1914), British Hebrew ar (*see* 12.29), died in London March 7 1914.

LITTI, GIOVANNI (1842–), Italian statesman (*see*). The elections of 1909 returned a strong Giolittian ity, but Giolitti as Premier found himself faced with the sity for renewing the steamship conventions which were to lapse. The Bill presented by his Cabinet on this subject pen to much criticism, having been designed to conciliate cting political interests rather than to solve the actual em. The vigorous attacks of the Opposition, led by Sonnino, induced Giolitti to adjourn the debate until tumn, when, the Cabinet having been defeated on a point cedure, he resigned (Dec 2). But he continued to play an and in fact dominant part in Parliamentary politics, for ajority of the Chamber and of the Senate, being thoroughly tian, the Sonnino Ministry and that of Sig. Luzzatti succeeded it only remained in power at his discretion. in March 1911 Luzzatti resigned in consequence of the e vote of the Radicals and the resignation of its two Radical ers, Giolitti was again called upon to form a government ch 31).

e chief event of his fourth Cabinet was the Libyan War. nally he was not enthusiastic over the African enterprise, ntroduced new and, to him, unaccustomed and unwelcome s into Italian political life; but he realised that public on demanded it and he did not care to run counter to the nt. He was criticised by the vestals of constitutional ion for having declared war without consulting Parlia- and for not having summoned it until several months later. ng the campaign, he was, moreover, severely blamed on round that he acted as though the war were merely an of internal politics and party combinations. When peace concluded fresh elections were held on the new franchise ntroduced by the Cabinet, which raised the electorate from ,000 to 8,000,000 votes (Oct. 26–Nov 2 1913); although a tian majority was again returned, his opponents, not only g the Socialists, but also the constitutional parties, were more numerous, and he felt that opposition to his rule was ng in the country at large even more than in Parliament. arious awkward problems which now faced the Government he divisions among its own supporters induced him to the opportunity of a hostile vote by the Radical group to (March 10 1914).

en the World War broke out his attitude was favourable to solute neutrality of Italy, as he believed that his country's sts lay in not siding with either group of belligerents, and e eve of Italian intervention he made an attempt, by using rsonal hold over the Parliamentary majority, to upset the dra Cabinet, but it was frustrated by an uprising of public n in favour of the war. During the progress of the cam- he avoided public affairs, although he assumed a Cassandra- ttitude in all his utterances, and his henchmen in the Press frankly "defeatist." He consequently lost his influence over the bulk of public opinion and in many quarters was regarded as little better than a traitor. But after the Armistice the unsatisfactory consequences of the peace negotiations, the heavy burden of suffering and loss caused by the War, and, above all, the disputable internal policy of the Nitti Cabinet, which was accused of handing the country over to the Bolshevik Socialists, brought about the return of Giolitti.

When Nitti was forced by the impossibility of governing the country to resign for the third and last time on June 9 1920 a new Giolitti Cabinet was the inevitable alternative. He succeeded by June 15 in forming a Cabinet which comprised a number of non-Giolittians of all parties, but only a few of his own "old guard," so that he won the support of a considerable part of the Chamber, although the Socialists and the Popolari (Catholics) rendered his hold somewhat precarious. His policy of inactivity during the occupation of the factories by the workmen organised by Socialist leaders in Sept. 1920 provoked the indignation not only of the manufacturers but of all the middle-class. He appears to have acted under the impression that the Socialists were much stronger than they really were, and therefore gave them a free hand with the object of avoiding bloodshed, and also perhaps with that of proving to the workmen that they could not run industry without the capitalists and the technical experts. When he realised the strength of the national reaction, he allowed the Fascists free rein to re-establish order and practically exercise many of the functions pertaining to the Government, while he assumed an attitude of Olympic calm and posed as being *au-dessus de la mêlée*, so as to avoid compromising himself with any party.

In foreign affairs Giolitti succeeded in achieving a solution of the Adriatic problem less unsatisfactory than most of the previous proposals of the annexation of new provinces under the peace treaties and of the altered state of public opinion on internal policy, he dissolved the Chamber on April 7 1921, and was confirmed in power by the elections on May 15. But he resigned with his Cabinet at the end of June, being succeeded as Premier by Signor Bonomi.

He played no part in the subsequent events, until at the time of the march on Rome he was one of the statesmen who advised the Premier Signor Facta to resign. On the advent of the Fascist Govt., he expressed his approval of it and instructed his followers to support it. At the elections of 1924 he presented a list of his own in Piedmont, which was not in opposition to but independent of the Government, and in an election speech he attributed many of the achievements of Fascism to his own policy. After the Matteotti affair he definitely went over to the Opposition but did not leave the Chamber, and his hostility remained fairly moderate. In 1922 he published two volumes of memoirs entitled *Memorie della Mia Vita*. (L. V.*)

GIRL GUIDES, a movement for the training of girls based on similar principles to those of the Boy Scouts (*q.v.*). Its aims are: to develop good citizenship; to train girls in habits of observation; obedience, self-reliance, loyalty and thoughtfulness for others; to teach useful service and handicrafts; to promote physical development; to make them capable of keeping good homes and bringing up their children properly. The training runs mainly in four directions: character and intelligence; homecrafts and handicrafts; health and physical development; service for others. The movement is non-political and interdenominational.

Origin and History.—After the Boy Scout movement had been founded by Sir Robert Baden-Powell girls in different places began to copy its activities, and banded themselves together as Girl Scouts. To meet the needs of these girls, Sir Robert and his sister, Miss Agnes Baden-Powell, in 1910 started a separate movement for girls, and gave it the name of Girl Guides. The movement received a charter of incorporation in 1915 and a royal charter in 1923. Princess Mary became president in 1920. Lady Baden-Powell (wife of the Chief Scout) was elected Chief Guide in 1918.

Organisation.—The governing body of the Girl Guides is the council, which meets annually and elects an executive of nine members. Sir Robert Baden-Powell is permanent chairman of the executive. The executive appoints county commissioners, who in turn appoint division and district commissioners to assist them. Under the latter come the captains, who do the actual training of the girls, grouped into companies. A guide company consists of from eight to 40 girls, and is subdivided into patrols, each under the charge of a patrol leader, who is herself a guide. She is either appointed by the captain or elected by the other guides, and has entire authority over her patrol, and entire responsibility for its conduct and efficiency. The affairs of the company are managed by the court of honour, consisting of the patrol leaders, who meet periodically, under the chairmanship of the captain. A company usually meets once a week, and goes to camp, if possible, for one week in the year.

Membership.—To become a member of the guide movement a girl or woman has to be enrolled. She makes a three-fold promise: to do her best to do her duty to God and the King; to help other people at all times; to obey the guide laws. There are 10 guide laws, namely: a guide's honour is to be trusted; a guide is loyal; a guide's duty is to be useful and to help others; a guide is a friend to all and a sister to every other guide; a guide is courteous; a guide is a friend to animals; a guide obeys orders; a guide smiles and sings under all difficulties; a guide is thrifty; a guide is pure in thought, word and deed.

After enrolment the members of the movement have the right to wear the guide uniform, navy blue with different badges to denote rank or proficiency. The badge of the guides is a trefoil, their motto is " Be Prepared." There are three main branches: the Brownies, aged from 8 to 11, the girl guides, aged from 11 to 16, and the senior guides, from 16 upward, who may be either rangers or sea guides. The officers are called guiders; they can receive training in guide methods at Foxlease Park, Lyndhurst, Hants, England, which was presented to the organisation by Mrs. Archbold Sanderson in 1922.

The guide movement has spread to the British Dominions and other countries. In 1924 a World Camp, attended by some 1,100 guides, from over 30 different countries, was held at Foxlease. At the end of 1925 there were some 613,209 members throughout the world. The Headquarters of the Girl Guides are at 25, Buckingham-Palace Road, London, S.W. The movement is financially self-supporting.

BIBLIOGRAPHY.—Sir R. Baden-Powell, *Girl Guiding, the Official Handbook* (1918); *The Brownie Handbook* (1920); *Annual Report*, Official (1925); *Rules, Policy and Organisation* (1926). See also *The Girl Guides' Gazette.* (M. Mo.)

GIRL SCOUTS: *see* BOY SCOUTS.

GLADDEN, WASHINGTON (1836–1918), American divine (*see* 12.63), died at Columbus, O., July 2 1918.

GLASGOW, Scotland (*see* 12.80), enlarged its boundaries in 1912 by the inclusion of Govan, Partick, Pollokshaws and several suburban districts, making it again the second city in Great Britain in population, and increasing its area from 12,975 to 19,183 acres. The number of wards was increased from 26 to 37, and the membership of the corporation from 80 to 113—three representatives of each ward, and two ex-officio members (the dean of guild and the deacon convener of the trades). Since 1918 Glasgow has sent 15 members to Parliament. A further ambitious scheme of enlargement of the burgh was promoted after the World War, owing to the congested state of the city and the fact that many of the housing schemes were situated outside the boundaries. It involved the incorporation of 22,000 ac., and met with opposition from adjacent counties and burghs; eventually, by an Act of 1925 (coming into force in May 1926), about half the proposed area, taken from Renfrewshire, Lanarkshire and Dumbartonshire, and including the important Yoker area near Clydebank, was incorporated. The population in 1921 was 1,034,174 and the rateable value in 1925 £11,040,693.

The Rent Strike.—Housing conditions have been extremely bad, and the new houses erected insufficient to accommodate even the normal increase in population; there has also been much unemployment. A legal campaign by the tenants, contesting the validity of notices of increase of rent under the Increase of Rent (Restriction) Acts, served without previous notice to quit, was supported by the decision of the House of Lords in a test case (*Kerr* v. *Bryde*) in 1922, and in the following year an amending Act to regularise the position was passed. Many tenants, however, refused not only the increased rent but any rent at all, and demanded a return to the pre-War standard. A large number of eviction orders were granted in 1924 and early in 1925, but their execution was rendered impossible in most cases by the violent tactics of the tenants. In June 1925 the unrecovered rents represented nearly a year's rental of tenanted houses in the borough, and the local authorities were seriously embarrassed by the nonpayment of rates. A rent commission was then appointed which recommended the simplification of the form of notice requi
and other reforms in the working of the Increase of Rent (
striction) Acts.

Public Buildings, Parks.—Additions to the municipal bu
ings, connected by two bridges with the older buildings, w
completed in 1923. The Mitchell library, the largest of the pu
libraries, was removed to North street in 1911; 25 branch lib
ries have been established. Since 1913 14 new chairs have b
founded in the university, and the western sections were be
extended in 1926, to provide new classrooms and a memo
chapel. The block of the Royal Infirmary which contained
famous ward in which Lord Lister first applied the use of a
septics was pulled down in the course of an extension schem
1924, in spite of widespread opposition. A new building for
Ear, Nose and Throat Hospital was opened in St. Vincent Squ
in 1926. In 1915 the corporation bought the Balloch Ca
estate, of which 200 ac. were made into the Loch Lomond P
Other purchases were the Linn Park of 180 ac. (1919); and
Ruchazie and Frankfield Park of 300 ac. (1920). The Newla
Park was given in 1913, the Glenconner Park in 1914 and
Dawsholm Park in 1920. In 1911, 121 ac. of the grounds
Pollok House were given for use as a public park for a perio
10 years. Statues of Lord Kelvin (1913), Lord Roberts (19
Thomas Carlyle (1916) and a war memorial to men of the Ca
ronians have been erected in Kelvingrove Park; and a war
morial cenotaph was unveiled in George Square in 1924. Kel
grove and College United Free Church and Kelvin Hall, a la
building used for exhibitions, etc., were destroyed by fire in 19

In 1924 a beginning was made with the provision of furt
dock accommodation on an area of land acquired by the Cl
Navigation Trustees between Shieldhall and Renfrew. Contra
were signed for the construction of railway lines and a road
the new dock area from the new trunk road of the Glasgow
poration scheme. A big electric generating station was ope
at Dalmarnoch Bridge in 1920, and the largest gasworks of th
kind in Great Britain were completed at Govan in 1921.

GLASGOW, UNIVERSITY OF (*see* 12.82).—The following
new chairs have been founded since 1907: Mining, medic
(Royal Infirmary), obstetrics and gynaecology (Royal In
mary), surgery (Royal Infirmary), pathology (Royal Infirma
Scottish history and literature, French, German, organic che
istry, physiological chemistry, bacteriology, mercantile l
applied physics, theory and practice of heat engines, electri
engineering, public health, medical paediatrics, Italian, Spa
and accountancy. New lectureships have been instituted
Celtic, psychology, social economics, geography, dermatolo
clinical medicine, clinical surgery, clinical obstetrics, disease
the throat and nose, diseases of the ear (Royal Infirmary),
teria medica and pharmacology, electrical diagnosis and the
peutics, Russian, clinical tuberculosis.

New Buildings.—Considerable progress has now been ma
with the extensions of buildings which were postponed owing
the World War. The new zoology building, erected at a cost
about £112,000, is now occupied, and the building which is
complete the west wing and includes the War Memorial Cha
is in course of erection. The estimated cost of this building
about £122,000.

The students themselves have been active in furthering
student welfare scheme and, including grants from the Go
the Carnegie Trust and the proceeds of a bazaar, a sum
about £85,000 has been collected. Out of this fund there ha
been provided a union for women students and the necessa
expenditure to convert the houses presented by Lord Mac
and Mr. Lawrence MacBrayne into men students' hostels
the house presented by Mr. J. M. Robertson into a wome
hostel. The money, about £12,000, necessary for the erection
a pavilion on the athletic ground at Westerlands—which is
open—has also been provided out of this fund. Grants have
been made to the athletic club and the boat club. The acco
modation of the present union for men students is quite ina
quate. A site for a new building has been secured and steps
being taken to secure the remainder of the necessary funds.

r Donald McAlister became principal in 1907, and in the ersity itself, as outside in university matters generally, has cised a remarkable influence.

Students

Session	Men	Women	Total
10–1 . . .	2,108	682	2,790
15–6 . . .	1,163	658	1,821
20–1 . . .	3,576	1,132	4,708
23–4 . . .	3,275	1,419	4,694
24–5 . . .	3,069	1,529	4,598

ıe figures for session 1910–1 represent a normal year; 1915–6 a year. The figures for the other years show the large increase in ıumbers of students which has taken place since the War.

LASS, CARTER (1858–), American politician, was born ynchburg, Va., Jan. 4 1858. He received his education in Lynchburg schools and learned the printer's trade, which he wed for several years, eventually becoming proprietor of Lynchburg *Daily News* and *Daily Advance*. He was elected ne Virginia State Senate for two terms (1899–1903) and was ember of the State Constitutional Convention in 1901. He elected in 1902 to the national House of Representatives, thereafter was continuously re-elected until his resignation 918. As chairman of the House Banking Committee he was ve in framing and passing the Federal Reserve Bank Law. 918 he entered President Wilson's Cabinet as Secretary of Treasury. Under his guidance the fifth Liberty Loan was ted in April 1919. In Nov. 1919 he resigned, following his ointment and subsequent election to the United States Sen- In 1924 he was elected for the term 1925–31.

LASS (*see* 12.86).—Since 1910 considerable developments in glass industry have occurred, both in the glass produced in the varieties of glass manufactured. In the following le attention is, of necessity, given to the British glass inry. When the War drew attention to the British position in ect of glass generally, it was in the direction of scientific sware and special glass for certain industries, that the ciencies were realised. (*See* also OPTICAL GLASS.)

boratory Glass.—Before the War nearly all the glass and glass ratus used in laboratories throughout the United Kingdom was ined from abroad. The main kinds of glass required for labora- purposes may be grouped thus: Soft glass for tubing, and for a ber of articles and vessels where the highest resistance to chemaction is not required; glass highly resistant to chemical action; hard glass for combustion tubing; glass for thermometers.

ft Glass.—Such a glass must be soft enough to be readily worked flame, and must stand prolonged heating without showing the ges in appearance and working qualities generally described as trification. Before chemical glassware of foreign origin became tically universal in laboratories, vessels and apparatus in great ety were made from lead glass. The advantages claimed for non- glass as a material for laboratory apparatus have been proved, there is no likelihood of a return to lead glass, which, however, be made of such high resistance to the action of water, and of y solutions which also abstract alkali from glass, that in some ial cases vessels made from it are only surpassed by silica in tance to chemical change.

the early days of the War it was recognised that there would be rious shortage of laboratory vessels. A simple sodium-calcium- ate glass was unsuitable since tubing made from it is practically ess to workers in laboratories. The immediate advance made the addition of alumina, either as such, or preferably in the of felspar. The use of alumina for retarding devitrification and rendering a glass workable in the flame was known in Great ain, and at least three British manufacturers had for some years luced glasses containing various percentages of alumina up to t 10%.

sodium-potassium-calcium-aluminium-silicate type of glass has t satisfactory general properties. Arsenic is not permissible, and only constituent other than those indicated which might be ed was a small amount of manganese dioxide, to disguise the green ur due to the presence of iron in the material used. The formula n here shows the approximate composition of a batch mixture essed in percentages of silica and oxides of the metals in the ous ingredients of the batch: SiO_2, 68; Al_2O_3, 4; CaO, 7; K_2O, Na_2O, 14·5. This yields a good glass, soft enough for flameking while possessing good durability.

se of Potash Felspar.—It became necessary to conserve supplies otassium compounds, of which the amounts that could be apioned for use in glass manufacture were sufficient only for the production of certain optical glasses. To some extent nitre was available and was used. Potash felspar, which for long had been an ingredient in certain glasses, was a convenient form of aluminium compound for introducing alumina. The amounts of this material employed varied between wide limits, and glasses of good working qualities were obtained.

Borax.—Varying proportions of borax were employed, and in this way sodium-potassium-calcium-aluminium-boro-silicate glasses of good working qualities and of marked durability were produced, which met many of the requirements of laboratory workers. The boro-silicate glass possessed many desirable properties when the glass was well made and the necessary technical skill had been acquired. It failed, however, when used for X-ray tubes. A glass of the general type indicated in the formula above is quite suitable for such work, and hence X-ray bulbs and tubing can be made from it in the course of working a pot for a variety of other articles.

Experience shows that the best type is on the lines of the formula given, and that the presence of notable proportions of the oxides of aluminium and potassium are essential. Potash felspar has been mentioned as a convenient source of alumina, and part of the alkalies may be usefully added as nitrates. In general, all the materials of the batch mixture should be as pure as can be obtained commercially, so that the composition of the glass may depart as little as possible from that which it is intended to have, and which has been proved to give satisfactory results. One or two remarks which are relevant for almost all glasses may be made here.

Anhydrous Materials.—As far as it is possible to obtain and to store them, all the substances for a batch mixture should be free from water. A glass made from anhydrous materials often differs from one calculated to give the same composition finally, but produced from a wet batch, or from one containing an ingredient having a notable proportion of combined water. In addition to some lack of general stability, the glass from a wet batch may show a greater tendency to devitrification when heated in a flame or by radiation. The amount of water left in a glass may be very small, but it affects the behaviour of the glass. However, the action of water to effect change in glasses either during their production or on subsequently heating them is an advantage in respect of the production of certain coloured glasses and apparently of some opal glasses.

Homogeneity.—All glasses for laboratory use should be made in such a way as to secure the greatest possible homogeneity. As a general rule, the long-founding so much insisted upon by many experienced glass manufacturers cannot be dispensed with if the nicest possible refinements of a good glass are to be realised. Stirring to secure homogeneity is a necessary operation in making optical glass. It is not customary to stir glass for laboratory use, but such glass would be improved by being stirred if it were economically possible.

Annealing.—The subject of annealing has, in recent years, been given much attention, and several investigations have been carried out. Results of much interest and importance have been obtained, dealing with the conditions for removing strain in glass and with the problem of annealing, both from the theoretical and a practical point of view. These results emphasise the importance of thoroughly annealing any glass articles which are required to withstand marked changes of temperature, and of arranging that any vessels, etc., which in the course of production are re-heated locally, shall be re-annealed. Tubing is not customarily annealed as part of the process of manufacture, but for certain purposes, notably with tubes which are to be ground, it is an advantage to anneal them.

"Resistance" Glass.—Laboratory glassware, to deserve this description, must possess great stability, and must part with only minute traces of any of its ingredients when it is exposed to the action of the majority of solutions and liquids used in a chemical laboratory. The chief varieties made can be included in two types: one containing compounds of zinc and the other free from this metal. In neither type is the inclusion of arsenic or antimony considered to be permissible.

The following formulae, illustrative of these two types, give approximate proportions for batch mixtures expressed in percentages of the oxides contained in the various ingredients of a batch:—

(A) SiO_2 . . .	66	(B) SiO_2 . . .	66
B_2O_3 . . .	8	B_2O_3 . . .	9
Al_2O_3 . . .	9	Al_2O_3 . . .	2·5
CaO . . .	5	ZnO . . .	8
MgO . . .	1	MgO . . .	5
Na_2O . . .	8	Na_2O . . .	9·5
K_2O . . .	3		

Adjustments of the proportions given can be made to suit different furnaces and also to fit in with the amount of broken-up glass from previous meltings (cullet), which is incorporated in the batch. Of these two types of resistance glass, (A) requires a rather higher temperature in the making and on the whole presents more difficulties than (B). It has also a somewhat higher coefficient of expansion, is less liable to withstand sudden changes of temperature and has been made of very high chemical resistance and of satisfactory behaviour when quickly heated or cooled through a greater range of temperature than it would usually be exposed to in a laboratory. It is probably fair to give preference, on the whole, to glass of type (B) as inherently more capable of withstanding sudden changes of temperature, and, being the easier to make, there is less likelihood with vessels made from it of mishaps due to imperfect manufacture. Whichever class of glass is chosen, all vessels and apparatus made from it need thorough annealing.

Combustion Tubing.—Tubing of very hard glass is essential for many laboratory experiments, and is largely used in the analysis of carbon compounds by combustion, but in tubing of various diameters it is required for a number of other purposes. The general composition of Kavalier's combustion tubing is indicated by the following percentages to the nearest whole numbers: SiO_2, 78; CaO, 8; K_2O, 12; Na_2O, 2. Glass of this kind served many useful purposes in laboratories, but it was difficult to use in a blowpipe flame. The Jena glass which took its place possessed greater plasticity over a longer range of temperature. During the War very hard glass tubing was much needed, and as the result of experiments on a laboratory scale and in glass works, tubing of a type similar to the Jena combustion tubing was produced. With regard to hardness and suitability for working in the flame it fulfils its purpose most satisfactorily. Unlike the pre-War glass, it does not show anything like the tendency to become opal when heated for a long time. The following is the composition for a batch mixture, given as for other glasses in the percentage of oxides: SiO_2, 68·5; B_2O_3, 5·5; Al_2O_3,6; CaO, 8; BaO, 6·8; Na_2O, 3·2; K_2O, 2. With this glass there is not much latitude allowable if the full hardness of the glass is to be realised and difficulties in manufacture are to be avoided. The glass requires a high temperature for its successful production.

Thermometer Glass.—The manufacture of thermometers of all kinds has been carried on in Great Britain for many years, and British capillary tubing of high quality and technical perfection made both from lead glass and from various other types of glass, has been in constant demand. Jena thermometer tubing was largely used by British thermometer makers. During the War very great numbers of thermometers were called for, the greater proportion being for medical purposes, but many also for scientific and industrial use. Manufacturers of glass produced tubing to meet the demand, in lead glass, for the production of which they were ready and pre-eminent, and in other varieties of glass having properties closely similar to two Jena glasses of high reputation. One of these can be used for thermometers, capable of standing high temperatures up to about 500° C., and the other is for more general application. The following formulae, given as for other glasses in percentages of oxides and with similar reservations, indicate the nature of batch mixtures for these types of glass:—

High Temperatures		Ordinary Temperatures	
SiO_2	73·5	SiO_2	67·0
B_2O_3	9·7	B_2O_3	2·5
Al_2O_3	5·8	Al_2O_3	2·7
Na_2O	11·0	CaO	6·5
		ZnO	6·7
		Na_2O	14·6

Vessels and Apparatus.—Scientific glassware may be broadly classified as furnace-made and as lamp-blown. The former is for the most part produced by blowing into moulds molten glass gathered from the furnace on a blowing-iron. Before the War, lamp workers for laboratory apparatus were few in number in Great Britain and were chiefly engaged either in making a comparatively small amount of apparatus to special design or in repair work. Glass for such apparatus is supplied to the lamp blower in the form of tubing, in the production of which, therefore, there had also been a great development.

For glass for miners' lamps, a glass withstanding rapid changes of temperature exceptionally well was necessary, since the lamp glasses are thick and the flame of the lamp may often touch them. There was an urgent demand for them early in the War. It was successfully met, and such glasses of British make are now produced in large quantities. Another glass on similar lines, but differing somewhat in composition, was prepared for the production of chimneys for incandescent and high-pressure gas illumination, paraffin lamps, etc. In addition to withstanding heat changes well such a glass must be markedly resistant to the chemical action of hot products of combustion. Both these glasses consist chiefly of alkaline boro-silicates having a high percentage of boric anhydride. They need a high temperature for their successful production in a homogeneous state. When well founded their low coefficients of expansion render articles made from them highly resistant to sudden variations in temperature over a long range.

Glass rods for half-watt electric lamps were required, to hold the thicker tungsten wires which support the filament of this metal. They had to be made specially, since no existing glass of British make capable of withstanding heat changes was also sufficiently reliable in respect of not cracking round the sealed-in wires. This glass in most cases involved also the production of special rods to join with it and with the stem of the lamp.

Other glasses were needed which, while making safe joints with ordinary laboratory tubing, etc., would hold platinum, copper, iron or nickel wires. Such glasses are often described as sealing-in enamels. Several of these have been made, and, generally spe
they are of the type either of a soft glass containing a high perce
of lead, or of one free from lead and containing a notable prop
of a fluoride, such as cryolite. The coefficient of expansion
glass, in relation to that of the metal wire used, has to be take
account.

Jars for Preserving Fruit and Meat.—Though numbers of thes
long been made in Great Britain, about 80% of the total n
used had been obtained from abroad. Great increase in th
duction of these vessels was required to meet the needs, enh
as they were by the War, and the necessity for more economi
duction led to a review of methods and to the adoption o
machinery.

Glassware for Medical Purposes.—The War caused a great in
in the demand, and very large quantities of vials, tubes, syr
graduated measures, etc., had to be made. Most of these co
produced from glass, and by methods familiar to manufact
but some requirements had to be met by investigation and e
ment before suitable glass was produced.

There was considerable increase during the War in the prod
of coloured glasses, *e.g.*, for spectacles to protect the eyes of the
numbers of men working at steel furnaces. Coloured glas
considerable variety were also wanted for other purposes, b
comparatively small amounts. Some of them needed investi
and a number of experiments before the conditions for their pr
tion could be determined.

Progress in the Use of Machinery.—The greatest advance i
economic production of certain types of glassware was in the dir
of the introduction of machinery and minor labour-saving d
which was only rendered practicable by concurrent improveme
the means for assuring a continuous supply of molten glass in
able condition to permit of the machines being run continu
The common practice in the past was to found the glass in p
direct-fired furnaces. There has been a gradual tendency for t
some of them being of very large capacity, holding as much
tons of molten glass, to take the place of the older pot fur
Those glasses which are only required in comparatively small
tities or of absolute purity, as in the case of optical glass, c
coloured glasses, and those liable to contamination from fu
gases, will still have to be pot-founded.

Automatic Machinery.—The development of machinery in
manufacture has been by gradual evolution. In many Am
factories, neither the raw materials nor the glass is handled a
stage during the progress of manufacture. Conveyors transf
raw material from the trucks to the storage bin; automatic wei
discharge the requisite quantity of material from the storage
a rotary mixer mounted on a trolley; another conveyor transfe
mixed batch to the batch storage bin in close proximity to the
ing end of the tank, for the ready release of the batch down a
at periodic intervals into the tank.

Types of Machines.—The types of machines may be conven
divided into the following groups: pressing machines for the
duction of tumblers, meat and jelly jars, bull's-eye lenses, tabl
and pavement lights; press and blow machines for all types of b
and many kinds of food containers; blow machines for el
lamp bulbs, lamp chimneys and similar articles; rolling mac
for plate glass, figured and ribbed glass and reinforced sheet for
and window glass, and for drawing tubes and rods.

There are many other types for miscellaneous purposes, incl
cracking-off machines for severing the fashioned article from
waste glass, employing multiple fine jets of flame which impin
the line of severance which is usually started by a short diamo
at the predetermined point: calibrating machines for accu
dividing measuring devices such as thermometers, burettes, pi
and cylinders; grinding and polishing machines for preparin
finishing the surface of plate glass; machines for forming the sto
of bottles and for grinding the seating in the neck of the b
flowing devices and feeding machines, to withdraw from the p
tank, by means of a gathering-iron, a sufficient quantity of m
glass to make the article required.

Press Machines.—A very limited number of types of articl
be made with a solid mould. Only such as have both an int
and external taper, the diameter being reduced in the directio
the movement of the plunger, are suitable. In all other cases
the ware has external shoulders or ornament, the mould mus
hinged. In semi-automatic and fully automatic machines the
ments of the plunger and mould are operated by compressed a

Refractories and Pots.—With the introduction of more eff
pot furnaces and tanks in which higher temperatures were re
it soon became evident that the question of refractories would
to be investigated in order that the pots, tank blocks and fu
parts, would stand up to the increased strain which was bein
upon them.

In so far as concerns the majority of types of optical glass, a
it were an economical proposition, for other glasses also, pots
porcelain nature or of a composition approximating in relative
portions of alumina and silica to kaolinite have given the most
factory results. In connection with the manufacture of optical
in America for war purposes it was found that a pot of the porce
type was the best suited to their purpose. In other directions

ble experimental work has been devoted to the production of
ɩy the ordinary casting and by the vacuum casting processes,
lso of pots from osmose clay. In each case results of great
se have been obtained.

: tendency has been to adopt the recuperative principle, in
there are two sets of channels or passages, one for the air
, and the other to carry away the hot products of combustion;
mperature of the air is raised due to interchange of heat by
ction through the common party wall of the channels. As the
f the secondary air and hot flue gases is constant in direction,
are, therefore, no reversing valves to be operated, as is the case
regenerative type, and it is claimed that the furnace can be
ained at a more even temperature in the former than in the

: recuperative type of furnace is producer-gas fired. The
:es, according to the designer, differ in respect of the disposition
ir elements; in one type both the producer and recuperators
:uated immediately below the furnace, and both the air pas-
and hot flue-gas passages are disposed horizontally, whereas in
er type the recuperators are at the sides, and the air passages
rtical whilst the flue-gas passages are horizontal. It is claimed
e latter type that glass from a broken pot can be more easily
with and is not likely to cause so much damage.

firing has not been installed to any extent in the glass industry
gland, and in very few, if any, cases has the furnace been de-
l specifically for oil fuel. During the first half of 1921 some
.l glass furnaces in England were fired with heavy oil.

ter results were obtained with the heavier grades of oil, and
'urnaces lend themselves more readily to this type of fuel. In
:se of pot furnaces the pots are liable to suffer on account of
:egular heating due to localised combustion.

ı result of efforts to improve the existing types of oil burners in
rection of better efficiency, etc., several oil burners are now on
arket, in some of which atomisation is effected by steam under
ıre. In others mechanical means and air pressure are utilised.
ugh more complete atomisation is obtained by the former means,
e burner utilising air pressure with some mechanical means for
ng atomisation gives more complete combustion, higher tem-
ıres and increased cleanliness without discolouration or de-
ıtion of the glass, due to the effects of the flame coming into
:t with it. Moreover, with oil fuel the temperatures can be
easily controlled.

ıealing.—Prior to the War in annealing optical glass an efficient
n of well-lagged electrically heated towers ensured a satis-
y result. In other types, however, a primitive, straight-
ʒh tunnel (usually coke heated) formed the lehr. It was exceed-
draughty and the glass was hurried through in all too short a
During the War, however, when the annealing needed to be
suspicion, close attention was devoted to the subject of im-
l lehrs. Considerable care was exercised to ensure efficiency
; operation. The site was well chosen, the system of heating
onsidered in relation to the necessity of a variation in the
ıum temperature according to the class of ware being annealed,
f a gradual fall in temperature after passing the hottest zone.
utions were taken to prevent draughts sweeping through the
nd so defeating the object of the operation. [See W. Rosenhain,
Manufacture (1919); H. T. Powell, *Glass Making in England*
)].

OEBEN" AND "BRESLAU."—The escape of the two
rs "Goeben" and "Breslau" from Messina on Aug. 6 1914
heir flight to Constantinople exercised a large influence on
ttitude of Turkey.

sition in Aug. 1914.—When the World War broke out the
ıs naval forces in the Mediterranean were as follows:—

TABLE I.

:ish forces under Vice-Adml. Sir A. Berkeley Milne:—
cruisers.—"Inflexible," "Indomitable," "Indefatigable"
ɩ2-in., 25 knots), 1st Cruiser Sqn., Rear-Adml. E. C. Trou-
lge; "Defence" (4 9·2-in., 10 7·5-in.), "Black Prince,";
uke of Edinburgh," "Warrior" (6 9·2-in., 10 6-in., 22 knots).
cruisers.—"Chatham," "Dublin," "Gloucester," "Wey-
ıth."
yers.—5th Flotilla, 16 Destroyers.
nch forces under Vice-Adml. Boué de Lapeyrère:—
ships.—One Dreadnought, six "Lord Nelson" type (4 12-in.,
)·4-in.), nine older battleships.
ıred cruisers.—Six.
yers.—24.
ian forces:—
ships.—Three Dreadnoughts, three "Lord Nelson" type.
trian forces:—
ships.—Three Dreadnoughts, three "Lord Nelson" type.
man forces under Rear-Adml. Souchon:—
cruiser.—"Goeben" (10 11-in., 25 knots).
cruiser.—"Breslau" (12 4-in., 25½ knots).

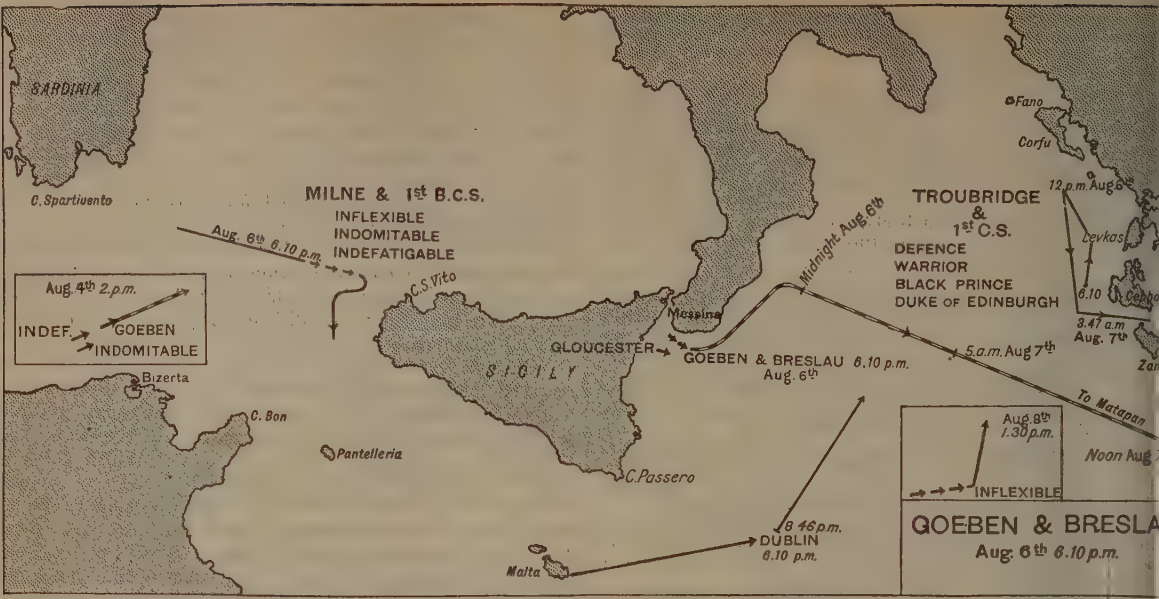
The original orders for the Mediterranean fleet in the event of war were to concentrate at Malta and watch the entrance to the Adriatic, but these were overridden by a series of Admiralty telegrams. The British fleet was at Malta on July 29. On the 30th, Adml. Milne received instructions that his first task was to assist the French in the transport of their troops and to bring the "Goeben" to action if she attempted to interfere. These instructions were sent without reference to the French commander-in-chief, who had not asked for assistance, and the two admirals remained unaware of one another's plans. On July 31 the Italian Govt. informed the British that it intended to remain neutral, a communication of great import, which did not reach the commander-in-chief. On Aug. 1 the "Goeben" and "Breslau" left Brindisi for Messina, the rendezvous decided on in 1913 under the terms of the Triple Alliance.

Search for the "Goeben."—On Aug. 2, at 2:45 P.M., Milne received further orders from home to shadow the "Goeben," watch the entrance to the Adriatic and remain near Malta himself. He accordingly took up his station that evening in the "Inflexible" off Malta, and at 9 P.M. Troubridge sailed with the "Indomitable" and "Indefatigable," the four armoured cruisers and four destroyers to watch the approach to the Adriatic. About 8 P.M. that evening, Milne had been given permission to get in touch with the French admiral, but received no answer to his signals and remained ignorant of the French plans. That night (Aug. 2–3) Milne heard of the "Goeben's" arrival at Messina, and, in answer to his request for instructions, was told by the Admiralty to maintain his watch on the Adriatic, but the "Goeben" was his objective and was to be followed and shadowed wherever she went.

Meanwhile, in Messina, Souchon had received the warning telegram about midnight Aug. 2; he stopped coaling abruptly and put to sea at 1 A.M. Aug. 3 with the intention of bombarding the Algerian coast. The "Chatham" was ordered to look for the "Goeben" in Messina, and passed through the Straits at 7 A.M. (Aug. 3), only to find the harbour empty. In order to locate the "Goeben" and protect the French route, Milne at 9:40 A.M. ordered Troubridge, then on his way to the Adriatic, to proceed west with the "Indomitable," "Indefatigable" and 1st Cruiser Sqn., leaving the "Gloucester" and destroyers to watch the Adriatic. This order was modified at 3:18 P.M. (Aug. 3), when Troubridge was sent back to the Adriatic with the 1st Cruiser Sqn., while the battle cruisers went on to the west, with orders to cruise between Africa and Sardinia. Milne was greatly handicapped all this time by his ignorance of the French dispositions, and received no information from home on this point. Souchon on his way to the African coast received news at 6 P.M. (Aug. 3) of the outbreak of war with France from the Italian wireless station at Vittoria, but held on his way. The Admiralty, having lost sight of the "Goeben," assumed that she was on her way to attack the Atlantic trade routes, and at 8:30 P.M. (Aug. 3) ordered the "Indomitable" and "Indefatigable" to proceed after her to Gibraltar at high speed. They were then south of Sicily and went off at 21 knots.

"Goeben" Sighted.—At 3 A.M. on Aug. 4 Souchon received from Nauen, the great German wireless station, the Kaiser's order to proceed to Constantinople. Deciding to finish his venture, he went on to the African coast, fired a few salvoes into Bône and Philippeville at 6 A.M. (Aug. 4) and made off. At 9:15 A.M. on his way East, he narrowly escaped meeting the French 1st Sqn., which passed him only 24 m. away. Then, by a stroke of good luck, the "Indomitable" and "Indefatigable" on their way westward ran right into him, 40 m. north of Bône, at 10:32 A.M. (Aug. 4). The battle cruisers turned to the east and followed him at 11,000 yards. Their guns were loaded and manned, but war was not declared and they did not fire.

The day was misty, the "Goeben" was at least two knots faster, and by 4:35 P.M. was out of sight. The Admiralty, where it was thought that the "Goeben" was going west, asked the Foreign Office to agree to her being engaged if she attacked French transports, and the order to do so was sent, but did not reach Milne till 5 P.M. Meanwhile he had received during the



afternoon the news of the Italian declaration of neutrality and an order not to approach within six miles of the Italian coast. Italy in her declaration of neutrality had claimed a six-mile limit, which had been accepted without demur. Belligerents were thereby debarred from committing acts of hostility within this limit, but no convention of international law debarred them from entering neutral waters. Italy had not asked for anything of the sort, and the restriction was cancelled on Aug. 6 at 7:46 P.M.; but its immediate effect was to debar Milne from passing through Messina Straits, thus preventing the immediate concentration of any forces he might station at the two entrances.

Meanwhile, the "Indomitable" and "Indefatigable" were still going east on the "Goeben's" track, and were between Sicily and Sardinia when at 6:30 P.M. (Aug. 4) they received orders from Milne to steer west and go slow, and turning round they abandoned the pursuit. In giving this order Milne was evidently influenced, partly by the idea of covering the French transport route, partly by the Admiralty injunction against approaching the Italian coast. He did not know that the French admiral had his whole fleet guarding the route between France and Africa.

Declaration of War.—The warning telegram reached Adml. Milne at 7:02 P.M. (Aug. 4) stating that the ultimatum would expire at midnight. When hostilities commenced at that hour (Aug. 4–5), the "Inflexible" was in Malta channel, steering west to join the "Indomitable" and "Indefatigable"; the "Goeben" was approaching Messina, and Troubridge with the 1st Cruiser Sqn. was about 60 m. west of Zante. The "Goeben" arrived at Messina at 4 A.M. on Aug. 5 and started to get in coal, but on the protest of the British consul difficulties arose and the work was slow. News of her arrival was sent that forenoon by Sir Rennell Rodd, British Ambassador at Rome, to London, and though it did not reach Milne from London till 5 A.M. on Aug. 6, he had already received warning of it from the "Gloucester" at 5:30 P.M. on Aug. 5 and also a report from Malta. At 11 A.M. on Aug. 5 he was off Pantellaria in the Straits of Malta, and proceeded to Bizerta, where the "Indomitable" was sent in to coal. A still more important piece of information never reached the commander-in-chief, namely, that at 7 P.M. (Aug. 5) the Italian authorities had given Souchon 24 hours to leave the port. During the night of Aug. 5 Milne continued to patrol with the "Inflexible" and "Indefatigable" between Bizerta and Sardinia, while the "Indomitable" was coaling at Bizerta, and while Troubridge's cruiser squadron was patrolling on the route from Messina to the Adriatic ready to engage the German ships by moonlight.

"Goeben" Again Escapes.—About 6 P.M. (Aug. 6)
decided to close the northern entrance of the straits, and a
P.M. was 15 m. off Cape S. Vito (the northwest point of S
when the "Gloucester's" wireless began to sound. The "
ben" and "Breslau" were leaving Messina by the sou
entrance. The "Gloucester" followed them closely, a
8:30 P.M. Capt. John Kelly in the "Dublin," on his way
Malta to join Troubridge, received orders to attack them
steered to intercept them, but the "Goeben" passed him i
night unseen. Milne was not conversant with the ticklish
of affairs in Turkey, and had merely been told that the
were mining the Dardanelles. He proceeded therefore at
erate speed (15 knots) to Malta, arriving there with the
cruisers at noon on Aug. 7, just as the "Goeben" was appr
ing Cape Matapan. He was still uncertain of the exact
ments of the French, and was still inclined to think of the
of the western route.

Germans Make for the Dardanelles.—Souchon had bee
at liberty to act as he might think fit. He saw nothing
long spell of inactivity before him at Pola, and had decid
proceed to the Dardanelles. On leaving Messina he ma
feint of steering north till about 11 P.M., but the "Glouce
(Capt. William Kelly) followed him close, signalling his
move. Troubridge with the 1st Cruiser Sqn. was off Ceph
at 6:10 P.M. Aug. 6, and, thinking Souchon was making f
Adriatic, steered at first for Fano Island (at the mouth
Adriatic), but, concluding at midnight that Souchon's
course was a feint, turned round and proceeded south a
speed. He had already informed the commander-in-chief
he would not risk his cruisers in a daylight action with the
guns of the "Goeben," and had been told that the circumst
would not arise. From the positions signalled by the "
cester," he found that he could not hope to intercept her
daylight. He therefore abandoned the attempt and a
course to the eastward for Zante at 3:50 A.M. (Aug. 7). Lik
commander-in-chief, he saw no great danger in the "Goebe
course. Its vast consequences were beyond their ken.

At 4 P.M. Aug. 7 the "Goeben" was off Cape Matapan
the "Gloucester" still clinging doggedly behind. She
engaged the "Breslau" at 1:35 P.M. at 11,500 yds. but
received orders not to follow beyond Cape Matapan, and t
back at 4 P.M. The "Inflexible" and "Indefatigable"
then coaling at Malta 400 m. away, and it was not till
A.M., Aug. 8, that they left for the Aegean in chase. There
still time to do something, for difficulties had arisen as t
"Goeben's" entering the Dardanelles and she was still cr

Aegean, where Souchon had arranged for a collier to meet the lonely little island of Denousa (near Naxos). But an unlucky mischance occurred. A false alarm of war ustria was sent out from the Admiralty at noon on Aug. ie received it at 1:30 P.M., when he was halfway to , and, in accordance with the instructions for war with ı, altered course to the northeast to concentrate the fleet Adriatic. The alarm was cancelled a couple of hours out as the admiral was informed that the situation was , he continued on his course.

oon on Aug. 9 the "Inflexible" was 40 m. west of Zante, was only at 2:50 P.M. that the Admiralty sent him an message to resume the chase. He had lost 24 hours, and enter the Aegean till 3 A.M. on Aug. 10. At 5:18 A.M. he Belopulon Light (36° 56′ N., 23° 30′ E.), just as the ben," 120 m. to the eastward, finished coaling off Denousa. d received orders by wireless through the German S.S. ral" at Smyrna to proceed to Constantinople, and shaped at 5:45 A.M. for the Dardanelles. It was too late to cut , nor had Milne any intelligence of her whereabouts. All ay he was searching for her in the Aegean. At 5 P.M. as off Cape Helles. A Turkish torpedo boat appeared the signal "Follow me." She entered the Dardanelles at utes past 5 on Aug. 10. All the hills of Gallipoli looked on her as she passed. Milne, still searching for her, re- the news at noon on Aug. 11 and was ordered to watch it. As the "Weymouth" approached the Straits the guns forts began to train. At the beginning of this most fateful r of accidents lay the unhappy telegram instructing the l to protect French transports, which did not need pro- n.

escape of the two ships seriously affected the attitude of y to the Allies. The "Goeben" in particular was very , and by her operations in the Black Sea involved Turkey tilities with Russia. In Jan. 1918 the "Goeben" and lau" left the Dardanelles and attacked British ships off os. The "Breslau" was sunk by a mine, but the "Goe- though damaged, escaped. She was again active in the Sea fleet; and, having been again damaged by a mine, ned crippled in the Sea of Marmora till located there by lies after the Armistice.

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ETHALS, GEORGE WASHINGTON (1858–), American eer, was born in Brooklyn, N.Y., June 29 1858. He ated from West Point Military Academy in 1880 and re- a commission as second lieutenant of engineers. In 1882 s stationed at Cincinnati, where he was engaged in improv- e channel of the Ohio. Later he taught engineering at West but returned to Cincinnati in 1889. Afterwards he was in of the construction of the Muscle Shoals Canal on the essee and of a canal near Chattanooga, Tennessee. On the eak of the Spanish-American War in 1898 he was com- ned lieutenant-colonel of volunteers and appointed chief eer of the First Army Corps. In 1900 he was commissioned in the regular army and three years later was engaged in ing fortifications near Newport, Rhode Island. He was made a member of the General Staff in Washington, and 05 graduated from the Army War College. In 1907 he ppointed by President Roosevelt a member of the Isthmian Commission, with the rank of lieutenant-colonel, and after- became chairman and chief engineer. Two years later he romoted colonel.

work, hitherto in charge of civilian engineers, was re- ised and directed by army engineers subject to the control President of the United States. Several changes of plan, as widening the canal, were inaugurated, and after seven labour Col. Goethals completed his task. On Aug. 15 1914 the canal was declared open to world commerce (*see* PANAMA CANAL). Col. Goethals was appointed the first civil governor of the Canal Zone by President Wilson in 1914 and in the following year was made major-general. He resigned the governorship in 1916, and was appointed chairman of the board constituted to report on the Adamson Eight-hour law. In 1917 he was appointed state engineer of New Jersey, but after America's entry into the World War he was released to serve as manager of the Emergency Fleet Corporation. He had little faith in the plan for a wooden fleet, and resigned after three months. Toward the close of 1917 he was appointed acting quartermaster-general, United States Army, becoming in 1918 chief of the division of purchase, storage and traffic. He was also a member of the War Industries Board. At his request he was relieved from active service in March 1919.

GOITRE (Lat. *guttur*, the throat).—Goitre or Derbyshire neck (*see* 12.191) is a term used for abnormal enlargements, usually chronic, of the thyroid gland in the front of the neck. The enlargement may be general and uniform (parenchymatous goitre), or may be localised to one part of the gland or to the isthmus connecting the two halves or lobes. Local enlargements are either innocent, which are common, or malignant, which are rare; the innocent growths are known as adenomas (adenomatous goitre) which at first solid may soften down and become liquid-forming cysts; these cystic goitres or bronchoceles contain yellow, glue-like material (colloid); from bleeding into their interior may rapidly enlarge, otherwise they grow slowly, or may exist for many years without increasing in size or causing discomfort. They often arise in parenchymatous goitres. Malignant disease commonly starts in an adenoma and is generally a carcinoma which grows slowly but has a special tendency to produce secondary deposits (metastases) in bones. The other form of malignant disease, sarcoma, is much rarer, but runs a rapid course.

Simple Goitre.—This is usually endemic, *i.e.*, occurring in special regions, such as Derbyshire, the Thames Valley, the Yorkshire Dales, Hampshire and Sussex, in the neighbourhood of the Great Lakes in North America, in Switzerland, the Pyrenees and some mountainous parts of Asia, and is then due to some local condition, especially the water supply. In Kashmir Col. R. McCarrison correlated it with infection of the drinking water; "goitre springs" and "wells" are known, and fish and animals may also be affected in endemic areas. The observation that boiling the water prevents the incidence of goitre and the occurrence of epidemics of acute goitre in schools are compatible with this view. But that this is the only cause is uncertain, for simple goitre can be prevented by the administration of iodine and the water in goitrous regions is hard and poor in iodine. Goitre may also occur sporadically in areas where it is rare, but is seldom congenital except in endemic regions. It appears most commonly about puberty and is about seven times commoner in females than in males. Large goitres may give rise mechanically to difficulty of breathing by compressing the windpipe.

Toxic Goitre.—The adenomatous enlargement may remain latent without any symptoms for years, and then become active and produce an internal secretion which excites toxic symptoms resembling, but not exactly the same as, those of exophthalmic goitre, protrusion of the eyes being absent.

The preventive treatment of simple goitre consists in boiling the water, removal from an endemic district, and the administration of iodine, or iodide of potassium, in small doses. But in cases of adenomatous goitre iodine is said to lead to a toxic goitre. Exposure to X-rays may reduce the size of the goitre, but by producing adhesions renders surgical removal, should it become necessary, less easy. Surgical removal is necessary for pressure symptoms, toxic manifestations, and may be desirable for cosmetic considerations.

Exophthalmic Goitre. (Synonyms, Graves' or Basedow's disease.)—This has very striking symptoms—an enlarged thyroid gland, protrusion of the eyes, rapid action of the heart and palpitation, tremor, extreme nervousness, wasting, flushing, sweating and mental irritability. It is indeed the converse of myxoedema. The skin may be pigmented, and in bad cases diarrhoea, vomiting and indigestion may be troublesome. Ninety per cent, if not more, of the patients are women. The basal metabolism (the minimal production of heat) is raised and this may be connected with the wasting and tolerance to cold. There is a structural change in the thyroid, probably due to poisons from the alimentary canal, but it may come on after mental shock or emotion. As a result of the change in the thyroid its internal secretion is altered (dysthyroidism) and causes the nervous symptoms. The disease is usually chronic; more than half the patients recover and others improve but do not become absolutely normal. Acute infections, such as influenza, are likely to prove fatal. In a few instances the morbid activity of the thyroid gland is followed by atrophy and myxoedema.

Treatment.—The patients should live a simple life in fresh, country air, avoid much protein (meaty) food, stuffy rooms and excitement. Bromides, quinine hydrobromate, belladonna, digitalis and X-rays or radium to the gland should be employed. If these measures fail, and the case is severe, operative removal of part of the gland or ligature of some of its arteries should be undertaken; the operative mortality of excision of half the gland is now about five per cent. Iodine in the form of Lugol's solution improves the patient's condition so that operation can be more safely undertaken. (H. Ro.)

GOKHALE, GOPAL KRISHNA (1866–1915), Indian politician, was born at Kolhāpur of a humble Chitpavan Brahman family. Graduating at the Elphinstone College, Bombay, in 1884, he joined, as professor of history and political economy, the group of teachers at the Fergusson College, Poona, pledged to serve for 20 years on a merely nominal salary. He remained on the staff finally as principal, until 1902.

Throwing himself fervently into politics, he was associated with the Indian National Congress from its start, and became for some years its joint secretary. In 1897 he paid the first of several visits to England, and gave evidence before the Royal Commission on Indian Expenditure. From then onwards he specialised as a critic of Indian official finance. In 1902 he became a member of the Bombay Legislature and was elected in 1902 to represent the non-official members thereof in the viceregal legislature. His persuasive eloquence, close reasoning, accurate knowledge of the subjects discussed, and instincts of statesmanship won him the Indian leadership, and Lord Curzon recognised his earnest patriotism by nominating him for the C.I.E. in(1904).

Consulting him freely in reference to his projected constitutional reforms, Lord Morley wrote of him to the Viceroy as appreciating executive responsibility and having an eye for the tactics of common sense (*Recollections*, vol. 2, p. 181, 1917). He was fiercely assailed by the extremist section, which never succeeded in his lifetime in capturing the congress machinery. In 1905 he became president of that body, on the occasion of its meeting at Benares. In the same year he founded at Poona his Servants of India Society, whose members take vows of poverty and lifelong service to their country in a religious spirit. In the enlarged viceregal legislature set up in 1910 Gokhale was the commanding Indian figure. His quickness in debate, the attractive literary style of his speeches, his studied moderation, and the care which he took to master his subjects, made him a most effective critic of the Govt. though he indignantly disclaimed the title of the leader of an opposition party.

Besides his brilliant handling of general topics, and more particularly of the annual budgets, he promoted measures for compulsory education on a basis of local option, but did not survive to see this principle introduced from 1918 onwards in all the large provinces. Though his last years were clouded by illness he went to South Africa to acquaint himself at first hand with the grievances of Indians in that country. His last public duty was to serve as a member of the Indian Public Services Commission 1912–5. His death at Poona Feb. 19 1915 was a severe blow to the Constitutional party at a critical moment in India's political history. His last political testament, entrusted on his death-bed to the Aga Khan, was published in Aug. 1917, and outlined plans of reform based on provincial autonomy.

Gokhale's intense patriotism, powerful grasp of facts great industry raised him head and shoulders above his cor poraries; and his moderation, invariable courtesy and lofty sonal character marked him out as one of the last and gre of the old school of congress politicians before the age of co-operation.

GOLD (*see* 12.192).—Since the rise of the Spanish Empi the New World, over £4,000,000,000 of gold has been produ Only 15% of this amount was produced between 1493 an Californian alluvial discoveries of 1848, and nearly half has produced in the first quarter of the century. It is worth whi turn back to the earlier figures in order to measure the rap of the advance.

Value of World Output

Period	World's Output	Proporti %
1493–1600	103,000,000	2·5
1601–1700	125,000,000	3·1
1701–1800	259,000,000	6·4
1801–1900	1,568,000,000	38·4
1901–1925	2,026,000,000	49·6
Total 433 years	4,081,000,000	100

Of the total the United States has contributed 22%, the Tr vaal 21% and Australasia 19%. The following table shows value of the production in different areas:—

	Total amount	Amount produ in 1912–26
	£	£
United States (practically since 1849)	894,000,000	203,000,00
Transvaal (since 1884)	844,000,000	519,000,00
Australasia (since 1851)	709,000,000	92,000,00
Russia and Siberia (since 1814)	370,000,000	40,000,00
Mexico (since 1521)	140,000,000	40,000,00
Canada (since 1858)	116,000,000	58.000,00
India (since 1880)	67,000,000	29,000,00
Rhodesia (since 1898)	61,000,000	41,000,00
West Africa (since 1880)	26,000,000	17,000,00
	3,227,000,000	1,039,000,00
South America, etc. (since 1493)	854,000,000	113,000,00
Total 433 years	4,081,000,000	1,152,000,00

Mr. Eduard Suess has calculated that during the period 18 75 the annual yield of £22,000,000 was obtained as to £19,300 or 88% from alluvial and as to £2,700,000 or 12% from lo By 1890 the output of £24,500,000 was derived as to £11,000 or 45% from alluvial, as to £11,500,000 or 47% from lodes as to £2,000,000 or 8% from the stratified banket of the Tra vaal. So productive has the last source of the metal beco that of the World's gold production of £81,500,000 in 1925, £4 000,000 or 50% came from banket, while lode mining yie £34,000,000 or 42%, and alluvial had fallen to £6,500,000 or 8 Thus has the day of the individual digger disappeared; much the alluvial production is now obtained by dredging, and exp tation by organised capital has taken the place of earlier metho

Though production has advanced so rapidly in the course the present generation, there are indications that, apart fr any new discoveries which may yet be made, the output reach its zenith in 1915. Thereafter, partly as a result of restricti of production due to the increased costs resulting from the Wo War, but partly also as a result of exhaustion of mines, the annu total fell from £96,400,000 to £65,500,000 in 1922 (a year exce tionally affected by a white miners' strike in the Transva recovering to £81,500,000 in 1925. The principal figures of t output for the period 1911 to 1925 are given in tabular fo on opposite page.

This table shows clearly the commanding position of the Briti Empire, which was responsible in 1925 for 70% of the producti and particularly of the Transvaal, which yields three-fourths the Empire's and half of the World's total. It also indica

World's Gold Production, 1911 to 1925
(In millions of pounds at 84s. 11½d. per fine oz.)

	Transvaal	Australasia	Canada	Rhodesia India, and W. Africa	British Empire total	United States	Rest of the World	World Total
1	35·0	12·4	2·0	6·2	55·6	19·9	19·5	95·0
2	38·7	11·2	2·6	6·9	59·4	19·2	17·3	95·9
3	37·4	11·0	3·4	6·8	58·6	18·2	17·9	94·7
4	35·7	9·8	3·3	7·7	56·5	19·4	14·5	90·4
5	38·6	10·2	3·9	7·9	60·6	20·8	15·0	96·4
6	39·5	8·3	4·0	7·7	59·5	19·0	15·0	93·5
7	38·3	7·4	3·1	7·3	56·1	17·2	13·0	86·3
8	35·8	6·1	3·0	6·1	51·0	14·1	13·9	79·0
9	35·4	5·5	3·3	5·9	50·1	12·4	12·5	75·0
0	34·7	4·7	3·3	5·4	48·1	10·5	10·7	69·3
1	34·5	3·8	3·9	5·2	47·4	10·3	10·3	68·0
2	29·8	3·9	5·4	5·5	44·6	9·7	11·2	65·5
3	38·9	3·7	5·2	5·1	52·9	10·3	12·3	75·5
4	40·7	3·6	6·5	5·3	56·1	10·7	13·2	80·0
5	41·0	3·0	7·4	5·0	56·4	11·0	14·1	81·5
	554·0	104·6	60·3	94·0	812·9	222·7	210·4	1,246·0

such countries as Australia and the United States are de- ng. So far as can be foreseen the recovery from the post- year 1922 has largely spent itself.

e destination of the gold taken out of the earth in the period 1493 can be fairly gauged and is given in the following , the first line of which is necessarily conjectural:—

onsumption of the World's Aggregate Gold Output, 1493–1924, with Proportions of Production Consumed
(In millions of pounds at 84s. 11½d. per fine oz.)

	Industrial Arts (Europe and America)[1]	India[2]	China and Egypt[3]	Available as Money (difference)	World's Output[4]
3–1834	? 300 53%	?66 12%	?	? 196 35%	562
35–1844	25 73%	4 12%	?	5 15%	34
45–1854	31 20%	10 6%	?	115 74%	156
55–1864	52 20%	51 19%	?	160 61%	263
5–1874	101 40%	35 14%	?	118 46%	254
75–1884	112 52%	22 10%	14 6%	68 32%	216
85–1894	102 38%	15 6%	8 3%	140 53%	265
5–1904	144 26%	56 10%	25 4%	334 60%	559
5–1914	216 24%	146 16%	20 2%	519 58%	901
15–1924	180 23%	155 20%	10 1%	445 56%	790
	1,263 32%	560 14%	77 2%	2,100 52%	4,000

Based on Soetbeer for 1831–80 and on the Bureau of the United es Mint for 1890–1913, the later figures being approximated by writer on the Bureau of the United States Mint's incomplete istics.

Years to March 31 following. Net imports plus country's own luction.

Egypt from 1879 only and China from 1889 only, plus, in the of the latter, the country's own production.

Mostly based on figures supplied by the Bureau of the United es Mint.

he industrial arts and India have the first call on gold pro- tion. They largely increased their demands after the out- rings of gold by California and Australia after 1848 and 1851, reby serving to moderate the great increase of prices of com- lities which took place, and largely maintained their rate of orption for some time after the gold output had commenced lecline. Again, after production in the 'nineties started its t climb to the height of 1915, they increased their demands eptionally until for the 20 years to 1924 industry absorbed ,000,000 and India £15,000,000 per annum. On the whole have taken 46% of the aggregate gold production, and all his has been effectively withdrawn from the amount avail- as money, for India's imports and its own production have wholly turned into jewellery, possessions and hoards, gold circulating. The proportion left for addition to the world's k of gold money to date has been a little more than one-half. he distribution and re-distribution of the aggregate output ween the end of 1913 and the end of 1924 is as follows:—

Distribution of World's Aggregate Gold Production in 1913 and 1924

	Dec. 31 1913		Dec. 31 1924	
	£	%	£	%
State banks and Treasuries	960,000,000	30·8	1,750,000,000	43·7
Other banks	130,000,000	4·2	160,000,000	4·0
In circulation	497,000,000	15·9	110,000,000	2·8
Hoarded			80,000,000	2·0
World's stock of gold money	1,587,000,000	50·9	2,100,000,000	52·5
Absorbed by industrial arts (Europe and America)	1,062,000,000	34·0	1,263,000,000	31·6
Absorbed by India	398,000,000	12·8	560,000,000	14·0
Absorbed by China and Egypt	73,000,000	2·3	77,000,000	1·9
World's gold output (from 1493)	3,120,000,000	100	4,000,000,000	100

The figures set down for money in circulation and hoarded are necessarily guesswork and may be too high, but the table serves to show that while about £400,000,000 has been taken out of the pockets of the public as the result of the monetary changes produced by the World War, about twice that amount has been added to the stocks in Central Banks.

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GOLD COAST (*see* 12.203).—The British territory in West Africa known as the Gold Coast includes Gold Coast Colony proper (23,490 sq. m.), Ashanti (24,560 sq. m.), the protected Northern Territories (30,600 sq. m.) and the British mandated portion of the former German colony of Togoland (13,040 sq. m.) making a total of 91,690 sq. m., with a population of 2,298,383, of whom 1,173,439 are in the colony proper.

The colony, which is under a governor assisted by an executive and a legislative council, consists of an agglomeration of small, self-contained and mutually independent native states, each of which is under the immediate management of its own tribal organisation. The paramount chiefs are chosen by the tribesmen from families from among whose members alone a chief can be selected. Each paramount chief is the occupant of a stool, which is reputed to be the seat of office of the original founder of the tribe, and he is assisted by a number of sub-chiefs whose jurisdiction is personal rather than territorial. Permanent cultivation due to the extensive planting of cocoa has led to the definition of the territorial limits of tribal areas.

The remarkable economic advance of the Gold Coast has been accompanied by a great extension of the means of communication. Under Sir Hugh Clifford (1912–9), the railway extension from Mangoase via Koforidua to Tafo was completed, and numerous important public works were constructed. Under his successor, Brig-Gen. Sir Gordon Guggisberg, the railway was carried west-north-west to Kumasi, the capital of Ashanti (July 5 1923), which had previously been reached by the line from Sekondi (Oct. 1 1903).

Railways.—Railway communication now consists of the Sekondi-Kumasi line (167 m.), with branches and the Accra-

Kumasi line (196 m.); and a railway is being constructed from Huni Valley, on the Sekondi-Kumasi line, to the neighbourhood of Kade (120 miles). These railways are on the 3 ft. 6 in. gauge. There is also a system of good roads, 1,268 miles in length, maintained by the Department of Public Works, and other roads maintained by the chiefs. Motor transport has been introduced with good effect. The harbours at Accra and Sekondi have been greatly improved, but have not been adequate to the growing trade of the colony, which was valued at £17,408,075 (imports £8,448,862: exports £8,959,212) in the year 1923. In 1921 it was decided to construct a deep-water port at Takoradi, not far from Sekondi, at a cost of £1,600,000, and this work is now in progress.

Industries.—The chief agricultural industry is cocoa growing, and the United Kingdom now receives fully two-fifths of its cocoa imports from the Gold Coast. Cultivation is almost entirely in the hands of the native peasantry, who have made a great success of this industry; the value of the cocoa export in 1923 being £6,566,973. Other products are kola, timber (especially mahogany), palm oil and a small quantity of cotton. Mining is an important industry, especially of gold and manganese. The former is widely diffused throughout the Colony, Ashanti and some parts of the Northern Territories, while the latter exists in large quantities close to the railway line within 40 m. of the port of Sekondi. The shipments of manganese ore reached 181,623 tons in 1923–4, valued at £410,182, and the value of the gold exported in the same year was £852,548. Diamonds are also exported and valuable deposits of bauxite have been discovered.

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(P. E. L.)

GOLDIE, SIR GEORGE DASHWOOD TAUBMAN (1846–1925), the founder of Nigeria (*see* 12.211), from 1908 to 1919 was an alderman of the London County Council, on which he served as chairman of the finance committee. From 1905 to 1914 and from 1915 to 1920 he was president of the National Defence Association. He died in London on Aug. 22 1925.

GOLDMARK, KARL (1832–1915), Austrian composer (*see* 12.212), died at Vienna Jan. 2 1915.

GOLDZIHER, IGNAZ (1850–1921), Jewish Hungarian Orientalist (*see* 12.219), died at Budapest Nov. 13 1921. Since 1910 he has published "The Influence of Parsism on Islam," trans. in C. P. Tiele, *The Religion of the Iranian Peoples* (1912, etc.); *Die Richtungen der islamischen Koranauslegung* (Leiden, 1920).

GOLF (*see* 12.219).—Since 1910 the popularity of golf has increased steadily in Great Britain, while in the United States of America it has spread like a prairie fire. There could be no more striking evidence than the fact that the profession of the golf architect has now become an exceedingly busy and prosperous one. Tracts of woodland, where it would once have been deemed impossible to make a course, have been hacked and hewn into shape, tree stumps have been blown up with dynamite and on one famous course in America, the Lido, sand has been sucked up from the sea by giant engines and spread over a flat marsh in picturesque hills and valleys. The designing of courses has developed into an art requiring skill, experience and imagination.

This, which may be called the second great boom in the history of the game, began with the coming of the rubber-cored ball and is no doubt largely due to it. The ball made the game far easier and pleasanter for the average man to play, but it has had its disadvantages. The ball goes so far that there has been a constant cry that courses are too short. Consequently clubs have had to remake their courses, taking in more ground with great attendant expense. Some attempts have been made, though not with any conspicuous success, to limit the ball's activities. In 1920 there was passed a rule, still in force, which lays down that the weight of the ball shall not be greater than 1·62 oz. avoirdupois and the size not less than 1·62 in. in diameter. The "implements committee" of the U.S. Golf Assn., after exhaustive
experiments, proposed a further slight limitation. At the a
meeting of the Royal and Ancient Club in 1925 it was pro
that a ball thus further limited should be used in the ope
amateur championships of 1926, but the proposal was re
by a large majority.

The Game in the United States

In the United States, in the earlier years of this century
may be said to have altered largely the lives of the uppe
middle classes there, by the introduction of the "co
club" habit. Now it has spread to all classes of society.
American towns have public links where anybody can play
on the payment of a small fee or for nothing. Chicago
the list with nearly 20 of such courses, and all over the co
they are growing rapidly. It is significant that there has
officially instituted by the U.S. Golf Assn. a public
championship which draws many entries and produce
golf, the winner being often one who was a caddie in boy

Standard of Play in the U.S.A.—In these circumstances
only natural that the Americans should have produced very
players. Their standard of play is now unquestionably h
than Great Britain's. As long ago as 1904 Mr. Walter Trav
Australian born who had become an American citizen, wo
British amateur championship at Sandwich. Curiously en
although the standard of play in America is now far higher
in Mr. Travis's day, no other American amateur won the c
pionship until 1926, when the coveted prize fell to Mr.
Sweetser. Mr. Travis's fine victory marked the begi
of the American challenge, but it was not until eight years
that the menace to British supremacy was fully realised.
1913 Harry Vardon and E. Ray went touring through Am
and took part in the open championship at the country cl
Brookline, Mass. They seemed certain to have tied for first
when almost at the end of the day Mr. Francis Ouimet, a y
Boston player who had only lately played in his first am
championship, managed to tie with them by means of a
finish. On the next day the tie was played off over hol
horrible conditions with sheets of rain and muddy gro
Mr. Ouimet held his two opponents all the way, gradually
them down and beat them handsomely.

Changes during the World War.—A year later golf practi
ceased in Great Britain owing to the War but it naturally
tinued to grow and flourish in America. Up till that time
of the professionals in America had been imported Scotsme
Englishmen, but there was gradually arising a race of "h
bred" professionals and after the War they were both fo
dable and numerous. When the British open championship b
again in 1920, the great British golfers, Vardon, Braid, Ta
and Herd, had grown a little too old. They were, as they still
very fine players, but their youth is not perennial and the
strain of a championship had become something too much
them. Great Britain had then, as to-day, many very skilful
fessional golfers but none perhaps who combined skill with
peramental virtues as did those four.

In 1920 the series of American invasions began with Ha
a "home-bred," and Barnes, a Cornishman who had gon
America as a very young man. Barnes did well, but Ha
failed on this his first visit and Duncan, for whom that year
an *annus mirabilis*, won the championship. Next year they
again and Hagen was clearly becoming acclimatised to Bri
golf; but the winner was Jock Hutchison, a St. Andrew's-
player, professional to the Glenview Club near Chicago
though a Scottish golfer, played a typically American game.
tied with Mr. Roger Wethered, who had the misfortune to
one vital stroke by kicking his own ball, and then won easil
the play-off. At the third attempt in 1922 Hagen was succes
winning at Sandwich by a single stroke, despite a wonde
spurt by Duncan in the last round. The next year was on
encouragement for Great Britain, for Havers, a young pro
sional of great power and promise who learnt his game at
wich, managed to beat Hagen by one stroke. There were o
invaders from America, Barnes, Macdonald Smith, one

Carnoustie family, and Gene Sarazen, a young "home- ' player of Italian parentage, who had suddenly come into nence. Barnes and Sarazen failed to qualify but Mac- d Smith finished high on the list.

1924 all four came to Hoylake and Hagen won by one , chiefly by means of a most gallant finish. Indeed he has himself to possess unique powers of recovering from lties and of turning defeat into victory. In 1925 he did not but Barnes won, beating Ray and Compston by a stroke. onald Smith appeared at one time almost assured of victory iled badly in the last round, during which he was rather ered by an enormous crowd. The names of American pro- nals already mentioned make up a large part of the history American open championship but there is a word to be about one truly astounding golfer, Mr. R. T. Jones, com- called "Bobby." Mr. Jones has actually won the ican open championship only once, a feat equalled by Mr. e Travers, Mr. Ouimet and Mr. "Chick" Evans, but championship since the War his aggregate of scores is by 19 strokes than that of the next best man, Walter n. That is an eloquent piece of statistics to which nothing be added.

e Walker Cup.—The history of American and British ama- golf centres chiefly round the Walker Cup which was given well-known golfer, Mr. Walker, for matches between the countries. In 1920, an American amateur team came to part in the amateur championship at Hoylake, played a h against a British team, and won decisively. That was e the giving of the cup. Walker Cup matches have since played on the National golf links, Long Island, in 1921, at ndrews in 1923 and at Garden City, New York, in 1924. American team has won on each occasion, very easily in wn country, by a narrow margin and a most courageous at St. Andrew's. The American team won also in the two ving years, 1925 and 1926. In Messrs. Jones, Evans, Ouimet, ord, Gardner and Sweetser they had the nucleus of a stronger than any Great Britain could command; and it is in that any American team will always be a very formidable The American amateur is invariably well taught and ided in his boyhood and he has a steadiness and consistency nich very few British amateurs seem able to attain. This more remarkable because, unless he goes to Pinehurst or Beach or other southern courses in the winter, he probably less golf than do British golfers, who can and do play all the round.

GOLF IN FRANCE AND ELSEWHERE

fore coming to British golf, something must be said of that her countries. As long ago as 1907, Arnaud Massy, originally arritz fisherman, won the British open championship. He never repeated that feat, though he tied with Vardon in and has several times beaten strong fields of British players ne French championship and did so once again in 1925. e has been no other French professional as good as Massy, here has been a number of very good ones, such as the late s Tellier, Gassiat, Laffitte, Daugé, and one most remarkable rmed player, Yves Bocatzou. The French amateurs have ly yet reached the same standard, but France has pro- d one extremely good lady player, Mlle. Simone de la me. She is already a very fine player and in soundness of od probably comes nearer to the British lady champion, Miss hered, than any other lady.

ere are to-day some very good courses in France. Paris has oulie, Chantilly, St. Cloud and Fontainebleau. Le Touquet, Étaples, is excellent, a mixture of seaside sand and inland trees; and Wimereux, lately remodelled, promises well. In Riviera English visitors have made courses of varying qual- Cannes has one very pleasant one among pine trees at oules and the new Cannes country club, rather further off Iougins, is probably better. Sospel, in a mountain valley e Mentone, is very charming, and others that are at least y and worth playing on are Costebelle, Valescure and Cagnes, near Nice. On the Côte d'Argent there is La Nivelle, near St. Jean de Luz, where Massy is the professional, and Biarritz. Moreover, close to Biarritz a new course is being made of which its promoters think very highly. Nor must Pau be forgotten. It is a club of now almost venerable age, one of the oldest out of Scotland. Switzerland and Italy have courses which are at least very beautiful. Indeed there are courses wherever British people are to be found. Canada, if it has not yet quite attained to the American standard of skill, is almost as keen and spends almost as much money on its courses and club houses. Australia has some good courses, notably perhaps Seaton near Adelaide and Kensington near Sydney; and it has bred at least one first-class professional, Joseph Kirkwood, who has several times done well in the British open championship and is now one of the leading professionals in America.

Japan has taken to the game with enthusiasm although the turf of the country is not of the best kind. It possesses a golf paper, *Golfdom*, and has some good players, although none have yet reached the standard of its lawn-tennis players. In short, in regard to its world-wide character, the game is now only second to lawn tennis.

THE GAME IN GREAT BRITAIN

In Great Britain golf has become steadily more and more popular, and nowhere more markedly than in its original home, Scotland. In Scotland it is essentially the people's game and there are many municipal courses on which it can be played at the minimum of expense. In England it is still largely the game of the comparatively well-to-do, but municipal golf is on the increase and wherever it arises it is an instant success, as witness the public course in Richmond Park which is crowded with all sorts and conditions of players. There are to-day far more golfers than there used to be who have begun the game as boys. It is not a school game but many boys play in their holidays; and considering this fact it is rather surprising that Great Britain does not breed more good young players. The universities of Oxford and Cambridge are full of golfers, but only a few of them are good golfers and the standard of university teams is not noticeably higher than it used to be. The number of players who may fairly be called good has of course increased very greatly throughout the country as a whole, and championship fields have correspondingly increased.

British Amateurs.—It has already been said that when the game was resumed after the War, the leading British professionals were a little past their best. Much the same may be said as regards the amateurs. Mr. John Ball, Mr. Hilton and others of their generation had naturally begun to think of retiring and their places were left open. Two very brilliant young players, too young to be heard of before the War, at once made their presence felt after it, Mr. Cyril Tolley and Mr. Roger Wethered. Of all British golfers in late years, these two have been the most essentially dramatic, and have taken the largest share of public attention. Both can hit the ball enormous distances, both are on their day almost unapproachably good and both can be, on an off day, disappointing. They lack the consistency of such a player as Mr. John Ball, but the game as played by them is an exciting and attractive one. Each has won the amateur championship once. Mr. Tolley has won the French open championship against a strong field, and Mr. Wethered did the best thing which any British amateur has done for a long time when he tied for the open championship with Jock Hutchison.

A golfer of a rather different type, Sir Ernest Holderness, has twice won the amateur championship since the War and, though he has not the magnetic powers of a Tolley or a Wethered, he is beyond doubt a very fine player. In the matter of consistency and steadiness he challenges comparison with the best of the elder amateurs. In 1925 another eminently consistent player, Mr. Robert Harris, won the amateur championship. It was a most popular victory, for Mr. Harris has now been among the leading amateurs for a long time; he was in the semi-final of the amateur championship as long ago as 1907 and in the final in 1913 and 1923.

These two players, Sir Ernest Holderness and Mr. Harris, probably make the safest models for the young amateurs of the present day, for the reason that they are both essentially straight and accurate. There is some danger lest too much importance should be attached to length and that young golfers should indulge in an orgy of slogging. Still, in the last few years, there has been noticed a great increase of driving power. This cannot be wholly accounted for by the increasing skill in the manufacture of the rubber-cored ball. On the whole the amateur standard is going up; but there is still room for a combination of the elder and younger virtues.

British Professionals.—No one or two professionals have definitely succeeded to the throne left vacant by the "triumvirate," Vardon, Braid and Taylor. Duncan appeared likely to do so when he played so wonderfully well in 1920, but he has since been somewhat fitful and inconstant. He is a magnificent golfer but lacks something of solidity and stolidity. Much the same may be said of Abe Mitchell, who has never yet won the open championship, though he has been very successful in tournaments by match play. It is almost impossible to imagine anything better than Mitchell's golf when things are going well; his brother professionals always expect him to win; but he too seems to want that power of rising superior to circumstances, which Hagen so conspicuously possesses. The two Whitcombes, George Gadd, Ockenden, Havers and many others all play exceedingly well without quite rising to the greatest heights. In 1925, however, there appeared suddenly another player, Compston, who adds great determination and character to great physical strength and may possibly be the man for whom the British golfing world has been waiting. He was unquestionably the player of the year and appears, far from relaxing his efforts after a victory, to go from strength to strength. Late in the year he was rather heavily defeated by Abe Mitchell, who played golf of overpowering brilliancy, but this will not discourage him.

Golf for Ladies.—In its ladies' golf Great Britain is strongest. For the first few years after the War Miss Cecil Leitch was the outstanding figure. She has all the qualities of a great player; it is possible to criticise her rather unorthodox methods, but not their results. She is still as good as ever, but she has been surpassed by Miss Joyce Wethered, who to equal strength and courage adds a sounder method. Indeed she is so sound in everything she does that it is impossible to suggest even the smallest loophole in her armour. She won the English close championship five times in succession and the open championship three times in four years, the last time after a terrific struggle with Miss Leitch, in which both played superbly. She has now no worlds left to conquer. These two ladies have dominated ladies' golf since the War, but there are some other excellent players, such as Miss Fowler, Mrs. Macbeth, Miss Chambers, and amongst American invaders, Miss Glenna Collett and Mrs. Fraser, formerly Miss Alexa Stirling. Lady golfers, although they now drive a great deal further than their predecessors, have not yielded to the passion for big hitting as have some of their male contemporaries. For the most part they play very accurately. Their iron play is a great deal more forceful than it used to be and, generally speaking, the difference between good men's golf and good women's golf to-day is one not of kind but only of degree.

SOME GOLF COURSES

The select list of championship courses has been slightly enlarged. Two amateur championships have been played at Westward Ho, and one at Deal, which had previously been only upon the rota for the open championship. The open championship has been played at Troon and is to be played in 1926 at Lytham and St. Anne's. The fixed rota has in both cases been abandoned and, as time goes on, other fresh courses will no doubt get their turns. The management of the two championship meetings is now in the hands of the championship committee of the Royal and Ancient Golf Club. Its members are appointed by the Royal and Ancient but are not necessarily members of that club. They are chosen from representative golfers in different parts of the country. It may here be added that England, Scotland, Ireland and Wales has now each its Golf Union. There is also a large number of county un county matches and county championships. Mention also be made of the Professional Golfers Assn. which do great deal of useful work on its members' behalf and man certain competitions, such as *The News of the World* and *Daily Mail* tournaments open to its members.

It would be impossible to enumerate all the new and courses which have come into existence since 1910. There not so many new sea-side ones of quite the first rank, th there is certainly one, Prince's, Sandwich, which is as fine as in the country, and another, Saunton, in North Devon, w promises to be so. The great increase is in good inland cou This is largely due to the discovery that the country of fir and heather, such as is to be found particularly in Surrey, ca turned into the very best kind of inland course. The Lon golfer has consequently a wonderful choice of fine courses wi easy distance, Sunningdale, Walton Heath, Woking, Worples West Hill, St. George's Hill and Addington are among the l ing ones. Ganton and Alwoodley, in Yorkshire; Hollinwell Nottinghamshire; Sandwell Park, near Birmingham; and G eagles, in Perthshire, are perhaps the best outside the Lon district, but the list is really unending. Finally it has regretf to be recorded that golf is no longer played on Blackheath earliest home in England. The classic heath is now given to football players and its sacred turf has been largely kicke pieces. The Royal Blackheath Club has, however, moved home to Eltham, where it still flourishes and retains its pr claim to be the oldest golf club in the world.

Winners of British Championship, 1911–26

Year	Open	Amateur	Ladies
1911	H. Vardon (Prestwick)[1]	H. H. Hilton, (Prestwick)	Miss D. Cam bell (Portrush
1912	E. Ray (Muirfield)	J. Ball (Westward Ho!)	Miss G. Raven croft (Turnberry)
1913	J. H. Taylor (Hoylake)	H. H. Hilton (St. Andrews)	Miss M. Do (St. Anne's)
1914	H. Vardon (Prestwick)	J. L. C. Jenkins (Sandwich)	Miss C. Leitc (Hunstanton)
1915–1919	No M	atches	
1920	G. Duncan (Deal)	C. J. H. Tolley (Muirfield)	Miss C. Leitc (Newcastle, C Down)
1921	J. Hutchison (St. Andrews)[2]	W. I. Hunter (Hoylake)	Miss C. Leit (Turnberry)
1922	W. Hagen (Sandwich)	E. Holderness (Prestwick)	Miss J. Wether (Sandwich)
1923	A. G. Havers (Troon)	R. H. Wethered (Deal)	Miss D. Chamb (Burnham)
1924	W. Hagen (Hoylake)	E. Holderness (St. Andrews)	Miss J. Wether (Portrush)
1925	J. M. Barnes (Prestwick)	R. Harris (Westward Ho!)	Miss J. Wether (Troon)
1926	Robert T. ("Bobby") Jones (St. Anne's)	Jesse Sweetser (Muirfield)	Miss C. Leitch (Harlech)

[1] After tie with A. Massy.
[2] After tie with R. H. Wethered.

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LITZIN, BORIS BORISOVICH, PRINCE (1862–1916), ian physicist, was born on Feb. 18 (old style) 1862 in etersburg (Leningrad). He was educated in the naval ol and naval academy. In 1887 he left the active service for tific studies and went to Strasbourg. In 1891 he was inted *privat-docent* at the University of Moscow and in 1893 essor of physics at Dorpat. The same year he was elected w of the Academy of Sciences in St. Petersburg and in 1908 a ber of the same. His early research was in spectroscopy, his world-known work is on the methods of earthquake ob- tions and on the construction of seismographs, which are in all Russian and in many foreign observatories. His valu- book, *Lectures on Seismometry*, was published in 1912 and slated into German in 1914. He received the degree of D. Sc. the University of Manchester in 1910. In 1911 he was ed president of the International Seismological Association. 913 he was appointed director of the Central Physical (now physical) Observatory at St Petersburg and achieved good lts in the organisation of the meteorological service through- Russia, especially during the World War, but his work was short by his death from pneumonia on May 4 1916 at New rhof, near St. Petersburg. He took part twice in expedi- s for observations of solar eclipses, once in 1896 at Novaya lya and the second time in 1914 near Riga, where he obtained ndid photographs of the corona. (A. Fo.)

OLLANCZ, SIR ISRAEL (1864–), British scholar, was born ondon of a Jewish family July 13 1863. He was educated at City of London School and afterwards at University College, don and Christ's College, Cambridge. From 1892 to 1895 was Quain student and lecturer in English at University ege, London and in 1896 was appointed university lecturer in lish at Cambridge, becoming in 1906 university professor of lish language and literature at King's College, London. He ame secretary of the British Academy on its foundation in 3 and was knighted in 1919. He was general editor of the *ple Classics* and *King's Library* series and of the *Book of nage to Shakespeare* which appeared in 1916. His published ks include *Cynewulf's Christ* (1892); an edition of C. Lamb's *cimens of Elizabethan Dramatists* (1893); *Exeter Book of glo-Saxon Poetry* (1895) and *Hamlet in Iceland* (1898).

OLTZ, COLMAR VON DER (1843–1916), Prussian gen- , military writer and organiser of the Turkish Army (*see* 27). Gen. von der Goltz was made a field-marshal in 1911 retired in 1913. In Aug. 1914 he was appointed Governor- eral of Belgium, then occupied by German forces. In Nov. he same year he was attached to the Turkish headquarters aide-de-camp-general to the Sultan. In April 1915 he was ced in the chief command of the I. Turkish Army in Meso- amia, and succeeded in investing Gen. Townshend's British es at Kūt-el-Amāra in Dec. 1915. He died April 19 1916 at hdād and was said to have been poisoned by the Young ks. His latest work was *Kriegsgeschichte Deutschlands im n Jahrhundert*, 2 vol. (1910–4).

OLUCHOWSKI, AGENOR, COUNT (1849–1921), Austrian esman (*see* 12.227), died at Lemberg March 29 1921.

OMPERS, SAMUEL (1850–1924), American labour leader 12.230), was convicted in 1907 and sentenced to 12 months' risonment for contempt of court in disobeying an injunction hibiting *The Federationist* (the organ of the American Federa- of Labour), from blacklisting the Buck Stove and Range Co. t. Louis. On his appeal, the U.S. Supreme Court waived the viction on technical grounds. New proceedings were insti- ed and another conviction and sentence in the lower court set aside by the Supreme Court on the ground that the statute imitations had expired before the second prosecution was nched. Although in theory opposed to all war, after the out- ak of the World War he resisted any tendency in labour unions avour peace at any price. He was appointed a member of Advisory Commission of the U.S. Council of National De- ce in 1917.

ompers represented the American Federation of Labour at Peace Conference in Paris 1918–9, and was appointed chairman of the International Committee on Labour Legislation. He was also Chairman of the American labour delegates at the convention of the International Federation of Trades Unions at Amsterdam in 1919. He consistently opposed socialistic movements among the unions and favoured collective bargaining. He opposed compulsory arbitration in labour disputes and urged that labour unions be exempt from the anti-trust law. In 1921 he was elected president of the American Federation of Labour for the 40th time. In Dec. 1924 he was taken ill at Mexico City, whither he had gone after attending the annual convention of the American Federation of Labour at El Paso, Tex. As he had expressed a wish to die on U.S. ground he was placed on a special train, bound for New York City. He died at San Antonio, Tex., Dec. 13.

GOMPERZ, THEODOR (1832–1912), German scholar (*see* 12.230), died at Baden, near Vienna, Aug. 30 1912.

GOODHUE, BERTRAM GROSVENOR (1869–1924), American architect, was born at Pomfret Hill, Conn., April 28 1869. He studied architecture in New York City with James Renwick and in 1891 entered the office of R. A. Cram in Boston, Mass., later becoming a partner. In 1903 the firm opened an office in New York City of which Goodhue took charge. After 1914 he practised alone. He designed churches and cathedrals which were thoroughly modern yet Gothic in inspiration. At the same time he was one of the most prominent exponents of the sky-scraper building. Among the structures designed by him are St. Thomas's Church, the Chapel of the Intercession, and the Church of Saint Vincent Ferrer, New York City; the Nebraska State Capitol, Lincoln, Neb.; St. Mark's Church, Mount Kisco, N.Y.; St. Thomas's College, and the National Academy of Sciences and National Research Council in Washington, D.C.; Mandel Hall, at the University of Chicago; the California Institute of Technology, Pasadena, Cal.; and the Exposition buildings for San Diego, Cal. He was also the architect for the Cathedral of Maryland, Baltimore. He died in New York City April 24 1924.

GOODNOW, FRANK JOHNSON (1859–), American educationist, was born in Brooklyn, N.Y., Jan. 13 1859. Educated at Amherst College, Mass., he studied law at Columbia (LL.B., 1882), subsequently proceeding to the École Libre des Sciences Politiques, Paris, and the University of Berlin. He was appointed instructor in history and lecturer in U.S. administrative law at Columbia University in 1883, becoming professor in 1891, and Eaton professor of administrative law and municipal science in 1903. During 1906–7 he was acting dean of political science. He was legal adviser to the Chinese Govt., stationed at Peking, during the years 1913 and 1914. He was appointed president of Johns Hopkins University, Oct. 1 1914.

Among his published works are *Comparative Administrative Law* (1893); *Municipal Home Rule* (1895); *Municipal Problems* (1897); *Politics and Administration* (1900); *City Government in the United States* (1904); *Principles of the Administrative Law of the United States* (1905); *Municipal Government* (1910); *Social Reform and the Constitution* (1911); *Principles of Constitutional Government* (1916).

GOODWIN, NATHANIEL CARL (1857–1919), American actor (*see* 12.239), died in New York Jan. 31 1919.

GOODWIN, WILLIAM WATSON (1831–1912), American scholar (*see* 12.240), died in Cambridge, Mass., June 16 1912.

GORE, CHARLES (1853–), British divine (*see* 12.254), was, in 1911, appointed Bishop of Oxford, where he remained until 1919 when he resigned and settled in London. His recent works include *New Theology and Old Religion* (1908); *Orders and Unity* (1910); *The Question of Divorce* (1911); *The Religion of the Church* (1916); *The Epistles of St. John* (1920); *Belief in God* (1921); *The Holy Spirit and the Church* (1924).

GORGAS, WILLIAM CRAWFORD (1854–1920), American army surgeon, was born at Mobile, Ala., Oct. 3 1854. He was educated at the University of the South, Sewanee, Tenn., and Bellevue Hospital Medical College, New York, taking his M.D. in 1879. In 1880 he entered the Medical Corps of the U.S. Army. During the Spanish-American War he served as major in the Medical Corps, and was sent, after the Santiago expedition, to Havana, where he was in charge of yellow-fever patients.

From 1898 to 1902 he was chief officer in charge of sanitation measures in Havana, and there conducted many experiments in connection with the discovery that yellow fever was transmitted by the mosquito. Because of his success in eliminating yellow fever there he was made assistant surgeon-general, U.S. Army, with the rank of colonel, by special Act of Congress in 1903.

In 1904 Gorgas was sent as chief sanitary officer to Panama, where two of the main obstacles to building the Canal were yellow fever and malaria. Here again his methods were so effective that in two years he eliminated yellow fever from the Canal region. Malaria also was brought under control. In 1907 he was appointed a member of the Isthmian Canal Commission by President Roosevelt, and the following year was U.S. delegate to the first Pan-American Medical Congress, held at Santiago, Chile. He was president of the American Medical Association, 1908–9. In 1913 he was called to the Rand Gold Mines in South Africa to suggest means for combating the frequent epidemics of influenza. This he found was largely due to crowding the labourers together in barracks. In 1914 he was made surgeon-general, U.S. Army, with the rank of brigadier-general, becoming major-general in 1916. In 1918 he was retired. He then became the permanent director of the yellow-fever work of the International Health Board of the Rockefeller Foundation. He went to Central America, and under his direction investigations of yellow fever were made in Guayaquil, Ecuador and Guatemala. In 1919 he accepted a contract with the Government of Peru to carry out a sanitary programme in that country. He died in London July 3 1920, and was buried in the Arlington National Cemetery, Washington, D.C.

GÖRGEI, ARTHUR (1818–1916), Hungarian soldier (*see* 12.256), died May 21 1916.

GORST, SIR JOHN ELDON (1835–1916), British politician (*see* 12.261), died in London April 4 1916. His son, Sir John Eldon Gorst, died at Castle Combe, Wiltshire, July 12 1911.

GOSSE, SIR EDMUND (1849–), British critic (*see* 12.268), retired from the post of librarian to the House of Lords in 1914. In the previous year his autobiographical *Father and Son* (1907) was crowned by the French Academy, and an edition of his *Collected Essays* was issued. In 1917 he published his important *Life of Algernon Charles Swinburne*, the fruit of his great knowledge of the poet and many years' friendship with him. He received numerous honours from universities and governments, British and foreign, and was knighted in 1925. He continued to write weekly critical articles in *The Sunday Times*, and selections from these were reprinted in *Books on the Table* (1921) and *More Books on the Table* (1923).

GÖTEBORG or Gothenburg, Sweden (*see* 12.271), with a population in 1923 of 227,343, is now the first port of Sweden and the chief centre of the shipbuilding industry. The value of its foreign trade increased from 811,409,000 kronen in 1915 to 1,725,061,000 kronen in 1924. The harbour, which has been considerably enlarged, is the largest in Sweden, and was made a free port in 1922; a dry dock was in course of construction in 1925. Göteborg is now a port of registry for steamers to all parts of the world, and is no longer only a port of call. The town, which is an important industrial centre, with over 400 factories in 1920, has an area of 7,407 hectares. The first Swedish fair, held in the town in 1918, was later recognised by the Government as an international industrial fair. Among new buildings are a commercial institute, Lorensberg (1914); a Latin high school (1919); the Natural History Museum in Slottskogen Park (1923); a fine public school (1917); and Masthugget church (1916). The Navigation School was rebuilt in 1916, and a marine museum, with models of vessels, shipbuilding exhibits, etc., was opened in 1913 and endowed with over 1,000,000 kronen in 1917. A new botanical garden was opened in the Anggården in 1923. The restoration of the Kristine church was undertaken in the same year. The railway line to Stockholm was undergoing electrification in 1926.

GOTO, SHIMPEI, Viscount (1856–), Japanese politician, was born in Iwate-Ken and studied medicine in Germany. As the first civil administrator of Taiwan (Formosa) under Gen.
Kodama in 1898, and as the first president of the South M
churia Railway in 1906, he laid the groundwork of Japan's c
nial enterprises. He was Minister of Communications in 1908
1912; of Home Affairs in 1916; Foreign Affairs in 1918; and ma
of Tokio (1921–2). He exchanged conversations with M. J
regarding the reopening of Russo-Japanese relations upon
own initiative and personal responsibility in 1922. After
great Japanese earthquake in 1923 he became again Ministe
Home Affairs and president of the reconstruction board.

GOUGH, SIR HUBERT DE LA POER (1870–), Brit
soldier, was born Aug. 12 1870, a son of Gen. Sir C. Gough,
joined the 16th Lancers in 1889. In 1911 he became brigadi
general commanding the III. Cavalry Brigade at the Curra
where his attitude with regard to Ulster and the use of the tro
in 1914 caused a grave political crisis (*see* English Histor
He took his brigade to France in Aug. of that year, and after s
cessive promotions was given command of the newly constitu
V. Army; with this he played an important part in the battle
the Somme. In 1917 he was for some time in charge of the Yp
offensive, where his conduct of the operations received consid
able criticism. The brunt of the great German offensive
March 1918 fell on his troops, who were unable to withstand
pressure and fell back with heavy loss in personnel and materi
Gough's dispositions under circumstances of the utmost difficu
were appropriate, and responsibility for the disaster did not r
with him; nevertheless he was deprived of his command by t
Government—punished, as was commonly said, for the failin
of 1917, that had now been amply balanced. In 1919 he was
some months head of the British Mission to the Baltic Stat

GOUIN, SIR LOMER (1861—), Canadian politician, w
born at Grondines, Quebec, March 19 1861. Educated at La
and McGill universities, he was called to the bar in 1884,
became Q.C. in 1900. In 1897 he was elected to the Quebec Leg
lature and from 1905 to 1920 was Prime Minister and Attorn
General of the province. He declined to join Sir Robert Borde
coalition Ministry, subsequently declaring his allegiance to t
Liberal opposition. Knighted in 1908, Gouin received t
K.C.M.G. in 1913. Sir Lomer was included in the Cabi
formed in 1921 by Mr. Mackenzie King, as Minister of Justic
He was one of the Canadian representatives at the fourth asse
bly of the League of Nations at Geneva, when he succeeded
obtaining an interpretation of article 10 of the Covenant in t
form of a resolution. In 1924 he attended the Imperial a
Economic Councils in London as one of Canada's represent
tives, but later in the year retired from politics. Gouin's first wi
(d. 1904) was a daughter of Honoré Mercier, a former Premi
of Quebec.

GOURAUD, HENRI JOSEPH ÉTIENNE (1867–), Fren
general, was born at Paris on Nov. 17 1867. He entered St. C
in 1888, and was commissioned to the infantry in 1890. In 18
he was seconded for duty under the colonial administration; an
thereafter he gained much experience of active service in th
French Sudan, in which he served almost continuously for tw
years. In 1904 he was promoted lieutenant-colonel, made com
mandant of the Chari (Congo) territory, and an officer of th
Legion of Honour. In 1907 he was promoted colonel. He nex
served in Morocco, where he remained until the outbreak of th
World War.

On Sept. 17 1914 Gouraud was promoted temporary genera
of division, and the following Jan. was appointed commande
of the Colonial Army Corps. On Feb. 15 1915 he was made
substantive general of division. In May he replaced D'Amad
as commander of the force in Gallipoli, where he was so badl
wounded that his right arm had to be amputated. He wa
awarded the médaille militaire on July 10 1915. On recoverin
from his wound he went to Italy in charge of a mission, and the
in Dec. 1915 he was appointed to command the IV. Army.
year later he was sent temporarily, as commissioner general, t
Morocco; but he again took command of the IV. Army in Jun
1917. From 1915 to the summer of 1918 the sector of the IV
Army was relatively quiet, save for one moment in the spring o
1917 in which it was drawn into the ambit of Nivelle's offensiv

he Aisne, and at that time Gouraud was in Morocco. Thus, n on July 15 1918 the Germans launched their last offensive he Champagne front, Gouraud had had little executive expe- ce as an army commander in battle, and before the "zero" Pétain had had some difficulty in convincing him of the essity of a "coil spring" defence. But when the time came raud carried out its principles admirably, and brought the mans' last effort to a standstill in his battle zone. Gouraud awarded the grand cross of the Legion of Honour on Dec. 918. In Oct. 1919 he became high commissioner in Syria and mander-in-chief in the Levant. He was succeeded by Gen- Weygand in 1923 and was appointed military governor of is.

OURMONT, RÉMY DE (1858–1915), French writer, was born Bazoches-in-Houlme (Orne) April 4 1858. He was descended n a family of painters and engravers well known in the 15th 16th centuries, and on his mother's side from the poet Mal- be. He settled in Paris in 1883, and entered the Bibliothèque ionale. In April 1891, however, he was requested to leave, r he had published an article in the *Mercure de France* en- ed "Le Joujou Patriotisme." He continued to contribute to periodical and to numerous other papers. His work, which is reat variety and extent, is remarkable for its bold and flexible ıs and great erudition, and his wide range of subject is shown *Sixtine*, a "*roman de la vie cérébrale*," his *Esthétique de la gue Française*, a notable essay on language and phraseology his series of *Promenades Littéraires* and his notorious *Lettres Amazone*. He died in Paris Sept. 27 1915.

n addition to the works mentioned above he wrote: *Le Pélerin du nce* (1896), *Le Livre des Masques* (1896–8), *Le Problème du Style* 02), *Physique de l'Amour* (1903) and *Pendant la Guerre* (1917).

OVERNMENT (*see* 12.292).—Short as it is, the period since o has been momentous in the development of government. e period divides itself into three parts: the years before the r, 1910–4, the years of War 1914–8, and the years of recon- uction after the War. But in the history of government the rs 1914–8 stand out in large letters. War, and especially dern war, sees the state writ large. Yet, divided as it thus is, period 1910–26 should be seen also as a whole. For the ideas state organisation and control which were put into practice in 4–8 were forming in the preceding years of peace.

The steady growth in the functions of the state, especially he seven years before 1914, made easier the task of the mobil- tion and control of national resources in time of war. So again er the War, while the years of reconstruction saw a reaction inst control, yet the range and the boldness of state action in r, and the magnitude and complexity of the problems of ettlement, left both the theory and the practice of the state re advanced than in the pre-War years. Despite therefore, exceptional conditions of the years of War, the period presents unity in its development greater than at first sight appears. events recede and the period can be seen from a greater tance this will become more evident.

The General Idea of the State.—In judging the position of the eory and practice of government at any period of time it is eful to ask three questions: (1) What changes have there been the general idea of the state? (2) What developments stand t in the forms of government? (3) What is most noteworthy regards the scope and functions of the state? The most damental question is, What change is there in the general a of the state? Three things in this period deserve special phasis. First, the remarkable growth in the sphere of govern- ent. The period might be called that of the changing state, h a great and on the whole steady increase in the functions of vernment. The movement of state and community control, ich had been gaining momentum for over a generation, ex- ds in a wide variety of directions. The movement is universal, smuch as it shows itself in varying forms and degrees in all ntries with a developed system of self-government, and with ighly organised economic life.

Second, there is the growth in the moral idea of the state. ght not might is the valid basis of the state, but the significance of this wins recognition slowly. Yet this period will be seen to mark a great advance in this respect. The state exists to make life good. The idea of social justice reveals itself more fully both in the relations of the individual to the state and in the relations of states one to the other. The challenge to the crude theory of the state as might is made in deed as well as in word. There is a new emphasis on the truths that there can only be one morality for the individual and the state, and that, as the state exists to secure justice, its acts, as much as those of the individual, must conform to common moral principles.

The third aspect is the new emphasis on the value of the individuality or personality of the individual and of the group. The end of the state is the individual. The doctrine of sovereignty becomes less formal and dogmatic. The idea of the community transcends that of the state. For the community embraces the great family of groups and associations which the state must recognise as also sharing with it in the expression of man's social and political nature.

I. FORMS OF GOVERNMENT

There have been in the period very important developments in the structure of government, international, national and municipal. But of these by far the most memorable has been the great international constitution embodied in the Covenant of Nations 1919. The establishment of the assembly and of the council of the League, with their regular meetings and with their important array of permanent and special committees, the organisation of the secretariat of the League, the establishment of the international labour bureau under the Treaty of Versailles, and the creation of the Permanent Court of International Justice, (*q.v.*) are achievements of the highest significance in the history of government. The years 1899–1910, opening with the first Hague Convention, had seen a great advance in international arbitration and methods of peaceful co-operation; the crucial year 1914 had seen the ratification of the first of the treaties between the United States of America and other countries to submit all questions under dispute to a tribunal of investigation before recourse to war; but it is above all to the years 1919 and after that one must look for the foundations of the international polity.

Second, this period has been marked by the importance and variety of developments in government within the British Empire—in itself a league of nations, whose constitutional experience has had a peculiar value for the great world League. The Union of South Africa in 1910, expressed in a constitution distinctive in type from that of the other great federations within the British Empire; in the Government of India Act of 1919, embodying a bold experiment in diarchy; the constitution of the Irish Free State, under the Government of Ireland Act 1922, with the status of a Dominion; and the establishment of the Parliament and Government of Northern Ireland, under the Government of Ireland Act 1920, the first example of legislation and evolution within the United Kingdom, are events of great constitutional interest.

Meanwhile important developments have taken place affecting the general system of relations within the Empire. The imperial conference of 1911—the organisation and work of the committee of imperial defence, the development of the imperial War cabinet in 1917–8, and the conscious advance towards fuller equality of status with the mother country on the part of the Dominions—especially the world recognition of the Dominions and of India as member states in the League of Nations, and the efforts made by post-War conferences to provide more effective methods of imperial consultation and co-operation—mark the period as one of the highest importance in the constitutional history of the British Empire.

Third, this period will be notable for the advance throughout the world in the adoption of representative forms of government and in the progress of democratic ideas and institutions. The political constitutional changes since 1910 in China, including the establishment of a republican form of government, are the most striking indication of the changing East. However superficial and subject to reaction many of these changes may be, they are evidences of the will to learn from the political experience of the West, and, with Eastern participation in international institutions of government, are part of the great movement which is bringing the world closer together.

In Europe itself the World War brought many changes in government, and the new constitutions in Germany, the Baltic States, Poland, Czechoslovakia and Yugoslavia mark the advance throughout Europe of common representative forms of government. In most cases these new constitutions show an acceptance of the cabinet idea of responsible government, but methods of direct popular judgment through the referendum and the initiative have also a wide place in modern European constitutions. Notable also is the widespread adoption, in new and old constitutions, of proportional representation.

It remains to be seen how far the organisation of government on these lines is going to provide a sufficiently strong and stable executive, and how far experience may lead those nations which have adopted the system of parliamentary government to study and follow more closely the British model, which has secured a greater measure of stability and of clearness of responsibility than has resulted from other types of parliamentary government.

Trend Towards a Working Harmony.—In this connection also it may be noted that the trend of opinion, based on experience during the period, has been in favour of the system which secures close harmony between the legislature and the executive. In states where the established system was based on a more marked acceptance of the division of powers, and where, as in Sweden, the constitution presented a " dualistic character," development has been steadily towards greater harmony between the parts of government, giving thereby a more unitary character to the constitution. Even in the United States of America, the great example of the separation of powers, there has been an increasing recognition of the value of closer relations between the parts of government, and the working system of the constitution seems to be moving towards the realisation of this object. In this connection one of the most notable developments has been the adoption of a budgetary system by the Federal Govt. in 1921, as well as by individual states of the Union. In general it may be said that the increasing body of comparative evidence on the practical efficiency of different methods of legislative and administrative organisation is bringing about a closer approximation of the different forms of government one to another, and a clearer understanding of the qualities and defects of each type.

While this has been happening in the progress of a representative government, it is also important to recognise that in this same period there has been a great increase in the critical attitude of mind in almost all advanced countries towards the working of representative institutions. Discontent with parliamentary and congressional institutions has been vocal, and the reaction has expressed itself in various ways. In Russia, with the revolution of 1917 a new system of government, based on councils of soldiers, workers and peasants, has been developed. The challenge of this type to the established representative system of parliamentary government has not so far succeeded in the states of Central and Eastern Europe which have given themselves new constitutions since 1918. On the other hand, especially in the Southern European states, the reaction against the weakness and corruption of government has led to the establishment of a series of dictatorships which, even when they maintained the form of parliamentary government have denied it the substance of power. These reactions from representative government are significant. War increases the strength of the executive, and the experience of the first years of peace emphasised the need of authority and leadership. But, apart from this, there has been a growing recognition that, even in normal times, good government in democratic States requires clearness of responsibility and the power to act, and that in many cases representative institutions, parliamentary and congressional, have dissipated power and obscured responsibility.

Functional Representation.—In another direction, closely related to the foregoing, the period has also shown interesting developments in the growth of ideas and of institutional f expressing what is called functional representation. The s of thought which has given prominence to these ideas has more extreme expression challenged the authority of a p mentary system based on regional representation, and has sc to replace this by methods which would directly reflect opinions of the various economic and social groups withi community. The vogue of this school of thought has been not simply to dissatisfaction with the working of the exi forms of representative government, but also to a sense o importance of securing the expert knowledge of the group and of giving to the groups the largest measure of self-go ment and control in the development of their functions.

In practice, the great increase in the organisation, not on industrial and economic but of social and cultural groups w the body politic, extending often beyond national bound has influenced the institutions of government, local, nat and international. Nowhere is this more clearly seen than i formation of representative councils or committees, us consultative, but in some cases invested with considerable s tory authority, which have been associated with the p departments of administration in Great Britain. In Gern the place given in the new constitution to the economic co of the empire is an expression of the same tendency. This not, however, involve the overthrow of the well-establi forms of representative government. Gradually the adjustr of the new to the old order is taking place, and the theor representative government is thereby enriched and strengthe For there is no alternative to representative governme democracy is to survive in the modern world. Such at seems to be the trend of progress through the changing com of political, social and economic conditions.

It is worthy of note also that in this political evolution the going on a process both of centralisation and decentralisat In all federal states there has been during this period a ma growth in the power of the central government, while in st with a more unitary type of constitution, like Great Britain France, methods of devolution and of regional reconstruc have been making headway. But in both types, centralisa and decentralisation are actively proceeding, a consequenc the growth in the functions of the state and of clearer differ ation of the powers which should belong respectively to l national and international authority.

Nor should the increased attention in this period to local ernment, urban and rural, be overlooked. Nowhere have d opments in this field been more significant than in the Un States. The great amount of experiment in that country in forms of municipal government indicates a more active pe of interest in local affairs, while the progress of the munic home rule movement is a further expression of the democ idea that government must be decentralised, and that the s of local responsibility has to be safeguarded in the great mo nation state. Thus this period has brought forth import developments in international, federal, national and local ernment. It will stand out also as one in which the nations h been coming nearer to one another in constitutional thought in forms of government.

II. FUNCTIONS OF THE STATE

The years 1910–25 have seen a great extension in the funct of the state. In the last quarter of the 19th and to an increa degree in the first decade of the 20th century the state has b abandoning the policy of *laissez faire*, and building up a structive plan of community action, aiming at better social economic standards of life. In education, in public health provision for housing, in factory and workshop standards the regulation of industrial disputes, in the developmen municipal services, the new idea of the functions of the state being progressively revealed. The years 1906–10 opened rich fields of state activity; and 1910–4 saw further import developments, which, however, were checked by the outbr of hostilities.

xtension of State Activity.—In Great Britain the establish- it of the development commission and of the road board ked a new constructive policy of state aid. Thus, the re- ces placed at the disposal of the development commission bled a comprehensive scheme of agricultural research to be ertaken, while later the establishment under the Privy Coun- f the committee for scientific and industrial research, and of medical research committee were further recognition of the t and growing function of the state in this sphere. The road rd was also the forerunner of developments of state policy o-ordinating and controlling transport, culminating in later s in the establishment of a ministry of transport. So again pre-War years saw the establishment of national health in- nce and the first steps in the development of unemployment rance under the National Insurance Act of 1911.

he outbreak of war led to a great extension of state functions. ntary methods gradually gave place to state control. The lation of man power, the control of imports and exports, the onalisation of the supplies of munitions, the regulation of cultural production, the rationing of food supplies and of materials for industrial requirements—these and other meas- of state action demonstrated the power of state organisation me of war. Peace brought with it a reaction. Nevertheless, r the War there remained a wider idea of community right obligation. The gravity of the problem of unemployment to measures of relief by central and local authorities of a acter and amount hitherto unknown. The state has also called upon to exercise extended functions in relation to the onal resources of coal, power and transport; while the devel- ent of a much more comprehensive policy for the assistance griculture and forestry and the establishment of the Food ncil are indications of the steady growth in state function.

oluntary Effort.—But side by side with the growth of gov- nental power is the increase in voluntary economic and social nisation, and in the association of voluntary with statutory es in the work of government. There is great significance for future in this renascence of voluntaryism. It marks a new e in the development of government, in which not simply he people by their votes choose their rulers, but in which to ncreasing extent they are associated with the administration overnment in its many branches. The state is becoming e flexible. The organisation of the community is proceeding, simply by bureaucratic efficiency, but by the democratic hod of making the people experience to an increasing extent, ugh voluntary organisations, the part which they alone can n the work of government.

Just as the theory of *laissez faire* had to yield to changing conditions, so the theory of a socialistic state, meaning thereby state ownership, state operation and state control, is giving place, at least in the Anglo-Saxon countries, to a conception of community life, in which there is not only room for individual and voluntary organised effort, but in which it is seen that the increase of state action to be really effective and desirable has to be accompanied by a growth in the more flexible forms of association which come under the category of voluntary and self-help movements. It may well be that, as the Anglo-Saxon race has contributed beyond any other people to the development of representative institutions of central and local government, so the political genius of the race may reveal the part which voluntary associations have to play in the development of democracy and in the meaning of community life. In all these respects the period 1910–25 is significant in the history of government. (*See* SOCIAL SERVICE.)

BIBLIOGRAPHY.—The main sources of evidence for the study of modern governments are to be found in the official records of parliamentary proceedings in the several countries and in the reports of the administration departments and of special commissions on committees of inquiry. For the text of the constitutions W. F. Dodd, *Modern Constitutions* (1909) and P. Dareste, *Les constitutions modernes* (1910) are the most convenient collections while the most useful source for the post-War constitutions is the *Jahrbuch des öffentlichen Rechts* (Tubingen). As regards general studies of modern government, Viscount Bryce, *Modern Democracies* (1921); A. Esmein, *Éléments de droit constitutionnel français et comparé* (1921) and G. Jellinek, *Allgemeine Staatslehre* (1922) are of standard value. A wide range of studies of government in War time has been issued by the Carnegie Endowment for International Peace. A useful series of studies in governmental organisation is published by the Institute for Government Research (Washington, D.C.). (W. G. S. A.)

GRACE, WILLIAM GILBERT (1848–1915), English cricketer (*see* 12.308), died at Eltham, Kent, Oct. 23 1915. His elder brother, EDWARD MILLS GRACE (1841–1911), died at Thornbury, Glos., May 28 1911. See F. S. A. Cooper, *W. G. Grace, Cricketer* (1916), Lord Hawke and others, *The Memorial Biography of Dr. W. G. Grace* (1919).

GRAF, ARTURO (1848–1913), Italian poet and critic (*see* 12.315), died at Turin May 29 1913. *Poesie*, a collection of his best poems, appeared in 1915.

See Sartori Treves, *Arturo Graf, romanziere e poeta* (1904).

GRAIN ELEVATOR.—The term elevator has been universally adopted on the North American continent to describe a granary consisting of deep bins or silos, the grain being elevated to the top of these bins for the purpose of filling them. It is also commencing to be generally used by such other countries as have adopted this method of grain storage.

The grain elevator is the natural outcome of the bulk-handling

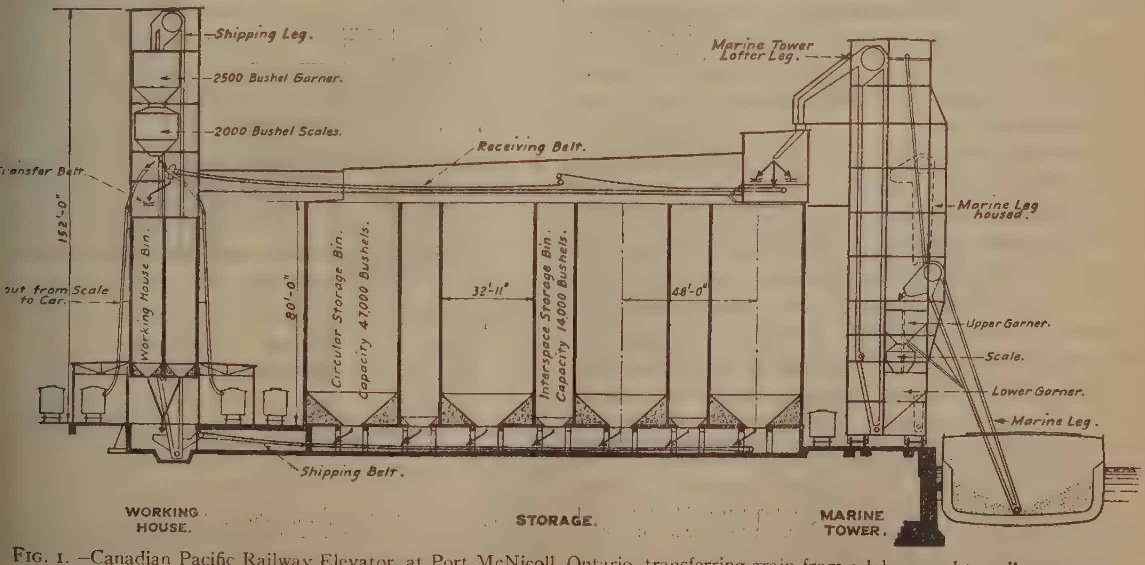

FIG. 1.—Canadian Pacific Railway Elevator, at Port McNicoll, Ontario, transferring grain from a lake vessel to railway cars. Its storage capacity is 4,000,000 bushels.

system as distinguished from the bagging system, and it is this that makes it possible for a port, equipped with up-to-date elevators and grain galleries, to receive and ship out such vast quantities of grain as are handled at Canadian and United States ports, of which Montreal holds the premier position with an export record of over 4,000,000 tons per annum. Previous to the introduction of the bulk-handling system, grain was, and still is, in many countries, handled in bags. To attempt to handle a large grain crop in bags is about as economical as supplying city water in buckets instead of water mains. Grain is a semi-fluid material, and the bulk-handling system uses this fact.

Distribution of Elevators.—Although Canada and the United States are still the only countries in which grain is handled entirely in bulk through elevators, there has been a noticeable movement toward this method in several other countries and already there are examples of up-to-date elevators in Europe, Australia and the Argentine. Russia has a few dotted over her vast grain territory, and South Africa has also made a commencement. The complete bulk-handling plan adopted by the New South Wales Govt. with its chain of elevators from the grain growing districts to the ports and a 5,500,000 bushel terminal elevator at Sydney, is the most complete example of a bulk-handling system of elevators outside North America, the entire system having been constructed under the supervision of the Metcalf Co. of Montreal. The two elevators at Manchester and also that at Dock One, Buenos Aires, are examples of this type by the same company.

Capacity.—The storage capacity of the elevators of the United States is approximately 1,000,000,000 bu.; that of Canada 250,000,000 bu. and the portion of the Australian system already completed 20,000,000 bu., whilst the entire up-to-date elevator storage of the remainder of the world probably does not exceed 5% of the totals of those countries.

Construction.—Until about the end of the 19th century, elevator bins were almost universally constructed of wood, but about that time a demand for a fireproof form of construction began to be felt, owing to the heavy losses by fire and, to some extent, to the increasing price of timber. Steel plate and also tile bins commenced to take the place of those of wood, but this era did not last owing to the introduction of reinforced concrete, which has become practically universal for this class of building.

Use of Concrete.—Since the adoption of concrete as a material of construction, the size of elevator bins has been considerably increased. Circular bins of over 30 ft. in diameter are quite common, and the depth has been increased to as much as 110 feet. The square form of bin, which was almost essential in wood construction, has been largely superseded by circular concrete bins. Another marked advance since 1910 is the general adoption of individual motor drives to all units of machinery, such as belts and lofter legs, and the substitution of silent chain or double-helical gears as a means of power transmission in place of the rope drives formerly used.

Car Dumpers.—One of the most drastic changes in American elevators for many years has been in the method of unloading grain from railroad cars. Until quite recently this was done by means of power shovels. The inner grain door of the car was removed by means of a crowbar and frequently destroyed in the process. Two large scoops or shovels were then carried to the ends of the car by hand and automatically drawn back by ropes operated by drums on the line shaft. This method, although still in general use, entails considerably more man power and more time than is at all in accordance with modern ideas on grain handling. The mechanical car dumper, which automatically opens the grain door without damaging it and dumps all the grain out through the doorway of the car without any manual labour, is being rapidly adopted in the newest types of elevators.

The operation of the Metcalf car dumper is as follows: The car to be unloaded is hauled on to a platform about 58 ft. long, over rails which are in line and continuous with the track rails at either end of this platform. The car, having been run on to this platform, is automatically clamped in position. The platform, with the car, is then raised 10 ft. by means of wire cables,
and simultaneously tilted sideways through an angle of 14°
the grain door rammed in. The platform with the car upon
then tipped endways, first in one direction and then in the ot
until all the grain has run out into a pit with a hoppered bot
below rail level. The grain is drawn off from this pit on to a
conveyor, is conveyed to an elevator leg, carried up to sc
above bins, weighed and distributed in the usual manner.

One of these car dumpers is capable of unloading seven 2,
bu. cars per hour, and as there are batteries of four dumper
the Harbour Commissioners of Montreal Elevator No. 3,
Baltimore and Ohio Railroad Company's elevator at Baltim
and the Santa Fé Railroad Company's elevator at Ka
City, each of these plants has an unloading capacity of 28 t
per minute. (L. C. H

GRAIN PRODUCTION AND TRADE (*see* 12.322).—Accor
to the official statistics furnished to the International Instit
of Agriculture, the production of cereals in those countries
which figures are available during the period was as follows

World Production of Principal Cereals (Russia and China excluded) Millions of cwt.

	Average 1909–13	Average 1919–23	1923–4	1924–5	1925
Wheat . .	1,590	1,621	1,836	1,627	1,75
Rye . . .	503	410	447	357	49
Barley . .	486	415	487	442	52
Oats . . .	980	948	1,062	1,019	1,09
Maize . .	1,705	1,713	1,804	1,527	1,75
Total . .	5,264	5,107	5,636	4,972	5,61

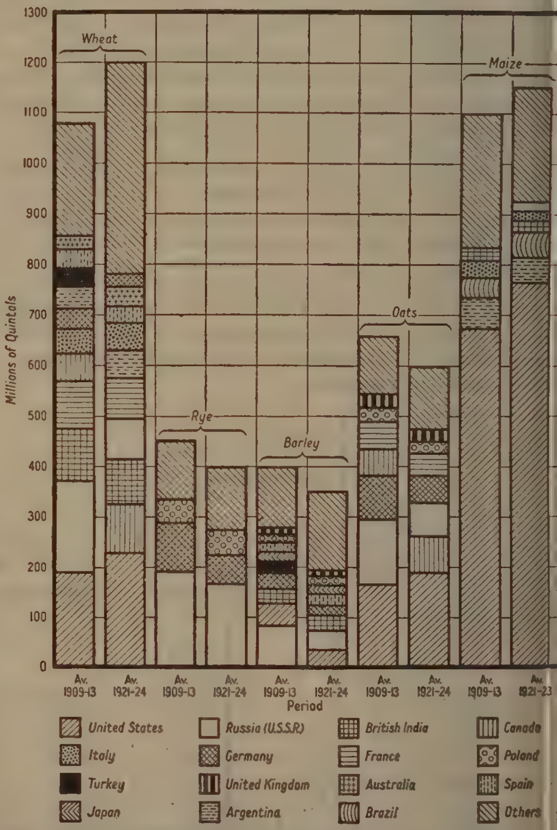

FIG. 1.—Diagram showing the average annual world production
Wheat, Rye, Barley and Oats, for the period 1909–13 to 1921–4, a
of Maize for 1909–13 to 1921–3. The production in the princi
producing countries for which figures are available is indicat
"Others" includes the production in Egypt, Hungary, Mexi
Rumania, Yugoslavia and the other minor producing countries, a
an estimate of production in those countries for which no figures a
available. The diagram is based on figures given in the Internatio
Yearbook of Agricultural Statistics for 1924–5.

These statistics do not include the crops of Russia or China, t they give an approximate indication of the yields in the rest the world. Apart from those two countries, the world's pro- ction of these five cereals taken together on the average of the e years after the Armistice was nearly up to the pre-War erage. In 1923–4 the world had an exceptionally good crop of eals, 7% above the pre-War average, but in the following year 24–5 the yield was poor, being 6% below the pre-War average. 1925–6 the harvests were exceptionally good, 13% better n in 1924–5, practically equal to the good yield of two years ore, and 7% above the pre-War average. According to official tistics furnished for Soviet Russia, its average yield of these e cereals for the five years before the World War was 1,247, 000 cwt., in 1924 it was only 767,000,000 cwt., and in 1925–6 reased to 1,069,000,000 hundredweight. This last estimate s perhaps too sanguine, as the Russian harvests suffered from l weather; but it may be said that for the world as a whole, luding Russia, the yield of these five cereals in 1925 was much ter than it was in 1924, and somewhat higher than the pre- r average.

hese five grains form a large proportion of the food of the abitants of the temperate regions, but perhaps nearly as much in in the form of rice and millet is consumed by the inhabi- ts of the tropical and sub-tropical countries. The world's ld of rough rice (excluding China) in 1924 was 1,613,000,000 ., as compared with 1,413,000,000 cwt., the pre-War average, l if statistics for China were available it would appear that the world as a whole the weight of rough rice produced is ater than that of wheat. Of that quantity 132,000,000 cwt. s exported, as compared with the wheat export of 430,000,000 ndredweight.

I. THE WHEAT YIELD

ield.—The yield of wheat in those areas for which compar- e statistics are available was approximately as follows:—

Yield of Wheat in Millions of Quarters of 480 lb.

Area	Average 1909–13	Average 1919–23	1923–4	1924–5	1925–6
ırope (excluding Russia)	167·8	135·5	155·0	130·2	170·7
orth America	112·3	145·1	160·7	143·2	137·7
sia	48·7	49·0	52·0	50·8	46·8
rica	12·5	12·4	14·1	11·4	14·5
gentina	18·4	23·5	31·0	23·9	26·8
ıstralia	11·3	12·7	15·6	20·2	12·5
Total (excluding Russia)	371·0	378·2	428·4	379·7	409·0
viet Russia	94·2	..	..	47·7	82·7
Total (including Russia)	465·2	..	..	427·4	491·7

hese figures do not include China and a number of unimpor- countries, and it may be roughly estimated that on the pre- average the whole world produced about 490,000,000 quar- . The statistics for Soviet Russia are not very trustworthy, if they be included, the totals indicate that, for the world whole, the wheat harvest of 1925–6 is considerably above the War average. For the countries other than China and Soviet sia, it appears that on the average of the five years after the the yield of wheat was about equal to the pre-War average. the average of the three years 1922–3 to 1924–5 their yield 405,700,000 qr.—that is, 9% above the pre-War average. a comparison be made between the average pre-War yield the average yield of 1922–3 to 1924–5, it appears that the age yield of Europe (excluding Russia) has decreased from to 152 million qr., and there is a very large but indeter- te decrease in the yield of Soviet Russia. The average ls of Asia and Africa were much the same as before; but was an increase in Canada from 25 to 48 million qr., in United States from 86 to 97 million, in Argentina from 27 million, and in Australia from 11 to 16 million. These ases more than made up for the decrease in the average yield of Europe and Soviet Russia. The average yield of wheat in the whole world may be therefore roughly reckoned at about 500 million qr., of which about 50 million qr. are grown in the Southern Hemisphere and reaped in Dec. and Jan., while the remaining 450 million qr. are grown in the Northern Hemisphere and reaped at various times between March and October.

Import and Export.—As the production and consumption of wheat are much more important in the Northern than in the Southern Hemisphere, it is convenient to adopt for the world's cereal year the 12 months ending with July, just before the principal new harvests are reaped north of the equator. For cereal years so calculated the following statistics give approximately the net imports and the net exports of different areas, flour being reckoned as wheat at the rate of three of flour equal to four of wheat.

Net Imports of Wheat in Millions of Quarters

Area	Average 1909–14	Average 1914–9	Average 1919–22	1922–3	1923–4	1924–5
Importing countries of Europe	69	..	69	70	70	80
Non-European countries	13	..	12	17	30	13
Total imports	82	69	81	87	100	93
British Isles	27·0	23·9	25·6	27·0	29·0	28·3
France	5·5	10·1	7·2	5·7	6·5	3·9
Italy	6·6	9·3	11·7	14·4	8·8	11·2
Belgium	6·1	..	4·5	5·0	5·0	5·0
Holland	2·8	..	2·4	2·9	3·3	3·3
Germany	8·5	..	6·8	4·7	3·7	9·9
Czechoslovakia	..	..	1·8	1·2	2·5	2·6
Greece	0·9	..	1·4	2·0	2·3	2·7
Egypt	1·0	..	1·0	0·9	1·0	1·2
Japan	0·5	..	2·0	1·7	3·5	1·5

The figures for the War years are necessarily incomplete for some countries.

Net Exports of Wheat in Millions of Quarters

Area	Average 1909–14	Average 1914–9	Average 1919–22	1922–3	1923–4	1924–5
Russia	20·5	..	−3·0	..	2·9	−2·0
Danubian countries	13·2	..	1·5	1·0	3·0	3·2
Canada	11·8	19·7	18·4	36·4	43·1	23·9
United States	13·4	27·5	31·3	20·5	13·7	28·9
Argentina	10·3	11·9	18·7	17·4	21·5	15·3
Australia	6·6	6·4	12·5	6·1	10·5	15·3
India	6·2	3·7	Nil.	3·6	2·5	4·7
Total all exporting countries (including others not mentioned above)	82	70	81	87	100	93

Apart from the years of war, the demand for wheat from abroad of all the importing countries of the world was, on the average of the three years after the War, much the same as it was on the pre-War average, but on the average for the three cereal years completed in 1925 it increased from the pre-War 82 to 93, having risen to 100 in 1923–4, when wheat was cheap owing to the exceptionally good harvests of that year, and fallen again to 93 in 1924–5, when the price of wheat had risen owing to comparatively poor harvests.

The demand of the British Is., which import about 30% of the whole world's surplus for export, remained remarkably steady, notwithstanding great fluctuations in price, and averaged 28,000,000 qr. for 1922–5, *i.e.*, from Aug. 1 1922 to July 31 1925, as compared with the pre-War average of 27,000,000 quarters. Belgium and Holland taken together imported an average of 8,200,000 qr. as compared with their pre-War average of 8,900,000 quarters. The demand of France, Italy and Germany, which produce a large proportion of the wheat they require for their consumption, varies considerably. On the average of the years 1922–3 to 1924–5 France's import was 5,400,000 qr. compared with the pre-War 5,500,000, but it rose to 6,500,000 in 1923–4, when prices were low, and fell to 3,900,000 in 1924–5, when prices were high. Italy's import averaged 11,500,000 qr., against the pre-War average of 6,600,000 for a smaller population, but it was considerably higher in 1922–3 and 1924–5, when Italy had poor harvests, than in 1923–4, when she had a very good harvest. Germany's average import was 6,100,000 as compared with the pre-War average of 8,500,000 qr. for a larger population; and it was only 3,700,000 in 1923–4, when her own harvest was fairly good but her currency was disorganised, and rose to 9,900,000 in 1924–5, when her harvest suffered greatly from wet weather, and her exchange was on a better footing. Greece, with her increased population, has raised her average import from 900,000 to 2,300,000 quarters. Egypt's average is much the same as pre-War. Japan has raised her average from 500,000 to 2,200,000 qr., but this includes the exceptional import of 3,500,000 qr. in 1923–4, due chiefly to the effects of the great earthquake.

The many importing countries outside Europe, for which detailed statistics are not available, including China, Brazil and other tropical and sub-tropical areas, have apparently imported on the average of 1922–3 to 1924–5 about 20,000,000 qr. against the pre-War average of 13 million. They are even more ready than the European countries to increase their consumption of wheat when it is cheap and to lessen it when it is dear, and they imported much more wheat in the cheap year for wheat 1923–4, when rice was comparatively scarce and dear, than in the year before or the year after, when wheat was dearer and rice cheaper.

As regards the exporting countries, the most remarkable feature was the disappearance of Russia as an exporter. Before the War the Russian Empire on the average produced 102,000,000 qr. of wheat, more than one-fifth of the world's total yield, and exported annually 20,500,000 qr., one-fourth of the world's exports. On the average of the three years after the War, she imported 3,000,000 qr., largely as famine relief, and during the three years 1922–3 to 1924–5 she imported nearly as much as she exported. In the year 1925 she had a much better harvest. The Danubian countries also, Rumania, Bulgaria, Yugoslavia and Hungary, which before the War had an average export of 13,200,000 qr., on the average of those three years exported only 2,400,000, their average yield having fallen off from 39,200,000 to 30,000,000 qr., no doubt owing largely to the impoverishment caused by the War and to the partition among the peasants of the large estates, which formerly furnished a great part of the exports. India had before the War an average yield of 43,800,000 qr., and an average export of 6,200,000 quarters. During the five war years her average yield was 44,000,000 and she exported an average of 3,700,000 quarters. The three years 1919–21 included two poor harvests—the average yield was only 37,800,000 qr., and there was practically no net export; but the three years 1922–4 were years of good harvests, with an average yield of 45,600,000 and an average export of 3,600,000 quarters. This makes the average consumption of these three years about 42,000,000, against an average pre-War consumption of about 38,000,000 quarters. Apparently India utilised her increase of prosperity to increase her consumption of wheat, more especially as during part of that period wheat was unusually cheap and rice unusually scarce and dear.

While Europe and Asia thus failed to maintain their former supply of surplus wheat, the deficit was more than made up by North America, Argentina and Australia, although their exports varied greatly from year to year. During the five war years Canada increased her average export from 11,800,000 to 19,700,000 qr., the United States from 13,400,000 to 27,500,000 qr. and Argentina from 10,300,000 to 11,900,000 quarters. Australia's average export remained about 6,600,000 qr., the difficulty of transport over such a great distance in time of war having made it impossible to export the whole of her surplus. On the average of the three years 1919–20 to 1921–2 Canada exported 18,400,000, the United States 31,300,000, Argentina 18,700,000, Australia 12,500,000 qr.; and on the average of the three cereal years 1922–3 to 1924–5 their exports were, Canada 34,500,000, the United States 21,000,000, Argentina 18,100,000 and Australia 10,600,000 quarters. Thus on the average of these three years the requirements of all the importing countries of the world, amounting to 93,000,000 qr., were supplied approximately in the following proportions: Canada 37%, United States 23%, Argentina 19%, Australia 11%, India 5%, other countries 5%.

Consumption.—If it be assumed that the consumption of a country during a cereal year is represented by its yield plus or minus the quantity imported or exported, the following statistics give a rough idea of the consumption of certain countries
which comparable statistics are available:—

Consumption of Wheat in Millions of Quarters

Country	Average 1909–14	Average 1914–9	1922–3	1923–4	1924–5	Avera 1922–
British Isles	34·4	32·7	35·2	36·5	35·0	35·6
France	45·1	36·8	36·1	40·9	39·0	38·7
Italy	29·5	30·2	34·6	36·9	32·5	34·7
Germany	27·5	...	13·7	16·7	21·1	17·2
Canada	12·8	12·1	13·6	16·2	13·1	14·3
U.S.A.	72·3	75·2	85·0	83·5	82·7	83·7
Argentina	8·0	8·3	8·5	8·5	8·5	8·5
Australia	4·7	7·2	6·4	6·5	6·0	6·3
India	37·6	40·2	42·2	44·1	40·8	42·7

During the World War the importing countries of Europe h
great difficulty in obtaining the wheat they required from abroa
and took special measures to reduce the consumption of whe
and as a result of these measures, and of the great rise that to
place in the price of wheat, several of those countries conside
ably reduced their average consumption. For the British Is. t
pre-War average of 34,400,000 fell to an average during the W
of 32,700,000 quarters. On the average of 1923–5 it rose to 3
600,000 qr., while the population increased from 45,200,00
1911 to 47,400,000 in 1921. During the War the French co
sumption was reduced from the pre-War average of 45,100,0
to 36,800,000 quarters. For 1922–3 to 1924–5 it only ave
aged 38,700,000 qr., although the population (including Alsa
Lorraine) was practically the same in 1922 as it had be
in 1911. On the other hand, the people of Italy found it diffic
to keep down their consumption of wheat, and during the W
the average annual consumption increased from 29,500,000
30,200,000 quarters. For 1922–3 to 1924–5 it averaged 34,700,0
qr., the population having increased from 34,700,000 in 1911
39,700,000 in 1923. The consumption of wheat per head
Germany is much less than it was before the War, as, accordi
to the statistics, the average consumption of 1922–3 to 1924-
for a smaller population was only 17,200,000 qr. as compar
with the pre-War average of 27,500,000 quarters. Canada a
the United States, with an increased population, consumed c
respondingly increased quantities. Australia during the W
was unable to export the whole of her wheat surplus, and mu
of it was wasted or was still in the country at the end of the W
Her average consumption for 1922–3 to 1924–5 was 6,300,0
qr. as compared with 4,700,000 qr. before the War, owing chi
to increase of population. India also had difficulty in exporti
her wheat surplus during the War, and her consumption the
fore increased. For 1922–3 to 1924–5 it averaged about 42,00
000 as compared with the pre-War average of 38,000,000 q
although the increase of population between 1911 and 1921 w
only from 315,000,000 to 319,000,000.

The Question of Price

The price of wheat varies greatly according to its variety, clea
liness, purity, uniformity, strength and condition. It also vari
often very rapidly, with reported changes in the world's weather a
expected changes in the relation between the world's supply and t
world's demand. The cost of ocean freights is another factor in t
calculation. The pre-War average freights on wheat imported in
the United Kingdom were approximately per qr. of 480 lb.: from Ne
York 2s., from Buenos Aires 3s. 6d., from Karāchi 4s. and fro
Australia 7s. The pre-War average prices of wheat, in importi
countries, after deducting import duties, were approximately, p
quarter of 480 lb.: Britain, home-grown 32s., imported 35s.; Fran
32s.; Italy 33s.; Germany 32s.; and Austria 37s.; and in expor
ing countries—Russia 33s.; United States (Chicago) 30s.; Cana
(Winnipeg) 30s.; India (Karāchi) 31s.; Argentina (Buenos Aire
31s. and Australia (Melbourne) 31s. Owing to the cheapness
ocean freights there was no great difference in the average pric
in importing and in exporting countries; and hardly anywhere
the world, except in places far from the sea, or in countries whe
there was a high import duty, was the pre-War average price
wheat below 30s. or above 35s. a quarter.

During the War, owing to the destruction or immobilisation
many ships, to urgent military requirements and to the increase
risks, there was a great rise in ocean freights, and after a time t
British Govt. took control of the whole merchant shipping of

ire and of the arrangements for the import of wheat, not only Britain, but into the Allied countries also. At the date of the istice freight rates being paid for wheat per qr. to the United dom were—from New York 50s., from Buenos Aires 48s. and Karāchi 53s. After the Armistice the control of shipping was tained for a considerable time, but the rates of ocean freight fell rapidly, and by Dec. 1920 (when the movements of shipping practically freed from control) the rates were approximately— New York 8s., from Buenos Aires 8s. 7d., from Karāchi 9s. 1d. from Australia 22s. 6d. After that date there was a further fall in these rates, and in Nov. 1925 they were approximately— New York 3s., from Buenos Aires 3s. 4d., from Karāchi 4s. 3d. rom Australia 8s. 9d.—that is to say, freight rates were not very higher than before the War, and as prices were about 55 % r than before the War this meant that shipowners in 1925 ght wheat to Britain on payment of only about two-thirds of re-War value in commodities. This great fall in the commodity of freight rates was no doubt mainly due to the fact that the l's gross tonnage of seagoing steel and iron steamers had in- ed since 1914 by 38 %, while the quantity of merchandise ring cargo space was less.

order to trace the course of the world's price of wheat during eriod 1913–25, it will be sufficient to quote the prices of wheat t the middle of Nov. (when it is usually possible to frame an oximate estimate of the yield of the harvests in the northern sphere and of their probable yield in the Southern Hemisphere) hicago and Winnipeg as representing the exporting countries, or London or Liverpool as representing the importing countries, hich may be added the average price obtained about that date rmers in England and Wales for home-grown wheat, according e corn trade returns.

Price of Wheat about Nov. 15

ear	Chicago cents per 60 lb.	Winnipeg No. 1 Manitoba, cents per 60 lb.	London or Liverpool No. 1 Manitoba, shillings per 480 lb.	England and Wales Home-grown shillings per 480 lb.
3 .	88	83	34	31
4 .	114	119	48	35
5	108	104	57	53
6 .	184	200	77	69
7 .	217	221	83	70
8 .	223	224	80	72
9 .	227	224	78	73
0 .	188	211	116	90
1 .	119	111	50	46
2 .	117	106	49	42
3 .	105	97	44	40
4 .	156	167	66	54
5 .	164	140	55	48

iring the War the price of wheat rose rapidly both in exporting n importing countries. After the Armistice, the price of wheat nued to rise for a time, and in July 1920 wheat sold both in ıgo and Winnipeg at about 280 cents per bushel—more than times its pre-War price. Soon after that date government con- egan to be removed and freights and prices rapidly fell, and by 1921 the price of wheat at Chicago was only 119 cents per l and at Winnipeg 111—that is, only about 35 % above the Var average. In the following two years there was a further and in Nov. 1923 the prices quoted were at Chicago 105 and nnipeg 97—that is, less than 20 % above the pre-War price. arly in the British Is. the price of wheat rose until in Nov. 1920 Manitoba wheat was being supplied by the Govt. at 116s. r., and the British farmer was being paid about 90s. per qr. for -grown wheat. These prices again were about three times the Var prices, but it must be remembered that they were reckoned erling, and that in that year the British paper pound was only about 75 % of the gold sovereign. After control was removed was a very rapid fall in the price, and by Nov. 1921 Manitoba t was selling in Liverpool at 50s. per qr. and British wheat was t 46s.—that is, about half the price obtained 12 months before. e was a further fall of price in the following two years, and in 1923 Northern Manitoba wheat sold at 44s. and British wheat s. per qr. or only about 30 % above the pre-War price.

ese very low prices in 1923 were no doubt mainly due to the tionally good harvests of that year, both in Europe and in the as a whole, and to the impoverishment of the importing ries of Europe. The low price continued through the winter 23–4; but after May 1924 drought developed in south and eastern Europe, and Canada and central and northern Europe ed a cold, wet summer, and it became evident that the harvest in Northern Hemisphere as a whole would be a poor one. The price of wheat accordingly rose rapidly until at the end of 1925 the price of No. 1 Manitoba in Liverpool was 76s. 6d.— above its price 12 months before. It then came to be realised that this price was higher than was justified by the prospects, and the price fell rapidly in March and April to about 60 shillings. In consequence of the good harvests of 1925 in the Northern Hemisphere it fell further to 55s. in the middle of Nov. 1925, but then rose again owing to the disappointing harvests in the Southern Hemisphere, and in Jan. 1926 was about 62s.—almost double the pre-War price, while the British farmer was getting 53s. a qr. for his home-grown wheat—about 70 % above the price of 1913.

(J. Wi.*)

II. THE GRAIN MARKETS

Great Britain is the only country where the demand for imported wheat is constant and extensive. There are many others which import wheat from time to time, but merely by way of supplement to their home-grown food crops. These circumstances have resulted in the establishment of the London grain trade in the commanding position of the chief market of the world, primarily for wheat business, but also for maize, oats and barley. It is not only for delivery in London itself that this trade is done. A very large portion is for other destinations, and cargoes for ultimate discharge in Scotland, Ireland or Wales, at Dutch, Belgian or German ports, or even in the Mediterranean, are bought and sold by London brokers, on the accustomed basis of London contracts. A considerable business in grain from overseas which does not enter London is registered daily in the grain trade journals, cargoes of wheat and maize forming the greater portion.

The usages and terms of the London market are matters within the competence of the London Corn Trade Assn., a corporate body including members of all grain trade firms of consequence, in Great Britain, on the continent of Europe, and among exporters from North and South America, from India, Australia and Africa. Brokers and traders in all the principal towns of Britain, and millers with establishments in many parts of the world, find it advantageous to belong to the London Corn Trade Association. Most of those not strictly connected with London are also members of their own local associations, of which the Liverpool Corn Trade Assn. is the most important, and is followed by those of Hull, Bristol, Leith, Antwerp, Hamburg, Genoa, etc. The main object of these associations is the protection of the common interests, by defining terms of contract, by providing for arbitration in cases of dispute, and by taking measures to uphold the rights of traders against infringement. The predominance of North America among the grain markets of the world is an outstanding fact, and it is not too much to say that the wheat quotations of Chicago and Winnipeg are those most regarded as deciding the course of the world's grain trade from day to day. In some seasons the Chicago price is all-important, in others it shares supremacy with Winnipeg. The qualities quoted are so well known that is is needful only to mention No. 2 Winter or No. 1 Manitoba in order to afford a definite basis of transactions. In this respect the business in North American grain is done on terms differing from those adopted by other exporting countries.

In the United States and in Canada the system of government inspection of grain for settling grades is very efficient, and the certificate of the government inspector is accepted as final. By far the greater part of the grain business in the United States is in connection with produce intended for internal consumption or manufacture, and the terms agreeable to American buyers have therefore to be accepted by exporters from the United States. In Canada the relative size of overseas trade is much greater, but the system of inspection and grading is even more precise than in the United States, and is accepted by exporters. In dealing with Argentina, whence the tropical passage may cause the grain to deteriorate on the voyage, the contract basis throws this risk on the shoulders of the exporter in South America, and wheat is sold with a guarantee of natural weight to be verified at discharge of the grain. Wheat from Australia is sold as fair average quality at time and place of shipment, and similar stipulations are made in the special contract form for Indian wheat, with a guarantee in case of damage by weevil, or deterioration by the excessive mixture of barley or any other extraneous matter.

By far the larger portion of the world's wheat crops finds its way to the flour-mill, though some considerable quantity is used for cattle or poultry food. The miller, therefore, may be set down as the ultimate buyer of wheat. With the gradual consolidation of mills under the management of a few leaders of the industry, each of these millers has become, individually or in his corporate capacity, a very important factor in the grain trade. He is, in most cases, the original buyer of grain for British ports, to be discharged direct from the ship into his warehouse communicating with the mill by grain elevators and conveyors. In the British grain trade of to-day there is very little scope for the merchant who formerly purchased a wheat cargo for apportionment in suitable quantities amongst millers. The miller does not manufacture flour entirely from one cargo, or even from one sort of wheat. In the ordinary way, when supplies from various exporting countries are plentiful, he will probably mix three or four different kinds, in carefully defined percentages, in order to provide the baker with just such flour as he has been accustomed to sell to the public.

In most of the exporting countries there are well-established firms who employ agents to buy from the farmers, and thus collect adequate quantities for loading their chartered ships. In countries such as Canada and Australia the farmers themselves have formed pools or syndicates, with managers who negotiate with exporters. In the United States, grain export business is so interdependent with future trading that it may be more conveniently treated under that heading. With the exception of relatively small parcels of wheat, very little is sold on the corn exchanges after arrival. It has become the practice for millers to buy, even for their minor requirements, when the grain is still overseas or on passage. It is also customary for bakers to contract two or three months ahead for flour to be delivered, and these contracts are sometimes made with Canadian, Australian and American millers.

Futures.—Apart from direct sales of overseas wheat to millers, considerable business is done by traders who buy wheat for shipment and, either immediately or later, sell a similar quantity for delivery at a future period. This future delivery trading, known also as *marché à terme* or *mercado á término*, originated in the United States and has been established at Liverpool for nearly half a century. It was adopted at Buenos Aires in 1908 and is now carried on at Winnipeg. There are future delivery exchanges, including grain contracts, at Antwerp, Paris, Berlin, Genoa, etc. At Chicago and Buenos Aires futures trading is established for wheat, maize and oats; at Winnipeg for wheat and oats; in all three and in Liverpool wheat absorbs the chief attention. It may be considered as essential that, to avoid cornering, a future delivery exchange should have an ample available supply of such qualities of wheat as are in favour with millers; in other words, the exchange should be located on a main route of transit between the grower and the consumer. Unless this condition is fulfilled the business organisation seldom succeeds.

By means of one or other of these exchanges the farmer can, if he chooses to do so, sell his crop of wheat whenever the price suits him, months before it is ready for the reaper, and thus practically eliminate any risk of falling prices. The miller who has purchased a cargo of wheat can sell an equal quantity in the form of contracts for future delivery. Naturally, he will not find this course desirable unless there is an apparent profit between the price paid for his cargo and that obtainable for future delivery of wheat. He has also to buy wheat for his mill, and if he sells the contracts for future delivery his next enterprise is to sell the flour to be manufactured later, and as he achieves this to buy in his wheat contracts. He thus makes four transactions in place of the simple purchase of wheat abroad and the sale of flour at home. He has safeguarded himself against market losses, and is ready to continue his day-to-day disposal of the flour. It will be noted that in selling wheat for future delivery in a given market he has to rely upon others for fulfilment of these wheat contracts, for he does not intend to deliver from his purchased cargo; hence it is clearly his aim to deal only on markets where there is a steady influx of wheat.

This series of transactions needs only to be multiplied indefinitely, and attributed to traders who are not millers, in order to form a basis of opinion on the grain futures markets. Speculation of course exists, and may carry prices too high or too low. Fluctuations in quotations for future delivery are often extreme and very rapid, for on receipt of some information affecting crops the first interpretation of its meaning is shown in the future delivery market. Sharp fluctuations are not, however, always misfortunes. The purchaser of a wheat cargo who has duly sold futures against it may find that his contracts for sale can be repurchased at a discount of say 3%, and that he can resell his cargo at a discount of 2%. He may probably do the business both ways and come out with a net profit of 1%; he sacrificed 2% on the original price of the cargo, but the sacrifi more than compensated by the 3% gain on the future delivery

Future trading involves, in effect, a daily settlement by seller buyer alike of difference in price arising from market fluctuati and a payment by both parties at the time of making the cont of a cash margin according to the regulations which form part of contract stipulations. In all four markets, Chicago, Winni Buenos Aires, Liverpool, the grain trade clearing house attend these matters, keeping a registry of the contracts entrusted to i members of the association which carries out the future deli business; non-members are not recognised by these association entitled to obtain this security of position. The penalty for payment of differences at the appointed time is the immediate or purchase, as the case may be, of all contracts standing in the n of the defaulting member in the clearing-house registry. T powers are entrusted by their own members to the Liverpool Trade Assn. to the Chicago Board of Trade, the Winnipeg G Exchange and to the Buenos Aires *Mercado á Término de Cere* respectively.

At Chicago, which is by far the greatest grain futures mar there has always been an avoidance of strictness in procedur regards details, and a resulting immense business in contracts future delivery. The trade is in contracts for future delivery, n wheat for future delivery, and it is not surprising that this busi in contracts should annually reach an aggregate far exceeding U.S. yearly wheat crop. The tenderable descriptions of wheat prise many varieties; in practice, Hard or Red Winter wheat is effective basis. There are certain specified places where deli may be made, and American farmers make great use of the Chi Board of Trade.

At Buenos Aires the Mercado á Término not only registers contracts submitted to the clearing house, but in consideration small fee takes up the contracts with buyer and seller respecti accepting the responsibility towards each party during the curr of the contract. It therefore devolves upon the Mercado to call sufficient margin, and to collect the day-to-day differences. urally the Mercado, in its own interests, keeps strict watch over extent of trading done by its members, and the managers can for increased margins if they are dissatisfied with the posi created. The basis of the wheat contract is the typical wheat of country in sound condition, with the proviso that the natural w attains the requisite standard. Delivery may be made at any way station in the republic, with adjustments for transport expe just as is customary in transactions for immediate delivery.

In Liverpool wheat may be delivered from any of the follo descriptions: American winter or spring Manitoba, Argentin Australian, provided that the sample fulfils the requirement grade.

Maize.—The trade in maize is a very large one, though not e to that in wheat; except in Mediterranean and Danubian land maize consumed in Europe is imported, chiefly from Argentine South Africa. Although the enormous maize crop in the Un States comprises three-fourths of the world's yield of maize, little of it is sent abroad; the United States are not usually seller maize on European markets, though it is generally possible to this grain from them for special requirements, by paying a mod premium. The course of prices for maize is governed by quite d ent factors from those which affect the wheat market. The ex of consumption in some European countries varies greatly different seasons of the year, for droughts may reduce the hay fodder crops and throw the demand on maize, or a season favou to field growth may curtail requirements seriously. The Un States maize crop is chiefly consumed locally, for hog or cattle ing, and most of it is therefore never sold as maize on the market. Any examination of market conditions in the Un States is therefore incomplete unless the meat and provision tr are also studied. Of all the varieties of grain brought from overs maize requires the most care in selection for an ocean voyage. contains a larger percentage of water than does wheat, and is more likely to spoil by heating, if put on board soon after har or in the summer weather of six or eight months later.

Barley.—Most of the oversea trade in barley is in the varie suitable for malting or distilling; compared with wheat or maiz business is small, and in few hands. On the British markets supplies of home-grown barley and those of all kinds of foreign b ley are about equal in quantity, so that brewers and maltsters select the desired quality from either source. The suitability barley for malting is one of the technical studies of the grain tra and a really accurate judgment on a particular sample is not an matter. California and Canada are the main exporters of good m ing barley, but these crops are seldom equal in quality to that England. Russian and Danubian barley are classed much lo down than Canadian, but generally contain a valuable percentag grains fit for malting, separable by machine.

Oats.—The British trade in oats is chiefly in home-grown gra of the country's ordinary requirements over 80% is produced the British Is., and a very large proportion is used locally for dai ing or other cattle food, or horse provender. Imported supplies chiefly from North America.

re.—Finally, rye enters little into trade in Great Britain. The producing countries are Russia, Poland and Germany, whence lies are drawn for Belgium and Holland also. Germany is times a buyer and sometimes a seller, while Russia, with an ense production, did not offer to sell for export in 1925, except ig harvest time. Except under the stimulus of high post-War s the United States has not grown rye at all freely, and now rts but little. (J. H. Hu.)

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RAMOPHONE: *see* PHONOGRAPH.

RAND RAPIDS, Mich., U.S.A. (*see* 12.350), had a population 7,634 in 1920 of whom 28,355 were foreign-born, including argest colony in the country from The Netherlands (11,422). 925 the official estimate was 153,698. Annexations of tory in 1915, 1924 and 1925 increased the area to 22 square . While the city kept its title as "the furniture capital of rica," the manufacture of aeroplanes and other essential ucts during the World War led to the permanent expansion further diversification of industries. The commission-manform of government was adopted in 1916. The aggregate e of manufactured products rose from $42,231,100 in 1909 09,135,000 in 1919, and, after a slight decrease in 1921, to ,277,997 in 1923. In 1925 a reconstruction of the city was r way in conformity with a comprehensive city plan, ted in 1922. The public schools were in process of reorsation and a junior college had been added; there was a rvised playground within half a mile of every child's home; iltration plant, built in 1914, had been doubled in size; a ge disposal plant was under construction; several fine hotels, itals and office buildings had been erected. Grand Rapids is nd only to Des Moines in the proportion of homes owned % in 1920). It has a high proportion of children at school, all amount of child labour, a low percentage of illiteracy, general death-rate and a low infant mortality.

RANT, DUNCAN (1885–   ), British painter, was born at iemurchus, Inverness-shire, son of Major Bartle Grant, was educated at St. Paul's School, London. He early ed his remarkable decorative sense, working with Roger at the Omega Workshops, London, and at the same time uced some highly individual painting. His early work ind "The Lemon Gatherers" (1911), now in the Tate Gal- and the "Seated Woman" (1912). Modern French inces, particularly those of Cézanne, made themselves strongly his design and brushwork, as may be seen in the "Tight-Walker" (1918), "Snow Scene" (1921), "The Hammock") and many still-life pictures of this period. Grant, who ne a member of the London Group, also carried out interest- domestic and scenic, decorations and designs for emeries. See Duncan Grant, *A Collection of Plates*, with inction by Roger Fry (1923).

ANVILLE-BARKER, HARLEY GRANVILLE (1877–   ), h playwright, was born in London Nov. 25 1877. At the f 13 he was sent to the Theatre Royal, Margate, then a ination of stock company, theatre and dramatic school. He first appeared in London in the following year, at the Comedy Theatre, under Charles Hawtrey. His first play, written in 1893, was produced by amateurs. From 1895 onwards he acted in a variety of plays, in Shakespeare with Ben Greet, and, with William Poel, in *Richard II.* and Marlowe's *Edward II.* In 1899, his play *The Weather-hen* (written in collaboration with Herbert Thomas) was produced in London. In 1900 he became interested in the newly formed State Society, first as actor, then as producer, and his own play, *The Marrying of Ann Leete*, was produced by the Society in 1901. In 1903 he collaborated with William Archer in the framing of *A Scheme and Estimates for a National Theatre.* In 1904 he joined J. E. Vedrenne in the management of the Court Theatre, London. There, during three years he produced, and at first acted in, a variety of plays by Ibsen, Bernard Shaw, St. John Hankin, John Galsworthy, John Masefield, Maurice Hewlett, Gilbert Murray (translations from Euripides) and his own *The Voysey Inheritance* (1905). In 1906 he published *Prunella* in collaboration with Laurence Housman. A later play, *Waste* (1906), was banned by the Censor, but was privately performed by the Stage Society. *The Madras House* (1909) was produced by the Frohman Repertory Company at the Duke of York's Theatre in 1910, and a revised version of it was revived in 1925. By 1910 he had given up acting, but until 1914 produced plays in London, including two by Shakespeare upon a platform stage with "conventional" decoration. After the War he maintained no active connection with the Theatre. He published various other works, including *The Exemplary Theatre* (1922), dramatic criticism, also translations of several foreign authors. He was public lecturer on the art of the theatre to the University of Liverpool in 1921–2 and he delivered the British Academy Shakespeare lecture in 1925.

GRAPHS: *see* STATISTICS AND GRAPHS.

GRAVITATION: *see* ASTRONOMY.

GREAT BRITAIN.—The following article is a continuation of the one on the UNITED KINGDOM (*see* 27.598). The change in title is rendered necessary by the altered political status of Ireland. As the change took place during the period under review reference must necessarily be made to Irish affairs, but primarily the article is concerned with Great Britain only (*i.e.*, England with Wales and Scotland), with the lesser islands belonging thereto. It deals with seven matters: (I.) Constitution; (II.) Local Government; (III.) Defence; (IV.) Finance and Banking; (V.) Population; (VI.) Industry and Trade, including agriculture; (VII.) Communications. (*See* also BRITISH EMPIRE; ENGLISH HISTORY; IRELAND, NORTHERN; IRISH FREE STATE; SCOTLAND; WALES.)

I. CONSTITUTION

The years 1910–25 were momentous in the history of the British constitution. They opened with an acute struggle between Lords and Commons which has left a permanent mark on the constitution, in the shape of the Parliament Act. Four years later, with the outbreak of the World War, the country entered on a period of arrested development; a truce was called between the two great political parties and a kind of constitutional moratorium declared in which the operation of the Parliament Act, alike in its application to the duration of Parliament and to the machinery of legislation, was arrested; two statutes, the Welsh Church Act and the Government of Ireland Act, which had been forced through under its automatic action, were suspended.

During the same critical period many rules of the constitution—some statutory, others conventional—were also in abeyance; the re-election of Ministers, on acceptance of an office of profit under the Crown, was one; the cabinet system, in its normal aspect, was another. A kind of super-cabinet, known as the War Cabinet, came into existence, and with it another constitutional novelty, the "Cabinet Secretariat" as a liaison between the Government departments. The liberty of the subject, as the result of that *lex regia* the Defence of the Realm Act and its successors, coupled with a latitude of judicial interpretation which reached its high-water mark in *Rex* v. *Halliday* (*ex parte Zadig*), underwent severe restrictions, and, for the period of the

War and some time beyond it, the country lived under a kind of statutory martial law as unprecedented in its history as the tremendous struggle which necessitated it.

Return to Constitutional Principles.—With the end of the War and the return to normal conditions of existence, constitutional principles reasserted themselves. The courts of law, always jealous of the liberty of the subject, administered severe and salutary checks to the encroachments of the executive, and a series of remarkable judicial decisions, most notably *Chester* v. *Bateson* ([1920] 1 K.B. 829) declared one "D.O.R.A." regulation after another *ultra vires*, while at the same time, in the great constitutional case of *De Keyser's Royal Hotel* v. *the King* ([1920] A.C. 508; [1919] 2 Ch. 197), the courts asserted, if they did not actually extend, the right of the subject to sue the Crown by petition for losses sustained as the result of the exercises of the prerogative in the matter of requisitions. The Defence of the Realm legislation lapsed with the efflux of time, though not the bureaucratic temper to which it ministered, and Parliament, in endowing the executive with somewhat similar powers, in cases of "emergency," under the Emergency Powers Act 1920, was careful to impose the most stringent parliamentary checks upon their exercise. As the result of the De Keyser case, the executive found itself threatened with thousands of claims for compensation, and an Indemnity Act, imposing a time-limit upon such claims and establishing a special procedure for dealing with them, was placed on the Statute Book. The Act had been most jealously scrutinised in its passage through the legislature, and it soon became apparent that Parliament was as little inclined as the judiciary itself to tolerate a continuance of the usurpations of the executive, whose sole justification had been their temporary character. With the fall, in Oct. 1922, of Mr. Lloyd George's Coalition administration, the conventions of the constitution resumed their sway.

Statutory and Other Changes.—It would, however, be a great mistake to regard post-War conditions as testifying to a mere reversion to type. Great statutory changes of a permanent character took place, the most notable of which were the Representation of the People Act 1918, the Parliamentary Qualification of Women Act 1918, and the Sex Disqualification Removal Act of 1919, statutes which, among other things, effected a complete revolution in the civic position of women, removing, as they did, all disqualifications of sex for admission to the franchise, to a seat in the Commons, to service on juries and all public functions. Constitutional changes of equal magnitude were effected by the grant of self-government and Dominion status to Southern Ireland, and by the establishment of representative legislatures and, in some measure, of self-government in India (*see* INDIA). Equally important were the developments in the status of the Overseas Dominions (*see* BRITISH EMPIRE; CANADA, etc.).

Many statutes of considerable constitutional importance, dealing with legal procedure and the administration of justice, were enacted during the years 1920–5, such as the Administration of Justice Acts 1920 and 1925, the Judicature Act 1925, the Criminal Justice Act 1925; and for a long time two such fundamental rights of the subject as procedure by indictment before a grand jury and trial by jury in civil actions at common law were seriously threatened as the result of innovations during the War, which, long after its termination, appeared likely to perpetuate themselves by statute. Another Act of considerable constitutional importance was the British Nationality and Status of Aliens Act 1918, which amended the British Nationality and Status of Aliens Act of 1914. The period under review was also notable for the number of leading cases in constitutional law. Moreover, the growing political consciousness of the working classes had, even before the War, been productive of new conditions, some permanent, others transient. One was the judicial decision known as the Osborne case (*Osborne* v. *Amalgamated Society of Railway Servants* [1909] A.C. 87), resulting in legislation (the Trade Union Act of 1913) for the protection of minorities against the political levy on members of trade unions; another, of which the issue has yet to be seen, was the claim to the active exercise of political power. The policy of direct action,
i.e., the exercise of political pressure upon the Governmen
the day by resort to the weapon of a general strike, was
immediate cause of the action of Parliament in conferring dra
powers on the executive, in case of emergency, to deal by pro
mation with any such threats to the normal economic life of
community. The Govt. exercised this power effectively du
the general strike of May 1926.

The appearance of a minority Government in 1923 raise
constitutional question, long dormant, namely the right
Prime Minister, even though in a minority in the House of C
mons, to ask and receive authority from the King to diss
Parliament. This was a question as to which there could b
real doubt in the minds of those acquainted with constituti
developments since 1858, but none the less it had been the
ject of much dispute when Mr. Ramsay MacDonald accep
office in Jan. 1924. His exercise of this prerogative of the Cr
in the following Oct. may be said to have settled the ques
beyond further dispute.

THE PARLIAMENT ACT AND OTHER MEASURES

Parliament.—The enactment of the Parliament Act in 1
consequent upon the rejection of the Finance Bill by the H
of Lords in the preceding year, limited the authority of
House of Lords. (*See* ENGLISH HISTORY.) It was an emerge
measure, designed to secure the immediate passage into law
Liberal Govt's. legislation. The preamble recognised this to
extent of admitting the necessity of further legislation
substitute for the House of Lords as it at present exists a sec
chamber constituted on a popular instead of a hereditary bas
The implied promise has never been redeemed and the prob
still awaits solution, a solution that has become all the
imperative in view of the vast extension of the franchise effe
by the Act of 1918, the peculiar sensitiveness of post-War gov
ments to public opinion, and the appearance on the polit
scene of a new and powerful party whose avowed object i
revolutionise the economic basis of society by legislation.
did the authors of the Act foresee its constricting effect upon
legislative procedure of the House of Commons itself. The
fusion in which the Government of the day found itself invo
in its financial legislation during the session of 1914 was a
direct consequence of the Parliament Act, for new question
to the legitimacy of tacking non-financial provisions o
finance and revenue bills were raised.

The discretion given to the Speaker under the Act, of deci
whether, in giving or withholding his certificate, a bill c
within the new statutory definition of a money bill, has inve
his ancient office with a judicial authority the particular exe
of which no government can foresee. That authority has hi
to been exercised with the complete independence characteri
of the Speaker's office, but the new powers conferred upon
constituting as they do the sole constitutional safeguard ag
sudden and revolutionary legislation by a party temporaril
a majority in the House, may yet expose the office to poli
capture—to quote the expression of the Trade Union Cong
in Oct. 1924.

The effects of the provisions of the Parliament Act confining
Lords to a suspensory veto in ordinary, as distinct from finan
legislation have been less apparent, as only two measures had
to the end of 1925, been forced through under their operation
they have invested the process of legislation in the Commons w
new rigidity, owing to the necessity of any bill, which is to tak
vantage of the automatic machinery of the Parliament Act, re
ing the character of the same bill in each successive session.
incidental result is the restriction of the right of private member
propose amendments to a government bill, by way of sugges
in its later and automatic stages.

The constitutional crisis of 1910–1 was productive of an
statute, equally novel but much less revolutionary in its charact
the Provisional Collection of Taxes Act. That crisis disclosed
fact, long known to constitutional lawyers, that the budget res
tions under which duties are collected have no legal force, and
the result of the case of *Bowles* v. *the Bank of England* ([1913] 1
57), it was found necessary to enact a statute giving, for the fu
statutory effect, for a limited period of time, to Ways and M
resolutions varying or renewing taxation imposed during the
ceding financial year.

e procedure of the House of Commons during the period under
w has undergone little change and the problem of how to secure
effective control of the House over the estimates remains exact-
ıere it was. It is essentially a problem of parliamentary time,
ı is limited, and the increasing devolution of the legislative func-
of the whole House to standing committees has, with the in-
ing demand for legislation, not solved the question. A new
:ture was made in 1921 by the appointment of an estimates
nittee, but it is confined by its terms of reference to considering
economies can be effected "consistent with policy," which in
ice means that it had no power to deal with questions which
sters choose to regard as outside its jurisdiction. The mere
that its reports are presented after Supply is concluded has de-
d it of any effective voice in the control of expenditure.

interesting departure in the grant of legislative autonomy to
Established Church was effected by the Church of England
nbly Powers Act of 1919. Under the Act powers of legislation
lelegated to the newly constituted National Assembly of the
ch, but subject always to the control of Parliament to be
ised through an "ecclesiastical committee" consisting in equal
bers of members of both Houses. Upon the report of this com-
ee, measures submitted by the Assembly shall, if approved by
olution of both Houses, be presented to His Majesty for the
assent in the same form as a bill. The co-ordinate authority
ed to the House of Lords by this Act, and the legislative inde-
ence secured to members of both Houses, is a noteworthy
rture, but the legislation contemplated does not, of course,
ıke of the character of a government bill. None the less the
s a noteworthy experiment in devolution.

ıe Electorate.—The electoral changes effected by the Repre-
ıtion of the People Act were immense, far surpassing in magni-
the three Reform Acts of the preceding century. Not only did
franchise women and add no less than 13,000,000 electors to
egister, but it also altered and simplified the law of registration,
ted a redistribution of seats, abolished the property qualifica-
and, much more questionably, removed the pauper disqualifica-
At the same time it reduced the qualifications for the exercise
vote, in the case of men of 21 years of age, to the simple require-
of six months residence, or, in the alternative, occupation of
ıess premises, either or both of which might confer the right to
not more than two votes being so conferred. In the case of
en the minimum age is 30, and the basis of qualification has to
ought in the local government franchise. Innumerable other
ges in the machinery of registration and election were effected
he Act. Taken in conjunction with the two Acts previously
ioned its effect is, except in the matter of age, to assimilate the
status of women entirely to that of men. A curious anomaly
s, however, in regard to the position of peeresses. The wife of
er may be elected to the House of Commons, but a peeress in
own right may neither be elected to the Commons nor take her
in the Lords: this was the decision of the Committee of Privileges
iscountess Rhondda's Claim (1922).

ıe Cabinet and the Ministry.—An important, if limited, change in
aw governing the acceptance of office by Ministers was effected
he Election of Ministers Act 1919. Temporary measures had
passed during the War relieving new Ministers on appoint-
from the necessity of seeking re-election; the Act in question
etuated this departure, to the extent of providing that no mem-
on appointment should in future vacate his seat if his acceptance
fice should take place within nine months after the issue of a
lamation summoning a new Parliament. For such a measure
is much to be said, in that it dispenses with the necessity of a
e Ministry, constituted on the resignation of its predecessor
a defeat at the polls, from being subjected to the hazards of a
lection. In 1926 the House of Commons passed a measure
ned to dispense altogether with the necessity of seeking re-elec-
on the acceptance of office.

me of the new ministries created during the War disappeared,
our became permanent—Pensions, Labour, Transport and Air,
ast being responsible for the creation of a new Secretaryship of
. The number of Secretaries of State was further raised to
by the Secretary for Scotland being raised to that dignity.
status of the Dominions overseas has been recognised by the
ion of a Secretaryship of State for the Dominions, but though
ly distinct from the Secretaryship for the Colonies it is united
it in the person of one and the same minister. The Local
ernment Board was reorganised and renamed the Ministry of
th. With the establishment of the Irish Free State the Irish
e was abolished and Irish affairs were transferred to the Colonial
e.

ıe immediate result of the War appeared to be the exaltation of
position of the Prime Minister to a personal ascendancy
npatible with the principles of cabinet government. The insti-
n of the War Cabinet, whereby a small inner council of Minis-
freed from all administrative duties decided all questions of
y—other Ministers being summoned to these deliberations at
discretion of the Prime Minister communicating with them
ugh his own secretariat—could only be justified in time of grave
onal peril. The result was to place in his hands an almost exclu-
power of initiative in Cabinet business, and to undermine the time-honoured principle of the collective responsibility of Ministers. The evil results of this system were manifest long after the War, with effects upon ministerial discipline which were forcibly illustrated by the circumstances attending Mr. Montagu's resignation of the seals as Secretary of State for India.

The disappearance of the War Cabinet, and of the Coalition Govt. of which it had been the offspring, marked a return to normal procedure. In two respects, however, the ascendancy of the Prime Minister would appear to have become permanent: one is that the Permanent Under-Secretary to the Treasury has come to be regarded as the head of the whole civil service, and as an official through whom the Prime Minister may exercise a certain degree of authority over all departments otherwise than through the Ministers in charge of them—possibly an anomalous position; the other is the precedent created by Mr. Asquith when he obtained from the King before the dissolution of 1910 a contingent guarantee that if the Government were successful at the polls such a number of peers would be created as the Prime Minister might think necessary to secure the passage of the Parliament Bill into law.

In one important respect the precedents created by the War Cabinet have left their mark on the constitution. The Cabinet Secretariat, although completely disestablished as an instrument in the hands of the Prime Minister, survives to the extent that minutes of Cabinet proceedings are now kept by a permanent official, who is thus placed in a position of peculiar delicacy if not of peculiar authority. The tradition of "Cabinet secrecy" is to that extent changed. The departure has been much criticised by constitutional purists, but the exact position is obscure.

The Executive.—The outstanding constitutional problem is the continual encroachment of the executive either by using the prerogative or by the presumed exercise of statutory powers, upon the rights and liberties of the subject. The only safeguard against this tendency is the vigilance of Parliament and the independence of the judiciary. The term of office of the Labour Govt. was marked by an attack by the Prime Minister upon the independence of the judiciary in the person of Mr. Justice McCardie, who in the case of *O'Dwyer* v. *Nair* (reported in *The Times*, May 1–June 6 1924) had made certain observations on the attitude of the executive in the case of General Dyer. For this Mr. Justice McCardie was severely criticised in the Commons by Mr. Ramsay MacDonald. On behalf of the judge it was urged that the subject-matter of the judge's remarks was directly raised by the defendant in his plea of justification, and was therefore such as the judge was bound, by the duties of his office, to deal with. The claim put forward by the Prime Minister to the immunity of the executive from judicial criticism was a far-reaching one.

In the *Board of Education* v. *Rice* (1911) the court of appeal and the House of Lords had reminded a department that "it is not an autocrat free to act as it pleases," and had granted rules for the issue of writs of *mandamus* and *certiorari* to control its arbitrary disregard of the law in the exercise of the semi-judicial powers conferred upon it by the Education Act. In *Dyson* v. *the Attorney-General* ([1911] 1 K.B. 410, and [1912] 1 Ch. 158), the Court laid down for the first time that a subject threatened with penalties by the revenue authorities, for non-compliance with interrogatories which were *ultra vires*, had the same right of access to the courts for a declaration of the law against the executive as if the defendant were a private person. These cases are only two out of many. The whole subject is both too large and too technical to be dealt with here, but reform is urgent in two directions: (1) in the assimilation of the rights of the subject to sue the Crown to his rights against a private defendant, (2) in the restoration of both judicial and parliamentary control over the exercise of powers of "subordinate legislation" by Government departments. In one respect there has been a notable reform—namely, the Acquisition of Land (Assessment of Compensation) Act of 1919. This statute provides that where, in the pursuance of any statutory power, land is acquired compulsorily by any government department or local authority, the right of the owner to the assessment of compensation by an independent arbitrator, instead of an official valuer, is to be restored.

The Liberty of the Subject.—For some months during the War the subject was deprived of his rights to trial by jury even in criminal cases, under the Defence of the Realm legislation, but the suspension of this right was short-lived. In the case of the right to a jury in civil actions the situation was much more serious. For seven years, from 1918 to 1925, this right was taken away, and it was the exception, instead of, as hitherto, the rule, that a litigant in a common law action should, on demand, have the right to have his case tried by jury. In the case of *Ford* v. *Blurton* (38 T.L.R. 801) this invasion of an ancient right of the subject was vigorously criticised by the Court of Appeal itself, and the old rule was eventually restored by the Administration of Justice Act of 1925. So too the ancient process of indictment by grand jury was abolished during the War, and for it was substituted, as the accusing authority, the attorney-general. After the War, however, it was restored.

In the case of *R.* (*ex parte O'Brien*) v. *Secretary of State for Home Affairs* ([1923] 2 K.B. 361; A.C. 603), the executive, acting under an order in council which purported to be made under Defence of the Realm legislation, reincarnated as late as 1923 in the form of regulations under the Restoration of Order in Ireland Act, had arrested, with a view to summary deportation to Ireland, an Irishman resident in England; he applied for a writ of *habeas corpus*. The Court of Appeal, in an exhaustive survey of this “ subordinate legislation,” severely criticised the action of the executive, declared the legislation in question *ultra vires* and granted the rule for the issue of the writ. The judgment may be regarded as the classical authority on the scope of *habeas corpus*, and the House of Lords, on appeal, upheld it, at the same time laying down the important principle that their appellate jurisdiction, while always available against a refusal of the writ, does not extend to an appeal against the grant of it—in other words, the right of the subject to summary release, on the determination of an inferior court that he is illegally detained, is established.

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(J. H. Mo.)

II. LOCAL GOVERNMENT

There have been no radical changes in the system of British local government since 1902, when the *ad hoc* education authorities, the school boards, were abolished and their functions transferred to the county and town councils. The hierarchy of local authorities stands in general as it was reorganised in the last two decades of the 19th century. In England and Wales the chief administrative units are counties, county and non-county boroughs, urban and rural districts and parishes.

The county of London has a unique subdivision into the city and the 28 metropolitan boroughs, and there are also in the metropolis and elsewhere a number of joint authorities for special purposes—asylum boards, hospital boards, water boards, burial boards, etc. Scotland has counties, burghs—royal, parliamentary and police—and district committees of the counties in place of the English rural districts. It also has *ad hoc* education authorities and lunacy authorities (district boards of control). The Scottish parish council is the poor law authority, corresponding to the board of guardians in England and Wales. Northern Ireland in the main follows the English system, while in the Irish Free State local government in 1926 was in the melting pot.

The principal reforms of recent years in Great Britain fall under four heads:—

1. The old central authorities, the Local Government Board and the Scottish Local Government Board, were abolished in 1919 and their functions transferred to new creations, the Ministry of Health (for England and Wales) and the Scottish Board of Health;
2. The local government electorate was enlarged by the Representation of the People Act 1918, which extended the vote to women and to certain classes of men hitherto disfranchised;
3. The Rating and Valuation Act 1925 remodelled the machinery of assessment and rating, abolishing the parish overseers and putting their duties in the hands of the county borough and urban and rural district councils;
4. Apart from these specific reforms there has been a general tendency to enlarge the powers of the local authorities, especially in the sphere of the social services. Acts dealing with maternity and child welfare, tuberculosis, venereal diseases, mental deficiency, housing and town planning and education, have all added considerably to the work of the county and town and district councils. At the same time the big towns have grown still bigger, not only by increase of population, but often by extension of their area through the absorption of surrounding districts.

All these developments have revealed grave defects and inconveniences in the system, and have led to a widespread demand for reform. The counties have struggled against the constant encroachments of the county boroughs. The county boroughs and the more important non-county boroughs and urban districts complain, and with reason, that while their functions have been increased they are still unduly controlled and thwarted by the central authority and Parliament. And the absorption of surrounding districts by the big towns and the expansion of public needs have made it more and more difficult to administer effectively such services as transport, water supply, electricity, regional planning, police, etc. This problem is particularly acute in the metropolitan area, and in 1921 a royal commission, under the chairmanship of Viscount Ullswater, was appointed to inquire into the local government of Greater London. The majority of the commission, however, reported unfavourably to substantial change. They contented themselves with rec mending:—

(*a*) Some redistribution of functions inside the administra county;
(*b*) A reduction in the number of the petty local authorities in outer districts;
(*c*) The creation of a statutory advisory committee to assist tral departments in dealing with questions of transport, hou and town planning and main drainage;
(*d*) A scheme for further equalisation of rates within a 10- radius from Charing Cross.

There were two minority reports. The first proposed Greater London should be made into a congeries of county oughs with certain services reserved for administration by a tralised authority. The second recommended a new author popularly elected, for the governance of the whole area. body would be directly responsible for all the large central s ices, and would require to have carefully defined powers co-ordination and supervision of the work of the minor l authorities within its area.

In 1923 another royal commission was appointed, with Earl of Onslow as chairman, to inquire in particular into question of the creation and extension of county boroughs generally into the constitution, areas, functions and mutual lations of all local authorities. It issued a first report in which proposed certain reforms in the machinery for creatin extending county boroughs. The most important of these were

1. All proposals for the constitution of county boroughs shoul made by private bill instead of by provisional order. Proposals the extension of county boroughs should also be made by priv bill, unless the county borough concerned prefers the provisio order procedure and no other local authority concerned objects.
2. The minimum population entitling a borough to apply county borough status should be 75,000, instead of 50,000.

This somewhat conservative report was generally regarde a compromise, designed in the main to ease the friction betw the counties and the towns. In 1926 the commission was paring to deal with the second part of its reforms, which it clear would be considerably affected by the proposed legislat for the break-up of the poor law.

The main problems, therefore, remain unsolved. New win bursting old bottles, and no general agreement has been reac as to the kind of new bottle that is wanted. On two poi however, there is a growing consensus of opinion. A conces must be made to the demand of the great municipalities for centralisation—for local discretion, that is to say, to carry their services or extend their enterprises, including “ munici trading ” schemes, with less interference from Westminster Whitehall. This power they claim in the interest alike of ciency, economy and democracy. On the other hand, there urgent need for a large measure of local centralisation, for constitution of areas and authorities adequate to the performa of services which transcend existing boundaries. The atten may be made to meet this need either

(*a*) By special joint committees of neighbouring local authori for various services such as transport, water supply, electricity so on; or, better, (*b*) by a more drastic reorganisation which wo set up new authorities—“ super-local authorities,” so to speak— these services, as well as for the general supervision of local gove ment throughout their areas.

This was what the second minority report of the Ullswa Commission recommended for London, and it is obviously able of application in other parts of the country. It is in pri ple the line of reform advocated by the “ regionalists.” Regi alism implies a re-organisation in which the whole country wo be divided into a number of regions or provinces, say seven ten or a dozen. These provinces would be natural and not mer artificial units, since different parts of the kingdom have disti ties of common interest, both economic and “ cultural ” (*e* London and the Home Counties; East Anglia; the West Co try; “ Lancastria ”). They would, it is claimed, be the efficient possible units for administering the larger services; on them would be devolved the bulk of the present cen

ority's powers in respect of the supervision of the work of
subordinate, but largely autonomous, local authorities within
region.

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III. DEFENCE

1913 an important investigation was held by the Committee
mperial Defence into the principles which govern the defence
Great Britain. For several centuries there had been two
ols of thought. The one, supported by several eminent sol-
s, held that it was necessary to maintain a large army for
nce against invasion. The other, supported by the majority
reat seamen, held the view that it was essential to the eco-
ic life and prosperity of the population to maintain a navy of
cient strength to keep open their sea communications
inst any single foreign navy, or any anti-British combina-
s at sea; and that a fleet, strong enough to achieve that pur-
, would also be in a position to secure the immunity of Brit-
territory from invasion by a foreign army. The invasion
ol met this plea with the argument that the British Fleet
ht be "enticed away" from home waters and the opportu-
then seized to pass a foreign army across the Channel or the
th Sea; and, furthermore, that the larger the home defence
y, the greater the force that must be employed by prospec-
ly hostile foreign countries for effective invasion, and the
er the task of the navy, upon which "freedom to manoeu-
" would thus be conferred during the lengthy process of
mbling the hostile invading army, and transporting it across
intervening sea.

he Question of Invasion.—The invasion school was particu-
active during the years immediately preceding the World
, partly in order to maintain the proposition that the recent-
stablished Territorial Force was required mainly for home
nce, as the terms of enrolment of its members seemed to
cate, and partly in order to support a widespread movement
the introduction of national service for a similar purpose.
controversy came to a head during the years 1913–4, when
Committee of Imperial Defence devoted much time to an
ustive inquiry into the question whether invasion by a
nan army, bearing in mind the size of the German mer-
ile marine, was a more feasible proposition than invasion
French army, which had been ruled out of court some
s before, after a similar investigation by the Committee of
erial Defence, mainly on the plea that French merchant
ping did not suffice for the purpose. The inquiry of 1913–4
ted in the conclusion that invasion, defined as a military
ation on a large scale intended to conquer the country, was
a danger against which it was necessary to make special
ision under the then existing conditions of relative sea-
r, but that the landing of military "raiding forces" upon
sh shores was a possible contingency, against which mili-
forces must be provided.

e situation was thus summed up by the late Sir Julian Cor-
in his official history of the War:—

> e truth is that, with rare and special exceptions, as when the
> y's chief naval force was not based in the Home Area, our
> or Grand Fleet always operated from its home station. Its
> mount duty was to secure the command of Home Waters for
> afety of our coasts and trade . . . . For defence against invasion the system was obviously the only one possible; for control of trade it had been found efficacious, and never more so than proved to be the case in the War of 1914.

In order to draw up definite plans to meet the assumed danger from military raiding forces in time of war, the War Office required definite estimates of the strength of such forces which might succeed in slipping past the naval dispositions. As the strength of these forces must depend upon the number and size of the transporting vessels, this was clearly a question for the Admiralty. The maximum strength agreed upon and accepted by the naval authorities was a military raiding force of 70,000 men, and Sir Julian Corbett has told us that, in naval opinion, no such raid was likely to be attempted except across the North Sea. In the actual event, the coasts of Great Britain were immune from military raiding forces in the World War, although on several occasions definite rumours of their probability caused the authorities to make dispositions for which considerable military forces were employed, at periods when there was an urgent need for their services beyond the seas. For instance, in March 1918, during the time of greatest anxiety for the safety of the British Army on the Western Front, over 41,000 officers and nearly 130,000 other ranks of the army, classed as "fit for general service in any theatre of war in all respects, both as regards training, physique and mental qualifications," were retained in the United Kingdom, while the total strength of the home army, mostly of men in lower categories, reached a total of nearly 2,000,000. In that connection it is also necessary to bear in mind the need to maintain military forces in Great Britain in aid of the civil power, should such a demand arise. The attitude of the population of parts of Ireland, which necessitated the presence in that country of British troops during and after the War provides an example.

There was yet another demand for soldiers in the United Kingdom, to guard, against "evilly-disposed persons," certain vulnerable points of which the loss or destruction would adversely affect the navy, army or air forces. Large numbers of men belonging to the combatant forces, most of them unfit for service abroad, were employed upon work of this nature, besides strong forces of police.

Personnel.—It was also necessary to provide military personnel, especially artillery and engineers, to man the defended ports and naval bases and anchorages, essential for the use of the navy, mercantile marine, and troop transports. The arrangement between the Admiralty and War Office was that the army should be responsible for the fixed defences, guns, forts, electric lights, and so forth and for defence of the land fronts, while the Admiralty provided floating booms as obstructions, and, at some places, submarine mines and the personnel connected therewith. The Admiralty also made arrangements for an examination service, to visit and examine vessels before they were allowed to enter British harbours. A few places, including Scapa Flow in the Orkneys and Cromarty on the east coast of Scotland, received special treatment, the Admiralty providing marines to man the coast batteries and lights. Another important task which fell upon naval personnel was mine sweeping, to keep free of enemy mines the channels leading to and from British ports and anchorages, and there was an additional and only partially foreseen demand for coast watching, in aid of the coastguard. This task was performed to a great extent by volunteer watchers, the boy scouts taking a very active part in the movement.

Coast Defences.—In connection with the general question of fixed coast defences, it is important to realise their limitations. "People often say," wrote Admiral Mahan, "that such and such an island or harbour will give control over such a body of water. It is an utter, deplorable and ruinous mistake." The same author explains further that "control of a maritime region is ensured primarily by a navy, and secondarily by positions, suitably spaced from one another, upon which, as bases, the navy rests, and from which it can exert its strength," and that "in a naval war coast defence is the defensive factor, the navy the offensive. Coast defence, when adequate, assures the naval commander-in-chief that his base of operations—the dockyards and fuel depôts—is secure. It also relieves him and his Government, by the protection of commercial centres, from the necessity of considering them and so leaves the offensive arm perfectly free." On the whole it may be said that British defences adequately performed these functions in the World War, but it is necessary to take note of the point that they did not secure complete immunity for the coastal population; Scarborough, Hartlepool and other places suffered from bombardment by hostile war vessels. Owing to popular demands, these bombardments affected both the movements and the distribution of the sea forces in home waters.

Attacks During the War.—Reviewing the situation, from the defence point of view, of the British Isles in the World War, it is found that naval strength and dispositions secured the country from military invasion or raids, but that some places on the coast, which were considered to be immune under international agreements arrived at in conferences at The Hague, were subjected to bombardment from the sea. The special provision referred to is to be found in Article 25 of the 1907 Hague Conference, which forbids the bombardment, "by any means whatsoever," of undefended towns.

Air Raids.—This is a new feature in warfare, which affects very seriously the defence of Great Britain. The situation was thus described in Aug. 1914:—

> It seems safe to assume that the few hundred aircraft at present at the disposal of any military power would be unable to bring serious pressure to bear upon a hostile nation numbering many millions, spread over wide areas. The moral effect which would be produced by highly mobile aircraft dropping bombs first over one city, and a few minutes afterwards over another city a hundred miles away, would no doubt tend to produce local panics, but, given the right spirit, the material effect would not suffice to produce concerted action amongst the population to force their government to stop the War. (*Sea, Land, and Air Strategy*, 1914.)

This prediction was borne out in the years 1914–8, but considerable damage was suffered in the United Kingdom from air raids. These raids provide the only precedent, derived from actual experience, of the effect of air raids upon the civil population of Great Britain. Putting aside the comparatively trifling loss of naval and military personnel, 619 civilians were killed by aeroplane raids and 498 by air-ship raids, the numbers of injured being 1,650 and 1,236 respectively. Of the total of 1,117 killed, 618 were women and children. Of the 2,986 injured, 1,562 were women and children.

There was no question of pressure being put upon the Government for this reason to end the War without victory. The tendency was to stiffen the determination of the nation to endure all things rather than accept defeat. The deductions to be drawn from the statistics are (1) that airships, owing to their vulnerability, do not afford cause for anxiety, provided that the experience of the World War is studied and adequate defensive measures are adopted; but (2) that the menace from aeroplanes is more serious, though strictly limited in radius. Whether this radius can be increased much beyond the estimate in 1924 of 200–300 m.[1] is a question for the future. The point has been advanced that a reduction of bombing-load, and therefore an increase of fuel-radius, can be effected by substituting lighter and more deadly chemicals and gases for heavy explosive bombs. The increase in range of artillery fire was yet another development which may affect the future defence of Great Britain, for certain ports on the East Coast, and even inland towns, could now be subjected to bombardment from positions on land.

Comparison Between Pre-War and Post-War Conditions.—The situation in 1925, as compared with that in 1910, can thus be summarised. As long as a sufficiently strong navy is maintained, immunity from invading armies can be ensured in the future, as it has been in the past. The menace from the air would depend upon the country with which Great Britain might be engaged in hostilities, and would not be very serious except in a war against countries within the radius of action of bombing aeroplanes starting in large numbers from land aerodromes. Long-range bombardments of certain places near the East Coast co
be effected by heavy ordnance in similar localities. The na
and the merchant shipping under its protection, would be o
to air attack when carrying out their task of keeping up the tra
port over the high seas of essential goods to and from Gr
Britain; air forces, under naval control, would be essential
meet this menace. The general effect of the air menace, a
factor in the problem of British defence, may be gathered fr
the attitude of successive British Govts., which have foun
necessary to adopt a "one-power" standard of strength in
air, to establish a separate air force controlled by an Air Minis
and to appoint an air officer as commander-in-chief of the ho
air forces, a step which, in time of peace, has been conside
to be against the best interests of the nation if applied to
military forces.

Irish Free State.—The grant of self-government to the Irish F
State has a considerable effect upon the defence of Great Brit
This quasi-political question cannot be dealt with exhaustively
an article devoted exclusively to defence. Its main features are
the control by the Free State Govt. over its own forces; (2)
loss of a large number of recruits, of a wide area of recruitm
for the British Army, and of important training grounds; (3)
prospect for Great Britain in future emergencies of having a frien
population in southern Ireland, in place of one bitterly hostile
requiring the presence of a strong British garrison; (4) the contin
provision of a small nucleus of British troops in certain defen
ports, and also the question of the ability, if not the eagerness
the Irish of the Free State to deny their harbours to war ves
hostile to Britain, and to provide an organisation for coast-watch
to ascertain and report, as was done by British coastguards
1914–8, the movements of such vessels within sight of the I
coast. Unless these services are adequately fulfilled, the establi
ment of a Free State in Ireland would, in a grave emergency such
the World War, affect adversely the defence of Great Britain.

Conclusion.—In conclusion, we have noted that the princi
change between 1910 and 1925 in the defence of Great Brit
has entailed the provision of a large localised Air Force, control
by an Air Ministry and an air officer commanding-in-chief,
addition to the air forces needed to accompany British fle
and armies upon their world-wide mission. Nevertheless,
burden of home defence may bear less heavily upon the Brit
people than their responsibility for defending people of ot
races and nationalities, spread over both hemispheres (*see*
FORCES; ARMY; COAST DEFENCE; NAVY; etc.).

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IV. FINANCE AND BANKING

The years immediately preceding 1914 were a period of rapi
growing expenditure, due (1) to the increase of the navy a
(2) to social reforms.

National Expenditure

	1908–9	1914–5 (Estimates)
Debt	£28,000,000	£23,500,000
Army	26,840,000	28,885,000
Navy	32,188,000	51,550,000
Old Age Pensions	..	12,710,000
Insurance of Working Classes	..	9,312,000
Other Expenditure	65,264,000	81,064,000
Total	£152,292,000	£207,021,000

The growth of £15,800,000 in other expenditure was larg
natural expansion, *e.g.*, an increase of £8,000,000 in the p
office. The increase in total expenditure (after allowing for t
reduction of £4,500,000 in the debt charge) was £59,000,000,
which defence contributed £21,400,000 and social legislat
£22,000,000.

So great an increase in expenditure had naturally involv
additional taxation. The extensive measures of new taxati
imposed by Mr. Lloyd George's budget of 1909 (which was
jected by the House of Lords and was only passed after a gene

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[1] Report of Sub-Committee of Committee of Imperial Defence (Cmd. 2029, 1924).

ction) provided the greater part of what was required. The ture in that budget of greatest permanent importance was the titution of a supertax, that is to say an additional income tax large incomes. Incomes above £5,000 were taxed at 6d. in the ınd on the excess over £3,000. At the same time the rate of ome tax on unearned income was increased from 1s. to 1s. 2d. er the great effort of 1909 the natural expansion of revenue ficed to cover expenditure till 1914. In that year further taxan became necessary, and the budget as finally adopted (before War crisis) provided for an increase in estate duties, a rise in income tax on unearned incomes from 1s. 2d. to 1s. 3d. (the ned still remaining at 9d.), and an important extension of supertax. Supertax was applied to all incomes over £3,000, l was more elaborately graduated (the rate on the excess of income over £8,000 was 1s. 4d. in the pound). The estimated ld for a full year was thereby raised from £3,300,000 to 770,000 (*see* Income Tax).

The War Period.—From the beginning of the War in Aug. 4 it became impossible to dissociate the budget position from state of credit generally. In the first place, the Government had to come to the assistance of the financial world and pport credit through the initial crisis. Secondly, expenditure the War soon grew to such dimensions as to put an almost bearable strain on the financial fabric of the country.

The outbreak of the War threw first the stock exchanges and n the foreign bill markets of the world, but above all of Lon, into utter disorder. The machinery of remittance to Lon broke down almost completely and the London accepting ıses found themselves faced with bankruptcy. The Government was forced to step in and to proclaim a moratorium for ots, statutory power was taken for the Treasury to issue legal ıder currency notes for £1 and 10s. and the Government guarteed advances by the Bank of England to acceptors to pay pre-moratorium bills (*see* Stock Exchange).

War Borrowing and Inflation

It was in the midst of this state of confusion that the early stages the War were financed. For the initial expenses, advances of .720,000 were obtained from the Bank of England on "Ways Means" (*i.e.*, under the powers annually conferred by the Conidated Fund Act and Appropriation Act). The War was cost about £1,000,000 a day. There followed half-a-dozen issues Treasury bills of £15,000,000 at a time. In Nov. 1914 addinal taxation was imposed and a loan of £350,000,000 (3½% 95, redeemable 1925–8) was decided on. By that time serious soundness was already developing in the situation. The issue £90,000,000 of Treasury bills did not in itself overstrain the rket. But the advances made by the Bank of England for the -moratorium bills, with its advances to the Government and ge imports of gold, destroyed the Bank's power of controlling money market. Bank Rate had been reduced to 5% on the pening of the banks on Aug. 7, but in Sept. it ceased be effective and the market rate fell to 3%. In Nov. it below 3. Part of the 3½% loan was taken by the banks, and any case the loan was not applied to strengthen the position the Bank of England. In Feb. 1915 the market rate of disınt fell below 2%. The private deposits at the Bank of England exceeded £130,000,000.

At last, in March 1915, severe measures were taken to counact the growing inflation, which had already caused a considble rise of prices. The Bank of England came into the Money rket as a borrower at call on the same footing as the discount uses, and lent the proceeds to the Government. The money s accumulated in balances, and public deposits at the Bank e from £27,000,000 at the end of Feb. to £114,000,000 at end of March and other deposits fell to £90,000,000. On ril 13 a new departure was made, in that Treasury bills in united quantities were placed continuously on sale at fixed rates interest to all comers. But the rates were still low (2¾% for 3 nths, 3⅝% for 6 months, 3¾% for longer maturities). Public posits rose to £130,000,000 and more. It was the Treasury bill e, and not bank rate, which regulated the money market.

By that time the cost of the War had risen to £3,000,000 a day and exceeded one-third of the national income (even if this be assumed to have risen in proportion to prices, which were 25% higher than in 1913). This outlay (after deducting a modest contribution from the tax revenue) far exceeded the amount that the people could save. But inflation only made the situation worse. That the cost of the War was itself swollen by the high prices was the least part of the evil. Easy credit makes trade profitable, because it encourages buying and consumption. It directs savings away from gilt-edged investments into trade. In 1915 conditions were extremely abnormal, but, for all that, this tendency was at work. Lavish expenditure by the public on consumable goods was competing with the Government, not only for the investment of the available savings, but for the employment of the available labour and productive power. Inflation, once started, continued throughout the War and for some time afterwards and only spasmodic and half-hearted steps were taken to check it till 1920, when prices had risen to three times the pre-War level.

Mr. McKenna, in June 1915, brought out the second war loan (4½% at par, redeemable 1925–45). It was for no specified total amount. The banks again undertook to subscribe for a very large amount, but the loan was planned much more for the ordinary investor and less for the money market than the 3½% loan of November. It also remained open longer, and there was more propaganda. Subscribers were given the right to convert their holdings into any future long-dated war loan. Holders of 3½ per cents or of consols were allowed to convert these securities into the new loan if they subscribed in addition a certain amount of cash to it. The loan yielded £587,000,000 of cash, but £200,000,000 came from the banks, and the balance was but a modest contribution from genuine savings towards the growing expense of the War.

While the loan was still being subscribed, ominous signs of weakness began to appear. The rise of prices was resumed. The exchange on New York fell below $4.80 to the £1 sterling; at the end of Aug. it dropped to $4.50. The Government sought a remedy in the sale of gold and securities in New York. Gold received in 1914 and deposited at Ottawa, gold displaced from circulation by currency notes, gold extracted from the precious reserves of France and Russia, all were drawn upon. The total net imports of gold into the U.S. in 1915 were $420,000,000, of which two-thirds came in the second half of the year. The British Govt. collected American securities from British holders, and either sold them or pledged them in America. There was also direct borrowing in America, starting with the Anglo-French loan of Oct. 1915 ($500,000,000, five-year 5 per cents at 98).

By means of these resources it became possible to "peg" the exchange at 4·76½. That measure made inflation more ruinous to the country than before. Inflation creates an excess of imports, which can be corrected, if the gold standard is abandoned, by an adverse movement in the exchanges. If the Government prevents that adverse movement by undertaking to sell foreign currencies to all comers, the excess of imports continues, and the Government has to pay for it. There were obstacles to imports in 1916 (especially lack of shipping), but the burden assumed by the Government was still a formidable one. The British Govt. also had to supply the necessary resources for pegging the French franc.

What was needed above all was the cessation of inflationary finance. The 4½% war loan had been of some assistance. In Aug. 1915 the lowest rate for Treasury bills was fixed at 4½%. In Sept. new taxation was imposed calculated to yield over £100,000,000 in a complete year, and in May 1916 further increases brought the revenue for the year 1916–7 above £500,000,000. But the cost of the War had risen to £4,500,000 a day and the rise of prices above the peace-time level exceeded 50%. In Dec. 1915 five-year 5% Exchequer bonds were put continuously on sale from day to day, but yet in March 1916 the floating debt (Treasury Bills and Ways and Means Advances) was almost £600,000,000.

In July 1916 Bank Rate was raised to 6%, and the Treasury bill rate to 5½. The effect of Bank rate on borrowing depends on the profits of trade; 6% is by normal standards a very high rate, but in face of the profits promised by an orgy of inflation it counts as low. At any rate it was not high enough to have much effect in 1916. The sale of five-year Exchequer bonds (raised to 6% in Oct. 1916) continued till Jan. 1917. Mr. Bonar Law, who had become Chancellor of the Exchequer in Dec. 1916, then decided on a third World War loan.

This took two forms: 5 per cents at 95 (redeemable 1929–47) and income-tax free 4 per cents at par (redeemable 1929–42). A "Depreciation Fund," equal to ⅛% per month, was to be applied to buying up stock in the market whenever it was below the issue price. The amount asked for was unlimited, and the zeal of the public was stimulated by intensive propaganda. It was wisely decided to ask for no direct subscriptions from the banks. The cash raised was £816,000,000, and Treasury Bills subscribed amounted to £124,000,000. In addition holders of 4½% war loan and of the Exchequer bonds since issued were entitled to convert into the new stock. The total amount created was £2,067,000,000 of 5 per cents and £52,000,000 of 4 per cents.

Even after this great effort the floating debt at the end of the financial year (March 31 1917) amounted to £680,000,000. Prices were almost double the peace-time level. Growing difficulty was experienced in providing resources for the support of the American exchange. The vast quantities of gold sent to the United States (whose net imports of gold from Jan. 1915 to March 1917 amounted to $1,192,000,000) not only paid for goods, but brought about a credit inflation and rise of prices there. Indeed otherwise the discrepancy in value between the pound and the dollar would have been far too great for any pegging operation to be feasible. But the effect of the credit inflation in America was to make borrowing there more difficult in face of the insistent demands of trade for all available supplies of capital. It was found possible to raise loans of $250,000,000 in Aug. 1916, $300,000,000 in Oct. 1916 and $250,000,000 in Jan. 1917, but the market was growing more and more reluctant.

All such anxieties were dispelled by the entry of the United States into the War in April 1917. Thenceforward the necessary resources both for supporting the exchange and for buying food and materials were advanced to the British and Allied Governments by the American Govt. itself. The British Govt. continued to provide funds to enable the Allies to buy goods in England, but the amount lent was about equal to the amount borrowed from the American Government. Inflation in the United States was accelerated and the export of gold thence was prohibited. The price index rose from 162 in March 1917 (100 being the average of 1913) to 203 in Nov. 1918. The English price index in Nov. 1918 was 229. The cost of the War to the British Exchequer had risen to £7,000,000 a day. Bank Rate had been reduced to 5½% on Jan. 18 and to 5% on April 5 1917.

After the 5% war loan, borrowing was effected through Exchequer bonds, re-christened in Sept. 1917 "National War Bonds." They were 5 per cents, but were repayable on maturity at a premium (2% on the 5-year bonds, 3% on the 7-year and 5% on the 10-year), and were convertible at the holder's option into 5% war loan at 95 (*i.e*, a £100 bond would buy £105 5s. 3d. of war loan). There were also income-tax free 4% 10-year bonds, repayable at par, and convertible into 4% war loan. National War Bonds were continuously on offer till the Armistice and thereafter till May 1919 (those issued after Jan. 1919 having no conversion rights).

Much attention had been given to the attraction of savings from the working classes. Special facilities were given for the purchase of the 4½% war loan of 1915 in bonds of small denominations. In 1916 a special issue of War Savings Certificates was started. The subscriber paid 15s. 6d. for a certificate entitling him to £1 after five years, and he could obtain repayment at any time at the sacrifice of a part of the accumulated interest. The interest accumulating, and not payable periodically, was not liable to income tax, and to prevent too extensive an evasion of income tax by well-to-do holders, the amount of certificates which could be held by any one person was limited to £500.

On March 31 1919 the National Debt amounted to £7,481,000,000, an increase of £6,775,000,000 since March 31 1914. The external debt was £1,365,000,000, or, if certain items which could be set off against debts due to the British Govt. from Canada, France, Italy and Russia be omitted, £1,179,000,000. The internal floating debt was £1,339,000,000[1] including £455,000,000 of Ways and Means Advances; the latter included su lent by Government Departments (partly from the Curre Notes Account, partly from trading accounts and many ot sources). But a large part was money borrowed at call thro the Bank of England from the Money Market, extra inter being paid for foreign-owned balances.

War Taxation.—Though there were heavy increases in in rect taxation, far the greater part of the war taxation was dire as the following comparison shows:—

Taxation in Peace and War

Source of Revenue	1914–5 (Peace Estimate)	1918–9
	£ · millions	£ millions
Customs and Excise	75·3	162·2
Income Tax	48·1	255·6
Supertax	5·8	35·6
Excess Profits Duty	. .	285·0
Other Direct Taxes	42·1	45·9
Other Revenue	35·8	104·7
	207·1	889·0

The rate of income tax had been raised to 2s. 6d. in 1915–6 a to 5s. in 1916–7. In 1918–9 the rate was raised to 6s.; the effect this last increase was not fully seen till 1919–20, when the yield £317,000,000. Supertax rates had likewise been raised, and the hi est zones of income paid 4s. 6d. The biggest tax of all was the Exc Profits Duty, which had been imposed by Mr. McKenna in Se 1915. This was a tax on the excess of the profits made by any fi or company in the year of assessment over the annual profits ma before the War (computed in the case of a business established sin the outbreak of war from its capital). Administratively it was off-shoot of the income tax, for the income tax assessments disclos both the current profits of a business and its pre-War standa The rate of tax was at first 50%, and was raised in 1916 to 60% a in 1917 to 80%. Excess Profits Duty was a powerful correcti of inflation. It provided £645,000,000 revenue in the three yea 1916–7 to 1918–9, and £540,000,000 more in the difficult years t followed. It diminished the evil tendency of inflation to accentua the inequalities of wealth. By it the extravagant profits whi made trading enterprises unduly attractive to capitalists, in co petition with the needs of the Government, were materially reduce Excess profits duty was never anything but a makeshift. It was f of anomalies and minor injustices. But these, in the emergency the time, were as dust in the balance compared to its advantages.

The indirect taxes imposed included import duties on motor-ca clocks and watches, musical instruments and cinema films—officia known as the new import duties, but more commonly called t McKenna duties. They are noteworthy as being the first protecti duties imposed since the days of the Peelites.[2] They were ostensil intended to support the exchange and to economise tonnage.

The Cost of the War

An exact calculation of the cost of the War to Great Brita would be impossible, and what follows can be regarded as more than an approximation. The day after the declaration war with Germany the Government obtained from Parliame a vote of credit of £100,000,000, for "expenses, beyond tho provided for in the ordinary grants of Parliament, arising out the existence of a state of war." Certain services, such as nav and military operations, maintenance of trade, relief of distres were specifically mentioned, but the total was not divided in subheads like an ordinary vote. Till March 1919 the cost of t War was met from successive votes of credit. The total audite expenditure from votes of credit was £8,417,000,000. T table on the opposite page shows the principal details.

Civil Departments drew on votes of credit for any expenditure excess of their own votes, attributable to the War. Some items met (*e.g.*, for cost of living bonus to civil servants) were not part the cost of the War. But on the other hand the ordinary votes bo many war charges such as the civil pay of staff absent on milita service, or the cost of administrative work arising out of the Wa The total includes £1,665,000,000 of loans to Allies and Dominion These were an immediate burden when advanced, but the ultima burden is only such part as is never repaid. The immediate bu den was relieved by the advances received from the Canadian a American governments.

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[1] Exclusive of Treasury bills amounting to £73,000,000, included in external debt (see Cd. 1648).

[2] Except the ephemeral corn duty of 1902.

Vote of Credit Expenditures
(£ Millions)

	1914–5	1915–6	1916–7	1917–8	1918–9	Total
Army	211·9	526·7	587·8	725·8	824·7	2,876·9
Navy	51·7	205·7	209·8	227·4	334·1	1,028·7
Air Force	..	..	..	2·5	85·4	87·9
Munitions	·7	224·6	504·9	641·0	458·3	1,829·5
Railways and Canals	6·8	5·9	16·9	26·4	49·6	105·6
Shipping	..	..	8·1	110·9	100·4	219·4
Food	9·7	7·3	22·4	79·3	41·5	160·2
Loans to Allies and Domns.	51·8	316·0	544·7	488·3	264·6	1,665·4
Exchange Account	..	53·1	..	..	3·7	56·8
Pre-moratorium Bills	..	30·6	..	..	..	30·6
War Pensions	·1	2·2	7·8	23·7	46·6	80·4
Old Age Pensions	..	..	1·5	5·2	6·0	12·7
Other Expenditure	4·0	11·6	59·1	101·4	87·0	263·1
	336·7	1,383·7	1,963·0	2,431·9	2,301·9	8,417·2
Receipts	..	2·5	10·3	5·1	3·6	21·5
	336·7	1,381·2	1,952·7	2,426·8	2,298·3	8,395·7

		£ millions
From the net total of		8,395
Deduct:		
Peace establishments of Army and Navy for four years say	500	
War pensions paid during the War	80	
Allowances to old age pensioners	13	
Exchange account (working balance)	53	646
Net Cost		7,749

In the years following the last vote of credit, there were large tlays and also large receipts due to the War, as shown in the lowing table (in £ millions):—

War Expenditures and Receipts

	1919–20	1920–1	1921–2	1922–3	1923–4
Army	411·8	165·7	86·4	50·2	46·1
Navy	154·1	92·5	76·0	57·5	54·1
Air Force	54·3	20·7	13·6	9·0	10·5
Middle East	..	..	27·0	9·8	7·2
	620·2	278·9	203·0	126·5	117·9
Peace Establishments	160·0	160·0	155·0	120·0	112·9
	460·2	118·9	48·0	6·5	5·0
Munitions	..	16·1	6·3	2·2	·8
Railway and Canals	56·5	42·7	73·3	32·7	·9
Shipping	..	·9	..	7·0	1·9
Ministry of Food	2·7	1·6	..	..	..
Loans to Allies, etc.	137·9	24·5	3·4	..	..
Training and Resettlement of ex-soldiers	41·4	25·2	9·9	5·4	3·0
Coal Mines	26·1	15·0	2·0	1·2	·8
Other Expenditure	16·3	12·8	6·5	4·6	3·2
Total Expenditure	741·1	257·7	149·4	59·6	15·6
Receipts[1]	254·4	265·7	110·8	43·4	29·7
	486·7	(8·0)[2]	38·6	16·2	(14·1)[2]

[1] Mainly sales of war stocks, ships, etc., but exclusive of repara- ns.

[2] Excess of receipts over expenditure.

A further net sum of £22,250,000 was provided through the il contingencies fund (advances, 1919–20, £64,500,000; re- yments 1919–20 to 1921–2 £42,250,000). The total net war penditure is thus (in £ millions):—

Total War Expenditure

	British Expenditure	Loans to Allies, etc.	Total
Votes of Credit	6,084	1,665	7,749
Subsequent Years	376	166	542
	6,460	1,831	8,291

Advances *from* Allies were:—	
United States	865
Canada	184
France, Russia and Italy (gold)	136
	1,185
Voluntary contributions from India and Colonies (principal only) up to 1923	90
	1,275

This may be regarded as reducing the net "immediate burden" of advances to Allies to £556,000,000. The burden of War pensions, actuarially capitalised at some date in the midst of the War, may be put at £1,000,000,000.

Finance After the War

In 1919 the tremendous overstrain of the War period was still making itself felt in the direction of inflation. The most obvious symptoms of weakness were in the floating debt and the external debt (see above). The shortage of tax-revenue and genuine savings, as compared with the expenditure to be met, was made good partly by drawing on foreign resources, partly by bank credits. Practically, with the cessation of advances from the American Govt., foreign resources ceased to be available. Bank credits meant the creation of the means of payment out of nothing—pure inflation. Excessive Government borrowing seemed so entirely adequate an explanation of the growing inflation that a more insidious cause was hardly taken into account. Bank rate had remained at 5%, but had not been made effective. The Treasury bill rate, which governed the market, had been reduced since Feb. 1918 to 3½%. Under war conditions the effect of cheap commercial borrowing in stimulating business was undoubtedly much diminished though not entirely avoided. With the return of peace its full effect would be felt.

The committee on currency and foreign exchanges after the War, presided over by Lord Cunliffe, had presented a grave and authoritative report in Aug. 1918. The report urged the cessation of Government borrowing, but also the use of a high Bank rate to protect the gold reserves. The foundation of all their recommendations was that "under an effective gold standard all export demands for gold must be freely met." "The conditions necessary to the maintenance of an effective gold standard in this country no longer exist, and it is imperative that they should be restored without delay." Unless the remedies approved by experience were applied, "there will be very grave danger of a credit expansion in this country and a foreign drain of gold, which might jeopardise the convertibility of our note issue." The Committee condemned proposals for "a liberal supply of money at low rates," based on a further growth of the note issue, because "in the result the gold standard will be threatened with destruction through the loss of all our gold."

In spite of these wise and emphatic recommendations, the gold standard was abandoned without an effort, as soon as the arrangement for supporting the New York exchange with American credits was brought to an end. A regulation under the Defence of the Realm Act, replaced in 1920 by the Gold and Silver (Export Control) Act, prohibited the export of gold (March 1919). The régime of cheap money continued. Burdened with heavy war commitments the Budget for 1919–20 brought the prospect of a heavy deficit. In June a new 4% loan was offered for subscription in two forms, the funding Loan, at 80, redeemable 1960–90; and the Victory Bonds, at 85, repayable by annual drawings at 100.

During the War the issue of loans at a considerable discount had been avoided, the lowest price of issue being 95. This was a favourable contrast to the policy during the Napoleonic wars, which swelled the nominal amount of the debt and diminished the effectiveness of the big conversion operations of the 19th century. The Funding Loan represented a change in that respect. It secured the investor against the reduction of his interest after 1960 unless the market rate of interest had fallen by then below 4%. That is a very slight advantage to the investor, and any difference that it made in the price of the loan would not go far to compensate the Government for the loss of what might be a valuable option in the future.

The twin loans yielded £475,000,000, but £92,000,000 had been subscribed by banks, so that the real contribution towards sound finance was only £383,000,000. Moreover, the well established but deceptive city tradition of fertilising a loan with cheap money had been followed. The sale of Treasury bills had been absolutely suspended, and the Government had borrowed at a low rate from the money market and so far as necessary from the Bank of England. The inflationary tendency, already serious, was accentuated. The sale of Treasury bills was resumed on July 14. In Oct. came a change; the rate for three months bills was raised from 3½% to 4½%—the first step towards a restriction of credit. In Nov. the rate was raised to 5½% and Bank Rate to 6%. In Dec., pursuant to a recommendation of the Cunliffe Committee, a limit was imposed upon the currency note issue. A Treasury Minute of Dec. 15 1919 (a purely administrative instrument without statutory validity) prescribed that the fiduciary issue of currency notes (those uncovered by gold or Bank of England notes) in any year should not exceed the maximum fiduciary issue recorded in the preceding year. The actual maximum recorded for 1919 was £320,600,000, and accordingly this became the prescribed maximum for 1920. Under this rule the limit can decrease but cannot increase. The limit for 1926 was £247,900,000.

Inflation in Great Britain works through bank credits, but a limit on the supply of legal tender money, if really meant to be effective, was bound to react on the creation of credit. Nevertheless in the opening months of 1920 inflation continued unabated. The price level (*Statist* index, 1913 being 100) rose from 217 in April 1919 to 313 in April 1920. The American exchange fell one-third below par. In April 1920 the sales of Treasury bills at the fixed rate of 5½% fell off, and £55,000,000 had to be borrowed from the Bank of England on Ways and Means. An abyss of inflation seemed to be opening. The Treasury bill rate was thereupon put up to 6½%, and Bank Rate to 7% (April 15).

The next week Mr. Austen Chamberlain introduced the Budget for 1920–1. Inflation was swelling the revenue from the heavy taxes already in existence, but fresh taxation was nevertheless imposed. A tax revenue exceeding £1,000,000,000, in addition to enormous receipts from liquidation, was budgeted for, and the estimated surplus was £234,000,000. The severe régime of high discount rates and no Government borrowing, recommended by the Cunliffe Committee, was being applied. But after a year of unconscionable inflation, a stronger dose was needed than they ever contemplated, and produced results which they never thought of. A year of 7% Bank Rate caused a tremendous collapse of prices, while the exchange was little improved (*see* CURRENCY), and the gold standard was not restored.

The peril of inflation had vanished. It was excessive deflation that was now the trouble. But a contraction of credit, while it brings depression, bankruptcy and unemployment, nevertheless, after the first passing phase of stringency, causes a rise in the prices of fixed-interest securities and favours funding operations, just because it diminishes the profits of production and trade.

When the budget for 1921–2 was introduced in April 1921, little progress had been made with the floating debt, which still amounted to £1,243,000,000. The loan issues of 1919, together with an issue of 5¾% Exchequer bonds in Feb. 1920, had been mostly used up in meeting a deficit of £326,000,000 for 1919–20 and a large amount of maturing bonds. The surplus of £230,000,000 for 1920–1 had been needed partly to pay off external debt (including $250,000,000 of the Anglo-French loan of 1915 maturing in Oct. 1920), and partly to pay off bonds. Further heavy maturities were in prospect. By April 1922, £138,000,000 of Exchequer bonds would have to be met, and between Oct. 1922 and Feb. 1924 the 5-year National War Bonds, amounting to £574,000,000. Certain securities also had the privilege of being used in payment of Death Duties and Excess Profits Duty. The total amount so used had been averaging £70,000,000 a year. The Depreciation Fund on the War Loan of 1917 required over £30,000,000. All these obligations had to be met if the floating debt was to be prevented from increasing.

In the Budget statement in April 1921 was announced the issue of a new 3½% Conversion Loan. It was to be a funded stock like Consols, being redeemable only at the option of the Government (after 1961), and not at any fixed due date. A sinking fund of 2% per annum on the amount outstanding was to be applied so long as the price was below 90. Cash subscriptions were not asked for, the loan being destined only to be exchanged for the 5-year and 7-year National War Bonds. At that time gilt-edged stocks had not recovered far from the lowest levels of 1920. The 4% funding loan which had fallen to 66 in Dec. 1920, stood at 71. The 5% War Lo had risen from 81½ to 88. The National War Bonds (carrying premium on redemption) were slightly below par. From £160 £163 of 3½% Conversion Loan was offered to the holder of £100 National War Bonds. The stockholder was secured a return about 5⅔% on his money, and the interest could not be reduced fore 1961, and even then only if the Government was able to borr at less than 3½%. By good fortune the loan was a failure. O £164,000,000 of National War Bonds were converted, out £630,000,000 to which the offer applied, but even so the increase the nominal amount of the debt was about £100,000,000.

A year later, still months before the earliest maturities National War Bonds, the situation had been transformed by t trade depression. The 4% Funding Loan at 88½, and the 5 War Loan at 99 were well above their issue prices. The Conve sion Loan, which had been offered in April 1921 on terms co responding to a price of 62, had risen to 77¾. Treasury Bon to yield 5½%, and then, as the market improved, 5% had be sold to an amount exceeding £400,000,000. In 1922 a furth batch of £70,500,000 of National War Bonds were convert into 3½% Conversion Loan on the basis of a price of about When the bonds were above par it ceased to be profitable use them in payment of duties. And now that the 5% War Lo was well above the issue price, the option attaching to Natio War Bonds of converting into it at the issue price became profi able, and in the three years 1922–5, £251,000,000 were so co verted. No difficulty was found in raising the money to pay £100,000,000 in cash in the same period, and in addition t floating debt was reduced from £1,243,000,000 in March 192 to £742,000,000 in March 1925 (inclusive of £166,500,000 advances from Public Departments).

In April 1921 the pre-War system of selling Treasury bil by public tender was reverted to. The change was an importa one, because it meant that in respect of the discount rate t Treasury followed the market instead of leading it. So long the Treasury sold all the bills that the market would buy at prescribed rate and no more, the Bank of England was boun to lend to the Treasury if the sales of the bills did not produ enough. A Bank Rate appreciably above the Treasury bill ra could not be made effective. A Bank Rate below the Treasu bill rate would be equally unworkable. In fact the Treasu had usurped the place of the Bank as regulator of credit. S long as bills are issued by tender in just sufficient amounts meet the needs of the Treasury, the Bank of England can di charge its responsibilities undisturbed.

In 1924 a new form of Conversion Loan was created, a 4½ security redeemable in 1940–4, in order to make a beginning wit the conversion of the great 5% War Loan. The Government has t option of repaying that loan at par at any date after 1929. Th amount involved is enormous. Conversions of National War Bond had raised the total in April 1924 to £2,100,000,000. Difficult might be experienced, even in a favourable market, in dealing wit so great a mass of stock, if notice were given in respect of the whol in or after 1929, and there may therefore be advantages in converti moderate portions at a time by offering suitable terms to the holder The amount converted into 4½% was £148,000,000.

American Debt.—The net external debt had been reduced fro £1,179,000,000 in March 1919 to £948,000,000 in March 1922, o which £856,000,000 represented the debt to the American Govern ment. But these figures exclude the interest on the American deb which the American Government had spontaneously suspended i 1919 and which had been accumulating ever since. Towards th end of 1922 it was decided to negotiate with the American Govt for the settlement of the arrangements for paying off the debt. sum of $100,000,000 was paid on account and in March 1923 a agreement was negotiated by Mr. Baldwin, the Chancellor of th Exchequer, who with Mr. Norman, Governor of the Bank of England, visited the United States for the purpose.

The loan had been till then in the form of an obligation payabl "on demand" and yielding interest at 5%. The agreement reduce the suspended interest to 4¼%, and fixed the future interest at 3 for 10 years and thereafter at 3½. The capital of the debt (includin past interest) was rounded down by a small cash payment t $4,600,000,000, and was to be paid off by instalments in 62 years starting at ½% ($23,000,000) and rising gradually so as to keep the annual obligation for interest and principal together approximately fixed at about $161,000,000 for 10 years and $184,000,000 thereafter. Great Britain has the option of paying the debt either in "U.S. gold coin of the present standard of weight and fineness" or in gold bullion or in bonds of the U.S., and may postpone the ment of half of any instalment of interest. There was in addition ebt of $61,000,000, being the balance of the advances of silver de for the benefit of India under the Pittman Act of 1918. This was paid off in 1923 in cash. (*See* Debts, Inter-Allied.)

inking Fund.—The sinking fund in operation at the beging of the War (a fixed debt charge of £23,500,000 inclusive interest) had become obsolete. Surpluses of revenue over enditure were legally applicable to the redemption of debt e "old sinking fund"), and under the Finance Act of 1920 rplus could be so applied as it accrued, instead of being acnulated in Exchequer balances till the end of the year. The umulation of a surplus of £200,000,000 like that of 1920–1 ld have been an absurdity. The Finance Act of 1923 reled the fixed debt charge arrangement, and established a sinking fund. A sum of £40,000,000 was to be included in expenditure of the year for the redemption of debt in 1923–4, ,000,000 in 1924–5 and £50,000,000 in 1925–6 and subsent years. With the fixed debt charge the saving of interest t to increase gradually the amount applicable to debt renption. Under the sinking fund of 1923 it goes in diminution xpenditure, the sum applicable to debt redemption remainat £50,000,000. Surpluses, however, remain, as before, licable to debt redemption. Realised surpluses have been follows (in £ millions):—

920–1	1921–2	1922–3	1923–4	1924–5
230·6	45·7	101·5	48·3	3·6

epayments of principal of War advances to Dominions and relief loans are paid to the National Debt Commissioners for t redemption, without appearing in the Exchequer account.

ost-War Taxation.—The year 1919–20 was financially a War with a heavy deficit. The Excess Profits duty was reduced from to 40%, but at the same time heavy additional duties were placed beer and spirits, calculated to produce an additional revenue eeding £50,000,000, in a full year. The budget of that year (Mr. amberlain's) is noteworthy for the introduction of preferences in our of products of the British Empire. Protective duties were not oduced for the purpose, but the preference was grafted on the enue duties already in existence (sugar, tobacco, tea, etc.) The r 1920–1 saw the end of War deficits. Nevertheless big additions e made to taxation, further increases on beer and spirits, an inased super-tax, a new tax on the profits of limited companies, a rise in ess Profits duty to 60 per cent. On the other hand an important plification of the system of Income Tax abatements involved a of revenue in a full year of about £30,000,000 (at 6s. in the nd). This year saw tax revenue at its maximum, £1,031,700,000. he years 1921–2 to 1924–5 were years of steady remissions of ation. Excess Profits duty was repealed (1921). Corporation fits Tax was first halved (1923), then repealed (1924). Income was reduced from 6s. to 5s. (1922), to 4s. 6d. (1923) and to 4s. 25). The duties on beer (1923), sugar (1924) and tea (1924) were uced. The "McKenna" duties were repealed by Mr. Snowden 1924, but reimposed by Mr. Churchill in 1925. The Safeguarding ndustries Act, 1925, imposed a number of protective duties.

Analysis of Expenditure

	(£ millions)					
	1919–20	1920–1	1921–2	1922–3	1923–4	1924–5
Ordinary						
Debt	332	350	332	324	347	357
Defence	160	160	155	120	113	111
War pensions	99	106	96	81	73	70
Education	41	56	61	49	48	49
Old age pensions	19	25	26	22	23	25
Health and labour ministries	19	28	38	31	32	34
Other	123	157	196	135	148	146
Total ordinary	793	882	904	762	784	792
Exceptional						
Bread subsidy	50	40	..	..	..	..
War expenditure	741	258	149	60	16	4
	1,584	1,180	1,053	822	800	796

Expenditures.—These liberal reductions of taxation could not be effected without substantial economies in expenditure. In 1921 a Committee with Sir Eric Geddes as Chairman made a searching investigation of the expenditure of public departments and recommended extensive savings. The foregoing table analyses public expenditure up to 1924–5 (appropriation accounts) and distinguishes ordinary from War expenditure.

The diminution of £142,000,000 in ordinary expenditure in 1922–3 is not wholly due to economy. The exclusion of Irish services relieved civil votes of about £20,000,000. The heavy fall of prices relieved expenditures not only directly, but also through the consequent reduction of the bonus dependent on cost-of-living, which is added to civil service salaries. The increase in ordinary expenditure in 1922-3 was due to the rise of £23,000,000 in debt charges, consequent on the establishment of the new sinking fund and the beginning of the payment of the American debt.

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(R. G. H.)

Banking

During the post-War period, and especially in the period 1918–20, the British banking system underwent a process of change which, although from the historical standpoint only a continuation of tendencies which had been in operation for many years, in fact altered the whole balance of power within the sphere of domestic banking, and altered considerably the relations which used to obtain between the sphere of the domestic banks and those operating predominantly overseas. As a consequence there arose a series of problems which were still unsolved at the end of 1925. These were the adjustment of the internal economy of the banks to the new scale of business which they were undertaking; the relations of the banks with the central bank and the money market in the technical sense; and the relations of the banks with their customers and to the national economic life as a whole.

The Amalgamation Movement.—This consisted in the process of reducing the total number of independent banks. In contradistinction to the developments in Germany, the technical form assumed by the process of concentration was exceedingly simple. Whereas in Germany a whole series of intermediate forms existed between complete fusion of banking establishments and completely independent institutions, such as the exchange of shares, pooling of resources, agreements not to invade territory, interlocking directorates and stock-ownership without the extinction of the legal existence of the firm whose shares had been acquired, the founding of subsidiary enterprises by joint action, etc.; but in Great Britain, when two banks amalgamated, the separate legal and economic existence of the amalgamating establishments ceased. Moreover, the field of operation of the British joint-stock banks was confined to England and Wales: Scottish and Irish banking being conducted under different legal codes, it was thought impossible to amalgamate such institutions with English banks: and no attempt was made, except shortly before the War, to invade the sphere of the foreign and colonial banks. It was only in 1905 that the first attempt was made by an English joint stock bank (the Midland) to open a separate branch in the City of London for the conduct of foreign operations, an example which was very soon followed; whilst in 1911 the first overseas venture of an English joint-stock bank was made when Lloyds Bank acquired the business of Armstrong and Co. in Paris.

Simple as the nature of the British amalgamation movement was, both as regards form and aim, it had sufficed to reduce very materially, even in pre-War years, the total number of separate banks. By 1910 the total number of separate joint-stock banks in England and Wales had been cut down to 45, the number having been 104 in 1890 and 77 in 1900. At the same date there were only nine private partnerships conducting a banking business—a sufficient proof of the extent to which the process of absorption by joint-stock banks had affected a transformation of banking conditions since joint-stock banking was first permitted under the Act of 1826. These 45 banks possessed between them 5,102 branches, paid-up capitals and reserves of £81,000,000, deposits amounting to £721,000,000 and outstanding acceptances to the amount of £52,000,000. At the same date the deposits of the remaining private bankers were only some £27,000,000. By 1914, the number of joint-stock banks had fallen to 38, their branches had risen to 5,869, their capitals and reserves stood at £82,000,000 and their deposits at £896,000,000, whilst the number of private banks had decreased to eight, and their deposits stood at £33,000,000. The leadership among English joint-stock banks at that date already belonged to the five banks which have since become known as the "Big Five." At the end of 1914, the deposits and numbers of offices of these banks stood as follows:—

	Deposits £	Offices
London, City and Midland	125,700,000	1,027
Lloyds	117,700,000	1,085
London County and Westminster . .	101,000,000	363
National Provincial	74,900,000	447
Barclays	167,400,000	606

Behind these leading banks ranged four large banks with deposits of over £40,000,000 each, viz.: Parrs, the Union of London and Smiths, the London Joint Stock, and the Capital and Counties, whilst five banks possessed deposits of between £20,000,000 and £30,000,000.

Home Absorptions.—The history of the amalgamation movement after 1918 is but a description of how the leading five banks completely absorbed their powerful but somewhat smaller rivals, by a process of competition among themselves. The critical years were 1918 and 1919. In those two years, to mention only the more important events, the National Provincial absorbed the Union of London and Smiths, the Sheffield Banking Co. and the Bradford District Bank: Barclays (having absorbed the important United Counties Bank in 1916) took over the just amalgamated London, Provincial and South Western Bank; the Westminster absorbed Parrs Bank and the Nottingham and Nottinghamshire Banking Co.; Lloyds Bank took over the Capital and Counties and the West Yorkshire Bank; finally, the Midland absorbed the London Joint Stock Bank. In the same years the Bank of Liverpool amalgamated with Martins Bank, and absorbed the Halifax Commercial Bank, the Palatine Bank and Cocks, Biddulph and Co., thus forming a new and powerful group, better able to stand centripetal pressure from the older and more powerful combinations. The competition to absorb did not relax in later years, and affected particularly the remaining private bankers. In 1920 the Westminster took over Beckett & Co. of Leeds; in 1923 Cox and Co., and H. S. King and Co. were absorbed by Lloyds, and Holt and Co. by Glyn Mills and Co. In the following year the old firm of Child and Co. was acquired by Glyns, and Grindlay and Co. by the National Provincial, while the Royal Bank of Scotland absorbed Drummond and Company. In the same year also the National Provincial absorbed the Guernsey Banking Co. and the Westminster took over the Guernsey Commercial Banking Co.

Affiliations and Extensions Oversea.—Even more significantly, the amalgamation movement no longer confined itself to traditional forms and areas. During and after the War, the "Big Five" converted their undertakings from unified structures to banking groups with a main stem representing the amalgamations, with branches from the main stem in the shape of affiliated and subsidiary undertakings, and with undertakings owned in common. Thus the Midland affiliated the Belfast Banking Co. in 1917, the Clydesdale Bank in 1920 and the North of Scotland Bank four years later: Barclays control two affiliated institutions, the British Linen Bank (1919) and the Union Bank of Manchester (1919), and possesses subsidiaries in the shape of Barclays Bank (Overseas) Ltd., Barclays Bank S.A.I. at Rome, and Barclays (Dominion, Colonial and Overseas) Bank. Barclays' holding of shares in the Colonial Bank and the Anglo-Egyptian Bank were turned over to the last named, formerly the Colonial Bank, with which the Anglo-Egyptian Bank and the National Bank of South Africa are amalgamated. Lloyds Bank has a footing in India through the acquisition of Cox and Co. and H. S. King and Co., is affiliated with the National Bank of Scotland and the Bank of London and South America (an amalgamation of the London and River Plate Bank and the London and Brazilian Bank), is joint owner with the National Provincial Bank of Lloyds and National Provincial Foreign Bank Ltd., and is a shareholder (as are also the Westminster, the National Provincial and Standard Bank of South Africa) in the Bank of British W Africa.

The Westminster Bank has affiliated the Ulster Bank, is a sha holder in the Royal Bank of Canada as well as in the British Ital Banking Corporation (as are also its leading competitors, Lloy and the National Provincial), and owns the Westminster Fore Bank Ltd. The National Provincial has affiliated Coutts and (1920), is a shareholder in the P. and O. Banking Corporation, a is half owner of Lloyds and National Provincial Foreign Bank. Th with the exception of the Midland Bank, all the leading institutio are interested directly in overseas banks. The tendency to be terested in such concerns has affected even the smaller joint-sto banks: thus Williams Deacons Bank and the Union Bank of Sco land are both shareholders in the British Overseas Bank, and a ve large number of concerns other than those already mentioned a included among the shareholders of the British-Italian Banki Corporation.

Effect of Amalgamations.—So vast a development as this w well calculated to attract public attention and to cause alar But, in the main, public attention and criticism have been co fined to the absorption and extinction of competing banks with the confines of the country and have concerned themselves litt with the other features of the situation, which, as a matter fact, represented a more significant breach with tradition. C March 11 1918, when the competitive amalgamation moveme was at its height, the Treasury appointed a committee on ban amalgamations to investigate the whole position. The committe reported on May 1 of the same year, but the evidence laid befo it was not made public. The committee was clearly not ver impressed by the argument that the growth in the scale of bus ness undertakings justified the latest amalgamations, and wa influenced by the view that when two banks of national scop join together, the effect is a net reduction of competition.

It thought the tendency for amalgations to reduce the ratio capital and reserves to deposits undesirable, and gave cautiou assent to the view that circumstances might produce somethin approaching a money trust at a comparatively early date. Th committee therefore recommended legislation requiring tha the prior approval of the Government must be obtained befo any amalgamations are announced or carried into effect, "i cluding under this term proposals for interlocking directorate affiliations, and in fact, any arrangements which in effect wou alter the status of a bank as regards its separate entity an control." Though no such legislation was carried, the prior con sent of the Treasury is obtained before amalgamations are car ried into effect, and Lloyds' Bank was refused permission t acquire the shares of the National Bank of India in 1919. S far as the domestic situation is concerned, Treasury control doe not appear to have affected the course of events very much.

The alarm which the movement has created is in the main du to the feeling that the absence of effective competition woul mean less ample facilities and higher charges for the public, a well as greater rigidity in the business intercourse with banks It is almost impossible to gauge how far the latter fear may hav been subsequently justified: it is perhaps also significant of th greater power of the banks that they had not, by the end of 1925 raised the rate on time-deposits to the pre-War level of 1½% below bank rate. What is undoubtedly true is that the amalga mation movement has not in any way checked competitio among the banks in the creation of new offices. These continu to increase in a ratio for which there would seem to be very little real justification.

The amalgamations of 1918–9 were undoubtedly in part com petitive: the leading banks absorbed others lest some competin bank should do so. The cost of acquisition was thus in some case unnecessarily high, but the relative smallness of British bankin capitals—a disadvantage from other standpoints—prevented thes high acquisition costs from being a very serious permanent burden A more legitimate reason for expansion was undoubtedly the feelin that the end of the War would see intensified competition betwee Great Britain and Germany, for which strong and powerful bank were needed: but whilst this was hardly a justification for the internal absorptions (in view of the already large size of the the existing banks) it was a legitimate argument as regards overseas expansion. On the other hand, the later and lesser amalgamation which accompanied the trade depression of 1921 and subsequent years re no doubt forced upon the absorbing banks by the position of the aker banks, and by the fear that a general distrust of the banking stem would arise if a series of failures were allowed to take place. Occurring at a time when all economic phenomena were affected d distorted by the War (in particular, in the case of banking ures, by inflation) it is impossible to say to what extent the actual ovements of deposits, loans, investments and advances would ve been different, had amalgamations been less frequent.

Statistics of the "Big Five" Joint Stock Bank

	At June 30							(At Dec. 31)
	1914	1920	1921	1922	1923	1924	1925	1925
apital and Reserves	56·7	101·4	106·1	106·3	106·2	109·2	109·3	111·6
cceptances	32·7	74·8	47·4	45·5	64·5	73·0	79·8	97·2
eposits	642·4	1,585·1	1,620·1	1,600·2	1,504·2	1,518·7	1,509·0	1,522·1
ash in Hand and at Bank	100·3	263·2	253·6	242·5	230·0	246·2	252·4	258·1
nvestments	97·2	330·0	303·2	377·0	324·8	319·0	264·7	259·2
iscounts, Loans, Advances and Money at Call	488·8	1,077·9	1,147·5	1,064·3	1,031·4	1,037·9	1,075·8	1,090·4
over for Acceptances, Premises, Sundries	46·5	90·2	69·3	68·2	88·7	97·8	105·2	123·2
otal Assets or Liabilities	731·8	1,761·3	1,773·6	1,752·0	1,674·9	1,700·9	1,698·1	1,730·9

The most significant changes are the decline in deposits since the ximum of 1921 and the fall in investments accompanied by a rise advances and discounts. This would indicate that the banks are sponding to the needs of trade by reducing their holdings of fixed erest-bearing securities and of Treasury bills. Substantially the me results are revealed by taking the total banking figures of eat Britain, as under:—

Banking Liabilities and Assets

	Liabilities In £, millions of		
	1922	1923	1924
apital and reserves	156·2	156·1	161·4
ndivided profits	8·2	8·5	8·7
eposits	2,209·4	2,154·7	2,136·3
cceptances	91·9	118·6	142·4
otes, etc.	33·8	31·5	31·8
Total	2,499·5	2,469·4	2,480·6

	Assets In £, millions of		
	1922	1923	1924
ash in hand, at bank, and at call and short notice	503·6	487·6	508·5
nvestments	585·2	542·9	492·9
iscounts and advances	1,291·9	1,291·3	1,309·7
remises and cover	118·8	147·5	169·4
Total	2,499·5	2,469·3	2,480·5

(T. E. G.)

V. POPULATION

The decennial census due in 1921 was planned for April 24 of at year. Owing to the coal dispute then in progress the enu- eration was postponed to June 19. The total population und at this latter date may be compared with that found in 11 as follows:—

Before 1921 the decennial increase per cent had never been less than 10% for England and Wales. The number of females to 1,000 males in England and Wales, had, since the date of the first census in 1801, never been less than 1,036 (in 1821) and never, until 1921, been more than 1,068 (in 1901 and 1911). For the large excess of women in 1921 and for the unusually small increase per cent that occurred during that period, the War is in part responsible. The effect of the War can be more clearly seen when the crude birth rates and crude death rates since 1911 are considered. The crude rates are the numbers born and the numbers dying per 1,000 of the population during the year to which they refer. Deaths due to the War occurring abroad are excluded.

TABLE I. *Total Population of Great Britain*

Area	Date of Census	Persons	Population	Increase of Population since the preceding Census	Decennial increase per cent of Population	No. of Females to 1,000 Males
ngland and Wales	1911	36,070,492	M 17,445,608 F 18,624,884	3,542,649	10·89	1,068
ngland and Wales	1921	37,886,699	M 18,075,239 F 19,811,460	1,816,207	4·93	1,096
cotland	1911	4,760,904	M 2,308,839 F 2,452,065	288,801	6·5	1,062
cotland	1921	4,882,497	M 2,347,642 F 2,534,855	121,593	2·6	1,080

The effect of the War upon the death rate was to check the decline which had been in evidence previously. The influenza epidemic of 1918, which may be traced to the War, caused a high death rate that year. Since the War the death rate has declined to a lower figure than was ever shown before 1914. When the infant mortality rates for these years are considered (that is the number of children dying under one year of age per 1,000 born) it appears that the greatest improvement has been effected in the case of infants. The infant mortality rate, for instance, which in England and Wales was 128 for the period 1901–1910 and 100 for the period 1911–1920, declined to 83 in 1921, to 77 in 1922, and to 69 in 1923.

The effect of the War upon the birth rate was to cause during the progress of hostilities a more rapid decline than had been in evidence before and to cause after the end of hostilities a sudden rise to a higher figure in 1920, since when it has declined to a lower figure than was ever reached before. The decline in the crude birth rate which had been taking place for more than 50 years is mainly to be accounted for by decline in the number of children born to wives of reproductive age, but partly also by a change in the age distribution of the population. Owing to this change in age distribution there is now a smaller percentage of wives of the most reproductive ages than formerly.

These two facts may be illustrated as follows. In the period 1911 to 1915 there were 189·7 births per 1,000 wives aged 15 to 45; whereas there were in 1921, 176·5; in 1922, 161·6; and in 1923, 156·3. During the same period, however, of 100 wives

TABLE II. *Birth Rates and Death Rates: 1911–1924*

Date	Birth Rate per 1,000 of the Population		Death Rate per 1,000 of the Population	
	England and Wales	Scotland	England and Wales	Scotland
1911	24·3	25·6	14·6	15·1
1912	23·9	25·9	13·3	15·3
1913	24·1	25·5	13·8	15·5
1914	23·8	26·1	14·0	15·5
1915	21·9	23·9	15·7	17·1
1916	20·9	22·8	14·4	14·3
1917	17·8	20·1	14·4	14·3
1918	17·7	20·2	17·6	16·0
1919	18·5	21·7	13·7	15·4
1920	25·5	28·1	12·4	14·0
1921	22·4	25·2	12·1	13·6
1922	20·4	23·5	12·8	14·9
1923	19·7	22·8	11·6	12·9
1924	18·8	21·9	12·2	14·4

under 45 the proportion of wives under 35 has decreased, and this partly accounts for the decline in the number of children per wife. Thus in 1901 there were 593 wives under 35 years of age out of every 1,000 wives under 45; in 1911, 559; and in 1921, 535.

The changes in age distribution revealed by the census indicate that the proportion of young persons in the population is declining while that of old persons is increasing. There were, for example, out of every 10,000 of the population in England and Wales, 2,094 persons under 10 years of age in 1911 and 1,806 in 1921, whereas there were 297 persons of age and over in 1911 and 344 in 1921. The fact that the average of both sexes in Scotland was 28·0 in 1911 and 29·6 in 1921 illustrates a similar change in that country.

Distribution in Urban and Rural Areas.—The density of the population in England and Wales was 649 per sq. m. in 1921 and 164 per sq. m. in Scotland. The population was distributed as between urban and rural areas in the following proportions: England and Wales 79·3 % urban and 20·7 % rural in 1921, as compared with 78·1 % and 21·9 % in 1911; Scotland 77·3 % urban and 22·7 % rural in 1921 as compared with 75·4 % urban and 24·6 % rural in 1911. When making comparisons between England and Wales on the one hand and Scotland on the other in this respect, it must be remembered that owing to differences in local government between the two areas the terms "urban" and "rural" are used in somewhat different senses.

Two further points should be borne in mind when considering figures for urban and rural areas. These areas do not remain constant from census to census. Areas, formerly classed as rural, are from time to time added to the total urban area owing to changes in the organisation of local government. The population classed as urban therefore occupies a somewhat larger area at each succeeding census. Again the urban area includes many small towns and therefore not all those classed with the urban population are living under strictly urban conditions. A better picture of the urbanisation of the country is provided by the fact that 33·8 % of the population of England and Wales were in 1921 living in towns of over 200,000 inhabitants each. The concentration of population in certain areas may also be illustrated by the fact that out of the 53 counties in England and Wales the 12 most populous counties contain 67·1 % of the population while the 7 most populous of the 33 counties of Scotland contain 71·9 % of the population.

Another method of illustrating the same point is to calculate the proportion which each county respectively contributed to every 100,000 of the population in 1921. It is then found that Lancashire contributed 13,007, London 11,838, Yorkshire 11,041, Durham 3,905, Essex 3,881, Warwickshire 3,669, Staffordshire 3,560, Middlesex 3,307 and Glamorganshire 3,305. Eight counties in England and Wales show an actual decrease in total population between 1911 and 1921. They are Cornwall, Herefordshire, Montgomeryshire, London, Rutlandshire, Westmoreland, Cardiganshire and Merionethshire. London as a whole, it may be noticed, has increased, the increase having taken place outside the county administrative area. In Scotland 17 of the 33 counties show decreases within the same period. Every county in England and Wales shows an increase in total population between 1801 and 1921, but in Scotland five counties, Argyll, Berwick, Orkney, Perth and Sutherland, had in 1921 fewer inhabitants than in 1801.

The most populous towns of England and Wales in 1921 were as follows:—

London (administrative county) .	4,484,523	Sheffield . .	480,639
Birmingham . .	919,444	Leeds . .	458,232
Liverpool . .	802,940	Bristol . .	376,975
Manchester . .	730,307	West Ham . .	300,860

In Scotland the most populous towns in 1921 were:—

Glasgow	1,034,174
Edinburgh	420,264
Dundee	168,315
Aberdeen	158,963

In England and Wales there were 46, and in Scotland four towns each with more than 100,000 inhabitants.

Distribution by Occupation.—The first use which can be made of the information collected at the census regarding occupation is to classify the population according to industrial status. Table III. illustrates the result.

The number of women recorded in Table III. as "gainfully" occupied is relatively small because most women not "gainfully" occupied are married and household duties are not included in in the term "gainful" occupations. Of the 10,542,599 women in England and Wales for instance, in 1921 over 12 years of age, who were not "gainfully" occupied, 6,886,931 were married.

TABLE III. *Industrial Status of Persons Gainfully Occupied, 19*
12 Years of age and over

Industrial Status	England and Wales		Scotland	
	Males	Females	Males	Females
Employers .	563,203	73,708	88,745	9,445
Employees .	10,800,276	4,664,603	1,354,078	584,096
Working on own account . .	749,239	327,021	91,996	39,244
	12,112,718	5,065,332	1,534,819	632,785

The population may next be classified according to the occup tions followed. The chief occupations in England and Wales and Scotland respectively were as follows:—

TABLE IV. *Chief Occupations by Sex, 1921*

Occupations of Males	Total in each Occupation	Occupations of Females	Total in each Occupation
England and Wales			
Metal working .	1,540,235	Personal service .	1,676,42
Transport and communication .	1,420,593	Textile workers .	608,96
Agriculture . .	1,171,298	Makers of textile goods and dress	548,01
Commerce and finance . .	1,063,120	Commerce and finance . .	496,05
Mining and quarrying . .	1,061,749	Clerks and typists . .	429,69
Clerks and typists	568,034	Professional . .	359,98
Scotland			
Metal working .	280,210	Personal service .	168,14
Agriculture . .	169,984	Textile workers .	92,40
Transport and communication	169,912	Commerce and finance . .	83,11
Mining and quarrying . .	151,884	Makers of textile goods and dress	53,96
Commerce and finance . .	116,460	Clerks and typists . .	67,96
Workers in wood and furniture .	80,860	Professional . .	44,97

Since a new classification by occupation was used in 1921, co parisons with former censuses cannot easily be made. It should remembered that this classification is by occupation and not by dustry. It might with care make possible a rough estimate of t numbers engaged in sedentary and non-sedentary occupation, skilled and unskilled occupations and similar comparisons. It d not show the numbers engaged in different industries. Thus cleri workers are placed in a separate group. If all such workers are al cated to the industries with which they are usually associated, it possible to classify the population by industry. This is done in t following table.

TABLE V. *Chief Industries, 1921*

England and Wales		Scotland	
Industry	Total in each Industry: Both Sexes	Industry	Total in each Industry Both Sexes
Commerce and finance . .	2,275,148	Commerce and finance . .	289,369
Manufacture of metals . .	2,196,014	Manufacture of metals . .	368,610
Personal service .	2,046,825	Personal service .	199,648
Public administration and defence	1,335,879	Agriculture . .	183,086
Mining and quarrying . .	1,283,728	Mining and quarrying .	179,95
Transport and communication	1,203,566	Transport and communication	155,564
Manufacture of textiles . .	1,153,829	Manufacture of textiles . .	151,16
Agriculture . .	1,123,962	Public administration and defence	143,19

The precise scope of the industries included in the above ta requires careful examination if the figures are to be properly app ciated. Thus commerce and finance includes persons engaged in

of wholesale and retail dealing, in auctioneering and valuing
ll as in banking and insurance. Shop assistants therefore form
e part of the total in this group. The manufacture of metals
les also the manufacture of machines, implements, conveyances,
ery and watches. Personal service includes not only domestic
e but also service in lodging houses, hotels, clubs, laundries and
irants. Public administration and defence includes, in addition
fighting services, those employed both by local and central
nment authorities. Transport and communication includes
employed in connection with storage. The manufacture of
es includes not only those engaged in the manufacture of cotton,
and silk goods but also those engaged in the manufacture of
us miscellaneous products such as lace, carpets, rope, asbestos,
and tarpaulins, as well as those engaged in dyeing, printing,
hing and calendering.

ien the population is thus classified, it is seen that those en-
l in certain industries are less in number than those engaged in
orresponding occupations. Those engaged in the transport in-
y, for example, are fewer in number than those engaged in the
ation of transport and this is so because some of those who
transport as an occupation appear in the industry table as
ging to another industry. Thus while a railway man would
ir among those engaged in transport both as an industry and
occupation, a carter employed by a mining company would be
d as following the occupation of transport but belonging to the
try of mining. Those who follow the occupations of mining
griculture comprise nearly all those who are engaged in the cor-
nding industries, whereas those engaged in commerce and finance
occupation only form about half of those engaged in the corre-
ling industry owing to the fact that numerous clerical workers who
v the clerical occupation belong to the industry of commerce
inance. Four of the eight chief industries are not industries in
veryday meaning of the term, namely, commerce and finance,
nal service, public administration and defence, and transport
communication. If they are omitted from consideration, the
try of the manufacture of metals takes the first place in Great
in.

e low place of agriculture is noteworthy. It was once considered
rkable when those engaged in agriculture were less numerous
those engaged in all other industries taken together. Agricul-
s now not even the most important industry from the point of
of numbers, having fallen to the fourth place in England and
s and to the second place in Scotland. It is possible to classify
tries broadly into those which are extractive, manufacturing,
butive and certain miscellaneous groups. If agriculture, mining
ishing are regarded as extractive and commerce and finance
ransport and communication as distributive, then the following
is obtained. In England and Wales of all those engaged in in-
y, those engaged in manufacture comprise 43·6%, in distribu-
20·3%, in extraction 14·0%, in personal service 11·8%, in
c administration and defence 7·7%, in professions 2·9%, in
and entertainment ·7%. In making this calculation the
67 persons engaged in the gas, water, electricity industrial
have been included among those engaged in manufacture. It
d be noticed that about 60,000 of them are employed by local
rities and that a certain percentage of all those in this group
d more properly be included among those who are engaged
work of distribution.

using.—For the purpose of the census a structurally separate
ing is defined as any room or set of rooms having separate
s to the street or staircase. Thus a flat is such a dwelling. In
ting the number of rooms, sculleries, bath rooms, shop or
rooms are excluded. The total number of dwellings was found
7,759,821, having a total number of 39,894,618 rooms. There
thus an average of 5·14 rooms per dwelling in England and
s, but as some dwellings were occupied by more than one family
were only on the average 4·55 rooms per family. As the average
er in a family was 4·14 the average number of rooms per person
1·1. But these averages by themselves give little or no idea of
ctual housing conditions of the population. Thus there were no
than 3,480,273 private families with less than ·5 rooms per
n, while there were 17,429,709 persons belonging to families
less than one room per person. Again 9·6% of the total private
y population was living with more than two persons per room
ngland and Wales. Judged according to this standard the
ties vary greatly. London has 16·1% of the population living
more than two persons per room while Cornwall has only 2·8.
figures, however, take no account of the size of the rooms.
ing statistics tend to show a progressive improvement when the
ns of one census are compared with those of preceding censuses,
gh the figures for 1921 exhibit a check to the rate of improve-
. The following figures for Scotland show the number of
pied houses per 100 of the population: 1881, 19·8; 1911, 21·3;
921, 21·7.

rital Conditions.—Of the male population in England and Wales
21 55% was single, 41·4% married and 3·6% widowed. Of the
e population 53% was single, 38·3% married and 8·2%
wed. The large number of widows, 1,621,658, is noticeable,
nting to nearly three times the number of widowers. There
at this date 8,464 men and 8,218 women divorced.

Language.—The census returns show that the use of Welsh and Gaelic is declining. The proportion of persons three years of age and over in Wales and Monmouthshire speaking Welsh only was 85 per 1,000 in 1911 and 63 per 1,000 in 1921, while in Scotland the proportion of those speaking Gaelic only was 4·56 in 1911 and 3·47 in 1921. The proportion of those speaking both English and Welsh and English and Gaelic has also declined.

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England and Wales: Registrar-General, *Weekly returns of births and deaths*; *Quarterly returns of marriages, births and deaths.*

Scotland: *Weekly returns of births, marriages and deaths in sixteen towns of Scotland; Monthly returns of births, marriages and deaths in sixteen towns of Scotland; Quarterly returns of births, deaths and marriages of Scotland.*

(A. M. C.-S.)

VI. INDUSTRY AND TRADE

The period of 1910–3 was one of steadily improving trade, but during the first seven months of 1914 there was a perceptible decline of prices and employment.

The War Period.—The principal effects of the World War were the alteration of the normal directions of foreign trade, owing to the interruption of commerce between the belligerent nations and the influence of blockage policies on the commerce of neutral countries; the gradual assumption of control by the Government over both production and distribution; the diversion of production and distribution; the diversion of production into new channels for the supply of War requirements and to make good the loss of imports due to the interruption of commerce; and great changes in labour conditions.

Government Control.—The progress of control by the Government is thus described in the Report of the War Cabinet for the year 1917 (Cmd. 9005, p. 130).

> As the military struggle developed in scope and intensity, and the necessity of concentrating national efforts on the War became more pressing, section after section of industry was taken over, and wages, prices and profits, from raw material to finished product, were placed under Government control. The process of extending State control, taking over more works and applying it to an always widening range of products, continued unbroken right up to the end of 1916. Whilst no exact demarcation line can be fixed, if a broad definition of the character of the movement to that period were attempted it would be that industries essential to War needs had been taken under Government control whilst industries serving the civil population were still left in private hands. In the same way 1917 may be described as the year in which State control was extended until it covered not only national activities directly affecting the military effort but every section of industry—production, transport and manufacture.

Towards the end of June 1917 the country was faced by a serious crisis in the cotton industry, owing to the difficulty of securing supplies of raw cotton. With the co-operation of the industry, a cotton control board was set up. The production of the cotton mills was cut down to 60%, extensions only being allowed on payment of levies, and the sum thus raised utilised for the benefit of the work-people in the less employed mills. The control board thus established contained representatives of the employers and the employed and also of the Government.

A board of control on somewhat similar lines was set up for the wool textile industry, to deal with the difficult problems which arose from the fact that, after Government requirements had been met, rather less than 20% of the output of the trade was left for civil needs. According to the War Cabinet Report for 1918 (p. 210), there was no question raised in connection with the wool textile industries to the solution of which the board did not contribute a most valuable part. Somewhat similar arrangements were made for the jute, flax and hemp industries.

One important effect of the Government control and of the strain put upon various industries by War conditions was the attempt made to extend the standardisation of production even into the clothing industries. By the end of 1918 there had been put on the market £15,000,000 worth of standard suits, over 2,000,000 lb. weight of hosiery, 1,000,000 blankets and 8,000,000 pairs of standard boots. These schemes of standardisation did not long survive the end of the War, though they may have led in some degree to simplification and the reduction of patterns. Of more lasting effect was the great alteration brought about in the productive capacity of various industries.

The manufacture of explosives and propellants was chiefly carried out in special Government factories, but shell cases, rifles, guns, trench weapons, aircraft, tanks, etc., could be produced in different classes of engineering works, and the engineering industry of the country was by degrees almost entirely absorbed in this work, which led to a very considerable expansion of engineering capacity. The same cause brought about a 50% expansion of capacity in the iron and steel industry, and varying increases in many smaller industries.

Various new industries had to be created to supply essential products which were formerly imported from sources rendered unavailable by the War. Amongst these may be mentioned dyestuffs, a large range of fine chemicals, optical and scientific instruments and their components, and various special products such as magnetos. A special Act (The Dyestuffs [Import Regulation] Act 1920 [10 and 11 Geo. V., Ch. 77]). was passed in 1920 prohibiting the importation of dyestuffs except under licence, the idea being gradually to build up by these means British production of essential dyestuffs. In 1921, the Safeguarding of Industries Act (11 and 12 Geo. V., Ch. 47), subjected to an import duty of 33⅓% a wide range of the other articles mentioned above.

War conditions brought about:—

(*a*) Changes in wages, (*b*) new methods of negotiation and relations between employers and employed, (*c*) the introduction of new processes and spread of repetition work, (*d*) improvement in the position of unskilled relatively to skilled labour, (*e*) an enormous increase in the industrial employment of women and (*f*) an increased interest in the improvement of methods of production and the welfare of workers.

Prices and Wages.—The complete control assumed over various industries fixed on the State the responsibility for the control of wages. The cost of living rose steadily during the War (from 100 in July 1914 to 205 in July 1918), and as the demand for War material was practically unlimited the adoption of the cost of living as a standard in the fixation of wages was almost inevitable. This principle was, however, not universally adopted, nor was there any generally accepted decision as to whether the increase should be a flat rate for all workers (on the ground that all need approximately the same minimum amount of food, clothing, etc.), or a rate proportional to earnings or varying inversely with earnings. The method generally adopted by the Government in the controlled industries was, however, to give a flat rate War wage.

This principle had the very important effect of introducing a change in the relation between skilled and unskilled labour, the position of the unskilled being very greatly improved. The following summary by Professor Bowley of the progress made from 1914–20 may here be quoted:—

> After a few months of unsettlement the demand for War materials and the withdrawal of men to the Army resulted in very plentiful employment. The opportunity of increased family earnings at former rates of pay together with an active patriotic spirit prevented for some time demands for increased wages. As food became scarce and prices rose, however, earnings became insufficient in some cases to meet the reasonable needs of efficient subsistence, and bonuses and War wages were given, while the great demand for labour had its natural effect in raising rates of wages. So far as generalisation is possible, we may state that the growth of rates of wages generally lagged behind that of prices, but earnings, in those very numerous cases where piece rates or overtime gave facilities for additional work and pay, increased more rapidly than prices from the outbreak of the War to the Armistice. In the early part of 1919 the War rates continued, though earnings probably tended to fall; and the working classes, fairly content with existing rates in view of the slight fall in prices, devoted their attention to reduction of hours, so that in fact the normal working week was generally reduced by some 10%, while the same money was received for the shorter week as formerly for the longer. When the rise of prices set in again there were continued further upward movements of wages, and at the same time several of the more powerful trade unions made definite efforts to secure a higher standard of living than before the War, while the principle of a minimum wage, intended to be sufficient to allow a livelihood more liberal than had been customary, was widely applied. The re was that during 1919 and 1920 there was a race between wages prices.

With regard to the employment of women, the follow figures sufficiently illustrate the position:—

Average figures for men and women in industrial employment (manufacturing)

	July 1913	July 1918	July 192
Men	6,301,000	5,058,000	6,016,90
Women	2,178,600	2,970,600	1,987,99

The end of the year 1920 marked the peak of prices, and slump of 1921 came upon a chaotic wage position. In s classes of work real wages were higher than pre-War, bu others they were lower. Railway workers, coal-miners, dock and others had definitely obtained improvements in their sta ard of living. The effects of War tendencies continued in va ing degrees in different industries, sometimes without consideration for what the commercial conditions enabled industry to sustain. Moreover, the operation of foreign com tition upon certain industries created a great disparity betw wages in these industries and those in the non-competitive sheltered industries (covering about one-half of the total sons employed), and it is the general view of industrialists t the high level of these latter wages added a very considera burden of cost to the less fortunate industries and seriou hindered their revival. (*See* PRICES; WAGES.)

Industrial Relations.—The experience of such bodies as cotton and wool control boards, the spirit of comradeship gendered by the War, and the strengthening through War perience of the nation's realisation of the dangers of indust strife, created a new attitude towards the relations betw employers and employees. This found expression in individ works in the growth of works committees and other co-operat methods, and nationally in the establishment of the scheme joint industrial councils, recommended by what is known as Whitley Committee's Report. Of these there were by the of the year 1921 between 50 and 60 in operation, covering s important industries as wool and allied textile, heavy chemi printing, pottery, flour milling and gas and electricity supp

The fact that the scheme was not adopted in coal-mini cotton, engineering, railways, iron and steel, and certain ot industries was largely due to the existence in those indust of well-tried conciliation schemes, which neither party desi to change. The intention of the scheme was that the coun should include in their scope not only conciliation but a w range of subjects of general interest to the industry, such technical education, etc. This intention has only been very p tially carried out. Another evidence of the new spirit was foundation of such bodies as the National Alliance of Employ and Employed (now called the National Industrial Allianc the Industrial Welfare Society; the Institute of Industr Psychology; the Industrial Fatigue Research Board, bod which still survive to carry on the useful work indicated their titles. (*See* INDUSTRIAL RELATIONS.)

Scientific Research.—The War strongly stimulated a m beneficial movement for scientific research. In 1917 Parl ment voted a sum of £1,000,000 to be administered by a spec committee of the privy council in grants to trades willing form research associations. In 1924, 23 industrial resea associations were in actual operation, and the privy council co mittee was able in its report for 1923–4 to record the opini that the scheme promised to be a marked success. There h also been a substantial extension of research work by individu firms. (*See* INDUSTRIAL RESEARCH.)

Trade Organisation.—Shortage of raw materials and oth factors made it absolutely necessary for the Government, wh handling industrial questions, to be able to deal with trades a whole. This led to the formation of voluntary representati associations in a considerable number of industries, while t increased realisation on the part of industrialists of the imp tance of mutual consultation and co-operation for commerc oses led to the foundation in 1916 of the Federation of ish Industries, a strictly non-political body dealing solely commercial questions.

ne tendency towards amalgamation of individual firms was much stimulated by War experience and by the recom- dations of Government committees, which brought home dustrial leaders the necessity of safeguarding supplies of material, enlarging the scale of production, etc. The ar- nent firms, faced with large extensions of plant, sought to itate the employment of these after the War by the acqui- n of subsidiary businesses, capable of acting in the capac- f suppliers of material or buyers of partly finished products. e were also considerable amalgamations in the iron and electrical engineering, in cocoa, chocolate, biscuit and glass stries. The formation of a large combine in the jute trade 920 may also be mentioned, but there was not any very ral enlargement of units in the textile industries. These ous amalgamations have not all been equally successful.

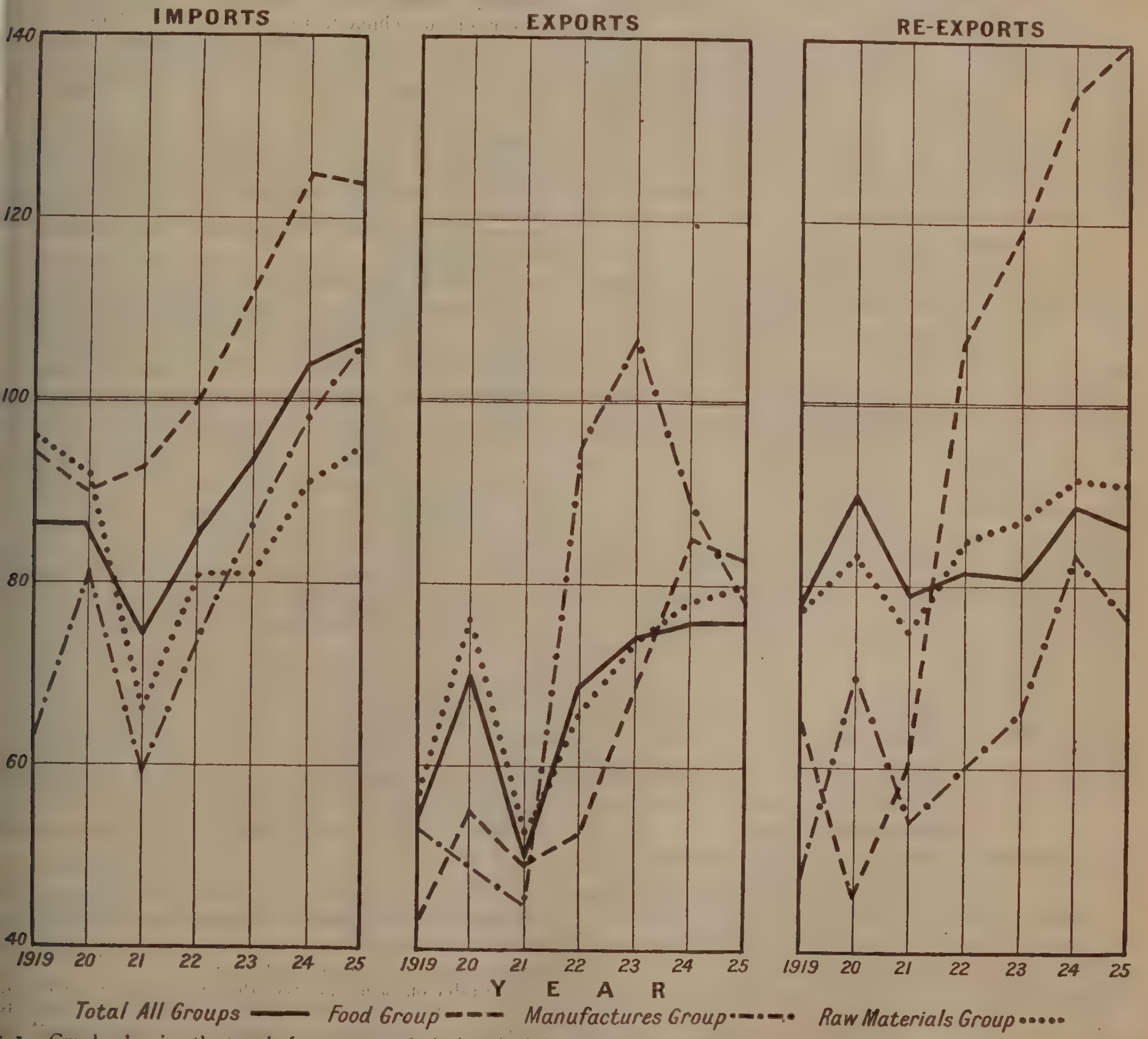
rade Development.—Owing to changes in values and methods cording it is difficult to compare post-War trade with that 913. The following chart and tables show the course of trade e United Kingdom and in certain specified industries. Fig- are for the whole of the British Isles up to April 1 1923, and Great Britain and Northern Ireland after that date. The quantity index has been compiled to compare the post-War overseas trade with that for 1913.

Overseas Trade of the United Kingdom in value and volume, 1913, and 1919 to 1925

1. IMPORTS

Year	Food, Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total	
	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.
1913	295	100	270	100	201	100	769	100
1919	719	93·9	607	96·1	296	63·2	1,626	86·4
1920	766	90·1	710	91·8	453	81·8	1,932	88·4
1921	567	93·3	271	64·9	244	59·0	1,085	74·3
1922	472	99·5	298	80·8	230	72·4	1,003	85·8
1923	509	114·0	325	80·7	257	86·3	1,096	93·3
1924	571	125·4	400	90·5	300	98·0	1,277	104·0
1925	572	123·9	425	95·3	320	107·8	1,322	108·2

The Slump of 1921.—It will be observed that in the year 1920, in almost every industry, the total value of exports had enormously increased, although the actual quantities exported were



: I.—Graphs showing the trend of overseas trade (volume) of the United Kingdom from 1919 to 1925. The volume in 1913 is taken ual to 100, the volumes for the years 1919 to 1925 being shown as percentages above or below that of 1913.

2. Domestic Exports

Year	Food Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total[1]	
	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.	Mill. £	Index of vol.
1913	34	100	66	100	414	100	514	100
1919	34	43·7	111	53·6	641	56·4	786	54·9
1920	51	55·3	145	48·9	1,120	76·5	1,316	70·9
1921	37	48·9	64	45·1	589	50·8	690	49·8
1922	36	52·7	102	94·7	569	66·5	615	68·9
1923	44	68·9	131	107·5	580	73·5	755	74·6
1924	57	85·6	107	89·3	619	78·7	783	76·1
1925	55	82·4	84	78·9	616	79·8	755	76·0

3. Re-exports

Year	Food, Drink and Tobacco		Raw Materials and Articles mainly unmanufactured		Manufactured Articles		Total	
	Mill. £	Vol. index	Mill. £	Vol. index	Mill. £	Vol. index	Mill. £	Vol. index
1913	16	100	64	100	30	100	110	100
1919	43	65·1	83	77·8	38	48·7	164	78·2
1920	46	45·3	123	83·2	54	70·7	223	90·3
1921	30	60·2	50	74·6	27	53·4	107	78·6
1922	22	106·6	55	85·2	27	59·8	104	81·5
1923	25	118·1	67	87·5	27	65·9	119	80·7
1924	30	134·3	76	91·8	34	83·4	140	88·4
1925	32	139·4	91	91·2	31	76·6	154	87·3

Exports of Metals and Metal Products
(In millions of £)

(Reproduced by the Courtesy of the British Engineers' Association)

	1913	1920	1921	1922	1923	1924
Iron and steel and manufactures thereof:						
Declared value .	55·4	128·9	63·6	60·9	76·2	74·5
Corrected value .	55·4	40·3	22·2	38·4	49·7	47·9
(on basis of 1913 average values)						
Non-Ferrous metals and manufactures thereof:						
Declared value .	12·0	25·8	11·7	11·5	14·5	15·6
Corrected value .	12·0	14·7	8·8	11·2	12·7	12·9
Cutlery, hardware, implements and instruments:						
Declared value .	7·1	13·6	9·0	6·4	7·4	8·5
Corrected value .	7·1	5·2	3·2	3·3	4·4	5·5
Electrical goods and apparatus:						
Declared value .	5·4	11·6	13·0	7·3	10·2	10·1
Corrected value .	5·4	4·3	4·4	2·9	4·3	4·3
Machinery:						
Declared value .	33·6	63·4	74·6	51·5	44·5	44·7
Corrected value .	33·6	23·3	24·2	19·3	20·9	22·3

Exports of Coal and Coke
(Quantities in millions of tons. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Coal								
Quantity .	73·4	35·2	24·9	24·7	64·2	79·5	61·7	50·8
Value . .	50·7	83·2	99·6	43·0	72·5	99·8	72·1	50·5
Coke								
Quantity .	3·3	3·2	3·9	1·6	3·7	5·0	3·9	3·3
Value . .	2·9	9·1	20·7	3·4	5·2	10·1	6·2	3·8

Motorcars and Chassis
(Values in millions of £)

Year	Imports				British Exports			
	Cars		Chassis		Cars		Chassis	
	No.	£	No.	£	No.	£	No.	
1913	6,820	1·7	7,958	1·9	7,595	2·4	1,234	0
1919	4,365	1·3	2,240	0·7	1,514	1·0	678	0
1920	33,332	10·5	12,106	4·3	5,309	3·9	3,124	2
1921	7,397	1·8	4,069	1·1	2,721	2·3	1,041	1
1922	14,315	2·5	8,517	1·5	1,934	1·3	1,107	0
1923	17,199	2·9	12,627	1·7	4,232	1·9	2,022	1
1924	14,717	3·0	12,459	1·8	12,754	3·7	2,905	1
1925	34,722	6·3	15,617	2·2	19,316	5·1	2,620	1

Artificial Silk
(Including yarn and manufactures thereof other than apparel)

Imports (in millions of £)					
1920	1921	1922	1923	1924	1925
0·6	1·2	2·6	4·4	5·5	6·9
Exports (in millions of £)					
3·0	1·7	2·6	3·5	4·3	5·4

less than in 1913 by varying degrees, and that this position
suddenly changed in 1921, when the volume of exports fell
fraction of the volume in 1913, though the values continued
be substantially higher. Thereafter quantities gradually
and values fell. The causes of the slump were described as foll
in a report issued by the Federation of British Industries in
year 1922:—

> Although there was, for various reasons, considerable delay in
> resumption of the normal flow of orders for manufactured goods a
> the War, and the intake by the countries normally buying la
> quantities of such goods was during 1919 and 1920 far below
> normal, the demand was more than the capacity of the manufact
> ing countries, hampered and reduced as it was by the effects of
> War, could supply.
>
> At the end of 1918 a boom in manufactured goods was experienc
> in Japan, which passed to the United States, and later in turn
> Great Britain, to France and Belgium and finally to Germany.
> these circumstances, and with Central Europe very largely unable
> import at all, Great Britain was in a relatively fortunate position
> obtaining supplies of food and raw materials. In 1919 the necess
> foreign credit was secured in the first few months by a continua
> of borrowing, and subsequently to a large extent by the very li
> earnings of our shipping and the abnormal prices we were abl
> secure for our coal exports. To the goods we were able to buy in t
> way have to be added the considerable imports on government a
> count ordered during the War, but not shipped till after the Ar
> stice. In 1920 the demand for our manufactured goods was so inten
> that though the tonnage exported was small compared with 19
> the total value was very much larger, the average price being nea
> four times the average pre-War price.
>
> These developments were accentuated by the fact that ma
> countries had heavy accumulated stocks of raw materials which th
> were unable to realise, as these accumulations were largely of ma
> rials normally taken by the Central Empires and other countr
> which were still out of the market. Unable to realise their produc
> these countries in turn were unable to buy the manufactured go
> they required, and the normal circle of commerce was interrupt
> The effect was immediately to prick the bubble of prices. Purchase
> all over the world ceased to buy our goods, and, as prices fell, tend
> to defer purchasing altogether until they could see some sign th
> prices had touched bottom. On the one hand, therefore, man
> facturers were left with high-priced goods for which the dema
> had suddenly ceased, while, on the other hand, there were hea
> accumulations of unsold agricultural products and raw materials
> the hands of potential buyers in distant parts of the world. Th
> has had the result of checking production throughout the world bo
> of agricultural products and manufactured goods.

Another factor which acted as a depressing influence imm
diately the slump commenced (and had, indeed, prevented so
industries from profiting by the boom) was the liquidation
the Government of the enormous stocks of War material held
them at the conclusion of hostilities.

The table on page 273 gives the production of various indu
tries, together with the trend of population in Great Brita
and the outward passenger movement for the periods 1911
1913 and 1919 to 1925.

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[1] With minor items included.

Statistics (Production and Population) for the United Kingdom

ar	(1) Cotton Spindles (000's omitted)	(2) Cotton Consumption (in thousands of bales, 000's omitted)	(3) Raw Wool Imports retained in the U.K. (in millions of lb.)	(4) Pig Iron production (in thousands of tons)	(5) Steel production (in thousands of tons)	(6) Gross merchant tonnage launched in Great Britain and Ireland (in thousands of tons)	(7) Coal Raised (in thousands of tons)	(8) Iron Ore produced (in thousands of tons)	(9) Imports of Wheat retained for home consumption (in millions of cwt.)	(10) Estimated Population of Great Britain (in millions)	(11) Net Passenger Movement outwards to places out of Europe (number)
11	54,522	3,240	529	9,526	6,461	1,804	271,892	15,519	97·7	40·9	272,996
12	55,317	3,734	517	8,751	6,796	1,739	260,416	13,790	108·9	41·1	316,139
13	55,652	3,667	539	10,260	7,663	1,932	287,430	15,997	105·4	41·3	329,073
19	..	..	911	7,398	7,894	1,620	229,037	12,240	71·4	41·7	7,903
20	58,692	3,074	672	8,034	9,067	2,056	229,295	12,678	109·3	42·5	154,174
21	56,140	1,678	449	2,616	3,703	1,538	164,344	3,471	79·8	42·8	149,924
22	56,605	2,275	699	4,902	5,880	1,031	250,808	6,836	96·2	43·1	119,162
23	56,583	1,919	361	7,440	8,481	646	278,141	10,875	99·9	43·4	252,776
24	56,750	1,695	435	7,307	8,201	1,440	269,134	11,051	116·7	43·6	117,874
25	57,116	2,344	414	6,236	7,397	1,079	246,671	..	96·4	..	..

) Raw cotton spinning spindles based on the July issues of the International Cotton Federation statistics, not including doubling and te spindles. (2) Consumption of American cotton lint based on the International Federation's spinners' returns for years ending July (3) Total raw wool retained in the United Kingdom compiled from the trade returns for the U.K. (4) and (5) Production of pig iron steel according to statistics compiled by the National Federation of Iron and Steel Manufacturers. (6) Lloyd's Annual Summary of building. (7) Production excluding Ireland from 1922. Prepared from the Board of Trade Returns. (8) Output according to the annual rt of the Secretary for Mines. Production excluding Ireland from 1922. (9) Total wheat retained for home consumption compiled from U.K. trade returns. (10) Estimated population compiled from the annual reports of the Registrar-General. (11) Board of Trade urns.

THE VARIOUS INDUSTRIES

oal.—The story of the coal industry was a particularly un- py one. In 1914, 1,133,746 men were engaged in the coal es of Great Britain, of whom 150,000 approximately joined or war services. At the end of the War there were 1,008,867 in 1924 1,230,248 men in the industry. Immediately after War huge demands for coal arose. During this time due ntion could not be given to maintenance problems, and this, pled with the return of the miners from the armies, created te difficulties in organisation, leading to increased costs with iced outputs. The market showed considerable inequalities, ort prices being extremely high as against home prices. Dur- 1920–1 exports steadily fell, but in 1922–3 there was a sudden sustained improvement, due to the disturbance of conti- tal production through the occupation of the Ruhr. As this or gradually ceased to operate the depression set in again. 1925 the Government appointed a Commission to inquire and report upon the economic position of the industry. ir report was published on March 10 1926 (*see* COAL).

ron and Steel.—The export figures increased very largely in 2, the reason in this case also being the French occupation he Ruhr. When this artificial stimulus was withdrawn the sperity of the industry immediately declined. This decline tinued through 1924 until the last quarter of 1925. The fol- ing statement by the National Federation of Iron and Steel nufacturers summarises the position at the commencement he last quarter of 1925.

last Furnaces in Operation.—There are in the United King- some 480 blast furnaces for the production of pig iron, which he basic material for the manufacture of iron and steel. If demand for pig iron required it, some 360 of these furnaces ld be blowing at one time. In 1913 there was an average of furnaces blowing throughout the year; the maximum number ving at any one time since the War was 303 in Sept. 1920. the present time there are only 129 furnaces in blast, the nber having steadily fallen since May 1923.

ig Iron.—The decrease in the number of furnaces in opera- is naturally reflected in the production of pig iron. Pig reached its maximum production in the year 1913, when 60,300 tons were produced. In 1920 the output amounted ,034,700 tons, but in 1924 this had fallen to 7,307,400 tons n average of 609,000 tons monthly, and this has still further en in the present year, so that the average monthly output the first nine months amounted to only 529,400 tons, the out for Sept. amounting to 448,700 tons.

Steel.—The output of steel ingots and castings in 1913 amounted to 7,664,000 tons, but owing to war needs the steel-making capacity of the country was expanded by approximately 4,000,000 tons per annum, and the country has now the capacity to produce at least 12,000,000 tons annually. In 1920 the output of steel ingots and castings amounted to 9,067,300 tons. In 1924 the output had fallen to 8,201,100 tons, or an average of 683,400 tons monthly, and in the first nine months of 1925 the average was 609,400 tons.

Exports.—The prosperity of the iron and steel industry depends very largely upon the extent of its export trade. In 1913 the total exports of iron and steel amounted to 4,969,200 tons; in 1924 exports were 3,853,100 tons, or an average of 321,100 tons a month, while the average in the first nine months of 1925 was no higher than 300,000 tons a month. In Sept. exports touched their lowest point for 1925 and amounted to 273,200 tons.

Imports.—Imports, on the other hand, have increased in spite of the fact that the increased capacity during the War was sufficient to make it unnecessary for any steel to be imported. Imports of iron and steel in 1913 averaged 186,000 tons a month; in 1924 they had increased to 202,400 tons a month, and in the first nine months of 1925 amounted to 227,000 tons a month.

The decline in this trade has been due to causes which have affected other industries, *i.e.*, depreciated exchanges abroad, lower taxation, lower wages, longer hours in other countries and high foreign tariffs, the difficulties of the steel trade being accentuated by the increase in productive capacity both here and abroad.

Engineering.—In regard to the engineering industry, the same causes were in operation. The year 1925, on the whole, saw an improvement. An unfavourable feature, however, was a rise in the average value of machinery imported in comparison with the average value of machinery exported, showing that the imported goods are of a more highly developed and costly character than those exported. The position of the electrical side of the industry was more satisfactory than that of the other branches, no doubt because of the great increase throughout the world in the consumption of power.

Shipbuilding.—Particularly unfortunate was the experience of the shipbuilding industry. The productive capacity of the world has, since the slump of 1921, been greatly in excess of demand, due to the extension of plant throughout the world necessitated by the rapid wastage of tonnage during the War, and also to the continued depression of international trade which reduced the demand for freight.

Exports of Cotton Products

(Quantities in millions of lb. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Yarn:								
Quantity . .	210·1	162·6	147·4	145·9	202·0	145·0	163·1	189·5
Value . .	15·0	33·9	47·6	23·9	26·5	21·0	27·8	30·5
Piece Goods:								
Quantity . .	6,580·0	(1)	4,435·4	2,902·3	4,183·7	4,140·2	4,444·0	4,433·7
Value . .	97·8	..	315·7	317·1	142·4	138·3	153·4	150·5

[1] Not available.

Exports of Woollen and Worsted Products

Reproduced by the courtesy of the Wool Textile Delegation, 1925 figures being added

(Quantities in millions of lb. Values in millions of £)

	1913	1919	1920	1921	1922	1923	1924	1925
Tops:								
Quantity . .	43·6	14·9	23·8	34·7	41·6	38·9	41·2	32·0
Value . . .	3·7	3·2	5·0	4·4	4·4	5·3	6·5	5·3
Worsted Yarns:								
Quantity . .	49·9	24·6	24·6	23·5	42·9	34·9	45·6	38·9
Value . . .	5·0	10·6	11·5	5·2	7·6	6·2	9·1	7·9
Woollen Yarns:								
Quantity . .	4·8	4·0	6·4	6·0	9·7	9·2	8·3	6·0
Value . . .	0·5	1·3	3·2	1·9	2·3	1·9	1·9	1·5
Alpaca and Mohair Yarns:								
Quantity . .	17·2	1·5	4·3	4·1	6·8	9·6	8·4	8·0
Value . . .	2·2	0·6	1·9	1·3	1·5	2·3	2·0	1·9
Other Yarns:								
Quantity . .	8·5	2·0	3·3	..	2·8	2·8	3·6	4·6
Value . . .	0·4	0·4	0·2	0·1	0·3	0·3	0·4	0·6
Woollen Tissues:[1]								
Quantity . .	105·9	130·9	187·2	76·6	121·6	148·6	164·7	132·3
Value . . .	14·5	60·4	75·2	24·6	25·1	28·3	30·1	26·3
Worsted Tissues:								
Quantity . .	62·5	33·2	77·3	40·8	62·3	62·9	56·8	47·3
Value . . .	6·2	11·7	26·7	11·2	11·8	11·4	10·0	9·0

[1] Returns in sq. yd. from 1920 onwards.

Exports of Heavy Chemicals

(Quantities in millions of cwt. Values in millions of £)

	1913		1919		1920		1921		1922		1923		1924		1925	
	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£	cwt.	£
Sodium Carbonate, including Soda Crystals, etc. . . .	3·9	0·7	4·1	1·5	4·5	2·0	3·0	1·2	5·0	1·6	6·0	1·7	6·1	1·6	5·5	1·5
Caustic Soda .	1·5	0·7	1·0	1·3	1·0	1·4	0·6	0·7	1·5	1·6	1·6	1·3	1·8	1·4	1·7	1·3
Sulphate of Soda	1·3	0·1	0·5	0·7	2·0	1·2	0·4	0·4	1·4	0·3	1·5	0·4	1·5	0·3	1·5	0·2
Bleaching Powder (Chloride of Lime) . .	0·7	0·2	0·3	0·3	0·4	0·5	0·2	0·2	0·2	0·2	0·3	0·1	0·3	0·2	0·4	0·2
Heavy Coal Tar Oils . .	mill. gal. 36·8	0·6	mill. gal. 13·7	0·4	mill. gal. 24·7	1·3	mill. gal. 14·0	0·7	mill. gal. 25·6	0·7	mill. gal. 47·9	1·8	mill. gal. 45·3	1·7	mill. gal. 37·1	1·1

Exports of Fertilisers

(Quantities in thousands of tons. Values in millions of £)

	1913		1919		1920		1921		1922		1923		1924		1925	
	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£	tons	£
Basic Slag, Super-phosphates, Guano, etc. . . .	381·0	1·4	58·5	0·7	73·6	1·1	28·6	0·3	54·2	0·4	86·9	0·5	116·7	0·7	128·9	0·8
Ammonia Sulphate . .	323·1	4·4	92·9	2·2	109·6	3·7	128·5	2·7	144·3	2·4	253·3	4·0	277·7	3·7	262·3	3·3

otton.—The position of the American section of the cotton
e was continually unsatisfactory. Owing to short cotton
s the price of material was so high that the relatively poor
kets, in which the great majority of sales are made, were
illing to pay the prices which manufacturers were compelled
sk. Here again the year 1925 gave promise of an improve-
t. In regard to the finer side of the trade, that using Egyp-
cotton, the raw material supply was more satisfactory, and
e was consequently better. Moreover, this side of the in-
ry suffered less than the American section from the tendency
cotton-growing countries to install spinning machinery.
ily, reference should be made to the policy of recapitalisation
igher values during the boom period, the subsequent effects
hich seriously embarrassed a number of firms (*see* COTTON).

ool.—In regard to the woollen and worsted industry, there
very rapid recovery of trade in the second half of 1921, which
tinued, subject to a slight setback at the end of that year,
ugh 1922 and 1923, the demand generally being for the finer
s of goods at the expense of lower grade. During 1923 there
a further setback largely due to the disturbance in conti-
tal trade through the Ruhr occupation, which had so sub-
tially benefited the iron and steel and coal industries. During
first half of 1924 there was a gradual recovery, which, how-
r, affected the heavy more than the finer goods; but in the
nd half of that year the depression returned, and continued
ing the opening of the year 1925. In the latter part of 1925
e were signs of recovery. In this industry, as well as in cot-
, there was a world shortage of material which maintained
es at a relatively high level, and was detrimental to consump-
in the impoverished state of most markets. In neither wool
cotton had the policy of central control, initiated during the
r, maintained its power (*see* WOOL).

hemicals.—The chemical industry includes heavy chemicals,
stuffs and intermediates, fine chemicals and fertilisers. The
gress of the heavy chemical trades since the War was ex-
nely variable, as is shown by the export figures in the above
les. These have been chosen as samples, the great variety of
ducts in the industry making any general statistical state-
t impossible.

yestuffs and Intermediates.—At the outbreak of War less
n 20% of the colours used here were actually made in Great
tain, the market being dominated by the German industry.
cessation of imports soon created a dye famine, and prices
to unprecedented heights, to the great injury of the textile
other dye-using industries. By the end of the War, however,
tish makers were able to supply not only their own essential
uirements, but also some of the needs of our Allies. Govern-
nt assistance and finance were necessary to enable this result
be attained. In addition the Government assisted the for-
tion of a new company called the British Dyestuffs Corpora-
, Ltd., an amalgamation of various existing concerns, and
f invested a large sum in the corporation. In 1925 it was
med that the British industry was meeting 80% of the needs
British colour users, and that an average reduction of 50%
rices had been effected since 1921. The working of this sys-
of protection and partial Government control had not, how-
r, been altogether happy, and during 1925 a reorganisation
carried through, the Government giving up its shareholding
he corporation.

ine Chemicals.—The following summary is taken from
volume *Chemicals* by Ashe and Boorman (Ernest Benn, Ltd.
4) in the series, on *The Resources of the British Empire:*—

> rior to 1914 the fine chemical industry was practically a monop-
> of Germany, although several British firms possessed an inter-
> onal reputation for some of their products. The War cut off
> rely our normal supplies of all kinds of fine chemicals, and beyond
> stocks in the country we had no means of obtaining supplies of
> s such as aspirin; of anaesthetics such as novocaine; of remedies
> as salvarsan; of synthetic photographic chemicals which were
> to aerial photography and for X-ray work in the hospitals; of
> hetic tannins required in the leather industry; of analytical
> ents for chemical analysis in the great steel works and in prac-
> lly every other industry; and of a variety of other fine chemicals
> ssary for research work and in industry. Fine chemical manufacture was hurriedly undertaken in Great Britain, under most adverse conditions in respect of buildings, plant and processes, and very substantial progress was made. In a few months British salvarsan and salicylic acid were on the market; other drugs soon followed, and before hostilities ceased there was scarcely a synthetic drug of real importance that was not made in this country in sufficient quantities, and in many cases with a margin for export. The same was true of the synthetic photographic chemicals, amidol, metol, paramidol and glycin, and at the present time British photographic chemicals are second to none in quality. Of the synthetic perfumes and flavourings a certain number were made here before the War, but since the production has been largely developed. At the end of 1925 it was estimated that the British production was thrice as great and the volume of exports double what it had been before the War.

Fertilisers.—The fertiliser industries, producing basic slag, sulphate of ammonia and superphosphate of lime suffered much from the agricultural depression, due to bad harvests throughout the world, and from the fact that many of the products are the by-products of other industries. Before leaving the chemical industry mention must be made of the successful establishment since the War of a large scale plant for the fixation of nitrogen by synthetic process; this is a matter of great importance as Great Britain was previously entirely dependent on imports of nitrate of soda.

Motorcars.—The progress of this industry is well illustrated by the tables given above. Satisfactory features were the increased exports in 1923–4 and reduction of imports in 1924. It may be noted that a 33⅓% *ad valorem* duty on imported motor cars, components and accessories was imposed in 1917, removed in July 1924 and reimposed in July 1925.

Artificial Silk.—Before the War artificial silk was not regarded as of sufficient importance to be allowed a special heading in official statistics. The figures given above show how prominent a place the trade held in Great Britain in 1925. It must be remembered that the figures represent values only, and that prices fell during the period 1921–5 (*see* ARTIFICIAL SILK).

Sugar Beet.—The development of the sugar-beet industry in Great Britain is in too early a stage to make any statistical record possible. The Government pledged itself to a generous scheme of subsidy, and the new industry started under favourable auspices. At the end of 1925 there were 10 factories actually in operation.

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(C. T.)

VII. AGRICULTURE

The period 1911–25 witnessed great changes in the cultivation of the soil, in the prices of agricultural produce, in the ownership of land, and still more in the relation of the State to the industry. Indeed, the period witnessed the popular acceptation of the idea that agriculture stood on a different footing from other industries and as such demanded that the State should have a "policy" calculated in one way or another to encourage the full cultivation of the soil.

Before the World War, Government action was of a very limited character. Its most important function was the eradication of contagious diseases of animals in continuation of the policy begun in the '60s for the prevention of the spread of foot-and-mouth disease, cattle pleuro-pneumonia, swine fever and rabies. A beginning had, it is true, been made in promoting agricultural education and research, in the extension of small holdings, and in the improvement of light horse breeding, but generally in this period the policy of the Government, apart from the suppression of animal diseases, was one of non-interference with the industry, combined with some tentative efforts towards education and the spread of information.

The War Period.—With the outbreak of war, agriculture assumed a new significance. It ceased, at least for the time being, to be an industry pursued, like other occupations, entirely for the benefit of those engaged in it. The production of food became a national question. For a time it seemed as though the increased prices would in themselves provide sufficient stimulus, and it was not immediately obvious in what direction the State could usefully intervene. Gradually, both the food and labour supply became increasingly difficult, and in Jan. 1917 the Food Production Department was established under the Board of Agriculture with a view to more active steps being taken through county war agricultural committees and otherwise to stimulate the cultivation of the soil.

The Corn Production Act.—In the following March the Government announced an entirely new policy, which was afterwards incorporated in the Corn Production Act, 1917. This new policy was based on the view that in order to get farmers to plough up grass land and grow more cereals it was necessary to give them confidence in the future course of prices by providing a Government guarantee that the prices of wheat and oats should not fall below a certain figure during the next few years. The Act, as ultimately passed in Aug. 1917, fixed the prices as follows:—for 1917, wheat 60s. and oats 38s. 6d. per imperial quarter; for 1918–9, 55s. and 32s.; and for 1920–1–2, 45s. and 24s. respectively. Provision was made for the payment to the grower of the average difference between these prices and the average price ruling in the seven months following the harvest in each year. These guarantees, however, never became operative, as the actual price throughout the period was above the guaranteed price. Apart from the guarantees, the Act embodied another new and important departure in policy by providing for the establishment of an agricultural wages board, whose duty it was to fix minimum wages for workmen in agriculture and to see that not less than these wages were paid. This was combined with restrictions on the raising by land-owners of agricultural rents, and with power to enforce the proper cultivation of the land by farmers. Thus the policy contained in this Act was of a dual character: on the one hand it ensured to farmers for a period of six years certain minimum prices for their two principal cereal crops and protected them against any undue raising of rents; on the other hand it required them to pay adequate minimum wages to their workers and to cultivate their land in accordance with the rules of good husbandry.

As a policy of a less permanent character, very active steps were taken by the Food Production Department (under Lord Lee) during 1917–9 in the direction of increasing the area under the plough and generally in promoting the output of food. The increase in the area of the corn and potato crops between 1916 and 1918 was over 1,500,000 acres in England and Wales alone, while the total increase in the United Kingdom was just on 3,000,000 acres.

The Selborne Committee.—In the meantime, the question of the policy to be adopted in regard to agriculture after the War had been considered by the Agricultural Policy Sub-Committee, of which Lord Selborne was chairman. The reference to this committee was "to consider the methods of effecting an increase in the home-grown food supplies, having regard to the need of such increase in the interests of national security," and their report was issued in July 1918. It contains a full exposition of the position of agriculture in this country and deals in detail with the various problems presented, the object being "to formulate a scheme of agricultural policy which may be generally accepted by the nation and adhered to through a long course of years." Briefly, the committee took the view that the security and welfare of the State demanded that agricultural land should be made to yield its maximum production of foodstuffs, and that if this object was to be attained it was necessary to provide a basis of security and stability in the conditions under which agriculture is carried on. The method they recommended was the permanent adoption of the principles underlying the
Production Act, viz.: a minimum wage for the agricultu
labourer, a guaranteed minimum price for wheat and oats
the farmer, and a control of cultivation sufficient to ensure
the State a permanent development of agriculture and
proper utilisation of the land.

These principles were incorporated in the Agriculture
which, after prolonged discussion, was passed on Dec. 23 19
The minimum prices guaranteed under this Act were to be as
tained annually on the basis of the estimated cost of product
in any year as compared with 1919. Within a few months of
passing of the Act, however, it became apparent that a seri
slump in agricultural prices was taking place and that the bur
on the State involved in the guaranteed prices would be
large. This was combined with a general financial stringe
which demanded a reduction in all Government expenditure

A Reversal of Policy.—The result was that the main operat
clauses of the Agriculture Act, 1920, were repealed by the
Production (Repeal) Act, 1921, and the whole policy of
the intervention of the State in agricultural wages, prices
in the control of cultivation was abandoned. Some tempor
compensation was given to farmers by the payment of a subs
on wheat and oats grown in 1921, which amounted to the
of £18,000,000, and the sum of £1,000,000 was added to
development fund, mainly for the purpose of promoting
cultural education and research. The Agricultural Wages Bo
was abolished, and in its place conciliation committees represe
ing both employers and workers were established to fix wa
by voluntary agreement.

Between 1921 and the end of 1925, a great deal of discuss
took place as to the adoption of some national policy in reg
to agriculture, and a large number of proposals were put
ward. A conference representative of the various interests
proposed with the object of arriving at some agreed met
which would be acceptable to all parties and shades of poli
opinion, but owing to preliminary differences this confere
was never held. The Council of Agriculture, which is a sta
tory but unofficial body, proposed a scheme which, among o
matters, involved a subsidy amounting to some £5,000,00
£6,000,000 for the encouragement of arable cultivation in
land and Wales, but public opinion appeared generally to
opposed to subsidies of any kind.

Thus, at the end of 1925 there was no broad national po
recognised by the State in regard to agriculture of a chara
comparable with what was attempted by the Corn Produc
Acts. On the other hand, between 1921 and 1925 a great m
agricultural questions were dealt with separately, and
extensive action was taken by the State in the direction of
tering and promoting agriculture. Very considerable sums
voted annually by Parliament with this object, and the posi
may be summed up by saying that policy is in the directio
helping the farmer to help himself without the interventio
the Government either in regard to prices or cultivation.

Agricultural Wages.—In regard to agricultural wages,
State again intervened and by the Agricultural Wages Reg
tion Act, 1924, provided machinery whereby minimum w
for workers in agriculture must be fixed in England and W
It was not thought necessary to include Scotland in its provis
because Scottish workers appeared able to arrive at satisfac
agreements with their employers without any assistance.
English Act provides for wages to be fixed locally by 47
mittees covering the whole country, each committee being
posed of an equal number of employers and workers (us
six to eight on each side), two impartial members appointe
the Minister of Agriculture and a chairman. In the even
failure to agree, an agricultural wages board similarly co
tuted has power to act in default.

Apart from this action in regard to labour, the newer feat
of the agricultural policy are the action taken in regard to
settlement, education and research, and sugar beet, to
may be added the enquiries and investigations carried ou
the first instance by the Linlithgow committee and subseque

by the Ministry of Agriculture in regard to the marketing of agricultural produce. Combined with these developments is a continuance of the older policy in regard to the control of contagious animal diseases, more especially foot-and-mouth disease, which of late years has presented a more formidable problem than it did for a long period prior to the World War.

Land Settlement, Education and Research.—A forward movement was begun after the Armistice in the direction of settling ex-service men on the land, and under the Land Settlement (Facilities) Act the area of land in England and Wales held by public authorities for letting as small holdings was more than doubled, viz.: from 201,000 ac. at the end of 1918 to 447,000 ac. at the end of 1924, while the number of occupiers increased from 13,874 to 30,177. As regards research and education enormous progress has been made, research institutes (connected in most cases with universities) being now provided for the study of all the scientific sides of agriculture, while instruction of a practical character is undertaken under the direction of the local authorities in every county in the country. This work is maintained or aided by grants from the Ministry of Agriculture, the expenditure from Parliamentary funds in England and Wales alone in 1925–6 amounting approximately to £647,000.

Another direction in which Parliament is providing large funds for the assistance of agriculture is by encouraging the establishment of the sugar beet industry by subsidising the manufacture of sugar from home-grown beet for a period of 10 years under the British Sugar (Subsidy) Act, 1925. The acreage under this crop rose to 55,000 ac. in 1925, and it was expected that this figure would be doubled in 1926. Considerable expenditure is also incurred in the direction of the improvement of livestock. An attempt was made under the Agricultural Credits Act, 1923, to establish a scheme of co-operative credit societies aided by loans from the State, but the number of societies actually established is very small (*see* CO-OPERATION).

The change in the attitude of Parliament towards agriculture may to some extent be measured by the change in expenditure. Thus in 1911–2, the total expenditure of the Board of Agriculture and Fisheries was £251,000, of which possibly 10% represented expenditure on fisheries. This covered England and Wales and Scotland. In 1925–6, the gross estimate for the Ministry of Agriculture (excluding expenditure on fisheries) was £3,277,000 for England and Wales alone, while the estimate for the Board of Agriculture for Scotland amounted to £452,000. The bulk of this expenditure took the form of grants for the purposes mentioned above and involved in most cases considerable additional expenditure on the part of local authorities and others.

A factor which has vitally affected both agriculture itself and the policy of the State has been the change in the price of agricultural produce since the War. During the War, prices naturally rose very considerably, and the rise continued till towards the end of 1920. In the middle of 1921 a severe and continuous slump set in, with the result that the prices of agricultural produce generally, which were 202% above pre-War prices in Sept. 1920, fell to 57% above in Sept. 1922, and with some fluctuations remained more or less at this level for the next three years, the figure for Nov. 1925 being 53%. The sudden fall in prices resulted in severe capital losses, and made agriculture, at any rate for a time, a very precarious undertaking (*see* AGRICULTURE).

In this connection, reference may also be made to another factor connected with the change in the value of money. The prevailing system of tenure in Great Britain is that of landlord and tenant, whereby the land and buildings are provided and maintained by the landlord at a rent which is generally admitted to give only a very small return by way of interest on the capital represented. The much higher rate of interest obtainable during the post-War period on first class securities led to extensive sales of estates, and is said to be resulting in a gradual change in the older system in the direction of a greater tendency towards occupying ownership. Such statistics as are available suggest that the percentage of land occupied and farmed by the owner increased from about 15% in 1920 to 25% in 1924.

Changes in Cultivation.—The changes in cultivation in Great Britain in the 14 years 1911 to 1925 reflect the policy of the period. Up to 1916 there was little development; in 1917 the pressure for increased food production began to make itself felt and reached its maximum intensity in the following year. With the close of the War the impetus was lost, and the proportion of land under the plough gradually decreased and fell below the pre-War level. The following figures, in thousands of acres, show the changes in Great Britain from 1911 to 1925:—

Acreage under Crops and Grass (000's omitted)

	Corn Crops	Arable Land	Permanent Grass	Total Acreage under Crops and Grass
1911	7,041	14,648	17,447	32,095
1917	7,308	14,606	17,251	31,858
1918	8,974	15,852	15,896	31,749
1925	6,321	13,912	16,549	30,461

The decline in the total acreage under crops and grass is to some extent compensated by an increase in mountain and heath land and rough grazings not included under that heading. The area under wheat (included in the above table under corn crops) which was 1,906,000 in 1911, reached a maximum of 2,636,000 ac. in 1918, and declined to 1,547,000 ac. in 1925. In regard to livestock, a very striking feature was the way in which on the whole the flocks and herds were maintained during the War, notwithstanding the shortage of feeding-stuffs. From 1916 to 1920, however, there was a quite noticeable decline in the number of sheep, part of which has since been recovered. As compared with pre-War years cattle are somewhat more numerous, while the pig population, always a fluctuating factor, reached a maximum in 1924. As a broad indication of the magnitude of the industry it may be mentioned that the total value of the "output" of agricultural land in Great Britain represented by the produce sold off farms for consumption elsewhere was estimated in 1923 at £259,000,000.

Agricultural Policy in 1926.—In Feb. 1926 the Government issued a considered statement on agricultural policy, which declared that the Government was not prepared to recommend subsidies for the increase of corn growing or arable cultivation and that it was definitely opposed to compulsory control of cultivation. "The right course in the best interests of the industry itself and of the nation as a whole is to proceed on the lines of education and encouragement rather than of coercion, to endeavour to create that confidence which is essential for progress, to stimulate the private enterprise of those engaged in the industry, and to assist them to organise themselves on an economic basis." It then went on to indicate the lines on which the Government would proceed, such as the development of agricultural credit, small holdings, afforestation, land drainage, marketing of agricultural produce, housing in rural areas, protection against disease and the development of sugar beet cultivation.

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(R. J. T.)

VIII. COMMUNICATIONS AND TRANSPORT

At the outbreak of the War the Government took complete control of the railways under an agreement whereby the companies were guaranteed their pre-War revenues. The fact that the War lasted for more than four years, and involved a far-reaching rearrangement and redistribution of the trade and traffic of the country, made the strict terms of the agreement practically inapplicable. A huge sum of money was required to put the companies back into their pre-War condition of repair and efficiency. Rolling stock had been removed to other countries, stations closed, permanent way and other plant allowed to fall into comparative disrepair, staff seriously depleted, and the arrangements for the routing of traffic widely altered. The costs of operation had also risen enormously.

The Ministry of Transport.—The Government, foreseeing the difficulties which would arise if control were suddenly removed, passed in 1919 the Ministry of Transport Act, which gave the Minister powers to control the operation of all existing means of internal transport. One provision in the Act has proved of permanent importance. This was section 21, which provided for the setting up of the Rates Advisory Committee composed of five members: one person of legal experience (to be chairman), two representatives of trading and agricultural interests, one representative of transport interests, and one representative of labour. It was laid down that before directing any revision of charges, etc., the Minister should consult this committee.

The Act was immediately followed by a reference from the Minister to the committee to report upon an interim revision of railway rates for merchandise and minerals. The committee reported in favour of a general increase varying according to class from 25 to 60%, with flat rate additions, and increased charges for collection and delivery. This was brought into operation on Jan. 15 1920. On May 11 the Minister announced his determination to undertake to complete revision of railway charges and invited the committee to report on the general principles which should govern the revision, including the classification of merchandise traffic. Meanwhile he directed the increase of rates up to 100% above pre-War as from Sept. 1 1920.

As a result of the committee's general report, there was finally passed the Railways Act 1921, which had the effect of entirely reorganising the railway system of the country. The Act's most important provisions may be summarised as follows:—

1. The railways of Great Britain were amalgamated into four large groups, the Southern, the Great Western, the London, Midland and Scottish and the London and North Eastern.
2. A new tribunal called the "Railway Rates Tribunal" was set up to which almost all the powers of the Railway and Canal Commission and many new powers were entrusted, its most important function being the settlement of the schedules and charges of the amalgamated companies. The tribunal consists of one person of legal experience, who is chairman, one person of railway experience and one of commercial experience, and is obviously the successor of the Rates Advisory Committee.

The first of these provisions was intended to facilitate working economies by eliminating costly competition, and the second to provide a cheap and business-like tribunal for exercising the necessary control over the new system

Charges and Wages.—The Act laid down an entirely novel principle in regard to the basis of charge. Section 58 provides that the charges be fixed on a basis estimated to yield an annual net revenue ("the standard revenue") equivalent to the aggregate net revenues in the year 1913 of the various companies absorbed by the amalgamated company together with allowances for interest on capital expended or raised since Jan. 1 1913, or capital which had not at that date become fully remunerative. Section 59 provides for periodical revisions of the charges and also lays down that if on any such review the tribunal finds that the net revenue of the company is substantially in excess of the standard revenue, such excess shall be divided between the public and the railway companies, 80 % being allocated to reduction of charges and 20 % being retained by the company as profits. This increased standard (the old standard plus 20 % of the excess) is then to become the standard revenue of the company.

The tribunal was also given power to revise the classification of goods, and some control was vested in it of exceptional rates. There is no doubt that the framers of the Bill intended, by extending the number of classes and instituting a strict revision of exceptional rates, to reduce the complexity of the rate books, which were said to include more than 80,000,000 exceptional rates, many of them obsolete. The powers which the Bill proposed to vest in the tribunal for this purpose were however strenuously opposed by both traders and railway companies, and, although the tribunal has increased the number of classes from 8 to 21, it is improbable that the new provisions will succeed in substantially reducing the number of effective exceptional rates. In regard to wages and provisions of service, the Act provides that all disputes in regard to these shall be referred to two bodies, the Central Wages Board and the National Wages Board, the latter acting as a court of appeal from the former. Both these bodies are in the nature of conciliation committees including representatives of the companies and their employees; the National Wages Board also includes representatives of railway users.

Between the passing of the Act and the end of 1925, the Railway Rates Tribunal was more or less continually involved in the carrying out of the reorganisation of the railway system entrusted to it by the Act. The ascertainment of the standard revenue proved a very great difficulty, and might indeed have proved impossible but fo the formation of a committee known as the traders' co-ordinatin committee, representative of all trades substantially interested i railway traffic, and of such great organisations as the Federation British Industries, the Association of British Chambers of Commerce etc. This committee has been legally represented before the Tribuna and has been able to negotiate settlements with the railway companies. It appears likely that the almost insuperable difficulties involved in the application of the Act will be surmounted in this way Reverting to the question of charges, these have been reduced b successive concessions in 1922 and 1923, till at the beginning of 192 they were 50 % above pre-War, with certain flat rate additions, som of the heavy traffic standing at 40 %.

In July 1914 the railway trades unions were preparing a claim fo improvement of conditions and increase of wages, to be presented i Nov. 1914, when an existing agreement was due to run out. On th outbreak of War it was agreed between the unions and the companies that the existing agreement should continue, but should b terminable by six weeks' notice on either side. The government during the War granted various increases of wages, and in Nov. 191 the unions gave notice to terminate the agreement. There followe a prolonged negotiation in which the unions, the companies and th government were all involved, and on Sept. 26 1919 500,000 railwa workers came out on strike. Work and negotiations were resume on Oct. 5, and an agreement reached on March 20 1920. Under thi rates were divided into two classes, "A" rates and "B" rates. Th "A" rates represented the pre-War rates plus certain flat rate additions. These latter were to be subject to adjustment according t the cost of living. The "B" rates represented practically the pre-Wa wages plus 100 %, and it was agreed that, whatever the change i the cost of living, wages should not fall below this level. In 192 the railway unions put forward claims for a general increase o wages, and the companies counter-claimed for a general reduction The National Wages Board rejected both claims, but provided tha new entrants into the railway service should no longer be entitled t the benefit of the "A" rates. The Board also stated that they di not regard the "B" rates as an "irreducible minimum."

The Removal of Control.—The position of the companies afte the removal of Government control in 1921 was an unfavourabl one. The economies promised through amalgamation were slo in materialising, and the trade depression resulted in a declin of traffic which was only temporarily alleviated by the grea increase in the iron and steel and coal traffic caused by the French occupation of the Ruhr. At the same time the rapid increase o road transport has diverted from the rail a considerable an increasing volume of the high grade traffics which were the mos lucrative to the railways, whose position has been further complicated by the great increase in working costs. Expenditur in 1924 exceeded that of 1913 by £96,000,000 or 117 %, wherea to meet this additional burden receipts had only increased by £88,000,000 or 70 %. Coal was 142 % higher than in 1911 and 89 % over 1913; other materials were 67·9 % and wages 153 % above 1913. There was an increase in staff due to the operation of the eight hours' day, the staff in the four amalgamated companies having increased by 76,000 or 13 %.

The companies' financial position was, however, relieved by the fact that in 1922 the Government, in order to clear up claims for compensation under the control scheme, handed over to them sums amounting in all to £62,000,000, making over £100,000,000 so distributed since the beginning of control. The companies were able in the years 1923 and 1924 to maintain their dividends by drawing money (over £5,000,000 in 1924–5) from their reserve funds, which had been enormously augmented by these grants. It should be mentioned that the companies have made efforts to secure legislation enabling them to carry by road, but hitherto without success. Meanwhile, they are no doubt endeavouring to effect economies in their operating expenditure. Electrification schemes are being put in hand, notably by the Southern Company. The L.&N.E.R. and the G.W.R. have taken steps to increase the size of the mineral trucks on their systems, the ideal apparently being a 20 ton standard; and passenger services are being co-ordinated, etc. Attempts are also being made to obtain relief from the burden of local rates.

Canals.—During the War the Government took over the great bulk of the canals, the object being to relieve the railways as far as possible of traffic which could equally well go by water. The arrangements for compensation were similar to those made with the railway companies. The great value of the canals during the War caused a revival of interest in their potentialities, especially as the railway system was very congested during the early post-War period. The government instituted inquiries into the possibility of reviving the canals which had largely fallen into disuse prior to the War, but no government felt justified in undertaking the somewhat ambitious schemes of reorganisation which have been recommended at various times. Local schemes, have, however, been under consideration in various districts, and with government and municipal assistance important improvements are being made on the waterways between Nottingham and the Humber. It is possible that further developments may be undertaken, notably between Birmingham and the Mersey, and Birmingham and the Severn.

Roads.—The development of road transport during the first decade of the 20th century directed attention to the condition of the roads in the country, and as a result the Development and Road Improvement Funds Act was passed in 1909. Under this Act a Road Board was constituted with powers:—

(*a*) To make advances to county councils and other highway authorities in respect of the construction of new roads or the improvement of existing roads;

(*b*) To construct and maintain any new roads.

The income of the Road Improvement Fund was to be derived from motor spirit and carriage licence duties. During the World War the income was absorbed into the general revenue of the country and road development was arrested. By an order in council dated Sept. 22 1919 the powers and duties of the Road Board were transferred to the Ministry of Transport. In 1919–20 a special fund of £10,536,000 was set aside for the road and bridge programme, and arterial road construction actively proceeded with, particularly in the London area. Under the Finance Act 1920 a new system of taxation, registration and licensing of mechanically propelled vehicles was introduced and came into force on Jan. 1 1921. Special schemes were put in hand for the relief of unemployment, for which £4,000,000 was provided from the Road Fund in 1920–1. The income of the Road Fund in 1922–3, derived from motor spirit duties, carriage licenses, Exchequer grants and motor taxation, was £12,802,754: these receipts had increased in 1924–5 to £15,234,225. During the period 1919–25 arterial roads were constructed in the London area, Scotland, etc.; the total length of new construction was 169 miles, and 48 miles of existing roads were widened. On March 31 1925 the total commitments of the Road Fund amounted to £36,087,000. Expenditure by local authorities on the maintenance, improvement, etc., of roads increased from £18,903,840 in 1913–4 to £28,413,674 in 1919–20 and to £45,431,036 in 1921–2. The great increase during the post-War period was due partly to the practical cessation of work during the war period and partly to local unemployment relief schemes. After 1921–2 expenditure by local authorities was considerably reduced.

Postal Service.—Telephone tariffs varied widely in different areas in 1910, but by 1921 a system of uniform charges had been instituted as far as possible. The National Telephone Company's system was transferred to the Post Office on Jan. 1 1912. The number of exchanges increased from 1,566 in 1910 to 3,971 on Dec. 31 1925, and the number of telephone stations from 619,399 in 1910 to 1,357,908 on Dec. 31 1925. The acceptance of telegrams from subscribers by telephone, and delivery to them by the same means increased greatly between 1910 and 1925. Rates for inland telegrams on Sept. 1 1920 were double those of 1910.

The following table shows the more important alterations in postage rates between 1910 and 1925:—

Changes in Postal Rates

	1910	June 1918	June 1920	June 1921	May 1922
Initial letter rate (inland and imperial) .	1d.	1½d.	2d.	2d.	1½d.
Initial letter rate (foreign)	2½d.	2½d.	2½d.	3d.	2½d. (May 1923)
Postcard rate (inland)	½d.	1d.	1d.	1½d.	1d.
Initial printed paper rate	½d.	½d.	½d.	1d.	½d.
Inland parcel rate (up to 2 lb.) . . .	4d.	6d.	9d.	9d.	6d. (May 1923)
Inland parcel rate (up to 11 lb.) . . .	11d.	1s.	1s. 6d.	1s. 6d.	1s. 3d. (May 1923)

Air Mails.—The post-War period was marked by the development of commercial aviation. The Post Office inaugurated air mail and parcel services between London and the Continent. Mails are accepted by the air mail for Belgium, France, Morocco, Algeria, Germany, Denmark, Norway, Sweden, etc.; air services established in Continental countries are used to supplement this service. The total weight of letter mail despatched by air in 1925 was 15,520 pounds. The air parcel service carried during that year 50,000 lb. of parcel air mails to Paris, Holland and Germany including the Rhine Army.

Wireless and Cables.—Wireless services considerably increased between 1910 and 1926. A new wireless station was built at Hillmorton, near Rugby, and was opened for service from Jan. 30 1926. This station was able to send messages which could be picked up by ships at sea and by every efficient receiving station in the world. In 1925 the British Govt. owned and worked two cables between Great Britain and Halifax, Nova Scotia. One, in German ownership before the War, is worked directly between London and Halifax. The other, purchased from the Direct United States Co., and taken over by the British Post Office in 1922, is worked from London to Newfoundland and Halifax. The two cables are called the imperial cables.

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GREAT LAKES AND ST. LAWRENCE (*see* 12.399 and 24.21).—The Great Lakes and the St. Lawrence form one of the greatest and most important transportation routes in the world, rivalling in tonnage and economy of operation any other existing water transportation route. To July 1 1924 the United States Federal Govt. had expended about $150,000,000 for improvements in the Great Lakes-St. Lawrence system, exclusive of expenditures by Canada, by States or Provinces and by municipalities.

Traffic.—During the 30 years 1895–1925 over 1,500 million tons of freight moved through the locks at Sault Ste. Marie alone. The 72,000,000 tons which passed through these locks in 1924 included 13,500,000 tons of flour and grain and 42,500,000 of ore, moving east, and 13,500,000 tons of coal moving west. Except for the construction of several experimental Diesel engine-driven vessels, no great developments were made in the type of the large bulk freighter in the 15-year period ending in 1925. The highly specialised freight-handling equipment at the terminals, which has in large measure accounted for the economic system of transfer, has developed only in size during the same period. The record for handling cargo between shore and ship is 16½ min. for loading 12,508 gross tons of ore and 3 hr. 5 min. for unloading.

During the 20 years 1905–25 a considerable tonnage in limestone and sulphur grew up. The stone, used as a flux in ore furnaces, is transported on self-unloading vessels between harbours on Lake Huron and the great iron and steel centres in the vicinity of Lakes Michigan and Erie. Sulphur is carried by water from the wells in Texas and Louisiana to New York, and thence in barges through the New York State barge canal to Buffalo, Cleveland and other points on the Great Lakes. Package freight on the Great Lakes has not kept pace with bulk freight, though still amounting to over 1,000,000 tons. Over 90% of the commerce has been confined to the upper lakes, a small portion only passing into Lake Ontario and the St. Lawrence. Traffic on the upper lakes has increased to such an extent that the locks at Sault Ste. Marie in existence in 1910 (two American and one Canadian) were not sufficient to cope with the traffic, and two new locks (numbered 3 and 4) were constructed on the American side and put in operation in 1918. Each of the new locks is 1,350 ft. long and 80 ft. wide, with 24½ ft. of water over the sill. The old Weitzel lock has not been in operation since 1918.

Harbours.—Originally the mouths of rivers were used as harbours on the lakes. It was necessary to dig out the bars which usually formed at the lake entrance, and later piers were constructed at river mouths which contracted the area of flow and tended to keep the channels scoured out. Still later, breakwaters were built in the lakes to protect pier entrances from wave action. As conditions became more congested in the rivers, the breakwaters were extended to form large outer harbours. These structures were originally stone-filled timber cribs, the tops of which, after the timber decayed, were replaced by concrete or stone. The more recently constructed breakwaters are formed of a line of concrete caissons sunk side by side, or of a long rubble mound composed of stones varying from half a ton to 10 and 12 tons in weight, more or less carefully placed. Some of these outer harbours are as much as four and five m. long and afford ample protection to the largest lake vessels.

Maintenance dredging must be carried on at all times in most of the harbours of the Great Lakes. About 65 harbours on the upper lakes (excluding Lake Ontario) have an authorised project depth of 19 ft. or more at low water; about 65 others on the Great Lakes-St. Lawrence system have been improved so as to be available for smaller vessels.

Connecting Waterways.—The critical points in the navigation of the lakes are the connecting waterways. These, like the harbours, require continuous dredging to preserve project depths and to remove obstructions. The Lake Carriers' Association, a federation including nearly all the owners of freight-carriers on the lakes, have formed an efficient system of communication and supervision which permits them to take advantage of water conditions and load their vessels to the greatest possible depth. The deepening and widening of the connecting channels authorized some years ago have practically been completed; and at many of the most critical points, such as the Neebish channels below Sault Ste. Marie and the channels between Lakes Huron and Erie, separate upbound and downbound passageways are maintained. On the upper lakes the minimum width of channels used for two-way traffic is 500 ft., whereas 293 ft. is the least width of channel now used for one-way traffic. The controlling depth of water between Lakes Erie and Superior is still 20 ft. at low-water datum. A dike on which sluice gates are installed has been constructed across St. Mary's river near Sault Ste. Marie. The gates are operated under the supervision of an international board of control in order to maintain water-levels in Lake Superior and to compensate for diversions on both the Canadian and the American sides at Sault Ste. Marie for power purposes.

The question of diversion of water from Lake Michigan into the Chicago drainage canal for the purpose of sewage disposal has not been settled. The Supreme Court of the United States decided against Chicago in a suit instituted to enjoin the Chicago sanitary district against withdrawing water. However, in order to permit the Chicago Sanitary Commission to prepare plans and construct works necessary to take the place of the prevailing system of sewage disposal, temporary authority to divert 8,500 cu. ft. of water per sec. from Lake Michigan was granted by the United States War Department for a period of five years under certain conditions, which, when carried out, will permit the reduction and perhaps the eventual discontinuance of the diversion for sewage purposes. The question is of importance because of enormous losses claimed by shipping interests on account of lower water levels. It has been stated by government engineers that the diversion of 8,800 ft. from Lake Michigan affects the level of Lake Erie from ·38 to ·43 ft.; of Lakes Michigan and Huron from ·42 to ·44 ft.; and of the St. Lawrence river at lock No. 25 from ·6 to ·65 of a foot.

Erie-Ontario Routes.—Two navigable routes (1926) connect Lake Erie with Lake Ontario. The Erie branch of the New York State barge canal system, completed in 1918, connects Lake Erie and the Niagara river through the Oswego branch of the barge canal with Lake Ontario at Oswego. The barge canal route continues through the State of New York and connects with the Hudson river at Troy, forming a complete waterway available for vessels of less than 12-ft. draft and requiring not more than 15½ ft. of head room. A new Welland canal between Lake Erie and Lake Ontario is being constructed to replace the existing one. It is estimated the work will be completed in 1930. Seven lift locks will replace the 25 locks in the present canal, and the distance between the two lakes will be shortened to 25 miles. The new canal is being excavated to a depth of from 25 to 26½ ft. below Canadian low-water level. The new locks will be 820 ft. long by 80 ft. wide, and, in order to provide for possible future deepening of the canal, will be constructed so as to accommodate vessels drawing 30 ft. of water. The estimated cost of the completed structure is $110,000,000.

The question of improvement of the St. Lawrence river from Lake Ontario to tidewater in the interest of navigation and power development is being seriously considered by joint action of the United States and Canada. The St. Lawrence river affords opportunity for the development of over 4,000,000 H.P. of hydroelectric energy. On account of the many interests involved on both sides of the border, it had been difficult to effect an agreement on the question of the St. Lawrence improvement.

By treaty stipulation the amount of water that may be d verted from the Niagara river for power purposes has been lim ited to 36,000 cu. ft. per sec. on the Canadian side and 20,000 cu ft. per sec. on the United States side. Of the Canadian diversio all but about 10,000 cu. ft. per sec. is used by the Hydroelectri Power Commission of Ontario, in three plants, the largest which, near Queenstown, has a head of over 300 ft. and develop about 500,000 H.P. from the nine turbo-generators installe Of the American diversion practically all the water is utilise by one concern with an installation of over 500,000 horsepowe

Boundary Water Treaty.—In 1909 the United States and Grea Britain signed a treaty known as the " Boundary Water Treaty," whereby the waters between the United States and Canada wer guaranteed free and open to the inhabitants of both countri on equal terms, and principles governing the use of boundar waters were laid down. An international joint commission, cor sisting of three members from Canada and three members fro the United States, was established.

TABLE I.

Lakes	Area of Water Surface	Maximum Recorded Depth	Mean Elevation Approved Low-Water Datum	Ordinary Fluctuations, Water Surface	Average Date of Opening of Navigation	Average Date of Closing of Navigation
	Sq. Miles	Feet	Feet	Feet		
Superior	31,810	1,180	601·6	2·5	April 23	Dec. 9
Michigan	22,400	870	579·6	2·8	April 12	Dec. 15
Huron	23,010	750	579·6	2·6	April 6	Dec. 17
St. Clair	460	26	573·8	. .	March 30	Dec. 18
Erie	9,940	210	570·8	3·0	March 29	Dec. 17
Ontario	7,540	738	244·5	3·3	April 5	Dec. 18

TABLE II.

Rivers	Length	Least Width	Greatest Width	Limiting Depth at Low Water	Current in Navigated Portions	Discharge at Mean Stage
	Miles	Feet	Feet	Feet	Miles per Hour	Cubic Foot-Seconds
St. Marys	63	300	24,000	21	1–3½	(1)
Strait of Mackinac	30	10,900	100,000	110	. .	47,000
St. Clair	40	800	5,100	20	1–5	203,000
Detroit	31	1,900	19,000	22	1–6	208,000
Upper Niagara	20	1,500	8,000	10–23	1–7	207,000
Lower Niagara	15	210	2,600	30	1–2½	207,000
St. Lawrence to Montreal	179	1,200	40,000	14	1–6	240,000

[1] In its original condition the mean stage discharge of the S Marys river was about 78,000 cu. foot-seconds. The flow of th river is now entirely controlled by regulating works.

TABLE III.

Commerce (in short tons) on the Great Lakes

Year	Total U.S. Commerce on Great Lakes (Adjusted)	Canals at Sault Ste. Marie (Reported)	Detroit River (Estimated)	Welland Canal (Reported)	St. Lawrence Canals (Reported)	N.Y. State Barge Canal (Reported)
1910	92,044,843	62,363,218	73,526,602	2,326,390	2,760,752	3,073,41
1920	111,139,686	79,282,496	80,410,082	2,276,072	3,067,962	1,421,43
1921	71,460,170	48,259,254	63,973,308	3,076,422	3,734,065	1,457,80
1922	94,038,090	66,067,258	68,497,062	3,391,419	4,319,919	2,260,76
1923	125,517,551	91,379,658	92,170,460	3,755,912	4,541,528	2,572,63
1924	109,831,279	72,037,390	80,073,850	5,037,412	5,536,374	2,658,67

[1] Old canal system partly closed down between 1910 and 1918 du ing construction of a new 12-ft. canal.

[2] Includes 566,351 and 626,357 tons for 1923 and 1924 respe tively of local terminal traffic that did not pass through the canal

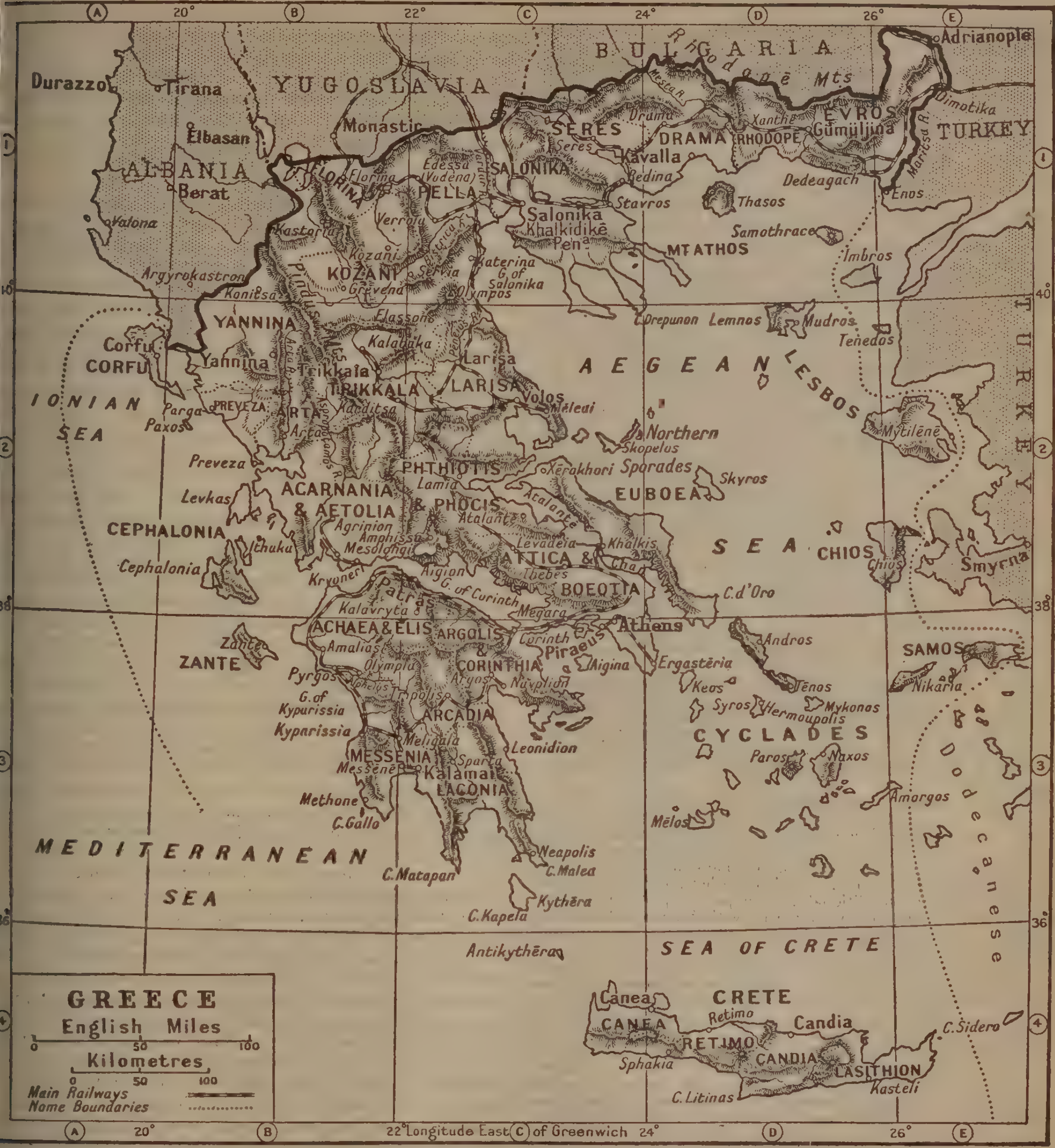
(H. T.*)

RECO-TURKISH WAR: *see* BALKAN WARS.

REECE (*see* 12.425), a republic of southern Europe and a mem- of the League of Nations. Its area is 49,200 square miles. area of Old Greece in 1912 was 24,400 square miles. The Bal- Wars of 1912–3 resulted in the addition of New Greece, con- ting of Macedonia, Epirus, Crete and a number of islands in the gean, with an area of about 21,600 sq. m., making the total a of the country about 46,000 sq. m. in 1914. After the World ar, Greece occupied Thrace and a part of the vilayet of Aidin Asia Minor, and these occupations were confirmed by the aties of Neuilly and Sèvres. But, as the result of the Asia nor campaign, Greece in 1922 evacuated Asia Minor and stern Thrace in favour of Turkey, and by the Treaty of Lau- ne in 1923 she also retroceded Imbros and Tenedos. The a of Greece after these various changes, is now about 49,200 uare miles.

A census taken in 1920 gave the total population of Old and New Greece as 5,536,375, including Thrace. An estimate which allows, on the one hand, for the subsequent loss of territory and for the transfer of the Moslem inhabitants of Greece to Turkey, and, on the other hand, for the influx of some 1,400,000 refugees from Turkey after the war in Asia Minor, would place the population in 1925 in the neighbourhood of 6,200,000.

The various racial migrations which have been brought about by the wars from 1912 onwards, whether voluntary or compulsory, involving the transfers, in either direction, of nearly 2,500,000 Greeks, Bulgarians and Turks, have had the result of introducing homogeneity in the regions affected, where before there was great diversity. Thus the proportion of Greeks in the population of Macedonia and Western Thrace, which stood at 43 and 36% respectively before the Balkan Wars, is, in 1925, 88 and 62%. (L. G. R.)


GREECE
English Miles
0 50 100
Kilometres
0 50 100
Main Railways
Nome Boundaries
20° 22° 24° 26°
22° Longitude East of Greenwich 24°
40° 38° 36°
BULGARIA
Rhodopê Mts
YUGOSLAVIA
ALBANIA
TURKEY
Durazzo
Tirana
Elbasan
Berat
Valona
Argyrokastron
Adrianople
Dimotika
Maritsa R.
EVROS
Xanthe
Gumuljina
RHODOPE
Dedeagach
Enos
Monastir
SERES
Seres
Drama
DRAMA
Kavalla
Pedina
Stavros
Thasos
Samothrace
Imbros
Florina
Edessa (Vodena)
SALONIKA
PELLA
Verroia
Salonika
Khalkidikê
Pena
MT ATHOS
Kastoria
Kozani
KOZANI
Servia
Grevena
Katerina
G. of Salonika
Olympos
Konitsa
YANNINA
Yannina
Elasson
Kalabaka
Larisa
LARISA
Trikkala
TRIKKALA
Volos
Corfu
CORFU
Parga
PREVEZA
ARTA
Arta
Karditsa
Preveza
Paxos
IONIAN SEA
Drepanon
Lemnos
Mudros
Tenedos
AEGEAN SEA
LESBOS
Mytilênê
Northern Sporades
Skopelos
Skyros
PHTHIOTIS & PHOCIS
Lamia
Xerakhori
Atalante
Atalanta
EUBOEA
Levkas
ACARNANIA & AETOLIA
Agrinion
Amphissa
Mesolonghi
Ithaka
CEPHALONIA
Cephalonia
Levadeia
Khalkis
ATTICA & BOEOTIA
Thebes
CHIOS
Chios
Smyrna
Kryoneri
Aigion
Patras
G. of Corinth
Megara
C. d'Oro
Kalavryta
ACHAEA & ELIS
ARGOLIS
Corinth
CORINTHIA
Piraeus
Athens
Aigina
Ergastêria
Andros
Zante
ZANTE
Amalias
Olympia
Pyrgos
G. of Kypurissia
Kyparissia
Argos
Nauplion
Tripolis
ARCADIA
Keos
Tenos
Syros
Hermoupolis
Mykonos
CYCLADES
Paros
Naxos
SAMOS
Nikaria
Megalopolis
Meligala
MESSENIA
Messênê
Sparta
Kalamai
LACONIA
Leonidion
Methone
C. Gallo
Amorgos
Melos
MEDITERRANEAN SEA
C. Matapan
Neapolis
C. Malea
Kythêra
C. Kapela
Antikythêra
Dodecanese
SEA OF CRETE
Canea
CANEA
CRETE
Retimo
RETIMO
Candia
CANDIA
LASITHION
Kasteli
C. Sidero
Sphakia
C. Litinas
A B C D E
1 2 3 4

I. POLITICAL HISTORY

In Jan. 1910 the Military League had summoned Veniselos from Crete as their political adviser, and he had arranged for the election of a National Assembly. But the obstruction of the party leaders soon obliged him to take the premiership himself and to appeal once more to the electorate. When the second revisionary National Assembly met on Jan. 22 1911, he took office at the head of an overwhelming majority. During the following 18 months the constitution was revised, internal administration was thoroughly overhauled, army and navy were remodelled and trained under French and British missions, and the Macedonian feud was forgotten.

The Balkan Wars.—A treaty was signed with Bulgaria (May 1912) who had already signed a treaty with Serbia for the partition of Macedonia, and in Oct., the first Balkan War broke out. Montenegro declared war on Turkey, Oct. 8; Turkey declared war on Bulgaria and Serbia, Oct. 17, but offered Greece the island of Crete and other concessions to remain neutral. Veniselos however realised the supreme importance of including Greece in the new grouping. The long-excluded Cretan deputies were admitted to the Greek Chamber and Greece declared war on Turkey on Oct. 18 1912.

The Balkan allies gained rapid success. The Greek Army cleared Macedonia and occupied Salonika (Nov. 9); the fleet blockaded the Dardanelles. Greece refused to sign the armistice obtained from the other allies (Dec. 3) but joined the conference which met a fortnight later in London. The allies demanded from Turkey the surrender of all the territory their armies actually held in Europe together with the fortresses invested. The seizure of power by the " Young Turkish " party at Constantinople prevented the acceptance of these terms, and hostilities were re-opened on Feb. 3 1913. But after Adrianople had surrendered to Bulgarians and Serbs, Scutari to the Montenegrins, and Janina to the Greeks under Prince Constantine—who 12 days later (March 18) became King on the assassination of his father George I. at Salonika—Turkey by the Treaty of London (May 30) signed away collectively to the Balkan allies all her territory in Europe west of a line drawn from Midia on the Black Sea to Enos on the Aegean Sea, leaving the Powers to settle the problems of Albania and the Aegean Islands.

Second Balkan War.—The erection of an independent Kingdom of Albania, by excluding Serbia from the Adriatic, rendered inevitable a quarrel between the allies. Greece, alarmed at the menacing attitude of Bulgaria, had in June signed a defensive alliance with Serbia, and when Bulgaria attacked without warning (June 30) she was heavily defeated, and after the intervention of Rumania was compelled to sign the Treaty of Bucharest (Aug. 10 1913) which excluded her from the Aegean port of Kavalla and carried the frontier of Greek Macedonia eastwards to the river Mesta and northwards to Doiran and Florina. The course of events had thus compelled Veniselos to substitute a policy of balance of power for that of a Balkan League.

The Aegean Islands.—The Powers assigned to Greece (Conference of London, Feb. 1914) all the islands of the Aegean actually occupied by the Greek fleet during the war, with the exception of Tenedos and Imbros and of the islands of the Dodecanese which Italy had occupied in 1912 as security for the Turkish fulfilment of the Treaty of Lausanne (Oct. 18 1912) pledging her good faith that her occupation should be conditional and temporary. After the World War, Veniselos negotiated an agreement with Signor Tittoni (July 29 1919) by which all these islands were to revert to Greece unconditionally, the cession of Rhodes alone being made contingent on a plebiscite to be held within five years of England's cession of Cyprus. This agreement was recognised by the Supreme Council, the time limit within which the plebiscite was to be held being extended to 15 years, on the signature of the Treaty of Sèvres (Aug. 10 1920) in accordance with which Tenedos, Imbros and Lemnos, which had been occupied during the War by the British fleet, were handed over to the Greek authorities on June 25 1921. The Tittoni agreement was repudiated by Italy, who remained in occupation of the Dodecanese, after the fall of Veniselos and the non-ratification of the Treaty of Sèvres. Turkey closed the Balkan war with Greece by a provisional agreement (Treaty of Athens, Nov. 13 1913) but refused to accept the decision of the Powers of Feb. 1914; consequently the *de jure* possession of the islands remained in suspense until the Treaty of Lausanne (July 24 1923) whereby Turkey renounced in favour of Italy all rights over the Dodecanese, and recognised Greek sovereignty over the remaining islands as conferred by the Conference of London, subject to certain provisions for their demilitarisation, and with the exception of Imbros and Tenedos, which were retroceded to Turkey on condition that they should enjoy full local autonomy.

The World War.—Greece definitely annexed Crete and thus emerged from the Balkan Wars with a very large acquisition of territory in Epirus, Macedonia, Crete and the Aegean Islands, with a total population of over 1,800,000, or almost as much as that of " Old Greece." Turkey's refusal to recognise the ru
of the London Conference was accompanied by a boycot
Greek shipping and an organised persecution of the Greek
Asia Minor. But her evident intention of re-opening hostil
with Greece was anticipated by the outbreak of the World
The attitude of the Greek Govt. as stated by Veniselos was n
in doubt. Not only did her interests and tradition bind he
support Great Britain and France; she was bound to Serbia
her defensive alliance, the purpose of which would best be se
if Greece stood by to prevent Bulgaria from making any ho
move and to guard Serbian communications with the Aeg
King Constantine on the other hand naturally inclined to
many for family reasons, and believed in her victory; bu
never found the courage to declare openly his intention to re
neutral, preferring to temporise.

In Feb. 1915, when England definitely required Greek
for attacking the Dardanelles, the proposals of Veniselos
specific Greek forces to co-operate with the British fleet
unanimously approved by his own majority in the Cham
and by a Crown Council of all the political leaders in the k
dom. King Constantine however dismissed Veniselos and
solved the Chamber (April 10 1915). The new premier Goun
co-operated with the German propaganda in Athens to repre
Veniselos as inspired only by love of war and hatred of the K
King Constantine was thus brought into party politics as a
sonal opponent of Veniselos and leader of the " pro-Germa
policy of neutrality. In mid-June the electors nevertheless
turned the Liberal (Veniselist) party with a majority. But
Veniselos, after a delay excused by the King's illness, at
returned to office (Aug. 22), his efforts to immobilise Bulg
by threatening Greek action were useless, because Germany
already been secretly informed that Greek neutrality woul
guaranteed by King Constantine even in the event of a
garian attack on Serbia. Bulgaria mobilised on Sept. 19 1
and King Constantine allowed his Prime Minister to ord
counter-mobilisation, and even to suggest to England and Fr
that they might reinforce the Greco-Serbian co-operation
some of their own troops, a suggestion which led to the A
landing at Salonika. But as soon as Veniselos, on the eve of
Bulgarian attack, explained once more his well-known polic
defending Serbia and received a vote of confidence, he
abruptly dismissed, and M. Zaimes was put up (Oct. 5) to exp
that the Greco-Serbian Treaty had " a purely Balkan cha
ter." The Chamber was again dissolved and elections hel
December. The Liberals abstained from the polls, as a pro
against this second and unconstitutional dissolution, and a
ernment was formed under M. Skouloudes (Nov. 6), who decl
" very benevolent neutrality " towards the Entente.

From this time forward the King began not only to expect
eagerly to desire a German victory. The violence of his parti
was aggravated when the " Three Protecting Powers," Brit
France and Russia, demanded certain administrative cha
which might prevent any connivance between the Govt.
the German espionage (June 21 1916). The Greek Army, w
owing to the known sentiments of its general staff threate
or at least inconvenienced, the Allied base at Salonika, wa
last demobilised; whereupon the Bulgarians invaded Maced
and seized Kavalla. Meanwhile King Constantine would f
time to time change his Premier (Zaimes, June 23; Kalog
poulos, Sept. 16; Lambros, Oct. 9; Zaimes, May 3 1917) and
the French or British minister to suggest terms on which it m
suit him to abandon his " neutrality." When in Aug. Ruma
joined the Allies and the King still refused to move, Venis
seceded to Salonika (Sept. 25 1916) with Gen. Dankles and A
Condouriotes, set up a Provisional Government and out of
the kingdom which declared its allegiance to the Triumvi
began to organise a state militant. The Allies refused t
official recognition to the Salonika Govt., although Venis
troops were already fighting for them. At Athens the Fre
admiral suggested that King Constantine might surrender s
of his war material. The King was understood to consent;
when French and British marines landed to take delivery t

re shot down by Greek troops from prepared positions (Dec.
916).

The Allies now broke off relations with the King, but, owing
the hesitations of Russia and Italy, did not demand his abdi-
ion till June 1917. He retired to Switzerland (June 12) and
second son Alexander was put on the throne. Veniselos
urned to Athens as Prime Minister of a nominally united
eece (June 26), recalled the Chamber which had been uncon-
utionally dissolved in Nov. 1915 and formally declared war
inst Germany, Turkey and Bulgaria (June 29). By April
8, the Greek Army had been mobilised and re-equipped. In
y 250,000 Greek troops shared in the Macedonian offensive
ich culminated in the capitulation of Bulgaria (Sept. 30 1918).

Treaty of Sèvres and Fall of Veniselos.—At the Peace Confer-
e (Paris, Jan. 1919) Veniselos' presentation of the Greek
ims was remarkably successful. As affecting Bulgaria these
re embodied in the Treaty of Neuilly, to which was annexed a
eco-Bulgarian convention for the protection of racial minori-
s, etc. (Nov. 27 1919). Bulgaria was cut off from the Aegean,
Allies undertaking to ensure her an "economic outlet." This
blem has not hitherto been solved, as it was found impossible
Lausanne (Jan. 1923), even with the guarantee of the League
Nations, to devise any scheme, other than a territorial cor-
lor, acceptable to Bulgaria. The Treaty of Sèvres (Aug. 10
20) assigned to Greece the greater part of Thrace, and a man-
te, based on Greece's interest in the Greek population of Asia
inor. It also assigned to her the basin and hinterland of
yrna under a strictly controlled régime. Greek troops had
ded at Smyrna at the request of the Supreme Council on
ay 15 1919.

Unfortunately during these negotiations Veniselos had lost
uch with his people, and the Govt. at Athens had proven incom-
tent and corrupted. The resulting discontents were exploited
Constantine's agents. Not the Greek peasants only but many
the urban population were innately averse to Veniselos'
th-century ideas. In Aug. 1920 Veniselos returned to Athens
ed out, and angrily refused any electioneering compromise
th the 16 leaders of opposition. Then King Alexander, playing
th a pet monkey, was bitten. He died of blood-poisoning
ct. 25) and his younger brother Prince Paul having refused
e Government's offer of the throne, the restoration of King
nstantine became the real issue at the general election. On
v. 14 1920 Veniselos was heavily defeated at the polls. He
signed, and with many of his ministers and officials left the
untry. A government was formed by the aged Demetrius
lli which entrusted the Regency to the Dowager Queen Olga.
Aiter the formality of a plebiscite King Constantine returned
Athens (Dec. 19 1920). The Allied Powers refused to recog-
se him officially, withdrew their financial assistance, and agreed
reconsider the Treaty of Sèvres, which though signed had not
en ratified and had already been repudiated by the Turkish
ationalists. The withdrawal of their support was serious. The
mistice concluded with Turkey (Oct. 30 1918) had made very
complete provision for the disarmament of the Turkish forces
d it was partly in order to restore order in Asia Minor and
otect the Christian populations that Greek forces had been
thorised to land at Smyrna. But the Supreme Council, al-
ough it had finally (July 1920) asked the Greek troops, in Mr.
oyd George's words, "to clear up the whole neighbourhood
tween Smyrna and the Dardanelles," a task successfully
complished in 10 days, had set very definite limits to the Greek
my of occupation: and Mustafa Kemal had had time to organise
ormidable force. Greece was isolated; France and Italy both,
ertly or covertly, supported Turkey, and Great Britain de-
ned to embark on expensive Eastern adventures.

Greco-Turkish War.—Yet the new premier M. Kalogeropoulos
eb. 7 1921) and his successor M. Gounaris (April 7) rejected
e moderate proposals of a Conference of the Three Powers
ritain, France and Italy) which met in London (Feb. 21) to
onsider the Treaty of Sèvres; and instead actually ordered
m London an offensive (March 24) against the Turkish Na-
nalist positions, which after seizing Afiun Qarahisar and Eskishehr, was disastrously defeated (April 5) with 4,000 killed and wounded. On June 11 (anniversary of the fall of Constantinople in 1453) King Constantine left for Smyrna hailed by the government press as emperor designate of Constantinople and commander of the Anglo-Greek forces in the Near East. On June 19 the Allied Powers again offered "their friendly services to prevent the reopening of hostilties," but the offer was magniloquently rejected. The Greek forces opened their new offensive in July. A month later they were within 60 m. of Angora. But in August they were disastrously defeated on the river Sakkaria with very heavy losses. On Sept. 29 1921 King Constantine returned to Athens. On Oct. 16 Gounaris and his foreign minister Baltazzi, after receiving a vote of confidence in the Chamber, left for London and at last placed the interests of Greece without any reserve in the hands of Lord Curzon. Meanwhile the French "Franklin-Bouillon" agreement with Kemal had been signed at Angora (Oct. 20 1921); and Lord Curzon's ability to make peace was limited by the difficulty of coming to a preliminary agreement with France and Italy. Gounaris thus abandoned all Greek interests vested in the Treaty of Sèvres. He also gave up all claim to the balance of credits guaranteed to Greece by the Allies during the War and received in return permission to raise a loan on the open market if he could (agreement with Sir R. Horne, Dec. 21 1921). At Athens this was represented as a financial triumph, and thus arose considerable outcry in British Press and Parliament to the effect that England was secretly financing the Greek Army. Meanwhile the true situation was hidden from the Greek people; the persecution of Liberal deputies and journalists continued. Nor were the Liberals consulted when Gounaris on returning to Athens (March 10 1922) was compelled to reform his government. When the Near East Conference met in Paris, proposals for an armistice and the evacuation of Asia Minor by the Greek Army were transmitted to Athens and the two Turkish governments of Constantinople and Angora (March 26). The real Turkish power, that of Angora, explained away the apparent acceptance of these terms at Constantinople by making it plain that Turkey would accept only the immediate evacuation of Asia Minor.

A few days before the Conference Gounaris had privately addressed to Lord Curzon a desperate appeal for help and confession of imminent disaster. On May 11, after vainly following Mr. Lloyd George to Genoa, he resigned and joined M. Stratos in a coalition under the premiership of M. Protopapadakes, who had previously as Minister of Finance raised a forced internal loan by cutting in half all the bank notes in circulation. The first act of the new Govt. was to remove the commander-in-chief, Gen. Papoulas, who had privately advocated strengthening the front by the reinstatement of Veniselist officers previously removed, and to appoint in his stead Gen. Hadjanestes. In July the Govt. had the independence of Ionia proclaimed by the high commissioner of Smyrna, M. Sterghiades. They also issued a report that the Allies would shortly allow the Greek Army to occupy Constantinople; while Gen. Hadjanestes, a figure of notorious eccentricity, completed the demoralisation of the front and actually transferred large bodies of troops from Asia Minor to Thrace. The Turks attacked on Aug. 26 and entered Smyrna on Sept. 9 1922; five days later the whole city, with the exception of the Turkish quarter, was burned to the ground.

Revolution of Chios.—The Govt. resigned on Sept. 8, after ordering the demobilisation of the troops who were leaving Smyrna. But the attempt to scatter the remnants of the army as they were evacuated from Asia Minor failed. Many units landed on the island of Chios; and there a revolution headed by Col. Plasteras broke out on Sept. 26. King Constantine left the country and died in the following Jan. at Palermo. Eight of his principal ministers and advisers indicted by a special Commission of Enquiry were tried before an extraordinary court martial of 11 officers. Six of the accused (Gounaris, Stratos, Baltazzi, Theotokes, Protopapadakes and Hadjanestes) were shot immediately after the verdict (Nov. 28 1922). The executions shocked Europe. The British Minister, Mr. Lindley, who had refused to take the responsibility of guaranteeing that the accused, if reprieved, should never again take part in politics, left Athens. But they had a salutary effect on the Greek Army. Thousands of deserters returned to the colours, and a small but efficient army, reformed on the Thracian frontier under the command of Gen. Pangalos, greatly strengthened the hands of the Greek representative (Veniselos, who had consented to represent his country abroad) and of all the Allies at the second Conference of Lausanne which finally succeeded in signing peace with the Turks on July 24 1923.

Refugees and Minorities.—Meanwhile the Revolutionary Govt., after proclaiming an amnesty for all political offences (Jan. 22 1923), was confronted with the problem of the million destitute refugees expelled from Asia Minor. For some months the settlement of the refugees on a productive basis was organised with the help of American charitable societies; later the Greek authorities had to depend entirely on their own resources until a loan was raised (Dec. 1924) the administration of which was guaranteed by the League of Nations. In 18 months the Refugee Settlement Commission of the League of Nations had settled more than half a million refugees in new villages and urban districts throughout Greece. This settlement increased the homogeneity of population on the Greek frontiers, where the problem of alien minorities had already been reduced by a system of exchanging populations, embodied in the Greco-Bulgarian Convention (1919) for the voluntary emigration of minorities and the Greco-Turkish Convention (Jan. 30 1923) for the compulsory exchange of Moslem and Greek-orthodox minorities. These agreements (together with the Turco-Bulgarian agreement of 1913) completed and regularised a series of migratory movements which had begun with the Balkan Wars and had transformed the populations of Thrace and Macedonia. Thrace east of the Maritsa is now completely Turkish, Western Thrace predominantly Greek; and in Sept. 1925, the League of Nations Refugee Settlement Commission reported that Greek Macedonia was then "crowded with an active and industrious population, of which more than 90% were Greeks by race and sentiment" (*see* REFUGEES).

The Corfu Incident.—On Aug. 27 1923, the murder of the Italian member of the Greco-Albanian Frontier Commission led to the Italian bombardment of Corfu. Greece appealed to the League of Nations through whose agency the dispute was ultimately settled (*see* LEAGUE OF NATIONS). Greece's correct and conciliatory attitude in this unfortunate dispute did her great credit.

Return of Veniselos.—At home the revolutionary Govt., led by Cols. Gonatas and Plasteras with M. Alexandres as Foreign Minister, made genuine attempts to return to constitutional government. They failed however to form a moderate centre party (Sept. 1923); and a month later the extreme Royalists, under Gen. Metaxas, attempted to raise a counter revolution, which was easily suppressed. There was evidence that Gen. Metaxas had been in communication with King George II. The Republicans thus received a tremendous impetus, and though at the elections (Dec. 16 1923), from which the Royalists abstained, they were defeated, they had secured the support of the army and the navy, under the influence of Gen. Pangalos and Capt. Hadjikyriakos, whose pressure was so energetic that the Govt. to avoid disorder requested the King to absent himself during the meeting of the National Assembly which was to decide the future of the Throne. On Dec. 18 1923 the King and Queen left for Rumania. Adm. Condouriotes was appointed Regent and Veniselos was invited to return to Greece. In view of the apparent unanimity of the appeal he found it impossible longer to refuse. He returned (Jan. 4 1924) only, he was careful to announce, temporarily, in order to "put an end to civil war," and proposed to solve the constitutional problem by an immediate plebiscite. The Revolutionary Committee resigned and Col. Plasteras retired into private life.

Establishment of a Republic.—A week after his arrival Veniselos unwillingly accepted the premiership. He proposed (Jan. 23) that a plebiscite should be held in two months' time, under the supervision of committees representing every party, to decide whether a republic was desirable, and if not who should be king. The decision was to be followed by a general election held under a system of proportional representation. He found himself opposed however by the extreme Republicans under M. Papanastasiou who insisted on the immediate expulsion of the dynasty and establishment of a republic by a vote of the Assembly. Veniselos resigned the premiership (Feb. 4) to M. Kafantares who also favoured a plebiscite. He succeeded (Feb. 27) in defeating the Republican motions in the Chamber and was proceeding to
negotiate for a joint programme with the Royalists when
Officers League was reformed and demanded from Regent
Premier that a republic should be set up without more ado.
Kafantares resigned, Veniselos left Greece (March 10) an
government was formed by M. Papanastasiou, who propose
settle the fate of the throne by a resolution of the Chambe
be ratified by a subsequent plebiscite. After the King had refu
a very generous offer if he would abdicate voluntarily, there
no difficulty in getting the necessary vote. The republic
proclaimed on March 25 1924. The plebiscite, the arrangem
for which were accepted by the Royalists, was held on Apri
when 758,742 voted for the republic and 325,322 for a monar
The republic under the provisional presidency of Adm. C
douriotes was recognised on April 23 by England, who had resu
diplomatic relations on Jan. 16.

The Govt. of M. Papanastasiou was strengthened by
inclusion of Gen. Pangalos, Col. Kondyles and Adm. Hadji
riakos; but the two last-named officers soon left it again and
Papanastasiou resigned, and was succeeded by M. Sofoules
July 19, after a violent attack on the Minister for War, G
Pangalos, by M. Mihalakopoulos who himself formed a gove
ment on Oct. 7.

The Unratified Protocol.—At the end of July 1924, Bulgarian ko
tadjis captured on Greek territory at Tarlis were shot down by t
escort, and a month later a Commission of Inquiry appointed by
League of Nations censured the local authorities though it exoner
the Greek Govt.; a satisfactory feature was that the report
signed by the Greek member of the commission. On Sept. 29
Bulgarian and Greek delegates (Col. Kalfoff and M. Politis) mee
at Geneva signed a protocol providing that each Power should
point as its official advisers for carrying out the treaty protect
the interests of minorities Col. Corfe (British) and Major de Roo
(Belgian), who were already at work on the frontier as members
the existing mixed commission for the exchange of populations
pointed under the Greco-Bulgarian convention of 1919. T
authority would be a protocol embodying provisions containe
the Treaty of Neuilly and repeated in an annexe to the Treaty
Sèvres. Unfortunately this sincere and generous movement was
garded at Belgrade as an arbitrary recognition of the existence
"Bulgar" minorities in Greece which might lead Bulgaria to cl
similar privileges for "Bulgar" minorities in Serbia. Serbian
noyance and Greek suspicion were quickened by exagger
rejoicing in the Bulgarian press. On Nov. 27 Serbia denour
the Alliance with Greece and this undoubtedly determined Gr
repudiation of M. Politis. On Feb. 3 1925, the Greek Cham
refused to ratify the protocol and on March 14 it fell to Ve
selos to announce and defend this refusal before the Council of
League.

Negotiations with Serbia.—On April 27 1925 negotiations for
newal of the Greco-Serbian alliance were opened at Belgrade
soon broke down over the preliminary demands of Serbia. Ser
demanded the control and exploitation of the railway from Ghev
to Salonika; an extension of the Serbian zone on the harbour
Salonika; and a recognition that the Slavs of Macedonia were
"Bulgars" but "Serbs." This last demand was referred
Greece to the League of Nations. With regard to the railway
she offered to rebuild and reorganise the line or to appoint a
manent League of Nations official to arbitrate on all Serbian c
plaints but objected to any such cession of rights as would be
only a diminution of sovereignty but a continual source of fricti
The negotiations were broken off on June 1, and a subsequent
posal that the line should be worked by a French company (Oct.
was not more successful. With regard to the larger question of
Alliance, which remained in suspense, there was a possibility th
both Powers having disclaimed any territorial ambitions, nego
tions might be re-opened (Jan. 1926) for the conclusion of a Balk
security pact analogous to that of Locarno.

The Patriarchate.—At the Conference of Lausanne the Turks
consented to the maintenance of the Oecumenical Patriarch at
Phanar provided he exercised no civil or administrative pow
But on Jan. 30 1925 the new Oecumenical Patriarch was expe
from Constantinople by the Turks, who contended that he was
an "inhabitant of Constantinople" and that accordingly he was
exempted by the Treaty of Lausanne from the provisions of
Convention for the Exchange of Populations. In any case the Gre
had put themselves in the wrong by ignoring the usual formaliti
election and failing to obtain Turkish consent to his candidatu
The Council of the League of Nations referred the dispute to
Hague Court (March 14); but meanwhile Greece and Tur
arrived at a settlement, Greece persuading the expelled Patriarch
resign.

Gen. Pangalos Seizes Government.—Meanwhile the Natio
Assembly had not yet succeeded in voting the new constituti

ad there were numerous complaints of peculation and admin- trative inefficiency. On June 16 M. Mihalakopoulos reformed is government but 10 days later, confronted by an ultimatum om Gen. Pangalos and Adml. Hadjikyriakos, he resigned. Gen. angalos formed a government (June 26) including Adml. Hadji- yriakos, M. Kofinas and, later, M. Rentes (July 2), an experi- nced diplomatist, and after receiving a vote of confidence dis- olved the Assembly. The new constitution, issued by procla- nation on Sept. 30, provides for a president to be elected for a erm of five years and a Senate of 150 members, 100 to be elected y the parliamentary franchise, 30 by various guilds and cor- orations and 20 by Chamber and Senate. Gen. Pangalos romised that it should be submitted for ratification after elec- ons to be held in the new year. A proposal to court martial M. Papanastasiou for issuing a democratic manifesto was can- elled (Oct. 5) but Gen. Plasteras was expelled from Athens Oct. 24). Two officials were publicly hanged for embezzlement.

On Oct. 19 there occurred a fresh frontier "incident" with ulgaria, in the course of which the latter appealed to the League f Nations (*see* League of Nations: *Work of the First Six ears*). The commission ordered Greece to pay damages and ound she had violated the Covenant by occupying Bulgarian erritory with her troops. The commission also made various ecommendations for avoiding frontier incidents (including a ystem of frontier guards under neutral officers), and for com- leting without friction the convention for the Exchange of Populations. The undoubted success of the League was obscured n Athens by an inevitable comparison with the Corfu affair, ut the decision of the Council in accordance with the report was ccepted by the Greek Govt. on Dec. 15.

Meanwhile Gen. Pangalos was making strenuous efforts to uppress political rancour at home. On Nov. 24 at a conference with the party leaders he received assurances that the constitu- ional question would not be raised at the elections in March nd on this understanding the election of a senate was fixed for an. 10, and two Royalists, M. L. Roufos and M. Sehiotes, entered he Government. Apparently however it was too much to expect olitical leaders not to talk politics. On Jan. 3 1926 and in sub- equent proclamations Gen. Pangalos announced that the sena- orial and parliamentary elections would be indefinitely post- oned and that his Government had decided to concentrate all xecutive and administrative powers in its own hands; with the declared aims of economy and internal order and the forcible econciliation of contending factions the Ministries of National Economy and Public Assistance were abolished, the permanence of the civil service was suspended and the Press was forbidden o publish any articles written by MM. Kafantares, Papanas- asiou and Mihalakopoulos. Adml. Hadjikyriakos and M. Sehi- otes immediately resigned. At the Ministry of Finance M. Tan- alides, replacing M. Kofinas who had gone on a debt-funding mission to Washington, issued a forced loan similar to that of 1922 from which foreigners were not to be exempted (Jan. 23). All these measures were received by the people with the fatigue and listlessness which were becoming almost a substitute for political stability. Indeed while the agreeable M. Roufos re- mained at the Foreign Office to develop the improving relations with Serbia, Italy and Albania there was a prospect that Greece might at last enjoy a period of tranquillity and good government. The dictatorship of Gen. Pangalos had the merits as well as the defects of a fire-eating common sense, and it had the advantage of not being disguised in any pretentious ideology. (J. N. M.*)

The Country's Defence

The normal duration of military service, which is compulsory for all Greek citizens, is two years in the active army, 11 in the reserve and eight in the territorial army. Men are called up at the age of 21, and are liable for service until 51. Territorials are only called up in case of invasion or threat of invasion, and are only called up for training twice in the fourth and eighth year for a fortnight. The peace-time strength of the army is 12 infantry divisions, 1 cavalry division and a certain number of units unattached. The total personnel in 1924–5 was 66,484. The Greek Navy consists of 5 old battleships, 1 armoured and 1 protected cruiser dating from before the World War, 11 destroyers and 36 smaller units, including 2 submarines. (X.)

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II. ECONOMIC AND FINANCIAL HISTORY

Pre-War Position.—The economic situation of Greece during the early years of the present century, up to the outbreak of the Balkan War in 1912, was marked by a steady if moderate progress. Industrial enterprises for local purposes were established in considerable number. Communications by road and railway were extended, and large additions were made to the mercantile marine. The premium on gold gradually declined, and finally disappeared in 1909. By the Valaoritis law of 1910, providing for the automatic issue and withdrawal of notes against gold or foreign exchange, the currency was definitely stabilised at par on the gold exchange system, to the great advantage of the general economy and the credit of the country.

The state of the public finances, though less satisfactory, also showed signs of improvement at the latter end of the period. A series of deficits from 1907 to 1909 had to be met out of a portion of the proceeds of a new foreign loan raised for this and other purposes in 1910. At the same time, a programme of fresh taxation was introduced, including income tax and succession duties, with the result that the accounts up to 1912 showed a substantial surplus of revenue over expenditure. The varying interest on the old gold loans, payable out of surplus revenues in the hands of the International Financial Commission, marked a sensible upward progress.

The Balkan Wars of 1912 and 1913 threw a considerable strain on the resources and the finances of Greece, which was, however, relieved in some measure by the material assistance rendered by Greeks abroad. Immediate war expenses were defrayed chiefly out of the balance of the 1910 loan and the proceeds of various provisional loans, which were liquidated by means of a new consolidated loan issued in 1914, and taken up for the greater part in Paris and London. This loan was secured on the revenues assigned to the International Financial Commission, an institution which, though regarded as an encroachment on the sovereign rights of the country, has been found useful on repeated occasions as a means of providing security for fresh loans. The economic strength of Greece was greatly enhanced by the acquisition of territories of both actual and potential value, including the important port of Salonika, the rich tobacco-growing districts of Drama and Kavalla and extensive areas in Macedonia capable of productive development.

The World War.—After the outbreak of the World War, and during the period of neutrality of Greece, which lasted from 1914 until 1917, there was a considerable accumulation of private wealth in the form of foreign balances, but the country suffered severely from internal conflicts, from the economic blockade of Old Greece in 1916–7 and from the prolonged mobilisation and war preparations. Noteworthy economic events during this period were: the law of 1915 facilitating the formation of co-operative societies; the connection, in 1916, of the railway system of Greece with those of Europe; and the agrarian legislation of 1917, which provided for the expropriation of large estates in favour of the peasants, and at the same time prohibited the alienation or mortgage of the peasants' holdings and their subdivision at death.

The entry of Greece into the War in 1917 involved a large increase in military and naval expenditure. Fresh taxation was imposed, including a tax on War profits, and a certain sum was raised by an internal loan and by the issue of National Defence bills. But the bulk of the funds required was provided by advances in kind from the Allied Powers and by credits opened by the latter for expenditure in Greece, against which payments were effected in notes by the Greek Government. These credits were treated as cover for the note issue. The very considerable expansion in the paper currency which resulted from these arrangements did not cause at first too heavy a demand for exchange, for the factors which contributed to strengthen the foreign balances during the period of neutrality continued to operate until the end of the War.

With the close of the War, however, and the suppression of restrictions on trade, the accumulated purchasing power of the country made itself felt in a large demand for foreign goods. Large purchases of Greek and other securities were made in foreign markets, and the depreciating currencies of Europe offered an attractive field for the speculator. The resultant pressure on the exchange funds of the note-issue was so great that before the end of 1919 the available reserves were exhausted, the exchanges began to fall away from the gold parity, and the Valaoritis law became a dead letter. In the course of 1920 a portion of the Allied credits was realised, but this was quickly absorbed by purchases of supplies, and the excess of imports reached unprecedented proportions.

Effects of the Greco-Turkish War.—At the same time, the Govt. found itself involved in fresh liabilities in connection with the military operations in Asia Minor. To raise the considerable funds required, recourse was had to a large internal lottery loan, to issues of National Defence bills, to loans from the National Bank and, finally, to inflationary issues of paper money. The fall in the exchanges was accelerated by the withdrawal of financial support and credits by the Allies on the return of King Constantine in 1920. By the end of that year the drachma had lost 60% of its gold value. This depreciation of the currency reacted unfavourably on the budget, while the prosecution of the Asia Minor campaign entailed ever-increasing expenditure. In 1921 and 1922 issues of paper money and National Defence bills were effected on a large scale, without authority from the International Financial Commission taxes were raised and a forced loan was extracted from note-holders by compelling them to surrender one-half of each note in exchange for a government bond. The disaster in Asia Minor in 1922 reduced the finances and credit of the country to the lowest ebb, and by the end of the year its securities were quoted on the international markets at prices yielding 20% to the investor, while the drachma had lost 94% of its gold value. This collapse of the monetary unit, with the concomitant rise in the price-level, profoundly disturbed economic conditions throughout the country, and caused serious losses among particular sections of the community. The bulk of the public debt being on a gold basis, the real charge of its service on the state finances was not greatly reduced by the depreciation.

Refugee Settlement.—The influx from Asia Minor and Thrace of a vast number of destitute refugees threw a fresh burden on the resources of the country, and enlisted the sympathy and assistance of foreign countries, especially of England and America. Under the auspices of the League of Nations an independent refugee settlement commission was set up in 1923, for the establishment of the refugees, and a refugee loan was issued in 1924, in London, New York and Athens, guaranteed by revenues assigned to the International Financial Commission. Meanwhile, the Govt. made strenuous efforts to put its finances in order. Considerable fresh taxation was imposed in 1923, including a capital levy to be spread over five years, which has given very mediocre results. The floating debt was largely increased in 1923 and 1924. A fresh uncovered issue of paper money was made in 1923, and at the same time a law was passed authorising further issues against cover in funds abroad. The exchange, after violent fluctuations, settled down in 1924 to about one-tenth of the gold parity. By 1925 the public finances had so far recovered that the Govt. was able to allocate special revenues to the reduction of the floating debt, and to present a balanced budget. But this equilibrium was afterwards disturbed by fresh expenditure and by a renewed fall in the exchanges, due to an inflationary banking policy and a maladministration of the foreign exchange fund created by the law of 1923. At the end of 1925 the drachma had again fallen back to one-fifteenth of its gold parity.

Notwithstanding the instability of the political régime, of the public finances and of the monetary policy, the country as a whole showed remarkable powers of recuperation after a period of 10 years of war ending in a great national disaster. The refugee population tended to become an asset instead of a burden. The refugees settled in Macedonia, extended the cultivated area and increased the production of crops, while large numbers found employment in industrial and other occupations. The expropriation of agricultural properties for the benefit of refugee an other peasants was accelerated, on terms very unfavourable t the owners, by special legislation in 1923 and 1924. The mercantile marine, which had been reduced by nearly two-third during the War by sales and losses through enemy action, wa restored to its original strength. Exports expanded slowly, bu the growth of imports bore witness (apart from the portio attributable to foreign loans) to the extent of the country's additional resources in the form of shipping and other profits, o remittances from emigrants and of investments that wer held abroad.

The greatly increased burden of public debt was mitigated b the fact that the larger part of it was held by her own nationals Nascent local industries, hampered during the War for lack o fuel, took a fresh upward stride, stimulated in some degree b high tariffs and other protective measures, and by the influx o refugee labour. The extension of building operations and othe forms of economic activity afforded evidence of increased prosperity, but an exact measure of real progress could not be ascertained while inflation continued. Railways, roads, ports an urban services generally were still in a backward state. At th end of 1925, however, numerous projects were in contemplatio or in course of execution, with the aid of foreign capital, fo extensive improvements in these directions and for the furthe development of local resources.

Statistical Comparisons.—The following statistical table summarises the changes in some of the salient economic and financia features of Greece over an interval of rather more than ten years *i.e.*, 1914 to 1924.

	1914	Present day	
Area, square miles	46,000	1925	49,200
Population	4,800,000	1925	6,200,000
Production of cereals, tons	847,000	1925	871,000
Production of tobacco, tons	25,000	1925	66,000
Production, currants, tons	158,000	1925	133,000
Production of emery, tons	16,000	1925	20,000
Production of lignite, tons	20,000	1925	111,000
Exports, drachmas	178,500,000	1925	4,320,000,000[1]
Imports, drachmas	318,800,000	1925	9,834,000,000[1]
Joint stock companies	68	1925	325
Companies, capital of, drachmas	363,000,000	1925	2,190,000,000[1]
Co-operative societies	5	1925	3,655
Letters carried	29,810,000	1924	73,403,000
Telegrams despatched	1,968,000	1924	5,502,000
Telegraph lines, miles	5,735	1924	11,225
Railways open, miles	1,366	1925	1,689
Piraeus entries, steamships	3,809	1925	7,915
Piraeus entries, net tonnage	4,067,000	1925	5,044,000
Mercantile marine, steamships	474	1925	467
Mercantile marine, gross tonnage	830,000	1925	912,000
Bank deposits, drachmas	474,000,000	1925	5,755,000,000
Bank deposits, postal savings, drachmas	700,000	1925	93,500,000
Note circulation, drachmas	253,000,000	1925	5,339,000,000
Public debt, gold £	43,900,000	1925	77,800,000
Public debt, currency, drachmas	173,600,000	1925	7,918,000,000
Ordinary revenue, drachmas	207,700,000	1924-5	4,719,000,000
Athens cost of living, index no.	100	1925 Dec.	1,644
Exchange on London, drachmas per £.	25	1925 Dec.	378

[1] These figures must be considered in relation with the exchange.

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REEK LITERATURE, ANCIENT (*see* 12.507).—Our knowl- ge of ancient Greek literature has been increased greatly since beginning of the century. In 1918 Sir Frederick Kenyon ew of 920 literary papyri: Professor Oldfather in 1923 counted 67. No entirely new authors have been discovered equal in portance to Bacchylides, Herondas and Timotheus, and no w treatise quite equal to Aristotle's *Constitution of Athens.*

The New Comedy.—Of Menander we have considerable frag- nts—found in 1907—from seven plays, ranging from 550 es to 88, and can form some opinion of at least three: *The itrepontes* (Appeal to Arbitration), with ten characters; *The rikeiromenê* (Girl with her Hair Cut), with eleven; and per- ps *The Samian Woman.* Again, we have part of the plot of *e Priestess.* A man's wife has left him (possibly for religious asons) and become a priestess; he does not know what she did th their son, and the priestess is unapproachable. His slave etends to be possessed by a demon, and so gets taken in to the iestess to be treated. He finds out that the boy is being reared their own by certain neighbours, and tells the father, who es straightway to claim his son. But these neighbours also ve a genuine son of their own, and by mistake the old gen- eman lights upon him. The boy decides that the old man is ad, and tells his foster brother, who, consequently, when his ther approaches him on the same subject, humours him as a natic. . . .

An opening like this shows how far we have travelled from e simple μῦθοι of the 5th century. We can see that Menander vented his plots, and invented them with an ingenuity and mplexity utterly beyond the conceptions of the great trage- ans. We can appreciate his exquisite style; colloquial, yet fined, subtle and witty and capable of much emotional power. is palely reflected in the *urbanitas* of Terence. Contempo- ries who were still under the spell of tragedy and the Old omedy could ask themselves "whether Menander copied life life Menander"; but on a modern reader he will not make an pression of realism. Lost or exposed children, recognitions, be- ayed maidens, captured cities and heroines sold into slavery, ithful or ingenious slaves, indulgent or cross parents, play a rger part on his stage than they ever did in real life.

Yet the general effect does give a vivid picture of Hellenistic thens. It is an easy-going and cultivated commercial society, eering as best it can, with much understanding and sympathy d humour, amid the shipwrecks of a tormented world. There e no villains, no cruelty; the women have character, the be- ayed maidens have generally been betrayed in the excitement of me wild religious festival, and the betrayer suffers torments of morse. Except in the exposing of children, a favourite motive Hellenistic fictions, Menander's moral outlook would com- are favourably with that of Molière, not to speak of Congreve.

Callimachus.—Callimachus too has become a reality and we an understand the immense influence he exercised upon the ugustan poets. We possess many fragments from his *Aitia r Origins*, one of them 80 lines long. Unfortunately nothing is omplete; but the fragments show a mastery of the Greek legiac couplet unknown before. The diction is rather precious. he style often reminds one of Ovid, romantic with a touch of elf-mockery, as though the poet felt the absurdity as well as the oveliness of the archaic legends which he collected with so much est. The Alexandrian courtier is shown in his "Lament on the eath of Arsinoe," his "Coma Berenices" (which we know in a atin version by Catullus) and other fragments. His gnomic oems are written in the assumed character of the ancient Hip- onax, but have none of that satirist's ferocity. One tells the tory of the prize for wisdom, which was offered first to Thales ut refused by him because Bias was wiser, and by Bias because omeone else was wiser and so on by all the wise men in turn. nother contains a contest for superiority between the laurel nd the olive, somewhat flat to modern taste.

Another acquisition is a large fragment of a *Life of Euripides* y Satyrus, a Peripatetic of the 3rd century B.C. It takes the orm of a dialogue; one of the characters is a woman; and the tone that of drawing room *belles lettres* rather than history. There is much gossip and anecdote, given for what it is worth; many quotations, and some good literary criticism, *e.g.*, the observation that Euripides wrote the "things that held the new comedy together, peripatetics, betrayed maidens, supposititious children, recognitions by rings and necklaces, etc." The fragment comes from Satyrus' *Lives* in six books, the last of which dealt with the lives of the tragedians. It is extremely interesting as a specimen of the new subject of study introduced by the disciples of Aristotle, personal biography of writers and *savants.* Satyrus seems to have been the chief authority for the anonymous *Life* which has come down to us with the MSS. of Euripides.

Lyric Poets.—Another new author of great interest is the Boeotian poetess Corinna, a contemporary and compatriot of Pindar, though curiously different from him. She stands right outside the sphere of Homeric influence. Her language is the colloquial Boeotian which she spoke, unaffected by literary tradition. Her themes, to judge from the two poems preserved, "The Contest of Kithaeron and Helicon," and "The Daughters of Asopus," are little more than local folklore. She cannot have been quite uneducated; her metre is too correct; but her work leaves the impression that Boeotian women in the 5th century, though they learnt *Mousikê*, did not know much literature. Unlike Sappho, she was a neither a bluestocking nor a genius.

Sappho herself is now represented by about 100 new fragments, but the papyri have been so crushed and broken that very little is continuous or intelligible. The most beautiful of the new songs is perhaps equal to the best known before and has the same poignancy. It begins: " . . . and simply I long to be dead. She left me sobbing, and said: 'Sappho, we have suffered terrible things. I swear, against my will I leave you.'" The exceptionally careful study of the whole material by Mr. Lobel has shown, first, that the papyri are very exact in reproducing dialect, and secondly that Sappho, except in poems modelled upon epic, wrote almost entirely in her native Lesbian. She stands between the rusticity of Corinna and the literary polish of Alcaeus.

Alcaeus also is represented by more than 100 new fragments, various in subject and metre, but seldom large enough to yield continuous sense. A comparison of Helen and Thetis, a few lines about Sisyphus' attempt to outwit Death, much about *dura navis, dura fugae mala, dura belli* confirm but do not greatly enrich the impression made by the previous fragments. There is style, spirit, vigour, variety and there must have been a mass of minute and intimate history. But we find perhaps more continuous beauty in the new fragment of Ibycus, passing in dreamy memory the great shadows of the Trojan War, or the short burst of lyrical hexameters in the style of Alcman.

Pindar, of whom we had before only *epinikia* (victory songs) is now represented by considerable fragments of paeans, *parthenia* (girl songs) and dithyrambs. The paeans show the same abrupt and tortured magnificence of style as the extant *epinikia;* the *parthenia*, as Dionysius of Halicarnassus (Demosth. 39) had remarked, are simpler, and show Pindar in a new mood. "Maidenly thoughts be mine and maidenly speech upon my tongue," says one fragment.

The Drama.—There is also much beauty in the lyrics of Euripides' *Hypsipyle*, one of which is a nurse's song to a baby, with the accompaniment of a rattle and a new effect in one of the scenes where a mother, raging against the nurse who has inadvertently caused the death of her child, is suddenly reduced to silent tears by the presence of the gentle sage, Amphiaraus. The quiet exit of Amphiaraus to his foreseen death, and the subtle indications of Hypsipyle's life-song devotion to Jason, the brief romance of her youth, are in Euripides' most characteristic style. The fragments of Sophocles' Satyr-Play, the *Ichneutae* (Trackers), have great charm. The infant Hermes has stolen the cattle of Apollo; the Satyrs go as detectives to track the thief, and hear underground the first music known on earth—the child playing on the lyre he has made. The remains of Sophocles' *Eurypylus* are very small, but show the great 5th century style.

Increase of Historical Knowledge.—If we turn from our direct gains in beautiful literature and try to estimate the new light thrown by recent discoveries on the history of Greek literature as a whole, the results are much larger. The excavations of Minoan Crete, though they have brought us no Greek text, make a difference to our understanding of the Homeric poems and of the whole heroic tradition. We see quite clearly now that the poems do not stand at the beginning of literature. There were ages of literature before them. Even their heroic subjects can in many cases be shown to have been already known in or before the 16th century B.C. Gems and frescoes of that date show us the siege of a city, like Troy; a man under the belly of a ram and clinging to its long wool, like Odysseus escaping from the Cyclops' cave; a scene in a deep glen, where a young man attacks an older man in a chariot, as Oedipus attacked Laius. This means that some of the main romantic motives used in Greek heroic poetry were already traditional then, attached to what names we know not. Again, the celebrated "Ring of Nestor" (*Jour. Hellenic Studies*, 1925) shows scenes of initiation and of the next life, ideas which have generally been considered post-Homeric and even for the most part post-classical. We see now that they were in existence before Homer as well as after; and the characteristic theology of Homer, with its avoidance of these ideas, shows itself to be not a thing of primeval simplicity, but a peculiar product of the "Heroic Age" (*i.e.*, the age of the destruction of Minoan civilisation by the Northern invaders). Again, while the excavations indicate pretty clearly that neither of the Homeric poems as a whole is "history," they also show that both are full of historic memories, in various degrees confused and fragmentary, and transmuted into the "heroic" mould.

Variety in Greek Literature.—But what we chiefly learn from the papyri is to appreciate the immense variety of Greek literature, especially in the Hellenistic Age. We have now specimens of three Satyr-Plays, instead of only the *Cyclops*. We have large masses of the New Comedy. We know something of the Alexandrian elegy and idyll, including bits of Euphorion as well as Callimachus. We discover the prevalence of poems in the style of different ancient writers: compositions in imitation of Hipponax, of Epicharmus, of Anacreon, of Alcman and letters professing to come from Hippocrates. We are reminded of the Delian Hymn with its claim to be by "Homer" himself.

Religious or ritual poetry is represented by several hymns and paeans connected with the temple of Apollo at Delphi or that of Asclepius at Epidaurus. The most curious is a paean to Asclepius, which occurs in four almost identical copies of different dates and places. It seems to have been a stock form, with places left open, so to speak, for the names of the particular city or individual wishing to perform the rite. More primitive worships, though in late form, are expressed in the Cretan Hymn to the Kouretes and the Eretrian Hymn to the Idaean Dactyls. The religious literature connected with Egyptian gods, such as Isis and Serapis, is of course extensive, but is generally in prose.

Peculiarly striking is the great mass of light lyric poetry from Hellenistic or early Roman times. A poignant "Paraclausithyron," or "Weeping outside the Door," by a woman; another, less good, by a man; several love-songs in loose Ionic metres (one starting with the poignant line *κατάκειμαι μεθ' ἑτέρον, σε μέγα φιλοῦσα*); soldiers' songs; sailors' songs; a song to the Rhodian winds; a song of spring in the woods; a lament by a boy who has lost his pet cock; a powerful though roughly written complaint, of Roman date, by a girl whose lover is being sent to fight in the amphitheatre as a *mirmillo*, and who desperately wants to buy him off; a charming quasi-philosophic flute-song, written in a tricky metre with a refrain (*αὔλει μοι*), the first letters of each stanza forming an acrostic.

Novels and Light Verse.—Our own commonest form of light literature, the novel, is also well represented. There are three fragments of the preposterously romantic *Chaireas and Callirhoe* of Chariton, which had evidently great popularity: one of Achilles Tatius. The new evidence shows that these romances are much earlier than was supposed, Chariton about 200 A.D. and Achilles about 300. There are also fragments of several novels hitherto unknown—*Semiramis and Ninus, Herpyllis, Chionê, The Dream of Nectanebo*, etc. The supply of novels is equalled by that of "Mimes," or short realistic dialogues for acting or reading aloud. They are poor stuff, illustrating p haps the pleasure in sheer coarseness which sometimes marks over-refined age.

More interesting are the poets who write under the inspirati of the Cynic "diatribê," or popular philosophical appeal conscience. The confusions and inequalities of Hellenist society stimulated a contempt for worldly standards and civilis conventions and a tendency to exalt the poor, the untaught, a the oppressed. In poetry this led to a revival of the scazons, "lame iambics," of old Hipponax, which affected both Cal machus and Herondas in later times, and has left us fragmen of a 3rd-century anthology, in which the chief figure is Phoen of Colophon. Better than these scazons are the "meliambi" Kerkidas the Cynic (*flor.* 250 B.C.), who is known as a friend the general Aratus, and is perhaps to be regarded as the auth of the anthology itself. They are full of strange words and fa tastic compounds which suit the mordant and rather brut style of his "diatribê." It is instructive to observe that Cl anthes the Stoic, when writing his more ideal exhortations, avoi the deliberately fractious metres and uses the harmonious hex meter or iambic.

In prose philosophy we have some striking specimens of 5t century sophistic; a fragment of Hippias (?) on Music, deridi the theories which invested it with subtle moral values; and tv of Antiphon the Sophist, known previously for his denunci tions of slavery, with a highly provocative treatment of th difference between *Phusis* and *Nomos*. There is also a fragme of a dialogue by that strange character, Aeschines Socraticu And meantime the charred remains of the library of the Ep curean philosopher at Herculaneum are slowly being deciphere much Philodemus, Polystratus "On Unreasoning Contempt ousness," with fragments of Demetrius Laco, and the Sto Hierocles. Nor should we forget the uncommonly interesti Epicurean Gospel, inscribed by Diogenes of Oenoanda on a lar wall, so that the world may read and be saved (2nd centu A.D.) "*Grammatikê*" or philology is represented by Chrest mathies, "Lives" or "Sayings" of eminent writers, by scho and glossaries and by a valuable fragment of Didymus' Co mentary on Demosthenes.

History, etc.—The additions to our historical literature a considerable. Besides the *Constitution of Athens* we have mo than 500 complete lines of a 4th century historian, who aft much controversy seems likely to be identified with Ephoru rather than with Theopompus or Cratippus. It deals chief with the year 395 B.C. Other fragments attributed to Epho treat the history of Sicyon and other subjects. There are sma pieces of Timaeus, the Sicilian historian, and of Philochorus, t Attic chronicler. There are bits of what seem to be the authen despatches of the third and second Ptolemies, and perhaps al of the first (*P. Oxy.*, 679), dealing with their own campaigns; al of Sosylus, who lived in Hannibal's camp, and, according Polybius, "gossipped like a barber," on the "Deeds of Hannibal Of Satyrus we have spoken above. There is some history al in the new fragments of the orators Lysias and Hyperides.

But both as history and as literature the largest and most su prising additions to our knowledge are to be found in the no literary papyri, of which there must be more than 10,000. Th may be divided into (*a*) official and (*b*) private, the first consisti of laws, rescripts, edicts, documents about taxes, judicial pr ceedings and the like, the second of contracts, receipts, wil manumissions and private letters or memoranda. Their val is increased by the fact that they often fall into large cohere groups, such as the papers about the Serapeum, the correspon ence of Cleon, the public architect, or of Zenon, the great esta agent. Combined with the rich mass of Hellenistic inscriptio these documents have illuminated the life and social history the Hellenistic age to a degree undreamed of before.

BIBLIOGRAPHY.—The new texts are to be found in the princi collections of Papyri, *e.g.*, B. P. Grenfell and A. S. Hunt, *The O rhynchus Papyri* (1898, etc.); *The Tebtunis Papyri* (1902) and *T Hibeh Papyri* (1906). See also *Berliner Klassikertexte, Berli Griechische Urkunden*, Boll. della Societa Papyrologica Italia

chiv für Papyrologie*, and the various publications of the British useum. The following separate publications are convenient (dates er to first edition): S. Sudhaus, *Menandri reliquiae* (1914); Schroeder, *Novae Comoediae Fragmenta* (1915); R. Pfeiffer, *llimachi Fragments* (1923); E. Diehl, *Supplementum Lyricum* 910); Hans von Arnim, *Supplementum Euripideum* (1913); E. iehl, *Supplementum Sophocleum* (1913); F. Bilabel, *Kleinere istorikerfragmente* (1923); F. Blass, *Bacchylidis Carmina* (1912); Crusius, *Herondae Mimiambi* (1923); B. Lavagnini, *Eroticorum aecorum Fragmenta Papyracea* (1922); A. S. Hunt, *Hellenica yrhynchia* with fragments of Theopompus (1909) and *Tragicorum aecorum Fragmenta Papyracea* (1912). Larger and more important e W. G. Headlam and A. D. Knox, *Herodas* (Cambridge, 1922); E. bel, *Sappho* (Oxford, 1925); J. U. Powell, *Collectanea Alexandrina* smaller fragments of poets of Alexandrine age, epic, elegiac, lyric d ethical (1925). See also the lists in W. Schubart's *Einführung in e Papyruskunde* (1918) and *The Greek Literary Texts from Greco-man Egypt*, by C. H. Oldfather, University of Wisconsin (1923); ilamowitz-Moellendorff, *Menander, Das Schiedsgericht* (1925).

(G. G. A. M.)

GREEK LITERATURE, MODERN (*see* 12.524).—The troubled ars from 1910 to 1925 were marked by one event of capital portance to the literature of modern Greece, the all but total nquest of the entire literary field by the spoken language, mmonly called the demotic or romaïc, after a century's struggle ith the official or scholastic tongue, called the pure or catharéussa.

In 1910, Costis Palamas published the remarkable narrative rical poem *The King's Flute*, in which he celebrates, in the oving atmosphere of Byzantium, the continuity of Greek roughout the ages. In *The Immutable Life* he appears as a bold novator, inspired by French intellectualism, and definitely esblishes his position as a poet of world wide fame. Before losing mself in memories of his childhood, as he does in his next work *ongings for the Lagoon*, 1912) he shows that he possesses the ernal spirit of ancient Hellas, of Byzantium and of modern reece. He is a poet of the intellect and of thought, whose work, hile showing the influence of Western symbolism, is yet filled ith imagery and with glowing verbal music. In works such as *mbs and Anapaests* and *The Grave* he has given expression to e deepest emotions. He was strongly influenced by the prohetic genius of Joannes Psuchares, a master in every *genre* of prose, ho introduced into Greece all the most recent linguistic theories. ithout his example it is unlikely that Palamas would have suceded in realising his powers. So was founded the new School Athens. Palamas, himself an occasional novelist and critic, ecame the centre of the popular renaissance.

Among the stylists pure and simple of the school we find John ryparis, a disciple of Hérédia; Laurence Mavilis, strongly inuenced by Italian literature, who was killed in the war of 1912; e Baudelairean Papantoniou Costas Ouranis; Aristos Camanis, whose work is chaste and, if anything, a little cold; and the elicate genius of Malakassis, who owes much to Moreas and to *he Intermezzo*. Peter Vlastos wanders from sphere to sphere, evelling in subtlety of rhythm and metre. All the storied past f Greece comes to life in his work. Apart from these, the dreamy ambros Porphyras has written his *Shadows;* Sotiris Skipis has ung of his longings for his own country (*Song of Apollo*) and the ufferings of the fugitives from Anatolia. Myrtiotissa in his movg work has sung of passion, while G. Souris and Pol Arcas ave turned to satire, and Drossinis, forerunner of many others, as produced his picturesque idylls.

But apart from simple melodists like these tardy Parnassians, he newer poets venture even further than Palamas into unharted territory. Among them are Angelos Sikelianos, who ediscovered the secrets of the ancient myths of sea and land, nd who hymns the greatness of life; Rigas Golphis, bitter, loquent and passionate; the fiery Varnalis, Ph. Yophyllis, who mbodies in his work the minutest details of modern life, and avaphis, who, apart from the others, evokes, in a strange and nadorned style, the Alexandrian decadence which resembles his wn depression.

Prose Writings.—Modern Greek prose is unusually rich both n *conte* and in the novel. The scattered but recently collected ork of Papadiamandis, who disappeared in 1908, remains unequalled. Carcavitsas and Ephtaliotis painted the sea and the islands, and left models for others, as also did the regretted poet, novelist, critic and translator, C. Hatzopoulos. Costis Passayannis, Vlakhoyannis and the Epirote Ch. Christovassilis are accomplished writers of the heroic and the picturesque. D. Voutyras is more deeply moved by the troubles of the working classes. There are also C. Theotokis of Corfu, who combined criticism of society with the study of character, and showed himself in his novels, *The Slaves in their Chains* and *The Life and Death of Karavelas*, as a cruel and unrelenting realist, also C. Paroritis, the powerful author of *Red He-Goat*, and Madame J. Dendrinos, who excels in depicting the ravages of passion. No one, however, in the novel or the theatre has excelled G. Xenopoulos, the creator of a whole gallery of pictures of Zante and Athens (*Isabel, Woman from Three Aspects*).

But Xenopoulos is not alone among Greek dramatists. Paulos Nirvânas, that fine critic and subtle observer, brought Ibsenism into fashion. Spyros Melas and Pandelis Horn achieved remarkable work with a high social aim, D. Tangopoulos distinguished himself in philosophical drama and N. Poriotis shows in *Rhodopi* that tragedy in verse is still to be found in Greece. Among the younger writers Constantinides in *Photinoula* reveals himself as a coming dramatist, and Valsa wrote a model of philosophic comedy in *The Council of Ministers*.

In other spheres, we may mention the names of J. Dragoumis as a critic, of Philindas and of Triandoephyllides in philology and the study of language, while we must not forget the well-known Psuchares, Lambros in history, Politis in folklore, Andréades in political and social economy, Xenopoulos, Nirvânas and Cambanis in literary criticism, Voutieridis in the history of literature. The influence of the literary reviews is shown by the fact that modern Greek literature is becoming more and more westernised in inspiration and form and ceasing to be Byzantine. (P. Le.)

GREEK RELIGION (*see* 12.527).—Our knowledge of this subject has been put on a new basis by researches into the beliefs of pre-Dorian Greece and Minoan Crete. N. M. P. Nilsson's conclusions, that a Mother-goddess and a divine child, who is born, is suckled by an animal and dies annually are characteristic of Crete and of the mainland, that this pre-Greek goddess survives in the Olympian pantheon as Athena and as Hera, that at Eleusis and many other places a cult was continuously practised from prehistoric times, and that the great cycles of Greek mythology all centre round sites important in the Bronze Age, are of the utmost value.[1]

How far this Minoan religion, which has clear affinities with Asia Minor, Philistia and Cyprus, was part of a general Aegean or even Mediterranean culture, we cannot yet say: Sardinia offers a remarkable point of contact.[2] These researches into prehistoric beliefs have transformed the study of Greek mythology. We recognise in it not a little confused history, even if Forrer's identification of Eteokles and Andreus, mythical kings of Orchomenus, with potentates mentioned in the Hittite tablets from Boghaz-Köi (*see* ARCHAEOLOGY: ASIA, WEST), should be seriously contested; we see in it also the reflex of old sacred traditions or rites (thus the death by burning of Herakles on Mount Oeta reflects a fire-ritual there annually performed), the influence of folklore motives distributed over a wide cultural area, and the effects of the desire to tell a good story for its own sake.[3] This study is in a favourable position, since Wilamowitz, Robert and others have done much to determine the earliest form and later developments of heroic stories,[4] while Nilsson, Eitrem, Farnell and many writers in *Religionsgeschichtliche Versuche und Vorarbeiten* have increased our knowledge of ancient ritual.[5]

Others, again, have investigated, not without exaggerations, the survival of ritual forms in drama and in the great games, and the gain to knowledge is clear, though it must be remembered that the search for a single origin of a human custom may well prove illusory, that a rite can arise independently or by parallel development in two places and that at the same time few rites or beliefs have developed unchanged by external influences. Not all athletic contests started as acts of homage to a dead man, but some did, just as all heroes are not degraded gods, but some (as, for instance, Hyakinthos) are.[1] Ritual origins can be forgotten; so could also the original meaning of certain survivals of primitive culture in historic Greece.[2] At the same time, the value of anthropological parallels appears in W. F. Otto's conclusions, partly based thereon, that in Homer the ψυχή or soul in Hades is not the θυμός or soul of the living man.[3] The study of cult has further shown how moral requirements grow out of ritual requirements, and how important is the group as contrasted with the individual.[4] In the study of cults and in particular of their geographical distribution has lain the chief advance in knowledge of Greek religion of the central period.[5]

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[1] Summarised in his *History of Greek Religion* (Oxford, 1925).

[2] *Cf.* T. Ashby, *The Year's Work in Classical Studies*, p. 117 f. (1923–4).

[3] *Cf.* F. Pfister, *Philologische Wochenschrift* (July 1922); L. R. Farnell, *Greek Hero Cults and Ideas of Immortality* (Oxford, 1921), is of great value.

[4] C. Robert, *Die Griechische Heldensage* (1920–   ) is noteworthy as giving a learned and critical survey.

[5] S. Eitrem's chief work is *Opferritus und Voropfer der Griechen und Römer* (Oslo, 1915). A good survey is F. Pfister's article "*Kultus*" in Pauly-Winowa Real-Encyclopädie.

Meanwhile we have learned much of the Hellenistic age as the period in which Eastern beliefs made their way into the West, and in which many of the religious phenomena of the Empire have their roots; among these are ruler-worship, astral and other mysticism, as also certain liturgical forms and the type of magic familiar in Roman Egypt.[6] Side by side with newer ideas the old worships lived on; there is no simple formula which expresses the religious attitude of the three centuries following Alexander's death. Survivals of ancient paganism in Christianity[7] and in modern Greek beliefs and folklore have been much discussed; on many important points agreement has not been reached, but much progress in detail has been realised.

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(A. D. N.)

GREELEY, ADOLPHUS WASHINGTON (1844–), American soldier and scientist, was born at Newburyport, Mass., March 27 1844. Enlisting in 1861 as a private, he served in the Civil War, and rose to be brevet major. In 1867 he was appointed second lieutenant in the regular army and became chief signal officer and brigadier general. While commanding at Lady Franklin Bay, one of the 13 international circumpolar stations, 1881–4, he reached, in 1882, 83°24′ N. 42°45′ W., the farthest north at that time. Two relief expeditions failed to reach him, and wh the third, under Capt. Schley, rescued him at Cape Sabine, but seven of his party were dead. From 1887 to 1906 he admi istered the Weather Bureau and the Signal Corps. Under hi were built more than 25,000 m. of cables and telegraph lines Alaska, China, Cuba; Porto Rico and the Philippine Islan Promoted major-general in 1906, he conducted relief operatio in San Francisco and put down the Ute rebellion. He serv with the international conference, London, 1904, at the reque of the British Govt. and was dean of the American delegati to the wireless conference at Berlin that year. Retired for a in 1908, in 1910 he was sent by President Taft to represent t United States at the coronation of King George V. He wro extensively on meteorological, electrical, geographical and oth subjects. His best known popular volumes are *Three Years* *Arctic Service* (1885); *Handbook of Polar Discoveries* (1909 and *Handbook of Alaska* (1925).

GREENOCK, Scotland (*see* 12.548), had a population 81,123 in 1921. The area of the borough is 2,945 acres. The are several large shipbuilding yards, and a torpedo factory. T old West Kirk is to be removed and re-erected at Seafield permit of the extension of Messrs. Harland and Wolff's shi yard. The new works at the harbour include a tidal basin and "always afloat" dock, the entrances of which are closed caissons to keep in 32 ft. of water at low tide. In 1921 the were three miles of quays in the port. Lady Alice Park was giv to the town in 1910, and Lady Octavia Park in the followi year; in 1919 Togo House was presented and opened as a m ternity hospital.

GREGORY, ISABELLA AUGUSTA, LADY (1852–), Iri playwright and author, was born March 5 1852, the younge daughter of Dudley Persse of Roxborough, Co. Galway. In 18 she married Sir William Gregory, a well-known Irish M.P. S produced many plays, essays, volumes of folklore, versions ancient sagas and romances concerning early Irish heroes, a did much to popularise the Anglo-Irish dialect of English spoken in the west. She translated for the Abbey Theatre se eral of Molière's plays into this dialect under the title of *T Kiltartan Molière* (1910). Her work as playwright and direct of the Abbey Theatre, in association with W. B. Yeats, w extremely fruitful. This theatre was opened in 1904 and La Gregory told its story in *Our Irish Theatre* (1914). Sir Hu Lane, whose life she wrote, *Hugh Lane's Life and Achieveme* (1920), was her nephew.

Among Lady Gregory's other works are: *Cuchulain of Mu themne* (1902); *Gods and Fighting Men* (1904); *Seven Short Pl* (1909); *The Kiltartan History Book* (1909); *Irish Folk History Pl* (1912); *The Golden Apple* (1916); *The Kiltartan Poetry Book* (1919 *The Dragon* (1920).

GRENADES (*see* 1.869 and 12.578).—A grenade is a sma metal missile, usually filled with high explosive, which may b thrown by hand or projected with the aid of a rifle. Grenad may also be charged with poison gas and incendiary or smok producing compositions, but the essential features of the vario kinds remain the same. Gunpowder grenades, made of woo bronze and other materials, were used in the 16th century, to b revived later in a high explosive form at the siege of Port Arthu in 1904 and in the trench fighting of the World War. Grenade are described as percussion or time grenades, according as t whether they explode on impact or after a definite time interva

Hand Grenades.—At the commencement of the World Wa the limited supply of grenades in the British Army was of th percussion type, in which a needle in the head of the grenade by direct impact caused to fire the detonator, a head-on fa being insured by means of tail streamers. At a later date, a all-ways fuse was suggested which would fire the grenade i whatever position it alighted. The main disadvantage of the pe cussion type is the danger of it exploding if accidentally droppe after being made "live" prior to throwing by the withdraw of the safety pin or other safety device. These consideratio led to the adoption of time grenades as being safer in action an allowing time in case of accident for the bomber to get clear o hrow away the grenade. Furthermore, time grenades are more asily improvised than percussion ones, and during the period of evere shortage of munitions in the World War, many such grenades were constructed locally out of any handy receptacle. For his purpose a short projecting length (usually 5 sec.) of safety use terminating in a detonator (for high explosive fillings) within he grenade was employed. Various friction or strike and cap ombinations were used to ignite the fuse before throwing.

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[1] On the drama *cf.* F. M. Cornford, *Origin of Attic Comedy* (1914); Sir W. Ridgeway, *The Dramas and Dramatic Dances of non-European Races* (1915); on the games H. J. Rose, *Aberystwyth Studies*, No. 3, p. 24 (1922); L. Malten, *Römische Mitteilungen*, vol. 38, 39; N. M. P. Nilsson, *Deutsche Litteraturzeitung* (Sept. 1925).

[2] H. J. Rose, *Primitive Culture in Greece* (1925), is very useful for its criticism of the supposition that totemism and tribal initiations were prevalent.

[3] *Die Manen* (Berlin, 1923).

[4] *Cf.* J. E. Harrison, *Themis* (1912), significant rather as one of the first attempts to employ modern psychological theory than for positive addition to knowledge.

[5] E. Ciaceri, *Culti e miti nella storia dell'antica Sicilia* (Catania, 1911); Baege, *De Macedonum sacris* (*Dissertationes philologicae Halenses, 22*) (Halle, 1913); G. Gianelli, *Culti e miti della Magna Grecia* (Florence, 1924); R. M. Peterson, *Cults of Campania, Rome, 1919* (1923).

[6] *Cf.* Franz Cumont, *Astrology and Religion among the Greeks and Romans* (1912); R. Reitzenstein, *Die Hellenistischen Mysterienreligionen*, 2nd ed. (1920); *Das iranische Erlösungsmysterium* (1921); E. Norden, *Agnostos Theos* (1913); S. Eitrem, *Papyri Osloenses* (1925); The Hopfner, *Griechisch-ägyptischer Offenbarungszauber* I., II. (1922–4).

[7] *Cf.* C. Clemen, *Religionsgeschichtliche Erklärung des Neuen Testaments* (1924); the new Leipzig journal, Αγγελος; W. R. Halliday, *Folklore Studies* (1924), *cf.* also his chapter in R. M. Dawkins' *Modern Greek in Asia Minor* (1916); and the journal Λαογραφια (Athens, 1909–).

The principle of the time grenade is represented in its greatest erfection in the Mills grenade (see fig. 1), invented during the War, f which enormous quantities were supplied to the British Forces. consists of a barrel-shaped iron casting, *a*, externally grooved in egments to ensure good fragmentation, and of a size to be coneniently clasped in the hand, weighing 1 lb. 8 oz. and containing ½ to 3 oz. of high explosive, *b;* amatol or ammonal in powder form convenient. The essential principle is that the ignition of the ime arrangement *c* is caused mechanically, as soon as the grenade eaves the bomber's hand. This is effected by the release of a triker *d* actuated by a powerful spring *e* which until then is retrained by a lever *f*. On withdrawing the safety pin *g*, this lever still held to the grenade by the thrower's fingers (see fig. 2), ut on the grenade leaving his hand, the loose lever flies off and cap *h* is struck which ignites the 5 sec. length of safety fuse *c*, which in turn fires the detonator *j* and explodes the grenade.

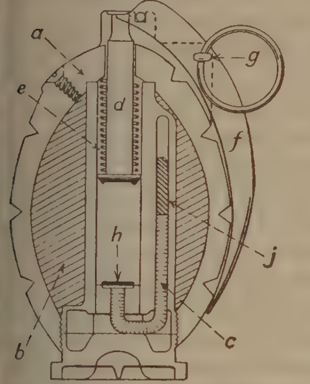

Fig. 1.—Section of Mills Grenade.

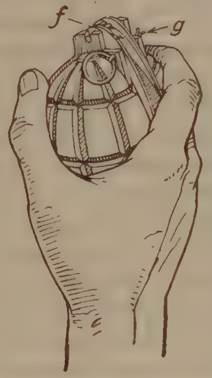

Fig. 2.—Grip for throwing.

Rifle Grenades.—Previous to the World War rifle grenades ad been designed in order to obtain an increase of range beyond he restricted limits of hand throwing. These grenades were of he percussion type with a steel tail rod, with or without a gas heck, which was inserted about 10 in. into the muzzle of the rdinary service rifle and propelled by the gases from a blank artridge, which impinges on the tail rod. The rodded rifle grenade described above is open to serious objections, being unhandy, nd liable to bulge and split the barrel, particularly if the rod is ot accurately straight and consequently tends to buckle. In ny case, a severe strain is thrown on the rifle, which is eventually ound to damage it. This led to the introduction from the French f the discharger-cup or *tromblon*, which is a short cylindrical cup ttached to the muzzle of the rifle, into which the grenade is fitted nd from which it is propelled by the gases from a blank cartridge fired in the rifle, acting on the base of the grenade. The Mills grenade can be adapted for firing from a discharger-cup y the addition of a gas check plate, which is screwed into the ase; the side of the discharger-cup holds the loose lever in position until the grenade is projected clear, when it flies off and sets he grenade in action. In this way rifle and hand grenades an be made practically interchangeable, thus simplifying both upply and transport in the field.

Future Design.—The tendency of future design is in the direction of percussion grenades, which are considered to be more effective than time ones, chiefly in that no time is given in which o get clear or to throw back the grenade before it explodes, in he event of the time fuse being too long in its burning. The chief difficulty to surmount is so to design the grenade that it is safe if dropped vertically by accident, but is made "live" in the space of a short flight. Other essential conditions are to act in any position of impact or fall after throwing, to be interchangeable with trifling adjustment as a hand or rifle grenade, to be weatherproof and mud proof and to be simple in manufacture and use.

Bibliography.—G. M. Ainslie, *Hand Grenades* (1917); G. Dyson, *Grenade Fighting* (New York, 1917). See also the official *Text Book on Service Ammunition.* (C. D. C.)

GRENFELL, WILFRED THOMASON (1865–), British medical missionary, was born Feb. 28 1865 at Parkgate, Cheshire. He was educated at Marlborough and Oxford, where he took the degree of M.D., and studied medicine at the London Hospital under Sir Frederick Treves. At his suggestion Grenfell, in 1889, joined the Royal National Mission for Deep Sea Fishermen and for three years cruised with it in the North Sea as medical missionary. In 1892 he went to Labrador as first medical missionary and there did a great work, building hospitals, establishing homes and missions for the inhabitants, and organising industrial schemes and co-operative stores. In 1906 he received the C.M.G. in recognition of his services. Besides the work he did locally in Labrador and northern Newfoundland, culminating in the opening by King George of the Seamen's Institute at St. John's in 1912, Grenfell lectured in Canada, America and England in order to raise funds, and the mission expanded rapidly until, in 1912, its English, American and Canadian branches were united by the formation in New York of the International Grenfell Association, of which Grenfell became superintendent. During the early part of the World War he was attached as major to the Harvard Surgical Unit in France. In 1920 he became F.R.C.S. and in the same year received the gold medal of the National Academy of Social Sciences of America.

Grenfell's publications include: *Vikings of Today* (1895); *The Harvest of the Sea* (1905); *Labrador: the Country and its People* (1909, re-issued 1913 and 1922 with additional chapters); *Adrift on an Ice-Pan* (1910); *A Labrador Doctor* (1920, abridged 1925); *Northern Neighbours* (1923).

GRETNA, Great Britain, was the scene of a great undertaking during the World War. On a tract of land some 10 m. long and from one to two m. wide, partly in Dumfries, along the north shore of the Solway estuary, and partly in Cumberland, hundreds of stone, brick and steel buildings were erected for the making of munitions and providing for the wants of the workers who flocked there. These buildings included administrative buildings, schools, churches, messrooms, shops, halls, post-offices, fire-stations, etc., as well as factories, glycerine and ether distilleries, electric light and refrigerating plants. The buildings fell largely into two groups, one at Dornock to the west, and one about seven m. to the east at Mossband and Longtown. There were in addition two garden villages, one at Gretna, in the centre, and one four m. to the west at Eastrigg, with some 16 sq. m. of agricultural land, which has since been settled with ex-service men. The whole undertaking, about which great secrecy was preserved during and after the War, cost over £9,000,000 and employed at one time 24,700 people. It was sold in July 1924, although some members of Parliament made efforts to secure its use as a national factory.

GREY, ALBERT HENRY GEORGE, 4th Earl (1851–1917), British administrator, the son of Gen. Charles Grey, Queen Victoria's private secretary, and grandson of the 2nd earl, the Prime Minister (*see* 12.586), was born Nov. 20 1851; he was educated at Harrow and at Trinity College, Cambridge, where he graduated with a first class in law and history in 1873. As his uncle, the 3rd earl, had no children, Albert Grey was the heir-presumptive to the earldom, and he sat in Parliament as a Liberal, first for South Northumberland, and then for the Tyneside Division, from 1880 to 1886. The Liberalism which he displayed in the House of Commons and developed greatly in a crowded after-life was unlike the conventional Radicalism of the period. He was an enthusiastic social reformer, and a whole-hearted imperialist. He was one of the 93 dissentient Liberals who by voting against the Liberal Govt. decided the fate of the Home Rule Bill of 1886. He lost his seat in the ensuing General Election and did not reappear in Parliament till he succeeded his uncle in the earldom in 1894. The interval had been largely filled with travel—chiefly along the by-ways of the British Empire. He was in South Africa when his uncle died, and his knowledge of, and interest in, that country led to his appointment in 1895, after the Jameson Raid, as administrator of Rhodesia in succession to Dr. Jameson. There he became a close friend and ardent admirer of Cecil Rhodes, and it was natural that, on returning to England, he should join, in 1899, the board of the Chartered Company. He visited Lord Milner in South Africa after the Boer War, and returned once more in 1912 to unveil the Rhodes memorial on the slope of Table Mountain.

Canada, however, where he went as governor-general in 1904, was the part of the British Empire to hold the first place in his affections. He was no stranger there, but had already visited the Dominion twice, being brother-in-law of his predecessor, Lord Minto. His enthusiasm for the land and the people, his idealistic outlook, his bright and simple manner, his utter lack of conventionality and stiffness, his fondness for travelling and nature and sport captivated the Canadian heart. His term of office was twice prolonged; but Canada was loth to see him go in Oct. 1911, even though his successor was to be the Duke of Connaught. Never much of a party man, he was still less so after his return to public life in England. He devoted himself to the causes which appealed to him. Of these the Federation of the Empire was the first, and he would only contemplate Irish Home Rule as part of a federal scheme. He made a helpful contribution to licensing reform by the institution of the Public House Trust, and he worked hard for proportional representation. He forwarded all promising efforts for the improvement and organisation of agriculture. Lord Grey died at Howick, Northumberland, after a serious operation, on Aug. 29 1917, leaving, by his wife Alice Holford, a son who succeeded him in the earldom.

GREY OF FALLODON, EDWARD GREY, 1st Viscount (1862–), British statesman (*see* 12.588), became Foreign Secretary in Sir Henry Campbell-Bannerman's Ministry formed in Dec. 1905. Sir Edward Grey (as he then was) had previously announced that the Liberal Govt. would maintain Lord Lansdowne's policy of an *entente* with France and an alliance with Japan, and during the general election of Jan. 1906 he was asked by France, who was being pressed by Germany about Morocco, whether, in case of a Franco-German war, she could reckon on British assistance in arms. He replied that he could promise nothing which would not be fully endorsed by public opinion, but that, if war were forced on France through the *entente* respecting Morocco, he believed British public opinion would rally to her support. The French Govt. then suggested conversations between military experts.

After consulting the Prime Minister, the Chancellor of the Exchequer and the War Minister, he agreed, on the understanding that such conversations should in no way bind the British Government. The Algeciras conference on Morocco followed in the spring of 1906, and the constant support which, on his instructions, the British representatives accorded to the French helped to produce a satisfactory result and to strengthen the Anglo-French entente. In 1907 he came to an understanding with Russia. He concluded a convention with her about Persia, by which the integrity of that country was to be maintained, but Britain recognised that Russia had rights and interests in the northern zone and Russia recognised that Britain had rights and interests in the southern zone. In the same year he forwarded Anglo-American friendship by sending Mr. (afterwards Lord) Bryce to Washington as British Ambassador; and concluded a convention with Spain binding the Powers to maintain the *status quo* in the Straits of Gibraltar and neighbouring waters.

In 1908—the year in which Mr. Asquith, an intimate friend of Sir E. Grey, became Prime Minister—the European situation was considerably modified by the assertion in Oct. by Prince Ferdinand of the independence of Bulgaria and hi assumption of the title of King and the simultaneous annexation by Austria-Hungary of Bosnia and Hercegovina, which she had administered under the Treaty of Berlin. These strokes o policy moved the indignation of both the Russian people and the Russian Govt.; but the German Emperor announced that he would stand by his Austrian ally in “ shining armour ” and Sir E. Grey, though he protested against the infraction o the public law of Europe, was naturally unable to promis Russia anything more than diplomatic support. The action o the Central Powers confirmed him in the view that it was the who might be the principal danger to European peace; bu he was able to keep on friendly terms with them.

The labours of the Foreign Office, coupled with membership of the House of Commons, left him little leisure for forwarding the general policy of the Government. Nevertheless, as occasion arose, he defended all the principal controversial measures. His main preoccupation, however, was British relations with Germany, who gave dramatic notice of her dissatisfaction with the spread of French aims and influence in Morocco by despatching, at the beginning of July 1911, the gunboat “ Panther ” to the northwest African coast at Agadir, to protect, it wa alleged, German interests. In view of this further attempt to test, and if possible loosen, the entente, he issued a warning through the mouth of Mr. Lloyd George speaking at the Mansion House, that Britain intended at all hazards to maintain her place among the Powers. The warning sufficed to make Germany lower her tone, and subsequently Sir E. Grey explained to Parliament that the foreign policy of the Government was a continuation of Lord Lansdowne's and had got rid of the constan trouble with France and Russia; that British friendship with these Powers, far from constituting a hostile encirclement of Germany afforded a guarantee that neither would pursue an aggressive policy towards her; but that, when a nation had the bigges army and was increasing its already big navy, it was natural that other Powers should be apprehensive.

While a section of Radicals and Labour men were suspicious of Sir Edward's policy, public opinion in general (including the Conservative Opposition) supported him and was pleased when in the following year his able services were marked by the very unusual distinction, for a commoner, of the Order of the Garter In the beginning of 1912 he was a party to sending Lord Haldane on an informal mission to Berlin to reassure the Emperor and his Government as to the pacific intentions of Britain and to probe the intentions of Germany. The Cabinet formally notified the German Govt. that Britain would neither make nor join in, any unprovoked attack on Germany. But nothing would content the German Govt. but an absolute pledge by Britain of neutrality if Germany were engaged in war —a pledge which Sir E. Grey naturally could not give. Largely in consequence of this ominous rebuff, he exchanged letters on Nov. 22 1912 with the French Ambassador, agreeing that, if either Britain or France had grave reason to expect an attack by a third Power or a menace to the general peace, both Governments would consult whether they should co-operate and what measures they should take in common. Still he found himself able to work in general harmony with the German Govt in the efforts made by the Powers, in conference in London, to bring a settled peace to the Balkans, which had been distracted in 1912–3 by a series of local but furious and barbarous wars.

In this matter the diplomacy of Germany had appeared so reasonable that he was taken aback by her unyielding attitude in the negotiations arising out of the Austro-Serbian dispute As soon as he heard of the Austrian ultimatum delivered at Belgrade on July 23 1914, he realised at once that Russia could not allow Serbia to be crushed and exerted himself in the most strenuous fashion to save Europe from the threatened catastrophe. Acting generally in conjunction with France and Russia one or both, but in face of a lukewarm or hostile Germany, he urged upon Austria the extension of the alarmingly short time-limit of 48 hours; he proposed indefatigably various schemes for conciliation and conference; he pressed upon Serbia the essity of going as far as possible to meet Austria. In fact, bia accepted almost the whole of the Austrian demands; Austria would be content with nothing less than com- e submission, and on the expiry of the time-limit de- ed war on Serbia. On July 29 Germany, asserting that war inevitable if Russia attacked Austria, endeavoured to chase the neutrality of England by undertaking, if England ained neutral, to make no territorial acquisitions at the ense of France—an undertaking which did not extend to French colonies—and by promising to respect Belgian grity, after the War, if Belgium had not sided against many. Sir E. Grey next day absolutely refused to make bargain of the sort at the expense of France and Belgium. view of the apparent threat to Belgium, he asked France and many whether they were prepared to respect Belgian neu- ity provided it was not violated, and he asked Belgium ther she would remain neutral. France and Belgium both ied affirmatively, while Germany temporised. Hopeful otiations which had been begun directly between Russia and stria were wrecked by a German ultimatum to Russia to ntermand her mobilisation; and on Monday Aug. 3 Germany lared war on France.

he moment for decision had come for Great Britain. Russia asked her to declare herself against Germany and so give German general staff pause; France had asked her to co- rate as Germany was about to invade French territory. Cabinet had hitherto been divided, a strong section press- for the preservation of neutrality, and so Sir Edward had n unable to reply favourably to either Russia or France. now Germany had declared war on France, and was ap- ently about to disregard the neutrality of Belgium. The position, through Mr. Bonar Law, tendered support for ive measures to aid France and Russia; and Sir Edward, h a Cabinet rallying, with few exceptions, to his view, was to make an appeal in the House of Commons on Aug. 3 public and Parliamentary support to a policy of action. speech finally decided a wavering public opinion; with the eption of some Radicals and extremist Labour men, all parties, uding the Irish Nationalists, accepted the necessity of war. Edward demanded next day that Germany should respect neutrality of Belgium, and, on the German refusal, England nt to war.

ne of Sir Edward's first tasks was to turn the association the Powers fighting Germany and Austria into an alliance, ch bound its members to fight in common, and make peace ommon. In the course of the negotiations for this purpose he not hesitate to guarantee the support of Great Britain for attainment of long-cherished national objects, provided t these did not conflict with the aims of liberation and self- elopment common to the Allies: the most striking case ng the promise, after Turkey entered the War on the side of Central Powers, that Russia should have Constantinople. ch of his time and attention was occupied by difficult ques- ns arising out of the blockade of Germany and the consequent erference with the trade of neutrals. Public opinion in Great tain constantly complained that the blockade was not en- ced with sufficient strictness; while the United States, as principal neutral, harassed the British Govt. by repeated es. denouncing the methods of the British Navy as un- essarily prejudicial to American trade and contrary to inter- ional law. He was perhaps more successful in his answers to Americans than in his justification to the British public; and rge body of opinion in America accepted his explanations as sonable.

he tenure of the Foreign Office by a statesman so high- ded, sincere and experienced as Sir Edward Grey was rywhere regarded as such a valuable asset for Great Britain t it appeared only natural and fitting for Mr. Asquith, when templating the formation of a coalition government in y 1915, to lay down, as one of the essential conditions, that re should be no change in the office of Foreign Secretary. one could refute with such authority the intermittent assertions of the German Chancellor that it was England and not Germany that was responsible both for the origin and for the continuance of the War. When the pacifists called for negotiations in May 1916, he showed that when the Germans professed a readiness for peace it was only for a peace on the basis that Germany had won and the Allies were beaten; but the Allies were not beaten, and the first step towards peace would be taken when Germany began to recognise the fact. Credit must be given to Sir Edward for facilitating, in the early summer of 1915, the entry of Italy—till May 3 a member of the Triple Alliance—into the War against the Central Powers. It was, however, a bitter disappointment to him that his grave warnings failed to prevent Bulgaria, in the autumn of the same year, from taking the field against the Allies. Allied troops were sent to Salonika, and he offered Cyprus to Greece in order to induce her to carry out her treaty obligations and go to Serbia's aid against Bulgaria. But on this issue King Constantine won the support of his people against M. Venizelos, and Serbia was crushed before help could reach her.

In July 1916 an affection of the eyes, which had been giving him increasing trouble, made it advisable that he should have as much relief from work as possible, and he accepted a peerage. When a few months later, in Dec., his friend and chief Mr. Asquith was succeeded in the premiership by Mr. Lloyd George, failing eyesight and political comradeship both united to determine him to bring his 11 years' tenure of the Foreign Office to a close. He had served for a longer consecutive period than any predecessor, and in his official methods he carried out his own precept—that foreign policy required not striking effects nor bold strokes but careful steering.

After his resignation Lord Grey took little or no part in public life for several years. Happily, though he never regained normal vision, rest and quiet gradually worked a decided improvement in his eyesight. But, with the exception of a three months' mission in 1919 to the United States to deal with questions arising out of the peace, he did not definitely emerge from his retirement till 1922. It was the time of the decadence of the coalition government and Lord Grey urged that it was not trusted and should come to an end, which happened within a few months; he was also anxious to resuscitate the Liberal party, a process which was only partially effected. In foreign affairs he pressed for the re-establishment of good relations with France, and for the arrangement of an inclusive peace pact, beginning with France. When such a pact was concluded at Locarno in 1925 he welcomed it warmly. But the cause to which he devoted most of his energy was that of the League of Nations. He was especially anxious that Germany should be included as a member at the earliest possible date, and maintained that this should be the only business of the spring meeting of the League in 1926, which unfortunately separated without effecting it.

Much of his time in these years was taken up in the compilation of a straightforward narrative and vindication of his course in foreign policy, which was published in 1925 under the title *Twenty-five Years, 1892–1916*. He had published in 1899 another volume on *Fly-Fishing*, his favourite recreation. In 1885 he married Dorothy, daughter of Shallcross F. Widdrington, of Newton Hall, Northumberland. She was killed in a carriage accident in 1906, and in 1922 Lord Grey married, as his second wife, Pamela, sister of George Wyndham, widow of the 1st Lord Glenconner. (G. E. B.)

GRIERSON, SIR JAMES MONCRIEFF (1859–1914), British soldier, was born at Glasgow Jan. 27 1859 and joined the Royal Artillery in 1877. Noted from the outset as an exceptionally keen student of his profession, from 1896 to 1900 he was military attaché at Berlin. As a colonel he was with Lord Roberts during the advance from Bloemfontein into the Transvaal; but he was then transferred to China to act as British military representative on the staff of Count Waldersee, commander-in-chief of the Allied forces against the Boxers. In 1904 he was appointed director of military operations. He commanded the 1st Div. at Aldershot from 1906–10, and was in 1912 put in charge of the Eastern command. On the outbreak of the World War Sir J.

Grierson was selected for the command of the II. Army Corps. He proceeded to France, but died suddenly on Aug. 17 1914 while his troops were still assembling in the area of operations. A good linguist and unusually well acquainted with most of the European armies, Grierson had an understanding of "la grande guerre" and an intimate knowledge of the German Army that made his premature death an incalculable loss to the British cause.

GRIFFITH, ARTHUR (1872–1922), Irish politician, was born in Dublin March 31 1872 and began his working life as a printer. When the Irish party was divided over the Parnell case, Griffith, like Dublin artisans in general, sided with Parnell and against the clergy. But the rancorous quarrels which then disfigured Irish politics disgusted young men and led them to despair of success along constitutional lines.

New organisations came into existence in Dublin, the most important being the Gaelic League for the revival of the Irish language. Griffith joined this movement, but, since it was professedly non-political, his main activities were with the Celtic Literary Society, the leading figure of which was William Rooney. Over and above all these minor groups there existed the Irish Republican Brotherhood or Fenian Society, of which Griffith became a member. He went to South Africa in 1896, owing to lack of employment in Dublin, but home-sickness brought him back to Ireland in 1898. In 1899 *The United Irishman,* a weekly paper, was established, through the columns of which he was destined to influence Ireland.

Early Writings and Aims.—At first Rooney counted for more in the new movement than Griffith, for he possessed that personal magnetism in which Griffith was lacking, yet after his death in 1901, the paper strengthened rather than weakened. No such journalism had appeared in Dublin since the time of Young Ireland. It was savagely political; but its politics had an idealism which was foreign to the agrarian revolution. Griffith cared passionately for the things of the mind; his own writing had the beauty of trenchant steel; and he welcomed contributions from the best writers in Ireland, W. B. Yeats, "A. E." and the rest. No contributor expected to be paid, for all knew that Griffith himself lived on a pittance.

Later, when the power of his pen was recognised, generous offers were made to him, but he rejected them, and steadily pursued his own aim. That aim was both destructive and constructive. He sought first to divert his countrymen from the attempt to win self-government through parliamentary action at Westminster, and secondly to persuade them to work for it in their own country. Physical force was then popularly regarded as an illusion; and Griffith, though all his intimate associates were Fenians, recognised that the majority of Irish Nationalists did not think separation from Britain possible. He therefore resigned membership of the I.R.B., and aimed at winning over the separatists to work for a Parliament in Ireland united to that of England only by the link of the Crown. As a means to this end, he proposed passive resistance and an appeal to moral force. Payment of taxes was to be refused. Members elected to Parliament were to absent themselves from Westminster, and to sit in Ireland as a Council and govern only by the assent of the nation. Tribunals were to be set up to which cases should be brought, and the British courts were to be deserted.

Rise of Sinn Féin.—This policy was first publicly announced at a meeting in Dublin in Oct. 1902. The body which met called itself Cumann nan Gaodheal or "Society of the Gaels." But the name chosen to represent their policy was Sinn Féin "Ourselves"—Irish words which in their proverbial use mean roughly "Stand together." The name was soon transferred from the policy to its adherents. Candidates were put forward at municipal elections and by 1906 there were 14 Sinn Féiners on the Dublin corporation. But Griffith's propaganda was mainly confined to the capital; and in 1907 a member of the Irish party, who resigning his seat, stood for re-election as a Sinn Féiner, was heavily defeated. The attempt to return a Sinn Féiner to Parliament was not renewed for 10 years.

The new policy at first did not make much headway. Resistance to taxation proved difficult because all taxation except income tax was indirect, and a large proportion of income
payers were Unionists. The only effective forces were the
sonality and the pen of Arthur Griffith. His paper changed
name in 1906 when damages for libel were awarded against
United Irishman. That journal disappeared, and re-emer
as *Sinn Féin.* In 1907, when the Parliamentary party had
fered a reverse, *Sinn Féin* appeared as a daily paper, but
experiment soon had to be abandoned, and after another ba
ruptcy *Eire* became its name. Griffith wrote no books: but
published in 1905 a pamphlet called *The Resurrection of Hung*
which described how an almost vanished language had been
stored to national use, and how the elected deputies of an anci
nation, through a policy of abstention from the Austrian Asse
bly, gained full freedom under a dual monarchy.

The Volunteer Movement.—Griffith, during these years, tau
the rising generation to despise and distrust not only the meth
but the character of those who were then leading the
national movement and he was less scrupulous in his modes
attack than a publicist should be. Yet when it became clear
1911 that a Home Rule Bill was seriously intended, he
nounced his intention not to hamper Redmond. But the meas
proposed was wholly unlike his ideal and he condemned it
and branch, his most furious opposition being directed agai
that partition of Ireland which he was later constrained to acce
In the shaping of events, neither he nor his paper counted
much till the growth of the Ulster Volunteers revived the hope
the physical force party.

Griffith supported the counter-organisation of the Irish
unteers by word and deed. He was one of those who received
rifles landed at Howth in July 1914. The outbreak of the Wo
War revived all his importance. The Volunteers split,
tenths of them adhering to Redmond in support of the Brit
cause but the remainder, active and determined, remained
Ireland; and Griffith's paper was their main organ. The cens
ship attacked it, but instead of *Eire*, there came out *Scissors*
Paste, a journal consisting of extracts from war news arra
to give an impression very unfavourable to the Allies. It was
one of many journals. Griffith had founded a school, a "
quito press" and had set the example of tenacity and cour

The Easter Rising.—The Easter Rising of 1916 was a surp
to the majority of Irishmen. Griffith took no part in it,
thereby lost influence with the extremists. But the British
thorities remedied this by putting him into Frongoch, the
tention camp in Wales, which became a crowded academy
Sinn Féin. Yet when in July 1917 the prisoners were relea
Mr. de Valera was chosen as their leader. Griffith proposed
election at the Convention of Sinn Féin, while he himself retur
to his desk, re-issuing his paper as *Nationality;* this also was
pressed and re-appeared as *Eire Og*. He was again put in
in 1918. At the General Election after the Armistice, Sinn
swept the board outside Ulster, and Griffith's policy was put
force. The elected members (such as were not in prison)
sembled as Dail Eireann, the Irish Parliament. But, going
yond Griffith's plan, they declared for an Irish Republic, elect
Mr. de Valera as President and Griffith as Vice-President.
these men were then prisoners; but after some months the Pr
dent escaped and Griffith was liberated.

Griffith as Leader.—During Mr. de Valera's absence in Ameri
from June 1919 to the close of 1920, Griffith acted as head of
"Irish Republic." His policy now was carried out in its entire
The elected bodies, county councils and municipalities refuse
take orders from the British authorities in Dublin Castle;
Féin courts were set up and functioned with notable success;
come tax was withheld. But these forms of passive resist
were effective only because active resistance was in progr
Griffith neither launched nor controlled the guerilla war, to
pressure of which England finally yielded.

During that struggle, power rested with Collins and ot
young men. Yet Griffith had still a great part to play. W
the truce was proclaimed and negotiations were opened in J
1921, Mr. de Valera refused to accept the responsibility of a
ing the full separatist demand. Griffith, thereupon, underto

leadership of the delegation which finally secured the in- sion in the treaty of the substance of Sinn Féin's original de- nd. Defending this settlement in the Dail, he spoke with the viction of one whose ideal had been accomplished and who w that it satisfied the desire of Nationalist Ireland in general. hout his authority, prestige and sense of realities, it is un- ly that any settlement of the difficult Irish question would e been reached.

lany of those who supported him would not accept the full sequences of the treaty; and when Mr. de Valera resigned, fith was elected President, not of the Free State, but of the ublic and the army continued to be in theory the Republican y. To meet the difficulty, Griffith set up a Provisional Govt. h Michael Collins as Chairman to carry on till a general elec- should have ratified the treaty. This resulted in an illogical ision of authority and as months passed Griffith's public erances as President were often contradicted by the action naction of the Provisional Government. During the final cussions with the British Govt. in June 1922, concerning the aty, he interviewed the leading Irish Unionists and pledged self to secure them full representation in the public life of the e State. His conception of Ireland was less narrowly Gaelic n that of Sinn Féin in general.

fter the elections on June 16, when a plain verdict was given acceptance of the treaty, the Government was at last forced take action against the mutinous section of the army. Civil began on June 27. In July the main bodies of the Irregulars re everywhere decisively beaten, and on Aug. 11 a force sent nd by sea occupied Cork, the last important town to be re- ned. On the morning of Aug. 12 Griffith fell dead suddenly on way to his office in Dublin. The strain had killed him, and completion of his life work was left to a younger generation. sentially he must rank as a publicist, an educator, an inspirer action. Few men in history have accomplished more for ir country than he by his unpaid pen. (S. G.)

RIMSBY, England (*see* 12.603), has an area of 2,868 ac. the county borough and of 1,798 ac. in the parish, with 117 of water and 248 of foreshore, and a population in 1921 82,355. The fishing trade has increased largely since 1910 has necessitated the provision of a new dock; there are siderable imports of timber and ice, and the town has some factories. The tramways were taken over by the corporation 1925. St. Augustine's Church was built in 1911, St. Luke's 1912 and St. Peter's (Roman Catholic) in 1919; a new parish, t of St. Stephen's, was made in 1911. A children's home in ighowgate was opened in 1913, and Queen Mary's hostel, built the National Mission to Deep Sea Fishermen, in 1925. A War emorial in Bargate was unveiled in 1921. The Grimsby wlers and their crews did splendid work in sweeping for nes during the World War (*see* MINELAYING).

GROSSMITH, GEORGE (1847–1912), British comedian (*see* .619), died at Folkestone March 1 1912.

His son, GEORGE GROSSMITH (1874–), British comedian, d third of the name, who made his first appearance at the aftesbury Theatre in an operetta by his father, became a well- own figure in musical comedy, especially at the Gaiety Thea- London. He was the author, or part author, of many musical ys, songs and revues, and took a leading part in popularising ue in London. Together with Edward Laurillard he became see and manager of several London theatres. During the rld War he served as lieutenant in the R.N.V.R.

GRUNDY, SYDNEY (1848–1914), British dramatist (*see* 12.640), d in London July 4 1914. His last play, *A Fearful Joy*, was blished in 1908.

GUAM (*see* 12.648).—American naval station in the North cific, the largest of the Marianas Islands. The native popu- ion. 60% of which lives in the chief town, Agaña, was 14,912 June 30 1923, and 15,160 on June 30 1924. On the latter date ere were also living on the island 550 non-natives, besides the rsonnel of the naval establishment amounting to 814. With non natives are included the families which are the result marriages with native women.

Production.—Agriculture is the chief occupation, and the Government is making efforts to develop this, so that the island may be more nearly self-supporting and have a larger surplus for export. Copra is the chief crop and about the only export, the normal crop being about 800 tons. In 1923–4 the first coconut-oil mill in the island was erected. Maize and other foodstuffs grow readily. A good grade of coffee is produced, and excellent tobacco can be grown. Fish are plentiful in the waters surrounding the island, but the fishing industry has never been developed to its full capacity, and fish foods are imported.

Education.—Education is compulsory up to the age of 12. In 1923–4 there were 16 primary schools, one intermediate school, one high school and one school for Americans, besides two private schools. Pupils attending the schools were 2,833, of whom 2,676 were in the public schools. The number of American teachers increased from 4 in 1922–3 to 14 in 1923–4. Teaching is in English. Athletics are a recognised part of the curriculum, and baseball is played enthusiastically throughout the island. About 40% of the public receipts are expended on education.

Finance and Trade.—The revenues for the fiscal year 1923–4 amounted to $137,805, and expenditures to $152,781. Revenues for 1923–4 included land taxes, about $42,000; licences, about $15,300; court fees and fines, about $10,650; customs and revenue collections over $9,000 (approximately $6,657 being customs collections); and productive industries, about $27,600. The Government is also collector of customs and revenues. The balance of trade is heavily against Guam. Imports and exports in 1923 were valued at approximately $674,556 and $94,086, respectively, and in 1924 at approximately $632,721 and $66,095 respectively. In 1923 1,432,568 lb. of copra were exported to the United States, and in 1924 2,110,000 pounds. The heaviest import is of food supplies, amounting in 1924 to over $245,000. The only banking institution is the Bank of Guam which was established by the Naval Govt. in 1915, for general banking business and as a depository of the Naval Govt. of Guam. It has a capital stock of $15,000 fully paid up. On June 30 1924 its surplus amounted to $29,000.

Administration.—The administration is directly under the Department of the Navy, and the Governor is a naval officer with the rank of captain who is appointed by the Secretary of the Navy. The Governor has full power and authority to make laws for the government of the island, from which there is no appeal. He is assisted by a native Congress which has only advisory power. The Guam Congress on July 1 1925 resolved that the Congress of the United States be petitioned to enact a law making all native Chamorros of Guam citizens of the United States, or that Congress grant them the privilege of becoming citizens of the United States by naturalisation. The cadastral survey is proceeding rapidly and new roads are being constructed. The Dollar Line has established a regular service to Guam, and there are regular sailings to Manila and Japan. Recent public improvements are a new post-office in Agaña, the capital, school buildings and a number of roads.

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(J. A. Ro.)

GUARANTEES: *see* SANCTIONS AND GUARANTEES.

GUARDIANS, BOARD OF: *see* POOR LAW.

GUATEMALA (*see* 12.661).—A republic of Central America and a member of the League of Nations. Its estimated area is 48,250 square miles. The capital, Guatemala City, was completely destroyed by earthquake between Jan. 25 1917 and Jan. 24 1918.

I. POLITICAL HISTORY

Guatemala was little affected by the World War, but on April 27 1917 she broke off diplomatic relations with the German Govt., and on April 23 1918 adopted "the same belligerent attitude as the United States." Guatemala was one of the signatories to the Treaty of Versailles June 28 1919. In 1915 Manuel Estrada Cabrera, who had been dictator since 1898, was re-elected for the term 1917–23. In 1920, however, a group of intellectuals known as the Unionist party opened a newspaper campaign against him, which developed into a revolutionary movement and spread to the National Assembly. When the army became infected Cabrera resigned (April 1920) in favour of the vice-president, Carlos Herrera, who was elected President by the National Assembly. His Government was promptly recognised by the Powers. Herrera, who had wide experience of agriculture, banking and commerce, aimed at encouraging foreign capital, stimulating immigration and internal development. He worked energetically to repair the damage caused by the earthquake of 1917–8, and erected many valuable public buildings. On Oct. 10 1921, after prolonged preliminary negotiations, Guatemala, Honduras and Salvador signed a pact of union at San José, agreeing to form a Central American Union. (*See* CENTRAL AMERICAN UNION.)

Each state, for the time, was to conduct its own internal affairs; but the signatory states were to constitute a unit on foreign affairs and for matters of common interest. Costa Rica and Nicaragua failed to enter the Union. On Dec. 7 1921 the Opposition overthrew Herrera, leader of the Unionist party which was favourable to the Union, and Gen. Orellana, leader of a military faction, was elected President in March 1922 for a term of six years. A revolt against him in July was put down with bloodshed. Pres. Orellana repudiated the Pact signed on Aug. 20 1922 by Nicaragua, Honduras and Salvador (*see* CENTRAL AMERICAN UNION) on the ground of avoiding "entangling alliances." His Government was represented, nevertheless, at the Washington Conference of 1922–3 and signed the conventions there agreed upon. In June 1924 it was the first Central American republic to adopt the international commissions of inquiry provided for by the Washington Conference. The National Assembly ratified the general Treaty of Peace and Amity there drawn up.

In Aug. 1924 Guatemala reached an agreement with the United States, according mutual most-favoured-nation treatment in customs, and in Nov. effected a commercial treaty with Germany on the same principle. By a decree of April 28 1925 all foreign companies domiciled in Guatemala must appoint a representative for legal and non-legal transactions. In April 1925, also, women obtained independent legal personality. Under the 1923 general Treaty of Peace and Amity, Guatemala agreed to limit its armed forces for a period of five years to 5,200, and moreover to restrict aircraft to 10 aeroplanes and to maintain no navy.

Education.—Primary education is free and compulsory between the ages of 6 and 14. In 1917 there were 1,942 government schools, with 54,479 pupils in attendance. After the destruction of Guatemala City by earthquake in 1917–8 education suffered a check until 1924, when it received special attention. In 1924 there were 1,477 Government schools, and a number of private secondary, professional, normal and vocational schools, as well as four schools of commerce. There were 94,177 pupils in attendance and 4,284 teachers.

II. SOCIAL AND ECONOMIC CONDITIONS

The census of 1920 gave a population of 2,004,900, and the estimates for 1923 were 2,454,000. About 60% of the population are pure Indians. In Oct. 1924 a contract was authorised for the admission of one hundred Czechoslovak farmer families, for whom were assigned 4,500 hectares of undeveloped lands. Dwellings, medical attendance, schools and hospital service were included in the contract.

Finance.—A new monetary system was introduced in Nov. 1924, with the quetzal (equal to the dollar) of 1·504665 grammes of pure gold as the unit, having a value of sixty pesos. It was to be coined in 5, 10 and 20 quetzal denominations, with subsidiary silver and copper coins. The silver peso in Oct. 1924 was worth $.5376, although only unconvertible paper currency was then in circulation. Provision has been made since Feb. 1925 for a circulation reserve fund, by a tax of an added 50 cents a quintal on coffee and a graded tax of 20 to 30 cents on sugar exports.

The Government budget for the years 1921–4 was (in pesos)

	Expenditures	Revenues
1921	387,365,234	256,261,970
1922	348,489,894	306,810,074
1923	396,121,964	385,874,260
1924	471,969,841	466,190,332

In 1924 revenue in quetzales was 8,101,686 and expendit 8,095,573. Current expenditure for 1921 deducting items requiring cash outlay, such as amortisation of the external deb transfer securities in London to the Council of Foreign Bondhold was actually only 324,049,887 pesos. Increase in 1922 revenues largely due to the high rate of foreign exchange and to collectio the export tax on coffee in gold.

The total debt Dec. 1922 was £1,908,563 constituted as follows $1,257,898, 11,923,401 silver pesos and 181,887,314 paper pe At the end of 1924 the external debt was considered as £1,875 and the internal debt £1,426,961. The total debt was then in dol 13,239,240.

Industry.—Exports mainly consist of coffee and sugar; cotton bananas are among the growing exports. The figures of the ye 1922–4 for the exports of coffee, sugar and bananas were:—

	Coffee (lb.)	Sugar (lb.)	Bananas (bunches)
1922 . .	94,000,000	24,000,000	3,884,170
1923 . .	96,000,000	27,000,000	4,384,077
1924 . .	89,000,000	18,000,000	5,547,531

The principal imports are cotton goods, flour and other foodstu The average wheat production is 400,000 bu., equivalent to 90, barrels of flour. Milling is not commercially developed. During year preceding May 1 1925 the cotton crop reached 30,000 quint a large increase in spite of poor crops in certain parts. Commer conditions in 1925 were excellent, due to high coffee prices. portation of automobiles and other luxuries was heavy. Imp duties for 1924 amounted to 19,921,316 pesos and $3,009,315, total of 3,341,336 quetzales. Exports produced revenues of 56, pesos and $1,435,492, or a total of 1,436,437 quetzales. A bank decree stabilising exchange aided merchants in the conduc business.

A contract for developing petroleum fields by a New company in the departments of Ezabal and Alta Verapaz was proved in Nov. 1924. Another contract provided for similar deve ment in Alta Verapaz, Quiché and Huehuetenango. Changes in mining and petroleum development law make the sole tax 10 cent on the gross product in two zones and eight per cent in others. Contracts endure 40 years; the geological surveys begin within six months from the date of the concession.

The foreign commerce for 1913 showed imports worth $10,062, and exports worth $14,450,000. For recent years the figures were

	1923	1922	1921
All countries			
Imports . . .	$10,840,781	$10,751,660	$13,369,6
Exports . . .	14,725,567	12,065,949	12,130,8
United Kingdom			
Imports . . .	1,665,643	1,599,131	2,289,0
Exports . . .	355,249	306,591	133,6
France			
Imports . . .	307,148	355,678	480,1
Exports . . .	24,694	17,977	11,9
Germany			
Imports . . .	1,302,267	1,199,910	1,240,3
Exports . . .	2,047,320	1,961,395	1,757,3
United States			
Imports . . .	6,519,630	6,644,449	8,177,4
Exports . . .	11,330,986	7,883,386	8,114,1

For 1924 the exports to the United States were $10,089,156, the imports $8,823,542.

Communications.—British interests in the International Railw Co., incorporated in 1912, and controlling 597 m. of railway, acquired by American capitalists in 1924. A branch is to be structed from the Mexican boundary and the Caribbean coast the Southern end of Salvador. A new line south to Asunción has been approved by the minister of promotion. A private building programme, initiated in 1924, provides for the buildin new roads from Guatemala City to San Jose; from Antiqua Panajachel, thence to Quezaltengo; and from Guatemala to Sa Ana in Salvador. The first of these will serve important coffee sugar export interests. Three wireless stations largely suppl telegraph lines, which are difficult to maintain in the tropical for They are at Quezaltenango, a gift from Mexico, Puerto Barrios at the capital.

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UCHKOV, ALEXANDER (1862–), Russian politician, born in Moscow. He studied at the universities of Moscow Berlin and, after leading an adventurous life of travel, en- d politics. He helped to found the Russian "Octobrist" ty in the hope that the Tsar's Govt. would work with the mod- te Liberals of the Zemstvo, while safeguarding the monarchical iciple. In 1910 Guchkov was elected president of the Duma, as Stolypin became more reactionary, the Octobrists lost ir standing ground, and Guchkov eventually resigned the sidentship of the Duma. In the elections to the fourth Duma failed to secure a seat. During the World War, however, he in charge of the Red Cross organisation on the German nt, and devoted his energies to refitting the army on the hnical side. When the March Revolution of 1917 broke out chkov became Minister of War, but he was powerless against mounting flood of desertion and demoralisation in the army, resigned in despair. Emigrating he found himself without per place and influence, and later took refuge in Paris, where pleaded for a reunion of all parties against the Bolsheviks.

UERRINI, OLINDO (1845–1916), Italian poet (*see* 12.672), l at Bologna Oct. 21 1916.

UESCHOFF, IVAN EVSTRATIEW (1849–1924), Bulgarian itician, was born at Philippopolis Feb. 1849. He was educated t at Philippopolis, and was then, in 1865, sent to Owens Col- e, Manchester, for four years. He remained at Manchester usiness with his father until 1872, when he returned to Bul- ia. In 1877 he was arrested by the Turkish governor and demned to death for political propaganda against Turkish , but was saved by the intervention of the British and Amer- n Consuls. He then began to send accounts of the Turkish ocities to *The Times* and *The Daily News* (London). In 1878 eschoff became general manager of the Bulgarian National nk at Sofia, and was Minister of Finance from 1894 to 1897. was elected president of the Sobranie (National Assembly) 1901 and became Prime Minister in 1911. As such, he con- ded defensive alliances with Serbia, Greece and Montenegro inst Turkey, and so paved the way for the Balkan victories 1912. After the London peace treaty, May 30 1913, Gueschoff igned with his Cabinet. During the World War he retired m politics and became president of the Bulgarian Red Cross. died at Sofia March 11 1924.

GUESDE, JULES BASILE (1845–1922), French socialist (*see* 672), died in Paris July 28 1922.

UIANA, BRITISH (*see* 12.676).—The sole British possession the continent of South America, has an area of 89,480 sq. es. The population of the colony at the end of 1924 was ,204.

ugar maintains its position as the principal export from tish Guiana; of the area under cultivation 57,000 ac. are ped. The value of the sugar exported in 1924, with its by- ducts—rum, molasses, molascuit—was approximately £2,- ,000. Between 1915 and 1924 machinery to the value of 500,000 sterling was imported for the equipment and improve- nt of the sugar factories. Exports of rice in 1924 were valued £65,120, an increase on the exports for 1923, which were ued at £57,018. The production of diamonds has increased ce 1913; in 1923 214,385 carats were exported, valued at 32,585. The output of gold has decreased; in 1924 the orts were valued at £19,600, as against 63,803 ounces exported 1914 and valued at £232,085. The value of bauxite exported 1924 was £176,200, and in the same year balata valued at 4,400 was exported. The chief imports are foodstuffs, manu- ured textiles and machinery. Under the British preferential ff imports from the United Kingdom, Canada and other British possessions have increased, while imports from the United States have decreased.

The forest area of 78,000 ac. contains many valuable woods—greenheart, which is produced only in British Guiana, and mora, both of which are suitable for shipbuilding and are resistent to marine borers, purpleheart and crabwood. 168,454 cu. ft. of timber, valued at £26,006, were exported in 1924. Difficulty of access has limited the exploitation of the mineral and timber wealth of the colony to the northern half. The development of the forest lands is being actively pursued by the newly-created Forestry Department, which began its work of locating fresh sources of supply of commercial timbers in Nov. 1925. British Guiana participated in the British Empire Exhibition in London 1924–5, and a resident trade commissioner has been appointed in London.

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GUIANA, DUTCH (*see* 12.680).—The only Dutch possession on the South American mainland, has almost doubled its population since 1910. Statistics obtained in 1925 gave the population as: Europeans, 1,422; natives, comprising Indians and bush negroes, 56,339; Javanese, 18,685; Hindus, 30,974; Chinese, 1,454. The population of the capital, Paramaribo, in 1925 was 44,772. In 1923 there were 35 public schools in the colony with 5,296 pupils in attendance, a Government normal school with 127 students, and 55 private schools attended by 9,481 pupils.

The shortage of labour that followed on the abolition of slavery in 1863, causing the reduction of the plantations from 500 to 5 sugar plantations and 66 for other products, created a labour problem that led to the introduction of Chinese, Javanese and Hindus as contract labourers. The chief products are sugar and coffee; next in importance come bananas, rice and cocoa. Cotton is produced on a small scale, and oranges and coconuts are grown by the crofters, many of whom were originally contract-labourers. The principal articles of export are sugar, coffee, bananas, cocoa, balata. Timber is furnished from the hinterland and gold is mined in many districts. Important deposits of bauxite are known to exist in the colony, but hitherto this mineral has not been worked on any large scale. The balance of trade is usually adverse, and the deficit is adjusted by an annual subvention paid by the Netherlands Government. During the four years 1922–5 the sum required for the state subvention has progressively decreased. Imports in 1924, mostly foodstuffs and manufactured articles, were valued at £624,704. Exports, consisting of agricultural and mineral products, besides timber and balata, were £617,453 during the same year.

See J. M. Brown, *The Dutch East* (1914); A. S. Walcott, *Java and Her Neighbours* (1914); also *Jaarcijfers voor het Koninkrijk der Nederlanden*, annual publication of the Colonial Office, The Hague. (J. C. K.)

GUIANA, FRENCH (*see* 12.681), has an area of about 32,000 sq. m. and a population (1921) of 44,202, including 2,368 Indians (natives). Some Indian tribes may have escaped enumeration, but in any case the colony is very sparsely inhabited. About 10% of the people are whites and another 10% negroes; the remainder are mostly of mixed blood and locally are called Creoles. Cayenne, the capital and chief port, had 10,146 inhabitants; St. Laurent du Maroni, 1,300. The colony is best known as a penal settlement and as including the Iles du Salut, one of these islands being the notorious Devil's Island. The 1921 census figures included 3,775 convicts.

The natural resources of the country remain very little developed. The chief industry is gold mining, the gold produced representing fully half the value of the exports. The mines are near the Dutch and Brazilian frontiers respectively. The forests contain valuable timbers. Rosewood is exported and there are factories for the extraction of rosewood essence. Balata is also obtained from the forests. Small quantities of coffee, cocoa and sugar figure in the exports, but labour is scarce and dear and only a very small portion of the land is cultivated. The adverse trade balance in 1921 was 25,000,743 francs. The cost of the penal settlement is borne by France. There are few roads and but 15 m. of railway. A seaplane service is maintained between Cayenne and St. Laurent and there is a wireless telegraph station. The colony is represented in the French Parliament by one deputy. See *Le Journal de la Société des Américanistes de Paris*, for articles on the history and explorations of the country.

GUILD SOCIALISM: *see* SOCIALISM.

GUILLAUMAT, MARIE LOUIS ADOLPHE (1863–), French soldier, was born at Bourgneuf, Charente Inférieure, Jan. 4 1863. He left the military school of St. Cyr in 1884, and became a captain in 1893. He served for three years in Tongking with the Foreign Legion, and during the Boxer rising in 1900 was in Tientsin where he received his first wound. In 1903 he was appointed professor of military history at St. Cyr and in 1908 lecturer on infantry tactics. After being director of infantry at the Ministry of War from 1911, he became *chef de cabinet* to the Minister of War, M. Messimy, in 1914. At the outset of the World War, Guillaumat, who had already taken part in 12 campaigns, commanded a division at the battle of the Marne and later in the Argonne. Subsequently, in command of the I. Army Corps, he took a notable part in the battle of Verdun and the Somme. In Dec. 1916 he was given the command of the II. Army in front of Verdun and directed the attack of Aug. 20 1917, which succeeded in freeing the position.

In Dec. 1917 he was sent to Salonika as commander-in-chief of the armies in the East (*see* SALONIKA CAMPAIGNS) but was recalled in July 1918 to take command of the entrenched camp at Paris in face of the enemy advance. He urged the launching of an offensive in Macedonia both at the Inter-Allied War Council at Versailles and before the British War Cabinet; and on Sept. 4 1918, at the London conference, his advice was adopted. In Oct. 1918 Gen. Guillaumat was given the command of the V. Army on the Aisne for the final advance. After the war he was president of the commission of inquiry into the surrender of the frontier fortresses and later was elected a member of the Conseil Supérieur de la Guerre. After being entrusted with a mission to Athens, where he drew up a plan for the reorganisation of the Greek army, he took command of the army of occupation in the Rhineland at the end of 1924.

GUILLAUME, CHARLES EDOUARD (1861–), French physicist, was born at Fleurier, Switzerland, Feb. 15 1861. Educated at Neuchâtel, he became a *docteur-ès-sciences*, and devoted himself to the study of practical physics. He is principally known for his invention of the metal, invar, an alloy of nickel and steel which, having a co-efficient of linear expansion of only ·0000008 for one degree Centigrade, is in general use as a material for standard measures and instruments of precision. In 1920 he was awarded the Nobel Prize for physics and he became director of the international bureau of weights and measures.

Guillaume's works include: *Traité pratique de la thermométrie de précision* (1889); *Les radiations nouvelles; Les rayons X, etc.* (1896); *Les applications des aciers au nickel* (1904); *Détermination du volume du kilogramme d'eau* (1910); *Compensation des horloges et des montres* (1921); *Les récents progrès du système métrique* (1907–21).

GUINEA, FRENCH (*see* 11.102). Revised estimates give the area as 90,000 sq. m. and the population (1925) as 2,000,000. There were 2,000 Europeans, of whom half were French. From the port of Konakri (population 9,000) a railway 411 m. long was completed in 1915 to Kankan, on the Upper Niger. Palm oil and kernels, ground nuts, rubber and hides are the chief exports. Since 1922 cotton has been grown in the Niger regions. Coffee and bananas are other crops.

GUISE, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

GUITRY, LUCIEN GERMAINE (1860–1925), French actor (*see* 12.705). In 1920 he came to London with his son Sacha, and achieved an immense success in *Pasteur*, when he played the title rôle. He also played in his son's play, *Mon père avait raison.* He died in Paris June 1 1925. Sacha Guitry's play, *Deburand*, had a successful run in New York and London.

GULLSTRAND, ALLVAR (1862–), Swedish physician,
born June 5 1862 at Landskrona. In 1894 he became professo
diseases of the eye at Uppsala and in 1913 was appointed
fessor of physiological and physical optics at the same univers
His investigations concerned the general laws of dioptrics, a
conception of the theory of optical images; the extrication of
optical images in the eye, and the eye's relation to the diffus
of light. In 1911 he was awarded the Nobel Prize for medic
Among Gullstrand's works are *Allgemeine Theorie der mono*
matischen Aberrationen (1900), *Die optische Abbildung in het*
genen Medien und die Dioptrik der Kristallinse des Mens
(1908) and *Einführung in die Methoden der Dioptrik des A*
des Menschen (1911). He received the honorary degree
Sc.D. at Dublin in 1912 and became honorary member of
Ophthalmological Society of the United Kingdom in 1916.

GUN: *see* ARTILLERY; ORDNANCE.

GUNNERY, NAVAL.—It is no easy matter to hit, and keep
hitting a moving target at sea, with a gun mounted upon an
stable platform that is also moving in relation to the tar
With a single gun firing, at short ranges, the gunlayer can fol
the path of his shot and see it strike the water or target, and
correct his sights so that the next shot will hit. With sev
guns firing, under battle conditions at even moderate ran
this becomes a sheer impossibility for anyone stationed at
guns. Hence the necessity for controlling the fire of the guns
ship from a central position remote from the guns themsel
The control officer is usually stationed high up in the ship wh
he is in a good position to spot the fall of the shot and has all
available information for estimating the hitting range and
communicating it to the guns. The gunlayers keep their g
continuously laid upon the target and the guns are fired at
command of the control officer.

Let us consider a simple case of a ship firing at a towed tar
at a range of about 10,000 yards. The range of the target is
tained by the rangefinder and certain corrections, which wil
explained later, are applied to the rangefinder range to obt
the estimated " gun range " which is passed to the guns. As
firing ship and the target are both moving, it is obvious that
range must be changing at a certain rate. This rate of chang
range is estimated and is applied to the gunsights at set inter
The deflection is estimated by the control officer and is appl
to the sights. The control officer then fires a salvo of two or m
guns and watches the fall of the shot. He makes a spotting
rection in range and deflection, calculated to get the next sa
to fall, if possible, upon the other side of the target to the
one. If this happens he halves his original spotting correct
applies it in the opposite direction and fires again. This t
salvo should fall very close to the target, if it does not hit,
if the rate of change of range has been estimated correctly,
sequent salvoes will, theoretically, continue to hit. This is a
simple case of a bracket system, which is used in one form
another by all control officers.

Corrections.—The corrections which must be applied to
range observed by the rangefinders in order to obtain the hit
or gun range are due to (1) the variations in muzzle velo
caused by the wear of the guns, (2) the change in muzzle velo
due to changes in the temperature of the charges, (3) the di
tion and force of the wind and (4) the height of the barom
and thermometer. The first two are usually applied as a cor
tion upon the sights of each individual gun and remain more
less constant for any one day. The last two factors are varia
from hour to hour and are applied as a direct correction to
rangefinder readings. The rate at which the range is changing
variable factor since it depends upon the relative bearing betw
the two ships, which is constantly changing. The same appl
in a lesser degree, to the deflection, and constant corrections
necessary in both rate and deflection to maintain hitting a
it is once established.

Increase of Range.—Thus there are many problems to
solved, even in the simple case of firing at a target at 10,
yards. Battle ranges have now been extended up to 20,000
or more, and as the range is increased the problems with wh

control officer is faced become much more complicated. At ges which approach the limits of visibility the observation of fall of shot becomes extremely difficult, and it is practically ossible to tell whether shot are falling over or short, unless are falling directly in line with the target. As the range eases errors caused by the roll, yaw and pitch of the ship, h at moderate ranges are not so serious, become accentuated have to be taken into account.

rial and Error Process.—The trajectory of the shell reaches ry high altitude and the wind and atmospheric conditions he upper air cannot be known with sufficient accuracy to en- a correct forecast to be made of the effect upon projectiles. effects of the variations in muzzle velocity, due to the wear he guns, to changes in the temperature of charges and to r more obscure causes, become more pronounced. Range ob- ation, even with the most perfect instruments and with the trained observers, becomes unreliable when the visibility is r and the errors in the rangefinders themselves become ter as the range increases. It thus becomes a matter of great culty to make an accurate forecast of the initial gun range deflection. It has become the practice to obtain the hitting ge by a process of "trial and error," employing a large bracket em and using the gun as its own rangefinder, obtaining what stance is possible, under prevailing conditions, from the in- ments of observation. This can be done as long as the fall hot can be observed, but becomes impossible as soon as this dition ceases to exist. The use of aircraft to assist the spot- officer, or to carry out the whole of the observation of fire at eme ranges, naturally suggests itself, and it is in this direc- , followed by the possible introduction of some form of irect fire, that future developments may be expected.

THE MECHANISM OF FIRE CONTROL

he installation used for the control of fire was intricate in years before 1914, and War experience has made the addition urther complications necessary. Little can be said of the de- s of the various instruments used, as the majority of them are fidential, and the functions, and even the existence, of some hem are kept as secret as possible. The main problems are the e for all and may be divided into three parts:—

1) The communications between the control stations and guns.

2) The apparatus for obtaining the hitting range and de- tion and for keeping them both correct.

3) The arrangements for firing the guns and for observing the of shot.

ommunications.—The positions between which communication st be maintained are the observing positions aloft, the principal trol position, usually in the vicinity of the conning tower, the nsmitting station and the turrets or other gun positions. Com- nications must be rapid and sure, as most of the information sent nly of value at the moment of transmission and loses its signifi- ce if any delay occurs. Hence several lines usually exist between ortant stations, any one of which can be used in the event of akdown of the others. All lines of communication are usually con- trated from outlying stations into the transmitting station. This ion is situated in the centre of the ship, well below the armoured k in the quietest position that can be selected and is the centre he whole control organisation.

oice-pipes are used to a great extent between stations that are manently manned and that are moderately close together. To be ient a voice-pipe must be as straight as possible, and there are l-defined limits of length for each diameter of pipe beyond which acoustic properties are lost. Voice-pipes are difficult to make ertight and gastight.

he telephone is used between all stations, often in addition to the e-pipe. There is usually a telephone exchange, in or near the nsmitting station, solely for the use of the fire control organisation quite independent of the general telephone system of the ship. telephone transmitters and receivers are of many patterns and specially designed for use by operators who have other duties to orm, or who have to use the instruments in positions which are osed to the weather. Electro-mechanical transmitters and re- ers are used for passing ranges, deflection, bearing, orders and er information of a standard character between the control itions and the guns. There are several different patterns of these ruments, those most commonly used in all navies being the Barr troud "step-by-step," and the Vickers "counter" types.

Frequently one transmitter is arranged to work a number of receivers in outlying stations. A development of these instruments is found in the "follow the pointer" method, which is commonly used for sending ranges from the transmitting station to the guns. The transmitter takes the form of a sight dial upon which the range is set by moving a pointer to the required setting. The motion of the pointer is transmitted electrically to pointers upon the gunsights. A mechanical pointer, geared to the mechanism which works the gunsight, is kept in line with the electric pointer by the sightsetter, and the sight is thus kept set without the sightsetter having to watch the movements of a separate instrument. The large clock-faced dials and other similar arrangements which are often seen about the upper works of warships are used for communicating the range and deflection in use to consorts who may be firing at the same target. Their place will doubtless be taken in the future by wireless telegraphy or telephony.

Rangefinding and Rangekeeping.—In the transmitting station are situated the majority of the calculating instruments, and to this position are passed the results of all observations of range, bearing, course of enemy, fall of shot, etc. Also all orders from the chief control officer to the guns are passed through the transmitting station. As a rule the control officer is in direct communication with the officer in charge of the transmitting station by means of a large, direct voice-pipe. The functions of the majority of the instruments in the transmitting station and their details are naturally confidential. Broadly they consist of arrangements for deducing the course and speed of the enemy from such data as may be available, and for calculating from this the rate of change of range and deflection that should be applied to the gunsights. In the British service the Dreyer calculating table is in general use, and to this constant improvements are being made to meet the changed conditions brought about by the increasing range at which the guns are used. The details of this calculating table are secret, but there are other patented apparatus, notably the Argo and the Ford, which aim at achieving the same results. Apart from the calculating apparatus, some form of which is in use in all navies, there are a certain number of instruments which are generally employed.

Rangefinders.—The rangefinder most commonly used by all navies, and which forms the equipment of the British fleet is the Barr & Stroud coincidence instrument. In a capital ship there are at least six large rangefinders, mounted in various positions, and the number and size of the instruments are reduced proportionately in smaller ships. The observations of each instrument are transmitted electrically to the transmitting station, where apparatus exists for obtaining rapidly a mean of all the observations, thus giving what is called the "mean rangefinder range." To this are applied corrections for the density of the air, the effect of wind, the temperature of the charges, the nature of the projectile, the change of range during the flight of the projectile and for several other variables. The result is the gun range which is passed to the guns.

Change of Range Calculators.—To obtain the rate at which the range is changing at any moment involves the solution of two triangles, the functions of which are the course and speed of the firing ship, and the bearing, course and speed of the target ship. The first two of these are known, the third is easily observed, but the other two can only be obtained by calculation, or judged approximately by observation. There are several types of calculators for this purpose, but that used in the British service is the Dumaresque in which the elements are set graphically, and the resulting rate of change of range corresponding to the settings is read off in "yards per minute" which is what is required. The speed of the target ship must always be guessed in the first instance, but instruments known as inclinometers are being experimented with, whereby the angle between the course of the target ship and the line of fire can be observed with fair accuracy at any moment. The course of the target ship is thus obtained.

Range Clocks.—Some type of clock, which can be set to run at the rate at which the range is changing is used in all navies. In the British service the Vickers clock is used. This consists of a powerful clockwork escapement, driving a large pointer around a clock face, the perimeter of which is graduated in yards. A method of altering the speed of the pointer is fitted, so that it can be made to move at speeds of 0 to 2,000 yd. per min. in either direction. Arrangements are made for large corrections in range to be put on the perimeter of the clock without interfering with the motion of the pointer, so that the clock can always be run at the gun range that it is desired to transmit to the guns. There are many other uses to which it can be applied.

Deflection Calculators.—It is a difficult matter to obtain the correct deflection for hitting a target at long range. There are many types of deflection calculators, wherewith, by using the data available in the transmitting room, an approximation to the theoretical deflection can be obtained. All these instruments, however, have their limitations, because, although the allowance can be made for the wind at the firing ship, at long range the wind effect at the target may be entirely different. Also the direction of the wind in the upper air, through which the trajectory of the projectile passes, is an unknown factor. The practice is to calculate the proper setting as near as possible and to correct it by observation of fall of shot. Deflection is of the greatest importance in ranging, for at long ranges, unless the shot fall in line with the target, it is impossible to tell whether they are short or over.

Bearing Indicators.—These instruments are mounted in the control positions, and consist of a bearing plate, mounted with the zero in the fore and aft line of the ship. A telescope or binocular is suitably mounted and the bearing of any object, with reference to the ships fore and aft line, can be readily observed. In the Evershed type used in the British Navy, the bearings are transmitted electrically to the guns and to the transmitting station. This forms a ready method of indicating the correct target to the guns, and from the observations the rate at which the bearing is changing can be obtained.

Observing and Firing the Guns

Before the range at which heavy guns are used at sea became so extended, a single gun was used for ranging, before opening fire with the whole broadside. The differences between the ranging of individual guns, due to wear and a variety of other causes, become accentuated at long ranges, and no two guns can be built that will always shoot precisely the same.

This leads to a "pattern," or spread, resulting when a number of guns of the same size are fired at the same elevation. Apart from this, in practice the errors in laying of the individual gunlayers have to be taken into account. The "spread of the salvo," as it is called, can be reduced by making careful adjustments, but it can never be eliminated entirely, even if there are no errors in laying the guns. The spread can, however, be made an approximately constant quantity, by careful adjustments and training of the personnel, and this quantity is known to the control officer of each individual ship. To base the corrections for the broadside upon the result of the fall of a shot from a single gun is obviously liable to lead to large errors, and at extreme ranges the splash of a single shot is extremely difficult to see.

It is now the general practice to range with a salvo of several guns, usually half the broadside, and to continue firing alternate salvoes of an equal number of guns. The object of the control officer, knowing the approximate spread of his salvoes, is to give such corrections, using some form of bracket system, as will bring the mean point of impact of the salvo on to the target. This is termed a straddle—that is, some shots short and some over, and when this is achieved, the control officer knows that he is obtaining the maximum hitting effect from the armament that he is controlling.

Director Firing.—Practically all navies have now adopted some form of master sight or director, whereby all guns can be fired by a single layer. This system of firing has many advantages, chief amongst which are the elimination of smoke interference between the guns; the reduction in personal errors in laying; and the fact that it is far easier to spot the fall of a salvo that falls "all together" instead of being spread out over an irregular time interval.

In the British Navy the director installation invented by Adml. Sir P. Scott is used. This consists of a director sight mounted aloft, or in a director tower well separated from the guns themselves. The sight is similar to a gunsight and is carried in a mounting which can be trained and elevated in the same way as a gun mounting. The motion of the director mounting is transmitted electrically to training and elevation receivers at the guns. On these receivers are mechanical pointers geared to the training and elevating gear of the turret or gun. The gun is moved in training and elevation so that the mechanical pointers are kept in line with the electric ones worked by the director mounting. The guns thus follow the motions of the director or master sight and are laid at the desired elevation and training. The gun range and deflection are set upon the director sight, and the director telescope is laid upon the target in the same manner as a gunsight. The firing circuits of all guns are brought to a single trigger at the director sight, so that all guns can be fired simultaneously by the director layer.

This brief description indicates the principle upon which the director is worked, but in actual practice there are many complications. Corrections have to be made for the relative positions and levels of the different gun mountings and the director sight and for many other matters. The installation is intricate, but has stood the test of prolonged war service and the results achieved by it have been invaluable. In capital ships there are, as a rule, two director sights, one mounted aloft and one just above the level of the guns, which can be used alternatively for the main armament. A director is also fitted for use with the secondary armament. Light cruisers are fitted with directors for th main armament, and a modified form is used in destroyers.

Squadron Control.—In the foregoing, the control of the fire the guns of a single ship has been dealt with, but under mod battle conditions, it often happens that one or more ships engage the same target. When this occurs, unless there is so pre-arranged organisation between the firing ships, confus will occur owing to the spotting officer taking the fall of anot ship's salvoes for his own. Therefore a pair of ships firing at same target generally fire a salvo or pair of salvoes alterna each waiting upon the other and correcting the gun range by fall of the other's salvoes. This necessitates an intimate int communication between the two control officers, which is possi by wireless telegraphy.

A squadron of four ships may fire together at the same targ the fire being controlled by the control officer of the leader, orders the gun range at which each ship shall fire, after receiv the result of observations as to fall of shot from his own the firing ship's spotting officers, and possibly from the air. I case such as this, the object of the squadron control office the same as that of the control officer of a single ship, that is bring the mean point of impact of the shell from the armam he is controlling as near the target as possible, for then o can he be sure that he is getting the maximum hitting effect. view of the extreme ranges at which future actions at sea will fought, it appears certain that fire tactics will tend to develo the direction of concentrated fire by pairs of ships or by squ rons, aided by observation from the air. The perfecting of intricate organisation of the fire control of any ship is the m important item in making her an efficient fighting unit requires arduous and painstaking exercise lasting over ma months. (*See* ORDNANCE.) (S. H. W.

GUNPOWDER: *see* EXPLOSIVES.

GWALIOR, MAHDO RAO SINDHIA, MAHARAJA OF (18 1925), was born Oct. 20 1876, and succeeded his father, Jayaji Rao Sindhia, in 1886 (*see* 12.748). He threw him with the utmost keenness into the supervision of every detai state management, endowing Gwalior with an excellent system light railways, carrying out irrigation projects, husbanding revenues and raising the standards of administration by unc ing vigilance. In the World War his two regiments and trans corps fought with distinction in France, East Africa, Egy Palestine and Mesopotamia. A boundless and inventive g erosity found scope in his constant presentation of munition war and princely donations to various relief funds. He took main part in purchasing, equipping and maintaining the hosp ship "Loyalty," which carried 15,000 war patients; and provi a convalescent home at Nairobi in East Africa—to mention c a few of his gifts. A lieutenant-general in the British Army was Hon. A.D.C. to King George V., and the bearer of sev Grand Crosses; his permanent dynastic salute was raised to maximum of 21 guns, and Oxford and Cambridge confe honorary degrees upon him. King George V. also honoured by becoming sponsor to his heir, George Jivaji Rao (b. 19 The Maharaja went to Europe in the spring of 1925, partly recuperate his impaired health, but died in Paris on June 5.

GYMNASTICS (*see* 12.752).—This form of athletic sports changed little since 1910. The undoubted influence of the revi Olympic Games upon the modern development of athletic sp and exercises has not greatly affected gymnastics, perhaps cause of the already high state of efficiency reached prior to revival. The International Gymnastic Federation, which but one affiliated nation outside Europe, *i.e.*, the United Sta was founded in 1881, and 20th-century efforts have tended rat to consolidation and perfection than to extension and progr One important feature was the foundation, in 1923, of an In national Federation for the promotion of the educative, ins of the executive, branch of the art. Both federations have t British affiliations, that to the Fédération Internationale Gymnastique being the Amateur Gymnastic Ass'n and tha the Fédération Internationale de Gymnastique Educative b the Ling Association.

'he enormous development of athletic sports throughout most he European countries has not caused gymnastics to suffer; great festivals at Nuremberg, Leipzig, Frankfort and in den, France and Switzerland continue to attract thousands gymnasts. On the continent of Europe the movement is ional: in Great Britain, and to a lesser extent in the United tes, interest in gymnastics is individual. The repetitive char- er, the absence of the competitive spirit, perhaps also the ective discipline so necessary, appear to have too little in mon with the Anglo-Saxon character for gymnastics ever rouse the enthusiasm which prevails in the European coun- s. The inclusion of gymnastic competitions at the Olympic nes has not appreciably affected the situation. (*See* ATH- ICS; OLYMPIC GAMES.) (P. Lo.)

YNAECOLOGY: *see* WOMEN, DISEASES OF.

YROSCOPE (*see* 12.769).— This instrument has rapidly be- ie of technical and commercial importance after having been irded as little more than a toy or means for use in demon- iting the dynamics of solid bodies. The developments in its struction and application, since torpedoes, submarines and oplanes came into extensive use, have been numerous. In- tive efforts in connection with it were greatest about the r 1920. From a commercial standpoint, the successful appli- ion of the gyroscope in the arts has led to the establishment of oortant industries turning out gyroscopic appliances with ors weighing up to about 90 tons.

mprovements in Construction.—Since 1910 many improvements e been made in the construction of the gyroscope and its modifica- ı, the gyrostat, independently of accessories for rendering them ful in the arts. Messrs. Gray and Burnside's gyrostat, designed efly for experimental purposes, is essentially a direct current tric motor, the rotor of which, in the form of a Gramme ring ıred between the peripheral parts of two magnalium disks, serves he wheel or rotor of the gyrostat. The field magnet and brush r are within the space between the disks, and the commutator is ıred to the inner side of one of the disks. The rotor, made up of heavy ring, the very light disks and the commutator, is mounted ı stationary shaft and may be driven at a speed of 25,000 revolu- ıs per minute. Enclosed in a magnalium casing, the whole forms ompact, portable apparatus.

n Rutt's gyroscope, the relative arrangements of the parts is ersed, so as to leave the rim of the rotor entirely free, the rotor ng mounted adjustably on a central gimbal carried by a rotary ft.

t is important that the rotor of a gyroscope should be mounted in urately adjusted bearings, especially when the rotor is spun at a h velocity. In order to satisfy this requirement, when ball bear- s are used, Messrs. Griffin and Sons, Ltd., mount the rotor on a ular spindle encircling a screwed rod secured within the Cardan g carrying the rotor; the ends of the spindle rotate against ball rings held in correct position by adjustable sleeves on the rod. e spindle and rod are concentric but do not touch each other. e rotors of many gyros are rotated in a partial vacuum to reduce tional resistance. In order to minimize the resistance and at the ne time keep the interior of the gyro casing cool, Messrs. Anschütz, ır Kiel, circulate hydrogen, helium or other light gas through the ing.

Gyrostatic Horizon.—On ships, aeroplanes, etc., where the use a mercury bath for obtaining an artificial horizon is often im- acticable, one of the methods adopted is to employ a gyrostat th its spinning axis vertical and carrying a plane reflector at ht angles to that axis. This, the first practical use of the gyro, s introduced by M. Serson in 1774.

ince 1910, several forms of this type of apparatus have been signed. Fig. 1 shows the main features of the gyrostatic horizon Messrs. Anschütz & Co. A box *a* is mounted on knife edges by a pension differing from the ordinary Cardan in that the horizontal e joining the knife edges *b*, which directly supports the box, is ow that joining the knife edges which support the outer ring, both es being higher than the centre of gravity of the box and its achments. Within the box is the rotor *c* supported by ball bear- s *d*, *e* and rotated by any suitable motor. A rotary ring *f* carries adjustable weight *g*, by means of which the centre of gravity of whole is moved out of the gyroscopic axis so that this axis is con- ained to precess in such a way as to compensate for the effects of earth's rotation; by means of a scale, graduated in degrees of itude, the weight can be adjusted correctly. An annular vessel containing mercury or oil, and formed with perforated partitions, employed for damping precessional movements of the gyro.

Gyro-compass.—This instrument of precision is used in the rious navies of the world, and in the mercantile marine; it is used extensively in submarines, for which the magnetic compass is unsuitable. A gyro-wheel, mounted to rotate rapidly about an axis free to turn in any direction, but provided with a form of gravity control, limiting its tilting movement, tends to set itself so that its axis points in the direction of the true north. This represents the working of the principle on which the construction of the gyro-compass depends. The many forms of gyro-compass which have been patented differ mainly in the construction of their gravity control.

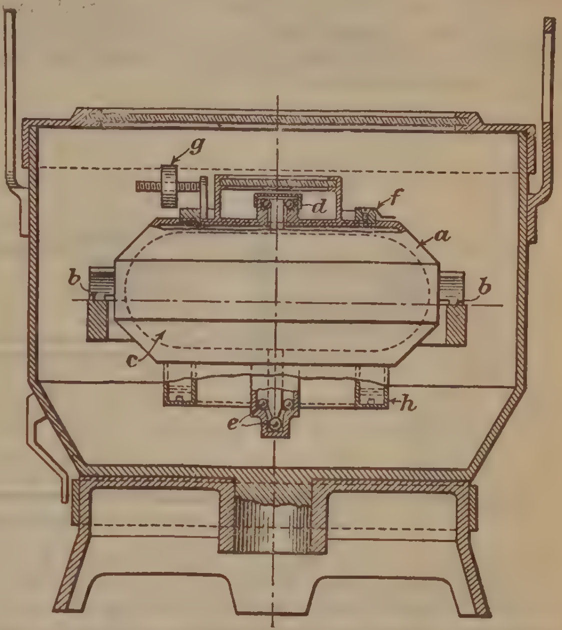

FIG. 1. Diagram showing the main features of the gyrostatic horizon of Messrs. Anschütz & Co.

In 1852 Foucault used a gyro apparatus to demonstrate the earth's rotation; this was the first practical step towards the production of the gyro-compass. A form of gyro-compass, constructed by Sir W. Thomson (afterwards Lord Kelvin) was exhibited in 1884. In the early part of this century the increasing use of submarines demanded the provision of a compass unaffected by magnetic conditions, and Dr. Anschütz invented a gyro-compass in which the rotor and its casing were mounted in a support floating in mercury, thus limiting movement about a horizontal axis. This compass was unreliable when the ship was rolling, and, to overcome this defect, Messrs. Anschütz & Co. introduced, in 1912, an apparatus comprising three gyros, two of which eliminated errors due to rolling. This apparatus was used in the German navy.

In the gyro-compass of The Sperry Gyroscope Co., of New York (British patent specifications, Nos. 15669 of 1911 and 135500), the gyro-wheel casing is supported by a suspended wire, any twist of which caused during the working of the compass is taken out by a follow-up mechanism of special construction. The Sperry Co.'s compass was adopted for use in the British and Allied navies, and was improved by Messrs. Harrison and Rawlings, who introduced a mercury control attachment (British patent specification, No. 131987).

The suspension of the vertical axis in the Brown gyro-compass (British patent specification, No. 124529) is provided by a pulsating column of oil under great pressure. In Henderson's gyro-compass (British patent specification, No. 166570) the gyroscope has its centre of gravity and that of its gravity-control apparatus at its centre of suspension, and relative motion between the gyro and gravity control is arranged to produce a controlling couple.

Gyro-apparatus for Stabilising Wheeled Vehicles.—About the year 1905, Mr. L. Brennan, of Gillingham, introduced his monorail car, in one form of which he employed two gyrostats rotating in opposite directions and mounted in a horizontally pivoted frame. The gyrostats were geared together so as to rotate in opposite directions; one was provided with means for automatically accelerating the precession when the car swayed to one side, thus effecting stabilisation, in accordance with Lord Kelvin's rule that acceleration of the precession causes the gyro to rise against gravity. In 1909, Mr. Brennan introduced powerful mechanism to control the precessional movements or to alter the position of the centre of gravity of the car, *e.g.*, by sliding the car body on the under-carriage.

The car was generally unreliable when running rapidly round sharp curves, and its gyro bearings were liable to overheating. Several of the cars were exhibited at different times; a large one was run at the Brennan factory, on Nov. 10 1909. This car had two bogies, each with two double-flanged wheels. The rotors, 15 cwt. each, were rotated at a speed of 3,000 r.p.m.; the gyros were encased and in a partial vacuum. At a speed of about 7 m. an hour, the car travelled satisfactorily on a curved track and could travel on gradients up to 1 in 13.

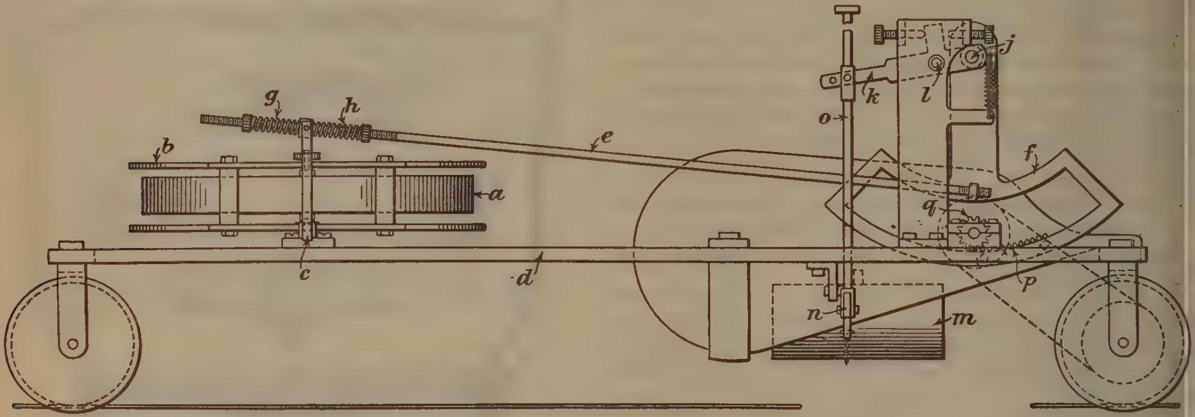

FIG. 2.—Diagram showing principal parts of P. Schilowsky's Auto-car.

The monorail car of R. Scherl, of Dresden, had one or more gyrostats with their rotors on vertical axes and mounted so as to be in unstable equilibrium and positively connected to the car at every moment. Scherl's car was not successful, difficulties having been experienced on inclines and when running round curves to right and left.

In the auto-car of P. Schilowsky, described in British patent specifications, Nos. 12021 of 1909 and 941 of 1914, the gyrostat, like Scherl's, is unstable. Fig. 2 shows diagrammatically the principal parts of the car. The rotor *a* is mounted in a frame *b* supported by pivots c^1, one at each side of the car frame *d*. A rod *e* connects the gyro to a quadrant *f*; this rod is encircled by adjustable springs *g*, h^1, to obtain a yielding connection. The quadrant *f* is suspended at j^2 from a lever *k*, fulcrummed at l^1 and caused to oscillate by the action of a pendulum *m*; the pendulum is pivoted to the car frame and presses against a cord which extends from a fixed part of the frame over a pulley and then beneath the pendulum, on its way to one arm of a bell-crank lever *n*; this is connected to a rod *o*, which rocks the lever *k*.

When the pendulum presses against the cord, as a result of the tilting of the car to one side, the quadrant *f* is lifted and a rack p^1 on the quadrant engages with a rotating pinion q^1; consequently, pressure is applied by the rod *e* to the gyro mounting with the result that its oscillations are annulled and the car brought into an upright position. Although only one pendulum is shown in fig. 2, the auto-car had two pendulums to enable the car to reverse and take curves to right and left. The inventor, in 1914, made trial runs in cars of this type and met with much success. Claiming that a monorail system of transport would be quicker and cheaper than the existing systems, Messrs. Scherl and Schilowsky, at different times, have considered plans for laying down extensive networks of lines, especially in Germany, but nothing seems to have been done.

Dr. J. G. Gray, of Glasgow University, has designed a two-wheel car controlled gyroscopically. This car has a front and a rear compartment, each running on a wheel and connected together by a vertical swivel-joint. The front compartment carries a gyrostat mounted in fixed lateral bearings and the rotor is spun in the vertical plane containing the wheel base. A motor for driving the car is installed in the rear compartment. A car of this kind was shown at a meeting of the Inst. of Civil Engineers, on June 17 1925. The car was driven forwards and the gyro rotor was spinning clockwise as seen from the left-hand side of the car, but when the car swayed to one side the two compartments were thrown out of line. Then, in consequence of the propulsion by the rear compartment, an acceleration of the gyroscopic precession was effected and the car was brought back to the upright position.

Gyroscopic Apparatus for Stabilising Ships.—The earliest u
of the gyro principle for stabilising ships was made by E.
Schlick, of Hamburg, in 1903. He mounted a number of gy
stats in the ship and used, for eliminating precessional motio
a braking-mechanism exerting a constant pressure on the gy
mountings. His invention was improved by Messrs. Swa
Hunter and Wigham-Richardson by using spring-controlled
floating bearings for the gyro frames and regulating the braki
effect in accordance with the degree of rolling of the ship.

The gyroscopic apparatus of E. A. Sperry and The Sper
Gyroscope Co., of New York, is of an active kind, for its acti
is not limited by the rolling of the ship but may itself impart
the ship a rolling motion so that the ship may be listed and he
up to the full strength of the gyro apparatus installed. Co
trolled in this way, the ship may be extricated from a diffic
position, may be used as an ice-breaker or, as set out in Briti
patent specification, No. 149439, a rolling motion of predete
mined magnitude may be maintained in a warship while her gu
are being fired.

The important elements of a Sperry stabiliser are the main gy
the small control gyro, the precession engine and the system
electric circuits. The main gyro may have its spinning axis verti
and is so mounted that a precession can be imparted to it by mea
of a circular rack which engages with a pinion of the precession e
gine. The control gyro, spinning on a horizontal axis, is so sensiti
that it precesses as soon as the ship begins to roll and effects t
closing of an electric contact which, by means of relay switch
operates the precession engine, thus bringing into action a power
stabilising couple. Next, the control gyro stops the precession eng
and is ready to deal with the next wave impulse.

Among the stabilisers built by The Sperry Gyroscope Co. is th
for the liner "Huron" of 18,000 tons displacement. A large bic
ical casing encloses the main gyro in a partial vacuum and the gy
wheel, made by bolting together two disks each 13 ft. diam., weig
about 100,000 pounds.

In the stabilising apparatus of Sir J. B. Henderson, of the Ro
Naval College, Greenwich, the velocity of the gyroscopic precessi
is controlled wholly by means of a single mechanism, which may
a continuously variable speed-gear of the variable-stroke pump ty
of the mechanical type or of the viscous resistance type. Fig
shows the mounting of a gyroscope and its hydraulic connectio
with the ship and fig. 4 a controlling means comprising a variab
stroke pump.

The rotor casing *a* is mounted on trunnions *b* in the Cardan ring
which is carried by trunnions *d* supported by standards *e*, bolted
the deck so that the trunnion axis *d* extends fore and aft. The rin
is connected by rods *f* to the buckets *g* of the single acting pum
h, *j*, which have suction valves *k* and spring-controlled delive
valves *l*; the suction pipes *m* and delivery pipes *n* may lead to t
sea far below the water line. When a wave strikes the ship, t
pressure in one of the pumps *h*, *j* increases at once and tends to fo
the gyro to roll with the ship. The hydraulic cylinders *o*, *p* of
precession-control apparatus are mounted on the ring *c* and th
plungers *q*, *r* are connected to a crank *s*, fixed to the trunnion *b*
the gyro case. In order to prevent the ship from rolling, the veloci
of the plungers *q*, *r* should be proportional to the difference of pr
sure in the cylinders *h*, *j* and the ratio between them must have
certain value. To effect this, the cylinders *o*, *p* are respectively co
nected by pipes *t*, *u* to the cylinder of a variable-stroke pump *v*, t

ton of which is connected to a spring-controlled piston *w*, working ı cylinder *x*; the ends of this cylinder communicate with the pumps nd *j* respectively, by means of pipes *y*, *z*.

n a gyro apparatus designed by the Tokio firm, Mitsubishi sen Kaisha, the precessional movements of one or more ostats effect the closing of electrical circuits controlling an engine ich is geared up to rotary retractile fins projecting from the ship's ge.

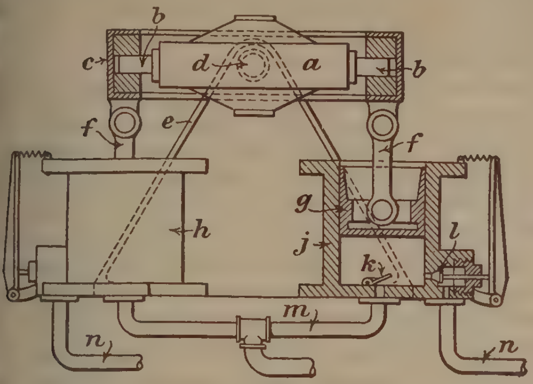

Fig. 3.

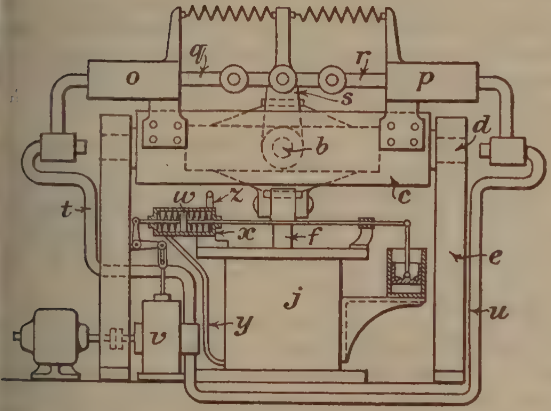

Fig. 4.

Fig. 3.—Diagram showing the mounting of a gyroscope, and its draulic connections with the ship; and Fig. 4, a controlling means mprising a variable stroke pump.

Gyro-stabilisers for Aircraft.—One of the more recent of these abilisers is The Sperry Gyroscope Co.'s, which has two pairs oppositely rotating gyrostats, with their precession axes vercal, mounted in a Cardan suspension, the outer ring of which as its pivots above the centre of gravity of the gyro-apparatus. he lateral and longitudinal balancing planes of the aeroplane e respectively actuated by relative displacements between the yro-apparatus and two control arms carried on the aeroplane. These arms control the working of a motor which adjusts the planes. A still more recent stabiliser, that of the Société Anonyme des Établissements Marmonier Fils, comprises two gyros mounted in an elongated frame supported by horizontal pivots, each gyro carrying a pendulum bob. The rotors spin in a horizontal plane and in opposite directions with equal velocities.

Gyro-steering Apparatus for Torpedoes.—Since 1910, improvements have been mainly in details in connection with the driving of the gyro-rotor, its locking and releasing mechanism, or the arrangement of the gyro-apparatus to minimise the effects of rolling of the torpedo.

Gyro Turn-indicators.—In a form developed at Farnborough, the rotor was mounted outside the aeroplane and driven by the wind, the rotation being in a vertical plane at right angles to the direction of flight. The direction and rate of turn was indicated by a precession-actuated pointer. In the Reid control indicator, a compact combination of gyro-turn-indicator, airspeed indicator and clinometer, manufactured by Messrs. Vickers, Ltd., the rotor of the turn-indicator is driven by a jet of air passing through a compound Venturi tube placed in the slip stream of the propeller. The turn is indicated by means of precession-actuated electric contacts, which switch on one, two or more green lamps, if the turn is to the right, or one, two or more red lamps, if the turn is to the left; the number of lamps switched on is directly proportional to the rate of turn (*see* AIR NAVIGATION).

Gyro-apparatus for Indicating Rate of Angular Motion.—This is usually employed for recording the rolling motions of a ship. In the Cunard liner "Laconia," fitted with Frahm's anti-rolling tanks, a gyro pendulum was used for recording the rolling motions. Its rotor was horizontal and driven by an electric motor; the rotor was mounted in a Cardan ring suspended in a stand secured to the deck, the pivots of suspension being fore and aft. The angular motion of the stand relatively to the gyro represents the rolling of the ship and is recorded by a pencil beneath which a paper band travels continuously.

Gyroscopic Transmission Gear.—The gyro principle has been utilised in transmitting power, the gyro serving as a flexible connection between a driving and a driven shaft. (*See* VARIABLE TRANSMISSION GEAR.)

Other Applications.—In apparatus for measuring deviations of bore-holes from the vertical, the gyroscope has been employed to compensate for rotation, in the bore-hole, of the outer casing containing the measuring apparatus. Messrs. Krupp's fire control apparatus for use with naval guns makes use of a gyrostatic apparatus at the observation station and a precisely similar apparatus at the gun station, both apparatuses being connected electrically so as to operate strictly in unison. The gyroscopically controlled photographic camera of Prof. Sir J. B. Henderson comprises a gyro-controlled prism for counteracting the effects of lateral movements and pitching of the support and a gyroscopically rotated sensitive plate to compensate for rolling movements. The camera is intended chiefly for aerial photography and is rigidly secured to an aeroplane.

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(T. E. L.)

HAAG, CARL (1820–1915), British painter (*see* 12.780), died at Rother Thurm, Oberwesel, Germany, Jan. 17 1915.

HAASE, FRIEDRICH (1827–1911), German actor (*see* 12.782), died in Berlin March 17 1911.

HAASE, HUGO (1863–1919), German politician, was born Sept. 29 1863, at Allenstein in East Prussia. At the outbreak of the World War he was parliamentary leader of the Social Democratic party in the Reichstag, but in 1916 he seceded with the Independent Socialists, who refused to vote the estimate and war credits, and became their leader. In this capacity he exercised a moderating influence upon the extreme section of the Independents, who at a later date (1920) joined the Communists. He was one of the commission of six who conducted the Government of the German Reich, in the name of the people, immediately after the revolution of Nov. 1918. Haase died on Nov. 7 1919 from wounds received in an attempt upon his life while he was entering the Reichstag building.

HABER, FRITZ (1868–), German chemist, was born in Breslau Dec. 9 1868. He studied at the universities of Berlin and Heidelberg and at the technical high schools at Charlottenburg and Carlsruhe. He was then appointed staff professor at Berlin University and afterwards became director of the Kaiser Wilhelm Institute for physical chemistry and electrochemistry. He made a special study of thermodynamic technical gas reactions, and also made experiments in connection with the equilibrium of ammonia and the influence of very high pressures and high temperatures. During the World War he studied the gases used in warfare and their effective frustration by gas masks and chemical means. He conducted particularly important researches in collaboration with Bosch, which led to the establishment of the Haber-Bosch process for the production of nitrogen manure. After the War the large works at Leuna, near Halle, produced more nitrogenous manure, according to this process, than was imported previously in the form of nitrate of soda. The chief characteristic of the process is the continuous reaction under a pressure of 200 atmospheres, and the most important raw material used is water gas, produced from coke and gypsum (*see* NITROGEN, FIXATION OF). His recent works include *Beitrag zur Kenntnis der Metalle* (1919); *Über die Synthese des Ammoniaks: Die Chemie im Kriege* (1922); *Fünf Vorträge aus den Jahren 1920–3: Über die Herstellung des Ammoniaks aus Stickstoff und Wasserstoff* (1924).

HABITUAL OFFENDERS.—In the law, as in common parlance, a habitual offender is one who is repeatedly guilty of criminal offences, who makes a business of crime. In this broad sense the term is identical in meaning with recidivist, a constant backslider. In a more restricted and accurate sense, however, habitual offender denotes one who has become a recidivist by force of habit, and this opens up a wide and interesting divergence of opinion among psychologists as to the mainsprings of conduct. One school of students of this science stresses the hereditary element in human nature—instinct, impulse, the innate characteristics—and to the most extreme of these every " true " criminal is by propensity if not in act, a recidivist. The criminal is born, not made. The other school, believing that our original endowment differs only in degree and not in kind, lays the emphasis on environment, the individual's experience of life. The criminal is the product of circumstances.

The Schools of Thought.—Without drawing too fine a line between the adherents of these two schools of thought, it may safely be asserted that the medical criminologists tend to align themselves with the former and the sociological criminologists with the latter. Many psychiatrists have committed themselves to the view that all recidivists, if not all criminals, are either insane or psychopathic personalities. There is, on the other hand, a strong current of psychological thought in evidence at the present time, which strongly supports the view expressed in the popular maxim, " man is a creature of habit." Habit is not only a manner of acting but of thinking and feeling as well. Will, co science, impulse, are all the fruits of habit. Indeed they *are* th habit of which the external act or conduct is only the expressio The habitual offender is what he is because his experience of li has been such as to cultivate criminalistic ways of thinkin feeling and acting.

Probably no one would deny that the development of the anti-social tendencies comes easier to some than to others, but t clear implication of this doctrine is that, given a sufficiently e environment, no man that is born of woman is so endowed b nature as to resist its moulding influence. On the other hand is conceded that some, probably a very small proportion of t whole, are born into the world with such a defective equipme as to render them very unlikely subjects for the development a socially useful character. Such are the neurotic individua who early in life develop into insane or psychopathic persona ties. The notion, current a few years ago, that the feeble-minde are of this sort, has now been generally abandoned. Mental defe is a handicap in leading any kind of life, good or bad, but involves no predisposition towards the latter. The net result that the good life is not an individual endowment but a soci achievement, and the same is true of the evil life.

That the habitual offender is not irredeemable appears to ha been demonstrated by the experience of Camp Hill in Englan and by fortunate periods in the recent history of Sing Sing a Auburn prisons in the United States. " Habit is second nature but like the original nature, it is still plastic and susceptible new and more wholesome influences.

BIBLIOGRAPHY.—The literature of the subject is still, for the mo part, to be found in psychologic and other periodicals. Books articles that may be read with profit are:

John Dewey, *Human Nature and Conduct* (New York, 1922 S. Hobhouse and F. Brockway, *English Prisons To-day* (Londo 1922); B. Glueck, " A Study of 608 Admissions to Sing Sing Prison in *Mental Hygiene*, 2 (1918); " Jack " Black, " Breaking the Sha les," *The Call* (San Francisco, 1918, 1926). (G. W. K.*

HABSBURG (*see* 12.787), the former ruling dynasty of th Austro-Hungarian Empire. The Habsburgs' relations with the subjects were defined in the 18th century, when Charles VI last of the Habsburgs proper, issued the pragmatic sanctio which was accepted by the estates of his peoples. The fam dominions were hereby declared indivisible, and the descendan of Charles were accepted as their hereditary rulers in perpetuit so long as a male or female member of them remained. Th dynasty of Habsburg-Lorraine, founded by Charles's daughte Maria Theresa, and her husband Francis I., ruled in virtue this contract. In 1918 there were over 120 archdukes or ar duchesses, descendants of Maria Theresa, who could thus su ceed to the throne.

Results of the War.—Charles I. (*q.v.*), the last ruling Empero Austria and King of Hungary, succeeded his great-uncle Nov. 21 1916. At this time his subjects still protested loyalty the dynasty; but during the collapse of Oct. 1918 one nati after another repudiated its rule. The Poles of Galicia, who ha long been practically independent, formed a national council Cracow on Oct. 28 1918 and soon after adhered to the republ of Poland. The Ruthenians of East Galicia decided on Oct. to form a separate state. The Czechoslovaks on Oct. 21, in manifesto dated the 18th, declared themselves independent a expressly repudiated Habsburg rule. The Yugoslavs made ve similar proclamations during the last days of October. On Oc 27 Count Andrássy, the Austro-Hungarian Foreign Ministe accepted President Wilson's demands " regarding the rights the peoples of Austria-Hungary, particularly those of t Czechoslovaks and Yugoslavs." The states of Poland, Yug slavia and Czechoslovakia soon after came formally into bein and although Charles never renounced his sovereign rights these territories, the Habsburg family has made no serious clai to reassert them; although a small monarchist party in Croat since toyed with the idea of reuniting with Hungary under bsburg rule. The treaties of Saint Germain and Trianon petuated the boundaries of these States, and confirmed Italy l Rumania in the possession of their parts of the former bsburg monarchy. Most of the treaties of the "Little tente" (*q.v.*) are expressly directed towards the maintenance these frontiers, especially those of Hungary, and thus im- itly (the forms of those states being what they are) to the lusion of the Habsburgs from these territories.

Position of the Emperor Charles.—There remained only rman-Austria and Hungary. On Nov. 11 1918 Charles issued roclamation in which he stated:

> till, as ever, filled with unchanging love towards all my peoples, ill not oppose my person as an obstacle to their free development. ecognise in advance the decision which German-Austria will take its future form of State. The people has assumed the government ough its representatives. I renounce any share in the affairs of te. At the same time I remove my Austrian Govt. from its ce.

The Provisional Govt. of German-Austria proclaimed a ublic on the following day. On March 12 1919, following elections, the first national assembly repeated this declara- n. Charles, however, refused to abdicate in his own name and t of his dynasty. Thereupon the national assembly, by decree April 2 1919, banished all Habsburgs from Austria and con- cated the family property for the benefit of the War invalids. bsburgs who renounced all rights other than those of private izens were, however, allowed to live unmolested in Austria, d several of them did so. The legitimist movement in Austria s been very weak since these events. Vienna is almost fanati- ly republican, and even in the provinces, the monarchist move- nt in favour of the Wittelsbach dynasty has been quite as ong as the legitimist Habsburg movement. Austrian repub- ans claim that Charles's acceptance in advance of the republic s equivalent to a renunciation of the throne.

Charles and Hungary.—Charles issued a similar proclamation Hungary on Nov. 13 which Karolyi answered by proclaiming e Hungarian Republic on Nov. 16. When, however, the ght regained power in Hungary after Karolyi's and Kun's gimes, it proceeded by Act I. of 1920 to abolish all legislation ssed by these two Governments. Hungary, therefore, reverted the status of a kingdom, and controversy arose whether or not arles's action has annulled the pragmatic sanction, in which se the monarchy in Hungary, under her old constitution, was ctive or not. "Legitimists" and "free electors" disagreed lently, the latter usually demanding the election of a Habs- rg but one whose person and wife should be more popular an those of Charles.

On Feb. 2 1920, during the discussions on the draft treaty of ianon, the Allied and Associated Powers declared that a absburg restoration in Hungary would be a matter of inter- tional concern and that they would neither recognise nor lerate such a restoration. They attempted to insist on Hun- ry's styling herself a republic, but finally, in view of the jections raised by the Hungarian delegation, compromised on e word "Hungary."

Charles returned to Hungary and attempted to assert his im on March 27 and Oct. 20 1921 (*see* HUNGARY). On April 4 e Conference of Ambassadors insisted that Charles should ve Hungary. After the second coup, under pressure from e Powers and the Little Entente, the Hungarian Parliament ssed a decree (Nov. 3 1921) whereby the sovereign rights of arles and the pragmatic sanction were declared forever rogated and the right of the Hungarian nation to elect its king free choice restored. On Nov. 10 Hungary addressed a note the Powers consenting only to elect its king in agreement th the Powers and accepting the notes of Feb. 2 and April 3 21. The Legitimist party, however, still looks on Otto as the gitimate king since Charles's death on April 1 1922. Otto and s mother share this view.

Habsburgs are scattered over Europe. Most reside in Hun- ry, Austria and at the Spanish Court. Their financial position various. They have lost all valuables and estates owned in virtue of their rank. Great controversy was aroused by the fact that Charles took with him, and sold, the crown jewels. Many of the family, however, as the Modena and d'Este branch, own vast private fortunes and great estates. The Hungarian branch was fortunate in this respect, as their wealth was not touched by the non-socialist Government. The Polish Govt. at first sequestrated Habsburg estates, but afterwards released them. Austria confiscated all estates, etc., that were not purely private property. The income of the senior branch of the family is small.

The Archdukes.—The remaining Habsburgs have not been prominent outside the realms of politics. The Archduke Frederick (b. 1856) became inspector-general to the Austro-Hungarian army after the murder of the Archduke Francis Ferdinand (*q.v.*) in June 1914. His command was only nominal, his chief of staff, Conrad von Hötzendorf, performing the real duties. In 1917 the Emperor Charles took his place. The Archduke Eugen (b. 1863) also held a high command, assisted by Gen. Krauss. The Archduke Joseph (b. 1872) resided in Hungary, where he enjoyed great popularity. During the World War he commanded a division, and later an Army Corps. At the debâcle he assumed a nationalist Hungarian attitude, recalled the Hungarian troops under his command from the front and acted as intermediary between the King and Karolyi's Government. While Karolyi still took the oath of loyalty to King Charles, Joseph had already repudiated the monarchy and his own title. He lived quietly on his own estate as "Joseph Habsburg" throughout the Commune; but after its fall, he assumed power on Aug. 6 1919 as administrator of Hungary. He was forced to retire on Aug. 22, as the Entente declared that they would not negotiate with Hungary under a Habsburg and were "obliged to insist upon the present pretender to supreme power in the Hungarian State resigning." After this time Joseph took little part in public life.

The Archduke Albert (b.1897), son of Archduke Frederick supported by his wife, Isabella, became the chief candidate of the "free Electoral party" in Hungary, with whom he had close relations. The Archduke Stephen (b. 1860), whose estates were in Galicia, was put forward as a candidate by the Polish monarchist party. His son, the Archduke William (b. 1895), at one time aspired to the throne of the Ukraine. Although many archdukes, including Frederick and Francis Ferdinand, were known as collectors, the Habsburgs have not been prominent as creative artists. Archduke Leopold Wölfling wrote a book entitled *Habsburger unter sich.* (*See* AUSTRIA.) (C. A. M.)

HADFIELD, SIR ROBERT ABBOTT, (1859–), British metallurgist, was born in Sheffield Nov. 29 1859. Educated at Sheffield Collegiate School, at an early age he interested himself in metallurgy, subsequently becoming chairman of Hadfields, Ltd., Hecla and East Hecla Works, Sheffield, and director of other important companies. In 1883 he patented his process for the production of manganese steel (*see* 14.809) and became famous as the inventor and improver of various metallurgical processes, including low hysteresis steel and many other special ferrous alloys. He became a member of many scientific committees, and was president of the Iron and Steel Institute (1905–7), of the Faraday Society (1914–20), and of the Society of British Gas Industries (1917–8), besides being master cutler of Sheffield 1899–1900. In 1908 he was knighted; the following year became F.R.S., and was created a baronet in 1917. Sir Robert received many honours, including 10 gold medals, from scientific and learned societies; and became corresponding member of the French Academy of Sciences; hon. member of the Royal Swedish Academy of Sciences; and officer of the Legion of Honour. He published over 160 scientific and technical papers of considerable importance. His book *Metallurgy and Its Influence on Modern Progress* is a standard work of reference.

HADLEY, ARTHUR TWINING (1856–), American economist and educationalist (*see* 12.798), was elected a director of the New York, New Haven and Hartford Railway in 1913. In 1914 he lectured at the University of Oxford on "Institutions of the United States." In 1915 he endorsed college military camps and advocated the counting of military training for a degree.

In 1920 he resigned as president of Yale University and the same year was elected a director of the Atchison, Topeka and Santa Fé Railway. He wrote *The Moral Basis of Democracy* (1919) and *Economic Problems of Democracy* (1923).

HADLEY, HENRY KIMBALL (1871–), American composer, was born at Somerville, Mass., Dec. 20 1871. He studied theory and composition under Emory and Chadwick in Boston, completing his studies in Vienna. In 1904 he went to Germany, where he was Kapellmeister in Mainz Opera House for two seasons, and produced his opera *Sofie* in 1909. Returning to the United States in the same year, he was conductor of the Seattle Symphony Orchestra until 1911, and of the San Francisco Symphony Orchestra 1911–5. In 1921 he became associate conductor of the N. Y. Philharmonic Orchestra. He produced three grand operas: *Azora* (Chicago Opera Co.), *Bianca* (Society of American Singers) and *Cleopatra's Night* (Metropolitan Opera House). He composed also ode-music for the Worcester (Mass.) Festival (60th Anniversary) and *Resurgam* for the Cincinnati Festival, 1923, in addition to four symphonies, overtures and cantatas, three tone poems, ballet suites and over 150 songs. He was elected a member of the American Academy of Arts and Letters in 1924.

HADOW, SIR WILLIAM HENRY (1859–), British scholar and musician, was born at Ebrington, Glos., Dec. 27 1859. He was educated at Malvern and Worcester College, Oxford, and after taking his degree remained at Oxford as a tutor and fellow of his college. In 1909 he became principal of Armstrong College, Newcastle, retaining this post until 1919, when he became vice-chancellor of Sheffield University. He was in 1918 appointed assistant director of education for the troops by the War Office and also worked for the Y.M.C.A. He was knighted in 1918 and was made a C.B.E. in 1920. In 1922 he became Stevenson Lecturer to the University of Glasgow. Well known as a great authority on the history of music, Sir Henry Hadow also composed many songs and pianoforte pieces besides the incidental music to Robert Bridges' *Demeter* (1905).

He published *Studies in Modern Music* (1894 and 1895); *Sonata Form* (1896); *A Croatian Composer*, a valuable tract on Haydn (1897); the section "The Viennese Period" (1904) in *The Oxford History of Music*, of which he was the editor; *Citizenship* (1923); and *Music* (1924) in the Home University Library.

HAECKEL, ERNST HEINRICH (1834–1919), German biologist (*see* 12.803), died at Jena Aug. 8 1919.

HAFSTEIN, HANNES THÓRDUR (1861–1922), Icelandic statesman and poet, was born Dec. 4 1861. As a young man he became known as a lyrical poet. In 1901 he was elected a member of the Althing, and soon became a leader of the Home Rule party. It was chiefly owing to his influence that Denmark consented, in 1903, to the transfer of the residency of the Minister for Iceland from Copenhagen to Reykjavik. On Jan. 31 1904 Hafstein was appointed to this office and inaugurated a new era of practical reform. His first work was to arrange a telegraphic cable to Great Britain and a net of telegraphs and telephones all over the island. His efforts, however, were hampered by the extremists, who demanded greater political independence from Denmark. Their obduracy led to his resignation in 1908. On the victory of the Home Rulers in 1911, Hafstein again became Minister in 1912, but had to resign in 1914 after new and fruitless efforts to effect reconciliation. He lived, however, to see the full reconciliation between the two countries in 1918, and the recognition of Iceland as an independent state in union with Denmark. He died Dec. 13 1922.

HAGENBECK, CARL (1844–1913), German collector of wild animals (*see* 12.814), died at Hamburg April 14 1913.

HAGGARD, SIR HENRY RIDER (1856–1925), British novelist (*see* 12.816), was knighted in 1912. Among his later novels are *Child of Storm* (1913); *The Ivory Child* (1916); *Love Eternal* (1918); *The Ancient Allan* (1920); and *Heu-Heu: or the Monster* (1924). Much of his time, however, in his later years was devoted to matters affecting the welfare of the Empire. As a member of the Dominions Royal Commission he travelled round the world and, to further schemes for settling ex-service men on the land, he visited various parts of the Empire, writing a
port to the Royal Colonial Institute. He also wrote *Rural D*
mark and its Lessons, 1911. He died in London May 14 19

HAGUE, THE (*see* 12.817), with a population in 1923
328,581, continues to be a centre of diplomatic and internatio
movements. In 1910 the tribunal of arbitration of the No
Atlantic Fisheries met in the city, and in 1915 the Internatio
Congress of Women. In 1917 an agreement was reached h
by British and German representatives as to repatriation
disabled prisoners, etc., and in 1920 a committee of the Leag
of Nations Council met here to frame a scheme for the Perman
Court of International Justice. (*q.v.*) In 1913 the Palace of Pea
to which most countries of the world contributed gifts, was de
cated. In 1922 the house, lent to the town, with his pictures a
furniture, by Dr. Bredius, the art historian, was opened to t
public; in 1924 a museum, chiefly for educational purposes, w
large Greek, Asiatic and Egyptian collections, was established.

HAIG, DOUGLAS HAIG, 1st Earl (1861–), British soldi
was born in Edinburgh June 19 1861, son of John Haig,
Cameronbridge, Fife. He was educated at Clifton and Bra
nose College, Oxford, and in 1885 joined the 7th Hussars.
was promoted captain in 1891, afterwards passed through t
staff college and was employed with the Egyptian Army
1898 during the Nile campaign, for which he was given a bre
majority. On the outbreak of hostilities in South Africa in 18
he went out to Natal on the staff, and was present during t
opening engagements near Ladysmith. He was afterwards ch
staff officer of the cavalry division during Lord Roberts' v
torious advance from Cape Colony through the Orange Fr
State into the Transvaal, and was promoted brevet lieutena
colonel for his services.

In the later phases of the struggle he was in command o
column and later was controlling groups of columns; at the cl
of the war he was appointed A.D.C. to the King, promoted b
vet-colonel, and given the C.B. Col. Haig subsequently co
manded the 17th Lancers for a year, after which he went out
India as inspector-general of cavalry; this appointment he he
until 1906, having been promoted major-general in 1905,
which year he married the Hon. Dorothy Vivian, daughter
the 3rd Lord Vivian. From 1906–9 he was a director in the W
Office, and during this time he was intimately concerned in t
development of the general staff and the improvements effect
in the organisation of the army, which were set on foot wh
Lord Haldane was Secretary of State. In 1907 he published
volume of *Cavalry Studies*. His next appointment was that
chief of the general staff in India, which he held for three yea
being promoted lieutenant-general in 1910. In 1912 he w
brought home to take the command in Aldershot, and in 19
he was made a K.C.B.

On the mobilisation of the Expeditionary Force in 1914, S
Douglas Haig took the field as commander of the I. Army Corp
which he led during the Mons, Marne and Aisne operation
and the first battle of Ypres; he was promoted full general
Nov. for his services. On the division of the British Exped
tionary Force into two armies at the beginning of 1915, he w
placed at the head of the first. On the front of his army duri
1915 there took place the battles of Neuve Chapelle, Festube
and Loos, and at the end of the year he succeeded Sir Joh
French in the chief command. He had been made a G.C.B.
the autumn.

At this time the armies were passing through a period
transition. The regular army with the exception of its cavalr
had almost ceased to exist and the first need was to weld i
remnants, the new armies created by Lord Kitchener and t
Territorial Army, into a whole capable of combined action bo
in attack and in defence. This involved the creation behind t
lines of a large number of schools of instruction in the use of t
new weapons, which the requirements of trench warfare ha
created, and of the old ones which had been brought back wit
the service of war. Beyond and above this technical instructio
came the training of the larger formations of all armies and f
this it was necessary that a certain number of divisions shoul

placed sufficiently far behind the line to allow them the und and the opportunities for gaining experience.

This remained one of the chief items of Sir Douglas Haig's itary policy until a late period of the War. It was a policy ich often brought him into discussion both with the French erals and with the French statesmen, who were continually ssing him to take over a larger extent of front. Sir Douglas ig pointed out that it was not possible to compare a national ny created during the course of the War with one which had n long established in time of peace, and that the Germans oughout the War maintained a greater density of men oppo- the British lines than they did elsewhere. In the event, his icy was justified by the fact that in the latter half of 1918 the itish Army, was as a whole, at least as efficient as any which s then fighting in the War.

The campaigns and battles of the British Army in France and lgium are dealt with elsewhere and it is here only necessary to er to the principles which guided Sir Douglas Haig in certain the crises of the War. The first of these during his command se out of the German attack on Verdun during the first half 1916. On that occasion he assisted the French by relieving ir troops in the front and by preparing for the battle of the mme. While that battle disclosed defects both of preparation d of execution, its results convinced Sir Douglas Haig that it d caused such exhaustion of the German armies as should be ploited at the earliest possible moment. He therefore agreed th Joffre to renew the battle early in 1917.

But the battle of the Somme had caused grievous losses and e gains of ground as shown on the maps appeared trifling. erefore, neither French nor British statesmen were prepared agree to a policy which to their minds seemed likely to exhaust eir resources before it caused the enemy to yield. The con- uence of this was the replacement of Joffre by Nivelle and e assembly of an Allied Conference at Calais at the end of b. 1917, at which it was decided to give Nivelle the general ection of the British Army, while he was at the same time to in active command of the French Army. This arrangement, litarily unsound, early produced friction. For Nivelle, who s ill-informed of events on the British front, issued to Haig structions which were inappropriate both as to form and sub- nce. These differences were adjusted at a further conference London, but they created the impression that Haig was posed to any form of unity of command, which was not true.

The direct result of the failure of Nivelle's campaign was a ve of depression which spread through the French Armies d resulted in serious mutinies. Pétain, who had succeeded velle, appealed to Haig to keep the Germans occupied while was restoring the morale of the French troops. To this peal Haig responded by opening in the summer of 1917 a mpaign in Flanders, which began with Plumer's victory at essines and was followed by the battle of Passchendaele. It s only with difficulty that Haig won the consent of the British vt. to this campaign. By the middle of Oct. of that year tain was able to tell Haig that the French Army was suffi- ntly restored to be able to look after itself; and it might have en wiser to have stopped the battle of Passchendaele then, as no equate return was gained for the exhaustion caused by the olongation of the attack in execrable weather.

The crisis brought about by the success of the German-Aus- an attack on the Italians at Caporetto following on the col- se of Russia, resulted in the creation in Nov. 1917 of the preme War Council, the first meeting of which was held at e end of the following January. This meeting had been preceded a renewal of French demands for an extension of the British nt, which Haig eventually met by agreeing to take over a rtion of the line at and south of Peronne with his V. Army. this meeting a difference of policy between Haig and his vt. was disclosed. The commander-in-chief anticipated an rly attack by the Germans and asked for reinforcements: e Prime Minister wished for an offensive campaign in Pales- e, and won his way; and at this same conference, it was cided to create an Allied general reserve on the Western Front under the control of the military representatives of the Supreme War Council with Foch as chairman. During Feb. 1918 Haig became more than ever convinced that a great German attack on his front was imminent, in which he differed from the military representatives, who did not expect it before May. When the military representatives applied to him for divisions for the general reserve, he answered that in view of the lack of reinforcements, the extension of his front and the massing of German troops, he would be unable to furnish these divisions, and the formation of the general reserve broke down.

With what calm determination Haig met the great German offensive of the spring of 1918 is described elsewhere. In the most critical days of that offensive it was Haig's direct intervention with the British Govt. which brought Lord Milner to France, a visit which resulted eventually in giving Foch direct control of the Allied Armies. With Foch Haig's relations were as harmonious as they had been with Joffre, and in the late summer of 1918 the British commander-in-chief reaped at last the reward of his patient policy. When in Aug. 1918 Rawlinson's IV. Army won the victory of Amiens, Foch desired that Rawlinson should follow up his success. Haig, convinced that this would result in another deadlock, and confident now in the superior morale and efficiency of his army, persuaded Foch to agree to an extension of the battle northwards, and so came about the breaking of the Hindenburg line which made it clear that victory could be won in 1918.

For his great services Sir Douglas Haig was raised to the peerage as Earl Haig and Baron Haig of Bemersyde and was given a grant of £100,000. The Order of Merit was also conferred upon him, and the ancestral home of the Haigs at Bemersyde was purchased by national subscription and presented to him. On returning home he was for a short time commander-in-chief in Great Britain, but when that position was abolished he refused other offers of employment and devoted himself wholly to the welfare of ex-service men. He succeeded in uniting other organisations with the British Legion, of which he became president. He also created and became president of the British Empire Services League, a union of the ex-service men's organisations of Great Britain and the Dominions; he was also appointed chairman of the United Services Fund, which together with the fund he established for the benefit of ex-service men forms one of the largest benevolent organisation in the country. (*See* LOOS; NEUVE CHAPELLE; SOMME and articles on other battles of the World War; also WESTERN FRONT.) See *Sir Douglas Haig's Despatches*, ed. J. H. Boraston (1920) (F. B. M.)

HAINISCH, MICHAEL (1858–), Austrian statesman, was born Aug. 15 1858, at Aue, near Gloggnitz, Lower Austria, the son of a manufacturer, and Marianne Hainisch, a pioneer of women's rights. After a short career in the Austrian public service, he devoted himself to the study of social and agricultural questions. He was founder with Engelbert Pernerstorfer of the Gesellschaft der Fabier on the model of the British Fabian Society. Hainisch, who was particularly active in the cause of popular education, founded and endowed many hundreds of popular libraries. His works include: *Die Zukunft der deutschen Oesterreicher* (1892); *Voraussetzungen und Berechtigung des Sozialismus* (1919); *Die Landflucht* (Jena, 1923). Hainisch was elected first President of the Austrian Republic in Dec. 1920 and re-elected unanimously for a further period of four years, Dec. 1924.

HAITI (*see* 12.824), a republic in the West Indies and a member of the League of Nations. Its area is 10,204 square miles. No reliable census of the population has been taken. Estimates vary from 1,500,000 to 2,500,000, the most reliable giving 2,028,000 in 1924.

I. POLITICAL HISTORY

The principal event in Haitian affairs in the period 1910–25 was the military intervention on the part of the United States, which developed into a close political and fiscal protectorate. The first part of the period was marked by constant revolutionary turmoil and by rapid political disintegration. In July 1911

President Simon was overthrown and on Aug. 14 1911 Cincinnatus Leconte became president. A year later (Aug. 8 1912) the presidential palace was blown up and Leconte and a number of his followers killed. The National Assembly at once elected Tancrede Auguste, a prominent planter; he died the year after, and on May 4 1913, Senator Michel Oreste was elected.

Intervention of the United States.—Dec. 1913 ushered in a period of political turbulence, and three military presidents assumed office in quick succession: Oreste Zamor, on Feb. 8 1914; Davilmar Theodore, on Nov. 7 1914; and Vilbrun Guillaume Sam, on March 4 1915. The last named, after withstanding the attacks of his opponents for several months, was compelled to seek refuge in the French legation in the night of July 26 1915, while 200 political prisoners in the gaol of Port-au-Prince were massacred by order of one of his followers. At the funeral of the victims a party of mourners invaded the French legation, dragged out the ex-president, handing him over to the mob for death, and killed the ex-gaoler. Two hours later a U.S. cruiser arrived at Port-au-Prince and landed marines. U.S. forces occupied the country, disarmed the natives and restored order. Although U.S. naval officers assumed charge of most administrative functions, the Haitian governmental organisation remained intact. On Aug. 12 1915 Sudre Dartiguenave was chosen by the Haitian Congress as president. A treaty having been accepted by the Haitian Govt. in 1916, the U.S. Senate advised ratification. Ratifications were exchanged at Washington and the treaty was proclaimed on May 3 1916.

Modelled upon the American-Domingo Convention of 1907 (*see* 24.194), this instrument was designed to secure political stability and economic development in Haitian affairs by a political and fiscal protectorate, to remain in force for a period of 20 years. By its terms the President of Haiti appointed, on the nomination of the President of the United States:—

(*a*) a receiver-general of customs to take charge of the customs houses;

(*b*) a financial adviser to be attached to the Ministry of Finance;

(*c*) American officers to organise and command a Haitian constabulary (gendarmerie) which was to replace the Haitian armed forces, such officers to be later succeeded by qualified Haitians;

(*d*) engineers and doctors to supervise the public works department and public health services respectively.

Haiti agreed not to increase the public debt and not to modify the customs duties without the consent of the United States; the United States undertook to intervene when necessary for the preservation of Haitian independence and the maintenance of a stable and effective government. The treaty provisions were promptly put into effect, and determined entirely the subsequent course of events.

In the early period of American intervention the division of authority caused friction, but with the appointment in 1922 by the President of a high commissioner to supervise and co-ordinate the activities of the treaty officials and the military occupation, native irritation and the friction between the American authorities and the Haitian Govt. disappeared. The U.S. marines were later withdrawn from all interior points and concentrated at Port-au-Prince and Cape Haitien. The maintenance of order was placed in the hands of the Haitian gendarmerie. This was composed of native troops, but the officers generally were officers and enlisted men of the U.S. Marine Corps.

The future of Haiti presented in 1921 the gravest problem of United States influence in the Caribbean (*q.v.*). Early termination of military occupation was, in the opinion of those in responsible charge, certain to result in reversion to old conditions. On the other hand, public sentiment in the United States did not view with satisfaction the definitive abandonment of the one great opportunity left the negro race to demonstrate, even after repeated trial, an ultimate capacity for self-government. Until 1921 the establishment of civil order had engaged the best energies of the American officials. With this accomplished, opportunity was afforded for rendering the further offices contemplated by the treaty in a way conducive to the ultimate assumption of civil authority by the Haitian Govt.; subject only to those reservations as to political stability and fiscal solvency in force in other areas within the range of American influence in the Caribbean.

Borno as President.—Louis Borno, who was elected on April 10, was inaugurated on May 15 1922 as president of the republic. He found civil order firmly established through an efficient native gendarmerie. Roads had been constructed and bandi eliminated, and the peasantry enjoyed, for the first time p haps in their country's history, complete freedom. Pu health services had been greatly improved under American sup vision, great progress being made in town sanitation. A vigor policy of financial reform was adopted, with very satisfact results. The public debt, which in 1915 amounted to $36,000,c had been reduced to $22,046,252 at the close of the fiscal y 1924–25. The budget had been balanced and a comforta surplus realised by 1923–4, thus enabling the Govt. to sp substantial sums on public works and other developme Borno was re-elected president in 1926.

II. ECONOMIC HISTORY

Production and Trade.—The chief crop is coffee, which represen in 1925 some 75% of the total income of the country. Other im tant products are cotton and sugar. Great efforts are being mad develop systematic cultivation, for even in 1925 coffee and cot grew semi-wild. An agricultural school had been established at Po au-Prince, experimental stations set up under American official system of premiums inaugurated to encourage coffee growers, a attempts made to improve the coffee and sugar crop and encour the growth of other crops, such as cocoa, sisal, hemp and tobac A modern sugar-cane mill and refinery were erected at Port- Prince, as well as a smaller plant near Cape Haitien, and also cot ginning plants, etc. Means of communication and transport being improved in order to open up the country and develop agricultural, forest and mineral resources; in 1925 some 7,500 m road were open to traffic, motor roads totalling about 650 m. lin up the chief towns. Only some 60 m. of railway line were in opera in 1925, but the lines were being extended. Banking is in the ha of the National Bank of Haiti, a subsidiary of the National C Bank of New York, and the Royal Bank of Canada.

Foreign trade had greatly improved between 1915 and 19 The following table shows the value of imports and exports fr 1916 to 1924:—

	Imports $	Exports $
1916–7	8,606,086	8,932,88
1917–8	10,180,693	7,743,53
1918–9	17,117,608	24,762,22
1919–20	27,398,411	21,620,92
1920–1	11,957,206	6,590,40
1921–2	12,350,271	10,712,21
1922–3	14,157,963	14,591,01
1923–4	14,696,128	14,176,33
1924–5	20,237,565	19,403,76

The chief articles of export in 1923–4 were coffee, valued $10,361,776; raw cotton, $2,068,628; raw sugar, $620,412; logw and logwood extract, $440,670; cotton seed, $202,580; and coc $139,341. Exports to France were valued at $9,369,923; the Un States, $1,329,251; Denmark, $847,118; the United Kingd $722,699; Germany, $652,688; and Belgium, $509,375. Impo were mainly from the United States, $11,817,376; the Uni Kingdom, $984,600; France, $885,228; and Germany, $447, Both imports and exports increased during 1924–5, when the to trade approximated $40,000,000, with a small balance in favour Haiti.

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HALDANE, RICHARD BURDON HALDANE, 1st Viscou (1856–), British statesman, philosopher and lawyer (12.831). In 1910 he was appointed chairman of the royal co mission on university education in London. To organise a u versity of the first order in, of, and for London, which sho secure for science and scholarship, under wise conditions, t full use of the great resources, human and material, of the cap of the British Empire, was a task demanding constructive stat manship in a high degree. The report of this commission (C 6717) dated Dec. 1911 dealt faithfully and vigorously with t problems placed before it. Effect has not yet been given to mmendations. Time may show that the university will and reform itself from within. If, and when, the university sets f, or is set, in order, the counsels of this commission, which the impress of the chairman's mind, will form the basis of ew activities.

March 1911 he was raised to the peerage and appointed a ıber of the Judicial Committee of the Privy Council—that t important tribunal which constitutional lawyers know to practical bond of Empire. As a student of the principles ch underlie all systems of law, he found the cases brought re the committee to be of absorbing interest, perhaps, most cially, those from India, where the fundamental principles ındu law are based on religious duty and philosophic con- s, unfamiliar to the west.

1912, at the request of the Cabinet, he visited Berlin to uss disarmament proposals and on his return reported to the inet information he gathered there as to the attitudes and litions of those then guiding the policy of Germany. To be a senger of conciliation and co-operation between the two ons was a duty for which he was in every sense especially ipped, but he was, and soon knew he was, to be baulked by conditions under which Germany was then ruled. Much ty capital was made out of this visit, both then and later ing the War. To have refused the opportunity was impos- e. To have sent any other member of the Cabinet, would e been infructuous. Something resulted from the mission, not all that he had hoped for. Lord Haldane accepted the arting of the full result he had looked for with characteristic rage and dignified silence. In 1912 he succeeded Lord Lore- n as Lord Chancellor and presided over the House of Lords h dignity and efficiency.

Vhen the War broke out in 1914, the great reorganisation of War Office which he had effected was tested to the extreme. labours were justified by their fruit. A new model had n created. There was a new spirit in the army. It had been on the way of becoming a learned and scientific profession. had been organised in accord with sound principles and its stituent elements had been brought into close relationship l enabled to co-operate with and understand one another. By creation of the Officers' Training Corps in 1909, the universi- and schools were able to contribute in the time of need ctly the type of officer required. The Militia had been laced by a Special Reserve of real value as events showed. Territorial Army had been created, and saved the situation re than once. The General Staff was brought into existence the issue of a special army order, establishing it on the foot- it held during the War and after. To Lord Haldane, again, lue the decision of the Dominion Conference in 1907, accept- the principle of an Imperial General Staff, by which con- ted action and intelligent co-operation between armies drawn m all parts of the Empire was made possible. The experi- ntal mating of Minerva with Mars had, indeed, been fruitful l felicitous.

Practical reasons and popular prejudice account for his sence from the first Coalition Ministry in 1915, when he eived the Order of Merit. He was then free—as free as any riot of his nature and temperament could be in such stressful s—to turn to philosophy. He published in 1921 *The Reign Relativity*, a masterly presentment of profound, scientific and taphysical thought, and in 1922, *The Philosophy of Human-*, an abiding memorial of the dictum *Das Geistige allein ist Wirkliche*. When Einstein came to England to lecture, he s the guest of Lord Haldane, who presided over the gathering ich heard the exposition of the theory of relativity from its coverer. Always eager to promote national education, Lord ldane devoted much time and energy to the Workers' Educa- nal Association, which owes much of its success to his support.

Lord Haldane was Lord Chancellor in the Labour Ministry of Ramsay MacDonald (1924), and working chairman of the mmittee of Imperial Defence, where his experience, tact and lefatigable industry were invaluable, and, on the fall of the bour Ministry, Mr. Baldwin invited him to continue his long association with it. The report of the Machinery of Government Committee (Cd. 9230, 1918), of which Lord Haldane was chairman, pointed out that "Further provision is needed in the sphere of civil government for the continuous organisation of knowledge and the prosecution of research in order to furnish a proper basis of policy." Accepting this declaration of principle, Mr. Baldwin established in 1925 the Committee of Civil Research, on which Lord Haldane has served as a member. Thus, through every department of State, in education, in university life, in the army, in the law and in industry are found the effects of his master mind, of his clear vision, of his resolute adherence to first principles and of his practical philosophy. Elected first Chancellor of Bristol University, he has been Lord Rector of Edinburgh, and has received many honorary degrees. His book, *Before the War*, gives an account of his political activities at that time.

HALE, GEORGE ELLERY (1868–), American astronomer, was born at Chicago, Ill., June 29 1868. He studied at the Harvard College Observatory and the Massachusetts Institute of Technology, graduating in 1890. He was director of the Kenwood Astrophysical Observatory, in Chicago, from 1890 to 1896. From 1892 to 1905 he was at the University of Chicago as associate professor of astrophysics, professor, from 1897, and director of the Yerkes Observatory, after 1895. In 1904 he became director of the Mount Wilson Solar Observatory (Cal.) of the Carnegie Institution of Washington, a position which he held till 1923, when he became honorary director in charge of policy and development. He invented the spectroheliograph first used in 1892 for photographing solar prominences, and won an international reputation for his solar and stellar spectroscopic work. He was awarded the Janssen Medal by the Paris Academy of Sciences in 1894, the Rumford Medal by the American Academy in 1902, the Draper Medal in 1903, a gold medal by the Royal Astronomical Society in 1904, the Bruce Medal by the Astronomical Society of the Pacific in 1916, and the Janssen Medal by the Astronomical Society of France in 1917. He was the author of *The Study of Stellar Evolution* (1908) and *Ten Years' Work of a Mountain Observatory* (1915), besides numerous papers in scientific publications.

HALIFAX, Nova Scotia (*see* 12.843).—The population of the city in 1921 was 58,372. The public buildings and many of the houses built of stone show a considerable taste in architecture. Much of this stone was brought from the dismantled homes and fortifications of Louisburg. About one-tenth of the city area was devastated by the explosion on Dec. 6 1917, of a French steamer carrying 3,000 tons of T.N.T., on colliding with a Norwegian steamer on its way with a relief cargo for Belgium. The reconstruction of a Greater Halifax has been carried out on modern lines of town planning.

The harbour is accessible all the year round to the largest vessels. New docks and railway stations, in course of construction, will give it an area of over 200 ac. and make it one of the best equipped ports in the world. Grain elevators and conveyor systems will meet the needs of expanding commerce. Halifax claims to have the lowest port charges on the Atlantic coast. There are a number of manufacturing industries, including the largest sugar refinery in Canada, and the city is also an important distributing centre. Halifax is the chief winter port of Canada and the Atlantic terminus of the Canadian National Railways. It has a naval dockyard and training school.

HALL, GRANVILLE STANLEY (1846–1924), American psychologist and educationalist, was born at Ashfield, Mass., Feb. 1 1846. He graduated from Williams College in 1867 and took the degree of Ph.D. at Harvard in 1878. After holding the chair in psychology at Antioch College, 1872–6, he pursued further studies at Berlin, Bonn, Heidelberg and Leipzig. He was professor of psychology in Johns Hopkins University, 1881–8, and was then elected the first president and made professor of psychology of the newly formed Clark University, Worcester, Mass. which, under Hall's personal leadership, was devoted, during its first two decades, chiefly to educational research. He became widely known as an exponent of the culture-epoch theory of mental development, a doctrine set forth in his most influential work, *Adolescence*, 2 vol. (1904). During the later years of his presidency his influence perceptibly diminished, this being partly due to the lack of scientific method in his work. He resigned in 1920 and died April 24 1924.

Hall's numerous published works include: *Educational Problems* (2 vol., 1911), *Founders of Modern Psychology* (1912), *Senescence* (1922), and *Life and Confessions of a Psychologist* (1923).

HALLE, WILMA MARIA FRANCISCA, LADY (1839–1911), Anglo-German musician (*see* 12.853), died in Berlin April 15 1911.

HALSBURY, HARDINGE STANLEY GIFFARD, 1st Earl of (1823–1921), British lawyer and politician (*see* 12.867), died in London Dec. 11 1921. The year of his birth, earlier given as 1825, was subsequently found to have been wrongly stated. The records of Merton College, Oxford, show him to have been born on Sept. 3 1823.

HAMBURG, Germany (*see* 12.871), with a population in 1922 of 1,025,502, is the second city of Germany. Its commerce, industry and shipping had been increasing up to the outbreak of the World War, which sharply arrested its development, but after the Armistice it began to recover. In 1923 the port was entered by 13,192 seagoing vessels of 15,344,999 tons, as compared with 16,427 of 14,185,496 tons in 1913. Traffic at the end of 1925 was about 90% of the pre-War figure. The proportion of shipping flying the German flag was only half what it had been, and emigrant and tourist traffic much less. The Hamburg-Amerika line, which had made great strides before the War, had 89 steamers of 386,000 tons in 1924. Since 1910 new docks have been built on Waltershof Is., forming a second free port, and large shipyards were laid down at Finkenwerder in 1918. New buildings include the Trade Corporation House (1912–6) in Neustadt, the Museum of Hamburg Antiquities (1914–20) and two ten-storyed office buildings of vitreous brick on the Messberg. The Exchange was rebuilt in 1908–12, and the Institute for Tropical Diseases in 1914. Great S. Michael's Church, burnt down in 1906, has been re-erected on the old lines and the Kunsthalle, to the east of the Binnen-Alster, has been much enlarged. The tunnel under the Elbe from the St. Pauli district to Steinwärder, which is entered by lifts, was finished in 1911; but a two-storyed bridge over the river, begun in 1914, was still unfinished in 1925.

The university, founded in 1918, with a democratic constitution, is in Rotherbaum, to the north of the city, in a building originally designed as a lecture hall. Near it is a statue of Hermann von Wissman, the explorer, which was erected at Dar-es-Salaam and removed here in 1922. Space in Ohlsdorf cemetery for 700 graves of men who died in the district during the World War has been acquired by the British Government. A memorial commemorating the seamen of Hamburg who died as prisoners of war in America was unveiled in 1920.

In 1917 a commission was appointed to bring about a reform of the class franchise which had hitherto existed in the Hanseatic cities, and a measure of electoral reform was adopted. The city and territory had nevertheless as severe an experience of the revolutionary movement as any region of Germany. The Council of Workmen and Soldiers assumed complete political power in Nov. 1918. The region of Cuxhaven belonging to Hamburg declared its independence in Jan. 1919 under Communist leadership, but the republic only lasted four days. In Jan. and Feb. 1919 Communist disturbances broke out in the city itself. The new constitution adopted in 1920, reduced the authority of the senate, and the power which it formerly wielded is now in the hands of the Bürgerschaft (representative assembly), which consists of 160 members elected on the system of proportional representation.

HAMBURG, UNIVERSITY OF.—By a process of natural development the University of Hamburg was formed in 1919 from the material of the Colonial Institute, and consists of the faculties of law, medicine, philosophy and natural science. Special facilities exist for study of the history and culture of the Orient generally, of India, China, Japan, Africa and the South Seas. Anthropology, folklore and missionary problems among the many notable features of the courses—especially summer course, which attracts a large number of students.

HAMILTON, SIR IAN STANDISH MONTEITH (1853– British soldier, was born at Corfu Jan. 16 1853. Educate Wellington College and in Germany, he joined the arm 1872. He served with the 92nd Highlanders in the Afghan and the Boer War of 1881, and was severely wounded on Ma Hill, one arm being permanently disabled. He was then several years intermittently on the staff of Sir F. (Lord) Rob He served in the Nile Expedition of 1884–5, in Burma in 188 and on the staff of the Chitral Relief Force in 1895. He c manded a brigade on the North-West Frontier in 1897, and a wards the School of Musketry, Hythe. In the South Afr War he commanded a mounted infantry division during advance from Bloemfontein to Pretoria and into the eas Transvaal. He returned home early in 1901 to become mili secretary at the War Office, but towards the end of the went back to South Africa nominally as chief of the staf Lord Kitchener, although in reality he was employed chief the commander-in-chief's deputy to control particular gr of operations from time to time during the closing stages of struggle.

He was afterwards again military secretary and then qua master-general at the War Office, and in 1904 he went out to Far East to accompany the Japanese armies in the field. impressions under the title *A Staff Officer's Scrap Book* (2 1906–7), by reason of the interest of its subject, the charm the author's style, and the combination of war experience an imagination which inspired his judgments and criticisms, at took rank in Europe as a modern military classic. His lite ability, though a token of unusual imagination and clearnes thought, rather prejudiced him throughout his career in the of old-fashioned soldiers. On his return he had charge of Southern Command until 1909, and was afterwards adjut general at the War Office for a year. He took a prominent on behalf of the voluntary service system during the camp in favour of compulsory service led by Lord Roberts, and in course of this controversy he published a book *Compul* *Service* (1910), which he wrote at the request of Lord Hald In 1910 he was appointed commander-in-chief in the M terranean and inspector-general of the Overseas Forces.

On the outbreak of the World War in 1914 Hamilton se for some months as commander-in-chief of the Home Def Army in England. Then in March 1915, he was selected to charge of the Mediterranean Expeditionary Force (*see* D danelles Campaign). The naval effort to force the Dardan having failed, he found himself obliged to undertake operat in the Gallipoli Peninsula, and although his army was very equipped for the task, he succeeded in landing it in the face of enemy, but was brought to a standstill. Having, after consi able delay, received substantial reinforcements, he made a g effort in Aug. to improve his position, but partly through inertia of some of the local commanders, sent out without sulting him, the operations miscarried, and a situation of st mate arose. The Government consulted him in Oct. as to expediency and feasibility of withdrawing from the penins and on his pronouncing himself strongly opposed to suc policy he was replaced by Sir C. Monro and returned ho In 1920, after the issue of the *Report* of the Dardanelles C mission, he published his own story of the campaign under the title of *Gallipoli Diary* (2 vol., 1920), and in 1921 *The S* *and Body of an Army*. For this *Encyclopædia* Sir Ian wrot brilliant article on War. (B. H. L. H.

HAMILTON, Ontario (*see* 12.891), had in 1921 a populatio 114,351. It was estimated (1924) at 120,235. Hamilton's graphical position gives it excellent shipping facilities on Great Lakes. The city is on the Canadian Pacific and Cana National Railways and is connected with several lines of United States. It is the centre of a system of city and subur lines, and the municipal supply of electric power is cheap and p tically unlimited. Hamilton has about 700 factories, inclu largest plough works and implement works in the British pire. Besides its Anglican and Roman Catholic cathedrals, city has 89 churches, 50 banks, 45 schools (public, private technical), five hospitals and three public libraries.

AMMARSKJÖLD, HJALMAR (1862–), Swedish states- , was born at Tuna Feb. 4 1862 and educated at the Uni- ity of Upsala, where in 1891 he was appointed professor ivil law. After establishing his reputation as a jurist, he ed an important part in national politics and became Min- of Justice in the Van Otter Cabinet, holding this post from –2 when he was appointed president of the Göta high court. 905 he was Minister of Education in the Lundeburg Cabinet also a delegate to the conference with Norway at Karlstad e time of the dissolution of the union. He was Swedish Min- in Copenhagen from 1905–7 when he became governor dshörding) of the province (län) of Upsala. He had been dish delegate at the Hague conferences in regard to private rnational law in 1900 and 1904, and from 1904 was Swedish nber of the Hague International Board of Arbitration. In he was Sweden's leading delegate to the Hague Peace Con- nce and in 1909 acted as president of the Franco-German rd of arbitration in regard to the Casablanca affair. He pre- d in 1913 over the Franco-Italian arbitration court regarding seizure of vessels during the Tripoli War. In Feb. 1914 he eeded Staaff as Prime Minister, retaining this post during World War until 1917 (*see* SWEDEN). Hammarskjöld became ember of the Institut de Droit International and a curator he Académie de Droit International at The Hague. In Dec. he was appointed by the Council of the League of Nations rman of the commission relating to the codification of inter- onal law.

AMMERSTEIN, OSCAR (1847–1919), American musical ctor, was born in Berlin. He went to the United States in 3, where he made money as an inventor of cigar manufac- ng machinery. In 1870 he became lessee and manager of a ery theatre and after 1880 built and operated the Harlem ra House, the Olympic, the Victoria and other theatres. In 5 he built the Manhattan Opera House, in avowed rivalry the Metropolitan Opera House. In the operas which he luced there he broke away from the classics and presented works of modern composers, for example Massenet's *Thäis*, ussy's *Pelléas et Mélisande* and Charpentier's *Louise*. He red artists such as Melba, Tetrazzini, Bonci and Renaud Campanini as conductor and artistic director. In 1911, ever, he was compelled to sell his concern to the Metropol- Opera Company, agreeing to abstain from producing grand ra for 10 years within the latter's territory. He then went ondon and built the London Opera House, but here again he d to make a commercial success of the undertaking. Re- ning to New York in 1912 he built another theatre for the pose of entering his former field of grand opera, but the Met- olitan Opera Company secured an injunction prohibiting from so doing. He opened his new house under the name of Lexington Theatre in 1914, with the usual form of theatrical gramme. He died in New York City Aug. 1 1919.

AMMOND, JOHN HAYS (1855–), American mining en- eer, was born in San Francisco March 31 1855. He studied at Sheffield Scientific School, Yale University (Ph.B., 1876), af- vards taking a course at the Royal School of Mines, Freiburg, ony. In 1880 he was engaged in the U.S. Geological Survey he California gold fields, afterwards practising as consulting ineer, in which capacity he visited most of the countries of th and South America. In 1893 he became associated with nato Bros. and Cecil Rhodes in South Africa, acting as con- ng engineer for the Consolidated Gold Fields Co. of South ca, the British South Africa Co., and the Randfontein Estates d Mining Company. As one of the leaders of the Rand faction, vas, in Jan. 1896, after the Jameson Raid, arrested and con- ned to death, but the sentence was commuted, and later he released on payment of a $125,000 fine. In 1900 he returned he United States and became largely interested in mining erties and irrigation projects both in the United States and Mexico. He was president of the Panama Pacific Exposition Commission to Europe, 1912; chairman of the World Court Commission, 1914–5; and chairman of the U.S. Coal Commission 1922–3. He became general manager and consulting engineer of the Guggenheim Exploration Company.

His son, JOHN HAYS HAMMOND, JR. (1888–), American inventor, was born in San Francisco April 13 1888. He studied at the Sheffield Scientific School, Yale University (B.S., 1910). Devoting himself to electrical developments and experiment, he invented a torpedo for coast defence controlled by wireless energy, a system of radio control of ships and a system of selective radio telegraphy; also various electrical devices the use of which for military purposes was secured by the U.S. Government.

HAMSUN, KNUT (1859–), Norwegian author, was born Aug. 4 1859 at Lom in the Gudbrandsdal Valley, the son of poor parents. He started to write at the age of 19 when he was a shoemaker's apprentice at Bodö in North Norway, and for the next 10 years earned his livelihood in various ways such as coal trimmer and country schoolmaster. He eventually went to America, where he became a tram conductor in Chicago and a farm labourer on the prairies. In 1888 he published, in a Danish magazine, the fragment of a novel, *Sult*, which was later translated into English, as *Hunger*. This work at once attracted attention by the beauty of style and originality of treatment. His works from this time onward revealed a richness of talent which rapidly increased his reputation. He is akin to the Russians in his psychological analysis of morbid types, but the American influence is apparent in his use of startling metaphors and the aptness of his expressions. An intense love of nature also characterises his work. He is chiefly known to the English-speaking world by his three novels, *Hunger*, *Growth of the Soil* and *The Woman at the Well*. In 1920 Hamsun was awarded the Nobel Prize for literature.

HANDICRAFTS, ARTISTIC (*see* ARTS AND CRAFTS, 2.700).—The revival of interest in and the practice of the artistic handicrafts which was organised in the early 'eighties in England by Morris, Crane, W. A. S. Benson, W. R. Lethaby and their associates exercised an influence which soon extended to other European countries, the United States and Canada. Although it must be admitted that the dream of its founders has not been and cannot be realised, that influence is not dead. The quality of production may and must vary from time to time with the varying skill of the worker; but a standard of excellence has now been promulgated which is—if not yet equal to the hopes of the pioneers of the movement—at least well advanced in that direction.

The arts and crafts movement was, and is, a protest against machine-made goods and commercialism, and though these, in the nature of things, must continue, definite results have been achieved. The influence of the movement upon the trade side of art-industry has been undeniable. The machine-made article cannot—or, at all events, does not yet—equal in technical execution the hand-made article. But in colour, in pattern, in form, one has only to compare the shop-window display of the period since 1910 with that of the earlier period, to see how great has been the advance of taste. And there has never been so great a demand for books, magazines and the written word generally relating to the arts, as there is at present; in itself a fairly convincing evidence of the growth of interest in the subject on the part of the public.

I. HANDICRAFTS IN GREAT BRITAIN

An effort is being made, in Great Britain, by various societies and with some support from the Govt., in the direction of a general revival of village handicrafts. It is too soon to measure its success; but the movement is worthy of record.

Furniture.—While it is true that the most important of the industrial arts, the making of furniture, is suffering to some extent from a fashion for 18th-century reproductions, steady progress is being made towards what may turn out to be a veritable 20th-century style, of which the distinctive features appear to be simple construction based on good joinery rather than on cabinet-making. The use of woods selected for their natural beauty and undefiled with polish or stain is another characteristic. Ornament is scantily applied and with increasing attention to utility and comfort; and the general tendency is towards rather substantial and even massive forms, although work on more delicate lines is not wanting. Undoubtedly the most distinguished figure in these, and in other, branches of craftsmanship was Ernest Gimson, whose style seems to be well on its way to becoming a tradition. But distinguished work in England has also been done by E. A. and S. H. Barnsley, P. Waals, A. Romney Green, S. Gordon Russell, C. A. Richter and Ambrose Heal. The wood carving of G. Jack and Lawrence Turner and the carved wood puppets and other figures by William Simmonds are especially notable. Continental furniture follows much the same principles, with perhaps more reliance on mass than on line; as for instance in the work of Louis Sognot of Paris, Hans Hloucat of Vienna and the productions of the Deutsche Werkstätten, Munich.

Silversmiths' Work.—In silversmiths' work, progress has hardly been maintained so far as regards a demand on the part of the public for really fine personal craftsmanship, although, again, the design characteristic of the revival is being reflected to some extent in commercial products. Most of those who are concerned with presentation plate still seem afraid to entrust their commissions to artists whose names and individuality would enhance values. For church purposes, however, admirable work has been done, especially as altar furniture, pastoral staves, etc., by Alwyn Carr, Henry Wilson, Omar Ramsden, Edward Spencer and others; and the series of episcopal and other seals engraved by Cecil Thomas would come into this category. A search for variety has revived, in new form, a combination of shagreen with silver or copper, worked with considerable success by Paul Cooper. Modern jewellery, with its distinctive use of stones *en cabochon* rather than cut, has perhaps kept its small place, but has not affected the more popular taste to any appreciable extent, and of enamels it can only be said that the art has lost rather than gained ground. The silversmiths' work of the Scandinavian group shows promise and originality, and French artists still display extraordinary technical skill and ingenuity; but for obvious reasons there is little new movement to record.

Textiles.—Textile fabrics generally show a tendency towards simple and effective colouring, side by side with a revival of the brocade and chintz patterns of the 18th century, and a still powerful oriental influence. Patterns directly based on flower and plant form have no longer the vogue of the earlier years of the century; though the renaissance of good needlework, due very largely to the efforts of Miss May Morris and Mrs. A. H. Christie, as well as to the effective work done by the Dept. of Textiles of the Victoria and Albert Museum under Mr. A. F. Kendrick, seems to be firmly established in Great Britain. On the Continent, peasant design has influenced pattern, and a definite revival of tapestry in Sweden is to be noted. In this class reference must be made to the effect of the costume designs of Léon Bakst originating a new movement which has spread far beyond its original purpose. Design in carpets and rugs, so far as it exists at all, appears to be almost entirely subservient to Persian and Near Eastern motives; apart from these, however, public taste seems to prefer unpatterned colours to an increasing extent.

Glass.—Much more attention has recently been given to original design in glass-ware on the continent of Europe than in Great Britain; and while there is perhaps too strained an effort in this direction, it cannot be denied that a fair amount of good work is being done. That of Marinot of Paris is decidedly in this class, for it keeps well within reasonable limits in appropriate treatment of the material and yet achieves a novel and highly decorative effect. Some excellent glass for table use is being made in Sweden and Denmark; and the more highly elaborated designs of E. J. Margold of Darmstadt and of the cut-class made under the direction of Prof. G. Beckert of Czechoslovakia are enterprising in pattern and by no means without interest. If in this
department Great Britain is behind, in stained glass she
made distinct progress. A Gothic tradition is, in this insta
almost essential; but its treatment of subject can be, an
sufficiently modern for all practical purposes. The desig
Christopher Whall, P. Woodroffe, G. Kruger Gray, G. P
and others have continued and developed the new life inst
in this art by William Morris and Sir P. Burne-Jones.

(E. F.

II. HANDICRAFTS IN THE UNITED STATES

In the first quarter of the 20th century the artistic h
crafts, or arts and crafts, have made substantial progress i
United States of America. When the revival began with
Boston Exhibition in 1897, the standards were not partic
high and the amount of work being done throughout the cou
was insignificant. The Boston Society of Arts and Crafts
organised in this year and has maintained its leadership i
movement ever since. Its annual sales have increased
$4,000 in 1901 to over $200,000 in 1925.

The arts and crafts were taken up with fervour and a
number of societies were soon organised. The result was
with the showing at the St. Louis Exposition in 1904 and a
Boston Exhibition in 1907, fairly good standards were establi
in all branches of craft work. It must be admitted that crafts
who were foreign-born and trained contributed largely to
rapid advance. While some of the initial enthusiasm died d
after a few years, there has been a decided renewal of int
since the World War. Distinguished work is now being d
which has had considerable influence on commercial work
in the improvement of popular taste.

Probably the most important advance has been made in
field of stained glass, in which it may be said that an outstan
American style has been established, notable for its decora
character and its emotional quality of colour. While it
definitely carries on the traditions of the early stained glas
is already adding traditions of its own. The fact that the
portation of fine stained glass from Europe has dropped off at
75% in the last ten years, although there has been an unpr
dented number of fine churches built, is due to the work of
men as Charles J. Connick, Nicola D'Ascenzo, Henry W
Young, J. Gordon Guthrie, Lawrence Saint and Joseph
Reynolds.

In metal work, there has been the greatest advance in ironw
and jewellery. Samuel Yellin is doing some masterly work
iron, as well as Frank L. Koralewsky, Morgan Colt and
Marie Zimmerman. In quality of design and technique,
standards have been reached by such jeweller-craftsmen
Frank Gardner Hale, Edward E. Oakes, Herbert Kelley,
Margaret Rogers, Mrs. Josephine H. Shaw, Mrs. Eda Lord Di
and Horace E. Potter. The early American silversmiths car
their art to a high point of perfection, and those of the pres
generation have been content to follow along the Colonial li
without attempting much originality or change. American si
is characterised by good lines and plain surfaces, with
decoration than is usual in Europe. The marked increase in
demand for handwrought silver is due to the notable work
Arthur J. Stone, George C. Gebelein, James T. Woolley, Ge
E. Germer (who has done some fine ecclesiastical pieces), Doug
Donaldson, George J. Hunt, Porter Blanchard, Karl F. Leino
John P. Petterson and F. J. R. Gyllenberg. A growing dema
for pewter is recently apparent, stimulated by the work of Les
H. Vaughan.

The leading American woodcarver is undoubtedly I. Kir
mayer, who has developed a style of his own which he ca
American Gothic, characterised by the introduction of archit
tural motives in the drapery, but more especially by strength
character, reverence and a mastership of all the best traditio
In furniture, as in silver, there has been a harking back
Colonial times, and the standards of public taste have be
raised enormously through the great vogue of antique pieces a
good modern reproductions. No new styles have been develop

In textiles the advances have been largely in batik and blo ating. The names of Miss Lydia Bush-Brown, Miss Helen yden, Charles S. Todd, Jean Paul Slusser, Arthur Crisp, Miss ll Witters, Gilbert Fletcher and Mrs. Marion Maercklein odbridge stand out prominently. Weaving has been restricted gely to Colonial models.

reditable work is being done in pottery. The porcelains of s. Adelaide A. Robineau and the tiles of Henry C. Mercer and s. Mary Perry Stratton have a high reputation. Other master ters are Charles F. Binns, Arthur E. Baggs, Edmund de Curtis, H. Varnum Poor and R. Guy Cowan.

ome excellent illumination has been done by Sister Olive nces, Sister Magdalen, Miss Winifred M. Crawford and Mrs. rtrude S. Bassett. The demand for hand bookbinding must ays be limited, but good work was done by Miss Mary Crease rs, Mrs. Averill Cole Howland, John F. Grabau and Miss anor I. van Sweringen. In the field of fine printing and ography it is generally conceded that such men as Bruce gers, D. Berkeley Updike, and T. M. Cleland are among the ders. The demand for good commercial printing and binding stimulated many of the leading publishers to put out books really artistic merit. American craftwork is holding its own h that of Europe and, in comparison, its dominant characistics seem to be its conservatism and restraint.

(H. P. M.)

HANGAR: *see* AERODROME.

HANIHARA, MASANAO (1876–   ), Japanese statesman, s born in Yamanashi-Ken. He graduated from Waseda Unisity, Tōkyō, in 1897 and entered the diplomatic service. In 9 he went to the legation at Seoul (Korea), as attaché, being nsferred to Washington in the same capacity in 1901. After ear of service there, he was made secretary, invited specially study American affairs, and later became chief secretary for eign affairs. He felt that American-Japanese relations were satisfactory and wished to impress upon the citizens of the ited States the necessity for friendly co-operation with the anese. He was sent to San Francisco as consul-general in 6, remaining until the end of 1917. Returning to Tōkyō he t became director of political affairs and then, in 1919, Viceister for Foreign Affairs. As vice-minister he was one of the r delegates to the Washington Conference 1921–2. In 1923 was appointed Japanese Ambassador to Washington, and it naintained in America that his reference, in a public speech, to " regrettable consequences which would follow the passage " the Immigration bill, was responsible for the bill becoming . The Japanese Govt., realising that some blunder had been de, recalled Hanihara in 1924.

HANKOW, China (*see* 12.919).—A great commercial entrepôt is vided for China by the three large cities, Hankow, Hanyan l Wuchang, at the point where the Han flows into the Yangtze ing. The population was given in 1923 as 1,646,800. In sumr the surrounding country is flooded, and vessels drawing ft. can get up to Hankow, but during the winter the port is essible only to vessels drawing 12 ft., even at favourable peri, and as the water falls hulks are moved out from the banks, h which they are connected by staging. In 1921, however, a er commission was formed, and the work of levelling the river l from Hankow downstream was begun. The advisability of d prevention works is also being investigated. Hankow, ing to its strategical importance, suffered considerably during Revolution of 1911, and in Nov. two-thirds of the city was troyed by fire, as a result of bombardment by the Imperialists. 1914 80% of the area was again covered with houses on the old tern. Several new roads, however, have since been laid out the rear of the native city on reclaimed land, and a scheme housing large numbers of the poorer classes on new areas, to eve the housing problem, has been promulgated.

he industrial development of the district, increasingly active er the World War, is reflected in the building of a number of tories and workshops, and foreign interests are largely inased. The British Bund has become the banking and comrcial centre, and a number of imposing banks and offices have n erected, including a customs house, a large Chinese hospital in European style in the native quarter, and a church in the French Concession. The British Concession has been enlarged, and the concessions, each with its own municipal council, now extend for over 2 m. along the river. Those of the Germans and Russians have been taken over by the Chinese authorities. The water supply of the city is good; and there have been no recent outbreaks of cholera. After the World War trade expanded steadily, though the black tea trade, Hankow's staple industry in former days, has declined, largely because of the elimination of the Russian market. The interruptions to communications and the constant impositions which have resulted from the internal troubles of China, as also the increased competition since the re-entry of German traders, have greatly troubled exporters.

HANN, JULIUS (1839–1921), Austrian meteorologist and climatologist, was born near Linz, Upper Austria, March 23 1839. In 1865 he became editor of the *Zeitschrift der Oesterreichischen Gesellschaft für Meteorologie*, and from 1877 was occupied in the Central Meteorological Institute at Vienna. In 1873 he was appointed professor of physics at the University of Vienna. He acquired a world-wide reputation for his works on atmospheric dynamics and thermodynamics, the " atmospheric pulse," cyclones and climatology. His principal works are *Die Erde als Ganzes; Die Atmosphäre und Hydrosphäre* (1872); *Handbuch der Klimatologie*, 3 v. (1908); *Lehrbuch der Meteorologie*, 3d ed. (1914) and many papers in his own *Zeitschrift* and the reports of the Akademie der Wissenschaften. He died in Vienna Oct. 1 1921.

HANUSCH, FERDINAND (1866–1923), Austrian politician, was born Nov. 9 1866 in Oberndorf, Silesia, the son of a poor Silesian weaver. After a childhood of crushing poverty, Hanusch became in 1900 secretary of the Austrian Textile Workers' Union. In 1907 he entered Parliament as a deputy. He was a pioneer of the Austrian trade union movement, especially in his own branch of industry, and did much to improve conditions for this class of labour, which were abnormally bad. In Oct. 1918 he became secretary of state in the new ministry of social welfare, and was author of most of the social legislation of the period, including the eight-hour day, the Works Councils Act, the law compelling employers of 14 hands or more to increase their staffs by 20% in order to reduce unemployment, and the laws dealing with the unemployment dole. He was universally respected for his personal probity and first-hand knowledge of labour problems and conditions. He died Sept. 28 1923.

HARA, TAKASHI (1856–1921), Japanese politician, was born at Morioka. After studying law and practising journalism he entered the diplomatic service, and was *chargé d'affaires* in Paris in 1886. In 1892 he was appointed director of the commercial bureau at the Foreign Office, and in 1895 became Vice-Minister of the department. He acted as minister to Korea from 1896–7, when he became chief editor of the Osaka *Mainichi*. Still deeply interested in politics he became the leading spirit of the Seiyu-Kai (Liberal) party. From the end of 1900 to May 1901 he was Minister of Communications in the Ito Ministry. He then reverted to journalism, and became chief editor of the Osaka *Shimpo*, and was elected a member of the House of Representatives for Morioka in 1902. Definitely abandoning journalism he was appointed Minister for Home Affairs in the first Saionzi Ministry of 1906, in the second Saionzi Ministry of 1911 and in the Yamamoto Ministry of 1913. On Sept. 29 1918 Mr. Hara, as the first commoner to become Prime Minister of Japan, formed a Cabinet based, for the first time in the history of Japanese politics, on strictly parliamentary principles. He was assassinated by a demented youth in Tōkyō on Nov. 4 1921.

HARBORD, JAMES GUTHRIE (1866–   ), American soldier, was born at Bloomington, Ill., March 21 1866. He graduated from the Kansas state agricultural college, Manhattan, Kan., taking the degree of B.S. in 1886. He joined the 4th Infantry in 1889 and was commissioned in the cavalry in 1891. Serving in the 5th, 11th, 10th and 1st Cavalry, he became a major in 1914. From 1903 to 1914 he served in the Philippine Constabulary. He became brigadier-general in 1917, and was chief of staff of the American Expeditionary Force in France 1917–8. He commanded the Marine Brigade near Château-Thierry, June 1918, being appointed major-general on June 26. He commanded the 2nd Div. A.E.F. in the Soissons offensive under Mangin, July 1918, after which he was placed in command of Service of Supply. He was reappointed chief of staff A.E.F., May 26 1919, and was head of the American military mission to Armenia, Aug. 1919. He served as deputy chief of staff, U.S. Army, 1921–2. Retiring from the army Dec. 29 1922, he became president of the Radio Corporation of America.

HARCOURT, LEWIS VERNON HARCOURT, 1ST VISCOUNT (1863–1922), British politician, was born in London Feb. 1 1863, the elder son of Sir William Harcourt (*see* 12.939). He was educated at Eton and afterwards travelled widely, becoming well known for his interest in art. In 1899 he married the only daughter of Walter H. Burns, of New York. In 1904 he was elected Liberal M.P. for the Rossendale division of Lancs., retaining the seat until 1916, and on the formation of Sir Henry Campbell-Bannerman's Government (1905) he became First Commissioner of Works. In 1910 he became Secretary of State for the Colonies in the Asquith Cabinet, and on the formation of the Coalition Government in 1915 again became First Commissioner of Works. In 1917 he was raised to the peerage. He died in London Feb. 24 1922, leaving a young son who succeeded to his title.

HARDIE, JAMES KEIR (1856–1915), British politician, was born on Aug. 15 1856 at Legbrannock in Lanarkshire of very poor parents. He was a message boy at six, and at 10 a "trapper" in a mine. After 13 years underground he became a miners' agent and helped to form the Ayrshire Miners' Union which was the first organised body to put forward the demand for a Labour party. In 1888 he stood as Labour candidate for Mid-Lanark and in the same year formed the Scottish Labour party. In 1892 he was elected for West Ham as the first Independent Labour M.P. At the formation of the Independent Labour party in 1893 he was made chairman, and eventually succeeded, with James Ramsay MacDonald, in forming the Labour party. He lost his seat in 1895, but was returned for Merthyr in 1900, 1906 and 1910. In 1894 he founded *The Labour Leader*. In 1908 he made a tour of the world. As a begetter of the Labour party and on account of his personality and courage he is considered one of the party's heroes. He died in Glasgow on Sept. 26 1915.

See J. B. Glasier, *Keir Hardie; the Man and His Message* (1919); W. Stewart, *J. Keir Hardie. A Biography* (1921); F. Johnson, *Keir Hardie's Socialism* (1922); D. Lowe, *From Pit to Parliament; the Story of the Early Life of James Keir Hardie* (1923).

HARDINGE OF PENSHURST, CHARLES HARDINGE, 1ST BARON (1858–), British diplomat, was born in London June 20 1858, second son of the 2nd Viscount Hardinge. He was educated at Eton and Trinity College, Cambridge, and in 1880 entered the diplomatic service. He became secretary of legation at Teherān in 1896, and in 1898 went to St. Petersburg as secretary of embassy. In 1903 he returned to England and became assistant Under-Secretary for Foreign Affairs, becoming later (1906–10) permanent Under-Secretary. In the latter capacity he accompanied King Edward VII. on his foreign visits. He was created K.C.M.G. in 1904, G.C.M.G. in 1905 and K.G. in 1916. From 1904 to 1906 Sir Charles Hardinge was ambassador to Russia, and in 1910 was appointed Viceroy of India and raised to the peerage. Lord Hardinge returned to England in 1916 and was reappointed to the post of permanent Under-Secretary of Foreign Affairs. In Nov. 1920 he succeeded Lord Derby as ambassador in Paris, retiring in 1922.

HARDING, WARREN GAMALIEL (1865–1923), 29th President of the United States, was born at Corsica (then Blooming Grove), Morrow co., Ohio, Nov. 2 1865, son of George Tyron Harding, a farmer and country doctor, and Phebe Elizabeth Dickerson. He studied in the common schools, and from 14 to 17 at the Ohio Central College at Iberia. He taught in a country school for a year, read law for a short time, worked in a newspaper office and in 1884 became editor and proprietor of the *Marion Star*. On July 8 1891 he married Florence Kling. Having attracted the notice of Senator Joseph B. Foraker (*see* 10.628), he was encouraged to enter state politics, and was early recogni as an effective speaker. He served two terms in the Ohio sen (1900–4), and during the second was influential in secur Senator Foraker's re-election to the U.S. Senate. From 1904 1906 he was lieutenant-governor of Ohio, but in 1910, wh nominated for governor by the Republicans, was defeated b plurality of 100,000. In the campaign of 1912 his paper support President Taft. In 1914 he defeated Foraker in the Republi primaries as candidate for the U.S. Senate, and was elected w a majority of 100,000 for the term of 1915–21; but his friends with Foraker remained unabated.

In 1916 Mr. Harding was delegate-at-large from Ohio to t Republican National Convention, of which he was chosen p manent chairman. In the Senate he was regarded as a "saf man, who could be relied upon to support orthodox Republi policies. In 1915 he urged "preparedness" for naval defe In 1916 he voted against the confirmation of Louis D. Bran as associate justice of the U.S. Supreme Court. In 1917 he g his support to the declaration of War against Germany, and a to all the War measures, including the Selective Draft a Espionage bills. He favoured the death penalty for spies, b after the War advocated amnesty for political prisoners. opposed the suggested Federal control of food and fuel. favoured the Prohibition Amendment, and voted for the V stead Act, enforcing War-time prohibition, over the Presiden veto. He favoured the anti-strike clause of the Cummins Ra way bill, and voted for return of the lines to their owners with a year after the end of the War. He was for exempting Americ shipping from Panama Canal tolls and also supported wom suffrage. He was opposed to the Covenant of the League Nations, holding that "either the Covenant involves a surren of national sovereignty and submits our future destiny to t League, or it is an empty thing, big in name, and will ultimat disappoint all of humanity that hinges its hopes upon it." voted for the Lodge reservations and also for the Reed reser tion that the United States alone should judge whether mat of direct interest to it should be brought before the League; finally he voted against ratification of the Treaty as submitt by President Wilson. He maintained that Americans sho show chief concern for America, and opposed all tendenc toward internationalism. He supported the Knox resoluti declaring that war with Germany was ended.

At the Republican National Convention in 1920 Mr. Hardi was not at first among the prominent candidates for preside On the first ballot he received $65\frac{1}{2}$ votes (493 being necessa for choice), 39 of these being from his own state. On the eigh ballot he received $133\frac{1}{3}$ votes, on the ninth $374\frac{1}{2}$ votes, and the tenth he secured the nomination with $692\frac{1}{2}$ votes, the res being due largely to the support of certain influential U.S. Se tors, delegates to the convention, who hoped that as presi he would be amenable to the Senate. He did not "stump" t country, but conducted his campaign from the "front porch of his own home. Mr. Harding based his campaign chiefly up criticism of the Wilson administration, denouncing especia the excessive power that, as he maintained, had been exercis by the executive as a result of War centralisation; he demand as speedy as possible a return to normal conditions, political a industrial.

While opposing the Covenant of the League of Natio Mr. Harding gave to many of his supporters the impression th he desired an "association of nations" which, without t characteristics of a super-state (such as he believed the Leag to be), might safeguard peace. But he retained the politi support of many who were opposed, like Senators Borah a Johnson, to any sort of international association. In the N elections he won an overwhelming victory over James M. C the Democratic nominee, also from Ohio; he carried, genera by immense majorities, all the northern states and all but of the states on the border between North and South, and cut down materially the Democratic majorities in the Sou The electoral vote was 404 for Harding against 127 for C The popular vote was 16,138,000 for Harding against 9,142, Cox. In Ohio the popular vote was 1,182,000 for Harding inst 780,000 for Cox. The sweeping character of his victory s due less to his own personal strength or to the weakness of x than to the national reaction against the Democratic party l the popular feeling against President Wilson. Mr. Harding igned from the U.S. Senate in Dec. 1920, and was inaugurated irch 4 1921, the sixth President to come from Ohio.

The promise frequently made by Republican campaign leaders t Mr. Harding would surround himself with advisers of acity and experience, seemed to be fulfilled by his choice of inet members. The outstanding names were those of Charles Hughes and Herbert C. Hoover, who became Secretary of te and of Commerce respectively. The distinguished career the former and the widespread confidence in his ability and itical integrity had marked him for the most important posi- n in the Cabinet; and there had been a general demand that new administration should utilise the organising ability played by Hoover in many fields. Various elements in the publican party, nevertheless, had stoutly opposed their pointment, so that the President's choice showed that he was pared to exert his independence of party managers and to ist upon administrative efficiency. The choice of Andrew W. llon, a wealthy banker and ironmaster of Pittsburgh, as retary of the Treasury, was welcomed by men of business; l though that of Will H. Hays to be Postmaster-General was he nature of payment of a political debt to the man who had n the manager of the Republican campaign, it was early tified by his administration of the Federal postal service.

Mr. Harding's inaugural address, and his first message to ngress, delivered in person on April 12, voiced his desire to urn to "normalcy," as he expressed it. Retrenchment in enditure formed a major item in his programme, together h a prompt and thorough revision of taxation. He advocated adoption of a national budget system, and the Congress hav- passed a Budget bill similar to that vetoed by Mr. Wilson in o, he approved it on June 10 1921; it provided for a Budget reau in the Treasury Department and the appointment of a ctor of the budget, the first being Charles G. Dawes, formerly eral purchasing agent of the American Expeditionary Force. sident Harding's first budget was presented Dec. 5 1921. President was insistent upon the need of repealing the excess fits taxes and reducing transportation taxes and income sur- es. The need of financial retrenchment led to his opposing proposal that War veterans should receive a cash bonus. In matter, as in others, he proved his ability at this early stage esist political pressure. As regards the tariff he advocated, as mporary stop-gap, the passing of the emergency tariff, which been vetoed by President Wilson, but which with slight ration was approved by Mr. Harding on May 27 1921. He ed the need of adopting a permanent tariff policy, and on 5 1921 suggested a "flexible tariff" which might provide the adjustment of rates to meet unusual and changing con- ons. Such adjustments might be made, in his opinion, by executive on the advice of the Tariff Commission.

Ir. Harding's interest in agricultural problems was keen; in first message he asked special protection for agricultural rests, and in his second he declared that something more n protection must be given the farmers, advocating warmly encouragement of co-operative marketing plans. As regards nestic legislation, the President, in general, assumed the rôle noderator. He disclaimed any desire to enlarge the powers responsibilities of the executive, which, he declared, were ady too large; and he aimed at close co-operation with Con- s. In marked contrast to his predecessor, he left adminis- ive responsibility to the members of his Cabinet. Foreign cy was largely determined by Hughes, financial by Mellon, the problem of unemployment was thrown upon Hoover. President, however, frequently played an active rôle in the erences necessary to secure general agreement, as on Aug. 21 when an accord was reached between the Treasury and Representatives on the taxation plan.

he foreign policy of the administration at first seemed likely to emphasise independence of action, on contradistinction to that of President Wilson; the threatened war between Panama and Costa Rica was prevented by a sharp note from Secretary Hughes; the claims of the Japanese to a mandate over Yap were stoutly denied; the administration refused to follow Great Britain in resuming trade relations with Soviet Russia. President Harding made plain in his first message that the United States would not enter the League of Nations. But he expressed himself warmly in favour of active co-operation with other nations of the world, and by accepting the invitation to participate in inter-Allied councils indicated that he would avoid a policy of isolation. In rejecting the League Covenant, he said "we make no surrender of our hope and aim for an association to promote peace, in which we would most heartily join." The President advocated a declaration of peace with Germany by resolution, and the immediate negotiation of a treaty. This policy was adopted by Congress, which agreed upon a joint peace resolution, signed by him on July 2. On Aug. 25 1921, a treaty with Germany was signed, embodying the President's plan of including most of the stipulations of the Versailles Treaty, but repudiating adherence by the United States to any clause referring to the League of Nations. This treaty and similar pacts with Austria and Hungary were ratified by the Senate, Oct. 18 1921.

The most important step taken by President Harding during the first year of his administration was the calling of an international conference on the limitation of armaments. On May 25 1921 the Senate had adopted an amendment of Senator Borah to the Navy bill, authorising and inviting the President to call such a conference. Mr. Harding's preliminary invitations to the principal naval Powers (Great Britain, Japan, France and Italy) were sent July 10, and formal invitations Aug. 11. He made clear his belief that the question was closely connected with the problems of the Pacific and Far East, and invitations were also sent accordingly to China and to the smaller European Powers with Far-Eastern interests—Holland, Belgium and Portugal. The invitations were accepted, and the conference assembled at Washington on Nov. 12. President Harding avoided the example set by his predecessor, and did not himself participate as a delegate. He displayed his political tact in the choice of the American delegation, which was led by Secretary Hughes and included, besides Elihu Root, two members of the Senate, Lodge and Underwood, the Republican and Democratic leaders respectively. The policy drafted by the President and Mr. Hughes was direct and vigorous. They refused to permit the vital problem of limitation of armaments to be side-tracked, and surprised the conference by proposing a 10-year naval holiday and a drastic scrapping of tonnage by the three chief naval Powers. The President made it clear that he regarded the conference merely as a step in securing international understanding and goodwill; he advocated the convening of succeeding conferences as a possible means of securing an international association for the promotion of peace, and he approved the principle of substituting an understanding between the United States, Great Britain, France and Japan regarding Far-Eastern problems, for the existing Anglo-Japanese Treaty. (*See* WASHINGTON CONFERENCE.)

The Washington Conference was the highwater mark of the Harding Administration. Thereafter he faced the development of blocs in the Republican party which destroyed its solidarity, and the growth of criticism which was manifested by the elections of 1922, as a result of which the Republican majority in the House was reduced. Mr. Harding's veto of the Bonus bill indicated his unwillingness to sacrifice principle to expediency. But he found difficulty in explaining the administrative incompetency, or worse, of office-holders in Washington; resentment was felt against the Republican national organisation controlled by the Old Guard; there was outspoken criticism of the new tariff; keen discontent among the farmers led to the election to the Senate of Shipstead and Magnus Johnson. Again the threat of a Third party became imminent.

In the summer of 1923 Mr. Harding set forth on a tour across the United States and to Alaska, designed to reassure the farmers and reawaken enthusiasm for the Administration. The President, already tired, became ill on the trip back from Alaska and was stricken with pneumonia in San Francisco. On Aug. 2 1923 he died suddenly. (C. Sey.)

HARDY, THOMAS (1840–), English novelist (*see* 12.946); in later years received increasing recognition, not only as a great novelist but also as a poet. His great epic-drama *The Dynasts* (1904–8), a chronicle play of England's struggle against Napoleon, with an accompaniment of philosophic comment chanted by a chorus of "phantom intelligences," was in part produced at the Kingsway Theatre, London, in the early months of the World War, and again at Oxford in 1920. several volumes of lyrical poetry followed (*Selected Poems* in 1916; *Collected Poems* in 1919—but now incomplete). His first wife died in 1912, and in 1914 he married Florence Emily, daughter of Edward Dugdale, herself a writer of children's books and articles in periodicals. Both on his 70th and on his 80th birthday he received tributes of respect and admiration throughout the English-speaking world.

Thomas Hardy's career naturally divides itself into three periods. The first of these contains his work as a novelist, and ends with *Jude the Obscure* in 1896 (*The Well-beloved*, published in book form in 1897, appeared serially in 1892). The second period consists of *The Dynasts*, the three parts of which were issued separately in 1904, 1906, 1908: no doubt the greatest single achievement of his career. The third period may be said to begin with *Time's Laughing-stocks* in 1909, and is wholly devoted to lyrical poetry. It is not often that an artist's life can be divided so definitely into separate stages, each stage characterised by the use of a different form; and, next to its length and plenty, and consistently noble idiosyncrasy, this tripartite division is perhaps the most remarkable feature of Mr. Hardy's career as a whole. The lyrical period, however, does not give us an entirely new development of his genius.

While he was writing novels, he had occasionally experimented with poetry, and some of the results were published, in *Wessex Poems* (1898) and *Poems of the Past and the Present* (1901), between *Jude the Obscure* and *The Dynasts*. The volumes published since *The Dynasts* also contain a good many more of these earlier poems. But from 1909 onwards Mr. Hardy wrote nothing but lyrical poetry, and this may therefore truly be called his lyrical period. (*A Changed Man* in 1913 merely rescued from the periodicals of former years several stray pieces of minor fiction.) It represents a new concentration of his power, but certainly no diminution of it. Devotion to lyrical expression has produced a mastery almost as signal in its kind as his command of the art of fiction; and his 70th year saw him beginning, with *Time's Laughing-stocks*, the series of volumes—*Satires of Circumstance* (1914); *Moments of Vision* (1917), *Late Lyrics and Earlier* (1922), *Human Shows, Far Phantasies* (1925), which has shown him to be the most original, the most poignant, and also the most copious, of contemporary lyrical poets.

The originality of the technique in these volumes does not by any means consist in a mere breach with the accepted conventions, but rather in its highly individual—to some, perhaps, rather disconcerting—compound of the conventional and the unconventional. Most of these lyrics maintain an exact and even rigid formality of stanza, in which a scheme of rhymes is imposed, as it seems, arbitrarily and at all costs. The effect is sometimes justified by its music; but more often by the compact force its pressure gives to language almost conversational in its idiom and choice of words. Yet the diction which defies poetic tradition and seems to despise the magic of elaborated verbal suggestion, is oddly blended with stiff literary phrases and even with words that one might expect only lexicographers to think of. The truth seems to be that, in lyrical technique, Mr. Hardy has no prejudices either for or against the conventions. He is simply concerned with the matter which intense feeling and profound understanding have enabled him to imagine in a way peculiarly his own, and to express this faithfully he has forged a technique peculiarly his own, out of whatever the language of literature or of speech could offer him. Readers who are willing to allow him this liberty can hardly fail to be impressed, perhaps nowhere else in recent poetry, by the subtlety, dep and variety of his versions of the experiences common to h manity: the commonplace becomes in his hands something ri and strange. Naturally the habit of thought and outlook the world, which we find progressively insistent in the series the Wessex novels, and which inspire the turbulent matter a monumental structure of *The Dynasts*, are very evident also the lyrics; which indeed are often in the nature of marginal co ments on themes previously used.

But something like the quintessence of his tragic power m be found in such ballads as "A Trampwoman's Tragedy," such keen discrimination of pathos as "Near Lanivet," a something too like the quintessence of his irony to be altogeth comfortable in *Satires of Circumstance* or "Ah, are you diggi on my grave?" Nor is the rustic humour of his beloved Dors villagers wanting, nor the vivid delight in nature, in the extra dinary range of his lyrical art. It is, in fact, the same Har in the lyrics as in the novels and *The Dynasts;* but a Hardy wh if his lyrics were all we had of him, would surely, by virtue them alone, hold a secure, indeed a unique, position in mode English literature. (L. Ab.)

HARE, SIR JOHN (1844–1921), British actor (*see* 12.948), di in London Dec. 28 1921. He made his latest appearance on t stage in a revival of Grundy's *A Pair of Spectacles* at Wyndha Theatre in 1917.

HARINGTON, SIR CHARLES HARINGTON (1872– British soldier, was born at Chichester May 31 1872 and co missioned in the King's (Liverpool) Regiment in 1892. A service in the South African War, he held a series of staff a pointments, and on the outbreak of the World War went France as general staff officer, 2nd grade, of the III. Corps. ability brought him rapid promotion and in June 1916 he bec major-general, general staff of the II. Army. He remained ch of staff to Gen. Plumer in France for nearly two years, w the exception of a short interval in Italy. The combined tal of the two men were such that the II. Army became prover for its excellent staff work and for carrying out any operation w the maximum economy of life. Messines 1917 was perhaps th most brilliant feat. In April 1918 Harington was recalled to War Office to become deputy chief of the Imperial Gen Staff. In the following year he was created Knight comma of the Bath. In Sept. 1920, he succeeded Gen. Milne as C mander-in-chief of the British forces, and subsequently of Allied forces at Constantinople and in the Black Sea. His and diplomacy in a difficult situation, especially during Chanaq incident, helped to avert serious complications, and fittingly acknowledged in Parliament. On his return to Engl in Oct. 1923 he was appointed to the Northern Command.

HARLAN, JOHN MARSHALL (1833–1911), American ju (*see* 12.954), died in Washington, D.C., Oct. 14 1911.

HARPIGNIES, HENRI (1819–1916), French painter (13.15), of whose drawings there was an exhibition in Lon in March 1910, died in Burgundy Aug. 25 1916.

HARRIGAN, EDWARD (1845–1911), American actor (13.17), died in New York City June 6 1911.

HARRISON, FREDERIC (1831–1923), British man of lett (*see* 13.23). Frederic Harrison's death at Bath from sud heart failure at the age of 92, on Jan. 14 1923, closed an unusu long and active career devoted to literature and religious serv

In his last book *De Senectute* (1923), which he did not liv see published, he re-affirmed his life-long principle and attachm to the religion of Auguste Comte, and no estimate can do justice which does not take into account the essentially relig character of his life, of which all his written works may be to be a contributory expression. Though Frederic Harris originally came into prominence in the days (1850–80) of figh agnosticism, he was never himself an "agnostic," and in fact severely criticised by the leading agnostics, notably by Hu and Herbert Spencer, etc.; moreover, as a Positivist, he w republican in spirit and, what was new at that period, a soci gist. It was this positivist sociology which caused him as a you an to espouse the cause of trade unionism, which he did with ch energy and legal skill as adviser to the Royal Commission Trade Unions in 1867, that he was really the inspirer and under of the trade union law as it existed from 1868 to 1906. one the less, his religion did not permit him to embark upon a iblic career. He virtually retired from politics (in the party nse) and from legal practice in mid-life, this latter very largely the enforced consequence of his pioneer fight on behalf of ide unionism, and took to letters.

At the age of 80 he published his *Autobiographic Memoirs,* vol. (1911). Among the books that flowed almost annually m his pen may be mentioned: *Memories and Thoughts* (1906); *itional and Social Problems* (1908); *Tennyson, Ruskin, Mill d other Literary Estimates* (1899); *George Washington, etc.* 901); *The Creed of a Layman* (1907); *Realities and Ideals* 908); *Novissima Verba* (1920); *De Senectute* (1923). As an storian Frederic Harrison did not belong to the modern school specialisation, and ranks as a " literary-historian "; as essay- , he excelled, occupying a distinguished place both for the undness of his judgment and for the vigour and clarity of his yle. Politically, he stood in the position of an unofficial pro- nsul, and for some years before the World War he repeatedly irned his countrymen of the impending crisis arising out of the med system of Europe, and of the necessity of British prepara- on to meet it. An article he wrote in *The English Review* in 13 proved to be only too prophetic. During the War he stood falteringly for victory and for the cause of France. His son, né, was killed in Flanders in 1915.

Frederic Harrison can hardly be classified either as a pure in of letters or as politician by virtue of his religious opinions iich debarred him from active participation in worldly affairs, d even as a critic the humanist motive was uppermost. His e may be described as an attempt to introduce Comte's Human- sociology into this country, to which end he devoted all his ergies. For 20 years he was the leader of English Positivism d regularly lectured at Newton Hall, being also a co-founder of d contributor to *The Positivist Review*. His political views were llously put forward in that organ. He was not a Radical in e party sense though always a Liberal in spirit. Internationally, was a life-long supporter of France, and in 1870 vehemently ged British support of Gambetta as against Bismarckianism. he was a " Little Englander," it was because of his champion- ip of the " Little Peoples," and during the Boer War his pro- unced anti-jingoism led him into acute controversy. Publicly, attitude was often misunderstood for that reason. He may said to have been a republican in spirit, a humanist by con- tion and a " meliorist " as politician.

Frederic Harrison had not originally wished to found a Posi- ist centre or sect, but after the secession of Dr. Congreve on e crucial issue of allegiance to French Comtists, he virtually d no alternative, and it was thus that Newton Hall came into ing. As the head of that body, Frederic Harrison found copious e for his scholastic knowledge and energies as lecturer and cher, and though in that position he was " labelled," the cerity and disinterestedness of his opinions were so universally ognised that his public moral authority did not lose through lation. In this way he occupied a kind of " chair " of public orals, such as is hardly conceivable in any other country, hence unflinching war determinism in 1914 caused him to be ore popularly known and appreciated in extreme old age than d been the case during the Victorian epoch when, as a human- , he found himself neither on the one side nor the other of the eat Victorian struggle for " liberty of thought," the founda- n of which intellectually had been laid by Auguste Comte and arles Darwin.

In this great battle of " reason," which started at Oxford, Har- on played a conspicuous part, though never as an iconoclast d in interest, spiritually; *i.e.*, outside the intellectual ethicism sing out of the new criticism, for he neither adhered to the litarianism of Mill nor to the " dry light " of the debaters the famous Metaphysical Society of which he was a member. sitivism was at that time regarded as a " heresy " both by orthodoxy and by the agnostics, and in the controversies that ensued Harrison drifted somewhat out of the movements of his time. He was perhaps the last survivor of the " great " Victorians. He will be remembered as a supreme individualist, a slashing controversialist, as a practical idealist and citizen. Thus he consistently advocated the return of the " Elgin Marbles " to Greece on the ground that the statuary belonged to the historical religion of the Greeks. He was a friend of President Roosevelt and twice lectured in the United States. He was at his best as critic of life and art in the relation of the past to the present, which was Comte's " law " of continuity, but Harrison was alive to the academic weaknesses in Comte's *Polity* and rejected any dogma. In his latter years he resided at Bath, of which city he was given the freedom. He refused all titles or " honours." His ashes, mingled with those of his wife, repose in an urn placed in the chapel of Wadham College, Oxford, according to his last wishes. See Austin Harrison, *Frederic Harrison: Thoughts and Memories*, 1925. (A. Hn.*)

HART, SIR ROBERT (1835–1911), Anglo-Chinese official (*see* 13.30), died at Great Marlow, Bucks., Sept. 20 1911.

HARTLEPOOL, England (*see* 13.34), had a population (1921) of 20,997 and an area of 924 acres. It is connected with West Hartlepool by rail and tramway over Hartlepool Bay. West Hartlepool had in 1921 a population of 68,689 and an area of 2,958 acres. The parish church was restored in 1921, and the Baptist church, destroyed by bombardment, was rebuilt. An obelisk has been erected in Victory Square, West Hartlepool, as a war memorial. In 1924, 5 ac. of land were levelled for additional timber storage, and a quay was built for the fishing industry in 1910. The total area of docks in the Hartlepools is now 200 acres. In Dec. 1914 the towns were shelled by German cruisers and a little damage was done.

HARTLEY, SIR CHARLES AUGUSTUS (1825–1915), British engineer (*see* 13.35), died in London Feb. 20 1915.

HARTLEY, JONATHAN SCOTT (1845–1912), American sculptor (*see* 13.35), died in New York City Dec. 6 1912. Among his last exhibits were " Young Hopi Stick Thrower " (1911) and " The Cradle of Pan " (1912).

HARVARD UNIVERSITY (*see* 13.38).—The history of Harvard University after 1909, when Abbott Lawrence Lowell succeeded Charles William Eliot as president, is one of change and growth to meet new needs and opportunities.

Buildings.—Three residence halls for freshmen (Gore, Standish and Smith) accommodating about 450 men, built near the Charles river at a cost of approximately $2,500,000, were opened in 1914; and in 1919–20 a number of other dormitories, originally erected by private enterprise, were purchased by the university, thus largely increasing the residence halls under its control; in 1924–5 over half the undergraduates of Harvard College and a considerable proportion of the students in the graduate schools located in Cambridge were housed in buildings owned by the university. In 1925–6 Massachusetts Hall, which was a residence hall from 1720 to 1870, was again occupied by students, and two new dormitories, Lionel and Mower halls, became available for seniors; the erection of a third dormitory in the Yard was begun, while by the Charles river a fourth large dormitory for freshmen was under construction. Two new chemical laboratories, the Wolcott Gibbs and the Thomas Jefferson Coolidge, Junior, Memorial, were opened in 1913–4; these facilities for the study of chemistry were, in 1925–6, being increased by large laboratories, which at time were under construction at a cost of approximately $2,000,000.

During 1914–5 the university's museum buildings as originally planned by Louis Agassiz in 1859 were completed by an addition to the Peabody Museum. A building for the Music Dept. and the Cruft High-Tension Laboratory were also opened in 1914–5. In the same year the Widener Library, the largest of college libraries, erected by his mother in memory of Harry Elkins Widener, of the class of 1907, who lost his life in the " Titanic," was first used. The Germanic Museum, to exhibit the evidences of Germanic civilisation in the widest sense, was completed and opened in 1921. The new Counting-House, finished in 1925, provides adequate offices for the officials, except the treasurer, who have charge of the university property and accounts. In the same year work was begun on the buildings for the Graduate School of Business Administration, provided through the gift of $5,000,000 by George F. Baker; these buildings occupy a large tract on the Boston side of the Charles river. The erection (1925–6) of a new Art Museum at a cost of $1,200,000 to take the place of the Fogg Museum, long outgrown, was also made possible by friends of the university. Improvements have been made in athletic fields, gymnasia, etc.

Endowments.—The period under consideration was remarkable for the rapid increase of funds. In spite of the World War, graduates and friends gave approximately $17,000,000 in the decade 1909–19. Of this about $5,000,000 was for buildings and immediate use; $12,000,000 for permanent endowment. With the close of the World War the alumni revived a project, started before the War but then suspended, to secure additional endowment, and organised in 1919 a committee for the purpose. At the close of the fiscal year 1924–5 over $14,000,000 had been subscribed, of which over $12,875,000 had been paid into the treasury. The total productive endowment of Harvard University on the same date was approximately $70,000,000.

New Plan of Admission.—In 1910–1 a new plan of admission to Harvard College was adopted, which endeavours to test the intellectual condition of the applicant for admission and to establish a closer co-operation with preparatory and high-school authorities. From experience the plan is found to secure closer articulation, especially with public schools, and to provide the college with a better grade of student. In its essential features the "new plan" has been followed by a number of other important colleges. In 1923 the experiment was begun of admitting without examination students who have completed in regular course in a good secondary school a programme of study which fulfils in all respects the requirements for admission to the privileges of examination under the new plan, provided they have ranked in scholarship in the last two years of their school course among the highest seventh of the boys in the graduating class and are recommended by their school. So far as can be judged, students so admitted are above the average of their class in scholarship. In 1924, 48·4% of the freshman class entered from public schools.

The former free elective system, which furnished little or no direction to a student's choice of studies, was modified in 1910 by requiring each student to choose enough courses in one field of knowledge to enable him actually to gain considerable knowledge of that subject; and by distributing a certain number of courses among other fundamental subjects to secure a more systematic and well-rounded education. At the same time the "degree with distinction" was established for high attainment in general, coupled with distinguished success in the subject to which the student has given most attention. Beginning with 1916, general final examinations on the student's field of concentration were introduced in the departments of history, government and economics for all students; the plan was later extended to all other departments except the natural sciences.

In the years following 1916 a system of tutors was developed to direct the private reading of the students. The tutor meets his men individually each week and advises as to their private study; he is in no sense a coach. The results thus far show that the tutorial system is of great educational value; it encourages the student to think of his chief subject as a whole, and to read independently in his field; while the general final examination gives an opportunity to test his capacity at the end of his course. The two have resulted in increased interest on the part of the students and in higher scholarship among students of varying abilities. In 1925 out of the 516 students who presented themselves for the general final examinations in their several fields, 111, or 21·4%, obtained degrees with distinction.

The Engineering School.—In 1915–6, after the Massachusetts Institute of Technology had decided to move from Boston to Cambridge, all instruction in engineering was virtually transferred to it under a co-operative agreement entered upon between the Institute and Harvard. There being doubt, howeve
as to whether such co-operation was allowed under the terms
the Gordon McKay bequest which was given to Harvard Univer
sity to further applied science, application was made by th
university authorities to the Supreme Court of Massachusett
The decision of the court in 1917 was adverse, and Harvar
again established a School of Engineering Sciences, which, i
spite of conditions caused by the World War, made a successfu
beginning, and in 1924–5 had 36 instructors and 258 student
on the register.

Graduate Schools.—The period under review was marked b
constant developments in the graduate schools of the universit
The Graduate School of Arts and Sciences grew steadily i
numbers, although in common with other departments i
suffered a temporary check by the World War. Its students a
mostly preparing for careers as teachers and scholars; and,
spite of the economic disadvantages under which the professio
of teaching still labours, it is impossible to meet all requests com
ing to the school for teachers and research workers. In 1924
the total attendance was 763. The preparation for the scientifi
management of business given to young men by the Graduat
School of Business Administration won wide appreciation, caus
ing large resort to the school (614 in 1924–5) and it became ne
essary to limit the number of students. In the Law School
post-graduate year of study was established, leading to the de
gree of S.J.D., intended especially for men wishing to prepar
themselves for teaching law and for research in jurisprudenc
In 1924–5 the number of teachers was 24 and of students 1,20
representing 175 colleges. In the Medical School departmen
of pharmacology, of tropical medicine and industrial medicin
were organised, and a School of Public Health was establishe
Affiliation with hospitals, many of them grouped near the schoo
and changes in the faculties secured one of the largest and strong
est organisations for the teaching of medicine and for medic
research in the United States.

A separate faculty of architecture was established in 191
having under its charge the Graduate Schools of Architectu
and of Landscape Architecture, which respectively had (1924–
48 students from 19 colleges, and 39 students from 22 colleg
In 1920 the instruction in education, which had previously be
given under the faculty of arts and sciences, was organised
the Graduate School of Education with a separate faculty. T
this school women, as well as men, who hold an academic degr
are admitted, this being the only part of the university where c
education is recognised. In the year under review the school ha
37 instructors and 272 students, representing 86 colleges. T
Theological School was created in 1922 by an affiliation betwe
the Harvard Divinity School (1816) and Andover Semina
(1808); but this union was dissolved by a decree of court in 19
With the Divinity School are associated the Episcopal Theologic
School (in Cambridge), Boston University School of Theolog
and Newton Theological Institution. The degrees of Master
Theological Science (S.T.M.) and Doctor of Theology (Th.D)
were established for those wishing to continue their studi
after obtaining the ordinary degree, and the ordinary degr
itself (S.T.B.) is now given on the basis of a general examinati
at the end of the student's three-year course.

University Extension.—Subsequent to 1909 Harvard Unive
sity united with Boston University, Boston College, the Massach
setts Institute of Technology, Simmons College, Tufts Colleg
Wellesley College, the Boston Museum of Fine Arts, the Ma
sachusetts Board of Education and the School Committee
the City of Boston in offering courses in university extensio
These courses are given ordinarily in Boston to a considerab
number of students each winter.

War Services.—Ten thousand Harvard graduates and studen
entered the army or navy of the United States during the co
flict; of these 70% received commissions. No complete recor
exist of those who engaged in non-military service, but it m
safely be said that over half the Harvard men of every age to
an active part during the World War. The Roll of Honour co
tains 372 names of men who gave their lives.

The number of students in 1924–5 was as follows:—

College	3,009
Graduate School of Arts and Sciences	763
Special Students	32
Engineering School	258
Theological School	74
Law School	1,201
Medical School	506
Dental School	204
School of Public Health	30
Graduate School of Business Administration	614
Architecture	87
Graduate School of Education	272
Bussey Institution	25
Summer Schools of 1924 (446 deducted for duplication)	2,686
Total	9,315

1908–9 the corresponding total was 5,250. The number of ficers of instruction and administration in 1924–5 was 1,319; in 08 9, 743. The total number of volumes and pamphlets in the iversity library in 1924 was over 2,320,000. Radcliffe College or women), in which instruction is given by Harvard teachers, though not part of Harvard University, had in 1924–5 908 udents. (C. H. M.)

HARVEY, GEORGE BRINTON McCLELLAN (1864–), merican editor and diplomat, was born at Peacham, Vt., Feb. 1864, and was educated at the Peacham Academy. At the ge of 18 he became a reporter on *The Springfield* (Mass.) *Re-ublican*, and later on *The New York World*. In 1885 he was pointed by Governor Green of New Jersey as aide-de-camp his staff, and was reappointed by Governor Abbett. The tter also made him insurance commissioner of New Jersey in 90. During 1891–4 he was managing editor of *The New York orld*. Then for several years he was engaged in the construc-on of electric railways, and in 1898 organised a syndicate hich secured possession of the lines in Havana, Cuba. The llowing year he purchased *The North American Review*, which ereafter he edited for several years. During 1900–15 he was esident of the publishing house of Harper & Bros., and during 02–13 was editor of *Harper's Weekly*. In 1903 he purchased *he Metropolitan Magazine*.

Harvey was said to have been the first to suggest (in 1906) oodrow Wilson, then president of Princeton, as a presi-ntial possibility. In the campaign of 1912 he gave Wilson rong support; but after the latter's nomination an estrange-ent developed, due, as it was generally understood, to the ct that Wilson intimated that his cause was being jeopardised Harvey's officiousness. In 1916 Harvey urged the election Charles E. Hughes, the Republican candidate for President. e was strongly opposed to the League of Nations, on the ground at it involved the yielding of national sovereignty. In 1918 established *The North American Review's War Weekly*, later lled *Harvey's Weekly*, which bitterly denounced the Wilson lministration. In 1921 he was appointed ambassador to Eng-nd by President Harding, a position which he held till Nov. 23. He became editorial director of *The Washington Post* in May 24, resigning May 31 1925. Harvey's books include *Women* 08) and *The Power of Tolerance, and Other Speeches* (1911).

HARWICH, England (*see* 13.47), with a population of 13,046 1921, and an area of 1,541 ac., including Halstead, added to e borough in 1917, is the most important naval base on the st coast of England. Flotillas operating from the harbour did gnificent work during the World War, particularly in mine eeping in 1917. The main quay was extended by 1,000 ft. 1911, and there are now berths for nine steamers, and moor-gs for nine more in the river. A train ferry to Zeebrugge was ugurated in 1924. The parish of Dovercourt has been united th that of Harwich for purposes of local government. A metery was opened at Parkeston in 1910. The electricity ply was taken over by the municipality in 1925.

HAUPTMANN, GERHART (1862–), German dramatist e 13.68), hardly added to his reputation as a dramatist after 09. He produced *Kaiser Karls Geisel* (1908); *Griselda* (1909); *e Ratten* (1910), the latter in his earlier realistic manner; *Gabriel Schillings Flucht* (1912); *Das Bogen des Odysseus* (1914); *Winterballade* (1917); *Indipohdi* (1921) and *Peter Brauer* (1921). His novels include *Der Narr in Christo Emanuel Quint* (1910); *Atlantis* (1912); *Der Ketzer von Soana* (1918); *Phantom* (1923) and *Die Insel der Grossen Mutter oder Das Wunder von Île des Dames* (1924). In 1921 appeared *Anna*, an epic poem.

See C. Holl, *Gerhart Hauptmann*, etc. (1913); W. Bonsels, *Das junge Deutschland und der grosse Krieg, aus Anlass des Briefwechsels Romain Rollands mit G. Hauptmann über den Krieg und die Kultur* (1914); A. Esprey, *G. Hauptmann und wir Deutschen* (1916); P. A. W. Gaude, *Das Odysseusthema bei Hauptmann* (1916); J. H. Marschan, *Das Mitleid bei G. Hauptmann*, with bibliography (1919); Paul Fechter, *Gerhart Hauptmann* (1922).

HAVANA, Cuba (*see* 13.76).—The population of Havana, the capital of Cuba, was 360,517, according to the census of 1919. Since that time it is estimated that there has been a still further increase to perhaps 500,000 inhabitants in 1926, for which immigration, mainly Spanish, is largely responsible. Havana, once rather backward in civic improvements, now compares as favourably with other cities of the world in its attractive, up-to-date appearance as it does in commercial and industrial importance. Motor cars swarm the streets, which for the most part are very narrow, but this condition has been relieved by having traffic go one way in all but the wider thoroughfares. In keeping with the wealth of Cuba, the capital has an unusual number of splendid private residences, excellent hotels, and luxurious club houses. The Spanish clubs are astonishingly rich. One of them, the Galician Club, has 67,712 members, while the Asturian Club has 60,351. The university of Havana, the principal educational institution of Cuba, has over 4,000 pupils, of whom some 3,000 are in daily attendance.

Havana is the economic, as well as the political, social, and intellectual centre of Cuba. Nearly all of the larger commercial companies and banks have their main offices there. The volume of trade through the port of Havana surpasses that of any city in the Western Hemisphere, except New York. About 75% of all Cuban imports enter at Havana, but the proportion of exports is considerably less. The customs receipts at this port are some 75% of the total collected in the island. Havana is connected with other parts of the world by means of a number of steamship lines and cables. There is even through freight train service from the United States, making use of a ferry from Key West, which is six hours away. (C. E. Ch.)

HAVRE, LE (*see* 13.82), the second seaport of France, had a pop. of 163,374, including the garrison, in 1921. Work has been continued on the last stages of the 1909 programme of port improvement, which includes a large graving dock and wharfage in the tidal basin, a floating dock and pontoons, a basin for large oil tankers and reservoirs in the outer harbour, and a wharf and mole for goods storage in the north part of the port. A petroleum pipe-line to Paris has been built, but Havre is still only linked by one line of railway to the capital, and is badly connected with other towns in its own district. An escalator is to be built in Rue de Montmorency, one of the steepest streets. In Aug. 1924 a monument was unveiled commemorating the hospitality shown by the town during the War to the Belgian Government, which was housed in a hostel at St. Adresse to the northwest of Havre, after the fall of Antwerp. At the same time a golden sword of honour was presented to the King of the Belgians on behalf of the French people. During the World War large numbers of British and American troops and vast quantities of ordnance and stores passed through the port, and after the Armistice it formed one of the American embarkation points. Trade has again reached its highest pre-war point. In 1924, 4,021 vessels of 8,264,645 tons entered and cleared the port, as compared with 4,018 vessels of 5,671,975 tons in 1907, previously the highest figures recorded.

HAWAII (*see* 13.83).—A group of islands in the North Pacific Ocean, annexed to the United States on Aug. 12 1898, and now represented in the American Congress by a delegate elected biennially. In 1925 the population, including military and naval personnel of 17,094, was 323,645 (an increase, exclusive of such personnel, of 59·7% since 1910).

Race must not be confused with nationality. Birth in Hawaii, as well as elsewhere in the United States, makes one an American citizen. Of the above total, 202,165 were Americans and 121,480 (including Filipinos who are neither citizens nor aliens) were not. Immigration of Orientals in the earlier stages produced an abnormal ratio not only of aliens to citizens but of adults to children and males to females, but later there was a rapid tendency toward normality. Except among Americans and Filipinos, the increase in population was in 1925 mainly through births. Departures have latterly exceeded arrivals, and the departures have been largely of adult aliens. The birth-rate was 41·57 and the death-rate 12·74 per 1,000 in 1925. While there was a growing tendency toward intermarriage among all races, the extremists in preserving racial solidarity are the Koreans and Japanese. The most noticeable social feature in Hawaii is the comparative absence of those racial antagonisms and prejudices prevailing in Asia and Europe.

Immigration has been occasioned by the rapid growth of industries. Many Latin and Oriental unskilled labourers were assisted to reach the country but this is now impossible under the immigration laws. Many of these with their children under improved conditions become skilled labourers. Hence the constant need of replenishing the supply of unskilled labour. The last immigration assisted by the Government (1906–12) comprised 5,288 Spanish, 4,962 Portuguese and 2,056 Russians. Since then the only assisted immigration has been of Filipinos by the sugar producers. These increased from 2,318 in 1910 to 49,335 in 1925. Chinese immigration, restricted previously, has been prohibited since 1898. The Chinese decreased until 1910, but have since increased slowly. The Portuguese, Porto Ricans and Koreans are increasing slowly and the Spanish are decreasing. The Japanese departures have exceeded arrivals since the "Gentlemen's Agreement" of 1907. The native-born Japanese, being American citizens, present the most important problem for the future. They increased from 4,855 in 1900 to 70,860 in 1925. Experience tends to show that the Japanese as well as the Chinese vote will be intelligent and conservative. Notwithstanding the comparatively small percentage of Anglo-Saxon Americans, the atmosphere—political, social and commercial—is conspicuously American.

Industries and Commerce.—Due mainly to the enterprise of the Anglo-Saxon element, the application of scientific methods, favourable soil and climatic conditions, location at the cross-roads of the Pacific and the American protective tariff, Hawaii has enjoyed prosperity for half a century.

Although prices of the principal products were low in 1925 the gains since 1910 were marked. Exports increased from $47,029,631 to $105,599,818; imports from $26,152,435 to $81,802,547; taxable property from $150,268,467 to $360,832,895; bank deposits from $13,324,305 to $60,809,716. Trade was chiefly with the mainland of the United States—$104,095,273 of exports and $72,145,418 of imports in 1925. The exports comprised sugar, $71,468,150; fruits and nuts, chiefly canned pineapples, $27,943,493; coffee, $1,197,535; sugar machinery, $616,270; and smaller values of molasses, hides, tallow, wool, canned fish, bananas, rice, honey and other products. Imports from foreign countries are largely nitrates from Chile, bags from India, and food supplies from Japan.

The sugar crop has increased considerably in recent years, not by increase of acreage, but by scientific discoveries of better methods of cultivation, fertilisation and irrigation, and new varieties of cane. The most striking feature in Hawaiian industries is the extent to which science is applied—through such agencies as the sugar planters' and U.S. experiment stations, the University of Hawaii and the territorial Bureau of Agriculture and Forestry. The yield of sugar per acre is larger than in any other country; but the cost is greater and 18 months is required for a crop. In 1925 the crop was 776,000 short tons—an average of about 6½ tons per acre. A few fields yielded over 18 tons, and one plantation averaged over 12 tons throughout. Half the acreage is irrigated by means of conduits from mountain streams, storage reservoirs and pumping from artesian and surface wells. The crops from the irrigated lands, though more costly, are so much greater as to be more profitable in general than those from the unirrigated lands in the wetter districts. The industry is conducted by corporations owning the mills and raising the cane. The capital stock is widely distributed and bought and sold freely on the exchange. The labourers receive house, fuel, water and medical attendance free. Day labourers, few in number, receive a minimum of a dollar a day plus a turnout bonus of 10% if they work 23 or more days a month plus a profit-sharing bonus of 1 % for each of a cent by which the average price of sugar for the month excee 4½ cents. About 95 % of the labourers take work by contract, as th gives them greater remuneration and more independence. Much h been accomplished in improving the living conditions of the e ployees by replacing tenements with cottages and garden spac providing hospitals, entertainment halls and motion-pictur play-grounds, kindergartens, social-service workers, instruction industrial methods and creating an *esprit de corps* by various mea

The canned pineapple industry is entirely a growth of rece years. Its output in 1925 was 8,728,580 cases of two-pound ca One factory is the largest fruit cannery in the world. The cr has been increased materially by the use of mulching paper. This rolled out on the fields in long strips, through holes in which t plants are set out. It serves many purposes, such as preventing wee from growing, conserving moisture, etc. While Hawaii exports a imports a larger percentage of what it produces and consumes th most countries, there is nevertheless much subsistence farming, a several industries, such as the livestock and fishing industries, figu largely in local trade. Much attention has been given to the import tion and raising of thoroughbred stock. The principal food of t Hawaiians is *poi*, manufactured from the root of the *taro*. There a no mineral products except building stone, lime and salt. Althou Hawaii is essentially an agricultural country, the industries are su as require much manufacturing, not only directly, as in sugar, r and coffee mills and fruit and fish canneries, but also indirectly, in iron and fertiliser works and can factories of large size. Ma factures of other products, such as biscuits, macaroni, starch, sho clothing, boats, etc., are on a small scale. Strikes of serious ext have occurred only twice, in 1909 and 1920, and unionism has o tained little foothold. There is a compulsory Workman's Co pensation law.

Communications.—Commerce on the Pacific is growi rapidly owing to industrial development on both sides of t ocean and the construction of the Panama Canal. The Fe eral and territorial Govts. and private enterprises have d veloped shipping facilities in Hawaii, located as it is at the co mercial cross-roads provided facilities at lesser ports for int island traffic; and developed the principal port on each of t four large islands for trans-Pacific and inter-island traffic. the newer wharves are of concrete. At Honolulu there a electrical freight-handling apparatus, automatic coal-handl plants, oil storage tanks connected with the wharves by pipe l and floating dry-docks. From 1910–25 the number of deep- steamers, exclusive of naval vessels, army transports and co bunker vessels, increased from 545 to 1,037; while sailing vess decreased from 232 to 31, and the combined tonnage increas from 2,589,097 to 7,993,137 tons. Some of these vessels solely between Hawaii and ports of the United States, mai San Francisco, Los Angeles and Seattle, but in part Atla ports; others are trans-Pacific, making Hawaii a port of between San Francisco and the Orient, Canada and the Ant odes, the Orient and Mexico or South America, while oth are round-the-world steamers. A fleet of 13 steamers is enga exclusively in the inter-island trade. There are 350 m. of se railways on the four principal islands and over 600 m. of priv railways on the sugar plantations. Hundreds of miles of c crete and macadam roads have been constructed. Beside cable there are four powerful wireless plants for trans-Pac communication, and smaller stations for communication tween the islands and with ships at sea. The five larger isla are well covered with efficient telephone systems.

Administration.—A direct primary law has been in operat since 1913 and woman suffrage since 1920. Racial distribut of voters differs much from that of population, dependin the case of each race partly on eligibility to naturalisation a partly on the percentage born in the United States and length of time the race has been in Hawaii. Hawaiians and pa Hawaiians are citizens; adult immigrant Portuguese, Span and Porto Ricans have generally been ineligible for naturali tion because of illiteracy; and Chinese, Japanese and Koreans ineligible under the Federal laws. In 1924 the registered vot comprised 21,575 men and 13,164 women, as follows: Hawa and part-Hawaiian, 16,685; Latins, 5,203; other Caucasia 9,124; Chinese, 2,016; Japanese, 1,711. There are two m political parties, Republican and Democratic, with the for usually in the majority.

Finance.—The bonded debt of the territory on June 30 1925 was 7,990,000. This has been incurred since 1910 for public improve-ents. Much current revenue also is expended on public improve-ents. The only local-government indebtedness consists of $2,080,-o public improvement bonds of the city and county of Honolulu d $1,280,293 district improvement bonds, the latter payable solely the property benefited, but $6,776,872 of the territorial debt has en incurred for county improvements, for which the counties reim-rse the territory in interest and sinking funds. The total revenue the territory and counties for the year ending June 30 1925 was 7,756,070 of which $8,283,262 went to the territory and $9,425,390 the counties ($47,418 undistributed) as compared with $2,621,758 d $1,394,695 respectively in 1910. The Legislature has recently ovided for a territorial budget system, a pension system for ritorial employees, and a uniform accounting system for the unties.

Education.—The educational system of Hawaii ranks high efficiency. It includes all grades from kindergarten to uni-ersity as well as a normal school and schools for the physically efective and feeble-minded. There is much manual work and dustrial training. Medical inspection of pupils is regularly ade and treatment is furnished free or at moderate prices and tention is given to nutrition. The university, established in 07, has 1,096 students. It possesses an aquarium and marine ological laboratory, conducts extension work and performs portant services in industrial experimental and research work. he number of pupils in the schools increased from 25,537 in 10 to 64,916 in 1925, of whom 55,044 were in the public hools and 9,872 in private schools. The cost of the public hool system is about $5,000,000 a year. More than half e pupils are Japanese. In addition the Japanese maintain an tensive system of so-called language schools. In 1920–5 laws ere passed subjecting all foreign-language schools, including me Chinese and Korean, to the supervision of the Department Public Instruction, limiting the sessions to shorter periods stricted to after public school hours, requiring the teachers to ss satisfactory tests in the English language, American his-ry and institutions and ideals of democracy, and providing r textbooks of superior pedagogical value and more suitable subject matter for American pupils. In 1912 a territorial brary was opened in Honolulu, with numerous stations through-t the territory which it supplies through travelling libraries.

Charities.—Of all the departments of the territorial govern-ent none except that of education is of wider scope or expends ore out of current revenues than that of public health. Phy-cians are employed or subsidised so that all, however indigent remote from population centres, may have proper medical ttendance. The principal territorial institution under this epartment is the leper settlement on the island of Molokai, ith its auxiliary hospital in Honolulu. Formerly emphasis as laid on isolation, but since 1909 emphasis has been placed n treatment, with the result that the number of lepers has een greatly reduced. Much progress has been made through ientific research and experimentation in effecting cures. haritable and welfare institutions abound in Hawaii.

History.—Hawaii's recent growth in importance has been arked not only in the scientific development of industries and s the commercial cross-roads of the Pacific, but as a great urist resort, as the great western military and naval outpost f the United States, and as the friendly meeting-place of East nd West. The tourist business has come to rank third in xtent. In 1909 the chain of small islands extending 1,200 m. the northwest of the larger islands was created a bird reser-ation—the largest and most numerous bird colony in the world. n 1916 the active volcanoes of Kilauea and Mauna Loa and e extinct crater of Haleakala were created a national park. he capital city, Honolulu, has grown rapidly. The naval sta-on and military post in Oahu Island are the greatest belonging the United States. Honolulu has been the seat of numerous an-Pacific conferences to foster among Pacific peoples the spirit f inter-racial brotherhood and promote co-operation among em for their common welfare—scientific, educational, press, mmercial and food conferences in 1920–4 under the auspices f the Pan-Pacific Union, and the Institute of Pacific Relations, atterned after the Williamstown Institute in 1925 under independent auspices. These unofficial conferences as well as the official Washington Conference bear witness to the growing importance of the Pacific area in world affairs. In 1920 the centenary of the landing of the missionaries was celebrated. The governors since 1907 have been: W. F. Frear, 1907–13; L. E. Pinkham, 1913–8; C. J. McCarthy, 1918–21; W. R. Farrington, 1921–.

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HAWTREY, SIR CHARLES HENRY (1858–1923), British actor (*see* 13.104), was knighted in 1922 and died in London July 30 1923.

HAYASHI, TADASU, COUNT (1850–1913), Japanese statesman (*see* 13.109), died at Tokyo July 10 1913.

HAYES, PATRICK JOSEPH (1867–   ), American Cardinal, was born in New York City Nov. 20 1867. Graduating from Manhattan College in 1888, he continued his studies at St. Joseph's Seminary at Troy, N.Y., and was there ordained priest in 1892. After a graduate course at the Catholic University of Washington, he became curate of St. Gabriel's parish in East 37th St., New York City. In 1903 Archbishop Farley of New York, who had been his parish priest, appointed him his secretary and chancellor. In the same year Cathedral College was opened, and he became its first president, an office which he held for 11 years. In 1914 he was consecrated titular bishop of Tagaste and bishop auxiliary of New York. In the following year he was made rector of St. Stephen's Church, and on Nov. 24 1917 was appointed Catholic chaplain bishop for the U.S. Army and Navy, in which capacity he travelled extensively, appointing chaplains to the various camps. He was made Archbishop of New York in 1919. Early in 1924 he was summoned to Rome by Pope Pius XI. and was made a cardinal at a consistory held on March 25, being assigned the Church of Santa Maria in Via as his titular church.

HAZLITT, WILLIAM CAREW (1834–1913), British bibliographer (*see* 13.120), died at Richmond, Surrey, Sept. 8 1913.

HEALTH: *see* PUBLIC HEALTH.

HEALTH, MINISTRY OF.—The English Ministry of Health was set up by statute in 1919. The Act had as its principal object the concentration of the health services of England under a single Minister responsible to Parliament. These services had grown up under many departments: The Local Government Board, the Insurance Commissioners, the Privy Council, the Home Office and the Board of Education. The Act established a Minister of Health for England and Wales with a parliamentary under-secretary. Wales was given a Board of Health separately constituted but responsible directly to the minister. A similar Act was passed in the same year setting up a Scottish Board of Health. This last is a separate organisation and its parliamentary chief is the Secretary for Scotland, who has a parliamentary under-secretary for health for Scotland. There are thus two separate national health administrations in Great Britain whose only link is the association of their parliamentary chiefs in the Cabinet.

Powers of the Ministry.—The main organisation in the new Ministry of Health was the transformed Local Government Board, and this explains many of the functions, remote from its title, which the Ministry still exercises, such as, for example, its power over the finance of local authorities. When the Ministry came into being (July 1 1919) it assumed from that date the whole of the powers and duties of the Local Government Board, and of the English and Welsh Insurance Commissioners, save for the powers of the latter over the Medical Research Council (then the Medical Research Committee). The powers of the Privy Council relating to midwives were immediately vested in the new Ministry. On Oct. 1 it took over, as provided by the Act, the powers of the Board of Education with respect to the health of mothers and young children, and of the Home Office in relation to infant life protection under the Children Act 1908. On Dec. 1 the Ministry further assumed responsibility for the duties of the Board of Education regarding the medical inspection and treatment of children and young persons. Arrangements had, however, to be made to enable certain of these latter duties to be carried out by the Board of Education on behalf of the Minister of Health.

In May 1920 the Ministry took over from the Home Office the administration of the Anatomy Acts and of certain powers and duties in relation to lunacy and mental deficiency. Many powers inherited from the Local Government Board have been similarly transferred to other departments, such as the Home Office, the Board of Education, the Electricity Commissioners and the Ministry of Transport. An example of this process may be seen in the Order in Council dated May 27 1921, transferring the powers of the Ministry over electoral registration and elections to the Home Office.

Activities of the Ministry.—The activities of the Ministry are classified in five main sub-divisions: (1) public health, (2) local administration and taxation, (3) housing and town-planning, (4) administration of the Poor Law and of the Old Age and Widows and Orphans, Pensions Acts, (5) national health insurance. Of these, housing is the greatest purely post-War development, and has under the 1919 (Addison) Act and the 1923 (Chamberlain) and 1924 (Wheatley) Acts expanded so greatly as to form almost a Ministry in itself. Important matters relating to health services and administration are still under other departments. Of these the Privy Council holds perhaps the greatest share, though the Home Office has duties in relation to the inspection of factories and workshops, etc., of much importance to national health. The Medical Research Council, as stated above, was not transferred to the Ministry with the other branches of the Health Insurance Commissions, but passed under the Privy Council. (The Medical Research Council originated under the Insurance Act of 1911 as the Medical Research Committee.) In addition the General Medical Council, the controlling body of the medical profession, is under the Privy Council and not the Ministry of Health.

The Scottish Board.—The Scottish Board of Health performs duties in Scotland almost identical with those of the Ministry of Health in England. It is derived similarly from the Scottish Local Government Board and the Scottish Insurance Commission. The only service with no English counterpart is that financed from the Highlands and Island Medical Services Fund (instituted by statute in 1913), which provides practically a State medical service in these areas and is subsidized directly from the Exchequer.

It will be seen that the Ministry of Health is in no sense a department corresponding, say, to the Ministries controlling any of the fighting services, with a unified authority and sole responsibility for one task and one task only, which in this case would be the safeguarding of the nation against disease and the increase of its physical efficiency. The fact that the health services are worked almost entirely through local authorities, themselves popularly elected, would make this in any case impossible. It is not yet certain, even, whether these "health" functions will ever form a major portion of the Minister of Health's task. So far, the housing problem, the supervision and overhauling of local government, and, from time to time, the solving of vexed questions in the national insurance schemes have thrown altogether into the background the direct purposes from which, presumably, the Ministry originally received its name. It is indeed more than doubtful whether the health problems of the nation, affected as they are so intimately by finance, by food supply and by distribution of population, can ever b satisfactorily separated from the other activities with whic they interlock.

BIBLIOGRAPHY.—Very full information on all the subjects referre to will be found in the annual *Reports* of the Ministry and of th Scottish Board of Health. Health questions in particular are ex haustively dealt with in the separately published *Annual Report* o the Chief Medical Officer "On the State of the Public Health." (W. E. EL.)

HEALTH INSURANCE: *see* INSURANCE, SOCIAL.

HEALY, TIMOTHY MICHAEL (1855–), was born a Bantry on May 17 1855, the son of Maurice Healy, clerk of th Bantry Union. His mother was the daughter of a schoolmaste in this little west Cork town. Three of her brothers, A. M. T. D. and Donal Sullivan, became Members of Parliament, as did three of her sons, Thomas, Maurice and Timothy Healy The eldest married his cousin, a daughter of T. D. Sullivan This group of closely related politicians was the nucleus of th "Bantry Band" which included also W. M. Murphy, M.P. founder of *The Irish Independent*. In the succeeding generation Kevin O'Higgins, Timothy Healy's nephew by marriage, be came vice-president of the Irish Free State when his uncle was made its first governor-general.

But the future governor-general inherited nothing but brain and a strong nationalist tradition. He began to earn his living at 13, and his early youth was spent as a shorthand clerk in a railway office at Newcastle-upon-Tyne. Here he became wel known in Irish political and literary societies. In 1878 he moved to London and began in his spare time to contribute to the New York *Nation*. In 1879 Parnell on his first mission to America found that he needed a secretary and wired for Mr. Healy, who was already known to him. In 1880, after Parnell had been elected chairman of the Irish party, a parliamentary vacancy occurred in Wexford City, and Mr. Healy was elected.

From the first he slapped the House of Commons in the face but he attended very closely to all its business. In 1881 Mr Gladstone's Land Bill began the revolution which gave the Catholic Irish ownership of the land instead of being mere cultivators under landlords. Mr. Gladstone said that with the exception of three Irish law officers only Mr. Healy understood it, and it is doubtful whether anybody but Mr. Healy understood the effect of the famous "Healy clause." Introduced as an amendment, this guaranteed that in future rent should not be chargeable on tenants' improvements. When the bill became an act, Mr. Healy, called to the bar in 1884, defended the tenants' interests in innumerable cases that arose in its application. In 1883 his audacious tongue secured him the distinction of being sent to gaol. Later in the year when a Liberal seat became vacant in County Monaghan he was selected to make the first Nationalist inroad on Ulster. He won. At the general election of 1885 with the extended franchise Monaghan became a safe seat. Mr. Healy attacked South Derry and won the constituency—by surprise tactics. In 1886, however, he was defeated, but was returned for North Longford.

His relations with Parnell now became less friendly, and he joined Biggar in opposing the candidature of Captain O'Shea for Galway City. The opposition was only overborne by Parnell's personal intervention. But in 1889, when the divorce petition against Parnell was undefended, Mr. Healy drafted the resolution carried by the party in favour of Parnell remaining at his post. "Parnell," he said, "is not a man, but an institution." Later, however, in face of Mr. Gladstone's declaration he changed his mind, and from the time the "split" began, no speeches were so envenomed as Mr. Healy's. He was twice publicly beaten; but no form of menace had ever the least effect on him. In 1892 he became member for North Louth, and, as a member of the anti-Parnellite party to which the large majority of Irish Nationalists belonged, he was specially supported by the Catholic clergy. His rivals for leadership, Mr. O'Brien and Mr. Dillon, had more following among the laity, but Mr. Healy was always a priests' man. At this time he devoted less time to politics, for his practice at the bar was increasing, and in 1899 he became Q.C.

On the reunion of parties in 1900 he joined Mr. O'Brien in
ging that Mr. Redmond, leader of the Parnellite minority,
ther than Mr. Dillon, leader of the anti-Parnellites, should be
osen as chairman of the united body. But a long indulgence
the savage spirit of faction which followed the Parnell "split"
d rendered Mr. Healy difficult to work with, and in 1902, on
e motion of Mr. William O'Brien, he was expelled from the
nited Irish League, though he retained the support of the
atholic hierarchy and of Mr. Murphy's influential newspaper.
1906 Mr. William O'Brien, having split away from Redmond's
ain body with a few followers, made a working alliance with
s former adversary and his brother Maurice, member for Cork
ity. In 1910, when Mr. Healy was beaten in North Louth, Mr.
'Brien provided him with a constituency in north-east Cork.
Mr. Healy joined the English bar in 1903 and took silk in
10. He was unceasingly employed on English cases, more
pecially of a political character, and defended many of the
ffragettes. In Parliament no speaker was more able to draw a
owded house, and his wit and eloquence were specially popular
ith the Tories, because he said more biting things of the Na-
onalist party than Englishmen could invent. With Mr. O'Brien
opposed the Budget of 1909 which led to the clash with the
ouse of Lords; and on the Home Rule measure of 1912, while
ving it general support, he furiously opposed partition.

In 1914 he was a vigorous supporter of Britain in the World
ar, but the course of events from 1916 onwards, culminating
the introduction of conscription, drove him finally to side
ith Sinn Fein, and in 1918 he resigned his seat to allow an
prisoned Sinn Feiner to be returned. Little was publicly
ard of him during the years of turmoil which followed until,
the close of 1922, the constitution of the Irish Free State
aving been made law by the Irish Parliament, and subsequently
the British, the office of governor-general had to be filled.
hen Mr. Healy's name was first mentioned for the post there
as general incredulity, but the appointment soon commended
self to Irishmen of all sections. The Free State Government,
eaking through the mouth of Mr. Healy's nephew, Mr. Kevin
'Higgins, defended the choice of "an old man of the people,"
hile others realised that Mr. Healy, though an extreme nation-
ist, had in many respects a most conservative mind. Those
ho feared the worst from a tongue and a temper which he had
ever before governed were surprised by the result; for during
is continuance in office as the representative of King George Mr.
ealy in no way added to the Government's difficulties, while
e did more perhaps than any other person to cultivate the good
ill of the Protestant minority. (S. G.)

HEARST, WILLIAM RANDOLPH (1863–), American
ewspaper proprietor, was born in San Francisco, Cal., April 29
863. He entered Harvard in 1882, but left after three years
ithout finishing his course. As the only child of George F.
earst, a mining man of great wealth, he had the use of ample
apital at the outset of his career. In 1886 he became proprietor
f *The San Francisco Examiner*, the first of a long chain of pa-
ers to come under his control. In 1895 he bought the New
ork *Journal* and in the following year founded *The Evening*
ournal, the morning paper being known after 1902 as *The*
ew York American. Other papers founded by him were *The*
hicago American (1900); *The Chicago Examiner* (1902); *The*
os Angeles Examiner (1902); *The Boston American* (1904);
nd *The Atlanta Georgian* (1906). He also purchased *The*
oston Advertiser (1917); *The Chicago Herald* (1918), thereafter
ombined with *The Examiner* as *The Herald and Examiner;*
he Washington Times (1919); and the Milwaukee *Wisconsin*
ews (1919). He was likewise proprietor of *The Cosmopolitan*
agazine; Good Housekeeping Magazine; Harper's Bazaar; Hearst's
agazine; Motor Magazine; and *Motor-Boating Magazine.*

Hearst's papers were sensational in form and contents and had
n enormous popular circulation. They upheld the cause of the
eople against the moneyed interests, but the charge was often
rought that they appealed to the baser passions. They were
merica's chief representatives of "yellow journalism" (*see*
9.569). In 1916 they were barred from circulation in Canada "because of garbled dispatches" concerning the World War. After America's entrance into the War they were frequently charged with disloyalty, and in many towns attempts were made to suppress them. From 1903 to 1907 Mr. Hearst was representative in Congress from New York, and in 1904 had support as presidential candidate at the National Democratic Convention. In 1905 he was Democratic candidate for mayor of New York on the Municipal Ownership ticket, and four years later on the Independence League ticket; in 1906 he was candidate for the governorship of New York on the Democratic and Independence League tickets, being defeated in every instance. He strongly opposed the League of Nations. He became head of the news syndicate known as the International News Service.

HEART, DISEASES OF THE (*see* 13.132).—The years from 1910 to 1925 have been a brilliant epoch in the history of cardiology. Most of the credit for this must be given to British workers, amongst whom the late Sir James Mackenzie and Sir Thomas Lewis have been pre-eminent. For a long time Mackenzie had been carrying out his memorable investigations on the venous pulse, using for this purpose a modification of Dudgeon's sphygmograph; but it was not until after his invention of the Mackenzie ink polygraph in 1908 that the investigation of cardiac arrhythmia by graphic records became at all general as a clinical routine. By means of this instrument, or better still by Lewis's modification of it, it is easy to obtain a prolonged simultaneous record of the arterial and venous pulses together with time marks of ⅕ of a second. The careful study of such records yields much valuable information.

Electrical Records.—Electrical records of the heart beat have given even more accurate results. A minute electrical current is generated when the heart, or any other muscle, contracts; and in 1887 Waller was able to record the electrical current generated by the human heart beats, using for this purpose the capillary electrometer. In 1903 Einthoven, of Leyden, invented his string galvanometer (*see* 11.430), an extremely sensitive instrument capable of detecting a current of less than $\frac{1}{60,000}$ millionth of an ampère; this has the advantage of being practically aperiodic and free from "lag," grave defects of galvanometers previously used. It consists essentially of a powerful electro-magnet, between the poles of which is stretched a very fine fibre, usually a filament of drawn quartz, silvered to facilitate conduction.

If a minute electrical current passes along this fibre the fibre moves across the magnetic field in one direction or the other according to the direction of the current through it. By putting the human heart in electrical connection with the fibre, either by means of contacts from the chest wall in front of the heart, or, more conveniently, by three electrodes in which the two hands and one foot are immersed, the fibre is found to oscillate with each heart beat. The movements of the fibre are magnified by a projection lantern and photographed on a moving plate; the source of light is interrupted rhythmically at a known rate (usually every 1/25 of a sec.), and thus is obtained a curve of the electrical variations associated with each heart beat together with appropriate time marks. On such a curve the variations due to auricular and ventricular contraction respectively can be very clearly differentiated, the wave representing auricular contraction being designated arbitrarily as "P," and that representing the commencement of ventricular contraction "R." The time interval between these two components of each normal heart beat can be measured very accurately.

Heart Block.—In health this time interval is between 0·18 to 0·20 sec.; if the junctional tissues between auricle and ventricle are injured, either by disease or by cardiac poisons, conduction between auricle and ventricle is delayed and the "P.R." interval may become 0·24 sec., or even more. This state of affairs is known as heart block, and in its early stages can be recognised only by means of graphic records. With more severe damage of the junctional tissues, higher grades of auriculo-ventricular block ensue; thus the ventricle may respond only to every alternate auricular beat, or to every third or fourth auricular beat; or, finally it may be impossible for any stimuli to reach ventricle from auricle, in which case there is complete dissociation between the upper and lower chambers of the heart, the former beating at their usual rate of 60–80 per min. while the ventricles take on a rhythm of their own, usually at a rate of about 35–40. This condition is known as complete heart block. The presence of these more serious grades of heart block can often be surmised on clinical grounds, but graphic records are essential for their certain recognition. Heart block is one of the rarer causes of irregular heart action.

Other Features.—There are other causes of cardiac arrhythmia, some of which are benign, others serious. Quite early in the century it was impossible to differentiate with certainty between the benign and the serious types. Now, thanks to the knowledge derived from graphic records, this differentiation can be made with confidence, and often without the necessity for taking polygraphic or electro-cardiographic tracings. For instance, previously " intermissions " of the pulse were always considered to be serious. Probably many an operation has been unnecessarily postponed or cancelled on account of what are known as " premature beats "; these are extra-contractions which arise, either in auricle or in ventricle, independently of the ordered sequence of normal beats, every one of which arises in the upper part of the right auricle (the sinu-auricular node) and spreads thence from auricle to ventricle. These premature beats are now easily recognised and, in itself, this type of arrhythmia is devoid of serious import; no surgeon would now think of postponing an operation merely because of the presence of this type of arrhythmia, which is almost invariably present from time to time in most elderly subjects.

Auricular Fibrillation.—But there is another common type of cardiac arrhythmia known as auricular fibrillation which is of much more serious prognostic significance. Here, as a result of serious pathological changes in the heart muscle, the auricles cease to contract rhythmically as a whole in a series of orderly beats; but the auricular musculature is in a constant state of incoordinate and futile twitchings; in consequence, the ventricles, instead of being stimulated from above rhythmically at the rate of about 70 per min., now are overwhelmed by a series of stimuli which pour down on them like an avalanche. They do their best to respond, and contract rapidly and irregularly at a rate of 120–180 per minute. This condition, sometimes known as " delirium cordis," is very constantly associated with cardiac failure, usually ending in dropsy, shortness of breath and eventually, if progressive, in death. It is a dangerous condition, but when recognised—and about its recognition there is now seldom any difficulty—it may be controlled by the administration of digitalis. This drug depresses the conductivity between auricle and ventricle, and consequently only the more powerful auricular stimuli reach the ventricle after its use; the ventricle now beats, still irregularly, but more slowly, and consequently, having time for a longer rest between each beat, more powerfully. The auricles may fibrillate in paroxysms lasting a few minutes, hours or days; but more commonly the condition is a permanent one. It brings about a very considerable degree of disability, but, if properly controlled by the use of digitalis and if the patient is content to live within his limits, it is often compatible with 10, 15 or even 20 years of very fair health.

The Circus Movement.—Lewis has recently demonstrated by means of the string galvanometer that in auricular fibrillation, as in its sister condition, auricular flutter, instead of each auricular beat arising, as described above, in the sinu-auricular node and radiating thence throughout the auricles, a " circus movement " takes place in the auricular muscle, often around the mouths of the great veins entering the right auricle. We have to conceive of a wave of contraction whirling around, usually in an irregular circle, and one whose disposition in space varies from beat to beat. From this contractile path are projected into the surrounding auricular muscle countless stimulating impulses, very much as sparks are thrown out from a catherine wheel, and, as a result, the whole of the auricular musculature is thrown into incessant, shimmering contractions. So soon as this explanation of auricular fibrillation was put forward and accepted, it was manifest that, if we could bridge the gap between the advancing crest and the retreating wake of the contractin wave in its "circus," the heart might revert to normal rhythm It has been found that quinine and its allied alkaloids, of whic quinidine is the one usually employed, have such an effect. I rather more than 50% of cases of auricular fibrillation it i possible to bring about a reversion to normal rhythm b the use of quinidine. Unfortunately the process is not devoid of risk, and there is a tendency for many of the cases t relapse into fibrillation when quinidine is withdrawn, so tha cases for quinidine therapy should be carefully selected and i administration should not be attempted by those inexperience in its use.

Paroxysmal Tachycardia.—This is yet another condition th recognition of which is often possible only with the aid of electrocardiographic records. Here the heart beats with great rapidit (rates of 150–200 per min.), but regularly. There is an abru transition from the normal and slow, to the abnormal and rapi rhythm; the attack may last for a few seconds, or for a few days and ends as abruptly as it began. Such attacks may be associated with great respiratory and mental distress, and may lea to cardiac failure. Their differentiation from a purely nervou form of rapid heart action may be impossible without an electrocardiogram taken during both normal and abnormal periods It is very important from the point of view of both outlook an treatment to be able to decide whether a case of palpitations is purely nervous phenomenon, or true paroxysmal tachycardia, more serious and intractable condition.

X-rays in Cardiology.—Of recent years X-rays have been use more and more in the investigation of cardiac disease. By thei help alone really accurate information can be obtained as t the size of the heart and aorta. Percussion of the chest wall and the location of the apex beat of the heart by the finger, ar all we have to rely on, apart from X-rays, in estimating the siz of the heart, and the information derived therefrom is vague an often misleading. By means of the X-rays the dimensions of th cardiac silhouette can be determined to a nicety, and much wor has been done, particularly by French physicians, in ascertainin the normal standards of measurement of this cardiac silhouett and in tabulating departures from such standards in variou pathological states.

Vital Capacity.—Much work has been done with regard to th vital capacity in health and disease. The vital capacity is th maximal amount of air which an individual is able to expire from the lungs after taking the deepest possible inspiration. As result of vast numbers of observations by many different investigators all over the world we now know what the vital capacit of any healthy individual of a given height and weight should be Disease of either heart or lungs may very materially diminish the vital capacity, and the figure obtained for an individual' vital capacity increases or diminishes according as the diseas in question advances or tends to recovery. This, therefore, is means of recording numerically a functional disability and it progress. This is a possibility the value of which is greater tha is at first apparent. Unfortunately, the statement of a patien that he is better or worse is not always a true index as to th progress of his disease; and even when his doctor thinks there i an improvement, sometimes the wish is father to the thought.

The trend of all this instrumental investigation of the heart' action has been to stress the importance of the heart's muscl in cardiac pathology and to minimise the effect of valvula lesions, to which so much attention was formerly paid. Possibl the pendulum has swung a little too far in this direction, wit the result that there has been a tendency to make light of, o even altogether to ignore, quite definite valvular lesions in th absence of any evidence of muscular defect. Such an attitud is deplorable, for it is doubtful if the heart's valves are ever diseased without, at the same time, some defect in the heart' musculature, and, in any case, it is manifest that a heart of whic one of the valves either leaks or is narrowed is not as efficient a organ as one whose valves are healthy. The essential point i that the physician should refrain from diagnosing valvular disease unless he is sure of his grounds. Many of the cardiac mur rs heard through the stethoscope are not necessarily indicac of valvular or of any other disease. The innocuous nature of se "exo-cardial," "cardio-respiratory," or "haemic" murrs, had long been known to the more experienced physicians, t it required the mass experiment of the World War to teach lesson to the rank and file of the profession.

Lessons of the War.—During the early stages of the War thouds of healthy men were refused for general service on the unds of such murmurs, and many thousands more were unnecarily invalided out of the army, often with pensions, by reason the discovery of such murmurs after enlistment. Another on of the War was that the condition known as soldier's rt is usually not associated with any disease of the heart itf. The rapid heart action which is the most striking feature of s condition, though it is, in fact, only one of many symptoms sent, is due to a general rather than to a local condition.

In Dec. 1925 Yandel Henderson, of Yale University, pubed some work which may well prove to be of the greatest portance in clinical medicine as well as in physiology. He has ceeded in perfecting a comparatively simple method of deterning in adult or child, healthy or sick, the output of the heart r beat. From this it is easy to calculate the actual work done the heart, and to recognise with certainty departures from normal standards of efficiency. Thus we now have, at last, imple method of ascertaining with accuracy whether a heart functioning normally or not, and of re-examining the patient m time to time, and observing whether a defect of cardiac ction previously discovered is stationary, improving or deterating.

However valuable may be the information derived from elec-cardiographic and X-ray examination, from analyses of pired and expired air, or of arterial and venous blood, and m many other modern methods of clinical investigation, no e of these ancillary diagnostic aids as yet surpasses or equals importance the old-fashioned method of medical history tak. Symptoms properly elucidated and interpreted, are to-day, previously, more important than physical signs and laboratory ts. An ache beneath the breastbone brought on by exertion d passing away with rest, is of more significance than an errant electro-cardiogram. It will be a bad day for clinical dicine when physicians devote their time entirely to laborary methods of investigation and neglect the less dramatic t equally vital elucidation of the patient's symptoms.

(M. A. C.*)

HEART AND LUNG, SURGERY OF (*see* 13.133).—Since 1910 w surgical work on the heart has been mainly devoted to three bjects.

I. SURGERY OF THE HEART

Removal of Foreign Bodies Retained in the Heart Wall.—The fety of the methods of surgical approach to the heart has been rther demonstrated. Surgeons in many countries have reoved war missiles from the wall of the heart and from the perirdium with a surprisingly small mortality. R. le Fort (*Bull. Mém. Acad. de Méd.*, vol. 80, p. 147, 1918) removed 11 foreign dies from nine patients, with one death. Roberts successfully moved a bullet from the posterior wall of the left ventricle, hich had been present for seven years and was causing cardiac sturbance. The approach by resection of one rib and traversing e pleura was excellent. He had also removed four fragments shell from the pericardium in four patients by the same route, th no mortality.

Operations for Stenosis of the Valvular Orifices of the Heart.—new field for surgery in the treatment of what has for long en a purely medical subject is being opened up by work which at the present moment largely experimental. The subject is ll in its infancy, but enough has been done to show that with rther experience certain selected cases of mitral stenosis, in hich the musculature of the heart has not been too much damed, may be submitted to operation with a fair prospect of provement. Duff S. Allen and E. A. Graham (*Jour. Amer. ed. Assoc.*, Sept. 23 1922 and *Arch. of Surg.*, Jan. 1924) have invented an instrument which they call a cardioscope. This is a tube, closed at one end by a lens, which is introduced into the heart through a small incision. When the lens is pressed against the heart wall so that no blood intervenes, the endocardium, illuminated by a small electric bulb, is clearly visible. In the wall of the tube is fitted a rod ending in a small knife, with which a stenosed valve may be incised under direct vision. In dogs, when the incision to introduce the cardioscope was made in the auricular appendix, all the dogs recovered. E. C. Cutler and S. A. L. Levine (*The Boston Med. and Surg. Jour.*, June 28 1923), believing that a mere incision in the stenosed ring will heal without relief of the stenosis, invented an instrument which punches out a piece of tissue.

They have used this successfully in the case of a girl, aged 12, suffering from mitral stenosis. She was alive 10 months later and was still improving. H. S. Souttar (*Brit. Med. Jour.*, Oct. 3 1925) reports a brilliant operation on a girl of 15 with mitral stenosis and regurgitation. He exposed the heart by a flap operation, and placed a light clamp on the base of the auricular appendix. After two guide sutures had been inserted, the appendix was incised and drawn over the finger like a glove, haemorrhage being thus obviated. The interior of the auricle was easily explored by the finger, no effect on the pulse being noted. The blood pressure instantly fell to zero as the passage of blood through the orifice was abolished. Souttar intended to divide the stenosed orifice with a knife passed along the finger, but as the stenosis was found to be of moderate degree with little thickening of the valve, he contented himself with stretching the orifice with the finger. The appendage was ligated at its base and the wound of the chest wall closed. The patient's condition was improved and she was well three months later, though still somewhat breathless on exertion.

Cervical Sympathectomy for Angina Pectoris.—The cause of this very distressing disease is not settled with certainty. But as changes in the cardiac muscle, coronary arteries and aorta are usually present it may be considered.

Jonnesco, of Bucharest, in 1916 first performed the removal of the left cervical sympathetic chain, including the upper and middle cervical ganglia and the first thoracic ganglion. The result, followed for four years, was complete relief from symptoms. T. Jonnesco operates under spinal anaesthesia (*La Presse Méd.*, April 26 1922). W. B. Coffey and P. K. Brown (*Arch. Int. Med.*, vol. 31, p. 200, 1923) report six cases with one death and great improvement in the other five, H. Lillienthal (*Arch. of Surg.*, vol. 10, p. 531, 1925) three cases. In one, the cervical sympathetic was removed on both sides. All were cured. H. H. Kerr (*Ann. of Surg.*, vol. 82, p. 354, 1925) reports five cases. He removes the superior cervical ganglion only, under local infiltration anaesthesia by novocain, and obtains the same results as the others by the more formidable operation performed by Jonnesco.

II. SURGERY OF THE LUNG

Since the World War the surgery of the lung has made great strides, and in all countries is engaging the attention of active workers. While differential pressure anaesthesia of some kind is still advisable, the introduction of intra-tracheal insufflation has enabled the elaborate and costly pressure chambers to be dispensed with. For many types of operation ordinary inhalation anaesthesia, especially by nitrous oxide and oxygen, suffices. Local infiltration anaesthesia, combined with nerve blocking by novocain or some similar drug, is largely used, and for some operations is essential. It is being combined with light analgesia by nitrous oxide and oxygen, or even ether by some surgeons in the case of nervous patients, for whom deep general anaesthesia is inadvisable (*see* ANAESTHETICS).

Surgical Treatment of Pulmonary Tuberculosis.—Direct operations on the tuberculous lung, either by drainage of tuberculous cavities or the resection of one or more lobes of the lung, have been abandoned by the majority of thoracic surgeons. The great advance in latter years has been in devising methods of collapsing the affected lung either temporarily or permanently.

Principles of Collapse Therapy.—In all other parts of the body it is found that rest of the affected part is beneficial, but in the case of the lung the respiratory movements, exaggerated by coughing, continue unless the lung is compressed. By collapse, stasis in the lymphatic vessels occurs, preventing spread of tubercle bacilli to other parts of the lung and diminishing the entrance of toxins into the general circulation with consequent improvement of the general resistance of the body. Congestion of the collapsed lung with blood appears to occur, favouring the formation of fibrous tissue and healing of the lesions. Mechanically, the effect is to allow the retraction of the new formed fibrous tissue and to collapse cavities and dilated bronchi. This prevents the retention of secretions, which often become secondarily infected with other organisms, and allows the walls of the cavities to come in contact and so to heal. This retraction occurs normally to a limited extent by the pulling up of the diaphragm, the pulling over of the mediastinum, and the assumption of the expiratory position by the ribs, but falls far short of that necessary for complete obliteration of the cavities.

Methods of Producing Collapse.—Artificial pneumothorax was first proposed by James Carson, of Liverpool, in 1821, but was introduced into practice by Forlanini, of Pavia, in 1882 (*Gazz. d. Osp.*, 1882). It is now extensively practised by physicians all over the world. By the introduction of air, oxygen or nitrogen through a hollow needle into the pleural cavity the lung may be more completely collapsed than by any other method. As this method is simple and satisfactory it is the method of choice, and other operations are only undertaken when this is impossible, through the presence of adhesions binding the two layers of the pleura together (*see* PNEUMOTHORAX).

Division of Adhesions.—Where the adhesions are few and bandlike, so that a partial collapse only can be obtained, it is necessary to divide them. The operation of thoracotomy and division of the bands by direct vision is unnecessarily severe. Jacobaeus, of Stockholm, in 1913 devised an instrument similar to a cystoscope, which he calls a thoracoscope. After the induction of a pneumothorax this is introduced under novocain anaesthesia through a canula. Through a smaller canula a galvanocautery is introduced. Thus the adhesions may be burnt through under the vision of the operator without opening the chest cavity (H. C. Jacobaeus, *Proc. Roy. Soc. Med.*, 1922–3, vol. 16, p. 45). By using the cautery at a red heat only, haemorrhage is avoided. The adhesions often pull out a cone of lung substance in which may be a prolongation of a lung cavity, so that it is important to burn the adhesions through as near the chest wall as possible.

Paralysis of the Diaphragm.—Stuertz first proposed this operation by division of the phrenic nerve in the neck, which was independently devised by Sauerbruch. The result of depriving the diaphragm on one side of its motor innervation is that it rises in the thorax as much as 2½ to three in., thus allowing the lower lobe partially to collapse and putting it at rest. The operation is easily done in a few minutes under local anaesthesia by novocain, the nerve being found running obliquely across the scalenus anticus muscle in the neck. At first the nerve was simply divided, but it was found that accessory fibres joined it below the point of section in 20–30% of individuals. W. Felix's operation of " Exairesis " (*Deutsch. Ztsch. f. Chir.*, No. 171, p. 283, 1922) has gained favour. In this modification the lower end of the divided nerve is seized in forceps and gradually drawn out of the thorax. Sometimes the whole length of the nerve as far as the diaphragm is successfully extracted, but in any case the collaterals which join it in its upper part are also severed so that the paralysis is complete. The operation is used where basal adhesions are preventing full collapse in pneumothorax, as an addition to thoracoplasty, in some cases of early tuberculosis of the lower lobe only and for the relief of pain in the region of the diaphragm on coughing.

Extrapleural Pneumolysis.—The operation consists in separating the parietal layer of the pleura from the chest wall over a limited area and filling the space thus formed with some material which is not absorbed, thereby compressing the lung beneath. A portion of one rib is resected and the posterior pe osteum and endothoracic fascia are carefully incised. The glov finger then separates the outer surface of the parietal pleura fr the inner surface of the endothoracic fascia. As the air whi enters the cavity thus formed is rapidly absorbed it is necessa to provide some filling. Tuffier, in 1910, first used fat obtain from omentum or a lipoma. This has become one of the favour methods, the fat being obtained from the patient's thigh (Tuffi *Bull. et mém. Soc. de Chir. de Paris*, vol. 49, 1249, 1923). If very careful aseptic technique is not followed the fat may extruded. Owing to the difficulty of obtaining enough fat, Ba in 1913, used a paraffin filling (H. Baer, *Münch. med. Woche schr.*, vol. 68, 1921). This is readily available but is heavy, an tends to be extruded later in many cases. E. W. Archibald, Montreal (*Am. Rev. of Tuberc.*, vol. 4, p. 828, 1921), has used pedicled muscle graft obtained by detaching the pectoral muscl

The operation is almost confined to apical lesions and is use either alone, or following thoracoplasty, in cases where the ape of the lung is incompletely collapsed. It may also be of servi where the apex alone is adherent and a satisfactory pneum thorax has collapsed the lower part of the lung.

Extrapleural Thoracoplasty.—Collapsing operations on th chest wall were suggested as long ago as 1888 (Quincke) an 1890 (Spengler). In 1907 Brauer and Friedreich removed larg portions of the ribs in their lateral portions. Wilms, in 19 removed portions both posteriorly and anteriorly. The moder operation of paravertebral thoracoplasty is due to Sauerbruc and the Scandinavians: Bull, of Osol; Saugman, of Veilefior Jacobaeus and Key, of Stockholm. The operation may be do in one, two or more stages and consists essentially in resecting portion of the first to the 10th or 11th ribs posteriorly through long incision posterior to the scapula and turning forwards alo the 10th rib. The muscles attached to the scapula are divide and the scapula is turned forwards. It is essential that the rib should be resected as far back as the tips of the transverse pro esses of the vertebrae. The length of rib removed varies fro ½ in. of the first rib to 7 or 8 in. of the middle and lower one The operation is a severe one, but the mortality, which was a first about 8% has been reduced by proper selection of cases t about 2% in the hands of experienced operators. Many opera tors still prefer a local anaesthesia by novocain, but the tendenc now, except in cases with profuse sputum, is to operate unde general anesthesia by nitrous oxide and oxygen preceded by a injection of morphine and hyoscine. The results of these opera tions have shown that in cases of unilateral or mainly unilate pulmonary tuberculosis which are not improving under sana torium treatment a new field of hope is opening out. F. Sau bruch (*Chir. der Brustorgane*, 1920), H. C. Jacobaeus and E. Ke (*Acta Chir. Scand.*, 1923); P. Bull (*Proc. Roy. Soc. Med.*, 19 vol. 17, p. 1); J. Alexander (*Surg. of Pulmon. Tub.*, 1925); Gravesen (*Surg. Treat. of Pulmon. and Pleur. Tub.*, 1925).

Bronchiectasis.—Three types of operation are used in th treatment of this distressing condition: (1) Drainage operatio (2) operations to collapse the lungs, (3) radical excision of th affected part of the lung. (1) Drainage operations are palliati only and aim either at drainage of abscess cavities or, by makin a permanent bronchial fistula, at reducing the amount of sp tum. (2) All the forms of collapsing operations which are in u for pulmonary tuberculosis have their place in the treatment bronchiectasis. They are phrenicotomy, pneumothorax, extr pleural pneumolysis and extrapleural thoracoplasty. The pri ciples involved are, firstly, that the spaces in which secretio collect and decompose are obliterated by the collapse of th lung, and secondly that the new formed fibrous tissue in its co traction no longer pulls open the walls of the bronchi soften by inflammation, but can now pull inward the mobilised wal of the thorax. (3) In certain types of bronchiectasis the resul of collapsing operations are not satisfactory, and in consequen amputation of the affected lobe or lobes of the lung has bee performed. This procedure has produced real cures but th mortality of the operation is high. The longest series of cas is that published by H. Lilienthal, of New York (*Arch. of Surg*

. 8, 1924), whose mortality is nearly 50%. Many of his iients were, however, desperately ill. Evarts A. Graham *rch. of Surg.*, vol. 10, p. 392, 1925) has practised pneumectomy the actual cautery, in one or several stages, on 20 patients. these, 50% were cured, 30% improved and 20% died.

ntrathoracic Tumours.—Innocent intrathoracic tumours are ng diagnosed with greater frequency owing to the increasing of X-rays. H. C. Jacobaeus and E. Key (*Acta. Chir. Scand.*, 53, p. 573, 1921) have successfully removed four fibromata the transpleural route. T. P. Dunhill (*Br. Jour. of Surg.*, 2) removed a fibroma by Gask's modified sternum splitting ration. J. E. H. Roberts (*Tr. Roy. Soc. Med.*, 1926) has noved four innocent tumours, two fibromas, an encapsuled lothelioma and a dermoid cyst, three by the transpleural te and one by sternum splitting.

Malignant Tumours of the Lung.—Radical operations for the noval of carcinomata of the lung are rarely possible owing to later stage at which patients come under observation. Sauerbruch (*Chir. der Brustorgane*) has operated in five cases: e, with a carcinoma of the lower lobe the size of a small fist, s alive five years later; another was alive after three years. uerbruch advises a two-stage operation or three-stage operan, ligature of the branch of the pulmonary artery to the ected lobe being done as a preliminary followed by thoralasty and resection of lung.

Palliative operations often give great relief from distressing nptoms and prolong life for many months; they are (1) inage of a secondary lung abscess or empyema, (2) drainage sterile abscess due to necrosis of growth, (3) exposure of the wth for the insertion of radium, (4) treatment by X-rays.

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(J. E. H. R.)

IEAT (*see* 13.135).—The summary of recent works, given ow, is arranged for convenience as far as possible in the order he earlier articles connected with heat in the 11th ed. of the 3., as enumerated in 13.157, and references to them are made ere necessary.

nternational Notation.—The symbolic notation here adopted ased on that recommended by the International Commission the Unification of Physico-Chemical Symbols at their meetat Brussels in 1913, as extended by a special Committee of Physical Society of London under the presidency of Sir J. J. omson. Fortunately their recommendations coincide in the in with the notation employed in the 11th ed. of the *E.B.*, t a few changes have been made for the sake of uniformity, indicated in the following list.

Alphabetic Index of Symbols.

$A = 1/J$, Reciprocal of mechanical equivalent of heat.
a, Numerical factor for reducing PV to heat units.
B, Constant of integration in expressions for E and H.
b, Co-volume in characteristic equation of gas.
C, Cooling-effect of Joule and Thomson (*see* 27.901).
c, Co-aggregation volume in gas-equation.
E, Intrinsic energy.
G, Gibbs' function, $T\Phi - H$.
H, Total heat of vapour, $E + aPV$.
h, Total heat of liquid.
J, Joule's equivalent.
K, k, Thermal Conductivity, and Diffusivity.
L, Latent heat.
M, Mass.
m, Molecular weight or mass-flow.
N, Number of atoms or molecules.
n, Index in formula for c.
P, Pressure generally.
p, Saturation-pressure.
Q, Quantity of heat energy.
R, Gas-constant in $PV = RT$.
S, Specific heat of vapour; s, of liquid.
T, Absolute temperature; t, from 0°C.
U, Velocity of motion.
V, Specific volume of vapour; v, of liquid.
W, Work.
X, Cross-section of pipe or nozzle.
Φ, Entropy of vapour; ϕ, of liquid.
β, Radiation constant in $\beta\nu/T$.
γ, Ratio of specific heats of gas.
Λ, Velocity of light, 3×10^{10} cms/sec.
λ, Wave-length; ν, frequency.
η, Viscosity of gas.

CALORIMETRY

Units of Heat.—One of the most fundamental points in the measurement of heat is the relation between the practical units corresponding to the various methods discussed in the earlier article (*see* 5.60), in which the most important experimental evidence then available was described and reviewed. Some of the conclusions reached have since been contested, but additional experimental evidence has been obtained which seems to confirm the views previously maintained.

The experiments of Rowland by the mechanical method, agreeing closely with those of Joule when reduced to the scale of the gas thermometer, showed that the gram-calorie at 20° C. (defined as the quantity of heat required to raise the temperature of 1 gram of water at 20° C. under atmospheric pressure by 1° C. on the scale of the hydrogen thermometer) was equivalent to 4·180 joules of mechanical energy. Those of Reynolds and Moorby between 0 and 100° C. gave the equivalent of the gram-calorie as 4·1832 joules for the mean of the whole range, showing that the mean calorie was nearly the same as the calorie at 20° C., in contradiction to the results of earlier experimentalists who had obtained much higher values for the mean calorie. The best of the previous results by the method of mixtures for the variation of the specific heat of water between 0° and 100° C. were those of Lüdin (*see* 5.64, fig. 6), which gave a somewhat improbable curve for the variation, indicating a value 4·206 joules for the equivalent of the mean calorie, if the calorie at 20° C. was equivalent to 4·180. Most of the older results for the mean calorie, *e.g.*, those of Dieterici (*Wied. Ann.*, 33, p. 417, 1888), giving 4·244 by an electrical method with an ice-calorimeter, were much higher than Lüdin's. On the other hand, the continuous electrical method (*see* 5.65), in which platinum thermometers were employed in place of mercury thermometers, while agreeing very closely with Rowland's results from 5° to 30° C., gave a much slower rate of increase than Lüdin's for the specific heat between 40° and 100° C., and a value 4·186 joules for the mean calorie, confirming Reynolds and Moorby.

The later experiments of Dieterici, by the method of the ice-calorimeter employing a 10 times smaller current with a coil of higher resistance in order to reduce the uncertain errors of the electrical measurement, gave an equivalent 4·192 joules for the mean calorie. He also redetermined the constant of the ice-calorimeter, using water at 100° C. sealed in thin bulbs of quartz-glass, and obtained a value 15·491 milligrams of mercury per mean calorie, appreciably higher than the value 15·44 previously employed. This has since been confirmed by E. Griffiths (*Proc. Phys. Soc.*, 26, p. 1, 1913) who found the value 15·486 for a mean calorie of 4·184 joules. Owing to the smallness of the quantities of heat available for measurement at low temperatures, the ice-calorimeter is unsuitable for investigating the variation of specific heat in the neighbourhood of the freezing-point, but the observations of Dieterici at temperatures above 100° C. by the same method gave a rate of increase of the specific heat of water slightly exceeding that found by Regnault, which could not be reconciled with Lüdin's curve showing a maximum of specific heat at 87° C.

Messrs. W. R. and W. E. Bousfield (*Phil. Trans.*, A, 211, pp. 199–251, 1911) succeeded in reproducing Lüdin's results with remarkable fidelity by a most ingenious method of electric heating with a vacuum-jacket calorimeter. The heating-coil consisted of a long spiral of small-bore glass tubing filled with mercury, the expansion of which in a capillary tube was made to indicate the actual temperature of the mercury at any time when traversed by the electric current. The observers were thus enabled to avoid the source of error due to the superheating of the conductor above the temperature of the calorimeter. The uncertainty of heat-loss by evaporation from the surface of the water was minimised by protecting the surface with a cover in the form of a metal box maintained as nearly as possible at the same temperature as the water during an experiment. The rise of temperature over predetermined ranges, 0°–13°, 13°–27°, etc., was observed with suitable mercury thermometers of limited scale, standardised at the National Physical Laboratory. The corresponding quantities of electrical energy supplied, when corrected for external heat-loss and for the thermal capacity of the calorimeter, gave the increase of total heat of water, or the mean specific heat over each range. By adding the increments of total heat for each range, the *variation* of the total heat h, or the small difference $h-t$, could be obtained at each of the points of observation, as in the following table:—

Temperature C.	13°	27°	40°	55°	73°	80°	100°
Bousfield	0·058	0·058	0·059	0·124	0·242	0·306	....
Lüdin	0·057	0·059	0·064	0·119	0·285	0·371	0·633
Formula (1)	0·070	0·072	0·054	0·038	0·046	0·062	0·159
Dieterici	0·010	0·011	0·013	0·031	0·090	0·128	0·303

Bousfield's observations did not extend beyond 80°, owing to the difficulty of excessive evaporation with an open calorimeter. According to his curves, the corresponding values of the specific heat appear to be approaching a maximum at 80° C., a little lower than that shown by Lüdin's curve. The value of the specific heat at 80° C., according to Lüdin's formula, is 1·0184 in terms of the specific heat at 20° C. taken as unity, and exceeds the value given by the continuous electric method by 1·55 %. This looks alarming at first sight, but the method of comparison in terms of the actual specific heat, though commonly adopted, is really unfair, because the quantity actually observed in Lüdin's method is the total heat, which shows a difference of only 0 31 calorie according to the above table at 80° C. Dieterici's observations at 100° C., where they were most reliable, differ by only 0·14 % from the continuous electrical method, and he does not claim an order of accuracy greater than 0·1 % for the ice-calorimeter.

Continuous Mixture Method.—Since the number of separate determinations of the specific heat of water at points between 50° and 100° C. by the continuous electric method was only 12, and since these were made under conditions of exceptional difficulty, and differed most widely from the values found by Lüdin and Bousfield, it was felt to be desirable to confirm the variation in this region by an entirely independent method of equal accuracy. The continuous mixture method (Bakerian Lecture, *Phil. Trans.*, A, 1912, vol. 212, pp. 1–32) was devised for this purpose, and consisted in passing a steady current of water, initially at 100° C., through an interchanger, in which it gave up a large part of its heat to a current of cold water initially at 25° C., emerging at a temperature in the neighbourhood of 70° C., without having actually mixed with the cold current. The same current was then cooled to an accurately regulated temperature in the neighbourhood of 25° C., and re-entered the interchanger as the cold current. The point of the method is that the circulation is continuous, so that the water equivalent of the interchanger is not required, and that the hot and cold currents are *the same*, so that the quantity of the current divides out of the equation (except in the small term representing the external heat-loss) and need not be determined with an accuracy greater than 1 %, since the external heat-loss can easily be reduced to a small fraction of 1 % of the heat-exchange between the currents. The actual temperatures t_1 and t_2 of the hot current on entering and leaving the interchanger, and those of the cold current, t_3 and t_4, were observed with platinum thermometers to 0·001° C. If s' is the mean specific heat of the hot current between t_1 and t_2, and s'' that of the cold current between t_3 and t_4, we have the equation

$$s'(t_1-t_2)=s''(t_4-t_3)+\mathrm{X}/\mathrm{M},$$

where X is the external heat-loss in gram-calories per second, and M the value of the water current in grams per second. The heat-loss was determined, as in the continuous electric method, by varying the flow M while keeping the temperatures the same. In a large number of trials it was found that the ratio of s' to s'' agreed with the value 1·0050 given by the continuous electric method, but disagreed materially with the value given by Lüdin's formula. It was concluded that the discrepancy from Lüdin's formula was probably to be attributed to the unavoidable errors of his method, due to losses by evaporation at temperatures above 50°, and to the uncertainties of zero-point and stem-exposure which cannot be eliminated in the employment of mercury thermometers.

Formulae for the Specific Heat of Water.—It is usual to employ an empirical formula of the type, $s=1+at+bt^2+ct^3+$etc., which is familiar and convenient for the application of the method of least squares to the results of observation. The formulae most often quoted for water are those of Lüdin and Dieterici, which are as follows in terms of the calorie at 20° C.:—

$$\begin{array}{ll} \text{Dieterici,} & s=1{\cdot}0013-0{\cdot}0104(t/100)+0{\cdot}0208(t/100)^2 \\ \text{Lüdin,} & s=1-\underset{\pm 0\cdot 00025}{0{\cdot}07668}(t/100)+\underset{\pm 0\cdot 040}{0{\cdot}196}(t/100)^2-\underset{\pm 0\cdot 030}{0{\cdot}116}(t/100)^3 \end{array}$$

The probable errors of the coefficients, as given by Lüdin, are shown in the line below his formula. The formula of Dieterici represents his observations satisfactorily from 50° to 300° C., but does not apply to the variation near the freezing point, which cannot be represented satisfactorily by this type of formula without an additional term. The formula of Lüdin is fairly accurate between 0° and 25°, but appears to give results about 1 % too high between 60° and 90° C. It is also inconvenient in practice, because the coefficients are large and of opposite signs, giving the small variation required as a difference between relatively large terms. In the preliminary reduction of the results of the continuous electric meth
(*B. A. Rep.*, 1899) it appeared that a formula of this type wo
be unsuitable, and the observations were accordingly represen
by three simple formulae for different ranges of temperature betw
0° and 200° C., as given in the previous article (*see* 5.66). Th
have since been combined into a single equivalent formula, wh
is more convenient for several purposes:—

$$s=0.98536+0{\cdot}504/(t+20)+0{\cdot}0084(t/100)+0{\cdot}009(t/100)^2$$

The value of the constant is adjusted to make $s=1$ when $t=2$
The other terms are small and positive, and can be calculated w
sufficient accuracy for all possible purposes by means of a 10-
slide rule. This formula agrees very closely with the table p
viously given, but represents a later and more accurate reducti
It is of no theoretical significance, and cannot safely be extrapola
much above 100°C., but still agrees very closely with Regnaul
observations at 160° C. Above 100° C. it is better to use the therm
dynamical formula (*see* 27.903) suggested by McF. Gray, wh
agrees very closely with experiment from 40° to 100° C., but does n
represent the increase of specific heat with fall of temperature n
the freezing point. Gray's formula was re-defined by Callendar
representing the change of total heat of water under saturation pr
sure, and then agrees very closely with the observations of Dieter
at high temperatures, when corrected to give the change of to
heat in place of the intrinsic energy. It has a simple theoreti
foundation, and greatly simplifies the thermodynamical relati
between liquid and vapour. There is good reason to believe (Calle
dar, *Properties of Steam*, pp. 160, 196) that it continues to h
satisfactorily right up to the critical point, where the specific h
becomes infinite.

By experiments on the supercooled liquid, Prof. H. T. Barnes h
shown that the increase of specific heat with fall of temperature c
tinues to follow the same curve above and below the freezing poi
By very accurate experiments on mercury, using the continuo
electric method, he has shown that a diminution of the specific h
with rise of temperature occurs as in the case of water, but persis
up to a minimum at 140° C. It appears probable that a simil
phenomenon would be found for all liquids at low vapour pressur
but it is masked in the case of volatile liquids by the opposite eff
of the vapour-molecules, as represented by the thermodynami
formula. The diminution of the specific heat of water was attribu
by H. A. Rowland to the presence of a small proportion of soli
molecules in the liquid near the freezing point. The rapid incre
of the specific heat of a solid as the fusing-point is approached m
similarly be attributed to the presence of a small but rapidly increa
ing proportion of liquid-molecules in the solid. The proporti
required in either case, to explain the diminution of hardness a
rigidity of the solid, or the anomalous expansion of water near
freezing point, is small, but cannot be calculated with certainty
account of our imperfect knowledge of molecular forces and dim
sions. Such a theory would be difficult to verify in any case
experiment for the liquid and solid molecules.

Specific Heat of Gases and Vapours.—The continuous elect
method was first applied in the case of steam (*see* 27.901) and ga
results near 100° corroborating Regnault's value at higher temper
tures. The same method was applied to air and CO_2 by W. F.
Swann (*Phil. Trans.*, A, 1910, vol. 210, p. 199), who found resu
from 2 to 5 % higher than those of Regnault. Swann's formula h
since been verified by Holborn and Jakob (*Zeit. Ver. Deut. Ing.*,
p. 1429, 1914) and it is now generally recognised that this meth
is the most accurate for the determination of the specific heat
any fluid at constant pressure. Swann's values for air at 20° a
100° C. were closely consistent with those of Joly at constant volu
(*see* 5.67), and gave a ratio of specific heats very nearly equal
1·40, as required by the kinetic theory for a diatomic gas. Th
also showed a very small increase with temperature at the rate
only one-half of 1 % for 100° C. His values for CO_2 verified wi
improved accuracy the rapid increase with temperature foun
by Regnault and Wiedemann for this gas, which amounted to 12
for 100°. This increase of specific heat was not accounted for on th
kinetic theory, which required that all the degrees of freedom
a gas molecule should be equally excited, and should contrib
constant terms to the specific heat. The apparent discrepancy wa
explained (*B. A. Rep.*, 1908, p. 340) by supposing that a natu
frequency of the gas-molecule would be excited by radiation
direct proportion to the intensity of the corresponding frequency
each temperature. It was shown that a natural frequency havi
a wave-length of the order of 15 microns would be competent
produce the observed effect in the case of CO_2, contributing, wh
fully excited, a term R to the specific heat. An attempt was acco
ingly made to investigate the relation between the variation of th
specific heat of gases and the absorption and emission bands
their infra-red spectra. Some qualitative agreement was foun
but it was very difficult to make quantitative measurements of th
kind required, or to frame a consistent theory. For instance, the
is a strong band at 4·4–4·5 microns both in the emission and a
sorption spectra of steam. This band corresponds to the ma
mum ordinate of the wave-length spectrum of full radiation at
temperature T=647° C., the critical point of water, and appea
to be closely related to other properties of steam. There is no doub

t the properties of any substance are intimately related to the
ural frequencies of the molecules, but the form of the relation
not be predicted with certainty; and the quantitative measure-
its are not yet sufficiently exact to distinguish between many
sible hypotheses.

'he experiments of A. Eucken (*Sitz. Akad., Berlin*, 33.1, p. 141,
2) on the specific heat of hydrogen at low temperatures were
y instructive in this connection. The gas was electrically heated
various temperatures in a thin steel vessel under considerable
ssure at constant volume. The specific heat was found to dimin-
from nearly 5R/2 at ordinary temperatures to nearly 3R/2 at
60°, after which it remained practically constant down to T=35°.
experiments were undoubtedly of considerable difficulty, but
re seems no reason to doubt their substantial accuracy.

cken's results have recently been confirmed with remarkable precision by
Brinkworth (*Proc. Roy. Soc.* (A) 207, p. 542, 1925) using an entirely independent
hod of experiment. He observed the cooling effect in adiabatic expansion with a
pensated platinum thermometer at various temperatures between 20° C. and
3° C., and deduced the corresponding values of the ratio of the specific
s at constant pressure and at constant volume. The actual specific heats at
temperature could be deduced with certainty from these observations. This
hod is unaffected by the thermal capacity of the containing vessel, whereas in
ken's method the thermal capacity of the vessel must be known with consider-
accuracy. Brinkworth also showed that the heat-loss could be most satisfac-
y eliminated by using vessels of different sizes. Assuming that the variation
e specific heat was due to the response of some particular frequency of the
cule to the same frequency in natural radiation at each temperature, he states
Callendar's radiation formula fits the observations better than Planck's but
satisfactory agreement cannot be obtained by assuming a *single* frequency.
he's calculations do not seem to improve the agreement. The effect is probably
to an absorption band of $\lambda=25$–30μ in the infra-red.

Specific Heat of Solids at Low Temperatures.—The early experi-
its of Sir J. Dewar, Sir W. A. Tilden and others, had shown that
ds at low temperatures deviated from Dulong and Petit's law
he constancy of atomic heat in the same way as carbon, boron
silicon, at ordinary temperatures, but they failed to show the
extent of the deviation, or to indicate a probable explanation.
Einstein suggested (*Ann. Phys.*, 22, p. 180, 1907) that the atom
solid might be regarded as an electric resonator with three de-
es of freedom possessing a particular frequency, independent of
temperature, and capable of responding to the same frequency of
iation. Adopting Planck's theory and radiation formula, he
wed that the specific heat at constant volume should approach
limit $3R=5{\cdot}94$ calories per gram-atom at high temperatures,
required by Dulong and Petit's law, but that the variation at
temperatures should be given by the expression

$$s=3Rz^2e^z/(e^z-1)^2 = 3Rf(z) \qquad (2)$$

re $z=\beta\nu/T=C/\lambda T$, as in Planck's formula. The symbol ν de-
es the natural frequency of the atoms, and λ the correspond-
wave-length in cm. such that $\nu\lambda=\Lambda=3\times10^{10}$, the velocity
ght. The constant, $\beta\Lambda=C$, is Wien's constant of radiation.
king H. F. Weber's observations on the variation of the specific
t of the diamond, extending from T=222° to 1258°, Einstein
wed that they agreed qualitatively with this formula, if we
ld assume the diamond atoms to possess a single frequency cor-
ponding to the wave-length 11 microns. Taking the substances,
l, NaCl, KCl, $CaCO_3$ and SiO_2, for which the optical fre-
ncies in the infra-red were known, he showed that the frequen-
agreed in order of magnitude with those required by his formula,
that the observed wave-lengths were somewhat shorter than
se calculated from the specific heats. This could be attributed
he fact that most of the substances showed more than one fre-
ncy, and that the frequencies were not strictly monochromatic,
indicated by the width of the corresponding absorption bands.
any case there were other effects, such as work of expansion,
luded in the specific heats as ordinarily measured, and it might
doubted whether the optical frequencies corresponded exactly
h the thermal vibrations of the atoms.

An important series of experimental measurements, extending
vn to the temperature of liquid hydrogen, was made by W. Nernst,
A. Lindemann and their collaborators (*Sitz. Akad., Berlin*, p.
, 1911), on a number of metals and other solids, including
se for which the optical frequencies were known. They found,
already indicated, that Einstein's formula gave too low values
the specific heats at low temperatures, if the optical frequencies
e assumed in calculating the value of $f(z)$, and that much better
eement could be obtained by taking the mean of $f(z)$ for the
ical frequency, and a similar term, $f(z/2)$ at half the optical
quency:—

$$s=3R[f(z)+f(z/2)]/2 = 3Rf''(z) \qquad (3)$$

same function, $f''(z)$, of z was assumed to apply to other sub-
nces, such as the metals, but the appropriate values of z were
cted to fit the observations on the specific heats. Some sub-
nces, such as SiO_2 (in the forms of quartz and quartz-glass)
benzine, C_6H_6, which gave a different type of curve, were
resented by formulae with two or three different values of z,
h value of $f''(z)$ being multiplied by a fractional coefficient
resenting the proportion in which the corresponding molecule
supposed to be present. But such cases could not be regarded
verification of the theory, because it would obviously be possible
represent almost any type of variation in this way. Einstein
objected that even the simplest of these formulae, namely (3), was too empirical to be satisfactory from a theoretical standpoint; that a cubical crystal, such as KCl, or NaCl, could not have two different frequencies; and that there was no evidence in either case of an optical frequency with half the experimental value, since, according to Rubens, the crystals became again transparent before this frequency was reached, and had a value of the refractive index which was nearly normal. He also indicated two other objections to the "quantum" theory on which Planck's formula was based. (1) According to the quantum theory it did not follow, as required by the classical mechanics, that the oscillator with three degrees of freedom would have three times the energy of a linear oscillator. (2) It was very difficult to conceive the distribution of energy among the oscillators at low temperatures required by the theory. Thus for the diamond at T=73° only one molecule in 100 millions would possess a single quantum of energy, all the rest would be absolutely quiescent. It was physically impossible to conceive such a distribution of energy, which moreover would make the thermal conductivity of the diamond at such temperatures entirely negligible, whereas, according to Eucken, it was nearly as great as that of copper at ordinary temperatures. For these reasons Einstein preferred to rely mainly on the expression for the energy of an electric oscillator in equilibrium with radiation as deduced from Maxwell's equations, and to regard Planck's formula for the distribution of energy in full radiation simply as representing the results of experiment.

Debye's Theory of Specific Heat of Solids.—The theory now most commonly accepted is that of P. Debye (*Ann. Phys.*, 39, p. 789, 1912), who attributes the heat energy to mechanical or acoustic vibrations of the solid with all possible frequencies up to a certain limit ν_m. According to a theorem attributed to the late Lord Rayleigh (*Sound*, i., p. 129, 1877) the number of possible degrees of freedom of a system of N discontinuous mass-points will be 3N. According to another theorem by the same author (*Phil. Mag.*, 49, p. 539, 1900), the number of possible frequencies in a given volume of a *continuous* medium between the limits ν and $\nu+d\nu$ may be represented by $C'\nu^2d\nu$, where C' is a constant depending on the volume and the velocity of propagation. The total number of possible frequencies from 0 up to a limit ν_m is $C'\nu_m^3/3$. If we equate this to 3N, we find $C'=9N/\nu_m^3$. Adopting Planck's expression for the energy of an electric oscillator with one degree of freedom as applying to each possible frequency of the N atoms in a gram-atom, we obtain the energy $(RT/N)z/(e^z-1)$ for each frequency. Multiplying this by the number of frequencies between ν and $\nu+d\nu$, namely $(9N/\nu_m^3)\nu^2d\nu$, and integrating from 0 to ν_m, we obtain the energy of a gram-atom at T, from which the specific heat at constant volume is obtained by differentiation with regard to T. Unfortunately the integral cannot be expressed in finite terms and is too complicated to reproduce here. It is evident, however, that it will be a function of z_m, or $\beta\nu_m/T$, or T_m/T, where $T_m=\beta\nu_m$.

Thus the *form* of the curve representing the variation of the specific heat (which depends on a single parameter T_m or ν_m) is the same for all substances on Debye's theory, if the temperature scale is altered for each in proportion to ν_m. This point has been very carefully tested by E. H. Griffiths and E. Griffiths (*Phil. Trans.*, A, 214, pp. 319–357) for the metals Al, Ag, Cd, Cu, Fe, Na, Pb, Zn. Their results indicate qualitative agreement with the theory, but show characteristic differences, greatly exceeding the limit of experimental error, which may possibly be attributed to other effects not included in the simple theory. Thus the curve for Fe differs from that for Cu by nearly 20% between corresponding temperatures, which may be attributed to the magnetic properties of Fe. The curve for Na shows a rapid rise towards the melting point, reaching an excess of 25% above 3R, followed by a diminution of specific heat for the liquid, as in the case of water and mercury. Many simple compounds, such as NaCl, show curves of a very similar type to the metals, which has been used as an argument that the specific heat must be attributed entirely to the atoms, and that the free electrons supposed to exist in metals cannot make any appreciable contribution. Thus if there were two free electrons per atom, as required by some theories, the electrons alone would account for the whole specific heat according to the kinetic theory at ordinary temperatures; and it would be necessary to suppose that the number of free electrons diminished to zero at low temperatures, which would make it difficult to account for the enormous increase in electric conductivity of pure metals demonstrated by Kamerlingh Onnes in the neighbourhood of the absolute zero.

One of the commonest objections to Debye's theory is the arbitrary nature of the assumption of an abrupt limit of frequency ν_m. This assumption is made on account of its simplicity, but is highly improbable from a physical standpoint, though it might be expected to give results of the right order of magnitude. W. Sutherland (*Phil. Mag.*, 20, p. 657, 1910) had previously shown that the wave-length of the elastic vibrations of solids was of the same order of magnitude as the distance between the atoms for frequencies corresponding to the optical frequencies in the infra-red, so far as these were known. If the forces holding the atoms in place in a crystal lattice are electromagnetic, as commonly assumed, we should expect that the energy would be shared between matter and aether, and that the natural frequencies of the optical and mechanical vibrations would be the same. The wave-length and velocity of the natural frequency as measured outside the crystal would be reduced inside the crystal in the same proportion as the ratio of the velocity of light to that of an elastic vibration, or of the wave-length outside the crystal to the lattice constant, *i.e.*, in the case of rocksalt, NaCl, about in the ratio 2×10^5 to 1. Since the energy in the cube of the wave-length remains constant, the energy-density of the external radiation of the natural frequency would be increased in the cube of this ratio, and would be of the right order of magnitude to explain the specific heat of the solid on the usual theory of resonance as applied by Einstein. We have seen, however, that the assumption of Planck's radiation formula gives too low a value for the specific heat at low temperatures on Einstein's theory. If on the other hand we interpret Lord Rayleigh's formula, namely $C'Te^{-z}\nu^2d\nu$, as representing the *partial pressure* $pd\nu$ of radiation between the limits of frequency ν and $\nu+d\nu$, the latent heat of emission or absorption of radiation per unit volume between the same limits, according to Carnot's principle, is represented by the expression

$$T(dp/dT)=C'T\nu^2(1+z)e^{-z} \qquad (4)$$

and the total heat of a gram-atom of solid in equilibrium with radiation having this distribution of energy is given by

$$H=3RT(1+z)e^{-z} \qquad (5)$$

The specific heat as ordinarily measured, when the external pressure is small as compared with internal pressure, will be simply

$$s=3R(1+z+z^2)e^{-z} \qquad (6)$$

This expression, unlike that similarly deduced from Planck's formula, gives good agreement with the observed value of the specific heat in the case of rocksalt, when the optical frequency corresponding to 51 microns is assumed, at a temperature corresponding to the maximum of the frequency curve, where $z=2{\cdot}732$, $T=100°$, and $s=8{\cdot}67$ (doubled for a gram-molecule of NaCl). We should expect to get good agreement at this point, in spite of the fact that the actual vibrations in a solid cannot be strictly monochromatic (as Einstein pointed out) but extend for a distance of an octave or more on either side of the maximum, as indicated by the absorption spectrum. The effect of this is to reduce the steepness of the monochromatic curve, bringing it into good agreement with observation at high and low temperatures, without materially affecting the agreement at the mean point corresponding to the maximum of the frequency curve. If we assume the value $\lambda_m T=0{\cdot}290$ for the wave-length λ_m (corresponding to the maximum ordinate of the wave-length spectrum of full radiation at T), in deducing the appropriate value of Wien's constant βA in formula (4), the maximum ordinate comes out the same as in Planck's formula, provided that the same value of the Stefan-Boltzmann constant σ is assumed in the fourth power law σT^4 for the total radiation. The two curves also agree so closely throughout their whole extent that it would be very difficult to decide between them by experiments on radiation. We should therefore be justified, according to Einstein's reasoning, in applying formula (4) in the deduction of the specific heat of a solid, especially when we find that the result gives such good qualitative agreement with the optical frequencies.

An obvious objection to Debye's theory in the case of transparent substances, such as quartz and rocksalt, is that, if the atoms have all possible frequencies below a certain limit, they ought to be completely opaque in this region, and to become suddenly transparent when the limit ν_m is surpassed. Experiment shows, however, that, *e.g.*, quartz, which begins to be opaque at about four microns, and has optical frequencies corresponding to 9 and 21 microns approximately, and possibly one lower, becomes almost perfectly transparent below 100 microns. The variation of its specific heat is of an entirely different type to that given by Debye's theory but corresponds closely, according to formula (4), with its optical frequencies. Ice and benzol, which are also hexagonal, show a variation of specific heat similar to quartz, according to Sir J. Dewar. The corresponding optical frequencies have not yet been observed, but it appears that water must have some frequencies below 100 microns to account for its remarkable opacity to long wave-lengths, and the variation of its specific heat. We should naturally expect that the torsional vibrations of an elastic solid, which are of the same kind as those of light, would be excited by radiation, and would be intimately connected with the optical frequencies. It is quite possible, however, that the compressional vibrations, which are of a different type, and propagated with a different velocity (that of sound), would continue to exist at low temperatures without affecting the transparency. These acoustic vibrations, though not capable of being excited directly by radiation, would be necessarily excited by the impacts of the molecules of the surrounding gas, with a distribution of energy corresponding to the Maxwellian law, and might be expected to provide a term in the specific heat of a somewhat similar character to the Debye term for compressional waves at low temperatures. It is noteworthy that Nernst and Lindemann in their latest reductions have found it necessary to retain the original Einstein term $f(z)$ for transparent substances in their formula (3), but have replaced the hypothetical term $f(z/2)$ by a term of the Debye type. The appropriate frequencies are calculated in most cases by Lindemann's semi-empirical formula from the molecular weight m, the atomic volume V, and the temperature of fusion T_f, but with different values of the constants for the terms, as follows:—

$$\nu_\epsilon=2{\cdot}12\times10^{12}(T_f/m)^{\frac{1}{2}}V^{-\frac{1}{3}}$$
$$\nu_m=3{\cdot}08\times10^{12}(T_f/m)^{\frac{1}{2}}V^{-\frac{1}{3}}$$

of which the first gives the optical frequency of Einstein and second that of Debye. The cube root of the atomic volume is portional to the lattice constant, and the elastic constants of a s must be closely related to the temperature of fusion. Nernst Lindemann assign equal importance to the two terms, but we sho naturally expect from elastic theory, as given by Debye and o previous writers, that the numerical coefficients should have di ent values, and should be proportional to $1/u_1^2$ for the comp sional waves, where u_1 is the velocity of sound, and $2/u_2^2$ for the sional waves, where u_2 is the velocity of light *in the solid* for particular optical frequency considered. This may not fit so with Planck's radiation formula for the Einstein term, but app to give better agreement with experiment if formula (4) is sub tuted for Planck's. The appropriate frequencies cannot be ca lated from the elastic constants for a discontinuous medium w out introducing arbitrary hypotheses, which are unsatisfact because the effect of the hypothesis selected is most import at the point where the discontinuity commences and it is difficul avoid selecting an hypothesis to give the desired result. Ther the further difficulty that the values of the elastic constants somewhat uncertain and liable to vary with temperature and depend on the particular specimen tested, especially with metals.

Sir J. Dewar (*Proc. R. S.*, 1913, A, 89, pp. 158–169) has measu the mean specific heats of the elements between the boiling po of hydrogen and nitrogen by means of his liquid hydrogen calor eter. The results for the specific heats, when plotted against atomic weights, give a curve showing a most remarkable coi dence with the well-known curve of atomic volume as a peri function of the atomic weight. In other words, the specific hea nearly proportional to the atomic volume, or to the cube of lattice constant, for similar substances, at this low temperat corresponding to a mean about T=50°. The relation does not tend to be exact, though it is a fair approximation over the ra 20° to 80°, but it illustrates the point that the atomic volume is most important factor in determining the frequencies.

In the case of the metals, which are opaque to all frequen below a certain limit, we should expect the possible frequencies extend over a considerable range, and to be grouped about a m in a similar way to the velocities of gas molecules on the kin theory. But there are many possible alternatives to the somew arbitrary hypothesis of Debye. We might suppose, for insta that of N molecules in a gram-molecule, the number possessing frequencies between the limits ν and $\nu+d\nu$ was represented an expression of the type

$$(N/2)e^{-x}x^2dx$$

in which $x=\nu/\nu_0=\beta\nu/T_0=\theta z$, where z denotes $\beta\nu/T$, and $\theta=T$ Multiplying this by expression (6) divided by N for the specific h of a single molecule of frequency ν, at a temperature T, and in grating the product from 0 to ∞, we obtain for the specific heat gram-molecule

$$s=3R(\theta^3/(1+\theta)^3)(1+3/(1+\theta)+12/(1+\theta)^2)$$

This is much simpler than Debye's expression, but gives a v similar curve. The *mean* frequency, $\nu_m=3\nu_0$, is nearly the s as Debye's limiting frequency. More accurately, Debye's chara istic temperature corresponds to $2{\cdot}91T_0$, in place of $3T_0$, on acco of the difference in the values of the constant β, which are in ratio 4·9651/4·8284 in Planck's and Rayleigh's formulae for rad tion. If Debye's scale is multiplied by 2·91, his curve agrees closely with (9) from $\theta=0{\cdot}6$ to $\theta=1{\cdot}0$. Below $\theta=0{\cdot}6$, (9) agr better with the Nernst-Lindemann curve (3), except that (9) te to vary as T^3 at very low temperatures, instead of vanishing ex nentially. Above $\theta=1$, the curve (9) lies above Debye's by a qu tity corresponding to the difference of the specific heats at cons pressure and volume. This is to be expected, because (9) repres the rate of change of total heat, which is the same as that of in sic energy for all practical purposes under the condition of sm external pressure and negligible expansion. Thus in the case water under atmospheric pressure, the increase of total heat betw 0° and 100° C. is 100 cals. C., and exceeds that of intrinsic en between the same limits by only 0·001 cal. C., which is 100 ti smaller than the limit of accuracy of observation; whereas change of total heat *at constant volume* between the same limi the case of water exceeds that of intrinsic energy by 21 cals., appro mately; but the correction from constant volume to constant pr sure is very uncertain, even in the best known cases. It theref appears to be more logical to employ a formula giving the spe heat at constant pressure directly, in place of applying an un tain correction. It should be observed, however, that (9) assu the mean frequency ν_m to be independent of T, as in Deb formula, which may be a good approximation in many cases. cannot be exactly true if the molecule changes its state. Curve reaches $s=3R$ a little above $\theta=2$, attains a maximum 3·195R $\theta=4$, and falls again to 3R at $\theta=\infty$. The fall is of the er of magnitude to explain the diminution of specific heat in the e of water, mercury and sodium. The distribution postulated (8) appears to apply fairly to most of the metals, but it fails ably for many other substances. Such cases might be treated pirically by modifying the distribution, or assuming special juencies, but such hypotheses would be of little value unless their sical meaning could be interpreted with reference to other perties of the substances.

CONDUCTION OF HEAT

n 1910 the very attractive theories of P. Drude and H. A. rentz were still commonly maintained, and were continually ng applied to the explanation of electrical and thermal effects. ording to their views a metal contained a number of free trons moving in all directions with velocities corresponding hose of gas-molecules on the kinetic theory. Drude showed t this assumption led to an approximately correct value of ratio of the thermal to the electric conductivity in the case ure metals, and Lorentz showed that it accounted for the g wave radiation from hot bodies. There were numerous er applications of the theory which appeared to correspond remarkable manner with experimental facts, but there were serious difficulties which appeared to render the adoption uch a theory premature.

he fluid state of scientific opinion on the subject in 1911 is l illustrated by the views expressed about that time by J. H. ns. In the report of the Solvay Congress, 1911, *On the Theory Radiation and Quanta* (Gauthier Villars, Paris, 1912), assuming t there were two free electrons per atom of the metal, Jeans k the view that the specific heat of metals was entirely due to movement of free electrons and not at all to the movements he atoms, "a hypothesis which accords well with our knowle of the internal movements of solids." On the other hand, is report on the quantum theory (*Phys. Soc.*, London, 1914), dopted the theory of Debye (according to which the specific t was entirely due to the movements of the atoms) as prob "destined to be final," and concluded that the free elecs do not contribute sensibly to the specific heat.

ir J. J. Thomson, *Corpuscular Theory of Matter* (1907), had ady pointed out that the number of free electrons required xplain thermal and electric conductivity was too large to ncile with the facts of specific heat on the assumption that electrons possessed the same energy of agitation as gas moles at the same temperature, and had proposed an alternative ry (*loc. cit.*, p. 86) previously suggested in his *Applications of amics to Physics and Chemistry* (1888). According to this , the metallic atoms, owing to their close proximity in the l state, were capable, under the influence of an electric field, orming Grotthus chains, along which they could exchange trons. There were no free electrons in the sense contemed by Drude and Lorentz, with velocities depending on the perature and contributing to the specific heat, but the ther agitation of the atoms tended to break up the chains, hat their number and length varied with the electric field in manner required to explain the relation between electric and rmal conductivity and many other effects.

n a later paper (*Proc. Phys. Soc.*, 27, p. 527, 1915), the same ry was applied to explain the striking phenomena of superductivity discovered by Onnes, who found that at very low peratures, in perfectly pure metals, a current once started ht continue for days instead of stopping almost instantaney on the cessation of the exciting field. According to J. J. mson's theory, it would naturally follow that, below a certain t, the thermal agitation would be insufficient to break up chains when once they were formed, which would explain it is that the electric resistance of most pure metals tends anish (apart from impurities) at a temperature *above* the lute zero. A working hypothesis of this kind is very useful he experimentalist as affording a mental picture of the physi conditions, and may help to explain the remaining diffiies with regard to the specific heats.

nductivity of Gases.—Prof. Knudsen drew special attention *ay Report*, p. 133) to the data for the thermal conductivity of s, as being more scarce and discordant, owing to experimental difficulties, than determinations of other properties, and as requiring attentive examination for the elucidation of the law of action between molecules. The hot-wire method of T. Andrews (*Phil. Trans.*, 1840) offers special facilities for relative measurements, such as the comparison of conductivities of different gases, or of the same gas at different temperatures, and has frequently been applied with this object in recent years. It has also been improved by introducing the usual compensation for end-effects, and employing more accurate methods of electrical measurement. But it remains liable to the difficulties depending on the small dimensions of the wire, and the uncertainty of the corrections for convection and radiation. For these reasons the parallel plate method, adopted by E. O. Hercus and T. H. Laby (*Proc. R. S.*, A, 95, p. 190, 1918) for measuring the *absolute* conductivity of air, deserves special mention, owing to the great care with which the method was applied, and the complete elimination of convection effects. They also give a very complete reduction of previous results for different gases with the view of testing the value of the numerical coefficient f in the relation, $k=f\eta s$, between the conductivity k, the viscosity η, and the specific heat s at constant volume. According to the theoretical investigations of S. Chapman (*Phil. Trans.*, A, 211, p. 433, 1911) the value of the coefficient f should be 2·5 for a gas constituted of spherically symmetrical molecules, which agrees with Maxwell's theory based on the inverse fifth-power law of force, and also with experiment for monatomic molecules. Unfortunately the variation of viscosity with temperature does not satisfy the fifth-power law, which requires that the viscosity should be directly proportional to T. The conclusion is that monatomic gases may have spherically symmetrical molecules, but that the law of force is different. Theory gives no clear indication with regard to the appropriate value of f for other types of molecules. Experiment gives approximately a linear relation, $f=2{\cdot}816\gamma-2{\cdot}2$, between f and the ratio of the specific heats. This gives $f=7/4$ for diatomic gases, which show fair agreement with each other. The experimental values for polyatomic gases are much less certain.

THERMODYNAMICS

Since the general principles of thermodynamics have not undergone any material change for the last 50 years, it will readily be understood that such progress as there is to record relates chiefly to matters of expression or convention, and to the practical application of the principles to engineering problems. The evolution of the steam turbine and the internal combustion engine, along thermodynamical lines, has illustrated the importance of an exact and consistent theory of the conditions limiting the efficiency, and of an accurate experimental study of the properties of the working fluid in either case. Thus the improvement of the internal-combustion engine has depended greatly on the extension of the thermodynamical efficiency of the cycle by using higher compression-ratios, which has necessitated careful attention to the reduction of heat-losses, to the properties of various fuels in respect of detonation, and to the specific heats of the products of combustion at high temperatures.

The displacement of the reciprocating engine by the turbine for large power units has similarly depended on the possibility of improving the economy by utilising high vacua. The high speed of the turbine has directed special attention to the importance of losses due to friction and supersaturation, which depend on the rapidity of expansion. The turbine realises the ideal condition of steady flow with an exactitude unattainable by the reciprocating engine. This has made it worth while for engineers to adopt the thermodynamical definition of total heat first proposed by Callendar in the 10th ed. of the *E.B.*, in place of Regnault's definition, which had sufficed for many years, but continually gave rise to minor difficulties and complications when applied to the turbine. In the article cited, and as repeated in the 11th ed. (*see* 26.811), the total heat was defined as the thermodynamic function $E+PV$, and was denoted by the special symbol F in order to distinguish it from Regnault's total heat H, representing the quantity of heat added to the fluid under the condition of constant pressure equal to that of vaporisation. By general convention, the symbol H has now been defined as representing $E+PV$, a property of the substance depending only on the state, and the symbol Q has been allocated to any quantity of heat added under special conditions.

Equations of Steady Flow.—These depend on the law of conservation of mass, and on the law of conservation of energy, of which they afford some of the simplest possible illustrations. If a fluid is flowing steadily at a constant rate M (mass per second) through a circuit (pipe or nozzle) of variable cross-section X, at a point where the mean volume is V per unit mass, and the mean velocity U units of length per second, we have $MV=kUX$, where the constant k is unity in any consistent system of units, *e.g.*, if U, X and V are measured in ft., sq. ft. and cu. ft. respectively. It is common practice, however, to measure X in sq. in., which must be reduced to sq. ft. by putting $k=1/144$; and similarly for other arbitrary systems. If we consider any two points (1 and 2) of a circuit for which M and X are known, the relation $MV=kUX$ makes it possible to determine either U or V at each point if the other is known. A second relation is obtained from the conservation of energy. Suppose for example that the points 1 and 2 represent the admission and exhaust of a turbine. When the flow is steady, for each unit mass entering at 1, unit mass must leave at 2. Unit mass entering at 1 carries with it its intrinsic energy E_1 and its kinetic energy $U_1^2/2g$, in addition to which work P_1V_1 is done by the pressure P_1 in forcing the volume V_1 into the turbine. Reducing these to heat units by the appropriate numerical factors, a and J, we have finally for the total energy entering the turbine with each unit mass of fluid, $H_1+U_1^2/2Jg$, where H_1 is the initial value of the total heat, which is always tabulated in heat units per unit mass. Similarly the total energy carried out per unit mass at 2 is $H_2+U_2^2/2Jg$. Since the total quantity of energy existing in the turbine remains constant when the conditions are steady, the excess of the energy carried in over that carried out must be equal to the external work W/J done by the turbine together with the external heat-loss Q, both expressed in thermal units per unit mass passing through the turbine. We thus obtain the general equation representing the conservation of energy:—

$$\text{Heat-Drop, } H_1-H_2=W/J+Q+(U_2^2-U_1^2)/2Jg \qquad (10)$$

The reduction factors, a, J, g, can be omitted for absolute or C.G.S. units, but it is better to retain them explicitly, because the various quantities can seldom or never be measured in absolute units in practical work and the retention of the symbols saves much trouble and many mistakes.

In this equation, as applied to a turbine, the term W/J, representing the external work, is the most important on the right-hand side. The external heat-loss Q, and the leaving-loss, depending on the kinetic energy wasted in the exhaust, can be reduced to small corrections, which are readily applied. The external work is the equivalent of the corrected heat-drop, which can be calculated if the initial and final states of the steam are known. The equation takes exact account of any work wasted in internal friction, which does not appear explicitly in the equation because it affects both sides equally. The same equation can be applied to a reciprocating engine, or to any appliance admitting of steady flow.

Joule and Thomson (*Phil. Trans.*, 1854–62; *Proc. R. S.*, 1856) were the first to employ the function E+PV in their experiments on the flow through a porous plug or orifice. They discussed the various terms in the equation with great precision, but did not apply it to a steam engine, which was first done by Hirn and Rankine, though the equation is commonly attributed to Zeuner. In an ideal throttling experiment, such as that designed by Joule and Thomson, the equation shows that the total heat remains constant, $H_1=H_2$, provided that $U_1=U_2$ and that W and Q are negligible. The lines of constant total heat on the PT diagram can be determined by observing the initial and final values of P and T in a sufficient number of throttling experiments. It is then possible to deduce the actual values of H under any conditions by measuring the specific heat and latent heat at any one pressure, preferably atmospheric for most fluids.

In applying the equation to the discharge through an orifice Joule and Thomson showed that the kinetic energy generated was equivalent to the drop of E+PV, or H, which follows immediately from equation (10) if W and Q are negligible. In the usual case, starting from rest, U_1^2 is negligible as compared with U_2^2, so that U_2 is given by the simple relation

$$U_2=(2Jg)^{1/2}\,(H_1-H_2)^{1/2} \qquad (11)$$

For given conditions, V_2 is known in terms of H_2 and P_2, so that the discharge M/X per unit area can be deduced by applying the relation $M/X=kU/V$. Joule and Thomson showed that the discharge would reach a maximum in the case of air under adiabatic conditions when the final pressure after passing the orifice was 0·52 of the initial pressure, a result which had previously been deduced in a similar way by de St. Venant and Wantzel (*Comptes Rendus*, 1839) from Poisson's equation for the adiabatic, namely $PV^{\gamma}=\text{constant}$. They also showed that the velocity of the discharge under this condition was simply related to the velocity of sound in the air at the original temperature and pressure, but they failed to interpret the relation. Osborne Reynolds (*Phil. Mag.*, 1886, p. 194), using the same equations for a perfect gas, showed that the velocity at the throat or minimum area of the stream was *the same* as that of sound in the gas under the same conditions, so that, when this velocity was reached, no further lowering of pressure beyond the throat could possibly increase the discharge. The same result is easily shown to apply to any fluid, either liquid or gas, in the absence of friction. The condition that M is to be a maximum for a given value of X gives $d(M/X)=0$, whence $dU/dV=U/V$. Eliminating dU/dV by differentiating (11), we obtain, f isentropic flow (Φ const.)

$$U^2=aJgV(dH/dV)_{\phi}=aJgV^2(dP/dV)_{\phi} \qquad (1$$

which is the expression for the velocity of sound. This equation al gives the maximum discharge by substituting M/X for kU/V.

In steady-flow calorimetry the drop of H between given initi and final states can be deduced from equation (10) by observi the quantity of heat Q which must be abstracted, under con tions such that W and U^2 are negligible. The pressure is usual constant, but if there is a large drop of pressure between the initi and final states, as in Regnault's experiments on the total heat water, the difficulty is avoided, without changing H_1, by using throttle, which is precisely what Regnault did, though he w unable, owing to the defective state of thermodynamics at th time (1847), to appreciate the exact effect of this proceeding. T same method can be applied for measuring the total heat of ste in any state, including the latent heat. In all cases of steady fl the quantity measured is the change of total heat, which is the mo important property to determine for steam engines or refrigerati machines working on any modifications of the Rankine cycle. (the other hand the intrinsic energy E is the property required the constant volume cycle of the internal-combustion type.

A very simple and instructive illustration of the equation steady flow is that of the temperature gradient in a fluid und gravity. If a current of air is flowing steadily upwards at a mod ate speed, the external heat-loss Q and the change of kinetic ener are negligible, and the drop of total heat is equivalent to the wo done against gravity, giving $W/J=1$ calorie C. for each 1,400 ft. ascent. This would evidently be the same for any fluid wh ever. In the case of dry air the specific heat is nearly independ of the temperature and pressure, and the change of H is equal $S(t_1-t_2)$, where $S=0{\cdot}241$ is the specific heat at constant pressu The drop of temperature will therefore be $1/0{\cdot}241=4{\cdot}15$° C. in 1,4 ft.; or the temperature gradient, 0·296° C. per 100 ft. This result evidently quite independent of the initial temperature, or pressu or height, so long as we can afford to neglect the small variatio of S and g. In an ascending column of *damp* air, condensation se in with formation of cloud as soon as the temperature falls belo the dew point. The drop of H remains 1 calorie per 1,400 ft., b the temperature gradient is greatly reduced by the liberation of t latent heat of the vapour. On the other hand, in a descending cu rent, as in the ventilating shaft of a mine, the temperature increas with depth at the rate of nearly 3° C. per 1,000 ft., which, however, usually much less than the natural gradient of underground te perature (due to outflow of heat through the earth's crust), whi sometimes exceeds 10° C. in 1,000 ft. In this case there will be condensation, but the air may be cooled by evaporation, if the mi is kept wet to reduce dust, as is usually the case.

According to equation (10) the rate of increase of temperatu with depth, denoted by dt/dx, is equal to $1/JS$, and is uniform adiabatic flow if S is constant. The *pressure* gradient, dp/dx, gravitational units, is equal to the density $1/V$, or p/JRT, if R expressed like S in calories per 1°. Dividing by dt/dx, we ha $dp/dt=Sp/RT$, giving the adiabatic equation, which is commo assumed as the starting point to find the temperature gradie But the reverse order is more instructive as showing why the te perature gradient dt/dx is uniform.

Properties of Radiation.—The flow of heat by radiation from o body to another at a lower temperature is the commonest case steady flow. Owing to the high velocity of radiation and the abse of thermal capacity in the circuit, the steady state is established i small fraction of a second if the temperatures of source and si are constant. The quantity measured in a radiation experime is not the energy E of the radiation, as is frequently assumed, b the total heat E+PV, which is the same in the case of radiatio the latent heat of emission, namely $VT(dP/dT)$, for a volume according to Carnot's principle. This is universally admitted in t deduction of the fourth-power law (*see* 13.155), which follows f the fact that the pressure of full radiation is one third of the ene density, so that the latent heat of emission per unit volume is times the pressure. The quantity directly measured in experim on full radiation is the quantity of heat emitted per sq. cm. second from a black-body or perfect radiator at a temperatur and is denoted by σT^4, where σ is the Stefan-Boltzmann cons of full radiation. By the geometrical conditions of the problem, t quantity σT^4 is $\Lambda/4$ times the latent heat per unit volume, or times the energy-density in an isothermal enclosure at T, where is the velocity of light. The qualitative verification of the fou power law requires only a receiver capable of giving correct rela values of the radiation received, and is now generally accepte satisfactory; but the absolute measurement of the value of the c stant σ is a much more difficult problem, which has frequen been attacked in recent years without obtaining so high a deg of concordance as is desirable in so fundamental a research. value $5{\cdot}32\times10^{-5}$ ergs per sq. cm. per second, found by F. Ku baum in 1898 (*see* 13.155), was accepted for several years, tho it rested on a somewhat doubtful value of the absorption coeffic of the bolometer. Moreover, the assumption that the radi energy measured was equivalent to the electric energy required roduce the same rise of temperature in the bolometer, was rendered omewhat uncertain by conduction effects at the ends of the strips. similar bolometer, with the end-effects compensated, as employed the solar eclipse of 1905, gave the somewhat higher value $5{\cdot}60\times$ 0^{-5}. Kurlbaum (1912) gave the corrected result $5{\cdot}45\times10^{-5}$. F. 'aschen and W. Gerlach, by a modification of Ångström's method *Ann. Phys.*, 38, p. 41, 1912), found the value $5{\cdot}80\times10^{-5}$, which was onfirmed by G. A. Shakespear (*Proc. R. S.*, A, 86, p. 180, 1912), and y H. B. Keene (*Proc. R. S.*, A, 88, p. 49, 1913), who found $5{\cdot}67\times$ 0^{-5}, and $5{\cdot}89\times10^{-5}$, respectively. W. Coblentz (*U.S. Bur. St.*, 12, . 553, 1916), by a method similar to that of Paschen and Gerlach, ound the value $5{\cdot}72\times10^{-5}$, which is a fair mean of the previous esults. One of the most promising methods is that of the radio-alance (*Proc. Phys. Soc.*, 23, pp. 1–34, 1910), in which radiation eceived through a measured aperture is completely absorbed in a mall copper cup, and is compensated by the Peltier cooling-effect ue to a current through a thermojunction. Unfortunately, these xperiments were interrupted by the War, and the final reductions ave not yet been completed. There seems to be little doubt that urlbaum's original value was too low, but there are many pit-alls in such difficult experiments, and most of the methods adopted re liable to some objections.

It is generally admitted that the distribution of energy in the pectrum may be represented within the limits of experimental rror by Planck's formula (*see* 13.156), namely,

$$E d\lambda = C'\lambda^{-5}d\lambda/(e^{c'/\lambda T}-1) \tag{13}$$

If this formula is integrated from 0 to ∞, and equated to σT^4, ssuming that it represents the distribution of energy in the spec-rum as observed experimentally, we find for the constant C', in erms of c' and σ, $C'=15\sigma(c'/\pi)^4$. The value of the distribution onstant c' is most readily deduced from the wave-length λ_m cor-esponding to the maximum ordinate of the energy curve at T, nce by Wien's law the product $\lambda_m T$ is the same for all tempera-ures. According to Planck's formula the maximum occurs at the oint $\lambda_m T=c'/4{\cdot}9651$. Planck took $\lambda_m T=0{\cdot}294$, and $\sigma=5{\cdot}30\times$ 0^{-5}, giving $C'=3{\cdot}735\times10^{-6}$, and $c'=1{\cdot}460$. But if $\lambda_m T=0{\cdot}289$, nd $\sigma=5{\cdot}72\times10^{-5}$, then $C'=3{\cdot}708\times10^{-6}$ and $c'=1{\cdot}435$, according to e latest values of $\lambda_m T$ and σ. A comparatively small error in c', hich is raised to the fourth power, suffices to neutralize the error σ. The weak point of the method is that the position of the max-num of an experimental curve cannot be fixed with any certainty hen the curve (as in this case) is far from symmetrical on either de of the maximum.

It is too commonly assumed that Planck's radiation formula, in ite of the weighty objections that have repeatedly been urged gainst it, is so firmly founded in theory and experiment, that no her formula is worth considering in comparison with it. It is so frequently asserted that no formula based on the "classical" echanics can possibly satisfy the required conditions. The argu-ent is somewhat as follows. The number of possible vibrations per nit volume of a continuous medium possessing the properties the ether, between the limits λ and $\lambda+d\lambda$ of wave-length, ould be represented by $8\pi\lambda^{-4}d\lambda$, according to Lord Rayleigh's ethod of calculation (*Phil. Mag.*, 49, p. 539, 1900), if the length path between each reflection is restricted to an integral multiple half a wave-length. If the different frequencies are regarded as parate inconvertible entities, like the molecules of different gases, etween which the energy must be equally divided, the whole of e energy would accumulate in the infinitely short waves, which is surd and contradicts experiment. It would be more natural, owever, from a physical standpoint to regard Lord Rayleigh's rmula

$$(8\pi RT/N)e^{-c''/\lambda T}\lambda^{-4}d\lambda \tag{14}$$

corresponding to the partition of energy among a number of *milar* molecules, according to Maxwell's law, which is universally lmitted in the kinetic theory of gases, as resulting from the steady ate produced by collisions. The steady distribution of energy of diation in equilibrium with matter arises in a similar manner from e Döppler effect, by which the energy of a group of waves is anged in the same proportion as the frequency at each encounter ith a moving obstacle. The frequency, or the reciprocal of the ave-length, corresponds to the energy, and occurs in much the me way in Rayleigh's formula, as the square of the velocity, or e kinetic energy, in Maxwell's law. On this view, Lord Rayleigh's rmula evidently represents the distribution of pressure-energy etween the different wave-lengths about a mean value RT/N, which, cording to the law of equipartition, should be the same as the essure-energy of a single gas-molecule at the same temperature.

If we take Rayleigh's formula as representing the pressure dis-ibution in full radiation, the expression for the latent heat of sorption L as measured experimentally (corresponding to (4) ove, but expressed in terms of the wave-length λ in the normal ectrum) may be written

$$L d\lambda = C''(T+c''/\lambda)\lambda^{-4}e^{-c''/\lambda T}d\lambda \tag{15}$$

tegrating from 0 to ∞ we find $C''=\sigma c''^{3}/8$. The maximum of is curve occurs at the point where $c''/\lambda T=2+2\sqrt{2}$, whence $c''=$ $8284\lambda T$. The absolute value of the maximum ordinate comes out $0{\cdot}65603(\sigma T^4/\lambda_m)$. The value of the same ordinate, calculated in the same way for Planck's formula (13), but with $c'=4{\cdot}9651\lambda_m T$ comes out $0{\cdot}65755(\sigma T^4/\lambda_m)$. It is a curious and significant fact that the maxima should be so nearly the same when the same values of the experimental data are assumed for both curves. The total areas of the two curves are the same, and they agree so closely throughout their whole extent that it would be practically impossible to distinguish between them with certainty by experiments on the distribution of heat in the spectrum. The greatest difference amounts to about 1% of the maximum ordinate, and occurs near the point $\lambda=\lambda_m/2$ on the short wave-length side, where the curve is very steep. This difference becomes quite appreciable in the specific heats, when the curves are differentiated, and seems to lead to better agreement with experiment than Planck's formula as explained above.

The most serious difficulty from an experimental standpoint in applying Planck's formula, is that the latent heat of emission per unit volume is always tacitly assumed (following Planck) to be the same as the energy-density, without taking any account of the pressure, whereas the existence of the radiation pressure is universally admitted as the basis of the deduction of the fourth-power law. The work done by the pressure, if it exists, cannot consistently be neglected in experimental measurements of radiation in steady flow. This is one of the most fundamental points in practical thermodynamics, but had not up to 1921 received sufficient attention from the mathematicians who have worked so elaborately on the theory.

VAPORISATION

A good deal of attention has been devoted in recent years to the study of the properties of vapours employed in heat engines and refrigerating machines. The importance of the thermodynamical aspect of the problem has been widely recognized by engineers as the only sure guide to improvements in efficiency, and it has been realised that equations employed to represent the properties of the working fluid must be exactly consistent with the laws of thermodynamics, if it is desired to avoid discrepancies in the results of calculations by different methods. The principal properties of vapours were discussed from this point of view in the earlier article (*see* 27.897). The theory there given still holds good, but it will be of interest to discuss some of the evidence which has since accumulated on the experimental side. The case of steam, for which the experimental data are more accurate than for any other substance, will be taken, as being far the most important to engineers, and as illustrating the properties of vapours at moderate pressures. At high pressures, on the other hand, in the neighbourhood of the critical point, the data for steam are somewhat deficient, owing to the difficulty of the experiments, and the impracticability of using steam as a working fluid under these conditions. In the critical region the properties of carbonic acid have been most widely studied on account of its use for refrigeration.

Properties of Steam.—The equations for steam, first proposed by Callendar in the 10th ed. of the *E.B.* (1902), were founded on experimental measurements (1) of the specific heats, s and S, of water and steam by the continuous electric method, (2) of the Joule-Thomson cooling-effect C with a differential throttling calorimeter and (3) on the adiabatic index γ for dry steam with a very sensitive platinum thermometer. These experiments, taken in conjunction with the laws of thermodynamics, sufficed to determine all the required properties fairly accurately at moderate pressures.

The experiments on the specific heat of water extended from 0° to 100° C., and, when taken in conjunction with those of Regnault at higher temperatures, showed that the total heat h under saturation pressure could be represented, with sufficient accuracy for the purpose, by the thermodynamic formula

$$h = st + avT(dp/dT) = st + vL/(V_s - v) \tag{16}$$

in which the constant $s=0{\cdot}99666$ is chosen to make h at 100°C. = 100 cals. C., or 180 B.T.U. per lb. at 212° F., reckoned from 32° F. The symbol a is the factor for reducing any product of dimensions pv to heat units. When p is in lb. per sq. in. and v in cu. ft. per lb., the reciprocal $1/a$ (which it is most convenient to use with a slide rule) has the value 9·722 on the Centigrade scale, and 5·401 on the Fahrenheit scale of temperature. V_s and v are the volumes of the dry saturated vapour and the liquid respectively, and dp/dT is rate of increase of saturation pressure p with temperature. When taken in conjunction with Clapeyron's equation for the latent heat, formula (16) gives a very useful relation between the total heat H and the volume V for *wet* saturated steam in any state,

$$H - st = aVT(dp/dT) = pV/\Pi \tag{17}$$

The factor $\Pi = p/aT(dp/dT)$, which varies slowly and is independent of the wetness, has been tabulated, as affording the most expeditious and accurate method of calculating either H or V when the other is known. The relation between H and V when p is given is that most commonly required in practical work. The same formula leads to a simple expression for the entropy Φ,

$$\Phi = s \log_e (T/T_0) + aV(dp/dT) \qquad (18)$$

which applies to wet steam of volume V, and also to the liquid if v is substituted for V. T_0 represents the freezing point, 273·1° C. or 491·6° F.

Values ranging from 0·305 at 0° C. to 0·665 at 160° C. had been proposed by various writers in 1900 for the specific heat of steam, but the direct measurements by the continuous electric method at atmospheric pressure from 100° to 160° C. gave results but slightly exceeding those of Regnault over the range 124° to 224° C., and showed that the limiting value S_0 at zero pressure was probably nearly constant and equal to 0·477. This was confirmed by L. Holborn and H. Henning (*Ann. Phys.*, 18, p. 739, 1905) in a qualitative manner by comparison with air over the range 110° to 820° C.

The experiments on the cooling-effect C, when combined with those of the specific heat S, showed that the product SC was a function of the temperature only, and gave the simple expression for the total heat,

$$H = S_0T - SCP + B \qquad (19)$$

for dry steam at any pressure P. The values for dry *saturated* steam, given by putting the saturation pressure p in this expression, while differing materially from Regnault's formula, gave good agreement with the experiments (*see* 27.902) of Dieterici at 0° C., and of Griffiths at 30° and 40° C., when the constant B was deduced from Joly's observations at 100° C. with the aid of the experiments on the specific heat of water. This formula was closely confirmed by the observations of H. Henning (*Ann. Phys.*, 21, p. 849, 1906) on the latent heat between 30° and 100° C. His later observations (*Ann. Phys.*, 29, p. 441, 1909) also gave good agreement with the same curve at 180° C., but showed a discontinuity at 120° C., which may be attributed to inevitable experimental errors in such difficult work. At higher temperatures, up to 260° C., equation (19) received theoretical confirmation from the formula for the latent heat proposed by M. Thiesen, namely, $L = L_1(t_c - t)^{1/3}$, based on the vanishing of the latent heat at the critical temperature t_c. As first applied by Thiesen himself (*Ann. Phys.*, 9, p. 80, 1902) to the case of steam, with 365° C. for the critical temperature, this formula gave results which were much too low for the latent heat. It was shown, however, by Traube and Teichner (*Ann. Phys.*, 13, p. 620, 1904) that the true value of t_c was 374° C., which brought Thiesen's formula into agreement with (19) to less than 1 in 1,000 all the way from 0° to 260° C., when the constants were properly determined from the known values at 0°, 100°, 180° and 374°, giving the result

$$\log L = 1{\cdot}9638 + 0{\cdot}3151 \log (374 - t) \qquad (20)$$

in the logarithmic form as required for practical calculations. The importance of this formula arises from the fact that direct determinations of H_s (for dry saturated steam) become exceedingly difficult and uncertain at temperatures above 180° C., owing to errors from leakage and wetness, and that a formula of this type has been verified for many other substances in the critical region, so that it affords the best guide to the probable variation of H_s between 200° and 374° C.

The throttling experiments showed that there must be a considerable variation of S with pressure, corresponding to the variation of SC with temperature. But the experiments on the adiabatic expansion of dry steam showed that the index $n+1$ in the equation P/T^{n+1} = constant, was very nearly constant and equal to 13/3 over a wide range of P and T. Since $S_0/R = 13/3$, it followed that the total heat of dry steam must be expressible in the form

$$H = (13a/3)P(V - b) + abP + B \qquad (21)$$

giving the convenient expression for the volume of dry steam,

$$V = (3/13a)(H - B)/P + 10b/13 \qquad (22)$$

It also followed that the coaggregation volume $c = c_0(T_0/T)^n$ in the equation

$$V - b = RT/aP - c \qquad (23)$$

must vary with temperature according to the index $n = 10/3$, giving for the variation of S and C, in terms of c, the formulae

$$SC = a(n+1)c - ab \qquad (24)$$

$$S = S_0 + an(n+1)cP/T \qquad (25)$$

It was obvious that these could not apply accurately at high pressures in the critical region, but they afford ample accuracy for all purposes in the pressures required in steam-engine practice.

The Munich experiments (*Forsch. Ver. Deut. Ing.*, 21, 1905) by O. Knoblauch, R. Linde and K. Klebe, on the volume of steam, proved to be quite inconsistent with the well-known equation of Zeuner, then commonly accepted, but showed the most remarkable agreement up to 180° C. with formula (23) deduced from the throttling experiments.

The variation of S with pressure given by (25), as predicted by the experiments on C, was qualitatively confirmed by the experiments of O. Knoblauch and M. Jakob (*Forsch. Ver. Deut. Ing.*, 36, p. 109, 1906) extending to 8 atmospheres.

Knoblauch and his collaborators have since extended their observations on th specific heat up to 30 atm. (425 lb.), and have published Steam Tables (Oldenbourg, Munich, 1923) extrapolated to 60 atm. (850 lb.). These results are in very fair agreement with (19), (22) and (23), especially near the limit of 850 lb. at a moderate degree of superheat, but show a rapid fall of total heat on approaching saturation. (See also "World-Power," for May and June 1924, and June 1925. Callendar has since extended his observations with the differential throttling calorimeter to 1,000 lb. pressure, and finds (as explained in *Properties of Steam*, p. 83 that the assumption that the cooling-effect C is a function of the temperature only gives better agreement with experiment at high pressures near saturation than th Joule-Thomson equation (23), though both are in practical accord at moderat pressures or high superheats. There is always a difficulty in securing accurat observations of the total heat or specific heat of *saturated* steam owing to systematic errors of wetness, but results accurate to 1 in 1,000 may readily be obtaine at a moderate degree of superheat.

Adiabatic Heat-drop.—The change of total heat H in frictionles adiabatic expansion or compression is frequently of considerabl interest as representing the work done by or on the fluid in the idea case, when there is no internal friction, and when no heat is supplie or lost externally. If the laws of thermodynamics are summarise in the form

$$dQ = Td\Phi = dH - aVdP \qquad (26)$$

in which dQ represents heat supplied per unit mass by friction o otherwise, we observe that, in the case of isentropic flow, for whic $d\Phi = 0$, the change of H is equal to the integral of $aVdP$ along th adiabatic, which is readily obtained by substituting for V in term of H and P from (22) or (17), for any given initial state and final pressure. We may also obtain the general expression for Φ from thos for H and V by integrating $d\Phi = dH/T - (aV/T)dP$. These expressions may be put in various forms according to the purpose fo which they are required. One of the most useful for dry steam is

$$DH_\phi = (H' - H'')_\phi = (H' - B - abP')(1 - T''/T') + ab(P' - P'') \qquad (27$$

in which H′, P′, T′, and H″, P″, T″, represent the initial an final states. An exact expression for the adiabatic heat drop DH_ϕ in the case of wet saturated steam, is readily obtained in terms of H and T′, T″. But in practice it is usually more convenient to tabulate H and ϕ, and the Gibbs' function $G = T\phi - H$, which has th advantage of being a simple function of the temperature only, an independent of the wetness for a mixture of water and steam in any proportions. From the definition of G, if ϕ is constant at its initia value ϕ'', we obtain immediately the convenient expressions

$$DH\phi = (T' - T'')\Phi' - G' + G'' = H' - H_s'' + T''(\Phi_s'' - \Phi') \qquad (28$$

The first expression is general, and is readily applied if G′ and G are tabulated. The second is obtained by substituting for G′ an G″ in terms of H and ϕ, but is applicable only if the final state saturated, so that H_s'' and ϕ_s'' are the tabulated values for dr saturated steam.

Effects of Supersaturation.—For the general theory of the behaviour of a vapour when cooled below the saturation temperatu without condensation *see* 27.898–9. The state of supersaturatio is very common, in rapid expansion, and has proved to be of son practical importance, as affecting the discharge through a nozzl and the efficiency of a turbine. It appears that steam usually follows the dry adiabatic, $P/T^{13/3}$ = constant, for some distance belo the saturation point. The drop of temperature is about three time as rapid as along the wet adiabatic, and the volume is smaller tha that of saturated steam at the same P and H. The heat-drop, an the velocity generated, are also smaller, for a given pressure dro than in the case of steam which is assumed to remain in the equili rium state of saturation throughout the expansion. If the initia steam is dry saturated, it usually remains dry for some distanc beyond the throat of a nozzle, so that the discharge, as given i equation (12), is obtained from the dry adiabatic, by substitutin $(dP/dV)_\phi = 1{\cdot}3P/V$ at the throat, which leads to values about 5 larger than those given by the equations for wet steam. This confirmed by experiment, and is represented by the numeric formula for the discharge M/X_t in lb. per sec. per sq. in. of throa when P′ is in lb./sq. in. and V′ in cu. ft./lb. in the initial state,

$$M/X_t = 0{\cdot}3155(P'/V')^{\frac{1}{2}}, \quad P_t/P' = 0{\cdot}545 \qquad (29$$

in which the small quantity b is neglected as being usually beyon the limits of possible accuracy of measurement.

The defect of heat-drop on reaching the throat is about 5%. If th steam continued to follow the dry adiabatic to low pressures, t defect of heat-drop would often reach 20%, which would be ver serious. But soon after passing the throat, the coaggregated mol cules begin to act as condensation nuclei, according to Kelvi equation (*see* 27.898). When this limit is reached, the condensatio takes the form of a very thick fog of exceedingly fine particles, a is extremely rapid, owing to the enormous number of nuclei avai able, about 10^{22} per lb. of steam. If the expansion is relatively slo the steam is transformed into the saturated state, and remains near saturated for the rest of the expansion. But if the expansion very rapid, as in an expanding nozzle at a velocity of 3 or 4,000 ft./se the steam will remain near the supersaturation limit with a loss heatdrop amounting to nearly 8% at low pressures, involving a co responding loss of efficiency. According to Wilson's experiments low pressures (*see* 27.899), the supersaturation limit is reach when the pressure is about 8 times the normal saturation pressu corresponding to the actual temperature of the steam. The equiv lent wetness of the steam at this point, when transformed to t aturated state at the same P and H, would be about 3%. This ppears to be confirmed by turbine tests at these pressures, but Wilon's experiments do not afford any direct evidence with regard to he limit at which condensation starts at higher pressures. It appears n theoretical grounds that the pressure ratio corresponding to the upersaturation limit should not be so high as 8 at high pressures, hich would require an excessive increase in the drop of temperature nd in the equivalent wetness of the steam at high pressures.

There is some evidence that the equivalent wetness at the superaturation limit is the same, namely 3%, at high as at low presures. This would permit a very simple method of calculation, but iore experimental tests are required to decide the point. The effect initial superheat in improving the efficiency of a turbine cannot satisfactorily explained on the older theory that the steam is in ie equilibrium state of saturation throughout the expansion, but a necessary consequence of the phenomenon of supersaturation. he loss due to supersaturation may be entirely eliminated if the uperheat is sufficient to prevent supersaturation. In any case the ss will be greatly reduced by superheat, and the results of calcuition appear to indicate that the improvement of efficiency may e exactly accounted for in this way. This point has been very illy discussed by H. M. Martin, in "A New Theory of the Steam urbine" (*Engineering*, vol. 106, 1918); and also by H. L. Callendar, *roperties of Steam*, pp. 305–12.

REFERENCES.—On the practical side, Sir J. A. Ewing's *Mechanical roduction of Cold* and *Thermodynamics for Engineers* (1920); on the heoretical side, H. S. Carslaw, *Fourier's Series and Integrals;* and . H. Jeans, *Dynamical Theory of Gases.* For experimental details it always necessary to refer to the original papers, but *Physical and hemical Constants* by G. W. C. Kaye and T. H. Laby (1921) gives a andy and up-to-date summary of numerical results. (H. L. C.)

HEATING AND VENTILATION (*see* 13.160 and 27.1008).—he close association between heating and ventilation, especially modern practice, makes it desirable to treat the two subjects ogether.

I. HEATING

When the temperature inside a building is maintained above hat out-of-doors, a sufficient quantity of heat must be continuusly supplied to replace that which passes by conduction hrough the walls and roof of the building and to warm the coniderable quantity of in-leaking air. The heating system has to roduce the proper amount of heat and to distribute it.

The earlier forms of heating apparatus, such as the stove and he fireplace, deliver their heat to the room principally by adiation. In general, heating by convection is to be preferred om a standpoint of comfort in severe climates, and for this eason and because of the dirt and labour necessitated by their are, the stove and the fireplace are being largely superseded, specially in North America, by the warm-air furnace or by team and hot-water systems. In Great Britain the fireplace is till an acceptable method of heating because of the relatively iild climate.

Warm Air Furnace.—The warm-air furnace system satisfies he requirement of a source of heating removed from living uarters, gives a fairly successful distribution of heat throughout he house and is very low in cost compared with steam and hotvater systems.

It consists of a firepot in which the fuel is burned and a more or ss extended flue for the gases of combustion, the whole being surounded by a sheet-metal casing through which a current of air asses, absorbing heat from the hot surfaces of the firebox and flue nd passing thence through metal ducts to the rooms above. Air supplied to the base of the furnace casing either from out-of-doors r, more economically, by a return duct from some central room of ie house. The fundamental difficulty with the warm-air furnace that the force producing the circulation of air through the system, eing due only to the difference in the densities of the heated air in ie pipes and the unheated air without, is necessarily very small and onsequently it is difficult to heat rooms remote from the furnace, articularly under adverse wind conditions.

Steam-Heating.—This system consists of a boiler in which the eam is generated, a number of so-called radiators located in the ooms to be heated, and a system of piping which conveys the steam the radiators and returns the water of condensation to the boiler.

The Vapour System.—The so-called vapour system is a steam ystem operating at a pressure of only a few ounces above atmosphere compared with a pressure of one to five pounds for the ordinary eam system. In the vapour system the steam enters the radiator rough a valve near the top and the displaced air and the water condensation are conveyed away by return piping, the air being nally discharged from the system through a vent near the boiler. To prevent the flow of steam from the radiator into the return piping, a trap is usually installed at the discharge end of each radiator.

For large buildings the vacuum steam system is used very extensively. The arrangement of the radiators and piping is nearly the same as in the vapour system, and a vacuum pump is connected with the return piping. This increases the differential pressure through the system and promotes the rapid flow of steam to the radiators and the complete removal of air.

Hot-water System.—In the hot-water system, which is widely used in Great Britain, water is heated in a central heater, flows through pipes to the radiators, where it delivers its heat, and thence back to the heater. Circulation is produced, in the simple gravity type system, by the difference in weight of the column of heated water in the supply pipe and the column of cooler water in the return pipe. Most large systems employ forced circulation, produced by a pump in the circuit, thus insuring positive flow and permitting the use of smaller pipes. The hot-water system, because of the thermal capacity of the water contained in it, gives a less fluctuating output of heat to the rooms, but is for the same reason less readily capable of responding when the outside temperature changes. The hot-water system, using forced circulation, is frequently employed in heating groups of buildings because the heat output can be readily controlled from a central point by adjusting the temperature of the water.

Steam is produced for a heating system by a boiler which usually has the furnace or firepot incorporated in it. Where electricity is used for heating—a procedure sometimes employed where coal is expensive and electric current cheap—the boiler is fitted with electric heating elements of the submerged resistance type. In recent years, due to the increasing cost and scarcity of anthracite coal, boilers have been developed which will burn bituminous coal successfully and without excessive smoke. (*See* BOILERS.) This is accomplished by the introduction of air at certain points in the furnace or by other means for burning the volatile matter before it is chilled by contact with the cold boiler surfaces.

Temperature Control.—Temperature control is frequently applied to schools, offices and public buildings in order to secure constant room temperatures. There are several systems in use which regulate the flow of steam to radiators and adjust the position of dampers, under the control of a thermo-stat. Compressed air or electricity are used to furnish the power required.

Central Heating.—In Great Britain, and in Europe generally, the term central heating usually refers to the heating of a building by means of a furnace instead of fireplaces. As understood in North America, however, the term refers to the supplying of heat to a number of separate buildings from a central plant. When portions of a city are thus heated the term district heating is often synonymously used.

Either steam or hot water may be used as the medium for conveying the heat from the central plant. The pipes are carried either in tunnels, permitting ready access to them, or are buried a few feet below the surface enclosed in some form of conduit to insulate the pipe against excessive loss of heat and to protect it. The conduit sometimes consists of a thick-walled wooden box or tube in which case the wood serves as the insulating material; or it is made of concrete or clay tile and a layer of magnesia or asbestos is applied to the pipe as an insulator.

There are extensive systems of this type distributing steam commercially for heating, cooking and to some extent for power in New York City, Detroit, Pittsburg, Rochester, St. Louis and elsewhere. The largest areas covered are about one sq. m. in extent. Business districts and good residential districts of high class are the desirable territory.

Frequently the exhaust steam from electrical generating plants is utilised and is distributed at a pressure of from 2 to 10 lb. above atmosphere; but in some cities steam direct from the boilers at pressures up to 100 lb. or more is used. The consumption of heat by the individual buildings is metred either by a steam meter in the supply pipe or by a meter which measures the water of condensation as it is drained from the heating system of the building. Losses of all kinds between the boiler outlet and the consumer's meter are, in the more efficient systems, from 15 to 20% of the steam sent out from the boilers. Hot water is used as the distributing medium in some cases, but is not regarded as commercially satisfactory, largely because of the lack of a suitable means of measuring the amount of heat used by each consumer.

II. VENTILATION

The modern conception of ventilation (*see* PUBLIC HEALTH) distinguishes between the internal and the external effects of the atmosphere upon the body. Those factors having an internal effect are chiefly the humidity of the air affecting the mucous membranes in the respiratory passages, the amount of dust and bacteria in the air and the nature and strength of odours. Externally, the temperature, humidity and motion of the air play perhaps an even more important part by controlling the rate of heat loss from the skin. It is only recently that this cooling power of the air in ventilation has been quantitatively studied. In 1913 Sheppard and E. V. Hill established by tests a comfort zone, which showed, for still air, the relation between temperature and humidity necessary for comfort. More recently Houghten, Yaglou and others, in an investigation sponsored by the American Society of Heating and Ventilating Engineers, the U.S. Bureau of Mines and the U.S. Public Health Service determined the complete relations between temperature, humidity and air motion as they affect bodily comfort.

An adequate system of ventilation must supply a sufficient quantity of air, properly heated and humidified, so that its cooling effect will be correct. Dust and bacteria must be reasonably absent, and odours not excessive. In the more elaborate systems of ventilation, such as are used in schools, theatres, auditoriums and other densely occupied buildings, the air used for ventilation is drawn by a centrifugal fan over steam coils, passed through an air washer for cleaning and humidification, and forced by the fan through a system of ducts to the various inlet points of the rooms to be ventilated. Air is withdrawn from each room, through properly located outlets, into an exhaust duct and discharged to the outside by the exhaust fan.

Arrangement of Ventilating System.—The air washer consists of a spray chamber, in which the air is humidified, followed by a series of baffles wet by sprays which remove most of the dust, and finally there are a number of dry baffles which serve to remove any entrained water. The ventilating system may be used for heating as well as for ventilation.

Artificial cooling is sometimes used in theatres by supplying refrigerated water to the air washer (*see* REFRIGERATION).

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HEBREW LITERATURE (*see* 13.169).—Modern Hebrew literature, the beginnings of which go back to the 18th century, is universal in scope and secular in spirit, thus contrasting with the purely legal, ritualistic or homiletic works of earlier times. This literature took its rise in Italy (M. H. Luzzatto, 1707–47), whence it shifted to Germany, showing at first, notably through the influence of Moses Mendelssohn (1729–86), a rationalistic and cosmopolitan tendency.

Following a brief period of activity in Galicia dominated by Biblical criticism and historical scholarship (Krochmal, 1785–1840; Rapoport, 1790–1867), Hebrew literature assumed a new character in Russia and Lithuania, where the so-called Haskalah movement developed—a humanistic and humanitarian spirit which set itself against the traditional exclusiveness of the Jew. It found expression in the historical and scientific compendia of Kalman Schulman (1819–99), in the novel (Mapu, 1808–67) and in poetry (Lebensohn, 1828–52; J. L. Gordon, (1831–92). The novelist P. Smolenskin (1842–85) heralded a reaction, hastened by the pogroms against the Jews, towards a Jewish national policy, which culminated in Zionism. Since his day Hebrew literature has been largely dominated by the idea of a national revival. This idea has found its most complete expression in the essays of Asher Ginzberg (Ahad Ha'am) who has resisted the tendency to lay undue stress on the economic and political factors in Zionism and has insisted on the conception of Palestine as the cultural centre of the Hebrew race.

The individualistic and symbolic spirit in Hebrew literatur
has been greatly influenced by the modern mystic movemen
among the Jews known as Hassidism. In the sphere of fictio
this spirit found its foremost representative in Isaac Loe
Perez (1851–1915), whose stories are distinguished by artisti
beauty and tenderness. Humour is the dominant characteristi
of two other famous Hebrew story-writers—S. J. Abramowitsc
(known as "Mendele," 1835–1918) and S. Rabinowitz (know
as "Sholem Aleichem," 1859–1916). Judah Steinberg (1863
1908), author of many stories, excels in the delineation
character, and in him the individual finds more complete an
varied representation than elsewhere in Hebrew literatur
This fact, and the clearness and fluency of his style, give hi
high rank among Hebrew novelists. Another novelist of som
distinction is R. A. Brandes (1851–1902), who chose the struggl
for religious reform as the theme of his principal novels.

Poetry has made rapid strides in modern Hebrew literatur
There is a host of contemporary poets, the most representative
whom is Hayyim Nachman Byalik (1873–). With the ex
ception of Judah ha-Levi (fl. 12th century) he is perhaps th
leading Jewish national poet, inheriting the idealism and th
prophetic seriousness of his people. He is pre-eminently th
poet of Jewish woe. To Jewish national hopes and aspirations h
seldom gives expression in his verse. None of the Hebrew poet
has grasped and represented the spirit of the Ghetto and it
poetry with so much sympathy and so much tenderness
feeling as Byalik. The ideas of Ahad Ha'am and the influenc
of Gordon's style and form are traceable in his poems. Next t
Byalik and in strong contrast with him stands Dr. Saul Tsche
nichowski (1875–). He was the first to introduce int
Hebrew poetry an admiration for the Greek spirit and the sens
of complete enjoyment of life. His work is remarkable for it
easy gracefulness and its varied rythms and metrical form
Dr. Jacob Cahan (1880–) is an idealist, whose poems be
the stamp of a marked individuality. In the poems of Zalma
Schneor (1886–) there is at times a gentle pessimistic vei
and his verse is full of life and beauty; the rhythm has harmon
and tunefulness, the imagery is rich, varied and striking, an
the movement quick and bold. His prose, too, is marked by th
same qualities. Among a list of poets of less distinction may
mentioned, Jacob Steinberg, Jacob Fichman, Isaac Katzenelso
J. J. Koplewitz, David Schimonwitz, the brothers Simon a
Pesach Ginsburg, Hillel Bavli, Judah Karni, A. Schlonsky,
Zebi Greenburg, Avigdor Feuerstein, Benjamin N. Silkiner a
Simon Leo Halkin. Modern Hebrew poetry, like Hebrew poet
in general, has been strongest in lyric.

The various transformations of Jewish life brought about
the Zionist and other Jewish movements and the influence
foreign literatures had their effects upon the shaping of co
temporary Hebrew fiction, notably the short story and
novel. There has been created a Hebrew short story, artistic
technique and generally psychological in presentation, delinea
ing the individual in a variety of moods and situations; but
the same time marked by a minute, torturing self-analysis,
an impotence in the will of the heroes and by an outlook up
life that is gloomy and despondent. The creators of these stor
are followers of Micah Joseph Berdyczewski (1865–1921), w
in his view of life was influenced by the individualistic theories
Nietzsche. Among the most notable story-writers of this gro
are Isaiah Domosehvitzky (known as J. Bershadsky, 187
1908), Joseph Hayyim Brenner (1881–1921), Gershon Sch
mann, Uri Nisan Gnessin (1880–1913), Hirsch David Naumb
and Isaac Dob Berkowitz. The melancholy and morbid spi
which some of these writers have introduced into the Hebr
sketch and novel is almost entirely traceable to the influen
of the Russian and Scandinavian literatures of the last f
decades. A notable exception to this tendency is S. J. Agnon,
original symbolico-mystical writer of short stories and a mas
of Hebrew style. Other writers of fiction who are free from t
pessimistic strain are A. A. Kabak, Moses Smilansky, L.
Orloff, S. Ben-Zion Guttman, Eliezer Steinman, Asher Bara
and A. Reubeni.

The adaptation of the Hebrew language to the needs of modern life owes much to Eliezer Ben-Yehuda (1858–1923), one of the pioneers of the idea of a Jewish national renaissance, whose ten-volume Hebrew dictionary (*Thesaurus totius Heraitatis*) is a monument of a life's devotion to the revival of Hebrew. The talent of David Frischmann (1863–1922)extended over the domains of the feuilleton, the short story, poetry and criticism. Dr. Joseph Klausner (1874–   ), the editor of the leading Hebrew monthly *Hashiloah*, is active in many fields—criticism, history, scholarship and journalism. He possesses considerable erudition and historic insight. Hillel Zeitlin, a mystic, has made original contributions to various phases of modern Hebrew literature. The greatest Jewish journalist, writing for Jews in Hebrew and in many other languages, is Nahum Sokolow. Reuben Brainin is a fine stylist and an able ritic but his literary ideas and tastes are perhaps too much determined by outside influences. In Dr. Simon Bernfeld (1860–   ) Hebrew literature has a many-sided and very prolific writer with a gift for presenting the results of scholarly research n attractive literary form. Wolf Jawitz (1847–1924) was a historian and a philosopher of religious romanticism. David Neumark (1866–1924) made original contributions to the study of Jewish philosophy. Jacob Klatzkin, Fishel Lachower, S. B. Maximon, Dr. S. M. Melamed, Joel Blau, Osias Thon, Mordecai Ehrenpreis, S. I. Hurwitz and others have contributed much to he development of the essay in Hebrew literature.

Hebrew literature, including its vernacular is a primary factor esponsible for the rejuvenation of the national Jewish spirit and for the emancipation of Jewish life from external influences. Literary activity came to a virtual standstill as a result of the World War and its consequences, which bore with especial everity on eastern Europe, formerly the chief centre of Hebrew iterature. During the last few years there has been a revival in eastern Europe, and a certain development in America; but he centre of this activity has shifted to Palestine.

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(Jo. B.)

HECTOGRAPH: *see* OFFICE APPLIANCES.

HEDIN, SVEN (1865–   ), Swedish explorer, was born in Stockholm Feb. 19 1865. He was educated at the högskola in Stockholm, and Uppsala University and later studied at Berlin and Halle. In 1885–6 he travelled through Persia and Mesopotamia, and in 1890 was attached to King Oscar's Embassy to the Shah of Persia. In the same year he visited Khurasan and Turkestan and reached Kashgar in 1891. He is best known through his ravels in Tibet, which placed him in the first rank of modern Asiatic explorers. Between 1893 and 1897 he travelled across the Asiatic continent from Orenburg by the Ural over the Pamirs and the plateau of Tibet to Peking. During two other expeditions, (1899–1902, 1906–8) he made valuable additions to the scientific knowledge of these tracts and explored specially he sources of the Sutlej and the Brahmaputra. In 1902 he became a Swedish noble, and in 1909 the Indian Government nvested him with the K.C.I.E. During the War he made requent visits to the Turkish front and in 1923 he travelled round he world, through the United States, Mongolia and Russia.

Sven Hedin's writings include: *Journey through Persia and Mesopotamia and the Caucassus* (1887); *Journey through Khorasan and Turkestan* (1892–3); *Through Asia* (1898); *Central Asia and Tibet* 1903); *Adventures in Tibet* (1904); *Scientific Results of a Journey in Central Asia 1899–1902*, 8 vol. (1904–7); *Transhimalaya*, 3 vol. 1909–12); *Overland to India*, 2 vol. (1910); *Bagdad, Babylon, Nineveh* (1917); *To Jerusalem* (1917); *Southern Tibet*, 12 vol. 1917–22); *Eine Routenaufnahme durch Ostpersien*, 2 vol. (1918–24); *My Life as an Explorer* (1926).

HEDJAZ: *see* HEJAZ.

HEIDENSTAM, VERNER VON (1859–   ), Swedish writer, was born July 6 1859 in Olshammar. He lived for several years in the south of Europe, Egypt and the East. On his return home, he began his literary career with a collection of poems entitled *Vallfart och Vandringsaar* (Pilgrimage and Years of Wandering) (1888) based on oriental life, and which formed a protest against the naturalism then prevalent in Swedish literature. This led to the great literary renaissance of 1890 in Sweden. In 1889 he published *Endymion*, an oriental story, and in 1892 his great work, *Alienus*, a fanciful romance concerning a pilgrimage in search of beauty through various ages and countries. His other collection of *Poems* (1895) indicates the author's transition to national ideas. This national tendency attained its zenith in his great prose work, *Karolinerna* (The Carlists), translated into English in 1902, a collection of stories about the time of King Charles XII. Then followed *Den Hellige Birgittas Pilegrimsfaerd* (St. Bridget's Pilgrimage) in 1901, besides descriptions of Sweden in ancient times and in the Middle Ages in *Folkungaträdet*, 2 vol. (1905, 1920), and *Svenskarna og deres høvdinger* (Swedes and Their Chieftains), 2 vol. (1908, 1909). In 1915 Heidenstam published *Nya Dikter* (The New Poet), and in 1916 was awarded the Nobel Prize for literature. See F. Böök, *Sveriges moderna litteratur*, 2nd ed. (1921).

HEIJERMANS, HERMAN (1864–1924), Dutch writer (*see* 13.212). His later plays include *Schakels* (1904); *Allerzeilen* (1906); *De Groote Vlucht* (1908); *Ahasuerus* (1912) and *Eva Bonheur* (1919). He lived for a few years in Berlin, but returned to Holland in 1912 in order to manage a society of players, and devoted himself to that work. He died in 1924.

HEJAZ (*see* 13.217).—Under the Ottoman régime the Hejaz, extending from Maʿan and ʿAqaba in the north to Hali Point on the Red Sea coast in the south, formed a *Vilayat* with a *wali* resident at Mecca, controlling a garrison of about 7,000 troops. In 1904 Turkish control of the northern part of the Hejaz was strengthened by the completion of the Hejaz Railway down to Medina. In 1908 Husain ibn ʿAli was appointed to be Amir of Mecca, and soon set himself to thwart the Turkish Govt., particularly in the matter of the extension of the railway to the city of Mecca.

The War Period.—The proclamation of a *Jihad* by the Turks at the outset of the World War made Arabia a source of potential danger to the Allied cause. Effective control of the Hejaz would have enabled the Turks and their Allies to threaten the sea route to the East, and Great Britain sought to counter this danger by entering into negotiations with Sharif Husain. The latter, inspired by great personal ambition, was ripe for rebellion against the Turks, and, after a lengthy correspondence on the subject of the terms on which he should espouse the Allied cause, raised the standard of revolt on June 5 1916. Mecca and Jidda (the latter after bombardment by British ships) were soon wrested from the Turks, and Taif surrendered to the Sharifian forces in September.

The Sharifian armies were unable to make any impression on the strong Turkish defences at Medina, but at this time Col. T. E. Lawrence appeared upon the scene, and in concert with Husain's third son, Amir Faisal, organised a brilliant guerilla campaign against the Hejaz Railway and the Turkish positions further north. The ports of Yenbo', Wejh and ʿAqaba (1917) fell in rapid succession, and with the subsequent capture of Maʿan and Shaubak, the Hejaz reached the northern frontier which it kept till July 1925. Medina, successfully defended by Fakhri Pasha till the end of the War, only surrendered on the receipt of explicit orders from Constantinople in Jan. 1919. The Amir Faisal represented Husain, who had assumed the title of king in 1916, at the Peace Conference of 1919 at Paris, and the Hejaz was admitted as an original member of the League of Nations, but King Husain eventually refused to ratify the Peace Treaties. In March 1919 King Husain's relations with Ibn Saʿud became strained owing to a dispute over the oasis of Khurma, and in May his forces advanced to occupy the place. They were routed by the Wahhabis at Turaba, and later (1922) Khaibar and Taima were in turn occupied by Ibn Saʿud.

Meanwhile, in the summer of 1921, Lawrence visited Jidda on behalf of the British Govt. to negotiate a treaty with King Husain, but negotiations broke down owing to the latter's inability to accept the *de facto* position in Palestine. Negotiations were subsequently kept alive by Dr. Naji al Asil, Hashimite representative in London, but were finally abandoned on the outbreak of war between Nejd and Hejaz in Sept. 1924.

Post-War Events.—The Sharifian administration, mild enough during the War, became more and more autocratic and even tyrannical with the passage of time. King Husain alienated the sympathies of his own people, and went out of his way to court the enmity of his neighbours. By the terms of the Peace Treaties he undertook to maintain the annual pilgrimage under satisfactory conditions for all Moslems, but this part of his administration left much to be desired. There was much corruption in all government departments. Education was wholly neglected. Even the army was not maintained on an efficient basis. An Air Force was inaugurated in 1921, but was allowed to disintegrate owing to the King's parsimony—it was revived in the autumn of 1924 by his successor and reorganised in 1925. An effective scheme of wireless communication, with eight or nine well-equipped stations, was perhaps the brightest feature of King Husain's administration. The nucleus of a transport fleet (four ships) was also formed by him, and proved invaluable during the war with Nejd. A local coinage and stamp issue emanated from Mecca during these years, and a semi-official newspaper (*Al Qibla*) was started by the King for propaganda purposes.

Meanwhile the storm was approaching. King Husain refused until too late to send a representative to the Conference convened at Kuwait by the British Government. In Jan. 1924 he arrived in Transjordania on a visit to his son, ʿAbdullah, and, while there, he assumed the vacant title of *Khalifa* on the deposition of the Turkish Sultan-Khalifa by the Kemalist Govt. of Angora. He then hastened back to Mecca to issue invitations to the Moslem world to recognise his new status, but his overtures met with little success, and the Wahhabi Sultan realised that his ambitious enemy must be crushed at once.

Husain Abdicates.—In Sept. 1924 Ibn Saʿud launched his armies on the Hejaz. Taif fell without a show of resistance. Consternation reigned at Mecca, and King Husain, under pressure from the notables of Jidda, abdicated on Oct. 5 in favour of his eldest son, ʿAli, who was acclaimed as "King of the Hejaz only." King ʿAli evacuated Mecca and hastily recruited an army from Palestine, Syria and Transjordan to defend Jidda. Tahsin Pasha al Faqir, the commander of the so-called "Victory" division, organised a strong defensive position of trenches and barbed-wire entanglements in a semi-circle round the town. Ibn Saʿud himself arrived at Mecca in Dec. and the attack on Jidda began on Jan. 4 1925. The Wahhabis occupied the few villages outside the entrenched position, but had not succeeded in reducing the town at the end of June when the siege was temporarily raised to enable them to perform the pilgrimage. Meanwhile Ibn Saʿud, having occupied the ports of Qunfida and Lith south of Jidda and that of Rabigh north of it, extended his operations further north. Medina and its seaport Yenbo' were invested, while Umlaj, north of the latter, was occupied. On Dec. 5 Medina surrendered and Wejh followed suit. King ʿAli realised that his situation was hopeless and abdicated on Dec. 19. Jidda then surrendered simultaneously with Yenbo', and Ibn Saʿud was master of all Hejaz, of which he was formally proclaimed King at Mecca on Jan. 8 1926. For bibliography *see* Arabia. (H. St. J. B. P.)

HELFFERICH, KARL (1872–1924), German financier and politician, was born in Neustadt-on-the-Havel July 22 1872. In 1901 he became a professor of political science in Berlin, and in 1906 went to Constantinople as manager of the Anatolian Railway. He returned to Berlin in 1908 to take up the chairmanship of the Deutsche Bank. In 1913 he was the chief German delegate at the Paris conference for the settlement of Balkan financial affairs. In 1915 Helfferich was appointed Secretary of State for the Imperial Treasury, where he followed the principle of defraying the cost of the War by borrowing rather than by fresh taxation, relying on a final German victory. In June 191 he left the Treasury for the Home Office. In June 1918 he wa appointed to succeed Count Mirbach, who had been assassinated, as Germany's representative in Moscow. He was, however unable to occupy this post, and returned to Berlin to conduct th economic and industrial demobilisation of Germany after th Armistice. He was fatally injured in a railway accident nea Bellinzona April 23 1924.

HELICOPTER: *see* AIRSCREW.

HELIGOLAND BIGHT, BATTLE OF THE.—This naval actio was fought in the Bight on Aug. 28 1914 between British an German naval forces. According to the original British pla three submarines were to lie off Heligoland to attack Germa cruisers, while three others were to be posted to the west t entice their destroyers out. The Harwich flotillas were then t come in from the north and, sweeping on a nine miles front t the westward, were to cut off any light craft patrolling to th west of Heligoland. Adml. Jellicoe proposed to reinforce th flotilla with Vice-Adml. Beatty's battle cruisers and the 1st Light Cruiser Squadron. This proposal was only approved o Aug. 26 and, as there was no time to send the operation order north, Beatty left Scapa with only a general idea of the pla and no details of the intended movements of the submarines The forces from Harwich had already sailed and did not know that Beatty was on his way to reinforce them.

British Forces.—On Aug. 27 the British forces were all on their way to the Bight, organised as follows:—

TABLE I.

Sweeping Force (Commodore Reginald Tyrwhitt): "Arethusa," 2 6-in., 6 4-in., 28·5 knots; "Fearless," 10 4-in., 26 knots. Thir Flotilla, 1st, 2nd, 3rd and 4th Divs., 16 destroyers; First Flotilla, 1st, 2nd, 3rd and 5th Divs., 15 destroyers. Total: 2 light cruisers, 31 destroyers.

Submarine Force (Commodore Roger Keyes): "Lurcher," "Firedrake," E4, E5, E9 (off Heligoland); E6, E7, E8 (west of Heligoland).

Battle Cruiser Force (Vice-Adml. Sir David Beatty): 1st Battl Cruiser Sqn., "Lion," "Queen Mary," "Princess Royal," a 8 13·5-inch.

Light Cruiser Squadron (Commodore W. E. Goodenough) "Southampton," "Falmouth," both 8 6-in.; "Birmingham," "Nottingham," "Lowestoft," 9 6-in.; "Liverpool," 2 6-in., 1 4-inch.

Cruiser Force K (Rear-Adml. Sir A. G. Moore): "Invincible," "New Zealand," with four destroyers.

Cruiser Force C (Rear-Adml. A. Christian): "Euryalus," "Bacchante," "Cressy," "Hogue," "Aboukir," all 2 9·2-in., 12 6-in. "Amethyst," 12 4-in.

Total Forces: 5 battle cruisers, 9 light cruisers, 5 armoured cruisers, 37 destroyers, 6 submarines.

It was light at 4 A.M. Goodenough with the 1st Light Cruiser Squadron had met Tyrwhitt at 3:45 A.M. and was at first mistake for an enemy, but the cruisers were recognised in time. By A.M. the sun had risen, and the forces were in position some 6 m. northwest of Heligoland. It was a fine morning with a smooth sea and a gentle breeze blowing from the northwest. Beatty' battle cruisers were some 30 m. to the westward and all wa ready. The flotillas started off to the southeast at 20 knots, th "Arethusa" and 3rd Flotilla ahead, with the "Fearless" an 1st Flotilla 2 m. astern. The 1st Light Cruiser Squadron followe 8 m. behind. From a point 12 m. west of Heligoland, which h should reach at 8 A.M., Tyrwhitt intended to turn west and sweep anything in the Bight into his net. The Germans knew nothing of the impending attack. Posted round Heligoland i a semi-circle they had two lines of patrols, an outer line of nin destroyers 25 m. from the island and an inner line of older vessels (3rd Minesweeping Div.) 13 m. from it. These were supported by a flotilla at Heligoland, three cruisers on outpost duty, and a battleship in the Jade.

German Forces.—The German disposition in detail was a follows:—

TABLE II.

Outpost Forces: Outposts, Outer line, 9 destroyers; Inner line, 11 torpedo boats.

In Support of Outposts: 11 destroyers, 5th Flotilla (Heligoland). Light cruisers, "Stettin" (10 4·1-in.), "Hela," 4 4·1-in. (off

Heligoland), "Frauenlob," 10 4·1-in. (off Jade). Battleship, "Heligoland," 12 12-in. (in Jade).

In Wilhelmshaven Roads, Wilhelmshaven and off the Ems: Light cruisers, "Ariadne," "Kolberg," "Cöln" (Rear Adml. Maas, First Leader of Flotillas), "Strassburg," "Stralsund," "Rostock," "Mainz" (off the Ems). Battle cruisers, 1st Scouting Group, "Seydlitz," "Moltke," "Von der Tann," "Blucher." Battleships: 1st and 3rd Sqdns. (7 dreadnoughts).

Total Forces: 8 battleships, 4 battle cruisers, 10 light cruisers, 20 destroyers, 11 torpedo boats, 8 submarines.

The movements of the heavy German ships were governed ntirely by the time of low water on the outer Jade bar. This was at 9:33 A.M. and meant that between 7 A.M. and noon no German battleship nor battle cruiser could put to sea.

THE EARLY OPERATIONS

The activities of this eventful day started at 4:45 A.M. when the British submarine E7 fired a torpedo at the detroyer G194 patrolling some 25 m. northwest of Heligoland, nd Rear-Adml. Maas, the German flotilla admiral, at 6:45 A.M. ent out the 5th Flotilla from Heligoland to hunt the submarine. The sea was smooth, the sky overcast and weather dull. At 7:53 A.M. the "Arethusa" struck the outer patrol line and sent G194 flying towards Heligoland with the "Laurel" and her division in hot pursuit. They drew away to the east and at 7:26 A.M. Tyrwhitt turned to the southeast to support them. A few minutes later they sighted the German 5th Flotilla coming up, and sent it also flying back.

The report from G194 reached the German flagship about 7:30 A.M., and on it becoming clear that a considerable force of British destroyers had penetrated into the Bight, the light cruisers were ordered to proceed. The "Stettin" was already on her way at 7:58 A.M., though she had not raised a full head of steam. By this time the German 5th Flotilla was calling oudly for cruiser support. The alarm had gone at Heligoland, and by 7:50 A.M. the whole fortress was standing to its guns. The visibility was then about 16,000 yd., and German destroyers came into view driving pell-mell towards the island. The British were overhauling them. One of the destroyers had been hit in the stokehold at 7:50 A.M. and her position was becoming critical, when at 7:58 A.M. the "Stettin," coming round the north of Heligoland, appeared on the scene and opened fire on the "Laurel's" division at 9,300 yards. A 8:05 A.M. the "Fearless" sighted her and opened fire; the "Stettin" retired behind Heligoland to get up steam for full speed, while the "Fearless," receiving a signal at 8:12 A.M. to alter course to west-quarter-south, turned accordingly to begin the sweep.

This brief respite had enabled the German 5th Flotilla to get clear and they came streaming in towards Heligoland. The inner patrol line was under a heavy fire from the "Arethusa," and the torpedo boats D8 and T33 suffered severely, but at 8:08 A.M. the "Frauenlob" arrived on the scene from the south and engaged the "Arethusa" on a southwest course. A sharp action ensued at 6,500 to 4,000 yards. Only the forecastle gun of the "Arethusa" remained in action, and eight men were killed. The "Frauenlob" received some 10 hits and had nine killed and 28 wounded. At 8:25 A.M. the "Arethusa" turned to west-quarter-south and the "Frauenlob" turning south broke off the action.

The Second Phase (see fig. 1).—By 8:30 A.M. this phase of the operation was over and both flotillas were proceeding to the west with the "Fearless" some 6 m. north of the "Arethusa." Goodenough's light cruisers had also turned west at 8:30 A.M. and were some 12 m. to the westward. Beatty was moving to and fro with his battle cruisers about 45 m. to the northwest. The attack had not developed according to plan, for the German patrols had broken back and reached home with one exception. This was V187, the flotilla leader's boat, which the "Fearless" sighted to the westward at 8:15 A.M., and which was sunk after a hot chase by the "Goshawk," "Phoenix" and "Ferret" at 9:10 A.M. The destroyers had lowered boats to rescue the survivors, but the "Stettin," which had now got steam up, reappeared on the scene and drove them off. Five boats in the scurry had to be left behind, but E4 (Lt.-Comm. E. W. Leir), emerging suddenly, rescued the "Defender's" men, took an officer and two of V187's crew "as a sample," then disappeared as suddenly and silently as she came. By 8:55 A.M. the "Fearless" had rejoined the "Arethusa" and the flotillas were now from 12 to 15 m. west of Heligoland steering west-quarter-south.

Commodore Keyes, in the "Lurcher," not knowing Goodenough's cruisers were on the scene, had mistaken them for the enemy and asked for help, but recognised them at 10 A.M., and as the "Southampton" had already attempted to ram E6, Goodenough decided to withdraw to the west and leave the field clear for the submarines. Tyrwhitt had turned boldly back to help Keyes at 9:45 A.M. The "Arethusa" stopped for repairs at 10:17; her engines were disabled and she was only able to go 10 knots. A lull of half an hour ensued. By this time the Germans were beginning to appreciate the situation. At 8:20 A.M. the commander-in-chief, Adml. von Ingenohl, had taken over the command from Hipper, the admiral of scouting forces, and had ordered the battle cruisers to raise steam and to proceed as soon as there was water on the bar. The German light cruisers, eager to attack, were pushing out as soon as they could raise steam. They now began to appear on the scene.

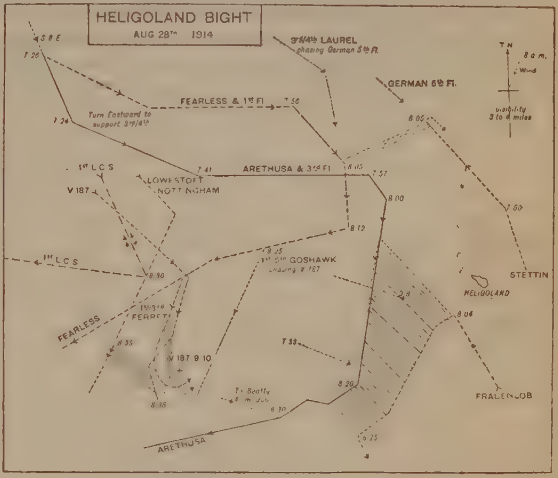

FIG. 1.—Flotillas at 8:30 A.M.

The "Arethusa" had got under way again at 10:40 A.M. and was making slowly to the west when at 10:46 A.M. the "Strassburg," which was trying to get in touch with the "Stettin," appeared in the southeast, coming up on a north-north-west course. She opened fire at about 8,400 yd., crossed the "Arethusa's" stern, turned and disappeared to the north in the mist. The "Cöln" had come up behind her at 11:5 A.M., but after exchanging a few salvos she too passed on. At 11:16 A.M. the "Strassburg" reappeared to the north and steering a parallel course to the west opened a heavy fire at 8,650 yards. The 1st and 2nd Divs. of the 3rd Flotilla went off to the northwest and, joined by the 1st Div. of the 1st Flotilla, attacked her at 11:35 A.M. Two torpedoes ran past her and she disappeared in the mist. The destroyers rejoined the "Arethusa" and continued their course to the westward.

When the "Cöln" appeared Tyrwhitt had signalled for support, and when the "Strassburg" came in sight the second time, Capt. Blunt of the "Fearless," foreseeing the concentration which the German light cruisers were striving to achieve in the mist, sent an urgent signal to Beatty for assistance. Beatty had been waiting and watching round a position in 54° 28′ N., 6° 20′ East. The situation was obscure, but between 11 and 11:30 A.M. it was clear that Tyrwhitt was engaging a cruiser some 30 m. to the eastward, and at 11:20 A.M. Goodenough was ordered to support him. Then came Capt. Blunt's signal from the "Fearless" couched in terms of urgency. Beatty did not know that the "Arethusa" could only go 10 knots, but he knew that the flotillas were only 26 m. from Heligoland, and that the German base at Emden lay close to their flank. He decided at once to take his whole force in the Bight. At 11:24 A.M. his battle cruisers had been formed in single line ahead, and working up to full speed he proceeded east-south-east to throw their tremendous weight into the issue of the day.

The Main Action

The " Mainz " had left the Ems shortly after 7 A.M. and was making at full speed to the east to cut off the British destroyers and to join the " Strassburg " and the " Stettin." At 11:30 A.M. she was sighted almost right ahead by the 2nd, 3rd and 5th Divs. of the British 1st Flotilla as they came west with the " Fearless " and " Arethusa " some miles behind. The " Mainz" turned to the north and opening a heavy fire chased the destroyers to the north for 20 minutes. But at 11:50 A.M. the situation suddenly changed. Out of the mist to the north-northwest there appeared four light cruisers coming down at high speed. They were Goodenough's cruisers. For an anxious minute the destroyers were uncertain whether they were friend or foe, then they recognised them and turned eagerly to join them. The " Mainz " recognised them too and fled to the southward at 25 knots. The range was over 7,000 yd.; she received two hits and drew away in the mist, sending at noon a signal—the last she sent—that she was being chased by a battle cruiser. It was received at 12:05 P.M. and the " Moltke " and " Von der Tann " were ordered to proceed, screened by the German 8th Flotilla. In the river it was clear, and no one had informed the German command of the mist prevailing in the Bight. The " Mainz," running to the southeast had hardly drawn away from the light cruisers when at 12:08 P.M. she sighted the " Fearless " and the 3rd Flotilla coming west. She swung round to south as the 1st and 2nd Divs. of the British 3rd Flotilla turned to north and the 4th Div. to south to engage her.

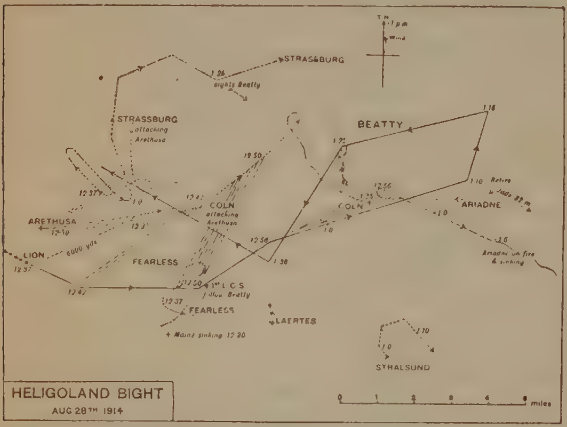

FIG. 2.—Beatty Enters the Fight.

Sinking of the " Mainz."—In the action that ensued the " Mainz's " rudder was damaged and her port engine brought to a stop. She then concentrated her fire on the 4th Div. at about 5,000 yards. The " Laurel " was hit by the first salvo; the fourth blew up a number of lyddite shells, and with her captain severely wounded and her after funnel blown away, she crawled away hidden in her own smoke and steam. The " Liberty " had her mast shot away and her captain killed. The " Laertes " was hit four times by a single salvo at 4,000 yd., and stopped dead. But the " Mainz " had been hit at 12:15 P.M. on the port side amidships by a torpedo fired by one of the destroyers, and Goodenough's cruisers which were now closing, opened a deadly fire which reduced her quickly to a wreck. At 12:25 P.M. they ceased fire; the " Lurcher " coming alongside saved her crew and at 1:08 P.M. she settled by the bows and sank.

British Battle Cruisers in Action.—The situation was still far from clear; the flotillas were scattered; the " Strassburg " and " Cöln " had appeared to the northeast and opened a heavy fire. Then suddenly out of the mist there emerged Beatty's fou great battle cruisers steaming at high speed. They swept pas the sinking " Mainz " and on to the northeast with Goodenoug and his light cruisers following in their wake. The Germa cruisers fled, but it was too late. At 12:37 P.M. the " Lion ' sighted the " Cöln " on the port bow and opened fire at 3,80 yd.; the " Cöln " ran desperately to the northeast, but a heav shell disabled her engines. Then she gained a brief respite, fo the " Ariadne " was sighted by the " Lion " trying to cross he bows on a southeast course. Fire was opened on her. She wa hit by the first two salvos and disappeared in the mist to th southeast, on fire and sinking.

Beatty now decided to withdraw, and at 1:10 P.M. made th signal to retire. The " Lion " came gradually round to a westerly course and at 1:25 P.M. sighted the " Cöln " again, steerin slowly to the southeast. Her admiral had fallen; her captai was seriously wounded. The " Lion " sent a 13·5-in. shell int her; she listed to port and sank with flag flying at 1:35 P.M. B this time both the " Stettin " and " Strassburg " had sighted and reported the British battle cruisers, and at 1:50 P.M. th German light cruisers were ordered to fall back on the " Moltke ' and " Von der Tann." It was not, however, till 2 P.M. that th battle cruisers passed the bar of the Outer Jade. The Germa battleships were then raising steam, and the battle cruisers wer ordered (2:41 P.M.) not to advance against the British, but t wait for the " Seydlitz " 25 m. west of Heligoland.

By 3:50 P.M. the three German battle cruisers had reache that position, and there they were joined by the " Strassburg," " Kolberg " and " Stralsund." They made a short sally, bu there were no signs of any British ships, and they turned bac before reaching the spot where the " Cöln " had sunk. For th British it remained only to get home. At 4:30 P.M. Rear-Adml. Campbell's cruisers met the destroyers and the " Laurel " wa taken in tow by " Amethyst." The " Arethusa " struggled o at six knots till 7 P.M., then signalled for assistance, and at 9:30 P.M. was taken in tow by the " Hogue " and returned safely.

Results of the Battle.—Mist, uncertainty and the speed of th German light cruisers had hampered the British submarines. The German submarines had all been held back off Heligolan and by the time they were finally dispatched to attack th British battle cruisers, the latter were out of reach. The engagement was a severe blow to the German fleet. They los three light cruisers and one destroyer, and their casualties wer 63 officers and 649 men killed, 20 officers and 361 men wounded, nine officers and 140 men prisoners; a total of 1,242 against th British 35 killed and some 40 wounded.

The engagement had important ulterior consequences. Whe Beatty swooped down on the Bight, he drove a great wedg into German naval policy, for the loss of the cruisers confirme the Kaiser in his determination to restrict the German fleet t a strictly defensive policy. For the British Navy and Natio the victory came at an opportune time. The irresistible advanc of the German Army had filled many with something like dismay. The news of a naval victory at the very gates of the enem lightened the gloom, and gave the nation faith in the navy' ability to face its gigantic task.

BIBLIOGRAPHY.—J. S. Corbett, *History of the Great War: Naval Operations* (1920); E. Mantey, *Der Krieg zur See,* (A. C. D.)

HELIOTHERAPY (*see* PUBLIC HEALTH; THERAPEUTICS).— Heliotherapy, or treatment by sunlight, has been intermittentl practised since the dawn of history, but its scientific exploitatio dates from the time of Finsen, who especially developed light treatment by the employment of artificial sources of light, notably the carbon arc. It owes much to the work of Bernhard an Rollier, who commenced treatment with natural sunlight earl in the present century. The latter especially, by the brillianc of his results and his enthusiastic advocacy, has done much to popularise its use, especially in nonpulmonary tuberculosis.

Its employment on an extensive scale in Great Britain was initiated with the establishment of the Treloar Cripples' Hospital at Alton. It was employed to some extent with gratifying results on septic wounds contracted during the War, but interest s been especially aroused since that period, the abnormally e summer of 1921 and the institution of Daylight Saving ling general notice to the importance and significance of sun-ht in our lives both in health and disease. Further researches numerous investigators have done much to demonstrate the nner in which sunlight is of therapeutic value.

Essential Conditions.—The most obvious benefits are noted by nical observation on patients suitably exposed to solar rays. rtain essentials are necessary to demonstrate these beneficial sults. The patient exposed to the sunlight should first be climatised; he must never be too hot or too cold; in brilliant nshine his head should be protected, and if there is much glare s eyes should be shielded by dark goggles. Exposure should gradual: first the feet are sunned for short periods daily, the gth of exposure and the area exposed being increased slowly, that at the end of a fortnight exposure of the whole body may generally tolerated with safety. Periods of exposure are adually lengthened, until eventually the patients are often le to tolerate and benefit by exposure of the nude skin for from ree to four hours daily.

There are great variations in the optimum exposure of dif-rent individuals. Generally speaking, brunettes tolerate ex-osure better than blondes; individuals who freckle but whose ins do not brown must be exposed with great caution, while binos can barely tolerate exposure at all. On the normal skin erythema develops within six hours of exposure; care should taken not to exceed this erythema, and blistering is to be oided. Gradually the skin becomes bronzed, and as this onzing or pigmentation deepens so may exposure be pro-nged, the pigment protecting the patient from the harmful fects of the actinic rays.

Insolation necessarily involves exposure of the body to the ld air, and the latter has been shown to increase the meta-lic activity of the subject treated. The rays of greatest thera-eutic value are the ultra-violet or actinic rays, the light waves shortest wave-length in the solar spectrum. These are most tense at the seaside or on the mountains. Excess of heat rays to be avoided, and insolation for its therapeutic value is thus tter carried out in temperate than in tropic regions. Properly med exposure on the individual responding to treatment is sociated with a tonic and exhilarating effect; exposure unduly rolonged results in fatigue and exhaustion, and is to be avoided.

Effects of Insolation.—While properly applied insolation ex-cises a tonic effect on the body, it has been demonstrated that is equally stimulating to the mind. The exposed subject is otably more cheerful and exhilarated, and evidence has been lduced to show that mental responses are brisker and mental tivities more pronounced. On the body the effect of insolation ay be described as local or direct and remote or indirect. ight exercises a beneficial effect on superficial lesions by reason f the direct bactericidal action of the actinic rays, assisted by he favourable inflammatory response which carefully timed xposure elicits.

The remote beneficial effects are more marked but less easy to xplain. Eidenow has shown that the haemobactericidal power often raised after an erythema dose. This enhanced power of he blood to destroy pathogenic organisms is obtainable equally hen a portion or the whole of the skin is exposed, and, if in-reased haemobactericidal power is alone sought, fractional xposures of different portions of the skin at consecutive sessions the method of treatment of choice. Sonne has demonstrated hat the visible rays of the solar spectrum have considerable enetrative power, pass through the skin, and are absorbed in the ubjacent blood, their physical being transformed into thermal nergy. He has suggested that this local heating effect is of value n destroying deleterious circulating toxins. Investigations have hown that the calcium, phosphorus and iron content of the blood nay be raised by insolation.

Sunlight treatment has its greatest therapeutic value in in-reasing and maintaining bodily tone and energy, in the treatment of the various manifestations of surgical tuberculosis, in he treatment of rickets and the relief of nervous asthma. It is of proved value in certain affections of the skin, notably psoriasis. It is of great assistance in a variety of conditions, accelerating and consolidating the cure, particularly in convalescence from debilitating diseases such as infectious fevers. Its stimulating effect is seen in increasing fecundity and in the treatment of certain defects of the endocrine glands. The range of its usefulness is being rapidly extended, in the main, as an aid to cure rather than as a specific treatment. See A. Rollier and others, *Heliotherapy* (1923). (H. J. G.)

HELIUM (*see* 13.233).—Helium, next to hydrogen, is the lightest of all the chemical elements. Except at exceedingly low temperatures, it exists only in the gaseous form.

Sources of Helium.—Investigations carried out since 1895 have shown that helium is widely diffused throughout the earth. It can be obtained from many types of rocks, minerals and earths, and it is present in varying amounts in probably all natural gases and spring waters. It is present, too, in the atmosphere of the earth to the extent of about one part in 185,000 by volume. Evidence that helium is universally distributed is afforded by the fact that many of the white stars exhibit its absorption spectrum, while certain other stars and nebulae show the bright line spectrum of the gas. Helium has also been found in a meteorite that reached the earth at Augusta Co., Va., United States of America.

Helium from Rocks and Minerals.—In the case of most of the rocks and minerals that contain helium in appreciable amounts the gas is present as a result of the radioactive disintegration of the uranium or of the thorium present in them. Of all the minerals examined, thorianite, which consists chiefly of thorium oxide, is probably the richest in helium. It has been found to contain 9·5 cu. cm. of helium per gramme.

Monazite, a phosphate of thorium and other rare earths, contains on the average about 1 cu. cm. per gramme. Cleveite, samarskite and fergusonite contain a little more than monazite. Helium is found in minute quantities in practically all the common minerals of the earth, and its origin in them has been traced to radioactive matter that is universally distributed in minute amounts in the material constituents of the earth's crust. In two cases helium has been found in minerals in the absence of appreciable amounts of uranium and thorium compounds, namely in beryl and in sylvine (potassium chloride). It is interesting to note, however, in this connection that potassium and rubidium in their elemental state as well as in the form of chemical compounds have been shown to be radioactive at least to the extent of emitting beta rays. In extracting helium from the mineral thorianite, which is imported from Ceylon usually for the manufacture of thoria, the method generally followed is that given by Lord Rayleigh. The mineral dissolves readily in strong nitric acid, and the helium contained is then liberated. The gas contains a certain amount of hydrogen and of oxides of carbon, also traces of nitrogen. To get rid of carbon some oxygen is added to the helium and the mixture is exploded with an electric spark.

All the remaining impurities, including the excess of oxygen, can then be taken out of the gas by Sir James Dewar's ingenious method of absorption with charcoal cooled in liquid air. Helium is but slightly absorbed by the cold charcoal, and consequently can be pumped off from the vessel containing the charcoal in a state of the highest purity. If liquid air is not available helium can be purified by the methods employed for argon, the various impurities present being removed by one or other of the agents —calcium carbide or metallic calcium, copper oxide, caustic potash and phosphorus pentoxide. If thorianite is not available, monazite, which is more abundant, may be utilised. In 1895 Lockyer showed that the helium contained in minerals could be extracted from them by heat; J. A. Gray (*Proc. Roy. Soc.*, 82A, p. 301, 1909) confirmed this discovery at a later date, and showed that helium could also be extracted by simply grinding the minerals into a fine state of division.

Helium from the Atmosphere.—Helium may be extracted from the atmosphere by passing ordinary air through tubes cooled with liquid hydrogen. At the temperature of liquid hydrogen all elements in the air become solidified excepting helium, and the latter, after passing through the tubes, can be collected in a highly purified state. In the process of the liquefaction of air, or in that of extracting nitrogen or oxygen from the air by liquefaction and rectification in large industrial plants, it has been found feasible to include in the machines used for the purpose devices that allow the helium and the neon of the air to be separated out, these two gases being the only constituents of the atmosphere that remain in the gaseous form when air is liquefied. As charcoal cooled with liquid air has more condensing power for neon than for helium, it is generally used to separate out the helium from a mixture of these two gases. Final purification, however, is best effected by the use of liquid hydrogen.

Helium from Mineral Springs and Natural Gases.—Helium is found in the gases evolved from many thermal water springs. Moureu and Lepape, who made an exhaustive determination of the helium content of the gases evolved from mineral springs in France, found that many of them contained a considerable proportion of helium. At one spring in Maizières it amounted to 5·92%, and at two others in Santenay (Côte d'Or) helium contents of 8·4% and 9·76% by volume were found. In the hot springs of Bath, England, the helium amounts to about one-thousandth part of the gas evolved. Traces of helium have been found in the gases of the thermal springs in Iceland, and also in many of the natural gases of the other countries in Europe. The quantities involved in the latter, however, are extremely small and the occurrences unimportant. Lord Rayleigh has suggested that the helium found in hot springs may be derived from the disintegration of common rocks at great depths.

By far the best practical sources of helium are the natural gases of America. In Canada, while natural gases are found in all the provinces, they exist in commercial quantities only in the provinces of Alberta, Ontario and New Brunswick. The helium content of these gases has been determined on several occasions, and the latest results are those given by the Mines Branch of the Dept. of Mines of Canada. This report shows that while helium is found in all the Canadian gases it has not been found to be present in any of them to a greater extent than 1%. A conservative estimate of the amount of helium recoverable from the natural gases of Canada would be 5,000,000 cu. ft. per annum.

In the United States of America the main helium resources occur in the Texas, Mid-continent and Appalachian natural gas-fields, where the supplies of helium-bearing gas are widely distributed, and where in some localities they are of great magnitude. The helium content of the gases from a majority of the wells is not greater than 0·6%, but in Kansas a number of wells exist that give a supply of natural gas containing from 1·5% to 1·84% of helium. It is estimated that it would be possible to extract nearly 50,000,000 cu. ft. of helium yearly from the natural gases of the United States.

Properties of Helium.—Helium is less soluble in water than any other gas, and recent determinations by Antropoff give the following values for its solubility: 0° C. ·00967, 10° C. ·00991, 20° C. ·00996, 30° C. ·01007, 40° C. ·01029, 50° C. ·0108. Quartz glass at a red heat is freely permeable to helium. The effect is even perceptible at a temperature as low as 180° Centigrade. At 500° C. quartz glass has been shown by Williams and Ferguson to be 22 times as permeable to helium as to hydrogen (*Jour. of Am. Chem. Soc.*, Oct. 1922). This property has been put forward as the basis of a practical method of separating helium from other gases. M. Travers has suggested, also, that it may explain the liberation of helium from minerals by heat, the gas being enabled to permeate the siliceous materials in which it is enclosed. Thorianite, however, contains no silica, and until it is shown that metallic oxides are permeable to the gas this explanation can scarcely be accepted as valid. With rubbered balloon fabrics the permeability to helium has been found to be less than to hydrogen, the ratio of helium to hydrogen permeability being about 0·7. With skin-lined fabrics the ratio of helium to hydrogen permeability has been found to be about unity. The temperature coefficient of increase of pressure at constant volume is perfectly normal for helium, and has a value of 0·0036614 (Fourth Int. Cong. on Refrigeration, June 1924). The thermal conductivity at 0° C. is given by Schwarze as 0·0003386, and the viscosity as determined by Schultze at 15° C. is 1·086 compared with that air as unity. This determination has been confirmed by Rankin

The velocity of sound in helium at 0° C. is 971 metres per se and the ratio of the specific heats, C_p/C_v, has the value 1·6 at 180° C. and 1·659 at 18° C., which indicates the monatom character of the gas. At 18° C. the specific heat at constant pre sure, C_p, is 1·251, and the atomic heat consequently 5·004. T refractive index of helium at normal pressure and temperatu for the wave-length 5890Å is 1·000035. Helium has two res nance potentials, 19·77 volts and 20·5 volts, and its ionisati potential is 24·5 volts. The minimum sparking potential f helium is 261 volts. Gaseous helium at normal pressure ar temperature has for its dielectric constant 1·000074. Helium a gas is diamagnetic, and according to Hector (*Phys. Rev.*, Oc 1924, p. 148) it has a volume magnetic susceptibility of $-0{\cdot}78$ 10^{10} at 20° C. and 760 mm. pressure.

Helium Atoms and Nuclei.—The atomic weight of helium 4, and its density is 1·995. Since the gas is monatomic its atom and molecular weights are the same. Of all the rare gases heliu alone has no isotopes (*q.v.*). The square root G of the mean squa molecular velocity of the atoms of gaseous helium at 0° C. $13{\cdot}11\times10^{4}$ cm. sec^{-1} and the mean free path at normal pressu and temperature is $28{\cdot}5\times10^{-6}$ centimetre. The molecular dian eter as deduced from the viscosity of the gas is $2{\cdot}18\times10^{-8}$ centi metre. Like the atoms of other elements, those of helium have nuclear structure, the positive electric charge on the heliu nuclei being 2ϵ where ϵ is the elemental charge of electricity. Th two electrons that neutralise the nuclear charge are supposed t describe about the nucleus two nearly circular orbits with plan that are inclined to each other at an angle of 120°. The radiu of these orbits is approximately $1{\cdot}25\times10^{-9}$ centimetre. Spec troscopic evidence goes to show that while helium in its norma state exists in the form of atoms with crossed electronic orbits can also, under electric excitation, be transformed into a meta stable state designated as orthohelium. With atoms in the latte state the electronic orbits are supposed to be in the same plan with one orbit circular and the other elliptical, the major axis o the elliptical orbit being approximately four times as great as th diameter of the circular one.

For spectroscopic purposes helium, with its atoms in th normal state, is sometimes given the designation parhelium The alpha rays expelled by radioactive substances have bee shown to be helium nuclei. The initial velocities with which they are expelled from such substances vary from $2{\cdot}22\times10^{9}$ cm. sec^{-1} to $1{\cdot}45\times10^{9}$ cm. sec^{-1} according to the radioactive substance that gives rise to them. The corresponding kinetic energies are $1{\cdot}53\times10^{-5}$ and $0{\cdot}645\times10^{-5}$ ergs. It was by observations on the scattering of alpha rays of very high speeds through large angles by thin sheets of matter that Rutherford in 1911 established the view that atoms generally possess a nuclear structure.

Through phenomena associated with this scattering of alpha rays by matter it has been shown that the nucleus of a helium atom possesses very great stability. Helium nuclei themselves are supposed to be complex in their structure and to consist of four hydrogen nuclei and two electrons. Numerous experiments lead one to take the view that a helium nucleus or alpha particle behaves in impacts with nuclei of other atoms as if it were a perfectly elastic body, spheroidal in shape, with its minor axis 4×10^{-13} cm. in the direction of motion and its major axis $8\times$ 10^{-13} centimetre. The mass of a helium atom is slightly less than the combined masses of the hydrogen nuclei and electrons of which it is constituted, and this indicates that a large amount of energy must be liberated during its formation in the form of radiation of wave-length approximately $1{\cdot}75\times10^{-11}$ centimetre. A view held by astrophysicists generally is that the exceedingly high temperature of certain stars that exhibit a helium hydrogen spectrum can be accounted for by assuming them to be the seat of the formation of helium out of hydrogen. By bombarding the nuclei of the atoms of various elements with alpha rays, Rutherford has proved that atomic nuclei generally have a complex structure with hydrogen nuclei and electrons as primary constituents, and in some cases with helium nuclei as secondary ones.

Liquid Helium.—The liquefaction of helium was achieved H. Kammerlingh Onnes at Leyden in 1908. In Jan. 1922 a rogenic laboratory was instituted in the University of Toronto d helium was liquefied in Jan. 1923. Finally, in the summer 1925 helium was liquefied in small quantities in the Reichs- stalt, Charlottenburg, Germany. Liquid helium is a colour- s, very mobile liquid with a low surface tension. According Onnes and Boks (*Leyden, Comm.*, No. 170) the density of uid helium has a maximum value of 0·1462 at 2°·39 K with a lue 0·1404 at 3°·19 K. and one of 0·1456 at 1°·49 K. assuming e absolute zero to be −273°·09 Centigrade.

The saturation vapour pressure (p. in mm.) of liquid helium is 15 at 1°·475 K., 359·5 at 3°·516 K., 757·5 at 4°·205 K., 1329 4°·9 K. and 1668 at 5°·16 Kelvin. The heat of vapourisa- n at 4°·25 K. has been estimated to be 19·38 gr. calories. e critical temperature of helium is 5°·19 K., the critical pres- re (p. in Int. Atm.) 2·26, and the critical density 0·066. The slope diameter" is −0·0033 and the boiling point at atmos- eric pressure is 4°·21 Kelvin. The triple point temperature d pressure (p. in Int. Atm.) are respectively less than 0°·89 K. d 0·002 (see *Report* of Fourth Int. Cong. on Refrigeration, ne 1924). According to Kammerlingh Onnes the Boyle point s close to 20° K. and the "inversion temperature" to 40° elvin.

From certain considerations brought forward by Perry (*Jour. Phys. Chem.*, vol. 28, No. 10, Oct. 1924) it can be shown that e optimum working pressure to use when liquefying helium, ter cooling it with liquid hydrogen, is between 15 and 20 atmos- eres. The lowest temperature attained by H. Kammerlingh nnes with liquid helium boiling under low pressure was a few ndredths of a degree below 0°·9 kalium. The vapour pressure rresponding to this temperature was estimated to be 0·013 illimetres of mercury.

Liquid helium has been extensively used as a refrigerating gent by H. Kammerlingh Onnes and his collaborators and by hers when investigating the physical and chemical properties various substances at the lowest attainable temperature. hough the great majority of the investigations carried out have en connected with the thermal properties of substances, others aling with the phenomena of phosphorescence and fluorescence, agnetism and magneto-optics, crystal structure, radioactivity d electrical conductivity have led to results of great scientific lue. Probably the most interesting phenomenon discovered d investigated by H. Kammerlingh Onnes through the use of uid helium is that of electrical super-conductivity in metals. this field of investigation Onnes has shown that at tempera- res attainable only with liquid helium the metals mercury, ad, tin, indium and thallium offer no resistance to the passage electric currents through them and become perfect electrical nductors. It may be added that up to 1926 helium, alone of the elements, had not been solidified.

Chemical Activity of Helium.—Although helium is chemically ert under ordinary conditions, evidence obtained in recent ears suggests the possibility of its exhibiting chemical activity nder certain very special conditions. Particularly under the fluence of the electrical discharge, helium atoms may be united ith other helium atoms in the same state or with atoms of other ements, to form compounds either of a fugitive or a permanent haracter. The fact that helium under certain conditions can be ade to emit a band spectrum in addition to its line spectrum notes the possibility of the gas existing in the molecular form.

Experiments made by E. H. Boomer (*Proc. Roy. Soc.*, vol. 09, No. A 749, p. 198) with an intense electric discharge from incandescent tungsten filament in helium at low pressures ow that a distinct and stable compound can be formed out of ngsten and helium with the formula $W He_2$. Boomer has also tained evidence of chemical combination of helium with the apours of mercury, iodine, phosphorus and sulphur. These mpounds are fugitive in character and appear to be stable only very low temperatures.

Industrial Uses.—In 1914 Sir Richard Threlfall put forward suggestion to the Board of Inventions of the British Admiralty, that if helium were available in large amounts it might be used to replace hydrogen as a filling for airships. The fact that helium is non-inflammable and non-explosive and possesses 92% of the lifting power of hydrogen makes it a most suitable material for giving buoyancy to airships. Following up the suggestion, Prof. McLennan and his associate, Mr. John Patterson initiated experiments for the British Admiralty on a semi-commercial scale on the natural gases of Canada. A machine was designed, constructed and successfully operated, with results that showed it was quite feasible to extract helium economically from natural gases when helium was present in them to the extent of only 0·33%. At the same time vastly greater experiments were initiated and carried through independently by the military and naval authorities of the United States, in co-operation with the Bureau of Mines of that country. Enormous quantities of helium were extracted from the natural gases of Texas, and the possibility of separating out the helium from the natural gases at a low cost was fully demonstrated.

In the electrical industry helium may be used for the construction of thermionic amplifying valves of the ionisation type and of gas arc lamps. In spectroscopy, especially for investigations in the ultra-violet region, helium is of use and possesses an advantage over most other gases in that it is transparent to light of extremely short wave-lengths. Owing to its high dielectric properties and its high heat conductivity it has been proposed to use helium in place of oil as a filling for transformers and for surrounding the switches and circuit-breakers of high tension electric transmission lines. Tests have been made by the General Electric Co. of the United States on the use of hydrogen as a cooling medium for large electric generators. These machines were operated in an atmosphere of hydrogen, with the result that owing to the lightness of hydrogen the windage loss was reduced, and owing to its high heat conductivity compared with air, the generators were made to give a 30% greater output with the same temperature rise. Since helium is also a light gas with a thermal conductivity slightly greater than that of hydrogen and can be used without the danger of explosions occurring, it would appear that it may be used for the same purpose if obtainable in large quantities at a low cost.

In 1917 considering the hygiene of labor, it was suggested by Elihu Thomson and others that if divers and workers in tunnelling operations carried on under high atmospheric pressures were supplied with a mixture of oxygen and helium in place of air the liability to caisson disease might be minimised or perhaps eliminated. Preliminary tests made in this direction by R. R. Sayers, W. P. Yant and J. H. Hildebrand for the United States Bureau of Mines (*Reports of Investigations*, Serial No. 2,670) have shown that through the use of helium and oxygen mixtures as a substitute for air in diving work the time of decompression can be materially reduced. This results from the fact that helium diffuses more readily out of the blood and body tissues than nitrogen. As the depths at which divers can operate depend largely on the duration of the period of decompression these experiments open up the possibility for extending somewhat the safety depth limit for diving operations.

Spectra Modified by Action of Helium.—A number of investigators, including Merton, Barrett, Johnson, Cameron and others, have shown that profound modifications may be observed in the spectrum of an element when it is present in small quantities in a discharge tube containing helium at a comparatively high pressure. As an example, the "comet-tail" spectrum discovered by Fowler is greatly enhanced by high-pressure helium. Merton and Pilley, too, were able with the addition of helium not only to bring out the hitherto practically unknown arc spectrum of atomic nitrogen, but also to isolate it completely from the spark spectrum of this element. McLennan and Shrum recently made some observations on the spectrum of small quantities of air in a large admixture of helium, and analysis of the spectrum obtained by them with these mixtures showed the presence of a line at $\lambda = 5577\cdot35$ Ångström units. When mixtures of oxygen and helium were used and an uncondensed discharge passed through, the line $\lambda = 5577\cdot35$ Å. was enhanced.

The line was obtained with the strongest intensity when the partial pressure of the oxygen in the mixture was about $\frac{1}{25}$ that of helium, the partial pressure of the latter being about three centimetres. The line was also obtained with pure oxygen, which shows that it belongs to the spectrum of this element. As the intensity of the line when obtained with pure oxygen is low, it would appear that the function of the helium is to maintain the oxygen atoms in a state that permits them to radiate the light $\lambda=5577{\cdot}35$ when once they are brought into that state by electrical stimulation. These results have a bearing on problems connected with the identification of the lines in the auroral spectrum, and McLennan and Shrum's experiments are of interest in that the wave-length $\lambda=5577{\cdot}35$ Å. which they obtained with oxygen is identical with that of the green line in the spectra of auroras that has long defied identification. The result is also interesting in that it may be taken as evidence of the existence of helium containing a small amount of oxygen in the upper atmosphere, for it is known that auroral displays originate at atmospheric heights of about 100 kilometres.

The Spectrum of Helium.—Both theory and experiment indicate that in the ultra-violet spectral region the radiation emissible by helium does not include any wave-length shorter than $\lambda=228$ Ångström units. The line spectrum of helium as observed ordinarily in vacuum tubes consists of a system of singlet series and a system of doublets. The doublets are very close and are somewhat unusual in that in the sharp diffuse series the more intense component is on the more refrangible side, while the first principal line has its stronger component on the side of the greater wave-length. It is generally accepted by spectroscopists that the singlet series of wave-lengths in the spectrum of helium originate in parhelium, and that the doublet series have their origin in atoms in the metastable or orthohelium state. Besides the line spectrum there is, as previously stated, an interesting band spectrum of helium which is well developed under appropriate conditions. Fowler has shown that the heads of some of the stronger bands, in contrast with all other known band spectra, are arranged in accordance with the laws of line series. There is, however, no apparent relation between the band and the line series, except that the main series of bands runs nearly parallel with the principal series of helium doublets.

All lines in the helium spectrum that have been investigated are resolvable by magnetic fields into normal Zeeman triplets. Recently Curtis and Jevons (*Nature*, Nov. 21 1925) showed that a Zeeman effect can be obtained with certain lines in the band spectrum of helium. The wave-lengths of a number of lines in the spectrum of helium were accurately measured by Merrill at the Bureau of Standards, Washington (*Astrophys. Jour.*, 46, p. 357, 1917) and are now accepted as secondary standards for the purpose of spectrum analysis. They are as follows:—

(I.A.)	(I.A.)	(I.A.)
2945·104	4026·189	4921·929
3187·743	4120·812	5015·675
3613·641	4143·759	5047·736
3705·003	4387·928	5875·618
3819·606	4437·549	6678·149
3888·646	4471·477	7065·188
3964·727	4713·143	7281·349

BIBLIOGRAPHY.—An extensive bibliography of the work on helium is given in *Circular* of the Bureau of Standards, Washington, No. 81 (1919).

For the results of low-temperature investigations the *Communications* from the Physical Laboratory of the University of Leyden should be consulted. (J. C. McL.)

HELSINGFORS or HELSINKI (*see* 13.252), the capital, chief seaport and only large town of the republic of Finland, had a population in 1922 of 201,435. The chief buildings are largely classical in style, but a number of modern ones showing the national spirit by using local materials and peasant decorative motives, have been erected, in particular a church overlooking the town, the cyclopean parliament buildings on the heights of Brunnparken, a new railway station and a fine memorial to those who fell in the Finnish fight for freedom. The town is an industrial centre, and the harbour accommodates the largest
vessels, but it is usually closed by ice from Jan. to the end
April, except for a channel kept open by an ice-breaker. T
harbour has been much improved in recent years, and had ov
7,000 yd. of quays in 1924; in 1925 a coal wharf was in ere
tion, and a goods station was to be built alongside the harbou
In 1918 civil war, promoted by Bolshevist intrigues, broke o
in Finland, and Helsingfors was occupied by Red Guar
Later they were defeated by Finnish nationalists under Germ
leadership.

HEMY, CHARLES NAPIER (1841–1917), British painter (
13.265), died at Falmouth Sept. 30 1917.

HENDERSON, ARTHUR (1863–), British politician, w
born in Glasgow of working class parents Sept. 15 1863; but h
work and interests subsequently lay at Newcastle (where
served an apprenticeship as moulder at Robert Stephenson
Co.'s works), and in the county of Durham. He became pron
nent in the trade union movement, and after a while took
leading part in local affairs, being for some years a member
the Newcastle city council and the Darlington borough counc
He was mayor in 1903; and was made a magistrate for the coun
of Durham. He entered Parliament for Barnard Castle, as
Labour member, at a by-election in 1903, and soon made h
mark. In 1908 he was elected chairman of the party, a po
which he held for two years and to which he was re-elected aft
the outbreak of war in 1914, when the then chairman, M
Ramsay MacDonald, had to resign owing to his pacifist view
As chairman, at the opening of the new session in that autum
Mr. Henderson promised the full support of organised Labo
in maintaining the "splendid unity" of the nation.

When the first Coalition Ministry was formed by Mr. Asqui
in 1915, Mr. Henderson was included in the Cabinet mainly
adviser of the Government on labour questions arising out
the World War, with the office, first of President of the Board
Education, and afterwards of Paymaster General. He show
himself resolved on a strenuous prosecution of the War, strong
advocating both the Munitions Bill and the Registration Bi
and having no hesitation in taking the further step of comp
sory service. He followed up this action by urging the Labo
party to rally in Dec. 1916 to Mr. Lloyd George, and by accep
ing himself the position of an original member of the War Ca
net of four without portfolio. In the spring of 1917 he visit
Russia, just after the Revolution, on behalf of the British Gov
and found the then provisional Govt. at St. Petersburg (Len
grad) strongly in favour of an international Labour and Social
conference, which was to meet at Stockholm under the auspi
of the International Socialist Bureau. He came to the conclus
that, provided the Conference were merely consultative,
would be better that British representatives should go, rath
than permit Russian representatives to meet German represen
atives there alone; and accordingly, on his return to Englan
being still secretary of the Labour party as well as a member
the War Cabinet, he promoted the participation of Briti
Labour therein. But public opinion in general was strong
against any conference with Germans in the midst of war; t
Sailors and Firemen's Union refused to carry the delegate
French, Belgian, Italian and American Labour declined to ha
anything to do with the conference; and all his Labour colleagu
in the Government opposed his views. On Mr. Lloyd Geor
expressing the surprise of the rest of the War Cabinet at h
action, and their dissent from his policy, he resigned.

Mr. Henderson warmly espoused the Labour decision of t
latter part of 1918 to take the Labour men out of the governme
and to appeal for support on a purely Labour platform in co
junction with the pacifist wing of the party. This cost him h
seat in Parliament at the general election of Dec. 1918, when n
pacifist Labour candidates were successful. Indeed, ill-luc
pursued him also at the next two general elections, in 1922 an
1923; but in all three cases he returned to the House of Commo
a few months later at a by-election. In the Parliament of 1923-
he had the satisfaction of having two sons as fellow member
though they were both defeated in the autumn of 1924. I
MacDonald's Ministry he was secretary of state for home affairs

he was not conspicuous either in administration or in debate.
actively endorsed the policy of his party in 1925–6 in severing
mselves definitely from the Communists who advocated
ned revolution; and he protested strongly, in March 1926,
inst the suggestion made by the Independent Labour party
the formation of a comprehensive international society which
uld include the Communists. (G. E. B.)

IENRI, ROBERT (1865–), American painter, was born
Cincinnati, O., in 1865. In 1886 he entered the Pennsylvania
idemy of the Fine Arts, Philadelphia, Pennsylvania. Pro-
ding to Paris in 1888 he studied at Julien's and the École
Beaux Arts and visited Spain and Italy. Returning to the
ited States he became in 1891 an instructor at the Women's
iool of Design, Philadelphia. In 1896–1900 he was again in
is and exhibited at the Salon. During an extremely active
as a painter, he found time to teach, many of his pupils
aining marked distinction. During the period 1915–23 he
ght at the Art Students' League, New York City, and also
velled extensively. His portraits are distinguished for their
our and vivacity. Of his works, "La Neige" was purchased
899 for the Luxembourg in Paris, and "Girl in White Waist"
er destroyed by fire) was purchased by the Carnegie Insti-
e, Pittsburgh, in 1904. His other works include "Young
man in Black," in the Art Institute, Chicago; "The Spanish
psy," in the Metropolitan Museum, New York City; and
ndian Girl in White Ceremonial Blanket," in the Corcoran
llery, Washington, D.C. He wrote *The Art Spirit* (1923).

IENRY, EDWARD LAMSON (1841–1919), American painter
13.299), died at Ellenville, N.Y., May 9 1919.

IENRY, O. (1862–1910), American short story writer, was
n in Greensboro, N.C., Sept. 11 1862. His real name was
lliam Sydney Porter. Until the age of 15 he attended school,
n for five years served as clerk in his uncle's drug store. The
oor employment threatened his health, and in 1882 he went
a friend's ranch in La Salle co., Texas. Here he spent two
rs, absorbing the colour and robust life of the southwest.
1884 he moved to Austin, Texas, worked as bookkeeper and
n spent four years in the General Land Office.

n 1887 he was married, and about this time he began to send
agraphs and humorous sketches to newspapers. During
1 he was teller in the First National Bank of Austin. In
4 he bought Brann's *Iconoclast*, a satiric weekly, and trans-
med it into an extraordinarily humorous farrago of skit and
lesque, illustrated by himself; the venture was not a success
l in 1895 he joined the staff of the Houston *Post*, writing a
ly column. In 1896 he was indicted on a charge of having
bezzled funds (amounting to about $1,150) from the bank in
stin. The details of this affair have never been cleared up;
re seems no doubt that he was innocent; the bank's affairs
re very slipshod; he may have been shielding some friend; in
case, in a moment of insane impulse he fled from trial and
nt to Honduras. The fatal illness of his wife brought him
k in 1897. While waiting for trial he had the first news of
eptance of some of his stories by important magazines. In
8 he was sentenced to five years in the Ohio Penitentiary.
term was reduced to three years and three months for good
aviour. In prison he seriously settled down to story-writing,
l probably took his famous pseudonym from the name of a
nch pharmacist mentioned in a dictionary of drugs. He left
son in 1901 and went to New York in 1902. In 1903 he con-
cted to do a short-story a week for the New York *World*, at
o each. His first book, *Cabbages and Kings*, was published
904. In 1907 he was married to Miss Sarah Coleman, a boy-
d friend. He died in New York June 5 1910, and was buried
Asheville, North Carolina.

he varied phases of O. Henry's life are reflected in his stories.
e extraordinary productivity of his eight years in New York
ught him rapid fame, though he himself lived secluded and
wn to few. The sale of his books has been enormous and they
e been translated into many languages. For ingenuity of
and racy vividness of narration he has rarely if ever been
passed, but he has been sharply criticised for turning the short story into a "vaudeville stunt." But the genial magic of his fine imagination, antic humour and brilliant narrative skill triumph over the occasional journalism of his method. Subsequent tendencies in literary technique run in an altogether different current, yet O. Henry remains endlessly and enchantingly rereadable. His New York stories are the most famous, but it is probable that some of the southern and western tales, in which there is less strain for glittering effect, are of more lasting value. The tragedy of his own life taught him a chivalrous tenderness for the unlucky; some of the greatest native endowments a writer can have were undeniably his, but his reckless use of them often arouses the trained reader's amazement. Of him, as much as of any modern writer, it can be said that he had "no talent, only genius."

O. Henry's stories were collected in book form under the following titles: *Cabbages and Kings* (1904); *The Four Million* (1906); *The Trimmed Lamp* (1907); *Heart of the West* (1907); *The Gentle Grafter* (1908); *The Voice of the City* (1908); *Roads of Destiny* (1909); *Options* (1909); *Whirligigs* (1910); *Strictly Business* (1910); *Sixes and Sevens* (1911); *Rolling Stones* (1912); and *Waifs and Strays* (1917).

See C. Alphonso Smith, *O. Henry Biography* (1916) and also posthumous collections of sketches and fragments, *e.g.*, *O. Henryana* (1920), *Letters to Lithopolis* (1922), *Postscripts* (1923). (C. My.)

HENRY, VICTOR (1850–1907), French philologist (*see* 13.301), died at Sceaux, near Paris, Feb. 8 1907.

HERBERT, VICTOR (1859–1924), American musical composer, was born in Dublin, Ireland, Feb. 1 1859. His musical education was received in Germany, where he studied under the leading masters. He became principal violoncello player in the Court Orchestra, Stuttgart, also appearing as a soloist on the concert platform in European musical centres. In 1886 he accepted a position as solo violoncellist in the Metropolitan Orchestra, New York City, being subsequently connected with other orchestras as soloist and conductor. In 1894 he was appointed bandmaster of the 22nd. Regt. (N.Y.) Band. In 1898 he became conductor of the Pittsburgh Orchestra. He composed the music for a number of light operas, of which his greatest successes were *Babes in Toyland* (1903), *Mlle. Modiste* (1905), and *The Red Mill* (1906). In 1904 he organised Victor Herbert's New York Orchestra. In 1911 he wrote a grand opera, *Natoma*. More successful, however, was the music which he composed for the photoplay, *The Birth of a Nation*. In his later years he composed much for musical revues. He died in New York City May 26 1924.

HERCEGOVINA: *see* BOSNIA-HERCEGOVINA.

HERCZEG, FERENCZ (1863–), Hungarian novelist and dramatist, was born at Versecz (Viršet) of a family of German extraction. He decided first to adopt a legal career, but soon turned to literature, and after the publication of his first novel his reputation and popularity steadily increased. He became honorary president of the Petöfi Society and a member of the Hungarian Academy. He was several times elected a deputy and through the medium of his review, *Magyar Figyelö*, showed himself to be a staunch supporter of Count Tisza. He was a master of the psychological novel, excelling in the analysis of the feminine mind and in depicting the life of the nobility and of the well-to-do *bourgeois* class. Among the most notable of his historical novels are *Pogányok* (The Pagans) (1902) and *A hét sváb* (The Seven Swabians), while his tragedy *Byzance* (1912) is considered a masterpiece. His novels and plays have been translated into nearly every European language.

HEREDITY (*see* 13.350 and BIOLOGY; CYTOLOGY; EMBRYOLOGY; EVOLUTION; MENDELISM; SEX).—Heredity is the relation of organic continuity between successive generations. It is a genetic or flesh-and-blood relation, effected by the germ-cells which are liberated from parents and develop into offspring. Heredity secures the continuance of a specific organisation; it implies some measure of racial entailment or organic inertia; and yet it does not preclude variability, that is to say the occurrence of marked differences between offspring and their parents.

Even if there had been no evolution there would still be heredity; it would be the genetic relation between successive generations of unprogressive Protists. But there could be no evolution without heredity, for heredity implies the possibility that new departures can be entailed from generation to generation. It is possible that in early times and among simple types there was greater variability than is common nowadays and among more advanced types, and that the evolution of the hereditary relation, *e.g.*, in the advance from asexual to sexual reproduction, put a useful check on the occurrence of variations. But it does not conduce to clearness to say that variation is older than heredity, or to make any antithesis between the two sets of facts. There is a contrast between complete hereditary resemblance in successive generations, which might be compared to inertia in the physical domain, and marked variation, which might be compared to kinetic divergence; but the hereditary relation is such, especially in sexual multiplication, that it allows of novelties or new departures. In short, heredity includes the possibility of variation.

Vehicle of the Inheritance

By inheritance is meant all that the organism is or has to start with in virtue of its hereditary relation to its parents and ancestors. Thus it does not include ante-natal infection, or any imprint impressed on the embryo before birth, or any result of being nurtured in the same environment as the parents. In asexual multiplication the vehicle of the inheritance is obviously the separated off-bud or portion, and it is of interest that a small fragment of a polyp or of a leaf may develop into a perfect organism, always provided that the initial amount be not too minute, that it contain a fair sample of the different kinds of cells in the body, and that it find the appropriate environment. Thus drops of minced sponge, forced through a sieve, may develop into typical forms.

In sexual reproduction the vehicle of the inheritance is obviously in the sex-cells or gametes, but the question arises whether the cytoplasm counts at all as a bearer of hereditary qualities, or whether these are restricted to the chromosomes. That the latter bear many of the hereditary characters is practically proved by Mendelian and micro-dissection experiment, and it is believed by many students that the characters or, more strictly, their initiatives, technically called "factors" or "genes," lie in linear order in each individual chromosome.

The Chromosome Theory.—Some of the arguments for this chromosome theory of inheritance may be briefly stated (*see* Mendelism). (1) There must be significance in the persistence of a particular number of chromosomes for each species, *e.g.*, two for the threadworm of the horse and 48 for man. (2) There is a parallelism in oögenesis and spermatogenesis such that the normal number of chromosomes is reduced to one half by a chance meiotic division, and this conforms to the facts of Mendelian inheritance. (3) In fertilisation there is a restoration of the normal number $(\frac{n}{2}+\frac{n}{2}=n)$, and homologous chromosomes from the two parents unite in couples. The two parents contribute in equal amounts the chromosomal warp and woof of the offspring web, as Van Beneden first showed in his famous paper of 1883. But the full force of this cannot be realised without linking the fertilisation to the antecedent maturation. As McClung puts it:—

> In preparation for the union of the sperm and ovum in fertilisation, by which the duplex chromosome series is established in a new individual, each of these germ-cells reduces its own duplex state to a simplex one by segregating its maternal and paternal members of each pair into different cells by chance distribution in relation to the others.

We may perhaps say that this shuffling of the hereditary cards is one of the opportunities for the origin of fresh permutations and combinations—new departures in short. But there is another suggestion of variability in the fact that in the pairing of chromosomes before maturation-division there is an intimate physical contact (synapsis) in virtue of which there may be interactions and resulting changes. This may be another fountain of variation. (4) In related species there is often a close resemblance in the shape and structure of the chromosomes, and several cases are known in which the numbers of the chromosomes in a gro of species form an arithmetical series, such as multiples of sev in roses. (5) In some cases there is strong evidence to warra associating a particular chromosome with a particular charac in the organism, notably McClung's correlation of the access chromosome with sex (*see* Sex).

An individual chromosome with a recognisable peculiarity shape has sometimes been traced from generation to generati and there is no getting past the large fact that the chromoson are the only individualised elements that perpetuate themsel with precision from generation to generation. (6) In some ca the unit characters or separably hereditary characters of organism form a number of linked groups of unequal numeri value, and with these there is sometimes correlated a similar nu ber of chromosomes, differing proportionally in size. (7) Here a may be noted the growing evidence that there is in the chror somes of the various individuals of a species a definite and c stant linear arrangement of factorial areas or chromomer. Plain then, there are many reasons for regarding the chromosomes the bearers of the hereditary factors.

The Cytoplasm in Inheritance.—On the other hand, the cell unity, and a physiological firm, so that the cytoplasm of ovum may be very important although it is not the bearer of hereditary factors. The experiments of Wilson, Conklin a others show that an egg-cell may contain definitely locali materials that are made use of in the development of partic structures in the embryo. These, therefore, must be compone contributing to the resultant, yet it has to be kept in view th the organisation of the materials in the egg is effected under control of the nucleus and its chromosomes.

Since modern studies of genetics have had very largely to with the newer and more external specific characters, it see premature to shut out the possibility that the vehicle of the ol and fundamental hereditary characters may be in part at le carried by the cytoplasm of the egg-cell, which would not nec sarily mean that they were outside nuclear influence. L maintained that racial characters were cytoplasmic and speci characters chromosomal. Yet, since the quantity of cytopla in the spermatozoön as compared with the ovum is very min on Loeb's view the female parent should count more pred inantly than it does. The question should not be foreclosed.

Fundamental Facts of Heredity

The largest fact is that all kinds of inborn characters, nor or abnormal, "bodily" or "mental," important or trivial, str tural or functional, except complete sterility, may be contin on in the next generation. Even subtle characters, such longevity and fecundity, may form part of the hereditary org isation which is continued on in the lineage of germ-cells. T term "transmitted" should be given up, since it suggests t erroneous idea that the parent makes and endows the germ-c that become the offspring. The parent is more like a trustee.

Continuity of the Germ-Plasm.—The large fact of the p sistence of a general resemblance from generation to generati depends on the continuity of the germ-plasm. What Weism and Galton suggested has been confirmed in detail, that t germ-cells from which offspring develop are continuous alo an unspecialised cell lineage with the fertilised ovum that ga rise to the parent. In many cases the future germ-cells are seg gated at an early stage in development (even at the first clea in Ascaris), but whether they are set apart very early or not, t germ-cells are those cells which have remained unspecialised, approximately the whole inheritance intact, not having sha in body-making and the differentiations therein involved. S saving clauses must be added:—(*a*) for plants where the disti tion between germ-plasm and somatoplasm is only incipient piece of leaf readily developing into a whole plant, flower a all); (*b*) for animals in which the reproductive organs are late being recognisable, *e.g.*, when there is a prolonged asexual la period as in Echinoderms and many of the higher insects; a (*c*) for a few more difficult cases, known experimentally in a higher animals, such as the frog, where body-cells are said to to form germ-cells. But on the whole, the fact of the conity of the germ-plasm is a firm foundation-stone.

erminal Origin of Variations.—It follows theoretically from continuity of the germ-plasm that any novel peculiarity in germ-cells, still more in the fertilised egg-cell, may be coned in the germ-cell lineage of the offspring and thus reappear he next generation, and so on. But what is possible on ral grounds must be proved for particular cases; and it is wn of many new departures of germinal origin that they come ay. The variants breed true. This leaps to the eye when the lty is pathological, but it holds even more true of the normal. olds (*a*) for what may be called "recombination-characters," re the novelty is interpretable as a reshuffling of ancestral ors, yielding, as it were, a new pattern; and (*b*) for mutations h are more distinctively novel—brusque emergences of some ure which was not distinctly represented in the ancestry. s new combinations and mutations agree in being in many s very heritable, whereas it is uncertain that this can ever be of exogenous "modifications," which do not emerge from in but are imprinted from without.

n his prolonged studies of garden snapdragons, Prof. Erwin r finds that there is an abundant occurrence of small mutas (of unexplained germinal origin) which are hereditarily ened and summed up into stable varieties. For this organism ems that the minute mutations count for more than striking e mutations in the establishment of stable cultivated races; it is interesting to note that they correspond closely to the ll variations that Darwin started with as his main form of utionary raw material. In other organisms, however, new binations may count for most, and in others large mutations; indispensable quality is that the germinal new departures are that they can be hereditarily continued.

isappearance of a Germinal Variation.—The non-continuance variation of germinal origin may come about in different s. Its chromosomal representative (a "factor" or "gene") be lost in a maturation-division, *e.g.*, in the formation of the polar body which is given off from the ripening egg-cell and r comes to anything, though it carries off one member of of the chromosome-pairs. Or it is possible that when two ologous chromosomes are coupled in intimate synapsis, an ence passing from one to the other may change the nature factor. When they eventually separate they may have lost ained by "crossing-over" (*see* MENDELISM). Or it may be a factor or gene changes in character just as a microbe somes does, perhaps in response to a subtle environmental ulus.

nother possibility is that the new departure may be fatal or al, or that it may result in a sterile organism. What often pens is that a variation seen in the first filial generation does reappear in the next owing to the absence of some environtal or nurtural influence necessary for its developmental ression. But what is common to all theories of evolution is the hable postulate of *the heritability of variations*. What disuishes the Lamarckian school is the inclusion of somatic odifications" as part of the evolutionary raw material.

nit Characters.—Another foundation stone laid by experital work is the concept of unit characters, features that are tinued on, intact, from generation to generation, without ding or fractioning, either present fully or absent altogether. ther words, unit characters illustrate Mendelian inheritance, the analysis of the organism into a bundle of unit characters for its corollary the germinal representation of these unit racters by a set of factors or genes in the chromosomes of the n-cells. What a "gene" is, we do not know; perhaps a p of molecules in some particular collocation. They are n compared to ferments. The progress of investigation has cated that genes are not immutable, that they may influence another and be influenced by their cellular environment, that may be distributed in linked groups, that several different es may be concerned in the development of one character, that gene may influence several different characters. Finally, the ression that the genes find in development may be dependent on the presence of the appropriate liberating stimulus in the environment.

What has been actually proved is that the organism includes a congeries of unit characters which are hereditarily continued as units, somewhat like the radicals in chemical reactions. It is possible, however, that part of the inheritance consists of a consolidated bloc of fundamental racial characters, which undergo little if any change in the course of generations. It is possible, for instance, that the characters constituting a rabbit a rodent are not hereditarily continued in the same way as the unit characters that constitute the rabbit an Angora.

Galton's Two Laws.—Also important as averaging statistical conclusions are Galton's laws of inheritance. According to the law of ancestral inheritance an inheritance is not merely dual, it is multiple; and the average contributions made by grandparents, great-grandparents and so on, are definite and diminish in a precise ratio according to the remoteness of the ancestor. The two parents between them contribute, on the average, one-half of each inherited faculty, each of them contributing one-quarter of it. The four grandparents contribute between them one-quarter, or each of them one-sixteenth; and so on backwards. This will not apply to cases which illustrate clear-cut Mendelian inheritance; but when characters blend, or have so many factorial units involved that they seem to blend, there may be value in Galton's conclusion that on the average the inheritance of an individual is a mosaic of ancestral contributions. The second law is that of filial regression, or what might be called the tendency to approximate either upwards or downwards to the mean or average of the stock. As Galton said:—

> The more bountifully a parent is gifted by nature, the more rare will be his good fortune if he begets a son who is as richly endowed as himself, and still more so if he has a son who is endowed yet more largely. But the law is even-handed; it levies an equal succession-tax on the transmission of badness as of goodness.

The value of a fine parentage is obvious, but "the ablest of the children of a few gifted pairs is not likely to be as gifted as the ablest of all the children of a great many mediocre pairs." On the other hand, two gifted members of a poor stock may be personally equivalent to two ordinary members of a good stock, but the children of the former will tend to regress; those of the latter will not. To take Prof. Karl Pearson's illustration, the mean height of the sons of, say, 1,000 six-ft. fathers will be 70·8 in.; the mean height of the sons of 1,000 66-in. fathers will be 68·3 in., again a regression toward the mean of the general population. "The father with a great excess of the character contributes sons with an excess, but a less excess of it; the father with a great defect of the character contributes sons with a defect, but less defect of it. The general result is a sensible stability of type and variation from generation to generation." Galton's laws are statistical, not physiological; they require correction in regard to characters which are subject to persistent keen selection, either natural, sexual or artificial; they will not apply to sharply defined "unit characters" which do not blend. The data which Galton utilised were chiefly the records of family faculties, as to stature, eye-colour, temper, artistic ability and so on, but they were to some extent supplemented by measurements in Galton's anthropometric laboratory, and by observations on plants and animals. The most reliable data were those relating to stature, and they are open to the criticism that they included indiscriminately what is due to somatic modification and what is due to germinal constitution. In the view of many biologists this greatly lessens the value of Galton's laws.

The Past in the Present.—Looked at broadly, the facts of heredity illustrate the way in which the past lives on in the organism, active and acting. The inheritance includes many items of different degrees of antiquity, some very ancient. These have for the most part useful inertia, but there is often a striking persistence of anachronisms, both of structure and function. There is a remarkable staying power in characters that illustrate Mendelian inheritance, whether for good or ill. There is an indubitable recapitulation of phylogeny in ontogeny, especially in organogenesis; and it is the continuity of the germ-plasm that makes all this possible. For the same reason, there is a conservation of advantageous tentatives in so far as these are the outcome of germinal variations. In short, heredity and development show us the organism as a historic being, and moreover as one that enregisters the ages that are past.

HEREDITY AND DEVELOPMENT

The most elusive of problems concerning heredity is the most familiar one: how does the hereditary material in the chromosomes and in the cytoplasm develop into the organism. There is a hereditary preformation of some sort in the chromosomes with their genes, and to this the cytoplasm—with so little in the way of organisation to start with—responds in a perfectly precise and controlled way; but physiological embryology, though rapidly progressive, is still a long way from an understanding of what occurs. As to the mind of Aristotle, so to the biologists of to-day, development remains a central secret (*see* EMBRYOLOGY).

Transmissibility of Somatic Modifications.—Some advance has been made in regard to the long-standing problem often designated "the inheritance of acquired characters." The history of the discussion shows that Weismann and Spencer, who took opposite sides, meant by "acquired characters" only one kind of thing—those somatic changes that are directly due to some peculiarity in use and disuse, nutrition, or environmental influence, and which persist in the individual, for some time at least, after the inducing conditions have ceased to operate. It is irrelevant and illegitimate to maintain that "acquired characters" should mean something else. As long as the Weismann-Spencer argument continues, it is necessary to keep to the original use of the terms. That there are corollaries must be allowed, such as (*a*) the transmissibility of the secondary effects of modifications, or (*b*) the possibility of a specific influence being impressed simultaneously on soma and on germ-cells. But the main question is a precise one: Can a modification, as defined, affect the germ-cells in such a specific or representative way that the offspring will, through its inheritance, exhibit, even in a slight degree, the modification which the parent or parents acquired? May there come about in the germ-cells a heritable registration of some specific modification imprinted on the parental body?

To get a clear issue, as regards the precise problem, there should be an avoidance of (*a*) data referring to Unicellulars, where there is only a beginning of the contrast between somatoplasm and germ-plasm; (*b*) data which involve the possibility that the germ-cells may be influenced along with the body by some penetrating toxin or hormone or radiation or the like, connected with the imprinting of the original modification and (*c*) data relating to viviparous organisms, *e.g.*, mammals and seed-bearing plants, where it may be that a modification of the parent, such as acquired immunity or acquired evergreenness, comes to be shared by the offspring because of the intimacy of the antenatal partnership. If this occurred it would have in the first generation the same practical result as if there had been a specific repercussion on the germ-cells, but it would not be a convincing case, unless it held good when the modification was exhibited by the male parent only. Both for placental mammals and for seed-bearing plants it is easy to conceive of specific metabolic products or metabolites passing from the mother to the offspring before separation occurs.

Need for Data from at Least Three Generations.—When organisms are transferred to novel surroundings or conditions of life, such as those of a colder climate, it often happens that an advantageous modification is induced, such as a longer coat of hair in a mammal; and it may be that this modification appears in increased expression in the next generation. But this would prove nothing more than modifiability, for the second generation was exposed for a longer time than the first to the modifying influence. But if the character in the third generation was larger in amount than in the second, an interesting fact would be established.

Changed Environment.—Yet the crucial cases must be those where the offspring of modified parents develop in an environment which does not include the modifying factor which effec the change in the parental soma. Thus in Prof. W. E. Ag model experiments, specimens of the entomostracan Simocep lus that were reared in water with certain nutritive peculiarit showed a distinctive reversal of their two shell-valves doubt due to the altered metabolism. They were reared to matur and then transferred to ordinary water where they libera their ova. These developed into individuals which showed modificational peculiarity that their parents had acquired.

Later on, however, when the parents again liberated ova, abnormal effect was seen only to a very slight degree, and i third brood (not generation) it had dwindled away. This v instructive case suggests that the abnormal nurture had result not in any disturbance of the inheritance, but in the formati of some peculiar non-living metabolite, which was included in cytoplasm of the egg, passed passively into the body which veloped from the egg, and there produced on the body of offspring the same effect as it originally produced on the bo of the parent which acquired the character in question. As supplies of the metabolite were exhausted, its influence dwind in the second brood, and disappeared in the third. This ill trated the importance of changing the environment in su experiments.

Alcoholised Animals.—Many experiments have been made the effect of alcohol (usually inhaled fumes) on animals, the results are not altogether in accordance. Thus while th may be no observable deterioration in the treated guinea-pi there is clear evidence of this in their untreated offspring. On other hand, Prof. Raymond Pearl found that after alcohol tre ment his fowls produced offspring which were superior in marked degree to those produced by non-treated controls. Pear interpretation of this is that the alcoholic treatment eliminat all the inferior germ-cells in the ovary of the fowls, leaving coast clear for the superior ones to produce the next generati Of the reality of this process of germinal selection there is so histological evidence.

In Dr. F. B. Hansom's experiments on white rats there was observable effect on to the end of the second generation. Th that were subjected to inhalations of alcohol were in no different from their relatives that breathed normally. Moreov the treated offspring of the treated parents were indistingui able from their first cousins, the untreated offspring of untreat parents. But in the third generation, a change occurred. At age of 20 days, before any individual treatment, the members the treated lineage showed themselves inferior in body weig body length and tail length, when compared with their count parts on the untreated lineage. When alcohol-inhalation beg the difference became more marked, as if the animals were sponding to the abnormal condition with a new susceptibility. reached a maximum of nearly 10 times the probable error.

Now the natural inference at this stage in the experim would have been that the influence of two previous generatio of alcoholic inhalation was beginning to make itself felt. And the effects were observable before individual treatment beg the inheritance of the generally deteriorative influence of alco might have been held as proved. But the remarkable fact that the fourth generation showed a marked improveme "The treated side of this generation for the first half of growth curve is back to the fold with the first two generatio Later there is some response to the treatment and a conseque dropping off in the curve." This remarkable result suggests th some process of germinal selection may have been at work. elimination of inferior germ-cells; but it also suggests caution.

Prof. Charles R. Stockard's experiments on alcoholis guinea-pigs, continued for 13 years, showed no deterioration the treated parents up to seven years, which is a great age these animals. But the deteriorative influence on the immedia offspring and on later descendants was shown in debility, sho life and arrested development. Yet there was no evidence of transmission of any particular character. The probability is th the alcohol, saturating through the body of the parent, poison the germ-cells and deteriorated the constitution of the offspri

general way. But here, again, there was the remarkable
omenon, that after three generations of treating, there was a
ed improvement. The members of the fourth filial genera-
of treated "pigs" were actually superior in vitality to the con-
. This may have been due to the elimination of the weak-
and defectives, perhaps also to a sifting out of germ-cells.
her Striking Experiments.—Dr. Bentley and Dr. Griffith
d that some of the progeny of rats rotated for a long time
round-about showed a high degree of disequilibration and
ioration, but it is possible, as Dr. Detlefsen has suggested,
some microbic infection (causing inflammation of the
ory labyrinth) may have complicated the issue.
inting towards a transmission of specific modifications are
ntricate experiments of Prof. M. F. Guyer and Dr. E. A.
h on the continuance of artificially induced eye-defects in
its. Very suggestive in the same direction are Dürken's
riments on the colour of the pupae of the common white
erfly, where there seemed to be a hereditary effect of artificial
ination. To many biologists it seems that there is unques-
ible validity in the numerous experiments of Kammerer
h point in several cases to the hereditary continuance of a
ntal modification. Thus when the young of the spotted
nander are kept on black backgrounds the black patches on
skin increase in size, while if they be kept on yellow back-
nds the yellow patches increase. This change towards
ter blackness or towards greater yellowness was found to
o a considerable extent heritable, for the offspring of the
ified parents showed a similar change in a marked degree.
ed they began in a colour phase nearly, though not quite, as
nced as that at which their parents left off.
ıus it would be possible to continue citing cases first on one
and then on the other, on both sides open to detailed crit-
. But the moral seems to be that this long-discussed ques-
cannot even now be regarded as closed. There must be a
nt accumulation of more data, more rigorously tested or
ied; and the question at issue is of such importance as to
d any hurry to a conclusion.

NATURE AND NURTURE

ider than the question of the transmissibility of somatic
ifications is that of the relation between hereditary nature
environing nurture. The difference between the two com-
entary factors is referred to in Prospero's description of Cal-
as "a devil, a born devil, on whose nature nurture will never
." It is evident, however, that the two factors should not
pposed as if they were antithetic, for while no amount of
ure will make a bad inheritance good, there can be no de-
pment at all without a minimum of nurture, and on the
rosity of the nurture the development of the heritable char-
r will in some measure depend.
t the beginning of the individual life the implicit organism
the inheritance are one and the same, but by subjecting germ-
and embryos of the same origin to different "nurture"
ctional, nutritional and environmental) it can be shown
there are different reactions according to the developmental
litions. The young proteus kept in darkness remains un-
ented, but its neighbour reared in a well-lighted laboratory
mes dark. A Chinese primrose (*Primula sinensis*) reared at
C. will have white flowers (var. *alba*), but its neighbour, or,
on, itself brought under the influence of higher temperature
C.), shade and moisture, will have red flowers (var. *rubra*).
rding to diet a tadpole may become large and poorly dif-
ntiated, or small and well-differentiated. There are scores
ch cases.
ggs, embryos, larvae and so on, of the same genetic origin,
develop very differently according to the conditions of life,
conversely, differently endowed young organisms may de-
p very differently though reared in nurtural conditions which
precisely the same, as we see when good seed and poor seed
sown in the same plot. Therefore, it is legitimate to dis-
uish the hereditary factor in development from the func-
l or the environmental factor. As we have said, an antithesis between hereditary "Nature" (Galton's "natural inheritance") and extrinsic "Nurture" (all manner of environs mental, nutritional and functional influences) is illegitimate, since both are necessary components of a resultant, as clay and heat to brick, or water and wind to wave; yet for the reasons given, it is permissible and useful to discriminate between the two aspects. It is sound biology to say of some particular peculiarity in an organism that it is due (*a*) to the loss of some item in the natural or germ-plasmic inheritance, or (*b*) to some nurtural defect which inhibited the developmental expression of items that were certainly present in the inheritance, as subsequent breeding shows. Similarly, on the positive side, it makes a difference if the development organism has received factors for a particular character from both parents; and it makes a difference if the nurture is unusually stimulating as regards the expression of a particular character.

ENVIRONMENT AND INHERITANCE

Some biologists are so sensitive to the abstractness of all the biological pigeon-holing, that they have seriously proposed to include the normal appropriate environment of the young organism as part of its "heredity," for, as they say, what does the inheritance amount to if the appropriate environment is wanting—a bundle of cheques but no bank. Perhaps, however, this is unnecessarily pedantic, after it has been agreed that these various "aspects" are devices for scientific analysis. Every living creature must have its surroundings; every embryo must have its nurture; function is only the unending sequence of actions and reactions between organism and the environment. All this may be granted, and yet it is useful and necessary to try to distinguish in development the respective influences of "nature" and "nurture"—including in the latter three sets of conditions: environmental, nutritional and functional.

Up to a certain point the fertilised ovum of a mammal may be induced to develop outside the mother, or an isolated neuron of a chick-embryo will grow in a droplet under the microscope, thus illustrating the hereditary inertia. Yet if the larval proteus be reared under red light in the laboratory, the minute primordium of the eye, which in the normal cave-environment remains arrested and buried, increases in size and in the differentiation of optic structures. It may actually grow to meet the skin and become a seeing eye, thus illustrating the potency of altered environment as a liberating stimulus. No doubt there are nurtural limits outside which normal development will not occur, but the majority of organisms in natural conditions find this minimum environment at least. This will be agreed to by all. What is more interesting is the question how far changes in the nurture, such as are of frequent occurrence in natural conditions, will serve as inhibitants and stimulants. The same kind of sponge may grow into a dwarf that lives in a hole excavated in an oyster-shell, or in conditions of greater freedom it may grow into a large vase. If a bonellia larva rests for a while on the proboscis of the adult and absorbs inhibitant nutritive material from the skin, it develops into a pygmy male; but if, after the free-swimming stage, it settles down in the mud, and not on a proboscis, it develops into a large and vigorous female.

Function and Heredity.—Along with the environmental and nutritional influences, those of active functioning must be included, though it is of course evident that the activity or inactivity, the restlessness or sluggishness of the developing organism is an expression of its particular inheritance. The free-swimming tunicate larva has in ordinary cases no alternative to becoming sedentary; the collapse is an expression of the inheritance. Yet in some cases the individuals of a family, clutch or litter, vary demonstrably in their heritable constitutional bias in the direction of greater or less activity—perhaps the commonest of all variations—and thus there arise differences in development which afford raw material for natural selection. Especially in relatively less stereotyped forms, *e.g.*, in fishes compared with mammals, the importance of active functioning in the course of development is momentous, for it is on the active functioning that the detailed expression of hereditary characters depends. A vicious circle must be avoided, but not so timorously that we thereby miss a great truth.

The degree of development, *i.e.*, the expression of hereditary characters, depends in part on surroundings and food, but it also depends on the activity of the young creature such as the fish-larva, and on the action of part on part. The degree of this activity depends largely on the inherited constitution (and partly on food and environment), therefore we are not suggesting that it is a separate entity or anything of that sort. We are only emphasising a commonplace that is often missed: The differentiation of characters in development depends in part on the functioning of the young organism, and changes in the intensity of the functioning will result in changes in the evocation of structure. The changes in intensity of functioning may be of the nature of germinal variations, or they may be reactions to environmental stimulus. If the environmental stimulus should become constant, a modificational specific character might arise.

It is possible that many constant characters of a species are really of the nature of constantly re-impressed modifications. As Dr. Harry M. Kyle puts it: "The constancy of a species depends upon the persistence of a normal environment." From this point of view we get a useful new light on heredity. To some extent, especially in the lower grades of life, the inherited material may be moulded this way or that way if the nurture is changeful, or it may find a deceptively stereotyped expression when the nurture is very constant from generation to generation. Between inheritance and environment comes the activity of the individual. Dr. Kyle's *Biology of Fishes* (1926) may be cited for its many illustrations of this important thesis.

HEREDITY AND DISEASE

For biological purposes a disease may be defined as a deteriorative process which tends to disintegrate the unity of the organism. The associated pathological changes cannot be separated off in any hard and fast way from ordinary vital changes, and what is a disease in one animal may be normalised in another type—let us think of the growth and decay of the stag's antlers. Yet disease implies that certain processes of metabolism have got out of place, out of time and out of tune.

For biological rather than medical purposes, again, we may distinguish four kinds of disease:—(1) There are environmental diseases, such as debilities due to lack of light or to deficiency in certain constituents of the food. Perhaps rickets may serve as an example. (2) There are functional diseases, which are due to overwork, lack of exercise or to some deteriorative factor in the occupation. Some kinds of heart strain, certain forms of obesity and lead poisoning may serve as examples. (3) There are the familiar microbic and parasitic diseases, due to the poisonings, lesions, blockings and so forth that are produced by intruding organisms of a hostile character; as in plague, tuberculosis, sleeping-sickness, malaria, and the disturbance brought about by hookworm, bilharzia, and other non-microbic invaders of man's body. It has to be recognised that part of what is, for practical purposes, called the disease in such cases, is the organism's defensive or even offensive reaction to the intruder, as in the phagocytosis associated with inflammation. (4) On a different plane are organic or constitutional diseases, which are due to some very early germinal or embryonic disturbance or defect.

A deteriorative peculiarity in the metabolism associated with excretion may find expression in kidney disease; or some defect in the inheritance may express itself later in one of the forms of epilepsy; or some inborn and at present inexplicable lack of balance in the functioning of the endocrinal glands may lead to one of the forms of diabetes. Apart from parasites, there is almost no disease in wild nature, where it is speedily nipped in the bud if it shows itself; in mankind and in his stock, where selection for health is less searching and insistent, where the struggle for existence is rarely with the gloves off, and where the conditions of life are often very artificial, disease is rife. In the case of organic or constitutional diseases, the organism starts with an inherited handicap, to which ill-advised nurture may add. In the other kinds of disease, the immediate cause is in great extrinsic, though less so in occupational diseases, but the extri influence may have its deteriorative effect increased by hereditary predisposition on the organism's part, which has to fight a battle with two fronts.

A few general statements may be made in regard to here and disease. There is no proof that modification-diseases vironmental, occupational or habitudinal) can be transmi from parent to offspring, but they may bring about a gen weakening of the germ-plasm, and they may influence the prejudicially through the mother. Microbic diseases are transmissible, though a susceptibility to them may be, though very early—ante-natal—infection may bring abou semblance of heritability. As a disease is a process, there are instances of hereditary disease in the strict sense; but there many instances of definite heritable taints, that is to say, stitutional predispositions or susceptibilities that render organism peculiarly liable to deteriorative influences in surro ings, in nutrition and in functioning, or to the assaults o truding microbes. If a hereditary taint is a recessive Mende character it will be masked by the corresponding domi character, that is by normality. Thus it will not find indivi expression, though it remains part of the inheritance. It is sible that a pathological feature, *e.g.*, a nervous disturbance, find expression earlier and earlier in development, until it comes fatal at a very early stage (Sir F. W. Mott's "la anticipation").

HEREDITY AND CONSANGUINITY

The older view that consanguinity is necessarily of itself teriorative has not been confirmed experimentally. Lea man's case apart, where psychological and social considera complicate the issue, there is abundant evidence that the breeding or endogamy of healthy stock may go far without deteriorative results. In the early chapters of the establishm of some of the famous stocks of domesticated animals there been very close inbreeding. If there is a well-defined tain some sort, it is plain that inbreeding will increase it if exhibited by both the parents. If a given character exhi Mendelian inheritance, the result of inbreeding must alwa the isolation of homozygous types—pure as regards the char in question. It matters not whether the character is adva geous or detrimental, except that in the latter case it may cross the limit of viability. If we suppose that a herd incl a percentage of individuals with a recessive taint, this will to become less conspicuous in conditions of outbreeding or amy, since the offspring of recessive tainted and domin normal will appear normal.

But in conditions of inbreeding or endogamy, the taint become more and more conspicuous, since the chances of tainted parents coming together will be greater, and the offsp will be homozygous recessives. Thus there will come abou isolation of a homozygous tainted type (or, in more com cases, types), and the rapidity of the isolation will be in pro tion to the intensity of the inbreeding. When the taints inte the breeder practically he fixes his attention on them, and in the past, consanguinity has been blamed for causing wha merely discloses. It should be noted that there may be rem able combinations of deteriorative recessive characters, pr ously hidden by their dominant allelomorphs, and that may be a general reduction in the vigour of the herd as diffuse. We cannot wonder, then, that inbreeding has come have a bad name. But the facts all point to the conclusion what the inbreeding itself does is to expose undesirable cha ters that already existed, but have been masked by their inants. It follows that inbreeding can be used as a sieve for radical improvement of a stock, since the exposed abnormali deficiencies and undesirabilities can be artificially eliminated

A subsequent outbreeding with good stock will re-invigo the purified inbred stock, for there will be a pooling of good ities comparable to the previous accentuation of bad Moreover, there may be a useful outcrop of fresh variations,

often follows the introduction of fresh blood. It may be
itely concluded, then, that inbreeding is not injurious be-
e of the consanguinity, and that if the breeder understands
: is happening, it may be made highly beneficial. The
rimental evidence will be found conveniently in *Inbreeding*
Outbreeding, by E. M. East and D. F. Jones (1919). There
is to be no biological reason for objecting to the marriage of
thoroughly healthy cousins; and it would appear that the
nation of periods of inbreeding and outbreeding has counted
nuch in the history of human stocks and tribes and races.

nclusion.—One cannot turn from this survey without
ring to the fatalistic impression that the study of heredity
ot to produce: the hand of the past has such a heavy grip.
'the other side of heredity" must also be emphasised—the
stence of the stable, the conservation of advantageous qual-
the continual emergence of the new, the influence of nurture
termining the degree of development to which the hereditary
re attains, and, in man's case, the dominant importance of
xtra-organismal or social heritage. A man cannot alter the
ber of his separate hereditary "talents," to use the phrase-
y of the immortal parable, but he can trade with what he has,
he is thus not only born, but made.

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ERGESHEIMER, JOSEPH (1880–), American author,
born at Philadelphia, Pa., Feb. 15 1880, and was educated
Quaker school in Philadelphia. As a writer of fiction he is
nguished by the warmth and colour of his descriptive pas-
s and by his psychological insight.

is publications include: *The Lay Anthony* (1914); *Mountain*
d (1915); *The Three Black Pennys* (1917); *Gold and Iron* (1918);
Head (1919); *The Happy End* (1919); *Linda Condon* (1919);
Cristóbal de la Habana (1920); *Cytherea* (1922); *The Bright*
el (1922); *The Presbyterian Child* (1923); *Balisand* (1924);
n an Old House (1925); *Tampico* (1926).

ERKOMER, SIR HUBERT VON (1849–1914), British painter
13.364), died at Budleigh Salterton, Devon, March 31 1914.

ERMANT, ABEL (1862–), French author and dramatist,
born in Paris Feb. 3 1862. A brilliant wit and an exquisite
ist, he consistently devoted his abundant talents to des-
ing the lighter side of life. His most characteristic works
those grouped under the general title, *Mémoires pour servir*
istoire de la société (1905), wherein, with unfaltering gaiety
a humour saved only by the delicacy of its expression from
earing scabrous, he mocks the aristocracy and wealthy
rgeoisie of France. He excels, too, in long series of amusing
ogues. *Le Caravansérail* (1917), a study of rich foreigners
ged into the cosmopolitan circles of Paris, is perhaps his
-known work, but the series of *Scènes de la vie des cours et des*
assades, which includes *La carrière* (1894) and *Le sceptre*,
o), no less pungently portrays the complications of diplo-
y in a dignified Central European court. Among his plays
be noted *La meute* (1896), a comedy of parasites, and
ie, ou la curieuse d'amour (1900), which with infinite grace
lays the reactions of a light-headed woman to the successive
ses of revolutionary and imperial France.

HERRICK, ROBERT (1868–), American author, was born at Cambridge, Mass., April 26 1868. He was educated at the Cambridge Latin School and at Harvard University where he graduated in 1890. He was appointed instructor in rhetoric at the Massachusetts Institute of Technology in 1890 and three years later accepted a similar position at the University of Chicago, where he became professor of English in 1905. His novels and short stories deal with the complicated problems of modern life in realistic fashion. They include *The Man Who Wins* (1895); *The Gospel of Freedom* (1898); *The Web of Life* (1900); *The Real World* (1901); *The Common Lot* (1904); *The Memoirs of an American Citizen* (1905); *The Healer* (1911); *One Woman's Life* (1913); *The Conscript Mother* (1916); *Homely Lilla* (1923); *Waste* (1924); *Wanderings* (1924): and *Chimes* (1926).

HERRIOT, EDOUARD (1872–), French politician, was born at Troyes, in Champagne, July 5 1872, the son of an officer. He was sent first to the Lycée of La Roche-sur-Yon, and afterwards to that of Louis-le-Grand, which bore the reputation of being the best school in France. He then entered the École Normale Supérieure, which included many eminent teachers such as Brunetière and Gaston Boissier, both of whom were men of authority and unquestioned reputation. Here he remained working assiduously for several years, and while delighting in the pursuit of learning thoroughly enjoyed the interchange of ideas with his fellow-students, on whom he left an unforgettable impression. In 1894 he graduated with high honours. Whilst undergoing his military service at Nancy, his favourite relaxation was the study of Greek literature. His book *Philon le Juif* (1897) was crowned by the Académie Française.

Having been appointed a professor at the Lycée of Nantes, he was entrusted the following year first with the Chair of rhetoric, and then of higher rhetoric at the Lycée of Lyon. He imparted to his pupils not merely the principles of knowledge but also the love of it for its own sake; a scholar of great refinement, he possessed the gift of stimulating others, and his discourses were so lucid and attractive that all who heard them were captivated. On relinquishing his Chair he became a popular lecturer, as well as journalist and propagandist, and his book, *Madame Récamier et ses Amis* (1905), achieved widespread popularity. His *Précis de l'histoire des lettres françaises* (1905) shows that his literary criticism was based on a minute study of the text.

A man of M. Herriot's wide sympathy could not fail to be drawn into public life. In May 1904 he was made a municipal councillor and deputy Mayor of Lyons and the following year became Mayor. Thenceforward, with the exception of three months, he guided the destinies of Lyons; for at each successive election of the Municipal Council he resumed office. In 1910 he became a member of the conseil général and in 1912 senator for the department of the Rhône. From Dec. 1916 to March 1917 he occupied the post of Minister of Public Works, Transport and Supplies in the Cabinet of M. Briand. During this time he inaugurated a policy of restriction which enabled France to economise her resources, while at the same time lessening the drain on them caused by the World War, and enabling her to gain a more speedy victory. Having to a large extent solved the problem of supplies, he proceeded to bring order into the transport service. Stations, railway lines and ports were cleared and an efficient service was maintained.

M. Herriot now felt that by entering the Chamber, he would be better able to carry out his cherished ideas. He therefore renounced his office as senator, and was elected in Nov. 1919 deputy for the Rhône department. He was then appointed a member of the Finance Commission and reporter-general of the Budget of Public Instruction. The Radical party now chose him as their leader, and as a defender of the principles of democracy he soon reached the front rank of French statesmen. As an orator he showed subtlety and versatility, combined with a vivid imagination, while his delivery was pleasing and impressive. At times he was a man of the people, then at other times his eloquence was that of the scholar soaring into metaphysics. Both in speaking as well as writing M. Herriot always approached his subject from the loftiest standpoint—the result of his wide knowledge, culture and absolute integrity. His chief qualities might be summed up in three words: logic, wisdom and conviction; and it was the combination of these which enabled him to draw up a formula for an experimental policy.

Even before hostilities had ceased, M. Herriot turned his attention to post-War problems. By his actions as well as in the Press he insisted on the necessity for the reconstruction and economic development of his country. In 1916, at the moment when the victory of Jan. seemed imminent, he organised the Lyons Fair, that magnificent international market which not only promoted the economic interests of the town and district, but at the same time contributed in a remarkable degree to national prosperity. This exhibition, though it cost the inhabitants of Lyons nothing, possessed a great palace to which each successive year new pavilions were added. That it proved a formidable rival to the Leipzig Fair, and had an ever-increasing success, was a striking testimony to M. Herriot's robust optimism. In 1917 he published *Agir*, a book which at a time when the fate of France was so uncertain, bore the character of an unflinching act of faith; for in it M. Herriot maintained that the culture and civilisation of France were too deep-rooted and too strong to be overcome. This gospel of action soon inspired the faint-hearted with fresh hope.

After the victory, M. Herriot brought out a work in two volumes, *Créer* (1919), dedicated to the youth of France. It contained his programme of reconstruction, and gave his compatriots a fine example of resolution, fearlessness and patriotism. A similar example emerged from his visits to Russia, the U.S.A. and Canada. He was soon confronted with an even harder task than before, for as head of the Radical party the eyes of all French democrats were turned towards him. It was he who inspired the opposition and acted as its mouthpiece, yet he remained faithful to his original ideals, and even in the heat of conflict never allowed himself to forget that one day the responsibility of office might fall to him again. After the elections of May 1924 he became Premier and Minister of Foreign Affairs and immediately set to work to reform the policy of France. During the London conferences, in the application of the Dawes plan and finally over the Geneva protocol, he displayed a rare combination of idealism and common sense, and outlined those great aims, in pursuit of which the nations of the world should unite to avoid war. By these efforts he gained the confidence of all men of good will, not only in Europe but over the whole world. Germany in consequence offered to draw up a security pact destined to be signed eight months later at Locarno.

This admirable achievement, however, by no means disarmed M. Herriot's adversaries. The financial problems which he had to face were the occasion of innumerable attacks upon him and finally a hostile vote of the Senate obliged him to resign in April 1925. A few days later, he was elected president of the Assembly by the deputies who desired to testify to the courage, zeal for work and talents of the leader of the Left. The office of President gained an added lustre through the tact, good humour and timely exercise of his authority shown by M. Herriot, and everyone cheerfully submitted to his arbitration. During the many critical moments in the history of contemporary French politics, M. Herriot, with his idealism, practical wisdom and patriotism, proved a guiding light. He devoted his few leisure hours to writing *Dans la forêt Normande*, a book worthy not only of a great writer, but also of a philosopher. (L. Ri.)

HERTLING, GEORG, Count von (1843–1919), German statesman, was born in Darmstadt Aug. 31 1843. In 1882 he was appointed professor of philosophy in the University of Munich. From 1875 to 1890 and again from 1893 to 1912 he was a member of the Reichstag, from 1909 being for a short time the leader of the Centre (Catholic) party. In 1912 he was appointed president of the Bavarian ministry and minister for foreign affairs, and in 1914 was elevated to the rank of count by King Ludwig III. On Nov. 1 1917 he accepted the chancellorship of the Reich, which he had refused in July of that year; and for 12 months he strove against the encroachments of the military authorities upon the political affairs of the Empire. The failure of the German offensives in 1918 finally destroyed his hop being able to negotiate with the Allies on anything like e terms and feeling at last unequal to the struggle against introduction of real parliamentary Government, he resi Sept. 30 1918, and returned to his home at Ruhpolding in U Bavaria, where he died Jan. 4 1919. His reminiscences published in 1919 under the title of *Erinnerungen aus mei Leben*. See also Karl Hertling, *Ein Jahr in der Reichska* (1919).

HERTZ, JOSEPH HERMAN (1872–), Chief Rabbi of United Hebrew Congregations of the British Empire, was in Rebrin, Czechoslovakia, Sept. 25 1872. Emigrating to Am as a child, he was educated at New York City College, Colu University, where he took the degree of Ph.D., and the Je Theological Seminary of America. He was a Rabbi in Johan burg, South Africa, from 1898 to 1911 and, during the Boer was expelled by President Kruger for pro-British sympat and for advocating the removal of religious disabilities from and Catholics in the South African Republic. From 1906 to he was professor of philosophy at Transvaal University Col Dr. Hertz was elected to the Chief Rabbinate in succession to Hermann Adler, in 1913. In 1920–1 he undertook an exte pastoral tour, visiting the Jewish communities in South Af Australia, New Zealand and Canada. He became Preside Jews' College, London, in 1914. In 1925 he was made on the board of governors of the University of Jerusalem and ch man of the administrative board of its institute of Jewish stu He also became vice-president of the Anglo-Jewish Associat the London Hospital and the League of Nations Union. Am other Jewish writings, he published an anthology *A Boo Jewish Thoughts* (1917), of which 17 editions had appeare 1926. He was a member of the original board of translato the Jewish Bible Version, 1896–1903.

HERTZOG, JAMES BARRY MUNNIK (1866–), S African politician, was born at Wellington, Cape Colony, A 3 1866. Educated at Victoria College, Stellenbosch and sterdam University, he became a judge in the Orange Free S in 1895, and served through the South African War of 1899 He voted against peace at Vereeniging and, frankly hostil the British connection, he helped to keep alive this anti-Br feeling after the War. On the grant of responsible govern in 1907, he became attorney general and minister of educa in Fischer's ministry, and forthwith began to undo the wor the Crown Colony Administration. He tried to force upon schools a system of compulsory bi-lingualism—Dutch English—which was crude and impracticable. The direct education resigned, and one of the three inspectors, dismi without enquiry, won an action for libel against Hertzog *cause célèbre*.

In the first Union Cabinet, in 1910, Hertzog became mini of justice under Botha, but his attitude made the position tenable. Botha resigned in 1912, took office again, reconstru his Cabinet and left Hertzog out. The latter then forme opposition party with complete independence of Britain as goal, and his perfervid nationalism gained him much influ among the old Republican Boers. After the World War he tinued his separatist policy but finally formed a "pact" the Labour party. In 1924 this Coalition came to power Hertzog as prime minister, whereupon he disclaimed any tical application of his republican policy. In 1925 he bro the native question into the forefront of the political arena, rendering a great service to the future of the country owin the increasing gravity of the problem in its relation to the tinued supremacy of a comparatively small white populati (H. Gn.

HERVIEU, PAUL (1857–1915), French dramatist and no (*see* 13.405), produced his last play, *Le Destin est maître*, in 1 He died in Paris Oct. 25 1915. See A. Binet, *Portrait psy logique de Paul Hervieu* (1914); H. Burckhardt, *Studien zu Hervieu* (1917).

HEWART, GORDON HEWART, 1st Baron (1870– British lawyer, was born Jan. 7 1870 at Bury, Lancash

ng graduated as a scholar of University College, Oxford, he
alled to the Bar in 1902 and practised on the northern cir-
After an unsuccessful contest in Northwest Manchester
12, in which year he took silk, he was elected as a Liberal
eicester in 1913, and after the rearrangement of constitu-
s in 1918 represented the eastern division of that city from
till his retirement from Parliament. In Dec. 1916 he was
inted solicitor-general in Mr. Lloyd George's Coalition
rnment. Having afforded useful support to the adminis-
on by his talents as a debater, he was made attorney-general
n. 1919, and was admitted to the Cabinet in 1921. He gave
rial assistance in the conduct of reconstructive legislation,
took an active part in the final phase of the negotiations
the Sinn Feiners, being one of the signatories of the so-called
Treaty. He acted as president of the War Compensation
t from 1922. He had been knighted in 1916; on Jan. 16
he was sworn of the privy council, and on March 24 1922
appointed lord chief justice, being at the same time created
n Hewart of Bury.

EWLETT, MAURICE HENRY (1861–1923), British man of
rs (*see* 13.417). The best of his later works are *Mrs. Lance-*
1912); *Bendish* (1913); and *Mainwaring* (1921). His main
est, however, was directed from fiction to verse. *The Song*
e Plow (1916) has been recognised as one of the most con-
able narrative poems of the century; it describes the for-
s of the English farm labourer from the earliest times to
World War, and though occasionally the imaginative beauty
bscured by necessarily prosaic detail, contains numerous
ages of a fine masculine vigour. *The Village Wife's Lament*
8) is a more uniform and but slightly inferior poem. In
of Proserpine (1913), Hewlett attempted, with some success,
int in delicate prose at the mystical semblances of nature,
his essays, *In a Green Shade* (1920), were warmly received.
translations and imitations of the sagas, including *Thorgils*
readholt (1917), also deserve mention. The popularity of his
er fiction concealed from many of his contemporaries the
ngth and originality of his later work. He died at Broad-
ke, near Salisbury, June 15 1923.

EYSE, PAUL JOHANN LUDWIG (1830–1914), German
elist, dramatist and poet (*see* 13.438), received the Nobel
e for literature in 1910. His later works include *Helldunkles*
n (1909); *Italienische Volksmärchen* (1914) and *Letzte Novel-*
(1914). He died at Munich April 2 1914. Several volumes
is letters have appeared (1916, 1917, 1919). See also H. Raff,
l Heyse (1910).

IBBEN, JOHN GRIER (1861–), American educationist,
born at Peoria, Ill., April 19 1861. He graduated from
ceton University in 1882; was a student at Princeton Theo-
cal Seminary from 1883 to 1886; and later studied at Berlin.
1887 he was ordained a minister in the Presbyterian Church
was a pastor for four years at Chambersburg, Pennsylvania.
1891 he returned to Princeton, where he taught logic as an
ructor (receiving the degree of Ph.D. in 1893), assistant pro-
or, and from 1907 professor. In 1912 he succeeded Woodrow
son as president of the university.

is works include *Inductive Logic* (1896); *The Problems of Phi-*
phy (1898); *Hegel's Logic* (1902); *Logic Deductive and Inductive*
5); *The Philosophy of the Enlightenment* (1910, contributed to the
chs of Philosophy); *A Defence of Prejudice and Other Essays* (1911)
The Higher Patriotism (1915).

IGGINSON, HENRY LEE (1834–1919), American banker,
born in New York City Nov. 18 1834. At the age of 17 he
ered Harvard University, but before finishing his course
ered the banking house of S. and E. Austin, of Boston. He
r went to Vienna for a year, where he studied music. In the
il War he served as a volunteer officer. In 1863 he was severe-
wounded at Aldie, Va., and in the following year was honour-
y discharged. In 1868 he joined the banking firm of Lee,
ginson and Co., of Boston, with whom he remained until
death. His interest in music led to his founding the Boston
nphony Orchestra in 1881. A long line of distinguished direc-
s placed this organisation in the first rank. It was a stimulating source of musical education in America and won full recognition abroad. In 1891, as a memorial to certain friends who died in the Civil War, he presented Soldiers' Field to Harvard University; and in it the stadium was built. In 1899 he erected the Harvard Union as a general meeting-place for all undergraduates. For many years a fellow of Harvard University, he died in Boston, Mass., Nov. 14 1919. See Bliss Perry, *The Life and Letters of Henry Lee Higginson* (1921).

HIGGINSON, THOMAS WENTWORTH (1823–1911), American author (*see* 13.455), died in Cambridge, Mass., May 9 1911. See *T. W. Higginson: The Story of His Life* (1914), by his wife, Mary Potter Higginson.

HILDEBRANDSSEN, HUGO HILDEBRAND (1838–1925), Swedish meteorologist, was professor of meteorology and director of the Meterological Institute at Upsala from 1878 to 1906. He was an associate member of the Comité Permanent International Météorologique from 1882 to 1885, ordinary member from 1891 and general secretary from 1900 to 1907. In 1886 he undertook, in conjunction with the Hon. Ralph Abercromby, the classification of cloud forms, and he published in 1896 his *Atlas international des nuages* (with Riggenbach and L. Teisserenc de Bort), together with *Les bases de la météorologie dynamique* (1898–1907), in collaboration with Teisserenc de Bort. Hildebrandssen became an honorary member of the Royal Meteorological Society of London in 1888, which awarded him the Symons Gold Medal in 1921, and also a member of the Royal Institution of Great Britain. He died in 1925.

HILL, DAVID JAYNE (1850–), American diplomat, was born at Plainfield, N.J., June 10 1850. After graduating in 1874 from the University of Lewisburg, Pa. (later known as Bucknell University), he became instructor in Greek and Latin there and from 1877 professor of rhetoric. In 1879 he was elected president of Bucknell, and in 1888 of the University of Rochester. In 1896 he resigned and went abroad to study public law. In 1898 he was appointed assistant secretary of state by President McKinley. While in Washington he was also professor of European diplomacy in the school of comparative jurisprudence and diplomacy. In 1903 he was appointed minister to Switzerland, being in 1905 transferred to Holland. He was a delegate to the Second Peace Conference at the Hague in 1907. From 1908 to 1911 he was ambassador to Germany. In 1914 he was proposed as a candidate for the Republican nomination for the U.S. Senate from New York to succeed Elihu Root.

Hill's best known work is his *History of Diplomacy in the International Development of Europe*, embracing *A Struggle for Universal Empire* (1905); *The Establishment of Territorial Sovereignty* (1906) and *The Diplomacy of the Age of Absolutism* (1914). His other writings include *World Organisation as Affected by the Nature of the Modern State* (1911, lectures delivered at Columbia University); *Impressions of the Kaiser* (1918); *Present Problems in Foreign Policy* (1919); and *American World Policies* (1920).

HILL, JAMES JEROME (1838–1916), American capitalist (*see* 13.464), died at St. Paul, Minn., May 29 1916. He resigned the chairmanship of the board of directors of the Great Northern Railway in 1912. He had long thought that the farmers and millers of the north-west needed a large financial institution near at hand to which they could easily turn for aid. Accordingly in 1913 he secured control of the First and Second National banks of St. Paul and merged them, thereby increasing local facilities for loans. On learning in 1914 that friends had raised $125,000 for establishing as a tribute to him a chair of transportation at Harvard he added a like amount. During his later years he gave much attention to the Hill Reference Library, in St. Paul, to which he contributed liberally. He was the owner of a remarkable collection of modern French paintings, including fine examples of Puvis de Chavannes, Corot, Delacrois, Millet and others. He was the author of *Highways of Progress* (1910), a work dealing with the subject to which he had dedicated his life.

HILL, OCTAVIA (1838–1912), British philanthropist (*see* 13.465), died in London Aug. 13 1912.

HINDENBURG, PAUL VON (1847–), German soldier. Paul Ludwig Hans von Beneckendorff und von Hindenburg was born in Posen Oct. 2 1847, the son of a Prussian officer. His childhood was spent in his parents' house, and later in Pinne and Glogau. In 1858 he entered the cadet school at Wahlstatt in Silesia, afterwards joining the chief cadet academy in Berlin. At an early age the severity of the training in the Prussian cadet corps lent a note of inflexibility to his character, and developed in him strength of will, resolution and cool-headedness. Intellectually, he developed relatively late, owing to early illnesses and to his too rapid physical growth. Ambition awoke in him slowly; but as success crowned his efforts it grew unceasingly, and won him the reputation of a particularly gifted pupil. At the age of 18 he entered the 3rd Foot Guards at Danzig as a second-lieutenant in 1866, and soon after made his first appearance on the battlefield. At the battle of Königgrätz he stormed with his squadron an Austrian battery under fire. He took part in the war of 1870–1 as adjutant to a battalion, and after gaining distinction at St. Privat, became adjutant to the regiment.

After three years at the staff college in Berlin, he served with the general staff in 1877, and was soon promoted to the rank of captain. The next years were spent as company commander and chief of battalion and in various posts on the general staff. In 1883 he became an instructor at the Staff College in Berlin; and later, on the general staff under Count Schlieffen, he was the spiritual pupil and assistant of that strategist of genius. Several years' labour in the Prussian War Office developed his talent for organisation. After serving from 1893 to 1896 as commander of the 91st infantry regiment (Oldenburg), he was promoted major-general, and for four years served as chief of the general staff of the VIII. Army Corps at Coblenz, subsequently commanding the 28th Div. at Karlsruhe for three years. In 1903 he became general in command of the IV. Army Corps at Magdeburg. In 1911, being 65 years old, he was placed on the retired list.

The Outbreak of War.—The outbreak of the World War found him leading a life of seclusion in Hanover. It was in response to the threatening development of the opening campaign in the East against the Russians that on Aug. 22 1914 he was appointed commander-in-chief of the VIII. German Army, and had assigned to him Maj.-Gen. Ludendorff as chief of staff. Though hardly acquainted with one another previously, a reciprocal confidence soon resulted, which, despite divergence of character, led to a unity of thought and deed without analogy in history. Hindenburg has given a detailed account of his relations with Ludendorff in his memoirs. When, in Germany, after the War, from personal and political motives, attempts were made to make a scapegoat of Ludendorff, the marshal denied these accusations, saying: "We belong to one another till death. Gen. Ludendorff acted in constant accord with me. He who strikes at him strikes at me." General Ludendorff, too, in his war memoirs, fully reciprocates this attitude of complete trust and confidence.

It must be recognised that the disposition of Ludendorff was the more active, that a demonic spirit resided in him which was responsible for those decisive acts which changed the course of the world's history. His memoirs of the War and his demeanour in German politics after the War are instinct with the vehement passions of one who has been subjected to many attacks, just or unjust. During the War it was only the presence of the marshal's authority that prevented the vivid, sensitive and at times well-nigh fanatical temperament of his colleague from losing self-control. The character of Ludendorff was the harder, that of Hindenburg the greater. Their processes of thought ran upon separate lines, but each tested his own conclusions and completed them by reference to the other. Ludendorff bore the whole burden of the technical execution of the decisions, a task which he carried through with titanic strength. Hindenburg remained predominantly in the sphere of pure thought, supplying rather the static element in leadership, and leaving the dynamic side in the other's hands.

Hindenburg possessed a gift of inestimable value, and Ludendorff enabled him to develop it—that of economising his own mental energy and guarding it against strain and premature exhaustion. He was thus enabled to retain his nerve force unti end of the War, when he was then able to assume a heavier more thankless task, that of saving his fellow-countrymen the whirlpool of the revolution. In the political sphere, Ludendorff's vigorous intervention frequently involved the shal in spite of all his distaste for political activities, in q tions which he would probably have otherwise avoided. Hin burg as a soldier was hampered by mistrust of his own poli ability. Ludendorff frequently had to convince the chief of general staff of the necessity for taking political decisions. the constraint of conscience and the sense of moral responsib caused Hindenburg and Ludendorff to intervene at all in polit questions.

Tannenberg.—The battle of Tannenberg, which lasted Aug. 26 to 31 1914, found its origin in the dispositions, invol the assembly of strong forces on the southwest flank, adopte the superseded Gen. von Prittwitz after breaking off the gagement at Stallupönen (Gumbinnen). Hindenburg's m lay in converting the possibility thus acquired of a successful fence against Samsonov's Russian Army of the Narew in victory, whereby despite the numerical inferiority of the mans the enemy were twice encircled and practically annihila The most brilliant feature of the operations was the concen tion of all available forces in order to overwhelm this ene despite the threats to Hindenburg's rear, first by Rennenka in the north and later by new Russian forces which were proaching from the south. In the subsequent battle of the surian Lakes, Sept. 7–12, the Niemen army under Rennenka was so thoroughly dispersed in the wood and marsh lands as t unfit for further operations for weeks. In the opening of his c paign in East Prussia Hindenburg showed consummate mas in the employment of interior lines and in using a central posi to prevent hostile forces which were advancing from diffe directions from uniting on the battlefield. His plan was to o whelm the first of these with lightning swiftness, and then to t with all his strength upon the others.

Hindenburg was unable to follow up his victories in E Prussia by advancing across the Lower Narew; the Aus Hungarian allies had suffered a heavy defeat in Galicia, and German commander was compelled to hasten to their immed aid with the bulk of the German forces available in the E This led to the combined offensive of the German IX. A through Southern Poland towards the Vistula and of the Au ans in Galicia across the San. The German advance met little resistance, but the roads were mere morasses. On Oct the Vistula was reached between Jozefoff and Dęblin (Iwange after an advance along the Opatow-Radom line. The attempt cross the river failed, and the Austrian allies, too, came t standstill. Finally, the German offensive drew upon itself gre superior Russian forces which, advancing past Warsaw, assa its left flank. In this way the ally was relieved. Hindenb himself succeeded in escaping the threatened envelopment fr the north by a timely withdrawal upon Upper Silesia. With vision of genius he grouped the great bulk of his forces about railway line running to West Prussia, and at the beginning Nov. advanced in a surprise attack from the Wrzesnía-Th line upon the right flank of the main Russian forces lying southern Poland. He succeeded at the battle of Lódź in bringi the "Russian steamroller" to a standstill, and eventually c pelled the enemy to withdraw behind the Bzura and Rawka.

Further Operations in the East.—Hindenburg in the meanti had been appointed marshal and commander-in-chief of all German forces in the East. His next blow was in Masuria Feb. 1915 against the northern wing of the Russian Army the Upper Bobr, and led to the annihilation of the X. Russi Army. But the attempt to advance across the Narew to Bia stok failed, owing to a powerful Russian counter-offensive Prazasnysz. The general eastern campaign, directed by G von Falkenhayn, was now concentrated upon Galicia, where May 8 the break-through at Gorlice-Tarnow initiated a prom ing offensive. The front line of the army group of Hindenbu stretching from the upper Vistula as far as Courland, remai onary throughout this period, except for local offensives and ge scale cavalry raid. Not until the middle of July was lenburg's front-line set in motion, in co-operation with the rious progress of the offensive in Galicia and southern nd. But Gen. von Falkenhayn and the Marshal differed amentally in their attitude towards the cardinal problem of War. Hindenburg's conviction, founded on the teaching of sewitz, was that the salvation of the Central Powers depend- the destruction of the Russian colossus. He believed that a t " Cannae " was attainable in the East, and that with such tory all political and military considerations which fettered ommander in his power of decision would vanish.

lkenhayn, on the other hand, held that it was sufficient by ns of a " campaign with limited objectives " to keep the sian Army at bay and to cripple its offensive power. Hinden- 's proposal was to take the offensive on his extreme left on the Niemen northwards past Kovno in the direction of a and beyond, and thus to sever the northern arteries of Russian Army—namely, the railways. This plan was rejected alkenhayn in favour of the advance across the lower Narew, h proved successful, for in conjunction with the successes of kensen and of the Austrians in southern Poland it caused the le Russian front line to waver. Yet it was only gradually and nsequence of continual front-line engagements that the enemy wed themselves to be driven back upon their rearguard munications towards the East. Several times during the ations Hindenburg brought up the question of his original ect; he also carried out unaided the attack upon the fortress ovno, which fell on Aug. 18. Eventually, early in Sept., enhayn gave way ostensibly, without, however, placing at denburg's disposal the strength requisite for carrying out his s. The offensive upon Wilna, begun too late, encountered erful Russian forces, and it was only possible to press back Russian front line, no decisive encounter having taken place.

rom the autumn of 1915 onwards Gen. von Falkenhayn ted the East as a merely subsidiary seat of war; for while he striving to wear down the French forces at Verdun the Ger- eastern front was condemned to inactivity. This facilitated great Russian successes in June and July against the Austro- garian front, which was broken through and almost shat- d at Luck. In Aug. when the danger was at its greatest, the le of the eastern front from the Gulf of Riga to Galicia was ed under Hindenburg. He brought order where chaos had ned. On the upper Sereth, at Brody and on the Styr a new part arose, which, however, proved tenable only where Ger- troops stiffened their allies' resistance. Meanwhile the ggle for Verdun continued to rage, and the battle on the me reached its culminating point.

t Headquarters.—When in Aug. Rumania joined the Entente, Marshal, who was now the national hero, was appointed f of the general staff in place of Falkenhayn, while Gen. endorff remained with him as quartermaster-general. The German High Command found itself confronted with in- merable heavy tasks. While the campaign against Rumania to be improvised, it was necessary to stand on the defensive he West. The offensive against Verdun was abandoned, not hout the French having gained numerous local successes to- rds the end of the year. Hindenburg expressed his final aim he words: " We intend, not to hold out to the end, but to quer." An intensive submarine campaign was carried out as ply to England's hunger blockade.

n the East every nerve had to be strained to force Russia to ke a separate peace, while in the West the defensive cam- gn continued. The end of 1917 found the Quadruple Alliance, pite the tremendous demands made upon their strength— , despite the fact that they were almost exhausted—consider- y nearer to their objective. The U-boat warfare was slowly surely producing its effect. The Italians had in a brief but verful offensive been, not indeed annihilated, but decisively eated. In the East the German hammerblows at Tarnopol, Riga Osel (Saaremma) had broken the fighting spirit of the new ssian ruler Kerensky, and carried the Bolsheviks into power. Peace was negotiated with them and with Rumania at Brest-Litovsk and Bucharest and, under military pressure, was finally attained in the winter of 1918. There remained the last and hardest task, the reckoning with France and England in the West, before America should be in a position to intervene as a military factor in the War on land.

In the spring of 1918 Hindenburg set himself to place the cornerstone upon the structure of his military achievements. All available effectives were utilised for this decisive conflict. The great offensive on both sides of St. Quentin was to break through the front line of the French and British on the southern flank of the latter, to roll them up towards the north and drive them towards the coast. From the tactical point of view the first blow in the direction of Amiens was a brilliant success. But it led to no practical advantage, and was supplemented by the attack upon the Lys front. But, here, too, the operations for a break-through miscarried, resulting only in a second massive concentration on the enemy front. Hindenburg, notwithstanding, clung to his resolve to deal the British a decisive blow in Flanders.

It was necessary, however, to effect a diversion in order to draw off the French reserves and to occupy them elsewhere. This led to loss of time, from which the enemy derived advantage. For the intervention of America loomed threateningly near. The first diversion at the Chemin des Dames gained considerable ground and drew in a large number of the French reserves, but not enough to pave the way for the decisive blow in Flanders. A new diverting attack on both sides of Rheims failed, whereupon Marshal Foch seized the initiative and from Villers Cotterêts attacked the German Marne position on the flank with strong forces. The Americans now appeared in the capacity of attacking troops. Hindenburg abandoned the Marne salient and held up the break-through on the Vesle. But from henceforth the initiative remained steadily in the hands of the French generalissimo, while the German reserves melted steadily away.

From a military standpoint the War was lost with the reverse of Aug. 8. Yet Hindenburg still hoped to cripple the fighting spirit of the enemy by a strategic defensive and to secure a peace compatible with the dignity of the German people. But Bulgaria's defection caused the complete collapse of the Macedonian front, and Hindenburg realised that an immediate armistice was necessary to give the army breathing space. With a just appreciation of their prospects of victory, the enemy took their time over granting an armistice, and summoning the full strength of their tremendous material superiority proceeded to force the German Army to throw in its last reserves. Meanwhile Turkey and Austria abandoned their rôles as allies of Germany, who found herself flung entirely upon her own resources in the final struggle. Hindenburg and Ludendorff wished to rouse the people to a final heroic effort of exertion; but the Cabinet of Prince Max of Baden lacked the capacity to check the revolution, and Germany was handed over unconditionally to the dictates of the enemy.

The marshal, victor in countless battles, had to return home, therefore, not as supreme war-lord but as a beaten general. Yet even in misfortune and profound humiliation his spirit remained unbroken, and he succeeded in extricating his country from the disorder of the revolution. On April 26 1925, the German people elected him President of the Reich.

Hindenburg stands out as the typical German, a personality of classic mould, unbroken by the tragedy of his life. He had a profound understanding of all human affairs, and he was thus enabled to pursue a steady line of conduct and to adhere to it during the appalling downfall of his country.

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(W. F.)

HINDUISM (*see* 13.501).—In Hinduism we may discern four main elements: religion, race, country and social organisation. They may not be separated. They are inextricably interwoven.

The life of each is bound up and is an integral factor in the life of the others. It is a living whole forged by the organic stresses of history and a long past, from diverse sources from various materials and it is still a living vigorous whole.

Its diversity is appalling. Uniformity could not be expected as a feature of the religious experience of 232,000,000 people of different racial origins, of different history, of different environment, tradition and social structure. Yet there is a true Hindu polity: there are features common to North and South, to East and West. Much of it belongs obviously to the universal pattern for the agelong problems, whose presentations, at various times, in differing modes, constitute the stimulus to religious activity, are based ultimately on certain definite universal experiences and facts. Man is born of woman, grows and withers like the grass. Whence and whither and why? The debate of fate, foreknowledge, freewill follows inevitably certain lines, and the solutions to these problems conform to type because they are universal problems, wherever, as is markedly the case in India, thought has turned to the scrutiny and analysis of experience.

What of unity is there in all this? Where is it to be found? What is the factor or force that transcends this welter of diversity and binds it into a whole? Not community of origin, not community of speech. A clue may be found in the view that " Though Hinduism has no one creed, yet there are at least two doctrines held by nearly all who call themselves Hindus. One may be described as polytheistic pantheism . . . the second doctrine is commonly known as metempsychosis, the transmigration of souls or reincarnation, the last-named being the most correct." Here most certainly are elements which Hinduism shares with and derives from lowlier cults. From these very elements and beliefs, the social fabric draws its strength. The new-born child is no stranger, dropped from the skies: he is one of the community returning for a brief while to the world to which again and again he will come till liberation shall have been won. These beliefs we now know to be part and parcel of the socio-religious manifestations of many so-called savage tribes. They make for the stability of social structure. They validate morality. They have a survival value.

The Hindu does not admit that a belief in reincarnation expresses pessimism. By judicious and timely expenditure a sinner may escape hell, but he cannot escape a disadvantageous rebirth—a belief which establishes a closer and more vital and socially valuable connection between morality and religion, which he cannot discover in other types of religion. What gives perennial force to these beliefs is their practical relation with the structure and rules of Hindu society and their ethical value.

In another aspect this belief lays emphasis upon the continuity of life while recognising to the full that change is ceaseless. The continuity of the Universe, which to a materialistic world is enshrined in the scientific dogmas of the indestructibility of matter and the conservation of energy, is a real doctrine of perpetual validity and practical ethical import in Hinduism, which recognises a material law in the spiritual world, as well as a spiritual law in the material world.

The charge is brought that Hinduism exhibits both intellectual and moral extravagance, yet the value of truth and of progressive revelation in religion is rated high. The moral extravagance, as the West judges morals, which exists in Hinduism, is in large part the result of the intellectual extravagance whereby logic is exalted to perilous heights unchecked by reason.

Is it absurd to affirm that Deity cannot be fettered, must be free in all respects, may act when and where and as it will? If this be true of the Divine, then in like measure as some men are the vessels of divinity, so will they be set free from the trammels and conventions that bind the ordinary lesser man. Such at least would seem to be the argument. The consequences drawn from it justify the criticism that what may be true of the Divinity is in practical reason inapplicable to humanity.

The sense of mystery, the recognition of power, the apprehension of an order dimly seen but always felt, are there. Hinduism provides a mode of life as well as a religion, a guide to an interpretation of the relations between man and man, bet one group and another, between humanity and divinity. regulate these relations, to secure safety for all, there are mi observances and ordinances which seem to be, but at de view are not, incongruous with the philosophic subtlety charac istic of Hinduism at its highest and best.

Hindu polity is aristocratic, not egalitarian. It recog and utilises and explains the inequalities of individuals an groups of individuals. It is based on a sense of duty an reciprocal obligation permeating the whole society from King to the peasant. *Dharma* is duty. In the caste sys with its hierarchical gradations, its complex relations, its jea endogamy, its fissiparous nature, it expresses an exclusive which at first sight seems to create a rigid barrier, but its pro of proselytisation is by the absorption of whole communi and that process is still active. The groups find a place, and s in course of time are known to have risen high by use of polit and other circumstances. The highest height is still reser for the Brahmin who, when a long view is taken of Indian tory, has often proved himself worthy of the trust he inherited.

Times are changing. The printing press is active. schoolmaster is in the land. There is talk, loose talk, m talk of rights. Democracy and the ballot box constitute court of final appeal. Ideas spread fast, faster than e knowledge, and wisdom lingers. Yet appeals to the old id are heard and heeded by millions. Saintliness and chara are recognised for what they are, great social forces. An e tional need awakened and created by the stirring political eve of this period was satisfied by the worship of *Bande Mata* the symbolic identification of a religious entity with a ra and political ideal.

The old spirit lives and exerts its influence in countless wa The development of industrialism in India has already m vast alterations in the mode of life of millions by changing distribution of wealth and by augmenting the range of hum and social ambitions. Those who but yesterday were poor without honour, today are prosperous and seek for esteem recognition. Hindu polity in the social order is based on principle of " attaching more importance to the differen between social groups than to that which they have in co mon." Wealth is power and power is worshipful always. W dom, too, is power and still has its meed of respect, thou perhaps not as fully as in the golden days, when great was " influence exercised by Indian philosophers in every grade society, from the highest to the lowest, solely by reason of th superior intellectual qualities and personal virtues."

Much has been, much yet remains to be, learnt by the seri student of religious and social problems from the vast array Indian religious experience in which, daily, fresh contacts established between Hinduism, Islam, Christianity and Pri itive Culture. The diversity, polytheism, philosophic mo theism, practical henotheism, of Hinduism affect profoun and intimately all it touches, and it assumes fresh forms a provokes change and reaction within the religious communit it touches. The census records display losses and gains a analyse them fairly. Within it the cement of philosophy wh binds together the aboriginal beliefs, its prime material, is strong as are the reforming movements like the Brahmo Sa which, judged by numerical standards, is weak, even declin but is ever gaining fresh hold on the intelligentsia, especiall Bengal. The Arya Samaj in the Punjab has gained greatl recent years. It has developed the practice of *Shuddhi:* (*a*) t conversion to Hinduism of persons belonging to foreign religi (*b*) the reconversion of those who have recently or at a rem period adopted one of the foreign religions; and (*c*) reclamati of the so-called Depressed Classes. In conservative Southe India whence great movements have originated in the past, much so that " it would be more correct to describe Indi religion as Dravidian religion stimulated and modified by t ideas of Aryan invaders," many forces are at work which a ined surely to find expression in religious modes, perhaps efore, in a development of an emotional theism founded on belief that "every man by his own efforts can come into ediate contact with the Great Being whom he worships." induism needs no apology. As Sir Charles Eliot has finely : "If Hinduism were really bad, so many great thoughts, nany good men would not have grown up in its atmosphere. re than any other religion it is a quest of truth and not a d . . . it is truly dynamic and in the past, whenever it has ned in danger of withering, it has never failed to bud with life and put forth new flowers. More than any other religion duism appeals to the soul's immediate knowledge and ex- ence of God. It has sacred books innumerable, but they e in little but this, that the soul can come into contact and macy with its God, whatever name be given Him and even Ie be superpersonal . . . the task of religion is . . . not to mote the welfare of tribes and states, but to effect the en- tenment and salvation of souls." Purified from within, duism in its highest expression by which it, as any other gion, has a right to be judged, with its great vitality, its power adaptation, its philosophic tradition, its insistence on the elopment of the powers that are latent in man and are in pardy of being atrophied by modern dependence on machin- , may yet serve humanity by correcting the stress laid by er schools of thought upon the material to the neglect of spiritual.

IBLIOGRAPHY.—The Census reports for 1911 and 1921 contain uable data and critical examination of the statistical evidence ected. The Provincial reports are also full of matter. The lication of *The Tribes and Castes of Bombay*, 3 vol. (1920), com- es a series of most important books so far as the main part of tinental India is concerned. The religions of the Lower Culture dealt with in the *Birhors*, by Sarat Chandra Roy (1925) and the nographs of the Assam and Burma Ethnographical Surveys. ir Charles Eliot's *Hinduism and Buddhism* (1921) is a fine pre- tment of facts based on personal knowledge and a critical investi- ion of the texts. Such works as *The Crown of Hinduism* by J. N. quhar (1913), *The Chamars* by G. W. Briggs (1920) and *The lage Gods of Southern India* (1921) by the Rt. Rev. Henry White- d, D.D., may also be consulted.

IINES, WALKER DOWNER (1870–), American lawyer, s born at Russelville, Ky., Feb. 2 1870. He was educated at den College and the University of Virginia. From 1893 to 4 he was with the Louisville and Nashville Railway in the al department and, after 1901, as first vice-president. He ctised law in Louisville, Ky., 1904–6 and in New York City 6-16, becoming specially versed in questions of interstate nmerce. In 1906 he became general counsel for the Atchison, peka and Santa Fé Railway, later becoming also chairman of executive committee, and then chairman of the board of ectors. In Feb. 1918, after the U.S. Govt. had assumed con- l of the railways as a war measure, he was appointed assistant ector-general, and in Jan. of the following year director- neral. He resigned in May 1920, and was designated by Presi- t Wilson as arbitrator in the distribution of German, Aus- an and Hungarian inland shipping under the Peace Treaties. Oct. 1921 he resumed the practice of the law in New York ty. In 1925 he made an investigation and report of navigation the Rhine and Danube for the League of Nations.

HIPPIUS, ZINAIDA (1869–), Russian poet and prose iter, was born Nov. 8 1869 at Belev, in the Tula province. She rried Dmitry Mereshkovsky in 1889 and went to live in Petersburg (Leningrad). Later she went to live in Paris. Hip- us was one of the leading poets of the Russian symbolist move- nt of the 'nineties and her poetry bears the usual character the movement: the cult of beauty, mysticism and individual- n. The influence of Nietzsche's philosophy is also apparent as in famous line "I love myself as I love God" which became the gan of the Russian "decadents." Her later poetry shows the luence of the neo-Christian theories of Mereshkovsky but at same time reveals deep individual and emotional power. Her ose works were much inferior to her poetry, but under the pseu- nym of "Anton Krainy" she was known as a trenchant liter- critic.

HITCHCOCK, GEORGE (1850–1913), American painter (*see* 13.533), died on the island of Marken, Netherlands, Aug. 2 1913.

HITCHCOCK, GILBERT MONELL (1859–), American politician, was born at Omaha, Neb., Sept. 18 1859. He was educated at Omaha and Baden-Baden (Germany), and the law school of the University of Michigan. He was admitted to the bar in 1881 and practised law in Omaha for four years. In 1885 he founded the Omaha *Evening World*, and four years later bought the Omaha *Morning Herald*, combining the two papers into *The World-Herald*. He was representative in Congress 1903–5 and 1907–11. He was elected U.S. Senator for the terms 1911–7 and 1917–23. After the sinking of the "Lusitania" in 1915, he believed that action on the part of America should be limited to a demand for reparation. In 1917, however, he supported the resolution for a declaration of war against Germany, and in 1918 became chairman of the Senate committee on foreign relations. When the President submitted to the Senate the Treaty of Versailles, Senator Hitchcock led the administration forces by virtue of his office, giving strong support to the League of Nations.

HOBART, Tasmania (*see* 13.544), the capital of Tasmania, is the political and social, but not the commercial or trade centre, as it is reached from the north coast by a slow railway journey. Since electric power has been available from generating works at Great Lake, which began to give a large output in 1921, zinc works, a chocolate and sweet factory, and carbide manufacturing works, have been started near the town. A large number of summer visitors from the Australian mainland provide a livelihood for many inhabitants of Hobart, which had a population of 53,132 in 1921 (including suburbs), representing a quarter of the population of Tasmania. The magnificent sheltered harbour in the river Derwent, which is 2½ m. wide at Hobart, has some 2½ m. of wharfage, with depths of 45 to 65 ft. alongside the pier.

HOBHOUSE, LEONARD TRELAWNEY (1864–), British sociologist, was educated at Oxford; he became fellow of Merton College in 1887, and of Corpus Christi in 1890. Engaging at first in journalism, he served for five years on the staff of *The Manchester Guardian*. An active Liberal, he was secretary of the Free Trade Union in 1903–5 and published several political works, notably *The Labour Movement* (1893; 2nd ed., 1898) and *Democracy and Reaction* (1904), showing strong sympathy with collectivism, which he maintained to be not inconsistent with Liberalism. But in 1907 he was appointed Martin White professor of sociology in the University of London, and next year became editor of *The Sociological Review*. Thenceforth, except for a few war publications, he devoted his energies to writing and lecturing on ethical, psychological and sociological subjects. His principal works are *The Theory of Knowledge*, 3rd ed. (1921); *Mind in Evolution*, 2nd ed. (1915); *Morals in Evolution*, 2 vol., 3rd ed. (1915); *Development and Purpose* (1913); and *Principles of Sociology* in four separate sections (1918–24); the social application of ethical principles; in collaboration with G. C. Wheeler and M. Ginsberg, *The Material Culture and Social Institutions of the Simpler Peoples* (1915); and with J. L. Hammond, *Lord Hobhouse; a Memoir* (1905).

HOCKEY (*see* 13.554).—Since the World War, hockey has definitely established itself in Great Britain as a very popular game. During the years immediately before 1914 there was a steady increase in the number of clubs affiliating to the various county associations, and also in the number of teams put into the field. To-day there are about 1,000 clubs in England alone. In Ireland, the game more than held its own, but in Scotland and Wales there was little or no progress, due in some measure to lack of suitable grounds. In the services and at the universities, however, every year saw new adherents to the game, and since 1908 Cambridge has given a "full blue" for hockey. In 1910 the foreign countries in which hockey was played were France, Germany, Belgium, Denmark and the Netherlands. An annual match was instituted between England and France in 1907 and in 1913 Germany was also met. Turning to British dependencies, we find associations flourishing in Australia, New Zealand, South Africa and India.

The post-War period in Great Britain is noteworthy for the fact that the game is rapidly becoming more democratic. This is largely due to the initiative of the large banks, insurance companies and business houses in providing larger and better grounds for their employees. A newcomer to the ranks in the services is the Royal Air Force, which has some 30 affiliated stations. This arm of the services, together with the navy and the army, form the Combined Services Hockey Assn., which plays annual matches with one or other of the five divisions into which the English counties are grouped. The number of public schools playing hockey is now considerable.

The Game throughout the World.—It is, however, in foreign countries and, in a less degree, in the Dominions, that hockey has made a large stride forward since the World War. Taking Europe first of all, Spain, Austria, Switzerland and Czechoslovakia, have many flourishing clubs. The French have taken to the game with enthusiasm, and they hold inter-regional matches, corresponding to the divisional matches held in England. The Belgians are forging ahead and the Germans have a large number of players, Hamburg being the chief centre.

Turning to the Dominions, Australia and New Zealand are making headway. In South Africa, too, the game is increasing in popularity, with the result that in 1925 a South African Federation was formed. But so far as numbers are concerned, India is the biggest hockey country in the world. It is roughly computed that there are about 3,000 teams in India and recently an All-India Federation was formed to include the 24 provinces. The game in India is generally played all the year round; the natives are very fast and amongst them are many clever players. Japan is a newcomer to hockey and has formed an association to which some 50 clubs are affiliated. The Japanese Army and Navy have also included the game in their athletic curriculum and there are several service teams. In China a few of the more educated Chinese prefer hockey to association football, and it is extensively played in China by foreigners of various nationalities, principally in Hongkong, Shanghai, Pekin and Tientsin.

BIBLIOGRAPHY.—S. Christopherson and E. L. Clapham (rev. by E. Green), *Hockey and Lacrosse* (1909); E. E. White, *Learning to Play Field Hockey* (1920); S. H. Shoveller, *Hockey* (1922); H. Frost and H. J. Cubberley, *Field Hockey and Soccer for Women* (1923); K. E. Lidderdale, *Hockey for Girls and Women* (1924); see also *The Hockey Annual*, and *The Hockey and Amateur Football Monthly* (London). (S. H. S.)

United States and Canada.—The game of Ice Hockey is native to Canada and was first played in an organised way in the cities of Kingston, Quebec and Montreal and before many years it was the acknowledged national winter game of the country. The game was introduced into the United States in the early 90's, when Canadian teams played in New York City and Baltimore. To-day it is a recognised winter sport throughout many of the northern states.

Although in Canada and the United States the game is very generally played on open-air rinks, all organised club or league hockey is played in covered rinks. Practically all the covered hockey rinks in the United States and a considerable number of those in Canada have artificially frozen ice surfaces, which give assurance of a good sheet of ice, no matter how the weather conditions may vary during the ice hockey season. In Canada and the United States, organised hockey is played under the jurisdiction of leagues or associations—the professionals, the amateurs, the colleges and the schools having their respective leagues or associations. The playing rules and the laws of the game are fundamentally the same in all leagues or associations. There is some variation in the rules pertaining to off-side play, penalty for fouls, and other minor points.

The principles of the game are quite simple. An ice hockey team is composed of six players, each one having a designated position. There are the goal guard, the right and left defence, and the three forwards—right-wing, left-wing and centre. A stated number of substitute or relief players are allowed each team—not more than six. The game requires steadiness and speed on the skates, dexterity and agility, the capacity to think and act quickly, and physical fitness. The hockey stick is made of elm wood, except for some of the lower grades t may be made from ash. It is with the stick alone that the pla manipulates the object called the puck, which is a disc mad rubber, one inch thick and three inches in diameter. The jective point in the game is to score by driving, pushing or slid the puck through the opponents' goal. Present-day rinks are l out to give an ice surface of anywhere from 180 to 210 ft. lo by 80 to 85 ft. wide. A goal post with nets attached is fixed each end of the ice surface about 10 to 15 ft. from the end boa The goals are four feet high and six feet wide. (T. Ho.)

HODGES, FRANK (1887–), British politician, was b at Woolaston, Gloucestershire. At the age of 14 he entered Vivian Colliery at Abertillery, S. Wales. His fellow miners p vided him with a scholarship to Ruskin College, Oxford, in 19 and he later went to France. Returning to the mines, he a conducted classes in economics and French. In 1912 he beca a miners' agent and six years later secretary of the Min Federation of Great Britain. In 1921 he was made joint sec tary of the National Wages Board. Elected to Parliament 1923 as member for Lichfield, he resigned his post as Secreta of the Miners' Federation. He became a Civil Lord of the A miralty in the Labour Ministry of 1924. He lost his seat at election of that year; and in 1925 was made General Secretary the International Miners' Federation. He is the author *My Adventures as a Labour Leader* (1925).

HODGKIN, THOMAS (1831-1913), British historian (s 13.557), died at Falmouth March 2 1913.

HODLER, FERDINAND (1853–1918), Swiss painter, was bo at Gurzelen in the canton of Berne March 14 1853. He receiv his early education in drawing from a Swiss landscape paint at Thun, but his artistic career began at Geneva in 1872, wh he worked under Barthelémy Menn, at the same time studyi at the university. In 1874 he won the Calame prize for a la scape. After various journeys, notably in Spain, which expla the Spanish influence in much of his earlier work, he settled do in Geneva where, with a few intervals, he remained until h death. Among his most important pictures are the "Cortè des Lutteurs" (1887), "La Nuit" (1891), "L'Elu" (189 "Eurythmie" (1895), "L'Émotion," "La Vérité" (190 "Le Jour," "L'Amour" (1908). He also painted humoro portraits and landscapes, together with many water colou and lithographs. He received many commissions for decoratio from official bodies, notably the large-scale decoration on t wall of the Hall of Arms in the National Museum of Züri called "La retraite de Marignan" (1900). In 1907 he w entrusted with the decoration of the University of Jena, and i 1911 he painted his "Unanimité" for the town hall at Hanove He died at Geneva May 19 1918.

HÖFFDING, HARALD (1843–), Danish philosopher (s 13.561), resigned his professorship at the University of Cope hagen in 1915. Among his later works are: *Moderne Filoso* (1904, English version 1915); *Spinoza's Ethica* (1906, etc.); *Henri Bergson's Filosofi* (1914, English version 1915); *Den st Humor* (1916, English version 1924); *Totalitet som Katego* (1917); *Oplevelse og Tydning* (1918); *Ledende Tanker i det 19 Aarhundrede* (1920); *Relation som Kategori* (1921).

HOFFMAN, MALVINA (1887–), American sculptor, wa born in New York City June 13 1887. She studied sculpture i New York with Herbert Adams and Gutzon Borglum, and i Paris with Auguste Rodin. After obtaining recognition in Paris where she was awarded a first prize at the Salon in 1911 fo "Russian Dancers," she settled in New York. Her memoria group, "The Sacrifice," presented to Harvard University b Mrs. Robert Bacon, but placed temporarily in the Cathedral c St. John the Divine, New York City, is considered the finest c her works. Three portraits by her of Paderewski, when exhibite in New York in 1920, attracted great admiration. Other work of hers are "John Muir" in the American Museum of Natur History, New York City; "Modern Crusader" in the Metro politan Museum of Art, New York City; "Bacchanale Russe in the Luxembourg Musé, Paris, and "Gervase Elwes" i Queen's Hall, London. One of her latest commissions was ic size stone group over the entrance of Bush House, Strand, don. Miss Hoffman was married to Mr. S. B. Grimson e 6 1924 in New York City.

OFMANNSTHAL, HUGO VON (1874–), Austrian poet, born in Vienna Feb. 1 1874. He took the degree of Ph.D. he University of Vienna and when still a schoolboy originated Romantic School in Austria by his lyric and semi-dramatic ry, which aroused much controversy at the time. He was uninfluenced by Stefan George's example and Hermann ir's criticism, but the melody and colour of his language, and art with which he gave poetic expression to complicated itual moods, in particular, were entirely new. A genius for reciating bygone cultures and a sensitive understanding of beautiful in art and in nature, characterised both the youth the man. Hofmannsthal is little indebted to contemporary ism, but his almost too susceptible personality is tinged by umerable literary influences from the Attic tragedians down Victor Hugo, Swinburne, Browning and D'Annunzio. This of originality is especially noticeable in his dramatic poems, a few of which are simply old plays of Sophocles, for example, Calderon, Molière and Otway cloaked in modern form and rit. Nevertheless he has an abiding place in the history of rature as founder of the whole German neo-romantic drama. ew of his dramas became known outside Austria through the sic of his friend Richard Strauss, others through Reinhardt's stival at Salzburg. His collected poems appeared in 1911. In er years he turned his attention to society comedy. The most racteristic of his dramas are: *Gestern* (1892); *Der Abenteurer die Sängerin* (1899); *Der Tor und der Tod* (1900); *Der Tod Tizian* (1901); *Oedipus und die Sphinx* (1906); *Cristinas Heim-r* (1922); *Das Salzburger grosse Welttheatre* (1922); and his retti: *Elektra* (1903) and *Der Rosenkavalier* (1911). See mono-ph by Sulger-Gebing (1905).

HOGG, SIR DOUGLAS McGAREL (1872–), British lawyer l politician, was born Feb. 28 1872, the son of Quintin Hogg, nder of the Polytechnic, London. He was originally intended a business career, and on leaving Eton spent eight years with father's firm of West India merchants. After serving in the ith African War (1899–1902), on his return to England he indoned commerce for the law. Called to the bar in 1902 he thwith took a leading position as a junior, and when he be-ne K.C. in 1917, immediately came to the front. His deadly wer of cross-examination, easy mastery of facts and fig-s and persuasive speech made him formidable in every id of case.

In 1922, on entering Parliament as Conservative Member for irylebone, he became Attorney General and a Privy Councillor Mr. Bonar Law's Government, receiving the usual knighthood en to a law officer. In opposition, or in office he showed him-f a powerful debater, his vigorous speech on the Campbell pros-ution (*see* ENGLISH HISTORY) had not a little to do with the de-t of Mr. Mac Donald's Labour Government. When the Con-vatives returned to power in 1924, Sir Douglas Hogg was re-pointed Attorney General, with a seat in the Cabinet.

(R. S-D.)

HOLLAND, HENRY SCOTT (1847–1918), English divine, was rn at Ledbury, Hereford, Jan. 27 1847. He was educated at on and Balliol College, Oxford; in 1872 he was ordained, be-ming the same year a tutor at Christ Church. In 1882 he was nior proctor of the university, and the same year was made a non of Truro and examining chaplain to its bishop. He was pointed a canon of St. Paul's in 1884, and in 1886 precentor. refused the offer of the see of Norwich in 1893, but in 1910 s appointed regius professor of divinity at Oxford. He died Oxford March 17 1918. Scott Holland was closely associated th the Christian Social Union for many years. He was a suc-ssful tutor and a popular professor; but it is as a preacher at he is most vividly remembered. In 1905 his *Personal Studies*, ich first appeared in *The Commonwealth*, were published in ok form. He also wrote a notable essay on *Faith*, several lumes of sermons and a life of the singer, Jenny Lind. See *fe*, by Stephen Paget (1921).

HOLLAND, JOHN PHILIP (1841–1914), American inventor, was born at Liscannor, County Clare, Ireland, in 1841. He was educated at Limerick, and was a school teacher in Ireland prior to migrating to the United States. He was teaching in New Jersey when the Civil War broke out and the conflict between the "Merrimac" and the "Monitor" suggested to him the idea of a submarine. He became a pioneer in this field and one of the most successful designers of submarine craft. The first boat, built in 1875, was a failure and it was not until his ninth attempt in 1898 that he produced a serviceable submarine from the practical standpoint. This boat was commissioned for the U.S. Navy and orders for others were placed with Holland. His great achievement was the furnishing of the submarine with two methods of propulsion, a 50 H.P. gasolene engine to be used when on the surface and electric storage batteries when submerged. The British Admiralty acquired all the patents for Great Britain, although his avowed purpose had been to invent a craft that would overcome the British naval supremacy. Holland then turned his attention to the construction of submarines for sea-going purposes, constantly improving upon his original model, and all his subsequent boats were built for the U.S. Navy, the types tending constantly to become larger. He died at Newark, N.J., Aug. 12 1914.

HOLLAND: *see* DUTCH LITERATURE; NETHERLANDS.

HOLLYWOOD, Cal., U.S.A., the principal seat of the motion-picture industry, was annexed to Los Angeles (*q.v.*) in 1910.

HOLMES, OLIVER WENDELL (1841–), American jurist, was born at Boston March 8 1841, the son of Oliver Wendell Holmes, the poet and essayist (*see* 13.616). He graduated from Harvard in 1861. On the outbreak of the Civil War in that year he enlisted and served three years in the 20th Mass. Volunteers, rising to the rank of lieutenant-colonel. He was wounded three times—at Ball's Bluff, Antietam and Fredericksburg. He concluded his military career as aide-de-camp on the staff of the 6th Div., retiring in July 1864. In that year he commenced the study of law at Harvard, obtaining his LL.B. in 1866, and was admitted to the Suffolk (Mass.) bar March 4 1867. He practised law in Boston, and in 1870 was appointed instructor in constitutional law at Harvard, at the same time becoming editor of *The American Law Review*, which latter position he held for three years. In 1871–2 he was university lecturer in jurisprudence. In 1873 he edited the 12th edition of Kent's *Commentaries*, since recognised as the standard edition. In the same year he became a member of the firm of Shattuck, Holmes & Munroe and engaged in an active practice.

In 1880 Holmes was appointed lecturer on common law at the Lowell Institute. His articles in *The American Law Review* contained the germs of the lectures which he delivered before the institute, and these in turn, in an amplified form, were published in 1881 under the title *The Common Law*. The object of the work was to present a general view of the common law, and this was done with a wealth of illustration, a charm of language and a clarity of reasoning which, apart from the erudition displayed, gave Mr. Holmes an international reputation. In 1882 he was appointed professor of law at the Harvard Law School, but resigned to accept an appointment on Dec. 8 of the same year as associate justice of the Supreme Judicial Court of Massachusetts. This position he occupied for 17 years, becoming Chief Justice on Aug. 2 1899. On Dec. 4 1902 he became an associate justice of the Supreme Court of the United States. As a judge his opinions are conspicuous for their literary style and epigrammatic force. In 1924 he was awarded the Roosevelt Memorial Association Medal for the development of public law. In addition to the works already mentioned he published in 1891 a small volume of *Speeches*, re-issued with additions in 1913 and *Collected Legal Papers* (1920).

HOLROYD, SIR CHARLES (1861–1917), British painter-etcher (*see* 13.618), died at Weybridge, Surrey, Nov. 17 1917. He arranged for the transference of a large portion of the Turner bequest to the Tate Gallery, London.

HOLTZMANN, HEINRICH JULIUS (1832–1910), German theologian (*see* 13.620), died at Baden-Baden Germany Aug. 6 1910.

HONDURAS (*see* 13.649).—A republic of Central America and an original member of the League of Nations. On Nov. 15 1922 Honduras notified the League of its intention to withdraw because of the onerous annual contribution. The area is estimated at 36,000 square miles. The population in 1914 was estimated at 562,000; official figures gave the population in 1923 as 773,408. The capital, Tegucigalpa, had an estimated population in 1923 of 40,000; the population of La Esperanza was 11,453; and that of Santa Rosa 10,574. The inhabitants are mostly Indians and mixed races: there are a few Spaniards and a large proportion of negroes. Honduras broke off diplomatic relations with Germany on May 17 1917, and on July 19 1918 war was formally declared. The constitution of Honduras was remodelled and proclaimed in a new charter on Oct. 3 1924, which gave the legislative power to a congress of 43 deputies in the ratio of one member for every 15,000 inhabitants.

I. POLITICAL HISTORY

In 1910 Miguel R. Dávila (the creature of President Zelaya of Nicaragua), who was elected president of Honduras for four years in 1906, was eliminated in a rapid campaign by Manuel Bonilla, the former president. Dr. Francisco Bertrand, who had been chosen provisional president at a peace conference brought about by the United States, served as vice-president until the death of Bonilla in 1913, when he succeeded to the presidency and was elected to a second term of office in 1915. In the campaign of 1919 a Liberal revolt forced Bertrand to resign office and flee the country. Gen. López Gutierrez, who led the revolt, caused himself to be declared dictator, and was elected president in October.

An attempt to overthrow the President was made by revolutionists from Nicaragua in Aug. 1922; and when, in May 1923, war material of the 1922 movement was discovered near the boundary, new civil disturbances were foreseen. By June many of the citizens had been driven into exile by the warring factions. Further violence marked the presidential campaign in Oct. when Gen. Tiburcio Carias, a Conservative, was opposed to two Liberal candidates. The returns of the election indicated that Carias was the popular choice, although he was a confirmed revolutionist and opposed by the Government. Early in 1924 conflicts between the three presidential candidates, Dr. Arias, Dr. Bonilla and General Carias, caused American casualties, and marines were sent to the Nicaraguan boundary and to Tegucigalpa. In April 1924 Mr. Sumner Welles was sent by President Coolidge to arrange a conference between the contestants and the neighbouring republics at Amapala. The conference was successful, and Gen. Vicente Tosta was elected president with the moral support of the United States, superseding Gen. Fausto Dávila, the provisional president.

At the beginning of July, as no arrangement could be made regarding the future president, serious disaffection was manifested and political disturbances again broke out. Both the political leaders and the revolutionists accepted Dr. José María Caseo and Ramón Alcero Vastro as president and vice-president respectively. The election at which a successor to provisional president Tosta was to be chosen was postponed from Nov. 25 to Dec. 28–30. The elections were held on the postponed date without any disorder, and Dr. Miguel Paz Baraona was elected president, with Presentación Quesada as vice-president. The new president was inaugurated on Feb. 1 1925. In March diplomatic relations with the United States, which had been severed in Feb. 1924 were resumed. In 1925 political disturbances were recurrent: Tegucigalpa was held in a state of siege in May by revolutionists, and in the west Gen. Gregorio Terrera had been actively in rebellion since February. Nicaraguan and Honduran officials prevented revolutionists from Nicaragua entering the country. Martial law prevailed. In Aug. General Tosta, as Minister of War and Marine, announced at Tegucigalpa that peace had once more been restored. Honduras ratified the first three of the Washington conventions of 1922–3, and the 13th, providing for international commissions of inquiry (*see* CENTRAL AMERICAN UNION). In Aug. 1925 eight of the agreements were awaiting the final approval of the republic.

Defence.—Military service is compulsory for all citizens Honduras on attaining the age of 21. Under the conventi signed at Washington on Feb. 7 1923 the standing army of the public was limited to 2,500. A congressional decree of Apri 1923 fixed the strength of the regular army at 3,036 of all ran

Education.—Primary education, which is secular, is free a compulsory from seven to 15 years of age. The number of c dren who do not receive instruction is high, estimated at 57 Of 79,199 children of school age in 1922 it was estimated t 32,976 attended school. In 1922 there were 850 public scho with 1,127 teachers. There were five public secondary scho and four training colleges. The National University at Tegu galpa was staffed in 1922 with 36 professors and attended by students. Military and aviation schools have been established the capital, and a school of jurisprudence at Comayagua. T Government offers two exchange scholarships with the Unit States. Expenditure on education in 1919 was 384,980 pesos.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The budget of 1923–4 was adopted by Congress the budget for 1924–5 owing to political disturbances in 19 Revenue and expenditure were estimated to balance at 9,204, silver pesos; the budget for 1925–6 was estimated at 10,832,4 pesos. The fiscal years 1914–5 to 1920–1 showed a deficit; s pluses occurred in the years 1921–2 to 1924–5. Recent politi warfare has, however, eliminated all surpluses. Military expe iture was the largest item in the budget, constituting in the cal year 1920–1 45% of all government expenditure. The forei debt, as reported by the Corporation of Foreign Bondhold amounted in Oct. 1924 to £29,114,775. The contract for the justment of the external debt was approved by the Council Bondholders and forwarded to the National Congress for sa tion. This ratification had not been given by Feb. 1926. T basis of the arrangement took the sum of £452,000 as the rep sentative value of the external debt incurred in the wars of 18 1869 and 1870, and interest on this sum at 8·86% was allowed the period of the new agreement. The total payment was to con of £1,200,000 in semi-annual instalments of £20,000 for 30 yea

Production and Industry.—Business prosperity was depres in 1923 and 1924 by wars. In the early part of 1925 compl stagnation followed bad political conditions, banditry on frontiers and floods in the fruit districts. The principal cult is that of bananas and coconuts. In 1920 the export of bana was 11,524,149 bunches; in 1923 the exports were 12,520,4 Coconuts dropped from 12,647,508 in 1920 to 8,360,720 in 19 The 1924 sugar production in the Puerto Cortes district, 30,5 950 lb., was twice that of 1923 and four times that of 1922. T prospect was that the 1925 production would show a further crease. Silver production increased in 1924, when more th 2,000,000 oz. were produced. Bananas rank first in order of i portance amongst the exports, and next in order are sugar, silv coconuts, hides, cattle, gold. Imports, in order of importan are manufactured products, foodstuffs, raw materials and lumb The United States has 90% of the trade. The chief figures trade totals of three years were:—

	1924	1925
All countries		
Imports	11,137,917	12,752,761
Exports	7,897,046	11,983,051
United Kingdom		
Imports	401,218	295,921
Exports	658,320	203,888
Germany		
Imports	198,792	308,197
Exports	10,485	28,170
United States		
Imports	9,783,811	10,252,257
Exports	7,186,045	11,072,463

Communications.—The national railway of 66 m., which w taken over by the Government in 1912, was in 1920 placed in t rol of the Compañía Agrícola, which in 1924 was reconsti- d as the Cortes Development Company. The line has been hauled to meet the demands for transporting the banana s. Four other railroads are owned by fruit companies. In the mileage of the railways was 934. Telegraph lines in 1922 lled 4,662 and telephone lines 873 miles.

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ONDURAS, BRITISH (*see* 4.615).—A British Crown colony entral America. Its area is 8,598 sq. m. and the estimated ılation (1923) is 45,527; the birth rate was 37·91 per 1,000 the death rate 20·50. Belize, the chief town, had a population 921 of 12,661. In 1923 there were 65 primary schools with 4 pupils on the registers. The Government expenditure on ic education in 1923 was £10,615. There were five private ols conducted by religious institutions, with 499 pupils.

inance and Commerce.—The chief sources of revenue were oms duties, excise and land tax and the sale and letting of wn lands. Revenue and expenditure for the four years -4 were:—

	1920–1	1921–2	1922–3	1923–4
venue	£232,496	£227,409	£234,059	£224,928
penditure	191,114	290,284	226,114	247,576

toms duties levied on the majority of imports were, in 1923–4, ,969; preferential treatment is accorded to goods of British in, 10% *ad valorem* being accorded to manufactured goods. orestry products are the chief source of the colony's wealth, agriculture has tended to engage the population. The forest was estimated at 4,000,000 ac., or nearly one-half of the re area; and 9,967,186 superficial ft. of mahogany were ex- ed in 1923, as well as 663,437 superficial ft. of cedar wood. ıitive methods of cultivation employed have prevented the lopment of banana cultivation: in 1923, 332,500 bunches of ınas were exported, and 5,964,706 coconuts. The chief orts were, in order of importance, clothing and articles of ırel, foodstuffs, cotton goods, hardware and machinery. balance of trade was adverse during the years 1922–4. total trade figures were:—

	1921–2	1922–3	1923–4
ıports	£688,000	£692,716	£830,594
ports	627,000	593,178	657,794

922, 71% of the export trade was with the United States and 8% with Great Britain.

he United States gold dollar is the monetary unit, and ish and United States gold coin are legal tender. In 1912 king business was taken over by the Royal Bank of Canada. osits in the six Government savings banks were in March 4 $164,236.

e A. B. Dillon, *Geography of British Honduras* (1923); *Colonial e Reports*, annual series, London.

ONGKONG or HIANG-KIANG (*see* 13.657) is an island off southeast coast of China, 11 m. long and from 2 to 5 m. d. It is a British Crown Colony and was ceded to Great ain by the Chinese Govt. in 1841. The total population of gkong and the leased territory of Kowloon was estimated 3) 681,000, of whom the majority are Chinese British sub- s. At the Washington Conference the Chinese delegates asked c. 3. 1921) for the surrender of all the leases of Chinese itory, including Kowloon, to foreign Powers, but Mr. (Lord) our declared that Great Britain could not contemplate the ender of Kowloon, as without it Hongkong would be strate- lly untenable. He also pointed out that Hongkong ranks "easily first among the ports of the world," was a free port and therefore that its preservation was not only a British but a world interest.

Shipping and Trade.—The total shipping entering and clearing at Hongkong in 1924 was 764,492 vessels of 56,731,077 tons; barely more than one-third of the tonnage of ocean going ships was British. Hongkong's annual turnover of trade aggregates nearly 150 million sterling a year. Her import of opium remains important, amounting in 1923 to 550 chests uncertificated Indian opium and 216 chests Persian opium. The Persian opium went to Formosa; of the Indian opium 290 chests were for the Macao opium farmers and 186 for the Government monopoly. The total imports of all goods in 1924 (including bullion) were valued at £75,155,000, of which 13·1% came from the United Kingdom; the total exports at £63,675,000 of which only 1·2% were consigned to the United Kingdom. There are no duties upon imports and exports except on liquors and tobacco and a light due on shipping of 2 cents per ton for each call. Hongkong itself produces little and is principally a port of trans-shipment for goods. Some of her chief exports are rice, tin, tea, tobacco, etc.

Revenue and Expenditure.—The budgets for the three years 1924–6 are as follows:—

	Revenue Hongkong dollars	Expenditure Hongkong dollars
1924	24,209,638	26,726,426
1925 (revised estimate)	22,279,855	30,032,127
1926 (estimate)	23,790,615	21,367,743

In spite of apparent deficits the Colony's credit balance was expected to be over $5,000,000 at the end of 1925 and about $2,500,000 at the end of 1926 as the Government, in view of large balances in the Treasury from previous years deliberately budgeted for deficits.

Industries.—The four leading industries are shipbuilding, rope-making and the manufacture of sugar and cement. Other industries are glass blowing, soapmaking and toy manufacture, etc. In 1921 Hongkong's shipbuilding yards launched more vessels than the rest of the British Empire, outside the United Kingdom, together.

The Boycott of 1925.—For 80 years Hongkong progressed in mutually advantageous trade relationships with Amoy, Foochow and Canton and Swatow in South China, but in June 1925, an anti-foreign boycott began in China which interrupted commercial intercourse. The circumstances leading to this boycott were mainly the discontent of "young China" with foreigners' extra-territorial rights and with foreign concessions, and the impotence of the Central Government in Peking to enforce its own mandates. At the beginning this anti-foreign feeling was mainly directed against Japan and led to various strikes in Japanese cotton mills in Shanghai in the early part of 1925. On May 30 1925 the famous "Shanghai incident" occurred when a meeting was held by Chinese students to protest against the action of Japanese mill-owners who a fortnight before had fired in self-defence on Chinese strikers. Ordered to disperse the students resisted and attacked the police station. The police fired on the mob, killing four outright and wounding several, five fatally. This incident was the signal for a violent anti-foreign outbreak. As British interests predominate in China British firms were the main objects of attack by means of a commercial boycott and Hongkong, as the exemplification of the British Empire, was an obvious target.

The first serious manifestation was the withdrawal of ships' crews on June 19, followed by a general exodus of workers. Regulations were promulgated by the "All China General Labour Union" and the "Canton-Hongkong Strike Committee," the main points of which *vis-a-vis* Hongkong were that goods exported from or imported to Kwangtung should not pass through Hongkong and that foreign vessels passing through Hongkong should not discharge cargo in Kwangtung. In consequence of this boycott serious damage has been done to Hongkong's trade. The policy adopted by the British Govt. has been that of patience, *i.e.*, allowing the Chinese merchants to discover for themselves that Hongkong is not the only sufferer by the suspension of trade relations. (*See* China.)

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HOOKWORM (*see* 2.58), parasitism caused by the hookworms *Necator americanus*, *Ankylostoma duodenale*, and, more rarely, *Ankylostoma braziliense*, which inhabit a relatively small portion of man's small intestine. A single healthy female hookworm passes daily several hundred eggs which leave man in his excrement. Under favourable conditions, such as its deposit on suitable soil, larvae form therein, hatch, develop to an infective stage, and enter the soil. Infection ordinarily occurs through the piercing by infective larvae of the skin, commonly of one who walks barefoot over infected soil. Carried by the circulation from the skin to the lungs, larvae reach the air passages and, like all foreign bodies, are driven up these to the throat, are swallowed, and so finally reach the small intestine. Man's normal mechanisms are thus subverted to the hookworm's use.

The treatment of ankylostome infestation involves, firstly, disinfestation by a vermifuge or anthelmintic, and, secondly, neutralisation of ill effects consequent on infection. To increase their concentration in the bowel, and presumably their efficacy, anthelmintics have customarily been preceded by purging and fasting. Accumulating evidence however suggests that purging lessens effectiveness. Starvation, beyond the ordinary nightly fast, increases, for some drugs, risk of poisoning the host. Anthelmintics are best given in the early morning. The ideal vermifuge, with a dosage which poisons all hookworms without endangering the host, is non-existent. The dosage employed for any drug should give the greatest efficiency compatible with safety, and may be termed the optimum dose. Attainment of increased safety is attempted by dividing the optimum dose into fractions, usually 3 or 4, given with intervals of one or two hours, by which means treatment can be stopped at any stage should ill effects appear, while efficacy is apparently increased; nevertheless supervising costs of mass treatment are thereby increased. Subsequent removal of the drug by purgation lessens risk of poisoning.

The many millions of persons infected throughout the tropics necessitates mass treatment, the essentials of which, namely safety, efficacy, cheapness, and palatability are varyingly combined in the five anthelmintics in present or recent use. These are eucalyptus-chloroform, betanaphthol, thymol, oil of chenopodium, and carbon tetrachloride. By some they have been administered promiscuously to whole communities in which examination of a few individuals has shown a high rate of infection.

Eucalyptus-chloroform has been almost completely abandoned as inefficient. Pure betanaphthol, in optimum dosage of two grammes, is inefficient; in larger doses it has caused deaths in India and Brazil. Thymol and oil of chenopodium, in their respective optimum doses of 4 grammes and 1·2 cubic-centimetres or mils (the latter dose equalling 48 drops or 20 minims) have for *N. americanus* equal efficiency and minimal risk; contrary statements emanate from the use of oil of chenopodium in excessive dosage of 3 mils, due apparently to considering a drop of this liquid as equivalent to a minim. For *A. duodenale* chenopodium appears the better drug, and is, in London, the cheaper. Its active principle is ascaridol. Unfortunately the oil contains markedly varying quantities of this substance, and its amount lessens on keeping. Ascaridol, extracted and administered in place of the whole oil, is effective but relatively costly. Carbon tetrachloride, recently introduced, has been taken by many thousands of persons in dosage of three mils, and has proved most efficient. The medicinally pure drug produces in large doses, in dogs, extensive fatty degeneration, followed by necrosis of the liver, and, apparently, of the kidneys; changes aggravated by starvation and fatty food, and lessened by glucose. Extensive similar change has been present in man when death has followed the 3-mil dose. A number of such deaths are now recorded.
Clearly this dose requires reduction, so that the efficacy of car
tetrachloride under optimum dosage has still to be ascertai
It is the cheapest of all advocated treatments. A combinatio
this drug with ascaridol is being tested.

Hygienically viewed, treatment of whole unsanitated c
munities lessens the risk of further infections; since destruc
of female worms diminishes the seeding of egg-containing
terial upon the soil, and, on the whole, the number of infec
larvae originating therefrom. Nevertheless, an imperfe
treated, and still lightly infected, person, seeding a favour
spot, is a danger to the community.

Individually viewed, disinfestation, by treatment, of the
viously ill and presumably heavily infected, restores hea
always provided damaged tissues be still repairable. In the
of apparently healthy, but infected, persons, comparison of t
condition of general health, wage-earning capacity, blood s
and, in children, development of body and mind, bef
and again a sufficient period after, disinfestation shows
they are often markedly improved by disinfestation; so th
light infection definitely handicaps the apparently heal
Whether the lightest infections do, or may, penalise the i
vidual is questioned. If, as now appears likely, we can detec
fection by a single female worm, treatment producing com
disinfestation of such cases, combined with critical observa
of conditions before and after effecting this, will doub
shortly settle this point, so vital to the individual and commu

Iron and arsenic, ineffective before, may be essential for
bating anaemia after disinfestation. Treatment of skin les
at the site of infection varies with the condition present.
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(C. La

HOOKER, SIR JOSEPH DALTON (1817–1911), British bota
(*see* 13.671), died at Sunningdale, Berks., Dec. 10 1911.

HOOPER, HORACE EVERETT (1859–1922), publisher
The Encyclopædia Britannica, was born in Worcester, M
Dec. 8 1859. He was of English descent, his father's family
ing settled in New England about 1650, while his mother
a descendant of John Leverett, Governor of Massachus
1672–9. Having been educated in the public schools of W
cester and of Washington, D.C., he started in business in e
life at Denver, Colo., but a few years later removed to Chic
where with others, he organised the Western Book & Statio
Company, with book stores in a number of the large wes
cities. In 1895 he moved to New York and joined a comp
for the sale of *The Century Dictionary*, and his success in
enterprise led to wider fields. In 1897 he went to London
arranged with A. & C. Black, publishers of *The Encyclop*
Britannica, for a reprint of the 9th Edition of that work, and
The Times for its sale through that paper. Later he purch
the copyright. By reducing the price and by providing for
ments in small monthly instalments the sale of the work
revolutionised, 70,000 sets being sold in the next five y

The success of this enterprise led Mr. Hooper to have prepa
in 1902, a large supplement in 11 volumes (under the editors
of Sir Donald Mackenzie Wallace, President Arthur T. Ha
of Yale, and Mr. Hugh Chisholm) which, added to the volu
of the 9th Edition, formed the 10th Edition. For this also t
was a large sale. His next enterprise was *The Historians'*
tory of the World, 1904, a work in 25 volumes. Meanwhile
Hooper's relation with *The Times* grew more close. He took
intimate part in the business management, and it was at
suggestion and under his personal direction that *The T*
Book Club was formed. In 1908 when the proprietorship of

s passed into the late Lord Northcliffe's hands, Mr. Hoop- onnection with that paper came to an end.

1903 Mr. Hooper entered upon a larger enterprise than any ttempted, the preparation of an entirely new edition, the of *The Encyclopædia Britannica*, under the editorship of Hugh Chisholm. This was published in the closing months 10 and the first of 1911 under an arrangement with the bridge University Press. Hitherto all large works of refer- had been issued volume by volume over a period of years. is energy and the liberal expenditure of money, Mr. Hooper ged that the 11th Edition of *The Encyclopædia Britannica* l all be published at the same time, thus greatly enhancing sefulness of the work. Of this edition 75,000 sets were sold e next few years, the use of India paper being one factor in ccess. In 1915 Mr. Hooper published the work in a smaller heaper form known as the Handy Volume Issue, the con- being identical with the original issue. In this form nearly oo sets were sold within a few years. The last enterprise in Mr. Hooper was engaged was the publication in 1922 of hree War Volumes of *The Encyclopædia Britannica*, which lemented the 11th Edition, and with the 29 volumes of that n constituted the 12th Edition.

r. Hooper's success in publishing and distributing so widely nportant works mentioned above lay partly in the original- oldness and brilliance of his operations, but chiefly in his in the intelligence and ambition of the great masses of the le. He believed in the educational value of good books, and the people would order such books and use them if the er were properly placed before them. The ideals he set e himself were the maintenance in *The Encyclopædia Bri- ca* of the highest standard of scholarship and the placing of ork as an educational aid in the greatest number of homes. y professional educationalists of note have done less than he rd popular enlightenment. For a number of years Mr. er lived in England. He was a strong believer in the unity e English-speaking peoples, and exerted his influence toward emoval of causes of friction between England and America the establishment of cordial feeling and a mutual under- ling. He died at Bedford Hills, N.Y., June 13 1922.

OOVER, HERBERT CLARK (1874–), American engineer public official, was born of Quaker parentage on a farm at Branch, Ia., Aug. 10 1874. After the death of his father 78 and of his mother three years later, he was brought up in arm homes of Quaker relatives in Iowa and Oregon. At the f 13, while attending night school at Salem, Ore., he began rn his own living, working in truck gardens and as an office When Leland Stanford, Jr. University was opened in 1891 ntered with the first class and specialised in engineering. uating in 1895, he worked for a time with the U.S. Geo- al Survey, in California mines, and as a junior engineer in ornia, Colorado and New Mexico. In 1897 he went to ralia as mining engineer; returned to the United States in ; and subsequently accepted the post of chief engineer of newly established Dept. of Mines at Peking, China. In a he made extensive surveys, which, however, were inter- ed by the Boxer outbreak. He returned to California in and thereafter was engaged as an engineer in the United es, China, Australia, Burma and elsewhere. When the War ght this phase of his career to a close in 1914, the companies hich he was directing engineer employed upward of 175,000

r. Hoover was in Europe in 1914 on a mission for the pro- d Panama-Pacific Exposition, and so happened to be in lon at the outbreak of the World War. At that time thou- s of Americans in Europe found their funds shut off, and Hoover organised a committee for their relief, facilitating eturn of over 100,000. The sudden invasion of Belgium by Germans rendered a large part of the Belgian civilian popu- n destitute, and on Oct. 22 1914, the Commission for Relief lgium was organised and Mr. Hoover appointed chairman. RELIEF). Its activities were later extended to devastated hern France. This organisation administered over $950,000,000, provisioning some 10,000,000 people—a task requiring the most rigorously economical system of food distribution. The commission operated a fleet of about 200 ships. Mr. Hoover's services were rewarded by King Albert I. of Belgium, who, as a unique distinction, ordained him "Citizen of the Belgian Nation and Friend of the Belgian People."

In Aug. 1917, after the entry of the United States into the War, President Wilson appointed Mr. Hoover U.S. Food Administrator. He at once established an organisation throughout the United States for stimulating production, preventing speculation and hoarding, and conserving food supplies. Exports of food were increased from a pre-War rate of 6,000,000 tons per annum to a rate of 20,000,000 tons per annum. He established the U.S. Grain Corp. and the Sugar Equalisation Board, which, together with the Food Purchase Board under his direction, purchased and delivered all army, navy and foreign supplies, the total turnover amounting to over $11,000,000,000. Mr. Hoover also served as chairman of the Interallied Food Council. After the Armistice, which at his suggestion provided for the furnishing of food supplies to enemy countries, he became chief executive officer of the joint Allied committee which later developed into the Supreme Economic Council. He also established the American Relief Administration, which, together with the U.S. Food Administration and U.S. Grain Corp., was instrumental in alleviating the food situation of Europe, separate food administrations being formed in 23 different countries. By the autumn of 1919 these organisations had handled some $700,000,000 worth of supplies. As a result the great typhus epidemic in Poland and Rumania was successfully resisted. Six million outcast and ill-fed children were cared for through a special fund. After the Armistice Mr. Hoover raised a fund of over $50,000,000 with which to continue child-feeding in eastern and central Europe during 1920 and 1921. In 1922, he superintended the systematic distribution of food to 12,000,000 persons in the famine-stricken districts of Russia, a task requiring over 1,000,000 tons of food and an expenditure of over $65,000,000.

In 1920 Mr. Hoover's friends conducted an unsuccessful campaign to secure his nomination for the presidency on the Republican ticket. After Harding's election as president, Mr. Hoover entered his Cabinet as Secretary of Commerce. He signalised his assumption of office by a complete reorganisation of the department, his object being to change the attitude of government toward business from that of interference to that of co-operation. He sought the aid and advice of prominent men engaged in industry, agriculture and commerce, and, with their co-operation, co-ordinated the various bureaux of his department, in order that it might serve most effectively the interests of producers, manufacturers and distributors. Noteworthy among the means employed was the encouragement, through a Division of Simplified Practice, of a general reduction in the number of different varieties and sizes in which articles of commerce were manufactured. (*See* STANDARDISATION.) Both as a means of stabilising credit and production and as an aid in the expansion of foreign trade, the statistical services of his department were widely expanded and made promptly available. The Patent Office and the Bureau of Mines were transferred to Mr. Hoover's department in 1925. Legislation pending in 1926 for the placing of civil aviation and wireless telegraphy under its supervision failed.

Early in 1923 Mr. Hoover had aroused interest by pointing out the danger of a foreign monopoly of raw materials and urged a world-wide search for new sources and increased supplies of rubber. This action was directed chiefly against the alleged monopoly of rubber by Great Britain, the government of which had passed legislation affecting the price of rubber, the United States being the chief consumer of this commodity. His other important activities included the chairmanship of the St. Lawrence river and Colorado river commissions and of the North-eastern Super-power committee. He presided over a number of national radio conferences and served on the World War Foreign Debt commission. At the Republican National Convention of 1924 he was put forward, against his protest, for the Vice-Presidency, and received 334½ votes, Gen. Dawes being nominated with 682½. He was at different times offered the Secretaryship of the Interior and of Agriculture, but he preferred to remain at the head of the Dept. of Commerce.

Outside his official activities Mr. Hoover organised in 1922 the American Child Health Assn. and became its first president. He also served as trustee of Stanford University, where he founded the Hoover War Library. In 1925 he accepted the chairmanship of the National Research Endowment, which undertook to raise $20,000,000 for research in pure science.

He wrote *Economics in Mining* (1906); *Principles of Mining* (1909), and, jointly with his wife, Lou Henry, a translation (1912) of Agricola's *De Re Metallica,* a Latin treatise on mining and metallurgy which had remained the standard textbook for almost 200 years after its appearance in 1550. He published *American Individualism* in 1922. (J. W. T.)

HORNADAY, WILLIAM TEMPLE (1854–), American zoologist, was born at Plainfield, Ind., Dec. 1 1854. He was educated at the Iowa State College. Having made a special study of zoology, he travelled extensively to collect specimens, visiting (1874–9) Florida, Cuba, the West Indies, South America, India, Ceylon, the Malay Peninsula and Borneo. From 1882 to 1890 he was chief taxidermist at the U.S. National Museum, Washington, D. C. In 1896 he became director of the N.Y. Zoological Park at the Bronx, New York City, from which position he retired in 1926. He was active in promoting game preserves and instigating legislation for the protection of wild life, having been instrumental in founding the Permanent Wild Life Protection Fund ($105,000). It was largely due to his action that the bison was saved from extinction on the American continent.

Hornaday wrote a number of fascinating works on animal life, among which may be mentioned *Two Years in the Jungle* (1885); *American Natural History* (1904); *Camp-fires in the Canadian Rockies* (1906); *Our Vanishing Wild Life* (1913); *Minds and Manners of Wild Animals* (1922); *A Wild Animal Round Up* (1925).

HORNE, HENRY SINCLAIR HORNE, 1st Baron (1861–), British general, was born Feb. 1 1861. He joined the Royal Artillery in 1880 and served on the staff throughout the South African War (1899–1902). In 1912 he became inspector of artillery, and in Aug. 1914 he went to France in command of the artillery of the I. Army Corps. At the end of 1915 he was given charge of the XV. Army Corps in Egypt and he took this to France in April 1916, and commanded it during the opening phases of the battle of the Somme. His method of employing his guns during these operations attracted much attention and was signally successful, as was recognised by his being chosen in Sept. to succeed Sir C. Monro as leader of the I. Army. His troops took a prominent part in the battle of Arras, 1917, and when the enemy, in March and April 1918, made his great effort they repulsed all attacks that were made upon their front. Then, when the Allies' counter-offensive developed in the late summer, their part in the final victories was conspicuous. For his services he was raised to the peerage as Baron Horne of Stirkoke, and received a grant of £30,000.

HORNE, SIR ROBERT STEVENSON (1871–), British politician, was born at Slamannan Manse, Stirlingshire, Feb. 28 1871. Educated at George Watson's College, Edinburgh, and the University of Glasgow where he graduated as M.A. and LL.B. he took first-class honours in philosophy in 1893 and in 1895 became lecturer in philosophy at University College, Bangor. Called to the Scottish bar in 1896, in 1910 he became a K.C., and stood unsuccessfully as a Unionist for Stirlingshire in both the general elections of that year. In the course of the War he was appointed assistant inspector-general of transportation. In 1917 he was made director of the Admiralty Dept. of Materials and Priority. In 1918 he became director of the Admiralty Labour Dept., being also made Third Civil Lord of the Admiralty and created K.B.E. Later in the same year he was elected Unionist member for the Hillhead Division of Glasgow. In 1919 he became Minister of Labour and as such presided over the National Industrial Conference of February and April 1919. In 1920 he became President of the Board of Trade and received
the G.B.E. In 1921 he was appointed Chancellor of the
chequer in succession to Mr. Austen Chamberlain, in Mr. Ll
George's Coalition Ministry, but he did not accept office un
Mr. Bonar Law or Mr. Baldwin. Instead he associated him
with the management of two or three large commercial und
takings, including one of the leading English banks and beca
an important figure in business circles. He was elected l
rector of Aberdeen University in 1921.

HORNIMAN, ANNIE ELIZABETH FREDERICKA (1860–
British theatrical manager, was born at Forest Hill, Lon
on Oct. 3 1860. Educated privately, she studied art for a per
at the Slade School under Prof. Legros. At an early age she
came interested in the theatre, and to the furtherance of
cause most of her subsequent life was devoted. Her first thea
cal enterprise at the Avenue Theatre, London, in 1894 wa
failure. In 1904 she became associated with the Abbey Thea
Dublin, and subsidised the Irish National Theatre Society, wh
presented a series of plays by Irish dramatists dealing with v
ous phases of Irish life. She will be chiefly remembered, howe
for her institution in 1907 of the Repertory Theatre movem
in Manchester. She acquired the Gaiety Theatre, Manches
in 1908 and converted it into a repertory house in which som
the best known plays of modern times were originally p
duced. In 1921 she relinquished her control as owner and c
ductor of this enterprise, after 14 years of unbroken success.

HORSE-RACING (*see* 13.726).—During the World War hor
racing and the breeding of thoroughbreds were beset with
precedented difficulties. The latter was quietly carried on
spite of the scarcity of forage. As for the former some owners
racehorses went out of business altogether, but many carried
with the restricted racing permitted by the Government.

Racing Before the War

In 1910 the colts that gained classic distinction were N
Gow (Two Thousand Guineas), Lemberg (The Derby) a
Swynford (St. Leger). When both colts were really well th
was little or nothing between Lord Roseberry's Neil Gow, a s
of Marco, and Mr. A. W. Cox's Lemberg by Cyllene. Thou
Lemberg was beaten by a few inches by Neil Gow for the Gu
eas, revenge came in the Derby. Lemberg won; Neil G
who had developed curb trouble a day or two before the ra
was unplaced. Yet, when Neil Gow was right again, the p
ran a memorable race for the Eclipse Stakes and a dead h
resulted. Swynford came on the scene rather late in the seas
Lord Derby's big colt, a son of John O'Gaunt, matured la
and was never heard of until he won the Liverpool Sum
Cup under a low weight. There was a big gap to be brid
between that achievement and the winning of the St. Le
but Swynford was a colt right out of the ordinary. He dev
oped with amazing sureness and rapidity, and, ridden by Fra
Wootton, then a boy jockey of rare skill and understandi
he won; though Maher, who had the mount on Lemberg,
much blamed at the time for riding with poor judgment, whi
it was alleged, robbed the Derby winner of the hono
Lemberg was Cyllene's third Derby winner. His four
Tagalie, came only two seasons later. The two earlier ones h
been Cicero (1905) and Minoru (1909). Both Lemberg a
Swynford were destined to achieve fame at the stud. It is
teresting to recall that in 1910 the highest priced yearling amo
the Sledmere lot made only 1,900 guineas. In 1920 Lord Glan
gave 14,500 guineas for Blue Ensign from the same stud.

In 1911 the Derby winner, Sunstar, bred and owned by
J. B. Joel, was above the average. This brown son of Sundri
and Doris won both the Two Thousand Guineas and the Der
in addition to the Newmarket Stakes. He could not be train
again through breaking down in the Derby, which he won
three lengths. This explains his absence from the field for
St. Leger, which that year was won by Prince Palatine, a bay
of Persimmon. There was nothing in Sunstar's two-year-
career to suggest such distinguished classic honours, though
was a smart colt. His dam, Doris, was an insignificant lit
mare by Loved One that could win only a paltry selling ra

l with Sundridge, who was no more than a brilliant sprinter
in training, Doris produced the high class Sunstar, whose
orth was disclosed when he came through a great trial in
e for the Two Thousand Guineas. He proved to be an
shing foal getter, and included in his progeny were some
highest class horses of their day, *e.g.*, Buchan (twice the
r of the Eclipse Stakes), Craig an Eran (winner of the Two
sand Guineas in 1921), Galloper Light (winner of the
l Prix), Sunny Jane (winner of the New Oaks), Somme
Blink, Skyrocket and Zambo. It was the owner of
ar, who, in the following year, gave £40,000 for Prince
ne after that horse had won the Ascot Gold Cup in
on to taking St. Leger honours in 1911. Prince Palatine
ought primarily for stud purposes, but he was not a suc-
ınd after a few seasons was sold to France, and later, was
d in America.

year 1912 was not a good year for three-year-olds. There
o outstanding horse unless it was Tracery, who was late
turing, and on that account was only "half" a horse when
e occasion of his debut, he was able to run third for the
to the grey filly Tagalie and Jaeger. It said something
e poverty of the colts when Sweeper II., owned by Mr.
ea, who bred the colt in France from American parents,
he Two Thousand Guineas. Sweeper II. was trained in
Britain and ridden by Maher. It was believed that he
win the Derby, but he proved to be sadly deficient in
na. It was in the One Thousand Guineas, the classic race
llies, that Tagalie forced herself on public notice. The
mean-looking daughter of Cyllene could stay, as well as
t, and the combination of virtues enabled her to win the
y. Greys were sufficiently rare on our racecourses at that
to attract special notice. Then she was a filly, and though
rinetta had won the Derby as well as the Oaks only four
before, the instances of fillies winning the Derby were still
few indeed.

en Tracery won the St. Leger he was a different horse.
d of being lacking in strength and development generally
s now "made up," though still leaving further scope for
vement as a four-year-old. He won the St. Leger by five
s and among his victims far down the course was the grey
y winner. Tracery was destined to become noted as a sire.
id well in Great Britain and was sold to the Argentine
er, Señor Unzue, for the unprecedented sum of £53,000.
ft behind him a Derby winner in Papyrus (1923), and sub-
nt to that event he was repatriated for a big sum, but did
ve for more than one covering season.

e Derby of 1913 was a drama of thrills. There was the hot
rite, Craganour, belonging to Mr. Bower Ismay, who had
between 3,000 and 4,000 guineas for the son of Desmond and
ration II. as a yearling. Craganour was a high class two-
old, and grew into a medium-sized colt, of a light bay
r. Onlookers said he won the Two Thousand Guineas;
udge said he did not beat Mr. Walter Raphael's Louvois,
had a clear margin to spare. Craganour made no mistake
t winning the Newmarket Stakes, and came to Epsom an
anding favourite for the Derby. He was ridden by the
rican, Reiff, who for some years had been riding in France.
unknown Aboyeur, in the colours of Mr. A. P. Cunliffe, led
favourite into the straight. They raced close together,
just as the favourite had appeared to get the better of a
what rough argument the outsider left the rails and bored
probably bumped Craganour. They passed the winning
with Craganour's head in front. The stewards held an
ry, the outcome of which was that they disqualified
anour and awarded the race to Aboyeur. Craganour within
days was sold by his owner for £30,000 to Mr. Martinez
z for stud purposes in the Argentine, where he proved to be a
ble stallion. Mention may be made of the St. Leger success
ight Hawk, an unconsidered outsider, bred and owned by
el Hall Walker, afterwards Lord Wavertree. This again
non-vintage year.

e Tetrarch.—In 1913 a horse appeared that was destined to make remarkable history, both on the racecourse and at the stud, that wonder, The Tetrarch, the weirdly marked grey with big irregular white splotches, something after the manner of the nursery rocking horse. He was a well developed colt by Roi Herode, a French-bred stallion that had been located at the Straffan Station Stud in Ireland, and, mated with Vahren, produced The Tetrarch, who as a yearling found his way into the sale ring and at 1,300 guineas passed into the possession of Major Dermot McCalmont. He ran seven times as a two-year-old and was never beaten. He was a prodigy, and it is a pity that through injuring a leg while galloping, he could not be trained as a three-year-old. As a sire he became an immediate success. His progeny showed themselves to be possessed of remarkable speed, and the outcome was that there was immense competition for his stock in the sale rings, while breeders keenly sought his services for their mares. He did not sire a Derby winner, but he is represented in the records by no fewer than three winners of the St. Leger in Caligula (1920), Polemarch (1921) and Salmon Trout (1924).

The classic winners of 1914 were Kennymore (Two Thousand Guineas), Princess Dorrie (One Thousand Guineas and Oaks), Durbar II. (Derby) and Black Jester (St. Leger). They did not possess much distinction; in fact the Derby winner, who belonged to Mr. Duryea and was brought from France, was probably the worst Derby winner of the century. Princess Dorrie was a daughter of the St. Leger winner Black Jester (who went to the Argentine), but though such a fine stake winner, she did little of note as a matron at the stud. Black Jester was a son of Polymelus, one of the greatest sires of the period under review, for in several years he headed the list of winning sires. Black Jester only did fairly well at the stud, though he had many moderate winners to score for him.

Racing During the War.—It was not long before the effects of the War on racing were noted. Agitation against racing of any kind so far influenced the Government that representations were made by the Cabinet to the Jockey Club, the outcome of which was the cancellation, in 1915, of horse racing at all places except Newmarket. This took effect on the eve of what should have been the Derby meeting at Epsom. Thereafter for that year racing was restricted to Newmarket, and so that those concerned should not be hit too hard the Jockey Club instituted a series of extra meetings. It was at one of these that special races took place for the three-year-old colts and fillies, an arrangement lasting till 1918. There was a New Derby and a New Oaks.

It is extraordinary that while Rock Sand in 1903 was the last horse to win the triple crown, the Two Thousand Guineas, Derby and St. Leger, yet three horses in four years were each capable of winning the Two Thousand Guineas and the substitute races for the Derby and St. Leger known as the New Derby and the September Stakes. The explanation does not wholly lie in the fact that Pommern (1915), Gay Crusader (1917) and Gainsborough (1918) were above the average of Derby winners. In peace times horses must visit Epsom and Doncaster in search of classic honours as well as Newmarket. The mere variation of ground and the possibility of flukes, such as the splendid fairness of Newmarket must reduce to a minimum, have doubtless been contributing to the strange fact that Rock Sand in 1903 was the last horse to win all three classic races.

Pommern, who was by Polymelus from Merry Agnes, was bred by his owner, Mr. S. B. Joel, and from the manner of winning his races was a worthy holder of the highest honours on the turf. Not improbably the best three-year-old of 1916 was Hurry On, an unusually big and powerful chestnut colt by Marcovil from Tout de Suite, bought for less than 1,000 guineas by Lord Woolavington as a yearling and never beaten during his three-year-old season. It was the only year of racing he had, and before it was over he had disposed of all brought against him, including Clarissimus, who had won the Two Thousand Guineas for Lord Falmouth. Fifinella, a filly by Polymelus from Silver Fowl, bred and owned by Sir Edward Hulton, was unquestionably the classic heroine of the year, for in the same week she won both the New Derby and the New Oaks. She was no doubt a brilliant filly.

It is a pity that such a horse as Gay Crusader, by Bayardo from Gay Laura, should not have lived in times when he could have been tested at Epsom and Doncaster. All we know is that he was an exceptional colt as a three-year-old, carrying all before him and causing his great trainer, Alec Taylor, to regard him as the best horse he has ever trained, not excepting Bayardo himself. Gay Crusader was the first foal of his dam, and was a light fleshed horse with plenty of size and simply perfect action. He was equally brilliant, according to his trainer, at five furlongs or two miles, and it was a great regret to him that he could not train him as a four-year-old. From the same stable came Gainsborough to win the Guineas and the two substituted classics at Newmarket in 1918. He was a son of Bayardo from Rosedrop, who ranks as the winner of the Oaks in 1910. He was of a different type and possessed of more substance. Both he and Gay Crusader, have made their mark as sires, and Gainsborough has the distinction of siring Solario, the St. Leger winner of 1925.

Racing After the War

After the War racing at once entered upon a period of great prosperity. Attendances increased by many thousands at all racecourses, and the prices of bloodstock soared to astonishing heights. It was in 1919 after winning the Derby with Grand Parade, a son of Orby, and a number of big races at Ascot, that Lord Glanely spent money lavishly on young bloodstock. When he gave 11,500 guineas for a yearling by Swynford from Blue Tit, bred at Sledmere, he established a new record for a yearling, hitherto held by Sceptre, who had cost 10,000 guineas. In 1920 Lord Glanely gave 14,500 guineas for a yearling by The Tetrarch from Blue Tit. Prices remained high to the end of 1925, which was associated with the wonderful dispersal sale of Sir Edward Hulton's bloodstock.

Among classic winners Grand Parade was rather less than the average height of racehorses, and this has been true of more than one other Derby winner since the War, *e.g.*, Papyrus and Manna, while Humorist was not by any means a big horse. On the other hand Captain Cuttle (1922) and Spion Kop (1920) were undoubtedly big horses, especially Captain Cuttle, who was a son of Hurry On. Grand Parade was just an average Derby winner, neither more nor less. Spion Kop was a son of Spearmint, who won the Derby as far back as 1906. With his four white legs Spion Kop, who belonged to Major Giles Loder, was a conspicuous horse. He certainly won in fine style, though, like Sansovino, the hero in 1924 in Lord Derby's colours, he was not destined to do much afterwards. This has been a feature of the post-War Derby winners. Grand Parade went to Ascot, where he had great difficulty in beating a single opponent. He went forthwith to the stud. Spion Kop was kept in training until he was four years old, but he was a disappointment.

Then came the ill-fated Humorist in 1921. Donoghue, who rode Captain Cuttle, Papyrus and Manna to victory, in addition to Pommern and Gay Crusader, rode one of his most brilliant races on him, and within a month the horse died. He was found in his box dead from internal haemorrhage. Humorist had been sired by Polymelus, and was the foal of Jest, a delightful little mare that had won both the One Thousand Guineas and the Oaks for her owner and breeder, Mr. J. B. Joel. Captain Cuttle by a very easy victory stamped himself as a high-class colt, but he did not stand much further training, though he won afterwards. Papyrus, as a yearling, cost Mr. Ben Irish, a farmer, who had won an Ascot Gold Cup with Periosteum, 3,500 guineas. He was a Derby winner well up to the average, a medium-sized dark brown son of Tracery, with marked quality and a beautiful temperament. After finishing second to Lord Derby's filly, Tranquil, for the St. Leger, he was sent to New York to run a match against America's champion, Zev. With only a month in that country, on strange going, and after a trip across the Atlantic, the Derby winner had little or no chance, and he was beaten. Papyrus was unlucky as a four-year-old, for when giving away much weight h second for the Eclipse Stakes and for the Jockey Club St At least he did train on better than the others.

Sansovino won the Derby in heavy going in 1924, and whe weather was about as bad as it could be. He was twice ask race at Ascot, and though he won the first time he seemed all to pieces afterwards. He won once as a four-year-ol then went to the stud, after breaking down during the ra the Jockey Club Cup. The three-year-olds of 1925 were the average. Manna, a charming colt by Phalaris that 6,000 odd guineas as a yearling, won both the Two Thou Guineas and the Derby for Mr. H. E. Morriss. He broke at the start of the St. Leger won by Solario, and that wa last of him on a racecourse. It is true, therefore, that the War classic winners have not trained on as they should done. The last Derby winner to win an Ascot Gold Cu Persimmon, and that was in 1897. In 1926 the Derby was by Coronach owned by Lord Woolavington.

The Bloodstock Market

It was after the War that the Aga Khan took up owne and then breeding in Great Britain on a large scale. Hi vestments, chiefly in yearlings, for two or three years must run well into six figures, and he had many horses in trainin one of the finest studs in Ireland. He won the Two Thou Guineas (Diophon) and the St. Leger (Salmon Trout). He second for the Derby to Manna with Zionist, a colt tha good enough to win the Irish Derby. With Mumtaz Mah daughter of The Tetrarch, for which he paid 9,700 guineas yearling, he had a remarkably fast two-year-old. By his e prises he had much to do with the flourishing state of the bl stock market. At Doncaster in 1925 Sir Victor Sassoon 12,000 guineas for a yearling filly by Tetratema from Co and the Aga Khan paid 10,500 guineas for a filly by Gay Cru from Tête-à-Tête, both being greys. At Sir Edward Hu wonderful sale a total of 288,380 guineas was realised. highest price was 17,000 guineas paid on behalf of an Ame buyer for the Oaks winner, Straitlace, a daughter of Son-in- Other mares made respectively 12,000 and 12,500 guinea two-year-old filly, Silvretta, 13,000, and a two-year-old Legatee, that had never seen a racecourse, 9,100 gui In 1926 racing in England was flourishing, with appar more wealthy owners than ever, even though the old ra patrician owners would appear to have died out. The bre industry is in a healthy state, with all the countries of the coming to Great Britain for replenishment.

The story of racing and breeding in England durin period under review would not be complete without reference to the demonstration made in England by French- horses, and to the steadily ascending values of the high- British thoroughbred in what is unquestionably a world- market. The latter may be said to embrace every country i world in which racing takes place, and which must periodi come to England for the replenishment of its studs and sta In particular, reference is made to North and South Ame First, however, as to the successes of the French horse England, even though for the most part the blood of known strains emanating from England can be found in pedigrees.

Racing in Foreign Countries

France.—France, even more than England, neglected ra and breeding during the war. The result was that for a three years after the War, matters were at a low ebb in Fra Several successful raids were made on the Grand Prix de when it came to be re-established. This race is open to all, like the French classic races, which are strictly confined to ho bred in France, whereas the English classic races are open to world. The first English post-War Grand Prix winner was Anthony de Rothschild's Galloper Light, a son of Sunstar, undoubtedly a high-class horse. Next came the undistinguis looking black horse, Comrade, owned by M. de St. Alary, n Ireland and trained in England. His was a most romantic only for the reason that he was actually bought for only 25 as in the sale ring as a yearling by Mr. P. P. Gilpin, who d him. Such a low-priced horse was not entered in the sh classic races, but luckily he was put in the Grand Prix mph in it. Then a third year did England triumph in e's big race at Longchamps. The hero this time was Lem- , a chestnut son of Lemberg, that had been purchased as a ng for several thousand guineas on behalf of Lord Manton. nora won the Newmarket Stakes and was placed third in erby won by Humorist. Two or three weeks later he was nce, and there won the Grand Prix.

e position was destined to alter most abruptly. England ot won the Grand Prix since up to 1925, perhaps because st-class horse has endeavoured to do so. On the other the French have failed in England's classic races, but they ved a signal success in 1924 when their fine stayers, Massine ilbert de Savoie (the latter a Grand Prix winner), finished and second respectively for the Ascot Gold Cup. In the year the fastest horse in France up to a mile, Épinard, over to win the Stewards Cup of six furlongs at Goodwood. the brilliant horse did under a big weight for a three-year- Later in the year he was beaten only by a neck for the ridgeshire when his weight was the very big one for a -year-old of 9 stone 2 pounds.

was in 1924, too, that Sir Galahad III., a French classic er, was exploited at Lincoln and won the Lincolnshire licap. A year later another French classic winner in Tapin imilarly successful in the same race, but history will always hat the most notable achievement of horses sent from ce was when Forseti won the Cesarewitch and Masked el the Cambridgeshire of 1925. Both these horses were owned e same man, Mr. A. K. Macomber, who for some years past naintained elaborate breeding and racing establishments ance.

gentina.—Argentine breeders, as has been already stated, ased Tracery for £53,000 and Craganour for £30,000. have bought freely since, but the really big business since Var has been with the United States, in which country has been rapid development of breeding and racing. The was doubtless encouraged by the visits of the English y winner Papyrus, and of Épinard, but their breeders have een afraid to pay large sums for some notable horses. -class sires that have gone there include Stefan the Great The Tetrarch), Royal Canopy (by Roi Herode), Bright ht (by Gay Crusader) and St. Germans (by Swynford). said that £20,000 was paid for St. Germans. The others cost sums running well into five figures. High-priced year- and mares have found their way there, including Straitlace, ated, for 17,000 guineas, and Sunny Jane, a New Oaks er in England during the War.

dia.—India has not bought so freely since the War as just e, but the reason is economic and is not concerned with any g off in appreciation. She has simply been outbid by other tries. South Africa, Australia, Egypt and the Far East are ar customers. To Germany went Caligula, a winner of the eger since the War. Austria and Hungary are countries are rapidly regaining ground, their breeders having pur- ed for large sums the sires Light Hand, by Sunstar (de- d by Lord Astor to be the best colt he has ever bred) and ar, by Tracery, second in the Derby and also bred by Lord r. Italy is well in the market, while France is at all times a r. These facts explain why the value of the British thor- bred in a general sense has never been so high in history as the War. Moreover, this is true after making due allowance he depreciation in money values and the fluctuations in the anges.

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RACING IN THE UNITED STATES

United States.—There is the greatest possible difference between the surroundings of racing in Europe and in the United States. "Time" is the great factor in the States, instead of varying weights, in determining the speed and endurance of a horse, and training methods are totally distinct. There is no one representative body governing racing, but the states of New York, Maryland, Illinois and Kentucky have each its own body, so that punishments and penalties are limited to the individual area; this is not good for the sport. Jockeys, after passing their apprenticeship, are totally beyond control, except when riding; and, owing to a foolish emasculation of the Scale of Weights, most of the good riders of the United States are obliged to migrate to Europe almost as soon as they become really competent. The card of any day—exclusive of fixed weight stake events—will average 20 lb. below the scale for each horse started, irrespective of age or distance.

Until the jockey passes from his apprenticeship and is eligible to a contract to ride, good care is taken of him. In a number of Associations or Jockey Clubs there are churches, nightschools, gymnasiums and hospitals; for the horses there are ambulances to remove injured animals from the course, and hospitals. As for racing proper, the Westchester Racing Assn., near the City of New York, is probably the most beautiful and the most perfectly equipped course in the world. Its grandstand covers and seats 30,000, and its lawns and tree-studded, flower-bedded paddocks cover several acres.

The famous "Ten Thousand Pounder" races of Europe were balanced in U.S. racing, in 1925, by the £11,700 Futurity, the £11,500 Coffroth Derby, the £10,700 Pimlico Futurity, the £16,600 Preakness, the £10,600 Kentucky Derby, with a great probability of the Belmont and the Hopeful Stakes far exceeding these figures in 1926. All of these amounts have been built since the crucial year of 1911, when Charles S. Hughes (later Secretary of State) was Governor of the State of New York and was responsible for the passage into law of the Agnew-Hart bill, and for the drastic enforcement which caused the arrest of more than 300 well-known people only to have them discharged later for lack of evidence, and which frightened the six important associations in the state into ceasing racing for two years and caused the exportation of animals of the best blood in the country to the value of about £400,000. Racing would probably have been killed utterly in the state but for the courageous amateur sportsmen of the United Hunts Racing Assn., who laughed the law to scorn, declined to be intimidated, asked for arrest and went on racing. Two years later the important associations found courage to open their gates, and, by the underwriting of expenses by certain prominent lovers of the sport, racing was resumed at a minimum scale, and under the same, unamended law which closed the courses has prospered like the proverbial green bay tree.

In 1925 17 states accounted for 1,656 days of sport with 11,579 races decided; the stakes alone represented a value of £460,000 as against £132,700 in 1910; and the yearling sales in 1925 had a total value of £373,360, with an average of £640, as against the 1910 record of a gross value of £36,000 and an average of £65. In 1925 a new record price for a yearling was reached, this being the £10,000 paid for the colt by Man O'War, out of Tuscan Red by William Rufus. During 1925 £2,515,450 was distributed in stakes and purses, as against £600,000 in 1910.

As to the really great horses appearing since 1910, personal opinions vary widely, all depending on the quality of competition met. The interesting high-lights on the question are that Luke McLuke proved that the famous Domino strain could go a distance if properly prepared; Hourless, by Negofol, was a great performer in 1917; and in 1920 came Man O'War (whose one scandalous defeat must not be reckoned against him). He defeated every rival, and this son of Fair Play out of Mahuba, by Rock Sand, proved a remarkable sire, for all of his dozen or so progeny have won good races. Regarding the visits of foreign horses, Papyrus never had a chance, as he was shod for a fast course and raced in mud, but his conqueror, Zev, has been useless since the contest. Épinard, the French horse, was unlucky, and should have won at least one of his three races. Neither race proved anything or threw any light upon the excellences of U.S. horses bred mainly from English blood, as against the British home-bred product. (W. P. P.*)

HORTHY DE NAGYBANYA, NICHOLAS (1868-), Hungarian admiral and regent, was born June 18 1868 at Kenderes, in the family mansion in the county of Szolnok (Eastern Hungary). His family belonged to the landed gentry, and from 1635 ranked amongst the nobility. After studying at the naval academy at Fiume he entered the navy of the Dual Monarchy. After considerable sea service he was appointed A.D.C. to the Emperor Francis Joseph, and served in the naval department of the War Ministry in Vienna. At the outbreak of the World War he was appointed to command the cruiser "Novara." After Italy joined the Allies Horthy distinguished himself in the naval raids on Porto Corsini and San Giovanni di Medua, and particularly at Otranto, where on May 14 1917, with the cruisers "Novara," "Saida" and "Helgoland," he broke through the ship cordon blockading the Straits of Otranto. Horthy, although severely wounded, remained on deck and continued the fight until he succeeded in returning safely with his ships to his home port, despite the enemy's heavy fire. He was awarded the Military cross of Maria Theresa. Near the end of the War Horthy was appointed commander-in-chief of the Austro-Hungarian fleet.

After the collapse of the Monarchy and when revolution broke out in Hungary Admiral Horthy returned to the home of his ancestors and began to organise the counter-revolutionary forces in southeastern Hungary. Thanks to his popularity as a war hero, Admiral Horthy added considerably to the influence of the informal counter-revolutionary Government of Count Julius Károlyi, which in Hungarian territory occupied by French troops endeavoured to form a nucleus for all partisans of law and order. When it became obvious that the fall of Bolshevism was imminent, the second "Szeged Government" appointed Horthy to be commander-in-chief of the national army, which, after the flight of the people's commissioners (Aug. 1919), entered Transdanubia and succeeded in restoring order in territories where law and discipline had been upset by the Red Terror of Bela Kun. When the Rumanians finally withdrew their troops from the centre of Hungary the new national army, with Horthy at its head, entered Budapest on Nov. 16 1919 amidst the cheers of the population.

The restoration of order was no light job, and it was done with no light hand by a sailor who regarded the spirit of discipline in his ship as more important than the praise of kings or the blame of politicians. Horthy has been frequently attacked for failing to restrain retaliatory outrages of those who suffered under the Red Terror, and who themselves created what has generally been termed the White Terror. It must be remembered, however, that all the normal forces for maintaining order had previously been dispersed, and that without such forces it was practically impossible to control what was a natural reaction, however regrettable. When in Feb. 1920 the national assembly of Hungary was elected, Admiral Horthy, still commander-in-chief of the army, was practically the only possible candidate for the regency. Consequently he was elected to this office on March 1 1920.

As regent or governor, as the office is variably termed, Admiral Horthy had the bitter duty of ratifying the Treaty of Trianon, which his second Government, that of Count Paul Teleki, carried through in Nov. 1920. The gravest responsibilities, however, which the regent was called upon to meet were the two attempts of the late King Charles to regain the throne of Hungary. The regent of Hungary was then in a desperate conflict between an allegiance sworn as admiral and privy councillor to his king and the oath taken as regent to the Hungarian national assembly. First, in April 1921, he refused to obey the summons to hand over the Government to King Charles when the latter came to Hungary unarmed. On that occasion the Hungarian Govt. succeeded by peaceful means in getting the king to leave the country. At his second venture, in Oct. 1921, King Charles came with troops against the capital. regent and Count Bethlen's Government had no alternativ to fight him, as the Allied Powers and the states surroun Hungary were definitely opposed to the restoration of a Habs monarchy. It was a poignant task for the regent to disarm hand over to the former enemy powers the anointed beare St. Stephen's crown.

As the disturbances inevitable after revolution, Bo vism and monarchical "putsches" died down, and the li the country became more normal, the personality and ac of the regent ceased to have such critical importance. R sentative government, exercised through the national assen resumed its ordinary sway, and Admiral Horthy performe duties with constitutional correctness, supporting the ef of Count Bethlen's Government towards the economic re struction of the country. He had to lead his country thr difficulties which few men in history have had to face, and small wonder that in doing it he had to take drastic meas and has made many enemies. It is doubtful, however, if gary could have found a regent more energetic in times of or equally constitutional in times of peace. Horthy ma described as a typical sailor, frank and simple and dire manner, with no suspicion of diplomacy, and devoted to s but in official life a strict observer of the ceremonies which pertain to the head of a state that is still a monarchy.

(W. Go

HOSPITALS (*see* 13.791) (1912–25).—At the beginning o period under review two special points should be noted in nection with the general development of hospitals:—

1. The development of operating and clinical methods led increasing specialisation in the departments of general medi and surgery in hospitals.

2. From the architectural point of view, simplicity and fort were being increasingly sought, and buildings and hos premises were being to an increasing extent adapted to necessities of sanitation and hygiene.

General Features.—Attempts to create large hospitals ou urban centres and in favourable climatic conditions have to a large extent successful. In the case of old hospitals, it was difficult to make rapid changes, the various services been installed in special buildings and annexes, divided one another, each dealing with a special subject, *e.g.*, surgery, cli work, ophthalmic work, otolaryngology, children's disea gynaecology, epidemics, etc. Whereas in Anglo-Saxon hosp the principle of placing hospitals under independent ma ment maintained by voluntary aid has been adhered continental countries there has been an increasing tend to centralise hospitals by placing them under municipal, or national authority. The former method tends to encou individual initiative and the desire to make each hospita perfect as possible. The latter allows of the most practica economical distribution of the various services betwee departments concerned.

Statistics.—Hospitals were more frequented in 1912 tha previous years. This fact must be attributed not to the incr in the tendency to disease, but to the addition of a large nu of buildings and wards which allowed of a larger numbe patients being received. The dissemination of the principle hygiene has familiarised the public with medical methods has caused a marked increase in the number of patients treatment. Various statistics show the movements of pa in hospitals during the years preceding the War. In 191 hospitals in London (general hospitals, children's cli gynaecological hospitals, anti-tubercular hospitals, etc.), 9,171 beds, dealt with 134,749 patients, and were attende 1,329,567 persons.

In 1912, the Paris Department of Public Relief (*l'admi tration générale de l'assistance publique*) admitted to its ge hospitals (Andral, Beaujon, Boucicaut, Broussais, Cha Cochin, Hôtel-Dieu, Laennec, Lariboisière, Necker, Pitié Antoine, St. Louis and Tenon) 147,828 patients, and 46 patients to the special hospitals (St. Louis, Maternité, Br

Germany, in 1912, had 9,054 hospitals with 535,579
This figure includes general hospitals, military and naval
als, lunatic asylums, sanatoria, maternity homes, special
, children's hospitals, homes for the blind, etc. In 1912,
edical institutes of Vienna dealt in all with 82,939 patients.
e United States there was a noticeable increase in the
er of hospitals and clinics, and there was a considerable
pment of the specialisation of medical and surgical de-
ents.

r Conditions.—The World War of 1914 compelled hospitals
pt themselves rapidly to new requirements, *e.g.*, assistance
wounded, ambulance work, mobile hospitals in the army
medical staff, additional nurses, etc. Existing hospitals
ransformed to meet the new requirements. In addition, a
number of extra establishments were improvised.

itary and naval hospitals are directly dependent on the
ry medical service and are divided as follows:—

Permanent military hospitals, already existing in time of peace,
pecially adapted for the reception of sick and wounded sol-

Civil hospitals were placed, together with their staff, under the
ion of the military authorities;
Hospitals were installed in public or private buildings, such as
, schools, private houses, etc., to receive and deal with the
wounded from the front;
Hospitals in the zone of military operations were carried on in
nent premises or under canvas, even underground, nursing
and relief posts dealing with first aid to the wounded before
vacuation to the rear.
As described in the article MEDICAL SERVICE (ARMY), ambu-
of every type were employed. Aeroplanes, trains, barges and
specially converted and equipped, were used for the transport
and wounded to base and home hospitals.
Special hospitals for orthopaedic, for tuberculous, neurasthenic,
sed and gassed cases were organised. Electro-therapeutical,
-therapeutic, helio-therapeutic massage and special sections
also developed.
Convalescent homes were set up and many private mansions
used for this purpose.
Temporary hospitals were erected to receive influenza patients,
alaria camps were organised.

utral Countries.—In non-belligerent countries there was no
considerable change in the organisation of hospitals
een 1914–9. By the force of circumstances, the con-
tion of new buildings was slowed up, technical methods
ined more or less stationary, and the nursing staff tended to
ish, in view of the large number of volunteers serving in
elligerent countries. In 1917–8, statistics of the move-
of disease and mortality remained more or less equal
ose of 1914. Anti-epidemic hospitals were organised in
numbers in Poland, Russia, Hungary, Rumania and the
c countries.

arantine Stations.—Quarantine stations, which before the
were limited to maritime ports, were, after the War, set up
e borders of Poland, Czechoslovakia, Rumania, Hungary
the Baltic States, for the supervision of travellers arriving
countries contaminated by exanthematic typhus and re-
ng fever. Three model stations, set up by the International
Cross Committee at Narwa in Estonia, Riga in Latvia,
Iniö in Finland, dealt with the reception, supervision and
fection of thousands of prisoners arriving from Russia on
onvoys of repatriated prisoners between 1919–22.

ecial Hospitals.—The Italian Red Cross has been most
e in districts affected by malaria, and with this end in
has organised the anti-malaria sanatorium of Massalubrense,
ther with a number of motor ambulances. In Georgia, the
ical institute of Tiflis is engaged in centralising the work
e various clinics and hospital stations. In 1913 12,500
ria patients were treated in the hospitals of Tiflis. In
ntal countries may be mentioned the leper hospitals (the
es and Siam), hospitals for the treatment of snake-bites
nese Red Cross at Bangkok), and the anti-epidemic and
mer hospitals of the Chinese Red Cross at Shanghai.
itals have been supplemented by dispensaries, preventive
es, consulting offices, convalescent homes and mountain
toria and seaside hospitals. Venereal disease and derma-
tological hospitals have considerably developed. Cancer hospitals have been improved and perfected, especially as regards radio-therapeutic services, anatomo-pathological laboratories and radio-therapeutical, photo-therapeutical and radiological work.

Developments.—In 1924, the number of hospitals in London was 118 (as against 106 in 1913), the number of beds 13,460 (as against 11,840 in 1913), the number of patients treated 177,300 (as against 145,600 in 1913) and the number of consultations 6,677,000 (as against 5,020,000 in 1913). Among the principal hospitals included in these general figures, St. Thomas's Hospital alone received 10,139 in-patients and gave 488,600 consultations; St. Bartholomew's Hospital received 8,648 in-patients and had 344,226 out-patients, the London Hospital 17,331 in-patients and 553,965 out-patients, Guy's Hospital 9,495 in-patients and 487,452 out-patients. In Paris, the number of sick persons received was 238,912 in 1923, of whom 153,794 were in the general hospitals, 43,403 in the special hospitals, 29,329 in the children's hospitals, 2,071 in the mental hospitals and 10,315 in various homes and asylums.

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United States.—During the period from 1912, and more particularly from 1914 to 1925, the development of hospitals in the United States has been unprecedented. This development may be considered under the heads of (*a*) the present trend of hospitals as a social factor, (*b*) the present day construction, (*c*) specific examples and (*d*) statistics of 1925 and the increase during the period in question.

Hospitals as a Social Factor.—While there is a continued development and refinement of the care of the sick in the hospital to-day, the conception of the function of this institution has materially broadened, with a rapidly increasing tendency to regard it as a community health centre from which to radiate all health activities, particular emphasis being placed upon the development of out-patient departments (this as a means of teaching and practising preventive medicine and thereby obviating the necessity of the hospital bed), district nursing and social service. In the larger cities medical centres are being developed, in which case the foregoing community functions are associated with the instruction of student bodies in various branches, including medicine, nursing, public-health work, social service, and, in many instances, dentistry.

The tendency to develop isolated speciality hospitals is being replaced by provisions for the specialities as departments of the general hospital or by the affiliation of already existing speciality hospitals with existing general hospitals. The different types of schools teaching health work, with the various hospitals, form these medical centre groups, in which are included convalescent homes as an integral or co-ordinated part.

Present-Day Construction.—While in the earlier period hospital development in the United States was largely patterned after the developments in Europe, the present trend of large institutions is toward the "skyscraper hospital"—as St. Luke's Hospital Annex, in Chicago, with 19 stories; the Jefferson Hospital, in Philadelphia, with 17 stories; and the new Presbyterian Hospital of the Medical Centre of New York City, now under construction, with 22 stories. This tendency is extending even into the country districts where the value of land is not a factor—the University Hospital at Ann Arbor, Mich., with its nine stories, being an example.

Economy and effectiveness of administration is claimed by the promoters of the multi-story hospital movement. The newest developments lay emphasis upon small wards with a maximum of 10 or 12 beds, numerous single rooms for patients of all types, and elaborate facilities for private patients. In this type of construction it is quite common to find the kitchen, laundry and all essential services provided for in a single building along with the housing for the patients. This type of construction and administration, which is distinctly American, is not at this writing being followed in the United States to the entire exclusion of the methods commonly pursued in Europe.

Specific Examples.—A typical example of the hospital movement in the large American cities is to be found in the Medical Centre in the City of New York, in which the Columbia University College of Physicians and Surgeons, Presbyterian Hospital, Sloane Hospital for Women, Vanderbilt Clinic, The Babies' Hospital, Neurological Institute, State Psychiatric Institute and Hospital, Presbyterian School of Nursing and certain other schools and hospitals are reconstructing their institutions on a single plot of ground, having jointly undertaken all the branches of medical teaching, research and care of the sick, their simultaneous constructional programmes involving $20,000,000.

Increase in Recent Years.—At the close of the year 1925 a complete census of all the hospital facilities in the United States, however owned and controlled and for whatever type of patient, showed that there were 8,695 hospitals—a figure somewhat in excess of 50% of the number of institutions of this character in the world. These hospitals provided a total of 836,576 beds, of which 34,511 were bassinets. This compares with 5,037 hospitals, with 532,481 beds, in 1914. Of the total number specified, 341,480 beds are devoted to the care of mental and nervous diseases.

While the development of the large institutions has made unusual progress, yet the growth of the small institutions in the smaller communities seems to have a special significance and to be indicative of the popularisation of the hospital in the public mind. While in 1920 44% of the 3,027 counties in the United States had community hospitals, the record of 1925 shows an increase to 56%; 52% of all the hospitals in the United States being of 40 beds or less. The close of the period finds recorded 1,117 new buildings planned, with $309,000,000 involved in a year's construction; the total value of hospital properties being variously estimated between $4,000,000,000 and $5,000,000,000.

In the year 1925 the 56 privately owned hospitals of all types in New York City receiving partial support from the United Hospital Fund reported 12,022 hospital beds, 230,988 cases, and 3,456,111 days of hospital care—this being independent of the state and municipal hospitals in New York City. All types of hospitals in New York City, excepting those for the insane, provided 32,167 beds, treated 510,859 patients and gave 8,813,721 days of hospital care; treated 1,028,347 cases in out-patient departments and had a total of 3,595,261 out-patient department visits.

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HOUGHTON, ALANSON BIGELOW (1863–), American diplomat, was born at Cambridge, Mass., Oct. 10 1863. He was educated at Harvard (B.A. 1886), subsequently studying at Göttingen, Berlin and Paris. He associated himself with the Corning Glass Works N. Y., in 1889, becoming successively vice-president and president, and, in 1918, chairman of the board of directors. He was elected a member of Congress in 1919 and re-elected in 1921, resigning in 1922 on his appointment by President Harding as U.S. ambassador to Germany, a position which he held until 1925, when he was appointed ambassador to Great Britain in succession to F. B. Kellogg.

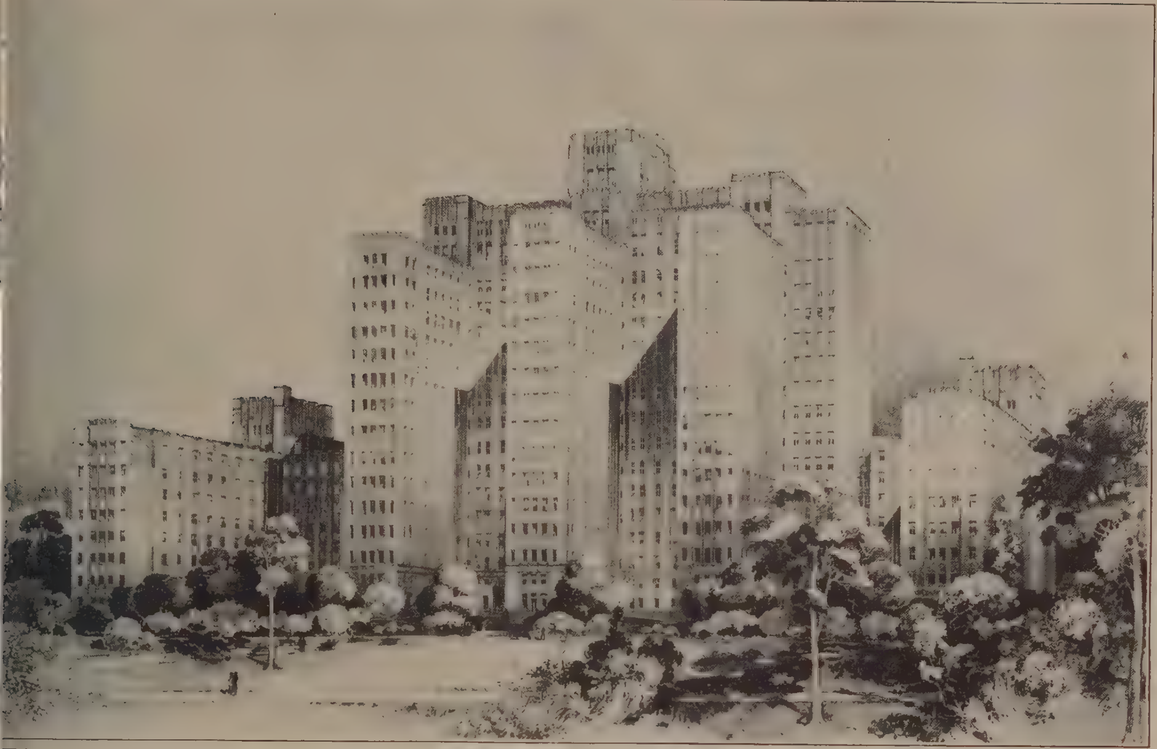
HOUGHTON, WILLIAM STANLEY (1881–1913), British playwright, was born at Manchester Feb. 1881, and educated at Manchester grammar school. He became a cotton broker, but employed his leisure in dramatic criticism for *The Manchester Guardian* and in the writing of plays. *The Dear Departed* (
was produced by Miss Horniman at the Gaiety Theatre, Ma
ter, in 1908 and afterwards in London. With *Hindle Wakes* (
he leapt into fame. It had a long run in London and later i
same year *The Younger Generation* (written and played in
chester in 1910, 2nd ed. 1913) was successfully produced a
Haymarket Theatre, London, with *Trust the People* (191
following year at the Garrick and *The Perfect Cure* (1912) a
Apollo. His early death in Manchester, Dec. 10 1913, cut s
career of much promise.

HOURS OF LABOUR (*see* LABOUR LEGISLATION, 16.7).—
position in regard to hours of labour reached in the years i
diately following the Armistice of 1918 was further consoli
during the succeeding years and in some directions a move
was made towards a further reduction of the daily and w
working hours, in practice as well as by legislation. The Eur
economic crisis, however, particularly that occasioned by the
the German mark, the abnormal unemployment in Great Br
in Switzerland and later in Germany reacted on the nationa
international position in regard to working hours and tend
check the movement towards general reduction. The weig
the reparations burden upon Germany weakened the cam
of the trade unions there towards shorter hours, and Germa
rivals felt the influence of the longer hours ("Mehrarb
which were instituted, with the consent of the German
unions, in certain branches of industry in 1924.

Many workers during this period showed themselves rea
undertake overtime work whenever possible, or even to
a "second eight"—in another factory or workshop at the
clusion of their normal day's labour. This latter case was
on grounds of social policy, a statutory offence in some coun
and was frequently used as an argument in favour of the
working day. These phenomena contradict the experien
the pre-War period; they are explained in certain countries
depreciating currency by the failure of wages to keep pace
rises in the cost of living, in others by the prevalence of u
ployment, which has given the employer a powerful wea
against the worker whose chance of obtaining new employm
once thrown out of work, is very slight. In either case the fo
the temptation upon the worker to earn as much as possi
obvious, and the trade unions have sometimes (notably in F
and Italy) had to abandon their traditional opposition tow
overtime, or even moderate their insistence upon increased
of pay for overtime work. In Germany the trade unions
for a time their demand for overtime pay in regard to the "M
arbeit" hours, whilst retaining it for any further hours.
Great Britain, the overtime rates were almost universally
tained owing to the strength of organised labour.

I. THE GENERAL INDUSTRIAL STANDARD

Standard Day and Week.—But these weakenings of the ge
movement were everywhere recognised as exceptional and as
to temporary factors. Public opinion in general as reflect
the various legislatures supported the trade unions in their
sistance to any demand for extension of hours, and the "st
ard" working day or working week has successfully maint
itself. In Great Britain collective agreements showed no tende
towards an extension of hours; successive parliamentary atta
on the Belgian 8-hour Act of 1919 were easily repulsed; in
Netherlands, though the 45-hour week established by law
came 48 hours for certain branches of industry and comm
(and thus was brought to the international normal) excep
to the latter were permitted only temporarily and to meet spe
emergencies. The ceding of the "Mehrarbeit" in Germa
whereby the workers in certain industries agreed to work a
tional hours, usually four to six per week, without demanding
increased rate of pay for these hours, was their contribution
wards improving the situation brought about by the neces
of reparations payments. It led directly to a correspond
extension of hours in the neighbouring and competing h
iron industry of Polish Silesia (declared by the Governmen
be temporary and dependent on the German situation),



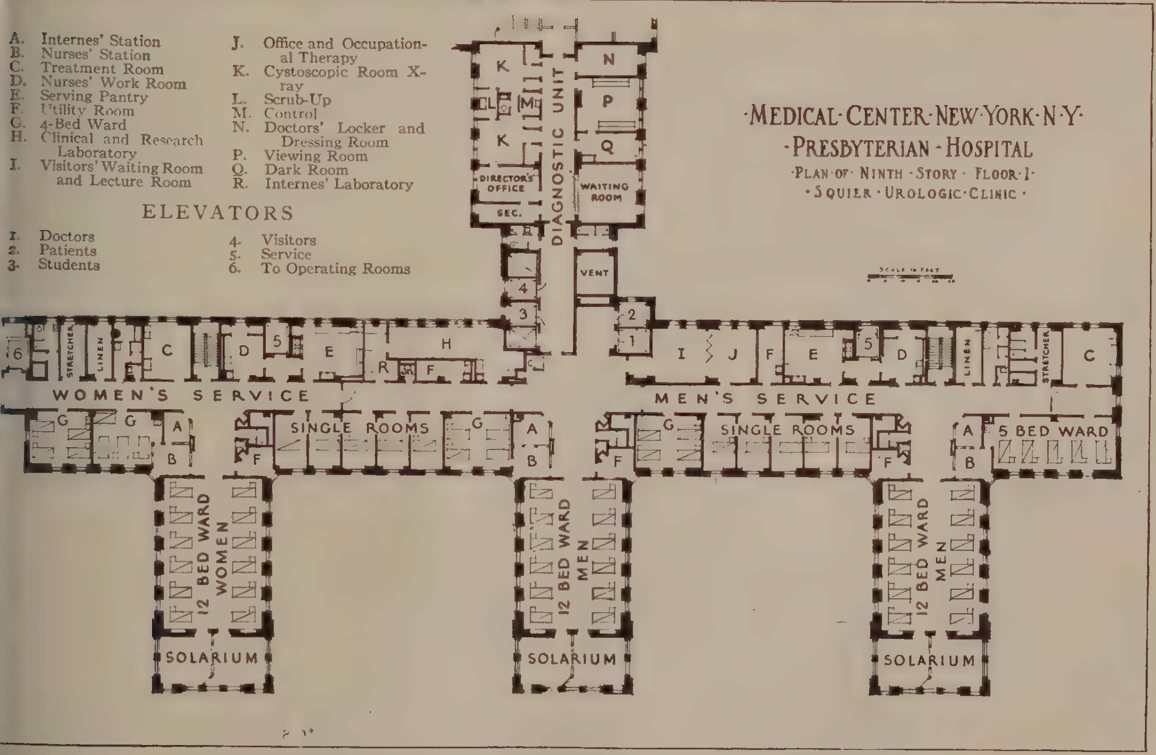

A. Internes' Station
B. Nurses' Station
C. Treatment Room
D. Nurses' Work Room
E. Serving Pantry
F. Utility Room
G. 4-Bed Ward
H. Clinical and Research Laboratory
I. Visitors' Waiting Room and Lecture Room
J. Office and Occupational Therapy
K. Cystoscopic Room X-ray
L. Scrub-Up
M. Control
N. Doctors' Locker and Dressing Room
P. Viewing Room
Q. Dark Room
R. Internes' Laboratory
ELEVATORS
1. Doctors
2. Patients
3. Students
4. Visitors
5. Service
6. To Operating Rooms
MEDICAL CENTER NEW YORK N.Y.
PRESBYTERIAN HOSPITAL
PLAN OF NINTH STORY FLOOR I
SQUIER UROLOGIC CLINIC
SCALE IN FEET
DIAGNOSTIC UNIT
DIRECTOR'S OFFICE
SEC.
WAITING ROOM
VENT
STRETCHER
LINEN
WOMEN'S SERVICE
MEN'S SERVICE
SINGLE ROOMS
5 BED WARD
12 BED WARD WOMEN
12 BED WARD MEN
SOLARIUM

FIG. 1. Sketch Perspective:—typical example of American "Skyscraper Hospital."
FIG. 2. Floor plan of the same.

difficulties, without however actually bringing about ension of hours, in Czechoslovakia. The "Mehrarbeit" ıly temporary: a statement of the German Minister of r in March 1926 showed that less than 500,000 industrial s out of a total of 12,000,000 workers covered by collective ıents worked normally more than the 48-hour week. The n in Poland was amended *pari passu* with the improven Germany. From Aug. 1925 the extensions permitted, allowed in certain branches of industry a 10 instead of an day, were gradually withdrawn, and the situation at the 1925 was nearly normal.

"8 and 48" rule maintained itself as a "standard," and e quarters was even held to have the demerit of many standince movement towards it may be from below 48 as well as bove it. The Netherlands 45-hour week became in effect ɔur week; the Polish 46 was in the same danger.

orking week of less than 48 hours is not uncommon. Rigid ation of the 8-hour day in combination with the "English end" leads to a 44-hour week, which became the legal inıl limit in New South Wales and Queensland from Jan. West Australia, however, rejected a bill to this effect. In Britain working hours (except in regard to women and en, mine-workers and employees in certain "sweated") are not regulated by law, but by collective agreements. nany such agreements provide for a week shorter than 48 In the metal trades, wood-working and furniture, and the ering and shipbuilding it is 47; in building generally 44; tiles, whilst most agreements provide for 48, the frequent ce is to work 45 or 46. A proposal by the engineering ems in July 1925 to extend the working week from 47 to 50 w of foreign competition met with no success, and a similar sal made for the same reason to extend the miners' working om seven to eight hours was not supported by the Comn which enquired into the conditions of the coal industry 6. Attacks in 1924 and 1925 on the Polish 46-hour week rly failed, though their basis was the opportuneness of a . to the "normal" 48.

ould seem fairly clear that the rule is to be maintained, and erely as a standard, but as a maximum. It seems to be a definitely gained, from which further advances in social ess may be made as conditions permit.

plication of the "8 and 48" rule.—In fact the "8 and 48" s now very generally established for industry throughout ɔe, including Soviet Russia, either by law or by collective nent. The details of its application vary. It is not univerapplied to all factories and workshops; in Sweden and Switd it is not applied to very small establishments. Nor is it y rigidly enforced: factory inspection, which is very effiin Germany, the Netherlands, Belgium, Great Britain, ıoslovakia and the Scandinavian countries, is much less nt in France and Italy and virtually non-existent in certain countries. Its application depends, too, upon the vigilance onsciousness of the trade unions. Where they are strong, r collective agreement is valid in practice; where weak, both ɔyers and workers can often offend against either with comive impunity. Nevertheless, such dependable statistics as vailable show a high degree of uniformity in the average actually worked in corresponding industries in the various pean countries; and, at least in the great industrial states, nents concerning unfair competition based on alleged difces in hours—except in rare and unusual cases—should be carefully examined before being accepted.

e rule holds too in the British Dominions generally, though with differences of application, and has recently made progress in the United States, where however it tends to the form less of a fixed maximum than of a "basic" rule ıe determination of wages. A decision (1925) of the Railroad d, for example, provides that all hours worked over eight e day shall be paid for at increased rates; thus the 8-hour is accepted as the normal whilst the working of additional is not prohibited. This is in agreement with the Internal Convention of Washington, which makes no attempt to restrict overtime internationally further than to insist on an overtime rate of 25% above the normal. In South America, wherever legislation on the subject exists, the "8 and 48" rule prevails.

In the important industrial states of Asia the working day and week are normally longer than in the countries hitherto mentioned. Progress in the reduction of hours except in India has been slow. The reluctance of Japan to reduce her working hours is probably the main factor in the situation. A second is the confused state of China, where factories working 12 and 14 hours a day exist side by side with others which have introduced and 8- or 9-hour day. An attempt to reduce hours by general agreement in certain Chinese cities, notably Shanghai, met with partial success only. Persia has not many industries susceptible of regulation in this matter; in her carpet industry, which employs numbers of children, sometimes of tender years, hours are restricted to eight daily. In Palestine, although legislation was lacking, the immigrant Jewish population, which brought with it the industrial concepts of Europe, secured for itself by agreement with the employers the almost complete application of the "8 and 48" rule, which it endeavoured to extend to the Arab workers. In 1925 Turkey adopted legislation providing for a 60-hour week—the first limit imposed by statute—to include the time necessary for prayer, and for the cleaning of work-places and machines. Miners work a 6-hour day.

Hours of Labour in Asia and Africa.—Recently increased attention has been paid to the question of the working hours of native races not yet accustomed to the regularity demanded by modern conditions and now forced upon them in the rapid development of many hitherto untouched areas. Plantations, mines, road and railway construction and even factories are making enormous demands upon the native populations of, for example, Central Africa, and the transition to modern industrial conditions appears to be very difficult. Many experts in colonial affairs hold that an 8-hour day for many of these natives is much too arduous; yet much longer hours are often exacted. The mortality rates among native workers are disquieting; in recent years rates of 8 and 10% per annum have been recorded in Africa, and these in areas where supervision is better than the average. Some attempts have been made to meet the situation; hours are limited to eight in certain African mining areas; the immigrant Chinese workers in Samoa (under mandate to New Zealand) have an 8-hour day, and it is becoming regular both in Asia and in Africa that, where workers are engaged under indenture or contract, the number of daily working hours (usually eight) shall be inscribed in the indenture. In the more important islands of the Dutch East Indies hours are regulated by law, or are prescribed in indenture. It is clear, however, that the problem of the utilisation of the labour of these peoples without injury to their physique and their numbers is far from being solved, and that the question of their working hours has not yet been sufficiently examined.

Exceptions to the "8 and 48" rule.—The "8 and 48" rule clearly cannot be and is not applied to all industrial occupations indifferently, and some have been excepted from its application both in national and international legislation. Among the difficulties of application is the redoubtable scourge of the 12-hour day in certain continuous processes, and in some seasonal industries. The two-shift system in continuous processes is replaced, in the International Convention on hours, by that of three shifts: the 12-hour day and 84-hour week thus becoming the 8-hour day and 56-hour week. This change, which involves a large increase of staff, has been strongly resisted, and has not yet been inscribed in all national legislations; but the old system is disappearing, even in the United States, where the two-shift system and the 12-hour day were specially prevalent. In some seasonal occupations, notably in the sugar beet industry in Europe, the great difficulty of bringing more temporary workers and accommodating them near their work for the 10 or 12 weeks of the "season" has prevented the reform in some areas; in others where conditions are more favourable, it has been carried out in spite of the handicap in competition involved; the social advantages have triumphed over the economic disadvantage.

The distribution of work over the days of the week implied in the "8 and 48" rule may not always correspond, not only to the economic needs of a particular case, but to general changes of opinion on these matters. The English week-end (short Saturday), for example, has become much more general over the continent of Europe; it is the rule in the British Dominions and in the United States and spreading elsewhere. It is not consonant with a strict application of the 8-hour day and the 48-hour week, and has led sometimes to the institution of a 44-hour week, sometimes to the working of more than eight hours on some days to compensate for the shortened Saturday.

A relatively new development—the five-day working week—shows signs of becoming popular. In certain industries it has long been the practice, in Great Britain, France and other countries, to complete the working week in five days, since the overhead expenses made it uneconomic to work a short Saturday of four or five hours. In Great Britain, especially since the War, with the consent of employers and workers, the practice extended, notably in boot and shoe factories and chocolate works where it is almost the normal, and it appears to be favourably received even where the economic argument is not perhaps so powerful as in the industries (*e.g.*, dyeing) to which it was first applied. The social attractions of the five-day week begin to outweigh the disadvantages involved of a 9- or 10-hour working day.

II. IN COMMERCE, AT SEA AND IN AGRICULTURE

Hours of Labour in Commerce.—In commerce, legislation on hours of labour generally belongs to the post-War period. The increasing development of the large departmental store has changed fundamentally the position in the shop-keeping world and has forced the regulation of working hours, either by legislation or by collective agreement.

In Great Britain both methods have been used, but the Shops Act of 1912 affects only the labour of young persons under 18 and provides for a maximum working week of 72 hours (including rest periods). Collective agreements and general practice have largely superseded the provisions of the Act. Few employees of large urban establishments now work 72 hours in the week, some only 43. The agitation of the organisations of shop-assistants for reduction has been generally successful. The obstacles to progress are the numerous small establishments which are frequently managed by their owners and have few or no paid workers in the ordinary sense; it is considered unjust to compel establishments which have employees to close whilst leaving open the small shops of the owner-workers. There is also the difficulty of changing the shopping habits of the general population.

Certain British regulations on closing hours adopted during the War period have not given general satisfaction. Nevertheless, many European countries have introduced legislation: Austria (1919), Czechoslovakia (1918), Finland (1917), France (1919), Germany (1923), Italy (1923), Poland (1919), Portugal (1919) and Russia (1922) have each adopted Acts which fix the normal working week in commercial establishments at 48 hours. In the Netherlands, the law of 1922 imposes 10 hours per day and 55 per week as maxima. In the other cases the 48-hour week seems to be rather the principle than the practice. The legislation itself provides for numerous exceptions and in a very much more elastic manner than is general in industry.

In Germany the hours may be lengthened by collective agreement between workers and employers, or by the judgment of an arbitration court, and the 48-hour week in commercial establishments is probably rather the exception than the rule. In Czechoslovakia, the law is seldom strictly applied. The French Act of 1919 permitted the application by decree of the 8-hour day and 48-hour week not only to industry but also to workers in shops and offices. A number of decrees have been issued, affecting for example employees in banks and public offices, and shop-assistants. Most of these decrees are regional in their application: it has been found easier to regulate hours in the larger towns. The decrees affecting industry (now covering all but very minor branches) cover the commercial workers attached to the industry (clerks and employees in the offices) also. In Italy a similar system of regulation is in effect in the larger towns.

A vast amount of local legislation, by-laws, etc., govern this matter, shop-keepers themselves very often fixing closing hours through their associations. Very little of this form of regulation however is definitely based on the notion of restricting working hours for employees; other factors enter into account.

Hours of Labour at Sea.—The seafarers' hours are still more difficult to regulate and relatively little national legislation on the question exists. The different categories of workers employed on a modern vessel, and the difference in the effort demanded of them is one cause of difficulty; another is found in the risk attached to the sea-service and the necessity of abandoning all regulation in time of stress. Yet a third arises, curiously enough, in the seaman's problem of what to do with himself on board ship when he is neither at work nor asleep. This latter is gradually being overcome by the more factory conditions now insisted upon by many states in reg living accommodation on board.

The vast majority of seamen, including the British, have ob regulation of hours by means of collective agreements, but in cases the legislatures have intervened. The most interestin probably the most successful interventions, are the Acts of F (1924), Norway (1919) and Sweden (1919). These divide th sonnel of a vessel according to the nature of its work: the engin staff is required to do not more than 16 hours work in two conse days, whilst the ordinary seaman works not more than 24 ho the same period. Other arrangements are made for small vess cases where the crew is not divided into watches, for coastal t and for work whilst in port. These Acts seem to have been satisfactory in application, though the seamen concerned dem reduction of the hours prescribed. A French decree of 1925 e ing the application of the 1919 general Act to the sea service pr alternative methods, either an 8-hour day may be worked, or hour week, irregularly divided as regards the daily limit averaging of hours over a month, the 8-hour average bein served. These hours are subject to exceptions to meet sea gencies. Greece in 1923 extended her general labour legislati decree to cover sea workers, but it does not appear that her legislation, which is somewhat special and not applied as yet land industries, has been adopted at sea. In Portugal w hours are regulated by a decree of 1923; whilst in port the 4 week is maintained, at sea the hours for the deck staff a stewards and pursers are 84, and for the engine-room 56. A S decree of 1919 lays down as maxima a 10-hour day for office for ordinary seamen, and 8 for the engine-room crew. In Yugo a decree of 1924 provides a 10-hour day and 60-hour week. Ur has applied the 48-hour week and Argentina has under conside the question of the regulation of hours at sea by legislation. mark is revising her maritime legislation upon the lines o Finnish, Norwegian and Swedish Acts.

The French decree above mentioned makes an important ne parture in defining "hours of *effective* work," An Act of 19 which this and earlier decrees were based had stipulated the day, but in practice and by a decree of 192 it had been cons that 12 hours of presence were held to constitute eight ho *effective* work. In 1925 the Council of State found this to be al and defined "hours of effective work" as "the time during the crew are, in consequence of an order given, at the disposit the captain and away from their ordinary living quarters." Thi important and far-reaching decision will have its effects on national legislation and agreements, including probably the jected legislation under consideration in Germany and the N lands. In both these cases the proposed reforms are stated based upon the principle of the 8-hour day.

In Great Britain the matter is dealt with solely by coll agreements, which are exceedingly complicated and not unive applicable. They are not so much intended to limit the ho labour directly as to secure that overtime rates are paid after a "normal" has been reached, and thus to penalise employers exact the longer day. Emergency cases (of which the master vessel is sole judge, and which may be cases of salvage, fog stranding or other circumstances affecting the safety of the are not usually affected by these overtime pay arrangements general, the agreements provide for overtime rates when the w day in port exceeds eight hours, with special arrangement Saturday (five or six hours) and Sunday (ordinary necessary r work up to four hours), and for days of arrival and sailing. A the ordinary system of watches results in a longer day being w except for the categories known as day-workers (*i.e.*, those normally work only during the day) who have similar hours to detailed above.

This may be taken as fairly typical of the terms arrange collective agreement, not only in Great Britain but elsewh countries where legislation has not been adopted. The Aust and New Zealand seamen however have secured better terms. agreement they have a strict 8-hour system which is probabl most favourable to the workers yet obtained anywhere; the qu of its consecration in legislation is stated to be under conside

Hours in Agriculture.—The attempt to apply the regulati hours of labour to agriculture has aroused keen controversy. lation on the subject is still experimental, and a perfect syste yet to be devised. Little or no legislative regulations existed b 1918, though Ecuador in 1916 passed an Act that "No laboure engaged in agriculture shall be compelled to labour more than hours daily, six days per week." Information as to the succe application or otherwise of this law is lacking. Where so muc pends upon the seasons and the weather, and where the ca animals and crops makes demands that have often little refe to a time-table, the regulation of hours is complicated and dif Nevertheless it has been more or less scientifically attempted b in several countries, and has come into practice by agreeme others.

The German regulations, issued under the provisional Ag tural Labour Act of 1919, make a serious attempt to deal wit question of seasonal variation of work, prescribing daily maxi

nd 11 hours during three four-monthly periods into which the
as divided for this purpose. Time spent in travelling to and
he farm is calculated as working time—another point which
used much difficulty in agriculture and in other occupations.
zechoslovakia, the Act of 1918, which introduced the 8-hour
ry generally, seems to have become in practice an Act for
ing wages, so far as agriculture is concerned. There does not
to be in fact any limit upon the hours worked, but overtime
must be paid for hours worked beyond an average of eight
ay. Portugal (1922) prescribed a maximum working day.
a (1921) prescribed a maximum yearly average of nine hours
Austria an average of 10 in Lower Austria; in Upper Austria,
onsecutive hours of rest and two hours for meals are provided
e possible working hours being thus limited. An Estonian
1921 created district joint commissions which were empowered
e upon hours, with a maximum of nine daily on a yearly aver-
is stated however that these commissions do not work well,
at the hours situation is confused. The Spanish decree of
does not appear to be rigidly applied, and little information
ilable as to the working of a Costa Rican decree of 1920. In
ases the 8-hour day was the basis of the systems laid down.
taly collective agreements from 1900 onward specified gener-
from sunrise to sunset" as the limit of working hours, with
eriods of from three to four hours during the summer day and
r ones in spring, autumn and winter. In April 1919 an agree-
was made in regard to day-workers (mostly the seasonal
rs employed in rice cultivation) providing an 8-hour day, with
rates for overtime. The collective agreements made between
and 1923 secured progressively favourable conditions for
ltural workers; the advent of Fascism however changed the
n fundamentally and the rural custom of collective bargaining
virtually over. Alongside the system of agreements in Italy a
tive code governs hours in agriculture. The migratory workers
rice areas, who are mostly women, were the subject of legisla-
s early as 1866, and their hours are now determined (apart
the results of collective agreements) by regulations of 1908
under the Public Health Code of 1907, which prescribe a 10-
day for workers resident on the rice estates and a 9-hour day
hers. Other agricultural workers (day-workers and those with
d annual salary) are further covered by a Royal decree of
issued in pursuance of a Legislative decree of the same year,
lays down the 8-hour principle but permits a 10-hour day dur-
period not exceeding three months in the year.

England and Wales legislation does not directly affect hours,
he Agricultural Wages (Regulation) Act of Aug. 7 1924 regu-
them indirectly and indeed has given the best results of legis-
in any country. The District Committees set up under the
ave the power of fixing weekly wage rates, and in so doing they
based the rates upon a certain number of hours of work per
in general between 48 and 52, but in some cases extending to
onger hours than these are indeed worked, but must be paid
overtime, and are thus avoided or reduced to a minimum wher-
possible with suitable arrangement of hours. The agricultural
er here further enjoys the "guaranteed week"; he is guaranteed
ull minimum week's pay even though weather or other condi-
make it impossible to work the total number of hours. This
ntee of pay in occupations where irregularity of hours is a
re, may prove a solution of much difficulty. It exists on the
sh railways, and in a modified form at the docks. Excepted
the guarantee in agriculture are, in general, female workers,
e wages are usually fixed on a casual hourly basis.

llective agreements are not ruled out by the British legisla-
quoted, and in fact play a large part, within the framework
ided by the work of the District Joint Committees, in the
g of hours.

III. INTERNATIONAL ACTION

he Washington Convention.—The standard "8 and 48" rule was
ecrated in the Convention on Hours in industry adopted by
first session of the International Labour Conference, held at
hington in 1919. Its adoption was based upon general prac-
at the end of the War and upon the resolutions of many in-
ational congresses and conferences of previous years, as well
pon the opinions of governments expressed in the documents
ared for this session. The Convention provides, in brief, for
-hour day and a 48-hour week in industrial establishments
l sizes except in workshops where only members of the same
ly are employed. It makes special provision (eight hours daily
56 weekly) for continuous processes; it permits more than eight
s daily where a short Saturday is worked; it allows excep-
s of a permanent nature for workers whose duty it is to pre-
beforehand for the general running of the establishment,
r example enginemen in a factory, or who must be employed
time after the general work of the establishment has ceased,
for intermittent work; it provides also for exceptions of a temporary nature to meet unusual pressure of work. By a special and very elastic Article it permits the 48-hour week to be exceeded, provided the average of 48 is maintained over a period of three weeks or more, where the ordinary rule is not capable of application. It leaves overtime to be regulated by the states themselves, stipulating only that employers and workers shall be consulted, and that an overtime rate of not less than one and a quarter times the normal rate shall be paid.

Since 1919 the question of the ratification of this Convention by the State Members of the International Labour Organisation has been the predominant issue in international labour affairs. By March 1926 Bulgaria, Chili, Czechoslovakia, Greece, India and Rumania had ratified it unconditionally and Austria, Italy and Latvia conditionally upon the ratification of certain other countries. In Brazil, Denmark, Estonia, France, Germany, Lithuania, the Netherlands, Poland, Spain and Uruguay the governments concerned had recommended its ratification to their Parliaments, but the latter had not yet signified their approval. The great European industrial states were still holding back, as was Japan. In India, which had ratified the Convention and materially reduced her working hours in consequence, employers and workers alike continued to protest that, with Japan refusing to reduce her working hours, amelioration in India and China was impossible. The great European states were reluctant to bind themselves unless assured that their industrial competitors would be equally bound. At first some governments held that the provisions of the Convention were too rigid; then, that they were too elastic, and that their ratification and application would not necessarily, owing to different interpretations of their terms, lead to uniformity of action. Hence the conditional nature of the ratifications of Austria, Italy and Latvia and hence also similar conditions inscribed in the bills for ratification submitted to the parliaments of certain other countries.

In Great Britain, difficulties of another nature hindered the progress of a bill for regulating hours and making possible the ratification of the Convention which was introduced by the Government of Mr. MacDonald. It was held in some quarters that the existing agreements regulating the hours of work on railways could not be brought into accord with the Convention; the railway employees were reluctant to change these agreements, and the Government therefore hesitated to take action which might, it was thought, precipitate a crisis. Differences of interpretation were possible also on various other points and consequently, in order if possible to arrive at agreement upon them before ratification, a meeting of the Ministers of Labour of Great Britain, Belgium, France and Germany was held at Berne in 1925. The meeting was partially successful, but the British Govt. decided to convoke the same ministers, with a representative of the Italian Govt. in addition, to a conference in London in March 1926.

The London Agreement, 1926.—At this meeting, which was prepared for by the circulation to the governments concerned of a memorandum on the points at issue, to which all replied, complete agreement was reached on all the issues raised, with one exception mentioned below. This agreement, signed by all the Ministers present, is likely, to have far-reaching effects on the fate of the Washington Convention and on the question of industrial working hours in general. It covers the following points:—

> Working hours are defined as those during which the workers are at the disposal of the employer; deductions for rest pauses and breaks, except scheduled breaks for meals, are therefore not possible, and this decision disposes of much controversy on the question of "effective" working time and the system of grading occupations in accordance with a scale. This is made even clearer by the agreement upon a definition of "intermittent work," the effect of which is to confine the application of this term to such occupations as those of door-keepers and watchmen which "are not concerned with production properly so-called and which, by their nature, are interrupted by long periods of inaction during which these workers have to display neither physical activity nor sustained attention, and remain at their post only to reply to possible calls."
>
> The Conference further agreed upon matters concerning the five-day week (see above) the regulation of overtime, and overtime pay (with the agreed minimum of 25%), the working of railways (thus removing an important British difficulty), and the recuperation

of time lost by holidays. On all these questions opinion was unanimous, but on one last point—the possibility of the suspension of the application of the Convention "in the event of war or other emergency endangering the national safety"—the British Minister reserved approval pending consultation with his Government.

The conclusion of this agreement removed many important difficulties in the way of ratification of the Convention by the European industrial powers. The ministers undertook to report to their Governments, which could then proceed with their consideration of the question of ratification. In the cases of Great Britain and Germany, at least among these Powers, it would be necessary to secure the adoption by the parliaments of new legislation, and in France and Italy new administrative measures would be required. If these difficulties could be overcome, and the ratifications of the five countries registered (simultaneously or otherwise) the international position of the "8 and 48" rule would be secured.

Protection.—The Berne and London Conferences of Ministers of Labour were reflections of the preoccupations of the governments and of the employers more directly than of the workers, who meanwhile formulated and discussed other policies in regard to the Washington Convention. In British trade union circles, for example, the revival by the Safeguarding of Industries Act of the policy of protection gave rise to the proposition that what workers should be more precisely protected against is that form of unfair competition which consists in exploiting their fellow workers abroad, and that the only form of "protection" acceptable to the workers as a whole would be one which would differentiate against goods produced by such methods and, in particular, by the exaction of excessive working hours. The adoption of such a policy, it is claimed, would give a powerful weapon to the more advanced states and enable them to insist on social progress in other countries whose backwardness retards the general advance in welfare. Similar ideas inspired the Austrian Social Democrats who carried in the Lower Chamber a resolution to increase import duties by one-third in the case of goods coming from countries where the conditions of employment, particularly in the matter of hours, were not satisfactory.

In the international field the same ideas appear to be gaining ground. In 1925 a joint committee of the International Socialist Congress and of the International Trade Union Congress decided to examine the possibility of a system of boycott applied to goods manufactured in countries where the Hours Convention is not observed. Later on in the same year a committee of the British Labour party published a report recommending such a boycott, which, it was stated, was not without precedent. Books which contravened the law on copyrights, and goods manufactured in foreign prisons cannot be imported into Great Britain; the great chocolate manufacturers have agreed not to purchase slave-grown cocoa. On the same principle, goods produced under conditions inimical to the worker should, it was argued, be refused admission. These proposals indicate a tendency which may develop as Labour or Socialist Govts. become more general and as the interdependence of states one upon another in the matter of social amelioration becomes more widely recognised. The Washington Convention affects industry only; hours in commerce, agriculture and employment at sea are not as yet regulated by any international convention.

Commercial, Maritime and Agricultural Hours.—The International Labour Conference has not yet considered the question of working hours in commercial undertakings. In 1920 a draft Convention instituting the 8-hour day, with suitable modifications, for seafarers was lost at the Conference of Genoa by a fraction of a vote. Since then the question has been the subject of constant negotiation between seamen and shipowners, and the organisations of the former, national and international, have decided (1926) to urge that the subject be placed again on the agenda of the Conference. The Conference at Geneva in 1921 held the moment not ripe for the regulation of hours in agriculture. Indeed no proposal to limit working hours in agriculture in the precise way which is possible in industry was ever put forward. Agricultural conditions do not lend themselves so readily as do those of industry to the fixation and limitation of hours, but it seems prol that international action in the matter cannot be long dela the hours exacted from agricultural labourers in many coun are unconscionable and are a powerful factor in bringing a the very active migration to the towns, which is a troubles social problem in almost all modern states.

Charter for Native Labour.—Equally pressing is the nee international action in regard to the hours of labour exa from subject populations in colonial areas. Here again the creasing force of competition makes it difficult for one cou to advance in this as in other social matters unless neighbou areas move forward also; yet it is probably true that the suff entailed by delay is more intense and the economic waste and is relatively greater in these areas than in the countries where population is capable of defending itself. As has been said ab local legislation has made a beginning and on the basis thus vided it seems possible that international action may be called upon to build. The discussions on the Draft Conven on Slavery adopted by the Assembly of the League of Nation 1925, though it did not enter into the details of the regula of native labour, showed clearly enough that there was a spread feeling that a "Labour Charter" for native peoples an urgent necessity. The resolution of the Assembly called the attention of the International Labour Organisatio this necessity will not, it is to be supposed, remain without eff and undoubtedly the hours question must be one of the first it is one of the most important, to be dealt with by the mem of the League of Nations.

REFERENCES.—The texts in English, French and German of of the Acts cited above, and in general of Acts relating to Hour Labour, are published by the International Labour Office in "Legislative Series." Monographs on the hours situation in a ber of important countries have been issued from the same sou For the general situation in regard to the Convention of Washing see the Directors' Reports to the successive sessions of the In national Labour Conference since 1919. The text of the conclus of the London Conference of March 1926 was published in *Times* of March 20. For hours of work in agriculture (Engl and Wales) see Report of Proceedings under the Agricultural W (Regulation) Act, 1924, issued by the Ministry of Agriculture Fisheries. (H. A. G.*

HOUSE, EDWARD MANDELL (1858–), American sta man and diplomat, was born at Houston, Tex., July 26 1858 seventh son of Thomas William House and Mary Eliza Shearn. His father, who had left England as a boy, came Texas when it formed part of Mexico, joined the revolu and helped to free it and bring it into the Union. The you House was educated at the Hopkins Grammar School and nell University, and returned to Texas in 1880, where he l for more than 30 years as planter. His chief interest, howe was public affairs. He took an influential part in the succe campaigns of Governors Hogg, Culberson, Sayers and Lanha and during the period 1894–1904 his political influence in Te was regarded as decisive.

He refused invariably to become a candidate for office hims but he acted as the intimate adviser of the several govern named. Although frequently urged to participate in natio politics he remained aloof from the disastrous Democra campaigns that followed the Bryan candidacy of 1896; but 1912 he played a major rôle in securing the nomination Woodrow Wilson, and at the time of the election Wilson had co to put full trust in him, offering him a choice of Cabinet positio Following his custom, House refused any office, but politica as well as personally he remained closer to the President th any member of the official family. It was upon his recommend tion that Wilson chose a number of his Cabinet; after t inauguration both President and Cabinet utilised his wi knowledge of men and his shrewd estimate of political effects help them in meeting legislative and administrative problem he exercised a great influence in the framing of the Fede Reserve Act and also played an important part in th organisation of the original Federal Reserve Board. Wils spoke of him as his "independent self."

use's chief interest lay in foreign affairs, and through close ct with American ambassadors abroad and his intimacy European statesmen, as well as the confidence of the lent, he was able to influence the course of American n policy. In 1913 he helped to tide over the crisis in ons with Great Britain over the Panama tolls exemption Wilson secured the repeal of the exemption. In 1914 he took formal negotiations with the diplomatic representa- of Argentina, Brazil and Chile, which led to the drafting pan-American pact designed to guarantee peace in the ern Hemisphere. The proposed pact was never translated a formal treaty, but it was of historical significance as ing an initial step in the development of Wilson's policy of ing a League of Nations. In the spring of 1914 House, ap- nsive lest war should break out in Europe, sailed for any to offer the assistance of the United States in reaching arrangement between England and Germany which might war. He talked with high officials of the civil Government, rmy and navy, and had a conference with the Kaiser, in he received some encouragement. William II. later said:— e visit of Colonel House to Berlin and London in the spring 14 almost prevented the World War." At London he found dward Grey ready to entertain any feasible plan to preserve . This, House wrote to the Kaiser on July 7 1914. The ler of the Archduke Francis Ferdinand, however, pre- ated war before the plan could be developed.

turning to the United States, House maintained close in- cy with the British and German ambassadors and thus d to smooth American relations with the belligerents. an. 1915 Wilson sent him abroad to study the possibility merican mediation. He suggested the principle of the eedom of the Seas," after visits to London, Berlin and Paris, possible step towards a compromise; but the sinking of the sitania" ruined all chances of success. In the autumn, se proposed that Wilson suggest to the Allies that a peace erence should be summoned; if Germany refused the con- ice or rejected terms calculated to ensure a just settlement, United States would enter the War on the side of the Allies nforce such terms. House left for Europe again in Dec. , visited England, Germany and France, and finally made aforesaid offer to the British, the substance of which was rporated in a memorandum drafted by Grey and himself. Allies, however, refused to take advantage of it.

the summer and autumn of 1916 House took an influential in the campaign which led to Wilson's re-election. At the of the "Sussex" crisis and the German Peace Note of Dec. , his private negotiations with Bernstorff were of high im- ance. After the United States entered the War, he kept in touch with the chiefs of the war-making agencies, and was onsultation with the special envoys of the Allies: Balfour, thcliffe, Tardieu, Reading. In the autumn of 1917 Wilson ed him chief of the special American mission designed to rdinate Allied war needs, especially the problems of finance, ly, tonnage and man-power. The conferences in London Paris which he attended proved to be the turn of the tide. r his return he was intimately concerned in Wilson's drafting he Fourteen Points, and at the request of the President he ted a tentative covenant for a League of Nations, which ned the basis of Wilson's later plan. In Oct. 1918 Wilson him to Paris to represent the United States at the Allied ncil which granted an armistice to Germany.

fter some difficulty, House succeeded in pledging the Allies to son's Fourteen Points as a programme for peace. He had viously organised "the Inquiry," a body of experts for ecting authentic data for the use of the Peace Conference. se was one of the U.S. Peace Commissioners signing the aty of Versailles, and although ill at the opening of the con- nce he played an important rôle by reason of his intimacy with opean statesmen. He was a member of the commission that ted the League of Nations' Covenant, and ultimately most he details connected with the formation of the League were led with his co-operation. In July and Aug. 1919 he represented the United States in the organisation of the Mandates system. After his return to the United States he urged President Wilson, by letter, to compromise with the Senate so as to secure ratification of the Versailles Treaty and the entrance of the United States into the League. A serious illness, coming at the same time as the physical breakdown of Wilson, combined with other factors to interrupt the close relations between the two men which had persisted since 1911.

Col. House had won a reputation for such sagacity and disinterestedness that his advice was continually sought by political leaders even after the overthrow of the Democratic party in 1920. Arthur Griffiths asked that he be named arbiter in the Anglo-Irish dispute. He continued his interest in international questions and maintained close relations with the ruling statesmen of Europe.

In 1912 House published, anonymously, a political romance, *Philip Dru;* in 1921 he edited (with Charles Seymour) *What Really Happened at Paris*, a series of essays on the Peace Conference written by members of the American Delegation. He also wrote, after 1920, a number of articles upon contemporary politics and political leaders for *The Philadelphia Public Ledger*, *Foreign Affairs*, *Harper's* and *The Encyclopædia Britannica*.

BIBLIOGRAPHY.—*The Real Colonel House*, by A. D. Howden Smith (1918), a brief but accurate biography covering House's career to 1918; *The Intimate Papers of Colonel House*, arranged as a narrative by Charles Seymour (1926). (C. SEY.)

HOUSEHOLD APPLIANCES.—The working equipment for the household has achieved a new importance in recent years. In the 19th century, labour-saving machinery was adopted in industry; the 20th century has witnessed a progressive application of such machinery to the work of the household, the most important advances falling within the period following 1910. This change is little indebted to the initiative of the housekeeper herself, although a growing desire for the elimination of drudgery, together with a scarcity of domestic help, has provided an incentive to the engineer and manufacturer to meet this need with numerous mechanical devices.

The wide adoption of such appliances has owed much to the increasing availability of electricity for power and to the development of automatic machinery and standardised methods of production. A large part in their distribution has been played also by advertising, demonstrations in stores and the home and similar methods employed by manufacturers to make known their products. A number of manufacturing and distributing plants, including gas and electric-light companies, especially in the United States, are now maintaining home-service departments directed by women trained in home economics.

Schools and colleges, and also government departments, have been giving attention to the subject of household appliances during recent years in the United States, Canada, Great Britain and, to some extent, in other countries. A significant factor in this development of household devices, in some of the English-speaking countries, has been the work accomplished by enterprising home magazines that have established service bureaux, and also laboratories for the testing and investigation of household appliances.

ELECTRICITY IN THE HOME

The outstanding feature in the development of household appliances, during the period under review, 1910–26, has been the greatly extended use of those operated electrically. This fact in turn has had an important bearing on one aspect of house construction, namely, the wiring, which is increasingly ordered with a view to the use of electrical appliances. This involves the installation of a large number of appliance outlets, properly placed, instead of a limited number of lamp sockets. In districts where electricity is very cheap, houses are being wired with circuits of high current capacity to provide for electric ranges and certain other cooking devices which cannot be used on ordinary circuits. There has been a general improvement in the fittings or fixtures, such as switches, sockets, plugs, etc., the restrictions of regulatory bodies having helped to maintain minimum standards which in practice have been exceeded by the better manufacturers. Attachment plugs have largely been standardised, thereby ensuring the same interchangeability in appliance connections as appertain to incandescent lamps. In the United States the parallel blade plug is superseding all others.

The electric curling iron is reputed to be one of the oldest, if not the oldest, of electrical appliances. In 1926, however, the electric flat iron had a far greater sale than any other electrical appliance. The electric toaster leads in the field of small table devices, but there are many others which find a place in the kitchen or dining-room, such as percolators, table-stoves, grills, hot plates and waffle irons. The general use of nickel chromium resistance wires, introduced about the year 1910, assured the practicability and therefore the beginning of a really extensive use of electric heating appliances. These alloys can be heated to redness in the air without oxidation and the physical properties of ductility and malleability they possess permit the fabrication of heating units in a wide variety of designs. The popularity of electrical heating devices owes much to the ease with which the heat may be regulated, and this is often automatically accomplished, notably in ranges, flat irons, warming pads and percolators, by means of thermostats, which may either limit the temperatures or keep them at the desired level. In some cases additional controls are provided to start and stop the current at predetermined times. In certain central house-heating plants an electric motor controlled by a thermostat operates dampers and drafts. If the fuel used is oil or gas the heating becomes, by this device, entirely automatic, but if coal is burned, refuelling is necessary. (*See* HEATING AND VENTILATION.)

Small Motors.—Among the more important factors in the wider application of electricity to household appliances has been the perfection of light-weight, efficient motors. The motor of small size and light weight has made possible portable electric vacuum cleaners, electrically driven mixers, floor-polishers, coffee-grinders, knife-sharpeners, sewing-machines, etc. Sewing-machines designed for the incorporation of a motor are portable, light in weight and easy to operate. In motor design the important problem is lubrication, because, in the household, motors frequently go unoiled for relatively long periods and their use is intermittent, often being confined to an hour or two each week. It is now customary to provide oil-wells of relatively large capacity, which do not need replenishing for long periods. In many instances ball bearings are provided, packed in grease, so that lubrication will not be required, perhaps for the life of the device, or at least until some other parts need attention or replacement, when the ball bearings can be repacked.

The tremendous increase in the use of electrical appliances in the United States during recent years has been due, in no small degree, to the almost complete standardisation of the type of current furnished for consumer supply, namely, 110 or 120 volt 60-cycle alternating. Direct current is mainly confined to a few large centres, where its use is economically feasible. In many other countries a lack of a standardised current has placed almost insurmountable obstacles in the way of a general use of electrical appliances in the household. An indication of the rapidity with which they have been adopted in the United States is afforded by the fact that the number of electric vacuum cleaners in use rose from an estimated figure of 18,000 in 1910 to 5,000,000 in 1925. In the same period the number of electric washers increased from 3,000 to 3,500,000. The number of houses wired for the use of electric current rose from 2,934,900 in 1910 to 13,406,777 in 1925. Incidentally those equipped for the use of gas increased from about 5,000,000 in 1910 to 10,720,646 in 1925.

THE EQUIPMENT OF THE KITCHEN

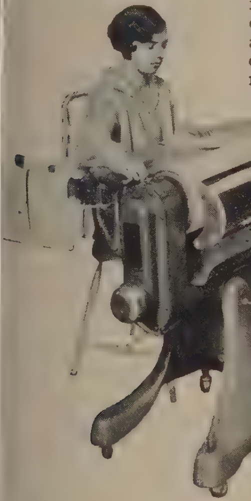
As regards the kitchen the present trend is in the direction of a smaller kitchen, used only for the preparation of food. In the smaller modern apartments the kitchen has become a kitchenette, with more wall space than floor space. This fact as well as the desire to obviate unnecessary motions, has led to careful planning in the arrangement of the refrigerator, w cabinet, range and sink. The working surfaces at sink, ra work-table and kitchen cabinet have been raised to a he better adapted to the worker, that found most generally s able for the sink being 34 in. from working bottom to the f The kitchen cabinet, as a valuable space saver, is grow steadily in favour in the United States, Canada and poss in a few other countries. More recently these cabinets h been supplemented with additional storage units, a cupbo and a broom unit. Thus equipped, the cabinet really br the storage pantry to the work-table and provides comp and convenient storage space. While it would be sounder gineering practice, as applied to the kitchen, to have in s all tools and materials needed for daily use, popular taste parently objects to having utensils hanging uncovered on ho beside the proper working centre, or to seeing food contai on open shelves. Kitchen cabinets are, therefore, all provi with doors, behind which equipment and food materials stored. These cabinets are available in so-called built-in un which may include a refrigerator, storage and broom cupbo and may be installed to form part of the permanent fitting the kitchen. Cabinet cases and their accompanying units usually finished in either white or grey enamel, and nearly cabinets have porcelain-enamelled iron table-tops, usually constructed as to permit being drawn out for use and pus back within the general body of the cabinet when not requi

Porcelain-enamelled iron linings have become very common refrigerators. The most noteworthy development in dome refrigeration has been the increasing use of mechanical units supplant ice. In the United States and Canada up to the p ent time the actuating part of the unit has been almost ex sively of the compressor type operated by an electric motor. some European countries machines operating on the so-ca expansion principle are coming into use. In these machi there is no motor, the compression of the gas refrigerant be accomplished in closed vessels through the application of he The source of heat is usually gas or electricity. Sinks are usu ly provided with drainboards frequently cast in one piece w the sink, the material used being porcelain-enamelled ir porcelain or vitreous china. Combination faucets for hot a cold water have proved very convenient. As steps toward m ing the precision of the laboratory possible in the kitchen, capacity of kitchen measuring cups has been standardised a thermometers have been specially designed for registering t temperature of the oven, of the fat in deep frying and of s ups in home candy-making.

Ranges.—Ranges are frequently equipped with thermost for the automatic control of oven temperatures. In both g and kerosene ranges, there has been a marked improvement the construction of the burners, making possible better co bustion. In England the "all-gas" kitchen, in which g is used for cooking, heating and water-heating, is a develo ment of the years 1915–26. The cabinet type of gas cook or range, in which the oven is located adjacent to the coo ing top, has become common in England and in the Unit States. Some electric and gas ovens have been constructed utilise the principle of the fireless cooker, by which baki is done on retained heat. Another development is the i proved insulated gas-range oven, designed for the greater co servation of fuel. Porcelain-enamelled iron is used for the e terior of gas ranges, and some have oven linings of this materi

Fireless cookers have been improved by the use of aluminiu linings and by the employment of heated radiators produci oven temperatures for baking, the latter innovation necessitating safety valve in the cover of the cooker to provide for the esca of steam, thereby avoiding danger of explosion. A later d velopment was the electrically-heated cooker. The pressu cooker is employed for canning and for high-altitude cooker In this device, the steam generated is confined within the coo ing utensil and, by the increased pressure, raises the boilin point of the liquid. Cooking, therefore, takes place mo rapidly and with a consequent economy of fuel.

Laundry and Cleaning Equipment

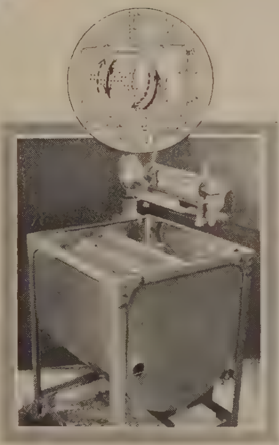


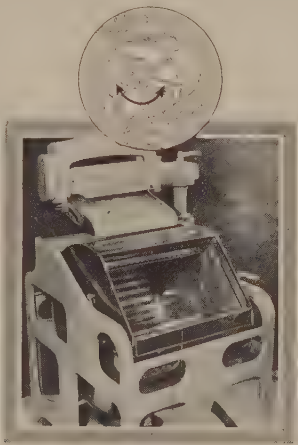
'his ironing-machine has an electrically heated shoe and ıe padded roll is revolved by a small motor. The operaor's right hand is on the lever controlling the mechanism that moves the shoe away from or up to the roll. Mechanically operated ironers are rapidly superseding the older types of machines which require considerable exertion on the part of the operator in order to bring the roll and shoe together against the action of the springs which maintain the pressure. Similar household ironing-machines use gas for heating the shoe instead of electricity.

The floor scrubbing and polishing-machine above has a ¼ horsepower motor mounted on a circular base. The motion of the motor shaft is transmitted by gears and a chain drive to a brush or polishing pad under the base.

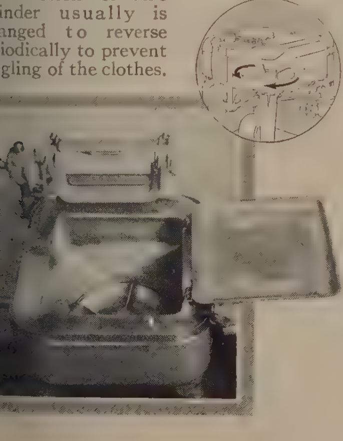
In electric suction cleaners air, moved by a motor-driven fan, enters the floor nozzle carrying dirt into a fabric bag which retains the dirt as the air passes through the pores of the bag. Generally a tractor or a stationary brush is fitted to the nozzle. Other cleaners have a brush in the nozzle revolved by the motor. Another type has a combination agitator and brush which taps the floor covering to loosen the dirt.

iously there are many
's to produce the relative
ion between clothes and
er necessary to flush the
out of the fabrics and in
way wash them. As a
ural result many different
es of washing machines
e been developed. The
hine at the right represents
cylinder type, in which
hes are placed in a cylindri-
container having perforated
s or ends and transverse
fles to lift the clothes as the
nder revolves. The cyl-
er is revolved about its axis
another container holding
er to a depth about half
between the bottom of the
inder and the axis.
e-motion of the
inder usually is
anged to reverse
iodically to prevent
gling of the clothes.

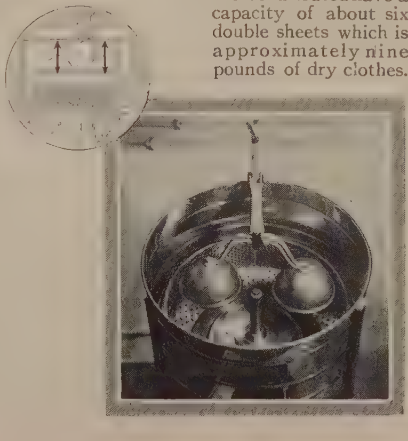




The machine illustrated at the left is an oscillator washer. In machines of this type the clothes are placed directly in the water in a tub that generally is shaped somewhat like a cube with two of the ends rounded. The tub is rocked or oscillated on its transverse axis so that the water and clothes are tumbled about in the washing process. Both machines at the left have power-driven wringers, the direction of rotation of the rolls being reversible and the wringer being movable about the support so that it may be used in any one of several positions, such as wringing from tub to basket. Washing-machines similar to these illustrated have a capacity of about six double sheets which is approximately nine pounds of dry clothes.



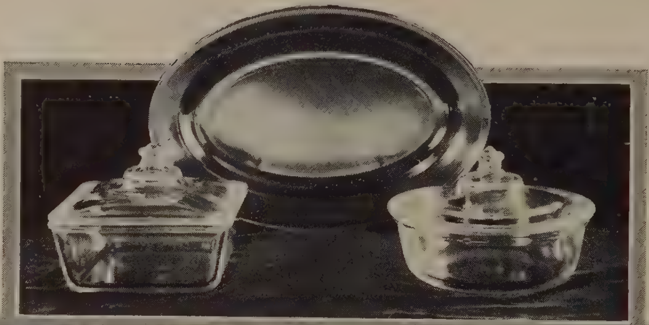
The washer, at left, has a tub of square cross section with rounded corners. The washing action is produced by a dasher or gyrator, a circular plate having vertical vanes or paddles. The clothes are dragged back and forth through the water, and the water is rather violently agitated by the gyrator as it rotates around the vertical axis. This machine has a power wringer.



In the machine at the right, the inverted hollow hemispheres are moved up and down in the clothes and water contained in the cylindrical tub. This action is typical of so-called vacuum cup washers. The one illustrated has no wringer, the drying being accomplished by centrifugal extraction. During the drying operation the inner basket is spun about the vertical axis at high speed.

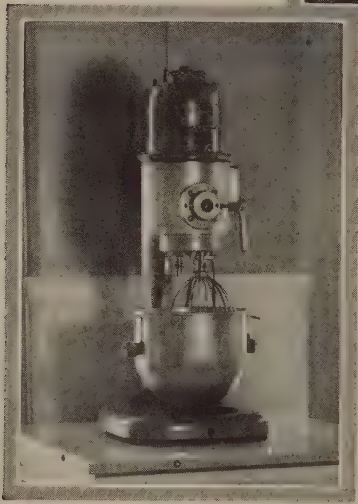
Kitchen Equipment

A lighting fixture, adapted to kitchen or laundry, designed to give proper diffusion and distribution of light with a high brilliancy incandescent lamp.

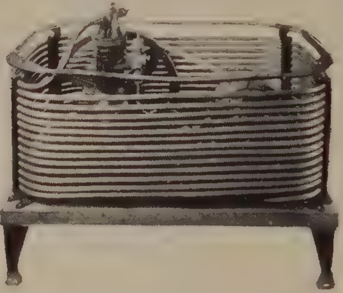


Glass of special composition which will withstand oven temperatures is being used extensively for oven cookery in casseroles, baking cups, platters and other suitable forms.

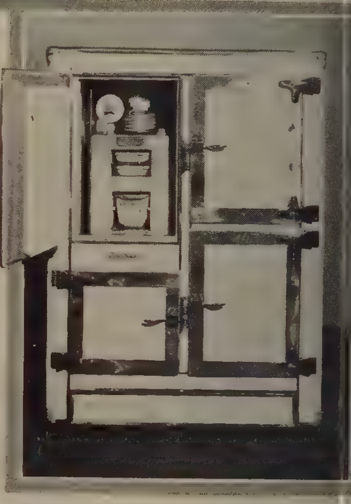
Advantages of the steam pressure cooker are economy in time and fuel. It has important applications in cooking at high altitudes, and for canning.



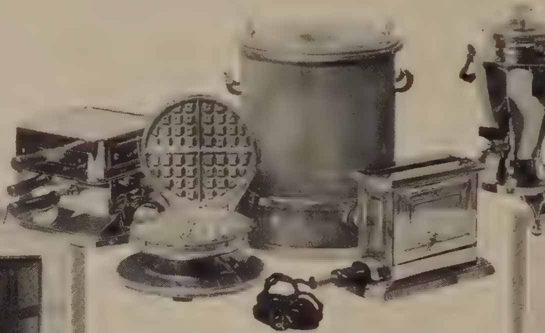
This beater and mixer is operated by the motor at the top which, through gears, drives two vertical spindles below, to which whips or beaters may be attached. A horizontal shaft drives other attachments such as coffee grinder, food grinders, ice chopper and ice-cream freezer. Three speeds are available.



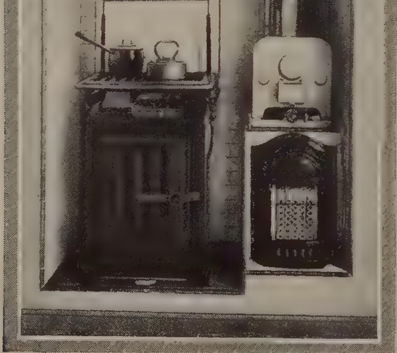
The motor-driven compressor compresses a gas refrigerant that becomes liquid in the condenser coil. The liquid is expanded in a coil in the refrigerator absorbing heat from surroundings. Expanded gas passes to intake of compressor and cycle is repeated.



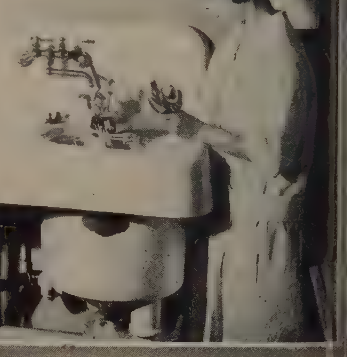
The tank in this refrigerator is the portion of the refrigerating unit which takes the place of ice. In it is a coil through which passes the refrigerant, such as sulphur dioxide, methylchloride, ethyl chloride, propane or isobutane. Outside of the coil is brine or other liquid having a low freezing point.



The appliances shown above include, from left to right, table stove, waffle iron, insulated cooker, toaster, and coffee percolator urn. All of these are electrically heated.



To the left is an English "all gas" kitchen having a cooker or range, a gas fire or room heater and a boiler or water heater.



The dishwasher at right is motor-operated and part of a kitchen sink. The motor is connected with a vertical shaft which projects through the bottom of the tank. On top of the shaft is a dasher to splash water over the dishes held in suitable racks. A cover is provided to reflect the splashed water over the dishes. There is a valve-controlled drain to the house waste pipe.

e dish-washer, both non-electric and electric, although lable for some years, has been slow to meet with popularity. epends on the action of a spray of hot water over the dishes, motive force being provided either by water pressure from ucet or by an electrically-driven agitator immersed in water. etal dish-drier, valuable in the saving of time and in the pos- ties for sanitary dish-washing, has not yet come into as ral use as it deserves. A machine of many uses in the kitch- the electric beating and mixing machine. It has a variety ttachments for various types of work. Among the minor ces of value should be mentioned stainless steel cutlery, developed in England (*see* Rustless Steel); oven-proof ; and a foot-lever attached to garbage cans, by which the r may be operated without the necessity of any stooping on part of the user.

Cleaning and Laundry Work

e scrubbing brush is being eliminated partly through ges in floor coverings and surface finishes, which lend them- s to easier cleaning methods, and partly through improve- ts in cleaning devices. The push-broom has come into wide the brooms with stout, heavy fibre being largely replaced acuum sweepers for cleaning carpets and rugs. Brushes ecialised design and material have been adapted to a large ber of different uses, the bristles varying in stiffness, size arrangement and the shape and handle being adjusted to unction for which the brush is intended. There is a tendency eplace wood by metal for the backing of such brushes. An rtant labour-saving device is a scrubbing brush rotated n electric motor, which may be used for polishing waxed s.

acuum Cleaners.—The first vacuum cleaners were hand- ated and were of the pump type. An electric cleaner, in- uced a little before 1910, was made by attaching a motor e of these hand-machines. In other machines a centrifugal directly attached to the motor shaft, replaced the suction p. Increased efficiency of the motor and fan has permitted at reduction in the size and weight of the cleaner. There wo general classes of cleaners: those relying on suction and depending mainly on a motor-driven brush. Those of the class clean by creating, through and across a floor covering, rent of air, which is carried through the cleaner by revolv- an and takes the particles of dust with it to be deposited e a bag provided for the purpose. Some of these so-called cuum cleaners" are provided also with fixed brushes inside tside the nozzle or with revolving brushes within the nozzle, notion of the brush being transmitted by the wheels on h the machine travels. These machines are distinguished the second type by the fact that the action of the brush condary in importance to that of the air current. In the d type, called "suction sweepers," the brush itself, re- d by motor, does the major part of the work, agitating loor covering in such a way as to loosen the dirt. The suc- produced by a fan raises the floor covering to the mouth e nozzle and carries the dirt into the bag. Various attach- s may be used with electric cleaners for cleaning cushions, lstered furniture, draperies and other surfaces.

undry Equipment.—Although primitive equipment and ods of laundering are still widely used, modern laundry ods are gradually driving out those century-old pieces of ment—the washboard and the boiler. These are not necessary achine-washing, when there is available a supply of hot r and soaps in flake and chip form or in cakes. The f stationary tubs, made of glazed porcelain or porcelain- elled iron, is becoming more common and, as in kitchen ment, tubs and ironing boards are being raised to a more ortable minimum working height. The use of the com- ion faucet for hot and cold water is increasing. Washing- ines, both hand and power-operated, are to a considerable t supplementing the stationary tubs. The electric wash- achine was first used a little before 1910, and by 1926 was her general use in the United States and Canada.

The purpose of all washing-machines is to drive the soapy water through the soiled clothes with sufficient force to wash out the dirt. In the so-called "dolly," one of the earliest types, the clothes are dragged back and forth through the water in a tub by means of prongs or pegs projecting into the tub from a base that is moved first in one direction and then in the other around its vertical axis. The sides and bottom of the tub are generally corrugated, so that there is something like a washboard action as the clothes are dragged back and forth by the prongs. A second type might be called the "pump circulating type." It consists of a tub in which a water-pump operated by an electric motor maintains the circulation of water, and the clothes are carried around and kept continuously in motion by the circulating stream. Another type has several paddles mounted on a plate in the bottom of the tub. It moves first in one direction and then in the other around its vertical axis, swirling the clothes and water back and forth.

The vacuum-cup, or suction, washer has two, sometimes three, cups shaped like inverted funnels or hollow hemispheres, which move up and down so as to plunge down into the clothes and water and force the water through the clothes. There is a constant shifting of the relative position of cups and clothes to ensure thorough washing. The oscillating type of washer consists of a tub generally shaped somewhat like a cube with rounded ends, in which a rocking action keeps the clothes in motion.

In the cylinder, or rotary-type, washer the clothes are placed in a perforated cylinder supported in a tub containing water. The cylinder revolves in one direction and then reverses, repeating this regularly, thereby keeping the clothes in a backward and forward motion over strips of wood or metal along the inner surface. Washing-machines often have power-driven wringers attached. Among the improvements introduced into the wringer is the use of semi-hard rolls, to prevent breaking of buttons and serious injury to the fingers of the operator if accidentally caught between the rolls. There is also a type of washer fitted with a centrifugal drier instead of a wringer in the form of an inner perforated container, which revolves rapidly, throwing the water out of the clothes. For filling these power-machines and emptying them there are fillers and drainers, working with a syphon action. Labour is saved, however, by having a supply of hot and cold water piped directly to the machine with a piped outlet for waste water. This arrangement involves having the machine permanently installed in the house. Clothes driers heated by gas are available for indoor drying, and indoor clothes racks have been ingeniously designed with a view to economy of space.

Ironing Machines.—The ironing-machine (formerly called mangle) was first operated by hand and, not being heated, accomplished its work entirely by pressure. The power-driven heated ironing-machine was developed in the United States about 1910. Both gas and electricity may be used for supplying heat, and mechanical control is, in some cases, now substituted for manual control. The larger machines have a roll length of about 48 in. and the smaller ones of about 28 inches. Water-softening plants are sometimes installed for use with household laundries to meet the problem of softening hard water.

Heating and Ventilating

In a large number of homes electrically-driven fans have long been used to give a cooling breeze in the summer. It is becoming more generally recognised that fans may be advantageously used in winter to improve the circulation of air in a closed room or to assist in direct ventilation to outdoors, thereby ridding the air of smoke or vapour. A specialised fan has been designed for attachment in window frames of kitchens for the purpose of ridding the room of cooking odours.

Auxiliary room-heaters, utilising the easily controlled fuels, are in common use. Gas heaters, of the so-called radiant type, have been making big strides in this field. They were first used in England, where they were practically always placed in front of a coal fireplace. Later "built-in" gas grates were introduced, and these have greatly increased in use. These grates take up less floor space and require a much smaller flue than the coal fireplace. Kerosene heaters, mainly taking the form of a large kerosene burner set in a suitable case having a steel drum for radiating heat, find frequent use in the autumn and spring to take the chill from one or more rooms and to help the main heating plant in periods of extremely cold weather. Electric-heaters of the radiant type are in general use, but more extensive development in electric house-heating appliances has been prevented through the relatively high cost of electricity in comparison with other available fuels.

Water-heaters.—In assuring a supply of hot water for household uses water-heaters play an important part as labour-saving appliances. One of the older methods for obtaining hot water where plumbing was installed was the provision of a hollow cast-iron section or water-back for one side of the fire-box of the kitchen range, this section communicating with a tank for storing the hot water. A similar method uses a coil or pipe inserted in the fire-box of the house-heating furnace or boiler and communicating with a storage tank. These methods of heating water suffer from the disadvantage that they cease to function when the furnace is not being used and when some other fuel is used instead of coal in the kitchen range. One of the cheapest methods of obtaining an abundant supply of hot water in the coal-burning regions of the United States is a small stove especially designed for the purpose of communicating with a water-storage tank. Gas is used extensively for heating water, sometimes in addition to a water-heating attachment to the house furnace. There are several types of gas water-heaters, the simplest consisting of a gas burner placed below a coiled pipe or cast-iron water-container attached to a tank by two pipes to permit circulation of water through the coil or container. This type of heater is frequently known as the side-arm heater. It is generally designed to be operated whenever hot water is desired, but attachments are made so that it can be converted into a thermostatically controlled heater to maintain a constant temperature in the storage tank. Another type of control is of the clock variety, so arranged that the gas flame will be extinguished after the burner has been in operation for a definite time, which can be varied as required. Another type of gas water-heater is simply a combination of gas burner and storage tank with automatic temperature control, known in the United States as the automatic-storage type. To avoid loss of heat during idle periods the tanks of these heaters are heavily insulated with such materials as corrugated asbestos paper, in layers sometimes $1\frac{1}{2}$ to 2 in. thick, mineral wool, ground cork, etc. An adjustable thermostat controls the burner, which has a pilot light burning continuously.

The so-called instantaneous type of gas water-heater is controlled by the opening and closing of any hot-water faucet on the pipe line attached to the heater. This control is effected by means of a hydrostatic valve, which operates through differences in pressure. When all the faucets on the hot-water line are closed the conditions of pressure on both sides of the hydrostatic valve are such that the latter remains closed, but when any faucet is opened, the release of the pressure operates the valve, which in turn opens the gas valve supplying the burner.

Kerosene or coal-oil water-heaters are in use in districts where gas is not available. The majority of these heaters are practically identical in principle with the side-arm gas water-heater already described. Some kerosene water-heaters, however, consist of a complete unit of tank and burner. This unit has a thermostatic control, which extinguishes the burner when the water in the tank reaches a certain maximum temperature. Electric water-heaters have not come into very general use because they are comparatively expensive to operate, unless electricity is very cheap. They are easy to control, the heating elements do not require oxygen as do the burners of any device depending upon combustion, and there are no products of combustion to pollute the air. The efficiency, also, can be made relatively high, because the heating elements may be immersed directly in the water.

HOUSING (*see* 13.814).—Even before the outbreak of War
problem of sanitary and suitable housing deeply engaged the
tention of all persons interested in promoting the welfare of
population, especially of the working classes. The populatio
modern large towns had risen very rapidly through influx f
outside, and the working classes in particular were crowded
gether in narrow, over-populated quarters. Thus a chief ai
pre-War housing reform was the construction of cheap w
men's accommodation, together with the clearing of the
slums. The methods of this reform hardly went beyond the
vision of easy building credits and cheap sites, the reductio
building costs, the systematic planning of new residential
tricts, and the encouragement of co-operative building activ
The ideal form of dwelling, the so-called garden city, which a
at giving every family a beautiful and healthy home surroun
by a garden, could only be realised in a few model examp

I. A GENERAL SURVEY

Apart from the so-called "public utility building," which ai
at no profit beyond a normal and fixed return on capital, al
all building activity before the War was conducted by pri
enterprise. The margin of profit was arrived at by estimating
difference between the sum necessary for amortisation of
capital invested and the proceeds of the annual rent, after
duction of all taxation and costs of repairs, upkeep and admi
tration. This margin was not as a rule very high, but represe
a secure income for the landlord-proprietor; experience
shown this to be one of the safest of all forms of investment.

Changes During the War.—The World War brought first a
ing-off of demand, followed later by a very rapid increase in
costs of building, which reduced and finally abolished altoge
the return on capital in new buildings. Moreover the econo
weakness of states and individuals made it impossible to a
rents to rise at the same rate as building costs. The raisin
rents on this basis was almost always countered by the state
restrictive legislation, partly out of consideration for the fam
of the soldiers called up for active service and partly in the b
that the universal and increasing rise of prices was only a t
porary phenomenon. It seemed advisable, therefore, to let r
form an exception to this rise; this was achieved by prohibi
the raising of rents, either in all dwellings or in partic
categories of them. This prohibition was regularly supplemen
by other restrictions, such as prohibition of notice to quit. T
there arose in almost all European countries a special tenant
tection legislation, which imposed artificial restraints on
natural development of prices on the housing market.

Thus arose the difference between the rent paid for old dw
ings and the economic rent of new dwellings, a difference so g
that tenants could not pay for dwellings in new buildings.
at the same time rents, kept stationary at the pre-War level,
lost so much purchasing power in view of the general ris
prices that they often barely sufficed to cover the costs of
most necessary repairs. In most cases they no longer counte
a source of income for the landlord-proprietor. Thus pri
capital withdrew from building activity, as it could find m
more profitable application in many other branches of product

Housing Shortage.—Therefore a demand for housing accom
dation, which grew suddenly and rapidly, especially after
War, was confronted with a complete lack of supply of
dwellings. Moreover, the housing accommodation to han
on the decrease, since little or no renovating or repairs had
carried through for several years. Since it was impossible in
countries suddenly to let rents rise at one bound to a level w
would make the construction of new dwellings completely
nomic, there was no resource but to draw the necessary buil
capital out of national resources through other channels
those of free initiative.

State and Municipal Assistance.—States and municipa
were forced to spend on this object, under various headings
in various degrees, in part even by an actual subsidy of bui
activity. They took over the payment or guaranteed
ment for interest, redemption charges, amortisations and re

it of advances for building purposes, granted loans from lic funds, either free of interest or on easy terms; and granted -repayable building subsidies (in the form of premiums, sub- es *à fonds perdus*, etc.), either to cover the annual interest redemption charges or to cover the so-called "non-recover- building costs," *i.e.*, that part of the capital invested in ding on which interest and amortisation cannot be obtained.

ocial Aspects of State Assistance.—This far-reaching financial stance of building activity enabled the public authorities to l certain social requirements in the dwelling houses which helped to erect. Public assistance in building was as a rule ined to the construction of small dwellings and workmen's ses, subject to the fulfilment of certain minimum conditions social, hygienic and ethical nature and usually assistance was given to the "public utility" building activity of the local horities and co-operative societies. Only in its later stages this public assistance extended to include private building vity, and then mostly on the pre-War lines of remission of tion and of credit facilities. As, however, the resources ch could thus be applied to the construction of new dwellings , even so, usually insufficient to meet the actual demand, it ned imperative to supplement them by measures controlling ing housing accommodation.

ost-War Housing Policy.—Post-War housing policy may be divided into three groups of measures, under the head- : "tenant protection," "distributive" and "productive ing policy." Rents in existing dwellings should only be raised degree justified by the general economic situation and the ral ability of the population to meet them. This ideal can be realised when the conditions governing notice to quit be regulated at the same time (tenant protection). Since low encourage an uneconomic utilisation of existing accommo- on and, combined with the restrictions on notice, make an stment of the housing market difficult, it is necessary to re proper utilisation and just distribution of existing dwell- accommodation through official supervision (distributive ing policy). The systematic encouragement of direct build- ctivity becomes a task for legislation and administration, as ined above (productive housing policy). Although tenant ction and distributive housing policy are essentially excep- l measures which infringe on the liberty of the individual spose of his property, they have nevertheless lent a charac- ic stamp to the housing policy of almost all European states.

nant Protection.—Tenant protection assumed different s in different legal systems. In countries where fixed-period s are customary (France, Belgium, Italy, Rumania, the Can- f Geneva), the extension of the period of lease was secured w in some cases, in others left to the decision of special rent liation offices or tenant protection commissions composed of ords' and tenants' representatives in equal numbers. untries where leases are regularly contracted for indefinite ds and are terminable by notice (Central and North Europe) ght of giving notice is legally restricted, subject to the legiti- interest of the landlord (personal requirement), on condi- that the tenant can find another suitable dwelling; offences mitted by the tenant (arrears in payment of rent, disturb- of the peace, sub-letting without approval, etc.); or con- ations of public interest (alteration of the house, official rement of accommodation, etc.). In Germany, the right to notice has been abolished altogether and replaced by appli- n to a court of law for termination of the lease. Tenant pro- on has also often been extended to the increasingly common of sub-tenancies. Special provisions for periods of grace in of notices to quit are designed to eliminate, where possi- ompulsory evictions, which are undesirable if only in the st of public peace.

striction of Rents.—Measures for the protection of tenants ub-tenants against increases of rent have varied widely in ent countries according to the intensity of the housing age. In many of the neutral countries (*e.g.*, Holland, Spain) issions were set up, usually giving equal representation to rds and tenants, to consider whether a disputed increase of rent was justified. Other countries (England, France, Belgium, Italy, the Scandinavian countries, etc.) went further, introducing legislation or regulations by which certain categories of tenants or dwellings where such protection seemed advisable were liable to increases of rent only on a fixed graduated scale. In determining the percentage of increase, the taxable value of the house, the average expenditure necessary for its upkeep, etc., were taken into consideration. According to the country's general housing policy, the tendency was apparent, in greater or lesser degree, to bring rent gradually into line with the general level of prices and thus clear the way for the removal of rent restrictions.

The countries most severely affected by the housing shortage, especially those of Central and Eastern Europe, sometimes even reached the stage of making every increase of rent illegal, on the principle of placing the whole question of fixing rents on an exactly defined legal basis and thus abolishing freedom of contract in rent questions. As these were the very countries where the devaluation of currency with its devastating economic consequences appeared in its acutest form, the adaptation of the real rent, which had often sunk to a minute sum, to the new monetary conditions, formed a particularly difficult problem.

Allocation of Existing Dwellings.—These are the countries which were forced to take the most drastic measures in their distributive housing policy. In western countries, the authorities generally confined themselves to prohibiting the demolition of dwelling-houses, the utilisation of dwelling-space for other than dwelling purposes, the use of two or more dwellings by one occupant, etc. In many cases, too, permits to enter and settle in a district were introduced to restrict the liberty of moving (especially in Switzerland and Czechoslovakia) in order to secure the available dwelling-space for the native population. In some cases strangers were excluded from the benefits of tenant protection.

In the countries of Central and Eastern Europe, where the housing shortage was worst, housing policy even resorted to the radical measures of official requisitioning and allocation of available dwelling-space. Here again the interpretation of the word "available" varied sensibly. In some cases only dwelling-room which was actually empty or easily dispensable was subject to these measures, in others the dwelling-space allowed per head, or rather, the number of heads allowed per dwelling-room was fixed by law, and every dwelling-room beyond this was requisitioned and allocated to persons requiring accommodation (Germany, Austria, Czechoslovakia). Such measures were not far from the socialisation of dwelling-space, as actually practised in Hungary under the Communist régime and in Soviet Russia, where the Govt. carried its principle of "condensing" housing so far, that not only dwelling-rooms, but also unused corners of rooms were requisitioned and officially occupied. Even so, the housing crisis in Russia surpassed that of the worst-situated of the European countries.

Economic Effects of Rent Restriction.—The allocation of requisitioned dwelling-space presupposed a just and rigorous classification of the applicants according to the urgency of their needs. An entirely new and very responsible administrative branch was therefore created in public, especially municipal administration, which created an expensive and intricate apparatus (housing offices). The economic consequences of the restriction of rents in comparison with those of before the War was a far-reaching alteration in the utilisation of the national income. Of the enormous sums which had formerly been employed in the form of rent to pay interest and amortisation of the capital invested in dwelling-houses and to maintain the stock of dwelling-houses, only a small fraction was now applied to the same end. In this way the capital invested in dwelling-houses was partly consumed without any compensation being received. How far this was the case in the different countries is best seen from the table on the next page, which shows the percentage expenditure on rent in the total cudget of a workman's family before and after the War.

But a closer observation of the consequences of rent restrictions seems to show that the alteration in the distribution of the national income goes far deeper than is apparent at first sight, *Percentage Expenditure on Rent in the Total Budget*

Country	Pre-War	July 1922	July 1924
Denmark	14·2	11·14	11·22
Norway	15·7	11·40	11·30
Sweden	11·9	11·2	12·38
Switzerland	10·4	9·9	9·88
Great Britain	16·0	13·7	13·76
Finland	11·8	10·3	11·92
France	12·0	7·2	6·60
Italy	11·4	4·34	6·84
Germany	18·0	0·34	10·62
Austria	14·6	0·66	1·18
Poland	18·1	3·44	5·07
Hungary	18·0	0·22	0·77

and that the relative expenditure on different objects of the working population in particular has been deeply influenced by the fall in rents. For it became the almost universal practice to determine wages by reference to the general level of prices, so that the real wage of the workman, that is the purchasing power of his wage measured in commodities, should remain essentially stable. In reckoning the general level of prices, rent was considered as a factor. The workman who only paid in real value half as much or less for his dwelling as before the War, could therefore be content with a proportionately smaller real wage without impairing his general standard of life.

In view of the fall of the national income in many countries, this reduction of the workman's real wage, while not perceptible to himself, was perhaps actually necessary, at any rate advisable as making cheaper production possible. In any case, similar consequences of the rent restrictions also had their effect on the income and relative expenditure of other classes of the population. It became impossible to find paying tenants, especially for new working-class dwellings erected at greatly increased cost. They could not therefore be built with any prospect of a return on the capital invested, and were not built at all except where the state or the municipality intervened with assistance from public funds. But even this fund was modest in comparison with the capital which had been employed before the War in erecting dwelling-houses. A further consequence of this rent policy has been therefore a change in the application of the available national capital.

Modification of Restrictions.—Under these circumstances, all countries which did not aim at complete destruction of the value of housing property as a step towards socialism began to feel the need of restoring normal economic conditions in the housing market and of gradually raising rents into line with the general price level. The legislative methods adopted, the so-called "modification of rent restrictions," varied greatly in different countries; it was a general rule that the dwellings of the poorer classes were affected last by the rise in rents, and only quite gradually. Some governments found it expedient not to restore to the house owners that part of the national income which the increases of rent had rediverted into its former channels, but, after covering the expenses of repairs, upkeep and administration, to reserve the remainder as "rent duties" for public ends, either the construction of new dwellings for the most necessitous classes of the population, or else (as, for example, in Germany) for the general financial reconstruction of the state. In any case, since the raising of rents, if severe shocks to the economic system are to be avoided, must almost always be distributed over a long period, the capital necessary for new building had to be drawn from other sources than private capital seeking investment.

Other Methods of Financing Building.—The application of public money to housing is generally confined within as narrow limits as possible. Attempts have often been made to induce employers to help in raising the necessary means. Building subsidies from public funds have often been made conditional on the employers' providing subsidies of an equal amount. Some countries (*e.g.*, Yugoslavia) have even imposed a legal compulsion to build, on well-to-do individuals and firms who have been obliged at their own expense to provide by building for the accommodation of themselves, their families and their employees.

Reduction in Costs.—Another important way of bringing t rent of new dwellings into correspondence with the means tenants is by reducing the cost of building. This can be do by using less expensive forms of construction, employing cheap materials, standardising and typifying certain elements of t house. In almost all countries architects, engineers and contra tors have been occupied with these questions. In England, t Govt. has made elaborate enquiries in this direction, and h recommended certain useful new types of building. Attemp have been made to reduce building costs by co-operative me ods. Encouraged by many municipal authorities and by t trade unions, guilds, building organisations and social buildi enterprises have sought to solve the financial problem by eli nating profit and increasing output. But surrounded as they a by a world organised on non co-operative lines, they ha achieved no more than partial successes. No new method, new system has been fully successful in combating the housi crisis. The qualitative elements in housing—the improvement hygienic, ethical and social standards—have to be conside under the head of CITY PLANNING.

II. HOUSING IN VARIOUS COUNTRIES

The neutral states of Europe naturally suffered least from housing crisis consequent on the World War. Nevertheless, th did not wholly escape it, and, in fact, the Scandinavian sta Holland and Switzerland all adopted a more or less extens tenant protection policy. These countries, however, suffe very much less than the belligerents from the stoppage of bui ing; in none of them did building cease altogether. Therefore th could set about filling up their gaps much sooner. Holland is only country besides Spain in which extensive building activ since the War has already brought the end of the housing sho age in sight.

Countries of Western Europe.—Those victorious states wh found wide stretches of their country in ruins at the end of War had to reconstruct many thousands of ruined houses. I gave a welcome opportunity within the narrow limits of finan possibility of realising as far as possible the ideas of the hous reformers by building small family houses in garden settleme Remarkable successes have been achieved on these lines in the constructed districts of Northern France, Belgium and It Poland and Yugoslavia have also carried through the work reconstructing their devastated districts with much succ In Belgium, the *Société Nationale des Habitations à Bon Mar* with its wide network of local organisations, has done excell work in public utility housing construction, and financial ass ance has been given by the State.

In Italy legislation for the *case popolare ed economiche* has b of great importance, whereas the French housing action ba on the legislation *pour les habitations à bon marché* does not pear to have given really satisfactory results, although con erable financial assistance has been given and a great appara of offices and *sociétés d'habitations à bon marché* establish Great Britain has attacked her housing problem with m greater energy and correspondingly greater success, as wil seen in the article on the following page.

Germany and Austria.—Most states of this group have b compelled to requisition housing accommodation. The meth adopted were often influenced by political tendencies. T degree of success depended mainly on the economic capabil of the different countries. Germany suffered a severe hou crisis as an effect of the depreciation of her currency, though spent large sums from public funds and inaugurated a r successful housing policy in many industrial districts, *e.g.* the Ruhr. The particular character of her housing problems met by the organisation of housing offices, official control of exchange of dwellings, the assistance of rural building from funds of the so-called "productive unemployment relief" construction of miners' homes out of the proceeds of a dut coal, self-help associations such as the Lüneburg "Notgem schaft," building guilds, state-assisted limited companies erecting dwellings for dismissed employees, etc. Germany's cy aimed at raising rents in comparatively rapid stages to r pre-War level; the landlord-proprietor receives, however, so much of this increase as will correspond to the revalua- of mortgages in progress in 1925.

he housing shortage in Austria brought with it a strict tenant ection policy. In Vienna, rents were kept down in a way ch amounted to expropriation of the landlords in favour of tenants. The municipality of Vienna then itself took over building activity for the city, covering the deficit which it rred out of general and special taxation (rent tax).

ther Countries.—The more favourable financial situation of other succession states enabled Czechoslovakia and Yugo- ia especially, both to undertake state-assisted building vity on a much larger scale and to resume private enter- e. The reduction of war and emergency measures dealing tenant protection and distributive housing policy is already advanced in these countries, as also in Hungary, Poland, nania, Bulgaria and Greece.

Russia, the change of system in general economic policy in brought a return to more fruitful methods of housing policy r the original epoch of municipalisation and socialisation out, however, bringing noticeable relief. The European sing shortage thus presents a problem of such extent that, iew of the continuous increase of the population, it will be before it vanishes from the order of the day. (K. P.)

OTE.—The above sketch is based chiefly on the volume *European sing Problems since the War*, published by the International our Office, Geneva (1924).

nited States.—Housing conditions in the United States ely parallel those of European countries. The conflagration however, is greater, due to the large use of wood in the truction of dwellings. On the other hand, the much more ral use of modern systems of plumbing, heating and lighting es for greater comfort. The relative newness of American s means that they are less harassed by the survival of lete types of dwellings. The problem of slum demolition is efore not as acute or as prevalent as in Europe.

e National Housing Assn., established in 1910, and directed Mr. Lawrence Veiller, has promoted the study of local ing conditions and the framing of state housing laws and housing ordinances. Approximately 100 local housing sur- have been made in the last 20 years, most of them ting in improvements of local housing conditions. State- surveys made in California by the State Commission of igration and Housing and in New York State by the mission of Housing and Regional Planning are especially worthy.

gislation.—The revised edition of Lawrence Veiller's Model sing law has been used as the basis of housing acts in a number of states and cities. The Recommended Minimum uirements for Small House Construction of the United States t. of Commerce, prepared by a special committee with the eration of Dr. John M. Gries, Chief of the Division of ding and Housing, are widely used as the basis for building s, and that division has played an important rôle in pro- ng building, housing and zoning legislation and in providing ral information on these and kindred subjects.

gencies of Improved Construction.—Among the scores of lim- dividend companies for improved housing, the City and rban Homes Co. of New York City is conspicuous for the nsiveness of its building operations. The Metropolitan Life rance Co. and the Bayonne Housing Corp., with the aid of ew J. Thomas, architect, have made notable advances in ment house architecture, especially in planning for sunlight. most striking of recent developments in row and group ing have been made by the City Housing Corp. of New City in their Sunnyside development and by the Bridgeport sing Assn. at Bridgeport, Conn., and the Octavia Hill Assn. iladelphia. The garden community designed by John Nolen lariemont, near Cincinnati, O., although not designed for -earning families, is the best recent example of community ning with detached housing.

Co-operative Housing.—A movement for co-operative ownership of apartments has been cultivated by the National Assn. of Real Estate Boards. The only important recent venture in co-operative suburban housing is that of the Garden Homes Co., near Milwaukee.

Industrial Housing.—Several hundred American industrial corporations have provided industrial villages or extensive improved housing developments for their employees. Among these should be mentioned the U.S. Steel Corp., which has built in scores of communities; the General Motors Co. at Flint, Mich.; the Goodyear Tire and Rubber Co. at Akron, O.; Norton Co. at Worcester, Mass.; the Mount Union Refractories Co. at Kistler, Pennsylvania and the Ford Co. at Detroit.

Governmental Housing.—In the United States the building of houses is left to private enterprise. During the World War the Federal Govt., through the U.S. Housing Corp., the Emergency Fleet Corp. and the War Dept. built many thousands of houses in well-planned communities, as an emergency measure. These projects have since been disposed of by sale to individuals or corporations. They have, however, served to interest many leading architects and town planners in the problem of industrial and suburban housing, and thus have led to improvement in general standards of industrial housing.

Housing Finance.—There is no provision by the Federal or state governments for public loans for small-house construction. The recent attempt by the state of North Dakota to provide such loans has been pronounced unsuccessful. The construction of private dwellings is largely financed through building and loan associations, which are semi co-operative in their organisation and methods. In 1924 there were 11,844 associations of this character, with a membership of over 8,500,000 persons, and total assets amounting to over $4,700,000,000.

Educational Agencies.—In 1922 Better Homes in America, Inc., was established by Mrs. William B. Meloney to organise local committees to study and improve local conditions of housing and home-life. Under the leadership of its president, Herbert Hoover, Secretary of Commerce, this organisation in 1926 formed 2,937 committees in cities, towns and villages throughout the United States. These committees have arranged lecture and discussion programmes, contests for home improvement and demonstrations of the better types of small house architecture, furnishing and landscaping.

The Architects' Small House Service Bureau, established by the American Institute of Architects, has contributed greatly to the improvement of prevailing standards in small house planning and design by issuing hundreds of plans of single-family houses of from three to six rooms. Such plans, with specifications and quantity surveys, are sold at nominal cost to families throughout the United States who are interested in building homes of their own. (J. F.)

III. HOUSING IN GREAT BRITAIN

Despite legislation during the preceding 50 years or thereabouts, housing of the working classes throughout England and Wales in the census year of 1911 was far from satisfactory. Economic facts mainly account for the paradox of surplus accommodation (5·6%) existing in conjunction with some 250,000 families surplus to structurally separate dwellings; 405,010 tenements of four rooms and less were occupied by more than two persons in one room. Insanitary areas and unfit houses abounded. The conditions in Scotland were worse. Local authorities, even later than 1890, with few exceptions, did not consider that housing the people fell within the essentials of their activities, and up to 1909 a legal obligation existed to sell, within 10 years, houses erected in discharge of rehousing obligations.

Unregulated and speculative individual effort dominated this branch of the building industry to the extent that some 95% of pre-War working-class accommodation was built by private enterprise. Increasing cost of production operated to diminish output until fear, inculcated by the taxation of land, produced by the Finance (1909–10) Act, dried up the sources of speculative house building. The dangers due to increasing population cribbed by inadequate and wasting accommodation failed to secure national recognition, although private bills to stimulate production by subsidy were introduced unsuccessfully from 1911 to 1914.

Thus the outbreak of the World War in Aug. 1914 found housing in arrear. War conditions, causing large migrations and increased marriages, rapidly absorbed vacant accommodation in the cities. Rent Restriction Acts controlling rents and preventing evictions, but aggravating slum conditions, followed. Normal upkeep of houses was checked, and new construction was suspended by military requirements. Production and import of building materials ceased, and the ranks of skilled labour became depleted. The end of the War revealed a deplorable condition. The perpetual housing problem due to poverty had been intensified, and accommodation was lacking for many whose capacity to pay was undoubted. It was estimated (1918), possibly in excess of the immediate effective demand, that a deficiency of approximately 500,000 houses existed, of which 109,000 were needed in Scotland.

The census of 1921 later revealed 760,543 families in England and Wales surplus to structurally separate dwellings. The replacement of unfit dwellings to an approximate amount of 205,000 was not included. In addition, the London County Council required 29,000 new dwellings and immediate clearance of insanitary areas involving rehousing of 40,000 persons. It is noteworthy that nevertheless health statistics were good.

The problem presented was incapable of rapid solution. Skilled operatives were reduced by 50% as compared with 1908, and the remainder absorbed in maintenance and by contract builders. Material was scarcely procurable. An unparalleled financial stringency prevailed, with cost of living of wages and of material increased by over 100% on pre-War figures. The working classes, which constitute about three-fourths of the population, mainly require houses let at weekly rents. Even if building for sale were feasible, to let at an economic rent was impossible.

The Act of 1919.—In these circumstances the Coalition Govt., stimulated by the slogan "Homes for Heroes," rapidly passed the Housing, Town Planning, etc., Act 1919. This epochal Act embodied three principles: an obligation on local authorities to effect housing schemes, a State subsidy to housing and stringent penal clauses relating to compensation payable for insanitary property. The State shouldered all liability on approved schemes exceeding a 1d. rate borne by the local authority. The standard of housing was raised, but the incentive to local extravagance, countered by paralysing departmental centralisation, combined with exclusion of private enterprise, marred the Act. Prices soared until an annual loss per house of £50, to be met throughout the loan period of 60 years, was not uncommon. The average cost, exclusive of London, in 1920 was £860 for non-parlour and £972 parlour type. Nearly £100 must be added to building prices for land, roads and sewers. In London it cost as a minimum £158 per person housed as compared with £43 per person pre-War, and the average per habitable room in a tenement block attained £375 comparable with less than £100 pre-War. A total of 174,540 houses excluding some 3,000 temporary huts was the result of the Act at a (Treasury) cost of about £175,000,000, exclusive of the 1d. rate borne by the local authorities.

The Act of 1919.—The Housing (Additional Powers) Act 1919 remedied the exclusion of private builders, to whom a lump sum subsidy averaging about £240 a house was given, which provided nearly 40,000 houses at a total cost to the Government of £9,493,155; it forbade conversion or demolition of dwelling houses, and, to conserve labour for dwellings, attempted prevention of "luxury" building; the latter prohibition proved more injurious generally than beneficial. Both output and cost were seriously affected by the trade unions of this sheltered industry, which defeated all attempts to increase production by a dilution with ex-service men or otherwise. The results attained by the 1919 Act were not commensurate with the cost. Therefore in June 1921 the Government curtailed the scheme to "the number built, building or for which tenders have been approved," and notified a contribution not exceeding £200,000 a year for the improvement of insanitary areas in England a Wales. The suspension of the Act led to a fall in prices, and a va hope of abolishing subsidy was entertained in some quarters. T average cost (excluding London) in 1922 for non-parlour type w £362 and with parlour £393. By 1925 prices had reached £440 a £495 respectively, but in 1923 it was deemed expedient to enac limited subsidy (£6 a year for 20 years) for houses or flats of specif dimensions and containing a bath. The (Chamberlain) Act succ fully aimed at promoting private enterprise and owner-occup both by subsidy and loan. The Small Dwellings Acquisition 1899 was extended and co-operation with public utility and build societies sought. Up to the end of 1925 over 278,484 houses been arranged for under the Acts of 1923 and 1924, of which 151, were completed.

Acts of 1923 and 1924.—Before the 1923 Act could become operat the advent of a Labour Govt. led to fresh legislation, to *pari passu* with the 1923 Act. After conferring with the build industry and the local authorities a financial basis was agreed between taxpayer and ratepayer. The former was to pay twic much as the latter, viz.: £9 and £4 10s. respectively, for 40 ye and any remaining gap between cost of production and inc should be filled by rent from the tenant. Heretofore rent fixat had proceeded on the basis of comparable accommodation in neighbourhood: now special conditions were attached on the b of pre-War rents as amended by Rent Restriction Acts. This w diminish rent where production costs were low. In agricultural ishes, of defined limits, the subsidy was raised to £12 10s. becaus the special difficulties of rural conditions. The Housing (Finan Provisions) Act 1924 propounded a fifteen years' programme, ject to biennial revision of contributions, under which 2,500, houses should be provided; an apprenticeship scheme, under w the ratio to craftsmen was increased to one in three, instead of unattained permitted maximum of from one in four to one in se was an essential adjunct of the Act. But an apprenticeship sch requires several years before fruition, and augmentation of cr men was overdue.

The continuing shortage of skilled labour led to investigatio new methods and materials for cottage construction. Conc speedily established itself as a substitute for brick, but the neces of eliminating plasterers' and bricklayers' work evolved novel ty notably the factory-made "steel" house. Progress in such has been hindered by the hostility of the building industry and timidity of local authorities.

Consolidating Act of 1925.—The permanent law relatin housing was consolidated into the Housing Act 1925, and attached table shows progress up to the end of that year. In London area progress was retarded by special difficulties, ma due to London's magnitude, the population being eight t that of Birmingham, the next largest city (excluding Scotla and the inaccessibility of housing sites.

The housing problem is not solved, and the economic posi now as ever, refutes the idealistic standard of one dwelling family, every family a dwelling. It will take much expend and many years of persistent national endeavour to achie practical standard enabling all capable of paying a mod rent to occupy a structurally separate dwelling, to establi margin of surplus accommodation, to suppress overcrow and to abolish insanitary areas and unfit houses. But a post lies in an adequate supply of skilled labour, and a measu town planning applied to built-up areas is indicated as a corol

Pre-War Number of houses provided	Greater London	England and Wales (including Greater London)	Scotlan
Average per year in five-year periods ended —			
1904	25,500	116,370	14,55
1909	17,860	102,706	9,12
1914	9,330	60,648	2,85
Post-War.			
To end of 1920 .	2,642	221,000[1]	35,00
1921	12,921		
1922	16,913		
1923	10,229	71,934	
1924	17,339	125,762	
1925	23,000[1]	166,952	..

[1] Estimated.

Bibliography.—Hansard's *Parliamentary Reports; Censu turns for 1921; Public General Acts*, 1919, etc. (9 and 10 Ge chapters 35, 45, 60 and 99 of 1919; 10 and 11 Geo. V., chapter 1920; 11 and 12 Geo. V., chapter 24 of 1923; 15 Geo. V., ch 14, 15, 16 and 17 of 1925). (C. B.

OUSMAN, ALFRED EDWARD (1859–), British poet scholar, was born March 26 1859 and educated at Broms- ve School and St. John's College, Oxford. From 1882–92 ıeld a post in the Patent Office, and then became professor of in at University College, London, until 1911. He filled the ınedy Chair of Latin at Cambridge from 1911 onwards, being elected fellow of Trinity College. His editions of Manilius ɔ3–20) and of Juvenal (1905) are well known to classical ɔlars, but he is most widely famed as the author of the lyric ıence, *The Shropshire Lad* (1896), a work with few rivals of kind in the language. His only other published volume oetry was *Last Poems* (1922), which showed a command of cate cadence and a fine sensibility no less distinguished than se of his early work.

OUSSAYE, HENRY (1848–1911), French historian (*see* 28), died in Paris Sept. 23 1911. After his death were pub- ed *Iêna et la campagne de 1806* (1912), and *La patrie guer-* (1913). See L. Sonolet, *Henry Houssaye* (1905).

OUSTON, Texas, U.S.A. (*see* 13.828).—A few years after the rld War, Houston became a world port, with 33 steamship s in 1925 operating regularly to the principal ports of North South America, Europe and the Orient. Its total tonnage xports, imports and coastwise traffic (1924) was 5,343,598 s, valued at $294,796,871. The first bale of cotton was orted in Nov. 1919; shipments for the season 1924–5 were 1,828 bales. The 25-ft. ship channel, completed in 1914, deepened to 30 ft. and widened between 1919–25. Un- an enabling Act, passed in 1921, the navigation district Harris co. assumed operation of the port and made ex- sive improvements in port facilities. The projected intra- stal canal from the Mississippi river to the Houston Ship nnel will connect the port with 6,000 m. of inland waterways. value of manufactures within the city limits was $23,015,000 909; $86,874,000 in 1919; $89,133,777 in 1923. The area was cased from 17·4 sq. m. in 1910 to 36·5 sq. m. in 1920 and to q. m. in 1925. The population in 1920 was 138,278, of whom 60 were negroes and 12,088 foreign-born; in 1925 it was nated at 164,954; the local estimate for the metropolitan rict was 250,000. Between 1920 and 1925 great progress was le in paving and widening streets, constructing sewers and ges, improving the fire department, building driveways along bayous, adding parks and beautiful public buildings and ısforming the business section with modern office buildings hotels. Rice Institute opened for its first academic year on t. 23 1912 in buildings on its 300-ac. campus.

OWARD, LELAND OSSIAN (1857–), American ento- ogist, was born at Rockford, Ill., June 11 1857. He gradu- l from Cornell University, becoming B.S. in 1877 and M.S. 883. After serving as assistant entomologist at the U.S. ɔt. of Agriculture, Washington, D.C., in 1878, he was made f of the Bureau of Entomology in 1894. From 1904 he was sulting entomologist in the U.S. Public Health Service, and n 1895 honorary curator of the U.S. National Museum. was in 1917 a member of the committee on agriculture and irman of the sub-committee on medical entomology of the ional Council of Defence.

oward wrote *Mosquitoes—How They Live* (1901); *The Insect* k (1902); *The House Fly—Disease Carrier* (1911); a monograph mosquitoes for the Carnegie Institution (1912); and many ernment bulletins.

OWELLS, WILLIAM DEAN (1837–1920), American novelist 13.839), died in New York May 11, 1920. In 1915 he ived the gold medal of the National Institute of Arts and ers for his work in fiction. To within a short time before his h he continued to contribute to the "Editor's Easy Chair" *larper's Monthly*. His later works included *My Mark Twain* o); *Imaginary Interviews* (1910); *Parting Friends: a Farce* 1); *Familiar Spanish Travels* (1913); *New Leaf Mills: a* *onicle* (1913); *The Seen and Unseen at Stratford-on-Avon: a* *tasy* (1914); *The Daughter of the Storage and Other Things in* *se and Verse* (1916); *The Leatherwood God* (1916); and *Years* *My Youth* (1916). In 1920 he edited with an introduction *The Great Modern American Stories.* He left unfinished *Years of My Middle Life.*

HRDLIČKA, ALĚS (1869–), American anthropologist, was born at Hampoletz, Bohemia, March 29 1869. His early education was received in Bohemia. He studied at the New York Eclectic College becoming M.D. in 1892. In 1894 he joined the New York State service, investigating the insane and other defective classes, and became in 1896 associate in anthropology in the State Pathological Institute. He was a member of the Hyde expeditions to Mexico and the southwestern United States in charge of physical anthropology, 1898–1903. In the latter year he was appointed assistant curator in charge of the division of physical anthropology at the U.S. National Museum, Washington, D.C., becoming curator in 1910. As a member of various anthropological expeditions he made researches in many parts of the globe. He became a leading exponent of the theory that the North American Indian is of Asiatic origin. Among his works are *The Eskimo Brain* (1901); *Ancient Man in North America* (1907); *Ancient Man in South America* (1912); *Anthropological Work in Peru* (1914).

HROZNY, BEDRICH (1879–), Czech orientalist and archaeologist, studied in Prague, Vienna, Berlin and London. In 1904 he took part in the Seelin excavations in Ta'anuk (north Palestine), on the basis of which he wrote *Die Keilschrifttexte von Ta'annek* (1904) and *Die neugefundenen Keilschrifttexte von Ta'annek* (1906). In 1905 he was appointed professor at the University of Vienna, and in 1919 became professor of cuneiform research and ancient Oriental history at the Charles University of Prague. Hrozny's name became known chiefly in connection with the study of the ancient Hittites. He left the solution of the Hittite hieroglyphics to chance, proceeded to work on the basis of Hittite documents from the Boghazkoi archives written in cuneiform script, and in 1915 thus succeeded in deciphering the Hittite language, which he proved to be an Indo-European tongue, closely akin to the Iranian, Celtic, Italic and Slavonic families of speech. His solution was attacked from many quarters, but he substantiated his claim by the success with which he read and translated a number of documents, among others a Hittite legal code (published in Paris, 1922, under the title: *Code Hittite provenant de l'Asie Mineure, I. Partie: Transcription, traduction française*). In 1925 excavations for the purpose of further research were made under his direction by a Czech scientific expedition to Asia Minor.

HUBAY, EUGENE DE (1858–), Hungarian composer and violinist, was born at Budapest Sept. 15 1858. His first teacher was his father, who was a professor of the violin, as well as a composer and conductor. From 1871–5 he studied in Berlin under Joachim, and later, on the recommendation of Liszt, gave successful violin recitals in different countries including England. While in Paris he was associated with Vieuxtemps and Massenet. In 1882 he succeeded Wieniawski as professor of the violin at the Brussels Conservatoire, and in 1886 was appointed to a similar post at the Budapest Academy, of which he has been the director since 1919. His pupils include many eminent violinists, among them Vecsey, Jelly d'Aranyi and Szigeti. Hubay has written the following operas: *The Violin Maker of Cremona; Anna Karenina; Alienor; Die Maske; Moosröschen; Lavottas Liebe*, etc. His other compositions include symphonies, violin concertos, and solos and songs. His early works, based on Hungarian and French elements, were exclusively lyrical, while his later compositions show more dramatic rhythm as well as more modern tone-colouring.

HUBER, MAX (1874–), Swiss lawyer, was born Dec. 28 1874 at Zürich. He became doctor of law at Berlin University in 1897 and, on the conclusion of his studies, travelled extensively and made a prolonged sojourn in the Far East. From 1902 to 1921 he held a law professorship—first extraordinary and subsequently ordinary—at the University of Zürich. In 1921 he resigned his chair and became honorary professor. The Swiss Federal Council on many occasions consulted him as an expert in international questions and he was a Swiss representative at the Hague Conference in 1907. During the World War he was legal adviser to the Swiss Political Department. In this capacity he was entrusted with several missions to the Peace Conference, to the League of Nations and to various governments. In 1920 and 1921 he was deputy delegate to the Assembly of the League of Nations. He was a member of the Jurists' Committee of the Council of the League of Nations dealing with the Aaland Islands question and of the International Blockade Commission. He became both a judge of the Permanent Court of International Justice and a member of the Permanent Court of Arbitration.

HÜCH, RICARDA (1864–), German poet, was born in Brunswick July 18 1864 and educated there. Later she studied in Zürich, where she took her degree. She was appointed secretary of the library in Zürich and married first Dr. Ceconi, and later Dr. Richard Hüch, a lawyer. She wrote a number of romantic and imaginative novels, among which may be mentioned *Aus der Triumphgasse* (1902); *Vita Somnium Breve, Ein Roman* (1903); *Der grosse Krieg in Deutschland* (1912–4); and *Der wiederkehrende Christus* (1925). Her most important historical works are *Blüthezeit der Romantik* (1899); *Ausbreitung und Verfall der Romantik* (1902); *Das Risorgimento* (1908). In 1919 appeared a volume of reflections, *Der Sinn der heiligen Schrift*, which reveal a profound knowledge of psychology.

HUDSON, WILLIAM HENRY (1841–1922), British naturalist and writer, was the son of Daniel Hudson (1804–68), who was himself born of English parentage at Marblehead, Massachusetts. W. H. Hudson, Daniel's third son, was born at Quilmes, near Buenos Aires, Aug. 4 1841, and remained with his family on the pampas until about the age of 29, when he came to England. From then the greater part of his life was spent in poverty, and his difficulties were accentuated by frequent ill-health. His wife, Emily, long kept a boarding-house in London, where Hudson too lived, known to only a small circle of appreciative friends. A civil list pension granted in 1901 aided him somewhat, but he voluntarily relinquished this in later years when belated success reached him. He died in London Aug. 18 1922 and was buried at Broadwater, Sussex. His writings include the memorable pictures of the South America of his youth, such as *The Purple Land* (1885); *A Crystal Age* (1887); *El Ombú* (1902); *Green Mansions* (1904); *Far Away and Long Ago* (1918); of the English countryside, such as *A Shepherd's Life* (1910); *Dead Man's Plack* (1920); and the posthumous *A Hind in Richmond Park* (1922); ornithological works, as his collaboration with P. L. Schlater in *Argentine Ornithology* (1888–9); and his own *British Birds* (1895); and *Birds of La Plata* (1920); and many pamphlets for the Society for Protection of Birds. A bird sanctuary with a decoration by Jacob Epstein was erected to his memory in Hyde Park, London, in 1925.

See H. J. Massingham, *Untrodden Ways: Adventures among the Works of Hudson, etc.* (1923); Morley Roberts, *W. H. Hudson* (1924).

HUGEL, FRIEDRICH VON, Baron (1852–1925), Catholic theologian, was the son of Karl von Hugel (1775–1870), Baron of the Holy Roman Empire, a German by birth, an Austrian subject, and Austrian minister to the grand ducal court of Tuscany at Florence where on May 5 1852 Friedrich was born. Baron Karl had married Elizabeth Farquharson, a convert from Presbyterianism to the Catholic Church. In 1867 the family went to England and made their home at Torquay.

Friedrich von Hugel's education was curiously miscellaneous: brought up a Catholic, he was early made acquainted with Anglican forms and doctrines; from 8 to 15 he had a Rhenish Prussian Lutheran tutor, whom he loved, the Catholic historian Alfred von Reumont meantime supervising the course of the teaching; to his father perhaps he owed a turn for science, studying geology and entomology. Hebrew he learnt from a Rabbi and from the Catholic priest—Professor Gustav Bickell, the Biblical critic and commentator on Job. This singular upbringing, his mixed ancestry and his knowledge of languages, together with his natural gifts helped him to become one of the most sympathetic, resourceful and persuasive religious teachers of his age, and won him many friends in many lands. He took into his purview all history, all races, all religions, all philosophies, all literature. But while he possessed a generous sympathy
for all seekers after truth, he held the Catholic Church to poss
in its creeds, worship, history and institutions, the fullest, ri
est and deepest realisation of religion. He accepted the Pap
and the principle "*ubi Petrus ibi ecclesia*," but at the same ti
he thought that the government of the Church was ov
centralised, and he believed that the bureaucratic tendency co
be counteracted by the healthy interaction of energy between
head and the members of the whole body of believers.

His Biblical scholarship led him into relations with the Hig
Criticism and he accepted what he regarded as the assured res
of such studies. This association with modernist Biblical cri
led him to be classed with Modernists. When the crisis of M
ernism was over, he made it more and more clear that frien
and sympathetic as he was to them, as to all others who w
troubled by doubts, he could not follow the Modernists who
volted from Rome and that he rejected altogether their the
of belief. He wrote that the main spiritual influence, dating fr
1886, which had strengthened his faith, had been the teach
and the example of the Abbé Huvelin, a remarkable French pri
who wrote no books but "wrote in souls." Baron von H
himself brought out no book until he was fifty-eight. A lette
The *Times Literary Supplement* of May 25 1922 on L
Duchesne is of value for its treatment of the subject, but
as an apologia for the Baron's own religious belief.

In 1873 the Baron married Lady Mary Herbert, a daugh
of Sydney Herbert (Lord Herbert of Lea). He died in Lond
Jan. 27 1925 and by his own wish was buried in Downside Abb
Bath, Somersetshire. He asked that his library should be giv
to St. Andrews University. In his will are the words "I de
to die as I have striven to live, a devoted member of the Cath
and Roman Church."

His works include: *The Mystical Element of Religion as studie
St. Catherine of Genoa and her Friends* (1908, new and rev. ed. 19
Eternal Life, a Study of its Implications and Applications (1
2nd ed. rev. 1913); *The German Soul in its Attitude towards Et
and Christianity*; *The State and War* (1916); *Essays and Addresse
the Philosophy of Religion* (1921).

HUGGINS, MARGARET LINDSAY, Lady (1848–1915), Bri
astronomer (*see* 13.857), died in London March 24 1915.

HUGHES, CHARLES EVANS (1862–), American law
and statesman, was born at Glen Falls, N.Y., April 11 1
He attended Colgate University from 1876 to 1878, whenc
proceeded to Brown University (B.A., 1881; M.A., 1884).
studied law at Columbia University, taking his LL.B. degree
1884 and obtaining a prize fellowship at the Columbia law sch
In the same year he was admitted to the New York bar,
engaged in practice till his appointment as professor of la
Cornell University in 1891, a position which he relinquishe
1893 in order to resume practice. He continued, however,
maintain his connection with Cornell in the capacity of sp
lecturer, and, in addition, was a special lecturer at the
York law school from 1893 to 1900.

In 1895 he was retained as counsel for the Stevens Gas C
mission, appointed by the New York State Legislature to in
tigate the cost of gas; and in the same and following years
counsel for a committee of the New York State Legislat
known as the Armstrong Insurance Commission, formed
the purpose of investigating life insurance companies. In
he was nominated for mayor of New York City by the Re
lican convention, but declined to stand. In the coal invest
tion of 1906 he acted as special assistant to the Attorney-Ge
of the United States. In the same year he was elected Gove
of the State of New York, defeating William Randolph He
and was re-elected in 1908. He resigned Oct. 6 1910, on be
appointed Associate Justice of the Supreme Court of the Uni
States by President Taft.

Candidate for the Presidency.—In 1916 he resigned from
Supreme Court on being nominated for the presidency by
Republicans, but was narrowly defeated by President Wood
Wilson, who had been renominated by the Democrats. Hugh
election was considered assured when the campaign began;
though he "stumped" the country widely he disappointed

ple because he took no definite position on any of the specific stions involving the stand of America in the World War, and ecially as regards the sinking of the "Lusitania." The result he election was doubtful until a full count had been made, eventually hinged upon Minnesota and California, normally ublican states. Hughes carried Minnesota by a few hundred es, but lost California by a few thousand. The electoral vote 277 for Wilson against 254 for Hughes. The popular vote 9,129,606 for Wilson against 8,538,221 for Hughes. The owing year he again entered upon the practice of law in New k City. In 1917 he was appointed chairman of the Draft peals Board of New York City by Governor Whitman, and 918 he acted as special assistant to the U.S. Attorney-Gen- in charge of the investigation of alleged waste and delay in construction of aircraft. He was president of the New York Association in 1917–8, and of the Legal Aid Society 1917–9. was the leader of the New York Bar Association in its oppo- on to the expulsion of the Socialists from the New York State gislature in 1920.

s Secretary of State.—On the inauguration of President rding, March 4 1921, he became Secretary of State. One of first steps was to intervene in the Panama-Costa Rica dis- e respecting their boundaries. The two states had drifted actual hostilities, but on March 18 1921 Mr. Hughes advised m, in terms which practically amounted to an ultimatum, to ange for a peaceful delimitation of their joint frontier—a sug- tion which they ultimately accepted. The Soviet Govt. proached him in his first month of office asking that the United tes should resume trade relations with Russia, but he promptly ected the Soviet proposals. Later on M. Chicherin communi- ed with him with a view to the recognition by the United tes of the Soviet Republic, but this also was refused, Dec. 1923.

n 1921 Mr. Hughes, under authorisation by President Hard- sent out invitations suggesting a conference on the limita- of armaments to be held at Washington. The conference held—Mr. Hughes being chief U.S. delegate—with the lt that seven treaties were negotiated relating to limitation naval armaments, the fortification of islands in the Pacific relations between China and other Powers (*see* WASHING- CONFERENCE).

n a speech at New Haven in Dec. 1922 Mr. Hughes dealt at gth with the matter of German reparations, and unofficially gested a committee of experts to investigate. This was the esis of the committee which ultimately prepared what is wn as the Dawes Plan (*see* REPARATIONS). The Tacna-Arica pute afforded another instance of Mr. Hughes's intervention behalf of peace (*see* TACNA-ARICA). It was largely due to Hughes's efforts also that a convention was signed between U.S. and British governments by which the U.S. authorities re permitted to search British vessels on the high seas within 2-mile limit from shore, the purpose being to prevent the uggling of liquor into the United States. One of the last acts Mr. Hughes before he retired from office was to suggest a ution of the controversies between Brazil, Colombia and u as to certain portions of their boundaries. A settlement effected in March 1925.

Mr. Hughes's attitude in respect of foreign affairs during his m of office was well set forth in an address entitled "The hway of Peace," delivered by him before the Canadian Bar ociation Sept. 4 1923. "The League of Nations," he said, y its constitution presupposed that peace could be maintained economic pressure and military force." He dissented from s, since he believed that there was no path to peace except as will of peoples might open it. The way to peace was through eement, not force. "There is no lawgiver for independent tes; the outlawry of war necessarily implies a self-imposed traint." Upon this hypothesis was consistently based his ole attitude towards world politics. He was, however, in our of the adherence of the United States to the World Court International Arbitration. The judicial impartiality of Mr. ghes's character fitted him admirably to succeed in handling the international problems confronting him as Secretary of State, but he lacked the dramatic and popular qualities which might have led to his choice as chief executive of the nation.

He resigned office March 4 1924 and retired into private life. He was, in the April following, elected president of the American Society of International Law. In 1925 he acted as chairman of the New York State Reorganisation Commission, appointed to investigate the structure of the State Government. The commission reported March 1 1926, urging that the 180 state bureaux and departments be merged into 18, and that an executive budget system be introduced.

In addition to numerous addresses, most of which have been reproduced in pamphlet form, Mr. Hughes has published *Addresses and Papers* (1908); *Conditions of Progress in Democratic Government* (Yale Lectures, 1910); *Addresses 1906–16* (1916); *Foreign Relations* (1924); and *The Pathway of Peace* (1925).

(H. W. H. K.)

HUGHES, SIR SAMUEL (1853–1921), Canadian soldier and politician, was born at Darlington, Ont., Jan. 8 1853. In the Fenian raids of 1870 he served with the Canadian volunteer militia, and in 1873 he was gazetted to the 45th Regiment. Educated at Toronto University, he lectured at a Toronto collegiate institute until 1885, when he took up journalism, being editor and proprietor of the Lindsay *Warder* from 1885 to 1897. In 1892 Hughes was elected to the Dominion Parliament, but service in the South African War interrupted his political career. Returning to Canada after the coronation of King George V. in 1911, he became Minister of Militia and Defence, and was chiefly responsible for the creation of the overseas force which sailed for Europe in 1914. In 1915 Hughes was created K.C.B. and promoted major-general; but in the following year disagreements with Sir Robert Borden resulted in his resignation. Hughes criticised severely the strategy and leadership of Sir Arthur Currie. In July 1921 he announced his intention of retiring from Parliament, and he died at Lindsay, Ont., Aug. 24 1921.

HUGHES, WILLIAM MORRIS (1864–), Australian statesman, was born Sept. 25 1864 at Llansantffraid, Montgomeryshire, Wales, and received his early education at Llandudno Grammar School. Moving to London, he became a pupil teacher at the Burdett-Coutts schools, Westminster, where he attracted the attention of Matthew Arnold, then an inspector of schools; and at the age of 20 he emigrated to Australia. Here he began a period of picturesque wanderings, which it would be hard to parallel in the life of any statesman, ancient or modern. He drove sheep and cattle across the vast spaces of New South Wales and Queensland, worked on farms and cooked for harvesting gangs, became a sailor on coasting steamers, prospected for gold, tramped from station to station doing odd jobs, mended everything, from umbrellas to locks and from ovens to violins, taught children in remote settlements, walked hundreds of miles organising for the Australian Workers' Union, and in the end drifted back to Sydney and gravitated, as was only to be expected from the bent of his mind and character, to politics. He formed the Sydney waterside workers into a militant organisation, and entered the New South Wales Parliament in 1894 as member for the Lang division of Sydney.

As a member of the Opposition Mr. Hughes had no chance of showing administrative ability, but he became known as an effective debater, and devised the Labour party's caucus system of settling all internal dissensions outside the House and presenting a united front in Parliament. Then in 1901 came federation, and as member for West Sydney in the first House of Representatives Mr. Hughes found the wider scope that his political genius demanded. In 1904 Mr. J. C. Watson formed the first Labour Ministry, and Mr. Hughes, who in the midst of his industrial and political work had found time to qualify as a barrister, became Minister for External Affairs. The Ministry was short-lived, but thenceforth it was clear to friends and foes alike that a new force had entered Australian politics. During the years that followed Mr. Hughes went on developing until the hesitating, ineffective speaker of the 'nineties became one of the most brilliant and powerful orators in the Empire, and his courage, energy, intellectual gifts and dominating personality made his succession to Mr. Fisher almost inevitable.

Mr. Hughes was attorney-general in the Fisher Ministry of 1908, and revealed not only a remarkable gift of eloquence and a mordant wit, but a breadth of view and a warm Imperialism hardly to be looked for in a party which, not so many years before, had toyed with the idea of "cutting the painter." He was largely responsible for the scheme of compulsory military service which later proved so valuable, and he was heart and soul with his leader when Mr. Fisher, who had returned to office after the Liberal defeat of 1913, made his historic offer in 1914 of Australia's last man and last shilling. In 1915 Mr. Fisher went to London as high commissioner, and Mr. Hughes, as his logical successor and the man to whom Australia looked for strong leadership in the dark days of war, succeeded him as Prime Minister. Thus this frail little man, who weighed only seven stone, who suffered increasingly from deafness and ill-health, and who had depended for higher education entirely on what reading he could find time for in the intervals of work ranging from the mending of kettles to the organising of strikes, had as his reward the highest honour that his countrymen could offer.

On the whole they were not disappointed. Mr. Hughes, by his driving force and faculty of kindling enthusiasm, gave an immense stimulus to the raising and maintenance of the Australian Expeditionary Forces; and with equal energy he devoted himself to the task of eradicating German commercial influence from Australia. Germany, he found, had almost a monopoly of the output of Australian mines, and German firms controlled even the supplies of metals needed by the British Govt. for munitions. By the end of 1915 he had brought forward legislation which annulled all German contracts, transferred control of output to the newly established Australian Metal Exchange, prevented trading with the enemy, and disinherited enemy shareholders in commercial enterprises of every kind. This was practical statesmanship of very real importance.

In the following year he visited England and attracted wide attention by preaching a renaissance of the British race based upon a greater development of the Empire's resources and a closer-knit economic system. Returning to Australia with the conviction that a stronger flow of reinforcements was needed, he attempted to introduce conscription. On this issue the Labour party split, and the result was that Mr. Hughes formed a coalition government composed of the Liberals and that section of the Labour party which followed him on the conscription issue. The conscription referendum, on which the Government was defeated, was marked by great bitterness, and there followed a period of industrial and political strife without parallel in Australia's history. Mr. Hughes was hotly attacked for his autocratic methods, for his excursions into state shipowning and shipbuilding, and for his policy of concentrating power in his own hands by means of the War Precautions Act, the establishment of boards to control industry, and the appointment of special tribunals to settle industrial disputes over the head of the Arbitration Courts. But so long as the War lasted there was no alternative leader acceptable to the people, and the Prime Minister left to attend the Peace Conference with his prestige higher than ever. His assertion of Australia's right to proclaim something rather like a Monroe Doctrine for the Pacific did a great deal to awaken Americans and the world to the importance of Australasia; and at Versailles his advocacy, as eloquent as it was dogged, of the Commonwealth's right to a mandate over the former German colony of Papua, helped to make history. His quarrel with President Wilson, embittered by mutual dislike, gave rise to some of the most piquant passages in the annals of the conference.

In Australia, on his return, Mr. Hughes found grave industrial troubles disturbing a country already weighed down by an immense load of debt and the problem of reabsorbing 400,000 men into civil life. In peace as in war he gave Australia a bold and brave lead, and a gift of £25,000, raised by private subscription, showed that some at least of his countrymen were not ungrateful. But he could not prevent discontent revealing itself in the secession of certain Liberal-Nationalists and the form tion of a new Country party. As the conditions which ha brought it into existence disappeared, the War party which led began to crumble, and in Feb. 1923, after holding office Prime Minister for eight years, he was forced by a Liberal-Cou try party coalition to resign in favour of the Treasurer, M S. M. Bruce. Then, a leader without a party, he stood asi and awaited his chance. (G. C. D.)

HULL, England (*see* 13.870), with a city area of 11,854 a including 2,495 ac. of the river Humber, had a population in 1 of 287,013. The port was enlarged in 1914 by the opening King George's Dock, with an area of 53 ac. and provision f future extension to 85 ac., a large grain silo and fine equipme The total water area of the docks is 236 ac. with 10 m. of qua The extensive and varied traffic of Hull was much affected the World War, as the city was in the area of the North S operations, but the volume of trade had almost recovered 1926. The numerous industries include a large production vegetable oil. There are some 300 steam trawlers in the fishi fleet, which did valuable service during the War. In 1914 t chief magistrate was created lord mayor.

New churches include St. Colomba's (1914), St. Mary Sculcoates (1916), St. Nicholas', Hessle Common (1915) and t German Lutheran church (1911). A Friends' meeting house built in 1919, a synagogue in 1914 and a large Wesleyan-Meth dist Hall in 1910. The City Hall and Municipal Art Galler were opened in 1910, and the Guildhall enlarged in 1915; a stat of the 1st Baron Nunburnholme was placed in front of the lat in 1913. In 1912 a home for incurables was built and a new po law hospital in 1914. During an air raid in that year some houses were wrecked and 24 persons were killed. The coun chamber at Trinity House, together with many art treasures, destroyed by fire in 1924. The Rt. Hon. T. R. Ferens, a be factor to the city in various directions, initiated in 1925 a fu for the establishment of a university college with a gift of £25 000. He had previously given land on Cottingham road, the outskirts of the city, as the site of a new technical colleg but this is to be made available for the university college.

HUMAN GEOGRAPHY.—Geography is defined (*see* 11.61 by Dr. Mill, as the exact and organised knowledge of the tribution of phenomena on the earth's surface. Human geo raphy on this view would be the corresponding type of know edge of phenomena relative to mankind. While it is possible bring in a great deal under this heading of distributional stu yet this does not express the aim towards which many worke have striven from at least the time of Herodotus onwards.

Ratzel, Vidal de la Blache and Herbertson.—Space cannot given for a historical survey, else we might discuss the sta points of thinkers of many centuries and regions down to Mont quieu, Humboldt, Ritter, Le Play, Buckle and Reclus. Ra reacted against writers who overemphasised personality in terpretations of history. He urged that in treatises touchi both history and geography the history was likely to expand duly. His anthropogeographic studies discuss especially human relations of natural features and his method has been veloped by Miss Semple into that of a study of influences geographic environment. Some workers on these lines ha failed to see how much of an "environment" has been made man's previous work. Vidal de la Blache made a special cont bution to the clarification of thought on human geography. him the study of place is the foundation and the place-relations modern life are the centre of interest. Proceeding from descri tion to interpretation, he was led to look upon those place-r tions as stages in long courses of evolution from the past towar the future. Indeed the realisation of the time factor is a gre feature in all his work.

He again has contributed markedly to the idea of man as agent modifying the world about him, influenced by the stage human action as he found it, but also doing much to make setting wherein his successors are to act their parts. One of typical statements may be rendered thus: "The personality a country, its *genius loci*, is not a matter given beforehand nimate nature, it is in large measure a product of the activity man, of an activity which confers a unity on matters that uld otherwise lack it," and again, " If a region has personality, has been gained through the effort of its successive inhabi- ts." He saw, as did Herbertson, that the *genius loci* changes th the spirit of the time. In a sense, then, the student of hu- an geography aims at picturing the settings of the stage of man activity at all places and at all times, even if he is primari- concerned with the present. If he limits himself by not looking ck to the past out of which the present has come, he is not ely to be able to glimpse the future arising out of the present, d his work will be still-born.

Evolution and Human Geography.—It is obvious from what s been said here that human geography is a daughter of Dar- nian thought, for Darwin brought to a head the problem of ations between organisms and environments and their in- ences upon one another, and for him also the present was but stage in the succession from past to future. The application d modification where necessary, of the thought brought to ition by Darwin, has occupied the minds of biologists ever ce. The stages of conquest of the land by backboned animals m fish-like beginnings up to the varied orders of mammals are ing worked out in ever increasing detail, and equally the dead- ds of evolution, the extinct orders, are followed to their dis- pearance.

The extension of Darwin's point of view to man has proceeded me distance, but, in the study of man's relations with his en- onment, that extension meets with difficulties largely because the highly varied fields of study, which must necessarily come, ether directly or indirectly, into consideration. Outlines of e progress of men's relations with their environments from the rliest days of stone to the latest days of steel are being worked t in many ways, and also, just as in the study of animals, dead- ds, such as the jungle-covered cities of Ceylon, the monuments Easter I., are receiving attention from many points of view, luding that of the geographer. At the same time, it is well at one should guard against too ready acceptance of theories determinist sequences in history such as those suggested by inders Petrie and Spengler.

Culture Origins.—It is unfortunately as easy as it is dangerous argue, largely *a priori*, that a given environment produces rtain results in human culture, and there have been thinkers o have argued that numbers of the more fundamental inven- ons such as metal tools, pottery, cultivated wheat, domestic ttle have been made independently in several regions as parallel sponses to the influences of those environments. Enquiry has rown doubt on several of these conclusions and many now ink that food production had one localised origin, while prob- ly the same conclusion is true for pottery (*see* ARCHAEOLOGY; CIAL ANTHROPOLOGY). The varying spreads of these main lk-inventions, probably quite as much by contacts as by mi- ations, have been important means of modifying men's rela- ons with their surroundings far from their place of origin. Thus introduced into the study of the setting of the scene of man's tivity a cultural-historical element, and geography is brought to close relation with folk-history. Geography studies the scene, story the sequence of the action, but both need the sister science anthropology in its widest sense, the science which analyses e types of man and of his forms of expression.

Geography, History and Anthropology.—In the study of men's e and work on earth there is thus special opportunity for co- eration of human geographer, historian and anthropologist, e first contributing his survey of the factors of place in men's rk, the second elucidating the time-sequences, and the third lping to discriminate types of humanity and of human expres- on involved. It is on the increase of such co-operation rather an on more definite separation of studies that hopes for a great ture advance of knowledge in human affairs depend.

The great man of history is often the man who has a special namic vision of the world about him, who sees whither the inds of multitudes are tending and what the work of con- mporary pioneers will mean in the coming days, and he crystallises out inchoate thoughts. He thus depends very much upon the scene as he finds it. With Francis of Assisi and with Peter the Great, for example, we have the personal factor of vision, energy and initiative extraordinarily developed, yet even here the scene whereon they play their part has its influence upon that part, and the geographer, with his spatial discipline, his study of place, has his share to contribute towards the interpretation even of these mighty personalities and of their work.

If human geography works, especially at the analysis of place relations of mankind, it is deeply concerned both with the comparison and classification of the scenes of human work and with studies of distributions of human phenomena of every kind. For their interpretation it seeks to relate these distributions to one another in order to see how one influences another in the present, and how one in the present has been influenced by another from the past. The collection of data for maps, and the creation of maps which picture the data collected in the most useful way for study of their mutual relations is thus one of the tasks of the human geographer, a task as yet only begun (*see* FOLKLORE).

Culture Distributions.—Among the studies of cultural distributions made in order to get a picture of life in various environments and to suggest interpretations thereof, one may mention especially those of Clark Wissler in North America, and refer the reader to, *inter alia*, his study of *Man and Culture* (1923).

The discussions which followed, for example, the publication of Jovan Cvijic's *La Péninsule Balkanique* (1918) with its studies of cultural distributions show how much need there is for co-operation between students of types, be it of houses or other forms of human expression, and students whose aim is that of the human geographer, namely, the statement of the setting of the stage of human action.

The human geographer utilises, with understanding, the results of his colleagues' work, but concentrates on his own task, his study is the study of places, but in the idea of place are included the features of the place which are due to man's work. He needs that understanding of his colleagues' work, perhaps most of all as a protection for himself against the ascription to influences exerted by the place under discussion of features which may be imported or which may have arisen through other types of sociological influence such as those elaborated by Rivers (*v. inf.*). At the present stage of development, there is scope both for the human geographer, who will concentrate on the picturing of the scene and for the worker in the border zone, who may try both to make the morphological analysis of the facts discussed and to picture the setting of the stage as far as he can.

The anthropological student with his morphological discipline distinguishes types of men, of material objects or of customs or forms of expression in language, and he then seeks their relations with one another and is thereupon impelled to map their distribution in space. In this way, for example, he is led to see a great awakening of life near the western shores of Europe at or just before the dawn of the metal age. He sees the germ of that life developing in the west of the Iberian peninsula, according to some from local, according to others from imported, seeds. He follows the new life to the Garonne estuary, the south and west coasts of Brittany, Ireland and even farther. To make his story live he needs the help of the human geographical point of view accustomed to picture man's relation with environments. The study of copper objects and their successors in bronze must be far more than merely a classification of types.

Human geography can help archaeology (*see* ARCHAEOLOGY) to see the setting of the life of the bronze age. And on the other hand, the human geographer, who is trying to see the modern relations between man and environment in what we may call the Celtic fringe of Europe will miss a great deal unless he appreciates the early days of metal and has some notion of the inheritances those days have left to our own. With this equipment the human geographer is enabled to avoid the gross error of seeking to state the relations of particular men to their particular environment solely in terms of relations observable at present, as well as the other gross error of stating that such relations have come into existence on the spot at which they may now occur

Culture Spreads and Contacts.—Few thinkers have done more in our day than the late W. H. R. Rivers; to show how spreads of culture have altered men's relations to their environments. He worked just outside the sociological frontier of geography and emphasised not only the apparent naturalisation of imported elements of culture, a naturalisation sometimes so marked that *a priori* arguments could easily be constructed to show that these elements of culture must be native, but he has also shown that there is much more in the matter. Importation of elements of culture has often led and still often leads to the weakening of local custom, that is to the removal or abrogation of ancient habits. He has shown that, in some cases, the weakening affects so much that the whole life of the people concerned is dislocated beyond repair and they die out (*see* ANTHROPOLOGY, APPLIED). Sometimes the weakening of old custom due to new contacts has avoided this catastrophe, but has been sufficient to set free a large amount of human initiative and effort. In such cases, new features have appeared that are the result of the play of this liberated initiative, but quite probably have no close relationship to the imported elements of culture. These last acted as the ferment; their direct part in the ultimate result may be small enough.

Especially following Rivers' work and that of the "Kulturhistorische" School in Germany, the study in cultural distributions has had its importance increasingly recognised. We see far more fully than heretofore some of the founts of human initiative, of human influence over environment. We appreciate in a deeper way the fact that men may knit widely differing relations with one and the same region, for we see how much will depend, for example, on the dominance of ancient custom in one case and the importation of cultural elements and associated liberation of initiative, or it may be its destruction, in another. The contrasts between native Patagonian huntsmen and Welsh agricultural immigrants at Chubut illustrate these points.

We see also the wide bearings of the principle illustrated, for example, by the commonplace fact that railways began by linking together places already in existence and then went on not only to modify them and their activities, but also to create new centres, in England new groups of factories, new suburbs, new watering places, in Canada new capital cities, new agricultural lands and the like.

Synthetic Regional Studies.—One of the most appropriate tasks of the human geographer is the study of a particular region, as the setting of human life, and multifarious have been the recent efforts in this direction. Vidal de la Blache wrote his classic *Tableau de la Géographie de la France* (1903) and his followers have written monographs on several of the "pays" or natural units of human life in that country. The monographs vary greatly in value, but on the whole avoid fairly well the errors in the argument of physical determinism. There cannot be said to be a physical predestination of the special developments of human activity in a particular region, the efforts of man, the contacts of autochthones and immigrants and their consequences, all need to be brought into the story. A distinguishing feature of the monographs of this school is the intimacy of the writers with the district about which each writes; that intimacy and attachment have been emphasised by Herbertson and by Younghusband as valuable aids in serious regional study. In several of the monographs in question, on the other hand, there is a lack of maps of cultural distributions especially as regards distributions giving clues to the local beginnings of civilisation; historic documents, however, are widely utilised. J. F. Baddeley's *Russia, Mongolia and China* (1919) and Sir M. A. Stein's *Serindia* (1921) are monumental works on their respective regions which have appeared recently, while Hilton Simpson has made studies of the people of the Aures massif. New works on regional planning for Dublin, Deeside, Doncaster and East Kent are valuable examples of applications of the regional study of human geography.

Scope of Human Geography.—In this province of study of a region and in that of study of cultural, including commercial distributions, the work of the human geographer is well recognised even if he be held to need for this work some systema
knowledge of allied sciences that his work must necessar
touch. The subject of general human geography is, on the oth
hand, still at such an early stage of development that its conte
and scheme are still subject to argument.

Huntington.—Ellsworth Huntington's attempt to give
scheme avoids a claim to be more than a sketch to help you
students to form pictures of the world about them. He treats
men in relation to location, land forms, bodies of water, soil a
minerals, climate, vegetation, animals and other men. F
him the subject is a mass of problems of the relations betwe
environment and human activity. In the course of the work,
touches upon the very deep problem of the relation of man
climate, of his varying energy and initiative in different enviro
ments and he thus introduces study of man along with study
place, with this justification, namely, that such study of man
essential if there is to be a reasonable picture of men in the
various environments.

Schrader.—F. Schrader, towards the end of his life, sketch
a characteristic policy for the development of human geograp
in the 20th century, suggesting that with the modern develo
ment of world-wide connections there was an immensely i
creased practical need for increase of our knowledge and c
sense of the natural laws which rule material and spiritual e
changes of activity between man and the world. Geddes h
long emphasised the need for correlated studies of place, wo
and folk, but without detaching from this wide general task t
special part which the geographer should undertake, unless it
that of place.

Brunhes.—Brunhes has made an attempt to be more sy
tematic and has suggested human geography as the study of a
those facts of the surface of the earth in which human activ
plays a part. He tries to work out first the facts of such occu
tion of the soil as is not directly productive, and treats especial
houses and roads; then he takes up man's work with vegeta
and animal material for productive purposes; next he takes u
man's destructive influence on plants, animals and inanima
materials. Subsequently, after giving analyses of the social l
of a number of natural units of humanity, he proceeds to stu
the bearings of his earlier pages on growth of human society a
its organisation. The debt of this writer to the thought of t
sociological school of Le Play seems to be considerable.

De la Blache.—Vidal de la Blache left at his death notes f
a large work and these have been arranged for publicati
Starting as do both Schrader and Brunhes with the idea of t
world's effective unity, he makes the study of the distribution
population the first concern of human geographers, who m
try to follow its forms of nucleation and its types of scatteri
its migrations and oscillations. Following this, he considers
regional succession the great agglomerations of human popul
tion. In the second place, he includes study of the forms
civilisation to be pursued, especially regionally, but apparent
to be discussed under subjects such as materials, food, co
structions, sites, habitations and so on. In the third plac
he proceeds to the study of the circulation of men the world ove
roads, railways, sea-transport and so on. It was evidently his i
tention to proceed to survey the evolution of races and the di
persion of cultures, and he sketched maps of the distribution r
spectively of animal and of vegetable products used by man an
of constructions which may be supposed to be autochthonous i
different regions of the world.

Commercial and Political Geography.—G. G. Chisholm's ency
clopaedic work, *Commercial Geography* (1889–) may be looked up
as a type of study of a special subdivision of human geograph
which has a peculiar importance for practical life. Several oth
recent works have discussed commercial or economic geograph
with a considerable measure of success.

A few words on political geography may be added. Ratzel
here one of the chief pioneers and his followers in most countri
make the state the unit of treatment, describing and sometim
seeking, to interpret the physical, demographic and econom
facts of each state. A large body of material for political geo

hy has been published in the British Foreign Office and miralty handbooks designed to assist discussion of the treaties recent years. This study is in a sense an applied development general human geography; in another sense it is an alternative dy. Human geography in the stricter sense could not at all nerally accept state frontiers as natural boundaries for divisions its discussions and might well seek, as in some recent studies frontiers, the geographical interpretation of those boundaries ich are in essence human facts.

Conclusion.—The contrasts between Huntington, Brunhes d Vidal de la Blache are evident. In Huntington's work we d the emphasis on man; in that of Brunhes the main emphasis on work; in Vidal de la Blache, the repeated efforts towards ial consideration of regions gives emphasis to place. But all that studies of forms of civilisation occurring in various en-ronments, *i.e.*, that studies on a regional basis are a funda-ntal task; and all bring out the impossibility of the attempt to imit at all strictly mutually exclusive spheres for what may called human geography and anthropology. It is possible at esent only to urge that, in the latter, the main object of study man, his various physical, social and other forms, *i.e.*, imarily morphological.

In human geography, on the other hand, the main object of dy is place relations of men of all kinds, and of any or all their forms of expression the world over. The place relations of e present day are not the only legitimate objects of study. e need the study of these place relations in the past as well if are to have an eye to the future, but it is the present that ves us the truest starting point, for it is here that we may ob-rve most directly how man influences and is influenced by en-ronment. From a study of the present, also, as from nothing se, we may be led to say that man and his surroundings are anging together, and that we cannot set man and environment opposition to one another, save for convenience of discussion, d with the full consciousness that as we do this we deliberately crifice something of the concrete reality. We may accept these awbacks for the sake of reaching generalisations of a manage-le kind, but we must recognise the incompleteness that is a cessary consequence.

There is reason to hope that, on the one hand, regional studies ll progress and that on the other hand studies of distribution of en and of their forms of expression, present and past, will be epened. The first will need intimate acquaintance, loving miliarity, to use Herbertson's phrase, as its starting point, d, however much it may concentrate on the present, it will need consider the past at every turn; it may well need also to bring to its purview some results of study of the differences between an and man; it must remember that the environment presents man opportunities and difficulties, possibilities rather than mpelling influences. The second will need increase of emphasis the study of the places involved and the possibilities they offer deny; that is to say, the student of place will be called upon play an increasing part here, but it remains obvious that the udent of the morphology of the forms of expression studied is ually important, and this is a field especially for a combined fort of students of place, time and type in relation to human ings and their forms of expression, both material and spiritual.

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HUMPERDINCK, ENGELBERT (1854–1921), German musician (*see* 13.891), died at Neu Strelitz Sept. 27 1921. His last opera, *Die Marketenderin*, was played at Cologne in 1914.

HUNEKER, JAMES GIBBONS (1860–1921), American musical critic, was born at Philadelphia Jan. 31 1860. He graduated at Roth's Military Academy, Philadelphia, and was a law student for a time, subsequently studying the piano in Philadelphia, Paris and New York. He was teacher of the piano at the National Conservatory, New York City, 1886–98, becoming musical and dramatic critic for the New York *Recorder* and *The Morning Advertiser*. From 1900 to 1912 he was musical and dramatic critic for the New York *Sun*. In 1912 he joined the New York *Times*, but returned to *The Sun* in 1919. He died in Brooklyn, N. Y., Feb. 9 1921. His writings on music, literature and art are notable for their style and popular appeal. His published works include *Chopin: the Man and his Music* (1900); *Overtones: Music and Literature* (1904); *Franz Liszt: a Study* (1911); *Ivory, Apes and Peacocks* (1915). He also supplied the text for Josefy's edition of Chopin's works.

HUNGARIAN LITERATURE (*see* 13.924).—Hungarian literature at the beginning of the 20th century was on the brink of a revolution. The intellectual life of the country was undergoing a crisis. After 1,000 years of a history sometimes glorious, but more often tragic, Hungary was faced by new difficulties which threatened her very life: the social question, the defence of her civilisation and her language against the Slav and Teutonic races, and the antagonism between the essentially rural nature of the Hungarian people and the Americanism and cosmopolitanism of the capital, Budapest.

Writers were divided into two camps: the traditionalists and the moderns. This division still persists. The older generation, inspired by Hungarian nationalism, had joined in the celebration of the country's 1,000th anniversary in 1896 and had accepted modern civilisation but remained firmly opposed to cosmopolitanism and radicalism. They still longed for the Hungarian steppes and the old folk songs. From this generation originated what is known as the Turanian movement, which draws its inspiration and its themes from the East and endeavours to arouse in the Hungarian people the consciousness of their non-European origin. The numbers of this older generation diminish year by year. The patriotic and classical poets, Joseph Lévay (1825–1918) and Alexander Endrödi (1850–1920), followers of Jean Arany, towards the end of their lives burst again into song. In 1910 Hungary lost the novelist Koloman Mikszáth, the most notable successor of Jókai, the immortal painter of the Slovak peasant and the aristocracy of Northern Hungary. Among contemporary writers of this school are the poets Jules Vargha and André Kozma, the novelist Ferencz Herczeg and the critic and essayist Eugene Rákosi, their organ being the review *Budapest. Szemle*, edited by Géza Voinovich.

In opposition to the older generation were the moderns, who hailed the advent of capitalism and industrialism in place of the old provincial spirit. These intellectual radicals wished to eliminate from literature all national characteristics, and to promote the cause of realism with its materialistic philosophy. They turned their faces towards the West, not the chauvinistic West, but the home of cosmopolitanism and anti-nationalism. The moderns gathered their forces in the early years of the 20th century, using as their rallying point a review with the symbolic title *Nyugat*, edited by Ignotus. Round it gathered the young poets of the symbolist and romantic school.

Chief among these men was André Ady, an original Magyar genius, whose primitive and prophetic gifts place him in the first rank of Hungarian poets. Influenced as he was by French symbolism as well as by the works of Zola, he drew inspiration also from the days before the school of Arany, from the melancholy, sometimes crudely expressed, Protestant hymns of the 16th century, from the songs of the rebels against the Austrians, from the archaic and primitive beauties of the Hungarian Bible. His robust language and brilliant vision illumine the depths of the soul. He tilts against conventional morality and describes love with all the voluptuousness of the realist: a trait which is, in fact, common to all the moderns. He is distinguished by a certain aristocracy of mind, as, for instance, in his attitude towards the Nietzschean cult of the Ego, but in his general outlook, and in his hedonistic glorification of blood and treasure, and above all, in his sympathy for the poor and despised, he inclines towards Socialism.

Compared with him, modern lyrical poets such as Michael Babits, Jules Juhász, Désiré Kosztolányi, Árpád Tóth, Gabriel Oláh, Ernö Szép have confined themselves to pure aestheticism, seeking to express the emotions of a cultivated, almost neurasthenic, minority. The realistic novelists found a successor in Sigismond Móricz, whose preoccupation with brutish peasants and corrupt petty tradesmen reflect his political tendencies. His work is the antithesis of that of idealistic novelists such as Géza Gárdonyi (d. 1923) and Cécile Tormay.

When the World War broke out, these two camps, the traditionalists and the moderns, were still divided by a great gulf. Cosmopolitan literature was silent for a time. The poets of tradition hailed the conflict with acclamation. One poet, a soldier, Géza Gyóni, in a language learnt from the moderns, turning his back on *l'art pour l'art*, succeeded in expressing the horrors and pathos of the War. The moderns were not long in making themselves heard, but, as might have been expected, their pacifist leanings were only accentuated by what had happened. Far from joining in the martial chorus which then predominated, their symbolist and decadent verse reflected the trouble in their souls, whilst glorifying man and life.

The final disaster, and the revolution of Oct. 1918 unmasked the political connections of *Nyugat;* its contributors joined hands with the rabble. In the intoxication of the first success the moderns threw off the mask. Their review declared itself to be definitely on the side of the revolution and of Count Karolyi. They looked forward to the end of the old feudal agricultural Hungary, the Hungary of officialdom, of the nobility and of the nationalist writers grouped around both.

During its four months' reign Bolshevism kept literature under strict control. Newspapers were suppressed and the right of publication withdrawn. A single publisher held all the world of thought in fee: the State printed nothing but propagandist papers and pamphlets. The socialised theatres were forced to produce plays in celebration of the revolution. Futurist and expressionist writers alone were protected and subsidised by the "literary directory." This upheaval brought no good to literature. Expressionism pushed to extremes led nowhere.

After the fall of communism, literature set itself to assist in the task of national regeneration. With no definite theories of art or literary programme it expressed the grief of the divided country and its longing for the lost provinces. Although historic Hungary was divided into five parts, Magyar literature kept its unity. In political Hungary the novel took the place of the lyrical poetry of the pre-War period. Désiré Szabó, in his loftily conceived work, describes the great cataclysm of the World War and the determined defence made by the Hungarians, in both the material and moral spheres, against the foreign invader.

Hungarian literature from this time onward endeavoured to break the bonds of torpid decadence and of anti-national radicalism, and to place before a people, struggling in the shadows of adversity, a new conception of the world which should be healthy, energetic and modern, thus again proving that Hungarian literature has always been something more than a mere exercise in aesthetics. Modern drama is striving to create new and lasting values, both poetic and philosophical. Romanticis has reappeared, and talented dramatists such as Feren Herczeg, Ferencz Molnár, Louis Biró and Melchior Lengy have attained to well-deserved success in the theatres of Europ and even in those of America. Realism and purely theatrical effec have, for the time, being quite vanished from the Hungarian stag

In discussing Hungarian literature we must not forget th of the lost provinces of Hungary. In Transylvania in particul there has been a remarkable renaissance. The reawakening a feeling for the mother country has also made itself felt in th Northern Carpathians. There, poets such as the Transylvani Végvári often express under pseudonyms the sadness which, Magyars, they cannot but feel.

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HUNGARY (MAGYARORSZÁG, *see* 13.894), an independent kin dom of Central Europe. Previous to 1918 Hungary formed pa of the Austro-Hungarian Empire, whose monarch was Apostol King of Hungary. The Lands of the Hungarian Crown had a area of 125,402 sq. m., of which Croatia and Slavonia, whic were in political union with Hungary, occupied 16,420 sq. mile The census of 1910 gave the population of Hungary as 20,886,48 including 10,050,575 Magyars (for racial statistics *see* AUSTRI HUNGARY). The Treaty of Trianon (*see* TRIANON) in 1920 d prived Hungary of all Croatia, Slavonia and Transylvania an much of Hungary proper. Her new frontier runs as follows:—

> Starting from the junction of the Czechoslovak and Austria frontiers near Bratislava, southeast to the mouth of the Ipel rive then along its course to a point 10 km. below Lučenec; hence sout east above Salgotarján, northeast up to a point lying 20 km. sout of Košice, southeast above Sátoraljaújhely to Csap, thence alon the Tisza to the junction of the Rumanian and Czechoslovak fro tiers. After running west of the Satul Mare Oradia-Mare line, turns west, and runs south of Makó to the Yugoslav frontier belo Szeged; hence south of the junction of the Maros and Tisza sout west to a point on the Dráva south of Pécs; hence west and nort west along the Dráva to the mouth of the Mur; along the Mur, th north to Szentgotthard; hence north to Köszeg, then makes a loo to include Sopron, crosses Lake Neusiedler (Fertö), thence north the Czechoslovak frontier.

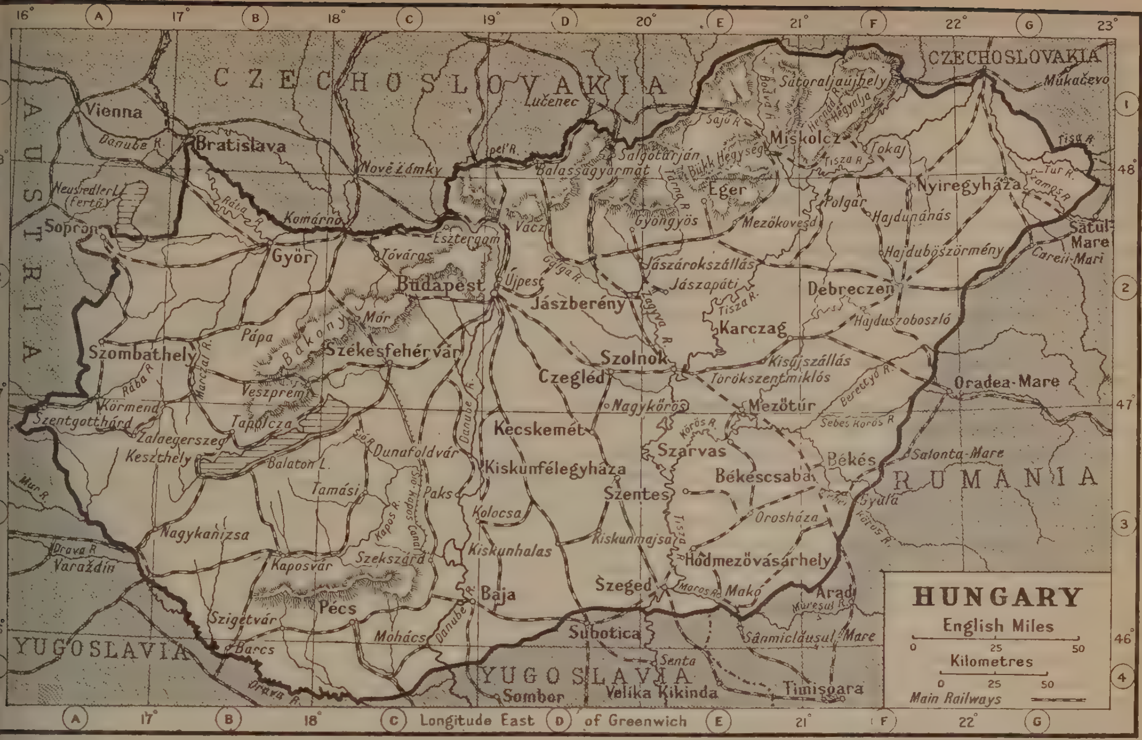
The area comprised within these frontiers is 35,916 square mile Population (1920), 7,989,143. Of these 7,147,530 were Magyar 551,211 Germans, 141,882 Slovaks, 23,760 Rumanians, 36,858 Croat 17,131 Serbs, 1,500 Ruthenians, 69,271 other races. Some 3,250,00 Magyars were living within the frontiers of Czechoslovakia, Rumania Yugoslavia and Austria (*see* MINORITIES). The Treaty took fro Hungary all her gold, silver, copper, salt and mercury mines; a but one of her iron mines; her largest and best collieries; and 86 % o her forests. The only branch of productive territory of which sh retained over half is viticulture (68 %). The strongest social elemen left to her was her peasant class (4,449,105 persons were engaged i agriculture). There was a very large intellectual class, compose largely of ex-state employees formerly resident in the territory o the present Succession States, the settlement of which formed a grav problem.

I. POLITICAL HISTORY

At the fateful Crown Councils of July 7 and July 19 1914, th only person present who opposed the idea of an attack on Serbi or any measure beyond the formulation of severe but acceptabl demands to Serbia was Count Stephen Tisza, then Hungaria Minister President. Thanks to his influence alone, a passag was entered in the minutes of the second council as follows:—

> The Common Cabinet Council, on the motion of the Ministe President of Hungary, decided that immediately after the com mencement of hostilities the foreign Powers should be notified o the fact that the monarchy was not waging a war of conquest, an that it was not the object of the monarchy to annex the Kingdom o Serbia.

Tisza, however, made no statement on his conduct until Oct 17 1918 when he mentioned it in the Lower Chamber of th


CZECHOSLOVAKIA
AUSTRIA
RUMANIA
YUGOSLAVIA
Vienna
Bratislava
Danube R.
Neusiedler L. (Fertö)
Sopron
Győr
Komárno
Nové Zámky
Lučenec
Esztergom
Vácz
Budapest
Újpest
Szombathely
Szentgotthárd
Körmend
Pápa
Veszprém
Székesfehérvár
Mór
Bakony
Tapolcza
Zalaegerszeg
Keszthely
Balaton L.
Nagykanizsa
Kaposvár
Szigetvár
Barcs
Pécs
Mohács
Szekszárd
Paks
Dunaföldvár
Kolocsa
Baja
Kiskunhalas
Kecskemét
Kiskunfélegyháza
Czegléd
Nagykőrös
Jászberény
Szolnok
Szentes
Szarvas
Békéscsaba
Békés
Gyula
Orosháza
Hódmezővásárhely
Szeged
Makó
Arad
Subotica
Senta
Sombor
Velika Kikinda
Timisoara
Sânmiclăusul Mare
Salgótarján
Balassagyarmat
Gyöngyös
Eger
Miskolcz
Sátoraljaújhely
Tokaj
Mezőkövesd
Polgár
Hajdunánás
Hajduböszörmény
Nyiregyháza
Debreczen
Hajduszoboszló
Karczag
Kisujszállás
Törökszentmiklós
Mezőtúr
Jászárokszállás
Jászapáti
Oradea-Mare
Salonta-Mare
Careii-Mari
Satul-Mare
Mukačevo
Tisza R.
Körös R.
Maros R.
Drava R.
Varaždin
Mur R.
Rába R.
HUNGARY
English Miles
0 25 50
Kilometres
0 25 50
Main Railways
Longitude East of Greenwich
16° 17° 18° 19° 20° 21° 22° 23°
46° 47° 48°
A B C D E F G
1 2 3 4

ngarian Parliament, enumerating the documents in which it s recorded (*see* Austria-Hungary).

The Collapse of the Monarchy.—The causes of the catastrophe 1918 were partly internal, partly international. After the th of Francis Joseph I. on Nov. 21 1916 the rule of the Dual narchy gradually lost its character of stability. Austria was ady weak; and the dismissal of Tisza (May 22 1917) made ngary, too, helpless. However, as the armies of the monarchy l occupied considerable enemy territories, few people thought he possibility of its sudden collapse. The protracted war had ome extremely and increasingly unpopular. The general ire for peace and the weak and irresolute policy of the Gov- ment contributed to encourage the defeatist agitation. The ice propaganda was furthered by the publication on Jan. 8 8 of President Wilson's Fourteen Points, which were accepted h implicit faith by the Hungarian people, who have always wn a sincere enthusiasm for the great ideas of mankind. The urn home of large numbers of soldiers released from Russian tivity after the Treaty of Brest-Litovsk (Mar. 3 1918) fur- red the growth of communistic and anti-militarist ideas, which re enormously strengthened by the privations and suffering ised by the blockade. Only on the capitulation of Bulgaria pt. 29 1918) did the situation become quite clear. The rev- tionary movement now ceased to be a merely sporadic phe- menon; foretokens of the coming upheaval became everyday urrences.

The first signal of the process of upheaval was a demonstration students on Oct. 25, the crowd being, however, dispersed by police. The same day the so-called National Council was med, with Károlyi as its president, together with a soldiers' uncil and a students' council. Lieut.-Gen. Baron Lukachich, o had been appointed military governor of Budapest, sug- sted that Károlyi and the members of the National Council be ested; but the suggestion was not approved by the Govern- nt just resigned. Two days later the National Council issued proclamation with the title "Amnesty and land for the sol- rs," which foreshadowed the coming of Bolshevism. Now nts succeeded one another with bewildering rapidity. Two npanies ordered to the front mutinied and, joining the groups of demonstrators during the evening of Oct. 30, attacked and seized the headquarters of the commander of the garrison, the telephone exchange and the general post office. Gen. Lukachich telephoned to Vienna for instructions, but the King refused to consent to the employment of the armed forces at the Baron's disposal. By the morning of Oct. 31 the town was completely in the hands of the revolutionaries; Károlyi was appointed Prime Minister. His Cabinet included principally persons without seats in Parliament, Social Democrats and Radicals; of the parliamentary parties only the Independence party (Kossuth party) was represented in the Government, several of the ministers chosen by Károlyi belonging to it.

The same afternoon Count Stephen Tisza was murdered, probably by emissaries of the soldiers' council. His friends had repeatedly warned him; but he had remained in Budapest in a final effort to unite all the elements of order against the rabble. Tisza knew how critical was the situation and he knew that he was threatened by death. The followers of Károlyi ordained as a national holiday the very day on which they laid Tisza low. On the other hand, it appeared to Károlyi's opponents that with the disappearance of a formidableantagonist he lost his personal initiative and became little more than a puppet in the hands of Jászi, the Radical party and the Socialists.

The first measure taken by the new Government was to demobilise and scatter in all directions the soldiers pouring back from the front. The war minister—Béla Linder—declared that he "did not wish to see soldiers"; and Hungary was thus disarmed and rendered powerless both to stem the internal anarchy of the country and to resist occupation from without. The first result was universal looting and robbery; then followed the invasion of the Czechs, Rumanians and Yugoslavs. The Czechs were able to occupy the almost impregnable fortress of Komárom on the Danube without striking a blow, for the troops of occupation met not the slightest resistance anywhere. In vain did the inhabitants everywhere protest against the occupation; the Government was both unable and unwilling to do anything to lend weight to their protests.

On Nov. 1 the Austro-Hungarian delegates had met the Italian generals Diaz and Badoglio to conclude an armistice. Point 3 of the conditions enunciated was that the Austro-Hungarian troops were to evacuate all enemy territory occupied in the War; a line of demarcation was drawn in the southwest; elsewhere it was to consist of the former political frontier. Gen. Weber, who was authorised by the Hungarian Govt. to negotiate for Hungary, accepted these conditions in the name of Hungary. Károlyi and a delegation of his Government, however, believing that he could get better terms from the Entente, called on Gen. Franchet d'Esperey in Belgrade, who concluded a separate "military convention" with them on Nov. 13. This fixed a line of demarcation well within the old political frontier (Bistrita-Nagy-Szamos-Marosfalli-Subotica-Baja-Pécs), the line of the Drava. Hungarian troops were to withdraw behind this line, but Hungarian police, gendarmerie and civilian control would continue to function. The Allies were entitled to occupy any towns or other points of strategic importance but would not interfere with the internal administration. Hungarian troops were to remain to secure the line of demarcation.

In fact, however, the occupying troops, backed by the inter-Allied missions in Budapest, denied Hungary any sovereign rights in the territory outside the line of demarcation; assumed the civilian administration, removing the Hungarian officials; disarmed the gendarmerie and police; set up an economic boundary; interrupted communications; forced inhabitants to take an oath of allegiance to themselves, and even pressed them into military service. It thus became abundantly clear that Károlyi could not obtain better terms from the Entente, and his popularity at once began to wane.

Proclamation of the Republic.—On Nov. 13 Charles IV. issued the Eckartsau manifesto, declaring that he "resigned all share in the conduct of state affairs and was prepared in advance to accept any decision to be taken by Government respecting the future form of government of Hungary." The Károlyi Govt., without consulting Parliament, at a mass meeting in Budapest proclaimed Hungary a republic (Nov. 16). Under pressure from the Government the House of Deputies proclaimed its dissolution; the only protest against this arbitrary measure was that contained in the declaration read by Baron Wlassich, president of the Upper House (House of Magnates), who at the same time announced that the Upper House had adjourned its sittings for an indefinite period. The counter-revolution received legal sanction from the illegality of the proclamation of the republic. William Böhm, who was Minister of War under Károlyi, writes that there were 50 cases of riot, most of them involving fatal consequences, while 14 different military formations were raised to deal with the counter-revolutionary movement. Complete anarchy prevailed in the administration. The Government admitted that the "national councils" of the provincial towns were daily guilty of grave abuses but alleged that it was powerless to prevent them. Jászi admitted that they had made a revolution without having any men to do the everyday work.

Not only did they fail to do anything to save the territorial integrity of Hungary, they were even incapable of achieving any radical reform. They were not satisfied with a mere republic, "it had to be a people's republic." The plebiscite promised by the National Council was never held by the Károlyi Govt., for their few months of power yet sufficed to make them not dare to appeal to that national public opinion in the name of which they consistently spoke and acted. Károlyi was proclaimed President of the Republic on Jan. 11 1919 and on Jan. 19 formed a Cabinet under the presidency of Denis Berinkei, then Minister of Justice. It had no proper support either among the bourgeoisie or among the socialists; yet it created a whole series of laws and ordinances. Never had there been so rapid and so general a promotion of public employees, for the older employees were in general regarded as unreliable. Following the precedent of the United States Károlyi as "provisional President of the Republic" took part in the Cabinet Councils and frequently spoke at these meetings.

There were two questions of first-rate importance: universal suffrage and land reform. A protracted discussion preceded the drafting of an ultra-modern suffrage bill (drafted and pass *intra muros*, without reference to Parliament, which did exist). But the bourgeois parties were beginning to recover fr their apathy. The suppression of individual liberty, the inti dation of the bourgeois press, and the policy of internment last began to change their initial lethargy into a determinati to rally their forces; and it was already clear that a very stro Catholic party would contest the elections; consequently, G ernment continually postponed the elections and finally mano vred them off altogether. Nor did Government materialise promised scheme of land reform.

The Allied Powers meanwhile bombarded Hungary w ukases. Col. Vyx, their representative in Budapest, permitt the Czechs, Rumanians and Yugoslavs to pass at will beyo the line of demarcation. The Government still maintained t a "peace by agreement" would follow; shortly afterwar however, the radicals and Jászi resigned from the Cabinet, wh was now clearly lacking the support of public opinion.

The Soviet Republic.—The agents of the Russian Soviet long since begun their work in Budapest. Béla Kun, who been sent home from Russia to organise the Hungarian Sovi had been in Budapest with some associates since Nov. 19. Th men had money; they were daring and active and rapidly gai a following, not only in the organised proletariat but also amo the socialists and the "intellectuals." They arranged dem strations among the soldiers returned from the front; they manded the payment to these men of immediate relief. C tinuously increasing their demands, they gained larger and lar masses to the cause of revolution. On Feb. 20 1919 a mass me ing of unemployed yielded entirely to Communistic influen To intimidate the Socialists they attacked the offices of th organ the *Népszava*, killing seven policemen and wounding After protracted discussion the Government imprisoned B Kun and his followers. The funeral of the murdered policem was a gigantic demonstration of the people against Bolshevi and in favour of Socialism. It seemed as if Bolshevism had b finally overthrown.

On the morning of March 20, Col. Vyx handed Károlyi a n establishing a new neutral zone between the Hungarian a Rumanian troops. This area comprised some 2,000 sq. m. predominantly Magyar territory. Vyx afterwards stated th the zone was to be purely neutral, remaining under Hungari administration. Károlyi contended that Vyx had stated th Rumanian troops would occupy this area. At a Cabinet Cou the same evening Károlyi resigned as President of the Republ and a resolution was passed that, as the Coalition Govt. saw prospect of solving the political crisis or of ensuring producti the Social Democrats must take over the government. T Socialists, however, were too weak unless supported by the Co munists. On March 21, at noon, the Socialists decided to co to terms with the Communists, undoubtedly at Károlyi's p sonal instance. It is true that the difficulties were numerou but Károlyi and Jászi had been unequal to them. The ho aroused by their promises had not been fulfilled and their ph of the revolution had ended in chaos.

The agreement between the Socialists and Béla Kun was ma in the prison. The Communists dictated and the Sociali accepted everything. The whole Social Democratic party unit *en bloc* with the Communists. Pending the decision of the Th International the new party was styled "the Socialist party Hungary"; it was to take over the power at once in the na of the proletariat; the dictatorship was to be wielded by Labourers, Peasants and Soldiers' Council; urgent steps we to be taken to organise a "class army" and completely disa the bourgeoisie; a reign of terror was to be proclaimed to ens the rule of the proletariat; a close military and spiritual allian was to be made with the Russian Soviet.

By the evening (March 21 1919) the streets were in the han of armed Communists; at 6 P.M. the public prosecutor visit the prisons to release the prisoners. At the head of the govern council was placed Alexander Garbai, a bricklayer. His ass

s in the council of people's commissaries were Kun, Joseph
iny, president of the Soldiers' Council and Sigismund Kunfi,
ondary school teacher who had been a member of Károlyi's
inet. The people's commissaries and practically all the lead-
persons were Jews, a fact which explains the anti-Jewish
ng which later prevailed in Hungary. Károlyi's revolution
been in part an imitation of that of Kerensky; Hungarian
munism took Lenin as its model, though Lenin is said to
warned Béla Kun to take into due account the fact that
litions in Hungary were essentially different from those pre-
ng in Russia. As the majority of the people's commissaries
been prisoners of war in Russia, they often spoke Russian
eir meetings. They ordained the "communisation" of the
, of industrial establishments, of houses and factories, of all
rtakings and shops. Jewels of a value in excess of 2,000
ns were to be surrendered; the deposits entrusted to the
s (both savings and current account deposits) were seized
communised.

rom the outset there were two distinct currents of opinion
e Government: a moderate and an extremist. At first the
list influence predominated and the action of the communists
more of a chicanery than a persecution. On April 4 Gen.
ts arrived in Budapest to negotiate with Kun's Government
ehalf of the Allies. He offered to recognise the disputed
not as a political frontier, but as a line of demarcation only,
e bordered by a neutral zone. Kun insisted that the Bol-
ik system must be introduced in the neutral zone. Smuts
e off negotiations. On April 16 the Rumanians advanced
g the line of demarcation up to the Tisza (Theiss). As their
tion was now menaced by the danger of a counter-revolu-
, the Bolsheviks resorted to undisguised persecution. In
apest alone they took 481 "hostages," and several thousands
e throughout the country. The Red Army was organised,
arily to ensure the maintenance of the dictatorship. Later,
n they saw that the national feeling and popular exaspera-
was growing even more formidable, and that terror, intern-
t, torture and assassination could no longer keep passions
heck, the Bolsheviks commenced an offensive campaign,
ated the Czechs, occupied Košice (Kaschau) and advanced
o the Polish frontier at Bardiov (Bartfa). But, after receiv-
Clemenceau's note of protest dated June 8, they withdrew
r troops, and on June 13 were fixed the definitive frontiers
h condemned Hungary to dismemberment and helplessness.
his catastrophe instilled fresh courage into the counter-
lutionaries. On June 24 the cadets and officers of the mili-
academy, assisted by the Danube monitors, some of which
stationed in the winter harbour at Ó-Buda, assumed the
nsive. On this occasion the Red Army suppressed the coun-
revolution; but communism never recovered from the shock,
no one believed it could long maintain its position. As there
been counter-revolutionary movements in the provinces too,
Red Terror made its appearance. Indisputable official data
e recorded the murder by the terrorists of 585 persons, includ-
Louis de Navay, a former Speaker of the House of Deputies
one of the most distinguished Hungarians of his day; the
ber of persons of obscure origin who may also have fallen
ims to Szamuely's thirst for blood is unknown. Throughout
Commune Budapest suffered from a disastrous shortage of
visions, due not only to the blockade, but still more to the
sive resistance of the peasantry.

he Communists employed their money for propaganda pur-
es, particularly in Austria. Budapest lived mainly on pearl
ley and vegetable marrow; anyone desirous of obtaining bet-
food was compelled to go to the provinces and offer clothes
etroleum in exchange for meat or bread. Unrest and dis-
tent were general; even the trade unions were beginning to
in secret against the Soviet régime. There was a breach
ween Béla Kun and Haubrich, commander of Budapest and
ler of the iron and metal workers. As an open rupture seemed
inent, it was proposed that the garrison of Budapest should
laced under Szamuely, the most bloodthirsty of all the Jack
ches in the service of the dictatorship. Luckily, the Italian colonel, Romanelli—who had already collaborated with the American mission to save the lives of hostages and prisoners—prevented this baleful scheme.

On July 20 Béla Kun began hostilities against the Rumanians in the hope that his propaganda had demoralised their troops. The Rumanians defeated him easily and advanced on Budapest; whereupon the outbreak of internal discontent overthrew the Bolshevik régime. The Soviet Govt. resigned on Aug. 1. Most of its leaders fled to Austria. A Socialist Govt. under Peidl was formed, which guaranteed the sanctity of private property. On Aug. 4 the Rumanians entered Budapest. Two days later the organised bourgeoisie overthrew the Socialist Govt. in which they felt no confidence since its recent connection with the communists, and a Government was formed under the presidency of Stephen Friedrich.

The Counter-Revolution.—The restoration of a stable régime in Hungary proved extremely difficult. In May 1919 a counter-revolutionary Government had been formed at Arad—then already occupied by the Rumanians—under the presidency of Count Gyula (Julius) Károlyi, which endeavoured to act as the representative—as against the reign of terror of the Commune—of the ideas of bourgeois order, of the historical integrity of Hungary and of the principle of legal continuity. At first this was little more than a demonstration, since it lacked real power. After a few days the Rumanians sent this Government under military escort, first to the state estate at Mezöhegyes and then to Szeged which, was at that date occupied by French troops.

The Szeged Govt. began to organise a counter-revolutionary army out of a nucleus of volunteers who had distinguished themselves during the War and had fled to Szeged to escape the Bolshevik Terror. Its sphere of authority hardly extended beyond the inner confines of the town, but the authorities in occupation made many difficulties for both the military organisation and the civil administration. A certain success was achieved by the Szeged Govt. through its representatives in Vienna, under the guidance of Count Bethlen. This "detachment" kept in touch with foreign countries and informed public opinion of the West of the misdeeds of the Hungarian Soviet régime.

After the fall of the Commune the Szeged Govt. suspended its activity, and those detachments of the Hungarian national army which had been formed at and near Szeged moved their quarters to Siófok on Lake Balaton. The Government appointed Admiral Nicholas Horthy commander-in-chief of the national army.

In Budapest, meanwhile, the popular Archduke Joseph assumed the government, assisted by Stephen Friedrich as Prime Minister; but the Supreme Council in Paris refused to recognise any Habsburg in a position of authority in Hungary and sent four generals to Budapest to represent the four Principal Allied Powers. The Archduke Joseph was forced to resign. The four generals were fully occupied in thwarting the excesses of the Rumanian troops of occupation in Budapest, who plundered and destroyed property wholesale. According to the report dispatched by Col. Loree to Paris, the value of the goods requisitioned by the Rumanians exceeded 90,000,000 gold crowns (about £3,750,000). The Rumanians also aggravated the difficulty of the Friedrich Government. The Entente then deputed Sir George Clerk to negotiate as plenipotentiary delegate of the Supreme Council and pave the way for the constitution of a Coalition Government to include all the political parties with which the Entente could properly conclude peace. On Nov. 22 Friedrich resigned, and a Government, including representatives of all parties, was formed, Huszár being Minister President.

On Nov. 14 the Rumanians withdrew to the line of the Tisza (Theiss), and Horthy entered Budapest at the head of the small national army, amid the enthusiasm of his many adherents. General elections were held in Jan. 1920 on the basis of a suffrage (secret ballot) of a practically universal character. They gave a considerable majority for the parties of the Right which formed the Government alone. This was a natural reaction after nearly a year of excesses committed by the extreme Left. Those regrettable acts of violence known and described abroad as the "atrocities of the White Terror" sprang from a similar revulsion. It is a fact that, immediately after the fall of the Commune, certain "detachments" were formed in various parts of the country, which arbitrarily executed Communists; however, such atrocities were nothing like as numerous as those committed by the Soviet régime. The victims of the period following the overthrow of Communist Dictatorship number, according to data compiled by the Hungarian Ministry of Justice:—

Victims of the White Terror	279
Killed while attempting armed resistance	9
Killed in flight	19
Total	307

By Act I. of 1920 the new National Assembly restored and once more put into force all that part of the ancient constitution which had been destroyed or eliminated by the revolutions. Act XLV. of 1921 proclaimed Hungary to be a monarchy (kingdom), the decision relative to the exercise of the kingly power being postponed to a later period. On March 1 1920 the National Assembly elected Horthy to the office of Regent unanimously and by acclamation. At the same time a law was passed defining the constitutional power of the Regent.

The Treaty of Trianon.—The Hungarian peace delegation, headed by Count Albert Apponyi, Count Paul Teleki and Count Bethlen, arrived in Paris Jan. 7 1920. On Jan. 15 it received the conditions of peace framed by the Allied Powers, to which it replied on Feb. 27 in the form of a long memorandum, which, together with Count Apponyi's speech made when handing it over to the representatives of the Allied Powers, took the view that the conditions were unjust and must lead to catastrophic results. But the leading members of the Peace Conference would not agree to a plebiscite. The delegation was, however, allowed to put its observations before the Peace Conference itself with better success. Thus, M. Millerand promised, in the name of the Allied Powers, that the boundary commissions should be instructed, where they found the new frontiers involved any economic or ethnical injustice, to appeal to the League of Nations. Unfortunately, the Conference of Ambassadors found that any alteration of the frontiers, however slight, would be equivalent to a breach of the Peace Treaty.

The Treaty of Peace was signed on June 4 1920 in the Trianon by the Hungarian delegates and ratified by the Hungarian Parliament on Nov. 15. M. Simonyi-Semadam, who had succeeded M. Huszár as Prime Minister in March 1920 with a transition Cabinet, resigned in July 1920. Count Paul Teleki, the new Prime Minister, carried through the first stages of Hungarian consolidation. There were only slight differences among the four Government parties. The orthodox Legitimists and Liberals formed the Opposition. On the monarchist question Legitimists and Free Electionists were found in Government and Opposition parties alike.

King Charles' Attempts at Restoration.—On March 27 1921 King Charles IV., misled by the general depression which followed the signature of the treaty, and ill-advised by his entourage, arrived at Szombathely, whence he motored to Budapest, driving straight to the residence of the Regent, whom he called upon to hand him over the power. Horthy replied that the nation was spiritually unprepared for so sudden a change, which might involve a grave upheaval. The Little Entente might use the restoration as a pretext to annihilate Hungary's independence. King Charles returned to Szombathely. Meanwhile the ministers of the Great Powers, of Yugoslavia and of Czechoslovakia declared that the continued residence of King Charles in Hungary might involve the most serious consequences.

On Oct. 20 of the same year King Charles and Queen Zita left Switzerland by aeroplane, landing at Dénesfa, near Sopron. The gendarme battalion stationed at Sopron joined the King, and its example was followed by other troops. The King appointed a Cabinet, with Stephen Rakovszky as Premier, and on Oct. 22 he started for Budapest, his soldiers following him. Telegraphic and telephonic communication with Budapest had been interrupted. As soon as the Government were informed of what happened, they declared that, in view of the foreign politi situation, the King was not entitled to exercise royal prero tives in Hungary and called upon him to leave the territory the country. The Regent sent a letter to the King explaining him that, if he entered Budapest, this might result in the of Hungary. His Majesty should come alone, unaccompanied soldiers or by his Cabinet, and clear the situation in confere with the legal Government of Hungary and with the minist of the Entente Powers. However, the King continued his j ney, refusing all intervention. On the next morning, Oct. 2 small skirmish took place between the King's troops and th of the Government, at Budaörs, near the capital. The Kin troops retired and dispersed. The royal couple were taken the abbey of Tihany, near Lake Balaton, there to await decision of the Entente Powers. Yugoslavia and Czechoslova had already decreed mobilisation. On Oct. 31 the Conferenc Ambassadors demanded the formal deposition of Charles and the dynasty. On Nov. 3 the Hungarian Govt. introduced a abrogating Charles' sovereign rights, and on Nov. 5 decla that before proceeding to settle the question of the election a future king, they will agree previously with the Great Pow represented on the Conference of Ambassadors, and will not without their consent.[1] On Nov. 1 the King and Queen had Hungary on the British monitor H.M.S. "Glowworm" Funchal on the island of Madeira (*see* CHARLES).

Period of Depression.—In April 1921 Count Bethlen had s ceeded Count Teleki as Premier. The international position Hungary had been seriously shaken by the royal attempts restoration. The tension only abated very gradually and events at Budaörs were doubly unfortunate since they follow closely on the Venice Conference (Oct. 11 and 12 1921) by whi thanks to the intervention of Italy, an agreement had be reached with Austria that a plebiscite should decide the fut of the town and environs of Sopron (Oedenburg). The plebisc went in favour of Hungary (*see* BURGENLAND).

At the end of the Commune the Hungarian crown had still be quoted in Zurich at 20% of its pre-War value. Since then it had clined steadily. The chief cause of the financial catastrophe naturally the historical and political collapse of Hungary, wh had been followed very rapidly by a general economic crisis. F the occupied territories, several hundreds of thousands of pu employees and their families had been pouring into the country, they had to be provided for by the Government. As there was a gr dearth of housing accommodation in Budapest, most of the mis able refugees had to live in railway trucks, indeed, incident monopolising for years a considerable proportion of the rolling st of the State railways, already grievously diminished by Rumani requisitioning. The destitution and misery of the population fearful; everybody everywhere demanded assistance from state, which, despite its meagre revenue, was compelled to assi unless thousands were to die of starvation. The state resorted inflation and the currency soon became worthless. Business st nated. The rate of interest at times reached 40–50% per mon Speculation was rife. No efforts of the successive finance ministe neither the stamping of the currency notes—a measure taken avoid a further inflation—nor the sequestration of 20% of the deposits, 15% of the shares and 17% of the larger estates, co remedy the situation. The rate of exchange in Zurich fell to 0·00 One or two branches of industry—such as the textile industry prospered, since they were protected by high tariffs and labour cheap; but the state and a very large part of the population we faced with utter ruin.

Conditions at home required a strong Government and a work majority in the National Assembly, and such an issue could only secured by new elections. On the expiration of the prescribed pe of two years, in Feb. 1922, the National Assembly was dissolve and the elections held in the spring gave the Government a majority. There was, however, a strong opposition consisting Liberals, Democrats, Kossuthites (independents), 24 Socialists 20 "Neutrals." In order to secure the working capacity of the tional Assembly, the standing orders of 1907 were revised wi beneficial results. In the elections of June 1922 the Bethlen Gover ment secured a great majority and formed the United party of sma holders, bourgeois, industrials and great landed proprietors. Out 242 seats in the national assembly the United party secured 14

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[1] See letter from Bauffy to the Conference of Ambassadors, Nov. 1921, in *Engagements internationaux pris par la Hongrie en ce concerne la dynastie des Habsbourg*, (League of Nations, Doc. and 160 of 1922.)

Christian National United Party 32. The Social Democrats ured 24 mandates.

Count Bethlen now reconstructed his Cabinet with a pro- mme of “ the complete liquidation of the revolutionary spirit, extension of civil rights and economic reconstruction.” His in object was to ensure consolidation. The tide of extremist sion was on the ebb, and the policy of the golden mean proved st likely to achieve favourable results. The conditions of lic safety were restored. The outrages perpetrated against Elizabeth Ward Club (on April 2 1922) and against the Inn ngrád (somewhat later) were the last attempts to subvert public er. It now became possible to set about realising the two most ent reforms: agrarian reform and financial reconstruction.

Agrarian Reform.—The land reform question is inseparably nected with the name of the late Minister of Agriculture, phen Szabo de Nagyatad. To provide the landless with land evy was raised upon the latifundia. Official figures for the iod Jan. 1921 to Nov. 1925 show that 845,567 cadastral ac. cadastral ac. = 1·422 English ac.) were requisitioned and tted respectively for 168,263 house sites and for the forma- n of “ dwarf ” and small holdings, while in 650 parishes 123,- cadastral ac. were taken over for the formation of small seholds. Proceedings for the compulsory purchase of land the purpose of grants to the landless have been instituted or lications for such institution filed in altogether 3,532 parishes. carry through such proceedings, the national land distribu- n tribunal has dispatched judges to 3,526 parishes, and the unal has exercised its right of pre-emption in 300 cases, ecting altogether an area of 15,816 cadastral acres. Landed perty has been parcelled out in 273 cases, the area involved ng 62,328 cadastral acres.

The Reconstruction Plan.—As a result of the World War and the sequent revolutions, the Hungarian state budget and balance of ments both showed a considerable deficit, while the unsettled arations problem perpetuated grave uneasiness in Hungary which in made foreign capital adopt an attitude of absolute reserve. e Government was convinced that economic reconstruction was of the question unless adequate capital was available to stabilise crown until public finances were again balanced. The Govern- nt could only secure the necessary capital by means of a foreign n, but there were grave obstacles in the way of a negotiation of h a loan, since, for the security of their reparation claims, the ied States had the right to regard those claims as a charge on all assets and revenue of the Hungarian State (“. . . the first charge on all the assets and revenues of Hungary shall be the cost of aration and all other costs arising under the present treaty . . .” t. 180 of the Treaty of Trianon). The loan which the Hungarian vernment desired to take up through the intervention of the gue of Nations could not be negotiated until the reparation com- ssion had, with the consent of all the states claiming reparation, eased the assets and revenues of Hungary from the general charge as stipulated, and until Hungary, as a member of the League of tions (she had been admitted Sept. 18 1922), had submitted a re- est to that effect.

On Oct. 17 1923 the reparation commission agreed in principle to spend the priority of charges on the assets and revenues of Hun- ry and thus to approve of the negotiation of the foreign loan to taken up under the aegis of the League of Nations. The Council the League, at its session in Paris in Dec., was thus able to cuss the flotation of the loan, while the experts sent to Budapest the Council elaborated—in conjunction with the Hungarian vernment—a programme of reconstruction. By request of the uncil the financial committee of the League—on the basis of gotiations carried on in respect of questions of detail with the rties concerned—drafted two protocols (*procès-verbals*), which re accepted by the parties concerned and adopted—*nem. con.*—at meeting of the Council held on Dec. 20.

The first protocol was of political nature. Great Britain, France, aly, Rumania, Yugoslavia and Czechoslovakia engaged to respect territorial integrity, sovereignty and independence of Hungary, t to endeavour to obtain any economic advantages calculated to langer that independence, and to abstain from all action likely to n counter to the spirit of the agreements to be concluded for the rpose of furthering the financial reconstruction of Hungary; ngary engaged to meet her international obligations faithfully d punctually, and similarly to abstain from all action in defiance the agreements to be concluded for the purpose of furthering her ancial reconstruction. The protocol affirms Hungary's full liberty action in respect of all questions affecting her own economic stem and commercial relations, while requiring her not to put into ce in her relations with any other state such special measures as ght be calculated to endanger her independence.

The second protocol contains the detailed conditions relating to the floating of the loan:—

The Hungarian Government shall submit to the League the programme of reforms to be gradually materialised and of economic reconstruction; detailed statements being presented every six months during the period of reconstruction of the minimum revenue expected and the maximum expenditure which the country is able to undertake, and the measures proposed to decrease expenditure and increase revenue; the whole must comprise a scheme which shall provide for the restoration of the balance of the public budget by June 1926. The programme must preclude any recourse being had to any other loan, or to inflation. Hungary engages to endeavour to conclude commercial agreements, in particular with the neighbouring states, for the purpose of eliminating the obstacles impeding trade. The Hungarian Govt. undertakes to secure the approval of the scheme by the National Assembly. It is empowered—within the period required for the restoration of the balance of the budget—to take up a foreign loan of 250,000,000 gold crowns to secure surplus expenditure, the proceeds of such loan to be available only in accordance with the provisions of the protocol. Hungary consents to the League of Nations appointing a commissioner-general to be resident in Budapest, whose duty it shall be to control the execution of the reform programme. The commissioner-general shall submit to the council a monthly report on the results obtained during the working out of the programme. As security for the loan the Hungarian Government mortgages the gross revenue of the customs, the sugar tax and the tobacco régie, the net revenue of the salt régie, and where required such other special sources of revenue (mortgage rights) as that Government shall appoint by agreement with the commissioner-general, save only the revenue of the Hungarian state railways. The Hungarian Govt. engages not to take any such measures as in the opinion of the commissioner-general are calculated to prejudice the value of the charges thus stipulated. This protocol also contains a provision to the effect that the obligations devolving on the Hungarian Govt. shall only be in force in the event of the reparation commission taking a decision to that effect.

At its meeting held on Feb. 21 1924 the reparation commission released the state revenues acting as security for the loan, and agreed to the floating of a loan of 250,000,000 gold crowns. At the same time the reparation commission fixed the payments and deliveries to be made by Hungary in respect of reparation liability within the limits of a fixed schedule amounting to 200,000,000 gold kronen spread over 20 years. These payments and deliveries are graduated from 880 tons of coal or its equivalent in value from Jan. 1 1924 to Dec. 31 1926; then until Dec. 31 1928, annual payments of 5,000,000 gold kronen which increase by degrees until 14,000,000 per annum is reached in 1942 and 1943. This removed the last obstacle to the putting into force of the Geneva protocol which was formally signed at Geneva on March 14 1924. The commissioner-general appointed by the League of Nations, Mr. Jeremiah Smith, an American citizen, took up his duties on May 1 1924.

Connected with the reparation question are the liabilities undertaken by Italy and by the Succession States, viz.: Poland, Rumania, Czechoslovakia and the Serbo-Croat-Slovene State, to pay to the Reparation Commission the value of the state properties (railways, forests, public buildings, etc.) of the former Austro-Hungarian Monarchy situated in the territories ceded to them, and further a contribution to the expenses incurred by the Allies in liberating the people of the said territories. These liabilities, which in the aggregate would amount to a very large total, were to be paid off, with 5% interest, in 30 years from Jan. 1 1926, but no payment has hitherto been made. It should also be mentioned that Italy and the Succession States were, in accordance with a now generally accepted principle of international law, required to take over a share of the pre-War Austrian and Hungarian public debts proportionate to the Austrian and Hungarian territories they respectively acquired.

The reconstruction imposed heavy burdens on the Hungarian people. The state was obliged to exercise the utmost economy in order to balance its budget; it had to dismiss many thousands of public servants—25,000 had been dismisssed up to Dec. 1925—and withdraw the subsidies previously granted to numerous branches of production. All taxes had to be raised to the utmost point possible. Yet the reconstruction proved a decided success, and the balance of the public finances was restored at the very opening of the period appointed for the reconstruction. The League of Nations expressed great satisfaction at the success of the scheme; and both the Council (in September 1925) and the General Assembly, during its 1925 session, conveyed to the Hungarian Govt. and the commissioner-general its sincere appreciation, also expressing its admiration for the generosity and self-sacrifice of the Hungarian taxpayers.[1] During 1924–5 the Hungarian Govt. was actively engaged in an endeavour to settle the questions still pending with other states, and in particular with Hungary's immediate neighbours, and to develop the friendly character of Hungary's international relations.

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[1] In June 1926 the Council of the League of Nations decided to terminate the control of Hungarian finance on June 30, the reconstruction having proceeded more rapidly than had been expected. Supervision was retained in two respects only—over the revenues assigned as security for the Reconstruction loans, and over the unspent balance of those loans.

A series of agreements were concluded with Austria, Rumania, Yugoslavia and Czechoslovakia, referring to legal questions and a general rapprochement in respect of economic and commercial questions and of financial and credit transactions. Hereby the Hungarian Govt. has shown indubitably that it is desirous to remain true to its own policy, the cardinal principles of which are consolidation and the solution of the fundamental problems of peace. These latter naturally include also the securing of the cultural, economic and political liberty of the Hungarian minorities living in the territories separated from Hungary by the Treaty of Peace.

(Be.)

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Defence.—Under Article 108 of the Treaty of Trianon the strength of the Hungarian Army (Royal Hungarian Honved) is limited to 1,750 officers, 2,334 N.C.O.'s and 30,916 other ranks—35,000 in all. Up to July 1 1922 the Honved officers had to be recruited exclusively from among former regular officers. The term of service for the rank and file is 12 consecutive years. Only voluntary recruiting is permitted. The army consists of seven mixed brigades; there are also four regiments of Hussars, four batteries, three battalions engineers. A mixed brigade consists of two regiments of infantry (each containing three battalions) one cyclist battalion, one squadron hussars, one artillery group of three batteries, one trench-mortar company, one signals company, one horse-transport detachment, one mechanical transport detachment. Heavy reductions were made on the application of the reconstruction scheme, and it is understood that the permanent establishment of the army in 1926 was much below strength. The police and gendarmerie consists of 2,100 officers and 9,900 men; the term of service is 20 years for the officers and 6 years for the men. See League of Nations, *Armaments Year Book* (1925–6). (X.)

II. ECONOMIC AND FINANCIAL HISTORY

Agriculture.—Of the population of Hungary in 1925 about 56% were engaged in agricultural work as compared with 30% in industry and commerce. Agricultural production was therefore the basis of the country's economic development.

In the five years which preceded the World War, Hungary's agricultural production showed a gradual but constant development in consequence of the draining of flooded areas and the extended use of agricultural machines and artificial manures. This development was arrested by the War, the succeeding revolutions, the occupation of the country by foreign Powers and by the provisions of the Peace Treaty. Owing to the scarcity of labour, draught animals and manure, the arable land, amounting to 5,600,000 hectares, could not be properly cultivated, and a considerable decrease of production resulted. The downward tendency reached its lowest level in the years 1919–20; from that time, progress, at first slow and later quicker, was visible, some crops showing in 1925 a yield which compared well with those of pre-War years.

The index numbers of the five principal crops showing favourable development (the average of the years 1911–5 being equal to 100) are as follows:—

Years	Wheat	Rye	Barley	Maize	Potatoes
1911–5 average	100	100	100	100	100
1920	52	64	66	84	106
1921	79	79	67	67	91
1922	75	79	67	82	68
1923	92	99	75	93	69
1924	70	70	45	125	79
1925	95	96	73	156	118

The following table shows the yield of seven principal crops:—

Crop	Average of the Years		Average of the Year	
	1911–5	in 1920	1921–4	in 1925
	(In metric quintals)			
Wheat	19,950,076	10,322,119	15,812,439	18,942,01
Rye	8,042,139	5,143,169	6,586,079	7,742,2
Barley	7,141,212	4,718,519	4,693,232	5,224,0
Oats	4,404,705	3,237,901	3,187,092	3,560,8
Maize	15,055,696	12,742,081	13,444,601	23,483,3
Potatoes	19,458,893	20,722,294	14,915,207	23,054,7
Sugar Beet	15,019,512	6,398,261	8,706,781	15,252,5

These results are due in part to favourable weather, but cre must also be given to the diligence and perseverance of the peo of Hungary. The abolition in 1923 of export and other ar trary restrictions on trading, and the subsequent stabilisation the currency under the League of Nations reconstruction pl also greatly contributed to increased production by assuring farmer sure markets at stable and profitable prices.

The values in millions of pounds sterling of the seven princi crops mentioned above amounted in 1920 to 14·2, 1921 to 22 1922 to 29·4, 1923 to 33·0, 1924 to 51·6 and in 1925 to 59·1 m lion sterling. Before the War the same seven crops produced the territory of present Hungary (calculated on the basis of prices of 1913) had a value of £48,400,000. The total value of agricultural products for 1925 was approximately £80,000,0 There is no reason to think that the production of 1925 cann be maintained or even improved, provided increased cre facilities for implements and plant are forthcoming.

Live stock, which in consequence of the War and occupatio by the enemy had suffered serious losses, showed in 1925 improvement both from the point of view of quantity and qu ity. Poultry farming also showed great advance after the W While only £700,000 worth of poultry and poultry produ (eggs, feathers, etc.) were exported by Hungary in 1922 the exports approximated to £2,900,000 in 1925. The production wine also showed an increase over pre-War figures for the sa territory, and there was steady development in fruit-growi bee-farming and silk production.

Land mortgage loans granted by the principal financial ins tutions in Hungary amounted in 1913 to £167·7 million, or 4 of their capital. The land mortgage loans granted by the sa concerns at the end of 1924 only amounted to £83,000 or 0· of their capital. In other words, the land in Hungary was pra tically free of all mortgage, owing to the depreciation of t currency. Towards the close of 1925 the 9·3 million hectare land in Hungary were worth £582·2 million, of which the 5 million hectares of arable land were valued at £406·5 millio.

Industry.—The total production of Hungarian industr (present territory) in 1913 amounted to 1,641·4 million go crowns, and in 1924 only 1,531·12 million gold crowns, *i.e.*, 6·5 less. The average production for each factory was 790,000 go crowns in 1913 and only 560,000 gold crowns in 1924, *i.e.*, a di nution of 29·1%. The value of the average working capac of one worker was 7,485 gold crowns in 1913 and only 6,066 go crowns in 1924 *i.e.*, a decrease of 19%.

In the various industries production figures were as follows:–

Industries	Value of Production in Millions of Gold Crowns	
	1913	1924
Iron and metal	252·49	193·58
Machines	251·30	160·49
Stone, pottery and glass	70·87	52·34
Wood and bone	41·42	36·14
Leather, hair and feathers	44·95	51·62
Spinning and weaving	82·24	193·44
Clothing	24·81	31·86
Paper	10·69	7·23
Foodstuffs	695·43	702·55
Chemicals	124·50	84·20
Printing	42·60	18·07

The larger industries showing the greatest progress since the ar are sugar and textiles. In 1924–5 the sugar industry manu- :tured 1,770,000 and exported 892,000 quintals of refined gar, as compared with an output of 1,500,000 quintals in 1923. t of home requirements in textiles amounting to 447,000,000 d crowns, home production in 1925 was able to supply textiles the value of 260,000,000 gold crowns, as compared with only .400,000 pre-War. Next to Minneapolis, Budapest has prob- ly the largest flour-milling capacity in the world, but only out 30% of the capacity was utilised in 1925, owing to lack the grain that formerly came to Budapest from the southern ritories now separated from Hungary.

Foreign Trade.—The foreign trade figures of Hungary for 1925 owed rapid improvement. For the first time since the War ere was a favourable balance in August. The figures for the years ending 1925 are as follows:—

ear	Import	Export	Excess of Import	Increase of	
				Import	Export
	In millions of pounds sterling			Expressed in Index Numbers	
920	17·3	6·8	10·5	100	100
921	21·6	10·5	11·1	125	155
922	22·4	13·7	8·7	129	201
923	17·6	14·1	3·5	101	206
924	29·2	23·9	5·3	168	350
925[1]	30·9	29·2	1·7	179	429

[1] The figures for 1925 are provisional.

The increase of the unfavourable balance in 1924 may be plained by the fact that after the abolition of import restric- ons a great number of goods were imported in a short period. e steady tendency of the commercial balance towards equilib- m was also shown by the decrease of the proportion of the favourable balance to total imports: 60·6% in 1920, 38·8% 1922, 18·2% in 1924 and 5·5% in 1925.

The new international commercial free harbour on the Danube Budapest, which was partly open in 1925 for traffic, is likely be an important aid to increased trade between the Western ates and the Balkans and the Levant.

Employment.—The unemployment returns compiled by the de unions—the only available statistics—showed a reduction m over 36,000 in Jan. 1925 to about 26,000 in Nov. of the ne year. The average wage level for full time was then er 100% of pre-War in gold and between 80% and 90% in me purchasing power.

Price.—The wholesale price index reached its peak at the ginning of 1925 at 159, and the retail index (Pester Lloyd) at 1, exclusive of rent. By Nov. of that year they had fallen to 9 and 123 respectively.

Trade Conventions.—The breaking up of the Austro-Hungarian onarchy, with its single customs union, into seven independ- t customs territories naturally proved a handicap to close de relations between Hungary and her neighbours. In the ginning of 1925 an autonomous customs tariff was brought to force. Although the new duties—partly for the protection home industries and partly as a basis of bargaining—were latively high, there was a marked increase of imports, indi- ting that the duties were by no means prohibitive. By the end 1925 Hungary had concluded commercial agreements with states on the basis of the most-favoured-nation clause, and finitive commercial treaties with five other states on the basis special tariff concessions. Negotiations with other and par- cularly with neighbouring states were proceeding, though owly, with a view to substituting the existing provisional agree- ents by definitive treaties. Among the many obstacles was e unwillingness of adjacent states to avail themselves of the rect transit facilities offered by the Hungarian railway lines. a result of this diversion of traffic to more roundabout routes, couraged by artificial rates, Hungary's ton-kilometre railway ures have fallen steadily—an instance of the problems that confront any solution of the economic difficulties in the Danubian basin.

THE COUNTRY'S FINANCES

Budget for 1924–5 and 1925–6.—The state budget for the fiscal year ending June 30 1925, as approved by the League of Nations, provided for a deficit of £4,200,000. Instead, there was a surplus of about £2,600,000. The budget for the year ending June 30 1926 estimated for a surplus of £1,200,000, although the League of Nations had originally estimated that in this year there would be a deficit of £2,100,000. The results of the first six months of the fiscal year 1925–6 indicated that the more favourable estimates were being borne out by actual results. The principal items of the budget for 1925–6 were as follows:—

Budget headings	Million pounds sterling
Expenditure for material	3·6
State debts	2·4
Treaty charges	0·3
Expenditure for personnel	8·0
Contribution to expenditure of autonomous bodies, comitats, etc.)	1·3
Pensions	3·1
Capital outlay	0·5
Total	19·2
Deficit of undertakings	0·4
Total of expenditure	19·6
Receipts from revenue, etc.	20·8
Surplus	1·2

Both expenditure and receipts showed increases over the League estimates, partly due to the rise of 17% in the value of the crown since the date of stabilisation.

In view of the satisfactory condition of the budget, the League of Nations in June 1925 released for productive capital expenditure 30,000,000 gold crowns from the reconstruction loan which had not been needed, as originally anticipated, to balance the budget, and also agreed that the budget surplus for 1924–5 should be applied similarly and for bringing the salaries of state employees nearer to the pre-War level. In Dec. 1925 the League released from the reconstruction loan a further sum of 20,000,000 gold crowns for capital expenditure in 1925–6; also, conditionally, 50,000,000 for 1926–7, leaving 82,000,000 out of the original loan of 250,000,000 gold crowns still to be released. As at Nov. 30 1925 the commissioner-general's account showed the available balance of reconstruction loan to be 152,000,000 gold crowns.

State Debt.—The total Hungarian state debt amounted to £329,800,000 sterling before the War, which represents a burden of £15·7 *per capita* of population. The debt of present Hungary, as constituted under the Peace Treaty, amounted to £57,600,000 sterling at the end of 1924, due allowance having been made for the allocation of the pre-War debt and of part of the War debt as provided by the Peace Treaty. Of this amount £2,000,000 represents the funded internal debt, £48,700,000 the funded foreign debt and £6,900,000 the floating debt. The burden *per capita* of the population amounts to £7, much less than the pre-War burden, mainly in consequence of the depreciation in the value of the obligations of the state.

Savings and Credit.—Coincidently with the stabilisation of the Hungarian currency on the £ sterling there was a marked increase in savings deposits. Figures from the postal savings banks and the 13 principal financial institutions in Budapest show that savings deposits steadily increased from £210,063 at Dec. 31 1923 to £5,012,500 in Nov. 1925, while current account deposits with the same institutions and over the same period increased from £4,876,952 to £13,029,166. The gross total of deposits is only about one-quarter of the pre-War amount.

The bank rate, which in March 1925 was 12½% was gradually lowered until in Oct. 1925 it reached 7%, credit and money conditions becoming correspondingly easier. This was facilitated by the introduction of foreign capital. In addition to relatively large short-term commodity credits for flour, sugar, etc., principally from England, and the participation of foreign capital in two of the leading Budapest banks, two long-term foreign loans were successfully floated towards the end of 1925, one of $10,000,000 in New York for 48 Hungarian municipalities, and another of £1,000,000 sterling in London against land mortgages.

Taxation.—Prior to the period of reconstruction in 1924 the Hungarian Govt. had recourse to many taxation expedients and drastic measures in their struggle to maintain revenue in the face of an ever-depreciating currency. The system of assessing taxation on the incomes and revenues of the previous year soon ceased to have any meaning. As a result of the War, the revolution and the Rumanian occupation there were also outstanding arrears due for some three or four years. In 1920 there was a forced loan by the stamping of notes amounting to 50% of the currency then in circulation, in 1921 a heavy capital levy, and in 1924 another forced loan based on the earned income and capital of each individual or firm operating in Hungary. Consumption (excise) taxes were fixed at a proportion of the actual price of the articles consumed, and the "turn-over" tax, payable simultaneously with the purchase of all articles, was introduced. The latter tax was fixed originally at 1·5% and subsequently at 3% of the sale price of each article and on each handling, thus amounting in many instances to a tax of 12%. (In Aug. 1925 this tax was reduced to 2%.) Arrears of taxation were drastically compounded, and land taxes were made payable in wheat or wheat values. Finally, by the passage of Act IV. of 1924 the Government were empowered to levy all taxes in values of gold crowns.

In a report presented to the League of Nations in Oct. 1925, the League commissioner-general in Hungary estimated that on the Hungarian Budget for 1925–6 the taxes levied by the state, excluding local taxes, amounted to 60 gold crowns *per capita* of population. This compared with approximately 45 gold crowns *per capita* pre-War, which, after making allowance of 35% for the depreciation in the value of gold, also worked out at 60 gold crowns *per capita*. Adding local to state taxation, the commissioner-general estimated that the total *per capita* taxation was 72 gold crowns per head. Estimating the national income of Hungary at approximately 3,600 to 4,000 million gold crowns, the commissioner estimated that the total taxation of Hungary represented between 14 and 17% of the national income. This compared with between 13 and 14% pre-War. According to the same authority this taxation was by no means light for an agricultural country such as Hungary. From one-fifth to one-quarter of these taxes were raised in 1925 by direct and from three-quarters to four-fifths by indirect taxation.

On the basis of the Government assessment for the fiscal year ending June 30 1926 the direct taxes, according to Commissioner-General Smith, were divided as follows:—

	Millions of gold crowns
Land tax	42
House tax	24
State participation in house rents	23
Corporation tax	10
Income tax	41
Property tax	8·7
	148·7

The estimates of indirect taxation for the same period are as follows:—

Turnover tax	103·6
Stamp and other similar taxes	52·4
Tax on commodities	55·6
Customs	85·6
Salt monopoly (net)	11·2
Tobacco monopoly (gross)	97·6
Transport tax	9·2
	415·2

Currency.—During the existence of the Dual Monarchy, Hungary and Austria had a joint monetary system and a joint bank of issue. After the outbreak of the revolution the Austro-Hungarian Bank was able for some time to continue its work in Hungary, but the Bolshevik régime seized the entire stock of notes. When these began to run short the so-called soviet republic issued their own notes. After the collapse of soviet rule in 1919, the Hungarian Govt. issued the necessary decree to enable the Austro-Hungarian Bank to continue its statutory work as "Manager of the Hungarian business of the Austro-Hungarian Bank."

In March 1920 the Government ordered the stamping of the notes of the Austro-Hungarian Bank which were in circulation within the country, and requisitioned 50% of these notes as a forced loan in order to secure, so far as possible, the carrying on of the state administration without constant application to the note printing press. As the creation of a special issuing institution appeared to be inevitable in consequence of the liquidation under the Peace Treaties of the Austro-Hungarian Bank, the state itself provisionally established the Royal Hungarian State Note Institute (M. Kir. Állami Jegyintézet), which began its activities on Aug. 1 1921. The notes of the Austro-Hungarian Bank, which had been provided with the Hungarian stamp, were exchanged in the same year against state notes.

When the State Note Institute commenced its work, the financial and economic position was such as to compel the state to cover its budgetary requirements not from revenues but by means of the note printing press. This naturally resulted in the gradual depreciation of the crown. The forced loan raised by stamping notes had covered the budget deficit only for a short time. In 1921 the Government had recourse to a non-recurring capital levy, but by the time most of the proceeds reached the Treasury the value of the crown had so depreciated as to nullify these efforts. In the first half of 1921 the exchange rate of the crown rose temporarily in Zürich from 1·05 to 2·85 Swiss francs (100 crowns), owing to the impression created by the taxation and other plans of the then Minister of Finance, M. Hegedus. When it was seen that these plans were impossible of realisation, and as Hungary's balance of payments became more and more unfavourable, the crown continued to fall, until in March 1924 it reached 0·0085 Swiss francs for 100 crowns. As the result of lo negotiations the League of Nations loan was raised, and the restor tion of normal economic and currency conditions was thus ma possible (*see* above, *Political History*). All restrictions in forei exchange were abolished in Oct. 1925, when the currency was co sidered to be sufficiently stabilised to be left to fluctuate fre according to supply and demand.

Central Bank.—The re-establishment of an independent bank issue was in the forefront of the programme of reconstructio The Hungarian National Bank was founded, with a capital 30,000,000 gold crowns, and commenced its activities on June 1924. From that day the state notes then in circulation were garded as bank-notes. Under its statutes the bank is precluded fro lending to the state, and is required to maintain against its no circulation a percentage of cover in precious metal and stable forei exchanges, on an ascending scale, beginning at 20% during the fi five years. The bank return of Dec. 31 1925 showed the proporti of cover to be 56·46 per cent. Since July 1924 the currency has be stable on a sterling basis. In Oct. 1925 the basis of stabilisati became gold, and all restrictions on dealings in foreign exchange we abolished.

The following table shows the development of the note circul tion:—

Date	Issuing institution	Circulation in paper crowns
Dec. 31 1920	Hungarian management of Austro-Hungarian Bank	14,307,808,630
Aug. 1 1921	State Note Institute	15,787,175,750
Dec. 31 1921	State Note Institute	25,174,941,187
Dec. 31 1923	State Note Institute	931,337,334,630
June 24 1924	Hungarian National Bank	2,520,113,700,576
Dec. 31 1924	Hungarian National Bank	4,513,989,561,419
Dec. 31 1925	Hungarian National Bank	5,193,937.447,500 (415,514,995·79 pengös)

New Currency.—On Dec. 31 1925 the currency *per capita* of th population was approximately 43 gold crowns. In the latter part 1925 the new monetary unit was chosen and named the pen divided into 100 fillér; 3,800 new units go to one kilogramme of fi gold, so that 1 pengö contains 0·26315789 grammes of fine gol The Currency Reform Law passed on Nov. 6 1925 provides for th minting of gold coins for 20 and 10 pengös from an alloy consistin of 900 parts of gold to 100 of copper, so that 3,420 pengös will struck from one kilogramme of this alloy. The National Bank required to buy gold in bars at a fixed price without limit and demand. Silver coins of one pengö will be put into circulation to total nominal value of not more than 45,000,000 pengö.

From Jan. 1 1927 the pengö will be the obligatory unit of accou in Hungary. The rate of conversion from the old to the new curren is 12,500 paper crowns to one pengö, or one gold crown = 1·15853 pengö. 1 pengö is therefore equal to 0·0359388 pound sterling, 0·1748985 dollar.

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(W. Go.*)

HUNTING: *see* FOX HUNTING: SHOOTING.

HUSAIN IBNA‘LI (*c.* 1854–), Amir of Mecca from 190 to 1916 and King of Hejaz from 1916 to 1924, was the second so of Muhamnad Ibn‘Aun of the ‘Abadila clan of Ashraf. He wa brought up in Bedouin surroundings, but spent a great part his life at Constantinople. Reputed to harbour Anglophil tende cies, he was deeply versed in the byways of Ottoman politi and his best trait was a profound knowledge of the desert, f which he always maintained a genuine affection. At the begi ning of his Amirate he won golden opinions by his sagacity an modesty and set himself vigorously to forward Turkish interest in Arabia. In 1910 he subdued a rebellion in ‘Asir and subs quently invaded Qasim without result, but in 1913 he began show his true colours by opposing the extension of the Heja Railway to Mecca.

When the World War broke out he entered into negotiatio with the British, which culminated in the Arab revolt in Ju 1916. In Oct. he proclaimed himself "King of the Ara Countries" though he was formally recognised only as Ki of Hejaz. At the Versailles Peace Conference (1919) he w represented by his third son, Faisal, but refused to ratify th treaty as a protest against the mandatory *régimes* imposed Syria, Palestine and ‘Iraq. Subsequently his domestic polic was marked by ever increasing avarice and reaction, while wed the seeds of future trouble by deliberately courting the mity of Ibn Saʻud. In March 1924, while on a visit to Trans-dan, he proclaimed himself Caliph, but war with Ibn Saʻud s already imminent and the Wahhabi attack on Zaif in Sept. ınd him unprepared. On Oct. 5 he abdicated and proceeded ʻAqaba, whence in July 1925 he was conveyed by a British rship to Cyprus, where he took up his residence.

By his first marriage Husain had three sons: ʻAli; ʻAbdullah, nir of Transjordan, and Faisal. The first of these, ʻAli Ibn ısain, who was born about 1880, took no conspicuous part in airs during his father's Amirate. After the World War he be-me Amir of Medina and in that capacity did much useful work connection with the reconstruction of the Hejaz Railway. In 24 he was pressed to accept the Amirate of Transjordan but clined in favour of returning to Medina. He succeeded his her as second King of Hejaz on Oct. 3 1924, but abdicated on c. 19 of the following year (*see* HEJAZ) and returned to Bagh-d to live as the guest of his brother Faisal.

HURGRONJE, CHRISTIAAN SNOUCK (1857–), Dutch entalist, was born at Oosterhaut Feb. 8 1857. After com-ting his studies in theology and Oriental languages he went Arabia, where he stayed for several years, and to other parts the Near East. The result of these travels was his work *ekka* (2 vol., 1888–9). He refused a nomination as professor Arabic at Cambridge University in succession to Robertson nith and also nominations in Germany and at Leyden, pre-ring to continue his studies on Islam in the Dutch East Indies 889–1906) where for some years he was counsellor to the overnment in Mahommedan affairs. In 1893–4 he published *Atjehers*, which was translated into English in 1900. He turned to Holland in 1906, where he accepted the chair of abic at the University of Leyden; in 1907 he was nominated unsellor for Indian and Arabian affairs to the Dutch and the ıtch East Indies Government. Among his other works are *Ned-and en de Islam* (1911); and *Verspreide Geschriften* (1923ff.).

HUTCHINSON, SIR JONATHAN (1828–1913), British surgeon *e* 14.13), died at Haslemere, Surrey, June 23 1913.

HUTMENTS: *see* BARRACKS.

HUYSMANS, CAMILLE (1871–), Belgian politician, was rn at Bilsen in Belgian Limbourg May 26 1871. After gradu-ing in Germanic philology at Liége, he became a professor, st at the Collège Libéral at Ypres, and then at the Université ouvelle, Brussels. He edited the *Petit bleu* and the *Peuple* and ter the War started the *Volksgazet* in Antwerp. He entered the ıamber in 1910, first as deputy for Brussels and then for ıtwerp, where he became an alderman of public instruction. 1914 he was secretary of the Socialist International party and ıile in Holland endeavoured to organise a congress at Stock-lm. Though he was severely criticised for this by his fellow cialists at the time, he completely regained their confidence ter and became the chief organiser of the Socialist party in ıtwerp. In June 1925 he became Minister of Science and Arts M. Poullet's Government. His chief works are: *Limburgsch ıarboek* (1891–5); *Zoponymische studie over Bilsen* (in conjunc-on with J. Cuvelin) 1897; *Stockholm* (1919); and numerous cialist brochures.

HWANG-HO (*see* 14.23).—A reconnaissance of the flood-ricken delta of the Hwang-Ho was undertaken by the Ameri-n Red Cross in 1911 and 1914; a promising series of observations the Kiang-Hwai engineers under H. E. Chang Chien was gun in 1911, and a critical review of these previous findings as made in the field in 1919–20 by John R. Freeman, partly connection with his work for the Grand Canal Improvement oard.

Through the province of Shantung the Hwang-Ho's fall to e sea has been found to be about 1 in 5,000, a steep gradient r so large a river. The current is therefore very swift, and the ver not only carries along great quantities of sediment, but e muddy bottom itself steadily works forward and the bed of e channel is raised. Measurements by Freeman's staff show at the river carries over 4% *by weight* of silt, and may even rry 13% in greatest flood. Naturally the stream drops a part of its heavy burden whenever its velocity decreases. Three types of deposit are to be considered: outside the outer dikes; between the dikes; and along the river bed within the main channel.

Deposits outside the Outer Dikes.—When the river overflows or breaches the outer dikes, it deposits over the land a sloping ridge of sediment which varies greatly in size, but probably during the past 1,000 years has not exceeded the equivalent of 10 ft. close to the main dike, tapering off to almost nothing at 5 or 10 m. away.

Deposits between the Inner and the Outer Dikes.—Whenever the river floods the space between the outer and inner dikes, the waters as they subside deposit their silt and a flood plain is formed. These flood plain deposits between the dikes, while varying from 12 to 20 ft., average 15 ft. above the low-water level. Probably they accumulate somewhat rapidly. It is this very action which can be utilised to form a permanent barrier of surpassing strength if the river be trained as Freeman suggests (*Proc. Amer. Soc. Civil Engineers*, May 1922, pp. 1113–67).

Deposits within the Main Channel.—When the summer floods subside, the river, in narrowing to its winter channel, slows up and deposits sediment on its own bed. Although much has been written about the Yellow river continually raising its bed, compelling the inhabitants constantly to build the dikes higher, there were no facts upon which to base such statements until the Red Cross in 1914, and the Grand Canal Improvement Board in 1919, gave cross sections, extending far beyond the dikes, showing broadly the relation of the elevation of the river bed to that of the adjacent country. These show that the river has done remarkably well in conveying nearly all of its silt to the sea, and that the rise of its bed has been extremely slow, in general not more than 15 ft. during the past 1,000 years, or perhaps 2,000 years—say a foot a century. Great as the river's land deposits have been, they are small in comparison with the total volume of sediment transported in 1,000 years, if the river during that time carried anything like the percentage of sediment recently observed. It appears that the Yellow river during all the historic period has carried to the sea 99% of the burden of silt gathered in the loess country.

The flow of the Yellow river varies much with the season, being ordinarily three times as great in flood as at low water. In the summer of 1919 a flood flow of 265,000 cu. ft. per sec. was measured (the highest for 10 years) with a minimum of 10,600 cu. ft. per second. This is remarkably small, considering the great extent of the drainage area; much of it, however, is a land of little rain, and the losses on the way are very large. Moreover, this river has no tributaries for some 300 m. from its mouth. Its only connections are with irrigation and navigation canals which serve during high-level periods to draw off water. Though practically useless for navigation, the Yellow river may, in spite of its relatively small discharge and variable flow, be a blessing in the way of drainage and irrigation if it is properly dealt with. (C. K. E.)

HYATT, ANNA VAUGHN (1876–), American sculptor, was born at Cambridge, Mass., March 10 1876. Educated at a private school at Cambridge, she commenced the study of art in Boston, proceeding later to New York City. There she studied a short while with H. A. MacNeil and Gutzon Borglum, under whose influence she acquired that knowledge of horses which is so signally exemplified in some of her works. She devoted herself chiefly to small bronzes. Her equestrian statue, "Jeanne d'Arc," was selected for Riverside Park, New York City, in 1915, and copies of it were erected at Gloucester, Mass., and Blois, France. This work, a "Saint Joan of Arc" in the Cathedral of St. John the Divine, New York City, and a "Diana" have been her chief figure compositions. Notable among her other works is a colossal "Lion on a Boulder" executed for the Dayton High School. In 1923 she married Archer Milton Huntington.

HYDE, DOUGLAS (1860–), Irish scholar and writer, was born at Frenchpark, Co. Roscommon, 1860, and was educated at Trinity College, Dublin. In 1891 he acted as interim professor of modern languages at the University of New Brunswick, Canada. He formed in 1893 the Gaelic League, for the preservation and extension of the Irish language, and was president of that body until 1915. In 1899 his production, before a vice-regal committee on education, of letters from leading Celtic scholars throughout Europe saved the Irish language on the intermediate board which regulated the curricula for Irish schools. During 1905 he toured America and raised £11,000 for the Gaelic League. On his return he was appointed a member of a royal commission on Irish university education. Dr. Hyde was made professor of Modern Irish at University College, Dublin, in

1909. He was co-opted by the Free State Senate in 1922, but failed to secure re-election in 1925. In the latter year he became editor of *Lia Fáil*. The movement created by him initiated an enthusiasm for the native language, which finally resulted in the teaching of the language being made compulsory in Irish schools.

Among Dr. Hyde's more important works are *A Literary History of Ireland* (1899); collections and translations of the *Love Songs of Connacht* (1893); *Raftery's Irish Songs* (1904); *The Religious Songs of Connacht* (1906). He also wrote several short plays in Irish.

HYDERABAD, SIR MIR OSMAN ALI KHAN, Nizam of (1886–), was born April 6 1886 and succeeded his father, Sir Mir Mahbub Ali Khan, on his death on Aug. 29 1911. His education had been under an English tutor, Sir Brian Egerton, and a nobleman of the state, of scholarly attainments, Imad ul Mulk (Saiyid Husain Bilgrami). Soon after accession he abandoned the traditional system of governing through a Diwan, and for five years was his own prime minister. In 1919 he constituted an executive council with a president and eight other members, each in charge of one or more departments. During the World War he enjoined on his subjects the duty of firm and steadfast devotion to the British cause and prohibited anti-British propaganda in his dominions. The War expenses of the state amounted to over three-fifths of the annual income. His Highness, already a G.C.S.I., was awarded the G.B.E., was promoted to hon. lieutenant-general in the British Army, and in 1918 King George V. conferred upon him the new and special title of Exalted Highness.

HYDROELECTRIC ENGINEERING.—The extent to which the water powers of the world have been investigated and developed during the past decade forms one of the striking engineering features of the period. Although falling or flowing water formed the earliest of the natural sources of energy to be utilised for providing power, some two-thirds of the water power at present in use has been developed since 1910.

The reasons for this are partly technical and partly economic. The technical development of electric generation and transmission has made it economically possible to utilise powers remote from any industrial centre, while the great developments in electrochemical, electrophysical and metallurgical processes have provided an outlet for such energy as could be cheaply developed. Most of these processes require relatively large amounts of energy, and all are economically dependent on the cheapness of this energy. They have created a demand for large blocks of cheap power which can, under favourable circumstances, be satisfied more readily from a water-power installation than from any other source.

Developments.—The urgent demand for energy to supply the abnormal requirements of the War period, combined with the increased cost of fuel, was responsible for an unprecedented rate of development in those countries having available water-power resources and normally dependent on imported fuel. Thus in France something like 2,500,000 of water-horsepower is now developed as compared with 750,000 H.P. in 1914. In Switzerland, the present output is 1,500,000 H.P. as compared with 880,000 H.P. in 1914. In Italy it is estimated that the total output will shortly amount to 3,000,000 horsepower. Japan, which only recently began to investigate her water-powers, has, since 1916, developed over 1,200,000 H.P., or about 20% of her available resources. Step by step with developments on the electrical side, advances have been made in the design of hydraulic turbines. These various developments have made it commercially possible to make use of large water-power at sites quite remote from any centre of industrial activity. In many cases industrial communities, attracted by the cheapness of the power, have grown up around such sites. In others the energy has been transmitted electrically for long distances, in some cases between 200 and 300 m., to some more convenient centre.

Available Water Power.—An estimate, based on papers presented to the World Power Conference at London in 1924, and on other sources, indicates that the amount of water-power, respectively available and developed in some of the chief cou tries of the world, is approximately as follows:—

Millions of Horsepower			
		Available	Developed
Great Britain		0·9	0·25
Canada		23·0	3·28
Remainder of British Empire including	Australia	35·0	0·7
	Africa (East)		
	Africa (South)		
	Africa (West)		
	British Guiana		
	India and Ceylon		
	New Zealand		
	Papua		
Austria		3·7	0.28
South America		54·0	0·42
Dutch East Indies		8·0	0·08
France		4·7	2·5
Germany		1·5	0·75
Italy		5·4	2·5
Japan		6·4	1·5
Norway		13·3	1·32
Russia		20·0	0·83
Spain		6·0	1·26
Sweden		8·8	1·42
Switzerland		4·0	1·49
United States		28·0	9·8

From these figures it appears that some 200,000,000 H. is available, of which approximately 27,000,000 is at prese developed or in course of development.

Uses of Hydroelectric Energy

While a large proportion of the energy developed from wate power is utilised for industrial purposes and for lighting an traction, an increasing proportion is being used for pulp an paper making and electrochemical and electrometallurgical proc esses; indeed the chief outlet for hydroelectric power in th near future is likely to be in connection with such processes an probably, railroad electrification. The amount of power alread used in electrochemistry is large. Thus the world's productio of calcium carbide alone requires some 500,000 H.P. and whe it is remembered that such products as aluminium, carborun dum, chromium, cyanamide, caustic soda, chlorates, magnesium phosphorus and silicon are only rendered commercially possibl by such processes, it will be realised that the future demand fo energy for their manufacture is certain to be large. Nitroge fixation is also likely to make great demands. In Norway alon some 400,000 H.P. is available for this purpose, and in view o the rapid depletion of the natural nitrate deposits, from whic four-fifths of the world's nitrogen consumption has hitherto bee supplied, and of the diminution in fertility of many of the grea wheat and cotton growing areas of the world, the production o artificial fertilisers by one or other system of nitrogen fixatio must, in the near future, become a question of great importance

Railroads.—The electrification of railroads has made rapid strides of recent years. In the United States some 3,300 m. o track have been electrified, while the Chicago, Milwaukee and St. Paul Railway has the longest electrified section in the world (850 m.), the power for operation being obtained from hydro electric stations. In France, much of the track of the Compagnie du Midi in the region of the Pyrenees has been electrified with the aid of water power, and it is anticipated that the whole system of about 3,000 km. will be electrified within 10 years.

The hydroelectric stations supplying these lines have a capacity of close on 300,000 horsepower. The Orleans Co. has a scheme for electrifying 3,000 km. of its lines, part of which is to be supplied from hydroelectric stations having a capacity of about 210,000 horsepower. In Austria some 1,800 km. of line is in process o electrification for which 120,000 H.P. is available from hydroelectric stations. In Germany about 1,200 km. is now electrified, its electricity coming from hydroelectric schemes. Much of the Swiss Railway system has been electrified, and the electrification of further trunk lines in these and other countries at present under consideration. Such developments will open a very large field for the utilisation of water-power where this available. (*See* RAILWAYS, ELECTRIFICATION OF.)

Agriculture.—Much energy is now being utilised in the United ıtes of America for purely agricultural purposes. In California, example, there is in effect one vast system of electrical supply :ending over a distance of 800 m. with 7,200 m. of high-tension ınsmission lines. This is fed from 75 hydroelectric stations interınected with 47 steam plants, to give a total output of 785,000 rse-power. A further group of 13 hydroelectric schemes now der construction will add another 520,000 horse-power. A large portion of this power is used in agriculture, and it is estimated ıt electric motors equivalent to over 500,000 h.p. are now talled on Californian farms. The Californian rice industry is nost wholly dependent on irrigation made possible by electric mping, whilst most of the mechanical processes involved in ming are being performed by electric power.

The economic development of many of the tropical dependcies of the British Empire, whose latent wealth is practically tapped, is directly inter-connected with the development of ɛir water-power resources. Not only would an abundant sup-of such power enable railroads to be operated, irrigation ıemes to be set on foot, and mineral deposits to be tapped and rked, but it would go far toward solving the labour problem ich promises to be one of some difficulty in the future.

While those outlets for electrical energy which are now in ht promise to absorb all the energy which can be cheaply veloped for many years to come, there are many other proble directions in which such energy might find a new and profble outlet. Among these may be mentioned the purification municipal water supplies; the dehydration of food products; d the preservation of timber.

LAY-OUT OF HYDROELECTRIC SCHEMES

High Head Schemes.—The layout of a hydroelectric scheme pends on the physical characteristics of the catchment area l site. High head schemes are of necessity located in mounnous country and are usually fed from streams of relatively all volume. Owing to this a comparatively small reservoir is en sufficient to provide sufficient storage of the head waters give uniform output over a considerable portion of the year a reasonable cost. The water may be brought directly from reservoir to the power house through a pipe line or pressure ınel if the gradient is suitable. Often, however, it is possible bring it through an open canal at a very flat gradient, to a ebay on the hill-side above the power-house, whence a short pe-line conveys it to the turbines.

Low Head Schemes.—Low head schemes are usually located on ers where the gradient is small, the head being provided by a m, or naturally by means of rapids or a waterfall. A river m, by raising the natural level of the water, provides a cern amount of storage, but seldom more than is sufficient to ore the night flow for use during the day. Such a scheme can erefore only give a continuous output equal to the dry weather pacity of the river, unless operated in conjunction with some am station capable of equalising the output at such times.

Several types of low head layout are available. Where a dam built, the power house is often constructed on one flank of the m with a short head race or tail race as is most convenient, d the dam itself is used as a spillway over which excess water discharged in times of flood. Where the river flows in a narw and steep gorge the power-house may sometimes with vantage be constructed in the dam itself, which now consists a hollow reinforced concrete structure. Where the river forms ong bend, it is often possible to cut across the neck of the nd and to utilise the head between the two points.

Medium Head Schemes.—In medium head schemes—utilising tween 40 and 200 ft. head—the layout is usually similar in oad outline to those involving either high or low heads. Where ch a scheme involves the use of a long closed supply pipe to turbines, having only a small gradient, somewhat special atment, however, becomes necessary. Owing to the large inertia of the column of water in the pipe line, any sudden demand for water caused by opening the turbine gates on an increasing load causes a relatively large drop of pressure at the turbines, which renders governing very difficult. To reduce this difficulty, a surge tank is fitted to the pipe-line at a point as near to the turbines as possible. This is a stand pipe surmounted by an open tank having a comparatively large surface area, whose upper level is slightly higher than that of the water in the reservoir. Any sudden demand is then supplied in part by flow down the stand pipe and the drop of pressure is greatly reduced. At the same time any rise in pressure caused by suddenly closing the turbine gates is also reduced.

In a low head station the available space is usually limited by the width of the dam on which it is built. In consequence, in such plants, there is a tendency to locate the switch gear and transformers either on floors above the machine-room, or, as is becoming more common, in an entirely separate building on the river bank. In some few cases all the transformers and high-tension switch gear are out of doors, and this will probably become standard practice in the future. It has even been proposed to place the whole generating plant outside, merely providing a portable cover for use during repair work. The recently planned Muscle Shoals development in Alabama was originally schemed along these lines. It has finally been decided to adopt the conventional type of station building, but the complete outdoor generating station will doubtless arrive in the near future.

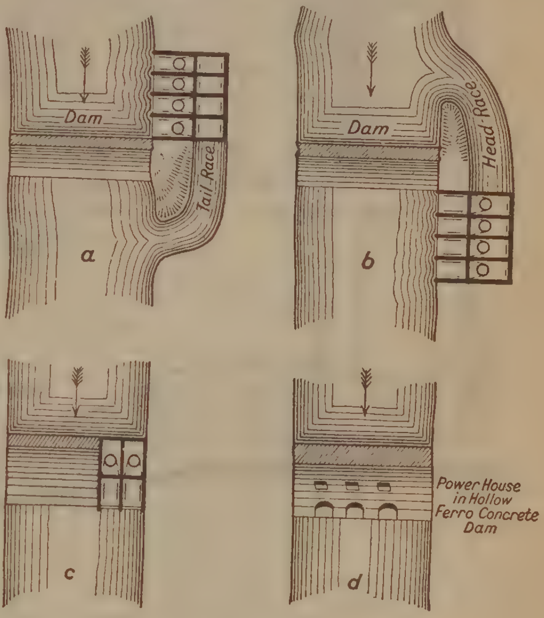

FIG. 1.—Types of Low-head Development.

Turbines.—The inward flow pressure turbine and the Pelton wheel are the only types of turbine used in modern hydroelectric schemes of any size. The type to be adopted depends largely on the available head. The Pelton wheel is a slower running machine than the pressure turbine and is therefore better fitted for very high heads. It has the further advantage for such heads, that since the water is discharged through one—or at the most two—nozzles, these may be of reasonable size when dealing with the small volumes of water normally available in high head schemes. The pressure turbine on the other hand with its full peripheral admission of water is well adapted to utilise the large volumes necessary in low head schemes, and its higher speed of rotation is also a great advantage in low and medium head plants, in enabling the cost of the electrical generators to be reduced. Broadly speaking the Pelton wheel is more suitable for heads above about 700 ft.; the pressure turbine for heads below about 250 ft. in small units and below about 500 ft. in large units;

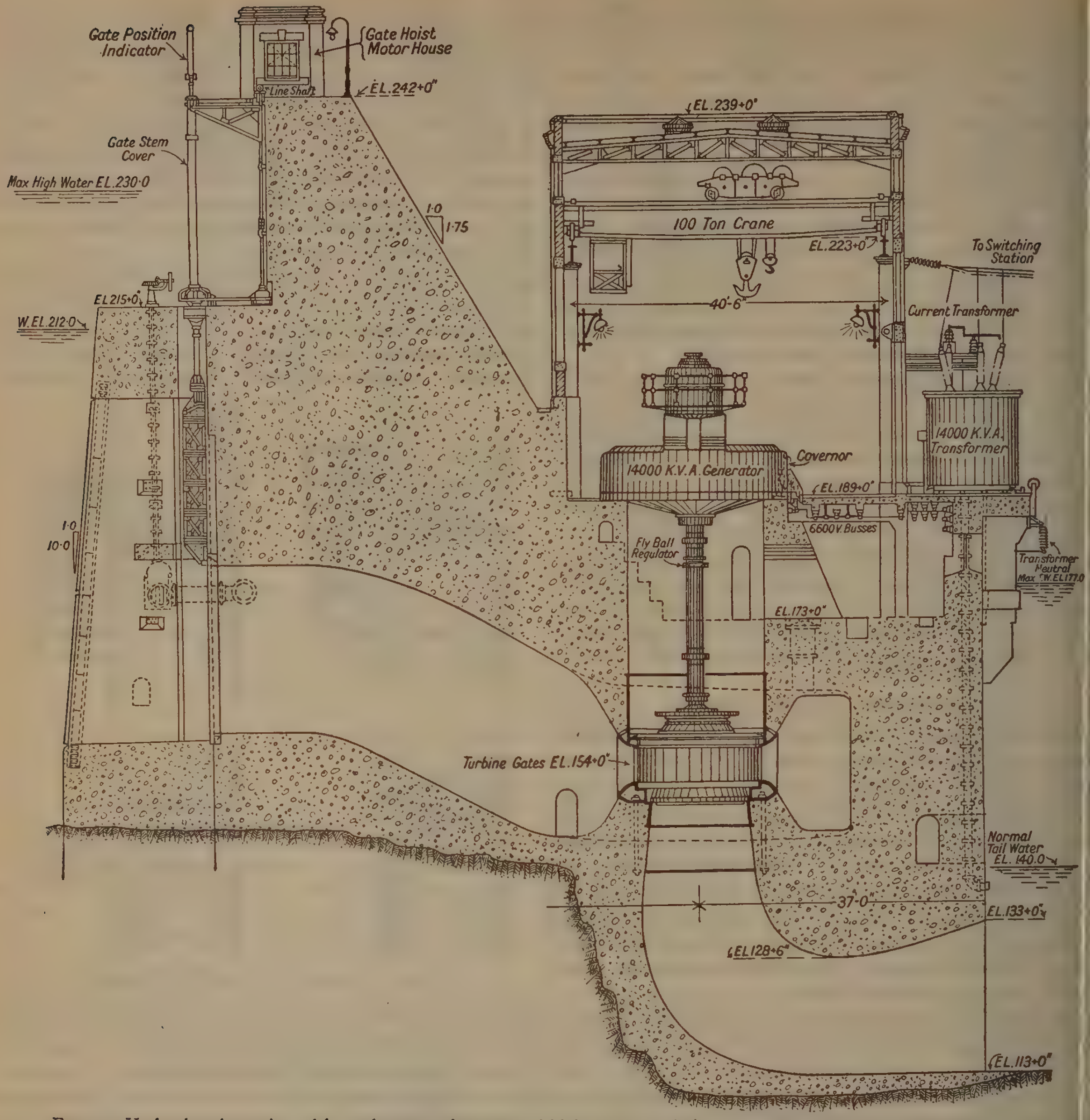
Gate Position Indicator
Gate Hoist Motor House
Line Shaft
EL.242+0"
Gate Stem Cover
Max High Water EL.230·0
1.0
1.75
EL.239+0"
100 Ton Crane
EL.223+0"
To Switching Station
EL.215+0
W.EL.212.0
40'-6"
Current Transformer
14000 K.V.A. Transformer
14000 K.V.A. Generator
Governor
EL.189+0"
6600 V. Busses
Fly Ball Regulator
Transformer Neutral Max W.EL.177.0
1.0
10.0
EL.173+0"
Turbine Gates EL.154+0"
Normal Tail Water EL.140.0
37'-0"
EL.133+0"
EL.128+6"
EL.113+0"

Fig. 2.—Hydroelectric station with outdoor transformers and high-tension switch gear. 14,000 K. V. A. under 80 ft. head.

while over the intermediate range of heads much depends upon the size of the units and the special circumstances.

All modern pressure turbines are of the mixed flow type, having inward radial flow through guide vanes surrounding the runner, and axial discharge. Pivoted guide vanes are universally used, speed regulation being attained by simultaneous rotation of these about their axes. Low head turbines—up to about 40 ft. head—are usually set in an open forebay. Either vertical or horizontal shaft machines may be used, but the former are becoming more common, especially for large units. For higher heads the water must be supplied through a pipe-line and the turbine is enclosed in a spiral casing so designed as to distribute the water evenly around the periphery of the guide vane ring. For heads up to about 120 ft. this casing may be moulded in concrete, but for higher heads and pressures a metal casing becomes necessary. This may be of cast iron, cast steel or of steel plate construction, and in order to give rigidity and increased safety in case of surges of pressure is sometimes embedded wholly or partially in the concrete of the substructur
Modern development is tending in the direction of units havin
a single runner and a vertical shaft on the top of which th
electrical generator is mounted. The weight of the shaft, runne
and generator is then carried from a single thrust bearing of th
Michell or Kingsbury type. This type lends itself to a simpl
and efficient form of setting, while the friction losses are extremely low.

One of the great drawbacks of the low head turbine in th
past has been its relatively slow speed of rotation, which necessitated either a slow speed and costly generator or expensiv
gearing. As a result of experiment it has, however, been possibl
so to modify the form of the runner as greatly to increase th
speed of rotation under a given head without seriously reducin
the efficiency.

Such runners are characterised by their small number o
vanes—often not more than four being used—and approximat
in form to that of a marine propeller. In one of the latest types

Kaplan, the vanes are capable of rotation about their own s so as to enable the vane angles to be adjusted to suit the ying flow of water at part loads. Further developments in the ection of increasing the speed are in active progress and mise to give important results. At the present time, howr, turbines are in existence which are capable of efficient ration at speeds at least three times as great as would have n thought possible 10 years ago.

The pressure turbine is now built in units capable of develop- upwards of 70,000 H.P. under a head of 300 ft., and this size ld readily be increased if necessary. If well-designed and talled in a suitable setting the efficiencies are remarkably h. Efficiencies of 93 % have been obtained on tests of vertical ft turbines at Niagara and values approximating 90% are te common. In a medium head plant the following are typical ues:—

raction of full load . . .	·25	·5	·75	·90	1·0
ercentage efficiency . . .	70	82	88	90	88

Pelton wheels are usually built as horizontal-shaft units with or two nozzles, and in sizes up to about 30,000 horse power. eed regulation is usually performed by a deflector which cuts the jet from the wheel, acting in conjunction with a central dle or spear which slowly reduces the size of the jet while the lector returns to its original position. The mechanism is rated by a relay cylinder supplied with pressure water or oil ough a pilot valve actuated by the governor. In a well-signed plant the instantaneous speed variation corresponding a sudden application of full load should not exceed 12 to 15%. e difference between the initial and final steady speeds should exceed 2% between full load and no load, and should not eed 5% with a load variation.

At constant speed the efficiency of a Pelton wheel falls off nparatively slowly as the load is diminished. A well-designed eel should have approximately the following efficiencies:—

raction of full load . . .	·25	·50	·75	·99	1·0
ercentage efficiency . . .	77	83	85	86	83

The lack of a suitable pipe-line has, until recent years, tended retard the development of plants for very high heads. Under h heads the necessary wall thickness, even with a moderate e diameter, becomes too great to permit of the use of riveted nts. Recent developments in electric welding and oxyacetye welding have, however, rendered it possible to construct table welded pipes and by their aid, and by the use of solid wn steel pipes in extreme cases, it has been found possible harness some very high falls. The highest as yet utilised is the Fully installation in Switzerland. Here the working head is 12 ft., corresponding to a working pressure of 2,360 lb. per sq. h. The pipe-line is 19.7 in. in diameter and 1¾ in. thick at its ver end, and each of the three Pelton wheels in the power-use develops 3,000 horsepower.

Pipe-lines.—The pipe-line for a water-power plant may be nstructed of steel, reinforced concrete or wood. Steel is the st usual, riveted pipes being suitable for all but the highest ads. For heads up to about 200 ft., reinforced concrete pipes are table and have the advantage of not deteriorating appreciably th age. As compared with steel pipes the materials are more sily transported and the friction losses are less. Large pipes moulded in site, and as the bulk of the materials is usually tained locally, only the cement and reinforcement require be transported for any distance. For small diameters, pre-ulded concrete pipes with loose-sleeve or spigot-and-faucet nts are often used.

For moderate heads, wooden pipes are extensively used in ntries where suitable timber is cheaply available, and under ourable conditions have a useful life of at least 25 to 30 years. ey are built up of wooden staves about 6 in. wide, shaped to correct radius and jointed end to end by thin metal plates ven into saw cuts on both the abutting ends, covering the nt. The staves are so arranged that the circumferential joints are not continuous. They are held together by circumferential steel bands which resist the bursting pressure, and whose diameter and spacing depends upon the pressure to be anticipated in each section of the pipe. The materials are easily transported and neither erection nor repair require any great degree of skill. If suitable timber is available the mill can be set up on the site and only the bands and shoes require transporting.

As heads and diameters increase the amount of steel necessary for the bands increases until it becomes comparable with that required for a steel pipe for the same duty. In general the range of useful heads is from 20 to 200 feet. These pipes have been constructed in sizes up to about 18 ft. in diameter.

Generation and Transmission.—Generators to be driven by hydraulic turbines range from the simple open-type machine which is often applicable to small units, to constructions approaching those of steam-turbine driven alternators, which are necessary for the largest high-speed machines.

At the present time the energy is almost universally generated as alternating current, on account of the simplicity and reliability obtained with a moderate generating pressure which is readily transformed to the highest pressures which may be required for economical transmission. Occasionally, however, the advantages of high-tension direct-current transmission may outweigh the essential difficulties of its generation, in which case the Thury system is available. Of the two types of alternating current generators, the synchronous and induction types, the latter has come largely into use in recent years, especially for automatic stations, on account of its robustness of construction and simplicity in operation.

Frequencies.—The question of the most desirable frequency is simplified by the fact that in most countries two frequencies—a high and a low—have become recognised as standard. In the U.S.A. and Canada, either 60 or 25 cycles per sec. is almost universally adopted; on the Continent 50, 16⅔ and 15; in Great Britain and South America 50 and 25 cycles. As regards the number of phases there is little freedom of choice, the question being largely determined by the nature of the load. Single phase supply, though offering some advantage in simplicity of equipment, involves increased losses in the generators and generally less reliable performance. This system is only used where absolutely necessary, as for direct supply to alternating current railways using commutator motors. Of the polyphase systems, three-phase is preferable to two-phase for general power purposes, since the plant is more fully standardised and therefore cheaper, while rotary converters are smaller, more efficient, and give better commutation on three-phase than on two-phase systems.

Distribution.—For distribution within a short radius of the power-house the voltage of generation and transmission will be the same as that required for the supply to consumers; but for transmission to greater distances, for which the voltage is stepped up, there is a wide choice of the voltage of generation. An unduly low voltage involves heavy and expensive bus-bars and switch-gear, and in large units presents difficulty in the construction of the stator windings of the generators. A very high voltage, on the other hand, requires a winding with many windings in series per slot, a greater thickness of insulation and involves a generally reduced reliability. From the point of view of the construction of the generator it is desirable to have two conductors per slot, and the stator current should then vary from about 300 ampères in the smallest to 1,000 ampères in the largest machines. It may therefore be shown that the most suitable voltage of generation, when not otherwise restricted for a three-phase machine, should vary approximately as follows:—

Output (kw.) .	200	500	1,000	2,000	5,000	10,000	15,000
Pressure (volts)	450	900	1,500	2,500	5,000	9,000	11,000

The power factor is here assumed to be 0·8. For two-phase machines the phase pressure should be about 0·9 times the above values.

One of the most important modern developments in transmission has been in the direction of reducing the losses by increasing the voltage of the transmission lines. (*See* ELECTRICITY, TRANSMISSION OF.)

Automatic Generating Stations.—The automatic generating station is especially suited to systems where numerous small-power falls are available. In such a case the expense of an operating staff at each would be prohibitive, but if each station can be made automatic, and all are linked into a common distribution system, the labour cost is reduced to a minimum. The first of such stations was set in operation in 1917. This is on the system of the Iowa Railway and Light Co., where it operates in parallel with a steam plant situated about two miles away. The automatic station contains three 500-K. V. A. generators driven by Francis turbines operating under a head of 10 feet. Normally the starting and stopping of these sets is accomplished automatically through the medium of float switches actuated by the change in the level of water above the dam. Provision is also made for controlling these operations as well as the gate openings of the individual turbines by push buttons in the central power-house. Other plants of this type have since been installed, and this method of development promises to do much to render it economically possible to utilise many low head river falls which have hitherto been neglected.

Combined Operation of Hydraulic and Steam Plants.—Owing to the variability of river flow, it is impossible to utilise more than a fraction of the total available energy unless machinery is installed which will have to be idle during the greater portion of the year. Broadly speaking it is found that the most economical results are obtained when the capacity of the turbines is such as will enable them to be run at full load for about six months in the year.

By operating a steam plant in conjunction with the hydraulic installation, it becomes economically possible to increase the capacity of the hydraulic plant, the defect of its output at times of less than normal flow being made good by the steam installation. The latter also serves as a stand-by in case of a breakdown of the hydraulic plant. (*See* SUPER-POWER.) The best method of operation of such a combination depends upon the type of load, storage capacity, etc., and can only be determined by special reference to the special circumstances of each individual plant. Very often, however, the steam station is entrusted with the special duty of carrying the peak load. (A. H. GI.)

HYGIENE: *see* INDUSTRIAL WELFARE; PUBLIC HEALTH.

HYMANS, PAUL (1865–), Belgian politician, was born at Ixelles, Brussels, March 23 1865. He became a barrister in 1885, and from 1898 to 1914 was professor of comparative pa liamentary history at Brussels University. From 1900 he wa deputy for Brussels and soon became the Liberal leader. Aft a mission to President Wilson in Aug. 1914 he was plenipoten tiary in London, 1915–7, when he became head of the Ministr of Economic Affairs. From 1918–20 and 1924–5 he was Ministe for Foreign Affairs. In Nov. 1918 he attended the inter-Alli Council at Versailles; he also represented Belgium at the Pea Conference in 1919 and on her behalf signed the Peace Treat In the same capacity he attended the conferences at San Rem Boulogne, Brussels and Spa. He played a leading part in th settlement of the Ruhr question, the Dawes Plan, the Se curity Pact and the economic union of Luxembourg with Be gium. In Jan. 1920 he was appointed Belgian representati on the League of Nations, and in the same year was made pres dent of the first Assembly at Geneva. A member of the Académi Royale de Belgique, M. Hymans wrote *L'histoire parlementai de la Belgique* and *Frère Orban.*

HYNDMAN, HENRY MAYERS (1842–1921), British politicia was born March 7 1842 in London. His father was a barrist and founder of the Hyndman Trust for building churches. Aft leaving Trinity College, Cambridge, he travelled extensively a became war correspondent for *The Pall Mall Gazette* during th Austro-Prussian War of 1866. In 1881 he founded the Soci Democratic Federation and from this time on was the chi exponent of Marxism in Great Britain. As such, he came int conflict with William Morris and later with J. Ramsay MacDo ald. Hyndman opposed the South African War; took an activ part in the Second International; but, in spite of his sympathi with India's demand for self-government he took a strongl Imperialistic line at the outbreak of the World War in 1914. H died in London Nov. 22 1921. One of his latest books, *Th Evolution of Revolution* (1920), clearly sets out his general view in addition to numerous other propagandist works he also wro *Records of an Adventurous Life* (1911); *Further Reminiscen* (1912); and *The Future of Democracy* (1915). See Rosalind Hyndman, *The Last Years of H. M. Hyndman* (1923).

HYTHE, CONFERENCE OF (May 15 to 17 1920), a meeti between the British and French Prime Ministers, togeth with the Chancellor of the Exchequer and the French Minist of Finance, in preparation for the Conference of Spa (*see* S CONFERENCE OF). A French proposal that France should granted priority in reparation payments seems to have bee put forward but not pressed, and the linking up of the reparati problem with the question of inter-Allied debts was propose publicly for the first time in the official communiqué.

BÁÑEZ, VICENTE BLASCO (1867–), Spanish novelist and politician, was born at Valencia Jan. 29 1867. He became an impassioned political agitator and suffered exile, hard labour and frequent imprisonment for his opinions, although was returned to Parliament on eight occasions by his native y. His early novels, of which *Canas y Barro* is considered the t, deal with life in Valencia and are in some respects superior to later productions. Although a republican, Ibáñez held strong i-feminist opinions. He travelled extensively and achieved rld-wide success as a writer for the cinematograph. Among best-known novels are *La Catedral* (1903, English translation, *e Shadow of the Cathedral*, 1909); *Sangre y Arena* (1908, Eng- translation, *Blood and Sand*, 1913); *Los cuatro Jinetes del ocalipsis* (1916, English translation, *The Four Horsemen of Apocalypse*, 1918) and *Mare Nostrum* (1918, English transla- n, *Our Sea*, 1920). He was unpopular in Spain, where his tings were ignored by the majority, and he eventually settled Paris, becoming the centre of a group of politicians with i-monarchical views.

CELAND (*see* 14.227), an independent State in personal union h Denmark. Its area is 40,437 sq. m. and its population is out 100,000. In 1918 Iceland was recognised as a separate gdom, with unlimited sovereignty, in personal union with nmark. According to the Act of Union there are no real nt affairs; Denmark, however, provisionally till 1940, takes rge of the foreign affairs of Iceland as its mandatory. For same period Danish and Icelandic citizens, residing in either te, enjoy in every respect equal rights. Since 1915 Iceland had its own merchant flag; since 1918 its own national arms. road Danish legations act on behalf of both Denmark and land. Iceland has a legation in Denmark, and Denmark gation in Iceland; other states are represented in Iceland by nsulates.

onstitution.—According to Iceland's new constitution (1920) King shares the legislative power with the Parliament, the hing, an assembly of 42 members, sitting in two divisions, Upper House (14) and the Lower House (28), but in cases of sension it can assemble as a joint parliament. The Cabinet nsists of three ministers, but there is no governor-general, and ry legislative Act passed by the Althing and many admin- rative measures must be sent to the King in Copenhagen for nature. Since 1920 Iceland has had its own supreme court, l (since 1911) its own university. Other improvements in ucation are the establishment of a teachers' seminary and a stem of public schools. In almost every other respect Ice- d in this period has made constant and rapid progress.

Population.—The total population in 1925 was 100,000 01, 78,000), about 50% living in towns and trading-stations. ere are seven towns with chartered privileges, the greatest of ich is the capital *Reykjavik*, which has about 22,000 inhabi- nts (1901, 6,700).

Industry.—The fishing trade has been considerably improved the introduction of new methods, especially steam trawlers d motor cutters, and the export of fish products, chiefly cured lit cod, herring and fish oils increased from a value of 11,000,000 in 1911 to 68,000,000 kr. in 1924. The cultivation of the l is also constantly improving, though in a smaller degree, and iry farming after the Danish method has been introduced, by ich the production of butter has been greatly improved. With exception of several handicrafts in the towns there is almost industry. Some woollen factories have been established, and eld a good return, but capital is lacking to provide as many are needed.

Water Power.—In its innumerable waterfalls (the greatest d most accessible estimated to represent about 4,000,000 horse wer). Iceland is in possession of almost inexhaustible motive wer, and it is very likely that considerable industries may ow up in Iceland in the near future; both Danish and Norwegian companies during the War petitioned the Althing for concessions to utilise some of the greater falls. The realisation of this plan was, however, hindered partly by the Icelanders' reluctance owing to their fear of invasion of foreigners and partly by the common European economic crisis. Thus far the water power has only been used to produce electric light in most of the towns and on some few farms.

Minerals.—The only mining industry is that of the precious calcareous spar, only found in Iceland, as the many rich sulphur mines and the lignite mines, worked during the War cannot pay on account of difficult transport to the coast. Both iron and copper and even gold have been found, and English as well as German experts have declared that the working of the gold mines near Reykjavik would be remunerative; here a German-Dutch Company was still engaged in preparatory investigations in 1925.

Communications.—Communications are constantly developing, and driving roads have been made in almost every district; bridges have also been constructed over most of the rivers, and a scheme for construction of a railway was in 1925 fully prepared by the Government. A telegraph cable to Shetland was opened in 1906, and telegraph and telephone lines inland have been extended practically throughout the whole country. In 1917 a wireless telegraph station was erected in Reykjavik and broadcasting (radio) introduced in 1925. The lighthouse system is yearly improving, and at Reykjavik a modern harbour with quays and cranes has been built. In 1914 Iceland acquired its own steamship company, which in 1925 controlled six mail steamers.

Public Health.—The birth-rate in 1923 was 26·5 per 1,000 and the death-rate 12·5 per 1,000, the latter showing a marked improvement on pre-war figures. A mental hospital and a sanatorium for tuberculosis, together with some other minor infirmaries, have been established and the building of a great state hospital in Reykjavik was commenced in 1925.

Liquor Control.—From 1912 onwards there came into force a system of complete prohibition of import and making of any liquor containing more than 2¼ % of alcohol, with the exception of medical requirements and denaturalised spirits for industrial use. But in 1923 Spain (the chief market for Iceland's fish products) forced Iceland to allow import and sale of Spanish wines, while the prohibition for the rest has been maintained.

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ICELANDIC LITERATURE (*see* 14.240).—As in the previous period poetry takes the foremost place; although great progress was made in novel writing, and the drama also gained in significance. Among the many lyrical poets Einar Benediktsson and St. G. Stephanson, resident in Canada, were the most important, both rather heavy in style, but rich in ideas and weighty in thought. Lighter and more elegant in style are Davíd Stefánsson, Stefán frá Hvítadal and Hulda (pseudonym Unnur Bjarklind), while the best novelists are Einar H. Kvaran and Gunnar Gunnarsson. Gudmundur Fridjónsson, Jón Trausti (pseudonym Gudmundur Magnússon) and Gudm. G. Hagalínre portray folk life with considerable skill; so do J. M. Bjarnason and Laura Salverson; both reside in Canada and portray the life of the Icelandic colonists there, the latter writing in English, *e.g.*, *The Viking Heart*. The best dramatists are Jóhann Sigurjónsson and Gudm. Kamban, whose dramas achieved a great success at the Royal Theatre in Copenhagen. The drama, *The Mother-in Law*, by an Icelandic countrywoman, Kristín Sigfúsdottir, was produced at Reykjavík and Winnipeg, and was much admired.

Among the more notable writers on other subjects were, Tón Adlis, Páll E. Olason and Jon Helgason on history, J. Th. Thoroddsen on geography, and Sigfus Sigfússon on folklore. Sigfús Blöndal published an Icelandic-Danish Dictionary, the first complete dictionary of modern Icelandic.

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IDAHO (*see* 14.276).—The population in 1920 was 431,866, of which the rural population, 312,829 constituted 72·4%. The total population in 1926 was estimated by the Bureau of the Census at 522,175. The average number of inhabitants per sq. m. increased from 3·9 in 1910 to 5·2 in 1920. Boise, the capital and largest city, had in 1920 a population of 21,393 (17,358 in 1910).

Agriculture.—Agriculture continues to be the principal source of wealth. In 1925 the number of farms was 40,582 as compared with 42,106 in 1920 and 30,807 in 1910. Nearly two-fifths of all the farms were between 100 and 174 acres. The average value of land and buildings per farm in 1925 was $9,213 as compared with $313,811 in 1920 and $7,955 in 1910. The number of mortgaged farms nearly doubled in the 10 years 1910–20. The farm value of all crops in 1923 was $81,308,000 as compared with an average value for the period 1917–21 of $106,209,000. The following table indicates the statistical position of several of the more important crops for the year 1924:—

Crop	Acreage	Production	Farm value
Oats . . .	184,000	6,624,000 bu.	$ 3,842,000
Barley . . .	162,000	2,958,000 bu.	2,426,000
Wheat . . .	933,000	17,828,000 bu.	23,355,000
Hay . . .	1,018,000	2,059,000 tons	25,120,000
Potatoes . . .	67,000	10,725,000 bu.	5,792,000

Specialised cash-crop agriculture is replacing the older type of farming. Because of transportation costs on bulky products, more attention is being given to seed production, beans, peas, head lettuce and the like. Dairying is of increasing importance, much of the output being marketed in the form of cheese. As a sheep-producing state, Idaho ranked fourth in 1924 with nearly 2·05 million head having an estimated farm value of 22 million dollars. The total value of all livestock on Idaho farms was estimated at $49,000,000, in 1924. Poultry production for the Pacific Coast market is rapidly becoming a leading agricultural enterprise. About half the farms in the state were under irrigation in 1920. The enlarged American Falls Dam, which was in 1925 the largest Federal reclamation project, was undertaken to provide additional storage capacity for the existing irrigated areas of southern Idaho.

Mining.—Mining continues to rank second in economic importance. The following table shows the value of mineral production since 1920:—

	Gold	Silver	Lead	Copper	Zinc
1920	$459,000	$8,379,000	$22,292,000	$ 491,000	$1,785,000
1921	552,000	6,184,000	9,559,000	172,000	94,000
1922	458,000	6,149,000	11,762,000	394,000	431,000
1923	733,000	6,158,000	18,550,000	2,292,000	603,000

Lead is first in importance, the principal mines being in the Coeur d'Alene district. Successful developments of lead-silver and lead-zinc ores have been made in the east central part of the state, largely stimulated by the mining activities of the Ford Motor Co. The extraction of silver is in most sections incidental to lead mining. In recent years there has been a renewed exploitation of zinc ores. The Interstate-Callahan Mine is probably the third largest producer of zinc ore in the United States. The largest copper-producing area is in Custer county. The Seven Devils range in Adams county is one of the most extensively mineralised copper belts in the west. Tungsten mines are being developed in Lemhi county. In southwestern Idaho are great quantities of phosphate rock which are being gradually exploited.

Manufactures.—There has been a marked growth since 1910 both in the number of manufacturing establishments and in the value of their products. The following are the chief industries, in order of importance: lumber, flour and grist mills, car and railway shops, printing and publishing. About half of the value of all manufactured goods is represented by lumber products. Idaho ranks first among the states in the area of state and national forests, aggregating approximately 19 million acres. In addition there are large stretches of privately owned timber land.

Transport.—In 1923 the state had 2,877 m. of steam railway and 89 m. of electric track. In 1915 the Celilo Canal, on the Oregon side of the Columbia river, was opened and vessels c
now pass from the Pacific to Lewiston, a distance of 480 mil

Government.—The legislature of 1919 completely re-organis
the state civil administration in so far as the limitations impos
by the state constitution permitted. The Administrative Co
solidation Act abolished some 46 boards, commissions and
fices and gave Idaho a consolidated form of state government,
as it is locally called, a cabinet or commission form of gover
ment, with the governor at the head, assisted by nine depa
mental commissioners. These nine departments are: Agricultu
Commerce and Industry; Finance; Immigration; Law Enforc
ment; Public Investment; Public Welfare; Public Work
Reclamation. Each commissioner is appointed by the govern
and, except "those under the constitution who are appointed
specific terms," may be removed by him at his discretion.
certain departments a small number of designated officers a
appointed by the governor, but on the whole the organisati
within each department is under the control of the commission
This consolidated form of government concentrates authority
the hands of the governor to a marked degree. The law provid
an executive budget system for the state. The Eighteenth (Pr
hibition) Federal Amendment was ratified Jan. 8 1919.

Education.—In 1924–5 there were 137,256 pupils enrolled
the state schools, of whom 19,759 were in the high schools a
117,497 in the elementary schools. The state university co
prises colleges of Letters and Sciences, Agriculture, Engineeri
and Law; schools of Forestry, Mines, Education, Business A
ministration and Graduate Study. The total enrolment in 19
was over 2,000. Idaho has attracted much attention because
its scientific and economical administration of higher educati
A Board of Education of five members appointed by the gove
nor for terms of five years, has general supervision over the n
mal schools and the Technical Institute, and, as a Board of R
gents, over the university as well. The result is a unified syst
of higher education with little duplication, low cost and exc
lent standard.

The governors during the period 1910–25 were: James
Brady, Rep., 1909–11; James H. Hawley, Dem., 1911–3; Jo
M. Haines, Rep., 1913–5; Moses Alexander, Dem., 1915–9; D.
Davis, Rep., 1919–23; C. C. Moore, Rep., 1923–

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Hailey, *History of Idaho* (1919); biennial reports of the Commissio
of Finance, the Board of Education and the inspector of min
bulletins issued by the state School of Mines (Bureau of Mines
the *Idaho Economic Bulletin*, issued by the School of Busin
Administration; and the *Forestry Bulletin* issued by the School
Forestry at the State university. (H. C. D.

ILLEGITIMACY (*see* 14.301).—Illegitimacy may be measur
in different ways. One way is to state the number of illegitima
births in every 1,000 births as in Table I. The range of variati
there shown between different countries is much more striki
than the variation between different times in the same countr
Where the figures are small they may be incomplete. Statisti
are not given for the United States as a whole; in New York t
rate is in the neighbourhood of 12, and in Pennsylvania,
In countries affected by the War the rates were generally highe
during the War period; thus, in Germany, the rates in the perio
1911–4, 1915–8, 1919–22 were 94, 115, 109; in Hungary, th
were 90, 104, 76; in France, 87, 132, 132 (the last for 1919 onl
Taking the rates as recorded, two causes might account for this:
might be due to a rise in the number of illegitimate births, or,
in this country, chiefly to a fall in the total number of birt
the second movement sometimes disguises the other. But
must be borne in mind that the figures for successive periods a
not really comparable for countries with altered territories.

A better method of measurement is to refer illegitimate bir
to the total of unmarried women at fertile ages. Thus, from t
date when the decline of the birth-rate in England began, ab
1876–80, to 1919–23, the number of legitimate births, per 1,
married women between the ages of 15 and 45, had fallen 44
the number of illegitimate births, per 1,000 single and widow
women between the same ages, had fallen 46%; while the num
of illegitimate births per 1,000 of all births had only fallen ab

o per cent. Table II. shows the illegitimate rates, calculated by is better method, in a few countries for which data are avail-le in a pre-war and a post-war period. The trend, though some cases slight, is downward, and we know that the same nd was apparent in earlier years. This does not necessarily ply a rise in the standard of morality: it may denote an in-easing use of means to prevent conception.

In Table III. the number of illegitimate births in England and ales in 1921, expressed per 1,000 of the total census population, is alysed according to locality and according to extent of urbanisa-n. The third column shows these rates as percentages of the rate the country as a whole. The last column represents an attempt the registrar-general to allow for the number of potential mothers nong the unmarried at different ages between 15 and 45 in each ality or class of area; for this purpose certain standard fertility es applicable to different age-groups are used, and the actual ths are compared with the "expected" births. The rates are her in Wales and the northern counties than in the southern and dland counties. The more accurate index also emphasises the hness of the rate in rural districts. These differences are in part e probably to differing degrees of familiarity with the use of con-ceptive measures. (*See* POPULATION.)

TABLE I. *Mean Number of Illegitimate Births per 1,000 of all Births, excluding Stillborn*

Country	1911–4	1915–8	1919–22	1923	1924
ngland and Wales	43	52	49	42	42
cotland	73	73	73	67	66
orth of Ireland	44[1]	45	44	45	43
pain	48	54	61	59	..
witzerland	47	46	42	36	37
etherlands	20	22	21	19	18
enmark[4]	113	115	109	108	..
orway	69	70	71	69	66
weden[4]	154	149	146	140	140
inland	77	82	85	88	..
apan	..	88[2]	82	77	..
outh Africa[3]	..	18	19	13	..
ustralia[3]	..	..	48	46	46
ew Zealand[3]	..	46[2]	45	45	45

[1] 1913–4. [2] 1918. [3] White population. [4] These figures are doubtless plained, in part at any rate, by a form of betrothal known as al marriage.

TABLE II. *Mean Number of Illegitimate Births per 1,000 Unmarried Women, aged 15 to 45*

eriod	England & Wales	Scotland	Switzerland	Netherlands	Denmark	Norway	Finland
09–13	8·0	14	8·9	5·0	26	14	18
919–23	7·8	13	5·6	4·5	20	13[1]	14

[1] 1919–22.

TABLE III. *Illegitimate Births in England and Wales, 1921, according to (A) Locality, (B) Extent of Urbanisation*

	Illegitimate Births per 1,000 of Total Population	Rates as percentages of that for England and Wales	Actual Births as percentages of Births which would have occurred with the Standard Fertility Rates
ngland and Wales	1·02	100	100
orthern Counties	1·12	110	109
Midland	1·00	98	99
outhern (including London)	0·92	90	88
Wales	1·03	101	111
ondon	0·89	87	79
ounty Boroughs	1·09	107	103
ther Urban Districts	0·96	94	94
ural Districts	1·07	105	120

(D. C. J.)

ILLINOIS (*see* 14.304).—The population of Illinois according to the U.S. Census of 1920 was 6,485,280, as compared with 5,638,591 in 1910 and 4,821,550 in 1900. The rate of increase 1910–20 was 15% as against 14·9% for the whole United States and as against 16·9% for the state in the preceding decade. The population as of July 1 1926 was estimated to be 7,202,983. The increase of 1910–20 was urban, the rural population continuing to decline. In 1920 the percentage of urban population in towns and cities of 2,500 or over was 67·9% and 41·7% of the total population lived in the city of Chicago. In 1920, 52·5% of the state's population was in cities greater than 25,000. Population in villages of less than 2,500 declined from 12% in 1910 to 10·5% in 1920. Purely rural population fell from 26·4% in 1910 to 21·6% in 1920.

Population of Cities of over 40,000

City	Population 1910	Population 1920	Increase %	Estimate 1925
Chicago	2,185,283	2,701,705	23·6	2,995,239
Cicero	14,557	44,995	209·1	62,238
Decatur	31,140	43,818	40·7	50,359
East St. Louis	58,547	66,767	14·0	71,423
Peoria	66,950	76,121	13·7	81,564
Rockford	45,401	65,651	44·6	76,462
Springfield	51,678	59,183	14·5	63,923

Agriculture.—While the census of manufactures shows Illinois to be an industrial rather than an agricultural state, there has been no absolute decline in her agriculture. According to the census of 1920 Illinois was second only to Iowa among the states in agricultural importance. Based on crop values, in 1923, Texas was first, Iowa second, and Illinois third, with farm crops amounting to $459,509,000. Cereals are still the main crop and maize is the leading cereal. The largest crop was that of 1917 when 418,000,000 bu. were produced from 11,000,000 acres. In 1923 the crop of 337,000,000 bu. was a slight increase over the years immediately preceding. In 1923, 62,506,000 bu. of wheat were produced, grown on 3,479,000 acres. The production of oats has declined, but in 1923 with a harvest of 135,100,000 bu. from 3,860,000 ac. she took third place in the United States. In 1923 Illinois ranked seventh in the production of barley and rye, producing 3·33% of the barley and 5·56% of the rye grown in the United States. In livestock, Illinois, Jan. 1 1923, with 1,125,000 milch cows, ranked fourth among the States; and in other cattle, numbering 1,477,000, ranked sixth. In number of swine, 4,460,000 and the number of horses, 1,277,000, Illinois ranked second only to Iowa.

Manufactures.—In the value of manufactures, Illinois, in 1923, ranked fourth among the States. In 1919 the total value of her manufactured products was $3,366,452,969. In 1923 the total value had risen to $5,041,519,455. Manufactures employed 645,433 wage-earners, working in 14,348 establishments. The ten most important industries with the values of their respective products in that year are as follows:—

Manufactured Products, Illinois, 1923

Slaughtering and meat packing (wholesale)	$606,320,553
Foundry and machine shops	275,955,047
Iron and steel, steel works and rolling mills	213,671,552
Electrical machinery and supplies	211,366,206
Clothing, men's	186,683,333
Cars, steam road (not back in repair shop)	159,364,227
Printing and publishing, book and job	138,227,215
Printing, publishing, newpaper, etc.	132,288,355
Cars, and general construction, steam	113,604,362
Bread, and other bakery products	105,289,516

The tendency in manufacturing was toward large-scale production and corporate ownership Of the 18,593 establishments in the state in 1919, the 799 producing $1,000,000 or over turned out some 75% of the products. In these industries 389,686 wage-earners were employed. Chicago, with its tributary manufacturing suburbs of Maywood, Harvey, Cicero, Blue Island, Chicago Heights, and, in Indiana, Hammond and Gary, is the greatest manufacturing centre of the state. A lesser manufacturing centre has grown up in the net of railways that centre at St. Louis, Collinsville, Granite City and Edwardsville. The third centre is formed by Moline and Rock Island with Davenport, Iowa. Joliet and East St. Louis were second and third respectively to Chicago in the value of products in 1919. Manufactures in Chicago, are generally diversified. The same is usually true in the smaller centres, although a few cities are noted for their special products. Thus, Rockford is best known for its furniture manufactures, Kewanee for boilers, Elgin for watches, Moline for farm implements and automobiles.

Minerals.—In mining and allied interests Illinois occupies an important position. Coal constitutes her leading production. During 1924 67,880,000 short tons were mined, a total exceeded only by Pennsylvania and by West Virginia. The value of her petroleum production in that year was$14,200,000. Limestone, sandstone, fluorspar, lead and zinc are the other leading products.

Communications.—For transportation, Illinois relies chiefly on its steam railways. With 12,046 m. of main line she was in 1924 second only to Texas. For over 30 years little new main-line road has been built. The important extension has been in double-tracking and improvement of the right-of-way and terminals. The field of passenger and light freight and coal transport, since 1900, has been invaded by the electric lines, which by 1924 operated 3,555 m. of track. The Illinois Traction System operates a ramification of electric lines across the state from Danville to East St. Louis and radiating throughout central Illinois; on certain runs it operates sleeping and parlour cars. Illinois' most important water transportation system is that of the Great Lakes. Receipts of grain at Chicago by lake have steadily declined of late years, although the lakes are still the usual route for shipment of wheat to eastern points. Flour shipments by lake are comparatively insignificant, an important fact in view of the increasing quantity of grain milled at Chicago. Iron ore is still shipped to Chicago and South Chicago by way of the Great Lakes. In 1900 the Sanitary District Channel was opened, providing a waterway with a depth of 20 ft. for navigation between Chicago and Lockport. But from Lockport to Utica, on the Illinois river, a distance of 62 m., there was no adequate means of water transportation. A legislative Act of 1919 actively supported by Gov. Frank O. Lowden provided for the issue of bonds to the amount of $20,000,000 for the construction of an eight-foot channel, "The Illinois Waterway," connecting the points mentioned. Little actual progress had up to 1925 been made towards carrying out this project for the Lakes-to-the-Gulf water route.

The improvement of the roads in the state of Illinois has in recent years been given marked attention. A state highway commission was created in 1905, various laws facilitating local road improvement were passed, and in 1914 state appropriations for hard roads were made from the proceeds of automobile licence fees. Actual construction was begun in 1914. Acts of Congress of 1916 and 1919, apportioning Federal aid in behalf of roads, allotted to Illinois $3,300,000 and $8,700,000 respectively. The question of issuing $60,000,000 in bonds based on automobile license fees for the construction of 4,800 m. of hard roads was submitted to the voters of the state in Nov. 1918 and was approved by them. Construction of roads under Federal aid and by means of this bond issue has been going forward. In 1922 722 m. were completed and over 1,000 m. in 1923. The state Legislature in 1923 authorised a bond issue of $100,000,000, providing for the continuance of a state-wide system of hard-surface roads, and this legislation was approved by the people at the General Election of 1924.

Banking.—The northern part of Illinois lies in the 7th Federal Reserve District and the southern part in the 8th, with headquarters respectively in Chicago and St. Louis. In 1925 there were 501 National banks in Illinois with aggregate capital stock of $94,480,000, aggregate surplus of $63,265,000 and total resources of $1,701,448,000. Of these banks 32 are located in Chicago, having resources amounting to $1,103,339,000. Side by side with the National banks is the system of state banks created by the Act of 1887, and operating under the supervision of the Auditor of Public Accounts. In 1925 there were 1,396
state banks with a total capital of $160,240,000, and aggreg
resources of $2,682,196,000. Of the state banks 176 are in C
cago, having resources amounting to $1,926,594,000.

Government.—Despite the difficulty of changing the orga
law, in the period 1910–25 there were far-reaching changes in
organisation of the machinery for government. Under the co
stitution of 1870 an amendment must be initiated by two-thi
of both Houses in the General Assembly and approved by
majority of all persons voting at the next election. Further, in
session an amendment to but one article can be proposed, and
two amendments to any article can be offered within four yea
Revision of the constitution by amendment, therefore, prov
too difficult, and in 1917 the General Assembly voted to subm
to the people the question of a constitutional convention, whi
was approved at the election of Nov. 1918. Accordingly, in 19
an Act was passed for a convention to meet Jan. 6 1920. D
ficulties arose over Chicago's representation in the Gene
Assembly, and in Dec. 1920 the convention adjourned with
work unfinished to meet in Sept. 1921. Sessions were held
intervals until June 28 1922 when the constitution was adopt
for submission to the people for ratification at a special electi
to be held Sept. 12. The new constitution, in this election, w
defeated by a decisive majority.

Changes in the state's system of appointments have be
effected. First, in time, was the extension, by the Act of 1911,
the civil-service system, to the greater part of the state's e
ployees. Civil service now covers all state appointees, exc
those appointed by the governor and confirmed by the Senat
the scientific and academic staff of the University of Illinois a
the normal schools, and a few others. All examinations are co
petitive, although for some scientific posts "unassembled e
aminations" are given which consist of questions as to traini
and experience. By an amendment of 1917 all appointees m
be removed by the appointing authority, but are allowed
appeal to the state Civil Service Commission on allegation th
the removal is due to race, politics or religion. Reorganisat
of governmental machinery was begun in 1909 with the aboliti
of separate boards for the various state charitable instituti
and the establishment of one central board of control possessi
also certain powers over private charitable institutions. In ad
tion to this board a supervisory state charities commission w
created. There remained, however, over one hundred st
boards, bureaus and offices, paid and unpaid, created to execu
various acts and to supervise various state institutions. Th
result was disorder and waste. A reorganisation recommend
by a committee in 1914 was in great part adopted in the Sta
Consolidation Act of 1917. This Act necessarily left untouch
the constitutional offices, secretary of state, auditor of pub
accounts, treasurer, attorney-general and superintendent
public instruction, but set up in addition to them nine depar
ments—Finance, Agriculture, Labor, Mines and Miner
Public Works and Buildings, Public Welfare, Public Heal
Trade and Commerce, Registration and Education. The he
of these various departments, who are appointed by the govern
and Senate, have acted as a Cabinet for the governor. Illino
ratified the Eighteenth (Prohibition) Federal constitution
amendment Jan. 14 1910.

Public Finance.—Expenditures authorised by the Legislatu
for the biennium 1925–7 amounted to nearly $300,000,000.
the appropriations for 1925–7, $131,000,000 was for the co
tinuance of the hard-roads plan. It was anticipated that $
000,000 of this amount would be supplied from money receiv
by the state for automobile licences, while the remainder wou
come from the sale of $100,000,000 in bonds, the issue of whi
was approved by the people at the Nov. election of 1924. Amo
other more important items of appropriation were: Pub
Welfare Dept. including state charitable, penal and reformato
institutions, $28,979,000; omnibus bill, $23,718,000; sta
treasurer, retirement of and interest on bonds, $23,575,00
public schools, $16,223,000; University of Illinois, $10,620,0
state normal schools, five in number, $3,150,000; Agricultur
Dept. $2,691,000; Health Department, $1,041,000.

lucation.—In 1924 there were enrolled in the elementary ols of Illinois 563,614 boys and 534,684 girls. In the state schools there were 106,735 boys and 111,005 girls. This esents an increase of 113·76% in the number of high school ls during a period of ten years. In addition to the public ols there were, in 1924, 960 private schools with 195,552 ls. The total number of teachers in the elementary schools)24 was 42,865. In that year there were 9,117 high school hers. The net expenditure, including new grounds and lings and payments of bonded indebtedness with interest 922 was $103,375,359. Of this amount, $79,126,323 was t on current expenses, $20,386,043 for new grounds, build- and equipment, $2,224,466 for cancellation of bonded btedness, and $1,638,627 for interest on bonds. The salaries to teachers were comparatively low. The average salary nen was $1,679; for women, $1,449. A notable development ie public educational system was the growth in the number ownship high schools, and the number of community high ols following the legislation of 1917. Under the township -school law some 200 high schools were organised. Acts of ; and 1915 directed the payment by local school authorities uition for children who wished to attend high school elsere when there was none in their district. During one year,), 167 community high schools were organised, and at the of 1922 there were 465 such schools in the state. At the close he year 1924 the number had risen to 915. With the rapid vth in the numbers of high school graduates (24,507 in 1924) e was a corresponding increase in the enrolment in the uniities and colleges of the state. The attendance at the versity of Chicago, 1923–4, was 13,357; University of Illinois 83; and Northwestern University, 9,150. In addition, there in the state 29 colleges of recognised standing and 6 teachers' ges. Located in Chicago are four Class A medical schools, Class A law schools, three Class A dental schools and nine ools of theology.

ecent Political History.—In 1912, as a result of the Progres- secession, the Republican party for the first time in 16 years control of the state, the Democratic presidential elector ning by a vote of 405,038, as against 386,478 for the Pro- sives and 253,593 for the Republicans. The Democratic e ticket headed by Edward F. Dunne was elected by a somet larger plurality over Gov. Charles S. Deneen, Republican, Frank H. Funk, Progressive. The Democrats, however, did control the General Assembly on joint ballot, and had to promise with the Republicans on the election of one Demo- ic Senator, James Hamilton Lewis, and one Republican, vrence Y. Sherman, the latter to fill an unexpired term to 5. By 1914 the normal Republican majority in the state sserted itself, the popular vote for Senator in that year being Y. Sherman, Republican, 390,661; Roger Sullivan, Democrat, ,403; Raymond Robins, Progressive, 203,027. President odrow Wilson lost the state in the presidential election of 6 by 160,000 votes. Frank O. Lowden, Republican, was ted governor over Edward F. Dunne.

n spite of the appeal for the support of the administration of odrow Wilson which was made on patriotic grounds, only five mocratic Congressmen were elected by the state in 1918, and dill McCormick, Republican, defeated J. H. Lewis, Demo- t, for Senator by 53,024 votes. In 1920, after an extremely ter primary fight in the Republican party, Len Small was minated for the governorship over John J. Oglesby. In the ction, Republican state and national tickets swept the state overwhelming majorities. In the primary election for gover- , April 8 1924, Gov. Len Small received a plurality of 920 votes over Thurlow G. Essington, and Norman L. Jones s nominated by the Democratic party. Charles S. Deneen eated Senator Medill McCormick for nomination for the S. Senate on the Republican ticket. Governor Small made his npaign chiefly on his record for the promotion of the construc- n of hard roads. The road-bond issue of $100,000,000 for s purpose was voted on at the same time. Gov. Small was elected with a plurality of 345,028 votes over the Democratic nominee. Deneen was elected to the U.S. Senate. The governors of Illinois after 1905 were: Charles S. Deneen, Rep., 1905–13; Edward F. Dunne, Dem., 1913–7; Frank O. Lowden, Rep., 1917–21; Len Small, Rep., 1921–5, and 1925– .

See, in addition to the books listed in 14.311, *Centennial History of Illinois* (5 vol., published by the state, 1918–20) and later volumes of the *Illinois Historical Collections.* (J. A. J.)

ILLUMINATING ENGINEERING, term now used to denote all applications of natural and artificial light in the service of mankind. Progress in Great Britain since 1910 is largely the result of the formation (in 1909) of the Illuminating Engineering Society, in which makers of lamps and lighting appliances and users of light co-operate; all illuminants are represented and all aspects of the subject, economic, hygienic and artistic are considered. A similar body, the pioneer in this field, has been in existence in the United States since 1906, and corresponding bodies have been formed in Germany (1913), Austria and Hungary (1925) and Japan (1915). In Germany two additional societies operating in Karlsruhe and in the Rhine-Westphalia district have also been created.

Attention has been paid to illumination at many international congresses, thus promoting the exchange of views between experts in different countries. The re-organisation of the international photometric commission, founded in 1900, as the international illumination commission, was stopped by the World War, but a fresh start was made in 1921, and the leading countries are now represented with national committees for the respective countries.[1]

Much has been done towards standardisation and agreement on common principles. Definitions of the main photometric quantities have been adopted, and a more extended series of definitions, symbols, etc., framed, while sub-committees to deal with lighting legislation, automobile headlights, etc., have been formed. At the session held in Geneva in 1924 further activities were initiated and the Commission is now extending its work to deal with various practical problems.

The International Candle.—A noteworthy step, dating from 1909, has been the agreement between France, the United States and Great Britain and, recently, also Russia, on an international candle so that the same unit of light is now in use in all four countries; but in Germany and some other countries the Hefner candle (equal to 0·9 international candle) is still in use. Preservation of the unit of light is now effected by the exchange of specially prepared electric lamp-standards between the official laboratories in the countries concerned. Meantime experiments are being made with a view to evolving an absolute standard of light, *e.g.*, one based on the maintenance of a "black body" at a specified temperature. In the United States the standard is the *lumen* or the amount of light that would fall on a surface so placed that all its parts are at a distance of one foot from a light source of one candle power.

Technical Progress.—Progress in illuminants has kept pace with this advance on the scientific side. Electric lamps, filament and arc, have been developed (*see* ELECTRIC LIGHTING). In the field of gas lighting there has been steady progress in design, one instance being the smaller and more compact forms of high-pressure gas lamps, now rated to give 60 candles per cu. ft. of gas consumed. In low-pressure gas lighting the use of superheated clusters of inverted mantles has made possible a gain in efficiency estimated at 30%. The distribution of the light from a number of smaller mantles is considered an advantage, and the smaller types of mantles are the most durable. Cluster-lamps giving up to 2,000 c.p. are now available.

Theory of Radiation.—Researches into the theory of radiation and the principles underlying illuminants provide a clearer understanding of the luminous efficiency theoretically obtainable. Thus a light source yielding visible white light and no non-luminous vibrations would operate at approximately 26 c.p. per watt, whilst if the light were confined to the most efficient yellow-green section of the spectrum as much as 60 c.p. per watt might be obtained. But in the case of new illuminants efficiency is not the only consideration; such special qualities as the colour of the light (as in the neon lamps) or the nature of the supplementary invisible radiation (as in the quartz tube mercury vapour lamps) may be of even greater importance.

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[1] See J. W. T. Walsh, "International Co-ordination in Illumination," *Trans. First World Power Congress,* vol. 3 (Wembley, 1924).

Reflectors, etc.—The design of shades, globes and reflectors for use with lamps has assumed great importance. By suitable design of a reflector the distribution of light from a source may be altered with wide limits. Thus extensive, intensive and focusing forms of reflectors yielding standard curves of light distribution have been designed, and corresponding rules for height and spacing, designed to give even illumination on the working plane have been derived. In most cases a shade or reflector is designed to direct most of the light downwards, where it is chiefly needed. But other cases occur, for example in shop window lighting and the illumination of large posters, etc., where reflectors are so designed and spaced as to yield an illumination over an extensive vertical area.

Glare Prevention.—Another function of shades and reflectors is to screen the actual source of light from the eye. Even when only vacuum metal filament electric lamps were available the glare from exposed filaments irritated the eye and prevented it from registering the full effect of the illumination provided. In the case of the gas-filled lamps, with their very much brighter filaments, the need for scientific screening is yet more evident. Hence in the leading stores concealed lighting of show-windows, with the light thrown on the goods but the sources concealed from the eyes of observers, is coming to be regarded as the correct method; and it is only in the smaller shops that exposed sources of light are still too frequent.

A special instance of a concentrating reflector is to be found in the " floodlighting " units, consisting of an incandescent lamp with a special " bunched " filament at the focus of a parabolic mirror. Such units are miniature searchlights and are now being used to illuminate the façades of buildings. It is possible to limit the angle of dispersion to about 15° and with a 500 watt lamp a beam with a candle power exceeding 300,000 has been obtained. With the searchlight proper, using an arc, the dimensions of the source of light can be reduced to much smaller dimensions, and a beam of many millions of candle power attained.

Searchlights.—A notable advance during the War was the design of searchlights using specially cooled electrodes leading to a yet smaller and more brilliant source and corresponding greater concentration. The cooling has been effected by two distinct methods, a blast of air and a spray of alcohol; in both cases a very substantial increase in beam-candle power for a given current consumption was obtained.[1] The brightness of the crater in such cases has been estimated at 200,000–300,000 candles per sq. in., as compared with 85,000 c.p. per sq. in., in the case of the ordinary searchlight. In Germany, Lummer, working with an arc operating in a chamber under an air-pressure of 22 atmospheres, is said to have attained the enormous brightness of 1,500,000 candles per sq. in. But this method has apparently not yet reached a practical stage.[2]

Coloured Light.—An apparatus capable of projecting pure spectrum colours on the stage, which is in effect a giant spectroscope, has been designed. By the Mutochrome projector,[3] a series of superimposed patterns can be projected on the screen and the colour of each varied at will. This is likely to prove of considerable value to designers of wallpapers and coloured fabrics, as well as having a possible application for the projection of luminous scenery on the stage.

Artificial Daylight.—Efforts have also been made to provide " artificial daylight," *i.e.*, to correct the light from artificial illuminants and render it equivalent to normal daylight for the matching of colours. Two methods of effecting this correction have been applied. In the Sheringham unit the light from a gas-filled lamp is reflected from an upper surface coated with a pattern of
green, blue and a small amount of yellow in suitable proporti
In the system usually associated with the name of Mr. F.
Lamplough, the light is filtered through a combination of tin
glass. In either case the efficiency of the apparatus is necessa
low, 60% or more of the original light being lost in making
correction. But the advantage to firms in the dyeing indus
and others concerned with delicate colour-matching of hav
an invariable artificial light, independent of the wide variati
of natural daylight, is very considerable.

Industrial Applications.—The problems of the lighting
streets, schools, factories, shops, etc., of the avoidance of
strain in cinema theatres and the importance assigned to pro
lighting in factories, the interests of health, safety and efficie
of work, have been investigated by the Illuminating Engineer
Society and Home Office Committees.[4] Evidence on light
requirements in factories has been collected from many differ
sources, and records of over 4,000 tests of illumination in dif
ent factories have been presented. The minimum values
illumination in the interests of safety (0·25—0·4 ft.c.) are
tablished. Recommendations on the subject of avoidance
glare, flickers and inconvenient shadows have been made,
the illumination required for carrying out work done is shown t
not less than three foot-candles for fine work and five foot-c
dles for very fine work. Consultations with various joint indust
councils are now proceeding with a view to determining w
constitutes suitable and adequate lighting for processes in th
respective industries.

Progress in the United States.—In the United States detai
codes of industrial lighting have been adopted in seven differ
states. In principle these follow closely the recommendations
the British Committee. Methods of grading various light
units according to the degree of " glare " are outlined, and
positions which may safely be assigned to such units in a wo
shop are tabulated. The codes also contain standards of
illumination requisite for various processes, a distinction be
drawn in the most recent codes between the minimum va
desirable and higher values recommended in the interests
economic production. A considerable amount of research
been devoted to the relation between conditions of illuminati
and efficiency of work. Thus it has been shown by Dr. Ives
the United States Public Health Service that the dispatchi
service in post offices was expedited and rendered more accura
by better conditions of illumination;[5] tests in laboratories
Germany have likewise revealed a close connection betwe
illumination and many processes involving exact vision a
manual dexterity.[6] The subject of industrial lighting has lik
wise been studied by the International Labour Bureau of t
League of Nations in Geneva.

Particularly difficult cases of industrial lighting also form t
subject of study by the committee on illumination, worki
under the department for scientific and industrial research.
which eminent architects and medical men, besides lighti
experts, are represented. This committee also deals with
inquiries bearing on illumination received from the various go
ernment departments. In connection with this and other aspe
of lighting, increased attention is now being devoted to the h
gienic side, and at the international congress for the study
industrial hygiene held in Geneva in 1924 a special resoluti
was passed accepting good illumination as of equal importan
with heating, ventilation and sanitary conditions, in the interes
of health and safety.

Standardisation.—Standardisation in various fields is bei
dealt with by various sub-committees, working under the Briti
Engineering Standards Association, which have prepared spe
fications on the performance and dimensions of electric lam
and have also recently issued standard specifications for porta

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[1] The Sperry Searchlight, *Electrician* (Feb. 2 1917); Haydn T. Harrison, *Illum. Eng.* (March 1918).

[2] L. Bloch, *Lichttechnik* (1921).

[3] *Illum. Eng.* (May 1925).

[4] Reports of Departmental (Home Office) Committee on Lighti
in Factories and Workshops, *First Report*, Cmd. 8,000, vol. 1 and
(1915); *Second Report*, Cmd. 1418 (1921); *Third Report*, Cmd. 16
(1922).

[5] *Illum. Eng.* (April 1925).

[6] *Illum. Eng.* (April 1925).

nation photometers[1] and reflectors used for industrial light-)ther subjects now being dealt with include lighting glass- . and the illumination of schools, offices and streets.

ffic and Lighting.—Experience during recent years has ı that the questions of lighting and transport are closely d. With the progressive increase in the volume of fast- ı motor-traffic the necessity for good public lighting has ıe even more urgent than in the past; and the increase in umber of street accidents year by year has drawn public tion to the importance of the question. A new problem sented by the lighting of arterial roads connecting cities. routes are primarily intended for fast motor traffic and utility will not be fully realised unless adequate artificial ng is provided, enabling them to be used with safety by as well as by day. Special methods of illuminating such s are now the subject of consideration.

ny devices eliminating glare from powerful automobile ights have been suggested, some of the most promising on the limitation of the main portion of the beam below a n horizontal plane so as to avoid the direction of rays into yes of approaching drivers or pedestrians. But the most ul solution lies in the provision of better public lighting, ı would render very powerful headlights unnecessary.

ɔgress in these various directions has been aided very greatly e introduction of simple forms of instruments for measuring ination, of which quite a variety of types are now available. information acquired in this way has been very helpful in ng recommendations for the degree of illumination neces- for various purposes.

BLIOGRAPHY.—A. P. Trotter, *Illumination, its Distribution and urement* (1911); L. Gaster and J. S. Dow, *Modern Illuminants llluminating Engineering* (1920); M. Luckiesh, *Artificial Light, fluence on Civilisation* (1921); *Lichttechnik*, ed. by Dr. L. Bloch ssued by the German Illuminating Engineering Society (Mu- 1921); J. W. T. Walsh, *Elementary Principles of Lighting and metry* (1923); see also *The Illuminating Engineer* (The al of Good Lighting), official organ of the Illuminating Engi- ıg Society; *The Transactions of the Illuminating Engineering y in the United States;* and *Licht und Lampe* (Official organof the inating Engineering Society in Germany). (L. G.*)

USTRATION (*see* 14.321).—By 1910 the rapid advance in arious methods of process reproduction had resulted in the lete liberation of the draughtsman from any of those con- ıtions which had limited him in the days of the reproductive -engravers. This new freedom was in some ways a misfor- especially as photography made it possible to reduce a n to any convenient size, so that the artist too often forgot ether that his object was to decorate a book. The perfect rator is rare, and the most admirable drawings, when are merely attached to an author's text, may not be illus- ons at all.

e new interest in typography, stimulated by the work of am Morris, but in reaction against the heaviness of his , has resulted during the decade 1915–25 in an enormous ase in the number of beautifully printed books issued from ress. Many of the English editors content themselves with ypography, embellished perhaps with occasional head pieces *uls-de-lampe*, but most of these decorative details are well- ived, and pleasantly arranged with reference to the size of age and the area of the type.

e possibilities of the woodcut have been most fully appre- d and exploited on the European continent. Its advantage the intaglio methods, such as etching or copper-engraving, is the wood block can be printed with the type by a single tion. Technically, however, it is a reaction, and the small- of its field makes it unsuitable for use in illustrating popular zines. The efficiency of modern reproduction makes it pos- for an artist to design in almost any medium, with the nable hope that his intentions shall not be travestied on rinted page.

Some Notable Work.—Some of the best examples of the use of the half-tone and line-block processes in England are still to be found in *Punch*, and range from the graceful, elegant manner of Lewis Baumer and (until recently) of Claude A. Shepperson, to a sympathetic treatment of proletarian types in George Belcher's reproduced pencil drawings. The "sequence picture," influenced by the cinema, but drawing its first inspiration perhaps from Caran d'Ache, receives competent treatment at the hands of H. M. Bateman and "Fougasse." W. Heath Robinson in known not only as a comic artist of fantastic invention, but as a delicate illustrator of fairy tales. More purely decorative is the work of Edmund Dulac, who relies, as does also Arthur Rackham, on the three-colour process. The last three artists named have done much to raise the standard of the illustration of children's coloured books. The nursery picture-books of about 1900, in spite of the previous example of Kate Greenaway and Randolph Caldecott, were often crude in colour and ugly in design.

The influence of Beardsley is seen in the work of John Austen, Harry Clarke and "Alastair," while artists like H. M. Brock continued the Hugh Thomson tradition. F. Cayley Robinson and Russell Flint are perhaps best known for their painting, outside the sphere of illustration, but they have both done good work within it. Ethel Gabain (Mrs. John Copley) may be included in the English school, although her most important lithograph illustrations have been issued by French publishers. Two able architectural draughtsmen are E. H. New and F. L. Griggs, while Frank Brangwyn brings to the illustrations of books, such as Southey's *Life of Nelson* and Kinglake's *Eothen*, the same power of emphatic statement and grandiose conception as distinguishes his larger work. The early death of Lovat Fraser cut short a career of great promise which, in spite of its brevity, has exercised a far-reaching influence on various British arts. His method of working in flat tones and simple outline was peculiarly suited to modern colour-reproduction, and his example has been widely followed. Of the more "advanced" artists, many of whom have exploited the possibilities of the original woodcut, may be mentioned V. Gribble, R. Gibbings, Paul Nash, Albert Rutherston, Ethelbert White, A. Buckels and S. Gooden. The last-named has done much to revive the use of line-engraving on copper.

French Workers.—Enthusiasm for the original wood-engraving is greater perhaps in France than in any other country, and so much excellent work has been done by this method alone that the chief difficulty lies in the selection of representative names. A more or less homogeneous group is formed by Maxime Dethomas, with his dignified line, Hermann-Paul, with his broad handling and strong dramatic feeling; and Carlègle. The well-known *éditions Crès* are decorated admirably by Gus Bofa, by Siméon, by Sylvain Sauvage, by Contel and by Daragnès. The last-mentioned artist has used etching as well as wood-engraving, and indeed—now that the chief aim of the woodcut, to harmonise with the printed page, has been generally accepted—there is no reason why artists should not avail themselves of lithography, as does L. A. Moreau, or of line-engraving, like Laboureur, or of etching, like C. Laborde. Mention should be made of the colour woodcuts of Falké, the work of Brissaud, of Deslignères, of Galanis, whose curious use of white hachures is well known to English amateurs; of Raoul Dufy, better known in England as a painter; of Paul Vera, of Laboureur, with his curiously effective deformations; of Jean Marchand, and of Raphaël Drouart, all of whose work goes to make this present epoch of book production in France a very notable one.

Germany.—Germany perhaps more than any other country has felt the influence of the most extreme aesthetic theories. The disorder following the War and the sense of humiliation in defeat tended to anarchy and disillusionment in the arts also. An amazing number of fine books has been produced, but the illustrations to some of these are conceived in a slap-dash, sketchy fashion, impossible to harmonise with the necessary orderliness of a printed page. Even artists of the standing of Lovis Corinth and Max Slevogt sometimes scribble over, rather than illustrate, the works entrusted to them. The mass of modern German

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ritish Standard Specification for Portable Photometers, No. 1925).

ritish Standard Specification for Industrial Reflector Fittings lectric Lighting, No. 232 (1926).

work, however, is impressive. A few names may be singled out:—Max Pechstein, Alfred Kubin, Willy Geiger, Fritz Heubner, Julius Diez, Oskar Oestreicher, Wilhelm Wagner, Richard Seewald and George Grosz, the last-named being an able artist who exemplifies that curious obsession with sex which characterises too much modern German art. The general standard of book production in Germany is higher than it has ever been, and it is from Germany that the smaller countries of Europe, with the possible exception of a francophil Poland, draw most of their inspiration.

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United States.—The comprehensive word "illustration" covers two main branches of the art—the self-contained picture and the picture which forms the amplification of a literary theme. In the former, the illustrator is called upon to supply a picture of some situation of life or some theme or fantasy, complete and self-explanatory. In the latter, the illustrator has to embellish sympathetically the meaning of his accompanying text.

The subdivisions in both these classes are numerous. The self-contained illustration can be anything from a comic strip drawing to a poetic fantasy, but it essentially has to rest on its own individual merits. The illustration which has a literary partner can be anything from an advertising design to the pictorial embellishment of the finest periodical, book or treatise. These are the extremes covered by the word Illustration.

Perhaps the most prevalent and important branch of the art today is the illustration of magazines, books and newspapers. In recent years this art has reached a very high degree of proficiency, both in artistic technique and in the process of reproduction. Indeed it is probable that the vast improvements in reproductive methods and the refinement of paper have acted as incentives to illustrative artists. Illustrations for books, magazines and papers should be wedded to the text, and at the same time should extend the meaning of the text by their realistic, artistic or imaginative quality.

Most illustrations of to-day have realism as a predominating feature; it therefore might be argued that the great advances in artistic photography might supersede the hand-made illustration, but it is not so. The art of the illustrator cannot be dispensed with, for in its best form all the necessary realism is there, plus the almost indefinable pleasure which technique produces on the observer, whether he be an artist or not.

The best fiction illustration of the period is perhaps to be found in America. There are several very powerful illustrators in Europe, but on the whole the American illustrator excels. Amongst the many exponents of the art, selection is difficult, but it is not easy to imagine better or more applicable illustration than the work of Dean Cornwell in half tone and Dana Gibson in line—both men being leaders of schools of illustrative thought. The mere mention of these two names makes it hard to refrain from enumerating a host of other most capable illustrators, but space will not permit. The English counterparts to the above two artists are difficult to select, but the work of Frank Craig in half tone and of Frank Reynolds in line have provided some exquisite illustration. The work of all four has allowed artistic technique to help the story and yet not engulf it. They have all been great "stylists" and have many followers.

This analysis of illustration as an art holds good throughout the world, and in theory has been approximately the same since man became capable of illustration in even the primitive forms. There have naturally been modifications and peculiarities in ability and style due to elementary conditions; and there have been differences of technique, due in the main to racial causes. (B. B.)

IMMIGRATION: *see* MIGRATION.

IMMINGHAM, England, a seaport situated on the Lincolnshire shore of the Humber estuary, 9 m. S.S.E. of Hull and 5 m. N.N.W. of Grimsby, England. Constructed (1906–12) by the Great Central Railway Co. (now part of the London and N Eastern), the dock comprises a square basin and two long a (including a graving dock) running parallel to each other on western side, of a total area of 45 ac., with 5,400 ft. of quay the depth (30–35 ft.) is sufficient for practically any vessel af The dock is specially designed and equipped for dealing with coal, timber, grain and wool trades, and was officially ope by the King on July 22 1912. The area of the dock prope 2½ m. in length and 1 m. in greatest depth, is just over 1,000 with a river frontage of 1½ miles. The site was chosen beca the deep-water channel of the Humber, which lower down midway between the shores, here makes an inward sweep leads right to the dock gates, thus obviating much initial dr ing, providing ingress and egress at any state of the tide, rendering the towage of vessels unnecessary.

The original village of Immingham lies a little inland, b new town is growing up near the docks. The Grimsby ele tramways have been extended to Immingham and, in addi a light railway runs between the two places.

IMMUNITY (*see* BACTERIOLOGY, 3.175).—The term "im nity" is used in science in the technical sense. An ani is described as *naturally immune* against the microbe of dis if the microbe in question cannot establish itself in the orga and as *artificially immune* if it was naturally susceptible and been rendered insusceptible. Similarly, an animal is descri as *naturally immune* against a poison if its organism is natur proof, and as *artificially immune* if its organism has been dered proof against the poison.

Natural Immunity.—A few words may be said first respect to natural immunity against infection. We may tribute the fact that the body normally remains free from crobic infection to a conjunction of causes:—*First*, to the that its external and internal coatings furnish mecha protections against infection (this point need not be furt considered here); *secondly*, to the fact that the body is equi with special machinery for the destruction of microbes nature of this machinery will be discussed below in connect with acquired immunity); and, *thirdly*, to the fact that cert of the conditions which normally prevail in the animal orga are inimical to the growth of microbes as a whole or at any to the growth of certain classes of microbes. Of the conditi here in question two which are of quite dominant importance discovered in the course of researches on wounds carried in the World War.

Antitrypsin.—The first and more generally importan the antitryptic power of the blood fluids. Such antitry power will in every case hamper, and in the ordinary case pletely inhibit, bacterial growth. It will achieve this by tralising, in part or completely, the digestive ferments of microbes which would otherwise convert the unassimil native albumens of the blood-fluids and serous discharges assimilable nutrient materials. Antitrypsin in the bl fluids will therefore mean for the microbes therein implant either, a restriction of their food supply, or complete starvati The facts, as far as known, all comport with this inference.

To begin with, only a few species of microbes (the stap lococcus, streptococcus, pneumococcus and perhaps the crobes of all genuinely septicaemic diseases) can proliferate antitryptic blood fluids. Further, these microbes (we conveniently call them *serophytic* microbes) produce w grown in plasma (we are here generalising from observati made with staphylococcus and streptococcus) trypsin wh quenches the antitryptic power of the surrounding blood flu and then digests vacuoles in the surrounding clot. Again, serophytic microbes grow very much more vigorously (t streptococcus for example very many thousand times m vigorously) in the blood fluids when these microbes have, by artificial addition of trypsin, been relieved from the task themselves producing enough trypsin to quench the an tryptic power of the surrounding medium. And finally, all the kinds of microbes which are unable to grow in antitryptic blo fluids begin to pullulate there the moment trypsin is added

et it be noted here that a spontaneous addition of trypsin
s regularly in wounds as soon as the emigrated leucocytes
roken down under the influence of bacterial growth and
ourable external influences.

ect of Alkaline Reaction.—Again,—and here the second of
estraints on microbic growth spoken of above comes into
ion—in the course of research work on wound infections
icted in the course of the War, it was established, in con-
on with the microbe of gas gangrene, that the prolifera-
of this bacillus in the blood fluids and serous effusions is
ited not only by the antitryptic power but also by the
al alkaline reaction of these media. Proof of this is fur-
d by the fact that as soon as the alkaline reaction in ques-
is blunted off by the ante- or post-mortem formation of
acid in muscles deprived of their blood supply, or more
tly by an infusion of any acid into the blood, the bacillus of
ene multiplies without restraint.

tural Susceptibility.—The problem as to why a particular
al is naturally susceptible to particular poisons is likewise a
ical problem, but a chemical problem of a different order.
ulated in the technical terms which were introduced by
ch the problem is that as to why the tissues of the insus-
ble animal contain no *receptors* for the poison, that is to
no organic substratum upon which that poison can anchor
. This is a question of the aboriginal chemical consti-
n of the body—a question as to why a particular species of
al was constructed of one kind of elements rather than of
her.

quired Immunity.—The problem presented by acquired
unity to infections or poisons differs in important respects
that presented by natural immunity. With respect to such
orcement of the natural resistance it will be well to note at
outset (*a*) that it can be achieved apart from any violent
iological commotion; (*b*) that acquired immunity does not
y itself in any altered habit of body; and (*c*) that the con-
n may in many cases be present to-day and gone to-morrow.
these facts indicate that the acquired immunity cannot
lve anything in the nature of a revolutionary physiological
aval such, for example, as a fundamental alteration in the
l elements, or a cutting out of receptor elements from cells.
ticipating here, we may say that later it will be shown with
rd to acquired immunity to infections that this depends
the development of (*a*) increased antibacterial substances
e blood fluid; (*b*) increased efficiency in the leucocytes and
ncreased capacity for producing antibacterial substances in
onse to infection. Similarly it will be shown with regard to
ired immunity to poisons that this depends upon the ap-
ance of neutralising elements (so-called antitoxins) in the
d coupled with the acquirement of increased capacity for
orating these elements in response to an incorporation of
corresponding poisons.

arly Doctrines.—Confining ourselves to the problem as to
the bacterial infections are combated in the organism, we
begin by considering the two chief opposing doctrines which
promulgated, when, under the prompting of Pasteur's prac-
achievements in the field of prophylaxis, problems of im-
ity began to be first seriously considered. These theories
ded natural as well as acquired immunity.

umoral Theory.—In the theory which goes by the name of
humoral theory, natural immunity is attributed to the
ericidal substances contained in the normal blood fluids,
acquired resistance to the acquisition or increase of such
ericidal power. The general thesis, at any rate, of this
ry stands secure. Where microbes are killed otherwise
by physical agencies or by inanition, their destruction must
itably result from some form of chemical action. So, too,
acquisition of greater power of destruction must of necessity
nputed to the achievement of more potent chemical powers.
he other hand, it cannot of course be *a priori* certain that
antibacterial elements concerned in the destruction of
obes will be found in the blood fluids and only in these.
t the blood fluids do, in point of fact, possess bactericidal
power was demonstrated by Fodor and Nuttall, and it was at first thought, though a careful study of Nuttall's results should have prevented this, that such bactericidal action was exercised upon microbes without distinction of kind. Later research has, however, shown that the blood fluids are directly poisonous only for certain species of microbes such, for example, as the typhoid bacillus and the cholera vibrio. Certain other species of microbes, and in particular the microbes of specifically septicaemic diseases are, as we have seen, serophytic—the number that grow out in serum being as great as the number which grow out in the best artificial nutrient medium. Thus, the so-called *humoral theory*, though it would account for the organism possessing considerable resistance to typhoid and cholera, leaves unexplained the fact of the normal organism offering very considerable resistance to serophytic microbes.

What applies to natural, applies also to acquired immunity. There is nothing to show that increased resistance to serophytic microbes and septic infections generally is accompanied by the development of any bactericidal power in the blood fluids.

Phagocytic Theory.—An entirely different conception of immunity is that familiarly known as Mechnikov's *theory of phagocytosis.* In the humoral theory the problem of immunity is envisaged from the point of view of the bacteriological specialist and to some extent also from the standpoint of the chemist. Mechnikov for his part approached the problem from that of the morphologist who takes the whole field of animal life as his province. His theory of immunity therefore starts with the generalisation that the protozoa feed upon the lower forms of life such as microbes. It further regards the fact that the higher animals have been evolved out of colonial aggregations of protozoa. In every such colonial aggregation certain of the associated cells instead of becoming specialised persist in the condition of wandering cells.

With regard to these free-living members of the protozoal colony Mechnikov divined that they function as defensive cells. And he showed in connection with sponges and other invertebrates that these wandering cells collect round invading microbes and other foreign intrusions and that they thereafter proceed to ingest and digest them or, to aid otherwise in their elimination. Lastly Mechnikov pointed out that the leucocytes of the vertebrate were homologous to those wandering cells and performed exactly the same defensive offices. In particular when leucocytes emigrate from the capillaries into a focus of bacterial infection, in the normal case, they follow this up by ingesting the intruding micro-organisms, and killing them intracellularly. *Natural* or *native immunity* was thus, in the conception of Mechnikov, due to efficient leucocytic functioning; and *acquired immunity* to the leucocytes having by a *process of training* (as he called it) acquired a power of more effectively confronting, ingesting and destroying microbes.

Eclectic Theory.—The central tenet of the Mechnikov theory—the tenet that the leucocytes play a very important rôle in the defence of the body against infection—has now found universal acceptance, but at the same time the doctrine that resistance to infection depends in every case on the action of the leucocytes has proved untenable. In connection with the defence of the organism we must distinguish between (1) defence against infection by serophytic microbes, that is against microbes which like the streptococcus and staphylococcus proliferate in the normal serum, (2) defense against infection by microbes which are incapable of multiplying in the antitryptic normal serum but are not directly killed by it, and (3) defence against microbes which are directly killed by the serum.

(*a*) In connection with the first kind of microbe the fact that although they grow freely in the serum and plasma, these are killed in large numbers in the blood and in the serum, when living leucocytes are added, shows that the cellular elements of the blood here do the work of destruction.

(*b*) In connection with the successful killing of these microbes, the leucocytes must, however, in all cases have free mechanical access to the microbes. There would for example be default in this respect if, as would happen in dealing with infected defibrinated or infected centrifuged blood *in vitro*, the leucocytes settled to the bottom and the microbes were buoyed up out of their reach in the serum. The same would of course happen *in vivo* in all serous effusions.

(*c*) In connection with those microbes which are not directly poisoned but fail to proliferate in the serum, the most important restraining influence is the native antitryptic power of the blood, but once the antitryptic inhibitory action of the blood fluids and serous effusions has been neutralised the leucocytes, even when everything else favours them, will be impotent to inhibit microbic growth. On the contrary as soon as the leucocytes degenerate they will furnish a further quantum of trypsin and in this way directly conduce to the pullulation of all manner of microbes.

Lastly, the leucocytes do not seem to contribute to the defence of the organism against those microbes which, like the typhoid bacillus and the cholera vibrio, are directly poisoned by the serum. When we implant such microbes into defibrinated blood and then incubate and make microscopic preparations those microbes which are quickly ingested are found intact within the phagocytes while those which are left exposed to the action of the serum are distorted and dissolved. And again, when living emigrated leucocytes are brought to bear upon typhoid bacilli it would seem that few of the microbes are killed. Precisely similar results are obtained with extracts made from leucocytes. It was shown by Schattenfroh that such extracts exert bactericidal action upon the staphylococcus and streptococcus while they exert no such action upon the typhoid bacillus and the cholera vibrio. And again it was shown by Colebrook that the products of inflammation derived from foci of inflammation set up by incorporating into rabbits lint soaked in typhoid vaccine are powerfully bactericidal for the staphylococcus and streptococcus while for the microbes of typhoid and cholera they are not more bactericidal than ordinary serum.

This review of the facts shows that only in the case of serophytic microbes does the defence of the body depend upon the leucocytes and that when it is a question of defence against the other two classes of microbes (those whose growth is entirely inhibited and those which are directly poisoned by the serum) the leucocytes are either impotent or directly harmful.

Properties of the Leucocytes Concerned in Immunisation.—Mechnikov originally taught that the leucocytes were attracted to microbes and induced to phagocytose them by the toxin secreted by the microbes; and that there was here only an interaction between leucocytes and microbes and that the blood fluids could be left entirely out of the story. That that doctrine cannot be sustained can be demonstrated by a very simple experiment.

We begin by receiving a sample of blood taken direct from the vessels into normal salt solution. We then centrifuge and recentrifuge in further volumes of this normal salt solution so as to wash the cellular elements free from all traces of the blood fluids. We then make two so-called *phagocytic mixtures* combining in the one case (*a*) one volume of a bacterial suspension with (*b*) one volume of washed leucocytes and (*c*) one volume of 0·85% *salt solution*; and in the other case (*a*) one volume of washed leucocytes, (*b*) one volume of the same bacterial suspension and (*c*) one volume of *normal serum*. These mixtures are then placed in the incubator and after a suitable lapse of time a sample of each is examined under the microscope. In the first phagocytic mixture—that in which no serum was employed—the leucocytes have failed to ingest any microbes. In the specimen in which serum has been employed, the microbes have been plentifully ingested. This result depends not upon any stimulating effect exerted upon the leucocytes, but upon the fact that the serum has effected a chemical change—a so-called *opsonic change*—in the microbes. That this *opsonic change* does not in any sense affect the vitality of the microbe is shown in the case of serophytic microbes by the fact that the serum that exerts an opsonic effect furnished culture medium in which the affected microbes will all grow out into colonies. The blood fluids intervene further in the destruction of microbes in the interior of the phagocyte by combining with them in such a way as to favour their intracellular digestion. This action, which first described by Douglas, is known as the protryptic actio the blood fluids.

The living leucocyte can also kill microbes apart from ph cytosis. The following experiment is instructive. A shal receptacle is filled with a solid nutrient medium whose sur has been uniformly implanted with staphylococcus or stre coccus. The centre portions of the three cover glasses are thi carpeted with living leucocytes obtained direct from the bl We now, after different treatment, impose these cover gla side by side upon the implanted nutrient surface. In the cas the *first* cover glass the adhering leucocytes are brought application in conjunction with the adhering serum; in the of the *second* they have been washed free from every trac serum; and in the case of the *third* cover glass the adher leucocytes, instead of being employed living, have been ki by drying.

The whole preparation is now incubated at blood heat 12 hours or more. The microbes will then be found to have gro out forming an uninterrupted sheet of colonies over the wh surface of the nutrient medium except under those areas cover glasses 1 and 2 which are carpeted with living leucocy Here the implanted microbes have not proliferated, and mic scopic examination of the cover glasses shows that where leucocytes came into action in conjunction with serum microbes are all lying intracellularly; while where the leucocy were washed free from serum— the microbes are all lying ext cellularly. The experiment thus shows that microbes can killed by leucocytes both intra- and extra-cellularly, *i.e.*, both phagocytosis and also apart from phagocytosis. This holds t both under the conditions obtaining in this particular experime and also in numerous other conditions. That destruction microbes by leucocytes without the intervention of phagocyt occurs also very frequently *in vivo* is practically certain.

Results of Experiments.—Research has thus shown that destruction of microbes in the body does not proceed only al the lines laid down in the humoral and phagocytic theor Instead of there being, as was assumed in those theories, o one physiological device by which microbes without distinct are killed in the organism, nature would appear to prov different distinctive devices for different microbes. Some pa ogenetic microbes are combated by the bactericidal action the serum unassisted by the leucocytes, others again are p vented from proliferating by special agencies, such for example the antitryptic power of the blood; and again a third descripti of microbe, the serophytic microbes, are destroyed intra lularly and extracellularly by the leucocytes aided, or as the c may be, unaided, by the blood fluids.

The above deals only with the normal protective machine of the body as distinguished from that which comes into p in artificial immunity. In connection with the latter Me nikov, as will be remembered, taught that acquired resi ance was due not to any changes in the blood fluids, but to t leucocytes having been subjected to a process of training whi gave to them a greater capacity for confronting and ingesti microbes. This doctrine had to go by the board when it was sho in numberless cases that increased phagocytosis goes hand hand with increasing opsonic power in the blood fluids.

From this it was incautiously assumed—though this te was never definitely formulated—that the leucocytes co stitute in artificial immunity an invariable, and the blood flui the only variable, factor. That the phagocytic efficiency of t leucocytes was also a variable factor was first shown by Shatto and Dudgeon, who observed that the phagocytic efficien of the patient's leucocytes is in many cases of pyrexial infecti greater than that of the normal man. The phagocytic efficien of a patient's leucocytes may also, as was further shown Shattock and Dudgeon, be less than normal.

These observations have a direct bearing upon Mechniko doctrine with respect to acquired immunity, since, in all infe tions which are associated with constitutional disturbance antigens from the foci of infection are being brought in tion—in other words the organism is experiencing and is ng to *auto-inoculations*. It follows that, conformably with loctrine of Metchnikov, the leucocytes should in every of pyrexial infection be conducted by successive degrees to ndition of continually increased phagocytic efficiency. ad of that these cellular elements are, sometimes in localised ions, and practically always in streptococcus septicaemia, ed to a condition of diminished efficiency.

tificial Immunisation.—We have to consider next how to ase the effectiveness of the anti-bacterial machinery, *i.e.*, how oduce artificial immunisation against infection. The origi- oint of departure was the observation that those patients had contracted and recovered from an infectious disease thereby rendered proof against reinfection. That obser- n led, in connection with smallpox, to the adoption of a dure for the warding off of the disease. The procedure ted in various parts of the world and introduced to Europe Turkey, consisted in the implantation into the susceptible idual of material obtained from a patient suffering from pox. This procedure, which was denoted inoculation be- it resembled the grafting of an *eye* or *bud* into a new stock, reality the parent from which all other procedures of cial immunisation are derived. What required still to be was to purge inoculation of its dangers and to regulate the nising stimulus. This was successfully done in Jennerian nation. But the achievement of Jenner was in point of purely empirical.

steur's Work.—After Jenner came Pasteur and with Pasteur tific methods are for the first time brought into appli- n in connection with prophylactic inoculation. His initial vement was to recognise that the essential in Jennerian nation was that for a virulent infective organism obtained actual cases of smallpox there has been substituted an tive organism which by the operations of nature—to wit ransfer to the cow—had been attenuated in such a manner render it non-lethal for man. By the exploitation of that ral principle, by the employment of pure culture and by a ique of artificial attenuation adapted with infinite resource ch separate case, the whole series of Pasteurian successes in field of artificial immunisation were one after another ved. Artificial immunisation was not, however, purged all its risks by the procedures of Pasteur.

had not yet been transformed into a scientifically regulated dure. The Pasteurian vaccines were in point of fact standard- only thus far that recourse to attenuation placed in each a certain limit upon the proliferation of the vaccinating rial in the organism of a normally resistant man or animal.

ndardisation.—A great step in advance was taken when it established in connection with anti-typhoid inoculation the antigen required for the setting in motion of the machin- of immunisation can be furnished by the incorporation of lised microbic cultures. And further, important steps to achievement of a standardisation of bacterial vaccines made when a technique for the enumeration of the microbes cterial suspensions was devised, and when it was recognised weighed quanta of desiccated and powdered bacterial sub- ce could be employed in cases where, owing to the felting ther of the microbes, enumeration of the microbial suspension impracticable. The counting of the microbes or the weigh- of the bacterial substance is, however, only a means to an —the standardisation of a vaccine, *i.e.*, the determination of doses which will give the best "curve of immunisation."

he Curve of Immunisation.—The expression *curve of immunisa-* calls attention to certain fundamentally important points in ection with the reaction of the body to the incorporation of ines. In the pre-Pasteurian and Pasteurian periods, when s about the nature of immunising response were still vague, as assumed with regard to vaccines that they produced effects only after a certain incubation period (ordinarily after 10 days). And it was further taken for granted that curve of immunisation would from the beginning move ys in the upward direction. When, however, immunisation curves came to be constructed (and this was done first in connection with anti-typhoid inoculation) unanticipated features revealed themselves and in connection with these also time-relations which did not conform with expectation.

Negative and Positive Phases and Practical Importance of These.—In what may be called the normal case—*i.e.*, in the case where the dose of vaccine inoculated is sufficient to produce an appreciable constitutional disturbance, a bi-phasic curve of immunisation is obtained. For 24 or more hours after the inoculation the antibacterial power of the blood is reduced. This—the so-called *negative phase*—is followed by a phase of increased antibacterial power—the so-called *positive phase*—which may last for one or two or a number of days as the case may be. After this the antibacterial power falls away gradually to a level only slightly higher than the original normal. But despite this there would seem to persist in the organism (and this would seem to be the chief profit from inoculation) a power of making more rapid and more ample immunising response to any subsequent incorporation of antigen whether in the form of a subsequent inoculation of a similar vaccine, or actual infection.

When, instead of a quantum of vaccine which produces a constitutional disturbance, a smaller dose is inoculated, the negative phase is elided and a positive phase is well developed already 24 hours after the incorporation of the vaccine. And, finally, when excessive doses of vaccine, such as produce very severe constitutional disturbances, are incorporated, the negative phase may be correspondingly intense and may persist for many weeks. These facts have an important bearing upon prophylactic operations; they must also, as reflection will show, have an importance in connection with the immunisation procedure to which horses are subjected with a view to their producing antibacterial and antitoxic sera. Again substantially the same relations as between the quantum of vaccine inoculated and the type of response elicited, obtain in the case where vaccines are inoculated into patients who are the subjects of infection. But in that case the conditions are so far different that we have to consider in each case two quanta of antigen: that administered in the vaccine, and that already contained in the patient's organism. Where a patient is the subject of only a minimal infection, we may employ doses of vaccine nearly as great as those employed for the prophylaxis of healthy men. Where a patient is heavily infected, we are restricted to the employment of minimal doses, and finally, when the patient is already labouring under an excessive infection, the injection of vaccines can only do harm.

The principle that the kind of response, and the amplitude of the reaction, and the time-relations of the phases are in each case a function of the quantum of antigen brought into application is found to apply also to the case where the vaccine is added to the extravascular blood. We obtain *in vitro* every variety of effect according to the dose of vaccine brought into application and the time for which it operates upon the blood—the effects varying from an instantaneous increase of bactericidal power to a loss of most of that destructive power. And further different effects are obtained according as we select now one and now another method of testing. We obtain for example one result when we measure the bactericidal power of the whole blood; another when we measure the opsonic power of the serum; a third when we measure the phagocytic efficiency of the leucocytes. It must remain for the future to unravel these complications. For the moment the essential point to note is that the machinery of immunisation which was supposed to be constructed upon a very simple—and one may add foolproof—plan is in reality built up of very delicate and complicated elements.

The lessons which can be drawn from immunisation curves may now be summarised. The first of these is that excessive doses of vaccine may delay and possibly interfere with the prophylactic response, and further that such excessive doses of vaccine administered to patients suffering from an infection may definitely aggravate their condition. Other important lessons are that when appropriate doses of vaccine (*i.e.*, doses which are not followed by a negative phase) are administered, prophylactic effects may be obtained almost immediately after inoculation. And further it should be possible to arrest a general infection by inoculating in the incubation period and then employing a reduced dose of vaccine.

In connection with this attention may be directed to the statistical records of Haffkine's anti-plague inoculations in the Byculla Jail in the City of Bombay, and to the cases put on record by Miss Corthorn. The records of the Byculla inoculations make it probable that a prophylactic effect was here exerted already 24 hours after the vaccine had been given. And the cases recorded by Miss Corthorn seem to make good that attacks of the plague were not unfrequently aborted by the inoculation of the vaccine (*see* PLAGUE).

Further evidence showing that immunisation develops very rapidly after the inoculation of an antigen is furnished in the work of von Pirquet. If a first implantation of vaccinia is followed by similar implantations on successive days, the response to these latter differs from the response made to the first. This altered clinical response—which would appear to indicate a more rapid destruction of the later implanted infective material—was described under the name of *allergy*. It was further shown by Von Pirquet in connection with the inoculation of foreign serum that the supervening clinical reaction—which appears to indicate the throwing out of that foreign serum from the blood—is accelerated when the injection of serum is made into an organism which has been before subjected to that procedure. The interval between the injection of the foreign serum and the clinical manifestations associated with its elimination from the blood (normally 10–14 days) may be reduced to a very few minutes.

Further Questions in Connection with Artificial Immunisation.—A series of further questions in relation to artificial immunity have to be considered (1) Are there agencies other than vaccines proper—in other words, other than living or dead microbes or substances derived from the bodies of microbes—which will affect the bactericidal power of the blood and leucocytes? (2) Again are the antibacterial substances in the serum specific in the sense of operating only upon one particular variety of microbe or are they non-specific? (3) Further, will leucocytes which have acquired increased phagocytic efficiency, ingest more actively only one particular species of microbe, or all microbes without distinction? (4) Finally, what are the cells in the body which elaborate the anti-bacterial substances? All these questions are intimately linked up.

Non-bacterial Vaccine.—In connection with the question as to whether there are agencies other than vaccines proper which can increase or, as the case may be, diminish the bactericidal power of the blood, it has been shown that the infliction of burns increases the bactericidal power of the serum for the anthrax bacillus. This increased bactericidal power is no doubt referable to an absorption into the blood of disintegration products derived from the burnt tissues. Again, it has recently been ascertained that increased bactericidal power can be developed in the blood *in vitro* by adding to it foreign sera and also non-foreign sera which have been artificially altered by heating to 60° C. Lastly, it has been shown in connection with the irradiation of the skin with ultra-violet light, the light of the electric arc and sunlight, that by these agencies also the bactericidal power of the blood is increased, such increased bactericidal power depending upon an increased phagocytic power of the leucocytes and also an increased antibacterial power in the serum (*see* HELIOTHERAPY and PUBLIC HEALTH). It is not yet known how irradiation produces these results, but the consideration that radiations such as are here in question are much more likely to act by breaking down than by building up albuminous substances, taken together with the fact that increased bactericidal power is achieved only with a certain quantum of irradiation and that the blood suffers deterioration when larger doses are employed, would seem to point to the conclusion that we are here, in each case, dealing with effects produced by the absorption into the blood of an antigen in the form of disintegration products generated by the irradiation.

Specificity.—The non-bacterial antigens which have
under discussion above occupy at present a position apa
the respect that it would generally be held with regard to
that they might quite likely evoke a non-specific immun
response; whereas it would be generally held that bacterial
cines would produce only specific immunising response.
against this there is conclusive evidence to show that bac
vaccines also evoke non-specific immunising response in the
of increased bactericidal power in the blood, increased ph
cytic efficiency in the leucocytes and sometimes also incre
antibacterial power in the serum. Thus, for example, by
incorporation of staphylococcus the blood can be rendered
bactericidal for streptococcus. This can be achieved als
the addition of staphylococcus vaccine to the blood *in*
Similarly an addition of tuberculin to the extravascular b
will increase the bactericidal power of the blood to staph
coccus, increasing at the same time the phagocytic efficienc
the leucocytes.

These laboratory experiments are in consonance with the
tistical results obtained in connection with anti-pneumo
coccus inoculations at the Premier Mine in the Transv
Here, in 1912, in addition to a striking reduction in the incid
and death-rate of pneumonia, there was achieved a stri
reduction in the incidence and death-rate from "other diseas

Derivation of Product of Immunisation.—The discussion
the deeper problems as to where anti-bacterial substances
elaborated in the body, and as to how their production is t
explained, may be deferred for a moment. For the facts re
ing to immunisation against bacterial toxins must first
taken into consideration, by bringing out the following poi
(1) The machinery of immunisation is in reality a machiner
neutralising or otherwise disposing of poisonous substanc
poisonous substances being by definition those which enter
crippling or lethal chemical combination with the blood fluids
tissues. (2) The machinery of immunisation achieves its
by furnishing substances which enter, as the case may be,
neutralising or precipitating or destructive union with
poisonous substances above spoken of. (3) The machiner
immunisation is brought into operation only by a partic
class of poisons—to wit, by those which enter into crippling
not immediately lethal chemical combination with the cell
protoplasm—those which, to use the expressions of Ehrl
intrude themselves into the "side-chains" and not into
"vital ring" of that protoplasm. Of such poisons four ki
specially invite attention. These are: (*a*) the poiso
constituents of the bacterial protoplasm, (*b*) the albumi
substances contained in foreign sera and certain other foreig
buminous substances, (*c*) bacterial toxins such as those which
be filtered off from cultures of diphtheria and tetanus an
vegetable and animal toxalbumens such as abrin, ricin and
various snake venoms. With respect to the first the b
responds to their inoculation by a production of *bacterio-tr*
substances, *i.e.*, substances which enter into detrimental or le
chemical combination with bacteria. The inoculation of ser
followed by the elaboration and delivery into the blood of
tropic substances which neutralise and precipitate these s
The inoculation of bacterial toxins in like manner—and t
sovereign discovery was made by Behring—leads to the p
duction and delivery into the blood of toxitropic substan
These, known as bacterial *antitoxins*, neutralise and precipit
the corresponding toxins. And, finally, the inoculation of to
bumens is followed by an elaboration and delivery into the bl
of the appropriate neutralising substances.

Practical Results.—The discovery of bacterial antitoxins
led to important practical applications in connection with
treatment and prophylaxis of, in particular, diphtheria (
INFECTIOUS FEVERS) and tetanus (*q.v.*) By virtue of the
that toxins and antitoxins lend themselves to accurate qua
tative study, it has contributed much to our knowledge of
machinery of immunisation. It was through the study of
curves of immunising response made to the inoculation
tetanus toxin that the negative phase first became kno

it was by the study of antitoxin production that it was for
st time unequivocally established that the organism which
ade previous response to even a minimal quantum of a
s thereafter capable of responding to any further quantum
it poison with a prompter and ampler elaboration of
xins.

ther, by the study of the antitoxin content of the blood in
ation to diphtheria toxin, it has been shown that the pres-
f even a small quantum of antitoxin in the blood protects
st infection, and further that the insusceptibility of the
ity of adults to diphtheritic infection is correlated with the
sion of a minute quantum of antitoxin derived, as it would
from repeated minimal diphtheritic infections contracted
ir earlier life. The same would appear to hold also of the
t fever streptococcus. We have here, as reflection will show,
which illuminate the epidemiology of diphtheria and scar-
and show that it is possible and may under circumstances
visable to substitute for a prophylactic inoculation of a
rial vaccine, an injection of antitoxin, or alternatively an
ion of such quantum of toxin as will evoke an antitoxic
ise.

o further points about antitoxins have important bearings
the problem as to where and how products of immunisa-
re produced in the organism. (1) Antitoxins are quite rigidly
ic—each antitoxin neutralising only the particular kind
in in response to which it was engendered. (2) After a first
lation of toxins antitoxins are only very slowly produced.
arily an interval of 10 to 20 days elapses before they make
appearance in the blood.

ese properties are not, let it be noted, differential properties
titoxins; they characterise also certain kinds of bacterio-
substances. Specificity and comparatively tardy appear-
in the blood characterise for example agglutinins, and the
led "thermostable immune bodies."

ce there are two kinds of products of immunisation:
ind that are eminently non-specific and which are produced
diately (and can, as we have seen, be produced in the blood
ro); and another kind which are rigidly specific and are
rated only after a considerable lapse of time and are so
appears produced only *in vivo*; we may now seek for an
er to the problem as to how and where these various prod-
of immunisation are engendered. Since it may be taken as
n that these two kinds cannot well originate in the same
nd be engendered by the same kind of metabolic operation,
ay divide up the problem and consider first by what cells
y what kind of metabolic operation the non-specific anti-
rial substances are produced and then take up the question
where and how antitoxins and such antibacterial substances
specific are generated.

oduction of Non-specific Antibacterial Substances.—The former
ion presents no difficulty. The facts set forth above make
ar that non-specific antibacterial substances are elaborated
e leucocytes. And further the facts suggest that the leuco-
produce these substances as ordinary secretion incited
e chemical products derived from bacterial and cellular
egration products applied in suitable concentration.

rther the facts comport with the idea that leucocytes which
elaborated antibacterial secretions but have not as yet ex-
l these into the environing blood fluids will, by virtue of
increased content in antibacterial substances, possess in-
ed antibacterial efficiency, while the blood fluids will not
gained anything in antibacterial power.

nversely leucocytes that have excreted their antibacterial
ances will exhibit diminished antibacterial power and the
fluids which have received these secretions will have
ed an accretion of antibacterial power.

*oduction of Specific Products of Immunisation: Ehrlich's
hain Theory.*—The problem as to how these products of
nisation which indenture chemically with only one counter-
substance are engendered in the body, is of quite another
of difficulty, and it is one of the memorable achievements
rlich to have conceived how the furnishing of such specific products of immunisation could be accounted for. The problem presented itself to Ehrlich's mind in the following vivid manner: "If," it was thus that Ehrlich communed with himself, "If I take a guinea-pig—that is to say, a creature whose country of origin is Southern America—and administer to it abrin—a poison derived exclusively from Africa (and thus one which neither the tame guinea-pig nor its ancestry can ever have encountered) and if I now find that my guinea-pig furnishes me with an antidotal substance which indentures with the abrin as does a key with the wards of the lock for which it is made, is there then for me any way of escape from the conclusion that the organism of my guinea-pig has specially constructed an antidotal substance to fit the particular kind of poison I have administered—performing in this a feat of chemical analysis and synthesis which would balk the ablest chemist?" From the intellectual *impasse* into which this interrogatory seemed to conduct there was, Ehrlich discerned, a possible way of escape. He reflected that there must of necessity exist in the organism of any animal which is affected by a given poison a counterpart substance (or to use his technical term) a *receptor* which enters into chemical combination with that poison. In other words there must exist already preformed in the organism of susceptible animals, substances which have a chemical constitution such as would admit of their functioning as antitoxins.

At the same time these counterpart substances differ fundamentally from the non-specific antibacterial substances which were considered above. First of all they are not, as are the substances last mentioned, available in the form of secretory products produced only with a view to their being ejected from the cell. Instead of that, specific counterpart substances are integral elements of the cellular protoplasm, and elements of which it may be assumed with certainty that they subserve special functions in the internal economy of the cells of which they are constituents. Further the specific counterpart substances we are here considering differ from the non-specific antibacterial substances in the respect that while these latter are elaborated only in one particular variety of cell (to wit, in the leucocyte) the former are widely distributed in the organism, being located in each case in a different assortment of cells. Thus, for example, the counterpart substances to which the diphtheritic toxin would anchor itself would be located in a different assortment of cells than the counterpart substances with which the tetanus toxin would combine. And again the counterpart substances which would combine with abrin would be different. This would hold true also of the counterpart substances which would unite with the poisons derived from each particular variety of bacterial protoplasm.

So far it has been shown only that susceptible animals must by the very nature of things contain in their cell-protoplasm constituent elements which are the exact chemical counterparts of poisons. We are still very far from the solution of the mystery (*a*) of the organism furnishing antitoxins in the circulating blood; (*b*) of its furnishing antitoxins only to special classes of poisons; and (*c*) of its furnishing these in quantities far in excess of the quantum of counterpart substances originally contained in the organism. Ehrlich, in exploring for some way of exit from the labyrinth constituted by these questions oriented himself by the aid of a ground-plan, in which there was set out his general conception of the stereo-chemistry of protoplasm. In the plan in question the protoplasm is a structure made up of side-chains assembled round a central ring—the continued life of the protoplasm depending upon the integrity of the central (or as we may call it *vital*) ring; while the side-chains consist of elements which are integrated into the protoplasm for its nourishing and vital functioning. To this original ground plan there was now added by Ehrlich a new feature. The conception which he now added was that the side-chains of the protoplasm would, as soon as they became redundant, be cast forth from the cell into the circulating blood, forming there what he called *free receptors.*

Interpreted in the light of this so-called *side-chain* theory, the incorporation of poisons which make a chemical attack upon the vital ring of the cell protoplasm would abrogate the life of the cell and would therefore be incompatible with an elaboration of antitoxins. The situation is entirely different when the poison, instead of directing its attack to the vital ring, anchors itself on to one of the side-chains. After a temporary putting out of action of those functions which are discharged by the particular side-chains in question, this would lead to the replacement of the crippled side-chains, and thereafter to a hyper-replacement and to such redundancy of these in the protoplasm as would involve casting forth these side-chain receptors into the circulating blood. This theory, which is quite as applicable to the production of specific antibacterial substances as to the production of antitoxins—would seem to lie open to critical assault in that the hyper-replacement of side-chains does not necessarily conduct to an excretion of these into the circulating blood. In point of fact in the case of muscle, on which Ehrlich here relies, it leads to something very different, to a hypertrophy of this tissue.

Finally, the side-chain theory has met with hostile criticism more especially on the ground that it would compel us to believe that the noble tissues, such as those of the central nervous tissue which are poisoned by the toxins of diphtheria and tetanus, can be converted into secretory organs so prolific as to furnish in the blood tens and hundreds of thousands of units of the corresponding antitoxins. In point of fact the side-chain theory does not in any way require us to believe this. It would do so only if it had been established that poisons such as diphtheria and tetanus toxins attack only the central nervous system. But in point of fact Ehrlich assumed that the poisons which are responded to by a production of antitoxins are all *polytropic*—in other words they turn towards and combine chemically with a number of different tissues. So far therefore as the side-chain theory is concerned, we are thus authorised to assume that, not the cells of the central nervous system, but all or any of the other and less noble tissues which are affected by the toxins, are those which produce the harvest of antitoxins.

See E. Mechnikov, *Immunity in Infective Diseases*, trans. by F. G. Binnie (1907); Sir A. E. Wright, *Technique of the Test and Capillary Glass Tube* (1921). (A. Wr.)

IMPERIAL PREFERENCE.—This consists in the charging, by states belonging to the British Empire, of lower import duties on goods coming from another state of the Empire than on like goods coming from countries outside the Empire, or in exempting Empire goods from duty altogether.

History of the Movement.—Until after the middle of the 19th century, colonial products enjoyed a preference in the customs tariff of Great Britain, and British goods in the tariffs of the colonies. Preferences in both directions disappeared about the same time. But while Great Britain removed tariff restrictions equally from all imports, from whatever source, the Colonies—now obtaining responsible government, and looking upon customs as the only available source of public revenue—proceeded to impose equal duties on all imports, from whatever source. The British Govt. in vain protested in 1859 against the imposition of duties by Canada on British goods. The Govt. of Canada insisted on "the right of the people of Canada to decide for themselves both as to the mode and extent to which taxation shall be imposed." The principle of tariff autonomy was henceforward acquiesced in by the British Govt. and acted upon by the self-governing colonies.

This was the situation for almost 40 years, in the course of which colonial tariffs became distinctly heavier. So great, however, was the reliance in Great Britain on the most favoured nation clause in her commercial treaties with European countries, that by her treaty with Belgium in 1862 and with the German Zollverein in 1865 she actually bound her colonies, without consulting them, to grant as favourable treatment to the products of the treaty country as to those of the mother country, *i.e.*, to grant no preference to Britain.

Changed Sentiment.—A new stage in intra-imperial trade relations was opened in 1897. In that year Canada granted tariff concessions to all countries treating her on equally favourable terms. In effect this was a preference to British goods; and in 1898 the Canadian Tariff Act was converted from or general reciprocity to one avowedly of British preference. Imperial Govt. had already in 1897 given notice to termi the treaties with Belgium and the Zollverein.

In 1902 the policy of Canada became the policy of the Do ions. At the Colonial Conference of that year in London following resolution was passed:—

> That . . . it is desirable that those colonies which have n ready adopted such a policy should, as far as their circumsta permit, give substantial preferential treatment to the pro and manufactures of the United Kingdom. That the prime isters of the colonies respectfully urge on H.M.'s Govt. th pediency of granting in the United Kingdom preferential t ment to the products and manufactures of the colonies, eith exemption from or reduction of duties now or hereafter imp

Effect was given to this resolution by New Zealand South Africa in 1903 and by Australia in 1906.

Tariff Reform.—Meanwhile in England the re-impositio revenue purposes in 1902 of the old registration duty of 1 shill quarter on imported wheat had raised hopes of preferen Canada which were defeated by the abolition of the duty year. The episode completed the conversion of Joseph Ch berlain to the principle of preference; and imperial prefer was a prominent element in the policy of Tariff Reform w he laid before the country in 1903. The movement, how failed at the time to receive sufficient popular support in G Britain. At the next Colonial Conference in 1907, though resolutions of 1902 were reaffirmed by the colonial represe tives, the British Govt. put in a definite reservation that could not assent in so far as the resolutions implied that it necessary or expedient that the fiscal system of the United K dom should be altered.

Progress during the War.—The World War and the gene support which the Dominions gave the mother country considerable effect on public sentiment in Great Britain. E in 1917 the important committee appointed by the Govt consider commercial policy after the War (presided over Lord Balfour of Burleigh) recommended:—

> That H.M'.s Govt. should now declare their adherence to principle that preference should be accorded to the products manufactures of the British overseas dominions in respect of customs duties now or hereafter to be imposed on imports the United Kingdom.

A few weeks later the Imperial War Conference expressed i in favour of "the principle that each part of the Empire, ha due regard to the interests of our Allies, shall give spec favourable treatment and facilities to the produce and manu tures of other parts of the Empire": a resolution now pa unanimously by the representatives no longer of the Domin alone but also of Great Britain. In April 1917 Mr. Lloyd Ge and Mr. Bonar Law, on behalf of the Coalition Govt., annou their acceptance of the principle of preference, making it c that this did not involve the taxation of food. In Sept. 1 the British Govt. withdrew from the Brussels Sugar Conven on the express ground that they had "now approved the prin of giving preference to Empire sugar." And, finally, in Finance Act, introduced by Mr. Austen Chamberlain as Ch cellor of the Exchequer in April 1919, preferential rebates imports from the colonies or exemption from surtax were gran on practically all articles dutiable under the existing tariff.

The range of dutiable articles had been increased under st of war. For many years before 1915 the only duties imposed Britain were either purely for revenue purposes—those on cocoa, coffee, sugar and tobacco; or for revenue with a cert mixture of ethical motive—those on wines and spirits. the Finance Act of 1915 had introduced duties also on cert manufactured goods (the "McKenna duties")—cinema fil clocks and watches, motor-cars and musical instruments. Th were intended as luxury taxes, but had some protective eff On these the measure of 1919 was now able to give preferen

Post-War Changes.—The area of preference was still furt enlarged by the Safeguarding of Industries Act in 1921. I. of this Act provided for the imposition of duties on cert es produced by "key industries." The list included cameras ptical lenses and a large number of scientific instruments pparatus, chemicals and special appliances, deemed essen- r the safety of the Empire; and from these duties Empire were entirely exempted.

e growth of manufactures in Canada had affected the sit- n by enlarging the possibility of advantageous preference eat Britain beyond the primary foodstuffs: motor-cars are ample. A similar extension of possibilities from Australia brought about by the growth of fruit farming, largely as esult of the settlement on the land of ex-soldiers. The h Govt. took the opportunity of the Imperial Conference 23 to announce its readiness to enlarge the existing pref- e on dried fruits, to increase the rebate on Empire tobacco n certain wines, and to take other action of a similar char- Before these promises could be fulfilled, the Baldwin fell from power. The MacDonald Ministry which followed ed to carry out the intentions of its predecessors; abolished IcKenna duties; and, though it did not entirely throw over ence in revenue duties, so reduced the tax on sugar, tea ried fruits as to make the preference of less value.

ferences Granted by Britain.—On the return to office of Mr. vin at the end of 1924, the McKenna duties were restored the accompanying preferences; and the preference on dried , tobacco, wines and sugar was increased. The range of ence was further widened in two directions. The new uarding of Industries (Customs Duties) Act, 1925, imposed s on imported cutlery, gloves and incandescent mantles; the budget of that year introduced duties on silk, natural rtificial. To each of these new duties, Empire preference ttached.

ce the first grant of preference to the mother country by reat Dominions, changes have from time to time taken both in the general rates of duty and in the extent of the ence. In 1923 Canada, having in mind the removal of n restrictions on the importation of cattle into the British et, undertook to give a discount of 10% on existing duties ritish goods coming through Canadian ports. Australia sed its preference to British goods in 1920, and gave assis- to British trade both by anti-dumping legislation and by ures with respect to dyes. And during the last two decades le complex of preferences has grown up between the several nions and Colonies, many of them the result of definite es. And thus Preference within the British Commonwealth tions has already become a considerable factor in the eco- and political world situation. (*See* also TARIFFS.)

LIOGRAPHY.—The least partisan and most complete history of hole movement down to 1921 will be found in a *Report* on ial Tariff Policies (1922), prepared for the U.S. Tariff Com- on. Much information as to the views of the Dominions and as volume of trade affected is given in the *Record of Proceedings* e Imperial Economic Conference of 1923 (Cmd. 2009, 1924). ature and extent of the preferences accorded to Great Britain, to March 1925, together with the conditions governing the ssions, will be found in the *Survey of Overseas Markets* (1925) e Committee on Industry and Trade appointed by the British in 1924. That committee reported that "while it is difficult to n any exact statistical measure of the benefit to British trade of eferential treatment, the surveys of British Dominion markets he statistics of distribution of British trade leave no room for that the advantage has been substantial." (WM. A.)

PRESSIONISM: *see* PAINTING.

CHCAPE, JAMES LYLE MACKAY, 1ST VISCOUNT (1852– , British shipowner, was born at Arbroath, Forfarshire, 11 1852, and educated there and at Elgin. In 1874 he to India to join the firm of Messrs. Mackinnon, Mackenzie mpany, Calcutta, of which he ultimately became senior er; he became a member of the legislative council of the oy in 1891 and a member of the Council of India in 1897. as created K.C.I.E. in 1894. In 1902, consequent upon the r rebellion, Sir James Mackay negotiated a commercial y with China (*see* 6.204); he was then created G.C.M.G. 11 he was raised to the peerage as Baron Inchcape of Strath- Before the World War broke out, Lord Inchcape was already one of the most prominent figures in the British business world. As a representative of the shipping industry he took a leading part in all its affairs both during the World War and after. He served on most of the Government commissions of inquiry both in India and England. He was a member of the Geddes committee on national expenditure (1921), and chairman of the Indian retrenchment committee (1922). In 1924 he was created viscount and G.C.S.I. The positions of chairman of the P. and O. Steam Navigation Company and director of the National Provincial Bank and Suez Canal Company made him a leading figure in business circles.

INCOME TAX (*see* 14.356).—War provides a fertile soil for taxation, and a tax on income has been adopted during and since the World War in some countries which had hitherto rejected this form of direct taxation, long the sheet anchor of British finance.

I. THE UNITED KINGDOM

The British tax has been developed gradually in detail, reflecting at various stages in its history the growth of opinion, equality and justice, until to-day it is a financial instrument of great intricacy, subtlety and power. None the less the broad scheme of the law has remained unchanged in many essential characteristics for nearly a century. Flexibility is provided by the annual re-enactment of the whole income tax code through the medium of the continuation clauses in the yearly Finance Act, which serves also as the medium for amendments, extensions and declarations of the construction of the law.

The salient characteristics of the tax may be grouped under eight heads.

Scope.—The tax extends, broadly speaking, to all income arising in the United Kingdom by whomsoever it may be enjoyed, and to all income accruing to persons residing in the United Kingdom without regard to the place where it may arise. The tax walks, so to speak, upon the two legs of origin and residence. It therefore leads to the problems of double taxation. Provisions for relief against this defect, resting upon the principle of division of the total tax between the two taxing jurisdictions, exist as respects income liable both to United Kingdom tax and tax in any of the British Dominions overseas, except in the case of the Irish Free State, where the relief is based upon the principle of charging tax only in the country of residence. Further provisions for double taxation relief also exist as respects profits on shipping. One code of laws applies, generally speaking, to individuals, partnerships, companies and other bodies of persons. In the main the tax is a tax on the incomes of individuals, nearly 90% of the total actual income brought into charge being distributed among individuals who are actually resident in the United Kingdom.

Administratively, the tax is levied under five separate categories or schedules of income. But this is a matter of machinery only, and the tax borne by individuals is in reality only one tax on the total income of the individual, and not, as is often thought, a series of taxes on the separate sources of his income.

Definition of Income.—In respect of the ownership of lands, houses, etc., in the United Kingdom, the measure of income is the annual value, which means broadly the rent at which the property is let, or is worth to be let by the year (the tenant bearing his usual rates and taxes), less certain statutory deductions for repairs, and an average cost of additional expenditure on repairs, maintenance, insurance and management.

In respect of the profits on occupation of land in the United Kingdom, the measure of profit is made on a conventional basis, which assumes profits bearing a fixed relation to the annual value of the land occupied. To-day that relation in the case of land used mainly for the purposes of husbandry is one of equality, and in other cases it is a relation of one-third of the annual value.

No definition is necessary in the case of interest on public funds. Income from dominion and foreign securities (other than public debts) or from foreign and dominion stocks, shares and rents is normally liable on the full amount of the income, less charges which must necessarily be met abroad.

There remain the two main classes: income from trades or professions and income from employments. Here the broad rule is that the income to be charged is the excess of the gross receipts over the expenses incurred wholly, necessarily and exclusively in earning the profits or income in question.

The British income tax, in the words of one of the judges, “ is a tax on income,” and this is strictly construed by the exclusion from the scope of the tax of profits which are in the nature of capital gains; and in this respect the British system is strikingly different from that in force in the United States of America. In consequence, the law prohibits, in arriving at profits for income tax purposes, any deductions in respect of capital charges, lost capital or losses unconnected with the business. Provision is, however, made for a deduction from the statutory profits liable to tax of an allowance in respect of the depreciation of machinery or plant.

Computation of the Statutory Income.—The amount of income liable to be taxed *for* any year of assessment (a year running from April 6 to the subsequent April 5) may be, but frequently is not, equal to the amount of income earned or received by the taxpayer *in* the year. This arises from the great variety of rules which govern the computation on various bases of the statutory income of different classes. For instance, income from trades and professions or from dominion and foreign stocks, shares and rents was charged on an average of the three preceding years. Employments and income from interest on public debts or from dominion and foreign securities are charged on the basis of the year of assessment. In other cases an average of five years is used. Proposals were, however, made to Parliament in 1926 for sweeping away some of this medley of different bases, and for substituting in the case of profits from trades and manufactures, mines, railways, iron works, gas works and water works, etc., and of income from dominion and foreign securities and possessions, a uniform base of the profits of the year preceding the year of assessment.

Differentiation.—More than a century of agitation passed before this feature of the income tax was established in 1907. At first it was effected by a reduction of the normal rate of tax in favour of earned income. To-day the differentiation is granted by deducting from the earned income an allowance of one-sixth of that income subject to a maximum deduction of £250.

Graduation.—This is the principle of levying a heavier percentage upon large incomes than upon small. From the inception of the tax graduation in some form or other has figured among its characteristics. During the last half of the 19th century graduation was effected on small incomes by a scale of abatements which from 1909 to 1918 was continuously developed and widened. To-day graduation is effected as follows:—

The total of the statutory income from various sources having been ascertained, the amount of any earned income allowance is deducted therefrom. From the balance, called assessable income, there is then deducted an aggregate of various personal allowances and deductions (*e.g.*, for self or self and wife, children, housekeeper, dependent relatives, etc.), leaving a balance constituting the taxable income. Tax is calculated upon this taxable income by charging the first £225 thereof at half the standard rate and the remainder thereof at the standard rate. From the amount of tax so arrived at there is deducted any relief, expressed in terms of tax, due in respect of life insurance premiums or dominion tax.

If the system of graduation stopped at this point, the relevant curve would rise steeply until incomes in the neighbourhood of £2,000 were reached, but after that point it would flatten rapidly. In order to continue graduation an additional duty of income tax called super-tax is charged on any individual whose total income from all sources for the preceding year, as computed for income tax, exceeds a fixed sum which stands at £2,000. For administrative reasons this additional tax is assessed and collected separately from income tax, but it is only a part of the scheme of graduation for the direct taxation of incomes exceeding a fixed amount. The super-tax therefore continues the process of graduation by imposing an additional rate of tax on successive sections of the total income above £2,000. The effect of this system as a whole is to levy an effective rate of tax on each £ of the total income of an individual, rising gradually from a fraction of a penny in the £ until the rate closely approaches a maximum rate represented by the sum of the standard rate of income tax and the highest rate of super-tax.

The following table of the amount of income tax and super-tax and the effective rate of tax per £ of income on specimen incomes clearly illustrates the graduation of the tax in the case of married couples without children for the year 1926–7. It shows how the effective rate rises in the case of earned income from 2d. in the £ for a total income of £300 by gradual stages up to 9s. 7½d. in the £ on an earned income of £150,000. The rate for unearned income rises from 2½ for an income of £250 to 9·7½ to one of £150,000. Plotted on a graph, these effective rates fall upon a very smooth line unbroken by any abrupt jumps.

Income Tax and Super-Tax

Married Couples without Children, 1926–7

Total income	If income all “ earned ” income					If income all “ inves ment ” income			
	Income tax (including super-tax, if any)			Effective rate		Income tax (including super-tax, if any)			Effec rat
£	£	s.	d.	s.	d.	£	s.	d.	s.
250						2	10	0	
300	2	10	0		2	7	10	0	
350	6	13	4		4½	12	10	0	
400	10	16	8		6½	17	10	0	
500	19	3	4		9	32	10	0	1
600	32	10	0	1	1	52	10	0	1
700	49	3	4	1	5	72	10	0	2
800	65	16	8	1	7½	92	10	0	2
900	82	10	0	1	10	112	10	0	2
1,000	99	3	4	2	0	132	10	0	2
1,250	140	16	8	2	3	182	10	0	2
1,500	182	10	0	2	5	232	10	0	3
2,000	282	10	0	2	10	332	10	0	3
2,500	401	5	0	3	2½	451	5	0	3
3,000	526	5	0	3	6	576	5	0	3
4,000	801	5	0	4	0	851	5	0	4
5,000	1,113	15	0	4	5½	1,163	15	0	4
6,000	1,463	15	0	4	10½	1,513	15	0	5
7,000	1,838	15	0	5	3	1,888	15	0	5
8,000	2,213	15	0	5	6½	2,263	15	0	5
9,000	2,613	15	0	5	9½	2,663	15	0	5
10,000	3,013	15	0	6	0½	3,063	15	0	6
15,000	5,138	15	0	6	10	5,188	15	0	6
20,000	7,388	15	0	7	4½	7,438	15	0	7
25,000	9,763	15	0	7	9½	9,813	15	0	7
30,000	12,138	15	0	8	1	12,188	15	0	8
40,000	17,138	15	0	8	7	17,188	15	0	8
50,000	22,138	15	0	8	10½	22,188	15	0	8
100,000	47,138	15	0	9	5	47,188	15	0	9
150,000	72,138	15	0	9	7½	72,188	15	0	9

Collection of the Tax.—Perhaps the most famous characte of the British tax is the principle of collection at the source. Seli has called it, “ perhaps the chief cause of the success of income It dates from as early as 1803. Under this principle the t obtained, whenever it is possible to do so, by deducting it befor income reaches the person to whom it belongs. The formal a ment is accordingly laid, wherever this course is possible, on source of income by itself and on persons who are debtors in re of income belonging to other persons. Power is given to the pa income to deduct the appropriate tax from the payments to the ultimate proprietors of that income. For instance, a li liability company is assessed to tax at the standard rate on the of its profits, without reference to their ultimate destination. paying interest to its debenture holders, or dividends to its s holders, the company is entitled to deduct and retain the amou tax appropriate to the interest paid or dividend distributed, an investor thus receives his interest or dividend subject to this de tion of tax. It is estimated that approximately two-thirds of the yield of the tax is collected at the source.

Whether the tax charged in respect of any income brought assessment is collected by deduction at the source or not thus pends upon the ultimate proprietorship of the income assesse far as the person charged is not the ultimate proprietor, the t collected by deduction at the source; so far as he is, the tax lected directly. The chief classes of income in respect of which tax is collected directly are the profits from trade of indivi whether sole or partnership traders; the like profits of limited ity companies so far as they are not distributed to shareho debenture holders, etc.; profits from the occupation of land; in from professions and most employments; income from dominio foreign securities and possessions not paid through agents i United Kingdom; income from certain interest, discounts, etc.

The income of individuals upon which tax is collected direc charged in the assessments, as far as possible, at the respectiv standard and full standard rates on the taxable income, that is the balance of the assessable income remaining after deduction personal allowances and deductions due. As the total income o individual taxpayer may be made up of a number of separate i on some of which tax is borne by deduction at the source at th standard rate, and on others of which tax is collectible dir adjustments are in numerous cases necessary in order to restri total tax payable to the amount proper to the actual circumsta of the individual concerned under the scheme of graduation differentiation already described. These adjustments are mad far as possible when dealing with tax collected directly, any bal being dealt with by repayment of tax. They are greatly facili by the fact that personal statements of total income are rend

ally by almost every individual taxpayer, for purposes of either
ne tax or super-tax.

th the exception of tax collected at the source on interest on
c debts and on income from foreign dividends, etc., which is
at or shortly after the time of payment of the income from
n the tax is deducted, income tax contained in the main assess-
s for the year is due and payable on or before Jan. 1 in the year
sessment; tax contained in additional assessments signed after
date is payable on the day after the date of signature. To this
al rule there are, however, some other important exceptions.
bulk of the tax charged on income from the ownership of prop-
tax charged on any individual or firm in respect of lands occu-
for husbandry, or tax charged on any individual or firm in re-
of a trade, profession or vocation, and of most employments, is
ble in two equal instalments, the first on or before Jan. 1 in the
of assessment, and the second on or before the following July 1.
vay companies in England and Ireland pay tax on their profits
ur quarterly instalments, on or before the 20th June, Sept.,
and March. Manual wage earners assessed half-yearly pay
n respect of each half-year. Tax in respect of employments
r the Crown is deducted (usually quarterly) at the source.

ministration.—In this sphere there is a striking division of
ority. The original basis of income tax administration is
elled to a certain extent on provisions in the Land Tax Acts of
8th century. The main conception in 1806, as well as in 1842,
that of a temporary impost to be assessed and collected locally
a minimum of interference by the Exchequer. The responsi-
for assessment and collection of a very large part of the tax was
upon the local bodies of Commissioners possessing certain prop-
or other qualifications. Benches of these local or district com-
oners were and are still appointed for certain cities and bor-
s and for parts or all of a geographical county. The individual
nissioners are entirely unconnected with and independent of
al control. Each body has its own clerk. The Commissioners
also empowered to appoint assessors of taxes and collectors of
s. Except as respects profits from commercial, financial and pro-
onal activities, the assessor was charged with making the assess-
of tax; in the case of the income arising from the activities
tioned this duty was laid upon a body of commissioners known
e additional commissioners. On the main body of the local or
ict commissioners distinguished by being known as the general
nissioners, fell the statutory duty of signing and allowing
sments made either by the assessor or the additional commis-
rs and of hearing and determining appeals against such assess-
s. Fitted into this scheme was the officer of the Crown, known
nally as the Surveyor of Taxes, and to-day as H.M. Inspector
axes. In law his part was primarily to safeguard the interests of
evenue with strictly defined rights of intervention and objection
rious stages of the formal procedure laid down by the statues.

en in the early years this broad scheme was honeycombed with
otions which have grown rather than diminished with the pas-
of years. Certain assessments for instance are hived off under
ingle jurisdiction of a body known as the Special Commissioners
come Tax, each of whom, still independent of the revenue
ority, is appointed by H.M. Treasury. This body performs all
luties of district commissioners in Northern Ireland; it makes all
assessments on railway companies and on their officials; the
sment of foreign and dominion dividends paid through agents
e United Kingdom is under its care; it is also solely charged with
whole of the administration of the super-tax. Then there are
nissioners for the various public departments of State who are
ged with making all assessments on official salaries, etc. The
k of England and the National Debt Commissioners also act as
missioners for assessment of individual salaries, etc., paid by
e bodies and those of the Bank of England are also responsible
he assessment of the profits of the bank. Again all assessments
nanual weekly wage earners which are for a half year only are
e by H.M. Inspector of Taxes. The taxpayer normally charged
he District Commissioners may, if he wishes, elect to be dealt
by the Special Commissioners and even if he allows his assess-
t to be made by the District Commissioners, he may take an
eal against that assessment to the Special Commissioners.

uring the past 50 years income tax grew so much in importance
complexity that its efficient administration compelled a con-
able development of the methods of administration. The high
uation of the tax rests very largely upon the factor of the total
me from all sources of the taxpayer. As business and finance
grown in complexity, the sources of individual incomes have
fied accordingly, necessitating close and continuous inter-
munication between various parts of the country. The scheme
dministration originally laid down having made no adequate
ision for inter-communication between the various bodies of
missioners, this defect has been almost of necessity filled by the
lopment of the official organisation of the Inspectorate of Taxes,
tioning under the direction of the Board of Inland Revenue. In
tice, therefore, to-day the Inspector of Taxes carries out, with
full concurrence of the various bodies of commissioners, most of
duties that are vitally essential to the smooth-working efficiency
e machinery of administration. Nevertheless, the key functions
e district commissioners have been preserved throughout. In the absence of any detailed accounts or other evidence, it is the additional commissioners who determine the amount of the assessment upon business profits; even more important, the general commissioners still retain their appellate functions and so stand in an independent and impartial position between the taxpayer and the representative of the revenue.

Rates and Yield of Tax.—During the three years preceding the War, 1911–3, the normal rate of tax was 1s. 2d. in the £ and the net produce of each penny of the rate was round about £3,000,000. At that time the exemption limit stood at £160 and out of some 19,000,000 of occupied persons only 1,200,000 were within this scope of the tax. In 1915–6, the exemption limit was reduced to £130. Notwithstanding the depreciation in the value of money it remained at that level until 1920. In 1920–1, when the system of differentiation and graduation was radically altered in accordance with the recommendations of the Royal Commission on the Income Tax of 1920, the effective exemption limit was raised to £135 of assessable income, or £150 in terms of earned income. Under the influence of the change in the price level and the consequential movement of wages the total number of individuals within the scope of the tax rose in 1919 to 7,800,000, but it had fallen in 1925–6 to 4,200,000.

The standard rate of tax was changed on six occasions between 1914 and 1925. The peak rate of 6s. in the £ stood for the four years from 1918–9 to 1921–2 inclusive. It was reduced to 5s. in 1922, to 4s. 6d. in 1923 and to 4s. in 1925. The statutory income of persons liable to tax amounted in 1913–4 to £951,000,000 and the net tax collected in that year amounted to £43,500,000. These figures relate to the whole of the United Kingdom of Great Britain and all Ireland. For 1924–5, the total statutory income of persons liable to the tax for the new United Kingdom of Great Britain and Northern Ireland was estimated at £2,300,000,000. In 1924–5 the Exchequer receipt was nearly £274,000,000; in 1925–6 the Exchequer receipt was £259,000,000 and it was estimated that the collection in 1926–7 would amount to £255,000,000.

The preceding figures relate to income tax alone and do not include the yield of the super-tax. Prior to the War the point at which liability to this tax commenced was £5,000. Incomes below that figure were exempt from this impost. In 1914 the exemption level was reduced from £5,000 to £3,000. In 1918–9 the scope of the tax was altered to include all incomes exceeding £2,500 and in 1920–1 further extension was made by the alteration of this limit to £2,000. Before the War the rate of super-tax was 6d. for every £ of the amount by which the total income exceeded £3,000, although, as noted, no liability arose unless the total income exceeded £5,000. A graduated scale was introduced in 1914–5, increased in weight in 1915 and 1918, until it reached the peak rates in 1920, when it ranged from 1s. 6d. in the £ for every £ of the first £500 of the excess over £2,000, to 6s. in the £ on every £ of income above £30,000. A reduced scale[1] of rates of tax came into force in 1925–6. In the year before the War only 14,000 persons were liable to this tax. In 1924–5, the number of individuals charged had risen to 90,000. A similar and even greater increase marks, of course, the annual yield of the tax. From £3,250,000 in 1913–4 the year's collection had grown to £68,500,000 in 1925–6. These figures may be completed by noting that during the 10 years from 1916–7 to 1925–6 inclusive, the British taxpayer paid £2,768,000,000 in income tax and £493,000,000 in super-tax, making a total of £3,261,000,000. This burden was borne in addition to £1,280,000,000 in the form of Excess Profits Duty and Corporation Profits Tax, each of which was levied upon business profits before the income tax and super-tax were due to be computed.

II. THE BRITISH DOMINIONS

Taxation according to faculty, that is, direct taxation based upon the principle of ability to pay, so early established in Great Britain, was naturally carried overseas to the various British possessions. It is not therefore surprising to find income taxes firmly established to-day in South Africa, in the provinces and protectorates there as well as in the Union, in Canada, where also there are provincial income taxes as well as the Dominion tax, Australia, where a similar widespread use of the tax is made, New Zealand, India and in most of the West

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	Rate in the £ s.	d.
[1] On the first £2,000 of the income	nil	
On the next £500 (to £2,500)	..	9
On the next £500 (to £3,000)	1	..
On the next £1,000 (to £4,000)	1	6
On the next £1,000 (to £5,000)	2	3
On the next £1,000 (to £6,000)	3	..
On the next £1,000 (to £7,000)	3	6
On the next £1,000 (to £8,000)	3	6
On the next £2,000 (to £10,000)	4	..
On the next £5,000 (to £15,000)	4	6
On the next £5,000 (to £20,000)	5	..
On the next £10,000 (to £30,000)	5	6
On the remainder (above £30,000)	6	..

Indian islands. Naturally also there is a strong family resemblance between the various income tax systems, most of them having been strongly influenced by British law. Income is usually defined broadly but comprehensively, but there is a general absence of the schedular arrangement of the British tax. Broadly speaking, the year preceding the year of assessment is favoured as the basis of computation of the income to be charged. The minimum amount of income exempted from tax varies, but personal allowances to the taxpayer, his wife and children are general. Graduation of the tax is a common feature, and the device of an additional tax, or super-tax, is freely adopted. In some Dominions, graduation is extended also to companies. The methods of graduation range from simplicity to formulae of great complexity. Differentiation in favour of earned income is found, but is not widely favoured. Taxation at the source is a frequent feature, especially in respect of dividends paid by companies. The rates of tax vary widely, as may be expected from the range of budget requirements of communities of different populations and varying degrees of wealth. As a rule, the income tax in the British Dominions overseas is one tax levied upon the base of the total income, irrespective of the nature of the components of that income. In this respect, the British tradition is followed.

III. SOME EUROPEAN COUNTRIES

Latin Countries.—In Latin communities, a more complex system of income taxation is commonly found. There the development of the income tax as a fiscal instrument has been slower, and has met with much greater opposition. The influence of the ancient taxes in France of the real estate tax (*contribution foncière*), the door and window tax (*contribution des portes et fenêtres*), the business tax (*patentes*) and the personal property tax (*contribution personelle et mobilière*) led to the introduction by Caillaux, shortly before the World War, of an income tax, in the form of seven schedular taxes on income, combined with a general income tax on total income. Under this system, the schedular income taxes (*impôts cédulaires or impôts sur les revenus*) are but lightly linked together. Different rates may be, and often are, imposed under the several schedules; each schedule may have its own scale of personal abatements or reliefs; each may have its own rules for the computation of income. In France, the seven schedules cover buildings and land, agriculture, dividends, interest, etc. (again divided into four subgroups), industrial and commercial profits, salaries and pensions, professional earnings and mining. Each of the seven schedules has its own method of assessment, usually its own particular allowances, and its own special rate of tax. The general income tax (*l'impôt général sur le revenu*) is steeply graduated.

Belgium, on introducing an income tax into her fiscal system in 1919, followed the same method of schedular taxes combined with a general income tax. Here, there are three schedular taxes, on income from real property, income from investment of personal property and, lastly, income from trade business or profession or employment. Agricultural profits are included under the third schedule. For the first two schedules there is the same flat rate, but for the third, the rate of tax is graduated according to the amount of income. The general income tax is also graduated. In Spain and Italy similar systems prevail.

An income tax, designed to measure and to tax the almost infinite variations of methods by which men seek the means to satisfy their wants can never be simple, but the schedular system adds complexity to complexity. Moreover, so far as the rates of tax are differential, they tend to affect the ordinary incidence of an income tax, and so to set up reactions upon economic effort which defy measurement. There is also a strong tendency to regard the schedular income taxes, not as personal taxes but as real income taxes, a contradiction in terms which is at present proving a grave obstacle to the development of a satisfactory solution of the problem of double taxation.

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ancial Statements Presented to the House of Commons by the Chanc
of the Exchequer (Annual).

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IV. THE UNITED STATES

Although taxes on gains and profits derived from personal abi
as distinguished from property—so-called "faculty" taxes—w
employed in the American colonies before the middle of the
century, no successful use of the general income tax was made in
United States until the Civil War; and the income taxes then adop
were soon thereafter repealed, or fell into practical disuse.
demand for effective income taxation, however, showed great vi
ity. It kept moribund income tax laws on the statute books in
eral states; led to abortive experiments with the tax, particularl
the 'forties and 'nineties; and finally in 1909 resulted in the adopt
of a Federal excise tax "with respect to the carrying on or do
business" by corporations, equivalent to 1% of the annual net
come over and above $5,000. This proved to be in substance
effective income tax.

State Income Taxes.—In 1911 the State of Wisconsin adopte
general income-tax law applicable to individuals, partnerships
corporations. The practical success of this tax encouraged ot
states to adopt similar laws or to vitalise the administration of
successful income-tax laws already on the statute books; and
though a few states either repealed or rejected the tax, about
third of the states in 1925 had income taxes. The adoption of inco
taxes by the states has been largely for the purpose of replac
the unsatisfactory personal-property tax (particularly on intangi
personal property) and the so-called corporation franchise tax.
newer state income taxes are generally administered by state or c
tral authority, but provide for the return of a substantial portion
the tax to the county or local governments. There is an increas
tendency to assess the tax on the basis of the Federal income-
return and an effort is made by apportionment devices to exempt
whole or in part business or corporation income derived from pr
erty located and business transacted outside the state. Jurisdictio
questions and multiple taxation thus constitute fundamental p
lems. The various state income taxes differ considerably in th
exemptions and rates, but in general the rates are much lower th
in the Federal tax, the highest rates—in S. Carolina—being
third of the Federal rates. However, the combined Federal
State taxes represent a serious burden on the larger incomes.

Federal Income Tax.—The foundation for the Federal syst
of income taxation was laid by the ratification on Feb. 25 19
of the Sixteenth Amendment to the Constitution, which p
vides:—

> That Congress shall have power to lay and collect taxes on
> comes, from whatever source derived, without apportionme
> among the several states, and without regard to any census
> enumeration.

The development of the Federal income tax is suggested
the accompanying tabular statement. Under the Revenue
of 1926 the income tax carries exemptions of $1,500 for sin
individuals, $3,500 for heads of families and $2,000 for
porations. Under the personal income tax there is a furth
specific exemption of $400 for each child under 18 years and
every dependent incapable of self-support. Individuals
subject to a split normal tax of $1\frac{1}{2}\%$ on the first $4,000 of ta
able income, 3% on the next $4,000 and 5% on the remaind
and to a surtax ranging from 1% of the net income betwe
$10,000 and $14,000, to 20% on the net income in excess
$100,000. Corporations are subject to a flat rate of $13\frac{1}{2}$
(since Jan. 1 1926). Earned income (to the extent of $20,000)
taxed 25% less than unearned income, all incomes of $5,000
less being considered as earned. Net income is defined as
income and gains "from whatever source derived," excluding ce
tain specified classes of income and less certain specific deduction

The most important characteristic of the Federal income ta
is its striking productivity, the elasticity of which is illustrate
in the table. The present exemptions are high compared wit
similar exemptions allowed in other countries, and only a sma
proportion of the population is directly affected by the tax.
large proportion of the tax is collected in the industrial or urba
states and is thus marked by some unfortunate class and se
tional characteristics. Compared with similar taxes of othe
countries the rates on small and moderate incomes are low, whi
the rates on the larger incomes were until the year 1925 unusual

Federal Income Tax

Personal Income Tax	1913	1916	1918	1919	1921	1923
tal number of returns[1]	357,598	437,036	4,425,114	5,332,760	6,662,176	7,698,321
cent number of returns to opulation	0·37	0·43	4·27	5·03	6·28	6·94
tal net income	$3,900,000,000	$6,298,577,620	$15,924,639,355	$19,859,491,448	$19,577,212,528	$24,840,137,364
tal tax yield	$28,253,535	$173,386,694	$1,127,721,835	$1,269,630,104	$719,387,106	$663,651,505
erage tax per individual	$79.01	$396.60	$254.85	$238.08	$107.98	$86.21
erage rate of tax:—						
ncomes $1,000–$2,000	..	..	1·19 %	0·87 %	0·81 %	0·49 %
ncomes $5,000–$10,000	..	0·61 %	4·34 %	3·10 %	2·90 %	2·04 %
ncomes $25,000–$50,000	..	1·41 %	13·32 %	12·13 %	11·53 %	7·67 %
ncomes $100,000–$150,000	..	3·48 %	33·68 %	33·12 %	32·00 %	19·85 %
ncomes $1,000,000 and over	..	11·09 %	64·65 %	64·87 %	63·59 %	23·53 %
neral average rate	0·725 %	2·75 %	7·08 %	6·39 %	3·67 %	2·67 %
rmal rate $4,000 and under	1 %	2 %	6 %	4 %	4 %	4 %
rmal rate over $4,000	6 %	2 %	12 %	8 %	8 %	8 %
ximum surtax	..	13 %	65 %	65 %	65 %	50 %
omes under $5,000:—						
Per cent of total returns	..	36·60	89·17	87·67	92·10	91·87
Per cent of total net income returned	..	9·92	59·00	56·14	2·37	66·29
Per cent of total tax	..	1·15	12·84	10·16	12·90	12·21
omes over $100,000:—						
Per cent of total returns	..	1·54	0·10	0·11	0·035	0·056
Per cent of total net income returned	..	29·47	6·22	5·9	2·37	3·67
Per cent of total tax	..	73·11	41·66	42·77	28·11	31·76
sonal exemptions:—						
To individual	$3,000	$3,000	$1,000	$1,000	$1,000	$1,000
To head of family	$4,000	$4,000	$2,000	$2,000	$2,500[2]	$2,500[2]
or each dependent	..	..	$200	$200	$400	$400

Corporation Taxes	1913	1916	1918	1919	1921	1923
tal number of returns	316,909	341,253	317,579	320,198	356,397	398,933
turns showing taxable income	188,866	206,984	202,061	209,634	171,239	233,339
turns showing no taxable ncome	128,043	134,269	115,518	110,564	185,158	165,596
tal net income	$4,714,000,000	$8,765,900,000	$8,400,000,000	$9,412,000,000	$4,336,000,000	$8,322,000,000
ome tax yield	$43,127,740	$171,805,150	$653,198,483	$743,535,888	$366,443,621	$937,106,798
r profits and excess profits ax yield	..	..	$2,505,565,939	$1,431,805,690	$335,131,811	..
tal tax yield	$43,127,740	$171,805,150	$3,158,764,422	$2,175,341,578	$701,575,432	$937,106,798
and total— ndividuals and corporations	$71,381,275	$345,191,844	$4,286,486,257	$3,444,971,682[1]	$1,420,962,538	$1,600,758,303

Returns reporting net income in excess of personal exemptions.

or net income of $5,000 and over, this exemption was reduced to $2,000.

. From the technical standpoint, the striking characteristics ie Federal tax are: The high ratio of surtax to normal tax; marked difference in the normal tax applicable to individ- and corporations respectively; the taxation of gains from occasional sale of capital assets, at a flat rate of 12½%; its re, largely because of constitutional limitations, to reach est on municipal bonds and other tax-free securities; the l use of "stoppage-at-source" (whereby the normal tax is held and paid direct to the government by payers out of nents due to corresponding payees); and the credit accorded ncome and profits taxes paid to foreign countries on income ved from sources therein.

he tax law is extremely complex, largely owing to the taxa- of capital gains and to certain "cushions" or relief pro- ons designed to protect the tax-payer against hardship; but law has been simplified in a measure by the repeal of the ss-profits tax and of many of the special war provisions such llowances for amortisation, inventory losses and the like. has been accompanied by a movement away from cen- sed administration of the tax, and by a steady reduction in rates. Nevertheless, complexity, centralisation and high ax rates still cause excessive delay in the audit of the larger rns. The interpretation of the law has been much improved he creation in 1924 of a Board of Tax Appeals (an extra- inistrative tribunal whose decision is final unless modified he courts), and by giving local revenue agents the power to t and settle the smaller cases. The American tax reveals a ual approach to the British position on capital gains and s, which are taken into account at a special rate of 12½%.

BLIOGRAPHY.—E. R. A. Seligman, *The Income Tax* (1914); . Kennan, *Income Taxation* (1910); D. O. Kinsman, *The In- Tax in the Commonwealths of the U.S.* (1903); R. M. Haig (ed.) *The Federal Income Tax* (1921); G. E. Holmes, *Federal Taxes* (1926 ed.); Treasury Department, *Regulations* 65 (1924); Bureau of the Census, *Digest of State Laws Relating to Taxation and Revenue* (1922); Prentice-Hall, *Federal Tax Service* (annually); Commerce Clearing House, *Federal Tax Service* (annually); Corporation Trust Co., *Income Tax Service* (annually); *National Income Tax Magazine* (monthly); *Bull. of National Tax Assn.* (monthly). (T. S. A.)

INDEX NUMBERS.—The phrase index number is sometimes applied to any series in which a chosen term is written as 100 and the other terms expressed as percentages of it. The earlier and more general use is, however, consonant with the following definitions:—"An index number [is] a number adapted by its variations to indicate the increase or decrease of a magnitude not susceptible of accurate measurement" (Edgeworth, *Economic Journal*, 1925, p. 379); "index numbers are used to measure the change in some quantity which we cannot observe directly, which we know to have a definite influence on many other quantities which we can so observe, tending to increase all or diminish all, while this influence is concealed by the action of many causes affecting the separate quantities in different ways" (Bowley, *Elements of Statistics*, 1920, p. 196). Thus index numbers are applied to the measurement of the *general* movement of prices, cost of living, wages, production, consumption, employment, etc.

The data from which index numbers are formed consist of records of particular quantities at two or more dates or places and information about the relative importance of these quantities in a general measurement. In constructing an index number to measure the movement of any defined magnitude it is necessary to decide on the choice of the separate quantities, on their relative importance, on the period or place to be taken as base, and on the formula of compilation. Thus, in the *Statist* index number the objective is the measurement of the change of wholesale prices in the United Kingdom, 45 commodities are selected and regarded as of equal importance, the period 1867–77 is taken as base and the average price in that period of each commodity is equated to 100, the terms in each series of prices are expressed as percentages of that average (" price-relatives "), and the simple average of the 45 relatives in any year form the index number for that year.

A distinction is drawn, but not by all writers, between two classes of index numbers: (*a*) where, as in the definitions quoted above, the object is to measure the movements of a magnitude without specific reference to any pre-determined application, *e.g.*, the purchasing power of money in general (" indice monétaire ") as conceived by Jevons, *The Variation of Prices and the Value of Currency since 1782* (1865); (*b*) where the measurement is to be applied to a defined group, *e.g.*, the changes in the cost of a quantitative standard, such as is used in a Cost of Living index (" indice budgétaire "). Many index numbers, however, are intermediate between these classes, and much of the analysis of the form and content of the numbers is appropriate to both. Thus, in all cases of price measurement, only those commodities can be included which are measurable in a defined and unchanged unit, and for which the price can be ascertained, and (unless the geometric mean is used) a base period in which each price is equated to 100 must always be selected.

(*a*) In the measurement of the purchasing power of money in general it is argued that the prices of all commodities, not subject to regulation or monopoly, are equally significant. Theoretically the problem is one of pure sampling, and the precision of the result in any year is directly proportional to the square root of the number of independent terms included and inversely proportional to the mean dispersion of these terms from their average in that year. In practice, the terms are not completely independent, for the prices of related commodities influence one another, and the precision is thus reduced. Also, the greater the interval from the base year, the greater tends to be the dispersion and the smaller the precision. In periods when prices are changing rapidly, as in the years 1914 to 1923, the dispersion is usually considerable and the measurement loses accuracy.

There are three types of averages applicable to price-relatives: their arithmetic mean as described above for the *Statist* index number; the geometric mean of the same numbers, that is the nth root of their product if there are n commodities; and the harmonic mean, which is the reciprocal of the arithmetic mean of the reciprocals. Thus, for two commodities whose prices were 6d. and 10d. in the base year, and 1s. and 2s. 1d. in any other year, the price-relatives are 200 and 250, their A.M. is 225, their G.M. is $\sqrt{(200 \times 250)} = 223{\cdot}6$, their H.M. is $1 \div \frac{1}{2}(\frac{1}{200} + \frac{1}{250}) = 222.2$ If the latter year is taken as 100, the relatives in the original base year are 50 and 40, the A.M. is 45, and 45:100 = 100:222·2. The H.M. of the " forward " relatives gives the same measurement as the A.M. of the " backward " relatives; or, if the comparison is between two places the H.M. of the relatives when the first is taken as base gives the same measurement as the A.M. when the second is so taken.

These statements are more readily expressed algebraically. Write $P_1, P_2 \ldots$ for the prices in the first year (or place), and $p_1, p_2 \ldots$ for the second. Write $100\frac{p_1}{P_1} = r_1 = A(1+d_1) \ldots$ where $A = \frac{1}{n}\Sigma v$ is the A.M. of the price-relatives.[1] Then $\Sigma d = 0$, the Geometric Mean, $G = \sqrt[n]{(r_1 . r_2 \ldots)}$ and

$\therefore n \log G = \Sigma \log A(1+d_1) = n \log A + \Sigma d - \frac{1}{2}\Sigma d^2 \ldots = n \log A - \frac{1}{2}ns^2$, approx. where s is the standard deviation of the dispersion of the relatives each divided by A, and mean d^3, etc., are neglected. Hence $A = Ge^{\frac{1}{2}s^2} = G(1+\frac{1}{2}s^2)$, approx. if s is small. Also the Harmonic Mean, $H = 1 \div \frac{1}{n}\Sigma\frac{1}{v} = nA \div \Sigma(1+d)^{-1}$

$\therefore A = H \times \frac{1}{n}\Sigma(1-d+d^2 - \ldots) = H(1+s^2)$, approx.

$\therefore H = G(1-\frac{1}{2}s^2)$, and $\sqrt{AH} = G$, approx.

Thus, if s is small A, H, G differ little from each other, b
$A > G > H$. If G is the correct measurement A exaggerates a r
and underestimates a fall (since $100 - A < 100 - G$), while H h
the opposite effect. The G.M. of A and H is very nearly
For the *Statist* index number in 1913 (1869–79 base perio
$A = 85{\cdot}0$, $G = 80{\cdot}9$, $H = 76{\cdot}5$, $s^2 = {\cdot}104$. As regards precision
sampling A may be written as $A\left(1 \pm \frac{s}{\sqrt{n}}\right) = A(1 \pm {\cdot}053) = 85 \pm 4$
if the 45 correlated entries are taken as equivalent to
independent (*Statistical Journal*, p. 316, Mar. 1926). In this ca
the standard error attributable to sampling is about the sa
as the difference between A and G.

A general change in the relation of currency to its use tends
affect all prices in the same proportion, and " if other disturbi
causes may be considered proportional to the ratio of change
price they produce in one or more commodities, then all t
individual variations of prices will be correctly balanced
against each other in the Geometric Mean " (Jevons, *Investi
tions in Currency and Finance*, 1884, pp. 121–2; see also Bowl
Economic Journal, 1921, p. 202). The Geometric Mean is the
fore considered appropriate to this problem. It has the a
vantage that it gives less importance to extreme measuremen
than does the Arithmetic Mean. It has the further advanta
that the comparison by its use of any two years is independe
of the choice of the base year (*see* below).

(*b*) The method generally used in the more objective proble
of measuring the change of cost of a fixed aggregate of goods is
follows: The quantities of defined commodities which are p
duced or consumed in a year, or exported or imported, or a
purchased in a week by a family, are estimated and the pric
per unit are ascertained in a base year or period and also in t
year to which the measurement is to refer. This budget
quantities is valued at the base year prices and again at the pr
of the year in question; the latter total expressed as a p
centage of the first gives the required index number. The co
putation is often effected by writing down the relative expe
ture (quantity × price) on each commodity in the base ye
applying to each the percentage that its price in the seco
year forms of that in the first, and adding the products. T
sum (divided by the total of the base year's relative expen
itures) gives the same index number as before. Cost of Livi
index numbers are computed by this method. In this form t
index number appears as a " weighted average," where t
weights are the relative expenditures and the things weighted a
the price-relatives. From the theory of weighted averages it
known that considerable roughness in the weights has litt
effect on the result. It may also be regarded as an averag
price-relatives which form a sample of a larger group than th
included, and therefore—as under (*a*)—its precision depen
on the square root of the number of independent relatives an
inversely, on their dispersion about their average.

Write $Q_1, Q_2 \ldots$ for the number of units of quantities, P_1
$\ldots$ for the prices in the base period, $p_1, p_2 \ldots$ for those in the ye
in question. Then $E_1 = Q_1P_1 + Q_2P_2 + \ldots$ is the total expenditu
in the first year, and $E_2 = Q_1p_1 + Q_2p_2 + \ldots$ is the total expen
ture in the second year. Then the index number is $I_1 = 100E_2 \div$ I

Now write $Q_1P_1 = l_1E_1$, $Q_2P_2 = l_2E_1 \ldots$, with $l_1 + l_2 + \ldots =$
Write $100p_1 = r_1P_1$, $100p_2 = r_2P_2 \ldots$, so that $r_1, r_2 \ldots$ are the pri
relatives. Then the new index number is $l_1r_1 + l_2r_2 + \ldots$
$(Q_1P_1r_1 + Q_2P_2r_2 + \ldots) \div E_1 = 100(Q_1p_1 + Q_2p_2 + \ldots) \div E_2 =$
The weighted Geometric Mean, $G_1 = \sqrt[n]{(r_1^{n_1} r_2^{n_2} \ldots)}$ whe
$n_1 + n_2 + \ldots = n$, so that $n \log G = n_1 \log r_1 + n_2 \log r_2 + \ldots$ T
English Board of Trade, for its index number of wholesale price
uses a similar form in which, if for example n_1 is the weig
assigned to cereals, $r_1^{n_1}$ is replaced by ${}_1r_1 \times {}_2r_1 \times \ldots$ to n facto
where ${}_1r_1, {}_2r_1 \ldots$ are price relatives of n_1 different quotations
cereal prices. When $n_1, n_2 \ldots$ are once chosen the compariso
between any two years A and B is independent of the base yea

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[1] Such an expression as Σv is to be read $v_1 + v_2 + \ldots + v_n$ where n is the number of similar terms.

f the price ratios for the years are written ${}_{a}r_1$, ${}_{a}r_2$ . . . and ${}_{b}r_2$ . . . and G_a, G_b are the resultant means, then log $\frac{G_b}{G_a}=$ $G_b-\log\ G_a=n_1(\log {}_{b}r_1-\log {}_{a}r_1)+n_2(\log {}_{b}r_2-\log {}_{a}r_2)+$ . . . log ${}_{ab}r_1+n_2 \log {}_{ab}r_2+$ . . . , where ${}_{ab}r_1$, ${}_{ab}r_2$ . . . are the ratios ie prices of the year B to those of the year A, and the prices he base year do not enter. If with similar notation the ımetic average is used, we have $A_b \div A_a=(n_1\cdot{}_{b}r_1+n_1\cdot{}_{b}r_2+$ $\div(n_1\cdot{}_{a}r_1+n_2\cdot{}_{a}r_2+$ . . .), in which no corresponding elimination s place.

ıe weakness of this method is that, when we make a comıon between two years or two places, the relative expendis generally differ and each scheme appears to have an equal ı to be included. This difficulty may be met theoretically by ›uting the index twice, first with the expenditures in year or A and then with those in B and averaging the result. comparison between places this method is applied, but it ldom that the necessary "weights" can be obtained for than one year, and till there is a further census of proion or a new collection of working class budgets the double ›utation cannot be made. Further, if the weights are availfor three years or places, A, B and C, the index for B in ence to A multiplied by that for C in reference to B does not ny weighted average formula give that for C in reference to ·100), as it should. This so-called "condition transitive" is ıatisfied by any formula that is symmetrical with regard to hts.

rite ${}_{a}Q_1$, ${}_{a}Q_2$ . . . and ${}_{a}P_1$, ${}_{a}P_2$ . . . for quantities and prices and ${}_{b}Q_1$, ${}_{b}Q_2$ . . . , ${}_{b}P_1$, ${}_{b}P_2$ . . . in B. The "forward" index ber is $I_a=100\Sigma_a Q_1\cdot{}_{b}P_1\div\Sigma_a Q_1\cdot{}_{a}P_1$ and the "backward" number is $I_b=100\Sigma_b Q_1\cdot{}_{b}P_1\div\Sigma_b Q_1\cdot{}_{a}P_1$. The Geometric ı $\sqrt{I_a\times I_b}$ is Prof. Irving Fisher's "Ideal index number" *Making of Index Numbers*, 1922, p. 220). The arithmetic ıge, $\frac{1}{2}(I_a+I_b)$ and the form $I_2=100\Sigma\frac{1}{2}({}_{a}Q_1+{}_{b}Q_1)\cdot{}_{b}P_1\div$ $Q_1+{}_{b}Q_1)\cdot{}_{a}P_1$, may be conveniently used. The three forms ıerage may be expected to give nearly identical results. which the quantities at the two dates are averaged, is perthe simplest in idea. Each average lies between I_a and I_b, s greater than I_a if an increase of prices of a commodity the general increase from year A to a later year B is cored with a relative decrease of the quantity purchased, as may pected if there is a possibility of substitution of one comty for another without any general change of standard ley, *Statistical Journal*, 1919, pp. 343 *seq.*).

their measurement of the change of Import or Export index from year A to the consecutive year B, the Board of Trade the formula I_b and for comparison with the next year C ormula $100\times\frac{\Sigma\,{}_{b}Q_1\cdot{}_{b}P_1}{\Sigma_b\,Q_1\cdot{}_{a}P_1}\times\frac{\Sigma\,{}_{c}Q_1\cdot{}_{c}P_1}{\Sigma\,{}_{c}Q_1\cdot{}_{b}P_1}$ which does not equal $\frac{{}_{c}Q_1\cdot{}_{c}P_1}{{}_{c}Q_1\cdot{}_{a}P_1}$ obtained by direct re-valuation of the C quantiıy the A prices and, if there is a very rapid change of quanand prices, may differ considerably from it. This is an ple of the "step-by-step" or "chain" method of index ›ers. Note that from A to B, $100\frac{\Sigma\,{}_{b}Q_1\cdot{}_{a}P_1}{\Sigma\,{}_{a}Q_1\cdot{}_{a}P_1}$ is an index ›er of quantity of trade (prices constant), and $100\frac{\Sigma\,{}_{b}Q_1\cdot{}_{b}P_1}{\Sigma\,{}_{a}Q_1\cdot{}_{a}P_1}$ index number of value of trade. The product of these ırements of price and quantity is the index of value (× 100). ce no form of index number satisfies all the conditions can properly be laid down (see *e.g.*, Gini, in *Metron*, 1924, ı and 134), on the one hand we must select the form most l for a particular purpose, on the other we can only expect ion when different relevant forms give approximately ıme result, for which the conditions are that the dispersion ces from their average should be small and the number of tuent elements should be considerable. *See* COST OF G: PRICES. (A. L. Bo.)

EX SYSTEM: *see* OFFICE APPLIANCES.

INDIA (*see* 14.375).—The fifth regular census of the Indian Empire (March 1921) gave a total population of 318,942,480, of whom 247,003,293 dwell in British India, and 71,939,187 in the Indian States. The corresponding figures of area were 1,805,332 sq. m., of which 1,094,300 lie in British territory, and 711,032 in the Indian States. With an area rather more than half that of the United States, the country has a population about three times as large. But the increase in population, 1.2% during the decade 1911–21, was the lowest in any similar period since the decennial census was instituted:—the result of a widespread failure of the crops through drought in 1918, and an epidemic of influenza which is estimated to have carried off anything up to 10,000,000 victims.

Political Divisions.—British India consists of (*a*) nine major or "Governor's" provinces, viz.: Assam, Bengal, Bihar and Orissa, Bombay, Burma, Central Provinces and Berar, Madras, Punjab and United Provinces of Agra and Oudh; (*b*) two minor provinces, viz.: Baluchistan and the North-West Frontier Province; and (*c*) certain smaller administrative areas, viz.: Ajmer-Merwara, Andamans and Nicobars, Coorg and Delhi. The present article deals exclusively with British India, except where the contrary is stated.

The Indian states are governed by ruling princes and chiefs, and are in political relation with the British Government through the medium of political officers specially attached to the larger units or groups. The rulers of 119 states have a salute of guns, which forms a rough measure of their relative importance, as it varies from 21 guns to 9; the remaining 442 states and estates have no salute. Many of the smaller estates are divided up among several sharers. The more prominent individual states are Hyderabad, Mysore, Baroda, Kashmir and Gwalior; and apart from these units the main territorial groups of states are Rajputana, Central India, the Western India states, the Punjab states and the Madras states. Burma contains a number of Shan states, which technically form part of British India, though they are administered through their hereditary chiefs.

Religions, etc.—A classification by religions would divide every 1,000 of the people into 686 Hindus, 217 Moslems, 37 Buddhists, 31 Animists, 15 Christians, 10 Sikhs and 4 Jews, Parsees and followers of other faiths. The census recorded 22,600,000 as literate, in the sense of being able to write a letter in their own vernacular tongue; and 2,500,000 were returned as able to read and write English. Seventy-one per cent of the people are supported by agriculture, 1% only by organised industry, another 9% by the simple hand industries, 7% by trade and transport, 1½% by the professions and liberal arts, and 1½% by the administration and protection of the country.

I. GENERAL HISTORY

Lord Hardinge as Viceroy.—In the spring of 1910 the appointment of Lord Kitchener to succeed Lord Minto as Viceroy seemed probable. Fate reserved Lord Kitchener for other tasks, and the choice fell on Sir Charles Hardinge, permanent Under-Secretary for Foreign Affairs and formerly ambassador at St. Petersburg, who was raised to the peerage as Lord Hardinge of Penshurst. His long viceroyalty (Nov. 1910–March 1916) was strenuous and eventful. The earlier years were marked by the visit of King George V. and Queen Mary to India, the selection of Delhi as the site of the future capital of the Indian Empire, the revision of the "partition" of Bengal and the nefarious attemps of anarchists to compass the deaths of the Viceroy and his wife on the occasion of their state entry into Delhi. The closing years saw India in the throes of the World War.

Lord Hardinge, like his predecessor, had an hereditary connection with India, as his grandfather, the 1st Viscount Hardinge, was Governor-General (1844–8) in the stirring times of the first Sikh War. The goodwill of Indians towards the new Viceroy deepened as they saw his genuine liking for their country; his zeal to obtain redress of the grievances of Indians residing in other parts of the Empire; and his endeavours to associate their political leaders with the work of government under the reformed Councils scheme. His diplomatic and Foreign Office experience and knowledge of the politics and conditions of the East enabled him to handle dexterously and effectively the external affairs of India and to enter into the difficulties and apprehensions of Indian Mahommedans. He cordially pursued the policy of friendship and co-operation with the ruling chiefs of native States that Lord Minto had inaugurated. When the World War came in 1914, the popularity of his administration and the personal influence and friendship which he had acquired with the ruling princes had much to do with the magnificent response of India to the call of the Empire.

The Morley-Minto Reforms.—The scheme of administrative reform which had been worked out between Lord Minto and Lord Morley, then Secretary of State for India, was in full operation when the new Viceroy arrived. The main object of the India Councils Act, 1909, had been to enlarge the Legislative Councils and make them more fully representative, introduce the elective principle, give greater powers of discussion and of obtaining information from the executive. In each Council the nominated members comprised: (1) a substantial *bloc* of officials, the *bloc* in the Imperial Legislative Council being large enough to secure, together with the members of the Executive Council, an absolute majority; (2) non-officials nominated to represent classes or interests which would otherwise be unrepresented or inadequately represented.

In all the councils, with the exception of that of Bengal, the nominated members exceeded in number the elected members. The number of the latter in any province was too few to admit of any system of territorial constituencies and direct voting. Special constituencies therefore were formed, such as universities, chambers of commerce, groups of municipalities and district boards, and also for Mahommedans as a separate class or community. The councils were empowered to discuss and move resolutions on the annual budget and in like manner to raise discussions by resolution on matters of general public interest. But they did not vote the budget, and resolutions operated only as recommendations which were not binding on the Government. The councils had no direct control over the executive, though they could inform and influence it; Lord Morley had emphatically said that India was not ripe for parliamentary institutions and that he would be no party to creating them. The Act increased the number of members of the executive councils of Madras and Bombay from two to a maximum of four, thereby providing a seat for an Indian or two Indian members; it also authorised the creation of an executive council in any province having a lieutenant-governor. The policy of associating Indians with the executive government thus affirmed as regards to provinces, was given effect to in the Government of India by the appointment first of Mr. S. P. (afterwards Lord) Sinha, and then of Sir Ali Imam as Law Member of the Governor-General's executive council.

Working of the Reforms.—Lord Minto had predicted that the conciliatory measures embodied in and associated with these changes would clear the political atmosphere. He prophesied rightly. On Jan. 5 1911, a deputation from the Indian National Congress presented an address to the new Viceroy expressing deep and heartfelt loyalty to the Crown and appreciation of the reforms which " had done much to bring about a better understanding between the Govt. and the people. " As the enlarged Legislative Councils settled down to their work, even the advanced party found in the new powers a healthy outlet for their energies. As consultative and critical bodies the reformed councils exercised a real and growing influence and were an educative force. They formed, directed and developed public opinion in political matters. They acted as a restraint upon the autocratic tendencies of the Executive and made it more responsive to popular demands, and they strengthened its hands when it had to sustain Indian interests against the interests of Great Britain or of the self-governing Dominions.

The King's Visit.—The royal visit in the winter of 1911 was a complete success. The presence of the King-Emperor and his Consort in India touched the imagination of the people. Delhi ceremonies drew vast crowds eager to see and salute sovereign. When a visit to Calcutta followed, the welc given by the populace of that city was even more enthusia and unrestrained. On Dec. 12 1911, in a great arena out Delhi specially prepared for the occasion, the King held a c nation durbar at which he received in person the homage of great officers of state and the ruling princes and chiefs of Indian Empire. Largesse and “ boons ” of various kinds granted, and an announcement made of great political mom The seat of the Govt. of India was to be transferred from cutta to Delhi; Eastern Bengal was reunited to Bengal and enlarged province given a Governor in Council; Bihar, Or and Chota Nagpur, tracts which are loosely connected Bengal proper were made a Lieutenant-Governorship in Cou and Assam was reformed into a chief commissionership. secret had been well kept, and the surprise was complete. scheme, though open to obvious objections was ingenious cleverly balanced. A reasoned exposition of its object is tained in a despatch, dated Aug. 25 1911, from the Govt India to the Secretary of State, submitting the proposed cha for the home Govt's approval in advance of the King's visi

Time alone will test the wisdom of these changes, autoc cally conceived and dramatically carried out. The buildin the new capital was thrown back by the World War, and cost, which was originally estimated at £4,000,000, will gre exceed that amount. New Delhi, it is urged by opponents of scheme, will be merely cold-weather headquarters of an off hierarchy, an imposing mass of buildings untenanted for matic reasons during eight months of the year; while the G of India, rotating between it and Simla, will live perpetually bureaucratic atmosphere. On the other hand the drawback Calcutta were many, and constitutional changes have empha the desirability of removing the supreme Govt. from imme contact with the internal administration of Bengal. The p dential Government of reunited Bengal is an undoubted suc the bitterness of feeling engendered by the “ partition ” has appeared, and the interest of the Mahommedan populatio the Eastern districts receives a just measure of attention the local Government. The province of Bihar and Orissa is weak feature of the scheme. The artificial union of two bl of territory, geographically apart and without linguisti racial affinities, can never be a convenient administra unit.

Lord Hardinge's internal Administration.—The beginning sustained advance in popular education was made at the D coronation durbar, at which a recurring grant of 50 lakhs (£ 000) to local Govts. for the purpose was announced. This followed in succeeding years by larger grants. From 1911–5 recurring grants amounting to £3,250,000 and recurring gran £826,000 were made to the provinces. The total annual exp iture on education rose during the period by nearly £3,000 and the number of boys and girls at school or college by 1,500, This expansion was numerically greatest in the primary sch A wide educational policy was laid down, embracing the uni sities and secondary and technical schools and colleges. search and post-graduate instruction were promoted in universities. A well-equipped medical college was establi at Lucknow, raising the number of medical colleges in Indi five, schools of tropical medicine were founded in Calcutta Bombay, and an institute of science at Bangalore. Non-recu imperial grants for public health service, amounting to £2, 000, and recurring grants of £368,000 were made, rendering ticable the execution of sanitary measures which a few years fore seemed beyond the limits of financial possibility. appointment of a royal commission under the presidency of Islington, to inquire into and report on the public services of with a view to increasing the proportion of Indians in the hi offices was warmly approved. Another popular measure was establishment of a Legislative Council in the Central Provi

Indians in the Dominions and the Colonies.—Serious content was provoked by the position of indentured labo colonies to which it was permitted, and by the treatment ndian residents in South Africa and Canada. The first ble arose over the refusal of the Natal Govt. to accept n immigrants as permanent citizens of the Union after the ation of their indentures. As no redress was obtained the t. of India in 1911 prohibited for the future indentured ration to Natal. In the following year the grievances of ndian domiciled in the Union against the Union Govt. came head. The Indian settlers resorted to "passive resistance." situation was aggravated by strikes and riots among an labourers in Natal. Intense feeling was aroused in India ports of the treatment of passive resisters by the magistrates he rough handling of strikers and rioters by the police. In eech delivered in Madras (Nov. 24 1913), Lord Hardinge essed evident sympathy with the passive resisters in their gle against "invidious and unjust laws," and pressed for quiry in South Africa by a strong and independent com- e on which Indian interests should be fully represented. e Union Govt. resented the Viceroy's language, but the lated indiscretion served its purpose. A commission of iry was appointed, and a solution was at length reached and died by the Union Govt. in its Indian Relief Act, 1914. closed the passive resistance struggle. In the action took Lord Hardinge's Govt. had the warm approval of the ated classes. With regard to Canada the grievances of ns were less easy of settlement, and Lord Hardinge only advise a policy of reciprocity, which could be made tive without direct retaliation and would not raise questions e personal status of Indians in Canada.

volutionary Crime.—A new and sinister feature in Indian ad forced its way to the surface soon after Lord Minto ed in the country. The wide-spread unrest, which he found g the educated classes, and endeavoured to appease by ical reforms, had its echo among other classes which were eated by economic discontent and with whom crude ns of self-rule and political freedom easily "yoked them- s," as Lord Morley put it, "to deep invisible roots of race, creed and inviolable caste." Secret societies, com- chiefly of young men belonging to respectable families, g up in many districts of Bengal, having for their object eliverance of India from the foreign yoke. This they t to compass by assassination and terrorism. The art of -making was imported from Europe. Revolutionary liter- and the use of pistols and explosives were sedulously ed, and a series of anarchical crimes occurred from 1907–9. roup of measures were passed for dealing with seditious meet- publications and associations, and for establishing special dure and special tribunals for the trial of anarchical crime. was apparently restored; but in Bengal trouble broke out towards the close of 1912; and by the end of 1913 the ordi- forces of law and order in that province had been definitely n. On Dec. 23 1912, as the Viceroy was making his first entry into Delhi, a bomb was thrown and exploded in the *ah* of the elephant on which he and Lady Hardinge were g, severely wounding him and killing an attendant. The ants were never brought to justice, but there is little t that they were connected with the anarchical movement in al which had extended to the Punjab. In 1914 and 1915 rev- onary activities became more daring, with the assistance erman agents in America and the Dutch East Indies; but igorous use of the special powers provided by the Defence dia Act broke up the movement for the time being and ed order. The organisation of the revolutionary societies, inter-connection and propaganda methods, their success in pting the educated youth of the country, are minutely ibed in the report of the Sedition Committee (1918) over Mr. Justice Rowlatt presided.

THE WAR PERIOD

lia's Effort.—On the outbreak of the World War in Aug. the response made by India to the needs of the Empire was testimony of her pride in the British connection. The political leaders instinctively suspended their controversies with the Government, and gave her their support. The martial classes eagerly responded to the call to arms. From the rulers of native states lavish offers of help poured in. They were recounted in the Viceroy's telegram to the Secretary of State, dated Sept. 7 1914, which was read in both Houses of Parliament and circulated throughout the Empire. As a wonderful demonstration of loyalty and generosity, its effect on popular feeling was immense.

With this confidence and enthusiasm were mingled some alarm and bewilderment. Trade came to a standstill. There were runs on the banks, encashment of currency notes and hoarding of coin. In the remoter districts rumours of the Collapse of the British *raj* disturbed the countryside. The Mahommedan peasantry in parts of the Punjab raided and burned the houses of Hindus and moneylenders, and military force was required to restore order. In Bengal the revolutionary societies redoubled their criminal activities. In San Francisco and Vancouver an Indian revolution was openly preached to the Sikhs settled there, and numbers of them were incited to return to the Punjab to take part in a general rising. Their designs were detected, but for some months the Punjab was disturbed by murders, dacoities and robberies, and the reckless use of arms and explosives.

India as a whole however was so calm that the Govt. was able to denude itself freely of its military resources to meet the demands of the home Govt. for troops and war material. Most of the British troops, the flower of the Indian army, the best of the artillery, and large quantities of ammunition were despatched to France and other theatres of war. In Sept. 1914 a force of 70,000 men was sent to France. By the end of 1915 India's contribution amounted to nearly 80,000 British and 210,000 Indian officers and men. At one time the original British garrison was reduced to only 15,000 men. These were gradually supplemented by territorial and garrison troops from home, but throughout the War the British element in the army in India was far below the defensive needs of the country.

The entrance of Turkey into the War placed Indian Mahommedans in a difficult position; but they loyally rallied to the side of the Crown. Against a few prominent agitators only was it necessary to take action. The premier Mahommedan prince, the Nizam of Hyderabad, and the Begum of Bhopal, in addresses to their co-religionists, effectively stated the British case, and exposed the falsity of the pretexts by which Enver Bey and his associates sought to justify the entrance of Turkey into the War. These addresses and a declaration by the Govt. of India as to its attitude towards Islam in general and the Holy Places in particular served greatly to maintain tranquillity.

Retirement of Lord Hardinge.—In Nov. 1915 Lord Hardinge completed his fifth year as Viceroy, but at the request of the home Govt. remained in office until the following April. In a farewell speech to his Legislative Council he expressed his wish to see "the early realisation of the just and legitimate aspirations of India," but he besought his hearers not to be led astray by impracticable ideals, but to look facts squarely in the face and to realise that in the Dominions self-government had been the slow product of steady and patient evolution.

Lord Chelmsford's Administration.—Lord Chelmsford, the new Viceroy, assumed office on April 4 1916. Previously Governor of Queensland and of New South Wales, at the time of his appointment he had been serving as an officer with a territorial battalion in India; and he was cast at once into one of the most difficult periods of British-Indian history, momentous alike in the number and magnitude of the problems demanding solution and in the gravity of the issues they have raised. In the very first year of his administration the political peace enjoyed by his predecessor came to an end. In the early part of the year Mrs. Besant succeeded in getting her scheme of Home Rule considered by leading members of the National Congress and the Moslem League. She continued to advocate it with great energy among students and school-boys in Madras, established a Home Rule League, celebrated a "Home Rule" day, and declaimed in her paper *New India* against the Government. Mr. B. G. Tilak, who up to 1914 had been serving a sentence of six years' imprisonment for sedition, was equally active in Bombay. In Oct. 1916, a group of elected Indian members of the Imperial Legislative Council submitted a memorandum on proposed reforms to the Govt. of India. They described the Morley-Minto reforms as having created Legislative Councils which were mere advisory bodies without any effective control; they propounded a scheme which, while retaining irremovable executives responsible to Parliament and the Secretary of State, would have subjected them in legislation, finance and administration, to the orders of a legislative body in which elected members would be predominant.

At meetings held in Lucknow in Dec. 1916 the National Congress and the Moslem League agreed upon a scheme of reforms as the irreducible minimum with which the National party would be content. The Moslem League, originally founded for the protection of Moslem interests against Hindu ascendancy, had fallen under the influence of the "young" Mahommedans, who made Home Rule their objective and joined forces with the Congress on the condition that in certain provinces in which the Mahommedans were in a minority they were guaranteed a proportion of seats in the future Legislative Councils in excess of the number they could hope otherwise to win. Effect was given to this compact, henceforth known as the "Lucknow Compact," in the Congress-League scheme. Following the Lucknow conferences an energetic Home Rule campaign was opened in all provinces. The stir in the Nationalist camp was quickened by the knowledge that the views of Lord Chelmsford's Govt. on political reforms had for some time past been before the home authorities. A preliminary and informal examination of the changes possible and prudent had been made by Lord Hardinge. Lord Chelmsford immediately on assuming office took up the inquiry from the point where his predecessor had left it. At the close of 1916 his government submitted to the Secretary of State a considered scheme of reforms, and asked for an authoritative declaration of policy. Was the goal for the Indian peoples to be responsible government? If so, by what stages and steps should it be reached? The questions raised were large and delicate. The Cabinet was preoccupied by the War. In July 1917 the Secretary of State Mr. (Sir) Austen Chamberlain, resigned on the report of the Mesopotamian Commission.

Declaration of Aug. 20 1917.—It fell to his successor, Mr. E. S. Montagu, to announce on Aug. 20 1917, in the House of Commons, the Indian policy of the government.

> The policy of H.M. Govt. is that of increasing the association of Indians in every branch of the administration and the gradual development of self-governing institutions with a view to the progressive realisation of responsible government in India as an integral part of the British Empire . . . . Progress in this policy can only be achieved by successive stages. The British Govt. and the Govt. of India, on whom the responsibility lies for the welfare and advancement of the Indian peoples, must be the judges of the time and measure of each advance, and they must be guided by the co-operation received from those upon whom new opportunities of service will thus be conferred and by the extent to which it is found that confidence can be reposed on their sense of responsibility.

In the course of the winter Mr. Montagu visited India, and a joint report, dated April 22 1918, by himself and the Viceroy was drawn up before he left.

War Conference of 1918.—The Montagu-Chelmsford report was nearing completion when attention was recalled to the pressing realities of the War. In the Near East, German troops had penetrated the Caucasus and Turks were invading Persia. With the collapse of Russia, the opening up of a road to Afghanistan and thence to India seemed possible. In a telegram (April 2 1918), the Prime Minister made an appeal to the Govt. and people of India to redouble their efforts and prevent German tyranny from "spreading to the East and engulfing the world."

Lord Chelmsford's reponse was to convene a War conference at Delhi, to which many ruling princes and representatives of all provinces of every shade of opinion were invited. The conference heartily and loyally responded to the appeal, and agreed upon a programme of measures of no small value. In the five months preceding the Armistice 200,000 men were recruited, and
had the War gone on this number would have been great
creased. In the spring of 1917 the Legislative Council ha
cepted the Govt's. proposal to make a free gift of £100,00
to the home Govt. towards the expenses of the War. Thi
in addition to the obligation the Indian Govt. had under
of bearing the normal charges of all troops on the Indian
lishment sent overseas. The part borne by India in the Wa
the sacrifices made by her people for the common cause ar
resented by an addition of over 230 crores of rupees (£153
000) to her debt, the sending overseas of 800,000 combatant
400,000 non-combatants, and the furnishing of foodstuff
other supplies at the cost of much privation among the
classes. If the agriculturists as a body and some other se
of the community made money out of the War, the urban
and the multitude of persons on small salaries and fixed in
suffered greatly from the dearness and scarcity of foo
clothing.

India After the War

Reception of Montagu-Chelmsford Report.—The Armisti
Nov. 1918 was the signal for general rejoicings but ushere
season of political strife and agitation unfavourable for the
ful introduction of the new constitution. The Montagu-Ch
ford report had been published in the previous July. In the
session of the Legislative Council the report was re
for consideration to a committee of the non-official me
and was approved by them, with certain qualifications.
moderate party held a special conference in Nov. at Bo
and accepted the general principle of the Montagu-Chelm
scheme, while urging that it should be enlarged in certain
On the other hand the National Congress, which ha
become the organ of the extreme national party, wholly
demned the scheme at its Dec. meeting, demanded ful
vincial autonomy at once, and asserted India's right to
determination. Unhappily another controversy now
which was fated to overshadow and prejudice the con
tional question by the passions which it kindled an
bitterness which it imported into the relations of the
and the Government.

The Rowlatt Bill.—The report of the Sedition Com
over which Mr. Justice Rowlatt presided had discusse
outbreaks of seditious crime, particularly from 1907, an
provided impressive evidence of the existence of a revoluti
and anarchical conspiracy in Bengal and elsewhere and the
fectiveness of the ordinary criminal law to deal with it.
Committee proposed to strengthen in certain minor re
the existing law, and to endow the Governor-General in C
with emergency powers, to be used only in specified areas
only after a notification declaring the existence of a state of
in those areas which demanded emergency measures.
measures included: (*a*) the trial of seditious crime by three
of the highest status, without juries or assessors who were
to be affected by public discussion or deliberate terrorism
(*b*) the investing of a provincial Government with powe
internment similar to those conferred under the Defence of
Act, but modified by checks in the shape of local investig
and visiting Committees. In Jan. 1919 the publication o
draft bills embodying the Committee's proposals was foll
by a violent campaign by the Nationalist press and Natio
politicians. They were represented as an attack upon the
lar liberties, an attempt to invent crimes, a monstrous engi
tyranny and oppression, the forerunner of a policy of rea
and an unmerited slur upon the loyalty and law-abidingne
the Indian people. A whirlwind of excitement swept throug
cities of upper India, a strange medley of ignorance and
of political unrest and domestic discontents, of conscious
geration and mendacity.

While the bills were before the Legislative Assembly, M
K. Gandhi, a well-known social and religious reformer, re
in the Bombay Presidency as an ascetic and holy man, initi
a passive resistance movement. *Satyagraha*, as he terme
meant insistence on truth and a reliance on soul force. O

latt bills receiving the Viceroy's assent, Mr. Gandhi an-
nced a day of general mourning and cessation of business.
March 30 a *kartal*, or closure of shops, took place at Delhi,
mob came into collision with the police, and deaths occurred.
ave of excitement passed over the Punjab. Violent disturb-
s broke out in Lahore, Amritsar and other centres when
s came that Mr. Gandhi had been forbidden to enter the
vince and had been sent back to Bombay under arrest. Be-
n April 10 and 15 mobs were in possession of these and
r towns in the central Punjab. Disorder assumed the char-
r of open rebellion, definitely anti-government and anti-
ish, communications were cut, and the civil authority was
maintained by military force. Martial law was proclaimed
mritsar on April 14, was extended subsequently to other dis-
s and was not finally withdrawn from every part of the Prov-
until June, although order was generally restored by the
of April. But the situation remained critical owing to the
ian War, and it was thought prudent to run no risks.

Bombay the news of Mr. Gandhi's arrest at Delhi was the
sion of an immediate outbreak of disorder in Ahmadabad,
capital of Guzerat, and in neighbouring towns. The military
to be called in, but not before numerous acts of incendiarism
violence and some loss of life had occurred. The disturbances
inated on the arrival of Mr. Gandhi, who expressed great
ow at the excesses of his followers and was allowed to address
normous meeting at which he upbraided the people for their
ence.

mritsar.—On April 13 " the tragedy of Amritsar " occurred.
hat city banks and other buildings had been pillaged and
it and Europeans murdered. The civil officers, finding them-
es powerless to cope with the mobs in possession of the city,
d upon the military to restore order. Brigadier-General Dyer,
officer commanding, deemed it necessary in the course of his
ations to disperse forcibly an unlawful assembly held in the
inwala Bagh. Nearly 400 persons were killed by the fire of
roops, and probably thrice that number wounded. His ac-
aroused intense indignation among Indians of all shades of
ical opinion, and became the subject of most bitter contro-
y, which was in no wise allayed by the appointment towards
end of the year of the Hunter Committee to inquire into the
disturbances which had arisen in consequence of the Row-
legislation. General Dyer's action was condemned by this
mittee, and it was decided by the authorities that he should
ive no further employment in India. After a warm debate in
House of Commons (July 8 1920), this action was approved
30 votes to 129, but the House of Lords, on July 20, by 129
s to 86, passed a motion "deploring" the treatment of Gen-
Dyer as " unjust " and as "establishing a precedent dan-
us to the preservation of order in the face of rebellion." *The*
ning Post, taking this view, raised a considerable sum as a
monial to the censured officer. In June 1924, the case came
the law courts in London. Sir Michael O'Dwyer, who was
enant-governor of Bengal at the date of the Amritsar affair
ight an action against Sir Sankaran Nair, formerly member
he viceroy's council, whose book *Gandhi and Anarchy* had
ibuted to him a responsibility for the shooting. Sir Michael
wyer won the action, receiving £500 damages, and the judge,
Justice McCardie, expressed the view " that the time and
method of General Dyer's punishment, if he were wrong,
most unfortunate."

he Afghan War, 1919.—Relations with Afghanistan had been
ormly good ever since the Amir Habibullah's visit to Lord
to in 1908. He had been received in state at Agra on Jan. 9
iat year, and afterwards went to some of the principal cities
idia and made a prolonged stay in Calcutta. The Amir was
hted with his reception, and let it be known that his friend-
with the British Govt. had been immensely strength-
. During the World War he was staunch; but on Feb. 20
, he was murdered, and his son Amanullah ascended the
ne.

ie succession was disliked by powerful factions in the state;
in his difficulties the new Amir lent an eager ear to the distorted reports of the disturbed state of the Punjab and of the nature of the Rowlatt Acts which found their way to Afghanistan. He concluded that an invasion of India might prove a solution of his domestic differences, appealing as it would to the religious fanaticism of his Mahommedan subjects, deeply stirred by the humiliation and defeat of Turkey and by the British conquest of Mesopotamia. His plan was to incite the independent tribes to rise and to follow up their raiding parties with his Afghan regular forces. But the frontier tribes were slow to move. Aggressive movements of his troops in the Khyber were countered by the rapid mobilisation of the army in India early in May, the occupation of the Afghan advanced base at Dacca and the bombing by aeroplanes of Kabul and Jalālābād. By the middle of May the Afghans asked for a cessation of hostilities, and in June the Amir accepted an armistice. In July his representatives attended a conference at Rawalpindi and on Aug. 8 a treaty of peace was signed, under which the Amir lost his subsidy and the privilege of importing arms through India. A separate letter officially recognised the freedom of Afghanistan from foreign control. Doubts have been expressed as to the wisdom of this concession. But control over the foreign policy of Afghanistan has always been nominal rather than real, and the withdrawal of the subsidy in itself implied the rescission of the reciprocal obligation.

Waziristan Expedition.—The Rawalpindi Treaty did not end the troubles on the frontier. The independent tribes of Wazirs and Mahsuds, who occupy a large block of country south of the Khyber line between Afghanistan and the British districts to the east, had risen in May at the instigation of the Afghans and raided the adjoining British districts. The Indian Govt. determined to undertake the permanent pacification of the country, a serious undertaking, as the tribes could place some 30,000 well-armed men in the field. A strong force was assembled on the frontier in Oct. and an ultimatum given to the tribes. The Wazirs in the Tochi Valley were soon subdued, but the Mahsuds fought with dogged obstinacy and great skill. There were two considerable encounters (on Dec. 21 1919 and Jan. 14 1920) with heavy British casualties. In the end the Mahsuds accepted the terms imposed upon them, and the military operations closed on May 7 1920.

The Non-co-operation Movement.—In Dec. 1919 the Montagu-Chelmsford scheme of constitutional reform became law by the passing of the Govt. of India (Amendment) Act. The King's proclamation of Dec. 23 dwelt in eloquent and arresting language on the political advancement conferred upon the Indian peoples, authorised the Viceroy to extend the royal clemency to political offenders in the fullest measure compatible with the public safety, and announced that the Prince of Wales would visit India to inaugurate the new constitutions. The effect of these gracious words was unfortunately marred by the excitement which attended the inquiry of Lord Hunter's Committee then in progress into the Punjab disturbances of the preceding April. The National Congress met at Amritsar, and passed resolutions denouncing the Government's action in the Punjab, demanding the recall of Lord Chelmsford and condemning the reform scheme as disappointing and unsatisfactory. This hostility towards the administration and rejection of the reforms by the extreme section of the Nationalists developed in the ensuing months into a definite " non-co-operation " movement organised by Mr. Gandhi.

The publication in 1920 of the report of the committee presided over by Lord Hunter, and of the correspondence between the Govt. of India and the Secretary of State regarding its findings, and the subsequent debates in Parliament renewed the bitterness and indignation which the Amritsar proceedings had aroused in India. About the same time the terms of the Sèvres Treaty became known to Indian Mahommedans and added flame to the " Khilāfat " agitation, which the pro-Turk section of that community had been vigorously fomenting. In Aug. Mr. Gandhi proclaimed in a letter to the Viceroy his adoption of non-co-operation as a remedy against a Government for which he retained " neither respect nor affection " on account of its " unscrupulous, immoral and unjust" action in the matter of the Caliphate and its failure to punish adequately the officials responsible for "the wanton cruelty and inhumanity" with which the disorders in the Punjab were suppressed.

In Jan. 1921 the Duke of Connaught visited India in place of the Prince of Wales, and inaugurated the new constitutions. The speeches delivered by him in opening the Legislative Assembly, the Council of State and the Chamber of Princes at Delhi and the Legislative Councils of Madras, Bengal and Bombay made a deep impression. His earnest appeal, as an old friend of India, to all parties, British and Indian, "to bury along with the dead past the mistakes and misunderstandings of the past," struck a note which found response in the proceedings of the new legislatures and in the Indian Press.

On April 2 1921 Lord Chelmsford made over the office of viceroy to his successor Lord Reading. No viceroy had been more tried by circumstances beyond his control, and no viceroy had shown more steadfast courage, patience or devotion to the highest ideals of his great office. The era will be a landmark in the history of modern India. It saw India started on the road to self-government and admitted on equal terms to a partnership in the British Empire. (T. W. Ho.)

THE NEW CONSTITUTION

During Lord Chelmsford's viceroyalty an important change had taken place in the political machinery. The Morley-Minto reform had introduced the electoral principle into the Indian legislatures, and given them a wider sphere of influence over the executive government. But in effect they remained advisory bodies, and the absence of any administrative responsibility whetted their critical faculty without giving them any corresponding practice in the actual work of government. The executive authorities, imperial and provincial, remained governments of officials, responsible to the Secretary of State, and through him to the British Parliament, and not amenable in any direct sense to popular control in India.

From this arrangement to the announcement of Aug. 29 1917 was a wide step, involving organic change and not taken before time. The enthusiasm which had welcomed the Morley-Minto reform had long evaporated, and the demand by the Indian leaders for administrative power was insistent. The Montagu-Chelmsford report conceded the justice of the demand, and proposed that responsible government, in the sense of government by ministers primarily responsible to an elected assembly, should be conferred on India by progressive stages. It recognised that India was not yet ready for full responsible government, that an electorate had to be created and that its representatives must at first be inexperienced. Its authors proposed therefore to confine the first stage of advance to the major provinces, and in these provinces to set up a dual form of government, generally known as "diarchy." This device, accepted only after all possible alternatives had been found impracticable, was a division of the provincial field of government into two sections, one of which would be transferred to the control of ministers chosen by the Governor from the elected members of his legislative council.

In July 1919 a bill embodying this scheme, with certain modifications, was introduced into the House of Commons, read a second time and referred to a joint select committee of both Houses presided over by Lord Selborne. The committee, after an elaborate investigation and hearing nearly 70 witnesses, accepted the main principles of the scheme, and dealt at length with the political and administrative problems involved in the bill. Their report (H.C. 203) is a most valuable constitutional document, indispensable to a study of the new régime. The bill passed both Houses substantially as amended by the committee, and received the Royal Assent on Dec. 23 1919. It takes the form of amendments of the Government of India Act, and has been so drafted as to admit of its being textually incorporated into the principal Act. As is usual with statutes relating to India, it left a great deal of the new constitution to be worked out by rules drafted and applied by the Government to meet the needs of each particular case.

Demarcation of Spheres.—If its provisions were taken in l
sequence, the first feature of the new Constitution would
demarcation of the duties of the "central" or Imperial
from those of the provincial Governments. The former r
certain powers of supervision and control over the prov
administrations; but its direct functions are now specif
listed, and the departments which are under the prov
Govts. are similarly enumerated. These Governments
their revenue from the departments under their own
trol, *i.e.*, land revenue, stamps, excise, forest, etc. The Im
Govt. takes the yield of its own central departments—rail
post and telegraphs, customs, income tax, salt, opium, etc
present, however, these do not balance its budget, which c
the whole cost of the defence of India; and consequently i
to levy subsidies from the provinces, though it is pledged to
go them when the development of its own resources shall pe
As with the administrative and financial powers, so also ar
law-making powers of the central and the provincial autho
carefully delimited.

The Provincial Sphere.—Each of the major provinces is
placed under a Governor. The whole of the provincial de
ments are divided in each province into two groups, the
served" and the "transferred." The former (at present la
order, justice, police, the land, etc.) are administered b
Governor and his executive council (of whom at least one
ber is an Indian); the latter (education, public health, excise,
are administered by the Governor and two or more Mini
who are chosen by him from among the leaders of the prov
legislature. These two bodies work independently, each i
own field; and their responsibilities are clearly distingui
The Governor is the link of union, and has full discretion to
them together for joint consultation on matters of con
interest. The Executive Council in its control of reserved
jects, is responsible through the Govt. of India and the Secr
of State to the British Parliament; the Ministers in their co
of transferred subjects are responsible to the legislative co
on the spot. This, in the briefest terms, is the system which
been named or nicknamed "diarchy." Its purpose is to pr
a field of actual duty in which Indian leaders can be train
actual practice in the art of Government. On the one hand,
will have the assistance of the Governor, and opportunit
consulting their official colleagues in the executive council
the other hand, the field entrusted to them will be car
defined, so that their work can be seen and judged by the
torate, and so also that any consequences of their inexpe
may not affect the sphere of administration which remains i
hands of the executive council.

The legislative council in each province has a large el
majority, with an element (under 30%) of officials and nomi
members. The elections are direct and the constituencies
ly territorial. A property qualification, differing in diff
provinces, determines the franchise. The vote has been giv
about 5,000,000 of the adult male population in the wh
India, female suffrage being left to the local option of the p
cial councils. For whatever legislation and supply they req
both halves of the Government are dependent on the legisl
thus constituted. In the "transferred" sphere, Ministers
secure the support of the legislature. If they fail, their
fails; and the ordinary course is for them to resign or be dism
by the Governor, so that they may be replaced by Ministers
can carry the legislative council with them.

In the "reserved" sphere, it is the task of the Govern
his official colleagues to reconcile the legislature to their p
But if they fail, their responsibility for right policy to the B
Parliament is in no wise diminished; certain safeguards
accordingly provided against the event of the council refus
law or supply for which it has been asked by them. The Go
or has an exceptional power to pass such a law by his own d
if he certifies that it is essential for the discharge of his resp
bility; but a measure enacted in this way has to be rese
for His Majesty's pleasure. Similarly the Government m
store a grant for expenditure which has been refused or red

the council if the Governor certifies in the same sense; and ase of emergency he may authorise any expenditure which ay be in his opinion necessary for the safety or tranquillity he province or for the carrying on of any department." Fi- y, should the legislature take action in any department which Governor regards as dangerous, he has wide powers to stop a or to refuse assent to it, or to return it for reconsideration, or :eserve it for the consideration of the Governor-General. ensive safeguards thus exist against the possible misuse of its er by the provincial legislature.

he Imperial Sphere.—In the central Government there o diarchy. The Governor-General and his Executive Council whom there are now in practice not less than three Indian nbers) still remain in sole and undivided responsibility to iament for the supreme Govt. of India. The central legisla- , however, has been radically altered by the 1919 Act. Lower House, or Legislative Assembly, has 144 members, 103 whom are elected direct by constituencies similar to those ch elect to the provincial legislatures but larger in area and a higher property qualification. In the Upper House, or ncil of State, are 60 members, of whom 33 are elected on a more restricted franchise. In neither Chamber therefore is e an assured majority for the Government, to secure the s, the taxation measures or the expenditure grants which it iires for the administration of the country. The underlying ception of this unusual situation is that it should throw the ernment more upon the support of the elected representa- s of the people and weaken its reliance on the direction of the etary of State. It was anticipated that, where the Executive t. and its legislature are in accord on policy, there would be a vention of non-interference by the Secretary of State, subject ourse always to the overriding power of the British Parlia- t. It was not, however, unforeseen that the Central Govt. not always be able to carry the legislature with it, and ma- ery was provided for avoiding a deadlock in such an event. legislative business a difference between the two Chambers be referred to a joint sitting. If in either Chamber a bill is osed or amended so as to affect "the safety or tranquillity ritish India or any part thereof," the Governor-General may it. He may also, as under the previous constitution, veto a or refer it for His Majesty's pleasure. Should he recommend l which either Chamber accepts and the other rejects, he may t it as enacted; or if both Chambers reject it, he may make it an Act on his own responsibility. In both cases, however, the ernor-General must first have certified that the "passage of bill is essential for the safety, tranquillity or interests of ish India or any part thereof," and the measure must subse- ntly be laid before both Houses of Parliament; effect may be given to it, unless in a state of emergency, until His Maj- 's assent has been received. In financial business the supply nts have to be voted by the Legislative Assembly; but if a nt which the Governor-General declares to be essential to discharge of his responsibilities is refused or reduced, he may ore it. Expenditure on defence and in the political and ec- astical departments, charges prescribed by law, loan charges certain salaries and pensions need not be voted; and the ernor-General has power to sanction vital expenditure in s of emergency.

urther Development.—The above is an outline of the complex me that comprises the first stage in what the preamble of the Act describes as "the gradual development of self-govern- institutions." As "the time," to quote the Act again, "and manner of advance can be determined only by Parliament," provided that, 10 years after the passing of the Act, a Par- entary Commission will go to India, to inquire into the work- f the reforms, and to report on the desirability of establish- the principle of responsible government, or of extending, ifying or restricting the degree of responsible government ady existing. In other words, the retention or otherwise of electoral system and diarchy will be examined on the evi- e of the work actually achieved; and it will be decided, if chy is retained, whether further departments should be transferred from the official half of each provincial Government to the control of Ministers. It has been necessary to recite the main features of the new constitution because of the influence they exercised on the political history of Lord Reading's viceroyalty.

LORD READING'S VICEROYALTY 1921–6

Arriving in April 1921, the Earl of Reading brought to the office of Governor-General a prestige not exceeded by that of any of his forerunners. Having served as Law Officer of the Crown, Cabinet Minister, Lord Chief Justice of England and British High Commissioner in the United States, he enjoyed an eminence both as a lawyer and as a statesman which made his selection a particular compliment to India. The task which confronted him required all his courage and all his experience. Though the actual machinery of the new constitution had begun its work with relative smoothness, the country was seething with an excitement for which the political changes were merely a pretext. A moderate section of Indian leaders commanded the Councils and furnished ministers to the provincial Governments. But they owed their position to the boycott of the whole scheme by the extremist politicians, whether Hindus or Moslems, who had taken no part in the elections of the previous winter, and now held no place in the Councils or the Ministries. The real battle of India's future was being fought outside the domain of constitutional Government.

Hindu Extremism.—The more advanced Nationalist party were gaining strength and audacity under the magnetic leadership of Mr. Gandhi, who had been appointed virtual dictator of their forces at the National Congress of Christmas 1920. He was sweeping the country with his cry of non-violent non-co-operation. The yoke of foreign dominion was to be thrown off and the curse of western commercialism eradicated. India would then be worthy of complete Home Rule, and a date (at first Sept. 30 1921, but subsequently extended on several occasions) was actually prophesied for the disappearance of the British Government. In his campaign Mr. Gandhi was aided by bands of "national volunteers," pledged to deliberate lawlessness, and carrying the spirit of unrest from the towns into the rural areas. Outrage after outrage showed the inability of the masses to distinguish between non-co-operation and anarchy. The tide of disaffection was rapidly rising, and the jails could no longer contain the volunteers who courted a tolerable martyrdom. The condition of the country had not been worse since 1858.

Mahommedan Extremism.—Moslem feeling also had been growing in acerbity for several years. Long persuaded that it might rely on the special consideration of the British Govt., it had been rudely shocked by the reversal of the partition of Bengal in 1911, for the severance of Eastern Bengal into a separate province had been regarded as a measure for the protection of the large and impoverished Moslem community in that area. Genuine distress was felt at the misfortunes of Turkey in Tripoli (1911–2) and the Balkans (1912–3); and among the younger men a movement of active sympathy with the "Young Turk" party made considerable headway. When the Sherif of Mecca revolted against his Turkish overlords it was not only the young Indian Moslems who condemned his action, or resented the part which they were convinced that Great Britain had played in fomenting it. Though there was very little active disloyalty during the war, and although the cooler heads among the Indian Mahommedans disapproved the action of Constantinople in siding against Great Britain in the World War, an under-current of religious solidarity was stimulated by economic discontent and a lively sense of the waning of the power of Islam.

The Treaty of Sèvres was attacked as a device of England to humiliate her former friend and ally; and a movement of protest was headed by two brothers, Mahomed Ali and Shaukat Ali, whose liberty had been restrained for seditious agitation during the War. Their followers were known as the Khilāfat party from their claim that the temporalities of the Sultan, as Khalifa of Islam, should be restored. With them there was no pretence of non-violence; they attempted to seduce the Mahommedan troops, played on religious fanaticism and talked of proclaiming an Indian republic. Seeing in them a useful adjunct to his own campaign, Mr. Ghandhi took the Khilāfat movement under his wing. It was in a struggle against this combination of forces that the first three years of Lord Reading's Govt. were mainly spent.

The Moplah Rising.—In Aug. 1921 the most serious of many unpardonable deeds of violence broke out. The Malabar country in Madras is occupied by 2,000,000 Hindus and about 1,000,000 Moplahs, an ignorant Mahommedan peasantry of mixed Arab and Indian descent with an evil reputation for outbreaks of fanaticism. Among the latter the Khilāfat excitement spread like wildfire; and during July and Aug. 1921 meetings were held and arms collected to prepare for the coming of an Islamic millennium and the overthrow of British rule. When the magistrate of Calicut attempted to make some arrests, he was met by armed force, and rebellion immediately broke out. Railway and telegraph lines were cut, roads blocked, Government offices burned and a Moplah king proclaimed. The few Europeans who failed to escape from the district were brutally murdered, and then the Moplahs turned upon their inoffensive Hindu neighbours. They burned villages, sacked temples, outraged women, massacred and attempted wholesale the forcible conversion of the Hindus to Islam. The extraordinary difficulties of the country made the task of suppression particularly difficult; and the troops which were locally available had to be reinforced at the beginning of Oct. by four battalions, a pack battery and a section of armoured cars. A drive was then made through the affected area, and the rebellion gradually collapsed. It is estimated that during the campaign the Moplahs lost 3,000 in killed alone.

The whole tragedy was a definite fruit of the extremists' challenge to law and order. It was also the first shattering blow to the Hindu-Moslem unity which the extremists had hoped to establish for their own purposes; Mr. Gandhi and his lieutenants professed to belittle the outbreak, but it soon became apparent how gravely the Moplah atrocities rankled in the minds of the ordinary Hindus. Meanwhile the Ali brothers had got to the end of their tether. In Oct. 1921 they were arrested, tried at Karachi and sentenced to two years' imprisonment. But the Khilāfat agitation was not now to be checked, and it soon gained fresh momentum.

Visit of the Prince of Wales.—On Nov. 17 1921 H.R.H. the Prince of Wales landed at Bombay for the visit to India which had been postponed in the preceding year. Efforts, partly successful, but frequently defeated by the Prince's arresting popularity, were made to boycott the public ceremonials arranged in his honour; yet the tour was courageously carried through. He rapidly traversed British India, carried through a heavy tale of ceremonies and interviews, visited several of the leading Indian States, as well as Nepal, inspected the northwest frontier, attended the Kadir Cup (pig-sticking meet) near Meerut, and finally left for England from Karachi in March. The just comment on results of the tour is a quotation from the Viceroy's telegram to the Prince on his departure: "You leave India having won India's heart, for the road to the heart of the people lies through knowledge and sympathy. From the day you landed in India you set yourself to gain the one; Providence has endowed you with the other."

Decline of Non-co-operation.—The year 1921 marked the apogee of the extremist movement, and among moderate men of all classes it was felt that the Govt. of India was approaching the limits of permissible patience. Mr. Gandhi was preparing a scheme of mass civil disobedience, both aggressive and defensive, and was on the eve of launching it, when on Feb. 4 1922 another hideous outrage occurred. At the Chauri Chaura village, in the east of the United Provinces, 21 policemen and village watchmen were set upon by a mob of "volunteers" and excited peasants and battered to death or burned alive. Mr. Gandhi at once suspended his orders for civil disobedience, issued a new "constructive programme" which threw his followers into confusion, but he was at last arrested on March 10 1922. Put on trial at Ahmadābād on three charges of spreading disaffe and instigating the overthrow of the Government, he ple guilty and was sentenced to six years' simple imprisonn His trial produced no popular excitement. It was overshad by the resignation by Mr. E. S. Montagu of his office as S tary of State, as a sequel to his having published, without net approval, a dispatch from Lord Reading's Govt., in w His Majesty's Govt. was urged, in deference to Mahomm sentiment in India, to revise the Treaty of Sèvres.

The cause of non-co-operation now began to waver. The unteer movement was collapsing from want of funds. Mr. dhi's repeated prophecies of the millennium had been falsi The Nationalist schools which had been started to rival the ernment institutions had been failures, and masses of stud saw their careers imperilled. Nor was the boycott of the maintaining its popularity among the lawyers who abound Mr. Gandhi's camp. The unity of Hindu and Mahomm action was severely shaken by the numerous outbreaks of r violence. Above all, good harvests were steadying the ma and economic discontent was being allayed. By the end of a strong section of the Nationalist party wished to reverse policy of holding aloof from the councils.

The Akali Riots.—The unsettlement, however, which Nationalists had engendered, was no longer theirs to curb, took little heed of political manoeuvres. It had now penetr the slow-moving Punjab, and the doctrine of non-violent struction to authority was bearing strange fruit on unlikely For some years there had been a reforming movement among Sikhs, directed at recovering a number of scattered temple their religion from hereditary incumbents (Mahants) and ploying their revenues for the spiritual service of the people erally. The puritan reforming section (Akalis) had got into habit of taking the law into their own hands, and ejecting violence the Mahants of whom they disapproved. The appealed to the courts, or engaged armed retainers to de their property. In either case it was necessary for the Gov ment to intervene; and it suited the employers of the A bands, adherents of the non-co-operation movement, to dis this intervention into hostility against the Sikh religion. attempts by the Government to bring the Akali fervour orderly channels were frustrated, and in 1922 the Akalis es lished such a reign of terror that military assistance had t supplied to the police.

Then came the episode of the Guru-ka-Bagh, one of the extraordinary stories of recent Indian history. At a small te 10 miles from Amritsar the police had prevented some A from trespassing and cutting trees; whereupon from all ove Punjab bands of Sikhs assembled to assert their right over land. The method they employed was bewildering in its de ture from the usual martial spirit of the Sikh. A band of A volunteers started every morning from Amritsar, under a to employ no violence but to reach the temple or to return s less. The police who were deputed to protect the property w obliged to use their batons (in India, their *lathis* or iron- bamboo staves) sufficiently to stun the volunteers, who were t carried trimuphantly back to Amritsar in the ambulance which their sympathisers had in readiness. This demonstra went on day after day, until the whole Sikh community was i ferment and its traditional loyalty to the Government was but destroyed. In 1923 the animosity of the Sikhs was tu against the administration of the Nabha State, the Mahara which had abdicated rather than face an inquiry ordered b Govt. of India. Regrettable incidents occurred; but the fu of the whole business at last began to dawn upon the S mind, and by the end of 1924 common sense was reassert itself.

It was not only in the Punjab that 1924 and 1925 were diffi years. Moslem feeling was very bitter about Great Brita treatment of Turkey. Susceptibilities were set on edge by Greek invasion of Asia Minor, and subsequently elated by victories of Mustafa Kemal. Either emotion had a tenden bring the Moslems into conflict with their Hindu neighbou racial tension again became acute in the latter half of 1922. following two years were thus marked by an almost continu- succession of sporadic disturbances in Northern India.

cond Phase of Lord Reading's Viceroyalty.—At the end of came the second general election. A strong section of the gress Party, adopting the label of Swaraj (Home Rule), e away from Mr. Gandhi's programme of boycott and put up ass of candidates for the councils. The Liberal or Moderate y, which had predominated in the first triennium of the new latures, were attacked as having supported the Government lstering up an unpopular constitution. They had also lost sion and discipline, and a new party, describing itself as pendent, but standing on no common platform, made serious ads on their position. For the Swarajists the election was a tantial victory. They secured nearly half the elected seats e Central Assembly; and in at least two of the provinces they manded the provincial councils. Their discipline was good, they had entered the legislatures with the avowed object uniform, continuous and consistent obstruction with a view ake Government through the Assembly and the Councils ossible." It was only in the central provinces, however, that proceeded at once to extremes, rejecting the budget pro- n for the salary of Ministers, and ultimately compelling the ernment to resume the "transferred" subjects and suspend operations of diarchy. In the central legislature, which first after the elections on Jan. 31 1924, they concentrated on de- ding that the grant of full responsible government should be dited. When this was not endorsed by the Government, retaliated, in coalition with a sufficient number of members he other parties, by rejecting the Finance bill for the year, the result that the Viceroy had to use his emergency powers certify the necessary expenditure of the administration. episode, however, and the subsequent conduct of the Nation- Coalition during the remainder of the session, established n in the rôle of a constitutional opposition, thus marking w stage in the political development of the country, so that second phase of Lord Reading's viceroyalty may be taken as ng from Jan. of 1924.

he last prop of non-co-operation was knocked away when, special summer session of the legislature, the Swaraj party d with the Government on a tariff measure; and Mr. Gandhi, had now returned to politics, threatened to lead his followers of the National Congress into a campaign of social reform and du-Moslem unity. Of the latter the prospects were gloomy, the tale of racial conflicts and bloodshed was ever length- g. The culminating outbreak occurred at Kohat in Sept. 4, and ended in the whole of the Hindu population fleeing n the town. A unity conference, hurriedly got together at hi, though attended by representative members of all the ian communities, ended in little but good resolutions. Equally fective was an attempted coalition of all the political parties he councils; but Mr. Gandhi was won back to the Congress p, and the opening of 1925 found the Swaraj party temporari- n a position of considerably improved strength. In Bengal, oting their policy on opposition to an ordinance which the ernment published against a recrudescence of revolutionary ne, they refused for a second time to vote salaries for Minis- , with the only result that the Governor in Executive Council imed control of the transferred departments and diarchy for me was at an end. But in the Central Assembly the policy of cking took second place to a growing divergence between the Independent party and the Swarajists.

he Muddiman Inquiry.—In the autumn of 1924 an important uiry into the working of the new constitution was held by a mittee under the presidency of Sir Alexander Muddiman. appointment was in response to the demand by the National- politicians for the early abolition of diarchy in favour of some n of provincial autonomy. Its business was to advise on any ects in the working of the 1919 scheme and on any amend- ts compatible with the general purpose and structure of scheme. The report (published as cmd. 2,360 of 1925) was wofold one. A minority of the members found that the new system had broken down, that transitional measures were inappropriate, and that steps should at once be taken to establish a permanent constitution. The majority on the other hand recorded their opinion that, though the experiment had worked too short a time to justify a final verdict, they were not convinced that it had failed. They recommended several minor improvements in the machinery and procedure; but they concluded that, "except by some form of dualism, it was not possible to afford an equally valuable training towards responsible government in India and still to safeguard those conditions upon which government depends." The Swaraj claim that responsible government should be expedited was by implication rejected.

While the controversy which followed the publication of the Muddiman report was running its course, Lord Reading accepted an invitation from the Secretary of State for India (now the Earl of Birkenhead) to visit England for the purpose of personal discussion in the summer of 1925; the Governor of Bengal, Lord Lytton, officiating as Viceroy in his absence. This was the first exercise of a new Act enabling viceroys and provincial governors to obtain leave during their term of office. It was obviously desirable to announce a line of policy in answer to the protestations of the Nationalists that the 10-year period of experiment should be curtailed, and that the British Parliament ought not to impose its judgment as to the fitness of India for self-government.

On July 10 accordingly Lord Birkenhead made a careful statement in the House of Lords, reviewed the working of the Reform Act of 1919, and emphasised the lack of co-operation and the actual hostility displayed by a section of the Indian leaders. He expressed his willingness to consider any practical scheme of advance on which Indians could agree, and he did not close the door to an antedating of the statutory inquiry due in 1929, if Indian leaders gave evidence of a sincere and genuine desire to work the present machinery. On Aug. 20 a corresponding speech was made by Lord Reading in opening the autumn session of the Indian legislature, coupled with a plea for a closer co-operation. This did not avail to dissuade the Assembly from rejecting the advice of the Muddiman Commission; but when, in the same month, the Chamber had for the first time to elect its own president, its choice fell on Mr. V. J. Patel, who accepted the office and solemnly dissociated himself from all parties, although he had been formerly one of the most advanced non-co-operationists in the Swaraj camp.

Regrouping of parties was the keynote of the caucus meetings at Christmas 1925. The die-hard Swarajists flung an ultimatum at the Government, with threats of civil disobedience, obstruction and the refusal of office; and over this the Congress split. A new wing of the party, representative mainly of western India, broke off and declared for a policy of "responsive co-operation." At a separate conference the Liberals prepared a separate platform; so did the Independents; and a powerful gathering of Moslems at Aligarh assented to a definite anti-Hindu propaganda. The united front which political India had seemed to present in 1921 was seriously disintegrated by 1926; but the processes of schism and reunion are never at an end.

Administrative Progress.—Although political excitement during Lord Reading's viceroyalty seriously hampered the daily routine of administration and often went near to paralysing the legislatures, yet the administrative system was too firmly rooted to be rendered fruitless. In the provinces the output of legislation was abundant; and in the Central Assembly measures of much importance were painfully hammered out, notably in the removal of racial privilege, in establishing a protective fiscal system, and in meeting problems of organised labour which were for the first time emerging in India. The rural community, it is true, were left the Cinderella, as well as the catspaw, of political advance; but Lord Reading sufficiently appreciated their dominant importance to procure, on the eve of his departure, the appointment of a royal commission to go into the whole question of agriculture. Fortunately there had been steady advance in agricultural prosperity. A short monsoon in 1920 necessitated considerable famine-relief operations in the succeeding year; but thenceforward a series of remarkably good harvests lowered prices and restored the contentment of the masses. The epoch of economic distress in 1920–1 had affected the manufacturing classes even more than the patient agriculturists. Labour trouble came to the front as never before, 1921 witnessing no fewer than 400 strikes of varying magnitude, and legislative measures of a new type began to appear on the statute book.

Social Organisation.—An amended Factory Act in 1922 prescribed a 60-hours week and raised the minimum age of child workers from nine to 12. A Mines Act in 1923 dealt with the employment of women and children below ground, restricted the hours of adult labour to 60 above ground and 54 below, and enacted a weekly day of rest. The first Workmen's Compensation Act came into force in 1924, and measures were undertaken for the regulation of trade unions and the settlement of industrial disputes. Many of these steps were taken in ratification of the conventions adopted by the International Labour Conference held at Washington in 1919. They were described by the Director of the Geneva Labour Office as " the first tangible results in the East of the ideals inspiring Part XIII. of the Treaty of Peace." The same official formally thanked the Govt. of India for " the conspicuous example of social and labour progress which it is showing to the world." Besides these legislative measures, a quieter process was at work in the steady improvement of the depressing housing conditions in the large labour centres, such as Calcutta, Bombay and Cawnpore. The city improvement schemes there and elsewhere have produced remarkable results, which, even from a purely material point of view, should prove remunerative; for nothing has prejudiced the efficiency of Indian labour more than the periodical flights of the labourer back to the healthier conditions of his native village.

In the social organisation of India the post-War record is one of considerable change. The non-Brahmans of Madras struck against Brahman domination, and seized power in the new provincial legislature. The lowest strata of outcasts or " untouchables " have shown signs of organising for their own protection and betterment, and Mr. Gandhi led a vigorous, if not a wholly popular mission for their uplift. Some flutterings of a feminist movement were perceptible. An accomplished Indian lady, the poetess, Mrs. Sarojini Naidu, occupied the chair of the National Congress of 1925. Numerous ladies of the classes which formerly prided themselves on their seclusion are now to be met on political and other platforms, and some little progress is being made towards the recognition of the re-marriage of Hindu widows. Social progress, however, lags far behind political aspirations.

Recrudescence of Political Crime.—Allusion has already been made to the inroads on the tranquillity of the country which ensued on extremist agitation. They unfortunately provided cover for a revival in Bengal of revolutionary crime on the familiar lines:—dacoities, looting, assassination and the intimidation of witnesses. Conspiracies multiplied in 1923; and early in 1924 an inoffensive Englishman was shot in the streets of Calcutta in mistake for a police official; the Bengal Provincial Conference in the following July passing a resolution laudatory of the " noble self-sacrifice " of the murderer. In Oct. 1924 came a special ordinance for dealing, by exceptional procedure of arrest and trial, with anarchical offences in the province; and among the earliest suspects against whom it was enforced were two members of the Bengal Legislative Council, and the chief executive officer of the Calcutta Municipal Corporation. By the extremists some capital was made of this departure from the ordinary and not too effective methods of the criminal law; but the restoration of order which followed the ordinance was its justification.

The Indian Civil Service.—Not least among the anxieties of the time was the effect of political change on the public services which constitute the main structure of Indian administration. It was not only that members of the Indian Civil and other services found their position substantially altering, as they became transformed from the originators of policy into the subordinate executants of a quasi-parliamentary system. This was inevitable, but it was accompanied by virulent attacks from Indian politicians, who impugned the good faith of the services and made no secret of their desire to replace Englishmen by their own countrymen; and it was accentuated by the domestic anxiety w resulted from the growing cost of living, of passages to Eng and the like. Many valuable public servants retired prematu and the English universities soon stopped the supply of rec of the type that had previously been available.

In 1923 a royal commission was appointed to inquire int whole problem; it was composed of four Englishmen and Indians with Lord Lee of Fareham as chairman. In May it presented a report[1] remarkable for its unanimity. It re mended a large increasein the recruitment of Indians fo services, and the entrusting entirely to local Governmen recruitment for the " transferred " services. On the other h it advised several alleviations of the financial position of E peans in the services, the adequate protection of the servic the execution of their duties, and the establishment of a P Service Commission on the lines familiar in several of the Do ions. These proposals were attacked in the Assembly, but Govt. of India showed their intention of accepting the re and its implications, and certain declarations by the h Govt. made it clear that they were determined to maintain policy of keeping a strong and competent European elen in the leading services. Recruitment almost immediately proved, though certain of the services, particularly civil medical appointments, cannot pretend to offer former attractions to Englishmen.

Indians Abroad.—The Indian Relief Act of 1914 in the U of South Africa and the outbreak of the War in the same pushed into the background for a time the indignation fel India about the treatment of its nationals in certain of the do ions and crown colonies. But the grievance soon acquired incre impetus with the argument that Indian troops were considered enough to fight by the side of forces from parts of the Em which refused civic rights to Indians in peace time. Raised definite form at the Imperial Conferences of 1917 and 1918, issue led to a " reciprocity agreement." Trouble revived, h ever, in various forms in Natal and the Transvaal, in East rica and in Fiji; and the Imperial Conference of 1921 was a called into consultation. It passed a resolution to the effect British Indians domiciled in another part of the Empire sh be given recognition of their right to citizenship. South Af however, where it is estimated that 160,000 Indians are sett declined to be a party to this declaration, and has unifor urged its own responsibility for regulating the status of its habitants in its own interests. In Natal (where the most of Indians are domiciled) and the Transvaal the tendency, in s of theoretical concessions, has been to discourage Indian sett by imposing definite civic disabilities; and the Union Gov support of the " Class Areas bill " has alarmed the Indian tlers, who believe that it will be used as a weapon for the pulsory segregation of Asiatics in urban areas.

Bitter though the feeling became in South Africa, it reac an even more acute point in Kenya, where at one time th seemed an imminent prospect of open hostilities between British and the Indian settlers. There the Indians had grievances: the closure of the highlands of the colony to th compulsory segregation, inadequacy of their franchise and re sentation and threats to stop immigration. From an inq held by the Colonial Office in 1923, a policy was announced H.M. Govt. which, though conciliatory on most of the point issue, failed to allay the sympathetic agitation in India; and whole question was again brought before the Imperial Con ence in the same year. Four of the Dominions and the Colo Office itself accepted the principle of consultation with Govt. of India on the status of Indians in the Dominions Colonies; South Africa stood alone in refusing to hold any hopes of the extension of the political rights of the Ind residents. From the informal discussions that ensued, a m accommodating temper developed. In Kenya the former set ment was modified by the Labour Govt. in 1924, and tens was relaxed by the local Indians accepting certain nominati for the legislature. In South Africa the patient labours of a de

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[1] East India (Civil Services in India), Cmd. 2128 of 1924.

from India paved the way for the appointment of a con-
e to which the Union Govt. assented in April 1926.

those who do not know India, there is difficulty in appre-
g how seriously these grievances react on the political situa-
here. They are universally interpreted as betokening racial
ance, an intention to humiliate Indians as such, and the
ion in practice of that Imperial citizenship which India is
offered in theory. They provide extremists with a handle
timulating popular indignation against the British Govt.
hey complicate its task. On the other hand, little allowance
en made in India for the considerations which are of vital
ent to a European community imbedded in a vastly larger
enous population.

e North-West Frontier.—On the conclusion of the War which
ew Amir forced on India in 1919, there came clear evidence
revival of Russia's old thrust towards India. It was with a
to fomenting revolutionary trouble in India that Bolshevik
icles were pushed into Persia and Afghanistan; and when in
a Russo-Afghan treaty was concluded, one of its chief fea-
s was the establishment of Russian consulates so near the
n border as Kandahar and Jālālābad. The Amir was not
se from playing off one of his neighbours against the other;
after inviting a mission from India to come to Kabul and
tiate an Anglo-Afghan treaty, he kept it dangling through-
1921 before coming to final terms in Nov. of that year.
conditions included the complete independence of Afghan-
, and the opening of legations at London and Kabul. With
ccrediting of an Afghan Minister to the Court of St. James,
riod of greater cordiality was inaugurated, though serious
ion arose in 1923 over the Afghan attitude towards certain
tier outrages, and in 1925 a Russo-Afghan Trade Conven-
indicated the continued flirtation of the Amir with his Soviet
hbours. He has also secured a treaty of alliance and mutual
nce with the new Turkish Govt. of Angora. Meanwhile he
embarked on a programme of domestic reform and progress,
h offers some promise of opening his country to European
ences.

elations with the frontier tribes improved after the cam-
ns of 1919 and 1920; but in 1923 a gang of outlaws in Afghan
itory were guilty of slaying two British officers near Landi
al, of shooting the wife and abducting the daughter (after-
ds gallantly rescued) of an officer in Kohat cantonment, and
nurdering another officer and his wife at Parachinar. Apart
n the necessary punitive measures, the Govt. of India initi-
l a permanent policy of controlling the Mahsud country, one
he chief storm-centres on the border. Dropping the plan of
tary occupation, they adopted a scheme of penetration of
ls suitable for motor transport, guarded by local irregulars,
commanded by two strong posts at Razmak and Manzai.
even higher importance was the extension by five years of
our in the most forbidding country, of the Khyber railway
n Jamrud to Landi Khana; the first train through the Khyber
ss being run on Nov. 2 1925. A new treaty was signed with
pal in Dec. 1923. It contains provisions for mutual informa-
n of any trouble with adjoining states, and others for regulat-
the transport of arms and merchandise. The traditions of
ndship with this allied state have been strengthened.

Retirement of Lord Reading.—At the end of March 1926 Lord
ading laid down the office which he had filled with courage
l distinction during a period of special difficulty. By the exer-
of extreme patience, he had allowed the vehemence of 1921 to
aust itself without deriving fresh food from any untoward
p of the Government and he had guided the inevitable reaction
o constitutional channels. He had taken measures for the
ncial health of India, and particularly for economy in its
litary administration. He had been diligent in removing
evances within India and vigilant for her interests abroad.
retirement he received the high honour of promotion to Mar-
ess: and he was succeeded by Lord Irwin of Kirby Moordale, a
ndson of the Sir Charles Wood who, as Secretary of State for
lia, had laid down the lines of the existing educational system
1854.

II. EDUCATION

The dominant factor of the educational system continues to be, as from the East India Company's days, the insistent demand of the middle-classes for secondary and university education as a means of livelihood. This has been supplied by the State to the limits of its means on very cheap terms, to the comparative neglect of the agricultural and labouring classes who, while not actively hostile to the schoolmaster, were well content to do without him. The effects of this neglect, the failure of secondary education to meet the needs of the country's industrial development and the largely unsatisfactory character of such education for any purpose combined to make educational reform the most urgent, as well as one of the thorniest, of current administrative problems. The lines laid down by Lord Hardinge's Govt. were vigorously pursued by his successors.

University Education.—The Calcutta University Commission reported in 1919. Presided over by Sir Michael Sadler, it consisted of seven members, of whom four came direct from England and two were Indians. The report condemned in emphatic and impressive language the whole system of secondary and university education, as it existed in Bengal, and, subject to qualifications, in other parts of India. It was based on an external examining university and a multitude of affiliated colleges scattered throughout the country. It was content to leave the ordinary student to believe that the passing of examinations is the only thing of value in a university training. The affiliated colleges were, as a rule, poorly staffed and equipped; the teaching mechanical; and the conditions for the students pitiable. The secondary schools feeding the colleges were even worse; and boys entered the university so ill-prepared that the first two years were spent in what was really school and not college work.

The commission advised radical reforms. The universities should be centralised, unitary, residential, teaching bodies with a government of their own. Tuition of a preparatory and not a university type should be removed to a new grade of intermediate colleges, where the curriculum would be of a varied kind and would lead up to appropriate examinations not under university control though qualifying for entrance to a university, and having an independent value as a certificate of general education. Students would thus enter the universities at a later age and at a stage represented by the old "intermediate" examination, thus relieving the universities of a part of their unwieldy host of undergraduates. These recommendations were generally welcomed, and most of the former universities (including the Hindu University at Benares, which owed much to the energy of Mrs. Besant) have been re-constituting themselves accordingly, while new universities of the teaching and residential type are being built up at Dacca, Aligarh (Moslem), Lucknow, Rangoon, Patna, Nagpur and Delhi; yet another being under contemplation at Agra to relieve the external work at Allahabad. The multiplying of universities, however, may go too far; there is already some danger of the lowering of standards, in competition for undergraduates; and it is hoped that an Inter-University Board for all India will be strong enough to maintain standards and insist on modern methods of instruction. The latest returns were materially affected by the boycott of governmental institutions under Mr. Gandhi's stimulus; but they showed the number of students at universities and colleges to be in the neighbourhood of 60,000, of whom more than two-thirds were Hindus, and not so many as 3% women.

Secondary Education.—The establishment of "intermediate" institutions advised in the Sadler report, and the equally essential improvement of the mass of high schools, have not progressed so rapidly as university reform, mainly owing to the shortage of funds. Boards for secondary and intermediate education, however, have been set up in several provinces and improvements are being slowly effected. The attendance at secondary schools of a non-technical type in 1922 was 1,240,000, females being in the ratio of rather over 10%. The "national" schools, with their cult of the spinning-wheel, which Mr. Gandhi started at the height of his non-co-operation movement, have now largely disappeared, the best of them having been rescued by applying for official recognition. Technical and commercial schools were equally handicapped by narrow means, and the 1922 attendance at them was only some 21,000.

Primary Education.—The pace of development here has recently been seriously retarded by financial difficulties; in 1909 the number of children at primary schools was 4,420,000; in 1918 it was 6,000,000; by 1922 it had risen only to 6,310,000. And yet it is from them that all true improvement must start, as well as all hope of creating an intelligent electorate. The difficulties are many: the traditions which confine education to certain castes, communal troubles, bad communications, the dearth of competent teachers, but above all the poverty of the rural parent, who cannot spare his sons from the ranks of the bread-winners and has no belief whatever in educating his daughters. To these permanent obstacles must be attributed the fact that, according to the census of 1921, only 122 in every thousand men, and 18 in every thousand women, in the country can read and write. Scarcely 3% of the population are enrolled in the primary schools, and the total numbers under instruction of all sorts are 9,300,000 out of the 247,000,000 inhabitants of British India. In face of these figures it is not surprising that the legislatures have frequently turned to the remedy of compulsion. Acts asserting the compulsion principle have been passed in several provinces, but the translation of principle into practice is still incomplete. Meanwhile the decentralisation of primary education offers a prospect of greater elasticity, especially in adapting the school curriculum to rural needs.

III. DEFENCE

Indian Frontiers.—The defence of India is a three-fold problem—the protection of its land frontiers, the maintenance of internal order and the guarding of its seaboard. It is natural to think of the frontier problem mainly in terms of the turbulent northwest border, where the military strength has so long been obliged to concentrate. Not only is the attitude of the tribes incalculable, but Afghanistan, though the present treaty relations with it are excellent, has too often developed a spirit of unprovoked aggression in the past; and the ancient menace of a Russian invasion through Afghan territory has, after long abeyance, revived in the new form of Bolshevik activity directed against the stability of government generally and British government in particular. "The road to London," declared Lenin in 1920, "is through Kabul and India."

But grave though these preoccupations are, other frontiers must not be forgotten. On the northeast, Nepal is a state of considerable military importance which furnishes, from its Gurkha peasantry, some of the best material in the Indian army. Fortunately it has a long tradition of friendship with India and many common interests. Behind it however and marching with India on its flanks lies Tibet, harmless enough in normal times, but always liable to Chinese influence. China herself adjoins Burma for over 1,000 m., and occasional lawlessness affords some indication of what might follow the development of an unfriendly spirit at Peking or even in the province of Yunnan. Further south, a fringe of French Indo-China and then 600 m. of Siam complete the Indian border.

Nevertheless, the northwest frontier remains at present the focus of interest. Its military risks are enhanced by the extraordinary physical difficulties of the country, by the almost unparalleled fierceness of its climate, by the fact that the sturdy mountaineers are now well-armed, and also by the oscillation of the British Govt. in the past between a policy of standing on an artificial borderline against the Pathan tribes and a forward policy of advancing the British sphere of influence, or even of control, towards the frontier of Afghanistan proper.

The Kitchener Reorganisation.—It was thus on the defence of the northwest frontier that Lord Kitchener riveted his attention when, in the course of his long tenure of the post of commander-in-chief, he set himself to the task of reconstituting the army in India. Though able men before him had done much to make it an efficient instrument of war, Lord Kitchener brought to bear upon the problem new ideas and methods. The organisa
the Indian Army which he inherited dated from the M
It failed, he considered, to distinguish sufficiently between
quirements of internal security and those of offensive w
It did not earmark troops for these two distinct purpos
train and equip them accordingly, but left the selectio
mobilisation of an active army in the event of war to t
moment. Lord Kitchener aimed, therefore, at creating
the forces at his disposal (some 230,000 men in all), a fiel
capable of being immediately mobilised, of the strength
he considered would be required to defend India against
sian advance through Afghanistan, until help could be ob
from England. He proposed to mark off this army fro
troops allotted for internal defence, to distribute it conven
by divisions (each division comprising some 13,500 comba
of all arms), in homogeneous military areas, and to train
war formations under the generals who would command
field. He broke up the four army commands which he
existing, and replaced them by nine divisional command
each divisional command he proposed to place a self-cont
division of the field army, together with the necessary co
ment of garrison troops that would be left behind for in
defence in the event of mobilisation. When fully mobilise
field army would comprise some 120,000 combatant troop
more than half the total strength of the army in India. Ade
transport and supplies were to be provided and every arr
ment made to enable each division of the field army, thoro
trained and fully equipped, to pass rapidly to a state of war,
required, without confusion and dislocation.

It was a large scheme, involving many subsidiary ref
such as enlarged staffs, extensive re-grouping of troops and
ing of barracks, better training and equipment, increase
and allowances for the soldier. It had only been partially
into execution when the War broke out; financial difficultie
intervened, and the fear of Russian aggression had been al
by the Anglo-Russian agreement of 1907. In the meantime
greater progress had been made in the United Kingdom i
organisation, training and equipment of the British Army,
expeditionary forces dispatched from India were found in
earlier stages of the War to be inferior in these respects t
British troops. Then came the serious complaints of the effici
of the higher military command in the Mesopotamian campa
leading to the inquiry set up by Act of Parliament, and
grave indictment of the Indian military system as regards
administration and organisation, contained in the report of
George Hamilton's Commission (Cmd. 8610 of 1917). The
tem was described as cumbrous, slow-moving and over-central
in the last degree. Almost immediately ensued the Afghan
of 1919, followed by the Waziristan campaign, with rene
complaints against Indian army administration.

The Esher Committee Report.—It was thus decided to set
a Committee, with Lord Esher as chairman, to inquire into
organisation and administration of the army in India. In
judgment of this committee, which reported in 1920, the exist
military system was defective in many respects. Their reco
mendations involved considerable modifications of the Kitche
scheme. To one of them prompt effect was given; the nine
sional commands created by Lord Kitchener were replaced
smaller territorial units, and these were grouped into four ar
commands, the commanders of which would take over much
the responsibility which had hitherto been centralised in
commander-in-chief and army headquarters. The more i
portant proposals of the committee regarding the functions
the military forces in India in any scheme of Empire defen
the authority to be exercised over them by the British W
Office, and the position and duties of the commander-in-ch
were hotly contested by the Indian Nationalists, who saw
them a design of subordinating the Indian Army to the neces
ties of the Empire and of encroaching on the independence
India.

Indian Army.—The army in India is composed of Briti
regular troops, which form part of the British Army transferr

period of service to the Indian establishment, and of the n Army. The latter consists of Indian troops raised by ndian Govt. and commanded by Indian officers holding Viceroy's commission and by British officers holding the 's commission. The numerical proportion in which the component parts of the army should stand to each other ixed in the first instance in 1858, and further considered 393, when the ratio of one British soldier to 2·5 Indian ers was definitely adopted and has since been adhered to as permanent basis. The proportion is struck on the regular s, including the imperial service troops maintained by Indian s. No account is taken, on the one hand, of the Auxili- Force, recruited from the European and Anglo-Indian nunity, or, on the other hand, of the reserves of the Indian , the Indian territorial force, the armed police, or the s of the Indian states.

e British troops are necessarily the most costly part of the nisation; both on this account and from a sense of national , Indian critics of military expenditure constantly press reduction in the British element. In the course of a de- in the Central Assembly in March 1921, the then commander- ief, Lord Rawlinson, stated the case for not altering the ortion of British to Indian soldiers while the existing irements of internal and external defence remained. Other ures of great importance however have been taken to meet aspirations of Indian Nationalism for an Indian share in country's defence. Since the War, King's commissions been made available for Indian gentlemen who qualify as ts at the Royal Military College, Sandhurst, where 10 ncies are reserved for them annually. In order to secure ble candidates for Sandhurst, a military college has been lished at Dehra Dun, with a six-years' course of preparatory ation. The question of providing a Sandhurst training ly in India was subsequently referred to a special committee, hich two of the Nationalist leaders consented to serve.

r the effective employment of young Indian officers hold- he King's commission, it has been arranged to officer eight of the Indian Army entirely by Indians, gradually as their and length of service may justify, with the object of thus ituting the nucleus of a national Indian Army in the future. her momentous step was the enrolment of an Indian terri- l force in 1921. It consists of 20 provincial battalions, t 12,000 strong, liable for general military service; and are in addition a number of university training corps. gside of these the old volunteer force continues under her name. It is now the Auxiliary Force, confined to pean British subjects, and liable only for local service in gencies.

1914 when the War broke out, the regular forces in India prised 75,575 British soldiers, including 2,689 commissioned ers; 159,861 Indian Army troops, including 2,771 Brit- commissioned officers and 341 British warrant and non- missioned officers; and 21,069 imperial service troops. The ves of the Indian Army numbered 36,000 odd, and the nteer force consisted of some 38,000 Europeans and Anglo- ans. During the War the Indian Army was greatly enlarged, emands were made upon it by the home Government for ice abroad. In the last year of the War the Govt. of a undertook to raise an additional 500,000 combatant uits, and no doubt the full number would have been secured the Armistice not intervened. Demobilisation began in 1919, but was interrupted by the Afghan War and the equent campaign against the tribes in Waziristan. On Jan. 926 the Indian troops serving in the country mustered 668 men, or approximately the pre-War strength; the ish troops were only 60,359 men, or some 20,000 below pre- strength. The defence charges in India before the War were it £20,000,000 a year; after all the economies advised by Inchcape Committee, they are in the neighbourhood of 500,000, which represents an annual charge, for the pro- ion of their country, of 3s. per head of the population of ish India.

Naval Defence.—The third branch of India's defence, the protection of her vast seaboard, has hitherto been left to the British Navy, with minor assistance from the Royal Indian Marine. Without that powerful aid, India's weakness would be disastrous. "Her sea-borne trade," writes Professor Rushbrook Williams, "is rich; the proportion of her wealth collected into centres within practicable distance of her coastline very great. Good harbours are few; and from the naval point of view, with certain exceptions, not easily defensible. It seems, therefore, no exaggeration to state that adequate naval protection will in future constitute a postulate of her national existence. Should her surrounding seas fall under the dominance of her foes, she can never be secure along the road to prosperity." At present India makes an annual payment of £100,000 towards the navy, and maintains the Royal Indian Marine. Nationalist sentiment has combined with a recognition of India's helplessness at sea to claim the institution of an Indian Navy and the creation of a class of Indian naval officers; there is also a demand for an Indian mercantile marine assisted by the State. In the spring of 1926 the Government announced its intention of setting up a Royal Indian Navy, at a cost of 63 lakhs (£420,000) a year. With its headquarters at Bombay, it will be composed at first of 4 sloops, 2 patrol craft vessels, 4 trawlers, 2 service ships and 1 depot ship. It is to be a sea-going force, whose function in peace time will be the training of personnel for war service in the Indian Ocean and Persian Gulf, port defence, survey work and marine transport. (ME.)

IV. THE INDIAN STATES

The relations now subsisting between the Indian states and the British Govt. are the outcome of an evolutionary process which still continues (*see* 14.407 *seq.*). The Mutiny, the passing of the East India Co. and the grant of *sanads* of adoption to the rulers in 1862 obliterated the peril of annexation, breached the barriers of isolation and inaugurated for the states a new era of union under the Crown. Queen Victoria's proclamation of 1858 announced to the "Native Princes of India" that all treaties and engagements made with them would be scrupulously observed and that their rights, dignity and honour would be respected. The British Govt., while emerging as paramount power, thus guaranteed to the ruling princes and chiefs the measure of sovereignty which they severally possess in their internal affairs. As regards the nature and extent of this sovereignty, the following extract from a minute by Sir Henry Maine may be quoted: "There may be found in India every shade and variety of sovereignty, but there is only one independent sovereign, the British Government. . . . The mode or degree in which sovereignty is distributed between the British Govt. and any Native State is always a question of fact which has to be separately decided in each case, and to which no general rules apply." Two important principles have, however, been laid down by statute, namely, first, that the Indian states "have no connections, engagements or communications with foreign powers," and second, that the British Govt. has the right to protect and govern subjects of the states when resident or found abroad. For international purposes, therefore, state territory is in the same position as British territory, and state subjects as British subjects.

Status of the Princes.—The assumption of the Govt. by the Crown in 1858 called the princes to greater responsibilities as well as to higher honours. Lord Curzon speaking at Gwalior in 1899 claimed the rulers of the states as his colleagues and partners in the administration of the country. Their new prerogatives involved obligations not envisaged when the treaties were framed, but proceeding naturally from the solidarity of the states with British India. Many forces were at work tending to draw the relationships between the princes and the Crown into conformity with a single type, and also to increase the Govt. of India's interest in the administration of the states. The result was over-rigidity of treatment and the formulation of rules which seemed to the princes to transcend the provisions of treaties. Lord Minto, perceiving an atmosphere of discontent, took the occasion to make a declaration of policy, during a visit to the Maharaja of Udaipur in Nov. 1909. He interpreted the proclamations of Queen Victoria and King Edward as inculcating a more sympathetic, and therefore a more elastic policy, and he laid stress on the fact that the foundation stone of the whole system must be the recognition of identity of interests between the Imperial Govt. and Durbars and the minimum of interference with the latter in their own affairs. Lord Minto had already taken the princes into his confidence by consulting them officially on the question of the growth of sedition in India. His declaration and the spirit in which it was acted upon gave great satisfaction to the ruling princes.

Lord Hardinge, pursuing the same policy, in 1913 and 1914 invited some of the princes to meet him in conference at Delhi to discuss a scheme for founding a central college at Delhi at which students from the various chiefs' colleges might complete their education and take a degree. H.H. the Maharaja of Bīkaner delivered a notable speech at the 1914 gathering when, speaking on behalf of his brother princes, he said:—

> We trust, and we are confident that Your Excellency will before long convene similar meetings to deal with other subjects in which we and the states represented are no less closely concerned than this one of the college, and on which our deliberations will not only be of the greatest advantage to ourselves, our states and our people, but also, we hope, of some value to the Imperial Government.

Lord Hardinge in 1914 created a new post of political secretary to the Govt. of India, in order that closer attention might be devoted to relations with the states. The past fifteen years had proved an era of striking progress and development, and the rulers themselves, encouraged to play more important parts in the drama of Indian affairs, were becoming daily more advanced in their own administration, so that new methods of political treatment were required.

In Aug. 1914, on the outbreak of the War, the princes vied with each other in the offer of loyal service. In a telegram which stirred England the Viceroy reported that the rulers of the states in India, numbering nearly 700, had with one accord rallied to the defence of the Empire and offered their personal services and the resources of their states. From among the many princes who had volunteered for active service Lord Hardinge selected seven rulers, including the veteran Sir Pertab Singh (Regent of Jodhpur), who would not be denied his right to serve the King Emperor in spite of his 70 years. His nephew, the Maharaja, who was but 16 years old, went with him. Contingents of all arms were accepted from 12 states, besides a camel corps from Bīkaner. A hospital ship was given by various states at the instance of the Maharaja of Gwalior, and as the War progressed there were many fresh evidences of the spirit of loyalty animating the princes and their peoples. The support afforded by the Durbars in the matter of raising recruits was of particular value.

Minorities and Successions.—In 1916 Lord Chelmsford, in spite of War preoccupations, decided to invite the princes to another conference. In his opening speech he laid stress on the magnificent assistance rendered by the states. The most important of the subjects discussed at the conference related to the form of administration to be adopted in a state during a minority. In 1909 Lord Minto had become aware that several of the rulers felt strongly that they had a right to be made acquainted with the considerations which guided Government in minority administrations. He therefore ascertained the opinion of the leading Durbars, and prepared a statement of the general policy of Government in the matter. In 1915 attention was again drawn to the matter in consequence of representations made by certain of the rulers that in some cases in the past the rights and privileges of states guaranteed by treaty or otherwise had been unwittingly infringed during the minority period by the exercise of the prerogative of the paramount power.

Lord Hardinge thereupon convened a committee consisting of three rulers of states and three political officers to consider the question. Their recommendations were fully debated in the conference of 1916, with the result that a resolution was published in Aug. 1917 laying down the principles for th duct of minority administrations. In it the Govt. of asserted their rôle as trustees and custodians of the interests and traditions of a state during a minority admitted that the special conditions of each state re special treatment, and promised to attach due weight to re by individual ruling princes or chiefs regarding any prin which they might wish to be adopted in the case of thei states or families, while reserving to themselves freed action in dealing with such requests. Seventeen general ciples were laid down for observance during minority ad trations. The resolution was received with much satisfa by the princes, and the general opinion was that the prono ment of Government was an event hardly second in con tional importance to the *sanads* of adoption granted by Canning.

The next conference, held in 1917, saw the decision of an very important question, viz.: the form of recognition by ernment of successions in the states. Lord Chelmsfor nounced that in the case of the succession of a direct natura recognition on the part of a paramount power was purely fo and that the obligation on the part of the new ruler to o it in no way impaired his inherent right to succeed. He als nounced the relaxation of the requirement that rulers of s before paying visits to places in British India should obtai previous concurrence of the local Government concerned. requirement had proved irksome in practice, and under the arrangement the obligation was limited merely to visits t stations and other places where special local conditions render concurrence of the local authorities necessary.

The Chamber of Princes.—His Highness the Mahara Bīkaner, who earlier in the year had been one of the I representatives at the Imperial Conference and a member o Imperial War Cabinet, took the lead in this conference. I final address to the Viceroy he expressed the hope of the pr that before the British Govt. came to any decision on the ject of political reforms to be introduced in British India ruling princes would also be consulted. He stated:—

> We feel that we too must keep a definite goal in front of us, whilst it is essential that our rights and privileges and our pos as allies and friends guaranteed to us by solemn treaties and en ments with the British Govt. remain unaltered, our states ca afford to lag behind in the general advance which India's ass tion with Great Britain alone has rendered possible. It is for t reasons that we are now all the more anxious to see the early es lishment of a constitutional chamber which may safeguard interests and rights of ourselves and of our states.

Lord Chelmsford replied that any scheme which they m put forward would receive most careful and sympathetic sideration from the Govt. of India. A draft scheme was acc ingly prepared by a committee, and was discussed informally the Viceroy and certain of the princes in the presence of Montagu in Feb. 1918 during his visit to India. In Dec. the King issued a royal proclamation signifying his assen the establishment of a chamber of princes, which was e tually inaugurated by the Duke of Connaught in Feb. From the proclamation then read, we quote the following:—

> In my former proclamation I repeated the assurance, give many occasions by my Royal predecessors and myself, of my d mination ever to maintain unimpaired the privileges, rights dignities of the princes of India. The princes may rest assured this pledge remains inviolate and inviolable. I now authorise Viceroy to publish the terms of the constitution of the new cham My Viceroy will take its counsel freely in matters relating to territories of the Indian States generally, and in matters that a those territories jointly with British India, or with the rest of Empire. It will have no concern with the internal affairs of ind ual states or their rulers or with the relations of individual state my Government, while the existing rights of the states and t freedom of action will be in no way prejudiced or impaired.

His Royal Highness also conveyed to the princes a spe message of thanks from His Majesty in public acknowledgm of their splendid record of achievement during the War. alluded to the fact that H.H. of Bīkaner had taken part in Peace Conference and had signed the Treaty of Versailles, wh

. the Maharaja of Nawanagar had attended the League of
ons Assembly at Geneva. H.H. the Maharaja of Bīkaner
appointed to be the first chancellor of the chamber (Naren-
Mandal), and was re-elected to the office each year until 1926
he was succeeded by H.H. the Maharaja of Patiala.

ith the growth of new conditions and the unification of
a under the British power, a body of usage affecting the
y position of the states had insensibly come into being, and
Durbars were therefore anxious that for the future they
at have a voice in the formulation of political practice.
mmittee of princes, known first as the codification com-
ee and afterwards constituted as the standing committee
he chamber, accordingly met at regular intervals and
eved useful work with the advice and assistance of officers
the secretariat and administrative departments of the
t. of India in revising the summaries of political practice
r various heads such as mining concessions, railways, tele-
hs and telephones, mints and currency, opium, extradi-
, etc. The results were reported at successive meetings of
chamber of princes.

he Salute states in the Punjab Province were taken into
ct relations with the Government of India in Nov. 1921,
ugh the appointment of an agent to the Governor-General.
milar arrangement was made in 1923 for the five states in
Madras Presidency, and in 1924 for the Bombay states of
hiāwār, together with Cutch and Palanpur. A new first-
s political appointment was created for the last-mentioned
p, and the Bombay Political Dept. was amalgamated with
of the Govt. of India. In 1921 the Gwalior state was
rated from the Central India Agency and was brought
direct contact with the central Government through a single
rmediary officer, while in Rājputāna the states of Bīkaner,
hi and Jhālawār were at different times placed in direct
tions with the agent to the governor-general instead of
ugh a subordinate political agent. At the meeting of the
mber in the autumn of 1921, Lord Reading announced that
the future, except at installations and investitures, where
l custom would continue to be followed, the King had been
sed to dispense with the presentation of nazars at ceremonial
ts or receptions, either to himself or to the members of his
ily or to any of his officers to whom it had hitherto been
omary to present them.

n 1918 and 1921 the King conferred many honours and
inctions upon ruling princes and chiefs and others in
gnition of the services rendered by the Indian states during
War. The style of " His Exalted Highness " was conferred
n the Nizam of Hyderābād, and the title of " Faithful Ally of
British Govt." was formally confirmed to him. The Prince
Vales, during his Indian tour, in the winter of 1921–2, visited
ny of the states and was received with loyal enthusiasm and
ndid hospitality. At the Imperial Conferences of 1921 and
3 respectively T.H. the Maharao of Cutch and the Maharaja
Alwar were included among the representatives of India, and
the meetings of the League of Nations from 1921 onwards
I. the Maharao of Cutch, the Maharaja of Navānagar (twice),
Maharaja of Bīkaner and the Maharaja of Patiāla.

Soon after the War, certain problems in connection with the
anisation, training and maintenance of the Imperial service
ops were taken up by the Govt. of India in consultation with
ruling princes and chiefs concerned. His Highness the
haraja of Alwar, after pointing out that the greater states
l, during the War, not only placed their units of Imperial
vice troops at the disposal of Government but had depleted their
n power to keep these units up to full strength, advocated a
nplete policy of trust in the states and asked that the policy
ght be applied in such a manner as to eliminate all distinctions
ween Imperial service units and the local forces or armed
ice of the states. After prolonged consideration, a compre-
nsive scheme was prepared for the reorganisation of the
te forces, embracing not only the first line troops but also the
egular troops and the state police. The armament and equip-
nt of the first line troops was to be improved, the irregular troops were to be armed and organised in such a way as to transform them into an efficient reserve, while the police were to be given suitable weapons to enable them to cope with dacoits. More than thirty states joined in the scheme. To facilitate the training of military officers, certain vacancies at the Prince of Wales' military school at Dehra Dūn were offered to boys nominated from Indian states.

In view of the contemplated repeal of the Press laws of British India, a resolution passed in the chamber of princes in 1921 asking that some special means of protection might be given to the Indian states in place of the relevant provisions of the Press Act. Lord Reading's Govt. considered that they were obliged in honour to agree to such protection, but the Legislative Assembly vigorously opposed a bill which was brought in under the title of Indian states (Protection against Disaffection) bill. It became necessary for the governor-general to exercise the extraordinary powers allotted to him by the Govt. of India Act, and to certify that the bill was essential for the interests of British India. The bill was passed by the council of state and eventually became law.

In 1908 the Govt. of India recommended to the Secretary of State that the necessary legislation should be undertaken in order to enable subjects of Indian states, while retaining their primary allegiance to their states of origin, to become eligible for certain services in India, admission to which was under the existing law confined to British subjects. The required provision was eventually made in Section 96A of the Govt. of India Act.

A New Indian State.—Before Lord Minto left India, he announced at Benares that the Govt. of India, with the sanction of the Secretary of State, had decided to grant to the Maharaja of Benares and his successors a permanent status amongst the rulers of India, by constituting part of the family domains as a state. This remarkable step, which involved the transfer of some 300,000 persons from British to Indian rule, was taken in view of the unique position of the Benares House, representatives of which had played important parts in relation, first to the court of Delhi, and afterwards to the British Government. The change was effected by means of an instrument of transfer, the provisions of which ensured to the residents of the territories the rights and privileges which they had enjoyed under the British administration. In 1919, in view of the success of the measure, the town of Rāmnagar, adjacent to Benares City, was also handed over to the Maharaja for use as his capital. In 1913 the instrument of transfer in virtue of which the province of Mysore had been transferred in 1881 to the present ruling family of the Mysore state was superseded by a treaty, the wording being altered in certain respects to meet the wishes of the present ruler. The change was announced during Lord Hardinge's visit to the state in the same year.

Constitutional Development.—While the paramount power has parted with none of its prerogatives, the evolutionary process has gradually led to a certain breaking down of the isolation of the states among themselves, the strengthening of their position and the advancement of the dignity of the princes. They not only gained, in the chamber, means for expression of their collective needs and opportunity for influencing the development of political doctrine, but they were admitted, as joint representatives of India, to the innermost councils of the Empire through the appointment of a member of their order to successive Imperial Conferences and meetings of the League of Nations.

Thus the integral connection of the states with the British Empire has been further emphasised, and the possibility that constitutional changes in British India may react on the states has been more effectively recognised. In a few advanced states, legislative bodies have been constituted analogous to those in British India, Mysore being a prominent example, while in others the rulers have devised means for the people to voice their grievances and aspirations more easily through consultative councils. The movement is unhurried, as the time and manner of change, if change there is to be, rests with each individual ruler. But it cannot be denied that the processes at work in British

India must impair the vitality of the conservative traditions which have their stronghold in the states, and for this reason, the princes must be keenly interested in the development of constitutional reforms beyond their borders. While it is an accepted axiom that the independence of the states in matters of internal administration carries with it the counter-obligation of non-interference in British Indian domestic affairs, any fundamental change in the system of government in British India may be claimed to fall within the category of matters of Imperial or common concern, in regard to which the princes may reasonably expect to be heard. (R. Hd.)

V. ECONOMIC HISTORY

General Survey.—The economic history of India during the seventeen years 1909–25 falls naturally into three chronological divisions: pre-War, War and post-War.

The first period was one of rapid progress. After the famine year of 1908 the monsoons were satisfactory, and the harvests good. The general conditions of world trade favoured Indian commerce and Indian prosperity. Exchange was steady, budgets showed surpluses. As a debtor country India profited by the general rise of prices, needing to export smaller quantities of goods to meet interest charges. As also the prices of foodstuffs and raw materials were rising faster than those of manufactured goods, the exchange of Indian exports for imports was carried on with greater profit to India. In these five years the money values of Indian sea-borne trade increased by 40%; the gross earnings of the railways and of the post office by one-third. Characteristically, the increased purchasing power was used to absorb gold and silver to the amount of £127,000,000. But also some notable new industrial enterprises were launched, and a stronger spirit of enterprise was displayed both in commerce and industry.

The outbreak of the World War produced a temporary panic, quickly allayed. The interruption of foreign trade threw India largely upon her own resources. Efforts were made for the production of manufactured articles, particularly War requisites, not previously attempted, and various industries which work up native raw materials for the home market expanded considerably. A strong stimulus was given to the old demand that the State should take a leading part in the development of Indian resources, both by means of a protective tariff, and by helping private enterprise in the raising of capital, by research and by developments of the educational system; and a great change took place in the attitude of the Government to these questions.

The transition from the War period to international peace was marked by the "famine" of 1918, followed by another monsoon failure in 1920; by the visitation of influenza, which in 1918 and 1919 probably killed not fewer than 10,000,000 people, by much political agitation and the recasting of the constitution. A post-War boom of trade in 1919 and 1920 was followed by a severe slump in 1921 and 1922; exchange fluctuated violently, the sterling value of the rupee first rising to a record height, and then falling in a most embarrassing manner. Five years in succession showed budget deficits, amounting in the total to over 100 crores.[1] But in 1922 a steady recovery began, well maintained till the end of 1925. The monsoons, during the five years 1921 to 1925, were on the whole good, and, given good monsoons, Indian commerce is solidly based on an imperative world need for Indian staple products. There was a "return to normalcy," but not to the pre-War normal. The War cataclysm has left among its permanent effects important economic and political changes including a reversal of fiscal policy from free trade to protection.

Agriculture and Irrigation

Since the census of 1921 showed that 70% of the total population of the Dominion were supported by agriculture and pastoral industry, not Indian agriculture only, but all Indian economic prosperity is necessarily a gamble in rain. During the period under review only two serious monsoon failures occurred, those of 1918 and 1920. That of 1918 was one of the worst on r
over all India the estimated out-turn both of rice and of
was in 1918–9 25% below the previous quinquennial av
This was much worse than in the great famine of 1899, but
was no corresponding distress; the maximum numbers on
never went beyond 600,000, as compared with 5,000,000.
was partly because the harvest of 1917 had been a recor
so that the famine year was helped by an unusually large
over; but it also indicated that government efforts to pr
agricultural prosperity had achieved a large measure of su
The great shortage in the total amount of grain available i
country necessitated exceptional measures, in addition t
well-tried methods of dealing with unemployment and
tution. Export of grain was prohibited; the surplus of B
was secured by India, and 200,000 tons of wheat were imp
from Australia. The failure of the later rains in 1920 proc
famine conditions in certain districts in the early part of
and the number on relief went up to 400,000; and it wa
till after the country had recovered from that shortage
export of grain could again be freely permitted.

At the biennial meeting in Pusa, in Dec. 1919, of
Board of Agriculture, a conference of Imperial and Provi
Departments of Agriculture, the problem of famine policy
once more re-examined in the light of the experience of
and a new programme was drawn up of measures calculate
minimise the loss of grain, fodder and cattle during yea
deficient rainfall, including plans for improving the storag
grain, the growing of better fodder crops, evolution of impr
varieties of drought-resisting cereals and emergency mean
irrigation. Special attention was given to the great los
cattle, though this had been mitigated in the Bombay Dec
one of the worst areas, by the success of the Bombay
cultural department in turning prickly pear into valuable fo
by burning off the prickles in the flame of the blacksm
forge. Meanwhile among the intelligentsia of the towns t
arose a foolish and short-sighted demand for the prohibitio
export of foodstuffs even in normal years, a demand whic
successful, would multiply and intensify famines by remo
the commercial incentive to agriculturists to produce a surplu

The Departments of Agriculture had been reorganised e
in the twentieth century, and, with still very inadequate
sonnel and funds, they have achieved important results
great variety of directions. One important branch of
work consists of the introduction of improved varieties of pla
This involves, firstly, research in order to obtain from abroa
evolve locally, the variety which will prove its superiority u
Indian conditions; secondly, growing the improved variet
sufficient quantities to furnish the ryots with seed; thirdly,
vincing ryots by means of demonstration farms, and otherw
of the advantage offered; and, fourthly, in many cases, watc
over the subsequent fate of the new variety to prevent it f
being swamped by inter-mixture with others. The area sow
1923–4 with improved varieties popularised in this way
ceeded 5,000,000 ac., including over 2,000,000 ac. under w
and rice, and even more under cotton. The work on wh
accomplished by the Imperial Research Institute at Pus
famous; very valuable work has also been done on suga
Coimbatore. The work of provincial departments is too va
to be even summarised here; as examples, taking one prov
(Madras) only as representative, mention may be made of
Agricultural College at Coimbatore; the introduction and p
ularisation of Cambodia cotton, which gives upwards of 200
of superior lint per acre, as compared with the ordinary In
crop of 80 lb. of short staple cotton; the vigorous propagand
single paddy transplantation and the growing of green man
which has been of immense value to rice cultivators; the selli
on a large scale at cost price of fish manure; the fight agai
insect pests of cotton and other crops by the Madras Pest A
and its system of popular education in agricultural science
means of simply expressed tracts in the vernaculars.

A forward step was taken along the lines of linking toget
the efforts of all the agricultural departments by the establis

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[1] Lakh = 100,000 rupees; crore = 10,000,000 rupees.

ent in 1920 of the Indian Cotton Committee, which is financed a small cess on each bale of cotton produced. This has been llowed by measures for the control of cotton gins and the ansport of cotton in order to prevent adulteration of superior owths, and the inter-mixture of seeds of improved with improved varieties. It is perhaps significant that there is w more Indian cotton to be found on the Liverpool market an before the War, and the difference in the price it realises as mpared with American has almost disappeared. The total op of Indian cotton has now reached 6,000,000 bales of 400 lb. ch, as compared with a pre-War quinquennial average of 000,000 bales. A great deal of the extra cotton grown goes to Japanese and Chinese mills. It is intended to apply the me principles of inter-provincial co-operation to the still more fficult problem of cattle improvement. The Tamil proverb, the calf of the good cow dies," gives a scarcely exaggerated ea of Indian backwardness in the science of cattle-breeding.

An extension of the irrigated area is the most effective of all easures of famine prevention. The area annually irrigated by vernment works has now reached some 28,000,000 ac., which not much less than the total cultivated area of Great Britain. e area irrigated by wells and other privately owned sources is out 21,000,000 acres. The two greatest irrigation schemes e world has ever known are being carried out in the Indus sin, the Sutlej valley scheme and the Lloyd (Sukkur) barrage. e way for the former was prepared by the Triple Canal proj- t, sanctioned in 1905 and completed in 1917. The surplus ters of the Jhelum are held up by a head weir, and carried thwards by a canal to the Chenab, part being used to water large area between these rivers, but most being poured into Chenab above the intake of the old Chenab canal. The mand on Chenab water being thus reduced, some 20 m. higher a new head weir on that river has been constructed, which ters a great area between the Chenab and Ravi, and, crossing Ravi river, passes on to water the northwestern half of the wer Bari Doab, which is land lying between the Ravi and Sut- . Altogether over 1,700,000 ac. are annually irrigated by the als; and the execution of the project makes it possible to lise the Sutlej river, not only to complete the irrigation of the ri Doab, but also to irrigate a great area on the southeastern e of the Sutlej.

y the Sutlej valley scheme four head weirs are being con- ucted on that river, three above and four below its junction h the Chenab; 2,075,000 ac. will receive a perennial supply water; 3,033,000 ac. a controlled supply from the beginning April to the middle of October. The new canals will super- e a number of "inundation canals," which give a somewhat ertain supply from May to Sept.; and also will bring into tivation 3,750,000 ac. of desert waste. An interesting ture of the work is that mechanical excavators are being d because of shortage of labour.

t Sukkur, where the combined five rivers of the Punjab enter nde through a narrow gorge, the Lloyd barrage is being built, 25 ft. long between the faces of the regulators on either side, ich will control the flow of water into seven great canals. en fully developed the area annually irrigated will approach 00,000 ac., considerably more than the whole cultivated a of Egypt. As a necessary corollary the port of Karachi, of ich the trade has already nearly quintupled since 1897, will further developed by harbour works at a cost of £2,000,000.

owhere in India outside the Indus basin is there scope for rks of equal magnitude, but a great scheme is being carried for the irrigation of Oudh, by canal fed from the Sarda river. s project has been under contemplation for 50 years, but has n in abeyance because of the opposition of the Oudh land- ers (taluqdars). They have now altered their views as a lt of the experience of 1918, and the increasing cost, due to g wages, of well irrigation. The area to be irrigated is mated at 1,700,000 acres. In Madras even older schemes planned by Sir A. T. Cotton, the great pioneer of scientific al irrigation in India, have been revived, for great storage rvoirs in the Cauvery, Bhavani, Tangabhadra and Kistna rivers; and the Cauvery scheme has been sanctioned. All over India smaller works are being planned, debated and put into execution. (*See* IRRIGATION.)

Co-operation.—The policy of active encouragement of rural credit banks on the Raiffeisen plan, as the most effective means of remedying the chronic indebtedness of cultivators and improving the business side of agriculture, was adopted, after long discussion, by the Act of 1904. Registrars of co-operative societies were appointed for the different provinces, to draft model rules, register, inspect and audit the accounts of co-operative banks, and also to carry on propaganda and education in co-operative principles. In 1912 an amending Act was passed, as the result of eight years' experience; and also to extend the official encouragement to co-operation in other fields. The number of registered societies increased from 5,432 in 1911 to 61,106 in 1924; the membership from 308,000 to 2,314,000; the capital employed from Rs. 227 lakhs to Rs. 4,053 lakhs[1] (about £30,000,000). The great majority of the societies are village banks; but there are 522 "Central Banks" situated in towns, which gather in deposits, supply funds to the rural banks in their neighbourhood, and act as links between them. There are also "Apex" banks, for the provinces of Madras, Bombay, Bengal, Bihar and Orissa, Burma, the Central Provinces, Assam and Mysore. Encouraging progress is being made by societies for purchase and sale; sales to members aggregating Rs. 113 lakhs in 1924 and purchases from members Rs. 93 lakhs. There were 442 cattle insurance societies, with 6,693 members, a small but very hopeful beginning; and there is a promising movement in urban areas to use the principle of co-operation in house building and milk supply.

MANUFACTURING INDUSTRIES

On the basis of the number of people who are employed hand-loom weaving is still by far the greatest of Indian non-agricultural industries. The census of 1921 found very nearly 2,000,000 hand-looms at work, and the actual number was probably considerably greater. The Indian Industrial Commission (1916–8) discovered that the consumption of mill-spun yarn by hand-loom weavers increased by about 30% in the two decades before the War, which would more than compensate for the diminution in the output of hand-spun yarn. The War itself helped the weaver, Indian mills not being able to make up adequately the deficiency of imported cloth; so also did the very high prices of mill-woven cloth after the Armistice. But from 1922 onwards weavers' difficulties have greatly increased. The development of mill manufacture in China has deprived the Japanese mills of part of their Chinese market, and caused them to make greater efforts to dispose of their output in India. In the fierce and very equal competition which so ensues between Indian and Japanese mills, it is the hand-loom weavers who suffer most. In some districts after a struggle to live on less than subsistence earnings, they have been compelled to abandon their hereditary calling; in others, where the level of skill and enterprise is higher, they have given up cotton weaving for silk, or textures with gold or silver thread interwoven, which are called in India "lace work." The industry as a whole shows a surprising degree of vitality, fly-shuttles, which increase a weaver's output from 20 to 100%, have been adopted widely, and so also have simple machines for winding and warping, owned and used co-operatively.

Out of some 1,400,000 workers in factories of all sorts, about one-quarter are employed in cotton-mills, and some 80,000 in cotton gins and presses. This industry has had very considerable vicissitudes, but taking bad years with good, it has been prosperous and progressive. The total Indian consumption of mill-woven cloth is much the same now as in the years immediately preceding the War, in spite of the very great increase of price. But whereas before the War Indian mills supplied just under 30% of this production, their share has risen (1924–5) to 52%; while the share of the United Kingdom has fallen from 68·5% to 42·5, Japan now getting 4% of the market. On the other hand Indian mills have lost in China their chief foreign market. The supremacy of Bengal in jute is more firmly established than ever; nearly two-thirds of the jute grown is consumed by the Bengal mills, as compared with less than half before the War; so that Bengal now produces about twice as great a bulk of jute manufactured goods, mainly in the form of gunny bags, hessian cloth and cordage, as all the rest of the world. Such industries as leather tanning, paper manufacture, brewing, woollen manufacture, which are of considerable though minor importance, were greatly stimulated by War conditions, and maintain part of the advance so won.

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[1] Lakh = 100,000 rupees; crore = 10,000,000 rupees.

The two most notable new enterprises launched in the five years immediately preceding the outbreak of War were projects of the late Mr. J. N. Tata, which were brought to fruition by his sons and their partners after his death in 1904. The Tata Iron and Steel Company was successfully launched in 1907 with Indian capital; it began operations in 1908 and produced iron first in 1911. When the World War broke out it was in a position to be of great service both in Mesopotamia and in other war theatres; and, since the military requirements were for steel, the company converted into steel as much as possible of the iron it produced, though the sale of iron in the open market would have been much more profitable. Dividends of 20% on the ordinary and 290% on the deferred shares were paid in 1917 and 1918; again in 1920 and 1921 ordinary shareholders got 16% and deferred shareholders 200%; but since 1922 no dividends have been paid except preference shares; and the heavy fall in the price of steel caused by intense international competition compelled the company to seek governmental aid. Various other attempts have been made in India to produce steel on modern lines; and in the boom period after the Armistice a number of schemes for exploiting the extraordinarily rich and abundant ore deposits of Orissa for this purpose were floated; the chief result of which was to increase the potential output of the Bengal Iron Company. The Tata Iron and Steel Company is the only one actually producing steel.

Equally notable was the Tata project of utilising the heavy rainfall on the Western Ghats to supply Bombay with electric power. In order that power should be available throughout the year it was necessary to create great storage reservoirs on the Deccan tableland. The first completed was at Lonavla, whence there is a fall of 1,725 ft. to the power-house at Khopoli. The works were formally opened on Feb. 8 1915. The Andhra valley project with its artificial lake further to the north, was initiated in 1916 and completed in 1922, and supplies 100,000 horsepower. It is being followed by the Nila-Mula scheme to the south of Lonavla, expected to supply 150,000 H.P., and preliminary work is being done on the Koyna Valley project, still further to the south, to yield 350,000 horsepower. The original purpose of these schemes was to make the Bombay mills independent of coal; but as the amount of power available has increased, it is becoming possible also to revolutionise the methods of transit and consequently the conditions of housing of Bombay. By the electrification of the railways in the immediate neighbourhood of Bombay it is hoped that third-class fares may be reduced to a rate of 11 m. for one anna (approximately one penny). This will make effective the work of the Bombay Improvement Trust, which is charged with the duty of reclaiming the islands to the north of Bombay and converting them into residential and industrial areas, thus making it possible for the most prosperous, but also the most terribly congested, city in India to expand to healthy dimensions.

The close of the World War was marked by a great outburst of speculation. The aggregate authorised capital of new joint stock companies floated in the year 1919–20 alone was Rs. 281 crores, whereas the paid-up capital of all registered companies in existence in 1914 was only 75 crores. Subsequent liquidations were heavy. The most important of the new projects which failed to realise expectations was the Tata Industrial Bank, the shares of which were being bought eagerly in the early part of 1920 at a high premium. Its object was to finance new industries on much the same lines as those followed by the "D Banks" in Germany; but after a short run it was amalgamated with Bombay Central Bank, which does ordinary banking busin the capital being considerably written down.

Banking.—On the other hand an important step towards organisation of a more complete and effective banking syst for India was taken in 1920 by the amalgamation of the Pre dency Banks of Bengal, Bombay and Madras into the Imper Bank of India. The Imperial bank was authorised to establis branch in London, which had not been allowed the Presiden Banks, and its London Branch takes over from the Bank England the business which the latter had previously d for the Govt. of India. The Imperial Bank has also been quired to open 100 new local branches to supplement the branches of its three constituents. A great deal more remains be done to knit together the various sorts of banks operating India into a sound and efficient system. There was a heavy m tality among Indian joint stock banks in 1913–7. The cau of this weakness still in large measure remain, and it must regarded as a factor retarding the progress of India towards complete financial autonomy.

THE GOVERNMENT AND INDUSTRY

Since 1910 there has been a change of policy in relation to dustry. In that year the principle of *laissez-faire* was asserted Lord Morley's despatch refusing assent to the plans of Madras Govt. for the encouragement of new industries, incidentally sentencing the Madras Department of Industr to temporary impotence. This department had been built step by step since Dec. 1897 by the initiative and under the c trol of Sir (then Mr.) Alfred Chatterton. At a total net cost £33,000 a prosperous manufacture of aluminium hollow-w had been established, the use of oil engines for pumping wa for irrigation popularised, well-boring carried on extensively, use of the fly-shuttle, automatic dobbies and subsidiary machi introduced among hand-loom weavers, and other import work accomplished. A similar policy had been initiated in United Provinces by Sir John Hewett; and there also it dropped in consequence of Lord Morley's adverse judgment the case of Madras. The outbreak of War brought a change the attitude of the India Office, and in May 1916 the Ind Industrial Commission was appointed to report on poss means of direct governmental encouragement of industry incompatible with the existing fiscal system. Its positive rec mendations were numerous and varied. Departments of dustry were in consequence re-created in Madras and United Provinces, established also in the other provinces, under the reformed constitution, put in the charge of Ind ministers.

Tariffs.—The reservation excluding the existing fiscal syst from review was only temporary. The Reform of the Cons tution was speedily followed by the appointment in 1921 of the Indian Fiscal Commission, which reported in fav of "rapid industrialisation by means of discriminating prot tion." In accordance with that recommendation an Ind Tariff Board was appointed in July 1923, to report on the ind tries referred to it which had applied for protection. The f and most important of these was steel, and the Tariff Bo recommended that bounties should be paid on the producti of heavy steel rails and fish plates on a descending scale beg ning at Rs. 32 per ton, and that specific duties roughly equival to 30% *ad valorem* (*e.g.*, Rs. 40 per ton on steel rods) should levied on other forms of British or other imported steel. T assistance not being sufficient to enable the Tata Iron and St Company to manufacture steel at a profit, an additional boun of Rs. 20 per ton on 70% of the monthly ingot production voted for the period from Oct. 1 1924 to Sept. 30 1925; and it subsequently decided that this bounty should be continued the diminished rate of Rs. 12 per ton till March 31 1927. 1925 also an old controversy was concluded by the resolve the Government to abolish the excise duty of 3½% *ad valorem* cotton cloth woven in Indian mills. Hence the duty of 11% imported cloth becomes undisguisedly protective.

abour Organisations.—The post-War period has seen a re- rkable increase of class consciousness among Indian urban rkers. Trade unionism on British lines made its first appear- e during the War in Madras, the pioneer society, the Madras bour Union, being a fairly solid organisation of the cotton- l operatives, which quickly found imitators among the alu- ium workers, the employees of the oil companies and others. e great rise of prices and the industrial boom of 1919 furnished most favourable possible conditions for a rapid advance of de unionism; increased wages were necessary, employers e most anxious to avoid stoppages, but they were not in all es ready to grant increases in proportion to the rise of prices ept under pressure, for fear the rise in price might be only porary.

ombay was the chief storm centre. The cotton operatives in ticular showed unsuspected staying power, and not only se- ed advances during the boom which meant an increase in as well as nominal wages, but also, in 1925, won a more re- kable victory in resisting successfully a reduction of wages ing the slump. Indian trade unions are still largely dependent he help of outsiders as organisers, and the success of particu- unions mainly depends on the single-mindedness with which se voluntary associates work for the material benefit of the nbers. There can be little doubt that in the future trade onism will prove a permanent and growing element in Indian strial life.

abour Legislation.—India was represented at the Interna- al Labour Conference at Washington, which was followed an "All India Industrial Welfare Congress" held in Bom- in April 1922. Important labour legislation was enacted in same year. The Factories Act of 1922, which came into force July 1, raised the age of admission for children from 9 to 12, full time work from 14 to 15, prohibited night work for wom- and enacted for all workers a maximum day's work of 11 rs and a maximum week of 60 hours. The Mines Act forbade employment of children and young persons below ground, le still permitting that of women, and limited the week's k to 60 hours above ground and 54 hours below. The Work- 's Compensation Act of the same year was a very carefully ted measure providing, on conditions designed to minimise ation, for compensation for death or accident for 3,000,000 in- trial workers. The contention that long hours of labour are e tolerable and justifiable under Indian than under European ditions springs from interested motives, and is not based upon al fact.

ailways.—In 1907 the route mileage of Indian railways open raffic reached 30,000 m., of which over 15,000 m. was standard ") gauge, and most of the remainder metre gauge. On March 925 the mileage was 38,269 m., of which 18,781 m. were standard ge. At that date 1,200 m. were under construction and 1,084 m. dition had been sanctioned. A great deal of unfavourable criti- has been levelled against the railway policy—or, rather, policies the Indian Govt., with special justification on the counts of of enterprise, vacillation and undue complexity. But the broad remains that nearly 40,000 m. have been constructed with a tal liability of £500,000,000, which convey passengers at an age rate very little over one farthing (3·74 pies) per mile, and ls at an average rate of one half-penny (6 pies) per ton per mile. eover, they make profits which are sufficient to meet all in- st charges and also to make substantial contributions to the nue of the country.

nportant changes are now taking place in railway administration. relations between the Railway Department and the general ad- istration are being altered to give the railways more financial onsibility and independence; on the termination of the leases of East Indian Railway and the Great Indian Peninsula Railway I. R. and G. I. P.), together comprising nearly 5,000 m., the king of these two lines was taken over by the State; and the em of departmental management is being superseded by divi- al organisation, which was tried successfully first on the Great an Peninsula Railway.

oreign Trade.—In the years immediately preceding the War an foreign trade made rapid progress. Very high freights and t difficulty in securing cargo space during the War necessarily ced the volume of sea-borne traffic very greatly; but the impera- need of belligerent countries for many sorts of Indian produce ed prices to rise so much that the money value of the goods ied was not greatly altered. The exports of private merchandise from India were valued at Rs. 249 crores in 1913–4 and at Rs. 253 crores in 1918–9; imports at Rs. 183 crores and Rs. 169 crores respectively. In 1924–5 the value of the exports went up to Rs. 398 crores and of imports to Rs. 243 crores. These figures disguise rather than reveal the essential facts with regard to the changes in Indian foreign trade. There has been a considerable reduction in the volume of imports, most marked in cotton goods and other textiles; but from this decline, in spite of protective duties, iron and steel have been exempt, the increase in Indian production being no greater than the increase in Indian demand; and there has been a very great increase in the imports of machinery and mill work. Other imports which have greatly increased are mineral oil and motor-cars. The volume of exports is now at least as high a level as before the War; but the character has considerably altered. Less grain is being exported and more tea; much less raw jute and a great deal more manufactured; the export of raw cotton has increased, and so has that of cloth, particularly coloured piece-goods, but the export of yarn has greatly declined.

India has in fact become much more self-sufficing with regard to manufactures, and less disposed to export food and raw materials except where, as in the case of cotton, high prices and increased production make export specially profitable. The causes of this change are partly to be found in higher freights and higher import duties; partly also in the changed condition of world trade as a whole, regarded as an interchange of manufactures for foodstuffs and raw materials, in consequence of which the Indian peasantry get only a small increase of price for most of the things they sell, but have to pay a great deal more for what they buy. But it is also partly due to Indian progress in manufacturing equipment and industrial organisation.

(G. Sl.)

Summary Statistics

		1913–4	1923–4
Area under cultivation		(million ac.) 219·2	222·5
Area under forest		(million ac.) 82·6	86·0
Yield of rice		(million tons) 28·8	28·2
Yield of wheat		(million tons) 8·4	9·7
Yield of tea		(million lb.) 307·2	375·4
Yield of cotton		(million bales, 400 lb. each) 5·9	6·0
Yield of jute		(million bales, 400 lb. each) 8·9	8·4
Yield of raw sugar		(million tons) 2·3	3·3
Yield of rubber		(million lb.) ..	14·5
Output of coal[1]		(million tons) 16·2	19·7
Output of gold[1]		(oz.) 596,000	422,000
Output of petroleum		(million gal.) 278	294
Cotton	persons employed[1]	261,000	333,000[2]
	looms	96,688	137,238[2]
	spindles	6,620,000	7,245,000[2]
	output of yarn[1]	(million lb.) 683	617
	output of woven goods[1]	(million lb.) 260 (thousand doz.) 895	402 759
Jute	persons employed	216,000	321,000[2]
	looms	36,050	47,528[2]
	spindles	744,289	1,003,179[2]
	mill consumption	(million bales) 4·5	4·7
Railways	route mileage	34,656	38,039
	train mileage	156,276	158,949
	passengers carried	(millions) 458	599
	goods carried	(million tons) 82·6	98·2
Deposits in banks		(crores of rupees) 96	196
Post office: no. of items carried		(millions) 1,050	1,209
Value of total imports[3]		(millions) £165	£207
Value of total exports[3]		(millions) £177	£255
Imports (net) of cotton pce. gds.		(million yd.) 3,110	1,329
Imports (net) of iron and steel		(million tons 1·0	·8
Imports (net) of silk		(million yd.) 35·5	16·2
Exports (net) of cotton yarn		(million lb.) 154	..
Exports (net) of rice		(million tons) 2·4	2·2
Exports (net) of wheat		(million tons) 1·2	·6
Exports (net) of jute bags		(millions) 369	414
Exports (net) of jute cloth		(million yd.) 1,061	1,349
Exports (net) of tea		(million lb.) 293	339
No. of scholars under education	male	5,828,190[4]	8,315,188
	female	952,531[4]	1,001,466
Expenditure on education		No comparable information available	£12,560,000
Taxation per head			4·1 rupees
Land revenue per head			1·4 rupees
Exchange on London		16⅜d.	17⅝d.

[1] These figures include the Indian States.
[2] These figures are for 1922–3.
[3] Exchange is taken at 15 rupees = £1.
[4] These figures are for 1911–2.

(Me.)

VI. NATIONAL AND PROVINCIAL FINANCE[1]

The Indian revenues are largely dependent on the seasonal rains. If the monsoons are weak and the crops fail, land revenue has to be remitted or its collection postponed, railway receipts fall off, the agricultural population consumes less, the Customs and Excise revenue declines, heavy expenditure is incurred in the relief of distress, exports diminish and the exchanges move against India, increasing the cost of meeting her obligations abroad. Good and bad seasons tend to occur in cycles. Lord Hardinge's viceroyalty started in a good cycle. The four years 1910–4 were years of financial prosperity. The ordinary revenues were expanding, and there were large windfalls in the opium receipts, due to the high prices which the Chinese were offering during the last few years of a trade that was being steadily reduced under an agreement for the complete cessation of the export of opium from India to China in a given period. It thus became possible to make large grants to the provinces for education and public health.

The War Period.—With the outbreak of war in 1914, Indian finance enlarged its experiences. Direct expenditure on the War was at first small, as India was charged only with the normal cost of her armies engaged on the various fronts; and the pre-War military charges of about £20,000,000 rose only gradually to £29,000,000 in 1917–8. But India's external trade was dislocated, and her railway and Customs receipts suffered accordingly; so that the first two years were marked by deficits. In 1916–7 additional taxation was imposed, but the export of war material had now begun to assume large proportions, and agriculture was also flourishing. In 1917 the financial position was sufficiently strong to justify the Indian Govt., with the approval of the Legislative Council, in making a contribution of £100,000,000 to the home government towards the cost of the War; and in 1918 a further contribution was volunteered, which had, however, to be subsequently revised after the Afghan War, and was adjusted finally at about £14,000,000. In 1917–8 taxation was again increased, but such was the activity of trade and the general prosperity of the country that a surplus of £8,000,000 was realised.

Then the tide turned, and for a series of years the national accounts failed to balance. The old standard of military expenditure was doubled; the Afghan War of 1919 and the succeeding troubles in Waziristan threw a heavy burden on the revenues; a weak monsoon in 1920 was followed by considerable agricultural distress; the trade boom which had been stimulated by the heavy manufacture of war material slowly exhausted itself, and exchange was crumbling; while a rapid rise in the cost of living left the government with no option but to make some corresponding increase in the wages of its army of employees. The deficits were met by temporary expedients which had recently been strangers to the Indian financial system—dipping into balances, accommodation from the banks and borrowing for revenue purposes.

The New System.—With 1921–2 started a new era. The estimates of the central administration were entirely separated from those of the provinces; and the former were for the first time subjected, with reservations already explained, to the vote of a popular Assembly, which took the place of the old and comparatively complacent Legislative Council. In an attempt to balance the budget, the Customs tariff was raised from a general *ad valorem* rate of 7½% to 11%, with 20% on certain luxury articles; postal and railway rates were enhanced, and the taxation on incomes stiffened. But a severe trade depression had now set in, and there had been two feeble monsoons. The year closed with over £22,000,000 to the bad; and, what was even worse, the government was compelled to budget for a further deficit in 1922–3, the legislature having rejected several of its proposals, among which a rise in the salt duty was prominent, for improving the revenue.

But sharp retrenchment had now become imperative; and in the winter of 1922 a special committee under Lord Inchcape attacked the whole problem of expenditure. Their recommen tions,[2] comprehensive and drastic, extending to military as we civil charges, were put into effect, so far as time admitted, in estimates which were laid before the Assembly in March for the ensuing year. To complete the rehabilitation of the b get, the government proposed to double the salt tax (roug from a farthing to a half-penny per pound); and when this prop was defeated in the Assembly the Viceroy restored it by the of his exceptional powers, thereby provoking a fierce polit controversy. The result justified the means, for a marked vival in trade combined with the financial reforms to sho small surplus at the end of 1923–4. The budget for the succ ing year was wrecked as the result of an extremist demons tion in the Assembly; and the Viceroy had again to interpose arbitrary authority, though he was careful to certify expendit at a minimum figure which allowed the salt tax to revert t old rate of 1¼ rupees per 82 pounds.

Railways.—Despite this untoward start, 1924–5 went trade steadily improved, and with it exchange revived, the ending with a substantial surplus. Its course was marked by important financial changes. On the one hand, the financ the railways was definitely separated from the general accou and now became a self-regulating entity instead of a handm to the general revenues and the sport of their vicissitudes. railway budget is now framed upon considerations of a consist railway policy, and its only connection with the national bud is that it is bound to make an annual contribution from its ceipts, calculated at 1% on the capital liability of the penultim year, plus one-fifth of the surplus profits, if any, in that yea

The Protective Tariff.—The second landmark of 1924 was enforcement in practice of the policy of discriminative protec which a tariff committee of some years earlier[3] had recommen for the Steel Industry Protection Act of 1924 imposed import du which were clearly expected to be prohibitive on certain articles ufactured from steel, while it granted bounties on heavy steel r fishplates and railway wagons manufactured in India. Hardly the Act passed when the bounties were found inadequate to t purpose and were enhanced. Schemes for similar protection to o domestic industries continued to be formulated, and the whole tr of Indian political opinion is in their support. The following year another fiscal measure of great, if more sentimental, importa The excise duty on cotton goods manufactured in India, which originally been imposed to counterbalance the tariff on impo cottons, and which had for many years been resented as a sacrifi Indian interests to Lancashire, was at last abolished from De 1925, in fulfilment of an arrangement which had been reache settlement of a disastrous strike among the cotton-mill worker Bombay. The accounts for 1925–6 seemed likely to close on the side; and the estimates for 1926–7 again presumed a surplus, altho the law of averages would point to the near approach of a s monsoon.

Budget of 1925–6.—The main constituents of the central bud if 1925–6 be taken as a sample, are as follows:—

Source	Revenue	Object	Expend ture
	£ millions		£ million
Customs	30·9	Defence (net)	37·5
Taxes on income	11·6	Debt services	12·1
Salt	4·6	Civil administration	7·3
Opium	2·4	Other charges	8·3
Railways (net)	3·5		65·2
Currency and mint	2·7	Surplus	·5
Provincial contributions	4·5		
Other receipts	5·5		
	65·7		65·7

The customs tariff, which long stood on a purely revenue foot with a 5% charge all round, is now divided into protective, protective and general sections. The protective section is at pre restricted to manufactured iron and steel, but the so-called protective duties include luxury rates, such as 25% on sugar 75% on cigars, while the *ad valorem* duties in the general sect range from 2½% to 30%. There is a low export tariff on jute, hi rice and tea. The taxation on incomes includes a supertax, and attention has been given to perfecting what used to be a most satisfactory source of revenue; all income from agriculture is exem ıe production of salt, whether from mines, lakes or sea water, is a overnment monopoly, and the duty on it used to be treated as the serve or balancing factor in the Indian budget; but popular presre now seems likely to standardise it at 1¼ rupees per maund, or out one farthing per pound. Opium is a steadily diminishing ure; in 1918 there were 207,000 ac. under cultivation for the opium ppy, in 1924 there were only 133,000 ac.; exports to the Chinese ırket were extinguished, and in May 1926, it was announced that exports of every kind are to cease, even to foreign governments. ıis cessation is to be by a tenth each year.

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[1] In this section the rupee is taken throughout at a conventional value of 16 pence. The full story of exchange is discussed later.

[2] *Report of the Indian Retrenchment Committee* (Delhi, 1923).

[3] *Report of the Indian Fiscal Committee, 1921–2* (Cmd. 1764).

Provincial Finance.—Obviously, however, the figures quoted ove do not cover the whole field of the state's revenue and exnditure. Quite £50,000,000 of receipts, representing their collecns of land and irrigation revenue, excise, stamps and forest inne, appear in the budgets of the nine provincial governments. A nilar sum is expended by them on their administrative business, stice, education, public works, police and gaols, public health, etc. is clear-cut demarcation of financial responsibility was part of the w constitution. From 1833 up to 1921 the accounts of the imperial d provincial authorities had been amalgamated; in the budget of 21-2 they were separated. The local governments now receive the ld of the sources which they administer, and are responsible for the penditure of the provincial departments, both reserved and transred. By far the most important of their resources is the land enue, which, together with the cognate receipts from irrigation, npose more than half the total budget provision of the provinces. inions differ as to whether it is a rent or a tax; but it is a legacy m Mogul rule, and proceeds on the assumption that all the land he property of the Crown.

In Bengal and Northern India a class of intermediary landlords s been gradually evolved, and they are assessed on their rent rolls; Madras and Bombay the revenue is assessed directly upon the t or cultivating occupant, with reference to the estimated output his land. The whole system is being caught up into the region of itical argument, as problems of much importance are beginning to ide popular feeling, *e.g.*, the permanency or otherwise of the essments, the security of tenure in the landlord provinces and the ht of the State to determine rents. In order to enable local governnts to discharge their new functions, they have been given powers taxation, scheduled so as not to invade the sphere earmarked for requirements of the central Government. They have been horised, for the first time under the new constitution, to raise ns, either through the central Government or independently, and ıe of the provinces have already borrowed, for works of improvent such as irrigation and city development schemes.

rovincial Contributions.—The severance of provincial finance n the general accounts brought to the front a problem inherent in federal constitutions, even if they are as embryonic as in India lay. In former years the central Government used to finance itin part by taking a share of the revenues collected in the proves; and incidentally it thereby kept alive its right to intervene in management of the sources from which such revenues flowed. en on the road to provincial autonomy a point was reached at ch this right was curtailed, and the provincial revenues were lited wholly to the provincial exchequers, it became apparent t the central Government had no longer the control of funds icient for its own business. In India the customs, salt, opium and railway receipts, income tax, etc., when once they ceased to be plemented by a share of the provincial land revenue, stamps and ise receipts, etc., proved inadequate to meet the demands of nce, the public debt and the other liabilities reserved by the cen-Government.

nder this compulsion, and arguing that the provinces should itably] contribute to the defence of the country, the Govt. ndia (with the full concurrence of the Select Joint Committee of liament) imposed a levy on the provinces. The total sum which y were asked to pay was about £6,500,000. It was distributed ng the provinces in rough ratio to the advantage which each had ned by ceasing to share its provincial revenues with the central ernment; and hopes were entertained that the central finances ıld improve with sufficient rapidity to enable those tributes to be dually reduced and in a short period completely remitted. Adsity defeated those hopes, and the reduction has been slow and gular. Meanwhile the provincial legislatures, with rare exceptions, e fastened on the arrangement as the main cause of their own ncial stringency, and have magnified a not unreasonable and ely temporary expedient into an intolerable grievance, under er of which there has been a tendency to evade the imposition of ation that might have balanced their own budgets. Several local rnments claim, in addition to their own separate revenues, a e of the taxation upon income collected within their boundaries; some concession on this point has been yielded as an exception to general rule of separate resources, by giving each province an wance of three pies for every rupee by which the income assessed ıin the province exceeds the income that was similarly assessed 920-1.

ocal Finance.—The 772 municipalities of British India have the osal of an annual revenue of over £9,000,000, exclusive of Governt grants and borrowings; and the district and local boards have a nal revenue of about £8,000,000. Both classes of bodies have been endowed by the 1919 constitution with a financial independence commensurate in its degree with that of the provinces. The six port trusts have statutory powers for their own business, and control an income in the neighbourhood of £5,000,000; Bombay and Calcutta in particular having raised considerable loans which rank only second in the Indian market to Government securities.

Indebtedness of India.—The Govt. of India borrows both locally in rupees and in England in sterling—the former now to a very much larger extent than before the War. The position at the beginning of the War was thus described officially:—

Out of a total debt equivalent to £274,000,000 outstanding at the end of March 1914, only about £13,000,000 represented ordinary or unproductive debt. The annual interest on the latter was £750,000 only, and on the productive debt about £8,500,000, so that our total interest charges amounted to some £9,250,000. Railways and irrigation works in the same year yielded us a return of £15,250,000. Thus we had left some £6,000,000 of clear revenue from our great capital undertakings, after meeting interest charges on our entire public debt.

This was the result of a long, careful policy of converting unproductive debt, *i.e.*, money raised for military purposes and the like, into productive debt, by the device of short borrowing for the capital required on railways and irrigation. It had put India into a very strong position to face the changes brought about by the War. The War debt, inclusive of the gifts to the home exchequer, the loans for the expenditure on the Afghan War and subsequent frontier operations, as well as the borrowing necessitated by the series of budget deficits, all went to swell the volume of the unproductive debt; and on March 31 1926 the total indebtedness of India was:—

In India	Crores of rupees
Loans	368·35
Borrowed from the paper currency reserve	49·65
Other obligations	93·27
	511·27
In England	£ millions
Loans	266·43
Other obligations	76·05
	342·48

Of the total it was considered that about 23% was unproductive. The productive loans included the capital liabilities for irrigation, which were taken over by the provinces when that subject became wholly provincial. The "other obligations" are mostly unfunded debt, such as post-office cash certificates and savings bank accumulations, provident funds, etc.; while in England £57,500,000 are accounted for by capitalising liabilities which are being liquidated by certain terminable railway annuities. In lieu of a general sinking fund an arrangement was started in 1924 by which an annual sum is appropriated from revenue for the reduction or avoidance of debt; it is calculated at four crores plus one-eightieth of the amount by which the outstanding debt of the year exceeds the debt outstanding on March 31 1923.

VII. CURRENCY AND EXCHANGE

The foundation of the currency system is the rupee (16 annas or 192 pies), a coin weighing 180 gr. and containing 165 gr. of pure silver. The subsidiary coinage comprises pieces of silver, nickel and bronze; all being legal tender up to one rupee only, except the 8-anna piece, which, like the rupee itself, is legal tender without limit. The sovereign also circulates as freely as Gresham's law permits. Alongside of these is a paper currency, at first of slow and lingering growth, in the form of Government currency notes, the higher denominations of which are, strictly speaking, encashable only in the currency circle (usually an area of one or two provinces) for which they were printed. The favourite notes are for 1, 5, 10 and 100 rupees; but there are also others for 2½, 20, 50, 500, 1,000 and 10,000 rupees. The note circulation as a whole is backed, as to more than one-half, by a reserve of gold and silver, and as to the balance by Government securities held partly in England and partly in India, with a margin for seasonal expansion based on trade bills up to a strictly defined amount.

The exchange value of the rupee follows the ordinary economic law and depends on India's trade balance with the outer world. When there is a big surplus of exports, import bills are at a premium and the rupee rises in terms of sterling; when in bad years exports decline and there is a relative glut of import bills, the rupee falls in terms of sterling. The operation of this law, however, assumes a fairly constant adjustment of the volume of currency to the requirements of trade. If there were no restriction on the output of rupees, the gold value of the coin would tend to fluctuate with the gold value of silver. Up to 1873, although the Indian mints were open, the rupee continued steady at an exchange value of 2s.; then the price of silver began to tumble until the rupee dropped almost to 1s., and so disastrous were the consequences to the finances of the country that in 1893 it was decided to close the mint to free coinage and establish a "managed" currency, with the rupee as a token coin. By this policy an equilibrium was sought.

The Rupee During the War.—By the beginning of the War this system had reached considerable strength. The rupee had been given by law a parity of 16d., and trade conditions had never put it beyond the power of the Government to maintain the exchange at approximately that figure. The machinery for managing the currency was simple. The Indian Govt. bought silver and coined rupees to meet the requirements of the country. So long as silver was under 43d. an oz. there was a profit on the operation, which was placed to the Gold Standard Reserve and (except for a brief and partial diversion) invested in sterling securities in London. Against this reserve the Govt. of India could sell sterling drafts (technically known as " reverse Councils "), if the exchange value of the rupee threatened to fall. On the other hand, if it were rising, the Secretary of State could increase his normal sales of rupee drafts on India (technically known as " Councils "), which would be met out of the Govt. of India's reserves of rupees or, if necessary, by fresh minting. Should this fail to check the rising exchange, it was generally possible to count on a free importation of private gold which would either pass into circulation or be presented to the Government for the purchase of rupees. All these arrangements were working smoothly in 1914. The Gold Standard Reserve stood at £26,000,000, all except £4,000,000 being held in gold or gold securities in England. A continued favourable balance of trade had encouraged the import of gold, of which £70,000,000 worth had been absorbed between 1910 and 1914. The Paper Currency Reserve had £24,000,000 in gold or gold securities, and the note circulation had risen to 66 crores (£44,000,000).

With the War came new and disturbing demands. India was called upon to supply the British Govt. and the Allies with immense quantities of raw materials, manufactured goods and foodstuffs for War purposes, and also to provide funds in India and in countries where Indian troops were fighting. The Indian Govt. had therefore to disburse a rupee currency in very large amounts. The home Government repaid its debts by credits in London, but the Indian Govt. required money in India, and the difficulty was to remit specie. Gold was unobtainable, silver was becoming very scarce in the London and American markets. The Indian Govt. was therefore compelled to increase the note issue without a corresponding increase of rupees held against the notes. The notes were convertible and their encashment drained away the reserve stock of rupees. The time drew near when either inconvertibility must be declared or silver obtained in large quantities for coinage. So seriously were the political effects of inconvertibility regarded that the Government strained every nerve to avert it. The 1-rupee and 2½-rupee notes were invented; the import and export of the precious metals were put under the strictest regulation; and the mints worked night and day.

The Pittman Act.—Yet, with the world shortage of silver, inconvertibility was all but reached in 1918, when help came from the Govt. of the United States. Congress was prevailed upon to pass the Pittman Act as an emergency measure. This Act enabled the Government to borrow from the Treasury the greater part of the dollar reserve of 375,000,000 oz., held as security for silver certificates. The United States Govt., as soon as it obtained this authority, allowed the Indian Govt. to purchase 200,000,000 oz. of silver dollars on terms much below the current market prices, and accelerated the dispatch of the metal to India. From July 1918 onwards American silver began to arrive in large quantities and was coined into rupees. For some months the new money went out of the reserves as fast as it was coined, but by Dec. 1918 the convertibility of the note issue was secured. Between March 1916 and March 1920 the output of the mints was represented by the enormous quantity of 1,390 million new rupees (£93,000,000) as currency.

Throughout this struggle another anxiety grew apace, in the risk of being unable to maintain the rupee as a token coin at its statutory parity with sterling. Sterling was depreciating and silver was rapidly appreciating. From its pre-War price of about 26d. per oz., silver advanced to an average of 31d. in 1916, of 48d. in 1918 and of 61d. in 1920, touching the figure of 89d. in Feb. of that year. As the conversion of the rupee into bullion became profitable when silver touched 43d., the rapid rise beyond that figure led to a wholesale melting down of rupees for clandestine export; and the Government was forced to protect itself by hurriedly pushing up the parity of the rupee until it stood at 2s. 4d. in Dec. 1919, while for a short time private remittances fetched over 2s. 10d.

The Indian Currency Committee.—The whole problem was then referred to a committee of currency and banking experts sitting in London. Reporting early in 1920, this body (with one notable dissentient) recommended[1] that the rupee should be correlated to gold, and not to sterling, which by that time had depreciated in relation to gold and had no certain value, and that it should be given a new statutory ratio equivalent to one-tenth of the gold contained in a sovereign. This would give the rupee the equivalence of 2s. when the pound sterling returned to parity with the sovereign. The committee were of opinion that the price of silver expressed in pence would remain at the point that would make the retention of a 1s. 4d. rupee impossible unless the coin itself was diminished in weight or fineness. This alternative they rejected. They thought that, having regard to the higher price levels of the world, India would still able to maintain a favourable trade balance with a 2s. rupee, that any consequent readjustment of rupee prices of Indian exp staples would be to the advantage of the Indian consumer by act as a drag on internal prices.

The Indian Govt. accepted the committee's recommendation, in Sept. 1920 the Indian Coinage Act established the new ratio of rupee as one-tenth of a gold pound. But currency was alre laughing at the law. There was a rush of remittances to Engla and at the same time the export trade of India fell off. In comn with other countries whose exports consist of raw materials, In found the demand for its produce suddenly dry up. The former plus of exports gave place during the second half of 1920 to a la adverse trade balance which had to be liquidated by bills on Lond Exchange persistently dropped from 2s. 6d. the rupee, which in first months of 1920 roughly represented the parity of one-tenth gold sovereign, to below 1s. 4d. in the early part of 1921, and price of silver receded to 32d. the ounce. The Government ende oured to maintain the rupee at its new exchange value by sel drafts on their resources in London, but economic forces were strong for them, and after they had diminished their gold holding this way by well over £50,000,000, they abandoned the struggle left exchange to find its own level. It steadily dropped to betw 1s. 4d. and 1s. 5d., when the sale of Councils was tentatively rec menced, at whatever they could fetch without regard to the st tory parity. In the hope of ending this anomaly, another curre committee was appointed towards the end of 1925, when the ru had become fairly steady near 1s. 6d.; it had not reported w Lord Reading resigned. Meanwhile, the position had improve readiness for any further attempt to control exchange. The G Standard Reserve had reached £40,000,000 of sterling securitie point at which it was decided that further accretions should be ployed in reducing the rupee securities in the Paper Curre Reserve. The latter in March 1924 contained £68,000,000 in and silver, and over £9,000,000 in sterling securities.

The strenuous efforts made during the War to preserve the vertibility of the currency notes were rewarded by a rapid expan of their popularity. The circulation (66 crores) of March 1914 alr trebled in the next 10 years, touching 186 crores in March 1 notwithstanding the practical disappearance of the 2½-rupee and 20-rupee notes. In 1920 the whole system was improved by Paper Currency Amendment Act of that year, which allowe unlimited note issue provided a metallic basis of 50% was obser required the gold backing to be held in India and introduced principle of a certain definite expansion of the note issue during busy season against trade bills of a durance not exceeding 90 d Before the note circulation became so firmly established as it no several attempts were made to lighten the task of supplying I with silver currency by the employment of gold. Among them the opening of a branch of the British Mint at Bombay, intende coin sovereigns and 15-rupee gold pieces. Like all other sin experiments, it was defeated by the immediate disappearance of into the hoards of the people. Nearly 3,500,000 gold coins minted at Bombay in 1918–9, and work was then abandoned.

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INDIANA (*see* 14.421).—The population in 1920 was 2,930 an increase of 229,514, or 8·5% over the 2,700,876 of 191 against an increase of 7·3% in the preceding decade. ninth in rank among the states in 1910 Indiana fell to ele

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[1] Report of Committee on Indian Currency (Delhi, 1920).

1920. The density in 1920 was 81·3 to the sq. m.; in 1910,
9. The population as of July 1 1926 was estimated at 3,124,
). The urban population (in places of over 2,500) was 50·6%
:he whole in 1920, as against 42·4% in 1910.
[he six cities of Indiana with a population of 50,000 or more
re:—

	1920	1910	Increase %	Estimated 1925
ıdianapolis . .	314,194	233,650	34·5	358,819
ort Wayne . .	86,549	63,933	35·4	97,846
vansville . .	85,264	69,647	22·4	93,601
›uth Bend . .	70,983	53,684	32·2	80,091
erre Haute . .	66,083	58,157	13·6	71,071
ary . .	55,378	16,802	229·6	76,870

lgriculture.—In 1925 there were 195,785 farms of five acres
l over, the total farm land area, which forms 94% of the total
a of the state, being 91,917,780 acres. The assessed value in
4 of all farm property was $2,218,034,991. The chief crops
corn, wheat and oats which produced in 1924, 100,317,606,
353,066 and 58,782,554 bushels respectively. Hay and rye
also produced. In 1924 the area under tobacco cultivation
; 20,695 ac., yielding 18,362,243 pounds valued at $3,057,000.
ge quantities of tomatoes are grown besides other vegetables
l fruits of all sorts. The number of livestock reported on
ı. 1 1925 was 557,472 horses, 103,235 mules, 1,296,163 cattle,
,000 sheep and 3,006,242 swine.

lineral Products.—Coal mining was the principal industry,
340,000 short tons being mined in 1924, the state continuing
rank sixth in this respect. Petroleum wells yielded in the
ıe year 935,000 barrels valued at $1,700,000. The large stone
.rries of Monroe and Lawrence counties produced 70% of the
estone used in the United States for building, the 1923 output
ıg valued at $17,692,112. Indiana oblitic limestone is used in
rly every state and in foreign countries. Indiana has valu-
: clays, shales and kaolin, and is sixth among the states in
ımic production, her clay products in 1923 being valued at
,643,128. Drainage tiles, encaustic tiles, fire-proofing, terra-
a, sewer pipe and stove linings are other important clay
lucts. Pottery products include earthenware, stoneware,
te granite, semiporcelain, sanitary ware and porcelain elec-
al ware.

ducation.—In 1921 the state increased the tax levy for com-
ı-school support as well as for the support of the higher edu-
onal institutions and provision for teachers' pensions was
:ted. There was a tax levy of five cents on each $100 of tax-
: property for the support of the three higher educational
itutions of the state, producing about $2,750,000, and a levy
fraction of a cent for vocational education producing yearly
ut $115,000. In 1924 $64,696,230 was spent on education.
925 the tax levy for higher education was repealed and the
e state schools received special appropriations.

onstitution and Government.—During the decade 1910–20
e was much discussion over amending the constitution of
state, a difficult undertaking under the constitution of 1851,
much as amendment requires the assent of two legislatures
ratification by a majority of the electors. In 1914 an effort
made to bring about a state convention to revise the con-
ıtion. A conference was held at the state university, out of
:h grew the Constitutional Convention League, whose pur-
it was to bring about such a convention. Under the in-
nce of this league, while the Legislature refused to call a
stitutional convention, it agreed to submit to the voters by
rendum in 1916 the question whether such a convention
ıld be held. The proposal was voted down by a large ma-
y, partly because of the expense involved, partly from fear
adical innovations. The vote for the convention was, how-
, so large that two Assemblies approved a series of 13 amend-
ts which were submitted to the voters in 1921. All the
ndments but one were rejected.

uring the 12 years 1913–25 much legislation was passed
nding governmental functions. Only a summary of this
be attempted here: In 1913 an inheritance tax was imposed. In 1915 laws were enacted dealing with industrial aid to the blind; flood prevention; the direct primary for state nominations; workmen's compensation for injuries; and arbitration in industrial disputes. In 1917 a Prohibition Act was passed, made more drastic in 1925 by provisions making the possession of intoxicants a penal offence and the Eighteenth (Prohibition) Federal Amendment was ratified Jan. 14 1919. Provision was also made for a system of state parks, with a commission charged with reforestation and the conservation of natural resources; and a Highway Commission was created charged with building a complete system of state roads, for which purpose, in 1923, a gasoline tax of 2 cents a gallon was provided, increased to 3 cents in 1925, bringing to the commission for road building from $6,000,000 to $7,000,000 annually. In 1921 a state budget system was adopted, and cities were allowed, at their option, to provide for city planning and to adopt the city manager or commission form of city government. In 1921 the Riley Hospital for children, a memorial gift from citizens to the state, was established under the care of the university. In 1921 the university took over the only Dental College in the state.

Since 1909 the governors of the state have been as follows: Thomas R. Marshall (Dem.), 1909–13; Samuel Moffet Ralston (Dem.), 1913–7; James Putnam Goodrich (Rep.), 1917–21; Warren T. McCray (Rep.), 1921–3; Emmet F. Branch (Rep.), 1923–5; Ed. Jackson (Rep.), 1925–

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INDIANAPOLIS, Ind., U.S.A. (*see* 14.427), which claims to be the largest city in the world not situated on navigable water, ranked 21st in size in 1920, with a population of 314,194, of whom 34,678 were negroes and 16,958 foreign-born. In 1925 the official estimate was 358,819. The population increased 34·5% between 1910 and 1920, but the number of foreign-born decreased 14·2%. The area was increased from 33 sq. m. in 1910 to 43·5 sq. m. in 1920, and to 49·5 in 1925. The output of its factories was valued at $126,313,000 in 1909; $398,667,000 in 1919; $262,285,896 in 1921; and $346,858,158 in 1923, when there were 783 establishments within the city limits employing 45,818 workers. The leading industries were meat-packing, manufacture of automobiles and automobile accessories, metal trades and machine shops, canning, manufacture of wearing apparel and printing.

After the disastrous Ohio Valley floods of 1913, a concrete levee 40 ft. high was built along the west side of the White river with a 60 ft. driveway on the top. This was completed in 1916. A new street lighting system was installed in 1915 and improved from time to time. A $3,000,000 sewage purification plant was installed in 1925. The elevation of the railway tracks entering the Union station was begun in 1917, and the old Union dépôt was rebuilt and enlarged into an attractive and commodious station. A city plan commission was established in 1919, and a zoning ordinance adopted in 1922. The park area had been increased by 1925 to 2,544 ac. and there were 53 m. of boulevard and 46 city playgrounds. The War Memorial Building, costing $10,000,000, which houses the national headquarters of the American Legion, was nearing completion in 1925. The cost of living is relatively low in Indianapolis (94% of the average for 31 American cities in Dec. 1924), as would be expected from its exceptional transportation facilities and its favourable location with respect to agricultural and manufactured products and coal mines.

INDIAN LITERATURE.—In Europe literature is, as regards its subjects, largely international, and any new fashion, such as romanticism, pessimism, the psychological novel, the detective novel, is quickly propagated. The individual qualities of prominent writers are soon known, directly or through translations, and evoke responses more or less obvious. Moreover, the similarity of social conditions and outlook lends interest to the same problems everywhere, and international science causes them to be approached from the same points of view.

English and European Forms.—In India the bulk of the educated public is acquainted with English; new English publications are quickly available in the libraries and reading rooms; any new book which has obtained a vogue in England will soon be reviewed in India and be a subject of articles in magazines. Moreover, India has in England, America, France, Germany and elsewhere numerous students, and some journalists, who are living the lives of those countries and sharing their interests; and we have also to reckon with the presence in India of a considerable community of English and other administrators, teachers, missionaries and business men. Consequently, there is a very large output of writings which in spirit and manner, and often in subject, are not properly Indian, but either international or what may be termed "colonial." In Bengal alone over 1,000 publications in English (irrespective of bilinguals) are produced annually, and there are over 100 English periodicals of different kinds. We might mention in addition the large number of works by Indians and officials or ex-officials in India which are actually published in England.

A second department of Indian literature consists of writings in Indian languages which are based upon European models or deeply affected by such. Here we have a great mass of fiction, biography, history, much drama, lyric poetry, travels, political and social pamphleteering and an immense magazine literature, modes which are simply copied from European models. In this sphere we should not overlook the considerable number of actual translations or adaptations of individual works in English, French and so forth. This might be described as the vernacular literature of absorption.

A third stage is represented by that vernacular literature which, while it has absorbed European influences, has yet recovered an Indian outlook and temper, whether in the course of nature or in obedience to the strong reactionary feeling. Already in the 'eighties of the 19th century Bengal had produced a novelist, Bankim Chandra Chatterjee, whose work exhibits a creative synthesis of the new and the old; and at the present day the Bengālī language has, irrespective of its outstanding representative, Sir Rabindranath Tagore, a modern literature conscious of an independent inspiration.

A fourth department is constituted by the continuance of ancient modes and conceptions.

Linguistic Distribution.—Apart from the influence of particular centres, such as universities, the literature is very unevenly distributed. The matter must be stated in terms of languages. In the field of Assamese, Oriya, Bihārī, Punjābī, Sindhī, Nepālī and Kāshmīrī, the Rājasthānī dialects and Malayālam of southern India, the old modes may be said to prevail with little innovation.

High Hindī, in regard to which the same might a few years ago have been said, is rapidly equipping itself with literary and scientific compositions on modern lines. Urdū, the chief organ of Mahommedans in Hindustan, the Panjāb and Central India, is further advanced in the same direction. The two chief languages of the Bombay Presidency, Gujarātī and Marāthī, more especially the former, have a considerable modernising literature. The Telugu of Madras is perhaps not so far advanced; but Tamil has a large productivity, hardly second to Bengālī. Special educational efforts have led to the publication of a fair number of manuals in Kanarese (Mysore), as also in Gujarātī (Baroda) and Urdū (Bhopal and Hyderabad); but other Indian States are not productive on modern lines.

English.—For publications in English about the same proportions hold as for modernised vernacular literature. English works are, indeed, far more prevalent in the provincial capitals, whereas those in the vernacular abound in the less anglicised districts, Gujarātī, for instance, favouring Ahmadābād, Marāthī Poona. The non-modernised literature is also published in all considerable places.

Classical and Other Languages.—The chief classical langua
India, Sanskrit, is represented by editions of two kinds, thos
old Indian lines with or without commentaries in Sanskrit
modern vernaculars, and those with commentaries in Eng
The former are very widely published in the Deva-nāgarī c
acter, or in Bengālī, or in Gujarātī or in the south Indian al
bets, sometimes even in the Panjābī or Urdū; and there
various combinations of these scripts. Editions on Euro
lines appear for the most part in the provincial or state cap
or in the university towns. New original works in Sans
are not infrequent in the sphere of oriental philosophy, ph
ogy, science and religion; occasionally there appear new p
and dramas of considerable extent and literary merit; and t
are also Sanskrit periodicals, including even a daily newspa

Other classical languages are: (1) Prākrit, usually that o
Jains and published in the Bombay province or in the Hind
Mārwārī-speaking areas; (2) the Buddist Pāli, rare in India
the Tibetan, published at Calcutta and Darjeeling; (4)
Pahlavī of the Parsees, published in Pahlavī or Gujarātī s
in the Bombay Presidency; (5) the Arabic, appearing chief
Delhi, Lucknow, Hyderabad; (6) the Persian, more occasi
Many of the vernacular languages also have their old or clas
periods, and prominently the Dravidian group, Tamil, Tel
Kanarese and Malayālam; re-editions of their classical w
are very frequent, and for the most part they are publi
within the areas of the respective vernaculars.

Translations of Sanskrit works are innumerable in nearl
the vernaculars, the *Bhagavad-gītā* for instance being re
duced many times every year; and some degree of the s
favour extends to some of the local classics, the Hindī poem
Tulasī-dāsa, and the Hindī *Bhaktamāla.* Among modern H
writers Swami Vivekānanda, Bankim Chandra Chatterjee
Rabīndranāth Tagore, Romesh Chunder Dutt and Harapr
Sāstrī have also a popularity in several languages; and po
novels, in particular the favourite *Chandrakāntā* (from
Hindī), and its imitators, are frequently translated. Portug
publications appear at Goa, French at Pondicherry and Chan
nagore; the Roman Catholic missions print some brochure
Latin, and there is even an Italian periodical issued from M
galore (*La Missione di Mangalore*).

Alphabets.—The literature of India is, therefore, hi
polyglot, while individual publications are very often bilin
at least. The alphabetic aspect of the matter has also
partly indicated. In spite of the attention which has
given to the possibility of a common script for India,
advocating the Roman, some the Devanāgarī (which h
Hindī periodical devoted to its interest), there is no eviden
progress toward simplification; there is a certain amoun
Roman-Urdū, and Roman is usually employed for the Kon
form of Marāthī and for the rendering of previously unwr
languages. But in general each leading language holds t
traditional script. Sometimes it has more than one; for
Mahommedan writes his Panjābī or Hindī or Malayālam
Tamil (not, however, his "Musalmānī-Bengālī") in the U
character, with any necessary modifications. The Sikh
write his Sindhī in the Gurumuphi of the Panjāb. Bilin
books are therefore unusually also bialphabetic (except
regards the above-mentioned case of the Sanskrit, or sim
cases with Pahlavī and Gujarātī, or Arabic texts with Persia
Urdū); and this adds to the multiform appearance of
Indian literary output, already sufficiently variegated, eve
we overlook such characters as the Multānī, Modī, Ka
Savara, which indeed are rarely printed, or the numerous
writings appearing in philological works. The format of
book is not seldom that of the old Indian *pothī*, sometimes
Bengal) even printed on palm leaves; while the Panjāb G
muphi and the Mahommedan Arabic are much less often prin
than lithographed from handwritten originals.

SUBJECTS AND FORMS

To begin with the lowest stratum, we must note the existe
in India of an extensive, really popular literature in verse.

parts of India, but especially perhaps in the Punjāb, in the narese country and in the Tamil area, there is a constant duction of songs and ballads, provoked by any notable asion, such as a prize fight, a flood or calamity, a crime, a gedy, a personality or social event, an act of administration; se have a real, though probably in general a brief, life upon lips of the people, who sing them over their work or in their ial gatherings. Of late years this form has been largely used political propaganda, innumerable small collections of tional songs" appearing in all the chief languages. There also many collections of songs for special occasions; *Garbhī* gs for women, marriage songs, songs for the Holī (spring) ival and other celebrations, boat songs for aquatic sports in ssa and Bengal and so forth. At certain times of the year Mahommedans put forth vast quantities of "verses" in nour of Mahomet or dirges for Hasan and Husain. Religion a large share in this poetic activity: songs in honour of shna (especially in Hindustan, Bengāl and Orissa, but also in jarāt and Southern India), of Caitanya (*kīrttans* in Bengal), Kārttikeya, Ganeśa, Dattātreya, Vithobā (in the Marāthī a); songs for pilgrims to or at the various shrines (innumere in the Telugu and Tamil country); songs for temple rites; ections of Jain hymns; and the many publications of Chris- sects, which in some cases (Roman Catholic) even deign follow Indian models. Not all this popular literature is verse, since there are occasions when sacred stories in prose *ari-kathās* and the like) are narrated in or near the temples.

ral Preservation of the Classics.—An oral existence appertains to a good part of the various classical writings of India. is is the case not only with Sanskrit works such as the Mahābata and Rāmāyana, some parts of the Purānas, and some ries such as those of Sāvitrī and Hariśchandra, but also to the sics of the several vernaculars. Not to mention the substance stories and legends, the texts of such poets as Kabīr and asī-dāsa in the Hindī area; Vidyāpati, Govind Dās and many ers in Bengal; Narsinh Mehta, Mīrā Bāī and Prēmānand in jarātī; Nāmdēv and Tukārām in the Marāthī country, lā in Kashmir; the Sūfī poets of Sindh; the Vaishnava and va saints and moralists of the Tamil country, are very familiar the lips of ordinary people in their respective areas, and, ides being used in education, are frequently re-edited. In Punjāb some parts of the Sikh *Granth* are similarly used.

he Drama.—On the borderland between the oral and the rary we have the drama. In India it was indigenous in many ns, from the heroic down to the morality, miracle play, the e, the shadow or puppet show. Except in the extreme south ndia, it would seem that the popular forms of representation e been more or less levelled out. The ordinary play, proed chiefly in Calcutta, Bombay and Madras, is similar to European forms—melodrama, social sketch, burlesque, blem play (the old man and the young wife, the modern ng man or woman and so forth), love story: it is generally rspersed with verses, and these are often separately published popular use. The more literary drama, still sometimes in skrit, takes its subjects chiefly from old Indian poetry and nd, and is not seldom an adaptation of a particular Sanskrit k (the *Śakuntalā*, the *Mahābhārata* and *Rāmāyana* or sodes therein, and so forth). The choice is to some extent cted by local celebrity, and occasionally a political application may be suspected.

agazines.—The pabulum of the ordinary reader in India is nished by the magazine, containing essays, biographies and criptions, short stories and serials, notes and not rarely strations. The total output is enormous; for in addition to diversity of languages we have to reckon with the division he Hindus into castes with their separate interests and claims. ortant castes prefer an organ (or competing organs) of their , which, along with the ordinary magazine material, will tilate any matters having a communal bearing. This literae, therefore, presents no ordinary problem to the bibliogers; somewhere in India it should be sedulously collected preserved, on account of the special biographical and sociological items which it contains. Schools and colleges have their organs (usually, however, in English). The missionary agencies, including the Salvation Army, issue innumerable periodicals of all grades, both in English and in the vernacular. Trades and the business world, professions (teaching, medicine, law, astrology, and so on), and grades of official service all contribute to the mass of vernacular organs. There are further a *Hindī Punch*, a *Hindī Graphic*, a Gujarātī and Marāthī *Tit-Bits*, and short story magazines; music and the stage are also represented by popular periodicals. Special interests, such as the cause of women, social service, co-operation, labour, economics, business, arts and sciences, travel, boy-scouting are similarly equipped. The chief vernaculars have usually at least one literary periodical of a fairly high type. In some cases they have flourished during long periods: the *Sentamil* of Madras is in its 24th volume, the Hindī *Saravatī* in its 25th, the Bengali *Bhāratī* in its 49th, the Gujarātī *Samālochak* in its 30th, the Marāthī *Vividhajñānavistara* in its 56th. The Urdū *Humāyun* also is of some standing.

Indian Poetry.—Modern Indian poetry, excepting translations and adaptations of old Sanskrit works and themes, is usually in the form of short lyrics issued in small collections. Larger productions are for the most part collected works of single authors, or anthologies or the outcome of literary Eisteddfods. In the Hindī area the ballad of old style attains a greater length, as do Tamil *Kāvyas* on classical models. The poetry is generally erotic, ethical, philosophical or religious; but the satirical and controversial, and also, as we have seen, the political, claim a place. The verse forms are usually the traditional ones: only Bengālī, it appears, manifests original power in this direction.

Fiction.—Fiction on European lines is making rapid headway in India, and it is supplanting the old romantic tales, at least so far as prose is concerned. The Punjab may still reprint its *Hīr* and *Ranjhā*, *Rāja Rasālu*, etc., the Sindh its *Sassī* and *Punnūn*, the Urdū language its *Lailī* and *Majnūn*, and Hindī the tales of *Bhartarī* and *Gopīchand*. The novel is popular both in the form of the short story and of more substantial narratives; and it reflects all the varieties of subjects which have a vogue in English, historical, social, romantic, adventurous (including the detective novel). A new feature is the translation of well-known (including English) novels into several languages and the immense vogue of such popular stories as that of the Hindī *Chandrakāntā*.

Religious Literature.—Indian religious literature, in so far as it is not lyrical, philosophical, argumentative or philological, consists mainly of manuals of ritual for daily life (*dinacaryā*) or for particular occasions (marriage, burial, times and seasons, pilgrimages, vows), and of the stories therewith associated; for instance, the story of the Tulasī plant and that of Satya-Nārāyana are constantly reproduced. Benares takes a prominent part in such publications. Since each section, from the Vedic *Śākhās* downwards, must have its separate rituals, it results that the number of such publications is very great. Especially in southern India the innumerable local shrines have their little manuals, each setting forth the sacred legend and the rites to be observed. In the case of the orthodox and older sects, which have sacred texts in Sanskrit, this literature is often bilingual (at least), reproducing or copiously citing the originals.

We pass to a consideration of the activity in the reproduction of old canonical texts, with or without commentaries, for the purpose not of ritual but of study and edification. This accounts for a great mass of republication: in the Punjāb, for instance, there is a steady stream of thick volumes of *Selections from the Ādi-granth*. There are some valuable series of such canonical texts; the Jains have several and the Madhva doctrine of south India and the sect of the Mahārājas in Bombay have thus made accessible their chief writings. Important sects have usually one or more periodical organs, which, amid other matter, publish and comment upon their authoritative books. Many religious texts are, of course, not the property of any particular sect, and are therefore variously reproduced; and from these we can hardly separate those which are of a philosophical rather than of a religious character: such are the Vedānta writings, the Madras periodical *Vedānta-dīpikai*, and other philosophical journals; of wider scope, the *Siddhānta-dīpikai* and the Marāthī *Tattvajñāna-vistara.* There are English periodicals belonging to one or the other of the above two groups: such are the *Vedānta-kesarī* of Madras, the Ahmadī *Review of Religions* and *The Theosophist* (which also has vernacular allies). Modern philosophy is represented by the Calcutta Philosophical Society, and by a now extinct Indian Philosophical Review published during several years in Baroda.

Philology.—Philology of a more general character is no longer in India restricted to one or two classical languages, Sanskrit, Prākrit, Tamil, Pahlavī, Persian, Arabic. There are societies which devote themselves to the publication of old texts in the existing vernaculars. The Bangīya Sāhitya Parishat, with its *Pattrikā* and its series of separate old Bengālī texts, has a very honourable record. The Tamil Sangam of Madura (which issues the *Sentamil*) is likewise distinguished. There are now other Sāhitya Parishats in the province of Bengal, and for Telugu also there is the Āndhra Sāhitya Parishat. For Hindī there are the Nāgari-prachārini Sabhā and certain Mandalas; for the Panjāb the Khālsā Tract Society; in Gujarāt, where societies for publication seem to flourish, the oldest is the Gujarāt Vernacular Society, while there is also a Sāhitya Parishat, and a Sāhitya-vardhana Society; in Marāthī an important series of editions of old poetry was published under the title *Kāvya-samgraha.* In literary history there are very important and extensive works by Rai Saheb Dineschandra Sen (Bengālī); Sir G. Grierson and the Misra brothers (Hindī); G. M. Tripāthī and K. M. Jhāverī (Gujarātī); Prof. W. B. Patwardhan (Marāthī); and Vīresalingam Pantulu (Telugu).

As to the general philological activity of India, it is hardly possible to draw any clear line between indigenous scholarship and that affected by European methods: the main aim and procedure of scholarship are the same everywhere, and whether a commentary is in Sanskrit or Bengālī or English seems to make little essential difference. Only comparative philology is new to India. This philological activity, wherewith is associated the investigation of archaeology and pre-British history, and from which we may exclude the astounding output of educational work up to the level of university text-books, is connected chiefly with organisations of some kind. The Govt. of India itself maintains an Archaeological Survey, which publishes annual reports in the several provinces and at headquarters, and splendid quarto and folio monographs on special matters, as well as a periodical relating to Epigraphy (*see* ARCHAEOLOGY: *India*). This example is followed by Indian States, Mysore, Travancore, Hyderabad, Kashmir. Several provincial governments have published catalogues of Sanskrit MSS. (Bengal, the United Provinces, Bombay, Madras, the Central Provinces); States, small and great, Kashmir, Nepal, Baroda, Mysore, Travancore, Alwar, Bhaunagar, have taken their part. Important series of Sanskrit or Arabic texts, too, are officially edited in Bombay, Mysore, Travancore, Kashmir, Hyderabad, Baroda.

After the Governments we may mention the universities, colleges and libraries as active in the publication of texts and researches (the universities of Calcutta, Madras, Lahore, the Benares Sanskrit college, the Maharajahs' College, Vizianagram, the Bankipur public library). Important journals are issued by societies (the Asiatic Society of Bengal, which has also published under the title *Bibliotheca India* a vast collection of Sanskrit, Arabic, Persian and Tibetan texts; the Bombay branch of the Royal Asiatic Society, the Mythic Society of Bangalore, the Bihar and Orissa Research Society, the Hyderabad Archaeological Society, the Bhandarkar Oriental Institute); and some, like the *Sanskrit Research*, the *South Indian Research* and the *Jain Purātattva*, are occasionally started independently or by religious bodies. The books issued by authors, editors, or individual publishers are, however, more numerous and on the whole the Indian publication of philological, historical and archaeological matter relating to pre-British India quite
dwarfs in bulk all that is done outside. Much is highly mer
rious, and some of it is fully equal to the best productio
Europe. The monumental *Linguistic Survey of India*, edite
Sir G. Grierson for the Govt. of India, is now (1926) al
completed (*see* PHILOLOGY).

History.—For educational purposes and general read
many short histories of India, of England and of other coun
are produced both in English and in the vernaculars.
original research and independent judgment will be found ch
in the few first-hand histories of particular states and dynas
and with a few exceptions (such as the Marātha research
Rai Bahadur, D. B. Parasnis and the volumes of Mar
records published by the Marātha Historical Society of Po
the volumes of Professor Sarkar concerning Aurangzeb,
biography of Jahāngīr and the *Journal of Indian Hist*
published by the Allahabad University School of Indian Hist
the works on South India by Professor Kumāraswāmy Aiyan
Subrahmanyam Aujar and a few others) in the works of Engl
men. The valuable monographs produced in Europe or I
by Indian scholars relate for the most part to ancient times,
are less historical than philological. Many volumes of rec
and calendars in English have been published by local gove
ments; the gazetteers also are replete with historical infor
tion not absorbed in formal histories; and there are several so
ties, the Bengal Historical Society, the Panjāb Histor
Society and the United Provinces Historical Society, wh
journals are composed of original matter.

Biography.—Biography, including autobiography, is now p
ular in India, taking chiefly the form of short mem
which in the case of princes and of important religious lea
such as Debendra Nāth Tagore and Dayananda Sarasvatī,
attain a considerable length; so also in the case of histor
personages, Sivājī, Jahāngīr and others. A very favourite fo
of which there are old examples, is the serial biography, cont
ing lives of saints, lives of famous women, hierarchical, dyn
and family biographies. Valuable work of this kind has b
done in regard to the Tamil and Telugu saints and poets,
the poets of Bengāl and Gujarāt. Small volumes of "pr
reminiscences" have been published by political offenders,
the number of short "lives" of popular heroes, such as
Tilak, Mr. Gokhale and Mr. Gandhi, is beyond count
The old form of biography in verse is still favoured in rela
to saintly and historical characters: naturally, it has aims o
than information and research. Many Indians, from prin
downwards, have written accounts of their travels, whether
England, on the continent of Europe, in America or in o
countries, including the Far East. But India itself furni
rich material and occasions for travellers' experiences, especia
in connection with its shrines and pilgrimages, so that such tit
as *Bhārata-bhramana* quite naturally recur. (F. W. TH.)

INDIANS, NORTH AMERICAN (*see* 14.452).—The Indians
no longer warlike nor to any extent resistant of the white m
methods for their civilisation.

I. IN THE UNITED STATES

The United States assumes that health, education and indus
are essential to the Indian's self-support and citizenship. Acc
ingly, the Federal policy is to hasten his advancement and p
tect his personal and property rights. By Act of June 2 192
Indians within U.S. territory not already citizens were made
Under the administration of the Bureau of Indian Affairs th
are provided health supervisors, school and agency physici
field matrons, nurses and travelling dentists, whose duties de
nitely pertain to the physical welfare of the Indians, and h
pitalisation is widely maintained against all forms of disease.

Education.—For education, the Federal Govt. conducts
day schools, 59 reservation and 18 non-reservation boardin
schools, having an attendance of over 25,000 pupils. The cour
of study prescribed combines scholastic with such industri
training as is well adapted to Indian needs and temperamen
The aim is to prepare girls to become good housewives an
mothers, and to fit boys for practical farming or to give the

knowledge and practice in mechanical industries as will to skilled workmanship. The day-schools carry six grades, the boarding-schools six, nine or 12 grades. The object of latter is to embrace six elementary grades, a junior high rse of three grades, and a senior high course of three addi- al grades. From the more advanced schools students may uire full training in such chosen trade or occupation as may lify them to engage in remunerative pursuits upon their luation. In all Federal schools prominence is given to hy- e, to moral conduct, to religious culture in any Christian omination and to the practice of thrift. State public schools e become accessible generally to Indian children, and in these ools there are over 34,000 enrolled. Over 7,000 are received ission and private schools. Approximately 87% of the Indian dren of the United States are enrolled in some school. There been a steady increase in the number who speak, read and e English.

o promote reservation industries there are maintained dem- tration and experimentation farms, and several hundred ners, stockmen and assistants are employed in giving prac- l instruction in modern methods of agriculture and the up- eding and handling of live stock. Loans have been made to rgetic Indians from tribal or public funds as initial capital, these measures have been generally successful. Special ention has been given to the reclamation of arid and semi-arid ian lands, resulting thus far in a total area of lands under structed works approximating 636,000 ac., with an ulti- e area approximating 1,370,000 acres. The annual crop ues derived from these irrigated lands are equal to all prior . Tribal herds of sheep and cattle have been maintained on umber of reservations with financial profit, but chiefly to ourage individual ownership and enterprise.

laska.—The affairs of the Alaskan natives are supervised by U.S. Bureau of Education. Eighty-five schools are conducted six superintendents, nine physicians, 27 nurses and 157 teachers. e hospitals are maintained. The work is carried on in 85 villages tered along the coast and on the great rivers. Imperfect trans- tation and climatic conditions render the service very difficult, the progress is substantial. Despite the heavy mortality from ase, the population has slowly increased to approximately 27,000. Bureau of Education has established three industrial schools, ated at Eklutna, 28 m. north of Anchorage, on the Alaska Rail- l, at Kanakanak, on Bristol Bay and at White Mountain, on river, 25 m. from Golovin, on Norton Sound. Instruction is en in carpentry, in boat-building, mechanical and marine engineer- for boys; and for the girls: home-making, nursing and sanita- . When the Alaska school service was established, about 1885, aborigines of Alaska were in primitive conditions, which have dually disappeared. In many of the villages, the old huts have n replaced by neat well-furnished houses. Many Indians are ployed by the great canneries of southern Alaska. They own l operate fleets of power-boats, which are of service in transport- fish from the fishing grounds to the canneries. Some find employ- nt in the mines, while others are pilots, trappers, storekeepers, gers or ivory carvers. In northwestern Alaska the reindeer ustry is the basic industry, introduced to furnish a vocation that rantees food, clothing and transportation. Herds were found in 6 near all of the principal native settlements of western Alaska l at various other points. So rapidly have the herds increased t the total number of reindeer in Alaska was in 1925 estimated at ,000, of which about 255,000 are owned by the natives.

General Progress.—Under the policies outlined, the North erican Indians have made unusual progress during the years o–26. Their population is greater than at any time in the ceding half-century. They depend less upon "medicine n" and more upon medical science and sanitation. As com- red with earlier periods, they are giving more attention to manent homes; are less nomadic and superstitious. The men are better housekeepers, and infant mortality is decreas- . The day of paint and feathers and blanket garb has almost sed away. The younger school-trained element is creating a v leadership, manifested in changing habits, customs, indus- l pursuits and social life. Marriage by tribal custom is yield- to legal rites, and crime is diminishing. Substantial advance- nt is noticeable in agricultural operations and stock raising, he use of modern machinery and methods and in large gains ndividual funds.

The acceptance by the Indians of American principles of government and civilisation was in some sense disclosed by the World War. In the United States the number of Indians in military service was more than 10,000, three-fourths of which represented voluntary enlistment. In Canada the number exceeded 4,000, all of whom entered voluntarily. The percentage of Indian male population of military age in the World War was probably equal to that of the whites thus engaged, and their proportion of volunteers even greater. They were distributed almost entirely in white organisations, and were highly commended by their officers. Indians ineligible for war duty were active in Red Cross and other relief work and responded to emergency demands for productive labour. (C. H. Bu.)

Comparative Information About the Indians in the United States, Exclusive of Alaska

Population and Citizenship	1911	1925
Population	322,715	349,595
Indians receiving allotments of land	164,215	245,521
Indian citizens of the United States	179,830	349,595
Educational and Vital Conditions	**1911**	**1925**
Indian children eligible for school	63,411	77,597
Indian children in Federal schools	23,647	25,706
Indian children in state public schools	11,000	34,452
Indian children in mission and private schools	4,750	7,280
Total Indian children in all schools	39,397	67,438
Capacity of all schools for Indians	43,015	64,910
Hospitals and sanatoria maintained	50	84
Capacity of hospitals and sanatoria	1,268	2,573
Indian patients treated	8,408	27,775
Indians given medical examination	42,645	83,306

II. IN CANADA

The Indians in Canada numbered in 1923 about 109,000 and are now slowly increasing. They are regarded as minors under the law and are administered by the Department of Indian Affairs under the Indian Act, whose aim is to promote the advancement of the Indians in the arts of civilisation. If, and when, enfranchised they lose the advantages of protection by the Department and are merged in the general population. Agents, 114 in number, have been appointed to encourage the Indians to settle in the Reserves set apart for them which amount to 4,911,259 ac., valued at $52,941,629. The capital of the Indian Trust fund on March 31 1923 amounted to $11,516,213. The attendance at the 340 schools provided for them was 66·5% of the pupils enrolled—6,931 boys and 6,792 girls. The total income of Indians for 1923 from all sources was estimated at $9,940,349.

INDO-CHINA, FRENCH (*see* 14.490), French colony in Asia, consisting of the colony of Cochin China (under a governor, with 20 provinces, each under an administrator); the four protectorates of Tongking (23 provinces), Annam (16 provinces), Cambodia (13 provinces), Laos (10 provinces), each with a *resident supérieur;* and the territory of Kwangchow Bay, leased from China for 99 years, under an *administrateur en chef.* Its area is 299,621 sq. m. and the population (1924) 19,624,000, of which 26,137 were Europeans (24,882 French) and 14,522,000 Annamese.

Political History and Administration.—Indo-China contributed two fighting and 17 labour battalions during the War, 48,900 other war workers and much war material. It contributed largely (Europeans and natives alike) to the war loans. Political troubles during the War were trifling, in spite of enemy agitation. The governor-general during the War was M. Ernest Roume. M. Alexandre Varenne, a Socialist Deputy, was appointed in Nov. 1925. His arrival coincided with the accession of a new emperor in Annam. Relations between the emperor and the French authorities were settled by the convention of Nov. 6 1925. The *résident supérieur* of Annam has been granted permanent authority by the emperor to consult the representatives of the people and to discuss with them any important reform or questions which may arise.

The powers of the governor-general have been reinforced by a decree of Sept. 2 1920. His local decrees (*arrêtés*) have real legislative force. He can dissolve or suspend the *conseil colonial.* He fixes taxes and contributions (except customs duties) leviable in the colony as a whole, or locally, with the advice of local authorities and vote of local chambers. The *conseil supérieur* (*see* 14.491) has been superseded since Oct. 24 1911, by a council of government with very similar duties and composition, and thus still almost entirely official; but it now includes *délégués* (elected by French votes) for Tongking, Annam and Cambodia; native representation is increased from four to five.

In Dec. 1924, the governor-general, Martin, announced a sweeping reorganisation of the whole system. The council will bear the name "congress of the Indo-Chinese union" and consist of 44 members (27 representing the French, 17 the native element) elected by the local elective assemblies of Cochin China, Tongking and North Annam, Annam and Cambodia and Laos. It will have extended financial powers. The old council and its committee will continue under new names and with reduced membership; the new congress will send delegates to both. M. Varenne will probably bring the system into force. The colonial council in Cochin China has been reorganised, its powers extended, and its electoral and native elements strengthened. Natives now have five-twelfths of the representation. The native franchise has been radically reorganised; it now includes all male native French subjects with a clean judicial bill who possess either a property qualification (payment of a land tax of 21 piastres, or a corresponding dealer's licence) or a capacity qualification gained by possession of educational diplomas, exercise of certain public functions, or "services rendered to France." This franchise gives the vote to very many small peasant proprietors; abolishes the headman oligarchies; and amounts to a far-reaching social and political revolution in the villages.

In the protectorates the councils have been democratised on similar lines and natives given an increased share in self-government. This is, it is true, limited mainly to budgetary and fiscal matters; but the change has worked smoothly; the natives have often given sound advice on technical questions. They are keenly interested in self-government, education, etc. There are also native provincial councils and native representation in the municipalities of the large towns. The system will be extended under M. Varenne.

Education and Culture.—The educational movement is parallel to the political, but as the province has over 2,000,000 children of school-going age much remains to be done. In 1924–5 primary and secondary French schools had an attendance of 2,525 (about half natives); the 3,395 Franco-native official schools, an attendance of 213,977; the private schools (native and missionary) one of 99,790, the expense on education being 6,000,000 piastres (1924). The 1917 public instruction code laid down the principle of the teaching of French, even in elementary schools, but there are reservations, defined in the *arrêté* of Sept. 18 1924. French is taught with the native tongue during the first three years of primary instruction, and is the obligatory teaching medium of the last two, which are, however, attended by only 23% of the native pupils. The "University of Indo-China" at Hanoï is a high school with many branches giving practical and theoretical training; it aims at turning out competent native assistants for the different French administrators, and training lawyers, planters, traders and manufacturers. Most of the students are Annamese. The *École Française d'Extrême Orient* at Hanoï, under the patronage of the *Institut de France*, conducts valuable research work in native art, history and language. It has a fine library and museums in Hanoï, Tourane, Saïgon and Phnom Penh, and has done epoch-making work in its *Inventaire* of Cambodian and Cham monuments, its excavation of the ruins of Angkor, etc. (see its two vols., *L'École Française d'Extrême Orient depuis son origine jusqu'à 1920* (1922) and its semi-annual *Bulletin*).

Budget.—The general budget, under 24,000,000 piastres in 1901, was 64,602,000 piastres in 1925, almost all drawn from indirect taxation. Local budgets (drawn from land tax, etc.) were 48,978,000 piastres. Each spent about 30% of receipts public works. Reimbursements to the French budget for m tary expenditure reached 10,000,000 fr. in 1925. The deb only 400,000,000 fr., absorbing 2·8% of the total revenue.

Defences.—The divisional general commanding troops in In China (Hanoï) has under him three brigadier-generals (To king two, Cochin China). Troops consist of two regime French Colonial Infantry (Tongking, Cochin China); two b talions of the Foreign Legion; two regiments artillery; detachments French gendarmes; two flying squadrons, wh also do excellent work in mapping and fiscal service. There four native regiments of tirailleurs in Tongking, one in Coc China. There are five "military territories" on the Chin frontier and in Laos. The medical service is relatively importa and helps in the general sanitary organisation. The navy under the command of a *capitaine de vaisseau* (Saïgon). local squadron has been reduced almost to nothing since War. There is question of handing the Saïgon Arsenal over t private enterprise.

Commerce, Agriculture, Industry.—Although there is stil plethora of French officials (about 4,600), especially in the lo ranks of the Customs and Excise and similar services, there over 3,000 French non-officials (males), traders, manufactur and planters. In 1922 there were from 250–300,000,000 invested in private French enterprises. Rice remains the sta product; 4,750,000 ac. in the Mekong Delta were under r in 1920. There were 62,500 ac. of rubber plantations and ot tropical plants were cultivated successfully. The anthrac mines of Hongay and Dongtrieu produce 1,000,000 tons an ally. The production of zinc (40,000 tons) and phospha (20,000 tons) is important. In 1925, 33,833 hands were enga in mining (329 Europeans). The presence of coal has given bi to a rapidly expanding industry in the Red river delta, wh there are large cement works, brick, tile and ceramic wor three naval yards (beside the Saïgon arsenal), two importa French river steamer companies, three large cotton spinni works and minor industries. Home industry (lace-making, et employs many native women. The piastre, worth 2·50 fr. bef the War, was in 1926 worth 15 fr.; but on a piastre basis, expo have increased by 77% since 1900, imports by 14% only. Si the end of the War exports are some 164,000,000 piastres an ally, imports 132,000,000, rice being the main article export (maximum, 2,325,000 tons in 1921). Imports to France fr Indo-China in 1925 were 612,000,000 fr., exports 760,000,00

Communications.—There are now 2,075 km. of railways. important line, 126 km. long, is planned which will run fr Tanap to Thakhek and link up Central Laos with Central nam. Tourist traffic is now possible and encouraged. Over 000,000 piastres were spent during the years 1919–25 on dredgi irrigation, etc., and 50,000,000 piastres on roads, of which the are now over 30,000 km. (11,000 metalled, 9,000 made possib for motors in the dry season).

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INDUSTRIAL ASSURANCE: *see* INSURANCE, SOCIAL.

INDUSTRIAL EDUCATION.—In the United States special aining for industry in regularly organised courses is of recent igin. It was common before the World War and before re-ictive legislation checked the influx of immigrants from Europe American industries to secure most of their skilled workers m the Old World. The pressure of industrial competition l manufacturers to see that America must do something to in workers, and the labour situation during and since the ar led to a rapid expansion of industrial education. The War so led to a complete redistribution of the men and women o were engaged in industry and greatly stimulated agencies voted to the training of adults. The Federal Govt. attempted ring the period of demobilisation to provide for the industrial adjustment. Especially was the effort made to care for sabled and partially disabled soldiers by training them in rms of work suited to their physical and mental abilities.

The first serious effort in the United States to provide indus-ial education in public schools was made by the State of Mas-chusetts in 1905. A commission was appointed by the Gov-nor under the authority of the Legislature to make a report on e matter of industrial legislation. This commission was fol-wed by a second, and the final outcome in 1913 was a code of ws providing for state-aided and compulsory vocational edu-tion. In 1911 Wisconsin adopted a law creating for the state d for local districts, school boards in control of vocational ucation separate from those in charge of the common schools. is radical step has not been imitated in other states.

The Federal Board for Vocational Education.—In 1917 the ngress of the United States was persuaded by a group of in-strial managers and by a small group of educators, chiefly ose interested in the Massachusetts and Wisconsin experi-ents, to set up a Federal board known as the Federal Board for cational Education, which was the disbursing agent for a rge Federal appropriation to be distributed to the States on dollar-for-dollar arrangement for the purpose of encouraging dustrial courses, especially in high schools. This board is au-orised to supervise courses in agriculture, commercial subjects, me economics and industrial or trade courses. The latter are w provided in public schools either in all-day trade schools, all-day courses in technical high schools, in part-time courses continuation schools, in part-time courses on the co-operative an or in night schools, and in so-called extension classes or portunity schools, where workers come for training when not oc-pied in wage earning. Much of the industrial training outside the all-day schools is arranged so as to be available for adults.

Statistics.—The number of centres to which Federal support s been given in successive years and the registration in indus-ial courses in these centres are shown in the following tables:—

Trade and Industrial Schools

	Evening	Trade Extension	General Continuation	All-day
1918	300	341	. .	168
1920	435	119	322	199
1922	620	150	506	237
1924	776	238	582	279
1925	816	225	556	297

Number of Pupils Enrolled

	Evening	Trade Extension	General Continuation	All-day
1918	46,333	53,005	. .	18,596
1920	48,354	17,159	98,082	21,224
1922	66,477	33,106	167,911	31,390
1924	84,973	35,475	256,133	33,262
1925	86,540	30,400	265,335	39,666

Relation to General Education.—The tendency at the time the Federal Board for Vocational Education was organised was to make a sharp distinction between general education and academic education. This tendency was strengthened by the example of Germany, which was regarded before the War as the most successful nation in developing industrial education. The tendency in 1926 was to unite trade training and general education rather than separate them. Many high schools have made industrial courses a part of their regular programme. On the other hand, trade schools have found that it is necessary to include general courses if young people are to be properly trained for life in a democracy. *See* also COMMERCIAL EDUCATION. (C. H. J.)

INDUSTRIAL PSYCHOLOGY.—Industrial psychology may be defined as the study of the conduct of men and women in their capacity as wage earners. It aims at describing and explaining all those activities by means of which a person adjusts himself to his economic environment; hence it must take into account the fundamental elements of man's constitution, his innate tendencies and their expression in thought, feeling and action both on the conscious and unconscious level, as well as his acquired aptitudes. As yet, only a tentative beginning has been made, so that we are far from even an approximation to scientific generalisation.

HISTORY OF THE SCIENCE

The development of industrial psychology has been largely determined by its history. Prior to 1914, psychologists concerned themselves but little with industrial problems. A few writers occasionally saw a possible industrial application of some psychological generalisation; and in 1913 Münsterberg[1] made a more ambitious attempt. Industrial development had been governed by the claims of machinery, rather than of man. The enormous improvement in machinery during the 19th century, the studies made in the natural sciences, the growing knowledge of the mechanism of the body, all tended to focus general interest on man's likeness to a machine. The phrase "the human machine," which is rightly applied to part of his structure, became synonymous with man himself rather by implication than by design. The outbreak of the World War, with its urgent demands for increased production in all departments of activity, brought home to society the futility of considering the worker merely as a machine.

Industrial operations, as usually conducted, had been implicitly based on a crude mathematics. If 6 units of work could be done in one hour, then 6 x 8 would be done in 8 hours, 6 x 12 in 12 hours. The physiological necessity for sleep prevented the complete working out of this principle. Up to about 6 or 7 hours, according to the nature of the work, there seemed nothing obviously wrong with the calculation; when however, the problem was one of 12 hours, the discrepancy between the facts and the calculation challenged investigation. Though it was not then recognised, that stage marked an epoch in the history both of psychology and of industry. The focus of interest was changed from the machine to the worker of the machine, and the assistance of psychology, hitherto looked upon as a somewhat recondite study, was invoked.

The Work Curve.—Previous work of a more or less theoretical character into problems of fatigue suggested the lines of investigation. Hence the earliest work in industrial psychology was concerned with fatigue. As the time was one of urgency, the problem had to be dealt with practically, and the only measure to hand was the one which had prompted the inquiry, viz., the work curve, obtained by computing and graphing the hourly output records of numbers of workers. The reproach is sometimes made against industrial psychology that it is primarily interested in output. The truth is that output happens to be a convenient measure. Psychology's real interest lies in what is measured.

Hours of Work.—Thus the earliest systematic inquiries of industrial psychology concerned the problem of the 12-hour day in munition factories, and used as data the records of large numbers of people working over long periods. Comparisons were made between groups of people working a 12-hour day and other comparable groups working a 10-hour day.[1] In many processes the results of the latter groups showed such an increase in hourly output as more than counterbalanced the shorter time available for production, so that the total production was actually greater than when the hours of work were longer. Similarly lost time and sickness were found to diminish with the shorter working day. When hours are shortened, a long period elapses before adaptation to the new conditions is fully obtained; on the other hand, when hours are lengthened, there is sometimes an immediate reduction in hourly output.

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[1] H. Münsterberg, *Psychology and Industrial Efficiency* (1913).

Since the War, researches along these lines have been pursued in such different occupations as: charging of blast furnaces, silk weaving, shell making, metal-polishing, tinplate manufacture and in the processes of collar machining, folding and shirt ironing in the laundry trade. The curves of the output of the average worker, when graphed, usually assume the same general shape, viz., a rise at the beginning of the spell, a period of relative stability, and a fall at the end. The interpretation of these empirical facts cannot yet be given. Slight variations occur according to the arrangement of the hours of work, but the type remains characteristic of many industrial processes. Muscio, experimenting on women medical students doing mental tests, obtained similar curves.

Rest Pauses.—An important innovation stressed by the industrial psychologist has been the introduction of short rests, in the middle of a working period, of about 10 or 15 min. duration. These regular breaks are technically known as rest pauses. It is sometimes argued that frequent irregular rests are invariably taken by the workers, either voluntarily or because the supply of work fails, and that regular rest pauses are therefore not required. Where, however, direct experiment has been possible, it has shown that the organised rest pause is the better working arrangement.

The observations of H. M. Vernon for the Health of Munition Workers' Committee proved the advantage of breaking up working spells, and since then it has been verified in the boot industry, in metal-polishing, in celluloid-polishing, in shirt ironing, in sweet-packing, in handkerchief-folding and in stamping lids. The introduction of a rest about the middle of the spell of work improves the output as a rule by about 5%, and in some processes it affects advantageously the period preceding the rest. Not only is the work improved, but the regular rest is much appreciated by the worker. The probability is that the improvement is largely due to changes in feeling; most people can face with equanimity and possibly enthusiasm the prospect of two hours' work at the end of which will come a period of free time, but to face four or five hours of unbroken labour is depressing.

The subject of rest pauses has not yet been exhaustively studied, and particular cases need particular study; still the above statements seem to be valid in general. Exactly when a rest pause should occur must depend on the nature of the work, while the amount of actual increase in output will vary with the relation of the human factor to the machine factor in the particular process.

Physical Environment.—Among other influences which have been shown similarly to affect the worker and have been effectively measured by means of the output curve are improvements in lighting, heating, ventilation and seating. (*See* FACTORY AND WORKSHOP LAW; FACTORY DESIGN; OFFICE MANAGEMENT.)

MOTION AND TIME STUDY

At an early stage the young science of industrial psychology had to encounter the previous application of quasi-scientific methods to industry, initiated in America by Taylor and Gilbreth. Their general object was to study the nature and rate of the movements made by a worker in order to eliminate the unnecessary ones. This is technically known as motion and time study. Unfortunately this study had resulted in imposing on all the so-called "one best way," obtained by analysing the mo
ments of the quickest workers. So unnatural a procedure aw
ened much criticism and no little resentment. It is not irrelev
to note that the movement originated with engineers, not w
psychologists.

Properly conducted, motion and time study are but spe
applications to industrial processes of the laws of habit formati
Young learners pick up, by watching proficients, many acti
of industry; with practice they evolve a commendable copy
uncritically they may adopt some unnecessary movemer
which, while apparently not interfering with the work, may
come fixed; the result is that the worker develops muscu
habits harmful to himself, or fails to attain a speed commensur
with his real ability. Just as the skater, swimmer or golfer
proves by expert teaching, itself the resultant of careful study,
does the industrial worker. In such varying trades as
weaving, metal-polishing, chocolate covering, it has been fou
that by systematising movements and by training novices in
relevant motions, a saving of energy results, which is an
vantage to all concerned. Faulty methods of learning are
only a hindrance during the learning period, but there is also
invariable tendency for the worker to regress to them un
certain conditions, even when they are apparently overcom

The aim of Taylor and Gilbreth, in standardising the time a
method taken to perform a task, was primarily to reduce the c
of production, and they also had in mind the welfare of
worker and higher wages. From the worker's point of vi
however, the drawback of their system was that it produce
feeling of being always keyed-up. From the psycho-physiologi
point of view it was based on the fallacy that the shortest a
speediest movements were necessarily the least tiring and th
the best style of movement could be obtained from combini
a number of best movements adopted by different workers.
the study of industrial processes in relation to the worker is
be scientific, it must consider the whole of the conditions, no
part; it must regard the worker as a human being, not as the p
former of a limited set of movements.

LEADERSHIP AND MONOTONY

Important though the material environment undoubtedly
no workers can do their best unless the general mental enviro
ment is right. Not even the very best material conditions w
result mechanically in good work, and sometimes even po
material conditions can be nullified by good mental conditio
By this is understood the conditions governing the group as
whole, dependent primarily on the efficiency or otherwise of
leadership. Industrial life is often criticised for failing to supp
that effective stimulus of working for a common end, which
more obviously evident in the army. Actually there are mo
factories where there is this sense of working for a common end
well as for individual wages, than those not familiar with t
inside working of factories are aware of.

If, as McDougall[3] asserts, "the personalities of its leade
more effectively than any other factor engender national uni
and bring it to a high pitch," it is no less true that a factory ow
its corporate unity to the personality of its leader and h
deputies. The time may come when it will be possible to test f
leadership as it now is for intelligence; at the moment the prob
lem has only been formulated. The qualities of leadership a
required by all those in charge of others, and there is no corre
tion between ability to do a job and ability to superintend othe
doing it. To the psychologist there are certain types, almo
neurotic, whose symptoms find expression chiefly in their rel
tions with others. The person who reacts always to the emotio
aroused in himself by a situation and not to the situation itsel
the inevitable "nagger" who can never govern easily becau
he is always at war with himself, the "obsessional"[4] whose ob
session can be readily touched up by the work—these represe

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[1] *Health of Munition Workers' Committee*, (*a*) *Interim Report*, Cd. 8511 (1917); (*b*) *Final Report*, Cd. 9065 (1918).

[2] *The Medical Problems of Flying*, Medical Research Counc
Report No. 53 (1920).

[3] W. McDougall, *The Group Mind*, p. 135 (1920).

[4] M. Culpin, *The Nervous Patient*, p. 92 (1924).

few whose emotional development makes life much harder
r some of their subordinates and unbearable for others. If
eir other qualities, *e.g.*, their business acumen, are so out-
anding as to justify their position, then they need as emotional
terpreter someone of different temperament to neutralise their
ore pernicious effects.

A good leader should possess vitality, sympathy, justice and
umour, as well as knowledge of the work. The emotional, and
a corollary, the physical effect on subordinates of different
ypes of leaders is patent throughout industry. Where the com-
ands of one are cheerfully obeyed, those of another arouse
uculent antagonism or sullen acquiescence. Can anyone doubt
e effect on the health, happiness and efficiency of the workers?
any authorities are unwittingly the cause of the sick leave they
eplore among subordinates.

Monotony.—In addition to the effect of the leadership, one
as to accept the fact that in modern industry, with its sub-
ivision of labour, a large number of people are employed in
peating the same limited set of movements for hours, days,
onths and years. This "repetition of movement" is often
roneously called monotony. Literally "monotonous" means
of one tone;" it suggests absence of change and refers rightly
the general mental atmosphere and not to the movements of
e worker. Repetitive movements must either be studied as
ch, in which case they belong to the psychology of habit forma-
on, or else put in their complete setting, including, at least, the
petition work, the varying amount done as the hours go on,
e opinions of fellow workers and authorities about that work,
ysiological changes, emotional changes, and the collective life
the factory. The total reaction at any given moment will be
e reaction to a composite situation which constantly changes.

The worker on one process often stigmatises some other pro-
ss as monotonous, when to the observer there is nothing to
oose between them. There are compensations too in many
ocesses if one studies the worker as a human being and not
erely as the performer of a repetition process; *e.g.*, some workers
perience a sense of power in operating a large or a delicate
achine. It is not suggested that repetition work is good in
elf; but merely to describe the repetition work as monotonous
d to imply that such description embraces the whole psycho-
gical situation, is misleading.

VOCATIONAL GUIDANCE AND SELECTION

Observation of workers shows that in particular posts some are
uch more successful both subjectively and objectively than
hers. Hence arises the question of vocational guidance, which
ust be distinguished from vocational selection, a simpler
oblem. The latter problem sets out to select a worker to fit
e job, the former to select for a given person (usually an
lolescent)that job most suited to his capacities. This theoreti-
lly presupposes a knowledge of the person, a knowledge of all
ssible occupations, and a power of relating one to the other.
hose who have done most work in this field are convinced that
e most useful measure of a person is his general intelligence.

Mental Ratio.—By suitable tests it is possible to gauge with a
gh degree of accuracy the intelligence of any child, and to ex-
ess it in a quantitative form, known as the mental ratio. This
mains fairly uniform throughout the years of growth, and
born intelligence does not develop to an appreciable extent
yond the age of puberty. It is the amount and kind of knowl-
ge and interests that separate the adult from the child, not the
telligence with which he deals with that knowledge and those
terests. To put a child of a high level of intelligence to a job
quiring little, is wasteful, while the reverse process is futile;
oreover, the one provokes discontent, the other worry.

Temperament and Character.—In other directions, viz., the meas-
ement of temperamental and character qualities, less advance
s been made. In this field, observation and interpretation are
ll the only methods available. There are some occupations
ere people of a particular temperament are more likely to
come inefficient and break down than in others.[1] This temperament is characterised by a disproportionate development of fear in some form. Whether this is due to its innate strength or to an environmental repression, or both, cannot be adjudged yet. The sufferer shows over-anxiety concerning things he cannot alter, is unduly sensitive to the opinions of authorities, etc. Sometimes the symptoms appear in a more objective form, masking their actual subjectivity, so that the focus of anxiety appears outside the sufferer, who, with more than normal frequency complains of machine trouble, unsuitable keys (in telegraphy), etc.

Such people, in the interests of themselves, their fellow-workers and the work, ought to be diverted from occupations where their mental make-up cannot fail to be expressed in the work. If they enter such occupations as telegraphy or dispensing or even coal-mining they will almost certainly break down: the breakdown will be attributed to overwork, although actually the over-work may have rather subjective than objective reality. If there is an occupational disease recognised as such, the problem is still further complicated.[2]

When the qualities of the applicant for a job have been assessed and the requirements of various trades are known, it is possible to advise a child as to what he may most advantageously take up.

Organisation.—A vast field is however still untouched. Most of the studies made so far relate to those aspects of industry which are primarily means to an end, not ends in themselves, and even in this limited sphere there is much to be done. Little is known as yet, for example, about the organiser and his organisation. It is obvious that the organisation of a big business is no mere rule-of-thumb working out of principles gained by even a scientific analysis of other places; it has some of the qualities of a work of art, and the attitude of mind of an original organiser is akin to that of the artist. No real appreciation of the field of industry is possible without a recognition of this.

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INDUSTRIAL RELATIONS (*see* ARBITRATION AND CONCILIATION, 2.331).—The term "industrial relations" is used to denote the relations between all those who are engaged in industry. The history of industrial relationships up to the outbreak of the World War is a history primarily of conflict. The workpeople had only achieved something like equality of bargaining power by dint of unremitting struggle, first for the right of association, then for the recognition by the employers of their organisations as their authorised mouthpieces.

Strikes and lock-outs, when they occurred, were increasingly stubborn as the fighting resources of the trade unions multiplied, and increasingly devastating in the economic losses which they entailed to both parties as their scope became magnified. In order to prevent the outbreak of these deadly contests, the State was compelled to set up machinery for conciliation and arbitration, and statesmen were forced to pay increasing attention to industrial questions in drafting their political programmes. But in the heat of this long-drawn-out battle between the two opposing forces the essential community of purpose which should have united them was almost completely forgotten by both sides. That both derived their living from industry and that both would perish if it withered, was a thought which seldom occurred either to Capital or Labour as a whole, the one intent upon maintaining the inalienable right of the capitalist to undivided ownership and responsibility, the other on demanding some form of socialisation, a term with many and fluid meanings but generally interpreted as implying the ownership and control of industry by the State. It is true that both parties counted in their ranks men who held that a new order, substituting co-operation for conflict, was the only road to individual or national prosperity. Their voices were seldom heard, however, above the din rising from the two contending camps, each firmly entrenched in its doctrinal positions and defying assault.

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[1] M. Culpin, *The Nervous Patient*, p. 175 *et seq.* (1924).

[2] The serious nature of this is well brought out in the occupational disease known as Miners' Nystagmus. *Cf.* (1) Special Report Series, Medical Research Council, Nos. 65, 80. *Reports of the Miners' Nystagmus Committee*, London (1922–3). (2) W. Eddison, "Psycho-neurotic aspects of Miners' Nystagmus," *Brit. Jour. Med. Psychology*, vol. 3, pt. 2 (1923). (3) W. Inman. Critical Notice. *Brit. Jour. Med. Psychology*, vol. 3, pt. 3, pt. 4 (Cambridge, 1923).

The War introduced an abnormal period in the relations between employer and workman in every industrial country of importance, because all of them were belligerent. The paramount necessities of the State and the control which it exercised over the production of almost every article except those of purest luxury suspended the free play of economic forces. Though disputes and occasionally strikes occurred, usually for higher wages to meet swelling prices, they were quickly settled by government intervention instead of by the normal processes of industrial warfare. Nevertheless, the disturbance of all accepted values which the War created, the realisation of the national dependence on the industrial worker and the partial obliteration of class distinctions by the common struggle brought about a new attitude towards the whole question of industrial relations. It is not too much to say that with the Armistice industrial relations entered upon a new phase. As yet it is still in its very early stages. To suggest the lines of its ultimate development would be premature, but there are certain novel features which have emerged and which may be taken as marking a definite departure from pre-War conceptions. They may be illustrated from the experience of the three principal industrial countries, Great Britain, Germany and the United States, where under different forms and conditions similar tendencies may be traced. In contrast to them there is the Russian experiment where with the abolition of private capital the problem of industrial relations might be supposed to have been eliminated. Nevertheless the distinction between management and workers has gradually re-emerged and with it the problem once more begins to revive, as may be seen from the article RUSSIA.

I. THE WHITLEY COUNCILS IN GREAT BRITAIN

The Whitley Report.—In March 1917 a committee, presided over by Mr. J. H. Whitley, now Speaker of the House of Commons, and usually known by his name, presented its first report to the Minister of Reconstruction on the relations between employers and employed. It proposed the establishment of Joint Industrial Councils consisting of an equal number of the employers and workers in all well organised industries. Two points may at once be noticed as indicating that the authors of the report, who included several prominent employers and trade-union officials, had abandoned the view that the relation between capital and labour must necessarily be one of fundamental antagonism. In the first place, they proceeded on the assumption that trade unionism was an integral part of the industrial machinery and that any industrial reconstruction must be based on its frank recognition. Though it is true that this principle had been admitted before the War wherever collective bargaining had been firmly established, it has to be remembered that even in 1911 a national railway strike took place to secure its recognition by the companies and that in many of the lesser industries it was still far from being universally honoured.

Secondly, the committee emphasised the need for "the largest possible measure of co-operation between employers and employed." They declared that, in order to improve industrial relations, it was essential not merely to offer workpeople better conditions and a higher standard of comfort, but also "to enlist their active and continuous co-operation in the promotion of industry." The notion of co-operation was thus re-introduced into industrial history for the first time since the factory system came into existence. No doubt isolated attempts had previously been made to revive it in individual works by means of profit-sharing schemes, works committees and similar devices, but it had never been authoritatively laid down as a principle that should govern the whole field of industrial relations.

Joint Industrial Councils.—In consonance with these gene
objectives, the Whitley Committee proposed three classes
function for the Joint Industrial Councils. In the first pla
they were to provide the means for settling wages and worki
conditions. Secondly, they were to consider questions conce
ing the development of their industries as a whole, such
technical education, the initiation and utilisation of industr
research and inventions, the improvement of processes and m
chinery. Thirdly, they were to discuss certain other matt
which involved the partial association of the workpeople in t
general conduct of industry by utilising their practical kno
edge, securing to them "a greater share in and responsibil
for the determination and observance of the conditions un
which their work is carried on," "ensuring the greatest possi
security of earnings and employment," and discussing "orga
isation and appropriate questions relating to managemen
Moreover, in order to carry the spirit of co-operation from o
end of the industry to the other, it was recommended that t
councils should devolve some of their duties on district counc
and works committees.

That this was a far-reaching programme involving a n
approach to the problem of industrial relations hardly nee
emphasis. That it should not yet have been fully realised
hardly a matter for surprise, especially when the grave econom
crisis which weighed heavily upon industry after the War
borne in mind. Like other new institutions, the Joint Industr
Councils have been roundly condemned as useless, because in
few years they have failed to perform a miracle by changing t
whole industrial atmosphere. But transformations as profou
as those which the complete realisation of the Whitley schem
would mean are only accomplished slowly. They demand
long process of education both of employers and workers. Wh
is important to notice is not the shortcomings but the achiev
ments of the councils.

Seventy-three councils were brought into existence with t
active assistance of the Ministry of Labour. At the end of 19
58 were still in operation. Fifteen had fallen by the waysid
usually because they were premature on account of an insuf
cient degree of organisation in their trades. The comprehensi
report issued by the Ministry in 1923 shows that the survivo
had already accomplished a large amount of excellent work.
is true that the greater part of it was devoted to settling hou
wages and disputes, but when it is realised that many of t
industries concerned had never before possessed any machine
for these purposes, their repeated success in solving thor
questions without conflict is in itself an immense testimony
their value. Many councils, however, have gone further a
already performed work of a more constructive character.

Remarkable schemes have been set on foot in several trad
for improving education and regulating the conditions of appre
ticeship. Much has been done to improve safety and health i
collaboration with the factory inspectors and the Industri
Fatigue Research Board. At least 12 councils have gone ver
carefully into commercial questions, such as foreign compet
tion, the improving of transport facilities and the provision o
raw materials. Finally, the pottery, tramway and wire-drawin
councils have set an important example by investigating th
costs, wages and finances of their industries. It is only by exam
ining the detail of the work done that the progress which it rep
resents and the influence which it has had on the relations be
tween the employers and the workpeople concerned can be fairl
estimated. Enough has been said, however, to justify the opinio
that the Whitley scheme is operating steadily and beneficiall

Methods in the Five Great Industries.—One of the princip
criticisms levelled against the scheme is that it has not bee
thought fit for adoption by the largest industries—mines, cotto
engineering, iron and steel and shipbuilding. In these industrie
machinery for bargaining and for dealing with disputes ha
long been in existence, which they did not wish to alter int
conformity with the Whitley model. It may, however, be note
in passing that, except in the iron and steel industry, seriou
stoppages have occurred in all the others since the Armistice

nay yet be found that some machinery for co-operation on a ader basis than now exists is necessary to ensure peace and sperity in these industries.

inally, special mention must be made of the important innoon made in the relations between the railwaymen and the ipanies by the Railway Act of 1921. It was originally proed to provide for the inclusion of two Labour representatives the Board of Management, but this suggestion was dropped avour of a scheme setting up a Central and a National Board deal with wage claims and disputes, and Railway Joint Counon each of the four great lines to deal with the local applicaof national agreements, suggestions as to operating, working kindred subjects, and other matters of mutual interest such ‘co-operation with a view to securing increased business, ater efficiency and economy.” Under these councils are secal councils, while in every station or dépôt where 75 men are loyed a local departmental committee is established, whose eral objects are to provide contact between management and loyees and to increase the latter’s interest in their work by ng them an opportunity of discussing matters affecting not their own conditions but also the efficiency and organisaof the working of the railway. In other words, the Whitley iciple has been adapted to the railways and has certainly tributed to their smoother working.

onclusions.—This brief survey will have made it clear that Great Britain a distinct change is observable in industrial tions since the War. A rival notion to that of the diametrical osition between capital and labour has been introduced in shape of co-operation for the common benefit of both. This involved not only the unqualified recognition of the trade ons as part of the machinery of industry, but also the admisof the right of the workman to some participation in its cy and responsibilities. Lastly, except in the case of the es and the railways, the demand for the direct nationalisaof industry is perhaps less confident than it was before the eriences of the War and the Russian Revolution, but the of syndicatising industries still on commercial lines with e supervision has acquired a good deal of prominence.

I. THE GERMAN SYSTEM OF WORKS COUNCILS

he development of German industrial relations since the istice has taken place in a very different setting. Whereas reat Britain the War produced a disturbing interlude which the general organisation of society unchanged in its outward is, if modified in its spirit, in Germany the close of hostilities ight about a radical transformation. The German Revolunot merely substituted a republic for a monarchy, but it red the whole social equilibrium. For the first years of the Germany the Social Democratic party was the dynamic e in the Government, and it was during that period that the stitution of Weimar was framed. That remarkable docut introduced profound changes in the sphere of industrial tions as in other spheres of German life. After laying down principle that the “labour force” (*Arbeitskraft*) falls under special protection of the Federal Govt. and enumerating ous measures to ensure that protection, the constitution vided in Article 165 for the establishment of two institutions ch are beginning to play an important part in German indusl life—the Federal Economic Council (*Reichswirtschaftsrat*) the works councils (*Betriebsräte*).

peration of the System.—Works councils (*q.v.*) have not been ed during a normal period, and it is still premature to pronce any definite opinion on their value and possibilities. It nevertheless be stated with considerable confidence that works councils have established themselves as a permanent ure of the German industrial system, whatever modifications may be destined to undergo. To say this does not mean the employers are fully reconciled to them or that the kers are fully conscious of their possibilities. The former show the greatest reluctance to admit the councils to any participation in the problems of production. They have uently placed obstacles in their way and have generally tried to restrict their functions to that of intermediaries between workers and management. As a result, the number of cases in which works councils can be stated to have had a beneficial effect on production is small, though on the other hand the employers’ fears that they would have a subversive and pernicious influence have not been realised, save where the Communist element has succeeded in gaining control. The workers, on their side, have often not proved themselves capable as yet of using the new machinery effectively. Their lack of technical knowledge has hampered them, while in smaller works a considerable amount of indifference is still to be found. At the same time, they have established their right to receive important information, which the trade-union leaders regard as a means of gradually educating Works Councillors in their duties.

On the social side the results of the works councils have been more pronounced. They have played a considerable part in the enforcement of the eight-hour day by exercising a supervision on behalf of the trade unions, which has prevented abuses and secured closer observance of the collective agreements. But perhaps the most remarkable results achieved by the councils from the workers’ standpoint have been in connection with dismissals. By investigating innumerable cases in which improper grounds of discharge have been alleged and by taking them before the conciliation boards, the works councils have gradually built up a jurisprudence which affords a real guarantee to the worker against arbitrary action on the part of his employer. If the councils had attained no other results, their action in this field alone would have justified their creation from the workers’ point of view. On the whole, it may be said that, although their value and effectiveness vary greatly in accordance with the spirit which both sides have brought to bear on them, the works councils have justified themselves and are likely to acquire further authority as time goes on.

III. THE GERMAN FEDERAL ECONOMIC COUNCIL

Functions of the Council.—Any estimate of the influence of the Federal Economic Council on German industrial relations is subject to the same qualifications as in the case of the works councils. As an institution it is still in its infancy; in fact, its form is still provisional and remains to be finally determined by a bill under consideration in 1926. Hitherto it has consisted of 326 members, but experience has shown this number to be too large and the bill reduces it to 126, of whom 41 are to be nominated by the employers’ organisations, covering industry, agriculture, commerce, banking and transport, 41 by the trade unions of various kinds, 14 are to represent private corporations such as the municipalities, co-operative associations and insurance companies, and 30 are to be appointed by the Federal Govt., including two representatives of the Press. The functions to be allotted to this permanent council are analogous to those which the provisional council has been exercising during the past six years. In the first place, all government bills of an economic or social character have to be submitted to it for advice and its views must be presented to the Reichstag, whether favourable to the Government’s proposals or not. The council may also depute members to explain its conclusions while the bill is under discussion in Parliament. The council has a further power of considerable importance, namely, that of conducting “inquiries into questions of fact, in the economic and social field” (*Untersuchung tatsächlicher Verhältnisse auf wirtschafts- und sozial-politischem Gebiet*), and for this purpose the council is to be armed with compulsory power to obtain information and to hear evidence on oath.

Similar Institutions in other Countries.—It will be seen that the Federal Economic Council is not merely or even primarily concerned with industrial relations, but that it is called upon to advise upon all economic questions and to exercise functions of a semi-political character. In fact, it represents the modern tendency, which may be found in the formation of a *Conseil National Économique* in France and in the new Fascist *Consiglio Superiore dell’ Economia Nazionale* in Italy, to submit economic questions to the consideration of expert professional bodies instead of leaving them to be exclusively decided in the light of the political circumstances of the moment, which exert so large an influence on the deliberations of Parliaments and often produce results that are hardly consonant with the best interests of the country. From the point of view of industrial relations, however, such bodies are of considerable significance, as they mark once again the post-War tendency to admit representatives of the workers to direct consultation on the wider problems of industry, instead of leaving them as hitherto to be dealt with only by governments and employers. Enough has been said of the new bodies which the German Constitution has called into being to show that in Germany, as in Great Britain, this tendency has won a large measure of recognition and the status of the worker is undergoing a gradual development in the direction of participation in the responsibilities of management.

IV. TENDENCIES IN THE UNITED STATES

To turn from Europe to the United States is to discover industrial relations based on quite other conditions and determined by circumstances which find no parallel in the Old World. The industrial evolution of a new country with vast natural resources and incalculable possibilities of expansion must necessarily differ widely from that of small, highly developed areas such as Great Britain and Germany. The United States was a predominantly agricultural country until very recent times, and the phenomenal growth of its industry in the last two generations has not even yet been so great as to make it predominantly industrial rather than agricultural. There is still a far greater measure of fluidity in American than in European life. The workman of to-day may still be an employer to-morrow and a millionaire before he dies. A man who fails in the town can still return to the country, or who fails in one job can pass to another with the certainty of finding employment. In a word, the towering occupational and class barriers which hem in the European worker's progress through life only exist as yet in a very minor degree in the United States. The consequence has been a different attitude towards the whole subject of industrial relations. The outlook both of employers and workers remains essentially individualistic. While until recently the former has been uncompromising in the maintenance of his undivided sovereignty in his own plant, the latter have shown little interest in the orthodox doctrine of class warfare, only a moderate inclination to trade unionism and a positive repugnance to many forms of State interference. The late Mr. Samuel Gompers throughout his career fought vehemently against any endorsement of State schemes of insurance by the American Federation of Labor, and demands for industrial legislation which have been pressed for years by the trade unionists of Europe have been vigorously opposed by the trade unionists of America.

Besides this individualistic tradition, which is characteristically American, there is another factor which has directed industrial relations into unfamiliar channels. The ordinary growth of the population was quite insufficient to supply the vast demand for labour created by the rapid expansion of American industry. The result was a tremendous acceleration of the stream of immigration from about 1890 onwards, until in the years preceding the War it had attained an annual figure of over a million. A large proportion of these new American labourers were drawn from southern and eastern Europe, instead of from the northern countries which had previously furnished the main body of immigrants. They had little or no industrial experience, they were usually ignorant of the meaning of trade unionism, and even if they attempted to combine for trade purposes, they were unable to comprehend the speech either of their own officials or of their fellow members. As a result, the employers enjoyed a power in the United States which their European colleagues had long since forgotten. Trade unionism was weak and extremely difficult to promote in the face of the natural obstacles already mentioned, reinforced by the relentless and uncompromising hostility of the employers. Nevertheless, in certain industries, notably the garment trade, one of the worst paid and most difficult to organise, it made astonishing progress, and even in other industries such as the steel industry, coal districts like West Virginia, where organisation was un to obtain a solid foothold, the workers began to band toget for fighting purposes, often under the aegis of the loose- extremist body known as the "Industrial Workers of World."

Industrial Warfare.—Under these conditions industrial fare was carried on by both sides with a violence and ruthl ness never approached in Europe. In the face of the enorm power of American capitalism, which was often unsparingly to crush any incipient combination for protecting their inter the workers were driven by a feeling of desperation not me to resistance but to open revolt. Strikes were not just tes endurance and organisation, but not infrequently produ armed conflict and considerable bloodshed. In the decade ceding the War and during the War itself industrial relati in America were apparently growing steadily worse, and it generally concluded by European observers that their devel ment was following the normal course already familiar in Eur that as the abyss between capital and labour widened, orga sation would grow stronger on either side until each was fectly entrenched against the other. Despite certain pecu features, there was no essential difference in the problem presented itself in the new world. America was a generat behind Europe in its trade unionism, but was pass through the same recognisable stages and would arrive at essentially similar conclusion. The damming of the immigrat river first by the War and then by "quota" legislation wo only hasten the process by solidifying the working masses in United States and removing one of the principal obstacles to growth of trade-union organisation.

American Proposals.—Though it would perhaps be rash assert that this view has already been falsified by experie events seem to point to a different evolution. Since the Ar stice there has been more discussion of industrial relations in United States than perhaps in any other country. The Americ public seems to have awakened to its immense importance the whole future of the country. When President Wilson cal his industrial conference in 1919 to elaborate proposals for bet relations, it aroused far more interest among the general pub than did a similar conference convened by Mr. Lloyd George England in the same year. Although it reached no very positi conclusions, it probably served its purpose by acquainting American people with the elements of the industrial proble

Since that time their education has been steadily continued the Press of all grades. The output of books, magazine newspaper articles on the subject has been immense. Big e ployers like Henry Ford, J. D. Rockefeller and Edward Fil distinguished men of learning such as President Eliot of H vard, politicians, journalists, church congresses and numero private bodies have contributed actively to the discussion, wh a great deal of industrial investigation has been done both individual research workers and by institutions such as Russell Sage Foundation. The result has been to create atmosphere more favourable to the peaceful improvement industrial relations than exists in any European country. Wit out by any means pretending that the old prejudices or anta nisms as between capital and labour have been eliminated, may be said that they have been already softened by the f play and approval given to liberal and progressive ideas, a restrained by the feeling of responsibility which the nation interest displayed has engendered.

What, then, are the tendencies which are beginning to sho themselves as the result of all this American discussion? In th first place, there is a marked insistence on the application democratic principles to industry. America is a country whi prides itself above all on its democracy, and once the questio is stated Americans find it as difficult to approve autocrat methods in industry as they do in politics. Moreover, they a beginning to believe that in a democratic country comple industrial autocracy is not really possible, or that, in Mr. File words, "industrial democracy is inevitable, because politic er has been given to the masses." In fact, the widespread rest evoked in the problem of industrial relations in the ed States is largely due to the belief that unless it can be ed by industrial methods within industry, it will become a ical problem to be solved by political methods outside stry. For many Americans, then, the solution of the indus- problem appears fundamental to the maintenance of democ- . The general view now gaining ground among them may ummed up in a dictum of the Bureau of Industrial Research. ne of the great tests of democracy in the years to come will he ability of American employers and wage-workers to find sis of democratic co-operation in the government of indus- Unless industry can be constitutionalised on a democratic s, there is serious danger of class conflict culminating in e form of revolution."

xperiments in Certain Industries.—In order to "democra- " industry numberless "plans" are now on trial. In the nent trade a regular system of co-operation has been estab- d by the employers and the Amalgamated Clothing Workers merica, starting with Messrs. Hart, Schaffner and Marx, of the largest firms in Chicago, and thence spreading through industry. On the railways an interesting experiment has initiated on the Baltimore and Ohio Railroad which has e been adopted by other great American lines and by the adian National Railway. Joint committees have been set rather similar to those which exist on the British railways, main objects of which are the promotion of efficiency, the ination of waste and the stabilisation of employment. All available evidence testifies to their success, both from the loyers' and the workers' standpoint. A large number of perative schemes may be found in other industries, varying ely in type but all based on the idea of securing the whole- ted collaboration of the workpeople by enlisting their direct rest in the running of the establishment.

n some cases constitutions have been set up on the American el with a Senate and a House of Representatives, in others profit-sharing element is introduced in some shape or form. no means all of these schemes have been instituted in agree- t with the trade unions; in fact, it would probably be true ay that the majority were promoted by the employer with object of preserving the "open shop" and keeping unionism But whatever their origins, these works committees have oubtedly done much to improve industrial relations. The istics published by the National Industrial Conference rd, an important employers' organisation, show that in 1924 e were 814 establishments possessing works committees re 1,177,000 workpeople were employed, as against 225 loying 391,000 in 1919. When compared with the whole of erican industry, this does not represent a very large propor- and as in the case of some of the British Whitley Councils, e works councils have failed to survive in the United States. maintain, therefore, that the "democratic" movement in istry is universal or overwhelming would be misleading. re is still a large section of employers who remain wedded to fashioned methods and who are opposed even to collective gaining. There is no doubt, however, that the new method is ing steady progress, and what is perhaps most significant he changing attitude of labour towards it.

ages and Production.—As has already been pointed out, the vidualist tendency and the vast influx of immigrants have dered trade-union organisation far more difficult in America n in Europe. In addition, the American working man is e intent on earning good wages than on any other objective. standard of living is considerably higher than that of any opean worker and his principal aim is to elevate it still her. He is therefore disposed to assist in increasing produc- , if by doing so he is assured of increasing his own income. has no objection to adopting "capitalistic" methods, to ing bonds or to taking shares in the enterprise which employs , if he sees in them the means of augmenting his material perity. As a result of this attitude one finds that the situa- in the United States differs from that in Europe.

In the first place, there has been a great increase of output per head since the War, due to the improvement of machinery and the more economical use of the forces of production, while on the workers' side there has been a reduction of hours and a rise in real wages. The American workman, so far from offering resistance to mechanical progress, has frequently promoted it, and some trade unions even employ their own experts on scientific management, to which until recently they were violently opposed.

Secondly, the purchase of stocks by employees has developed in a remarkable way. One American economist calculates that, whereas shareholders with an income between $1,000 and $5,000 only received $38,000,000 or 1·8% of the total dividends reported in 1916, they received in 1921 no less than $562,000,000 or 22·7%. To illustrate this point, it may be mentioned that out of the 60,000 employees of Armour & Co. 40,000 are stockholders. In the Philadelphia Rapid Transit Co, 11,000 employees held over $10,000,000 worth of stock in 1925, more than double the value of their holdings in the previous year. Similar instances could be multiplied to show that the American worker is becoming a holder of capital.

Workers' Investments.—Thirdly, labour has initiated its own banking movement. The first labour bank was founded at Washington in 1920; at the end of 1924 there were 33 already in existence, with resources estimated at about $150,000,000. The leading part in this movement was taken by the Brotherhood of Locomotive Engineers, one of the strongest American trade unions, under the leadership of Mr. Warren S. Stone. Their objects, as he states them, are simply to offer the working man safe custody for his money and sound advice for its investment. But it is calculated that the American workers are in a position to save from $6,000,000,000 to $7,000,000,000 annually, and Mr. Stone asserted that "if they would save and carefully invest their savings, in 10 years they could be one of the dominating financial powers of the world." This suggests possibilities in labour banking which are at least still far from being realised. The experiment is yet in its childhood, but whatever its final form it must exert a considerable influence on the psychological attitude of American labour towards capitalist enterprise.

Co-operation Rather than Warfare.—Mr. Stone defined three phases in the trade-union movement. The first two—organisation and the struggle for collective bargaining—are familiar in all industrial countries. "The third cycle or phase," he says, "lies in constructive development towards a system of co-operation rather than war; and the most striking evidence of this phase is the labour bank." Though we have seen some evidence of a similar tendency in Great Britain and Germany, it is only in America that the labour movement seems to be consciously and openly adopting a co-operative policy. In doing so they are not abandoning the goal of securing an even larger share in the control of industry, but their method of approach is entirely different. Instead of preaching the destruction of capitalism, they are aiming at its peaceful penetration. Prof. Carver, of Harvard, goes so far as to claim that "the only economic revolution now under way is going on in the United States. It is a revolution that is to wipe out the distinction between labourers and capitalists by making labourers their own capitalists."

This is probably an overstatement of the case, but it is certain that the policy of co-operation with capital and of intensifying production is looked upon with favour by the American Federation of Labor. The last report of their Executive Council, after defining collective bargaining as the first function of trade unionism, states that "there is a still more important function that the union can render—that of participating in finding better methods of production and greater production economies." It recommends that the Baltimore and Ohio scheme of union-management co-operation should be closely studied and the advice of experts on shop management systematically sought. The Executives even recommend that their members should take part in works committees in establishments where the trade union is not recognised, on the ground that they promote solidarity among the workers and may thus assist trade union organisation. Mutual confidence between employer and employed are essential in order that the latter may be assured a fair return for the increased efficiency which he helps to secure, but on this condition co-operation to promote industrial prosperity is put forward as the policy to which organised labour should give a fair trial.

It would be hazardous to conclude, however, that industrial relationships in America are definitely set in the path of conciliation and co-operation. The phenomena which have just been briefly reviewed are not universal in character and have occurred during a period of overwhelming prosperity. How far they may be its cause or its consequence is an undecided question. Some observers think that the enthusiasm of labour for high production would be killed by a period of trade depression; others that it depends for its maintenance upon the uninterrupted progress of mechanical invention, which by multiplying production without increasing prices has given the American worker a steadily rising standard of living. All that can be safely said at the moment is that the United States is experimenting boldly with a new relationship between employer and worker and that the success already achieved is sufficient to make its further development a matter of obvious interest and importance.

V. CONCLUSION

This bird's-eye view of the development of industrial relations seems to suggest that they are now entering a critical, perhaps a decisive, phase of their history. Just as the end of the War ushered in a new era in international politics, so it may be destined to mark a new point of departure in the politics of industry. It is certain that, like all other human institutions, they cannot remain stationary. Either they must develop further on the lines of conflict rendered constantly more menacing to the community, as the strength and resources of the organisations of both sides increase and become growingly capable of exerting pressure on its vital organs, or alternatively conflict must give place to co-operation based on the recognition of the essential partnership of labour and capital and on their common interest to stimulate production, if they are to survive in an age of aggravated competition. Whereas before the War the signs of this latter tendency were barely discernible, clear evidence of its growth has been shown to exist to-day in Great Britain, Germany and the United States. A similar movement may be found in other industrial countries such as Czechoslovakia, Austria and Norway, where compulsory works councils are in operation, or in France, where there are voluntary councils in many factories. But it is much too soon to suggest which of the two tendencies will prevail. The decision between them will only be slowly worked out over the coming decades. The ultimate answer will determine for good or for evil the future course of our industrial civilization.

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INDUSTRIAL RESEARCH: *see* RESEARCH, INDUSTRIAL.

INDUSTRIAL SCHOOLS.—In Great Britain children may be sent to industrial schools on such charges as found begging, found wandering and not having any home, found destitute and hav
parents undergoing imprisonment, found in the care of a pa
or guardian of criminal or drunken habits, frequenting the c
pany of a reputed thief, residing in a disorderly house and
more serious offences, such as theft, larceny, housebreaking.

Industrial schools tend to approximate more and more clo
to the ideal of residential elementary schools, situated in plea
surroundings in rural districts, for the attendance of chil
suffering from parental neglect, or subjected to an environm
likely to cause delinquency or criminal habits. The schools
inspected by the Home Office and the Board of Education,
as far as possible "institutional" life is eliminated. As m
freedom is allowed as is consistent with the maintenance of o
and good conduct, and the clothing supplied is similar to
worn by ordinary school children.

School Routine.—School routine, as a rule, consists of gen
educational work and vocational training in equal proporti
Sports and games are encouraged. The trades and occupat
taught to boys are tailoring, shoemaking, carpentry, farm
gardening and instrumental music; a few of the institutions
training ships. Girls are trained in all branches of dome
work. The after-careers of the great majority of industrial sc
children are satisfactory, and many of the children obtain lu
tive and congenial employment. With the decline in truan
truant schools have been discontinued, and truants are usu
committed, in London and elsewhere, to industrial schools u
they reach the age of 16.

Boarding-out.—Many education authorities have adop
schemes providing that children under eight years of age
are committed to industrial schools shall, whenever conditi
are suitable, be boarded-out with foster parents. By this
rangement the children receive the advantages of home life,
erally in rural surroundings, and can attend the local element
schools. In 1925 nearly 300 London children were boarded-
with foster parents. Cordial and often enduring relations
formed between the children and their foster parents.

Statistics.—The number of persons dealt with in juve
courts has decreased during recent years. In 1913, proceedi
were taken against 37,520 children. During the War the num
reached the high-water mark of 51,323 in 1917. There has si
been a gradual decrease; in 1924 the number was 29,624.
majority of the "1924" children were dealt with as follows

Fined	9,190	Bound over	2,41
Dismissed	6,560	Ordered to be whipped	60
Placed on probation	5,812	Sent to reformatories	52
Charge withdrawn	3,779	Sent to industrial schools	52

The decrease in the number of charges may be attribute
improved social conditions, increased and more efficient organ
tion of children's care work, and the development of the
tional system of elementary education. There has also bee
large decrease in the number of committals to industrial or
formatory schools in proportion to the number of child
charged, largely due to the greater use now made by the co
of the powers conferred by the Probation of Offenders Act, 19
Magistrates hesitate to remove a child from its home un
they are satisfied beyond doubt that such a course is in
best interest of the child. (*See* CHILD LABOUR AND WELFARE.
(G.H.GA.

INDUSTRIAL WELFARE AND MEDICINE.—Human bei
possess intelligence, and their health depends on psycholog
as well as on physiological environment. Mental and phys
activity are necessary to health. From the industrial poin
view both require to be maintained in order to ensure efficien
which spells for an employer a contented personnel and for
employed physical health and a "worth while" life. Appre
tion of this point of view has in recent years been expres
through different activities aimed at maintaining mental c
tentment and physical health, at preventing sickness and mor
ity, and at restoring the sick to health; these lines of activity
not mutually exclusive. They may for convenience be conside
under the headings of Industrial Welfare, Industrial Fatigue a
Industrial Medicine.

I. INDUSTRIAL WELFARE

This entails not merely compliance with statutory require- nents as to the provision of specified accommodation, but the ask of getting each worker to take an intelligent interest in his wn health and efficiency, in that of his fellows and in that of the stablishment to which he belongs. The movement, which was nly embryonic before the World War, received great impetus in ;reat Britain from the recommendation of the Health of Muni- ion Workers' Committee that welfare work should be adopted or munition workers, and from the series of memoranda the ommittee issued explaining how the work should proceed.

Progress in Wartime.—A department was created in the Iinistry of Munitions to develop the scheme which at first was articularly pursued for women, girls and boys. Welfare super- isors were appointed to supervise (*a*) needs within the factory, nd (*b*) needs outside the factory. The work within the factory overed the selection of workers for engagement; supervision of eneral behaviour; of progress and apprenticeship; of transfer nd disposal of workers; of general cleanliness, ventilation and emperature; of canteens; of ambulance, rest-rooms and first- id; of cloak-rooms and sanitary conveniences and of overalls.)utside the factory it covered housing accommodation, transit acilities, sick visiting, recreation and education. The keeping nd studying of personal records of earnings, sickness and acci- ents was organised. Welfare committees composed of workers ere found invaluable to the activities of the superintendents. 'he scheme was first developed for national factories, but the timulus to private firms of financial assistance from excess rofits duty helped greatly to wider extension of the policy.

While activity on these lines, which came to an abrupt termi- ation on the cessation of hostilities, was still in progress, the Iome Office, in 1916, consolidated much of the ground won by btaining powers under the Police, Factories, etc. (Miscellane- us Provisions) Act, 1916, enabling the Secretary of State by rder to require occupiers of factories to make reasonable pro- isions relating to "arrangements for preparing or heating and aking meals; the supply of drinking water; the supply of pro- ctive clothing; ambulance and first-aid arrangements; the upply and use of seats in workrooms; facilities for washing; ccommodation for clothing; arrangements for supervision of orkers." Under these powers 14 orders have already been made oncerned with the special needs of different industries. At the ame time a series of valuable pamphlets have been issued to set rth how the requirements of the orders can be complied with. ction on these lines continues; but already some matters have ecome of general application, thus drinking water must now be upplied in all factories, while the provision of first-aid has be- me generally compulsory under the Workmen's Compensation ct, 1923.

Extension of Voluntary Welfare.—Meanwhile activities which ay be called "voluntary" welfare have extended, notwith- anding the tendency during trade depression to hold back from ew ventures. At least 1,000 firms to-day have welfare workers, compared with about 30 in 1913. Housing efforts, recreation rounds, institutes, educational schemes, nurses and sick visiting, nteens and dental clinics at factories, all provide examples of tension of factory welfare without legal compulsion. In these ays modern industry is recognising that well-directed welfare an economic proposition and makes for contentment.

The Mining Industry.—Reference has so far been confined to e welfare movement in reference to factory employment; but tion has not been confined entirely to this field. In England in 72 the Metalliferous Mines Regulation Act called for the ovision of accommodation for enabling persons employed in etalliferous mines to dry conveniently and change their clothes. 1910 the Mines Accidents (Rescue and Aid) Act gave power make orders relating to: (*a*) The supply and maintenance of ap- iances for use in rescue work, and the formation and training of scue brigades; (*b*) The supply and maintenance of ambulance pliances and the training of men in ambulance work.

The Coal Mines Act of 1911 contained, too, an important ause providing for accommodation and facilities for taking baths and drying clothes where the majority of workmen employed in a mine desire such. Unfortunately this clause was a dead letter except at some half-dozen collieries. But under the Mining Industry Act, 1920, welfare work for miners received a great impetus. This Act provides a fund, derived from a levy of 1d. a ton on the output of each mine every year, to be applied for purposes connected with social well-being, recreation and conditions of living of workers, and with mining education and research, and with such purposes as the Board of Trade may approve; but the provision of dwellings is expressly excluded from such purposes.

The fund amounts to about £1,000,000 a year; its allocation is directed by an independent central committee on which both miners and colliery owners are represented. Four-fifths of the contributions coming from each coal-field must be spent within that field: the remaining one-fifth of the fund is devoted to welfare matters of mutual interest to the whole industry, such as the promotion of research into safety and health, and the provision of higher education for miners and their families, to each of which purposes the central committee has set aside approximately £500,000 out of the first five years' contributions to the fund. Expenditure from the fund is now year by year keeping pace with contributions. The Act of 1920 was due to expire in 1925, but the success achieved by the activities thus instigated has led to prolongation of the life of the levy to the fund for a further five years.

The total credits of the fund on Dec. 31 1925 amounted to £4,740,339; and apart from the £100,000 already mentioned, allocations had been made for district purposes as follows:—

Description	Total Number of Schemes	Total Number of Allocations	Money Allocated
Recreation (chiefly recreation ground and institutes) . .	844	1.455	2,027,564
Health (convalescent homes, pithead baths, ambulance and nursing services, etc.) . .	126	198	958,771
Junior education . . .	18	25	26,362
Expenses of district committees	. .	96	25,464
Total	988	1,774	3,038,161

The research is directed by a safety-in-mines research board, acting in collaboration with a health advisory committee; higher education is effected by assistance given to local education authorities and universities.

The central committee consults with district committees concerning the amount and purposes of grants in each district. Interest attaches to the items shown on the table just given. They display the activities of the fund as progressing (with the one exception of a few allocations for pithead baths) on needs *outside* working hours; while progress in factory welfare made under statutory orders is extending with regard to needs *within* working hours. The contrast is sharp.

A Comparison.—In the case of factories voluntary effort is forwarding outside welfare schemes; but in the mines no similar efforts are taking place with regard to such needed inside welfare as the provision of drinking water, improved lighting, pithead baths or kitchens.

The procedure followed in these two lines of advance is also in contrast. Factory welfare proceeds through statutory orders, compliance with which can be enforced; while mining welfare consists of activities, originated and pursued by the mining community, but financed through a statutory levy. Thus the activities pursued for munition workers have been diverted into two separate streams. Still all welfare activities, in addition to their wide social aspect, undoubtedly exert a powerful influence in promoting industrial health.

II. INDUSTRIAL FATIGUE

The maintenance of health in industry, especially with regard to women and young persons, has always been a driving force in our code of legislation controlling factories and mines, but its close study is practically a new science, known technically as the study of industrial fatigue. In Great Britain the study is to-day pursued on general principles by the Industrial Fatigue Research Board, an integral part of the Medical Research Council. This board came into existence in 1918, owing to appreciation of a national need for intensive investigation to which attention was directed during the War by the activities of the Health of Munition Workers' Committee. Problems of interest to particular establishments are tackled by the National Institute of Industrial Psychology (*see* Industrial Psychology). Much practical knowledge as to human activity, embodied in over 30 reports issued by the board, and in the Journal of the Institute, has been placed on a scientific basis.

Certain points may be succinctly stated: work is necessary to health, and health is needed for efficient work; even steady work is better than spasmodic efforts; an optimum temperature, which should vary about a mean, exists for each process and is associated with best output, least sickness and fewest accidents; ventilation is to be read in the stimulating effect of air movement, rather than in change of air; rest periods during long spells of work, particularly if posture is changed, may increase output and lessen monotony; monotony in repetitive work, in temperature, in ventilation, in long spells of activity without pauses, and even in food supply, is disadvantageous; good factory canteens improve health and output; change of personnel, *i.e.*, labour turnover, reduces production and increases lost time due to sickness and accident; suitable overalls create pride in work and in person; vocational training adds joy to work; vocational selection on engagement increases output and reduces labour turnover; certain workers exhibit a predisposition to sustain accidents and should be employed only where accident-risk is at a minimum; the tendency to sustain accidents is associated with a tendency to fall sick.

The introduction into industrial organisation of such knowledge promises rapidly to revolutionise industrial management, and to prove the health-value to the community of well-conducted occupations. More knowledge as to the laws of human activity remains to be acquired; but by adopting what is already known, industry will prove to be our most powerful influence for maintaining public health.

III. INDUSTRIAL MEDICINE

Industrial medicine is concerned with the prevention of sickness and the restoration to health of the disabled. Prevention calls first for determination of causes, and is based on information gathered from various sources. Thus, the occurrence of industrial accidents must be notified by employers to inspectors of factories and of mines. Modern research into data so collected has enabled important protective measures to be adopted, and has also established the tremendous importance of personal, as contrasted with mechanical, factors; they account for 80% of industrial accidents. Further, just as in the case of sickness, the newly employed and those who are not-quite-well are disposed to sustain accidents, while some workers exhibit a definite predisposition to get hurt. Action should, therefore, aim at interesting workers in accident prevention through the safety-first movement (*see* Safety First), at reducing labour turnover, at maintaining health, and at eliminating the susceptible. Under the heading of accidents are here included sudden gassings, *e.g.*, from carbon monoxide, nitrous fumes and arseniuretted hydrogen, as well as caisson disease.

Occupational Diseases.—Information as to the occurrence of certain occupational diseases, *e.g.*, anthrax, toxic jaundice, chrome and epitheliomatous ulcerations, and poisoning from lead, mercury and arsenic, is obtained from notification sent by practitioners to the chief inspector of factories. Lead poisoning is the leading instance; it has been used, on account of its specific effect upon women, as a stalking horse for legislative advance against industrial poisons; its causation, displayed by study of notified cases, has now been narrowed down to inhalation of dust and fumes containing lead. Measures adopted to prevent the
generation of dust or to keep it under control, have proved
successful that lead poisoning in factory industries has l
most of its terrors; only where measures have not been, or ca
not be, adopted, as in the house-painting industry, is it stil
serious occupational menace; but constant alertness is need
to perfect the protection of those employed as new processes co
into vogue, *e. g.*, the use of the oxyacetylene flame to cut throu
steel plates coated with lead paint when breaking up old shi

Compensation claims for diseases named in the Schedule
the Workmen's Compensation Act, 1906, give information co
cerning the occurrence of other diseases, of which certain tro
bles which particularly concern coal-miners are the most i
portant, *i.e.*, nystagmus, and miners' beat knee, beat hand a
beat elbow. Here recent investigation into causation is ahe
of prevention; thus, the distressing trouble, nystagmus, of whi
the manifest symptom is involuntary oscillation of the eyeba
is associated with work for long periods in imperfectly light
galleries of coal-mines; the worse the illumination, the great
the prevalence of the disease. Owing, however, to the dang
of explosions from mine-gases, the problem of improving t
lighting underground is not a simple one (*see* Coal; Mining).

Cataract.—In contrast stands another compensatible e
trouble, cataract, which occurs among glass blowers and fu
nacemen exposed to glowing heat. Here means for preventi
are known; they consist in wearing spectacles, the glass of whi
has been specially devised for cutting off heat rays· but di
culty arises in getting the workers to use them.

Phthisis.—Further knowledge is drawn from occupatio
mortality records. They reveal any undue prevalence among
group or groups of workers of some particular cause of deat
phthisis is the most notable example (*see* Tuberculosis). R
cent statistical investigation has shown that when this cau
of death (*a*) is the only one in excess, its undue prevalence
due to the spread of infection among persons whose daily wo
brings them close together, *e.g.*, in tailoring, printing and maki
boots and shoes; (*b*) is associated with excessive death-rat
from other lung diseases, and occurs later in life than usual,
happens among sandstone masons, gold-miners, tin-mine
grinders of metal, some pottery workers and others; its excessi
prevalence is due to inhaling fine dust of silica, which sets u
condition in the lungs known as silicosis, a condition which tak
some years to develop and predisposes its victims to tuberculo
infection; and (*c*) is associated with excessive death-rates fr
all other causes of death, and occurs rather earlier in life th
usual, as occurs among publicans and inn-servants, its und
prevalence is caused by excessive indulgence in alcohol.

Knowledge of causation in each case points the way to p
vention: (*a*) Commodious, well ventilated and lighted premis
associated with medical examination to eliminate the tuberc
lous, will rid tailoring, printing and shoe-making from the scour
of phthisis. (*b*) Reduction to a minimum of risk from breathi
silica dust must abolish silicosis; the problem now belongs
the technical engineer and is being solved in certain industri
Compensation is granted for silicosis on the South African g
mines, on the Broken Hill mines of Australia, in Ottawa, Cana
and in Great Britain in the refractories industry under the pow
of the Workmen's Compensation (Silicosis) Act, 1918, which m
be extended to other industries. The financial burden of co
pensation is promoting active attention to dust prevention a
control. (*c*) Limitation of alcohol consumption, such as has be
taking place in this country in recent years, and could be exte
ed, has already reacted not only upon the occurrence of phthi
in industry, but also of ill health from other causes, includi
accidents.

Cancer.—Another disease to which mortality records ha
directed attention is occupational cancer (*see* Cancer). Work
who handle pitch, a distillation product of gas-tar, and othe
who mix pitch with coal-dust in the manufacture of briquett
suffer from warts which appear on the exposed parts of t
skin, and also on the scrotum. These warts show a special ten
ency to become epitheliomatous with the formation of " pitc
cancer. Shale-oil workers coming in contact with crude paraf

product obtained by distillation, similarly suffer from warts
d "paraffin" cancer; but workers manipulating refined paraf-
do not suffer. Chimney-sweeps have long been noted for
eir high death-rate from scrotal cancer which originates from
posure to soot, a distillation product of coal. Quite recently
equally high mortality from scrotal cancer has been revealed
nong mule-spinners in the cotton trade due to contact with
bricating oils, possibly obtained from shale. Cancer of the
s and buccal cavity is nearly confined to males who by smoking
pose these parts to the distillation products of tobacco. The
idence here summarised suggests that certain products ob-
ined by distilling vegetable substances can sensitise the skin
cancer, *i.e.*, to the filter-passing virus now known to be the
ecific agent concerned.

Evidence from the dye industry suggests that the products
question may possibly be benzene compounds. Workers in
is industry exposed to certain amino-benzene compounds, par-
ularly benzidine and naphthylamine (compounds which, when
ey gain access to the body, are excreted by the kidneys), have
en found to develop malignant tumours of the bladder. The
w growths which occur on the skin in the tar cases, and in
e bladder in the dye-workers, have certain features in common:
first there is a simple hyperplasia; the exact moment when
lignancy supervenes is a matter of doubt; and metastasis is
e exception. Possibly we have in these benzene compounds
stances of substances which, by modifying tissue growth,
ssess the power of preparing the way for the cancer virus.

More recently still lung cancer is reported among arsenic and
balt miners in Saxony, possibly due to radium emanations
m inhaled dust. To radium emanations is also described
crosis of the jaw, a most painful disease, among workers apply-
luminous paint.

Effects of Treatment.—Treatment during the early stages of
ess and injuries sustained in occupation is not peculiar to
lustrial medicine, even though recent advances in ortho-
edic surgery have been of great benefit to those manually
ployed. But in a few cases treatment is special to the disease,
, the onset of caisson disease can be met by immediately
ubmitting the victim to the high pressure atmosphere from
ich he has just too rapidly emerged; or, again, persons over-
ne by carbon monoxide gas can be best brought round by
new method of administering a mixture of oxygen and carbon
xide through artificial respiration; while burns caused by acids
alkalis, which must be specially neutralised before ordinary
atment is applied, may be added to the list.

onvalescence.—The convalescent stage on the contrary may
profoundly expedited by occupation, particularly where re-
very is slow and tedious. The industrial convalescent tends
her to return to work too soon before he is ready for full em-
yment, when he may quickly break down again, or, by saving
nself, develop bad habits; or to delay—particularly if he is
eiving compensation—until he has lost skill, developed some
rmanent stiffness, or become neurasthenic. He needs, at an
ly stage, amusement to divert his thoughts; next, occupa-
nal therapy, in which work is performed for wages during
nited hours, in order to occupy his mind and assist in restoring
t or weakened function, *e.g.*, a hand stiff after a wound; or
tly, vocational training for new work when he cannot return
his previous occupation.

ccupational Therapy.—At each stage industry can play its
rt, but with regard to occupational therapy and training
is the only available agency. "After-care" in workshops,
l special settlements for those discharged from tuberculosis
natoria is pointing the way, which is equally valuable for ortho-
dic, mental and other cases. The need for occupational
rapy and vocational training is rapidly coming to the front
h in Great Britain and America; and industry is being called
on in its own interests in order to regain skilled workers, in the
erest of the patients, and of the community on which they
st otherwise be a charge, to play its part in restoring to useful-
s those who have broken down in its service and must either
ain their strength anew or start life afresh.

IV. WELFARE AND MEDICAL SERVICES

The need for welfare supervisors in factories is now well recognised; and, even though trade depression in recent years has held in check the creation of such posts, they continue to increase in number. The duties attached to the post must determine the staff required, but the following scale is some guide:—

Welfare supervisors for women and girls: up to 300 workers, one welfare supervisor; a further 300 workers, one assistant supervisor; a further 450 workers, a second assistant supervisor; a further 600 workers, a third assistant supervisor.

Total 1,650 women and girls, one senior welfare supervisor and three assistants. After this number one assistant should be added for every 600 workers. Welfare supervisors or apprentice masters for boys: up to 100 boys, one welfare supervisor; a further 200 boys, one assistant supervisor; a further 350 boys, a second assistant supervisor; a further 500 boys, a third assistant supervisor.

Medical Service.—Medical service in factories commenced with the appointment of certifying surgeons under the Factory Act of 1844, but it has not advanced with the importance of the work. A proposal was embodied, however, in the last Factory Bill, which may appear in the next consolidating Factory Act, to modify these posts in such a way as may be expected to improve the service. Already a few firms are employing whole-time medical men, and others part-time, to render service far in advance of anything now contemplated by legislation; they find the return from such service far outweighs the cost. The duties which must determine the size of the medical staff, often include examination of new comers, treatment of injuries and sickness originating on the premises, re-examination after a period of absence, ambulance lectures and organisation of first-aid treatment, health inspections of every part of the premises. Such duties for a personnel of 2,500 at an engineering factory are found to provide ample work for one whole-time medical officer. It is significant that no firm that has once established a medical service, has been known to abolish it; the tendency is rather to extend it. Closely allied comes dental service at factories, which is steadily increasing on account of the better health and time keeping which the service gives.

The varied activities outlined above, viewed as a whole, present an interesting and rapidly growing influence for good. The 19th century saw attentions directed to perfecting the power-driven machine and the industrial process, while the health and comfort of the worker were comparatively neglected. The seeds of deep-seated disaffection, a manifestation of ill-being, were thereby sown. To-day advances in processes and in machinery continue, but the need is being grasped for attention to the human machine. In industrial health lies the solution of many problems.

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INDUSTRY, WAR CONTROL OF.—Government control of industry has appeared sporadically in every important war of modern times, under the form of commandeering of supplies and means of transportation and production. It has also occasionally assumed the form of price-fixing. But, except in the rare cases of cities under siege, governmental control never assumed the form of a general system, dominating the whole economical life of a belligerent nation, before the World War of 1914–8. In that War the general control of industry was inaugurated promptly by Germany, after a considerable delay by France and England, and, after many half-way measures that proved ineffective, by the United States in the last year of the War. In the case of every belligerent nation the extension of control was a gradual process, which had by no means reached its logical limits when hostilities came to an end.

The conditions that forced control of industry upon the several warring nations were:—

1. Universal conscription, with its tendency to disorganise all industries, essential and unessential alike, by the withdrawal of the most energetic labourers and "key-men" in the technical and administrative staffs;
2. the vast consumption of material and equipment under the technical conditions of modern warfare;
3. the insatiate demand for financial resources for maintaining and supplying the huge armies in the field and the services incidental to them;
4. the maintenance of the health and spirit of the working civil population through the provision of the necessities of life at practicable prices.

While the conversion of national industry to the uses of war was nowhere complete, it is a conservative estimate that in all the chief belligerent states from three-fourths to four-fifths of all industry was by the time of the Armistice converted to the meeting of war requirements, direct or indirect.

I. GERMANY, FRANCE AND THE UNITED STATES

Germany.—The first systematic action toward industrial control was taken by Germany. Upon the declaration of war by England it became at once evident that overseas supplies of raw materials, on which German industry had become largely dependent, would be cut off. The conservation of supplies on hand and their appropriation to essential uses was imperative. Within a fortnight, at the instance of Walter Rathenau, the Government, in co-operation with the cartels, had completed a rapid survey of the material resources of the nation and had worked out a policy, based partly on the requisition of materials and plant, but mainly on voluntary agreements, which offered a reasonable assurance of the continuous supply of military necessities on the scale then contemplated as adequate—erroneously, as the development of the War proved. Through the Reichsbank and the system of financial institutions dependent on it the necessary credit was supplied without stint to all industrial enterprises regarded as essential for war. The mobilisation plans provided from the outset for the exemption of "key-men," technical and administrative, and the suppression of unessential industries provided labourers to take the place of those who had been called to the colours. On Dec. 2 1916, the control of industrial resources was strengthened by a law instituting an industrial conscription of labour, applying to all males between 16 and 60. Auxiliary measures stiffened Government control over industrial enterprises. But to the end of the War the essential basis of industrial control was the quasi-voluntary agreement between the Government and the independent business man or group of business men, with a reserve power of compulsion in the Government's hands resting on the control of materials, credit and labour. This power of compulsion served to secure supplies, but did not restrict prices so strictly as to preclude large war profits, with attendant manifestations of popular discontent that grew more serious as the War dragged on.

France.—In France the outbreak of the War was followed by a mobilisation of men for military service which took the experts and "key-men" out of industry along with those who could be easily replaced. In consequence economic life was seriously dislocated. Unemployment reached extraordinary proportions. After the mobilisation in Aug. 1914, the principal industries employed on the average only 60% of their normal personnel, and as late as Jan. 1915, 20% of the industrial working population was unemployed.

French industry, being highly individualistic in spirit, was far slower than that of Germany to adjust itself to war needs and war control. Gradually, however, a machinery of control was set up, of which the most effective part was the disposition of ma power. Committees of economic action composed of busin men and engineers were organised in the several departmen to co-operate with the military and administrative authorit in supplying labour to agriculture and the essential industries.

Price control, so far as the munitions and supplies for t army were concerned, was effected through contracts, wi sufficient reserve power over labour, raw materials, transpor tion and credit on the side of the Government to ensure reasc able terms. The prices of products for the use of the civil po lation were subject to an informal and inadequate cont through the departmental committee of laymen co-operati with the administrative authorities. In neither case was t control rigid enough to check a rise in prices, which produc much discontent among the workers, whose wages did not r in equal proportion.

United States.—The situation in America, upon her ent into the War, was in many respects peculiar. The Allies had ready attained to a practical maximum of their industrial w effort, and the demands of war were still rapidly expanding. this effort American industry had already come to play a co spicuous part. Allied war industry was drawing heavily America for steel, copper, cotton and a large class of wholly partly finished war materials. A powerful chain of war indu tries had been built up in America; labour and materials w rapidly advancing in price, and profits rose on a huge scale.

The American Govt. was forced to meet the problem supplying the American armies with the materials of war wit out cutting off the supplies needed by the Allies. Control w essential not only to national but to international ends. Where in the early part of the War each belligerent had aimed primar at effecting the most practicable distributions of resources b tween its own military and essential civil uses, the Unit States from the outset was confronted with the problem of ma ing the best practicable distribution among the military, Alli and essential civil uses. American control was bound to envisa the entire system of needs of the Allied and Associated Powe

More fundamentally, the United States represented the la reserve of men, munitions and money. There was no possibilit of making good deficits in production from any neutral sourc except, of course, that certain raw materials like the nitrates Chile had to be drawn from neutral territories. In the circun stances the need for thorough-going control of industry w peculiarly vital.

The difficulties to be overcome in instituting control wer however, all but insurmountable. No close relation betwe government and industry had been developed, as in Germa neither was the American administrative system adapted prompt co-ordination. At the outbreak of the War the army a navy, each enjoying the power of commandeering, were in position to enter the market for supplies, in competition wi the Allied purchasing agencies, and there was no authority a where competent to allocate limited supplies in the order of in portance of needs or to keep prices within bounds. A council national defence, consisting of the Secretaries of War, the Nav the Interior, Agriculture, Commerce and Labour, with a advisory council and a widely ramifying organisation of con mittees, of executives and experts, had been created prior to t declaration of war. Out of this grew a multiplicity of organs control, a War Industries Board, a railway control, a contr of ocean tonnage, a food administration, a fuel administratio and a War Trade Board. But there was no central co-ordinati principle except the war powers of the President, which in th nature of the case could be exercised only sporadically.

Co-ordinated control of industry came into existence o March 4 1918, when the President, by a letter, reorganised th War Industries Board and specified its duties, constituting it i effect the administrative organ with power to apply the Pre ident's war powers over industry. Mr. Bernard M. Baruch w named by the President chairman of the board, with direct r sponsibility for its functioning, the other members of the boar to act in an advisory capacity.

As finally reorganised the board controlled the exercise of e power of requisitioning. The army and navy, the railroad lministration, the food and the fuel administrations, the War rade Board, the Shipping Board, the War Finance Corpora- on, the Allied Purchasing Commission and other agencies aling with industry, were required under the President's ders to co-operate with the War Industries Board. Thus it came possible to secure effective co-ordination in the whole ld of industry. The board was in a position to control exports d imports, the movement of traffic over the railways and coast- ise shipping; it was able to ration out materials, fuel, power, edit facilities to every business establishment in the country, place a check upon every construction enterprise, public or ivate, except on proof of absolute necessity, to standardise oduction in the interest of economy, and in short to do every- ing necessary to ensure that the resources of the nation at war ould be applied most effectively to the national needs, both of e people as a whole and of the military forces.

In America direct authority to fix prices was never granted by w nor established by executive order. The War Industries oard had, however, sufficient power to control prices in effect, d in case of need it actually controlled them. No specific eory of fair prices lay behind the board's control, but a concep- on of efficient economic organisation for war. The standard ward which price-fixing was working in its last phase was one hich would have permitted peace-time profits and wages but thing more. The problem of price-fixing in the United States as greatly increased because prices had already reached a very gh level before America entered the War.

Labour.—War control of industry in its highest phase of de- lopment amounted in effect to nationalisation of economic sources, labour, capital, material things. Men could not work what they liked best or put their capital to the most lucrative es or sell their materials and goods to the highest bidder. They ere called on to subordinate their private interests to the na- onal needs. The conception of public service became general- ed, as it were, and although with the end of hostilities private otives were again given free play, the conception of service tained a large measure of its vitality, exerting a considerable fluence upon action.

Labour, conceived of as "man-power," won recognition early the history of war control as the most vital of the national re- urces. The proper provisioning of labour, care for the health the labourer and his family, maintenance of proper housing andards and the like, assumed the rank of military necessities. ere too the influences set in motion in war carried over into mes of peace. In no country did public opinion settle back to its old indifference to the requirements of labour. It would hardly an exaggeration to say that the ideal of a living andard of wages attained a new influence through the experi- ice of war control.

Permanent Economic Results.—One of the most striking results war-time control was the revelation of the extent of economic aste in the conventional scheme of production. By co-ordina- on, concentration of effort upon essentials and by curbing of cessive variety in forms through standardisation, it became ssible for the United States, while maintaining 4,000,000 men nder arms, to supply the civil needs of its population with no preciable lowering of peace-time standards. While recognising at such extreme application to practical needs would in the ng run be deadening to industry, most leaders of industry me out of the War convinced of the necessity of eliminating uch waste that had gone unnoticed in the pre-War period.

War control of industry promptly fixed in the minds of those ho participated in its decisions a conception of international onomic interdependence. Control of the resources within a ation led straight to the necessity of controlling exports and im- rts, and this in turn led to an understanding of the need of ermanent economic relations under which all nations might ave equal access to the raw materials of the world. This re- ains a problem, the solution of which will tend to lessen the ances of war.

Another result of the war-time control was the more systematic survey of the potential resources, and their development where at all practicable. As a consequence, many resources are being developed in peace that formerly had been neglected. War control, with its compulsion to the use of substitutes, gave a greater freedom and elasticity to production, making a higher degree of efficiency possible in peace time. Incidentally to the control of industry, financial institutions, money and credit were everywhere subjected to control, with the result that new and more efficient methods of handling specie reserves and managing the flow of credit were devised and added to the normal equipment of peace times.

Some countries, finding themselves cut off because of the War from their usual sources of manufactured articles, soon learned to make these things for themselves, with the result that when peace returned the old manufacturing countries found that a part of their former markets for manufactured articles had been permanently lost. And so with raw materials; new sources of supply and substitutes were found. Thus, international trade is a longer time finding its normal ebb and flow.

For the most part the achievements of war control were made possible only by the solidarity of feeling and concentration upon national purposes engendered by extreme national necessity. No conclusions as to national control in peace time can be deduced from them. What may be deduced from the experience of the World War is that war under modern conditions demands drastic control of industry. War cannot now be conducted incidentally with business as usual. (B. M. B.)

II. CONTROL IN GREAT BRITAIN

During the first two years after the outbreak of the War comparatively few changes of importance were made in the British industrial and commercial system. In general, reliance was placed on the pre-War method of stimulating supplies to meet Government requirements by means of high prices. The slogan "Business as usual," which began as a useful injunction to people to keep their heads, exercised later a harmful influence in retarding the necessary transformation of industry and its subjection to an organised control without which the War could not have been won. The chief factors which finally overcame the resistance, not only of the business community, but also of the Government itself, to any drastic interference with industry were: (1) the rise in prices, which threatened to increase the cost of the War to an intolerable extent; (2) the competition of the civilian demand with vital requirements for war purposes; (3) the attitude of labour—the necessary corollary to "business as usual" is "strikes as usual"; (4) above all, the need for economising tonnage after the inception of the unlimited submarine campaign in Feb. 1917.

Fixing of Prices.—Unlike Germany, which began with the control of raw materials and was later driven to a (very inadequate) control of manufacturing processes, in Great Britain control started with the fixing of the prices of finished products and was then extended inevitably through each stage of production until it reached the raw material. Cost accountancy played an exceedingly important part in the British system of control. For each process of manufacture conversion costs were established, based on careful investigation, which allowed a reasonable profit to the normal firm. The restriction of profits on Government contracts increased the attractiveness of the civilian trade in which prices were not regulated, and, besides prejudicing military supplies, gave rise to great inequalities in the treatment of different firms. This led to powers being given under the Defence of the Realm Acts to the Government to requisition the output of any firm—which in turn immediately brought to the front the question of raw material prices. It was realised that a stable basis must be obtained on which to build up the series of conversion costs. Hence the Government was forced to purchase or control the supplies of the principal raw materials of industry so as to be able to allocate them to manufacturers at fixed prices. One of the greatest of these operations was the Government purchase in 1916 and following years of the whole of the British and Australasian wool clips (*see* WOOL). By the end of the World War over 90% of the total imports into Great Britain were brought under the control of the War Office, the Ministry of Food, the Ministry of Munitions, the Board of Trade and the Admiralty.

In the munition industries the price of iron and steel was fixed in 1916, and the continual increases in the costs of production due to rising wages were met by subsidies to the producers. No private business was allowed to use any of the necessary raw materials without a certificate or licence from the Ministry of Munitions. The engineering industry was reorganised on a very comprehensive scale, and government factories were set up in great numbers. The experience obtained in these factories as to exact costs of production was very valuable in enabling prices of contracts given to the great armament and other outside firms to be reduced during the course of the War in spite of increases in wages. The labour problem, which was especially great in the engineering industries, was met, on the one hand by the suspension (for the duration of the War) of trade-union restrictions on women's labour, output, etc., and by a great restriction of the right to strike; and on the other hand, by the power given to the Government to declare any establishment to be a "controlled establishment" under the Munitions of War Acts, and as such liable to have its whole output requisitioned at prices fixed by the Government, and to pay to the Treasury 80% of its "War profits" (*see* MUNITIONS OF WAR).

In the face of great difficulties the system of price fixing based on costings was successfully applied to agriculture, and advantage was taken of the control of prices to stimulate in particular the direct human foodstuffs—wheat and milk— and to make their production relatively more profitable than meat and butter. Thus the mistakes made, especially in Germany and Austria, of fixing maximum prices which on the one hand tended to discourage agriculture and production, and on the other led to the over-stimulation of meat and animal fats, were avoided.

Decentralisation.—An essential feature of the British system of war-time control was decentralisation and the greatest possible measure of local autonomy. In some cases, branches of the departments themselves were decentralised, *e.g.*, the Department of Wool Textile Production had its headquarters in Bradford, and in the munitions and most other industries important local offices were set up in different parts of the country. Wherever possible the existing organisation of each trade was utilised and drawn into the scheme of control. While broad lines of policy were laid down by officials of the civil service (not necessarily permanent officials), their detailed application and local operation in each trade were largely left to representative bodies of the trade, working in co-operation with the Departments concerned. In two important industries autonomous bodies were set up with executive powers. The Board of Control of the Woollen Industry, sitting in Bradford, was composed in equal proportions of representatives of the War Department, the industrial and commercial interests, and labour, and to this body, on which the departmental representatives were in a minority, was transferred complete control over the whole civilian side of the industry (within the limits of the wool allocated by the military Supply Department for civilian consumption) together with other important functions. In the cotton industry, the Cotton Control Board sitting in Manchester was constituted the legislative organ for regulating the industry. This board also was composed of industrial and labour representatives with two nominees of the Board of Trade.

Very great importance was also attached to the establishment in the different branches of each trade of advisory committees of business men who gave their services voluntarily and did much valuable work in the practical operation of schemes of control. In the Ministry of Food an agricultural council representing producers and a consumers' council were set up, to which orders were submitted before they were issued, thus ensuring the willing co-operation of all concerned.

All Industry Under Control.—Until Feb. 1917, in many industries, government control was still somewhat perfunctory, but from then onwards the increasing intensity of the War an the submarine blockade led to a great tightening up of the wh system. The great decrease of tonnage, together with the int Allied pooling of supplies, imposed a tremendous pressure o British industry which could only be met by concentrating th whole resources of the country on essential services, and on thos alone (*see* CONTROL, INTER-ALLIED). The Government ma use of its control over raw materials to interfere drastically wit the course of trade, and above all to restrict the freedom of i dustry working for civilian consumption. This it accomplishe partly by rationing the supply of raw materials to non-militar producers, or (in the case of food) to the home consumer, an partly by its man-power policy. In some industries, *e.g.*, boot clothing, the state secured the adoption of schemes for the pr duction of standardised articles, the profit at each stage of pr duction and sale being limited on the same lines as militar supplies. The popular discontent over the excessively high price for such products was thus in some measure alleviated.

By the end of the War, virtually no important branch o industry had been left without some form of regulation or co trol. The system of Government control in England, which f comprehensiveness and efficiency of operation was unequalle in any other belligerent country, would have had even more fa vourable results if it had been possible to apply it earlier in th War, and if it had been supported by a system of war financ which avoided inflation, with all its evil consequences.

(C. W. G.*)

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INFANTRY (*see* 14.517).—To appreciate the lessons learne from the experience of infantry in the World War in relation t the past as well as to the future, it is necessary to emphasise on particular aspect of infantry evolution—the gradual decrease i size of the unit which one man can command. It is desirable als to visualise what "command" really implies. A corporal is sai to "command" the squad of recruits which he is training o a barrack square; he does it by shouting words of comman to them. Marshal Foch also "commanded" the Allied armies i Western Europe in 1918; he did it, however, without raising hi voice above its usual pitch.

Between the marshal and the corporal were a host of intermediate commanders of every sort, kind and description, bu we are concerned here mainly with infantry commanders an especially with those in the junior ranks. For theirs is the hardest task in a battle, and it is upon them that success depends "The wisest plans, the most thorough preparations, the most brilliant guidance avail nothing unless the fight is won by the fighters—by the platoons." The minds of superior officers therefore are devoted—especially in peacetime—to hard thinking on the problem of what they can possibly do or invent to make junior infantry commanders superior to the adversaries whom they may meet in action. A general's command implies much forethought as well as some experience in its holder, and thus his "command" again has a different meaning. He is a trainer, and it is with respect to this aspect of "command" that we are chiefly concerned.

UNITS AND WEAPONS

If we turn to the past for a moment, we find that the Greeks invented and trained their phalanx and the Romans their legion, and with these two systems the infantry arm dominated the known world for several centuries. Each of these formations was trained by precise drill, executed almost daily by junior commanders. Moreover this drill was in each case suited to the age and the *esprit de corps* of the period. In battle the voice of the infantry superior could be heard and was instantly obeyed, both in the phalanx and the legion. Then ensued the Dark Ages and comparative chaos dominated by feudal horse soldiers until archery made infantry again supreme. Precise drill was at the ot of the success of the archers and fire orders were strictly en- rced.

If we take Crécy (1346) as an example, we find that Edward I. initiated fire orders himself, though he left the command of e front-line to his son, the youthful Prince of Wales, in charge the archers. A careful survey of the ground at Crécy from the mmanding position of its windmill, in which King Edward was sted, enables one to see how it was possible for him to issue e orders to the archers posted below him. They were only a w hundred yards from him, but he could see better than they uld when the crowd of French cavaliers would offer the best rget to the British longbowmen. These bowmen had under veral reigns been disciplined and drilled with precision in the e of their weapons, and that is why they defeated the gallant it undisciplined mob of horsemen who attacked them without ethod at Crécy. It is also obvious that the diminutive size of e battle-field enabled the commander-in-chief, posted behind s reserve, to initiate fire orders and see their effect—in fact he rformed duties which now appertain to platoon commanders. oreover, the size of the whole battle-field corresponded with a ctor allotted to one battalion or at most to two in 1918.

Thus the process of devolution of the physical command oc- ipied some five centuries, chiefly because it took all that time to ter infantry armament from bows to Lewis guns; partly also ecause each generation of professional soldiers clung with punc- lious tenacity to the unsuitable drill of a previous age. Similar nacity is visible to-day but changes are in the air. Frederick e Great (1740) attained parade-ground precision even during e shock of encounter, and won his battles by means of remorse- ss drill, stepping to music and machine-like fire tactics with in- curate muskets. Such is the force of tradition that in 1914 erman companies in Flanders illustrated Frederick's tactics ith the aid of song to inspire their *Parademarsch* within close nge of British infantry. But their opponents' rifles were ac- rate in 1914 and the death roll was enormous.

Frederick, however, did not teach one system on the barrack quare and then practise a totally different one on active service; ut that is what the British infantry did before the South frican War (1899), and what some officers would like it to do gain. Their line of reasoning is that, as every war alters tactical rmations, it is not of much avail to learn any tactics which may erhaps be discarded in the next war.

British Infantry in 1913.—In Oct. 1913, the British infantry nderwent a drastic change, in spite of much opposition. The d "Eight Company" battalion was altered, and the system as adopted of dividing battalions into four companies, each 200 rong. This change gave a peace strength of about 100 men per mpany available for training and the organisation of a battal- on at the beginning of the War was as follows:—Headquarters, achine-gun section (two guns), four companies. A company nsisted of its headquarters and four platoons; a platoon of four ctions. A section was commanded by a non-commissioned ficer and was a normal fire unit. Four battalions, from various giments, were grouped into a brigade. In the British Army e regiment, is a unit of sentiment and the spring from which *sprit de corps* arises. It is based on a fixed regimental dépôt which the common link of battalions scattered over the British Em- ire. The four-company battalion marked a stepping-stone in e history of the British infantry, because the platoon became e "tactical" unit instead of the company. As a logical con- equence the fire unit (section) decreased in size and became e command of a junior N.C.O.—a corporal or lance-corporal. At first this change seemed incomprehensible to the lay mind, ecause it was contrary to the idea that in modern war the im- rovement of communications tends to centralisation and con- rol by the higher authorities. But the extent of the modern attle-field and the increase and improvement of mechanical eapons tend to isolate and break up infantry units more and ore. A further consequence of the change was that British fantry organisation became based on a four-unit system from e brigade to the platoon. This uniform distribution of units in ultiples of four proved to be handier than the French or the German distribution in multiples of three. By the end of 1918 the four-unit system was pronounced to be the best, whether for tactics, administration, reliefs or daily routine—but especially for tactical handling in the field. One reason for this is that "odd" numbers destroy the even distribution of duties.

Other Armies, 1914.—In the German, French and U.S. armies the regiment consisted of three battalions, and was a tactical as well as an administrative unit. In Germany it was commanded by a colonel with a lieutenant-colonel as his second-in-command. The battalion, commanded by a major, was divided into four companies, each commanded by a captain. The company was divided into three sections (*Züge*) each under a subaltern who had as his understudy or second-in-command, either a sergeant-major, a "vice-sergeant-major" or a "sword-knot ensign" (aspirant-officer). On mobilisation for war one additional officer was allotted to each company. Prior to mobilisation every infantry regiment and Jäger battalion was provided with a machine-gun company of six guns, plus one spare.

The French company was organised into four sections, commanded in war by three subalterns and one adjutant (superior company sergeant-major). The sections were grouped in pairs to constitute *pelotons* (platoons) under the senior of the two section leaders. In peace there were only two subalterns on the establishment for the four sections. Machine-gun sections were allotted to battalions as in the British Army. In the United States the company was composed of three officers and 150 rifles, divided into two sections, each of three squads. In the World War, however, the U.S. infantry regiment was remodelled on the continental model, having also a regimental machine-gun company, a headquarters company and a supply company.

Thus before the War the infantry battalion was in almost every country about 1,000 rifles strong allotted to four companies each commanded by a mounted officer. But the British battalion was the weakest in fighting strength, because its First Line Transport and other services were deducted from its 1,000 rifles, whereas the regimental systems of continental infantry provide these services from a separate establishment. The subalterns were dismounted officers whose commands varied as follows: British 50 men, German 80 men, French 50 men, United States 75 men. But in the British infantry a large proportion of the 50 men borne on the strength of the platoons were absent on other duties. For instance, they were signallers or machine-gunners, or bandsmen or transport drivers or pioneers—they were in fact everything except fighting infantrymen, and they should never have been on the rolls of the fighting platoons. The British Treasury, however, ordained otherwise and thus made training and fighting difficult for every platoon commander.

Changes during 1914–8.—During the progress of the War the basic organisation of the infantry of the belligerent powers was not materially altered. The changes were chiefly in the direction of additional weapons and a multiplication of kit, which reduced the infantry soldier to a beast of burden laden under a weight which destroyed his mobility. In 1915 the British infantry, as compared with the German, suffered from a paucity of machine-guns, and was slow to increase its machine-gun strength. At first an increase was made (up to four per battalion), and when manufacturers raised their output these were formed into machine-gun companies. They were gradually divorced from the infantry and formed into a machine-gun corps, firstly as brigade machine-gun companies and finally as divisional battalions. By the time this had been accomplished the lighter Lewis gun had made its appearance and had been allotted to infantry units. The first issue (not long before the battle of Loos 1915) was only four guns per battalion, but by the end of Nov. 1915, when brigade machine gun companies had been formed, the establishment of Lewis guns was increased.

The tendency at first was to use this weapon like a heavy machine gun, but when its characteristics were better understood it took its place as a company weapon in 1916, and as a platoon weapon in Feb. 1917. By March 1918, 36 per battalion became available. We then find the platoon composed of four sections, two of which were armed with one Lewis gun each. The allotment of an automatic weapon on such a scale marked an important step in the tactics of infantry. One of these new weapons, handled by only two men, could deliver a stream of bullets equal in number to, and more accurately aimed than, what could formerly be projected by 25 soldiers with rifles. Obviously the number of men required in the forefront of the battle could be reduced without affecting the volume of fire. This meant fewer casualties and bigger reserves and the maximum number of soldiers in every section was reduced to one leader and six men, making a total for all ranks of a platoon only 31 actually taken into action.

The Germans were faced with the man-power problem before any of the other belligerents, and they also appreciated the value of the light machine-gun. In March 1917 they issued three to every company, and afterwards raised this allotment to six by giving two guns to each platoon. Finally, each German battalion consisted of a heavy machine-gun company of 12 guns and three infantry companies armed with six light machine guns each, without counting the special machine-gun companies allotted to divisions for every battle. This tremendous increase in automatic weapons had an inevitable effect on infantry formations. The costly attacks on narrow frontages were abandoned. The successive lines or waves of men gave place to open formations. The four sections of a platoon were gradually separated from one another and compelled to manoeuvre and fight under their own leaders. When platoons were too weak to man four sections they fought with only two, one of which was armed with a Lewis gun. The frontages allotted to the leading platoons were increased and in some of the great battles of 1918 we find platoons attacking on frontages of 200 and even 300 yd. with very small effectives. Fire-power was at last understood.

Special Weapons.—In addition to the Lewis gun, rifle-grenade and hand-grenade, the Stokes light mortar proved to be a useful infantry weapon. Although it did not form an integral part of battalions, the brigade light-mortar batteries drew their personnel from the infantry and the mortars were allotted to battalions during operations. The light mortar was the nearest approach to an infantry gun in the British Army and, though not an ideal weapon, rendered great help in reducing enemy machine guns and strong points. The German mortars in the summer of 1918 were distributed as follows: each regiment had a regimental "*minenwerfer*" company, organised in three sections, each with three light *minenwerfer*, and in addition two or three medium *minenwerfer*. The important part played by these weapons in battle tended to prove that infantry, when scientifically armed and on ground that affords cover for movement, can act independently of other arms, and is capable of fighting its own local battle either with or without artillery support and tanks. To fulfil this rôle, however, it needs to be more highly and scientifically trained than before the World War. The importance of training the commanders of companies, platoons and sections cannot be over-emphasised, and it was the shortage of these trained officers and non-commissioned officers which caused so much deterioration after the battle of Ypres in 1917. It was also the cause of avoidable casualties in every subsequent battle.

Post-War Organisation.—The British infantry battalion is now organised in a battalion headquarter wing, and four companies. The wing includes a machine-gun platoon. Each company consists of company headquarters and four platoons, each platoon of headquarters and four sections, two of which are armed with one Lewis gun each. The platoon is the largest unit composed of men whose sole duty is to fight, and the War established it as the "tactical unit" of infantry. The section is the fire unit and consists of a leader and six men, a number which experience has proved is the largest that can be directly controlled in action by one commander. Thus the British subaltern officer's command in battle became 28 fighting men, as compared with 50 in 1914—but the Lewis guns, rifle-grenade and hand-grenade increased the fire-power of the platoon out of all proportion to the number of its men.

The French battalion comprises a headquarters group, three ordinary companies, a machine-gun company and a section of accompanying weapons (mortar or infantry gun). The compan at war strength is composed of a headquarters section and fou combat sections, and the section of three groups. The fightin group consists of a team of riflemen and a team of automat riflemen, the team in either case comprising a corporal and fiv men. In peace or when the strength is lowered by casualties, th number of sections in the company, or groups in the section ma be reduced, but the actual groups are maintained at full strength The French nowadays place all their reliance upon the ligh automatic rather than on the rifle, and their new organisation the outcome. Although their group is far stronger than the Bri ish section, to which it corresponds, the side of all its ten men cen tres round the service and introduction of the one *fusil-mitrailleu* and the rifle team inevitably loses much of the value of its greate mobility. On the other hand, the British organisation, thoug possessing greater freedom and power of manoeuvre, means tha the platoon commander has the difficult rôle of combining fou sections of which two are radically dissimilar in arms and i action to the other two. The German battalion, also, consists o three companies and a machine-gun company. A company i organised in three sections; each section (*Zug*) is divided int four or five groups (*Gruppe*) of eight men each—two ligh machine groups and either two or three rifle groups.

The Rôle of Infantry

The question is sometimes put, "What is the use of infantry Is it not butchery to expose men on foot to the mechanical ho rors of the battle-field of to-day?"

Limitations of Machines.—Man on foot is still more uni versally mobile than any machine. The more destructive weapon become the more does man seek impregnable shelter in which h can escape the missiles of death-dealing machines. An enem may conceal himself in a hiding place which is inaccessible t any machine; but where man has entered there also man ca follow to seek him out, and until the assailant possesses a me chanical octopus he must himself go in to dislodge his adversary The appliances manufactured by inventive genius only help t break down the barriers to this final act of combat. A grea artillery bombardment will drive the enemy to ground, but eve where concentration of shell-fire is achieved, it cannot dislodg him. He is safer in his dug-out than in flight. The tank is tangible, it is true, and therefore less petrifying, but man can avoid i or hide from it more easily than from infantry. Moreover it i less agile, more cumbersome, more limited in its modes of actio than the foot-soldier. There are types of obstacles which it cannot yet surmount, ground which will not bear its weight, o which is too rough or steep to cross. Cavalry like infantry is a human arm, but it affords too easy a target, is too quickly stopped by rifle or machine-gun fire and is less mobile on rugged and broken ground. Its superior speed is insufficient compensation for these drawbacks except against broken and flying infantry. Thus we see that infantry is still essential in battle, that its power is based on human rather than on material factors, and that its tactics spring from moral elements of which one is fear.

Destruction of Enemy Morale.—To wear down the enemy's nerve control is the rôle of the commander, of the artillery, of bombing aeroplanes. When opposing armies are in close contact the infantry shares in the process by raids and false attacks. In the battle the part of the infantry is to snap, not wear down, the enemy's control over his fear. The fracture is effected by the enemy's realisation that he is powerless to ward off his assailant's blow. To accomplish this we must pass a sufficient though not necessarily a larger proportion of men through the curtain of his fire to a point so close to him that they can assault or offer the threat of an assault which he realises he is powerless to prevent. The key to this assault is fire at short range to pave a way for the onslaught. Hence formations which avoid loss by taking advantage of cover and conserve the will to close with the enemy are necessary. Surprise, the simpler, more certain and less costly method, is effected by assault from an unexpected direction against an unguarded spot. The key to infantry success is therefore movement or in military language nocuvre. Fear above all is caused by uncertainty and appre- ision of the unknown which breaks down the will to resist l gives to the assault in flank or rear its supreme value. Thus close quarters mere numbers are not the deciding factor, l assaults are better launched by platoons than by battalions.

trengthening One's Own Morale.—What are the factors which ble the average man to fight down fear? First undoubtedly nes confidence—confidence in his superiority to the enemy, ed on his own skill in handling his weapons; faith in his der's skill and judgment combined with devotion to him as nan; trust in and comradeship with his fellows—the assurance t he will be backed up, that his efforts will not be in vain. ondly, *esprit de corps*—which is allied to confidence. Thirdly, cipline—the power of association to overrule instinct. Lastly, ion to minimise reflection on the dangers to be faced.

THE TRAINING OF INFANTRY

onfidence is born of training—the training of each individual, training of the leader, the training of the unit. These cessive trainings forge the infantry weapon and make it fit act its part on the battle-field. Moreover these various inings of human beings symbolise the truth that man is still master of the machine. But no greater error is current to- than that infantry is the most easily trained arm. None ds more care, more skill if it is adequately to play its part. r it is the least mechanical and by far the most human arm in stence. Yet experience of the World War indicates that of all arms and services, infantry, the backbone, was the least ined. This defect was due not so much to the reason that care, less research and thought were devoted to it—though se factors counted—but to the reason that it is the most icult arm to train, because it possesses so few concrete ele- nts. It is concerned with tactics and ground.

lements of Training.—To train infantry is to exercise an , whereas to train gunners is to apply a science; the one uires an artist, the other a calculator. The man in the ranks the artillery, the tank corps, the air service, is often a me- nic—executing a concrete task in a definite manner. Initiative he province of the officer, but even he in the subordinate ks of other arms is concerned with producing a material ct. The infantryman's use of material—his weapons—is only eans to an end not an end in itself. He himself survives the ntific developments of countless wars because his human ue remains unchanged. Even in the employment of his pons he is guided by variable factors and conditions. But use of his variety of weapons is only complementary to the he makes of tactics and ground before he gets to grips with enemy.

he variety of elements with which he has to deal has led a rule to each different unit being trained—too often mis- ined—according to the whims and prejudices of its temporary nmander, who is apt to confine himself to such parts of the ject as he himself knows best. Hence a tendency towards r-emphasis of such matters as drill, musketry, bayonet nting, which can be easily mastered by the intellect of the rage officer. Hence also the neglect of tactical training, ich demands thought and is difficult to learn and teach be- se it deals with moral and variable factors and requires a dicum of imagination.

inor Tactics and Fire Tactics.—The tactics of infantry must based on human nature and not on mechanics or geometrical fection. Yet it is almost incredible how in the past showy lutions deduced from the parade-ground have persisted on battle-field. It is a truism to say that a revolution has been ught in infantry tactics by the inventions which mechanical ence has brought to bear on war. But it is no less true that consequences of this revolution take years to understand. is lesson may be summarised in the phrase—"the power manoeuvre." It needs a complete reorientation of military ught and fresh views before we begin to extract right methods m the melting pot of war. Yet that infantry which soonest rns its lesson will be supreme.

A mastery of elementary tactics is essential if infantry is to attain its goal in battle. It must be permeated by the best doctrine which the last war can teach, and its junior commanders must no longer be subjected to the whims or prejudices of whoever happens to be in temporary command. Moreover the doctrine should be adopted by authority and be expressed in language so simple and by metaphors and illustration so clear, that it can be as readily grasped by subalterns and corporals as by general officers. Its manual of instructions should be as intelligible to the Australian bushman as it is to the staff college graduate.

Development of Leadership.—In 1806–15 the British were capable of a sustained effort in the theory of tactics as originated by Sir John Moore, and there is reason to believe that British infantry could to-day be trained to as high a pitch of comparative excellence—but not without a definite doctrine of minor tactics and some evidence of leadership to inspire its wholesale adoption. This quality of leadership in peace-time needs the special ingredients of spirit, intelligence and human sympathy, together with sufficient character and determination to carry conviction to the mass. Just as Sir John French inspired a new doctrine of peace training at Aldershot after the South African War, so now could a leader develop the experiences of the last war and reduce fire tactics to simple exercises for platoon and company commanders.

Such a doctrine would probably be based on the little group of men following a corporal whom it knows because he has trained it. In the hurly-burly of modern war these little groups retain cohesion because men will follow a leader whom they see close to them, whose voice they can hear and whose presence is familiar. These groups (named sections), trained by higher leaders whom they trust, will forget themselves and accept any risks in battle if they are convinced by habit that their effort will not be in vain, that their successes will be immediately supported. A fire unit which forms part of a trained team will sink itself unhesitatingly if it knows that the rest of the team will not leave it in the lurch or allow it to bear the brunt alone; that, when it has spent itself to make an opening, others will relieve it of the burden. But can we reasonably expect generals who were trained in pre-War tactics to take the lead and compel their subordinates to alter their methods of training?

TACTICS AND MANOEUVRE

For decades the infantries of all countries attempted to produce tactics adequate to the new weapons at their disposal by multiplying the lines which were successfully used by their forerunners in the days of the musket—with its short-range and slow rate of fire—and the case shot and solid shot of the artillery. They moved shoulder to shoulder with intervals. The idea of manoeuvre was absent. Even down to the closing stages of the World War the action of infantry units in battle—as distinct from a skirmish or an affair of outposts—was confined to frontal attacks. Manoeuvre was the weapon of the higher commanders only. A division or a brigade moved as a body; hence it was its commander alone who had the power of striking an enemy force at two or more different angles concurrently. We have already seen how slowly the idea of decentralised fire orders developed. It was the same with decentralised manoeuvre.

In any large action each of the infantry units was allotted only a fraction of the frontage of the force of which it formed a part. This narrow sector was hedged in on either side by neighbouring units of a corresponding size. How then was it possible for attack or defence on the part of infantry units to be aught but straight to their front? How can they manoeuvre if they have no space to move in? And how can they be expected to move to a flank if they possess no intervals and no flanks?

The Continuous Line.—Thus it came to pass that in spite of the fire effect produced by scattered Boers sitting on distant *kopjes* in South Africa (1899), and in spite of Japanese losses in assaults at Port Arthur and elsewhere in Manchuria (1904), European tacticians failed to shake off certain notions about continuous lines and storming masses. They appreciated the importance of putting what they called "weight" into the decisive attack, but failed to realise that the weight or forcefulness of an attack no longer increases in proportion to the number of infantrymen thrown into it. In South Africa wide and premature extensions were adopted to minimise losses on the flat veldt, but such extensions did not lead to any idea of manoeuvre. On the contrary, the unmanageable thin lines one behind the other were incapable of intelligent manoeuvre—as was discovered in peace training after the South African War.

Even then the idea of manoeuvre to a flank by a small body was not grasped, or at any rate was not taught as a definite doctrine. Skirmishing lines in extended order made rushes and utilised ground; they fired in small bodies and opened at long ranges; at the decisive points they were gradually thickened up into a crowd. These crowds surged forward at a given signal and assaulted to their front. But the infantry soldier was so near his neighbour in these sham battles that he had scarcely sufficient space to load and fire his rifle without hitting one of his friends; the units became so mixed together in the process of thickening up that neither the corporal nor the subaltern could exercise control over his own men or any unit; often he could not find them during the decisive stage of the battle. Fortunately the "cease fire" sounded and reorganisation took place; but in 1914–8 there was no "cease fire" and no umpires and the warring infantries were slow to learn. This was no doubt inevitable, and is a sufficient reason to try now to gather the lessons of 1918, and it may not be out of place to suggest that the tactical experiences of 1918 have not been embodied in the tactical handling of units in 1926.

Group Formations.—Official manuals seem always to lag behind the age, and in fact human nature conquered the line formation before its breaking up was officially sanctioned. Tradition held fast to her pre-War habit, but the need for a control which could not be obtained with the extended line helped to breach the ramparts of orthodoxy. The group attained its final and complete recognition after its success against the German "pill-box" defence in the dreary wastes of the Ypres salient in the autumn of 1917. Also the Germans in their 1918 offensive deliberately trained their infantry in similar groups with orders to penetrate everywhere by infiltration. British dispersion, enforced by new weapons and human nature, rendered penetration possible by attacking infantry groups—termed "sections" in the British army—between the posts or machine-gun "nests" of the defenders. By exploiting every initial penetration the commander on the spot attacked in front and flank simultaneously such posts of the enemy as opposed him in his own sector. This newly acquired power of manoeuvre restored to infantry the master-key of victory, and retains for it still the important rôle which the old stereotyped tactics were rapidly losing. But it took three years of war and unprecedented losses to drive home a lesson which peace training may probably obliterate.

The Infantry Attack.—The outstanding lesson gained from the new-won possession of infantry units—the power of manoeuvre—is that tactics can be based on the fundamental principles which govern the action of other independent bodies which manoeuvre. The platoon is no longer fixed in a segment of the machine of battle but is an independent moving part fighting its own small action.

Its forward sections should press on unceasingly in order to find and penetrate any weak spots in the defence and to advance to the objectives assigned to them. If the forward body of a platoon is checked by an enemy post, it fixes it firmly by fire so that the enemy's attention is absorbed "by a menacing hand at his throat" whilst the manoeuvre body (termed the platoon reserve) works round his flank to deliver a surprise blow. This act of fixing can be achieved by a combination of fire with movement. There must be the threat of the forward spring in order to fix the enemy's attention. Fire alone, from the hastily chosen halting places of an attacker, cannot be relied on to absorb the whole attention of a defender behind selected cover. Unless each forward infantry section is imbued with a determination to
press forward, the posts of the defence may be able to b
cross-fire on groups which have penetrated the position.
there is still a further means by which the enemy can be fix

Artificial Smoke Screen.—The World War added a us
weapon to the infantry—armament-smoke. This new eler
gives the user the conditions of day but imposes on his ad
sary the conditions of night. Mist or fog has often been a deci
but accidental factor in battle, but with the introductio
artificial fog which can be projected at the will of the user,
enemy's view is impeded whilst his own movements take p
in daylight. In attack, the forward sections may fix the en
posts more effectively by firing smoke to windward of them t
by rifles or Lewis guns. Thus smoke helps small local assau

Decisive Manoeuvre.—The manoeuvre body of an infa
company follows close behind its forward platoons and rem
under the hand of the captain. If and when the whole of a
ward platoon is held up by the fire of an enemy centre of re
ance, the captain uses his manoeuvre body to turn a fl
To achieve this he might have to quit his allotted sector
follow in the wake of a more successful unit on his flank. Pas
through the gap he turns and assaults an exposed flank of
centre of resistance. Such a blow has the moral effect—con
as a surprise and threatening the line of retreat—which is
key to victory. But if the defenders of the post turn to r
this flanking attack, the forward body should rush in and ass
them from the front. Such combinations are simple if p
training is staged on the basic principle of "fixing and
noeuvre," as the key formula of fire tactics.

This combination of fixing and manoeuvre is the bed-
principle of every street fight. Watch a couple of small b
tackling a bigger one. What happens? One of the small b
rushes straight at the big boy, and when his attention is fi
the other runs in from behind and delivers a blow. The
small boy puts all his energy into this effort, for he knows
stinctively that if he fails the opponent will beat them e
separately. But if the big boy attacks one of the small o
the other in like manner rushes in from behind. Thus fi
and decisive manoeuvre should become a formula engraved
the mind of every infantry corporal and subaltern, and he sh
also be trained to act upon it instinctively. It has won gen
acceptance since the end of the War and concerns above all
tactics of the platoon, which is the smallest unit which can
and manoeuvre without waiting for orders from a superior.

Defence.—Attacking infantry, owing to its open formati
can offer immediate resistance to hostile counter-attack.
halts and each unit consolidates its own ground forthwith, v
its defensive posts distributed in depth and disposed to g
each other support by fire. The rôle of the forward bodies i
break up the enemy's organised attack. If the attacker ma
a gap or effects a lodgment into the position of any forw
bodies, the reserves counter-attack to throw him out. Sho
the attack break through the forward positions on a br
front, the reserves take him in flank by fire. Just as manoeu
is superior to frontal attacks, so is defence-fire which enfila
from a flank the more damaging to the attackers' morale.
this as in all cases the training and determination of the bet
infantry wins the day, but the great advantage possessed by
defence—almost its only advantage—is that its action can
thought out beforehand. Its reserves can be placed on a fla
in readiness for action, and can be practised on the act
ground to counter-attack from favourable positions with a
iliary arms to help them.

Picture of an Infantry Battle.—Who is there with experien
of big attacks embracing miles of country in France that h
not seen the most resolute infantry suddenly assailed by a bu
of surprise-fire from the flank or rear? Its self-forgetting det
mination grows uncertain; it ceases to move and looks furtiv
for cover. If the surprise-fire continues from invisible shoote
the men become irresolute and nervous. The will to advance
gone. If the threat of a counter-assault from a flank shou
immediately follow they look to their rear and break or drib
away. Unless their own commander coming on from behi

n throw in an opportune reserve to counter the counter-attack d restore the local situation, the attack is stopped. That is w, so often in France, one German machine-gun nest—just e little group inspired by the will to resist, nourished in the inciple of surprise—would hold up the attack of a company d sometimes of a whole battalion.

It is thus we learn to visualise the infantry unit—battalion, mpany or platoon—in the battle of to-day. It possesses the wer of offensive movement and yet is protected by its open mations. Its articulation into interdependent moving bodies pable of manoeuvre is the main infantry feature developed the World War. The illimitable extension of fronts, brought out by the vast numbers which nations in arms put into the ld, forced the military leaders to seek and discover a solution the deadlock—and they found it at last by granting the power manoeuvre to infantry units down to the platoon. This revotionary idea began to emerge in the Flanders attacks of 1917 t was still only in its chrysalis stage when the War terminated 1918. It still lacks a clear, simple working formula which can practised by lance corporals in their daily exercises.

Future Development

A question naturally arises as to the probable direction which e development of infantry will take under conditions caused new inventions, particularly mechanical ones. In what way ust we improve and reform our infantry methods in order to hten the infantryman's burden in view of the probability at he may have to wear a gas mask in every future attack? ne question may be considered under two heads: firstly, means increase mobility; secondly, tactical doctrine.

Mobility.—Almost every mechanical advance means a step wards greater mobility. Every arm and branch of the service becoming more mobile—or else decaying—under the influence the petrol era. In the transport of an army the horse has ready given way to the road motor, and this in turn promises yield to a cross-country tractor with caterpillar tracks. The avy artillery is already motor-drawn, and the lighter field tillery will follow suit. Mobility is the foundation stone of the lue of infantry. Its unique position has always rested upon e fact that it is more *universally* mobile than other arms. ıt on the normal field of battle, if it is to maintain its unrivalled sition as the "handyman" of war, its mobility must keep ce in proportion with that of the other arms. To give it creased mobility two problems must be solved. Firstly, means ust be devised for bringing infantry to the scene of its action ore quickly and with less fatigue than by the use of its legs. the second place, infantry equipment must be lightened. ne soldier must not again be treated as a beast of burden—her means than piling loads on his back must be devised.

Equipment.—If infantry is to possess an adequate agility weapons and ammunition must be lightened to an appreable extent or they must be carried for him. In fact the fantryman of the future must be regarded as an athlete. very article which he does not need in the combat itself must discarded or carried for him on accompanying transport.

Wanted: a Battle Drill.—A further development in tactical ethods which has been mooted is a controllable system of ovement on the battle-field. At present armies retain drill ovements for the parade-ground and throw them aside when ey go on active service. As human nature in battle retains ly that which has become instinctive habit it is scarcely surrising that in moments of crisis one has seen men advancing, gainst the deadly fire of machine-guns, in close-packed bodies. ut if drill were brought up to date on the lines of open order id the group, it is probable that moments and even hours of riceless value would be saved. But even during the actual tack, there might well be occasions when an ingrained method control could be used to quicken the manoeuvre of deployed its and direct them to take advantage of local situations. oice control would be out of the question, but if signals were w and simple, visual control might be used, particularly if a earer means of signalling were devised.

Let anyone with experience of war ask himself if there were not moments in his recollection when he might, had his men been drilled in such a system, have saved precious minutes, an opportunity which never returned, by the use of a signal instead of the slow method of sending a message by runner. The old close order was under control, but modern fire made it impossible. With extended order the battle degenerated into the chaotic movements of an uncontrolled mob. An ingrained system of battle drill, in which intervals and distances were purposely exaggerated, would enable sub-units to be manoeuvred, to be opened or closed in "concertina" fashion according to the ground and local circumstances. Such a system might go far to combine the flexibility of the old with the invulnerability of the modern formation.

It seems improbable that in the future we shall see the extensive and elaborate field fortifications of 1914–8. The new mobility brought in by the tank, the caterpillar tractor and the aeroplane, would appear to prevent the stagnation which produced labyrinthine entrenchments in the World War. (*See* Machine Guns; Strategy; Tactics; War.) (I. Max.)

INFANT WELFARE: *see* maternity and infant welfare.

INFECTIOUS FEVERS.—In this article the various infectious fevers are dealt with.

Chicken-pox, or Varicella (*see* 6.130).—Several writers have maintained within recent years that a close relationship exists between herpes zoster (shingles) and chicken-pox, and that the virus of the two diseases is identical, on the grounds that: (1) Chicken-pox in one individual may follow herpes zoster in another within the ordinary incubation period for the former, *i.e.*, within 21 days. (2) In such cases no other source of infection may be discoverable. (3) Much less frequently herpes zoster may be apparently contracted from a case of chicken-pox. (4) Herpes and chicken-pox may sometimes coexist in the same individual. The problem, however, cannot be solved until the causal agent of chicken-pox has been discovered.

Diphtheria (*see* 8.290).—The principal cause of the spread of this disease is now generally admitted to be the human carrier, whether sick or healthy. In the great majority of cases the disease is disseminated by the diphtheria bacillus being expelled from the mouth or nostrils by coughing, sneezing, spitting, kissing or speaking. Apart from tonsillectomy, which is not always practicable, there is no certain method of ridding the carrier of bacilli. On this account a remarkable change has taken place in the methods of prevention of diphtheria. In 1913 Bela Schick of Vienna devised a test whereby immunity or susceptibility to diphtheria can be determined. The test is performed by injecting intracutaneously a minute dose of diphtheria toxin. If the subject is immune, no reaction occurs, whereas susceptibility is shown by the appearance of a small red swelling at the site of injection within 24–48 hours. Those found to be susceptible are given three subcutaneous injections of a mixture of toxin and antitoxin, which was first introduced by Von Behring in 1913, but not used on an extensive scale until some years later by Park and Zingher in the United States. After the lapse of some weeks or months immunity as determined by the Schick test is established and lasts for some years, if not throughout life, whereas the immunity afforded by injection of diphtheria antitoxin is not likely to last longer than three or four weeks.

The experience of the years from 1910 to 1925 has confirmed the earlier observations as to the value of the antitoxin treatment of diphtheria. Death and severe paralysis are practically unknown when the patient receives an adequate dose within the first 24 hours, but become increasingly frequent with each 24 hours' delay. The intramuscular method is the best mode of administration, as it is quite as simple as the subcutaneous and ensures more rapid absorption of the antitoxin.

Measles (*see* 17.947).—Caronia of Rome has isolated (1923) a minute diplococcus, which he regards as the specific cause of measles, from the blood, bone-marrow, naso-pharynx and cerebrospinal fluid of children during the prodromal and eruptive periods. Injection of healthy children with attenuated cultures of this organism produced immunity to measles, but inoculation of large and repeated doses gave rise to a typical though mild form of the disorder. Further confirmation of Caronia's investigations is required before his organism can be accepted as the cause of measles. Subcutaneous injection of the serum of convalescents within the first six days after exposure to infection is a preventive method first employed by Nicolle and Conseil in 1918 and subsequently carried out on a large scale by Degkwitz in Germany and other clinicians on the Continent and in the United States. In nearly all cases this method either prevents an attack of measles altogether or renders it very mild. In the absence of convalescent serum, which is often difficult to obtain, the whole blood or serum of adults, especially the parents, who have had measles, can be used.

Scarlet Fever (*see* 24.303).—The recent work of G.F. and G.H. Dick indicates that scarlet fever is a local infection of the throat caused by a particular type of *Streptococcus haemolyticus*, which is capable of producing a soluble toxin, absorption of which gives rise to the general manifestations of the disease. These observers successfully inoculated volunteers by swabbing their tonsils and pharynx with a culture of the organism. Subsequently they devised the "Dick test," which determines the susceptibility or immunity of an individual to scarlet fever, and is performed by injecting into the skin a filtrate of the culture which produced the disease. If the person is immune no reaction occurs, while susceptibility is shown by the appearance of a red area within 12–24 hours. Desquamation, which was formerly considered as the chief agent in the dissemination of the disease, is now generally regarded as harmless, unless the scales have been contaminated by discharges from the nose and ears. The duration of infectivity is now held to be much shorter than formerly. It is probable that most cases cease to be infectious in the course of the fourth week, unless they are complicated by discharges from the nose or ears. Specific immunisation against scarlet fever is still in the experimental stage, but very promising results have been obtained by subcutaneous injection of susceptible persons with a small amount of the toxic filtrate of the variety of *Streptococcus haemolyticus* which causes scarlet fever. Further observations are required to determine the duration of the immunity acquired by this method. Passive immunity can be acquired more rapidly by injection of a special scarlet fever antitoxin, but is probably less permanent.

The method employed by the late Dr. Robert Milne, consisting in inunction of the skin with olive oil and application of 1·20 carbolic oil to the throat, has proved to be valueless, as it does not prevent the spread of infection or the occurrence of complications and return cases. Encouraging results have been obtained from the use of an antitoxic serum prepared by injection of horses with gradually increasing doses of sterile scarlet fever toxin. It has been found that if the serum was given early the course of the disease was shortened, and the incidence of complications and sequelae greatly diminished.

Typhoid and Paratyphoid Fevers (*see* 27.503).—The great diminution in the incidence of these diseases in recent years in many countries has been due partly to immunisation in the army and navy during 1914–19 of a large proportion of a particularly susceptible age-group and partly to the careful supervision of the water and milk supplies, which has reduced the disease to such an extent that the health authorities are able to devote more attention to the prevention of contact and carrier cases. Numerous statistics have been published in various countries showing the efficacy of antityphoid and antiparatyphoid vaccination. Among the most striking are those given by Russell. During the two years in which the United States took part in the World War there were 1,065 cases of typhoid or paratyphoid or one among 3,756 men, with 156 deaths or one death among 25,641 men, as compared with one case for every seven men and one death among every 71 men in the Spanish-American War of 1898. The duration of immunity following inoculation varies from two to four years or longer, but under certain circumstances, such as ingestion of massive doses of typhoid bacilli and impairment of resistance, which are specially liable to occur among soldiers on active service, the immunity is lost in a much shorter time. The serum treatment of typhoid and paratyphoid fe
is still in the experimental stage, the great decrease in these
eases having prevented a trial of it on a large scale in re
years. Vaccine treatment unlike vaccine prophylaxis has
become generalised, and the results obtained are inconst
Some observers, indeed, regard the vaccine treatment of typ
as an example of non-specific proteintherapy, as the same res
have been obtained by injection of *B. coli* and staphylococ

Diet.—The modern tendency is to feed rather than to st
the typhoid patient, who is now no longer condemned to an
clusively milk diet for several weeks, but may be allowed o
readily digestible articles of diet from an early stage. A n
liberal diet enables the patient to offer a better resistance to
disease, to be less liable to complications and to make a n
rapid recovery.

Treatment of Carriers.—After the carrier state has lasted
months without being affected by drug treatment such as
amethylene tetramine for urinary carriers, and chloroform, m
thol and lacto-bacillin for intestinal carriers, operations such
removal of the gall-bladder (cholecystectomy) in the cases
intestinal carriers, or of the kidney (nephrectomy) in the cas
urinary carriers must be considered.

Paratyphoid Fevers.—These are acute infectious diseases
to the action of bacilli, of which three varieties have been
scribed, viz., *Bacillus paratyphosus A*, *Bacillus paratypho*
B, and *Bacillus paratyphosus C*. Though on the whole
severe except in war time, they closely resemble typhoid fe
in their clinical appearance and course, and can only be dis
guished therefrom by bacteriological examination. Anot
point of difference is that while typhoid fever is an exclusiv
human disease, paratyphoid fevers may infect both man
animals, *e.g.*, dogs, cows, rabbits and pigs, and be transmit
from man to animals and vice versa.

Typhus (*see* 27.508).—As the result of their study of the epid
ics which occurred in Tunis from 1906 to 1909 Nicolle and
collaborators have shown that typhus is transmitted by the
or faeces of infected lice, and not by other insects such as bu
fleas or mosquitoes, or by discharges from the mucous me
branes as in other infectious diseases. Recent research indic
that the minute intracellular organism known as *Ricket*
prowazeki is the cause of typhus, this conclusion being based
experiments showing that the virus of typhus and *Ricket*
prowazeki are inseparable in infected lice, as well as on the pr
ence of bodies indistinguishable from *Rickettsia prowazeki*
typhus lesions in man, where they have been found with gr
regularity in the blood-vessels of the various tissues.

The Weil-Felix reaction, which was described by Weil a
Felix of Prague in 1915, occupies as important a position in t
diagnosis of typhus as the Widal reaction in that of typh
fever, or the Wassermann reaction in that of syphilis. It co
sists in the agglutination by the patient's serum in a diluti
above 100 of a proteus-like organism named X 19 isolated fr
the urine of a typhus case. The reaction appears toward the e
of the first week, rises rapidly to its maximum between the 1
and 13th days, and gradually falls in convalescence, but may
main positive for months and thereby enable a retrospecti
diagnosis of typhus to be made. The prophylaxis of typhus co
sists in the complete delousing of patients and contacts, as well
in the disinfection of clothing, which is best carried out by stea
The serum and vaccine treatment of typhus is still in the expe
mental stage.

Whooping Cough (*see* 28.616).—It is now generally recognis
that the micro-organism in the form of a cocco-bacillus, d
scribed by Bordet and Gengou in 1906, is the causal agent
whooping cough. It is found in a practically pure culture in t
catarrhal stage and first week of the paroxysmal stage, and the
rapidly diminishes in number, being outgrown by numero
other organisms, especially *Bacillus influenzae* and the pneum
coccus. In the great majority of cases, therefore, the diseas
ceases to be contagious long before the characteristic whoopi
has ceased. Recent writers have drawn attention to the fa
that whooping cough is not so rare in adults as it is commonly su

ed to be, but that it may assume at this period atypical forms
ich are responsible for a spread of the disease. A vaccine pre-
ed from the Bordet-Gengou bacillus usually in association
h other micro-organisms has been used on a large scale in the
vention and treatment of whooping cough, but clinicians
by no means unanimous as to its value. Among the numer-
drugs recommended for the treatment of the disease ether
ninistered by intramuscular injection has recently enjoyed
onsiderable vogue on the ground that it reduces the number
l severity of the paroxysms. (J. D. Ro.)

NFLATION: *see* CURRENCY.

NFLUENZA (*see* 14.552).—The term influenza will be used to
ly "a pandemic outburst of disease characterised, clinically,
a rapid course, catarrh of the respiratory tract, pyrexia and
ne degree of prostration; and epidemiologically, by a tendency
occur in several successive waves at short intervals of time."
is provisional definition is applicable to the visitation of 1918–9,
l to other outbreaks of febrile respiratory catarrh more re-
te in time and about the distribution of which less is known,
is not applicable to the sporadic cases or even the localised
demics of respiratory catarrh to which the name influenza has
n so often applied, especially in the years following fairly
sely upon pandemic outbursts.

The Influenza Pandemic of 1918–9.—This pandemic swept over
world in three successive waves, the first appearing quite
ldenly in May and June 1918, the second starting at the end
September or early in October and waning in December, and
third wave, less uniform in character, appeared early in
rch 1919. This outbreak, attributed by France to Spain,
Spain to France and by America to Eastern Europe, seems to
ve appeared almost simultaneously amongst the nations of
"Entente" on the Western front, and amongst all those
nmunities in intimate touch with them and in the closely
ked theatres of war. It showed the explosive character that
possible only for a highly invasive infection assisted by con-
ions of swift communication such as obtain in modern war.
This first wave made its appearance a little later amongst the
ntral Powers and their neighbours. Early in July it attained
full proportions in Germany, Austria, Norway, Sweden and
nmark, Holland and Switzerland. In several large areas of
world's surface, in the South American republics, in Ber-
ıda, the British West Indies, the Azores and in the islands of
Pacific and Australia, the summer of 1918 seems to have
ssed without an influenzal outbreak. In New Zealand, cases
said to have appeared in Aug., the harbingers, perhaps, of
autumn, rather than the first manifestations of the summer,
vc.

This first wave passed rapidly, so that a "frequency curve"
weeks, in which the incidence in the worst week is taken as
o %, shows a steep ascent to a maximum, followed by an
ually steep and almost symmetrical fall, the whole episode
ssing within about five or six weeks. So benign was the type
t many cases among soldiers at the battle-front escaped
ord, as the men never "reported sick" but merely rested for
day or so in their units, and this was fortunate, as the army
spitals were soon overcrowded. The death-rate was incon-
lerable, but there was an ominous tendency to a higher mor-
lity amongst the later cases, just before the wave came to an
d, seeming to suggest an increase in virulence. The first batch
cases looked "like a mild attack of measles without a rash."
spiratory catarrh, congested conjunctivae, headache, lassitude,
rexia of short duration, a feeling of prostration with the return
temperature to normal, and then a rapid recovery of health;
ch was the course in the vast majority of the cases during the
st wave. Complications were almost unknown during this out-
eak. A few cases which developed broncho-pneumonia or
emorrhagic oedema of the lungs towards the end of the wave
nt up the case mortality. In all these characters, the first wave
sely resembled the outbreak of 1890, except that in 1890 the
ath-rate was greatest amongst the middle-aged and elderly,
ile in 1918 the chief sufferers were amongst the "young adult"
oups.

The Second Wave.—Towards the end of September or early in October, the second wave suddenly gathered force and swept over the world. St. Helena is said to have escaped. Mauritius, too, had a reprieve; and the quarantine measures applied by Australia were successful for the moment but this fatal pandemic spread throughout Europe, America, Asia and Africa.

The upward curve of morbidity was almost precisely similar to that of the summer and the maximum was reached as quickly as in the previous wave, but the fall was much slower and less regular. The outstanding difference between the two waves was the marked tendency to pulmonary complications and the high death-rate of the second. The singularly uniform syndrome of the summer epidemic gave place, in the autumn, to several varieties of clinical picture depending on varying combinations of several factors, amongst which might be reckoned the virulence of the microbic invader, the resistance of the patient, the nature of the bacterial flora of his respiratory tract, and environmental conditions such as occupation, wages and housing. As a rule, the attack was ushered in by the catarrhal and pyrexial symptoms noted in May and June. In many cases, especially where circumstances permitted of immediate rest and treatment, the disease took a favourable course towards recovery, although prostration was clearly always a more marked feature than in the summer. In others, the early pyrexial catarrh was sometimes followed by intense toxaemia leading so rapidly to a fatal issue that there was no time for pulmonary complications to develop. But frequently the lungs became severely affected and the patient passed into a state of anoxaemia recalling that due to exposure to the "pulmonary irritants" of gas warfare.

But there was a formidable difference between the two conditions. While the "phosgene" patient had to deal with a sterile exudate, evoked by a chemical irritant and capable of rapid absorption if vitality was maintained, the lungs of the influenza patient were charged with an exudate evoked by a living virus which had already overcome tissue resistance and could offer to "secondary invaders" conditions of symbiosis favourable to their growth. Here lay the danger. The virus of influenza could open, as it were, the door to the *streptococci*, *pneumococci*, *staphylococci* and other organisms normally held within safe numerical limits upon the respiratory mucous membrane. The *post-mortem* appearances, while tending to have certain basal characters in common, varied considerably with the nature of the "secondary invaders" and other factors. In nearly all cases, there was a haemorrhagic tendency not often seen in other acute lung affections; and this sometimes amounted to a haemorrhagic oedema involving the greater part of both lungs. "Wet lungs," "dripping lungs," were expressions frequently heard in the *post-mortem* room. Areas suggesting haemorrhagic infarcts with their bases extending under the pleura were often noticed. The cut surface of the lungs showed, as a rule, peribronchiolitis and patches of broncho-pneumonia with a general state of oedema throughout the parenchyma of the lung; or a whole lobe might give the appearance of red, or in older cases, grey hepatisation.[1] The third wave had no distinctive characters. It resembled the first wave rather than the second, though pulmonary complications and fatal cases were fairly numerous.

Etiology.—As to the causative organism of influenza we remain, even now, still in doubt. The view that the *Bacillus influenzae* (Pfeiffer) was the cause of the disease, received little support from the new investigations carried out from 1918 onwards. This work was directed, for the most part, to the search for a "filter-passing virus." During the second wave of 1918, the researches of C. Nicholle and Lebailly in the French War Zone, of H. G. Gibson, F. B. Bowman and J. I. Connor at Abbeville, and of J. A. Wilson at Étaples, in the zone of the British Armies in France, afforded highly significant evidence in favour of a filterable virus, although the restrictions imposed upon bacteriological work by war conditions and the transitory nature of the epidemic rendered conclusive findings impossible.

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[1] For a detailed account of the *post-mortem* appearances, together with their morbid histology, see the article by Maj. Tytler, R.A.M.C., in *Special Report Series No. 36*, Medical Research Council (1919).

In 1919, an investigation was undertaken by Zamanouchi, Sakakami and Iwashrima, in which the filtered and unfiltered emulsions of sputum from 43 cases of influenza were injected into the throats and noses of 24 healthy volunteers, six of whom had recently suffered from influenza. Of the 18 previously uninfected persons, all developed influenza after an interval of two or three days, but the six who had had the disease remained in good health. Similar results were obtained with the filtered blood of patients. At the same time, the spraying of cultures of Pfeiffer's bacillus, sometimes "pure," sometimes mixed with other respiratory bacteria, into the throats of 14 healthy persons failed to lead to illness of any kind.

P. K. Olitsky and F. L. Gates in the Laboratories of the Rockefeller Institute for Medical Research were able to approach the subject with much more deliberation and with a much better equipment than was available in France; and their results are proportionally more convincing. Like Gibson and his coworkers, they produced in rabbits a condition closely resembling human influenza by means of filtered or unfiltered nasal secretions taken from human patients during the earliest stages of the attack. They provided independent confirmation of the discovery of Gibson and Bowman that "cultures" in Noegouchi Medium were capable of transmitting the disease to animals, and showed that the anaerobic and filterable organism thus cultivated retained its activity after long exposure to glycerine and possessed antigenic properties. To the minute organism isolated by them in the course of this inquiry, they gave the name of *Bacterium pneumosintes* (πνεύμων lung: and σίντης injurer), "since a striking feature of its effect in rabbits is to diminish the resistance of the lungs to the action of ordinary pathogenic bacteria."

Their work received speedy confirmation at the hands of Dr. M. H. Gordon, C.M.G., F.R.S., in the course of an influenzal outbreak among the Nursing Staff of St. Bartholomew's Hospital, London, in 1922. Still further support for a "filter-passer" as the virus of influenza was later provided by Sir Spenser Lister in South Africa. These independent inquiries, leading to similar findings in America, England and South Africa, go far to establish the "case" for a filterable virus as the causative agent of influenza; but caution is still needed in drawing final conclusions until a more precise knowledge is available as to "filter-passers" in general (*see* FILTER-PASSING MICROBES).

Epidemiology.—In the absence of final knowledge as to the causative agent, many points of fundamental importance still remain obscure. Was the pandemic of 1918–9 a sudden awakening to virulence of some germ already widely distributed in western Europe or was it a "new arrival" operating in "virgin soil"? Then the question arises: "Where could such a germ come from?" If previous pandemics were due to the same agent, no doubt, somewhere, from one pandemic to another, some human individual or chain of individuals carried on the virus until the time was ripe for a fresh outbreak.

The first wave coincided with the arrival of the first drafts of American troops in Europe, who must have brought into common circulation pathogenic strains that had long remained dormant in isolated and relatively immunised communities. The crowded troopships afforded just the incubation places that would permit of the maturation of such an infection; and Europe, with its crowded concentration areas and billets, offered an unequalled opportunity for its spread. The last influenzal pandemic had occurred just 28 years before. There might be a few scattered "carriers" and perhaps some residual immunity among the middle-aged and the elderly; but the adolescents and the young adults would in 1918 be "virgin soil." It was just these lower age-groups that suffered most.

How, then, explain the second wave with its greater severity? —and the third? Surely, if immunity played a part, these waves should have been much less extensive, much more benign, and confined to those persons who had previously escaped. These are good, but not final, arguments. The passage of the first wave may have left behind it a virus of exalted virulence, many "carriers" and many "allergic" subjects whose behaviour to reinfection might betray the phenomena of hypersensitivene of the respiratory surfaces and a tendency to inflammatory ex dates on contact with the air-borne virus. Under such cond tions a fresh outbreak would be specially likely to arise in th fall of the year, a period of rapid fluctuations of temperatu when the chill evenings drive men into the warmth and close con tact of crowded dug-outs, shelters and billets.

It is impossible to believe that the so-called "influenza" t which deaths were attributed every year between 1892 and 191 was the same disease as the fulminating pandemic that followed Apart from the extreme contrast in invasive power, the distr bution of "influenza" mortality by age-groups[1] emphasises th essential difference between, let us say, the death-rates for 191 and 1918, the one having a preponderating death-rate among the old, the other, amongst the young. Such differences can har ly leap into existence within a few months. The known facts o increase and diminution of bacterial virulence do not support th idea that such a vast alteration is probable or even possible i so short a time.

Acquired Immunity.—Evidence that morbidity and mortalit were less marked, in the second wave, amongst those who ha been attacked in the first, when thoroughly analysed[2] was foun to indicate that "these data show a considerable immunisin power in the summer attacks and we conclude, although wit natural hesitation, that it is probable, on the average, that a appreciable degree of active immunity was attained by those wh passed through an attack in its first and mildest manifestations.

The evidences for immunity are of varying efficiency in di ferent places, and the populations of many areas show no tend ency at all to acquire resistance to infection as judged by comparison between the behaviour of those attacked and thos missed by the first wave when confronted by the second.

We believe these data to be unsound as a basis for comparison. It is highly probable that many persons were infected during th summer and yet failed to show appreciable illness. The vas difference that may exist between the numbers *infected* and th numbers *affected* by a bacterial invasion can be judged from wha we know of the meningococcus and the diphtheria bacillus. An yet these latent infections may confer active immunity, as we know from the "Schick Reaction" in the case of diphtheria and from many other examples as well. The mere fact of a previ ous "attack" is not a safe guide in classifying populations fo inquiry as to their relative immunities. The best evidence of the acquisition of immunity is to be found in the phenomena o natural recovery of the individual and of the disappearance of pandemic waves from the community. The fact that these groups of pandemics are separated by long and fairly regula intervals, as a rule about 20 years, is not without significance in this connection, since at least this period might be necessary to reduce the residual "immune population" from the last pandemic to an ineffective number.

Artificial Immunity.—No vaccine can be entirely satisfactory unless it is known to contain the virus or germ of the disease in question. The vaccine issued by the War Office and afterwards by the Ministry of Health was confessedly of a provisional nature since the causative agent was still uncertain. Its formula was as follows:—

	Per cu. cm. of vaccin
Bacilli influenzae (Pfeiffer)	400,000,000
Pneumococci	200,000,000
Streptococci	60,000,000

Unless Pfeiffer's bacillus be accepted as the causative agent, this vaccine must be described as consisting entirely of the "secondary invaders." As such, its issue was entirely justifiable and its effects were such as might be expected: satisfactory in diminishing complications and mortality but practically *nil* in preventing the disease. Vaccine, then, cannot, as a prophylactic help us much at present; nor can we, in the light of recent experience, hope for great results from general measures of hygiene.

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[1] *Proceedings of the Royal Society of Medicine* (Jan. 1919).
[2] *The Report of the Ministry of Health*, chap. 6 (1918–9).

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E, WILLIAM RALPH (1860–), English divine, was June 6 1860 at Crayke, Yorks., the son of William Inge, ime provost of Worcester College, Oxford, and was edu- at Eton, and at King's College, Cambridge. From 1884 8 he was a master at Eton, and during the last two years it time was fellow of King's College, Cambridge. From o 1904 he was fellow of Hertford College, Oxford. Bampton er in 1899, and Paddock lecturer in New York in 1906, 905 to 1907 he was vicar of All Saints', Ennismore Gar- London, and in 1907 was made Lady Margaret professor of ty at Cambridge. In 1911 he became dean of St. Paul's, his sermons attracted great attention owing to their ality, their caustic criticism of the tendencies of modern id a somewhat pessimistic tone which earned for him the quet of "the gloomy dean."

iong Inge's numerous historical and theological works may entioned *Society in Rome under the Caesars* (1888); *Christian* *icism* (1899); *Types of Christian Saintliness* (1915); *Phi-* *y of Plotinus* (1918); *Outspoken Essays* (1919, Second ; 1922); *Personal Religion and the Life of Devotion* (1924).

GLIS, ELSIE MAUD (1864–1917), British physician and on, was born at Naini Tal, India, Aug. 16 1864. After a iood spent in India and Australia, in 1878 she settled with amily in Edinburgh. She studied at the school of medicine omen in Edinburgh and at St. Margaret's College, Glasgow, iating M.B. and C.M. In 1895 she took up private practice linburgh and was instrumental in establishing a second l of medicine for women in that city. Dr. Inglis became one of iost prominent suffrage workers in Scotland. In Aug. 1914, ed by her, a special committee of the Scottish Federa- of Women's Suffrage Societies, aided by the National Union omen's Suffrage Societies, undertook the organisation of the ish Women's hospitals for foreign service, and raised ooo. She first went to Serbia in April 1915 to relieve Dr. u at Kragujevac. In Nov., during the enemy invasion rbia, Dr. Inglis and a few others remained behind until 1916 as prisoners of the enemy to care for the Serbian ded. In Aug. 1916 she took a unit to the Dobruja for service the newly formed Serbian division attached to the Russian . She died at Newcastle-on-Tyne Nov. 27 1917. See Lady ces Balfour: *Dr. Elsie Inglis* (1918).

ITIATIVE (*see* 23.1).—The initiative is one of the two forms rect popular legislation, the other being the referendum. zerland is the classic land of both initiative and referendum. ite as 1910 its experience with these devices of popular was much more extensive than that of the rest of the d combined.

ie Swiss example was copied first in the United States where nitiative was introduced by South Dakota as early as 1898. equently nearly half the states in the American Union have ited one or both forms of direct legislation. Most of these nonwealths are west of the Mississippi, but of more recent s five eastern states, among them Ohio and Massachusetts, accepted the initiative. Twelve states provide for official tins of information, commonly known as "publicity pam- ts," containing texts of laws to be voted upon with argu- ts pro and con, which are distributed before the vote to all ors in the state. As a common feature of the commission commission-manager forms of government now in effect in e 400 cities throughout the United States, direct legislative hods have also been made widely applicable to local charters ordinances.

ollowing American developments in this field the next great in the extension of the initiative was taken after the World by the constitution makers of several revolutionised or new es of Europe. In varying forms this device has been established by the constitutions both of the German Reich (1919) and of the Prussian State; also by the constitutions of Austria, Estonia and the Free City of Danzig—all the latter dating from the year 1920. The constitution of the Irish Free State (1922) provides specifically for the referendum; it authorises also the Irish Parliament to establish the initiative by law, expressly stipulating that a petition signed by 50,000 voters shall be sufficient to start action either upon a constitutional amendment or upon an ordinary law.

Swiss Experience.—Up to 1908 the Federal initiative in Switzerland was employed, generally without success, to promote radical measures. Since that year it has scored a number of constructive achievements, among them the amendments providing for Federal regulation of water-power (1908) for election of the National Council by proportional representation (1918) and for the submission of treaties concluded for periods of 15 years or more to popular vote upon the same terms as ordinary legislation, *i.e.*, petition signed by 30,000 voters or demand of eight cantons (1921). In 1922 a drastic capital levy initiative proposal brought forward by the Socialists was defeated by a popular vote of 736,652 to 109,702 and by all cantons against none. Experience with direct legislation under the new constitutions of Europe has been too brief to warrant conclusions. In Germany where a petition requires 3,000,000 signatures, the initative has been used but once (June 20, 1926) but without success. (*See* GERMANY.)

American Experience.—In the United States the initiative has been freely employed, so freely indeed that in connection with referendum measures the ballots of certain states have been at times greatly overcrowded. The initiative has been repeatedly used by small reform groups to advertise their projects. In Oregon it was employed successfully to pass a so-called compulsory school attendance law (1922), obviously inspired by hostility to parochial schools, which was held by the Supreme Court of the United States (1925) to be unconstitutional. Coincident with the extension of direct legislation there has developed a tendency to exclude from its operation certain classes of measures, particularly finance bills and Acts of an urgent character. Thus in the United States the Massachusetts initiative and referendum amendment (1917) bristles with restrictions excluding from popular vote religious issues, judicial tenure and powers, local legislation, specific appropriations, anti-Prohibition measures and various personal and property rights. In spite of much criticism, however, direct legislation is generally sustained by popular opinion in those American states which have provided for its establishment.

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INLAND WATER TRANSPORT.—Transport by navigable waterways in the last years before the War reached very high figures indeed. In 1875, 10,400,000 tons were carried by water in Germany; in 1910, 64,750,000 tons. The bulk of the increase was on the large rivers and canals; the less important waterways showed no advance, and in some cases actually a falling-off. In the Netherlands and Belgium the ports of Rotterdam, Amsterdam and Antwerp benefited by the great development of Rhenish industry in Germany, the Rhine being admirably suited for carrying both ores and coal. In the riparian states of the Danube the movement of industrial products downstream and of cereals and oil upstream has produced a similar increase in water-borne traffic.

This general development of traffic by navigable waterways everywhere led to the undertaking of important hydraulic work in the construction of new waterways and the improvement of existing ones. Steps were taken to regulate and canalise rivers; canals were cut to link up important rivers; existing canals were enlarged so as to be navigable by vessels of larger tonnage; and gradually a whole network of navigable waterways has spread over central and western Europe. The total length of the navigable waterways in France before the War was more than 11,000 kilometres. In Germany it exceeded 10,000. The capacity of the German waterways was on the whole greater than that of the French, since many of the canals in France were navigable only for vessels of 300 tons or less.

Effects of the War.—The World War interrupted the development of inland navigation, and its termination was followed by a transport crisis due mainly to the disorganisation of the railways through the wear and tear of rolling stock and rails, and the destruction of considerable portions of tracks and railway installations. Normal currents of traffic had to be re-established, and demobilisation raised a difficult transport problem. Even the full use of navigable waterways was insufficient to meet immediate requirements. The destruction of many waterways with their works (bridges, locks, etc.) and of many vessels used in inland navigation, helped to make matters more difficult. But repairs were fairly quickly effected and in 1920–1, indeed, when the railway crisis was still acute in consequence of a shortage of rolling stock, there was a surplus of inland navigation tonnage owing to the considerable increase in freights due to the rise in the cost of living. Governments avoided or took measures to prevent any great increase in railway rates until the existence of large deficits showed that it was necessary to adapt rates to the increased expenditure. Navigation, on the other hand, being entirely in the hands of private individuals, had to adapt itself immediately to the increased working expenses.

Furthermore, governments in some cases used the railways to establish new currents of transport, which had become desirable in consequence of altered frontiers, or to help national seaports to compete with foreign seaports. Sometimes, too, by instituting competitive rates on the railways, governments tried to obtain larger receipts which would enable them to meet the deficit of the railway budget. Another factor which unfavourably affected the financial results of inland navigation concerns was the absence of proper upkeep of the waterways during the years 1914–8. Rivers which require constant attention suffered to a large extent in this respect, and it proved impossible to employ the river-craft to their full capacity.

But the main cause of the bad conditions of inland navigation after the War was that financial and economic crises, the instability of the exchanges, and general impoverishment did not allow the resumption of transport which had been expected.

In France the total amount of goods carried on rivers and canals, which was 41,896,754 tons in 1913, was only 21,500,000 in 1920. In 1924 the figure had risen to 36,758,000 tons, traffic assuming large dimensions in the north of France, as well as in respect of goods and vessels coming from and proceeding to the port of Strasbourg. The following figures for the port of Paris may be noted: in 1913, 4,786,649 tons were loaded and 11,709,824 tons unloaded; the figures for 1924 were respectively 2,769,166 tons and 10,221,228 tons.

The total traffic for the Rhine, which in 1913 was 54,562,574 tons, had fallen in 1918 to 25,608,609 tons and by 1923 as low as 16,608,609 tons. In that year—a quite abnormal one certainly, owing to the Ruhr occupation—traffic through the port of Duisburg-Ruhrort, which in 1913 was about 26,000,000 tons, and which was still 14,000,000 tons in 1922, fell to 3,980,412 tons.

The situation is exactly the same as regards traffic across the German-Dutch frontier near Lobith. From over 37,000,000 tons in 1913 the figures fell in 1918 to scarcely 5,000,000 tons, but by 1924 had risen again to 23,000,000.

On the Danube in 1911 the total movement of goods was 6,802,639 tons and in 1924, 3,757,010 tons. The year 1925, however, showed a considerable increase in traffic.

The same effects are observable in Russia, although, in this case, it is necessary to take account of the great disturbance caused by the Civil War, the Bolshevist régime and the famine which ravaged the Volga basin in 1921. In 1913 the total weight of goods carried by water amounted to 2,281,900,000 pouds (approx. 38,000,000 tons), of which corn accounted for 229,000,000 pouds. In 1920 the total figure had fallen to 665,500,000 pouds. The corresponding figure for corn is negligible. For 1925 the total figure was, according to official statements, 1,405,200,000 pouds.

Nevertheless, general improvement took place. Take as an example the port of Rotterdam. The total amount of goods transported on barges in 1924 was 19,000,000 tons, whereas in 1923 the figure was only 8,000,000 tons. Even allowing for the effects of the Ruhr occupation, this denotes a very considerable increase.

Extension of Waterways.—The improvement of navigable waterways was resumed after the War and, although many big schemes can hardly be expected to materialise, it is none the less true that a large number of far-reaching plans are already in course of being realised, or are ripe for execution.

Rhône-Rhine Navigation.—The navigable waterway which the canalisation of the Rhône would establish from Marseilles through Lyons and Geneva (if the French and Swiss governments agreed
about the régime for the Lake of Geneva), might be of first-
importance for traffic to Switzerland, and the eventual continua
of this waterway through Switzerland by the canal known as En
roches (a scheme warmly supported by the Swiss Assn. for Rh
Rhine Navigation), would increase its importance. This schem
a navigable waterway between the Rhône and the Rhine thro
Switzerland seems still immature.

Rhine Navigation.—The second large scheme prepared by
French Govt. is for the great Alsace Canal between Huningue
Strasbourg. This canal, which will serve both for navigation and
supply of water-power, is to follow a course nearly parallel to
Rhine over a distance of about 114 kilometres. The plan invo
the erection of a weir across the Rhine bed. Further, eight po
stations will be constructed on the canal and two locks place
each station. The dimensions of this waterway would allow ba
of 1,200 tons, normal type on the Upper Rhine above Mannh
The scheme for this canal required the approval of the Central C
mission for Rhine Navigation. After giving its consent to the
struction of the first reach of the canal in 1922, the commissio
April 1925 approved the scheme for the sèven other reaches sub
to certain conditions.

Switzerland has prepared a scheme for the regulation of the R
between Strasbourg and Basel. This scheme has also been condit
ally approved by the Central Rhine Commission, and the work
therefore shortly be put in hand (*see* RHINE).

Communication with Antwerp.—A clause in the Treaty of Versa
provides for the possible construction of a deep-draught canal f
Antwerp to the Meuse and the Rhine, ending in the neighbourh
of Ruhrort. The early execution of this scheme is unlikely, especi
as the plan for the Antwerp-Moerdijk canal, which is provided
in the new Dutch-Belgian Treaty, will secure for Antwerp ad
tages at least equal to those offered by the Antwerp-Ruhrort c
and at an infinitely smaller cost. No technical details are yet kn
of the Antwerp-Moerdijk canal scheme, but the waterway
created will be made navigable for the large Rhine barges, that
say, for vessels up to 3,000 tons.

Meuse Canalisation.—In the Netherlands the most import
scheme now being carried out is the canalisation of the Meuse
Dutch territory, which further involves a junction canal betw
the Meuse and the Waal and the Juliana canal from Maasbr
southwards, the latter intended to link up the mining centre with
navigable waterways of the country. The canalised Meuse wil
navigable for boats of 2,000 tons. Locks 260 metres long will be
to take a tug and two barges of 2,000 tons each. The Meuse-W
canal will be navigable for boats of the same tonnage.

Completion of Rhine-Vistula System.—In Germany two l
schemes are being carried out. The Mittelland canal, which
connect Hanover with the Elbe near Magdeburg, will establish
uninterrupted navigable waterway between the Rhine and
Vistula. This canal will form the last section of the waterway be
with the construction of the Dortmund-Ems canal between
and 1899, followed by the Rhine-Herne canal, opened in 1914,
the Bevergern-Misburg canal constructed during the War.
last-mentioned canal, which is 172 km. long, is without locks.
total length without locks, including certain parts of adjacent can
is no less than 213 kilometres. The Mittelland canal will be nav
ble for boats of 1,000 tons. It will cross the Elbe by a bridge,
plans for which have been submitted for the approval of the In
national Elbe Commission.

Rhine-Main-Danube Connection.—The second important sch
in process of execution is the junction between the Rhine, the M
and the Danube. The idea of linking up the Rhine and the Dan
is a very old one. Charlemagne conceived the idea of constructi
canal, traces of which can still be seen. The Ludwig canal, opene
1846, was only navigable by small boats up to 120 tons and
never been much used. It is anticipated that the area tapped
the Rhine-Main-Danube navigable waterway will exceed that
any other European river and canal system. The scheme invol
the canalisation of the Main, the construction of lateral canals
of a junction canal between the Main and the Danube, joining
with the latter near Kelheim. It also necessitates the regulatio
the Danube between Regensburg and Hofkirchen, and betwe
Passau and the frontier and in addition its canalisation over
stretch between Hofkirchen and Passau, that is to say, in the
varian Kachlet. The waterway will be navigable for canal barges
1,200 tons and for Rhine barges up to 1,500 tons. The scheme
provides for the utilisation of hydraulic power; in fact, it is the p
duction of electric power that has made the scheme practicable.

Other German Schemes.—Among the other plans for the constr
tion of canals in Germany, such as the Hansa canal, the canal fr
the Weser to the Main, the Kuesten-Kanal and the junction ca
between Neckar and Danube, only the last deserves serious co
sideration at present. The canalisation of the Neckar might b
considerable value for the development of navigation and for
port of Mannheim. At one time it seemed that, mainly for politi
reasons, opinion in Germany was in favour of constructing
Weser-Main canal (the Weser being the only important river wh
has escaped internationalisation), in order to direct part of
traffic from the Danube to Bremen, after the construction of t
Main-Danube canal. The Weser could also carry some of the tra

ılly carried by the Rhine and the Elbe. But the changed polit-
tuation makes it improbable that this scheme will be put into
at any early date.

ian Waterways.—In Italy a canal has been constructed from
o to Brondolo on the Lagoon of Venice. A canal is also in
of construction from Milan to the confluence of the Adda and
, whereby Milan will be linked by waterway to Venice.

choslovakian Waterways.—In Czechoslovakia, besides canalisa-
vork on the Elbe and the Moldau and the regulation of the
be, the Govt. has carefully considered two canal schemes, an
Danube canal and an Elbe-Oder canal navigable for vessels of
tons. The length of the Elbe-Danube Canal would be about
lometres. Its course would follow as far as possible the line of
ıost important towns. Financial considerations are retarding
ecution of these schemes.

ish Waterways.—Polish plans include schemes for several canals
, navigable by boats of 1,000 tons, would constitute, together
he regulated parts of the Vistula, a complete system of naviga-
ıterways across Poland. This plan would involve the construc-
f a canal which would start from Kattowitz in Upper Silesia,
northwards and join the Vistula either at the mouth of the
or near Thorn, making use in several of its sectors of existing
ıble waterways as, for example, Lake Goplo. Another canal
extend from Posen via Konin and Warsaw to Pinsk, taking
art of the Warte and of the canalised Bug, together with the
structed King's canal between Brzesc and Pinsk. The latter
way would have to be continued from Pinsk to the Russian
er in order to link up with the great navigable system of
ı.

Russian System.—The Russian rivers which are naturally
ıble have suffered but little from the lack of upkeep in the
of the last 10 years. The proposal to construct the Rostov
to unite the Volga and the Don may be carried into effect,
h there are great technical difficulties in the way of this scheme.
mpletion would reduce the cost of transport of oil from Baku,
om Astrakhan, corn from the valleys of the Volga and the
, coal from the Donetz and merchandise from Persia. The
tance of the proposed canal is obvious, as the immense system
Volga, which is navigable for more than 16,000 km., will thus
ked up with the Black Sea, and the Baltic, Black and Caspian
vill be connected by navigable waterways. There is already a
e between Leningrad via the Mariinsky system and the Volga
rakhan and thence to the Persian port of Enzeli. The immense
ory of Russia may become of capital importance in the future
the point of view of inland waterway communications. The
ı of waterways is more than 200,000 km. in length, of which at
t some 40,000 are navigable. The Asiatic Russian system
he Ob-Yenesei mouths to Central Asia and Lake Baikal lies
e the scope of this article.

nomic Considerations.—Economic considerations will natu-
play an extremely important part in any decisions taken in
to the improvement of existing waterways or the con-
ion of new ones. The question will inevitably arise whether
way would not prove more serviceable than a waterway.
reference will clearly go to whichever mode of transport is
er. In comparing the advantages of waterways and rail-
we must distinguish between rivers and canals; and we
further discriminate between canals built across flat
ry and those constructed across land where there are
ed differences in level.

ers not naturally navigable may generally be rendered nav-
by regulation works, such as spur dikes or longitudinal
or by canalisation works such as the construction of dams
the bed of the river and locks to enable boats to pass.
orming of large reservoirs in the upper courses of water-
belonging to the basin of a large river may also constitute
cellent means of improving navigability by regulating the
f water. In this way a greater minimum depth is obtained
he period of navigability during the year is lengthened.

a rule the cost of building a railway having the same
ing capacity as a river is appreciably higher than the cost
king the river sufficiently navigable. Moreover, the cost
er-craft having a given loading capacity is less than that of
y rolling stock having the same capacity. Further, the
ge power of a locomotive is only a small fraction of that of a
This argument remains true even if a proper use of a water-
nvolves the execution of improvement works. Moreover,
conomic development of the area served by the river leads
considerable increase in passenger and parcels traffic, for
the railway is necessarily more suitable than the water-
so that we always find railway lines alongside the river, connecting up the various important centres situated thereon. The argument that a river can compete with a railway holds good even if the traffic does not, strictly speaking, consist of heavy goods, such as ores or coal. The Danube is a case in point; before the War the volume of traffic on that river amounted to nearly 7,000,000 tons.

The case is different, however, if it is an artificial navigable waterway, *i.e.*, a canal, which has to be built. As a rule such a work is not justified from the economic point of view unless the prospective traffic in heavy goods (ores, coal, building material, cereals, and certain other agricultural products) is to amount to several million tons per annum. In order to determine the cost price of transport by canal we have to allow for possible profits and advantages derived from the exploitation of hydraulic power, and accordingly we have to make a distinction between a canal crossing flat country and a canal built in mountainous districts. Many projects for artificial waterways have been rendered feasible by the utilisation of water power. Wherever the configuration of the ground has permitted, recent schemes have combined the construction of a navigable waterway with the exploitation of hydro-electric power. The question therefore whether, in any given case, it is preferable from the economic point of view to construct a canal rather than a railway cannot be answered so readily as when the alternatives are a railway and a river; the answer depends upon a very large number of factors.

International Rivers.—A special category of waterways is constituted by those which come under the scope of the Convention on the Régime of Navigable Waterways of International Concern[1] concluded at Barcelona on April 20 1921. The criteria adopted at Barcelona were the fact of crossing or separating a number of countries, and natural navigability to and from the sea. In addition to the obligations which devolve upon riparian states, particularly in connection with works of upkeep, the Barcelona Convention lays down the principle of freedom of navigation and equality of treatment for all flags.

The objection has sometimes been raised that two different ideas have been confused, namely, the territorial idea and the idea of international traffic. It is clear that if it is in the interest of international traffic that there should be no flag discrimination, this principle applies wherever international navigation is carried on, independently of the fact whether the navigable waterway crosses or separates several states or not.

On the other hand it is only natural that, as regards international rivers, there was a desire to impose certain strict obligations on riparian states in connection with the hydraulic works to be carried out; these obligations, however, should rather be regarded as reciprocal obligations between riparian states. It would seem not impossible by drawing a clear distinction between the territorial idea and the idea of international traffic, to lay down, for all navigable waterways on which international traffic can be carried on, contractual provisions similar to those which have been drawn up for maritime ports.

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[1] In the application of the statute, the following are declared to be navigable waterways of international concern:

1. All parts which are naturally navigable to and from the sea of a waterway which in its course, naturally navigable to and from the sea, separates or traverses different states, and also any part of any other waterway naturally navigable to and from the sea, which connects with the sea a waterway naturally navigable which separates or traverses different states.

It is understood that:

(*a*) Trans-shipment from one vessel to another is not excluded by the words "navigable to and from the sea";

(*b*) Any natural waterway or part of a natural waterway, is termed "naturally navigable" if now used for ordinary commercial navigation, or capable by reason of its natural conditions of being so used; by "ordinary commercial navigation" is to be understood navigation which, in view of the economic condition of the riparian countries, is commercial and normally practicable;

(*c*) Tributaries are to be considered as separate waterways;

(*d*) Lateral canals constructed in order to remedy the defects of a waterway included in the above definition are assimilated thereto.

(*e*) The different states separated or traversed by a navigable waterway of international concern, including its tributaries of international concern, are deemed to be "riparian states."

2. Waterways, or parts of waterways, whether natural or artificial, expressly declared to be placed under the régime of the General Convention regarding navigable waterways of international concern either in unilateral Acts of the states under whose sovereignty or authority these waterways or parts of waterways are situated, or in agreements made with the consent, in particular, of such states.

Inquiry into Existing Conditions.—In accordance with a resolution of the Economic Conference of Genoa, which was approved by the Council and Assembly of the League, the Organisation for Communications and Transit decided in 1924 to make inquiries of the various European governments concerned regarding the present situation of inland navigation in their respective territories. It also decided that the study of the complex problems which might be raised in connection with the great international rivers with many riparian states, should be entrusted to Mr. Walker D. Hines, United States Director of Transport during the War, who was appointed after the War as arbitrator in the allocation of river tonnage on certain international rivers. Accordingly Mr. Hines carried out an exhaustive study of the position of inland navigation on the Danube and also carefully examined the existing difficulties on the Rhine. It is hoped that Mr. Hines's reports on Danube and Rhine navigation as well as the results of the general inquiry will help to promote co-operation among the riparian states and to solve existing difficulties, in order that inland navigation may develop unhindered, and may occupy among the various means of communication a position which will enable it to play a great part in restoring economic stability and promoting the prosperity of the European nations. For the development of inland water transport in America *see* the articles Great Lakes and St. Lawrence and Mississippi River.

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INOUYE, KAORU, Marquess (1835–1915), Japanese statesman (*see* 14.587), died Sept. 1 1915.

INSANITY (*see* 14.597, and Psychiatry; Psychoanalysis; Psychosis; Psychotherapy).—A change in the conception and in the handling of the facts characterises the present century. Instead of " Lunacy " and " Insanity " we speak to-day of mental disorders, of psychoses and psychoneuroses, viewed as problems of the adaptation of the individual to his environment.

During the World War a wide range of mental disorders had to be met by medical and military officers many of whom had never before concerned themselves with such problems. A new type of sympathy and sense of duty towards the victims of " war shock " laid the foundation for a more understanding interest in mental disorders in general, and aroused the demand for their effective management, not by mere relegation to official asylums, but by active therapeutic measures.

Definition.—" Insanity "—implying as a rule an incapacity to grasp the fact and nature of the existing sickness or disorder and a lack of responsibility for personal care and conduct, with possible neglect of or actual danger to self or others—is a contingency rather than the essence of many disorders, and cannot properly be studied and understood by limiting oneself to the " insane " as we find them in the centres of segregation which we call asylums, refuges, retreats or mental hospitals. The wider field of psychiatry (*q.v.*) now includes mental and behaviour problems outside as well as inside hospital walls, and experienced help, medicinal at times but also to a large extent taking the form of guidance in the problems of adaptation, has supplemented or replaced mere custody in institutions. Mental hygiene, administered through mental health boards and committees in the United States and in several European countries, offers constructive and preventive measures which are carried out largely in centres where physicians, psychologists and
workers collaborate in the work.

Advances in Etiology

Nationality and Race.—Interesting statistics on menta
orders in different nationalities making up the admissio
the Massachusetts hospital at Worcester, and to the New
state hospital at Blackwell Island suggest that national and
habits play an important part, the greatest differences lyi
the relative rôle of alcohol and syphilis and in the frequen
temperamental and psychoneurotic maladjustments.[1] The
admitted had 27·69% alcoholic psychoses and 37% largely
chogenic (temperament- and behaviour-determined) diso
while the Jews presented 0·32% alcoholic but 65% largely
chogenic disorders. Of the Irish only 7·59% showed paresis
a form of brain syphilis); of the Jews 14%; of the Germans
and of the negroes 29·41%.

Occupation.—The incidence of mental disorders in
occupations is dependent largely on the degree of exposu
harmful influences, and also on the temperamental factors
may determine the choice of a profession.[2]

Heredity.—The question of heredity is not as simple
appeared in 1911. While the dispositions are inherited, it
highly probable that additional factors, in the form of life-
riences, play a considerable rôle. The attempts to use Men
principles led to the conviction that affective disorders (m
depressive psychoses) follow a dominant, and schizophreni
orders a recessive type. The work of Mott and others ap
to show that these two conditions may follow a law of anti
tion according to which the mental symptoms develop
earlier age in succeeding generations of psychopathic
Lately, we meet with the assumption that at least two or
factors are needed to determine schizophrenic or manic-d
sive attacks, and geneticists like Jennings even tell us th
had best forget the theory of unit characters, in man, beca
the complexity of the facts to be considered. Eugenics (*q.v*
shown itself applicable in two ways, negatively in the ste
tion of the most obviously degenerate offspring of psycho
families, and positively in the training of the young to
healthy mating and sound sexual hygiene.

Infections.—The claims made with regard to the impor
of infection (14.598) and in the publications of a few surg
inclined psychiatrists have not been borne out under
scrutiny. Both the " agglutinines pointing to strepto
infections present in every case " of manic-depressive diso
and the claims of 80 to 90% recoveries after removal of
infections and of the colon, are largely discredited, part
the very material of those making the claims. In the face
the propaganda, the theory of autointoxication and much
more recent theory of endocrine disorders as etiological f
in mental disturbances are having an equally difficult time
the rigorous tribunal of strict hospital and field work and
tical tests. This does not mean that the " physical causes
being neglected or belittled. Much research has been
still being carried out on the morbid anatomy and biochem
of the psychoses and psychoneuroses. Mott has demonst
changes in the endocrine and particularly the generative g
of dementia praecox which in his view point to an " inbor
of vitality " in these patients. However, the old contro
between the physiogenic and the psychogenic theories as
causation of mental disorders is dying down before the
and more comprehensive conception of psychobiology, acc
to which the physical and mental make-up, the perso
tendencies and the determining factors and situations are
into account in the study and treatment of the patient.
cases constituting or akin to the dementia praecox or s
phrenia or parergasia group (described as katatonia and
phrenia in 14.606) have been shown to be much more re
understood and formulated for purposes of treatment
genetic-psychodynamic basis, with special attention to the

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[1] G. H. Kirby, *New York State Hospital Bulletin*, 1, p. 666.

[2] James V. May, *Mental Diseases, a Public Health Problem*, p

tances of the development of symptoms, than on the basis sweeping claim of inevitable deterioration due to " un- n " toxins or other causes, or on the theory of insufficiency docrine glands.

Special Types of Disorder

eble-mindedness.—The study of feeble-mindedness has been hed in various ways. The Binet-Simon tests and their fications furnish a dependable and comparative measure of ctual intelligence in terms of the " mental age " and the elligence quotient " or I.Q., *i.e.*, the mental age attained ed by the chronological age. One speaks of idiots where the nable age does not exceed three years, of imbeciles up to a -year level and of the higher grades of feeble-minded or ns between the eight and 15-year level. A retardation of less three years may lie within the range of error. The British commission of 1904 found that in groups of urban indus- and agricultural areas there was an average of ·32% of e-minded children and adults in the general population, of ·83% of feeble-minded among the children of school age, a higher percentage in towns than in country districts. A e-to-house survey of the children of school age of a well-cir- cribed industrial district of Baltimore, Md., was undertaken e Henry Phipps Psychiatric Clinic and published by Dr. C. ie Campbell.[1] Since then numerous surveys in the United s have corroborated the Baltimore results, which make it that about 2% of the children of a community should have al institutional training and some of these protection for an additional 6% should be in special classes for the re- d, and another 5% should have at least individual adapta- of the curriculum.

eater attention to the psychology of education has revealed act that children may fail to keep up to the standard of age for causes other than feeble-mindedness, and may pre- problems of maladjustment which had best be handled by sychiatrist. In England and Scotland the Mental Defi- y Act of 1913 has widened the range of defectives who may y be committed to institutions and makes provision for l imbeciles. Early diagnosis and anti-syphilitic treatment fect due to congenital syphilis is followed by improvement.

quired Mental Diseases.—A distinct advance is shown by act that the disease entity concept is giving way to the less atic concept of reaction-types. The specifications of the s of mental disease given in 14.597 are to-day largely replaced more genetic and constructive formulation and interpre- n of patients or individualities.

mentia Praecox.—An intermediate phase of rather opti- c simplification had introduced the concepts of maniac- essive (or affective) psychoses as essentially non-deteriorating, posed to the schizophrenic psychoses (also called dementia cox), which are apt to pass into deterioration, emotional ference and apathy. The manias and the melancholias d constitute the manic-depressive psychoses, while hebe- nia and katatonia are now included in schizophrenia. But these diagnoses, which aim largely at prognosis, have had eld to the recognition that one had best admit a number of tically important reaction-types of special working and ency of evolution, requiring further a specification of the al factors and the assets of the patient both for the deter- tion of the intrinsic nature and the formulation of a prog- s in each case.

ne simple notion of " one patient one disease," and a classi- ion under a one-name diagnosis indicating either a good or d outcome, cannot do justice to the multiplicity of points h demand consideration. A totally new conception of the titution of personality and its hereditary and individual ponents has supplemented the formerly dominant and almost sive conception of brain destruction by poisons and other cies. There is to-day less interest in special disease entities in the working of definite processes or developments vari- open to modification and adjustment.

The psychoanalytic contributions towards our knowledge of personality and towards the interpretation of mental symptoms, and the methods of treatment based on these theories, are variously evaluated, but have been stimulating in the study and utilisation of life-experiences (*see* PSYCHOANALYSIS and PSYCHOTHERAPY).

General Paralysis.—One of the most remarkable changes has occurred in our experience with the most fatal and disastrous form of mental disorder, general paralysis or paresis. There is no longer any doubt about its being due to an invasion of the brain by the spirochaete of syphilis. The disease may occur in children or adolescents through hereditary transmission of this organism, as well as in adults in whose cases symptoms may appear 10 or even more years after acquired syphilitic infection. But, far from being a uniformly fatal disease, it has now been found to yield to treatment. Early diagnosis, assisted by the application of the Wassermann test to the cerebrospinal fluid and not only the blood serum, and therapeutic infection with malaria (*q.v.*) or other recurrent fevers which appear to be incompatible with syphilis of the nervous system, enable as many as 40% of patients to enjoy a prolonged remission from their symptoms or to obtain a complete cure.

Commitment or Certification

It is unfortunate that there will probably always be a group of patients or phases of illness that lie between the two extremes of (1) voluntary co-operation and (2) forcible treatment. While there is a growing desire to extend facilities for treatment on a voluntary basis, it frequently happens that delay in dealing with an unwilling patient involves risks when suicidal or homicidal impulses are present. Following the lead of the continental clinics, hospitals have been opened in the United States and elsewhere for the study and treatment of early cases of mental disorders.

Most of the American institutions have an increasing number of " voluntary commitments " requiring in writing a " three days' notice of intention to leave," so that the physician may have the right to detain the patient pending the consideration of the best course to take in the further care. The commitments themselves in many states are left to a statement of two impartial physicians; in others they require court procedure or even jury trial, a method that is, however, more and more limited to habeas corpus actions, *i.e.*, a demand to show cause for the detention of a patient as a " committed " person.

The medico-legal problems of responsibility in mental disorders are still in an archaic state on account of the unfortunate fact that the rules of evidence which were invented for the normal are not favourable for the presentation of facts which have a psychiatric bearing. Another point of loose practice occurs in the United States in the proper disposal of patients who are declared " not guilty on account of insanity." A patient who gets into conflict with the laws should remain under safeguard until he shows evidence of insight and capacity for self-management.

The principles of equity procedure in use in juvenile courts promise beneficial reform and valuable experience based on a study of the individual delinquent according to psychiatric principles. The moral changes which are liable to follow an attack of epidemic encephalitis constitute a new and difficult problem (*see* ENCEPHALITIS LETHARGICA).

Statistics.—Statistics are notoriously inadequate where no continuous census and control of the population and its whereabouts is maintained. The number of " certified " insane patients under care in England and Wales was 131,557 on Jan. 1 1925, an increase of 1,217 over the number on Jan. 1 1924, but evidently less than the number before the War; 48·9% are males, 51·1% females. The recovery rate calculated on the direct admissions is given as 34·86%. The death-rate calculated on the daily average number of interned patients is 7·62%. The absence of any greater increase of numbers during and since the War is probably only apparent. The fifth report of the British Lunacy and Mental Deficiency Board of Control (1919) brought out a ratio of 208 (instead of the usual 76) cases of death to each

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[1] *Mental Hygiene*, 1917, i., pp. 96–147.

1,000 of the interned insane and defective population, owing to a temporary increase of tuberculosis, diarrhoea and dysentery, typhoid fever, etc. The lack of fresh milk and fats and the disorganising of the nursing through the War must have been largely responsible.

Effects of Prohibition.—Considerable interest adheres to the question of the effect of prohibition in the alcoholic mental disorders. Wherever the alcohol traffic has been brought under control the reduction of "alcoholic insanity" has been striking. Where propaganda against prohibition has been most active, a moderate return of the old conditions has been noticeable. The experiment is too short and too imperfectly carried out to furnish an answer to the many questions arising.

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(A. Mey.)

INSECT BITES AND STINGS.—Insects may be the cause of disease or of morbid conditions in man in several different ways: (1) by living *on* his skin or hair, as in the case of three varieties of pediculi or lice (the head-louse, the body-louse, the crab-louse); or *in* his skin, as with the itch-insect (though this is strictly not an insect at all but a spider-like parasite), or with the tropical chigger, jigger or sand flea; (2) by depositing their eggs on the skin or mucous membrane, or on wounds, whence the larvae find their way below the surface, usually by boring or burrowing, as is the case with several tropical flies; (3) by being the instrument of transferring a bacterial infection to man from some other animal, as is the case with the rat-flea in plague, or by taking part as host in the life-cycle of a spirochaete or a protozoon and passing the parasite on to man, as is done by certain mosquitoes in yellow fever or in malaria; (4) by the direct and immediate effects of their bite or sting. It is with this last method only that the present article is concerned.

In Great Britain, as in most other countries, such bites and stings are exceedingly common, the most frequent biting insects being the common flea, the bed-bug, gnats and mosquitoes, and the most frequent stinging insects being the wasp, the bee, the hornet and the ant. It should be realised, too, that the effects of the louse are due not merely to its presence, as mentioned above, but to its actual bite.

The consequences of these bites and stings are well known, very few persons escaping some personal experience thereof, though susceptibility varies widely in different persons. Local irritation may be extreme, and the skin lesion produced may vary from a small reddened or erythematous patch or a tiny papule, to large urticarial or nettle-rash wheals, or even to a spreading cellulitis or inflammation of the tissues under the skin. These effects, though giving rise to intense discomfort, are rarely serious and usually pass off completely in a few hours or at most a day or two. Occasionally, however, dangerous developments occur.

The conditions most likely to lead to such developments are: (1) a very large number of stings, as when a swarm of angry bees settles on the body; (2) the lesion being on a mucous surface such as the tongue, the palate or the pharynx; (3) the supervention of some local complication such as erysipelatous or other streptococcal infection, or the direct transmission of some form of septic poisoning as by the bite of a fly which has been feeding on putrid material. In all such cases skilled surgical aid should at once be sought, as in extreme instances death has occasionally resulted and urgent measures may be necessary to deal with the situation.

Treatment.—The poison injected with an insect sting is, at least in many species, formed by a mixture of the secretions of two glands, one of which is acid (formic acid) and the other of which is alkaline. In most cases the acid predominates; hence weak alkaline solutions (soda or ammonia) are commonly effective in allaying the irritation. In some cases, however, especially, it is said, with the sting of some wasps, the alkaline element is predominant and in such instances a weak acid lotion (s
diluted vinegar) gives most relief. Other local application
effective character are alcohol, spirits of camphor, a solu
menthol or of permanganate of potash, a dilute solution
bolic acid, or even slices of the homely onion. In every ca
sting itself, if it remains in the skin, should be carefully ren

As preventive measures when insects are prevalent, car
menthol, lavender and oil of eucalyptus appear to have
virtue; and skilful and assiduous campaigns against flies
quitoes and wasps have of late added greatly to the ameni
a number of localities. *See* Bacteriology; Kala-Azar;
sitology.

(H. B.

INSTALMENT SELLING is in essence an extension of cre
retail purchasers, under some form of contract by whic
purchaser agrees to make partial payments at stated int
over a period of weeks, months or even years. It enables
sands of persons of limited means to acquire goods which
could not otherwise possess. The goods purchased are u
delivered after the payment of an initial deposit. This dep
sometimes merely a nominal sum; but frequently it amou
one-fourth or one-third of the price of the goods. The sel
tains title, or its legal equivalent, in the property until th
instalment is paid. This is accomplished by means of a c
mortgage, a conditional sales contract or a lease. The la
the method employed in Great Britain. In this article a r
of American developments will be given first.

I. IN THE UNITED STATES

The customary practice in the United States, wher
greatest development of instalment selling has occurr
described as follows: "When goods are bought on lease o
ditional sales contract, the title remains in the sellers
passes to the buyer only upon completion of the stip
payment. Under the lease plan, instalment payment
designated as 'rent.' (This form of instalment sellin
devised to conform to the laws of certain states.) But wh
chattel mortgage form is used, the title passes immediat
the buyer, and he gives the mortgage as security for paym
the balance due. Under any of these forms, the sellers m
possess the property if the conditions of the sales contra
not met by the buyer." (See *Instalment Merchandising,*
pilation No. 2, issued by the National Association of Credit

A tremendous expansion of instalment selling took place
years following the World War. The aggregate amou
instalment credit in force in the United States in 192
estimated to be close to $3,000,000,000; and this est
though based on insufficient data, is believed to be conser
in view of figures from the automobile industry showin
the total of automobile instalment paper then outsta
amounted to about $1,500,000,000. The grand total
instalment sales in the United States in 1925 was said
$5,000,000,000.

This extraordinary development was naturally viewed
alarm" by many conservative economists, merchant
bankers. Aside from what might be called moral objectio
chief criticism was that large-scale instalment buying mus
to unhealthy inflation and consequent disorganisati
business and finance. It is probable that severe business d
sion, with its accompanying unemployment and the
quent failure of workers to pay their instalments, would
disastrous to commercial firms that had failed to scr
carefully all credit applications. On the other hand, i
pointed out with much force that a high element of safe
taches to credit risks, each relatively small, which are
scattered throughout the community. The continued succ
many firms whose experience in instalment selling long
dates the latest boom, is proof that such a business may
soundly and as profitably conducted as any other.

Credit merchandising, in fact, had made a rapid g
before the beginning of the present century. It was first a
extensively to the sale of subscription books and wa
adopted by the piano and musical instrument business. I

applied to the sale of furniture, sewing-machines, jewellery,
toves; and thousands of these products have been paid for
ıe month by people with moderate, steady incomes. A very
proportion of instalment purchasers in the days before the
mobile were housewives who found it possible to make
l weekly or monthly payments out of their household
vances. Women have continued to exercise a large influence
his type of buying; and most articles thus obtained are
led upon by the whole family.

or a long period a certain social disapproval hung over
lment buying, particularly if the articles purchased were
ries. The purchase of homes by this method was, however,
ys regarded as praiseworthy, and most homes have been
ht on this plan. The boom of recent years, which has
st entirely removed the social stigma, began with the
tion of this method of selling on a large scale by the auto-
ile industry. When the United States entered the World
the time payment plan was utilised in the sale of huge
tities of Liberty bonds; and in the years that followed many
stment houses did a considerable volume of business selling
rities on deferred payments.

ıe volume of instalment sales of automobiles prior to 1916 was
st insignificant. Mass production of motor-cars closely
wed the development of finance companies to care for in-
nent business. Some of these finance companies were
nised outside of the automobile industry; others were
nised by large manufacturers. One of the most important
ıese was the General Motors Acceptance Corp., the volume
hose transactions grew from $10,000,000 in 1919 to nearly
,000,000 in 1925. Alfred P. Sloan, Jr., President of the
eral Motors Corp., stated that the losses, *i.e.*, retail charge-
luring this whole period were only .199 of 1% of the volume
etail business handled. (See *Nation's Business*, April 1926.)
. Hanch, General Manager of the National Assn. of Finance
ıpanies reported the results of an extensive survey completed
ng 1924 as showing a loss ratio of less than ⅛ of 1% on
egate new and used car business, amounting to $195,500,000.
American Bankers' Journal, April 1926.) It is seen there-
that losses in collection have been very small.

1926 there were more than 1,000 finance companies in the
ed States created for the purpose of handling automobile
hases. More than 75% of all motor vehicles sold during the
ious year were purchased on the instalment plan, the deposit
lly being about ⅓ of the price of the car, the balance being
led into 12 equal monthly payments.

nance corporations did two kinds of business, wholesale and
il; that is, they financed the purchase of cars by dealers from
ufacturers and the purchase by retail buyers from dealers.
he case of one low-priced car it was possible in 1925 to get
ession by making an initial payment of $12.40, and furnish-
wo endorsements to the note. This was followed by weekly
nents of $5 for a year, and at the end of the year a so-called
on-payment completed the transaction.

he fee of the finance company added to the purchase price
known as the time-price. After deducting the initial pay-
t from this time-price the remainder was generally divided
12 or more equal parts which constituted the monthly pay-
ts. Finance corporations usually calculated 15% per annum
rest on money actually outstanding, or from 6 to 8% on the
hase price. However, in some cases, where initial payments
very low, the subsequent payments extending over more
a year, and with no responsibility by the dealer for col-
ons, the final cost to the purchaser was as much as 30%
ve the cash price.

inance corporations secured their funds from the banks,
the particular function they served was to provide the
ssary machinery for investigation, supervision and collection
h the banks lacked. The different contract forms employed
already been described. It was customary for the purchaser
ıake out a note to the dealer for the amount remaining after
initial payment. The dealer passed on this note to the
ıce corporation, which paid him its face value minus its own fee. The dealer would either indorse the note, and thus assume responsibility for the payment of the monthly instalments, or he would agree to re-purchase the car in case of default by the purchaser. In some instances, however, the dealer assumed no responsibility: under this, the "no-recourse" plan, the charges of the finance company were higher. Under any plan the purchaser was usually required to insure the car against fire, theft and accident.

The prosperity of the automobile industry and the enormous sale of motor-cars in the United States was the direct outcome of instalment selling. This fact could not escape notice by manufacturers and dealers in other products. Consequently many articles never hitherto distributed by this means were offered on the time-payment plan; and many retail merchants who had once frowned on instalment selling either adopted the method gladly as a proved means of increasing business, or did so reluctantly to meet competition. In 1926, in the United States, it had become possible to purchase practically every article of consumption costing upwards of $25 (with the possible exception of food) on time payments.

This trend was well illustrated by the announcement in 1925 by a leading men's clothing store of Chicago of a so-called "budget system" under which garments might be purchased on a cash payment of ⅛ to ¼ of the purchase price, the remainder being payable in 10 weekly instalments. This shop had always conducted its business very conservatively, and had refrained from everything remotely related to instalment methods. Other retailers were inclined to be censorious, and clothing manufacturers were divided as to the merits of this innovation. But the management reported, after a short test, that it was successful, and some interesting facts were brought out. This store, like many others of the same class, maintained charge accounts for a large number of customers; and it is stated that payment on these accounts was often delayed as much as 60 or 90 days. But the customer who pays ¼ down and then 10% of the balance each week pays for his goods more quickly than he would under the ordinary charge-account.

One of the most conservative stores in New York has instituted an elaborate budget system for the sale of furniture. This budget system is essentially a plan for selling on time payments, but it has the advantage that the store first consults with the purchaser as to his income and furniture requirements, seeking by this means to minimise their risk and at the same time more accurately to satisfy the customer's needs. The consultation is of genuine benefit to the purchaser and often enables him to make a larger purchase with greater economy than if he bought haphazardly or piece by piece.

It is apparent that under these conditions credit can be extended to thousands of persons to whom a merchant would hesitate to grant an open charge account. Moreover, the purchaser doubtless feels it safer and more convenient to budget his payments by the week or month rather than to have the entire amount fall due within 30 days and then allow the account to remain unpaid for a longer period, through the acquiescence of the store-keeper, but with a consequent impairment of the purchaser's credit standing.

Although it has been customary to add a time-price or interest charge in making instalment sales, some merchants have endeavoured to maintain the same price for the cash customer as for the instalment customer. This practice probably cannot long continue. Certain stores have already taken advantage of the situation to advertise "no credit" and "cut prices" for cash, with the idea of showing the public the cost of time purchases. The possibility of selling more cheaply on a strictly cash basis will doubtless prove sufficient incentive for the expansion of this class of business; and by the operation of ordinary economic law will serve as a salutary check on instalment buying.

The cost of instalment selling, considered by itself, is high. It has been estimated to be as much as $800,000,000 yearly in the United States. This might be regarded as sheer economic waste were it not for the fact that tremendously increased production, made possible by the time payment privilege, has served to lower prices; so that the purchaser buys enough cheaper to pay the cost. Increased demand likewise keeps factories busy and gives employment to more workers. The protagonists of instalment selling insist that much of the prosperity of the United States since the War, in the face of strong European competition with its cheap labour, can be traced to the development of the home market by means of time-payment financing. It is even suggested that certain backward countries could benefit by the cautious introduction of this method of marketing.

It is typical of the diversity of opinion which still envelops the subject that some authorities regard instalment buying as tending to demoralise the purchaser, while others, probably more numerous, believe that it benefits the individual and society. "We are sorry," said the Babson Statistical Organisation in July 1925, "to see this stampeding to an instalment business. We don't believe that it is wise for anyone unnecessarily to get into debt, whether manufacturer, merchant or the public. Getting into debt has been the cause of most failures, and we are sorry to see another stratum of the public adopt it. On the other hand, is there any ethical reason why your employees are not justified in giving serial notes for their purchases of goods, as you are justified in giving notes for your purchases?"

The story is told by a writer opposed to instalment selling of a man on an income of $60 a week who had contracted for purchase amounting to $72 a week. He explained that he could not resist the persuasive suggestions of salesmen. But most observers agree that the American household had not lost its sense of proportion; and the occasional emergence of cases like this is a reflection on the credit departments of the sellers rather than on the principle of instalment selling. It is probably true, also, that further experience with deferred payments not only tends to make credit departments more cautious, but likewise trains the purchaser to be on his guard against undertaking obligations which he cannot meet.

This training must have considerable social value. The workingman who seeks to buy a piano or an automobile on credit soon learns the importance of having a good reputation for meeting his obligations promptly. The instalment merchant would prefer, as a matter of fact, to sell an expensive article to a man of moderate income with a proved reputation than to a more prosperous individual who was dilatory in meeting his obligations. Having bought his automobile or piano, having discovered the value of established credit, and having learned some of the mechanism of business, the buyer becomes a more stable unit in the community. He sees it will not be at all impossible for him to buy his own home, and, if his interests lie in that direction, to establish his own business.

The question is at once raised: why does not the instalment purchaser save the money in the first place? The psychologists could doubtless provide a complete answer; it is perhaps sufficient to say here that it is easier to pay for an article already acquired, especially if the sense of obligation is reinforced by a properly managed collection department, than it is voluntarily to lay aside each week or month a certain sum for the satisfaction of a desire that cannot immediately be realised. The wage-earner, attempting to save, necessarily finds it difficult to resist the demands made on his money, even though he manages to avoid petty temptations to squander; and instalment selling serves its best purpose when it provides the purchaser with products of enduring value. The fact is business could hardly go back to the pre-instalment days even if it wanted to.

An analysis of the population in the area between Boston and Chicago, the Great Lakes and the Ohio river, proved that for the purchase of an article costing $75 or more, after house-rent, groceries and clothing are taken care of, only 10% can pay cash; 30% are entitled to standard credit terms on a 30 to 90 day basis, and 60% must have four months to one year to pay. (See *Advertising and Selling Fortnightly*, April 22 1925.) It is only necessary to glance through the magazines and note the advertisements of hundreds of articles selling for more than $75 to realise that these businesses could not prosper if they were forced to reduce their output to the level of the cash de
Where, then, does the money come from to pay for these pro
It is difficult to escape the conclusion that people work hard
deny themselves casual expenditures in order to pay for
thing of real worth which they greatly desire. In many inst
too, it is certain that the article so acquired promotes greate
ductivity on the part of the purchaser.

The opposition to instalment selling has come from
sources. Partly, no doubt, it is inspired by manufacture
merchants who have failed to change with the times;
from other manufacturers and merchants whose goods w
lend themselves to this method of merchandising and
suspect, rightly or wrongly, that money is being diverted
the purchase of their goods. Open opposition has come
labour leaders, who probably feel that the working-man
paying for goods on the instalment plan will be less dispo
go on strike, and perhaps prove more docile in his att
toward his employer. A few banks have expressed them
as opposed to the instalment business, but the majority hav
willing to underwrite it in one form or another, otherwis
vast expansion already noted could not have occurred.

If instalment selling is to continue on a sound and prof
basis, there is no doubt that certain precautions must b
served. (1) It seems undesirable to extend this meth
sale to expensive products of great fragility or little int
worth. (2) An article combining high cost of operation, u
and depreciation, with little or no earning power, is for the
part unsuited for sale on long-term credit. (3) Special safeg
must be devised if the goods sold on time have little or no
when repossessed, or if the period of payment is likely to o
their usefulness. (4) No company should engage in
business without a well-equipped collection department
the direction of an experienced credit man. (5) Credit sho
granted only after sufficient investigation to give a reaso
assurance of the applicant's ability and willingness to pay.

The last point is by all odds the most important; there
hardly be any "problem" as to instalment selling if all
departments were properly managed. The seller is never f
to sell against his better judgment, and if abuses have cre
the seller must take the major share of the responsib
Fortunately, such abuses tend to rectify themselves. There
surer road to business disaster than the extension of cred
terms that are too easy, or to irresponsible persons, or on
that are utterly unsuited to anything but cash sale.
principles of sound instalment selling are not new; they
discovered by the first banking institutions that began to
money for the promotion of business. They are princ
however, that may have to be learned all over again by
finance corporations and business houses who have take
instalment selling as a quick and easy means to greater pro

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II. IN GREAT BRITAIN

The development of the system of purchase on the instal
plan in Great Britain and her colonies has proceeded on si
lines to those outlined above in the United States, thoug
in so accentuated a form. The idea was by no means n
England, since pianos were being sold on the hire-pur
system in London so far back as 1838. The present cen
however, has seen an enormous expansion in instalment se
which has been accelerated since the end of the World
One instance of this will suffice. In 1919 few motor-cars
sold on the instalment plan in Great Britain. Four years
one of those best able to judge computed that of the £15,00
retail turnover on motor vehicles, over £4,000,000 was do
the hire-purchase system, the greater proportion of this
amount being spent on commercial cars, including motor-
motor-lorries and motor chars-à-bancs. In 1925 the total
over had risen roughly to £52,000,000, of which not less
one-half was done on the instalment payment system.

The estimate of the hire-purchase traders is that be
50% and 60% of the furniture turnover and over 50%

piano, motor-cycle, sewing-machine and farm implement iess in the same year was done on the same basis. Even the sh Govt. in 1926 was selling by instalments surplus army s including aeroplanes and horses. The percentage of lment selling of factory machinery in Great Britain is, ver, very low on account of the fact that British limited ity concerns prefer either to take a discount for cash or to credit for the full amount of the purchase, since many of are public companies. Particularly remarkable, however, he successes reached through the sale of what may be called plements of business." For instance, the Remington Type- r Co. offered their portable typewriters on the instalment m in April 1925, the terms being an initial payment of .od., followed by eleven monthly payments of £1.1s.od. ng the sales for the six months preceding this offer at the rate o per month (a purely fictitious figure) it was found that the had increased in Oct. 1925 to 210, in Nov. to 269 and in Dec. 5. Thus in eight months instalment selling had increased ale of portable typewriters by over 200%, while the news- r advertising for the eight months was only about 5% e that for the preceding six months. To-day there is ically no great London or provincial department store is not selling furniture, gramophones, wireless sets, pianos sewing-machines on the instalment system.

ie financing of instalment selling in Great Britain has pro- d more slowly than in the United States. There is one rtant reason for this. The City does not like motor flotations y time; and it likes motor finance corporations even less. rdingly, these companies have usually had to go to the ance companies or their own directorate for their money. her, the British public has never become enamoured of motor s, and this dislike has extended to the shares of the finance panies. Yet there are several corporations in Great Britain a turnover of £2,000,000 to £5,000,000 per annum, and it is able that the present prejudice of both the City and the l investor against the shares of such concerns will be over- eventually. The system of financing motor hire-purchase eat Britain is identical with that in use in America. In the of a new car, however, it is usual to ask 25% in cash as a payment, the remaining payments being spread over a d of 6 to 18 months. It is common for the financing com- to charge 7% to 8% on each transaction for 12 months' mmodation. Obviously the actual rate of interest paid is o to 16% since the average amount on loan for each month ly half of the total. It must be remembered, too, that etailer is normally charging his customer from 5% to 8% he credit given, so that the net cost to the retailer is quite l. It will be clear, therefore, that the use of the instalment iod of selling entails a greater capital in relation to turnover cash selling. In other words, it tends to turn a former cash iess back to the basis of the old-fashioned credit business, 1 the customer took from 3 to 12 months' credit.

ie question which exercises British business men is whether xpansion of instalment selling similar to that which has n place in the United States during the past six years would lutary or dangerous. Goods sold on the instalment system in a sense, put into stock. One of the main causes of any iess slump is the excess of goods in stock. In a time of ession it is clear that the number of failures to meet payment d increase. How seriously would it increase? Further, as bank rate rose, the financing companies without large re- es would find their profits heavily cut, and possibly turned losses. At the same time it would be difficult for them to re new business on account of shortage of money and er rates of interest. British finance and British business are pelled to study this problem for themselves, since the con- ns of American business are so different and no serious p has occurred in the United States since instalment selling me so prevalent. The conclusion, however, would appear to hat the sale by instalment of articles with a re-sale value, of articles which do not depreciate with enormous rapidity, fe within almost any achievable limits. But very large sales in articles unsuitable for re-sale owing to the heavy depreciation, *e.g.*, clothes, might be extremely dangerous if acute business depression became rapidly felt.

The legal aspects of instalment selling in Great Britain are somewhat different from those prevailing in the United States. The property in an article purchased on "deferred payments" passes to the purchaser, *i.e.*, he becomes owner from the moment of the first payment, whereas under the hire-purchase system the purchaser merely acquires the right of possession, no right or property passing to him until the final payment has been made. It is vital therefore for the business which desires to sell its goods on the instalment plan to see that the actual contract signed by the buyer is one for hire-purchase, in which the successive payments are considered merely as rent, until the final payment is made, prior to which latter event the ownership remains in the vendor. Otherwise the purchaser after obtaining possession will be able to sell or encumber the goods, and an innocent purchaser or mortgagee will obtain priority of title.

Another contingency which has to be considered in Great Britain is that of distraint for rent. In the United States generally the landlord does not possess this remedy. All he can do is to put the tenant who is in arrears out on the street together with his goods. In Great Britain the landlord can enter upon the premises, seize the tenant's goods found therein, and sell them to realise the amount of rent due, and this liability extends to goods purchased by the tenant under the hire-purchase system, other than pianos, sewing-machines, safes, gas-engines and printing-machines. On a par with this is the danger of the purchaser becoming bankrupt, in which case the trustee in bankruptcy may, and probably will, sell the goods in question for the benefit of the debtor's creditors, unless the agreement has been drawn up in consonance with the best British practice. The legal situation, generally speaking, is so full of pitfalls and the law on many points so uncertain that any firm considering entering into the instalment business should take care to obtain the best legal advice on all phases of the subject.

It should be added that, from a credit standpoint, the instalment business has proved quite as safe so far in Great Britain as in the United States. The average losses through bad debts by the members of the Hire Traders Protection Assn. is under 2% per annum. One of the leading London firms reported recently that their loss from bad debts was less than 1% per annum. Even in one of the most risky fields, that of the sale of motor-cars by instalment, the average percentage of losses from this cause has never been placed above 2½% by competent authorities. (C. Ch.*)

INSULIN.—In 1889 Von Mering and Minkowski proved that the complete removal of the pancreas from animals produced signs and symptoms which are practically identical with those found in human beings suffering from diabetes mellitus. Previous to that year the pancreas, the gland which secretes powerful digestive enzymes into the first part of the small intestine, was not definitely associated with the utilisation of sugar by the animal body. It was soon shown that a small amount of pancreas grafted under the skin prevented the development of diabetes in an animal from which the rest of the pancreas had been removed. It was also discovered that blockage of the pancreatic duct did not produce diabetes, although degeneration of the pancreatic tissue, with the exception of numerous small structures called the islets of Langerhans, resulted.

Historical Notes.—These minute structures apparently unrelated to the acinous tissue which forms the digestive enzymes, were first noted by Paul Langerhans in 1869. Schafer was one of the first to suggest that pathological changes in the islet tissue might be responsible for the production of diabetes in man. He also suggested that "Insuline" would be an appropriate name for the hypothetical internal secretion by means of which some authorities believed the islet tissue to exert its control over sugar metabolism.

Experiments and Discovery.—In the year 1921 Banting and Best, at the University of Toronto, began a series of experiments the results of which proved that a substance could be obtained from the pancreas which would enable diabetic animals to utilise sugar. This substance was originally secured from the degenerated pancreas of the dog. The degeneration was produced by tying the pancreatic ducts, which causes an atrophy of the cells of the gland which produce the digestive ferments, but leaves intact the islet tissue. The available supply of degenerated pancreas was, of course, very small and efforts were soon made to secure the material from other sources. After a series of experiments in which small amounts of material were obtained from the normal pancreas of the dog and from the fetal calf pancreas, the active substance was obtained from the adult beef pancreas by alcoholic extraction of the fresh tissue. This discovery provided ample material with which to study in detail its action on experimental animals and to apply it to the treatment of patients suffering from diabetes mellitus. Animals from which the pancreas has been removed suffer from the same symptoms that the human diabetic experiences (*see* DIABETES). The sugar which cannot be used accumulates in the blood and is excreted in the urine. The normal animal stores sugar in its liver in the form of glycogen, but the diabetic liver does not form this substance. The administration of insulin to the diabetic animal corrects all these abnormal conditions and enables the animal to utilise carbohydrate in a normal manner. The average life of a completely depancreatised dog before the discovery of insulin was less than three weeks. These animals have now been kept alive, by the administration of insulin, for over two years and will undoubtedly live much longer.

Use and Value.—Insulin was first applied to the treatment of diabetic patients in Jan. 1922. The results have been uniformly successful, and thousands of patients are now being kept alive by the hypodermic injection of this material. Insulin does not cure the disease but replaces the internal secretion which the diabetic has lost the power to produce. The substance is administered subcutaneously and is not effective when given by mouth.

Standardisation.—Insulin is standardised by observing the extent of lowering of the normal rabbit's blood sugar produced by small amounts of the active material. The administration of too much insulin to diabetic patients is dangerous but the situation can be recognised by the occurrence of definite symptoms. The condition can be quickly corrected by the ingestion of sugar in any convenient form.

Employment in Cases of Coma.—Previous to the discovery of insulin a large proportion of diabetics died of coma. The intelligent use of insulin combined with proper dietetic treatment prevents the development of coma. Patients in coma can in most cases be rescued by the administration of large doses of insulin.

Specific in Diabetes Mellitus.—Insulin has proved to be a specific in the treatment of diabetic coma. It is invaluable in the treatment of severe diabetes mellitus. The use of the active substance in the investigation of the physiology and the biochemistry of the carbohydrates in the animal body has already brought to light numerous important new facts. It is quite possible that it is in this last field that insulin will contribute most to the welfare of the human race and the progress of medical science. (C. H. B.)

INSURANCE (*see* 14.656).—The years immediately preceding the World War were not extraordinarily interesting from the insurance point of view, although those of military age who then effected assurances had, later, excellent reasons for satisfaction that they had done so, since all who were insured with British offices were covered, whether or not the risks of war were specifically excluded from the terms of the policy.

I. GREAT BRITAIN

Life Insurance

Most of the British offices transacting what is known as ordinary life assurance had issued policies free from all restrictions, whereas some of the companies transacting industrial assurance had specially excluded the risks of war. All these companies which had done so decided, however, to waive their
rights. The value of the complete cover may be gauged
facts that, after the outbreak of hostilities, an additional pre
of £7·7·0% was quoted to cover the war risks, and that th
soon advanced to as much as 20% per annum.

Losses of the War Period.—What the World War mea
life assurance was indicated in a paper read by Mr. H. B
assistant actuary of the Commercial Union Assurance
before the Insurance Institute of London on Dec. 20 1920
ferring to the British offices, Mr. Brown estimated th
losses during the five years 1914 to 1918 inclusive as follows

1. Mortality in excess of the pre-War ratio resulted in a l
about £3,000,000 a year.
2. Depreciation in excess of the amount for just before th
was estimated at £4,000,000 a year.
3. The reduction in the net rate of interest due to the high i
tax resulted in a loss, as compared with the pre-War peri
about £500,000 a year.

The total losses, as compared with the period immed
preceding the War could, therefore, be estimated at, rou
about £7,500,000 a year during the five War years. In the
immediately before the War the total divisible profits o
British offices, in respect of ordinary life assurance, amo
to about £6,500,000 a year, of which about £6,000,00
divided among the policy-holders, and about £500,000
distributed among the shareholders of the proprietary
panies. During the War the normal profits continued
realised subject to the deduction of the special war losse
scribed. The special war losses thus exceeded the normal p
of the same period and it may be estimated that, down t
end of 1918, the War probably cost the life offices, as a
about five years' bonuses.

Post-War Conditions.—After the end of the War a great c
came over life assurance conditions. Instead of sufferin
preciation in security values year by year, the investm
began to appreciate, while favourable opportunities for
investment of funds continued. Against this fact had to
the consideration that taxation continued to be heavy.
offices were, however, relieved from the burden of the s
war mortality. They were still guided in their calculatio
premium rates by mortality tables relating to the expe
many years ago. Investigations are being made by th
stitute of Actuaries into mortality experience, but the r
are not to be expected for some time. Meanwhile, thes
bodies have issued the results of their inquiries into the e
ence of annuitants. These show that the longevity of annui
is distinctly greater than that of the general public. C
quently, in 1924–5 most of the British offices amended
annuity rates and would probably have further increase
prices asked but for the favourable rates of interest which
obtained on their investments.

While the difficulties of the British offices due to the
were serious, they were far less formidable than those of so
the continental companies in countries whose currencie
preciated heavily in value. Agreements were reached bet
the different countries respecting the basis of settlement
large number of policies were, for instance, effected by Bel
with German institutions, and an agreement was only re
at the end of 1925 respecting the settlements. In the U
States the effect of the War on the insurance offices was
paratively small. The American offices have mostly withd
from life assurance outside the United States. This secessio
provided opportunities for Canadian offices some of which
vastly increased their business within the last decade.
assurance per head in Canada and in the United States is
much greater than the corresponding amount in Great Bri
The average sum assured in the last-named is only about
of the corresponding sum assured in Canada and not
more than one-third the assurance per head in the United St

Industrial Life Assurance.—Criticism of the industrial
assurance system in Great Britain led to the appointmen
May 1919, of a departmental committee by the Board of T
to inquire into the business carried on by industrial assu

ıpanies and collecting societies. The report of this com- tee was issued in July 1920, and made various recommenda- s. Evidence was given before the committee that the con- ience and economy in collection could be improved by the oduction of the block system, under which an agent is gned an exclusive area for his work. The lead in the reduc- of working costs has been taken by the Prudential Assurance , which by gradual steps has lowered its working costs from ;% of the premium income in 1920 to 27·86% in 1924. This ıction made possible the introduction of a reversionary bonus em for the industrial policy-holders on the general lines ap- d to ordinary life assurance. The committee recommended appointment of an industrial assurance commissioner, and first report, which was issued in 1924, showed that the ap- ıtment had been of value to the assuring population, particu- y in its relations with the less satisfactory type of offices.

Fire Insurance

ire insurance was affected by the World War in so far as tions existed between insurance companies and the assured ountries which were at war with each other and also by the ıence of the War on prices on commodities. This was par- larly seen in the great increase in the amount of the claims ing 1919–20. In fact, the cost of the claim settlements has ı much higher in the post-War period than in the pre-War od. This development is illustrated by the estimates of the of the principal fires in Great Britain and Ireland. The cost hese, which only take into account fires in which the dam- amounted to £1,000 or more, as estimated by *The Times*, ounted to £3,300,000 in 1916, to rather over £4,000,000 in 7 and to £5,500,000 in 1918. In 1919 the cost of the prin- l outbreaks advanced sharply to £9,462,000; in 1920 they e £9,374,000; in 1921 they amounted to £8,128,000; in 1922 6,218,000; in 1923 to £7,192,000; in 1924 to £5,017,400; and 925 to £5,122,100. It will be seen that since 1920 the cost he claim settlements has very much declined, which reflects, ny rate partly, lower values.

osses from Fires.—In order that the total cost of all the fires in ıt Britain and Ireland may be estimated, it is usual to assume 50% may be added to the above figures in order to include the of all fires in which the damage amounted individually to less ı £100,000. Excluding the exceptionally costly years 1919–20 ill be seen, therefore, that the total cost of all the fires in Great ain and Ireland may be calculated at something like £10,000,- These figures are small in comparison with the cost of the fires orth America, in which the British insurance companies transact ge volume of business. The losses in the United States vary very h from year to year, since losses, when they occur, are usually emely costly. In 1922, for instance, the total cost was estimated bout £80,000,000.

osses from Earthquakes.—There have been no other losses com- ıble with those caused by the earthquake at San Francisco in). The British offices settled all claims made upon them prompt- n full. On Sept. 1 1924 there occurred the great earthquake in ın. The British and American insurance companies had, how- , been careful specifically to exclude the risk of earthquake from erms of the insurance. It was generally held that, with such finite exclusion, they could not pay claims for damage for which were in no way liable. In order, however, to show practical ıpathy with the Japanese people, the British companies offered eturn all premiums for the year which had been paid in respect roperty damaged or destroyed. The American offices also in- ıted their readiness further to return the premiums paid, and the tude of the insurance companies was known to have created a ourable impression in Japan. Claims were also made in respect he damage caused by a great fire at Smyrna in Sept. 1922, during ar between Turkey and Greece. Insurance companies main- ed that the fire was a direct outcome of war, the risks of which been definitely excluded from the policies covering property in city. Their attitude was upheld in the courts.

nsurance managers have pointed out that claims are frequently l in respect of damage for which they are not actually liable. By lvertence, some fact may have been omitted from the proposal n, and insurance companies, instead of standing on their rights, e been ready to settle claims. In the case of damage directly sed by earthquake and war, an essential principle was involved h, it was declared, they could not throw to the winds in justice he rest of the assured and to their shareholders.

he increase in the size of buildings has meant a great increase he values at risk in limited areas, and losses in respect of commodities stored in warehouses now amount to very large figures. As an example, a fire in a tobacco warehouse in the Port of London in April 1923 amounted to as much as £1,050,000. The risk of damage caused by civil disturbance, which has been apparent in various countries since 1911, has induced the insurance companies to make the fact clear that such damage is not covered by the terms of the ordinary fire insurance policy. The risk may usually be covered for a small extra premium, and many commercial enterprises now take the precaution of specially effecting such insurance. When there are no exceptional circumstances rendering the risk unusually hazardous it is accepted for a nominal rate. In cases, however, in which the risk has seemed to be a quite serious one, high rates have at times been paid. The London market is the principal centre for the acceptance of such risks, and business has from time to time been transacted there in respect of most countries.

Marine Insurance

In the years immediately preceding the World War there was a demand for the insurance of ships and cargoes against war perils. The insurance was granted as a rule at nominal rates; but the existence of the demand was indicative of the uneasiness which prevailed. Happily for the maintenance of British commerce, a government scheme had been prepared in advance, since it had been realised that, unless the resources of the nation were behind British shipping, vessels would, on the outbreak of hostilities, remain in port or would immediately take shelter there and overseas commerce would have been brought to a standstill. When war broke out, schemes were immediately brought into operation. That designed to cover vessels was worked through the instrumentality of the mutual shipping clubs, and provided that, in return for a premium, the Government should assume the greater part of the risk. For the purpose of accepting the war risk on cargoes a government office was established in the city of London under the auspices of the Board of Trade and with the active assistance of leading underwriters.

At the same time, underwriters at Lloyds and of the insurance companies themselves wrote risks, with the result that the lesser risks were accepted by underwriters at rates below those quoted by the government office, which was thus called upon to assume the more serious risks. Underwriters also granted war insurance in respect of many neutral ships and their cargoes to which the British Govt. scheme did not apply. The maintenance of the government schemes was, however, of great value, especially at times when losses due to the submarine warfare were very heavy. But for the fact that the government scheme was available for the acceptance of the war risk, in respect of cargoes in British ships, the rates of premium quoted in the open market must at times have risen to very high, if not prohibitive, levels. A substantial surplus was realised on account of the government cargo insurance scheme.

Missing Ships.—One difficulty which had to be taken into account was that a large number of ships became missing, and that it was not always easy to decide if these had been lost though direct war perils, or if their loss had been due to the risks of navigation, especially as some of the usual aids had been withdrawn. This question was carefully considered by a committee representative of shipping and underwriting, and it was agreed that, in the event of vessels becoming missing, there should be arbitration. The underlying idea was that an arbitrator, after hearing such evidence as was possible, could form an opinion as to the probable loss of the vessels, whereas if the question had been taken into court the proceedings might have been long and costly and no better decision could have been expected. In some cases the loss was apportioned by the arbitrator in such proportions, as seemed reasonable, among the war-risk and marine-risk underwriters.

Underwriting.—In spite of the War, or rather because of it, large underwriting profits were made in the London market during the period of hostilities and immediately after it. Underwriters took great risks in which they were, as events showed, justified. The remarkable rises in the values of ships and commodities meant that premium incomes were very much augmented, and many companies, new and old, were attracted to the business. Two years after the cessation of hostilities there was a marked reaction. With the sharp decline in the values of tonnage and commodities the amount of insurance business likewise declined. In view, especially, of the great increase in the size of the market, there was not enough insurance to feed it, particularly as underwriters had become accustomed to assuming far larger lines than they had been used to write before the War. Severe depression set in, and various attempts were made, extending into 1926, to try to obtain some stiffening of rates.

An extraordinary feature of marine underwriting in recent years has been the extended period over which claims have been presented. Before the War it was considered that an account could, for practical purposes, be considered as closed at the end of the third year. There might then be still a few claims unsettled, but the total of these would not be of sufficient magnitude to disturb the main results of the underwriting as then disclosed. After the War no such calculations could be made, and it is now common for claims to be presented for any of the years up to 10 after which the insurance was written. There were special reasons for such delays during, and immediately after, the war period, when tonnage was in keen demand. Any repairs that could be postponed were deferred for as long as possible, especially as the repairing yards were fully occupied with work.

MISCELLANEOUS

Workmen's Compensation.—Important recommendations respecting the system of compensation for injuries to workmen in the United Kingdom were made by a departmental committee appointed by the Home Secretary in May 1919, which reported in July 1920. The committee was presided over by Mr. Holman Gregory, K.C., M.P., and included representatives of the workers and of insurance companies. The committee, after a thorough examination of the subject, found that there were certain defects in the system then obtaining, but were of opinion that these defects could be remedied, largely without resort to a state system of insurance, although not without the introduction of a certain measure of state control. They proposed that, in future, definite percentages of the premium income should be expended in benefits to injured workmen or their dependents and that the remainder should be available for the management expenses or profits of the companies, and the payment of commission to agents, the latter not to exceed 5% of the premium income in any case. They calculated that there would thus be saved on the then cost to employers a sum of between £1,250,000 and £1,500,000 a year, which, under the existing organisation, would be paid away in expenses of management, commission and profits.

In order to provide against the risk to the workmen of uninsured employers proving unable to meet the obligations placed on them by the Act, it was proposed that every employer other than the Crown, a local or public authority, a statutory company or a householder in respect of servants not employed by him for the purpose of his trade or business, should be required to insure against the workmen's compensation risk. Employers with an annual wage-roll exceeding £20,000 were to be entitled to claim exemption from compulsory insurance upon compliances with prescribed conditions. Householders were excluded from the provision of compulsory insurance because, as the risk of accidents to domestic servants is small, the premium charged by insurance companies is more or less nominal, and also because it was considered that the cost and difficulty of enforcement would be out of all proportion to the numbers of persons involved. The committee was informed that a large proportion of householders already insured, and they believed that when the proposed increased liabilities were effective, few would be so unwise as to fail to cover their risk by insurance. Up to the end of 1925 no legislative action had been taken on these recommendations.

Motor-Car Insurance.—The general insurance department of a composite company includes miscellaneous forms of insurance, among the chief of which is motor-car insurance. During the World War comparatively little was done in this type of business. In 1919–20, when private cars again came into use, the insurance experience was very unsatisfactory. Costs of repairs were on a high scale, and there was an epidemic of thefts. For 1920 some of the leading companies reported substantial losses. Early in 1921 rates of premium were advanced, and since then the business has, on the whole, been transacted on a fairly profitable basis.

Credit Insurance.—Of recent years notable developments have taken place in the insurance of bad debts in British oversea trade. This business has for many years been successfully transacted by the Trade Indemnity Co., in which the great composite insurance companies have taken a financial interest. In 1925, on the initiative of Mr. A. M. Samuel, M.P., then head of the Overseas Trade Dept. a committee of bankers, financiers and business men was set up in order to investigate the advantages that might be secured from a further extension of insurance facilities for this purpose. This committee, whose report was issued in the spring of 1926, made certain recommendations with a view to a further development of this type of business. (C. MA.)

II. THE UNITED STATES

The business of insurance, with its basic element of m
assistance, has shown a progress in the past 15 years bot
volume and ramification unsurpassed by that of any
industry. In the United States as in no other country ha
surance in all its various phases become universally recognis
an essential of commerce and industry. To this fact ma
attributed in large measure the achievements of Americ
business enterprises. Insurance coverages permit men
corporations to hazard their resources on new developm
without fear of loss from natural and unavoidable catastro
The importance of insurance as a national factor may
visualised by the fact that at the end of 1925 the comb
companies had a premium income of $4,000,000,000 with
admitted assets of over $14,000,000,000.

Life Insurance.—The life insurance companies aim to su
the demand for life insurance as best suits the wants of all cla
and conditions of men. The old life insurance policy, while
business was in an experimental stage, was so loaded
conditions and restrictions and so limited in its applicati
that comparatively few persons availed themselves of this
tection; but recently numerous forms of policies have
devised to suit the wants of all sorts of people, and the condit
and restrictions have been eliminated to such an extent
practically the only exaction remaining is that the person ins
shall pay his premium. The last 15 years have been not
prolific in the invention and development of plans of life in
ance. Ordinary life insurance, through its several classe
policies—whole life, limited payment, term and endowmen
provides ample choice for the selection of a form of protec
best suited to the needs, financial resources and saving abili
of all classes from the average wage-earner to the multi-mill
aire. The great industrial insurance companies, with t
weekly payment contract, reach the homes of the work
classes and enable them to provide for funeral benefits
against personal distress and dire want. Paramount among
recent innovations in life insurance is group insurance, thro
which industrial corporations collectively insure employees
gardless of age or physical defect. The premium is lower than
which could be obtained through individual contracts, by rea
of the overhead savings in insuring a large number under
policy. Other introductions include business and partner
insurance, disability, double indemnity benefits and mon
income insurance.

The comparative aggregates of the old line legal res
companies are proof of life-insurance expansion. In 1910
total life insurance in force was over $16,000,000,000 and
aggregate admitted assets totalled something short of $4,c
000,000. During 1910 the combined companies had a t
premium income of about $600,000,000 and wrote during t
year a trifle over $2,500,000,000 of new insurance. The t
for these companies for the year ending Dec. 31 1925, show t
legal reserve life insurance companies had over $71,000,000
of insurance in force, including industrial business, and asset
over $11,600,000,000. The premium income was almost $2,5
000,000 and the new insurance written in 1925 was over $16,0
000,000. In a country with a population of 115,000,000 peo
there were in 1926 practically 100,000,000 policies of life ins
ance in force, on what were estimated to be about 60,000
lives. So extensively has the idea of life insurance been s
in the United States that it is estimated that more than e
other person in the country is insured.

Fire Insurance.—Because fire insurance has for years b
recognised as an essential adjunct of industrial and comme
enterprise, its growth in the years since 1910 has not been, f
a comparative standpoint, as spectacular as life, casualty
miscellaneous insurance. Nevertheless, its progress has k
pace with the industrial development of the country and
met the demands imposed upon it by the upheaval occasioned
the World War and the evolution of recent years and rec
inventions. While in the period there was nothing in the nat
of a catastrophe such as the conflagration and earthquake

Francisco in 1906, nevertheless losses were uniformly high consistent underwriting losses were incurred. In the period, there were upward of 75 single fires in the United States ing property losses of over $2,000,000, and reaching as high ne instance as $35,000,000. The energy and resources of the insurance executives during the period have been directed g the lines of fire prevention and fire protection work. -insurance engineering experts are now consulted in every ding operation, and there is no incorporated village or city ch has not taken cognisance of the fire hazard by the organ- on of fire departments, by water systems and by the adoption re prevention and protection ordinances. Control of the sical hazard, however, has been offset by the development of moral hazard to which a great part of the fire losses at the ent time may be attributed. The growth in resources and me of the fire insurance business is indicated by a résumé e total transactions of the companies. The figures show that assets of the companies totalled $550,000,000 in 1910, were tly over $700,000,000 in 1915, over $1,000,000,000 in 1919, over $1,730,000,000 at the end of 1925. In 1910 the premium me of these companies was but $287,000,000. It had hed $353,000,000 by the end of 1915 and almost doubled f in the intervening four years, for during 1919 it was almost ,000,000. Consistent progress during the succeeding years lted in these companies showing a premium income in 1925 901,000,000. Modern industrial advancement has done h to stimulate the growth of fire-insurance companies, while he same time demanding a wider scope of indemnification. has resulted in the undertaking of many additional lines surance by the fire-insurance companies, the principal of h is motor-vehicle insurance. Other lines of insurance sacted by fire companies include tornado, windstorm and one, hail, inland marine, sprinkler leakage, riot and civil motion, air-craft, explosion, earthquake, rain, crop, flood, and freeze, tourist baggage, parcel post, water damage, use occupancy, and registered mail. While the total premium me from many of these lines is at the present time small, rtheless it indicates a comprehensiveness of service quite in ing with the modern tendency to place upon insurance the len of preventing economic or financial catastrophes from possible anticipated contingency.

ean Marine Insurance.—Ocean marine, which is the oldest wn form of insurance, reached a volume during the period of World War never before approached. The demands placed n insurance companies for marine coverages exhausted the urces of existing carriers, and induced the entry of most of arger fire-insurance companies into this field. To supplement her the demand during the War, there was organised a bureau ar risk insurance by the U.S. Treasury Department. This of inestimable assistance to American commerce, and pro- ed a premium volume during the period of its existence of ut $50,000,000, the bulk of which was obtained between . 17 1916 and April 27 1918—almost $39,000,000. Ocean ine insurance, however, has not progressed in America with r forms of insurance, because it is bound by national laws subject to national taxation, though it is an international ness and in direct competition with international carriers, stricted by laws and not subject to the high taxation im- d upon American carriers. The premium volume of Ameri- companies for ocean marine insurance amounts to around 000,000 per year.

asualty and Miscellaneous Insurance.—Casualty insurance is latest development among the general classifications of rance prevailing in the United States. To a great extent it fies modern progress, and the bulk of its business is directly to modern economic and inventive conditions, workmen's pensation and automobile liability insurance being the two ing classes in regard to premium volume. The forms of alty and miscellaneous insurance cover accident; automobile sion, property damage, and liability; bail bonds; bank sits; burglary and theft; credit; check forgery; engine machinery; fidelity; flywheel; health; live stock; liability, public, elevator, employers, etc.; plate glass; property damage and collision; surety; steam boiler; sprinkler; title; workmen's collective and workmen's compensation. In 1910 casualty and miscellaneous insurance companies had total assets amounting to about $300,000,000, while their total premium receipts were $94,000,000. The leading classes of business were liability insurance, with premiums of $28,000,000; accident, with premiums of $23,000,000; fidelity and surety, $15,000,000; health, $6,000,000; plate glass, $3,500,000; burglary and theft, $2,500,000. In 1925 we find that companies offering the various forms of casualty insurance and miscellaneous insurance had over $1,700,000,000 of assets, while their premium volume was almost $650,000,000. In that year the leading classes of coverage were as follows: workmen's compensation, premium income, $130,000,000; automobile liability, $117,000,000; surety bonds, $56,000,000; liability (public, etc.), $47,000,000; accident, $45,000,000; automobile damage, $41,000,000; fidelity, $33,000,000; burglary and theft, $28,000,000; health, $20,000,000; plate glass, $16,000,000. It is worth noting that the writings in two of the individual lines of casualty insurance in 1925 exceeded the total writings in all classes in 1910. (A. L. J. S.)

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INSURANCE, SOCIAL (*see* 14.656).—Social insurance is the name given to the arrangements, whether provided by the state or private agencies, whether voluntary or compulsory, for paying a certain sum of money, or goods and services in kind, as compensation for the loss resulting from certain kinds of emergencies which in their nature lead to diminished capacity to earn or to an increase of expenditure. The object of all branches of social insurance is to protect the workman against the fact and fear of insecurity and its accompaniments—the exhaustion of savings, a lowered standard of living and recourse to public or private charity. This device gives him a legal right to a definite sum. The causes which may reduce the workman to want are of two kinds: those which are unexpected, catastrophic and undesired emergencies, and which entail a lowered capacity to earn or an inability to earn; and those which are desired and normal happenings, but entail an increase in expenditure even where the income has not diminished. In the former class should be included industrial accidents and occupational diseases, non-industrial accidents, ill health, invalidity, blindness and unemployment, burial, unprovided widowhood and unprovided orphanhood and, in the latter, old age, maternity and provision for growing children. In order to deal with these problems modern states have created new institutions, assumed control of existing machinery and provided subsidies, and their legislation on the subject constitutes in its totality a veritable code guaranteeing the workman a minimum of security in all his emergencies.

I. GENERAL INTRODUCTION

Origin of Social Insurance.—Social insurance began as a device employed voluntarily by workmen to protect themselves against emergencies. Trade unions, friendly societies, employers' welfare funds and private insurance companies organised provision for the cost of burial, ill-health and unemployment, and settled the rates of contributions and of benefits. Germany, under Bismarck, was the first country to realise the value and necessity of the compulsory method of insurance against sickness, industrial accidents and old age, which was applied to practically the whole industrial population by the laws of 1883, 1884 and 1889. Great Britain was the first to experiment (in 1911) with a national compulsory system of unemployment insurance, and possesses the most comprehensive system of pensions for widows and orphans of any country in the world. The schemes first introduced in the Central and Western countries in Europe are now being copied by other countries, by the South American Republics and Japan.

Since the War new risks have been provided for in countries where before only one or two were recognised. Classes hitherto excluded from insurance legislation are being brought increasingly within its scope. Gradually the families of insured members are being recognised as standing in equal need of insurance with the breadwinner. Money and service benefits are being added to bring them up to an amount which will give the insured population a minimum sufficient to maintain them in efficiency.

A new factor which is likely to grow increasingly insistent is the effect of compulsory insurance on the costs of production and consequently on international competition. It is in the interest of countries like Great Britain and Germany, which spend heavy sums annually on social insurance, to press for the extension of similar activities in other countries. In 1924 Great Britain spent an aggregate of some £170,000,000 (contributed by employers, workers and the State) and Germany some £60,000,000 on the various branches of the social insurance systems. The International Labour organisation has adopted at its annual conferences a number of conventions and recommendations on unemployment insurance, maternity insurance and workmen's compensation, and the exhaustive studies made by its staff provide an armoury of information.

In Great Britain legislation in connection with provision against social risks, either by way of compulsory insurance, provision by the employer or regulation of voluntary insurance falls under the following heads: compensation for industrial accidents and industrial disease, old age pensions, sickness and invalidity insurance, maternity, unemployment, widows' and orphans' pensions, blind persons, family endowment (provision for children under the War Pensions and Unemployment Insurance Acts). Each of these is dealt with below.

Great Britain may claim to have the most comprehensive system of social insurance in the world, but most industrial countries have adopted some schemes covering one or more risks. The two branches most highly developed in the United States of America are workmen's compensation and pensions for widows and orphans.

Basis of State Action.—Why does the State interfere in the matter of social insurance? From the days of the Elizabethan Poor Law the State has been the ultimate resort of those who are destitute. When all other means had failed those in distress, they could turn to their parish for relief, though this relief has generally been inadequate and granted only under deterrent conditions. Social insurance reduces the number of those who will become destitute.

Moreover, unless compulsion is applied, few will make adequate provision against these social emergencies. But to the community as a whole, assuming no change in our habits, these risks are unavoidable, and it is now regarded as the business of the State to contrive that they shall be provided for. Even the individual who is fully conscious of the dangers he runs will frequently be unable to make adequate provision, and therefore Parliament may decide that the immediate costs should be borne by the employer or by the State itself. Another consideration has been slowly emerging. Only Parliament can decide that large bodies of people shall be compulsorily insured. When it has gone so far it cannot allow private organisations to administer the insurance badly or at too great a
Since the administration is extremely simple, once the act
has worked out costs in relation to benefits, there is everywh
tendency for social insurance to be organised through St
monopolised funds. Behind all these arguments of a prac
nature lies the consideration that every worker is an asse
the State, and the community as well as the individual su
when his health or efficiency is impaired.

Limits of Social Insurance.—Many of the older advocate
social insurance are beginning to be nervous about its col
growth, and complaints are frequently made of the heavy bu
which it imposes on the nation. It is misleading, howeve
lump together, as some critics do, aggregate expenditure
pensions, health and unemployment insurance, workmen's c
pensation and burial insurance premiums, and bring o
grand total of some two or three hundred million pounds w
is called "national expenditure." It is not national expendi
in the sense that it is all provided by the Exchequer. On w
men's compensation and burial insurance the State pays noth
And its contributions in respect of the three compulsory in
ance schemes are, of course, only a fraction, even if a subs
tial fraction, of the total cost.

The following tables show the respective shares of the work
the employer and the State in Great Britain.

Health, Widows and Orphans and Old Age Contributory Pensio
(weekly contributions)

	Worker	Employer
Men	9d.	9d.
Women	6d.	7d.

State contribution (*a*) Health: two-ninths of the total cost of ben
(payable on disbursement). (*b*) Pensions: £4,000,000 a year. (T
will be a slowly rising *additional* cost to the Exchequer in respe
old age pensions at 70, equal to £1,700,000 in 1926–7 and £4,700
in 1935–6. At the same time there will be a relief to the Exchequ
respect of health and unemployment insurance. The *net* Exche
charge on all these pensions will, it is estimated, be £5,700,00
1926–7, rising to £6,400,000 in 1935–6. The finance of the sch
is complicated; it will be found discussed in detail in the Gov
ment Actuary's Report on the Financial Provisions of the Wido
etc., Pensions Bill, Cmd. 1925.

Unemployment
(weekly contributions)

	Worker	Employer	State
Men	7d.	8d.	8d.
Women	6d.	7d.	6d.
Boys (16–18)	3½d.	4d.	4⅝d.
Girls (16–18)	3d.	3½d.	4⅜d.

Moreover, it is plain that if the State were not paying t
millions which have been reduced by the Economy Act of
into the insurance funds, it would be forced to pay as much
perhaps even more, in other ways—*e.g.*, in supporting a pu
health service, in various palliations of unemployment, in e
Poor Law relief, or some similar form of public assista
State-aided insurance, in short, is judged to be true economy.
it is that we find extensions and improvements being advoca
in all directions. The paradox of social insurance, indeed, is
steady growth in spite of constant attacks upon it and the l
of any visible widespread enthusiasm for it.

Unification.—Parallel with the movement for the extens
of social insurance there is a movement for its unification.
present all the emergencies are treated by different adminis
tive machinery, with different methods for raising funds
different rates of contributions. Since the objects underly
all these schemes are broadly the same, the prevention of
titution, the abolition of the fear of insecurity and the provi
of a minimum in all periods of need, it is undesirable that th
variations should continue. Moreover, the workman, the
sured person, wishes to be spared the trouble of dealing wit
host of organisations. However the present medley has be
brought about, it is surely desirable that all these diffe
schemes should be unified. And unification must be taken

not merely the correlating, co-ordinating or riveting er of all the schemes, but their complete amalgamation ject of finance, administration and underlying principles. advantages claimed for a unified scheme are:—

The problem of social emergencies will stand out prominently eps for prevention will thus be encouraged.

Administrative expenses would be very much less and insur- ould be provided cheaply. The benefits given for the same ms will consequently be higher.

The workman dealing with one body will be more likely to his rights and how to claim them.

Existing anomalies, such as death by industrial accident re- different treatment from death through a non-industrial nt, or natural causes, will be abolished.

A department of state will be better able to tackle the whole m than the variety of agencies that now are at work. Im- nents will be carried out more easily, investigations will not npered by private interests.

doubt such a department of state would be a huge affair. ould the change over from the present system be easy. l interests and inter-departmental jealousies would have overcome, and the machinery for dealing with every d workman greatly extended and improved. But that is rection in which social insurance is tending, and not only at Britain. In some of the more important recent codes of insurance, those of Russia and Czechoslovakia, sickness, ge, invalidity and death are treated in unified schemes. roposed French and Australian schemes are also very ehensive. The unification of social insurance is also being ed in Germany.

II. WORKMEN'S COMPENSATION

Great Britain the Employers' Liability Acts of 1880 and orkmen's Compensation Acts of 1897, 1906 and 1923 con- the legislative basis for providing compensation to eople who suffer "personal injury by accident arising out l in the course of employment," or in consequence of one industrial diseases brought specifically under the Act of In the Act of 1880 negligence had to be proved against nployer. But in the Act of 1897 employers were held to be isible for injuries arising out of work in their establish- , even when negligence could not be proved, on the ground he workman was unable to bear unaided the monetary loss injuries involved. In 1906 the scope of workmen's nsation was greatly increased. In the Workman's Com- tion Acts the individual employer is alone held to be isible for paying compensation, and neither the worker nor ate makes any contribution towards the cost. It is still o the employer to choose whether he will insure himself in private insurance company against the risk of having to compensation claims, or pay them himself.

number of workpeople who obtain some measure of tion is estimated at over 17,000,000, but the statistics of orking relate only to some 8,000,000, to those employed ipping, factories (to which the Factory and Workshop apply), docks (including wharves, quays, etc.), mines, ies, constructional work (not including building construc- and railways.

es of Compensation.—The rates of compensation laid down e Act of 1923 are broadly: for partial incapacity, a sum to half the difference between the man's earnings before fter the accident; for total incapacity, half-wages up to a num of 30s. a week. Compensation is payable from the day of incapacity. Where, however, the incapacity lasts ur weeks, the first three days also rank for compensation. in addition to the loss of at least half his wages the workman st cases suffers the loss of the waiting period, the cost of s, medicines, artificial limbs, etc., the cost of training for job; and in all cases where disputes arise he is liable to the costs of litigation. Although in theory the employer le to bear the total costs of an accident, in practice it is ful whether much more than a third of its financial burden ed upon him, the workman bearing still about two-thirds loss.

In fatal cases a sum of between £200 and £300 is paid to the widow, which may be raised by additional allowances for children up to a maximum of £600. It should be observed that whilst some provision is made for dependents in the case of fatal industrial accidents, no provision is made for their needs in the case of non-fatal accidents.

The Home Office has estimated that the total of the charges and expenses for workmen's compensation in the seven great industries was not less than £5,000,000 in 1913 and 1914, £6,000,000 in 1919, £8,500,000 in 1920, 1921 and 1922, £9,000,000 in 1923. But these figures relate only, as we have seen, to about half the industrial population. Assuming that the accident rate in the other occupations is only half what it is in the seven great industries, then in 1923 the cost of workmen's compensation to employers must have been about £13,500,000. Since, however, the workman is still made to bear between one-half and two-thirds of the loss resulting from an accident, it has been estimated that the annual loss due to industrial accidents and diseases amounts to between £30,000,000 and £40,000,000 per annum.

The administrative expense in the case of workmen's compensation has for many years been about 50% of the premium income. The Holman Gregory Departmental Committee reported in 1919 that "During the last five or six years the employers have had to pay £100 in premiums for every £48 paid out in benefits to insured workmen." The companies agreed in 1923 to confine administrative expenses to within 40% of the premiums they received, with a further reduction to 37½% at the beginning of 1927.

Although employers generally insure themselves against the risk of being called upon to pay workmen's compensation, they are not bound to do so, and very frequently the smaller employers fail to make any such provision. Cases thus arise where the workman is obliged to take less than he is entitled to by law. It has therefore been proposed that employers should be compelled to insure, so that the workers may be certain of receiving compensation.

Over 30 diseases have now been scheduled as being due specifically to various industries and in respect of which compensation is provided. But in the many kinds of industrial diseases which may also arise apart from the employment—*e.g.*, bronchitis in cotton workers—no compensation under the Act is provided. This system is also criticised as involving frequent litigation and delay in payment. Moreover, agents are alleged frequently to induce injured workmen to take smaller amounts than their due. Insurance companies, as often as they can, induce the workman to accept a lump sum, since in spite of their heavy cost of administration they have only clumsy machinery for making weekly payments and for the review of benefits as the children grow older or die. Lump sum payments very frequently mean the rapid dissipation of benefits.

Neglect of Preventive Measures.—Perhaps the most serious fault is the neglect of preventive measures. There is little evidence of a steady and significant decline in the number of industrial accidents, of which about 400,000 occur annually. The neglect of the well-known and tried devices of the "Safety First" Association, with their educational influence on the workpeople, both by employers and by the insurance companies, is a glaring piece of carelessness. Second only to this in importance is the scant attention paid to the rehabilitation of injured workmen.

It has been suggested that a Government fund for insuring employers against the liability to pay compensation could be run at a much lower administrative cost than private insurance. In the United States competitive funds have an administrative expense of 6 to 9%. Another suggestion is the linking up of workmen's compensation with health insurance and the scheme for widows' and orphans' pensions. This might be desirable in itself, but would necessitate compulsory insurance in a state scheme. It would indeed involve altering the whole basis of the present law. The device of workmen's compensation has been so widely adopted that the International Labour Organisation was able to adopt a convention on this subject at its conference in 1925.

III. PENSIONS

Old Age Pensions.—Old age pensions were first granted in Great Britain by the Act of 1908. This Act, which was amended in some particulars by the Acts of 1911, 1919 and 1924, provided for the payment of pensions to all persons who had reached

70 years of age, who had been British subjects for at least 10 years or if natural British subjects had resided in the United Kingdom for a period of not less than 12 years since attaining the age of 50.

The amount of the pension was to be adjusted to the means of applicants. They must be below a certain standard before they could claim, and the pension was in no case to exceed 10s. a week. The scheme was non-contributory in character, and the entire cost of the pensions and of the administration was defrayed out of national taxation. Under the existing Acts, the application for a pension must be made, in the first place, at the local post office on a "claim to pension" form. The local excise officers appointed under the Acts by the Treasury to be pension officers report on the means of the applicant; the pension committee decide on the validity of the report and the rate of pension. The claimant or pension officer, if dissatisfied with the decision, may appeal to the Minister of Health within seven days of receipt of the notice of the committee's decision. If the claim is allowed the applicant obtains his weekly pension at the local post office.

The Old Age Pension Act of 1908 was the first Act to provide permanent public assistance outside the Poor Law. Its advocates argued that even if the workman could save enough to provide for ill health or unemployment he could not be expected to save enough to provide both for himself and his wife after 70. The scheme adopted bore signs of its origin in the older system. The pension is granted only to those who are not, it is true, destitute, but necessitous. No one is eligible who has an income of £50 a year or over. The amount of the pension varies directly with the need of the applicant. The poverty qualification infringes the idea of social insurance, the essence of which is to grant a legal right to a definite sum. The pensions scheme, it is true, does this, but grudgingly and on conditions which savour of the Poor Law. It involves vexatious inquiries; it discourages thrift and the aid of relatives; it is unjust. On the other hand, it is the first branch of social insurance in which the State intervened directly. Its inquisitorial character was inevitable in a non-contributory scheme.

In 1910, the first full year of the working of the old age pension scheme, the cost was £8,468,128. In 1924 it amounted to £24,000,000. In 1965 the Government actuary estimates that the same scheme will cost more than double that amount, some £57,000,000. This is attributed to two causes, the growth in the annual number of births between 1850 and 1890 and the decline in the death rate. The cost of granting universal old age pensions without tests or a means limit would be an additional £14,000,000 a year, rising to about £19,000,000 in twenty years. The total net cost of administration of the scheme, covering the expenses of the pensions committee, was estimated for the year 1924 at £800,000. This constitutes an administrative expense of $3\frac{1}{3}\%$.

The operation of the old age pensions scheme revealed an appalling mass of poverty among those over 70, and it was known that the lot of those between 65 and 70 was little better. The Act of 1925 introduced contributory old age pensions at 65, and also abolished the means disqualification for those insured. This Act, however, allows the non-contributory pension at 70 to continue until it is slowly absorbed by the contributory insurance scheme.

Non-contributory old age pension schemes exist in:—

(1) Australia, Denmark, France, Great Britain, the Irish Free State, New Zealand, Norway, in certain of the United States and Uruguay.

(2) Contributory pension schemes have been introduced in Rumania, Spain, Switzerland, Belgium, Italy, the Netherlands, the Serb-Croat-Slovene kingdom, Bulgaria, Czechoslovakia, and recently in Great Britain.

The Act of 1891 passed by Denmark for assisting the aged has thus been the forerunner of the modern schemes of old age pensions and insurance which have now been adopted in most industrial countries.

Old age is assumed to occur at some stated age which varies from 50 to 70 years according to the country.

Pensions for the Blind.—In Great Britain the Blind Act of 1920 provided that all blind persons of the age of 50 or over should be granted pensions at the same rates and on the same conditions as those applying to persons of 70 and over. The local authorities are empowered to make provisions for the blind—such as the establishment of workshops, assistance to homeworkers,
teaching and assistance in book production—out of the
funds. Such provision is aided by a state grant.

Widows' and Orphans' Pensions.—The contributory O
and Widows and Orphans Act 1925 marked a new developm
social insurance in Great Britain. Two methods are ope
Government for making provision for widows and orphan
of compulsory contributory insurance, or as it is tern
Great Britain, contributory pensions, or that of non-c
utory pensions.

From January 1926 widows have received a pension of
week, together with 5s. for the first child under 14, or under 1
child is still attending school, and 3s. for each of the others
scheme has been linked with one for providing old age pens
10s. a week at 65 instead of 70 to all insured men and wome
out inquiry into their means. Both these schemes are joined
existing scheme of contributory health insurance and th
contributory old age pensions. It has been estimated th
benefits accruing to an insured man and his dependents un
Act are roughly equal in value to an endowment assuran
£200 payable at death or at the age of sixty-five.

But instead of being entitled to an old age pension, if his
was very restricted, at the age of 70, he will under the new sch
able to draw his weekly pension of 10s. for the rest of his
reaching the age of 65, whatever other sources he may poss
whether he gives up work or not. His wife will also be entitl
pension at sixty-five.

The new scheme provides also that on his death—at whate
—his widow will receive a weekly pension of 10s. until her
unless she marries again; if he leaves children at school under
of 16, his widow will be entitled to draw 5s. a week for the eld
3s. a week for each of the others; and if the children are mot
as well as fatherless payments will be made in respect of the
they reach the age of 14, at the rates of 7s. 6d. a week for the
child of a family and 6s. a week for each of the other children.

The pension age, it should be observed, is reduced only in t
of those who are insured, and it is only in their case that the e
means disqualification is to be removed. Those who have n
insured as workers remain under the existing system. The c
health insurance may be expected to be lessened by the s
because many workers who will be drawing their old age pens
65 will no longer be entitled to their invalidity benefits. Un
Economy Act 1926 the Government lessened, therefore, th
contribution to health insurance.

The first full year in which old age pensions at 65 will be p
be 1928–9, when the costs will be £12,400,000, from which th
steadily rise up to the maximum in 1965–6, when they will a
to £21,500,000. In that year the total cost of old age pensio
be £85,900,000. In the first complete year (1926–7) the
widows' and orphans' pensions will be nearly £11,000,000, a
amount will rise steadily until 1965–6, when it will be £38,8
In that year the total payment on account of old age pensio
widows' and orphans' pensions will be £125,000,000.

For many years to come the old age pensions scheme is t
growing liability and the war pensions scheme a dwindling o
1926 these two services cost about £94,000,000. In forty yea
will cost about £90,000,000. After that the state grants out o
grow less until, as the percentage of those who come in after
increases, the Government will be called on to pay less and les
its liability will gradually dwindle to nothing.

The contributions to be paid by the insured persons are 4
week by a man and 2d. by a woman, while the man's employe
pays $4\frac{1}{2}$d. and the woman's $2\frac{1}{2}$d. The State also contributes it
under the new scheme.

As regards the administration of the scheme, contributio
collected in the same way as in the case of health insu
In fact, the health and pensions contributions are comb
and the same stamp and the same card serve for both.
approved societies issue the certificates showing that a p
is entitled to benefits, but the actual payment is made b
post office. It is calculated that the administrative expens
be no more than 2% of the contributions.

Germany, Czechoslovakia, Italy and Holland have
inadequate schemes on a contributory basis. New Zea
most of the states of North America and Canada have a
non-contributory schemes of pensions for widows and orp

IV. INDUSTRIAL INSURANCE

Abuses of the Unreformed System.—By industrial life a
ance or burial insurance the working classes obtain be
sufficient to cover the cost of burial. This form of insura
common in Great Britain because of a very deep and

l terror of a pauper's funeral. Between 1903 and 1924 the ıt spent by the workers on this branch of insurance sed by about 400 per cent. The great success of the in-al insurance companies is due to the army of some 70,000 s employed by them to collect weekly the small premiums. l insurance is brought by them to the worker's home in ι form and at such a price that he can provide for it out of ıall earnings. Indeed, the agents have been able to per- many working class families, and especially the mothers, .e out one or more policies for each member of the house- so that it is a common thing for a workman to spend en 1s. and 2s. a week for this branch of insurance. It has :laimed that "there is scarcely a home among the millions working classes in this country which is not visited at once a week by these agents." In 1921 it was stated here were over 50,000,000 "industrial policies" in force, ıich £35,000,000 was paid annually in premiums. To this l be added the interest on invested capital. It is estimated :xpenditure for "death" benefits is equal to about twice ee times the amount spent on health, maternity, and dis-ent taken together.

s business has been subjected to very strong criticism. A tmental committee, presided over by Lord Parmoor, .ed in 1920. It was found that some 44% of the premiums in agency and management charges, proving that this ɔd was needlessly costly. Excessive house-to-house can-.g led to considerable overlapping and wasteful competition. ersistence of the agents led to the purchase of policies by ıs who could not afford to pay for them, with the result ome 5,000,000 policies lapsed annually. There had been :s and scandals and the system was full of abuses.

ee policies were proposed for dealing with the situation:—

To nationalise the business and to provide burial benefits *lsorily* under the national insurance scheme.

To control it, to remove the more flagrant abuses, and to he joint charges of administration and profits.

To control it, but to leave the insurance companies to remove ıin causes of complaint themselves.

'armoor committee recommended this third policy, which ı effect adopted by Parliament.

utory Regulation.—The Industrial Assurance Act 1923, tcome of the report, made the Chief Registrar of Friendly ies the industrial assurance commissioner, with wide s, and every office, whatever its constitution, which .cts industrial assurance business is now required to make ıs to him. The companies are required to make an addi- deposit of £20,000 in respect of industrial assurance :ss, and the collecting societies have to make a similar it.

accounts of the industrial assurance business must be kept .te from other branches of insurance business. The commis- has power to examine into and report upon the affairs of any ıny or collecting society where an offence has been committed ıis opinion is likely to be committed. Every office transacting usiness had to have a valuation made by an actuary not later he end of 1925, and where a deficiency was disclosed the com-ner might present a petition for winding up the company. ıpts are being made to lower the administrative expenses in vays. The "block system" of canvassing for business, by a definite area or number of blocks of houses is assigned to one is being substituted for the anarchic method which allowed agent to canvass where he would. Companies will still com-vith one another, but not the agents of the same company. is also an increasing tendency to pay agents by salary rather ɔy commission. This will give the company greater control, ncourage sounder methods of obtaining clients. In the third efforts are made to induce regularly employed people to pay ums monthly. Fourthly, higher premiums are canvassed for er to lower the proportion of administrative expense. One ıny working along these lines has reduced the expense from o something below 30% in a few years. But we are warned rom even this company we must expect no reduction of the f administrative expenditure to premiums below 20%.

re are strong arguments against allowing the business to ı voluntary. The present method, apart from incidental , is open to objection on the ground of its wasteful administra-nd the undesirability of continuing the voluntary method the compulsory is adopted in related branches of insurance. Now that we have a system of life insurance endowment policies in the widows' pension scheme, it is contended that it is absurd to omit life insurance burial policies.

Many countries grant this additional benefit in conjunction with their health insurance schemes, an arrangement which keeps administrative expenses low. The State can administer this benefit at an expense below 2% of the premium income.

V. HEALTH INSURANCE

The National Insurance Act of 1911 constituted in many respects a new departure in British social policy. Workmen's compensation was already in operation, but the judicial justification of the new scheme was entirely different, whilst the state was, and still is, very little concerned in its actual administration. The Old Age Pension Act might be regarded as the offspring of the old ideas of Poor Law, and it was very easy to administer. The device now introduced of contributory insurance conveying a legal right to a definite amount was unknown previously in Great Britain. The Act of 1911 was in fact a novel experiment, both as regards the health insurance and the unemployment insurance sections.

Health Insurance.—The National Insurance Act 1911, Part I., makes provision for insurance against loss of health and for the prevention and cure of sickness. It is compulsory on all manual workers between the ages of 16 and 70 and non-manual workers with incomes under £250 who have not claimed the right of exemption. Over 15,000,000 persons are included. The normal benefits provided under the scheme include:—

(1) The payment of a weekly benefit of 15s. for men and of 12s. for women for not more than 26 weeks as sick benefit.

(2) A disablement benefit after the 26th week of 7s. 6d. per week so long as the beneficiary is incapable of work.

(3) A maternity benefit of 40s. to the wife of an insured man, which is raised to £4 when she is herself an insured person.

(4) Provision for medical benefits. This medical benefit consists of such medical treatment as can consistently with the best interests of the patient be properly undertaken by a general practitioner of the usual professional skill. It also includes the provision of medicines and of such medical and surgical appliances as are approved by the regulations issued by the supervising body, the Ministry of Health.

The employer is responsible for the payment of the joint contribution for himself and for the employee, which since January 1926 is 9d. for each employed man and 8½d. for each employed woman, but he deducts 4½d. in the former case and 4d. in the latter case from their wages. But, as shown above, the contributions in respect of pensions are now combined with these, and the actual value of the weekly stamp affixed by the employer is 1s. 6d. for men, and 1s. 1d. for women. The purchase money of the stamps, which are obtained from the post office, is paid into the National Health Insurance Fund. The State adds two-ninths of the cost of the scheme. The benefits are determined actuarially on the basis of the contributions from the employers, the workers and the State.

The administration of the scheme is carried out by approved societies and insurance committees. Approved societies consist of trade unions and friendly societies, collecting societies and special branches of insurance companies, which are to be "recognised" if they are democratically controlled and non-profit making. The medical benefits are administered by the insurance committees. These consist of local bodies representing the interests concerned, the insured persons, the doctors and the Ministry of Health. Deposit contributors, of whom there are about 250,000 are persons unwilling or unable to become members of approved societies. They are entitled to benefits up to the amount of the contributions paid in respect of them. Unlike ordinary members, they cannot draw more than that amount if their illness continues.

Most approved societies have attracted the majority of their members from particular trades. In consequence some have a high sickness rate and some a low one. The latter are in a position to give additional benefits above the normal benefits; the former suffer from deficits even when they give only the normal benefits. This system involves a certain amount of unfairness, to counterbalance which four devices for securing some measure of equalisation have been introduced:—

(1) The system of "reserve values" to allow for the age distribution of members.

(2) The contingencies fund to guard against the probability of an excess of liabilities, or deficiency on valuation of a society due to expenditure for benefit being in excess of the expected.

(3) The central fund to guard against the probability of a deficiency on valuation caused by abnormal rates of sickness due to the nature of the occupation of the members or the environment in which they live, or an epidemic such as influenza, or some other cause beyond the control of the society.

(4) The women's equalisation fund to meet the fact that women, especially married women, have a high rate of disability, principally on account of child-bearing. This fund was withdrawn and a sum added to their reserve value in its place.

In spite of these funds, the benefits obtained by clerks and agricultural labourers are very much higher than those obtained by miners, and it has been suggested that the whole of the Government grant of two-ninths should be used to guarantee all insured members the same benefits.

Proposed Amendments.—A royal commission was appointed in July 1924 to inquire into the scheme of national health insurance, and to recommend any alterations or improvements that might seem desirable. It reported early in 1926. Two reports were issued, both recommending changes and extensions, but, the minority being a good deal bolder than the majority. There was general agreement on the fundamental soundness of the system, on the need for a considerable extension of benefits, and on abolishing the insurance committees and transferring their functions to the local health authorities. The extension of benefits advocated by the majority is, however, to be made only "as and when funds are available to meet the cost." The minority report, on the other hand, rejects this proviso, and makes definite recommendations in favour of an all round extension of benefits, and especially for (a) the provision of medical treatment and attendance for children of school leaving age and for the dependents of insurance; (b) extended provision for child-bearing women before, at and after confinement; and (c) increase of the rates of cash benefit paid under the Health Insurance Acts to the present rates under the Unemployment Insurance Acts—*i.e.*, 18s. a week for men and 15s. for women.

Furthermore, the minority recommended the abolition of the approved societies system. The approved societies, they hold, are a failure. They are not democratically controlled, they are uneconomical, and they are "a hindrance to the development of a complete public health policy." The local authorities, therefore, should take their place.

Compulsory health insurance schemes are to be found in many European countries, including Germany, Austria, Bulgaria, Czechoslovakia, Great Britain, Norway, Poland, Russia, Belgium and the Serb-Croat Slovene kingdom. All the States in Australia have introduced non-contributory maternity grants. Japan introduced a scheme of health insurance in 1922, and Chile in 1924. In Poland, Russia and the Serb-Croat Slovene kingdom the territorial fund has in effect a monopoly of insurance. In Germany, Austria and Czechoslovakia the territorial fund is the leading but not the sole insurance institution. In some countries, *e.g.*, Germany, Rumania and Bulgaria, survivors' insurance, consisting as a rule of both burial benefits and pensions for their dependents, is attached to the various health insurance schemes.

Unemployment Insurance.—Great Britain was the first country to introduce a system of compulsory unemployment insurance. The National Insurance Act 1911 (Part II.), as a first instalment, made provision for insurance against unemployment in certain selected trades. The scheme was extended to include additional groups of workers by the Munition Workers Act of 1916. The Act of 1920 brought into insurance all persons of the age of 16 and upwards employed under a contract of service, excepting domestic servants, outworkers, agricultural workers and non-manual workers employed at a rate of remuneration exceeding £250 a year. Employees of local authorities, railways and certain other public utility undertakings, members of the police forces, and persons with rights under a statutory superannuation scheme may, in certain circumstances, be excepted.

As in the case of Health Insurance, the scheme is co
utory, and the stamp and book method is employed for coll
contributions. Every insured person is given an unemplo
book, on which his employer fixes a stamp weekly for the a
to be paid in contributions in respect of himself and his emp
the part of the contribution made on behalf of the workm
of course, withdrawn from his wages.

The rates of contribution, as revised in 1926, are, for me
a week from the employer, 7d. from the employee and 8d.
the State; for women, 7d. from the employer, 6d. fro
employee and 6d. from the State. These contribution
paid into the unemployment fund, out of which come all
fits and administrative expenses connected with the sche

Rates and Conditions of Benefits.—The rates and conditi
benefits laid down in the 1924 Act are that after three
unemployment, provided no suitable work is available,
receive a flat rate of 18s. a week and women 15s. a week, w
additional allowance of 5s. a week for a dependent w
husband, and 2s. a week for each dependent child. Und
Act of 1920 one week of benefit was payable in respect of
six contributions, and not more than 26 weeks of benefit
payable in one year.

Every insured person claiming unemployment benefit must
his unemployment book at an Employment Exchange when n
a claim. If the insurance officer is satisfied that no work in h
trade is available, and that the workman is bona-fide unemp
he will receive his benefit. A workman is regarded as unemplo
the purposes of the scheme when he is able-bodied, efficien
though willing to work in his own trade at the current rates of
unable to find employment because of lack of work. Benefits a
paid to those thrown out of employment through trade disputes
employment exchange system, with its lists of employers in se
work-people and of workers in search of employment, togethe
other sources of information available to the officer in charg
ables him to judge of the bona fide of applicants for bene
they are offered suitable employment and refuse it, the
is withheld.

Courts of referees of employers and employees constitute a
of appeal from an insurance officer. He in turn has an
against them to an umpire.

The total number of insured work-people in Great Britai
Northern Ireland has grown to nearly 12,000,000 and the a
receipts of the unemployment fund at the present rate o
tributions are between £40,000,000 and £50,000,000 per annu
1922 the expenditure of the fund was over £58,000,000, and
to the Treasury was incurred, most of which has since been
repaid.

The extended scheme of 1926, including also the mass of
trial workers (agricultural workers and domestic servants a
cluded), was introduced on the eve of the trade depression,
reserve funds had not been accumulated to meet the great de
Rates of contributions and of benefits have been frequently ch
the unemployment fund instead of being a creditor has be
debtor of the Treasury. The administrative checks on app
originally intended and the limitation of benefits have no
applied. In 1920 there was introduced the system of what
first called "uncovenanted" benefit, and is now known a
tended" benefit. Extended benefit is benefit allowed to unem
persons who have exhausted their "standard" benefit (*i.e.*
they are strictly entitled to in respect of their contributions)
granted under certain conditions and at the discretion of the M
of Labour. This discretion was taken away in 1924 and ext
benefit was made a right, subject only to the fulfilment
statutory conditions; but it was restored by the Act of 1925.

All this has led to unemployment insurance being decried
"dole" system. But dole is clearly a misnomer for the st
benefit. And even as regards extended benefit, the expec
always is that the recipient of it is one who had contributed
fund, and who will in the future pay the premiums against the
fit he has drawn in advance. It should be noted that the debt
Treasury is not very large, and is certain to be repaid from t
employment fund as soon as the volume of unemployment
ishes. During a period of four years from the beginning of t
pression in 1920 workers' contributions were £62,000,000; th
employers £71,500,000, and of the State £46,000,000. Thu
Exchequer provided slightly over a quarter of the total a
spent. Taking the whole duration of the scheme, the State has
and lent very little more than was originally intended by Parlia
(The Economy Act of 1926 provided for a reduction of the
grant in respect of unemployment insurance.) Nor is it a fac
the same people have remained unemployed all these four
An investigation made in 1924 into 10,000 claims showed
4·7% of the claimants to unemployment benefit had had no in
employment from 0 to 29 of the 125 weeks of the period covered

had done some insured employment in from 30 to 59 weeks; in from 60 to 89 weeks; and 30·5% in from 90 to 125 weeks. it is wrong to say the workman is drawing a "dole," it is clear the nature of the insurance scheme has changed owing to the sity and continuance of the industrial depression. At present heme provides for the insurance of all workers in the insured s by means of premiums paid by or in respect of those alone are actually employed and not by all those who are insured.

ce unemployment is a normal feature of industry, there is na facie ground for making benefits equal wages. There is d a large school which demands "work or maintenance" unemployed, and maintenance at full rates of pay.

t the practical difficulties of this are obvious. Generally ing, criticism of unemployment insurance takes the form ggestions for improving and strengthening the existing ne, not for abolishing it. It is proposed that agricultural ers and domestic servants should be included, that greater r should be given to advisory committees of employers mployees in its administration, that Parliament should set body with authority to advise what political and economic es will mitigate unemployment, and an interdepartmental for giving effect to such policies.

irteen years' experience has demonstrated that compulsory ployment insurance is entirely practicable, that the British ne has been conceived on right lines, that it embodies which are socially desirable, that it is actuarially sound, it is extremely elastic, and that it has been one of the signal sses of British administrative effort.

lepartmental committee of inquiry into the whole question employment insurance was set up by the British Govern- in 1925.

mpulsory unemployment insurance has now been adopted other countries. It was introduced in Italy by a legis- decree in 1919, which was superseded by a decree of 1923. ia introduced it in 1920. Queensland adopted it in 1920 Soviet Russia includes it in its Labour Code. Poland luced a system in July 1924. The Irish Free State is nuing the compulsory system it took over from England. e voluntary system of unemployment insurance supported ate subsidies previously known as "the Ghent system," peration in nine States, but the British method is steadily ng more adherents.

urance by industry.—The proposal to organise insurance dustry has attracted special attention in relation to un- yment. But there is no reason why it should not be lered also in relation to the other branches of social insur- Workmen's compensation in this country is organised in nner which ought to satisfy the advocates of insurance by try, and it is possible, if it is desired, to organise unemploy- insurance and health insurance in a similar manner. idea underlies Professor Commons' scheme for the American s.

e arguments in favour of this course and against it may be y summarised as follows:—

the burden of these social emergencies in each industry is d directly on that industry, a financial incentive will be to the employers to prevent them in each industry, and a r arrangement might even be made for each firm so as to nt them in each firm, and so lessen their burden. Why it is asked, use this obvious instrument for stabilising yment? Each industry could form one representative isation of all concerned in it, which would attempt to le with these social emergencies. Experience of working her in this way by employers and workpeople would enable to face other problems. Thus insurance by industry is to be part of the wider policy of giving the workers some of control in industry. Another argument used is the e of adjusting benefits to earnings. Unfortunately, some of arguments have little force. Thus the money incentive can be offered would be relatively so small that experience the rebate system offered under the 1911 Act to employers kept a stable staff proves that it would have little or no in inducing employers to seek means to reduce the amount of unemployment. The desire to give the workman and his employer some share in the administration of the scheme can be achieved through increasing the functions of advisory committees both of employers and of work-people. Similarly the better adjustment of benefits to wages can be achieved in other ways.

There are many difficulties in the way of this proposal. First there is the difficulty of classifying and delimiting industries, though it must be admitted that the same difficulty will have to be tackled if Whitley Councils are ever to be made really effective. Nor have suggestions been wanting how to deal with the class of floating labour, especially of unskilled labour which finds employment now in one industry and now in another. It is argued also with force that in case of decaying trades the technical process may become obsolete, but the industry continues, and it is proper for the industry to bear the burden of maintaining those who are too old to adjust themselves to the new conditions.

But there are other serious objections. Each industry would have to institute its own system of exchanges, and this would make the administrative expenses of insurance high. Besides, workmen might be tempted not to transfer from a high benefit industry to a low one even when it was economically desirable for them to do so. Labour would tend to become immobile.

Moreover, it may be doubted whether it is really unfair for, say, clerks to pay towards the cost of insuring unemployment in the coal industry. They consume coal, the trades in which they are engaged probably use it. Shipbuilding is dependent upon the iron and steel manufacturing industry, engineering, woodmaking and other industries. Most industries are dependent on coal and transport, and they all use electricity and gas. When industry has grown so interdependent there seems to be no substantial injustice in a flat rate system. (J. Co.)

VI. MEDICAL ASPECTS OF HEALTH INSURANCE

Insured Persons.—The number of insured persons in Great Britain is approximately 15,000,000. They consist of persons under a contract or service, namely all manual workers without any income limit, and non-manual workers with an income limit of £250 a year. Certain other persons, within the same income limit, who have previously been employed insured persons or who have married an insured woman, are allowed to enter the scheme voluntarily. On the other hand some employed persons who have sources of income other than their employment may be exempted, and certain whole classes are excluded from compulsory insurance because they are serving under conditions which provide benefits equivalent to those of the insurance scheme.

The Medical Service.—This large proportion of the workers of the country has been entitled not only to the cash benefits described, but, since January 1913, to such medical advice and treatment as can reasonably be expected from general medical practitioners as a class, other than in respect to a confinement. This is a very wide range; and gratuitous service even beyond this range has repeatedly been given. There are about 15,000 medical practitioners engaged in this work. Every registered medical practitioner who wishes to do so has the right to take part in the service, unless and until he be removed therefrom after due inquiry according to prescribed methods and machinery. To this provision the medical profession has always attached the utmost importance. Equally important are the provisions that every insured person has a free choice of all available doctors, that he may change his doctor at any time, and that the doctor may, with due notice in the case of illness, request his patient to seek other advice. The maximum effective number of insured persons for whom any doctor may, single-handed, make himself liable is 2,500. With a doctor of quick mind, methodical habits, and considerable ability, who devotes the major part of his time to insurance practice this number is reasonable, but in an average case where a corresponding amount of private practice is undertaken, this number is probably too large for efficient work in times of stress. In some densely populated areas where the number of doctors is relatively few and the lists correspondingly large a certain amount of complaint may at times have been justified, but these conditions are, by common consent, adjusting themselves and the service improving. In fact, the number of doctors who have lists effectively exceeding 2,000 is small, the average number of insured persons per doctor being less than a thousand.

The aim of all these arrangements is to make the conditions of insurance practice approximate as nearly as possible to those of private practice. The actual and legal relationship between doctor and patient is the same in both, the only modification of this statement (and that a small one) being that since the whole body of insurance practitioners of an area have undertaken the responsibility for attending all the insured persons of that area, each practitioner must attend any insured person in an accident or other emergency whereas this is merely an obligation of humanity in non-insurance practice. In addition, the doctor under the insurance system undertakes to give certain certificates with regard to incapacitating illness and to keep certain records and make certain reports as required by the Ministry of Health.

Effects of the System.—After 13 years of such a system it is true to say, in general, that the incidence of incapacitating illness among the working population has diminished, that whole classes of persons are now receiving a real medical attention which formerly they did not get at all, that the amount and character of that attention is immensely superior to that given under any of the old forms of contract practice, that illness is now coming under skilled observation and treatment at an earlier stage than formerly, and that the bias towards preventive rather than mere remedial treatment has been reinforced.

Good as this is it might yet be better. The existing definition of insured persons includes some—the higher-paid manual workers—who could make the necessary provision for themselves without state aid. Equally clearly it excludes many others who urgently need such aid,—*e.g.*, poor persons not under a contract of service, such as hawkers and small tradesmen. The dependents of all the lower-paid insured persons, however defined, manifestly need aid for securing adequate medical attention in some way and might well be brought within the insurance scheme. To make the required adjustments will give rise to some formidable difficulties but these should be faced and overcome. The difficulty with regard to the inclusion of dependents is almost wholly one of finance. The difficulty of including other poor persons is that of collecting compulsory contributions (not necessarily weekly) from those who have no employer. The difficulty of excluding the higher-paid of those now included is that of applying an income limit to the manual worker as well as to the clerk. These difficulties are not insuperable.

Extension of Scope of Treatment.—The extension of the scope of the medical advice and treatment available so that it shall include not merely such as can in the best interest of the patient be given by general medical practitioners as a class, but also consultant and specialist services (including dental treatment), and the advantage of pathological laboratories, would not only be of immense advantage to both doctors and patients, but would solve a good many of the minor problems which give rise to daily troubles under the existing system. The expense of such an extension as has been recommended by the royal commission on the Insurance Acts, to whose reports reference has already been made, would not be prohibitive, and experience already gained would greatly facilitate the necessary working arrangements with the medical profession. A subsequent further extension to cover residential institutional treatment, the provision of nurses, and other ancillary services would be quite practicable and would complete a national system designed to leave no one without the means of readily obtaining adequate medical attention in all forms of illness. (H. B. Br.)

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INTELLECTUAL CO-OPERATION, International Institute of In Sept. 1921 the League of Nations, on the proposal of Léon Bourgeois, added to its existing technical committees International Committee on Intellectual Co-operation, ma up of distinguished scholars chosen first from 12, afterwards fr 14, different countries. Its membership included, among oth Mme. Curie, Prof. Einstein, Prof. Gilbert Murray, M. Ju Destrée and Dr. Millikan. M. Henri Bergson was elected first chairman.

The task assigned the committee was that of studying better organisation, through united international effort, literary, artistic and scientific work. The committee so became convinced that if it were fully to accomplish its task must have a permanent administrative organ to prepare its p gramme and carry out its plans. In 1924 the French Go offered to defray for the League the expenses of such organ, asking only in return that Paris be its seat. The Leag accepted the offer; and in Sept. 1925 the International Institu for Intellectual Co-operation opened its offices in Paris, at Palais Royal.

The institute is divided into seven specialised sections whi are as follows:—

General Section.—This makes a preliminary survey of all proble submitted to the institute. It draws up an annual set of internatio statistics on intellectual life and its changes in level. It studies general problems and suggestions that bear upon the internatio organisation of intellectual work.

Scientific Relations.—This section deals with specific problems international scientific organisation. It keeps in touch with important existing institutions and associations in this field, and a them to co-ordinate their efforts, encouraging the creation of n bodies where these are necessary. It follows closely the powerful still unco-ordinated activity of international scientific congresses

Artistic and Literary Relations.—These two sections study organisation, from an international point of view, of literary a artistic production. They prepared in 1926 a plan for an Int national Office for Museums. They investigate the question general protective laws for artists and works of art.

University Relations.—This section acts as a link between insti tions of higher education in all parts of the world. To this activ mmittee attached a particular importance from the first. In ey suggested to the Council and the Assembly of the League ed for an International University Information Office, since 1. In 1925 the Assembly decided to refer to the Institute for the question of a general international *entente* in matters of ion.

l.—This section deals with the legal problems raised by plans ernational intellectual co-operation. In accord with the International Labour Office, it studies the economic conditions of intellec- orkers.

rmation.—This section studies also the means by which the of intellectual work are diffused, particularly the problems of roduction and printing. It seeks to co-ordinate the activity of cal publications which treat the various phases of intellectual

institute is strictly international in character. Its officials to 20 different nations: the section for general affairs, for ce, had as its first head an Englishman; the section for sity relations a Pole; the information section an Italian; ction for artistic relations a Belgian; the section for literary ns a Chilean, a woman; the section for scientific relations a n; and the legal section a Spaniard.

staff, drawn from all parts of the world, represent the varied intellectual interests. But all of them, from the a director down, are moved by the same desire: to seek in ndividual problem submitted to them, with all the exactnd modesty of experts who understand the clear limitaof a given task, the methods best adapted to reconcile the ts of each nation with those higher interests of the mind overn the broad sphere of intellectual life.

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(J. Lu).

ELLIGENCE, ANIMAL (*see* 14.680).—A broad distinction is only drawn between instinctive and intelligent behaviour nals, and it is necessary therefore to frame some definition t is meant by intelligent action. In this matter McDougall writes as follows:—

> definition and demarcation of instinct and intelligence have uch debated of recent years; but no general agreement as to cise use of the words has yet been reached nor can be reached greement as to the nature of the facts denoted shall have been ed. But the great majority of all parties would agree that we operly call "instinctive" those actions of animals which seem urposive (*i.e.*, exhibit the marks of behaviour) and which are ned by any animal independently of previous experience of situations. . . . Intelligent action, on the other hand, is lly defined as one which seems to show that the creature has d by prior experience of similar situations, that it somehow to bear its previous experience in the guidance of its present Instinct (abstractly conceived and with a capital letter) is or inborn capacity for purposive action; intelligence is the ty to improve upon native tendency in the light of past exce (pp. 70, 71). (*See* PSYCHOLOGY.)

e authors, particularly Fabre and Bergson, have attempted ke the distinction between instinct and intelligence an te one, attributing to instinctive animals psychical powers almost miraculous kind. This view is not widely accepted se who have studied most carefully the manifestations of ct. The fact is that neither form of behaviour appears ." Glimmerings of intelligence may be awakened in even ost stereotyped of instinctive actions, and intelligent is often merely an extension and embroidery of instinctive iour. Their resemblances are more important than their nces—both are forms of purposive activity, adapted to ng some end connected with the maintenance and conce of life, and finding their driving force in the primary c impulses of the living thing (E. S. Russell, *The Study of Things*, 1924). The contrast is between the accuracy and nical undeviability of instinctive behaviour, inborn in the l, and the probing tentativeness of intelligent action, seeks to modify in the light of individual experience and pt to changing circumstance the blind impulsions of in-

Definition.—If we adopt this broad criterion—modifiability of behaviour in relation to past experience—we may say that intelligence in this sense is practically coextensive with animal life, for even the Protozoa alter their mode of reaction if their first response fails, and show the beginnings of "learning by experience" (Jennings 1906).

Animal Behaviour.—Since about 1900, much attention has been paid to the study of animal behaviour, both by zoologists, who have studied particularly the sensory physiology of animals and have tried to analyse their behaviour in terms of tropisms and reflexes (see, for instance, Loeb 1919), and by professional psychologists, who have studied particularly the intelligence of the higher animals (and some of the lower) by means of highly developed and ingenious mechanical contrivances, such as puzzle boxes, mazes, and the like. Nor should one omit to mention the good work done by field naturalists like Beebe and Miss Frances Pitt upon the behaviour of animals going about their ordinary business in their natural environment.

Experimental Work.—With respect to the question of the intelligence of animals, particularly of the higher forms, in the works of Yerkes, Thorndike and Hunter, and in the useful general account by Miss Smith (1923) and Kafka (1922), details are given of elaborate experimental researches carried out on habit-formation, the processes of association, sensory discrimination and so forth. Generally speaking, these experiments afford little evidence of anything like reasoning power even among the higher vertebrates. Learning appears to be a rather mechanical process, in which little intelligence, in the ordinary acceptation of the word, is shown. The objection may, however, be fairly made to many of these experiments that the animals are placed in unnatural conditions which inhibit them from developing the full range of their capacities. Of quite special interest in connection with the general problem of the intelligence of the higher animals are the experiments and observations of the distinguished German psychologist Köhler, on a number of chimpanzees which were kept at an experimental station in Teneriffe under very easy conditions of captivity. The apes had the run of a large open-air enclosure, and were allowed to develop a normal social life without undue interference.

The tests applied were simple and based upon a thorough and sympathetic knowledge of their normal behaviour. They consisted generally in setting the animal the problem of attaining a coveted object, say an attractive fruit, which was placed beyond their reach—outside the bars of the enclosure, for instance, or suspended high up from its roof. The use of a stick, or of anything which might function as a stick, to draw the object within reach was grasped at once, and one ape learned to join two sticks together if both were too short. The use of a short stick to draw within reach a longer stick with which to attain the objective also presented little difficulty to the more gifted individuals. Many learned to pile one box upon another in order to reach a high object—the best effort in this direction being a (somewhat ramshackle) construction of four boxes one on top of the other. What was really striking and significant about the experiments, however, was that the apes did not come by the solution of their problems by a random method of trial and error, but by suddenly grasping the situation after a longer or shorter period of puzzlement, and applying a correct solution straight away. Köhler argues very convincingly that these apes must possess a certain power of insight or judgment of the visual situation as a whole; their problem-solving is accordingly a very different thing from the gradual beating out of a solution through undirected effort and chance associations, which is found in the experiments of Thorndike and his school.

Thinking Animals.—In conclusion, a brief reference may be made to the so-called "thinking animals"—the Elberfeld horses, the Mannheim dog and others—which by means of signs can apparently spell out answers to questions and give the solution of mathematical problems. While the phenomena are not yet fully explained, there is a general consensus of opinion that these animals do not really reason, but are in some way guided unconsciously by their trainer—and perhaps by the spectators also. On the question of trained animals in general the works of Hachet-Souplet should be consulted.

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INTELLIGENCE, HUMAN (*see* 14.680).—This name is among the most widely used and hotly disputed in the psychology of to-day. To call any one "intelligent," or one of its synonyms, as "bright," "sharp," "brainy," or one of its antonyms, as "stupid" or "dull," is a universal custom, alike in scholastic work, industrial management and familiar conversation. The word has also long played a very conspicuous part as denoting the alleged distinguishing privilege of the human species.

But by far the greatest excitement has arisen from the claim raised that any person's intelligence can actually be measured by means of mental tests. After some important theoretical work by others (see later on), the first great practical success with these tests was effected by Binet and Simon in 1905. The test-scale devised by them was applied in a great many schools, and it still to this day—with radical revision—continues to be the standard scale, at any rate for young children. But the most startling achievement of the testing (chiefly by means of another scale) was its application to nearly 2,000,000 men of the American Army in 1918. The results proved to be so useful as to elicit a very high eulogy from the American Secretary of War. Since then, the application of one or other of the multiplying scales to schools, universities and other institutions has in most civilised countries extended so widely as to comprehend the greater part of the juvenile population.

What the Tests Measure.—Despite all this outward success, however, there has sprung up much and vehement criticism. The main source of trouble has been that those who are making such mental measurements cannot agree as to what they are measuring, or even as to what they ought to measure. For example, some think that intelligence should include memory, and they therefore introduce into their scales a certain amount of memorizing. But other testers rigidly exclude any such thing. Many—as Binet himself—first declare that memory does not appertain to intelligence, and then nevertheless proceed to make memorizing a conspicuous part of their actual tests. Similar confusion and inconsistency reign about imagination, about attention and about sensory perception; both theory and actual practice are at loggerheads as to whether the tests should include any or all of these. Some authorities go the length of wanting intelligence to embrace, not only the co-ordination of ideas, but equally that of movements. In short, this state of affairs can without exaggeration be called one of complete chaos.

Historical Development.—The key to understanding the situation appears to be supplied by historical considerations. With the old Latin-writing philosophers, intelligence (intelligentia) meant the using of the intellect (intellectus); and the latter word was their rendering of the still older νοῦς. This and sensory perception (αἴσθησις) were regarded as the two great faculties
of man. The sensory perception was his evil genius, tri
him with all manner of appearances and illusions, whils
intelligence opened his eyes to the real truth. But in cou
time other philosophers and psychologists brought into this
ory various complications. By some a further faculty of me
was added on. By others, imagination was honoured in
way. By yet others, attention, and even movement. More
alongside of this tendency to set up various faculties outsi
intelligence, and thus curtail the sphere of the latter, ther
occurred some change in the opposite direction of expandi
sphere; in this way, it was sometimes made to comprehend
sensory perception,—which had originally been regarded
very antithesis.

With lapse of time, these diversified doctrines, each
distinct as handled by the school which advocated it, beg
percolate down to wider and less instructed circles. In so
they became more and more intermingled. What the
eventually evoked in the mind of the man in the street—
too nice about logical consistency—was a confused reverbe
of all the different views. The last phase of the history was
modern psychologists—instead of properly moulding clear
for themselves—complacently took over this old notion
telligence from the popular usage. All went well enough
they began to examine what they had really got into their h
which proved to be a word with so many meanings as practi
to have none.

Definitions.—To cure such equivocality, the natural c
would seem to be a definition. Accordingly, there have
many attempts at this. Most adherents appear to have
gained by the proposal to define intelligence as *conscious a*
ability to new situations (W. Stern). But, unfortunately, no
could be more equivocal than the term "adaptation" i
Admittedly it means a change that fulfils some purpose; b
to whose purpose, and of what kind, nothing is usually
widely divergent interpretations are possible, and actually g
The next most favoured definition has been as *the capaci*
learn (Buckingham). But this "*learn*" is at least as bad a
"adapt." By the dictionary, it signifies the acquirement o
skill or knowledge. But most advocates of this definition
dently mean neither the acquiring of skill nor many for
acquiring knowledge (*e.g.*, memorizing). What they do me
left unstated.

Eduction.—Another interpretation of intelligence has
extensively advocated, namely, as the power to perform wh
called "*eduction*" (Spearman). This is said to have two f
of which the first consists simply in the perceiving of rela
between any two given ideas (taking "idea" in its bro
possible sense). The other form is when an idea and a rel
are given, and from these two there has to be found the co
tive idea. Now, eduction in this sense does escape the ba
equivocality. Also, it has shown itself to be a power of p
mount importance, especially as contrasted with the only o
possible ways of obtaining ideas (namely, by sensation an
reproduction). Moreover, this eduction does seem to ind
something which most persons will admit that they, in usin
word intelligence, are really "driving at."

Difficulties of Measurement.—Any way, even after fitting
term intelligence with the most irreproachable definition t
still remains a great difficulty in accepting the far-rea
claims to have *tested and measured it.* The rub consists in
fact that such a mental power—whichever of the definition
may choose for it, even the last—always admits of being su
vided; hence, a separate measurement would seem to be in
pensable for each subdivision.

Thus, Binet himself admitted that the intellect breaks up
several different faculties, and wrote about these: "The me
faculties of each subject are independent and unequal; wi
little memory there may be so associated much judgment. .
Our mental tests, always special in their scope, are each ap
priate to the analysis of a single faculty" (*Les idées mode*
sur les enfants, Paris, 1910). If he thought this, then wh
he not, why do not his followers, measure each of these indep

culties, memory, judgment, etc., one by one? Furthermore, faculty itself can be divided up. For instance, why should person have a good memory for some things and a bad one thers? And if we push this argument far enough, the red measure- ments would seem to become infinitely numernd therefore incapable of ever being really executed.

sts by Samples.—For this difficulty of measurement there been only two solutions so far proposed that deserve serious deration. The first and most widely known—especially iated with the name of Thorndike—is that the current measure *a representative sample* of the subject's abilities. his view, plausible enough at first sight, does not bear scru- In order to pick any genuinely representative sample of ing, every portion of this must be represented fairly (*see* c). For example, the sampling of a field of potatoes would r from representative if we selected many from some parr areas and few or none from others; we ought to divide the into equal parts, and pick an equal number from each. But e case of mental abilities there seems to be no possible od of settling what parts are really equal.

st Scales.—In a well known test-scale (Yerkes), judgment is to supply three test-elements, whereas ideation supplies one. On what conceivable ground can we settle whether ent is or is not three times as large a faculty as ideation? r test-scales no less arbitrarily reverse this ratio. As for cale of Binet, this even within itself gives the most widely gent ratios between different test-elements when the scale plied to children of varying ages.

efficients of Correlation.—There remains the other serious pt at solution (Spearman). If a large number of people ubmitted to two tests, the degree in which the same persons to excel in both cases can be expressed numerically by is called a coefficient of correlation. If several tests are there will of course be a correlation for each different pair sts. Now, proof has been given that, when the magnitudes these correlations satisfy certain mathematical conditions, and only then the score of each person in each test can be ed into two factors, of which the one has always the same (for the same individual), whereas the other varies independently from one test to another. These two factors have been olised as "g" and "s" respectively.

asurement of "g".—Further evidence has been furnished with suitable tests (of "eduction," *see* above), these mathecal conditions are actually fulfilled. It is easy to see, then, if the tests are made sufficiently numerous, the independent s of the "s" must tend to neutralise one another on an ge, leaving the "g" as a value uniformly characteristic of ndividual. This "g" it is that has actually been measured re or less accurately—by the mental tests now in usage. It t in the least equivocal, for we know exactly under what itions it always occurs. But there still remains the task of preting it; herein it resembles electricity, which was meas- with great exactitude long before its intrinsic nature was approximately understood. In both cases, too, the illumin does not arrive in a flash, but accumulates gradually.

the present moment, "g" seems to be best conceived as a n's "general mental energy," whereas the "s" varying test to test represents so many different mental "engines," any of which (alternatively) the energy can be switched. is "g," then, the "intelligence" receives yet another pos- interpretation. Here, it would not consist in any entire ty whatever, but constitute a factor that enters into multious (eductive) abilities. But whether or not the "g" be sted with this title of intelligence, it at any rate furnished original inspiration for the miscellaneous mixture of testents that currently claim to measure it (in this respect, t appears to have been an unconscious borrower). Also, it lies such tests with their sole genuine justification.

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(C. SP.)

INTELLIGENCE, MILITARY AND NAVAL.—Under this designation may be considered the work of obtaining, collating, interpreting and distributing information, in peace and war, about foreign powers, the countering of foreign powers' efforts to obtain intelligence, and the organisation which performs these duties. Information as to actual or potential enemies, allies and theatres of war, has always been required and obtained by governments and commanders in the field; the employment of spies, the questioning of prisoners, date from the earliest times in history, but never have the scope, and what might be termed the technique of military intelligence, reached such a high degree of development as in the World War.

I. INTELLIGENCE IN PEACE TIME

In time of peace, the relative military power of a nation with regard to other foreign powers, and in particular to its immediate neighbours, necessarily affects its foreign policy. Every government therefore maintains an intelligence system, which generally forms a section of the headquarters staff of its military forces (known in most countries as the General staff), for the purpose of:—

(*a*) Providing its Government with all necessary information regarding the military power of foreign nations;

(*b*) Devising means whereby, in case of war, all essential information concerning the enemy, allies and theatre of war may be placed at the disposal of the commander and troops, and the supply of further information continued throughout the campaign;

(*c*) Preventing the acquisition of information by the enemy.

Type of Information Required.—The fighting power of a nation can only be gauged when accurate and detailed information is available on certain factors, the most important of which are the organisation, strength and power of expansion, armament, tactics and morale of its armed forces, the characteristics of its leaders, its defensive works and fortresses, its communications, such as road, railway, waterway, aerodrome, cable, telegraph and wireless telegraphy systems, its physical and political geography, climatic conditions and economic and industrial resources in relation to military requirements. This information also enables the General staff to prepare, and keep up to date, plans for offensive and defensive operations, together with estimates of the forces required for their execution against any power or combination of powers, with which the particular power, either alone or in co-operation with other powers, might be brought into conflict.

Sources and Value of Information.—The main sources from which information is derived in peace time are statistics and economic data obtained from foreign government publications, from the Press and technical works, foreign training manuals, military and geographical publications and from information procured by the Secret Service.

When war breaks out, this intelligence system provides the commander and troops about to take the field with maps and all available information regarding the theatre of war, the armed forces and military resources of allied and hostile powers, with their special characteristics; this information forms the basis of the plan of campaign, but requires to be supplemented with information concerning the enemy's mobilisation, concentration and order of battle in general. For this purpose preparations must be made beforehand and an intelligence organisation provided for the troops in the field; the intelligence section therefore lays down the foundation of the intelligence organisation required in war and makes arrangements for expansion by training the special personnel required.

II. INTELLIGENCE IN WAR TIME

In war, the greatly increased activities of the home or headquarters intelligence service are mainly directed to areas outside the theatre, or theatres, of operations. In the latter, the armies in the field are provided with intelligence services of their own, who form an additional source of information for the home intelligence service, which is responsible for the further collation and distribution of the information thus received.

Field Organisation.—In the field, the intelligence section of the General staff collects and collates all information regarding the enemy's forces and intentions and the theatre of war, supplies to the commander, staffs and fighting troops all information which will assist them in preparing and carrying out plans for the defeat of the enemy and endeavours to prevent the acquisition by the enemy of similar information. To be of practical value, the information supplied must be relevant, furnished in time to be of use and in such form as will admit of its immediate application by those concerned. These conditions require the closest co-operation and mutual understanding between the intelligence and operations sections of the General staff. The developments, technical and otherwise, of modern warfare have placed at the disposal of the intelligence section many resources for collecting information which were not available prior to the 1914–9 campaign. Intelligence in the field has become a large and intricate organisation, the varied and complex nature of whose duties necessitates the employment as assistants to the General staff proper, of a large number of highly trained specialists.

Knowledge of the enemy's intentions is of supreme value to a commander, and the intelligence section should therefore possess throughout the campaign early, accurate and continuous information regarding the enemy's "order of battle," his movements of men and war material, his tactical method, armament and equipment, the organisation of his defences and rear services, the topography of the theatre of war. The relative value of these different classes of information varies with circumstances; the character of the operations may change at any moment from open warfare to stabilised warfare, or the reverse; an intelligence service must therefore be elastic both in method and organisation. Method, accuracy and speed are essential for the collection, reception, transmission and collation of information, but this work is of no value unless timely deductions can be made from the evidence available. The making of deductions, appreciations and forecasts both as to the probable action of the enemy and the prospect of successful operations undertaken by its own troops is the most important duty of an intelligence section. Its true function, in fact, is to represent the operations section of the enemy, for broadly speaking it provides all information concerning the enemy, the allies and the theatre of war, whilst the operations section provides similar information regarding the troops of its own army.

Scope and Nature of Information.—Information regarding the enemy's "order of battle" is of paramount importance. It includes the organisation, composition and strength of hostile formations, the direction of their initial concentration and subsequent movements, their distribution, morale and fighting efficiency, the characters of their commanders, methods of recruiting and man-power available to replace wastage. The identification of units is the foundation of all "order of battle" intelligence. Movements of men, supplies and material on a large scale normally portend some important development or a change of the enemy's plans, but as they must take place along organised lines of communication are difficult to conceal. Detailed knowledge of the enemy's system of communications and means of transport is therefore essential; the capacity of railways, quality of roads, navigability of waterways at different seasons, system of aerodromes and auxiliary landing grounds must be carefully studied if reliable conclusions are to be arrived at regarding the size of any movement and the time required for its execution.

Full information regarding the tactics and armament of the enemy at the outbreak of war is usually available by the study of his peace training and organisation; but his methods of employing troops and their weapons in the field must be followed very closely in order to discover new developments as early as possible. In the World War full knowledge of each others' pre-War tactics and armament was possessed by the opposing armies, but almost from the beginning of hostilities modifications and new ideas were introduced, which frequently provoked counter measures. Instances were the employment of poisonous gases, flame and gas projectors, "storm troops," Stokes mortars and tanks. All the economic resources of a State may be requi
meet the strain of a prolonged campaign, and accurate k
edge regarding these resources is one of the means of gaugi
enemy's staying power.

Sources and Means of Collecting Information.—The main so
of information are prisoners, deserters, local inhabitants, cap
documents and material, land reconnaissance and observa
hostile signalling communications, air reconnaissance and
tography, the enemy and neutral Press and agents; the pri
agencies for its collection are the fighting troops, the signal se
aircraft and secret service. The information, whether po
or negative, acquired by contact with the enemy is that on
every commander mainly relies in making his tactical
Hence, to keep the enemy under such close and continuou
servation that he can make no movement without being det
is the primary object of all reconnaissance, whether o
ground or from the air.

Ground reconnaissance may be purely topographical, *e.g*
acquisition of unmapped information about the ground; it
be tactical, *e.g.*, to discover the enemy's positions, the str
and distribution of his defences, his tactics, movements an
tentions; or for the purpose of obtaining "identifications,"
information about the hostile troops in line, their morale, a
ment and equipment, by the capture of prisoners or docum
These objects are achieved by sending out mobile troops, p
or raiding parties, or by observation from fixed points. The
may be visual or instrumental.

Visual observation for intelligence purposes is an orga
system for the observation of all enemy activity within the
of vision of its observation posts by trained observers pro
with a special equipment of maps, telescopes, periscopes,
its elements being generally so placed and co-ordinated tha
exact location of the enemy activity recorded can be fixe
intersection, *e.g.*, "flash-spotting." Instrumental observa
is mainly automatic, by instruments disposed to receive, t
form and transmit impulses from outside, *e.g.*, sound-ra
installations, electrical listening posts, wireless interception
direction-finding apparatus.

Air Reconnaissance.—Information from the air is derived
balloon observation, aeroplane reconnaissance and air ph
raphy. The development of air reconnaissance and ph
raphy has to a great extent revolutionised the whole servi
military intelligence in the field; not only are aircraft capab
assuming the duty of strategic reconnaissance, but the ca
has made it possible to obtain, particularly in position wa
a far more detailed and exact knowledge of the enemy's sy
of defence, communication and supply than has ever been
sible before. The principal weakness of air reconnaissance
photography, however, lies in their necessary dependence
the weather.

Balloon observation is used principally for the observatio
movement by road, railways, and in back areas, of defence wo
the location of hostile batteries and the observation of h
artillery activity. Aeroplane reconnaissance is used at the begi
of a campaign to locate the direction of the enemy's main concen
tion, to report on the movements and activities of the ene
troops; and subsequently to supply information on the la
tactical dispositions, the construction or destruction of bridges,
construction of new defences, etc.

Strategical reconnaissance involves long distance reconnaissa
extending frequently to distances exceeding 100 m.; they are us
carried out by single aeroplanes flying at such an altitude a
minimise the chance of hostile interference; at this height, m
ments of troops on the ground are unnoticeable, and the inform
gained is largely confined to reports of railway movements, act
at important junctions, formations of large camps, etc. It is o
necessary to fly at medium altitudes and to employ formatio
aircraft capable of dealing with air opposition, to obtain mor
tailed strategical information. Tactical information can only b
tained in sufficient detail by aircraft flying low (close reconnaissa
who can be expected to distinguish troops in the open and artill
in action, can dive near enough to the ground to clear up a
nite point, such as the existence of a machine gun emplacement
whether a trench system is occupied or not.

Photography forms an essential part of all air reconnaiss
Even in the cases of reconnaissances at high altitudes photogra
may be expected to show road movements, tracks, camps,

, battery positions, dumps, hospitals, light railways, telegraph
and other signs of military activity, while in the case of close
naissance carried out at lesser altitudes, photographs taken in
rable weather enable experts to discover the smallest details
enemy's defences.

III. THE SECRET SERVICE

e secret service supplies information regarding matters
d the enemy's front, and in his home territory, including
gth and location of reserves, rear defences and lines of com-
cation, internal conditions in the enemy's country and the
of his resources in man power and material.

ret Service Methods.—The methods employed in this branch
telligence work can only be referred to in general terms.
lly speaking, its duties are:—

Offensive, in the acquisition of information by means other
those described in Sections I. and II. above;
Defensive, in the prevention of the acquisition by foreign powers
ormation regarding the forces of its own country.

e duties of the offensive section, to which alone the name of
t service is popularly applied, are similar in peace and war,
var increases the importance, and with it the difficulties and
ers of the work of secret agents or spies.

ents work *à poste fixè*, on definite missions or on general roving
nissions; they penetrate into enemy territory through the ports,
guise of peaceful neutrals armed with all the necessary papers,
t there by other means, which in war include penetrating the
y lines, either in uniform or mufti, during the progress of an
n; landing behind them from an aeroplane or free balloon or
ng a frontier guarded by sentries and electrified wire. False
s, disguises, secret ink and all the other tricks beloved of the
ovel may form part of their equipment, but in practice, the
dangerous and efficient spy is the least sensational in his meth-
when arrested he invariably has all his papers in order, and is the
plausible person alive. An espionage system in war involves the
oyment of many thousands of men, women and even children
grades of society and of all professions: post-boxes, smugglers,
s, train watchers, pigeon men, couriers, runners, etc. All have
part to play, and that part, far from being ignoble, may be, if
ted by patriotism, as noble, as dangerous and as heroic as any
d in the armies in the field.

ntre-espionnage.—The duties of the defensive section, popu-
described as *contre-espionnage*, are also the same in peace
ar, but the machinery and methods vary when carried out
ome territory, in occupied enemy or allied territory.

e *contre-espionnage* section in home territory commands in
and war all the assistance of trained police, censorship, port
ol, hotel registration, the erection of arbitrary barriers such as
bited areas and of all the preventive measures which are the
ome of years of experience in combating enemy espionage under
onditions. In occupied territory, intelligence in the field equally
s these powers, and, in addition, the arbitrary powers of an
oying army, but the whole population is potentially hostile. In
l territory the difficulties are greater, as it is the ally who con-
in his own home territory all the real preventive machinery.

ne object of *contre-espionnage* is, first and foremost, preven-
Information may be gained by the enemy's agents equally
one's own troops and from the civil population; the former
sell or convey information deliberately, but will more prob-
convey it to the enemy's agents through indiscretion.

Leakage" may occur in several ways; gossip about impending
ations among the troops, especially when on leave and out of
ine; indiscreet conversations, messages and misuse of code on
telephones and telegraph; marking of railway trucks, transport
billets, with inscriptions giving identifications of units; indiscre-
in correspondence; careless handling of confidential papers and
s; taking orders, codes, books, papers of any kind, even private
rs into the front line; wearing of badges and numbers, which
al identifications and in many other analogous ways.

he *contre-espionnage* section is also responsible for the con-
of the civil population. This involves the control of circu-
n, of the use of telegraph, telephone and other methods of
munication, which might be utilised by enemy agents.

(T. G. G. H.)

TELLIGENCE TESTS.—An intelligence test or intelligence
nination is an instrument to measure the amount of intelli-
e shown by a human being or a lower animal. The instrument consists of a series of questions to be answered, or directions to be followed, or things to be learned, or intellectual tasks of any sort to be performed. Intelligence or intellect may be defined as the ability to perform intellectual tasks; and an intelligence test is a specially instructive sampling of such tasks.

Sample Tests.—The tasks shown below are representative of those used in standard intelligence tests.

"Show me your nose. Put your finger on your nose." Same with eyes, mouth and hair. Three responses out of four must be correct.

What is the difference between: (*a*) Laziness and idleness; (*b*) Evolution and revolution; (*c*) Poverty and misery; (*d*) Character and reputation.

Repeating three digits. After some explanation and practice, the person tested is asked to say 6-4-1, then to say 3-5-2, then to say 8-3-7. The test is passed if one series out of three is repeated without error, after a single hearing.

Repeating six digits reversed. The series used are 4-7-1-9-5-2, 5-8-3-2-9-4 and 7-5-2-6-3-8. The test is passed if one series out of three is repeated without error.

Tom runs faster than Jim. Jack runs slower than Jim. Which is the slowest of the three?

John said: I heard my clock strike yesterday, 10 minutes before the first gun fired. I did not count the strokes, but I am sure it struck more than once, and I think it struck an odd number."

John was out all the morning from the earliest hours; and his clock stopped at five to five the same afternoon.

When do you think the first gun was fired?

After some explanation and practice, the person tested is asked to "Finish what I say." At night you sleep in . . . . Mary has a ring on her. . . . You wear gloves on your. . . . You wear a . . . on your head.

The . . . of character is its ability to . . . liberty . . . from licence. Judicial decisions are of . . . or less authority as precedents . . . to circumstances.

A person who has been tested in respect of an examination consisting of from 50 to 200 such tasks may be given a score, and so be put in comparison with all others who have been tested with the same collection of tasks.

Intelligence Quotient.—Subject to certain limitations, the score may be expressed in terms of a mental age, that is, the age at which the average child is able to attain it. Thus if John Doe, aged 12·0, scores 118 in the national intelligence examination, and if the average child of age 13·1 attains a score of 118 in this examination, John Doe has a mental age of 13·1 years. John Doe's intelligence quotient, or I.Q., is his mental age × 100 divided by his chronological age, that is $\frac{13{\cdot}1\times 100}{12{\cdot}0}$, or 109.

This form of statement is useful for individuals whose scores are not higher than those made by the average child of 14, and whose chronological ages are not over 18. For higher levels and later ages the method is of doubtful value.

The score may also be expressed in terms of the percentage of some defined group who would attain lower scores than it. Thus, if 71% of persons aged 12·0 score lower than 118, and 29% score higher, in the national intelligence examination, John Doe may be recorded as in the 71 percentile for his age. This method is especially useful in the case of the higher levels of intelligence and adult ages. A more refined measure of this type expresses any individual's score as a plus or minus deviation from the average for some defined group in terms of the variability of that group as a unit. The technique by which this is done is beyond the scope of this article.

Systems in Use.—There are 30 or more such intelligence examinations now in use. Some, like the Pintner-Cunningham Primary Tests, are adapted to measure very young children aged two to five years. The National Intelligence Examination is designed to fit the intellects of the level of ordinary children from nine to 15. The Terman Group Test is especially suited to measure young people from 14 to 20. Some, like the Thorndike Examination for High-School Graduates, are adapted to measure gifted adults. Some, like the Army Group Examination Alpha, require an ability to read and write; some, like the Binet, are given orally; some, like the Army Beta, are largely independent of language. Some, like the Otis group Intelligence Scale, measure chiefly intellect as it operates with words and numbers and abstract relations; some are more concerned with information about things and persons. In some, the speed of response counts a great deal in determining the score made; in others, it counts very little, the time allowed being sufficient to permit almost everybody to do almost everything of which he is capable.

Historical Development.—Existing instruments for measuring intelligence developed from three roots: the tests of sensory acuity, memory, attention and the like devised in the early history of psychology; the interview, as of physician with patient or employer with candidate for employment; and the school examination. Galton, Cattell and Binet were pioneers in this field of psychology. Sir F. Galton's *Inquiries into Human Faculty* (1883) presented the general problem of the measurement of individual differences; and he soon thereafter set up in the South Kensington Museum in London a laboratory where any person could be measured in a series of physical and mental traits. Under the influence especially of Cattell, many short examinations or "tests" of special mental powers were devised and rather widely used in the United States from 1890 on. Important work was done by Kraepelin and Ebbinghaus in Germany. An eminent French psychologist, Alfred Binet, using the general form of an interview between physician and patient, enriched by suggestions from psychological tests proper, produced in 1905 what may be called a standardised interview, consisting of 30 questions and tasks, many of which were chosen from the tests of special powers now familiar to all psychologists. This "metric scale of intelligence" was further improved and divided into age levels in 1908, and finally revised in 1911. Many variations of it have been used in different countries.

While Binet was developing a scientific interview and record and score, various psychologists in America were testing children in groups by means of printed collections of tests. The next step was the arrangement of such a collection in a standardised unitary examination, after the general plan of written examinations in school subjects. One of the earliest and by far the most influential of such arrangements was the group examination Alpha prepared in 1917 for measuring recruits in the U.S. Army. This examination was taken by nearly 2,000,000 men, large groups (sometimes over 1,000) being sometimes examined at one time and place.

Modes of Use.—Since then, intelligence examinations have increased rapidly in number, have become diversified in nature, and have been much improved in respect of convenience in giving and scoring. They are widely used, especially in the United States, as an aid in the proper grading and classifying and treatment of school children; and in studies of special groups such as defectives, delinquents and dependents. The methods used in conducting intelligence examinations are also being applied to examinations in school subjects, producing the so-called "new-type" examinations and educational achievement tests. At least 1,000,000 such examinations were made in the case of school children alone in the year 1925. Some of the leading American universities require an intelligence examination as a part of the general admission requirement.

In spite of notable improvements during the last 20 years, existing instruments for measuring intelligence suffer from serious deficiencies. Just what they measure is not known; how far it is justifiable to treat the scores by ordinary arithmetic is not known; just what the scores signify concerning intelligence in general is in dispute. An intelligence examination is still a more or less undefined collection of tasks, its score is still a somewhat arbitrary summation of credits, and the correspondence of the scores to the abilities which they purport to measure is still far from perfect. Psychologists are working to supply these deficiencies, seeking to replace the undefined collections of tasks by tasks rigorously defined in nature and graded by a true scale of intellectual difficulty, so that the score may mean the precise height of intellectual difficulty which the person in question can master (*see* EXAMINATIONS).

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INTERNAL COMBUSTION ENGINES.—For the evoluti the internal combustion engine from its first appearance in tical form as the Otto Silent Gas Engine of 1876 down t year 1910 *see* the articles GAS ENGINE and OIL ENGINE (1 and 20.35).

The essential feature of all internal combustion engines i exceedingly rapid combustion, or explosion, within the wo cylinder itself, of a mixture of air and some inflammable g vapour; great heat is liberated by the explosion and this c a correspondingly great rise of pressure in the working mi which then drives the piston forward, so performing the wo stroke. All present-day internal combustion engines op upon either the Otto (de Rochas) four-stroke, or upon the (type two-stroke cycle; in the first of these only one wo stroke, per single-acting cylinder, occurs in every alternate lution at the crankshaft, while in the second a working s is obtained in each revolution.

The types from 1910 are conveniently referred for descri purposes to five groups, viz.:

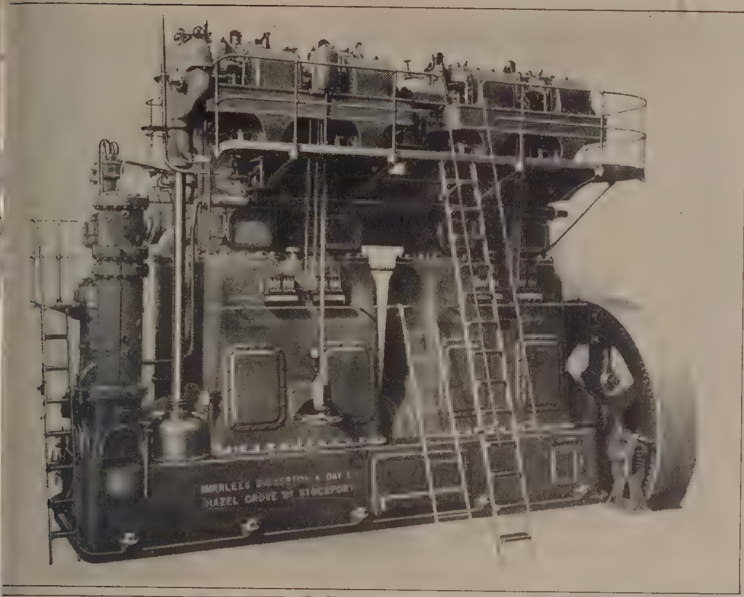
Large gas engines (exceeding, say, 400 H.P.).
Medium gas engines (less than about 400 H.P.).
Engines using heavy oils as fuel.
Engines using light oils as fuel.
Special types.

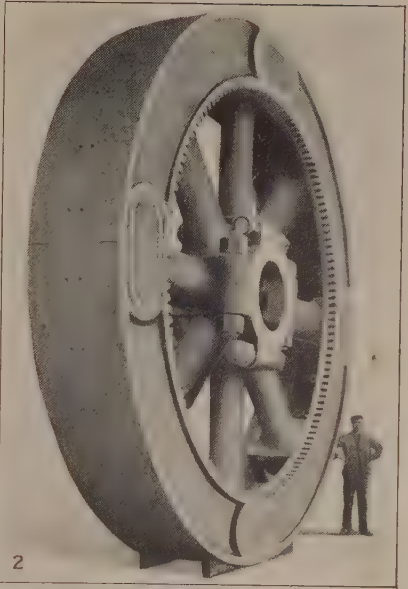
Large Gas Engines.—The changes in this class between and 1925 consisted almost wholly in improvements in deta the extended employment of waste substances as fuel for th producers; in the employment of high-tension electrical met of ignition; in better cooling and governing arrangements, The increase in the number of gas engines of the inverted-v cal multi-cylindered, quick-revolution, floor-space-saving ty also noteworthy.

The large, horizontal, slow-speed type is illustrated by Nürnberg, or M.A.N., four-stroke, single-cylinder or tandem twin-tandem, double-acting engines commonly using as producer gas, coke-oven gas, blast-furnace gas or natural One notable installation in Japan includes four horizontal t dem double-acting, single-crank, four-stroke cycle engines, e direct-coupled to a 1,500 kw. alternator.

The cylinders are $47\frac{1}{4}$ in. diameter and the stroke is $51\frac{1}{8}$ each engine is capable of developing 2,500 H.P. at 100 r.p. the fuel used is Mond producer gas, the producers (with ammo recovery) yielding 111,000 cu. ft. of gas per ton of Japanese c These engines are very massive; each cylinder weighs 25 to the fly-wheel 100 tons (see fig. 2 on plate) and the compl engine about 400 tons. At full load the consumption of fuel about 1·8 lb. per kw. hour. Among other similar installation that at the San Mateo power station of twin-tandem, dou acting, horizontal four-strokers, each unit containing four c inders, 42 in. diameter x 60 in. stroke, and developing 5, B.H.P. at 90 revolutions per minute. The M.A.N. type, thou large and heavy and occupying considerable floor space, is ceedingly reliable and economical; thus, a 2,000 H.P. M.A. engine using blast-furnace gas ran day and night during months; in 13,870 consecutive hours the engine actually r during 13,687 hours, *i.e.*, 98·6% of the whole time; and the st pages were due not to the engine but to repairs necessary to t blast furnace. A third noteworthy large installation has 17 ho zontal, twin-tandem, double-acting, four-stroke M.A.N. ty engines, capable of an aggregate output of over 50,000 hor power.

Large Two-stroke Gas Engines.—The large two-stroke Cle cycle engine has also found considerable favour in the horizont designs at Koerting and Oechelhauser. (*See* 11.499–500.)


MIRRLEES BICKERTON & DAY L
HAZEL GROVE Nr STOCKPORT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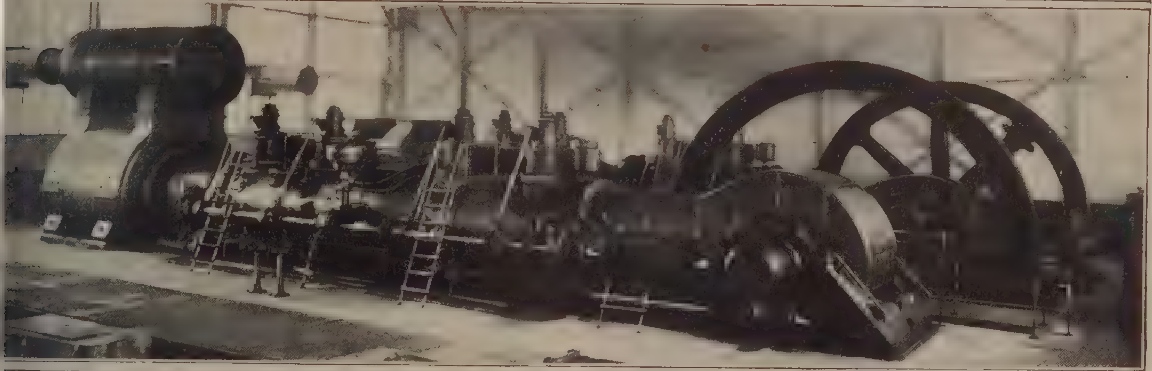

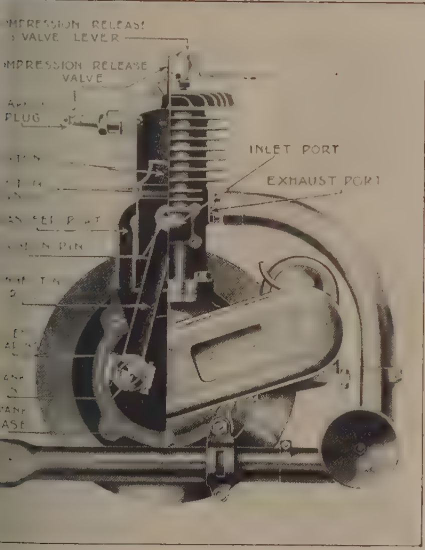
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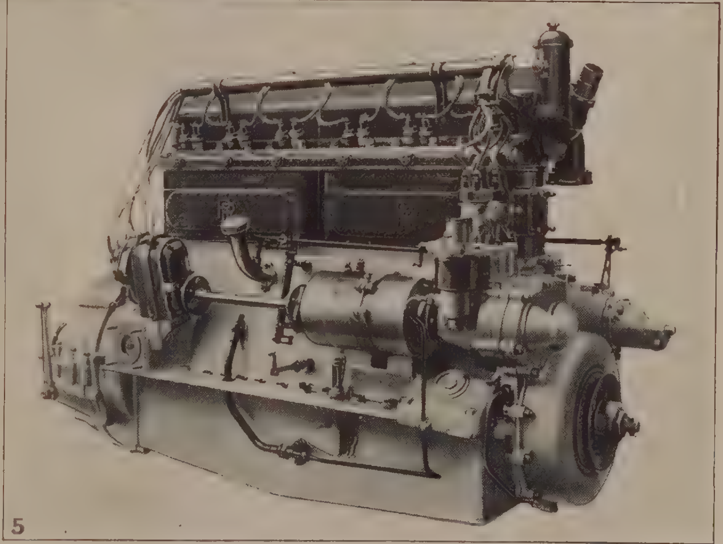
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1. 500 B.H.P. 4-cylinder Diesel engine. Fig. 2. Flywheel of 2,500 B.H.P. horizontal gas engine; approx. weight, 100 tons. 3. 3,000 B.H.P. Galloway twin-cylinder horizontal gas engine. Fig. 4. Part sectional view of modern air-cooled single-cylinder, two-stroke engine, with principal parts named. Fig. 5. Latest type Rolls-Royce 40–50 H.P. car engine.

(Fig. 4. By courtesy of "The Motor Cycle." Fig. 5. By courtesy of Messrs. Rolls-Royce Limited.)

rting.—The double-acting, two-stroke Koerting engine,
s characteristic very long water-cooled piston and central
exhaust parts has been built in England in units of up to
H.P., with cylinders $37\frac{3}{8}$ in. diameter x 63 in. stroke, run-
t 70 r.p.m., while on the continent of Europe units giving
H.P. per cylinder 42 in. diameter x 55 in. stroke x 80–90
have appeared; the Koerting type engines installed at
o aggregate 40,000 horsepower. The American Worth-
Co.'s first large inverted-vertical, cross-head-type, double-
, two-stroke engine, built in 1924, using oil as fuel in the
manner, employed the Koerting type piston.

elhauser.—The manufacture of this type of single-acting,
roke, opposed-piston, open-cylindered, internal combustion
has been greatly stimulated by the ingenious arrange-
adopted by Mr. Fullagar, who has retained the character-
dvantages of the type and has obtained in addition marked
ny in space, weight and production cost by associating
echelhauser cylinders side by side with cross-over piston
ng rods, as his power unit. The Fullagar engine is built in
nd mainly for marine purposes, using heavy oil as fuel in
iesel manner.

tical Gas Engines.—The considerable bulk and weight of
rizontal slow-revolution large gas engine has caused much
ion to be devoted to the faster-running, multiple-cylin-
, inverted-vertical type occupying much less floor space
f diminished bulk and weight. Prominent among builders
s type is the National Gas Engine Co. of England, who
a series ranging from a 4-cylinder, 2-crank, single-acting
troke, inverted-vertical tandem design of 300 B.H.P. at
p.m. to a 12-cylinder, 6-crank similar design of 1,500 B.H.P.
ng at 200 revolutions per minute. One installation of these
nal engines aggregates 11,500 horsepower. Horizontal
ple-cylindered engines are also built; one British installa-
ncludes six 500 H.P. four-cycle, four-crank, single-acting,
ntal, four-stroke engines running at 190 revolutions per
te. Fig. 3 on plate illustrates a horizontal gas engine
two cylinders in tandem, working on a four-stroke cycle.

dium Gas Engines.—In gas engines of less than about
H.P. no essential change has occurred; there is a steady
it by many builders of a practically standard type of four-
e, horizontal, single-acting, single- or double-cylindered
e using coal gas or suction-producer gas as fuel, and em-
d in a great variety of services by the smaller classes of
r users. Designs of two-cylindered engines range in power
about two up to some 300 H.P. or over. The gaseous
s provided by many more or less waste substances, includ-
ituminous slack, peat, scrap wood, sawdust, straw, cocoa-
usks, etc. These smaller gas engines, in conjunction with
rn plant producing gas from industrial and vegetable refuse,
ery valuable in enabling complete power plants to be in-
d and successfully operated by native labour in situations
te from civilised centres.

gines Using Heavy Oils.—It is in the entirely successful
f heavy oil (petroleum oils having a flash point exceeding
t 73° F.) as fuel in internal combustion engines that the
est advance was made from 1910–25; this applied to all
s of engines, from the smallest to the greatest, and particu-
to the exceedingly important and rapidly extending marine
cations where, owing to their relative compactness and the
nce of boilers and bunkers, the space occupied by the pro-
ng machinery is greatly reduced.

he earliest heavy-oil engines as, for example, those of Priest-
(1885), Samuelson, Thornycroft, Gardner and others, in-
d a vaporiser, heated by an external blow lamp, in which
uel was gasified, and then, mixed with a suitable volume of
air, exploded within the working cylinder by a hot tube.
pression pressures were necessarily low to prevent detona-
and the fuel consumption was correspondingly high. Next
Akroyd Stuart's (1886–90) epoch-making invention,
ssfully embodied in the Hornsby-Akroyd oil engine, of
ing the hot walls of an unjacketed vessel (communicating
gh a restricted passage with the water-cooled combustion chamber of the working cylinder) first to vaporise the charge of oil fuel pump-injected into it during the air-suction stroke, and then *automatically* to ignite the resulting charge of oil, vapour, and air at the end of the compression stroke. Equally important was the progress made by the Diesel engine (see fig. 1 on plate) from 1893 in both four-stroke and two-stroke designs; the essential feature of the true Diesel is defined as the injection of the oil fuel directly into the water-cooled combustion chamber at, or about, the end of the compression stroke; air alone is compressed to a pressure of some 500 lb. per sq. in., the resulting high temperature automatically igniting the explosive mixture of air and oil spray; the fuel feed is so regulated that combustion proceeds at approximately constant pressure during a small part of the working stroke.

The oil fuel was for long sprayed into Diesel engines by an air blast at a pressure of up to 1,000 lb. per sq. in., involving compressing plant costly in production and maintenance; moreover, the high compression pressure employed necessitated extremely strong and heavy parts, and an extraordinary refinement in workmanship in order to achieve permanently satisfactory running. The efficiency attained was, however, remarkable, and considerably greater than that of any other form of internal combustion oil engine. These practical drawbacks soon resulted in the production, for smaller powers, of a large, varied and important class of engines usually termed semi-Diesels, in which the charge of heavy oil fuel is sprayed, usually by a small force pump, into the combustion chamber at or about the instant of maximum compression. The heat of an uncooled portion of the combustion chamber wall, aided by the heat generated by the moderate compression of the air, then ignites the charge automatically as in the well-known Ruston C.C., and in the two-stroke Bolinder "hot-bulb" marine engine, as used in so many trawlers, and in ocean-going boats of up to 1,000 H.P. in two units. The semi-Diesel engines combine many of the advantages of the Akroyd and Diesel types in a practical manner, and show considerable economy in running.

More recently, about 1924, it was discovered that the "hot-bulb" or "hot-spot" in the combustion chamber could also be dispensed with, allowing the whole to be water-cooled as in the vertical, Vickers-Petter, two-stroke, two-part, heavy-oil, C-type engines which are built in sizes up to 500 H.P. running at 250 r.p.m., with six cylinders. In these the charge of oil is pump-injected into a completely water-cooled combustion chamber of approximately spherical form about one-half the diameter of the working cylinder; the compression employed, though much lower than that usual in the Diesel engine, is yet great enough to cause automatic ignition of the charge, and to ensure an economical use of the fuel; the cheapest grade fuel oils are used in these engines, having a flash point above 150° F., and otherwise also in accordance with B.E.S.A. specifications. The consumption of oil at full load in the larger engines is stated to be not more than 0·43 lb. per B.H.P. hour (*see* Marine Engineering). The progress evidenced in the application of the internal combustion engine to marine purposes of all types was of a revolutionary character during the period here contemplated, and continued at a constantly increasing rate; at the end of 1925 all the great British marine engineering companies had taken up their manufacture.

Engines Using Light Oil.—This comprises the petrol motor now applied universally to the propulsion of all types of road and land vehicles, aircraft, small motor-boats, farm tractors and miscellaneous small services. For road, land and air service they were still, in 1925, almost all four-strokers, with the exception of cars in the United States, where the six-stroker is equally popular except in the lightest classes, *e.g.*, motor-cycles, small motor-boats and a few light cars in which the simple three-port two-stroker had become well established. The progress of the petrol engine from 1910 consisted mainly in the perfecting of details of design, improved carburation, charging and ignition, in lighter moving parts, and in the commercial production of fuel mixtures free from liability to cause detonation or "pinking," thus enabling much higher revolution speeds to be maintained and greater mean effective pressures reached. The success attained is indeed remarkable, tiny petrol engines rivalling in efficiency large, high-powered engines of almost any other type. Small engines of racing type have been run in contests at well over 6,000 r.p.m., *i.e.*, upwards of 50 complete cycles per sec.; and tiny four-cylinder four-stroke engines of only 2·2 in. bore and 3 in. stroke were in extensive use in small "occasional four-seater" motor cars capable of speeds, on the track, of fully 80 m. per hour! A number of very encouraging attempts have recently been made to increase power outputs still further by aid of super-charging devices. At the British Motor Car Show of 1925, 65% of the vehicle engines were four-cylindered: 27% six-cylindered: and 5% eight-cylindered. Side by side valves were fitted in 45% and overhead valves in 44% of the exhibits.

Producer Gas Lorries.—A post-War development of much interest and potential value is that of driving heavy motor lorries by small high-speed internal combustion engines of the usual type, but using as fuel gas supplied by specially designed very small suction producers mounted upon the vehicle, and using anthracite, coke, charcoal, etc., as their fuel; encouraging progress has been made in this direction.

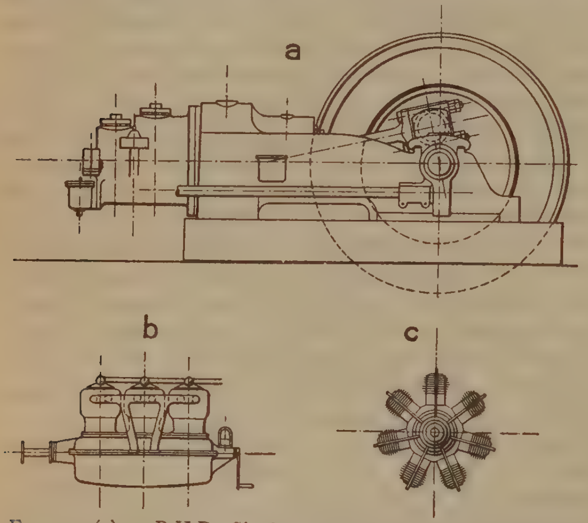

FIG. 1.—(*a*) 75-B.H.P., Single-cylinder Horizontal Engine. 200 R.P.M. Weight 200 lb. per B.H.P. Total 15,000 lb. (*b*) 75-B.H.P., 6-cylinder, Vertical, Water-cooled Aero Engine. 1,200 R.P.M. Weight 5½ lb. per B.H.P. Total 410 lb. (*c*) 75-B.H.P., 7-cylinder, Rotary, Air-cooled Aero Engine. 1,200 R.P.M. Weight 2¾ lb. per B.H.P. Total 205 lb.

Engines for Aircraft.—Characterised by their extreme lightness, these internal combustion engines display the utmost skill in design and refinements in manufacture, and important advances have been made in all details since 1910. (*See* AERO ENGINES; AERONAUTICS.)

Special Types.—Among special types of internal combustion engines may be mentioned the Humphrey pump. In 1913 an installation of five large Humphrey pumps at the Chingford reservoir of the Metropolitan Water Board commenced operations; this plant is capable of dealing with 180,000,000 gal. daily, a quantity exceeding the whole daily supply of Greater London. At the end of 1925 these pumps continued in regular service, and a second similar installation was in course of erection in Australia. The construction of a 1,000 million-gallon-per-day plant near Alexandria (Egypt) was commenced, but was not completed on account of the outbreak of the World War.

A second recent design of internal combustion engine of much interest is the Michell crankless engine oil-operated in the Diesel manner. In this engine the working cylinders are grouped symmetrically around the driving shaft, with their axes all parallel to the shaft axis, and the rotation is effected through a "swash-plate," or inclined disc affixed to the shaft upon which the several pistons act through a bearing "pad" of the well-known Michell thrust-bearing type. Engines of three, four, five, seven
and eight cylinders have been built, both of single-end
double-ended type. An eight-cylinder Michell engine of
recently built, showed on test a mechanical efficiency of
full load. The extremely great difficulties of the intern
bustion turbines still remain to be overcome, and little or
progress can be recorded in this type of motor during the
herein reviewed. (G. A.

INTERNATIONAL LABOUR ORGANISATION, THE.—T
ganisation was created in 1919 by Part XIII. of the Tre
Versailles, headed "Labour." This part was reprodu
all the later peace treaties, appearing as Part XIII.
Treaties of Saint Germain, Neuilly, Trianon, and Part
the Treaty of Sèvres. These treaties are the first known to
to contain articles dealing with labour.

I. ORIGIN AND CONSTITUTION

The idea of protecting labour by international conve
is in reality not a new one. Strictly speaking, its origins mi
traced back to the humanitarian theories of a handful of th
who over a century ago foresaw the necessity of estab
economic co-operation among the nations in order effectu
remedy the evils which might spring from the develo
of modern industry. The name of Robert Owen is often
as a pioneer of international Labour legislation on account
two memoranda which he submitted to the Congress of A
in 1818. In reality, although Owen was indisputably a p
of protective legislation for national, wage-earning L
his memoranda do not contain the idea of an understa
between governments for the establishment of identical
tive measures in favour of their wage-earners. A French
trialist, Daniel Le Grand, attempted to promote this
between 1840–60. But it was only after 1890 that
governments began to show an interest in it. A conference w
in Berlin, convened by the German Govt., but it confined it
enunciating a few very general principles. At last, in 1900 th
took form when a private organisation, encouraged and subs
by certain governments, was formed under the name
"International Association for Labour Legislation" (Ass
pour la prot. légale des Travailleurs) with headquarters at

In 1903 a technical conference summoned by the Asso
worked out two draft labour conventions, the one dealin
the limitation of night work for women in industry, the
with the prohibition of the use of white phosphorus in the
industry. In 1906 a diplomatic conference adopted these
and a few states ratified them. A new technical conf
was convoked in 1913 to regulate by new conventions the
hibition of night work for young persons employed in in
and to fix a 10-hour working day for women and young pe
The second diplomatic conference was due to assemble i
autumn of 1914. Meanwhile, the World War broke out.
the work which was taken up again and officially consecrat
the peace treaties which concluded the War of 1914–8.

Labour in the Peace Treaties.—It may be asked why c
dealing with the protection of labour were inserted in the
treaties. The pre-War movement in favour of protection of l
was not in itself strong enough to enforce it. In most coun
it was the work of intellectuals, legal experts, or politicians.
few exceptions (*e.g.*, Germany), the workers' organisations
little interest in it. But in almost all the belligerent State
War brought into prominence the share taken by the wo
classes in national defence and national life. The worker
came conscious of this fact. As early as Sept. 1914 a mani
of the American Federation of Labour declared that peace sh
not be signed without the participation of representativ
Labour. In July 1916 at a conference at Leeds, of the trad
ions of the Allied countries, again in Oct. 1917 at a confere
the trade unions of the neutral countries and the Central Po
at Berne, then again at the conference of the inter-Allied S
ists at London in Sept. 1918 the same idea was again taken

"The Treaty of Peace which will end the war and will a
to the peoples political-economic liberty and independen
said the London Manifesto, "must also safeguard the wo

f all countries from the attacks of international capitalist iton and assure it a minimum guarantee of moral and d order as regards labour legislation, trade union rights, on, social insurance," etc.

ediately after the War these tendencies grew far more pro- d. Revolutions had broken out in the conquered coun- nd their character had been invariably social. In the ous countries the leaders of the governments pronounced, rdance with the general feeling, that "the old world must ind that the working classes must receive a new place in tional communities. In Feb. 1919, at Berne, the trade of all European countries, allied, neutral, or defeated, d a labour charter and suggested that the old association, s labour office, should be transformed into a great official ation of international labour legislation. A few days (Jan. 29 1919) the peace conference had resolved to con- a commission for international labour legislation under esidency of Samuel Gompers, and had called on it "to e into the international means necessary to secure common on matters affecting the conditions of employment." The ssion sat from Feb. 1–March 24 1919. It worked out a text having been adopted by the peace conference on April 11 1919, became Part XIII. of the Treaty of Versailles.

iciples and Procedure of the Organisation.—A preamble head of Part XIII. defined as follows the principles which irth to the organisation.

> niversal peace, which it is the object of the League of Nations blish, can be established only if it is based on social justice, cial justice implies the working out of equitable conditions of which it is urgently necessary to apply.
>
> he regulation of labour conditions can be accomplished only tionally because "the failure of any nation to adopt humane ons of labour is an obstacle in the way of other nations which to improve the conditions in their own countries."
>
> he equitable conditions of labour, and the "humane condi- f labour," which must be applied were defined: the establish- of a maximum working day and week, the prevention of loyment, the provision of an adequate living wage, the pro- of the worker against sickness, disease and injury arising his employment, the protection of children, young persons, men, provision for old age and injury, protection of the in- of workers when employed in countries other than their own, ition of the principle of freedom of association, the organisa- vocational and technical education and other measures.

nother article (427) of the Treaty of Peace, these principles mulated afresh and in a more precise form and recognised ell fitted to guide the policy of the League of Nations" in rial matters. These principles having been laid down, the Treaty prescribed that a permanent organisation should ablished for their promotion. The commission, on meeting is, was approached with proposals emanating from work- presentatives and even from certain States (such as Italy) aimed at permitting a sort of international Parliament to labour conditions which every State would be compelled pt. Such proposals appeared incompatible with the idea ional sovereignty as entertained by most states. The In- ional Labour Organisation, it was thought, should not a "super-state," any more than the League of Nations. ommission adopted as a basis of its deliberations a British which was more modest and, above all, more elastic, and pted to reconcile the independence of individual States he authority of an official organisation.

e system adopted was as follows: The International Labour isation consists of two essential organs: the General Con- e of Representatives of the Members, and an International r Office controlled by a Governing Body. The conference "from time to time as occasion may require and at least n every year." It is composed of four delegates of each of ember States, of which two are government delegates and wo others represent respectively the employers and the eople. These last two delegates must be chosen by the nments in agreement with the industrial organisations, if organisations exist, which are most representative of em- rs or workpeople, as the case may be, in their respective ries. This shows a characteristic feature of the new organisation. In the Assembly of the League of Nations only Government delegates have seats, but here delegates representing the employers and the workpeople of the member states intervene. This indicates the solidarity of economic and protective forces which has imposed itself on the world since the War.

The conference deals with questions which have been included in its agenda by the governing body, and the agenda is transmitted to the member governments four months before the meeting of the conference. At the close of its discussions it may adopt Recommendations or Draft Conventions by a majority of two-thirds of the votes cast by the delegates present, but not otherwise. The member states undertake that, within a year at most from the closing of the Session of the Conferences, or if special circumstance prevent this, in no case later than eighteen months, they will bring the Recommendation or Draft Convention before the authorities within whose competence the matter lies, for the enactment of legislation or any other action. In the case of a Recommendation the member states will inform the Secretary General of the League of the action taken. In the case of a Draft Convention the member will, if it obtains the consent of the proper authorities, communicate the formal ratification of the Convention to the Secretary-General and will take all necessary action to make the Convention effective. In the case of a Convention the obligations which are assumed by member states on ratification are far stricter.

It is necessary to consider the exact weight which the system carries. The States, under the Peace Treaty, have not undertaken to ratify automatically all draft conventions adopted by the international Labour conference. They have simply undertaken to submit the drafts to the authorities competent to enact the legislation. Here lies the essential innovation. Finally, they are still free to ratify or not. But when there was only the International Association for Labour Legislation, before the War, the States which had sent plenipotentiaries to the diplomatic conferences were not even bound to approach their Parliaments with the resolutions adopted. Now they have undertaken this obligation. This obligation may seem to carry little weight, since each State remains free, within its sovereign rights, to ratify or not. But in essence the whole system rests on an appeal to the public opinion of each of these States, and an appeal to Parliament, which is, so to speak, the authoritative expression of this opinion. The whole mechanism invented by the negotiations of the treaty constitutes an act of faith in the feeling of justice which should animate corporate humanity.

Once the conventions have been ratified the mechanism of their application instituted by the Peace Treaty develops in the following manner: by the act of ratification the States contract a mutual agreement to respect equally all clauses contained in a convention. They must allow mutual supervision of their application of these clauses. By Art. 408 of the Treaty of Versailles they undertake to send an annual report to the conference in which they give a list of the measures for their application. Comparison of these reports may always form the subject of discussion at the conference. If one of the ratifying States fails to apply the convention, or applies it imperfectly, other ratifying States, or even industrial associations of employers or of workers may file complaints. When such complaints are received, the governing body of the international Labour office is charged to deal with them. If necessary it may submit the complaint to a commission of inquiry (Art. 409 and 414). In the last instance, the Permanent Court of International Justice can be called on to pronounce judgment. This court may even, under Art. 418, indicate the measures, if any, of an economic character which it considers to be appropriate and which other governments would be justified in adopting against a defaulting government.

II. THE I.L.O. IN OPERATION

The first conference was convoked at Washington in Oct. 1919. The international office was not yet constituted. The programme of the conference had been fixed in the peace treaty itself. A committee of organisation had been entrusted with its preparation. Six draft conventions were voted concerning:—

1. The limitation of hours of work in industrial establishments to eight hours a day and 48 hours a week.
2. Unemployment.
3. The labour of women before and after child-birth.
4. Night work for women.
5. The maximum age for the admission of children to industrial labour.
6. Night work for children in industry.

The Washington conference constituted the International Labour Office, and nominated its first governing body. This governing body appointed the director, M. Albert Thomas. In 1920 a conference was held at Geneva, which was devoted to maritime questions and passed three draft conventions. The first fixed the age of admission to work at sea, the second dealt with unemployment benefit in case of loss by shipwreck, the third dealt with finding employment for sailors.

In 1921 the third session at Geneva voted seven draft conventions dealing with:—

1. The age of admission for children to agricultural labour.
2. The right of combination and coalition of agricultural labourers.
3. Compensation for accidents incurred during work in agriculture.
4. The use of white lead in paint.
5. The application of the weekly rest to industrial establishments.
6. The age of admission of young persons to employment as trimmers or stokers.
7. The compulsory medical examination of children and young persons employed on board ship.

Each of these sessions voted at the same time a number of recommendations.

The fourth session at Geneva in 1922 only voted a recommendation concerning statistics and documents relative to emigration and immigration. The fifth session at Geneva in 1923 also voted only one recommendation concerning general principles for the organisation of inspection services destined to ensure the application of laws and regulations for the protection of workmen. The sixth session at Geneva in 1924 instituted the procedure of giving the conventions two readings, at intervals of one year. Some conventions were thus given a first hearing, most of them being voted in 1925. The session of 1924 only definitely passed one recommendation concerning the utilisation of the spare time of workmen. The seventh session, Geneva 1925, finally voted four draft conventions concerning (1) compensation for accidents arising out of employment, (2) compensation for sickness arising out of employment, (3) equality of treatment for workmen when employed in countries other than their own as regards compensation for accidents incurred during work, (4) night work in bakeries.

In all, then, not counting recommendations, twenty international Labour conventions were submitted to the States for ratification between 1919 and 1925. These conventions dealt with industry-commerce and in some cases navigation and agriculture. As regards agriculture a dispute arose in 1921. It was maintained that the international Labour organisation had not the right, under the Peace Treaty to deal with the protection of agricultural labourers. On this point the advice of the Permanent Court of International Justice was taken through the mediation of the League of Nations under Art. 14 of the Peace Treaty. The permanent court gave a judgment recognising the competence of the International Labour Organisation.

Ratifications.—In what proportion have the States ratified these conventions by the procedure indicated above? In March 1926 the League of Nations had registered 194 ratifications. This figure has given rise to much discussion. It is important to gain a just estimate of its worth. The International Labour Organisation includes 56 States. If one excepts the four last conventions of 1925, which could not be ratified by the time of writing, about 900 acts of ratification could in theory take place for the other 16 conventions. There are only 194—that is, about one-fourth. But this low figure calls for certain remarks. The same value cannot be attached to all ratifications.

1. There are a certain number of conventions which could not be ratified by all States, despite their general character. The maritime conventions, for example, do not interest the States which have neither coasts nor fleets. Similarly, there are countries of small proprietors where the number of wage-earning agricultural labourers is quite insignificant. There are others, again, where certai healthy industries against which conventions are directed ha established themselves.

2. There are numerous States in which industry is of litt portance and where national labour legislation hardly exists. Hedjaz, Siam and other States have indicated that the measure down in certain conventions are inapplicable to the conditions which the wage-earning labourers in these countries work.

3. International action is only beginning, and all sorts of re delay ratification; not merely the inexperience and inattenti the great national administrations, for which the interna conventions are often matters of secondary importance, bu the hesitation to contract obligations which sometimes appe threaten the output or at least the competitive capacity country on the international market. But in spite of these important results have been obtained.

In the eight years preceding the War the two conventio Berne had only been ratified by a very few States. When such conventions as that which forbids night work for w or that which attempts to cope with unemployment obtai ratification of 16 or 20 states, including great industrial cou like Great Britain, France or Italy, many thousands of men are definitely assured of the enjoyment of the bene reform. For, under the text of the conventions, the contr States cannot, for a period of 10 years, go back on the oblig which they have assumed, even in crises where they wou tempted to do so. The effect of the ratifications has been particularly important in certain countries, for example in where the conditions of labour have been greatly improve the application of the measures contained in the internat conventions such as that of Washington.

But even when the conventions are not ratified, they be the model on which the new national legislations form themse A country such as Belgium, for example, has established eight-hour day, which was voted in 1921 in strict conformity the clauses of the Washington Convention. Similarly, all young States of Central and Eastern Europe which were fo or resuscitated in 1919 have modelled their entire labour leg tion on the general rules laid down by the International La Organisation. It seems, then, that despite the difficulties inhe in its first constitution and despite the economic crises most nations have gone through since 1920, the work ac plished by the unification of labour conditions on a relati high level by the organisation has had appreciable results.

A Centre of Information.—The work of the International La Organisation is not confined to preparing the international ventions, to seeking to obtain their ratification by the States, watching over their application. Art. 396 of the Peace Treaty assigns it further functions which include the "collection and bution of information on all subjects relating to the internat adjustment of conditions of industrial life and labour." Also conduct of such special investigation as may be ordered by the ference." It has "to edit and publish in French and English pe ical publications." The conference may even assign to it, bes the functions mentioned above„ "such other powers and dut as it chooses.

Thus, since 1919, the International Labour Organisation has come a sort of great clearing house of all information on questions. It has a library of 150,000 volumes. The ideal woul to make of it a centre where workers would be certain of findi publications of all countries touching on the regulation of lab This office collects by means of corresponding offices in Paris, Ro Berlin, London, Washington and Tōkyō, and collaborators in ot capitals, periodical information on social developments in great countries. It publishes two general periodicals: the wee *Industrial and Labour Information*, the task of which is to give exact account of important news in the various branches of so life, and a scientific monthly review, the *International Labour R* It further publishes the *Industrial Safety Survey*, which reports new measures taken and all experiences obtained regarding secu of labour; and a *Monthly Record of Migration*. It publishes revi or bulletins giving a summary of all these publications for the in mation of different countries, in German in Berlin, in Italian in Ro in Spanish in Madrid and in Japanese in Tōkyō. Carrying on tradition inaugurated before the War by the Basel office, it publis an annual collection, in French, English and Italian, of the d ments of social legislation promulgated every year in different co tries (*Legislative Series*). Since its formation it has underta enquiries on a large scale in all matters of particular import Among them may be mentioned the great *Enquête sur la Produ* which deals with the economic situation of the world between 1 and 1925; an inquiry into the conditions of labour in all the ucing countries; inquiry into legislation and labour conditions ussia; another into labour conditions in Asia, etc. It publishes terly a *Bibliography of Industrial Hygiene.*

ıe I.L.O. has also attempted to simplify and unify methods of ur statistics used in different countries. Two conferences of ur statisticians have already been convoked under its auspices. y year more demands for information are addressed to it by rent governments. Corresponding committees, consultations of rts and special commissions permit the Office to maintain con- with technicians and scientists of the branches of social life.

ıternal Organisation of the Office.—In order to deal with its old task of keeping up daily contact with the governments, especially with the Ministries of Labour with which it corre- ds directly under Art. 397 of the treaty, and with the organi- ns of workers or employers, the office has to equip itself a sound internal organisation. Under the Peace Treaty it ministered by a governing body nominated for three years ıe Conference. The governing body consists of 24 members, hich 12 represent the governments, six the employers and he workers. Of the 12 governmental representatives eight ıg *ex officio* to the most important industrial countries (Ger- y, Belgium, Canada, France, Great Britain, India, Italy and n). If any dispute arises regarding relative industrial im- ınce, this must be settled by the Council of the League of ons. A system of indexes has been adopted (based on pop- on, working population in relation to the total population, n horse-power, length of railway lines, etc.) which makes ssible to decide this point. The six workers' representa- are nominated by the delegates to the conference represent- he workers, and the six employers' representatives by the oyers' delegates. The conference has proposed to enlarge the rning Body, but this will need the amendment of the Peace ty, and it has not yet been done on account of the slow edure of ratification of the amendment, necessary under 422 of the treaty.

.e Governing Body nominates a director and gives him his uctions. The director nominated in 1920 was M. Albert nas, formerly a French Minister of State. He is assisted by a ty director, who is an Englishman, Mr. Harold B. Butler. The nnel of the International Labour Organisation amounted in to about 370 employees of all ranks, who were drawn from fferent nationalities. Under Art. 395 of the Peace Treaty lirector "shall as far as possible, with due regard to the ency of the work of the office, select persons of different nalities." The nations chiefly represented among the per- el are France and Great Britain, because French and English ıe two official languages used by the office; next, Switzerland, ıse the executive personnel is recruited locally.

.e budget of the International Labour Organisation varies een 7,000,000 and 8,000,000 gold francs. This budget is duced annually by the governing body before the Assem- f the League of Nations. It is supplied for the most part by ibutions from the states which are members of the organisa- This contribution is fixed under a scale adopted by the ue of Nations for its own contributions.

lation to the League.—The International Labour Organisa- is in fact part of the organisation of the League. For this n, since 1920 it has been established at Geneva. It was first lled in an old college. In 1922 the sum of 3,000,000 gold s was voted for the erection of a suitable building on a site n had been given for this purpose by the Swiss Federation. I.L.O. is attached to the League of Nations and entitled assistance, when required, and receives the funds granted the states through the League, but is nevertheless, like the anent Court of International Justice, an autonomous in- ion. Its decisions are not subject to the control of the cil of the League: The Director of the office is in no way rdinate to the Secretary-General of the League. Indeed, mbership of the League carries with it membership of the . (Art. 387), it was decided by the persons who negotiated eace Treaty as by the Assembly of the League of Nations in that states which are not members of the League can be- members of the I.L.O. Thus, since 1919 Germany has be- d to the I.L.O. with equal rights without being a member of the League. A representative of the German Govt. has always sat on the governing body; the workers' group has regularly elected a German member, and the employers have also, since 1922, had a German member in the governing body. There are German employees throughout the office.

In order to gain general information and to carry through scientific research, the I.L.O. remains in almost daily contact with the U.S.A. and with Russia, the only two great states which, for various reasons, do not belong to the organisation.

Conclusion.—The organisation has often been criticised and attacked. It has been reproached with the desire to exceed the limits of its competence. The Permanent Court of International Justice decided, at least in the case of agriculture, that this criticism was not justified. It has also been reproached with being exclusively guided by the workers' interests, and even with being guided by Socialist thought. Yet, no instance has taken place which could justify such an accusation against the director or even less against the governing body. But one fact must not be forgotten, which was brought out in 1921 by a report of the Commission of Inquiry and Organisation of the League of Nations, that the International Labour Office is not simply an organ of conciliation or of keeping the balance between various industrial interests; it must look for conciliation only in order to attain a definite end, which is to realise the programme drawn up in the preamble to Part XIII. of the Peace Treaty. Experience also shows that measures protecting workmen are never fully carried through unless they are made by agreement with the workers and unless the workers are interested in their application.

It is one of the merits of the International Labour Organisation, as conceived and conducted since 1919, that it has been able to keep the sympathies and confidence of the important workers' mass organisations. It is true that the Communists, the leaders of the Third International, violently attack the collaboration of workers in the work of Geneva. But the International Federation of Amsterdam, with its 20,000,000 members, the Christian Unions, the Italian Fascist organisations, take regular part in the conferences of Geneva, and demand that the conventions be applied. It is equally remarkable that the employers continue to be represented at the conferences and on the governing body.

The office of the International Labour Organisation, while it aims at bringing about the "physical, moral and intellectual well-being of the wage-earners," attempts at the same time to take account both of the interests of production, and (to quote Art. 427 of the Peace Treaty) of the differences of climate, habits and customs of economic opportunity and industrial tradition, which make strict uniformity in the conditions of labour difficult of immediate attainment." Further, from the general point of view, the International Labour Organisation has helped to popularise among the industrial masses both of the workers and even of the employers the idea of a definite peace based on an economic understanding and the social solidarity of the nations. It is already the great centre of international collaboration. It is recognised as being one of the great factors of peace. Its history bears witness to all the difficulties attending new international creations. The life of a nation enjoys the natural support of geographical contiguity, of racial community and of age-long tradition. An international organisation can only come to birth and live if public opinion and the judgment of the governments favours a common programme. It appears that the programme of social justice drawn up in the Peace Treaty has sufficient authority and sufficient reason to assure the existence of the International Labour Organisation.

BIBLIOGRAPHY.—See *The Treaty of Peace between the Allied and Associated Powers and Germany*, Part XIII. (H.M. Stationery Office, London, 1925). A list of publications of the International Labour Office can be obtained from the Publications Department of the Office at Geneva, or from their correspondents in different countries.

(A. TH.*)

INTERNATIONAL LAW (*see* 14.694).—The outstanding developments in international law since 1910 are so distinctive that it has been considered expedient to deal with them under separate headings, rather than to attempt to present them in any one general article. The attention of the student is especially drawn to the following articles: ARBITRATION, INTERNATIONAL; BLOCKADE; COVENANT; INLAND WATER TRANSPORT; INTERNATIONAL LABOUR ORGANISATION; LEAGUE OF NATIONS; MANDATES; MIGRATION; MINORITIES; PERMANENT COURT OF INTERNATIONAL JUSTICE; SANCTIONS AND GUARANTEES; TREATIES; WASHINGTON CONFERENCE.

INTERSTATE COMMERCE (*see* 14.711).—Since 1910 Acts of the United States Congress and decisions of the Supreme Court have extended the scope of Federal control over interstate commerce. The regulation of railways was made more complete, the Federal authority being widened to cover railway rates on traffic within the states when such rates affect interstate commerce. The Anti-Trust Act 1890 was broadened and strengthened by the decisions of the Supreme Court in the oil and tobacco cases in 1911 and by the Clayton Act 1913. In the adjustment of labour disputes between employers and employees engaged in interstate commerce the Government assumed a constantly larger rôle.

Railway Regulation.—The Interstate Commerce Commission was given authority by the Hepburn Act 1906 to establish reasonable maximum rates on interstate traffic, but could act on complaint only. The Mann-Elkins Act 1910 authorised the commission to establish reasonable rates after hearings initiated by itself. This Act also made the Interstate Commerce Act apply to telegraph and telephone companies, and gave the commission authority to suspend proposed increases in rates. While such proposed increases were to become effective in 30 days, the commission might suspend the increase for 120 days, and, if necessary, for an additional period not exceeding six months. The Mann-Elkins Act provided also that no carrier might charge more for a shorter intermediate haul than for a longer haul until he had applied to the commission and permission had been granted because of special circumstances. The Supreme Court subsequently decided that a shipper who, in violation of this provision, has been charged the higher rate for the shorter haul is entitled to the full amount of his resulting damages, but not the difference between the rate paid and the lower rate published for the longer haul (*Davis v. Portland Seed Co.*, 1923, 264 U.S. 403).

The Panama Act 1912 made it unlawful for any railway company or common carrier subject to the Interstate Commerce Act to secure control of any common carrier by water operating through the Panama Canal or elsewhere, provided the carrier by water and the railway company did or might compete with each other. Any questions of fact as to competition were to be decided by the commission. If the commission should be of opinion that the public interests would be served and competition would not be prevented or reduced by the continuance of a control exercised by a railway company over a competing carrier by water, the commission might extend the period of control. In enforcing this provision, the commission compelled the trunk-line railways operating passenger and freight lines on the Great Lakes to dispose of them, but railways were permitted to continue the operation of steamships coastwise between New England ports. The use of the Panama Canal by vessels owned by a competing railway was absolutely prohibited. Any rail carrier that had entered into through arrangements with a carrier by water operating from a United States port to a foreign country was required to enter into like arrangements with any or all other lines of steamships operating from the same port, a provision designed to ensure to shippers from interior points the benefits of competition by through routes to foreign destinations.

The most important legislation affecting carriers enacted after the passage of the original Interstate Commerce Law in 1887 was the Transportation Act 1920, by which the railways, after 26 months of government operation, were returned to their owners. This Act provided for a more comprehensive regulation of carriers by the commission and established new principles in the regulation of rates, revenues and capital expenditure of the carriers. The commission, already the final authority as to rates, was further empowered and directed to adjust rates with a view to enabling carriers, as a whole, to earn as nearly as may be $5\frac{1}{2}\%$ on the aggregate value of their property devoted to the pul service. The commission might also authorise the carriers to ea one-half of 1% per annum additional, the amount thus earn to be devoted to improvements without capitalising the amou so invested. Individual carriers whose net operating revenu exceeded 6% were to devote one half of the excess to buildi up a company reserve fund until the amount reached 5%, t other half of the excess being turned over to the Governme and placed in a fund from which advances might be made to t carriers. At the end of two years after the passage of the A the commission was to determine the reasonable rate of retu on the aggregate value of the railways, and the commission fix the rate at $5\frac{3}{4}\%$ per annum. The Act also authorised the co mission to regulate railway securities, and amended the la against combinations so as to permit railway companies consolidate with the commission's approval.

Intrastate Rates.—The power of the Federal Govt. over i trastate rates was extended by important decisions of the Supre Court and by the Transportation Act 1920. In the Minnesota Ra Case (*Simpson v. Shepard* (1914), 230 U.S. 352), the Supreme Co upheld the action of the State of Minnesota establishing railw rates within the state, although the facts showed that these intr state rules affected the rates on interstate traffic and the revenues the carriers engaged both in interstate and intrastate traffic. 1914 the Supreme Court was also called on to consider the validity the order of the Interstate Commerce Commission in what is kno as the Shreveport Case. The business interests of Shreveport, L had complained to the commission that rates within the State Texas, which had been fixed by the state commission of Texas, we so much lower than the interstate rates that it was not possible f the merchants of Shreveport to do business in northwestern Tex The commission decided that the wide difference between the inte state and intrastate rates constituted an unreasonable discrimin tion, and the carriers were ordered to correct this. On appeal, t Supreme Court upheld the order of the commission (*Houston,* *and West Texas Co. v. United States*, 234 U.S. 342).

The principle established by this decision was embodied in t Transportation Act 1920, which provided that when the Intersta Commerce Commission finds that any intrastate rate constitutes unjust discrimination against interstate or foreign commerce, t commission may prescribe the maximum or minimum intrasta rate thereafter to be charged. Another important decision of t Supreme Court, rendered in 1922, affirmed an order of the Intersta Commerce Commission on this point in connection with what known as the Wisconsin Passenger Fares. The order of the comm sion required a horizontal increase of intrastate passenger fares excess-baggage charges to correspond with fares and charges fix for like interstate service in the same state. The Wisconsin Railr Commission sought to have the commission's order overruled, b the petition was denied (*Wisconsin R. R. Comm. v. C. B. and Q. R.* *Co.*, 257 U.S. 563).

Amendments to the Anti-Trust Act of 1890.—Prior to 1911 t Supreme Court by a series of decisions (*see* 14.711) had defi the scope of the Anti-Trust Law of 1890, but the net effect of t interpretations had been to limit its effectiveness. Howe in the oil and tobacco cases decided in 1911 (221 U.S. 1 and 1 the Supreme Court adopted a " rule of reason " formulated Chief Justice White, which gave greater flexibility to the A and promised to make the law more effective. The court he in effect, that the purpose of the law was to prevent und restraint of every kind, and that it did not deny to individua the right to enter into contracts when the right was not impro ly exercised. This interpretation of the Anti-Trust Law was u satisfactory to the extreme opponents of industrial combinatio and in response the Clayton Act was passed in 1914, prohibitin under specified provision, discriminations in prices. Lab unions and organisations of farmers were exempted from t provisions of this law. Interlocking directorates of banks we prohibited, and it was made unlawful for a corporation, engage in interstate commerce, to acquire control by stock ownersh of another corporation engaged in interstate commerce when su acquisition would lessen competition. Carriers engaged interstate commerce were prohibited, after two years from t passage of the Act, from dealing in securities or supplies a from making construction contracts amounting to more th $50,000 with a corporation, firm or partnership having on board of directors or as one of its officers a person who was the same time a director or officer of the common carrier. Th vision was suspended until after the conclusion of the World but was in force in 1921. An important decision of the reme Court subsequent to 1911 was its finding, in *United s v. U.S. Steel Corporation*, March 1 1920, that the largest l industrial combinations was not a violator of the Anti-Trust (251 U.S. 417). It reached the conclusion that the public rest would not be served by requiring the dissolution of the l Corporation, but that, on the contrary, its dissolution nt result in a material disturbance to American foreign trade.

djustment of Labour Disputes.—The Erdman Act 1898 was nded by the Newlands Act 1913, which provided for a board om five to nine men, and also created a board of mediation conciliation composed of a commissioner and two other offi- designated by the Government. By 1916, however, the rail- employees had become dissatisfied with the results of ration, and demanded the establishment of an eight-hour and a general increase in wages. The carriers resisted, and esulting deadlock was broken by the passage of the Adam- Act 1916, establishing the standard eight-hour day in the vay service and providing for a commission to decide upon es. The Supreme Court held the law to be constitutional U.S. 232). The Transportation Act 1920 substituted new hinery for the adjustment of disputes as to wages and work- conditions in the place of the provisions of the Adamson Act. he Transportation Act it became the duty of employers and loyees to endeavour to settle their differences by negotiation. egotiation failed, disputes as to working conditions might be red to boards of adjustment composed of an equal number presentatives of both sides. These boards might be either , district or national. Provision was also made for the ap- tment by the president of a railroad labour board of nine : three representing the public, three the employees and the companies. Such a board was constituted in 1920.

1926 Congress enacted the Railway Labor Act which sub- ted new machinery in place of that created in the Trans- ation Act of 1920. It makes it the duty of the carriers and employees to exert every reasonable effort to make and tain agreements. All disputes are first to be considered in rences between the parties directly concerned; and adjust- boards either on individual lines, or regional, or national provided to adjust disputes arising under such agreements to interpret and apply them. Disputes that cannot be so sted may be referred to a board of mediation by either , or the proposed board may intervene on its own initia- and if an amicable adjustment cannot be attained in this ner, an effort is to be made to induce both parties to agree luntary arbitration. Should such effort be unsuccessful and nterruption of commerce be threatened, the President is authorised, in his discretion, to create a board to investi- and report to him within the next succeeding thirty days, a proviso is included to the effect, that, in the event that eps leading up to the appointment of this emergency board to bring about a settlement, transportation may not be rupted for a period of 60 days. It is understood that act had the approval of large groups of railway executives, mployees, and is the result of a series of joint conferences.

nited States Coal Commission.—In 1922 an Act was passed ring that a national emergency existed in the production, portation and distribution of coal and other fuel. It gave lementary powers to the Interstate Commerce Commission sue, in transportation of coal or other fuel, orders for ities in car service, embargoes and other suitable measures, to take any other necessary steps for the priority in trans- tion, and for the equitable distribution, of coal or other fuel prevent their purchase or sale at prices unreasonably high. 23 an Amending Act established the U.S. Coal Commission t more than seven members for the purpose of securing mation in connection with questions relative to interstate nerce in coal and all questions and problems arising out of onnected with the coal industry. The commission's report ined a full account of economic conditions in the coal- g industry.

(E. R. J.)

INVENTION.—Nothing is more significant of the activities of human ingenuity than the tale of the inventions which reach the national patent offices for record and official approval. The stimulus of social conditions and economic necessity are marked most significantly here. Why some inventions succeed is often obvious. Many inventions fail to achieve commercial success though valuable and useful in themselves, sometimes because existing processes adequately satisfy the need, sometimes because they are too advanced and the need for them has not yet arrived. Indeed, analysis of the causes of failure is full of interest. The phenomena of cultural lag deserve serious study.

Previous Knowledge.—All inventions, in a sense, are conditioned by existing knowledge, nearly all depend directly or indirectly on previous conditions. The motor-car, the aeroplane, wireless telegraphy, the steam turbine, could not have reached their present stage of development without a long series of prior inventions. The science of the metallurgist, the chemist, the physicist, has made it possible to produce materials which combine strength with lightness, which possess properties in the required degree—magnetic, electric, chemical—so that even the simplest product represents the sum of a series of minor inventions and contributions to knowledge.

The range of problems presented to the inventor is well shown by the progress of invention as applied to the motor-car. The development of the internal-combustion engine entailed improvements in the magneto, in carburettors, in the "timing" gear, in the valves, improvements due to advances in electrical science and metallurgy. With increase of power comes the necessity for greater brake power. Night travel demands better lighting. Popular demand requires mass production. That in turn involves standardisation and that is impossible without prior advances in the manufacture of machine tools (*q.v.*) and measuring instruments (*q.v.*). Here pure science is called in to solve the problems which underlie modern economic activity. Then there is the need for simplification and strength. The car must be made safe and foolproof. The tendency to elaboration is constantly checked by the need for simplicity.

Key Inventions.—There are, of course, key inventions which open vast ranges of further development. These attract attention and are, in every sense, of the highest importance. Nevertheless, there may be as much ingenuity and utility in a single device which simplifies some elaborate process or meets some widespread human need. Such inventions as these, too, deserve, even if they do not always achieve, success.

Every Patent Office throughout the world when its records are studied broadly on these lines tells the same tale. Thus, in Great Britain since 1910, the trend of invention has varied considerably owing to important changes in social conditions. The inventions of the years 1910–4, when social conditions were normal, present a trend very different from that of the War period and different from that of the years 1919–25, which was a period of recuperation and reconstruction. These three periods, however, have one important common feature, viz., that the numbers of inventions relating to locomotion and intercommunication were exceptionally great.

INVENTIONS OF THE PERIOD 1910–4

Motor-cars, etc.—The first application of self-starters to motor-cars seems to have been made by the Adams Manufacturing Co., of Bedford, in 1911 and was followed by many inventions for mechanism of this kind. There were also numerous inventions for variable-speed gears, lighting sets, detachable rims and spring wheels. In motor-cycles, the replacement of belt or chain variable-speed gearing by toothed gearing and the introduction of the kick starter determined the modern form. Many forms of lifeguards for use on trams and omnibuses were patented and, after the taxi dispute in 1911, there were many inventions for registering "extras" (*see* MOTOR VEHICLES). Inventive activity was very marked in connection with internal-combustion engines, especially those of the fixed radial, revolving cylinder and "valveless" types, and in carburettors (*see* INTERNAL COMBUSTION ENGINE).

Aeronautics.—Many of the aeroplane inventions related to details of machines which, like the Farman biplane and the Morane monoplane, were well known. The use of these inventions eliminated, to a large extent, unsuitable flying-machines. Directly driven tractor screws and rear elevators became more generally adopted. The importance of aircraft as an auxiliary in warfare was appreciated and, in 1911, inventions for launching aeroplanes from the decks of battleships were patented. The airships "Beta" and "Gamma," built at Farnborough, made several successful flights; they were inflated with hydrogen generated in Oerlikon electrolysers, which usually employed a pure solution of potash. About the year 1912, the seaplane, provided with floats, was brought into use (*see* AEROPLANE; AIRSHIP; SEAPLANE).

Railway Signalling.—A series of inventions for automatic signalling to prevent trains from being signalled into a section containing a standing train was patented in 1911, after the accidents at Hawes Junction and Pontypridd. In 1913, there were many inventions for automatically signalling and stopping trains and in 1914 for locking carriage doors from the guard's van (*see* RAILWAY SIGNALLING).

Life Saving.—Following the disaster to the "Titanic" (*q.v.*) in 1912, there were many inventions for life-saving appliances for personal wear, detachable ships' fittings to serve as rafts, and boat-lowering gear; there were also inventions for enabling a ship to receive wireless distress signals when the operator was off duty.

Transmission Gear.—The Constantinesco system of transmitting power by means of a pulsating column of water was applied to rock drills and other apparatus.

Water Supply.—In the year 1913, the Metropolitan Water Board brought into use, at their Chingford reservoir, a powerful pump of the pulsometer type, the Humphreys internal combustion pump (*see* PUMPS).

Telephones.—The first automatic telephone exchange for public use in England was opened at Epsom, in 1912. Following this, there were many inventions relating to junction and trunk line working for facilitating the gradual introduction of automatic systems (*see* TELEPHONES).

Fixation of Nitrogen.—Many inventions for the synthetic production of ammonia from the nitrogen of the atmosphere were patented, some of the most important being those of the Badische Anilin und Soda Fabrik, developing the catalytic Haber process. (*See* NITROGEN, FIXATION OF.)

Medicine.—Ehrlich's invention of Salvarsan, introduced in 1910, for the treatment of venereal and other spirochaetal diseases, has been of great value (*see* PHARMACOLOGY).

Rubber, etc.—In 1911–3, there were many inventions relating to the synthetic production of isoprene and of rubber, the coagulation of rubber latex and the cold process of vulcanisation by using sulphuretted hydrogen and sulphurous acid gas in succession (Peachey's process). The use of accelerators, *e.g.*, piperidine, was also introduced in vulcanising (*see* RUBBER).

In 1913, there were series of inventions for converting heavy oils into motor spirit and for obtaining light oils from coal by carbonising at a low temperature.

Stainless steel, a chromium-steel alloy, was brought into use toward the end of the period.

Electric Lamps.—In connection with filaments for incandescent electric lamps, many inventions related to the production of osmium, tantalum, niobium, molybdenum, and tungsten and to apparatus for swaging and wiredrawing these metals. One of the most important inventions of the period was the half-watt lamp, British Patent Specification, No. 10918 of 1913 (*see* ELECTRIC LIGHTING).

The thermionic valve for use in wireless was another very important invention.

In the textile industry, there were many inventions relating to collecting dust in and ventilating cotton-mills and to mechanical means for shuttle-threading. There were numerous inventions for gyro-compasses (*see* GYROSCOPES), artificial horizons, gyro-stabilisers, and other apparatus depending on the application of the gyro principle. The selection and intermittent exposure of advertisements and the projection of cinema pictures in natural colours were important subjects of invention. There were also many inventions for slider or "lightning" fastenings for corsets, boots and pouches.

INVENTIONS OF THE WAR PERIOD

The numbers of inventions connected with industries, other than those of importance in warfare, fell off considerably. Inventions connected with military and naval operations were brought into use in rapid succession; periscopes (*q.v.*), Mills bombs (*q.v.*), the Lewis gun, the paravane (*q.v.*) for protecting ships from mines and torpedoes, camouflage (*q.v.*) systems, depth charges and other means for use against submarines, Pomeroy and other explosive and incendiary bullets for use against Zeppelins, the tanks (*q.v.*), body armour, and combination knives, forks and spoons are only a few examples.

Aircraft.—The inventions connected with aircraft were of outstanding importance and their use resulted in the production of many highly efficient machines. The Fokker monoplane had an all-metal fuselage and a tractor screw through which a Maxim gun was arranged to fire by means of a synchronising gear. The D.H.2, a British single-seater biplane with pusher screw and a wide range of fire was used successfully until it was superseded by machines with a tractor screw through which a Vickers machine-gun w arranged to fire by means of Constantinesco's hydraulic synch nising gear. The twin-engined Gotha was a long-distance Germ bombing-machine and was provided with a sighting-telescope ca ble of being used with scientific accuracy.

Thermionic Valves, etc.—Thermionic valves (vacuum tubes) for in telephony and wireless receivers (*see* VACUUM TUBES; WIRELE the recovery of benzene, toluene and other hydrocarbons in and coke manufacture, and the synthetic production of ammo received a great deal of attention.

Michell Bearings.—The segmental pivoted thrust blocks known Michell bearings were used on a large scale, especially in submar (*q.v.*). These bearings were first made in 1905 and, in 1913, w fitted in the cross-channel steamer "Paris." Michell bearings ta up a comparatively small space and are easily lubricated.

There was a large number of inventions for toys and games o warlike kind and for the manufacture of dolls' heads and eyes whi before the War, had been imported in large quantities.

INVENTIONS OF THE PERIOD 1919–25

The trend of invention reverted to a large extent towa improvements of commercial importance. It resembles t trend of invention for the period 1910–4, but presents the ad tional feature that rapid and extensive developments have be made possible by utilising inventions brought into use un war conditions. This is exemplified in aeronautics by the lo distance flights to many countries during the past few years; long-distance wireless telephony and broadcasting (*q.v.*) ma possible by the use, during the War, of efficient thermionic val in telephony from aeroplanes; and, in the chemical industry, the recent successes in the commercial production of ammo from the nitrogen of the atmosphere, following the improveme made during the War (*see* NITROGEN, FIXATION OF).

The Autogyro.—A remarkable form of aeroplane, the Autogy patented by Señor de la Cierva, of Madrid (British Patent Specifi tion, No. 196594), is capable of descending vertically or nearly with safety. It differs fundamentally from the Helicopter in that windmill is not driven by power but, as its name indicates, tu freely upon its shaft (*see* AEROPLANE).

Internal Combustion Engines.—The use of the Diesel and other motors in place of steam-engines has made great progress. A re invention by the Vulcan Co., of Stettin, introduces a hydraulic tr mission gear between the motor and the ship's propellor to minim the effects of vibration (*see* TRANSMISSION GEAR).

Turbines, etc.—During the last few years, there have been inventi for the application of turbine engines for driving locomotives a many inventions have had for their object the increasing of t efficiency of steam engines by using steam at very high pressu In the Blonquist steam generator, producing steam at about lb. per sq. in. the generator elements are horizontal steel tu rotating rapidly so that the water in each tube forms an annul A boiler at Weymouth, Mass., operates at a pressure of 1200 lb. sq. in. (*see* BOILER; STEAM ENGINE; TURBINE).

Motor-car Problems.—An inertia gear, invented by Constan nesco, is designed to adjust automatically the power develope the motor of a vehicle in accordance with the varying resistanc inclined roads or on roads having surfaces of varying quality. the supply of petrol to motor-cars and other vehicles on the ro there have been brought into use many forms of petrol pumps a other delivery apparatus; these have been mostly of Americ origin (*see* MOTOR VEHICLES).

Shipbuilding.—In the construction of ships, a combination of t longitudinal and the transverse systems of framing has been broug into use and there is a tendency toward the use of the longitudi for the bottom of the ship and the upper deck and the transvers the sides (*see* SHIPBUILDING).

Gyroscopes.—There has been great attention devoted to t application of the gyroscope in the arts, especially in connecti with automatic-steering apparatus, ship stabilisers, gun-cont apparatus and aerial photography (*see* GYROSCOPES).

Vacuum Tubes and Thermionic Valve.—For the efficient worki of thermionic valves, the use of high *vacua* is important and the have been inventions for obtaining these *vacua* by eliminating fro the bulb or other vessel not only the air but also residual mercu vapour. These *vacua* have also been of great importance in X-r tubes for shortening the time of exposure (*see* VACUUM TUBE Thermionic valves have also been used in gramophones to replace ordinary amplifying means; large diaphragms have also been us recently in gramophones for amplifying purposes.

Activated Carbon.—A form of carbon with an exceptionally hi degree of porosity has been invented. It is called "activated c bon" and its gas-occluding, catalytic and filtering properties very powerful; it is of great value in sugar refining.

Flotation Processes.—Oil and other flotation processes have be applied for the recovery of clean coal from coal residues and also separating molybdenite and various metals from their ores.

Deposits.—The location of ore deposits by means of electric nagnetic apparatus has also received a great deal of attention.

inless Steel.—There have been many inventions for improving nanufacture of the chrome-steel alloy used in making stainless (*see* RUSTLESS STEEL) for cutlery and other articles; a very tly proposed use of stainless steel is for making the metal gs of road vehicles.

ohol.—For obtaining methylic and higher alcohols (*see* ALCO- from carbonic oxide and hydrogen, the Badische Anilin und Fabrik has brought into use processes similar to their high- ure processes for the synthetic production of ammonia. e same company is also experimenting with processes for con- g coal into oil (*see* FUEL PROBLEMS).

ficial Silk.—Many inventions for improving the manufacture ficial silk (*q.v.*) have been patented. The dyeing (*q.v.*) of acetate he artificial silk usually called celanese, by the use of ionamines y adding a protective colloid, which may be obtained by grind- insoluble dye with sodium sulphoricinoleate, to the dye baths ceived attention during the past few years.

ber Processes.—There have been many inventions for the use elerators capable of powerful action in the vulcanising process UBBER), *e.g.*, aldehydes, amines and *p*-nitroso dimethylaniline. reatment of rubber latex which has been delivered in large ities by the rubber producing companies, has received a great f attention. A recent invention (Hopkinson's British Specifi- No. 157978) is for spraying the latex so as to atomize it; the in the sprayed latex is evaporated and crude rubber remains.

ficial Foods.—Many inventions relate to the production of ial foods containing large percentages of vitamins (*q.v.*) selected our healthy development or to counteract tendencies towards s, beri-beri and other diseases. Many of the vitamins intro- are of the fat-soluble A (cod-liver oil) type or of the water- e B (yeast) type.

of the most active subjects of invention has been the manu- e of artificial limbs, the efficiency and value of which have been erable. Destructible receptacles, intended for use once only roduced in vast numbers at a low cost have been patented in forms. These receptacles, for use in serving jellies, ices, etc. de of cardboard or other cheap material.

tography.—Photographic surveying from aircraft, employed during the War, has been utilised for topographic surveying. ethod has been found by archaeologists to be useful in discover- nd investigating traces of ancient encampments and other nents, for the views obtained show details not visible at close rs (*see* ARCHAEOLOGY: AIR SURVEY). Prof. Sir J. B. Hender- gyroscopically controlled camera has been designed chiefly on aeroplanes.

(T. E. L.)

A (*see* 14.732).—The population of Iowa according to the census was 2,419,927 on July 1 1925, as against 2,404,021 o and 2,224,771 in 1910. In 1920 the native whites of parentage numbered 1,528,553; those of foreign or mixed tage, 629,981; and the foreign-born whites, 225,647. The population was 19,005. There were in 1920 43·2 inhabi- per square mile as against 40 in 1910. In 1920 the urban popu- was 36·4% of the whole. There were seven cities having a ation of over 25,000 as follows:—

	1920	1910	Increase %
Moines	126,468	86,368	46·4
x City	71,227	47,828	48·9
enport	56,727	43,028	31·8
ar Rapids	45,566	32,811	38·9
uque	39,141	38,494	1·7
erloo	36,230	26,693	35·7
ncil Bluffs	36,162	29,292	23·5

iculture.—In 1925 the aggregate crop acreage in Iowa was ,893 and the value of the farm lands and buildings was ,427,734. In 1924 Iowa was first among the states in the ge, production and total value of both corn and oats. Iowa's crop in 1909 was 341,750,460 bu., valued at $167,622,834, ,229,378 ac.; in 1924, 304,752,000 bu., valued at 283,419,- om 10,884,000 acres. The number of cattle on Iowa farms 5 was approximately 4,507,000, of horses 1,229,000 and ep 891,000; while in the number of swine Iowa increased 7,545,853 in 1910 to 10,539,000 in 1924, but decreased to 000 in 1925.

nufactures, Mining and Transportation.—Meat-packing ues to lead manufacturing industries, the value of prod- f slaughtering and meat-packing having increased from 3,482 in 1909 to $152,631,945 in 1923. The second industry in value of products in 1923 was butter. In 1909 this product was valued at $24,440,715 and in 1923 at $67,972,113. Food preparations, including cereals and breakfast foods, were third, the value of these products increasing from $9,795,000 in 1909 to $37,698,210 in 1923. The value of all manufactured products was $259,237,637 in 1909; $690,042,714 in 1923. The most important mineral product in Iowa is bituminous coal; in 1910 the value was $12,682,106; in 1919 $16,903,358; in 1922 $16,119,000. The value of clay and clay products in 1919 was $8,127,000. Portland cement and gypsum products were also prominent. The railway mileage was 9,781.65 in 1910 and 9,843 in 1924. The mileage of interurban electric lines has increased from 373·92 to 946·49, or about 153%.

Education.—The Federal census of 1910 credited Iowa with the smallest percentage of illiteracy of any state in the Union (1·7 %.) In 1920, with a percentage of 1·1% it still maintained first place. State aid became an important factor in the development of public schools in the period following 1910. Legislation granted such aid to large, centrally located, consolidated schools, which replaced small scattered ones. At the close of 1920 there were 430 consolidated districts, including about 25% of the area of the state and taking care of approximately 50,000 pupils. In 1911 state aid was granted by law to high schools organising normal training of rural teachers of which schools there were, in 1918, 172. In 1917 a state board for vocational education was established to take advantage of the provisions of the Smith-Hughes Act offering Federal aid for vocational education. A law, enacted in 1919, provided for part-time schools for the benefit of children between the ages of 14 and 16 working on employment certificates. The establishment of these schools was required where there were 15 eligible pupils in the district, and attendance became compulsory.

Legislation.—The only constitutional change made during the period 1910–25 was an amendment ratified by the people in 1916 fixing the time of the general election for that year on the same day as the presidential election, the time of election thereafter to be determined by the General Assembly. In 1916 a constitutional amendment extending suffrage to women was submitted to the electors but was defeated. The Federal suffrage amendment was adopted in 1920. The vital portions of the "mulct tax" law of 1894 (*see* 14.734) were repealed by the General Assembly in 1915, thus restoring statutory prohibition in Iowa, but a prohibitory amendment to the state constitution was voted down by the electors in Oct. 1917. The Eighteenth (Prohibition) Federal Amendment was however ratified by Iowa Jan. 15 1919. The constitution of 1857 provided that in 1870 and every ten years thereafter the question, "Shall there be a Convention to revise the Constitution and amend the same?" should be submitted to a vote of the electors of the state, and in case of a favourable vote the General Assembly should provide by law for the election of delegates. In the election of 1920, for the first time, the vote showed a majority in favour of a convention.

The General Assembly in 1913 passed an Employers' Liability and Workmen's Compensation Act; and at the same session a Mothers' Pension Act was passed, providing for the granting to widowed and indigent mothers of sums not to exceed $2 per week for each child under 14 years of age. In 1915 the Perkins law was passed, providing free treatment for crippled children of poor parents. In 1917 an appropriation was made by the General Assembly for the erection and equipment of a hospital at Iowa City for such children. Two years later the General Assembly provided that adults as well might be sent to Iowa City for free medical and surgical treatment. In 1917 the General Assembly established at Iowa City a child-welfare station for the consideration of conditions and measures.

An important development was the farm bureau movement. By 1917 organisations among farmers in the state were numerous, and in that year the General Assembly passed an Act providing that where a farm-improvement association in any county had among its members 200 farmers or farm owners and had raised $500 in annual subscriptions, the county board of supervisors was authorised to contribute $2,500 for the employment of a county agent. A law in 1919 modified the amount and terms of the payment by the county and made the contribution mandatory. The movement gained rapid headway, county associations being established for the betterment of both social and economic conditions and the improvement of agricultural methods. In 1920 there was a farm bureau in each county and two in Pottawattamie county, and a membership of over 100,000. There was also a considerable growth within the state of a farmers' educational and co-operative union which had over 20,000 members in 1920.

Government and Finances.—The commission plan of government, authorised in 1907 for cities of 25,000 or more inhabitants, was extended to cities of 2,000 or more inhabitants. By 1920, nine cities had organised under the commission plan: Burlington, Cedar Rapids, Des Moines, Fort Dodge, Keokuk, Marshalltown, Mason City, Ottumwa and Sioux City. In 1915 the General Assembly passed Acts allowing cities to organise their municipal government under city-manager plans, but they have not been generally taken advantage of. The General Assembly in 1913 provided that Supreme, District and Superior Court judges should be nominated and elected on a non-partisan ticket, but in 1919 the nomination and election of judges was restored to a party basis.

In 1911 the office of commerce counsel was created, the incumbent to be appointed by the Board of Railway Commissioners and to serve as expert counsel for that board. In 1913 the Department of Insurance was created, and in 1917 a state Banking Department was organised and the office of Superintendent of Banking created. In 1915 a state Board of Audit and a state Board of Accountancy were created, and the office of Document Editor was established to relieve the Secretary of State. The road administration was reorganised in 1913 when the General Assembly established a highway commission consisting of the dean of engineering of the State College of Agriculture and Mechanic Arts and two appointive members. Highway legislation in 1919 divided the highways into primary and secondary systems, and arranged for the distribution of Federal and state aid funds for the hard surfacing of primary roads.

In 1923 the assessed valuation of property in Iowa was $1,766,329,861 on which were levied taxes amounting to $12,523,228 ($5.09 *per capita*). The funded and floating debt of the state was $11,797,100; the net debt was $11,715,131 ($4.76 *per capita*).

History.—The history of Iowa in the years 1910–25 was marked by no economic or political changes of great importance. The state remained predominantly agricultural. Although its manufactures increased in importance, it was little disturbed by industrial controversies. The supremacy of the Republican party in politics was not seriously questioned. Owing to a split in the Republican party in 1912, the Democratic candidate for President received the electoral vote of Iowa, but the state returned to the Republican ranks in 1916, and in 1920 cast an overwhelming vote for Harding for President and for Nathan E. Kendall for governor. Throughout the period U.S. Senator Albert B. Cummins continued to represent the state. The death of Senator Jonathan P. Dolliver in 1910 caused a vacancy, filled temporarily by the appointment of LaFayette Young. In 1911, William S. Kenyon was chosen to fill the position; he was reelected in 1913 and 1918. In 1920, Albert B. Cummins was again elected to the Senate, for the term ending March 4 1927. On Feb. 24 1922, William S. Kenyon resigned his office of Senator, Gov. Kendall appointing Charles A. Rawson of Des Moines to fill the vacancy until the next election. At the primary election held in June 1922, Smith W. Brookhart of Washington, Iowa, was chosen as the Rupublican candidate, and at the general election following was elected for the unexpired term. In 1924, Mr. Brookhart was nominated and elected for the term ending March 4 1931. Republican governors were elected or re-elected every two years, incumbents being: Beryl F. Carroll, 1909–13; George W. Clarke, 1913–7; William L. Harding, 1917–21; Nathan E. Kendall, 1921–5; John Hammill, 1925–

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'IRAQ (*see* MESOPOTAMIA, 18.179), a mandated Arab king in Asia Minor embracing the former Turkish vilayets of Bagh Basra and Mosul. Area 143,250 square miles. Population 2,8 282 (1920). 'Iraq is bounded on the west by Transjordan, the southwest by Arabia, on the south by a neutral zone, on southeast by Al Kuwait and the Persian Gulf, on the east by sia, on the north by Turkey and on the northwest by Syria. British Empire is the Mandatory Power.

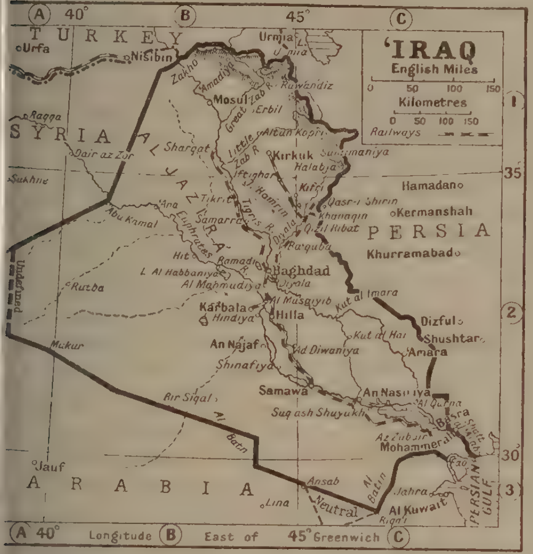
The terms of the mandate were never formally laid down the League of Nations, but the relations between Great Bri and 'Iraq were defined in a treaty concluded on Oct. 10 1 and ratified on Dec. 19 1925. On Sept. 24 1924 the League cepted this definition as giving effect to the provisions of Art. of the Covenant. The period of the treaty was extended 20 years by a subsequent treaty executed on Jan. 13 1926, ratified on March 30 1926. The 'Iraq Govt. is a limited m archy on the Egyptian model, with a King, a senate of 20 n inated members and a lower house of 88 deputies. The coun is divided into 12 liwas. The administration is in the hand the 'Iraq Govt., represented in each liwa by a Mutasarrif wh assisted by a British official with advisory powers. The 12 li are Mosul, Erbil, Kirkuk, Sulaimaniya, Diyala, Baghdad, laim, Kut, Karbala, Hilla, Ad Diwaniya, Muntafiq and Bas

I. POLITICAL HISTORY

Nationalist Movement.—During the years from 1911 up to outbreak of the World War, the Ottoman régime in the dist Mesopotamian vilayets showed marked deterioration. The hope that any efficient administrative system might be est lished in Mesopotamia vanished with the fall in 1911 of N Pasha, an energetic man of singular integrity, who had set self to the intricate task before him with all the rude strengt a Turkish soldier of the old order. The Italian and Balkan had weakened the central Government, while in the Arab pr inces, in particular, the disappointment of hopes born of constitution of 1908 was leading to a recrudescence of ra aspirations. Damascus and Beirut had long been centres nationalist movements, but already, at the end of 1913, the sc society called the Ahd (the league) embraced the three Mes tamian vilayets as well as Syria. A prominent figure in the m ment was Saiyid Talib Pasha of Basra. He had reached stage in his career when nationalist enthusiasm seemed best culated to serve his ambitions. He had, however, exhaust Turkish patience, and steps were about to be taken to dispo him in true Turkish fashion when War was declared on Oc 1914. Talib approached Sir Percy Cox, and offered to raise Arab revolt in return for recognition as an autonomous local ch The reply was not satisfactory; he fled to Al Kuwait, and the to Ibn Sa'ud, who interceded for him. He ended by going India, in voluntary exile, and, in 1917, was permitted to move Egypt, where he remained till his return to Basra in Feb. 19

The Mesopotamian Campaign.—The declaration of war followed on Oct. 31 1914 by a proclamation by the Politi Resident in the Persian Gulf to local Arab rulers explaining t Turkey had entered the War at the instigation of Germany promising the chiefs who had enjoyed the protection of Gr Britain that no act of that country should threaten liberty religion. With these assurances the princes of the Gulf w satisfied. Before military operations had begun, Sir Percy C whose efforts had consolidated the British position in the G joined the army concentrated at Bahrein as Chief Politi Officer. On Nov. 6, when the British took Fao fort, he iss a second proclamation repeating the assurances already giv

A determined attempt was made by the Ottoman Govt. rouse fanaticism by preaching a *Jihad*, but the tribesmen gave Turks less than half-hearted support. By Nov. 21 the Turks abandoned Basra; the British position on the Shatt-al-


'IRAQ
English Miles
0 50 100 150
Kilometres
0 50 100 150
Railways
(A) 40°
(B)
45°
(C)
TURKEY
Urfa
Nisibin
Urmia
L. Urmia
Zakho
Amadiya
Rowandiz
Mosul
Great Zab R.
Erbil
Ragga
SYRIA
Altun Kopri
Dair az Zor
Shargat
Little Zab R.
Kirkuk
Sulaimaniya
Halabja
Suhhne
AL JAZIRA
Iftighar
Kifri
J. Hamrin
Hamadan
Tikrit
'Ana
Abu Kamal
Samarra
Tigris R.
Qasr-i Shirin
Khanaqin
Kermanshah
Qizil Ribat
PERSIA
Euphrates R.
Diyala
Ba'quba
Khurramabad
Hit
Ramadi
L. Al Habbaniya
Baghdad
Al Mahmudiya
Diyala
Rutba
Undefined
Al Musaiyib
Kut al Imara
Karbala
Hindiya
Hilla
Dizful
Kut al Hai
Shushtar
Mukur
An Najaf
Ad Diwaniya
'Amara
Shinafiya
Samawa
An Nasiriya
Al Qurna
Bir Siqal
Suq ash Shuyukh
Basra
Al Batn
Shatt al 'Arab
Az Zubair
Mohammerah
Fao
Jauf
ARABIA
Ansab
Al Batin
Jahra
Lina
Neutral
Al Kuwait
Riga'i
PERSIAN GULF
1
35
2
30
3
(A) 40° Longitude (B) East of 45° Greenwich (C)

cured, and the refinery of the Anglo-Persian Oil Company
ıadan was safe. On Nov. 22 British troops entered Basra
ı the name of the general officer commanding-in chief, Sir
Cox published a third proclamation assuring the inhabi-
that Turkish rule was dead and that Great Britain was
good friend and protector. The British arrival at Basra
reeted with acclamation by the terror-stricken popu-
ivil administration was set up under the G.O.C., with Sir
Cox as Chief Political Officer. As success followed success,
measure of law and order followed in the wake of the arm-
he administration was well served by the revenue com-
ner, Mr. Dobbs, now Sir Henry Dobbs, who made the first
of agrarian conditions. His profound knowledge of tribal
n enabled him to discern and account for agrarian phenom-
ıd the accompanying tribal unrest and, not least, to draw
tribal criminal disputes regulations, on a model which had
d with success on the Indian frontier, thus solving the prob-
administering to tribesmen justice which should be ade-
and also comprehensible to their primitive understanding.
advance from Basra to Baghdad is described under
POTAMIA. A period of grave anxiety preceded the victory
ı'aiba, on April 12 1915, when a reverse would have en,
the annihilation of the Indian Expeditionary Force "D.',
the retreat from Ctesiphon, Nov. 25 1915, and the fall of
n April 29 1916, the fate of 'Iraq hung in the balance, but
organisation of the force under General Maude laid the foun-
ıs of victory, and Baghdad was occupied on March 11 1917.
he proclamation which General Maude issued upon the occu-
ı of Baghdad a definite promise was given that alien in-
ions should not be imposed, that Arab aspirations should be
ed and that on those grounds the collaboration with British
cal officials of Arab nobles, elders and representatives was
ed. A further development of civil administration was
when in July 1917, Sir Percy Cox was appointed Civil Com-
ner. The country suffered great loss in the death in Nov.
of General Maude, whose distinguished powers as a military
had earned the respect and admiration of 'Iraqis, but
General Marshall the success of British arms was carried on.
n Nov. 1917 the northern Euphrates was occupied up to
di, and in March 1918 up to 'Ana. In the same month, a
s incident occurred on the middle Euphrates. The holy
of Karbala and An Najaf were not only racked by internal
but both they and the adjacent tribesmen owned the sway
sian divines to whom the secular interests of 'Iraq counted
ıg. In the first years the British government of occupation
rtunate in finding in the recognised leader of these Mujtahids
of singular personality who, while consistently refusing
to give open advice on political questions, tacitly backed the Power which had been placed in command by the vicissitudes of war. Nevertheless, the holy towns presented a fertile field for intrigue, and when the government of occupation showed a determination to check the rapacity of the local chiefs of An Najaf, a plot, engineered from without, came to a sudden head with the murder of the newly appointed assistant political officer.

Sir Percy Cox was on his way home to attend a conference in London, but the situation was handled successfully by Colonel Wilson, afterwards Sir A. T. Wilson, who was in charge. He was aided by the universal condemnation of the An Najaf rebels by public opinion elsewhere and by the friendly relations which were maintained with the chief Mujtahid. Though An Najaf was blockaded, not a shot was fired; but the pressure exerted resulted in the handing over of the guilty by May 1. A court of specially qualified officers condemned 13 of the men to death. Over 100 persons were sentenced to transportation for life or for shorter periods, but all these have since been permitted to return.

Northeast of Baghdad, progress was hindered by the Russian débacle, but when, at the end of June 1917, the upheaval which was taking place in Russia obliged the Russians to retire, the British force gradually drove the Turks from the vacated positions, occupying Khanaqin in Dec. 1917, and Kifri in April 1918. The first task of the British administration was to save these provinces from the destitution and famine into which they had been plunged by the flux and reflux of Turkish and Russian armies, but again the British advance was impeded by the rapid dissolution of the Russian forces in Persia and the necessity of guarding northern Persia from Turkish attack. It was the more unfortunate, as nowhere was the establishment of administration effected more smoothly than among the Kurdish and Turkoman elements with which the British forces now came into touch. Kirkuk was reached in May, and immediately a provisional government under a local magnate, Shaikh Mahmud al Barzanji, was set up voluntarily in Sulaimaniya in friendly co-operation with the British. But the exigencies of the Persian situation made it impossible for the General Staff to maintain the position so easily acquired; the British, accompanied by a large number of the Christian population, abandoned Kirkuk, which was not reoccupied until the final advance, in Oct. 1918, ended in the occupation of the whole of the Mosul vilayet.

Liberation of 'Iraq.—On Nov. 7 1918, 10 days after the signature of the Turkish armistice at Mudros, the British and French governments issued a joint declaration of vital importance to the occupied Arab territories, stating their aims in the East to be:—

> The complete and final enfranchisement of the peoples so long oppressed by the Turks, and the establishment of national governments and administrations drawing their authority from the initiative and free choice of native populations.

The proclamation went on to promise encouragement and help in the establishment of native governments and administrations in Syria and Mesopotamia. General Maude's pronouncement had been made while the upshot of war was still doubtful, and was therefore discounted as a natural mode of propaganda, whereas the Anglo-French declaration was published after victory had been achieved. Together with President Wilson's Fourteen Points, it gave unbridled play to political speculation, which was further encouraged when the British Govt. directed Colonel Wilson to hold an inquiry as to whether the people of 'Iraq were in favour of a united Arab State from the northern boundary of the Mosul vilayet to the Persian Gulf under British tutelage, whether they desired that this state should be placed under an Arab Amir and if so whom would they suggest. In the light of experience it can safely be said that public opinion was not ripe to reply to these questions which, in the provinces, at any rate, were nothing but a bewilderment to tribesmen, landowners and cultivators. Save on the first point, which was unanimously approved, no definite answer was given. In Baghdad the representative Moslems assembled by the Sunni and Shi'ah Qadhis asked for an Arab State under a son of the Sharif Hussein. Elsewhere every variety of reply was given.

No action could be taken on replies so conflicting, but during the year 1919 some progress was made towards the appointment of local subordinates in an advisory capacity. Other factors had, however, come into play. The first of these was the establishment of an independent Arab State in Syria, largely the handiwork of a number of eager and adventurous ‘Iraqis who were anxious to return home and enjoy the same powers as those of which they stood possessed in Damascus or Aleppo. They carried on an active propaganda in ‘Iraq, and when, in March 1920, the Amir Faisal was proclaimed King of Syria they responded by electing the Amir ‘Abdullah King of ‘Iraq.

The movement in ‘Iraq which led to the rebellion of 1920 was part of a general resentment against the policy of the British and their allies. In India, Persia, Egypt and Turkey, no less than in Syria and ‘Iraq, a crisis was reached during the years 1919 and 1920, and the political credit of Great Britain fell low in the Eastern world. ‘Iraq was in the centre of this hostile vortex, and was specially affected by the Persian Shi‘ah divines, who were domiciled in the holy towns but were responsive to every shade of feeling in their own country. While the administration was still patently alien, British forces had been cut down to a minimum, and when, in May 1920, the British Govt. announced their acceptance from the League of Nations of a mandate over ‘Iraq, the Damascus Govt. had already, in the absence of the Amir Faisal and contrary to his orders, begun its encroachments. In answer to objections raised against the mandate by a self-chosen committee in Baghdad, it was announced (June 20) that Sir Percy Cox would return in the autumn to establish a provisional Arab Govt. and call an Assembly, freely elected by the people, in consultation with which he would prepare an organic law. But nothing would then have satisfied the claims of the Nationalist leaders, and on July 2 1920, the turbulent Shi‘ah tribes, encouraged by their religious leaders, broke into open revolt.

To restore peace and order was the first necessity. Troops were drafted in from India, and when Sir P. Cox reached Basra (Oct. 1), as High Commissioner, the rebellion in its main centres, the middle Euphrates, the Diyala and the adjacent part of Kirkuk district was already doomed to failure. By Nov. 10, a provisional Council of State was formed under the Naqib of Baghdad. It included Saiyid Talib Pasha as Minister of Interior, Sasun Effendi Haskail, the best known member of the Jewish community, as Minister of Finance, and Ja‘far Pasha al ‘Askari, distinguished for his services during the War and in the Syrian administration of King Faisal, as Minister of Defence. The Council of State, some of the members of which were without portfolios, represented all classes and sects of society; at its request some of the leaders of the rebellion who had been interned at Henjam were released at once. It gave immediate attention to the repatriation of ‘Iraqi officers from Syria and the Hejaz; to the reorganisation of civil government under ‘Iraqi officials, greatly facilitated by the return of many experienced men from Turkey; and to the preparation of an electoral law and the formation of an army. It was the arrival of ‘Iraqi officers who had served under the Amir Faisal which set on foot a movement in his favour in ‘Iraq. He had been driven from Syria in July 1920, and had since resided in England. To this movement Saiyid Talib was opposed, and during the absence of Sir Percy Cox in Feb. and March 1921, to attend the conference summoned at Cairo by Mr. Winston Churchill, Saiyid Talib's ambitions developed, and he assumed a menacing attitude towards the British efforts to secure a free discussion of the future government of ‘Iraq by its people. In April, after a direct threat on the part of the Saiyid, the High Commissioner secured his deportation to Ceylon, and the political atmosphere cleared.

The first result of the Cairo Conference was the publication of a general amnesty in May, and at the same time an attempt was made to ascertain the wishes of the Kurdish provinces as to their inclusion in the ‘Iraq State. The net result was that Sulamaniya remained under the control of the High Commission, but the rest of the Kurdish population was content with the promise of Kurdish officials, under the ‘Iraq Govt., and the local use of the Kurdish language.

Choice of a King.—Towards the end of June, the Amir F arrived in Baghdad, as a candidate for the throne. This c dature was known to be acceptable to the British Govt., an July 11, the Council of Ministers passed a resolution declaring King of ‘Iraq, on condition that his government shoul constitutional, representative and democratic. But Sir P Cox fortified himself by consulting the people, and a referen was carried out, through the Ministry of Interior, throug the country, with the exception of Sulaimaniya, with the r that 96% of the votes were cast in favour of the Amir F outside Baghdad most of the townships and districts stipul for the continuance of the British mandate. The Amir crowned on Aug. 23 1921, and entrusted the Naqib with formation of his first cabinet.

Troubles on Turkish and Arabian Frontiers.—The early of King Faisal's reign were troubled without and within. the north, Turkish nationalism had taken a turn distinctly tile to ‘Iraq. Turkish garrisons on the frontier had incre the tribes were flooded with propaganda, and a Turkish o with a small party of irregulars had occupied Ruwāndiz in 1921. From that advantageous position the Turks kept whole of southern Kurdistan in a ferment till they were fi ejected in the spring of 1923. Turbulent chieftains roused of the tribes of Sulaimaniya in the spring of 1922, and a ge cry was started for the return of Shaikh Mahmud, who had defeated by the British and deported in 1919. The B administration evacuated the province in 1922, and S Mahmud was reinstalled in the autumn, under binding a ances that he would be loyal to the British and ‘Iraq go ments. He entered at once into correspondence with the T

On the Arabian frontier, since the beginning of 1921, the o tions of Ibn Sa‘ud against Ibn Rashid had profoundly dist the tribes. As early as April 1921, the Shammar of Ibn R began to seek safety in ‘Iraq where a large section of the resides. Their presence embittered relations between and Nejd, and after the fall of Ibn Rashid's capital, Ha Nov. 1921, Ibn Sa‘ud's pretensions increased, and he cl the allegiance of the ‘Anizah on the eastern side of the S desert, who had always been attached to ‘Iraq. In M 1922 he permitted the leaders of his Akhwan, or Brethr attack the ‘Iraq desert camel corps and the shepherd grazing under its protection about 30 m. south of the ra between Baghdad and Basra. Heavy loss was inflicted.

Anti-mandate Agitation and the Preliminaries of the Treaty.—These dangers on the frontiers coincided with a s divergence of views between the British and ‘Iraq governme to the nature of their relations with one another. King Fais his Prime Minister asked for the complete abrogation o mandate and its substitution by a treaty of alliance, wh the British Govt. were aiming at a treaty within the scope mandate. The difference was largely technical, but it gav to grave misunderstandings and embittered controversy. I alleged that the attack by Ibn Sa‘ud, who was at that ti receipt of a subsidy from Great Britain, had been instigate the latter in order to show the ‘Iraq Govt. its weakness. A point the Shi‘ah divines took a hand in the matter and summ a conference at Karbalā, nominally to consider measures fence against the Akhwan, but with the underlying obje protesting against the British mandate. The conference a bled, but the Sunni shaikhs held off, the wiser among the Sh nipped any subsidiary intentions in the bud, and the meetin fined itself to petitioning King Faisal to take steps again Akhwan. But the heat engendered was not extinguished anti-mandate agitation continued through the summer, th in June the Council of Ministers accepted the treaty with Britain, subject to its acceptance by the Constituent Asse On Aug. 16 the Cabinet resigned, and Sir Percy Cox, wh tending a levee, was greeted by an anti-mandate demonstr He demanded and received an instant apology, but at the moment it was announced that King Faisal was struck do a dangerous attack of appendicitis, and an immediate tion was necessary.

ıs. by a singular combination of circumstances, the country
ft with no authority but that of the High Commissioner.
sued a proclamation explaining the situation, arrested and
ted certain agitators, and induced two of the Shi‘ah divines
ve voluntarily for Persia. By Sept. 10 1922 the agitation
ied out. On Oct. 10 1922 Sir Percy Cox and the Naqib
l a treaty of alliance between Great Britain and the ‘Iraqi
years (British Treaty Series No. 2), but ratification was
ed and negotiations over the subsidiary agreements dragged
til 1924.

sooner was the internal situation stabilised than the north-
n frontier again demanded attention. With Shaikh Mah-
n Sulaimaniya and the Turks in Ruwāndiz and its neigh-
ood, effective administration had ceased east of Erbil,
k and Kifri. In Oct. 1922 a measure decided on at the
Conference was put into force and the Air Marshal, Sir
Salmond, assumed charge of all imperial forces in ‘Iraq,
d troops, levies and air force. By his vigorous action he
l the Turks to retire to Ruwāndiz. But the autumn of 1922
he period of Mustafa Kemal's great triumph over the
s. It influenced both the Shi‘ahs of the Euphrates and the
of the north. On Oct. 21 1922 the King issued an Iradah
ng elections for the Constituent Assembly to begin; it was
ered by a fatwah, signed by the Shi‘ah divines of Karbala
adhimain forbidding participation in elections. In Nov.
aqib resigned, and ‘Abdul Muhsin Beg al Sa‘dun formed
Cabinet. In the same month elections were held in Great
in, during which a campaign was conducted against the
ent of the pledges to ‘Iraq. Mr. Bonar Law's Cabinet
in under obligation to consider the question, and Sir Percy
vas summoned to London in Jan. 1923, to take part in the
sion. He left in charge Sir Henry Dobbs who had come
s Counsellor in the previous December. The position of
ritish Govt. was extremely difficult. A solution was found
e reduction of the term of the yet unratified treaty
20 to a maximum of four years after the ratification of
with Turkey,[1] with the prospect of renewal at the end of
eriod. The treaty would lapse in the event of ‘Iraq be-
g a member of the League of Nations. The protocol em-
ng this agreement was brought back by Sir Percy Cox on
h 31 1923, and signed on April 30. Sir Henry Dobbs,
had acted since January, became High Commissioner in
1923.

rations in Mosul.—Meantime, in March 1923, Sir Henry
he Air Marshal had been obliged to take steps against the
sh threat in the north. The Amir Zaid, who had arrived in
lad in the previous autumn, went to Mosul, where he su-
tended the formation of a force of Arab irregulars to oper-
the plains if necessary. The strong stand taken by Lord
on at Lausanne reacted on ‘Iraq. Shaikh Mahmud, who
n league with the Turkish band at Ruwāndiz, was dealt
and in April, by a brilliant military movement, supported
r action, the Turks were ejected from Ruwāndiz, and a
ish chief put in as Qaimmaqam under the Mutasarrif of
. With a force of Assyrian levies behind him, Saiyid Taha
losed Ruwāndiz to Turkish influences. Though it was found
ssible to set up a local administration in Sulaimaniya, the
ing parts were placed under the ‘Iraq administration and
h Mahmud was allowed to return to Sulaimaniya town
he mountains between the town and the Persian frontier,
1924 his intrigues made it necessary to eject him from
maniya town. This was done by a column of the ‘Iraq
, with levies and air force support; the Sulaimaniya liwa
ncluded in ‘Iraq in March 1924, and sent representatives
Constituent Assembly. Shaikh Mahmud, with small rob-
ands, was still lurking on the frontier at the close of 1925;
d incurred the hostility of the Persian Govt. as well as
of the Govt. of ‘Iraq.

Elections.—In July 1923, King Faisal authorised his
nment to deport the chief obstructionist among the Shi‘ah
s, Shaikh Mahdi al Khalisi. This act was followed by the voluntary exodus to Persia of a number of other religious leaders, all Persian subjects. They were allowed to return after the Constituent Assembly had ratified the treaty, and have since passed out of political history. After its decisive handling of the Mujtahids, for which the ‘Iraq Govt. deserves the greatest credit, the elections went forward without a hitch. From the Kurdish mountains to the Persian Gulf, primary electors enrolled themselves with surprising alacrity, and, in marked contrast to their practice in Turkish times, the tribal chiefs pressed their followers to come forward in great numbers. Secondary elections began in Feb. 1924, and all results were declared by the middle of March.

Settlement with Nejd.—During the winter of 1923–4 an attempt was made to settle the growing differences between ‘Iraq and Nejd by a conference of representatives held at Al Kuwait under Colonel Knox. The main point of difference was the repatriation of Nejd tribes which had taken refuge in ‘Iraq. The ‘Iraq representatives rightly pointed out that, apart from the violation of tribal custom involved, they had not the requisite force to constrain these unwelcome guests to return to their own country, but they agreed to abide by stipulations considered satisfactory by the British Government. Though on lesser matters agreement was reached, Ibn Sa‘ud proved obdurate on the major issue, and just as the conference was about to reassemble in March 1924, his followers carried out a brutal raid on the ‘Iraq shepherd tribes. The conference thereupon broke up. Other raids occurred during 1924–5, and, as a result, the ‘Iraq Govt. made a determined effort to remove the tribes from the vicinity of the frontier and Ibn Sa‘ud gave orders to his Akhwan leaders to discontinue raiding. Finally, at the conference held at Bahra in the Hejaz between the Sultan and Sir Gilbert Clayton, in Nov. 1925, a treaty was drawn up between ‘Iraq and Nejd on the lines proposed by H. M. Govt. and the ‘Iraq Govt. at Al Kuwait.

Ratification of the Treaty.—Sir Henry Dobbs and the ‘Iraq Govt. had been engaged during the winter of 1923 in discussing the provisions of the agreements subsidiary to the treaty. The resignation of ‘Abdul Muhsin Beg, in Nov. 1923, occurred in the midst of these discussions, which were carried on with the new Cabinet presided over by Ja‘far Pasha al ‘Askari. The agreements were signed on March 25 1924, and the instrument of alliance being thus complete, the Constituent Assembly was opened by the King on March 27.

The debates on the treaty and agreements continued until June 10. There was much misrepresentation and some solid ground for dissatisfaction at the heavy burdens imposed on ‘Iraq by the obligation simultaneously to expand the army, redeem the capital cost of the railways and shoulder a large share of the Ottoman Debt. H. M. Govt. gave an undertaking that after the ratification of the treaty they would be prepared to reconsider certain of the financial obligations of ‘Iraq towards Great Britain, and the debates were brought to a close by the announcement of the determination of the British Govt. to raise before the League of Nations at the June session the whole question of the continuance of their mandate, and the warning that if the Assembly had not passed the treaty by June 10, it would be taken as a rejection. King Faisal and his government clearly discerned the attendant risks, the Cabinet called on its followers for support, and the treaty and agreements were accepted before midnight on the appointed date. The instrument was accepted by the League of Nations on Sept. 27 1924, as giving effect to the provisions of Art. 22 of the Covenant of the League for the regulation of the relations between ‘Iraq and the mandatory Power, and was ratified by King George and King Faisal in the winter of 1924. The Constituent Assembly then passed the Organic and Electoral Laws, and was dissolved on Aug. 2 1924. Ja‘far Pasha and his Cabinet having concluded their work, resigned office, and Yasin Pasha al Hashimi formed a new Cabinet.

The question which now overshadowed all others was the settlement of the northern frontier with Turkey. (*See* LEAGUE OF NATIONS; MOSUL.)

It had not been considered advisable to disturb the proceedings of the Frontier Commission sent by the League of Nations to Mosul in the spring of 1925 by the holding of elections; on

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[1] This took place on Aug. 6 1924.

March 21 1925, however, the Organic Law was promulgated and elections for the first parliament began. Yasin Pasha's Cabinet had previously passed four notable measures, vital for the further prosperity and stability of ‘Iraq. The first was the signature with the Anglo-Persian Oil Company of an agreement for the dredging of the Shattal-‘Arab bar. The second was a trade transit agreement with Syria. The third was the granting to an international group, known as the Turkish Petroleum Company, of a concession for the development of oil in the Baghdad and Mosul vilayets, while the fourth was the signature of long term contracts with over a hundred experienced British advisers and officials.

The visit in April 1925 of the Secretaries of State for the Colonies and Air gave opportunities for frank and valuable exchange of views, and also resulted in the adoption of a scheme which should provide for the speedier training of the ‘Iraq army, so that it might eventually assume responsibility for internal security and external defence.

Elections were completed by June 23 1925, but before parliament met Yasin Pasha resigned, owing to differences of opinion in his Cabinet, and ‘Abdul Muhsin Beg was again charged with the formation of a government. Parliament, consisting of two chambers, a Senate of 20 members, appointed by King Faisal, and an elected house of 88 members, met on July 16 in extraordinary session to consider the budget and certain necessary amendments to the Organic Law. Its debates were characterised by earnestness and good sense, and when its task was finished it was prorogued, on Oct. 28, by the Amir Zaid, acting as Regent during King Faisal's absence. The second session was opened formally on Nov. 1, but was postponed for six weeks and met definitely on Dec. 20.

The New Treaty.—The settlement of the question of Mosul (*see* LEAGUE OF NATIONS) was accepted by ‘Iraq with relief, and negotiations for the signature of the new treaty were initiated before the end of 1925. The treaty was signed by the representatives of the two governments on Jan. 13 1926, and accepted by the ‘Iraq Parliament on Jan. 18 and by the British Parliament on Feb. 18. It is contracted for a maximum period of 25 years or until ‘Iraq shall be permitted to become a member of the League of Nations. When the delimitation of the northern frontier along the Brussels line and of the Syrian frontier, which is as yet only provisionally fixed, has been completed, it will remain for ‘Iraq to satisfy the League that the conditions of membership laid down in Article I of the Covenant have been fulfilled. The arrangement was not accepted by the Turks until June, 1926. (*See* MOSUL.)

Since 1920 great progress has been made in this direction. A police force, which compares favourably with any in the East, does its part in preserving internal order; a body of responsible ‘Iraq civil officials is coming into being; communication by rail and road are opening up the country, the trans-desert route, in particular, having brought ‘Iraqi into much closer touch with Syria, Egypt and Europe; the tribal leaders are stepping into their place in public life, thus tending to reduce the former gulf between tribesmen and the effendis of the town. Justice is on the whole satisfactorily administered; the Ottoman Law still remains the principal system of law in use in the civil courts, while the criminal codes are founded on those of Egypt and the Sudan. Good hospitals exist in Baghdad, Basra and Mosul and smaller establishments in other provincial towns; the Baghdad hospital is as well equipped as any in Asia and is able to deal with and stamp out recurrent epidemics. Education has perhaps seen the greatest revolution since Turkish times. Arabic is now the medium of instruction, or the local vernacular in Kurdish or Turkoman districts. Great efforts have been made to provide a sound grounding. Four secondary schools are all that the Government can yet afford, but teachers are being trained, recruits engaged in Syria and the quality of education shows a marked improvement. The desert route has enabled many boys to seek higher education abroad. The agricultural department is raising the level of husbandry by providing selected seeds and has given special attention to the growing of cotton, which bids fair to become one of the most valuable crops of the country.

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II. FINANCIAL AND ECONOMIC HISTORY

The truth about the public revenue and expenditure of ‘ is very hard to determine. Figures dating back to the peri Ottoman rule bear small resemblance to fact, and during War period fancy played a large part in the preparation of fig relating to the “civil administration.” To draw a distin during that period between military and civil expenditure, tween the activities of the Expeditionary Force and those o Civil Service, and to analyse the respective liabilities of the perial Govt., the Government of India and the civil adminis tion of Mesopotamia were tasks which provided abun exercise for a lively imagination.

Revenue and Expenditure.—The average revenue during two years 1910–2 was made by the Treaty of Lausanne the termining factor in ‘Iraq's liability for the Ottoman P Debt, and the total figure for the three vilayets of Bagh Basra and Mosul was £T. 1,492,953. ‘Iraq was no source profit to the Ottoman Empire. Basra, in spite of a comp lack of harbour facilities, was an important gateway, and cust receipts there were heavy. But ‘Iraq was to all intents and p poses a foreign dependency in which other revenues were collected by means of minor military operations, the cos which exceeded their proceeds.

The Review of the civil administration of Mesopotamia w the British Govt. published in 1920 (Cmd. 1061 of 1920) figures showing a large balance of revenue over expenditure each of the four years ending with March 31 1919, and only a paratively small deficit for the following year, and stated that fo whole period of five years “the aggregate civil expenditure approximately £8,000,000 . . . while the receipts amounted to a £10,000,000.” 1920–1 was a bad year, with a rebellion in prog little revenue coming in and expenditure inevitably heavy. 1922 Parliament was asked to vote money to make good the “ deficit” in Mesopotamia on March 31 1921, from which date sponsibility for the finances lay with the ‘Iraq Government. figure was put at £1,087,000, but ultimately only £559,000 required. Even this figure, although supported by appropria accounts and audits, hardly represents the real facts. There expenditure in Persia and in Nejd, expenditure on refugees Armenia and from Russia, and expenditure in connection with tastic War-time enterprises, which had no real connection with public services of ‘Iraq. The financial mission which reported t British and ‘Iraq Govts. in 1925 (Cmd. 2438) quoted the fig as follows:—

	1921–2	1922–3	1923–4	1924– (Revis Est- mates
	(In lakhs of rupees)			
Expenditure	572	479	418	460
Revenue	528	475	508	520
Surplus	..	..	90	60
Deficit	44	4	..	..

The mission pointed out that for the year 1925–6 ‘Iraq was f with a liability of about 80 lakhs for the Ottoman Public Debt an increase in expenditure on the army of 34 lakhs, and that the of these two services was beyond the present financial capacity o country. They maintained that a reduction of one or the other inevitable, and in fact the Ottoman Public Debt contribution not been paid, the actual determination of an amount not havin sulted from the Treaty of Lausanne. The position of the pu finances of ‘Iraq affords no ground for pessimism. “History,” the report of the financial mission, “probably shows no instan a state expected to do so much so soon.”

The public revenue and expenditure are not a safe index of resources of a country even when, as in ‘Iraq, a large propo of the revenue is derived from the Government's share in agricultural output. The machinery of assessment and collectio primitive and defective; and the Government gets far less tha theoretical share, which over a large part of the country is as high 40%.

iculture and Irrigation.—'Iraq is a country within which
and records and traces of very ancient civilisation. Great
s of population were in existence thousands of years ago
ces which are now desert, and these great centres depended
eir existence on a highly-organised system of agriculture
on irrigation. Down to the 13th century 'Iraq was an
ltural country made wealthy by the proceeds of its har-
and its pastures. Those harvests and pastures depended on
gris and the Euphrates rivers which, thanks to an ancient
aborate system of irrigation canals, fed vast areas which
lie derelict. The destruction of that system is definitely
ble to the Mongol invasion of the 13th century. To that
ne catastrophe succeeded a long period of upheaval and
, and then the alien rule of the Ottoman Turk, inimical to
empts at reconstruction, and destructive not only of mate-
sources, but also of the initiative and capacity by which
resources are fostered and developed.

irrigation problem in 'Iraq was made the subject of an
ate series of enquiries and reports in Turkish times by Sir
m Willcocks, and he was responsible for the one important
eering enterprise which has been carried out in the country,
indiyah barrage across the Euphrates, which regulates the
y of water to an elaborate series of canals. The completion
programme which he sketched out would entail a capital
diture far beyond the present resources of 'Iraq; and the
sed difficulty of raising large sums of money for such enter-
after the Great War inevitably postpones the fulfilment
en a more modest programme. The whole question of irri-
n in 'Iraq requires further study and experiment before
tious schemes are undertaken. Irrigation without drainage
be a danger, and may even do more harm than good; for
ted land easily becomes salt and water lavished on one
may leave other areas, which need it equally, dry and unfer-
But the subject is now receiving close study, and it may
ophesied with confidence that the productivity of the coun-
ill be increased by a better use of the water available. The
diate need is for a systematic examination of possibilities
a rigorous avoidance of pretentious schemes inadequately
red.

pulation.—The population which once cultivated vast
of arable land has disappeared, and its restoration must
d less upon immigration from other Arab areas—for the
nal spirit of 'Iraq will not tolerate an alien immigration—
upon a lowering of the death-rate, and especially of the
of infant mortality, which will give the 'Iraqi nation the
ers for which the cultivation of such areas calls. The dif-
ce between desert and fertile land is summed up in this
of the world by the single word "water;" but fertile land
not be productive unless there is a population to cultivate it.
here else in the world will peace, order and good government
rely find reflection in economic development. Improved
itions of health, education and social well-being mean quite
itely in 'Iraq increased productivity.

tton and Oil.—There are well-grounded hopes that new
ces of wealth will be found in cotton and oil. A concession
granted in 1925 for the development of the oil resources of
Mosul and Baghdad Vilayets to the Turkish Petroleum Com-
, which represents a combination of international oil inter-
and is a development of the company which had obtained a
ise of a concession from the Ottoman Govt. in 1914. The
o-Persian Oil Company enjoys similar rights, in virtue of the
nal Persian concession of the D'Arcy Exploration Co., in
transferred territories" which were formerly part of Persia,
here boring for oil has already been successful. The British
on Growing Association have interested themselves actively
e development of cotton cultivation. The production is, as
comparatively small, but the possibilities have been effec-
y proved, and with the improvement of public security the
stment of more capital may be anticipated. There is there-
every reason to expect that a country which was once the
granary of the eastern world will once more become a great
-exporting land.

Communications.—To-day 'Iraq derives much profit from the transit trade with Persia. The route through Russia has been practically closed for some years, and its reopening must be dependent upon the most incalculable of all factors, the political and economic future of Russia. The 'Iraq railways, which have grown out of an emergency War-time line of communications, nearly reach the frontier of Persia, a country undeveloped as regards railways. Baghdad is the *entrepôt* of Persia and Basra its gateway, and the importance of fostering this transit trade is fully appreciated in 'Iraq. The motor service across the desert via Damascus to the Mediterranean at Beirut, due to the enterprise of a New Zealander, has already had far-reaching consequences, and an air service as yet in its infancy has possibilities which can hardly be gauged. 'Iraq looks West to-day, after looking East for thousands of years, and Baghdad is only a week from London.

Port of Basra.—'Iraq has inherited one asset of great value from the War period in addition to its railways—the port of Basra, where vessels of the deepest draught can lie alongside fine wharves fully equipped with railway connections, electric cranes and warehouses. Work is now in progress, and it is hoped nearing completion, which will provide a deep-water channel across the bar of the Shatt-al-Arab and thereby enormously improve the speed and reduce the cost at which vessels can be berthed and cleared. The Shatt-al-Arab is the way not only to the wharves of Margil and the navigable Tigris, but also to Abadan, where the refinery of the Anglo-Persian Oil Company is situated, served directly by a pipe-line from the oil-fields.

Imports and Exports.—Figures of imports into and exports from 'Iraq are as follows (in lakhs of rupees—re-exports excluded):—

	1922–3	1923–4	1924–5
Imports ..	969	879	890
Exports ..	370	422	423

They appear to indicate a heavy "adverse balance of trade," but like most figures relating to 'Iraq, they are misleading unless they are analysed. The expenditure of H.M. Govt. in 'Iraq on the maintenance of the garrison must be accounted an "invisible export," and there has also been a large export of currency—Indian rupees and rupee-paper—since the steady reduction of the garrison reduced the amount of currency needed for internal circulation. There is some reason for believing that the adverse balance has now almost reached vanishing point, and this view is confirmed by the latest movements of the exchange-rate with India. The percentage (in values) of imports from the United Kingdom in 1924–5 was 33, and of those from British India 30. Textile goods formed by far the largest item, sugar and carpets and tea coming next. All these items represent largely articles in transit between Europe and Persia. The principal items of local produce figuring among the exports were dates (183 lakhs in 1924–5), raw wool (84 lakhs) and grain (54 lakhs). (R. V. V.)

IRELAND, JOHN (1838–1918), American Roman Catholic prelate (*see* 14.742), died at St. Paul, Minn., Sept. 25, 1918.

IRELAND (*see* 14.742).—The first part of this article deals with the history of Ireland from 1910 to the creation of the Irish Free State, while the second discusses its agricultural development. Its history subsequent to that date is dealt with under IRELAND, NORTHERN; IRISH FREE STATE.

I. POLITICAL HISTORY

FROM 1910 TO THE OUTBREAK OF WAR

The year 1910 saw the opening of the most important period in the relations between Great Britain and Ireland since the Act of Union. The relative strength of the two great English parties in Parliament as the result of the general election in December made the Liberal Govt. dependent on the assured support of the Irish Nationalists; and this support could only be secured by a genuine effort to pass a Home Rule Bill into law.

Nationalist sentiment was by no means universal. There was a formidable minority for the maintenance of the Union. The line between Nationalists and Unionists coincided roughly with the line between Catholics and Protestants, though a certain number of persons of either religion held the political views generally identified with the other. The Unionist minority existed in every part of Ireland, but was more concentrated in the North. Even in the Unionist North there was a respectable Nationalist minority in Belfast, and in the predominantly Unionist counties of Antrim, Down, Armagh and Derry; in Fermanagh and Tyrone and in the city of Derry Unionists and Nationalists divided the population; in Donegal, Cavan and Monaghan Unionists were in a minority.

All over Ireland, but more particularly in the North, the political cleavage was deepened, and differences exasperated, by the difference in religion. In such circumstances it would not have been reasonable to expect a compromise on the political question; and the Nationalist party as a whole hardly attempted to secure one, or to face the issue of the position of the Unionist population under Home Rule. They seemed to expect that the minority, after violent protests, would accept a position which they would be no longer able to alter. Some of the Nationalists, notably Mr. William O'Brien, saw the necessity of attempting to conciliate the minority; and the All for Ireland League was inaugurated in Cork on March 31 1910, its declared object being to combine "all the elements of the Irish population in a spirit of mutual tolerance and patriotic goodwill."

The Rise of Sinn Fein.—Outside the Nationalist party a small but earnest body of Irishmen, led by Mr. Arthur Griffith, had been for a dozen years[1] declaring that the Nationalist party was upon entirely wrong lines. Their policy was to assert the position that Ireland was a separate and independent kingdom united to Great Britain by only one link, that of the Crown. They went further than the most advanced Nationalists, and claimed for Ireland in the United Kingdom the same position that Franz Deák had claimed for Hungary in the Austro-Hungarian Empire. This party, afterwards known as *Sinn Fein*, had for years insisted that the National movement should include all classes of Irishmen; they recalled the fact that some great leaders of Irish Nationalism in the past, such as Henry Grattan, Wolfe Tone, Robert Emmet and Charles Stewart Parnell, had been Protestants, and tried to enlist Protestant Irishmen in a comprehensive National movement. They repudiated and ridiculed the parliamentary policy of the Nationalist party; they would have the Irish members withdraw from Westminster and devote themselves to building up a national culture and economic life, and to developing Irish industry and commerce, in the hope of ending the economic dependence of Ireland upon Great Britain.

This party, though more intellectually vigorous than the Nationalist party, was small and without any very wide influence in 1911. Its importance lay in its almost fanatical earnestness and in the fact, not then apparent, that a revolution in the affairs of Europe was at hand in which the most drastic constitutional changes would be regarded as almost normal occurrences. But while the Sinn Fein party proposed a peaceful, though extra-constitutional, policy for the immediate future, it did not refuse to contemplate the possibility that Ireland, strengthened by years of perseverance, might in the end find herself strong enough to assert her freedom by force of arms. This brought it much nearer to the revolutionary elements in Ireland than to the parliamentarians.

Republican feeling was represented by the Irish Socialist Republican party founded in Dublin by James Connolly in 1896. It was not till 1911 that this party became active in Irish politics, but during the next few years its influence through Connolly's paper, *The Workers' Republic*, became more and more marked upon the Republican side; and the Irish Transport and General Workers Union founded by him, though not professedly Republican, could always be depended on to cast its weight upon the side of the more "advanced" political parties.

The Ulster Protest.—During the year 1911 Nationalist Ireland was practically undisturbed, but the Northern Unionists were in a ferment of unrest and apprehension. The introduc of the Home Rule Bill was imminent; and while Nation Ireland awaited events in comparative quiet, Unionists aware that, so far as Parliament was concerned, their cause lost. They were convinced that they had an unassailable They held that Ireland as a whole had benefited by the Un and that in particular the industrial development of North Ireland had been made possible by it. They believed that a governing Ireland would prove an irreconcilable enemy of British Empire, and, by its hostility in the case of a future would menace the safety of Great Britain. Ireland was, argued, a strategic position which on naval and military grou alike it would be madness to abandon.

Mr. John Redmond's prophecy that the grant of Home would produce in Ireland a demonstration of "imperial loyalt fell upon deaf ears, and it was not hard to produce statemen a very different tenour, not only from the acknowledged lea of Irish Nationalism of a previous generation but even fr other speeches of Mr. Redmond. Finally, they raised the gious objection to a Parliament which would be composed mai of Roman Catholics, and declared that they would never s it or submit to any laws which it might pass. Their ideals Protestants differed essentially from those ideals which wo command the respect of a Parliament of Irish Catholics, an force them to submit to the decrees of such a body would be tamount to religious persecution.[2] They refused to credit assurances from any quarter designed to allay their appreh sions, and declared that, in spite of any legislation to the trary, they would retain the constitutional position in wh they had stood for more than a century.

The views of the Irish Unionists had often been proclaim but their complete sincerity was called in question. The rest Ireland had not forgotten the United Irishmen, a body arose and had its chief strength in Northern Ireland, and th could not believe that the interval that had elapsed since 17 had completely extinguished in the North the love of indepe ence and the spirit of religious toleration which had once tinguished the Protestants of Ulster. They hoped with so confidence that this spirit would revive or that at the le Home Rule would be accepted under protest. And the Briti Govt. seemed to regard the often vehement defiance of th policy in Irish Unionist circles as but another example of Hi nian hyperbole.

On Sept. 23 1911 a great Unionist demonstration of prot against Home Rule, said by the Belfast newspapers to have be attended by 100,000 persons, was held at Craigavon near fast. It was addressed by Sir Edward (Lord) Carson, the lead of the Irish Unionist party. In the following week the Uls Unionist Council, strengthened by representatives of the Unio ist Clubs and the Orange Lodges, resolved to frame a constit tion and appoint a Provisional Govt. for the province of Ulst to come into operation when Home Rule should become the la of the land. This bold step aroused the Govt. to a sense of th nature of the resistance they might expect, and early in 19 Mr. Winston Churchill decided to explain at a public meetin in Belfast the general principles underlying the governme policy. The Unionist party organisers in Belfast decided that should be prevented, by force if necessary, from speaking in th public hall which had been engaged for his meeting.

No steps were taken by the Govt. to meet the challenge, an their inaction was interpreted in Belfast as weakness. M Churchill spoke (Feb. 8) under military protection, in a marque erected on a football ground, and explained that any measu of Home Rule would be part of a general scheme of devolutio not in any sense inconsistent with the federation of the Empir But nothing he could then say would have had the least effe he was mobbed on his way to the meeting, and had to slip out the town the moment it was over. A month later the Unionis a great counter-demonstration at Balmoral, a suburb of ast, over which the Protestant Primate presided. It was essed by Sir Edward Carson and Mr. Bonar Law, the latter hom declared that Protestant Ulster formed a separate tion" which it would be unjust to force into any political bination with the rest of the population of Ireland. From time on resistance to the Home Rule bill took more and more form of the assertion of the distinct nationality of the Ulster estants, and it was this which finally led the Ulster Unionists issociate their cause from that of the Southern Unionists.

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[1] Mr. Griffith's paper, *The United Irishman*, first appeared in 1899. The National Council of Sinn Fein was founded in 1905.

[2] The quite recent promulgation of the *Ne Temere* decree in Ir land did much to harden the attitude of Protestant Unionists, bei interpreted as an attempt to subordinate the law of the land to th decrees of the Church.

ome Rule Bill of 1912.—In April 1912 the Home Rule bill introduced in the House of Commons by Mr. Asquith. It osed to establish in Dublin a parliament strictly subordinate Vestminster (a large number of services being reserved for exclusive control of the British Parliament); it did not con- upon Ireland fiscal autonomy, nor did it propose to establish parate Irish Treasury; and Ireland was still to be represented he Imperial Parliament as an integral part of the United gdom. The bill was so far from an attempt to repeal the of Union, that it might have been expected to appease onist opposition: but it was received with uncompromising ility. No one in Ireland was entirely satisfied, although a ionalist convention officially endorsed the bill as satisfactory April 23. It was at best regarded as an instalment, while the eme Nationalists and the Republicans denounced the accep- ce of it as a surrender of Ireland's national rights. An amend- nt to exclude the four counties of Antrim, Armagh, Down Londonderry put forward on June 11 was defeated, both the ne Minister and Mr. Redmond declaring that Ireland must reated as a national unit; but the amendment was a sign of direction in which Ulster Unionists were moving.

he Southern Unionists, who would have been placed in a eless position by the acceptance of the amendment, or by solution of the controversy along similar lines, continued to test against any form of Home Rule; and English Unionists great demonstration held at Blenheim on July 27 pledged mselves through the mouth of Mr. Bonar Law to an almost onditional support of Ulster in resisting the bill. Fortified this assurance the Ulster Unionists took still another step. Sept. 28, amid scenes of great enthusiasm, the "Ulster Cove- t" was signed by large numbers, who pledged themselves lefend their political position by the use of any means which ght be found necessary to defeat the imposition of Home Rule on Irish Unionists. This pledge was at the time understood be a pledge on the part of the Ulster Unionists to resist Home le for the whole of Ireland. Undeterred by the temper of ter, and the opposition of the English Unionist party, the vt. pressed on with their bill, its repeated rejection by the use of Lords serving only to delay its final enactment.

Resistance of Ulster.—Meanwhile the Ulster Unionists de- ed upon a final defiance. They had begun to form companies Volunteers, who were drilled and practised but not yet armed; d on Sept. 25 1913 the Ulster Unionist Council formally ok upon itself the duties of a Provisional Govt. for Ulster, d appointed Sir Edward Carson as head of that Government. n. Sir George Richardson, an officer on the retired list, was pointed to command the Volunteer force, which was formally pected by the head of the Provisional Govt.; committees re formed to manage the various public services, posts, cus- ns, excise; and the administration of justice and even educa- n were entrusted to the care of their special committees.

Ulster Unionists drew a distinction between loyalty to the own and submission to Parliament. In general they acknowl- ge both; as adherents of the Act of Union, they could not but nit the right of Parliament to legislate for every part of the ited Kingdom. But they held that the Imperial Parliament uld not, without the consent of the Protestants of Ulster, alter Act which had conferred upon them the position which by terms they held in the United Kingdom. If Parliament passed Act giving Home Rule to Ireland in any form which they did t approve, then their duty to submit to its decrees ceased to st, and nothing remained but their loyalty to the King. When the royal assent to the Act was given some persons declared that the King had taken a step which put his authority upon a level with that of Parliament. But with the exception of momentary outbursts, the Ulster Unionists protested their entire loyalty to the Crown. This constitutional doctrine would be subjected to a delicate test if the King's army were called upon to support the decrees of Parliament, but it was hoped that the application of this test might be averted.

The proceedings in Ulster were not without effect on the rest of Ireland. The Parliamentary party and its supporters, with an easy optimism, assumed that the difficulty would settle itself, or that Parliament would in the last resort assert its own authority by force. But some elements hostile to the Parliamentary party held that what was happening was the just Nemesis of the policy which, they asserted, had persistently ignored the duty of persuading the Ulster Protestants to accept Home Rule under safeguards for their special interests and guarantees for their special rights. Nationalists of a more advanced type saw in Ulster's passionate repudiation of the authority of Parliament an assertion by a body of Irishmen that Irishmen had the right to the final decision of the terms upon which they would consent to be governed; and they were content to overlook the particular ground of the quarrel between Ulster and Parliament for the sake of the principle logically involved. The official Nationalists were not aware of the complete sincerity of the vast majority of Ulster Unionists, nor did they attach enough weight to the formidable objections to any attempt on the part of Parliament to enforce its authority; while the Nationalists who applauded Ulster overlooked the fact that Ulster's quarrel with Parliament was due not so much to the proposal to govern them in a particular way as to the proposal to divest itself of part of the functions of governing them.

The National Volunteers.—The example of Ulster was contagious. On Nov. 25 1913, at a meeting in the Rotunda in Dublin called by a Provisional Committee representing Sinn Fein, the Irish Republican Brotherhood and the Gaelic associations, it was decided to inaugurate the National Volunteers "to secure and maintain the rights and liberties common to all the people of Ireland, without distinction of class, creed or politics." This formula was a direct challenge to the Ulster Volunteers who held that, Ireland having no separate political existence, there were no rights and liberties which Ireland was specially called upon either to secure or maintain. The formation of the National Volunteers was not at all palatable to the Parliamentary party, who were still confident that Parliament would give adequate protection to any rights and liberties that might be endangered.

After the great strike which paralysed Dublin during the autumn of 1913, the Citizen Army[1] began to be enrolled, with headquarters in Liberty Hall, the property of the Irish Transport and General Workers Union. Though comparatively few in numbers, the Citizen Army, composed of men who with their families had suffered during the strike and were prepared to take great risks, played a very important part in later political developments.

The Govt. in Ireland, now awake to the possibilities of disturbance, proceeded to seize arms consigned either to Dublin or Belfast; and in December a proclamation was issued, in spite of the repeal of the Arms Act by Parliament in 1910, prohibiting the importation of arms into Ireland. The validity of the proclamation was immediately challenged in Belfast, and it was not until June 15 in the following year that the Court of King's Bench in Dublin ruled on appeal in favour of its validity. Meanwhile small consignments of arms were making their way into the country, and preparations were being made upon both sides for the wholesale purchase of arms on the Continent.

Proposals for Compromise.—A conference between representatives of the Govt., the two Irish leaders and the leader of the English Unionist party led to no result, Sir Edward Carson being now confident of his ability to beat the Govt., and Mr. Redmond being unwilling to consider the exclusion of any part of Ireland from the scope of the bill. The Prime Minister, however, on March 9 1914, proposed a compromise of his own, that six counties of Ulster should be excluded for five years, on the understanding that unless Parliament, at the end of that time, should otherwise determine they should be included without further delay. Both Irish leaders publicly refused to consider the expedient, Sir Edward Carson on the double ground that the security offered to his followers was insufficient, and that he could not agree to abandon the Unionists of the rest of Ireland. After his speech in Parliament he and the other Irish Unionist members withdrew from the House, and crossed to Belfast, where he issued his final challenge to the Govt.: "Give us a clean cut or come and fight us." The policy of the "clean cut" thus became the official policy of the Ulster Unionists as offering the best chance of success, but its adoption, nevertheless, was more or less a disappointment to Irish Unionists outside of Ulster.

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[1] The character and aims of this body are set out in *The Citizen Army* by P. O'Cathasaigh (Dublin, 1919).

The Curragh Incident.—It was clear now that Ulster Unionists were prepared, if necessary, to resort to arms, and the Govt. took measures to protect the military stores in Ulster from being seized. On March 20 the attitude of the army was brought into sudden prominence by the "Curragh incident." Gen. Hubert Gough, with a large number of the officers stationed at the Curragh in Co. Kildare, on being asked whether if ordered to Ulster they were prepared to go, replied by tendering their resignations, some of them (at least) on the ground that such a question should not have been put to an officer. Their refusal, though their resignations were subsequently withdrawn as the result of mutual explanations, led the Ulster Volunteers to believe that the army was with them, that it had yielded to the insistent appeals to refuse to be made the instrument of "coercing loyalists."

But the Ulstermen did not relax their vigilance, or countermand their orders for arms, on that account; and on the night of April 24 there was landed, under the superintendence of the Volunteers, at both sides of the mouth of Belfast Lough a consignment of nearly 50,000 rifles and 3,000,000 rounds of ammunition. The fact that the naval squadron, stationed at Lamlash for the purpose of supporting the army in the event of a conflict in Ulster, had not intercepted the vessel conveying the rifles was interpreted in Belfast as an indication that the sympathies of the navy, as of the army, were with Ulster.

On June 9 1914 Mr. Redmond identified himself formally with the Volunteers already in existence in Dublin and the South. The original committee, with some reluctance, for Mr. Redmond's policy was increasingly divergent from their own, allowed him to nominate additional members of the committee. The National Volunteers were still unarmed, but their arms were already on the way.

Meanwhile the Home Rule bill was nearing the end of its course. It passed its third reading on May 25 1914. The Govt. were considering an amending bill, as certain to be as strenuously opposed by the Upper House as the bill which it was intended to amend; and as a last resort a conference was called by the King at Buckingham Palace to see whether some compromise could be arranged. After three days the conference broke up on July 24, each party adhering stoutly to its original position. Two days later the National Volunteers landed a consignment of arms at Howth in broad daylight. The Deputy Commissioner of the Dublin Metropolitan Police, hearing of the landing, called upon the military for assistance, and intercepted the Volunteers who had superintended the landing as they marched back with their arms. After some parley, however, the details of which are uncertain, the Volunteers were allowed to retain their arms, on condition of disbanding before they reached Dublin, and the soldiers marched back to their barracks. On the way they were assaulted by a jeering mob, on which they turned and fired, killing three persons and wounding a considerable number. This occurrence caused a profound sensation. The Govt. decided to dissociate itself from the Dublin incident, and the Assistant Commissioner, whose zeal had brought it about, was eventually dismissed on the ground that he had exceeded his authority.

The War Period

When a few days later war was declared against Germa Mr. John Redmond, in a moving speech in the House of Co mons, declared that all quarrels between Great Britain and land were at an end, that Ireland ranged herself on the side England and her Allies, that English troops might with safe be withdrawn from Ireland, whose shores during the War wou be "defended by her armed sons." His attitude aroused great thusiasm in England, but in Ireland the response was less war On his own side the more advanced of his followers thought th he had failed in his duty to Ireland by this unconditional d laration, and the Northern Unionists, though they received words with respect, were inclined to wait before committing the selves. It was not long before party passion was again arouse The Cabinet had to decide upon their policy with regard to Ho Rule in the new circumstances. They chose to proceed as usu to the royal assent (Sept. 1914), but of postponing the oper tion of the Act for a year (or to a date after the terminati of the War to be fixed by Order in Council), with a promise introduce, in the interests of Ulster, an Amending bill when t War should be over.

Their action was denounced by the Unionist party both England and in Ireland as a breach of the war-time truce party politics; in Nationalist Ireland the promise of an amendi bill robbed the provisional enactment of Home Rule of much its value. The members of the committee in control of th National Volunteers divided into two sections, those in favo of Mr. Redmond's policy and those who adhere to the origin principles of the Volunteers. The latter seceded and formed distinct body, the Irish Volunteers, opposed to enlistment in th British Army and to any compromise upon the principle of th unity and independence of Ireland. But this party was in minority, and the appeals of Mr. Redmond and the Prim Minister (who came to Dublin to address a recruiting meetin met with considerable success. Southern Unionists united co dially with Irish Nationalists in the efforts to enlist Irish soldier many of the National Volunteers joined the army, and it seeme as if Mr. Redmond's enthusiastic support of the Allies was t prevail.

In Ulster recruiting was more successful. The Ulster Volun teers did not (any more than the National Volunteers) flock t the colours. They retained their arms, and they kept up thei organisation. They found themselves faced by a double duty that of protecting the Empire and that of securing their ow political position. The Ulster Division, formed out of thos Ulster Volunteers who enlisted and other Ulster recruits wh did not join the Irish regiments of the line, did not readily admi Nationalists or Catholics to its ranks; the Ulster Catholics wh enlisted were as a rule sent South to join the Division forme out of the Nationalist recruits of the other three provinces; an Sir Edward Carson refused to address a recruiting meeting company with Mr. Redmond.

During the year 1915 the Ulster mills and shipyards were working at high pressure on Govt. orders and the farmers were extremely prosperous. A period began in which constant employment at good wages was open to the workers and large profits could be made by the manufacturing and commercial community. As the War progressed this tended to check recruiting for the army. In Southern Ireland recruiting was at first fairly satisfactory, though the percentage of able-bodied men who enlisted was not so high as in Northern Ireland, and agriculture began as in Northern Ireland to enter on a period of great prosperity.

The political situation was peculiar. Nationalists and Unionists in the South had sunk their old political difficulties in the task of inducing men to enlist, but their efforts were checked and in the end nullified from two opposite quarters. The War Office in England made no concessions to the national feelings of the Irish recruits, who desired to be allowed to carry the national colours on service and were refused permission to do so. Difficulties were thrown in the way of the formation of an Irish Div. (though one was eventually formed), while the Ulster Div. was

to be favoured by the authorities. The Nationalist Irishmen
volunteered for the army resented this the more because it
ned to imply that the national claim was to be ignored in spite
he service which Mr. Redmond's trustful policy had done to
cause of England.

he Easter Rebellion.—The Sinn Fein party and the Irish
ublican Brotherhood had been long opposed to Mr. Redmond
his policy. The more belligerent spirits revived the old max-
that "England's difficulty was Ireland's opportunity," and,
ting to the increasing difficulties of the Allies, asked whether
time had not arrived for a vigorous attempt to secure what
right not soon again be possible to claim with such apparent
e of success. These arguments were enforced with growing
lness in a number of papers, *Sinn Fein*, *The Workers' Re-
lic*, *Irish Freedom*, *Eire* and *The Irish Volunteer*. These were
pressed three months after war had broken out, and the im-
tation of two American papers which proclaimed the same
cy, *The Gaelic American* and the *Irish World* was prohibited.
other papers sprang up to take their place, such as *Scissors
Paste* and *Nationality*. Pamphlets, some of them written
h considerable ability, in favour of the same policy, were
ely circulated. Organisers formed branches of the Irish Volun-
s, spoke against recruiting, and spread the doctrines of Sinn
n and the Republican Brotherhood. Arms, ammunition and
losives were imported. The Govt. arrested and deported
ie of the most active of these organisers and attempted, not
ays with success, to secure the punishment by the courts of
arrested on the charge of breaking the regulations made by
Defence of the Realm Act, 1914.

his party had agents and correspondents in the United
tes, and early in the war Sir Roger Casement had gone to
many, with the knowledge of the Irish Republican leaders,
induce the German Govt. to lend armed assistance in the
nt of an Irish rising. Most of these facts were known to the
horities, but the Chief Secretary, mistaking the significant for
accidental, took no drastic or immediate action. The Vol-
eers drilled, paraded and practised war-like manoeuvres
ler the eyes of the police.

s early as May 1915 the project of an immediate rising had
n discussed by the Committee of the Irish Volunteers, but it
not till the early part of 1916 that there was general agree-
it that the right moment had arrived. America was still
tral, and the friends of the Volunteers there could assist them
h comparative freedom. Germany was, it is true, unwilling
end help in the shape of an invading force, as Sir Roger Case-
it had requested, but was ready to send a vessel with warlike
es. It was hoped that Sir Roger Casement would arrive with
se late in the week preceding Easter, and Easter Monday was
d as the date for the rising. The Volunteers throughout Ire-
d were ordered to be ready for a "very interesting series of
noeuvres at Easter." The German vessel, the "Aud,"
ived with her stores, but sighting no signals from the land and
ng accosted by and requested to follow a British gunboat was
ttled by her crew. Sir Roger Casement landed from a sub-
rine on the Kerry coast; but by mistaking their directions, the
upants of one of the two motor-cars told off to capture the
marine cable station at Valentia drove into the sea and were
wned; no one met Sir Roger Casement, who was captured by
police and hurried across Ireland to prison in London.

he news reached Volunteer headquarters on the Saturday
ore Easter. The chairman of the committee, Prof. John Mac-
ll, at once countermanded the order for the "manoeuvres"
Dublin, and sent messengers to warn the country battalions.
a section had determined to persevere with their plans at all
s, and, without the knowledge of the chairman, attempted
Easter Monday to carry out their original design. On Easter
nday they proclaimed the Irish Republic. They seized the
t Office, the Four Courts, Stephen's Green, Boland's Mill and
ob's Biscuit factory, all strategical positions; they seized
ses on both sides of the road in Lower Mount Street, com-
nding the route by which any troops summoned from England
st have entered Dublin. But they failed to secure two very important points, the Castle and Trinity College; and though they held the telegraph headquarters in the Post Office, they did not capture the telephone exchange.

The authorities, civil and military, were for the moment paralysed. So complete had been their confidence that the officers of the Dublin garrison had been granted leave of absence to attend the Fairyhouse races. But on the evening of Easter Tuesday April 25 1916, the first companies of the 178th Infantry Brigade landed at Kingstown and fought their way past the fortified houses that lined their route. The light artillery shelled the Post Office, and on the evening of April 29 the Volunteer stronghold surrendered unconditionally to Sir John Maxwell. Outside Dublin City there was practically no fighting. The rising was foredoomed to failure; and there is some evidence to show that some of those who actually led it knew that this was so, and hoped for no more than that by the sacrifice of their lives they might, as other Irishmen had done before them, furnish to their countrymen an example which would not be forgotten in other days.

Of the leaders 15 were tried by court-martial and shot, 160 prisoners were sent to penal servitude for various terms and 1,841 were deported to England and interned there. From the date of these executions Sinn Fein and the Republican party began to acquire an influence and a following which in a short time made them the dominant factors in Irish political life.

Mr. Lloyd George's Conferences and the Convention.—Early in June 1916, Mr. Lloyd George was entrusted with the task of making another attempt to settle the Irish difficulty on the basis of the exclusion of six Ulster counties. Mr. Redmond and his party would have agreed to a temporary exclusion of them, provided that the Home Rule Act were put into immediate operation in the rest of Ireland; Sir Edward Carson and his followers claimed that the exclusion should be definite and permanent. No agreement was reached,[1] and at the end of July Mr. Duke became Chief Secretary for Ireland and Sir James Campbell, Sir Edward Carson's chief lieutenant, was appointed as Irish Attorney-General. It seemed as if a stern policy of repression were in contemplation, but the new Chief Secretary was more inclined to conciliation. In Dec. Gen. Maxwell, who had been in command since Easter, was recalled, and just before Christmas 600 of the prisoners interned in England were released.

The next year (1917) saw a revival of the irrepressible national feeling of which Sinn Fein became more and more the authoritative exponent. In Feb. the publication of the Sinn Fein paper *Nationality* was resumed, and two by-elections in Ireland in Feb. and May resulted in the return of Sinn Fein candidates. A statement by the Prime Minister (now Mr. Lloyd George) in Parliament on March 7, declining to consider any proposal for Home Rule which would place the Ulster Unionists under an Irish Parliament against their will may be taken as the final step in the process by which the Irish Nationalist party finally lost its influence both in Parliament and in Ireland. Later in the month Count George Plunkett, the newly returned member for North Roscommon, called a convention in the Mansion House, Dublin, to inaugurate an Executive for Sinn Fein; while in the middle of the following month the Prime Minister proposed to summon a convention representative of all shades of opinion in Ireland, including even Sinn Fein, to draw up proposals for an Irish settlement.

Mr. Lloyd George's proposal was accepted by all parties except Sinn Fein, who were offered a representation unequal to their importance in the country and whose principle—Irish independence—would not have been even considered by the other parties. The Ulster Unionists, while sending delegates, insisted that they should have no power to agree to any proposal which had not been communicated to and endorsed by the Ulster Unionist Council. As the Prime Minister had intimated that the Govt. would not be bound by the findings of the convention unless there was "substantial agreement" the Ulster Unionists were thus in a position practically to veto any finding which was not their own. On June 15, to provide an atmosphere of general goodwill for the convention, the remaining Irish prisoners were released and returned to Ireland. In July the vacancy in east Clare, caused by the death in action of Maj. Willie Redmond, resulted in the return of Mr. de Valera by an overwhelming majority. Mr. de Valera had been in command of a company during the Easter rising in Dublin and had just been released from prison.

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[1] Mr. Redmond asserted that Mr. Lloyd George had led him to believe that the exclusion contemplated was only temporary; even on this understanding he had great difficulty in persuading his followers (especially in Ulster) to agree to it. Sir Edward Carson claimed that he had understood Mr. Lloyd George to offer permanent exclusion, the only basis upon which he would negotiate; he was strengthened in his position by the attitude of prominent members of the House of Lords who, still opposed to Home Rule on principle, were likely to upset any arrangement with which the Ulster Unionists were not satisfied.

But in the autumn the atmosphere of goodwill was disturbed. The Volunteers began again to drill and the Govt. began again to arrest. And on Aug. 15 the military raided the barracks of the National Volunteers throughout the country and carried off their arms. This action, coupled with the complete immunity from disturbance enjoyed by the Ulster Volunteers, was significant. On Oct. 25 Sinn Fein summoned a convention of its own, at which Mr. de Valera was elected President, in place of Mr. Arthur Griffith, who had been till then the sole acknowledged, as he was still the ablest, leader in the party. The election indicated the final amalgamation of the Sinn Fein and the Republican parties and the formal acknowledgment by Sinn Fein of the service done by the leaders of the Easter rising. But the inexperience of the new leader was, fortunately for Sinn Fein, still allied to the ripe wisdom and real ability of its older chief. Mr. Lloyd George's convention reported on April 8 1918, but there was no "substantial agreement." It was decided therefore that the report furnished no basis for legislation and the situation in Ireland remained where it was.

But the Cabinet had by this time decided upon the application of conscription to Ireland. It was a most serious decision. The Parliamentary party joined with every other section of Irish Nationalist opinion in resistance to it, and the decision in consequence could not be enforced. Mr. Redmond did not live to see this final collapse of all his efforts for peace between Great Britain and Ireland, for he had died on March 6, the very day on which an Irish district (the Co. Tipperary) had been named a "special military area."

Military Rule in Ireland.—On May 1 Mr. Edward Shortt succeeded Mr. Duke, the viceroy (Lord Wimborne) was replaced by Lord French and the viceregal court was transformed into the headquarters of a military administration; at the same time Sir James Campbell was raised to the office of Lord Chancellor of Ireland. The new administration began by arresting prominent Sinn Fein and Republican leaders, and Sinn Fein, the Republican Brotherhood and their allied societies were "proclaimed." Conscription was not put into force; voluntary recruits, who were promised grants of land after the War, were called for in a viceregal proclamation and recruiting continued with some degree of success until the end of the War. At the General election of 1918, out of 106 members for Irish constituencies, Sinn Fein returned 73, who immediately refused to take their seats in Parliament, formed themselves into the Assembly of Ireland (Dáil Eireann) and elected Mr. de Valera as President of the Irish Republic, with a number of ministers of departments, answerable to the Dáil. From this date until the conclusion of the Anglo-Irish Treaty the history of Ireland is the record of one long struggle between two forces, the British Govt. in Ireland relying upon the right of possession, the existing law and the troops, and Dáil Eireann, claiming to be representative of Ireland's right to freedom and adopting the usual methods of insurgent peoples.

FROM THE ARMISTICE TO THE TREATY

During the year 1919, a large portion of the country was portioned off into "special military areas." The plan usually adopted was to proclaim any district in which an officer of the Crown had been shot. But efforts were not wanting to bring about a peaceful solution. The Irish Centre party, later changing its title to that of the Irish Dominion League, in which the most promine members were Sir Horace Plunkett, Gen. Sir H. Gough, Ca Stephen Gwynn and Capt. Henry Harrison, endeavoured to pre upon both English and Irish opinion through their organ, *T Irish Statesman*, the necessity for a solution of the Irish questio along Dominion lines.

The Republican party on their side endeavoured in vain have the case of Ireland brought before the Peace Conference b President Wilson. This hope had finally to be abandoned whe on May 31 the American Peace Delegation in Paris refused receive the Irish Republican envoys. In March the Govt. trie to placate Irish opinion by releasing their prisoners, and Mr. Valera, who had succeeded in Feb. in escaping from Lincoln jai was able to proceed to America to put the case of Ireland befo American statesmen and the American public and to raise republican loan in the United States. Shortly after he left t policy of boycotting the families and dependents of the poli began to be put into force with the object of bringing about whol sale resignations from the police force. Later in the year (o Sept. 12) the Govt. retaliated by proclaiming Dáil Eireann a "a dangerous association." This did little to ease the situatio and from the beginning of winter raids for arms, the burni of barracks and courthouses and the shooting of police becam matters of weekly occurrence. The first "reprisal" took plac on Sept. 17, when the soldiers at Fermoy wrecked the shops o tradesmen who, as members of a coroner's jury, had brought i an open verdict in the inquest on a soldier who had been shot o leaving church by a number of armed men who deprived th church party of their arms.

The Last Home Rule Bill.—Towards the end of the year th Govt. introduced the last Home Rule bill, providing for tw separate Parliaments in Ireland, one for six counties in Ulste the other for the rest of Ireland; each Parliament was to hav control of the government of its own area, while customs an excise, the army and navy, foreign relations and the Post Offic were reserved for the Imperial Parliament, Ireland contributin as its share of the cost of their upkeep an annual sum of £18,000, 000. The Act also contained provision for the amalgamatio of the two Parliaments by mutual consent. It fell far short o what the Republicans claimed; it was regarded with dismay b those Southern Unionists who still wished to continue the figh against Home Rule and with still greater dismay by the Unionist of the three Ulster counties which were not to come under th Northern Parliament. The Unionist party in the six countie agreed to accept it.

Repression in Ireland, 1920.—By April the Govt. had decide to make a final effort to suppress by force the Republican part and its sympathisers. On the 4th of the month, Sir Hama Greenwood was appointed Chief Secretary for Ireland, and th activities of the "Black and Tans" and the Auxiliaries, unde the control of Maj. Gen. Sir Henry Tudor, began. In July Gen Macready was appointed commander-in-chief in Ireland with a army of 60,000 men under his control. But on May 4 the corporation of Dublin formally acknowledged the authority of Dái Eireann, and its example was followed pretty generally throughout Southern Ireland. On May 19 the Sinn Fein courts began t function, and in a short time had replaced the King's courts ove a large area of Ireland. The conflagration spread to the North on Aug. 8 the shooting of a district inspector of police in Lisburn (Co. Antrim) was the signal for the burning by a Protestant mob of the shops and houses of prominent Catholics, and on Sept. 25 the shooting of a detective in Belfast led to similar excesses there. Four days before this the town of Balbriggan had been partially sacked as a reprisal for the shooting of two policemen in a public-house.

During the course of the year reprisals of this kind took place in nearly 20 towns, culminating in the serious conflagration in Cork on Dec. 18. These reprisals, except in the cases of Belfast and Lisburn, were the work of the Crown forces. But in the case of the "Black and Tans" and the Auxiliaries, recruited among ex-service men, it had been understood from the first that they were to be allowed a considerable freedom. Their excesses me notorious; roaming the country, armed to the teeth, they orised the countryside.

n the other side the Irish Republican Army, moving about ight or in lonely places, sheltered and protected by the favour, in some cases by the fear, of the inhabitants, laying ambushes, oting spies or persons believed to have furnished information he Crown forces, picking off small parties of their opponents, le life a nightmare to any members of the police and military found themselves outside their barracks. Both sides fired hrew bombs at the members of the other at sight, often in vded streets, to the danger of the civilian population. One of most horrible of the incidents of the struggle took place on the ning of Nov. 21, when 21 officers were shot at an early hour in ir lodgings, without opportunity of defence or escape. Such the condition of Ireland when on Dec. 23 the bill for the ter Government of Ireland became an Act of Parliament.

olicy of Reconciliation.—But early in 1921 it became ap- ent that the true facts of the state of Ireland could no longer concealed. The tide of opinion in Europe and America was inning to set steadily against Great Britain. The policy of eprisals" was checked and exchanged for one of "official risals." Gen. Macready issued an order that in future houses the vicinity of an ambush laid for the troops, whose inhabit- s might be presumed to have known of it and had not given ormation, were to be burned. But public opinion in England an to be roused.

n April 21 Lord Fitzalan was appointed Viceroy of Ireland, first Catholic to hold the position, and so great was the uni- sal desire for peace that early in the following month Sir James ig, who had succeeded Lord Carson as the leader of the Ulster ionists, held a conference with Mr. de Valera with a view to a tlement. During the same month, the elections for the two v Parliaments were held. In Southern Ireland out of 128 ts, 124 fell to the Republican party; in Northern Ireland out 52 seats the Unionists secured 40, the others being divided be- en the Nationalists and the Republicans. In Southern Ire- d the Republicans refused to acknowledge the new Parliament ich, in consequence, could not meet. On May 25 the Customs use in Dublin with all its records was burned to the ground by arty of the Republican Army, and on the following day the vernment resolved to send more troops to reinforce its army ccupation.

Meanwhile preparations went on for the formal inauguration Home Rule in the six counties of Northern Ireland, which by irony of fate were the first to accept a measure which a few rs before they had repudiated with anger. On June 7 the rthern Parliament was opened by the Viceroy, and on June 22 King and Queen visited Belfast, when His Majesty address- ; the new Parliament urged upon them and the rest of Ireland necessity for harmony and goodwill. But the Govt. had re- ved to yield, and on July 8 at a conference in the Dublin nsion House between Gen. Macready and the Republican ders and representatives of the Southern Unionists, invited by r. de Valera, a truce was signed by which the trial of strength ich had lasted for so long was finally to be at an end.

The Irish Treaty.—The relief in Southern Ireland was intense. was hoped that the details of an agreement would be settled a conference between the Prime Minister and the Republican voys: but after seeing them on July 14, the Prime Minister had neeting with Sir James Craig, who made it clear that the six nties would not under any circumstances agree to a union th the rest of Ireland, though they would endeavour so far as ssible to co-operate on a basis of mutual independence. Mr. oyd George thereupon offered the Republican leaders for the counties the status of a Dominion with certain reservations, inly with regard to the military, naval, fiscal and financial erests of Great Britain. On returning to Ireland and consult- Dáil Eireann and the Executive of Sinn Fein, Mr. de Valera imated to the Prime Minister, both on his own account and the spokesman of the Republican party, that these proposals ld not be entertained, and to this decision, in spite of vice and threats, the party adhered firmly.

Long negotiations followed, in which it seemed at every step that a break was inevitable; until finally on Sept. 30 the Republican leader accepted, with no other comment than the words "our respective positions have been stated and understood," an invitation to send envoys to London "with a view to ascertaining how the association of Ireland with the community of nations known as the British Empire may best be reconciled with Irish national aspirations." The Irish envoys were Mr. Arthur Griffith, the founder of Sinn Fein, Mr. Michael Collins, who had chiefly organised the military policy of the Republicans and had been Finance Minister of Dáil Eireann, Mr. R. C. Barton and Mr. G. Gavan Duffy, with Mr. Erskine Childers as their secretary; they met the Prime Minister, Mr. A. Chamberlain, Mr. Winston Churchill, Lord Birkenhead, Sir Gordon Hewart, Sir L. Worthington Evans and Sir Hamar Greenwood.

After protracted discussions there was signed on Dec. 6 a treaty by which Ireland was accorded the constitutional status of a Dominion; the right of Northern Ireland to intimate its desire to remain under the Act of 1920, provided it did so within one month of the ratification of the treaty by Parliament, being secured and provision made in that event for a commission finally to decide upon its boundaries. The new Dominion was to have complete fiscal autonomy, the right, within certain limits, to maintain an army and was to have its financial obligations to Great Britain regulated by mutual agreement or arbitration. The treaty was ratified by the British Parliament on Dec. 16. It was not till Jan. 7 that a debate, which had begun on Dec. 14 in Dáil Eireann, concluded by a division in favour of the treaty. Mr. de Valera, who disapproved of it, ceased to be President of Dáil Eireann and his place was taken by Mr. Arthur Griffith, Mr. Michael Collins becoming head of the new Provisional Govt. appointed to carry the provisions of the treaty into effect; and on Jan. 16 1922, Mr. Collins formally took over from the Viceroy Dublin Castle and all the offices of Govt. in the name of the Irish Free State.

Bibliography.—It is impossible to name all the books and pamphlets which have appeared on the Irish history of the years 1911–22. Current Irish events may best be studied in the files of the leading Irish newspapers, *The Irish Times* (Unionist), *The Freeman's Journal* (Nationalist) and the *Belfast Newsletter* (Ulster Unionist). The last named may be consulted for the manifestoes of the Ulster Unionist party and for the expression of the aims and feelings of the party. The Sinn Fein standpoint can best be studied in its newspapers, mentioned in the preceding article, files of which are preserved in the National Library, Dublin, and in its various pamphlets (to be found in the same library). The writings and pamphlets of Patrick Pearse, the intellectual author of the rising in 1916 and one of its principal leaders, furnish the best key to an understanding of the motives which gave rise to it. There are many official publications which should also be consulted, such as the *Report of the Royal Commission on the Rebellion in Ireland*, Cd. 8279 (1916); *Documents relative to the Sinn Fein Movement* (1916); *Report of the Proceedings of the Irish Convention* Cd. 9019 (1918), etc. On the conditions in Ireland during 1920 and 1921 the anti-Republican account is given in *The Administration of Ireland in 1920* (1921) and *Ireland in 1921* (1922) by I. O. (C. J. C. Street) published by Philip Allan & Co.; while the Republican account may be studied in the files of the *Irish Bulletin*. These should be supplemented by the *Report of the Labour Commission to Ireland* (London, 1921) and *Evidence on Conditions in Ireland* (American Commission, Washington, 1921).

(R. M. H.)

II. AGRICULTURAL CO-OPERATION

The main interest and importance of the co-operative movement in Ireland since the beginning of the World War consists in the struggle of its promoters to preserve and develop it as the chief agent for implementing a certain philosophy of rural life and evolving an agricultural policy consonant therewith. The movement had been initiated a quarter of a century before the War by men who were not themselves farmers, and its inspiration has ever since come from practical idealists. These men realised that in a country dependent upon a sound agricultural economy for the well-being of every section of the population, a technically educated and efficiently organised rural community was of the first importance.

In countries highly industrialised, agriculture could be neglected without disaster; in a country predominantly agricultural the efficient production and economical distribution of food was what mattered most. Yet those who saw that these ends could best be obtained by the application of the co-operative principle and system to the occupation of farming were chiefly concerned for the building of a rural civilisation which would provide intellectual interests and social amenities calculated to counteract "the lure of the city." For the solution of the modern rural problem as they saw it, they invented the formula: "Better Farming, Better Business, Better Living." To use a New World phrase, the "pivotal" thing was Better Business and Better Business was co-operation.

Agricultural Organisation Society.—The post-War civil disturbances in Ireland might well have wrecked the movement. War prices and a demand which ignored quality had considerably demoralised the dairy societies. The movement was in no condition to meet the sudden decline in prices which set in in 1920–1. It became clear that its future success—perhaps even its survival—would depend upon the ability of the Irish Agricultural Organisation Society to continue its service as guide, philosopher and friend of the societies. This central body had always derived from the farmers it served and from philanthropic individuals a large part of its funds. In the circumstances of the country, these subscriptions were bound to fall off. While the Development Commission, which was authorised by its Act to treat "the organisation of co-operation" as one of the ways of "aiding and developing agriculture," functioned in Ireland it subsidised the I.A.O.S. for this purpose. Under the Anglo-Irish Treaty the Commission transferred its functions and a proper proportion of its funds to the two Irish Governments. The I.A.O.S. had to be partitioned, an Ulster A.O.S. being formed to operate in the six northeastern counties.

The Govt. of the Irish Free State has from year to year continued the grants to the I.A.O.S. and for its first year the Govt. of Northern Ireland continued it to that part of the organisation movement which came within its territory. This, however, was not renewed, and in Northern Ireland the movement in consequence had greatly to restrict its work. But that the farmers there have come to realise its value is evident from the fact that of its total funds in 1925 more than two-thirds came from societies' contributions, so that it was able to end the year without a deficit.

The new Free State Govt. wished to reconstitute the agricultural policy of the country. This was to be expected in a land which, itself purely agricultural, had just obtained independence from a union of countries mainly industrial. The department was merged in a new Ministry of Lands and Agriculture, and a commission on Agriculture was set up which made many far-reaching recommendations, especially emphasing the importance of agricultural education and commending the development of co-operation as well as an increased subvention to the I.A.O.S. At present the Ministry and the organisation society are engaged in negotiations pointing towards increased Government aid.

Statistical Position.—In the country signs are not lacking of a renewal of co-operative enterprise. The largest trade federation of the movement, the Agricultural Wholesale Society, which made great progress in the more prosperous years, participated to the full in the country's economic depression; but "Irish Co-operative Meat, Ltd.," established in 1920, with headquarters in Waterford, is now preparing to work on a large scale. It was unable to function during the years of civil disorder, but has already a membership of 5,793, with a share capital of some £175,000, of which £65,000 has been paid up, the source of the capital being farmers or farmers' co-operative societies. The shipment of pigs was begun in 1925, and the society proposes shortly to deal weekly with 100 cattle, 1,000 pigs, and to be able to cold store 200 tons of butter (or equivalent produce) at one time. The Irish Co-operative Agency Society, which markets the butter of the creameries, had in 1924 a trade turnover of £555,649, representing a quantity of butter only slightly exceeded by the years 1920 and 1922, the highest recorded.

A further development took place in 1925. The credit societies were doing a dwindling business, largely because the I.A.O.S. could not pay for propaganda and inspection, but the Commission on Agriculture had recommended that this aspect of co-operative business be specially endowed; two winters disastrous for farming (1923–4 and 1924–5) had resulted in severe losses of live stock through fluke, etc., and the Dáil of the Free State, at the instance of the Minister for Agriculture, passed a vote for loans not to excee £100,000, for restocking of lands, to be advanced to credit societie approved by the I. A. O. S., to whom the administration of the schem was entrusted. Thus were re-established satisfactory relations between the state aid and the self help parts of a movement which ma encourage other countries to adopt the device of an "organisatio society," working in close co-ordination with the governmental Departments of Agriculture. There was, too, during the winter o 1925–6 a revival of energy among the dairying societies.

The organisation of about 150,000 farmers (in a country containin about 4,250,000 people) into a movement whose aggregate busines for the decade 1914–23 (inclusive) was well over £80,000,000—t which creameries contributed about one-half—is not an unimportant factor in Irish economics.

Education.—The need of all co-operative movements is always education, and the higher the development the greater i that need. The hampered condition of the Central Organisatio Society is probably the true cause of the halt of the movement a a whole. Up to the present, the I.A.O.S. has had to render man services, notably technical advice to creameries and other societies, which the Govt., through the Ministry, are now renderin under the Dairy Produce Act and the Agricultural Produc (Eggs) Act. To ensure the future of co-operation, technical instruction in itself is not the chief desideratum. When it ca leave that to the Ministry, the Organisation Society will concentrate on educating the farmers not only in credit and the technique of co-operation, but in the co-operative spirit—withou which loyalty and solidarity, essentials to success, must alway be lacking. The standard of efficiency required of the moder farmer is only to be attained by an educated man.

The Govt. of Northern Ireland, like that of the Irish Fre State, through its Dept. of Agriculture, enforces egg-grading but the Ulster Organisation Society, with an income of £913 3s. 6d., cannot do the work necessary to educate the farmer u to a standard which the Govt. can only punish him for failing t reach. The work, therefore, cannot be expected to show immediate spectacular results, but that, it must be understood, i as much due to the width of the aim as to the narrowness of th resources. And these two have another connection. To-day th central society's funds are largely drawn from the fees the farmers will willingly pay it for technical instruction, which is not a co-operative but a manufacturing technique. When that function is transferred to Govt. and the Organisation Society is devoted to its educational but less remunerative purposes, the farmers' financial support will for some time be considerably lessened.

Nevertheless, the founders of the movement were convinced that nothing less than a continual extension of the study of th rural problem—the regarding of agriculture as an *industry*, as a *business* and as a *life*—could bring the country population even to the standard demanded under modern economic conditions. The next step, therefore, in this concerted advance was to gather and distribute knowledge of every side of agricultural co-operative evolution the world over, and to provide a centre at which students and organisers could study and compare the progress of local developments. To provide this, the Co-operative Reference Library had been founded in Dublin in 1913. One of the founders of the Irish movement has endowed a trust (which the trustees christened the Horace Plunkett Foundation) for the purpose of extending the Irish philosophy of rural life throughout the British Commonwealth.

Under its auspices there was convened at Wembley in July 1924, a conference on agricultural co-operation in the British Empire. The delegates, who were thoroughly representative of agriculture in this vast area, approved the Irish policy, and called upon the Foundation to establish an office in London to act as a clearing-house for the exchange of experiences and opinions of all organisations which were putting the co-operative principle into practice. This has been begun by opening a London centre which, when the Carnegie United Kingdom Trust promised to defray the cost of maintenance, naturally offered hospitality to the Co-operative Reference Library, an offer which the Carnegie United Kingdom Trust approved. Thus the Foundation is in a favourable position to see that Ireland is kept fully informed of the progress of similar movements in other countries.

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RELAND, NORTHERN (*see* IRELAND, 14.742), a part of the
ted Kingdom of Great Britain and Ireland, with a certain
sure of local self-government. The population at the census
911 was 1,250,531; at the census of 1926 it was 1,255,881,
ncrease of 5,350. The population of Belfast, the capital, in
5 was 414,844. The area of 3,351,970 statute acres consists of
six counties of Antrim, Down, Londonderry, Armagh, Ty-
and Fermanagh, and the county boroughs of Belfast and
donderry.

I. POLITICAL AND CONSTITUTIONAL HISTORY

nder the Govt. of Ireland Act, 1920, the Lord Lieutenant, in
name of the King, summons, prorogues and dissolves
liament. He gives and withholds the Royal Assent to Bills
sed by the Senate and House of Commons, subject to the
owing limitations:—

) He shall comply with any instructions given by His Majesty
espect of any such bill or order; and
) He shall, if so directed by His Majesty, reserve any such Bill
Order for the signification of His Majesty's pleasure, and a Bill
Order so reserved shall not have any force unless and until within
year from the day on which it was presented to the Lord Lieu-
nt for His Majesty's assent, the Lord Lieutenant makes known
it has received His Majesty's assent.

he Senate consists of the Lord Mayor of Belfast, the Mayor
Londonderry and 24 senators to be elected by the members
he House of Commons; the House of Commons consists of
members; 13 members are returned to represent Northern
and in the Parliament of the United Kingdom. The members
he House of Commons are elected by the same electors and
he same manner as members returned by constituencies in
rthern Ireland to serve in the Parliament of the United
gdom, except that, in any contest election of the full number
members, the election is according to the principle of pro-
tional representation, each elector having one transferable
e. All election laws relating at the time of the passing of the
to the Commons House of Parliament of the United King-
n and the members thereof were, so far as applicable and sub-
to the provisions of the Act, to extend to the House of Com-
ns of Northern Ireland.

Ioney bills can only originate in the House of Commons and
y not be amended by the Senate. If the Senate reject, or
to pass, or pass with amendments to which the House of
nmons will not agree a public bill which is sent up to the
ate at least one month before the end of the session, and if
House of Commons in the next session again pass the bill,
h or without any amendments which have been made or
eed to by the Senate, and the Senate reject or fail to pass it,
pass it with amendments to which the House of Commons
l not agree, provision is made for the holding of a joint session.
ubject to the provisions of the Act, the Parliament has power
erally to make for the peace, order and good government of
rthern Ireland, with the limitations that it shall not have
ver to make laws except in respect of matters exclusively
ting to the portion of Ireland within its jurisdiction. The
own, armed forces, defence of the realm, relations with
eign States and certain other matters were excluded from its
ver. The Parliament cannot make laws interfering with
gious equality, taking property without compensation, etc
All executive power in Northern Ireland continued vested in
King, but exercised by the Lord Lieutenant or other chief
cutive officers for the time being appointed in his place. Certain taxes, such as customs and excise duties, were reserved to the Imperial Parliament; the postal service, post office savings bank, etc., were reserved temporarily, pending the formation of the proposed Irish union. The Act abolished the Supreme Court of Judicature for Ireland, and established the Supreme Court of Judicature of Northern Ireland, consisting of two divisions, the High Court and the Court of Appeal.

Developments After 1920.—A proclamation was issued by the Lord Lieutenant of Ireland (Viscount FitzAlan of Derwent) on May 4 1921 summoning a Parliament of Northern Ireland to meet in Belfast on June 7 following. The election of members of the House of Commons was held on May 24, the Unionists securing 40 seats to 6 Nationalist and 6 Sinn Fein. Elections for the Senate were held on June 12, and 24 Unionists were returned unopposed. The Ulster Unionist Council had on Feb. 4 unanimously elected Sir James Craig as leader of the party. The Nationalist and Sinn Fein members did not attend the opening of Parliament. The Hon. Hugh O'Neill was elected as Speaker of the House of Commons and the Marquess of Dufferin and Ava as Speaker of the Senate. On June 22 Parliament was formally opened by King George V. The first Cabinet was constituted as follows:—

Prime Minister, Sir James Craig.
Minister of Finance, Mr. H. M. Pollock.
Minister of Labour, Mr. J. M. Andrews.
Minister of Home Affairs, Sir R. D. Bates.
Minister of Education, The Marquess of Londonderry.
Minister of Agriculture and Commerce, Mr. E. M. Archdale.

Sir James Craig immediately made it clear that his policy was to preserve the existence of Northern Ireland as an integral part of the United Kingdom, and, while willing to contemplate common action with Southern Ireland under the Government of Ireland Act, to resist union with the rest of Ireland in any system which would involve separation from Great Britain and the abandonment of the representation of Northern Ireland in the Imperial Parliament.

The first task of the Government was to restore internal order. Political and religious animosities, to which unemployment arising from post-War decline in trade and industry had added fuel, had been kindled to a dangerous heat. Outbreaks of civil disorder leading to murder and arson had taken place. The anti-British party in Southern Ireland had undoubtedly contributed to increase the difficulties of the Government, presumably in the hope of forcing an all-Ireland form of government by making government under the Act of 1920 impossible. However, the disruption of this political party, which followed upon the Irish agreement of the winter of 1921–2, accompanied as it was by an outbreak of civil war in Southern Ireland, actually eased the situation in Northern Ireland, as it caused the withdrawal of certain elements of disorder which had been organised and introduced from outside and which were now called off to take part in the quarrels of their leaders.

After the setting up of the provisional Govt. in Southern Ireland, the Royal Irish Constabulary was disbanded under the Constabulary (Ireland) Act, 1922, which received the Royal Assent on Aug. 4 1922 and modified the provisions of the Govt. of Ireland Act by providing for the disbandment of the constabulary, in lieu of the transfer to the Govt. of Northern Ireland of the members of the forces serving in that area. Before this disbandment was completed the Parliament of Northern Ireland had established a new police force, the Royal Ulster Constabulary, and a considerable proportion of disbanded members of the Royal Irish Constabulary received appointments in the new Ulster force. A large body of auxiliary police was also organised and, thanks to vigorous measures both in and out of Parliament, order was restored in a comparatively short time.

The Irish Free State (Agreement) Act, 1922, affected Northern Ireland (although she was not a party to the agreement thereby given legislative sanction) in the following respects:—

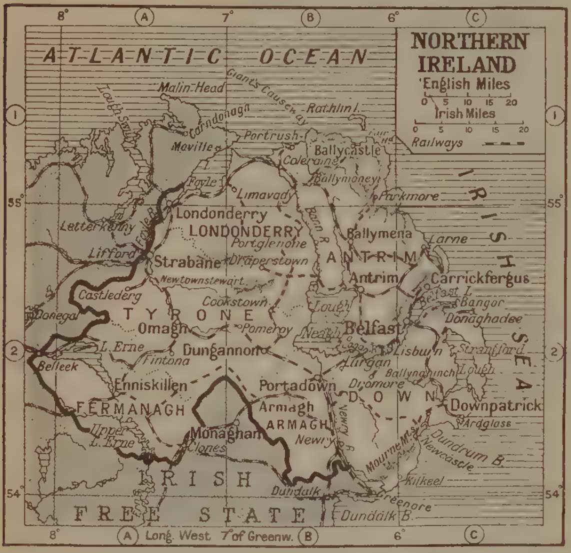
(*a*) it purported to give Dominion status to Ireland as a whole;
(*b*) it put a stay upon the exercise of the powers of the Parliament and Govt. of the Irish Free State, as respects Northern Ireland, until the expiration of one month;

(*c*) it enabled Northern Ireland to vote herself out of the Free State by means of an Address presented to His Majesty by both Houses of Parliament of Northern Ireland, before the expiration of the month above referred to, and it attached to the presentation of such an Address the consequence that a Commission was to be set up consisting of three members, one to be appointed by the Govt. of the Irish Free State, one to be appointed by the Govt. of Northern Ireland, and one (who was to be the Chairman) to be appointed by the British Govt., in order to "determine in accordance with the wishes of the inhabitants, so far as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland";

(*d*) it expressly preserved the Council of Ireland and the Irish Free State representation thereon, whilst depriving the Council of any powers in that State; and

(*e*) it offered to Northern Ireland, as an alternative to going out of the Free State, a continued existence under the Govt. of Ireland Act, subject to an overriding jurisdiction of the Parliament and Govt. of the Irish Free State, in all matters in respect of which legislative power is withheld from the Parliament of Northern Ireland under that Act.

The majority of the points in which the Constitution of Northern Ireland was affected by the setting up of the Irish Free State received attention from the Imperial legislature in the Irish Free State (Consequential Provisions) Act, 1922, which came into force on the same day as the Act providing for the Free State Constitution. This Act contained various provisions which were to take effect in the event of Northern Ireland voting herself out of the Irish Free State under Article 12 of the original Agreement. This voting out was immediately accomplished, and thus authority was given for various constitutional changes. Subject to the provisions of the first schedule (Modification of the Govt. of Ireland Act, 1920, etc.) to the Act, the Govt. of Ireland Act was only to apply to Northern Ireland. This schedule provided for the appointment of a Governor of Northern Ireland, and for the application of the provisions of the Govt. of Ireland Act, 1920, with respect to the Lord Lieutenant, to him. Further references in any other enactment to the Lord Lieutenant, were in their application to Northern Ireland, to be construed as references to the Governor of Northern Ireland. A Privy Council of Northern Ireland was to be established and there was to be a Great Seal of Northern Ireland. On Dec. 9 1922 the Duke of Abercorn was appointed Governor of Northern Ireland.


NORTHERN IRELAND
English Miles
0 5 10 15 20
Irish Miles
0 5 10 15 20
Railways
8°
7°
6°
A
B
C
1
2
55°
54°
Long. West 7° of Greenw.
ATLANTIC OCEAN
IRISH SEA
IRISH FREE STATE
Malin Head
Giant's Causeway
Rathlin I.
Carndonagh
Lough Swilly
Portrush
Moville
Ballycastle
Coleraine
Ballymoney
Foyle
Limavady
Parkmore
Londonderry
LONDONDERRY
Letterkenny
Foyle
Bann R.
Ballymena
Portglenone
Larne
Lifford
Strabane
Draperstown
ANTRIM
Newtownstewart
Antrim
Carrickfergus
Castlederg
Cookstown
Belfast L.
Bangor
Donegal
TYRONE
Lough
Donaghadee
Omagh
Pomeroy
Neagh
Belfast
L. Erne
Dungannon
Lisburn
Strangford
Fintona
Lurgan
Lough
Belleek
Ballynahinch
Enniskillen
Portadown
Dromore
DOWN
FERMANAGH
Armagh
Downpatrick
ARMAGH
Ardglass
Upper L. Erne
Monaghan
Newry
Newry R.
Clones
Mourne Mts.
Dundrum B.
Newcastle
Kilkeel
Dundalk
Greenore
Dundalk B.
Erne

During 1923, in spite of continued trouble with the Free State over the failure to agree on the boundary question, Northern Ireland progressed. The most important legislative achievement of the year was the Education Act, which came into operation, in the face of condiderable hostility, on Oct. 1 1923. Based largely on the recommendation of a committee of enquiry appointed in 1921 under the chairmanship of Sir R. Lynn, M.P., the Act marked a new departure in Irish educational a ministration by establishing the principle of popular contro Provision was made for the establishment of local education au thorities, to be formed by the county borough councils an county councils, with power to appoint administrative sub-area under regional committees. The fiscal separation from the Iris Free State, dating from April 1 1923, had an adverse effect o trade between Northern and Southern Ireland owing to custom duties levied by the Government of the Irish Free State on cer tain goods crossing the land frontier.

Boundary Question.—The chief obstacle to the developme of better relations with the Irish Free State during the year 1923 and 1924 was the boundary question. The Govt. of Northern Ireland declined to appoint a Commissioner under Artic 12 of the Irish Free State (Agreement) Act, 1922, and, as consequence of this refusal, the Irish Free State (Confirmati of Agreement) Act, 1924, was passed by the Imperial Gov whereby, in the event of the continued refusal of the Govt. o Northern Ireland to appoint a Boundary Commissioner, th power of appointment residing in that Govt. was to be transferred to, and exercised by, the British Govt., any Commissione so appointed being deemed to be a Commissioner appointed b the Govt. of Northern Ireland. The British Govt. and the Gov of the Irish Free State had, in the meantime, appointed as the respective Commissioners, Mr. Richard Feetham, a Judge o the High Court of the Union of South Africa, and Prof. J McNeill. Upon the passing of the above Act, the British Gov appointed Mr. J. R. Fisher, barrister-at-law, as the Commissione for Northern Ireland.

The Boundary Commission occupied upwards of a year i visiting, and hearing evidence in, the various border district in Ireland, and in considering the information so obtaine In Nov. 1925, on the eve of the promulgation of the report o the Commission, the Free State Commissioner withdrew. A conference was then held in London between the three Govts represented on the Commission, and a further Agreement wa concluded on Dec. 3 1925. By this Agreement, the Irelan (Confirmation of Agreement) Act, 1925, the three Govts "being united in amity" and "being resolved mutually t aid one another in a spirit of neighbourly comradeship" achieve at length the settlement which is set out in Article 1:—

> The powers conferred by the proviso to Article 12 of the sai Articles of Agreement on the Commission therein mentioned ar hereby revoked, and the extent of Northern Ireland for the purpose of the Govt. of Ireland Act, 1920, and of the said Articles of Agre ment, shall be such as was fixed by sub-section (2) of Section one o that Act.

The Act also provided that April 1 1926 should be the date a from which the powers in relation to Northern Ireland, whic by the Govt. of Ireland Act, 1920, were made powers of the Council of Ireland, were to be transferred to the Parliament and Govt of Northern Ireland. The Constitution of Northern Ireland coul not, before the consummation of this last Agreement, have bee described as being settled with finality. The establishment of a separate legislature has not led to a further differentiation of the law in Northern Ireland from that in other parts of the Unite Kingdom, but to the assimilation of the laws in Northern Ireland to the law in Great Britain, and to the enlargement of the status of the subject in Northern Ireland to that of the subject in Great Britain. It is, perhaps, to this undertaking above al that the Parliament of Northern Ireland, on a study of its statute-book, will be found to have addressed itself with vigour from its earliest inception. (Lo.)

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The financial provisions of the Govt. of Ireland Act, 1920, were necessarily of a very intricate and comprehensive character, as not only did that Act completely overthrow the whole system of finance in force since the Act of Union o 1800, but went further and set up in Ireland two Exchequers, each under an entirely separate jurisdiction. Subsequent events have considerably modified the operation of the 1920 Act and it is therefore not necessary to deal in this article with

hern Ireland's position as regards the Irish Free State but
ly to consider the relationship which exists under the Act
een Northern Ireland and Great Britain, and the financial
m which has been built up in Ulster since 1921.

e newly constituted State was not granted absolute finan-
autonomy. The Act of 1920 contemplated two distinct
es of revenue, and two classes of expenditure, (1) purely
revenue and expenditure and (2) taxation and expendi-
which by reason of the wider issues involved, should not be
ated to a subsidiary authority. Under the first heading
uch duties as stamp duties, death duties and licence duties,
her with expenditure on services such as old age pensions,
, education, etc., while included in the second category
he more important duties of income tax and customs and
e, and expenditure on the higher administration of justice,
and Commission and certain other services.

venue.—Approximately 90% of the taxes are imposed and
cted by the Imperial Government. In the year 1922–3 the
ue yielded by taxes under the control of the Imperial Govt.
nted to £10,700,000, while the ordinary "transferred" tax
ue amounted to £923,000. This revenue, after deducting
it the cost of the various services reserved to the Imperial
.; together with Ulster's contribution towards Imperial
diture, is remitted to the Exchequer of Northern Ireland,
is used in the ordinary way to meet expenditure on local
ces. As a further source of revenue to meet the "addi-
l expense incidental to the severance of the two Irish
s.," it was provided that the produce of the Land Purchase
ities payable by those agricultural tenants who had
ht out their holdings under the Land Purchase Acts (and
had effected their purchases by the payment of annuities
ding over a period of 65 years) should be transferred to
Northern Government. After making provisions for a
ng fund with the object of ensuring a permanent revenue
this service, these land annuities produce a net revenue
50,000 which should be added to the figures given above.

scal Uniformity.—The control by the Imperial authority
e main sources of revenue requires almost complete fiscal
rmity between Ulster and Great Britain, and necessarily
es that the industrial and general economic policy of the
ince must, in practice, largely conform to that of the
rial Govt., not only in a local sense, but also as regards its
ercial relations with foreign countries. Hence no tariff
ers can be erected between Northern Ireland and Great
in, and the normal flow of merchandise between the two
has continued without the inconveniences and hindrances
ting from the imposition of customs duties.

ntribution to Imperial Expenditure.—The Act of 1920 en-
that the Province should make a fixed statutory con-
tion to "Imperial" services, but this proving unworkable,
s eventually agreed to set up an arbitration committee
, after sitting for two years and having heard expert
nce on both sides, issued its final award in March 1925,
ng the principles upon which Ulster's contribution is in
e to be assessed. In brief, the contribution will be the
ce of revenue over expenditure; for the purpose of making
alculation the taxes over which Ulster has control are to be
med to raise a sum proportionate to the yield of similar
in Britain; while on the expenditure side the Province is
ed for development and social service a sum proportion-
the amounts required by Britain for similar purposes.

luction in Revenue.—The reductions in taxation made by the
cellor of the Imperial Exchequer from time to time in the inter-
g years between 1922 and 1925 have had their reaction on the
ues of Northern Ireland resulting in an annual diminution in
ue of approximately £1,889,000. The severe depression in trade
lso been responsible for a further diminution in revenue; the
yield of the taxes levied in Northern Ireland by the Imperial
falling from £10,562,000 in 1922 to £8,217,000 in 1925. These
tions were naturally reflected in a corresponding decrease in
ntribution which Northern Ireland was able to make towards
st of Imperial services.

lic Debt.—Unhappily the establishment of the Government of
ern Ireland synchronised with the beginning of a period of
nd commercial and industrial depression, with its natural
reaction on employment. The principal industries of the Province—shipbuilding and the linen trade—suffered to an unwonted degree, thus compelling the newly-formed Government to finance the Unemployment Insurance Fund to an extent quite disproportionate to that of Great Britain, whose varied industries scattered over a wide area ensure a greater degree of solvency for its insurance scheme. At the end of the financial year—1924–5—the accumulated deficit of the unemployment fund was approximately £2,300,000.

Capital Funds.—On its establishment the Government of Northern Ireland had received its apportioned share of the different capital funds previously set up in Ireland for administrative purposes, and including amongst others the Church Temporalities Fund, Teachers' Pension Fund, Development Fund, etc. It had in addition created certain other capital and sinking funds. To a very considerable extent the requirements of the Unemployment Insurance Fund and of Local Authorities and others to whom loans were made have been met by the temporary utilisation of this available capital. These sources were, however, insufficient to meet all the demands made on the Government, and a public debt was therefore created by the issue of Ulster Savings Certificates in April 1922, followed by an Ulster Loan Stock issue of £2,000,000 in Nov. 1925. The former issue, guaranteed by the British Govt. and providing a remunerative investment for savings, met with an immediate and sustained response throughout the Province. By March 31 1925 a sum of £1,500,000 (after deducting repayments) had been invested in this way. The proceeds of the Ulster Loan Stock issue are available only for the purposes mentioned in the Government Loans and Exchequer Provisions Act (N.I.) 1925, which do not include the making of advances to the Unemployment Fund. Of the stock £1,000,000 was reserved for the investment of Government funds, the remaining moiety being taken up by public subscription.

The Budget.—Statistics regarding the public finances of Northern Ireland for the year ended March 31 1925 showed a total revenue, including Post Office receipts, of approximately £11,336,000; the total expenditure for the same period amounted to £7,713,000, leaving a balance of revenue over expenditure of £3,623,000. Of this £3,472,000 was contributed to Great Britain, leaving a net surplus of £151,000.

Production and Industry.—Agriculture is one of the principal industries of the country and large quantities of butter, eggs and general agricultural produce are exported to Great Britain. Considerable quantities of flax are also grown and it is expected that the research work now being undertaken in this branch of agriculture will not only improve the quality of the flax but will also greatly stimulate general interest in this product.

During the post-War period the trade in live stock greatly increased. Up to 1926 Ulster had escaped the ravages of foot-and-mouth disease, and indeed was particularly free from outbreaks of animal diseases generally. During 1924 a total of 424,000 cattle, etc., were exported, chiefly to Great Britain.

The main industries of Northern Ireland are the manufacture of linen, shipbuilding, engineering, rope making, and distilling. The linen industry normally employs directly or indirectly approximately 120,000 workers. Over 1,000,000 flax spindles are in use, representing one-third of the world's entire flax-spinning capacity; 40,000 looms are engaged in weaving. The major portion of the shipbuilding industry is located at Belfast, where a large number of the world's most famous vessels have been built, including the well-known "Titanic" and "Olympic." During 1923, 12 mercantile steam vessels with a total tonnage of 75,782 were launched in the North Irish yards.

Over 50 important firms are engaged in Belfast and the immediate vicinity in the manufacture of textile machinery of all kinds; heating, ventilating and drying plants and almost every variety of equipment for factories. There are some 12 modern distilleries operating in Ulster which together produced during the year ended March 31 1924 a total of 2,534,426 proof gallons of spirits. A number of other industries are carried on. Belfast possesses the largest ropeworks in the world, which employ over 3,500 persons and can produce 350 tons per week of all classes of ropes and twines. Tobacco, soap, woollen goods, felt and aerated waters are also manufactured.

Trade.—Northern Ireland carries on a very considerable export trade. Statistics for 1923 show that the value of the exports for that year to Great Britain and foreign countries totalled £66,000,000, while the imports for the corresponding period amounted to £65,000,000.

Finance.—There are three banking companies having their head offices in Northern Ireland, viz.: the Belfast, Ulster and Northern banks. In addition there are several other banks operating in Ulster. The purely North Irish banks have all a close working agreement with one of the leading English Joint Stock Banks. The deposits in these three banks amounted in 1924 to over £48,000,000 while the advances of various descriptions totalled £31,000,000. In addition to these deposits the sums deposited in Trustee and Post Office Savings banks amounted to almost £9,000,000 in 1924. On Dec. 31 1924, there were approximately 1,350 living companies registered in Northern Ireland with a nominal capital of £71,000,000 and a subscribed capital of £59,000,000.

An analysis of the registered capital produces the following results:—

Banking, etc.	£11,000,000
Brewing and distilling	2,250,000
Shipbuilding	13,500,000
Textile manufacturers	21,000,000
Engineering	10,000,000
Others	13,250,000
	£71,000,000

Communications.—The principal ports of Ulster are Belfast, Londonderry, Coleraine and Newry, while in addition there are Royal Harbours at Donaghadee and Ardglass. Of these Belfast is the most important. Belfast Harbour covers 2,287 acres and possesses a total lineal quayage of 26,512 feet. There are in addition, five graving docks, the largest of which is 850 ft. long and 96 ft. wide at the entrance. During 1923 the number of vessels arriving at ports in Northern Ireland totalled 12,383 with an aggregate tonnage of 4,872,225.

Northern Ireland is exceptionally well provided with roads and a very marked increase in the use of motor transport has been noticeable in the post-War period. There were altogether 12,892 m. of roads in 1925 consisting of:—

Main trunk roads and the more important inter-town routes	1,023
Less important inter-town routes	1,111
All other roads	10,758
	12,892

There are seven private railway undertakings situated wholly in Northern Ireland and five others extending into the Irish Free State. The total mileage in Northern Ireland in 1925 was as follows: standard gauge 815 m., narrow gauge 301 miles. The authorised capital of the railways wholly in Ulster is £1,888,757 and of those partly in Ulster and partly in the Free State £11,141,356. The total receipts in 1923 amounted to £1,090,526 in the case of Ulster railways and £2,395,285 in respect of the others. (H. M. P.)

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IRISH FREE STATE (SAORSTAT EIREANN).—The Irish Free State, with the status of a British Dominion, came officially into being on Jan. 15 1922, when the Irish Peace Agreement, signed in London on Dec. 6 1921, by the British and Irish Delegations, already ratified by the British Parliament on Dec. 16, was adopted by a meeting of elected members of the Parliament of Southern Ireland convened by Mr. Arthur Griffith. In 1923 the State was admitted a member of the League of Nations. The New State is composed of 26 of the counties and four of the county boroughs of Ireland, and is divided into 269 baronies, 2,165 civil parishes and 51,158 townlands. Its area is 17,019,155 statute ac., and its estimated population in 1925 was 3,163,000.

I. POLITICAL HISTORY

The treaty which led to the creation of the Irish Free State was concluded by the British Govt. with representatives of an Irish Govt. which Great Britain had never recognised. From Jan. 1919, onwards, a large majority of the members of parliament elected for Irish constituencies had styled themselves Dáil Eireann—the Assembly of Ireland—had declared the Irish Republic in existence and had chosen a president and Ministers. In May 1921, when elections were held under the Government of Ireland Act 1920, Republican candidates were returned unopposed for all constituencies outside of Northern Ireland (except that of Dublin University) and for several constituencies in Northern Ireland. The Irish war was then at its height; th
was no civic life in the country and the members chosen w
simply nominees of the Republican Govt., which was in effe
council of the republican army.

This, the second Dáil, met for the first time after the truc
the Dublin Mansion House on Aug. 16 1921. All its memb
took the oath to the Republic. Negotiations with Great Brit
at first conducted by E. de Valera, were resumed by a delegat
headed by Arthur Griffith, "Vice-President of the Republ
and Michael Collins, its Minister of Finance. Great Brita
definite refusal to recognise an independent Irish Republic
been publicly repeated with emphasis.

When the terms of the treaty were published on Dec. 6 1
Mr. de Valera's announcement of his opposition came as a sh
In the Dáil's debate, prolonged until Jan. 8 1922, it was gener
admitted that the country at large was for acceptance. But s
speakers declared that their oath bound them to the Repul
some that the desire for acceptance was merely due to fear of
newed war; some, that to compromise was dishonourable,
that the democracy had no right to do what was morally wr
Many who advocated acceptance made the suggestion
it was a step to the Republic. The majority for acceptance
64 to 57, and when Mr. de Valera resigned the Presiden
Griffith was elected only by two votes. The wording of
decision hardly accepted the facts of the situation: Griffith
chosen President of the "Irish Republic."

The Provisional Government.—Under Article 17 of the tre
it was necessary to appoint a provisional government, and
was done at a meeting in which all members elected for c
stituencies in Southern Ireland were summoned. Opponents
the treaty absented themselves exactly as they had absen
themselves from the British House of Commons; but
four members for Dublin University attended, and decl
that they and those whom they represented were now
a common basis with other citizens of the Free State"
could act whole-heartedly with them for the good of Irel
Eight men were named members of the Provisional Governm
Collins being chairman. Griffith remained outside it. So
Gen. Mulcahy, who had been chief of staff of the Republi
Army and who now succeeded Cathal Brugha as Minister
Defence. In theory the army was still the army of the repu
and the Provisional Govt. had no force at its disposal.

The old constabulary was at once disbanded; it had since
ceased to be in any true sense a police force. Collins and
colleagues decided at once to form a new police, the Civic Gu
but it necessarily took time to organise, and its creators ha
cided in principle that it should be unarmed. British troops
rapidly evacuating the country, and those who had won
treaty felt it impossible to use support from this quarter. Th
was the Irish Army, now largely in uniform; but it soon beca
clear that the Army was a source of danger.

With the exception of Collins, only one man in the Provisi
Govt. was widely known in Ireland. This was Professor
MacNeill, for many years vice-president of the Gaelic Leag
who gained a new prominence at the close of 1913 as chief
moter of the Irish Volunteers and afterwards, from Sept. 1
as their chief of staff. Of the others, Mr. William Cosgra
Minister for Local Govt., had been a prominent member o
Dublin Corporation from 1913 on, and in 1917 was returned
Sinn Fein Member of Parliament. Mr. Duggan had been on
the signatories to the treaty. The others, Mr. K. O'Hig
Mr. J. Magrath, Mr. F. Lynch and Mr. P. J. Hogan were
young men with their careers yet to come. Mr. O'Higgins
thus described the situation: "The Provisional Govt.
simply eight young men in the City Hall" (where they met
first) "standing amidst the ruins of one administration, with
foundations of another not yet laid, and with wild men scre
ing through the keyhole."

Collins, a man of immense resource and energy, sought
strengthen his position by the success which would have
appealed to popular sentiment—the reunion of Ireland. Un
the treaty, if Northern Ireland consented, all powers retained

province by the Parliament at Westminster would pass to
'arliament of the Free State. Interviews with Sir James
;, the Ulster Prime Minister, were arranged. Settlement was
ible for North as well as South, since in Belfast there raged
rderous strife between Catholic and Protestant; but no
nmodation proved possible. The birth of the Free State
hus not unattended with difficulty.

th Griffith and Collins desired a general declaration from
ountry by an election. But the republicans, knowing as
as they what the result would be, resisted this, and Mr. de
a called instead, on Feb. 21, a convention of delegates of the
Sinn Fein organisation. At this meeting, Collins, seeing
a vote would go against him, consented to delay the election
t least three months and not to hold it till the draft of a
itution, based on the treaty, had been published.

ere was some disorder. Control of the republican move-
did not rest with Mr. de Valera; a section of officers in the
, headed by Mr. Rory O'Connor, who had directed en-
ring operations in the campaign of destruction during the
illa war, demanded the right to be consulted on the terms
y settlement. Meetings of this body were held in express
nce of orders in Dublin. Mutinous action was taken at
nel, where a store of arms was seized. This was followed by
rper outbreak at Limerick, where a body of troops occupied
arracks in the name of the republic. The officer commanding
ne Free State in the region was ready and anxious to act,
Collins, desirous at all costs to avoid war, caused an accom-
ation to be patched up.

eanwhile, Mr. de Valera proclaimed at meetings that there
only one legitimate Government in Ireland—that of the
blic. There was no law, and in parts of the south much
nce was offered to Protestants, nominally in reprisal for
ks on Catholics in Belfast, while raids across the border
the north intensified the danger of war. In March, Sir
y Wilson, who on retirement had entered Parliament for an
r seat, was put in charge of the Ulster defences, and organ-
the whole Protestant male population as an armed police.
outhern Ireland, the extremist Republican party definitely
ed renewal of war with England. They would stop at nothing
eir efforts to smash the treaty and their armed bands still
ed uncontrolled, levying toll from banks and commandeering
r-cars.

appeared from his public utterances that President Griffith
ed drastic action; but Michael Collins, the head of the
isional Govt., whose personal hold was stronger still, com-
ised, and on May 20 announced that he had reached agree-
with Mr. de Valera. An election was to be held, but Free
rs and Republicans were to put forward a joint panel of
idates, so arranged as to reproduce the distribution of views
e existing Dáil. After the election a coalition ministry was
formed, giving Mr. de Valera four seats in nine. The result
e election was not to be considered as a vote on the treaty.
al was made jointly that no other Candidates be selected.
organised Labour insisted on putting forward candidates,
other interests took courage to follow their example. Michael
ns, at Cork, publicly advised the people to vote as they
e. There resulted some appearance of a free election in
constituencies, where the polling took place on June 16.
ty-four candidates not on the agreed panel were elected—
ipporting the treaty. The Republican defeat was evident.

vil War.—Aggressive actions by the mutinous section of the
followed, and on June 22 Sir Henry Wilson was murdered
ondon by two Irishmen who had served in the British army.
British Govt. made it clear that the Free State must
A definite cause of action was afforded when the mutineers
ured in Dublin the assistant chief of staff of the Free State
y and held him as a hostage. On June 28 the Four Courts
quarters were summoned to surrender, and on refusal
was laid. So the disturbance began. After eight days'
ing—so local in character that the city's ordinary life went
the struggle in Dublin was over. Rory O'Connor was cap-
l after he had blown up the Four Courts with all their records. Mr. de Valera, who had joined the insurgents, escaped, but Cathal Brugha, after ordering his post to surrender, dashed out firing and was shot down.

Some districts of the country south and west was held by Republicans. The Government's army had neither a trained staff nor a system of supply: it had to improvise. But it had a few field guns to which, when brought into action, no resistance was offered. It was able to enlist practically as many ex-soldiers as it chose, but it refused to accept the offered service of professional officers who had held high command. Some ex-subalterns and company commanders, who had joined the I.R.A. in its fight against the British police, became generals. But the main successes in the field were due to General Murphy, a county surveyor who had got a commission early in the World War and ended by commanding a brigade.

To civil administration was now added military activity; five members of the Government took rank as generals, and Collins himself, flinging his whole energy into the struggle which he had so long sought to avoid became commander-in-chief. But on Aug. 12 Arthur Griffith died suddenly. Ten days later, on the 22nd, Michael Collins was killed in an ambush in the Co. Cork. Thus the task of establishing the Free State fell not to any man but to a group, representing a fraction of one section of the Irish people—the right wing of Sinn Fein.

Framing the Constitution.—It was necessary under the treaty that the third Dáil should as a provisional parliament frame a constitution which should also be adopted by the British Parliament before Dec. 6 1922. On Sept. 9 it was possible to summon this body to meet in Leinster House, the premises of the Royal Dublin Society, which contained a fine semi-circular concert hall. In the newly built College of Science, almost contiguous, the Government had established their offices. The block of buildings was placed under guard. None but carefully scrutinised representatives of the Press assisted at the nominally public debates. Under these conditions the Irish Parliament and Irish Govt. operated for nearly a year. Ministers lived as in a fortress.

At the Dáil's first meeting Mr. Cosgrave was elected President of the Irish Free State and he assumed the Ministry of Finance. Eleven ministers, proposed by him, were elected by the Dáil. The Dáil sat persistently to fulfil its task. The clauses of the constitution, which defined the relations between the Irish Free State and the British Crown and imperial defence, had been settled in discussion between Arthur Griffith and the British Govt., and to this extent freedom was limited. Ministers had the task of persuading the Dáil to accept the limitation; they had also to put forward their own proposals for all that was left free. Mr. Cosgrave entrusted exposition and defence very largely to Mr. Kevin O'Higgins, assisted by Mr. Ernest Blythe, who had become the minister for Local Govt., and Mr. Hogan, Minister for Agriculture. For legal advice they depended on the Attorney General, Mr. Hugh Kennedy, who was not then a member of the Dáil. The only constitutional lawyer in the assembly was Mr. Gerald FitzGibbon, one of the four members for Trinity College. His intervention in the debates was always received with great respect, and Mr. Cosgrave more than once recognised the steady goodwill of this little group of ex-unionists.

The constitution followed extreme democratic lines. Adult suffrage was adopted. But the political thought of the Dáil resented any departure from British models. Ministers desired to introduce the Swiss system of individual responsibility for ministers; a compromise was reached establishing one class of "extern" ministers who should be nominated and appointed by the Dáil at large, holding office for the duration of parliament, and at the same time a statutory executive council of not less than five nor more than seven, which must include the President and the Minister for Finance. Members of the executive council were vested with collective responsibility, and would fall as a body if the Government failed to obtain the support of Parliament while the "extern" ministers would remain in their posts. The referendum and power to initiate legislation by a popular vote were incorporated in the constitution, but without any sign of enthusiasm for these novelties.

The Restoration of Public Order.—The Dáil's real importance was that it brought back to Ireland some habit of public discussion by its criticism of the action of the executive. From 1919 onwards there had been a grave upset to civic life. The civil courts did not sit outside of Dublin; the press existed under a dual censorship—that of the British Govt. and that of the I.R.A. The old police force had been transformed into an irregular military force when the Free State came into being, for so long as open civil war could be said to exist the public and the Parliament acquiesced in the fact of military rule. But by the end of Sept. 1924 at latest, there were no formed forces of the irregulars in the field, and all towns were held for the Government. Demand began to be heard for courts to which men could bring their causes. But the essential was to restore order. Property of all kinds was assailed. Whole bands of men in the name of the Republic were commandeering what they required. Much private robbery followed. More serious than all, a trouble which had broken out in 1920, and had been repressed by Sinn Fein, now appeared again. The permanent land-hunger awoke, and even holdings which had been purchased under the Land Acts were invaded by rival claimants.

Courts were long in being framed, partly because the Govt. sought to find competent magistrates able to use Irish, which the constitution had declared to be the national language. The Civic Guard was being organised; but gunmen flouted, beat and in certain cases killed, members of this unarmed force. Mr. O'Higgins, Minister for Justice, however, stood resolutely to his principle: Ireland must be taught to regard the police, not as the agents of an outside power, but as its own servants, needing and deserving public assistance. He took a long view, and the issue has justified it; but for immediate purposes this body was useless. The irregulars were adopting against the Irish Govt. those tactics which the I.R.A. had used to make British Govt. impossible. The Government on its side was driven like the British to enrol a large force of soldiers, which finally exceeded 40,000. Its recruits joined a force without tradition of discipline; indeed, at the outset it professed semi-officially to condemn the ceremonies of saluting and other formalities. Such a force, hastily levied, with officers as untrained as the men, was not over trustworthy, and did not always give satisfaction by its conduct to the public for whose protection it was raised.

Neither was Ireland, at the close of a movement extending over more than 40 years, a country easily able to support government in the face of terrorism; and terror was applied. The ministry was slow to counter this menace. Trial by jury was futile in such a state of things. The gaols were crammed with prisoners, untried and unpunished. Power to try and to punish most drastically by court-martial was given by an act of the Dáil; yet till Nov. fear of the irregulars was stronger than fear of the Govt. throughout the country. At last a proclamation was posted announcing that four men had been tried, convicted and executed—in each case for having a revolver without licence. In the following week seven men were sentenced, on precisely the same charge, to long terms of penal servitude. Thus the right of Government to deal at its will with persons in arms against the state had been asserted. But the irregular campaign of wreckage went on. More executions followed, among them that of Erskine Childers, who had been the most powerful influence over Mr. de Valera. There was no improvement perceptible by Dec. 6, when the Irish constitution was formally ratified by both parliaments.

Formal Inauguration of the Free State.—Immediately this ratification was complete, Northern Ireland notified the British Govt., by address of both Houses of Parliament, that exercising its right under article 12 of the treaty, it refused to come under the Free State, and desired to retain its position created by the Act. The Free State being now formally constituted as a "Dominion," sensation was created by the appointment (Dec. 1922) of Mr. T. M. Healy, K.C.—so notable in the land war which preceded Home Rule—as its first Governor-General. He was duly sworn in on Dec. 7 by the new Lord Chief Justice. Next day, when the Dáil assembled to choose a senate, as provided by the constitution, President Cosgrave announced that one member of the Dáil had been shot dead and another woun on the way to the meeting. The man killed, General Hales, a popular hero of the guerrilla war, and next morning four of leading irregulars who were in prison were shot without trial way of reprisal. Among them was Mr. Rory O'Connor. All th had been arrested long before the proclamation of martial l Mr. FitzGibbon deplored the action. Let the Government for what powers they liked and he would support them, bu them abide within their legal rights. General Mulcahy's just cation of the step was not given till some months later, when pointed out that no other member of the Dáil had been tacked. In fact, the counter-terror succeeded. It was larg carried out with the assistance of a criminal investigation partment, armed police operating in plain clothes, over who as representing Cabinet responsibility, Mr. Joseph Magrath, Minister for Labour, presided.

The activities of the Free State Government were thus vigorous and drastic as those of the British police in Sir Ham Greenwood's régime, but there was this difference. The coun might now be terrorised into silence by the irregulars, but gave them no such willing support as it had given to the I.R Information came, surreptitiously but steadily, to the Free St troops. Further, in Dublin, where courts were now in sessi juries did their duty fearlessly. Evacuation by the Brit military, which had been suspended in early summer when t worst dangers threatened, was now completed; the division, c centrated near Dublin, embarked in Dec. 1922 among demo strations of affectionate goodwill from the populace.

In forming the senate, President Cosgrave nominated one h of the 60 members; the Dáil elected the other 30. The Presid made good the promise given by President Griffith to leadi Irish Unionists that they should be generously treated; nominations comprised several leading landlords and other pro inent Protestants. The Senate when constituted chose as chairman Lord Glenavy, who as Sir James Campbell had be Sir Edward Carson's chief lieutenant.

No cleric of any denomination was included in the body. Fr the first, self-governing Ireland ignored the power of the Chur A few days after the Provisional Govt. assumed office, witho any public announcement or legislative act, the two nominat boards which had controlled primary and secondary educati were notified that they were dispensed with. This was the mo significant, because the Catholic hierarchy as well as the Pro estant churches were represented on both. Thus, in the mi of revolution, education was taken out of the hands of the cler who had (by a series of compromises) indirectly controlled under the British administration.

There was not the least opposition to these steps. Pub criticism had virtually ceased to exist; the clergy were dumb the laity, but all men doubted whether the new governme could secure obedience. The most hopeful factor in the situati was that since the irregulars had been forced to concentra their forces against the Free State Army, and provocation fro them in Ulster no longer afforded justification for outrageo attacks on Catholics, Sir James Craig's government had succe ed in establishing order, though under a strict military contro Patrols of police enforced curfew all over the six counties.

In the rest of Ireland, the gravest danger was that forseen Michael Collins when he pointed out that criminal folly mig destroy "our belief in ourselves as a nation." There was orgy of destruction, which almost paralysed communication road and rail: houses were burnt or bombed by dozens, and th Government, once started on their path of severities, pursu it ruthlessly. By the end of Jan. executions had risen to 50, an the prisoners to ten thousand. No government could be popul under such conditions. Yet signs of weakening began to sho By May 1923, Mr. de Valera called upon his followers to abando hostilities and dump their arms in concealment. The sound firing was no longer heard in the streets, and public meetings we once more held. When Aug. brought the annual Horse sho ministers were seen moving freely in the crowd. The resumptio of normal civic life may be dated from this time.

April a marking fact had occurred: the Free State, still
aining and collecting the British system of taxes, found it
ary to set up a customs system at the ports and along the
border. The first object was merely ascertainment of
ie, but the machinery for a protective tariff existed. In
the Minister for Agriculture introduced a measure for the
etion of land purchase, and this was carried through
y. The third Dáil, which had passed the constitution, still ex-
but a general election on the new register with adult suffrage
emanded and it was fixed for the last days of August. The
of this trial of strength was curious. The Government's
had exposed it to much odium. Some 10,000 prisoners
letained in gaol, mostly untried, and over 70 men had been
ted. Yet President Cosgrave, Mr. O'Higgins and General
hy were each returned by huge majorities at the head of
oup in which they stood. But Mr. de Valera also headed
oll in County Clare (Professor MacNeill being second on
st) and his deputy in County Mayo defeated another minis-
d the republicans returned no less than 44 members out of
Government had in its own following less than half the Dáil.
he various groups of Independents were notably increased.
ese supported the treaty and the constitution. By Oct. the
parliament was formally opened with a speech from the
rnor General. His predecessor, Lord FitzAlan, the last lord
nant, had given assent to the action of ministers while
ng the constitution and crushing civil war. It was Mr.
's lot to represent the Crown during the reorganisation.

e *New Government.*—Ireland's accession to her new status
ractically signified on Sept. 10 1923 when her representatives
heir place with acclamation in the council of the League of
ns. A month later Mr. Cosgrave attended the Dominion
rence in London, where he was warmly welcomed. At
the executive council was for the first time constituted, con-
g of seven. Four other ministers were chosen as "extern,"
g individual, not collective, responsibility. These included
ostmaster General and the Ministers for Agriculture, for
ries and for Local Government. The last post was vacated
r. Ernest Blythe, who now became Minister for Finance.
ccessor, Mr. Burke, was little known.

e new Minister for Finance had at once to face a serious
ion. It had become clear that the State would not be
oyed by violence—there was fear lest it should be bank-
. Civil war had produced damages, then reckoned at
0,000, though, when compensation came to be paid, the
duced itself to about ten. But the army was costing over
0,000 a year, and taxation stood at the peak point to which
Britain had raised it. Business men in the Senate urged
the financial situation should be regularised. In Dec. the
rnment came to the country for a loan of £10,000,000 at
-the issue figure being 95, repayable at par in twenty years.
s oversubscribed in ten days, the subscribers numbering
22,000. This demonstration of confidence greatly cheered
ountry, and rounded off the satisfaction felt in comparing
ettled order of Christmas 1923, with the ruinous anarchy in
the year opened.

t this optimism did not last. The year 1924 was a very
ppy period. Organised resistance to the State was with-
n but the threat of it remained. Mr. de Valera's followers
ed to surrender or hand in their army. More than this, Ire-
was forced to realise how profoundly demoralisation had
d during a period in which law was defied and secret
isations enforced their mandates. There was much crime,
ially robbery with violence. The army, so rapidly raised,
reduced, for motives of economy, with equal rapidity, and
were suddenly thrown out of employment. A bad harvest
23 had left acute financial depression, and work was scarce.
while many political difficulties threatened. Hitherto no
had been taken to give effect to the provision in article 12
treaty under which, if Northern Ireland decided to remain
le the Free State, a commission of three was to be appointed
letermine in accordance with the wishes of the inhabitants,
as may be compatible with economic and geographic conditions, the boundaries between Northern Ireland and the rest of Ireland." But with the cessation of civil war Mr. Cosgrave's Government was pressed to demand its application. Immediately threats came from Ulster of resistance by force to the cession of a single inch of territory. Mr. MacDonald's Government attempted to settle the matter by private negotiation, but this failed. The Free State named Professor MacNeill as their representative on the commission; but Northern Ireland refused to make any appointment or recognise the commission in any way. In these circumstances, Mr. J. H. Thomas had much difficulty in finding a chairman. A pledge had been given that he should be a citizen of one of the dominions. Finally, Mr. Justice Feetham, a South African judge, consented to act. But Northern Ireland contended that in that representation, unless they themselves appointed a member, the constitution of the commission would in fact be void.

Threatened Mutiny.—A still more menacing situation arose in March 1924. A group of highly placed officers in the army issued a public demand to the Government that their opinions and interests should be consulted in framing public policy, and they withdrew themselves from duty. Steps were taken to place them under arrest as mutineers, and a fresh outbreak of fighting was narrowly averted, mainly by the personal efforts of Mr. Joseph Magrath, Minister for Labour. Angry debate followed in the Dáil, in which General Mulcahy declared that a secret society had for over a year existed in the army, and that the mutinous officers belonged to it. Mr. Magrath reported that the Fenian Society, or I.R.B., had also its adherents in the army, who influenced promotion in their own interest. The upshot was the resignation of Mr. Magrath, followed by that of General Mulcahy. Mr. Cosgrave in person assumed the post of Minister of Defence. The chief of staff, adjutant-general and quartermaster-general were dismissed. General Mulcahy as a private member moved a vote of censure on the government for these dismissals, but got no support in the Dáil. Mr. Magrath, followed by several other members, who had been prominent first against the British and later against the irregulars, resigned their seats—thus presenting to the country the spectacle of dissensions in the army and dissensions in that section of the original Sinn Fein party which provided and supported the government.

Legislation.—Added to all this was the unpopularity of the government's measures. Mr. Blythe reduced old age pensions from ten shillings to nine shillings. Taxation was severely levied; tenants in default with their land purchase annuities were forced to pay up; citizens who had withheld their income tax during the last years of the British administration, with Sinn Fein's approval, were now called upon for their arrears. More widely felt was the innovation of a customs barrier, causing delay in the delivery of goods; and, in addition, Mr. Blythe decided to embark experimentally on a measure of protection, its main function being a duty of 15% on imported boots.

In this, as in all else, government virtually acted entirely on their own initiative. The Oireachtas (or parliament) indeed had to endorse their acts, but since the republican delegates did not take their seats there was no powerful opposition nor any sustained criticism. Ireland had been traditionally concerned with politics in the abstract; concrete questions (except concerning land tenure) had never occupied the public mind. Thus, legislation was the work of the government, not of the parliament; and there was a great deal of it. Long before his second year of office was completed the Governor General had given his assent to over 100 bills. Many of these were temporary and provisional, but some were of the first importance. One of them indeed was not solely the work of the executive. In framing the new judicial system, government had the advice of a committee over which Lord Glenavy presided. The number of judges and their salaries were reduced, the office of Lord Chancellor disappeared; a supreme court was constituted and a high court, both sitting in Dublin. High court judges no longer went on circuit; a new order of circuit judges was instituted. As regards the magistracy, unpaid justices of the peace were abolished, and stipendiary district justices were appointed to cover the whole country.

Judges of the previous régime were free to retire on rather more than four-fifths of their salary, and most of them did so. In making the new appointments the Government showed a fine disregard of political record, and totally ignored religious differences. By 1925, five out of the nine high court judges were Protestants and several had been strong Unionists—for example, Mr. FitzGibbon, who became Lord Chief Justice. The effect of this was to confirm the allegiance already promised by the minority in the Free State; and from leading members of it, notably from divines of the Church of Ireland and of the Presbyterian Church, testimony was offered to the impartiality of the Government.

Yet one part of the legislative and administrative programme occasioned protests from the minority. The constitution had declared that the national language was Gaelic, which perhaps 10% of the existing population used in their homes. The Ministry of Education endeavoured to revive the national language by an intensive campaign in the schools, offering a much higher rate of endowment to those schools where Irish was not only a subject of teaching but the medium of it. Protestants, even when they desired to see Irish studied and preserved, regarded these provisions as unfair. Many of them, however, considered the whole study as a waste of time and money; and unquestionably many Catholics were of the same opinion. This was one great cause of the Government's growing unpopularity.

Yet the more unpopular the Government grew, the more people were forced to see that no alternative to it existed, and there was agreement on the necessity for some force to stand between the citizens and a relapse into anarchy. Ministers showed little disposition to win support by conciliating public feeling. They had succeeded by desperate courage in coming through when the State reeled about them, and they persevered in following out their own ideas. Mr. O'Higgins forced on a drastic bill to restrict the facilities for buying and selling drink; at another moment, with half a score of by-elections pending, he suppressed "goose clubs," a widespread form of Christmas sweepstakes. Mr. Burke, the new minister for local government, by simple administrative act suppressed the corporations of Dublin and Cork and put civic affairs into the hands of commissioners, young men not very well known. There was some outcry, but the country had got into the habit of taking orders; and presently, when the commissioners produced improved administration and reduced the inordinate rates, this experiment was approved. Outside the towns, the ministry abolished district councils, thus throwing more work on the county councils. A tendency to centralisation and even to bureaucratic administration showed itself in all directions.

Such a policy made enemies everywhere, and the weather was no friend to Mr. Cosgrave. A second bad season in 1924 hit the farmers hard, and Mr. Blythe was still levying taxes that were now actually higher than the British scale; for the reduction of income tax from 5/- to 4/6 in 1924 was not followed in the Free State. Also the post office had always been a losing service in Ireland. The new postmaster greatly cut down the public facilities, and kept the stamp at 2d when it was 1½d in Great Britain, and therefore in Northern Ireland. In short, if there had been any alternative ministry the Government would have fallen, but there was none: and the bellicose protestations of republicans kept them in power. Another thing assisted them: when a turn in English politics replaced a Labour Ministry by a strong Tory Government, English ministers kept faith absolutely with Ireland. The difficulty about constituting the boundary commission had been referred by Mr. MacDonald's Government to the Judicial Committee of the Privy Council, which found that without a new Act of Parliament enabling the Imperial Government to appoint a commissioner to represent Northern Ireland nothing could be done.

Parliament was summoned on Sept. 30 instead of on Oct. 28, as had been originally intended, in order to pass through its stages the Irish Free State (Confirmation of Agreement) bill, which had been introduced by the Government at the end of the session. The defeat of the Labour Government on another issue was not allowed to prejudice the Irish settlement, and just be
the dissolution the bill was passed by the House of Lords
received the Royal Assent. In the House of Lords, Lord Ca
had moved an amendment that confirmation of the bill als
required from the Parliament in Northern Ireland, but in
interests of peace was persuaded to withdraw the amendm
and contented himself with the fact that his protest had
entered in the records of the House. A well-known publi
from Ulster, was appointed; and the commissioners after
preliminaries in London proceeded to investigate opinion on
border itself during several months in 1925 without the l
disturbance. In the meanwhile, from many quarters, but not
from Mr. Cosgrave and his ministers, came utterances to
effect that there was no intention of coercing Ulster. She
choose her own time for uniting, if she chose, with the res
Ireland. This indicated a departure from the expectations
out by Michael Collins after the treaty was signed, for he
Ireland to hope that the commission's award would transfe
much territory to the Free State that Northern Ireland w
not be able to maintain its separate status.

At the opening of 1925 a group of by-elections showed defi
support for the Government, and Mr. Blythe's budget of A
marked an advance. He reduced the income tax by a shil
and he extended materially the area of protection, claiming
the tariffs already imposed had led to increased employmen
the boot trade and minor industries. Broadly, all clothing
ported ready made was now subjected to taxation.

This budget really marks the beginning of normal fina
The liabilities for compensation for damage were at last as
tained, amounting to less than £10,500,000, of which u
£4,000,000 remained to be paid. The army charge was red
to something over £3,000,000. Mr. Blythe considered anyt
over £2,000,000 as abnormal, but necessary in view of the
tinuing republican menace. The State's normal expenditure
estimated at £24,000,000 and the revenue at £26,000,000.
normal expenditure for compensation and the rest he propo
to meet by borrowing.

But it soon became apparent that the ministry were not
posing a mere negative policy of economy, and early in 1925
committed themselves to a project of utilising the Shannon
SHANNON) for a vast electric power scheme. Nor did this st
alone. By promise of a subsidy amounting to a total of
£1,000,000 a Belgian firm was induced to start the sugar
industry on a large scale, Carlow being chosen as the sit
the central factory. Simultaneously came a whole group of
posals for the development of Irish industry and Irish agri
ture, which had been interminably discussed in and out of
liament during the British régime. They stood committed
policy of industrial development, having as the pivot of
whole an enterprise so colossal that its possibility had never
been seriously considered under the old order. In the mean
tranquillity returned to the country so completely that it seem
dull. Tourists refilled their old haunts in summer; the Du
Horse Show enlarged its scope.

The Boundary Question.—In the late autumn a new
threatened not only its prestige but its existence. The report
the boundary commission was awaited without emotion, tho
a London newspaper published a forecast of its decision diffe
widely from any anticipations that had been formed in the
State. No plebiscite had been taken;[1] the article gave no inst
tions for holding one; and it was (rightly) assumed that
commissioners would take it Roman Catholics desired inclu
in the Free State and Protestants inclusion in Northern Irel
Three important towns, Derry, Enniskillen and Newry had
regarded as possible subjects of transfer to the Free
because in all three Catholics were in a majority. In Ne
the proportion was 70%. In two of the border counties,
rone and Fermanagh, Catholics were about 55% of the wh
The forecast showed that all the three towns were left as

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[1] Under Article 12 of the Treaty the wishes of the inhabita
were to be considered subject to geographic and economic
siderations.

: no county was transferred as a whole; and the cession to
'ree State of districts (for the most part very poor) in Ar-
ı, Fermanagh and Tyrone was offset by the transfer of a
ɔart of East Donegal. There was a fierce outcry, and Presi-
Cosgrave in response to it reiterated the Free State's con-
ɔn that the commission was only entitled to transfer to
natural destination those parts of the six counties whose
ɔitants desired to be in the general body of Ireland. He
ıasised also that the claim to Newry was in his opinion in-
sible. These declarations were followed by the announce-
that the Free State representation had withdrawn from
ommission. Professor MacNeill followed this up by resign-
is post on the executive council, and in the Dáil explained
after hearing the evidence he had agreed, for the general
to sign a unanimous report whose terms were "not dis-
ır" to the unauthorised forecast. He had never taken his
ıgues in the ministry into his confidence at any point in the
of the commission. But now in view of the expression of
ɔn he felt that adding his signature to such a finding would
embarrass his colleagues and not produce a settlement.

th the Government and Professor MacNeill were attacked
great violence in the Dáil and outside it. The Republican
r came into new prominence. Mr. Cosgrave refused to
ıit himself publicly to any line of action, and went to Lon-
Meanwhile it came to be generally admitted that no mem-
f the commission could invalidate the finding by refusing to
he report; that the award then issued had immediate effect
v, and that the Free State minority had declared willingness
lvance to accept the award. On the other hand, it was
y declared that any attempt to transfer Free State territory
ɔrthern Ireland would be resisted by arms.

London, however, negotiations proceeded, and Sir James
; was summoned from Ulster; and on Dec. 3, a fortnight
Professor MacNeill's resignation, a new agreement was
uded and made public, to which not only Great Britain and
'ree States were parties, but Northern Ireland also. It was
d that the award of the commission should not be published
hat the existing boundary should stand. This gave to Ul-
ıll that Ulster claimed, but it gave to Ireland the repose of
ty. Further, the treaty was altered by the cancellation of
le 5, under which Ireland assumed liability for the public
of the United Kingdom as existing in 1921 "in such pro-
ɔn as may be fair and equitable, having regard to any just
s on the part of Ireland by way of set off on counter claims."
at once liberated the Irish exchequer from an undefined
ing liability injurious to its borrowing power, while it wiped
ıe British books what most people regarded as an irrecover-
asset. Ireland, however, undertook to repay to Great
in compensation already paid for war damages in the period
21, and to add 10% to the compensation awarded to
ıants for damages suffered in the civil war from 1922 on.
total cost to Ireland was estimated at under £5,000,000.

gislation embodying the terms of this agreement was car-
without difficulty in Great Britain, and the Northern Par-
ənt expressed its satisfaction. But in the Dáil President
rave was angrily opposed by the Labour party and by some
s own followers. Attempts were made by Labour to induce
ıblican members to come into the Dáil for the purpose of
king the agreement, but they failed, and after much talk
Bill was carried by 71 to 20. Business men as a whole re-
ed the issue as fortunate for Ireland, which now definitely
me a country with a total national debt of under £20,000,000
less than a gross revenue. Other sections found their chief
action, as did President Cosgrave, in the changed relation
e government concerned, indicated in the preamble:—

> e British Govt. and the Government of the Free State being
> d in amity with the Government of Northern Ireland and being
> ved mutually to aid one another in a spirit of neighbourly com-
> hip, hereby agree . . .

immediate consequence was the disbandment of the Ulster
al police in two of its three branches. There could be no
er proof that a great cause of danger to Ireland has been
definitely removed. It is also plain that while the conduct of this business by President Cosgrave and his colleagues has been criticised, the policy of those who desired to tear up the settlement ran counter to the public desire. The Irish Govt. has been therefore strengthened by a difficulty which threatened its destruction.

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II. THE CONSTITUTION

The present political status of the Irish Free State is that of a co-equal member of the community of nations forming the British Commonwealth. It has a written constitution which rests on the provisions of an Act passed by Dáil Eireann sitting as a constituent assembly in the autumn of 1922, entitled an "Act to enact a constitution for the Irish Free State (Saorstát Eireann) and for implementing the treaty between Great Britain and Ireland signed at London on the 6th day of Dec. 1921."[1]

It is provided in this Act that the Constitution shall be construed with reference to the Treaty and that if any provision of the constitution or of any amendment thereof or of any law made thereunder is in any respect repugnant to any of the provisions of the treaty, it shall, to the extent of such repugnancy, be void and inoperative. It is also provided that to the extent to which they are not inconsistent with the constitution all laws in force in the Free State at the time of passing of the constitution are to continue to have full force and effect until repealed or amended by the Oireachtas.

In conformity with practice in the British Commonwealth the executive authority is vested in the King. The governor-general represents and fulfils the functions of the Crown. He is appointed "in like manner as the governor-general of Canada and in accordance with the practice observed in the making of such appointments"—which ensures that the Government of the Free State shall be consulted before any appointment is made. His powers are strictly limited as in the case of the Sovereign in Great Britain, all executive acts being done on the advice of the executive council. The latter consists of not more than seven nor less than five ministers, and is directly responsible to Dáil Eireann, retiring from office when it has ceased to retain the support of a majority of deputies.

Dáil Eireann may not at any time be dissolved except on the advice of the executive council, and Article 53 of the Constitution provides that the Oireachtas shall not be dissolved on the advice of an executive council which has ceased to retain the support of a majority in Dáil Eireann. The Parliament of the Free State cannot therefore be dissolved except with its own consent. The maximum life of a parliament is four years. The president of the Executive council, who is appointed on the nomination of Dáil Eireann, nominates the vice-president and the other ministers who form the Executive Council. The council is collectively responsible for all matters concerning the departments of state administered by its members.

Other ministers, however, who shall not be members of the executive council, may be appointed on the nomination of committee of Dáil Eireann, and these ministers are directly and individually responsible to the Dáil for the administration of their departments. Members of the executive must be members of Dáil Eireann, but this provision does not apply to other ministers. The legislature, known as the Oireachtas, consists of the King and two Houses, Dáil Eireann (the Chamber of Deputies) and Seanad Eireann (the Senate). In the Oireachtas is vested "the sole and executive power of making laws for the peace, order and good government of the Irish Free State."

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[1] The Royal Assent was given to the Act passed by the Imperial Parliament to give effect to the Irish Free State Constitution on Dec. 5 1922, and on the next day the King signed the proclamation announcing the adoption of the Constitution.

The Senate.—Seanad Eireann is composed of 60 members, the term of office of each member being 12 years. One-fourth of the members are elected every three years by proportional representation, the whole of the Free State forming one electoral area. At every election a panel of candidates is formed, consisting of three times as many persons as there are senators to be elected. Two-thirds of the panel is nominated by the Dáil, and one-third by the Seanad. In addition to these all persons who have at any time been senators have a right to be added to the panel if they so desire. Candidates, who must have reached the age of 35 years, are chosen on the ground that they " have done honour to the nation by reason of useful public service or that, because of special qualifications or attainments, they represent important aspects of the nation's life." Casual vacancies in the Seanad are filled by co-option, and co-opted members retire at the next triennial election.

The Chamber of Deputies.—Dáil Eireann (the Chamber of Deputies) is composed of members directly elected by constituencies determined by law. The number of members at present is 153. This number may, however, be varied from time to time, but shall not be fixed at less than one member for each 30,000 or more than one member for each 20,000 of the population of the State. In addition each university elects three members. As in the case of the Seanad, election to the Dáil is carried out on the system of proportional representation.

All citizens, without distinction of sex, who have reached the age of 21 years and who comply with the electoral laws, have the right to vote for members of Dáil Eireann, and all citizens who have reached the age of 30 years and who similarly comply with the electoral laws have the right to vote for members of Seanad Eireann. Voting is by secret ballot, and no voter may exercise more than one vote at any election.

Members of both Houses receive an allowance for expenses which is fixed at £360 per annum. Every member of the Oireachtas must take the following oath before taking his seat:—

> I............do solemnly swear true faith and allegiance to the constitution of the Irish Free State as by law established, and that I will be faithful to H. M. King George V., his heirs and successors by law, in virtue of the common citizenship of Ireland with Great Britain and her adherence to and membership of the group of Nations forming the British Commonwealth of Nations.

Powers of the Senate.—The powers of Seanad Eireann are limited. It has no authority to amend a money bill, but may make recommendations to Dáil Eireann regarding such bill within 21 days after a bill certified to be a money bill has been passed by Dáil Eireann. The definition of a money bill given in article 35 of the constitution is adopted from the United Kingdom " Parliament " Act of 1911. There is a proviso that the decision of the chairman of Dáil Eireann as to whether the bill is or is not a money bill may be appealed against before a committee consisting of three members of each House presided over by a judge of the Supreme Court. The Seanad may reject or amend all other bills, and may initiate legislation, but a bill passed by the Dáil which has not been passed by the Seanad 270 days after it was first sent to the Seanad is deemed to have been passed by both Houses in the form in which it was last passed by Dáil Eireann. Any bill passed or deemed to have been passed by both Houses may be suspended for a period of 90 days on the written demand of two-fifths of the members of Dáil Eireann or of a majority of the members of Seanad Eireann presented to the President of the executive council not later than seven days from the day on which such bill shall have been so passed or deemed to have been so passed. During the period of suspension the bill shall be submitted to a referendum if so demanded by one-twentieth of the voters on the register or by three-fifths of the members of the Seanad. These provisions do not apply to money bills or to bills declared by both Houses to be necessary for the immediate preservation of the public peace, health or safety.

Defence.—The Oireachtas has the exclusive right of raising and maintaining armed forces in the Free State, but under the provision of the treaty the army shall not exceed in size such proportion of the army in Great Britain as that which the population of Ireland bears to the population of Great Britain. Save in the case of actual invasion the Irish Free State shall not be committed to actual participation in any war without the assent of the Oireachtas.

Nationality, etc.—Every person domiciled in the Free State at the time of the coming into operation of the constitution, who was born in Ireland or either of whose parents was born in Ireland, or who has been ordinarily resident in the area of the jurisdiction of the Free State for not less than seven years is entitled to citizenship in the Free State. No title of honour in respect of services rendered in the Free State may be conferred on any citizen without the consen the executive council. Freedom of conscience and the free fession and practice of religion are, subject to public order morality, guaranteed to every citizen. No law may be made endow any religion or to give any preference or to impose disability on account of religious belief. No discrimination may made as respects state aid between schools under the managem of different religious denominations.

Court of Appeal.—The constitution provides that the Supr Court of the Free State is a court of final appeal and that its deci shall not be reviewed by any other court, tribunal or autho whatsoever, provided that nothing in the constitution shall im the right of any person to petition His Majesty for special leave appeal to His Majesty in council or the right of His Majesty to gr such leave. There is no provision, however, that decisions by King in council shall be binding on Irish Courts.

The judges of the Supreme Court and of the High Court an all other courts established in pursuance of the constitution can be removed for stated misbehaviour or incapacity and then only resolutions passed by both houses of the Oireachtas. See J. Swift McNeill, *Studies in the Constitution of the Irish Free* (Dublin, 1925). (J. G. D.

III. DEFENCE

The evacuation of the British garrisons from Free State te tory began with the ratification of the Anglo-Irish Treaty Dáil Eireann in Jan. 1922. Dublin was held until the treaty finally confirmed 11 months later, and then handed over to tachments of the Irish Republican Army which had given herence to the Provisional Government.

Administration.—As a result of an inquiry into the civil which began in June 1922, and the mutiny of March 19 changes were made in army administration. The command chief is now vested in the executive council and exercised throu out in the name of the Minister of Defence who, however, not allocate to himself any executive military command. H assisted by a council of defence, composed of a civil member ing as Parliamentary Secretary to the Minister and responsi for the finance of the Defence Forces, and by three milit members, the chief of staff, the adjutant-general and the qu termaster-general, whose business it is to deal with traini organisation, equipment and discipline.

The Army Vote for the year ending March 1926 was £3,0 774, and the strength of the forces amounted to 1,053 offi and 16,187 non-commissioned officers and men. The Free St is divided into four military districts—the Eastern, Western Southern Commands, and the Curragh camp where all recru undergo their training. Head-quarters of the three comma are at Dublin, Athlone and Cork, and are in charge of ma generals. There are nine brigade districts, and the infantry organised in 27 battalions. The remaining services are artillery, armoured car, engineers, signal, military police, medi and transport Corks, a school of music and a military col There is an Irish-speaking battalion and all officers and n commissioned officers are instructed in giving and receiving exe tive words of command in both Gaelic and English. The stren of the Air Force is 18 officers, 131 other ranks and 18 machi

Defence Provisions of the Treaty.—Under the Irish treaty was agreed, with a view to securing the international limitat of armaments, that the Irish Defence Forces should not exc in relation to military establishments maintained in Gr Britain the proportion which the population of Ireland bears that of Great Britain. The treaty also provides that defe by sea of Great Britain and Ireland shall be undertaken by perial forces. After five years from the date of the treaty (D 6 1921) a conference is to be held with a view to Ireland und taking a share of her own coastal defences. Harbour defen at Berehaven, Queenstown and Lough Swilly remain in cha of British care and maintenance parties. In time of war strained relations with a foreign power the Free State is pled to afford such harbour and other facilities as the British Go may require for purposes of defence. (J. W. Go

IV. EDUCATION

Since taking control, the Government of the Irish Free St has carried through changes in the educational system.

The first step was to unify control over educational matters der a Minister for Education. This involved the abolition of e three independent bodies through which, previous to 1922, ucation in Ireland was financed. The powers exercised by the ard of National Education were at once taken over by the ee State Ministry. The programme for primary schools has en considerably modified with a view to making it simple, ncentrated and national. Attention is concentrated on funda- ntal subjects, Irish, English, reading, writing and arithmetic. ovision is made for studying local needs in applying this pro- amme in any given locality. The salary question had already en satisfactorily settled under the British régime.

As regards tenure and method of appointment of teachers the l managerial system, under which the power of appointment d dismissal lay, under certain limitations, with the manager the school (usually a clergyman) has been retained. This stem means that each religious denomination controls the pointment of teachers in schools attended by the children of at denomination. The old " National " system provided for mbined literary and moral and separate religious instruction r pupils of different religions. The regulations provide that portunities must be afforded to the pupils of all schools for ceiving such religious instruction as their parents or guardian prove. Religious instruction is given at a time not counted hen computing attendance, and does not come under the super- sion of the officers of the Department. An outstanding defect herited from the old régime, the absence of any real system of mpulsory education, will be rectified at an early date. A bill scribed by the president of the Free State Executive as " of a astic type " has been laid before the Oireachtas.

Important changes with regard to the training of teachers are ing introduced. It is proposed to establish six preparatory lleges for candidates for the training colleges, five of these are be situated in those districts in which Gaelic is still a living nguage, and staffed with teachers capable of teaching the sec- dary school programme entirely through the medium of Irish. this way the future teachers will enter the training colleges fluent speakers, and having passed through a complete secon- ry course given in Irish. Thus a supply of teachers will be cured capable of carrying through the Department's programme r primary schools, aiming at the restoration of Irish as the rnacular.

Secondary Education.—As regards secondary education a ider problem confronted the Government. The administration the funds devoted to this branch was still hampered by the ause of the Intermediate Education Act of 1878 which pre- ribed that results fees were to be paid to schools on the results a general public examination. A system, advocated by the termediate Board in its Report of 1916 and by the Viceregal ommittee on Secondary Education set up in 1918, has been rought into operation by the present Government. Payment results has been replaced by a capitation grant, dependent n the reports of inspectors, who will take into account every ature of the school. The old rigid system with its fixed pro- ramme has been replaced by freedom, and examinations have een reduced to their proper place.

A salary scheme for teachers in secondary schools has been ut into force. Under it, men teachers are to receive from state nds 10 annual increments of £12 each, and subsequently six nnual increments of £15 each, while women receive 12 annual crements of £10 each. Holders of an honours degree of an rish or British university receive additional increments.

The Intermediate Education Board was replaced by two com- issioners in June 1923; and as from April 1 1925 their functions ere transferred to the Minister for Education. The funds pro- ided by the Act of 1878 and subsequent Acts for secondary lucation were transferred to the Department of Finance. In ture education in the Free State will be financed out of sums nnually voted by Parliament. Technical instruction has been laced under the control of the Minister for Education, retaining he organisation under local committees.

In 1925 there were 5,636 primary schools in the Irish Free State, with a total of about 500,000 pupils, and 286 secondary schools providing for 25,600 pupils. There were also 60 technical schools, with 21,800 pupils; 5 training colleges for primary teachers, with 820 teachers in training; while the names on the register of secondary teachers numbered 2,083.[1] (W. F. B)

V: ECONOMIC AND FINANCIAL HISTORY

The area of the Free State is 17,019,155 statute acres, made up as follows in 1918:—

Area under	Statute acres
Crops	4,406,105
Grass	7,775,137
Mountain lands, grazed	2,124,190
Mountain lands, barren	466,272
Woods and plantations	248,878
Turf bog	766,353
Marsh	339,297
Water, roads, fences town and building ground, etc.	89[illegible],523

In 1914, the valuation of the rural districts was £8,741,631 and of the urban districts £2,391,170, the total valuation being £11,132,801.

Population.—The last census of Ireland was taken in 1911. In 1911 the population of the 26 counties composing the Free State was 3,139,688, being 71·5% of the total population of Ireland; in 1925 it was estimated at 3,163,000.

In 1924, the number of marriages registered was 14,822, being 4·69 per 1,000 of the population, the number of births was 63,402, being 20·06 per 1,000 of the population, and the number of deaths was 45,180, being 14·29 per 1,000 of the population. While the reduction in the mortality from tuberculosis has been steady and continuous for many years, the death rate from cancer is increasing. Of the total deaths at all ages 15·2% were deaths of children under five years of age, and the number of deaths of infants under one year was equivalent to a rate of 7·2% of the birthrate. Infantile mortality is decreasing year by year.

Practically no emigration took place from Ireland during the War. It is estimated that the number of emigrants to " places out of Europe and not within the Mediterranean Sea " was 15,000 in 1922, 20,570 in 1923, and 19,077 in 1924. Of the emigrants in 1924, 12,016 were bound for the United States, 5,237 for British North America, 1,138 for Australia, 192 for New Zealand, 160 for British South Africa, 112 for India and 222 for other countries. The population of the Free State is overwhelmingly rural. There are only two towns with more than 50,000 inhabitants, namely, Dublin and Cork, and two others with more than 20,000, namely, Limerick and Waterford.

In 1911 the population of the 26 counties now forming the Free State contained 2,812,509 Roman Catholics, 249,535 members of the Church of Ireland, 45,058 Presbyterians and 3,805 Jews. The great majority of the population were English-speaking, but 16,869 spoke Irish only, and 536,848 were bi-lingual. Of persons aged nine years and upwards, 260,694 could neither read nor write, and 74,001 could read but could not write. The number of houses in the 26 counties in 1911 was 642,541, or one house for 4·88 inhabitants.

Agriculture.—The total acreage under crops was 3,832,240 in 1922; 3,739,146 in 1923; and 3,783,823 in 1924. The following are figures of acreage under crops and numbers of livestock in the Free State in 1922–3–4:—

Crops	1922	1923	1924
Wheat	34,469	31,764	27,465
Oats	813,970	785,939	756,313
Barley and bere	167,765	151,309	163,642
Rye	6,142	6,414	6,424
Beans and peas	447	428	408
Flax	4,915	8,066	10,499
Fruit	10,924	10,795	10,652
Hay	2,062,694	2,026,841	2,099,639
Live Stock	**1922**	**1923**	**1924**
Cattle	4,326,294	4,215,253	4,194,189
Sheep	3,067,473	2,994,420	3,127,921
Pigs	919,449	1,555,905	937,814
Goats and kids	192,298	195,022	193,484
Horses used in agriculture	306,552	312,410	308,552
Unbroken horses	122,549	96,888	79,988
Mules and jennets	25,276	23,919	23,160
Asses	221,991	220,468	218,439

There are 442,606 agricultural holdings, of which 86,033 are less than one acre, 223,991 above one and not exceeding 30 acres, 130,807 above 30 and not exceeding 500 acres and 1,775 above 500 acres.

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[1] *Annual Report of the Department of Education* (April 1926).

Unpublished official figures show that the percentage of land ploughed varies inversely with the size of the holding; that for equal acres of crops and pasture, the number of livestock (especially milch cows, pigs and poultry, and excepting sheep) rapidly increases as the size of the holding diminishes; and that the larger the percentage of land tilled, the larger the number of animals supported.

The cultivation of cereal crops plays a comparatively unimportant part in the agricultural economy of the Free State, and the bulk of the attention of the farmer is devoted to the raising of stock. As between the production of beef and of dairy produce, conditions vary in different parts of the country. In certain areas the soil, climate and type of holding favour the production of dairy breeds; in others beef breeds are predominant.

In accordance with detailed recommendations made by the Commission which reported in 1924, an Act was passed (No. 35 of 1924) providing for the testing, grading and packing of exported eggs, for the prohibition of the export of dirty or bad eggs, and for the registration of all premises where grading, packing or preserving is carried on. Another Act (No. 58 of 1924) made elaborate provision for the regulation of the butter trade. Butter can now be exported only by registered creameries, factories or exporters, and must be packed and marked in a specified manner. The most minute regulation of creameries and factories is insisted on, and provision is made for the establishment at a later date of a national mark or brand for creamery butter. The licensing of bulls was made compulsory by another statute (No. 3 of 1925). This measure, together with the Government's scheme for providing premium bulls and boars and for subsidising the purchase of pedigree rams, has resulted in levelling up the standard of the livestock in the country. Owing to the acute agricultural depression in 1924, power was given to county councils to abate rates on agricultural land for the year ending March 31 1925 and the budget of 1925 provided for the doubling of the agricultural grant.

Early in 1925 serious losses were sustained by farmers in many districts as a result of the prevalence of fluke disease. The Government supplied farmers in the affected areas with cheap supplies of suitable medicine and granted credit facilities to assist in the restocking of farms. £100,000 was provided from public funds for the purpose of making loans through the channel of co-operative credit societies in the districts concerned.

Land Purchase.—The total amount of the purchase money for which advances have been made under the Land Purchase Acts of 1870–1909 in respect of lands in the Free State is £99,110,046, the total area comprised in the sales being 11,159,356 acres. In addition, there are pending proceedings for which agreements for purchase had been entered into under the acts of 1903–9 representing a purchase money of £830,000 and an area of 120,000 acres. The British Govt. assumed responsibility for the completion of all sales pending at the date of the Treaty.

The Land Act of 1923 aimed at attaining the dual object of completing land purchase and relieving congestion. This Act provided for the creation of land bonds, bearing interest at the rate of 4½% in which all payments to landlords and encumbrancers were to be made. These bonds were later guaranteed, as to principal and interest, by the British Government. Advances made to purchasers were to be repaid by an annuity at the rate of 4¾% of the amount advanced, and the price to be paid was roughly equal to about 15 years purchase of the value of the holding, of which the Government contributed 10% in relief of the tenant. Very wide powers were given to the Land Commission to acquire untenanted land for the creation of holdings in relief of congestion, and to consolidate and exchange holdings with the same object.

The area of untenanted land already acquired by the Land Commission and the late Congested Districts Board and utilised for the relief of congestion amounts to 820,000 acres. Advances were authorised to be made to tenants of uneconomic holdings, tenants exchanging their holdings, persons who had been evicted and labourers who had lost their employment through the progress of land purchase. The money required by the Land Commission for making roads, fences, drains, etc., and for erection of buildings on newly created holdings is provided out of public funds, and so much as the Land Commission decides can be repaid by the purchasers is made repayable by them along with their purchase annuities. All arrears of rent due before the first gale day of 1920 were wiped out; but rent due after that date (subject to 25% reduction) was made recoverable.

It is estimated that advances amounting to £30,000,000 will b required to complete land purchase under the 1923 Act. As regard tenanted land, holdings situated on 6,000 estates have to be deal with, while as regards untenanted land, the Land Commission ha inspected or is making inquiries in respect of 750,000 acres, with a view to their acquisition for the purpose of distribution; and of thi area the Land Commission has acquired or entered into agreement for the acquisition of over 100,000 acres.

Congested Districts Board.—The Congested Districts Board wa dissolved in 1923 and its functions transferred to the Irish Lan Commission. (Land Law, (Commission) Act, 1923, No. 27 of 1923. By the Ministries Act of 1923 the agricultural and land branches o the Congested Districts Board were put under the Minister o Agriculture and the fisheries and rural industries branches under th Minister of Fisheries.

Fisheries.—The work formerly done by the Department of Agriculture and the Congested Districts Board in connection wit the fisheries and with rural industries has now been transferred to a separate Ministry, whose policy is to develop the deep sea fisheri and to organise the home demand for fish, which is at present ver small. The Government is helping the fisheries by making loans fo boats and gear, erecting and maintaining curing stations, and subsidising fishery schools. A brand for mackerel has been institute One urgent requirement is being delayed for financial reasons, namel a second patrol boat to keep the coast free from the numerou foreign trespassers who at present infest it.

Manufacturers.—Ireland was, even before partition, an overwhelmingly agricultural country, but the predominance of agriculture became greater than ever after the exclusion of the six countie The Agricultural Commission reckoned that three-quarters of the rea wealth produced in the Free State is farm produce. Too great dependence upon any one industry is always undesirable, and the government has taken steps to redress the unequal balance betwee the agricultural and manufacturing industries. The object aimed a by the government's policy is the development, not of large-scale urban industries, but of rural industries, especially those concerne with the working up of agricultural produce.

The treaty left the Free State at liberty to frame its tariff policy as it chose. There was a widespread popular belief that Irish industry could best be revived by the adoption of a high protectionist tariff, and the Government appointed a small committee of economists to inquire into the probable effects of protective duties. The report of this committee was strongly free trade in tone. It pointe out the numerous factors, besides external competition, that operate to retard the growth of industry in Ireland. The necessity for a dominantly agricultural country of the lowest possible prices of raw material and consumable commodities was pointed out. Nevertheless the Government proceeded to institute a number of experiments in protection.

The Finance Act of 1924 imposed a duty of 3⅗d per lb. on sugar confectionery, of 6d per lb. on cocoa preparations, of 10% ad valorem on candles, 15% ad valorem on boots and shoes, 33⅓% on glass bottles (not white glass) and 10% ad valorem on soap. The McKenna duties were altered so as to provide encouragement for the building of commercial motor bodies, and the imperial preference on manufactured tobacco was abolished. The Finance Act of 1925 went a good deal further in the same direction, but the Minister for Finance declared that the new duties were purely experimental in nature. This Act imposed a duty of 15% ad valorem on clothing, wearing apparel, blankets, and blanketing, and 33⅓% on bedsteads and wooden furniture; the duty on bottles was extended, and an additional duty of 10% was put on toilet soaps. On the setting up of the customs barrier in 1923 the manufacture of tobacco automatically secured a small measure of protection. The only corresponding steps taken in the direction of free trade were the repeal of the Dyestuffs Import Regulation Act, the Safeguarding of Industries Act, and the McKenna duties on gramophone records.

At the same time, some important revenue duties were abolished or reduced. It would appear, however, from the cost of living index numbers that the result of the new tariff (in conjunction with other causes, such as high wages and a bad system of retail distribution) has been to prevent the cost of living in the Free State from being reduced at the same rate as in Great Britain. This is shown by the following table:—

Cost of Living Index Numbers (*Basis: July 1914=100*)

Month	Free State			Great Britain and Northern Ireland		
	1923	1924	1925	1923	1924	1925
January	190	188	195	178	177	180
April	181	178	188	174	173	175
July	180	183	188	169	170	173
October	186	193	188	175	176	176

In addition to giving the protective assistance outlined above, the Government has endeavoured to encourage industry by means of subsidies, the development of cheap sources of power, and the pro-on of credit facilities. The growth of sugar beet and the manu- ure of beet sugar were encouraged by the grant of a subsidy able for 10 years to persons manufacturing in the Free State ar from home-grown sugar beet. A large Belgian-Czechoslovak- group, encouraged by the subsidy, has arranged to open a ar beet factory in Carlow.

n important attempt is also being made to provide the Irish ufacturer with cheap power. The Government sought the ad- of Messrs. Siemens-Schückert, who drew up a scheme for ising the great water power of the Shannon (*q.v.*). Another hod by which the Government attempted to encourage industry by helping enterprises to obtain capital on easy terms under the de Loans Guarantee Act (No. 41 of 1924). The maximum amount t might be advanced under Government guarantee under the Act fixed at £750,000. The Minister was further authorised to grant o guarantee loans proposed to be raised by any public authority ny association of producers or consumers "calculated to promote duction in the retail prices in Saorstát Eireann of essential com- lities." The maximum grant under this action was limited to ,000, and the maximum grant and guarantee together to £250,000. an amending Act (No. 19 of 1925) the period in which this stance might be rendered was extended; and the Finance Act of 5 provided for the advance of £300,000 to the National Land k for the purpose of trade loan guarantees. Finally the Ministry ndustry and Commerce has set up advisory committees in more n 30 of the principal industries to assist the Government in ac- ring information and in forming policy.

anking.—All the banks having their head offices in the Free te have numerous branches in Northern Ireland, and two of the fast banks have numerous southern branches. Shortly after the ty, the Belfast Bank, which is affiliated with the Midland Bank, its branches situated in the Free State to the Royal Bank of land. The Free State Government holds all the shares in the tional Land Bank. The Government's banking business, with a minor exceptions, is transacted by the Bank of Ireland. The ricultural Commission recommended the formation of a depart- nt for granting long term loans to farmers to be capitalised by the sting banks jointly, but this recommendation has not been fol- ed. Recently, there has been formed a company known as the lustrial Investment Trust for the purpose of affording financial istance to industry by means of long term loans. The National n, both as regards principal and interest, is repayable in sterling, are also the bonds created under the Land Purchase Act. The horised issue of the six Irish banks of note issue is £6,352,000, and average circulation of these banks' notes in May, 1925, was ,364,000, against which £10,688,000 was in gold and silver coin.

rade.—The customs barrier between the Free State and Northern land was set up in April 1923, but it was not until the beginning the following year that accurate values of imports and exports re obtained. The trade figures for 1924 are as follows:—

Class	Imports 1924 £	Exports 1924 £
1. Food, drink and tobacco	29,523,000	41,549,000
2. Other raw materials	6,314,000	2,490,000
3. Other manufactured goods	29,204,000	2,593,000
4. Live animals not for food	770,000	1,816,000
Totals	65,811,000	48,448,000

During the first nine months of 1925 the value of imports was 5,225,383, of exports £29,623,566 and of re-exports £814,034. It is probable that, if a full account of the international bal- ce of indebtedness were obtainable, it would appear that the visible items would more than make up for the adverse visible de balance. Very large sums are received from British and reign investments, and from emigrants' remittances from nerica. On the other hand, the Free State remits large sums account of land purchase annuities and pensions. There is sign, as far as can be gathered from banking or stock exchange urces, that the Free State is living on its capital.

Communications.—In 1914, there were in Ireland 28 railway com- nies operating 3,454 miles of line. The Irish railways were placed der the control of the British Government in 1917 and were re- sed in August, 1921, a few months before the treaty. During the ntrol period, the net receipts for 1913 were guaranteed, and on the ssation of control the Government paid the railways £3,000,000 in ll settlement of all claims. Meanwhile, wages had been raised by out 200%, while freight and passenger rates had been raised only 120 and 100% respectively. The resulting difficulties led to the ilways Act of 1924, modelled on the British Act of 1921, for nalgamating all the lines situated wholly in the Free State. On n. 1 1925, came into being the new Great Southern Railway, mprising all the companies in the Free State but excluding the eat Northern Railway (Ireland), which is partially situated in orthern Ireland. The average weekly receipts of the Great Southern Railway in 1925 were £12,500 lower than in 1924; and the interim dividends on the ordinary and preference shares due to be declared in July were passed. All classes of stock have fallen heavily in the market. The conditions which prevail in the Free State render the competition of the road vehicle very formidable; the average journey is short, and many places in the country are several miles from a railway station. The number of motor vehicles and cycles increased in two years from 22,240 to 36,836.

Finance.—The following table shows the revenue and expenditure of the Free State from 1922 to 1925:—

Year	Revenue	Expenditure	Deficit
	£	£	£
1922–3	28,611,600	31,395,589	2,783,989
1923–4	31,869,628	42,792,312	10,922,684
1924–5	27,542,200	29,718,631	2,176,631

The Minister of Finance, in introducing the 1925 budget, stated that the total amount payable out of the public funds of the Free State in respect of compensation for property losses and personal injuries, both pre-truce and post-truce, would not exceed £10,300,000, a considerably lower figure than had been at one time anticipated. Compensation for pre-truce damage would amount to about £7,660,000, towards which Great Britain would contribute about £3,560,000; and the damage committed after the truce would account for about £6,100,000. When the abnormal army expenses had been reckoned, and the consequential losses to trade and industry taken into account, the civil war had cost the people at least £30,000,000. In view of the greatly improved condition of the national finances, he proposed to meet about £6,000,000 of the estimated expenditure of £30,000,000 for 1925–6 by borrowing, as it was of an abnormal and non-recurrent character, and to relieve the taxpayer by lowering the income tax and making large reductions in indirect taxation.

Public Debt.—In Nov. 1923, the Irish Free State floated its first loan. The nominal amount raised by this loan was £10,000,000. The interest offered was 5% and the issue prices 95, the flat yield being thus about 5¼%. The loan is redeemable at par between 1935 and 1945. The Minister of Finance authorised the statement that both principal and interest would be paid in sterling. The loan was a great success, being oversubscribed in the Free State; no part of it was underwritten or taken by the banks. Provision was shortly afterwards made for the satisfaction of persons who had contributed to the official Sinn Fein loans floated during the Anglo-Irish fighting. Irish subscribers were to receive savings certificates, and subscribers elsewhere were to have their holdings redeemed.

The indebtedness of the Free State on Nov. 28 1925, was £13,483,693, made up as follows: Ways and means advances by public departments, £1,530,000; annuities under Telegraph Acts, £202,944; savings certificates, £1,488,000; national loan, £9,760,859; compensation stock, £501,850. The price of the national loan on Jan. 9 1925 was 98¾ and of compensation stock 93⅝. The agreement made between the British and Free State governments in Dec. 1925, provided that the outstanding liabilities of the Free State under the treaty in respect of the British National Debt should be settled by an annual payment of £250,000 for a period of 60 years.

Taxation.—The system of taxation in operation at the time of the treaty was taken over and, owing to the difficult financial situation created by the civil war, no reductions were attempted for a couple of years. In the years 1923–4 and 1924–5 the income tax was maintained at the rate of 5s., and the corporation profits tax was retained. In both these respects, the Free State taxes were higher than the British. The budget of 1924 reduced the super tax on very high incomes, and reduced the tea duty from 8d. to 5d. per pound. In 1925 the income tax was reduced to the British rate of 4s., and the exemption limit to corporation profits tax was raised. The duty on sugar was considerably reduced and imperial preference in that commodity discontinued, and the duties on tea, coffee, cocoa and chicory were abolished. The relief which the taxpayer might have derived from these concessions was counterbalanced by the burden of the new protective duties.

In addition to the sums raised by national taxes, the following sums were raised by local taxation: Year ending March 1922, £6,762,672; March 1923, £4,153,060; March 1924, £5,327,341.

The total (national and local) taxation amounts to £8 19s. 5d. per head of the population and the public debt amounts to £4 5s. 3d. per head. The debt is equal to 58·4% of the annual revenue.

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European Reconstruction Series, *Ireland* (March 15, May 10, July 26 1923); *Report of the Fiscal Inquiry Committee* (1923); *Report of the Commission on Agriculture* (1924); *Annual Reports of the Registrar-General (Ireland) on Marriages, Births, and Deaths* (1924); *Merchant Shipping List and Postal Directory* (1925); *Official Customs and Excise Tariff* (1925); *Report of Committee on Economic Statistics* (1925).

See also E. J. Riordan, *Modern Irish Trade and Industry* (1920); W. L. Micks, *History of the Congested Districts Board* (1925).

(G. O'B.)

IRISH LANGUAGE (*see* 5.622).—It is difficult to say with any certainty how far the Irish language has maintained itself in Ireland since 1910. The action of Dáil Eireann in making it the official language of their first meeting, nothing else being spoken on that day, gave a great stimulus to it in popular estimation. The Dáil did not, however, live up to the headline thus set. Speeches there are seldom made in Irish, and practically never in the Senate, where not a dozen, perhaps not more than half a dozen of the 60 Senators could understand, much less speak it. It was decided, however, that all legislation must be passed in both English and Irish, and an efficient staff of Irish scholars and translators was retained for this purpose.

Several books written in Irish were translated into German, Swedish and Norwegian. Dr. Pokorny of Berlin published translations of some of Pearse's, O'Conaire's and O'Siochfhradha's stories under the not very felicitous title of *Die Seele Irlands* (Max Niemeter, Halle, Saale). From this book the reader will get a good idea of the short story in contemporary Irish literature. Dr. von Sydow of Lund University translated Father O'Leary's novel *Séadna* into Swedish. Käte Müller-Lisowski published, with notes and introduction, in 1923 a volume containing 39 Irish folk-tales. She had previously translated Dr. Hyde's "True Storyteller of the Week." Dr. Reidar Christiansen also published an illustrated volume of Irish folk-tales in Norwegian.

Irish was recognised as the national language by the Dáil, and a corollary to this recognition seemed to be that it should be taught in the primary schools of the Free State, and so far as the schools are concerned the Government made great efforts to Gaelicise them. Naturally one of the principal difficulties that the new Government had to face was the fact that the great majority of the teachers were not qualified to teach Irish, much less to use it as a medium for teaching. With a view to remedying this, annual courses for the training of teachers in Irish were established in 1922. The courses for primary teachers extended over eight weeks in 1922, five weeks in 1923 and four weeks in 1924. Approximately 12,000 teachers attended annually at about 180 centres or colleges. The cost in 1922 was £76,000; in 1923, £66,000; in 1924, £42,500; and in 1925 about £45,000. Similar courses were held for about four weeks in each of the years 1922–3–4–5, at a cost of between £3,000 and £4,000 per year, for teachers employed in secondary schools.

Formerly many people might have been noticed, especially young men and women, wearing a gold ring on their dress in the streets of the bigger cities and towns. This was to show that they spoke Irish and wished to be addressed in that language. It was observed that many of these people came to a violent end, and the wearing of this ring was consequently to some extent discontinued. It is significant that after the formation of the Free State the wearing of this ring was largely resumed. For examinations held under the auspices of the civil service commission in the Irish Free State Irish was made an essential subject. Indeed, it seems certain that a knowledge of Irish will be in future years a necessity for all aspirants to Government posts and that no young man who does not know something about it will be looked upon as properly educated. From 1927–8 forward Irish is to be compulsory in all secondary schools.

Finally, it may be said that whilst the reading, writing and speaking of the Irish language increased very much during this period in the towns, amongst the cultured classes in the north-west, west and south, where it was naturally spoken, it did not fare so well; in many of these places barely holding its own against English. (D. Hy.)

IRISH LITERATURE: ENGLISH (*see* 5.622).—The literary revival in Ireland was the first evidence of a resurgent national spirit. It had its origin in the study of the older heroic literatu and of the folk poetry which still existed in Irish.

Poetry.—Its first expression was in poetry which retained th double mark of its origin set in W. B. Yeats' work to a standa of well-nigh perfect artistry and marked in George Russell's ("Æ writings with a profound consciousness of the divine origin a destiny of man. In time the poets broke away from folk theme which were becoming a mannerism but not before Padraic Colu had written verses of grave, deliberate beauty and Joseph Campbell had used similar material effectively but not without sophistication.

By 1910 the group of young poets, whose association in *Ne Songs* (1904) gave the appearance of a school, had broken bounds Seumas O'Sullivan had perfected his fastidious art and begu to show the shift of interest from country to town together wit a new and mordant note. A transition to prose marked the passing of youth and the coming of age of the movement. Movemen now it could hardly be called. It had become a diverse development of personality. James Stephens' *Insurrections* (1909) ma be taken as the turning point. Passing indifferently from poetr to prose and back again, reincarnating in both forms and in modern spirit the old prose sagas or the 17th century poetry O'Bruadar, O'Rathaille and Keating, passing from *The Charwoman's Daughter*, a Dublin slum idyll, to the riotous inventio of the *Crock of Gold* and *Demi-Gods*, and exhibiting at each tur the same leaping, exuberant fancy and the same wise and witt humanity, Stephens fitly represents the transition from the olde generation and the growing attraction to prose.

One mentions the poets of the Rebellion, Pearse, MacDonagh and Plunkett, executed in 1916, the tragic intensity of Dora Sigerson Shorter and the name of Francis Ledwidge, killed i Flanders in 1917, whose verse is lit throughout with sudde glimpses of natural beauty. Since their date one powerful poeti talent has appeared with Austin Clarke, whose eager imagination is fitly exercised in epic subjects. F. R. Higgins has writte some charming verses but his output is still too small to writ of him with assurance. Equally limited but more derivative i the work of H. Stuart in whom the later rhythms of W. B. Yeats are faintly echoed.

Prose.—The transition to prose synchronised with growing pre-occupation with public affairs. Æ's prose of imaginative revery sharpened in his attempt, *The National Being*, to shape a national polity and to bring back the thoughts of his countrymen from the frontiers and surfaces of political controversy to their spiritual base. His book has left its imprint on the Irish Constitution. In *The Interpreters*, written when political controversy had come to an issue, he breaks away characteristically from the passing shows of things to track political moods back to spiritual origins and "to relate the politics of Time to the politics of Eternity." Here and in *The Candle of Vision*, a book of pure mysticism, where he explores the creative imagination in an attempt to discover the operation of the divine imagination in the mind of the individual artist, George Russell's prose reaches its height. The chief stimulating literary influence of his period, and always more interested in life than in the shadows of life. Æ's work reconciles the superficial conflict of national and universal art. The aim of the former was clearly expressed in the writings of Pearse and MacDonagh—Pearse in his *Irish Anthology* and in a remarkable series of pamphlets, the most effective political writing since John Mitchell's, and MaDonagh in his analysis of Gaelic verse-forms and the Irish way of speech on Anglo-Irish literature. This form of criticism, the result of the language movement, has been reinforced by Daniel Corkery in a study of the Irish schools of the 17th and 18th centuries and is a growing formative influence on the younger writers.

The rebellion of 1916 played an inevitable part in the novels of this period, of which Eimar O'Duffy's are the most notable, but the psychology of its participants is best studied in Corkery's short stories, wherein whoever cares for the artistic presentation of a passionate human struggle will find a clear glass. His single novel, *The Threshold of Quiet*, written before 1916, is a study in

y and self-immolation, a shadow-play in whose penumbra
racters dwell in intense if quiet reality. The other signifi-
ovel of this period is Colum's *Castle Conquer*. The prema-
ath of Seumas O'Kelly was a grave loss to Irish literature;
aver's Grave is the best short story that has come out of
l. Succeeding disillusions born of civil war is expressed
recent work of Liam O'Flaherty, where a powerful crea-
culty atones for much brutality. There remains the unique
of James Joyce, the delicately stepping grace of whose
er Music is in singular contrast to his experimental,
hous prose.

ma.—John M. Synge, the outstanding dramatist of the
Theatre, died in 1910. He founded no school, his tragic
ation was not hereditable, and without that inheritance
ld be grotesque parody to imitate his manner of imaged,
coloured speech. Colum was the earliest of the peasant
rights; his best play, *Thomas Muskerry*, was produced at
bey in the year of Synge's death, and it was to his idiom
he new dramatists returned. Colum studied the peasant
tion to his surroundings. His fable was always significant,
nstruction taut and solid, his dialogue unforced. St. John
treated of certain situations peculiar to North East Ul-
ith some effectiveness, but most of the newcomers devel-
nly the genre study of the individual, detaching him from
lieu and leaning too often to melodrama or farce. Lady
ry has comic verve and inexhaustible invention, but to the
repertoire her exuberant and uncritical talent added
g save *The Image* (1910) to surpass her early *Spreading*
ws and *The Rising of the Moon*. Her real work lay in the
istration of the theatre through stormy days. The notable
mers before 1923 were Lord Dunsany, T. C. Murray and
x Robinson. Dunsany's highly personal talent ranges from
rotesque horror of *A Night at the Inn* and the *Queen's*
ies to the imaginative conception of *The Gods of the Moun-*
nd *The Tents of the Arabs*. He has singular inventiveness,
l felicity and at his weakest can construct a charming fable.
Murray's seven plays, of which *Birthright* (1910), *Maurice*
(1912) and *Autumn Fire* (1924) are the chief, show a
sense of dramatic situation with a capacity for easy, beau-
rose. Lennox Robinson, *Harvest* (1910) *The Whiteheaded*
1916), *The Lost Leader* (1918), possesses a less acute sense
matic construction, but has an unusual talent for inventing
sting character.

period under review closes in Dec. 1925 with the coming
of the Abbey Theatre. In its 21 years the Abbey has pro-
l 216 plays, the work of 86 authors, of whom 72 are Irish
mporaries. This record does not include the entire Irish
atic output, since certain secessions from the Abbey and
ish-speaking Drama League have produced interesting
s. That the vital impulse which was born in 1902 of the
ion of the writers Russell and Yeats with the players W. G.
rank Fay is not yet exhausted is proved by the advent in
of Sean O'Casey, the most powerful talent that has come
e Irish theatre since Synge. His plays *The Shadow of a*
an (1923), *Juno and the Paycock* (1924), *The Plough and*
tars (1926), measure the change of 25 years. The heroic
in verse or prose has given place to the drama of realism,
lain to the gunman. Casey has a consummate power of
ing and energising character, a speech that holds rich local
r without losing rhythm, pity and humour that transcend
qualor of the slums. In these gifts and in his passion for
, the fruit of enthusiasm and disillusion, lies his promise.

BLIOGRAPHY.—As a brilliant and scandalous chronicle of the
d George Moore's *Ave, Salve, Vale* (1911-4) is indispensable;
Gregory, *Our Irish Theatre* (1914) Æ *Imaginations and*
ies (1915); Thomas MacDonagh, *Literature in Ireland* (1916);
. Boyd, *Ireland's Literary Renaissance* (1916); *id.*, *The Con-*
rary Drama of Ireland (1918); Padraic Colum, *Anthology of*
Verse (1922); W. B. Yeats, *Plays and Controversies* (1923);
ox Robinson, *Golden Treasury of Irish Verse* (1925).

(C. P. C.)

ISH LITERATURE: GAELIC (*see* 5.622).—The decade
ving 1910 was a period of much activity in the publication of literature written in the Irish language. This activity took two forms, one the editing of older texts which had never seen the light before, and the other the creation of wholly new works. The Irish Texts Society in London, the learned magazine *Eriu* published in Dublin, the *Zeitschrift für celtische Philologie* published at Halle, the *Revue Celtique* of Paris and the *Celtic Review* of Edinburgh (which ceased publication after 1915) were the principal media for the publication of the older texts. The Irish Texts Society, in particular, published a number of handsome volumes, all *editiones principes* of important works. The veteran Dr. Whitley Stokes died in 1909. His last work, the Irish version of Lucan's Pharsalia, was published posthumously at Leipzig. Kuno Meyer died in 1919. The great native scholar Standish Hayes O'Grady had passed away in 1915.

The Gaelic Journal, which had been founded in 1882, came to an end in 1906 with the 197th number, and the want of a scholarly magazine dealing with the phases and difficulties of the more modern language was keenly felt. In 1912 T. O'Rahilly, later professor of Irish in Trinity College, Dublin, started a magazine *Gadelica*, to which he himself was the chief contributor, which reproduced all the best and most scholarly features of the old *Gaelic Journal*. Unfortunately this magazine came to an end in 1913. *Editiones principes* of valuable Irish texts published by various scholars are Manus O'Donnell's *Life of Columille* (Chicago, 1918), the first part of O'Clery's recension of the *Book of the Conquests of Ireland* (1916), *The Maguires of Fermanagh*, *The Flight of the Earls*, *The Book of the MacSweeneys*, *The Son of the Eagle*, Sean O'Neachtain's *Adventures of Edmund O'Clery*, the poems of *Pádraigin Hackett*, and others.

Perhaps amongst modern writers the name of Canon Peter O'Leary, parish priest of Castlelyons, must be mentioned above all others. Although he began to write late in life, after the rise of the Gaelic League, he produced an amazing number of excellent works, of which his first book, *Séadna* (1898) is nearly sure to live. His great merit is that he was the first to turn his back resolutely upon everything that was bookish and old and obscure, and to go for his mode of expressing himself to the folk speech of his native county of Cork. How suitable the speech of the people became in his hands to express the whole gamut of the emotions was to many a revelation. He died in 1920 and has left his trace upon the language more deeply than any other writer of his time. Father O'Leary stands for the most representative writer of the southern half of Ireland. The elder Pádraig O'Conaire (or Conry) would probably be regarded by many in 1925 as the best living writer of the northern half.

Irish literature got a great set-back during the political troubles following the rebellion of 1916. Two monthly magazines which published stories and folk-lore were burnt, one in Munster and one in Connacht (Connaught). The Connacht editor was "on the run" in the mountains, and of the joint editors of the southern paper one was "interned" and the other had his house burnt, with all the MSS. which he had spent half a lifetime collecting, and all the songs and music he had taken down from old people, now for the most part dead. Pádraig O'Conaire, too, had his little hut in the Dublin mountains burnt and several plays destroyed. (D. Hy.)

IRON AND STEEL (*see* 14.801).—Developments during 1910-26 in iron and steel were improvements in processes and equipment rather than new methods. An increase in the *per capita* consumption, far greater than the remarkable increase of the preceding decade, forced attention to means of securing maximum outputs as well as to the ever-present effort to secure economies. Larger units of manufacture were generally favoured and so-called "duplexing" and "triplexing" were outstanding features in steel-making. The latter part of the decade was marked also by a marvellous growth in popularity of the electric furnace, until at the end of 1922 there were 1,175 such furnaces in the world for steel-making alone, against 114 in 1910. The World War gave an artificial stimulus in general to plant expansion to meet the demands for ships and shells and resulted in a realignment of national capacity. In the main the following analysis is devoted to the economic side of the evolution of the period.

Iron Blast Furnace Construction.—Design was influenced by local experience of experts in the different iron-producing districts. Profiles depend on raw materials—quality of coke, nature and concentration of ores. Generally speaking, tendency toward greater bosh and shaft angles continued (bosh angle 75° to 80°; shaft angle 84° to 86°). The size of stack increased only in the districts treating low-grade ore, while with high-grade ore (50% to 62% iron) the 500- to 600-ton-per-day size became the standard and many old furnaces were enlarged. In the Minette district of Europe, where the ore charged contained between 30% and 35% iron, the 200- to 250-ton unit became popular in all new construction. The cubical capacity of a blast furnace ranged between 40 and 100 cu. ft. per ton of pig-iron blown in 24 hours.

Individual parts of blast furnaces received particular attention. The hearth construction became reinforced and often cooled to avoid breakouts of the molten metal, and greater attention was given to brickwork to limit the downward destructive action of the metal. Emergency tuyeres at mid-height of the bosh—standard in the Minette district—lost their popularity and disappeared in nearly all new furnaces. For the handling of the material—ore, limestone and coke—mechanical devices won increased favour owing to the enormous masses involved and to the growing scarcity of labour. In America, the simple skip hoist was almost universally adopted in new plants, while in Europe the drop-bottom bucket hoist became popular and its design was ingeniously varied. It is noteworthy that the drop-bottom bucket, which was originated in America (Duquesne works) and was perfected in Germany during the years 1905–10, was little used in the United States ten years later.

It had been supplanted by the cup-and-cone top with a rotary distributor (McKee); in Europe the double cup-and-cone construction, giving low drop height and assuring less breakage of the softer coke, was preferred. These two solutions were more or less linked to the hoist system adopted. The furnace interiors were bricked up, in America of standard-shaped refractories giving a multitude of joints, while it was customary all over Europe to use special large-volume brick, shaped to reduce the joints. Both systems seemed to give satisfaction to the operators, and comparisons were not possible owing to the difference in the operating conditions. Speaking generally, the American design with a plate lining involved less steel for construction, while the Luxembourg-Lorraine type of blast furnace was conservative and substantial.

Blast Furnace Operation.—General progress was marked; greater familiarity with the chemical problems and increased mechanical equipment made operation more easily controllable, results more positive and disturbances less frequent. The use of excessively fine ore was accompanied by a high-solution loss of coke, and agglomerating of ore was recognised as desirable. This led to increasing attention to sintering fine ore mixed with flue-dust, and recharging of dust without treatment seemed likely to die out. Higher temperature of the air blast was a noteworthy development, as each increase of 200° F. has been reflected by 4% to 5% reduction in coke consumption. In the Minette district 850° to 900° F. blast temperatures were quite common. The blast pressure, which remained without much change, varied according to districts and the forcing of the operation from 4 to 15 lb. per sq. inch. In case of a relatively cold spell within the furnace due to overfluxing, bad coke or dropping of a hanging, the introduction of kerosene (paraffin) through the tuyeres proved a quick remedy, although it necessarily required care and progressive application to avoid accidents. The use of this cure rendered superfluous the auxiliary tuyeres at mid-height of bosh. The use of the oxygen torch to burn out the iron notch in case of metallic incrustations, extremely difficult to remove, proved a great help to the working crews. Mechanical appliances in cast-houses were installed in increasing numbers to supplant hand work, especially in sand casting floors. Cranes equipped with lifting magnets and pneumatic hammers elastically suspended proved a step toward the best method of moulding, breaking and handling of sand-cast pig-iron. Fo qualities of pig-iron the continuous casting machines conti to be the accepted standard. In plants adjoining steel-w transport ladles of larger size (30 to 50 tons) and designs assu better insulation and easier skimming of slag were evolved.

Blast Furnace Gas.—Continuously increasing price of coal coke affected the economies of the blast-furnace gas and m it a by-product of great importance. The fuel value of original waste became more and more recognised in Ame The first effort, to avoid all gas losses so far as possible, led to installation of double furnace tops, which became universal. N gas-cleaning processes were developed to remove dust impur from the by-product fuel, thus increasing its adaptability combustion and securing greater efficiencies in its utilisat To facilitate operation and render supervision automa pressure-regulating devices were evolved and accumulators w installed to equalise supply and provide steady outflow. (cleaning attracted the attention of operators in Europ countries greatly in need of fuel, because the calorific valu the gas counterbalanced the cost of purification. In Amer the coal shortage, due to inordinate demand and dislocatio railway service, produced the same result. The first step in cleaning was the installation of a dust collector close to the takes and the downcomers of each blast furnace. In it the co dust was deposited by a slowing-down of the gas flow an sudden change in its direction. This apparatus was independ of all further cleaning methods.

To separate the fine dust particles two different processes w applied: (1) wet method; (2) dry filtration.

(1) By the wet method the gases were cooled by injection water, and the dust particles, passing through the fog artifici produced, were arrested by scrubbers. Experience led to a subd sion of the operations, called medium cleaning and fine clea with apparatus protected by patents. The sludge of dust and wa was removed by the application of centrifugal force, separating and liquid in specially designed fans or washers (Theissen, Brass etc.). The disposal of the water created a problem, as contaminat of rivers is against the law in most industrial countries. In dep ponds the settling of the impurities was incomplete and its remov tedious manual operation; and the Dorr thickener, developed in c concentration districts, was adopted, as assuring continuous se automatically by means of a special mud pump requiring little att tion. A drawback of wet systems was that the sensible heat of blast furnace gas was absorbed by the cleaning water and lost yond recovery. On the other hand, it permitted the installation smaller gas-piping and dispensed with the insulation of the li against heat loss, thus saving appreciable capital outlay in the cas long-distance distribution. Another drawback of the wet method w that recovery of the dust required driving off the water from t heavy mud in any briquetting or concentrating process attempt

(2) The dry methods of gas-cleaning had their advocates wh every little economy was watched, such as retaining the sensible he of the gas and saving the expense of water-handling in keeping t dust dry. To separate the dust out of the hot gases, filtration a peared to be the best process. With mechanical filtration, fin woven cloth or asbestos-fabric bags or slag-wool layers let the g pass at low velocity but retained the solid dust, which was remov periodically by return currents of clean gas. The principle was adopt in the Beth-Halberg system in Europe and the Kling-Weidle apparatus in the United States.

The chief ways in which blast-furnace gases were utilised we as follows:—

(*a*) *Cowper or Hot-blast Stoves.*—The absence of dust in the g provided for rational stove design, as the complicating side issues clogged-up passes and slagged-up checker holes disappeared, as w as the periodic waste of cooling, cleaning and warming-up of ea unit. The clean gas meant a reduction of the area of heating surfac and brick volume expressed by fewer stoves per blast furnace—thr to four per furnace against four to five 10 years earlier. Then bega a systematic study of the heat-transmission phenomena within t mass of checker work.

(*b*) *Boilers.*—Clean blast-furnace gas allowed for advantageo use in connection with steam boilers; first, through more efficie combustion, in effect less gas per pound of steam produced; secon higher ratings of boilers, in effect more steam per unit of boil evaporating surface or fewer boilers for a given plant capacity; an third, quick adaptation to any load required, in effect flexibility ease of operation. Many efficient burners were invented and son were installed on a large scale.

(*c*) *Metallurgical Furnaces.*—The removal of flue-dust mad possible a wider distribution of the blast-furnace gas, and in Europ use was made of the surplus gas with success in all kinds of furnace

calorific value coupled with the small amount of air required
plete combustion, opened fields where so-called mellow heat-
ies are demanded, such as core drying, mould drying, anneal-
sting and ore concentrating.

as Engines.—The principle that clean gas was indispensable
rnal-combustion engines was long recognised, but its practical
tion did not occur until after 1910. Also a cool gas was re-
as essential to secure adequate volumetric efficiency of each
Among gas engines, the four-cycle type outranked con-
ly the two-cycle type. Devices for close regulation were
ed on the principle of qualitative-quantitative mixture.
ilt-up cylinder seemed to win greater favour than the one-
sting. The safety of operation reached a parity with that of
ngines or turbines, the gas being clean. The exhaust heat
engines, representing some 40 % of the energy, was utilised
rate steam, and 70 % was thus recovered in some instances.
the various uses made of the gaseous by-products of the blast
only the heating of the hot-blast stoves was universally
All experts agreed that 30 % to 40 % of the gases are best
ed for that purpose. The surplus of 60 % to 65 % was utilised
other purposes already mentioned. In the utilisation to pro-
ast pressure and to develop power, the battle for suprem-
ween the gas-engine using blast-furnace gas and the steam
sing the gas to supply energy to engine or turbine remained
led. Thermal efficiencies were not the only issues at stake.
ope, the gas-engine had the firmer standing, while in America
ler seemed to be the more in favour. Even for generating the
ressures, the competition between gas-engine-driven air com-
s, steam-engine blowing engines and turbo-blowers had gone
out absolutely proving the superiority of any one combina-
Varying economic conditions in each country and different
onsiderations, as well as the purely technical aspects of the
n, were deciding factors. Europe, with its skilled workmen
ore stabilised market conditions, presented a background
t from that of America with its fluid trade conditions and its
ed unskilled labour.

Layout and Size.—A single blast furnace, built alone on a
matter how well chosen, proved not to be a logical industrial
ise. The number of such plants existing was the result of
ition, of fluctuating market conditions, and constituted an
ic waste, speaking generally. With combined units the ac-
equipment became cheaper in installation cost and in terms
output and more efficient in operation, through flexibility
surance against breakdown. Three to six furnaces grouped
l-laid-out plants were established as an economic whole.
id the loss of the sensible heat of the molten pig-iron and to
the metal without cooling, steel-works were logically joined
t-furnace plants. The two separate departments were thus
ed in one industrial unit, with the added advantage that the
of power available at the furnaces could be absorbed in the
mills.

ric Pig-Iron Furnaces.—Tests made at Trollhättan, Sweden,
onclusive only for high-grade pig-iron similar to the Swedish
al pig-iron. Since 1918, the Domnarfvet works in Sweden had
ed several shaft-type furnaces (with gas circulation using
62 % of iron ore and charcoal as a reducing agent). Mixtures
coal and coke up to 50 % coke were found satisfactory. Per
pig-iron produced, 3,400 lb. of ore (containing 61·5 % Fe),
of lime and 740 lb. of charcoal were charged; 15,000 cu. ft.
at 240 B.T.U. per cu. ft. were captured at the top; 2,150
tt-hours was the electric energy consumption per 2,000 lb.
iron. The problem of using electric current for supplying heat
blast furnace reactions had particular interest for the eastern
es in France, British Columbia, Brazil, Italy, as well as
n and Norway, where fuel is scarce and low-priced electricity
be made available.

Steel Plant.—The usefulness of mixers as an important adjunct
steel-making plant was universally recognised, as numerous
ations attest. Their field was established in equalising quali-
ly the successive outgivings of the blast furnaces and in de-
rising the molten metal. To accelerate the removal of sul-
less than 0·5 % of manganese proved most helpful. The shape
mixer that gave best results was the simple cylinder rotating
axis. The most popular size proved to be 1,000 to 1,400 tons'
ning capacity. Simple oil or gas burners without regenerating
er in the United States, with pre-heating checkers sometimes
rope, completed the equipment. In Germany, a 2,000-ton-
ty mixer was reported built, but only after considerable dis-
n as to its size. The mixer was, of course, brought into being
eiving metal from the blast furnace and delivering to the ladle
nsport to the steel plant as needed. Slag that floats on the top
bath must be skimmed off from time to time.

verter Plants.—No noteworthy development took place in
id-operating (Bessemer) converter or in the basic-operating
as) converter for making steel. The 20- to 25-ton-capacity
remained nearly universal. A 40-ton size was proposed in
y a Belgian engineer. As between Europe and the United
, the hydraulic tilting mechanism of the former did not give
the electric drive of the latter, nor did the gas-engine blowing
succumb to the turbo-blowers of American practice.

Open-hearth Plants.—Without radical change in type, sizes of open-hearth furnaces increased up to and above 100 tons' capacity, but the tendency was toward fully controllable sizes. The practice in the United States settled to 80 to 100 tons and in Europe 40 to 50 tons. Volumes of checker chamber increased to get better so-called flywheel effect. Greater attention was paid to port and head construction to lengthen life, and to a reinforced roof. Reversing valves were marketed for reducing flow resistance and waste of gas. Waste heat boilers were more generally installed, but not universally adopted because of their interference with concentration and general electrification of plants. Marked superiority or inferiority was not shown for the tilting construction of furnace when tested by use beside the stationary type. Natural gas disappearing in America, producer gas was the more generally adopted fuel. Powdered coal was tried with some success but without proved superiority; one difficulty was that checker chambers got clogged by ashdust. By-product tar and crude oil proved fuels well suited for the purpose if available at low price and in large quantities.

Electric Steel Furnaces.—The electric steel furnace for refining and melting iron and steel developed to a surprising extent in the decade 1910–20 in size and in number of installations. It proved ideally suited for quality products and high-grade materials, because no complication through fuel medium exists and because atmosphere and temperature are attainable practically at will. From 500-lb. capacity, single furnaces were built to 40 tons, with most of them of 5- to 8-ton capacities. (For electric furnace statistics, see *Iron Age*, Jan. 1 1921.) Of the 960 known electric steel furnaces in existence in Jan. 1921, 356 were in the United States, 150 in England, 100 in Germany, 60 in France and 43 in Canada. Of the total, 308 were Héroult arc furnaces, 102 Rennerfelt induction furnaces and 90 Greaves-Etchells furnaces. The electric furnace was adopted for making metal mixtures, ferro-alloys, special steels of high quality in large amounts—strict repetition being possible in an absolute positive way. A disadvantage was that the metal is not at rest but always in motion, through electric or magnetic influences. Though agitation was often desirable, the action hampered the separation of the slag and the rising of impurities out of the molten mass. A remedy for this was repeated skimming of slag and careful supervision. One unusual utilisation of the electric furnace was the making of pig-iron out of scrap, especially in the United States, to supply deficiencies in the amount of low-phosphorus pig-iron, particularly in the manufacture of ordnance. It amounted to a synthetic reconversion of steel into pig-iron. Fine coke was added to the slagged refined scrap for carburisation, and the method promised to be commercially feasible in regions having electric power but little local fuel available and situated so that delivered pig-iron was high in price. For deoxidation in the refining process and for recarburisation, ferromanganese and spiegeleisen retained their popularity in spite of high prices under erratic market conditions. In Europe pre-heating, often pre-melting, of the addition was the current practice, to save in the amount needed and to accelerate effects. In America the wasteful method of cold additions prevailed. Ferrotitanium, with carbon or carbon-free, was used, as well as ferrosilicon and aluminium in small quantities. Some steel plants made additions in the ladle, others finished the operation in the furnace.

Steel-making Operations.—The outstanding feature of steel-making operations was the recognition of splitting the refining process into two phases, or the two-slag method, to increase production and to lower production costs. The efforts of Bertrand-Thiel and Talbot recognised in effect this principle; and duplexing and triplexing were only operating variations of the same principle, to remove the impurities of the pig-iron stepwise in the furnaces best suited for each purpose. Thus sulphur and manganese pass out in the mixer; silicon and part of the carbon in the converter; the rest of the carbon and phosphorus in the open-hearth furnace; additions were made and alloys were added in the electric furnace. The plant necessitated considerable equipment, but it secured ease of operations, exact control of results and made possible quantity production. Below 1,600 tons per 24 hours, savings in operation were regarded as hardly possible, as in slack market periods overhead expense was too large. During the World War about 10 duplexing plants, refining in an acid converter and finishing in basic open-hearth furnaces, were built in the United States under the pressure created by an ammunition famine. Electric duplexing plants (meaning melting and preparing in open-hearth furnaces and finishing in electric furnaces) were built in large numbers, offering a special-quality product on a large scale. A number of new independent efforts were made to produce steel direct from the ore without the interpolation of the iron blast furnace, but none could be said to have been proved feasible on a scale beyond that of the laboratory.

The Shaping of Steel.—Rolling-mills (used if the demand for a product is large and if its shape lends itself to a continuous process, like rails, angles, plates, bars, etc.) and the forge-shop (if the shapes to be produced are complicated, short in length, unsuited for the rolling-mill), both change the shape of the metal heated at high temperature, about 2,000° to 2,300° Fahrenheit. Both require finishing departments to straighten, shear or bundle the rolled product or to clean off the fins, rough off the unevenness of the forging operations, and they may need annealing and pickling facilities to improve the quality of the product. A special process of milling the top and bottom of rail blooms, to remove cracks and roughness from the semi-finished steel and also surfaces decarbonised in the heating furnaces, was put into use at the Lackawanna mills in America and resulted in a reduction in the number of finished rails classed as seconds.

In the period 1908–26 the development of the rolling-mill was influenced, first, by the great manufacturing principles of concentration and specialisation, and, second, by the electrification of the motive power. Concentration demanded large production in one unit and suitable equipment to attain that aim; in other words, mechanical devices in preference to hand operation. Specialisation was applied to the shape to be rolled as well as to the mill used for production. Standardisation of rails, beams and angles, the reduction of the number of profiles, and the simplification of shapes were consequences, as well as the installation of mills for specific purposes. The application of these rational principles was accelerated by the use of the electric motor. The advantages were recognised about 1905, but the next 15 years brought their practical realisation. The numerous little steam-engines disappeared and the electric motor revolutionised the handling of the material by cranes and overhead trolleys as well as the mill accessories, like tables, skids, transfers, etc. The first step was the creation of central power plants where electricity was generated either in turbine or gas-engine generators, preferably with the help of the surplus gas from the blast furnace. Many steel plants in 1920 were equipped with 20,000- to 40,000-K.W. power stations. The second step was the development of speed reducing devices made necessary by the high speed of electric motors. The advance of the gear-cutting industry and the advent of spiral-type teeth, single or herring-bone, and the development of new types of teeth giving less wear, more rolling surface, and, later, the use of special hardened, heat-treated steels were eagerly taken up by the designers of mill machinery to increase the quality of their product. Reduction gears transmitting up to 5,000 H.P. came into daily use, and the ratio of 10 or 12 to 1 in one reduction gave satisfactory service. The third step was the development of speed-regulating devices, especially in connection with alternating-current motors, to secure efficient operation for variable conditions. The fourth step was the solving of the load problem of large, intermittently operating motors, reversing their direction of rotation by means of the motor-flywheel set advocated by the Austrian engineer Ilgner in connection with suitable controllers of which the Ward-Leonard system was the prototype. Much work and inventive genius were concentrated on these difficulties to bring about in less than 15 years the high efficiency and great safety of operation by electricity of steel mills. The development of the rolling mills is still progressing.

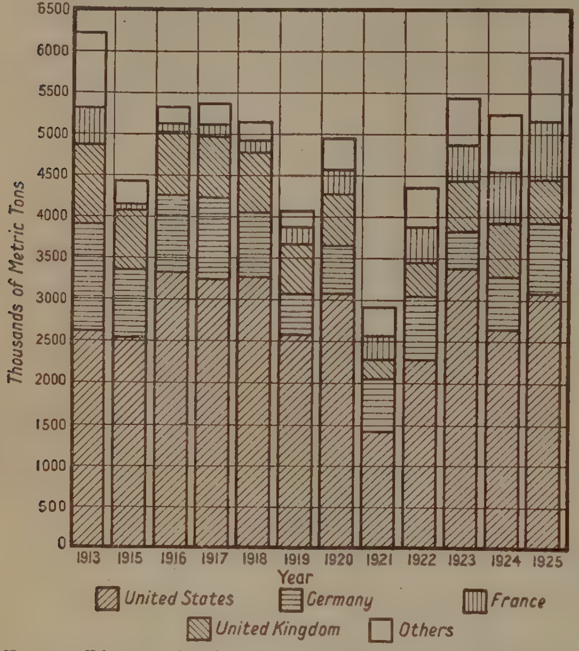

FIG. 1.—Diagram showing the production of Pig-iron in the principal producing countries, for 1913 and 1915–25 (monthly average). *Note:* "Others" include Luxembourg, Belgium, the Saar, Sweden, Canada, Poland and the Union of Socialist Soviet Republics.

For driving continuous mills electricity was preferred to the steam-engine. The uniflow steam-engine found favour up to 3,000-H.P. units, but installations were few. Where the effort was to bring about a complete electrification of the plant, steam-engines proved unpopular, possible economy being counterbalanced by complication of maintenance and other administrative considerations. For the reversing drive of large units, requiring loads up to 20,00
25,000 H.P., the electrical drive was not necessarily in the as
ancy. The high initial cost of the motor generator flywheel
with direct-current motor directly connected to pinion and mill
made the chief argument against universal adoption of electri
and numbers of old plants were reluctant to change their some
obsolete steam equipment. In America only a few engines as
as 25,000 to 30,000 H.P. (Weirton and Lukens) were installe
new work, and in England large vertical engines were built.
electrical units, however, increased considerably in number and
and considerable progress was realised in the matter of manoeuv
capacity, in standardisation of winding and accessories, in recor
output and efficiency of running. In 1925 the electrical industr
aggressively working on betterments, while the partisans o
steam-engine rested on past laurels. Parity existed on all p
except first cost of installation. Even for smaller mills of the re
ing type electrical drives were built, such as 24-in. mill (M
Indiana Harbor), 26-in. mill (Atlanta, Ga.). Two-high rever
plate-mills also disputed the field with the three-high type in th
dium-sized equipment, and latest universal-mill installations we
the reversing type electrically driven. The largest mill for plate
in. wide, at Lukens, Pa., which was completed in 1918, was of spe
design, reversing and steam-driven. (*Iron Age*, Jan. 2 1919.)

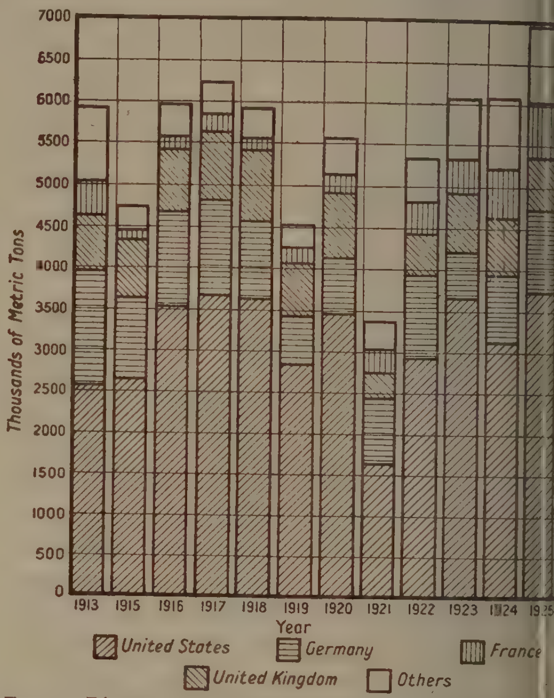

FIG. 2.—Diagram showing the production of Crude Steel in
principal producing countries, for 1913 and 1915–25 (mont
average). *Note:* "Others" include Luxembourg, Belgium
Saar, Sweden, Canada, Poland, Italy and the Union of Soci
Soviet Republics.

The concentration of production in large well-balanced pla
with adequate resources and sales organisation permitted a log
subdivision of the rolling-mill programme with a subsequent red
tion of production cost. The smallest bloom section, 6x6 in., ha
tendency to grow toward 8x8 in., as some experts claimed that
sq. in. was the economic limit of the range of a large mill. To red
the time required for roll changing, complete spare housings, co
pletely mounted, came to be good mill practice, these being drop
on the shoeplates by the cranes. In some specialty plants someti
two or three housings were changed together.

Furnaces.—The development of soaking, reheating and anneal
furnaces was influenced by the increasing price of fuel and consid
able efforts were made to boost heating efficiencies. In Europe g
firing with recuperation and regeneration of waste heat was
favourite, especially because producer-gas firing was much used a
remarkable results achieved. In America continuing shortage
natural gas for industrial purposes in regions such as the Pittsbu
district made a substitute market for crude oils, coke-oven gas a
powdered coal. Especially since 1915, the use of powdered c
developed to a surprising degree for all kinds of metal-heating app
cations. Mechanical stokers were evolved in numerous designs
dispense with hand labour and to control by mechanical contrivan
the combustion of coal in an efficient way.

ill Equipment.—Roller tables, skids, transfers, cooling-beds and ·s were perfected and installed in increasing numbers owing ly to the efficiency and handiness of electric motors. Variable- ·l drives gained in favour. Straighteners, saws, punches and ·s were made in conformity with the availability of electric ·r. Hydraulic devices were pushed in the background and elec- lrives supplanted engines in the field of these mill accessories.

etallographic Progress.—Metallographic knowledge spread ·he period 1910–25 from the university laboratory to the mill, outgrowing the narrow circle of students to become helpmate of the operator. Pyrometers or temperature re- ers and the scientific control of temperature came as a matter ourse in numbers of steel mills. The variety of alloy steels ·ed for practical uses was due to the theoretical investigations he metallograph. Chromium and vanadium, nickel and lt, tungsten and molybdenum added their special properties teel, and improved heat-treating methods enhanced these ities with a skill and positiveness hitherto unknown.

eyond the realm of iron and steel making, properly regarded, coming within the purview of the industry, the remarkable ·lopment of the period was the heat treatment of metals. ·ent hand-in-hand with the study (by means of the micro- ·e, and thus of the photomicrograph) of grain structure and transformations which take place in the so-called solid solu- s, according to the degree of heating and cooling given to the al. Practical applications of the investigations of the scientist numerous, and the history of the temperature experience given metal product going into an article of commerce was ·pted as equally important with the chemical constituents, two pieces of steel, identical chemically, may be made to ave physically very differently according to their crystalline e. (*See* METALLOGRAPHY.)

ther developments which must be briefly enumerated were: ·rts to test a material's fitness or agreement to specifications with- destroying it, as by X-ray photographs (sheets), or by magnetic analysis (by noting changes in permeability of an article of constant cross-section, as a rifle-barrel, wire or steel rail, by moving it through a magnetic field); these, however, were not definitely of commercial dependence, pending further investigation; success in making large chains of cast-steel links followed by heat treatment, such as annealing; efforts to cast in centrifugal moulds, such as cast-iron pipe by introducing molten iron into the rotating mould; commercial recovery of potash from blast-furnace flue-dust deposits at the base of hot stoves; making iron pipe by an electrolytic process of depositing iron on a rotating cathode in a ferrous-chloride electrolyte; commercial manufacture of a stainless steel having 10% to 15% of chromium, which, Harry Brearley in England discovered, gave amazing resistance to corrosion, so that it became the base of an important cutlery industry and offered a satisfactory material for rifle-barrels, turbine blades and steel articles subject to both erosion and corrosion; additions to the numberless varieties of alloy steels, largely to secure some desired physical characteristic for specific needs, such as increased tensile strength in terms of lighter members of a fabricated steel product; elements like cerium and zirconium entered the ferro-alloy circle, but a delineation of the various alloys and of their definite fields of usefulness was not completed.

Production.—The accompanying table shows the relative producing capacity of the leading industrial nations of the world. The figures are of actual production as well as capacity to produce. The world's steel-making capacity was put, in 1926, at 116,000,000 tons in round numbers. One-half was credited to the United States, which could make more than four times as much as Great Britain and more than three times as much as Germany. The United States' percentage of the world's pig-iron-making facilities was somewhat over 46%. More than one-third of the total annual output of iron ore in the world came from the United States, and of the American production 85% came from the Lake Superior district. The Lorraine ore-fields supplied about 25% of the world needs, 80% of its output going to France and Germany.

World statistics of the production of ore, pig-iron, and crude and finished forms of steel are obtainable from the National Federation of Iron and Steel Manufacturers, London.

Iron and Steel of the World

	Capacity to Produce		Largest Production Ever Made			
	Pig-iron	Steel Ingots and Castings	Pig-iron	Year	Steel	Year
iited States . .	49,000,000	56,000,000	40,361,146	1923	45,430,000	1925
ınada	1,300,000	1,900,000	1,107,000	1918	1,695,000	1918
exico	300,000	300,000	..	..	..	..
North America .	50,600,000	58,200,000	..	..	..	..
reat Britain . .	12,000,000	12,000,000	10,481,917	1913	9,553,715	1917
ermany . . .	15,000,000	17,000,000	19,309,172[1]	1913	18,935,089[1]	1913
ance	11,000,000	9,500,000	8,323,000	1925	7,289,700	1925
elgium. . . .	3,500,000	3,500,000	2,781,000	1924	2,780,000	1924
ıxembourg . .	2,800,000	2,250,000	2,547,861	1913	2,053,100	1925
olland . . .	150,000	..	..	..	..	..
ussia	3,500,000	3,500,000	4,637,300[3]	1913	4,769,200[3]	1913
oland	1,200,000	1,800,000	1,031,123	1913	1,648,533	1913
umania	350,000	250,000	..	..	..	..
ustria	600,000	900,000	384,000[2]	1924	541,000[2]	1924
ungary	400,000	400,000	295,000[2]	1923	283,046[2]	1923
zechoslovakia . .	1,300,000	1,800,000	1,050,000[2]	1924	1,350,000[2]	1924
aly	600,000	1,600,000	497,000	1917	1,311,000	1917
pain	600,000	600,000	497,726	1916	470,241	1917
weden	1,000,000	750,000	828,969	1917	614,111	1916
Europe . . .	54,000,000	55,850,000	..	..	..	..
apan	1,200,000	1,500,000	780,000	1919	845,036	1920
hina	950,000	400,000	257,648	1920	120,000	1922
ndia	800,000	350,000	613,627	1923	215,465	1923
ustralia . . .	500,000	400,000	416,050	1924	284,669[4]	1924
outh Africa . .	...	50,000	..	..	27,064	1923
The World . .	108,050,000	116,750,000	77,536,000	1913	80,308,000	1917

igures in tons: gross, for England, United States, etc.; metric, for France, Germany, etc.

Includes both Luxembourg and Alsace-Lorraine; 1913 pig-iron production of Luxembourg (2,547,861 tons) and of Alsace-Lorraine 364,000 tons), deducted from the reported figure, leaves 12,897,311 tons for Germany. Similarly, for steel, deducting the 1,336,263 tons uxembourg and 2,286,354 tons of Alsace-Lorraine, leaves 15,312,472 tons for Germany.

Austria-Hungary in 1916 produced 2,380,000 tons of pig-iron and 3,278,000 tons of steel,

Includes production of Poland.

One plant only.

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(W. W. M.)

See Electro-Chemistry; Electro-Metallurgy; Internal Combustion Engine; Metallography; Metallurgy; Rustless Steel; Turbine, Steam.

IRRIGATION ENGINEERING (*see* 14.841).—During the present century development has continued at an accelerated pace; one of the many causes was and is the desire to meet the world's demand for cotton, particularly the more valuable long staple varieties.

Barrages and Dams.—Where areas to be served were large enough, barrages have been built; where rivers have a very irregular discharge, dams have been erected to impound water from the flood seasons to augment the supply in drier periods. From the barrages or dams high-level gravitation canals lead the water to the soil. Where the barrage system is not possible, modern water-lifting appliances serve new lands, or in many cases replace in areas already cultivated both the hand-worked water-lifting appliance known in Egypt as the *shadoof* and the cattle-driven water-wheel. Irrigation is thus serving an ever increasing area throughout the world in regions where suitable soil, climate and plain exist in combination.

Distribution.—With these extensions, in places approaching the limits imposed by the volume of water available, the problem of equal distribution becomes important. This, in turn, depends on an accurate estimation of the volume. Measurements were formerly made by means of data obtained from noting the speed of objects floating with the stream at various depths. In the last 30 years, current meters replaced floats and give more regular results, but it was not definitely known whether these results indicated actual volumes.

Measurements.—This doubt has now been settled through the full-scale measurements made since 1905 at Aswan by which the Nile discharge has been calibrated to within an error of 1% of the actual volume passing during all but the very highest levels, and it is hoped in time these will be measured also. Current meter discharges taken simultaneously with the measurement at the dam, repeated a few times and the mean taken, gave very similar results and thus proved the accuracy of current meters. The data obtained from small scale models can be depended upon to within a small percentage of error.

Work in Egypt

The cultivable area to-day in Southern or Upper Egypt, from Aswan to Cairo, is about 2,500,000 ac. of which 2,200,000 were cultivated in 1910, 1,000,000 ac. being under the perennial form of irrigation and 1,200,000 ac. under the older basin system. In the Delta there were about 3,000,000 ac. cultivated, all under the perennial system, out of a total cultivable area of about 4,800,000 acres.

The area of all Egypt is, however, over 500,000,000 acres. Thus only about 7,300,000 ac. of this vast extent can be cultivated from the waters of the Nile. All the remainder must continue in its present inhospitable state unless a climatic change occurs.

In 1902 the completion of the original and low level Aswan dam permitted 1,000,000,000 tons of water to be stored annually from the season of excess waters in the river, to be released again in the following spring and summer. In the few years following 1902 the need for an immediate increase in the volume of water available summer irrigation became pressing if the area then cultivated to be annually assured of an adequate supply in really low yea and if some new areas not hitherto cultivated were to receive wa at all times. The work of storing more water at Aswan by heigh ing and thickening the original masonry dam and increasing capacity to 2,400,000,000 tons, was completed in 1912. The need existing areas for all the water available was accentuated by phenomenally low flood of 1913, which was followed as a natu consequence by a poor spring and summer supply in 1914.

The 1913 flood was estimated to be the lowest for 150 years a except for the existence of the various barrages and the dam acr the river, would have spelt famine as well as financial disaster to t country. The 1914 river, even when increased by the whole of t stored water from Aswan, was only just sufficient to ensure the safe of the cotton crop of that year. Additional supplies of summer wa are needed for some of the still uncultivated areas in the delta, a the conversion of further areas in Upper Egypt from basin perennial irrigation can only be satisfied by still greater control the Nile.

The construction of a dam on the White Nile near Khartou now being taken in hand, forming another, though not the fin stage in the provision of water for Egypt. The very least quantity water storable each autumn by the new dam will be greater th that now annually held up by the Aswan dam, and like it, the wa can be used in the following spring and summer in Egypt. With minimum of 3,000,000,000 tons thus provided, an additional 1,00 000 ac. of Egypt's waste lands may be given summer water.

Further Developments.—Further works must, however, undertaken in the Sudd region of the Sudan and even beyo it, before the final stage of an Egypt cultivated to its capacit with an adequate supply of water to meet all her requirement is reached. These works will most probably consist of traini the waters through the Sudd region to prevent waste and erecting of a dam at Lake Albert.

The Sudd region lies on the White Nile and commences abo 500 m. south of Khartoum and is in reality a vast plain throu which the White Nile meanders for 250 m. with its water eith at or just above ground level. As a consequence the whole forn a great reedy marsh interspersed with open lagoons; into it flo the flood season waters of the White Nile; they evaporate then selves away to such an extent that no great variation of volun is normally experienced at its outlet. The lost waters could great measure, be stored in Lake Albert and let out in such manner as best to suit the requirements of Egypt. Conservatio from evaporation when passing through the Sudd region can secured by confining the flow to a definite channel. The increase acreage which it will then be possible to cultivate in Egypt wi bring the total area up to its maximum of about 7,300,000 acre

Developments in the Sudan

Previous to 1910, except for a few thousand acres served b pumps, all the crops grown in the Sudan along the main Nil from Wady Halfa to Khartoum and the White Nile from Khar toum to the Sudd region were sown on land naturally inundate on its low banks by the annual rise of the Nile. On the Blu Nile, rainfall alone was depended on to fertilise the crops grown

About 1909 one of the uncultivated areas below Khartoum wa turned into a perennial irrigation farm and was among the first t produce cotton in the Sudan, by means of water pumped from th Nile. Soon after that date the possibility of growing cotton in th Gezira, that huge tract which lies in the fork of the Blue and White Niles, became apparent. Here some 5,000,000 ac. form a gentl sloping plain stretching along between both rivers for about 200 m from Khartoum. From this point southward the plain is interspers with small isolated granitic hills which, as a line south-east is tra versed, increase in number and height. Of the 5,000,000 ac. plair probably 3,000,000 will form the maximum area cultivable. On the remaining 2,000,000 ac. near Khartoum the soil is said not to be so good, being of a more sandy nature.

Two experimental farms of a few hundred acres each were set down in the cultivable area and proved after a few years' trial the suitability of the soil for cotton growing. The summer climate, however, was found to be too trying, although below Khartoum and in Egypt cotton is entirely a summer crop. Cotton sown in mid-July in the Gezira and picked in the following spring gave a return on an average of 400 lb. per ac., a figure equal to the normal Egyptian production. This result was obtained at a season of the year when there is usually an abundance of water in the river.

The cotton plant in the Gezira is in the soil from mid-July, when it is sown, to final picking in April, or a period of about nine months.

ceptional circumstances a final watering may be required as
s April 15, though normally the last watering is expected to be
by March 31. Long before either of these dates Egypt, not-
tanding her great reservoir at Aswan, in low river years requires
at the Blue Nile can supply. It became necessary, therefore,
vise the best method of lifting water from the Blue Nile on to
ain and of storing a sufficient volume of it to meet the demands
Gezira in those months when Egypt requires all that flows in
ver. The decision arrived at was to build a combined dam
veir at a point 5 m. south of Sennar, where a narrow belt of
o rock, which scarcely rises above the level of the plain on
side, runs across the river.
construction of the combined dam and weir was proceeded
and completed in July 1925, at a cost of about £6,000,000, the
system bringing the total up to about £9,000,000. The dam
tore about 600,000,000 tons of water for use in the critical
which extends from Jan. to March and possibly to April,
Egypt requires all that passes down in a very low year. The
canal leading from the dam is some 60 km. long before reaching
oint where branch canals spread out from it on to the land to be
ted. The area judged sufficient to form a commercial proposi-
n view of the cost of the works was 300,000 acres. It is now
ed this area can be considerably increased without endangering
t's supply. Certainly if an amicable agreement can be arrived
tween the two countries, greater areas can be cultivated in the
a in all other years than the phenomenally low one on which
00,000 ac. scheme was based.

w Projects.—When still greater areas have to be brought
cultivation, and it is possible that 3,000,000 ac. may even-
y be cultivated in the Gezira, either new storage works
be built or such further control of the Nile be organised
ll permit Egypt to reduce her demands on the volume in
lue Nile. Special storage works for the Sudan can probably
est built by permission of Abyssinia. At the exit of Lake
a in that country at the source of the Blue Nile, by storage
e lake, the annual flood waters can be controlled and about
,000,000 tons of water conserved for use at a later period,
permitting a great increase in the area cultivable in the
a.
ere are possible alternatives, such as the building of a mini-
Aswan dam somewhere near Roseires. Here a regulation
e river will not be quite such a simple matter as at Lake
a, as the flood waters at Roseires are heavily laden with
These must be allowed to pass and water only be abstracted
subsequent but still high stage when little or no silt is still
nt, otherwise Egypt would be deprived of this valuable
rial. If collaboration with Egypt in works in the Sudan is
ted, then the White Nile dam will be made as large as is
stent with safety so as to store as much water as can be
ed from the flood waters.
hatever capacity be given to the White Nile dam Egypt
still provide herself with more water than even it can hold,
some regulation of the Sudd region must of necessity be one
e features of such a provision, coupled with a huge dam at
source of the White Nile and the mouth of Lake Albert.
des the Gezira Plain the Sudan has other irrigation areas
e great improvements have taken place, as at Tokar and
sala.

kar.—The river Barakat rises in the rainy season in the Abys-
n hills and rushes as a chocolate-coloured thick stream on to the
r Plain where it eventually spreads out into a thin film which is
ed up by the thirsty soil. The plain, however, is much greater
tent than the water can cover, although some finds its way to the
s recorded in 1921. Great anxiety is continually caused by the
lity of the flood to break away into areas not hitherto cultivated
ven if cultivated, so far from Tokar as to be inconvenient for
sport. In recent years designs were studied for the purpose of
cising some control over the direction of flow. These have been
ied out and have so far been successful. The total area served
es greatly from year to year. In 1921–2 about 55,000 ac. were
led, though not all were cultivated.
ssala.—The river Gash rises in the Abyssinian foothills and
mes of considerable volume in the flood season by the time it
hes Kassala. Here it spreads itself over the plain in such a
ner that none of its waters ever reach the Nile or its nearest
utary the Atbara. Some control has been exercised over the
to keep the water annually to definite areas.
a really good year with the supply of water at a maximum,
00 ac. of cotton might be cultivated. Owing to the poor flood
925 only 11,000 ac. have been sown.

Progress in India

Irrigation gives valuable aid in the fight against those periodic famines which always happened after rainfall failures, and it also causes an increase in production through its extension into new and suitable areas hitherto lying fallow. During 40 years, 1885–1925 in particular, developments have steadily progressed. 10,500,000 ac. were irrigated in 1878–9; 19,250,000 ac. at the beginning of the century, and 28,000,000 ac. in 1923–4. Additional works now under construction will add 2,500,000 acres. New schemes are contemplated which will add a further 4,750,000 acres. When completed they will bring the irrigated area of British India up to about 36,000,000 acres.

These figures exclude the water supplied from the Punjab canals to 650,000 ac. in the native states. The Sutlej Valley project, mainly for the benefit of the native states, will increase the total by a further 3,250,000 ac., making in the proximate future a grand total of about 40,000,000 ac. of irrigated land in all India.

Mileage of Channels.—In 1900–1, 39,142 m. of channels were in operation; by 1920–1 this had increased to 55,202 m. or an average addition of about 800 m. of channels per annum. The annual revenue return is between 7% to 8% on the capital invested in government irrigation works.

The following table shows the acreage of crops matured during 1923–4 by means of government irrigation systems compared with the total area under cultivation in the several provinces of India:—

Province	Net area cropped	Area irrigated by government irrigation works	Percentage of area irrigated to total cropped area	Capital cost of government irrigation and navigation works to end of 1923–4	Estimated value of crops raised on areas receiving state irrigation
	Acres	Acres	%	Lakhs of rupees	Lakhs of rupees
Madras	36,424,000	6,891,000	18·9	1,207	3,556
Bombay Deccan	39,000,000	418,000	1·0	881	538
Sind	4,134,000	3,427,000	82·9	479	1,054
Bengal	22,806,000	93,000	0·4	422	78
United Provinces	35,011,000	1,979,000	5·6	1,577	1,348
Punjab	26,731,000	10,207,000	38·2	2,543	5,505
Burma	13,857,000	1,730,000	12·5	363	812
Bihar and Orissa	24,665,000	954,000	3·9	627	622
Central Provinces	17,427,000	438,000	2·5	483	281
North West Frontier Province	2,583,000	359,000	13·9	276	226
Rajputna	281,000	16,000	5·7	35	5
Baluchistan	286,000	26,000	9·0	32	5
Total	223,205,000	26,538,000	11·9	8,925	14,030

Thus nearly 12% of the net area cropped was irrigated by government works. The annual value of the crop so irrigated amounted to 1½ times the capital outlay expended on the works.

New Schemes; Madras Presidency.—(1) The improvement of the, at present, somewhat irregular supply of water in the Canvey Delta canals will add about 301,000 ac. to the 1,000,000 ac. already served. (2) The Vengalapuran scheme will provide water for 50,000 acres. (3) The Kishna river storage will serve about 1,750,000 acres. The Lower Bhavari project will command 110,000 acres.

Bombay Presidency.—Although only 1% of the land cropped was irrigated in the Bombay Deccan district, its annual average of irrigated land is now about 418,000 acres. The Bhavari river works and the Nira right bank canal scheme will increase this area by 35,000 acres.

Sind.—The rainfall in Sind averages only about 6 in. per annum. In one year out of five it is almost certain to be less than 2 inches. Sind, however, has the Indus carrying a supply of water which is capable of meeting her needs if properly utilised.

In 1926 inundation canals supplied what land is irrigated. There are no means of regulating the river level artificially and continuing the supply when the river falls, consequently these canals obtain a full supply only when the Indus is in flood. In the cold weather when the river is low, only the most fortunately situated obtain any supply at all and a minimum of 600 tons per sec. run to waste.

The cultivable area of the province is about 14,000,000 acres. The Indus is estimated to be capable of irrigating 12,000,000 ac. in the hot weather and 8,000,000 ac. in the cold season, or say 20,000,000 ac. in all of crop. In 1923–4 the net area cropped was 4,134,000 ac. of which 82·9 % or 3,427,000 ac. was irrigated; this is the highest percentage of irrigated to cropped area in the whole of India. The province naturally divides itself up into three main tracts, upper, central and lower Sind, and three large barrage projects are contemplated at an estimated cost of £50,000,000 to deal with them.

The main project now in hand consists of a barrage across the Indus just below Sukkur where the river passes through a deep gorge. From the barrage, seven canals (four on the left bank and three on the right) will run southwards and extend facilities for cultivation to the enormous area of 5,500,000 acres. 2,000,000 ac. represent the existing inundation irrigation area and will be given in addition an assured perennial supply by the new canals. The barrage when completed will measure 4,725 ft. between the faces of the regulators on either side. It will have a masonry floor across the river, above which an over-bridge of 66 spans, each of 60 ft., will be constructed. From this over-bridge shutters 60 ft. long and 18½ ft. high can be lowered on the floor when the river falls, thus pounding up the water to the level required in the canals; conversely, when the river rises, they can be lifted and the whole of the waterway of the bridge will be left free for the passage of the annual floods. These floods will be greater than those passing any other regulating structure in the world, at the maximum they will be nearly double the Nile flood.

The supply required by the whole system of canals will vary throughout the year from 22,600 cu. ft. per sec. in Jan. and Feb. to 46,000 cu. ft. per sec. from June to September. It is estimated that the annual net revenue after paying working expenses will be 10½ % on the capital expended. This is the return from water rates alone, but a further large increase in general revenues may be reckoned upon from the 3,500,000 ac. of waste land which will be brought under cultivation.

Bengal.—The percentage of 0·4 of irrigated to cropped area in Bengal is the lowest in the whole of India, the net area cropped being 22,806,000 ac. of which only 93,000 ac. are irrigated. The average rainfall is about 55 in. per annum. A project for a canal from the Damodar river is sanctioned which will irrigate 196,000 acres. Several minor works are being considered.

Punjab.—With the exception of Sind no portion of India is so favourably situated as regards its rivers, or so unfavourably as regards its rainfall, as the Punjab proper, expecially the tract between the Jhelum and the Sutlej—the greater portion of this district having less than 15 in. of rainfall per annum and much of it less than 10 inches. As a consequence great developments have already taken place in the irrigation scheme of the province. In all 10,207,000 ac. were irrigated in 1923–4. Further large works are contemplated which will increase the total and reduce to a minimum the waste areas.

The United States

One of the larger projects is that connected with the Colorado river which serves two distinct areas. The upper is at a considerable elevation above sea level and covers 4,500,000 acres. Of this about 1,500,000 ac. are now irrigated. In the lower basin there are 960,000 irrigable acres, of which about 670,000 are irrigated. When the works are complete the Colorado river will be controlled to a very large extent and thus reduce the dangers arising from excessive floods.

An interesting feature of U.S. irrigation works is the series of very high dams which have been built to control and conserve river supplies. The Elephant Butte dam has a height of 306 ft. and the reservoir has a storage capacity of 3,200,000,000 tons of water. So far this is the largest reservoir in the world. The Shoshone dam has a height of 328 ft. and has a capacity of 550,000,000 tons of water. The Roosevelt dam has a height of 280 ft. and the reservoir has a capacity of 1,650,000 tons of wa
The Arrowrock dam has a height of 348·5 ft. and the reser
has a capacity of 340,000,000 tons of water. The Pathfi
dam is 218 ft. high and the reservoir can contain about 1,3
000,000 tons of water. In all, the Bureau of Reclamation ha
schemes either in operation or in process of construction.

Canada

Irrigation in Canada has been so far very partially develo
and only in those provinces where extensive farming operat
are in progress, such as Alberta, Saskatchewan and Manit
Developments are based upon the administration of the Fed
Irrigation Act of 1894, under which the ownership of all sur
water supply is vested in the Crown and the latter grants
necessary licences for its use.

Occasional droughts occur all over the wheat-growing be
provision, however, is steadily and systematically being m
to supply as much as possible irrigation water to counte
their effects. The government authorities are systematic
obtaining data with a view to providing the maximum a
financially possible with water and are yearly carrying
expensive systems of irrigation.

On the eastern section of the Canadian Pacific Railway
a census of the yields obtained and the water used by a grou
10 farmers during the past season, 1924, shows that the aver
yield of wheat on these 10 farms was 19½ bu. per ac. with
irrigation of 4 in. deep plus rainfall; with two 4-in. irrigations
yields received were from 30 to 35 bu.; and with three 4-in. i
gations were as high as 43 bu. per acre. In this district the to
precipitation for 12 months was 11·24 in. of which 9·68 in.
during the growing season. The water available for irrigati
varies greatly in different provinces, some are much more favo
ably situated than others to receive it and certain provinces
the other hand hardly require irrigation. That the total wa
resources of Canada, however, are enormous can be gauged fr
the fact that it is estimated that there could be developed w
it 41,400,000 H.P. of which only 3,227,414 h.p. was being us
up to Feb. 1 1924. Some of the more important irrigation are
are mentioned below.

Alberta.—About 1,000,000 ac. were irrigated in 1923, of which 1,3
000 ac. were brought in about 20 years ago in the Lethbri
section.

Canadian Pacific Railway, Western Section.—A scheme has be
in operation in this district for about 16 years, the area be
218,980 acres. The 1923–4 season was, however, so ideal for c
production, owing to favourable moisture conditions, that lit
irrigation was used, and only 3,074 ac. were irrigated, chiefly
alfalfa and meadow grasses.

Canadian Pacific Railway, Eastern Section.—Irrigation has bee
in operation in this section for about 10 years, the total irrigab
area is 400,000 ac. which are gradually being developed, and
which 124,000 have been taken up. The conditions here rend
irrigation more necessary than in the western section owing to lowe
precipitation and slightly higher temperature.

Taber District.—Irrigation was established in May 1924; in th
Taber district. Of 17,244 irrigable acres, 3,625 ac. have already bee
taken up and irrigated.

Lethbridge Northern Irrigation District.—This project was com
pleted in May 1923. The irrigable area is about 105,000 acres.

United Irrigation District.—The irrigable area of this scheme
about 36,000 acres.

New West Irrigation District.—The irrigable area is 4,500 acres.

Bellaw Lomond Irrigation District.—The irrigable area is abou
55,000 acres.

There are other smaller installations now working, and man
more are proposed.

Irrigation in Australia

Owing to the lack of an adequate rainfall the advantages o
irrigation appealed many years ago to Australians. At first the
object aimed at was to develop in unoccupied territory. Whil
these efforts generally proved successful, in recent years the
policy has been to extend irrigation to existing pastoral settlements, and some very large conservation of flood water schemes
have been carried out under which considerable areas of land
are now in process of intenser settlement.

v South Wales.—The principal works in this state include:—
Murrumbidgee Gravitation Irrigation Scheme. –The Murrum-
river is controlled by a dam 240 ft. high at Burrinjuck which
onserve about 960,000,000 tons of water. The scheme is to
e about 200,000 ac. of which 120,000 ac. were settled by June
They are mainly devoted to vegetable and fruit-growing and
ng purposes.
Pump Irrigation Areas.—(*a*) At Curlwaa on the Murray river
2,000 ac., out of an area of about 10,600 ac., are receiving
ion. (*b*) At Hay about 1,000 ac., out of an area of 4,500 ac.
ceiving water from pumps on the Murrumbidgee river.
Projected Schemes.—New South Wales is investigating schemes
will utilise its share of the Murray river waters and which it
s may amount to 150,000,000 tons. This should bring under
ion an area of at least 100,000 ac. of land. It has also under
leration a number of smaller schemes affecting the Lachlan,
uarie, Hunter, Namoe and Peel rivers, but it is not possible to
ny estimate as yet of the areas which may be irrigated by them.

toria.—In Victoria the principal irrigation works are on
oulbourne, Murray, Loddon, Werribee and MacAllister
s. While the works for some of these schemes were com-
d before 1910, the areas to be irrigated are still only in proc-
f settlement and extension of the works are from time to
taking place. In 1923, 350,727 ac. were irrigated.
der the Goulbourne scheme, which comprises an area of
t 850,000 ac. and where 800,000,000 tons of storage has
dy been provided for, a dam is being built at Sugarloaf in
tages, the first one of which was so far completed that stor-
f water took place in 1922. It may ultimately be 190 ft. high
may eventually contain about 1,100,000,000 tons of water.
Murray river scheme already serves an area of 340,000 ac.
s capable of expansion when the Hume storage reservoir is
leted. This will form the largest sheet of fresh water in
ralia, as it will cover 47 sq. m. and may contain about
,000,000 tons of water. The Loddon river gravitation scheme
s 74,000 acres. The Werribee river gravitation schemes
acchus Marsh and Werribee serve 3,350 and 10,000 ac.
ctively.
e Mildura pump irrigation scheme lifts water from the
ray river and serves 45,000 ac., of which 13,000 ac. are under
se cultivation. The MacAllister river scheme consists of a
ge reservoir from which a gravitation supply will command
t 80,000 ac. and is far advanced. These watering schemes
usually conjoined with domestic water supply schemes for
s and villages, and do not in the ordinary sense irrigate
, although they do, in fact, make great areas of land avail-
for pasturing purposes. There are also some flood protec-
schemes, one of which at Kooweerup and Cardinia enabled
000 ac. of land to be brought into cultivation.
eensland.—The Dawson valley scheme now under construc-
comprises a dam 140 ft. high at Nathans Gorge to impound
it 3,100,000,000 tons of water. When completed it will be
second largest reservoir in the world. The area to be served
bout 250,000 acres. The Inkerman irrigation area of 4,500
is served by 230 shallow well pumps. Provision is being
le to increase it to 10,000 acres. There are a number of
ller pump schemes at Townsville, Rockhampton, Bingera
Fairymead, which collectively serve about 4,000 acres.
outh Australia.—The Rennearth scheme serves 7,850 ac.,
nly fruit producing. The Murray river pumping plants
e 17,800 ac. and are being extended to serve a further 11,000
s. The Cadett scheme serves about 1,200 ac. and is supplied
water pumped through 90 ft. of height. The Waikerie
eme serves about 9,800 ac. and has the water lifted through
ft. of head.
he Kingston scheme serves 500 acres. The Moorook scheme
es 1,000 acres. The Cobdoyla scheme is ready to serve about
o ac. which can be increased to 30,000 ac. of irrigable land.
Berni scheme serves 7,700 acres. The Chaffey scheme will
e 14,000 acres. The Murray Swamp land scheme will even-
lly make available for irrigation 13,700 ac. of which 5,800
are now cultivated. Smaller schemes serve about 10,000
in all. In Western Australia the Harvey irrigation scheme
es 4,000 acres.

THE UNION OF SOUTH AFRICA

Irrigation was at first confined to small schemes whose entire works usually lay within the boundary of one farm. Works of greater magnitude were made easier of accomplishment when the Govt. of the Cape of Good Hope, to encourage irrigation, passed the Act of 1876 known as the "Right of Passage of Water Act" in terms of which a proprietor was permitted to conduct water over the property of any other owner.

A further Act in 1877 provided for:—

(*a*) The establishment of Irrigation Districts and Boards,
(*b*) The granting of government loans to private individuals, and
(*c*) The repayment thereof at the rate of 8% per annum over a period of 24 years.

In the case of private schemes, both in the Cape and in the other provinces also, no complete record of the irrigable area has been made and even in the case of Board schemes such data as are available are frequently not based on actual surveys but are only estimates of the irrigable areas made during the earlier stages. Since 1916 great progress has been made with irrigation based upon conservation of water schemes.

The completed schemes, although numerous, are individually small in area, none exceeding 10,000 acres. Among those under construction or development are some of considerable magnitude. These latter include the Great Fish river scheme, where 75,000 ac. are to be irrigated, the Sundays river scheme of 36,000 ac. and the Kamanassie river scheme of 28,000 acres. The area of land under irrigation in South Africa as at March 31 1923 under Board schemes was about 130,000 ac. and the area to be served by works under construction is about 225,000 acres. Up to 1925 the state expended over £4,000,000 on completed schemes. Neither interest nor redemption can be paid on this sum until the land is wholly settled.

WORK IN CHINA

China with its huge population of about 300,000,000 has no doubt a very large area of irrigated land but no statistics are available as to its extent except in a few small special districts where Europeans reside or have commercial interests. Hitherto engineering has been largely devoted to preventing the rivers in more than average floods overflowing their banks and inundating the land, an effect which has been many times accompanied by great loss of life. Commissions have studied river control and the conservancy boards in recent years have reported on and carried out important works with this end in view.

Quite obviously there is a large field in China for this form of development, and no doubt in time it will be followed by the more usual irrigation works. The following opinion of the engineer reporting on the Yangtse in 1923 gives a remarkably clear indication of the conditions there—it applies with equal force to the other great rivers of China.

> To anyone who has inspected the Yangtse from the Goyes to the sea, and who has given the faintest consideration to the question of restraining a river of this magnitude in its course through hundreds of miles of low-lying land, thousands of square miles of its area being below high water level, and therefore subject to inundation, it must be obvious that draining works, to be effective, would have to be constructed on a gigantic scale, and although the river is, in itself, and its tributaries and creeks, practically the one means of transport and communication serving a population of nearly 200,000,000 people with ever-growing transport requirements, it must be obvious that, unless improvement works can be made self supporting, it is futile seriously to embark upon them. Such are the conditions which prevail to-day and so they must remain for many years; in fact, until the growth of trade and growth of means which would follow thereon bring the necessity for works within the bounds of commercial possibility.

DEVELOPMENTS IN OTHER COUNTRIES

'Iraq.—The construction of the Hindia barrage was one of the first steps undertaken. In 1925 the Diala Cotton Co. inaugurated a great scheme whereby 108,000 ac. will be fertilised by water from the Diala river, a tributary of the Tigris. The company, it is understood, intends to extend its operations as fast as possible under its concession; and a time can be envisaged when adequate control of the Euphrates and Tigris, under conditions

of peace and good government, will allow of great areas of the arid plains of 'Iraq to be once again cultivated.

Spain and Portugal.—Irrigation has been developed in a number of places in the peninsula since the beginning of the century and schemes for further works are being considered. None of those so far completed are of any great magnitude, but among the proposals there is one for the irrigation of 120,000 ac. on the Guadalquivir. The possibilities of this river are being studied for other areas, and are great if by regulation of its excess flow in flood time its waters can be conserved for use in the drier periods of the year. On the Tagus a scheme near Villa Franca is now being surveyed which, if carried out, will enable 30,000 ac. to be irrigated.

Arabia.—An interesting irrigation development is the possibility of reviving agriculture by its aid in the Yemen. A syndicate is now (1926) studying a project to examine the many reservoirs which in ancient times controlled flood waters for the benefit of agriculture in that region.

Mexico.—In Mexico, and particularly in northern Mexico where the rainfall is negligible in the lower or plain country, strips of land are cultivated near the rivers by irrigation. The total area is considerable, but there are no records of its extent. The works are somewhat primitive but have been constructed entirely by private enterprise and good results in crop are obtained from them.

South America.—An irrigation scheme on the Rio Negro was carried out in 1914 whereby 230,000 ac. are being developed. There are other minor irrigation works in the country. There are irrigation works, carried out almost entirely by private enterprise, in the other South and Central American republics.

(M. Mac.)

IRWIN, EDWARD FREDERICK LINDLEY WOOD, 1st Baron (1881–), British politician, was born April 16 1881. The only surviving son of the 2nd Viscount Halifax, he was educated at Eton and at Christ Church, Oxford, being elected fellow of All Souls College in 1903. In Jan. 1910 he was returned to Parliament as Conservative member for the Ripon Division of Yorkshire, and retained his seat until 1925. During the World War he served in France 1915–7 with the Yorkshire Dragoons, in which he held the rank of major, being mentioned in dispatches, and was an assistant secretary to the Minister of National Service 1916–8. In April 1921 he was appointed Under-Secretary of State for the Colonies. In this capacity he made a tour of the West Indian colonies, and published his conclusions on the administrative and economic problems which he encountered in a report issued in June 1922. From Oct. 1922 to Jan. 1924 he was President of the Board of Education. In Nov. 1924 he became Minister of Agriculture and Fisheries in Mr. Baldwin's second Government. In Oct. 1925 he was appointed governor-general of India in succession to the marquess (then earl) of Reading, being raised to the peerage as Baron Irwin of Kirkby Underdale two months later. Like his father, Lord Irwin, who had been sworn of the privy council in 1922, took a keen interest in ecclesiastical affairs, and published a study of John Keble in the "Leaders of the Church Series." He married in 1909 Lady Dorothy Onslow, younger daughter of the 4th Earl of Onslow by whom he had three sons and two daughters.

ISHII, KIKUJIRO, Viscount (1866–), Japanese diplomatist, was born at Chiba, Japan. Like other members of his family, he was destined to enter official life. His intention was to become a lawyer, but his studies in international law gave him a deep interest in foreign affairs. His early days were full of incident: the Meiji reconstructions took place before his eyes, and the constant stream of foreign influences soon aroused in him a desire to see and understand other countries. Leaving the law faculty of the Imperial University in Tokyo in 1890, he was made attaché to the Japanese Legation in Paris. During his stay in Paris he applied himself to the study of European languages and became proficient in French and English. He was made third secretary in 1893, and about this time he devoted much attention to the problems of economics and international trade. He was distressed to observe that Japan did not h such a position in the world's mart as in the opinion of m Japanese she deserved, and he set himself to find out the ca of the trouble. He endeavoured to form a Franco-Japan mutual trade association, and although his efforts did not first meet with the full success he desired, a certain stimu was at once felt. Some part of the fruits of Ishii's labours w seen in the commercial mission which was sent from France Japan in 1925.

In 1896 he was appointed Consul to Chemulpho (Jinsen) Korea. After this he was made second secretary and later fi secretary at the Japanese Legation in Peking. He was, the fore, in Peking in an official capacity during the Boxer risi In 1900 he was appointed Secretary of the Head Office and ch of the telegraph section of the Home Office Department, whi post he held until he became director of the Commerce Bure in 1904. In 1907 he was sent to San Francisco and Vancou in connection with the anti-Japanese riots there. His success this matter was the direct cause of his appointment in the follo ing year as Vice-Minister for Foreign Affairs. His love of Fran and understanding of French problems made him an easy favo ite for the ambassadorship to Paris in 1912, and on his retu he took over the portfolio for Foreign Affairs in the new Gove ment. He was chief of the Foreign Office for the period 1915- and in the latter year he was created Viscount, having be made Baron in 1912. He played a great part in American-Ja anese relations and was a special envoy to the United States 1917. He was nominated a member of the House of Peers 1916. In 1920 Viscount Ishii was for the third time officia delegated to Paris.

Perhaps Ishii's greatest claim on his country's gratitude w his work in connection with the so-called "Gentlemen's Agre ment" made between Washington and Tokyo in 1907. Lansi was the United States representative in the negotiations, f which reason the arrangement is sometimes called the "Lansin Ishii Pact." The western coast of the United States made re resentations to Congress deploring the increasing immigrati of Asiatics, notably Chinese and Japanese. It was claimed th owing to the Asiatic standard of living being lower than that Americans, there was a serious possibility of California becomi a Japanese colony, and the aid of legislation was invoked. Th Lansing-Ishii pourparlers resulted in the postponement of su gested legislative measures, and a yearly maximum (tentativel fixed at 150) was proposed. Japan, through Ishii, agreed not t issue passports for more than this number annually to enter th United States as residents, and it was through Japan's allege breach of faith in connection with this agreement that the Imm gration Restriction Act was passed by Congress in 1924. I substance, this Act was one of the proposals originally shelve by the labours of Lansing and Ishii.

In Dec. 1920 Viscount Ishii became Japanese delegate to th 11th session of the Council of the League of Nations. In Au 1923 he became President of the Council of the League and in th following month was one of the Vice-Presidents of the Assembly In Sept. 1925 he was again a Vice-President of the Assembly In March 1926 he was President of the Council at its 39th ses sion, and as such acted as President of the Assembly (Marc 1926) until the election of the new President. (A. N. J. W.)

ISLAMISM: *see* PAN-ISLAMISM.

ISMET PASHA (1884–), Turkish statesman, was born in Smyrna of a Turkish family of Malatia. He received his educa tion in the military schools of Turkey, and in 1903 graduated a an artillery lieutenant. Three years later he became a captain on the General Staff. After the Young Turk revolution of 1908 he was sent several times on military expeditions to Yemen During the World War he served with distinction on the Syrian front, and at the close of the War held the rank of colonel, and commanded an army corps. During the Armistice he occupie important positions in the War Office. At the time of the occupation of Constantinople by the Allies he escaped to Angora disguised as a common soldier and was appointed by the Great National Assembly to be Chief-of-staff during the military opera-

of the Nationalists against the Caliphate army and Ar-
Later he became Commander-in-chief of the Turkish
rn front, and in this capacity insisted on the formation of a
ar army in place of the irregular Nationalist forces. In the
time, the irregular forces were unwilling to submit, and the
Army had taken the offensive. At Ineunu, Ismet defeated
reeks, checked their offensive, subdued the irregular forces,
ucceeded in completing the organisation of a regular army.
emained in command of the western front until after the
on the Sakharia and the fall of Smyrna, in which events he
he right-hand man of Mustafa Kemal Pasha. In 1922 he
d the Armistice concluded at Mudania with the Allies, and
eded in securing the evacuation of Eastern Thrace. In
3, as Minister of Foreign Affairs and senior Turkish dele-
to the Lausanne Conference, he most ably defended the
ests of his country, and signed the Treaty of Lausanne.
ring the autumn of 1923, at the time of the declaration of
epublic, he became Prime Minister. After a short rest, due
iling health, he became Prime Minister a second time, to-
s the end of 1924, and shared in the suppression of the Shiekh
revolt in Kurdistan. The abolition of the Caliphate, the
ng of the medressehs (religious schools) and of the tekkes
asteries), the abolition of the tithe, the adoption of the
civil code, and the wearing of the hat are some of the mo-
ous changes which were realised during Ismet's tenure of
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ONZO, BATTLES OF THE: *see* ITALIAN CAMPAIGNS.

OSTASY.—When the great Trigonometrical Survey of India
initiated, it was found that the deflection of the plumb-line
he Himalayas was much less than the calculated amount
to the theoretical attraction of the visible mass of the moun-
Sir G. B. Airy suggested that this might be caused by the
ence of a mass of matter, of less than the average density,
r the mountains; this explanation was further investigated
rchdeacon J. H. Pratt, who applied the term "compensa-
" to the negative effect of the underlying defect of density,
mpensating the direct effect of the attraction of the visible
of the mountains.

1892 Maj. C. E. Dutton, discussing the greater problems of
ical geology, deduced a general principle that the weight of
ter under any unit area of the earth's surface tended to be-
e uniform, and suggested that this was brought about by an
rground transfer of material to balance the visible surface
sport from regions of erosion to those of deposition. To this
ciple he gave the name *isostasy* (*ἴσος* equal, and *στάσις*
tion), not as a synonym for Pratt's compensation, but as a
e for the principle and process, by which it was brought
t. In 1909 there appeared a very complete and elaborate
stigation of the subject by J. F. Hayford, in which the word
stasy" is used as synonymous with what Pratt called "com-
sation," and this use of the term has since become general
ng geodesists. Some inconvenience results from this two-
use of the word, to express either a measurable effect, or one
ry of the cause by which this effect is produced; but the
ge is too firmly established to be overcome, and the incon-
ience is lessened as it has become recognised that the deep-
ed variations in density, and consequently in bulk, to which
hdeacon Pratt gave the name "compensation," may be the
nary phenomenon and cause of the major differences of sur-
level. (*See* also GEODESY; GEOLOGY.)

e G. B. Airy, *Phil. Trans.*, 1855, vol. 145, p. 101; J. H. Pratt, *Phil.*
ns., 1859, vol. 144, p. 745; C. E. Dutton, *Bull. Phil. Soc. Washing-*
1892, vol. 11, p. 51; J. F. Hayford, *The Figure of the Earth and*
tasy, from Measurements in the United States (Washington, 1909);
Bowie, "Abnormal Densities in the Earth's Crust disclosed by
lysis of Geodetic Data," *Geog. Jour.*, 1924, vol. 63, p. 26.

(R. D. O.)

SOTOPES (Gr. *ἴσος* equal+*τόπος* place), is the term first ap-
d by F. Soddy in 1913 to substances which, though they had
rent atomic weights, yet had identical chemical properties
occupied the same place in the periodic table of the elements.
r a century earlier Dalton had postulated that atoms of the
e element are similar to one another and equal in weight. A little later Prout suggested that the atoms of all elements were composed of atoms of a primordial substance which he endeavoured to identify with hydrogen.

If both these theories were right, the atomic weights of all elements would be comparable with each other as whole numbers. This the chemists soon showed was quite incompatible with experimental evidence. It is true that many were very nearly whole numbers, far too many for the effect to be pure chance, but others, like chlorine, were hopelessly fractional. Of the two alternatives Dalton's is much the simpler from the chemical point of view and was therefore quite rightly chosen as a working hypothesis. From this in course of time it developed into an article of scientific faith, and, despite the complete absence of positive evidence in its support, no serious questions as to its validity were raised until late in the 19th century. Of such speculations those of Crookes were founded on unsound evidence and were soon discredited. The question could not be settled by ordinary chemical methods, which employ countless myriads of atoms and could therefore only give a mean result, and it was only by the discovery of radioactivity and the development of accurate methods of weighing individual atoms that the existence of isotopes was disclosed. The two advances were nearly contemporaneous but the first definite convincing proof of isotopy was found among the radioactive elements and their products.

The Radioactive Isotopes.—In 1906 Boltwood discovered ionium and found that it had similar chemical properties to thorium. Further research using the most delicate radioactive methods failed to indicate the slightest chemical separation of these two elements once they had been mixed, and even more surprising their spectra appeared to be identical. Other pairs of elements in the radioactive group showed corresponding identities and later investigations on the chemistry of the products of radioactive disintegrations enabled the chemical law of radioactive change to be formulated (*see* RADIOACTIVITY). This stated that a radioactive element when it loses an alpha particle goes back two places in the periodic table; when it loses a beta particle it goes forward one place. An alpha particle is a helium nucleus of weight 4, whereas a beta particle is an electron of negligible weight. It follows that if a body loses one alpha and two beta particles it will be back again in the same place in the periodic table although it will have lost a mass equal to four units of atomic weight.

Isotopic Bodies Predicted.—Supported by this law, which he was the first to state in its most general form, Soddy boldly claimed that these "isotopic" bodies would be both chemically and spectroscopically indistinguishable. He also predicted that the lead produced by the disintegration of uranium would have an atomic weight 206, while that of the lead produced from thorium would be 208, and that consequently the atomic weight of the lead found in uranium minerals should be less than that of ordinary lead (207·2) while that of lead from thorium minerals should be greater. These predictions were amply vindicated during the War by the work of experts on atomic weights (Richards, Hönigschmid and others), and it was shown beyond all dispute that the isotopic leads, though they differed by the predicted amount in properties such as atomic weight, density, and solubility which depend directly on the weight of their atoms, in all others, which do not—atomic volume, boiling-point, melting-point, refractive index and spectrum—were quite indistinguishable.

Practical Utilisation of Indicators.—The impossibility of separating isotopes has been utilised in ingenious manner by Hevesy and Paneth. By the addition of a small quantity of a radioactive isotope to an ordinary inactive element, the latter is, so to speak, indelibly labelled and can be followed by the methods of radioactivity, which are incomparably more delicate than those of chemistry. In this way the solubility of very insoluble salts can be readily determined. By the addition of a little thorium B, an isotope of lead, valuable information has been obtained on the assimilation of the salts of the latter element by living plants. The use of such radioactive indicators affords a direct proof of the ionic dissociation theory, it has led to the discovery of certain metallic hydrides and to the determination of the velocity of diffusion of molecules among themselves, an otherwise insoluble problem.

Positive Ray Analysis.—It is clear that the reasoning which led to the discovery of isotopes among the radioactive elements is inapplicable to those much more abundant ones which do not exhibit this property. Among the latter the presence of isotopes can only be demonstrated by weighing their individual atoms. This can be done by the analysis of positive rays, also called *Kanalstrahlen* or mass rays, which are electrically charged atoms of matter moving with such high velocities that they can be detected by means of their impact on a fluorescent screen or photographic plate. The usual method of producing these is by the discharge in gases at low pressure. In the region of the Crookes dark space and negative glow in front of the cathode the gas is ionised; that is to say, its atoms are split up into positively and negatively charged parts. The latter are the same whatever the nature of the gas, they are electrons and fly away from the cathodes constituting the well-known cathode rays. The remaining positively charged particles will fly toward the cathode. Their masses may vary from that of the lightest atom to that of the heaviest molecule in the gas, and their energies from an indefinitely small value to a maximum expressed by the product of the charge they carry, multiplied by the total potential applied to the electrodes. If the cathode be pierced, the rays pass through the aperture and form a stream of particles heterogeneous both in mass and velocity, which can be subjected to analysis.

The "Parabola" Method.—In Sir J. J. Thomson's "parabola" method of analysis, the particles, after reaching the surface of the cathode, pass through a long and very fine metal tube. By this means a narrow beam of rays is produced, which is passed through electric and magnetic fields causing deflections at right angles to each other, and finally falls upon a photographic plate. It can be shown that, if the mass of any particle is m and its charge e, when both fields are on together, the locus of impact of all particles of the same e/m, but varying velocity, will be a parabola. Since e must be the electronic charge, or a simple multiple of it, measurements of the relative positions of the parabolas on the plate enable us to calculate the relative masses of the particles producing them—that is, the masses of the individual atoms or molecules. The fact that the streaks were definite, sharp parabolas, and not mere blurs, constituted the first direct proof that atoms of the same element were, even approximately, of equal mass. For some time the results of the application of this method of analysis appeared to support the hypothesis of Dalton, as the elements introduced into the discharge tube gave single, or apparently single, parabolas in the positions expected from their chemical atomic weights. (*See* GASES, ELECTRICAL PROPERTIES OF.)

Examination of Neon.—But when, in 1912, neon was examined, the trace obtained was definitely double. The brighter curve corresponded roughly to an atomic weight of 20, the fainter companion to one of 22, the atomic weight of neon being 20·20. The line 22 could only be explained as due to a hitherto unknown elementary constituent of neon. This agreed well with the new idea of isotopic elements which was just then emerging from the investigations on radioactivity, so that it was of importance to investigate the point as fully as possible. The first line of attack was an attempt at separation by fractional distillation, but the result was entirely negative. The second method employed was that of fractional diffusion through pipe-clay which gave a small, but definite, positive indication of separation. It therefore seemed probable that neon was a mixture of isotopes.

The Mass-Spectrograph.—By the time that research on the subject was resumed at the Cavendish Laboratory in 1919, the existence of isotopes among the products of radioactivity had been proved beyond all reasonable doubt by the work on the atomic weight of lead. This fact automatically increased the value of the evidence of the complex nature of neon and the urgency of its definite confirmation. It was realised that separation could only be very partial at the best, and that the most satisfactory proof would be afforded by measurements of atomic weight by the methods of positive ray analysis. These would have to be so accurate as to prove beyond dispute that the cepted atomic weight lay between the real atomic weights of two constituents, but corresponded with neither of them. parabola method was not equal to this, but the required accura was achieved by means of an instrument shown in diagram in fig

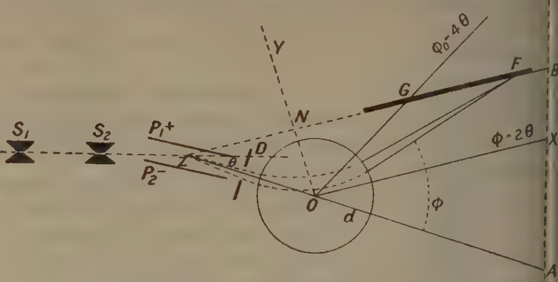

FIG. 1.—Diagram of Mass Spectrograph.

Positive rays are sorted out into a thin ribbon by two paral slits S_1S_2, and are then spread into an electric spectrum means of the charged plates P_1P_2. A portion of this spectrum d flected through an angle θ is selected by the diaphragm D and pass between the poles of a powerful magnet O, the field of which is su as to bend the rays back again through an angle ϕ more tha twice as great as θ. The result of this is that rays having a consta mass (or, more correctly, constant *em*) will converge to a focus and if a photographic plate is placed at GF as indicated, a spectru dependent on mass alone will be obtained. On account of its analo to optical apparatus, the instrument has been called a mass-spe trograph and the spectrum produced a mass-spectrum.[1]

Mass-Spectra.—Fig. 2 shows a number of typical mas spectra that are obtained by this means. The numbers abo the lines indicate the masses they correspond to on the sca o=16. It will be noticed that the displacement to the right wit increasing mass is roughly linear. The measurements of ma are not absolute, but relative to lines which correspond to know masses. Such lines due to hydrogen, carbon, oxygen and the compounds, are generally present as impurities or purposel added, for pure gases are not suitable for the smooth working the discharge tube. The two principal groups of these referen lines are the C_1 group, due to C (12), CH (13), CH_2 (14), C (15), CH_4 or O (16), and the C_2 group (24–30) containing th very strong line C_2H_4 or CO (28). These groups will be seen several of the spectra reproduced, and they give, with the CO (44) line, a very good scale of reference.

Mass Measurements.—Measurements of mass can be mad with an accuracy of 1 part in 1,000. It must be remembere that the ratio of mass to charge is the real quantity measured b the position of the lines. Many of the particles are capable c carrying more than one charge. A particle carrying two charge will appear as having half its real mass; one carrying three charge as if its mass was one-third, and so on. Lines due to these ar called lines of the second and third order. Lines of high orde are particularly valuable in extending our scale of reference.

When neon was introduced into this apparatus, four new line made their appearance at 10, 11, 20 and 22. The first pair (no shown in diagram) are second order lines. All four are well place for direct comparison with the standard lines, and a series o consistent measurements showed that to within about one par in a thousand, the atomic weights of the isotopes composin neon are 20 and 22 respectively. Ten per cent of the latter woul bring the mean atomic weight to the accepted value 20·20, an the relative intensity of the lines agrees well with this propor tion. The isotopic nature of neon was therefore settled beyon doubt. Spectrum I. on fig 2 (*see* next page) shows the first orde lines of neon and some of the reference lines with which they were compared.

Analysis of Chlorine.—The element chlorine was naturally the next to be analysed, and the explanation of its fractional atomic weight (35·46) was obvious at once. Its mass-spectrum is char-ed by four strong lines 35, 36, 37, 38. The simplest expla- of the group is to suppose that the lines 35 and 37 are due isotopic chlorines, and the lines 36 and 38 to their corre- ng hydrochloric acids. The elementary nature of 35 and ndicated by their second order lines at 17·5 and 18·5, and hen phosgene was used, by the occurrence of lines at 63 due to COCl^{35} and COCl^{37}.

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[1] A full description of the Mass-Spectrograph is given in *Isotopes* by F. W. Aston, Cambridge University Press, pp. 44 *et seq.*

r it was found possible to obtain the spectrum of the nega- charged atoms of chlorine. This showed only two lines 37; so that the lines 36 and 38 cannot be due to isotopes element. These results show that chlorine is a complex t, and that its isotopes are of atomic weight 35 and 37. a II., III. and IV. show the results with chlorine taken with nt field strengths (*see* CHEMISTRY).

Elements.—As the work progressed with other elements interesting results were obtained. Some elements, such on and oxygen, were found to be "simple"; that is, not es of isotopes. This was to be expected from their whole-

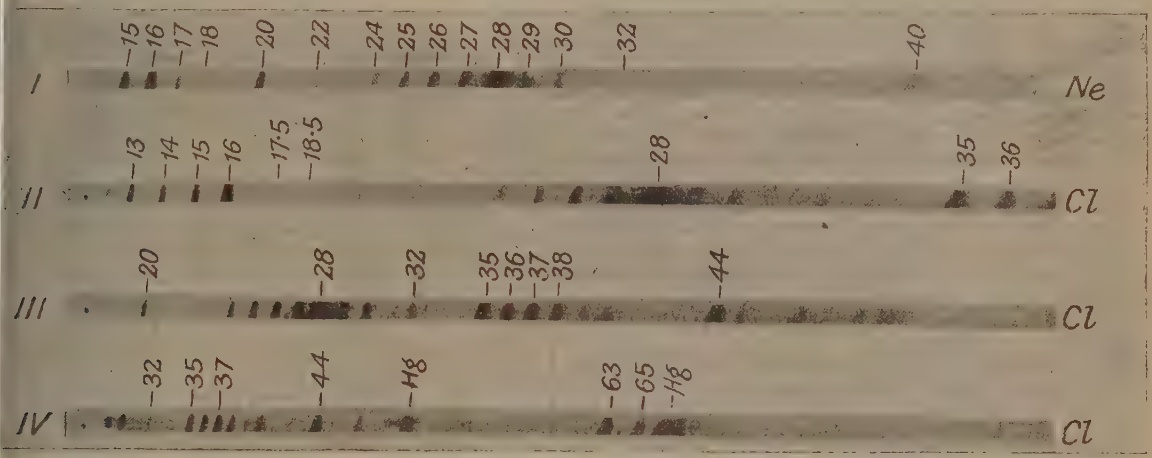


Fig. 2. Typical Mass Spectra

r atomic weights. Even more proved "complex," some ting of 7, and in the case of xenon possibly 9 isotopes. The exity of mercury is indicated by the blur of its unresolved and fourth order groups seen in spectrum IV. Its lines een resolved by means of a more powerful instrument. rays of the metallic elements, which are in the majority, t in general be produced in the ordinary vacuum discharge. can be investigated by means of anode rays.

constitution of the alkali metals was first discovered by se of an anode consisting of a platinum strip coated with f the metals, and heated electrically. Dempster, at Chi- produced mass rays of metals by heating the element in a e and ionising the vapour produced by electron impact. alyse the rays so formed he used low velocities and an ical method of detection. By this means he made the first ses of magnesium, calcium and zinc, and also confirmed sults already obtained for the lighter alkali metals.

re recently a large number of elements, including some of re earths, have been successfully attacked by means of the l method of "accelerated anode rays," and in all 56 out of known non-radioactive elements have been analysed into constituent isotopes or shown to be simple.

Whole-Number Rule.—By far the most important general of these investigations is that, with the exception of hy- n, the weights of the atoms of all the elements measured, herefore almost certainly of all elements, are whole num- to the accuracy of experiment. With the mass-spectro- , this accuracy is generally one part in a thousand. Of e, the error expressed in fractions of a unit increases with ass measured, but with the lighter elements the divergence the whole-number rule is extremely small. This enables ing simplifications to be made in our ideas of mass.

The original hypothesis of Prout can now be restated with the modification that the primordial atoms are of two kinds: protons and electrons, the atoms of positive and negative electricity. According to the modern theory of the nucleus atom (*see* ATOM; MATTER) all the protons and about half of the electrons are packed very close together to form a central, positively charged nucleus, round which the remaining electrons circulate, somewhat like the planets round the sun. All the spectroscopic and chemical properties of the atom depend on the net positive charge on the nucleus, which is the excess of protons over nuclear electrons. This is also clearly the number of planetary electrons in the neutral atom; it is called the "atomic number" and is actually the number of the element in the periodic classification: 1 for H, 2 for He, 3 for Li, and so on.

The whole-number weight of the atom, on the other hand, will be the total number of neutral pairs of protons and electrons it contains. This is also the number of protons in its nucleus, and is called the "mass-number" of the atom: 1 for H, 4 for He, 6 and 7 for the isotopes of Li, and so on. For the purpose of distinguishing isotopes it is customary at present to use the chemical symbol of the complex element with an index corresponding to the mass-number of the particular isotope, *e.g.*, Ne^{22}, Rb^{87}.

Packing Effect.—The whole-number rule is not mathematically exact, for owing to the extremely close packing of the charges of opposite sign in the nucleus, this will have a weight slightly less than the sum of the weights of its constituents. This loss of weight is called the "packing effect." Hydrogen, which has for its nucleus a single proton, will have no packing effect, and may therefore be expected to have an abnormally large weight. Comparison of this element with others by means of the mass-spectrograph, using special methods, shows that, within experimental error, the weight of its atoms on the chemical scale (O = 16) is indistinguishable from that obtained by chemical methods, namely, 1·0077.

The divergences of other elements are barely measurable at present, but the isotopes of lithium appear heavier than whole numbers by about 1 part in 1,000. Most of the heavier elements show a slight defect, which is to be expected if we take oxygen as having normal packing. The defect in the case of the isotopes of tin appears to be at least 2 parts in 1,000, which is 0·2 of a unit of atomic weight.

These considerations are of the greatest interest theoretically, for upon them rests the hope of the future liberation of the so-called "atomic energy." (*See* ATOMIC ENERGY.) The theoretical importance of chemical atomic weight has been somewhat reduced by the discovery that for so large a number of elements it merely represents a statistical mean. Its position as a natural numerical constant associated with an element has now been taken by the atomic number, which indeed defines the element, though from the point of view of chemical analysis, the mean atomic weight is as important as ever. The anomalies shown by those elements which, by their atomic weights, appear out of their right order in the periodic table, are now open to the simplest explanation. Thus argon, in which the heavier of two isotopes predominates, has a greater mean weight than potassium, in which the reverse is the case. The same explanation applies to cobalt, nickel, tellurium and iodine.

Since the atomic number only depends on the *net* positive charge on the nucleus, arithmetically any element can possess an indefinite number of isotopes. The table herewith shows that those present in detectable quantity are restricted both in number and range of weight, though the causes of these restrictions are at present unknown. No element of odd atomic number has more than two isotopes and, above atomic number 9, the mass-numbers of the isotopes always differ by 2, and the lighter is the more abundant constituent. The number of nuclear electrons tends to be even. That is, in the great majority of cases even atomic number is associated with even mass-number, and odd with odd. Beryllium and nitrogen are the only elements consisting entirely of atoms whose nuclei contain an odd number of electrons.

If the mass numbers of the various species of atoms are plotted against their relative abundance in the earth's crust, a strong preponderance of those of type 8n may be seen. There is an extreme difference of range between the abundance of isotopes in an element and elements in nature. In the case of elements of an odd atomic number this cannot be ascribed merely to lack of delicacy in the means of detection of their isotopes. Thus while there are only about three Cl^{35} atoms to one Cl^{37} and about two Ga^{69} atoms to one Ga^{71}, yet there are a thousand million more atoms of chlorine than of gallium. This suggests that isotopes have some relation in common more fundamental than that of identity of nuclear charge, an idea which is supported by other independent lines of reasoning.

Spectra of Isotopes.—As regards their series spectra, in which, on Bohr's theory, the two bodies concerned are an electron and an enormously more massive atomic nucleus, the prediction that isotopes should be indistinguishable is satisfied to a high degree of precision. So far the only effect detected is a minute difference of wave-length between the lines of Carnotite lead (206) and ordinary lead (207·2). The most accurate measurements by Merton indicate that this has a maximum value of 0·011 Å for the line $\lambda = 4058$. Smaller shifts are detectable in a few other lines, the wave-length for the lighter atom being the greater in all cases. In band spectra, where two nuclei are concerned, the isotope effects are much larger and in excellent agreement with theory. In the case of HCl bands in the infrared region the duplicate peaks are as much as 14 Å apart, and in position and relative intensity, correspond exactly with the results expected from the presence of HCl^{35} and HCl^{37}.

More recently by investigation of band spectra produced in the visible region by boron oxide and silicon nitride, Millikan has shown that separate band heads appear corresponding to the two isotopes of boron, in the one case, and to three isotopes of silicon in the other. These results constitute valuable independent confirmation of the results of the mass-spectrograph.

Separation of Isotopes.—It is perhaps a fortunate thing for the simplicity of chemical arithmetic that the artificial separation of isotopes is excessively difficult, while at the same time no process tending to that end in nature appears to exist at all. Of the artificial methods the only one giving complete separation is the actual analysis of the mass-rays, during which the isotopic atoms strike the plate at different points and therefore, if collected, would yield pure specimens. The quantities so produced would, with the means at present available, be far too minute to be of any practical value.

A large number of methods for partial separation have been suggested and tried. The first successfully used, which is only applicable to gases, is that of free diffusion through pipe-clay or other suitable porous material. The diffusion rates are inversely proportional to the square roots of the masses concerned. It follows that if a large volume V of a mixture of isotopes is allowed to diffuse, leaving a small residue *v*, the latter will be
in the heavier constituent than was the original gas. The a
numerical value of this enrichment, under ideal conditions,
isotopes, such as those of neon, which differ by 10% is only 20
so that only by the use of very large volumes, or laborious
titions, can any measurable change be achieved. The ori
experiments with neon gave a shift of atomic weight of ra
more than 0·1 of a unit. Harkins, at Chicago, by the u
19,000 litres of HCl, was able to obtain considerable sampl
which the atomic weight of chlorine differed by 0·055 unit.

Table of Elements and Isotopes

Element	Atomic number	Atomic weight	Minimum number of isotopes	Mass numbers o isotopes in order intensity
H	1	1·008	1	1
He	2	4·00	1	4
Li	3	6·94	2	7, 6
Be	4	9·02	1	9
B	5	10·82	2	11, 10
C	6	12·00	1	12
N	7	14·01	1	14
O	8	16·00	1	16
F	9	19·00	1	19
Ne	10	20·20	2	20, 22
Na	11	23·00	1	23
Mg	12	24·32	3	24, 25, 26
Al	13	26·96	1	27
Si	14	28·06	3	28, 29, 30
P	15	31·02	1	31
S	16	32·06	1	32, 33, 34
Cl	17	35·46	2	35, 37
A	18	39·88	2	40, 36
K	19	39·10	2	39, 41
Ca	20	40·07	2	40, 44
Sc	21	45·1	1	45
Ti	22	48·1	1	48
V	23	51·0	1	51
Cr	24	52·0	1	52
Mn	25	54·93	1	55
Fe	26	55·84	2	56, 54
Co	27	58·97	1	59
Ni	28	58·68	2	58, 60
Cu	29	63·57	2	63, 65
Zn	30	65·38	4	64, 66, 68, 70
Ga	31	69·72	2	69, 71
Ge	32	72·38	3	74, 72, 70
As	33	74·96	1	75
Se	34	79·2	6	80, 78, 76, 82, 77,
Br	35	79·92	2	79, 81
Kr	36	82·92	6	84, 86, 82, 83, 80,
Rb	37	85·44	2	85, 87
Sr	38	87·63	2	88, 86
Y	39	88·9	1	89
Zr	40	(91)	3(4)	90, 94, 92, (96)
Ag	47	107·88	2	107, 109
Cd	48	112·41	6	114, 112, 110, 111, 116
In	49	114·8	1	115
Sn	50	118·70	7(8)	120, 118, 116, 119, 117, 122,
Sb	51	121·77	2	121, 123
Te	52	127·5	3	128, 130, 126
I	53	126·92	1	127
X	54	130·2	7(9)	129, 132, 131, 134, 128, 130, (126),
Cs	55	132·81	1	133
Ba	56	137·37	(1)	138
La	57	138·91	1	139
Ce	58	140·25	2	140, 142
Pr	59	140·92	1	141
Nd	60	144·27	3(4)	142, 144, 146, (145)
Hg	80	200·6	6	202, 200, 199, 201, 204
Bi	83	209·00	1	209

Another method, following much the same numerical la
is that of Bronsted and Hevesey, which consists of free evapor
tion from a liquid surface at very low pressure. They obtain
two samples of about 0·2 cc. of mercury differing in density
5 parts in 10,000, or 0·1 of a unit. The atomic weights show
a corresponding difference, but the electrical conductivity of th
two samples was indistinguishable to one part in a million.

er methods of separation such as chemical action, centri- , ionic migration and thermal diffusion have only yielded e or entirely negative results. A very large number of pts have been made in recent years to discover any varia- ı the chemical atomic weight of elements known to be ex, which would indicate a change in the proportions of topes present. Boron, silicon, chlorine, iron and nickel ll received attention, but in no case with any certain posi- sult. From their experiments on silicon from no less than erent terrestrial and meteoric sources, Jaeger and Dijkstra ded that these gave products not differing in density by than 0·00004%.

accumulation of negative evidence of this kind is very ssive, and supports the idea that the evolution of the ele- , apart from those produced by radioactive disintegration, have been such as to lead to a proportionality of isotopes was constant from the start, and, since we know of no l process of separation, has remained constant ever since. W. Aston, *Isotopes*, 2nd ed., 1924. (F. W. A.)

AËLS, JOSEF (1824–1911), Dutch painter (*see* 14.885b), t The Hague Aug. 12 1911.

GAKI, TAISUKE, Count (1837–1919), Japanese states- died in 1919. True to his liberal principles, he forbade his apply for the succession to his title and it lapsed.

LIAN CAMPAIGNS.—Italy entered the World War as a tant on May 23 1915, when she declared war on Austria. ollowing article constitutes an outline of the struggle be- Italy and Austria from that date until the signing of the -Italian Armistice on Nov. 3 1918. The article has been d into five sections, namely: I. Italy's Strategical Position; he First Year's Campaign; III. Battles of the Isonzo and arso; IV. The Austro-German Effort; V. The Collapse of a. More detailed accounts of the outstanding battles in mpaign are given under separate headings, namely: Asiago, E of; Caporetto, Battle of; and Vittorio Veneto, E of.

I. ITALY'S STRATEGICAL POSITION

the outbreak of the World War the Italian General staff worked-out plan for an offensive campaign against Aus- ungary. The great military superiority of the Habsburg e and the unfavourable frontier drawn in 1866 seemed to the possibility of Italian offensive action. A glance at the nakes the position clear.

ginal Italian Plan.—When Italy was preparing to enter the the fact that Austria-Hungary was already heavily engaged ere offered the chance of an Italian attack, and Gen. Ca- , who took command on the declaration of war, had worked is scheme in expectation of simultaneous offensive action part of Russia and Serbia. The plan was based on the idea taly must hold on the north and push towards the east. astern front, though difficult enough, seemed less impervi- an offensive than the Alpine masses on the north. An in this direction was calculated to occupy a much larger er of enemy troops, which was obviously a part of Cador- uty, and was further a direct threat against a vital part of onarchy. These advantages were rightly held to compensate e fact that an advance eastward meant the lengthening of t already very long, and increased, moreover, the menace Trentino salient.

s threat was mitigated by the expectation of Allied action northeast and southern fronts of Austria-Hungary, which prevent the enemy taking advantage of the weakness ted. But, on the eve of Italy's declaration of war, the situa- ad changed. The Russian armies north of the Carpathians given way before the attacks of Mackensen and Böhm- lli. There was no word of movement, even of demonstra- on the part of Serbia, in spite of requests from the Allies, n May the Austro-Hungarian troops on the Serbian front reduced by five divisions, which were sent to the Isonzo- front, their place being taken by three newly-formed Ger- livisions.

Disposition of the Forces.—On the eve of war Cadorna's dispositions were as follows: Gen. Roberto Brusati's I. Army, with five divisions and 10 Alpine battalions, was to conduct a limited offensive in the Trentino, with the object of shortening the line and securing strong defensive positions. Gen. Nava's IV. Army, five divisions and seven Alpine battalions, was to attack the enemy communications in the Pusterthal and co-operate in an advance towards Tarvis; this advance was to be carried out by the "Carnia Force," consisting of one infantry division and 16 Alpine battalions under Gen. Lequio. The II. and III. armies, under Gen. Frugoni and the Duke of Aosta respectively, were to attack with all speed on the Isonzo front. Frugoni had eight divisions and the Duke of Aosta six, with three cavalry divisions. But on May 24 only three corps (seven divisions) and three cavalry divisions were ready to attack.

On May 20 the Austrian armies, which had been placed under the command of the Archduke Eugene, with Gen. Krauss as his chief-of-staff, formed little more than a screen. Gen. Dankl, lately in command of the Austrian I. Army, had about two divisions in Tirol, with some Landstürm battalions; Gen. von Rohr had a similar force to oppose an advance on Tarvis; and the Isonzo front, from Monte Nero to the sea, was lightly held by three divisions under Gen. Ludwig von Goiginger. But reinforcements were close at hand. Within a few days Rohr had two more divisions at his disposal, and by May 27 Gen. Boroević von Bojna, to whom the Isonzo front had been entrusted, had 90 battalions between Monte Nero and the sea.

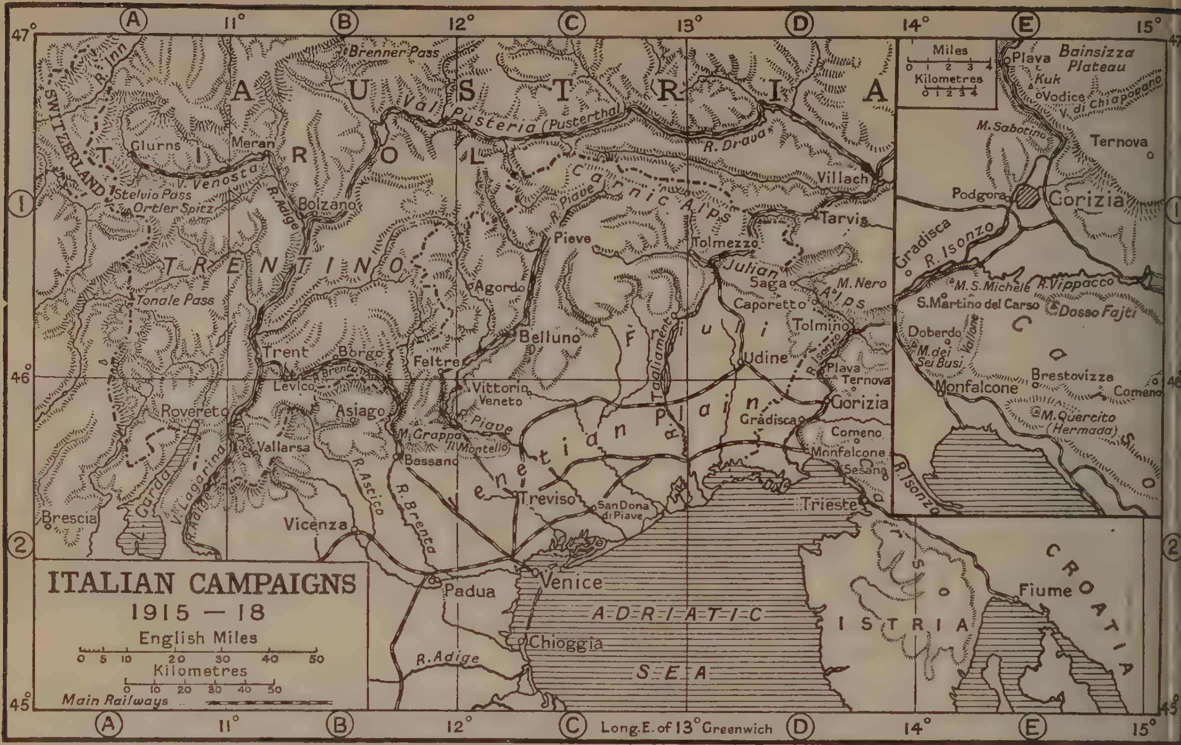
II. THE FIRST YEAR'S CAMPAIGN

The opening moves of the Italian offensive, all-important as they were in relation to the future operations, failed to obtain the results hoped for in Cadorna's design. The I. Army performed its limited task quickly and satisfactorily, but the IV. Army was very slow. Here, almost certainly, a good chance was missed. Lequio's Carnia force was quick to move and found that the enemy was equally quick. This sector was all-important to the Austrians, from the point of view both of offence and defence. It was essential to prevent a break-through to Tarvis and Villach, and if they could hold the frontier line it preserved for them the chance of the attack down the valleys leading to the Tagliamento. Here alone the way was blocked against any but an overwhelming force.

Italy Takes the Offensive.—Meanwhile, the II. and III. armies were on the move. Frugoni, with the five divisions of his army that were ready, attacked along the line of the Isonzo from the Saga to opposite Gorizia. The Duke of Aosta, with a single corps and two cavalry divisions, was to force the passage of the lower Isonzo and push on towards the Carso. The Austrians had withdrawn beyond the river, except at the two strong bridge-heads opposite Tolmino and Gorizia, which were held in force, and south of Gorizia the line of defence chosen was the Carso plateau. Speed and initiative were essential if the opening moves of the Italian offensive were to be successful, and at various points speed and initiative were lacking. The bridge-heads were invested, as were several other strong positions held by the enemy.

On the other hand, the country is extraordinarily difficult, and roads were few and mostly bad; and those which were suitable for the movement of troops and guns led only to the points which the enemy was holding in some force. Fortune, too, was against the attacking armies. Appalling weather made movement in the mountains almost impossible during the critical period, and when the chance of a surprise had gone the great barrier of the Julian Alps was an insuperable obstacle to such forces as the Italians could bring against it. Guns, machine-guns and transport were lacking. Farther south, in the plain west of the Carso, the Isonzo came down in sudden and violent flood and held up the Duke of Aosta's advance. The fords were impassable and bridges had been blown up by the retreating enemy.

By the end of the third week in June the Italians had gained several important positions, some of them after very hard fighting, but they had been brought to a stop before the Austrian


ITALIAN CAMPAIGNS
1915 — 18
English Miles
Kilometres
Main Railways
Long. E. of 13° Greenwich
AUSTRIA
TIROL
TRENTINO
Venetian Plain
Friuli
Carnic Alps
Julian Alps
ADRIATIC SEA
ISTRIA
CROATIA
SWITZERLAND
Brenner Pass
Val Pusteria (Pusterthal)
Glurns
Meran
Bolzano
Stelvio Pass
Ortler Spitz
V. Venosta
Tonale Pass
Trent
Borgo
Levico
Rovereto
Vallarsa
Asiago
Brescia
Vicenza
Padua
Venice
Chioggia
R. Adige
R. Brenta
R. Astico
Bassano
M. Grappa
Montello
Treviso
San Dona di Piave
Piave
Vittorio Veneto
Feltre
Belluno
Agordo
Pieve
Tolmezzo
Tarvis
Villach
R. Drava
Saga
Caporetto
M. Nero
Tolmino
Udine
Plava
Ternova
Gorizia
Gradisca
Comeno
Monfalcone
Sesana
Trieste
R. Isonzo
Tagliamento
Fiume
Bainsizza Plateau
Kuk
Vodice
V. di Chiapovano
M. Sabotino
Podgora
R. Vippacco
M. S. Michele
S. Martino del Carso
Dosso Faiti
Doberdo
M. dei Sei Busi
Brestovizza
M. Quercito (Hermada)
A B C D E
1 2
10° 11° 12° 13° 14° 15°
45° 46° 47°

main lines, and it became clear that the hopes of a war of movement must be given up, that only the slow processes of trench warfare could lead to success. The Italian mobilisation was now completed, and Cadorna had ready some 35 divisions. Against these the Archduke Eugene had some 20 divisions, including the Bavarian *Alpenkorps*, which had been sent to Tirol, although Germany and Italy were not yet at war. Boroević and Dankl were much weaker in infantry strength than the armies opposed to them. But they were strong in artillery, were very much better equipped with machine-guns, and held positions that were naturally ideal for defence and had been well prepared.

First and Second Battles of the Isonzo.—On June 23 began what is known as the first battle of the Isonzo. The II. Army, with a strength of 10 divisions and two Alpine groups, attacked the enemy lines in the Tolmino sector, and from Plava to Podgora, while the III. Army, with six divisions, moved to the assault of the western rim of the Carso plateau. The Itálians had not sufficient heavy artillery; Boroević had now nine divisions, with their march battalions, and further reserves were on the way. After very heavy fighting at Plava, where the earlier Italian advance had established a small bridge-head, at the Gorizia bridge-head (M. Sabotino and M. Podgora) and on the edge of the Carso the action was broken off on July 7. During the fortnight's fighting the Italians had gained a little ground at the cost of about 19,000 casualties. The Austrian casualties to date were 22,000.

After 10 days' breathing space Cadorna attacked again in the same sectors. Boroević had now 13 divisions under his command, but Cadorna had concentrated all his slender supply of heavy guns on the Isonzo front. No headway was made by the II. Army but a fierce struggle took place on the Carso. Monte San Michele was taken on July 20 but lost again, and six days later a fresh attack had the same result. The second battle of the Isonzo ended on Aug. 3 with the Italians close under the crest of Monte San Michele and the village San Martino del Carso, and in possession of most of Monte dei Sei Bus, farther south. The Italians lost some 34,000 men, but the Austrians also suffered severely and lost over 10,000 prisoners.

The Autumn Offensive, Oct.–Dec.—Various isolated actions were carried out on the long front during the summer, but the time was devoted chiefly to preparation for a big offensiv the autumn. By the middle of Oct. Cadorna could dispose 312 battalions on the Julian front. The II. Army now consis of 12 divisions and the III. of seven, while a reserve of five d sions lay ready in the Friuli plain. When the attack began Bo ević had about half this number of troops, but within a fortni he had the equivalent of 15 divisions at his disposal. It was the II. Army front that the Italian numerical superiority great; on the Carso the Duke of Aosta had no marked advant in numbers over the Archduke Joseph, who had assumed command in this sector in July. But the terrain on Boroev right was such that he could expect to hold with greatly infer forces, especially in view of the Italian weakness in artille The offensive went badly. By his main attack Cadorna h hoped to turn the Gorizia positions from both north and sou and as a secondary operation, after crossing the middle Isonzo, threaten Tolmino from the south, as well as from west and nor After a first phase lasting a week, the attack was renewed f days later on a narrower front, but the third battle of the Ison closed on Nov. 4 with little tangible result.

Six days later the fourth battle of the Isonzo was begun. a the struggle went on for more than three weeks, the offensi being finally broken off on Dec. 5. As men and munitions came exhausted the scope of the action had been gradually duced to an attack on the Gorizia bridge-head and still anoth struggle for Monte San Michele. Once more the artillery prov insufficient, and the main feature of the fighting was the her efforts of the infantry on both sides. During the two battl which were fought in persistent bad weather, the Italians l over 113,000 men and the Austrians about 90,000. The result the first seven months' campaigning was disappointing to tho who had hoped for far greater effects from Italy's interventio It was not generally recognised how poorly the Italian Arm was provided with the material necessary to modern war. I evitably, moreover, the Austrians had a great advantage in the nine months' war experience. They were clearly superior in sk to their opponents, and their superior skill was backed by spirit which the armies of the dual monarchy sometimes fail to show on the Eastern Front.

Preparations for 1916.—The winter months were busily en especially in the munition factories. It was beginning to gnised in Rome that estimates regarding numbers of men ells had to be revised. During the winter the small total y and medium guns was increased sevenfold, and great inadequate efforts were made to increase the supply of An important innovation of the winter was the *bombarda*, trench mortar, large numbers of which were constructed e up for the deficiency in heavy artillery. The *bombarda* fact much more than what is usually understood by the rench mortar. Its range was much longer, and the de- e power of its big projectile was very great.

supply of men, no less than that of material, required to be shed and augmented. In seven months the Italian losses field were close upon 280,000—66,090 killed, 190,400 d and 22,520 missing or prisoners. The Austrian losses ,000 killed, 97,000 wounded and 31,000 missing or prison- all 156,000. The Italian figure was in addition to casual- m sickness, which were heavy, including as they did the rom an outbreak of cholera in the II. Army. Men had to d not only to fill up the gaps but to make new formations. the winter the gaps were filled, and eight new divisions eady in the spring, while others were in process of forma- ad Cadorna had succeeded, after some difficulty, in having sses required for drafts called up well ahead of his imme- eeds.

BATTLES OF THE ISONZO AND THE CARSO

ng the early months of 1916 the only fighting of any im- ce took place in March, when Cadorna opened a big dem- ive action on the Julian front, with the object of preventing patch of Austrian forces to Verdun. The action contin- om March 11 to March 29, and received the name of the Battle of the Isonzo. Although it was only a demonstration, ard fighting took place, and both sides suffered consider- ss. Meanwhile, preparations for a real Italian offensive on lian front were well advanced, when news came that the ans were preparing a big attack in the Trentino.

rian Failure in the Trentino.—This attack, which is de- elsewhere (*see* ASIAGO, BATTLE OF) had a big initial suc- ut it was already condemned to failure when Brusilov, ing the appeal for co-operation made by Cadorna on May acked the weakened Austrian lines in front of him on June won the great victory that, if Cramon may be believed, ithin an ace of being decisive. The attack in the Trentino, on a miscalculation, nearly ended in the collapse of Aus- astern front, and brought only a slight territorial gain that compensation for the defeat elsewhere and for the losses d. Nor did the penalty end with these. Cadorna refrained nocking his head against the lines upon which his retreat- emy turned and stood. The positions he reached were ade- to his aims in the Trentino, which were purely defensive, nstead of persisting in his counter-offensive he rapidly his reserves back to the Julian front, smashed through the a bridge-head and took Gorizia, and drove the Austrians he western section of the Carso plateau.

Taking of Gorizia.—During the winter of 1915–6, in prep- n for an attack upon Gorizia and the Carso, the right of the II. Army had been transferred to the III., so that ont from north of Monte Sabotino down to the sea was the Duke of Aosta. At the end of July, when the delayed was imminent, the Duke had 16 divisions and a dis- ed cavalry division. He had 1,250 guns, of which 520 eavy or medium, and these were supplemented by nearly *mbarde.*

the Carso and about Gorizia Boroević was badly prepared et the Italian attack. He had only five divisions in line en Monte Sabotino and the sea, and one in immediate re- when the Duke launched his attack, and the Austrians aken by surprise. On Aug. 4 the Duke began with a feint t the low hills east of Monfalcone, and two days later the tack developed, when the VI. Corps attacked the Gorizia -head and the XI. the summits of Monte San Michele. The VI. Corps, commanded by Gen. Luigi Capello, had outgrown the dimensions of an army corps, for it consisted of no fewer than six divisions. Capello's attack was brilliantly successful. Monte Sabotino, which had resisted so many attempts at capture, was taken on the run in 40 min., while the greater part of the Podgora ridge was torn from the Austrians and some Italian detachments reached the river at sunset. The Austrians defended with the most obstinate valour, and gained precious time for their hard pressed commander.

Italian troops crossed the river on the night of Aug. 8, and the town of Gorizia was occupied next day without resistance, while a general attack on the Carso was breaking down the stubborn defence which had survived the loss of Monte San Michele early in the first days' fighting. On Aug. 10 the Austrians were driven back across the Vallone, the deep cut that separates the San Michele-Doberdo section of the Carso from the main plateau. Both to the east of Gorizia and on the far side of the Vallone the advancing Italians found themselves faced by new lines hidden among the woody slopes beyond the town and the stony undulations of the Carso. Attempts to continue the offensive were not successful. The sixth battle of the Isonzo was an important Italian success, but there was not sufficient weight of guns and ammunition to push the attack home.

Closing Operations of 1916.—In Sept., Oct. and again at the beginning of Nov. the Duke of Aosta attacked on the main Carso plateau, between the Vippacco and the Brestovizza valley, punching out a big salient on the northern half of the Carso, driving the Austrians back to their last line of trenches and occupying the important position of Dosso Fajti. But the seventh, eighth and ninth battles of the Isonzo were each broken off as soon as the attack slowed down. Cadorna was attempting to gain position for a bigger attack later on, when men, guns and shells should be more plentiful. Bad weather prevented another blow, and prevented also an attack in the Asiago uplands, which had been planned for the middle of November.

The year had seen much heavy fighting, and both sides had suffered severely. The Italian casualties were nearly 120,000 dead, 285,000 wounded and 78,000 prisoners, the bulk of the latter taken in the first days of the Austrian offensive in May. The Austrian losses were also heavy, well over 200,000 killed and wounded and some 60,000 prisoners. If the territorial gains at the end of the year's fighting were not great, Cadorna's continued attacks, following upon the costly failure of the Austrian offensive in the Trentino, had done their work in occupying an increasing number of the enemy's troops and wearing down his resistance. Cadorna's rôle was clearly marked out; so long as the plans of the Allies were based upon the policy of attrition, he had to hammer when he could, with what means he could collect from month to month as the output of guns and munitions increased and fresh troops were trained, keeping always in view as an essential aim that of attracting to his front, and wearing out, the maximum number of enemy forces. Judged from this standpoint, the Italian effort of 1916 was of the greatest value to the Allied cause.

Although Cadorna was strongly opposed to the dispersal of his forces in *petits paquets* and had resisted the suggestion of an expedition to Libya to quell the rising which had reduced the Italian occupation to a few points on the coast, the importance of the Balkan front had not been lost sight of by the Italian Government. Fresh troops were sent to strengthen the Italian position in Albania, and in Aug. a strong force arrived in Salonika under the command of Gen. Petitti di Roreto to take part in the Allied advance on Monastir. Early in Oct. an Italian column occupied Argyrokastron, and before Nov. the Italians were in touch with the left wing of the Allied forces based upon Salonika.

IV. THE AUSTRO-GERMAN EFFORT

At the Allied conference held in Rome in Jan. 1917 the formal proposal was made that an Allied force should join the armies of Italy in an attempt to smash the weaker of the two Central Powers. In spite of Mr. Lloyd George's advocacy the plan did not commend itself to the French and British military authorities; who offered, however, to send 300 heavy guns to Italy on condition that they were returned to the French front by the month of April. Cadorna declined the offer, on the ground that the season was unsuitable for an offensive on his front, and that the guns would have to be returned at the moment when they would be most useful. The question of closer co-operation was dropped for the time being, but the conference organised a line of communications through Italy to Salonika, via the southern Italian ports, a route which greatly lessened the dangers from submarine attack, and at the same time made a much smaller demand on the diminishing tonnage of the Allies.

Cadorna's Plan.—Cadorna embodied his proposals in a memorandum written after the Rome conference; they were as follows: If the Allies would give him at least 300 heavy guns he would make two attacks on the Trentino and Julian fronts—his own artillery was insufficient for this double offensive—and so find the enemy's weak point. He had the advantage of interior lines, and would move his reserves of guns and men from the Venetian plain according to the development of the two actions. If, on the other hand, the Allies would send a minimum of eight divisions in addition to the heavy guns, he would concentrate upon the Julian front and attack from Tolmino to the sea, with the object of breaking through towards Ljubljana (Laibach). Such an attack, in Cadorna's view, would have had decisive results. He believed that Austria could not recover from so severe a blow.

The plan was tempting, but it did not commend itself to the Allied commands. French and British opinion was against any further diversion of effort from the Western front, for there was the chief enemy, upon whose defeat the result of the war depended. And there were obvious technical difficulties in the way of supplying large French and British forces on the Julian front. Nivelle and Robertson, who visited the Italian front in the spring, agreed to the principle of direct co-operation by the dispatch of troops and guns in the event of necessity, but both were inclined to prefer co-operation by simultaneous attack, and while a scheme for the quick transport of troops from France to Italy was prepared, no definite engagements were taken. It was agreed, on the other hand, between Cadorna and Nivelle, that the Italian and French spring offensives should be timed to coincide as nearly as possible.

The Italian Spring Offensive.—Cadorna's attack was slightly delayed owing to a threat of an Austrian offensive in the Trentino, and later, by bad weather. But the Italian guns, which had been reinforced by 11 batteries of British 6-in. howitzers and 35 French heavy guns, opened fire on May 12. Cadorna feinted with the III. Army on the Carso, making his real attack with the II. Army, now under Gen. Luigi Capello, against the hills north and east of Gorizia. North of the town the greater part of the long ridge (Kuk-Vodice) running southward from above Plava was gallantly stormed and held against the most determined counter-attacks, but little progress was made east of the town. As soon as the occupation of the Kuk-Vodice ridge seemed assured Cadorna moved the bulk of his heavy guns southward and attacked with the III. Army on the Carso. Useful progress was made here also, a number of positions being captured, and the VII. Corps on the right carrying one line after another till they were half-way up Monte Hermada (Querceto). But ammunition was running very low; the offensive was broken off at a moment when it seemed as though further success lay very near. On the evening of May 26, when the attack on the Hermada was stopped, the defenders of the battered hill were reduced to under 100 men, each of whom received the Maria Theresa medal.

There was only a short breathing space. On June 4 the Austrians on the Carso counter-attacked in the most determined manner. Finding a weak resistance on the part of the troops who has come into line as reliefs, they freed the lower slopes of Monte Hermada, and took a large number of prisoners. During the four weeks' fighting Cadorna used 31 divisions and lost 132,000 killed and wounded and 25,000 prisoners. Boroević had held his ground, or nearly, with 17 divisions, and his losses, including 25,000 prisoners, were close upon 120,000.

The rumour of battle had scarcely ceased on the Julian
when the Italians attacked in force north of Asiago, on a
of nine miles. The attack failed. Progress was made at one
only, on Monte Ortigara, and here too, after a long and b
struggle, the attacking troops were thrown back. Between
10 and June 29 the Italians lost 24,000 killed and wounded
2,000 prisoners. The Austrian casualties were over 9,000.

Cadorna's Second Offensive, Aug.–Sept.—The general
tion at the end of June gave cause for disappointment and
anxiety. Russia was going out of action. The prospect
Entente victory with which the year had opened was cl
removed to a distance, and war weariness was making itsel
creasingly felt in Italy. The question of Allied co-operatio
the Italian front was once more discussed but without result
was decided that Cadorna should attack alone in August.
army was strung to the highest point of tension, awaiting
order to attack, when Pope Benedict XV. launched his ap
for peace. Parts of the army were shaken, for the Pope, in
impartiality, placed the two contending groups of Powers on
same level; he held out the hope that Germany and Austria
ready to consider certain territorial questions " in a concilia
spirit," taking into account " the aspirations of the peopl
and to the long and weary struggle he attached the label " us
slaughter." Some of the commands were anxious about
men when the attack began, on the night of Aug. 18.

As a matter of fact, the troops put aside their questioni
and the blow dealt to the Austrians was a very heavy one.
Isonzo was crossed in many places between Tolmino and P
and the greater part of the Bainsizza plateau was occupied
troops of the II. Army, while the southern end of the Chia
vano valley was passed and a footing obtained on the wes
corner of the Ternova plateau. But a long sustained
brought no further success. Cadorna intended to renew his
sive at the end of Sept. by an attack against the Ter
plateau, in the hope of definitely turning the Gorizia posi
from the north and cutting the main line of communications
tween the Austrian right and left. But towards the mid
the month news came of increased enemy forces and a pro
counter-offensive at an early date, and Cadorna, after t
stock, decided he must stand on the defensive. The four we
fighting in Aug. and Sept. had cost him over 16
men—40,000 killed, 108,000 wounded and over 18,000 pris
The toll taken by sickness had also been very heavy. The
were at low strength and the new drafts had not been sat
torily absorbed. A breathing space was urgently needed.

British and French Reinforcements.—The Austro-Germa
cess against the II. Army, the retreat of the Italian forces t
Piave, and the resistance in the new positions are desc
in a separate article (*see* CAPORETTO, BATTLE OF). When
gravity of the situation became clear, England and France
with all possible speed. The order was given for six French
five British divisions to entrain for Italy, and Foch and Ro
son hastened to the spot. An Allied conference at Rapallo
on Nov. 4, and from its discussions were born the Supreme
Council, which was to meet, once a month if possible, at
sailles, and the Versailles Military Council, which was to si
manently. It was agreed that the failure of the Italian ar
to resist the enemy attack called for a change in the Italian
mand, and Cadorna was appointed Italian military repres
tive at Versailles. He was succeeded by Gen. Armando D
commander of the XXIII. Army Corps, and the function
Gen. Porro, who was also relieved of his post, were divided
tween Gen. Giardino, who had been Minister of War during
summer, and Gen. Badoglio, commander of the XXVII. Co

V. THE COLLAPSE OF AUSTRIA

After the failure of Krauss and Conrad to break through
the Venetian plain, the Italian front saw no action of first
importance for nearly six months. The time was well occu
in reorganisation, but there were several minor combats.
German divisions left Italy at the beginning of 1918, in antici
tion of the great offensive which was being prepared on

n front. Gen. Plumer, who commanded the British forces,
t Italy to take up his old command. He had acquired a
opularity, and his departure was much regretted. Fortu-
he had a worthy successor in the Earl of Cavan. When
rman offensive in March 1918 pierced the line of the Brit-
Army four French and two British divisions were immedi-
ithdrawn from Italy. They were followed by the Italian
ps under Gen. Albricci. This left Diaz with 55 divisions
lian and five Allied) as against 60 freshly organised Aus-
ivisions, who were preparing for an early offensive.

ian Attacks Fail.—The original proposal of the Austrian
I staff, now under Gen. Arz von Straussenburg, was to
drive on both sides of the Brenta. Conrad, now in com-
in the Trentino, pressed for an attack in the Asiago up-
Krauss disapproved of both plans and urged an offensive
r sides of the Lake of Garda. Conrad's plan was chosen,
roević urged that this offensive should be accompanied by
ght drive by his armies across the Piave. This was agreed
both army groups attacked on June 15. Conrad attacked
cheuchenstuel's XI. Army from south of Asiago to Monte
a, while the Archduke Joseph attacked the Montello and
von Wurm crossed the lower Piave. Conrad had 27
ns at his disposal, and Boroević 23.

ad's attack was a complete failure. It went well to begin
ut at the end of the day all hope of success had gone, and
evening of June 16 he was finally beaten. Boroević, on
er hand, made good headway on the first two days, for the
ke Joseph took half the Montello, and Werzel von Wurm
shed an extensive bridge-head opposite San Donà di
But at the end of a week's fighting the Austrians were
held, and the order was given to retire across the Piave.
ilure was complete, and very costly. Conrad lost 36,000
nd Boroević over 60,000. The defeat broke forever the
ve power of the Austro-Hungarian Empire. The conscious-
impending disaster grew and spread through the mon-
and the troops were greatly disheartened by failure.

l Italian Offensive.—It was felt in many quarters that
hould have followed up the victory by a strong counter-
but he was unwilling to attack in force without careful
ation. He had had heavy casualties, over 40,000 killed
unded and a very large number of prisoners, and he pre-
caution. Plans were drawn up and preparations made for
nsive between the Vallarsa and the Brenta in September.
in Sept. Diaz went to Paris to discuss the situation.
s still pre-occupied in regard to his reserves, and asked
strong American force should be sent to Italy. This was
l, and in spite of criticism he delayed his offensive still
, while working out secretly a more ambitious scheme
was to be adopted if the chance should offer.

he middle of Sept. the victorious advance from Salo-
gan, and the chance seemed to have come.' 'On Sept. 25 or-
ere issued for a rapid concentration of troops, artillery
chnical services in the sector chosen for the attack, which
longer the plateau, but the Middle Piave." (Gen. Diaz's
). The attack (*see* Vittorio Veneto, Battle of) was
ed exactly a year after the disaster of Caporetto, and it
ed the armies of Austria-Hungary. Seldom in history has
t a disaster been followed by so complete a triumph. Yet
nal overwhelming success of Vittorio Veneto was not
greatest victory. The way to it was paved by greater
the wonderful recovery on the new line after the great re-
and the successful resistance against the last Austrian of-
that was the first ray of light to break upon those gloomy
s when the fortune of the Allies seemed at their lowest.
n the sum of Italian achievements be judged by the issue
e battles which were crowned with victory.

clusion.—Italy's contribution to the long effort that led to
umph of the Allies can only be gauged by a review of the
ign as a whole, by a realisation of the extent to which she
l the resources of Austria-Hungary, and of the price which
d. Her dead totalled 600,000; and 570,000 men were per-
tly disabled for military service by wounds or disease. For two and a half years the Italian armies were a constant threat to the Habsburg Empire and kept employed a number of divisions that increased from 20 to 40 (in the summer of 1917). During the last three months of 1917 the number of enemy divisions rose to 55, and in 1918 practically the whole effective strength of Austria-Hungary was arrayed against Italy, the number of divisions at one time approaching 70.

The figures speak plainly, and Ludendorff, in an interview published in the spring of 1919, placed among the chief causes of the German defeat "the lack of support from Austria, gripped ever more tightly at the throat by Italy." Cadorna rightly claimed that Italy's "grip on Austria's throat from 1915, compelling her to immobilise against us ever increasing forces, constituted the most notable result of our war, though it was little apparent to the eyes of civilians. It contributed largely to the victory of the Allied arms and to our final triumph."

Bibliography.—Italian official papers, *Diario della Guerra d'Italia* (1915–7); W. K. McClure, *Italy's Part* (1918); L. Capello, *Note di Guerra, 1915–20* (1920); L. Cadorna, *La Guerra alla fronte Italiana, 1915–7* (1921); T. N. Page, *Italy and the World War* (1921). (*See* also World War: Bibliography.)

(W. K. McC.)

ITALIAN LITERATURE (*see* 14.897).—The development of Italian literature, including philosophy and history, during the period 1910–26 was remarkable. Carducci and Verga mark the end of the stage during which Italians were finding themselves intellectually and politically. Pascoli, Fogazzaro, and D'Annunzio really belong to the new period which crystallised in the years immediately preceding the World War, and came to fruition in the social, political and spiritual revolution which followed it. These writers, together with Benedetto Croce and Giovanni Gentile, in the field of aesthetics and philosophy were largely responsible for widening the scope of intellectual activity and culture, so that they ceased to be narrowly Italian and became European.

The works produced in the first 25 years of the present century, and more particularly during 1910–25, are characterised by a spirit of daring, restlessness and youth; by intellectual curiosity, love of novel experiments and experiences, and above all by self-analysis, which, in some cases, led to egocentricity and decadence. Such defects, however, were due to the ebullience of youth seeking vent for its new-found energy rather than to weariness and to the search after sensations for their own sake. Writers aimed at the discovery of new forms of expression to supersede the old; thus, the Futurists were of service to the new literature, if only by reason of their attempt to break down inherited and stereotyped traditions in prose and verse. Prose underwent a remarkable change. It became crisper and at the same time more flexible, while language attained the unity long advocated by Manzoni.

Fresh interest was awakened in the most varied forms of criticism, in history, culture and philosophy of all times and in all countries. In this eclectic tendency Renato Serra, a young and promising critic who was killed in the War, saw the beginnings of a new form of classicism. Interest in foreign literatures, including those of the East as well as of the West, produced a vast library of translations varying in quality, but on the whole showing a marked tendency towards treating translation as an art. With the exception of Adolfo de Bosis' remarkable version of *The Cenci* (1916) and *Epipsychidion*, Carlo Linati's *Tragedie Irlandesi di W.B. Yeats* (1914), Raffaello Piccoli's *Drammi Elisabettiani* (1914) and Mario Praz's magnificent tour de force represented by his anthology of verse renderings *Poeti Inglesi dell' Ottocento* (1925), English literature found less translators than German, French or Russian, and contemporary writers, apart from Kipling, Shaw, Galsworthy and Barrie, are only available in the original. This cosmopolitan spirit acted as a stimulus to the growth of the new national literature rather than to imitation of foreign models. A further significant evidence of this new energy are the changes which have taken place in the publishing world, where the output has increased and the technical production improved as a direct result of the increase of the reading public of all classes.

Fiction.—Although strictly belonging to the preceding generation, Alfredo Oriani (1852–1909) and Carlo Dossi (1847–1910) did not receive due recognition until after their deaths. The former was obsessed by ugliness and horrors and at the same time had an intense love of beauty. The impartiality and variety of outlook was in part the reason for his popularity among the younger generation. And Dossi, by his harsh and elliptical style and his original and vivid treatment of his subject matter, unfashionable in his own day, opened out new paths to his successors. G. Pietro Lucini (1867–1914) is also of interest on account of his reaction to the various decadent European schools and as a forerunner of the Futurists who claimed him as one of themselves. Of an entirely different character is the work of Alfredo Panzini (b.1863) one of Carducci's best pupils. Possessing a quiet sense of humour tinged with irony, his attitude towards life is detached but not aloof. In what are generally considered to be his masterpieces *Le Fiabe della Virtu* (1905), *La Lanterna di Diogene* (1909), *Santippe* (1914) and *Viaggio di un Povero Letterato* (1919), Panzini is acutely sensitive to all forms of beauty and to the conflict between them and the evils and uglinesses of the world. He has the temperament of a poet; his style is pure, simple, direct and moving, the prose counterpart of Carducci's best lyrics.

Adolfo Albertazzi (b. 1865) learned the art of the short story from the Italian masters of the past and the modern writers of foreign countries. Some of those collected in the *Diavolo nell' Ampolla* (1918) and in other volumes are among the best of the kind published in modern times. It is worthy of notice that most of the novelists, dramatists and critics of to-day—men and women—have tried their hand at the short story of the magazine type. Of these Luciano Zuccoli (b. 1870), Virgilio Brocchi (b. 1876), Antonio Beltramelli (b. 1880), Guido da Verona (b. 1881) and Ugo Ojetti (b. 1871) who is also a very highly esteemed art connoisseur, and among the women writers Clarice Tartufari (b. 1868), Sibilla Aleramo (b. 1879), Neera (1846–1916), Amalia Guglielminetti (b. 1885) and Carola Prosperi (b. 1883) are the most popular. Generally speaking, most of these works are of value mainly as documents of social history rather than as literature.

The New School.—The younger novelists and story writers, though very numerous, shared a tendency to be egotistic, self-analytical and autobiographical, and cultivated a lyrical prose style. The lack of any national literary centre comparable with Paris or London has created regional groups united by geographical convenience, the individual members of which continued to follow, in part at least, the literary and intellectual tradition of their several provinces which, however, amounted to little more than impressionistic landscape-painting in words, as in the case of Carlo Linati, who in the finely written *Sulle Orme di Renzo* (1919) has given a poetical interpretation of the Lombard spirit as revealed in the countryside. The War practically destroyed narrow provincialism and successfully fused its best characteristics into a wider nationalism.

The great national and international reputation acquired by Croce and Gentile, both Neapolitans, the influence exerted on criticism by their review *La Critica*, founded in 1903, the fact that a considerable proportion of the best-known novelists and dramatists of the past 50 years (Capuana, Verga, Serao, Bracco, Pirandello) have been Southerners and, lastly, historical, geographical and racial conditions, have all contributed to produce a strong clan-feeling different from that of other regional groups. Of these the most important was perhaps the Florentine called "Gruppo della Voce," from the periodical of that name founded by Giovanni Papini and Giuseppe Prezzolini about 1909, itself the off-spring of an earlier review—*La Leonardo* (1903–7), which gave a great impulse to philosophical studies. Both periodicals had for their programme the revaluation of old values and the diffusion of new ideas in literature, art and philosophy. Scarcely one of the younger writers of any note did not contribute to one or the other of these reviews, which, in many cases, were the first to discover them. Not all of the contributors were of equal merit or free from any defects, but they showed the presence of a new
spirit and vitality much needed, and exerted an influence
reaching as it was important and often superior to their in
ual achievements. Papini (b. 1881), however, is the onl
who is at all known outside Italy mainly on account of the
advertised *Storia di Cristo* (1921), a work which has added
to a reputation really founded upon his autobiography, *Un*
Finito (1912), *Cento Pagine di Poesia* (1915), and the bril
provocative, and at times superficial critical essays *Stron*
(1916), Papini's encyclopaedic mind, ever in quest of new k
edge and intellectual experience, admirably typifies the
and virtues of the historical movement which came to an e
the outbreak of the World War. Papini, as the imposing bi
raphy of his works shows, has passed through many p
Pragmatism, Futurism and later Neo-Catholicism, always
serving a style, essentially Tuscan in character, at times
quial to the point of vulgarity, yet rich, vivid, lucid with a
tendency to rhetoric. Giuseppe Prezzolini also wrote some
lent critical essays, mostly on his contemporaries, but later
doned literature and philosophy for politics. Of the
principal contributors to *La Voce*, Scipio Slataper (1888–19
Triestino killed in the War, is best known for his notew
lyrical autobiography in prose, *Il Mio Carso* (1912) and a
gestive study on Ibsen published posthumously (1916).

Ardengo Soffici (b. 1879) is one of the most remarkable o
group. His best writings are a fragment of a novel, *Lemm*
Boreo (1912), two autobiographical journals, *Giornale di*
(1915) and *Kobilek, Giornale di Guerra* (1918), and the
criticism in *Il Caso Medardo Rosso e l'Impressionismo* (
and *Scoperte e Massacri* (1919). Soffici as a writer is both thou
ful and forceful and uses language impressionistically, freque
introducing exact and unexpected similes. The latter two w
did much to rouse the artistic youth of Italy to an intelli
appreciation of the significance of modern art movement
their insistence upon the necessity for the art-critic to be an a
(Soffici himself was a painter of some repute) and thorou
conversant with the technique of painting while possessing
capacity for feeling the values of form, colour and composi
Renato Serra, killed at the Front in 1915, was one of the
promising of the younger writers, who is best known for hi
markable psychological document, the *Esame di Coscienza*
Letterato, published in 1916, in which he examines the atti
of an artist and an intellectual towards the War with great
ness. The fact that some of it is mainly now of historical int
does not detract from its high literary value, which makes it
D'Annunzio's *La Leda senza Cigno* (1916–8) two of the very
works of art inspired in Italy by the War. Several other wri
such as Federigo Tozzi (1883–1920), Ferdinando Paolieri
1878), Bruno Cicognani (b. 1879) and Piero Jahier (b.
also have points of contact, in spirit and in style, with the
ence group. Several journalistic and literary coteries were
in Rome, such as that of *La Ronda* (1919), a short-lived but
periodical, edited by Emilio Cecchi (b. 1884). Among the
tributors were Antonio Baldini (b. 1889) and Riccardo Bac
(b. 1891). Since the advent of the Fascist Govt., however, R
is rapidly developing into the centre of Italian culture.

The Futurists.—It was very natural that the Futurist m
ment should have been started in Milan, since that city has al
taken the lead in any new intellectual movement, and in
present case, as the most modern and "mechanical" city
Italy, was peculiarly adapted to be its headquarters. It is
significant that after the World War it moved to Rome
an entirely new body of supporters, though still under the lea
ship of its founder, F. T. Marinetti (b. 1878). In the first Fu
ist manifesto published in 1909 in the Paris paper
Marinetti announced the new aesthetic of the machine, con
ered as symbol, source and teacher of a new artistic sensibil
and preached the beauty of speed. It was rapidly followed by
"Technical Manifesto of Futurist Literature" (1912), w
decreed that syntax should be replaced by "wireless imaginat
and words at liberty," and by others dealing with the thea
art, architecture and life. Apart from its sensationalism
self-advertisement and its principles of destructiveness, Futur

he less acted as an irritant and forced writers, and particu- oets, to react against stagnation and to define poetry anew, e difference between it and prose. Of the many books pub- by the first generation of Futurists some, like Filippo aso Marinetti's (b. 1878) extraordinary novel *Mafarka le ste* (1910), *Le Roi Bombance* (1910), a play, written origi- n French, and *Zang-Tumb-Tumb* or *The Siege of Adrianople* —an experiment in "free-words"—are among the curios- f literature. On the other hand, Palazzeschi's (b. 1885) ully grotesque tale, *Il Codice di Perela* (1911), and the vol- f free verse *L'Incendiario* (1910), Luciano Folgore's (b. *Canto dei Motori Versi liberi* (1912) and a few of Mari- earlier poems practically sum up the best literary ts of the movement.

Poets.—Carducci, Pascoli and D'Annunzio have had a number of followers and imitators, but either through f inspiration and technical ability or because fiction offered e profitable market none have produced anything of defi- nportance excepting Salvatore di Giacomo (b. 1860). He ritten some of the finest dialect poetry in Italian literature ed, like most of his other work, by the life of the Neapolitan ace. The poignant "Tarantella scura," the dramatic son- quence "A San Francisco," and the very beautiful song chie de suonno," republished in *Poesie* (1907), possess the rsal quality of true poetry, which is sometimes found also ew of Pascarella's and Trilussa's poems in Roman dialect. e others, Guido Gozzano (1883–1916), Marino Moretti 85), Enrico Pea (b. 1881), Amalia Guglielminetti (b. 1889) evidence at first of technical skill and lyrical vein which has degenerated into affectation and mannerisms. As the very anthology, *Poeti d'Oggi: 1900–1920* (1920), edited by i and Pancrazi paradoxically yet conclusively proves, those rite poetry to-day choose to do so by using prose instead of for their medium. In this sense many of the writers dealt above may justly be considered poets.

Drama.—There have been since D'Annunzio some suc- l attempts at poetic drama such as Benelli's historical lies *Maschera di Bruto* (1909) and *Cena delle Beffe* (1909), n in effective blank verse, Ettore Moschino's *Tristano e* (1910), Enrico Butti's fanciful *Castello del Sogno* (1910), E. L. Morselli's (1882–1921) *Orione* (1910) and *Glauco*). The latter of these are written in lyrical prose and are by e best productions of this type of drama. Some of the other rights like Dario Nicodemi have portrayed, with varying y, society life, according to the formula derived from the h dramatists. Others, following the realistic tradition of ana, Verga and Giacinto Gallina, have written light come- r dramas in dialect or local vernacular. Many of these are charming and well constructed, especially the Florentine *L'Acqua Cheta* (1908) by Augusto Novelli and *I' Pateracchio*) by F. Paolieri. Some notable plays of the grand-guignol have been written in Neapolitan dialect by Salvatore di mo, *Assunta Spina* and *O' Mese Mariano* (1910), Ernesto lo and Roberto Bracco, and, in Sicilian, by Pirandello à, 1917). The fame of Roberto Bracco as a dramatist however, on *Piccola Fonte* (1905) and *Piccolo Santo* (1912), latter being one of the masterpieces of modern Italian atic literature. Most of his plays present psychological and ual tragedies with hardly any external action, and are pro- cedly feminist in sympathies. Technically, they are remark- for austere simplicity of construction and lack of any nal appeal to the emotions.

e essential difference between Bracco and Pirandello is that s intellectual, the other cerebral. In Pirandello (*q.v.*) the atic form is a natural step from the novel and the short es, in which the characters are, *dramatis personae* always talk- mong themselves but unable to make each understood to ther, until they begin to doubt whether they really exist and ot shadowy forms conjured up by the imagination of those g whom they live and by which they are bound. The dra- c situations arise out of the contrast between what the in- ual is, what he conceives himself to be and what others think him. What is reality, if indeed there be such a thing, and what is unreality? Is there a dividing line between madness and sanity? Can life have a meaning outside the ever-changing, and arbitrary value attached to it by an individual? These are the problems which constantly reappear in his fiction and in his plays—the logical, if extreme, outcome of the introspective and psycho-analytical tendencies of his period. Pirandello has revealed his sense of theatrical technique but his situations are the result of logic rather than of ingenuity. He is responsible for introducing a new prose style, clear-cut, dry and nervous on the stage, a considerable achievement which may have far-reaching effects on his successors.

Next to Pirandello, Rosso di San Secondo (b. 1887), a Sicilian known also for his short stories, and Federico Valerio Ratti, author of a remarkable tragedy on Judas Iscariot, are the most promising dramatists. The work of the former has as its dominant motif the contrast of Life governed by discipline as opposed to impulse, symbolised respectively by the North and the South. The characters of *Marionette, che Passione!* (1918), *La Bella Addormentata* (1919), which he describes as a "painted adventure," and *Lazzerina fra i Coltelli*, his most recent and abstract work, are allegorical and poetical, and achieve a certain original and dramatic effectiveness. Luigi Chiarelli's play, *La Maschera e il Volto* (1917), presents in light comedy form many of Pirandello's ideas. Its success, perhaps, was due to the label of "grotesque" which he gave it and subsequently adopted loosely to denote plays of a similar genre such as Luigi Antonelli's *L'Uomo che incontro se stesso* (1919), Fausto Maria Martini's *Fiore sotto gli Occhi* (1922), and Cantoni-Gibertini's *Fantoccio*; other experiments were encouraged more by the desire to appear original than by dramatic ability.

Criticism.—Towards the beginning of the 20th century critical theories underwent a considerable change. This was due to the general reaction against positivism and materialism in favour of idealism, which found its most eminent supporter in Benedetto Croce (*q.v.*) Many have applied these principles, and even those who disagree with them have felt their influence. Croce has further made some notable contributions to the history of Naples, not counting those to philosophy. In this respect Gentile shares with Croce the right to be treated as one of the most important philosophical thinkers of the present day and as a critic. Among the older idealist—though not Crocean—critics, Arturo Farinelli, author of *Il Romanticismo in Germania* (1911), *Michelangelo e Dante* (1918), and several other valuable works; Cesare de Lollis, and Alfredo Galletti, who succeeded Pascoli in the chair of Italian literature at the University of Bologna and to whom he had devoted a very brilliant and profound critical study, are the most important.

To these three university professors all of whom combined wideness of literary sympathies and knowledge with uncommon critical abilities, should be added the name of a younger man—G. Toffanin—who at the time of writing has already given several proofs of originality, talent and scholarship of a very high order. The work of the militant critics is represented among other works by Thovez's essays *Il Pastore il Gregge e la Zampogna* (1910) and *Mimi dei Moderno* (1919); by Renato Serra's *Scritti Critici* (1910), and *Le Lettere* (1914), a brilliant survey of contemporary literature and its characteristics, as well as by the critical writings of Papini and G. A. Borgese (b. 1882) who, besides the *Storia della Critica Romantica in Italia* (1903) has also written *Rubè* (1921) an interesting autobiographical novel. In some ways their views are often paradoxical and exaggerated, but they possess, however, the frank enthusiasm and charm of youth added to knowledge and aesthetic appreciation.

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(A. DEL R.)

ITALO-TURKISH WAR.—Following the diplomatic discussions which took place between Rome and Constantinople during the summer of 1911, an ultimatum from Italy was delivered to the Porte on Sept. 28, demanding Turkey's consent to a military occupation of Tripolitania and Cyrenaica. A period of 24 hours was set by the ultimatum, and as the Turkish reply did not meet the Italian demands a state of war was declared as from 2:30 P.M. on Sept. 29.

Italian Naval Activity.—Military action was slow to succeed the formal declaration of war, and it was not till Oct. 11 that the first transports reached Tripoli. Meanwhile the Italian navy had been busy. On Sept. 28 a squadron appeared off Tripoli, and notice was given that if the town were not surrendered it would be bombarded. The obsolete fortifications were bombarded for two hours on Oct. 3, after the Turkish authorities had declined to surrender the town. By next day, the Turkish garrison, acting upon orders received from Constantinople, had retired into the sandy plains, and on Oct. 5 a force of 1,600 sailors was disembarked.

Meanwhile hostilities had been begun elsewhere. On Sept. 29 and 30 Italian destroyers under the command of the Duke of the Abruzzi sank the Turkish torpedo-boats off Prevesa in Epirus and on Oct. 1 Admiral Aubry left Augusta to go in search of the Turkish fleet, which the declaration of war had found at Beirut. But the orders given him were suddenly countermanded, and instead of steaming to the Aegean in order to intercept the Turks, he was sent to Tobruk, which was occupied by a detachment of sailors on Oct. 4.

The renunciation of the attempt to cut off the Turkish fleet was inspired by political reasons. The Italian Govt. believed that the Porte would soon realise that it was impossible to defend the Tripolitan provinces, and would be willing to enter into some arrangement that would satisfy Italian aspirations and save the face of Turkey. Another reason was the desirability of localising the conflict. Other European Powers were not willing that hostilities should be extended, and the other members of the Triple Alliance were particularly energetic in their disapproval.

Italian Expeditionary Force.—A week elapsed between the landing of the sailors at Tripoli and the arrival of the expeditionary force, and it was not till Oct. 20 that all the equipment had been put on shore. The force consisted of some 9,000 rifles with a few field and mountain batteries and two squadrons of cavalry. There was very little transport, for it had not been anticipated that the Turks would retreat towards the interior and receive support from the native tribesmen. That Neshat Bey, the Turkish commander in Tripoli, did receive this support was largely due to two men—Ferhat Bey, deputy for Tripoli and Suleiman el Baruni, a Berber from Fessato, who was deputy for the Jebel region.

Meanwhile Homs, Derna and Benghazi had been occupied. There was some resistance at each place, especially at Benghazi, but the first fighting of any importance was a sudden attack on Oct. 23 upon the Italian lines at Shara Shat in the Tripoli oasis, backed by a rising behind the lines. Two companies of Bersaglieri were cut to pieces, and the rest of the regiment were hard put to it to hold their own. Further attacks led to a withdrawal of the line, and to the clearing of the oasis behind the trenches.

Large reinforcements were sent from Italy, and by the fourth week in Nov. Gen. Caneva, who was in command of the expedition, had about 25,000 rifles and 16 batteries. He took the offensive, and in two actions cleared the oasis and sent the Turks and their tribesmen allies packing. Turkish headquarters were established at Aziziya, some 30 m. south of Tripoli.

Political Aspect.—At the beginning of Nov. the Italian Govt. had considered the possibility of extending the theatre of war, on the sea at least, in the hope of inducing Turkey to give up the struggle. Austro-Hungary intervened, backed by Germany, invoking Article VII. of the Triple Alliance. Italy's action being limited in this way, it was necessary to solve the problem directly, but the task was more difficult than it need have been owing to the limitations laid upon Gen. Caneva by the Italian Government. Gen. Caneva's orders appear to have been that he must not risk reverses or suffer heavy loss. I circumstances, an expedition in pursuit of the Turks and mobile allies seemed hardly practical.

In any event, months went by without any action of im tance in Tripolitania. In Cyrenaica there was one fight Benghazi, when a force of Arabs who had come near the were attacked and severely punished. Derna was closely throughout the winter, and Enver Bey, who had succeede reaching Cyrenaica towards the end of the year, organise formidable resistance, securing relative unity among the tri men, and a willingness to co-operate with the Turks, which never before existed.

Italian Offensive Renewed.—In April, the long spell of i tion in the western province came to an end, and from that onward the resistance of the Turks and Arabs was gradu broken by a series of operations at various points.

In April, also, Italian warships appeared off the entranc the Dardanelles. They were fired on by the Turkish forts their answer drew a fresh and very energetic protest from Vie The northern Aegean was left alone by the Italians hencefo but in May the island of Rhodes and 12 small islands of Sporades (subsequently famous as the Dodecanese) were c pied by Italy. During the summer there were a number of cessful actions in Tripolitania, and peace negotiations begun at Ouchy in August. Progress was very slow, and it not until Oct. 15, when two important victories had been by the Italians, at Derna and Sidi Bilal (near Zanzur) that Treaty of Ouchy was signed.

Conclusions.—The conduct of the Tripoli campaign was pre diced, first, by the failure of the Italian Govt. to judge the sit tion correctly, and secondly, by the limitations which were upon the military command. It was not possible at once launch a desert expedition, and the difficulties of an advance the Jebel, through country largely waterless, may be said justify the adoption of a less ambitious plan. What is difficu understand is the practical veto upon action of any kind, w immobilised large forces from Dec. till April and dela the carrying out of the policy which eventually put an end hostilities, the policy of extending the area of operations a striking a blow whenever the chance offered.

The operations of the summer changed the situation, but It ian prestige was not wholly restored by the later successes, o the subsequent actions against the tribesmen who did not down their arms when the treaty was signed. The policy of t Government bore heavily upon the army, which came in much unfair criticism and increased the difficulties of those w undertook the administration of the country after the pea The troubles which were to come with the outbreak of the Wo War may be traced in part at least to the hesitations and unce tainties of the six months following the landing.

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(W. K. Mc C.)

ITALY (*see* 15.1).—A country of Southern Europe and a mem ber of the League of Nations. Because of additions to th territory of Italy under the peace treaties (*see* St. Germa Treaty of and Trianon, Treaty of) the area of the countr was increased by 9,005 sq. m. to a total of 119,624 square mile The census of 1921 gave a total population of 38,755,576. Th population of the new territories at the date of the census wa Trento Venezia Tridentina 641,747; Fiume, Pola, Trieste an Zara (together constituting Venezia Giulia) 728,544; making total access of population of 1,370,291.

I. POLITICAL HISTORY

The Giolitti Government.—On the resignation of the Luzza Cabinet (March 18 1911), Sig. Giolitti formed a governme During the previous few years relations with Turkey had b come strained owing to the restrictions placed by the Porte o Italian enterprise in Tripoli, the only part of North Africa whe n expansion was still possible. At the same time the policy rmany aroused the suspicion that she was contemplating n in that province. The Nationalist movement, created at lorence Congress of 1910, and directed towards awakening ountry to the necessity of a more vigorous foreign policy, ated the occupation of Tripoli. The success was such that ti himself, anxious as he was to avoid foreign complica- could not afford to disregard it.

er a series of diplomatic incidents, an ultimatum was pre- d to Turkey on Sept. 28 1911, and no satisfactory answer obtained, war was declared on the 29th. Except for the lists, public opinion strongly supported the government, ding the war not merely as a colonial enterprise, but as a tic reaction against the old pusillanimous policy and the intrigues of Parliament. On Nov. 5 Italian sovereignty xtended to Tripolitania and Cyrenaica. Foreign Powers not friendly to Italy's African policy, and while Austria d a veto on the extension of the campaign to the Balkans, a s diplomatic incident arose with France over the searching talian cruisers of the French steamers "Carthage" and nouba," suspected of carrying contraband. Although the was satisfactorily settled at The Hague, it did not im- e Italo-French relations. On Oct. 15 1912 the peace pre- aries were signed at Ouchy, and the treaty on the 18th, the n retaining only spiritual authority over the inhabitants e annexed territories, Italy remaining in occupation of les and the Dodecanese until Turkey had withdrawn all roops from Libya and fulfilled her other treaty undertakings. total cost of the campaign had been 458 million lire. Fight- owever, did not end immediately, as the Arabs, secretly orted by Turkey, continued to resist in the interior.

g. Giolitti's proposals for the extension of the franchise ng the electorate from three to eight million voters), pay- of members and a government monopoly of life insurance voted without much opposition, as Parliament did not wish nbarrass the Cabinet during the War. At the Socialist con- of Reggio Emilia (June 1912) a group of leaders, including ida Bissolati and Ivanoe Bonomi, who approved of the rnment's African policy, were expelled from the party and ed a new group called the Reformist Socialists, prepared to borate with the Constitutional parties. The majority styled thenceforth the "Official" Socialist party. In the field of r there were strikes at the Fiat works in Turin, and among gricultural workers of Ferrara and a general strike at Milan e summer of 1913.

uring the Balkan Wars of 1912–3 Italy and Austria had agreed e creation of an independent Albanian state, thereby ex- ing the Serbs from Durazzo and the Greeks from Valona. ite of this settlement and of the Marquis di San Giuliano's mpts to arrive at a friendly understanding with Austria, ions were strained to breaking-point by Austria's treatment r Italian-speaking subjects and the menaces of the Austrian ary party against Italy.

t the elections of Oct. 26–Nov. 2 1913, under the extended chise, the Socialist group was increased to 79. For the first a Catholic party presented itself to the polls, the Pope hav- withdrawn the *non expedit*, and 33 Catholics were returned, e a number of Liberals and Democrats owed their success to olic support. Sig. Giolitti's position was somewhat shaken, although the Socialists were ready to give him tacit support xchange for concessions to their co-operative societies and ain measures of a demagogic character, disagreement among wn followers over the question of Catholic support, and the atened railway strike were likely to cause trouble. On March 914 he resigned and was succeeded by Antonio Salandra, a t-wing Liberal of high standing. San Giuliano remained at Foreign Office, but Gen. Spingardi was succeeded as War ister by Gen. Grandi. The revolutionary *Sindacato ferro-* now demanded a general increase of wages, but, owing to cial difficulties, the government could offer an increase to the lowest categories; the *Sindacato* threatened a strike, eventually gave way.

On the national festival of the Statuto (June 7 1914) riots broke out at Ancona because the authorities had forbidden the holding of an anti-militarist meeting. A general strike ensued in the town and the trouble spread to other parts of the Marche, to Romagna, and most of the larger cities. The movement was of a mainly revolutionary character; its leader was the Anarchist Enrico Malatesta, and Benito Mussolini (*q.v.*), editor of the *Avanti*, played a prominent part in it. For a week many towns were under mob rule, until a popular reaction led by the Nationalists cleared the streets of the seditious elements and the troops and police restored order. Sig. Salandra was criticised for his lack of energy in dealing with the outbreak, while the Socialists attacked him for his "reactionary" methods; a group of Giolittian deputies, headed by Orlando and Schanzer, tried to bring about his fall, but he secured a vote of confidence.

THE WORLD WAR AND THE PEACE

The Austrian ultimatum was presented to Serbia on July 23 1914. Italy co-operated with Great Britain in trying to avert a catastrophe, and public opinion, although realising that if a *casus foederis* under the terms of the Triple Alliance were to arise, Italy would be bound to stand by her Allies, was hostile to the idea of siding with Austria. General relief was caused by Italy's declaration of neutrality on Aug. 3 which was based on (1) Austria's failure to co-ordinate with Italy before taking action, (2) the fact that Italy had not been given time to act in favour of peace, or to make adequate military preparations and (3) the fact that Italy was not bound by the terms of the Alliance to take part in an aggressive policy. It was afterwards announced that no *casus foederis* could arise for Italy in a conflict in which Great Britain was involved.[1]

Neutrality declared, military preparations began. The reorganisation and re-arming of the whole army was largely the work of the new Chief of the General Staff, Gen. Luigi Cadorna (*q.v.*). The question now was whether Italy should remain neutral to the end of the War. The Triplicists, although fairly numerous in Conservative and diplomatic circles, and in a part of the army, hardly went so far as to advocate intervention on the side of the Central Powers, for the invasion of Belgium had created a very unfavourable impression, but they advocated neutrality. The Catholics were neutralists from dislike of "atheist" France and Orthodox Russia and from sympathy with Catholic Austria. The "Official" Socialists were neutralists because they opposed all war except class-war, but ended by openly espousing the Austro-German cause. The Nationalists, Irredentists and some Liberals, realising that this was the last chance for completing Italian unity and affirming Italy's position as a Great Power, favoured intervention, while the Democrats, Freemasons, Republicans and Reformist Socialists were interventionists from sympathy with France. Mussolini's little group of Syndicalists desired intervention, partly for the same reason as the Nationalists, but also in the hope that war would promote social changes. Mussolini resigned the editorship of the *Avanti!* and founded a new paper, *Il Popolo d'Italia*, which supported intervention.

On Oct. 9 1914 Gen. Grandi resigned on account of a disagreement with Gen. Cadorna, and was succeeded by Gen. Zupelli. A week later the Marquis di San Giuliano died, and the Prime Minister temporarily took over the Foreign Office. On Oct. 31 the Treasury Minister Rubini resigned on a question concerning the supply of funds for the army, and the Cabinet followed suit. But Sig. Salandra himself reconstructed it by Nov. 5, and selected Baron Sonnino as Foreign Minister. Owing to the troubles in Albania, the departure of Prince William of Wied and the Greek invasion of the southern districts, Italy occupied the islet of Saseno on Oct. 31, and on Dec. 26 the town and harbour of Valona. 1915 began with a serious earthquake in the Abruzzi (Jan. 13), which caused the death of 30,000 people.

The Treaty of London.—Meanwhile the interventionist tendency grew stronger. Both Salandra and Sonnino were determined not to let the War end without trying to acquire at least a part of the Italian districts of Austria, and to secure a rectification of the frontiers of 1866 which left Italy open to invasion. In Dec. 1914 Italy had reminded Austria that the invasion of Serbia, by tending to destroy the balance of power in the Balkans, gave Italy a right to compensation under the terms of Article 7 of the Alliance as renewed in 1887. Austria began by rejecting the claim, then suggested compensation at the expense of France, and finally offered a part of the Trentino to be ceded after the War, but Sonnino insisted on immediate cession, and to this Austria at last agreed. Sonnino demanded all the Trentino, the Isonzo valley, some of the Dalmatian islands, a free hand in Albania and the formation of Trieste and Northwestern Istria into an independent state, Italy in return to remain neutral to the end of the War. As Austria continued to give evasive replies, Italy opened negotiations with the Entente. On April 26 1915 the Treaty of London was concluded between Italy, Britain, France and Russia, to be completed by naval and military conventions. Italy undertook to intervene, and was promised the Trentino and Upper Adige valley to the Brenner pass, Trieste, Gorizia-Gradisca, Istria and the Istrian islands, Cherso and Lussin, Dalmatia as far as Cape Planka, Valona, full possession of Rhodes and the Dodecanese and in Asia Minor a zone of influence and eventually a share in its partition. If an independent Albania were created, it would be under Italian control, while Italy would not oppose the cession of the northern and southern districts to Serbia and Greece if the other signator so desired.

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[1] See EUROPE. The treaty of 1882 stated that "the treaty was not in any case directed against England."

The poet D'Annunzio by his fiery speeches, and Mussolini by his articles, largely influenced public opinion in favour of intervention. On May 3 1915 Italy denounced the alliance with Austria, but Prince von Bülow made a last effort to secure Italian neutrality through Giolitti. That statesman believed in the necessity for neutrality, as he had no confidence in Italy's powers of resistance, and, although informed by Salandra of Italy's engagements with the Entente, he continued his neutralist activities in collaboration with von Bülow. Salandra, knowing that if Giolitti declared his opposition, the Cabinet must fall, resigned on May 13. It seemed as though Giolitti's triumph were assured, but the voice of the country then made itself heard. Huge popular demonstrations in favour of Salandra and intervention were made all over Italy, and the King refused Salandra's resignation; Austria's final offer, no improvement on the last, communicated by Von Bülow to Giolitti before being communicated to the government, was rejected.

Italy Enters the War.—On May 20 1915 the Chamber and the Senate granted the Government full powers. Neutralism and Germanophilism had apparently disappeared, except among the Official Socialists. On the 23rd the general mobilisation was ordered, and on the 24th war against Austria was declared, while diplomatic relations with Germany were broken off. Owing to the persecution of Italian subjects in Turkey and Turkish assistance to the rebels in Libya, where Italian occupation was reduced to Tripoli and Homs and a port of Cyrenaica, War was declared against the Porte on Aug. 21, and against Bulgaria in September. On Dec. 1 Baron Sonnino adhered to the London Agreement, undertaking not to conclude a separate peace. An expeditionary force was sent to Albania, where it saved the remnants of the Serbian Army driven from its own country.

The initial successes of the Italian offensive were satisfactory, but did not lead to definite results. The subsequent defeats sustained in the Trentino and on the Asiago plateau (May 1916) shook the Cabinet's position, and on June 10 Sig. Salandra resigned. The Giolittians regarded this as a victory of theirs, but the new Cabinet was in no wise Giolittian. Sig. Paolo Boselli, the veteran statesman, respected by all parties, formed a Cabinet in which all shades of opinion, except the Socialists and Neutralists, were represented. Sonnino remained at the Foreign Office, while Orlando was transferred from the Ministry of Justice to that of the Interior.

The Austrian Trentino offensive had delayed Gen. Cadorna's attack on Gorizia, but this was now resumed, and on Aug. 4 1916 after 11 days' desperate fighting, the fortress fell and public confidence was thereby restored. That same month an expeditionary force was sent to Macedonia where it played a disti guished part in the Eastern operations. On Aug. 27 Italy c clared war on Germany, owing to the assistance she had afford to Austria and the seizure of Italian property by the Imper Government. In April 1917 the British, Italian and French P miers concluded a convention at St. Jean de Maurienne where it was agreed that in a future partition of Anatolia the Smyr area was to be assigned to Italy.

During the operations of 1916 and 1917 the Italians achiev some important successes, and above all pinned down Austria best troops, preventing her from sending reinforcements to t West. But the protracted struggle, the fearful losses, the co lapse of Russia, and the grave privations at home had acce tuated the feeling of depression in Italy, to which enemy an neutralist propaganda contributed. The Socialists fomented th discontent. Claudio Treves's phrase, "next Winter not a ma in the trenches," the German peace offensive, the Pope's all sion to "the useless carnage" and the defeatist campaign of th Giolittians began to affect public opinion and the war-wear troops. There were revolutionary riots in Turin (Aug. 191 and signs of a diminished military spirit among certain units the front. Gen. Cadorna had repeatedly warned the go ernment, and particularly the Minister of the Interior, Orland but no attention was paid to him. This state of affairs and ce tain military errors of Generals Cadorna, Capello, Badoglio an others resulted in the Caporetto disaster (Oct. 23 1917).

The Recovery.—After a defeat of these proportions it appeare impossible that the army and people could recover. But by No 22 the army had reconstituted its front on the Asiago-Grappa Piave line, and the enemy's advance was definitely held up British and French forces hurried to assist Italy, but did no come into action till December. Cadorna was relieved of h command and succeeded by Gen. Diaz. At the Rapallo inte Allied conference on Nov. 4 the Military Committee of Versaill was formed. In consequence of the Caporetto disaster the Bosel Cabinet resigned (Oct. 26), and on the 30th Sig. Orlando su ceeded, he himself becoming Prime Minister, Sonnino remaine at the Foreign Office and Nitti became Treasury Minister. Th necessity for relieving the refugees from the invaded area was serious problem, but it was efficiently handled, and the sight o the refugees helped to strengthen the spirit of resistance. Th army was rapidly reorganised and the losses in material mad good through the enterprise of the Italian manufacturers and th technical genius of Gen. Dalollio, Minister of Munitions.

On Jan. 8 1918 President Wilson published his famous Four teen Points. Those referring to Italy—"the rectification of th Italian frontiers on clearly recognised national lines," and "au tonomy" for the peoples of Austria-Hungary—were of a natur to raise anxiety as to his intentions. From April 8 to 10 the con gress of nationalities oppressed by Austria met in Rome, an although organised by a private committee, its delegates wer received by Orlando, to whom they presented the so-called "Pac of Rome," this should have been an earnest of mutual good-wil between Italy and the Yugoslavs, but it had no binding forc and compromised the solution of the territorial problems involved. Meanwhile the Yugoslavs were conducting a propa ganda to induce Britain and France to rescind the objectionabl clauses of the London Treaty, and even proposed that, shoul Italy remain obdurate, the Allies and America should cut of her supplies of food and fuel, a request which was rejected. Th economic situation was becoming worse, but Italy submitte to privations greater than those of any other Allied country. The shipping losses were serious, the bread ration was reduced to 250 grammes per head per day, meat was sold only twice a week, and many goods were unobtainable.

In June 1918 the Austrians launched a powerful new offensive on the Asiago-Piave front, but after a few initial successes, were driven back with heavy losses. The Italian contingent in Mace donia, commanded by Gen. Mombelli, contributed mate rially to the victory in the Balkans (Sept. 15–29). On Oct 24 Diaz launched his attack on the Austrians from Asiago to the sea, and by Nov. 3 "what had been one of the most powerful

; in the world," as the victory communiqué stated, " was
lated." Some 600,000 prisoners, 7,000 guns and immense
ities of material were captured. The same day at Villa
near Padua the armistice between the Italian and
-Hungarian armies was signed, the enemy under-
to evacuate all the territories assigned to Italy by the
n Treaty. The Armistice came into force on Nov. 4, fol-
a week later by that with Germany; to the latter's col-
the Italian victory had contributed, as it had opened the
nto the heart of Germany. The whole area within the Ar-
e line was rapidly occupied, as well as certain points be-
t for the maintenance of order. Italy's losses had amounted
l over 600,000 killed and a million seriously wounded, in-
g 220,000 permanently disabled. The knowledge of these
created a deep impression in Italy, but it was felt that they
ot adequately appreciated in Allied countries.

Peace Conference.—On Feb. 7 1919 the Italian Govt. pre-
a memorandum to the Peace Conference, embodying and
ing its territorial claims, which corresponded to those
l upon in London, but Fiume was also mentioned, because
t. 31 1918 the National Council of that town had, in the
of the Italian majority, applied for annexation to Italy.
were no difficulties about the Trentino as its population
wholly Italian. The Alto Adige contained a German-
ing population, but it would have been difficult to devise a
ctory frontier south of the Brenner. In the Venezia Giulia
half the population was Italian, but many of the Slavs
een recently imported by Austria to swell the non-Italian
tage; of the natives the majority were Italian, including
more civilised inhabitants. In Dalmatia the great major-
s Slav, but the civilisation and traditions of the province
Italian. Italian public opinion was unanimous in desiring
sfactory frontier and the protection of the *Italianità* of the
n communities east of the Adriatic, but was divided as to
etails of the settlement. The Nationalists demanded the
y of London territories plus Fiume. The *rinunciatari* were
to give up Dalmatia, part of Istria and the Trieste hinter-
because they wanted to conciliate the Yugoslavs and disre-
d strategic necessities, but demanded Fiume. Sig. Bissolati,
ter without portfolio, wished even to renounce the
Adige. In the Italian Peace Delegation too, opinion was
d; while Sonnino stuck to the Treaty of London and did
sist on Fiume, Orlando demanded the latter, but was pre-
to compromise on Dalmatia. The Yugoslav counter-
s extended to the old Italo-Austrian frontier and even
d it, and this attitude aroused much indignation in Italy,
ore so as, until the very eve of Austria's collapse, the Croats
Slovenes had behaved as faithful subjects of the Dual
rchy and had fought in the war against Italy, whereas
hey made their claims posing as Allies, and were treated as
by British, French and American statesmen.

e Government had many internal difficulties to contend
The army could not yet be demobilised owing to the un-
d conditions on the frontiers and the necessity for keeping
s in Albania, Bulgaria, etc. In Italy itself the Socialists and
munists, now that the war régime and the censorship were
ed, took advantage of the general weariness of the people to
nt revolutionary agitation, hoping to emulate their com-
in Russia. The financial situation was serious and Sig.
's budget statement for 1917–8, presented on Nov. 2 1918,
ed a deficit of 6,271 millions. Sig. Bissolati, disagreeing
his colleagues over the Alto Adige and Dalmatia, resigned.
n. 1 1919 the state of war was declared at an end throughout
, except in the Veneto. On the 3rd, President Wilson ar-
in Rome and was received with frenzied enthusiasm as the
who had contributed the most to end the War, but the
sters who discussed politics with him suspected him of little
athy with the more extreme Italian aspirations.

e Adriatic Question.—The ministerial crisis initiated by
lati's resignation came to a head on Jan. 18, and resulted in
esignation of Nitti, who wished to prepare the way for
ning the premiership himself, and of four other ministers. The Italian Peace Delegation to the Paris Conference, which first met on that same day, was composed of Sig. Orlando, Baron Sonnino, Sig. Salandra, Sig. Barzilai and the ambassador, Marquis Salvago-Raggi. On Feb. 17 the debate on the Adriatic question began, but led to no result. In the meanwhile frequent incidents between Italian and Yugoslav soldiers occurred on the frontier. The Adriatic debate in Paris was adjourned to give precedence to the treaty with Germany; to this the Italian delegation agreed, accepting all the proposals of the Allies, including the partition of the German colonies from which Italy was excluded. The delegation was severely blamed in Italy on this account. The Adriatic discussion was then resumed, and on April 23 Wilson published his famous appeal to the Italian people over the heads of their government, setting forth his reasons for opposing certain claims. The message caused wide-spread astonishment as a violation of the rules of secret diplomacy, while in Italy it aroused great indignation. Orlando started for Rome on the 24th to consult Parliament and the country, and was received with enthusiastic demonstrations. In the Chamber his policy was approved by 382 votes to 40 and found adherents even in the Socialist camp.

D'Annunzio took up the Fiume-Dalmatia question with fiery eloquence, and the Nationalists urged the government to annex both. Orlando failed to take advantage of the anxiety of Britain and France that Italy should sign the treaty with Germany, or of Wilson's desire that she should adhere to the League Covenant, to secure advantages for his country, and on May 5 he returned to Paris without having obtained any guarantees for Italy's claims. He found the German treaty ready and Italy's diplomatic position worse than when he had left. Discussions on the Adriatic question were resumed, and various proposals for its solution were advanced, including one suggested by M. Tardieu, on which agreement would have been possible, if President Wilson had not agreed to rejection by Yugo-Slavia. Orlando returned to Rome in June, and on the 19th he was beaten in the Chamber and resigned. Sig. Nitti now formed a new Cabinet, with Senator Tittoni at the Foreign Office, Senator Schanzer at the Treasury and Gen. Albricci as War Minister. On June 28 the new Peace delegation, presided over by Senator Tittoni, left for Paris, and the same day the treaty with Germany was signed by Baron Sonnino and the Marquis Imperiali.

Internal Troubles.—The internal situation now grew more serious. Prices had risen considerably. The government's measures for limiting them merely made the goods disappear for a time and then reappear at still higher prices. The bread subsidy involved a huge deficit in the budget, the doles to the unemployed encouraged idleness, and the regulations hampering trade rendered production ever more difficult. The workers received high wages, but were discontented because prices were rising, while both they and the war profiteers indulged in an orgy of extravagance. The people with fixed incomes felt the pinch most, but everyone grumbled. The Socialists, who now adopted the name of " Maximalists " to affirm their dependence on Moscow, encouraged the workmen in the belief that the War had been fought solely to enrich the capitalists, and that now it was the workers' right to secure all the wealth of the country. Ex-neutralists also helped to foment discontent. In Jan. 1919 the Partito popolare italiano (Catholic) was formed; it had a more definite programme and a more complete organisation than the old Catholic group, and it developed rapidly under the guidance of its political secretary, the Sicilian priest, Don Luigi Sturzo. It advocated reforms of a Christian-Socialist character, including the expropriation of the landed estates for the benefit of the peasants, but with compensation to the landlords. Its foreign policy professed to be patriotic, and favoured co-operation between capital and labour. It attracted some peasants and workers who would otherwise have gone Red.

A series of avowedly revolutionary strikes broke out in every trade, and even in the public services. A postal strike was threatened in Dec. 1918, fomented by the Socialist party, and only called off on the government's promise of higher wages. During a Bolshevik demonstration on April 13 1919 at Milan, a shot was fired at a patriotic *cortège*, which provoked a reaction in the crowd and the offices of the Socialist paper *Avanti!* were wrecked. Strikes of tramwaymen, employees of the secondary railways and the merchant seamen followed in quick succession.

At the Peace Conference, during the absence of the Italian delegation, Mr. Lloyd George and M. Clemenceau ignored the St. Jean de Maurienne agreement, and in accord with President Wilson decided to send Greek troops to Smyrna. Immediately after the Greek landing Italian troops occupied various points in southwest Anatolia. Italian forces co-operated with the British and the French in occupying other parts of Turkey, but the Italian view was that real peace could only be secured by a more conciliatory attitude towards the Turks. At the same time, in order to try to conciliate Greece, Sig. Tittoni concluded an arrangement with M. Veniselos in July 1919 for the delimitation of their respective spheres of military occupation, leaving the Greeks a free hand in Southern Albania. This last clause had an unfortunate effect on Italo-Albanian relations, but the whole agreement was afterwards rescinded, as Greece proved unable to carry out her part of the bargain. Meanwhile Italian steamship companies, banks and business firms showed considerable enterprise in the Near East.

D'Annunzio and Fiume.—Fresh troubles broke out at Fiume (*q.v.*), where on July 2–5 1919 the alleged antipathy of the French troops (mostly colonials) to the Italians and alleged sympathy with the Croats, led to reprisals, in which some French and Annamite soldiers were killed or wounded. The Peace Conference thereupon appointed an inter-Allied commission of inquiry, which proposed the dissolution of the Fiume National Council, elections to be held under inter-Allied control, the disbanding of the Fiume volunteers, the reduction of the Italian garrison, and the importation of British or American police. These proposals were about to be carried out when on Sept. 12 D'Annunzio arrived at Fiume from Ronchi, at the head of some Italian troops, whom he had induced to follow him to save the town for Italy, and a number of volunteers. Most of the Italian troops and seamen in the town and port joined him, and he set up a government of his own. The Allied troops departed, and Nitti stigmatised the poet's conduct in the most violent terms, calling on the workmen and peasants of Italy to back him up against the *Patriotards.* But a large part of Italian opinion supported D'Annunzio, and volunteers, including men of the highest character and also many adventurers, flocked to his standard.

Riots against high prices broke out in the summer of 1919 in various parts of Italy, and agents of the Chambers of Labour illegally requisitioned foodstuffs and other goods for which they paid prices far below the market rates. The Government did nothing. The Socialists and Communists then organised a general protest strike for July 20–1 against the policy of the bourgeois governments towards Soviet Russia and Hungary. But there was no revolutionary outbreak, and the strike was only partial, largely owing to the beginnings of reaction on the part of public opinion voiced by the various citizen committees, rather than to government action. The Fascist movement, under Benito Mussolini now began to arise as a patriotic reaction (*see* FASCISM). Strikes and disorders continued in various parts of Italy, but Sig. Nitti expressed the belief that the only remedy was to let the spirit of unrest wear itself out, regardless of the immediate danger to the country. He had created a new police force, the Guardia Regia, which, however, proved costly and unequal to its duties. The Premier's treatment of the army caused much dissatisfaction. In his desire to restore the "Peace spirit," he failed to protect the soldiers from outrage and insult, and advised them to go about in mufti and disarmed when off duty. A decree of the Minister of War, issued at the instance of Sig. Nitti, granted an amnesty to deserters, thereby placing them on an equal footing with those who had done their duty in the War. In consequence of the findings of the Committee of Inquiry on Caporetto, Cadorna and other generals were put on the retired list.

On Sept. 10 1919 the Peace Treaty with Austria was signed at St. Germain-en-Laye (*see* ST. GERMAIN, TREATY OF), whereby Italy definitely acquired the frontiers assigned to her by the Treaty of London on the north and northeast, plus the Sexton
valley and Tarvis. The German inhabitants of the Alto A
were dissatisfied with this decision, but their treatmen
that time gave no reason for discontent. On Nov. 12 Sena
Tittoni resigned from the Foreign Office and the peace
gation, and was succeeded by the eminent jurist, Sena
Vittorio Scialoja.

INDUSTRIAL AND POLITICAL UNREST

In spite of, or because of, the government's restrictive m
ures, prices had more than doubled. The government had m
the wheat trade a state monopoly. While it requisitioned do
tic wheat at a price below the cost of production, it had to
foreign wheat at the market price. Thus wheat-growing
discouraged at home, and bread was sold below cost ther
increasing the deficit by six milliards. Transport was disorg
ised. While the traffic had decreased, the staff, for demag
reasons, had been increased from 154,000 to 180,000, and af
wards to 240,000; the railwaymen had become more and m
idle and insubordinate and were wholly under the influence
the revolutionary syndicate, and thefts of goods on the railw
had reached unheard-of proportions.

The Extremists.—By the electoral law of Sept. 1919 the prop
tional system, whereby the voter voted not for a candidate but
a list, was adopted to please the Socialists and the Popolari, w
as the only two mass parties hoped to derive benefit from it. T
Socialists at the Bologna Congress decided to present a Ma
malist programme demanding the abolition of capital and
institution of a Soviet Republic, but the extremist group p
posed abstention from the polls and an armed rising. The Po
lari decided to present their own candidates instead of co-oper
ing with other parties; an extreme wing, led by Sig. Miglio
promoted strikes and disorders and differed little from the Soci
ists. The Constitutional groups were split up and were wit
a programme or organisation. The government was discredit
and unpopular. The elections were held on Nov. 16 1919:
Socialists, 101 Popolari and 30 Combatants were returned.
none of the Fascist candidates. On the opening of Parliame
by the King on Dec. 1 the Socialist deputies withdrew from
Chamber, and as a protest against this insult a patriotic dem
stration was held outside, in which some Socialist deputies w
injured. A general strike was proclaimed in consequence, a
at Mantua there were serious riots, the anarchists committing se
eral murders, breaking open the prisons and pillaging the sho

Fresh incidents occurred on the Adriatic coast, and at Sp
lato (Split) the Yugoslav mob attacked the Italian inhabita
under the eyes of the American admiral. Early in Oct. Sena
Tittoni had proposed a *modus vivendi* to D'Annunzio, where
Italian troops would occupy Fiume pending a settlement
Paris, Italy undertaking not to permit the annexation of Fiu
to Yugoslavia; but D'Annunzio refused to agree. At the Pea
Conference various proposals were suggested, but the All
and the United States reached no settlement.

The Socialist successes at the election resulted in further di
orders. On Jan. 13 1920 the postal employees went on strik
because their demands for higher wages were not instantly co
plied with; volunteers replaced the strikers, in spite of offici
discouragement, and this broke the back of the agitation. Bu
on the 22nd the railwaymen struck, and although here too vo
unteers enabled the management to maintain a reduced servic
on the 29th Sig. Nitti came forward with concessions and unde
took not to punish a single striker, in spite of the explicit pro
visions of the regulations. The strike ended in a triumph for th
revolutionists. In the spring there was a two months' strike
the secondary railways of Lombardy, and one at the Mazzon
cotton mills in Piedmont, where the government legitimised t
arbitrary seizure of the factories by the workmen. The railway
men in general refused to run trains conveying soldiers or polic
to places where there were disorders; there was a railway strik
at Cremona and elsewhere because the station-master, who ha
dared to dispatch a train supposed to be conveying war materia
to Poland, then at war with Soviet Russia, was not dismissed

Sig. Nitti, finding himself unable to conduct the Governme

face of the growing opposition, had resigned a first time on
12 1920, but as no one else was prepared to assume office
e difficult conditions, he reconstructed his Cabinet with a
anges. On April 17 the Supreme Council met at San Remo
pare the peace with Turkey, the Adriatic problem was also
discussed, but at the request of M. Trumbich, the Yugo-
Foreign Minister, direct negotiations were instituted at
za a few days later. On May 12 the Cabinet, having been
ed in the Chamber, resigned, and the crisis broke up the
za conference. No other combination having proved pos-
Sig. Nitti was again asked to reconstruct his Cabinet, which
omplished by May 21, but even in its third reincarnation
ved stillborn. The Prime Minister's failure to solve the
ic problem and the indignation aroused by the arrest of
almatians and Fiumani in Rome on account of an alleged
nade his position untenable. On June 4 he enacted a de-
ducing the bread subsidy, but yielding to the threats of the
ists, he withdrew it five days later and resigned without
g for a vote.

itti's Difficulties.—Sig. Giolitti now appeared the only
apable of forming a government, and this he achieved by
16. Count Sforza was chosen Minister for Foreign Affairs.
budget statement for 1920–1, presented on June 27 1920,
a deficit of 14 milliards.

ubles now broke out in Albania. In 1917 Gen. Ferrero had
imed an Italian protectorate over Albania, but the subse-
agreements whereby Italy undertook to allow Yugoslavia
Greece to occupy parts of the country aroused much
isfaction among Albanians. An Albanian Govt. had been
d at Tirana and the Italian garrisons were greatly reduced;
spring of 1920 Albanian bands began to disturb the Italian
s, and on June 5 they attacked and captured some of the
sts. An attack on Valona was repulsed with loss to the
y, but on June 24 Sig. Giolitti, alarmed at a mutiny which
roken out as a result of anarchist propaganda at Ancona,
yielding to the Socialist demands, announced that Italy
l withdraw her troops from Albania and negotiate with the
a Govt. An agreement was arrived at on Aug. 3, and
pt. 2 the last Italian troops departed, only the islet
seno being retained.

the Spa Conference (July 5–16 1920) Italy succeeded in
g her share of the German indemnity raised to 10%, and
of the Austrian, Hungarian and Bulgarian indemnities to
On Aug. 6 the Tittoni-Veniselos agreement was rescinded,
n the 10th the treaty with Turkey was signed at Sèvres; by
rms of the tripartite agreement Italy obtained "economic
ty" over a wide zone of Anatolia south and east of the
zone (Smyrna) and a concession for exploiting the Heraclea
ields. By a separate agreement with Greece,[1] Italy under-
to cede to the latter the Dodecanese minus Charki and Cas-
izo, which together with Rhodes were to remain Italian for
ars, and then, if Britain ceded Cyprus to Greece, a plebis-
vas to decide the fate of Rhodes.

e Rapallo Conference.—Serious anti-Italian disorders oc-
d on July 11 at Spalato, where the Croat mob murdered the
nander of the cruiser "Puglie" and wounded several officers
nen; protest demonstrations were held at Trieste, and shots
g been fired from one of the Yugoslav institutions, several
m were set on fire. At Fiume the National Council resigned
D'Annunzio proclaimed the Reggenza del Carnaro, for
h he drafted a curious, mystical, semi-medieval statute. As
dent Wilson's term of office was nearly up, the Yugoslavs
hat a direct understanding with Italy would be the best
ion. The Italian Govt. communicated its proposals to those
itain and France, which advised Yugoslavia to accept them.
nference was held at Rapallo on Nov. 8, Italy being repre-
d by Sig. Giolitti, Count Sforza, Sig. Bonomi, Gen. Bado-
nd Admiral Acton; Yugoslavia by MM. Vesnich, Trumbich,
a, Stoyanovich and Col. Kalafatovich. On the 12th the
y was signed. Italy waived her rights over Dalmatia, except
e town of Zara, and the following frontier was agreed upon: Mount Pec, Mount Yalovets; the watershed between the Isonzo and the Wurzen See and the Wocheiner Save, northeast slope of Mount Mezik, east slope of Mount Porzen, west slope of Mount Blegos, Zelse, Cabranska, east of Mount Trstenik, east of Griza, east of Mattuglie, frontier of the Fiume State on the Fiume-Castua road; the islands of Cherso, Lussin, Lagosta and Pelagosa were assigned to Italy, while both Powers recognised the independence of Fiume; the Italian-speaking inhabitants of the territories assigned to Yugoslavia were entitled to opt for Italian citizenship without having to leave the country, and full freedom of language, culture and religion were granted to Yugoslavs in Italian territory.

By a secret clause, which soon became public property, although Count Sforza denied its existence, Porto Baros, an integral part of the port of Fiume, was promised to Yugoslavia. D'Annunzio, however, refused to recognise the treaty, and his *legionari* occupied Castua and the islands of Vegli and Arbe (assigned to Yugoslavia) and tried to invade Dalmatia. But the Government, determined to enforce the treaty, established a blockade round Fiume; on Dec. 23, as D'Annunzio refused to obey Gen. Caviglia's summons to submit, military operations were commenced. There was some fighting, but on the 30th D'Annunzio authorised his plenipotentiaries to accept the conditions imposed. Fiume was to be placed under its own town council, with a local volunteer force to maintain order, assisted by Italian carabinieri, until after the elections for the Constituent Assembly. D'Annunzio left Fiume on Jan. 18 1921. But the elections in the spring of that year led to disorders necessitating the maintenance of Italian troops. The evacuation of Dalmatia, divided for the purpose into three zones, began in the spring of 1921.

Industrial Disturbances.—The internal troubles reached their zenith in the autumn of 1920. There were industrial, agricultural and railway strikes in various parts of the country, and in Sept. a very serious agitation broke out in the metal trades. These industries had earned large profits during the War and were paying high wages. But the cost of production was increasing, and there were signs of a coming slump, so that it was impossible to grant the still higher wages which the workmen now demanded. The workmen of the Romeo works in Milan now adopted obstructive tactics and sabotage, and the management retorted by a lock-out on Aug. 20. Thereupon the F.I.O.M. (*Federazione italiana operai metallurgici*) ordered all the metal workers in Milan to remain in permanence at the mills without working. The Federation of Mechanical Industries then extended the lock-out to the whole of Italy on the 31st, and the workmen, many of them armed, seized a number of factories in Lombardy, Piedmont and elsewhere.

Encouraged by the passive attitude of the authorities, they kidnapped owners and managers and tried to force them to run the works exclusively for the workers; armed "Red Guards" were organised, revolutionary tribunals set up and persons approaching the factories were shot at. At Turin the factory councils attempted to sell the goods manufactured during the occupation, although the owners warned the public of the nullity of such sales. But the workmen found themselves incapable of running the factories unaided, and the occupation ended by becoming merely an occasion for orgies. On Sept. 6 the General Confederation of Labour expressed its approval of the occupation, but declared that the movement must be placed under its own guidance in order to secure "collective management," and forbade any further extension of the seizures for the present. Nevertheless the extremists became more truculent, and at Turin a Nationalist student and a prison warder who happened to be passing near an "occupied" factory were brutally murdered by "Red Guards," and in many works the safes were broken open and the contents pocketed by the leaders.

Sig. Giolitti at last felt that he must do something. He summoned the representatives of the owners and the workers to meet him on Sept. 19 in Rome. At this meeting an agreement was arrived at; wages were to be raised and a form of workmen's control over industry, which the Government undertook to embody in a bill, was agreed to. The owners also agreed to pay for the work performed during the occupation, with deductions for damage done to the plant, but they refused to readmit all the workmen as the Government demanded, and only did so at last under protest against this imposition. The factories were evacuated on the 27th and work was resumed on Oct. 4. As a practical attempt to establish Communism, as the group by Bombacci hoped, the agitation had failed, and Giolitti claimed that by proving to the workmen that they could not run industry without the capitalist and the expert, they had been taught a useful lesson. But the Premier's real motive was probably the fear of provoking revolution and distrust of the nation's patriotism and courage. Incidentally the "occupation" wrought serious injury to Italian credit at home and abroad.

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[1] enounced by Italy, Oct 8. 1922.

The Fascists.—About this time agrarian troubles had also broken out in various parts of Italy, notably in the Veneto, the provinces of Bergamo and Cremona, the Lazio, Tuscany and Sicily. The peasants demanded contracts which, if accepted, would have left the landlords without enough income to pay the taxes. In this agitation Socialist and Left-wing Popolari vied with each other in revolutionary methods. The public meanwhile was beginning to weary of these constant disorders and of the tyranny of a factious minority, and the middle classes set to work to organise resistance. The Agrarian Association of Bologna was particularly active, but it was the Fasci, now arising all over Italy, under Mussolini's leadership, which organised the national reaction. The first attempt at resistance at Bologna, the hotbed of revolution, was on Sept. 20, when, as the result of a Communist attack on a patriotic procession, a kiosk where seditious papers were sold was destroyed. At a strike demonstration in the same city in Oct. 14 1920 against the "white terror" in Hungary, the Anarchist, Malatesta, incited the mob to violence, and a police inspector and a Guardia Regia were murdered. Small groups of Nationalists and Fascists thereupon paraded the streets; in an instant the tricolour flag appeared everywhere and the strike ceased. The municipal elections in Oct. and Nov. registered a decline in Socialist influence in Rome, Naples, Turin, Genoa, Venice and Florence, but at Milan and Bologna revolutionary majorities were again returned.

The assumption to office of the Red administrations was to offer occasion for fresh outbreaks of violence. In Bologna the Communist deputy, Bucco, secretary of the local Chamber of Labour who had been the Red tyrant of the province, now began to fear for his own safety and applied for police protection against the Fascists; he was spirited out of the city and after his departure a deficit of a quarter of a million was found in the accounts of the Chamber of Labour. On Nov. 21 1920 the first meeting of the new Bologna town council was intended to be the occasion for an armed rising organised by the Communists, with the help of the municipal guards and the fire brigade. There were anti-Socialist demonstrations in the streets organised by the Nationalists and Fascists, supported by other citizens, but in the town hall two councillors of the constitutional minority, Giordani, a disabled ex-officer, and Colliva were murdered by Communists. The upheaval of public opinion was now irresistible; the Red leaders had to fly for their lives and the whole fabric of Bolshevik organisation in Bologna crashed. The town council never met again and was eventually dissolved, while the Fascists wrecked or burned down various Socialist institutions. At Modena a Fascist was murdered and several others shared a like fate while attending their comrades' funeral; this led to a general anti-Socialist uprising there also, and similar episodes occurred at Ferrara. Throughout the Po valley the Fascists proceeded to break the tyranny of the "Red baronies"; the revolutionary *leghe* which had dominated labour in that area, were dissolved, and one Red town council after another resigned or was dissolved by the prefects, while ever increasing masses of workers, industrial and agricultural, went over to Fascism and thus formed the basis of the Fascist labour movement.

Socialist Dissensions.—During the last months the Maximalist Socialist party had begun to show signs of dissension. The extremist group led by Bombacci and Gennari advocated an immediate revolution, while the Turati-Treves group opposed the idea; at the Reggio Emilia congress Nofri and Ponzani,
had returned from Russia, proceeded to condemn the So
system. The Russian leaders demanded the absolute submis
of the Italian party to the orders of Moscow and the expuls
of all Socialists tainted with the Reformist heresy. At the
eral congress of the party in Leghorn (Jan. 13–22) a resolut
in favour of a middle tendency, supported by Turati, Tr
Buozzi, Baldesi, D'Aragona and the G.C.L., who called th
selves *Unitari* and were prepared to collaborate with bourg
Governments, was adopted. The Communists (represente
18 deputies) thereupon broke away and formed a party of
own. The new party now tried to affirm itself by a series of
rorist outrages in the hope of promoting revolution. Bombs
thrown in Florence on Feb. 27, killing and wounding several
sons, whereupon the Fascists retaliated by murdering Lavag
a notorious Communist railway organiser; the railwaymen
electricians went on strike and various affrays between Com
nists and Fascists occurred, until the troops intervened
restored order. At Empoli a number of unarmed sailors were
dered by Communists, and the Fascists, summoned from vari
parts of the country, inflicted severe reprisals. Similar oc
rences took place at Foiano della Chiana and other places.
everywhere the popular reaction, guided by Fascists and
tionalists, was vigorous and unmistakable. The Governme
unable to tackle the situation, itself, left the Fascists a free
to fight the Reds.

Sig. Giolitti now had the courage to propose the abolition
the bread subsidy, and presented a bill to that effect, which
voted by a large majority on March 1, in spite of Socialist
struction. The bill in favour of syndicalist control over indus
presented by the Premier in accordance with the agreement
the preceding Sept., encountered much opposition in Par
ment and was finally dropped.

Giolitti Resigns.—The Parliamentary position was becom
insecure, and a hostile motion on foreign policy proposed by
Amendola was rejected only by a small majority. On Apri
1920 Sig. Giolitti dissolved the Chamber, and on May 15
elections were held. Out of 535 seats (27 had been added for
new provinces) the Liberals and Democrats of various sha
secured 275, the Popolari rose from 101 to 107, the Socialists
from 156 to 122 Unitari and 16 Communists; there were in ad
tion four Germans for the Alto Adige and five Slavs for the Ve
zia Giulia. The Fascists were 38 and the Nationalists 10.
though the composition of the new Chamber was not very di
ent from that of the old, the Socialists and Communists
now faced by a vigorous Fascist-Nationalist group supporte
sympathisers belonging to other parties. On June 11 Parlia
opened, and in the debate on the speech from the Throne,
Nationalist Federzoni (*q.v.*) delivered a strong attack on C
Sforza's foreign policy. On June 26 the Cabinet secured only
small majority on a vote of confidence on foreign policy,
Sig. Giolitti resigned.

Sig. Bonomi formed an administration composed as follow
Bonomi (Presidency and Interior), Marquis Tomasi della T
retta (Foreign Affairs), Giradini (Colonies), Rodinò (Justice
Soleri (Finance), De Nava (Treasury), Micheli (Public Works
Belotti (Industry and Trade), Bergamasco (Marine), Corbi
(Education), Mauri (Agriculture), Beneduce (Labour), Giuffri
(Post Office), Ranieri (Liberated Territories). The Cab
comprised members of many parties, but the Popolari we
predominant and Don Sturzo ruled Sig. Bonomi with a rod
iron. Under Popolare influence, strengthened by that of these
Socialists Giuffrida and Beneduce, further advanced legislatio
was enacted. A bill enabling any public body to expropriat
land which in its opinion was inadequately cultivated, the owne
to be indemnified with land bonds of uncertain value paid for b
the whole community was introduced but aroused violent opp
sition and never became law.

Sig. Bonomi had the merit of deciding that the celebration
the ceremony for the Unknown Soldier should at last be held;
took place on Nov. 4 1921. Two days later the Fascist congre
was opened in Rome, and Fascism was definitely constituted in

al party. On the 10th the Communists and Socialists
ned a general strike as a protest against the presence of
cists in Rome; disorders ensued, in which five persons
lled and several wounded. The troubles had ceased by
n, after which the Fascist congress broke up. The debate
Chamber on the eligibility of the deserter Misiano, who
n returned for Turin and Naples, led to violent scenes,
Dec. 20 his election was annulled. During this same
the Banco di Sconto failed, and the Government was se-
lamed for not having prevented the collapse of so impor-
institution, whose actual condition was by no means
; as was proved at the subsequent legal proceedings be-
Senate,[1] the failure caused serious prejudice to the general
l and economic situation of the country.

publication by a French journalist of an account of an
ty insult attributed to M. Briand against the Italian
t the Washington disarmament conference led to anti-
demonstrations at Turin and elsewhere, until the mis-
anding was cleared up. The attempt to conclude a
cial treaty with Russia failed, as the Soviet Govt. refused
y the agreement. In Jan. 1922 Sig. Bonomi attended the
meeting of the Supreme Council, where it was decided
an economic conference in Genoa in the spring.

Facta Govt.—The Bonomi Cabinet was now attacked
sides, and when on Feb. 2 1922 the Democrats, 16
n were in the Government, went over to the Opposition,
nomi resigned. The King, however, asked him to go
Parliament, in order that by its vote it might give some
ion for a solution. This Bonomi did, and the Cabinet
been beaten on the 17th resigned definitely. It was not
e 25th that a new Cabinet was formed by Sig. Luigi
He was a thoroughly honest man, and his acceptance of
these circumstances was proof of his patriotism, but he
t a first-class statesman. He selected Senator Schanzer
Foreign Office, while the other Ministers were of respecta-
liocrity. On March 15 the Premier communicated to the
er the Government's programme, based on the restora-
order, and secured a vote of confidence.

22 the reconquest of Tripolitania was commenced with
ccupation of the port of Misurata at the end of January.
series of operations lasting through 1922 and 1923 the
colony was reoccupied. The Governor in this period was
Giuseppi Volpi, afterwards Finance Minister.

ble now broke out in the port of Naples between the Red
' union, which wished to retain its labour monopoly,
new Fascist dockers' union, created to combat the pre-
conditions of anarchy and graft brought about by the
The Red union proclaimed a strike in all the Italian ports
rch 18 as a protest against the existence of the Fascist
and the Government referred the solution of the conflict
enti-autonomi of the ports, a decision which caused much
faction in non-Socialist circles, as those bodies were
usly under Socialist influence. But the Fascists eventually
led in breaking the Red monopoly and restoring order
edom of labour in the ports, to the great advantage of
ritime trade of Italy.

Genoa conference was inaugurated on April 10. Sig.
presided with dignity, but the hardest work was accom-
l by Sig. Schanzer, who often succeeded in composing
nces between the British and the French and between the
and the Germans and Russians. The Russian delegation
first alarmed at the possibility of an unfriendly reception
Fascists, but the Fascist party directorate assured the
viks that if they abstained from interference in Italian
l affairs they would not be molested; this they undertook
and they carried out their undertaking.

railway syndicate at Bologna issued an order that all
was to be held up on May 1, and although the manage-
was able to secure an almost complete service, many rail-
n did cease work, thereby causing inconvenience and
delay. This time the Government did indict the members of the executive committee of the syndicate, and some of the leaders were punished. On May 24 the funeral procession escorting the body of the war hero Enrico Toti to the cemetery in Rome was fired on by Communists in the San Lorenzo quarter, with the result that two persons were killed and several wounded. The next day the Committee of Proletarian Defence and the Alleanza del Lavoro, a newly formed coalition of the Communist, Socialist and Republican parties and the G.O.L., ordered a general strike in Rome; the Fascists tried to organise a counter-demonstration, but were dispersed by the police. This strike, which ended on May 26, intensified the exasperation of all law-abiding citizens against agitators.

The Bologna Reds.—In the province of Bologna the Red unions had lost much of their influence, but the leaders managed to maintain authority with the acquiescence of the Government. While locally there was a scarcity of labour and very high wages, in the neighbouring provinces there was unemployment, but the Bologna union leaders were determined to prevent the migration of these "foreign" workers, lest their own monopoly should be menaced, and they induced the prefect to forbid it. The prefect's action was *ultra vires* as it violated the rights of individuals in the interest of a privileged class, and the Fascists, voicing the general indignation which it aroused, concentrated on Bologna in military formation and demanded the revocation of the decree and the removal of the prefect. Sig. Mussolini, having obtained satisfactory assurances from the Government, ordered the Black Shirts to demobilise and evacuate the city, which they did on June 2; the decree was then revoked, and the prefect transferred.

There were now rumours of a new cabinet crisis, and the Socialists were divided on the question of collaborating with a bourgeois government. The Fascists, Nationalists and the Right were opposed to any sort of Socialist infiltration, which would involve unlimited extravagance and more advanced legislation. On July 12 1922 Sig. Peano, the Treasury Minister, issued his financial statement for 1921–2, which showed a deficit of 4,500 million lire, while experts estimated it at 6,500 million; public opinion was seriously alarmed, but in Parliament the deputies were too busy over lobby intrigue in view of the expected crisis to worry about finance. There were disorders at Cremona, provoked by the left wing Popolari led by Miglioli and the Socialists; the Fascists mobilised and wrecked several Socialist institutions and Miglioli's own law offices. The Democrats in the Chamber seized the occasion to contract an alliance with the Popolari, and on July 19 Sig. Facta was outvoted and resigned. But it proved impossible to form a new Cabinet, and after various unsuccessful attempts by Bonomi, Orlando and Meda, during which even the Socialist Turati was summoned to the Quirinal for consultation, the King sent for Facta once more, and the old Cabinet was reconstructed, with Senator Taddei, prefect of Turin, as Minister of the Interior.

The General Strike.—On Aug. 1 a general strike throughout Italy was suddenly proclaimed by the Alleanza del Lavoro, as the result of a Communist initiative, supported by the Socialists, who were disappointed at having failed to secure a Democratic-Socialist Cabinet, and Turati proclaimed it a "legalist" strike, because its professed object was to affirm the authority of the State against the Fascists. Work was suspended in many factories and a part of the railwaymen struck; but the Fascists and Nationalists ordered a general mobilisation, and the Fascist directorate issued a manifesto calling on the public servants and the workers "to shake off the yoke of the politicians by whom they were led," and giving the Government 48 hours within which to prove that it possessed authority over its own employees and those who were attempting to destroy the nation. "On the expiry of this delay Fascism will assume full freedom to supplant the State." Serious conflicts between Fascists and Communists occurred at Milan, Ancona and other places, but the strike rapidly collapsed, and on the 2nd the Alleanza del Lavoro ordered it to cease; by the 4th all disturbances were over. During the strike agitation the Fascists delivered an attack on the Communist-

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case was tried by the Senate because there were senators
the accused.

Socialist municipality of Milan, which had for years ruled the city, bringing it to the verge of ruin and indulging in the most scandalous graft; the deficit was 375,000,000, there were bills for 101,000,000 lire overdue, and the richest city in Italy could obtain no credit anywhere.

The Liberal *Corrière della Sera*, as well as the Fascist press, had been conducting a very vigorous campaign against the administration, but the Government did not interfere. On Aug. 1 the tramwaymen, electricians, sweepers, employees of the waterworks and firemen of the city, all struck, but the Fascists and other citizens took their places; on the 3rd the Fascists succeeded in getting into the town hall and expelling the few assessors present, and for the first time since 1914 the tricolour was raised on Palazzo Marino amid scenes of great popular enthusiasm. The Fascists withdrew on the 4th and handed over the building to the prefect's commissioner. On the 27th, after the disastrous results of the inquiry into its financial administration, the council was dissolved and a royal commissioner placed in charge.

At Genoa the Fascists led a similar operation against the port consortium, which was largely under the influence of the Red dockers' union. Under Fascist pressure the consortium was dissolved and a royal commissioner appointed. The Fascists extended their action against a number of Socialist, Communist and Popolare town councils and institutions, forcing the administrators to resign; sometimes violence was resorted to, but in most cases the administrations resigned from sheer fright; very frequently evidence of embezzlement was discovered. Another operation was carried out against the provincial administration of Trento, and the Governor, Sig. Credaro, accused of being under the influence of the anti-Italian Pan-German elements of Bolzano, was recalled by the Government on the initiative of the Fascists. All these actions were of course illegal, but public opinion approved of them because it considered that the Fascists were doing what the Government should have done before.

The Fascist Programme.—Facta's position was daily weakening, and indeed the whole machinery of government was obviously breaking down. At the Socialist congress held on Oct. 3 the party split into two groups, the *Unitari* or collaborationists and the uncompromising *Massimalisti*; as a result of this split the G.C.L. broke off its alliance with the Socialist party and declared itself a non-political body, but many of its adherents had already gone over to Fascism. The Partito Popolare was also divided by conflicting tendencies, and the Pope enjoined on the bishops and clergy to abstain from partisan political activity. The moment was now ripe for a bold Fascist move. Sig. Mussolini considered that it was not enough to crush Bolshevism, and that if Italy was to become a really great nation the whole body politic must be reformed on Fascist lines, and the national finances re-established by eliminating extremist legislation and extravagance.

Although many Liberals approved of the Fascist programme, the Fascists themselves were convinced that it could not be carried out under normal Parliamentary conditions. They now demanded of the Government either a dissolution or the resignation of Facta and the formation of a new Cabinet comprising five Fascist Ministers; but the Premier rejected both alternatives. At a Fascist gathering at Udine on Sept. 29 Mussolini made an important declaration in favour of the monarchy, thereby securing the support of many non-Fascists. His hints at a revolution, however, were still regarded as figures of speech, but he was now entrusted by the party directorate with a mandate to conduct a political and even military action to bring Fascism into power. On Oct. 24 another Fascist congress was held at Naples, where 40,000 Fascists in military formation paraded the streets. In his speech at the San Carlo theatre Mussolini said that "what we have in view is the introduction into the Liberal State, which has fulfilled its functions . . . of all the forces of the new generation which has emerged from the War and the victory." In another speech he declared that "either the Government will be given to us or we shall seize it by marching on Rome."

March on Rome.—That same evening the Fascist Quadrumvirate was formed, composed of Michele Bianchi, general secretary of the party, Italo Balbo, commander of the armed *sq*
Gen. De Bono (ex-commander of the IX. Corps), who
organised them, and the deputy C. M. De Vecchi, while
Grandi, an authority on labour problems, was entrusted wit
political functions of the enterprise. The congress broke up
Salandra and Orlando, acting on behalf of the Quadrumv
called on Facta to resign, which, after some hesitation, he d
the 27th. In the meanwhile the general mobilisation of the
cists had been ordered, and they proceeded to concentrat
Rome in four columns. Both the Fascist leaders and the
officers were anxious to avoid any conflict between the *sq*
and the troops, and the news that martial law had been
claimed caused deep consternation. Facta had indeed dr
and issued the decree, but the King refused to sign it as it w
have meant civil war, and it was immediately withdrawn.
Salandra was now entrusted with the formation of a Cab
and he offered portfolios to De Vecchi and Grandi; but Muss
on being consulted rejected the proposal, for the formation
Cabinet of the old parliamentary type was now impossible.
Salandra's advice the King sent for Mussolini. The Fascist
umns began to enter Rome on the morning of Oct. 30 1922
the city was peacefully occupied; the only regrettable incid
were the murder of a Fascist at Valmontone by Commu
and the murder of some Communists by Fascists in the
Lorenzo quarter of Rome. Mussolini reached Rome from M
the same day, and at once presented himself to the King, wit
Cabinet list already prepared, which the King at once accep
As the presence of the *squadre* in Rome was no longer necess
and might lead to trouble, Mussolini ordered them to dep
this they began to do on Oct. 31, after paying a tribute of ho
to the tomb of the Unknown Soldier and homage to the K
by Nov. 2 all had left the capital.

The new Cabinet was composed as follows: Mussolini, Pre
and Minister of Foreign Affairs and the Interior; Gen.
(War), Adm. Thaon di Revel (Marine), Prof. Alberto De
fani (Finance), Prof. Tangorra (Treasury), Duke di Ce
(Post Office), Federzoni (Colonies), Prof. Gentile (Educati
De Capitani (Agriculture), Carnazza (Public Works), C
Teofilo Rossi (Industry), Cavazzoni (Labour), De Vecchi (
der-Secretary for Pensions). Although predominantly Fas
the Cabinet comprised members of all the chief groups ex
the anti-national parties; Rossi was a Giolittian, Cesar
Social Democrat, Gentile[1] and De Capitani Liberals, Tang
and Cavazzoni Popolari. Sig. Mussolini did not have a P
mentary majority, but he was supported by the mass of pu
opinion even outside Fascist circles. He gave stringent or
for the cessation of all acts of violence, and for the reinst
ment of the town councils which had been forced by the Fasc
to resign after Nov. 1. Occasional conflicts still occurred
on the whole order was restored with surprising rapidity.

On Nov. 16 the Premier informed the Chamber that for
second time the Italian people had given themselves a Gove
ment independent of any Parliamentary designation,[2] that
might have closed Parliament and formed a purely Fascist Ca
net, but that he preferred, at all events in the first phase, to fo
a coalition with all the national parties. He undertook to bala
the budget, provide for the working classes, but not in accorda
with any extravagant theories, and conduct the foreign pol
of Italy with firmness and dignity. He finally asked fo
powers for a year to carry out the necessary reforms, and th
were granted by 275 votes to 90. The Nationalists were n
absorbed into the Fascist party.

The Deficit.—The most urgent problem before the new Go
ernment was finance. The estimated deficit for 1922–3 was 6,
million lire and Sig. De Stefani at once proceeded to adopt dras
economies, reorganise taxation and encourage economic activ
without hindrances to production. Prof. Tangorra having d
on Dec. 21 De Stefani took charge of the Treasury as well. T
Ministry of the Liberated Territories and several under-secreta
ships were abolished, and by the decree of Jan. 23 1923 the Go

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[1] Gentile afterwards became a Fascist.
[2] The first was in May 1915.

t was enabled during one year to place on the retired list ials who were too old or otherwise incapable of fulfilling ıties, and to revise all appointments made under special islation since May 1915. The Guardia Regia, which had wered its purpose on account of defective discipline and ation, was disbanded. The Fascist and other armed were also disbanded, and the *Milizia Volontaria per la a nazionale* (*see* FASCISM), composed of *ex-squadristi* and l by ex-army officers, was created in Jan. 1923 to assist maintenance of order. In the administration of justice courts of cassation were reduced to one, and many minor uppressed. The railway staff, which amounted to 225,000 ne Fascists came into power, was reduced to 170,000. ge number of abuses were eliminated; the eight hours' nich had been reduced to five or six hours of real work, tored; railway thefts and damage to property were brought o trifling proportions, the system of equalising wages, so linesman or engine-driver was paid as highly as, or more n important official, was done away with; the free passes o the leaders of the revolutionary *sindacato ferrovieri* and other persons were withdrawn, discipline was re-estab- and bonuses for economy reintroduced. These reforms, were largely the work of the special high commissioner railways, Sig. Edoardo Torre, resulted in improving the out of all recognition, and converting the railway deficit, in 1921–2 amounted to 1,400 million lire, into a surplus of ,000 for 1924–5. A similar transformation was effected postal and telegraph services, where insubordination and nisation had reached incredible proportions under the s governments; here too a deficit of some 500,000,000 was ted into a surplus of 43,000,000. Originally the Govern- tended to restore the railways and some of the postal serv- private enterprise; this has been done for the telephones uly 1 1925, but not for the railways. Reforms of a similar were introduced into many other departments, and every- the number of officials was reduced.

Yannina Murders.—Soon after coming into power Sig. lini attended the opening of the Lausanne conference on ace with Turkey, and there he first came into contact is British and French colleagues. On Aug. 27 1923 the General Tellini, president of the inter-Allied commission delimitation of the Graeco-Albanian frontier, and four staff were murdered by Epirote bands near Yannina on territory, as a result of a violent campaign in the Greek gainst Tellini, who was accused of unduly favouring the an claims. On the 29th the Italian Govt. presented an tum to Greece demanding immediate satisfaction and an nity of 50,000,000 lire. As the Greek Govt. rejected some conditions, and denied responsibility for the crime, an fleet was sent to Corfu to occupy the island. The Greek ander having refused to lower the flag a few shots were n the fort, one of which killed or wounded a number of es,[1] who, unknown to the Italian admiral, were lodged in e island was then occupied. On Sept. 1 Greece appealed League of Nations Council, but as the Conference of Am- dors had also been invested with the conflict, the Italian te to the League Council, Sig. Salandra, maintained that onference alone was competent to deal with the matter, as the British delegate, Lord Robert (now Viscount) Ce- e Greek delegate, M. Politis; and the delegates of the small s insisted on the League's right to intervene. After ar- g that an inquiry should be conducted by the four Great s[2] the Conference of Ambassadors finally decided that e should make full satisfaction in the most solemn form ly and pay the indemnity of 50,000,000 lire. Italy declared he occupation of Corfu had no other object than that of obtaining satisfaction for its demands. On the 13th the Conference announced Greece's acceptance of its decision and Italy's undertaking to evacuate Corfu by the 27th, which was done. As a result of the conflict Italo-Greek relations were much improved, but there were controversies in the League Council between Sig. Salandra and Lord Robert Cecil and the delegates of Sweden and Norway.

The next important action of the Fascist Govt. in the field of foreign affairs was the settlement with Yugoslavia. As Sig. Mussolini had long recognised the difficulty of fully carrying out the Rapallo and Santa Margherita agreements, he had suggested, as early as Nov. 1922, to M. Ninchich the advisability of a more complete agreement. The Santa Margherita convention was ratified on Feb. 21 1923, and Italy proceeded to evacuate the third Dalmatian zone,[3] but the existence of the Fiume Free State was the chief obstacle to a real understanding. Sig. Depoli, head of the government, had resigned, as he could not continue to rule the town, which was threatened with starvation, and Sig. Mussolini sent Gen. Giardino to Fiume in Sept. 1923 to take charge of the administration, and provided him with adequate funds. Negotiations with Yugoslavia were then resumed, and on Jan. 27 1924 the various agreements were signed in Rome. By the first of these the two Powers undertook to collaborate in maintaining the conditions established by the peace treaties and to assist each other politically and diplomatically in case of a conflict. By a second convention Italy recognised Yugoslavia's full sovereignty over Porto Baros and the Delta, while Yugoslavia recognised that of Italy over Fiume; a free customs zone was also established comprising Fiume and Castua (the latter ceded to Yugoslavia). Ratifications were exchanged on Feb. 22, and subsequently a series of commercial agreements was concluded.

Mussolini and Parliament.—One of the main considerations of the Fascist party was the relation of the executive to the legislature. Parliament in Italy had long been degenerating, and after the War conditions had become worse than ever. Sig. Mussolini was determined not only to eliminate certain evils, but to prevent their recurrence, and above all to give stability to the government. In the summer of 1923 he drafted a bill whereby the country was divided into 15 constituencies, each voter to vote for the party list which he preferred, the party securing relatively the largest number of votes to be entitled to two-thirds of the seats in the Chamber, while the remaining third was divided among the other parties on a proportional basis. The bill encountered much opposition among the Socialists and the Popolari, and also among some sections of the Liberals, but it was admittedly only a temporary and tentative measure, and it was voted by a large majority in the Chamber in July and by the Senate in Nov. 1923. At a Cabinet Council on Dec. 31 the government renounced the full powers granted to it by Parliament a year previously, and on Jan. 25 1924 Parliament was dissolved.

Sig. Mussolini stated that he now wished to appeal to the country for a verdict on the work accomplished, but that, while recognising the value of the elective Chamber, it must not be accorded absolute predominance over the other organs of the State—the Crown, the Senate, the Executive—all of which have their allotted functions. He rejected the idea of electoral and political alliances with other parties, but decided to include in the government electoral list men of all parties or no party who might be counted on to render services to the country. He approached certain leading Liberal and Democratic statesmen of Southern Italy, where Fascism had less hold than in the North, in order to include them in the Government list. Salandra, Orlando, De Nicola and De Nava accepted. The Duke of Cesarò, Minister of Posts and Telegraphs, having quarrelled with the Premier over the latter's refusal to contract an alliance with the Social Democratic party, and also because he disapproved of certain influential Fascists, resigned and presented an opposition list of his own, chiefly in Sicily.

The Government list was prepared by the Fascist representa-

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lonel Lowe, of the Near East Relief Organisation, deposed ne casualties amounted to 100, including 20 dead, of whom 16 hildren.

r full details of the incident see the article by "Verax" in *ta italiana* for Dec. 15 1923; and for text of report see *The a Murders* and *The Occupation of Corfu*, George Glasgow on, 1923).

[3] The port of Dalmatia assigned to Italy by the Treaty of London and ceded by her to Yugoslavia at Rapallo had been divided for the purpose of evacuation into three zones.

tives in each constituency, passed by the "Pentarchy" (Finzi Michele Bianchi, Giunta, Acerbo and Cesare Rossi) and finally submitted to Mussolini for approval. In four constituencies there were extra lists for government supporters for whom there was no room in the government list proper. The government candidates comprised 200 ex-combatants, and a number of men eminent in science, literature, business, agriculture and industry. The opposition groups competed for the 179 seats reserved for the minorities. The elections were held on April 6, and, except in a very few cases, went off without disturbances. In all 7,628,859 votes were recorded (73% of the registered voters, a larger percentage than at any previous election). Of these 4,693,690 were for the government, *i.e.*, 65·25% of the recorded votes, not including those in favour of minority candidates who had declared themselves supporters of the Government; the Government thus would have been entitled to two-thirds of the seats independently of the new law. The supporters of the Government were 355 (Sig. De Nava having died), of whom 260 were Fascists and 114 members of other groups. The opposition groups were distributed as follows: Constitutional Opposition 12, Liberal Democrats 17, Social Democrats 11, Popolari 40, Massimalists 22, Unitari Socialists 27, Communists 17, Republicans seven. Of the ex-Premiers, Bonomi was not returned; Nitti and Facta did not stand, but Facta was raised to the Senate soon afterwards.

The Matteotti Murder.—Parliament was opened by the King on May 24 1924. After his overwhelming victory at the polls Sig. Mussolini held out the olive branch to the Opposition parties, and everything seemed to point to a return to normal political conditions; on June 7 the Chamber gave the Cabinet a vote of confidence by 361 to 107. But on June 10 the Socialist deputy Giacomo Matteotti, Secretary of the Unitario group, mysteriously disappeared, and a day or two later it was discovered that he had been kidnapped in a motor-car by Dumini, Volpi and other Fascists of shady antecedents and carried off to an unknown destination. The kidnappers, suspected of complicity in attacks on other anti-Fascist leaders, were caught at once, and four prominent Fascists—Marinelli, the administrative secretary of the party; Filippelli, editor of the *Corriere italiano;* Cesare Rossi, head of the official press bureau; and Naldi, the editor of the *Nuovo Paese*—were also arrested as accomplices. The body of Matteotti was discovered on June 13 buried in a lonely spot 20 km. from Rome.

The affair created a sensation, and the Opposition deputies and press seized on it to indulge in the gravest accusations against all the leading Fascists. On June 15 the Opposition deputies withdrew from the Chamber, stating that they would not return until the Matteotti mystery and the so-called "moral question"—that is, the supposed complicity of the Government in the affair—had been cleared up. The Opposition by this so-called "withdrawal on to the Aventine"[1] thus hoped to render Parliamentary business impossible and to exploit the consternation aroused by the crime to upset the Fascist Government. Among the persons more directly accused was Aldo Finzi, Under-Secretary for the Interior; he immediately resigned, and his resignation was accepted by the Premier as he had not proved equal to his duties, but when he brought libel actions against his accusers they were unable to prove their case by evidence.

The Chamber was now adjourned, and on the 16th Gen. De Bono, whose activities as chief of police had appeared faulty, was replaced by Sig. Crispo Moncada, prefect of Trieste. The same day Sig. Federzoni was transferred from the Colonial Ministry to that of the Interior: he immediately cleared the department of the doubtful elements who had taken advantage of their connection with it for purposes of their own. On the 30th all the Ministers placed their portfolios in the Premier's hands, and he effected the following changes: Federzoni, who had become Minister of the Interior, was replaced at the Colonial Ministry by Prince di Scalea, Gentile (Education) by Count Alessandro Casati, Carnazza (Public Works) by Gino Sarro Corbino (National Economy) by Cesare Nava. Most of under-secretaries were also changed, and many undesira expelled from the Fascist party.

Opposition Tactics.—The Opposition saw in the Matt affair a chance of mobilising a part of the nation against Government, and secured the support of many who had adh to Fascism only as long as they had believed it to be invinc and were ready to abandon it the moment they thought tha days were numbered. Orlando, who had been elected on Government list, and Giolitti, who had declared himself ben lently independent, joined the Opposition, professedly on stitutional grounds, but did not withdraw from the Cham The "Aventine" groups on June 27 confirmed their absten from Parliamentary activity, demanded the disbanding of Milizia nazionale, the repression of all acts of violence by cists (without mentioning those committed by non-Fasci and formed a committee for joint action; their unofficial lea was Giovanni Amendola. The conduct of the constituti Opposition, in allying itself with the revolutionary Social and the Popolari extremists, was much criticised even in Fascist circles. Various new Opposition associations were formed, such as the Lega italica, the Italia libera (with wh Gen. Peppino Garibaldi was connected), the Unione nazion etc. The directorate of the ex-combatants' association assumed an attitude of veiled hostility to the Government, as this created a sharp division within its ranks the Governm dissolved the directorate and placed a temporary board in cha

The press campaign now reached an unparalleled degree violence, Don Sturzo's *Popolo* vying with the Socialist *Ava* and Amendola's *Mondo*, and was a direct incitement to ma acts of violence committed against Fascists.[2] Sig. Musso therefore decided on July 8 to call into force the decree of J 12 1923 drafted by the Duke of Cesarò, and the prefects w ordered to apply Art. 3 of the Communal and Provincial l whereby in the interests of public order they were empowe to confiscate issues of papers containing seditious matter incitements to violence, and in the case of repeated offen temporarily to suspend their publication. This measure w afterwards completed by the royal decree of March 4 19 Several Liberal and Democratic organs which systematica attacked the Government were acquired by pro-Fascists.

The Crespi family, who were the chief shareholders of Milan *Corrière della Sera*, bought out Senator Albertini and brothers, who had for many years edited the paper; it th became more favourable to the Government in its outlook. T Milan *Secolo*, the Rome *Giornale d'Italia* and the Naples *Matti* as well as some other papers, have undergone a similar transfo mation; many of the members of the staff remained with th respective papers under the new conditions, while those w refused to do so received large indemnities under the very liber provisions of the Italian law on journalistic contracts. Seve opposition papers continued to exist, including the Democra *Mondo*, the *Voce Republicana*, the *Avanti!*, etc., but can exerc little influence. These measures were admittedly of a temp rary character, enacted in view of the transition from the to the new régime. An important reform was carried out in t Milizia nazionale; the decree of Aug. 4 provided that its memb should swear allegiance to the King. On Oct. 28 the Miliz took the oath.

In the field of foreign affairs a treaty was concluded wi Britain whereby the Transjuba territory was ceded to Ital There had been a previous agreement to that effect, but t British Foreign Office had raised difficulties, claiming that t question should be settled together with that of the Dodecanes the Italian Govt. persuaded Mr. Ramsay MacDonald that t two questions were wholly unconnected, and the treaty w signed on July 15 1924, whereby Italy secured a larger ar than had been at first contemplated. Ratifications were e changed on May 1 1925.

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[1] After the withdrawal of the Roman *plebs* on to the Aventine Hill as a protest against the aristocracy. Opposition deputies did not, as has often been reported in the foreign press, actually meet on the Aventine.

[2] Since the Matteotti murder 65 Fascists have been murdered b their opponents; among the victims was the deputy Casalini.

solini's Skill.—The Government's position had been
otedly shaken by the Matteotti affair, but no evidence
oduced implicating any of its members in it, and Sig.
lini parried the attack with consummate skill. The Fas-
rty, except for an insignificant number of defections,
round him solidly, and after the first bewilderment non-
pinion continued its support of him. The country tended
n down, in spite of occasional regrettable incidents pro-
by both sides, of which the most serious was the murder
Fascist deputy Casalini by a Communist on Sept. 12 1924.
hamber opened on Nov. 12, Orlando and the Communists
resent, while later Giolitti's attack on the Government
unconstitutional methods caused some surprise as coming
statesman who while in office had proved a past-master
art of violating the Constitution. The Premier had come
conclusion that the electoral law enacted in 1923 had not
satisfactory, and on Dec. 20 he presented a bill to Parlia-
roviding for the re-establishment of the old one-member
uency system, eventually passed by 307 votes to 33, and
ed by the Senate on Feb. 10 1925. This measure divided
ventine," as the Democrats and Liberals were in favour
while the Socialists and Popolari were proportionalists.
peech in the Chamber on Jan. 3 1925, Mussolini reaffirmed
compromising policy of Fascism, rejecting all alliances,
ated that the Government was determined to *Fascisitiz-*
e state, and that if the Opposition did not abstain from
s violence severe repressive measures would be resorted
ese declarations induced Salandra to withdraw his sup-
lthough, like Orlando and Giolitti, he did not retire on
"Aventine;" a part of his group (the Liberal Right)
away and formed the pro-Fascist National Liberals. In
Sig. Roberto Farinacci was appointed general secretary
Fascist party, which he proceeded to reorganise, giving
gidly intransigent character. His speeches and articles
nt the extremist attitude of Fascism.

onal Defence.—The bill presented by the Minister of
en. Di Giorgio, for reorganising the army on the basis of
ction of the peace-time effectives, the sums thus econo-
to be devoted to material, encountered much opposition
tary circles and in the Senate. On April 1 the Premier
ed the adjournment of the debate and appealed to the
s in the Senate to collaborate in improving the nation's
s. Gen. Di Giorgio felt called upon to resign, and Sig.
ini himself took charge of the War Ministry *ad interim*,
en. Cavallero as Under-Secretary; Gen. Badoglio was
ted chief of the staff and entrusted with the co-ordination
army, navy and air force. On May 5 Adml. Thaon di
resigned, and Sig. Mussolini took over the Ministry of
e and the newly created Air Ministry as well, with Adml.
i and Gen. Bonzani as Under-Secretaries. This arrange-
s regarded as leading the way to a future Ministry of
al Defence. A great manifestation in honour of the King's
was held on June 7. It was generally recognised that the
e of the monarchy had been greatly strengthened by the
régime.

Government was rapidly regaining the ground it had
consequence of the Matteotti affair. The decision of the
judicial committee, rendered on June 12 1925, on Sig.
i's charges against Gen. De Bono, acquitted the latter of
n connection with the Matteotti affair and of the other
serious accusations, only certain minor counts being de-
not proven. At the municipal elections of Palermo on
1925 the anti-Fascist list was supported by Orlando,
ad mobilised his adherents in its favour, but the Fascist
ured a large majority. In consequence Orlando resigned
t, declaring that there was no longer a place for him in
political life. His withdrawal from politics made very
mpression, as he had already to a very large extent lost
itical influence. The findings of the prosecuting section
Court of Appeal on the Matteotti case in Dec. 1925,
ommitting Dumini and four accomplices to trial for mur-
cluded premeditation and exonerated members of the
Government and officials from complicity. Cesare Rossi, Marinelli and Filippelli were consequently set free.

The trial of the five men accused of having caused the death of Sig. Matteotti was ended on March 24 1926, at Chieti. Dumini, Volpi and Poveromo were found guilty of non-premeditated unintentional homicide extenuated by the subnormal physical resistance of Sig. Matteotti and by other circumstances; Viola and Malacria were found not guilty. The sentence on Dumini, Volpi and Poveromo was 5 years 11 months and 20 days penal servitude of which 4 years are remitted under the recent amnesty and one year and 9 months were already served in awaiting trial. They had therefore to serve only 2 months and 20 days imprisonment.

Financial Reform.—In the spring of 1925 financial difficulties had arisen resulting in the serious depreciation of the lira, which fell from a little over 100 to the £ to close on 150; this was partly due to the heavy excess of imports over exports in consequence of the bad harvest of 1924, but also to speculation initially promoted by certain members of the Opposition who hoped to break Fascism through a financial disaster and the consequent panic in a part of the public, which believed that the Government intended to reduce the currency to zero after the example of Germany. The measures enacted to restrain speculation aroused much opposition in stock exchange circles and caused a temporary suspension of operations. Prof. De Stefani subsequently modified the regulations, but the Premier felt that a bold treasury policy was now necessary, requiring the services of a practical financier. De Stefani's great task in reorganising the fiscal system and balancing the budget was accomplished; for 1924–5 a surplus of 209 millions was announced, which eventually rose to 417 millions. In July he resigned and was replaced by Count Giuseppe Volpi, Governor of Tripoli, and formerly a business man of wide experience.

The American Debt.—After enacting new regulations, which effectively restrained illicit speculation and improved the currency (the lira rose to 120 to the £) he undertook the settlement of the War debt to the U.S., which was weighing heavily on Italian finance. On Oct. 22 he sailed for Washington, accompanied by Dino Grandi, Under-Secretary for Foreign Affairs, the manufacturer Pirelli, the banker Alberti and the diplomat Count Bonin Longare; on Nov. 14 an agreement was concluded whereby Italy's debt, originally $2,148,000,000, was reduced to $2,042,000,000 to be spread over 62 years, which, calculating the interest at 5%, reduces the actual value of the debt to $360,000,000 (a reduction of 82%); as the interest to be paid amounts to $73,000,000 the total to-day (1926) is $433,000,000. Five millions were to be repaid in each of the first five years, thereafter $20,000,000 till the 30th year, and $50,000,000 for the remainder. The agreement was ratified by the U.S. senate on April 21. A loan floated by the American banks for $100,000,000 to enable the Government to stabilise the exchange was subscribed several times over, while other loans for public works and the railways were also successfully floated in New York. On Jan. 27 1926 Count Volpi signed with Mr. Churchill an agreement in settlement of the Italian War debt of £610,000,000, whereby Italy contracted to pay an annual sum of £4,500,000, slightly reduced at first, over a period of 62 years. The first payment of £2,000,000 was made in March 1926.

The Government undertook several important reforms in the field of internal legislation with the object of giving a more essentially Fascist character to the state. In order to bring Southern Italy up to the standard of the more progressive North a series of measures were enacted for co-ordinating agricultural land reclamation, drainage, the building of roads and railways, etc., for which adequate funds were provided and a suitable civil service organisation created. The wheat crop of 1925 had beaten all records, amounting to 64,000,000 quintals (the pre-War average was 49,000,000), but Mussolini was determined to spare no efforts to increase the output until the 75,000,000 annually required by the population could be grown at home, thereby avoiding heavy payments abroad; all forms of encouragement to producers were adopted and various agricultural measures enacted, constituting what was known as "the battle for wheat."

Fascist Legislation.—Of the political Fascist measures the following are the most important:—

In order to eliminate the influence of Freemasonry in the administrative and political life of the country often inspired by foreign interests, a law was enacted in Dec. 1925 whereby all associations are obliged to communicate their statutes and their membership lists to the authorities, and, should secret societies continue nevertheless to exist, civil servants are forbidden to belong to them on pain of dismissal.

The law of Jan. 31 1926 provides that Italians living abroad who commit acts calculated to promote sedition in Italy or injure Italian interests shall be deprived of Italian citizenship, and in the graver cases even of their property.

The Government is empowered up to Dec. 31 1926 by the law of Nov. 1925 to dismiss from the public service officials who commit overt acts against the state and existing institutions or attempt to prevent the enforcement of the laws or to frustrate its policy.

The conditions of certain municipalities also called for reform. That of Rome, owing to the heavy charges entailed by the fact that it is the capital, could not defray expenditure out of the local revenues alone and constantly had to call upon the Government to make up the deficit; moreover it appeared desirable that the city should not be the scene of political wrangles and party conflicts. Consequently by the law of Oct. 28 1925, instead of an elective mayor and town council, a governor of Rome was created, to be appointed by Royal decree, assisted by two vice-governors, 10 *rettori* and an advisory council of 80 *consultori* to be selected from lists presented by the various economic, professional and educational bodies and certain other associations.

The law of Feb. 4 1926 provides that communes of less than 5,000 inhabitants, where municipal affairs were often run for the benefit of the mayor and assessors and their families, shall be administered by a *Podestà* appointed by royal decree, assisted by an advisory council of *consultori;* a *podestà* can also be appointed for five years in larger communes where the elective council has been dissolved twice in two years.

The authority of the prefects is strengthened with a view to co-ordinating the various provincial services (law of March 1926), while the advisory provincial economic councils are created (law of March 1926) to assist the prefects and the Government in all matters of an economic character composed partly of ex-officio and partly of elective members. The law of Dec. 24 1925 conferred greater power of Parliamentary initiative on the Prime Minister and otherwise extended his authority; it also provides for the infliction of penalties for committing offences against him.

Labour Tribunals.—The most important measure of all is the law of April 3 1926, whereby the labour corporations are recognised and invested with the right of legally representing the various categories (employers, workers, employees, professional men, landlords, peasants, experts, etc.), and all labour conflicts are referred to the labour tribunals attached to courts of appeal; strikes and lock-outs are declared illegal and persons promoting them or participating in them are liable to penalties; the original draft of the bill provided that recourse to these tribunals should be voluntary in industrial conflicts, and obligatory only in those concerning agriculture, and Sig. Benni, president of the Industrial confederation, supported this distinction, whereas Sig. Rossoni, president of the labour syndicates, insisted that such recourse should be obligatory in both cases. Sig. Mussolini intervened in the debate with a powerful speech. After he had taken a day for reflection, he decided in favour of Rossoni's view, which was then accepted even by Benni himself, who withdrew his objections.

Although most of the "Aventinians" continued to remain absent from the Chamber, the groups led by Salandra and Giolitti were present, together with Orlando's followers and the Communists and a few stray Aventinians who had begun to drift back and the Communists; the latter took part in the debates and an amendment proposed by one of them was adopted. The unity of the Aventiniani was gradually breaking up through internal dissensions and personal jealousy. The general internal situation continued to improve, although affrays between Fascists and anti-Fascists occurred from time to time. The most serious of these was the attack on Sig. Amendoli, (*q.v.*) near Montecatini, in the summer of 1925, and the outbreak in Florence on Oct. 3, when as the result of the murder of the Fascist provincial secretary Luporini by a leading Freemason, the latter and two Communists were murdered by Fascists, and the shops and offices of several persons supposed to be Freemasons wrecked. The affair was most regrettable, but it had been voked by the anti-Fascists, and the persons responsible, wh Fascists, or opponents, were all apprehended, and while t charged with murder were awaiting trial before the assizes lesser offenders had already been tried and condemned. prosperity of the country and the absence of unemploy have greatly weakened the Oppositions, many of whose mem as well as many dissident Fascists have shown a tendenc abandon their uncompromising attitude, and not a few applying for the Fascist *tessera*, but the party directorate rigid in their refusal to readmit them. In March 1926 Farin who had been counsel for the defence of Dumini in the Matt trial, resigned from the secretaryship of the Fascist party. was succeeded by Augusto Turati; the party directorate also changed at the same time, and on April 23 it decide admit no new recruits to the party until 1927.

The object of these various measures and of the general p of the Government is to give an essentially Fascist characte the state and its institutions, so that the main principle Fascism, notably the idea of the duty of all citizens tow the state and the necessity that all should co-operate under guidance of the government and of the men best suited the task in every field of activity, for the common good an dignity, prosperity and greatness of Italy, should come t taken for granted by the nation. It is a policy similar to of the men of the Risorgimento who succeeded in getting then novel ideas of the unity and independence of Italy accep by the mass of the people, who had until that time been in ferent or opposed to them. The gradual elimination of opposition was based on the view that an opposition in the s of a reasoned criticism of the Government's policy, which Government itself would have welcomed, did not exist; t were only the survivors of groups belonging to a dead past, hoped by a policy of factious scandalmongering, in alliance the avowedly anti-national groups, to reconquer their old dominance. Hence the lack of interest on the part of the n of the public at their disappearance.

The Plot against Mussolini.—A sensation was caused on N 5 1925 when it was announced that a plot had been discove to murder Sig. Mussolini. The Socialist ex-deputy Zanib was arrested in a room in a hotel commanding the Palazzo C armed with a rifle with which he intended to shoot the Pre while he was taking the salute during the march past of patriotic societies on Armistice Day (Nov. 4). Gen. Cap (*q.v.*) ex-commander of the II. Army, an active Freemason a bitter opponent of the Government, was arrested for c plicity in the attempt. Mussolini was greeted with enthusia demonstrations in consequence of his escape. Another atte on his life was made by the Hon. Violet Gibson, an apparen demented Irishwoman, on April 7 1926, on the eve of his dep ture for Tripoli. The Premier was slightly wounded in the n but proceeded nevertheless on his journey to visit Italy's No African colony.

In the field of foreign affairs a treaty with Egypt was c cluded, whereby the Jaghbub oasis was ceded to Italy, who exchange ceded to Egypt es Sollum. The oasis is import both as the headquarters of the Senussi sect and because dominates the caravan routes between Egypt and Cyrenai by possessing it Italy will be able to prevent the contraband arms from Egypt to the rebel tribes. The question had b long debated between Britain and Italy, and although Jaghb had been promised to Italy, Lord Milner had informed Sena Scialoja in April 1920 that, as in the case of Transjuba, the agr ment would only become effective after a general settlement all the problems before the Peace Conference, thus coupl the Jaghbub question with that of the Dodecanese. As have seen, this connection was rejected by Italy, and Brit had ended by accepting the Italian view, but with the conc sion of independence to Egypt in 1922 negotiations h had to be renewed with that country, and were concluded Dec. 6 1925.

policy of the Fascist Govt. to enforce the teaching of
in the schools of the Alto Adige, and otherwise to give
lian character to this district inhabited by 180,000 to
› Germans, aroused irritation in Germany, and the pan-
n elements voiced by Herr Held, the Bavarian Premier,
ed an agitation against Italy, advocating a boycott of
goods, and accusing the Italian authorities of terrorising
pulation. Sig. Mussolini on Feb. 6 1926 delivered a vig-
speech in the Chamber denouncing this campaign and
g the German Govt. that unless it ceased Italy would not
e to adopt strong measures. This outburst caused wide-
excitement abroad, but it achieved its object. Herr
mann replied in a very minor tone, admitting that the
s of persecution and terrorism were untrue, and this was
ed by a part of the German Press, although the Italian-
of the district was deplored. In Italy Sig. Mussolini's
t received general approval, as it was believed that
spoken to the Germans in the only language which they
tood. The anti-Italian agitation in Germany in fact died
and relations between the two countries had become
than they had been for a long time.

Italian Govt. attached particular importance to a good
tanding with the Balkan States, and on the occasion of
it to Rome of M. Ninchich in Feb. 1926 the question of
ugoslav relations was gone into once more, the conclu-
rived at being that in view of the general state of Europe,
closer collaboration between the two countries than had
ore been realised was desirable. The visit to Rome of the
Minister M. Roufos, while not leading to any definite
was an indication of the cordial sentiments of Greece
s Italy.

year 1925 was proclaimed by Pope Pius XI., an *Anno*
and over 1,000,000 pilgrims flocked to Rome from all
f the world. The Italian Govt. and the Rome munici-
collaborated with the Vatican in organising the transport
pilgrims and in making arrangements for their stay. Im-
ceremonies were held in St. Peter's and the other churches,
rbed by any untoward incident, in spite of the attempts
anti-Clericals and the Freemasons to discourage the
ages. Relations between the Church and the State con-
to improve in spite of occasional misunderstandings,
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II. THE PROBLEM OF DEFENCE

No country, with the exception of India, is protected by nature in the way that Italy is protected by the formidable barrier of the Alps, which not only affords a defence against invasion by land, but also protects her, to a great extent, from attack from the air. By the treaty of peace signed at Vienna in 1866 Italy was denied the full advantage of her natural strategic frontier and Austria was allowed to retain a foothold south of the Alps in the north and east of the province of Venice; throughout the Great War Italy was never able to overcome the advantage which this adjustment conferred on Austria.

As the result of the Treaty of St. Germain Italy, for the first time in modern history, has secured as her political frontier the line that must always be her strategic frontier. The Italian frontier now follows the high Alps from end to end. This frontier, fixed by nature, has been strengthened by diplomacy, for one-third of it is bounded by the neutral and buffer State of Switzerland.

The ethnographical frontier, however, is not identical with the strategic frontier, and Italy now suffers the disadvantage of including within her boundaries about 250,000 Austrians in the Trentino and 250,000 Slovenes in Istria. As an offset to her strong land frontier Italy suffers strategically from a very extended coastline, though with the former great Austrian naval base of Pola now in her hands the Adriatic may almost be considered as a purely Italian sea.

The Military Forces.—The importance which Italy attaches to her military forces is best indicated by her military budget, which for 1924–5 and 1925–6 in millions of lire were as follows:—

	1924–5	1925–6
Army	1,990	2,130
Navy	925	980
Air Force	399	449
Colonial troops	195	252

The above forces are under a Minister of War, a Minister of Marine and a Minister of Air. After the World War, Italy followed the British example in establishing an air force distinct from the army and navy; at first this was under an under secretary responsible to the Minister of the Interior, but in 1925 a Minister for Air was created on an equality with the Minister for War and the Minister of Marine. The three offices were, however, temporarily in the hands of Sig. Mussolini, the Prime Minister.

In 1925 also the appointment of a chief of the general staff was created; this officer, who will be a marshal or general of army, will be responsible to the Minister for War for the army and to the President of the Supreme Commission of Defence (Prime Minister) for everything relating to the execution of the Supreme Commission of Defence and for the eventual operations of war of the three services.

The Regular Army.—The army is now organised in 10 army corps stationed as follows: I. Turin, II. Milan, III. Verona, IV. Bologna, V. Trieste, VI. Florence, VII. Rome, VIII. Naples, IX. Bari, X. Sicily. It will be seen that five of these army corps are stationed in or about the valley of the Po. These 10 army corps consist of 30 divisions, three of three brigades each, 16 of two brigades each, and 11 of one brigade each, making a total of 52 brigades. In addition to the 30 divisions there are three cavalry brigades, three groups of Alpini, each of nine battalions, 12 regiments of Bersaglieri, a tank corps. The length of service in the army is for 18 months. The numbers called up each year are about 180,000. The recruits are called up in May; so between May and Sept. there are therefore

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the autumn of 1925 Mussolini made speeches of an unmis-
imperial nature. After the Locarno conference he said in
amber at Rome that " while the words of peace glisten on the
I must recognise that the skies have become populated with
ous airplanes and that new and deadly weapons are appearing
he sea." Early in 1926 he went to Tripoli, where he addressed
onial Agricultural Congress, saying " We are hungry for land
we are prolific and intend to remain so. There is no doubt
journey is destined to have profound repercussions on the
f the Italian people, repercussions which will be beneficial
at is our indestructible will." On July 23 he delivered
speech, breathing the same spirit. Although Mussolini has
en very outspoken in his addresses to his own people, he has
nciliatory in his relations with other European powers, and
ready to deny any thought of aggression by force, trusting
o friendly agreement to secure his ends. (ED. *E. B.*)

two classes with the colours, less the number dismissed after 12 months' service (about 60,000); the maximum strength in these months is therefore about 300,000.

The Colonial Army.—The colonial army consists of both Italian and native units, the latter with Italian officers and a proportion of native N. C. O.s. In 1925 the colonial garrisons consisted of 12,350 Italians and 23,000 native troops, of which all except 8,500 were in Tripolitania and Cyrenaica.

The National Militia.—The national militia is the development of the Fascisti militia. In Oct. 1924 this force by decree was declared to be part of the armed forces of the state, took the oath of allegiance to the King, and became subject to the same disciplinary and penal regulations as the regular army. In peace the national militia is directly under the orders of the Prime Minister; on mobilisation such members as are liable to join as reservists are drafted into the army, navy or air force; other militiamen come under the control of the Minister of War. The members of the national militia are all volunteers. The functions of this force embrace co-operation with the army and public security services in the maintenance of internal order and the defence of Italian interests throughout the world.

The militia is divided into two battalions. In 1925 the strength of the 1st battalion was 175,000 and of the 2nd battalion 120,000; the 1st battalion is composed of men who by reason of their occupation or domicile are liable to be called up at any moment. A general calling up of the national militia can only be ordered by the Prime Minister himself.

The Air Force.—This force, which is under a Minister for Air, is subdivided into four portions: An independent air force, which will consist of 78 squadrons; the army air force, which will consist of 57 squadrons; the naval air force, which will consist of 35 squadrons and six airships; the colonial air force, which will consist of 12 squadrons. These auxiliary air forces, although working under the orders of the other services, will depend on the air force in regard to technical matters, administration and promotion.

Munition Factories.—During the World War Italy was handicapped to an extent unknown by other Powers by her lack of raw materials and by the limited capacity of her munition factories, and was largely dependent on the Allies. Her home resources in coal and oil are extremely limited (*see* ECONOMIC HISTORY, below), and she has only very limited quantities of iron ore. During the War she developed her metallurgical industry with great energy and determination; the great works of Ansaldo and Fiat are a remarkable testimony of this development. In the manufacture of aeroplanes, airships and mechanical transport Italy is now in the forefront of manufacturing nations, whilst in regard to armament she is now self-supporting. Although her lack of raw materials must always present an almost insuperable difficulty to Italy, she has remedied this deficiency as far as is possible by exploiting her limited resources and by the development of electrical power. In regard to man power, Italy has no difficulties; her population of 40,000,000, which increases at a rate of 500,000 a year, is ample for her purposes. (J. DU.)

III. ECONOMIC AND FINANCIAL HISTORY[1]

Population.—A remarkable increase of the Italian population took place between 1910 and 1925. The losses due to the War, to epidemics and disasters and to the decrease of births in the years 1916–9, failed to check the increase, since they were balanced by the return of a number of emigrants (estimated at about 1,000,000) while comparatively few, about 363,000 have since left the country. Thus, it is estimated that the 34,600,000 enumerated in the 1911 census, giving a density of 121 to the sq. km. had increased at the end of 1925 to 40,500,000 or 131 to the sq. km. (including the restored territories, which are more sparsely populated than the peninsula), and this in a country two-thirds mountainous or very hilly, poor in minerals and with a soil exploited by some 3,000 years of cultivation.

The birth-rate, like that of most countries, shows a continuous decline since the 'seventies, but infantile mortality has also diminished. The increase in the number of marriages has co pensated for the decrease during the War, but the birth-rate p marriage is only at the pre-War level.

This rapid increase has resulted in the flooding of the labo market. The number of workers between the ages of 16 and is probably about 24,000,000 as against about 20,500,000 1911. The difficulty of absorbing this mass of labour wou have been even greater than it has been were it not for impro ments in industrial equipment, factory organisation, agric tural technique and also the extension of Italian territory. T pressure, however, is increased by the great number of war v tims, who are unable to contribute their full share of work.

Period	Marriages Per 1000 of pop.	Births Per 1000 of pop.	Deaths Per 1000 of pop.	Natur Increase Per 100 of pop.
1908–10	8·01	33·30	20·07	11·40
Normal pre-War[1] period	7·53	31·86	19·61	12·14
War period[2]	3·43	20·53	22·99	1·83
Post-War period[3]	10·31	30·00	17·60	12·60
Average of years 1911–24	7·40	27·80	19·60	8·25

[1] 1909–15 for births, 1909–14 for all other columns.
[2] 1916–19 for births, 1915–8 for all other columns.
[3] 1919–24 for births, 1920–4 for all other columns.
[4] Excess of live births over deaths.

Emigration.—In 1911 the Italians abroad numbered 5,500,0 including those who had emigrated long before that date b had retained their nationality, and whose children had declar themselves Italians. As the result of a special investigati Savorgnan found that in the 40 years 1872–1913 emigrati had effected a reduction of at least 3,800,000 persons in t natural increase of the population of Italy. During the War t movement naturally slackened. Conscription, and the inte demand for manpower at home removed alike the possibility and the incentive to migration. The total number of emigra in the four years was, in fact, barely three-fifths of the pre-W annual average. With the return of peace began a feverish r abroad, which was at its height in 1920 when those who h returned from the United States during the War realised t if they delayed they might not be able to get back at all. T numbers of those repatriated since 1921 have amounted annua to about half the total number of emigrants. In all probabili the proportion was formerly greater, since nearly all of those Europe and about 55% of those overseas returned for the wint Nevertheless, when a census of Italians abroad was taken in 19 it was found that there were 7,500,000 of them scattered abo the world. For statistics of the movement of population and t restriction of migration to the United States *see* MIGRATION.

The present stream of emigrants differs considerably fr that of 1909–13 in respect of quantity and quality, countries destination and districts of origin. The restrictions introdu by the United States and other countries have not only redu the total number of emigrants, but have tended especially exclude the Southern Italians, whose need for an outlet is gre est. The average of Italian emigrants to North America w about 200,000 for the years 1919 and 1920, and for the yea 1921–5 about 50,000; whereas the yearly quota allowed in 19 was under 4,000.

Percentage Distribution of Italian Emigration

Destination	From N. Italy		From Central Italy		From South Italy	
	1909–13	1922–4	1909–13	1922–4	1909–13	1922-
Europe and the Mediterranean basin	30	46	7	6	4	6
Countries overseas	10	13	7	5	42	24

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[1] Note should be taken of the varying value of the lire. Expressed in lire the annual average value of sterling was:

1914	25.35	1920	99.79
1915	27.90	1921	93.91
1916	31.27	1922	91.86
1917	33.03	1923	99.75
1918	30.31	1924	102.14
1919	50.08	1925	121.54

The parity value of the lire is 25.22.

In 1924 France took 201,715 Italians, mainly from North ly, and since the Armistice the annual average has been 126,- o, or nearly double the number employed there in 1914. This te of things is, however, unlikely to continue; the reconstruc- n of the invaded districts is practically complete, and the mand for agricultural workers in the Gironde and the Garonne s now been almost satisfied. In the near future Italians will y be wanted in the industrial regions of Northern France. ter France, the largest market for their labour is the Argen- e Republic; Switzerland, Germany and Austria will assuredly need them as they did in the past. This slackening in the w of emigration has not, however, checked the tendency to increase in the proportion of skilled workers among the emi- ants, and a lessening of the former preponderance of agricul- al labourers.

Percentage of Emigrants

Period	Agri-cul-turists	La-bourers	Brick-layers	Indus-trial Work-ers	Domes-tic Ser-vants	Other occupa-tions
909-13	32	30	12	12	3	11
919	16	13	9	17	17	21
920	26	20	10	22	12	9

PRODUCTION AND INDUSTRY

Agriculture.—Despite considerable fluctuations from 1911 wards agriculture has afforded a profitable occupation to 52 cent of the population, *i.e.*, to 11 millions over 10 years of . Besides food for direct consumption, the products included raw materials of more than half the total of the country's nufactures, indirectly providing occupation for 27·8% of se employed in industry. In the years immediately preced- the War the average annual production was valued at about oo million lire. Soil and conditions vary greatly, ranging m the rich fertility of some parts of Campania and Sicily, ich will grow all kinds of luxury produce, to the moorlands of north or the chalk-hills of Tuscany and the Lucan clays; m the plains of Lombardy and Venetia, where the "special" ps (tomatoes, sugar-beet, hemp, rice, vegetables, fruit) give ood return to energetic and prudent cultivators, to bare pas- es scorched by the sun all through the rainless summers, and rshy lands where the farmer is handicapped by malaria and poverty of the soil. Regions of the most intensive and ex- sive cultivation border on one another; the large estates uated on the gentle slopes which rise from the sea shore to the ls adjoin land divided into thousands of tiny holdings. Next miserable marshlands with neither houses, trees, shade nor ter, may be seen fertile oases with olives, oranges and lemons. These various agricultural regions do not all permit of the util- tion of large capital in the form of machinery, selected seeds, ligree stocks, proper buildings and skilled workers. Where mate and soil are favourable the owner can create a garden; ewhere the struggle is long and hard and the return extremely all. In such areas capital is not the chief need, but the Gov- ment can do valuable work in preventing the damage done by erosion in the mountainous regions and by making roads and aqueducts.

Progress in these directions is slowly being made, though it suffered a set-back during the four years of war, when, owing to the requirements of the army, labour, fertilisers, machinery and means of transport, were all difficult to obtain, and produce was requisitioned at fixed prices which were far too low to compensate for the many months of laborious toil. Faced by all these difficulties and by the necessity of slaughtering large numbers of cattle and cutting down the forests for military requirements, Italian agriculturists have achieved a great feat in surmounting this troubled period without experiencing an excessive diminution of crops, cattle and forests. The greatest difficulties, however, came in the next years, 1919–22, when the effects of the great deterioration of the soil during the War period were felt; the supply of fertilisers was still very scarce, and cultivators suffered from the uncertainty of prices, the constant disputes with the wage-earners, and the high costs of transport. But these troubles ended at last, and the abundant harvests of 1923 and 1925 made ample amends for the former privations.

The increase in production has been obtained with scarcely any increase in the area under cultivation. Much is due to the intensification of effort, to a more generous use of fertilisers. The efforts and sacrifices of the small proprietors, above all the new settlers, were specially meritorious, for the acquisition of the land had often deprived them of most of their savings, with the result that they had to reduce their standard of living to a very low level in order to scrape together their working capital. Superphosphates, nitrates, basic slag, potash and other fertilisers, supplies of which were heavily reduced during the War, are all now being used in greater quantities than in 1913. The import figures of agricultural machinery do not, owing to the changes in the tariff, give a correct index of the increase or decrease in the purchase of farm machinery; it is certain that the home manufacture increased after the War. Irrigation is also making progress, and year by year new schemes are being started; at the same time water-logged areas are being drained by means of electrical power with the result of abolishing malaria as well as improving the fertility of the land.

In 1911 Italy was nearly self-supporting as regards agricultural produce, except in wheat and timber, and the amounts of these imported were almost entirely paid for by the exports of other agricultural products, so that the agricultural balance is really about even. Moreover, the industry is highly profitable; at the average prices current, the gross value of the total produce of the soil is estimated at 41,700 million lire. The total value would probably have to be increased by several hundred million lire if the whole of the peasant production could be brought into the account, for it must be remembered that no less than 87% of the rural proprietors cultivate very small holdings, most of which are less than half a hectare, though 6/7ths of the total agricultural land is being held by 214,000 "large" and "medium sized" and 500,000 "small" owners. But even excluding this supplementary amount, the figure of 41,700 million lire represents an average of 3,180 lire contributed by each agricultural worker over ten years of age; and an average value of 1,467 lire

Principal Agricultural Products (in thousands of Quintals)

	Annual Average 1909–14	Index No.	Annual Average 1915–8	Index No.	Annual Average 1919–22	Index No.	1923	Index No.	1924	Index No.	1925	Index No.
Vheat . . .	49,270	100	45,510	92	45,400	92	61,190	124	46,310	94	65,600	133
laize . . .	25,680	100	23,000	90	21,800	85	22,660	88	20,830	104	26,140	102
ice . . .	4,870	100	5,320	109	4,700	97	5,210	107	5,910	121	6,200	127
otatoes . .	16,560	100	14,310	87	13,650	83	17,960	108	19,580	118	22,000	132
ugar-beet . .	17,240	100	12,580	73	16,800	97	26,990	156	37,240	215	13,000	76
rapes . . .	70,420	100	55,400	78	56,600	79	83,340	119	71,070	101	69,900	99
Vine . . .	45,520	100	35,800	78	36,200	79	53,950	118	45,020	99	43,000	95
lives . . .	10,770	100	12,980	120	11,300	105	11,420	106	14,460	134	9,100	86
live Oil . .	1,810	100	2,180	120	1,900	105	1,880	104	2,400	132	1,500	83
ranges and Lemons or Citrons and other fruits	7,890	100	7,330	93	6,430	80	6,180	78	6,500	82		
lemp . . .	850	100	880	103	815	96	603	71	740	87	1,170	138

of heavy produce for each hectare of agricultural or forest land, the lowest regional average being Sardinia with 460 lire and the highest, Lombardy with 2,580 lire.

Industry.—Of the 5,000,000 adults shown by the census of 1911 as occupied in industry, probably not less than a third were not employed in factories; and it must not be forgotten that a number of women and children entered as domestic workers actually help in the manufacture of articles of daily use or in making the numerous local products which reflect Italian artistic traditions, good taste and native skill, and which enter largely into the export trade. Such wares are embroidery, lace, carved furniture and terra cottas, wrought iron and chased metal work, decorative glass, spun glass and mosaics, stamped leather and illuminated vellum, all of which give ample opportunity to skilled workers and are mainly fashioned in small workshops. The multiplicity of such workshops and the extent of the sales to the public show the importance of these crafts.

Evidence of industrial development is generally sought for in the progress of large undertakings where thousands of workers are massed together, and certain branches of heavy industry are usually looked on as providing the best indices of the aggregate national activity. In Italy, however, the scarcity of fuel and of minerals, the difficulties of land transport due to the mountainous nature of the country, and also the special qualities of the working classes, who are not excessively robust, though quick, industrious and intelligent, have led to a preference for the working up of food products, textiles of various kinds, delicate machinery and housing accessories.

The census of industries which was taken on Jan. 10 1911 showed a very large number of undertakings (243,926), distributed throughout the country, the larger units being concentrated in North Italy, the smaller spread over the other parts of the peninsula. The larger units were comparatively few (only one-tenth of the total number—22,413 to be exact—employed more than 10 persons each), but this tenth possessed three-quarters of the aggregate mechanical and labour power. The distribution of the women, who constituted a third of the total number of persons employed, indicates the importance of the textile industries. These have been traditional for centuries in Italy, and were to be found in every valley, while domestic production had not yet disappeared. Next in importance, in respect of numbers of undertakings and employees, came food manufactures, while the steel and engineering industries were making but slow progress.

The War stimulated nearly every branch of industry, and the introduction of the shift system led to the expansion of plant and to new kinds of manufacture in which by-products, formerly neglected, could be utilised. The extraction of iron ore, pig-iron production and steel showed great increases. In addition to arms and munitions the requirements of the army included a vast number of commodities ranging from cloth to canvas, from shoes to motor-cars, from rubber to paper and from chemicals to naval dockyards. All these shared in the boom which followed the cessation of hostilities.

Employment.—After the Armistice a crisis was brought about by the necessity of substituting other industries for those of the War period, and the difficulties of forecasting demands were intensified by the shortage of raw materials, and by a fierce struggle for the control of associated or subsidiary products. With the assistance of industrial exhibitions organised at Milan, Padua and Naples, and of vertical combines which were formed on an extensive scale, the very difficult period of 1919–20 was at length surmounted. The workers' desire for a "new order" which should give them control of the factories, provoked a number of vast conflicts and strikes. In the first year after the Armistice 1,600,000 workers "downed tools," and 2,300,000 in the following year. In the two succeeding years the world crisis made itself felt, and the effects were intensified because, owing to the bad harvests, the spending power of the poorer classes was greatly reduced and the demand for manufactured goods thereby lessened. But in 1922 conditions began to improve; in that year there were less than 448,000 strikers, and the number of unemployed, which in Jan. 1922 had reached the maximum o 607,000, fell in the summer to half that figure and did not ris to any very great extent in the following winter. At the end o 1925, the number of unemployed was still reduced to the very small figure of 122,000. Certain undertakings which had been over-capitalised failed, and this directed attention to the necessity of reducing costs of production, which became of vita importance when active competition was renewed.

Price Level.—The recovery was brought about by the closing of the gap between internal and foreign price levels during 192 and by the diminution in the violence of fluctuations. Prospective costs and profits could then be estimated with less uncertainty. Another contributory cause was the halt in the upward course of wages; in 1921 these were five and a half times higher than the pre-War level, but they fell in 1922, and throughout 1923 and in 1924 remained at barely five times the pre-War figure, *i.e.*, the rise was a little less than that in the cost of living which was nearly six times the pre-War level. But in 192 statistics show a very marked upward trend of the level of wages caused by the ever-increasing cost of living. Imports of raw materials increased, and the mining industry almost entirely recovered.

Heavy Industry.—The production of pig-iron rose to only about a tenth below the 1910–4 average, and less was imported since scrap was being more and more utilised for the manufacture of steel, both by the Martin and electric processes.

	Imports of Principal Raw Materials (thousands of metric tons)			National Production (thousands of metric tons)		
Annual average	Iron and Steel Scrap	Pig-iron	Copper	Iron Ore	Pig-iron	Iron and Steel
1910–4	340	230	36	563	369	973
1915–8	212	243	74	829	407	1,150
1919–21	102	146	42	427	130	740
1922	306	136	46	311	158	1,046
1923	434	132	50	341	236	1,219
1924	538	201	58	219	304	1,359
1925	958	265	66	. .	. .	1,600

A still greater expansion of the steel industries was hindered by the scarcity of minerals and of coal, the inferior physique of the workers and the difficulties both of organising vertical combinations and of maintaining their efficiency. Hence the preference of the Italians for industries where these drawbacks are not felt in the same degree; such are the building industry, the making of cement blocks and the preparation of foodstuffs for which there is abundant demand. Tanneries and stocking factories have greatly increased in number and capacity, and their products, like those of automobile works, are very largely exported. The film and armament industries have fallen to a very low level, the results of which are especially felt in the redeemed provinces where they were formerly of great importance. On the other hand, beet sugar is being produced in 53 factories as against a little over 30 in 1911, and the production, which averaged 1,700,000 quintals in the five years preceding the War, has lately reached 2,750,000 quintals; it is true that in 1925 the amount fell to the 1910 level, but the set-back is merely temporary. As soon as the stocks accumulated during the boom period have been sold off, the beet area will certainly be extended both in Emilia and the Veneto, where four-fifths both of the cultivation and of the manufacture are carried on. In Campania about half of the preserved vegetable foodstuffs are made, of which the annual value is about 368,000,000 lire, and three-fifths are exported.

Textiles.—As regards textiles, the woollen branches of the industry seem on the whole to have made most progress; larger quantities of raw material are being consumed, and certain processes are being undertaken which were formerly not attempted in Italy. Washing and combing are no longer done almost entirely abroad, thanks to the improvements in machinery and equipment which have been made since 1915, especially in

Annual average	Raw silk production	Exports		Production		Imports	
		of raw silk[2]	of cotton, spun and woven	of electric power	of lignite	of coal	of petroleum, benzene and residual products
	(kilogrammes)	(kilogrammes)	(quintals)	(in million kilowatts)	(tons)	(tons)	(quintals)
910–4	4,780,000	7,193,400	538,800	2,300	654,000	9,940,000	1,387,000
915 8	2,492,000	4,720,000	586,000	3,200	1,540,000	682,000	2,260,000
919–21	3,600,000	4,740,000	575,000	4,100	1,335,000	645,000	2,310,000
922	3,990,000	4,410,000	390,600	4,300	946,000	8,838,000	2,911,000
923	5,233,000	5,180,000	587,900	5,400	1,133,000	9,134,000	3,489,000
924	5,563,000	5,440,000	775,500	6,000	1,048,000	11,221,000	3,767,000
925[1]	. .	6,370,000	800,000	7,600	. .	10,500,000	4,250,000

The whole year.
Considerable quantities of cocoons are imported—hence the excess of export over home production.

edmont and the Vicentino. The silk and cotton manufactures also expanding; better qualities of raw materials are being ed (*e.g.*, Egyptian cotton) and equipment and processes have en modernised and improved. In fine, owing to the cheapness female labour the textile industries have passed beyond the ge of catering for the home demand and for the poorest of the eign markets, and the exports are no longer confined to the arser kinds of fabrics, but include grades of medium fineness. e manufacture of mixed fabrics has been greatly facilitated the increasing development of artificial silk, for which until a v years ago Italy depended largely upon foreign countries.

Motive Power.—An index of the manufacturing capacity of ly is afforded by the figures of consumption of fuel and motive wer; although the Italian mines yield only one-twentieth of country's industrial requirements, the amount of hydro-ctric energy (leaving out of account the periods of interrup-n due to the exceptional drought) is almost three times as at as in 1913 and takes the place of at least 7,000,000 tons of l. In addition, the imports of coal are about the same as in 3, while those of petroleum and benzene have nearly trebled quantity.

Savings.—During the 15 years 1911–25 savings have experienced ious set-backs, especially in the form of deposits in savings in-utions and investments at fixed rates of interest. The effects of netary depreciation have been felt by those who did not wish or not know how to transfer their holdings of fixed interest bearing urities into industrial shares or real estate. The rate of interest bonds has risen from 4% to 6% and over. It is questionable ether the 35·7 milliard lire deposited in various credit and savings titutions in the middle of 1924 represented an equivalent purchas-power to the 7·6 milliard lire similarly deposited in June 1914. view of the rise of prices and diminution in the purchasing power the lira, the deposits in the middle of 1924 were probably equiva-t to about 5·5 milliard lire (pre-War values), but it should be served that current savings are more often invested directly in-ad of through the medium of credit institutions. The issue of h long and short dated treasury bonds, the total of which rose m a few hundred millions in 1914 to 30 milliard lire over a period en the consolidated public debt also trebled in amount, indicates of the many new avenues for savings which formerly found their y into banks and savings institutions. (A still larger field is now ered by industry, for example, the resumption of building after War has absorbed a considerable amount of savings.) It has n estimated that new savings in 1925 amounted to 15 milliard , equivalent to about 2½ milliard lire (pre-War values). The ompanying tables show the amount deposited in savings and credit titutions, the official discount rate, and the number and capitali-ion of joint stock companies:—

Number and Amount of Capital of the Principal Joint Stock Companies at the Beginning of Each Year

Year	Number	Total capital (million lire)	Amount per society (million lire)	Aggregate capital, calculated on the basis of 1913 purchasing power of the lira (million lire)
1913	2,951	5,506	1,870	5,506
1918	3,463	7,257	2,090	6,770
1922	6,075	20,249	3,340	8,975
1923	6,734	21,293	3,160	9,345
1924	7,782	23,421	3,020	10,170
1925	8,946	28,261	3,160	10,402
1926	10,515	36,278	3,450	11,444

Stock-exchange quotations of securities reflect the judgment of the market as to the resources, prospective profits, etc., of each undertaking. When grouped together for each industry the figures provide an index of the general financial forces influencing the different branches of economic activity.

	Index Numbers of Stock-Exchange Quotations for the Principal Joint Stock Companies and State Securities Calculated by Riccardo Bachi. Basis 100 for 1913					
	1914 Dec.	1918 Dec.	1922 Dec.	1923 Dec.	1924 Dec.	1925 Dec.
Credit Institutions	91	93	94	109	132	128
Inland Transport	93	151	150	167	215	228
Maritime Transport	94	184	114	124	181	154
Cotton	100	284	468	700	1290	1392
Mining	102	199	132	181	281	273
Iron and Steel	89	175	36	39	52	46
Engineering	84	121	25	25	36	32
Automobile	96	489	339	485	834	899
Electricity	95	144	113	139	203	196
Chemical	86	125	92	110	170	179
Sugar	90	156	193	229	375	282
Food	96	183	276	311	582	. .
Real Estate	97	125	145	192	351	259
General Average	92	125	90	107	163	154
State Securities	96	69	64	66	71	66

Bankruptcies.—The number of bankruptcies, after falling to one-third during the War period and to less than one-seventh in the following three years, rose in 1924 to the level of 10 years previously. As the population has become denser and those engaged in industry and commerce more numerous, this figure may be regarded as normal.

	1914	1918	1920	1922	1923	1924	1925
mounts deposited in the Postal and other Savings Institutions, banks, credit banks and peoples' banks, Monti di pietă, etc. (in millions of lire)	7,595	12,231	20,659	28,316	32,334	35,698	36,000
fficial rate of discount	5–5·50	5–5·50	5–6	6–5·50	5·50	5·50	5·50–7
ate of interest on the public debt (from annual averages)	3·62	5·66	6·62	6·55	5·97	5·28	5·44
ndex numbers of wholesale prices of commodities (R. Bachi) (from annual average)	100	409	624	562	575	585	690

Sales of Property.—The sales of fixed property, which increased in the period of social upheaval and threats of expropriation, continue to be somewhat numerous, owing to the profitability of small holdings and to the break up of the large estates. The very small values of the average transfer indicate a new reduction in size of properties transferred. Allowing for a certain amount of evasion it is possible that this reflects an increase in the number of transfers of small properties for building purposes.

Annual Average	Number of Bankruptcies	Transfers of Fixed Property		
		Financial Year	Number	Millions of Lire
1912-4	7,170	1914–5	343,332	1,006
1915-8	2,520	1920–1	508,433	4,158
1919-21	1,007	1921–2	498,700	4,781
1922	3,562	1922–3	465,367	5,490
1923	5,691	1923–4	462,700	5,664
1924	7,276	. .	. .	. .
1925	7,218	. .	. .	. .

TRADE AND TRANSPORT

The development of Italy's foreign trade has been affected both by the depreciation of the currency and by the increase of her population; allowing for the reduced purchasing power of money, the average value per head of the population was less in 1925 than in the period immediately preceding the War, but was tending to increase.

Directions of Trade.—The directions of both imports and exports show considerable changes, compared with pre-War. Imports from the United States and the Argentine increased by 10 times, only surpassed by Switzerland with a 12-fold increase, while imports from France, England and Germany increased only from three to five times. The extension of Italian exports has been greatest to England, France and Switzerland, followed by Germany, the Argentine and the United States.

Balance.—The adverse annual balance of trade, which was 1·1 milliard lire in 1909–13, rose in 1925 to about 8 milliard lire; against this must be set the expenditure of foreign visitors and the remittances of Italian emigrants, the former being probably of the larger importance. Movements in the values of total imports and exports are given in the following table:—

Foreign Trade 1910–25 (Special Trade)

Year	Imports			Exports		
	Total millions of of lire	Amount per head of pop. in lire		Total millions of lire	Amount per head of pop. in lire	
		a	*b*		*a*	*b*
1910–14	3,381	97	97	2,281	65	65
1919–21	20,123	546	105	8,700	236	45
1922	15,765	404	72	9,302	238	42
1923	17,189	436	76	11,086	281	49
1924	19,388	486	83	14,318	359	61
1925[1]	26,254	648	73	18,277	451	48

[1] The whole year.

(*a*) In lire. (*b*) In lire on the basis of purchasing power.

Transport.—The demands made by the War on both railway lines and rolling stock were very heavy; the length of railways was increased by 1,000 km., while another 1,000 km. were taken over in the restored provinces. On the state-operated lines the number of passengers increased during the last decade by 7%, and since 1922 the volume of goods carried has shown a considerable increase, following on the improvement in railway material and greater security of delivery. The charges both for passengers and for goods have been increased, while the *personnel* has been reduced and the price of coal has fallen from the excessive level of 1921, hence the deficit which arose during the years immediately succeeding the War has disappeared.

The net tonnage of the mercantile marine registered in Italian ports doubled between 1912 and 1924. The losses from submarines and mines were more than replaced by the shipping taken over in Trieste and Istria, and the ships as a whole are faster and more modern than before the War. Though the total weight of goods carried to and from Italy shows no appreciable increase compared to pre-War, a larger proportion is carried in Italian vessels, in spite of the obvious preference of importers from overseas to employ their own vessels.

All this economic development and also the emergence of Milan as a centre of importance in international trade could not fail to be reflected in the figures of the credit clearing-houses. The clearings which in 1913 amounted to 63 milliard lire, rose in 1925 to 1,03 milliards or by 16 times.

Year	Length of the Rlys. Km.	Railways		Tonnage of Mercantile Marine	Shipping		Credit Clearing House Figures
		Railway Traffic			Goods loaded and unloaded at Italian Ports		
		Passengers	Goods		Italian Flag	Foreign Flags	
		(millions)	(mln. tons)	(mln. tons)	(mln. tons)	(mln. tons)	(mlds. of lire)
1913	17,649	94	37	0·87	16·4	15·4	61
1918	19,066	65	29	0·70	7·4	9·4	188
1922	20,904	95	36	1·50	13·8	9·7	588
1923	20,907	100	45	1·63	15·4	10·2	830
1924	20,907	100	57	1·63	18·2	13·4	914
1925	20,907	110	64	. .	21·0	13·2	1030

National Finance.—The revenues of the state were about 2,40 million lire in 1910–1. This was the last of a series of years, beginning 1898–9, in which there was a continual surplus of revenue ove expenditure; from then onwards, first the Libyan War and then th World War occasioned a long succession of financial deficits. Th period 1911–25 falls naturally into four divisions.

1. *1911–2 to 1913–4.*—Owing to the Libyan War expenditure ros by 152 million in 1911–2, by 250 million in 1912–3, and by 18 million in 1913–4, resulting in deficits for the three years of 111 8 257·5 and 163·9 million lire respectively. These deficits do not include sums borrowed by the Treasury, as a result of which th National Debt increased from 15,746·5 milliard lire to 17,080· milliard lire.

2. *1914–5 to 1918–9.*—The War years thus began with a budge which could have been balanced with a very slight effort, and with a public debt of about 17·5 milliard lire. The following table show the increase in public expenditure due to the War:—

Year	Military Expenditure	Civil Expenditure	War Pensions	Total	Revenue	Deficit
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
1914–5	3,296	2,099	. .	5,395	2,560	2,835
1915–6	8,317	2,307	1	10,625	3,734	6,89
1916–7	14,069	3,497	30	17,595	5,345	12,25
1917–8	19,142	6,002	154	25,299	7,533	17,76
1918–9	23,280	8,942	229	32,452	9,676	22,77
Total for 5 years	68,104	22,847	414	91,366	28,847	62,51

The expenditure during the War years would have appeared much greater had it not been that many items remained in suspense a burdened the budgets of subsequent years. The increase of civi expenditure was due partly to the rapid rise in the cost of livi which necessitated increased salaries and bonuses, partly to allowances to the families of soldiers and to the refugees from invade districts, partly to the taking over by the state of the administration of the mercantile marine, and partly to the interest on th National Debt, which rose from 530 millions in 1913–4 to 2,6 millions in 1918–9. It was impossible to raise revenue to within measurable distance of such expenditure.

A part of the increase in revenue was automatic, arising as it di from the depreciation of money, and the consequent increase in th receipts from indirect taxation. The resources of the financial administration were greatly strained by the withdrawal of men for th army, by the dislocation caused through inflation, and by the task of collecting the new taxation imposed during the War, such as ne monopolies (matches, playing cards, coffee); a 5% tax on the lettin of houses; the War *centesimo* on incomes above 10,000 lire; the ta on War profits, etc. None of these new taxes brought in any considerable sums to the exchequer, with the exception of the tax on War profits. Framed on lines somewhat similar to those of the exces profits duties of the United Kingdom and the United States, this ta was at first levied by the Royal Decree of Nov. 21 1915 on all profit of the War years in excess of 8%, the rates varying from 10 to 30 this latter rate being applicable to all profits in excess of 20% on th capital invested in the undertaking. The growing feeling against Wa profiteers caused the rates to be raised to from 12 to 35% (decre of Aug. 31 1916), and shortly afterwards to 20 to 60% (decree o Nov. 9 1916). The yield of the tax increased from 108·2 million in 1916–7 to 451·6 million in 1917–8, and 805·8 million in 1918–9.

3. *1919–20 to 1921–2.*—The following table shows that the highes expenditure was reached, not during the War, but during the perio of liquidation immediately after the War.

	Military Expenditure	Civil Expenditure	War Pensions	Total Expenditure	Revenue	Deficit
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
19 20	8,085	13,851	1,158	23,093	15,207	7,886
20–1	9,212	25,780	1,236	36,229	18,820	17,409
21–2	6,798	27,114	1,549	35,461	19,701	15,760
otal for 3 years	24,095	66,745	3,943	94,783	53,728	41,055

f the civil expenditure 13 milliards were required for the service he debt, 5·1 milliards for exchange transactions, etc., 3·5 milliards the cost of the merchant shipping services, 5·3 milliards for food plies, 3·1 milliards for deficits on the state railways, 3·9 milliards War pensions, and 6·8 milliards for the reconstruction of invaded restored territories. The costs of all these services were greatly anced by the depreciation of the currency.

ortunately, the fall in the value of the lira also increased the lic revenue, which during the War had varied from 2·6 to 9·7 liards, and which rose in 1921–2 to 19·7 milliards. Part of this rease was due to confiscatory legislation passed under the in-nce of the socialistic and demagogic tendencies which prevailed er the War. A levy was imposed on increments in the values of perty, which ranged from 10 to 80% of the War gain remaining the taxpaper after the payment of the War profits tax. Before s had come into force it was increased by the law of Sept. 24 1920, ich involved a tax of 100% on all the War profits of industrialists l traders. In no country was so high a rate imposed, and during three years of liquidation the yield of the tax reached over 96 million lire. Further, an extraordinary levy on property was posed, which was designed to be a progressive tax on capital, ied at rates varying from 5 to 50%, but owing to the impossibility collecting the whole tax in a single year, it was necessary to spread ver a period of years, fixed, first at 30 and then at 10 to 20 years. Among taxes already in existence the succession duty especially ealed to the new social theorists, and by means of various tech-al modifications and by changes in the method of assessment, s was raised to 30, 50, 80, and, incredible as it may seem, to 103% the amount inherited. At the same time it must not be forgotten t credit is due for the abolition, on the initiative of Signor Giolitti, the disastrous policy of regulating the price of bread, which for itical reasons was sold below cost and threatened to send the ian lira into the abyss after the German mark.

. *1922–3 to 1924–5.*—Expenditure and receipts and the eventual ancing of the budget are shown in the following table:—

Year	Military Expenditure	Civil Expenditure	War Pensions	Total Expenditure	Receipts	Difference between Receipts and Expenditure (+ or —)
	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire	mill. lire
22 3	3,248	16,976	1,608	21,832	18,803	−3,029
23 4	3,704	15,820	1,475	21,000	20,581	− 418
24 5	3,286	15,284	1,453	20,023	20,440	+ 417

Except for the first four months, the period of transition from large icits to the budget equilibrium of 1924–5 took place under the trol of Signor de Stefani, head of the combined Ministry of ance and the Treasury. He contrived to restrict expenditure hin the limits of revenue by gradually eliminating abnormal enditure and by a return to the sound conditions of Treasury trol and supervision of accounts which had been largely abrogated ring the troubled War years. The Italian Treasury has always n accustomed to publish monthly statements of its position, but this has been developed by Signor de Stefani with the result that figures are now published relating to all the various aspects of the economic life of the country. It has not merely been necessary to cut down expenditure, but also to make provision against the disappearance of abnormal War revenues, in particular the tax on War profits and on property. Many relatively unproductive War-taxes were abolished in 1923 and 1924, and the remainder were simplified and given a permanent place in the tax system. Being convinced that certain taxes had been raised to an excessive height, he carried through important modifications and reductions; thus he abolished the inheritance tax on property passing within the family, and reduced it largely in other cases. Again, he reduced to half or less the taxes on land and on factories, and decreed a gradual modification of the rates of tax on incomes from other sources. But at the same time he instituted investigations into taxable incomes in such a way as to bring the taxpayers' returns nearer to the real incomes and to reduce evasion to a minimum. It may be noted that in 1918 the manufacturers, traders and professional persons subject to tax numbered 543,184, and that the aggregate revenue from this source was over 704 million lire, while in 1924 the number rose to 762,137, and the tax yield to about 2,793 million lire. There were also added to the number of direct taxpayers 1,260,090 agriculturists, proprietors, cultivators, and metayers, who in 1923, for the first time in the history of Italy, were subjected to an income tax, the resulting yield being 2,081 million lire.

Public Debt.—The series of heavy deficits during the 10 years 1914–23 inevitably affected the public debt of the state; moreover, the method of partly meeting the deficit by the issue of paper money was, in its turn, a powerful cause of the increase of expenditure and of indebtedness, much of which would not have existed but for the disturbing influence of the issue of paper money. Below is a summary statement of the movements of the Italian State debt since 1911, in millions of lire:—

Italian State Debt (in millions of lire)

	June 30 1911	June 30 1914	June 30 1919	June 30 1922	June 30 1923	June 30 1925	Dec. 31 1925
erpetual and long term debt	13,833	14,840	28,581	49,368	49,317	50,847	50,901
reasury bonds 3, 5, 7 and 9 years	. .	. .	5,835	7,232	10,718	12,411	12,223
reasury bills 3, 6, 9 and 12 months	82	380	15,054	25,417	24,835	17,583	18,307
urrent accounts bearing interest	57	61	450	415	351	832	942
otal interest bearing debt	13,972	15,281	49,920	82,432	85,221	81,673	82,373
otes issued by the Government or on Government account	436	490	10,293	10,316	10,192	9,168	9,163
oreign debt at par	. .	. .	19,206	21,615	22,187	23,404	. .

The foreign debt is not comparable with the internal debt, as it was contracted in dollars and sterling, and is here converted into lire at par, *i.e.*, gold lire, which are very different from the paper lire of the rest of the debt.

The internal debt reached its maximum on June 30 1923, which marked the end of extraordinary War expenditure. From then onward the amount decreased, and by Dec. 31 1925 the internal debt had contracted by 2·85 milliard lire. This affords the most significant proof of the improvement in economic conditions, of the growing yield of the ordinary taxes, and of the restriction of expenditure which characterised the long period of Signor de Stefani's control of finance. His successor, Signor Volpi, continued the process of financial reconstruction, and in particular settled the War debts with United States and Great Britain. The agreement concluded with the United States in Nov. 1925 reduced the debt from a nominal value of $2,042,000,000 to a present value at 5% of $430,000,000, distributed over 62 annuities rising from an initial minimum of $5,000,000 to a final maximum of $82,000,000. The agreement concluded with Great Britain in Jan. 27 1926 was set on payments distributed in 62 years, with yearly payments from £4,000,000 and £4,250,000 in the first six years, to £4,500,000 a year from 1931 to 1987. Considering that the national wealth of Italy was estimated at the beginning of the War at 100 milliards lire, and the national income at 20 milliards, it has involved a tremendous burden to maintain War expenditure which in the heaviest years reached 35 milliards, though reckoned in a currency which was continually decreasing in purchasing power.

Currency.—It is not surprising that the Italian economy should still bear the marks of this economic effort, of which the deepest is the decline in the value of money. The table on p. 578 shows the note circulation, the average circulation per head, and the average value of the lira in terms of gold.

During the period of actual fighting, when there was a deficit of 62·5 million lire, which could not be covered by internal loans amounting to 34·6 milliards, and foreign loans of 19·2 milliards, the state was forced to obtain advances from the banks, to the sum of 10·3 milliards, and the lira in consequence depreciated. In 1920 the value of the lira had fallen to 22 gold *centesimi*, and the total circulation had attained its maximum of 22 milliards. In terms of gold the circulation per head of the population increased only from 76·18 to

	Circulation (in millions of lire)			Paper lire per head of pop.	Rate of exchange of the paper lire in gold centesimi (average of the six months preceding and six months following Dec. 31)	Gold lire per head of pop.
	Bank	State	Total			
Dec. 31 1911	2,193·4	485·3	2,678·7	76·94	99	76·18
Dec. 31 1912	2,212·4	499·0	2,711·4	76·94	99	76·18
Dec. 31 1913	2,283·5	499·1	2,782·6	78·17	99	77·39
Dec. 31 1914	2,936·0	657·2	3,593·2	99·48	92·5	92·02
Dec. 31 1915	3,968·1	1,082·1	5,050·2	138·19	80	110·55
Dec. 31 1916	5,012·3	1,317·3	6,329·6	173·19	74·5	128·89
Dec. 31 1917	8,425·0	1,747·8	10,172·8	276·89	59·5	160·75
Dec. 31 1918	11,750·3	2,124·0	13,874·3	377·63	73	272·67
Dec. 31 1919	16,281·3	2,270·3	18,551·6	515·05	34	175·11
Dec. 31 1920	19,731·6	2,268·4	22,000·0	606·02	22	133·32
Dec. 31 1921	19,208·9	2,267·0	21,475·9	582·02	24	139·68
Dec. 31 1922	18,012·0	2,267·0	20,279·0	544·01	24	130·56
Dec. 31 1923	17,246·6	2,427·8	19,674·4	495·20	23	114·01
Dec. 31 1924	18,114·2	2,400·0	20,514·2	510·76	22	112·37
Dec. 31 1925	19,468·2	2,100·0	21,568·8	532·23	..	..

112·37 lire or not more than 50% of the increase in countries remaining on a gold standard; but the increase in the *per capita* circulation of paper money was the cause of a profound alteration in incomes and in the burden of taxation. It is estimated that the pre-War national income of 20 milliard gold lire had increased to 100 milliard paper lire in 1924–5. On the former income, the burden of taxation, both central and local, amounted to 2·5 milliards, or 12·5% of the national income, while in 1925, on the same basis, the tax burden rose to 20 milliards, or 20% of the national income of 100 milliards. These two proportions, 12·5% and 20%, reflect the changes in the burden of taxation resulting from the War. When it is considered that this increase in taxation was borne by a population whose average income per head before the War was about 500 to 550 gold lire a year (£20 to £22 sterling), and in 1925 was about 2,500 paper lire (£21 sterling), it is clear that if it was hard to pay 12·5% in taxation of an income of 500 to 550 gold lire, it is exceedingly hard to pay in taxes 20% of incomes of 2,500 paper lire. We may well speak of the heroic efforts of the Italian taxpaper, which have been the product of the War.

(L. E.)

IVORY COAST (*see* 15.98).—A French colony on the Gulf of Guinea. The area is 122,000 sq. m.; the population in 1925 was estimated at 1,400,000, of whom 1,100 were Europeans. From the lagoon port of Abijan a railway, 193 m. long, was opened to Bwake in 1913. Thence a motor road connects with the Upper Volta colony. Besides palm-oil and -kernels, fine woods, including mahogany and ebony, are exported. Forests cover two-thirds of the colony. *See* WEST AFRICA, FRENCH.

IWASAKI, KOYATA, 2ND BARON (1879–), Japanese philanthropist, was born in 1879, and succeeded to the barony in 1909. Educated at the Imperial University of Tōkyō and at Cambridge, England, he became president of the banking department of the Mitsubishi Company. His vast wealth was largely expended in experiments and benefactions. He instituted a research farm in the north of Japan for stock raising. His visit to England convinced him of the educational value of public libraries, and when the library of Dr. G. E. Morrison, for many years *The Times* (London) Correspondent in Peking, came into the market, Baron Iwasaki bought it for the students of Japan. He added to it the bulk of his own collection and in addition to buying a site and erecting a building to contain it, he allotted a sum of money annually to the institution for the purpose of keeping it up to date by the purchase of new books. The library is called the *T¯yō Bunko* (Oriental Library) and is situated in Kamifujimae Chō in Hongō, Tōkyō.

IZVOLSKY, ALEXANDER PETROVICH (1856–1919), Russian statesman, was born at Moscow March 17 1856, of an ancient Polish family which had been settled in Russia for generations. He graduated at the Imperial Lyceum of St. Petersburg (Leningrad) with the highest honours attainable, whereupon he became attaché to the chancellery of Prince Gorchakov. In 1879 he was appointed first secretary of the Russian Legation at Bucharest. After a spell of service in Washington he was charged with the resumption of relations between the Tsar's Govt. and the Holy See, a task which he fulfilled with great tact to the entire satisfaction of his chief, and incidentally won golden opinions of Cardinal Rampolla and Leo XIII. and received the post of Minister-Resident at the Vatican.

About this time he married Countess Toll, a friend of the dowager Empress Maria Feodorovna, to whose influence Izvolsky owed much of his professional success. His next posts, as minister plenipotentiary, were in Belgrade, Munich and Tokio. From the Japanese capital he warned Lamsdorff who was his chief of what was brewing for Russia in the Far East, but his reports on the warlike preparations were shelved as impertinent and ridiculed as absurd. He was next instrumental in having the Marquis Ito sent to Europe (1902) to settle differences with Russia, but the court camarilla in St. Petersburg thwarted all efforts towards an understanding. Two years later Izvolsky obtained from Japan moderate proposals for a friendly accord, which however were also rejected by the Tsar. Before hostilities broke out Izvolsky returned to Europe and through the Dowager Empress' influence became Minister Plenipotentiary at Copenhagen (1903). In the year 1906 he succeeded Count Lamsdorff as Minister of Foreign Affairs, moulding Russia's external relations and influencing the course of her domestic policy, as a Liberal, until the year 1910. From 1910 to 1917 Izvolsky was Russian Ambassador in France and after the revolution he fell ill and died in Paris Aug. 16 1919.

Izvolsky was endowed with more than average talents, considerable powers of observation, refined artistic tastes and a high sense of honour and duty. An omnivorous reader, he could talk interestingly about literature, art and history. But these and other accomplishments were neutralised by his consequential airs, his oracular pronouncements and his disdainful attitude. He carried self-respect to the point of self-worship and preferred stateliness to the close intercourse of friendship, and as he lacked the magnetic personal current which might have covered these defects, hosts of enemies confronted him at every stage of his career, countering his exertions and embittering his life. Few men have been more bitterly attacked than Izvolsky, whose main crime consists in his having practised the code of public morality that obtained in the school of diplomacy in which he graduated.

As the trustee of the Russian Empire in its external relations Izvolsky has no claim to high statesmanship nor indeed to genial gifts of any kind. He was a clever diplomatist—according to King Edward VII., the cleverest in Russia—with a very definite and circumscribed aim which he pursued with unflagging energy, an endless variety of means and untiring perseverance. When he became Foreign Secretary, France and Russia were but nominally allies, each one speculating on the intentions of the other; and the cardinal principle of his policy was to convert that alliance into an efficacious reality. This he did with occidental thoroughness. Hence he strove to draw Britain, Italy, Turkey, Bulgaria and Rumania into the Entente. Accepting as an axiom the inevitability of a great European war, the principal belligerents being France and Germany in the west, and Russia and Austria in the east, he came to the conclusion that between those future enemies there might be episodic arrangements and temporary makeshifts, but that there could be no complete settlement of differences except by the fortune of war.

zvolsky's first success was the liquidation of the war with pan, which he accomplished with remarkable foresight, breadth view, thoroughness and moral courage. His next task was re arduous; the displacement once and for all of the causes of rivalry between Russia and Britain. And it was largely to olsky's personal efforts that the realisation of this plan was e. He began by coming to an arrangement with Britain about rsia, Afghanistan and Tibet (1907). This reconciliation defi- ely baffled Aehrenthal's scheme which the Tsaritza of Russia voured—of a renewal of the Three-Kaiser Alliance.

Soon after this Izvolsky sounded Vienna unofficially as to w Austria would view an attempt by Russia to obtain the edom of the Straits. Aehrenthal, then Minister of Foreign airs, who was still on relatively friendly terms with Izvolsky, ce his residence as Ambassador in St. Petersburg, replied officially that no objection would be raised if Russia on her e agreed to the annexation of Bosnia and Hercegovina. This estion and answer were, however, followed by a marked olness in the mutual relations of the two Empires, and the tter dropped. The two states came together again when arged by Europe to draft and execute a scheme for the reform justice in Macedonia. But Austria secretly obtained from rkey, whose conduct she was supposed to be vigilantly super- sing, a railway concession in the Sandjak of Novi Bazar. In Petersburg, London and Belgrade the news aroused intense dignation. But after King Edward's visit to Reval (June 1908), volsky wrote a letter to Aehrenthal announcing that Russia d no objection to the Sandjak Railway if Austria would assent an Adria Railway for Serbia. At the same time he proposed at the Tsardom should obtain the freedom of the Straits and stria promulgate the annexation of Bosnia and Hercegovina. volsky and Aehrenthal then met at Buchlau, the Moravian residence of Count Berchtold (Sept. 15 1908), and agreed to this arrangement. Izvolsky held that he made the proviso that the two points be referred to a European Conference, while Aehrenthal asserted that he announced the annexation as impending. Both were probably right. A few days later Aehrenthal acting in good faith annexed the two provinces without more ado, whereas Russia was kept out of her *quid pro quo* owing to the refusal of England and France to open the Straits question at that inopportune moment.

After this the relations of the two Ministers became personally estranged and the intercourse between their respective countries grew almost hostile. Indeed war was in sight for a while and was seriously discussed in St. Petersburg, but Russia being unprepared, it was staved off. Izvolsky sought compensation for his diplomatic defeat in bringing about a meeting between the Tsar and the King of Italy at Racconigi (Oct. 23–5 1909) and making the first serious effort to draw Italy into the orbit of the Allies. In spite of this Russia and Germany seemed for a brief while to become friends again and during the Tsar's two months sojourn in Germany Izvolsky was relieved of his office and sent to Paris as ambassador. In this capacity he continued to sway the policy of his country over the head of his nominal chief in virtue of his knowledge, tact and energy.

Izvolsky's strength lay in his resourcefulness in adjusting means to ends and above all in his rare tenacity of purpose. His weakness lurked in a morbid sensitiveness which at time incapacitated him for distinguishing between the satisfaction of personal rancour and the furtherance of national interests. But neither his qualities nor his defects justify the hyperbole that he was responsible for the World War. His policy like that of his Austrian rival is a sequence of cruel illusions for which their respective peoples have had to pay. (E. J. Di.)

JACKS, LAWRENCE PEARSALL (1860–), British Unitarian divine, was born in Nottingham, where he received his early education. Afterwards he studied at London University, and at Göttingen and Harvard. In 1887 he became assistant to Rev. Stopford A. Brooke, at Bedford Chapel, London, and in 1889 he married Brooke's daughter, Olive Cecilia. He was subsequently minister of Unitarian churches in Liverpool and Birmingham. In 1902, on the foundation of *The Hibbert Journal*, Jacks was appointed first editor. In the following year he became instructor in philosophy at Manchester College, Oxford, and in 1915 was chosen principal of that college. Jacks wrote a number of books, of which the best known is his *Life and Letters of Stopford Brooke* (1917); others include *All Men are Ghosts* (1913); *From the Human End* (1916); *From Authority to Freedom* (1920); *The Challenge of Life* (1924); and *The Faith of a Worker* (1925).

JACKSON, HENRY (1839–1921), British classical scholar, was born at Sheffield March 12 1839. He was educated at the Sheffield Collegiate School, at Cheltenham College and at Trinity College, Cambridge, where he was elected fellow in 1864 and vice-master in 1914. From 1875 to 1906 he was praelector in ancient philosophy, and in 1906 was appointed regius professor of Greek, being given the O.M. in the same year. He resigned the vice-mastership of his college in 1919, and died at Bournemouth Sept. 25 1921. His important work in translating and commenting upon Aristotle's *Ethics* is alluded to in 2.513. He published *Texts to Illustrate a course of elementary lectures on Greek Philosophy from Thales to Aristotle* (1901) and a series of articles on "Plato's Later Theory of Ideas" (*Journal of Philology*); also *About Edwin Drood* (1911).

JÄGER, GUSTAV (1832–1917), German naturalist and hygienist (*see* 15.124), died at Stuttgart May 14 1917.

JAMAICA (*see* 15.132), a possession of Great Britain with dependencies in the West Indies. The area is 4,450 sq. m. and the estimated population (1924) 905,363.

Political History.—Immediately after the outbreak of the War (Aug. 4 1914) the legislature raised a Jamaica Volunteer Defence Force. Later it was decided to send a contingent overseas. War contingent funds were raised, and on Nov. 8 1915 the first contingent sailed for England. In all, Jamaica sent 243 officers and 10,168 men, who were enrolled in the British West Indies Regiment, which was formed on Oct. 26 1915 and saw much distinguished service in France, Egypt, Palestine and elsewhere. On March 22 1917 an Act for compulsory military service was passed, but conscription was never actually enforced. The Legislature agreed to pay the whole expenses of her contingents in the form of a contribution to the Imperial Treasury of £60,000 annually, beginning a year after the War. In 1921 the Hon. Edward Wood (now Lord Irwin) visited the Colony with a Colonial Office Mission, and made recommendations for the amendment of its constitution, which are still under discussion.

Fruit.—The chief staples are still fruit, sugar and the raising of stock. Owing to the prohibitive tariff in the United States of America, and the absence of steamers to carry oranges, etc., to the United Kingdom, the citrus fruit industry still languishes. In 1911 the export of bananas reached the record figure of 16,497,385 bunches. Exports, which fell after disastrous droughts and hurricanes in 1915–6–7 to 2,394,514 bunches, recovered, and in 1925 reached 14,896,581. Jamaica, which was not a party to the Canada-West Indies trade agreement of 1912, was a signatory of the agreements of June 18 1920 and July 6 1925. Under the latter, Canada will impose a customs duty of 50 c. per bunch on foreign bananas and admit Jamaica bananas free and will also provide a fortnightly mail passenger and freight service with refrigeration for 70,000 bunches of bananas, alternating with a fortnightly freight service with refrigeration for 50,000 bunches between Canadian ports and Kingston. At present the fruit industry is handled by five concerns, of which all but one carry the fruit to America. In 1925 the planters formed an association, one of whose objects is to secure the establishment of an alternative and independent direct line of steamers to carry fruit of all kinds to England.

Sugar.—Under the Canada-West Indies agreement Jamaica sugar will enjoy the increased preference of $1.00 per 100 lb. on 96° sugar entering the Dominion. In the United Kingdom the preference of British sugar, which was reduced in 1924 to 1s. 8·3d. per cwt. consequent upon the lowering of the duty, was restored in 1925 to 3s. 8¾d. per cwt., and the undertaking was given by Parliament that it would remain at that figure for 10 years. This has helped to establish confidence in the industry. In 1925 the Jamaica Sugar Estates Ltd. was floated with capital of £400,000 and a loan guaranteed under the Trades Facilities Acts to develop sugar production in St. Thomas-in-the-East.

Trade.—The percentage of total exports in 1923 were: Fruit 54·4; sugar 15·8; coffee 5·6; rum 1·2. The area under canes rose to 48,18 ac. in 1924, while that under bananas fell slightly to 74,548 acres. The total volume of trade shows expansion, imports having risen from £2,614,943 in 1910 to £4,827,074 in 1924, and exports from £2,568,222 to £3,122,961. In 1920 imports and exports reached the record figures of £10,313,300 and £7,146,000 respectively. In 1910–1 the colony's revenue was £990,399 and its expenditure £987,304. In 1924 the figures were £1,922,963 and £2,022,746. (*See* West Indies.)

Bibliography.—*Report by the Hon. E. F. L. Wood, M.P. (Parliamentary Under-Secretary of State for the Colonies) on his Visit to the West Indies and British Guiana 1921–2*, Cmd. 1679 (1922); Sir Charles Lucas, *The Empire at War*, vol. II (1923); Frank Cundall, *Jamaica's Part in the Great War, 1914–8* (1925); Herbert G. Felisser, *Jamaica and the Great War* (1917). (A. E. A.)

JAMES, HENRY (1843–1916), Anglo-American novelist (*see* 15.143), renounced the nationality of his birth and became a naturalised British subject in July 1915. The act was symbolic of his lifelong love for the country of his adoption, and hardly less of his strong support of British conduct during the World War. It enabled him to be the recipient, in 1916, of the Order of Merit, the crowning official recognition of his distinguished career as a man of letters. James's work after 1911 included a series of informally autobiographical volumes: *A Small Boy and Others* (1913); *Notes of a Son and Brother* (1914); and *The Middle Years* (1917), which give interesting glimpses of his youth and that of William James. Some volumes of essays and prose studies also appeared: *The Ivory Tower* (1917); *Within the Rim* (1919); and *In the Cage* (1919). James died in Chelsea, London, on Feb. 28 1916. A selection from his letters, edited by Percy Lubbock, was published in 1920.

JAMES OF HEREFORD, HENRY JAMES, 1st Baron (1828–1911), British lawyer and politician (*see* 15.144), died at Epsom, Surrey, Aug. 18 1911.

JAMESON, SIR LEANDER STARR (1853–1917), British politician (*see* 15.147). The union of the South African colonies in 1909 accomplished the principal object which Jameson had set before himself as a political leader. He wished to carry the spirit of union further by forming a combination of political parties to support a non-racial government for the new Union, regarded Gen. Botha as the natural leader of such a combination, and was completely ready to serve under him. This project of a "best man" government, however, was not accepted by Botha, who thought that the Dutch-speaking people of South Africa were not ready for it. The alternative, to which Jameson then set himself, was the formation of a new party representing the majority of the English-speaking people in the Cape, the Transvaal, the Orange Free State and Natal. The programme of the new Unionist party of South Africa showed his influence in every clause.

At the first South African general election in Sept. 1910 the Unionists won a considerable measure of success especially in the Cape and Transvaal provinces. Natal, where the English-speaking people were in a great majority, withheld from Jameson the general support which it might have been expected to give.

two years Jameson led the Unionists in the South African ise of Assembly with great moderation and self-restraint, but compelled by ill-health to retire from the leadership of the ty in 1912. He returned to England and settled in London, oting himself, when his health took a turn for the better, to iness interests, but on Nov. 26 1917 he succumbed after a rt illness. Jameson's name will stand very high among those he men who did service to South Africa and Rhodesia. Diffi- t and utterly free from self-seeking, his labours for racial recon- tion and material progress in South Africa were conspicuous, the close friendship of Botha was a final proof of the quality ais patriotism. Jameson was created a K.C.M.G. on the guration of the Union in 1909 and a baronet in 1911.

AMMES, FRANCIS (1868–), French poet and novelist, born at Tournay Dec. 2 1868, and when still a child went ve at Orthez. He studied at the Collège de Pau and the Col- de Bordeaux, and afterwards became for a short time a ary's clerk at Orthez. It was during this uncongenial em- ment that he published his first verses, in 1893. After that e, his poems and novels succeeded each other rapidly. The characteristics of his style are a great simplicity and a ccupation with the quotidian and humble manifestations of He takes great liberties with the alexandrine, which gives poetry a novel and refreshing charm. His works reflect a ipathy for the poor and for animals, and a profound sincerity he painting of French provincial life.

is works are: *Vers* (1893); *De l'Angelus de l'aube à l'Angelus du* (1898); *Clara d'Ellébeuse* (1899); *Le roman du lièvre* (1903); *me d'Anis* (1904); *Clairières dans le ciel* (1906); *Les georgiques tiennes* (1912); *Feuilles dans le vent* (1914); *Le Rosaire au Soleil* 6); *Le curé d'Ozeron* (1918); *Le poète rustique* (1920); *Les s des quatrains* (1923–5); *Ma France poétique* (1926). See also Braun, *Des poètes simples: Francis Jammes* (1900); A. de Bersan- t, *Francis Jammes, poète chrétien* (1910); A. Lowell, *Six French ts* (1915); P. Lasserre, *Les chapelles littéraires* (1920).

ANÁČEK, LEOŠ (1854–), Czech composer, was born in valy, Moravia, and educated in the monastery of the trian Friars in Brno under Paul Křížkovsky. After studies Prague, Leipzig and Vienna he returned to Brno, where in he became director of the organ school, and later professor omposition in the master school of the state conservatoire which the organ school developed. Janáček followed in žkovsky's footsteps as a collector of folk songs, especially of ravia, but went deeper than his master into their psychology. chief characteristics of his works are spontaneity and rich- of colour, together with vigour of idea and expression. hnically, his melodies proceed strictly from the verbal thm, and the orchestra is also assigned the function of a e creative atmosphere than is usual in modern symphonic ompaniments. Among his operatic compositions are *Jönufa: pastorkyňa*, a psychological drama of Moravian village life, produced in Prague 1916; and *Katya Kabanova* (1922), ed on *The Storm*, a Russian drama by Ostrovsky. In lighter od are *The Excursions of Mr. Brouček* (1920), an operatic re, and *Liška bystrouška* (1925), an animal opera. Janáček's aining works include a dramatic song cycle, *The Notebook of who Vanished;* a symphonic poem *The Fiddler's Child;* an nestral rhapsody *Taras Bulba;* a string quartette; a concertino small orchestra; the *Kreutzer sonata* and a sextette *Youth.* F. Bartoš and L. Janáček, *Kytice z rárodních písní moravs- h kterouž uvili F. Bartoš a L. Janáčck* (1890).

ANEWAY, THEODORE CALDWELL (1872–1917), American sician, was born in New York City Nov. 2 1872. He was cated at the Sheffield Scientific School, Yale University, and college of physicians and surgeons, Columbia University. m 1898 to 1906 he taught medical diagnosis in New York versity. In 1907 he became associate in medicine in Columbia versity, and two years later professor of medicine. In 1914 vas called to Johns Hopkins University as professor of medi- , and became physician-in-chief to John Hopkins Hospital. investigations in the phenomena of blood pressure opened up therto unexplored field of medical research. After America's rance into the World War, he became major in the Medical Officers' Reserve Corps and was engaged in research in Washington, D.C. He died at Baltimore, Md., Dec. 27 1917. He was a member of the board of scientific directors of the Rockefeller Institute for Medical Research. He was the author of *The Clinical Study of Blood Pressure* (1904).

JAPAN (*see* 15.156).—An empire of eastern Asia, one of the Great Powers, and a member of the League of Nations. The area, including Formosa, Karafuto (Japanese Sakhalin) and Chosen (Korea) is 262,826 sq. m. and the population (1920) 77,005,510.

I. POLITICAL AND SOCIAL HISTORY

The German Model.—Owing to the necessity of establishing a strong central authority—imposed upon Japan for self-defence as a result of the apparently aggressive policies in the Far East of Western Powers towards the end of the 19th century—and probably from an excess of conservative caution, as the country had just cast off its feudal traditions, the makers of modern Japan often turned to German legislation in seeking for models for the constitution and other laws. But an important factor that should not be lost sight of by students of Japanese politics is that English has long been by far the most extensively studied foreign language among the people. Whilst the static institutions remain more or less Teutonic in form, dynamic inspiration has continuously been drawn from English-speaking sources. That explains why the Japanese understand democracy along the lines of its common acceptation in the English-speaking nations; why the Press and students of politics often advocate the development of a polity somewhat like the British parliamentary system. The political history of Japan in the decade beginning 1910 was the last phase of the struggle between the cause of national security with which *the genros*, the Elder Statesmen, are popularly identified, and the progressive outcry for the emancipation of the people's will. As external dangers diminish, the *vox populi* speaks more effectively.

After the longest tenure of office in the constitutional history of Japan, four and a half years, the Marquis Katsura resigned the premiership in Aug. 1911, " with a view to renovating the spirit of the people. " With the collaboration of Marquis Komura, Foreign Minister, Marquis Katsura had accomplished various financial reforms, the annexation of Korea, and the revision of commercial treaties with Western Powers. Katsura was succeeded by Marquis Saionzi, who had led the Seiyukai party since the retirement of Prince Ito (*see* 15.272). During the premiership of Marquis Saionzi a severe shock was experienced by the whole nation on account of the death on July 30 1912 of the revered and beloved Emperor Mutsuhito. Meiju Tenno, as he was posthumously styled, after the name of the era of his 45 years' reign, was succeeded by his son, Yoshihito Shinno, who ascended the throne at the age of thirty-three.

Fall of the Saionzi Cabinet.—The downfall of the Saionzi Cabinet arose out of the paramount instinct of national self-defence. Before the end of 1912, the establishment of two army divisions in Korea (Chosen) had been tenaciously persisted in by Lt.-Gen. Uyehara, Minister of War. But his colleagues in the Cabinet, as well as the Press, counselled retrenchment and economy. Uyehara resigned, and the Premier sought for his successor. But no soldier would accept the post without a promise by Saionzi as to the two-division increase; and by law a Minister of War must hold the rank of a general or lieutenant-general in the active service. The Premier was constrained to request the Emperor to relieve him of his office. There followed a ministerial deadlock, until Katsura, actuated by chivalrous motives, descended upon the confused arena. He had been created a prince, and had made up his mind to offer the young Emperor loyal but non-political services for the rest of his life in the capacity of grand chamberlain and lord keeper of the great seal.

But the young and care-free generation of Japan had come to assert themselves, and the unconstitutional tendency of the *Genro's* activities had been made the object of popular criticism. The widespread suspicion that he hoped to direct the affairs of state unconstitutionally " from behind the sleeves of the Sacred

Dragon," coupled with his personal failing health, made the path of Prince Katsura's renewed political life immeasurably thorny and arduous. He found the Lower House unexpectedly intractable. Mr. Ozaki's resolution of no confidence caused a tremendous sensation; riotous mobs demolished the offices of *The Kokumin*, a newspaper which had been loyally supporting the ministerial programme. No choice was left to Katsura but to tender his resignation.

Prince Katsura then sought to prove his sincere desire for the constitutional development of the Empire by starting a political party, the *Rikken Doshikai* (the Constitutional Comrades Association). Under this banner there rallied all the members of the Chuo Club, and a majority of the members of the *Kokuminto* (the National party). But Katsura died in the following December. The Yamamoto Cabinet which followed (Feb. 20 1913) was short-lived, owing to the unfortunate "naval scandal," involving the arrest and trial of high officials in the navy, a foreign company having dispensed bribes in connection with the building of a Japanese warship.

Politics During the World War.—After the refusal of Prince I. Tokugawa, and the abortive attempt by Viscount Kiyoura, to form a Cabinet, Count Okuma, the "grand old man" of Waseda undertook, on April 16 1914, to stand at the helm of the Empire, backed by the legacy of Katsura, the *Doshikai;* and Baron Kato, the leader of that party, was entrusted with the portfolio of Foreign Affairs. It fell to the lot of this Cabinet to deal with the invitation of Great Britain to join in the World War under the Anglo-Japanese Alliance. In Nov. 1915 the enthronement of the Emperor was conducted with the time-honoured imposing ceremonies at Kyoto, and the whole nation was *en fête* for seven days in honor of the event.

Count Okuma, in tendering his resignation on account of ill-health in the summer of 1916, recommended Viscount Kato, who had yielded the charge of foreign affairs to Viscount Ishii and was outside the Cabinet, to be his successor. At that moment however, the *Genros* were reported to have intervened, and, in spite of the fact that Kato's new party—the *Kenseikai* (the Constitutionalists), which was an amalgamation of the *Doshikai*, the *Chuseikai* and the Koyu Club—commanded a majority in the Diet, Marshal Terauchi was appointed Premier on Oct. 9. This alleged irregular development excited the hostility, not only of the Kenseikai, but of the general public, and ended in an antagonistic attitude on the part of the Diet towards the new government. Parliament was dissolved, and a general election took place on April 20 1917. The result was a signal victory for the government party, the Seiyukai winning 157 seats, whilst the number of the Kenseikai dwindled from 204 to 117.

Actuated by the desire, in view of the War, to effect unity of all shades of opinions, Marshal Terauchi created the Temporary Diplomatic Investigation Council (*Rinji Gaiko Chosa Kai*), where leaders of all political parties were represented. Kato was invited to join, but refused on the ground that he could not associate himself with the idea of establishing a responsible body for external affairs outside the Cabinet itself. The "rice riot" and the ensuing serious disturbances and strikes, which raged like wildfire in various parts of Japan in the summer of 1918, sealed the fate of the Terauchi Cabinet, which tendered its resignation in the middle of September.

Growth of Democracy.—By that time democratic ideas had been gaining strength on account of the War and internal social unrest. Moreover, the manner in which the Terauchi Cabinet was installed had its inevitable reaction. The people demanded that the next administration should be more in keeping with the spirit of the parliamentary system. Mr. Takashi Hara, the leader of the Seiyukai in succession to the Marquis Saionzi, was entrusted with the task of forming a new Cabinet; he was the first commoner to hold the office of Premier in Japan. The ministers, except those holding the portfolios of war and the navy, were for the first time, a body of party politicians more or less free from the bureaucratic savour which had always clung to the former administrations. Incidentally, a new minister—the Minister for Railways—was included in the Cabinet.

In March 1918, in response to the popular demand, a politi
reform bill was passed, lowering the property qualification
voters to the payment of a direct national tax of three yen i
stead of 10 yen. The number of electors was thus more th
doubled, increasing from 1,450,000 to 3,000,000. The peo
were, however, not satisfied, and popular clamour for univers
suffrage followed. In Feb. 1920 a universal suffrage bill wa
last introduced by the Opposition in the House of Represe
tives. But on the ground that no election on the basis of exten
franchise had as yet taken place, and that consequently it
premature to make any further attempt at suffrage reform,
Diet was immediately dissolved. The nation was called upo
express its opinion on the matter by the general election of M
10. The result was a decided victory for the Seiyukai, the go
ernment party, which secured 280 seats, whilst the Kenseik
registered 110.

Cabinets of 1919 to 1924.—It fell to the fate of the Hara min
try to conclude the treaties of peace ending the World War
1919, and to send delegates to the Washington Conferenc
1921. But before the conference actually began its deliberatio
Hara was assassinated by a misguided and youthful megalom
niac on Nov. 4. Viscount Korekiyo Takahashi, Minister of
nance, succeeded to the leadership of the Seiyukai party and a
sumed the premiership on Nov. 13. There immediately follow
an occurrence of great political moment when the Crown Prin
Hirohito was appointed as Prince Regent on Nov. 25, owing
the continued indifferent health of the Emperor Yoshihito. Ta
ahashi attempted early in the next year the reorganisation
his ministry, which was a legacy from Hara and was not qu
amenable to his leadership. He failed in the enterprise and te
dered his resignation.

Adml. Baron Tomosaburo Kato, who had been Minister
the Navy in the past four successive cabinets and the chief de
gate to the Washington Conference, was nominated Premier
June 12 1922. He had no party affiliations, but had been assur
of the unconditional support of the Seiyukai party; and his
leagues were drafted from the Kenkyukai and the Koyu Cl
of the House of Peers, both of which maintained close conn
tions with the Seiyukai party. The first thing that Kato did a
the assumption of office was to abolish the anomalous institut
of the Temporary Diplomatic Investigation Council. Kato to
upon himself the faithful enforcement of the Washington tre
ties and, in domestic affairs, endeavoured to bring the nation
of the business slump and to cope with the social unrest that h
been gathering strength. However, before he could accompli
much in internal administration, he died on Aug. 24 1923.

The Cabinet resigned on the advice of the acting Premi
Count Uchida, and Adml. Count Yamamoto, who had lived
retirement since his downfall in 1914, was commanded by t
Throne to form a cabinet. Whilst he was busily engaged in t
formation of his ministry, there happened the historic earthqu
of Sept. 1. Late in the evening of the 2nd, the Yamamoto Cabi
was installed with "national solidarity" as its slogan. Ya
moto gathered round him men of long political experience a
recognised ability, and seemed determined to keep aloof fro
party politics. The Cabinet took prompt and effective steps f
the relief of the stricken population, but in considering the r
construction plans had to face dissensions within the Cabin
itself. Viscount Goto's ambitious project was not fully count
nanced by his fellow ministers, and the machinations of th
Seiyukai party further complicated the situation. When an a
tempt on the Prince Regent's life was made by a fanatic on De
27, the Yamamoto Ministry resigned, holding itself answerab
for the outrage.

A ministry was formed on Jan. 7 1924 under the premiershi
of Viscount K. Kiyoura, who was supported by the Kenkyuk
of the Upper House. This was again a non-party administratio
and its marked bureaucratic complexion combined with its appa
ent weakness soon met with popular disapproval as "a cabin
of the privileged class." At the same time the Seiyukai party
that had long been on friendly terms with the Kenkyukai, d
vided into two factions, one avowing its support of its old allies

he other denouncing the irregularity of non-party methods.
former seceded and set to work to form a new party
l the *Seiyu Honto*.

neral Election of May 1924.—Amidst such political develop-
s there intervened the general election of May 10, the result
nich turned out to be a victory for the Kenseikai party with
seats, the Seiyukai obtaining 137, the Seiyu Honto 94, the
gyo Doshikai (Business Men's party) 9, the Shinsei Club 24,
)okokai 21 and non-party 17. It was the first important in-
ce in which the government party failed to win a general
ion.

youra resigned and Viscount Taka-aki Kato, as the leader
e Kenseikai, formed a coalition cabinet on June 11 1924, in-
ng Mr. Korekiyo Takahashi (having renounced his viscounty)
e Seiyukai and Mr. Tsuyoshi Inukai of the Kakushin Club.
Kato administration was made historic by the passage of
niversal manhood suffrage bill on March 29 1925. All males
25 years of age could vote and it was estimated that the
ber of electors would increase fourfold and become about
)0,000. In April 1925 fissiparous tendencies became dis-
ible in the coalition cabinet, when Takahashi resigned his
ership of the Seiyukai as well as his ministerial chair. In
Inukai also announced his determination to retire from
ics. After the succession to the leadership of the Seiyukai of
Baron Giichi Tanaka, the reunion of the Seiyukai
the Seiyu Honto was frequently suggested. The crisis
in July, when the tax reduction scheme invited oppo-
n from the Seiyukai ministers. Kato resigned but was or-
d again to form his Cabinet. On Aug. 2 he again became
nier, with his colleagues composed exclusively of the Kensei-
artisans. Kato died on Jan. 28 1926 and his Cabinet was re-
tructed under the premiership of Mr. Reijiro Wakatsuki,
erto Minister of Home Affairs.

ocial Changes.—The chronological change from the Era of
ji (Enlightened Peace) to the Era of Taisho (Great Right-
ness) in 1912 incidentally marks an important period in the
ural history of the Japanese people. The wars with China
Russia had given them the assurance that their country was
from any foreign aggression, the fear of which had been a
etual nightmare to the founders of modern Japan. Their
iderable achievements in the domains of trade and industry
strengthened their belief in the destiny of the nation. Es-
ally the younger generation, whose cradles were neither
ated by the shapes of armed foreign " black ships " nor del-
l by the overwhelming influx of novel knowledge and strange
oms, were beginning to see that the undigested application of
tern laws and institutions would do more harm than good to
national wellbeing. The question in the mind of young Ja-
was whether it was not the mission of the Japanese people to
te a new civilisation by harmonising and uniting the East
West. The external relations of Japan, too, contributed
r quota to the cumulative change in the mentality of the
ple. Korea was annexed; China started a revolution; Califor-
legislatively discriminated against Japanese; the World War
urred; and Russia turned Bolshevist—all these quickened
ional and social aspirations.

t the beginning of the Taisho Era there was social disquietude
he air. The alleged attempt on the person of the Emperor
iji in 1910—a solitary occurrence in the age-long history of a
al people—the repeated famines in the northeast districts of
an, the disastrous eruption of the Sakurajima volcano, the
id rise in the cost of living, the revelation of naval bribery
ndals, the frequent change of cabinets—these had combined
engender misgivings in the people's minds. When the World
r came, the Taisho era was but two years old. Profiteers
ang up like mushrooms overnight; into the maw of factories
s poured a tremendous army of labour; the cost of living ad-
nced by leaps and bounds; and an age of Western capitalism
s in sight. Public sentiment in Japan was further stirred by
Allied assertions that the War was a democratic crusade
inst the rule of despotism and imperialism. Strikes, which
l long been stifled by restraining circumstances, began to be more and more frequently organised. As a consequence of successful strikes in 1917, no fewer than 417 occurred in 1918, a sudden increase in the occurrence coming in the wake of the " rice riot " started by fisherwomen in Toyama; and in 1919 the number increased to 497, which registered the high-water mark of labour agitation. Since the economic panic of 1920, the prospects of lower wages and unemployment have threatened the labourers, and strikes have come to take a defensive rather than an aggressive complexion. There were registered 282 cases of strikes in 1920; 246 in 1921; 250 in 1922; 270 in 1923 and 333 in 1924. These figures are in striking contrast to the average of 30 cases a year for seven years preceding the World War.

In the meantime, no fewer than 389 labour organisations had been formed by 1922. Until 1920, the Yuai Kai founded in Tokyo in 1912 by Mr. Bunji Suzuki had been the only trade union worth mentioning. It was expanded and renamed the " Nippon Rodo Sodomei " (General Federation of Japanese Labour) in 1921, and is considered the most important. Other large unions include the Government Employees' General Federation (Osaka), the Printers' Association (Tokyo), the Osaka Printers' Union, the Japan Seamen's Union (Kobe), the Kanto Transport Workers' Union (Tokyo) and the Federation of Mechanics' Union (Tokyo). Side by side with labour agitation in industries, tenancy disputes in agricultural districts became increasingly frequent. Local tenants' unions were organised by hundreds in the course of 1920–2, and they were amalgamated in the Japanese Farmers' Union (Osaka) and the Kanto Federation of the Japanese Farmers' Union (Tokyo) in 1922. It is significant that labour leaders, however drastic their theories may be, are generally moderate in practice, and that the General Federation of Japanese Labour passed a resolution in Feb. 1924 that when the universal suffrage bill then under discussion became law its members would effectively exercise their franchise. The law was passed in March 1925, and the Labourers' and Farmers' party was organised on March 5 1926 in Osaka.

Culture.—The rise of naturalism in Japanese literature synchronised with the war with Russia (1904–5), the attendant social changes encouraging men of letters to discard the old shibboleth and to proceed to the free, bold and realistic study of human life and nature. (*See* JAPANESE LITERATURE.)

Pure Japanese style painting has successfully been revived and developed in the hands of great artists like Gaho Hashimoto, Gyokusho Kawabata, Kogyo Terasaki, Taikwan Yokoyama and Seiho Takeuchi. In their works are noticeable traces of influence from Western masters. Works after genuine western canons have also been produced by pioneer artists such as Viscount Kiyoteru Kuroda, Fusetsu Nakamura, Saburosuke Okada, Eisaku Wada and Hiroshi Yoshida. They do not yet command the same respect and popularity as those of the native schools, but with the growth of popular appreciation of such paintings and the increase of buildings of a Western type, with their incidental demand for articles of interior decoration, the future development of the Western school of pictorial art seems assured in Japan. In the field of music, native and Western forms had in the past little or no influence upon each other in Japan. But the visits of great artists like Elman and Kreisler, as well as the popularising influence of phonographs, have aroused love and enthusiasm for Western music among the younger Japanese. How this trend will react upon the old Japanese music is yet to be seen.

The Great Earthquake.—On Sept. 1 1923 (11 hr. 58 min. 44 sec. central standard time) a great earthquake visited Japan. The severest shocks were felt along the coast of Sagami Bay in the districts of Hakone, Odawara, Kamakura, Yokosuka, Yokohama and Hojo, but even such distant places as Kobe and Osaka in the west and Fukushima and Sendai in the east were affected. The tremor that shook Tokyo was of secondary intensity. Scientists conclude that the earthquake was caused by a sudden depression in the bottom of Sagami Bay and a corresponding rise of land on its northeastern coast. Fires following the earthquake destroyed three-fourths of Tokyo (nearly 2,000 ac.), and the whole city of Yokohama, and were mainly responsible for the terrible loss of life.

According to the Social Bureau of the Department of Home Affairs, which published its official report in 1926, the casualties were as follows:—

Place	Killed	Injured	Missing	Total
Affected districts . .	91,344	52,074	13,275	156,693
Tokyo (city) . . .	58,104	26,268	10,556	94,928
Yokohama (city) . .	21,384	10,118	1,951	33,453

According to the Department of Education, the foreign casualties in Tokyo and Yokohama were:—

	Number of foreign residents	Killed	Injured	Missing	Total
Chinese . .	4,647	2,011	600	52	2,663
Other nationalities . .	3,616	146	852	715	1,713

The loss of property has been variously estimated, the industrial bank computing it at 4,800 million yen, consisting of 1,000 million yen for government property and 3,800 million yen for that of the inhabitants.

The earthquake occurred almost without warning. A large number of independent fires broke out at the same time, 122 being counted within 30 min. after the earthquake. Many of the fires were due to the combustion of chemicals, outbreaks in restaurants—it being meal-time when the earthquake occurred—and to the intense heat generated. The fire-brigades were in many cases unable to make use of the water-supply, owing to the damage caused to the water-pipes. In Tokyo the greatest tragedy of the earthquake occurred in the ground (230 ac. in extent) belonging to the Army Clothing Department in Honjo, where 40,000 people took refuge, most of them taking with them their belongings. At four o'clock in the afternoon fire approached this enclosure from three sides, and ultimately the whole 40,000 were destroyed in a furious tornado of flame. Brick buildings fared worst in the disaster; wooden-framed buildings of the European style behaved much better than the native ones; and the seismic value of reinforced concrete buildings was fully confirmed, though even they collapsed when their design was seismically imperfect. About 64% of all the buildings in Tokyo were destroyed.

The earthquake coincided with the Cabinet crisis caused by the death of the Premier Tomosaburo Kato, but emergency relief measures were nevertheless quickly and effectively taken. The requisition of foodstuffs and other relief materials was ordered; and Tokyo, Yokohama and its vicinity were placed under martial law. In the trying circumstances, the stricken population in general showed great courage, fortitude and *esprit de corps*. The army and the navy won the gratitude of the nation by their magnificent services in maintaining order and in re-establishing communications. Foreign countries were not slow in showing their sympathies. Their contributions in money and materials amounted to 27,000,000 yen, the largest share being taken by the American Red Cross, which gave more than $11,000,000. The relief services of the American Asiatic Fleet under Adml. Edwin A. Anderson that came to Yokohama from Dairen, and of the American military contingent under orders of Gen. Frank R. McCoy, were timely and efficient.

Undismayed by the appalling calamity, the Government and people immediately proceeded to the work of reconstruction. The official reconstruction plans of Tokyo and Yokohama were considered by the Reconstruction Council and the Reconstruction Board. Viscount Shimpei Goto, Home Minister and President of the Reconstruction Board, first proposed an ambitious plan for Tokyo with a view to reviving from the ashes an ideal modern city. But the Cabinet preferred a less expensive project, which was again drastically curtailed by the Imperial Diet in Feb. 1924. The plan thus decided upon authorises an expenditure of 468,438,849 yen, spread over six years, ending in 1928, to build new and wider streets, a modern sewage system, canals, bridges, parks and better means of transportation, and further to perfect agencies of social service, such as employment bureaux, day nurseries and infirmaries. In 1925 the population of Tokyo registered 1,995,303 and that of Yokohama 405,999 or 85% a 92% of the pre-earthquake population respectively.

II. FOREIGN RELATIONS

General Survey 1910–25.—Having emerged victorious fr the Russo-Japanese War, Japan was relieved from the long nig mare that Korea might be engulfed in the Russian hegemo and constitute a permanent menace to her national safety; mo over, the wrong done to her by the three-Power intervention wresting from her the natural fruits of her victory in the Chi Japanese War—the Liaotung peninsula—was avenged. But t Russian grip on North Manchuria and Mongolia was not o unabated but, on the contrary, was greatly tightened. Th were even fears of a renewed clash between the former fo Statesmanship, however, counselled Japan and Russia to co to a friendly entente in 1907. A similar understanding betwe Japan and France followed in the same year. Further, the co plicated post-War situation in Manchuria was decisively, if n definitively, disposed of by the Chino-Japanese understandin of 1909. In 1910 and 1916 more definite agreements were reach between Japan and Russia with the view of maintaining the s tus quo of Manchuria. Korea was, in the meantime, made a p tectorate of Japan, and the gradual development of affairs that country led to the final annexation. The Anglo-Japane alliance, which had been not only the keystone of Japan's fo eign relations but the mainstay of the general tranquillity Eastern Asia, was renewed (1911).

Whilst Japan's position in the Far East became thus more less reassuring, the dark cloud of anti-Japanese sentiment on t Pacific coast of the United States loomed up on the horizo China's revolution in 1911, instead of bringing immediate pea and liberty to the citizens of the Celestial Empire, divided t nation into irreconcilable camps, and contributed to the politic instability of the Extreme Orient. This meant an exacting bu den upon the diplomatic wisdom and tact of Japan. Japan wa on the one hand, still seriously considering how to cope with t situation in China and, on the other, how to safeguard Japane residents against discriminatory treatment in the west of Americ when the fateful Aug. of 1914 demanded other decisions.

Japan's part in the World War dwindles into insignificanc face of the stupendous efforts of other great Powers espousin the Allied cause. But she contributed what little she could wi her very limited national strength and resources. Her geograph cal situation, however, afforded her, from the economic poin view, a position of vantage. In pre-War days she was still stru gling in financial straits as a result of her Russian conflict, bu she came out of the World War with overflowing coffers, even these coffers were of modest dimensions. At the Peace Confe ence in Paris, she lost her case on the question of racial dignity but her claims with regard to Shantung and the South Sea Is lands were recognised, and her position among the Great Power was assured. But her immediate outlook in 1920–1 bristled wit difficulties and complexities. China had refused to negotiat on Japan's offer to restore Shantung; the Washington Gov would not agree to the Japanese point of view on the Yap question; several states on the Pacific coast of America wer quite determined to abridge the civil rights of Japanese res dents; Korean malcontents abroad were in a fitful mood of re bellion; the Siberian situation was far from tranquil. Japan' natural path of development was beset with suspicions and mis understandings. In these circumstances, Japan welcomed th Washington Conference of 1921–2 as a fitting opportunity for he clearly to expound her foreign policies. Subsequently, the sum mary exclusion of Japanese prescribed in the American immigra tion law of 1924 dealt a tremendous shock to the Japanese mind the Chinese situation continued to be unsettled; and Russia still remained an international enigma. But the progress of af fairs in Eastern Asia testified to the sincerity of Japan's pro nouncements at the conference table of Washington. Despite the differences which arose over many questions, there has de veloped a conviction that there would be no solution of the problems involved. At Geneva and elsewhere the pacific attitude of Japan was recognised.

PRE-WAR QUESTIONS

nchurian Questions.—Prior to the outbreak of the Russo- nese War, the growing international rivalry for spheres of nce in the Chinese Empire had convinced the interested rs of the necessity of establishing the policy of the " open " and equal opportunities for commerce and trade in that try. That principle was from time to time enunciated by t Britain in the later decades of the 19th century, but it was ved to Mr. John Hay, Secretary of State under President inley's administration, to make its definite pronouncement world. In Secretary Hay's Circular Note addressed to vari- Powers under date of July 3 1900, it was declared that the y of the United States was to assure permanent safety and to China, to preserve Chinese territorial and administra- ntity, to protect all rights guaranteed to friendly Powers by and international law and to safeguard for the world the iple of equal and impartial trade with all parts of the Em- The doctrine was accepted in principle by Japan, Great in, Russia, France and Germany. Japan went so far as to ude specific agreements for its execution with Russia (July 07) and France (June 6 1907). It was, however, understood the spheres of influence already established—Great Britain e Yangtze Kiang valley, Tibet and Weihaiwei; Germany in chow; Russia in Manchuria and Mongolia; France in Yun- were not to be prejudiced by the newly professed principle mmercial impartiality.

e Russo-Japanese War brought about the tenure by Japan Manchuria of a similar position to that which the great West- Powers had held in other parts of China. But " because churia had been the scene of the greatest war of modern s," the world's eye became fixed upon every act of Japan in region in " an exceptionally rigorous scrutiny " and " the ns behaved as though they expected her to live up to a stand- of almost ideal altitude." Meanwhile, China, for her part, nto a mood of impatient irritation on account of the pre- d encroachments upon her sovereignty, and the " rights- ery campaign," clamorously conducted throughout that Em- somewhat strained her relations with Japan in the early part 09 in respect of various questions in Manchuria. However, g. of that year, a series of agreements was reached between wo States by which all those outstanding problems were osed. Among the rest, Chinese sovereignty over Chientao onfirmed, and arrangements about railways, including that e Antung-Mukden line, were effected.

om out of the blue, there came from America a proposal for eutralisation of the Manchurian railways in Jan. 1910. In iew of Mr. Philander C. Knox, Secretary of State, that was calculated to further the principle of the " open door " by ng an end to the abnormal conditions obtaining in Manchu- But Russia and Japan could not accede to the scheme, on grounds that their established rights and interests ought to espected and that they were by no means threatening the ese sovereignty or the " open door " principle. Great Brit- ept aloof, declaring that the question should be settled ng the immediately interested Powers, namely, China, Japan Russia. Nor was the proposal to the taste of China, who re- ed it as a further encroachment upon her sovereignty. She ed that her treaty obligations with Japan and Russia pre- ed her from supporting the American idea. And the proposal hrough. Meanwhile, the Russo-Japanese negotiations as to future attitude in Manchuria and Mongolia came to a satis- ory conclusion and a steadying element was added to the tion in the Far East in the form of an agreement between n and Russia, signed at St. Petersburg on July 4, 1910, r which they pledged themselves to maintain the *status* in Manchuria and to abstain from any unfriendly compe- a in the development of that region. The Russo-Japanese *rochement* was further solidified, in view of the World War, he Convention[1] of July 3 1916, which provided that each of wo countries would not become a party to " any political arrangement or combination " directed against the other and that they would take counsel together for the necessary measures, " should the territorial rights or the special interests in the Far East of one of the High Contracting Parties be threatened." The agreement made greatly for the maintenance of good order in the Orient until the Russian Revolution brought about the drastic change of the whole situation. For later developments *see* paragraph on Washington Conference below.

The Annexation of Korea.—Japan had waged two wars, one against China and the other against Russia, in order to prevent Korea (*q.v.*) from becoming " a dagger pointed against Japan's heart." In June 1905 she established a protectorate over the Hermit Kingdom so as to put a definite end to the wayward and suicidal diplomacy of the Seoul courtiers, but the whole peninsula could not be cleansed of its inveterate political and social iniquities. The hopelessness of real reform under the existing régime had become manifest; and the assassination of Prince Ito by a Korean in Oct. 1909 was the climax.

The Tokyo Govt. thus came to the conclusion that " the responsibilities devolving upon Japan for the due administration of the country (Korea) cannot be justly fulfilled without the complete annexation of Korea to the Empire." The fusion was accomplished by a treaty concluded between the Governments of Japan and Korea on Aug. 22 1910. It was decided that the ancient name of Chosen should be revived in lieu of Tai-Han and in future be officially used. Under the terms of the treaty the Korean Imperial House was assured of high honours and dignities as well as a liberal grant for maintenance. Japan, at the same time, notified the foreign Powers concerned that their treaties with Korea, including those of extra-territoriality, were all annulled; but that, nevertheless, their vested rights and interests would be fully respected; that the tariffs in force in Korea would be maintained for 10 years; that cabotage would be permitted to foreign vessels for the same period; and that the port of Masanpo would be closed for naval reasons, but Shin Wiju or Gishu would be added to the open commercial ports.

The Anglo-Japanese Alliance.—The general changes of situation in the Orient after the Russo-Japanese War, notably the annexation of Korea to the Japanese Empire in 1910, impelled the British and the Japanese Govts. to revise the Agreement of Alliance concluded in 1905. The negotiations in London between Sir Edward (afterwards Viscount) Grey and Baron (afterward Count) T. Kato ended in the renewal of the Alliance on July 13 1911. The important feature of the new agreement was the inclusion of an Article exempting either high contracting party from the obligation to come to the armed assistance of the other against a third party when a general arbitration treaty was concluded between that other Power and a third party (Article 4). At that particular time a treaty of such a description was under negotiation between the British and the American Govts., and it was with the particular object of excluding the United States from the application of the Alliance that Article 4 was inserted.

The general arbitration treaty failed to obtain the consent of the American Senate for its ratification, but the British and Japanese Govts. undertook on several occasions to make it clear that the spirit in which the article was conceived had not on that account been altered in the least. The Alliance of 1911 was to last for 10 years, and, in the absence of a year's notice from either contracting party to terminate the agreement, it would automatically continue in existence, even after July 1921, until such denunciation was made. The World War, into which Japan readily entered on account of the Anglo-Japanese Alliance, ended with the Treaty of Versailles which brought forth the League of Nations. The question was then mooted, though more academically than politically, whether the Anglo-Japanese Alliance would not be in contravention with the letter of the Covenant of the League, and on July 8 1920 the two high contracting parties addressed a joint note to the Secretary-General of the League to the purport that the Agreement of Alliance would in case of its renewal be made to conform to the Covenant in its form. The renewal of the Alliance was discussed at the British Imperial Conference in London in June 1921; and it was then announced that, under the terms of the treaty, it would continue, without definite renewal. But at the Washington Conference, in Dec., the agreement made for a four-Power treaty (America, France, England, Japan) provided for the Anglo-Japanese Alliance being brought to an end.

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[1] ussian and Japanese notes printed Temperley, *Hist. of Peace erence*, vi, 634.

THE WAR AND THE PEACE

The World War.—No sooner had the World War broken out in 1914 than there took place several exchanges of views between the British and the Japanese Govts. as to possible assistance by Japan in the protection of British trade in the Far East. Japan soon made it clear that she was prepared to take the responsibility imposed upon her by the Anglo-Japanese Agreement of Alliance, should the menace of the Germans to British interests necessitate such a step. It was not long before such a contingency arose, and on Aug. 15 1914 the Japanese Govt. sent an ultimatum to Berlin demanding the immediate withdrawal of the German warships from Chinese and Japanese waters and the surrender of Kiaochow to Japan by Sept. 15, with a view to eventual restoration of the leased territory to China; a week was allowed to the German Govt. in which to make a definite reply. On Aug. 23, the term having expired without any answer being forthcoming from the Kaiser's Govt., Japan declared war against Germany. In coming to this decision Japan remembered that it had been through the machinations of the Berlin Govt. that Germany, France and Russia acted jointly in 1895 in "advising" Japan in the name of peace in the Orient, and not without a hint of force, to retrocede to China the peninsula of Liaotung, which had been won by Japan at a heavy sacrifice of life and treasure and ceded to her under the Shimonoseki Treaty, and further that it was barely two years after that incident that Germany had installed herself at Tsingtao on a flimsy pretext. The Japanese nation welcomed the opportunity of eradicating the German menace in the East which owed its inception to such unfortunate circumstances.

The first part which Japan took upon herself to play after she aligned herself with the Allies was the reduction of the German stronghold in the Far East. Tsingtao, on the bay of Kiaochow, had been converted in the hands of the Germans into one of the most impregnable fortresses in the Orient—the "mailed fist" calculated to intimidate any possible objectors to the Kaiser's imperialist aims. It served at the outset of the war as the only base of operations in E. Asia for the German marauders menacing the Allied trade routes. The five German warships forming the main part of Adml. von Spee's squadron had been running amok, not only in Chinese and Japanese waters, but as far as the South Seas. It was imperative to make these raiders homeless, if they could not be captured or destroyed, and the military and naval operations against the redoubtable base, which was under the command of Capt. Meyer-Waldeck and garrisoned by some 13,000 men, of whom 5,599 were German regulars, were started with the utmost dispatch.

On Aug. 27 the blockade of Kiaochow Bay was declared by the Japanese Navy and Lungkow, 150 m. N. of Tsingtao, was chosen as the point for landing troops. The selection of Lungkow as the spot for disembarkation had been agreed upon between the Japanese and British commanders, who saw the necessity of clearing the hinterland prior to the landing of troops at some point nearer the fortress. However, the point being outside the zone of the leased territory, it was thought necessary to have a war zone established, following the precedent of the Russo-Japanese War and negotiations with that view were started between the Japanese and the Chinese Govts. as early as Aug. 20. An understanding was soon come to between the two Governments, and the Peking Govt. issued a declaration establishing such a war zone on Sept. 3. The Chinese Govt., in the meantime, intimated to the Japanese Govt. that it might nevertheless be found advisable to enter a formal protest to Japan against her troops' landing at Lungkow, for the sole purpose of exonerating themselves from all responsibility towards the German Government. Upon Germany's strong protest against permitting the Japanese troops to land in the neutral territory, the Chinese Govt. went so far as to point out that Germany herself had in a measure created the uation through her unauthorised fortification of Tsingtao. an account of the actual operations and the taking of Tsing by the Anglo-Japanese forces, *see* TSINGTAO, CAPTURE OF.

Although Tsingtao was thus early captured, there still remai the important task of locating and disposing of Adml. von Sp squadron, consisting of the "Scharnhorst," the "Gneisen the "Nürnberg," the "Leipzig," and the "Dresden," w were seriously menacing the Allied commerce in the South S It had further been reported that several German warships at large in the Pacific Ocean. As early as Aug. 26 the battle ser "Ibuki" and the cruiser "Chikuma," and shortly a wards six more Japanese cruisers, were ordered to join the Bri China Squadron under the command of Adml. Jerram. T were further dispatched a squadron of eight cruisers to the C and the East Seas and two squadrons—one comprising two ba cruisers, two cruisers, and a division of torpedo destroyers the other one battleship and two cruisers—to the South Pa Ocean. The cruiser "Idzumo," which happened to be in M can waters, as well as the "Asama" and the "Hizen," entrusted with the patrol of the western coast of America co-operation with the Canadian "Rainbow" and the Bri cruiser "Newcastle."

In the middle of Sept. a great sensation was aroused by dramatic appearance in the Bay of Bengal of the German ra "Emden," which had effected her egress from Tsingtao be the blockade was instituted by the Japanese navy. Several ish merchantmen fell victims to her ruthless attack in appali swift succession, and it was only after two months' stren chase by the British and the Japanese squadrons that the " den" was sunk by the Australian cruiser "Sydney" near island of Cocos. In the meantime, Australian and New Zeala troops were being hurried to various theatres of war in Euro and Japanese warships assisted in the convoy of the transp across the Indian Ocean. At one time, whilst the "Emden" still working havoc in Indian waters, the "Ibuki" was oblig to convoy no fewer than 38 troopships by herself. Apart f the anxious as well as hazardous task of convoy, Japanese ships were, in Feb. 1915, called upon to hurry to Singapore land troops there to assist the British forces, side by side French and Russian marines, in suppressing a mutiny of In soldiers who had come under German influence. In 1917, an ter, the Japanese Navy undertook the guardianship of the sa of the Indian Ocean as far as the Cape of Good Hope. Von Sp squadron, as a result of the concerted operation of the Brit and the Japanese navies, was chased in the direction of C Horn towards the end of 1914, and on Dec. 8 was encountere Adml. Sturdee's squadron off the Falkland Is. and was comple annihilated, with the exception of the "Dresden," which, h ever, was also sunk by the British off Chile three months la Meanwhile the German gunboat "Geier" was disarmed and i terned at Honolulu, and thus the Pacific Ocean was cleared of enemy, greatly to the relief of Allied commerce.

The next, and not the least important, contribution of the Ja anese Navy toward the successful conduct of the War, was t sending of the cruiser "Akashi" and three destroyer divis under the command of Rear-Adml. Sato to the Mediterran The German submarine warfare was about that time begin to be carried on in a ruthless manner, and the British Navy h been earnestly requesting Japanese help. Whilst the Britis French and Italian forces were engaged in blockading the A atic Sea and the Dardanelles, Adml. Sato's squadron assum the all-important duties of convoying Allied vessels to and f between ports in the Mediterranean. The Japanese destroye successfully escorted 21 British warships, as well as 623 Britis 100 French, 18 Italian and 26 other troopships or merchantme totalling 788 ships, and they cruised altogether 220,000 miles.

The Peace Conference.—At the Peace Conference in Paris 1919 Japan was represented by Marquis (afterwards Prin Saionzi; Baron (afterwards Viscount) Makino; Viscount (afte wards Count) Chinda; Mr. (afterwards Baron) K. Matsui; an Mr. (afterwards Baron) K. Ijuin. The plenipotentiaries went t ce with the firm conviction, as Baron Makino had made un- ikably clear before he left Japanese shores, that the attitude pan at Paris should be, not so much to advance her own case e the comrade nations in the War, as to take counsel with in the creation of a new world in which justice and humanity d reign supreme and which would assure an enduring e. The first claim laid on the peace-table by the Japanese ates was for the recognition of racial equality. The public on of Japan demanded that, if a new era of righteousness airness was to be established and peace and good-will among were to be assured for all time, one of the postulates should e principle of the equal dignity of races. The Japanese na- had been deeply conscious of the discriminatory treatment d out to its nationals in various parts of the world. It recog- l that differences in ability, power and character among men ys exist; but it appeared wrong that there should be inequality pportunities—inequality before the law. The present state man civilisation having been achieved by a series of social, ious, political and economic emancipations, it seemed cer- y to be time that racial emancipation should, in the interests ie real progress of civilisation, be foreshadowed and ap- ed at least in principle. The original Japanese proposal for tion in the Covenant of the League of Nations read:—

> e equality of nations being a basic principle of the League of ons, the High Contracting Parties agree to accord, *as soon as ble*, to all alien nationals of the states members of the league l and just treatment in every respect, making no distinction, r in law or in fact, on account of their race or nationality.

explaining the Japanese position, Baron Makino made it r that "the question being of a very delicate and complicated ire involving the play of a deep human passion, the immediate isation of the ideal equality was not proposed, but that the se presented enunciated the *principle* only and left the actual king of it in the hands of the different Governments con- ed." Every national of the States in the League was expected share military expenditure for the common cause and, if need sacrifice his own person. In view of these new duties . . . ing before him . . . each national would naturally feel, and in demand, that he be placed on an equal footing with the peo- whom he undertook to defend even with his own life." The anese proposal, which was later somewhat modified in termin- y in an attempt to meet objections, obtained 11 votes out of n its favour, but it was ruled that unanimity was necessary. an abided by that decision, reserving the right to raise the ques- again at an opportune moment.

iaochow.—The disposition as regards Kiaochow was the next stion with which the Japanese delegates had to grapple. When Japanese people gave a hearty send-off to their plenipoten- ies, they had no shadow of doubt as to the final issue of this stion. The greater, therefore, was their disappointment, if not pefaction, when the Chinese delegates came out with a de- nd for the direct restoration of the ex-German stronghold. an claimed Kiaochow in recognition of all her military and al services. It was at the same time made clear that Japan uld be content, having once secured Kiaochow in her hand, to retain it in her possession, but to offer it to China as a mark good will and friendship. The Chinese delegates, however, isted that the declaration of war by China against Germany on g. 14 1917 had abrogated all her treaties with Germany, in- ding that of the lease of Kiaochow. Whether a lease treaty is a sort of *pacta transitoria* is, it was argued, a moot question; vould appear to be contrary to common sense to contend that aper declaration of war could as if by a magic wand trans- to her possession a formidable fortress which China could er have reduced with her own resources. China's further a was that her engagement of May 1915 had been made under ess and was therefore null and void. It is a fact, however, t China did not question the validity of that engagement, en she willingly concluded the formal understanding of Sept. 1918, which was actually based on the above-mentioned agree- nt of May 1915, and accepted an advance of 20,000,000 yen ler that understanding. The position of Japan, it should be observed, had furthermore been fortified by the previous undertakings of Great Britain, France, Russia and Italy in 1917, to support or at least raise no objection to the Japanese claim. The Supreme Council finally decided in favour of Japan, on May 5 1919 (Arts. 156–158, Treaty of Versailles).

The ex-German islands in the Pacific lying north of the equator, which had been under the Japanese occupation since 1914, were allocated to the Japanese administration under mandate at the Supreme Council held at the Trianon Palace on May 7 1919. They include the Marshall, Caroline, Palau (Pelew), and Marianne (Ladrone) islands.

THE RENDITION OF KIAOCHOW

With the coming into force of the Treaty of Versailles on Jan. 10 1920 the German rights and interests in Shantung passed to Japan, and the Tokyo Govt., in conformity with their obligation to China, and true to their public avowals (by Baron Makino in Paris on May 4 1919; by Viscount Uchida in Tokyo, May 17 and Aug. 2 1919), immediately instructed Mr. Obata, the Japanese Minister, to invite the Peking Govt. to open negotiations for effecting the restoration of the ex-German possessions in Shantung Province (Jan. 19). It was desired that the necessary preparations for accepting the restoration should forthwith be started, and that China should organise a police force to take over the charge of guarding the Tsinan-Kiaochow railway. As soon as such an organisation was completed—even were it prior to an agreement being reached as to the restoration—the Japanese troops would be immediately withdrawn. Three months passed without any response coming from Peking in reply to the Japanese overtures.

Japan repeated on April 26 her desire to start negotiations, and the Chinese reply (May 22) was that she could not conduct direct negotiations with Japan as to the question of Kiaochow on the basis of the Treaty of Versailles, which she did not sign, and further, that the whole public of China had assumed a strongly antagonistic attitude regarding this question; whereupon the Tokyo Govt. asked the Chinese Govt. to reconsider the matter, assuring the latter that they were ready to begin negotiations at any time China might deem convenient. But Peking again remained deaf, and at the first assembly of the League of Nations, in 1920, Dr. Wellington Koo reserved for "a more appropriate time in the future" the matter of bringing before the League certain "subjects of vital interest to China, affecting international relations."

Independently of the Washington Conference, an informal conversation regarding Shantung was started between the Japanese and Chinese delegates to that conference on Dec. 1 1921, through the personal good offices of Mr. Charles E. Hughes and Mr. Arthur Balfour (afterwards Lord Balfour). After a protracted discussion, especially in respect of the disposition of the railway, a treaty was signed on Feb. 6 1922 under which the restoration of the former German leased territory to China was finally agreed upon. For five months, beginning June of the same year, negotiations as to the execution of the treaty were conducted in Peking, and in Dec. all detailed arrangements were concluded. The administration of Tsingtao was transferred to China on Dec. 10; the Japanese garrison was withdrawn on Dec. 17; the Shantung railway changed hands on New Year's Day of 1923; and thus passed into history the 24 years' episode of Kiaochow Bay.

The Yap Controversy.—The council of the League which met in Geneva on Dec. 17 1920 decided upon the statute relative to "C" class mandates, under the terms of the Covenant of the League (Art. 22, 6) and pursuant to the decision of the Supreme Council on May 7 1919, allocating the ex-German South Sea Islands to Great Britain, Australia, New Zealand and Japan. The Japanese Govt. had been contending that, according to their legal interpretation, the principle of equal opportunities for trade and commerce should, under the Covenant, be assured to "C" class as well as to "B" class mandates (Art. 22, 5) (*see* MANDATES). But in view of the importance of unity and co-operation among the Allied nations, Japan gave her assent to the issue of the statutes, on the understanding that that "decision should not be considered as an acquiescence by the Japanese Govt. in the submission of Japanese subjects to discriminatory and disadvantageous treatment in the mandated territories, nor have they thereby discarded their claim that the rights and interests hitherto enjoyed by Japanese subjects in these territories should be fully respected."

To the statute relative to the islands north of the equator which came under the Japanese mandate, " as an integral portion of its territory," the United States took exception, on the plea that the island of Yap should not be included in the islands to be so assigned. It was argued that President Wilson had submitted to the Supreme Council his proposal of having that island internationalised for reasons vitally affecting the world communications, and that its decision, published on May 7 1919, should not be regarded as by any means conclusive. Further, the Washington Govt. declared that they had never ratified the Treaty of Versailles and accordingly were not bound by that instrument in any sense; but the United States should, treaty or no treaty, have a voice in the disposition of the affairs immediately arising from the World War. So far as the status of the island was concerned, Japan's position was that, if the published decision of the Supreme Council were not final, she did not know what she could rely upon as definite finality; the Allied Powers in Europe appeared to support the Japanese view. In the presentation of their case, the American Govt. further stated that " even if Yap should be assigned under mandate to Japan, all other Powers should have free and unhampered access to the island for the landing and operation of cables." Japan contended that " the (cables) question seems to be one which should be freely settled by the nation which has the charge of the place." During the Washington Conference an agreement between Japan and the United States was eventually signed on Dec. 12 1921 by which Japan's authority (as the mandatory Power) in Yap was admitted by the United States, while Japan accorded to the United States full rights and facilities regarding cables and other matters.

European Tour of the Crown Prince.—Japan's age-long tradition was broken when an heir to the throne left his native shores on March 31 1921. Crown Prince Hirohito set forth, escorted by Prince Kan-in and Count Chinda, upon a tour of study and observation in Europe. The battleship " Katori," carrying him on board, called at Hongkong, Singapore, Bombay, Port Said, Malta and Gibraltar, en route to Portsmouth, where she anchored on May 8. The reception by King George V. and the public of Great Britain was most cordial and spontaneous, befitting the alliance uniting the two nations for the past two decades. The Imperial tour subsequently extended to France, Belgium, Holland and Italy, and was everywhere attended with success. The Crown Prince returned to Japan on Sept. 31 1921. The minute reports of his foreign tour which daily reached home had a tremendous and almost historic effect in diffusing international and democratic ideas amongst the Japanese people.

The Washington Conference.—In the early months of 1921, when the renewal of the Anglo-Japanese Alliance and the proposal for universal disarmament were simultaneously discussed in Great Britain and the United States, Japanese public opinion evinced misgivings as to the real motives held by the chancelleries at London and Washington. But when President Harding dispatched his informal invitations for an international conference and his sincerity of purpose was evident, the Japanese Govt. entrusted Adml. Baron (later Viscount) Tomosaburo Kato, Minister of the Navy, Baron Kijuro Shidehara, Ambassador to Washington, Prince Iyesato Tokugawa, President of the House of Peers, and Mr. Masanao Hanihara, Vice-Minister for Foreign Affairs, to represent Japan at the conference on the limitation of armaments. Japan's attitude at the conference was to " place all cards face up on the table," and was considered worthy of great credit for enabling the conference to reach a successful end. Coincident with the disarmament conference, the Shantung conversations (*see* above) were started between the Japanese and Chinese representatives and the settlement of the protracted controversy is deemed a happy product of the harmonious diplomatic atmosphere created by the main conference.

In conformity with the agreements of Washington, Japan co pletely withdrew her garrisons from Hankow in July 1922, fr northern Manchuria in Sept. 1922, from Siberia in Oct. 1923 a from Tsingtao in Dec. 1923. With the scrapping of the sup dreadnought Tosa on Feb. 11 1925 the provisions of the disarm ment treaty were fully carried out, except in the case of t battleship " Mikasa." She was the flagship of Admiral Togo at t battle of the Japan Sea in 1905, and the Japanese people wish to preserve her as a historic memorial. The consent of the sig tory Powers was officially obtained, and the " Mikasa," disma tled, lies in Yokosuka Bay as a floating naval museum.

RELATIONS WITH CHINA

The Chinese Loan Consortium.—A gradual change came ab in the opening years of the 20th century in the general polic toward China of the Great Powers, who had become convinced the fruitlessness of mutual competition; signs also became visi of the altered attitude of Western financiers in regard to the i vestments in that Empire. In 1908, a British and a German ba undertook to finance in common the Tientsin-Pukow railway. 1911, a four-Power group consisting of Great Britain, Germa France and the United States, was formed in connection with t Hankow-Szechwan railway loan, as well as the loan for curren reform in China and industrial enterprise in Manchuria. Jap nese and Russian bankers agreed to joint this Consortium in 19 with the understanding that the special interests of Japan a Russia in Manchuria and Mongolia would not be interfered wi in the internationalisation of the Chinese loans. With the inau uration of Mr. Woodrow Wilson as President in 1913, the U Govt. decided to withdraw their bankers from the Co sortium, and subsequently the World War prevented Germa from remaining in the financial league. In 1917 the Consortiu now comprising the four Powers, Great Britain, France, Jap and Russia, invited the United States to rejoin in its activit The American Govt. hesitated at first to respond to this ca but in June 1918 took the initiative for the reconstruction of t financial group.

By that time the Tsarist régime in Russia had come to an en but the other nations interested expressed their assent to t American proposal; and negotiations were started in May 19 in Paris, between the financial representatives of Great Britai France, Japan and the United States, simultaneously with t Peace Conference. After considerable interchange of views, pa of which concerned the reservations by Japan as to S. Manchur and E. Inner Mongolia, an agreement was signed in New York o Oct. 15 1920. The most important feature of the new agreeme was that the object was purely and simply economic, being e tirely free from any political complexion. All the members we to pool their existing and future loans (*i.e.*, options) both as r gards industrial and administrative undertakings, with the excep tion of the industrial enterprises upon which substantial progre had already been made. As to Manchuria and Mongol the Powers arrived at a satisfactory understanding, Japan wit drawing her previous reservations. The statement of the Japa nese Govt. issued on April 1 1921 contained the assuranc that Japan only desired in those regions definitely to ensu " her national defence and the security of her economic life and she was confident that she could safely rely upon the mutu trust and friendship of the Powers in regard to the exigencies o any situation that might arise in future.

Equality of opportunity was fully guaranteed to all membe thus eliminating unnecessary and harmful competition. It wa believed that this co-operative action of the various bankir groups, which alone could offer the enormous amount of capit necessary for the reconstruction of Chinese economic life and fo the building of sufficient means of communication and transpo tation all over her vast territory, would be in the best interes of the Chinese people.

" Twenty-one Demands " upon China.—No country regrette more sincerely the continued internal troubles and disorder i China, which had been divided into warring camps since th Republic was proclaimed, than Japan herself, whose nationa

tiny is so intimately entwined with that of China. On Jan. 1915 the Tokyo Govt., impatient of Chinese diplomacy, sented "21 demands," as they were called. First, China st "give full assent" to Japan's disposal of Shantung and dge herself not to cede or lease either territory or island to hird power under any pretext. Also China must agree to an building a railway from Chefoo to Lungkou, and to the ning of treaty ports by agreement with Japan. Secondly, in th Manchuria and Eastern Mongolia, China recognises an's "special position," and grants to Japanese subjects a t or freedom to reside, own land for trade, manufacture or ing, with important railway concessions. Over China's olitical, financial or military advisers or instructors," in these vinces, "the Japanese Govt. shall first be consulted." Thirdly, Hanyehping Company with its mines is to be made "a t concern of the two nations" in which China shall not "dis- of the rights and property" except "with the previous sent of Japan." Fourthly, "the Chinese Govt. engages not cede or lease to a third power any harbour or bay along the st of China." Group V. of the so-called "demands" was sented secretly as "wishes." By Article I. "the Chinese vt. shall employ influential Japanese as advisers in political, ncial and military matters." The "wishes" also cover employment of Japanese advisers; land ownership by Japa- hospitals, temples and schools; the purchase of munitions of r from Japan; the right to construct the Wuchang-Nanchang d Nanchang-Hangchow railways; the priority of Japanese cap- l regarding railways, mines and harbour works in Fukien prov- e; and Japanese missionary propaganda. The ambitious gramme of the Tokyo Cabinet evoked adverse criticism from ious quarters, and it was unfortunate that whatever cogent sons there might have been, the "wishes" were not placed on table from the outset as well as the "demands." As to their rinsic merit, the London *Times* (Feb. 13 1915) observed: ven in the Peking version . . . these terms do not look harsh or reasonable in principle."

Even granting that some of the proposals were unwisely con- ved, the general belief that Japan purposed at that time to es- lish a veiled protectorate over China was a misconception of true attitude. For Japan it was a matter of superlative erest and importance that her neighbours should attain a good vernment, a prosperous industry and a flourishing trade. For se reasons, Japan pressed the Peking Govt., on May 7 5, to give a definite answer within a time limit. In the end Chinese President, Yuan-Shi-k'ai, acceded to the Japanese posals; and on the 25th of the same month, under the signa- e of Mr. Hioki and Lu Cheng-hsiang, the Chinese Minister Foreign Affairs, two treaties were concluded—one respecting province of Shantung, and the other regarding South Man- ria and Eastern Inner Mongolia—and 13 notes were exchanged. With reference to Shantung, the Japanese Minister, in an ex- ange of notes, made the following declaration:—

> If upon the conclusion of the present War the Japanese Govt. uld be given an absolutely free disposal of the leased ter- ry of Kiaochow Bay, they will return the said territory to China, ject to the following conditions:
> 1. Opening of the whole of Kiaochow as a commercial port;
> 2. Establishment of a Japanese settlement in the locality to be signated by the Japanese Government;
> 3. Establishment, if desired by the Powers, of an international tlement;
> 4. Arrangements to be made, before the return of the said terri- y is effected, between the Japanese and the Chinese Govts. th respect to the disposal of German public establishments and perties and with regard to the other conditions and procedures.

China's Pledges.—By the treaty respecting South Manchuria d Eastern Inner Mongolia, the Chinese Govt. pledged them- ves that the terms of lease of Port Arthur and Dairen, and the South Manchuria railway and the Antung-Mukden rail- y, should be extended to 99 years respectively; the Japanese uld be permitted in South Manchuria to lease land for residential, commercial, industrial and agricultural purposes, and further should be free to enter, travel, reside and pursue various vocations; that in Eastern Mongolia Japanese should be permitted to carry on, jointly with Chinese, agricultural undertakings; that Japanese conducting business in those regions should be submitted to Chinese police laws and taxation; that civil and criminal cases should be tried by the Japanese consul or by Chinese officials according as the defendant was Japanese or Chinese, save in cases of land disputes, where a mixed tribunal would have the power of adjudication (all this pending the eventual reform of the Chinese judicial system); that suitable cities and towns would early be opened to foreigners of China's own accord; and that various agreements relating to the Kirin-Changchun railway should early be revised.

At the Washington Conference of 1921–2 the Chinese delegation asked for the annulment of the treaties and notes of 1915 on the ground that they had been wrested from China under duress and without any *quid pro quo*. Baron Shidehara contended that a dangerous precedent would be established in international law if a treaty were to be revoked for the reason that it had been concluded against the spontaneous will of a party. He declared, however, that, in view of the changes that had taken place in the general situation since the signing of those treaties and notes, Japan was ready to modify some of their stipulations. Mr. Hughes claimed for the Americans all rights granted to Japanese nationals under these documents by virtue of the most favoured nation principle, while refraining from touching upon the validity question. Dr. Koo made a reservation as to China's "right to seek a solution, on all future appropriate occasions, concerning those portions of the treaties and notes of 1915 which did not appear to have been expressly relinquished by Japan."

The Ishii-Lansing Agreement.—In the course of the conversations that took place between Mr. Robert Lansing, the United States Secretary of State, and Viscount Ishii, when the latter went to Washington as Japan's special ambassador on the war mission in 1917, it was found advisable that a public announcement of the desires and intentions of the two Governments with regard to China should once again be made "in order to silence mischievous reports" that had been circulated. On Nov. 2 notes were exchanged declaring in part:—

> The Governments of Japan and the United States recognise that territorial propinquity creates special relations between countries, and consequently the Government of the United States recognises that Japan has special interests in China, particularly in the part to which her possessions are contiguous. . . . The Governments of Japan and the United States deny that they have any purpose to infringe in any way the independence or territorial integrity of China, and they declare, furthermore, that they always adhere to the principle of the so-called "open door" or equal opportunity for commerce and industry in China.

In view of the understandings reached at the Washington Conference of 1921–2, the two Governments declared the termination of the Ishii-Lansing Agreement in the form of notes exchanged between Ambassador Hanihara and Secretary of State Charles E. Hughes on April 14 1923.

JAPAN AND RUSSIA

Japanese Expedition to Siberia.—After the Russian revolution in 1917 an anomalous situation developed in Siberia owing to the contact established by German and Austro-Hungarian prisoners-of-war with Bolshevik forces, the former assuming the practical command. These Teutonic-Bolshevik allies seriously threatened the safety of the Czechoslovak troops who had essayed through the only available route of Siberia to join the Allied armies fighting on the Western Front in France. The U.S. Govt. proposed to the Japanese Govt. in the early part of 1918 to dispatch an Allied contingent to Eastern Siberia to assist the Czechoslovaks. To this Japan gave her assent, and on Aug. 11 1918 dispatched a contingent to Vladivostok; the United States and Great Britain also dispatched troops to Siberia. Early in Sept. Khabarovsk was captured by the Allied forces, and during the month of Oct. Bolshevik influence in Eastern Siberia signally declined, and the Czechoslovaks in the interior

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For the text see Temperley, *Hist. of the Peace Conf.*, vol. vi., 631 *seq.*

succeeded in re-establishing communication with their compatriots in the littoral districts. The Allied successes in Siberia endowed the anti-Bolsheviks, rallying under the banner of Adml. Kolchak, with fresh power; and the authority of the Omsk Govt., established in Nov. 1918, extended as far as the Ural regions by the end of that year.

But in May 1919 the anti-Bolshevik forces sustained a crushing reverse at the hands of the Red Army; and Adml. Kolchak's Govt. first removed from Omsk and then, toward the winter, to Chita. In the face of such unfavourable developments, Japan saw the necessity of speedily arriving at a definite understanding with the U.S. Govt. as to the future dispatch of reinforcements to Siberia. The Washington Govt., however, responded in Jan. 1920 with a sudden decision to withdraw all the American troops and railway experts; firstly, because the repatriation of the Czechoslovak forces was about to be completed, and secondly because the very unstable situation in Siberia would render futile any military assistance to the attempt to establish an autonomous Russian Govt. in Siberia. The American Govt. further stated that if Japan would continue in her endeavours in Siberia single-handed they had no objection whatever. In point of fact, the exigencies of the situation soon obliged Japan to send reinforcements. But the Bolsheviks were in the spring of 1920 fast establishing ascendancy in Eastern Siberia, having their headquarters at Vladivostok, Verkhne Udinsk, and Blagovyeshchensk—the three centres being more or less independent of each other. After the arrest and execution by Bolsheviks of Adml. Kolchak in Feb. 1920, the only remaining Tsarist leader was Gen. Semenoff, who had established his government at Chita and had the whole province of Trans-Baikalia under his sway.

The Nikolaievsk Massacre.—In March 1920 a most sanguinary incident occurred at Nikolaievsk, on the river Amur; all the Japanese residents of that city, men, women and children, numbering over 700, including Consul Ishida and his family, were tortured and massacred by the "Partisans," a Bolshevist guerilla gang infesting the littoral regions. The Japanese Govt. declared on July 3 that as there existed no responsible administrative centre in Russia which could negotiate concerning this flagrant outrage on Japan's prestige at Nikolaievsk, the Japanese forces would occupy certain places in Sakhalin province, pending the establishment of a legitimate government. At the same time, it was made known that Japanese contingents would soon be withdrawn, as in fact they were, from Trans-Baikalia, inasmuch as the Czechoslovak troops had been successfully assisted on their homeward journey (the last troops left Vladivostok in Sept. 1920), but that Vladivostok and Khabarovsk would still have to be garrisoned by a small military force. Upon inquiry from the Washington Govt., it was explained by the Japanese Govt. that Vladivostok was the prolific hatching ground of Korean revolutionary plots, and further that the safety of the Japanese residents had to be provided for and that Khabarovsk had a close strategic connection with Nikolaievsk. As soon as signs became visible of the growing stability of Khabarovsk, in Sept. evacuation of that region was immediately started.

Meanwhile, the Bolsheviks at Verkhne Udinsk began to style themselves the "Far Eastern Republic," and, in concluding an agreement for the suspension of hostilities with the Japanese military authorities in July 1920, drew up a memorandum to the effect that the Republic would follow democratic and not communist principles of administration, and would constitute itself a buffer state in the interests of a speedy return of peace and order to Siberia. Then the movement for the unification of the several "governments" in Eastern Russia was started, and in Nov. the so-called Amalgamation Assembly at Chita declared the independence of the "Far Eastern Republic" (adopting the name at first conceived at Verkhne Udinsk), holding as its territory the Russian provinces east of the Selenga river and professing anti-communist democracy as its basic political principle. The *coup d'état* which was carried out by the reactionary Kappelists in Vladivostok on May 26 1921 showed that the Siberian situation was still as unstable as ever.

In accordance with Japan's pledge at the Washington Conf ence of 1922, she withdrew her troops from Russian soil exce Northern Sakhalin as soon as the situation warranted the wi drawal, namely by Oct. 25 1923. Northern Sakhalin was evacu ted on May 15 1925, following an arrangement made at the ti of Japan's recognition of the Soviet Government.

Japan's Recognition of Russia.—Geographical propinqui and economic needs made it highly desirable for Japan to establish normal international relations with Siberia as so as the situation warranted such a course. A similar desire w apparently held by the Far Eastern Republic having its capi at Chita, and informal negotiations were conducted betwe the representatives of the Japanese Govt. and the Chita Gov at Dairen in Aug. 1921 and at Changohun in Sept. 1922; but agreements were reached at these conferences. In the meantim the Far Eastern Republic came to be amalgamated with the S viet Union. At the end of 1922 Viscount Shimpei Goto, in t private capacity of President of the Japan-Russia Society, invit M. Joffe to visit Japan for the twofold purpose of recuperati his health and of talking informally about Japanese-Russian lations. Private conversations were carried on between Goto a Joffe in the spring of 1923 (Feb.–May) at Tokyo and Atam Subsequently, the Japanese Govt. officially started the prelim inary informal negotiations with M. Joffe in Tokyo in Ju 1923, with Mr. Toshihiko Kawakami representing it as plenipotentiary.

The conference lasted until July, but owing mainly to the dive gence of views as to the settlement of the Nikolaievsk incider it again failed to arrive at a definite agreement. Then for som months the question of reopening the Russo-Japanese negoti tions remained in abeyance. But in Feb. 1924 Russia invite protests from Japan by successive drastic actions, such as th withdrawal of recognition to the Japanese consuls in Vladivosto and elsewhere, the discontinuation of postal services betwe Vladivostok and Tsuruga, the expulsion of Japanese press corr spondents from Russia and the arrest of Japanese military a consular officials at Vladivostok. It was suspected that, in tak ing such steps, Russia hoped to compel Japan to resume negoti tions at an early date. Mr. Kenkichi Yoshizawa, the Japane Minister at Peking, approached his colleague, M. Karakhan, th Soviet Minister, with insistent demands to make speedy amen for such flagrant irregularities. After several meetings of the tw representatives, it was decided that the thread of discussions a the Tokyo Conference would be taken up by them at Peking May 14 1924. The Peking Conference was protracted to the e of the year, holding no fewer than 77 sessions. At length a "co vention embodying the basic principles of the relations betwe Japan and the Union of Soviet Socialist Republics" was signe on Jan. 20 1925 and came into force on Feb. 26. Through thi convention and the accessory papers,

(1) Japan gave full recognition to the Soviet Union, re-establishi diplomatic and consular relations;

(2) Russia formally tendered Japan "an expression of since regrets" for the Nikolaievsk massacre of 1920, Japan having with drawn her claim for reparations and promising the withdrawal of th Japanese garrison in North Sakhalin by May 15 1925;

(3) In laying down the principles for a future treaty of comme and navigation, Russia recognised the doctrine of private ownersh "to the widest possible extent and on condition of reciprocity;"

(4) It was further agreed that propaganda would not be work either overtly or covertly by the governments themselves or their official agents;

(5) Regarding the question of natural resources, Russia signifie her willingness to grant to Japanese, concessions for the exploitati of minerals, forests and other natural resources in all Russian te ritories. As for oil, Russia pledged herself specifically to grant Japanese concerns the privilege of exploiting 50% in area of the fields already explored or to be explored on the east coast of Nort Sakhalin during the period of five to 10 years. Coalfield concessio on the west coast of North Sakhalin and the Dui district were als pledged;

(6) The fishery rights in Russian waters were granted to Japanes in principle, the private *modus vivendi* of 1924 being recognised;

(7) As for debts and obligations, a settlement was reserved fo future negotiations on condition that the Japanese Govt. an people would not "be placed in any position less favourable" th that which might be accorded to other governments or nationals.

Mr. Tokichi Tanaka went to Moscow as the first Japanese Am-
ssador to the Soviet Union in July 1925, and in company with
a went a Japanese delegation to negotiate with Russian author-
:s regarding Sakhalin concessions. A detailed agreement as to
exploitation was reached in Nov. following, and the founda-
n of Russo-Japanese economic co-operation was thereby laid.

THE EMIGRATION QUESTION

Anti-Japanese Movement in America.—In the opening years
the century, the continuous influx of a large number of Japa-
ıe immigrants from the Hawaiian Islands to California had
ısed much alarm to the labour organisations in that state, and
en in wider circles. Anti-Japanese feeling first overtly mani-
ted itself by the attempted segregation in 1906 of Japanese
ldren in the public schools of San Francisco. President Roose-
t early discerned that public sentiment on the Pacific slope
vards the Japanese was taking an untoward course, and, bent
on stemming the tide in time, in 1906 he pleaded, in his presi-
ntial message to the Federal Congress, that an Act should be
ssed investing the Japanese, who had "won in a single genera-
n the right to stand abreast of the most intelligent and en-
htened peoples of Europe and America," with the right to
turalisation, which had been reserved to "free white persons,
ens of African nativity and persons of African descent." The
ngress at Washington, however, did not, or could not on ac-
ınt of the agitation in the West, so proceed with the ques-
n. Nevertheless, an informal agreement was reached between
: Washington and Tokyo Govts., by which Japan pledged
rself that she would not issue passports for the conti-
ntal United States to those classes of Japanese who would, or
ght, engage in manual labour. Those Japanese who had pre-
ously resided in the United States, or were the immediate rela-
es of Japanese immigrants already in the United States, or
: "settled agriculturists" who were to assume active control
an already established farming interest (only three or four per-
ns actually came under this last category), were to be accepted.
pan promised to observe this arrangement voluntarily, and the
cere efforts of her government in executing it received recog-
ion from many American publicists.

This "gentleman's agreement," as it was generally styled,
s confirmed by a declaration on the part of Japan made simul-
ıeously with the revision of the treaty of commerce and naviga-
n in Feb. 1911. However, the feeling against the Japanese in
: United States subsequently became more and more pro-
ınced. Apart from sporadic legislation imposing restrictions
them with regard to civil rights, such as marriage and the pur-
t of an avocation, the Alien Land Act was passed by the Cali-
nia Legislature in May 1913, and put into force three months
er, despite strong Japanese protests and repeated admonitions
m President Wilson's Cabinet. This law prohibited aliens in-
gible to citizenship of the United States (including companies
: majority of whose interests were under the control of such
ens either in point of their number or the amount of capital
.d) from owning land in the state of California, allowing them
ly the privilege of leasing land on a three years' tenure. The
minology employed invested this law with an appearance of
nocent impartiality, but it was none the less obvious that the
panese alone would, in point of fact, be the sufferers from a
ious discrimination. (The ineligibility to citizenship was
nfirmed by the United States Supreme Court in a decision on
ov. 13 1922.)

Californian Agitation.—American participation in the World
ır tended to lull Californian opposition towards the Japanese.
ıt with the termination of the War it was renewed. In spite
the efforts of the Japanese Govt. to respect the susceptibil-
es of their American neighbours, of which the stoppage of
ssports in the spring of 1920 to the so-called "picture brides"
s an example, the day of the presidential election—Nov. 2—
tnessed the passage by the Californians of the most drastic
v yet enacted against "ineligible aliens," by which they were
prived of even those rights which they had formerly been al-
ved to retain of holding land under a three years' lease. The
Federal authorities had been averse to such a step, but the "initiative" poll decided in favour of the enactment by a majority of three to one (668,483 to 262,086 votes), and the law came into force as from the Dec. following. Thus in 1921 no Japanese might own or lease land, neither could he act as guardian of his own American-born offspring (who are of right American citizens) in whose name land is held, nor might he possess a share even in American-controlled landowning companies.

Anti-alien land legislation seemed to have become the fashion in 1921, the example set by California being emulated by Nebraska, Idaho, Oregon and Washington; the last two states, be it remarked, had systematically refused to make common cause with California during the past decade.

In this connection there would appear to be some misapprehension with regard to the rights of foreigners in Japan to hold land, and it has been stated that no such rights exist. This is not the case, as all persons, without discrimination, who are not Japanese subjects, may enjoy absolute ownership of land, if they are formed and registered under Japanese law as a juridical person, that is, as a partnership or corporation. There are, in fact, many such corporations in existence in Japan, composed exclusively of aliens.

Foreigners are further permitted to acquire rights in land, other than ownership, on the same footing as Japanese nationals, the following being some of the most important of these rights:—

1. *Superficies.*—This is a right *in rem* by virtue of which land belonging to another person can be used for the purpose of owning thereon structures, trees or bamboos. It can be created even though no structures, trees or bamboos are actually in existence on such land, provided that the object and intention are to use the land for the purposes named. The law contains no limitation upon the period of time for which that right can be created; consequently, a superficies for, say, 1,000 years will sell for a sum closely approximating to the value of a right of absolute ownership.

2. *Emphyteusis.*—This is the right *in rem* to carry on agricultural or stock farming on the land of another person. The period of time for its duration is to be fixed by the parties concerned at not less than 20 years and not more than 50 years.

3. *Lease in Perpetuity.*—This is a lease without limit as to its duration, and for all practical purposes it is as good as ownership. It was originally granted to foreigners within the foreign settlements for a nominal consideration paid to the Japanese Government. Although the foreign settlements were abolished in 1898, perpetual leasehold survives and is still enjoyed by foreigners.

4. *Leasehold.*—This is a right *in personam* effective only as between the parties concerned. When registered, however, it can be set up against third persons as the effect of such registration. The duration period is fixed at 20 years, renewable for a further 20 years from the time of renewal.

The climax of the Anti-Japanese movement was reached when an immigration bill containing a clause excluding Asiatics was passed by the American Congress on May 15 1924. A notable aspect of the controversy was that certain senators imparted to Ambassador Hanihara's phrase "grave consequences," an unintended meaning of a "veiled threat." Fears were expressed that the American Congress might suffer the abridgment of its prerogative to legislate about the question of immigration. The Japanese public keenly resented what they considered an overt affront, since they could not reconcile themselves to a proposal under which the Japanese quota would have been a negligible number of 100 immigrants a year. On July 1 the law came into force, and Japanese friendship toward the United States strengthened by the Washington Conference and American generosity at the time of the earthquake disasters, appeared to decline. But thinking Japanese knew that the American press united in disapproving the action of Congress, and felt that this legislation did not correctly reflect the sentiments of Americans as a whole.

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III. NATIONAL DEFENCE

The Army.—After the Russo-Japanese War six divisions were added to the Japanese Army, making the whole strength 19 divisions and in 1915 two more divisions were established for the defence of Chosen. After the World War it was planned to bring the Japanese military organisation up to the standard of efficiency and equipment necessitated by the lessons of the War. An 18-year reorganisation scheme involving 180,000,000 yen (£18,400,000) was passed by the Diet in 1918, and in 1920 it was decided not only to alter the scheme considerably, but also to expedite its execution and have it completed in 14 years, the estimate passed being 290,000,000 yen (£29,600,000).

Under the new scheme the number of divisions was to remain the same, but as a result of the disbandment of several small units the total peace strength of the army was to be reduced by 56,000 officers and men by 1925, and much of this disbandment has taken place. But, with the evacuation of Hankow and the withdrawal of Japanese forces from Shantung, Siberia and the mainland of Sakhalin, and also from Southern Manchuria, there has been a considerable redistribution of the Japanese Army, which has maintained the total strength of the home forces despite the reduction scheme. In war time this force could be expanded to 41 divisions with a total strength of 1,000,000 all arms. According to the latest budget figures, the total number of effectives in the land forces is 235,056, consisting of 16,879 officers, 216,114 other ranks and 2,063 gendarmerie. A Japanese division, it should be added, is generally composed of two brigades of infantry, one regiment of cavalry, one regiment of field artillery (with the exception of the 9th and 11th divisions, for which a mountain artillery regiment is provided), one battalion of engineers and one battalion of army service.

For the purpose of carrying out the new scheme for military aviation in 1919, the Army Department created an aviation section. In Jan. 1920 a military aviation school was started to train in the first year about 100 students, including both commissioned and non-commissioned officers. The military air service consists of six flying battalions and one balloon corps, and is now equipped with 150 standing machines.

Under the system of conscription, able-bodied males from 17 to 40 years of age are liable for service in the army. Those who have completed the middle school education, or have had an equivalent education, can apply for the volunteer service of one year instead of the ordinary three years' service. A young man who is receiving a liberal education may be exempted from military service until it is finished; residents abroad are also exempted.

The Navy.—As a sequel to the Russo-Japanese War, the Jap nese naval authorities came to the conclusion that the most ef cient fleet unit would be the so-called “8-8 plan;” viz., a un consisting of eight battleships, eight battle cruisers and a suitab strength of subsidiary vessels. The Diet agreed to the scheme principle in 1917, but owing to financial reasons it was decided t start with an 8-4 fleet. In the following year, the Diet passed expanded plan of 8-6 unit, spread over seven years. On accou of the strengthened financial situation, the naval authorities pr posed, in Dec. 1920, an additional appropriation of 751,900,00 yen (£76,990,000) beyond the 408,000,000 yen (£41,700,000) pr viously assigned for warship construction, with a view of con pleting the 8-8 unit scheme in eight years. The Diet gave its as sent to this proposal in passing the Budget for 1921–2, and, ac cording to this plan, Japan was expected to have in commissio by 1927 four battleships, four battle cruisers, 12 cruisers, destroyers, five gunboats, 12 fleet auxiliaries, six minesweeper and several submarines, thus bringing the strength of the Japanes navy in ships not exceeding eight years in age to eight battleship eight battle cruisers, 23 cruisers, 73 destroyers, approximatel 80 submarines, five gunboats, 27 fleet auxiliaries and 120 subma rines. In conjunction with this 8-8 scheme, the expansion of th naval air force was decided upon, and by 1923 the formation 17 service and two practice corps had been completed.

In 1910 the tonnage of the Japanese Navy was 524,273; in 1920 was 769,288. In 1920 its strength was 15 battleships, 7 batt cruisers, 16 light cruisers, 14 coast-defence vessels, 8 gunboats, destroyers, 20 torpedo-boats and about 20 submarines.

In accordance with the agreements at the Washington Conferenc reduction was made in the naval strength of Japan, including the abolition of the 8–8 fleet programme. The “Hizen,” the “Kashima, the “Katori,” the “Ikoma,” the “Ibuki,” the “Kurama,” th “Amagi,” the “Tosa,” the “Atago” and the “Takao” we broken up; the “Satsuma” and the “Aki” were sunk; the “S tsu” was converted to a target ship and the “Akagi” and th “Kaga” to aircraft carriers—all this completed by Feb. 9 19

The naval strength of Japan in 1925 was six battleships (191,3 tons), namely, “Nagato” (1919), “Mutsu” (1920), “Ise” (191 “Hiuga” (1917), “Fuso” (1914), “Yamashiro” (1915); fo battle-cruisers, “Kongo” (1912), “Hiyei” (1912), “Haruna (1913), “Kirishima” (1913); one aircraft carrier (9,500 tons); light cruisers (82,210 tons); 72 destroyers (77,025 tons); 41 su marines (32,838 tons); and two fleet submarines (2,800 tons). the course of building were two aircraft carriers (53,800 tons); ni light cruisers (73,995 tons); nine destroyers (12,960 tons); four su marines (3,659 tons); seven fleet submarines (11,510 tons) an three mine-laying submarines.

Regarding naval aviation, a new programme passed by the Die will give the Japanese Navy when completed 17 fleets and 136 plane stationed as follows: Kosumiga-ura, seven; Yokosuka, five; Saseb three; and Omura, two.

See *Armaments Year Book*, League of Nations (Geneva, 1926).

(H. Sa.)

IV. NATIONAL FINANCE

The State Budget.—The table at top of p. 593 shows the increa ing figures of the Japanese state budget for the fiscal years fr 1910–1 to 1924–5.

Although in the early months of the War the more or less disturb economic conditions in Japan checked the normal increase of reven in general, the gradual recovery, followed by the unprecedent prosperity of industry and commerce, caused the revenue to show a upward tendency. From 1916–7 the yield of income-tax, adjusted t meet national needs, had rapidly increased, and receipts from publi undertakings and state property contributed enormously to th general growth of the revenue. A war profits tax, enacted in 19 required of those liable to the tax the payment of either not less tha 20% of their income in excess of the average profits of pre-War da or, in case such could not be ascertained, of 10% of their invest capital.

In addition to the adjustment of the income tax to yield a lar revenue, the “saké” tax, the postal, telegraph and telepho charges and the price of tobacco (a government monopoly) were increased. Japan emerged from five years of the World War with h financial position considerably strengthened, though during 192 industrial unrest and economic depression reacted adversely national finance. The Government explored every available chan in order to counteract the loss of revenue by retrenchment.

Emergency Expenditure on Account of the Earthquake.—In th middle of the financial year 1923–4, however, as a consequence of th great earthquake, the Government was compelled to provide various emergency measures, the reconstruction of the devasta areas, and at the same time to make good the deficiency arising fr the reduction of taxes or exemption from taxation and other

Budget Figures 1910–25 (in 1,000 Yen)

Year	Revenue			Expenditure			Surplus Revenue
	Ordinary	Extraordinary	Total	Ordinary	Extraordinary	Total	
1910–1	491,331	181,542	672,873	412,009	157,144	569,154	103,719
1911–2	508,558	148,633	657,192	409,889	175,485	585,374	71,817
1912–3	552,085	135,306	687,392	416,895	176,701	593,596	93,796
1913–4	575,428	146,547	721,975	415,635	157,998	573,633	148,341
1914–5	536,342	198,305	734,648	399,225	249,195	648,420	86,227
1915–6	538,999	169,616	708,615	386,516	196,753	583,269	125,346
1916–7	622,052	191,256	813,308	386,065	204,729	590,795	222,513
1917–8	763,760	321,198	1,084,958	437,821	297,202	735,024	349,934
1918–9	911,579	567,536	1,479,115	490,167	526,868	1,017,035	462,080
1919–20	1,063,121	745,512	1,808,633	502,786	669,542	1,172,328	636,305
1920–1	1,174,677	825,975	2,000,652	709,314	650,664	1,359,978	640,674
1921–2	1,283,812	781,899	2,065,711	841,750	648,106	1,489,856	575,855
1922–3	1,428,206	659,139	2,087,345	891,257	538,432	1,429,689	657,656
1923–4	1,303,588	741,464	2,045,052	960,452	560,597	1,521,049	524,003
1924–5	1,265,652	388,458	1,654,110	1,082,400	571,710	1,654,110	. .
1925–6	1,299,321	250,493	1,549,814	1,021,763	528,050	1,549,813	. .

Note.—The figures to the financial year 1923–4 represent the settled accounts; those for the financial years 1924–5 and 1925–6 the budget mates.

ases in revenue. Under these exceptional circumstances the vernment, in order to avoid any serious weakening of the national nces, curtailed expenditure and postponed public works, and so med for the financial year a working budget which amounted to 92,821,754 yen both in revenue and in expenditure. Of this sum fall in taxes consequent on the disaster reached an amount of ,000,000 yen less than the original estimate.

At the 47th extraordinary session of the Diet in 1923 a programme the reconstruction of Tokyo was agreed upon after discussion, and upplementary budget was voted for the purpose; out of the total s voted, 13,180,721 yen was allotted to the fiscal year 1923–4. addition to the above vote for reconstruction a further sum of 83,989 yen was voted to the working budget, so that after these litions the revised working budget for 1923–4 amounted to 11,687,188 yen. The dissolution of the 48th session in Jan. 1924 ving rendered abortive the general budget for 1924–5, the Government drew up a working budget as follows:—

Revenue and Expenditure in Yen

	Revenue	Expenditure
rdinary	1,214,788,272	1,028,156,564
xtraordinary	194,265,814	380,897,522
Total	1,409,054,086	1,409,054,086

The extraordinary expenditure includes the following reconstruction appropriations:—

Expenditure in Yen

econstruction outlay	. .	87,607,000
Tokyo	77,955,000	. .
Yokohama	9,652,000	. .
oans	. .	1,283,000
ubventions	. .	3,816,000
nterest granted for local reconstruction loans	. .	38,000
Total	. .	92,744,000

In July 1924 a supplementary estimate, consisting of the following ounts, was submitted to Parliament and approved:—

	Yen
(*a*) Supplementary expenditure for reconstruction of Tokyo as a consequence of the earthquake	40,400,000
(*b*) Expenditure for reconstruction work on official buildings, and a grant for damage sustained by local authorities	122,300,000
(*c*) Other supplementary expenditure not concerning reconstruction	102,900

Further Emergency Measures.—As a result of the abnormal econom- and financial circumstances, following the earthquake disaster, number of emergency measures became necessary, of which the llowing are the principal:—

(1) Of the 84 Tokyo associated banks, no fewer than 74 had their incipal offices burnt down, with the result that the banking achinery almost ceased to work. An Imperial emergency ordinance as issued on Sept. 7 1923 proclaiming a moratorium of 30 days ithin the stricken area on all pecuniary obligations due on or before pt. 30 1923, under the civil code in force before the catastrophe.

(2) The Bank of Japan having done its utmost to respond to the orementioned measure by accommodating banks with the funds cessary for resuming their business, an ordinance was promulgated Sept. 27 under which the Government undertook to indemnify the bank to the extent of 100,000,000 yen in respect of losses incurred in rediscounting the earthquake bills.

(3) The operation of the customs law was temporarily suspended, and import duties were either abolished or reduced until March 31 1924 (*see* TRADE, INTERNATIONAL).

(4) In the stricken area exemption, reduction and deferred payment of taxes were allowed according to the circumstances.

(5) With the assistance of the deposit bureau of the financial department the Hypothec Bank of Japan and the Industrial Bank of Japan liberally financed their clients.

(6) An ordinance was issued by which state aid was to be given to fire insurance companies which voluntarily paid "sympathy money" to policy holders who suffered loss either directly or indirectly from the earthquake. The subsidy was to be repaid in accordance with terms prescribed by the Government.

(7) A law was promulgated by which an import duty—operative from Aug. 1 1924—of 100% *ad valorem* was placed on luxury and certain other articles.

(8) Reconstruction Savings Certificates were issued in small denominations.

Budget of 1925–6.—In drawing up the Budget for the financial year 1925–6 further retrenchment and reforms in finance and administration were effected, and the total estimates (in yen) were as follows:—

Budget of 1925-6 in Yen

Revenue	. .	1,524,000,000
Ordinary	1,300,000,000	. .
Extraordinary	224,000,000	
Expenditure	. .	1,524,000,000

Compared with the preceding year's estimates there was an increase of 35,000,000 yen in the ordinary expenditure and a decrease of 126,000,000 yen in the extraordinary, making a net reduction of 91,000,000 yen in the total expenditure. The Government adopted the policy of avoiding recourse to public issues, thus relieving the money market from the demands of state finance. At the same time, by the retrenchment of expenditure, it exerted itself to encourage thrift. The chief items of revenue and expenditure for 1925–6 were as follows:—

Revenue and Expenditure, 1925–6 (in 1,000 Yen)

Ordinary Revenue:—	
Land tax	74,004
Income tax	195,855
Business tax	57,282
Tax on liquors	196,377
Sugar excise	70,099
Consumption tax on textile fabrics	53,672
Customs duty	98,825
Other taxes	49,116
Stamp duty	82,142
Receipts from postal, telegraph, telephone services	203,603
Forests	39,288
Profits of monopoly	130,276
Other receipts from public undertakings and state property	22,023
Miscellaneous receipts	18,220
Transferred from special accounts	8,529
Total	1,299,311

Extraordinary Revenue:—	
Proceeds of sale of state property	4,715
Receipts from the issue of public loans	100,000
Local contributions to expenses incurred by the state for the benefit of certain prefectures	13,039
Funds belonging to special accounts transferred	26,077
Surplus of the preceding year transferred	104,119
Miscellaneous receipts	2,540
Total	250,490
Total revenue	1,549,801

Ordinary Expenditure:—	
Imperial household	4,500
Foreign affairs	15,783
Home affairs	41,177
Finance	282,341
Army	170,875
Navy	122,349
Justice	28,515
Public instruction	79,751
Agriculture	21,388
Industry and commerce	3,161
Communications	251,919
	1,021,759

Extraordinary Expenditure:—	
Foreign affairs	3,454
Home affairs	206,500
Finance	38,083
Army	28,514
Navy	105,016
Justice	2,075
Public instruction	19,212
Agriculture	20,690
Industry and commerce	7,646
Communications	96,856
Total	528,046
Total expenditure	1,549,805

Administrative Changes.—The principal changes in the financial and administrative system of the country made after the earthquake are:—

(1) the establishment of a special fund by means of a sum of about 130,000,000 yen to be taken out of the reserve capital of the Imperial mint, this fund to be applied to the improvement of national education and the development of industries in agricultural districts;

(2) the reorganisation of the deposit section of the department of finance by revising the administration and the mode of employing the fund belonging to that section, mainly post-office deposits, and by appointing a commission to advise the finance minister as to the proper method of employing the fund (this commission was set up in April 1925);

(3) the division of the old department of agriculture and commerce into two independent departments, one for agriculture and forestry and the other for commerce and industries (in March 1925);

(4) the creation of several new parliamentary secretarial posts (in Aug. 1924).

The National Debt.—The National Debt stood at 4,553,471,000 yen at the end of Aug. 1925, of which 3,051,455,000 yen represented the internal, and 1,502,016,000 yen the foreign loans. Of the external loans, an amount of 544,975,000 yen was raised in Feb. 1924: in New York $150,000,000 and in London £25,000,000. The proceeds were applied to the conversion and redemption of the outstanding balances of the Imperial Japanese Govt. 4½% loans, first and second series, issued on March 28 1905 and July 11 1905, respectively, and also to meet the expenditure for reconstruction work necessitated by the earthquake of Sept. 1923. The figures of the debt are as follows:—

Debt 1914–25 (in million Yen)

Financial year	Internal loans[1]	Foreign loans[1]	Total	Debt per head in yen
1914–5	991·5	1,514·8	2,506·3	46·968
1915–6	1,028·0	1,461·1	2,489·1	45·976
1916–7	1,097·4	1,370·2	2,467·6	44·919
1917–8	1,159·9	1,338·7	2,498·6	45·911
1918–9	1,268·8	1,311·1	2,579·9	45·976
1919–20	1,482·4	1,311·1	2,793·5	49·297
1920–1	1,809·6	1,424·3	3,233·9	56·506
1921–2	2,184·8	1,359·0	3,543·8	61·187
1922–3	2,450·1	1,358·5	3,808·6	64·887
1923–4	2,576·1	1,621·3	4,197·4	70·595
1924–5	2,822·9	1,506·7	4,329·6	80·000

[1] Amount outstanding at the end of the financial year.

V. ECONOMIC HISTORY

War Conditions.—Before the World War, Japan had alrea nearly recovered from the effects of the Russo-Japanese W and her economic activities had been making steady and m or less symmetrical progress. During the early days of the W the disturbance of international commercial relations broug about conditions which affected the Japanese nation in comm with the whole world. This state of affairs, however, chang later, when a huge demand arose on the part of the Alli Powers for the supply of immense quantities of munitions war, and when, in addition, the inability of the Europe belligerents to continue their overseas commerce on the pre-W scale caused a demand for Japanese products in the mark of India, the South Seas, Australia, South America and ev Africa. These factors, together with the natural decline imports from the European countries at war, conduced to tu the balance of Japanese trade in her favour practically for t first time in 20 years.

A great increase in the amount of specie held by Japan abro inevitably followed, while the stock of gold accumulated home rapidly grew. Then the rate of interest was lowered, a the prices of shares began to soar, thus causing general buoyan in the stock market. As a result Japan was placed in such position as to be able to redeem her foreign debt and to acco financial assistance to her Allies. This is shown in the followi transactions:—

Foreign debt redeemed	
4½% bonds	£20,516,400
Franc bonds	Fr. 200,009,500
Amount lent	
To Great Britain	Y280,000,000
France	126,000,000
Russia	240,053,067

Soon a considerable number of new undertakings, notably the field of shipbuilding, iron and steel manufacture and th chemical industry were brought into being. The rate of intere once again showed an upward tendency, and the issue of ban notes increased rapidly. The trend of circumstances describ above became more and more accentuated as time went o until at the end of 1916 the premature peace talk engender a spirit of temporary caution among Japanese manufacture and merchants.

The general international confusion of 1917, such as th introduction by the Germans of ruthless submarine warfare, th declaration by the United States of war upon Germany, th débâcle of the Russian revolution, and, in addition, the co tinuous internal troubles of China, all had repercussions up Japanese commerce. Nevertheless, in spite of the far-reachi effects of these great outside influences, Japan's trade and indus try continued on the whole to register a steady development.

Post-War Depression.—With the conclusion of the Armisti in Nov. 1918 the demand for warlike materials came to a abrupt end, and the branches of industry and commerce deali with iron, steel, copper, dyestuffs and chemicals received sudden and serious blow. There were even signs of economi depression, but the revived demand for foodstuffs and industri materials necessary for the economic reconstruction of Europ coupled with the trade activities in the United States, tem porarily maintained a prosperous state in Japan's commerc A telling blow to trade and industry was administered, howev by the financial panic which occurred in April 1920, due t over-speculation and the misuse of credit in certain quarters.

Readjustment.—Following the setback of the preceding ye the economic market had to devote itself in 1921 to the wo of readjustment, which caused general lethargy in industri enterprises and dullness in commercial transactions. It was these circumstances that in June 1922 the Government declar a new policy of financial and administrative retrenchment an readjustment, which was rigorously pursued until the who outlook became distinctly brighter; demand for money in th home-market declined, the balance in foreign trade improved, and the issue of banknotes decreased. In the latter part of

v. of the same year, however, this tendency was suddenly cked by the suspension of business of a few provincial banks. ergency measures were successfully taken by the Government well as by the Bank of Japan, but at the end of the year ney was still very tight and demands upon the bank for ances reached an enormous amount, with the result that a record was established in the issue of bank-notes.

n 1923, while the economic conditions of the country were in a state of unrest, Japan was suddenly visited by the aralleled catastrophe on Sept. 1, when the earthquake and flagration in the Kwanto district caused terrible loss of life well as severe material destruction. The effect on the coun- s sound economic and industrial foundation, however, was very serious, because the area devastated covered only a suming part of Japan, not a producing part. But the effect he disaster on the money market was felt to such a degree t for a time absolute financial confusion seemed imminent. tunately, emergency measures were promptly and effectively en by the Government, the Bank of Japan and the other ncial authorities to restore order in the business world. At end of Sept. 1925 the first step was taken towards the urn to a gold standard, when a shipment of 4,000,000 gold was consigned by the Bank of Japan to the Federal Reserve nk in New York. On Dec. 19 the removal of the embargo on shipment of silver bullion was announced.

Prices.—The following table shows, by wholesale price num- s based on Oct. 1899, the rise in prices of commodities in kyo between 1913 and 1924:—

Prices of Commodities
(Oct. 1889 = 100)

	1913	1916	1919	1923	1924
ice	183	116	390	277	327
heat	146	140	294	205	233
oya beans	142	136	284	225	253
alt	230	209	314	356	380
oy	103	104	255	233	200
ugar	243	258	472	378	360
aké	130	131	233	250	244
ea	113	128	235	303	341
ggs	117	114	263	214	212
ut tobacco	129	129	162	178	178
otton yarn	154	155	567	275	352
aw silk	118	155	274	279	239
abutae	83	105	200	200	185
imber	112	112	257	300	271
teel bars and rods	82	233	276	150	129
oal	134	145	421	311	334
irewood	151	140	355	373	311
harcoal	115	111	278	326	301
erosene oil	160	219	484	280	345
apanese paper	127	160	285	325	371
oreign paper	113	218	504	233	235
Average	137	153	324	270	276

Population, Production and Trade

Population.—The first national census took place on Oct. 1 1920. e following table gives the census figures for Japan proper, rmosa and Japanese Sakhalin, together with those obtained for rea from the local registrars' records. The figures for Japan proper rea 148,756 sq. m.) show that she ranks sixth in order of population ong the countries of the world, her number only being exceeded those of China, India, Russia, the United States and Germany. ith regard to the density of population, Japan proper (376 per . m.) ranks third, following Belgium (658), the Netherlands (536) d above Great Britain (374).

	Households	Population (1920)		
		Male	Female	Total
Japan proper	11,222,053	28,044,339	27,918,714	55,963,053
Taiwan (Formosa)	690,000	1,893,541	1,761,767	3,655,308
Karafuto (Japanese Sakhalin)	22,087	62,327	43,572	105,899
Chosen (Korea)	3,297,285	8,903,000	8,361,119	17,264,119
Total	15,231,425	38,903,207	38,085,172	76,988,379

The following table gives the census figures for 16 cities with a pulation numbering more than 100,000:—

Principal Cities

	Households	No. of Pop.		Households	No. of Pop.
Tokyo	456,820	2,173,201	Hakodate	29,155	144,749
Osaka	276,331	1,252,983	Kure	28,268	130,362
Kobe	138,986	608,644	Kanazawa	29,287	129,265
Kyoto	128,892	591,323	Sendai	21,861	118,984
Nagoya	92,426	429,997	Otaru	21,275	108,113
Yokohama	95,241	422,938	Sapporo	20,038	102,580
Nagasaki	37,036	176,534	Kagoshima	19,942	103,180
Hiroshima	34,553	160,510	Yawata	22,322	100,235

There are 31 cities with a population of from 50,000 to 100,000; 136 with from 20,000 to 50,000, and 374 from 10,000 to 20,000. On Oct. 10 1925 the second national census took place, but at the time of writing the full figures are not available. The results received to date show that Japan proper has a population of 59,736,000, including 30,012,000 males, an increase of 3,772,947 since the 1920 census. On Oct. 1 1924 the population of Japan proper was estimated at 59,138,900, which represented a yearly increase of about 800,000 for the five years ending 1924. In point of birth-rate, however, a tendency to decline has already set in, 36·2 per 1,000 in 1920 being the high-water mark.

Agriculture.—Japan, in common with most European countries, has witnessed a decrease in the number of people engaged in agriculture. During 1916 and 1917, when Japan was putting forth her greatest effort in producing munitions of war for the Allies, the number of those actually holding land decreased to the extent of 20,800 and 36,400 respectively; whilst in 1918, when the war boom in industry was practically over, the gain to agriculture was only 20,200 persons. This migration of the agrarian population toward cities, together with the modern industrial tendency of the nation, is making it more and more difficult for landowners to find tenants. Rural reorganisation has been an economic problem for some time.

Farmers and Tenant Farmers

	Farmers cultivating own land	Tenant farmers	Farmers combining tenantship
	%	%	%
1908	33·27	27·58	39·15
1923	30·60	28·23	41·17

The high proportion of small holders in Japan is characteristic of the agricultural life of the country, as is shown by the following table giving the percentage of total landholders with holdings of under 1·23 ac., etc.:—

	Under 1·23 ac.	Over 1·23 ac.	Over 2·45 ac.	Over 4·90 ac.	Over 7·35 ac.	Over 12·25 ac.
1908	37·28	32·61	19·51	6·44	3·01	1·15
1923	35·11	33·59	21·39	5·88	2·57	1·46

Rice still remains the staple food of the country, and the area under cultivation is nearly twice that devoted to the production of barley, rye and wheat. Intensive cultivation of all crops is carried out, and the limit of return has actually been reached in some cases.

Cotton, hemp and indigo were all retrogressive, the cotton chiefly owing to the large imports of cheaper cotton from abroad. The following table shows the area under cultivation and the production of the chief food products:—

Principal Crops

	Area under Cultivation		Production	
	1914 Hectares	1923 Hectares	1914 Hectolitres	1923 Hectolitres
Rice	3,008,298	3,121,363	102,834,926	100,056,199
Barley	611,218	473,859	17,225,132	13,701,265
Rye	721,306	557,774	13,001,461	10,564,001
Wheat	474,721	483,833	8,096,399	9,366,031
		1922		1922
Millet	203,087	151,630	3,984,178	3,511,698
Beans	589,694	580,712	8,256,823	8,278,735
Buckwheat	160,222	124,624	2,469,232	1,984,797
Rapeseed	123,092	90,609	1,593,065	1,229,310
			Metric tons	Metric tons
Potatoes	83,125	100,102	879,385	915,379
Sweet potatoes	302,493	288,372	3,679,155	3,768,963
Seed cotton	2,452	2,105	3,081	1,876
Hemp	10,926	10,023	9,469	11,815
Indigo (leaf)	4,476	4,652	8,176	8,333
Sugar-cane	22,414	25,711	1,001,078	812,489

Industrial Development.—Although the expansion of Japanese industries was enormous during the World War, the rate of progress registered in the pre-War period of 1908–13 had also been remarkable. In 1908 there were 11,390 industrial establishments and 196 Government factories; in 1913 the Government factories had decreased to 188 (in 1918 there was a further drop to 161), but the other industrial establishments had increased in number to 15,811, or by 38·8%. By 1918 the figure had risen to 22,391, an increase of 41·6% on 1913 and 96·6% on 1908. In a decade, that is to say, Japan had practically doubled the number of factories in operation; but the after-War trade depression affected industrial development to some extent.

The following table illustrates the development:—

Industrial Progress

Government factories					
	No.	Motors	Kilo-watts	Operatives	
				Men	Women
1913 (Mar. 31) .	188	5,211	217,965	99,992	29,994
1918 (Mar. 31) .	161	7,014	269,475	123,087	36,349
1922 (Dec. 31) .	. .	8,679	635,112	124,725	43,429

Industrial establishments					
	No.	Motors	H.P.	Operatives	
				Men	Women
1913 (end of)	15,811	19,084 1,330	1,122,597	375,596	540,656
1918 (end of)	22,391	41,689 878	2,006,098	646,115	763,081
1922 (end of)	46,427	86,312 804	2,942,730	834,314	856,705

Shipbuilding.—In 1898 a steamer of 6,000 tons, the first large boat to be built in a Japanese yard, was completed by the Mitsubishi dockyard at Nagasaki for the Nippon Yusen Kaisha. Subsequently the same dockyard and the Kawasaki establishment constructed steamers of over 10,000 tons, as well as cruisers for the Imperial Japanese Navy and for China. In 1912 these two dockyards had reached such a high state of development that each was entrusted with the building of a dreadnought of 27,500 tons. Soon after the outbreak of the World War the private shipyards enlarged their capacity for building and made marked progress, though handicapped by an inadequate supply of materials and skilled labour. But the yards have been suffering from post-War depression, and also from the effects of the Washington Agreement (*see* WASHINGTON CONFERENCE); being obliged to curtail the scope of their work, and, in some cases, completely to suspend it.

The number and total tonnage of ships launched in the years 1913, 1918, 1921–4 is as follows:—

Ships launched						
	Steamships		Sailing Vessels		Total	
	No.	Tonnage	No.	Tonnage	No.	Tonnage
1913 .	115	51,525	659	43,598	774	95,123
1918 .	443	540,531	1,804	161,964	2,247	702,495
1921 .	69	226,081	12	1,711	81	227,792
1922 .	57	71,076	14	2,167	71	73,243
1923 .	56	74,284	1	2,500	57	76,784
1924 .	39	71,440	6	1,006	45	72,446

With regard to her merchant fleet, Japan advanced during June 1914 to June 1920 from sixth to third position among the world Powers, since at the latter date she possessed 2,996,000 tons as against 1,708,000 tons in 1914, thus emerging after the War with an increase of 1,288,000 gross tons.

Raw Silk and Silk-Weaving.—The manual dexterity peculiar to Japanese women is a factor which ensures the lasting prosperity of Japan's raw-silk industry, and when full advantage has been taken of the various modern processes of production in silk filatures enhanced benefit should accrue. Japanese silk goods have made great progress, and particularly silk pongee, which has now practically driven the Chinese product from the markets of the United States. At the end of 1922 there were 2,863 factories engaged in the silk industry, employing 23,893 male and 262,732 female operatives.

Cotton Spinning.—In spite of the difficulties during the World War of importing from Great Britain and the United States sufficient machinery to meet the enhanced demand for cotton yarn, the spinning-mills of Japan prospered exceedingly. The paid-up capital invested in the mills at the end of June 1920 was 248,180,000 yen, equivalent to an increase of 288% over the pre-War figure; whilst the number of spindles in use in 1918 was 3,384,800, and in June 1920 3,689,000, compared with 2,409,900 in 1914. At the end of 1918 there were 6,710 factories, with 65,316 male and 218,041 female operatives, the total number of workers in the textile industries being 777,65 The latter figure includes about 25,000 who are engaged in the pr duction of knitted goods, consisting principally of gloves, stockin and underwear, in which a large trade, chiefly with British India, h grown up in the last few years. As knitting was formerly entirely domestic industry, there have been difficulties in producing goods uniform quality for export, and a system of inspection was therefo instituted towards the end of 1917, under which the exportation articles of inferior quality was prohibited. Previous to the War, t average output of knitted goods was 6,660,000 doz., valued 8,937,000 yen, but during the five years of the War the output ave aged 15,143,000 doz., valued at 23,073,000 yen. According to th report of the Cotton Spinning Association, at the end of 1923 t factories numbered 241, with an aggregate paid-up capital 376,273,000 yen, while the spindles numbered 4,422,000.

Iron Foundries.—Before the War there were only some 20 iro foundries in Japan, but the difficulties experienced during the War i obtaining from abroad the large quantities of iron and steel requir to meet the boom in industry resulted in the establishment of ove 250 foundries before the close of 1919. In 1914 the output of pig-iro amounted to 302,000 tons and of steel materials to 283,000 tons. I spite of the slump in the iron industry which occurred after th Armistice, 613,000 tons of pig-iron and 553,000 tons of steel materia were produced in 1919. The total investments in iron foundries at th end of 1921 amounted to 350,000,000 yen. In the same year th working capacity of the ironworks was 1,412,000 tons of pig-iron 1,033,000 tons of steel, and roughly 1,450,000 tons of steel materials while the actual output amounted to less than one-half the capacity *i.e.*, 556,531 tons pig-iron and 557,826 tons steel materials.

Machine and Tool-Making.—At the end of 1922 about 6,720 fac tories were engaged in various forms of machine-making; and also i many branches of metalwork and metalware. The manufacture o machinery for the production of electric apparatus and lamps, a well as the construction of dynamos, telephones, railway signals an measuring instruments, are practically new growths of the iron and steel industrial activity.

Dyestuffs.—The manufacture of dyestuffs was an untried industry in Japan prior to the War, and in 1913 no fewer than 6,000 tons o dyestuffs, valued at 8,000,000 yen, were imported for use in the cot ton and silk industries. After the outbreak of the War the cessatio of foreign supplies, chiefly derived from Germany, compelled Japa to make an effort to become, to some extent, self-supporting. I 1915 certain dyes were produced, the largest quantity being sulphuric black, then alizarin, acid blue and aniline salt. These were followed by yellow, red and blue acid, yellow and red direct, and purple, blu and brown basic colours. Early in 1916 the Government started an subsidised the Japan Dyestuff Manufacturing Co., which later su ceeded in producing an artificial indigo, though only on a laboratory scale. By 1918 they were in a position to export Japan-made dyes, but within a short time foreign dyes reappeared on the market, apart from the German indemnity dyestuffs which arrived in May 1921. Though the *ad valorem* duty was raised to 35% in 1920, these foreign products almost strangled the infant industry. In 1923, 23 factories, with a capital of 13,565,500 yen, were in existence.

Chemicals.—The manufacture of chemicals in Japan does not owe its inception to the War, but its great development and the many innovations introduced were the direct result of War-time conditions. There was, however, a sharp decline in the prosperity of the chemical industry immediately after the Armistice. In 1916 the Government set up a subsidised company for the production of glycerine, and as the result of extensive investigations at the industrial institute into the qualities of seaweeds and vegetable ash, the production of basic chloridised alkali increased from 2,000 tons in 1913 to 10,000 tons in 1917. The match industry, which formerly derived chlorate of potash from European sources, by the end of 1917 was able to depend on the home supply, and gained an important place in export trade; but of late, owing to the advance in price of raw materials, and also the rise in wages at home, the industry has been beaten, chiefly by the Swedish match industry, especially as regards exports.

The soda industry, although it existed as long ago as 1880, did not reach a high standard of technical perfection before the War, and also failed to satisfy the total annual requirements in caustic soda, amounting to about 25,000 tons. During the War, however, the number of factories increased to about 20, and the annual production rose to 14,000 tons in 1918 and 20,000 tons in the following year.

Some of the chief products in the chemical industry are: sulphuric, hydrochloric and nitric acids, sodium sulphate, carbonate of soda, caustic soda, iodine, potassium iodine, potassium chloride, ammonium sulphate, acetic acid, acetone and wood spirit.

JAPAN'S FOREIGN TRADE

The rapidity with which Japan's foreign trade had developed, both in volume and extent, during the half-century preceding 1925 provides a remarkable record in commercial history. The total value of exports and imports, which in the first year of Meiji (1868) amounted to the insignificant total of 26,000,000 yen (£2,650,000), increased 10-fold in 1895, 100-fold in 1917, and 167-fold in 1920; and though he three following years it had shown a great decrease, the le for 1924 again mounted to 4,260,623,000 yen.

avourable Balance.—The most striking progress was made during World War, when Japan's foreign trade leapt from 1,362 million (£139,000,000) in 1913 to 4,284 million yen (£438,000,000) in 1920; ough it should be remarked that these figures do not correctly esent the proper rate of increase in the volume of trade, owing he inflation of prices. In the very beginning the War reacted judicially upon foreign trade, as well as upon other branches he country's commerce and industry, and the first appreciable ct of the War in increasing trade showed itself in the returns 1915, when the adverse balance which had obtained for 20 years— the exception of the years 1906 and 1909—was superseded by vourable one. This favourable tendency was accelerated until excess of exports over imports attained 371,000,000 yen (£38,000,-) in 1916 and 567,000,000 yen (£58,000,000) in 1917.

he sudden expansion of trade due to the War was occasioned both ctly through the great demand by the Allied belligerents for nitions of war; and also indirectly through the temporary retire- nt of the great industrial Powers of Europe from the arena of ld commerce and trade. Soon after the outbreak of the War anese goods—chiefly consisting of semi-manufactured and fin- ed articles, such as cotton fabrics, leather goods, watches, silk ues and so forth—found their way in large quantities not only to established markets in the Far East, but also to various quarters he world hitherto but little explored by Japanese traders, namely, South Seas, South America and even Africa. The most conspicu- expansion, however, was effected in the exports to China and lia, and, until the outbreak of the Russian revolution in 1917, ge shipments of munitions of war and foodstuffs to Vladivostok for in European Russia assisted to augment the volume of trade with ia. The United States began to buy heavily in 1916, when the ures advanced from 204,000,000 yen (£20,900,000) in the preceding r to the substantial amount of 340,000,000 yen (£34,800,000) the ds purchased consisting mostly of raw silk, "habutai" (silk piece ds) cotton yarns, cotton fabrics and tea. British America and also xico increased their orders from Japan, and the South American de showed such prospects as to induce Japanese companies to en shipping facilities to Brazil through the Straits of Magellan.

The import trade, which had been on the wane in the early days the War, commenced to revive in 1916, owing to larger purchases raw materials and semi-manufactured goods, such as raw cotton, n, wool, crude caoutchouc, flax and jute. By far the largest vol- ne of raw cotton came from British India, but the United States d doubled her exports of that article to Japan as well as of iron in a elvemonth. Australia supplied Japan largely with wool.

An Adverse Balance.—The War was the cause of serious vicissi- des in 1917, and in a measure militated against the expanding nd of Japan's commerce. The entry of the United States of Amer- into the War, with its attendant embargo on steel, iron and gold, nporarily disturbed the economic equipoise of the Far Eastern pire. The Russian revolution and the subsequent repudiation of foreign liabilities by the Bolshevik commissaries introduced a sh factor of discouragement in the export trade of Japan. The ternal political feuds in China would also have dismayed Japanese porters but for the tremendous appreciation in the price of silver, ich resulted in maintaining an abundant demand for Japanese ticles. But in spite of all, Japan's foreign trade made progress re or less on the lines previously indicated, until a complete ange in the situation was brought about by the conclusion of the mistice in the autumn of 1918. The demand for munitions of war turally came to an end, but the rate of exchange on Europe con- nued at a high level. At home the cost of production had greatly creased owing to the advance in wages and the higher prices of in- strial materials, while the enriched public demanded a higher oportion of the necessaries of life. An anti-Japanese boycott was oceeding in China to add to the curtailment of Japan's exports.

All these circumstances, reinforced by the Imperial ordinance of ov. 1919 for the regulation of the price of commodities, tempo- rily exempting certain foodstuffs and industrial materials from port duties and restricting the exportation of cotton yarns, re- rsed the balance of foreign trade, which had been favourable to pan for the preceding four years. This unfavourable tendency con- nued in succeeding years, showing an adverse balance of trade in 20 as high as 387,780,170 yen. The Government had under con- deration several suggestions as to the best method of bringing about n improvement in foreign trade, but, though no special steps were ken, there were prospects of improvement, owing to the certainty at the economic condition of the country was advancing little by ttle, and in view of the fact that the adverse balance of 1922 was nly 252,856,414 yen—a decrease of 135,000,000 yen compared with he year 1920.

Unfortunately, however, the great earthquake of 1923 dissipated hese anticipations, for, on the one hand, the export trade declined harply owing to the burning of large stocks of raw silk, silk fabrics, tc., and the partial destruction of the productive capacity of cotton arn, cotton fabrics and other articles usually so prominent among he exports; while, on the other hand, the volume of imports continued to increase, due to the abnormal increase in the demand for wool, woollen yarn, etc. Also, in order to facilitate the supply of goods after the earthquake, an Imperial ordinance was promulgated, providing for the suspension until March 31 1924 of import duties on rice, beef, etc., and for the suspension or reduction of import duties on certain other necessaries of life, tools, machinery and materials for construction and civil engineering, with the result that imports were stimulated.

Thus the excess of imports over exports in 1923 reached the huge amount of 534,479,850 yen. In 1924 the tendency became even more pronounced—the amount being 646,157,000 yen—and this in spite of the expiration of the ordinance just mentioned, and the introduction of a tax of 100% imposed from June 1924 on the value of certain luxury articles. The excess of imports was chiefly due to the purchase of materials necessary for reconstruction.

Foreign trade prospects in 1925, however, were considerably brighter, owing to the fact that fewer reconstruction materials were being imported, while the economic conditions of Japan were becoming normal again, and the "Buy Japanese goods" slogan was having effect. In the latter part of the year 1925 such an excess of exports over imports shown would counteract to a great extent the excess of imports over exports shown during the first six months of that year.

The following table gives the foreign trade of Japan for 1913–25, and the movement of coin and bullion:—

Foreign Trade (in 1,000 Yen)

	Merchandise		Gold and Silver Bullion and Specie	
	Exports	Imports	Exports	Imports
1913	632,460	729,432	27,093	1,021
1914	591,101	595,736	29,650	9,107
1915	708,307	532,450	44,566	24,297
1916	1,127,468	756,428	28,079	101,030
1917	1,603,005	1,035,811	153,736	392,225
1918	1,962,101	1,668,144	938	5,016
1919	2,098,873	2,173,460	5,054	327,477
1920	1,948,395	2,336,175	3,897	404,727
1921	1,252,838	1,614,155	..	138,622
1922	1,637,452	1,890,308	2,180	1,672
1923	1,447,751	1,982,231	5,466	196
1924	1,807,258	2,453,390	5	4,099
1925[1]	1,656,188	2,033,345	4,008	138

[1] Up to end of Sept.

Exchange.—The dollar rate, which dropped to $38.50 per 100 yen at the end of 1924, rose by the middle of April 1925 to $41.50, this being the highest figure during the first half of 1925. At the end of Nov. 1925 it stood at about $42.00. In the sterling exchange steady improvement was also perceptible, the rate having risen from $19\frac{1}{4}$d. in Jan. 1925 to $21\frac{1}{16}$d. per yen in the middle of Nov. 1925.

Distribution of Foreign Trade.—The geographical distribution of Japan's remarkable expansion in foreign commerce according to continents is as follows:—

Exports by Continents (in 1,000 yen)				
To	1913	1920	1923	1924
Asia	275,928	998,374	587,397	757,061
America	191,761	632,245	634,212	782,882
Europe	147,225	195,590	79,838	175,051
Australia	8,638	58,115	32,639	41,907
Africa	1,846	39,620	25,240	41,202
Imports by Continents (in 1,000 yen)				
From	1913	1920	1923	1924
Asia	348,055	942,547	814,470	998,603
America	127,035	910,648	546,832	721,325
Europe	220,290	305,318	437,457	581,091
Australia	14,943	62,459	96,623	119,971
Africa	7,189	88,449	22,716	22,072

In receipt of exports from Japan the United States of America (41%) has always headed the list, the zenith of purchase being reached in 1919—828,097,621 yen; China (including Kwantung Province) follows with 23%; and then come British India (7%), France (5%), Hongkong (4%). The percentages refer to Japan's export trade in 1924. Notable, also, are the advances of Australia, the Philippine Islands, Germany, Italy, Peru, Belgium and others in the scale of demand for Japanese goods.

As regards imports into Japan, British India, which had been the chief supplier for several years precedent to the World War, yielded her place to the United States in 1916. The import trade of Japan in 1924 was shared by the United States of America (27%), China (17%), British India (16%); England (13%), Germany (6%), Australia (5%), Dutch Indies (4%), Canada (2%).

The following tables show the development of Japan's foreign trade in the more important commodities:—

Principal Exports (in 1,000 Yen)

	1914	1919	1924
Silk (raw, waste, floss)	161,797	623,618	706,220
Habutai	30,890	101,289	57,368
Silk tissues	34,022	162,476	125,842
Cotton yarn	78,554	114,232	109,537
Cotton tissues	34,840	280,311	326,750
Woollen tissues	1,198	11,124	2,401
Hosiery			22,024
Braids	14,355	20,014	9,170
Matches	11,052	32,968	9,212
Copper	28,467	25,889	2,366
Coal	23,914	37,723	22,396
Potteries	5,913	22,629	25,435
Paper	2,826	25,402	15,582
Aquatic products	13,416	16,191	24,786
Tea	12,709	18,402	12,781
Refined sugar	12,382	21,627	28,967

Principal Imports (in 1,000 Yen)

	1914	1919	1924
Raw cotton	218,974	667,866	605,271
Wool	14,783	61,304	88,041
Woollen and worsted yarns	4,140	668	63,510
Woollen tissues	10,225	12,301	61,648
Oil cake	34,864	135,188	103,674
Iron	36,319	227,797	196,398
Sulphate of ammonium	15,145	27,435	26,543
Coal	6,690	18,588	29,057
Timber	1,490	10,889	129,076
Paper	4,886	18,386	27,360
Machinery	24,494	89,221	128,345
Rice	24,823	162,070	70,804
Sugar	21,678	58,183	63,849
Wheat	8,488	38,530	73,839
Beans and peas	13,320	35,302	60,877

COMMUNICATIONS

Railways.—The first railway line in Japan was opened to traffic in 1872, subsequent development of the railway being chiefly in the hands of private companies. In March 1906 the railway nationalisation law was passed, and in the next two years the Government gradually assumed control of some 17 leading railway companies. On the completion of nationalisation the Government possessed 4,371 m. of railway, representing a capital of 700,000,000 yen. By the end of 1917 the process of absorption was practically complete. In the decade 1913–23 the mileage of the state railway system increased fron 5,473 m. to 7,013 m., and in the same period the number of passengers carried increased from 167,773,143 to 512,754,754. A marked advance was seen in the financial year 1918–9 in the receipts, which amounted to 104,135,074 yen, while in 1922–3 the receipts were 199,877,464 yen. A railway tunnel between Moji and Shimonoseki, under the Shimonoseki Straits, has been projected and its construction is expected to be started in 1927. This tunnel, which will be completely under the sea for one mile, will connect the island of Kiushu with Honshu on the mainland.

Posts.—The postal service of Japan has developed steadily, both in extent and efficiency, since 1908. There are three grades of post-office, known as first, second and third class. The first class is confined to the larger cities, such as Tokyo and Osaka, and these offices not only act as supervising offices for those of lower category, but also control maritime affairs in their respective districts. The great majority of the post-offices belong to the third grade, and are conducted on a contract system, which has proved eminently satisfactory. The post-offices in Japan include in their operations such diverse matters as the carrying, within limits as to size and weight, of every kind of freight, the collection of taxes and bills, the distribution of advertisements, and the paying of pensions and annuities on behalf of the national Treasury. The post-offices also undertake the business of state life insurance by a simplified process for the benefit of the middle and working classes. The expansion of the postal services is shown in the following table:—

Postal Service

End of fiscal year	Number of post-offices	Number of messages	Number of parcels
1909–10	6,946	1,464,557,721	20,281,823
1911–2	7,166	1,634,423,611	23,178,936
1913–4	7,268	1,798,716,674	25,370,165
1915–6	7,358	1,888,002,293	26,128,093
1917–8	7,647	2,362,802,401	33,243,648
1919–20	7,900	3,359,758,218	41,308,098
1920–1	8,025	3,815,527,979	43,322,650
1921–2	8,230	4,001,817,560	48,936,915
1922–3	8,477	4,126,958,030	51,355,991

The post-office savings bank was first inaugurated in 1875, an the rate of interest was raised from 4·2% to 4·8% in April 191 The number of depositors increased from 11,882,069 on Mar 31 1913 to 27,057,867 in 1922, the deposits having advanced i the same period from 191,122,853 yen to 994,976,098 yen.

Telegraphs.—Since 1879 Japan has belonged to the International Telegraph Convention, and in June 1908 she ratifie her membership of the International Wireless Union. The expansion of her home telegraph service has been noteworthy. I 1910, with a total of 3,951 telegraph offices, 101,500 m. of wire were in use and 28,205,032 messages were sent; in 1923 ther were 6,460 offices, 156,662 m. of wires in use, and 71,592,9 messages were transmitted.

Wireless.—Japan associated herself with the Internationa Wireless Union in 1908. In addition to the main wireless statio of Funabashi, erected in Nov. 1916, Japan has 11 other Government stations, with a daytime transmission distance varyin between 300 and 600 nautical m., the night distance being between 1,000 and 1,800 nautical miles. Two of these stations Choshi and Osezaki, have been reconstructed and have a daytime transmission power of 1,500 nautical m., with 3,000 m. a night. In the twelve months ended March 31 1914 there we 36,313 wireless messages, and 172,853 in 1922–3.

Telephones.—When first inaugurated in Dec. 1890 the telephone service failed to attract many subscribers, but its popularity gradually increased. The authorities started in 1909 a system of giving preference for an installation in consideratio of a payment varying between 150 and 285 yen, according to locality, and this system, which has been very successful, still obtains. The maximum annual charge for the telephone servic is 66 yen and the minimum 36 yen, according to locality, and at the end of the fiscal year 1922–3 there were 415,058 subscribers and 3,988 telephone offices, besides 1,538 fitted with automat apparatus. In the same period the length of telephone lines was 14,526 m., the length of wires 1,197,861 m. and the number of messages in the year was 1,933,759,123.

See *Japan Year Book* (annual, Tokyo); reports of the America Bureau of Commerce and of the British Department of Overseas Trade.

(K. M.)

JAPANESE LITERATURE (*see* 15.168). *The Taisho Era.*—The glory of Meiji was, alas, not to be sustained. Whether the mistake lay with the old giants of the Meiji era or in the insufficiency of their sons it is impossible at this close range to decide. In the later years of the Meiji period it became obvious that the spirit animating the intellectual and literary leaders was dying; some of the old magic still clung to the name of the dynasty, but nothing more. The new writers lacked the capability for sustained effort, their works were spasmodically produced, and were often completely without style. There was an unrestrained crudeness about the new literature which horrified those who still remembered the early Meiji period.

The change was almost complete when the young men began banding themselves together into various associations, such as the "New Romanisation Society" (Shin Romaji Kai), the "Foreign Language Research Society" (Gaikokugo Kenkyu Kai), the "Japanese Script Society" (Nipponji Kai), etc. These unofficial organisations achieved very little, except of positive harm. Americanisms, cant and slang terms, undistinguished from "standard English," were imported freely and incorporated into novels, belles lettres and even scientific treatises. The free-verse writers of England and America must be held responsible a peculiarly unpleasing form of composition which, while rely foreign to the genius of the Japanese language, was oted by the writers of this period in place of the *tanka* and *u* as the only possible style of poetic composition. The actual lt of these liberal importations from foreign fields was the l of ineffective and often vulgar books offered to foreign ents as Japanese contemporary literature. While book- luction was never so ample, it was never so uniformly devoid ierit.

he Meiji era translations of European classics and con- porary works, though marred by many faults of inexperience, still to be preferred to later versions. Bacon, Shakespeare, auley, Milton, Byron, Shelley, Keats, Victor Hugo, de ipassant, Dante, Heine, were all retranslated under this asty. The new translations are, however, far from being ible. In many cases, whole sections of the original are left anslated at the whim of the editor. Despite this, the char- r "zen" (complete) is found on the back of the book and on title-page. This renders such versions useless for class-work ven for purposes of reference. In other cases, scenes which purely national in the original work are recast, details being red to suit Japanese surroundings. Thomas Hardy's novels er particularly in this unnatural transmutation: in one or popular translations now in vogue Hardy becomes merely a liocre Bakin leading some dull puppets over dreary Japanese shes.

ussian Influence.—The outstanding literary feature of the shō era is the inundation of Japan by Russian works. Tol- ceased to be fashionable; Andreyev, Balmont, Sologub, hkin, Zinaida Hippius, Lermontov, Gogol, Tchekhov and geniev held the imagination of youthful Japan during these rs. Although no further impulse was needed, it was supplied the signing of the Russo-Japanese Treaty early in 1925, when nerous societies for the encouragement of research into sian literary and philosophic fields sprang into existence. sian plays were hastily and imperfectly translated into Jap- se (*The Cherry Orchard* was a noteworthy exception), and duced by Japanese actors at the Little Theatre in Tsukiji, kyo.

he modern native literature borrowed most of its colour and ch of its form from Russia. Gogol, in his more dreary moods, freely translated into novels of social life, and the senti- ntality so characteristic of the true Japanese novelist be- nes tinctured with a despair imported from the Siberian opes. Arishima Takeo, an idol of the young reader in modern an, demonstrated this phase not only in his novels, but in life and death. He was a married man, drawn by "mis- lerstandings" into an intrigue with a woman journalist (the ew woman" of his later novels). The truth of the affair was er revealed; in true dramatic fashion, Arishima and his paramour committed "*shinju*" (double suicide for love), in a house in unfrequented country place. This happened in 1922, and an be safely asserted that Arishima was more loved after his l-staged exit than he was during his lifetime. Obituary no- es drew parallels between this successful writer and such nly envisioned figures as Gogol and Andreyev. That the nts of contact were more imaginary than real did not deter tors from flights of the wildest fancy as to the effect Arishima's ith would have on Russia and the world generally.

The new-world treatment of women engaged the attention of iters of all classes, and political writers condemned the istic changes proposed by the novelists. Women in Japan gan to assert themselves, they emerged from the obscurity of dalism into the open highway of competition with men. urnalism, government departments, politics, municipal under- kings, social work, all claimed the attention of intelligent men. Foremost, perhaps, not only of modern woman-novel- s but of all since the days of Murasaki Shikibu is Mrs. Yayoi ogami, wife of Nogami Toyoichiro, the greatest living Japan- e authority on the classical drama (Nō), and translator of rnard Shaw. A later novel of hers, *Kaishin Maru* (The Sea- d Ship), is justly esteemed above all contemporary works.

Notable Writers.—No account of modern Japanese literature would be complete without reference to certain writers who, in spite of their lack of real merit, have captured and held the popular imagination. Natsume Sōseki is chiefly remembered for his *Wagahai wa Neko de Aru* (I am a Cat) and *Botchan* (The Boy). He died before the full force of change induced by indiscriminate importation had been felt, and his work was modelled rather on the later Meiji style. "*The Two Kikuchi*," as they were familiarly called (Kikuchi Kan and Kikuchi Yuhō), devoted themselves to the writing of novels in which women's problems are discussed and advanced views of social life are set forth. Kume Masao, Satomi Ton and Akutagawa Ryunosuke, also, in some measure gratified the current passion for original styles and exotic scenes. Kurata Hyakuso is regarded as the leading spirit of modern Japanese drama; one of his plays, *The Priest and his Disciples*, has been translated into English and published with the original text by Glenn Shaw (Tokyo, 1923). The sex-novel of Europe has its imitations in works by Tanizaki Junichirō and Morita Sōhei. Tanizaki writes very colloquially on the subject of hysterical women, psychoanalytic studies in the West providing him with unlimited material. Morita Sohei was once considered a very brilliant writer, his *Baien* (Sooty Smoke) being an exceptional success. It is an autobiography or diary of the new woman, and, from the Japanese point of view, Morita has solved the problem of woman definitely and finally. At the time of the issue of *Baien*, Morita's style became settled and followed closely the best traditions of mid-Meiji; this no doubt accounted later for his lack of popularity. He afterwards turned his attention to translations of Ibsen's plays, but his "originals" were English versions, and it readily appears from the Japanese that Morita frequently failed to understand the text he was translating. Ibsen's *Doll's House* (Morita's Japanese translation) was performed at the Imperial Theatre in Tokyo in 1923.

Matsuura Hajime was the only literary man of this period who remained true to the best traditions of his country's literary history. Unaffected by the many new movements for the development of art, letters and the drama, he is the foremost poet and essayist of modern Japan. In 1925 he resigned his professorship at the Imperial University in Tōkyō, "as a protest against the insincerity and shallowness of modern academicians, artists and writers, who would profane the shrine of pure art by setting up base images of foreign clay." He published two volumes of his university lectures on literature among his other writings, and it is probable that his works will be ranged alongside the best productions of the Meiji era by the literary historian of the future. In his *Bungaku no Byakkō* (The Pure White Light of Literature) Matsuura displays a sensitiveness and purity of ideal which had been lost to Japan since the close of the Nara period.

The constitutional ban on revolutionary and socialist doctrines resulted in the issue of a complete Marxian library and a series of handbooks purporting to be short cuts to Bolshevism. Imperfectly conceived dogmas were presented in attractive guise as the European panaceas: for all Japan's troubles there exists a very simple melting-pot, and this is a weird communism in which the state should be a machine very far removed from the activities of daily life. "Freedom" became the slogan of Young Japan, but the "freedom" publications are very pale shadows of their European parents, and even omit to define the freedom to which they relate. (A. N. J. W.)

JAQUES-DALCROZE, ÉMILE (1865–), Swiss composer and teacher of musical eurhythmics, was born at Vienna July 6 1865, of French-Swiss parents. He went to Geneva in 1875 where he attended the college and the university, and followed the courses at the Conservatoire. He then studied (1887) at the Conservatoires of Vienna and Paris and completed his musical education under Délibes. In 1886 he accepted the post of *chef d'orchestre* at Algiers. He then returned to Vienna and studied composition under R. Fuchs and A. Bruckner. After the death of Hugo de Senger, he directed the sol-fa and harmony courses at the Conservatoire of Geneva (1891). He has written many charming songs, including *Chansons populaires*, *Chansons du coeur qui vole*, *Chansons de route*, etc. These are written in the simple form of the folk song and have obtained great popularity, not only in Switzerland, but in other countries. His other musical compositions are very numerous, and include three string quartettes, two violin concertos and several orchestral suites; also symphonies and choral works on a large scale such as *La Veillée* (1893) and *Le Festival Vaudois* (1903).

Among his other descriptive compositions may be mentioned: *Le violon maudit* (1893), *Janie* (1893), *Sancho Panza* (1897), *Le poème alpestre* (1896), *Le bonhomme jadis* (1905), *Les jumeaux de Bergamo* (1908), *Echo et Narcisse* (1912), *La fête de Juin* (1914), *Les premiers souvenirs* (1918), *La fête de la jeunesse* (1923), etc. His great work has been the development of the eurhythmic instinct, particularly in children, and since 1915 he has been the director at Geneva of the *Institut Jaques-Dalcroze*, which he originally founded at Hellerau in Bavaria. His method consists of a development of the instinct for rhythm in close conjunction with the sense of hearing and the instinct for tone, and is based on defined relations between bodily movements and the movements of sound. Special schools, based on the Dalcroze Method have been founded in London, Paris and elsewhere. The system may be studied in the following works by É. Jaques-Dalcroze: *Rhythmic Movements* (1920); *Rhythm, Music and Education* (1921); *The Importance of being Rhythmic* (1925); and *The Eurhythmics of Jaques-Dalcroze*, by various authors (1912). (*See* EURHYTHMICS.)

JASPAR, HENRI (1870–), Belgian politician, was born at Schaerbeek, Brussels, July 28 1870. While Minister of Economic Affairs in Nov. 1918, he organised the reconstruction of Belgian industries; becoming deputy for Liége in 1919. In 1920, having been appointed Minister of the Interior and afterwards Minister for Foreign Affairs, he endeavoured, during the Inter-Allied Conference in which he took part, to strengthen the entente between England, France and Belgium, and to secure reparations and security for his own country. In 1922 he negotiated a pact of security and guarantee with England; this, however, owing to the defeat of the French Govt., failed to come into operation. Belgium's entry into the League of Nations was due to the efforts of M. Jaspar, as also was her representation on the Permanent Court of International Justice at The Hague. In July 1921 he concluded an economic agreement between Belgium and Luxembourg and other commercial treaties. He took part in the Dawes Plan negotiations in 1924, but resigned as Minister for Foreign Affairs on March 11 on the rejection by the Chamber of the Franco-Belgian Convention. In May 1926 took office as prime minister and minister of the interior. (*See* BELGIUM.)

JASTROW, MORRIS (1861–1921), American Orientalist, was born in Warsaw, Poland, Aug. 13 1861, but went to Philadelphia at the age of five. Educated at the schools of that city and in the University of Pennsylvania, he studied subsequently at the Universities of Leipzig, Breslau, Paris and Strasbourg, returning in 1885 to the University of Pennsylvania as professor of Semitic languages and librarian. He died June 22 1921 at Jenkintown, Pa. He published numerous works on the religions and civilisation of Babylonia and Assyria, and, in connection with the World War: *The War and the Baghdad Railway* (1917); *The War and the Coming Peace* (1918); *A Gentle Cynic* (1919); *Zionism and the Future of Palestine* (1919).

JAURÈS, AUGUSTE MARIE JOSEPH JEAN (1859–1914), French socialist leader, was born at Castres, Tarn, Sept. 3 1859, of an old but not very prosperous local family. His ancestors on his father's side included two admirals, of whom one was ambassador to Spain and to Russia, and Minister of Marine. His mother's family included distinguished professors, of whom one was for a long time mayor of Castres. Jean Jaurès was of pure bourgeois stock. His father, a man of exceptional physique and of a lively intelligence, carried on at Castres various commercial activities, but without much method or practical sense. His mother exercised a real influence over her sons, and Jean had always a deep reverence for her. Her prudent intelligence and her good sense made her the true soul of the family and the educator of her children. A strictly orthodox Catholic, b without fanaticism, she inspired in her sons a respect for sincere beliefs and opinions.

Jaurès began his studies at a private school; then, with h older brother, who became an admiral, he entered, thanks to scholarship, in Oct. 1868, the college at Castres. He was a pup of exemplary conduct and remarkable intelligence, devoted his work, "le premier en tout." Mingling little in the roug games of his comrades, he possessed already that depth of serio gravity which he preserved all his life under the cloak of h natural liveliness and unfailing good humour. This "rare combination of high intellectual qualities" obtained for him scholarship at the Collège Sainte Barbe at Paris, where he we in 1876. He was enabled thus to pursue his studies for two yea at the Lycée Louis le Grand and to prepare himself for th entrance examinations of the École Normale Supérieure, t which he was admitted in 1878 with the first place. His care there was the most brilliant possible, and his fellow student among them being Henri Bergson, predicted for him a grea political future.

After having passed the "concours d'agrégation" Jaurè was elected, in 1881, professor of philosophy at the Lycée d'Alb In 1883 he became lecturer in the University of Toulouse. Bu he had already set his mind upon a parliamentary career, a though his mother did her best to dissuade him. At the legislative elections of Oct. 4 1885 he stood for the department o the Tarn and was elected deputy, heading the list with 48,00 votes. He was 26 years old. During the first two years of hi term, he took little part in debates. His poetic and burnin eloquence embarrassed parliamentarians accustomed to th so-called "britannique" eloquence of Clemenceau, Waldeck Rousseau, Ribot, Pelletan, Freycinet and others. His maide speech was delivered Oct. 21 1886 on a question relating t primary education. In 1887 he spoke three times; but the following year, more self-confident and more familiar with th peculiar atmosphere of the Chamber, he made numerous speeches some of them very important, on the most diverse subjects which he approached each time with an amazing competenc and a constantly growing sense of authority. On every questio with which he dealt, he adopted a courageous attitude whic showed him incapable of sacrificing his principles to parliamentary compromise or to motives of self-interest. Without allyin himself to any party, he devoted himself passionately to th public good and to the general welfare; but at the close of th session the meagre results of his efforts discouraged him so mu that he decided to abandon politics, and asked to be reinstat in his post of professor at the University of Toulouse.

However, upon the insistence of his friends, Jaurès consent to stand for Parliament once more. Before dissolution, th Chamber had substituted the "scrutin d'arrondissement" fo the "scrutin de liste" and Jaurès presented himself in the first district of Castres, which had long been in the hands of th reactionary parties. But on Sept. 22, at the first poll, he found himself in a minority of 856 votes though he himself had obtained almost 9,000.

In Nov. Jaurès resumed the professor's chair. His lectures were now thronged with students, workmen, middle class folk, other professors, men of science, men of learning. During this period he wrote his theses for the doctorate. His French thesis was entitled *De la realité du monde sensible*. In his Latin thesis he traced the origins of German socialism *De primis socialismi germanici lineamentis apud Lutherum, Kant, Fichte et Hegel*. About this time an ardent religious revival had stirred the imagination of many liberal minds. The questions thus raised were discussed by Jaurès in his lectures; but his robust and healthy rationalism resisted the tendencies of the day, just as later he opposed the vogue of pragmatism. An admirer of Renan, he would not admit dilettantism in matters of religion and the "subjectivism of faith" never had any attractions for him.

In the midst of the formidable labours which his personal work and the preparation of his lectures involved, Jaurès found time to comment regularly on topics of the moment in the impor-

t local organ *La Dépêche.* There his ideas on politics and
nomics were seen to turn more and more towards Socialism,
which, at the close of 1890, he at last publicly announced his
esion. At the same time, public life claimed him again. On
y 27 1890 at a local election, he was chosen municipal coun-
or of Toulouse, and his colleagues appointed him forthwith
uty mayor, in special charge of public education. He took
s an important part in elevating the school of medicine into
culty. After the strike at Carmaux, in the course of which
lefended the claims of the miners, Jaurès was elected deputy,
893, at a local election, and his term of office was renewed at
general elections of 1894. Defeated again in 1898, he was
lected in 1902; and his electorate remained faithful to him
n that time on.

n Parliament, as soon as he returned, he assumed a position
reat authority in politics. He took a large part in the debates
the Panama and Boulangist crises, in discussions of agrarian
colonial questions, on fiscal policy and protectionist meas-
s, on syndicalism and the separation of Church and State,
military laws and electoral reform. In the Dreyfus affair his
rgetic intervention captured the Socialist party, which hesi-
ed at first to take part in a conflict which seemed not to con-
n the proletariat. He carried on a formidable campaign in
our of the condemned and innocent man, a "living witness
military lies, to political cowardice, to the crimes of authority,"
did he cease until Dreyfus was definitely rehabilitated. His
eches and his articles on this affair are collected in one volume
ed *Les Preuves*, a masterpiece of analysis and eloquent logic.
ed by the logical development of his metaphysical and reli-
us ideas to social conceptions which obliged him to accept the
ialist teaching, Jaurès adhered closely to the Socialist party,
ich at each new election gained a larger number of represent-
ves in Parliament. But he realised at once that the fragmen-
ion of Socialists into groups and sects would be a source of
itical weakness and an obstacle to the ideals of social justice
the liberation of humanity which he wished to attain. For
n the "sublime joy of leading all men towards the fullness
humanity," lay in the effort to achieve these ideals. The
ialism of Jaurès differs essentially from the Marxian doctrine,
principle of which is pseudo-scientific. "Our socialism,"
tes Jaurès, "is French in origin, French in inspiration, and
nch in character." His ultimate aim was harmony founded
justice. Social harmony implies the disappearance of an
ustice which provokes conflicts, hatreds and their horrible
sequences, an injustice originating in capitalist ownership.
rès was a socialist because "the domination of one class is an
rage against humanity." Into this doctrine he breathed his
n glowing and generous ideas and, at the same time, drew
m it the strength with which he animated it. "No serious
ial programme can be realised without a definite social doc-
ne," he wrote, and for him the whole socialist ideal must
pire organic reformatory action and thus establish a socialism,
nocratic, republican and lay.

All socialist sects have the same social ideal, but their differ-
es in tactics and methods paralyse common action. Jaurès
ove to bring about unification. At the Congress of 1901, a
tion of groups rallied to him under the name of the *parti*
ialiste français, while the others formed the *parti socialiste de*
nce! After the Amsterdam Congress in 1905, the two groups
lesced and Jaurès became, in fact, their moral and intellectual
ef. Thereafter his political activity was bound up with that
the unified Socialist party, whose parliamentary activity he
ected with great skill. He drafted most of the resolutions at
cialist congresses and defended them in an admirably con-
atory spirit.

His philosophy of history, unlike that of Marx, did not hold
t the development of human society is subject to a blind
erminism; he postulated for it an intelligent directing force
d an ideal wisdom. "History," he wrote, "although a phe-
menon which develops according to mechanical laws, is
vertheless an aspiration to realise itself according to an ideal
. . . . The universe is but an immense, a vague, aspiration towards order, beauty, liberty." To conform to this aspiration, Socialism, according to Jaurès, should seek reform to bring about a less contradictory social order, whose institutions would be less exclusive, less bitterly egotistic, less mischievous, which would cease to perpetuate strife, hatred and want; which would permit men to pass from a state of brutal competition and conflict to the state of co-operation; which would transform the economic passivity of the masses into initiative and responsibility, in which social energies, instead of being wasted on sterile and insane conflicts, would be co-ordinated for common action. To uphold these convictions, Jaurès, after the Amsterdam Congress in 1905, struggled alone against the entire International for a share of power and for the preservation of the democratic-socialist *bloc.* He violently attacked and denounced as impotent the German Social Democracy which dominated the Congress and was supported by the old French Socialist organisations. On April 17 1904 Jean Jaurès, with Aristide Briand, founded *l'Humanité*, which has become the daily organ of the Socialist party. His daily leading article in it was written for the most part from his seat in the Chamber.

Jaurès early discerned the danger which threatened the world. He foresaw that the unstable equilibrium of the Triple Alliance and the Triple Entente was bound to end in a catastrophe, and he wished to avert it by the simultaneous international action of the proletariat. A passionate lover of France, he sought to spare his country the horrors of devastation by war. While he maintained that a democracy should not have an aggressive policy, he did not deny the duty of every nation to defend itself. To prevent misunderstanding between socialism and patriotism he wrote: "A nation which could not count, in days of crisis or when its life is in danger, upon the national devotion of the working class, would be a wretched thing indeed." He supported the policy of arbitration and all measures to secure international peace, but at the same time, in the name of the workers of France, he insisted "that the nation organise all its military forces, irrespective of class or caste, for the sole purpose of national defence." Against Germany, militarist and absolutist, stood France, a nation in arms, practising "a policy of supreme national defence which would lead not only to peace but to the assurance of peace." Jaurès expounded and developed his ideas on the organisation of "a nation in arms" in his book, *L'armée nouvelle.*

The policy of world-wide solidarity which Jaurès proclaimed was of no avail against the blind forces which precipitated the War, but Jaurès continued to strive for peace. On July 28 1914, before the outbreak of war, he, and some of his most eminent Socialist colleagues, went to Brussels to confer, in the name of the French Socialist party, with representatives of international labour on the best means of averting the threat of war, which he still thought could be avoided. But he was none the less full of anguish over the fate of France, compelled to defend herself against aggression. On this subject, he certainly felt no hesitation, for he had always been animated by the purest patriotism.

> "Il y a un groupement historique qui s'appelle la France, qui a été constitué par des siècles de souffrances communes, d'espérances communes; les lentes formations monarchiques en ont peu à peu juxtaposé et soudé les morceaux, et les ardentes épreuves de la Révolution l'ont fondu en un seul métal. C'est la patrie française . . . Oui, il y a des luttes, des antagonismes profonds de classe. Mais quels que soient ces luttes politiques, ces divisions économiques, ces antagonismes sociaux, ils ne peuvent pas porter atteinte à l'idée même de la patrie. . . . Si notre patrie est menacée . . . nous serions des premiers à la frontière pour défendre la France dont le sang coule dans nos veines, et dont le fier génie est ce qu'il y a de meilleur en nous."

These noble words leave no doubt as to the attitude which Jaurès would have taken, or of the rôle which he would have played in the "holy war for our beloved France if ever she were attacked." But on the very eve of mobilisation, in Paris, on July 31 1914, at 9:40, Jaurès succumbed to the bullets of an assassin—a wretched half-wit, impelled to this stupid crime by the calumnies of the adversaries of the great tribune. His obsequies were celebrated on Aug. 4 in the midst of an immense popular gathering, and his body was interred at Albi. In 1925 his mortal remains were brought back to Paris, and, borne on the shoulders of his faithful miners of Carmaux, deposited in the Panthéon. (Ed. He.)

JEBAVÝ, VÁCLAV (1868–), Czech poet universally known as Otakar, Březina, was born at Počátky, Bohemia, Sept. 13 1868. After an education in science he became a secondary school teacher in Southern Moravia, where he lived a life of contemplative seclusion, declining the honours and material advantages offered him by the Government. His published works consist of five books of poetry: *Secret Distances* (1895); *Dawn in the West* (1896); *Polar Winds* (1897); *Temple Builders* (1899) and *The Hands* (1901), and a volume of prose essays, *Music of the Springs* (1903); besides a number of poems scattered in various literary papers.

Březina is admittedly the greatest modern Czech poet, and is even judged by some foreign critics to be the greatest mystic poet of all nations. His development as a mystic philosopher and religious visionary passed from the subjective pessimism of his early poems, through a transcendental revelation of mystic realities, to an evolutionary optimism and a joyful belief in cosmic brotherhood. His art manifests an analogous development from an intimate lyrical impressionism through ecstatic incantations of a high-priest and a seer to an impersonal, super-personal, dythyrambic poetry of the elements, suns and stars, and of human effort, suffering and mystic destiny. His diction is so concentrated and pregnant with thought that it presents considerable difficulty at first reading; but this is more than compensated for by the superlative beauty and entrancing music of his verse, the remarkable wealth of his imagery and the extraordinarily human and personal appeal of his philosophy which has its roots in the mystic tradition of the medieval Czech religious sects. He brought Czech poetical language to a stage of perfection which it had never before attained and which is difficult to surpass.

See Paul Selver, *Anthology of Modern Slavonic Literature* (1919); *Modern Czech Poetry* (1920), and *A Study in Czech Literature* (1921). (J. Cl.)

JELLICOE, JOHN RUSHWORTH JELLICOE, 1st Earl (1859–), British Admiral, was born Dec. 5 1859, the son of J. H. Jellicoe, a captain in the mercantile marine. His great-grandfather was Sir James Whalley Smyth Gardiner, the third and last baronet of that name. Educated at Rottingdean, he entered the navy as a Naval Cadet at the age of thirteen. He obtained his commission as sub-lieutenant in 1880, and his hard work and marked ability won him three first class certificates in his three examinations for the rank of lieutenant. He soon developed a strong interest in gunnery and joined the Royal Naval College in 1883 for the theoretical part of the course for gunnery lieutenant, where he distinguished himself by winning a special £80 prize. The following year he spent in H.M.S. "Excellent," and became a fully qualified gunnery officer. From now onwards gunnery was his speciality, though his interests were by no means confined to this branch.

His first sea-going ship as a gunnery lieutenant was H.M.S. "Monarch," in which he served from 1886 to 1888. During his first year on board he went to the rescue of the crew of a stranded steamer, taking charge of a gig, manned by volunteers. The boat upset in a heavy sea and he and the crew saved themselves with difficulty. He received the Board of Trade silver medal for his plucky effort. After two years on the senior staff of the Gunnery School, he was appointed to the Admiralty as an assistant to the director of naval ordnance. In 1893 he was promoted to commander, and shortly afterwards was appointed to H.M.S. "Victoria," flagship of Admiral Sir George Tryon, commander-in-chief of the Mediterranean Fleet. When the "Victoria" was rammed and sunk by the "Camperdown," Commander Jellicoe had to take to the water. As he was seriously ill at the time he would have fared badly but for the support he received from a young naval cadet, Mr. P. D. Roberts-West, until rescued.

Commander Jellicoe soon recovered and two months later was appointed to the battleship "Ramillies" which flew the flag of the new commander-in-chief, Admiral Sir Michael Culm Seymour. After a three years commission in that ship he w promoted to captain on Jan. 1 1897, and served on the Ordnan Committee. In 1898 he was appointed to the command of H.M. "Centurion," where he became flag captain to Admiral Sir E ward Seymour, commander-in-chief of the China Station. the latter's chief of staff he took part in the expedition to relie the legations in Peking during the Boxer rising in 1900. Durin these operations Captain Jellicoe was badly wounded. He w subsequently awarded the C.B. for these services.

Service at the Admiralty.—He returned to the Admiralty 1902 to be the naval assistant to the controller (Third Sea Lord Here he acquired an insight of the work of that department whi was to be of great value to him later. In Aug. 1903 he went sea again to take command of the fine armoured cruiser "Drake for a year. The year 1905 saw him in the responsible post director of naval ordnance at the Admiralty. During his peri of office he did much to further the advance of long range firin and to assist the development of naval gunnery on lines whi more closely approximated to the real conditions of war. T wards the end of his time he reached the top of the captains' li and was promoted to flag rank in Feb. 1907. In Aug. that year he hoisted his flag afloat in H.M.S. "Albemarl as rear-admiral in the Atlantic Fleet. The appointment was a year's duration only, when once more he returned to the A miralty, this time to become a member of the Board as Thir Sea Lord and Controller of the Navy. In Dec. 1910 he wa appointed acting vice-admiral in command of the Atlantic Flee being confirmed in that rank in the following November. A the end of the year he transferred his flag to H.M.S. "Hercules, on appointment to the command of the 2nd Division of the Hom Fleet.

In 1912 important gunnery experiments were carried out b two battleships of this division, the "Thunderer" and "Orion, the former being fitted with this system of director firing whic Sir Percy Scott had been perfecting. The trials culminated i competitive firings which took place under Admiral Jellicoe personal supervision. It was as a result of these practices a largely due to Admiral Jellicoe's insistent pressure that this mos valuable system was adopted as the primary one for laying a firing the guns of practically all classes of H.M. ships. The even may be regarded as yet another milestone on the path of th gunnery progress for which he was greatly responsible. After year in this command he returned to the Admiralty to rejoi the Board as Second Sea Lord.

The War Period.—He left Whitehall temporarily in 1913 t become commander-in-chief of the "Red" fleet during manoeu vres, flying his flag in H.M.S. "Thunderer," but had returne to the Admiralty, when, on the eve of War, he was sent to joi the Home Fleet at Scapa as second in command. The period o command of Admiral Sir George Callaghan was due to expire in a few months and Vice-Admiral Jellicoe had already bee designated as his successor. When war could no longer be averted, it was considered desirable that the change in this mos responsible naval command should not be delayed and Sir John Jellicoe was appointed commander-in-chief with acting rank o admiral. He had to perform a peculiarly difficult and trying duty in relieving his former chief, who was trusted and respected in an unusual degree throughout the fleet. That he achieved it so successfully was due to the chivalrous attitude of these two fla officers towards each other and to the very high reputation and strong personal regard which Sir John himself enjoyed.

Admiral Jellicoe was confirmed in his rank in March 1915, and for two years bore the exceptionally heavy burden of organising and training the Grand Fleet and keeping it ready for battle His great command was put to the test at the battle of Jutland Now that the full details of that action are better understood the skilful handling of the British forces against an elusive enemy in conditions of low visibility and approaching darkness, is being increasingly appreciated. The German fleet escaped at night and took refuge in harbour with many ships severely damaged and such was the impression left by Jutland that Germany r again risked a meeting with the Grand Fleet. The fruits lmiral Jellicoe's leadership on that day and of his incomble services throughout his period of command were seen e historic surrender of German ships at the end of the War. the latter part of 1916 Admiral Jellicoe was invited to be- First Sea Lord and regretfully left his last and greatest nand afloat to take up that appointment. It was largely to his tireless labours and wide experience that the grave er of the German submarine menace was eventually over-, although others reaped where he had sown. He left the iralty at the end of 1917. After the Armistice he was sent special mission to visit the Dominions and advise on the post- organisation of their navies. On this tour he flew his flag .M.S. "New Zealand." He was promoted to Admiral of 'leet in 1919 and the following year was made Governor of Zealand. During his four years in this high office he greatly ared himself to the people of that Dominion.

r his services in the War Admiral Jellicoe received the ks of Parliament and a grant of £50,000, and at the end of he was raised to the peerage as Viscount Jellicoe of Scapa, equently taking the additional title of Viscount Brocas of hampton. On his return from New Zealand and in recogni- of his services as governor he was, in 1925, created an Earl. eceived the K.C.V.O. in 1907, G.C.B. in 1915 and G.C.V.O. 16; he also holds a number of foreign orders. He married, 02, the daughter of Sir Charles Cayzer, Bart., and has four hters and a son and heir, Viscount Brocas, who was born in . Earl Jellicoe possesses in remarkable degree the power of ring others with his own loyalty and singleness of purpose. naval commanders since Nelson's time have enjoyed such tion and confidence as he did as commander-in-chief of the est fleet that ever set forth to do battle. (E. A.*)

LLINEK, GEORGE (1851–1911), Hungarian jurist (*see* 5), died at Heidelberg, Jan. 12 1911.

NA, UNIVERSITY OF (*see* 15.315).—In 1910 the number of ents was 1,946 and in 1925 it had risen to 2,153, when it had oreign students, of whom 69 came from Latvia and 49 from ia. The faculty of medicine is specially attractive to foreign ents. The university library possesses 325,000 volumes and ge collection of pamphlets.

NSEN, JOHANNES VILHELM (1873–), Danish author, born at Farsö, North Jutland, Jan. 20 1873, of a family of ant extraction. He studied at the University of Copenhagen afterwards travelled extensively, writing a number of novels, hes, essays and letters of travel and some volumes of poetry. en belongs to the new school of Danish literature which into being about 1900. Influenced by Whitman, Kipling H. C. Andersen, he repudiated the Brandes school with its ation of French literature and wrote of nature and outdoor Among his novels may be mentioned: *Kongens Fald* (1899–), a historical novel of the 16th Century; *Madame d'Ora* 4); and *Den lange Rejse* (1908–21) describing the evolution he Northern race from the glacial epoch to the time of mbus. In *Himmerlandshistorier* (1898–1910); *Skovene* (1904); *tiske Noveller* (1907–15) and *Myter og Jagter* (1907–24) he ribed life and scenery in his native country and abroad with ant imaginative talent and mastery of language. Jensen, became a firm believer in evolution, adopted in later years rely atheistic and biological view of life. See Otto Gelsted, *nnes V. Jensen* (1913).

NSEN, WILHELM (1837–1911), German author (*see* 15.321), near Munich Nov. 24 1911. His last work was *Fremdlinge r den Menschen* (1911). See W. Barchfeld, *Wilhelm Jensen yriker* (1913).

RSEY CITY, N.J., U.S.A. (*see* 15.331), produced 5,000 dif- nt kinds of articles in its 1,325 industrial plants in 1925. use of the diversity of its industries and the staple character eir products, Jersey City was less affected by the War than manufacturing cities, and suffered less in the succeeding ession. The aggregate value of manufactures rose from ,775,000 in 1909 to $374,183,000 in 1919; and then, after g to $289,796,274 in 1921, rose again to $313,999,142 in 1923. The average number of wage earners in factories for the same years was 25,454; 36,981; 30,026; 33,264.

The most important new industry is the manufacture of radio apparatus and supplies, for which several plants were established in 1924 and 1925. The population in 1910 was 267,779; in 1920, 298,103, including 8,000 negroes and 76,294 foreign-born (a slight decrease), of whom 14,855 were Italians, 12,451 Irish, 12,145 Poles and 11,113 Germans. In 1925 the official estimate was 315,280. A development plan, prepared about 1920, provides, among other engineering improvements, for the construction of a bulkhead across a part of Newark Bay, by which one square mile of territory suitable for industrial sites will be added to the area of the city. By improvements in the fire department, the city secured a rating in class A for fire insurance. Boyle's Thirty Acres, widely advertised as the largest arena in the world, was opened in 1921. The opening of the Hudson Tubes (1909) gave some impetus to building in the residence section on "the hill," which was thereby brought within eight min. of the financial district of New York. The completion of the double-tube vehicular tunnel in 1926 makes the connection still closer. The commission form of government was adopted in 1913.

JERUSALEM, Palestine (*see* 15.331), is now the seat of the Government of Palestine under the mandate given to Great Britain in July 1922 and the chief town of its province. A large hospice outside the Jaffa Gate, which was built and endowed by the German Empress in 1910, is used as Government House. The population in 1922 was 62,678, of whom 33,971 were Jews. An Armenian Patriarch was elected in 1921 with the formal approval of King George, and the position of the Orthodox Patriarch of Jerusalem has been confirmed by a commission appointed by the British administration.

On Dec. 9 1917 Gen. Allenby made an unostentatious entry into Jerusalem. Military administration was carried on until 1920, when a civil administration with an advisory council was set up. Since 1917 much good work has been done in the city, which under the Turkish régime was squalid and filthy. The streets are scavenged and thoroughly cleaned, and work has been begun on a drainage system. The old and inadequate water supply from Solomon's Pools has been replaced. The ancient aqueduct leading from the springs of Birket-el-'Arub, 14 m. distant, to Solomon's Pools has been cleared, and is used in part to lead the water to a large reservoir, whence it is distributed by gravity to Jerusalem. There is a second reservoir at Lifta, giving a total supply of 150,000 gal. daily. Since the completion of the installation the amount of water used in Jerusalem has increased tenfold. A town plan and civic survey have been made and several garden villages in the neighbourhood designed. The houses have been numbered and the streets named; some roads have been widened, and in 1924 King George V. avenue was opened. Laws have been promulgated against large shop signs and advertisement boardings, a chamber of commerce has been formed and a telephone system installed.

Roads fit for motor traffic all the year round have been made to Jaffa, Jericho, Hebron and Damascus. There is, however, no longer through railway connection with Cairo, as the swing bridge over the Suez Canal at El-Qantara was removed in 1920 at the instance of the Suez Canal Co., and the canal has to be crossed by ferry. The Government department of antiquities, founded soon after the establishment of the British administration, has the archaeological schools of the different nations under its control, with the assistance of an advisory board of representatives from the schools. Previously all antiquities found their way to Constantinople, but over 6,000 specimens have now been catalogued as a nucleus of a Palestine museum at Jerusalem. Excavating is only permitted to recognised scientific bodies.

Much good work has recently been done by the Palestine Exploration Society. The citadel has been cleared of débris and modern accretions, as also the Cotton Bazaar; the ornate clock tower on the Jaffa Gate has been removed and re-erected, shorn of its trimmings, in Allenby square, and the walk on the ramparts in part reinstated. Important excavations on Mount

Ophel have also been recently carried out by the society, following earlier efforts on the site in 1909–11 and 1913–4. Remains have been found of the north wall and tower of the Jebusite fortress, which was conquered by King David and formed the site of his city; and it is hoped to discover his tomb. In 1920 the ruins of a 4th-century church of much interest were discovered by Franciscan friars in the course of digging foundations for a church in the Garden of Gethsemane, and its excavation was completed by the Dept. of Antiquities. In 1921 the ancient school of St. Etienne, founded by French Dominicans, became the headquarters of the French Archaeological Society. The foundation stone of a Hebrew university was laid in 1918 on Mount Scopus, but until 1924 there was no teaching organisation. An institute of Jewish studies was started in that year, and in April 1925 the university was formally opened by Lord Balfour. The foundation stone of an institute of physics and mathematics was laid the day after the opening of the university.

JERUSALEM, UNIVERSITY OF.—The idea of creating a university in Jerusalem was first put forward in 1882 by Dr. Schapira, *Privatdozent* in mathematics in Heidelberg. After preliminary steps it was approved by the 11th Zionist Congress in 1913, and a committee of the congress purchased a site on Mt. Scopus (near the Mount of Olives) in 1914, the foundation stone was laid in 1918 by Dr. C. Weizmann, the president of the Zionist organisation, and the university was formally opened by Earl Balfour on April 1 1925. The object of the university was twofold; to carry out research in all departments, and teaching especially in the departments of Jewish and Oriental Studies, for which the university should be a world-centre. Departments of chemistry including physical chemistry, microbiology and Jewish studies are in existence, and there is an important agricultural research institute at Tel-Avio in connection with the university. The library already contains over 120,000 volumes and the estimated recurring expenditure for 1926 is £45,000. The scientific research is especially directed with a view to the material development of Palestine. See *The New Palestine* (New York) for March 27 1925.

JESPERSEN, JENS OTTO HARRY (1860–), Danish philologist, was born at Randers, Denmark, July 16 1860. He graduated in modern languages at the University of Copenhagen in 1884 and gained his doctor's degree in 1891 by a thesis on English laws. In 1893 he was appointed professor at the University of Copenhagen. From 1909–10 he lectured at Columbia University, New York. He produced a number of books on English grammar, the history of language, general phonetics and the philosophy of language, many of which were written in English. A practical philologist, Jespersen's view of the development of language was influenced by Herbert Spencer and Wilhelm Ostwald. His most important works are *Progress in Language* (1894); *Phonetics* (1897–9); *Growth and Structure of the English Language* (1905, Prix Volney, 1906); *Lehrbuch der Phonetik* (1913); *Language, its Nature, Development and Origin* (1922); *Philosophy of Grammar* (1924).

JESUS CHRIST: *see* BIBLICAL CRITICISM; CHRISTIANITY.

JEWISH LITERATURE: *see* HEBREW LITERATURE.

JEWS (*see* 15.371).—The Jewish population of the world on the outbreak of War in 1914 may be estimated at about 14,900,000. Of these, two-thirds were concentrated in eastern and south-eastern Europe, including (in round figures) just under 7,000,000 in Russia, 2,250,000 in Austria-Hungary and nearly 250,000 in Rumania. Of the remainder, about two-thirds lived in the United States, which had a Jewish population of close on 3,000,000, leaving a balance of about 1,500,000 for other parts of the world. There were about 600,000 Jews in Germany, and about 500,000 in the British Empire, including 250,000 in Great Britain and Ireland.

I. THE PRE-WAR PERIOD

Events in Russia.—In the years immediately preceding the World War, the condition of the Jews in Russia went from bad to worse. The legal restrictions by which the Jews were harassed were vigorously enforced and in some respects made still more
burdensome. In 1910 there was a round-up of Jews in Ki
Jewish houses were systematically raided by the police,
hundreds of families, who were unable to prove their right
residence, were abruptly expelled. The expulsions continue
1911–2 and were extended to other cities in which only pr
leged Jews were permitted to reside—notably Moscow, St. Pet
burg and Kursk—as well as to a large number of villages
various parts of the pale of settlement, where the governme
policy was to confine the Jews to the towns.

During the same period further disabilities were imposed
the Jews in the sphere of education. In 1910 the percentage r
which limited the number of Jewish pupils to a fixed proporti
was extended to schools of surgery and dentistry and to
schools of painting and architecture in the St. Petersburg Ac
emy of Fine Arts. The percentage rule was even applied to
Jewish secondary schools, which had hitherto been exemp
as private institutions. As a result promising young Jews
Jewesses, who found higher education out of their reach in R
sia, began to leave the country in increasing numbers to pur
their studies abroad. A third line of attack was marked by w
was known as the " scheme for the Russification of commerc
This scheme, designed to drive the Jews out of Russian tra
was launched during the premiership of M. Stolypin. M. Kok
tzeff, who succeeded M. Stolypin in 1911, viewed it with misgivi
but the anti-Jewish forces were too strong for him and, thou
never formally approved by the Govt. or the Duma,
scheme was put into practical operation, existing restricti
being used to cripple public companies under Jewish mana
ment and generally to discourage Jewish commercial enterpri
In Russian Poland the Jews also suffered severely from an e
nomic boycott organised by the Warsaw Nationalists, wh
candidate for the Fourth Duma was defeated by Jewish votes
the election of 1912. At Easter, 1911, a Christian boy was kil
at Kiev. The anti-Semites at once accused the Jews of rit
murder, and a Jew named Beilis was arrested. Beilis was k
for more than two years awaiting his trial which ended in N
1913 in his acquittal.

In the Third Duma a bill for the abolition of the pale of s
tlement received a considerable measure of support, while t
Fourth Duma also contained liberal-minded elements. B
though the Jews were not altogether friendless, their positi
grew worse rather than better. The Govt. remained fixed in
determination to crush them, and Jewish life in Russia present
a picture of almost unrelieved gloom.

Jews in Southeast Europe.—In Rumania the Jews were su
jected to much the same treatment as in Russia. In one respe
their position was even worse. Jews, as such, were deemed
the Rumanian Govt. to be aliens, even though they were nat
born and had no claim to any other nationality. As a sequel
the Berlin Treaty of 1878, under which the Powers recognis
her independence, Rumania undertook in 1880 to give the Je
liberal facilities for naturalisation. Had this pledge been fulfille
their status would have been gradually regularised, but the spi
in which it was carried out is shown by the fact that betwe
1880–1913, about 200 Jews were actually naturalised out of
Jewish population, mainly native-born, of over 200,000. T
Rumanian declaration of war on Bulgaria in 1913 brought 15,0
Jewish reservists to the colours. This produced a certain rev
sion of feeling and it looked for a moment as though at last t
Jewish soldiers would now be naturalised *en bloc.* A few indivi
ual applications were granted, but the anti-Jewish forces so
regained the upper hand, and the elections of 1914 brought in
power a reactionary Govt. from which Jews had nothing to ho

In Austria-Hungary the Jews were subject to no legal dis
bilities. In 1912–3 there were various affrays between Jewi
and German or Polish students at the universities of Vien
Czernowitz and Lemberg, but these incidents, though sympto
atic, were in themselves of no great consequence. In Moroc
the Jews suffered severely from an outbreak of disorder in 19
when mutinous troops of the Sultan's army sacked the Jewi
quarter at Fez, 60 Jews being killed and many severely wounde
A considerable number of Jews were affected by the territor

ges resulting from the Balkan Wars of 1912–3, and more
cially by the transfer of Salonika from Turkey to Greece.
ng the 200,000 inhabitants of Salonika there were about
oo Jews, who played a predominant part in its commercial
Though the Greek Govt. gave satisfactory assurances, the
ge of sovereignty was viewed by the Jews with misgivings
h have proved not altogether unfounded.

s a result of the conditions prevailing in Russia and Rumania,
continued to emigrate overseas in large numbers. Some of
settled in Palestine, where Jewish colonisation was making
ual progress with the support of Baron Edmond de Roth-
d and under the inspiration of the Zionist Movement
great majority, however, made their way to the United
es, where 495,459 Jewish immigrants were officially recorded
e five years 1910–4 (*see* MIGRATION).

II. EFFECTS OF THE WAR

e War completely changed the face of the Jewish world.
e Russian Empire it brought the Jews political emancipa-
but it also brought them unspeakable suffering and ended
ubmerging them in the flood of anarchy which followed the
pse of orderly government. As a result, the influential
sh community in the United States increased to 3,600,000
ns. Finally, the War led up to the Balfour Declaration,
h foreshadowed the establishment under international
antees of a national home for the Jews in Palestine.

asterh Europe.—The crowded Jewries of eastern Europe
he full impact of the War from the outset. The Russian pale
ettlement became almost at once a theatre of operations.
oo, did Galicia, with its poverty-stricken Jewish population
ver 800,000. The Jews were bound in any case to suffer in
mon with their neighbours, but their miseries were aggravat-
y wholesale deportations. Within a year of the outbreak of
nearly 1,500,000 Jewish refugees had been set adrift. To
e matters worse, the Polish Nationalists vigorously pur-
their vendetta against the Jews and revived the boycott
h began in Warsaw in 1912. So pitiful was the condition
e Jews that the Russian Govt. which had already made
tantial grants to the Petrograd Jewish Relief Committee,
tually issued, as a temporary measure, a decree permitting
Jews to reside freely in any of the towns of the Empire, with
in specified exceptions, of which the most important were
ograd and Moscow. This decree was dated Sept. 3 1915.
concessions thus granted gave the Jews some relief, though
ffect was minimised by the illiberal spirit in which it was
inistered.

blic opinion was ripe for much more sweeping reforms. Of
there was ample evidence in the friendly welcome which
Jewish refugees received from their Christian neighbours in
new homes, in the action of a number of important public
es who petitioned the Govt. in favour of the emancipation
e Jews, and in the protest of many enlightened Russian
iots against a policy which they regarded as detrimental to
sian interests and inconsistent with the spirit of unity which
national crisis demanded. But the reactionary traditions of
old régime were too powerful. Nothing was done for the Jews
916, and the inquiries of other Allied Govts., which were sym-
etically interested in their case, showed that they had nothing
ope for.

was not until the revolution of 1917 that their emancipation
me a possibility. The Jews whole-heartedly supported the
lution, and one of the first acts of the Lvoff Govt. was to
e a decree, dated April 3 1917, for the repeal of "all restrictions
religious and national character." This decree at one stroke
eved the Jews of all disabilities, and it only remained for
m to take their place in the new Russia. There was much dis-
sion in Jewish circles as to what that place should be, and
re was a strong feeling in favour of what was called national
onomy, the suggestion being that the Jews should be recog-
d as a national unit and enjoy, in common with every other
ionality in Russia, a limited measure of self-government.

he Jews had hardly been emancipated before these dreams were rudely shattered by the seizure of power by the Bolsheviks. Among the Bolshevik leaders and their satellites were a certain number of Jews, none of whom, however, played any part in the Jewish community, or had any ties with it beyond their Jewish birth. The great majority of the Jews sided with the moderates and suffered accordingly under the Soviet régime. The communal organisations were broken up, and many of their leaders were imprisoned. Living, as most of them did, by trade, the Jews suffered severely from the economic débâcle which the Bolshevik revolution brought with it, and to add to their distress it became increasingly difficult to send them relief from abroad.

In Rumania the conditions of the Jews remained as deplorable as ever, though they did not suffer from the War in the same degree as in Russia. On May 11 1917, representatives of the committee of native Jews were received by the King, who gave them vague but encouraging assurances. There, however, the matter ended and nothing was done for the Jews until a limited measure of emancipation was dictated by the Germans in the Treaty of Bucharest. The relief thus granted was of little practical value, and there was no change in the policy of the Rumanian Govt., which continued to harass the Jews and treated them with exceptional harshness in the occupied province of Bessarabia.

United States.—As already stated, one result of the disruption of Jewish life in eastern Europe was that the centre of gravity tended to shift to the United States. An American Jewish relief committee, later incorporated in the joint distribution committee, was founded in 1914 and took the lead in organising relief work among the Jews in the stricken areas in eastern Europe and elsewhere. The funds raised for this purpose in the United States during the War and the post-War period are stated to have reached a total of $60,000,000. American Jewry was also active in the defence of Jewish rights in eastern Europe, though in this field at least an equally prominent part was played by the English Jews, who also contributed considerable sums for relief work. At the same time, the American Jews began to play a part of growing importance in the Zionist movement, and were concerned in the negotiations leading up to the Balfour Declaration, of which President Wilson was a consistent and influential advocate (*see* ZIONISM).

III. THE JEWS UNDER THE PEACE TREATIES

The territorial changes which followed the War closely affected the Jews of eastern and southeastern Europe. Two-fifths of them were taken over by Poland, which had more than 3,500,000 Jews among its 27,000,000 inhabitants. About 250,000 Jews were included in Lithuania, about 100,000 in Latvia and about 8,000 in Estonia. Only 3,000,000 Jews remained under Russian rule, as compared with about 7,000,000 in 1914. Of these, two-thirds were in the Ukraine. About 350,000 Jews were left in Austria and about 500,000 in Hungary, as compared with about 2,250,000 in the former Austro-Hungarian Empire. Of the remainder, about 350,000 passed to Czechoslovakia, while as a result of the annexation of Transylvania and the Bukowina, together with the Russian province of Bessarabia, Rumania increased her Jewish population from a little over 200,000 to more than 1,000,000. These changes of allegiance were in themselves not necessarily for the worse, but they involved the disruption of old-established communities and broke them up in fragments, each of which had at once to reorganise its internal life and establish a *modus vivendi* with new and in most cases none too friendly rulers.

The Peace Conference.—It was in these circumstances that the Jewish problem was brought to the attention of the Peace Conference. It presented itself in a twofold aspect. The Allies had already undertaken to facilitate the establishment of a national home for the Jews in Palestine. This undertaking held good, but it was none the less necessary to define and safeguard the rights of the Jewish minorities in eastern and southeastern Europe. As to what those rights should be Jewish opinion was divided. The east European Jews themselves, speaking through their representatives on a body known as the committee of Jewish delegations at the Paris Peace conference, demanded the recognition of the Jews in the succession states as “ national minorities ” enjoying a substantial measure of self-government. This view was supported by the Jewish delegates from the United States but was opposed by those from Great Britain and France, who limited themselves to a programme of “ minority rights ” not implying the creation of anything in the nature of a state within the state.

This more moderate claim was eventually conceded in the Minority Treaties, of which the first was signed by Poland on the one hand and the principal Allied and Associated Powers on the other on June 28 1919. This treaty makes it impossible for Poland to create a class of foreigners possessing no national status, such as the Jews had been in pre-War Rumania. Racial, religious and linguistic minorities are to enjoy complete equality before the law, the free use of their own languages, the right to control their own religious, educational and social institutions and an equitable share of public funds allotted to educational, religious or charitable purposes.

Over and above these provisions, which apply to minorities generally, the treaty specifically empowers the Jews to appoint local committees for the management of their own schools and provides that they shall not be under any disability by reason of their refusal to attend courts of law or vote at elections on the Sabbath. Poland recognises these stipulations as matters of international concern and agrees that they shall be guaranteed by the League of Nations. The league formally guaranteed the treaty on Feb. 13 1920.

Similar obligations, in each case guaranteed by the league, were accepted by Czechoslovakia, Yugoslavia, Rumania, Austria, Hungary and Bulgaria. One important result of these transactions was the emancipation of the Jews in Rumania, including the inhabitants of the old kingdom, as well as of the territories annexed as a result of the War. After the close of the Peace Conference, undertakings on the lines of those contained in the Minority Treaties, though on the whole less stringent, were secured by the Council of the League from Lithuania, Latvia and Estonia. It was only in the exceptional case of Poland that it was thought necessary to make express provision for the Jews, but if the rights which they shared with other minorities were respected, they had little to fear.

Jews in Eastern Europe.—While the Minority Treaties were being negotiated in Paris a dangerous situation was developing in eastern and southeastern Europe. The Jews were in an unenviable position, both in the succession states, where an intolerant Nationalism was in the ascendant, and in what was left of the dismembered empires, where scapegoats had to be found for the humiliations of the peace settlement. They were peculiarly exposed to attack in the atmosphere created by Bolshevism in Russia and its momentary irruption into Hungary.

The Tsarist régime had subjected the Jews to a pitiless and systematic persecution. Most of them threw themselves, when the revolution came, on to the side of the Moderates, but among them were some who, goaded to desperation, developed what may be called a destructive mania. There was no Jewish blood in Lenin himself, but both in Russia and in Hungary a prominent part in the Bolshevik movement was played by men who, though long dissociated from the Jewish community, were nevertheless of Jewish birth. In both countries the overwhelming majority of the Jews were anti-Bolshevik, not only on grounds of principle, but also because the bulk of them were traders and belonged to the very class which had most to lose from a Bolshevik victory. Nevertheless, the enemies of the Jews branded them indiscriminately as Bolsheviks, and the alarm which the Bolshevik menace excited in Europe at the close of the War gave an impetus to reactionary forces which singled out the Jews as their targets.

In Poland the Armistice was followed by a series of anti-Jewish excesses which led the British Govt. to send out Sir Stuart Samuel on a mission of inquiry. The Samuel report shows that in disorders which occurred in the year after the War not less than 348 Jews were killed and a much larger number wounded. The more serious excesses were confined to the areas of Lemberg, Pinsk and Vilna, where Poland was still at war with the Ukr
ians and the Bolsheviks, but there were spasmodic outbreak
many parts of Poland proper, and throughout the country
Jews were suffering from a sustained commercial boycott.

In Hungary, the collapse of the Bolshevik revolution un
Béla Kun led to a violent reaction, which vented itself in atta
on Jewish life and property, while the sufferings of the Jew
population were aggravated by acute economic distress. Th
were also disturbing, though less violent, outbreaks of a
Semitism in Austria and in various parts of Germany, m
especially in Bavaria. But the principal storm-centre was
southern Russia, where the Poles, the Bolsheviks and the arm
of Gen. Denikin fought over the body of the still-born Ukrain
Republic. The British Minister in Warsaw reported in J
1920 that “ the massacres of Jews by Ukrainian peasant ba
can find, in their extent and thoroughness, no parallel except
the massacres of Armenians in the Turkish Empire ” (Sir
Rumbold to Lord Curzon, in *Report of Sir S. Samuel on*
Mission to Poland, Cmd. Paper 674, 1920). It was not u
1921 that the storm began to die down. By 1922 the Sov
Govt. which was now in possession, had restored some meas
of order, but massacre was succeeded by famine and pestilen
Early in 1923 there were reported to be 100,000 homeless Jew
orphans in the Ukraine, and in Odessa the Jewish death-rate
1922 is said to have reached 200 per 1,000. In Soviet Rus
there were no massacres, but though order was fairly well ma
tained, the Jews suffered from the Communist régime, wh
deprived them of their livelihood as traders, waged war on Ju
ism in common with other religions, and was ruthless in its me
ures against “ counter-revolutionaries,” with whom it was
posed to class the Zionists and, indeed, all Jews who clung to th
religious or national traditions.

As a result of the conditions thus created in eastern Eur
200,000 destitute Jewish refugees were set adrift in the bor
land between Russia, Poland and Rumania. Responsibility
their maintenance and eventual evacuation was assumed
the Jewish Colonisation Assn. and other Jewish bodies. As
as the end of 1925 there was still a residue to be provided
but the bulk of the refugees had by that time either been re
triated to Russia or been enabled to find new homes in
United States, Canada, Cuba, Argentina, Mexico or Palest
This was only one, though it was the most poignant, aspec
the problem of the Jewish emigration. Throughout the crow
Jewries of eastern Europe there was a growing desire to esc
from conditions which seemed to hold out little prospect of a to
able future. Between 1919–23, 238,000 Jews emigrated to
United States, while between 1919–25, 67,000 Jews emigra
to Palestine. In 1924 the Johnson law virtually closed the Uni
States to emigrants from eastern Europe. There was no lo
room for immigrants in Great Britain, and Palestine stood
itself as the one country in which the Jews had in principle
assured right of entry under an international guarantee.

The Period Since 1922

Since 1922 there have been no anti-Jewish excesses on t
scale of those which occurred immediately after the War, tho
in many parts of Europe there have been spasmodic outbrea
Nor have the Minority Treaties been entirely ineffective in sa
guarding the rights of Jews, though it has occasionally be
suggested that they have not been an unmixed blessing, in
far as they may have tended in some cases to keep minori
and majorities apart. But though anti-Semitism has changed
character, it has by no means ceased to give trouble. It h
shown itself in particular in systematic attempts to limit t
number of Jews in schools and universities by means of a *num*
rus clausus. Action on these lines has been semi-officially tak
in Poland and Austria, but the leading case is that of Hungar
where a *numerus clausus* based on legislation enacted in 19
has been openly enforced. The matter has been brought befo
the League of Nations as the guarantor of the minority claus
of the Treaty of Trianon. The Council decided in Dec. 19
to take no immediate steps, in view of the Hungarian Govt.

ance that the law was an emergency measure which would nended in the near future. In Poland, anti-Semitism has ty taken the form of a commercial boycott combined with nistrative pin-pricks, the cumulative effect of which has to place the Jews at a disadvantage in every walk of life. 1924, however, the situation has shown some improvement, n the summer of 1924 a more favourable atmosphere was ed by a formal reconciliation between the Govt. and the h group in the Chamber of Deputies. There is no reason ubt the Government's sincerity, but at the end of 1925 it till to be seen whether it would be able to translate its assur- of goodwill into substantial concessions.

Rumania the emancipation of the Jews has been almost leted, and only a few exceptional cases remain in dispute. ne other hand, the Jews are living under the shadow of an Semitic agitation which gives them no peace. If they have saved from serious excesses, it is due solely to the energy which the Govt. has intervened to keep order. The is true of Austria. Vienna is a hot-bed of anti-Semitism, serious rioting took place during the Zionist congress which there in the summer of 1925. In Lithuania, where the Jews st received liberal treatment, the short-lived Ministry of sh Affairs was abolished in 1924, and the Jews, like the Poles, suffered severely from the intolerant Chauvinism which is in the ascendant. In Soviet Russia the condition of the is more desperate than in any other part of eastern Europe. where they may at least hope for better days, but under the munist régime there can be no future for the traders who the great bulk of the Jewish population.

nd Settlement and Zionism.—In these circumstances, ex- nents have been made in the settlement of Jews on the land. nese the most important is that undertaken in 1925 by the rican Jewish relief organisation known as the Joint Distribu- Committee, which has made arrangements with the Soviet . for the colonisation of an extensive tract of land in the nea. By a large body of Jewish opinion in the United States project has been viewed with misgiving, not so much on its ts, as because it has been suspected of being backed by s unfriendly to Zionism. It has thus had the indirect effect rovoking Zionist demonstrations on an unparalleled scale, inating in Nov. 1925 in a conference at Baltimore at which esentatives of almost all sections of American Jewry pledged nselves to support the establishment of the Jewish national e in Palestine. This incident served to illustrate both the ing strength of the Zionist movement and the importance ne part which American Jewry has begun to play in Jewish rs. When the Jewries of eastern Europe were engulfed in War, the centre of gravity at once began to shift to the United es, and the change in the balance of forces has since be- e yet more marked, though American Jewry is still in process uilding up a Jewish tradition. In the United States, as in land, the Jews did not escape the back-wash of the anti- itic agitation which swept over Europe after the Armistice in both countries they have been to some extent on the de- ive against hostile propaganda, though it has not been of a acter to cause them serious anxiety.

he history of the Jews as a body during the past 15 years is appily bound to be, for the most part, the history of their tions to anti-Semitism. In this somewhat sombre picture stine stands out in sharp relief as the scene of a Jewish ren- ance in which the Jews, as such, are beginning to express nselves as a constructive force. It is for this reason that the blishment in Palestine of the Jewish national home has kin- the imagination of a multitude of Jews in all parts of the d, who see in it, not merely a promise of relief for the vic- of persecution, but the hope of a happier and more digni- future for the Jewish race as a whole (*see* ZIONISM).

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(L. ST.)

JEX-BLAKE, SOPHIA (1840–1912), British medical practitioner, was born Jan. 21 1840 at Hastings, Sussex. After holding a post as mathematical tutor at Queen's College, London, she studied the education of girls in America and became a pupil of Dr. Elizabeth Sewell and later of Dr. Lucy Sewell. Returning to England in 1868, in 1869 after some difficulty she was admitted with other women students to classes in medicine at Edinburgh University and in 1871 to hospitals. After attempting unsuccessfully to compel the university authorities to grant her a degree, she returned to London in 1874 and was largely instrumental in establishing the London School of Medicine for Women. In 1877 she obtained the M.D. degree of Berne and became a licentiate of the College of Physicians, Dublin. In 1878 she began practice in Edinburgh, where in 1886 she established the Edinburgh School of Medicine for women. She retired in 1899 and died at Mark Cross, Sussex, Jan. 7 1912. Her written works include *Medical Women* (1872) and *American Schools and Colleges* (1886). Her niece Katherine (b. 1860) became mistress of Girton College, Cambridge, in 1916; and another niece, Henrietta (b. 1862), became principal of Lady Margaret Hall, Oxford, in 1909. Both retired in 1921.

JIREČEK, HERMENEGILD, RITTER VON SAMAKOW (1827–1909), Bohemian jurisconsult (*see* 15.417), died in Hohenmauth (Vysoké Mýto) Dec. 29 1909. KONSTANTIN JOSEF JIREČEK (1854–1918), nephew of the above, archaeologist and historian, died in Vienna Jan. 10 1918.

JOB ANALYSIS.—This term, widely used since the World War, was applied by the personnel division of the American army to the analysis of occupational activities into their components, by means of which job specifications were drawn up showing exactly what a worker in each occupation was expected to do and be. On the basis of these specifications men were selected to fill positions such as those of chauffeur, gunsmith, etc. After the War the concept of job analysis was carried into industry, education and allied fields, where it is applied not only to the work involved in a trade or part of a trade, but also to the work involved in a profession. In view of this wide use of the term, analysis as it is employed in all kinds of occupational activities must be considered.

Though the term "job analysis" is recent, the technique it employs is not new. Under the term vocational analysis, investigators in vocational guidance have for some years analysed vocational activities into their component parts so as to secure a basis on which a person can choose a vocation. A pioneer study of this nature, *The Machinist*, was made in 1910 by Frederick J. Allen for the Vocation Bureau of Boston, Mass. Similar studies have followed in a number of other communities and for a number of other occupations. Again, the technique, if not the name, was used by the efficiency engineers of the early part of the 20th century. Taylor and others, in endeavouring to discover the unnecessary motions made by workers in industrial operations and in establishing standards of efficient performance, made analyses, dividing each job into units as minute as possible.

Community Surveys.—Educators have used the term and the method in seeking to establish a scientific basis for organising and teaching courses in vocational training. In 1914 the city of Richmond, Va., organised a survey of the community in order to discover its vocational opportunities and needs. Similar surveys followed in other cities, one of the most thorough being that of Cleveland. These surveys employed the method of job analysis, and their reports contain fairly detailed classification and descriptions of the operations involved in the various vocational activities in the communities. In addition to these surveys, analyses have been made in a more or less laboratory manner, having as their aim the dissection of vocational activities for the purpose of formulating methods of giving instruction. Under these circumstances Charles Allen formulates the steps to be taken as follows: (*a*) divide the work into unit operations; (*b*) divide each operation into operating points; (*c*) divide the operating points into two kinds, machine operating points and human operating points. These are then taught to apprentices as units or are put together into projects and taught as larger units.

Analyses by even more strict laboratory procedure have been carried out, chiefly by psychologists, in the effort to discover facts about learning which could be put to use in the training of apprentices. Bryan and Harter investigated telegraphing and discovered the rate at which learners could receive and send at various stages of their progress. Book made a similar study of typewriting. Wells and, later, Hoke investigated, among other things, the nature of the errors which a typist makes. On the basis of these facts a teacher of typewriting can direct a learner in the avoidance of errors and the more rapid acquisition of skill.

Procedure.—Analysis should be made from a number of points of view. Especially is this necessary when made for the purpose of drawing up job specifications or qualifications that must be possessed by the worker. Economic questions should be answered, such as how much money may be earned, how the demand for workers fluctuates, etc. From the physical point of view the analysis should specify the movements that the worker makes, the weights to be lifted and the like. Physiological data should be gathered showing such things as preferable age, height, sensory acuity and also liability to accident or to occupational disease. The psychological phase of the analysis involves a statement of the mental processes involved in the work, the degree of intelligence required, amount and kind of education, temperamental requirements. From the sociological point of view, inquiry should be directed toward the class of workers engaged in the occupation, their nationality, family status, etc. Thus true analysis requires and results in a complete, all-round view of occupational activity.

Prominent Errors.—In carrying out such complex investigations some mistakes are made, such as those due to the temptation to rely on opinions obtained by questioning workers and their employers. This "questionnaire method" has received severe condemnation from scientists and should be used sparingly by investigators in the field of job analysis. In the first place it yields chiefly opinions showing what some one thinks the work is like. Secondly, it usually states the components of the job in general, abstract words such as "accuracy," "quickness" and the like, which do not characterise any occupation in particular, being required in hundreds of different jobs.

Too great dependence on psychological tests is another error. There is a procedure whereby a number of psychological tests are chosen which seem to resemble the work being analysed. Those tests in which the good workers excel and the poor workers fall short are considered to call forth the same mental activities as those required in the job and to constitute therefore the analysed components of the work. As a matter of fact such an assumption is not valid. The activities called forth by the tests are merely test-activities and nothing more. No one can say that they are identical with the psychological processes of the work under consideration.

Scientific Method.—In formulating a procedure which promises scientifically valid results, and will be applicable regardless of the ends for which an analysis may be made, the underlying requirement is that the procedure must conform to the rigid technique of scientific method. It must be unbiassed and dominated only by the desire for the exact determination of co tions. Thorough analysis can be carried on only by trai scientists, though they must have the co-operation and assista of experts in the occupational fields as well.

In conducting an analytic investigation the first task is survey the entire vocational field in which the activity lies, determine its relation to the social organisation, then to div it into its occupational sections. These are to be describe terms of their relations with each other and their relation to whole field. Then each occupational section is described divided into smaller units. This division may be made by n observation, and the operations may at first be describe qualitative terms, but the descriptions should also be couc in quantitative terms.

Use of Measurements.—Measurement is an indispensable p of the process. The early quantitative analyses of Taylor w made with a stop-watch reading in fifths of a second. As principle of measurement has become more widely extend however, there has come a demand for measurements of grea precision, made with instruments used in the psychologi laboratory for the measurement of intervals of time as small one-thousandth of a second. For example, pictures have be made of the eye-movements made by proof-readers. T chronocinematographic method of Gilbreth offers much prom for the exact measurement of motions and time intervals invol in work operations. Motion pictures of the worker at his w are taken, in which is placed a clock that measures time millionths of an hour. The background in each picture is cro sectioned into squares of predetermined size. By examining t exact position of the worker in each succeeding picture in relati to these squares and to the time-recorder it is possible to det mine how much he has moved and at what rate.

Developments in Britain.—Excellent analytic work is being do in England by the Industrial Fatigue Research Board, organis during the World War for the purpose of assisting workers to do th work with as little fatigue as possible. The board has made analyti investigations on such matters as rest pauses, conditions affec accidents, elimination of waste motion. Though these analyses w instituted primarily to discover and eliminate the causes of unne sary fatigue, the results have been found useful in other ways, esp cially in giving a basis for more effective training of apprentices.

Some indication of the fundamental part which job analysis c play will be furnished by this list of ends which have motivated t various analyses that have been made: elimination of waste m tions; determining standard day's tasks; wage setting; figu accurate costs; arranging grades and routes of promotion; invent trade tests; establishing a curriculum for vocational educatio determining methods of teaching vocational activities; securing basis for choice of a vocation; securing job specifications for the s lection of workers. *See* also INDUSTRIAL PSYCHOLOGY; INTELLIGE TESTS.

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(H. D. K.)

JOFFRE, JOSEPH JACQUES CESAIRE (1852–), Fren soldier, was born Jan. 12 1852 at Rivesaltes, at the edge of th Eastern Pyrenees. According to a tradition preserved in th family, his stock is Spanish and noble, and its proper name Goffre. His great-grandfather fled from Spain for polit reasons, came to France, gave his name the French spelling Joffre, and became a merchant. The grandson of this fir Joffre adopted the trade of a cooper. He had 11 children, o of them being the future victor of the Marne.

The studies of young Joffre at the École Polytechnique we interrupted by the Franco-German War and he took part in th defence of Paris in 1870. Afterwards he passed out from th Polytechnique into the engineers and worked on the fortificatio of Paris. In 1876 he was promoted captain. The loss of hi wife so affected him, however, that he applied for a transfer t

-China, where he took part in the occupation of Formosa 85 and remained three years at Hanoi as chief of engineers. 888 he returned with General Mensier to Paris. In 1889 itered the railway regiment. In 1892 he was sent to Senegal uild a railway from Kayes to Bafoulabe. At the end of , a column commanded by Colonel Bonnier marched on buktu *via* the Niger. Joffre, who was a major, was ordered rm a second column, which was also to march on Timbuktu he left bank of the river. He left Segou on Dec. 27, to ve the news at Goundam at the end of Jan. that Colonel nier had been murdered on the 15th. Nevertheless, he coned his march on Timbuktu undaunted, and entered the n on Feb. 12 1894 after marching 813 kilometres. Some s later he went to Madagascar to form the base at Diego-ez. He was appointed general of brigade in 1900 and ral of division in 1905. While commander of the II. Army s at Amiens he was called to the Conseil Supérieur de la rre in 1910. This council, re-established in 1872, consisted ne generals who in time of war would have the chief comds. General Joffre was entrusted with the direction of the of communication.

nder the system then existing, the vice-president of the her Council became in time of war commander-in-chief of armies in the field. But in time of peace he had very little hority over his future subordinates. He could not determine er promotion or commands. The real authority lay with the f of general staff of the army. General Michel, vice-president he Higher Council, resigned in July 1911, and the Minister War, M. Messimy, decided to unite the functions of vice-sident and those of chief-of-staff of the army in one person, hat in the eventuality of war, the chief of the general staff ld become commander-in-chief. Who was to exercise these ted duties, which constituted a position of considerable power? Messimy thought of General Pau, who refused on the und that he had only 18 months' more service on the active . General Galliéni was due to pass into the reserve even ner. M. Messimy's choice accordingly fell on Joffre, who only 59 years old, and had therefore five years more on the ive list.

or three years Joffre exercised complete authority over the y. He had laid his plan of campaign, known as Plan 17, ore the Conseil Supérieur on April 18 1913. Germany having lared war on France on Aug. 3 1914, he took up the post of mander-in-chief on the 5th. From this day on, the history his life for more than two years was that of the War itself. is silent general, jealous of his authority but undismayed by most tragic events, had to bear on his broad shoulders a ght which only his coolness and energy enabled him to tain. After having attempted in vain to throw himself on flank of the advancing Germans, he was obliged to withdraw left wing a considerable distance. He resumed the offensive Sept. 6, and threw the Germans back to the Aisne in the morable battle of the Marne. He attempted then to turn ir right wing, a frustrated manoeuvre which ended with the al fronts resting on the sea. The Germans first made the empt to break the allied line on the Yser in Nov. 1914, and y failed. The French, in turn, tried vainly to break the rman front in Champagne, in the Woevre, in Artois and ultaneously in Artois and Champagne (Sept. 1915).

These checks, following on rash promises and high hopes, had rmed public opinion. A campaign was conducted against the mmander-in-chief, on the one hand by the friends of General lliéni, who accused general headquarters of having stolen the ry of the Marne; and on the other by the yet more powerful ends of General Sarrail, whom General Joffre had relieved of command in July 1915. They reproached general headarters for their blind confidence in 1914. They accused Joffre rejecting all superior authority and organising a regular vernment at Chantilly. So long as Millerand was Minister War he protected the commander-in-chief. But Millerand s replaced on Oct. 30 1915 by General Galliéni. Joffre had rved under the latter at Madagascar, and Galliéni had suggested Joffre to Messimy in 1911 for the post of chief of general staff. But at the beginning of the War, Galliéni, although designated successor to Joffre, had been left as military governor of Paris instead of being called to general headquarters. Then came the battle of the Marne, followed by rivalry, if not between the two commanders, at least among their general staffs. On Dec. 3 1915, however, General Joffre received, instead of the simple command of the north and northeast, the supreme command of all the French Armies, an appointment which put under his authority the Army of the Orient, commanded by none other than General Sarrail. But trouble was not slow in arising. On Dec. 16 the Minister for War demanded information on the state of the defences before Verdun. On the 18th he received a stiff reply from General Joffre, who offered to resign. Galliéni answered on the 22nd that Joffre enjoyed the complete confidence of the Government. Nevertheless, two months later, on Feb. 21 1916, the Germans attacked in front of Verdun, and the defences, which were incomplete, were forced in as far as the line of forts, to a depth of eight kilometres in four days. On March 7 Galliéni read to the council of ministers a memorandum pointing out the necessity of reforming the high command. His advice was not accepted; he was also ill; he therefore resigned, and was replaced on March 17 by General Rocques.

The new Minister was a personal friend of General Joffre. Nevertheless, the campaign against him lasted throughout 1916. This was partly due to the apparently indecisive result of the great Allied battle on the Somme, and the personal quarrel between Sarrail and Joffre continued. Finally, General Nivelle, commander of the II. Army operating before Verdun, having retaken the fort of Douaumont, appeared as a possible successor to Joffre. A decree of Dec. 13 1916 conferred on Joffre the title of technical adviser to the Government in matters concerning the direction of the War. He continued to hold the title of commander-in-chief of the French Armies. General Nivelle received the command of the north and northeast—that is to say, of the French front. The Army of the Orient again became independent of general headquarters.

What was this post of commander-in-chief and technical adviser? The Senate demanded an explanation. In a secret committee, which sat from Dec. 19 to 23, M. Briand, as Prime Minister, explained the decree of the 13th. The title of commander-in-chief was left to a man who had played an historic part and who deserved every consideration; but it implied no authority either over General Nivelle or General Sarrail, who remained free to conduct operations as they wished. Joffre would be consulting member in the War committee, which was merely an organ of preparatory work, its decisions being submitted to the council of ministers. However, on Dec. 13, M. Briand had made changes in the Cabinet, and had called General Lyautey to the Ministry of War in place of General Galliéni. Lyautey arrived in Paris on the 24th. He considered the post of commander-in-chief and technical adviser granted to General Joffre as incompatible with the authority of the Minister of War. These two offices were suppressed, but in compensation, General Joffre was created Marshal of France on Dec. 26. In the spring of 1917 he made a journey to North America. The Academie française made him a member on Feb. 14 1918, and he took his seat there on Dec. 19th. (H. Bi.*)

JOHANNESBURG (*see* 15.431).—In 1921 the population of the municipal area was 282,921, and of the suburbs 5,210. Of the inhabitants 151,836 were whites and 6,229 Asiatics. In 1911 the population was 237,104, compared with 155,642 in 1904. Its prosperity is bound up with the gold mines of the Witwatersrand, and it is the centre for the other municipalities on the Rand. Between 1910 and 1925 the town council acquired and worked all public utility services and the live-stock and produce markets. Law courts, a town hall and a municipal art gallery were completed by 1915. In 1922 the University of the Witwatersrand was constituted; it had grown out of the South African school of mines and technology. New buildings for it were erected in Milner Park, the site being given by the town council. In 1922 the

Anglican diocese of Johannesburg was created. A cathedral in the Romanesque style was designed, the Lady Chapel being first built. On the other hand, the Asiatic and native locations at Vrededorp, within a mile of the centre of the city, remained in an insanitary and shocking condition. The South African Asiatic Inquiry Commission wrote of the location in 1920: "It is difficult to conceive a worse slum existing in any part of the world." Certain reforms followed, and in 1924 the Union Government took powers to enforce throughout the Union decent conditions in native locations.

Johannesburg was the scene of riots in 1913–4 arising out of strikes by white miners and railwaymen, and in 1915, when, following the sinking of the "Lusitania," German property valued at fully £500,000 was destroyed. In 1917 the first South Africa trade union congress was held in the city. In 1919 there were strikes and disturbances among the native workers in the mines. Early in 1922 the white miners on the Rand went on strike; the movement was captured by communists and developed into an armed revolt, with street fighting extending to the centre of the city. Prompt action crushed the revolt by the end of March.

JOHN, AUGUSTUS EDWIN (1879–), British painter, was born at Tenby, Wales, Jan. 4 1879. He received his art education at the Slade School, London, and afterwards worked in Paris, later spending some time in Provence. He became a regular exhibitor at the New English Art Club, and in 1901–2 was teacher of art at University College, Liverpool, returning to London in 1902. His earlier work includes "The Way Down to the Sea" (1906), "The Kitchen Garden," "The Smiling Woman" (1910) and "The Mumpers" (1912). For the Arts and Crafts Exhibition at Burlington House, London, 1916, he executed a mural decoration illustrating "Peasant Industry." During the World War he held a commission as official artist in the Canadian Corps, and exhibited at the Canadian War Memorial Exhibition, 1919, a cartoon for a large decoration, "Canadians opposite Lens." He was later commissioned to paint the chief characters of the Peace Conference. He also painted portraits of Mr. Lloyd George (1916), Mr. Bernard Shaw (1916), Lord Fisher (1917), Lord Sumner (1918–9) and the Marchesa Casati (1918–9). His etchings form an important part of his work, the majority being produced between 1901–10. He is represented in the Tate Gallery by several pictures, including "The Smiling Woman," "Peasant Industry," "Robin," (1917–8), and "Rachael," and in the Print Room of the British Museum. His early work, with its definite contour enclosing areas of colour, relates him to the *quattrocento* Italian painters. Distortion for personal emphasis and decorative effect is another marked characteristic. In 1921 he was elected A.R.A. The Alpine Galleries Exhibition held in London (1923) showed John's versatility and energy in astonishing degree, interest being especially roused by his portrait of Mme. Suggia, the large imaginative composition entitled "Symphonie Espagnole"—in the vein of El Greco—and the studies of "Gitanas."

JOHNS HOPKINS UNIVERSITY (*see* 15.460).—The period from 1910 to 1925 was one of marked expansion. The productive endowment rose from some $4,500,000 to more than $21,000,000. The faculty grew from 189 to 394, with 67 additional instructors in the afternoon, evening and summer courses; students from 752 to 4,260 (2,601 not being candidates for degrees); the library from 148,242 to 273,652 bound volumes. Frank Johnson Goodnow, of Columbia University, constitutional adviser to the Republic of China, succeeded Ira Remsen as (third) president in Oct. 1914. Upon an initial state appropriation of $600,000, continued by annual grants of $50,000, a School of Engineering was opened in 1913, with instruction in civil, electrical and mechanical branches, extended in 1924 to include gas engineering, through gifts of the Southern Gas Assn. for five years. For this school two laboratories and a powerhouse have been erected.

In 1916 the move from the old site to Homewood was completed except for chemistry, which occupied its new laboratory in 1924. The tract is expertly developed, the arrangement of buildings a Latin cross, the style Colonial. A war memorial
dormitory was opened in 1923 in the name of the alumni.
ingeniously equipped laboratory in plant physiology, bota
garden and arboretum, athletic fields and concrete grand-s
complete the development to 1925.

In 1909 the university, in co-operatoin with Goucher Col
initiated college courses for teachers (now the College
Teachers); in 1911, summer courses; in 1916, evening cou
without degrees, for technical workers and in business econo
Extension to other state centres was authorised in
A School of Business Economics, providing academic trai
for business careers, and conferring the degree of Bachel
Science in economics, was opened in 1922.

Teaching in Medicine.—Medical development was
nounced in this period. The university received from
to the present, gifts and grants to about $20,000,000.
clinical departments of medicine, surgery, pediatrics, ob
rics, psychiatry and ophthalmology were placed on a
time basis. The General Education Board led with sev
large grants in all these cases, besides two laboratori
the new Hunterian (1915) and the pathological (1923)—
$3,000,000 for expansion now in process, including cen
heating plant (1925). Capt. Joseph R. DeLamar, who
in 1918, left bequests amounting to over $3,700,000 to d
In 1923, $2,000,000 was voted by the Carnegie C
for a new dispensary, and a similar amount was raised
endow the university Dept. of Psychiatry and the Phi
Psychiatric Clinic at the Johns Hopkins Hospital, one-
coming from the founders, Mr. and Mrs. Henry Phipps.
1925, the Wilmer Ophthalmological Institute, named after
first director, Dr. William Holland Wilmer, with endowm
of the university Dept. of Ophthalmology, was established at
hospital on a fund of $3,000,000 raised. Advanced ophthal
logical training in America is thus for the first time possi
The university has also profited from the establishment of
three other clinical institutes at the hospital, Harriet L
Home for pediatrics (1912), Brady Urological Institute (19
and the Woman's Clinic for obstetrics (1923), all teach
hospitals staffed from the school.

In 1918, under the direction of Dr. William H. Welch, assis
by Dr. William H. Howell, former dean of the School of Me
cine, a School of Hygiene and Public Health was opened, w
an annual grant from the Rockefeller Foundation, which
1922 became an endowment of $5,000,000, with another milli
for a building, which was completed and occupied in 19
This is the only institution of its kind in the United States, a
placed alongside the Hospital and the School of Medicine,
creates one of the strongest medical centres in the Americ
The main objects of this school are to train for public hea
work, promote investigation and disseminate sound hygie
knowledge. The degrees granted are Doctor of Public Heal
Doctor of Science in Hygiene and Certificate in Public Heal
Of the 150 students enrolled in 1924–5, 42 came from forei
countries. In 1925 the Institute of Biological Research w
established on a five-years' grant from the Rockefeller Found
tion, and in the same year announcement was made of t
Walter Hines Page School of International Relations, a pion
memorial to a former fellow. A minimum endowment of $1,00
000 was being sought in 1925, and it was announced that t
school was expected to open in 1927.

Scientific Expeditions.—The university dispatched four scie
tific expeditions abroad during this period, two botanical
Jamaica in 1910 and 1919, and two geological to South Ameri
for the first detail cross-section of the Andes, in 1919 and 19
while a fifth, to the Near East for archaeological explorati
and excavation (1924), was under the conduct of a faculty me
ber. Publication was very active, a current report recordi
some 600 printed contributions a year.

War Services.—The institution's service in the World War w
prompt, notably its staffing of Base Hospital No. 18, whi
crossed with the first contingent and provided the A.E.F. wi
its chief consultants in medicine, surgery, genito-urinary di
eases and medicine to the Air Service. An ambulance unit w

nised. Schools of navigation and marine engineering, under Shipping Board, were operated. The laboratories were turned to experimentation, while large numbers of the faculty students scattered to a great variety of service, field and ian. Twenty-four, who made the supreme sacrifice, are norialised on marble in Gilman Hall. (M. L. R.)

OHNSON, HIRAM WARREN (1866–), American politi- , was born at Sacramento, Cal., Sept. 2 1866. He entered University of California, but did not finish his course. He ime a reporter, at the same time studying law in his father's :e; was admitted to the bar 1888, and practised with his father his brother in Sacramento. In 1902 he opened an office in Francisco, where he became widely known in 1906–7 for vigour and success with which, as prosecuting attorney, he :eeded against dishonest public officials and corporations. was elected Governor of California for the term of 1911–5; in 1912 was an unsuccessful candidate for vice-president the ticket with Theodore Roosevelt), as nominee of the National Progressive party, which he had helped to organise. As ernor he signed in 1913 the Webb anti-alien bill, designed to hibit the ownership of land in California by Japanese, although the President had asked for delay. He was re-elected ernor 1915–9, but resigned in 1917, having been elected a . Senator. He opposed many of the policies of President Wil- 's administration and declared that a league of nations would olve the United States in European wars. At the Republican tional Convention in 1920 he had considerable support as sidential candidate, especially from those opposed to the igue of Nations and the Treaty of Peace as submitted to the iate. He was re-elected U.S. Senator for the term 1923–9.

OHORE: *see* MALAY STATES.

OINTS AND SINEWS: *see* MANIPULATIVE SURGERY.

ONES, ROBERT EDMOND (1887–), American theatrical igner, was born at Milton, N.H., Dec. 12 1887. He graduated n Harvard University in 1910 and began designing scenery the theatre in New York City the following year. He attcted attention by the boldness and originality of his concepis and exerted a marked influence in American theatrical art. iong the plays for which he designed the stage settings were *Man Who Married a Dumb Wife*, for Granville Barker (1915); *e Jest* (1919), *Richard III* (1920) and *Macbeth* (1921), for hur Hopkins; *The Birthday of the Infanta* for the Chicago era Association (1920); and *Beyond* and *Desire Under the Elms* the Provincetown Playhouse (1924). He published with K. cGowan *Continental Stagecraft* (1922) and *Drawings for Theatre* (1925).

ONES, THOMAS RUPERT (1819–1911), British geologist 15.500), died at Chesham, Bucks. April 14 1911.

ONESCU, TAKE (1858–1922), Rumanian statesman, was born Ploesci Oct. 26 1858, and after studying law in Paris was in 34 elected a deputy. He was Minister of Public Instruction Finance in various Conservative Cabinets until 1908 when founded the Conservative-Democratic party. In 1912 his oup formed a Coalition Cabinet under Maiorescu, in which iescu was Minister of the Interior. He represented Rumania the Peace Conference of Bucharest in 1913, and in 1914 he gotiated at Athens the peace between Greece and Turkey. hen the World War broke out, Jonescu was, from the first, favour of intervention on the side of the Allies. In 1918 he nt to Paris, and as head of the Rumanian national committee contributed greatly to the re-integration of Rumania in her hts as an ally when Germany was finally defeated. Jonescu s appointed foreign minister in April 1920; in the Averescu vt. and, together with Dr. Benes and Ninčić, the Czecho- vak and Yugoslav foreign ministers, he laid the foundation the Little Entente (*q.v.*). In Dec. 1921 he was entrusted by e King with the formation of a new Cabinet on the underinding that he should endeavour to govern with the same iambers. This proved to be impossible and on Jan. 18 1922 he signed. He died in Rome June 21 1922.

JORDAN, DAVID STARR (1851–) (*see* 16.406), American ucationalist and naturalist, was born at Gainesville, N.Y., Jan. 19 1851. He studied at Cornell University and at the Indiana Medical College. He was instructor in botany at Cornell 1871–2, and professor of natural history at Lombard University, Ill., 1872–3. He taught in the Indianapolis high schools 1874–5; in which latter year he was appointed professor of biology at Butler University, Indianapolis. In 1879 he became professor of zoology at Indiana University, of which institution he was made president in 1885. In 1891 he was appointed president of Leland Stanford, Jr. University, becoming its chancellor in 1913 and retiring in 1916. He was a member of the U.S. Fish Commission, 1877–91, 1894–1909; U.S. Commissioner in charge of fur, seal and salmon investigations for Alaska; and international commissioner of fisheries for Canada and the United States, 1908–10. He was active in promoting the cause of international peace, being chief director of the World Peace Foundation, 1910–4, president of the World's Peace Congress, 1915, and vice-president of the American Peace Society.

He was the author of a large number of books, among which are *Fishes of North and Middle America* (with B. W. Evermann, 4 vol., 1896); *Evolution and Animal Life* (with V. L. Kellogg, 1907); *World Peace and the College Man* (1914); *Classification of Fishes* (1922), and *Days of a Man* (autobiography in two vol., 1922).

JORGA, NICOLAS (1871–), Rumanian historian and statesman, was born at Botosani June 17 1871. At the age of 13 he was already writing articles on foreign politics in the *Românul*, a provincial newspaper. At 19 he finished his university studies in Jassy and went to Paris, Berlin and Leipzig. In 1894 he was appointed professor of universal history at the University of Bucharest. A man of great culture, Jorga made extensive researches in libraries and archives abroad and collected notes referring to the history of the Rumanian nation. As a result of his researches, he published over 20,000 documents in the *Annals* of the Rumanian Academy, of which he became one of the most prominent members.

Jorga produced numerous biographical and historical works, as well as many volumes on Rumanian art, towns, monasteries and historical monuments. He wrote several plays (historical dramas and comedies) which form part of the repertory of the Rumanian national theatres. He became also the director of *Neamul Românesc*, the official organ of the National Rumanian party. Jorga was for many years the chief of the nationalist party, which fused with the National party of Transylvania and the followers of Take Jonescu under the name of the National Rumanian party.

Among his best known works are: *Geschichte des rumänischen Volkes* (1905); *Geschichte des osmanischen Reiches*, 5 vol. (1908, etc.); *The Byzantine Empire* (Engl. trans. by A. H. Powles, 1907), and *Histoire des états balcaniques jusqu'à 1924* (1925). He also wrote numerous historical works in French, Italian and Swedish.

JOURNALISM: *see* NEWSPAPERS.

JOUVENEL, HENRI DE (1876–), French politician, was born in Paris April 2 1876. Having secured his degree in philosophy, he adopted a political career. Secretary of the committee of democratic conferences in 1900, he was made *chef de cabinet* in the ministry of justice in 1902, and *directeur de cabinet* in the ministry of commerce in 1905. He entered journalism shortly afterwards as chief correspondent on *Le Matin*. In Jan. 1921 M. de Jouvenel was elected Senator for the Corrèze. As member of the foreign affairs commission, he played an important part in the debates of the Senate, and attracted much attention by his ardour and outspokenness. He was chosen by M. Poincaré in 1922 to represent France on the Assembly of the League of Nations where he was instrumental in admitting Abyssinia to the League, and took an active part in the work of the commission of intellectual co-operation. He again represented his country in the League in 1924, and also became Minister of Public Instruction in the second Poincaré Cabinet in the same year. In 1925 he was appointed French high commissioner in Syria in succession to General Sarrail, whose administration had been signalised by serious disturbances. De Jouvenel at once set himself to the task of pacification, but realising the need of amicable relations with neighbouring countries he went to Angora early in 1926 and prepared a treaty with Turkey to be ratified by the French Government.

JOWETT, JOHN HENRY (1864–1923), British divine, was born near Halifax, Yorkshire, Aug. 25 1864. He was trained for the Congregational ministry at Airedale College, Bradford, the University of Edinburgh and Mansfield College, Oxford. In 1889 he was elected minister of a Congregational church at Newcastle-upon-Tyne, which pastorate he held until 1895 when he was chosen to succeed Dr. R. W. Dale at Carr's Lane Chapel, Birmingham. During the 15 years of his ministry there his reputation as a preacher grew steadily, and his name became known, not only throughout Great Britain, but also in America. In 1911 he went to the United States to become pastor of Fifth Avenue Presbyterian Church, New York. After the signing of the Armistice in 1918, he returned to London as minister at Westminster Chapel, Buckingham Gate, London. In 1920 his health began to fail, and two years later he was obliged to retire. He died Dec. 19 1923. In the course of his career he was chairman of the Congregational Union and president of the Free Church Council.

Jowett published a number of books of a devotional character, including *The High Calling* (1909); *Our Blessed Dead* (1909); *The Whole Armour of God* (1916); *The Friend on the Road* (1921); *Life in the Heights* (1924). See A. Porritt, *John Henry Jowett* (1924).

JOYCE, JAMES (1882–), Irish author, was born in Dublin Feb. 2 1882, and was educated at Clongowes Wood College, Belvedere College, and at University College, Dublin. His first published work was a small volume of lyrics, *Chamber Music* (1907). *Dubliners*, a set of tales and studies of Dublin personalities, followed in 1914, a novel, *A Portrait of the Artist as a Young Man*, in 1916, and *Exiles*, a play in 1918. Meanwhile Joyce had left Ireland, and lived abroad, in Rome, Zurich, Trieste and Paris. In 1922 appeared the fruit of his work between 1914 and 1921, *Ulysses*, published in Paris. This book, conceived and executed on a very ambitious scale, attracted much attention among critics and men of letters, in France as well as in England and America, as a portent of certain modern tendencies in the development of the novel; but its legally restricted sale, apart from its grammatical, verbal and moral difficulty, has left it little known to the general public.

JOYNSON-HICKS, SIR WILLIAM (1865–), British politician, eldest son of Henry Hicks, of Bexhill, was born on June 23 1865. The additional name of Joynson was assumed on his marriage in 1895 to Grace, daughter of Richard Hampson Joynson, of Chasefield, Bowdon. From 1888 he practised as a solicitor in London. He contested N. Manchester (1900) and N. W. Manchester (1906) as a Conservative, both unsuccessfully, but in 1908 he won the latter seat from Mr. Winston Churchill, who had sought re-election on his appointment as President of the Board of Trade. At the first general election of 1910, however, he was defeated. He returned to Parliament in 1911 as member for the Brentford division of Middlesex, and from 1918 represented the Twickenham Division. During the latter days of Mr. Lloyd George's administration Sir William—he had been created a baronet in 1919—was prominent among those who favoured the withdrawal of the conservatives from the Coalition, and in the Conservative Govt. which was formed by Mr. Bonar Law in 1922 he was successively Parliamentary Secretary to the Overseas Trade Department, Postmaster-General and Paymaster-General and Financial Secretary to the Treasury (with a seat in the Cabinet). When Mr. Baldwin succeeded Mr. Bonar Law as Prime Minister (1923), he became Minister of Health and, in Mr. Baldwin's second administration (1924) he was appointed Home Secretary. Sir William took an active part in the affairs of the Church of England and was recognised as one of the lay leaders of the Evangelical party. He did valuable work in connection with the development of automobilism in Great Britain—notably as chairman of the motor legislation committee of the House of Commons—and is the author of *The Law of Heavy and Light Mechanic Traction on the Highways* (1906).

JUBALAND, East Africa, formerly a province of Kenya Colony. On June 29 1925 the sovereignty over some 36,000 sq. m., the greater part of the province, and including the
of Kismayu, was transferred from Great Britain to I
Trans-Juba (Oltre Giuba) the ceded territory, which adj
Italian Somaliland, was placed under a high commissic
directly dependent on the Colonial office in Rome. Before
transfer the river Juba (*see* 15.531) formed the frontier.
valley of the Juba is fertile, the rest of the area is semi-
The inhabitants (some 150,000) are Somalis whose chief we
is in cattle and camels. (*See* KENYA; SOUTH AFRICA: HISTO

The British White Paper *Treaty Series No. 29* (*1925*) g
the text of the Anglo-Italian treaty and a map. See also R. C
Il Giubaland (Naples, 1921).

JUDAISM: 1910–25 (*see* 13.186).—It is no exaggeratio
say that the 15 years under review have been to Israel a pe
of woe and disaster, as well as of consolation and hope, suc
no similar period since the Dispersion.

Russia.—The darkest part of the picture is Russia, the fo
tain in modern times of the old Jewish life and, before the W
the home of one-half of the world's Jewish population. W
the period opened, Mendel Beilis, and with him Judaism a
religion and the whole Jewish people, stood arraigned in
courts of the Tsar at Kieff to answer the hideous charge of rit
murder. In vain the friends of humanity in England, Fra
and Germany protested that this accusation of religious ca
balism was an utterly baseless libel on Judaism, an insult
Western culture, and a dishonour to those who formulate
The Russian bureaucracy recoiled from no means that wo
insure the conviction of Beilis, as it would have furnished a c
venient apologia for pogroms, past and future. However,
Nov. 1913, an all-Russian jury acquitted Beilis.

One other instance to show the atmosphere in which Russ
Judaism had to live during the last years of the Romanoffs.
the same year, at the International Congress for the Suppress
of the White Slave Traffic held in London, Hertz called the att
tion of the world to the infamy of the Tsarist " yellow ticke
by which any Jewish woman, if she was willing to be registe
as a prostitute, was permitted free and unrestricted reside
throughout the Empire; whereas all other Jews and Jewes
were confined to the pale of Settlement, which was one of
fiercest battlegrounds of the World War.

The Jewish cities were taken and retaken by the rival armi
with attendant bombardments, burnings and pillagings. Add
to these were the summary expulsions and calculated inhuma
ties which the Russian military authorities perpetrated agai
the Jewish population. As a result, scores of important co
munities were ruined, and their religious institutions, th
rabbinical academies, together with every form of Jewish c
tural activity, destroyed to their foundations. Of the survivi
communities, hundreds were later annihilated during the ma
sacres of the Jewish population in the Ukraine during the yea
1919–21, massacres that for thoroughness and extent are su
passed by those in Armenia alone.

The Russian revolution completed this break-up of Russi
Jewry and its religious life. At first constitutional, the revol
tion brought full religious emancipation to all, but in the uniq
persecution of all religion that began soon after the Bolshevi
came into power, Judaism had to suffer most. Jewish co
munists have, from the first, taken a sinister delight in t
proscription of all Jewish religious teaching—whether in t
rabbinical colleges, in the elementary religious schools or ev
in homes. Synagogues were confiscated and converted into wor
men's clubs (as late as Sept. 14 1925), and even into stables.

During 1925 the bitter fight against religion seemed to ha
relaxed somewhat, and Christian and Mahommedan bodies a
now allowed to give religious instruction to small " groups "
their children after school hours. In the case of Jews, howeve
two children have been declared to constitute a school, and su
ject to the dire penalties for teaching religion or Bible to chi
dren at a school. Religious instruction is therefore given cla
destinely, underground or in lofts and at midnight, as in t
days of the Inquisition. In Dec. 1925 two teachers were se
tenced at Kieff to six months imprisonment with hard labo

this offence; and 200 children were imprisoned at Vinnitza, olia, for refusing to betray the name and whereabouts of r religious teachers. Zionists were pursued with a Tsar-like city, hundreds of them having been banished to Siberia. use of Hebrew as a bourgeois language is suppressed.

hese persecutions called forth among the faithful remnant a fervour and a deeper self-sacrifice for their faith; but Jewish itutional religion became paralysed in Soviet Russia, and religious outlook for the growing generation is dark indeed. ore the War, the intense religious and intellectual life of ssian Jewry was duly reflected in the works of a whole galaxy abbinical, Hebrew and Yiddish writers. With the outbreak hostilities all Hebrew and Yiddish publications of any kind e forbidden. After the revolution there was a brief literary ival, which was soon strangled by the Bolshevists.

Poland, Baltic and Balkan States.—Jewish religious life has in main resumed its pre-War aspect in Poland, the Baltic and Balkan countries, despite the economic ruin of a large por- n of the Jewries wrought by racial hatred and social unrest those politically immature states. In Poland a widely rami- net of Hebrew-speaking schools, both elementary and second- , has been founded by the *Tarbuth* organisation, and is recog- ed by the Government. In Greece, the only large, and auton- ous Jewish community of Salonika is declining in conse- ence of the failure of the Greek Govt. to keep the solemn dges it gave to respect the Jewish Sabbath. Its important binate is unfilled. In Turkey, the status of all religions has dergone violent transformation under the secularising Kemal- *régime*. The activities of the Chief Rabbinate, which hither- had practically the same powers as the Patriarchates of other nominations, were limited to ecclesiastical matters, and the ngregations were organised on autonomous lines. The Chief bbi, Chacham Bashi Bijerano, introduced far-reaching reforms the Jewish law of divorce. These have, however, not found cognition with the rabbinic authorities of other lands.

France and Central Europe.—Judaism in France has been engthened by the accession of the important religiously con- vative congregations of Alsace-Lorraine; as well as by the oroccan communities now under French control. In 1924, the and Rabbi of France, M. Israel Levi, appealed to the leaders east European orthodoxy to consider the enactment, in cordance with rabbinic law, of modifications in certain aspects the Jewish marriage and divorce law (Agunah). Italian wry found itself threatened by the new education law, with compulsory Catholic instruction.

Even a graver danger is its dearth of native rabbis. In Geneva wish questions of great religious consequence are often dis- ssed. In Feb. 1925 a proposal was submitted to the League Nations Commission of Inquiry into the reform of the calen- r to introduce " blank days " (*i.e.*, the last day or days of the ar to be considered outside the calendar). As one result of this ould be a constantly backward moving day of rest, the proposal as strongly and successfully opposed by the representatives of e Jewries of the East and of the West. In Germany, Czecho- ovakia, Austria and Hungary, the War and the dire condi- ons that followed it are responsible for the impoverishment of e Jewish schools of learning and the thinning of the ranks of e scholars and students.

Literature.—Among the noteworthy productions in the study Judaism written during this period by Central European holars are the works of the neo-Kantian philosopher Hermann ohen, *Die Religion der Vernunft aus den Quellen des Juden- ms* (1919), the magnum opus of Immanuel Loew, *Flora der uden*, of Simon M. Dubnow, *Weltgeschichte des Jüdischen olkes* (World History of the Jewish People) in 10 vol. ppearing in German and Hebrew (1925, etc.), of Ismar Elbogen, *er Jüdische Gottesdienst*, on the Jewish Liturgy (1913), of . Krauss, *Talmudische Archäologie*, 3 vol., on Jewish life in almudic times, and the *Monumenta Talmudica* (1914, etc.). The ollowing savants died in the period under review: Wilhelm Bacher, Abraham Berliner, David Hoffmann, D. H. Müller, . Harkavy, A. Epstein, Hermann Cohen and Jakob Guttmann.

British Empire.—In England Dr. Hermann Adler, the Chief Rabbi of British Jewry, died in 1911, and was succeeded by Dr. J. H. Hertz. In 1913 a Yeshivah—an institution devoted exclusively to Talmudic instruction—was for the first time opened in London. After the cessation of hostilities a comprehensive educational scheme was launched as a Jewish war memorial; and in 1920 the Chief Rabbi started on the first pastoral tour ever undertaken to the Jewish communities of the British overseas dominions. The Liberal Jewish movement, inaugurated at the beginning of the century, finally established itself by the erection of a synagogue in 1925. An attempt to attach a Liberal wing to Jews' College—the theological seminary of the Orthodox congregations—met with strong opposition. In Anglo-Jewish scholarship there are Principal Büchler's learned monographs; Israel Abrahams' *Studies in Pharisaism and the Gospels* (1917, etc.); Jacob Mann's *Jews in Egypt* (1920–2); and M. Gaster's *Exempla of the Rabbis* (1924). *The Pharisees* (1924) —by R. T. Herford, a Christian scholar—is a remarkable achievement. Israel Zangwill has produced a translation of Ibn Gabirol's Poems, *Selected Religious Poems* (1923); Nina Salaman, of Yehudah Halévy; and Dr. A. Cohen, of Berakhoth, *The Babylonian Talmud* (1921). Among popular works, there are C. G. Montefiore's books *Liberal Judaism* (1903–24) and the Chief Rabbi's anthology, *A Book of Jewish Thoughts* (1917 and 1920).

The United States.—The 3,600,000 Jews of America have now their own English version of the Bible, the result of many years' labour on the part of a group of scholars, among them Solomon Schechter and Joseph Jacobs. America has acquired great Jewish libraries, that of the New York Jewish Theological Seminary (including the Elkan Adler collection) being the largest in the world. The older rabbinical colleges are workshops of Jewish learning. To these have been added the Yitzchak Elchanan Yeshivah and the Jewish Institute of Religion, representing the two religious poles in American Judaism. Of scholarly works, there appeared Schechter's *Studies in Judaism*, third series (1924), H. Malter's *Saadia Gaon* (1921), J. Jacobs' *Jewish Contributions to Civilisation* (1919) and Israel Davidson's *Thesaurus of Mediaeval Hebrew Poetry*, vol. i. (1924).

The New Diaspora.—Eastern European Jewish emigrants, fleeing from racial hatred and economic ruin, find the doors of the United States all but barred and bolted to them. In consequence, they are scattered and dispersed to distant lands where grave dangers await their Jewishness and Judaism. Outside the Argentine Republic, the fresh arrivals find in most Latin-American countries little organised Jewish life and, too often, total abandonment of Judaism on the part of the earlier settlers. The Jewish Colonisation Assn. of Paris appointed I. Raffalovich as Grand Rabbin of Brazil to lay the religious foundations of the new Jewish centres in the youngest diaspora. Mention must also be made of the praiseworthy efforts of Dr. J. Faitlovich to bring the forgotten Jewish tribes of Abyssinia—the Falashas—into touch with the general body and religious currents of European Jewry.

Palestine.—The brightest spot on the Jewish horizon throughout this period is Palestine. The beginnings of the Jewish revival in the Holy Land date from long before the Balfour Declaration, when Eliezer ben Yehudah began his gigantic undertaking to make Hebrew the language of everyday speech, as well as of instruction in schools. One half of his monumental *Dictionary of the Hebrew Language, Ancient, Mediaeval and Modern*, was published in his life-time. Palestine became the home of Ahad Ha'am—the philosopher of Zionism—and of Ch. N. Bialik, the great neo-Hebrew poet. A Rabbinate for the whole of Palestine was called into existence, with A. I. Kook (Ashkenazi) and Jacob Meir (Sephardi) as joint Chief Rabbis. A Communities' Ordinance will, it is hoped, be promulgated, providing a democratic religious organisation for the Jewish population of the Holy Land.

The zenith of the spiritual revival was reached when the Hebrew University was opened by the Earl of Balfour on April 1 1925. It may be some time before the Jerusalem University fulfils the hope of being the sanctuary of the Jewish genius;

but a land focuses a people and calls forth, as nothing else can, its spiritual potentialities. It is the ardent faith of the architects of the New Palestine that the resurrection of the Jewish people on its own soil will reopen its sacred fountains of creative energy. As of old, only a remnant will return to the land of their fathers. But it is the national rejuvenation of that remnant that may open a new chapter in the annals of the human spirit. *See* JEWS.

BIBLIOGRAPHY.—*Reports*, for the years 1911–25, of the London Jewish Board of Deputies, Anglo-Jewish Assn., and the American Jewish Committee. The surveys of the year in the *American Jewish Year Book* in *Jahrbuch für jüdische Geschichte und Literatur*, and in *The Jewish Chronicle* at the end of the Jewish Year. General summaries of the Jewish situation covering longer periods are presented in the opening addresses at Zionist Congresses and in those of the Chief Rabbi at the Conferences of Anglo-Jewish Preachers. See J. H. Hertz, *Decade of Woe and Hope* (1923). (J. H. H.*)

JUDD, CHARLES HUBBARD (1873–), American psychologist, was born at Bareilly, India, Feb. 20 1873. He came to the United States in 1879, and graduated from Wesleyan University, continuing his studies at the University of Leipzig (Ph.D., 1896). He taught philosophy and psychology at Wesleyan University, New York University and the University of Cincinnati, 1896–1902. From 1902 to 1909 he was a member of the faculty of Yale University, becoming professor of psychology and director of the psychological laboratory. In 1909 he was appointed professor and head of the department of education and director of the school of education at the University of Chicago, where he served also for a period as chairman of the department of psychology. He took part in educational surveys of Cleveland, Denver, St. Louis, the States of Texas and Utah and the New York State rural survey.

His published works include *Psychology, General Introduction* (1907); *Psychology Laboratory Course* (1907); *Psychology of High School Subjects* (1915); *Introduction to the Scientific Study of Education* (1918); and *Psychology of Social Institutions* (1926).

JUDICIAL REFORM.—By judicial reform is here meant changes in municipal law which have for their object the classification and simplification of law or improvement in the administration of justice. It includes, therefore, the more orderly expression of the law as well as changes in the training and qualifications required of members of the bar in the organisation of courts and in judicial procedure. On the other hand, the term does not include those changes in municipal law induced by changes in political, social or economic conditions. The article deals only with the United States, as changes in this direction in other countries from 1910 to 1926 have not been very serious.

Characteristics of the Bar in the United States.—Since the close of the Civil War (1865) judicial reform in the United States, though encouraged and in a sense started by general public criticism of existing conditions, has been carried out only as the result of the efforts of the legal profession.

A member of the bar in the United States is one who has a right to practise in one or more courts of record. The bar in the United States or in any state is not a legally organised body. While each member of the bar of a court has, as such, rights and duties, the members as a group are not a corporation and do not as a body have any privileges or duties. They have not the right to exclude others from being admitted to practice, or even to determine the standards which must be complied with by those seeking the right to practice. They have not the right to establish rules for the regulation of the fees to be charged clients nor to prescribe the conduct to be followed by members of the bar in the practice of law, and they cannot disbar any member of the bar for unethical conduct.

Sources of Judicial Reform.—Judicial reform in the United States, therefore, has come, not through an officially organised bar with definite legal powers, but rather as the result of the action of voluntary associations of members of the legal profession—judges, practitioners and law teachers.

These voluntary law associations are of two kinds—selective and scientific. There are over 400 selective bar associations. These choose their members from the lawyers within a definite territory rather than from the practitioners at a particular court, though, practically, they never admit a person who is not a m ber of the bar of some court. Thus, there is a national bar a ciation known as the American Bar Assn. founded in 1878, a state bar association in each of the states, as well as local associations in all the large cities and in many of the count There has been no integration of these associations. A law may be a member of the American Bar Assn., his state asso tion and his local county or city association. As the name un which they are here classified indicates, these associations all organised on the selective principle. The fact that a per is a member of the bar of a particular court, as for instance, bar of the highest court of his state, while it may be a prerec site for admission, does not entitle him to membership in a association. Before admission to a particular bar associat his application must be passed upon by a committee of the as ciation, the thoroughness of the scrutiny varying with differ associations and in the same association at different times.

With the exception of a few local associations which date fr the first part of the 19th century nearly all the local, as well all the state bar associations, and also the American Bar As have come into existence since the close of the Civil War. T several scientific legal societies are the American Institute Criminal Law and Criminology, the American Society of Int national Law, the American Judicature Society and The Ame can Law Institute. All are of comparatively recent origin. Th are all nation-wide in membership and each has been founded carry on investigation and promote improvement in law, eith generally or with reference to particular subjects. Besides th associations the Assn. of American Law Schools, composed some 60 schools conforming to certain standards of admissi organisation and conduct, has done much to promote impro ment in legal education.

The American Bar Assn. and practically all the state a nearly all the local bar associations have committees which fr time to time submit to their respective associations drafts proposed legislation relating to the organisation of the courts to procedure and other matters pertaining to judicial refor If the association approves the draft, the committee will authorised to submit it to the Legislature of the state and ur its adoption. Rules of court, as well as legislative changes in pr cedure and cognate matters, usually have their origin in t action of these bar associations.

Classification of Recent Judicial Reforms.—In recent yea such judicial reforms as have taken place in the United Stat may be classified as follows:—

1. Those designed to elevate the character and improve the e ciency of the members of the bar.
2. Those designed to improve court organisation.
3. Those designed to unify, clarify or simplify existing law.
4. Those designed to improve procedure.

Reforms Designed to Improve the Efficiency and Elevate Character of Members of the Bar.—The existing requirements admission to the bar are usually a general education equivale to graduation from a high school (the school in which studen prepare for college or university), followed by three years legal study either in a law school, or in a lawyer's office. T states require at least a year in a lawyer's office irrespective the amount of law school training received, and in some of t southern states the required period of legal study is still only t years. Comparing the present requirements with those of t last quarter of the 19th century a decided elevation of standar and improvements in the methods of examination is observ This has been due in the main to two factors: the developme of good law schools in the majority of the states, especially t schools connected with the great state universities where t tuition is practically free, and the activities of the selective b associations. Nearly all of these associations have committ on legal education and admission to the bar and in many stat these committees have been active in urging on courts and Le islatures the necessity for more stringent requirements. In th movement for the elevation of educational standards the Amer can Bar Assn. has taken the lead.

he legal training of the would-be practitioner being now, ecially in the larger centres of population, left almost exclu-ely to the law schools, the selective law associations are taking onstantly increasing interest in the ethics of members of the A code of legal ethics has been formally adopted by the erican Bar Association. In some of the larger cities committees ointed by the local judges at the instances of the bar associa-n make an exhaustive examination of the history of each licant for admission with the view to determining his char-er. There is in most of the counties and in the larger cities a mmittee of censors either appointed by the judges or by the al bar association. These committees receive complaints inst attorneys, and where they believe the complaints well nded and the matter serious, institute in the courts proceed-s for disbarment.

Reform in the Organisation of State Courts.—The unit of te court organisation in the United States was, and largely l is, the county or a unit called the judicial district composed one or more counties. The principal trial court of each county district is independent of similar courts in other counties or tricts of the state. From each of these county or district urts there is an appeal on questions of law to an appellate urt of state-wide jurisdiction. In some states there are two pellate courts, one for cases involving comparatively small ounts, and in some other states a system of intermediate pellate courts, the case on appeal going from the trial court st to the intermediate appellate and finally to the highest court. As legal business in the larger states increased the first tend-cy was to create two or more county courts with co-ordinate isdiction in the counties in which a city was situated. Thus, the city of Philadelphia, which is territorially co-terminus th the county of the same name, there are five separate courts ch having identical civil jurisdiction.

The striking feature of the state court organisation in the ited States is the absence of any co-ordination of the various te courts for the efficient carrying on of judicial business. me progress has been made toward better co-ordination. In ny states, as in New York, the state has been divided o judicial districts, each district including several coun-s, though the extent to which the courts in each district ve been welded into a single and simple organisation ries. Again, in some states power has been given to the ghest appellate court, or to the chief justice of such court to nsfer temporarily a judge sitting in one county or district ich has little judicial business to a county or district where e judges need assistance. There still remains, however, though varying degree in the several states, much to be desired in the y of greater unification of court organisation.

Though little definite progress toward this goal has been made the last 25 years, there now exists a general recognition of its portance. Perhaps on account of the difficulties involved, the itial steps toward better court organisation have come, not so uch through the selective bar associations as through a single ientific legal association—the American Judicature Society. his society was organised in 1913. It has drafted acts estab-shing a unified system of courts for a large municipality and r a state as a whole. The reforms embodied in these acts usu-ly involve changes in state constitutions as such constitutions variably contain at least the general framework and often the tailed organisation of the state courts. The more recent state nventions called to draft new state constitutions have embodied part at least the suggestions of the society, but the constitu-ons themselves have failed of adoption, though the failure nnot be ascribed to the embodiment of the reforms suggested ut rather to a general reaction on the part of the electorate gainst any constitutional changes. In Louisiana a partial adop-on of the suggestions of the society has been effected, and one ty—Detroit—has adopted a unified criminal court, the only ne in the country.

Though the record of the attempts to adjust court organisa-on to the needs of modern America is significantly small, there every sign that the next decade will witness considerable progress, and this because there has already been adopted in several important states acts which create judicial councils with power to collect data concerning judicial administration and the operation of the rules of procedure.

Reform in the Organisation of the Federal Courts.—The Federal courts, other than the Supreme Court of the United States, were re-organised by the Act of Congress of March 3 1911. Prior to the Act, while continental America was nominally divided into nine judicial circuits, the real division for all practical purposes was the district, a much smaller unit. In each district there was a district court and a circuit court, the district court having Federal criminal jurisdiction and jurisdiction in a few classes of civil cases. The circuit courts were the principal Federal civil courts of first instance. There was an appeal directly from the district and circuit courts to the Supreme Court of the United States. The Act referred to abolished the circuit courts, made the district court a court of first instance in practically all Federal civil and criminal matters and divided the United States into nine circuits, with a circuit court of appeal in each circuit to act as an intermediate appellate court on questions of law. The re-organisation of the lower Federal courts has proved of very considerable practical advantage while the establishment of the circuit courts of appeal has greatly relieved the Supreme Court. Had such relief not been given, the great increase in the number of Federal cases, owing partly to the natural growth of the country and more especially to the adoption of prohibition and its enforcement by Federal statute, would have created a congestion of cases in the Supreme Court which would have indefinitely delayed all appeals.

Reforms Tending to Unify Existing Law.—The existence of 48 separate state jurisdictions naturally leads in practice to a wide diversity in legislation. Again, while all the states, except Louisiana, have the English common law as modified to meet local conditions, there is no Federal supreme tribunal to reconcile conflicting interpretations of the common law by the highest courts of the several states, and therefore, there exists a very considerable diversity in the law. The fact that land law, or the law of inheritance, or even the criminal law varies from state to state causes little or no inconvenience. The United States, however, has attained a remarkable degree of uniformity in economic and social conditions. Economically and socially it is one nation. Diversity in commercial law, therefore, or the law of personal property, or the law of marriage and divorce is a fruitful source of much inconvenience and considerable injustice. One of the objects of the formation of the American Bar Assn. was to promote uniformity of legislation and of judicial decision throughout the United States. The group, who in 1878 founded this association, as early as 1881, began to take steps to effectuate this purpose.

The principal outcome of their efforts was the establishment in 1892 of the National Conference of Commissioners on Uniform State laws. This conference is composed of delegates appointed by the governors of the several states, usually under state Acts authorising the appointment. As its name indicates, its object is to draft statutes which it recommends to the state Legislatures for adoption. In 1925 the conference had drafted during the 33 years of its existence 34 Acts. Many of these Acts which deal with commercial subjects have been widely adopted not only by the states but by Alaska and the island possessions of the United States—the Negotiable Instruments Act by 54 jurisdictions; the Warehouse Receipt Act by 48; the Bills of Lading Act by 26. The experience of the conference would seem to show that it takes from 20 to 25 years from the adoption of a uniform commercial Act by the conference before it is generally adopted in all the more important states. The conference is not confining its activities to the preparation of commercial Acts. Its Desertion and Non-Support Act has been adopted in 21 states. On the other hand, its draft Act relative to judicial procedure in divorce and its draft Acts dealing with social legislation have met with little acceptation, though many of the provisions of such an Act as the Child Labor Act have been incorporated into subsequently adopted state statutes on the subject.

The Clarification and Simplification of the Common Law—Work of The American Law Institute.—Perhaps the most important of the legal institutions which the United States owes to England is the common law system of expressing and developing law. The fundamental feature of the system is the general judicial recognition that a decision of a court in one case has a degree of binding force when later a case arises which presents similar or analogous facts. The common law is the law developed and expressed by judicial decisions. As a whole the decisions of the English and American courts form one of the two great systems of law in force in the world to-day, the Roman Law, the ultimate principal source of the codes of continental Europe and Central and South America, being the other.

The characteristic difference between a principle of law founded on decisions of the courts and a principle expressed in a statute is that the former, or common law principle, is never absolutely binding on a court. The power that makes can always modify if the strict application of the prior rule to the instant case would, in the opinion of the court, produce injustice. The common law, therefore, has a flexibility which the law of statutes and codes does not possess. This flexibility often prevents injustice. Systems of law, however, as human beings, have the defects of their qualities. There is an element of uncertainty in the common law from which law expressed in properly drawn statutes is free. This uncertainty has not often proved a serious defect when the law is expressed and developed by one court or group of courts organised in a unified system. But in the United States with 48 separate state jurisdictions and a large number of Federal courts distinct from the state courts, the conflict between the decisions in different states and between the states and the Federal courts, as well as the uncertainty as to the law in any one state, produces the most unfortunate consequences. When law is uncertain persons with just claims hesitate to assert their rights while opportunity is given to the party with an unjust claim or defence to begin or prolong litigation. Besides all this the common law system tends to accumulate a bewildering mass of precedent.

The multiplication of decisions regarded as precedent is a growing evil even where the precedents are confined to the decisions of a single jurisdiction. But in the United States there are 48 separate state jurisdictions, each with its separate system of courts, as well as the entirely separate system of Federal courts. The reported decisions in the United States already number (1926) approximately 700,000 cases recorded in about 11,000 volumes, and to this mass there is being added annually some 153,000 printed pages. To this accumulation of American precedent must be added the decisions of the English courts and the courts of other parts of the British Empire in *pari materia*, any one of which may be cited as persuasive authority in an appropriate case. It has become manifest that the whole common-law system threatens to fall through the accumulation of an undigestible amount of authority.

The conditions described have given rise to an attempt on the part of the American legal profession to preserve the common-law system by producing an orderly expression of the common law, which, though it will not have the binding force of statute law, will at least be regarded as having an authority far superior to that accorded any existing legal treatise.

The organisation undertaking the execution of this work is The American Law Institute, founded in 1923. The institute is a voluntary organisation with two classes of members—life members and official members. The number of life members is limited to 750, the membership being confined to the leading judges and lawyers in the several states. The official members are the members of the Supreme Court of the United States, the chief judge of the court of last resort in each state, the senior judge of each of the nine Circuit Courts of Appeal, the deans of the law schools belonging to the Assn. of American Law Schools, the president and principal officials of the American Bar Assn., the presidents of the state bar associations and the presidents of the principal scientific legal societies. The orderly expression of the common law on which the institute is engaged is called the Restatement of the Law.

The work on this Restatement has been (1926) under way three years. Already tentative drafts of parts of the law of C tracts, the law of Torts, the law of Agency and the law of C flict of Laws have been printed and distributed to the memb and to the profession generally for criticism and suggestion w a view to improvement. The plan of work adopted is to have preliminary drafts prepared by a reporter for the considerat of a small group of persons especially cognisant of the subject the draft. When the smaller group of experts has, by confere and discussion, produced a draft satisfactory to it, the draf sent to the council of the institute, a body of some 33 judges a lawyers of national reputation, and later, as amended by council, the draft is distributed as a tentative draft to the me bers of the institute. The object of this elaborate machinery not only to insure that the final draft when officially publish shall be well done, but that the legal profession as a whole, es cially the leading members thereof, shall have such a part in preparation that they will feel responsible for the work and g to it on final publication that authority which it is essential should possess if it is to counteract the existing tendency towa uncertainty and confusion as to what the law is.

Whether regarded from the point of view of expenditure money, time or skilled professional labour, no work of equal i portance or magnitude has ever been undertaken by the me bers of any legal profession. Indeed, the only work to which can be compared is the work on the Code, the Digest and t Institutes of the Roman law by Tribonian and his associat undertaken at the direction of the Emperor Justinian. That wo however, as well as the modern Code Napoléon and the mo recent codes of the nations of continental Europe and Sou America have had behind them the sanction of the state. T analogous work on the common law on the other hand, is bei undertaken by the lawyers of America as a voluntary enterpris though they have turned to one of the great public foundations The Carnegie Corp.—for the necessary financial assistance.

(W. D. L.)

The Reform of Procedure

Inheriting from the colonies, which in turn had copied ar adapted it from familiar English sources, the early courts the several sovereign states followed the system of procedu in lawsuits known as English common-law pleading, a syste based upon writs or forms of action, through which certa rights could be enforced in formal manner. The rapid te ritorial extension of jurisdiction and the growth of cities, wi corresponding complexities in the nature of rights to be a serted and wrongs remedied, soon began to cause gradual mod fication in each state by statutes passed from time to time, a shortcomings in the simple legal machinery of formerly rura communities were apprehended. There was no uniformity i these efforts, but generally speaking, such legislative alteratio were limited in scope, probably because usually inspired by di ficulties arising in specific cases, and the principal outlines common-law pleading remained intact. During the first half the 19th century, the chief result of these improvements wa to permit some fusion of the forms of equity with common law

However, in 1848, New York adopted a Code of Civil Pro cedure introducing a system of procedure and pleading which wa rapidly copied by other, and adopted by new, states until to-day it is in use in well over half of all. This was the culmination of a agitation and effort for procedural reform largely led by Davi Dudley Field, based upon earlier writings of Jeremy Bentham i England, Edward Livingston in Louisiana, and Napoleon's Code of Civil Procedure. The objects of the New York Code whose provisions can be found almost verbatim in most other American procedural codes, were to consolidate all forms, writs and causes of action into one simple universally applicable form, to remove all distinctions between law and equity, to permit free joinder of parties and causes of action, and to substitute for the previously highly technical and formal language used in the written statements required of parties, a simple, cogent and natural style of expression more in accord with the practice of daily life.

ith regard to all but the last of these objects, the code has successful. Its benefits were felt even in England, where its nple was persuasive in forwarding the reforms introduced by Common Law Procedure Acts of 1852 and 1860, and later the t Judicature Acts of 1873 and 1875. These, in turn, influ- ed the American Codes, which, since their first enactment, e not remained static but have, just as has the procedure in so-called common-law states, been frequently amended and, ome cases, improved, by legislative act. In many non-code es most of the procedural reforms of the codes have been pted without wholly abandoning distinctions and formulas itionally dear to practitioners trained to revere them.

hile the Federal Courts in each state are required by the formity Act to follow the procedure of the state in actions w, they are free of such restriction in proceedings in equity, on that side their practice is uniform throughout the country. Federal Equity Rules of 1912, promulgated by the Supreme rt in that year, are another landmark in the struggle for rm of procedure, simplifying and modernising, as they did, chnical but important class of litigations, not only locally but very state in the Union.

ince the great period of commercial expansion which culmi- ed in the Spanish-American War, the best minds at the Ameri- bar have more and more had forced upon them an apprecia- of the inadequacy of the courts to dispose efficiently of the me of work being brought into them. Inspired by the delays uncertainties which marred the work of the regular courts of , two strong movements away from the courts have mani- ed themselves. First is the tendency to create administrative si-judicial tribunals, manned presumably by experts and un- pered by the traditions and rules of evidence and procedure ch strike the average layman and legislator as being responsi- for the clumsiness of the courts. In Federal matters instances the Interstate Commerce Commission, the Federal Trade nmission, the appeal boards for taxes and customs, and num- us minor bodies in government departments; in the individual tes the Workmen's Compensation Boards and the Public lity Commissions show a similar drift.

nsofar as such bodies relieve the courts of difficult and hnical questions of fact, they are an unmixed blessing; at same time it is unavoidable that they are creating, each in its uliar field, bodies of precedent and law which are making ever re difficult and multifarious the science of jurisprudence. The ond tendency away from the courts is the reaction of the iness man rather than the legislator, impatient of the ignorance uries and the stump speeches of eloquent counsel. This induces growth of arbitration of commercial disputes by trade bodies organisations on behalf of their members. Large classes of nmercial differences are thus kept out of the courts and, as owledge of the benefits to be gained by this method, and nfidence in it, spreads, it will be more and more resorted to. In another direction it has been sought to improve procedure creating special courts such as courts for administration of ates of decedents, municipal courts with strictly urban juris- tion, juvenile courts, domestic relations courts, conciliation urts and similar divisions. In these cases, the procedure pre- ibed is generally less elaborate and more expeditious and *ad minem* than in the courts of general jurisdiction. To suppose, wever, that there is satisfaction with the results so far ac- mplished is an error, for many influences are at work to gative the value of the real improvements which have been tempted.

To-day, the greatest promise for reform in methods of pro- dure lies in the spread of admiration in the U.S.A. for the suc- ss achieved by the English courts in simplifying procedure, der the system introduced in the Judicature Acts, by which ocedure is regulated not by statutory enactment but by flexible les made by the courts themselves. A strong movement has veloped for the adoption of this system both in the Federal urts and in the state courts in the U.S.A., forwarded by the itings and utterances of Chief Justice William H. Taft and r. Elihu Root among public men, Dean Roscoe Pound of Harvard, Dean John H. Wigmore of Northwestern and Prof. Edson R. Sunderland of Michigan among scholars, Thomas W. Shelton of Virginia, Moorfield Story of Massachusetts and others among practising lawyers, and most of all, by the American Judicature Society and its secretary, Herbert Harley, under the munificent endowment of Charles F. Ruggles of Michigan. The success of the nation-wide improvement in Federal equity practice under the rules of 1912 has demonstrated the efficacy of this line of approach.

BIBLIOGRAPHY.—Roscoe Pound has prepared a complete bibliography of procedural reform which he has brought down to 1920 in the form in which it is printed in 5 Mass. *Law Quarterly*, 332. See also Hepburn: *Development of Code Pleading* (Cincinnati, 1897); Rosenbaum: *The Rule-making Authority in the English Supreme Court* (Boston, 1917); *Bulletins of American Judicature Society;* and Annual Reports of American Bar Association. (S. R.)

JUGOSLAVIA: *see* YUGOSLAVIA.

JUMPING: *see* ATHLETICS.

JUTLAND, BATTLE OF.—Called by the Germans the battle of the Skagerrak, this battle was fought in the North Sea between the British Grand Fleet, under Adm. Sir J. R. Jellicoe, and the German High Seas Fleet, under Adm. Reinhard Scheer, on May 31 1916. The scene of the main action was about 75 m. from the Dutch coast in the neighbourhood of lat. 57° N. long. 6° E. The encounter is memorable as being the only occasion throughout the World War on which the rival battle fleets met, also for the fact that it left the British fleet undisputed master of the German one up to the day of the latter's surrender. As a test of modern naval material it was prolific in lessons for both sides.

I. INTRODUCTORY

The movements of the fleets and squadrons were necessarily governed to a large extent by highly technical considerations, and the battle is not an easy one for the layman to follow without a painstaking study of its successive phases and the motives which produced them. Moreover, in order to obtain a true perspective of events it is necessary to keep in mind the following fundamental facts:—

(*a*) The Allied cause rested absolutely on the retention by Britain of that sea supremacy of which the Grand Fleet was the fulcrum.

(*b*) By the date of Jutland Germany's surface navy had already been rendered largely immobile and her mercantile marine had been swept off the seas.

(*c*) It was the definite policy of the British naval command to bring the German main fleet to action and annihilate it if possible, but there was no intention to gamble with the Allied fortunes by seeking an engagement in waters where mines, submarines and shore defences would give the enemy a definite advantage, nor under conditions where the outcome would be largely dependent on chance, such as a fleet action at night.

(*d*) It was the definite policy of the German High Command not to risk a decisive action until, by a process of attrition, the British forces might have become so weakened as to give good prospects of success.

(*e*) It was to pursue this policy of attrition that Scheer set out prior to Jutland, his object being to lure the British fleet out in the hope of falling on a section of it before it could be supported; but the last thing he intended or desired was to meet a united Grand Fleet.

The order of events can be conveniently summarised as follows:—

1. The German plan to entice the British fleet to sea while submarines were lying in wait for it, and in the hope of concentrating the High Seas Fleet on a detached part of it.
2. The sailing of the rival forces, neither realising the full significance of the coming impact.
3. The first contact and battle-cruiser action on the run south to the High Seas Fleet.
4. Beatty's run north leading the High Seas Fleet up to the Grand Fleet.
5. Jellicoe's main engagement with his combined Grand Fleet against the combined High Seas Fleet.
6. The German fleet's break-through the British destroyer flotillas at night, and the failure to send intelligence to Jellicoe which resulted in the escape of the enemy next day.

Situation before the Battle.—Adm. Jellicoe[1] has summarised the causes which led up to Jutland as follows:—

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[1] Earl Jellicoe's Personal Narrative of the Battle of Jutland in *These Eventful Years*, p. 327.

TABLE I.

SCAPA FLOW

Unit	Ships	Commander
Fleet Flagship and attached ships	Iron Duke 1 Destroyer 1 Flotilla Leader 1 Light Cruiser	Admiral Sir John Jellicoe.
First Battle Squadron		
6th Division	Marlborough, Revenge, Hercules, Agincourt	Vice-Admiral Sir C. Burney.
5th Division	Colossus, Collingwood, Neptune, St. Vincent	Rear-Admiral Gaunt.
Attached	1 Light Cruiser	
Fourth Battle Squadron		
4th Division	Benbow, Bellerophon, Temeraire, Vanguard	Vice-Admiral Sir D. Sturdee.
3rd Division	Royal Oak, Superb, Canada and fleet flagship (Iron Duke)	Rear-Admiral A. L. Duff
Third Battle Cruiser Squadron, attached	Invincible, Indomitable, Inflexible 2 Light Cruisers	Rear-Admiral Hood.
Second Cruiser Squadron also attached	Minotaur, Hampshire, Cochrane, Shannon	Rear-Admiral Heath.
Fourth Light Cruiser Squadron	5 Light Cruisers	Commodore Le Mesurier.
Fourth Flotilla	2 Flotilla Leaders and 17 Destroyers	Captain C. J. Wintour.
Eleventh Flotilla (part)	1 Light Cruiser and 4 Destroyers	Commodore Hawksley.
Twelfth Flotilla	2 Flotilla Leaders and 14 Destroyers	Captain Stirling

INVERGORDON

Unit	Ships	Commander
Second Battle Squadron		
1st Division	King George V., Ajax, Centurion, Erin	Vice-Admiral Sir M. Jerram.
2nd Division	Orion, Monarch, Conqueror, Thunderer	Rear-Admiral Leveson.
Attached	1 Light Cruiser	
First Cruiser Squadron	Defence, Warrior, Duke of Edinburgh, Black Prince	Rear-Admiral Sir R. Arbuthnot.
Eleventh Flotilla (part)	1 Flotilla Leader and 10 Destroyers	Commander Sullivan.

ROSYTH

Unit	Ships	Commander
Battle-Cruiser Fleet Flagship	Lion	Vice-Admiral Sir D. Beatty.
Fifth Battle Squadron	Barham, Valiant, Warspite, Malaya	Rear-Admiral Evan-Thomas.
First Battle Cruiser Squadron	Princess Royal, Queen Mary, Tiger	Rear-Admiral de Brock.
Second Battle Cruiser Squadron	New Zealand, Indefatigable	Rear-Admiral Pakenham.
First Light Cruiser Squadron	4 Light Cruisers	Commodore Alexander-Sinclair
Second Light Cruiser Squadron	4 Light Cruisers	Commodore Goodenough.
Third Light Cruiser Squadron	4 Light Cruisers	Rear-Admiral Napier.
First Flotilla (part)	1 Light Cruiser and 9 Destroyers	Captain Roper.
Thirteenth Flotilla	1 Light Cruiser and 10 Destroyers	Captain Farie.
Ninth Flotilla (part)	4 Destroyers	Commander Goldsmith.
Tenth Flotilla (part)	4 Destroyers	Commander Hodgson.
Attached	Engadine, Seaplane Carrier	Lieut.-Commander Robinson.

1. The pressure of the British blockade had led to insistent calls for action by the German fleet.
2. Scheer, who had assumed command of the High Seas Fleet in Jan. 1916, was chafing under his enforced inactivity.
3. A strong protest from President Wilson had caused the withdrawal of German submarines from the trade routes and thereby rendered them available for enterprises of a military character.
4. Scheer may have been led to believe that the steps announced in England to prevent a recurrence of such episodes as the Lowestoft raid, indicated that some division of the Grand Fleet was intended.

While Scheer was planning a new attack on the east coast of England, certain changes had, in fact, been made in the distribution of the British forces. Jellicoe, with the main part of the Grand Fleet, was still at Scapa Flow awaiting the completion of the outer defences of the Firth of Forth before transferring his base to the more southerly harbour, but he had detached the 5th Battle Squadron of four fast "Queen Elizabeths"[1] to repl the 3rd Battle-Cruiser Squadron of three "Invincibles," wh were at Scapa for gunnery practice, and sent them to reinfor Beatty's Battle-Cruiser Fleet at Rosyth. A third force, consi ing of the 2nd Battle Squadron, 1st Cruiser Squadron and destroyer flotilla, was based on Invergordon.

THE FORCES ENGAGED

The Grand Fleet.—Immediately prior to the battle of Jutla the following was the distribution and composition of the Bri ish forces which took part in the action:—

At Harwich were five light cruisers and about 20 torpe craft under Commodore Tyrwhitt, and at Sheerness was the 3r le Squadron consisting of the " King Edward " and the eadnought " flying the flag of Adm. Bradford. These two nands, however, took no part in the battle.

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[1] "Barham," "Valiant," "Warspite" and "Malaya." Th "Queen Elizabeth" herself was in dock.

he High Seas Fleet.—The main German forces, in preparation Adm. Scheer's project, had been concentrated in the Jade n. They were organised as follows:—

TABLE II. *German High Seas Fleet*

Unit	Ships	Commander
et Flagship	Friedrich der Grosse	Vice-Admiral Scheer.
st Battle Squadron		
1st Division	Ostfriesland, Thüringen, Helgoland, Oldenburg	Vice-Admiral Schmidt.
2nd Division	Posen, Rheinland, Nassau, Westfalen	Rear-Admiral Engelhardt.
cond Battle Squadron		
3rd Division	Deutschland, Hessen, Pommern	Rear-Admiral Mauve.
4th Division	Hannover, Schlesien, Schleswig-Holstein	Rear-Admiral F. von D. zu Lichtenfels.
ird Battle Squadron		
5th Division	König, Grosser Kurfürst, Kronprinz, Markgraf	Rear-Admiral Behncke.
6th Division	Kaiser, Kaiserin, Prinzregent Luitpold	Rear-Admiral Nordmann.
stroyer Flotillas	3rd, 5th, 7th and half 1st Flotillas	Commodore Michelsen.
	SCOUTING FORCES	
t Scouting Group Flagship	Lützow	Vice-Admiral Hipper.
ttle Cruisers	Seydlitz, Moltke, Derfflinger, Von der Tann	
cond Scouting Group	6 Light Cruisers	Rear-Admiral Boedicker.
urth Scouting Group	5 Light Cruisers	Commodore von Reuter.
estroyer Flotillas	2nd, 6th and 9th Flotillas	Commodore Heinrich.

ttached to the High Seas Fleet were sixteen U boats and " L " class airships, but these took no part in the action. he following is a summary of the principal armaments of the ital ships of the rival fleets:—

TABLE III. *Comparison of British and German Capital Ships at Jutland and Their Main Armaments*

BRITISH				
No. of each Class	Total Turret Guns			
	15 in.	14 in.	13·5 in.	12 in.
Revenge	16	..	..	..
Barham	32	..	..	..
Canada	..	10	..	..
Erin	..	..	10	..
Agincourt	..	..	..	14
Iron Duke	..	..	30	..
King George V.	..	..	30	..
Orion	..	..	40	..
Colossus	..	..	..	20
Neptune	..	..	..	10
3 St. Vincent	..	..	..	30
3 Bellerophon	..	..	..	30
Battleships	48	10	110	104
1 Tiger	..	..	8	..
3 Lion	..	..	24	..
2 Indefatigable	..	..	..	16
3 Invincible	..	..	..	24
Battle-Cruisers	..	..	32	40
7 Capital Ships	48	10	142	144
	Total Turret Guns			344

GERMAN		
No. of each Class	Total Turret Guns	
	12 in.	11 in.
4 König	40	..
4 Kaiser	40	..
4 Thüringen	48	..
4 Westfalen	48	..
4 Deutschland *	..	16
2 Preussen *	..	8
(* Pre-Dreadnought type.)		
22 Battleships	176	24
2 Derfflinger	16	..
1 Seydlitz	..	10
1 Moltke	..	10
1 Von der Tann	..	8
5 Battle-Cruisers	16	28
27 Capital Ships	192	52
Total Turret Guns		244

To sum up the British Fleet consisted of 37 capital ships, 8 armoured cruisers, 26 light cruisers and 80 flotilla leaders and destroyers. e German Fleet consisted of 27 capital ships, 11 light cruisers, 63 flotilla leaders and destroyers.

THE GERMAN PLAN

An order issued to the High Seas Fleet on May 18 ran as lows:—

> The bombardment of Sunderland by our cruisers is intended to npel the enemy to send out forces against us. For the attack on advancing enemy the High Seas Fleet forces to be south of the gger Bank, and the U boats to be stationed for attack off the st Coast of England. The enemy's ports of sortie will be closed by nes.

This order may be taken as defining the strategy of the enemy the above date.

In preparation for the execution of this scheme the U boats had already set out in order to be in their appointed stations by May 23, while some six or eight Flanders submarines had gone north to reconnoitre between Norway and the Firth of Forth. From that date to June 1 was the period during which it was intended to bring off the bombardment. But the weather continued to be unfavourable for airship reconnaissance. Scheer would not risk an advance on the English coast without ample warning of the approach of the British fleet, meanwhile the limit of endurance of his submarines was nearly spent.

On May 30, when he could wait no longer, he abandoned the bombarding plan and ordered Hipper, with the Scouting Forces to sail next day and to demonstrate off the southwest coast of Norway. This he anticipated would soon be known to the British Admiralty, and he hoped, by following the Scouting Force with the battle fleet, but keeping out of sight until the enemy appeared, that he might fall on a detached portion of the Grand Fleet, which would probably be sent out to protect the cruiser patrol and shipping to the northward. But events turned out otherwise.

II. THE PRELIMINARY ACTIONS

The Grand Fleet Sails.—The British Naval Intelligence Dept. was, however, already aware both of the movement of German submarines and that there was a "certain liveliness" in the Jade Roads, and Jellicoe was warned that a large operation on the part of the enemy appeared to be imminent. At 5:40 P.M. on May 30 the commander-in-chief and the admiral commanding the Battle Cruiser Fleet were sent orders to proceed to the predetermined rendezvous eastward of the Long Forties[1] in readiness for eventualities. A warning was also sent to the Harwich Forces and 3rd Battle Squadron at the Nore. By 10:30 P.M. the three sections of the Grand Fleet had left their respective bases at Scapa Flow, Invergordon and Rosyth and were heading out across the North Sea. The main battle fleet shaped course to a rendezvous in lat. 57° 45′ N. long. 4° 15′ E. where the forces under Adm. Jerram from Invergordon would meet him at 2 P.M. next day. Beatty, with the Rosyth force, was making for a point 69 m. S.S.E. of the battle fleet's position. (*see* fig. 1.) These dispositions would enable the battle fleet to intercept an enemy trying to attack the 10th Cruiser Squadron on the northern patrol, while the Rosyth force would guard against a raid.

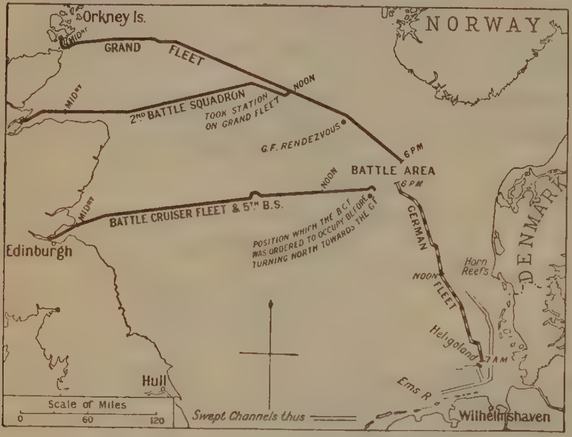

FIG. 1.—Approach of Rival Fleets.

When the British fleet put to sea 13 hostile submarines were lying off the coast; also U-67 was south of the Dogger Bank; and U-75, having laid the mines, which afterward sank the "Hampshire," was on her way home. The German submarines made few ineffective attacks; but in the main the under-water craft, as usual, proved unable to prevent free movement of the fleet.

To Jellicoe the position was by no means clear when he set out. The evidence pointed to another cruiser raid being afoot, but a misleading telegram sent from the Admiralty during the forenoon of May 31 informed him that directional wireless signals placed the German fleet flagship in the Jade river, thereby leaving Jellicoe with the impression that there was no reason for undue haste and he regulated his speed so as to economise his destroyers' fuel consumption.

First Contact.—Hipper, with the scouting forces left the Jade at 2 A.M. on May 31 and steamed northward, keeping well out of sight of the Danish coast. Scheer followed 50 m. astern with the battle fleet. During the early morning the German commander-in-chief received wireless reports from his U boats, but these proved vague and misleading, so much so that far from gleaning that a combined advance was being made by the British forces, he alludes to "our hope of meeting with separate enemy divisions" as being "likely to be fulfilled."[2]

At 2 P.M. Beatty, having arrived at his rendezvous, prepared to turn north in accordance with his instructions. Then followed one of those seemingly trivial events which are sometimes destined to have momentous issues. A stray merchant steamer attracted the attention of Commodore Alexander-Sinclair in the "Galatea," on the eastern wing of the light cruiser scr He stood on to the E.S.E. to examine her. Simultaneously "Elbing," on the western wing of the German scouting f sighted the same steamer and detached a destroyer to inv gate. Another instant and the rival warships had seen other. At 2:20, just as Beatty had turned to the northw "Galatea" hoisted the signal "enemy in sight." (See fig The result was to hasten a meeting which otherwise would, probably, have occurred further North and therefore nearer British battle fleet. Beatty at once set out to cut off the lin retreat of the enemy's light cruisers towards Horn Reefs, finding that they were apparently following the "Galat to the northwest, he hauled round more to the northward. had been steering northeast for some 10 minutes when the he smoke of Hipper's five battle cruisers was sighted on his s board bow, whereupon he turned back to the east.

Owing to the greater visibility to the westward, Hipper already sighted the six British battle cruisers, and now real that they were heading to cross his stern and cut off his lin retreat, and that he must hasten to fall back on the battle fl Beatty, knowing nothing of the greater forces to the sou could only regard this as a golden opportunity for getting grips with the enemy. There followed a hot running fight to southward between the opposing battle cruisers. The 5th Ba Squadron under Rear-Adm. Evan-Thomas which had b stationed five miles astern, panted after them trying to get i action. (*see* fig. 2.)

THE BATTLE CRUISER ACTION

At 3:34 Beatty formed the battle cruisers into single li increased to 25 knots and made for the enemy. About this ti the "Engadine" sent up a seaplane which reported Hipp course south. This is noteworthy as being the only occasion which British aircraft was used throughout the operations, the report failed to reach the battle-cruiser's flagship. At 3: however, the enemy could be made out distinctly from "Lion," and Beatty formed his ships on a line of bearing nor west to clear the smoke and bring their guns to bear, while turned to E.S.E. At about 3:48 fire was opened almost sim taneously on both sides at a range of approximately 16,0 yards.

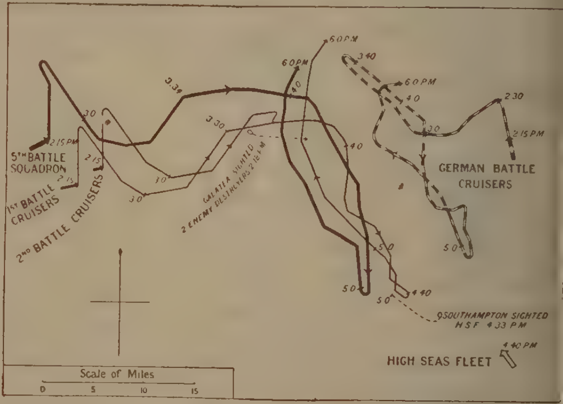

FIG. 2.—First contact and the Battle Cruiser Action. (2:15 P to 6:0 P.M.)

The British battle cruisers were at considerable disadvanta for they showed up well against the western sky, while visibili to the eastward was poor for observing their fire. German a counts agree that the British firing during this part of the acti was somewhat ragged, while they pay high tribute to that of t 5th Battle Squadron when it got within range. The better pr tection of the enemy's battle cruisers and the better shell wi which the heavy guns of his fleet generally were provid stood him in good stead, while the confusion in the interpretati of the signals for distribution of fire added to the disadvantag of the British battle cruisers.

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[1] The Long Forties are about 60 m. east of the Scottish Coast.

[2] *Germany's High Seas Fleet in the World War*, Adm. Scheer, p. 141.

e range was rapidly decreasing as the courses of the rival converged. A few minutes after 4 P.M. the "Lion" was ly hit by a shell from the "Lützow" which plunged into idship turret and killed nearly the whole of the gun's crew. or the presence of mind and devotion to duty of Major W. Harvey, R.M.L.I., who when mortally wounded saw to ooding of the magazine, the flagship would doubtless have destroyed. Up to this time, owing to a misunderstanding, Derfflinger" had been left unfired at, but was now engaged e "Queen Mary." In the rear of the line the "Von der " and "Indefatigable" were fighting a furious duel when o of three shells from the former crashed into the vitals British ship; she fell out of the line sinking by the stern, 6 P.M another salvo hit her and with a rending explosion rned over and sank with her 57 officers and 960 men. Now a moment's respite; both sides, finding the fighting too hot, ed to open the range, and soon the German shells were fall- ort and their fire ceased.

anwhile Evan-Thomas, by cutting corners, had manoeu- the 5th Battle Squadron into range, and shortly after 4 k the "Barham" opened fire on the "Von der Tann" at 19,000 yards. In spite of the poor visibility the battle- ' firing was very accurate, and Hipper had to take to zig- ng to dodge the great 15 in. salvoes. Nothing but the poor ty of the British shells, which burst without penetrating nemy's armour, could have saved his rear ships from de- tion. The van of the German line was not long out of n.

4:10 Hipper turned inwards two points while Beatty, having lished sufficient overlap, started to press his way to the ard again. The effect was to close the range rapidly and ngagement was fiercely renewed.

e "Lion" seems to have been still enveloped in the smoke r burnt-out turret, and practically invisible, with the result she was left in peace while the "Seydlitz" concentrated uns with those of the "Derfflinger" on the "Queen Mary." latter was fighting gallantly when at 4:26, a salvo crashed the "Queen Mary" forward, a red flame shot up and an sion rent her asunder. In another instant only a great pall oke marked the grave of this noble ship and her 57 officers ,209 men.

out this time a subsidiary battle was being fought between nes. The 13th Destroyer Flotilla, having attained a suitable ion, was launched to attack. At the same moment a Ger- flotilla advanced into the arena making for the 5th Battle dron. The two flotillas met; the enemy destroyers fired e torpedoes at long range and hastily retired before the rior gun-fire of the British craft. Evan-Thomas swung his le Squadron away two points and safely avoided the tor- es. Part of the British flotilla chased the fleeing enemy rds the van of the German battle cruisers, while Com- ler Bingham in the "Nestor," followed by the "Nicator," ued those making for the rear. When within 5,000 yd. of "Lützow," the two destroyers fired their torpedoes, but er adopted the same dodging tactics and swung his ships while the torpedoes ran clear or fell short of their mark. gallant pair of destroyers pressed on and fired more torpe- at a range of only 3,500 yd. under a hail of shell from the y's secondary armament. The "Nicator" escaped, but ight cruiser "Regensburg" appeared suddenly from behind battle cruisers and crippled the "Nestor" with two shots r boiler. The "Nomad," another destroyer, was also hit and helpless between the lines. Another small force of British royers had accounted for two of their opponents, "V.27" "V.29," when at 4:43 the "Lion" ran up the destroyers' ral recall. Events suddenly took a new and dramatic turn. ipper, sorely pressed ahead and astern, came welcome and ly relief. The German battle fleet was in sight.

rman Battle Fleet in Sight.—The head of the German battle was first sighted by the "Southampton" in which was Com- re Goodenough leading his 2nd Light Cruiser Squadron t two miles ahead of the "Lion." At 4:33, he made the signal "battleships southeast." Holding boldly to his course he was soon able to identify the High Seas Battle Fleet in full array. Mindful of the extreme importance of his information, he sent a wireless message direct to Jellicoe. Within ten minutes of this signal being dispatched the commander-in-chief had quickened the pulses of his own great command with the signal "enemy battle fleet is coming north."

Goodenough stood down to within 13,000 yd. of the enemy so that he could identify him in detail before turning north under a hail of shell fire. An admirable piece of cruiser work had not only galvanised many and far distant forces into activity, but it had crystallised the whole position for the British commands. Beatty also held his course until the German battle fleet was in sight, then, at 4:40, he turned 16 points in succession and started the run north, assuming the rôle of the pursued instead of that of pursuer. To Scheer it seemed as if his opportunity to fall on a detached part of the British fleet had come, but Beatty was happy in the knowledge that if the enemy was not frightened off prematurely he would be confronted with the whole Grand Fleet.

Fortunately Hipper was too occupied with the British destroyers' attacks to be able to take advantage of the target presented by the British battle cruisers as they wheeled in succession round the same point. By 4:50 Beatty with his line now reduced to four ships had straightened up on a northerly course and was re-engaging his late enemy. Hipper had just resumed his southerly course, after turning away from the British destroyers, when a torpedo hit the "Seydlitz" tearing a huge hole under water and putting a 15 cm. gun out of action. The ship's stout construction saved her, however, and she kept her place in the line. By 5 P.M. Hipper, too, had turned 16 points to the northward and taken up his station ahead of the battle fleet. Meanwhile the 5th Battle Squadron could not see the "Lion's" flag signal to turn about. Adml. Evan-Thomas saw Beatty turn, but was intent on hanging on to the rear of the enemy's battle cruisers, who were still on a southerly course, with the result that the two British squadrons passed each other at high speed. The "Lion" now repeated the signal to turn, direct to the 5th Battle Squadron, but before it could be obeyed, that squadron found itself under the guns of the German battle fleet.

Evan-Thomas turned 16 points at practically the same instant as Hipper, but in the process the "Barham" received a heavy shell which cost her casualties and the use of her wireless gear. The rear battleship of the line, the "Malaya," was a target for at least a whole division of enemy battle ships and suffered even more severely.[1] For some 20 min. she was straddled again and again and received serious damage below the waterline, but held on and eventually the whole squadron forged ahead and got clear. A plucky attempt by the destroyers "Onslow" and "Moresby" to attack the enemy battle cruisers just as they had turned north was defeated by the German light scouting group, but the "Moresby" stood on to within 8,000 yd. of the enemy's battle fleet and fired a torpedo at the third ship of the line; it did not take effect, but both destroyers escaped miraculously under a very hot fire. Scheer continued to hasten north after the apparently hard-pressed British squadrons. As he did so the motionless "Nestor" and "Nomad" came drifting down between the lines. They scorned surrender and fired their last torpedoes at the oncoming battleships but without effect. A moment later they were overwhelmed in a storm of shell. The undaunted "Nestors" gave three cheers for their sinking ship and sang a verse of "God Save the King" before the crews took to boats and Carley rafts, from which they were chivalrously rescued by enemy destroyers.

Once the 5th Battle Squadron had shaken off the German battle fleet the firing slackened. At 5:40 Hipper's squadron reappeared out of the mist and there was a temporary burst of firing from the British battle cruisers and the leading battleships, but Beatty was intent on joining his commander-in-chief and was reserving his forces for the greater issues impending.

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[1] "Barham" lost 26 killed and 37 wounded, "Malaya" 63 killed and 33 wounded.

III. THE MAIN ACTION

Meeting of the Battle Fleets.—Coming down from the northwest was Jellicoe in the "Iron Duke," at the head of a centre division of his six lines of battleships, each in single line ahead at manoeuvring distance apart. Directly ahead of him was the 4th Light Cruiser Squadron which with the destroyer flotillas was acting as an anti-submarine screen. Further ahead and spread for scouting were the 1st and 2nd Cruiser Squadrons. Twenty-one miles to the eastward were Hood's three ships of the 3rd Battle Cruiser Squadron, with two light cruisers and four destroyers.

Up to 2:45, the fleet had been steaming at economical speed, but, with the arrival of wireless messages indicating the presence of an enemy to the southward, the commander-in-chief increased to 17 knots and ten minutes later to 18 knots. Course was shaped southeast by south for Horn Reefs as previously arranged. At 3:59, as soon as he learnt that the enemy's battle cruisers had been sighted, Jellicoe increased to 20 knots and then sent Hood on to Beatty's support, so that when the report was received that the enemy's battle fleet was coming north there was nothing better to be done at the moment than to stand on as he was doing. The battle fleet was closed up in cruising formation, and it would have been useless, indeed dangerous, to deploy into line of battle until it was known on what bearing the enemy would be met. The leaders of divisions were already disposed at right angles to the most likely line of bearing on which to sight the enemy in order that they might wheel their ships into line with a minimum of delay. So the rival battle fleets approached, charging towards each other at a rate of nearly 40 knots, but as yet out of sight.

When in due course contact was made it did not come about quite as Jellicoe expected. The "Iron Duke" and "Lion" had communicated their respective positions from time to time, but zig-zagging and many other alterations of course had caused both flagships to be out in their reckoning. The "Iron Duke" was in fact some 4½ m. ahead (*i.e.*, to the southeastward) and the "Lion" 6¾ m. to the westward of their estimated positions as they approached each other. The reports of the enemy received by the commander-in-chief were therefore somewhat perplexing, and by the time it became evident that the German Battle Fleet would be met on a starboard bow bearing instead of right ahead it was too late to alter his dispositions. Hood, also, was thrown out in his calculations. Steering as he thought to join Beatty he found himself on the opposite side, *i.e.*, to eastward of the enemy. It was at this juncture that fighting broke out with renewed vigour.

At 5:40 the Battle Cruiser Fleet converging on the 1st Scouting Group, from the westward, saw the "Lützow" and her consorts emerging from the mist. Fire was opened at a range of about 14,000 yards. This apparently disconcerted Hipper, who turned away to the eastward. Hardly had he done so before he heard the guns of the 3rd Battle-Cruiser Squadron engaging his 2nd Scouting Group. The trap was closing in on him, but as yet he was unaware of the far greater menace to the northward; but he seems to have sensed danger and at 6:34, hotly pursued by Beatty, he turned southeast only to see his light cruisers being attacked by four British destroyers. These latter he took to be the forerunners of the British Battle Fleet and, now thoroughly alarmed, he doubled right back to southwest to seek the cover of his own battleships. In fact what he had seen were Hood's light forces. These had been hotly engaged with Boedicker's 2nd Scouting Group. In the initial skirmish the "Chester"[1] was badly mauled by the German light cruisers, but they in turn suddenly found themselves overwhelmed by the fire of the three "Invincibles." The "Wiesbaden" was reduced to a wreck and the "Pillau" and "Frankfurt" were badly damaged and only escaped by using their torpedoes, which forced Hood to turn away and break off the pursuit.

The destroyers which Hipper had seen were part of the 4th flotilla. Led by the "Shark," they gallantly went for the "Regensburg" and nine or ten enemy torpedo craft which seer
be preparing to attack the 3rd Battle-Cruiser Squadron.
course of this encounter the "Shark" was severely batter
eventually sank, fighting to the last under her mortally wo
captain, Commander Loftus Jones.[2] Hood avoided this att
turning his squadron sharply to starboard; and almost
same instant he sighted the "Lion" racing up from the
ward. He turned to meet her and then swung his squadro
station ahead of the Battle Cruiser Fleet and led the lin
south-easterly course. Jellicoe was left in doubt until th
last minute as to the exact position of the enemy. Some
to the southward was the High Seas Fleet, but between hi
his adversary were battle cruisers, cruisers and dest
belching smoke and gun fire and obscuring his view. Beatt
on the heels of his own particular quarry again, had lost
of the enemy battle fleet and at the moment could not a
the commander-in-chief's urgent enquiry. Nine minute
latter waited, then at 6:10 repeated his question "Wh
enemy's battle fleet?" The first definite information came
the "Barham," now rapidly closing with the 5th Battle S
ron from the southwest. She reported "Enemy's battle
S.S.E." At 6:14 the "Lion," having regained touch, repor
too, bearing S.S.W.

The Deployment (see fig. 3).—Within a minute of the "Li
report, Jellicoe had ordered the fleet to deploy on the p
easterly column. The manoeuvre was a vital one and the
mander-in-chief made a masterly decision. Had he followe

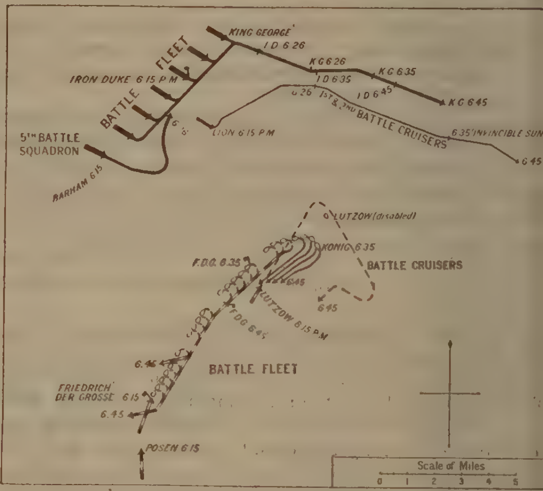

Fig. 3.—Deployment of British Battle Fleet, and first retire
of German Fleet. (6:15 P.M. to 6:45 P.M.)

natural inclination to deploy to starboard, *i.e.*, on the sid
ward the enemy, the ships on that wing would have f
themselves at grave disadvantage; the enemy would have
able to concentrate his fire on them while they would have
masking the other columns until each could turn up in re
succession. Moreover, the head of the British line would
had to make a sharp turn to port at once to prevent the en
crossing the "T." It is not too much to say that had Jel
made a wrong decision at this moment irretrievable dis
might have followed. As it was the Grand Fleet was place
the outset in a position of overwhelming tactical advant

The deployment, it will be seen, developed in the form c
obtuse-angled "L," one arm of which steadily lengthene
envelop the head of the enemy's line, while, during the pro
the British ships could give each other the maximum of sup
The battle cruisers hurried to their station at the head of
line, the 5th Battle Squadron slipped into place astern, cru
and destroyers automatically took up their pre-arranged
tions. The whole was a magnificent piece of fleet work, the
mination of fine organisation and training and a clear indica

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[1] Boy Jack Cornwell was awarded a posthumous V.C. for his exemplary conduct in this action.

[2] Awarded a posthumous V.C.

igh standard of leadership on the part of the flag officers anding the several divisions and squadrons.

now a tragedy occurred in the foreground of this impres- ene. Up to the moment of deployment Arbuthnot in the nce" with his 1st Cruiser Squadron had been scouting of the battle fleet, but on contact being made, it became his o engage the enemy's cruisers. Boedicker's 2nd Scouting was faintly visible to the southward and, followed by the rior," Arbuthnot turned to pursue them. He was about ver a *coup de grâce* to the now blazing and disabled "Wies- ," when out of the mist came both the British and Ger- attle cruisers hotly engaged. Holding on tenaciously, close the bows of the "Lion," the two cruisers soon found them- in a hurricane of fire as Hipper endeavoured to cover the en "Wiesbaden." Two great salvoes hit the "Defence" ck succession and at 6:19 Arbuthnot and his flagship dis- red in a sheet of flame. The "Warrior" limped away, as only saved for the time being by the battleship "War- " performing an involuntary circle round her, owing to the n jamming of the latter's steering gear. Clear of the fight- he sea-plane carrier "Engadine" made a brave effort to er home, but the "Warrior" had to be abandoned at 7 A.M. llowing morning and eventually sank.

the cloud of smoke over the spot where the "Defence" one down rolled away, the full measure of his peril was re- to Scheer. The High Seas Fleet was heading into the crook rapidly extending arm of the whole combined British e Fleet. It seemed to Jellicoe a glorious opportunity to fall s enemy and crush him. The signal was actually hoisted he Grand Fleet to close, when the commander-in-chief ed that his line had not yet straightened out, and the battle ers were not yet clear of his van; to turn to S.S.E. by sub- ons, as he wished, was not practicable at the moment. He o cancel the signal and hold on on a course which neverthe- harply converged with that of the enemy battle fleet.[1]

w yet another misfortune befell the British. Proudly lead- e 10-m. line of capital ships, was Hood in the "Invincible." ng closed to a bare 9,000 yd., she was furiously engaging Derfflinger," hitting her again and again with well directed es, when the "König," leading the van of the enemy battle came to the rescue of the battle cruiser. Once again the ing shell sought the vitals of the lightly armoured British the "Invincible" was torn asunder, her stem and stern high out of the water before she disappeared (6:34). With vent Hood, who had so finely upheld the traditions of his ric name, and his splendid crew of over a thousand officers nen. The British battle cruisers had indeed suffered heavily. able as their work had been in bringing about the main ac- they were clearly unsuited for "in-fighting." From now rds they rightly confined themselves to harassing the van e enemy when opportunity served, leaving the battleships ke the shock of closer contact. But close contact was the thing Scheer was seeking. He was in a trap and needed all vits to escape impending disaster.

e possibility of such a situation had not been overlooked by German commander-in-chief, and he had practised his com- d in a manoeuvre known as the *Gefechtskehrtwendung*, which really an "emergency retirement." In this the destroyers ed out, fired their torpedoes "into the brown," and put up oke screen while each big ship did a right-about turn and ated precipitately. This manoeuvre he ordered when at he found battleship after battleship of the Grand Fleet con- rating on the head of his line. It was not unattended with , but it was boldly ordered and skilfully executed. (See 3.) In less than three minutes the evasive enemy had disap- ed for the first time. The destroyer attack had not been sed home, and, although some of the British battleship divisions swung away momentarily to avoid the torpedoes, the course of the fleet as a whole was not deflected. Burney's flagship, the "Marlborough," was hit by a torpedo, but the damage was not so great as to force her to leave the line. The German light cruiser "Wiesbaden," now the only enemy in sight, came under a heavy fire and in ten minutes, a blazing wreck, she sank from sight.

Jellicoe, too, had foreseen the problem which now confronted him, and he had not been alone in seeking, for some time past, a satisfactory solution; it was agreed by the highest tactical authorities that to follow directly in the path of an enemy's battle fleet in a position where it could obtain the maximum advantage from torpedoes and mines,[2] was sheer foolhardiness. In fact, he had already summed up the situation when he wrote "Nothing but ample time and superior speed can be an answer, and this means that unless the meeting takes place fairly early in the day, it is most difficult, if not impossible, to fight the action to a finish." In point of fact, so little was the Grand Fleet superior to the High Seas Fleet in speed that even had Jellicoe pursued it directly it is doubtful whether he would have caught up with it before nightfall. It was now 6:40. There remained little more than two hours daylight. The enemy was out of sight somewhere to the south and west, but another advantage which the deployment to port had given was the overlap to the eastward which the Grand Fleet had secured. (See fig. 4.) Jellicoe was therefore in a position to work his way steadily between the High Seas Fleet and its possible lines of retreat to the German coast, and this he proceeded to do. At 6:44 he turned his divisions southeast. Simultaneously Goodenough turned south and led his Light Cruiser Squadron to look for the enemy. By 7 he was able to report the hostile battle fleet bearing S.S.W.

Five minutes before this Jellicoe had altered course to south, and now, knowing that he was again in a position of considerable tactical advantage, he ordered a turn of "3 points to starboard together" to close more rapidly. About this time a number of reports of submarines were being made to the commander-in-chief. The "Lion" had just reported sighting one, the "King George V.," leading the battle fleet, sent a warning that a submarine was just ahead of the "Iron Duke," then the "Duke of Edinburgh" reported one "2 points from right ahead." It is now known that there were no submarines in the vicinity, but these reports could not well be ignored, so Jellicoe took the best course possible and turned directly towards the supposed menace. Incidentally this brought the course of the fleet back to south and re-formed the divisions into line ahead, the leaders being disposed quarterly. Hardly was the turn completed before the enemy reappeared out of the mist.

The Battle Fleets Re-engage

Having extricated his fleet from one trap it seems incredible that Scheer should have deliberately walked into another (see fig. 5). In his official despatch[3] he says: "It was as yet too early to assume night cruising order. The enemy could have compelled us to fight before dark, he could have prevented our exercising our initiative, and finally, he could have cut off our return to the German Bight." If ever there was a man who wanted to avoid decisive action it was the man who penned those words, yet in the next paragraph of his despatch he makes the illogical statement: "There was only one way of avoiding this: to deal the enemy a second blow by again advancing regardless of the consequences, and to bring all the destroyers to attack." The manner in which the High Seas Fleet renewed the action was such that its course was practically at right angles to that of the Grand Fleet, whose battleships were stretched across his bows so that they could concentrate on the leading German ships, while those in rear trailed astern out of action. The evidence goes to show that Scheer hoped to pass astern of the British line and thence make his way to the eastward, possibly engaging a detached force en route. If he had succeeded, he could then have made for

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[1] The Grand Fleet deployed on a course southeast at 6:15. The oyment (excluding the 5th B.S.) was completed by about 6:40. German battle fleet approached on a northeasterly course. At , the "König," leading battleship, turned east, the remainder wing in succession (see fig. 3).

[2] Adm. Jellicoe had been informed by the Naval Intelligence Dept. that the German capital ships were known to carry mines.

[3] Battle of Jutland Official Despatches, p. 594.

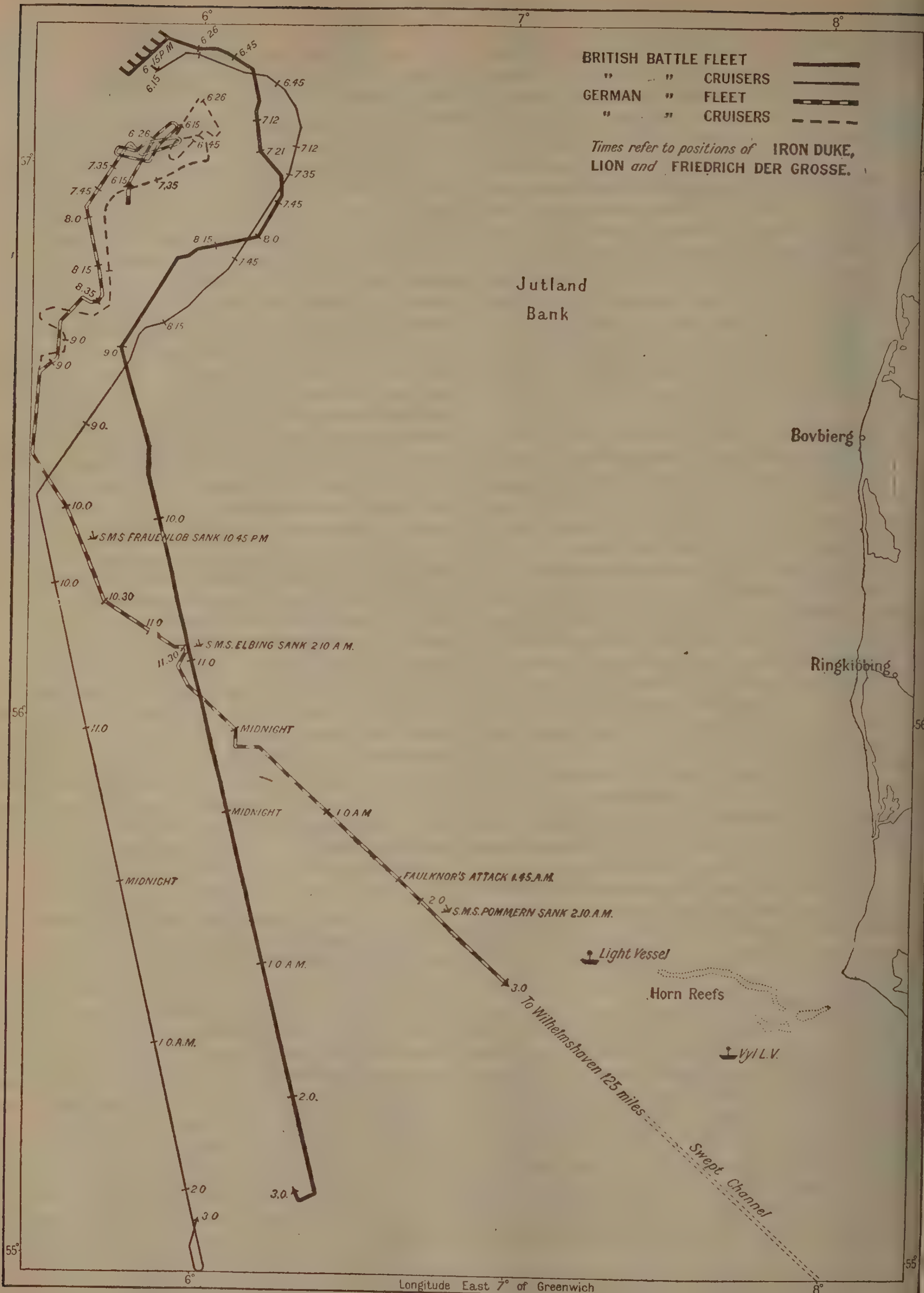
BRITISH BATTLE FLEET
" " CRUISERS
GERMAN " FLEET
" " CRUISERS
Times refer to positions of IRON DUKE, LION and FRIEDRICH DER GROSSE.
Jutland Bank
Bovbierg
Ringkibbing
Light Vessel
Horn Reefs
Vyl L.V.
To Wilhelmshaven 125 miles
Swept Channel
S.M.S. FRAUENLOB SANK 10.45 P.M.
S.M.S. ELBING SANK 2.10 A.M.
FAULKNOR'S ATTACK 1.45 A.M.
S.M.S. POMMERN SANK 2.10 A.M.
6.15 P.M.
6.15
6.26
6.45
7.12
7.21
7.35
7.45
8.0
8.15
8.35
9.0
10.0
10.30
11.0
11.30
MIDNIGHT
1.0 A.M.
2.0
3.0
6°
7°
8°
57°
56°
55°
Longitude East 7° of Greenwich

FIG. 4.—Course of the main action and escape of German Fleet. (6:15 P.M. to 3:00 A.M.)

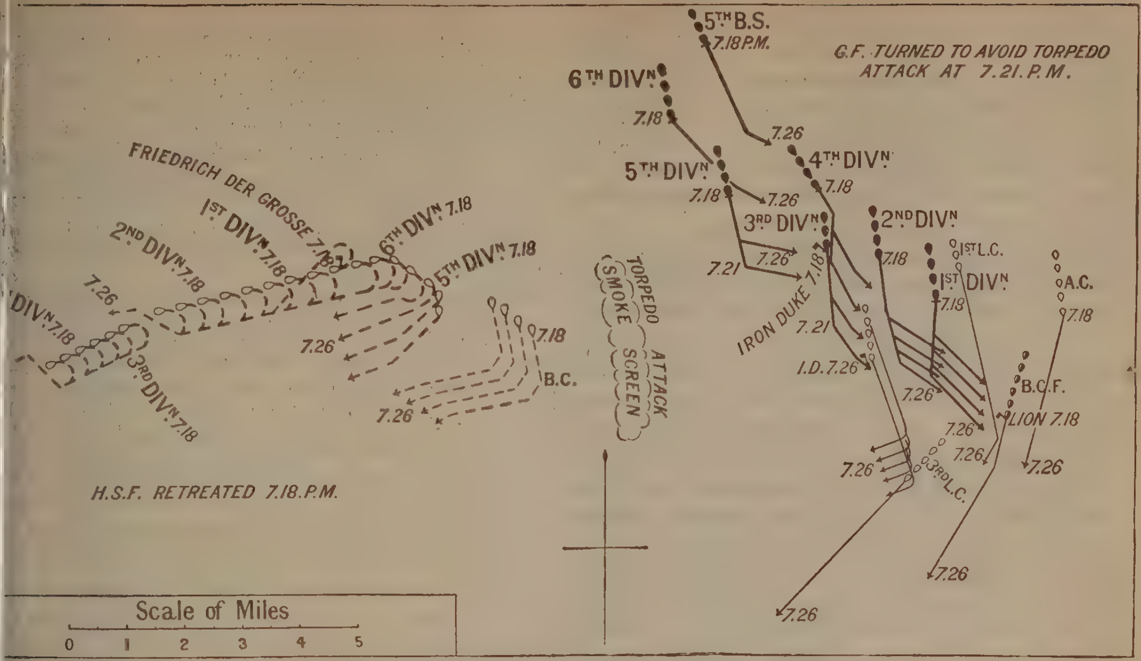

Fig. 5.—Second retirement of German Fleet. (7:18 p.m. to 7:26 p.m.)

, fighting a rearguard action with the attendant difficulties
s enemy.

t Jellicoe had forestalled him. The British Battle Fleet was
cross his path and, in the low visibility prevailing, the com-
er-in-chief had not risked dividing his forces. First some
y light cruisers appeared to the southwest of the "Iron
." A few minutes later, at 7:12, the 1st Battle Squadron at
orthward end of the line was seen to open fire. The "Marl-
gh's" gunnery efficiency had not been impaired by her
water injuries, and she discharged salvo after salvo at the
aig" as the head of the enemy battle fleet came into sight.
est of the squadron took up the engagement and soon the
ig German ships were smothered in shell at a range of less
9,000 yards. At 7:13 the "Iron Duke" came into action
. Once more the Grand Fleet was in a position of over-
ning tactical advantage and ship after ship joined her fire
icked out a battleship or battle-cruiser target as occasion
d. Meanwhile a small force of enemy destroyers had devel-
an attack which caused Sturdee to swing his 4th Division
two points to avoid their torpedoes. Directly the attack
expended itself, he turned back to the course of the fleet,
oximately south, which brought him into line astern of the
Division led by the "Iron Duke."

licoe had been holding steadily on his course across the
of the enemy, but seeing his rear divisions in some danger
gregation he ordered them to form astern of him, while the
ng George" was directed to lead the van into line ahead.
now the full fire-effect of the British battleships was rapidly
loping, and Scheer saw that his leading ships were in danger
nihilation; another "right-about turn" was imperative.
the enemy seemed right on top and half round him. Drastic
sures were necessary to get clear. The German battle cruisers
ld have to be sacrificed, if need be, to save the battle fleet.
made a signal to them, which, read literally, meant "charge
enemy; ram; ships are to attack without regard to conse-
nces." At the same time the destroyers, once again, were
ched *en masse* to attack.

he "Lützow" had been completely disabled in the first
act of the main engagement, and was still ablaze and out
ction. Hipper had not yet been able to get on board another
le cruiser, but Capt. Hartog, in the "Derfflinger" with the
remaining three, led off gallantly on what the Germans have called a "death ride." To make matters worse, the British battle cruisers which had been working round on the outer arc of the circle, so to speak, were now coming into action again. So the enemy's 1st Scouting Group became the centre of a perfect hurricane of fire. The "Derfflinger" had two turrets shattered to bits and was being hit again and again, the "Seydlitz," "Moltke" and "Von der Tann" were also suffering severely when the welcome signal came permitting them to withdraw. By 7:20 the German Battle Fleet had repeated its former tactics and was retreating pell-mell to the westward behind a dense smoke screen put up by its destroyers. The latter pressed on to attack with more determination this time. There was no other enemy in sight so Jellicoe was free to concentrate his attention on this one. A heavy fire was opened on the oncoming torpedo craft which made them loose their torpedoes at long range. At 7:21 the British commander-in-chief swung his ships away in two quick successive turns of two points each before the torpedoes could reach the line. The result was that this attack was completely foiled. A second and third attack were countered by Commodore Le Mesurier's 4th Light Cruiser Squadron which, crossing from its station on the disengaged bow, drove furiously at the enemy. One German destroyer, "S.35," was sunk and several badly damaged. Jellicoe was, for the time being, in complete ignorance of what his main enemy was doing, but directly the torpedo attack had spent itself he, at 7:35, swung the fleet back five points to starboard and steered S.by W. (see fig. 4.)

Beatty had by now worked his way round to the starboard bow of the Battle Fleet and was heading southwest. At 7:40 he signalled to the commander-in-chief to say that the enemy was about 10 m. N.W. by W. But the "Lion" was quite out of sight from the fleet flagship, and her own position, as she gave it, was obviously wrong. Jellicoe, however, turned southwest, on the same course as his battle cruisers. At 7:45 Beatty again reported the position of the enemy, this time adding that the latter's course was about southwest. This signal was made to the "Minotaur" by searchlight, passed by her to the "King George V.," who passed it on to the "Iron Duke," where it did not arrive till 7:59. Jellicoe promptly turned the battle fleet west by divisions, and increased to 17 knots to regain touch with the enemy. Hardly had he done so before a wireless message came to hand from Beatty saying: “Submit van of battleships follow battle cruisers. We can then cut off whole of the enemy's battle fleet.” The commander-in-chief at once ordered Adml. Jerram to comply with this request, but, owing to the unavoidable delay in cyphering, transmitting and decyphering the message, the “Lion” had by then lost sight of the enemy; moreover, the battle cruisers were not in sight from the “King George V.” In point of fact, the battle fleet was already steering straight for the enemy.

Although he had twice butted his head into trouble and twice withdrawn it considerably battered, Scheer was loath to be forced further to the westward and away from home. So, at 7:53, he hauled round and made his way tentatively to the southward. (*see* fig. 4.) Jerram had been somewhat at a loss to carry out his orders, but hearing gunfire on the port bow, he turned his division towards it, and at 8:21 was heading W.S.W. The firing came from Rear-Adml. Napier's 3rd Light Cruiser Squadron, which was engaging the 4th Scouting Group at the head of the High Seas Fleet. After a sharp conflict the enemy turned away and disappeared. Meanwhile, Beatty, who was also steering west, had again sighted the German battle cruisers and beyond them the pre-Dreadnought battleships steering south. He thereupon turned in succession to W.S.W. and opened fire. An attempt by hostile destroyers to attack the British battle cruisers was frustrated by Le Mesurier's light cruiser squadron. Beatty held on his course and was beginning to inflict severe punishment on the sorely stricken enemy battle cruisers; but they could stand no more, and, running out of action to the westward, sought cover behind the old ships of Admiral Mauve's 2nd Battle Squadron.

Meanwhile Jellicoe had good reason to be satisfied with the situation. His battle cruisers had made contact, he was between the German fleet and its own coast, and he seemed on the point of renewing the engagement. At 8:28 he turned by divisions to southwest and stood down on a converging course expecting momentarily to meet his adversary. But Scheer foresaw the impending collision, indeed his headmost ships were already in the track of the on-coming storm. He had no intention of suffering again from its full blast, and by 8:35 he had turned hastily to the westward and disappeared before the British battle fleet came in sight. So the firing died away and now the mists of night rolled down between the rival forces. It was past 9:00 before Jellicoe was fully informed as to the situation; then he received a message from the “Lion” reporting that at 8:40 the enemy's battle cruisers and pre-Dreadnought battleships bore from that ship N. 34° W. 10 to 11 m. and were steering southwest. Beatty at the same time made his position and gave his course also as southwest.

It was now an hour after sunset and growing darker every moment. The hazards of a fleet action at night were unthinkable to a wise commander. It only remained for Jellicoe to maintain his position between the enemy and the German coast until he could fight to a finish the next day. He therefore set about making his dispositions for the dark hours.

IV. EVENTS OF THE NIGHT

There were three potential lines of retreat for the High Seas Fleet. (*see* fig. 1.) The northerly one led to Horn Reefs, and thence down the swept channel inshore of the Amrun Bank minefield to the mouth of the Jade; the second would be reached by a southerly course to a swept channel which led eastward close to Heligoland; lastly, there was the swept channel which led from the vicinity of the Ems river parallel to the coast to the entrance into the Jade. (See fig. 1.)

Jellicoe's Dispositions.—At 9:17 Jellicoe ordered the fleet to take up night cruising stations. This meant that the battle fleet were to close up into three parallel columns with the 5th Battle Squadron, now consisting of three ships only,[1] on the port quarter. Beatty had already anticipated his commander-in- wishes and having taken station ahead and placed the 1 3rd Light Cruiser Squadrons to the southward and westw him, assumed the course and speed of the fleet; these were 17 knots. Five miles astern of the battle fleet Jellicoe mass destroyer flotillas. This had the following advantages:—

(*a*) It covered the rear of the fleet from attacks by hostile fl

(*b*) It increased the chances of intercepting the enemy sho endeavour to make to the eastward, and of obstructing his p by torpedo attacks.

(*c*) It kept the Grand Fleet destroyers clear of their own ships and therefore minimised the chances of disastrous mista the dark.

The value of these dispositions was to some extent dimi by the difficulty of communicating their purport to comma officers, especially those of the innumerable destroyers, b effect, the British fleet ploughing through the night preser living wall of steel barring the enemy's passage home.

Scheer's Return.—Scheer also prepared for the night. H Battle Squadron led the line and was followed by the 3rd Squadron; then came the older ships of the 2nd Battle Squ and lastly the three sorely wounded battle cruisers.[2] The cruisers of the 2nd and 4th Scouting Groups were stationed the head of the battle fleet, while in advance of all were th jority of the German destroyers groping like antennae int darkness. About 9:30 Scheer started to feel his way to the ward, the van of his line turning S.S.E.$\frac{1}{4}$E., a course which he for Horn Reefs. Shortly after 10:00 his advanced light cru came into contact with the right wing of the flotillas bri up the rear of the Grand Fleet. A sharp fight took place in the “Castor,” leading the 11th flotilla, was severely han The near-by destroyers would probably have retaliated more effect had they not been deceived by the enemy ma part of the British challenge for the day. This he appears to picked up through indiscreet flashing signalling between “Lion” and “Princess Royal,” about half an hour previo

The High Seas Fleet recoiled slightly after this brief encou but even the rival forces continued to converge and now Go nough's light cruisers once more came into the forefront o scene. He had been keeping in touch with the “Marlboroug division, but owing to the under-water injuries of the flagship latter was lagging nearly three miles astern of its proper sta The “Castor's” engagement had put the “Southampton” an consorts on the alert, and they were well prepared when, a 10:30, they suddenly found themselves abreast the 4th Scou Group. A fierce contest ensued. The “Southampton” was most vigorously assaulted. Her upper deck became a sham and she was blazing like a haystack from cordite fires, bu the midst of this holocaust she fired a torpedo which sunk “Frauenlob” with all hands. At the end of a quarter of an the enemy had had enough and drew off into the darkness. German light cruisers had already reported the presenc enemy light forces and the order stationing the British destr flotillas astern had been intercepted and translated to Scheer shore wireless station. From these reports he probably real that our battle fleet had drawn ahead. In any case he was termined to force his way to the eastward. At 10:30 he tur back to S.E.$\frac{1}{2}$E. heading direct for Horn Reefs Light Vessel.

The British Destroyers in Action.—The rest of the story of night is one of sudden encounters with an enemy fighting perately to get home while the British destroyers galla threw themselves in his path whenever opportunity served. German fleet was frequently in a state of much confusion, “Elbing” was rammed by the “Posen” and later had to sunk to prevent capture. The “Rostock” was torpedoed the 4th Flotilla and also had to be sunk. On the British side destroyers suffered severely. About 11:30 the “Tipperar was so badly damaged by gunfire that she sank the next morni The “Spitfire” met the great battleship “Nassau” nearly on, tore twenty feet from the latter's plating and carried it

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[1] The “Warspite” after her involuntary circle at 6:20 P.M. continued to have trouble with her steering gear. At 7:00 she withdrew from the action and at 8:50 was ordered back to Rosyth. She had been badly hit in the earlier fighting.

[2] The “Lützow” was limping along to the northward sink deeper and deeper by the bows. At 2 A.M. she had to be abando and was afterwards sunk with a torpedo.

forecastle. She was badly damaged but had done good
ion with her small gun armament, putting out the big
searchlights and causing a number of casualties.
shock of this conflict again caused the German fleet to
and the leading battleships turned away nearly eight
to the westward, but Scheer was adamant in his deter-
ion to break through at all costs while darkness gave hope
ape. He forced his van back, and by 11:34 the " West-
" was again leading the line to the south-eastward. In
er encounter a few moments later the " Broke's " steering
was disabled and she and the " Contest " rammed the
rrowhawk," and the latter had to be sunk the next day.
een midnight and 12:30 A.M. the " Fortune " and " Ardent "
sunk and the " Porpoise " disabled by gunfire, and the
bulent " was rammed and sunk with all hands. Again
gain the British light craft attacked, but from now on-
the enemy held his course; and the tragedy of that night
hat no accurate information of the German battle fleet was
isafed to Adm. Jellicoe.
miralty Messages.—Two reports, based on intercepted wire-
nessages, were sent to Jellicoe by the Admiralty. One,
tched at 9:58, received in the " Iron Duke " about 10:23,
not decyphered and read until 11, gave an obviously
position of the rear ships of the enemy battle fleet at
A second message, despatched at 10:41, received at 11:05,
read about 11:30, stated that the German battle fleet had
ordered home at 9:14, battle cruisers in rear, course S.S.E.
16 knots. This latter was a summary of several intercepted
ls but most unfortunately it omitted the fact that Scheer,
06, had made an urgent call for airship reconnaissance off
Reefs at daylight, clearly indicating his intended line of
at. The second Admiralty message referred to the enemy's
ments at 9:14, but at 11:38 Goodenough's report was re-
d[1] saying: " Have engaged enemy cruisers at 10:15 bearing
W.," and about the same time the " Birmingham " also
ted from astern: " Battle cruisers probably hostile in sight
least course south " (11:30). These reports came from
which had actually sighted the enemy long after the time
red to in the Admiralty messages. They indicated that he
not yet turned home. The " Birmingham," unfortunately,
ed the German heavy ships at a moment when they had
ed away from our torpedo attacks, his report therefore
misleading, but other ships might have saved the situ-
1.
11:35 the " Valiant," last ship but one of the 5th Battle
dron, noted what appeared to be " two German cruisers
at least two funnels and a crane amidships, apparently
ing to the eastward at a high speed."[2] These details make
rtain that the ships were battleships and should have been
gnised as such. The " Malaya," the last ship of the squad-
had a clearer view and noted at 11:40 " enemy big ships,
e points abaft the starboard beam, steering the same way as
." By the flash of an explosion the leading ship was seen to
" two masts, two funnels and a conspicuous crane (appar-
y " Westfalen " class)."[3] It was obvious that the enemy's
n fleet had closed in from the westward and was edging its
across the wake of the 5th Battle Squadron, yet for some
nceivable reason these two ships neglected to report what
had seen. Had they done so it would have greatly increased
chances of an overwhelming victory next day. The courage
self-sacrifices of the British destroyers did not provide the
thing lacking, *i.e.*, information. Before the curtain of
kness had lifted, Scheer had hacked his way through the light
es and passed to the eastward.
cheer was not yet out of the wood, however. About 1:45,
as a faint grey light was heralding the approaching dawn,
ot. Stirling, in the " Faulkner " with his fine 34 knot 12th
tilla, sighted large ships on his starboard bow, steering a southeasterly course. Even as he manoeuvred to attack he thought to send a wireless report to his commander-in-chief. The attack, carried out with the greatest dash and gallantry, resulted in the battleship " Pommern " being sunk without a trace. Again Capt. Stirling made his wireless message, but neither of his reports reached the " Iron Duke." About 2:25 in the growing light, the " Champion " with three destroyers sighted the enemy. One of the latter, the " Moresby," broke off at once and made a plucky attack which sank the German destroyer " V4," but the " Champion " turned to the eastward and made no report.

At 2:39 A.M. Jellicoe turned north. He had been left with the impression that the enemy had been following him south and now, with daylight rapidly returning, he was anxious to get in touch with a view to renewing the engagement. It had been his intention to close Horn Reefs at dawn, but the night fighting had scattered his flotillas and he deemed it imprudent to thrust into enemy waters until he could collect a destroyer screen. A signal from the Admiralty, despatched at 1:48 A.M. but not received in the " Iron Duke " until 2:40 informed the commander-in-chief that enemy submarines were apparently coming out from German ports. The battle fleet formed single line on the northerly course so as to be ready for emergency in the early morning haze, and so, retracing his path, Jellicoe expected momentarily to fall in with his destroyer flotillas and possibly the damaged " Lützow." Tyrwhitt's Harwich Force had, at last, been ordered to sea, and by 3:50 A.M. he was under way, much too late to be of service. From 3:15 A.M. Zeppelins began to be sighted and at 3:42 A.M. the battle fleet had turned expectantly towards the sound of guns, but found that it was only some British cruisers engaging one of the enemy airships. It was obvious, however, that by now the position of the British fleet must be known to the German command. The hope of meeting the enemy which had been growing fainter was finally shattered by an Admiralty message received at 4:15 A.M. saying that at 2:30 A.M. the High Seas Fleet was only 16 m. from Horn Reefs steering S.E.b.S. at 16 knots.

Beatty was still clinging to the idea that the enemy was to the south-westward, and asked permission to sweep in that direction; but at 4:30 A.M., having re-formed into cruising formation, Jellicoe regretfully made the signal " Enemy fleet has returned to harbour." Scheer reached Horn Reefs Light Vessel about 3 A.M. There he lingered for a short space receiving reports from his airships and taking stock of the condition of his fleet. At 3:30 A.M. he was informed that the " Lützow " had had to be sunk. The rest of the 1st Scouting Group was in no condition for serious action, the battleships which had been in the van had also suffered considerably, and he had only three light cruisers serviceable; moreover the visibility was such that he could not rely on airship reconnaissance. Indeed many of the reports which he received from this source have since been proved to be very inaccurate. A policy of discretion was obviously dictated, and he gave the order for the whole fleet to return to harbour. On the way in, the battleship " Ostfriesland " struck a mine laid in the channel by the British destroyer " Abdiel " but got home.

The losses may be summarised as follows:—

Ships	British	German
Battleships	Nil	1
Battle Cruisers	3	1
Cruisers	3	Nil
Light Cruisers	Nil	4
Torpedo Craft	8	5

Personnel	British	German
Officers (killed)	328	160
Men (killed)	5,769	2,385
Officers (Prisoners)	10	Nil
Men (Prisoners)	167	Nil
	6,274	2,545

The delay was due to " Southampton's " wireless gear having
n shot away.
" Valiant's " report in Jutland despatches, p. 211.
" Malaya's " report in Jutland despatches, p. 220.

On the face of them these figures would appear to leave the balance of Jutland in favour of Germany, so far as destruction of men and ships is concerned, but the value of the battle must be measured in its after effects and not in its momentary losses. There Britain was the gainer.

Results.—The broad effects of Jutland are a matter of history, but they may be summarised as follows:—

1. The High Seas Fleet after "consistently refusing action and manoeuvring with the sole object of returning safely to its base," as Jellicoe has put it, left the Grand Fleet in undisputed possession of the arena.

2. Although the German High Command must have realised that the Grand Fleet as a "fleet in being" was the fulcrum of the whole Allied cause, the High Seas Fleet only once left the Heligoland Bight after Jutland; this was on Aug. 19 of the same year. On this occasion Scheer was warned by airship reconnaissance that the British Battle Fleet was advancing to meet him, whereupon he returned to his base.

3. In Nov. 1918 Scheer ordered the High Seas Fleet to se
break the blockade." It was to have been a final bid for victor
inaction had only served to crystallise the memories of Jutlan
crews refused to weigh anchor. This mutinous outbreak a
helmshaven widened the fissure which shortly afterwards en
the whole German cause.

4. The full fruits of Jellicoe's domination of the German F
Jutland were yielded on Nov. 21 1918, when Beatty receive
surrender of the greater part of the High Seas Fleet.

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JUVENILE COURTS: *see* CHILDREN'S COURTS.

AISER, GEORG (1878–), German dramatist, was born at Magdeburg Nov. 25 1878, the son of a merchant. Educated in his native city, he became a merchant and joined the staff of the Deutsch-Ueberseeischen Elektrizi- Gesellschaft, Buenos Aires. After three years he was forced turn to Germany owing to ill-health. He lived for some at Magdeburg and at the Seeheim (Mariners' Home) in n. In 1903 he published his first drama and from that time rds wrote numerous farces, and plays dealing with social ethical problems. In 1920 he was prosecuted for embezzle- and sentenced to a term of imprisonment. His work cted considerable attention both in his own country and d. His play *Von Morgen bis Mitternachts* was produced nglish as *From Morn to Midnight* at the Regent Theatre, lon, in 1926.

s works include: *Die jüdische Witwe* (1911); *König Hahnrei*); *Die Bürger von Calais* (1914); *Von Morgen bis Mitternachts*); *Die Sorina* (1917); *Die Versuchung* (1917); *Gas* (1918 and); *Die Koralle* (1918); *Die Flucht nach Venedig* (1923); *Kolpor-* (1924).

LA-AZAR (*see* 15.637).—In 1881 a malaria-like fever, with enlargement of the spleen, was found to be causing serious ality at the foot of the Garo Hills in Assam, from whence it ad slowly eastward during the next two decades over some m. of the Brahmaputra valley, carrying off about one-third ne inhabitants.

usation and History of Parasite.—It was attributed by essive investigators to hookworm disease, epidemic malaria, Malta fever respectively, until in 1903 Leishman and ovan independently discovered its cause in a new minute ozoal parasite, Leishmania donovani, found in the spleen. he following year L. Rogers developed a flagellate stage ne organism in cultures, and suggested a biting insect, prob- the bedbug, as its carrier, a supposition which was sup- ed by Patton demonstrating the flagellate stage of the site in bedbugs fed on the blood of kala-azar patients in . But in 1925 Knowles and Napier, of the Calcutta School ropical Medicine, appear to have solved the difficult prob- by incriminating a sand fly, Phlebotomus argentipes, as the agent in transmitting the disease; this minute insect, to- er with kala-azar cases, being far more prevalent in areas alcutta with much vegetation than in the more crowded an quarter. After the discovery of the causative parasite 903 it was soon found that what had for a century been called arial cachexia in Bengal was nothing but a widely distributed adic form of the Assam epidemic kala-azar, the virulence of latter being due to its invasion of an area previously free n the disease. The disease is now recognised as being very valent over all Bengal, Bihar, the eastern part of the United vinces and in Madras, but the comparatively dry Punjab north-west frontier are practically free from the disease, a ain degree of humidity being necessary for it. A form of a-azar especially affecting children is also prevalent all round Mediterranean basin and in Egypt and the Soudan.

ymptoms.—Kala-azar is characterised by very prolonged er, often typhoid-like in the early stages, and frequently show- two or three rises and falls in 24 hours, the characteristic ble remittent fever, but with long intervals of low continued ntermittent fever, the total duration being seldom less than en months and often extending, with periods of freedom n fever, over several years; accompanied by extreme wasting, y great enlargement of the spleen, and later of the liver, some emia and extreme reduction of the white corpuscles of the od, which lowers the resisting power of the patients to secon- y infections with septic diseases, pneumonia, dysentery and hisis, which are far more frequently the ultimate cause of th than the original disease, the case mortality having been il recently from 80 to 96%.

Prophylaxis and Treatment.—As the result of his Assam researches of 1897, L. Rogers established a house and site infection of kala-azar and worked out a system of moving the sites of the villages and tea garden coolie lines, whereby the further progress of the epidemic up the Assam valley was checked for many years. J. Dodds Price successfully applied the same plan to stamping out the disease from a number of badly infected tea estates, thereby saving the industry in the Nowgong district. The debilitating effects of the 1918 influenza pandemic led to a recrudescence of kala-azar in the Assam valley, including the more eastern and little infected area. Fortunately by this time an effective treatment had been discovered in intravenous injection of tartar emetic and other antimony preparations, which now enables some 90% of the cases to be cured; a greater saving of life perhaps than has been effected in any such fatal illness by modern medical research, with the result that many thousand cases have been treated successfully each year in Assam and Bengal. Given adequate funds and organisation, this, the most terrible of tropical fevers, might be nearly stamped out of the large areas which it has decimated for centuries past and further epidemics prevented. See L. E. Napier and E. Muir, *Kala-Azar* (1923). (L. Ro.)

KAMERUN: *see* CAMEROONS.

KANSAS (*see* 15.654).—The population of Kansas on July 1 1925, according to the State census of that date, was 1,812,936, as compared with 1,769,257 by the Federal census of 1920. The estimated population on July 1 1926 was 1,820,296. Four cities (Kansas City, Wichita, Topeka and Hutchinson) had over 25,000 inhabitants in June 1926. 43.5% of the population lived in cities and towns of over 1,000 inhabitants. In the ten years from 1915 to 1925 the rural population increased only 5,000 while the urban population increased 135,000.

Agriculture.—Kansas is pre-eminently an agricultural state. It is the largest producer of wheat and corn taken together in the Union. The wheat crop in 1924 was 151,690,970 bu., and the corn crop was 118,789,236 bushels. The crops next in importance were oats and barley. There is an extensive livestock industry.

Mineral Products.—There are considerable deposits of bituminous coal along the eastern border of the state; production amounted in 1924 to about 4,150,000 short tons. Natural gas yielded 27·8 billion cu. ft. in 1920. There has been little effective control of the distribution of gas, and distributing companies have fixed rates in total disregard of their original contracts. The most striking development of the decade in this field had been in the production of petroleum which stood at only 3,000,000 barrels in 1914, jumped to 36,500,000 in 1917, reached the peak at 45,500,000 in 1918 and stood at 28,483,000 in 1924. The supply of materials for cement seems inexhaustible and the value of this product is exceeded only by those of oil, coal and gas. Kansas ranks fourth in the Union in the production of salt, of which the production in 1924 was reported by the State Geological Survey at 794,303 short tons, valued at $3,176,000. The Joplin zinc and lead field overlaps the southeast corner of the State, but while the field approaches exhaustion on the Missouri side, it is capable of indefinite development in Kansas. The output of zinc in 1924 was 105,392 short tons, valued at $13,700,960.

Manufactures and Transport.—Federal statistics distinguish 36 industrial groups in each of which the value of the annual output exceeds $300,000. The larger interests are based upon products of agriculture. The largest is the slaughtering and packing of meat, which in 1923 produced products valued at $224,661,483 —almost one-tenth of the total output of the United States. Nearly the whole of this industry is localised in Kansas City. The next largest industry is the milling of flour, which is widely distributed over the State. Slaughtering and milling together contribute considerably more than half the value of the manufactured products of the State. Railways and the industries subsidiary to them employ a large part of the labour of the State.

The railway mileage was 9,384 in 1923. The electric interurban railway mileage was 582 in 1923. With the building of hard-surfaced roads motor-bus lines are superseding electric railways.

Constitution.—Kansas in 1925 was still governed by her original constitution, adopted in 1859. Twenty-one amendments were made prior to 1910 and seven have been added since that time. The suffrage was extended to women in 1912, and under pressure of the World War the suffrage was limited in 1918 to citizens of the United States. Provision was made for recall of public officers in 1914, but the Supreme Court decided that the clauses are not self-executing, in that they make no provision for special elections, and the Legislature has not seen fit to give them effect. The constitutional requirement that all property be taxed at a uniform rate has delayed tax reform. An amendment permitting the classification of property for purposes of taxation was rejected by the people in 1914 and 1920 but finally carried in somewhat altered form in 1923. Two amendments were adopted in 1920. One, resulting from the efforts of Gov. Allen to reduce farm tenantry, authorised the creation of a fund to assist in the purchase of farm homes. The other so far removed the prohibition of State action in works of internal improvement as to allow the State to assist counties in building roads. No action has been taken by the Legislature under either head.

Legislation.—Generally speaking, legislation has followed the drift in other states. An exception was the " blue sky " law, for the regulation of investment companies, passed in 1911 and amended in detail in 1913 and 1915. It prohibits the sale in the State of stocks not approved by a board, consisting of the Secretary of State, the Attorney-General and the State Bank Commissioner, and thus prevents the floating of worthless securities. It has been extensively copied in other states. Another step in advance was the act of 1913 which provides for the nomination and election of judges by separate ballots without party designation. Since 1910 the administration of the State has become centralised to a high degree. The first step was taken in 1913 in reference to the various educational institutions, and in 1925 all the higher educational institutions were put under the control of a single board called a Board of Regents, consisting of nine members appointed by the governor for terms of four years and electing their own chairman. A provision that part of the board retire annually is intended to give it permanence and remove it from political control. An attempt, made by Gov. Capper in 1917 and renewed by Gov. Allen in 1921, to consolidate on a similar plan the various bureaux that compose the State Board of Agriculture did not succeed. In 1911 the State Board of Railroad Commissioners was superseded by a Public Utilities Commission, modelled on the commissions already established in New York and Wisconsin, to which was given supervision of all public utilities in the State.

The Eighteenth (Prohibition) Federal Amendment was ratified Jan. 14 1919. In 1919 a general strike in the coal-fields broke out, which suspended production and threatened a coal famine in the midst of an exceptionally severe winter. Gov. Allen took over the coal-mines and began their operation by means of volunteers recruited chiefly from among the students in the educational institutions, and called the Legislature in special session to provide against the recurrence of such conditions. The result was the passage in 1920 of an act which created a Court of Industrial Relations, consisting of three members. The act declared the manufacture of food and clothing, the mining of fuel and transport to be essential industries and " affected with a public interest " to such a degree as to justify public control. The right of collective bargaining was recognised but strikes were prohibited and the court was given authority, either on its own initiative or on complaint, to investigate and to issue orders regulating limitation of production, hours and conditions of labour, and rate of wages. Originally the Public Utilities Commission was merged in the Industrial Court, but in 1921 the former was re-established—a separate body and the Labour Bureau and the Industrial Commission were merged in the latter. Finally in 1924 the Tax Commission, the Public Utilities Commission and Court of Industrial Relations, including the Department of Labour, were consolidated in a single board of five
bers called the Public Service Commission. The power
court to fix wages has been annulled by the courts but in
respects it functions satisfactorily operating with the Bure
Labour as a department of the Public Service Commissio
considerable number of cities have abandoned the old city co
form of government. An act passed in 1907 and amend
1909 and 1913 authorised the adoption of a commission
of government in cities of the first and second class. Up to
54 cities reorganised under this law. In 1917 the Legisl
authorised the city-manager plan. All cities that have reo
ised since then (14 by 1925) have adopted this plan.

History.—Kansas has been overwhelmingly Republica
politics and there has been practically no Democratic press i
State. The following have been governors since 1909: W
Stubbs, Rep., 1909 and 1911. G. M. Hodges, Dem., 1912
Capper, Rep., 1914 and 1916. H. J. Allen, Rep., 1918 and
J. Davis, Dem., 1922. S. Paulen, Rep., 1924.

BIBLIOGRAPHY.—Session laws and Senate and House journal
issued after each legislative session. The last edition of the
piled Statutes was issued in 1923. Reports of executive departn
are brought together in a collective volume entitled *Combined*
partment Reports. Other important publications are the *Bie*
Reports of the State Board of Agriculture and the State Boa
Health and the collections of the State Historical Society.
State Library issued in 1920 a reprint of the *Proceedings of the*
stitutional Convention of 1859, with much supplementary histo
matter, edited by H. G. Larimer. (F. H. H.

KANSAS CITY, Kan., U.S.A. (*see* 15.660), annexed about
acres of territory between 1910 and 1920 and over 2,000
including Rosedale, in the following years. Its area is now (
23 square miles. The population in 1920 was 101,177 (104.9
to 100 females), of whom 14,405 were negroes and 11,721 for
born; in 1925 the state census gave it as 116,053. The
packing industry, in which the city ranked next to Chicago,
tinued to overshadow all other industries, contributing 75–
of the total value of factory products within the city li
which totalled $164,081,000 in 1909, $468,686,000 in
$235,561,733 in 1921 and $262,446,752 in 1923. The pac
industry and the livestock market illustrate the economic u
of the two Kansas Cities. The packing houses are on the Ka
side; the state line runs through the stockyards, of which
are in Kansas; the livestock exchange is in the Missouri
By 1925 over $7,000,000 had been invested in the water,
and power plant; the park area had been increased to 300 a
the connecting boulevards to 25 m. and plans for 50 m. more
been made by the city planning commission. A zoning o
nance was adopted in 1924. A city hall was erected in 191
memorial building, dedicated to those who lost their live
the wars of the country, in 1925; and a beautiful county c
house was under construction in 1926.

KANSAS CITY, Mo., U.S.A. (*see* 15.661), the ninetee
city in point of size, and the seat of a Federal Reserve Ba
was in 1924, with its contiguous neighbour across the state
the largest market in the country for hay, stock and feed ca
and stock hogs. It ranked first in distribution of lumber, se
kaffir corn and agricultural implements; second in meat-pack
and as a live-stock and horse and mule market; third in manu
ture of flour and soap and as a grain market; fifth in capacit
grain elevators; sixth in post-office receipts; and tenth in b
clearings.

The population in 1920 was 324,410, of whom 30,719
negroes and 27,320 foreign born; in 1925, according to
official estimate, it was 367,481. In 1924 the output of
manufacturing plants of Greater Kansas City was valued
$604,526,719; the goods distributed by the wholesale house
$727,327,171. Manufacturing was increased after the Wo
War by the establishment of branch plants of many east
firms. The making of open-hearth steel for local consumpt
developed. Large oil refineries were built, with direct pipe-li
from the producing fields. Transportation facilities were
creased by auto-bus lines over hard-surfaced roads built in ev
direction; and by the Kansas City Terminal Railway, wh

rates a system of depressed tracks, constructed at a cost of ,000,000, and a Union passenger station opened in 1914.

y 1925 the public school system included 90 elementary ools, five senior and three junior high schools, a teachers' ege, a junior college, 31 combination and special schools; ond issue of $5,000,000 for new buildings and equipment had been authorised. The common "chest" for 45 philanpic agencies was nearly $1,000,000; a city plan had been pted (1922); there were 3,470 ac. in the parks and playınds, 95 m. of continuous boulevard, an exceptionally fine ball park and 10 golf courses; a comprehensive zoning nance had been passed (1923); a new water supply plant to $11,000,000 was under construction; the Liberty Memorial, gned as the central feature of a group of buildings for cultural poses, was nearing completion opposite the Union Station a. The cost of living in Kansas City is relatively low (94·4% he average for 31 American cities, Dec. 1924). In 1925 w charter—the fourth prepared within eight years, and the d submitted to the voters—was adopted by a large majority, ing up the council-manager form of government.

APOK: *see* CELLULOSE; FIBRES.

APP, WOLFGANG (1868–1922), German politician, was born ew York July 24 1868. He was the son of Friedrich Kapp, ational Liberal member of the Reichstag in Bismarck's time, grew up under the Bismarckian influences. Having held ous minor official posts, he founded the agricultural credit itute in East Prussia, which achieved great success in proing the prosperity of landowners and farmers. He was conıently in close touch with the Junkers of East Prussia and ing the World War made himself their mouthpiece in an ck on Bethmann Hollweg (*Die Nationalen Kreise und der chskanzler* (1916). He was also one of the founders of the aterslandspartei." For a brief period in 1918 he was a Conative member of the Reichstag.

app remained in the background till March 12 1920, when Republican Govt. suddenly issued an order for his arrest. ecame known that he had organised, with General von Lütt and other officers, a conspiracy to occupy the Government es, and assume power in Berlin. This he actually succeeded oing on the morning of March 13. Kapp was installed in the erial Chancellary and at once styled himself "Chancellor of Reich." President Ebert and most of his ministers fled, to Dresden and then to Stuttgart. The Kapp Govt. was, ever, short-lived. The working classes of Berlin rendered its tinuance impossible by declaring a universal strike, and on evening of March 17, Kapp and Lüttwitz fled to Berlin. Wars were issued for their arrest, but Lüttwitz disappeared comely, and Kapp eventually escaped by aeroplane to Sweden. April 1922 he returned to Germany and was immediately sted for high treason, but he died on June 12 from the consences of an eye operation at Leipzig, before the case was heard.

ARACHI, India (*see* 15.672), has grown very rapidly, and the ulation, which was 216,883, half Hindu and half Moslem, in 1, has nearly doubled since 1901. In 1920–1, 364 plans for buildings were approved, and 367 in 1921–2. Among note public buildings are the municipal offices, begun before the rld War but unfinished in 1923; the fine Port Trust offices customs house (1915); a small causes court, revenue office paper currency office; the Jehangir Kothari hall; a home for r and defective persons, a new maternity home, and a Wel Association building; a masonic temple, a commercial ege and several schools. The foundation stone of a new ding for the chamber of commerce was laid in 1924. A parade h terraces and a pier to the water's edge was opened at New ton in 1921, and a People's Park has been laid out in the old of the river Lyari. A new embankment road skirts the old n and forms the southern boundary of the park. A contract placed in 1925 for a new conduit from Malir, 16 m. long, to ease the supply.

arachi is a progressive port with a great future. It receives produce of the Punjab, Sind, Baluchistan, Afghanistan, ch of Rajputana, and part of the United Provinces, while the Delhi trade has shown a tendency to pass through Karachi rather than Bombay. The great Sukhur barrage scheme, which received official approval in 1921, will bring the exportable produce of a further 3,500,000 acres to the port. Trade has recovered gradually from the effects of the War, and the exports are largely wheat. The imports are mostly cotton and woollen goods and yarn. A new boat basin was built in 1911, a wharf for coasting steamers in 1912 and work on other extensions is in progress. It is planned to build 13 new berths on the west side of the harbour. Land for six berths was reclaimed in 1923–4, and it is hoped that three berths, each 550 ft. long, will be finished by 1927. The North-Western Railway, on which Karachi is dependent, is now double-tracked as far north as Samasata.

KARNEBEEK, HERMAN ADRIAAN VAN (1874–), Dutch statesman, was Netherland's delegate to the Second Peace Conference at The Hague in 1907. In 1911 he became burgomaster of The Hague, holding this position until 1918, when he was appointed Foreign Secretary. In 1921 he presided at the second Assembly of the League of Nations.

KÁROLYI, MICHAEL, Count (1875–), Hungarian politician, born on March 4 1875, and descended from a famous and wealthy family, Count Károlyi, after a delicate childhood, took his degree at Budapest University, exhibited keen interest in horse breeding and horse racing and became, in succession to his uncle, president of the Hungarian Co-operative Society (Hangya). He then travelled a good deal, spending much time in Paris. In 1902 he stood for Parliament as a Liberal but was defeated. In 1905 he was elected to a short Parliament and took no further part in Hungarian public life until 1909 when he became president of the Hungarian Agricultural Society, and worked for the creation of an agrarian Centre party. He then resigned from the conservative Agricultural Society and, having come under the influence of the writings of Karl Marx, became leader of the Radical wing of the Independence party, and led the Parliamentary opposition against Count Stephen Tisza, then Prime Minister, with whom he fought a duel.

Opponents of Count Károlyi have maintained that his jealousy of Tisza and his enmity against the older statesman were the dominating motives of his career. Count Károlyi, in his autobiography, *Fighting the World*, while admitting that it was Tisza who drove him into a democratic camp, has maintained that his political ambitions were to break the relations between Austria and Hungary, substituting for them a Russo-Hungarian *rapprochement*, and also to destroy the capitalist system. In order to provide party funds for these purposes he entered into secret negotiations with the French Govt. and visited America. His return from that country coincided with the outbreak of the World War and he was interned in France, but was soon released on the understanding that on reaching Hungary he would do his best to bring the War to a speedy conclusion. He then seceded from the Independence group and founded the Károlyi party for the purpose of breaking with the Germans and entering into a separate treaty of peace. In spite of these opinions he married, on Nov. 7 1914, the step-daughter of Count Julius Andrássy, a statesman with utterly opposite views, and became an officer in the National Defence Hussars. He concentrated his activities throughout the War on pacific aims in the hope that their realisation would achieve in Hungary the enactment of universal suffrage, socialisation of industry and the division of land amongst the people.

On Oct. 25 1918, when the War was clearly lost, Count Károlyi founded the National Council composed of his own personal supporters, Social Democrats and Radicals. The Werkerle Cabinet resigned, and Count Hadik was appointed Premier by King Charles. On Oct. 30 there was a revolution, led by the Soldiers' Council and supporters of the National Council, who occupied practically all strategic points in Budapest. The next day Count Hadik resigned and in the name of King Charles Archduke Joseph had no alternative but to appoint Count Károlyi as Prime Minister, who then took the oath of allegiance to the King. The same day, Oct. 31 1918, Count Tisza was assassinated in his Budapest home by revolutionaries. On Nov.

16 the Hungarian People's Republic was proclaimed at a public meeting under the auspices of the National Council, and full powers were entrusted to the Cabinet of which Károlyi was Prime Minister. On Jan. 11 1919 the National Council formally proclaimed Károlyi as President of the People's Republic.

It was a short-lived triumph. The forces of disruption and discontent soon got completely out of hand and on March 21 1919 Count Károlyi handed over the Government to the Soviet of Bela Kun. Count Károlyi remained in the country unmolested until the eve of the collapse of terrorism and then left Hungary for Czechoslovakia. Later he was expelled from Italy for Communist propaganda and made his headquarters in Paris, visiting the United States, where he was prohibited by the Government from continuing propaganda presumably against the Hungarian Govt., which might have affected the League of Nations' loan for Hungarian reconstruction.

The High Court of Hungary found, after public trial at which Count Károlyi was legally represented, that on account of his actions during the War and in organising the revolution he was guilty of high treason and felony. As a result of that verdict Count Károlyi's estates were confiscated, a large portion of them being divided under Land Reform, among some 5,000 smallholders. Other accusations made against Count Károlyi by his fellow-countrymen were that by his systematic encouragement of mob-law and military indiscipline and by his weakness as Prime Minister and President he was the direct cause of the Bolshevist reign of terror and the subsequent occupation of Hungary by the Rumanian Army. It is further officially maintained that by negotiating a separate armistice with Gen. Franchet d'Esperey at Belgrade Károlyi deprived Hungary of many territorial and other rights to which she was entitled under an armistice previously concluded by Gen. Diaz on the Italian front with the Austro-Hungarian armies. (W. Go.*)

KATA THERMOMETER.—In considering measurement of ventilation we must bear in mind that the ordinary thermometer merely gives the average temperature of its surroundings. While the human body produces heat, and all day long is keeping itself at body temperature, the thermometer does not produce heat, but just registers the effect of the surrounding atmosphere upon itself. An instrument is needed, then, to indicate the cooling and evaporating power of the air.

The Kata thermometer is such and is far more indicative of human feeling than the ordinary thermometer. It records not only the effect of the temperature of the surrounding air on the cooling of its surface when at body temperature, but of the wind and any movement of the air, and also how quickly cooling takes place when its surface is wet, as the skin is when perspiration is going on. The Kata thermometer is a large-bulbed alcohol thermometer of standard size with stem graduated from 100° to 95° Fahrenheit. It is warmed up in hot water till the meniscus rises above 100° F.; the bulb is then dried, and the rate of cooling of the meniscus from 100° to 95° F. taken with a stop-watch. From a factor number determined for each instrument the cooling power is deduced in millicalories (1/1000 gramme calorie) per sq. cm. of the surface of the bulb at body temperature per second. In still air the dry Kata thermometer has a cooling power of about 10 at 0° C., and about 5 at 20° C.; with a wind of 9 m. per hour it has a cooling power of about 40 at 0° C., and 20 at about 15° or 16° C., and so on with different rates of wind. Wind is far more important than temperature to the cooling of the body; thus the still air is easily borne. In the case of the wet Kata thermometer a wet muslin glove covers the bulb. In factories, schools, etc., the reading of the cooling power of the dry Kata thermometer should not be less than 5–6 with a temperature of about 60° F., 7 at 70 and 8 at 80°, otherwise the efficiency of the worker and pupil will tend to go down. Observations made by the Industrial Fatigue Board in pottery, boot and shoe, cotton and printing works, showed that a great number of readings were below 6. The general mortality is greater in the trades with the lower readings. Great improvements could yet be made in this respect. See Medical Research Council, *Special Report, No.* 73 (1923). (L. E. H.)

KATO, TAKA-AKIRA, COUNT (1859–1926), Japanese sta man (*see* 15.696), resigned his post as ambassador in London Dec. 1913, having in the previous year been created a bar Returning to Japan, he joined Prince Katsura's third Cabine foreign minister for the third time but resigned soon after. then reorganised the Doshikai, created by Katsura, and renan it the Kenseikai or Constitutionalist party, of which he beca president in 1913 (*see* JAPAN). In April 1914 he joined the Oku Cabinet as foreign minister, resigning in 1915. It was during incumbency that Japan sent the so-called 21 demands to Chi In Aug. 1915 he was elected a crown member of the house peers and in the following year was created a viscount. T following decade proved a quiet period for Kato, but in 1924 became premier of the Coalition Cabinet of the Kenseikai, Seiyukai and the Kakushin Club. His administration was ma historic by the passage of the universal manhood suffrage la Owing to dissensions among members of the Cabinet, K reorganised his Ministry on Aug. 1 1925, forming it exclusiv with members of the Kenseikai party. On Jan. 28 1926 he d in Tokyo while in office. The Emperor, learning the gravity his illness, conferred upon him the dignity of count.

KATSURA, TARO, PRINCE (1847–1913), Japanese soldier a statesman (*see* 15,697).—In Aug. 1911 he resigned the premi ship in favour of Marquess Saionzi, after completing the work financial reform and treaty revision which he had undertak and received the rank of prince. On Dec. 20 1912 he again cepted office as Premier. In Feb. 1913, however, a vote censure on the Premier was moved in the Diet for the alleg misuse of imperial rescripts, and on Feb. 10 the Prince resign office. His health was already failing, and he died in Tok Oct. 10 1913.

KAVALLA (*see* 15.701).—This port on the coast of easte Macedonia, with an exposed harbour, has a population of ab 20,000. The immediate hinterland is a rich tobacco-growi country, but Kavalla is handicapped by the fact that the railw from Salonika to Dedeagach runs through Drama, 22 m. inla from the coast, with no branch line to Kavalla. Kavalla h belonged to Greece since the Balkan War of 1912–13. It w coveted by Bulgaria as a maritime outlet, and M. Veniselos w inclined to concede it to her, but this policy was ruled out by t outbreak of the second Balkan War. After the outbreak of t World War, when Bulgaria was still neutral, the British Gov attempted to attach Bulgaria to the Allied cause by offering cede Cyprus to Greece, on condition that Greece ceded Kava to Bulgaria. This offer was rejected by King Constantine's Gov Bulgaria intervened on the side of the Central Powers; a Kavalla has remained under Greek sovereignty, though t Bulgarians occupied it during the Salonika campaign. Duri the negotiations over the peace treaty of Neuilly (*q.v.*) wi Bulgaria, M. Veniselos offered to connect Kavalla with the ready existing narrow-gauge railway in the Struma vall which runs from the Bulgarian side of the frontier to Sofia. T would have contributed to the fulfilment of Article 48 of t treaty, in which the principal Allies assured to Bulgaria an e nomic access to the Aegean Sea; but no action has been tak upon the offer of M. Veniselos. See *Handbook of Macedon* (British Admiralty, 1920).

KEANE, JOHN JOSEPH (1839–1918), American Roman Cath lic archbishop (*see* 15.706), died at Dubuque, Ia., June 22 19 He had retired in 1911.

KEITH, SIR ARTHUR (1866–), British anthropologis was born at Old Machar, Aberdeen, Feb. 5 1866. He studie medicine at Aberdeen University; University College, Lond and Leipzig. He lectured extensively on anatomy and surger became a leading authority on anthropology, and an expert on t reconstruction of prehistoric man from fragments or fossil r mains. He was Fullerian professor of comparative anatomy a the Royal Institution from 1917 to 1923, became conserva of the Museum and Hunterian professor at the Royal Colleg of Surgeons in 1908 and acted as honorary secretary of th Royal Institution from 1923. He was secretary and la president of the Anatomical Society of Great Britain, presid

he Royal Anthropological Institute (1913–7), and in 1913
elected F.R.S. and *membre de la Société d'anthropologie de*
is. He was knighted in 1921, and was designated as president
he British Association for 1927. (*See* MAN, EVOLUTION OF.)

is published works include *Introduction to the Study of Anthropoid*
s (1897); *Human Embryology and Morphology*, 4th ed. (1921);
ient Types of Man (1911); *The Human Body* (1912); *Antiquity of*
(1915, 2nd ed. 1925); *Menders of the Maimed* (1919); *Engines*
ie Human Body (1919, 2nd ed. 1925); *Nationality and Race*
9); and *Religion of a Darwinist* (1925).

ELANTAN: *see* MALAY STATES.

ELLER, ALBRECHT (1845–1920), German painter (*see*
18), died in Munich July 13 1920.

ELLERMANN, BERNHARD (1879–), German novelist,
born at Fürth on March 4 1879. In his early books he en-
oured to describe his emotional experiences, *Yester und Li*
4), *Ingeborg* (1906), *Der Tor* (1909), English translation *The*
(1925). As the result of his travels abroad he wrote *Das*
(1910), English translation *The Sea* (1925), an exotic novel,
his Japanese book *Sassa Yo Yassa* (1912), the main part
hich is devoted to a description of Japanese dances. His
l *Der Tunnel*, dealing with the future, chiefly concerns the
ions between Europe and America and caused a great
ation on its appearance in 1913. He wrote articles on the
ld War in his capacity as correspondent, and also produced
books, *Der Krieg im Westen* (1915) and *Der Krieg im*
nnerwald (1916). After a long interval he published in 1920
ovel on the German Revolution, *Der 9. November*, English
slation *The 9th November* (1925), and later still his novel
edenklees Erlebnis (1923). In addition to a further novel, *Die*
igen (1922), he also wrote the drama *Die Wiedertäufer von*
ster (1925).

ELLOGG, CLARA LOUISE (1842–1916), American singer
15·719), died at New Hartford, Conn., May 13 1916. She
the author of *Memoirs of an American Prima Donna* (1913).

ELLOGG, FRANK BILLINGS (1856–), American diplomat
awyer, was born at Potsdam, N.Y., Dec. 22 1856. In 1865
ent with his parents to Minnesota, where he studied law and
admitted to the bar in 1877. He practised in Rochester,
., for 10 years, removing in 1887 to St. Paul. He was re-
d as special counsel for the United States in the actions
st the Paper Trust and the Standard Oil case. He also
ared as special counsel for the Interstate Commerce Com-
on in the investigation of the Harriman railways, and for the
ed States in the action to dissolve the Union Pacific and
hern Pacific railway merger. He was a delegate to the Re-
can National Conventions of 1904, 1908 and 1912, and was
ed U.S. Senator from Minnesota for the term 1917–23.
as also U.S. delegate to the fifth International Conference
merican States at Santiago, Chile, 1923. In 1924 he was
inted ambassador to Great Britain, succeeding G. B. M.
ey. He resigned in Feb. 1925, to accept an appointment as
Secretary of State. In this capacity he took a firm stand in
ort of United States citizens whose property rights in Mexico
threatened by proposed Mexican legislation.

ELLOGG, VERNON LYMAN (1867–), American zoologist,
orn at Emporia, Kan., Dec. 1 1867. He graduated from
University of Kansas, subsequently studying at Cornell
ersity, Leipzig and Paris. He was successively assistant
ssociate professor of entomology at the university of Kan-
890–4, and professor of entomology and lecturer in bionom-
t Stanford University, 1894–1920. Having acted as a
tor, in Brussels, of the American Commission for Relief in
um, 1915, he served as assistant to the U.S. Food Adminis-
r, 1917 and in various capacities with the American Relief
mission in Poland and Russia, 1918–21. He became per-
nt secretary and chairman of the division of educational
ons of the National Research Council, Washington, D.C.,
He wrote *American Insects* (1904); *Evolution and Animal*
with D. S. Jordan (1907); *Darwinism To-day* (1907); *The*
als and Man (1911); *Headquarters Nights* (1917); *Herbert*
er, the Man and His Work (1920); *Nuova, or the New Bee* (1921); *Human Life as the Biologist Sees It* (1922); *Mind and Heredity* (1923); and *Evolution* (1925).

KENDAL, WILLIAM HUNTER (1843–1917), British actor (*see* 15.727), died in London Nov. 7 1917.

KENT, ROCKWELL (1882–), American painter, was born at Tarrytown Heights, N.Y., June 21 1882. His early education was obtained in a boarding school in Connecticut. He studied architecture for a time, but turned to painting, and was a pupil of Robert Henri. Of a roving disposition, he went to sea as ship's carpenter, painting what he saw in his travels, and writing his impressions. His work was quite individual in its character, and attracted great attention by its unique qualities of light and shade. He also produced some book illustrations. His chief paintings in the United States are "Marine" in the Metropolitan Museum, New York City, and "Lone Woman" and "Mother and Child," in the Brooklyn Museum. He wrote two books of travel *Wilderness* and *Voyaging*, and contributed to magazines.

KENTUCKY (*see* 15.740), a State of the United States of America. The population in 1920 was 2,416,630, as compared with 2,289,905 in 1910—an increase of 5·5 per cent. There were 1,227,494 males and 1,189,136 females. The whites numbered 2,180,560, an increase since 1910 of 7·5%; the negroes, 235,938, a decrease of 9·8%; foreign-born whites, 30,780. The density in 1920 was 60·1 to the sq. m.; in 1910, it was 57%. The urban population increased from 24·3% in 1910 to 26·2% in 1920. The estimated population of 1925 was 2,488,423. The population of towns with over 20,000 inhabitants in 1910 and 1920 was as follows:—

	1910	1920
Louisville	223,928	234,891
Covington	53,270	57,121
Lexington	35,099	41,534
Newport	30 309	29,317

Education.—The large number of illiterates reported in 1910 (208,084) led to the creation of two illiteracy commissions in 1914 and 1918 respectively. In Rowan county in 1911 night schools for adult illiterates were inaugurated. A compulsory attendance law, consolidated schools, better organisation, and more revenue, reduced illiteracy from 12·1% in 1910 to 8·4% in 1920. An Act of 1920 granted to counties and cities ample taxing powers to provide for their schools. The census reported 702,391 children of school age, of whom 654,092 were enrolled in 1925. High schools shared in this expansion, increasing from 83 in 1910 to 493 in 1924. New State normal schools were established in 1922 at Morehead and Murray.

Agriculture.—The number of farms increased from 259,185 in 1910 to 270,626 in 1920, but improved land decreased from 14,354,471 acres to 13,975,746 acres, despite the efforts of the reclamation service, which expended $1,620,027 in the counties bordering on the great rivers and in the western coal area. This drainage and flood-prevention work involved 471,874 acres. The number of farm owners increased from 170,332 in 1910 to 179,327 in 1920; the number of tenants decreased in the mining counties and increased in Mason, Boyle, Mercer, Fayette, Bourbon, and Jessamine. The value of farm property rose from $773,797,880 in 1910 to $1,511,901,077 in 1920. The average value of farms in 1910, $2,452, rose to $4,823 in 1920, and the average value of the land from $21.83 per acre to $48.62. Live stock on Jan. 1 1925 included 334,000 horses, 272,000 mules, 536,000 milch cows, 433,000 other cattle, 715,000 sheep and 859,000 swine. The total value of live stock in 1920 was $148,125,506. The total value of farm crops in 1924 was $200,760,000; in 1925, $178,816,000.

Field crops in 1920 were valued at $347,338,888;and in 1924 at $200,760,000. Low tobacco prices in 1913 and 1920 led to demands for co-operative marketing associations, of which the most notable were organised under the Bingham Act of 1922. In general, these efforts were successful, although the dark tobacco "pool" released its members from their contracts in 1925. Tobacco is the chief crop: in 1922 there were 525,000 acres under cultivation yielding 446,290,000 lb. worth $87,019,000 but in 1924 corn (76,200,000 bu.) exceeded in value the tobacco yield.

Minerals.—The output of coal rose from 14,623,319 tons in 1910 to 55,187,000 tons in 1925; to provide for the increased output, most of which was produced in the eastern counties, the Louisville and Nashville Railroad constructed 333 m. of track and expended $30,000,000 during the decade of 1910–20. Because of low prices, petroleum was only marketed in small quantities before 1916. Stimulated by the War demand, prices rose from $2.05 per barrel on Jan. 1 1917 to $4.50 at the close of 1920. The following table shows the production during certain periods:

	No. of barrels produced	Value
1919	9,226,472	$24,459,016
1920	8,949,185	33,556,241
1925	7,064,553	14,129,106

The most productive pool, Big Sinking, was opened in Lee county, and a new field appeared in the south western counties, centering about Allen and Warren. In many locations the drillers opened gas wells which have reduced the State's dependence on West Virginia's supply, and Mt. Sterling, Winchester, Paris, Lexington, Frankfort, and Louisville now obtain natural gas. The principal oil refinery is at Louisville. From 1909 to 1919 the capital invested in mines, quarries and wells rose from 26 to 201 millions, or 651%; the value of products from 12 to 98 millions, or 715%. The value of manufactured products in 1921 was $302,742,000.

Communications.—Steam railway track increased from 3,641 m. in 1910 to 3,956 m. in 1923. There were 493 m. of electric railway track in 1924. Additional pipe-lines for oil were supplemented by river boats, for which locks were built by the United States Government. The state highway commission, set up in 1920, which had an income in 1924 of $11,157,000, controlled 2,360 m. of road in 1925. A new bridge has been erected at High Bridge; and, near by, the Dix river dam, developing 30,000 H.P. of electric current.

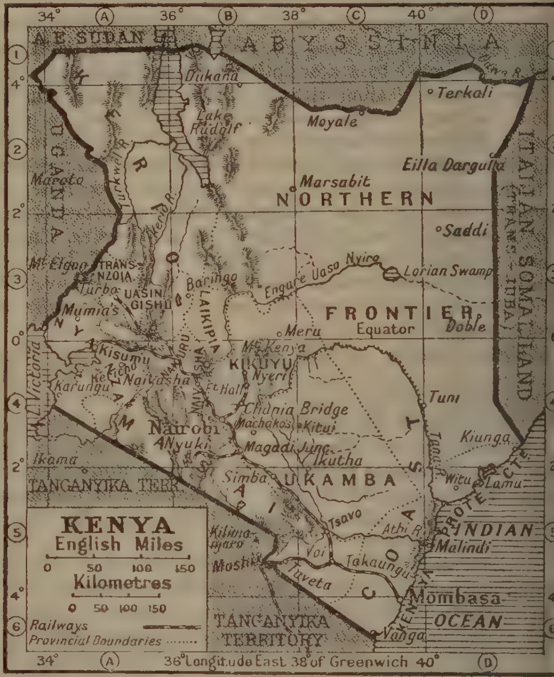
Finance.—The old revenue system, based on a general property tax, proved inadequate to meet the cost of progressive legislation. The Assembly in 1917 created a tax commission and classified grouping replaced the old property tax, so that the rate on general property became 50 cents per $100 assessed valuation. There is a graduated inheritance tax. Increased by licence and franchise revenues, the general fund is apportioned to various purposes. Under the new law, bank deposits rose from $11,000,000 in 1916 to $179,000,000 in 1917; assessed values from $922,000,000 in 1917 to $2,184,202,703 in 1925; railway valuations from $160,000,000 in 1917 to $233,372,000 in 1924. The total revenue in 1925 was $25,038,577. On July 1 1926 the bonded debt was $3,959,298. A floating debt, in the form of treasury warrants, sometimes exceeds $10,000,000.

Legislation.—The Acts of the General Assembly contain many provisions in regard to labour, education, and public health. The Child Labour Act of 1908 was improved in 1910, 1912, 1914 and 1916. Other progressive laws cover the subjects of tax reform, prisoners, banking, insurance, vital statistics and sanitation. In general the Assembly has welcomed all offers of Federal co-operation in matters of agricultural extension, road-building, and public health. An Act of 1920 to prevent the sale of worthless securities was due to the speculation in oil shares after 1916. A series of Acts permits all cities to adopt the commission plan.

History.—The increase of prices during the World War brought prosperity to purveyors of coal, petroleum, live stock, food and tobacco, and lured many producers into unwise ventures where they suffered severe losses after 1920. Kentucky felt keenly the advent of national prohibition, inasmuch as her distilling industry in 1914 occupied first place, with an output valued at $48,862,526. Between 1910 and 1925 the Democrats controlled the Assembly and elected three governors: J. B. McCreary (1911–5), A. O. Stanley (1915–9) and W. J. Fields (1923–7). The Republicans in 1919 elected as governor E
Morrow, who had been defeated by only 471 votes in 1
They chose as United States senators, R. P. Ernst in 1920
F. W. Sackett in 1924, in which year, for the first time in
history, Kentucky cast all her electoral votes for the Republ
party. In 1912 the 120th county (McCreary) was organised
of parts of Pulaski, Wayne, and Whitley. In Nov. 1917
United States Supreme Court declared void Louisville's r
segregation ordinance.

Bibliography.—On the administrative features see *Report of*
Efficiency Commission, 2 vol. (Frankfort, 1924); education, *P*
Education in Kentucky (N.Y., 1921); history, *History of Kentu*
ed. by C. Kerr, 5 vol. (Chicago, 1922). (E. T.

KENYA COLONY, formerly known as British East Africa
4.601), has an area (1926) of about 223,000 sq. miles. In 1925
greater part of the province of Jubaland (*q.v.*) was ceded
Italy. Population 1926 census: Europeans 12,529, Asiatics


34°
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A. E. SUDAN
A B Y S S I N I A
Daua R.
Dukana
Terkali
Lake Rudolf
Moyale
UGANDA
Turkwel R.
R
Kerio R.
Eilla Dargulla
Marsabit
NORTHERN
Marato
Saddi
Mt Elgon
TRANS-NZOIA
Turbo
UASIN GISHU
Baringo
LAIKIPIA
Engare Uaso Nyiro
Lorian Swamp
Mumia's
FRONTIER
Equator
Doble
Meru
Mt Kenya
KIKUYU
Nyeri
Kisumu
Kericho
Naivasha
Karungu
Ft Hall
Chania Bridge
Machakos
Kitui
Tuni
Nairobi
Nyuki
Magadi Junc.
Kiunga
Ikutha
Ikoma
Simba
UKAMBA
Witu
Lamu
TANGANYIKA TERR.
Tana R.
ITALIAN SOMALILAND
TRANS-JUBA
Tsavo
Athi R.
PROTECTORATE
INDIAN
Malindi
Kilimanjaro
Voi
Takaungu
Moshi
Taveta
Mombasa
OCEAN
TANGANYIKA TERRITORY
Vanga
COAST
KENYA
English Miles
0 50 100 150
Kilometres
0 50 100 150
Railways
Provincial Boundaries
36° Longitude East 38° of Greenwich 40°
①
②
③
④
⑤
⑥
4°
2°
0°

cluding Arabs) 26,789, Arabs 10,557, Africans (estima
2,483,500. A census of non-natives taken in 1926 gave the
lowing result: Europeans 12,505; Indians 26,758; Arabs 10,
others 3,821. An unofficial estimate placed the natives at s
2,600,000. The Arabs are people long settled in the coast la
the other Asiatics are mainly British Indians (22,822 in 19
The chief towns are Mombasa and Nairobi (*q.v.*).

I. POLITICAL HISTORY

Kenya presents problems not found in other parts of tro
Africa, where the white population is practically confine
officials, missionaries and traders, inasmuch as it contain
elevated area of about 15,000 sq. m. where climatic condi
have made it possible for a European community to ma
permanent home. Indian population presented another r
factor, and the task of the administration was largely to reco
the claims of the Europeans with those of the Indians, and
claims of both races with the rights and interests of nativ

White settlement in the highlands began in 1904; the ce
of 1911 showed 3,175 Europeans in the country, as ag
11,886 Asiatics. The settlers had the advantage of finding
Uganda railway built. They engaged in stock-raising and g
coffee, maize, wheat, barley, flax and vegetables. In the lowla
sisal, tobacco and coco-nut plantations were started. For ma
labour they were dependent on the natives, and the bulk o

m work was done by the Kikuyu, a tribe with an aptitude for
riculture. Sir Percy Girouard (governor 1909–12) achieved
somewhat difficult task of working harmoniously with the
tlers, whose grievances then were chiefly over the delay in
ting land grants, but who were already beginning to claim a
re in the government. The next year (1913) was most notice-
e for the acute controversy which arose over a missionary con-
ence at Kikuyu, when the Bishop of Mombasa (Dr. W. G. Peel)
ciated at a communion service in a Presbyterian church at
ich Anglicans, Presbyterians, Wesleyans and others com-
nicated. Apart from the theological controversy this service
used, it served to draw attention to the fact that, up to that
iod, by far the greater part of the work not only of Christian-
g but of civilising the natives and giving them industrial as
l as literary education was in the hands of missionaries.

he War Period.—The World War caused a setback in the
nomic conditions of the country. The majority of the white
e settlers went on active service and agriculture and stock-
ing suffered in consequence. Very heavy demands were also
le on the natives, who had to supply carriers, transport oxen
meat to the troops. They responded well to these demands
large numbers of natives joined the combatant ranks. After
War a brief period of revival in trade was followed by a longer
od of depression. Major-General Sir Edward Northey, who
over the governorship on Jan. 31 1919, had to deal with the
culties created by a period of change and strain. The white
lers were restive, the Indians were demanding political rights,
natives were in great need of careful guidance—so that on
one hand they should cultivate their reserves and on the
r hand supply the labour required for public works and the
is and plantations of Europeans. To add to the trials of the
le, white, black and brown, a currency crisis arose through
rise in the exchange value of the rupee—the Indian rupee
g the legal currency. An ill-advised stabilisation of the ru-
at 2s. in Feb. 1920 was quickly followed by the introduction of
inage based on British currency. In May 1921 the shilling
ided into 100 cents) was made the standard coin. These
ency troubles inflicted much hardship on the producing
es. Dissatisfaction arose also over the great difficulties en-
tered in carrying out a scheme launched in 1919 to establish
ldiers from Great Britain on the land. By 1924, however,
settlement was, on the whole, a success. Over 700 farms out
000 granted to ex-combatants were being worked.

ange of Status.—During this period of strain the change
a protectorate to a crown colony was effected (July 1920).
new colony was named after Mount Kenya, the most com-
ding natural feature of the country. The coast lands which
ed part of the Sultanate of Zanzibar were not annexed but
me the Kenya Protectorate. In 1919 a change in the con-
tion had introduced, for Europeans, an elective element in
egislative council, 11 single-member constituencies being
ed, with adult franchise on a residential qualification. At
ame time two members were nominated to represent the
n community. This discrimination against Indians was
erate. Sir Edward Northey, the then Governor, stated in
1919 that "though Indian interests should not be lost sight
uropean interests must be paramount." Prolonged agita-
ollowed. The Indians claimed equal rights with Europeans
common franchise, and they had the strong and unremit-
upport of the Government of India. The white settlers, to
the development of the country's resources was very largely
vehemently contested the claims of the Indians, most of
were clerks, mechanics, shop assistants, small traders and
rers, though they included professional men and merchants
h standing. The whites further alleged that the Indian
nce on the natives was bad.

e whole question came under consideration by the British
, whose decision was given in the Kenya White Paper in
1923. The most significant part of this decision was that—

> interests of the African natives must be paramount, and that
> d when, those interests, and the interests of the immigrant
> [European and Asiatic] should conflict, the former should
> prevail. As in the Uganda Protectorate, so in the Kenya Colony, the principle of trusteeship for the natives, no less than in the mandated territory of Tanganyika, is unassailable.

In respect to the franchise the British Govt. decided on a communal system of representation—that is, separate electoral rolls for Europeans, Indians and Arabs. The 11 seats on the Legislative Council for Europeans were retained; five seats on the council were allotted to the Indians and one seat to the Arab community, all on an elective basis; while one member was nominated specially to represent the natives. By means of other nominated members the Government, however, retained control of the council. The franchise apart, the British Govt. decided against the segregation of Indians in townships, but the practice which had been followed of reserving land in the highlands for Europeans was maintained.

The European community, despite some disappointment, loyally accepted the British Govt's. decision; the Indians continued their agitation—which included a refusal to pay the poll tax—and refused to elect members to the council. In Dec. 1924, however, more moderate counsels prevailed and it was decided to accept seats on the council. This settlement was largely due to the wisdom and courage of Sir Robert Coryndon, who became governor in Sept. 1922, and, while a firm upholder of native rights, fully recognised the work done by the Europeans and the services rendered by the Indians. Sir Robert died at Nairobi on Feb. 10 1925 and was succeeded by Sir Edward Grigg.

In respect to the natives, the policy of the administration was to guide them through their own chiefs and tribal organisations, and gradually to teach them the art of government. These efforts, supported by the missionaries and by many of the white settlers, met with a considerable measure of success. In 1922 they were extended to include, in addition to medical, educational and other services, direct encouragement of stock breeding and agriculture in the native reserves. This lessened the potential supply of labour for the Europeans, some of whom held that the first duty of the native was to work for the white man—though figures showed that the natives working on European farms increased from 53,000 in 1919–20 to 87,000 in 1923–4. Compulsory labour for private persons had been definitely prohibited in 1920. The root of the labour difficulty was that the population was insufficient for the intensive cultivation both of the European farms and the native reserves. In 1925 certain companies obtained permission to import labourers from Portuguese East Africa.

In 1924 a parliamentary commission, of which Mr. Ormsby-Gore was chairman, spent two months in Kenya, one of its main objects being to consider plans for the development of East Africa as a whole. It was followed in Feb. 1926 by a conference at Nairobi of the governors of all the East African territories. The parliamentary commission wrote in terms of high praise of the European settlers, "pioneers in a hurry," who desired to build in the highlands "a distinctive type of British civilisation" while obtaining "a more complete inter-relation and co-operation between the European and the African than exists either in South or West Africa."

II. ECONOMIC CONDITIONS

Under agreements reached in May 1926 the Masai reserves were increased by a portion of the disputed area known as the "Promised Land." The triangular portion of the Yatta plateau, which was to have been included as far as the Wakamba Reserve was omitted, as no natives have occupied it.

Kenya depends almost wholly on agriculture (including stock-raising), and development is largely a matter of increased means of communication. External trade passes through Mombasa (*q.v.*). The railway to that port also carries the produce of Uganda. Since 1917 Kenya and Uganda have formed an administrative unit for customs purposes, and there is complete freedom of trade between the two territories. The figures of trade therefore represent the total of both territories. On analysis it is shown that Kenya takes the bulk of the imports and Uganda supplies more than half the exports. The value of commercial imports into Kenya in 1913–4 was £2,147,000, the value of exports £1,482,000. For 1924, a normal year, the value of imports for consumption in Kenya was £4,038,000, while the domestic exports of Kenya were valued at £2,239,000. The chief exports from Kenya were coffee, maize, hides and skins (the last chiefly from native reserves). Kenya coffee is of high quality and is much favoured on the London market. It was not until 1922 that serious efforts were made to cultivate cotton, and the area in Kenya suitable for cotton is not very large. Up to 1925 the output was small but prospects were encouraging. The main mineral export is carbonate of soda from the Magadi lake.

Communications.—The transport system of Kenya and Uganda is under one administration, known officially as the Kenya and Uganda railway, marine and ancillary services. Since April 1921, when a central railway council was instituted the revenues from this source have been devoted exclusively to transport purposes; and in Feb. 1926 the office of High Commissioner of Transport was created, it being held by the Governor of Kenya. In 1911–2 a branch line (91 m.) was built to the Magadi soda lake; another railway (32 m.) was built from Nairobi to the Thika river (towards Mount Kenya). In 1915–6, for military purposes, a railway was built from Voi *via* Taveta to Kahe in (then) German East Africa. It links the Uganda railway with the Tanga railway. The Voi-Taveta line was bought by the Uganda railway in 1923 and reconditioned.

In 1921 a bold policy of railway development, accompanied by harbour improvements, was adopted, both to meet the needs of the settlers in the Uasin Gishu and Trans-Nzoia districts and the requirements of Uganda for the transport of its cotton crop. It was decided to build a line from Nakuru on the Uganda railway across the Uasin Gishu plateau to the border of Uganda, whence it would be continued to the Nile. By 1925 this railway had reached Turbo, 145 m. from Nakuru, and the next section of 75 m. to Tororo, inside the Uganda Protectorate, was under construction. In 1923–6 the Nairobi-Thika line was extended another 90 m. to Nyeri, and other smaller branch lines built. Road development was slow, but a motor road was made from Nairobi to Tanganyika Territory and another motor road from Nairobi to the Sudan. There are aerodromes at Kisumu and Nairobi.

Revenue.—Since 1912 the country has been self-supporting. Between 1909–10 and 1913–4 revenue increased from £503,000 to £1,123,000 and expenditure from £669,000 to £1,115,000. In 1920–1, the last year in which the railway returns were included in the ordinary budget, the figures were, revenue £2,978,786, expenditure £2,976,960, a surplus of £1,826 only. In 1922 and 1923 expenditure considerably exceeded revenue, but in 1924 revenue was £2,111,665 and expenditure £1,861,511—a surplus of £250,054—evidence that the years of acute commercial depression had passed. At the end of 1924 the funded public debt of Kenya was £8,500,000, incurred principally for transport development. The railway revenue in 1924 amounted to £1,635,000, and the gross expenditure to £878,000.

The Kenya White Paper (Cmd. No. 1922) of 1923 and the Report of the East Africa Commission (Cmd. No. 2387) 1925, are important British official publications, of which a full list is given in the *Colonial Office List* (London, yearly). See also the annual *Reports* issued by the Colonial Office, and the annual railway, native administration and other *Reports* issued at Nairobi; Lord Cranworth, *A Colony in the Making* (1912) and *Profit and Sport in British East Africa* (1919); C. W. Hobley, *Bantu Beliefs and Magic* (1912); Norman Leys, *Kenya* (1924); *A Handbook of Kenya Colony and Protectorate*, a British Admiralty publication (1920); *The East African Red Book, 1925–6* (Nairobi, 1925), and the *Year Book and Guide to South and East Africa* (London, annually). (F. R. C.)

KENYON, SIR FREDERIC GEORGE (1863–), British scholar, was born in London Jan. 15 1863. Educated at Winchester and New College, Oxford, he became a fellow of Magdalen College, Oxford, in 1888. The following year he was appointed an assistant in the British Museum, and became in 1898 assistant keeper of MSS. In 1909 he was appointed director and principal librarian. Created K.C.B. in 1912, he was president of the Classical Association in 1913, of the British Academy 1917–21 and of the Society for the Promotion of Hellenic Studies 1919–24. In
1918 he became professor of ancient history in the Royal Ac
emy. He was created G.B.E. in 1925. Among his numer
published works are three editions of Aristotle's *Constitut*
of Athens (1891, 1904, 1920); *Classical Texts from Papyri in*
British Museum (1891); *Catalogue of Greek Papyri in the Bri*
Museum (1893, 1898, 1907); *Our Bible and the Ancient Ma*
scripts (1895); *Palaeography of Greek Papyri* (1899); *Handb*
to the Textual Criticism of the New Testament (1901, 19
A student of Elizabeth and Robert Browning's poetry, in 1
he edited the centenary edition of Robert Browning's wo
In 1914 he published an account of the buildings of the Bri
Museum.

KER, WILLIAM PATON (1855–1923), British man of lett
was born at Glasgow Aug. 30 1855 and educated at Glas
University and Balliol College, Oxford. He was elected fello
All Souls College in 1879, professor of English literature and
tory at Cardiff in 1883 and of English literature at Univers
College, London, in 1889, a post which he held until 1922.
1920 he was elected professor of poetry at Oxford. His stu
of mediaeval literature were specially noteworthy, and among
publications were *Epic and Romance* (1897); *The Dark A*
(1904); *Essays on Mediaeval Literature* (1905); *Sturla the H*
torian (1907); *The Art of Poetry* (1923); and a number of collec
essays and lectures published in 1925. But these last work
this singularly inspiring teacher, a scholar of wide and hum
sympathies, were posthumous. He died suddenly in the A
at Macugnaga on July 17 1923 and was buried there.

KÉRATRY, ÉMILE, COMTE DE (1832–1904), French aut
and politician (*see* 15.753), died in Paris April 7 1904.

KERENSKY, ALEXANDER FEODOROVICH (1881–
Russian politician, was born at Simbirsk, and studied at
University of St. Petersburg, where he took his degree in law,
afterwards joined the St. Petersburg Bar. In 1912 he was ele
to the Fourth Duma and joined the Labour Group. He wa
reality an adherent of the Social Revolutionary party, but
was impossible in those days to enter the Duma under this
he chose the Group of Toil (Labour) in preference to the S
Democrats, whom he considered to be too pedantic and dis
from the people. As a member of the Duma he attained a cer
notoriety by impassioned speeches, but he was never
spicuous for constructive statesmanship. When the first rev
tionary Government was formed Kerensky was nomin
Minister of Justice and was for a short time head of the provisi
Government. (*See* RUSSIA.)

KEY, ELLEN (1849–1926), Swedish author, was born Dec
1849 at Sundsholm, the daughter of Emil Key and Coun
Sophia Posse. She early showed a keen interest in religious, l
ary and political affairs and lectured on various subjects in
native village. In 1868 her father became a member of the R
dag, and the family accordingly moved to Stockholm. It
then that she started to contribute to the feminist perio
Idun. In 1879, owing to family misfortune, she was forced to a
the teaching profession. She also established lecture course
young women. Her success as a lecturer was such that
was able to abandon teaching, and in 1903 went abroad
number of lecturing tours. She wrote numerous works in m
languages, chiefly concerned with the welfare of women
children. Her liberal theories concerning love and marria
the time met with great opposition. She died in April 1
Her principal work is *Tankebilder*, "Ideas," 2 vol. (1898);
Lifslinjer, Eng. tr. "Lines of Life," 3 vol. (1903–6).

See G. Monod in *La Revue Bleue* (1907) and E. Faguet i
Revue Latine (1907).

KEYES, SIR ROGER JOHN BROWNLOW (1872–), B
sailor, was born Oct. 4 1872 and entered the navy in 1885.
took part in the Vitu expedition in 1890 and for his servi
China in 1900 was promoted commander. From 1905 to
he served as naval attaché at Rome, Vienna, Athens and
stantinople. In 1912 he was appointed commodore in c
of the submarine service. During the World War he took
in the battle of Heligoland Bight, Aug. 1914, and in the Cuxh

In 1915 he became chief of staff to Admiral de Robeck, in
mand of the Eastern Mediterranean Squadron in the
ianelles. He was promoted rear-admiral in 1917, appointed
:tor of plans at the Admiralty and later took command of
Jover Patrol. In this capacity he directed the naval raid on
rugge and Ostend, April 23 1918, and was rewarded with
K.C.B. In 1919 he was created a baronet and received a
t of £10,000 in recognition of his services. He commanded
Battle Cruiser Squadron of the Atlantic Fleet from 1919
l 1921 when he was promoted vice-admiral and became depu-
iief of the naval staff. In 1925 he was appointed commander-
uief of the Mediterranean Station.

EYNES, JOHN MAYNARD (1883–   ), British economist,
born at Cambridge, June 5 1883, the son of John Neville
nes, registrar of Cambridge University. Educated at Eton
King's College, Cambridge, where he was 12th Wrangler
5), and president of the Union Society (1905), he entered
civil service in 1906 and from 1906 to 1908 served at the India
e. He was a member of the royal commission on Indian
ice and currency 1913–4, and in 1915 he joined the Treasury,
e during the World War he did important work in connec-
with loans to the Allies. At the Paris Peace Conference he
the chief representative of the Treasury and deputised for
Chancellor of the Exchequer on the Supreme Economical
ncil, Jan.–June 1919. He advocated certain principles which
onsidered should be applied to the financial and reparation
es of the Peace Treaty with Germany and when they were
ted he signified his disagreement with the treaty by resign-
n June 1919, and published in the same year his famous
Economic Consequences of the Peace. He was made fellow
subsequently bursar of King's College, Cambridge. In
he became chairman of *The Nation*, Ltd. In 1925 he mar-
Lydia Lopokova, the famous Russian dancer. His works
de *Indian Currency and Finance* (1913); *A Treatise on
ability* (1921); *A Revision of the Treaty* (1922); and *A Tract
onetary Reform* (1923).

YSERLING, HERMANN, Count (1880–   ), German
sopher, was born at Könno in Livonia on July 20 1880, of a
family. Until he was 14 years of age, Keyserling remained
e Könno and Rayküll estates. He then went to the Russian
l at Pernau, and afterwards studied geology and zoology at
va, chemistry at Dorpat, and geology at Heidelberg. In
he became a doctor of philosophy and in 1903 went to Paris,
he wrote criticisms on art, and also philosophical articles.
rst literary works were *Das Gefüge der Welt* (1906) and
erblichkeit (1907). During the years 1907–11 he travelled
rope. In 1910, the *Prolegomena zur Naturphilosophie* ap-
d, and he then turned his attention to the study of meta-
cs. In 1919 he married the granddaughter of Prince
arck. His principal work is *Das Reisetagebuch eines Philoso-*
(1919), which has been translated into English as *The
Diary of a Philosopher* (1925). He also founded the
ool of Wisdom" at Darmstadt. See H. Keyserling, *Der
zur Vollendung* (Darmstadt, 1919).

IVA (*see* 15.777), was once the capital of the Khroahrezm
blic, whose territory has now been absorbed into Turkmen-
(*see* Siberia). Khiva has always held a unique status
ssian Asiatic dominions and even now is understood to be
together with a small area surrounding the town, adminis-
directly from Moscow, though the surrounding country
part of other political units.

MIL PASHA (1832–1915), Turkish statesman, was the
an artillery officer, Salih Agha. Having completed his mili-
raining in Egypt as a cavalry lieutenant, he was appointed
Khedive, Abbas Pasha, tutor in English to his son Ibrahim
. In 1861 Kibrizli Mehemmed Pasha took him into the serv-
the Ottoman Government. He was twice governor of Je-
m and three times governor of Beirut. In 1878 he was ap-
d governor of Kossova and soon afterwards of Aleppo, with
nk of Pasha. He resigned as the result of the British pro-
gainst his conduct during the Armenian revolt at Zeitoun,
turning to Constantinople became Under-Secretary for the Interior. In 1881 he became minister of Evkaf, and after the resignation of the Kutchuk Said Pasha Cabinet in that year, Grand Vizier. In spite of his forced resignation from the governorship of Aleppo he steadily pursued a pro-British policy. He resigned the Grand Vizirate in 1887 owing to Russian intervention, but was reappointed in 1896. He was dismissed by Sultan Abdul Hamid, however, owing to his proposal that a Cabinet responsible to the nation should be formed, and was sent to Smyrna as governor, where he remained for 12 years.

After the promulgation of the constitution (1908) Kiamil Pasha joined the Kutchuk Said Pasha Cabinet and soon after became Grand Vizier for the third time. He was, however, strongly opposed by the Union and Progress party. During the Balkan War (1912) he became Grand Vizier for the fourth time, but was forced to resign in 1913 as the result of a military coup d'état and the unpopularity of the peace terms accepted by him. He retired to Egypt, and although he returned later to Constantinople he was forced by the Government immediately to leave. He went to Cyprus and died there in 1915. Kiamil Pasha knew English, French and Arabic and published a book on Turkish history in three volumes.

KIEL CANAL (*see* 11.816 and 15.787).—The Kiel Canal connects the North Sea and the Baltic. The sluices at the entrances at Holtenau (the harbour of Kiel) and Brunsbüttelkoog (mouth of the Elbe) are 1,082·6 ft. long, 147 ft. wide and 45·9 ft. high. The canal is 53·3 nautical m. long and 37·07 ft. deep. Vessels are admitted on it which do not exceed the following dimensions: depth 29·7 ft., width 131·2 ft., length 1,033·5 ft., height of masts over the water line 131·2 feet. Steam and motor-propelled vessels pass up the canal under their own power. The highest speed permitted is 8·1 knots, the lowest 5·4. Other vessels are tugged, either by private tugs or the tugs of the canal administration, as desired. Pilots are compulsory. They come on board outside the canal wharves in front of the entrances and are advisers to the ships' captains, who remain responsible for the conduct of their ships while using the canal.

Management.—The Kiel canal is owned by the German Reich, which administers it through the Reichskanalamt in Kiel. The managing director in Kiel and the port captains at the entrances to the canal are in charge of the shipping and the administration of their sluices under the Reichskanalamt. Special officials are in charge of the preservation of the canal works. Art. 380–386 of the Treaty of Versailles (June 28 1919) lay down certain regulations respecting the Kiel Canal. Canal and pilotage dues are limited to a rate sufficient to cover the cost of administration, maintenance and improvements. All mercantile and war vessels of nations at peace with Germany have permanent free use of the canal, without special permission, and on an equal footing (but as foreign ships of war pass through German territorial waters in approaching or leaving the canal they are expected to obtain permission through diplomatic channels). Subjects, goods and vessels of all nations enjoy equal treatment as regards payments and attention. Traffic on the canal is subject only to general police, shipping and sanitary and customs regulations. Goods in transit arrive under seal or are accompanied by customs officers and are not subject to any further customs formalities. In the event of violations of any of these conditions, or of disputes as to the interpretation of them, any interested Power can appeal to the jurisdiction instituted for the purpose by the League of Nations. A local German authority at Kiel is qualified to deal with disputes in the first instance.

The Kiel Canal being the safest, most convenient, shortest and cheapest route from the North Sea and the Baltic is increasingly used by merchant vessels. In 1913, 53,382 ships passed with 10,350,000 tons net displacement; in 1924, 45,843 ships with 14,070,000 tons net displacement. (M. C. M.)

KINDERSLEY, SIR ROBERT MOLESWORTH (1872–   ), British financier, was born Nov. 21 1872 and educated at Repton School. He entered upon a business career in London and became a partner in the banking firm of Lazard Bros. and Company. During the World War he became widely known to the public as president of the National Committee for War Savings. His services were recognised with the award of a K.B.E. in 1917 and three years later he was created G.B.E. He became a director of the Bank of England and in 1924 was appointed a member of the body which prepared the Dawes scheme after inquiring into Germany's capacity to pay her War debts. (*See* SAVINGS MOVEMENT.)

KINEMATOGRAPH: *see* MOTION PICTURES.

KING, WILLIAM LYON MACKENZIE (1874–), Canadian statesman, was born at Berlin—now Kitchener—Ontario, Dec. 17 1874, the son of John King and Isabel Grace, daughter of William Lyon Mackenzie, M.P., who had been prominent in the struggle for political freedom in 1837. He was educated at Toronto University, and became fellow of political economy in the University of Chicago and of political science in Harvard University. Mr. King entered the public service of Canada in 1900 as deputy Minister of Labour, and acted as editor of *The Labour Gazette* for some years. He was chairman of several royal commissions on industrial and immigration problems. In 1906 he represented Canada in negotiations with the British Govt. on immigration from Britain, and in the same year the honour of C.M.G. was conferred on him. He was Canadian representative to the Govt. of India on immigration from the Orient and was one of the British delegates on the International Opium Commission in China in 1909. He was elected as a Liberal member of Parliament for North Waterloo in 1908, and in 1909 was appointed Minister of Labour in the Laurier administration.

From 1914–7, under the auspices of the Rockefeller Foundation, Mr. King investigated the subject of industrial relations, and afterwards wrote *Industry and Humanity, a Study in the Principles Underlying Industrial Reconstruction* (1918), as well as other studies on economic subjects. During the World War he assisted leading industrial corporations in America to maintain a continuous maximum output of essential war supplies, and industrial representation plans were drafted under his direction which were adopted by the Colorado Fuel and Iron Co., the Bethlehem Steel Corporation, the Bethlehem Shipbuilding Corporation, the General Electric Co., the Consolidation Coal Co., the International Harvester Co. and other industrial corporations in America. At the National Liberal Convention at Ottawa in 1919 he was selected as the successor to Sir Wilfrid Laurier, and became leader of the Opposition in the same year. In 1921 he became Prime Minister of Canada, and in this capacity he attended the Imperial conference in 1923.

As Premier.—Mr. King's administration followed the Coalition Govt. which had been created during the War, and, although formerly there had been two parties in the House, a third party, known as the Progressives, was also returned in the general elections of 1921. It was this party which supported the Liberal Government. On the dissolution of the House in 1925 an attempt was made to return to the two-party system of government, but the Progressives were still given support. The Prime Minister himself was defeated, together with several of his ministers, but owing to the support and co-operation of the Progressives he was enabled to retain control. After the War many new problems arose, and both the Conservatives and the Liberals declared their policy. An able speaker, Mr. King in his appeal to the electorate urged the adoption of a tariff for revenue, and suggested that the problem of taxation could be solved with the aid of an advisory board on taxation. He also stated his willingness to give the principle of public ownership of railroads a fair trial, though he was averse to either a privately or publicly owned railway monopoly. The Liberal party further advocated the reform of the Senate of Canada by fixing an age limit, and by abolishing the life tenure of office for senators. The object of this reform was to make the Senate more responsive to public opinion. Mr. King maintained that the principle of Canadian nationalism could best be developed within the British Empire, and that the bonds of Empire would be strengthened by reciprocal trade treaties. He stated that no attempt would be made to dictate to Great Britain how she should tax her people. The policy of the Liberal party as expressed by Mr. King may be summed up as "unity, moderation and progress." (A. G. D.)

KIPLING, RUDYARD (1865–), British man of letters 15.825).—The appearance of *Puck of Pook's Hill* in 1906 ma the last attempt of Kipling to essay any new kind or mann writing. With one doubtful exception, all his later books ca referred to the existing categories. In 1909 appeared an authorised volume called *Abaft the Funnel*, into which an A can publisher collected a number of unprinted sketches stories belonging to the period 1888–90. Mr. Kipling issue authorised edition in New York (1909), but it has never published in England. The first authorised collection to f *Actions and Reactions* (1909), was *Rewards and Fairies* (191 companion volume to *Puck of Pook's Hill*, and neither b nor worse than its predecessor. This pair of volumes tri create for the young a semi-historical mythology of the En countryside.

The attempt was quite well worth making, and some o stories and verses are good; but they are not told simply eno Mr. Kipling's love of England is not of the kind that goes t making of myth. In 1911 Mr. Kipling joined Mr. C. R Fletcher in the production of a *History of England* for the yo His contribution took the form of 24 poems, some of which happily stimulative to the historical imagination, thoug read with the accompanying text, presenting to the you rather limited view of national duty. The years from 19 brought nothing but reprints and recensions, notably *S from Books* (1913), containing the verses and chapter head from all the volumes except the *Jungle Books* and *Jus Stories.*

Mr. Kipling inevitably contributed to the literature of War. For several newspapers he wrote poems and sets of art the most important of the latter being *The New Army in Tr ing* (1915), *France at War* (1915), *The Fringes of the Fleet* (1 *Tales of the Trade* (1916), and *Destroyers at Jutland* (1916). last three were collected into a volume called *Sea Warfare* (1 In 1917 appeared *A Diversity of Creatures*, a collection of st and verses in the old manner, clever, but not attractive. Ano volume of poems, *The Years Between* (1919), contained occasi verses written in war time, with some others of earlier date. volume is vaguely accusatory and oracular, and contains as m of the publicist as of the poet. In the same year appeared pamphlet *The Graves of the Fallen*, describing the work of Imperial War Graves Commission. *Letters of Travel* (1920 printed some 24 articles ranging in date from 1892 to 1914, showed how little the author had changed in style and ma over a long period. The one work by Mr. Kipling that lay ou his usual range was *The Irish Guards in the Great War* (1 a lengthy and competent compilation, including some ori matter in the old familiar manner. *Land and Sea Tale Scouts and Guides* (1923) intended for the instruction or insp tion of the young, is unworthy of the author and the purpose. Kipling received many honours from universities at home abroad, and in 1922 was elected Rector of St. Andrews. rectorial address, which was published as *Independence* (1 attracted much attention.

Mr. Kipling is, like Macaulay, a writer who remained to end what he was at the beginning. Some of his writing better than others, but none of them are older or younger others. His earliest work conveys a sense of full experienc latest has no other sign to post-maturity than a growing ace and tendency to scold. His immense efficiency was never o kind in which genuine growth or development is possible such as it was it remained undecayed. Mr. Kipling's pr clear, firm, tense and terse and the shaping of his best stor admirable. He possessed (as Shakespeare possessed) the jou ist's ability to use with apparent mastery the "cant" of m trades and callings: but this gift, though engaging, is artisti unimportant. Mr. Kipling often wrote as a publicist; but as a creative writer that he must be judged. Regarded mere a political teacher he would have to take a low place. No l or consistent or even practical body of doctrine can be dr from his vague accusations and rhetorical warnings, and, ind none need be looked for. The creeds of poets are more impor

emselves than to their readers. Mr. Kipling did his best
for Empire, not by thinking or writing imperially, but by
ling India artistically.
. Kipling always worked in the spirit of a good craftsman.
gh immediately popular as a writer, he never sought per-
publicity, and never consciously wrote down to the
dlings, even of politics. His general style indicates a long
of the Bible and his metres show that the influence of
burne was strong and enduring upon him. Admiration of
iblical prophets, however, produced in both writers a tend-
to the large, cloudy, oracular utterance that appears more
und than it is. But in all essentials, Mr. Kipling is an orig-
and underived writer. He noticeably added to the public
of quotations and to the repertory of poems known to
body. Few writers have found such a large body of sin-
admirers in so many regions, ranks and callings of British
e.

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RGHIZ OR QIRGHIZ REPUBLIC, an autonomous Socialist
t Republic of the R.S.F.S.R. The capital is Orenburg.
SIBERIA.)

RK, SIR JOHN (1832–1922), British explorer (*see* 15.829),
Jan. 15 1922.

TCHEN EQUIPMENT: *see* HOUSEHOLD APPLIANCES.

TCHENER, HORATIO HERBERT KITCHENER, EARL
–1916), British field-marshal (*see* 15.838).—Kitchener was
oted field-marshal just before he left India in 1909, and the
of St. Patrick was conferred on him on his arrival in
nd in 1910; but between India and England had occurred
t to Australasia, where he had been invited to examine the
ry arrangements, and where the very thorough suggestions
he made for their improvement were acted on with a
ptitude which bore full fruit in 1914.

cept for his command of the troops at the coronation of
George, Kitchener was now for the first time for nearly 40
to enjoy some months of leisure; but the failure of the
rnment to employ him aroused unfavourable comment,
was only silenced when in the late summer of 1911 he
ted the post of British agent and consul-general in Egypt.
next three years were perhaps the happiest of his life; he
n familiar circumstances though he had many changes to
since he had handed over the Sirdarieh to Sir Francis
ate.

the day he landed at Alexandria, Italy was presenting an
atum to Turkey, and there is no doubt that Kitchener's
nce and his prestige were mainly responsible for the safe
ge of Egypt through the critical period of the Tripoli and
n wars, and that no one but himself would have been able
event collisions between the Greek and Italian colonists
he natives. His idea was to keep the country busy with
ontemplation of its own affairs, and he initiated a policy of
mic reform the effects of which were to be enduring. His
amme comprised such items as village savings banks, the
'eddan law, the opening of cotton markets all over the
ry, cantonal courts, the promotion of the Department for
ulture to a ministry, school buildings, sanitation and press
vision, and the heightening of the Aswan dam—all of ab-
g interest to him, all receiving his assiduous care. Lord
er's great service in Egypt had been rewarded by an earl-
while he was still at the Agency, and the Prime Minister
ed the King that no lesser title should adorn his successor
g his tenure of the office. The *London Gazette* of June 1914
nced that the sovereign had been pleased to confer on Viscount Kitchener the honour of an earldom, and the telegram announcing his new dignity reached him just as he was starting for England on his annual leave.

At the War Office.—Kitchener had intended that leave to last until Sept., but on July 31 all heads of missions were ordered to repair to their posts, and on Aug. 3 Kitchener was actually on board the Channel boat when a message arrived from the Prime Minister requiring him to stay in England. Three days later he took over the seals of the War Office, to find, in his own words, "There is no army." The meaning of that trenchant observation was that for the titanic task the country had undertaken the British miniature Expeditionary Force, however gallant, was manifestly inadequate. Kitchener instantly laid his plans for an army of 70 divisions, coolly calculating that its maximum strength would be reached during the third year of the War, just when the enemy would be undergoing a sensible diminution of his resources in man-power. His scheme, of course, ran clean contrary to all accepted ideas: it had always been held that in time of war, though armies could be expanded, they could not be created, and to imagine otherwise seemed as surprising to our friends as to our enemies. The French general staff gracefully remarked that men had called new armies into being and men had utilised and maintained existing armies, but that for Lord Kitchener it was reserved to perform the two feats simultaneously. The Germans derided the Kitchener plan as impracticable.

In the early days of 1916 Kitchener could tell the Cabinet that 67 divisions were afoot and three in the mould; he was met by a representation that we must choose between a diminution of our forces and a reduction of our monetary advances to our Allies. He declined the dilemma. He did not think that England could present either of these conclusions to her Allies without proof positive that expenditure could not be reduced nor national income increased, that her administration was free from extravagance, that her taxable capacity was fully exploited and that all parts of the Empire were pulling their weight. The conflict of opinion was sharp and short, with the upshot that the 70 infantry divisions were assured of their existence, and the way was prepared for the Kitchener armies to take their part in the battle of the Somme which he knew was planned for the coming summer. "I have no fear," he said, "about winning the War; I fear very much we may not make a good peace." If he did not live to take his place at Versailles, at least as regards the creation and placing in the field of the great force which was to hold high England's honour he could review a finished work, for his last division to go overseas took ship the very day on which he himself set out on the journey from which he was not to return.

Kitchener's vision or intuition served him to protest, though vainly, against the concentration of the original B.E.F. so far forward as Maubeuge; his rapid and accurate grasp of a situation caused him to hurry to France after the retreat from Mons to insist, in the name of the Government, on the British Army remaining in the Allied line; and enabled him in 1915 to pronounce that the evacuation of the Gallipoli peninsula could be effected with infinitely less loss than had been gloomily predicted. Apart from these occasions he did little to interfere with the actual conduct of operations in the field. He knew and sympathised with the commanders, gave full consideration to their views, and did all that lay within human power to provide them with what was necessary for the performance of the duties assigned to them: moreover, he gave them his entire trust and his unswerving support; what this means to a commander perhaps only those with the experience of a commander can realise, and Kitchener himself had tasted of that experience.

Of the great difficulties which beset the Secretary for War, perhaps the greatest and the most discussed was that of providing guns and ammunition for a constantly and rapidly increasing army. The real root of the trouble was that the nation had plunged into Armageddon without armaments; there was not only a lamentable lack of munitions, but a total absence of all machinery for producing them. With barely means to keep the original expeditionary force on its feet, Kitchener had to provide for a long and far-flung struggle with a powerful enemy who for 40 years had devoted himself to preparation. A friend who in the early weeks of the War noted in him signs of strain asked him if he were sleeping well. "I shall never have a good night's rest," he answered, "until I have 2,000,000 rifles and their ammunition, and that cannot be yet." The output of arms and ammunition—when one remembers that a start was made from zero and that at the battle of Neuve Chapelle more stuff was fired than in the whole South African campaign—reached an amazing total in the first nine months of the War, and no finer provision of material was made from end to end of it. It was alleged at one time that the great production of ammunition in the autumn of 1915 was due to the energy of the newly born Ministry of Munitions, and a confident claim was made on behalf of this department to the increased supply of high explosive shells. Before the end of the War Kitchener's work was challenged in some quarters on this point; the answer furnished by the dossier of the master-general of ordnance presented a defence of the War Office, whence, as a matter of fact, came the first proposal of high explosive for use in France.

To be precise, the Ministry of Munitions was set up during the first week of June 1915. It was not until the end of Oct. 1915 that a single component of ammunition worth speaking of was delivered from the Ministry of Munitions' factories or orders, and not until April 1916 that the first complete round, made and filled under the orders and arrangements of the Ministry, was delivered to the army authorities. In other words, the army, for a period of more than 18 months, was furnished with continually increasing supplies under the former arrangements.

With the change of the Government in 1915, when the Prime Minister and the War Secretary alone retained their offices, an unhappy attempt was made from G.H.Q. in France to inflame public opinion against the man to whom a few weeks earlier the Commander-in-Chief had written, "Thank God you are there, and I mean it." The attempt failed to shake the rock of public confidence on which Kitchener stood, right up to and even beyond, his last hour: messages of goodwill poured in to him from camps at home and overseas, and from every class and community and corner of England; a month later he received, on his way to and from the Guildhall, one of the greatest ovations of his life—and the Order of the Garter. If Kitchener did not travel quite easily on political lines, his close personal touch with England's Allies was not the least of his contributions to the War, and his early and constant friendship with France gave him, so to speak, a flying start in gaining the best relationships with her public servants.

Russia's rôle was to him a matter of vital importance if the War was to be brought even within his own three year's limit; but in the autumn of 1915 he said to Joffre at Chantilly, "You are calculating on Russia remaining till the end of the War; I am making my calculations on her being out within six months." He had not been afraid to commit himself to serious responsibilities as to arming and equipping the almost weaponless Russian hosts, but even so it is as difficult to account for, as it is impossible to deny, the almost uncanny influence which his name exercised throughout the great eastern empire. He was thus able to criticise Russian methods with a freedom and to press his advice—more especially at the critical moment when Italy was hanging back—with an insistence that would have been tolerated at the hands of no other foreigner.

Proposed Visit to Russia.—Early in May 1916 the Tsar urged that Kitchener should visit Russia, promising that his counsel would be taken to the full even if that counsel included certain transfers of control into British hands. The consent of the British sovereign was obtained, and it was decided that Kitchener should start from Scapa Flow on June 5 for Archangel. He was asked to examine thoroughly the whole Russian situation: he was given a free hand to make arrangements and conditions which he thought advisable; he was to use all the influence which he had already acquired with the Tsar and the Russian military authorities to set the Russian military house in order, and he was asked to come back to England with all speed.

On the afternoon of the appointed day, Kitchener, h
paid a visit to Lord Jellicoe on his flagship, embarked o
"Hampshire," which was directed to proceed on what, wit
prevailing wind—as reported—would be the lee side o
Orkneys and Shetlands. The arrangements made for the v
of the cruiser have been, and perhaps always will be, op
question. It is at least certain that an unswept channe
chosen for her passage and that, under stress of weathe
destroyers who formed her titular escort turned about, le
the vessel, with her priceless freight, to steam to her doo
faithful steward had suddenly to give an account of his ste
ship. The same electrical impulse which the next mornin
claimed Kitchener's death to the world induced an emo
current so intense as to lack precedent or parallel. For a mo
it seemed as if a hush had fallen as universal as it was prof
and when the hush was broken there was exposed in fu
sway which Kitchener had established over the hearts and
of all sorts and conditions of men, and that the one m
England who had taken the least pains to win popularity
the hero of many peoples.

A week later the sovereign and his consort passed throug
throngs in and around St. Paul's Cathedral to a simple serv
hymn and prayer; simultaneously, at two-mile intervals
the sea to the Somme, British soldiers bade a *vale* to the
soldier; while in all parts of the world where two or three En
men were gathered together the name of a great Englishma
commemorated. The Queen-Mother at once placed hers
the head of a movement to secure a permanent and pra
memorial, and in answer to her appeal there poured in
every point of the Empire—from men, women and childr
all colours, classes and creeds—a stream of money, gatheri
volume until it reached the astonishing sum of over £70
On Dec. 10 1925 a memorial chapter in St. Paul's Cathedra
dedicated to Earl Kitchener and all who fell in 1914–8.

(G. A

KLEIN, FELIX (1849–   ), German mathematician,
born at Düsseldorf April 25 1849, and after studying at th
versities of Bonn, Göttingen and Berlin was appointed pro
of mathematics at the University of Erlangen. He later to
similar professorships at the Munich Technical College a
the universities of Leipzig and Göttingen (1886), and f
became at the latter university director of the school of m
matical physics. Klein, who became a member of the Pr
Academy of Sciences, specialised in the practical applicat
mathematics and mechanics, and in conjunction with A. Son
field worked on the problem of gyratory motion. He took s
interest in educational questions, and his well-known treat
the teaching of mathematics in Germany appeared in
Among Klein's other works should be mentioned *Vorles*
über das Ikosaeder und die Auflösungen der Gleichunge
fünften Grad (1884) and *Vorträge über ausgewählte Frage*
Elementargeometrie (1895).

KLINGER, MAX (1857–1920), German painter, etche
sculptor (*see* 15.847), died July 4 1920 at Grossjena near N
burg.

KLUCK, ALEXANDER VON (1846–   ), Prussian ge
was born May 20 1846 at Münster, Westphalia. He took
in the Austro-Prussian War of 1866 and the Franco-Prussia
of 1870, and was twice wounded at the battle of Colo
Neuilly. In 1906 he was promoted to the rank of gene
infantry, and at the outbreak of the World War was insp
general of the VIII. Army Inspection. He was placed in
command of I. Army of the West, which he led in the batt
Maubeuge and St. Quentin and the advance upon the M
(*See* FRONTIERS, BATTLES OF THE.) At the battle of the M
the faulty disposition of the German forces in the line of
and the success of the Allied offensive compelled Von Klu
withdraw his army to the Aisne positions. (*See* MARNE,
BATTLE OF THE.) In March 1915 he was wounded while vi
the front trenches, and was placed on the retired list in Oct.
He gave his account of the earlier operations in *Der Mars*
Paris und die Marne-Schlacht (1920).

:NIGHT, DANIEL RIDGWAY (1845–1924), American artist 15.851), died in Paris March 9 1924. Of his paintings, ailing the Ferry" is in the Pennsylvania Academy, Phila- ohia, and "The Shepherdess" in the Brooklyn Institute seum.

:NIGHTHOOD AND CHIVALRY (*see* 15.851).—The following nges have taken place among the orders of knighthood and valry since 1910. While many orders have disappeared, eral have been instituted since that date.

lustria-Hungary.—The World War, closed the history of the ers belonging to the Dual Empire.

British Empire.—As was inevitable, the huge number of people aged in the World War made it necessary that appointments ll the British Orders should be made on a greatly increased e, while two additional Orders were instituted. A change in method of wearing the badge of the Third Class (Companion) ome British Orders was made. Where it used to be worn lal-fashion on the left breast, it is now hung round the neck. *rder of the British Empire.*—This was instituted in June 1917, eward War services in all capacities, military and civil. In 8 a Military Division of the Order was created. The essential ures of the latest statute of the Order, published on Dec. 29 2, are as follows:—

here are five classes of the Order, which (like the Order of the n) is divided into military and civil divisions. Each class can be erred upon men and women equally.

ighest Class—Knights Grand Cross and Dames Grand Cross 3.E.).
econd Class—Knights Commander and Dames Commander 3.E. and D.B.E.).
hird Class—Commanders (C.B.E.).
ourth Class—Officers (O.B.E.).
fth Class—Members (M.B.E.).

he two highest classes of the Order wear a star, which is of silver, vo designs. In the centre is a golden medallion showing a repre- ation of Britannia seated, surrounded by a circlet of crimson nel bearing the motto of the Order, "For God and the Empire." he members of the first class wear the larger star on the left st, and the badge of the Order (*see* below) is also worn on the , which, in the case of men, is $3\frac{3}{4}$ in. wide, in the case of women, . wide, and crosses the breast from the right shoulder to the left the badge resting on the hip. A collar has been instituted for class.

ne members of the second class wear the smaller star on the left st, with the badge suspended, in the case of men, by a ribbon . wide passing round the neck, and in the case of women, from w of ribbon of the same width, placed on the left side, above the The third class wear the badge, in the case of men, from a on of the same width as the second class round the neck, and, e case of women, from a bow on the left side. The fourth and classes wear the badge on the left breast, from a ribbon $1\frac{1}{2}$ in. , medal-fashion in the case of men, from a bow in the case of en.

ne badge is a cross patonce, bearing in the centre the medallion circlet as in the star. An imperial crown in gold surmounts the . For the first three classes the cross is enamelled in pearl grey, ered with gold, while the circlet is of red enamel with the motto old. The commander's badge is smaller than that for the other classes. The badge of the fourth class is entirely silver gilt, e that of the lowest class is entirely silver. The ribbon of the r is purple for the civil division, and purple with a narrow red ral stripe for the military division.

nere are also two medals belonging to the Order: The gallantry al, which is rare, and is only awarded for conspicuous bravery, e the recipient knew, when he performed the deed of gallantry, his life was in danger, and the meritorious service medal, for meritorious service.

ompanion of Honour.—This order was instituted in June 1917, ne same time as the Order of the British Empire. It may be erred upon either men or women who have rendered con- uous national service, and for whom the distinction is deemed nost appropriate form of recognition, constituting, as it does, onour dissociated either from acceptance of title or classi- ion of merit, for it confers no title or precedence, simply the ls "C.H." after the recipient's name.

consists of the Sovereign and 50 members, and there is only class.

e insignia consists of a badge, worn by men suspended from the on of the Order which is passed round the neck, and by women ended from a bow of ribbon placed upon the left shoulder.

The badge is oval, and consists of a blue circlet ensigned with the imperial crown in enamelled colours and bearing in letters of gold the motto of the Order, "*In Action Faithful and in Honour Clear.*" In the centre is an oblong plaque, with thereon, on the dexter a representation of a mounted knight in armour, and on the sinister an oak tree, from the boughs of which hangs a shield charged with the Royal Arms. The ribbon is $1\frac{1}{2}$ in. wide, of carmine silk with an interlaced border of gold wire.

The Order ranks next to, and immediately after, the first class of the Order of the British Empire.

Estonia.—This country has established the *Liberty Cross.*

Finland.—The chief Finnish Order is the *White Rose of Finland.*

Germany.—Officially, the old Orders of the German Empire have ceased to exist, but they are still worn in many cases.

Greece.—In addition to the *Order of the Redeemer* (*see* 15.865), the *Order of George I.* was instituted in 1912, and has six classes—collar, grand cross, grand commander, officer, knight and companion. There are also two medals of the Order, silver and bronze. The ribbon is red.

Owing to the establishment of the Greek Republic, it is possible that some changes may be made with regard to these two Orders.

Latvia.—Latvia has instituted the *Order of the Three Stars.*

Persia.—It is not improbable that the new Shah may alter the present chief Persian Order, the *Timsal-I-Humayun* (the Shah's portrait), but the *Lion and the Sun* may still be continued.

Poland.—Since the restitution of Poland's freedom, the old Polish *Order of the White Eagle* has been re-instituted.

This is the premier Polish Order, only awarded for most exceptional services. There is only one class. The ribbon is light blue.

The origin of the *Order of Polonia Restituta* needs no explanation. There are five classes—grand cordon, grand officer, commander, officer and chevalier. The insignia is worn after the fashion of that of the French Legion of Honour. The badge is a white cross with the Eagle of Poland thereon, and the ribbon is of the Polish national colours, red, with white edges.

Russia.—All the Russian Orders of Chivalry have been discontinued, though they still continue to be worn by adherents of the monarchy who have refused to acknowledge the present régime.

Egypt.—In the days before the World War, services rendered to the Egyptian Govt. were recognised by the award of the Turkish Orders of the Osmanieh and Medjidieh (*see* 15.867), but the change in the administration of the country made it inevitable that these would disappear, and that the King of Egypt would institute new Orders. There are now six of these:—

Order of Mohammed Ali, instituted in 1915 in memory of the founder of the present dynasty. The premier Egyptian Order and rare. Three classes—collar, grand cordon and commander. Star and Badge similar in design, consisting of a sun of which the rays are alternately gold and silver; upon this is a six-pointed green star, each point terminating in a golden lotus flower. In the centre is a green enamelled disc, with the Arabic inscription "Mohammed Ali" surrounded with an inscription to the effect that "Clemency, Justice and Generosity are the strength of a Reign." The ribbon is of watered green silk with a white line close to each edge. Two medals, gold and silver, belong to the Order. They bear on the obverse the Arabic inscription, "Honour to Bravery."

Order of Ismail, instituted 1922 in memory of the father of King Fuad. Second Egyptian Order. For eminent services rendered to Egypt. Four classes grand cordon, grand officer, commander and officer. The Badge is a five-pointed azure-blue enamelled star, having in the centre a round plaque with the Arabic inscription "Ismail" surmounted by a wreath of laurel with red knots. Star is similar, but has silver rays between the angles. The ribbon is dark blue with a stripe of red towards each edge.

Order of the Nile, instituted in 1915, for useful service rendered to Egypt. Five classes—grand cordon, grand officer, commander, officer and chevalier. The badge and star are of practically the same design, and consist of a star of 10 rays, alternately gold and silver, thereon a white enamel five-pointed star surmounted by the crown of Egypt. In its centre is a golden disc with an Arabic inscription in blue, "What benefits does Egypt owe to the Nile, the source of her prosperity and happiness." The crown in the badge is placed between the two top rays. The ribbon is of watered blue silk, with a golden-yellow stripe at each edge. The officer has a rosette on his ribbon.

Order of Al Kamal, instituted in 1915, is for ladies only. Four classes—"Decoration of Al Kamal," first, second and third classes. The decoration is in brilliants, and is reserved for the Queen of Egypt and princesses of royal blood. The insignia is a star enriched with precious stones, worn on the left breast, and a cordon of light blue watered silk with golden edges, which, passing over the right shoulder, suspends a jewelled badge resting on the left side. The insignia of the first class (grand cordon) is similar in appearance and is worn after the same fashion, but it is not jewelled. The second and third classes wear a badge on the left breast, attached to the ribbon of the Order which is tied on in a bow, the second class having a rosette thereon. The star is gold, charged with ten ornamental flowers, and bearing in the centre the inscription "Al Kamal," surrounded by the words "Charity," "Duty," "Devotion," "Nobility," and "Pity." The badge is a star, of which the 10 rays are formed by the same flowers as on the star, surmounted by the Crown, and bearing the inscription "Al Kamal" in the middle.

Order of Agriculture, established 1915, is a reward for services rendered to agriculture. There are two classes—commander and chevalier. The insignia of the commander is a badge, attached to the ribbon of the Order, worn round the neck, while that of the chevalier is a similar badge worn medal-wise on the left breast. The badge is a five-rayed star, enamelled white, with leaves and pods of the cotton plant enamelled in colour. In the centre in green Arabic characters is the inscription, "Decoration of Agriculture," and above this, between the top rays a cartouche inscribed in Arabic, "He who sows, reaps." Above all is the Royal Crown in gold. The ribbon is watered silk, striped with green and golden-yellow.

Order of the Military Star of King Fuad.—This dates from 1919, and is conferred on natives and foreign officers of the Egyptian Army. It is a white enamel five-pointed star, suspended from a bar. The obverse is bordered with gold, each arm having a golden fillet in the centre. The centre is enamelled in red and blue (the colours of the Royal House of Egypt), and bears a garland of laurel surmounted by the Royal Crown which surrounds two crossed sabres of oriental type. The reverse bears the inscription in Arabic, "The Military Star of King Fuad." The ribbon has five equal stripes of blue, chamois, black, chamois and blue. Bars may be awarded for additional services. (A. V. W.-H.)

KNOWLEDGE, THEORY OF.—Theory of knowledge is a product of doubt. When we have asked ourselves seriously whether we really know anything at all, we are naturally led into an examination of knowing, in the hope of being able to distinguish trustworthy beliefs from such as are untrustworthy. Thus Kant, the founder of modern theory of knowledge, represents a natural reaction against Hume's scepticism. Few philosophers nowadays would assign to this subject quite such a fundamental importance as it had in Kant's "critical" system; nevertheless it remains an essential part of philosophy. It is perhaps unwise to begin with a definition of the subject, since, as elsewhere in philosophical discussions, definitions are controversial, and will necessarily differ for different schools; but we may at least say that the subject is concerned with the general conditions of knowledge, in so far as they throw light upon truth and falsehood.

It will be convenient to divide our discussion into three stages, concerning respectively (1) the definition of knowledge, (2) data, (3) methods of inference. It should be said, however, that in distinguishing between data and inferences we are already taking sides on a debatable question, since some philosophers hold that this distinction is illusory, all knowledge being (according to them) partly immediate and partly derivative.

I. THE DEFINITION OF KNOWLEDGE

The question how knowledge should be defined is perhaps the most important and difficult of the three with which we shall deal. This may seem surprising: at first sight it might be thought that knowledge might be defined as belief which is in agreement with the facts. The trouble is that no one knows what a belief is, no one knows what a fact is, and no one knows what sort of agreement between them would make a belief true. Let us begin with belief.

Belief.—Traditionally, a "belief" is a state of mind of a certain sort. But the behaviourists deny that there are states of mind, or at least that they can be known; they therefore avoid the word "belief," and, if they used it, would mean by it a characteristic of bodily behaviour. There are cases in which this usage would be quite in accordance with common sense. Suppose you set out to visit a friend whom you have often visited before, but on arriving at your destination you find that he has moved, you would say "I thought he was still living at his old house." Yet it is highly probable that you did not think about it at all, but merely pursued the usual route from habit. A "though or "belief" may, therefore, in the view of common sense, shown by behaviour, without any corresponding "menta occurrence. And even if you use a form of words such as is su posed to express belief, you are still engaged in bodily behavio provided you pronounce the words out loud or to yourself. Sh we say, in such cases, that you have a belief? Or is somethi further required?

It must be admitted that behaviour is practically the sa whether you have an explicit belief or not. People who are of doors when a shower of rain comes on put up their umbrell if they have them; some say to themselves "it has begun rain," others act without explicit thought, but the result exactly the same in both cases. In very hot weather, both h man beings and animals go out of the sun into the shade, if th can; human beings may have an explicit "belief" that the sha is pleasanter, but animals equally seek the shade. It wou seem, therefore, that belief, if it is not a mere characteristic behaviour, is causally unimportant. And the distinction truth and error exists where there is behaviour without expli belief, just as much as where explicit belief is present; this shown by the illustration of going to where your friend used live. Therefore, if theory of knowledge is to be concerned wi distinguishing truth from error, we shall have to include the cas in which there is no explicit belief, and say that a belief may merely implicit in behaviour. When old Mother Hubbard we to the cupboard, she "believed" that there was a bone the even if she had no state of mind which could be called cogniti in the sense of introspective psychology.

Words.—In order to bring this view into harmony with t facts of human behaviour, it is of course necessary to take a count of the influence of words. The beast that desires shade a hot day is attracted by the sight of darkness; the man c pronounce the word "shade," and ask where it is to be foun According to the behaviourists, it is the use of words and th efficacy in producing conditional responses that constitu "thinking."[1] It is unnecessary for our purposes to inqu whether this view gives the whole truth about the matter. Wh it is important to realise is that verbal behaviour has the cha acteristics which lead us to regard it as pre-eminently a mark "belief," even when the words are repeated as a mere bod habit. Just as the habit of going to a certain house when y wish to see your friend may be said to show that you "believ he lives in that house, so the habit of saying "two and two a four," even when merely verbal, must be held to constitu "belief" in this arithmetical proposition. Verbal habits are, course, not infallible evidences of belief. We may say eve Sunday that we are miserable sinners, while really thinki very well of ourselves. Nevertheless, speaking broadly, verb habits crystallise our beliefs, and afford the most convenie way of making them explicit. To say more for words is to f into that superstitious reverence for them which has been t bane of philosophy throughout its history.

Belief and Behaviour.—We are thus driven to the view tha if a belief is to be something causally important, it must be fined as a characteristic of behaviour. This view is also forc upon us by the consideration of truth and falsehood, for beha iour may be mistaken in just the way attributable to a fa belief, even when no explicit belief is present—for example, wh a man continues to hold up his umbrella after the rain has stopp without definitely entertaining the opinion that it is still ra ing. Belief in this wider sense may be attributed to animals for example, to a dog who runs to the dining-room when he hea the gong. And when an animal behaves to a reflection in a loo ing-glass as if it were "real," we should naturally say that "believes" there is another animal there; this form of words permitted by our definition.

It remains, however, to say what characteristics of behavio can be described as beliefs. Both human beings and animals so as to achieve certain results, *e.g.*, getting food. Sometim they succeed, sometimes they fail; when they succeed, the ant beliefs are "true," but when they fail, at least one is . There will usually be several beliefs involved in a given of behaviour, and variations of environment will be neces- to disentangle the causal characteristics which constitute various beliefs. This analysis is effected by language, but d be very difficult if applied to dumb animals. A sentence be taken as a law of behaviour in any environment contain- ertain characteristics; it will be "true" if the behaviour to results satisfactory to the person concerned, and other- it will be "false." Such, at least, is the pragmatist defini- of truth and falsehood.

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[1] See J. B. Watson, *Behaviorism* (1925).

uth in Logic.—There is also, however, a more logical method scussing this question. In logic, we take for granted that rd has a "meaning"; what we signify by this can, I think, be explained in behaviouristic terms, but when once we acquired a vocabulary of words which have "meaning," an proceed in a formal manner without needing to remember "meaning" is. Given the laws of syntax in the language re using, we can construct propositions by putting together vords of the language, and these propositions have meanings h result from those of the separate words and are no longer rary. If we know that certain of these propositions are we can infer that certain others are true, and that yet others alse; sometimes this can be inferred with certainty, some- s with greater or less probability. In all this logical manip- on, it is unnecessary to remember what constitutes meaning what constitutes truth or falsehood. It is in this formal n that most philosophy has lived; and within this region a deal can be said that is both true and important, without need of any fundamental doctrine about meaning. It even s possible to define "truth" in terms of "meaning" and t," as opposed to the pragmatic definition which we gave a ent ago. If so, there will be two valid definitions of "truth," gh of course both will apply to the same propositions.

ne purely formal definition of "truth" may be illustrated simple case. The word "Plato" means a certain man; the "Socrates" means a certain other man; the word "love" ns a certain relation. This being given, the meaning of the plex symbol "Plato loves Socrates" is fixed; we say that complex symbol is "true" if there is a certain fact in the d, namely, the fact that Plato loves Socrates, and in the rary case the complex symbol is false. I do not think this unt is false, but, like everything purely formal, it does not e very deep.

ncertainty and Vagueness.—In defining knowledge, there wo further matters to be taken into consideration, namely, legree of certainty and the degree of precision. All knowledge ore or less uncertain and more or less vague. These are, in a e, opposing characters: vague knowledge has more likeli- l of truth than precise knowledge, but is less useful. One of aims of science is to increase precision without diminishing ainty. But we cannot confine the word "knowledge" to t has the highest degree of both these qualities; we must ude some propositions that are rather vague and some that only rather probable. It is important, however, to indicate ueness and uncertainty where they are present, and, if possi- to estimate their degree. Where this can be done precisely, ecomes "probable error" and "probability." But in most s precision in this respect is impossible.

II. THE DATA

advanced scientific knowledge, the distinction between t is a datum and what is inferred is clear in fact, though etimes difficult in theory. In astronomy, for instance, the are mainly certain black and white patterns on photo- hic plates. These are called photographs of this or that part ne heavens, but of course much inference is involved in using n to give knowledge about stars or planets. Broadly speak- quite different methods and a quite different type of skill required for the observations which provide the data in a ntitative science, and for the deductions by which the data shown to support this or that theory. There would be no reason to expect Einstein to be particularly good at photographing the stars near the sun during an eclipse. But although the distinction is practically obvious in such cases, it is far less so when we come to less exact knowledge. It may be said that the separation into data and inferences belongs to a well-developed stage of knowledge, and is absent in its beginnings.

Animal Inference.—But just as we found it necessary to admit that knowledge may be only a characteristic of behaviour, so we shall have to say about inference. What a logician recognises as inference is a refined operation, belonging to a high degree of intellectual development; but there is another kind of inference which is practised even by animals. We must consider this primitive form of inference before we can become clear as to what we mean by "data."

When a dog hears the gong and immediately goes into the dining-room, he is obviously, in a sense, practising inference. That is to say, his response is appropriate, not to the noise of the gong in itself, but to that of which the noise is a sign: his reaction is essentially similar to our reactions to words. An animal has the characteristic that, when two stimuli have been experienced together, one tends to call out the response which only the other could formerly call out. If the stimuli (or one of them) are emotionally powerful, one joint experience may be enough; if not, many joint experiences may be required. This characteristic is totally absent in machines. Suppose, for instance, that you went every day for a year to a certain automatic machine, and lit a match in front of it at the same moment at which you inserted a penny; it would not, at the end, have any tendency to give up its chocolate on the mere sight of a burning match. That is to say, machines do not display inference even in the form in which it is a mere characteristic of behaviour. Explicit inference, such as human beings practise, is a rationalising of the behaviour which we share with the animals. Having experienced A and B together frequently, we now react to A as we originally reacted to B. To make this seem rational, we say that A is a "sign" of B, and that B must really be present though out of sight. This is the principle of induction, upon which almost all science is based. And a great deal of philosophy is an attempt to make the principle seem reasonable.

Whenever, owing to past experience, we react to A in the manner in which we originally reacted to B, we may say that A is a "datum" and B is "inferred." In this sense, animals practise inference. It is clear, also, that much inference of this sort is fallacious: the conjunction of A and B in past experience may have been accidental. What is less clear is that there is any way of refining this type of inference which will make it valid. That, however, is a question which we shall consider later. What I want to consider now is the nature of those elements in our experiences which, to a reflective analysis, appear as "data" in the above-defined sense.

Mental and Physical Data.—Traditionally, there are two sorts of data, one physical, derived from the senses, the other mental, derived from introspection. It seems highly questionable whether this distinction can be validly made among data; it seems rather to belong to what is inferred from them. Suppose, for the sake of definiteness, that you are looking at a white triangle drawn on a black-board. You can make the two judgments: "There is a triangle there," and "I see a triangle." These are different propositions, but neither expresses a bare datum; the bare datum seems to be the same in both propositions. To illustrate the difference of the propositions: you might say "There is a triangle there," if you had seen it a moment ago but now had your eyes shut, and in this case you would not say "I see a triangle"; on the other hand, you might see a black dot which you knew to be due to indigestion or fatigue, and in this case you would not say "There is a black dot there." In the first of these cases, you have a clear case of inference, not of a datum.

In the second case, you refuse to infer a public object, open to the observation of others. This shows that "I see a triangle" comes nearer to being a datum than "There is a triangle there." But the words "I" and "see" both involve inferences, and cannot be included in any form of words which aims at expressing a bare datum. The word "I" derives its meaning, partly, from memory and expectation, since I do not exist only at one moment. And the word "see" is a causal word, suggesting dependence upon the eyes; this involves experience, since a new-born baby does not know that what it sees depends upon its eyes. However, we can eliminate this dependence upon experience, since obviously all seen objects have a common quality, not belonging to auditory or tactual or any other objects. Let us call this quality that of being "visual." Then we can say: "There is a visual triangle." This is about as near as we can get in words to the datum for *both* propositions: "There is a triangle there," and "I see a triangle." The difference between the propositions results from different inferences: in the first, to the public world of physics, involving perceptions of others; in the second, to the whole of my experience, in which the visual triangle is an element. The difference between the physical and the mental, therefore, would seem to belong to inferences and constructions, not to data.

It would thus seem that data, in the sense in which we are using the word, consist of brief events, rousing in us various reactions, some of which may be called "inferences," or may at least be said to show the presence of inference. The two-fold organisation of these events, on the one hand as constituents of the public world of physics, on the other hand as parts of a personal experience, belongs to what is inferred, not to what is given. For theory of knowledge, the question of the validity of inference is vital. Unfortunately, nothing very satisfactory can be said about it, and the most careful discussions have been the most sceptical. However, let us examine the matter without prejudice.

III. METHODS OF INFERENCE

It is customary to distinguish two kinds of inference, Deduction and Induction. Deduction is obviously of great *practical* importance, since it embraces the whole of mathematics. But it may be questioned whether it is, in any strict sense, a form of inference at all. A pure deduction consists merely of saying the same thing in another way. Application to a particular case may have importance, because we bring in the experience that there is such a case—for example, when we infer that Socrates is mortal because all men are mortal. But in this case we have brought in a new piece of experience, not involved in the abstract deductive schema. In pure deduction, we deal with x and y, not with empirically given objects such as Socrates and Plato. However this may be, pure deduction does not raise the problems which are of most importance for theory of knowledge, and we may therefore pass it by.

Induction.—The important forms of inference for theory of knowledge are those in which we infer the existence of something having certain characteristics from the existence of something having certain other characteristics. For example: you read in the newspaper that a certain eminent man is dead, and you infer that he is dead. Sometimes, of course, the inference is mistaken. I have read accounts of my own death in newspapers, but I abstained from inferring that I was a ghost. In general, however, such inferences are essential to the conduct of life. Imagine the life of a sceptic who doubted the accuracy of the telephone book, or, when he received a letter, considered seriously the possibility that the black marks might have been made accidentally by an inky fly crawling over the paper. We have to accept merely probable knowledge in daily life, and theory of knowledge must help us to decide when it really *is* probable, and not mere animal prejudice.

Probability.—Far the most adequate discussion of the type of inference we are considering is obtained in J. M. Keynes's *Treatise on Probability* (1921). So superior is his work to that of his predecessors that it renders consideration of them unnecessary. Mr. Keynes considers induction and analogy together, and regards the latter as the basis of the former. The bare essence of an inference by analogy is as follows: We have found a number of instances in which two characteristics are combined,
and no instances in which they are not combined; we find a
instance in which we know that one of the characteristic
present, but do not know whether the other is present or abs
we argue by analogy that *probably* the other characteristic is
present. The degree of probability which we infer will
according to various circumstances. It is undeniable that
do make such inferences, and that neither science nor daily
would be possible without them. The question for the logic
is as to their validity. Are they valid always, never or so
times? And in the last case, can we decide when they are va

Limitation of Variety.—Mr. Keynes considers that mere
crease in the number of instances in which two qualities
found together does not do much to strengthen the probabi
of their being found together in other instances. The import
point, according to him, is that in the known cases the instan
should have as few other qualities in common as possible.
even then a further assumption is required, which is called
principle of limitation of variety. This assumption is stated
follows (p. 256): "That the objects in the field, over which
generalisations extend, do not have an infinite number of
dependent qualities; that, in other words, their characteristi
however numerous, cohere together in groups of invariable c
nection, which are finite in number." It is not necessary
regard this assumption as *certain;* it is enough if there is so
finite probability in its favour.[1]

It is not easy to find any arguments for or against an *a pri*
finite probability in favour of the limitation of variety. It shou
be observed, however, that a "finite" probability, in
Keynes's terminology, means a probability greater than so
numerically measurable probability, *e.g.,* the probability of
penny coming 'heads' a million times running. When this
realised, the assumption certainly seems plausible. The stro
est argument on the side of scepticism is that both men a
animals are constantly led to beliefs (in the behaviouris
sense), which are caused by what may be called invalid indu
tions; this happens whenever some accidental collocation
produced an association not in accordance with any objecti
law. Dr. Watson caused an infant to be terrified of white rats
beating a gong behind its head at the moment of showing it
white rat (*Behaviorism*, p. 126). On the whole, however, ac
dental collocations will usually tend to be different for differe
people, and therefore the inductions in which men are agre
have a good chance of being valid. Scientific inductive or an
logical inferences may, in the best cases, be assumed to have
high degree of probability, if the above principle of limitation
variety is true or finitely probable. This result is not so defini
as we could wish, but it is at least preferable to Hume's comple
scepticism. And it is not obtained, like Kant's answer to Hum
by a philosophy *ad hoc;* it proceeds on the ordinary lines
scientific method.

Grades of Certainty.—Theory of knowledge, as we have see
is a subject which is partly logical, partly psychological; t
connection between these parts is not very close. The logic
part may, perhaps, come to be mainly an organisation of wh
passes for knowledge according to differing grades of certaint
some portions of our beliefs involve more dubious assumptio
than are involved in other parts. Logic and mathematics on t
one hand, and the facts of perception on the other, ha
the highest grade of certainty; where memory comes in, t
certainty is lessened; where unobserved matter comes in, the ce
tainty is further lessened; beyond all these stages comes what
cautious man of science would admit to be doubtful. The attem
to increase scientific certainty by means of some special ph
losophy seems hopeless, since, in view of the disagreement
philosophers, philosophical propositions must count as amon
the most doubtful of those to which serious students give a
unqualified assent. For this reason, we have confined ourselve

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[1] The argument which leads to this conclusion is long and techni
cal. It has been criticised by Jean Nicod, *Le Problème logique d*
l'Induction (Paris, 1924), whose contentions are rebutted by M
R. B. Braithwaite in *Mind* (Oct. 1925). The outcome is to justify
Mr. Keynes in the main, though not in every detail.

discussions which do not assume any definite position on losophical as opposed to scientific questions.

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KNOX, PHILANDER CHASE (1853–1921) (*see* 15.882d), Amern politician, was born at Brownsville, Pa., May 6 1853. He duated from Mount Union College, Alliance, O., in 1872 and s admitted to the Bar in 1875. The following year he was pointed assistant U.S. Attorney for the western district of nsylvania. In 1877 he opened an office in Pittsburgh and n developed a lucrative practice. In 1901 he was appointed orney-general by President McKinley and was retained by esident Roosevelt. While he was attorney-general many imtant suits were instituted, notably those against the "Beef ust" and the Northern Securities Company. He resigned in 04, having been appointed to fill the unexpired term of Matw S. Quay, deceased, as Senator for Pennsylvania, and was elected to serve 1905–11. In 1909 he resigned to enter the binet of President Taft as Secretary of State, holding that ce for four years. He was again returned to the Senate for 7–23. In 1920 he offered a resolution declaring that war with rmany was at an end, which was adopted by both Senate and use, but was vetoed by President Wilson. A similar joint olution of Congress was approved by President Harding July 921, and a formal treaty of peace with Germany signed Aug. He died in Washington, D.C., Oct. 12 1921.

KNUTSFORD, SYDNEY GEORGE HOLLAND, 2ND VISCOUNT 855–), eldest son of the first Viscount Knutsford, was rn on March 19 1855. He was educated at Wellington and at inity Hall, Cambridge, where he secured honours in law and tinguished himself in athletics. He was called to the bar in 79, and in 1883 married Lady Mary Ashburnham, daughter of 4th Earl of Ashburnham. He succeeded to the title on the ath of his father in 1914. He became a director of the Underound Electric Railways Co. and other important companies, d was associated with a number of philanthropic enterprises. was appointed chairman of the London Hospital, and his oposal that certain city churches should be demolished in ler to provide funds for the sustentation of hospitals, though attracted several supporters, embroiled him in controversy.

KOBE, Japan, with a population of 714,976 in 1921 (including 27 foreigners, largely Chinese), has increased in importance a port as a result of the earthquake of 1923. A considerable rt of the trade of Yokohama was diverted to it, and part of this nsference will probably be permanent, owing to the excellent lway facilities of Kobe. The foreign population has also inased. Large sums have been spent on port improvement and d reclamation, and work is still in progress. In 1922 there re four quays, with berths for 19 vessels, and 19 more berths re projected for the completion of the extension scheme. A ge shipbuilding yard, the fourth, was opened in 1917. In 1910 bed of the Minatogawa river was reclaimed; the upper part s been made into a park, with a city hall and large market. e tramways have been extended to Hyogo, which is now adnistratively a part of Kobe. The city stretches five miles beeen the hills and the river, and is extending rapidly towards aka, with which it is connected by electric railway; the hill of kko-Zan behind the city has become a favourite summer resort. any Japanese have erected office buildings in the settlement, ich is well laid out. The water supply, previously very inadeate, has been extended. Although the south and southwest rts of Japan are supposed to be immune from serious earthakes, a shock in the neighbourhood of Kobe caused considerle damage and some loss of life in May 1925.

KODÁLY, ZOLTÁN (1882–), Hungarian composer, was rn at Kecskemét, Hungary, Dec. 16 1882. He studied under ans Koessler at the Budapest Academy of Music, where he became professor of composition in 1907. A leading exponent of the ultra-modern tendency in Hungarian music, he devoted himself enthusiastically to the collection and arrangement of Hungarian and Slovak folk-songs and his pioneer work in this connection was of great importance; for he and Bartók discovered a certain type of Hungarian national music, of a much greater purity and originality than the popular gipsy-music. This had a remarkable effect in transforming modern Hungarian music, and in opening up a new perspective. In his arrangement of folk-songs, Kodály successfully penetrated their inner meaning, and preserved their poetic spirit. His musical criticisms have appeared in Hungarian, American, French and Italian papers. His works include *Johannes Hary*, a musical comedy; *Psalm LV.*, for chorus and orchestra; two string quartets; a trio for strings; sonatas, piano solos, songs, etc.

KOKOSCHKA, OSKAR (1886–), German poet and painter, was born at Pöchlarn, Austria, March 1 1886. He was an expressionist, and produced a number of semi-dramatic works, written in whimsical vein, in which the problems of life were treated in a somewhat loose and vague manner. *Mörder, Hoffnung der Frauen* (1907), *Der brennende Dornbusch* (1911), *Hiob* (1917) and *Orpheus und Eurydike* (1918) were first published in the *Sturm* and afterwards appeared in collected form under the title of *Vier Dramen* (1919). *Mörder, Hoffnung der Frauen* and *Hiob* were performed for the first time in Dresden in 1919 and *Der brennende Dornbusch* was produced in Berlin under Kokoschka's direction by the "Junge Deutschland." In his staging of this piece Kokoschka revealed much original talent. His verse is, for the most part, complementary to the accompanying pictures. His poetical works include *Die träumenden Knaben* (Vienna, 1908; Leipzig, 1917); *Der weisse Tiertöter* (1920); *Der gefesselte Kolumbus* (1921); and among his more notable pictures and drawings are "Auswanderer" and "Der irrende Ritter." See Paul Westheim, *O. Kokoschka* (1919).

KOLÁČEK, FRANTIŠEK (1851–1913), Czech physicist, studied in Prague under E. Mach and in Vienna under Stefan. In 1882 he was appointed lecturer at the Brno (Brünn) Polytechnic, and in 1891 became professor of mathematical physics at the Charles University in Prague. His numerous publications (mostly in Czech and German) dealing with electromagnetic and optical theory and hydrodynamics include: "Dispersionserklaerung nach der elektromagnetischen Lichttheorie" (*Ann. der Physik* 1887, 1888), which gives the first explanation of dispersion on the basis of Maxwell's electromagnetic theory; "Theorie der Doppelbrechung" (*ibid.*, 1892); *Theorie des Kerr'schen Reflexion Phaenomens* (Prague, 1895); "Ueber Magnetostriktion" (*Phys. Zeitschr.*, vol. 6, p. 143, 1905), and "Zur Theorie der elektromagnetischen Gleichungen in bewegten Medien" (*Ann. der Physik.*, vol. 23, p. 698, 1907), which derives electromagnetic equations for moving media independently of the electron theory, and arrives at Lorentz equations which are related to a system of co-ordinates connected with the observer, thus satisfying the relativity criterion; also the excellent textbooks *Hydrodynamika* (Prague, 1899), and *Elektřina a Magnetism* (Prague, 1904). Koláček died in Dec. 1913.

KOLCHAK, ALEXANDER VASILIEVICH (1875–1920), Russian admiral, was born in 1875 and entered the Russian Navy in 1888. He served in the Russo-Japanese War of 1904–5 and at the beginning of the World War was in command of a destroyer in the Baltic. In the summer of 1916 Kolchak was appointed commander of the Black Sea Fleet, with the rank of rear-admiral. After the revolution in 1917 he took an active part in the fighting against the Bolshevists in Siberia. On Nov. 18 1918, by a decision of the Russian Govt. at Omsk, Admiral Kolchak assumed the title of Supreme Ruler of Russia. During the first half of 1919 the anti-Bolshevist army under his command met with considerable success but in the summer the army disintegrated, there were risings in the rear, and Omsk, the capital of the Siberian Govt., was captured on Nov. 15 1919. The Government was then transferred to Irkutsk, but after the creation of a new socialist administration at Irkutsk, Kolchak was asked to resign, and on Jan. 4 1920 he signed a ukase transferring his powers to Gen.

Denikin. Later he fell into the hands of the Bolshevists and was shot at Irkutsk on Feb. 7 1920.

KOMURA, JUTARO, Marquess (1855–1911), Japanese diplomat and statesman (*see* 15.892), was foreign minister in the second Katsura administration (1908–11) and died at Hayama Nov. 24 1911.

KOORT, JAN (1883–), Estonian sculptor, was born Nov. 7 1883 in the Tartu (Dorpat) district. He received his artistic training in the Baron Stieglitz Art School at St. Petersburg (Leningrad) and from 1905–8 studied at the École des Beaux-Arts in Paris under Prof. Mercier. For the purpose of completing his training he worked in the private studios in Paris of Adler, R. Collin and Lucas. He was represented in the exhibitions of the Paris spring and autumn salons in 1908 and in the Tartue exhibition, 1909. After a short stay in his own country, Koort again went to Paris in 1910 where he remained until 1915. In 1910 he exhibited in the Helsingfors art exhibition. In 1915 he went to Moscow, where his best work was produced, and in 1915 and 1916 took part in the exhibitions known under the name of “ Mir Iskusstwa.” The Tretjakow Gallery in Moscow acquired his granite “ Frauenkopf ” and the portrait of his wife executed in black granite is in the Moscow Gallery. Koort, who worked in granite, marble and wood, produced various decorative works in memory of those who fell in the Estonian War of Independence. His great talents are most forcibly revealed in a number of finely executed character heads.

KORAN: *see* ARABIC LITERATURE.

KÖRBER, ERNST VON (1850–1919), Austrian statesman, was born at Trieste Nov. 6 1850. He began his career as an official in the Austrian state service, and when the Emperor Francis Joseph was compelled to rely on cabinets of officials in view of the obstruction in Parliament, Körber became minister of trade under Gautsch in 1897, of the interior under Clary in 1899 and Prime Minister in 1900. He was the first man other than an aristocrat to hold this post since Schmerling. Körber attempted to solve the nationalist question by honest negotiation and compromise, but his efforts first to bring Germany and the Czechs in Bohemia to an agreement, and later to solve the language problem by dividing Bohemia into a German, a Czech and a mixed district, broke down. He succeeded in restoring confidence between the Germans and the Crown, but the Czechs renewed their obstruction and Körber was forced to rule, as his predecessors had done, with the help of para. 14 of the Austrian constitution (which allowed a Government to pass any measure on its joint responsibility, with “ provisional validity,” should it prove impossible to pass the measure through Parliament in the ordinary way). Körber employed this expedient on no fewer than 33 occasions. He evolved the Great Austrian canal scheme, the only example of constructive legislation on a large scale in Austria of modern times, which was voted but never carried into action. He was also able to introduce a better spirit into industrial disputes, winning the confidence of masters and men alike.

Körber resigned office in Dec. 1904, when the obstruction of the Hungarian party of independence made it impossible to carry through the periodical compromise with Hungary. He returned to politics as common finance minister in Feb. 1915 and became prime minister for the second time in Oct. 1916 after the murder of Count Stürgkh. His old confidence, however, was gone. He resigned in Dec. 1916 after a fresh dispute concerning the Hungarian compromise and died in Baden, disregarded and embittered, March 5 1919.

KOREA or Chosen.—On Aug. 22 1910 Korea (*see* 15.908) became an integral part of the Japanese Empire, under its ancient name of Chosen, formerly in use for over five centuries and now officially restored. With this event a new era dawned for what was formerly the “ Hermit Kingdom.” The ordered and systematic progress, already inaugurated by Japan in 1906, advanced steadily.

The peninsula of Chosen, with its outlying islands, has an area of 86,000 square miles. It is thus about as large as the mainland of Japan, or about two-thirds of the size of the British Isles. The population on Oct. 1 1920 was 17,264,119, including about 337,000 Japanese and about 23,000 foreigners. The density was on about 208 per sq. m., compared with 376 in Japan and about 3 in Great Britain. On Oct. 1 1924 the population was estimat at 18,677,800. The climate is dry and bracing, without inten variations of cold and heat, and, in contrast to Japan, there an absence of hurricanes and practically no visitation of eart quakes. The country is mountainous, especially in the nort but there are extensive plains, well watered with good rivers, the south and west, where are situated the excellent harbours Fusan, Mokpo, Chemulpho and Chinnampo. The miner wealth of the country is concentrated in the north, while agricu ture is the predominant characteristic of the level and ferti southwest. Chosen's geographical position affords her easy acce to the markets of China, Manchuria and Siberia, and a railwa line now connects her with northern Asia and thus to the hea of Europe.

I. POLITICAL HISTORY

Subsequently to the annexation, the functions of the Japane residency-general and of the Korean Govt. were merged in tho of a governor-general, the first to be appointed being Gen. Te auchi, with Mr. I. Yamagata, son of Prince Yamagata, as admi istrative superintendent. In Oct. 1916 Gen. Terauchi vacate his post to become Premier of Japan, and was succeeded by Ge Count Hasegawa, Mr. Yamagata continuing in office. An impo tant reform effected in this period was the unification of th police and the gendarmerie service, by which a better control the outlying districts was obtained where hitherto the peace an security of the inhabitants had been frequently disturbed b bands of robbers and marauders.

But widespread disturbances took place in March 1919. Th Koreans desired to achieve at one step that measure of “ sel determination ” which President Wilson's utterances appeare to them to justify. The disturbances, however, were quickl subdued, and the Japanese Govt. hastened forward refor measures which had already been contemplated. The heads the administration resigned, and Baron (later Viscount) Makot Saito was appointed governor-general and Dr. R. Midzuno ad ministrative superintendent. The reforms introduced were (1) the extension to civil officials of eligibility to the post of gov ernor-general, hitherto only open to a military officer of the ran of general; (2) the governor-general, formerly only directl responsible to the Throne, to be amenable to the Prime Ministe of Japan; (3) the governor-general to be relieved, even when military officer, of the right to the military command, whic should be exercised only by the commander of the army; (4) th substitution of a police force for the mixed system of gendarmeri and police. The Premier, Mr. Hara, also issued a statement tha the Government were desirous of further eliminating, as tim went on, all differences between Japan proper and Chosen i matters of education, industry and the civil services. A syste of provincial and municipal administration, similar to that i Japan, would also gradually be evolved.

Peace was thus established, although various agitators an malcontents who had fled either to Shanghai or to Manchuri from time to time made abortive attempts to stir up discontent. Episodes which occurred in the autumn of 1920 in the Chienta district, when a Japanese consulate was burned and attacks wer made on peaceful Japanese and other civilians, were subsequentl found to have been engineered by Korean agitators.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—After the Russo-Japanese War, 1904–5, Japan turne her attention more actively to the reform of Chosen fiscal affairs. Detailed regulations regarding revenue and expenditure were promulgated in June 1906, the system of public tenders was introduced, and a bureau of audit was established. The Seoul branch of a Japanese joint-stock bank was authorised to act as the central treasury of the Chosen Govt., and the post-offices were also entruste with Treasury business. In Sept. 1906 regulations with regard to the collection of taxes were issued and assessors appointed, all being made directly responsible to the Minister of Finance.

A law of 1901, not then put into force, by which the coinage syste was to be made analogous to that of Japan, became operative i June 1905, and it was further provided that the standard money o pan, or bank notes, should become the standard money of Chosen. ius Chosen became a gold country.

In consequence of the steady expansion of financial and economic airs, the Bank of Korea (renamed the Bank of Chosen in 1911) s established as a central bank in Oct. 1909, and took over the ties previously attended to by the First Bank, Ltd. The Bank of iosen, which has an authorised capital of 40,000,000 yen and a paid- capital of 25,000,000 yen, acts as cashier to the Treasury and ndles loan business, and, in addition, is authorised to issue bank tes and to engage in ordinary banking and trust business, such as discounting of drafts and other commercial papers. Also, sub- t to the approval of the Governor-General of Chosen, it may make vances to public corporations without security and represent other nks. Being the principal medium of exchange in Chosen, the lume of the note issue has steadily expanded with the develop- nt of economic affairs in the peninsula. Since Dec. 1917 the notes ve been allowed unlimited circulation in the Kwantung territory d the South Manchuria Railway Co.'s leased districts. At the ne time the notes were made to replace the gold notes formerly ued in Manchuria by the Yokohama Specie Bank, this further elling the volume of circulation bank notes issued by the Korean nks.

In March 1906, during the protectorate régime of Japan, the ricultural and Industrial Bank Regulation was enacted with the ject of giving relief to the straitened money market in the prov- es by the creation of a number of agricultural and industrial nks. The Government extended them help, such as by subscrib- to the capital, making loans free of interest and so forth. By the d of 1917 six head offices and 41 branches had been established in rious parts of the peninsula. In time they were adjudged inade- ate for the rapidly growing industrial and economic requirements, d this resulted in the promulgation in June 1918 of the Chosen lustrial Bank Law, in virtue of which a central bank bearing this le was established in Oct. of the same year by amalgamating the ricultural and industrial banks then existing.

At the end of 1923 there existed in Chosen 18 banks with 58 anches or agencies in addition to their head offices, 17 branch ices and agencies of banks which had their head offices in Japan oper, and at the end of June 1924 as many as 499 local credit sociations with a total membership of 357,000 persons.

The country's ordinary revenue rose from 44,764,559 yen in 1916–7 102,383,844 in 1924–5; while the extraordinary revenue rose from 437,548 yen in 1916–7 to 38,439,857 yen in 1924–5. The total penditure, which in 1916–7 was 57,562,710 yen, was 140,823,701 n in 1924–5.

Foreign Trade.—The external trade of Chosen rapidly increased th the development of her agriculture and industry. Exports, lued at 5,616,608 yen in 1912 (in addition to exports to Japan itself 15,369,009 yen), increased to 20,403,305 yen in 1923 (with 1,262,427 yen to Japan); and imports, 26,359,434 yen in 1912 us 40,756,013 yen from Japan), rose to 98,338,377 yen in 1923 us 167,452,350 yen from Japan).

During the same period the ratio of trade with Japan to that with eign countries may be seen from the following table:—

	Trade with Japan (including Taiwan and Karafuto)	Trade with foreign countries
	%	%
912	67	33
914	72	28
916	75	25
918	81	19
920	70	30
921	79	21
922	76	24
923	77	23

In 1924 the trade with foreign countries amounted to: imports, 882,000 yen, exports 22,495,000 yen.

Government Enterprises.—In 1908 a special Government office was ablished to control and foster the cultivation of the medicinal ant ginseng. The area under cultivation increased to 1,724 ac., e annual value of the medicinal ginseng raised being 2,000,000 yen.

In 1907 the Government commenced operations for the natural aporation of salt, a product hitherto obtained by the artificial boil- process, and the manufacture was developed as a Government terprise. By 1918 saltpans covering an area of 2,528 ac. were in eration, but, as the quantity of salt produced was still insufficient home consumption, in 1920 the Government began laying out an ditional 6,370 ac., the work to be completed in seven years. The t produced in 1923 amounted to 67,000,000 kin (88,600,000 lb.).

The production and manufacture of tobacco has been greatly stered by the Government. The area under cultivation increased om 33,261 ac. in 1915 to 42,525 ac. in 1919, the total value having en from 4,878,127 yen to 14,501,169 yen in the same period. In 23, however, the area had decreased to 19,885 ac., and the total lue for the year was 22,217,642 yen.

Agriculture and Industry.—Rice is the staple agricultural product, followed by barley, Italian millet, soy beans, wheat and red beans, in addition to which there are also such special products as cotton, tobacco, hemp and ginseng. The cultivation of fruit-trees has produced very good results, and the area of their cultivation is gradually extending, fruit-farming having received considerable impetus through the establishment of model agricultural farms. The Government undertook the reorganisation of sericulture in 1906, and the industry is now being carried on everywhere. Both fruit-farming and sericulture are engaged in as subsidiary industries by the agricultural class. The breeding of cattle, horses, goats and pigs is carried on nearly everywhere in the peninsula, though not as an independent enterprise. The cattle are well known for their great size and good quality, and a large number of them are exported annually to Japan proper and Asiatic Russia.

At the time of annexation a large part of the forests and plains of Chosen was in a state of utter desolation, but since the year 1907 afforestation has progressed uninterruptedly, with Government assistance, many private forestry enterprises having also sprung up in various localities. The total area of the forests of Chosen is believed to be about 13,500,000 acres.

The principal native industrial products are: textile fabrics, paper, pottery, metal ware, manufactured tobacco, brewed drinks and leather, but as these works are mostly carried on as subsidiary house industries, the production is insufficient to meet the demand, and even common articles of daily use have in many cases to be imported. With the steady development of manufacturing industries and the rapid strides with which agriculture, mining and other primary industries have grown, Chosen has begun to attract wide attention as a promising field of enterprise, especially in spinning, filature, the manufacture of pulp, cement, beet-sugar, matches, milling and iron founding.

In 1922 there were 53 agricultural companies with a total paid-up capital of 23,988,000 yen, 178 industrial with 27,390,000 yen, 261 commercial with 22,994,000 yen, 79 transportation with 27,694,000 yen and 188 others with 116,883,000 yen, making a total of 759 companies with a capital of 218,950,000 yen.

Mining.—A mining law enacted after the annexation, and made operative on April 1 1916, prohibited foreigners from acquiring mining rights in Chosen unless as a legal Japanese corporation, although the rights existing and already granted to foreigners by the former Korean Govt. were strictly respected. The principal mineral products, in addition to gold, are silver, zinc, copper, lead, iron, tungsten ore, graphite, coal (especially anthracite), quartz sand and kaolin. A number of Japanese mine-owners have recently commenced operations in the peninsula, and mining enterprise shows a steady expansion. The total annual yield of all the mines in the country was as follows:—

1910	6,067,952 yen	1918	30,838,074 yen
1912	6,815,121 yen	1920	24,204,688 yen
1914	8,522,418 yen	1922	14,503,781 yen
1916	14,078,188 yen	1923	17,326,894 yen

Fisheries.—The advance in the fisheries was mainly due to the provisions of the Fishery Law of 1911 under which new fishing associations have been formed, havens for the fishing fleet provided, and proper investigations conducted into the suitability of gear and the movements and location of fish. As a result, the fishing population increased from 93,400 with 16,709 boats in 1910, to 346,349 with 53,118 boats in 1918, the total value of the catch having risen from 7,871,910 yen to 32,863,402 yen in the same period. The total catch in 1923 reached the value of 51,700,000 yen.

Communications.—Some 3,850 m. of road construction and repair were undertaken at Government expense, and the cost of another 1,000 m. was shared between the Government and the local authorities, the total outlay being about 25,000,000 yen. The first railway line in Chosen, between Seoul and Chemulpho, was completed by a Japanese syndicate in 1900 and opened to traffic in Oct. of that year, whilst the same syndicate undertook the construction of the Seoul-Fusan railway (274 m.), which was completed and opened to traffic in Jan. 1905. The trunk line Seoul-Wiju (309 m.), which traverses the peninsula lengthwise, was built by the Japanese Army and completed in 1906. Branch lines were added from time to time, so that by the time Chosen became part of the empire some 759 m. of railway were in operation. By 1923–4 this figure had been increased to 1,189 miles.

Posts, etc.—Since 1910–11 the expansion of the postal, telegraph and telephone services in Chosen has been normal, the number of post-offices having increased from 447 in 1910–1 to 618 in 1922–3, the postal packets from 100,265,041 to 347,779,584 and the parcels from 1,589,722 to 4,565,571. The length of telegraph lines increased in the same period from 3,389 m. to 5,087 m.; the length of wires from 7,740 m. to 19,635 m.; and the number of messages from 7,127,235 to 9,850,157. The length of telephone lines increased from 314 m. to 4,447 m.; the wires from 10,121 m. to 45,704 m.; and the messages from 21,260,918 to 72,328,480.

A great increase both in the number of depositors and the amount of their savings was a feature of the Post-Office Savings Bank in Chosen; in 1911–2 there were 223,599 depositors (4,365,996 yen), and in 1922–3 there were 1,590,470 depositors (19,875,093 yen).

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KORNILOV, LAVR GEORGIEVICH (1870–1918), Russian soldier was born July 18 1870 in Ust-Kamenogorodsk, Siberia, his father being a Cossack officer. He entered the army, and was in 1892 commissioned and posted to the Turkistan artillery brigade. He devoted himself to service in Turkistan, whence he undertook journeys into Afghanistan, Chinese Turkistan, Persia and Baluchistan. He saw service as a staff officer in the Russo-Japanese War of 1904–5, and subsequently spent four years (1907–11) as Russian military attaché in Peking. In Galicia, Kornilov commanded an infantry division. He himself was captured and sent to the fortress of Laka, in Hungary, but he managed to escape, reaching Russia in the autumn of 1916. He was at once appointed commander of the XX. Army Corps. At the beginning of March 1917, with the outbreak of the Russian Revolution, Kornilov was appointed to command the troops of the military district of Petrograd.

He found the troops, in such a demoralised state that he asked to be relieved and sent to the front, and at the beginning of May he was made commander of the VIII. Army. Appointed by Kerensky supreme commander-in-chief, Kornilov presented his programme enforcing discipline in the army. The programme was, however, rejected, and this was the beginning of a split between Kerensky and Kornilov and the struggle between them ending in the outbreak of Sept. 8–12; Kerensky gained an apparent victory, and Kornilov was interned in Bikhov. On his release after the November revolution, Kornilov assisted Gen. Alexeyev in forming the Volunteer Army in which he took a command. On March 31 1918 he was killed in the Caucasus by the bursting of a shell.

KOSSUTH, FRANCIS (1841–1914), Hungarian statesman (*see* 15.916), died in Budapest May 25 1914.

KÖVESLIGETHY, RADÓ DE (1862–   ), Hungarian astronomer, was born at Verona, Italy, Sept. 1 1862. Educated at Pozsony and the University of Vienna, he became assistant to H. C. Vogel at Potsdam Observatory and later astronomer at the Ó-Gyalla Observatory. While still a student he evolved from Greenwich observations of velocities in the line of sight a first approximation of solar velocity. He constructed further for the Kis Kartal Observatory a handy and powerful spectrophotometer based on the principle of extinction by polarisation. After a year's collaboration at the Central Institute of Meteo ology and Terrestrial Magnetism at Budapest he became assis ant to Baron Eötvös. In 1897 he was appointed extraordinar and in 1904 ordinary professor of cosmography and geophysi at the University of Budapest. In 1905 he became gener secretary of the International Seismological Association, a pos tion he held till the dissolution of the Association in 1916. I 1905 he founded the Seismological Institute of Budapest. Aft the great earthquake of Messina he investigated the condition under which a rational prevision of earthquakes would be poss ble (*Sur l'hystérisis sismique*, 1912).

KOVNO or KAUNAS (*see* 15.921), with a population of 92 446 in 1923, became the capital of Lithuania in place of Viln (Wilno) when that town was included in Poland. Kovn has changed greatly since the World War. Previously a quie somewhat poor town, with no water supply, gas or moder drainage, it has now electricity and other services and a numb of new buildings, including large shops and theatres. Its im provement is largely due to the fact that the taxes of Lithuani are now spent in the country, since it gained its independence. Lithuanian university, called the Gedimine University in honou of a medieval prince, was opened in 1922. Kovno is the industri centre of the country, nearly one-fifth of the industrial establishments in existence in 1921 being in the city. Kovno was though to be a first-class fortress, but was reduced in a few days b German forces during the World War. Two churches wer wrecked, mills razed and much damage done. Great efforts t Germanise the town were made during the occupation. Th independence of Lithuania was ratified by the Constituent A sembly at Kovno in May 1920.

KRASSIN, LEONID BROISSODICH (1870–   ), Russian pol tician, was born in Kurgan, Tobolsk, the son of a civil servan He was expelled from the St. Petersburg Technical Institute i 1891 for taking part in a political demonstration on the occasio of the funeral of Shelgunov. He was arrested in 1894, 1907 an 1908 and banished for three years to Nijni Novgorod. He combined continuous revolutionary activity with great success i the engineering profession, taking important part in many larg works in Russia and holding eventually a responsible post in th company of Siemens and Schuckert. After the Nov. Revolution 1917, he organised the supply of munitions to the Red Arm during the civil war and became People's Commissar for Trad and Industry. In 1920 he was president of the Soviet delegatio that concluded the trade agreement with England. In 1922 h was a member of the Soviet delegation to Genoa. In London h concluded an agreement with Mr. Urquhart concerning concessions in Siberia, but this agreement was not ratified in Russia owing to the personal intervention of Lenin. When the Commissariats of Internal and Foreign Trade were united, Krassi became assistant commissar. He was for some time Sovie diplomatic representative in Paris and was appointed to Londo at the end of 1925.

KRAUS, KARL (1874–   ), Austrian critic and poet, wa born April 28 1874 at Jičin, Czechoslovakia. He attended th university of Vienna and attracted notice by two brochures *Die demolierte Literatur* and *Eine Kron für Zion*, and by hi periodical, *Die Fackel*. This review, of which he became edito in 1899, was at first largely, and later entirely, written by him It began its career by violent attacks upon abuses in literary theatrical, social and political circles in Vienna, and especiall upon the newspaper Press. Gradually it became the mouthpiec of a pitiless and scathing critic and, though the satirist's poin of view changed in the course of time, the middle classes an the liberal Press always remained the chief objects of Kraus' attack. His satire was most acute in his collected essays *Sittlichkeit und Kriminalität* (1902) and his volume of anti-wa poetry *Die letzen Tage der Menschheit* (1918) was compare with that of Juvenal and Swift. Kraus has great pathos at hi command, but his lyrical talent, as shown in *Worte in Verse* (1918), is cramped by his mordant wit. Nevertheless his influence upon the younger generation in Austria and Germany wa very considerable. As a lecturer upon his own and upon foreig ks, he achieved great success both in his own country and oad. He must also be reckoned, with Lichtenberg, Novalis Nietzsche, among the German masters of aphorism. Kraus's r works include *Sprüche und Widersprüche* (1909); *Pro o et mundo* (1912); *Nachts* (1919).

ee L. Liegler, *Karl Kraus und sein Werk* (1920); B. Viertel, *l Kraus* (1921).

REHBIEL, HENRY EDWARD (1854–1923), American writer critic, was born at Ann Arbor, Mich., March 10 1854. He ied law at Cincinnati 1872–4, but drifted into journalism, oting himself more particularly to musical criticism. He was he staff of the Cincinnati *Gazette*, 1874–80, then editor of New York *Musical Review*, and finally musical critic for the York *Tribune* till his death, which occurred in New York , March 20 1923. He was one of the most influential musical cs of his time, and in addition to lecturing on musical topics, e a number of popular books. Among these are *Studies in nerian Drama* (1891); *How to Listen to Music* (1896); *Music Manners in the Classical Period* (1898); *The Pianoforte and Music* (1911); *Afro-American Folk Songs* (1914); also works aining grand opera plots, motives and music. He was the erican editor of the 2nd ed. of Grove's *Dictionary of Music Musicians* (1904–10), edited Thayer's *Life of Ludwig van hoven*, 3 vol. (1921) and translated a number of foreign ical works.

REISLER, FRITZ (1875–), Austrian violinist, was born ienna Feb. 2 1875. At the age of seven he was admitted to Vienna Conservatoire and in 1887 won the Grand Prix on uation from the Paris Conservatoire, where he studied under senet and Delibes. In 1889 he made a successful tour of the ed States, but then abandoned music for some years, study- medicine and serving in the Austrian Army as an officer in a n regiment. His reappearance on the concert stage in in, March 1899, was followed by a wonderful tour of the ed States and Great Britain in 1900–1, and he later visited chief musical centres of the world. On the outbreak of the ld War in 1914 he rejoined his former regiment, but was nded and discharged from service, thereafter resuming his ical career. He published his war experiences, *Four Weeks e Trenches*, in 1915. He has also written numerous arrange- ts of music for the violin and piano, and his operetta, *Apple soms*, was produced in New York in 1919.

RILOFF, ALEXEI NIKOLAIEVICH (1863–), Russian hematician and naval architect, was born Aug. 3 1863 in yr, Simbirsk province, and educated in the naval school and l academy at St. Petersburg (Leningrad). In 1881 he joined navy. In 1896 and 1898 he read before the Institution of al Architects in London two remarkable papers on the lation of a ship on waves and was awarded the gold medal he Institution. From 1900 to 1908 he was superintendent of xperimental tank at St. Petersburg; and from 1908 to 1910 ctor of naval construction. In 1890 he became professor at naval academy and in 1916 member of the Russian Academy ciences. He devised for the Russian Navy a series of special -grade optical instruments, and published many scientific rs and textbooks, among which the most original are: *Approximative Calculations* (1906) and *On Differential ations of Mathematical Physics* (1912). He was also interested heoretical astronomy and translated into Russian Isaac ton's *Principia* with a valuable commentary, published by naval academy in 1916.

ROGH, SCHACK AUGUST STEENBERG (1874–), Danish iologist, was born at Grenaa and took his doctor's degree in by a thesis on the respiration of frogs. In 1916 he became essor of animal physiology at the University of Copenhagen. gh made important discoveries by his experiments in connec- with respiration, and in 1906 was awarded a prize by the na Academy of Science for the investigations which he ed out and described in a treatise, *Mechanism of Gas ange in Lungs*. In 1920 he was awarded the Nobel Prize for cine for his discovery of the capillary regulation of the con- nce of blood to the muscles. He afterwards continued his investigations of the capillaries and the blood, in which he discovered an element which influences the contraction of the capillaries. (*See* PHYSIOLOGY.)

Among his publications are: *The Respiratory Exchange in Animals and Man* (1916) and *The Anatomy and Physiology of Capillaries* (1922); and articles in *The Journal of Physiology*.

KROHG, CHRISTIAN (1852–1925), Norwegian painter and author, was born at Christiania (Oslo) Aug. 13 1852. After graduating in law, he went to Germany to study painting. During the following 30-odd years he lived alternately at Christiania and in Paris, until in 1909 he was appointed professor and director at the newly founded academy of painters and sculptors, Christiania. Krohg was the pioneer of the art of open-air painting in Norway which had its heyday in the first half of the 'eighties. He specialised in depicting the sea and the life of the pilots, which he rendered with a wonderful vigour and originality of incident and colouring. His deep interest in the social problems of his age is shown in his "Struggle for Existence" (1890) in the Oslo National Gallery. Krohg, besides being an excellent portrait painter, also possessed literary and journalistic talent. A selection of his literary works in four volumes appeared in 1920–1. He died on Oct. 16 1925.

KROPOTKIN, PETER ALEXEIVICH, PRINCE (1842–1921), Russian author (*see* 15.928), returned to Russia in June 1917, and died near Moscow, after a long illness, Feb. 8 1921.

KU KLUX KLAN (*see* 15.942).—On Thanksgiving night in 1915 William Joseph Simmons, preacher, travelling salesman and experienced promoter of fraternal orders, gathered some friends on Stone Mountain, near Atlanta, Ga., before a " fiery cross " and administered the oath of the " Invisible Empire, Knights of the Ku Klux Klan." A state charter gave corporate rights to his organisation. As Imperial Wizard, Simmons could hold office for life and have final authority unless opposed by two-thirds of the Imperial Kloncilium, council of supreme officers and delegates from other states.

Activities of Simmons.—Thus legally established, Simmons called upon the world to witness that his was a " high-class, mystic, social, patriotic, benevolent association " devoted to the sacred duty of protecting womanhood, to the idea of the " Fatherhood of God, Brotherhood of Man," to the principle of "white supremacy "—in short, to " real patriotism " and " pure Americanism." Simmons capitalised the mask of secrecy and roaming by night that had made so effective the old Klan. In the next four years, his order won some 5,000 adherents, mostly in the southern states. They displayed the patriotism of Klansmen on the " home front," against alien enemies, idlers, draft-dodgers, strikers in war industries and immoral women. Nevertheless, the tradition of the old Klan lost vitality. Simmons met financial difficulties. The order would have languished had not new impetus been given.

Growth of the Organisation.—On June 7 1920, Simmons contracted with E. Y. Clarke to increase the membership. As Imperial Kleagle, he was to receive $8 of the $10 admission fee, and $2 for every member added to a local Klan within six months after its organisation. He agreed to pay all expenses of the central office and $75 a week to Simmons. When Clarke's system was perfected, $4 of the original fee went to the local Kleagle, $1 to the King Kleagle or state sales-manager, $0.50 to the Grand Goblin, or head of the local Klan. The remaining $4.50 went to Atlanta. Other revenues accumulated from the sale of regalia by the subsidiary Gate City Manufacturing Company. When Congress made an investigation in Oct. 1921, it found that the Klan had funds enough to purchase an Imperial Palace and to take over control of Lanier University. The Invisible Empire then had a membership little short of 100,000. Expert salesmanship alone, however, did not account for the rapid growth of the Klan. It was not checked by the revelations before the Congressional Committee nor by the devastating attacks of such newspapers as *The New York World*. The control slipped from the grasp of Simmons and Clarke into the hands of Klansmen from the state of Texas and soon the order spread rapidly through the United States.

The Appeal of the Klan.—The appeal of the Klan came to a people suffering from the hysteria of the World War. Those who had enjoyed power in citizens' committees which forced the purchase of Liberty Bonds, intimidated German sympathisers and hounded slackers, saw in the Klan a continued outlet for their patriotism. Those who were outraged by immorality flaunted before inert police used the terror of the Klan to punish evildoers. Those chafed by the deliberation of the courtroom and convinced that the guilty too often slipped through some loophole in the law, found the Klan a direct way to prevent the miscarriage of justice. Whether authorised or not, many acts of violence were perpetrated in the name of the Invisible Empire. But far more numerous were those who cherished the racial and religious prejudices of their ancestors. Kleagles had no difficulty in selling membership in a crusade for Protestant Christianity and native Americanism. In the south, where the negro is a social problem, purity of womanhood and white supremacy are stressed in the creed of Klansmen. On the Pacific coast, Japanese compete with native farmers and labourers. There the cry is against aliens. In the eastern states the Klan is most suspicious of Jews and Catholics. To the Klansman, the Knights of Columbus are in conspiracy against the Constitution to prostrate the American people before the Pope.

From religious hatred the Klan in every section of the United States draws vitality. It has gained its greatest strength in the south and west, among descendants of the first white stock of America, those English and Scotch-Irish pioneers, strong Protestants, who laid the foundations of American society. A secret order offered to such persons escape from the dullness of frontier life into romance with weird ritual, exalted titles and closer friendships. It was the same impetus that during the middle of the 19th century spread "Know Nothing" (*q.v.*) lodges over the land. Jealousy and hatred of the Irish-Catholic newcomers swept them on into politics. For much the same reasons, descendants of the pioneers have joined the Ku Klux Klan and concentrated its power at the polls.

In Jan. 1926 it was impossible to say whether the Klan was still growing, or whether, like its predecessor, the Know Nothing movement, it would prove only another temporary though meteoric organisation.

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KUN, BELA (1886–), Hungarian politician, was born near Györ, of middle class Jewish parentage. He passed his youth unnoticed, and he eventually entered the University of Kolozsvár, where he graduated in jurisprudence. He intended to become a lawyer, but soon tired of the profession and took up journalism and politics. His upbringing and ideas naturally led him to sympathise with the "under-dog" and he early became an extremely active member of the Socialist party. But his work as a party organiser and agitator did not go beyond the limits of his province, and the same may be said about his influence and popularity. Having entangled himself in the question of the mismanagement of the funds of a workmen's co-operative society, he fell into disgrace and was obliged to withdraw temporarily from public life. He therefore went to Budapest and some time after succeeded in getting a minor post on the socialist daily paper, *Nepszava*.

Soon after the outbreak of the World War he was appointed lieutenant-commander of an ammunition supply column on the Galician front. Captured by the Russians early in the War, he was in Russia at the time of the revolution. He immediately ranged himself on the side of the Bolsheviks and became an apostle of their gospel among the Hungarian prisoners of war. After the Armistice, he planned to return to his country in order to help to win her to Bolshevism. He was already known to, and appreciated by, Lenin. He was therefore furnished with a false passport, and, disguising himself as a Red Cross doctor, succeeded in crossing the frontier together with some of his co
panions in captivity, all anxious to upset the present order.

Although Lenin did not fail to supply Kun with money to
him in his plans, more than money contributed to his succ
namely the critical condition of Hungary at that time: unacc
tomed to self-government, and flooded with crowds of ex-soldi
embittered at finding no employment or means of livelihood a
ready for the first opportunity to revolt. Kun's wild and re
lutionary gazette, *Vörös Ujsag* (*Red News*) which he began
publish soon after his return to Budapest, therefore found
merous readers amongst all those who, for one reason or anoth
disliked the Karolyi Government. Kun soon found himself
conflict with the police and on one occasion shortly before
advent to power was badly injured and imprisoned. He had
yet recovered and was still in gaol when the Karolyi Cabinet a
protest against the harsh conditions of the victorious pow
decided to hand over the government to the Bolsheviks, a
placed Kun at their head.

Kun's programme was to "arm at once, and forcibly trans
every industry and all landed property without conservation i
the hands of the proletariat." At first he collaborated with
Social democrats, but soon shouldered them aside, nationali
all banks, all concerns with over 20 employees, all landed pr
erty over 1,000 acres, every building other than workme
dwellings. All jewellery, all private property above the minim
(*e.g.*, two suits, 4 shirts, 2 pairs of boots and 4 socks) was seiz
servants abolished, bathrooms made public on Saturday nigh
priests, with the insane, criminals and shopkeepers employ
paid assistants were declared incapable of the active or pass
suffrage. International loans of over 10,000 kronen w
repudiated. All this entailed prodigious work and the creat
of a new bureaucracy which was most unpopular. Moreover,
reforms were unsuccessful; in practise the former owners
estates and factories remained on as their managers, the o
difference being that production deteriorated very rapidly a
the State had to pay the wages and make up the deficit. K
started to issue a new currency, which the peasants, alrea
disappointed that the large estates had not been parcelled o
and fearful that their turn would come to be nationalised, refus
to accept. They boycotted the towns; and as the blockade w
still on, the urban population starved, while prices soared.

Kun planned to convert the peasants to communism by fo
of arms; but meanwhile there were foreign campaigns to wa
After a first failure with the "soldiers councils" system, K
and Boehm organised a well-disciplined army, with which th
attacked and defeated the Czech troops occupying Slovak
Kun, who considered himself Lenin's advance guard in Cent
Europe, and held long daily conversations by wireless with
master, made tireless communist propaganda at home and
Vienna, and tried hard and not unsuccessfully to play off t
Allied great and lesser Powers against each other. When, ho
ever, the Entente stopped the Hungarian advance in Slovak
he could no longer appeal to nationalist feelings, and his po
tion became desperate. The peasants were discontented, t
counter-revolution was organising. Kun commenced a "R
terror" against his enemies in Hungary, and again attacked t
Rumanians, but they easily drove his forces back, and he fled
Vienna on Aug. 1. Here he was interned in the local luna
asylum, but after an attempt had been made to murder him
means of poisoned Easter eggs (which, being a Jew, he did n
eat), he was allowed to go to Russia.

Kun was a man of medium size, rather plump, On his sh
neck was a square, massive, bold head. He resembled a sm
shop-keeper rather than a tribune or revolutionary leader.
was, however, the only man amongst the Hungarian Bolshevi
who possessed at the same time an aptitude for ruling a count
and the exalted faith of an apostle. It was this idealism, his fi
belief in the truth of Bolshevism which gave him this superiorit
He was a cruel and violent man only when he thought it nec
sary for the triumph of his ideas. He was, however, impulsi
and incredibly naïve, with an extremely limited knowledge
men. (G. R*.; C. A. M.)

KUPKA, FRANTISEK (1871–), Czech painter, was born Dobruska in Bohemia. He studied at the Academy of Fine ts in Prague, at Vienna and in Paris, where he took up his rmanent residence. His inventive talent, strengthened by a se knowledge of contemporary society and coloured by his eptical outlook, was manifested notably in satirical drawings d caricatures which appeared in such Parisian papers as *corico*, *L'assiette au beurre* and *Le Canard Sauvage.* He be- me known principally through a series of drawings entitled L'Argent" and through his admirable illustrations to the ok *L'homme et la terre* by E. Reclus (1905). In 1908 Kupka ovided the illustrations for a bibliophile edition of *The Fates* C. M. R. Leconte de Lisle and three years later for the Lysis- ta of Aristophanes. He later began to experiment in new ections and looked for a new form of artistic expression. He came an adherent of the tendency known as "Orphism," and oduced large canvases in which the interest of the subject tter is subordinated to the rhythm of the colour scheme. His nical powers of observation, his bold imagery and philosophi- outlook make Kupka one of the most interesting and dis- guished artistic figures of his time.

KURDISTAN (*see* 15.949), is an expression applied to the ographical area stretching north and south from Mount arat down to the river Diyālā, and east and west from Persia the river Kara Su. It is now divided between Turkey, 'Iraq nder British mandate) and Persia, and has a Kurdish pop- tion of approximately 1,500,000 people.

Turkish Kurdistan consists of certain parts of the vilayets of rbekr, Bitlis, Hakkiari, Van, Erzerum and Adana, and is inhabited some of the oldest tribes like the Millis, Haiderans, Ravan- and the large group of tribes known under the generic appella- of Bohtan. 'Iraq comprises the core of Kurdistan proper: the es of the ancient kingdom of Shehrizor, such as Erbil, Kirkuk, aimaniya and the whole region of the two Zab rivers, as well as the ient and famous tribes like the Babans, the Hamavends, Jaffs the historic Bahdinan. Persian Kurdistan consists of the two *yats* (governments) of Luristan and Ardelan, and contains the khtiaris, the Lurs, the Kalhoris, the Ardelanis and their numerous -divisions. Between the lakes of Urmia and Van are scattered great tribes of Shikaks, Jallalis, the Hartoshis, the Mukris and ers. This division of the Kurdish race under three sovereignties kely to retard the growth of the Kurdish people into a homo- eous community, and may result in disastrous consequences for r future.

he Kurds before the War.—From an administrative point of w the Kurds of Persia since 1911 have undergone little change. Young Turk revolution 1908, however, gave new opportu- es to the masses of the Kurdish people. With the fall of dul Hamid were also suppressed the privileges of the so-called rdish Hamidiye Cavalry, which since 1890 had been a scourge scriminately for the peaceful Kurdish and Armenian peas- s. The suppression of the Hamidian régime brought forward e constructive and enlightened elements of the Kurdish ple, and several Kurdish deputies in the Turkish Chamber the Senate took up the cause of their nationality. Kurdish spapers and party clubs were established in Constantinople, hdād and Mōsul to cultivate a common language for the use ll Kurds. This nationalist movement was ably conducted by great Kurdish leaders, Sheikh 'Abdul Kader, a senator (hanged in Aug. 1925 by the Turks) and Baban Zadé Ismail Hakki.

Concurrently with this ensued war between the Young Turks and several Kurdish tribal chiefs. The former met strong opposition in 1909–12 in their attempt to repress those Kurdish chiefs who were favoured by the fallen Sultan. The Young Turks waged regular war against Ibrahim Pasha of the Millis, the Sheikh Barzani near Mōsul, the Hamavends and the tribes of Dersim. In spite of this warfare in particular areas, the tribes and the settled people greatly benefited by the general prosperity which resulted from greater liberty allowed under the Young Turk régime. As a result of the Turkish defeat in the Balkans, Sheikh Said 'Ali, of Khizan (southeast of Bitlis) rebelled in 1913. But he was soon captured and hanged.

The Kurds in the War.—None of the Kurdish tribes had any interest in the World War; yet from the beginning they were involved both on the Caucasian and the Mesopotamian fronts. Most of their manhood was killed in the War, and whole tribes suffered terrible losses owing to forced retreats and the consequent evils.

Kurdistan in the Peace Treaties.—At the Peace conference in Paris in 1919, Sherif Pasha, a Kurd, presented the claims of the Kurdish race demanding independence from Turkey. In the Treaty of Sèvres, Kurdistan was defined as a narrow strip of territory lying between the southern frontier of Armenia and northern 'Iraq. The Treaty of Lausanne did not mention Kurdistan. It left the delimitations of the northern boundary of 'Iraq to a friendly agreement between Great Britain and Turkey; failing this, the dispute was to be solved by the Council of the League of Nations (*see* MOSUL).

While the Council of the League was discussing this essentially Kurdish problem, a Kurdish rebellion broke out in Turkey in Feb. 1925, having Ginj and other middle Taurus heights as its centre. A Sheikh Said, followed by some well-known tribal chiefs, had some initial successes. The Turks collected regular troops, and after some short and decisive assaults broke the Kurdish rebellion and captured the Kurdish ringleaders. It was noted at the time that the powerful tribes of Bohtan, of Sasun and of Armenia in general did not rise in any way. A Turkish court-martial was set up at Diarbekr, which condemned to death Sheikh Said, Dr. Fuad, and 46 other Kurdish Nationalist leaders. They were all executed in Aug. 1925. The Kurdish leaders died with the independence of Kurdistan on their lips. The president of the Turkish court-martial stated later that the Kurdish rebellion had a purely nationalist motive.

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(A. SA.)

KUROKI, ITEI, COUNT (1844–1923), Japanese general (*see* 15.952), was put on the reserve list in 1909 and died in Tokyo Feb. 4 1923.

KUROPATKIN, ALEXEI NIKOLAIEVICH (1848–1921), Russian general (*see* 15.952), died at the village of Shemshurino in the Pskov district on or about Feb. 10 1921.

KUT, SIEGE OF: *see* MESOPOTAMIA, OPERATIONS IN.

LABOR, DEPARTMENT OF (*see* 16.25).—The U.S. Department of Labor is the outgrowth of an agitation that began shortly after the Civil War, when Federal recognition of interests and rights of the great group of wage-earners was first sought. This agitation resulted in the creation of a Bureau of Labor in the Department of the Interior in 1884. In 1888 this bureau was enlarged and made an independent establishment of the Government, with its head reporting directly to the President. In 1903, under the administration of President Roosevelt, the Department of Commerce and Labor was created, and the Bureau of Labor was transferred to this new department. Continued demand that the wage-earners be represented in the President's Cabinet led to the law of 1913 creating the present Department of Labor and transferring to it the Bureau of Labor (now the Bureau of Labor Statistics), the Children's Bureau and the Bureau of Immigration and Naturalisation. By the terms of this organic law, "The purpose of the Department of Labor shall be to promote, foster and develop the welfare of the wage-earners of the United States, to improve their working conditions and to advance their opportunities for profitable employment." The law also gave the Secretary of Labor authority to conciliate industrial disputes submitted to him for settlement, and this conciliation service has become one of the major functions of the department.

At the end of the World War the Women's Bureau and the U.S. Employment Service were taken over as normal and necessary adjuncts to the department, and built up from skeleton organisations left from work in the War. Of the strictly war services only the Bureau of Industrial Housing and Transportation remains, to dispose of the vast amount of property which it acquired for the convenience of workers and for the acceleration of production during the War. The Department of Labor as constituted in 1926, therefore, includes the bureaux of immigration, naturalisation, labour statistics, conciliation, women and children, whose titles sufficiently indicate their scope. (J. J. D.)

LABORI, FERNAND (1860–1917), French lawyer, was born at Reims April 18 1860. Educated at Reims and Paris, he spent several years in England and Germany. He was called to the bar in 1884, and rapidly made a reputation as a brilliant lawyer and advocate, being counsel for the defence in most of the important political trials of the day during a period of nearly 30 years. It was his conduct of the Dreyfus case, however, which placed him at the top of his profession and earned him his unique reputation. He fought with unremitting energy for his client during both the first and second revisions of the trial, in 1898 and 1899, a task attended with considerable danger, as political passions were so strongly excited at the time that Labori was shot at and wounded at Rennes on the eve of his cross-examination of the witnesses for the prosecution. Dreyfus was not finally declared innocent until 1906, and Labori never once relaxed his efforts on behalf of the unfortunate officer. Other notable trials in which he was concerned were the prosecution of Émil Zola for libel (1898) which arose out of the Dreyfus case; the Humbert affair (1902); and the trial of Madame Caillaux for the murder of M. Calmette, editor of *Le Figaro* (1914), when he secured her acquittal. He died in Paris March 14 1917.

LABOUCHÈRE, HENRY DU PRÉ (1831–1912), British politician, was born in London Nov. 9 1831. He was educated at Eton, and, after spending a short time at Trinity College, Cambridge, entered the diplomatic service in 1854, becoming in 1863 second secretary to the British embassy at Constantinople. In 1864 he abandoned diplomacy for politics, and in 1866 was elected Liberal member for Windsor, but was unseated on petition. In 1867 he won a by-election for Middlesex, but failed to be re-elected in 1868. In 1880 he again entered the House of Commons as Radical member for Northampton, and this seat he retained until his retirement in 1906. He began his journalistic career with *The Daily News*, of which he became part proprietor just before the Franco-German War. In 1874 he becam
associated with Edmund Yates on *The World* (*see* 28.908); bu
three years later he started *Truth* which had a remarkable recor
in the exposure of shams and organised impostures, especiall
frauds on the charitable. Labouchère was a strenuous advocat
of the abolition of the House of Lords (*see* 20.845, 846); at th
time of the Parnell Commission he had much to do with th
unmasking of Pigott; and he was a member of the inquiry int
the Jameson Raid, his hostility to Mr. Chamberlain being a
pronounced as against Lord Rosebery when the latter becam
leader of the Liberal party. After 1903 he lived mainly in Italy
at a villa near Florence, where he died Jan. 15 1912. See A. I
Thorold, *Life of Henry Labouchère* (1913).

LABOUR: *see* HOURS OF LABOUR; INTERNATIONAL LABOUR O
GANISATION; INDUSTRIAL RELATIONS; STRIKES; etc.

LABOUR, MINISTRY OF.—This department of the Britis
Govt. was set up in 1916 to deal with the increasing amount
administrative work caused by the extended activities of th
state. It took over certain duties from the Board of Trade an
also the administration of the national health insurance scheme
hitherto under the Treasury. The Ministry looks after mos
matters affecting the welfare of the wage-earners, includin
unemployment insurance, although the inspection of factorie
and workshops remains under the Home Office. It is also th
authority for dealing with industrial disputes. The Minister
Labour is the head of the department: his chief assistants a
the parliamentary secretary, like himself a politician, and th
permanent secretary, who is a civil servant. The head offices
the Ministry are at Montagu House, Whitehall, S.W.1. Some
the self-governing states of the British Empire have a publi
department charged with similar duties, and known as the Mi
istry of Labour.

LABOUR PARTY (*see* 16.28).—The year 1910 found the Labou
party in Great Britain marking time. In Parliament it w
hampered by the conflict between the two Houses; within i
self the Osborne decision (1908), that trade unions could n
legitimately subscribe money to political objects, had create
financial difficulties which had not been got over. In t
election of Jan. 1910 it ran 98 candidates, returned 40 and su
fered a net loss of five seats; in the Dec. election, of the sa
year, owing to financial stringency, it ran only 56 candidat
but returned 42. At the beginning of the year it polled a tot
of 505,690 votes; at the end 370,802. From 1911 till the ou
break of the World War in 1914 the parliamentary emba
rassments of the party continued. Pledged to Home Rule f
Ireland, the provisions of the Parliament Act compelled it
keep the Liberal Govt. in office. and deprived it of comple
freedom of action.

Industrially, the position was not good. The history of t
Labour movement is marked by decided swings backwards a
forwards, between a trust in industrial and in political actio
Between 1906 and 1910, the swing was towards politics; betwee
1911 and the outbreak of the World War it was towards indu
trial, or, as it is called, direct action. Trade union me
bership was on the increase; industry, especially railways a
coal-mining, was disturbed; the Osborne judgment drove acti
trade unionists on to the left as the political road seemed to
barred; trade-union action, as regards this Labour demand a
that, gave swift and decisive results that justified the impatie
mood of the time, whilst political action seemed to be impote
and slow.

Rise of the Syndicalists.—Moreover, in France and Americ
the new school of syndicalists had arisen. Its doctrines we
laid down in the former country by G. Sorel in his *Reflections s*
la Violence (1912), and elaborated in a series of books and pa
phlets written by members of the *Confédération Général d*
Travail; in the latter country De Leon, as a disciple of Ma
preached a similar doctrine, and the Industrial Workers of t

orld, a rival to the American Federation of Labor, was
unded to enforce it. The influence of these doctrines was felt
Great Britain. Several new socialist societies were started
om splits in the existing ones, like the Socialist party of Great
ritain and the Socialist Labour party, and though their
embership never reached more than 100 or 200, their virulent
d virile criticisms had some effect in spreading discontent
nongst sections of the Labour party. This was reflected in the
erature of the time, which consisted largely in defences of the
rliamentary position and of political as against direct action.
oking back upon those years, one really finds the beginnings
what later on has become known as Bolshevism. Upon this
ilosophy of the inevitable revolution the Russian Social
emocratic party split (1903) into the two schools which were
make history by the two revolutions of March and Nov. 1917.

Repeal of the Osborne Judgment.—At last, in 1913, the par-
mentary party succeeded in getting the Osborne judgment
pealed by the Trade Union Political Levy Act. To make
s possible the annual conference of 1911 had decided to
olish the pledge imposed upon all Labour members to act
ch the party and to be independent of other parties. This
litical success was an effective weapon against the syndicalists
d revolutionary trade unionists, and in the year preceding
e outbreak of war, the pendulum had begun to swing back
wards a belief in political action, and syndicalism had evidently
ne beyond its zenith. In addition to the Trade Union Act,
e party in Parliament had directed its attention (1911) to
ctoral reform, the women's suffrage agitation then being in
dence, a minimum wage, the feeding of necessitous school
ldren, and the government proposals for national health
urance. On the question of national insurance, the party
s much divided, and in the report which the parliamentary
mbers made to the annual conference the action of the recal-
rant minority was reported in terms of censure. In that
r (1911) payment of members was begun and a fund from
ich the party had made allowances to its members to meet
ne of their expenses was terminated. The year 1912 was one
ndustrial trouble and was marked by the passage of the Coal
nes (Minimum Wage) Act to end a coal strike—a historical
parture from which much in both government and trade
on policy dates.

The Party before the War.—The question of discipline within
party distracted its attention and reduced its efficiency, and
annual report for this year drew attention to the grave effect
t the action of certain members was having upon party
tunes. Nevertheless, by-elections showed a steady strength-
ng of the grip of the party in the country, the first approaches
a political understanding with the co-operators were made,
The Daily Citizen, the first Labour newspaper, appeared.
anwhile, the party had settled down to face seriously the
estion of organisation, and 1912 and 1913 show a great im-
vement in that respect. The first disappointment with
liamentary methods was still vocal, but was working itself
. The state of the country, owing to the Ulster agitation,
s overshadowing everything else. Civil war seemed to be
minent and preparations for it were being made. Obviously
eneral election had first of all to be held so as to get a vote
confidence for the Government's Home Rule policy. Over-
es were being made to ascertain how the party would stand
he conflict, and offers made to its leaders to join the Govern-
nt; but another cloud was hurrying up to blacken the whole
. The annual conference records are blank between Feb. 1914
Jan. 1916. The World War had come.

abour in the War.—The party hesitated. It had steadily
osed Sir Edward Grey's European policy, and it associated
lf at first with the neutrality committee. On Aug. 2 1914 it
olved to oppose Britain's entry into the War, but on Aug. 6,
a majority, it decided to make no statement when the first
credits were to be voted. Some of its leaders, including Mr.
nsay MacDonald, its chairman, resigned, and thenceforth
activities of the party were those of the nation. Through-
the War, however, it never ceased to discuss the best form of peace. It joined in an international conference of the socialist parties of the Allied countries in Feb. 1915, and issued a declaration of war aims; in May 1915 by a majority it joined the Coalition Govt.; in Jan. 1916 it was instructed by a special national conference to oppose conscription, and the Labour ministers resigned, but withdrew their resignation pending the annual conference which was about to meet. This condemned conscription, but refused by a narrow majority to ask for the repeal of the Act that had just been passed. The ministers remained. When in Dec. 1916 the new Coalition was formed, the party, by a majority, agreed to remain in it with added representation.

Meanwhile, the party was pursuing its discussion of peace terms, and in May 1917 decided to be represented at the abortive Stockholm Conference, to which delegates from the enemy states had been invited. This led to Mr. Henderson's severance from the Cabinet in August. The party was returning to its independence. At the annual conference held at Nottingham in Jan. 1918 a war-aims programme was agreed upon, in furtherance of a forward movement, and a new constitution making the enrolment of individual members possible was considered. Hitherto, the party had been a federation of socialist societies and trade unions; now, it proposed to form local labour parties in the constituencies, consisting of individual members as well as delegates from affiliated bodies. It also took a stand against Bolshevism and in favour of constitutional democracy. At a special national conference held in London in June, the declaration of the policy and principles of the party known as the new social order was launched, the truce had been broken in the Salford by-election won by Labour (Nov. 2 1917), and in Nov. 1918 the party withdrew its ministers from the Govt., and once more stood independent.

Labour in Office.—After the election that followed in Dec., the party strength was only 57, though its poll was increased to 2,244,945. A capital levy was advocated in 1920, and by 1922 the question of unemployment again came to the front. By-elections were encouraging and by the end of the Parliament the Labour party numbered 75 members. The election of Nov. 1922 brought up the number to 142 and Labour became the official opposition. Its vote in the country had increased to 4,236,733. In Dec. 1923 another election was held, and 191 Labour members were elected and the party vote increased to 4,348,379. The Govt., though in a minority, decided to meet Parliament. When it did so, in Jan. 1924, it was defeated by 328 votes to 256 and thereupon the first Labour Govt. in this country was formed with Mr. Ramsay MacDonald as Prime Minister. The Govt. could rely upon the support of less than one-third of the House of Commons and legislation was difficult. It directed its attention to unemployment, housing and to the preparation of national schemes for internal development. It had also to face a dangerous development in the Irish boundary problem and take legislative action to enable it to set up the Irish Boundary Commission.

Its foreign policy was devised to secure international co-operation and to pacify Europe, and it was successful in settling outstanding reparation difficulties at the London Conference (Aug. 1924) and was responsible for the protocol which was drafted at the Assembly of the League of Nations that year. It was also bent upon creating good diplomatic relations with Russia, for both economic and political reasons, and negotiated two treaties which were not ratified by its successor. The Govt. was defeated (Oct. 8) on its handling of a Communist prosecution, but really fell on its Russian policy. When the election came next month, the eleventh-hour publication of a letter, known as the Zinovieff letter, had considerable effect on the results, and, though the party vote increased to 5,551,549, its members fell to 151. The Govt. at once resigned and the party became the official Opposition. (J. R. M.)

LABRADOR (*see* 16.28).—By the end of 1925 considerable progress had been made by the agents of Canada and Newfoundland with the proposed case for submission to the Privy Council for its decision as to the boundary between the areas claimed by the two Dominions. Newfoundland claimed broadly, that her jurisdiction should embrace the whole watershed draining into the Atlantic, while Canada contended that a strip of seaboard a mile deep from high water is all Newfoundland should have. The territory in dispute contains the famous "Grand Falls" of Labrador, one of the greatest waterfalls in the world, besides several minor cascades capable of producing vast hydro-electric energy, while in the river valleys are large areas of forest growth capable of being converted into pulp and paper, so that the potential value of the region is very great. The population of Newfoundland Labrador at the census of 1921 was 3,774: this showed roughly a 10% decrease since 1911, mainly among the Esquimaux population in the Northern section, who were decimated by the epidemic of influenza in the winter of 1918–9. These natives do not exceed 1,000 in all, a decline of about one-half in some 35 years.

Lumbering, which in the period 1900–10 was undertaken in Hamilton Inlet, virtually ceased, largely because of difficulties arising out of the boundary dispute. The missionaries in the north, the Hudson Bay and Revillon Fur Companies further south and Newfoundland traders all over the region conduct its limited commerce. The Grenfell Mission pursues its humane activities among both transient fisherfolk and permanent settlers, and the Churches in Newfoundland, both Protestant and Catholic, maintain missionaries there in the summer, with one or two residing permanently. The hinterland is unpeopled save by some wandering tribes of Indians, who number only a few hundreds altogether, and are slowly dying out. Industrial conditions continue unchanged and the annual value of fish, furs and other articles exported from the coast to foreign markets averages about $500,000. Codfish to the value of about $1,000,000 a year is taken on the coast, brought to Newfoundland to be cured, and figures in the exports from that country.

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LACROSSE (*see* 16.54).—Lacrosse still has its stronghold in Canada, where it is looked upon as the national game. The number of amateur clubs to-day in the Dominion is approximately 1,465, as against 950 in pre-War days, but the professional game is practically dead, only three or four clubs having survived. Ontario is perhaps the chief centre, but Quebec, Manitoba, Saskatchewan, Alberta and British Columbia are all strong supporters. In the United States lacrosse is advancing more rapidly than in any other part of the world. The country has over one hundred teams, including many of the large universities and colleges, and the United States Military and Naval academies, whilst in California and elsewhere the game has taken a strong hold in the women's colleges. In Australia lacrosse is making headway, especially round Melbourne, Sydney and Perth.

The Game in England.—In England the game was increasing in popularity up to the outbreak of the World War, when all the clubs were depleted and disbanded. Players in the north of England, chiefly grouped round Manchester and Yorkshire, have always been far more numerous and generally more expert than in the south, where the game is centred round London and Bristol. It is also played at Oxford and Cambridge. In Ireland there has been no serious attempt to revive the game, which once had a good following round Belfast. In 1912 teams from Manchester and London played exhibition matches in Brussels and Ostend, and in 1913 similar teams visited Paris and Stockholm. Preliminary plans were on foot for a visit of a representative English team to tour Canada in 1914, but the World War put an end to the plan. Lacrosse, as played by ladies, has made great strides since the War, and ladies' clubs are numerous. It is largely played in girls' schools all over the country. The laws have been modified to suit the requirements of ladies, and inter-county and territorial matches are annual events. (C. O. L.)

LADD, GEORGE TRUMBULL (1842–1921), American philosopher (*see* 16.59), died at New Haven, Conn., Aug. 8 1921.

LAERMANS, EUGÈNE (1864–), Belgian painter, was born at Molenbeek St. Jean (Brabant) Oct. 22 1864. Deaf and dumb from birth, but gifted with a keen intelligence, he developed his talent in almost total isolation. He devoted himself t painting scenes of humble life, and might be considered a moder Pierre Brueghel the Elder. He has adopted, in place of the passive objectivity or dark humour of the old masters, a libera sympathy similar to that found in the works of Charles Degrou or Constantin Meunier, but which Laermans has interpreted in different manner, with feeling and power inspired by the injustice and inherent misery of an ill-organised social state Denied the usual channels of expression, he expresses, throug the medium of form and colour, his pessimistic view of life This pessimism is not only illustrated by his choice of subjec but also by the design and colour schemes which lend individuality to his work. Notwithstanding the rare harmonies of colou found in the work of M. Laermans which show him to be a master of technique as well as a painter, the artistic value woul appear subservient to its moral significance. This artist, alread deaf and dumb, was further unfortunate in the loss of his sight His works may be seen in the Luxembourg, Paris, and at Venice Brussels, Antwerp, Ghent, Liége and other places. (P. L.)

LA FOLLETTE, ROBERT MARION (1855–1925), America politician, was born on a farm in Primrose township, Dane co. Wis., June 14 1855. He graduated from the University of Wisconsin in 1879, studied law there for one term, and was admitte to the bar in 1880. He began immediately to practise in Madison and served as district attorney for Dane co. for two term (1880–4). From 1885 to 1891 he was a representative in Congress, and, as a member of the Ways and Means Committe helped to draft the McKinley Tariff bill. On being defeated fo Congress in 1891 he returned to practise in Madison. In 189 he was a delegate to the Republican National Convention. H was elected governor of Wisconsin in 1901 and was re-elected i 1903 and 1905. It was largely due to him that state laws wer passed for taxing railways according to valuation (1903), fo nominating all candidates for public office by direct vote of th people (1904) and for regulating the railways in the stat through a state commission (1905). He resigned the governorship in 1905 on being elected to the U. S. Senate, and wa reelected for three succeeding terms.

Mr. La Follette was an unsuccessful candidate for the presidential nomination at the Republican National Convention i 1908. In 1915 he was sponsor in the Senate for the Seamen' bill providing for better working conditions and increase of life saving equipment on board ship. He favoured, in 1916, a embargo on the shipment of arms from America, but supporte armed intervention in Mexico. After America's entrance int the World War he was a pronounced pacificist. The Republica National Convention held at Cleveland, O., in June 1924 rejected a platform presented on behalf of Senator La Follett by the Wisconsin delegation, and he received only 34 votes o being placed in nomination for President. Accordingly a Convention for Progressive Political Action was convened at Cleveland on July 4, at which, following a letter from La Follett denouncing both the Republican and Democratic parties, he was endorsed as a presidential candidate. He selected the nam "Progressive" for his party, and his platform included advocac of public ownership of water power and railways, strict publi control of all national resources, a recognition of agriculture a the basic industry of the country and abrogation of the powe of the Supreme Court to nullify legislation. During the electio campaign the American Federation of Labour agreed to suppor him. In the ensuing election he was beaten by both Republica and Democratic candidates, his electoral vote being 34, a against 382 for Coolidge and 136 for Davis, the popular vot being 4,686,681 for La Follette, 15,748,356 for Coolidge an 8,617,454, for Davis. His own state, Wisconsin, was the only one to give him a majority. He died at Washington, D.C. June 18 1925.

His son ROBERT M. LA FOLLETTE, who was born in Madison Wis., Feb. 6 1895, was elected by a large plurality Sept. 29 1925 to fill the unexpired term of his father's senatorship. He stood as a supporter of his father's platform of 1924.

AGERLÖF, SELMA (1858–), Swedish author, was born 20 1858 at Mårbacke in Vermland where she grew up in a vince rich in local tradition, and became a teacher in Landsa. In a literary competition in a weekly paper she won highest prize for some chapters of her first work *Gösta Bers Saga* (Eng. tr. 1898), which was published in two volumes in and attracted great attention. The book is a collection of ies of Vermland life in the year 1830, related with vivid imagi-on and lyric style. In 1894 she published *Osynliga Länkar* (In-ble Links) and from 1895 onwards was able to devote herself rely to writing. After visiting Italy for the purpose of ex-ling her studies, she published in 1897 *Antikrists Mirakler* g. tr. 1898) depicting life in Sicily. In 1899 appeared *Drott-ar i Kungahälla* (Eng. tr. 1917), historical legends, as well *En Herrgårdssägen* (Eng. tr., *The Legend of the Manor*, 1922). r a journey to Palestine and the East in 1900 she published *salem*, 2 vol. (1901–2, Eng. tr. 1903), describing a religious ement in the Swedish province of Dalarne, which led to an gration to Palestine. She also wrote *Kristuslegender* (1904); *Holgerssons underbara resa*, 2 vol. (1906–7, Eng. tr. 1908), ook for children; *Liljecronas Hern* (1911, Eng. tr. 1913); *karlen* (1912); *Dunungen* (1914), a dramatised novel; *Kej-n af Portugalien* (1914, Eng. tr. 1916); *Troll och Manniskor* *mons and Men*), 2 vol. (1915, 1921) and *Charlotte Löfvens-* (1925). In 1909 she won the Nobel Prize for literature, and 914 was elected the first woman member of the Swedish demy. Most of her books have been translated into English many other languages.

e J. Mortensen, *Literary Biography* (1908); André Bellesort, *uède* (1910); also works with title *Selma Lagerlöf* by O. I. Lever-1904); M. Jepson (1913); M. Kristensen (1917).

AGOS (*see* 16.74), the principal port and capital of the British ny and protectorate of Nigeria, West Africa. The popula-, including Iddo and Apapa, is 99,690 natives and about 1,000 es (1921). The town is built on an island in a large lagoon is reached from the Bight of Benin over a shifting sand bar. es protect the entrance to the harbour and vessels drawing . can enter it. Lagos is linked to Iddo Island, on which the inus of the railway to Kano is situated, by Carter bridge, Iddo in its turn is joined to the mainland by Denton bridge. customs wharf at Lagos is 1,183 ft. long and vessels of 22 ft. ght can lie alongside. At Iddo is a wharf 860 ft. long, draught eet. At Apapa, on the mainland, facing Lagos town, a wharf ft. long, under construction in 1924, was designed to take els drawing 26 ft., to which depth the bar was being dredged. re are several smaller wharfs and floating docks. By the drain-of swamps much has been done to improve sanitary condi-s. The town has fine public and commercial buildings and le water and electric light supplies. Some 25% of the inhab-ts are Christians and 53% Moslems. Lagos has been since the seat of an Anglican bishopric. In April 1925 the Prince Vales laid the foundation stone of the cathedral. The port s all the trade of Nigeria served by the railway to Kano r 700 m. long) and has a considerable canoe-borne trade the neighbouring regions. The former colony of Lagos is part of Nigeria. See *The Nigerian Handbook* (Lagos,).

AGUERRE, JEAN HENRI GEORGES (1858–1912), French er and politician (*see* 16.79), died June 17 1912.

AHORE, India (*see* 16.81), the capital of the Punjab, India, a centre for agricultural produce, is of little importance strially, except for the works of the North-Western Railway. population was 281,781 in 1921. The Dyal Singh College, enominational and affiliated to Calcutta University, was ded in 1910, and the Sanatan Dharma College in 1916. tern towers were added to the Cathedral Church of the rrection in 1913. An iron bridge over the Ravi was opened 915. In 1824 the old fort was taken over by the police, and a fort built by the military.

AIDONER, JOHAN (1884–), Estonian soldier, was born he Viljandi district. He completed his military studies e Vilna military school and the Nikolai military academy in St. Petersburg (Leningrad). On the outbreak of the World War, he was a staff officer on the Caucasian front, and in 1915 became divisional chief of the staff of the Russian Western Front. In 1917 he was promoted lieutenant-colonel in command of the Caucasian Grenadier Division and then chief of staff to the 62nd Division. On the formation of the Estonian National Army he was appointed to command the first Estonian Division. During the period of German occupation (1918) he negotiated with Soviet Russia concerning the prevention of the annexation of Estonia by Germany. He also organised from St. Petersburg the transport of the Estonian Army, via Archangel and Murmansk, to the Allied front. At the beginning of the Estonian War of Independence, (1918–9), Laidoner was appointed commander-in-chief of the Estonian Army; at the same time he became by arrangement leader of the Russian Northern Army until the latter reached Russian territory, when Yudenich took over the leadership. He conducted the operations with both military skill and political ability. On the conclusion of the War he left the army and entered politics, being elected representative of the Agrarian party in the first and second Riigikogu. He became president of the commission for foreign affairs and state defence of the Riigikogu, and Estonian delegate to the League of Nations. In 1925 he presided over the League of Nations Commission appointed to inquire into the Mosul frontier dispute between Great Britain and Turkey. (*See* ESTONIA.)

LAISANT, CHARLES ANNE (1841–1920), French politician (*see* 16.84), died at Asnières, near Paris, May 5 1920.

LAMMASCH, HEINRICH (1853–1920), Austrian jurist, was born at Seitenstetten, Lower Austria, May 21 1853. He was appointed professor at the University of Vienna in 1889, became eminent as a teacher of criminal and international law and his publications on these subjects deeply influenced their practice. Four times a member of the International Court of Arbitration at the Hague, being president three times, he helped to settle, among other cases, the dispute between Great Britain and America on the fishery rights off the North Coast of America in 1910. He was, perhaps, the most prominent Austrian pacifist during the World War and, as such, while incurring bitter hostility in the Austrian Herrenhaus, to which he had belonged since 1899, he inspired confidence elsewhere, and was chosen to preside over the final ministry which liquidated the central administration of the older Austria (Oct. 26–Nov. 13 1918). He published in 1919 *Der Völkerbund* and *Europas elfte Stunde*. Lammasch died at Salzburg Jan. 6 1920.

LAMONT, THOMAS WILLIAM (1870–), American banker, was born at Claverack, N.Y., Sept. 30 1870. He was educated at Phillips Academy, Exeter, N.H., and at Harvard where he graduated in 1892. He was for two years with the New York *Tribune*, and then for some time actively engaged in business. From 1903 to 1909 he was with the Bankers Trust Co. in New York, as secretary and treasurer and, after 1905, as vice-president. In 1909 he was elected vice-president of the First National Bank of New York City, serving for two years. On Jan. 1 1911 he entered the firm of J. P. Morgan and Co. He was active in raising additional endowment for the Harvard School of Business Administration. He took part in floating the British, French and Russian loans in America during the World War and from 1918–22 he was proprietor of the New York *Evening Post*. In 1919 he was financial and economic advisor of the American delegation to the Peace Conference in Paris. He was U.S. delegate on the international consortium for assisting Chinese industries and railways, and visited China as the representative of the American group. In 1921 he became chairman of the American committee for the China Famine Fund, and was chairman of the international committee of bankers which handled the question of the Mexican foreign debt.

LANCIANI, RODOLFO AMADEO (1846–), Italian archaeologist, was born in Rome Jan. 1 1846. He was educated in that city and in 1872 became secretary of the archaeological commission. In 1878 he was appointed director of excavations and professor of ancient topography in the University of Rome. Lanciani devoted his life to the study of the antiquities of ancient Rome, while by no means neglecting those of the Middle Ages; and in both fields he came to be recognised as a leading authority. He made important discoveries in the House of the Vestals, the Basilica Julia, the imperial palace on the Palatine, the baths of Caracalla, the temple of Jupiter Capitolinus, Ostia, Trajan's harbour at Porto and Hadrian's villa below Tivoli. He also worked with the minister, Guido Baccelli, to create the Passeggiata Archeologica, arranged the collections in the Antiquarium and organised the classical side of the Rome exhibition of 1911. In 1911 he was created a senator.

He wrote a great number of works on archaeological subjects in Italian and English of which the most important are: *Ancient Rome in the Light of Recent Discoveries* (1888); *Pagan and Christian Rome* (1892); *The Ruins and Excavations of Ancient Rome* (1897); *Destruction of Ancient Rome* (1899); *New Tales of Old Rome* (1901); *Storia degli Scavi e Musei di Roma* (1902); *Wanderings in the Campagna* (1909); *Ancient and Modern Rome* (1925).

LAND LAWS: *see* PROPERTY, LAW OF.

LAND TENURE (*see* 16.155).—There are in the course of recent history two outstanding and epoch-making events each of which was of great moment in bringing about far-reaching changes in existing conditions of rural tenure: the French and the Russian revolutions. The one has already receded into historic perspective, the second is an actual fact of to-day. The former broke up the feudal land system and did away with the obligations attaching to property in land, with the result that agricultural development became involved in a capitalist economy; the Russian revolution, while abolishing private property in land, swept away the capitalist agrarian conditions which had grown up during the 19th century. The land was nationalised, and the state gave the full use of the land to all who were prepared to cultivate it with their own labour.

Just as the ideas of the French revolution influenced the whole of European agrarian legislation, so the influence of the Russian revolution was felt throughout eastern Europe—that is, in the countries on the borders of Russia, all of which are agricultural countries in the fullest sense. Thus agrarian reform was undertaken by a whole series of states; and, speaking generally, the more closely the states followed the Russian agrarian revolution, the more radical were their reforms, both in principle and in practice. Estonia and Latvia came nearest in this respect, while the model was least closely followed by Finland, Austria and Germany. Between these two groups there lies a whole gamut of variously devised agrarian reforms. The objects of all reform schemes were: by means of a transformation of the existing conditions of land tenure to create a peasantry which is socially and economically sound; and to retain in the country the numbers of peasants who would otherwise emigrate, and thereby to identify them more and more closely with the homeland itself. In the realisation of these aims the War acted as an accelerating and releasing force.

I. THE JURIDICAL BASES OF LAND REFORMS

The juridical bases for the accomplishment of the agrarian reforms are to be found in the agrarian laws of different states.

If the land hunger of the population is to be satisfied—whether by the formation of new holdings, or by the apportionment of additional land to small peasant holdings already existing, or even by assignment of parcels of land to the land workers—a land fund of corresponding extent is obviously a first essential. This was usually achieved by devoting the state lands and the public land to the purpose, and, in varying degrees, by the expropriation of the large estates.

Russia.—A complete expropriation of rural land ownership in favour of the state, acting on behalf of the peasant, has been carried through only in Russia. The first so-called Land Decree of Nov. 8 1917 ordered the expropriation, without exception, of all the landed property of the large landowners, of all lands formerly the appanage of the Crown, and of monastic and Church lands. In the agrarian legislation of subsequent years this fundamental principle was retained (*see* RUSSIA). Some 40,000,000 desiatines in all (not including Siberia) were thus transferred from private large landowners to the peasantry as a whole. A similar solution by expropriation was originally enacted Estonia by the law of Oct. 10 1919. On May 15 1925, howev the Assembly amended this enactment by permitting 50 he tares of land to be restored in usufruct to the original owne In all an area of 2,147,100 desiatines—97% of the area held large estates—was expropriated in Estonia.

Latvia and Lithuania.—Partial expropriation was carried o in certain countries. In Latvia, by the law of Sept. 24 1920, t state land fund was formed of the state domains and forests, a to a limited extent by the expropriation of large estates. On average 50 hectares of land was restored to the original owne After the expropriation the total state property in land amount to 3,700,000 hectares. In Lithuania the law of Feb. 15 1922 e acted that state lands be appropriated, and that landed propert belonging to the former Russian Nobles' and Peasants' Agr cultural Banks, ecclesiastical lands and lands of private owne in excess of 80 hectares in any case, be expropriated. Owne of not more than 150 hectares farming their own lands we expropriated only after the division of the large estates.

Balkan Countries.—In Rumania the law of Dec. 14 1918, lat somewhat modified for the newly acquired territories, contem plated the entire expropriation of crown lands, the estates charitable societies, of absentees and foreigners and the esta lishment of a land fund of 2,000,000 hectares by partial expropriation of the private large landowners of over 100 hectare the size of the expropriation shares increasing as the areas to expropriated became larger.

In Bulgaria, according to the law of May 10 1921, the stat land fund is formed, *inter alia*, by expropriation of private e tates, leaving, however, 30 hectares to the owner when he work the land himself. In the case of non-cultivation by the owne four hectares only are restored to the owner, or 10 hectares f the whole family; under the extending law of July 21 1924 family with more than five members is allowed five hectare per member.

In Yugoslavia the decree of Feb. 25 1919 orders that the en tire landed property, including entails and estates with from 5 to 280 hectares of cultivable ground, be expropriated, providin about 1,100,000, hectares for distribution. In the autumn 1925 a new legislative project was laid before the Skupshtina which was intended finally to settle the question of the expropriation of the large estates. In Greece the agrarian laws 1920–2 provide for an expropriation of properties of over 10 hectares. According to a recommendation of the Ministry Agriculture dated Feb. 11 1925, land is to be restored, distric by district, to the extent of from 300 to 500 hectares. Cultivation is compulsory on pain of fresh liability to expropriation The process of obtaining land in Austria may be ranked as expropriation rather on formal grounds than in actual fact, sinc the expropriation does not press at all harshly and is not to an perceptible extent prejudicial to the tenure of large propert The object of the resettlement laws of 1919 and 1921 was th resumption of cultivation of farms which the large holders, mor particularly the owners of forest land, had devoted to purpose of sport or luxury. In such cases land which had been farme land at any period since 1870 may be expropriated on the deman of a qualified applicant.

Czechoslovakia.—The agrarian legislation of Czechoslovaki followed a middle course. In Czechoslovakia, by a law of Apr 16 1919, the State Land Office is empowered in the first instanc to impose certain restrictions on the property rights of larg land-owners; by the law of April 8 1920 the state must give a least six months' notice of expropriation to persons farming such land. Any area is regarded as a large estate on which there are more than 150 hectares of agricultural land, or which itself exceeds 250 hectares.

Poland.—In Poland, where the state merely regulates the conditions of tenure without forming a proper state land fund, the land reserve according to the Seim decree of July 10 1919, and the agrarian law of July 15 1920, is made up of the following categories of land: the state lands, the property of the former ruling dynasties, of the former Russian Peasants' Bank l of the former Prussian land settlement commission, mort- in lands, and also land acquired by forced sale of private prop- es which are more than 180 hectares in extent. In the indus- l and urban districts this limit may be reduced to 60 hectares, l in the west and east regions of Poland may be extended to hectares.

Jnder a law dated Dec. 28 1925 these limits may be ex- ded, by agreement between the Ministry of Agrarian Re- n and the Ministry of Agriculture, in the cases of large farms ich have a special importance in the economy of the country, h as farms with sugar factories, distilleries, etc., or farms ing employment to many workers, on condition, however, t the aggregate area in the whole country of the farms to ch this provision is applied shall not exceed 500,000 hectares. any case, before a forced sale the owner is given 30 days in ch to effect a voluntary sale of his parcel to the state. The a proposed for the land reserve is estimated at about 5,000,- to 6,000,000 hectares.

Iungary.—In Hungary the state has recourse to expropria- only when the required parcels of land are not to be ob- ned either by purchase in the open market or on the basis of gal right of pre-emption by the state, at the time of the aliena- of parcels. However, there may be expropriated, *inter alia*, perty to the extent of 100 cadastral *joch* (1 *joch*=0·575 hec-), which was bought during the War; such large estates as e changed hands in the way of sale since July 28 1864 and articular so much of each estate as still to allow the remaining tion to be brought under systematic cultivation. The area ing under the reform schemes is estimated at over 7,000,000 tares. For home colonisation in Finland there are available he first place, under the law of Nov. 25 1922 (Lex Kallio), state lands and the lands of public bodies, communities, rches, share companies, etc.; after these the property of rate owners is purchased in the open market, and only when t does not suffice, is the expropriation of estates of over 200 tares (in the north of over 400 hectares) carried out.

enerally speaking the percentage taken of the large property esponds to the number of complete hundreds of hectares uded in it; thus in the case of 200 hectares at least 2% is ropriated, and as a maximum 50% in the case of 5,000 hec- s and over. The lands illegally acquired by the timber com- ies were expropriated before any other lands.

ermany.—Finally, in Germany, under the National Settle- nt Law of Aug. 11 1919, state lands, heath and waste land already set aside for the provision of land for settlement in addition land acquired by the state right of pre-emption the occasion of large sales of private parcels of land. Only r this is recourse had to the expropriation of a part of the e estates. The Land Supply Unions (*Landlieferungsver- de*), the members of which are large landowners possessing r 100 hectares, are obliged to assign for settlement purposes east one-third of the total area of the large estates in the dis- t, or to reduce the cultivable area of the large estates to 10% he total agricultural area in the district. In this way over o,000 hectares of large landed property are to be expro- ted in Prussia in the coming years.

he methods of acquiring land are thus very various—com- e or partial expropriation with notice in advance, pre-emp- by the state on the occasion of alienation of property, pur- se in the open market—and each method is in its turn signifi- t of the spirit in which the land reforms were undertaken.

ompensation for Expropriation.—Very striking differences also found in assessing compensation for the expropriated tes, varying from the expropriation without compensation ussia to the payment of the full value of the land which ob- s in Germany. Latvia, following the precedent of Russia, ded not to give any compensation to the expropriated owners arge estates. In Estonia the question was still under discus- in 1926. In Lithuania compensation is reckoned on the is of the average prices of the years 1910–4. Owners who sess not more than 200 hectares receive the average market es at the time of the surrender of the land for areas under 150 hectares. Pre-War prices are also paid in Czechoslovakia with a corresponding reduction of the price in the case of estates of more than 1,000 hectares. In Rumania 40 years' rental is given for arable land and 20 years' rental for meadow land on expropriation; in no case, however, may the sum paid in compensation exceed the selling price of the year 1913. Compensation in Greece amounts to nearly 1·3 times the selling price. In Poland, as also in Bulgaria according to the law of 1924, half of the average local market price is fixed as the estimate of the compensation. In Yugoslavia, pending the final settlement of the question of compensation, a rent is paid to the expropriated owners up to the amount of the former net return. Payment of the average market price for the expropriated parcels has been established in Hungary, Finland and Austria, as in Germany.

Division of the Land Fund Among the Applicants.—In the distribution of the expropriated lands the principle of priority for ex-service men and their families runs through the whole agrarian legislation of the post-War period. In the states of western Europe measures were also taken for encouraging the settlement of ex-soldiers on the land, and legislation was passed with this object. In particular in England, according to a report of the Ministry of Agriculture ("Land Settlement in England and Wales, 1919 to 1924," London, 1925, p. 139) 16,461 ex-service men were, up to Dec. 31 1924, settled permanently, of whom 14,061 occupied 213,343 ac. of land. Much has been accomplished in this direction in France, Italy, Belgium and other countries.

The size of the peasant holdings newly brought into being is either determined according to an economic principle, or is fixed numerically. The former is the case in Russia, where the measure for land division is applied, sometimes in accordance with the farming system predominant in the different districts, sometimes according to the "work norm," *i.e.*, according to the sum of the work capacity of the family, or according to the "requirement norm," *i.e.*, according to the number of persons in the family. In Estonia, Bulgaria, Yugoslavia and in Finland, the size of the peasant holding is usually determined according to the "work norm," though sometimes also reaching the maximum numerical limit. In Germany the holdings must, according to the law, be of sufficient size to maintain a family. In the other states the average size of the holding is numerically fixed; thus in Latvia it is 22 hectares, in Lithuania from 8 to 20 hectares, in Poland not more than 15 hectares, in Czechoslovakia 6 to 10 or 15 hectares, in Rumania not more than 7 *joch*, in Hungary, 15 cadastral *joch*, and in Greece an average of 10 hectares.

Form of Management of the Farm Undertakings.—The most prevalent form of management of the new type of holdings in all the states is individual. In Russia 3% of the total area of the expropriated land was reserved for collectivist enterprises, 11% for the Soviet estates and 86% for individual holdings. The collectivist holdings have scarcely been able to maintain themselves, and since 1921 their number has fallen off. This seems the more remarkable, as a similar form of ownership was earlier familiar to the Russian peasant in the institution of the *mir*, although this juridical form was imposed on the peasants at the time of the freeing of the peasants in 1861 not on theoretical or socialistic grounds but rather for technical and fiscal reasons. Peasant enterprises managed co-operatively in very various forms are instituted under the agrarian reforms in Estonia, Latvia, in Czechoslovakia, Rumania, Hungary, Bulgaria and Greece. In the latter states the parcels expropriated by the Government are handed over to co-operative societies, which in their turn undertake the distribution of land to their members.

Legal Protection of New Peasant Holdings.—With a view to preventing any reversion, as the result of alienation, division, etc., to the former conditions of the apportionment of agricultural land, special measures have been included in the agrarian legislation of all countries, limiting the liberty of the peasants to dispose of the new holdings. In Russia, for instance, the land can be neither sold nor mortgaged nor given in free gift. It may not even be divided among the members of a family, unless the division leaves economic units of production. In Latvia a minimum limit of 10 hectares, and in Lithuania of 8 hectares, is fixed for the land parcels to be divided in the future. In Poland no parcelling of the newly formed holdings may take place, so long as they are burdened with a mortgage in respect of the unpaid balance of the purchase price, and in no case before the lapse of 25 years from their formation. Peasant holdings in Rumania may only be sold, divided, etc., after the lapse of 5 years from the definite conveyance of ownership. According to the extending law of March 1925, the state has the right of pre-emption in the case of alienation of peasant holdings, etc.

In retrospect it may be stated that in all the land reforms undertaken the endeavour is to modify the conditions of rural tenure within the limits of the existing land property rights. The principle of private property in the land as such is, as perhaps is clear from the expropriation legislation, not merely protected, but even placed upon a much wider basis and riveted more firmly into the general consciousness. In Russia alone not only are the conditions of land tenure reformed, but land tenure itself is subjected to a reform in the socialistic sense by a breaking down of the existing land rights. In the agrarian legislation of Estonia and Latvia some echoes of the theories of Henry George may be noted, and the land reforms in Finland, Austria and Germany rather bear the character of home colonisation.

II. THE RESULTS OF LAND REFORM

If the War, as has been said, acted as an accelerating force in the initiation of agrarian reforms, the period of their execution was very unfavourable from the economic standpoint. In the confusion prevailing in the whole after-War economy, the absence of capital and the depreciation of the currencies, and in view of the special interstate trade relations of the Central European countries, which tend towards an extreme protectionist policy and prevent any speedy re-establishment of the national economic policy in each case, the progress of the land reforms has been beset with difficulties. The distance in time from the introduction of the reforms is still too small to make it possible to pass a final judgment on the economic results of these important changes in land tenure. The results achieved cannot of course be looked upon exclusively as the consequence of the land reforms—*post hoc, ergo propter hoc*—but rather are regarded as the outcome of the whole development of agriculture in the separate countries. But the parallelism in the course of the two phenomena may be noted—the transformation of the conditions of tenure of agricultural land and the simultaneous increase in agricultural production.

Russia.—Virtually the whole of the large landed property was divided into nearly 20,000,000 peasant holdings. The first years of the revolution, during the period of militant communism, witnessed the gradual shrinkage of the area in cereal cultivation. Since the introduction of the new economic policy in 1921, and the publication of the Agrarian Code in 1922, cereal production has steadily increased, and, according to the data published by the International Institute of Agriculture at Rome in Dec. 1925, reached in 1925 the total of 180,000,000 quintals, as compared with an average of 205,000,000 quintals for the years 1909–13. The cereal export has also increased since 1922, and according to the original estimates of the Russian Central Statistical Office, in the commercial season 1925–6 to nearly 600,000,000 *poods, i.e.*, the equivalent of the pre-War annual grain export. In reality, the exports have been considerably lower than was anticipated, owing, amongst other reasons, to the deficiency in the country of industrial products serving either for the farms or for the household consumption of the peasants. The result of this deficiency is that the peasant withholds his grain from the market, and it cannot, therefore, be exported. However, as was remarked in the issue of Jan. 1926 of the *Bulletin de renseignement de l'Office commercial pour la Russie et les pays limitrophes*, published by the French Ministry of Commerce and Industry, "all the evidence confirms that the peasants had their barns well filled."

Baltic States

Estonia.—In Estonia the process of land reform is nearly accomplished. Of the 1,060,400 desiatines of land under cultivation belonging to the large landowners, 431,900 desiatines were already previously rented to small holders. The agricultural land thus available for the purpose of the land reform was 628,500 desiatines. According to official data 30,766 new farms have been established in the years 1919–24, and cover a total extent of 598,837 desiatines.[1] The number of families who have profited by the land reform is course, higher than the number of newly established farms, as larger parcel of land was often assigned to two or more famili Under the new conditions of the distribution of land the producti of flax for seed rose from 78,971 quintals in 1921 to 131,700 quint in 1925 (as compared with 164,126 in 1909–13), and the producti of flax as fibre from 67,202 to 148,100 (as compared with 169,171 1909–13). The export of linseed was 12,768 quintals in 1921 a 28,240 in 1924, and of flax fibre 52,280 and 104,328 quintals in t corresponding years. In both cases in the course of three years the is thus a 100 % rise. The export of butter has also advanced, amour ing to a value of about 2,000,000 marks in 1925 (or over 20 of the total exports), as compared with 1,000,000 marks in the pr vious year.[2]

Latvia.—In Latvia before the land reforms the estates of t nobles in Livonia embraced 463,449 hectares (32·3 % of private owned rural land), and in Courland, 533,689 hectares (30 %). 1924 more than half, viz., 61 % of the agricultural and forest land, h passed under state control, and approximately 50,000 new holdin had been established on such land.[3] The area cultivated in flax Latvia showed an even more rapid increase than in Estonia: fro 30,499 hectares in 1921 it rose to nearly 78,100 hectares in 1925, compared with an average of 69,619 hectares in the years 1909– In absolute figures, the export of flax, as seed, rose from 48,5 quintals in 1921 to 176,122 quintals in 1924, and the export of fl as fibre rose in the same period from 62,758 quintals to 204,4 quintals. In both cases accordingly the export has more tha trebled.

Lithuania.—In Lithuania 36 % of the agricultural area belong before the War to the large landowners, almost all of whom possess more than 2,000 hectares. There were 110,000 small holdings, b longing to 28 % of the agricultural population, which contained an average less than three hectares. Half a million persons, or fro 15 to 20 % of the agricultural population, were landless.[4] In th course of the land reform about 1,360,000 hectares, includin 400,000 hectares of agricultural land and 960,000 hectares of fores passed into the land reserve for the formation of small holdings. this connection also a rapid increase in the production per area is be noted. The flax growing area increased from 51,200 hectares 1922 to about 81,000 hectares in 1925, as compared with the avera area under cultivation of 55,167 hectares in the years 1909 to 191 and the production rose in the same period from 281,500 quintals linseed to nearly 486,600 quintals and from 205,000 to 421,5 quintals of fibre. A fair export trade is developing and amounts nearly half the total production in flax.

Finland.—In Finland, where in 1910 out of the total area 32,997,217 hectares not less than 91·4 % was forest, moorland, etc while the cultivated land only accounted for 5·7 %, and the meado land for only 2·9 %, the forest wealth is naturally the determinin element for the national economy. Of the total rural population 2,820,000 persons (84·2 % of the whole population of Finland), on 40·6 % are owners or tenant farmers and 59·4 % are agricultur workers of different kinds, who draw no assured subsistence from th land.[5] A systematic scheme of land settlement has been in progre since the beginning of the century. Up to Sept. 30 1925, by means grants from the land colonisation fund, 437,319 hectares were settle 11,845 new farms established, 4,078 small holdings enlarged an 6,000 sites for farm workers' dwellings granted.[6] The object post-War legislation has been to facilitate the transition of the tena cies into free ownership, as also the wider employment of land f settlement purposes; 43,343 small holdings were established betwee Oct. 25 1918, and March 1 1925. The wheat production of Finla has risen from 157,538 quintals in 1921 to 202,900 quintals in 192 and the export of butter from 64,652 quintals in 1921 to 131,910 1925; in 1913, 126,400.

Central European States

Poland.—Out of 1,000,400 peasant families in Galicia there we 813,000 who did not make an adequate living out of the land, whi 1,220,000 peasant inhabitants of Russian Poland owned no land all. Up to Jan. 1 1923, 271,197 hectares of land were available f land reform purposes, and 18,018 new farms were establishe 27,256 were enlarged, 3,199 workers' homesteads were erected an 360 special farms instituted.[7] An Agrarian Reform bill was pass in Dec. 1925, which provided for the distribution of 20,0 hectares a year among peasant farmers over a period of ten year the maximum areas tenable being 60 hectares in industrial areas, 3 acres in the border provinces, and 175 in other areas. Compensati to the owners was at the present value, from 25 to 50 per cent bei paid in cash, and the remainder in bonds.

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[1] Estonie Rigi statistika Reskburo: *Asumaa Majapidamised Eestis 1919–24* (Tallinn, 1924).

[2] *Revaler Bote*, No. 290, Dec. 19 1925.

[3] Bokalders, in *Neue Freie Presse* (Vienna, Jan. 31 1925).

[4] *Board of Trade Jour.*, No. 1211 (London, Feb. 12 1920).

[5] Dr. Oesten Elfving, "Die Bodenfrage in Finnland," *Archi für innere Kolonisation*, Parts 9–11 (Berlin, June–Aug. 1921).

[6] *Revue Sociale*, published by the Ministry of Social Affairs o Finland, No. 12, p. 889 (Helsingfors, 1925).

[7] Ludkiewicz Zdzislav, "La question agraire en Pologne," *Rev d'Économie Politique* (Paris, Dec. 1923).

Czechoslovakia.—In Czechoslovakia the land reform was practially complete in 1926. Before the War the great estates of over 500 ectares in extent absorbed altogether one-third of the total agriultural land. The land available for agrarian reform has been 229,688 hectares of arable and meadow land. Of this one-third emains in the hands of the large landowners, 80,000 hectares is left ith the former tenants under the form of tenancy, and 820,000 ectares are being apportioned into small and very small holdings. he number of farms of 2·5 hectares in extent has doubled, and that f farms of from 5 to 10 hectares has quadrupled, and the number f peasant farms of over 10 hectares has increased to a remarkable xtent.[1] The production of sugar-beet advanced from 40,716,551 uintals in 1921 to 84,083,300 quintals in 1925. The export of sugar eturned in 1921 as 376,328 metric tons, amounted in 1924 to 1,015,55 tons. The republic holds the first place among European sugarxporting countries and the third on the international sugar market.[2]

Hungary.—In Hungary before the land reform large estates of ver 1,000 *joch* amounted to 35·88 % of the agricultural area, the edium-sized estates of 100–1,000 *joch* to 16·62 %, and the small oldings under 100 *joch* to 47·5 %.[3] The very small holdings up to hectares formed 53·6 % of the total number of holdings and only ·8 % of the agricultural area; holdings larger than 575 hectares ormed 0·2 % of the total number of holdings, but nearly one-third f the entire agricultural area. Before Jan. 1925, 597,094 *joch* ad been assigned to the peasants, and 127,471 sites allotted for ouses. The production of wheat has risen from 8,052,950 quintals 1921 to 18,385,000 quintals in 1925. The wheat exports have also creased very considerably, having in fact advanced from 176,949 uintals in 1921 to 1,803,918 quintals in 1924. A great impetus has een given to the cultivation of vines, but owing to tariff difficulties e export of wine is at present very much reduced.

Austria.—In Austria only 156 peasant holdings, covering 2,824 ectares, had been settled up to June 30 1924, in accordance with the esettlement law.[4]

Germany.—In Germany 1,468,915 hectares of large landed proprty in Prussia ought, according to the Land Settlement law, to have een made available for home colonisation in the years 1919–22, hereas the area actually so available was only 95,576 hectares. hat form will be taken, under stable economic conditions, by this ome colonisation, as it was envisaged by the originator of the scheme, rof. Max Sering, and how far the cry of the land-hungry population really stilled,[5] only the future can determine.

BALKAN STATES

Rumania.—In Rumania nearly half of the total agricultural ea belonged before the War to the large landowners, though eir number was scarcely more than ½% of the total numer of all the agriculturists. At the beginning of 1925, 5,713,598 ectares of land, or 30 % of the whole agricultural area, were exproiated under the land reform and assigned to the applicants for nd. In consequence of this the small holdings now amount in Old umania to 80·94 % of the cultivable area and in Transylvania to 9·34 %.[6] The production of wheat had fallen off in Rumania, s compared with the pre-War production, but it again shows a very arked upward tendency. The area under wheat increased from 488,335 hectares in 1921 to 3,300,900 hectares in 1925, and the roduction from 21,381,484 quintals to 28,946,700 in the correspondg years. The wheat export has also recovered to some extent: it ose from 756,903 quintals in 1921 to 1,216,150 in 1924, and the heat flour export from 194,223 to 1,165,270 quintals. Expansion the cereals export was, however, made impossible on account of the creased duty, partly imposed on political and financial grounds, artly with a view to ensuring low prices for bread in Rumania, but is duty was eventually reduced. Quite apart from this, it has been ecessary to import a considerable volume of cereals into Transylania from the parts of Rumania where the supply was abundant.

Yugoslavia.—In Yugoslavia the conditions of rural land tenure aried very much according to the provinces. Generally speaking, very peasant in Old Serbia had his piece of land, and there was little cope for land reform. In those provinces, however, which were reviously under Turkish rule, mediaeval feudal conditions still preailed in the country districts: in Bosnia and Hercegovina, the *met* régime, in Macedonia and a part of Montenegro the *Tchiftchius* ystem. The agrarian reform completely did away with this régime, nd the former *Kmets* became small proprietors. In the former ustrian provinces such as Croatia, Slavonia, etc., more than half the agricultural land was in the hands of the large landowners, p to the end of 1923 in the whole of Yugoslavia 501,966 *joch* of ltivable land were divided among 185,905 families.[7] Wheat growing has made satisfactory progress, the yield rising from 14,100,300 quintals in 1921 to 22,403,100 in 1925, while the wheat export advanced from 470,729 quintals in 1921 to 1,772,764 in 1924.

Bulgaria.—In Bulgaria it is hardly possible to speak of a predominance of large ownership. The principal object of the land reform was to secure a better distribution of land between the medium sized and small farms, and up to the end of 1923, 1,885 hectares of land had been assigned to 780 persons. The cultivation of tobacco, which takes an important place in the agriculture of Bulgaria, has shown remarkable progress. In 1924 the production amounted to 436,975 quintals as compared with 129,848 quintals in 1914. In 1924 there was an export of 31,735,000 kg. of tobacco of the value of 1,828,109,000 leva.[8] In 1925 for various reasons the production of tobacco fell off to a perceptible extent.

Greece.—In Greece 832 large estates were expropriated up to 1923, and 7,500 small farmers were presented on an average with 13·5 hectares each. The peasants grow for the most part commercial crops, such as currants and wine-grapes, the export of which has noticeably increased.

WESTERN EUROPEAN COUNTRIES

In western Europe even less than in Germany or Austria is it possible to speak of agrarian reform in the sense in which it has occurred in the countries of eastern Europe. The conditions of tenure of agricultural land have undergone slow though continuous modification without any remarkable alteration having come about in the traditional agrarian system of the separate countries. In England, the classic instance of a country of large estates and large and medium sized tenancies, the number of occupying owners has almost doubled. In 1910 there were 55,433 such owners, holding 3,329,015 ac., while the total number had in 1924 become 94,236 holding 6,574,074 ac., or nearly one-quarter of the total area of England and Wales, 29,739,000 acres.[9] Thus there has come about in this country what the Hon. Edward Wood (Lord Irwin) called (Dec. 9 1924) "a silent revolution." Indeed, in view of the fact that the rôle of the large landowner as the provider of credit for agriculture is disappearing, while at the same time this function devolves more and more upon the state, he added ". . . and so you may well find yourselves in the course of the next 30 or 40 years within measurable distance of something like nationalisation by a side wind." This would imply the virtual realisation of the land reform programme as proposed by Lloyd George—the taking over of the land by the state, which then assigns it to tenants in hereditary usufruct.

Italy.—In Italy there were in 1912 4,931,000 agricultural holdings, including 3,275,000 of less than one hectare each, 614,000 of from one to two hectares, and 450,000 of two to four hectares. At the same time in some provinces the extent of the latifundia was very considerable for example, in Caltanisetta, out of the whole area of 322,865 hectares, 134,807 were latifundia, or 41·7 %; in the province of Palermo the percentage was 35·0, and in the provinces of Sicily taken as a whole nearly one-third.[10] A bill of the transformation of the latifundia for purposes of home colonisation was passed by the Chamber of Deputies on Aug. 19 1922, but was thrown out by the Senate at the end of the same year.

Denmark.—The agrarian policy is directed increasingly towards the promotion of rural small ownership. The object of the so-called old Small Holdings Act of 1899 was mainly the settlement of land workers. The land was procured for this purpose on the open market with the help of state loans. From 1900 to 1924, 11,451 small holdings were formed in this way, the state assistance amounting to about 100,000,000 crowns.[11] (*See* DENMARK: AGRICULTURE).

The intention of the framers of the new Small Holdings Act of Oct. 1919 was to establish peasant holdings as economically independent units, the Govt. supplying land on favourable terms to applicants by purchase of church lands, of entailed lands, etc. The average size of the holdings is now fixed at 7½ hectares, as compared with 3½ before the War. In accordance with this law in the years 1920–24, 2,251 new holdings were formed covering 15,874 hectares, and 3,040 hectares were allotted for 1,258 very small holdings. In all 14,960 peasant holdings have been formed since 1900. At the present time the question is being asked whether the obtaining of land for small holdings would not be greatly facilitated by expropriation of land in the case of property which exceeds a given extent.

III. CONCLUSION

The changed conditions of tenure of agricultural land are to be traced back almost entirely to social causes, and land reform is thus rather a problem of the more equal division of property than one of increase of production from landed property. None the less the land reforms are already of proved economic value, although the peasant holdings that are their outcome are still in the first stage of adaptation to the new conditions. The advance of agricultural production is determined, not merely by the greater or less area of the peasant farms, but in a marked degree also by the psychological attitude of the peasant to his land, his joy in production and will to work. It is this imponderable factor, defying measurement, but, when multiplied a million fold, yielding in due time great results, that is the true achievement of the agrarian reforms. The lessons of the War come to this, that a sound distribution of ownership, together with a large peasant class, tends to conditions of agricultural progress and forms the essential presupposition of social peace. (*See* also FARM ORGANISATION.)

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[1] Venkop, No. 214 (Prague, dept. 13, 1925).

[2] *Gazette de Prague*, No. 86 (Oct. 28 1925).

[3] Gustave Gratz, *La situation économique de la Hongrie*, p. 9 Budapest, 1925).

[4] *Der Oesterreichische Volkswirt* (Vienna, April 4 1925).

[5] *Deutsche Landwirtschaftliche Presse*, No. 15 (Berlin, April 11 925).

[6] Constantinescu Mititu, *L'évolution de la propriété rurale et la forme agraire en Roumanie* (Bucharest, 1925).

[7] *Revue économique et financière de Belgrade* (Dec. 1923).

[8] *La Bulgarie*, No. 718 (Sofia, Nov. 25 1925).

[9] Orwin and Peel, *The Tenure of Agricultural Land*, pp. 20–22 (Cambridge, 1925).

[10] G. Lorenzoni, "Latifundia in Sicily and their possible Transformation," *International Review of Agricultural Economics*, No. 3 (1923).

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LANE, FRANKLIN KNIGHT (1864–1921), American public official, was born near Charlottetown, P.E.I., Canada, July 15 1864. He graduated from the University of California in 1886. He began his career as a newspaper reporter, studied law and was admitted to the bar in 1889. He practised in San Francisco, drafted a charter for that city and soon afterwards, in 1897, was elected city attorney, to which office he was twice re-elected. In 1902 he was the unsuccessful Democratic candidate for governor of California, and the following year failed in his election for the U.S. Senate. In 1905 he was appointed by President Roosevelt a member of the Interstate Commerce Commission and was retained by President Taft, serving for eight years, part of the time as chairman. In 1913 he entered the Cabinet of President Wilson as Secretary of the Interior. During his term of office the wealth of Alaska was made more accessible by the construction of a Government railway. Dams were built in several western states for conserving the water supply in dry regions. To the Indians he gave special attention, maintaining that perpetual tutelage was wrong. He advocated development of national resources without waste as being reasonable conservation. He was an earnest advocate of reclamation of lan In 1916 he was a member of the American-Mexican Joint Hig Commission, and the following year became a member of th Council of National Defense. In 1920 he resigned his post a Secretary of the Interior. He was treasurer of the Europea Relief Council. He died at Rochester, Minn., May 18 1921. H was the author of *The American Spirit* addresses delivered i War time (1918). See also A. W. Lane and L. H. Wall, *Th Letters of Franklin K. Lane, Personal and Political* (1923).

LANE, SIR HUGH PERCY (1875–1915), Irish art collecto was born in Co. Cork Nov. 9 1875, the son of the Rev. J. W Lane. He entered the firm of Colnaghi & Co. in 1893 and rapidl made a name as a connoisseur of extraordinary perception. I 1898 he began dealing on his own account. He took a prominen part in the revival of an interest in art in Ireland, especially i establishing a gallery of modern art in Dublin. A fine collectio was ultimately made, and housed in Harcourt Street, Dublin where it was opened in 1906. He was knighted in 1909. Lan offered a number of old masters to the city of Dublin but, owin to the attitude of the Dublin corporation, his gift did not tak effect. He acted as adviser on the formation of the Johannesbur Municipal Gallery of Modern Art (1909), and brought togethe the Cape Town National Gallery collection of 17th centur Dutch pictures (1912). He was in 1914 appointed director of th National Gallery of Ireland. He was drowned in the sinking o the "Lusitania," May 7 1915.

See Lady Gregory, *Hugh Lane's Life and Achievements: with some account of the Dublin Galleries* (1920).

LANESSAN, JEAN MARIE ANTOINE DE (1843–1919), French statesman and naturalist (*see* 16.169), retired from politics in 1914. Among his latest works were *La crise de la République* (1914); and *L'histoire de l'entente cordiale Anglo-Française* (1916). He died at Écouén, Seine-et-Oise, Nov. 8 1919.

LANG, ANDREW (1844–1912), British writer (*see* 16.171), died at Banchory, Aberdeenshire, July 20 1912.

LANG, COSMO GORDON (1864–), Anglican divine, was born in Aberdeen Oct. 31 1864, the son of John Marshall Lang, sometime moderator of the Church of Scotland. Educated at Glasgow University and Balliol College, Oxford, he graduated in 1886 and two years later was elected a fellow of All Souls. In 1890 he was ordained and was appointed curate of the parish church of Leeds. From 1893 to 1896 he was fellow and dean of divinity of Magdalen College, Oxford, and from 1894–96 vicar of the University church of St. Mary's. In 1896 he became vicar of Portsea, and in 1901 suffragan bishop of Stepney, London, and canon of St. Paul's Cathedral. In 1908 he was appointed archbishop of York. His eloquence and clear common sense made him an influential member of the House of Lords, and in 1909 he was appointed a member of the royal commission on divorce.

His published works include *The Miracles of Jesus as Marks of the Way of Life* (1901); *Thoughts on some of the Parables of Jesus* (1906); *The Opportunity of the Church of England* (1905).

LANGLOIS, HIPPOLYTE (1839–1912), French general (*see* 16.177), died in Paris Feb. 12 1912.

LANGMUIR, IRVING (1881–), American chemist, was born in Brooklyn, N.Y., Jan. 31 1881. He studied at the Columbia school of mines, proceeding in 1903 to the University of Göttingen. He was instructor in chemistry at Stevens Institute, Hoboken, N.J., from 1906 to 1909, since which time he has engaged in physico-chemical research for the General Electric Co., Schenectady, New York. He invented the gas-filled tungsten lamp and the condensation pump for producing high vacua; his inventions in the field of electric discharges are largely responsible for the modern vacuum tube used in radio. In 1911 he discovered the atomic form of elementary hydrogen, and subsequently developed a process for welding metals by flames of atomic hydrogen. In 1917–8 he was engaged at the Naval Experimental Station, Nahant, Mass., developing devices for submarine detection. For his work in the field of molecular physics he received in 1918 the Hughes Medal of the Royal Society, London.

LANGUAGES: *see* FOREIGN LANGUAGES; PHONETICS.

LANKESTER, SIR EDWIN RAY (1847–), British biologist, s born in London May 15 1847, and was educated at St. Paul's hool, Downing College, Cambridge, and Christ Church, ford. In 1872 he was elected to a fellowship at Exeter Col- e, Oxford. During 1874–90 he was professor of zoology and nparative anatomy at University College, London, and from 91–8 Linacre professor of comparative anatomy at Oxford. om 1898 to 1907 he was director of the natural history depart- nt of the British Museum, and from 1898–1900 he held the llerian professorship of physiology and comparative anatomy the Royal Institution, London. He did valuable research k on the comparative structure of animals, both living and inct. To the general public he became known owing to his ccessful presentation of scientific subjects in a popular form. was elected F.R.S. in 1875, and was awarded the Royal edal in 1885 and the Copley Medal in 1913. In 1884 he founded e Marine Biological Association, becoming its president in 92. He was awarded K.C.B. in 1907. His numerous publica- ns include *Comparative Longevity* (1871); *Degeneration* 880); and the several editions of *Science from an Easy Chair* 908, 1910, 1912); *Diversions of a Naturalist* (1915); *Science d Education* (1919); *Secrets of Earth and Sea* (1920); and *eat and Small Things* (1923). He was for many years editor *The Quarterly Journal of Microscopical Science.*

LANREZAC, CHARLES LOUIS (1852–1925), French soldier, as born at Pointe-à-Pitre, Guadeloupe, July 31 1852. While the École de Guerre, the new French doctrine of strategy and ctics was being established under the influence of Maillard, anglois and Bonnal. To this doctrine Lanrezac himself con- ibuted in his study *La manoeuvre de Lützen*. He became colonel 1902, general of brigade in 1906, and general of division in 11. In 1912 he commanded the XI. Corps, and on April 10 1914 cceeded Galliéni as a member of the Conseil Supérieur de la uerre and commander-designate of the V. Army. His theories summarised in the article *Stratégie* of the *Dictionnaire mili- ire* were not in accordance with the modern theory of an inces- nt and universal offensive, of which plan 17 was an example. his plan assumed that the V. Army would attack east of the euse towards Neufchâteau. Lanrezac pointed out in his report July 31 1914 that if the extreme German right crossed the euse north of Givet the V. Army at Neufchâteau would be rned. Neither he nor Joffre anticipated the magnitude of the erman attack, though he feared an enemy attack between amur and Givet aimed at Chimay and the sources of the Oise d the direct road to Paris. He therefore sought and obtained rmission on Aug. 12 to place the I. Corps (left) in the Dinant gion, and to make preliminary arrangements for moving the rest his army towards the northwest. On Aug. 15 the Germans hav- g endeavoured to cross the Meuse at Dinant, General Joffre rdered the transfer of the army on the left bank.

On Aug. 21 Lanrezac asked Joffre whether he should attack e following day, but was then violently attacked by Von ülow's army, and the battle of Charleroi began. The arrival of e III. German Army forced the I. French Corps to fall back the Meuse, while the III. Corps had to yield. On the evening the 23rd Lanrezac was obliged to order a retreat, which lasted om Aug. 24 to Sept. 5. On Aug. 27 orders were given to renew e offensive at Saint-Quentin in order to assist the British. This rder provoked a violent disagreement between Joffre and Lan- zac. Nevertheless Lanrezac renewed his offensive on the 29th d at the battle of Guise, won a brilliant tactical success. But e retreat continued, and on Sept. 3 Gen. Lanrezac was lieved of his command. In 1917 he was offered the post of ajor General of the armies by M. Painlevé, but he refused d suggested Gen. Pétain. "He is one of my own children," said, "and I can answer for him." On July 3 1917 he was ade grand officer of the Legion of Honour and on Aug. 29 1924 was given the grand cross of the same order. He died on n. 18 1925.

See Lanrezac, *Le plan de campagne français et le premier mois de la uerre* (1920); Jules Isaac, *Joffre et Lanrezac* (1022); F. Engerand, *anrezac* (1926). (H. Bi.*)

LANSBURY, GEORGE (1859–), British politician, was born on Feb. 21 1859 in Suffolk. Working in a timber business, in London, he became a member and trustee of the National Union of General Workers. He abandoned his early Liberalism to found the Church Socialist League and to join the Independent Labour party. In 1909, as a member of the Royal Commission on the Poor Laws, he signed the Minority Report, and started an active campaign for its adoption. Elected M.P. for Bow in 1910, he supported the militants in the women's suffrage movement, and in 1912 resigned his seat to test opinion on the subject, but was defeated; he recaptured it, however, in 1922. In 1913 he became editor of *The Daily Herald*, which he carried on as a weekly during the War period. From 1920, on its revival as a daily, he was again editor, becoming general manager in 1922. In 1925 he resigned this post and founded *Lansbury's Weekly*, a journal friendly to communism. He visited India and Russia, publishing his book, *What I Saw in Russia*, in 1920. He was elected a borough councillor in 1901 and was mayor of Poplar from 1919–20 but he refused a post in the Labour Govt. (1924) and criticised its policy in many respects.

LANSDOWNE, HENRY CHARLES KEITH PETTY FITZMAURICE, 5TH MARQUESS OF (1845–), British statesman (*see* 16.184), had, during his tenure of office as Foreign Secretary (1900–5), definitely set his mark on British foreign policy at a critical period of history. In 1900 Great Britain felt all the disadvantages of isolation. Lord Salisbury's system of a general reliance on Germany and the Triple Alliance (Germany, Austria and Italy) had become no longer possible, in view of the open expression of German ill-will during the Boer War, and of the German resolve to build a fleet sufficiently large to constitute a serious challenge to the British Navy. On the other hand, Great Britain had nearly come to blows with France over Fashoda (Kodok), and her historical friction with Russia continued. Her isolation was especially marked in the Far East. Germany, Russia and France had forced Japan, after her Chinese War, to relinquish her conquest of the Liaotung peninsula. England had refused to join the other European Powers in their action, but had simply stood on one side. Subsequently Russia had over-run Manchuria and seized Port Arthur; France had effected a favourable revision of her frontier in the Mekong valley, and Germany had seized Kiaochow. It is Lord Lansdowne's main title to fame that he rescued Great Britain from this position of peril, procured her an ally in the rising maritime Power of the Pacific, Japan, and in Europe established her on terms of friendship and mutual understanding with France, by clearing away all the sources of bickering between Paris and London.

When the Duke of Devonshire resigned from Mr. Balfour's Government in 1903, Lord Lansdowne became the Conservative leader in the House of Lords, and though the fall of the Ministry in Nov. 1905 transferred him to the Opposition bench he remained the leader of the majority of that House till Dec. 1916. His polished and courteous manner, his thorough acquaintance, both with his work and with the idiosyncrasies of the peers, his cool temper and the sweet reasonableness of his expositions of policy speedily rendered his leadership most acceptable to his followers, in spite of the drawback, from the point of view of the Tory majority among them, that he was himself an old Whig. He rendered consistently patriotic support to the development by Sir Edward Grey of the foreign policy for which he himself had been responsible. In domestic politics he endeavoured, as far as possible, to limit points of difference with the Commons; but the measures of the Liberal Ministry almost inevitably brought about a conflict, which came to a head over Mr. Lloyd George's budget of 1909. In advising the Lords to reject it—as they did—he claimed that it was not an ordinary budget, but emphatically one which ought to be referred to the electorate to decide. Next year, however, he accepted the result of the general election of Jan. 1910, as making it obligatory on the peers to pass the Finance bill.

After the second general election of 1910 on the point of the Lords' veto, Lord Lansdowne brought forward in 1911, as an alternative to the Parliament Bill, a scheme for reconstructing the Upper House, which however was dropped after a second reading. When the Parliament Bill itself came up to the House of Lords, he moved and carried, by 253 to 40, an amendment providing for a submission to a popular vote of bills affecting the constitution or otherwise of great gravity. From that amendment he and his friends would not, he said, recede so long as they were "free agents." Ministers immediately announced that they would not accept the amendment, and that the King had consented to create, if necessary, sufficient peers to ensure the passage of the bill in its original form. Lord Lansdowne held that, after this threat of coercion, the peers had ceased to be free agents, and he therefore advised them to desist from further resistance. In this advice he was supported by Mr. Balfour; but a vehement opposition developed in the Conservative party, headed by the ex-Lord Chancellor, Lord Halsbury, and these "Diehards" were supported by such a large body of opinion that the bill was only carried eventually by 17 votes.

This episode gave a shock to Lord Lansdowne's authority both in the House and in the Conservative party, but he remained leader and co-operated cordially with Mr. Bonar Law after Mr. Balfour's resignation. He fought the Irish Home Rule Bill and the Welsh Disestablishment Bill strenuously on their successive appearances in the House of Lords, and procured their rejection by large majorities. But he was always ready for an agreement by consent over the Irish question, to avoid the "irremediable misfortune," the "overwhelming catastrophe," of civil war. The World War reduced all these issues to minor significance, and Lord Lansdowne associated himself with Mr. Bonar Law in tendering at once the support of the Opposition to the Government in rallying to the assistance of France and Russia. In 1915 he joined Mr. Asquith's Coalition Ministry without portfolio; and took the lead in pressing the military service bills on the House of Lords. At the close of that Ministry he retired from office, the leadership of the House and of the Conservative majority passing to Lord Curzon. In his retirement he got somewhat out of touch with public opinion, and published in *The Daily Telegraph*, in Nov. 1917, a letter in which, to the general surprise, he advocated a negotiated peace instead of the policy of Thorough, on which the Ministry and the Empire were set. His ideas received hardly any support save from the small pacifist section. In subsequent years he suffered much from ill-health, and so took little or no active part in politics.

Lord Lansdowne's great and various services to his country were rewarded with the K.G., G.C.S.I., G.C.M.G. and G.C.I.E. He was a trustee of the National Gallery and chairman of the British Royal Red Cross Society 1915–20; he received honorary degrees from Oxford, Cambridge, McGill and Leeds. His elder son, Lieut.-Col. the Earl of Kerry, D.S.O., married Elizabeth Caroline, only daughter of Sir E. S. Hope. His younger son, Lord Charles Mercer Nairne, was killed in action in France in 1914. Of his two daughters the elder married the 9th Duke of Devonshire and the younger the 6th Marquess of Waterford and, after his death, Lord Osborne de Vere Beauclerk. (G. E. B.)

LANSING, ROBERT (1864–   ), American diplomatist, was born at Watertown, N.Y., Oct. 17 1864. He graduated from Amherst in 1886, was admitted to the bar in 1889, and for the next 18 years practised at Watertown. In 1892 he was associate counsel for the United States on the Bering Sea Commission, and later was American counsel or agent before several important arbitral tribunals or mixed commissions, including the Alaskan Boundary Tribunal (1903), the Hague Tribunal for the arbitration of the North Atlantic fisheries (1910) and the Anglo-American commission (1911) for settling outstanding claims between Great Britain and the United States. In 1914 he was appointed counsellor of the Department of State. When W. J. Bryan resigned (June 8 1915), Mr. Lansing was appointed Secretary of State *ad interim*. He was definitely appointed Secretary of State on June 23 1915. In his attempts to uphold American rights he was called upon to direct notes to all the countries at war. In reply to a note addressed by England to neutrals, asking that all belligerent submarines be excluded from neutral waters, he said that the nature of each submarine must govern the decision. He thus drew an important distinct between the "Deutschland," which had peacefully brough cargo to America, and the U53, which had raided several sh off the New England coast, Oct. 7 1916. In 1917 he notif President Carranza, of Mexico, that the United States wo not adopt his proposed Pan-American plan of stopping shipment of food and munitions to all the European belligere In Nov. 1917 he signed an agreement with Japan (the Lansi Ishii agreement) which, while recognising Japan's special int ests in China, provided for a continuance of the "open doo policy for commerce.

Lansing was a member of the American commission to ne tiate peace at Paris, 1918–9, and, together with Viscount C and Col. House, prepared a draft of the League of Nations Jan. 1919. On Feb. 13 1920 he resigned as Secretary of St on being reprimanded by the President for having called gether the heads of the executive departments of the Gove ment. Such meetings of the Cabinet had, however, frequen been called before during the President's illness, naturally the Secretrary of State as ranking member. In Aug. 1920 opened a law office in Washington. He was the author of *Peace Negotiations* (1921); and *The Big Four and Others* (19

LAPWORTH, CHARLES (1842–1920), British geologist 16.208), died at Birmingham March 13 1920.

LARDNER, RING W. (1885–   ), American author humorist, was born at Niles, Mich., March 6 1885. He recei his education at the Niles High School and the Armour Instit of Technology, Chicago. He was a reporter on the South B (Ind.) *Times*, 1905–7, after which he spent four years in Chica contributing to the sporting columns of various newspapers th He was editor of *The Sporting News*, St. Louis, 1910–1, and sp ing writer for the Chicago *Tribune* 1913–9, after which date was connected with the Bell syndicate. His humour is base part on its racy use of vernacular and the language of illitera He wrote a number of books, among which are *Bib Ball* (1915); *You Know Me, Al* (1916); *Gullible's Travels* (19 *Treat 'em Rough* (1918); *The Real Dope* (1919); *How Write Short Stories* (1924); and *The Love Nest* (1926).

LARMOR, SIR JOSEPH (1857–   ), British mathematici was born at Magheragall in Ireland on July 11 1857, and educated at the Royal Belfast Academical Institution, Quee College, Belfast, and St. John's College, Cambridge. Fr 1880–5 he held the post of professor of mathematics in Queen's University, Ireland, and from 1885–1903 he was turer in mathematics in the University of Cambridge, su quently becoming Lucasian Professor there. He carried much valuable research work in mathematics and mathemat physics, displaying a particular interest in the problems of e trodynamics and thermodynamics, and in the electrical pro ties of ether and matter. He was intimately connected for m years with the Royal Society, of which he became a fellow 1892, serving on the council and acting as secretary from 19 12. He received the Royal Medal in 1915, and the Copley Me in 1921. In addition to these he was the recipient of m British and foreign honours and awards, including in 1914 de Morgan Medal of the London Mathematical Society of wh he was at that time President. He was knighted in 1901, from 1911–22 was Unionist member of Parliament for C bridge University. His writings include *Ether and Ma* (1900), and numerous memoirs on mathematics and physics.

LASCELLES, HENRY GEORGE CHARLES, VISCOUNT (18), eldest son of Henry Ulick Lascelles, 5th Earl of Harewo was born Sept. 9 1882. He was educated at Eton and ente the Army as a lieutenant in the Grenadier Guards. For a ti he exchanged military for diplomatic service, becoming an h orary attaché to the Embassy in Rome 1905–7, and A.D.C the governor-general of Canada (Earl Grey) 1907–11. He ser in France during the World War, being three times wounc and winning the D.S.O. with bar, as well as the Croix de Gue In 1922 (Feb. 28) he married Princess Mary, only daughte King George V., and he was the same year created a Knigh the Garter. Through his grandmothet, Elizabeth Joan ughter of the 1st Marquess of Clanricarde, he inherited property, though not the titles, of his great-uncle, the ond and last marquess, who died April 12 1916.

LATIN LITERATURE (*see* 16.257).—During the period from t to 1926 the progress of Latin scholarship ran on well- rked lines. The closing decades of the 19th century witnessed great revival of classical study, parallel, if not due, to the at discoveries in natural science. It was realised that the doc- nes which were current, in almost every branch of the study antiquity, needed to be re-examined; and that the evidence ilable was far more extensive than previous generations of olars had been willing or able to contemplate.

Hence came a great addition to the original sources of infor- tion accessible. Newly discovered inscriptions, papyri, numents of stone and bronze and ancient remains of every d; manuscripts and the products of ancient and medieval olarship were newly read or newly analysed, and so made ilable for wholly new study, often in monumental publica- ns like the *Corpus Inscriptionum Latinarum*, which, despite 15 volumes, is still not yet complete. This new stream of earch, strictly scientific in character, still continues with rdly any diminution; and students of Latin literature have rnt to give heed to the methods and the fruits of these studies.

Study of the Great Writers.—But the special feature of the rs since 1910 has been a reassertion of the older and larger jects of classical study, namely, the interpretation and appre- tion of the greatest authors, not in a spirit of opposition to new research, but in alliance with it, and on the strength of results. Thus, for example, in 1896 Theodor Mommsen was ntent to determine the date of an inscription, then newly dis- vered on the island of Philae in the Nile, and to show that it s probably one of the monuments set up or permitted to be up in his own honour by Cornelius Gallus during his governor- p of Egypt in 26 B.C.; and hence that it was one of the causes the anger of Augustus and of the fall and suicide of Gallus— good history, but, so far as Mommsen took it, with no par- ular literary bearing.

But Mommsen's results have since[1] been combined with what have now learnt about the poet-soldier Gallus from a deeper dy of Virgil's *Eclogues*, and with what the ancient commen- ors record about the curious ending—or want of ending—of ok IV. of the *Georgics*, so as to make clear how it was that gil came to mutilate what was probably the most perfect em he ever wrote; and to suggest also how innocent his bosom- end Gallus, despite his Gascon vanity, had been of the graver rges laid against him. In this way a fact of Virgil's expe- nce, which must have contributed profoundly to shape his neral outlook, appears in clearer light, and the standing riddle the Aristaeus-Proteus-Orpheus-digression has found its l solution; the whole patchwork is nothing but a half-hearted empt to replace the *Praise of Gallus* (and of Egypt) by piecing ether three epyllia, of the poet's own earlier work, short rative poems in the Alexandrine style.

Of similar interest is the discovery by Prof. G. E. K. Braun- tz, in the course of studies of the ancient place-names of rth Italy and of the family-names of the same area recorded inscriptions, of new evidence which places Virgil's farm near lvisano, 30 Roman m. northwest of Mantua, not at the tradi- nal site two m. to the southeast in the marshes of Pietole. is has elucidated the story of his expulsion from his farm in B.C., and thrown much light on all the *Eclogues* whose scene aid in North Italy—that is, as has been now pointed out, all se with odd numbers.

New and more searching methods of manuscript study have added much to our knowledge of Latin authors. The ford series of texts with critical notes, though they vary a d deal in the fullness of their record, have at least made it icult for an editor of any ancient book to frame his text or nment without regard to the evidence of the different manu- ipts and the judgment of competent scholars upon their rth; just as no future editor of Juvenal can dispense with Prof. A. E. Housman's text (1905), or of the *Culex* (now attributed to Virgil by a clear and marked preponderance of expert opinion) without the same scholar's *Apparatus Criticus;* or of the *Metamorphoses* of Ovid without the critical edition by H. Magnus. Dr. J. P. Postgate's *Tibullus* and *Phaedrus*, and Profs. R. S. Conway and C. F. Walters' Livy I.–V. and VI.–X., Prof. H. W. Garrod's Statius (*Thebaïd* and *Achilleid*)—all five volumes in the Oxford series—have offered similar service towards the better understanding of these authors.

Further, the more profound analysis of the history of manuscripts due to such scholars as L. Traube, A. C. Clark and E. K. Rand, besides the editors just mentioned, has revealed the frequency, not to say regularity, of certain causes of corruption—especially the loss of whole lines, or groups of lines, in uncial codices, and has thus imposed a certain check on haphazard emendation, and given new guidance for our procedure (or non-procedure) in difficult cases. One result is that the formula with which the most brilliant critical scholar of the 19th century, J. N. Madvig, was wont to cut the worst knots—"Livius scribere debuit" (so and so)—has disappeared from the work of self-respecting scholars. We have learnt so much more of the possibilities of error in tradition that we are humbler in framing judgments on the writings of great authors in the form in which the centuries have left them.

These illustrations will suffice to show the way in which new knowledge in epigraphy, in the study of place names and in textual criticism has deepened the study of ancient literature. It would be easy to increase their number by others drawn from comparative grammar, comparative religion, glossography and the many recent developments of archaeology. A typical example of the application of several different lines of inquiry to a literary purpose is W. Warde Fowler's exposition[2] of the *Carmen Saeculare* of Horace and its performance on June 3 17 B.C., which combines the results of his own studies of Roman ritual with the evidence of recent excavation on the Palatine and of the inscription of Augustus (discovered in 1890) recording the celebration and containing the words *Carmen composuit Q. Horatius Flaccus.*

To such indications of growing knowledge perhaps it may be serviceable, so far as the judgment of an individual scholar may be trusted in such a matter, to suggest a few parts of the field of Latin study which seem to have been comparatively neglected in the period under review. Chief among these is certainly the text of *Horace*, where the number of MSS. is very large, and our knowledge of them, both in quantity and quality, lamentably small. Next, the metre and language of *Plautus;* for, despite the work recorded below, no commentator seems yet to have realised the far-reaching effects of the Sonnenschein-Wallstedt[3] discovery of the lawfulness of a spondee, even one whose first syllable bears the word-accent, in the fourth foot of an Iambic Senarius, provided that accent and ictus coincide in the fifth and sixth feet; *e.g.*, in Trinummus, 410,

> "Quam si tu obicias formicis papaverem,"

the fourth foot *micis* is a spondee with the first syllable accented, but is legalised by the coincidence of word-accent and verse-ictus in the quadrisyllable (*papăverem*); a similar solution applies to the corresponding difficulty in Trochaics.

Catullus, Tibullus and Statius, though frequently edited in whole or part, have not yet been adequately handled in the light of our present knowledge, though on Statius much valuable work has been recently done. For a commentary on the *Natural History of Pliny*, that discursive encyclopaedia of ancient learning, the student is often obliged to go far back into the 19th century, or farther still, for even the most obvious kind of help.

Besides actual commentaries, this period has produced a wealth of critical studies, directed to determining as precisely as possible, in the light of all the evidence yet available, what were the actual thoughts and motives of the greatest authors viewed in relation to the history of their times, rather than to appraising their merit in the abstract—a vain ambition, responsible for much writing of a type fashionable in the 19th century, which now seems superficial. Contrast, for example, Conington's introduction to his edition of Virgil with that of S.G. Owen to Ovid's *Tristia* (Book 2); or with the series of volumes initiated by Warde Fowler, devoted at first to the interpretation of the *Aeneid*, book by book, and later to other Virgilian topics; such a series could hardly have been projected or published in any earlier epoch of scholarship.

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[1] *See* below under D (*New Studies of a Great Inheritance*, c. V.).

[2] *See* below, *Roman Essays and Interpretations*, p. 3.

[3] Emil Wallstedt, *Studia Plautina*, Lund Univ. Arskrift, 1909. Afd. 1 (esp. p. 89 ff.). E. A. Sonnenschein, *Accent and Quality in Plautine Verse*, Class. Rev. 20, p. 156 (1906).

Linked with this interpretative effort has been a desire, manifest alike in Britain, America, France, Italy, Germany, Holland and Scandinavia, to arrive at a clearer conception of the personality of the different authors, a desire more manifest than in any period since the New Learning of the 16th century. Indeed, in this and other ways the enterprising spirit of scholarship in the last quarter of a century has proved itself akin to that of the times of Thomas More, Spenser and Ben Jonson. Another is the multitude of translations of Latin authors begun in this period and still being poured out in many different series, affording no less clear evidence of quickened popular interest in classical study than did, in their own great way, the famous renderings of the Elizabethan era, North's *Plutarch* and Holland's *Livy*, to name no others; and in yet another feature, the abundance of what may be called propagandist literature which has grown up around Latin studies, the work of the 20th century shows a striking tendency to parallel, if not to imitate, the warm-hearted pleading of Roger Ascham or Sir Philip Sidney.

It is well to add that one of the features of the period has been the new organisation of the classical periodicals published in Great Britain; others have been newly established in the United States, Italy, Germany and Sweden. *The Classical Quarterly* had been separated, as an organ of research, from *The Classical Review* in 1906; but in 1910 both became the property of the Classical Assn., a body whose influence has done much to evoke and to guide the active work just described. In 1910 also a concordat was made between that association and the Society for promoting Hellenic Studies and the then newly formed Society for promoting Roman Studies respectively, by which the province of *The Classical Quarterly* was declared to be Greek and Latin language and literature (including texts, manuscripts and Indo-European Philology) approached by all methods save those mainly dependent on architectural remains or other archaeological evidence; whereas all study largely concerned with these was reserved for *The Journal of Hellenic Studies* and *The Journal of Roman Studies* in their proper spheres. This agreement has been happily carried out.

Further, when *The Journal of Philology*, long maintained by the support of the Cambridge Philological Society, was allowed to lapse (in 1920), that support was transferred to *The Classical Quarterly*. The *Review* and the *Quarterly*, with *The Year's Work in Classical Studies*, established by the Classical Assn. in 1906, are managed for it by the Classical Journals Board, on which the philological societies of Oxford and Cambridge are represented. All the Classical periodicals of Great Britain are therefore now conducted on a definite scheme which precludes overlapping. In America, beside the old-established *American Journal of Philology* and *Classical Philology* (a quarterly established in 1907), *The Classical Journal* (appearing in nine months of the year), which was founded in 1905, had by 1916 become the organ of the three powerful associations which now represent Classical studies in nearly the whole area of the United States.

In Italy the *Rivista Indo-Greco-Italica* began in 1916; in Germany *Glotta* (*Zeitschrift für Griech. u. Lat. Sprache*) at Göttingen in 1911; *Die Antike* (at Berlin) in 1923; and *Gnomon* at Berlin in 1924. In Sweden there was founded in 1925 *Litteris, an International Critical Review of the Humanities*, edited by Scandinavian scholars with associates in Germany, Denmark, England and France.

To this brief survey of the general tendencies of Latin scholarship may be added for practical purposes a brief list of the chief contributions to its different branches which have appeared in the period under review. The list is necessarily incomplete, b care has been taken to make it as representative as possible. is largely based on surveys by Prof. J. F. Dobson and Mr. A. Nock in *The Year's Work*, where fuller information will be foun

The following list excludes (*a*) all publications dealing with portion only of some large work, and (*b*) all new editions books published before 1911, save a few in either class of excep tional importance.

A. Critical Texts of Latin Authors; and Textual Studies.

1. Five excellent Series, two begun in this period, all continu (*a*) in the Oxford Bibliotheca Classica, *Livy 1–5* (1914) and *6*- (1919); R. S. Conway and C. F. Walters jointly (*21–25* in the press Ovid, *Tristia, Halieutica, Fragmenta*, S. G. Owen (1915); Phaedru J. P. Postgate (1919); Statius, *Silvae* (2nd ed., 1918), J. S. Phil more; *Thebaid* and *Achilleid* (1911), H. W. Garrod; *Tibullus*, J. Postgate (1914).

(*b*) In Teubner's texts (many re-edited): *e.g.*, *Apicius*, C. Giarr tano and F. Vollmer (1922); *Cato* (1923), G. Goetz; *Livy 41–45* ar *Fragments* (1912); W. Heraeus; *Martianus Capella*, A. Dick (192

(*c*) In the Corpus Paravianum (Turin): *e.g.*, *Caesar*, *Bellu Civile* (1916), D. Bassi; *Catullus* (1916) and *Cicero, De Republi* (1916), both by C. Pascal; *Justin* (1921), M. Galdi.

(*d*) In the Collection Budé (Paris): *e.g.*, *Lucretius*, A. Ernou *Ovid, Ars Amatoria*, H. Bornecque; *Seneca, Consolationes*, R. Walt

(*e*) In Hans Lietzmann's *Kleine Texte* (Bonn): *e.g.*, *Cicero P Milone*, with Asconius and the Schol. Bobiensia (1911), P. Wessne *Vitae Virgilianae* (1911), E. Diehl.

2. Single works: *Ovid, Metamorphoses* (Berlin, 1914), H. Magnu *See* also under B.

3. *Textual Studies: Apuleius*, D. S. Robertson, *Class. Quarter* (18), 1924. *Ibis*, A. E. Housman, *Journal of Philology*, 35 (1920 p. 287. *Livy;* R. S. Conway, C. F. Walters, J. F. Dobson, A. Ky Florence Whitehead, *Class. Quarterly*, 4–2 (1910–8), W. B. Anderso in *Class. Quarterly*, from 5 (1911) to 11 (1917). *Martial* and *Persiu* A. E. Housman, *Class. Quarterly*, 13 (1919) and 7 (1913); *Thebai* E. H. Alton, *Class. Quarterly*, 17 (1923), p. 175. *Thebaid* 2: W. Anderson, *Class. Quarterly*, 18 (1924), p. 203. *Virgil: Culex*, E. Alton, Hermathena, 14 (1920), p. 68 (based on A. E. Housman "Apparatus Criticus to the Culex," *Camb. Phil. Soc. Trans.*, 7, 1908

B. Editions with Commentary:

Prose authors: Caesar, *Bell. Gallicum* (Oxf., 1914), T. Rice Holme Cicero, *De Divinatione* (Illinois, 1923), A. S. Pease; *Disput. Tu culanae* (Berlin, 1918), M. Pohlenz; *Ad Q. Fratrem* (Leipzig, 1911 H. Sjögren; *De Finibus 1, 2* (Camb., 1925), J. S. Reid; of the gre commentary on the whole *Correspondence* (Dublin, 7 vol.), R. Tyrrell and L. C. Purser, the second edition as far as vol. 5 w completed by L. C. Purser in 1915; *Livy 6–8*, O. Rossbach (1925 *Ammianus Marcellinus*, C. U. Clark (1910 onwards); *Asconi* (Rome, 1920), C. Giarratano; Apuleius, *Apologia* (Città di Castell 1914), G. Marchesi, also (Oxf., 1915), H. E. Butler and A. S. Owe *Quintilian*, Book 1 (Camb., 1924), F. H. Colson; *Minucius Fel* (Utrecht, 1923), J. Van Wageningen; *St. Augustine, De Civitate D* (London, 1924), J. E. C. Welldon.

Poets: Ennius (Cambridge, 1925), Ethel M. Steuart; Lucretius and 2 (Paris, 1925), A. Ernout; and posthumously (Berlin, 1923 H. Diels; Horace, *Odes and Epodes* (Cambridge, 1921), H. Darnle Naylor, also (Berlin, 1917), R. Heinze; *Satires* (Paris, 1912), Plessis and P. Lejay jointly; Virgil, *Culex* (Paris, 1912), C. Plésent *Bucolics* (Paris, 1915), F. Plessis; *Georgics* (Paris, 1915), P. Leja *Grattius* (Oxford, 1918), P. J. Enk; *Manilius 1–4* (London, vol. 1921), A. E. Housman, also completely (Amsterdam, 1921), J. Va Wageningen; Ovid, *Tristia* 2, (Oxf., 1925), S. G. Owen.

C. Translations.

1. *Series:* (a) *Oxford Translations*, *e.g.*, *Catullus* (in English vers 1924), Sir W. S. Marris. (b) *Loeb Series: e.g.*, Caesar's *Gallic W* (1914), H. J. Edwards; *Cicero's Letters to Atticus* (1914), E. O. Wi stedt; *Velleius* (1914), F. W. Shipley; *Apuleius' Metamorphos* (1914), S. Gaselee. (c) *Bell's Classics; Varro on Farming* (Londo 1912), Lloyd Storr-Best.

2. Singly: *Lucretius on the Nature of Things* (London, 1918 Sir R. Allinson.

D. Literary Studies and Surveys.

1. *Studies:* (a) *Of the poets: The Original Element in Plaut* (Camb., 1917), K. M. Westaway; *Plautinisches in Plautus* (Berli 1922), E. Fränkel; *Ennius und Vergilius* (Leipzig, 1915), E. Norde *New Light on Lucretius*, John Rylands, *Lib. Bulletin*, 1926), J. P Postgate; *The Carmen Saeculare* (*Cl. Quarterly*, 4, p. 145), W. Ward Fowler; *Horace and His Age* (London, 1917), J. F. D'Alton; *Orazio Lirico* (Florence, 1920), G. Pasquale; *Horace, a New Interpretation* (London, 1924), A. Y. Campbell.

Of Virgil: In Blackwell's series (Oxford; continuing) *Vergil's Gathering of the Clans* (1916), *Aeneas at the Site of Rome* (1917), *The Death of Turnus* (1919), all by W. Warde Fowler; *Beasts, Birds and Bees in the Georgics* (1914), T. F. Royds; *Culex* (1926), D. L. Drew.

:r studies: *The Culex*, S. Elizab. Jackson, *Cl. Quarterly*, v. (1911); ıe Nationality of Vergil," *Class. Review* (1915), G. E. K. Braunz; "Copa Eclogue 5" and "Georg. 3, 1–48," *Class. Quarterly* 2–5), D. L. Drew; *Die Geburt des Kindes, Eclogue 4* (Leipzig,), E. Norden; *Where Was Vergil's Farm?* (Eclogues 1 and 9; ı Rylands, *Libr. Bulletin*, 1923), R. S. Conway; *Der Bukoliker* *ril* (Stuttgart, 1922), K. Witte; *Vergil's Biographia Litteraria* :., 1920), N. Dewitt; *Virgil and His Meaning to the World of* *lay* (Boston, 1924), J. W. Mackail.

f Horace, Virgil and others: *Collected Studies in Greek and Latin* *ılarship* (Camb., 1913), A. W. Verrall; *Roman Essays and In-* *retations* (Oxf., 1920), W. Warde Fowler; *New Studies of a Great* *eritance* (Cicero, Horace, Virgil and Livy; London, 1921), R. S. way; *Les Sources de Lucain* (Paris, 1912), R. Pichon; *Studi di* *eratura e Filologia Latina* (Turin, 1917), E. Stampini; *Latin* *ry* (London, 1922), E. E. Sikes.

) *Of prose authors: Cicero of Arpinum* (Yale, 1914), E. G. Sihler; *ro, a Biography* (Univ. of California, 1920), T. Petersson; *Les* *édés d'art de Tacite dans les Histoires* (Paris, 1918), E. Courbaud; *lies in Fronto* (Camb., 1912), M. Dorothy Brock; *Studia Ammia-* (Upsala, 1921), H. Hagendahl.

. *Surveys: The Love of Nature Among the Romans* (London, 1912), Archibald Geikie; *Agricola* (ancient Italian agriculture; Camb., 2), W. E. Heitland; *The Silver Age of Latin Literature* (London,), Walter C. Summers; *Geschichte d. Lat. Litteratur* (vol. 1 down 00 B.C., Berlin, 1913), F. Leo; *Storia della Letteratura Romana* vol., Naples, 1912, 1916), A. G. Amatucci; *The Legacy of Rome* f., 1923), edited by C. Bailey; *The Writers of Rome* (London, 1923), Vight Duff; *Kleine Schriften von Fr. Skutsch*, ed. by W. Kroh 14).

LEXICA AND INDICES.

'he vast *Thesaurus Linguae Latinae* (Berlin) is being resumed with Norden in place of F. Vollmer as editor-in-chief: in 1909 the letter as completed in vol. 4; in 1913 appeared vol. 3 of the *Onomasticon* w separate), with Proper Names beginning with C. *Index Catul-* *us* (New Haven, 1912), N. M. Wetmore. *Index Lucretianus* thenburg, 1911), J. Paulson. H. Merguet's *Vergil-Lexicon* (comted, Leipzig, 1912), H. Frisch. *Index to Suetonius* (1922), A. A. ward and C. N. Jackson.

METRICAL THEORY.

Iétrique (vol. 7 of *Manuel des études Grecques et Lat.*, ed. 2, Paris, 9), L. Laurand; *Early Latin Verse* (Oxf., 1922), W. M. Lindsay; *sodia Latina* (Oxf., 1923), J. P. Postgate;

YTHM IN PROSE:

Der constructive Rhythmus in Ciceros Reden, M. Zielinski (1914).

HISTORICAL AND COMPARATIVE GRAMMAR.

Report of the Joint Committee (of eight educational associations) on *mmatical Terminology* (London, 1911), E. A. Sonnenschein and ers. *Handbuch d. Lat. Laut- u. Formenlehre* (ed. 2, Heidelberg, 4), F. Sommer; *The Making of Latin* (London, 1923), R. S. ıway. The second edition of Karl Brugmann's *Grundriss der* *rgleichenden Grammatik* was completed by the publication of vol. part 2, in 1911.

NEW SOURCES AND OTHER AIDS.

. Manuscripts and Papyri: *The VI. Century Fragment of Pliny's* *ters* (Washington, 1922), E. K. Rand and E. A. Lowe; *Jews and* *istians in Egypt* (London, 1924), H. I. Bell, contains a letter of the peror Claudius; *Vorlesungen und Abhandlungen von L. Traube*, ted by F. Boll (1909–20) which, though written in Greek, should mentioned here.

. Glossography: *Ancient Lore in Mediaeval Latin* Glossaries d., 1922), W. M. Lindsay and H. J. Thomson; *Isidore and Festus* f., 1912), both W. M. Lindsay; *Corpus Glossariorum Lat.*, vol. 1 ipzig, 1923), G. Goetz.

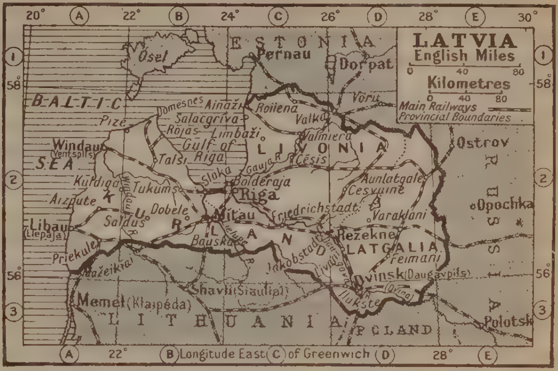
. Palaeography: *Introduction to Greek and Lat. Palaeography* f., 1912), Sir E. Maunde Thompson; *Companion to Classical Texts* f., 1913), F. W. Hall; *Storia e Critica di Testi Latini* (Catania, 4), R. Sabbadini; *Notae Latinae* (Camb., 1915), W. M. Lindsay; *Descent of Manuscripts* (Oxf., 1918), A. C. Clark.

. Chronology: *The Chronicle of S. Jerome* (2 vol., London, 1923), . Fotheringham. (R. S. C.)

ATVIA.—A Baltic state and a member of the League of Nans. The Republic of Latvia, lying east and south of the Gulf Riga, was proclaimed on Nov. 18 1918. It embraces the vinces of Vidzeme, Kurzeme, Zemgale and Latgale, covering area of 24,400 sq. m., with a population of approximately 00,000 inhabitants, mostly Lutherans, divided, according to census of 1925, in the following proportions: Letts 75·93%, ssians 10·28%, Jews 4·5%, Germans 3·4%, Poles 2·5% and ıer nationalities 3·39%. The principal towns with their popuions are Riga, 337,699; Libau (Liepaja), 60,762; Dvinsk augavpils), 40,640; Mitau (Telgava), 28,325; and Windau entspils), 16,384.

I. CONSTITUTION

The Constitution law, passed on Feb. 15 1922, came into force on Nov. 7, on the election of the first Latvian Parliament (Saeima) composed of one Chamber. The supreme executive power is vested in the electorate, which is composed of authenticated citizens of either sex who have attained the age of 21 years.



No lists are made of the electors, and consequently the voters are not bound to wards. The elections are effected by general, equal, direct voting, on the basis of proportional representation. The electorate is entitled (*a*) to elect 100 members of Parliament (Saeima); (*b*) at the instance of the president of the republic to decide, by means of a referendum, upon the dissolution of the Saeima, and thus indirectly on the president's resignation; (*c*) to submit to the Saeima amendments of the constitution or other proposed legislation on the demand of not less than one-tenth of the electorate; and finally, to demand a referendum for the adoption or rejection of bills and legislative resolutions. This right may be exercised in three ways: (1) by the obligatory referendum for proposed amendments to the constitution; (2) by the permissive referendum, in case on his own initiative or on the motion of at least one-third of the members of the Saeima, the president postpones for two months the promulgation of a law passed by the Saeima, and if not less than one-tenth of the electorate demand a referendum; (3) a legislative proposal brought forward by the nation is also put to the public vote if not accepted by the Saeima without alterations in the text.

The Saeima is elected for a term of three years, and its authority expires on the convocation of the new Saeima. The elections take place on the first Saturday and Sunday in Oct., and the new House assembles on the first Tuesday in November. The minority of the Saeima (not less than one-third) may demand the establishment of an inquiry commission and the shelving of a law passed by the Saeima for two months pending a referendum. The president of the republic is elected by the Saeima for a term of three years, with the possibility of being returned for a further period of three years, but his tenure must not exceed six consecutive years. The president has the power of initiating legislation, of granting amnesty rights, he is the chief of the armed forces of the state, and is vested with a suspensive veto right, though he may dissolve the Saeima only after a referendum. He may not be under 40 years of age.

The Cabinet of ministers is the executive organ. The responsibility of the Ministers to the Saeima is formulated in Article 59 of the constitution. The Prime Minister and the members of his Cabinet require the confidence of and are responsible to the Saeima for their official actions. The whole Cabinet must resign if the Saeima passes a vote of censure against the Prime Minister. If a vote of no confidence is passed on one of the ministers, he must resign, and the Prime Minister appoints another person in his stead. By the Cabinet law of April 1 1925, a vote of confidence of the Saeima is required before the Cabinet or a new minister may take up office. The Cabinet has the right in certain cases to proclaim martial law, and to issue emergency regulations. Resort was had to these powers on different occasions in the early days of the republic. The constitution secures freedom of action for the courts of law. The State Control law of Aug. 2 1923, based on paragraph 88 of the constitution provides Latvia with a completely independent and active State Control Department. The constitution of the Latvian Republic does not contain the usual legal guarantees for the citizens, but the right of assembly and the freedom of the Press are guaranteed by special laws which were passed by the first Latvian Parliament. The cultural autonomy of the national minorities has been legalised by the National Council.

II. POLITICAL HISTORY

Latvia's geographical location contributes to its political importance. This constant factor has always influenced the historical development of the country. Thus an important part is played by Latvia in connection with the problem of the *dominium maris Baltici* in the history of north-eastern Europe. The solution of this problem one way or the other has always affected the political position of the peoples on the Baltic seacoast. In the 9th century the Vikings crossed the Baltic to Russia, in the 12th the Germans proceeded from Bremen and Lübeck to colonise the Baltic coast, establishing a staple market at Wisby (Gothland). By then, the already politically organised Latvian tribes (Kurs, Semgallians, Seli, Talavians, Latgalians), moving seawards, had reached the mouth of the river Dvina and the seacoast, and assimilated the inhabitants of the coast, the Livs (of Finnish origin). The Latvian tribes, however, had not yet crystallised into an organised united state, and, while the Scandinavians were distracted by internal disturbances, the Germans gained a footing in Livonia.

After fighting until about 1450, an episcopal state was founded in conjunction with the Livonian Order, as the precursor of the Federal State of Livonia founded about the middle of the 15th century, and embracing Estonia and Latvia of to-day. The problem of the Baltic Sea was again acute towards the middle of the 16th century, when Moscow turned to the Baltic coast after having destroyed the trade of Novgorod (a Hanseatic creation) and annexed the Ruthenian duchies bordering on Latvia. Then it was that the Hanseatic structure of all the Baltic began to fall, while Germany was in the throes of the reformation movement and Sweden evinced a desire to establish itself beyond the Baltic Sea. Having made a union with Lithuania, Poland too, showed a tendency to expand in the same direction. These conflicting efforts led to a partition of Livonia, and so Estonia became Swedish, Livonia Polish, Pilten in North Courland and the isle of Oesel Danish, while Courland was converted into a duchy under Polish suzerainty, and later became an important state under Duke Jacob, a godson of James I. of England.

Simultaneously with the expansion of Sweden's power, Livonia and Riga were occupied at the beginning of the 18th century, whereby the Swedes contributed largely to the cultural progress of these parts by founding schools, establishing legal and clerical order, protecting the peasantry and translating the Bible. Latgalia alone was left under Polish rule. By then an united Latvian people had evolved out of the separate tribes, though the estate owners were not Latvians. This continued until the beginning of the 18th century, when, in alliance with Poland, Russia undermined Sweden's power and under the Treaty of Nystad, 1721, occupied South Finland, Estonia and Livonia, afterwards turning on Poland and destroying her.

The whole of Latvian territory was united under Russian rule after the partitions of Poland (1772–95). The reforms introduced by the Swedes were rescinded, and the estates which were formerly held in fee became the hereditary possession of the nobility. The position of the peasants grew worse, and repeated revolts ensued. Only in 1807 a law was passed in St. Petersburg giving the peasants hereditary possession of the land cultivated by them on their own behalf. But after Napoleon's downfall, this law was modified to the effect that the landlords retained possession of the land, which the peasants could acquire by purchase only. The landed proprietors, mostly German Balts, also recovered all their feudal privileges, as game and fishing rights, and patrimonial rights. They also enjoyed the sole right to establish industrial enterprises.

This state of affairs lasted till the beginning of the 20th century, and only shortly before the World War was the idea of a limited self-government with the participation of the more important small landowners conceived. During the 19th century the co-operative movement, loan-banks, etc., enabled the growth of a larger and more independent class of Latvian small farmers; the landless proletariat went to the towns and evolved in a revolutionary direction. A Latvian educated class came into being; a Latvian daily press and theatre were founded. A nationalist and revolutionary movement began to grow. The national leaders, A. Kronvalds, K. Valdemars, J. Kalnins, F. Grosvalds and others, received much valuable assistance from some liberal German clergymen. In the Latvian revolution 1904–5, the first declaration of Latvian independence was mad Russia had to reinstate herself by armed force. She put t revolution down with much bloodshed. There was practical no improvement in the position of the peasants, as not even t Russian conception of self-government (the Zemstvo) was e tended to this region (*see* also LITHUANIANS AND LETTS, 16.78

The War Period.—At the outbreak of the World War, the fu force of the attack fell on Latvia and the other frontier region In the year 1915 Tsar Nicholas II. permitted the organisati of a national Latvian Army, which subsequently proved to the foundation of Latvia's political independence. Neverthele the Latvian nation was subjected to great suffering in cons quence of compulsory evacuation to Russia.

After the Russian revolution in 1917 the Latvian Refuge Committee developed into a powerful organisation, and depute its representatives J. Chakste and Z. A. Meierovics to Stockhol and from thence to Paris, where they took part in the pea negotiations. On Nov. 30 1917, shortly after the Bolshevi revolution, the Latvian National Council, under the leadersh of V. Zamuels, was formed in Walk, Riga having been und German occupation since September. The National Counc issued an exhortation to the people to make practical use of th right of self-determination proclaimed by President Wilso The delegations sent to Paris and London were vested with fu powers by the National Council in Walk. The Brest-Litovs Treaty of 1918 was most emphatically rejected by the Latvia National Council. Solemn protest was raised against the di memberment of the Latvian nation by the then leaders of Ge many's eastern policy, which purported to create a Duchy Courland in personal union with the Kingdom of Prussia, an to make of Livland, Estonia and the adjacent islands a Balt state under German suzerainty. Latgale was to be ceded Russia in order to lend another direction to Polish irredentism Germany's Baltic policy was really introduced by the agraria regulation of Field-Marshal Hindenburg of July 17 1918 for th colonisation of Courland. A colonisation union, after the Germa pattern, was formed in Courland, at the disposal of which on third of the landed property of the Baltic nobility was volu tarily placed. The Hindenburg agrarian order nullified Balt private rights in respect of land agreements for a period of years, but made no provision for Latvian peasants.

The Allied victory in the autumn of 1918 frustrated the plans. The Democratic Bloc led by K. Ulmanis was formed Riga, and pursued the aims of the National Council in Wal After the collapse of German power in the Baltic, the Dem cratic Bloc gained a firmer footing and by Nov. 18 1918 th members of the Refugees' Committee in Petrograd and those the Walk National Council had arrived in Riga. The All-Latvi National Council was composed of representatives of the pea antry, of the workmen, making together two-thirds, while th last third was made up of the representatives of Latvian me chants and manufacturers, house-owners and national minor ties, of whom the representatives of the liberal Balts wer particularly active.

Independence.—The *de facto* recognition of the Latvian Na tional Council by Great Britain on Nov. 11, and shortly afte wards by other Powers, led to the solemn proclamation of th Latvian Republic on Nov. 18 1918. A provisional governmen was formed under K. Ulmanis pending the convocation of Constituent Assembly. J. Chakste, a barrister and former Lat vian deputy in the Russian Duma, was elected president of th National Council, then president of the Constituent Assembl and eventually by the Parliaments of 1922 and 1925, presiden of the republic.

The Provisional Govt. was practically penniless, and lacke military power. The Latvian regular troops, left in the lurc by the Russians, had retreated before the advancing German from the Dvina front to Russia, where their sense of disciplin was exploited by successive governments. Only after the con clusion of the Latvo-Russian peace treaty in 1920 were they able to return home. The work of national organisation wa rupted by Bolshevist invasion until May 22 1919. The isional Govt. and the National Council retired, under Bol- st pressure, to Libau, where they held their ground with elp of troops mobilised in Courland. A Latvian Army was ed, commanded first by Col. Kolpaks, and after his death ol. (General) Balodis. The German-Baltic Landeswehr also d the anti-Bolshevist front. Libau was then the seat of the nan occupation administration under Gen. von der Goltz. social democrat Winnig functioned as representative of the nan Government. Amidst these chaotic conditions the Ger- "Putsch" of April 16 1919 was foiled in the attempt to hrow the Cabinet of K. Ulmanis.

ie loyal forces, with the Baltic Landeswehr, advanced nst the Bolsheviks, liberated Riga on May 22 1919 and ned the enemy to the Russian frontier. Similar operations conducted in North Livland by the North Latvian Army r Col. Semitan, with whom the Estonians sided against the neviks. After the failure of the second adventure of the nan Balts near Wenden, the Provisional Govt. headed by lmanis returned to the capital on July 7 1919 and resumed vork of organising the state, despite the obstacles presented continuous state of war. The complete repulse of the Bol- ists would have been effected much sooner had Riga not attacked on Oct. 8 1919 by the "Bermondt-Avalov" os, composed of Russians and Germans in disguise, insti- d by the Baltic nobility. This invasion from the direction ithuania and Courland was liquidated by the end of Nov. with the help of British and French naval artillery. Latgale liberated from the Bolshevists in Jan. 1920 by combined sh-Latvian action; all Latvian territory was now free. With nany, which had assumed the protection of the Bermondt os, an agreement was made on July 15 1920 for the resump- of normal relations. Peace was concluded with Russia on 11 1920.

eanwhile the Latvian Constituent Assembly had met on 1 1920 and elected Mr. J. Chakste to the presidency. The stituent Assembly, summoned by general vote, passed the rian law of Sept. 16 1920, which liquidated the system of anded properties, and placed the expropriated land at the osal of a special land fund. The landlords were left in pos- on of a certain portion of their estates, not larger than 50 ares, with live stock and inventory. The law limits the area ne new farms to 22 hectares. In this way the number of l farms was increased to over 200,000 and the state was ed on a firm social basis (*see* FINANCIAL AND ECONOMIC HIS- , below). Many other important laws were passed, *e.g.*, Free Port Law of May 20 1920.

litical Parties.—The first Latvian Parliament, which met on 7 1922, consisted of 62 non-Socialist and 38 Socialist members. ne second Parliament, elected in Oct. 1925, there were 63 non- lists, and only 37 Social Democrats, four of whom belong to Revisionist branch. Communism is weak in Latvia, and is y banned. The non-Socialist deputies are divided among al parties. Many non-Socialists are returned by the peasantry. ne second Parliament, for instance, the Farmers Bloc, including sentatives of the so-called Young Farmers, was 27 strong. The speople elected representatives of the middle classes, besides Social Democrat deputies. There is also a conservative repre- tion originating from the parishes. The number of parties is y due to the system of proportional representation, which en- every 100 electors to add to the list of candidates. Moreover minorities form national groups in Parliament. In the second ament there were 5 Germans, 5 Russians, 2 Poles, 4 Jews.

ne Social Democrats adhere to the Second International, and l for the promotion of industry, protective labour legislation, the international neutralisation of Latvia. The Farmers' Union l for development of agriculture, for protective duties, ameliora- credits, restoration of the devastated regions, in general for sifying agriculture, and for efficient means of defence, civil , property rights and, politically, for a union of the Baltic es. The Democratic Centre share radical democratic views based ever, on the sovereignty of the state. The groups of the Right, xample, the National Christians, are strongly clerical. Another on represents trade and industry. The different Latgallian es present a variety of local demands, though they side with corresponding Lettish parties in questions of general State y. In ecclesiastical matters certain groups of the Left demand eparation of the Church from the state and the cessation of the state subsidy to the Church. The racial minorities make special demands, the Jews asking for extensive modifications in the law regarding citizenship, while others watch the interests of the landowners dispossessed under the Agrarian Reform laws.

Foreign Relations.—In the sphere of foreign policy the idea of a Baltic States Union is predominant. The so-called "small" programme seeks a union with Estonia and Lithuania—a lesser group advocating a Baltic Union embracing Finland and Poland. Towards proposals for a four-state-union excluding Poland, Finland maintains an attitude of reserve. In accordance with the Latvo-Estonian Treaty of Nov. 1 1923 negotiations were undertaken for a Customs Union between these two states. Latvia also entered into a defensive alliance with Estonia. No passports or visas are required for nationals crossing the Latvo-Estonian frontier. Negotiations with Poland led only to the conclusion of a consular convention. With Finland, as with the Scandinavian states, a treaty of commerce has been concluded, together with an arbitration agreement which was signed by the representatives of Latvia, Estonia, Finland and Poland at the conference of the Baltic states in Helsingfors in 1924. Latvia has also entered into a number of trade agreements and legal protection treaties with the European Powers, in particular a Treaty of Commerce and Navigation with Great Britain on July 22 1923, a trade convention with France on Oct. 29 1924, as well as trade agreements with Switzerland, Czechoslovakia, Turkey, Hungary, Austria, Japan, Belgium, Italy and the United States. In its trade agreements Latvia makes provision for the so-called Baltic and Russian clause, reserving the possibility of closer economic contact with the Baltic states and the development of transit traffic with Russia, which was facilitated by the technical agreements concluded in Aug. 1924. Relations with Russia are good and becoming more and more normal.

Latvia joined the Permanent Court of International Justice at The Hague, and couples the conclusion of trade agreements with the signature of legal protection and arbitration conventions. Negotiations for an economic treaty were begun with Lithuania on May 19 1924. With Germany an agreement was reached in principle regarding an arbitration convention and mutual settlement of claims.

As Latvia was recognised *de jure* by the Great Powers on Jan. 26 1921, and admitted to the League of Nations on Sept. 22 of the same year, diplomatic relations are maintained with the corresponding states. A concordat was signed with the Holy See on May 30 1922.

III. ADMINISTRATION, EDUCATION, ETC.

There are some 6,000 state officials. Teachers, judges, foresters, railwaymen, the agents and employees of government enterprises and monopolies are paid by the state. The Latvian Army is directed by experienced staff officers and graduates of the Riga Officers' School, who complete their military education in France and in Poland. Apart from the regular army there is a territorial voluntary defence force, divided into regiments and companies after the model of the Finnish Defence Corps. The Latvian Defence Corps include cavalry and cyclist companies. Military games and rifle clubs are also popular. The young people receive military training, and the Boy Scout movement is well developed in Latvia.

The whole country is divided into 19 administrative districts and 3 prefectures: Riga, Libau, Daugavpils. Extensive autonomy is granted to the towns and parishes. The smallest units of rural self-government are the rural communes, of which there are about 510 in all. Markets are held in 80 towns and villages, 37 of these having town councils.

Justice.—The administration of justice is entrusted to the justices of the peace, four district courts, the Court of Appeals and the Senate. The judges cannot be dismissed from office. The old local Baltic provincial law is still in force; and in Latgale the Russian law in part, pending codification. As the constitution provides only for a single legislative Chamber, the Saeima, the functions of a second Chamber are to some extent fulfilled by various committees in the different departments, as, for example, the financial council attached to the Ministry of Finance, the Agricultural Council to the Ministry of Agriculture, special committees for music, theatres, etc., attached to the Ministry of Education, and so forth. Civil interests are protected by numerous recognised associations, as chambers of commerce, guilds, etc.

Vital Statistics.—The bulk of the population of Latvia are engaged in agriculture, only 35% of the population being urban. 41,172 births and 28,399 deaths were registered in 1924.

Co-operation.—The co-operative system is widespread and both consumers' and agricultural societies are largely developed. The system of social clubs and unions is extensively adopted in rural districts, and is generously supported by the so-called Culture Fund created by levying a 3 % tax on railway tickets. It has thus been possible to establish public libraries, co-operative houses, etc., in the country. Education is further promoted by an itinerant theatre, several provincial theatres, and an opera house in Libau ranking second to the National Opera House in Riga.

Education and Culture.—School attendance is compulsory in Latvia. In addition to the public elementary schools there are secondary schools, commercial colleges, several language institutes, and other advanced and specialised educational institutions. Illiterates form only 8·5 % of the population, and for every 100,000 of the population there are 300 university students. The study of German or English is compulsory in the middle schools, German holding the first place; French and Russian are optional. Due encouragement is also given to the elementary and middle schools of the national minorities in the form of state grants to German, Russian, Jewish and Polish schools.

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IV. FINANCIAL AND ECONOMIC HISTORY

Latvia lost nearly 40% of her population in the World War, mainly by emigration in consequence of the German invasion. Hardly 300,000 have returned out of the refugee population of 1915–7. The greater part of the missing, near 650,000, perished. Almost all the industries and the industrial population were evacuated to Russia; 10,000 farms were utterly destroyed. Machinery and equipment of industries employing over 100,000 factory hands were sent to Russia in 20,000 railway trucks. Of these the Bolshevists have restored barely 200 trucks under the Peace Treaty of Aug. 13 1920. In Courland the population and cultivated areas at the time of the German occupation, 1915 to 1918, had diminished to one-third. Over half of the farms were destroyed or stood empty.

Production—Cultivated Areas.

	1909–13 hectares	1920 hectares	1924 hectares
Rye	351,000	196,000	266,000
Wheat	33,000	16,000	43,000
Barley	191,000	124,000	179,000
Oats	306,000	216,000	334,000
Mixed grain	. .	46,000	77,000
Peas	23,000	20,000	39,000
Potatoes	80,000	49,000	75,000
Flax	70,000	30,000	60,000

The total cultivated area was thus in 1924, except for mixed grain, 996,000 hectares, *i.e.*, 5·2 % less than in 1909–13.

The harvests were:—

	1909–13 metric tons	1920 metric tons	1924 metric tons
Rye	325,000	119,000	199,000
Wheat	38,000	11,000	43,000
Barley	173,000	66,000	162,000
Oats	279,000	113,000	271,000
Mixed grain	. .	29,000	76,000
Peas	18,000	13,000	35,000
Potatoes	639,000	375,000	676,000
Flax fibre	30,000	10,000	25,000
Flax seed	25,000	10,000	26,000

The grain harvest, apart from mixed grain, reached 833,000 metric tons in 1909–13, in 1920 only 322,000, in 1924 only 710,000. Only the potato harvest reached its pre-War figure, the linseed crop was the same, the flax fibre one-sixth less. Four-fifths of the flax fibre harvest is exported.

Finances.—When the Latvian Republic was formed on Nov. 18 1918, the country was greatly impoverished owing to the requisitioning of corn, cattle, horses, etc., by the German armies of occupation, though part of the supplies which could not be carried away were sold back to the peasants on the evacuation of the troops. In April 1919, a new paper currency, the Latvian rouble, was issued by the Govt., which continued for a considerable period to finance its requirements by this means, with the result that the exchange in terms of sterling rose from 215·5 roubles on Jan. 1 1920, to 2,000–2,400 roubles in May 1921. After the demobilisation of the arm the autumn of 1920, the fresh issues of currency were mainly production purposes, and flax, hides and linseed were purchase this means from the peasants. The sale of the stocks thus acqu brought in 2,000,000,000 paper roubles to the state and enabled Finance Minister in office in March 1921, Ringold Kalning, to r the value of the rouble to 1,140 to the pound sterling, at which p it was stabilised. The currency was backed by gold to the valu 15,000,000 gold francs and by foreign balances amounting to 7,7 000 gold francs. The lat (=gold franc) was fixed at a value o paper roubles, and the 2,270,000,000 paper roubles in circulat were thus covered to the extent of about 50 % in gold. In 1923 Bank of Latvia was founded and provided by the state with a cap of 10,000,000 lats.

The total foreign debt amounted to 39,360,000 lats in the mi of 1922, of which one-third had been paid off by the middle of 1 At the end of 1925 there remains a debt of 5,500,000 dollars to United States for famine relief in the summer of 1919, and of ab £1,350,000 newly regulated debt to England for War deliveries. finances in the last three years have been very soundly handl not only has the foreign debt been considerably reduced, but lo to the value of 30,000,000 lats were made from current revenue. Budget of 1925–6 provides for further loans amounting to 35,0 000 lats from current revenue for agricultural purposes and for construction of railways. The actual revenue for 1924–5 amoun to 215,680,000 lats and expenditure to 214,000,000. The Budget 1925–6 balances at 160,000,000 lats (excluding railway receipts the expenses of the spirits monopoly).

Trade.—Latvia's trade balance has been adverse since 1920. official figures showed the following results:—

Calendar year	Imports (In millions of gold lats)	Exports (In millions of gold-lats)
1920	97·0	62·3
1921	73·4	28·9
1922	107·4	102·0
1923	211·9	162·0
1924	256·4	170·6

But an inquiry undertaken by the Latvian "Ekonomists" 1925 No. 22 showed that the import figures were 10 % too high.

Taking into consideration the circumstance that the 221,000 r gees who had returned since the middle of 1920 had brought bac least 33,000,000 lats, that moreover the Letts who had emigrate America had remitted at least 33,000,000 to Latvia, that good transit to Soviet Russia brought in 18,000,000, that unregiste exports amounted to about 40,000,000, etc., the "Ekonomis reckoned that the balance of payments to Jan. 1 1925, in reality sho a surplus of 3,000,000 lats in favour of Latvia. The present wr considers, after comparing the figures of the Latvian exports those of English statistics of imports, that the Latvian ex figures are about 10 % too low, so that in reality a surplus of ab 55,000,000 lats would result in the Latvian balance sheet from 1 to Jan. 1 1925. In the year 1925, the imports, according to off statistics, amounted to 280,000,000, the exports to 179,600,000 la

By reducing the import figure by 10 %, and raising the ex figure by 10 %, the adverse balance is reduced from 70,000,000 41,000,000 lats. But unsold imported goods valued at 70,000,000 said to be in Latvian warehouses. Meanwhile the adverse bala has created such anxiety, that Parliament decided in 1926 to incre the existing high customs duties of 20 % to 100 %.

Latvia's chief exports are timber amounting to about 60,000,000 l about four-fifths of which goes to England, and flax export amount to about 20,000 tons, valued at 50,000,000 lats. In the calen year (1925) the butter export was estimated to be 7,150,000 k grammes, valued at 30,300,000 lats.

The chief imports are textiles, 50,000,000 lats, machines 24,000,0 foodstuffs 70,000,000. In 1924 110,000 tons of rye and wheat w imported, 20,000 tons of sugar, 4,000,000 lats worth of tobacco. T imports of tea and coffee are small, also of fruits, on account of high customs duties.

Agrarian Reform.—Under the agrarian laws, 499 private esta were appropriated in Courland with an area of 1,124,000 hecta in Livonia 1,300,000 hectares; in Latgale about 750,000 hecta But from this area must be deducted the old peasant properties, a forest and uncultivable land. In reality there remained for divis among the newly established peasant properties in Livonia and Co land only an area of 832,000 hectares of agricultural land, *i.e.*, ara meadow and grazing land, in Latgale rather more than 250,0 hectares. Up to June 15 1925, 82,761 new farms were establish enclosing 100,000 hectares of forest land. The newly founded peasa properties consisted of 15 to 17 hectares, the largest to 22 hecta But included in the above-mentioned 82,761 new farms are abo one-third garden and artisans' holdings with an area of about 2 to hectares. A further 20,000 small holdings are to be established. T state has retained about 1,500,000 hectares of forest and abo 500,000 hectares of uncultivable land, chiefly peat moor; the form landowning nobility have only retained 50 hectares of land each.

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UE, MAX VON (1879–), German physicist, was born
9 1879 at Pfaffendorf near Coblenz. He attended the uni-
ties of Strasbourg, Göttingen and Munich, and became an
tant in the University of Berlin, and later in Munich, being
equently called to the University of Zürich as professor.
here he went to the newly formed University of Frankfurt
the Main), finally proceeding to Berlin University as a
tor of the Institute for Theoretical Physics. He specialised
neoretical physics, and is regarded as one of the most
us champions of modern theories, and especially of Ein-
's theory of relativity. He also devoted his attention to
quantum theory, to the Compton-effect (alteration of the
iency of Röntgen rays), to Bohr's atomic model, to the
nstein-Bohr equation" and the disintegration of atoms.
914 he was awarded the Nobel prize for physics. Besides his
for scientific publications, he also writes for the daily Press.

ce 1910 he has published the following books: *Ueber e. Versuch*
ptik d. bewegten Körper (1911); *Die Beugungserscheinungen an*
unregelmässig verteilten Teilchen (1915); *Ueber d. Möglichkeit*
Versuche an Glühelektroden (1919); *Die Relativitatstheorie*
); *Ueber d. Auffindung d. Röntgen-strahlinterferenzen* (1920); *Das*
kalische Weltbild (1921); *Die Bedeutung d. Nullkegels in d.*
neinen Relativitätstheorie (1922); *Die Lösungen d. Feldgleichungen*
hwere v. Schwarzschild (1923); *Zur Theorie d. v. glühenden Metal-*
usgesandten positiven Ionen und Elektronen (1924); and with
V. Gordon, *Ein Verfahren z. Bestimmung d. Wärmeleitfähigkeit*
lühtemperaturen (1922).

UNDRY WORK (*see* 16.282).—Modern laundry work in its
nercial aspect requires an elaborate mechanical plant very
ent from the crude appliances which were the first out-
th of domestic processes of treading, pounding or rubbing.
ccess owes much also to chemistry, by which suitable soaps,
hes and solvents have been evolved.

chinery.—The washing-machine consists of a horizontal
drum in which revolves the inner cylindrical cage which
the clothes. This cage is divided into compartments of
us sizes, thereby offering a chance for sorting the clothes
so reducing, or almost eliminating, the need of marking
ents. Within each compartment, wash bags, "nets," are
ently used to hold fabrics of the same kind, thereby safe-
ling delicate garments. The machine is equipped with hot
old water and high-pressure steam, the latter serving as a
ng as well as a sterilising medium. With the rotation of the
which is reversed by automatic gearing every few revolu-
the clothes are rubbed or pounded, producing a displace-
of dirt through the soap and water which are forced through
bric. The operations of soaking, washing, bleaching (when
d), sterilising, rinsing, blueing and even starching, are
in the machine without removal of the garments and often
ut inspection during the process. Sterilising was formerly
nplished through boiling (212° F.), a process which, due to
ndency to weaken the fabric, has been replaced by keeping
arments at about 180° F. for a time sufficient to effect the
. Stains insoluble by soap and water require special chem-
leansing (*see* DRY CLEANING).

e process of drying, formerly accomplished by twisting by
or pressing between hard rubber revolving wringers, is
ed industrially by machines which in recent years, have
adapted for use in the home (*see* HOUSEHOLD APPLIANCES).
xtractor consists of a metal basket revolving in a closed
drum. There are two types, the "under-driven" and
over-driven." The latter is used for the heavy-type work
he wet-wash or bundle work. The basket makes 1,000
100 revolutions a minute, the water being expelled by
fugal force until the desired degree of dryness is attained.
rying is completed by means of box dryers, which, in their
improved form, consist of a heated revolving cage, called a
tumbler, within which hot air is agitated by means of suction fans and blowers. This device prevents the yellowing and scorching of fabrics through excessive heat and eliminates the adherence of lint to the clothes. A softer finish also is imparted by this means to woollen garments and the time required for finishing is greatly reduced.

Ironing.—Having been washed, starched and dried, the garments are then transferred to the ironer. The earlier form of ironer was the box mangle, by which clothes were calendered as in paper or textile manufacturing. This mangle, sometimes known as the "flat-work ironer," has been replaced in more up-to-date laundries by gas and steam-heated revolving rolls, which press against concave beds of polished metal or over-felted rolls, as a flat iron is used on a padded ironing table. Ironers may be operated by hand, gas, gasolene, electricity or steam. While it was formerly customary for laundries to charge for work by the piece, a "rough dry" service has been widely offered, in which the cost is based on weight, none of the work being ironed. Another service is "float iron," in which everything is pressed by the "flat-work ironer," the cost being considerably less than for work finished by hand.

Statistics.—The annual volume of business done by laundries in the United States in 1923–5 was between $300,000,000 and $500,000,000. The production of laundry machinery in 1923 was valued at $19,000,000, an increase of 46% over the corresponding figure for 1921. In the same period the output of home washing-machines increased 69%, standing at $57,000,000 in 1923. These increases reflect several economic and social factors, the more important being an increase in wealth and the scarcity of domestic help, both of which have operated to transfer laundering from the home to central plants. The same factors have led to the installation of numerous electric washers and ironers in the home. The popularity of light, delicate fabrics in women's garments together with the lavish use of colour have placed an added burden on laundries, making necessary the services of textile experts. The interests of the industry are furthered by laboratories, research bureaux and professional schools financed by the trade. Trade papers, courses in technical schools, co-operation among operators, and other factors have done much to improve the status and efficiency of the industry.

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LAURIER, SIR WILFRID (1841–1919), Canadian statesman (*see* 16.286), was defeated at the general election in 1911, but remained leader of the Opposition until his death. Previous to the dissolution of Parliament in 1911, he had begun negotiations for reciprocity with the United States which was vigorously opposed in the Dominion House of Commons, and was, in a manner, responsible for the fall of his party. The Banking Act introduced by the Conservative party was much on the same lines as that outlined by Sir Wilfrid during the last years of his administration. In the prolonged naval debate in 1913 Sir Wilfrid urged the maintenance of a purely Canadian Navy. At the outbreak of the World War in 1914 he eloquently defended Great Britain's cause and supported the urgent measures that were adopted for the maintenance of the Canadian troops. He was however strongly opposed to conscription on the ground that it was a departure from the enactments of the Military Service Act, and a still wider departure from the principles of constitutional government. When Sir Robert Borden was invited to attend continuous meetings of the War Cabinet in London, Sir Wilfrid expressed his desire to facilitate public business in Canada in order to make the absence of the Premier possible. He declined, however, to enter the Cabinet in the Coalition Government. In 1918 Sir Wilfrid took part in the debate on hereditary titles and honours in Canada and was pronounced in his utterances against them. He died in Ottawa Feb. 17 1919.

LAUSANNE, CONFERENCE OF:—The Conference of Lausanne, between the Turkish Govt. established at Angora, and the governments of the four principal Allied Powers (Great Britain, France, Italy, Japan), Greece, Bulgaria and Yugoslavia, with the United States represented by an observer, lasted, with a break in the middle, from Nov. 20 1922 to July 24 1923, and resulted in the signatures of no less than 17 diplomatic instruments.

The most important of these were:—

1. The Treaty of Peace itself (July 24 1923).
2. Convention respecting the régime of the Straits (July 24 1923).
3. Convention respecting the Thracian frontiers (July 24 1923), under which neutralised and demilitarised zones were established.
4. Convention respecting conditions of residence and business and jurisdiction in Turkey (July 24 1923), to replace the capitulations.
5. Commercial convention (July 24 1923).
6. Convention respecting the exchange of Greek and Turkish populations and protocol (Jan. 30 1923).
7. Greco-Turkish agreement on the restitution of interned civilians and the exchange of prisoners of war (Jan. 30 1923).
8. Declaration relating to the administration of justice (July 24 1923) to replace the capitulations (No. 11).
9. A protocol relating to the evacuation of the Turkish territory occupied by the British, French and Italian forces, and declaration (July 24 1923) (No. 14).
10. Protocol relating to the Karagach territory, and to the islands Imbros and Tenedos (July 24 1923) (No. 15).
11. Protocol relating to treaties regarding the protection of minorities in Greece, and regarding Thrace, which had been concluded on Aug. 10 1920 between Greece and the principal Allied Powers (July 24 1923) (No. 16). (*See* DARDANELLES; DEDEAGAACH; MOSUL; TURKEY.)

Conditions before the Conference.—The Lausanne Conference took place under conditions quite different from those which had prevailed during the Peace Conference of Paris, and the resulting diplomatic instruments therefore bore a different stamp from the four European peace treaties and the instruments subsidiary to them. At the time of the Paris Conference the Powers just defeated in the War of 1914–8 had been temporarily impotent, and the victorious Powers had agreed among themselves as to what the terms of peace should be. The draft treaties embodying inter-Allied agreements had simply been submitted to the defeated Powers for their observations, which the victors had then accepted or rejected at their discretion, after which the vanquished parties had been compelled to sign the instruments by *force majeure.* At the conference of San Remo (*q.v.*) a peace treaty between the Allies and Turkey had been drawn up by the same procedure, and after the representatives of the Ottoman Govt. of Constantinople had submitted their observations, and these observations had been rejected, they were compelled, at Sèvres, on Aug. 10 1920, to sign the terms presented to them. By this time, however, the Constantinople Govt. had ceased to exercise any authority in Turkey outside the narrow areas under the military occupation of the principal Allied Powers. The greater part of the country was under the effective control of a new national government seated at Angora; and this Govt. was carrying on a war against the Greeks (who had landed at Smyrna on May 16 1919, at the invitation of Great Britain, France and the United States).

The Angora Govt. repudiated the Treaty of Sèvres, and continued to fight for the terms laid down in the Turkish National Pact of Jan. 28 1920. In Sept. 1922 the Greco-Turkish War in Anatolia was brought to a decision by the complete victory of the Turkish Nationalist forces, who drove the Greeks into the sea, and came into direct contact with the British forces in the zone of the Straits. On Sept. 23 1922 the principal Allied Powers invited the Angora Govt. to a peace conference on two bases: (1) the restoration of Turkish sovereignty over Constantinople and Thrace up to the line of the river Maritsa; (2) the exclusion, pending the final settlement of Turkish military forces from Thrace, and respect by the Turks for certain zones adjoining the Straits which the Allied authorities had declared neutral during the Greco-Turkish conflict. On Sept. 23 the Angora Govt. accepted this invitation, and proposed a preliminary armistice conference, which met at Mudania on Oct. 3 and resulted in the signature of an armistice convention on the 11th.

Results of the Conference.—Thus the Turkish delegates came to Lausanne as victors in their recent local war with the Greeks, and on an equal footing with the principal Allied Powers. by whom they had been defeated four years earlier in the War 1914–8. Indeed, during the whole period of the Lausanne co ference, the Turks were less unwilling to resume hostilities tha were the principal Allied Powers, who had long ago demobilise the greater part of their forces in the East under pressure fro their taxpayers, and who could now no longer call upon t Greeks to fight their battles for them. This complete revers of the situation reflected itself in the contrast between the ter of the Treaty of Lausanne and the Treaty of Sèvres, as well in the method by which the Lausanne conference was conducte This conference was noteworthy as the first meeting betwe ex-allies and ex-enemies in the World War, in which peace w negotiated and not dictated. In this respect it anticipated t London reparations conference of 1924 and the Locarno securi conference of 1925.

The Turkish Gains.—In brief, the Turks secured at Lausan practically everything which they had demanded in the national pact. In respect of territorial boundaries, the form Arab provinces of Asiatic Turkey, which had been detached fro Turkey as a result of the World War and had been mandated France and Britain under the supervision of the League Nations, were not restored, but otherwise Turkey recover everything which she had possessed in 1914, particularly Smyrn Constantinople and Eastern Thrace. Even as regarded the Ar territories, she obtained some concessions, since the Lausan Treaty confirmed the rectification of the northern frontier Syria in Turkey's favour, which had been made by the so-call "Franklin-Bouillon" Agreement of Oct. 20 1921, while t destiny of the Mosul province was referred, by agreement b tween Turkey and Great Britain, to the League of Nation In regard to the Dardanelles and the Bosporus, the settleme made at Lausanne has been described elsewhere (*see* DARD NELLES). The special spheres of influence in Anatolia whi had been assigned to France and Italy by a tripartite agreeme of Aug. 10 1920, between these two Powers and Great Britai were tacitly dropped, and there was no further question giving autonomy to Northern Kurdistan or of ceding Turki territory to the Armenian Republic of Erivan, which had no been included in the dominions of Turkey's ally, the Union Socialist Soviet Republics.

Again, no restrictions were imposed on the Turkish naval a military forces, and no control was asserted by the Allies ov Turkish finance, though certain financial questions, such as t rate of exchange at which the pre-War creditors of Turkey we to receive payments, remained contentious. The capitulatio under which foreign residents in Turkey had lived since the 16 century were swept away, and the only special safeguard left foreigners was the institution of legal councillors, without exec tive power, who were to be nationals of ex-neutral states. for such minorities as remained in Turkey after the great exod of Christians from Anatolia and Eastern Thrace which acco panied the Greek débâcle of 1922, it was settled at Lausan that they should receive all, and only, the guarantees which h been secured to minorities in Europe in the special minorit treaties or minority clauses in the peace treaties signed aft the World War. Meanwhile, on Jan. 30 1923, the Greek a Turkish delegations had signed a separate convention providi for the compulsory interchange of minorities left on the wro side of the new frontier, with a special exemption in favour Christians domiciled in the city of Constantinople, and of Mo lems domiciled in Western Thrace.

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LAVERAN, CHARLES LOUIS ALPHONSE (1845–1922), Fren physician, was born in Paris June 18 1845 and was educated a the Strasbourg faculty of medicine. In 1874 he joined the st of the Val-de-Grâce military school of medicine, and four yea later was sent to Algeria. He remained there until 1883 and i was appointed professor of military hygiene and clinical cine at Val-de-Grâce. In 1894 he relinquished these posts took up work at Lille and Nantes. He was in 1895 elected mber of the French Academy of Science. His chief contribu- to medical science was his discovery of the *hématozoaire*, a site that causes malarial fever. He was the author of im- ant studies of sleeping sickness and of the rôle played by quitoes in epidemics. Laveran, who retired from active tice in 1897 and received the Nobel Prize for medicine in ; died in Paris May 18 1922.

s works include *Traité des maladies et des épidémies des armées*); *Du Paludisme et son hématozoaire* (1891); *La prophylaxie du disme* (1903); with Félix Mesnil, *Trypanosomes et trypanoso- es* (1912).

AW, ANDREW BONAR (1858–1923), British statesman, was in New Brunswick, Canada, Sept. 16 1858, the son of a byterian minister, the Rev. James Law, by his marriage Eliza, daughter of William Kidston of Glasgow. A Scot on sides, he came to Scotland when still a boy and finished his cation at Glasgow High School. He entered at once into mercial life in Glasgow, and became a member of a kins- 's firm, William Kidston and Sons, iron merchants, subse- ntly joining William Jacks & Co., also iron merchants. er acquiring a sufficient competence in business, he went into liament in 1900 as Conservative member for the Blackfriars sion of Glasgow.

lis commercial experience had led him to the conclusion t free trade, in the Cobdenite sense, was no longer beneficial Great Britain. A speech which he made on April 22 1902, in our of Hicks-Beach's corn duty, having favourably impressed House, he was promptly appointed parliamentary secretary he board of trade in the Conservative Government. When Mr. mberlain started his tariff reform movement in 1903, he nd a warm supporter in Mr. Law, who wished to see more material imported and fewer manufactured goods, who nted "dumping," and who held the true field of commercial ansion to be within the Empire and therefore advocated pref- ntial duties. Mr. Law shared in the general rout of the nservatives in Jan. 1906, and had another electoral mishap in c. 1910; but in each case came back to the House shortly at a election, and took his full share in the Opposition attack on Lloyd George's 1909 budget and on the Parliament Bill. kept aloof from the "Die-hard" movement, and warmly ended his leader, Mr. Balfour, from the reproaches cast upon . This loyal attitude, no doubt, was one of the reasons, and strong Tariff Reform programme was another, which rec- mended him to his party as Mr. Balfour's successor in the dership when the claims of Mr. (afterwards Sir) Austen amberlain and Mr. (afterwards Lord) Long appeared to ide the Conservatives pretty evenly. Both the rivals stood aside, d on Nov. 13 1911 Mr. Law was unanimously elected leader the Commons, Lord Lansdowne continuing to lead the party the Lords.

As Opposition leader, Mr. Law was very trenchant in his ticism of the Government, and put up a strong fight against ministerial bills introduced to take advantage of the Par- ment Act, his principal concern being the Home Rule Bill, d the situation created in Ireland by its introduction. At ster 1912 he went to Belfast, and, at a great demonstration esided over by Sir E. Carson, encouraged the Ulstermen to ist to themselves; and at a large Unionist gathering at Blen- im on July 27 he said that the Ulster people would submit to no cendancy, and that he could imagine no lengths of resistance which they might go in which he would not be ready to support em, and in which they would not be supported by the over- elming majority of the British people. Meanwhile, he had to al with differences inside his own party as to the extent to ich the Tariff Reform policy should be carried. A con- lerable section, especially strong in Lancashire, were definitely ainst any duties on food; and the assurances which Mr. Law ve in a speech at Ashton-under-Lyne on Dec 16 1912 did not nvince them that there was no possibility of food taxes being imposed without reference to the people. As the party dreaded a split, Mr. Law and Lord Lansdowne, in response to a general appeal, gave on Jan 14 1913 a formal promise that food duties should not be imposed without the approval of the electors at a subsequent general election. The imminent danger of the Ulster problem, on which Mr. Law had insisted for two years, brought ministers in 1914 to express a readiness for compromise; but no settlement, satisfactory to the Opposition, had been formed when the World War supervened.

Directly the crisis became acute Mr. Law wrote, on Sunday Aug. 2, on behalf of Lord Lansdowne and their colleagues, tendering to Mr. Asquith the unhesitating support of the Opposition in any measures necessary to support France and Russia; and when hostilities began he aided the national cause and promoted recruiting by speeches at the Guildhall, London, and in Belfast and elsewhere. Even when criticism of the management of the War began legitimately to spring up in the early months of 1915, he used his influence to repress or moderate its expression in Parliament. He promptly accepted Mr. Asquith's proposal in 1915 to assist in forming a Coalition Govt. and brought seven of his colleagues into the Cabinet, accepting himself the Colonial Secretaryship. He took charge in the House of Commons of the first military service bill in Jan. 1916 and got it through all its stages with little difficulty. He promoted the economic conference in Paris in June 1916 and, as principal representative of his country, was largely influential in carrying through the co-operative and protective resolutions then adopted. He was a member of the War Committee of the Cabinet, but, like Mr. Lloyd George, he was far from satisfied with its organisation and powers. It was natural therefore that he should be one of the four persons, besides Mr. Lloyd George, to whom that statesman, forcing the issue on Dec 1 1916, asked Mr. Asquith to confide the absolute conduct of the War. In the confused crisis which followed, the Premiership was offered to Mr. Law; but he recognised that Mr. Lloyd George was the Prime Minister whom the nation demanded, and to a Ministry formed under him, the Conservative leader brought the full cooperation of his party.

In this second coalition, Mr. Law, whose followers supplied the main body of the ministerial supporters, was partner rather than second-in-command of his chief. Besides Chancellor of the Exchequer and member of the War Cabinet, he became leader of the House of Commons, so as to enable the Prime Minister to devote the whole of his energies to the prosecution of the War. The House was at first disposed to resent this arrangement; but before long its respect and indeed affection were won by its new leader's business habits, his courtesy, his readiness to yield in non-essentials coupled with firmness in essentials, his exceptional clearness of head and of expression, and his extraordinary capacity for impromptu reply, without taking a note, at the close of a long debate on an intricate subject involving perhaps complicated figures.

It was his duty, as Chancellor of the Exchequer, to find the money to meet the gigantic cost of the War, and this was done principally by means of two great loans and by numerous increases of taxation. The first loan was launched in Jan. 1917, and its basis was the issue of a 5% Government Stock at 95, while there was also a 4% tax-compounded loan issued at par. This brought in £1,000,312,950 from 5,289,000 subscribers. The second loan, launched in Oct. of the same year, was in form of National War Bonds, combining the advantages of short-term securities such as Exchequer bonds, and three sorts of longer-dated securities for 7 and 10 years, interest being, as before, 5% or 4% tax-compounded. The amount was unlimited; all the securities were for continuous sale till further notice, so that there might be a steady and persistent flow of money loaned to the State. This novel device was most successful. Down to Jan. 11 1919, £1,446,625,613 of these bonds had been sold, and nearly £50,000,000 small post-office bonds in addition.

Mr. Law's first budget, that of 1917, only raised the excess profits tax from 60 to 80%, and increased the taxes on entertainments, tobacco and dogs. But in his second budget, in 1918, he imposed additional taxation calculated to bring in £114,000,000. Income tax was raised from 5s. to 6s.; farmers' tax was doubled; supertax was increased; the stamp on cheques became 2d.; beer and spirit duties were doubled and tobacco and match and sugar duties raised; letters were to be 1½d. and postcards 1d. It must have been with peculiar gratification that Mr. Law announced in April 1917 that the Imperial War Cabinet had accepted the principle of imperial preference. Throughout the War he opposed a firm front both to pacifists and to pessimists, and never doubted that there could be no peace "until the Germans are beaten and know that they are beaten."

As the general election of 1918 approached he responded heartily to Mr. Lloyd George's proposal that the Coalition should be continued to forward after-War reconstruction, and he joined with him in issuing the letters, or certificates, nicknamed "coupons," accepting coalition candidates. The Coalition obtained an immense majority, and among the Coalitionists Mr. Law's special followers, the Unionists, had a considerable predominance. When the Ministry was reconstituted in Jan. 1919 the arrangement by which Mr. Law led the House was continued, as the Prime Minister would be much away at the Peace Conference; but he was relieved of the Exchequer, and took the sinecure office of Privy Seal. He was one of the British peace plenipotentiaries, though his duties at Westminster seldom permitted him to go to Paris; and he appended his signature to the Treaty of Versailles. During 1919 and 1920 he had a strenuous time, dealing with after-War disorders and projects, and in particular with the passing of the Home Rule Act of 1920, constituting two subordinate Governments and Parliaments in Ireland.

Mr. Law's incessant labours during and after the War undermined his health, which suddenly broke down in March 1921; and, on the advice of his medical advisers, he resigned office at once, and went away to rest in the south of France. His retirement was felt in Parliament as a personal loss, and there was corresponding satisfaction when he returned in the autumn greatly (but not, as it turned out, permanently) restored, and took part in recommending the Irish Treaty to the House of Commons. During the first half, and more, of 1922 he only spoke occasionally, but he watched carefully the increasing reluctance of the Conservative party to support Mr. Lloyd George and the Coalition; a reluctance which had indeed resulted in the formation of a large group of independent "Die-hards" under Lord Salisbury's leadership. When the question was brought to an issue at the Carlton Club meeting on Oct. 19, the decisive factor was Mr. Law's declaration that the only method of preserving the unity of the party was to come out of the Coalition and to appeal to the country as an independent body. Mr. Lloyd George at once resigned, and Mr. Law, after being unanimously elected to his old post of party leader, formed a purely Conservative Government, which did not include the most prominent Conservative Coalitionists. His action was endorsed by the country at the general election in Nov., when the Conservatives returned 344 strong, a majority of 74 over all other parties put together. He at once reduced the inflated Cabinet secretariat, and restored the Foreign Office to its former position in the official hierarchy; and he carried through Parliament the bill to establish the Irish Free State Constitution.

Though he proclaimed the policy of his Government to be one of tranquillity and stability, he found himself in the winter deeply involved in political troubles. Unemployment was rampant, with Labour unrest and housing problems threatening; a European Conference at Lausanne proved impotent in face of the obstinacy of Nationalist Turkey; and M. Poincaré, the French Premier, insisted, in spite of Mr. Law's personal intervention at Paris, on despatching a French military expedition to the Ruhr to exact reparations from Germany. Mr. Baldwin, his Chancellor of the Exchequer, did indeed succeed in concluding in January at Washington an arrangement to fund the British war debt to the United States; but the terms were so severe that the Prime Minister was at first reluctant to accept them. After such an anxious winter it is not surprising that in
the spring his health once more gave way, and he resig
office on Whitsunday, May 20, after a Ministry which
lasted 209 days. He survived for five months, dying on Oct
1923. He was buried in Westminster Abbey, with every sig
general and genuine mourning, the pallbearers including
Prince of Wales, and past, present and future holders of
office of Prime Minister. He married in 1891 Annie Pitca
daughter of Harrington Robley, of Glasgow, by whom he ha
family; but he was left a widower in 1909. Two sons perishe
the World War. (G. E. B

LAWN TENNIS (*see* 16.300).—The recent history of lawn te
may conveniently be dated from the year 1911. In that
the late Anthony Wilding (killed on the Menin Road du
the World War) was defending his title to the world champ
ship he had won in 1910, and one of the Wimbledon champ
ships was won by France for the first time when Max Dec
and André Gobert beat Wilding and Ritchie in the challe
round of the Men's Doubles. In that year, also, Mrs. Lam
Chambers defeated her challenger, Miss Boothby, herself
ex-champion, by 6–0, 6–0.

France might have advanced still further in 1912, but An
Gobert always seemed to be fated to break down at Wimbled
In those days the champion (in this case still A. F. Wildi
had to stand out while the rest of the players fought for
honour of meeting him. Gobert met A. W. Gore, and looke
certain winner until the English player managed to pass
two or three times at the net and broke up his brilliant atta
Gore, however, failed to beat Wilding, who was at this ti
approaching the zenith of his powers.

Wilding and McLoughlin.—The year 1913 can fairly
described as the first big "boom" year in lawn tennis, the rea
being the presence of a great personality. This was a 24-ye
old boy named Maurice McLoughlin, who had won the champi
ship of America the year before. He was called the "Ameri
comet" and, with his merry eyes and his mop of red hair
instantly took the fancy of the great international crowd
Wimbledon. His service was tremendously fast, but swer
and broke as well, and like Tilden's and Patterson's of a la
day, it frequently beat his opponent outright—a feat rar
accomplished in first-class tennis today. It swept him strai
through the competition, past J. C. Parke and S. N. Dou
then at their best, with only one check when Roper Barr
took the match to five sets by sheer finesse. But Wilding
the surprise of everyone, instead of standing back to McLou
lin's service, stood up to it, and after a few failures, seemed
send it back harder the harder it came at him. It was a gr
battle, possibly one of the greatest Wilding ever fought. Ro
Barrett and C. P. Dixon beat the crack German players Ra
and Kleinschroth for the Men's Doubles, while Mrs. Lamb
Chambers, returning after a year's absence, once more won
Ladies' Singles quite easily. The prestige of British tennis
retrieved.

The year 1914 has been very rightly called "Brook
year." Brookes had not been at Wimbledon since 1907 wh
he won his second championship, and there was a good deal
speculation as to whether in view of the improved standard
play he would be able to hold his own. On this occasion
international element was less prominent as the Americ
champion, R. N. Williams, was not competing, but in any ca
judging by form, it is doubtful if he could have beaten Brook
The English players were largely what were coming to be term
"the old guard." Their skill was waning, and it was left to
German, Fritzhein, to give Brookes the most stubborn contes
It was touch and go all the way through the fifth and decidi
set, but the old champion's steadiness and generalship pull
him through. Wilding won the doubles in company wi
Brookes, and, once again, Mrs. Lambert Chambers proved th
she had no really dangerous rival among the women.

G. L. Patterson.—The years of the World War saw litt
championship lawn tennis, even in those countries which we
not directly involved. In America R. N. Williams, W. M
Johnston and Maurice McLoughlin shared the highest honours

, even there, in 1917, there was no competition. But as soon the War was over there was a vigorous revival and a real inning of a world-wide competition. The year 1919 saw ny newcomers with many new styles, but perhaps the most able was the Australian, G. L. Patterson, one of the most ceful players ever seen on a tennis court. His style was not ike that of Maurice McLoughlin, and his fastest service was ost untakable. He depended on it very largely, but, as was wn in the following season, he had weak points of which vantage could be taken once the fierceness of his first onught was checked. In the final he beat A. R. F. Kingscote, English international. In 1919 Mlle. Lenglen beat Mrs. mbert Chambers.

ilden and the "All Court" Game.—In 1920 William T. den, probably the greatest player the world has ever known, de his first appearance in this country, and defeated Patterson, holder of the championship. He was the first American mpion. There was a notable feature about Tilden's victory, indeed about the play of all the Americans. For some e lawn tennis, although increasing in speed, had, in the nion of many of the best judges, been declining in skill and esse. There had for some time been a reign of the serving volleying specialists, but Tilden and his compatriots ught back to England what is known as the all-court game. is tradition, which demands that a player shall be master of ry shot, was first laid down by Renshaw, and Pim, Baddeley, Dohertys and Wilding strengthened it. The ascendancy of all-court game was completed by the victory of Williams and rland in the Men's Doubles.

In 1921 lawn tennis became still more a cosmopolitan game d there was a large increase in the entries for the World ampionship from European countries. The meeting was morable for the contest between Tilden and a young South rican, B. I. C. Norton. The brilliant promise which the latter d shown was naturally gratifying to British spectators, for re had been no British Singles Champions since 1909, only e British finalist in the All-comers since 1912, and no British ly champion since 1914. It was true that Lycett and that remarkably versatile sportsman Max Woosnam had won the Doubles Championship, but this was the only honour which the Empire held, save Lycett's further participation in the Mixed Doubles honour with Miss Ryan. Tilden, although ill, insisted on playing, and almost paid the penalty. The first set opened rather tamely, with Tilden leading, but suddenly Norton blazed out and took the set 6–4. He followed this up by winning the next set 6–2, and the defeat of the champion seemed inevitable. Then there came an inexplicable collapse. Norton lost the next two sets 6–1, 6–love. Nevertheless even then he was able to keep the issue in doubt to the last, and twice was within a stroke of victory and the world championship before he lost the final set, 7–5.

The New Wimbledon.—The New Wimbledon was opened in the following year (1922). The title "world's championships" was dropped, the meeting being now designated simply "the championships." The fact that there were no American entries in 1922 was erroneously attributed to this change. But if there were no Americans there were worthy challengers from Australia. Patterson, the ex-champion, J. O. Anderson and P. O'Hara Wood were a trio of Australia's best and figured in everything until the finish. Patterson, who had seen the wisdom of playing an all-round game, beat Lycett in the championship, but Lycett had his revenge when, in one of the greatest Men's Doubles matches ever fought, he and Anderson, after looking hopelessly beaten, snatched a glorious victory from Anderson's compatriots Patterson and P. O'Hara Wood. Miss Ryan and Mlle. Lenglen won the Doubles, for the fourth year in succession. The latter won the Ladies' Singles, her opponent in the final round being Mrs. Mallory.

An American Year.—America was supreme in 1923. Not only did she win the Davis Cup again, with comparative ease, but also, sending her players over to Wimbledon without the assistance of Tilden, won the championship with W. M. Johnston, while another American, F. T. Hunter, was Johnston's opponent in the final. There was also in Europe in 1923 an American player, Vincent Richards, barely 20 years of age, who certainly had all the promise of becoming as great a champion as his tutor, Tilden.

Winners of the Championships at Wimbledon, 1911–26

Year	Gentlemen's Singles	Ladies' Singles	Gentlemen's Doubles	Mixed Doubles	Ladies' Doubles
911	A. F. Wilding	Lambert Chambers	M. Decugis and A. H. Gobert		
912	A. F. Wilding	Larcombe	H. Roper Barrett and C. P. Dixon		
913	A. F. Wilding	Lambert Chambers	H. Roper Barrett and C. P. Dixon	Hope Crisp and Mrs. Tuckey	McNair and Boothby
914	N. E. Brookes	Lambert Chambers	N. E. Brookes and A. F. Wilding	J. C. Parke and Mrs. Larcombe	Ryan and A. M. Morton
915 8		*No Competitions*			
919	G. L. Patterson	S. Lenglen	R. V. Thomas and P. O'Hara Wood	R. Lycett and Miss Ryan	Lenglen and Ryan
920	W. T. Tilden	S. Lenglen	R. N. Williams and C. S. Garland	G. L. Patterson and Mlle. Lenglen	Lenglen and Ryan
921	W. T. Tilden	S. Lenglen	R. Lycett and M. Woosnam	R. Lycett and Miss Ryan	Lenglen and Ryan
922	G. L. Patterson	S. Lenglen	R. Lycett and J. O. Anderson	P. O'Hara Wood and Mlle. Lenglen	Lenglen and Ryan
923	W. M. Johnston	S. Lenglen	R. Lycett and L. A. Godfree	R. Lycett and Miss Ryan	Lenglen and Ryan
924	J. Borotra	K. McKane	V. Richards and F. T. Hunter	J. B. Gilbert and Miss McKane	Wightman and H. Wills
925	R. Lacoste	S. Lenglen	R. Lacoste and J. Borotra	J. Borotra and Mlle. Lenglen	Lenglen and Ryan
926	J. Borotra	Mrs. L. A. Godfree	H. Cochet and Z. Brugnon	L. A. Godfree and Mrs. Godfree	

Borotra and Lacoste.—The fact that the Olympic games were taking place in Paris a fortnight after Wimbledon, contributed to make the international entry of 1924 one of the greatest in the history of the championship. For the first time the device of "seeding the draw," as it is called, was adopted. Under the old system it was quite possible that, if, say, America's four best players had entered for the championship, their names might come out of the hat one after the other, in which case two would disappear in the first round and one more in the second. This luck of the draw imposed great hardships on players who might have travelled some 6,000 miles to try their luck, and it was decided, internationally, that overseas associations might nominate not more than four players in singles, or four pairs in doubles, as representative players, and that these players should be drawn in four separate quarters of the draw. Smaller numbers were treated proportionately and the result proved excellent. Of course it was still possible that the two best players of two different countries might meet in the first round but that in fact did not occur.

Washer, the hard-hitting Belgian international, disposed of Brookes in the fourth round, and then, in "the last eight" were left Lacoste (France), Washer (Belgium), Williams (America), Kingscote (England), Borotra (France), Richards (America), Raymond (South Africa) and Washbourn (Africa). For the first time two Frenchmen, Jean Borotra and Rene Lacoste, appeared in the final. Borotra's brilliance, on this occasion, triumphed over Lacoste's steadiness, although in the remarkable repetition of that final, for Borotra and Lacoste were to meet again for the title in 1925, the result was reversed in unmistakable fashion. America shared a similar honour in the Men's Doubles, Vincent Richards and F. T. Hunter winning over their fellow countrymen R. Williams and W. Washburn. Owing to illness, Mlle. Lenglen, who should have met the English champion, Miss K. McKane, in the semi-final, was obliged to retire. Miss McKane met Miss Helen Wills, the young player from America of whom much had been heard. After looking almost hopelessly beaten at one time, the English player pulled the game out of the fire and scored a brilliant victory. On the other hand, with the aid of Mrs. Wightman, Miss Wills carried off the Ladies' Doubles, beating Mrs. Covell and Miss McKane. Miss McKane finally held a doubles championship, for, with the English international J. B. Gilbert, she won the Mixed Doubles.

The year 1925 may be claimed as French. Lacoste met and beat Borotra, the champion, in the final, while Borotra and Mlle. Suzanne Lenglen won the Mixed from de Morpurgo and Miss Ryan. Mlle. Lenglen and Miss Ryan got back the title of Doubles Champions which they had held together for so long. French players also did well in 1926, although Mlle. Lenglen was obliged to withdraw. (S. L.)

LAWRENCE, DAVID HERBERT (1885–), British novelist, was born at Eastwood, Nottinghamshire, Sept. 11 1885, and educated at Nottingham High School and University College, Nottingham. With his first books, *The White Peacock* (1911), *The Trespasser* (1912) and *Sons and Lovers* (1913), it became evident that a writer of great force and originality was rising in the younger generation. A police prosecution of *The Rainbow* (1915) seemed for a time to check Lawrence's fertility, but he issued *Amores*, poems, and travel impressions, *Twilight in Italy*, in 1916, further poems, *Look! We have Come Through!* in 1917, and another novel, *The Lost Girl*, 1920. Hereafter Lawrence's outlook and style were being deeply influenced by a study of psychoanalytical doctrine and by travel in Italy, Sardinia, New Mexico and Australia: a new note is evident in *Women in Love* (1921), *Aaron's Rod* (1922), *Kangaroo* (1923), *The Ladybird* (1923), *England, My England!* (1924), *St. Mawr* (1925) and *The Plumed Serpent* (1926). Miscellaneous writings include *Sea and Sardinia* (1921), *Psychoanalysis and the Unconscious* (1921), *Fantasia of the Unconscious* (1922), *Studies in Classic American Literature* (1923), two plays, *The Widowing of Mrs. Holroyd* (1914) and *Touch and Go* (1920). He wrote also a historical study, *Movements in European History*, which was issued as by "Lawrence H. Davison" in 1921, and under his real name in 1925.

LAWRENCE, THOMAS EDWARD (1888–), British expl and scholar, was born in Wales Aug. 15 1888, of a Leicesters family one branch of which had moved to the neighbourhoo Dublin and thence to Oxford. The second of five brothers, was educated at the Oxford High School and at Jesus Coll Oxford, where, in 1910, he took a first class in modern hist In order to study Crusading architecture he made in that yea tour through Syria on foot; and the colloquial Arabic, which then picked up, and his interest in and knowledge of archaeolo commended him to D. G. Hogarth, who was about to lead expedition to Jerablus on the Euphrates and excavate the sit Carchemish for the British Museum. Thither Lawrence wen 1911, helped by a postgraduate endowment at Magdalen Coll and at Carchemish he worked on and off till 1914, taking seve opportunities to explore Syria and Mesopotamia in native co pany, and accepting for a few weeks an appointment under Palestine Exploration Fund, which attached him to the Surv of North Sinai carried out by Col. Newcombe, R.E., for the W Office in the winter of 1913–4. Though naturally inclined scholarship and letters, he showed singular practical ability a capacity for leadership, and a remarkable power of inspiri confidence in Arabs.

On the outbreak of the World War, Lawrence, being bel standard height, obtained at first no more active service tha post in the geographical section of the War Office. But so after Turkey had joined the Central Powers he was sent by Lo Kitchener to Egypt and attached to a rudimentary Milita Intelligence Section. He was a moving spirit in the negotiatio leading to an Arab revolt and in the organisation of the Ar Bureau which, as finally constituted early in 1916, acted as st and intelligence office for the Arab campaigns. In the autum Lawrence, feeling that stalemate would ensue if closer liais between ourselves and the Arabs were not contrived, ask leave to go down to Jidda; and once there, was transferr definitely from military control to the Arab Bureau which w under the Foreign Office. Hearing good accounts of the Em Faisal, he persuaded Sharif Hussain to let him go inland and vis the force which had been driven back from Medina. He so won the confidence of Faisal, and induced him to reorganise h army and move North so as to threaten the communications Medina by attacking the Hejaz Railway. When his chief w established at Wejh, and the army of another brother, 'Abdul had been brought to Wadi Ais to co-operate, Lawrence rode into the interior to raise the northern tribes, and so extend t area to be held and defended by the Turks. He pushed right to and beyond Ba'albek, *i.e.*, far behind the enemy lines in Syri and on his return, having picked up a Huweitat force under t famous raider, Auda Abu Tayyi, he routed a Turkish battalio near Ma'an, and forced a passage to 'Aqaba which was occupie for Faisal in Aug. 1917. For this exploit he was promoted field rank and given decorations, British and French, whic however, he would not accept.

Lawrence, now cordially helped by General Allenby, prompte the successive forward moves made by Faisal's force, after 'Aqab had become its base, and himself organised and led a battle i Wadi el-Hesa, near Esh Shobek, in which the enemy suffered hi worst defeat in the open. He turned his attention in particula to train-wrecking and had such success that Medina becam virtually isolated, and a large reward was advertised for th capture of "El-Orens, destroyer of engines." Early in 1918 h made a desperate attempt to cut the Turkish Palestine army's railway communication with Damascus, and failed only by a hair's breadth. In that summer, in concert with Allenby, he induced Faisal to move up to Qasr Azraq and organise a new force to advance on Damascus. This duly moved up in the autumn side by side with Allenby's thrust and after breaking up the enemy's trans-Jordan army, entered Damascus som hours ahead of the British. Lawrence took charge of the city till Allenby could reach it, and suppressed attempts at reaction.

Called to the Peace Conference, Lawrence became one of its outstanding figures during the spring of 1919. His legendary fame as organiser and inspirer of guerilla tactics was enhanced by

forcible part that he played when Faisal, whom he had
npanied on a British tour, came to Paris. But fight as
ence might against French plans for Syria, he could not
ail in that milieu, and at last, retiring to his tent, he sat down
rite the narrative of his adventures. The first manuscript
subsequently lost; but he began again, and, after many
nsions, it was announced that the book, under the title *The*
s Pillars of Wisdom, would be issued in 1926. He was
ed a Research Fellow of All Souls, Oxford, in 1919, and
ed there for a year, but without much share in the college
In 1921 Mr. Winston Churchill called him to the Colonial
e as Adviser on Arab affairs, in which capacity he had a
share in making Faisal King of 'Iraq. But, disgusted with
failure of the Allies to fulfil adequately what he considered
moral obligations to the Arabs, and remorseful for the part
imself had played in leading them on, Lawrence abruptly
Government service in 1922 and, abjuring all official rank and
rations and even his surname, enlisted as a mechanic in the
al Air Force. Thence in 1923 unwelcome publicity drove
to hide in the Tank Corps; but, in 1925, he was re-trans-
ed to the R.A.F., still as a mechanic, this being the only grade
he would accept. (D. G. H.)

AWSON, VICTOR FREMONT (1850–1925), American editor
philanthropist, was born at Chicago, Ill., Sept. 9 1850, the
of Iver H. Lawson, a Norwegian immigrant, and educated
hillips Academy, Andover, Massachusetts. He took charge
is father's interest in *The Daily Skandinavian*, and in July
5 bought an interest in *The Chicago Daily News*, which had
1 organised six months before by Melville E. Stone as the
one-cent newspaper in the West. It was a four-page five-
mn daily. In 1881 Lawson and Stone started a morning
ion called *The Chicago Record*, since discontinued. In 1888
son bought Stone's interest, and remained sole proprietor
il his death, Aug. 19 1925. His principal achievement was
development of *The Chicago Daily News* as a powerful news-
er with cultural influence; to this end he divorced politics
news; supported non-partisan organisations for investigating
tical candidates; maintained free public lectures; developed a
e-spread foreign news service, and established *The Daily*
s fresh-air fund sanatorium for sick babies. His advocacy of
ostal savings bank caused him to be called the father of the
establishing such a bank.

awson supported Stone in his development of the Associated
ss, of which he was president from 1894 to 1900, and a direc-
until his death. In 1923 the University of Michigan, and in
4 Columbia University, gave him the degree of doctor of
s. He aided numerous colleges, hospitals, churches and
ools; by the terms of his will his estate benefited, among
ny others, the Chicago Congregational Missionary and Ex-
sion Society, The Young Men's Christian Association of
cago, The Chicago Theological Seminary (Congregational),
International Committee of the Young Men's Christian
ociation of New York City, Northland College, Berea Col-
e and the Northfield, Conn., schools. (H. H.*)

AZAREV, PETR PETROVICH (1878–), Russian physi-
, was born in Moscow April 1 1878. A doctor of medicine of
scow University, he did research work in science at Stras-
rg and in 1907 was appointed *Privatdozent* in physics and
istant to Prof. P. N. Lebedev at the University of Moscow.
1912 he became professor at the technical college in Moscow,
l in 1917 member of the Russian Academy of Sciences and
ector of the research institute of physics and biophysics in
scow. Lazarev's early investigations were in photochemistry;
showed by experiment that the velocity of photochemical
ctions is proportional to the absorbed energy and does not
end on the wave length of light. Another series of his investi-
ions is in molecular physics. His main work is on the funda-
ntal problem of biophysics—the stimulation of living matter.
s ionic theory of stimulation explains the process of senses and
muscular contraction and forms the basis of his theory for the
ctions of the central nervous sytem. In 1918 Lazarev became
d of the geophysical survey of the Kursk Magnetic and
Gravimetric Anomaly. Some of his papers have been published in French (*Comptes rendus de l'Académie*, 1923–4) and in English (*Science, Lancaster, Pa.*); *Jour. of General Physiology* (Baltimore, 1924).

LEACOCK, STEPHEN BUTLER (1869–), Canadian author and economist, was born at Swanmoor, Hants., Dec. 30 1869 and went to Canada at the age of six. He graduated at the University of Toronto and became a master of modern languages at Upper Canada College, where he remained 1891–9. The next four years he spent in the graduate school of the University of Chicago, where he took the degree of Ph.D. In 1903 he was appointed to the staff of McGill University, Montreal, becoming professor of political economy in 1908, and subsequently head of his department. In 1907–8 he made a tour of the British Empire, lecturing on Imperial Organisation under the auspices of the Cecil Rhodes Trust. His serious work includes biographies of R. Baldwin and La Fontaine in the "Makers of Canada" series; *Elements of Political Science* (1906); and *The Unsolved Riddle of Social Justice* (1920). It was as the author of a number of delightful short stories, parodies and skits, however, that Prof. Leacock became most widely known to the general public. His humourous works include *Literary Lapses* (1910); *Nonsense Novels* (1911); *Sunshine Sketches of a Little Town* (1912); *Behind the Beyond* (1913); *Arcadian Adventures with the Idle Rich* (1914); *Moonbeams from the Larger Lunacy* (1915); *Further Foolishness* (1916); *Frenzied Fiction* (1918); *Winsome Winnie* (1920); *My Discovery of England* (1922); and *The Garden of Folly* (1924).

LEAD (*see* 16.314).—The principal lead producing countries in the world are now the United States, Spain, Germany, Australia, Mexico. Other important producers are India, Canada, Italy and Poland. Russia and China possess deposits of ore which, adequately worked, would yield a very large output, but at present their production is quite small. The United States has widely distributed deposits, and an output of at least four times that of any other country. The magnitude of her reserves, moreover, ensure her retaining this eminence for many years. The home market, however, consumes practically the whole of her production, the export being almost negligible.

Spain ranks second to the United States as a producer of ore, and, with Australia, is the largest exporter in the world. The principal German lead mines are in Upper Silesia, which, before the War, produced about half the ore smelted in the country, the balance being imported. Other deposits occur in Saxony, Nassau, Westphalia and the Black Forest. In Australia, the largest part of the output comes from Broken Hill, New South Wales. Before the War 50% of the production was shipped for smelting elsewhere, Germany being the principal buyer. Since the War, however, Australia has done her own smelting at Port Pirie (S.A.) and Cockle Creek (N.S.W.). Mexico has large quantities of lead ores, but disturbed conditions and inadequate communications militate against production in proportion to the country's resources. She has, nevertheless, a large output. The principal mines are situated in the northern and central states. The following table gives the production of lead ore of the countries mentioned in the years 1921, 1922 and 1923:—

Country	1921	1922	1923
	long tons	long tons	long tons
United States	370,081	426,458	487,135
Spain	133,677	117,484	125,465
Germany	36,500	39,400	27,500
Australia	83,878	151,929	171,857
Mexico	59,540	108,681	153,217
India	47,300	56,400	68,900
Canada	29,768	41,655	49,658
Italy	14,796	15,083	21,153
Poland	580	7,106	15,000
Russia[1]	1,500	2,000	2,000
China[1]	2,000	2,500	2,000

[1] Approximate.

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LEADER, BENJAMIN WILLIAMS (1831–1923), British painter (*see* 16.320), died at Burrow's Cross near Guildford, Surrey, March 22 1923.

LEAF, WALTER (1852–), British banker and scholar, was born at Norwood, London, Nov. 26 1852. Educated at Harrow and Trinity College, Cambridge, he graduated as senior classic in 1874, and in 1875 was made a fellow and in 1920 honorary fellow of his college. In 1877 he entered the firm of Leaf, Sons and Co., becoming in 1888 chairman of Leaf and Co. Ltd. Later he became chairman of the Westminster Bank. Leaf was one of the founders of the International Chamber of Commerce, of which he was elected president in 1925. In 1918–9 he was chairman of the committee of the London clearing banks, and from 1919 to 1921, president of the Institute of Bankers. His scholastic attainments were recognised in his presidency of the Hellenic Society and the Classical Association. Among his classical works are *The Iliad* (1886–8, 1900–2), with English notes and introduction; *Companion to the Iliad* (1892); *Troy, a Study in Homeric Geography* (1912); *Homer and History* (1915); *Little Poems from the Greek* (1922); and *Strabo on the Troad* (1923). In 1882 he collaborated with Andrew Lang and E. Myers in a translation into English prose of Homer's *Iliad*.

LEAGUE OF NATIONS.—The Covenant of the League of Nations, incorporated in the Treaty of Versailles and the other Treaties of Peace in 1919, was perhaps the most remarkable of all the direct results of the World War. For the text of this document *see* COVENANT. (*See* also EUROPE; SECURITY).

I. ORIGINS AND FOUNDATION

The League of Nations may be regarded as a necessary result of the development of human society in political organisations. It is not an abnormal achievement of human idealism—a great leap in advance beyond the achievements of the present age, outstripping the practical needs and requirements of the world. On the contrary, it is a practical method for achieving practical ends which are of importance to every citizen of every country. The demand for an international organisation to prevent war has often been made in the last four centuries. Fundamentally, this demand is that the relations of States shall be subjected to something analogous to the system of law and order to which men have subjected themselves within the smaller units in which they live. It is one example of the truth of the maxim of the Roman lawyers—*ubi societas ibi lex*. But the purpose and the content of the rules for the conduct of their relations—the *lex*—necessarily depend on the nature of the units of the society and on the nature of their relations.

When Grotius wrote his famous work on the Law of Nations, he was writing of a Society of States whose intercourse was disturbed by the continual outbreak of war. Indeed, Europe had been convulsed by the Thirty Years' War for a whole generation prior to the publication of his work. Thus it was natural and indeed inevitable that the rules which Grotius produced for the guidance of the Society of States, as he knew it, amounted to little more than a code of laws for the better conduct of war. He did, indeed, sketch the outlines of a law for the pacific relations of States, and, in the following century and a half, his successors developed to some extent what he had begun. But only after the Napoleonic wars was the first serious attempt made to establish an organised system of conducting international affairs with a view to the avoidance of war.

To Alexander of Russia's scheme of a holy alliance we need only briefly allude. Though admirable in intention, it was rejected as "sublime nonsense and mysticism" by Cast reagh, and it eventually degenerated into a mere prop of desp ism supported by the empires of Central Europe and Fran But the work of Castlereagh himself is worthy of closer att tion. He tried to substitute for the chaotic political methods the past a system of diplomacy by conference, confining efforts, however, to the Great Powers, though he desired to ma their attitude to the smaller Powers one of "influence rat than authority." He provided his "Conference of Ambas dors" with an organised plan of work and with a secretari and he supplemented it by occasional conferences of the pr cipal statesmen of the Concert. His conference of ambassad continued to sit in one form or another for almost six years, a he held four or five of his conferences of principal statesmen.

The European Concert.—Later in the 19th century, Cast reagh's work bore fruit in the European Concert, which prov on many occasions to be an effective instrument for the joi settlement of Balkan problems and for the maintenance European peace. But at the time, and for the purpose for whi he had created it, Castlereagh's system of diplomacy by co ference almost completely failed. It did so because it never h in it the seeds of life. Its members differed fundamentally on the greater issues of international politics—while some of the were independent and autocratic sovereigns, subject to no co trol, and without the pressure behind them of a general dem cratic will for peace. It could truly be said that internation society was not ready for such schemes.

Since the Napoleonic wars, however, forces have been at wo which have changed the economic condition of the world, kni ting its many parts together, and making possible a permane international political organisation. The first of these forces the revolution in communications in the course of the last ce tury, which has brought the most remote parts of the wor nearer to each other than neighbouring towns were 100 yea ago. The second of the forces—a result of the first—is the r markable raising of the standards of civilisation through th co-operation of mankind in ever larger groups and in enterpris conceived and conducted on an ever greater scale. To-da much of the world's commerce is international, and it has b come evident that the interests of any one civilised country a indissolubly bound up with those of every other country, s much so that no sensible statesman will ever again base h policy on the principle that his country will gain by anothe country's loss.

Nor is this community of interests between peoples confin to their material well-being. It extends to every sort of scie tific, political and moral activity in which men co-operate f the progress of their race. On the other hand, revolution communications, rapidly destroying the factors of space an time, has rendered possible a development of warfare which ha changed its whole character and rendered it universal an destructive in a sense never hitherto imagined. Indeed, it is no too much to assert that another World War would almost cer tainly throw mankind back into the dark ages. For these, amon other reasons, some sort of international organisation for th conduct of the relations of States was, in 1919, essential, if the human race was not to abandon the hopes and the ideals fo which it had striven during centuries of progress.

ESSENTIAL CONDITIONS OF A LEAGUE

With the reasons for the failure of the earlier scheme of a century before, and with the nature of modern national States in our minds, we can perhaps now proceed to lay down the essentials of a league of nations.

It may be taken as commonly accepted that the purposes and objects of a league are the following: first, the maintenance of peace; second, and as a corollary to the first, the solution of international disputes by methods of law, if and when the necessary law exists; when it does not, their solution by political methods, by public debate, by impartial investigation and by conciliation on the basis of the accepted canons of right and justice; third, the promotion of international co-operation rever necessary or useful, between States and between the ens of different States. The promotion of such co-operation imply the development of rules and the general acceptance common machinery and common practice in ever wider eres of international activity.

urther, a first principle which must be borne continually in d is that the fundamental basis of all law, and the primary dition of all political organisation, is the consent of those who to obey it. And an important and relevant corollary of this position is that the force, even the united force, of the ater or more powerful members of a society cannot in the run coerce the will, or replace the consent, of the others. It seless, therefore, to plan any organism which depends on the operation of the powerful States, but which will not also ive the willing acceptance and co-operation of the great y of other States.

n examination of the results of these limiting conditions, of the lessons to be drawn from historical experience, and he accepted objects which it is desirable that a league should ieve, will indicate the minimum of rules and of machinery ch is essential.

embership.—In the first place, then, there must be rules ing down the conditions of membership of the League. As members of the League, in order to carry out the objects ich they agree upon, must give reciprocal undertakings, they st have some guarantee that those with whom they associate mselves are willing and able to carry out what they promise. xt, it is essential that all the members should enter into agree- nts to meet in conference from time to time. Third, it will in ctice be necessary that there should be some smaller organ n the full conference of all the members, which in the current siness of the League, and when executive action is required, act for and represent the whole. It is evident that the com- sition of such an executive organ will—in a society in which mbers are so unequal in size, population and power—involve st difficult problems of representation such as those that se in 1926.

ecretariat.—A further consequence of any attempt to organ- international affairs through regular conferences of all the mbers of the League, and through a smaller executive organ, he necessity for a secretariat which shall be charged with the ty of preparing the work of the organs of the League, which ll act as a central exchange for information among members d shall organise the central and technical services. The secre- iat would also have to keep the records of the League, super- e the execution of the League's decisions, and in general act an organising agency for the promotion of international co- eration. It is, perhaps, theoretically possible that these duties uld be fulfilled by means of national secretariats attached to representatives who compose the full conference or the cutive organ of the League; but there are great practical vantages in an international secretariat whose members are lividually independent of national governments.

The above represents the minimum machinery that is essential the effective working of any league. We must next consider minimum mutual obligations which the members of the ague must assume if it is to prove an effective instrument for maintenance of peace.

Peaceful Settlement of Disputes.—It is evidently essential that ery member must agree that it will not go to war with any er member without previously submitting the dispute to aceful methods of settlement. Further, and as a corollary to s first undertaking, there must be a second one providing for nmon action against members who break this fundamental eement. What the nature of this common action must be is a tter for discussion; but it must at the least provide for united d energetic moral pressure by the whole body of the League ainst the recalcitrant member. It may well be argued that in world as it is to-day this united moral pressure should be pported in whatever way may be possible by united material essure as well. What in any case is essential is to find some ans of bringing home to every citizen of a member which breaks its League agreements the universal disapprobation of the other members. Thirdly, it is practically, if not theoretically, necessary to lay down in advance, some method, or methods, for the settlement of disputes by peaceful means.

Great elasticity may be left as to the nature of these methods, and as to the choice of method which the parties to a dispute may adopt. But the agreements of the League should include plans for settlement by conciliation, or arbitration or judicial verdict; and these plans should be based on the essential principles by which alone moral pressure can be brought to bear on individuals or on Governments—that is to say, on strictly impartial inquiry into the merits of disputes, and on full publicity for the contentions of the parties and for the proceedings by which settlement is attempted.

It is further essential that the agreements of the League should include the automatic abrogation by members of all treaties or undertakings which are not consistent with their obligations as members of the League. No general organisation, such as a league of nations, can operate or inspire confidence in its members if the undertakings to which they agree by their membership are overborne or superseded by other inconsistent agreements which they may enter into with individual States.

The organisation and the undertakings indicated seem to constitute the minimum that can serve as the basis of any effective international organisation for the prevention of war. Beyond this minimum, there are other things not absolutely essential but highly desirable. For example, judicial verdict implies a court of international law. It is true that such a court might be set up *ad hoc* for any dispute in which it is required, but it is far better that a permanent court should be established as part of the machinery of the League. Such a court, indeed, appears to be a necessity if we are to achieve the development of international law as an increasingly important factor in the relations between States.

Again, it is highly desirable, though it is not theoretically essential, that the agreements of the League should provide that any dispute, or any circumstances affecting the peace of the world, should be a matter of general concern to every member, so that any member may be within its right in demanding the consideration of any such matter by the organs of the League.

Interdependence of States had so far advanced during the course of the 19th century that this principle received some slight and tentative recognition in the conventions for the peaceful settlement of international disputes drawn up by the conferences at The Hague. But the principle needs full recognition and application if countries are to be prevented from drifting into armed conflicts which in these times will certainly involve the interests of their neighbours.

And lastly, it is desirable, though again not essential, that the League should be given the necessary powers to enable it to act as the co-ordinating agency for the international activities of its members in all the multifarious spheres hitherto governed by international bureaux, by general treaties and by other forms of official and unofficial co-operation.

The Essential Provisions of the Covenant

Impartial consideration of the Covenant will show that it embodies every one of the features which have been enumerated as the essentials of an effective league. It may further be said that where it goes beyond the essentials it does so in a way which was intended to make, and does make, for greater completeness and efficiency.

Membership.—Article 1 of the Covenant consists of the rules of membership. It stipulates that the original members of the League shall be the signatories to the Covenant and such other States named in the annex thereto as shall accede to it without reservation; and that any fully self-governing State, dominion or colony may become a member if its admission is agreed to by two-thirds of the members and provided that it shall give effective guarantees of its sincere intention to observe its international obligations and shall accept the regulations of the League in regard to its military forces. These rules constitute a statement of the principles concerning membership that are essential if the members of the League are to have confidence that their mutual undertakings will be carried out.

Representation.—With regard to agreements to meet in conference, Articles 2, 3 and 4 of the Covenant stipulate for the creation of an Assembly consisting of three representatives of each member of the League, and for a smaller Council consisting of representatives of four great Powers and of four smaller ones. The Covenant does not lay down the intervals at which these bodies shall meet: it merely stipulates that the Assembly shall meet at stated intervals and from time to time as occasion may require; and that the Council shall meet in the same way, and at least once a year. It leaves these questions to be dealt with in whatever rules of procedure the council and the assembly might respectively consider it wise to adopt.

The question of representation of the members at the assembly was one which naturally involved serious difficulties. It was solved by according to every member an equal right to send three representatives.

The question of representation on the Council was still more difficult. A definite preponderance of influence in international affairs had been accorded prior to the World War, to the Great Powers of the world. It was inevitable, and right, that the Great Powers who are members of the League should be given permanent representation on its principal executive organ. The representation of the smaller Powers—an exceedingly difficult matter—was dealt with by providing that the four non-permanent members of the Council shall be selected by the Assembly from time to time in its discretion.

Articles 6 and 7 provide for the necessary secretariat, and for the nomination of a secretary-general, who shall make all the appointments to the staff with the approval of the Council. These articles also provide that every position in the secretariat shall be open to women. So much for the institutional organisation of the League as it was established by the Covenant.

Disputes.—With regard to the agreements not to resort to war, which are included above, among the essentials, the Covenant embodies almost everything that any responsible authority had in 1919 advocated as practicable. By Article 12 the members agree that if there should arise between them any dispute likely to lead to a rupture, they will submit the matter either to arbitration or to inquiry by the council, and they agree that they will in no case resort to arms until three months after an award has been made by the arbitrators or a report has been made by the council. Article 12 thus not only embodies an agreement not to go to war without previous recourse to peaceful methods of settlement for disputes, but also lays down two alternative procedures by which, through the agency of the League, settlement can be effected. The first is ambiguously referred to as " arbitration," but it is evident from Articles 13 and 14 (the latter of which provides for the establishment of a permanent court) that the use of the word " arbitration " is a loose one, and that what is really intended is recourse to legal decision. These two articles, indeed, leave great elasticity, but their purpose was to secure the establishment of a permanent court of international law to which the parties should in the normal course take disputes of a legal nature.

There is, moreover, at the end of Article 14, a clause designed to increase the value of the permanent court. This clause provides that the court may give an advisory opinion upon any dispute or question referred to it by the Council or by the Assembly. Thus, if a litigant should bring to the League a dispute in which it believes the law to be on its side, it will be able to demand, even if the other party does not agree, that the Council shall secure on the juridical questions at issue an advisory opinion from the court; and the court, in rendering this opinion, will give the Council the elements for a decision which would have all the force of a legal verdict. Thus the Covenant included provisions which went far towards securing that all international disputes of a genuinely legal nature shall be determined by legal methods.

With regard to the other alternative method provided for the settlement of disputes, which members agree to by Article 12, that is to say, inquiry by the Council, Article 15 lays down in considerable detail the procedure which is to be adopted. It provides that any party to a dispute can oblige the League to take cognizance of it by giving notice to the secretary-general. The parties undertake to communicate to the secretary-general as promptly as possible statements of their case, with all the relevant facts and papers. The Council is then given discretion to endeavour to effect a settlement of the dispute, and it is provided that if its efforts are successful, a statement shall be made public giving such an account of the dispute and of the settlement arrived at as the council may deem proper. If the council fails to settle the dispute, it is to make a report setting forth the merits of the dispute and the recommendations which the Council thinks would be suitable for a settlement, and this report is to be published. A report may be made either unanimously or by a majority vote, and any individual member of the League which is represented on the Council has a right to make its own public statement concerning the dispute.

There is a further provision in Article 15 to the effect that if such a report is agreed to by the Council unanimously, with the exception of the representatives of one or more of the parties to the dispute, the members of the League—including the parties—agree that they will not go to war with any party to the dispute who complies with the provisions of the report. This is a most important additional limitation of the right of members to resort to arms. Article 15 also allows an appeal from the Council to the Assembly, provided made within 14 days after the submission of the dispute to Council. If a dispute is so referred to the Assembly, the Assembl to deal with the matter in the same way as the Council, and i report is agreed to by all the members of the League represente the Council, and by a majority of the other members of the Lea exclusive in each case of the representatives of the parties to dispute, it has the same force as a unanimous report agreed to by Council, *i.e.*, the members of the League must not go to war with of the parties to the dispute which accept it.

These Articles, then, provide two, or rather three, methods which disputes can be settled by peaceful means through agency of the League. The first provides for legal verdicts the permanent court, when such verdicts are possible and use the second for arbitration by some special tribunal agreed to the parties to a dispute; and the third, for settlement by political agency of the Council or the Assembly, in accorda with procedure based on the principles of full publicity strict impartiality. The authors of the Covenant believed t publicity would of itself ensure impartiality; that it was conceivable that a council, acting as the representative of whole body of the League and in circumstances of utmost p licity, should conduct its inquiries into a dispute in any way consistent with the strictest fairness to all the parties concern

Sanctions.—Articles 12 to 15 also make provision for the n essential of a league—united pressure by all the members agai any of their number which disregards its undertakings. In p viding for a public report by the Council on the merits of a pute and for the publication of its recommendations as t settlement, the Covenant lays down a method which, in pr tice, must exert the strongest moral pressure on any state wh in defiance of Article 12 is disposed to go to war.

But the Covenant goes beyond this, and provides in Arti 16 that, if any member of the League in contravention of agreements resorts to arms, such a member is *ipso facto* " deem to have committed an act of war against all other members the League," and the other members are obliged to prevent financial, commercial or personal intercourse between the tionals of the Covenant-breaking State and the nationals any other State. It was difficult in the disturbed condition the world after the War to realise just what would be the eff of such a complete economic and financial boycott in times normal peace. But it is not too much to say that no civilis State would, in 1914, have ventured to declare war had it be threatened by such a universal boycott as is stipulated Article 16 of the Covenant.

It is sometimes held that in providing for such a univers boycott, the Covenant goes beyond the essentials of a league. is sometimes even held that it goes beyond what is practica and wise. But it must be remembered that Article 16 only com into force if a State insists on going to war without waiting any attempt at peaceful settlement, or where an agreed tribun or a unanimous council have given a decision which has be accepted by the other party. In other cases ultimate resort war is envisaged under the Covenant as legitimate, and t obligations of Article 16 would not come into force. Inde against a genuinely recalcitrant member of the League, t Covenant goes even further. Article 16 lays down that in ad tion to the blockade which is an automatic obligation of all t members of the League, the council shall consider and sh *recommend* to the several Governments concerned, what militar naval or air forces members of the League shall severally co tribute to the armed forces to be used to protect the Covenan In other words, while leaving again the greatest possible ela ticity, the Covenant foreshadows united military action, if it necessary, against a Covenant-breaking State.

To turn to another matter, the Covenant provides by Artic 20 for the abrogation of treaties, obligations and understandin which are inconsistent with its own terms, and thus meets yet another particular, the essentials of a league.

FURTHER PROVISIONS OF THE COVENANT

How far, and in what respects, does the Covenant go beyo these essentials?

Guarantees.—First, there are the much-discussed provisions Article 10. This Article has been very generally misunder- ood. Its effect is to guarantee the members of the League *ainst external aggression* which would impair their territorial tegrity or political independence; but this guarantee is only be enforced as the Council acting unanimously shall agree. practice the protection against sudden and unjust attacks ovided by Articles 12–16 will probably be much more useful, nd, if executed, all that is required. Article 10 is really only a ther clumsy assertion that territorial or political changes shall ot be made by aggressive war. Such changes, if required, must made under Article 19, which enables the Assembly to recon- der treaties which have become obsolete or dangerous to peace.

Armaments.—Second, it may perhaps be said that, by the ovisions of Article 8 on the subject of armaments, the Cove- ant introduces something which is extraneous to an agreement preserve the peace. But the history of the 20th century has emonstrated that if you prepare for war you will have war; that crease of armaments in one country provokes increase of maments in other countries, and that if rivalry in preparation r war continues, within a certain time war will break out. The thors of the Covenant believed that unless rivalry in arma- ents could be prevented, any league of nations, however it be nstituted, would fail. They therefore thought an agreement ot to engage in unlimited competition in armaments absolutely ecessary to the peace of the world. The Covenant deals with e matter in a way which is pre-eminently practical and sane. recognises that the maintenance of peace requires the reduc- on of national armaments to the lowest point consistent with ational safety, and directs the Council to formulate plans for ch reduction for the consideration of the several members of e League. In other words, the members agree to co-operate in orking out a general international plan embodying scales in ccordance with which their armaments shall be limited or educed.

Further, the members agree that they will, through the eague, endeavour to take measures for abolishing the evil ffects of the private manufacture of armaments and material of ar, and they agree to exchange full information as to their rmaments, their preparations for war and the condition of their dustries which may be adapted to warlike purposes. Lastly, y Article 23 they agree that, subject to conventions to be rranged, the international traffic in arms, admittedly one of the inor contributing causes of war, shall be placed under the eague's supervision.

These are only general principles. In themselves they would e of small value. But it was hoped by the authors of the Cove- ant that the action of the permanent machinery of the League ould in time enable its members to give effect to the purpose of rticle 8; and that thus great strides would be made towards he disarmament which everyone desires. In this respect, as in thers, the authors of the Covenant were careful not to travel o fast; they laid foundations on which those who were to ield authority in the League could later build.

Secret Treaties.—By providing in Article 18 for the publication f all treaties, the Covenant again goes beyond essentials. Yet o reasonable man can doubt that, under the diplomatic system hich prevailed before 1914, secret treaties of alliance, directly y their mere existence and indirectly through the mistrust which hey created, were one of the serious causes of international onflict.

Mandates.—Article 22 of the Covenant introduces a new prin- iple into international affairs which is certainly extraneous to he central purpose of a league. The mandates system which it reates is a great experiment in the government by advanced eoples of backward territories and races. The main principles re simple. The Article is based on the proposition that back- ard peoples and territories are not for the future to be exploited r the exclusive benefit of those who govern them; that, on the ontrary, their interests and well-being constitute a sacred trust f civilisation and that the way in which they are ruled is a atter of interest to the world at large. The Article therefore lays down that in the government of such territories the interests and progress of the inhabitants must be the guiding purpose of the administration. The methods by which their interests are to be protected and their development secured vary, of course, in every case with the nature of the territory and the character of the people concerned. But in every case the fundamental principles are the same; and to secure the observance of them the Covenant imposes on the mandatories a duty to make annual reports for submission to a permanent mandates commission; which is, in turn, to report to the Council. Here again the Covenant relies on publicity and public opinion as a guarantee that Article 22 will be faithfully carried into effect.

International Co-operation.—With regard to international co-operation, the Covenant in Articles 23 and 24 goes a great deal further than might be considered essential. It provides in general terms for the establishment of a labour organisation (which in fact has been elaborated separately by another agreement); for the equitable treatment of commerce; for the development of freedom of transit; for League supervision of the traffic in arms; for League action in matters of public health and for the general supervision by the League of all official, and also, if necessary or useful, of unofficial, international offices established for international purposes of general interest. The general effect of these provisions is to make the League what it is clearly desirable that it should be—a central organism through which international activities of every sort can be co-ordinated and, when useful, assisted by the council and the secretariat. There can be no doubt that the result of this must be to prevent waste of effort and promote efficiency in the conduct of international business of every kind.

Amendments.—In the last place the Covenant, by Article 20, provides a method by which it can itself be amended; and this, it may be held, is not an essential of a league. It is true that the Covenant might have been regarded as an ordinary international treaty, valid, as most treaties are now made, for a certain fixed period, at the end of which it might have been renewed or changed by the ordinary methods. But it was precisely because the authors of the Covenant did not regard it as an ordinary international treaty that they provided a special means for amendment; and there can be no doubt that, morally, Article 26 is of great significance, and that practically it may prove to be of great constitutional value. It still leaves it difficult to secure amendment of the terms of the Covenant. It can only be done if all the members of the council and the majority of the members of the assembly are agreed. But the fact that amendment is definitely envisaged is in itself important.

Generally, it may be said that when the Covenant goes beyond the essential features which are necessary to any effective league to preserve peace, it does so with one of two objects in view. Either it is with the purpose of giving real life to the machinery which it establishes: of bringing the international forces actually at work into effective co-operation, in order that members of the League may be brought closer together, and the League itself be strengthened and have the vitality that comes from continuous and varied work; or else it is with the purpose of removing those deep-seated causes which public opinion has recognised as having led to war. It is not by chance that the Covenant contains more or less elaborate provisions concerning armaments, the traffic in arms, annexation by conquest, the avoidance of unfair economic competition, imperial rivalry in the exploitation of backward countries, secret treaties and alliances. It is because these things have led to war in the past that the Covenant seeks to deal with them in a practical and effective way, to the end that war may be rendered less probable in the future.

It has already been said that the authors of the Covenant confined themselves to laying down the essentials of the organisation which they considered the League required and the general rather than the detailed obligations to which they thought that members of the League must agree. Elasticity is one of the chief "notes" of the whole machinery of the League. The Council and the Assembly are free to develop their own methods and systems as they choose, to appoint committees and commissions at their discretion, and to draw up codes of procedure which they can themselves change; they are thus able to give to the general principles of the Covenant the free development which experience may dictate.

It is in pursuit of this same elasticity that in several cases the Council is charged to carry into execution plans which the authors of the Covenant felt to be essential, but which they were not themselves, for lack of time and for lack of expert technical advice, able immediately to prepare. Much valuable work has been done under these provisions.

Preparation and Enforcement

The Covenant was prepared by a special Commission of the Peace Conference of Paris, consisting of ten representatives of the Great Powers and nine representatives of the smaller Allied States. This commission, appointed on Jan. 20 1919, was a body of remarkable authority. Presided over by President Wilson, its members included Colonel House, General Smuts (later Prime Minister of South Africa), Lord Robert (Viscount) Cecil, M. Léon Bourgeois (former Prime Minister of France), M. Veniselos (Prime Minister of Greece), M. Pessoa (later President of Brazil), M. Vesnitch (later Prime Minister of Yugoslavia), M. Scialoja (later Foreign Minister of Italy), M. Hymans (Foreign Minister of Belgium) and others.

The first draft prepared by the commission, based on proposals put forward jointly by the British and American delegations, was laid before the Peace Conference at a public meeting on Feb. 14; it was thereafter amended in the light of criticisms made by the conference, by the Press and by the neutral Powers at a special meeting held for the purpose of hearing their views; and the final draft was adopted by the Plenary Conference at another public meeting on April 28. It was, on the insistence of President Wilson, inserted as Part I. of the Peace Treaties made with Germany, Austria, Hungary and Bulgaria. By this device the Allied Powers were prevented from making peace with their enemies without being members of the League.

With the entry into force of the Treaty of Versailles on Jan. 10 1920, the League of Nations came legally into existence. Prior to this date, preliminary organisation of its work had been carried on by the secretary-general under the authority of a committee of the Powers. When all the Allied Powers had ratified the Peace Treaties (except the U.S.A., Hejaz and Ecuador, who failed to do so) the members of the League numbered 29. To these were added during the course of 1920 the neutral Powers, 13 in all, who in accordance with Article I. of the Covenant acceded to it without reservation. By successive admissions of ex-enemy and other States, the number of members had by 1925 risen to 56.

See also Covenant; Disarmament; Sanctions and Guarantees; Treaties; Versailles, Treaty of, etc.

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(C. of C.)

II. THE WORK OF THE FIRST SIX YEARS

In order to understand what has determined the character, scope and varying efficacy of the League during the first six years of its existence, it is necessary to bear in mind both the general conditions under which, and the organisation through which, it has been working. It is only by realising these conditions that we shall understand why some of the main international problems have been dealt with by the League and some outside it; and why its success in those which it has undertaken has varied from case to case.

The first of the determining political conditions is that the process of settling the terms of peace, of resolving the immediate problems left by the World War, was only begun and not
ended by the treaties of peace signed in 1919. For years afte
wards peace was still being negotiated in every capital in Europ
One of the treaties, indeed, the Treaty of Sèvres, was never ra
fied. Renewed war between Greece and Turkey, rather t
continuation, after an interval, of one section of the World W
than the outbreak of a new one, was to precede the new Trea
of Lausanne of 1923. But even those treaties which were du
ratified left unsettled questions of the first political importanc
in the forefront " reparation " and in the second rank a host
secondary, but still difficult and important, problems.

But the task of completing and executing the terms of sett
ment between recent combatants is very different from that
permanently preserving the peace of the world. The Covena
(*q.v.*), designed to create a permanent instrument, is natural
drafted as if the immediate war problems had been settled
the treaties of peace and as if, peace and normal conditions ha
ing been established, it was the task of the League to mainta
them. The questions left unsettled directly concerned the la
belligerents, not the world as a whole. Their settlement w
essentially a corollary of the treaties and a part of the sa
work. It was natural, therefore, that they should be dealt wi
not by the new world organisation, the League, but by conf
ences of the Allies or of the late belligerents similar in compo
tion and in character to those which had negotiated the treati

Limiting Factors.—In the second place, the scope of t
League's work has been limited by the fact that, while in essen
a world organisation, it has not yet received the adhesion of
countries, and in particular three of the seven principal cou
tries of the world have during the whole period now und
review been outside its membership.

These conditions derive additional importance from the fu
damental character of the League as an organisation. T
League is not a super-state with either the right or the authori
to impose its will on the sovereign States which compose it.
is essentially an organ for securing agreement between them, a
its power of action is at any time limited by the extent of pos
ble agreement. Except in a few special cases, of which the mo
important is that members undertake not to go to war to enfor
a claim rejected by all the members on the Council except t
disputants themselves, signature of the Covenant does not i
volve an obligation on any State to accept a decision of t
League without its own consent.

For the great bulk of its work, therefore, the League requi
unanimity. It can persuade, it can elicit a collective wo
opinion, both private and official, which it may use to aid
persuasion, but, except before the imminent threat of war,
cannot compel; and even in this case unanimity of the no
disputant members of the Council is required. It follows, the
fore, that the power of the League varies with the policies a
characters of the countries which compose it and of their re
tions between each other. How far this is from involving imp
tence, how great is the difference between the policy a count
would pursue if left alone from that which it can be induced
follow under the persuasion of collective opinion, the followi
account will show. But however wide the range within whi
such persuasion can be effective, there is at any given mome
a limit beyond which a country cannot be moved. And beyo
such limits the League is, for the great bulk of its work, imp
tent. In dealing with its various problems the League has
deal with exactly the same forces and differences of policy a
interest as if they were handled by other methods of negotiatio
and the organs of the League, the Assembly, and the Coun
comprise, indeed consist of, representatives of interested go
ernments themselves.

It follows that any serious divergencies of policy betwe
members of the League, and especially its more important me
bers, will be likely to enfeeble the League for its general wo
And it is obvious that the obstinate differences on reparati
and other questions touching Germany and on Near Easte
affairs, affecting as they did for some years the general relatio
of some of the principal countries on the council, necessari
limited the League's general power and progress.

iese limiting factors have diminished in importance as the s have passed. Little by little, the specifically War problems found a settlement, the transitional instruments of nego- on, supreme councils or allied conferences or the Conference mbassadors (*see* SAN REMO; SPA; PARIS; LONDON; CANNES; OA; LAUSANNE; and LOCARNO; also AMBASSADORS, CON- NCE OF; SUPREME COUNCIL) have ended or retired to a ndary place; and the permanent organisation has come into oreground. The number of member States has risen from 2 of the first Assembly to 55, in 1925, and the improvement ternational relations which, while largely developed at va, found its expression at Locarno, has immensely added e strength of the League to deal with such future troubles ay occur.

ORGANISATION OF THE LEAGUE

ie principal organs of the League are the Assembly, meeting lly once a year and representing all States; the Council, ing usually every third month and consisting of four per- ent members (Great Britain, France, Italy and Japan—to h Germany will doubtless shortly be added)—and six non- ianent members elected by the Assembly; the permanent tariat; a whole series of special organisations and com- ees (for finance and economics, transit, health, armaments, dates, intellectual co-operation, opium, traffic in women, ; and, working independently of the Council and Assembly, permanent court of international justice, and the inter- onal labour office.

ie respective spheres of competence of the Assembly and the ncil are not exactly defined in the Covenant. Each may deal any matter within the League's competence or affecting peace of the world. In practice, the size, composition and s of meeting of the two bodies determine their functions. Assembly affords an opportunity for an annual review, by responsible representatives of the Governments of the d, of the international situation. It largely creates the osphere and determines the general lines of policy for the ing year, and it is a convenient instrument for the concluding s in the negotiations of conventions and general agreements orld interest. The Council, on the other hand, has become League's executive organ. It deals with the host of special tions that arise for settlement throughout the year, and cts the multifarious permanent tasks of the League and the ial organisations through which they are carried on.

iese special organisations are in some respects the most esting feature of the League as an administrative machine. consist for the most part of permanent committees, com- d of specialists and experts drawn either from the depart- ts of the national governments or from private institutions. e experts work normally in their own countries, and they the special knowledge of national forces and conditions, possess the national influence, which no purely international als can retain. But they meet periodically as members of gular organisation. By this system, which follows closely principles of the inter-Allied central organisation built up in ater years of the World War, the League obtains an execu- instrument more expert, more effective and more economi- han could possibly be obtained by the unaided service of its whole-time officers. It binds together the national adminis- ons of the world and forms them into an instrument of national work. More than this, it permeates with its own those who in their own countries are carrying on national which reacts on the interests of other countries.

these six years some thousands of such persons, no small ortion of those who throughout the world are forming and iting the policy which determines international relations, learnt, in regular co-operation with those of corresponding ion in other countries, the international point of view. It is a system which, apart from its direct utility, effects a peace- enetration of the League point of view into national systems. is elaborate and elastic system the permanent secretariat is initing element—the "coupling." Its importance results from the immense range and variety of the organs which it serves, and from the fact that these organs consist of councils, commissions or committees meeting periodically, not in permanent session, and consisting of persons whose main work is elsewhere, in their respective countries.

POLITICAL DISPUTES

It is the task of the League to prevent political disputes causing war. It is most successful where it has been able, by patient work in improving international relations, to remove the causes of disputes before they arise. In this wider sense most of the work of the League has a political aspect. In its mandates and minorities work, for example, the League is continually trying to establish conditions which will diminish the risks of future conflict; and in such a piece of international co-operation as the reconstruction of Hungary, the existence of political differences constituted one of the main obstacles to success, and their settlements one of its main rewards. The definite political disputes threatening to disturb international relations and, in some cases, the peace of the world, which have been submitted to the League of Nations are treated in this work under the individual headings, but something must be said here to illustrate the methods by which the League discharges its primary responsibility of preserving the peace.

Aaland Islands.—The first of these disputes was between Sweden and Finland in 1920 over the Aaland Islands (*q.v.*). Neither country appealed to the League, but as the danger of conflict increased, Great Britain brought the matter to the Council under Article 11 of the Covenant. Both countries were invited to become members of the Council for the purpose, Sweden as a member State under the specific provision of Article 4, and Finland, not then a member, by special resolution in accordance with the general spirit of Article 17. Sweden urged the strong and persistent desire of the islanders themselves for union with Sweden, and her representative declared that "if Finland . . . failed to withdraw her troops a conflict was likely to arise." Finland claimed that her legal sovereignty was indisputable and that the Council was not competent because the matter was one which by international law was solely within the domestic jurisdiction of Finland. The Council, with the concurrence of both parties, appointed a commission of three international jurists to give an advisory opinion on this point (the court of justice not yet being established), and on the basis of its report declared itself competent. It then sent a committee of inquiry, consisting of a Belgian, a Swiss and an American, to investigate on the spot and propose a settlement. In conformity with the report of the committee and after hearing the views of the islanders, as well as the Finns and Swedes, the Council, in June 1921, decided that Finland's claims to sovereignty over the islands must be recognised but that the claim of Sweden and the islanders should be met by detailed guarantees ensuring neutralisation and a large measure of autonomy. This decision was followed by a conference of 10 Powers in Oct. to frame a convention providing for the neutralisation and demilitarisation of the whole archipelago. The convention was duly ratified and came into force in April 1922. No trouble has since arisen, and the settlement appears to be accepted as final and conclusive.

Vilna (Wilno).—The next dispute marked a failure in League action. The Treaty of Versailles left the eastern frontier of Poland to be fixed later by the Principal Allied Powers. No definite frontier was fixed, but a provisional line was drawn which left Vilna (*q.v.*) in the territory of Lithuania, a newly created State. A dispute arose between Poland and Lithuania over this line, and hostilities became imminent. The Council, in Sept. 1920, sent a military commission which prevented hostilities and provisionally arranged the disposition of the respective forces. But General Zeligowski, a senior Polish officer, crossed the line and entered Vilna with a considerable force. The Polish Government repudiated his action, but refused to send troops against him. The League's military commission arrested hostilities by establishing three neutral zones between the opposing forces, and the Council proceeded to deal with the territorial dispute. They first attempted a referendum and arranged to send a small international police force to maintain order during the plebiscite. But the inflammation of public opinion made it very unlikely that a fair expression of opinion could be maintained, and this plan failed. The Council next attempted conciliation by direct negotiations between the two Governments under the presidency of M. Hymans, the Belgian member of the council. A proposal made by M. Hymans himself that the Vilna territory should be an autonomous canton within the Lithuanian State was not accepted, and the effort at direct negotiation thus failed. The council then made a formal "recommendation" in accordance with Article 15; they adopted M. Hymans' report unanimously and with the assent of the full Assembly which discussed the proposal in Sept. 1922, called upon both countries to accept it. They refused, and the League did not enforce the recommendation. Finally, early in 1923, the Conference of Ambassadors, acting on behalf of the principal Allies under Article 87 of the Treaty of Versailles, definitely fixed the eastern frontier of Poland in such a way as to include the district of Vilna within it. The *fait accompli* prevailed. The League had succeeded in averting hostilities which would otherwise have been inevitable, but it had failed to secure the adoption of its own solution on the substance of the dispute.

Upper Silesia.—The next dispute was equally difficult, and again resulted from the incompleteness of the terms of peace signed in 1919. The Treaty of Versailles provided that a frontier was to be drawn in German Upper Silesia (*q.v.*), dividing the district between Germany and Poland in accordance with the "wishes of the inhabitants" as indicated by a plebiscite and taking account of "geographical and economic conditions"—two conflicting criteria which pointed to very different conclusions. The plebiscite was held in March 1921, but neither the Plebiscite Commission, nor a committee of experts, nor the Governments composing the "supreme council" could agree as to the line to be drawn. A Polish insurrection broke out, and production in the rich mining and industrial area of the "triangle" was stopped. There was the greatest tension not only between Poland and Germany but between the Allies – France proposing a line based on the plebiscite, giving the bulk of the disputed area to Poland, and Great Britain proposing a line more in accordance with economic considerations, giving the bulk of it to Germany. Repeated and prolonged attempts to effect an agreement failed. There was rioting and, indeed, for some days, fighting between organised volunteers. Work was stopped and there was danger of a serious rupture between the Allies. Having failed to reach agreement through their normal organ, the Supreme Council, the Allies, in Aug., asked the League to propose a frontier in accordance with the treaty, binding themselves to accept any agreed recommendation. The Council met in special session on Aug. 29 and referred the problem for preliminary examination to a committee consisting of the representatives of Belgium, Brazil, China and Spain—states which had taken no part in the previous discussions.

This committee came to the conclusion that the only practicable solution was to be found in drawing such a frontier as would attribute to each country a number of inhabitants proportionate to the votes recorded in its favour, while arranging special guarantees against the dislocation of the economic life of the district for a period long enough to enable it to be adjusted to the new frontier. That is, instead of trying to determine a frontier on a compromise between the conflicting plebiscite and economic considerations, they proposed to take the plebiscite as the basis of the first and to meet the second by an appropriate economic convention. This solution was adopted by the council, and by the Allied Powers, who traced the frontier accordingly. A Germano-Polish convention, ensuring the continuity of the economic life of Upper Silesia for a period of 15 years, was subsequently drawn up in agreement by the two Powers negotiating under the presidency of a Swiss statesman appointed by the League.

This settlement was severely criticised both in Germany and Great Britain. It must, however, be remembered that the League had no authority to fix an ideal frontier line, but only to apply the treaty provisions. The whole case is an illustration of the difficulty already mentioned of the League, designed as an impartial instrument for the preservation of peace, being used to complete the terms of a peace settlement between recent combatants. But at last agreement was reached, a cause of dissension between the Allies was removed, work was resumed and rioting ceased.

Albania.—A further risk of hostilities occurred in 1921 through a delay in the definitive settlement of a frontier. Albania (*q.v.*) was admitted as a member of the League in 1920, but the frontier question was still under consideration by the Conference of Ambassadors. In April 1921 Albania called the attention of the League to encroachments on her territory by Serbia and Greece. The Council, unwilling to complicate the task of the Conference of Ambassadors by separate intervention, asked the Conference to hasten their decision and called on the three countries to abstain from any hostile action. The question being still unsettled in Sept., however, the League appointed a committee of three impartial persons from Luxembourg, Norway and Finland to report on the situation. Before its arrival in Nov., however, Yugoslav troops entered the Mirdita district of Northern Albania. There was heavy fighting, and the defeat of Albania was almost complete. The British Govt. at once demanded the summoning of a special meeting of the Council under Article 11 to consider the situation and if necessary to agree upon measures under the "sanctions" article, No. 16, of the Covenant. At the meeting of the Council on Nov. 18, the Serb-Croat-Slovene State agreed to evacuate its troops and to respect the frontier which had now been definitely fixed by the Conference of Ambassadors. The League Commission of Inquiry personally accompanied the departing troops, and on Dec. 10 were able to report that the evacuation had been successfully completed without untoward incidents. A serious threat of conflict had again been averted and has not since recurred.

Memel.—The Memel problem is another instance of a peace treaty question handed over to the League because the Allies, acting through their normal machinery, had been unable to settle it. There was a strong reason for invoking the services of the League in this case because it involved extremely complex technical question transit and port facilities, with which the League's technical org sation was particularly fitted to deal. Lithuania, having suff from a *fait accompli*, pending the definite fixing of a frontier Wilno, successfully tried a coup of her own at Memel in Jan. 1 The Conference of Ambassadors fixed the frontier in a way which Memel in Lithuania on condition of a large measure of autonom the German population and guarantees for the development of port as an international outlet. But they failed to frame a vention acceptable to Lithuania to give effect to this condit Active conflict being threatened, the Conference in Sept. asked League to deal with the matter. The Council appointed an partial commission, which made a thorough investigation of the l conditions, and in March 1924 presented a complete draft conv tion to the council. This convention (for the terms of which MEMEL) was accepted by both parties and endorsed by the Al governments.

The Corfu Dispute.—A much more important dispute, affectin principal power, was brought before the League in the autum 1923. An Italian General and his staff, who were engaged as rep sentatives of the Conference of Ambassadors in fixing the fron between Albania and Greece, were murdered on Greek soil, by sons unknown, on Aug. 27 1923. The Italian Govt. demanded repa tion and apologies of the Greek Govt., who accepted some of conditions and refused others. The Italian naval authorities the upon occupied the island of Corfu, loss of life occurring in operation (*see* CORFU). Greece appealed to the League, but stated her willingness to accept any decision of the Conference Ambassadors. The position of the Conference, as a body wh decision both parties agreed to accept and as itself directly interest made the formal competence of the Council doubtful. The Cou therefore confined itself to discussing detailed suggestions fo settlement and forwarding them to the Conference of Ambassad The Conference adopted most of these suggestions, but with an portant modification on the question of reparation. With regard this it dispatched an Allied committee of inquiry and, on receipt its report, which it withheld from publication, it awarded Italy full amount of reparation which she had demanded. Corfu was th evacuated. The immediate question thus settled, the Council ferred to a committee of jurists the question of legal principle wh the case had raised with regard to the competence of the Coun the right of coercive action and the responsibility of a state political crimes committed on its territory. Unanimous repl were received to these questions and were transmitted by the Cou to the Assembly; and the legal position was thus more clearly est lished as regards similar incidents in the future.

The case was an extremely intricate one, and there has been mu difference of opinion as to the action of the League. The Leag facilitated a quick settlement, the early evacuation of Corfu and avoidance of hostilities; and the actual proposals which it made to the details of settlement are not open to adverse criticism. Bu did not secure the adoption of all these proposals. The action of Conference of Ambassadors, in giving its award, while withholdi the report on which it purported to base it, would have been possible if the League had been in full control of the case. The f tors which made effective League action difficult were partly special and dual position of the Conference of Ambassadors in question and partly, it must be recognised, the fact that one of parties involved was a Great Power and that the general relations the Powers were at the moment complicated by other questions policy. The degree and limits of the League's action accurately flect the extent to which it was possible to make a collective wo opinion effective under the conditions created at the moment by relations between the governments, and especially the Great Pow on the council. That this collective opinion had an important fluence on the settlement is indisputable, and the expression of opinion, made possible by the meeting of the Assembly, was ind a revelation to all who witnessed it of what is bound to be hencefo a new force of the first importance in the political life of the worl

Mosul.—The Conference of Lausanne in 1923 found that its m difficult question in the settlement of the terms of peace w Turkey was the frontier line between Turkey and the Brit "mandate" territory of 'Iraq. Agreement having failed, the trea provided that Turkey and Great Britain should attempt to rea agreement by friendly negotiations, and that, if these did n succeed within nine months, the question should be referred to Council of the League. The negotiations failed, and in Aug. 1 the question was accordingly brought before the Council, who pointed a commission of three (a Swede, a Hungarian and a Belgia to investigate on the spot. The commission worked for eight mon and then presented a report in which, after reviewing exhaustiv all the factors of the case, they recommended unanimously that best solution would be for the disputed district, including the to of Mosul, to be included in 'Iraq if the British mandate could continued for 25 years, but that, if this were impossible, it would better to assign it to Turkey. When the Council had this rep before them in Sept. 1925, they were faced with the contention Turkey that the Council's task under the Treaty of Lausanne one of mediation, not arbitration, and that no decision could binding unless Turkey herself had assented to it. The Council ask

visory opinion of the Permanent Court of International Justice,
replied that the Treaty had given arbitral powers and that
onsent of the two parties was not required, though unanimity of
ther members was necessary. With this opinion, the Council
ec. decided, by a unanimous vote of all members other than
disputants, that the territory should be assigned to 'Iraq,
ct to the prolongation of the British mandate and the assurance
l protection for the Kurdish population. The Turks refused to
t the court's opinion that an arbitral decision was binding, and
drew from the Council at which the above decision was taken.
British Govt. undertook to ask for authority to accept the
ngation of the mandate for 25 years or until such earlier
as 'Iraq could be accepted as a member of the League, and
unced their intention to attempt the renewal of negotiations
Turkey.

uring this difficult period the Council took various measures to
in the maintenance of the *status quo* without hostilities and to
tigate complaints as to Turkish deportations of Christians and
tions of the frontier. The mission of Gen. Laidoner on behalf of
League for this latter purpose is of special interest as being the
of its kind. (For the general settlement *see* MOSUL.)

e Greco-Bulgar Incident.—On Oct. 19 1925 shots were ex-
ged between two Greek and Bulgarian sentries occupying fron-
posts separated by 40 yards on the frontiers northeast of
ika. On Oct. 22 Greek troops, under orders from Athens,
ed Bulgarian territory through the Struma valley and penetrated
t 8 km. on a front of about 32 kilometres. Bulgaria telegraphed
peal to Geneva asking the secretary general to convene a special
ing of the Council under the powers conferred on him by Article
the Covenant. This appeal arrived on Friday morning, Oct.
The secretary general at once decided to convene the Council,
after telephonic conversation with M. Briand, the president for
ime being, fixed it at the most quickly accessible place, Paris,
at the earliest date physically possible for members requiring to
from Stockholm, London and Rome, Monday, Oct. 26.
e same time it was arranged that a telegram should be sent to
governments in M. Briand's name, as president, calling on
sides to abstain from all hostilities. This telegram was also
tched the same Friday morning. Preparations had been made
Greek attack on the Bulgarian town of Petrich with a force of
men and three batteries at 6 A.M. on Saturday, Oct. 24;
the Bulgarian Commander had orders to resist. Briand's
ram, arriving in the two capitals on Friday, was immediately
ive. Orders arrived from Athens just in time to stop the Greek
k on Petrich.

Monday, the 26th, the Council met in Paris. The situation of
ediate danger, viz., the presence of Greek troops in Bulgarian
ory, was at once dealt with. Evacuation was demanded within
e-limit of 60 hours, and an assurance that the necessary orders
been given was asked within a time-limit of 24 hours. The same
orders were telegraphed to British, French and Italian military
chés to proceed from Belgrade and Athens to supervise the
uation. The attachés received their instructions on Tuesday,
eeded immediately by special trains, and arrived on the scene
tion about 2 P.M. on Wednesday, Oct. 28. There followed one
e most dramatic and significant scenes in history. The attachés
ce summoned the two commanders and gave them detailed in-
tions in the name of the League of Nations as to the evacuation,
ribing the times at which the evacuating troops should move
he interval which was to elapse before Bulgarian troops might
the abandoned territory. Within about 11 hours of the
rs' arrival, and eight hours before the expiration of the time
the last Greek soldier left Bulgarian soil.

e Council proceeded to deal with the question of reparation and
feguards against the recurrence of similar incidents. They
inted a commission, under the chairmanship of Sir Horace
bold, and including French and Italian generals and Dutch
Swedish civilian members. The commission reported to the
cil at Geneva at its meeting in the first week in December. Its
ngs (*see* BULGARIA) were approved by the Council and accepted
e two governments. The incident was closed and future security
e Balkans substantially increased.

e League in this case acted with promptitude and efficacy. The
expressed and developed at the recent Locarno conference, the
ve weakness of the countries directly concerned and the fact
this was the kind of problem with which the League was de-
d to deal, and was not complicated by the difficulties of incom-
y defined treaty provisions, all doubtless contributed to this

ese eight cases have been chosen as best illustrating the
acter of the political problems with which the League was
during the years 1920-5, and its method of working. Other
tes were brought before the League: between Hungary and
ania about the expropriation of certain Hungarian nationals
ransylvania; between Hungary and Austria about the Bur-
nd; between Hungary and Czechoslovakia about a frontier
itation; between Finland and Russia about Eastern
Karelia; a frontier dispute (Jaworzina) between Poland and Czechoslovakia, and a dispute between France and Great Britain with regard to the nationality of persons born of British parents but resident at Tunis.

Two Comments.—In reviewing the League's action in these political disputes as a whole, two comments at once suggest themselves:—

1. The extent of the League's power to act effectively necessarily varies with the general international relations of the governments in and outside the League. After Locarno the Council deals promptly and decisively with the Greco-Bulgar trouble. With the Vilna incident, which occurred when the relations between the principal powers were difficult and complicated by many divergencies of policy in other questions, the action is slow, indecisive and unsuccessful.

2. The League, whose normal task is to preserve peace on the basis of treaties fully concluded, is placed in a difficult position when it is asked to complete the work of settling terms of peace. In the Upper Silesia, Memel, Vilna and 'Iraq cases this was a complicating factor. In such cases the treaties are either incomplete or ambiguous; they may be complicated by *obiter dicta* in the course of the negotiations; the League is held responsible by public opinion not only for a decision within the limits of its mandate but for the character of the mandate which it has had no power to vary; and by the very fact that it is continuing the work of making terms imposed by a victor its impartiality is compromised.

DISARMAMENT AND SECURITY

The reduction of armaments is the first of the specific tasks imposed by the Covenant. There is none on which the League has achieved so little direct and tangible result, for armaments remain, in the world as a whole, at a level not very substantially lower than in 1913, and no reduction is directly traceable to League action. But the indirect results have been of great importance. For it at once appeared that reduction of armaments required an increased sense of security; and the search for methods of obtaining this led to the growth of a belief in all-inclusive arbitration, the most notable and fruitful political development since the Covenant.

The first action of the League was to appoint a "temporary mixed commission" to prepare the way for armament reduction. This commission, consisting partly of politicians (though not representing their governments), partly of military and other technical experts, and partly of persons representing special classes of public interest (*e.g.*, working-class opinion), finally elaborated a draft treaty of mutual assistance. The basic principle was a combination of a general and special guarantees. Within the cadre of a general treaty, groups of states would enter into detailed arrangements to support each other if attacked, and as a condition of being entitled to this support they would agree to proportional disarmament. The proposal was criticised on the ground that the detailed plans for reciprocal military support contemplated would be unlikely in fact to lead to reduced armaments and, above all, that the authorised grouping of friendly states against prospective enemies was in conflict with the essential spirit of the League. At the 1924 Assembly, when it was clear that these objections would be fatal to the draft Treaty, the whole problem was reviewed on another basis. In a month the "Geneva Protocol" was elaborated and unanimously agreed for recommendation to the governments (*see* SECURITY).

This second scheme also failed to win acceptance, the new Conservative Govt. of Great Britain taking the lead in its rejection as the previous Labour Govt. had led the opposition to the earlier treaty. Great Britain was not prepared to accept the unlimited obligation of arbitration in her own disputes, or the responsibility of assisting the enforcement of such arbitration over an unrestricted range of other countries who might accept the obligation.

Apart from the objection of substance made to certain of the principles of these two schemes, it may be suggested that their rejection was in part due to the methods and procedure by which they were framed, which differed from the ordinary practice and traditions of the League. The temporary mixed commission included in one body diverse elements (statesmen, experts, etc.) who, under the ordinary League system, are separated into clearly differentiated committees, each with its own competence and defined rôle. In fact, serious misunderstandings sometimes arose as to the extent to which a statesman connected with a government, but not on this matter representing it, might be taken to be reflecting its policy or a policy it might be induced to accept. Moreover, the commission for a technical body, which it was in principle, perhaps worked too long without the effective direction of a political authority like the Council. The Geneva Protocol, on the other hand, was dealt with too rapidly by the political body, the Assembly, the work of experts having to proceed simultaneously with the political discussions and not having preceded them, as is the normal League method. The consequence was that the Assembly was acting more as an advisory body recommending a scheme than a political authority of fully accredited representatives. For so important a project the work of political preparation had been inadequate.

When all is said, however, it is difficult to regret even the haste of the 1924 Assembly, for the demonstration which it gave of the genuine desire of a large part of Europe for all-inclusive arbitration, and the impetus it gave to the movement towards arbitration throughout the world, have been perhaps the most important factors in political history since 1919.

Certainly the preparation of these two schemes was essential to the Locarno agreements of 1925. By "preparation" of course is not meant merely the technical elaboration of the proposals. In international agreements, that is always the least part of the work. It is the preparation of the public opinion of the world, of the minds of ministers and their advisers, which is the important thing. The preparation, in this wider sense, at Geneva was the indispensable basis of the Locarno treaties. These treaties provide for all-inclusive arbitration, on very much the Protocol principle, but over a restricted though wide range of countries; and for mutual guarantees and support somewhat similar to those of the original treaty of mutual assistance. It is, however, of their essence that the main vital guarantee is "bilateral" and not based upon a grouping of Powers presumed to be friendly against others presumed to be unfriendly.

Traffic in Arms.—Apart from these efforts to deal with the fundamental problem involved in the reduction of armaments the League has worked at the two subsidiary and connected questions of the traffic in arms and their private manufacture.

A Draft Convention to regulate traffic in arms was drawn up at a conference of 44 states, including the United States, Germany and Turkey, in Geneva in June 1925. The object of this Convention is to establish a general system of supervision and publicity over the international trade in arms and munitions, and a special system for certain land areas and maritime zones. Governments alone are to have the right to export or import arms exclusively designed for war, and a licensing system is provided for. In general, it may be said that the Convention does not give any effective authority to control traffic by international action, but is likely to provide the publicity which is the first condition of either national or international restriction when that proves practicable. This international aspect of private manufacture of arms, is still (1926) under preliminary study.

THE SAAR, DANZIG, MANDATES, MINORITIES

In certain areas of the world the League, normally an instrument through which sovereign states settle their differences or co-operate in matters of international concern, has itself direct and special responsibilities for government and administration. In the Saar it has the full responsibility of a sovereign state, exercised through a permanent commission appointed by and responsible to the Council. The small free city of Danzig is under its special protection, and a resident High Commissioner of the League acts as arbitrator on disputes between the free city and Poland. Over the large area of the mandated territories separated from the German and Turkish Empires by the terms of peace, it is responsible for seeing that the mandatory powers govern and administer in accordance with the mandate and the provisions of the Covenant. And in a number of states it has duties with regard to the protection of minority populations.

The Saar Basin.—The Saar Basin (*q.v.*) is a mining district
a predominant German population of some 700,000, whic
Treaty of Versailles transferred from Germany to the trustees
the League for 15 years, after which its future fate is to be d
by a plebiscite. The treaty prescribes the form of govern
through a governing commission, subject to the Council of the L
only, the inhabitants having no rights of representative gover
outside purely local administration, though the Commission a
quired to consider the views of elected representatives before c
ing the laws or imposing new taxes. The treaty also transferr
property in the mines to France in compensation for the destr
of the mines in Northern France.

The Saar Govt. is thus, by treaty provision, not by Leag
cision, purely autocratic and unrepresentative. With an over
ing plebiscite and situated between France and Germany,
inevitable that its inhabitants should have developed an extr
sensitive political consciousness and that the district should
been a mirror reflecting the controversies of its two great
bours. There has in fact been considerable political frictio
tension, varying directly with the changing political relati
France and Germany.

The Council and the Commission have been criticised for some
appointments on the Commission, for the introduction of the F
franc as the sole legal tender, for questions affecting educati
certain administrative decrees designed to prevent disturbance
ing a strike in 1923, for the presence of French troops for the
tenance of order which the treaty contemplated would be under
by local gendarmerie, and in general for an undue regard for F
interests. The inquiry made by the League in July 1923 showe
some of the charges were not without foundation. The Comm
has now developed an elected advisory council, designed to g
full representation to the wishes of the inhabitants as is p
under the autocratic régime imposed by the treaty; the admi
tive measures complained of in 1923 were changed with the te
tion of the strike; French troops were gradually replaced by
gendarmerie, and the political tension generally relaxed wi
improved relations of France and Germany.

The main grievances, substantial though they had often
have in reality been complaints against the provisions of the t
against conditions which those provisions made practically inev
Entrusted with the execution of terms imposed by the vict
League is at once compelled by those terms to action which
the mark of its origin, and at the same time is criticised by the
ards properly applicable to an international authority which
only impartial but unfettered.

Danzig.—The free city of Danzig, a small wedge between
Prussia and the Polish Corridor, is important as the chief ou
the sea for Polish trade. To act as a kind of court of first insta
the disputes bound to arise out of the intricate and nicely ba
provisions of the Danzig constitution (*see* DANZIG) it was pr
by the Treaty of Versailles that the League should appoint a r
high commissioner, a further appeal lying to the Council. The
been great tension and mutual suspicion throughout practical
whole six years between Danzig and Poland, such as some
almost to make negotiations between the two impossible.
these conditions the Council has had to devote much ti
nearly every meeting to disputes of which the one about Po
right to have post-boxes under her own control within Da
typical and the best known. The economic life of the city has
whole been satisfactory, the vessels entering the port and the e
rising considerably above the pre-War level. The demoralisa
the German mark caused great difficulties, however, and
was urgently needed to adjust her port and other facilities
new conditions. The League gave an expression of its spec
terest in the city by assisting her to introduce successfully a
currency of her own and later to raise a municipal loan for de
ment purposes.

Mandates.—The German colonies and the Arab provinces
Turkish Empire, ceded as a result of the World War, were not
ferred to other states in full sovereignty. Their administratio
entrusted to different mandatory powers under the general
vision of the League. For the terms on which the mandates
given and the general supervision exercised by the League th
the permanent mandates commission, *see* MANDATES.

It is difficult to measure the extent to which this system of
vision does in fact modify colonial administration. No indi
can of course be found by searching the League records for ins
of censure and repentance. That is not the way in which t
fluence of a collective opinion operates, or can operate, witho
ruptive results on the conduct of Great Powers. That does not
however, that this influence is not profoundly effective. Man
powers and their administrators are keenly sensitive to the
and informed criticism which is always forthcoming in the Co
sion's meetings, even if it finds little reflection in the public
tions; and the desire to avoid risk of exposure to it is a fac
daily colonial administration comparable with the influence exe
by Parliament on Whitehall by the right to ask questions
responsible minister.

Minorities.—The work of the League in the protection of
ities (*q.v.*) is one of the most important, and perhaps the most d

all its current duties. Nine states are under treaty obligation, l five others have by declarations accepted a similar engagement, observe in their administration certain principles designed to ure to racial and religious minorities within their territories pro- ion of life and liberty, the free exercise of religious rights and the use of their native tongue, with opportunities of education in it ere it is the native tongue of a considerable proportion of the ulation. The minorities number in all some 30,000,000, and are ituated that no possible treaty provisions or frontiers could have en them rights of sovereign self-government without creating umerable states or enclaves. They are free citizens of the states which they belong, and the only ultimately satisfactory solution hat they should become indistinguishably incorporated in the eral political life of the country. In the meantime the racial, gious and traditional feelings of enmity between them and those form the majority of the population subject them to the dangers lifferential majority government and administration.

he difficulties so caused constitute perhaps the greater part of political troubles and political dangers of Europe. It is a problem eculiar delicacy, for the minorities constitute a kind of state with- the state, and interference with or even open criticism of the ernment on which the daily conditions of their life depend may ays do more harm than good. For this reason complaints are v considered officially by the Council if they are put on the nda by a member of the Council, who satisfies himself that they sufficiently serious and well founded to justify this action; and council itself deals directly with these questions, not entrusting m beforehand to any technical committee. The League's in- nce is exercised for the most part in the form of private repre- tations and conversations which gain their authority from the that the sanction of a public discussion at the Council always ains as a possibility in the background.

Economic and Financial Reconstruction

The reconstruction work of the League shows, better than thing else, that the League is not confined to a limited range pecial tasks, but is an instrument which the governments of world can use for any form of international co-operation y wish to undertake. The Covenant imposes scarcely any cific economic or financial duties. It implies the preparation conomic sanctions; it contains the obligation to secure and intain freedom of communications and transit and (in a vague l ambiguous phrase) equitable treatment for the commerce all member states; but there is nothing which directly con- nplates such tasks as that of the financial restoration of a ntry.

he League's work in this sphere began with the Brussels ncial conference held under its auspices in Sept. 1920. Ex- ts from 39 countries, named by the governments but not resenting their policy, met to consider the methods by which ble finances and currencies could be restored. They drew up eries of unanimous resolutions which, elaborated as they were the later Genoa Conference of 1922, have since served as a ful guide and support to countries attempting to restore their nces. More important, however, than the establishment of general body of doctrine was the League's practical work in elf restoring the finances of two countries, Austria and Hun- y, whose problem was beyond their own unaided resources.

ustria.—It is interesting to observe the mechanism of the League lealing with the extraordinarily complex political and financial blem of the republic of Austria (*q.v.*). A sub-committee of the ncil handled the political aspects of the question. The financial nmittee worked out a technical scheme of reconstruction; the nomic committee considered what immediate economic measures ld be useful; a legal committee worked side by side and prepared formal instruments to embody the technical recommendations; behind all the Assembly provided the motive force of the col- ive good will of the world towards an effort to save a member e from destruction. The composition of the financial committee, which the heaviest burden fell, deserves special attention. It sisted of experts, partly drawn from national treasury depart- nts and partly from private finance. They sat as experts and not epresentatives of governments, and were thus able to recom- nd proposals involving government action, without waiting for assent of the governments. At the same time, their position bled them to estimate with special knowledge how far it was sible to induce the several governments to go.

he principles of the scheme proved of such importance in the ure history of European recovery, and were so novel and untried he time, that it is well to summarise them briefly. The immediate ble with Austria was that her currency was rapidly falling to . This was due primarily to the fact that the revenue was in- icient for the public expenditure, and the government, having no other resources, was meeting the deficit by printing notes. The scheme therefore provided that the inflationary issue of notes should cease and, to assure this, that the right of note issue should be transferred from the government to an independent Bank of Issue, working on commercial principles. This of course did not solve the problem. Inflation resulted from the unbalanced budget. Austria was, therefore, required to undertake internal reforms which would bring the budget into equilibrium. As this would take some years, and it was essential to stop inflation at once, it was proposed to raise an external loan of some £27,000,000 which would be available to meet deficits during this period. As security for this loan Austria's assets, primarily her customs and tobacco receipts, were assigned and placed under control. At the time, however, there was an obvious danger that Austria herself would fall to pieces, in which case her customs and tobacco receipts might also disappear. They were, therefore, an insufficient basis on which to issue a loan. This difficulty was met by securing government guarantees of the loan, in different proportions, from Great Britain, France, Italy, Czechoslovakia, Sweden, Holland, Belgium and Denmark, two other countries, Spain and Switzerland, associating themselves with the loan in a somewhat different form. In addition, a political protocol was signed assuring Austria's political and economic independence. Lastly, there was to be a Commissioner-General responsible to the council in general control of the whole scheme, controlling the assigned revenues, holding the proceeds of the loan, and supervising the reform of the Austrian budget.

The scheme was therefore essentially one of *financial* reconstruction. It did not directly undertake the economic restoration of the country. Its contribution to economic development was to afford the indispensable basis of a sound currency.

This work is now practically completed. The currency was at once stabilised in 1922 and has remained absolutely stable ever since, the only currency in Europe remaining stable throughout the period. Taxation receipts covered ordinary expenditure during 1924–5 and a large part of the reconstruction loan has been available for increasing the capital resources of the country by productive investment. The control of the budget ceased on Dec. 31 1925, and it is anticipated that the office of the Commissioner-General will be terminated before the end of June 1926.

Hungary.—The results in Austria led, a year later, to a request for similar aid from Hungary, whose currency and finances reached the same position as Austria's, though more slowly. Here the problem was technically easier, as Hungary had a solid agricultural basis for her economic life and was more than self-sufficient in the primary necessities of food. But it was politically more difficult, for her neighbours, particularly Czechoslovakia, Serbia and Rumania, speculated anxiously as to the attitude of a restored and strengthened Hungary, and their relations with her were embittered by many unsettled disputes. The League could not act except at the unanimous wish of all the interested countries, who included Hungary's neighbours, and it looked as if this would prove an insuperable obstacle. Under the influence of the League, however, these disputes were settled—with an incidental advantage to the political situation of Central Europe extending far beyond the immediate results of the reconstruction scheme.

The scheme was identical in its main principles with the Austrian, but the loan was less than half the amount, it was issued without government guarantees and provision was made for a moderate reparation payment under technical conditions which afforded a valuable precedent for the German problem. The Hungarian crown was at once stabilised in relation to sterling and with sterling has now gone on to gold. The budget recovered its balance after the first few months. Control began on May 1 1925. The first subsequent financial year (July 1 1924 to June 30 1925) showed a surplus of 63,000,000 gold crowns and there was a further surplus in the first six months of the following financial year. The great bulk of the loan, therefore, not being required for its primary purpose of meeting budget deficits, will be devoted to productive investment. It is anticipated that the control will end with a declaration by the Council that the financial stability of Hungary is assured at about the same time as the Austrian, *i.e.*, in June 1926.

German Reparation.—Though the League had no direct responsibility for handling the German reparation problem, the experience gained in the Austrian and Hungarian schemes certainly contributed to its solution. The most important principles of the Dawes scheme had been anticipated, and for the most part tried in practice, in these earlier schemes. It is sufficient to mention the stabilisation of the currency, the foundation of an independent bank of issue, the provisions for the maintenance of budget equilibrium (with the important difference that no general budget control was necessary in Germany), the fixation of reparation payments not for all time but for a considerable period, the principles of the control of the assigned revenues and the " transfer " system.

Greek Refugee Settlement.—Reconstruction work of a somewhat different kind has been undertaken by the League in the settlement of Greek refugees (*see* Refugees) who to the number of nearly 1,500,000 or more than a fifth of the population of Greece, fled back to Greece as a result of the Greco-Turkish War, a task evidently beyond the unaided resources of Greece. With the aid of the League a loan of £10,000,000 was raised and employed to settle the refugees in productive employment, mainly upon the land. The work, directed by a refugee settlement commission, consisted of an American chairman and a British vice-chairman, selected by the League, and two Greek members, chosen with the Council's approval by the Greek Government. The bulk of the refugees were housed, allotted land, and started on their new careers with a small initial capital and the necessary equipment.

Among other work carried on under the direction of the financial committee have been the introduction of a new and stable currency, later followed by a municipal loan, for Danzig; financial advice to Estonia and Albania; and a study, which is still continuing, of the problem of double taxation.

Trade and Commerce.—Meantime the economic committee has been working patiently at the task of securing more "equitable treatment" for commerce in the spirit of Article 23 of the Covenant, and in removing impediments to international trade. The most important achievement in this sphere was the conclusion in Oct. 1923, of a convention for the simplification of customs formalities. In addition, a convention has been arranged which has removed some of the obstacles to commercial arbitration. The committee have also considered the equitable treatment of foreigners (the recommendation of a code of principles to guide governments in their treatment of foreign enterprises established in their territories) and the suppression of fraudulent trade marks. They have embarked upon an attempt to secure the abolition of prohibitions of exports and imports.

A communications and transit committee, with numerous subcommittees, includes experts in land, sea and air transport, and is responsible to a periodical conference. The first important conference was held at Barcelona in 1921, when two conventions were approved laying down the general principles that transport originating in one state and crossing a second into a third, or transport making use of through international waterways (*see* INLAND WATER TRANSPORT), should enjoy complete liberty of transit with equal treatment for all flags and freedom from customs duties and vexatious dues. A second conference held at Geneva in Nov. 1923 dealt with international railway traffic, equality for shipping in maritime ports, the transmission of electric power across a third state and the development of hydraulic basins situated between two or more states. The maritime ports convention, drawn up at this conference, provides for equal treatment of all states in port dues and regulations, while the railway convention codifies existing railway practice as regards international traffic and aims at simplifying frontier formalities for passenger and goods traffic. All the conventions concluded at these conferences provide for machinery of compulsory arbitration similar to those contained in the clauses of the Peace Treaties of 1919 relating to communications and transport. In such cases the transit committee of the League acts as a mediatory body before a case goes for compulsory settlement to the international court of justice. The transit organisation has been instrumental in effecting considerable improvements in the passport system (particularly in the abolition of visas in many cases) and it has arranged a further passport conference to continue this work in 1926.

Among other questions studied are the reform of the calendar, commercial aerial law, wireless regulations, international motor drivers' licences, etc.

MISCELLANEOUS QUESTIONS

The League is also an instrument of positive co-operation in work of general benefit to the world. The short space here allotted to this must not be taken as an adequate measure of its relative importance in the general achievements of the League. For its health work the League has the assistance of a technical health committee, composed, like the financial, economic and transit committees, of experts. This health organisation has had the active co-operation of the United States, Germany and Russia, as well as the member states, and its activities have extended throughout Europe and the Eastern Mediterranean, tropical Africa and the Far East.

Public Health.—Its first important work was to assist Poland by means of an Epidemic Commission with the best western experience to prevent the spread of typhus through Poland to Europe. For this purpose it was necessary to attack the problem in Russia itself, and the Commission went to Russia, established effective co-operation and opened offices in Moscow and Kharkov. This was followed by a European conference at Warsaw in May 1922, attended by Soviet Russia, the Ukraine, Turkey, Germany and 24 other states. A draft convention was drawn up and has since become the basis of bi-lateral agreements between the nations adjoining Poland and Russia. Public health courses were arranged for health officers at Moscow, Kharkov and Warsaw. The Epidemic Commission next gave assistance to the Greek health authorities in dealing with the dangers of epidemic resulting from the sudden immigration of
masses of Greek refugees in and after the Greco-Turkish w

Apart from such emergency assistance, much has been don
secure an interchange of knowledge and experience between
public health organisations of the world, to promote their
operation and to study the characteristics of special epidemi
endemic diseases and the methods of combating them. Vari
missions have visited the Eastern Mediterranean, the Far E
Greece and Albania, the Balkan States, Russia and Italy, Pal
tine and Syria and Persia. Scientific work is also being d
with a view to the standardisation of sera and of certain dr
for the treatment of diphtheria, tetanus and dysentery.

An interesting experiment, which has been made possible
a large scale by the generosity of the Rockefeller Foundation
the interchange of selected officers of health administratio
Officers of one country visit those of another, study their metho
participate for some weeks or months in practical work a
then meet at Geneva to compare results. Lastly, the hea
organisation maintains an epidemiological intelligence servi
publishing at regular intervals detailed information of the mo
ment of epidemic disease throughout the world.

Drug Traffic.—Of what may be called the social questi
handled by the League the control of noxious drugs, and p
ticularly opium, has been the most difficult and important. T
League took as its starting point the Opium Convention of 19
which had been signed by most countries in the world.
advisory committee was appointed to prepare a plan to ma
the application of this convention more effective in practi
They took as their aim the restriction of the traffic to medici
and scientific requirements, and started an investigation to
cover the extent of these requirements. Finally, the U
Govt. sent a delegation to participate in the work of this co
mittee, and in any conference which might follow, and
attend the 1924 Assembly which reviewed the progress of
previous year and a half. Two plenipotentiary conferences
lowed in the winter of 1924–5. The first of these dealt with
question of the gradual suppression of opium smoking in the
East with a view for its ultimate abolition.

At this an agreement was reached under which the signat
states undertook (*a*) to strengthen the measures already p
vided for in the convention of 1912 and (*b*) to suppress entir
the consumption of prepared opium in their respective te
tories within 15 years from the date at which the poppy-grow
countries should succeed in preventing the clandestine expor
tion of raw opium from constituting a serious obstacle to
restriction of consumption in the former territories. The sec
conference drew up a convention for the more effective rest
tion of the production or manufacture of narcotics and of
international trade in them. The latter is to be controlled
particular by a system of export authorisations and imp
certificates. A permanent central board is to be establis
which is to receive periodical estimates from the contract
parties of the quantities of narcotics they need and ask for
planations if they are such as to suggest a danger of illicit tra
A further protocol engages the signatory states to take measu
which shall completely prevent, within five years, the smuggl
of opium out of their territories from constituting a seri
obstacle to the suppression of the use of prepared opium
other countries.

The American delegation had brought a complete program
of their own, which they failed to get adopted. The chief
ference was that they wanted a more definite undertaking th
the other countries thought practicable for the restriction of
growth of the raw product and for the cessation within a term
years of the prepared opium. They ultimately withdrew fr
the conference, as did China.

White Slave Traffic.—Certain work has also been done by t
League in connection with the traffic in women and the prot
tion of children. A convention was drawn up by the 1921 Asse
bly strengthening in certain respects the provisions of two p
War conventions dealing with traffic and has been signed by
states. The problem is also being studied by one of the t
committees of the Commission for the protection and welfare

dren and young people, which includes representatives of untary organisations and makes annual recommendations to Assembly. The study of child welfare is undertaken by the ld Welfare Committee of this Commission.

part from this general work the League took direct practical sures in 1921 to rescue, and where possible restore to their people, women captured and removed from their homes ing the military operations in the Near East, houses of refuge ng established at Constantinople and Aleppo. Lastly, in 3, the League arranged a conference at which a convention drawn up to assist in the suppression of the international ffic in obscene publications.

umanitarian Work.—Two important pieces of humanitarian rk have been undertaken by the League through Dr. Nansen. 1926 large numbers of war prisoners were still in Russia and acent countries awaiting the means of repatriation. With aid of certain charitable societies Dr. Nansen organised a t of steamers under League charter in the Baltic and Black s and 427,386 prisoners of 26 different nationalities were reriated at the astonishingly low cost of less than £1 a head. Nansen also undertook somewhat similar work for the settlent of large numbers of Russian refugees. Their movements re assisted by the invention of a special system of identity tificates, as a substitute for passports, and considerable progs has been made in finding them employment.

Two other pieces of humanitarian work may be mentioned in clusion, a convention drawn up at the 1925 Assembly for the pression of slavery (*q.v.*) and restriction of forced labour, and scheme prepared by Senator Ciraolo and now being worked t in collaboration with Red Cross organisations, for the proion of insurance against national calamities such as earthakes. Among other tasks, the most novel departure has haps been the work of the committee on Intellectual Coeration (*q.v.*) which has till recently been presided over M. Bergson and has included among its members Prof. nstein, Madame Curie and Prof. Gilbert Murray.

Under Article 24 of the Covenant some international bureaux ablished by convention must be, and others may be, brought der the League. Four such organisations have now been iliated, viz.: relief bureau (for the repatriation of distressed rsons), a hydrographic bureau (to secure co-ordination in drographic work), an office for the control of liquor traffic in rica and a committee for air navigation. The League issues a ndbook giving information about some 360 international ganisations and a quarterly bulletin giving some account of eir work.

SUMMARY OF WORK

In these six years (1919–25), therefore, the League has averted stilities in some half-dozen cases and probably prevented at st minor wars in several of them. It has made a substantial ntribution to Europe's recovery by the guidance and influence the Brussels Financial Conference; by the direct reconstrucn of Austria and Hungary; by the model so afforded for the lution of the German problem and the self-restoration achieved other countries; and by a series of transit and customs forlities Conventions and other measures designed to remove the pediments to international trade. It has repatriated some ndreds of thousands of refugees and established nearly 00,000 in productive employment in Greece. It has exercised varying but increasing influence over the government of some ,000,000 of minority populations entrusted to its guidance. has supervised the mandatory administration of the former lonial Empire of Germany and Turkey. It has directly govned the district of the Saar and has assisted in the government Danzig. It has worked at a number of social problems, the gulation of opium and other drugs, and the protection of men and children.

Apart from these tangible and visible results, it has peneated and modified the policies of national governments through e regular contact, and co-operation in international work, of reign Ministers, quarterly and annually at meetings of the Council and Assembly, and of their advisers and technical assistants both at these meetings and at a series of technical conferences and discussions. Beginning with disarmament but extending to security, it has prepared the way for the great extension of comprehensive arbitration embodied in the Locarno agreements and doubtless destined to extend beyond them.

On the other hand, the League remained long impotent before the protracted conflicts which reflected the incompleteness of the conclusion of peace in 1919 both in diplomacy, as in the reparation question, and in actual hostilities, as between Greece and Turkey. In some of the disputes which it has handled, it has been indecisive or ineffective; in others, the nature of its action has apparently been determined as much by the relative strength of the disputants as by considerations of ideal justice. It has made no material progress in securing disarmament. Its work in removing the fundamental causes of war, and in particular those which spring from economic policy, has only begun.

Whether these results will be regarded as disappointing or as satisfactory will doubtless depend mainly on the standard by which they are judged. By comparison with the pre-War position and methods of negotiation there can be no doubt that they represent a very great achievement. No better illustration can perhaps be found than in two references to Lord Grey's book, *Twenty-five Years* (1926). Of the London Conference of Ambassadors of 1913, for example, he says in effect that it lasted eight months, discussed minor questions and settled nothing, but was well worth while because it gave the world a sense of confidence to think that there was some method of international contact during a period of tension.

In contrast with this, even the Assembly of 1925, the least spectacular of recent years, in three weeks dealt with a mass of useful work, of real if secondary importance, and the assurance of a regular method of international contact is now not temporary but permanent. Still more significant is the account which Viscount Grey gives of the conference of the Balkan Powers when they met, as it happened in London, after the first Balkan conflict of 1912. He believed that the policy they were discussing would mean both the resumption of war and a disastrous result, as indeed it did. But neither Great Britain nor any other Great Power was directly concerned. If his opinion were asked in unofficial conversations he gave it, informally, tentatively—and in fact without effect. Neither he nor anyone else felt able to intervene in a matter directly affecting only the negotiating States. The second disastrous war followed. In contrast with this the settlement of the recent Greco-Bulgar dispute of 1925 illustrates the recognition of the new principle that a war is the concern of the whole world.

If, however, our standard of judgment for the results of the six years is not the pre-War position but the ultimate ideals of the League, it is no less clear that the League's work is only in its infancy. The League is not yet universal in its composition. Its ability to deal with a first-class dispute between first-class Powers has fortunately not yet been tested. There is as yet no complete assurance that such a dispute would find the League united and effective. Nor has more than a beginning been made in removing the causes from which such disputes may arise. This, the ultimate object of the League, must in the nature of the case be a progressive, and indeed a permanent task. It means a complete, if gradual, revolution in the traditional and historic attitude of the nations of the world to each other and a transformation of many of their policies. In this work the League may lead, but it can never advance far beyond, the public opinion of the world. The scope is illimitable and the task unending.

BIBLIOGRAPHY.—The main authorities are the League's own publications, which give complete information as to all its activities. In the first place the *Official Journal* contains the minutes of the Council with the documents presented to it; while the records of Assembly meetings are issued in special supplements. All Treaties registered under Article 18 of the Covenant are published in the *Treaty Series*. All reports of specially appointed League Commissions are at once published, as are also the periodical reports of permanent officers and authorities carrying on League work (such

as the Commissioners General in Austria and Hungary, the Greek Refugee Settlement Commission, the Saar Governing Commission, etc.). As these official records are very voluminous the League also publishes (*a*) an abbreviated *Monthly Summary*, giving a regular account of League activities and (*b*) a series of special pamphlets as to special tasks (health work; reconstruction of Austria; mandates, etc.) and a general summary "A Survey." In addition, the League issues technical publications on various subjects of world interest. Of these the most important are the *Economic Publications* (including a *Monthly Bulletin of Statistics*, which gives a synopsis of all main statistics indicative of economic development throughout the world, and annual publications on *Currency, Public Finance, Trade and Commerce*), a *Military Year Book* and a *Monthly Epidemiological Report*. These publications are issued in English and French through League agents (in England Messrs. Constable).

Books on the League work are numerous, especially with regard to special subjects (the Saar, Opium, etc.) and the general principles and conception of the League. Of those which summarise the general work of the League the following may be mentioned: Publications by the League of Nations Union (1920, etc.); Organisers of the League of Nations, *The League of Nations Starts* (1920); W. Schücking und H. Wehberg, *Die Satzung des Völkerbundes. Kommentiert* (1921); L.V.A. Bourgeois, *L'Oeuvre de la Société des Nations 1920–1923* (1923); P. Munch, *Les Origines et l'Oeuvre de la Société des Nations* (1923); R. Williams, *The League of Nations To-day* (1923); H. G. Alexander, *The Revival of Europe* (1924); M. Fanshawe, *Reconstruction*, a full summary to 1925, well documented (1925). League of Nations Information Section, *Pamphlets on the League of Nations*, its Covenant and its various activities; P. J. N. Baker, *The Geneva Protocol for the Pacific Settlement of International Disputes* (1925); Sir G. G. Butler, *A Handbook to the League of Nations, brought down to the end of the 5th Assembly*, with an explanation of the Protocol . . . with an introduction by the Right Hon. Viscount Cecil of Chelwood, 2nd ed. (1925). The publications of the World Peace Foundation include a number on the work of the League. Among these are *Handbook on the League of Nations, 1920–24*, and the *Yearbook of the League of Nations* (1925). (A. Sr.)

LEARNED SOCIETIES.—Incorporated by royal charter in 1902 "for the promotion of historical, philosophical and philological studies," the British Academy has since 1910 proved itself a potent force in the branches of learning which come within the scope of its activities.

The Proceedings of the British Academy, of which 10 vol. have been published, comprise "communications," together with special annual lectures endowed by private benefactors, or by public subscription. Other publications are *Supplemental Papers* (1911, etc.) and the annual *Schweich Lectures* on Biblical Archaeology, inaugurated in 1908.

The Fund—an anonymous endowment of £10,000—has also enabled the Academy to help forward the work of excavation in Bible lands. The series of *Social and Economic Records* under the direction of the late Sir Paul Vinogradoff, was started in 1908, with the support of a Government grant; five vol. have now been published. A renewed grant in aid of the Academy's work has furthered the continuation of this series. The publication, by the Clarendon Press, of the facsimiled *Old Testament of the Codex Sinaiticus* (1911–22) was made possible by an anonymous gift.

National Commemorations.—Since, in 1908, it organised the commemoration of the tercentenary of Milton's birth, the Academy has become the recognised co-ordinating body for the organisation of similar national commemorations, aided in this by the foundation of the annual Master Mind Lecture (one of a number of endowments, under the will of the late Henriette Hertz). The Academy's activities in furthering the Shakespeare tercentenary in 1916 were stimulated by the establishment, in 1911, of the annual Shakespeare Lecture (endowed by the late Mrs. Frida Mond). The annual Raleigh Lectures on History (founded by Sir Charles Wakefield, in 1919) the tercentenary of the death of Sir Walter Raleigh, were inaugurated by Lord Bryce, president of the Academy, with a survey of world history.

Among other endowments may be mentioned the Warton Lecture on English Poetry; the Philosophical Lecture; the Italian Lecture; the Lecture on Aspects of Art; the Lecture on English Philology and Literary History; the Cromer Prize for Greek Essay; the biennial Prize for English Studies. The Academy administers also the Rose Mary Crawshay prize fund for English literature, an annual prize of £100 awarded to a woman of any nationality for work on English literature.

Educational Work.—The Academy has provided a platfo
for dealing with educational needs. Thus, the School of Orien
Studies, now an integral part of the University of London, w
largely the outcome of a scheme submitted to the Academy
1904 by the late Professor Rhys Davids. The organisation of I
perial Studies, now recognised in London and in other Briti
universities, was directly due to proposals made by Sir Sidn
Low, in a paper read before the Academy in 1912. The Engli
Place-Name Society, founded in 1921, to carry out the survey
English place-names, was inaugurated under the auspices of t
British Academy in 1923, as the result of a statement submitt
by Professor A. Mawer, now Director of the Society. The me
bership of the Society, drawn from all parts of the country,
ready numbers some 700. The foundation of the British Scho
of Archaeology in Jerusalem in 1919 was brought about by t
Academy, in conjunction with the Palestine Exploration Fun
Students are now being trained at the school to fill posts creat
by the formation of a Government Department of Antiquiti
The compilation of a register of the archaeological sites of Pal
tine has been taken in hand. The Government Museum of Anti
uities has been organised. The exploration of various sites
Palestine and, not least, the excavation of two palaeolithic cav
in Galilee, and the discovery of the "Galilee" skull, are amo
the early achievements of the school, under the directorship
Professor J. Garstang. The establishment of the British Scho
at Jerusalem, in which the late Professor Leonard King was p
marily concerned as initiating the idea, must take an importa
place among the more recent efforts of the Academy. In all th
archaeological work the Palestine Exploration Fund has be
foremost and active, and among its recent excavations are tho
on the Hill of Ophel at Jerusalem, the results of which confir
the view as to the site of the City of David. Meanwhile remar
able discoveries have been made in the Near East (*see* ARC
AEOLOGY: *Western Asia*).

Among the enterprises promoted by the Academy is the *Enc*
clopaedia of Islam (1908, etc.)—perhaps the most important pro
ect of the International Associations of Academies (which laps
at the outbreak of the World War). The scheme was launched
the meeting of the Association held in London, 1904. The enc
clopaedia is issued in English, French and German. Sir Thom
Arnold, nominated by the Academy, acts as English edito
The Government of India, through the Academy, contribut
towards the publication of the English issue.

International Relations.—Internationally, the Academy
closely associated with the newly established Union Académiq
Internationale, in which body it represents Great Britain. Th
principal proposals of the *Union* in which the Academy is co
cerned are the following: (*a*) *Corpus vasorum* (1922, etc.); (
Catalogue of Alchemical MSS (1926, etc.); (*c*) *Dictionary of Media*
val Latin; (*d*) *Forma Imperii Romani;* and (*e*) supplements
the *Corpora Inscriptionum graecarum et latinarum.*

Other Learned Societies.—The leading departmental societie
the Society of Antiquaries, the Royal Historical Society, th
Royal Society of Literature, the Early English Text Society, th
Selden and other societies have all continued, developed an
renewed their activities, during the period under consideratio
Among newer developments may be mentioned the remarkab
progress of the less eclectic institutions, such as the Englis
classical, historical, geographical and modern languages assoc
ations, and the important part played by them in securing du
recognition for humanistic studies, in the scheme of nation
education. The value of classical study is increasingly reco
nised and there is due appreciation of the danger likely to accru
were it submerged by newer studies. The organisation of co
operative research in studies appertaining to modern languag
and literatures was advanced by the foundation, in 1916, of the
Modern Humanities Research Association. Many agencies hav
promoted the recognition of English and its paramount positio
among modern studies—notably the English Association, and, i
more specialised work, such societies as the Early Text Societ
the Malone and the S.P.E. (Society of Pure English), of which
Dr. Robert Bridges, is the founder and leading spirit.

The Shakespeare Association (incorporating the Shakespeare ly Committee), founded in close connection with the Shake- are Tercentenary, 1916, has started a survey of Shakespeare in e various countries of the world, and has published a number papers. The Bibliographical Society, founded in 1892, has nce 1910, mainly owing to the activities of Professor A. W. Pol- rd, issued a number of important publications on English liography. In 1920 the society took over *The Library*, founded the late Sir John MacAlister in 1888, and incorporated its *ansactions* with it, as a bibliographical quarterly. (I. G.)

SOCIETIES IN THE U.S.A.

A feature in the United States during the period 1910–26 has en a marked tendency towards decentralisation and specialism constantly narrower groups or subjects. The number of soci- ies has increased, with a corresponding increase in the number individuals engaged in research work, but the professed scope the large majority of these organisations is local, particularly the fields of history, ethnology and geology. All the older cieties continued to function, with little or no change in organ- ation or objective. The Smithsonian Institution maintained s pre-eminency, particularly in the fields of American ethnol- y and astrophysics. The American Oriental Society, founded 1842 for the promotion of Oriental studies and the encourage- ent of research in Eastern languages and literature, continued publish a journal which has appeared without a break since 43, and extended its activities by including in its field of search the historical study of religion in its widest scope. he National Geographic Society, with possibly a larger mem- ership (700,000) than any other society in the United States, as very active both in organising and financing explorations d in publication.

Of recent formations the Carnegie Institution of Washington, .C., is the most important. It was endowed in 1902 by the late ndrew Carnegie with a sum of $22,300,000 to encourage in the roadest and most liberal manner investigation, research and dis- overy and the application of knowledge to the improvement of ankind. Organised in departments, including those of experi- ental evolution, embryology, botanical research, marine biol- gy, meridian astrometry, eugenics and nutrition, it is working nergetically along its selected lines of investigation. In addition other work in terrestrial magnetism, researches are prosecuted atmospheric electricity, magnetism in general and other allied opics. The Institution has physical laboratories at National ock Creek Park, D.C., a nutrition laboratory at Boston, Mass., here studies of the metabolism of normal individuals and of iabetics and other researches connected with metabolism are onducted, and a desert laboratory for botanical research at ucson, Arizona. In addition it maintains the Mount Wilson bservatory at Pasadena, California.

LEATHER (*see* 16.330).—Several noteworthy advances have een made since 1910 in the science and practice of leather anufacture.

IMPROVEMENTS IN MANUFACTURING METHODS

New Institutions.—A notable addition to the institutions ngaged more particularly in the study of scientific problems f the leather industry is to be recorded. In 1924 the American anners' Council established a leather research department in e University of Cincinnati as a memorial to members of the dustry who lost their lives in the World War. In the first lace the department is to be devoted to research work, but ventually it will extend its activities to the training of chemists r the industry. A leather research institute has also been stablished at the Darmstadt Technische Hochschule.

New Bating Materials.—Probably the most notable change in he processes of light leather manufacture is to be found in the tilisation of artificial bating or puering materials in place of he natural materials formerly used. In manufacturing soft exible leathers the skins were exposed, after removal of hair r wool, to a bate or puer made by fermenting the excreta of owls or dogs. The researches of J. Turney Wood of Nottingham resulted in the production of a satisfactory substitute from the pancreas of animals, which contains enzymes capable of bringing about most of the desired changes in the skins. Under various proprietary names, and usually mixed with ammonium chloride, pancreatic preparations have superseded the old type of puer to a great extent. The artificial bates are free from the objectionable features inseparable from the use of fermented natural material, are more uniform in composition, and their action upon skins can be better controlled. For a few purposes tanners find that the artificial bate is not entirely satisfactory, but a large proportion of European and American tanneries no longer use the natural bates.

New Tanning Materials.—A great number of new vegetable tanning materials have been brought to the attention of tanners from time to time, but the staple materials now used are not very different from those employed in 1910. The use of mimosa bark as a source of tannin has certainly increased, and this material, grown largely in South Africa, is exported either as such or in the form of a solid concentrated extract of the bark. Several modern extract factories have been erected for this purpose at convenient points in South Africa, and the product competes with the solid quebracho wood extract of South America as a relatively low-priced and efficient tanning material.

The sulphite cellulose liquors, by-products of the paper industry, have found some application in the leather industry. Although not strictly tannins, when suitably treated they combine with hide substance, and have been successfully used in conjunction with ordinary tanning materials in the production of sole leather.

Synthetic Tanning Materials.—As a result of the researches of Dr. E. Stiasny, of the Leather Industries Dept. of Leeds University, synthetic tanning materials have been manufactured and used on a commercial scale, and were particularly useful when the regular supplies of tanning materials were interfered with during the War. In principle the preparation of synthetic tannin is simple. Phenolic bodies such as cresol are treated with sulphuric acid, and under carefully regulated conditions the product is condensed with formaldehyde and partly neutralised with an alkali. The first synthetic tannin of this type was named "Neradol" by Stiasny and manufactured by the Badische Anilin und Soda Fabrik. Various firms now produce similar materials in most European countries and in the United States. The synthetic tannins have many of the chemical properties of tannin, and are capable of converting skin into leather, but they appear to give more satisfactory results in practice when used in conjunction with other tanning materials. A great many modified processes of manufacture have been suggested from time to time, but there is some diversity of opinion amongst tanners as to the merits of synthetic tannins, and in their present form it is improbable that they will replace the natural tanning materials to any great extent.

The Chrome Process.—The chrome tanning process is now utilised in the manufacture of a large proportion of all boot upper leathers. It is estimated that in Great Britain about 80% of such leathers are now chrome-tanned, and this figure probably represents the approximate proportion used in other countries. Chrome-tanned sole leather is now manufactured in appreciable quantity, and as the early disadvantages associated with it have been overcome, a waterproof, non-slipping chrome sole, more durable than the vegetable tanned product, is now produced. It will probably be used in increasing quantity, although more costly to produce than the older type, and this fact may restrict its use.

Use of Pigments.—In the finishing of coloured leathers pigments are now used in increasing quantity, as a more uniformly coloured surface can be obtained than is possible in most cases with coal-tar colours alone. The leather is dyed with solutions of the latter in the ordinary way, and in the final stages of finishing very finely ground pigments suspended in suitable media are sprayed or swabbed over the leather surface. On the highest grade leathers this may be unnecessary, but the appearance of medium and low-grade skins is improved by the treatment.

Machinery.—The developments on the mechanical side of tannery equipment have been concerned chiefly with the improvement of existing types of machinery. Probably the most interesting to the British sole leather tanner is to be found in the perfection of the unhairing and fleshing machinery. Machines which remove hair and flesh from skins and sides (*i.e.*, half hides) have long been available and used in tanneries throughout the world, but the special difficulties connected with the manipulation of heavy whole hides were not met until the Turner Tanning Machinery Co., Ltd., developed the pneumatic roll unhairing and fleshing machine. British sole leather tanners who work whole hides, as distinct from sides, through the earlier processes in the tannery, found this machine particularly useful when manual labour was scarce in 1914–8, and have continued to use it successfully since then.

The Liming of Hides.—Two devices with the same object—the economisation of labour in the liming of hides—have been patented and found some application in sole leather tanneries. In both systems the hides are suspended in pits containing the depilating solution, and in one (Forsare) the liquor is agitated and circulated between the hides by blowing compressed air through perforated pipes fixed at the bottom of the pits. In the other system (Tilston, Melbourne) the liquor is distributed by means of a paddle which moves slowly along the bottom of the pit. The heavy manual labour involved in handling and setting the hides by the orthodox method, where hides are piled in a pit, is avoided, but both of the new systems require a larger pit space for dealing with a given number of hides than does the older method. In the period under review there has been a notable increase in the number of chemists employed in the leather industry, and there are few important tanneries which do not now employ one or more specially trained chemists on their staffs.

(D. McC.)

II. THE TRADE IN LEATHER

The main differences in the distribution of the industry since 1911 affect the position of Great Britain and the United States. Great Britain, with the exception of certain classes of leather, is becoming a bigger producer and much less dependent upon import supplies. Export from the United States has declined in quantity. The rest of the world remains approximately where it was, though there is a tendency to an increase in leather production in those agricultural countries where there is a substantial supply of hides which previously were exported, *e.g.*, South Africa.

World Production of Hides.—There has been a small increase in the world's annual supply of hides, though this increase has not been equal to the rate of increase in population within the same period. Every tanning country has a certain supply of hides of its own, but most of the big ones require to import from other countries. Dividing all countries into the two categories:—(*a*) "tanning countries" and (*b*) "hide exporting countries," there has been an increase in the aggregate in the number of cattle in the "tanning countries" of about 2% on a total of about 200,000,000 which is a rate of increase appreciably less than that of the population of those countries. On the other hand, there has been an increase of about 15% in the aggregate number of cattle in the "hide exporting countries" on a total of about 300,000,000. It is probable, however, that this is an overstatement of the real increase as in one or two countries the pre-War figures were defective.

The most important hide producing country from which heavy leather tanners draw their supplies is Argentina, in which country there has been a substantial increase in the number of cattle, the pre-War figure being 25,800,000 and the latest post-War figure being 37,000,000. In 1913 the export of frozen and chilled beef from the Argentina was only 4,119,000 quarters. In 1921 the figure had risen only to 4,730,000 quarters, but by 1924 the total was 9,547,000 quarters, falling slightly in 1925 to 8,921,000. One of the most significant features about this increase, of considerable interest to tanners in estimating future supplies of hides, is the fact that the increased export has been mainly to the continental countries of Europe. Before the World War Argentina exported practically no beef to th countries, but since the War Germany, Holland, Italy, Belgi and France have all imported beef from Argentina on a su stantial scale. If this indicates a change in social habits these countries leading to an increase in the consumption meat, there is likely to be a further demand for cattle in Sou Africa and Australia, as well as in South American countri which will react favourably upon supplies of hides for tanne

Against this, however, must be set off the diminution in t supply of dry hides from many parts of the world. The hic from the meat works throughout the world are by-products the meat and would come forward in undiminished numbe even if the price obtained for them was substantially less th at present. Dry hides, however, come from the outlying pa of the earth, and frequently the hide has to be carried so hundreds of miles by land before reaching the port. The hides are not forthcoming unless there is satisfactory return f the labour and costs involved, and a distinct relationship c be traced between the price and the supply of dry hides. Duri the period of high prices in 1919, for instance, some millions hides were brought forth which would never have come forwa but for the high prices ruling. Owing to the increase in tran port and handling charges, the return to the original holder the hide now is less than it was before the War, and the dim nution in the supply is to be measured by some millions. Th United States is now taking practically no dry hides, thoug the consumption in Great Britain is being maintained.

Tanning Materials.—The chief tanning material supplie before the War were quebracho extract from Argentina an chestnut extract from various European countries as well as th United States. A rapid increase is shown in the exportation quebracho extract from Argentina and a decline, in compariso with the pre-War figures, in the export of logs, the figures bein as follows:—

	Quebracho Logs	Quebracho Extract
	Tons	Tons
1913	383,964	79,684
1920	56,582	122,837
1921	30,857	120,100
1922	124,822	167,845
1923	113,639	208,586
1924	93,797	216,322
1925	116,940	274,245

Supplies of chestnut, however, are diminishing. In France i particular, exports have fallen very substantially, because th forests in past years have not been properly replanted. Import of chestnut extract into Great Britain from France in 1913 wer 35,800 tons, while the figure for 1925 was only 11,000 tons. I the United States also there is a reduction in the production o chestnut extract, due to the ravages of the chestnut blight.

Against this reduction, however, has to be set off the increase consumption of wattle bark as a tanning agent. The wattl tree, which was indigenous to Australia and was introduced int South Africa in the last decade of the past century, has mad very rapid strides. The Australian industry has fallen to very small dimensions, but the exports of wattle bark from Sout Africa increased from 65,000 tons in 1913 to 121,000 tons in 1922, declining slightly since. In addition to these exports o bark from South Africa, substantial quantities are now converted into extract in South Africa and exported to tanners throughout the world in the form of a solid extract, somewha similar in appearance to quebracho extract. The biggest tanning material company in the world has interested itself in the developments of the South African wattle industry.

Demand for Leather Goods.—On the leather side, there has been a substantial increase in the amount of leather made for the upholstery of motor cars. Although only a relatively small proportion of the cars manufactured in the world are upholstered in leather, the amount of leather required is substantial, and many firms who formerly produced leather for saddlery and harness work have turned over to this class of production.

further change is the production of fancy leather for boot l shoe purposes, and the extensive use of coloured leathers caused considerable difficulty to upper leather manufac- ers, who find that their industry has become one subject to ion. It is probable that the consumption of sole leather in world has not increased, as there have been a substantial nber of substitutes which have made a certain degree of dway. The competition of substitutes against leather for the s of boots, however, is largely an economic one, and with the er prices of hides which have now been reached, it is probable t the field for the substitute will be limited. In belting ther also, in certain countries, substitutes have made head- y, though in the United States, where special propaganda in interest of leather belting has been undertaken, the substi- e has declined in importance. (E. C. SN.)

EBEDEV, PETR NIKOLAJEVICH (1866–1912), Russian sicist, a master of experimental research, was born on Feb. (old style) 1866 in Moscow, son of a merchant. He was edu- ed at a German secondary school and a technical college in scow, and in 1887 went to study physics under Kundt in asbourg. He took his doctor's degree in 1891 and published first research on the Mossotti-Clausius theory of dielectrics. the same year he was appointed assistant in physics at the iversity of Moscow and in 1892 professor. In 1895 he produced y short electric waves and published his work on the double raction of electric rays. He also succeeded in proving, experi- ntally (1899), the existence of the extremely small pressure ich light exercises on bodies. In 1901 appeared his classical rk: *Experimental Research on Light Pressure* (published in 13 in German in *Ostwald's Klassiker*). Finally in 1910 (*Annal- der Physik*, April) he succeeded in measuring this pressure, eoretically determined by Maxwell. In 1911 Lebedev had to ve the university for political reasons, and started, with his pils, a private laboratory. His further work was mainly on origin of the earth's magnetism, but death from heart failure March 1 1912 stopped his ingenious experiments. He founded Moscow the Lebedev Physical Society. In 1913 his *Collected searches* were published in Russian under the auspices of this ciety. (A. FO.)

LE CATEAU, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

LECOCQ, ALEXANDRE CHARLES (1832–1918), French musical mposer (*see* 16.355), died in Paris Oct. 24 1918.

LEDGER: *see* BOOKKEEPING.

LEE, SIR SIDNEY (1859–1926), a British man of letters (*see* .363), died in London March 3 1926. He was knighted in 1911 d was president of the English Association in 1917. His lec- res on *The French Renaissance in England* were published in 10; and his later works include *Principles of Biography* (1911) d *Shakespeare and the Italian Renaissance* (1915). At the time his death, he was engaged on the second volume of his official ography of *King Edward VII.*, the first volume of which had peared a year previously.

LEE, VERNON (pen-name of Violet Paget)(1856–), British thor, was born in France, of English parentage, on Oct. 14 56. She lived almost entirely near Florence, and was a well- formed and acute student of Italian art, history and literature. er *Studies of the Eighteenth Century in Italy* (1880) is typical of veral books of essays; *Miss Brown* (1884); *Hauntings* (1890); *anitas* (1892); *Sister Benvenuta* (1906); and *Louis Norbert* (1914) e among her novels. *Satan the Waster*, a philosophic trilogy, as an ambitious dramatic satire on war and civilisation (1920), d among many other works may be mentioned *Gospels of narchy* (1908), essays on political subjects, *The Sentimental aveller* (1908) and *The Tower of Mirrors* (1914), essays on the irit of places, and *Proteus, or the Future of Intelligence* (1925).

LEEDS, England (*see* 16.368), had a population of 458,320 1921, and in 1925 it was stated to be nearly 500,000. oundhay, Seacroft, Shadwell and part of Crossgates were in- ded in the borough in 1912, Middleton in 1919, and part of del-cum-Eccup in 1925, making the total area 30,136 acres. In 18 the parliamentary borough was redistributed in six divi- ons, each returning one member. The city museum was acquired by the corporation in 1921 from the Leeds Philosophic and Literary Society. Kirkstall Abbey House, an historic building near Kirkstall Abbey, was bought by the municipality in 1924, and the old Kirkstall bridge over the Aire was replaced by a new bridge in 1912. The corporation owns the fine mansion of Temple Newsam, with an estate of 935 ac., in the Hunslet rural district in the east of the city, where there is a fine collection of arms and art treasures. A farm in connection with the estate has been worked as a municipal dairy farm since 1922. At Middleton 316 ac. have been leased for a public park, and 427 ac. bought for a housing scheme.

In 1924 and 1925 respectively the corporation obtained parliamentary powers to enable them to carry out very extensive street improvements in the city. New office buildings, capable of accommodating a staff of 350, were acquired and equipped in 1925. Under the provisions of the Leeds Corporation Act 1924 the city was constituted one township under a separate board of guardians by the amalgamation of the former townships of Leeds, Armley and Bramley, Holbeck and Hunslet and the former parish of Osmondthorpe. The construction of a reservoir at Leighton, 46 m. distant, was completed in 1926. In 1926 the tercentenary of the granting of the city charter was celebrated.

LEEDS, UNIVERSITY OF (*see* 10.43).—In the period under review, the professorial staff has been strengthened by the institution of chairs in English language, philosophy, medieval history, applied mathematics, physical chemistry, agricultural chemistry, bacteriology, therapeutics and clinical surgery. New departments of Russian and Spanish languages and literatures and of geography have also been established. Provision has been made for the residence of both men and women students. The university now has a hall of residence with accommodation for 120 men and four halls for women with accommodation for about 175 students.

Temporary structures were erected to accommodate the influx of students after the War and private dwelling houses were adapted for various departmental purposes. Considerable additions have been made to the site, however, and the efforts of the university authorities are now being directed to the provision of a range of adequate and permanent buildings. The university council has set aside special funds to aid research in all departments. With the help of grants from the Government, special investigations have been undertaken in animal nutrition, flax-growing, etc. A staff of research chemists has been appointed in the coal gas and fuel industries department, where investigations are carried out in co-operation with the Institution of Gas Engineers and the National Benzole Association. An International Research Laboratory for the leather industries has been established by means of public subscriptions as a memorial to Professor H. R. Procter. Considerable developments have taken place in the department of pathology and bacteriology which works in close association with the Leeds General Infirmary and the Health Committee of the Corporation.

In the department of agriculture a large volume of advisory work is done in the county. More than 1,400 problems were dealt with in 1924, 750 of them involving personal visits. Research is in progress in all branches of agricultural science and organised courses of lectures, demonstrations, etc., are conducted in the three Ridings of Yorkshire. The Rawdon Baptist College, the York Diocesan Training College and the Leeds Central Technical College (printing department) have been affiliated to the university, recognition being given, for purposes of degree work, to certain courses of study at these institutions.

In co-operation with Armstrong College, Newcastle-upon-Tyne, the university, at the request of the North Eastern Railway Company, undertook the conduct of lectures and examinations in connection with the company's educational system—a scheme which has since been extended throughout the area of the London and North Eastern Railway Company's service. Striking developments have taken place in the extramural work of the university. Five tutorial classes were conducted in 1910: in 1925 there were thirty-eight. In addition to these regular, three-year courses, a considerable number of one-year classes, introductory courses, single lectures and extension courses are given each year throughout the university's area. Public lectures are arranged in the university each session on literature, history, art, science, music, etc., while mid-day music recitals have become a regular feature of university life.

Between 1910 and 1914 the average number of students was 650. Between 1914 and 1919 the average fell to 540 but rose in the quinquennium 1919–24 to 1,329. There were 1,435 students in 1925. The appeal for a fund for new buildings produced £263,085 and £124,314 for the development of the university. Sir Edward Brotherton, Bart. gave £20,000 for bacteriological research. The Clothworkers' Company have made capital as well as annual grants amounting in all to £251,333. Sir James Roberts and Lord and Lady Cowdray have been generous benefactors.

LEE OF FAREHAM, ARTHUR HAMILTON LEE, 1st Viscount (1868–   ), British politician, was born at Bridport, Dorsetshire, Nov. 8 1868. Educated at Cheltenham and Woolwich, he entered the Royal Artillery in 1888, retiring with the rank of brevet-major in 1900. From 1893 until 1900 he was professor of strategy and tactics at the Royal Military College in Canada, during which period he organised the military survey of the Canadian frontier. He was British military attaché with the United States army during the Spanish-American War in 1898, and in the following year was military attaché to the British Embassy at Washington. In 1900 he entered the House of Commons as Conservative member for the Fareham division of Hampshire, which he represented for 18 years. He was Civil Lord of the Admiralty from Oct. 1903 until the resignation of the Balfour ministry in 1905. In 1912 he carried through Parliament an Act aimed at the white slave traffic. On the outbreak of the World War he rejoined the army, and served as a colonel on the staff. In 1915–6 he was personal military secretary to the Secretary for War (Mr. Lloyd George) and in 1917–8 director general of food supplies. He was made K.B.E. in 1916, G.B.E. in 1918, in which year he was created baron; and was sworn of the privy council in 1919. He joined Mr. Lloyd George's administration in 1919, first as Minister of Agriculture and then as First Lord of the Admiralty (Feb. 1921–Nov. 1922). In 1922 he was made a viscount. He was a member of the Imperial Cabinet in 1921, a delegate to the Washington Conference, Nov. 1921–Feb. 1922; and in 1923–4 chairman of the royal commission on the public services of India, for which he was created G.C.S.I. in 1925. In 1921 he presented to the nation, as a residence for the prime minister for the time being, the house and estate of Chequers on which subject he writes in this Encyclopædia.

LEFROY, HAROLD MAXWELL (1877–1925), British entomologist, was born at Crondall, Hampshire, Jan. 20 1877, and was educated at Marlborough and King's College, Cambridge, where he graduated in 1898. He early specialised in entomology and became in 1899 entomologist to the Imperial Department of Agriculture for the West Indies, a position which he held until his appointment in 1903 as imperial entomologist for India. In 1912 he was appointed to the newly created chair of entomology at the Imperial College of Science and Technology, South Kensington, and in 1913 he became honorary curator of the insect house of the Zoological Gardens, London. He devoted himself particularly to the study of the life history of insects of economic importance in the field, and as imperial silk specialist for India in 1915 and 1916 he did much valuable work for the silk and cotton industries. During the World War as temporary lieut.-colonel in Mesopotamia he conducted sanitary measures against flies, and in 1917 served as an expert on the royal commission on wheat supplies, dealing effectively with the problem of beetles in wheat. He subsequently devised means of combating the depredations of the death watch beetle in old buildings. He died in London on Oct. 14 1925, poisoned by the fumes of a gas with which he was experimenting for insect destruction.

His publications include *Indian Insect Pests* (1906); *Indian Insect Life* (1909); *A Manual of Entomology* (1923); and articles in *The West Indian Bulletin*, the *Agricultural Journal of India*, and many official papers.

LEGAL EDUCATION (*see* 9.603).—The purpose of this arti is to indicate the main tendencies of legal education in Engla and Wales since 1910, and to trace the general development legal education in the United States from the beginnings to t present day.

I. ENGLAND AND WALES

The most noteworthy feature of the period under review h been the greatly increased interest which law has received at t hands of those interested in education generally. Two princip tendencies have been revealed—first, an increasing demand f scientific legal education for both branches of the legal profe sion; and, second, the serious consideration by educational bodi of the advisability of including elementary instruction in law the curriculum of the ordinary schools.

Systematic legal education is now provided by the older a the newer universities, the Council of Legal Education, the La Society and the approved law schools set up by the Law Socie under the provisions of the Solicitors Act 1922. There are fa ulties or departments of law at the Universities of Oxford, Ca bridge, London, Birmingham, Durham (Armstrong College Leeds, Liverpool, Manchester, Sheffield and Bristol; and depar ments of law at the following university colleges: Aberystwyt Exeter, Nottingham, Leicester, Southampton, Bangor, Swanse and Cardiff. In some cases these faculties and departmen provide qualifying courses for degrees in other faculties. Thu at the university of London, the degree examinations for B.S (Economics) include industrial law, and for bachelor of com merce (B.Com.) commercial law, contract, banking an insurance.

Professional Law Schools.—A degree in law, however, is not i England a professional qualification. Before he can practise, th student must pass in the case of a barrister the examinations the Council of Legal Education, and in the case of a solicitor th Law Society's examinations. The instruction provided by th Council of Legal Education for such Bar students as care to tak advantage of it constitutes a complete curriculum in law. Th organisation is in the hands of a director of studies and a body readers of high standing. Lectures are given in the Inns of Cour lecture rooms. The Law Society from the year 1903 onward has held a school of law at the Law Society, Chancery Lane where lectures and classes under the control of a principal an director of legal studies and a body of readers, lecturers and tu tors have been given to increasing numbers of students both fo the intermediate examination and the final examination of th Law Society, and in lesser numbers for the degree in law at London University.

From 1903 until the passing of the Solicitors Act of 1922 attendance at a law school was entirely voluntary, and a matter o personal choice for each individual articled clerk. By the Ac of 1922, however, subject to certain exceptions, every article clerk, before presenting himself for his final examination at the end of his period of articles, must have attended substantiall for 12 months at an approved law school. To meet this requirement law schools had to be organised in the principal provincial towns.

The contribution of the law schools at Oxford and Cambridge to the cause of legal education is noteworthy. These universities supply practically the whole of the teaching staff engaged on this branch of educational activity as well as the bulk of the research students. Nor are these activities confined to the academic field. At Cambridge there are few colleges that do not possess their law clubs affiliated to the University Law Society; these bodies meet frequently for discussion and debate, and at intervals hold moots. This practice of mooting, which has also been revived in its ancient home, the Inns of Court, is a valuable addition to the practical side of legal education.

Law and General Education.—Apart from the study of law as a professional education, it may be said that educational establishments generally have come to allow a greater importance to the knowledge of law as part of the equipment of every citizen. Considerable attention and prominence has been given to the er by distinguished judges and others, and lectures have given in which the idea has been formulated. It has not een found practicable, however, to introduce elementary nto the average school curriculum, and it may be doubted ner such a suggestion is likely to be carried into effect in ear future. Clearly, only those who are approaching the usion of their school life would be able to profit by such ction, and it is notorious that sixth-form students already a very full curriculum. (E. L. B.*)

II. THE UNITED STATES

erican legal education begins in 1784 (or perhaps 1782), Judge Tapping Reeve of Litchfield, Conn., set up the first l for the teaching of the common law.

rly History.—There had been no legal profession in the ies until the 18th century. Before the revolution a certain er of lawyers had received their training in England, in nns of Court. But a system of courts, manned by lawyers requiring a trained profession to practise before them, was called for by the economic conditions of the colonies until rd the middle of that century; nor were the executive and ative justice, characteristic of the colonial polity, wholly rseded by judicial justice until after the revolution. Legal ation was at a low ebb in 18th-century England. The uni- ties had never taught the law of the land. The medieval m of the Inns of Court had decayed, and the system that obtains had not been set up. Hence there were no good els at hand after the revolution, and American legal educa- had to develop its own methods. So far as the models were lish, they were, first, the purely apprentice training of the r branch of the profession in England (for in general the ed States took the attorney or solicitor for its type, rather the barrister), and, second, the academic lectures on the of the land which began with Blackstone's lectures as Vin- professor at Oxford. This example was followed eagerly merica. Wythe's lectures at William and Mary (1779), on's at the College of Philadelphia, now the University of sylvania (1790), Kent's at Columbia (1793) and Parker's arvard (1815) were of this type. They were not instruction w to prospective lawyers so much as lectures to young lemen as part of their general cultural training. Later this of academic lectures upon law was grafted upon the appren- training which was the first type of legal education in America. fter the revolution, students ceased to go from America to Inns of Court. Then education for the Bar became dis- tly American. Beginning from this point, three stages of lopment may be distinguished. These stages correspond to e periods in American legal history. The method of each e is a response to the needs of the period in which it grew up.

pprentice Training.—First, there is a stage of apprentice ing, either in the office of a practising lawyer or in a law ol organised as an expanded law office and applying office hods of instruction. This sort of training sufficed for the ls of the time immediately after the revolution. The develop- t of judicial justice administered in courts by trained judges d for practitioners who knew the art of the lawyer's craft. n the United States took over English law as the law of its ral commonwealths, in the first instance it took over English l procedure. Except for land law, at the time of the revolu- the greater part of English law was expressed in terms of edure. Thus there was need of lawyers who knew how to g a lawsuit and how to conduct it through the courts. Ap- tice training was adapted to this need. Judge Reeve's law ol grew out of the practice of taking a number of students a country law office where the press of business did not rfere with instruction. Just because it grew out of such a office, the exact date of establishment of the school at Litch- l cannot be fixed.

he law schools of the period were modelled on that institu- . In effect, they were but expanded law offices in which pre- tors who were practising lawyers carried on the teaching side he law office as their chief activity. Such was the Harvard law school, the oldest of the existing law schools in the United States, in its first stage (1817–29).

At this time there was little differentiation of local law. But the whole tendency of the apprentice training was to dwell upon the local and temporary rather than the universal and enduring elements in the body of legal materials, and this unfortunate feature served to develop and entrench many provincialisms in the law of the several states, since, until, much later, the bulk of the profession was apprentice trained. In general the first stage prevailed until Joseph Story began to teach law at Harvard (1829). Also in many parts of the country the simpler needs of a rural or even pioneer society required nothing more than an apprentice-trained profession, so that the method of that stage has persisted in many localities into the present.

College Teaching.—A second stage begins with the appointment of Story as Dane professor at Harvard, and extends until the epoch-making work of Langdell after 1870. There was nothing in the way of a rule-of-thumb apprentice training, which, under 19th-century conditions, could be done better in a law school than in a law office. But with the growth of the law something more than a rule-of-thumb training in practice was required, and the second stage of legal education was a response. From Story to Langdell the law schools continually increased in influence. The accepted mode of training came to be study in a law school in which law was taught by lectures and from text-books with the teaching apparatus of the old-time college.

The era of expansion that followed the adoption of the constitution called for creative juristic activity and creative legislation. Study of substantive law was called for. It was necessary to investigate each item of the common law of England with reference to its applicability to the conditions in the New World. The traditional materials of 17th-century English law had to be reshaped so as to make of them a common law for America. A mere apprentice training could not meet these demands. Text-books had to be written to guide the courts in the new departments of law, which were formative on every hand. These text-books came from the law schools and soon gained the upper hand as the bases of instruction, even where the whole spirit of instruction remained that of the first stage. The best examples of the second stage are the teaching of Story and Greenleaf, and later of Parsons, Washburn and Parker at Harvard, the teaching of Dwight at Columbia, and the teaching of Cooley and his colleagues at Michigan.

Scientific Study of Jurisprudence.—In a third stage there is scientific study of the legal system of English-speaking countries on the basis of the sources. An analytical and a historical method, as methods of a general science of law, are applied to the sources, and thus system is put into each branch and department of the law. By the time of the Civil War the formative period of American law and legal institutions was substantially at an end. With few exceptions, the great text-books that had guided the courts speak from before the Civil War. In the last quarter of the 19th century, law books tend more and more to be mere indexes to the decisions: they cease to be creative. The need of the time had come to be in another direction. Now there was need of systematising the law which had developed in the period of growth. In response to this demand, within less than a decade after the end of the Civil War, Langdell, who was appointed to Story's chair at Harvard in 1870, had inaugurated the method of study from adjudicated cases which has come to prevail in the majority of American law schools of high grade.

This method seeks, through analytical and historical study of the sources, to give a grasp of the traditional art of deciding cases on the basis of reported judicial experience. It teaches the traditional art of developing grounds of decision from the authoritative legal materials. This is the enduring element in Anglo-American law. Conditions in many localities, in which requirements for admission to the Bar are low, and candidates have insufficient preliminary training to enable them to study the sources directly, have led to persistence of the method of lectures and text-book instruction in schools in which the teachers are actively engaged in practice, and hence the spirit is that of apprentice training. In such schools local law and procedure are chiefly stressed. Probably 60% of those who come to the Bar to-day are trained in such schools. (R. Po.*)

LEGIEN, CARL (1861–1920), German labour leader, was born Dec. 1 1861 at Marienburg (West Prussia). A turner by profession, he entered the trade union movement in Hamburg. In 1887 he became president of the turner's association, and in 1890 member of the general commission of the German trade unions. He was president of this commission from Jan. 1 1891 until the general German trade union association was founded in 1919, when he became its president, which he remained until his death. The leading organiser of the German trade union movement, in 1901 he founded the International Trade Union League, being its first secretary from 1903–19. During the World War he prepared the way for the legal recognition of the trade unions, which was granted in Jan. 1918. Together with Leipart, who succeeded to his post after his death, he formed the Arbeitsgemeinschaft (community of labour) at the end of 1918—an institution destined to set on foot the reconstruction of German economic conditions after the War by co-operation between the employers federations and the trade unions, the latter enjoying equal rights. His last great achievement was putting down the Kapp Putsch in March 1920. He died in Berlin Dec. 26 1920. Legien wrote many works on trade union questions, including *Die deutsche Gewerkschaftsbewegung* (1911).

LEGOUIS, ÉMILE (1861–), French scholar, was born at Honfleur on Oct. 31 1861. Educated at Honfleur and in Paris, after teaching for a year at the Collège d'Avranches, he was made *agrégé d'anglais* in 1885. He was next appointed lecturer at Lyons; and after passing his doctorate in 1896, he became professor at Lyons. In 1904 Legouis was appointed special lecturer in English at the Sorbonne. He is the author of many important critical works on English literature.

Among his publications are *Le Général Michel Beaupuy*, with G. Bussière (1891); *La jeunesse de Wordsworth; Étude sur "Le Prélude,"* crowned by the Académie française (1896); *Shakespeare* (1899); *Morceaux choisis de la littérature anglaise*, with M. Beljame (1905); *Chaucer* (1910); *Edmund Spenser* (1923); and with L. Cazamian, *Histoire de la littérature anglaise* (1924). He also collaborated in the translation of Chaucer's *Canterbury Tales*, crowned by the Académie française, 1908.

LEGROS, ALPHONSE (*see* 16.380) (1837–1911), Anglo-French artist, died in London Dec. 8 1911.

LEHÁR, FRANZ (1870–), Hungarian operetta composer, was born at Komárom, Hungary, April 30 1870. After studying at Vienna and Prague, he became a conductor. His opera *Kukuska*, afterwards called *Tatiana*, was performed in 1896, and since then he has written about 30 operettas. The popularity of his music is due to the charm of its melodies; and especially to the orchestration of his waltz themes, which, with their sensuous grace, are typical of 20th century light opera. His most famous musical comedies are *The Merry Widow* (1905) and *The Count of Luxemburg* (1909). He also wrote *The Man with the Three Wives; Gipsy Love; Eva; Alone at Last; The Blue Mazur; Frasquita;* and *Paganini* (1925).

LEHMBRUCK, WILHELM (1881–1919), German sculptor, was born Jan. 4 1881 at Meiderich near Duisburg, the son of a miner. He received his artistic training at the Düsseldorf Academy, lived from 1910 to 1914 in Paris, where he gained recognition for his art, and afterwards resided in Zürich and Berlin. Lehmbruck was a sculptor of great sensibility, and his art, especially in the last phase, is moving in its spirituality and tenderness. His best known works are: "Weibliche Figur," in Duisburg; "Weiblicher Torso," at The Hague; "Frau Lehmbruck," at Essen; "Knieende" at Mannheim; "Grosse Sinnende"; "Grosse Rückblickende"; "Sterbender Krieger"; "Sitzender Jüngling"; "Emporsteigender Jüngling", and a portrait of Fritz von Unruh in Frankfurt. He also produced numerous etchings of high merit. He died by his own hand in Berlin March 25 1919. See Paul Westheim: *W. Lehmbruck* (1919).

LEICESTER, England (*see* 16.393), with a population of 234,143 in 1921, and an area of 8,582 ac., was created a city in 1919, and has grown rapidly, particularly to the south. At Aylestone
a town to accommodate 7,000 to 8,000 people is being
(1926) by the municipality on a site of 206 acres. A schem
been approved by Parliament, and is now being carried ou
the reconstruction of old, and the construction of new st
in the centre of the city, affecting between 700 and 800 build
The erection of a garden city at Braumstone is also con
plated. A measure creating a diocese of Leicester has rece
the royal assent after passing through the National Ch
Assembly and Parliament. It will include the whole of Leice
shire, and St. Martin's Church, constituted a collegiate chur
1922, will be the cathedral. The Harvey Lane Baptist Ch
was destroyed by fire in 1921 and replaced by the mem
hall—completed in 1924. The Church of St. Augustine's, N
foundpool, was finished in 1912, and that of St. James
Greater in 1914. Another new parish was created in 1924, w
the Church of the Holy Apostles was consecrated.

De Montfort Hall, built by the corporation, was opene
1913. In 1921 a University College was founded, the site
buildings in Victoria Road being the gift of Mr. T. Fiel
Johnson. An extensive addition to the colleges of art
technology has been decided upon and to this end certain
joining properties were purchased in 1924. A new central e
tricity station was opened in 1922, and an extension begu
the following year. Leicester is a partner with Sheffield, Nott
ham and Derby in the Derwent Valley Water undertak
The first part of the scheme, which includes 35 m. of aqued
from Derwent Valley to the Ambergate Reservoir, was finis
in 1912.

LEIPZIG, Germany (*see* 16.399), the fourth city of Germ
and a large industrial centre, had a population of 636,485 in 1
including Mockau and Schönefeld, incorporated in 1915; E
ocker-Windorf, Leutsch, Paunsdorf and Wahren, incorpora
in 1922, added a further 32,105 persons to the population.
famous fair has been resumed, and is held yearly in Septem
The university is one of the largest in Germany. The term
station, through which most of the traffic between Prussia
Saxony passes, was completed in 1915; it contains 26 tracks
covers an area of 172,000 feet. After the Revolution there w
serious demonstrations against the Government in the city,
in April 1919 a Soviet republic was set up, but was put do
by government troops in the following month.

LELAND STANFORD JUNIOR UNIVERSITY (Stanf
University) (*see* 16.406).—The work of the university has
recent years been so reorganised that the first two years con
tute a so-called lower division with certain specified requireme
including biology, a course in citizenship, etc. The major
partment system now becomes operative at the beginning of
junior year, and degrees are granted upon the recommendat
of the departments. Stanford sold most of its large ra
properties in 1919, and in 1925 had about $28,000,000 in inve
ment securities. Its educational plant on the campus, toget
with the Stanford Medical School, Lane and Stanford Hospit
Stanford School for Nurses and Lane Medical Library—all
San Francisco—and the Hopkins Marine Station on Monte
Bay, were valued in all at $11,000,000. The medical sch
owed its origin to the fact that the director of the Coo
Medical College in 1910 turned over that institution and
associated Lane Hospital to Stanford.

In addition to the schools of law, medicine, and education a
the graduate school, there have been organised schools in biol
and social science, also in 1925 engineering and a gradu
school of business, and in 1926 a school of letters and a sch
in physical science. In 1921 the Food Research Institute
Stanford University was organised with the help of the C
negie Corp. of New York to make a study of the production,
tribution and consumption of food. New dormitories for m
and women have been recently constructed, so that 1,000 m
and 250 women live in university buildings. There is a housi
scheme by which practically all of the faculty and most of
students live on the campus. Volumes in the library number
377,904 in 1924, of which 57,722 were in the Lane Medi
Library and 27,067 in the Law Library. Herbert Hoover,

uate of Stanford, presented to the university the Hoover
Library, comprising approximately 47,500 volumes and
erous documents covering the history of the World War.
1924–5 the students numbered 3,312, of whom 500 were
en and 591 graduates. Limitation in funds and equipment
lted in restrictions in the body to something over 2,500.
re is now a tuition fee of $75 per quarter, and a tuition note
em enables students to postpone payment until three or
e years after graduation. Military training is not required,
there is a field artillery unit of the Reserve Officers' Train-
Corps, and an ordnance unit was established in 1925. Dur-
the World War, Stanford was represented by 3,000 of its
bers, graduates and undergraduates. A students' army
ning corps unit was organised in the War period. Dr. Ray
an Wilbur became president Jan. 1 1916. (R. L. W.)

EMAÎTRE, FRANÇOIS ÉLIE JULES (1853–1915), French
c and dramatist (*see* 16.408), died in Paris Jan. 21 1915.

EMBERG, BATTLES OF.—Lemberg (Polish, Lwów), the capi-
town of Galicia, was twice during the World War the centre
series of battles. The first series constituted the opening
paign between Russia and Austro-Hungary in Aug. and
t. 1914; it resulted in the defeat of the Austrians and the
upation by the Russians of the whole of Eastern Galicia.
second series was fought some 10 months later during the
at Russian retreat which was started by Mackensen's offen
on the Dunajec in May 1915. It gave Austria re-possession
emberg and of practically the whole of Eastern Galicia.

I. THE BATTLES OF 1914

he main concentration of the Austro-Hungarian forces for
ion against Russia at the opening of war in Aug. 1914 was
de in Central and Eastern Galicia. In the general plan of the
tral Powers the rôle of the Austro-Hungarian Army was to
gage the main Russian forces till the German Army had over-
elmed France and was free to transfer its principal weight to
Eastern theatre.

lternative Policies.—Two main alternatives were open to the
strians, to await attack or themselves to take the offensive.
the former course were chosen, the line of the river San, be-
een the Carpathians and the Vistula, was indicated as the
ongest available position. On this they might well hope by
active defence to hold up the maximum Russian effort for
he time and to win local successes by counter-attack. But
ence entailed not only the abandonment of Eastern Galicia
also the surrender of the passes over the Eastern Carpathians
the opening of a road into Hungary. This might have
ious political consequences. Moreover, in the years preceding
War, the military opinion of almost every country in Europe
proclaimed insistently that offensive action was the solution
all major difficulties in war. Certainly Conrad von Hötzen-
f, the Chief of the Austrian General Staff, optimistic by tem-
rament, was not the man to adopt a defensive attitude willing-
He determined to attack, though the advantages hoped for
m a speedier mobilisation were not secured owing to errors
de during the preliminary deployment against Serbia.

The chosen line of attack was northwards against one flank of
Polish salient; probably Conrad hoped that a German offen-
e might eventually be made from East Prussia against the
er flank of the salient. The problem of supply was not easy,
ce the terrain between the Vistula and Bug rivers, where the
vance was to be made, had been left, at the instance of the
ssian General Staff, without good communications in antic-
tion of the Austrian plan. It was indeed the obvious direc-
n of any invasion of Russia from Galicia, since an advance
twards would leave the lines of communication exposed,
ile to the northeast lay the trackless marshes of the Pripet.

The Rival Forces.—The Austrian main forces were divided into
r armies, of which two, the I. (Dankl) and IV. (Auffenberg),
re to carry out the offensive, directed on Chelm (Kholm) and
blin respectively; the II. (Bohm-Ermolli) and III. (Bruder-
nn) were to be deployed east of Lemberg to hold off the
ssian armies advancing from the Kiev district. The II. Army had, however, been originally dispatched to the Serbian frontier, and was at first represented by one corps only, the XII. (Kövess). North of the Vistula, Kummer's group of Austrian Landsturm and Woyrsch's corps of German Landwehr were to advance on Sandomierz and Dęblin (Iwangorod) respectively, to protect the left flank of the I. Army and to foster a Polish rising in favour of Austria.

The Russians also deployed four armies on their southwestern front. Their plan was almost the exact counterpart of the Austrian. They purposed to hold the Austrian offensive wing by a defensive force of two armies on the line Lublin-Chelm, and to smash the Austrian defensive wing by an offensive group of two armies advancing west from the Kiev military district on Lemberg. Each of the opponents was thus dependent on the power of his defensive wing to resist the shock of the other's striking force long enough to enable him to gain a decision by his main effort.

Both armies had large masses of cavalry, but there was a pronounced difference in their tactics. The Austrian cavalry seldom practised dismounted fire action and were singularly ineffective on foot; the Russian cavalry, on the other hand, fought largely as mounted infantry. The Russian artillery shot well and was far more effective than the Austrian, but the musketry of the Austrian infantryman was better than that of his rival; he was also handier in manoeuvre. The morale on both sides was excellent at the beginning, although that of the Austrian was to deteriorate rapidly under defeat. In the higher command the Russians held the advantage. Ivanov, the generalissimo of the southwestern front, was no strategist, though an experienced and well-loved commander; but his chief of staff, Aleksyeev, was one of the best brains of the Army; and in Ruzski (III. Army), Plehve (V. Army), Brusilov (VIII. Army), and Ewarth (IV. Army) he had under him probably the four ablest army commanders in Russia—certainly the four most successful. Conrad, the virtual Commander-in-Chief of the Austrian armies—the Archduke Friedrich was the nominal head—was a man of determined and obstinate character, but a better strategist in the office than in the field; nor were the Austrian army commanders the equals of the Russian.

Numerically, the Russians had an advantage, though by no means an overwhelming one. The Austrian striking wing, which comprised 350 battalions, 150 squadrons and 150 batteries, was superior in strength to the Russian IV. and V. Armies which had each four corps and two cavalry divisions; but their defensive wing (200 battalions, 170 squadrons, 130 batteries) was considerably inferior to the Russian III. and VIII. Armies, especially before the arrival of the two corps of the II. Army which had been left opposite Serbia.

On Aug. 15, before concentration was complete, the Austrian cavalry pushed forward to ascertain the Russian movements, but gathered little information. On Aug. 20 the I. and IV. Armies began their offensive. The first engagements in the neighbourhood of Krasnik were favourable to the Austrians, the advanced troops of the Russian IV. Army being driven back on Lublin. The Austrian I. Army was strengthened by Kummer's Landsturm Corps, which crossed the Vistula to join it, while Woyrsch's Corps of German Landwehr was in close touch on the left bank of the Vistula. The mission of these two formations to foment an insurrection in Russian Poland had proved fruitless.

Battle of Komarów.—The Austrian IV. Army now became engaged in a battle with the Russian V. Army, which lasted from Aug. 26 to Sept. 1. Assisted by the Archduke Joseph Ferdinand's group, which had been formed from troops of the III. Army to manoeuvre between its left and the right of the IV. Army, Auffenberg attempted a double envelopment of the Russian force. This manoeuvre met with considerable success; a large part of Plehve's Army was at one time surrounded, and escaped only owing to the sudden withdrawal of the Austrian Corps which had seized its line of retreat—a withdrawal actuated by false reports of Russian troops in its rear. The Russian Army was broken in two, part retiring on Chelm and part on Hrubieszów on the Bug. Before the Austrians could gather the fruits of their victory, events in Eastern Galicia occasioned their recall. Losses in the battle were heavy on both sides.

Operations in Eastern Galicia.—Meanwhile the Austrian covering force (II. and III. Armies) had met with disaster. Although the II. Army consisted of one corps only and the III. Army was weakened by the absorption of the Archduke Joseph Ferdinand's group in the Kómarow battle, yet the High Command sent the two armies forward to the attack. They joined battle with the Russian III. and VIII. Armies on Aug. 26 on the line of the Złota Lipa about Złoczów. On the evening of Aug. 27 they were forced to retreat. Reinforced by the VII. Corps from Serbia, they again gave battle on the Gniła Lipa on Aug. 29 and 30, and again suffered defeat. They now fell back through Lemberg, which was evacuated on Sept. 2, and took up a defensive position west of the city on the line of the Wereszyca and the Gródek lakes.

Battle of Gródek—Rawa-Ruska.—The rear of the victorious Austrian I. and IV. Armies was seriously threatened by the failure of the eastern wing. The question now arose of withdrawing the whole of the Austrian forces to the line of the San, or of continuing the battle round Lemberg on a different plan. Conrad chose the bolder course and determined to seek an immediate victory. He ordered the IV. Army to break off pursuit of the Russians and to change front from north to south. The plan was that this army should strike towards Lemberg at the right flank of the advancing Russians, while the II. and III. Armies held them frontally. The complicated wheel of the IV. Army had been executed by Sept. 5. On Sept. 6 it commenced its march southwards, leaving behind a group under the Archduke Joseph Ferdinand to protect its rear. As it advanced south, its left column became engaged with the right of the Russian III. Army and was pinned to the east of Rawa-Ruska, while the centre and right columns, meeting no resistance, continued southwards, and eventually wheeled into line with the Austrian III. and II. Armies, facing east.

Conrad changed his plan again; he had missed with his left, so now, like an obstinate but unskilful boxer, swung his right at the enemy, viciously but ineffectively. On Sept. 7 he ordered the IV. Army to stand fast and hold the Russians to their ground, while the II. and III. Armies left their prepared defensive positions and struck northward at the Russian left wing. A radical change of plan so hurriedly evolved was hardly likely to succeed. The II. and III. Armies could make little ground, while the position of the IV. Army rapidly became untenable. In its rear the I. Army was being forced back from Lublin by the reinforced Russian IV. Army, while the Russian V. Army had rallied and was again advancing, driving before it the Archduke Joseph Ferdinand's weak group. Finally the left wing of the IV. Army itself was being outflanked north of Rawa-Ruska by the Russian III. Army. On Sept. 11 Conrad issued orders for a general retreat to the line of the San.

Austrian Retreat.—The withdrawal was successfully carried out without serious interference by the Russians. The II. Army retired in the direction of Sambor, and the III. towards Przemyśl, the IV. on Jarosław, and the I., together with Kummer's and Woyrsch's forces, to the lower San. The detachments farther east, along the Dniester, retired to the Carpathians. The line of the San was not held for long. The Russian IV. Army had been reinforced by the IX. Army from Warsaw and forced a passage of the lower San on Sept. 14. The Austrians were too shaken and disorganised to enter on a new battle, and resumed their retreat, leaving the fortress of Przemyśl to stand siege. They finally halted on Sept. 26 some 50 m. east of Cracow on the line of the Dunajec by Tarnow and Gorlice to the Carpathians. The Russians, who also required a pause for reorganisation—losses had been very heavy on both sides—made no serious attempt to follow up beyond the San.

Causes of Austrian Failure.—The advantage of "interior lines" which the Austrians enjoyed in this campaign has been partly discounted by the great size of modern armies and the time required to obtain the decision in a battle. It is true that the Germans were at this very period gaining brilliant successes
by action on interior lines against Samsonov and Rennenk
in East Prussia, but their achievements were only rend
possible by the inertia of Rennenkampf. In Galicia, the
tinued pressure by Ruzski's and Brusilov's armies on the
trian detaining wing denied to Conrad the time require
complete his successes in Poland. But the Austrian High
mand appear to have suffered throughout from lack of a
cut plan, and to have depended too much on the course of ev
It is difficult to trace in their original organisation for the
paign any recognition of the need for that "mass of manoeu
capable of being transferred from one wing to the other, wh
the essence of action on interior lines. Also, the ineffective
for delaying action of their masses of cavalry deprived the
trians of a powerful weapon. The Russian scheme of operat
was straightforward and demanded only driving power by
higher commanders and hard fighting and marching by
troops. An opportunity of turning the Austrian retreat in
rout seems, however, to have been missed, when the IX. A
from Warsaw directly reinforced the IV. Army instead of b
directed west of the Vistula on the Austrian line of retreat.

II. THE BATTLES OF 1915

The fighting which led up to the second series of battles ro
Lemberg in the summer of 1915 is described under the hea
DUNAJEC-SAN. After being driven from the San, the Rus
III. Army (now under Lesh instead of Radko Dimitriev)
VIII. Army (Brusilov) took up a position to the northwest
west of Lemberg. Their line ran from the Vistula along
heights north of the Tanew river, thence west of Rawa-Rusk
Magierów and Janów to the Wereszyca river and Gródek la
The XI. and IX. Armies continued the line southeast along
Dniester.

Comparison of Adversaries.—Mackensen's pursuing f
consisted of the Austrian IV., German XI. and Austrian
Armies, in that order from north to south. On the Dniester
Linsingen's Southern Army and Pflanzer-Baltin's VII. Ar
In the number of available formations there was no great
parity between Mackensen's group of armies and the Rus
III. and VIII. Armies; on each side there were about 40 infa
divisions, and the Russians had five or six cavalry division
Mackensen's two. But the two Russian armies now embra
an improvised assembly of formations and units taken from
parts of the line; even so their losses had not been made
and they were much under strength; there was a shortag
ammunition, both for guns and rifles; and morale had natur
suffered under two and a half months of continual defeat.

Austro-German Attack.—As usual, the main thrust at
Russian position was delivered by the German XI. Army.
was directed through Magierów against the line Zólki
Rawa-Ruska, approximately at the joint between the Russ
III. and VIII. Armies. The assault was made on June 19, a
the Russian position had been battered by the German g
and the attackers broke right through to the Rawa-Rus
Lemberg railway. Brusilov held on to a fortified position wes
Lemberg till the 22nd, and then evacuated it under the th
that came from the north and the direct pressure from
Austrian II. Army.

Re-grouping of Armies.—The Russian armies were now s
apart; the VIII. Army retired fighting to the line of the Up
Bug and Gniła Lipa; at the same time the XI. and IX. Arm
gave up the Dniester line below Halicz. The III. Army me
while, to protect the left flank of the Warsaw salient, was for
to retire north towards Lublin and Chełm. To fill the gap
tween the III. and VIII. Armies, a new army, the XIII. un
Gorbatovski, was formed of troops drawn from the right of
III. Army and left of the VIII. The Austrian armies were a
re-grouped; the II. Army, the Southern Army and VII. Ar
were to continue the pursuit eastwards; Mackensen with
IV., XI. and a new "Army of the Bug," to be formed und
Linsingen, was to strike northwards between the Bug and V
tula; while the I. Army, withdrawn from the west of the Vistu
was to fill the gap between the two groups.

he Eastern group drove the Russians back at the beginning uly from the Gnita Lipa to the Zlota Lipa; no farther fighting place here till the end of August. Farther east, Pflanzertin's VII. Army and Lechitski's IX. were engaged in an insive conflict along the Dniester between July 14 and 19. nwhile on Mackensen's front the Austrian IV. Army had heavily counter-attacked near Krasnik by the Russian IV. ny and had been driven back some distance, losing 17,000 oners. The check was only temporary, and so soon as the rouping was completed, Mackensen again advanced. For further operations of this force, *see* BREST-LITOVSK, BATTLES (*See* also EASTERN FRONT CAMPAIGNS.)

BLIOGRAPHY.—M. von Gember, *Die Russen in Lemberg* (1916); Müller-Brandenburg, *Schlacht bei Grodek-Lemberg, Juni 1915* 8); A. W. F. Knox, *With the Russian Army 1914–17* (1921); lso WORLD WAR: BIBLIOGRAPHY. (A. P. W.)

EMONNIER, ANTOINE LOUIS CAMILLE (1844–1913), Bel- poet (*see* 16.415), published among his later works *L'amant ionné* (1904); *Tante Amy* (1906); *La maison qui dort* (1909) *La chanson du carillon* (1911); as well as *L'école belge de ture, 1830–1905* (1906). He died in Brussels June 13 1913. L. Bazalgette, *Camille Lemonnier* (1904).

ENGLEN, SUZANNE (1899–), French lawn-tennis player, born at Compiègne May 24 1899. She was taught to play is by her father and began to show brilliance at an early age, ing the championship of Picardy when only 14 years old. une 1914 she won the hard court singles and doubles in Paris. ing the World War she played in exhibition matches on the era for the French Red Cross 1916–8. In 1919 she made her appearance at the Wimbledon tournament and won both singles and doubles championships, defeating Mrs. Lambert mbers in the final round. In the following year she won the s' singles at Wimbledon and mixed doubles champion with Patterson. In Aug. 1921, after again winning the singles doubles at Wimbledon, she visited America and was ded (2–6 retired) by Mrs. Mallory in the second round of the A. ladies' singles championships. At Wimbledon however, e following year Mlle. Lenglen defeated Mrs. Mallory 6–2, in the final round of the ladies' singles. In the same year she won the French National Championship, took all three pionships in the Brussels tournament and was undefeated ughout the season. She again won the singles at Wimbledon 23 and 1925, but was obliged to retire in 1924 owing to ill- as she was also in 1926. (*See* LAWN TENNIS.)

ENIN, VLADIMIR ILYICH ULYANOV (1870–1924), founder guiding spirit of the Soviet Republics and the Communist national, the disciple of Marx both in theory and in prac- the leader of the Bolshevik party and the organiser of ct. revolution in Russia, was born on April 9 (22) 1870 e town of Simbirsk, now Ulyanovsk. His father, Ilya laevitch, was a schoolmaster. His mother, Maria Alexana, whose maiden name was Berg, was the daughter of a r. His eldest brother (b. 1866) joined the "Narodovoltze" dom of the People movement),[1] and took part in the ccessful attempt on the life of Alexander III. For this he xecuted in his 22nd year. Lenin, the third of a family of six, leted his course at the Simbirsk gymnasium in 1887, win- the gold medal. His brother's execution, indelibly stamped s consciousness, helped to determine his later life.

the summer of 1887 Lenin entered the Kazan University to law, but was sent down in Dec. of the same year for taking n a gathering of students and was banished to the country- His repeated petitions in 1888–9 for permission to re-enter niversity of Kazan or to be allowed to go abroad to continue udies met with refusal. In the autumn, however, he was d to return to Kazan, where he began the systematic study rx and first entered into relations with the members of the Marxist circle. In 1891 Lenin passed the law examinations St. Petersburg University, and in 1892 he began to practise barrister at Samara. During this year and the next he red for the defence in several trials. His life, however, was chiefly filled by the study of Marxism and its application to the investigation of the course of the economic and political development of Russia and subsequently of the whole world.

In 1894 he moved to St. Petersburg, where he came into touch with the workers and began his propaganda work. To this period belong Lenin's first polemical writings directed against the popular party, who taught that Russia would know neither capitalism nor the proletariat. These were passed from hand to hand in manuscript form. Soon after, Lenin started a theoretical struggle against the falsifiers of Marx, in the legal Press.[2] In April 1895 Lenin first went abroad with the intention of entering into relations with the Marxist group abroad known as the "Osvobozhdenie Truda," "Deliverance of Labour" (Plekhanov, Zasulich, Axelrod). On his return to St. Petersburg, he organised the illegal "Union for the struggle for the liberation of the Working Class," which rapidly became an important organisation, carrying on propaganda and agitation among the workers and getting into touch with the provinces. In Dec. 1895 Lenin and his closest collaborators were arrested. He spent the year 1896 in prison, where he studied the lines of Russia's economic development. In Feb. 1897 he was sent into exile for three years to the Yenisei province in eastern Siberia. At this time, 1898, he married N. K. Krupskaya, his comrade in the work of the St. Petersburg Union and his faithful companion during the remaining 26 years of his life and revolutionary struggle. During his exile he finished his most important economic work, *The Development of Capitalism in Russia*, based on a comprehensive and systematic study of an enormous mass of statistical material (1899). In 1900 Lenin went abroad to Switzerland with the intention of organising, with the "Deliverance of Labour" group, the publication of a revolutionary paper intended for Russia. At the end of the year the first number of the paper *Iskra* (The Spark) appeared in Munich, with the motto "From the Spark to the Flame!" The aim of the paper was to give a Marxian interpretation of the problems facing the revolution, to give the political watchwords of the struggle, and to organise on this basis a centralised "underground" revolutionary party of Social Democrats, which, standing at the head of the proletariat, should open the struggle against Tsarism, rousing the oppressed masses, and, above all, the many millions of peasants.

The idea of an organised party leadership of the struggle of the proletariat in all its forms and manifestations, which is one of the central ideas of Leninism, is closely connected with the idea of the hegemony of the working class within the democratic movement of the country. This idea of hegemony, having become the central point of the Leninist political conception and practical work, found direct expression in the programme of the dictatorship of the proletariat when the development of the revolutionary movement had prepared the conditions for the Oct. revolution.

The second Congress of the R.S.D.R.P. (Brussels, London) in July and Aug. 1903 accepted the programme worked out by Plekhanov and Lenin, but ended with the historic split of the party into Bolsheviks and Mensheviks. Thereupon Lenin entered on his separate path as leader of the Bolshevik section, later the Bolshevik party. The differences, which began at first with questions of party organisation, gradually extended to fundamental questions concerning tactics and finally to the question of the party programme. The Mensheviks tried to bring the policy of the Russian proletariat into line with that of the liberal bourgeoisie. Lenin saw in the peasantry the closest ally of the proletariat. The occasional agreements and closer relations with the Mensheviks failed to arrest the constant widening of the two lines—the revolutionary and the opportunist—the proletarian and the petty bourgeois. The struggle with the Mensheviks forged the policy which led to the break with the Second International (1914), to the Oct. revolution (1917) and to the change of the party's name from the compromised title of Social Democrat to that of Communist (1918).

A revolutionary situation was created in the country by the defeat of the army and navy in the Russo-Japanese War, the shooting of the workers on Jan. 9 (22) in 1905, by the agrarian disturbances and the political strikes. Lenin's programme was the preparation of an armed rising of the masses against Tsarism, the creation of a provisional revolutionary Government which was to organise the revolutionary democratic dictatorship of the workmen and peasants for the radical deliverance of the country from Tsarism, serfdom and all medieval rubbish. Accordingly, the third congress of the party, consisting exclusively of Bolsheviks (May 1905), passed a new agrarian programme which included the confiscation of the domains of the landowners and the Tsar.

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[1] Narodovoltze was a revolutionary terrorist society.

[2] As distinct from the Press which was published illegally—"underground" by revolutionaries.

In Oct. 1905 the All-Russian strike began. On the 17th of the month the Tsar issued his manifesto about the "Constitution." In the beginning of Nov. Lenin returned to Russia from Geneva, and already, in his first article, appealed to the Bolsheviks, in view of the new situation, to increase the scope of their organisation and to bring into the party wider circles of workers, but to preserve their illegal apparatus in anticipation of the counter-revolutionary blows which were inevitable. In Dec. Tsarism began to counter-attack. The rising in Moscow at the end of Dec., lacking as it did the support of the army, without simultaneous risings in other towns and sufficient response in the country districts, was quickly suppressed.

In the events of 1905 Lenin distinguished three main features—(1) the temporary seizure by the people of real political freedom, real in the sense of not being limited by their class enemies, apart from and in spite of all existing laws and institutions; (2) the creation of new and as yet only potential organs of revolutionary power in the shape of soviets of workers', soldiers' and peasants' deputies; (3) the use of force by the people against those who had employed it against them. Those conclusions, from the events of 1905, became the guiding principles of Lenin's policy in 1917 and led to the dictatorship of the proletariat in the form of the Soviet State.

The suppression of the Dec. rising in Moscow threw the masses into the background. The Liberal bourgeoisie came to the front. The epoch of the first two Dumas began. At this time, Lenin formulated the principles of the revolutionary exploitation of parliamentary methods in immediate connection with the struggle of the masses and as a means of preparation for a fresh attack.

In Dec. 1907 Lenin left Russia, to return only in 1917. Now (in 1907) began the epoch of victorious counter-revolution, prosecutions, exile, executions and emigration. Lenin led the struggle against all decadent tendencies among the revolutionaries; against the Mensheviks, the advocates of the liquidation of the "underground" party—hence those known as "liquidators"—and of the change of their methods of work into purely legal ones within the framework of the pseudo-constitutional régime; against the "conciliators" who failed to grasp the complete antagonism between Bolshevism and Menshevism and tried to take up an intermediate position—against the adventurist policy of the Socialist revolutionaries who tried to make up for the inertia of the masses by personal terrorism; finally, against the narrow partisanship of a part of the Bolsheviks, the so-called "callers-off," who demanded the recall of the Social Democratic deputies from the Duma in the name of immediate revolutionary activity, though conditions at that moment offered no opportunity for this. In this dim epoch Lenin showed very vividly a combination of his two fundamental qualities—that of being an implacable revolutionary at bottom, while yet remaining a realist who made no mistakes in the choice of methods and means.

At the same time, Lenin carried on an extensive campaign against the attempt to revise the theoretic basis of Marxism on which his whole policy was founded. In 1908 he wrote a major treatise dealing with the fundamental questions of knowledge and directed against the essentially idealistic philosophy of Mach, Avenarius and their Russian followers, who tried to unite empiric criticism with Marxism. On the basis of a deep and comprehensive study of science Lenin proved that the methods of dialectical materialism as formulated by Marx and Engels were entirely confirmed by the development of scientific thought in general and natural science in particular. Thus Lenin's cons revolutionary struggle, in which he never lost sight of the sma practical details, went hand in hand with his equally cons theoretical controversies, in which he attained to the grea heights of comprehensive generalisations.

The years 1912–4 were marked in Russia by a fresh outb of activity in the workers' movement. Breaches made t appearance in the counter-revolutionary régime. At the be ning of 1912 Lenin summoned a secret conference of the Rus Bolshevik organisations in Prague. The "liquidators" declared to be outside the party. The split with the Menshe became definite and final. A new central committee was elec Lenin organised from abroad the publication in St. Petersbu a legal newspaper, *Pravda*, which in its constant conflict with censorship and the police exercised a guiding influence on vanguard of the working class. In July 1912 Lenin, together his closest collaborators, moved from Paris to Cracow in ord enable him to be in closer touch with Russia. The revolutio movement in Russia was growing, and was thereby giving Bolsheviks the preponderance. Lenin, in active contract Russia, sent articles under different pseudonyms almost e day to the Bolshevik legal newspapers, drawing the inevit inferences from them in the illegal ("underground") Press. this time, as well as before and after it, N. K. Krupskaya, a nearest helpmate, was the centre of the organising work. received comrades coming from Russia, gave instructions to ot on their way there, set up "underground" connections, w conspirative letters, coded and decoded. It was in the s town of Poronin in Galicia that the declaration of war fo Lenin. The Austrian police suspected him of being a Russian and arrested him, but he was released after a fortnight expelled to Switzerland.

A new and wider phase of Lenin's work now opened. It an international scope. Lenin's manifesto, published in the n of the party on Nov. 1 1914, denounced the imperialistic c acter of the War and the war guilt of all the great powers, wh long past had been preparing a sanguinary struggle for the pose of widening their markets and destroying their rivals. patriotic agitation of the bourgeoisie on both sides, who t the blame each upon the other, was shown to be a manoeuv deceive the workers. The manifesto points out that the maj of Social Democratic leaders were now on the side of the b geoisie of their own country, thus violating the resolution o International Socialist congresses and bringing about the d fall of the Second International. It points out that from point of view of the Russian Social Democrats the defe Tsarism would be the most desirable issue of the War. defeat of their "own" governments should be the slogan o Social Democrats of all countries. Lenin subjects to a mer criticism not only Socialist patriotism, but different shad pacifism which dreams of peace but capitulates to war, and, occupied with platonic protests, withdraws from the revolutio struggle with Imperialism. The struggle with pacifism dev into a great struggle with centrism, that is, with those elem of the working class movement which are midway betwee Social Democrats and the Communists, supporting the form actual practice (for instance, the I.L.P. in Great Britain).

The theorists and politicians of the Second Internat redoubled their accusations of anarchism which they had b brought against Lenin. As a matter of fact, all Lenin's the and practical work, both up to 1914 and after, was characte by a twofold struggle, on the one hand with reformism w from the beginning of the War gave its support to the imper policy of the propertied classes, and on the other hand anarchism and all the different varieties of revolutio adventurists.

On Nov. 1 1914 Lenin promulgated a programme for the ation of a new International "to undertake the task of orga the forces of the proletariat for the revolutionary attac capitalist governments, for the civil war against the bourge of all countries, for the attainment of political power and victory of Socialism."

n Sept. 1915 (Sept. 5 and 8) there was held at Zimmerwald in tzerland the first conference of European Socialists who were osed to the imperialistic war. Thirty-one delegates were ent. The left wing of the Zimmerwald conference and of the r one at Kiental adopted Lenin's demand for the transforma- of the imperialist war into a civil war, and became the eus of the future Communist International. The latter ked out its programme, tactics and organisation under in's guidance, and it was Lenin who directly inspired the sions of the first four congresses of the Communist Inter- onal.

enin was prepared for his struggle on an international scale only by his profound knowledge of Marxism and his experi- of the revolutionary struggle and party organisation in sia, but also by his intimate acquaintance with the workers' ement throughout the world. For many years he had fol- d closely the internal affairs of the most important capitalist es. He was a thorough master of the English, German and ich languages, and could read Italian, Swedish and Polish. realistic imagination and political intuition often enabled to reconstruct a complete picture from isolated phenomena. n was always firmly opposed to the mechanical application e methods of one country to another, and he investigated decided questions concerning revolutionary movements, not in their international interreactions, but also in their con- national form.

e revolution of Feb. 1917 found Lenin in Switzerland. His mpts to reach Russia met with the decided opposition of the sh Government. He accordingly decided to exploit the gonism of the belligerent countries and to reach Russia ugh Germany. The success of this plan gave occasion to n's enemies for a fierce campaign of slander, which, however, powerless to prevent him from assuming the leadership of arty and shortly afterwards of the revolution.

n the night of April 4, on leaving the train, Lenin made a h in the Finlyandsky station in Petrograd. He repeated developed the leading ideas it contained in the days which wed. The overthrow of Tsarism, he said, was only the first in the revolution. The bourgeois revolution could no r satisfy the masses. The task of the proletariat was to to strengthen the power of the Soviets, to rouse the country icts and to prepare for the conquest of supreme power in the of the reconstruction of society on a Socialist basis.

is far-reaching programme was not only unwelcome to those ged in propagating patriotic Socialism, but even roused sition among the Bolsheviks themselves. Plekhanov called n's programme “crazy.” Lenin, however, built up his not on the inclinations and views of the temporary leaders revolution, but on the interrelations of the classes and the of mass movements. He foresaw that the distrust of the geoisie and of the Provisional Government would grow ger daily, that the Bolshevik party would obtain a majority Soviets and that the supreme power would pass into their . The small daily *Pravda* became at once in his hands a ful instrument for the overthrow of bourgeois society.

policy of coalition with the bourgeoisie pursued by the tic Socialists, and the hopeless attack which the Allies the Russian Army to assume at the front—both these the masses and led to armed demonstrations in Petrograd first days of July. The struggle against Bolshevism became intense. On July 5th grossly forged “documents” were hed by the counter-revolutionary secret service. These rted to prove that Lenin was acting under the orders of the an general staff. In the evening “reliable” detachments oned from the front by Kerensky and Cadet officers from stricts round Petrograd occupied the city. The popular nent was crushed. The hounding of Lenin reached its . He now began to work “underground,” hiding first in grad with a worker's family and then in Finland; he man- however, to keep in touch with the leaders of the party.

July days and the retributions which followed aroused a of energy in the masses—Lenin's forecast proved right in every particular. The Bolsheviks obtained a majority in the Soviets of Petrograd and Moscow. Lenin demanded decisive action to seize the supreme power, and on his side began an unremitting fight against the hesitations of the leaders of the party. He wrote articles and pamphlets, letters, both official and private, examining the question of the seizure of supreme power from every angle, refuting objections and dispelling doubts. He drew a picture of Russia's conversion into a foreign colony if the policy of Miliukov and Kerensky continued, and he predicted that they would consciously hand over Petrograd to the Germans in order to destroy the proletariat. “Now or never!” he repeated in passionate articles, letters and interviews.

The rising against the Provisional Government coincided with the opening of the second Congress of the Soviets on Oct. 25. On that day, Lenin, after being in hiding for three and a half months, appeared in the Smolny[1] and from there personally directed the fight. In the night sitting of Oct. 27 he proposed, at the session of the Congress of the Soviets, a draft decree about peace which was passed unanimously and another about the land, which was passed with one dissentient and eight abstentions. The Bolshevik majority, supported by the left wing of the Socialist revolutionaries, declared that supreme power was now vested in the Soviets. The Soviet of People's Commissaries was appointed, with Lenin at their head. Thus Lenin passed straight from the log cabin where he had been hiding from persecution to the place of highest authority.

The proletarian revolution spread quickly. Having obtained the land of the landed estate owners, the peasants forsook the Socialist revolutionaries and supported the Bolsheviks. The Soviets became masters of the situation both in the towns and the country districts. In such circumstances the constituent assembly which was elected in Nov. and met on Jan. 5 appeared a patent anachronism. The conflict between the two stages of the revolution was now at hand. Lenin did not hesitate for an instant. On the night of Jan. 7 the All-Russian Central Executive Committee, on Lenin's motion, passed a decree dissolving the constituent assembly. The dictatorship of the proletariat, said Lenin, meant the greatest possible degree of actual and not merely formal democracy for the toiling majority of the people. For it guaranteed to them the real possibility of utilising their abilities, putting as it did in the hands of labour all those material goods (buildings for meetings, printing presses and so on) lacking which “liberty” remains an empty word and an illusion. The dictatorship of the proletariat in Lenin's view is a necessary stage in the abolition of class divisions in society.

The question of war and peace provoked a new crisis in the party and the governing body. A considerable proportion of the party demanded a “revolutionary war” against the Hohenzollerns, leaving out of account altogether the economic situation of Russia and the temper of the peasantry. Lenin felt that it was necessary for propaganda purposes to drag out negotiations with the Germans for as long as possible. But he demanded that, in the event of a German ultimatum, peace should be signed even at the price of a loss of territory or the payment of an indemnity —“Let us give way in space, but gain time,” he said. The revolution kindling in the west would sooner or later undo the hard terms of peace. Lenin's political realism manifested itself in all its strength in regard to this question. The majority of the Central Committee in opposition to Lenin made a further attempt to avoid yielding to German Imperialism by declaring the state of war at an end, but refusing at the same time to sign an imperialistic peace. This led to a renewed attack by the Germans. After heated debates in the Central Committee at the sitting of Feb. 18 Lenin won a majority for his proposal that negotiations should be reopened forthwith, and that the German terms which were now still more unfavourable should be signed.

The Soviet Govt. on Lenin's initiative transferred itself to Moscow. Peace having been attained, Lenin now brought before the party and the country the whole question of its economic and cultural organisation.

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[1] Smolny, originally an institute for the daughters of noblemen, was the headquarters of the Bolsheviks during the revolution.

The greatest trials, however, were still to come. A counter-revolutionary movement was approaching from the borders. By the end of the summer of 1918 Central Russia found itself surrounded by a ring of fire. Hand in hand with the Russian counter-revolution there came the rising of the Czechoslovaks on the Volga; on the north and south came the British intervention (in Archangel on Aug. 2, in Baku on Aug. 14). Food supplies were cut off. In these conditions of unexampled difficulty, when things seemed hopeless, Lenin never even for so much as an hour ceased to direct his party and the Government. He estimated the extent of each new danger and showed the way to safety. He carried on propaganda work in meetings and in the press, roused ever new forces from among the masses, organised the sending of the workers into the country to get corn, directed the creation of new war divisions, followed the enemy's movements on the map; he was in direct telegraphic communication with the young divisions of the Red Army and looked after their equipment and supplies from the centre. He followed the international situation, finding his bearings by the dissensions in the camps of the imperialists. At the same time he found time for attentive interviews, both with the first foreign revolutionaries who appeared on Soviet soil and with Soviet engineers about plans for electrification or for new methods of utilising peat or of developing a system of radio stations, and so on and so on.

On Aug. 30 the Socialist-revolutionary Kaplan aimed two shots at Lenin when on his way to a workers' meeting. This attack intensified the civil war. Lenin's strong constitution quickly recovered from the effect of his wounds. During his convalescence he wrote a pamphlet, *The Proletarian Revolution and the Renegade Kautsky*, directed against the most prominent theorist of the Second International. By Oct. 22 he was again speaking in public.

The war on the home fronts remained as before his chief occupation. Economic and administrative problems had necessarily to take a subordinate place. The civil war fed from abroad was at its height. It was only thanks to Lenin's titanic energy, clear vision and unshaken will that the struggle ended (at the beginning of 1921) with the utter defeat of the counter-revolution. The Government grew in strength. The main instrument of the struggle as also of the further constructive work always was and still remains the party organised by Lenin—the party which received a thorough apprenticeship during its period of work "underground." The hard school of the civil war produced seasoned main cadres of organisers.

Lenin always considered the Oct. revolution from the standpoint of the European and world revolution. The fact that the War had not led immediately to a proletarian revolution in Europe had enormously increased the difficulties of Socialist reconstruction. The roots of these difficulties lay in the interrelation between the town and the village. This roused Lenin at the beginning of 1921 once again to consider the problems of the internal economic régime. The Socialist reconstruction of society was impossible without agreement between the proletariat and the peasantry. It was therefore essential to change radically the régime of "war communism" produced by the civil war. The system of requisitioning superfluities from the peasants must be replaced by a tax correctly assessed. Private interchange of commodities must be allowed. These measures, introduced by Lenin with the full concurrence of his party, began a new phase in the development of the Oct. (Nov.) revolution, that known as the "new economic policy." Lenin pointed out subsequently that such a policy—with of course the necessary modifications—would be an inevitable phase in the Socialist reconstruction of every country.

In his policy within the Soviet Federation Lenin paid the greatest attention to the position of the nationalities which had been oppressed under Tsarism, and he tried in every way to create for them the conditions of free national development. Lenin made unsparing war against all imperialist tendencies within the state organisation, and especially within the party itself—the purity of whose ideas he guarded with the utmost jealousy. The charges of oppressing nationalities made against Lenin and his party with reference to Georgia, etc., were by means the product of any national struggle, but of the sh class warfare within the nation.

The principles of national self-determination, which in western European working class movements extend only to national minorities of the so-called civilised countries, Le insisted on applying in full to the colonial peoples, and he ch pioned their right to separate themselves completely from t mother country. His doctrine was that the Western Europ proletariat should refrain from mere declarations of sympa with oppressed nationalities, and instead should join them in struggle against imperialism.

At the eighth congress of Soviets (1920) Lenin made a rep on the work carried out on his initiative for the drafting of a p for the electrification of the country. The gradual effort towa a high degree of technical development is the mark of the succ ful transformation from the system of small scale peas economy, with its lack of co-ordination, to the system of la scale Socialist production based on a single, comprehensive p "Socialism is a Soviet Govt. plus electrification."

The exhaustion brought on by excessive hard work ove number of years ruined Lenin's health. Sclerosis attacked cerebral arteries. At the beginning of 1922 his doctors forb him daily work. From June to Aug. the disease made ra progress, and for the first time he began to lose, altho transiently, the power of speech. At the beginning of Oct. health had so much improved that he once again returne work, but not for long. His last public utterance ends with expression of his conviction that "from Russia under N. will come Socialist Russia."

On Dec. 16 he became paralysed in the right arm and However, during Jan. and Feb. he still dictated a numbe articles of great importance for the policy of the party on struggle against bureaucracy in the Soviet and party orga tion; on the importance of co-operation in gradually bringing peasants into the Socialist organisation; on the struggle aga illiteracy; and finally on the policy in regard to national oppressed under Tsarism.

The disease progressed and he lost completely the powe speech. His work for the party came to an end, and very his life also. Lenin died on Jan. 21 1924, at 6:30 P.M., at Go near Moscow. His funeral was the occasion for an unexam manifestation of love and grief on the part of millions.

The main work of Lenin's life was the organisation of a p capable of carrying through the Oct. revolution and of dire the construction of Socialism. The theory of the prolet revolution—the methods and tactics to be pursued—consti the fundamental content of Leninism which as an internati system forms the culminating point of Marxism. Lenin's s aim filled his life from his school days onwards. He never hesitation in the fight against those he considered the enemi the working class. In his passionate struggle there was never personal element. He fulfilled what he considered to b demands of an inevitable historical process. Lenin combine ability to use the materialistic dialectic as a method of scien orientation in social developments with the deep intuition true leader.

Lenin's outward appearance was distinguished by simpl and strength. He was of middle or rather below the mi height, with the plebeian features of the Slavonic type of brightened, however, by piercing eyes; and his powerful head and his still more powerful head gave him a ma distinction. He was tireless in work to an unparalleled de His thoughts were equally concentrated whether in his Sib exile, the British Museum or at a sitting of the People's missaries. He put the same exemplary conscientiousness reading lectures in a small workmen's club in Zurich an organising the first Socialist State in the world. He appreci and loved to the full science, art and culture, but he never fo that as yet these things are the property of a small mino The simplicity of his literary and oratorical style expresse extreme concentration of his spiritual forces bent on a single n personal intercourse Lenin was even-tempered, courteous and ttentive, especially to the weak and oppressed and to children. Iis way of life in the Kremlin was little different from his life as n emigré abroad. The simplicity of his daily habits, his asceti- ism in regard to food, drink, clothes and the "good things" of fe in general in his case did not spring from so called moral rinciples, but came about because intellectual work and intense ruggle not only absorbed his interests and passions but also ave him such intense satisfaction as to leave no room for sub- diary enjoyments. His thoughts never ceased to labour at the sk of freeing the workers till the moment of its final extinction.

His works include: *Ekonomicheskoye soderzhaniye narodnich- tvai Kritika evo v Knige g. Struve, 1895* (The Economic Content the popular party and Mr. Struve's criticism of it. The reflection Marxism on bourgeois literature); *K Kharakteristike ekonomiches- wo romantisma* (1897) (The characteristics of economic romanti- sm), Sismondi and our Sismondists; *Razvitiye Kapitalisma v ossie*, 1899 (The development of Capitalism in Russia). The process making a home market for large scale industry; *Chto Dyelat*, 1902. Vhat is to be done? French trans. *Que Faire?* The most urgent estion of our movement; *Dve taktiki sotsial—demokratii v mokraticheskoi revolyutsii*, 1905 (Two tactics of the Social Democ- cy in the democratic revolution); *Agrarnaya programma sotsial mokratii v pervoi russkoi revolyutsii 1905–1907* (1907), (The agrarian ogramme of the Social-Democrats in the first Russian revolution 05–7); *Za 12 let.*, 1908 (During 12 years), Two tendencies in ussian Marxism and Russian Social Democracy); *Materialism i piriokrititsism*, 1909 (Materialism and empiriocriticism). Critical servations on a reactionary philosophy; *Krakh II. Internatsionala*, 15 (Collapse of the Second International. Eng. trans., 1919; *tsialism i voina*, 1915 (Socialism and War. In collaboration with noviev. German trans., 1915); *Imperialism, Kak noveishii etap. pitalisma, 1917* (Imperialism, the final stage of capitalism); ench trans., 1923; *Pisma o taktike*, 1917 (Letters about tactics); *roki revolyutsii*, 1917 (Lessons of the Revolution. Eng. trans., 18; German trans., 1921); *Gosudarstvo i revolyutsiya*, 1917 (The ite and revolution. Engl. trans., 1919). The Marxist doctrine out the state and the tasks of the proletariat in a revolution. ench. trans., 1919; German trans., 1918; *Grozyashchaya Katas- fa i Kak c nei borotsya*, 1917 (The catastrophe which threatens us d how to struggle with it. French trans., *La catastrophe imminente es mesures de la conjurer*, 1918). German trans., 1918; *Uderzhat li sheviki goeydarst vennuyu vlast?* 1917 (Will the Bolsheviks main- n power? German trans., 1921); *Proletarskaya revolutsiya i renegat utskii*, 1918. (The proletarian revolution and Kautsky the negade. Eng. trans., 1920); French trans., 1919; German trans., 18; *Vybory v Uchreditelnoye Sobraniye i diktatura proletariata*, 19. (The dictatorship of the Proletariat and elections to the Con- tuent Assembly. Eng. trans., 1920); German trans., 1920; *tskaya bolezn "levisny" v kommunisme*, 1920 ("Left Wing mmunism, an infantile disorder." Eng. trans., 1921; French ns., 1921; German trans., 1921); *Krizis v partii*, 1921 (The Crisis the Party); *O prodnaloge*, 1921 (On the tax in kind. German ns.); *Stranichki iz dnevnika*, 1923 (Pages from my diary); *O operatsii*, 1923 (On co-operation. French trans. Sur la Coopération, 4); *Luchshe menshe, da luchsche*, 1923 (Better little but good); *raniye sochinenii T.T. 1–19*, 1921–4 (collected works in 19 vol.). There are two German editions of Lenin's collected works— *sgewählte Werke Sammelband*, 1925, and *Auswahl aus seinen rken.* (L. T.)

ENINGRAD: *see* PETROGRAD.

EONCAVALLO, RUGGIERO (1858–1919), Italian composer 16.455), died at Montecatini Aug. 9 1919.

EPROSY (*see* 16.479).—Since 1910 a new and more hopeful in the 3,000-year-old leprosy problem has been opened up by discovery of an improved treatment of at least the earlier ges of the disease. It still remains a great scourge, recent mates placing the world's lepers, including early little recog- d cases, at two to three millions, the great majority being met h in tropical and subtropical Asia and Africa, the last having highest numbers in proportion to population.

eprosy is most prevalent in hot damp climates, and least in dry areas, humidity being apparently favourable to the vival of the lepra bacillus and its transmission to others, usu- through long and close contact, 40% of traced infections g due to living in the same house and 30% more to sleeping he same bed with a leper. Children and young adults are t susceptible. The disease is less infectious than tubercu- s, and many advanced crippled nerve cases lose their infec- ty. One-third of the isolated lepers in South African institu- s were recently released on this account, with great reduction in expenditure and in opposition to segregation, which is only necessary in infective stages, and has resulted in the reduction of the lepers in Norway to only 5% of the numbers known in 1856, when it was introduced there. Sweden and Iceland show very similar results. Under the more difficult conditions in poor tropical countries such as Hawaii and the Philippines, and in the absence of an effective treatment, the effects of this policy have not been so good and it has led to hiding of the earlier and more amenable cases, from whom infections may arise before they are discovered and isolated.

Treatment.—Numerous suggested remedies, including nastin, having failed to fulfil their early promise, only the old Indian drug, chaulmoogra oil, was known to have some power of retarding the progress of the disease by such doses as could be taken orally on account of its nauseating properties. But slightly better results were obtained by Victor G. Heiser in the Philippines by prolonged painful courses of intramuscular injections of the oil, which few patients would submit to. Real advance was made in 1916–7 when L. Rogers injected the soluble sodium salts of the fatty acids of chaulmoogra and other oils intramuscularly, and still better intravenously. This produced febrile and local reactions, accompanied by extensive destruction of the lepra bacilli in the diseased tissues, with subsequent absorption and eventually complete disappearance of the nodules and the organisms in a considerable proportion of not very advanced cases.

Dean and Hollmann at Honolulu soon after introduced the practically important modification of using intramuscular injections of ethyl esters in place of the more troublesome intravenous ones of the sodium salts, enabling a larger number of cases to be treated. The result was that in the last four recorded years the number of cases discharged as recovered by a board of medical experts, has numbered 53% of the 399 admissions during the same period, and the total lepers, including advanced incurable cases among whom the mortality is high, are being reduced at a rate which will nearly solve the problem in Hawaii within about 25 years.

Further, at the great Culion leper settlement of the Philippines a little over 4,000 cases in all stages have been treated during the last two or three years, and 645 have already cleared up and are bacteriologically negative. Good progress is also being made in many other countries. Many early cases are now coming forward, for the first time in the age-long history of leprosy, in the early amenable stages and asking for admission to the leper institutions in order to obtain the new treatment. They consequently recover before they have reached the more infective stages, cutting short numerous foci of infection in the houses. Active research work, still further to improve the treatment, is going forward in several important centres. The disheartening old asylums for hopelessly advanced and often quite harmless uninfective lepers are giving place to agricultural colonies, much on the lines of tuberculosis sanatoria for the infective cases amenable to treatment.

Hospital clinics are being established to enable the early uninfective cases to be treated as out-patients without the cost and disadvantages of separation from friends and relatives, and only sufficient funds and organisation are required to enable this loathsome disease to be reduced to negligible proportions in many parts of the world within a very few decades. (See F. Oldrieve, *India's Lepers*, 1924.) (L. Ro.)

LEROY-BEAULIEU, HENRI JEAN BAPTISTE ANATOLE (1842–1912), French publicist (*see* 16.485), died in Paris June 16 1912.

LEROY-BEAULIEU, PIERRE PAUL (1843–1916), French economist (*see* 16.485), died in Paris Dec. 9 1916.

LEVASSEUR, PIERRE ÉMILE (1828–1911), French economist (*see* 16.505), died July 9 1911.

LEVELLING: *see* SURVEYING.

LEVERHULME, WILLIAM HESKETH LEVER, 1ST VISCOUNT (1851–1925), British man of business born at Bolton Lancs. Sept. 19 1851, was the son of James Lever, a grocer. His education, received at the Bolton Church Institute, was cut short in 1867 when he went into his father's wholesale warehouse as an apprentice. With his zeal for knowledge and a wonderful memory, he utilised every opportunity for self education, attending evening classes for shorthand, drawing, French and chemistry, and interesting himself particularly in accountancy, pictorial art and architecture. Persuading his father to make him his commercial traveller, he showed such capacity that in 1874 he was taken into partnership and was thus able to marry the friend of his childhood, Elizabeth Ellen, daughter of Mr. Crompton, linen draper, of Bolton.

In 1877, having foreseen that important economies in transport of goods could be effected by opening a branch of the business in Wigan, he established a centre there which ultimately became more profitable than the Bolton headquarters. It was doing so well in 1884 in the hands of his father and capable assistants that he was on the point of abandoning it to them and seeking a fresh field for his activities; but refreshed by a holiday in the Isle of Lewis he returned to the Wigan shop "full of ideas about soap." These "ideas," it soon appeared, could not be realised until he had personal control of the manufacture. He accordingly leased a small soap works at Warrington, which had previously been carried on at a loss, and speedily, by his energy, activity and general good management, transformed it into a well-organised, flourishing business, with London branch premises and agents all over the country, well encouraged and supported by their chief's extensive advertising schemes of striking novelty and enterprise.

Soon, a freehold site where he would have more space for expansion became urgently necessary, and this he found for himself, near Bebington, Cheshire, where on Bromborough Pool Mrs. Lever on March 3 1888 cut the first sod for the foundations of Port Sunlight, the now famed model industrial village—a conspicuous example of successful town planning, with parks, tree-bordered thoroughfares, open spaces and halls, institutions and dwelling houses of great and varied architectural interest, the last named well adapted in size to the needs of the occupants, and provided with baths and gardens in front and allotments behind. As for "the space for expansion," the original 56 acres (of which 24 were reserved for the works and 32 for the village) were latterly extended to 547 acres, 287 allotted to works and 260 to the village, including its extensions.

The firm's expansion overseas has become world-wide, for in 1925 it was recorded in *Progress*, one of the company's magazines, that over 250 companies in all quarters of the globe were associated with Lever Brothers. Through Bromborough Pool and the Mersey, Lord Leverhulme had from Port Sunlight secured access by water to London and to British ports generally for home trade, and to the waterways of the world for his exports, as well as to the sources of the raw materials for soap manufacture. These facilities, owing to his foresight and enterprise, are about to be greatly increased by the opening of the Bromborough dock under construction on the Mersey side, from and to which ocean steamers will take and bring cargo.

Mr. Lever and his brother, before they moved to Port Sunlight, had determined that their employees should share in their prosperity. The prosperity sharing pledge was primarily redeemed in the creation of Port Sunlight village with its abundant amenities, and in the spaciousness of the factory area and the buildings erected thereon with all the arrangements now comprehended in the term "factory workers' welfare." Those who lived in the village further enjoyed "prosperity-sharing rents," based on the cost of maintenance repairs and renewals, the interest on the capital expended being a charge on the company's profits. The same principle was applied to works welfare expenses, beginning with a pensions scheme called the Employers' Benefit Fund, long service awards, cottage hospital, holiday club, but including in later days the co-partnership scheme and the many benefits flowing from it, *e.g.*, free insurance policies, unemployment and sickness benefits, staff college training and scholarships. The effect of the prosperity-sharing environment on the workers was a frequent subject of inquiry on the part of visitors; to Mr. and Mrs. Lever it was a source of pride, cultivating as they did the affection of the children an missing no opportunity of promoting their health and happine and entertainment, or of meeting them in their Sunday schoo and day school festivals.

In 1906 (12 years after the incorporation of the private co pany of Lever Brothers Limited into a public company) an attac was directed by a powerful Press organisation against an arrang ment made by Mr. Lever with some other soap makers, whic was mistakenly denounced as a soap trust. It was shown, how ever, in the course of the legal action taken by Mr. Lever again his principal assailant, that on the contrary, the object of th plan was to render better service to the public as well as to th distributors, both wholesale and retail. On the third day Mr. Lever's ordeal in the witness box the counsel for the defen withdrew the plea of justification, as well as every imputatio made upon Mr. Levers' honour and integrity, and apologis for having made the attack upon him. Mr. Lever presented th University of Liverpool with the amount of the damages a costs awarded to him, together with an additional sum whi brought the endowment up to £100,000.

Mr. Lever was in politics an advanced Liberal and, in aid his party against strong Conservatives, allowed himself to nominated a Parliamentary candidate six times in all, thrice f Birkenhead, twice for Wirral and once for the Ormskirk Divisi of Lancashire. He scored a notable victory on his second can dature for Wirral in 1906, and introduced bills on old age pe sions and payment of members, which were afterwards taken by the Government and became law. After being raised to t peerage he made a favourable impression in the House of Lor by his speeches on labour questions, and on decimal coinage introduced a bill which was remitted, with another, to a sele committee, which, however, did not complete its sittings with the life of that Parliament.

In 1909 Mr. Lever launched his great scheme of co-partn ship with employees. "A remarkable year" he characteris this, for it happened to be the centenary of his father's bir the 21st anniversary of the foundation of Port Sunlight, a the year in which his son was coming of age and entering t business. The scheme, avoiding the objections to ordina profit-sharing arrangements, was contrived to give to manag and other employees a common interest with the employer avoiding loss as well as in sharing gain, the motto of all bei "Waste not, want not." A reduced *facsimile* of the partners certificate is bound together with a number of Lord Lev hulme's addresses explaining his scheme, in "The Six-H Day" referred to below.

The years 1910–4 brought to the founder of Port Sunli fresh honours but also severe personal sorrows. In 1910 brother died. In 1911 he was made a baronet; in 1913 he recei from the King of the Belgians the Cross of Grand Officer of Order of Leopold II. On July 24 of the same year he suffe his heaviest bereavement in the loss of Lady Lever, who been his companion on many voyages, had visited with him concessions on the Congo, and, on her return, had been mad Fellow of the Royal Geographical Society. Her memory honoured, when on the visit of King George V. and Queen M in 1914 His Majesty laid the foundation stone of the Lady Le Memorial Art Gallery. The completion of this building impossible until the close of the World War, but then becam lordly treasure house, built, furnished, endowed and dedica to Lady Lever's memory by her husband, the Princess Beat opening it in 1922.

Sir William's war activities included the loan of sev buildings as hospitals, and service on many committees, incl ing the Liquor Control Board and the Army and Navy Cant Board. He was also gazetted Hon. Col. of the 2nd Vol. B the Cheshire Regt., in which, in its early days, as a volunt training corps, he had drilled as a private.

After his baronetcy, many other public honours were stowed on him. He was raised to the peerage in 1917 as B Leverhulme (a name chosen by himself as combining that o late wife with his own) and the designation "of Bolton oors" as indicating his unceasing affection for his native wn. He was high sheriff of Lancashire in 1917 and mayor of olton in 1918–9. The University of Edinburgh conferred upon m the hon. degree of LL.D. He was also made hon. fellow of e Royal Institute of British Architects.

In 1918 Lord Leverhulme turned his attention to the subject reconstruction after the War and advocated the running of achinery in factories in double shifts of six hours in order to sorb the unemployed and to increase production at a lower st. Under the title of *The Six-Hour Day and Other Industrial estions* a selection of Lord Leverhulme's speeches and writ- gs on co-partnership, education and business was edited by r. Stanley Unwin, and published with an introduction by scount Haldane. The editor, in his preface, remarked that Lord Leverhulme prescribes a six-hour day, but manages to rk sixteen." He might have added that further time was ved for business transactions by his habit of travelling to and m London by night trains. When at home in London he e at 4:30 A.M. to read reports and prepare for the day's inter- ws and correspondence. It was in 1918 also that Lord Lever- lme bought from Col. Duncan Matheson the Island of Lewis, quiring later North and South Harris also. He spent large ms in a sincere effort to extend and develop the fishing in- stry and to help the islanders in other ways, but lack of sup- rt, especially on the part of the Scottish Office, led to the andonment of his schemes as far as Lewis was concerned; d he gave the town of Stornoway, including Lewis Castle d its grounds, to the people of Stornoway. He continued his velopments in Harris, where more local appreciation was own, until his death.

One of Lord Leverhulme's personal enterprises for the eco- mic development of his Hebridean properties was the open- or acquisition in 1919 of the retail fish shops, since familiar the public as "Mac Fisheries," to serve as an outlet for the ing industry of Lewis and Harris, the catches being conveyed swift steamers to Fleetwood and then distributed to over 300 ps in England, of which 110 were in London. Lord Lever- lme, having borne the whole of the expenses of the formation l development of Mac Fisheries, handed the business over to ver Brothers a year or two later with its capital intact.

mong Lord Leverhulme's many benefactions, the presenta- n to the nation of Stafford House, renamed in compliment to Lancaster House, and now constituting a home for the ndon Museum, is conspicuous. He was a generous benefactor the Congregationalist denomination, of which he was a mem- ; and jointly with his brother he erected the Blackburn Road urch, Bolton, as a memorial to his parents. He also built rist Church, Port Sunlight, St. George's Church, Thornton ugh, and Neston Congregational Church. He was a renowned lector of antique furniture, pictures and Chinese porcelain, l presented the larger part of his wonderful collection to the ly Lever Art Gallery at Port Sunlight. In Freemasonry he ched the high rank of Grand Junior Warden of England.

n 1922 Lord Leverhulme was made a viscount. Awarded Messel memorial medal in 1924, it fell to him to deliver the ssel memorial lecture to the Society of Chemical Industry itled "Science, Religion and Workshop," a typical example his happy gift of relieving solid and serious argument with f intervals of humorous anecdote.

t the 15th distribution of partnership certificates to his loyees, on his 72nd birthday, Lord Leverhulme protested inst a suggestion that he was without hobbies "other than unselfish and noble hobby of devising schemes for the bene- nd interest of his workpeople." He said he had a great many bies, adding, "I think road-making is my greatest hobby, then I have the building of towns. Port Sunlight was my . I am now engaged on my 11th—Moor Park in Middlesex. re are five or six in the Congo and others in various places." ord Leverhulme began his seventh journey round the world Nov. 14 1923 and completed it on March 24 1924. His last ney was to West Africa, returning to London on the morn- of March 15 1925. He resumed his business activities with his usual unsparing disregard of self, and caught a chill, which suddenly ended his remarkable career, on May 7 1925.

The testimony of Lord Leverhulme's fellow directors, embodied in a resolution drawn up on the morning of his death, summed up his life and work as "distinguished by genius, courage, imagination and devotion to duty, a career inspired by the highest ideals of public spirit and service to his fellow men, and notably by his interest in the welfare, education, better housing and amelioration of the conditions of labour of every rank of industrial worker, as evinced by his creation of co-partnership, life insurance, old age pensions, educational and other schemes for the benefit of his employees and by his gifts to the communities of Port Sunlight and Merseyside, to his native town of Bolton and to the nation." The directors further testified to "his natural simplicity, the charm of his character, the wealth of his affection and the loyalty of his friendship." (A. P.)

LEVI, SYLVAIN (1863–), French orientalist, was born in Paris March 28 1863. Educated at the University of Paris, in 1886 he was appointed a lecturer at the school of higher studies in Paris. As special lecturer in Sanskrit he taught at the faculty of letters from 1889 to 1894 when he was appointed to a professorship at the Collège de France. In 1897 and 1898 he made important tours of scientific research in India and Japan, and from 1921 to 1923 he travelled in India, Indo-China, Japan, Korea, Siberia and Russia. Prof. Levi became a director at the school of higher studies and a member of numerous societies, including the Royal Asiatic Society, the Linguistic Society and the Society of Jewish Studies. In 1923 he was made an officer of the Legion of Honour. His works include *Le théâtre indien* (1890, Prix du Budget, Académie des Inscriptions et Belles-Lettres); *La doctrine du sacrifice dans les Brahmanas* (1898); *Le Népal* (1905–8).

LEVY, AUGUSTE MICHEL (1844–1911), French geologist (*see* 16.519), died Sept. 21 1911.

LEWIS, ISAAC NEWTON (1858–), American soldier and inventor, was born at New Salem, Pa., Oct. 12 1858. On graduating from the U.S. Military Academy in 1884 he was given a commission in the artillery. From 1894 to 1898 he was a member of the board on the regulation of coast artillery fire in New York harbour. In 1898 he became recorder of the Board of Ordnance and Fortification in Washington, and the same year made a study of ordnance in Europe which led to the re-armament of the U.S. field artillery. He is the inventor of a number of range finding and other mechanical and electrical instruments used for artillery fire control purposes in U.S. coast defences. From 1904 to 1911 he was instructor and director of the coast artillery school at Fort Monroe, becoming lieutenant-colonel in 1911. In 1913 he retired from active service with rank of colonel. The same year a machine-gun of his invention (the Lewis gun) was accepted by the British, French and Belgian Govts. after it had been rejected in America. Throughout the World War it was extensively used by all the Allies. Col. Lewis refused to accept the royalties, amounting to $1,276,000, on his guns made for the American Govt. after the United States entered the World War.

LEWIS, SINCLAIR (1885–), American author, was born at Sauk Centre, Minn., Feb. 7 1885. He graduated from Yale University in 1907, and was engaged for a time in newspaper work, being reporter on various papers. He acted in an editorial capacity for the Frederick A. Stokes Co., the Publishers' Newspaper Syndicate, and George H. Doran Co., at the same time writing short stories and novels. Among his works are: *Our Mr. Wrenn* (1914); *The Trail of the Hawk* (1915); *and Free Air* (1919). His early work owed much to the influence of H. G. Wells. By *Main Street* (1920), a study of a small town, he won wide recognition while he provoked much criticism. *Babbitt* (1922) was one of the most discussed novels of the century, and added a new word to the English language. It was followed by the scarcely less popular *Arrowsmith* (1924).

LEYGUES, GEORGES (1858–), French politician, was born at Villeneuve-sur-Lot on Nov. 28 1858, and educated in his native town, Toulouse and Bordeaux. On arriving in Paris he took up the study of the law, but his natural bent inclined him at the same time towards letters and he was well received in the Parnassian group of poets. After pursuing wide travels, ranging from the polar regions to the Levant, he entered politics. At the age of 26 he was elected deputy for the Lot et Garonne department. In 1894 and 1895 he was given Ministerial posts, respectively in the Dupuy and Ribot Cabinets. In June 1898 he was elected vice-president of the Chamber, but he resumed ministerial office in the 3rd Dupuy Cabinet of the same year. In Waldeck-Rousseau's Cabinet (1899–1902) known as that of "defence and republican action," he held the portfolio of public instruction, while M. Sarrien appointed him Minister for the Colonies in 1906. In the Clemenceau Cabinet of 1917 he was Minister of Marine. In 1920, when M. Millerand became President, M. Leygues was asked to form a Government. He remained until 1921 Prime Minister and Minister for Foreign Affairs. He was again Minister of Marine in the cabinets formed by M. Briand in Nov. 1925 and March 1926. His publications include *Le Coffret Brisé* (1882); *L'École et la vie* (1904); *La Pologne* (1918); *Colbert et son oeuvre* (1920).

LIANG SHIH-YI (1869–), Chinese politician, was born in Kwangtung, and, unlike many other Chinese republican leaders of his time, was educated wholly in China and knew no other language than his own. Graduating with honours in classics, he was appointed secretary to Tang Shao-yi when that statesman led a mission to India in 1906, and then began a successful career in the civil service. He was appointed director of railways and assistant director of the Chiao T'ung Bank in 1907, acting director of Imperial Chinese Posts in 1911, acting minister of communications in 1912, acting vice-minister of finance in 1913, and a member of the council of state and director-general of customs and taxes in 1915. The failure of Yuan Shih-kai's monarchical *coup d'état*, of which he was one of the supporters, compelled him to resign, but in 1918 he returned to favour as Speaker of the Senate. Throwing in his lot with Chang Tso-lin in the contest between the latter and Wu Pei-fu, he became Prime Minister in 1921. The defeat of Chang, however, resulted in his fall, and he left Peking in 1922 to escape Wu's vengeance and took no further part in politics. He visited Europe in 1924.

LIAPUNOV, ALEXANDER MIKHAILOVICH (1857–1918), Russian mathematician, was born April 25 (old style) 1857, a son of the astronomy professor in the University of Kazan, and the brother of the musician and composer Sergei M. Liapunov. In 1901 he was made a member of the Russian academy of science and later was appointed professor at Kharkov University. He died Oct. 31 1918 in Odessa. His mathematical research belongs mainly to hydrodynamics and his chief work is *Sur les figures d'équilibre peu différentes des ellipsoïdes d'une masse liquide homogène douée d'un mouvement de rotation* (1909–12). His voluminous investigations are very specialised and not available to the ordinary reader, but they are of incomparable value to specialists. They are published in French and in the *Memoirs* of the Russian Academy of Sciences (1895, etc.) and his first treatises, which appeared in Russian, are translated into French and published in the *Annales de Toulouse*.

LIBERAL PARTY (*see* 16.538).—When the House of Lords rejected the budget at the end of 1909, Mr. Asquith immediately dissolved Parliament and appealed to the electors. The appeal was not only for the passing of the budget, but also for the permanent removal of any control over finance by the Upper Chamber, and for a time limit on any veto on any other legislation passed by the House of Commons. In the election, the Liberal party lost a considerable section of its enormous majority. But Mr. Asquith had, in combination with the Irish and the Labour members, a majority of 124 pledged to these two operations.

The Parliament Act.—The budget was passed in April, but in May 1910 King Edward VII. died and a kind of truce of God was called on the important constitutional question between Lords and Commons. Delegates from both sides discussed all possible forms of double chamber government for the remaining nine months of the year. Agreement was finally found to be impossible. The conference broke up and immediately Mr. Asquith again dissolved Parliament, this time with the written guarantee of the new King, George V., that if the country again
endorsed his policy the royal prerogative would be exercised
create a sufficient number of peers to cause the necessary b
to become law. The election resulted in almost exactly the sam
balance of numbers as that which was held nearly 12 montl
before. Mr. Asquith's Veto bill passed through all its stages
the House of Commons by majorities of over 100, and the amen
ments which the Lords endeavoured to make to it were rejecte
The Conservatives were informed they must either allow the b
to pass or its passage would be effected by the creation of se
eral hundred new peers. They chose the former course.

The Liberal Programme.—The Liberal Govt. then proceede
to endeavour to carry measures, the principles of which t
House of Lords had previously rejected and the House of Co
mons previously approved—Home Rule for Ireland, Wels
Disestablishment, and the creation of a more democratic fra
chise by giving each man only one vote. Of these the last w
withdrawn owing to its complication over the question of givi
the votes to women. Home Rule passed after many months
most bitter controversy and the organisation of continge
rebellion both in Ireland and in England. But it was only p
on the statute book after the opening of the World War in 191
accompanied by a condition suspending its operation till th
War was over. The Welsh Disestablishment bill was also pass
and came into operation after the War was over. Mr. Llo
George also passed his great contributory insurance schem
and in 1913 he launched an ambitious land policy in town a
country, which was accepted by the Liberal party and on whi
they intended to appeal to the country.

The War Period.—But all such plans were swept away by t
outbreak of the World War in Aug. 1914. The Liberal Cabin
was seriously divided between the policy of neutrality and t
policy of intervention, and at one time the resignation of t
Govt. appeared inevitable. The War was conducted exclusiv
by the Liberal Cabinet until May 1915, when failures in t
field, the anxiety of the people and the bitter attacks by t
newspapers, made it essential that a *union sacrée* should
formed in Britain as it had been formed in other countri
There was therefore constructed the first Coalition, in whi
Mr. Asquith remained Prime Minister and the most importa
offices—the Foreign Office, the Chancellorship of the Excheq
the Ministry of Munitions—were still held by Liberals; but
which all the Conservative leaders and some representatives
Labour were included.

This Govt. continued to direct the operations of war until t
late autumn of 1916. Owing to that War's prolonged cont
uance, with many disastrous defeats, the renewed attacks of
popular newspapers, and the gigantic loss of life and treasu
the public mind was prepared for a further change. An intri
of a few men, ostensibly directed toward giving Mr. Ll
George control of the War operations but in fact designed
exclude Mr. Asquith and the Liberals from the Cabinet, pro
unexpectedly successful. Mr. Asquith resigned with all
Liberal colleagues. Mr. Lloyd George constructed a Cabi
composed of Conservatives, some minor Liberal memb
Labour members and business men.

Mr. Lloyd George as Premier.—For the next two years Mr.
quith and his followers, being a substantial majority of
Liberal members in the House of Commons, confined th
selves to suggestions and criticism. But their support for
inquiry into the allegations made by Sir Frederick Maurice
the conditions which led to the greatest defeat the British Ar
has ever experienced on March 21 1918, created a break betw
the two sections of the party. In the following autumn, w
Germany was utterly vanquished, Mr. Lloyd George iss
what was called a coupon, contained in a letter signed by h
self and Mr. Bonar Law, which was published as a recommen
tion to voters in all constituencies to vote against Liberal me
bers and candidates who still declared allegiance to Mr. Asqui

The Election of 1918.—The result was a débâcle. Mr. Asqu
and all the Liberal ex-ministers who were faithful to h
were defeated and only some 30 such Liberals were return
These, under the leadership of Sir Donald Maclean, who h

ver held Cabinet office, maintained some sort of opposition inst the overwhelming forces of Mr. Lloyd George's Coalition. soon became apparent, however, that the great mass of the erals in the country were bitterly opposed to this Liberal-ry combination. Mr. Asquith was returned for Paisley at a -election and assumed the leadership of what was scornfully med the Wee Frees. In a fierce political civil war, carried on three years, it was obvious that Mr. Lloyd George's nominees ld only be elected by Conservative votes and that the Lib-ls were either in large numbers joining Labour or remaining ggedly determined to destroy the Coalition.

n 1922 Mr. Lloyd George and his Coalition were overthrown an intrigue, very similar to, and in part conducted by the ne men, the one which had placed him in power. A con-vative Govt. was formed and in the appeal to the country eral was still found fighting Liberal, the result being the struction of a considerable section of Mr. Lloyd George's lowers, thus leaving the two Liberal sections still in a negligi- minority in the House of Commons.

Liberal Reunion.—The year after, however, Mr. Baldwin, o had succeeded Mr. Bonar Law as Prime Minister, unex-ctedly appealed to the country for a general tariff as a means relieving unemployment. The Liberal leaders came together so vital a question; Mr. Lloyd George accepted Mr. Asquith leader of the party, and the two ex-Prime Ministers issued a nt appeal. The distrust of the Coalition by the Liberals in country, however, had caused so many to turn to Labour t, although those who had been followers of Mr. Asquith ned a large number of seats, the number of those who had en concerned with the Conservatives and the "coupon," re still further diminished. Although they had secured sub-ntially the same number of votes, the Liberals found them-ves in members 30 behind the Labour party, and with no party a majority, Mr. Asquith announced the intention of the erals to support a Labour Government. For nearly a year t Labour Govt. was retained in office by the votes of Liberal mbers, although it refused any agreements or consultation ncerning policy and set up candidates in almost every con-tuency against the Liberals who were supporting it in the use.

The Election of 1924.—Such an impossible position was ter-nated in unexpected and almost casual fashion. The Labour ime Minister decided to dissolve Parliament in preference to cepting any form of inquiry concerning the vague insinuations ociated with the initiation and then withdrawal of a prose-tion against a communist newspaper and its temporary editor, . Campbell. In the dissolution which followed, while Labour ceived a severe setback, the Liberal party in Parliament was most annihilated although polling more than 3,000,000 votes d the largest Conservative majority was returned since the eat Reform bill. Mr. Asquith, who was defeated, retired to House of Lords as Lord Oxford, but remained leader of the eral party. Mr. Lloyd George was elected chairman of the eral "rump" of 40 that remained in the House of Commons, whom some 10 formed themselves into a Radical group and used to accept his leadership. The remaining 30 were mostly cted by Conservative votes and some were pledged, in critical isions, never to vote against the Conservative Government.

This desperate condition in Parliament was, however, not lected by the Liberals in the country who over large areas oceeded to initiate Liberal campaigns, to collect substantial ds, and to prepare for a reversal of the decision when the t general election should come. The Liberal party also set lf down to consider vital social programmes; to issue pro-uncements on such subjects as coal and power, the land and nation and towns and the land. A small group in the House Commons maintained a lively opposition to Mr. Winston urchill's Budget of 1925 and to any tampering with free de in the Safeguarding of Industries bill.

The revolutionary conclusions of Mr. Lloyd George's Land mmittee, in part watered down by a compromise with the eral candidates association, were accepted by the delegates in a great Liberal convention representing the whole of the country, as an essential part of Liberal policy. This formed a cause or an excuse for flight from the party of certain ex-ministers and persons of wealth. In 1926, however, Lord Oxford remained undisputed leader of the party as a whole, and Mr. Lloyd George chairman of a rather forlorn and divided group in the House of Commons, while great energy was being shown by a land and nation league to spread the new reform doctrines especially in rural England, and vigorous attempts were made to reverse the verdict of the last election and place some 500 Liberal candidates in the field before the next appeal to the electors. (*See* English History.) (C. F. G. M.)

Early in May this co-operation was interrupted by a serious difference between Lord Oxford and Mr. Lloyd George over the general strike which broke out on May 3. Lord Oxford held with the Government that the general strike, being a threat to the constitution, must be defeated before any negotiations for peace were considered. Mr. Lloyd George attributed the strike to precipitate action by the Cabinet which he condemned and supported the plea of the Archbishop of Canterbury for a negotiated peace. On May 10 Mr. Lloyd George declined in writing to attend a meeting of the shadow Cabinet summoned by Lord Oxford who, in communications of some severity, interpreted this abstention as tantamount to resignation. Mr. Lloyd George refused to resign and at meetings of the Liberals who had seats in the House of Commons was supported in that attitude by 20 votes to 10. The situation was complicated by Mr. Lloyd George's contributions to the Press in the United States and by his alleged but strongly denied negotiations with Mr. Philip Snowden, representing moderate Labour. Also, Lord Gladstone accused Mr. Lloyd George of withholding the funds with which he was entrusted at the late general election. (Ed. *E.B.*)

LIBERIA (*see* 16.539).—By an agreement reached in 1910 France obtained some 2,000 sq. m. of hinterland which Liberia had claimed but had not administered. This reduced the area of the republic to about 40,000 square miles. Estimates made up in 1925 put the Americo-Liberians at about 20,000, of whom approximately half live in Monrovia, the capital. The native population is believed to be decreasing, it numbers probably 1,000,000 to 1,250,000. Some thousands of negroes in the coast region have adopted the religion (Protestant forms of Christianity) and the standards and language (English) of the Americo-Liberians, whose authority has become generally recognised over the whole country. Primitive conditions prevail throughout the interior.

History.—The condition of Liberia in 1910–11 was far from satisfactory. It was burdened with debt, it had granted many concessions without being able to control the regions in which the concessionaires were to work, and its authority rarely extended more than 20 m. from the coast. The frontier regions, which adjoined French or British colonies, were in a disturbed condition; the French especially were troubled by the remnants of Samory's army (*see* 24.642) and other malcontents who took refuge in the Liberian forests and raided across the frontier; hence the annexation by France of part of the border region. It appeared as if the experiment of "running" the country by American negroes—as alien to the bulk of the natives as are white men—on the lines of the constitution of the United States would collapse. However the intervention of the United States Govt. led to a financial re-organisation which gave the Americo-Liberians a new start. There was some trouble with Germany in settling the matter. The German Govt. energetically pressed its claims, the gunboat "Panther" being anchored for a month off Monrovia, with its guns trained on the executive mansion. All difficulties were overcome however by June 1912, when an international loan of $1,700,000 (£340,000) was raised, the bonds to be issued for not fewer than 40 years. The customs duties and certain taxes were pledged as security for the loan, and are administered by an American receiver-general, who is also Financial Advisor to the Liberian Government. Thus in effect the control of finances is in the hands of the United States and expenditure is kept within the limits of the revenue. A frontier police force was also organised by officers of the United States Army, and as a result Liberian authority was better maintained.

During the World War the Germans, deprived by force of arms of their own colonies, found in Liberia their last foothold in West Africa. But in Aug. 1917 Liberia declared herself in a state of war and expelled the Germans. She was a signatory of the Treaty of Versailles, her representative at the peace conference in Paris being Mr. C. D. B. King. Mr. King was in 1920 chosen as president of Liberia and in 1924 was re-elected for a second term. He strove, with some success, to improve conditions in Liberia and was the originator of a system of road building which gave a prospect of opening up the interior.

Economic Conditions.—The natural resources of Liberia are almost untouched; the only cultivated crop of importance for external trade is coffee and the other industries for export are practically confined to the products of the oil-palm and piassava fibre (prepared from the raphae palm). While Monrovia has two wireless stations and direct cable communication with Europe and New York, there are no harbours and no railways and until means of transport are developed the wealth of the forests and the mineral resources cannot be utilised. The Government, however, has no money to spend on reproductive works. In 1925 an American firm obtained a concession of 1,000,000 ac. primarily for the establishment of rubber plantations. Meanwhile the bulk of the trade was in the hands of British and German firms, the Dutch being next in importance. The United States took but an insignificant fraction of the trade. Between 1913 and 1923 the volume of trade about doubled. In the last named year imports were valued at £298,000 and exports at £242,000. Revenue in 1912–3 was $618,800, accounts being kept in American currency, though the money in circulation is British. In 1923–4 revenue was $380,000, expenditure $371,600.

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LIBERTY LOANS, the name given to the four loans floated by the U.S. Govt. during the World War. A fifth loan, floated after the Armistice, was called officially the Victory Liberty Loan, but is here considered as the Fifth Liberty Loan. Between May 14 1917, when the First Liberty Loan was offered to the public, and May 10 1919, when the campaign for the Fifth Loan was brought to a close, the people of the United States subscribed $24,072,111,400. Of this amount, $21,432,924,700 was finally accepted by the Secretary of the Treasury. The Fourth Liberty Loan, concluded Oct. 18 1918, was, however, larger than any single loan issued by any of the other belligerents, and realised a total of nearly seven thousand million dollars. The number of subscribers to this loan was more than 21,000,000, or one-fifth of the total population of the United States. Moreover, the U.S. Govt. was able to dispose of the Liberty Bonds on very favourable terms; they were issued at par, the rate of interest varying from 3½% on the First Loan to 4¾% on the Fifth. There were a number of reasons for the favourable terms obtained. The United States was immensely wealthy and had just passed through a period of great prosperity; its record for quick payment was unique; patriotic spirit was at a high pitch; advertising on an unexampled scale was undertaken; and the rate offered, while lower than those of European countries, was high as compared with the 3% and 2% paid in recent years on U.S. Govt. bonds.

When America entered the World War the Govt. realised that, in addition to the money needed to prosecute the War by the United States itself, large sums must be raised to relieve the already overstrained credit of the European Allies. The total amount of these loans to foreign countries was $9,842,468,566, to which was added later from sales of war material, etc., $736,040,776, making a total of $10,578,509,342. This money, excluding that derived from sales of war material, etc., was part of the amounts raised in the Liberty Loans. The financial policy of the Govt. was to raise from one-fourth to one-third of the necessary funds from taxation, the rema
der from loans. The Treasury Dept. throughout the War met c
rent obligations by issuing short-term Certificates of Indebtedne
which were absorbed by the Federal Reserve Banks and to so
extent by outside banks and private persons. These certificates w
retired either by exchange for Liberty Bonds or by redemption fr
money obtained through the sale of such bonds. The Liberty Loa
constituted therefore a series of funding operations. These ope
tions were intended not only to extend the debt over a period
years, but to distribute it as widely as possible. The success of t
policy is indicated by the facts that 53% of the individual subscr
tions for the Fourth Loan were for $50 bonds, and that approximate
25,000,000 persons were, at the end of the War, holders of Libe
Bonds. Before the United States entered the War such a res
would have been thought impossible, for it was then estimated th
there were only about 350,000 bond investors in the United Stat

Under the Act of April 24 1917 the Secretary of the Treasu
was authorised to issue bonds to the extent of $5,000,000,000
a rate not to exceed 3½%, these bonds to be convertible in
bonds of a higher rate if such should be issued before the end
the War. The Secretary of the Treasury made the first iss
$2,000,000,000 and proceeded to create a War Loan Organisati
in the Treasury Department. The 12 Federal Reserve Ban
were used as the central agencies in the 12 Federal Reser
Districts, and each of these banks formed Liberty Loan Co
mittees. To each district a "quota" or proportional part
the whole issue was allotted. The value of advertising in arou
ing the public had been clearly demonstrated in the campaig
for the British War Loans, and the Treasury Dept. made use
every available means of publicity. As a result the First Lo
was oversubscribed by more than $1,000;000,000.

In subsequent campaigns the methods employed in placi
the First Loan were developed and extended. In each city
organisation known as Four-Minute Men was formed; the
men visited places of public resort, including the play- a
motion-picture houses, and spoke for four minutes on behalf
the loans. The Govt. assisted local authorities in organisi
street parades in which men from the training camps parti
pated; captured German war material was displayed; disti
guished soldiers and other visitors from Great Britain, Fran
and the other Allied nations were given elaborate receptio
These campaigns were of great value as a means not only
selling the war bonds but of keeping up the morale of the peop

The following are the figures of the number of persons su
scribing to each of the five Liberty Loans, the total of the amou
asked for, the subscriptions and the final allotments:—

Loan	Subscribers	Amount asked	Subscriptions	Allotments
		$	$	$
First (1917)	4,000,000	2,000,000,000	3,035,226,850	1,989,455,5
Second (1917)	9,400,000	3,000,000,000	4,617,532,300	3,807,865,0
Third (1918)	18,308,325	3,000,000,000	4,176,516,850	4,175,650,0
Fourth (1918)	22,777,680	6,000,000,000	6,992,927,100	6,964,581,1
Fifth (Victory, 1919)	11,803,895	4,500,000,000	5,249,908,300	4,495,373,0

(F. H. H.)

LIBRARIES (*see* 16.545).—This article is concerned with t
main developments of the public library service and with certa
special aspects of library work since 1910.

I. GREAT BRITAIN AND IRELAND

Great as was the advance achieved during the last quart
of the 19th century, and especially under the influence of Andr
Carnegie during the years 1900–10, a still greater advance to
place after 1910, and especially from 1918 onwards. Up to t
latter date the service had suffered in two main respects, name
the 1d. rate limit which, except in the great cities, prevent
anything like adequate expenditure on books and salaries, a
the practical inapplicability of the Libraries Act in the small
centres of population. These difficulties had been set forth wi
vigour and persistence by the Library Association, and in 19
the position was restated by Professor W. G. S. Adams in a rep

ublished by the Carnegie United Kingdom Trust, which showed hat the great majority of public libraries were utterly unable o provide an adequate service on the 1d. rate, and that the only ope for rural areas and the smaller towns lay in the establishment of a co-operative system.

Acting on this report the Carnegie trustees set up a number f circulating systems on a regional basis.[1] The county was the nost hopeful unit, and during the years 1915–8 a number of ounty councils, through their education committees, and with he aid of substantial trust grants, set up experimental schemes nder which, from a central store, collections were sent out on eriodic loan to villages where they were as a rule housed in the chools and administered by the schoolmaster. The earliest chemes were those of Staffordshire, Cardiganshire, Carnarvonhire, Perthshire. As the county authority then had no power levy a library rate, the whole cost was borne by the Trust.

Legislation.—The success of the experiment was immediate nd convincing. In the Education (Scotland) Act 1918 it was rovided (clause 5) that the county education authority should ave powers to levy a library rate. In England and Wales the rinciple was recognised by the Public Libraries Amendment ct of 1919 by which county councils were empowered to levy rate, entrusting the administrative arrangements to their eduation committees. The same powers were set up in Northern reland by the Public Libraries Act of 1924, and in the Irish ree State by the Local Government Act of 1925.

After the passing of these Acts the system spread with great apidity under the encouragement of the Carnegie trustees (who xpended altogether £310,300 during the period 1915–25), and y the end of 1925 the only administrative counties which had ot received trust grants were: in England, Westmoreland, ampshire (Isle of Wight)—both of which, however, had less mbitious schemes, not under the 1919 Act—Rutland, Lincolnhire (the Holland division) and Scilly; in Wales, Carmarthenhire; in Scotland, Argyll. In Ireland there were schemes in hree of the northern counties, and 14 of the southern counties.

The system began with the distribution of boxes of books to illages. Within 10 years in several counties the motor-van brary had displaced the box; co-operation with municipal braries had begun; sets of books were provided for all organised dult classes; special collections (*e.g.*, for teachers, agriculturalts, students of local history, etc.) had been made; in a few cases, the basis of differential rating, small libraries of the municipal ype were set up in semi-urban areas too large to be served on he purely circulating system.

The Act of 1919, besides establishing the county as a library nit, removed the rate-limit in England and Wales. In Scotland 1920 the limit was raised to three pence. In Ireland the same xtension was sanctioned in 1920, with a further extension to 6d. r county boroughs. The majority of municipal libraries took reater or less advantage of their new freedom, but there was uch leeway to make good, and up to 1926 insufficient provision r book purchase and salaries was still common. The American brary in 1926 was spending roughly four to five times as much er head as the average British library. Perhaps the most hopel sign was a tendency on the part of the weaker libraries to -operate with the new and vigorous county systems, or with her neighbouring boroughs.

The Central Library for Students.—Apart from the borough d the county service, the chief important development is the tablishment of a national lending library of serious books,—own as the Central Library for Students—as a reserve to the cal services which, under the most favourable conditions, must ways find a difficulty in meeting the needs of specialist readers. This library was started in 1917, largely to supply organised adult education classes, but in 1925 it also served 235 borough and 47 county libraries; with a stock of roughly 31,000 books, the issues from the three depots (London, Dunfermline, Dublin) totalled approximately 54,000. The library has been financed chiefly by the Carnegie Trust with substantial contributions from the Cassel Trust, the Thomas Wall Trust, and the United Service Fund and a comparatively small revenue from the voluntary subscriptions of borrowing libraries. Its sponsors have stated a case for a government subsidy, the library being capable of becoming in a real sense the keystone of the national lending service.

Co-operation with Special Libraries.—Thanks to grants from the Carnegie Trust, many special libraries agreed during 1922–5 to place their collections (rare and irreplaceable works excepted) at the disposal of the central library—a step of great importance towards a systematic inter-loan service. This policy of co-ordination was advanced a further stage in 1925 by the establishment of the Association of Special Libraries and Information Bureaux, and the initiation by the Association of University Teachers of a tentative system of exchange between university libraries.

The Carnegie Trustees prepared a fresh report, issued in 1924, which surveyed the situation during the period 1921–3. It showed that the smaller borough libraries were still financially embarrassed, and indicated the desirability of co-operation between them and the county service. Similar conclusions emerged in the report of the adult education committee appointed by the President of the Board of Education (1921–3). Accordingly, in 1924, the President of the Board set up a departmental public libraries committee, under the chairmanship of Sir Frederic Kenyon, Director of the British Museum, and representing both librarianship and education. This committee was expected to report towards the end of 1926 or the beginning of 1927.

Librarianship.—The pressing importance of raising the standard of education among public librarians received continuous attention from the Library Association and the Carnegie trustees. There was a strong feeling in the profession against the appointment of persons over 16 years of age, which automatically excluded university graduates; moreover, up to 1919 and even afterwards salaries were too low to induce university graduates in any numbers to enter the service. In that year, however, with the aid of a Carnegie Trust grant, a school of librarianship was set up in University College, London, and since that date the number of students taking librarianship as a post-graduate course has appreciably increased. Summer schools have been successfully established both by the school and by the Library Association, and a number of chief librarians have arranged special courses for their junior staffs. Library committees in the United Kingdom were still, however, very far behind those of the United States in their appreciation of the importance of a high standard of general education in the ranks of librarianship, matriculation being normally the maximum requirement, with the understanding that promotion would depend upon the taking of the certificates of the Library Association (*see* 16.560).

Building Developments and Equipment.—The progress of library building was seriously interrupted by the World War, comparatively few libraries having been erected since 1914. The Carnegie Trust in 1917 ceased to make grants and in 1925 decided to consider no further applications. Between 1914 and 1926, however, existing promises were honoured in 26 cases, the more important being those made to Barrow-in-Furness, Nottingham (two branches), Barking, Bethnal Green, Ipswich, York, Gateshead, Exeter. The total sum expended by the Trust on public library buildings in 1914–26 was £295,600. In every case the modern system known as "open access" was adopted, and stress was laid upon accommodation for children. Great improvements were effected in design, with the object of securing better lighting, more effective supervision and the greater convenience of public and staff. Card catalogue and subject-lists have almost entirely taken the place of printed catalogues. There was a steady tendency to make the library, as in the United States, a more vital and potent factor in communal life, by developing the practice of giving lecture courses illustrative of the use and resources of the stock, of supplying schools with loan collections, and by co-operating generally with education authorities, of admitting non-residents to the reference room and (on payment of a small subscription) to the use of the lending department, and of giving special facilities to teachers and students. Library policy has, in fact, become far more liberal than it was before the War. Of the greatest importance to business men and students has been the establishment in great city libraries, since 1919, of commercial and technical departments, notably those of Birmingham, Manchester, Liverpool and Glasgow. The machinery of distribution, through branches, with the aid of union catalogues, was greatly developed (*e.g.*, especially in Glasgow).

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[1] The idea in itself was not a new one. The principle was already nbodied in voluntary schemes in Dorsetshire, in Yorkshire (under e auspices of the Yorkshire Village Library), and had been tried Scotland as early as the middle of the 17th century; in Indiana, S.A., as early as 1816. The trustees, however, for the first time Great Britain systematised the principle by the adoption of the unty authority as the administrative unit. Several attempts to t up rural services based upon a central borough library came to thing.

National Libraries.—Since 1910 two new national libraries have come into existence, the National Library of Wales, on a splendid site just outside Aberystwyth and the National Library of Scotland, formerly the Advocates' Library (*see* 16.557*c*), in Edinburgh. The former is a magnificent building begun in 1911, opened in 1915. It was not yet complete in 1926, but it already housed a splendid collection of books, manuscripts, historic papers, etc. It had the finest Welsh collection in existence and was strong in other Celtic languages. Its printed books numbered 450,000. It was erected by funds subscribed by the Welsh people themselves with a pound-for-pound government grant. The Faculty of Advocates presented their historic library to the nation in 1923, and it was duly vested in trustees by Act of Parliament in 1925, having received a generous endowment of £100,000 from Sir Alexander Grant. The Advocates retain the law section. The copyright privilege is enjoyed by both these libraries.

Between 1910–26 considerable development took place in the British Museum library. The accommodation for readers was increased by the addition of a reserve reading-room in the northern extension. There was also an extension of storage room, and a scheme for increasing the book-stack was initiated. The length of shelving grew to some 55 miles. Of the other copyright libraries, plans were prepared for increased accommodation in the Bodleian Library and the library of the University of Cambridge, but financial difficulties prevented progress. The same difficulty confronted the library of Trinity College, Dublin. As regards the last-named, the reluctance of Irish publishers, after the recognition of the Irish Free State, to send books to the copyright libraries in Great Britain seemed likely to imperil the copyright privilege; the right was, however, confirmed. The National Library of Ireland was closed for some time during the period of political unrest, but was subsequently reopened.

II. THE UNITED STATES

The County System.—As in Great Britain, the most distinctive development in the United States since 1910—though not so widespread as in Great Britain—has been the attempt to deal with the needs of rural areas. The county system began in Indiana in 1816; Wyoming legislated in 1886. Travelling libraries were established in New York, Wisconsin and Michigan between 1890 and 1900. Ohio and Maryland adopted the county system in 1898; Wisconsin and Oregon in 1901 and 1903. After 1910, however, the system was put upon an entirely new level of efficiency in California, where there were in 1925 no less than 42 county schemes holding jointly 2,500,000 books, with a total annual income of $1,250,000. The system was greatly strengthened by the existence of the fine state library in Sacramento, which acts as a kind of clearing-house (with a union catalogue) and central reserve for the whole state.

In a single year (1924) county libraries borrowed no less than 37,000 volumes for special readers. It is remarkable that by 1926 some 60 independent town libraries had voluntarily merged themselves in their respective county systems, thus greatly adding to the service of books upon which their readers might draw, and reducing their expenditure. The local centres are as a rule upon a more elaborate scale than their British counterparts: they have small, but admirably arranged, reading-rooms, permanent collections, and paid librarians, the circulating syste being, except in the case of very remote centres, only suppl mentary. A different system obtains, *e.g.*, in the State of Massa chusetts and other eastern states, where the unit is the tow ship, and the whole machinery is based upon a central office the department of education. By 1926 the county systems ha been established by statute in 29 states, but schemes were operation in only 200 counties out of 2,964. There is, howeve no doubt that under the influence of the Carnegie Corporatio of New York, supported by the fine example of California, t scheme is likely to spread rapidly.[1]

Municipal Service.—There has also been great progress in t municipal library service which, though of the same gener type as its British counterpart, has shown itself considerab more elastic. Several magnificent libraries, including those Detroit, San Francisco and Cleveland, have recently bee erected.

Librarianship.—The profession of librarianship is better pai and more highly esteemed than in the United Kingdom. B tween 1887 and 1919 no less than 15 schools of librarianship we founded, the more important being the New York State libra school at Albany, the Pratt institute school at Brooklyn, t Carnegie library school at Pittsburgh and the Drexel institu school at Philadelphia.[2] The profession is largely in the han of women, though most of the senior posts in the large cities a still held by men. In 1921 nearly half the students in the librar schools were college graduates. The American Library Associ tion (membership nearly 7,000) is an active and efficient bod founded in 1876, with headquarters in Chicago. It represen both the United States and Canada. It issues select biblio raphies, a specimen catalogue, reading courses (etc.) and, wit the aid of subsidies from the Carnegie Corporation of New Yor has undertaken important inquiries into the training of libr rians, and the relation of the public library to adult educatio Some 60 committees were at work in 1925 upon important pro lems of various kinds. The association in 1924 established library school in Paris with the aid of funds from the Americ committee for devastated France.

In 1923 a calculation showed that, as regards places havi not less than 1,000 inhabitants, 53·5% of the population ha access to public library facilities,[3] of which more than half owe their buildings mainly to Andrew Carnegie. In the more activ city systems, *e.g.*, at Cleveland (which in 1925 opened a magni cent new building on the most modern lines at a cost of ove $4,000,000 and which spends at the rate of rather more tha $1·25 per head), in New York City, at Detroit, Chicago, Pitt burgh, Boston, Newark, Indianapolis, Brooklyn, all kinds developments have been devised with the object of bringing t service into the closest contact with the life of the communit A great feature is made of commercial and technological colle tions; juvenile departments (usually under specially train assistants), service to schools, library clubs for adolescent service by telephone, teachers' libraries, music departments— all these illustrate the tendency to departmental specialisati which is making the public library a real factor in civic life. the new Cleveland library the arrangement of book stacks a reading rooms gives a concrete illustration of this importa development. The system of distribution through branches a sub-branches, in shops, factories and public buildings of ma kinds, is likewise designed to bring the communal stock direct to the service of the public. The public library has in fact b come the intelligence bureau of the community.

The Library of Congress.—The Library of Congress is t pinnacle of the whole structure. Unlike the British Museu this library, under reasonable safeguards, lends the rarer boo which state, municipal and county libraries do not posse There is, in fact, a recognised inter-loan system, working u wards from the village to the Federal library, under which a reader may as a rule obtain access to any publication whi sts in the country. In this scheme the universities and many ecialist libraries participate. Of the greatest importance in s connection is the national card-index system operated by Library of Congress, which supplies (at a very low price, d yet on a self-supporting basis) accession cards, fully regis-ed and annotated, to any library in the country. Several ousand libraries buy these cards, and thus tend gradually to ndardise their systems of cataloguing and classification.

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[1] See H. C. Long, *County Library Service* (1925).
[2] See C. C. Williamson, *Training for Library Service* (1923).
[3] W. S. Learned, *The American Public Library* (1924).

SPECIAL LIBRARIES

The chief development is the tendency, both in the United ngdom, and in the United States, towards systematic co-ordi-tion with a view to greater accessibility of special resources th on the inter-loan basis and for the benefit of the general blic. The American Association of Special Libraries was med in 1909, and has issued a directory. The formation of a rresponding British Association has already been recorded, d a similar directory was begun by this body in 1926.

In Great Britain, during 1910–26 there was a great develop-nt of scientific, technical and commercial libraries and bureaux information. The scientific and research associations, large mmercial and manufacturing firms, and the great industrial oups, awakened to the necessity of having well-organised -to-date collections for the use of their officials. The same vement has developed in America, probably to an even larger ent, though in that country the public library has, until ently, undertaken a larger proportion of this kind of service. great importance in this connection are compilations like the *orld List of Scientific Periodicals*, the *Subject Index of Periodi-s*, both started since 1915.

Mercantile Marine.—Reference may also be made to efforts behalf of sailors in the Mercantile Marine. The British ilors Society has attempted this service for more than a cen-y. Since 1920 it has revived and developed its arrangements der the stimulus of a Carnegie Trust subsidy. The Seafarers' lucation Service (founded 1920), also with the aid of a trust ant, and contributions from the owners and the men's unions, s succeeded in placing substantial libraries of a more advanced nd upon 150 ships. The Carnegie Corporation of New York has nilarly financed the American Merchant Marine Library Asso-tion. In Great Britain a system of supply to lighthouses and htships was initiated by the Carnegie Trust with the aid of public authorities concerned.

Libraries for the Blind, etc.—In Great Britain the needs of the nd have been met by the establishment of the National Library the Blind in London, founded in 1882. The present building s opened in 1916, and a large extension was begun in 1925, total cost being roughly £50,000. Books in Moon or Braille pe are lent freely to public libraries, and individual readers. sectional library for deaf education was set up in the library the University of Manchester in 1920. Hospital collections distributed under the auspices of the Red Cross Society. collection for the use of nurses and health visitors has been up by the College of Nursing (1921). The libraries of most the learned societies were financially embarrassed during and er the World War, but since about 1921 they have been doing eir utmost to make up arrears of book purchase, binding and aloguing. (J. M. M.)

LIBYA (*see* 16.578).—On the occupation of Tripolitania and renaica (Benghazi) by the Italians in 1911–2 Libya (Libia liana) was adopted as the common designation of the two onies. (*See* CYRENAICA; TRIFOLITANIA.)

LICHNOWSKY, KARL MAX, PRINCE (1860–), German lomatist, was born March 8 1860 at Kreuzenort in Upper esia. He entered the German Foreign Office in 1884 and from 4 to 1911 held secretarial posts in different German embassies road. In 1912 he was sent to London as ambassador, and re-ined at that post until the outbreak of the World War. He k part in the negotiations for a convention with Great Britain arding the Baghdad Railway and various colonial questions, ich was initialled on June 12 1914. Lichnowsky was con-ced that for years the relations between Germany and Great Britain had been mismanaged and misunderstood by the Foreign Office in Berlin, and, in particular, he believed that Bethmann Hollweg and his advisers failed to appreciate the pacific attitude and intentions of Sir Edward Grey and the British Govt. during the crisis that ended in the World War. He embodied his views in the pamphlet entitled *Meine Londoner Mission*, which he circulated privately in manuscript among his German friends. This document came into the hands of an opponent of the war, Capt. von Beerfelde, who was the means of its being published, without authorisation, in 1918. The publication exercised a very prejudicial effect upon the German war spirit and there were loud demands among the Conservatives and National Liberals for the prosecution of the author. The Prussian Upper House, of which Lichnowsky was a member, passed a resolution excluding him from that assembly. It became impossible for him to live in Germany, and he sought refuge in Switzerland.

LIEBERMANN, MAX (1847–), German painter, was born in Berlin July 20 1847. He studied from 1869–73 at the school of art in Weimar, from 1873–8 at the Paris Academy under Munkaczy, then for a short time in Barbizon with Millet, in Holland, and finally from 1878–84 at the Munich Academy. In 1898 he was appointed a professor at the university of Berlin. He became the chief exponent of the impressionist school of painting in Germany and the leader of the "secession." Liebermann won the Grand Prix at Paris in 1889 and received gold medals at Venice, Berlin, Vienna, Dresden, Munich and Antwerp. He became president of the Berlin Academy, a member of the Brussels, Dresden, Milan, Munich, Stockholm and Weimar academies and a corresponding member of the Institute of France. His chief pictures are "Jesus among the Scribes" (1879); "Jam Makers" (1879); "Women Plucking Geese" (1894); "Samson and Delilah" (1902); "The Board of Hamburg Professors" (1906); portraits of F. Maunann, Gerhart Hauptmann, Dehmel and Ed. Meyer.

See C. H. Rosenhagen, *Max Liebermann* (1900).

LIEBKNECHT, KARL (1871–1919), German politician, was born in Leipzig Aug. 13 1871. The son of Wilhelm Liebknecht (*see* 16.592), he qualified as a lawyer, and speedily became a prominent member of the extreme Left wing of the Socialist party. After serving a sentence of 18 months' imprisonment for high treason, in 1908 he was elected to the Prussian Chamber of Deputies, and in 1912 entered the Reichstag as a Social Democrat. Not long after the outbreak of the World War he was expelled from the Social Democratic party on account of his violent opposition to the policy of the Government and the successive votes of credit, and formed a faction of his own, *Die Sozialdemokratische Arbeitsgemeinschaft.* Arrested again in 1916 on a charge of high treason he was sentenced to four years' penal servitude; he was reprieved, however, on the eve of the revolution in Oct. 1918. He at once became the leader of the Spartacists, and was largely responsible for that party's insurrection in Jan. 1919. During the rioting he was arrested; and while being conveyed from military headquarters in the west end of Berlin to the prison at Moabit on Jan. 15, he was shot down by his escort while, as was subsequently alleged, he was attempting to escape. His associate, Rosa Luxemburg, perished the same night.

LIÉGE, Belgium (*see* 16.593), with a population in 1921 of 165,096, has been much improved in recent years, and has grown rapidly; it is a clean, prosperous and well-built city, and is the centre of the iron and armament manufacture of Belgium and of a coal-mining district. The production of zinc and of motor-cars has also become important. Of the 56 blast furnaces in the country in 1925 Liége had 20. There is also a large cattle market. Suburbs have arisen on the heights to the north, and a circular boulevard has been laid out with connecting roads. A number of houses near the university were destroyed by bombardment and by fires started after the German entry, and the bridges over the Meuse were blown up by the Belgians in their retreat; but the town as a whole, being an important centre, was spared by the Germans. The Place de l'Université has been renamed Place du 20 Août, in remembrance of the burning of houses and shooting of 18 persons as they escaped from the fires, by the Germans. The Place Verte is now Place du Maréchal Foch. Liége was the first large town captured during the War. The valiant defence of its powerful ring of forts delayed the German advance for a week and caused the enemy heavy losses. A number of the citizens were deported in 1916 during the German occupation. The city has since been granted the Cross of the Legion of Honour, and a representation of the Perron Liégeois, which symbolises the liberty of Liége, has been reproduced on a postage stamp. The forts were repaired by the Krupp company in 1914–5 (*see* BELGIUM, INVASION OF).

LIFE: *see* BIOLOGY.

LIFTS: *see* ELEVATORS AND ESCALATORS.

LIGGETT, HUNTER (1857–), American soldier, was born at Reading, Pa., March 21 1857. He graduated from the U.S. Military Academy in 1879, and saw service in the west against the Indians. In the Spanish-American War in 1898 he served on the staff of the adjutant-general, and later was in the Philippines where, as major of volunteers he served for three years. In 1902 he was appointed a major in the regular army and spent several years with the Dept. of the Lakes and at Fort Leavenworth. In 1909 he attended the War College, and on graduating in 1910 was appointed a director there, and in 1913 president, becoming brigadier-general in the same year. From 1915 to 1917 he was again in the Philippines, being for one year commander of the Department. In 1917 he was made major-general and commander of the Western Dept., but in Sept. went to France as commander of the 41st Div. of the American Expeditionary Force. He was at the second battle of the Marne, at St. Mihiel and in the Argonne commanding the I. Army Corps and later the I. Army, and commanded the III. Army of Occupation on the Rhine. In 1919 he was commander of the Western Div., and in 1920 commander of the IX. Corps Area, retiring March 21 1921.

LIGHTING: *see* ILLUMINATION ENGINEERING.

LIGHTNING: *see* ATMOSPHERIC ELECTRICITY.

LIGHT RAILWAYS, MILITARY.—These are 60 cm. gauge railways laid with steel rails, weighing 20 lb. to the linear yard of rail, on sleepers weighing from 11 to 22½ lb. each, according to the weight of the rolling stock used, and laid 2 ft. 6 in. apart on a ballast track, the ballast consisting of sand, gravel, mine earth or burnt clay.

Rolling Stock.—The rolling stock consists of three types of wagon:
1. Low-sided four-wheeled trucks with capacity of four tons.
2. Flat bogie wagons with carrying capacity of eight tons.
3. Bogie well wagons with carrying capacity of 10 tons. The latter being used almost entirely for transporting heavy ammunition.

Motive Power.—The motive power consists of:
1. Six-wheeled, coupled locomotives weighing up to 14 tons, capacity 60 H.P., and capable of hauling 65 tons up a gradient of 1 in 40.
2. Four-wheel coupled locomotives weighing up to eight tons, capacity 35 H.P., and capable of hauling 40 tons up a gradient of 1 in 40.
3. Petrol tractors weighing up to four tons and capable of hauling a load of 14 tons up a gradient of 1 in 40; these petrol tractors have two gears, the speed on the low gear being about four miles and on the high gear 10 m. per hour.

During the latter part of the World War 1917–8 light railways were very extensively used on the western front for transporting supplies to the smaller supply depôts away from the standard gauge railways, and ammunition to the heavy gun and howitzer positions. During 1917–8, 1,780 m. of light railway were laid but only about half of this was ever used. While the War was stationary light railways were of very great service to the armies, but as soon as a retreat or a continued advance took place they soon became out of action. They are not economical, the maintenance alone during 1917 being on an average 15 men per mile, which, as the lines became consolidated was reduced to five men per mile. The average effective haul of a locomotive was 23 train m. per day, and that of a tractor was 20 train m. per day. The average coal consumption per locomotive was 62 lb. of coal per effective train mile and the average petrol consumption per tractor was ·56 gal. of petrol per effective train mile. The average loaded wagon mile per day per effective w 4·25.

With the advance in Sept. 1918, light railways were of gre assistance in getting forward ammunition and evacuating t wounded. They were joined on to the German 60 cm. railwa which had not been destroyed, but they were soon left behi and the armies relied entirely on the standard gauge railwa and road transport.

Light railways, when worked to their maximum capaci carry, on an average, about 140 tons of supplies per mile of tra per day, according to the grading of the line, and the cost in ma power for operating purposes only, as compared with a standa gauge railway, is as 3·45 to 1 per m., and cost in man power f construction as 2·2 to 4·7.

An extension to light railways, known as "*foreways*," and us for carrying supplies from the end of the light railways up to t trenches, consisted of 60 cm. gauge track laid on an unballast formation; the rails weighing about 9 lb. per linear yard rail on sleepers weighing 8 lb. and spaced 3 ft. apart, centre centre; on these lines, flat-topped, four-wheel trollies we pushed by two men during the night right up to the communic tion trenches. Early on in the War the armies objected to the foreways being laid with steel rails urging that the noise steel wheels grinding on steel rails would attract enemy fi The first of these lines were made of pitch pine rails nailed on wooden sleepers; but the friction between steel wheels and woo en rails was so great that the trollies were continually bei derailed. (D. L.)

LILLE (*see* 16.685), the fifth largest town in France, had population of 200,952 in 1921. About 1,000 houses were d stroyed by German guns in 1914, and during the German occ pation a munition dump on the southeast ramparts blew causing much damage. The old church of St. Margaret w partially and the Hôtel de Ville completely destroyed. Befo their departure the Germans blew up several of the town bridge The Palais des Beaux Arts, from which many works of art we removed in 1914, has been reconstructed. Lille was made t seat of a bishop in 1913. Before the War Lille provided so four-fifths of the French production of cotton and linen fabri and yarn, and both industries were in a flourishing conditio but the War caused immense loss; only one flax spinning m was in a condition to resume work soon after the Armistice, a it is computed that two-thirds of the total number of spindl were lost. Their replacement, however, was practically co pleted by 1924, and the industry gradually recovered, thou handicapped by scarcity of labour and yarn and the high pri of the latter.

The War Period.—Lille was first reached by advance Germa patrols in Aug. 1914. It was afterwards re-occupied by t French, but they retired again early in Oct., the serious defen of the city not being part of the general plan of campaign. Aft several days' bombardment the Germans entered on Oct. 1 1914 and remained till Oct. 1918, when they were outflank by the Allied capture of neighbouring towns. The deportati of a large number of citizens in 1916 was the culminating poi of tyranny suffered by the people of Lille under German rul The city was a favourite resort for German officers on leave, it was not shelled by the Allies, although it was within range the guns.

LIMA, PERU (*see* 16.689).—During the 20 years ending i 1926, and particularly since 1920, the city of Lima has experi enced a series of modernising influences. The population, i cluding that of Callao, was in 1926 estimated at 250,000 and wa slowly rising. Many of the narrow streets radiating from Pla Mayor, the heart of the city, have been paved, and new busine houses have been erected, including one of the finest hotels i South America. Large sums have provided modern sanitation waterworks and sewerage. In the Exposition and other newe parts of Lima, avenues and boulevards radiate from attractive circles and modern parks; there are thousands of ornamenta trees, and many fine residences face these modern streets and boulevards. Seaside resorts at La Punta, Chorrillos,

aflores and Ancon are growing, and electric car lines and
or vehicles link them with Lima.
he educational system has made marked progress under
sed laws. The general increase of Peruvian cotton, sugar,
ep-farming, petroleum, mining and new irrigated areas is the
is of this progress. Revised taxation provides several million
ars annually for highway construction. A motor-car in
5 succeeded in making the trip over the trail from Lima to
quipa. Automobiles can now be operated from Lima to Piura.
nent, cotton and other Lima industries are increasing their
put, while land values in the capital and suburbs have
e than doubled in a decade.

IMAN VON SANDERS, OTTO (1855–), German soldier,
born in Stolp, Prussia, Feb. 17 1855. Entering the German
ny in 1874, he held various posts in the cavalry and in 1913
was sent to Turkey as leader of a German military mission.
appointment as commander of the I. Turkish Army was
ulled on account of Russian protests, but he remained in-
ctor of the Turkish Army. Made a Prussian general in
1914, in Nov. of the same year he was given the chief
mand of the Turkish troops in the Caucasus. In March
5, as commander of the V. Turkish Army, he successfully
osed the British and French attacks on the Dardanelles and
peninsula of Gallipoli. In 1918 Von Sanders succeeded Von
Goltz as leader of the Turkish forces in the Middle East,
was thus in command in Syria and Palestine when General
nby was victorious there. Von Sanders escaped capture,
after the Armistice he gave himself up to the Allies and was
rned until Aug. 1919. He gave an account of his experiences
Turkey in *Fünf Jahre Turkei* (1920).

INDAU, PAUL (1839–1919), German dramatist and novelist
16.717), published in 1909 a collection of short stories *Der*
ld des Tages. A volume of memoirs, under the title *Nur*
nnerungen, appeared in 1917. He died in Berlin Jan. 31 1919.
elder brother, RUDOLPH LINDAU, died in 1910.

INDENTHAL, GUSTAV (1850–), American engineer,
born at Brünn, Austria, May 21 1850, and was educated
re, and at Vienna. Having been engaged in railway and
lge work in Austria and Switzerland, he went to the United
tes in 1871. He was engineer at the Centennial Exposition,
ladelphia, from 1874 to 1877, after which date he practised
Pittsburgh as consulting engineer in railway and bridge con-
ction till 1890, when he moved to New York City. He was
nmissioner of bridges for the City of New York, 1902–3. He
gned and acted as consulting engineer for the steel arch
lge spanning the East river at Hell Gate. This bridge, known
Hell Gate Bridge, was commenced Nov. 1914, and opened
traffic March 1917. With its approaches, it is about $3\frac{1}{2}$ m.
ength, and contains the longest steel arch in the world (1,017
). Its cost was approximately $18,500,000.

INDLEY, NATHANIEL LINDLEY, BARON (1828–1921),
lish judge (*see* 16.719), died at Norwich Dec. 9 1921.

INDSAY, NICHOLAS VACHEL (1879–), American
er, was born at Springfield, Ill., Nov. 10 1879. In 1897 he
ered Hiram College, O., but left after three years to study
in Chicago and New York. For several winters he was a
I.C.A. lecturer, and during 1909–10 lectured for the Anti-
on League in his native state. Meanwhile he had begun
ng the summers a series of wanderings on foot which carried
through many states, reciting or singing his own verses like
ncient minstrel and delivering an occasional lecture, receiv-
in return food and lodging. In 1920 he visited England,
re he gave recitals. Many of his poems have the true ballad
, and are very popular.

s works include *General William Booth Enters Into Heaven, and*
Poems (1913); *The Congo, and Other Poems* (1914); *Adventures*
e Preaching the Gospel of Beauty (1914, prose); *The Art of the*
ing Picture (1915, prose); *A Handy Guide for Beggars* (1916,
e); *The Chinese Nightingale, and Other Poems* (1917); *The Golden*
of Springfield (1920, prose); *The Golden Whales of California,*
Other Rhymes in the American Language (1920); *Going-to-the-Sun*
3); and *Going-to-the-Stars* (1926), the two latter being illus-
d by the author.

LINDSAY, NORMAN (1879–), Australian artist, was born at Creswick, Victoria, Feb. 23 1879. He began to draw for a Melbourne newspaper at 16, and in 1901 moved to New South Wales where he afterwards lived. He joined the staff of the Sydney *Bulletin*, and became its chief cartoonist, a post which he retained for many years. His chief characteristics as a cartoonist are imaginative power, grim strength, marked individuality of style and a certain coarseness. All of these qualities are apparent in his illustrations to Theocritus, Boccaccio, Casanova and Petronius, the best of which have been collected in *The Pen Drawings of Norman Lindsay* (1918). As an etcher he shows extraordinary facility in the treatment of flesh and massed figures; and he also achieved distinction as a painter in oils and water colours, a lithographer, an engraver and a maker of model ships. In 1925 an exhibition of his paintings was held at the Leicester Galleries, London.

LINDSEY, BENJAMIN BARR (1869–), American judge, was born at Jackson, Tenn., Nov. 25 1869. He was educated in the public schools and attended Notre Dame (Indiana) University and the Southwestern Baptist University, Jackson, Tennessee. At the age of 16 he began to earn his livelihood in Denver, continuing his studies in a law office. He was admitted to the Colorado bar in 1894. In Jan. 1899 he was appointed Public Guardian and Administrator of Denver. He was instrumental in securing the passage of The Colorado Juvenile Court Law of April 12 1899, which gradually changed the whole system of dealing with juvenile offenders in Denver, the change including the establishment of a Juvenile Court conducted solely in the interest of children. He was appointed judge of that court in Dec. 1900, to which he has since been elected for ten consecutive terms. Because of his championship of Juvenile Courts, he earned for himself the name of "the Father of the Juvenile Court." He was also the author of the first parental laws in the United States making the Juvenile Court a Parental and Family Court as well, and also of the "Chancery Court Procedure" in dealing with adult offenders. He wrote *Problems of the Children* (1903); *The Beast* (with Harvey O'Higgins) (1910); *Children in Bondage* (with George Creel) (1914); *Pan-Germanism in America* (1919); *The Doughboy's Religion* (with Harvey O'Higgins) (1920); *The Revolt of Modern Youth* (with Wainwright Evans) (1925); *Childhood, Crime and the Movies* (1926) and a large number of brochures dealing with problems of juvenile delinquency, domestic relations and crime. (*See* CHILDREN'S COURTS.)

LINSEED: *see* OILS AND FATS.

LIQUID AIR.—An intensely cold, blue, somewhat magnetic liquid having a density nearly equal to that of water is obtained by subjecting compressed air to the action of intense cold. At atmospheric pressure, air liquefies at a temperature of −191·4° Centigrade. The properties of bodies plunged into it are greatly altered; *e.g.*, flowers and other delicate objects become exceedingly brittle and lead becomes hard, elastic and sonorous.

Cailletet Process.—Many unsuccessful attempts to liquefy air were made before M. Louis Cailletet, of Châtillon-sur-Seine, announced to the French Academy, in Dec. 1877, that he had liquefied air by a process in which cooled, compressed air, previously freed from carbon dioxide and moisture, was caused to issue from a nozzle into a receiver so as to expand suddenly; the receiver was made of glass and liquefaction was apparent from the formation of a mist.

Pictet Process.—At the same time, M. Raoul Pictet, of Geneva, working independently, made known his success, achieved by using a cascade or successive temperature-fall process. He obtained a temperature of about −65° C. by the expansion of sulphur dioxide around an arrangement of tubes in which carbon dioxide was being liquefied and then using the resulting liquid to obtain a temperature of about −130° C. around a tube conveying compressed air to a nozzle whence the air issued.

Other Processes.—By both these processes, liquid air was obtained but only to evaporate almost as soon as it was formed. The next achievement was the production of liquid air in quantities large enough to be collected. The importance of using a temperature as low as possible to effect liquefaction was more fully appreciated and MM. Olszewski and Wroblewski of Cracow used ethylene instead of carbon dioxide in their cascade process and obtained a temperature low enough to effect liquefaction without final expansion of the compressed air. Another cascade process, carried out at the Cryogenic Laboratory of Leyden, under the direction of Prof. Kamerlingh-Onnes, made use of a temperature of −150° C., obtained by using methyl chloride and ethylene. During a long period of experiments, Prof. Dewar made large quantities of liquid air; he usually obtained the successive falls in temperature by means of liquid carbon dioxide and ethylene.

The cascade processes were complicated and too costly for commercial use and were abandoned in favour of improved expansion methods. As early as 1857, Mr. C. W. Siemens obtained provisional protection for an invention for obtaining very low temperatures by causing cooled compressed air to expand in an engine; the cold air thus produced was used to cool the compressed air on its way to the engine, a cold intensifying effect being thus obtained. No complete patent specification was filed and nothing further seems to have been done by the inventor. An apparatus of this type was patented, however, by M. Ernest Solvey of Brussels (British specification No. 13466 of 1885). It comprised an annular chamber in which compressed air expanded while doing work on a piston fitted in an extension of the outer wall of the annular chamber; this chamber was protected by a jacket packed with a thick layer of non-conducting material. It was assumed that, by the cold-intensifying effect obtained, as in Siemens' apparatus, liquefaction of the air would be effected. In practice, however, this did not take place. The difficulties of lubricating and working the engine and the inefficiency of the jacket prevented attaining a temperature below about −95° C.

Linde Process.—A process depending on reduction of temperature during expansion, but not employing an expansion engine was invented by Prof. Carl Linde, of Munich. The apparatus, described in British Specification No. 12528 of 1895, comprises an air compressor communicating with a cooling coil through which the compressed air passes on its way to a reversed-flow heat interchanger, having two tubes of different diameters and about 300 ft. long; one tube is inserted in the other so as to leave an annular space between them and then both are coiled helically. The convolutions are separated from one another and from the outer casing by raw sheep's wool. Cooled, compressed air passes through the inner coil and issues past a regulating valve into an expansion vessel, whence it flows back, through the annular space between the coils, to the compressor. This cycle of operations is repeated until the cold-intensifying effect of the interchanger becomes so great that some of the compressed air is liquefied, as it passes the regulating valve, and collects in the expansion vessel.

Hampson Process.—In his Patent Specification No. 10165 of 1895 Mr. W. Hampson describes an apparatus in which compressed air is passed through a long pipe and expanded to a lower pressure to return in its expanded state over the pipe in such a way as to intensify the cooling produced by the expansion.

Claude Process.—An ingenious process, invented by M. Georges Claude of Paris, employs an expansion engine working in association with a reversed-flow heat interchanger and a liquefying chamber. Pure, cold air at a pressure of about 40 atmospheres passes through the central pipe of the interchanger, and the greater part of this air is led to the expansion engine and expands therein to a pressure of about four atmospheres, while doing external work. The air leaves the engine at a temperature not substantially lower than −140° C., the critical point for air, enters the lower part of the liquefying chamber, circulates around a series of vertical tubes therein and is led away through the outer annular space in the heat interchanger. The smaller part of the pure, cooled, compressed air passes into the upper part of the liquefying chamber, flows through its tubes and is cooled and liquefied, the liquid air falling into the lower part of the chamber, whence it is withdrawn. By this means, the compressed air is not allowed to liquefy in the expansion engine, which can be worked satisfactorily, lubrication being effected, when necessary, by means of petroleum ether. In a modification, compound expansion is employed, an additional expansion cylinder with its corresponding liquefying chamber being provided. According to M. Claude (*Comptes Rendus*, vol. 142, p. 1335), the output of liquid air may be as much 0·66 litre per horse-power hour in the single expansion and c in the compound process.

Manufacture of Oxygen.—The most important use of liq air is in the manufacture of large quantities of commercia pure oxygen. Prof. Linde, in his British Patent Specificat No. 12528 of 1895, describes a process and apparatus, work in association with his liquefying apparatus, for obtaining oxy from the liquid air by fractional evaporation, the nitrogen be driven off first, since its boiling-point is about −194° C. wh that of oxygen is −182·5° C., at atmospheric pressure. T products were substantially pure oxygen and nitrogen mi with a rather large quantity of oxygen. The purer the oxy obtained the less was the yield. To remedy this disadvanta Prof. Linde, in a later improvement, treated the liquid air i rectifying column and completed the process of separating oxygen and nitrogen by a fractional evaporation.

Other Gases.—Since the introduction of Linde's process obtaining oxygen, numerous inventions have been patented obtaining oxygen, nitrogen, argon, helium, neon, xenon a krypton from the air. In the processes of M. Claude and Société l'Air Liquide, the air is not liquefied as a whole but such a way that it yields two liquid portions, one rich in oxyg and the other very rich in nitrogen; each of these liquid portio is rectified so as to obtain oxygen and nitrogen of a high deg of purity. For further information the reader is referred to t reports on the cross-action in the Chancery Division and t Court of Appeal between British Liquid Air Co., Ltd. and Br ish Oxygen Co., Ltd. (*Reports of Patent Cases*, 1908, pp. 218– 577–614).

Liquid air is applicable for cooling objects which are requi to be hooped and for fitting metal tubes into a tube plate havi holes too small to receive the tubes. The use of liquid air a motive fluid has been often proposed. An early use of liquid was in the preparation of explosives, some of which were us during the construction of the Simplon Tunnel. Liquid air h also been used in mine rescue apparatus.

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LIQUOR CONTROL (*see* 16.759).—In this article it is propos to give the outlines of restrictive legislation in respect to liqu except as regards prohibition in the United States, which treated under PROHIBITION. *See* also BOOTLEGGING.

I. IN GREAT BRITAIN

In 1913 the Act was passed granting, *inter alia*, local opti to Scotland. The Act provided that one-tenth of the electors the area concerned could demand a poll to decide on the con tions of sale of intoxicating liquor. If 55% of the poll and 35 of the electors voted for no-licence the resolution to that effe would be carried: for a limitation of licences a bare majority the poll and the votes of 35% of the electors would be sufficie The third alternative to be put before the electors in each ca was a resolution for no change. The local option sections of t Act did not come into operation until 1920; the result of a p thereunder is binding in the area concerned for three years, a no further poll can be taken during that time.

Defence of the Realm Regulations.—The outbreak of the E ropean War, in 1914, at once raised the question of the necessi of some form of liquor control alike in the interests of efficien in the fighting forces and amongst civilians engaged in munitio works and other vital industries, and of economy in the provisi of essential supplies. The Defence of the Realm Act 1914 a thorized the creation by Orders in Council of new authorities t provide for the safety of the Realm, and the delegation to suc new or to existing authorities of power to issue regulations fo the same purpose.

Under this Act regulations were immediately passed en powering competent naval and military authorities to contr the opening of licensed houses in the neighbourhood of defende

ours. and forbidding the sale or supply of intoxicating
or to members of H.M. forces on duty or with intent to in-
acitate them for duty. By further regulations in subsequent
rs the same authorities were to close down or regulate the
ning of licensed houses and to prohibit trading within the
under their control, and received further special powers
r dockyards. In 1916 a general order was made under the
prohibiting the supply of intoxicating liquor to members of
fighting forces on duty or in hospital. When the food short-
became acute, the Food Controller imposed stringent re-
tions on output in 1917–8.

iquor Control Board.—The Liquor Control Board was created
une 1915, as the authority empowered under the Defence of
Realm Act (No. 3) 1915 to issue regulations under the 1914
to control the liquor trade in any district to which such
trol should be applied by Order in Council. The board was
ed with wide discretionary powers including those of closing
n licensed premises and clubs, regulating the hours of open-
irrespective of the provisions of the Licensing laws, prohibi-
of the sale of specific liquors and of treating, and generally
egulating the supply and sale of intoxicating liquor. The
trol by the board was first applied to the Lowlands of Scot-
l and the more important shipbuilding and industrial centres
England, but it was subsequently extended until, by the
dle of 1918, it had been applied to 29 areas covering in all
e-quarters of England, Scotland and Wales.

these areas the Board reduced the permitted hours of sale of
intoxicating liquors on week-days, which before the War had
ged from $19\frac{1}{2}$ hours in London to 11 hours in Scotland, to a general
imum of $5\frac{1}{2}$ hours for consumption on licensed premises and $4\frac{1}{2}$
rs for off-sales, with a further reduction on Sundays of half an
r in each category. In the case of spirits the off-sale was further
ailed to $2\frac{1}{2}$ hours 5 days in the week, and was prohibited alto-
er on Saturday and Sunday. In certain areas in the North and
t of Scotland the sale of spirits was, at the instance of the
iralty, prohibited absolutely and this prohibition remained in
e until 1919. The Board further introduced compulsory dilution
pirits: spirits which before the War were retailed at 25° below
f (or 35·91 % pure alcohol) were obliged to be diluted to 30°
w proof (or 33·37 % pure alcohol), and were permitted to be sold
0° below proof (or 23·49 % pure alcohol). Further regulations
e made forbidding treating and extending existing provisions
inst credit sales of intoxicating liquor in licensed houses and clubs,
making illegal the common practice in the trade of giving an
ssive measure to customers known as the "long pull."

reviously to the special powers given to the Liquor Control
rd, extended powers had been given to the licensing justices
the Intoxicating Liquor (Temporary Restriction) Act 1914,
in view of the wider powers exercised by the Board these are
parativeIy unimportant. Many of the Board's regulations
tinued in force after the termination of hostilities in 1918,
the Board was not finally abolished until the passing of the
ensing Act of 1921.

icensing Act 1921.—That Act, which applied to both Eng-
and Scotland, adopted and made permanent some of the
lations which the Board had instituted, notably the prohi-
on of the "long pull" and of credit sales in the case of "on"
sumption. The Act fixed the permitted hours of sale at 9
rs in London and 8 hours elsewhere, between 9 A.M. and 11
in London, or 10 P.M. elsewhere, and made them applicable
only to licensed premises, but also to registered clubs which
re the War had been free from such restrictions. The times
pening of licensed premises within the fixed limits were left
he discretion of the local licensing authorities, and in clubs
he option of the members, the hours so fixed to be included
he rules. The Act also encouraged dilution by permitting all
its to be sold without special notice at 35° below proof, in-
d of the standard of 25° below proof required before the War
all spirits except gin. On the other hand beer of an original
ity not exceeding 1·016° and containing not more than 2%
roof spirit was by the Act not to be treated as intoxicating
or, and no excise duty was required for its sale.

ale to Young Persons.—In 1923 a bill was introduced in the
se of Commons by a private member, Lady Astor, and be-
e law, prohibiting the sale of intoxicating liquor to young persons under 18 for consumption on licensed premises, with a slight modification allowing certain non-spirituous alcoholic drinks to be served with a meal in the case of young persons over 16.

The Carlisle Experiment.—An important experiment of the Liquor Control Board, which has remained as a permanent institution, was the introduction in 1916 of a system of state purchase and state supply of intoxicating liquor in certain areas. It was first tried in the Carlisle area to combat drunkenness amongst the many thousands of munition workers drafted into the district for the new factories around Gretna. In view of the differences in English and Scottish licensing law, Gretna and Carlisle were made into separate districts for administration, and a third district was subsequently created when the experiment was extended to the area of Cromarty Firth including Dingwall and Invergordon. The working of the system was in the hands of the Board with the assistance of local advisory committees. On the final abolition of the Board its functions were taken over by the Home Office and the Scottish Office respectively.

The system was to purchase all breweries and licensed premises in the districts for agreed sums by way of compensation. Some of the breweries so purchased were closed down, the number in the Carlisle district alone being reduced from five to three, with considerable saving in working expenses in all cases, and the number of licences was cut down by nearly one-half. In addition all grocers' licences were suppressed, and facilities for "off"-sales reduced by about 80%. Many of the licensed premises retained were renovated, and where possible considerable structural improvements were made to allow for the provision of cheap and good meals; and disinterested management was completed by the appointment of salaried publicans who received commissions only on the sale of food and non-alcoholic beverages, and did not have to consider the interests of shareholders or of brewers or of competitors. Under this system no liquor advertisements are displayed on licensed premises, and no money is spent in advertising intoxicants either in newspapers or on hoardings. Further no money made out of the sale of intoxicants can be subscribed by the department which is responsible for providing drink to any political organisation or to any anti-temperance propagandist body.

II. MEASURES IN OTHER EUROPEAN COUNTRIES

Denmark.—A comprehensive licensing law came into force in Denmark on Jan. 1 1913. The new law had for its object the effective regulation and control by the municipal and communal authorities of all places of entertainment where meals, lodgings, refreshment, etc., are provided. A distinction in the regulations was made, as in other Scandinavian countries, between urban and rural districts.

The new law established "off" and "on" licences for the sale of "strong drinks" which included spirits, wines and all beers which contained $2\frac{1}{4}$ % or more alcohol. Special licensing boards were constituted in each municipality, to whose discretion the allocation of licences was absolutely entrusted. The licences which might be issued by the licensing boards were to be for life or a fixed term of years, and all licensed premises were to be closed for at least five hours between 11 P.M. and 8 A.M. The age limit below which it was forbidden to supply young persons with strong drinks was to be fixed by local police regulation. In no case was the limit to be lower than 16, and only in four towns is it as low. Stringent penalties were enacted for violation of the Licencing Law, including heavy fines, imprisonment and forfeiture of the licence.

During the War, the distillation of spirits from home-grown wheat or rye was prohibited, though not from potatoes. An important law which came into operation in 1925 fixes the number of licensed premises in existence on Jan. 1 1924 as the maximum. New licences are subject to a form of local option, and the local authorities are empowered to restrict the issue of a new licence to a public utility company on the Gothenburg principle.

Iceland.—From 1912 there has been complete prohibition of the import or manufacture of liquor containing more than $2\frac{1}{4}$% of alcohol with limited exceptions for medical and industrial use. A slight relaxation has, however, since been made, under pressure from Spain, to permit the importation of Spanish wines.

Sweden.—An important piece of liquor legislation was the law of 1917 which made the "Bratt System" universal throughout Sweden. This system of liquor control, which came into force throughout Sweden on Jan. 1 1919, was a striking development, on the basis of the "Gothenburg System" of disinterested management through controlling Companies, or "Bolags." The "Gothenburg System" had been confined to the control of the retail sale and distribution of the national spirit or "brännin." The sale of wine, beer and imported spirits had been outside its monopoly.

The effect of the new law was to bring the retail liquor trade—the trade in ordinary beer excepted—under the control of the System companies. All intoxicating liquors of an alcoholic strength greater than 3·6% were thus affected. The beer manufactured and sold in Sweden is below that strength.

The transfer of "off" spirit licences was abolished; the import of spirits, wines and beers was only permitted through the agency of the "Bolags"; and the maximum amount of spirits purchasable by each citizen was limited to 4 litres *per mensem*. A new age limit was fixed, and persons under 21 and sometimes 25 were not allowed the right to purchase distilled liquor. Convicted drunkards were also debarred from purchasing intoxicants.

The private trader, however, still retained his interest in the wholesale liquor trade. The organisation of the wholesale trade under the System Companies was brought about through an enterprise founded by Dr. Bratt and his associates in 1917, called "Spritcentralen," which, by an enactment in 1923, obtained from the Government the right to the exclusive wholesale sale of liquors other than beer until 1928. The system worked by the "Bolags" is one of personal control, in which the "motbok" or pass-book, plays a large part. The "motbok," in effect, is a ration book with coupons entitling the holder to purchase his prescribed quantity of liquor in each month, and no more.

Norway.—A system of disinterested management has also been in force in Norway for a considerable period. The "Samlag" in Norway takes the place of the "Bolag" in Sweden, though its powers are more limited. The "Samlags" control the sale of "Braendevin," the national Norwegian spirit, whilst beer and wine, except in rare instances are still in the hands of private traders.

The Norwegian system, based on the Acts of 1871 and 1894, left two options open to each community at the periodical poll:

1. The "Samlag" system for the retail sale of spirits, or
2. Prohibition of all retail sale of spirits.

The results of the 1913 polling showed a definite voting down of existing "Samlags": out of 26 towns polling, the "Samlag" was voted down in 15.

But, outside the "Samlags," the sale of spirits is conducted by means of "privileged" (*i.e.*, life interest) licences, wholesale rights and special "off" and "on" licences issued by magistrates and town councils.

During the war period Norway imposed far-reaching restrictions, leading up to the total prohibition of the sale of spirits, both "on" and "off." The continuance of prohibition was endorsed at a national poll in 1919.

III. TEMPORARY WAR REGULATIONS

Liquor legislation in other European countries, since 1911, has mainly been concerned with the imposition of special restrictions during the War period, and the subsequent modification of those restrictions.

France.—In France, for instance, the need for some control of the liquor traffic was recognised soon after the outbreak of the War, and one of the first War-time restrictions was the absolute prohibition of the sale of absinthe in Feb. 1915.

The opening of new establishments for the sale of spirits and other liquors (except those having a wine basis) was also forbidden. In 1915, the "off" sale of alcohol was forbidden before 12 noon, and the "on" sale of spirits to women and children was absolutely prohibited. The sale of wine, beers and cider was, however, left untouched. The War regulations have since disappeared.

Switzerland.—On the outbreak of War the Swiss Government prohibited the use of potatoes for the manufacture of spirits, and rationed the sale of spirits by the state monopoly.

Italy.—In 1913 Italy prohibited the importation and manufacture of absinthe and enacted a law requiring special permits for the sale of spirits and liqueurs.

Germany.—In Germany the sale of alcohol was forbidden in the towns during the early mobilisation period; and restrictions were placed on the quantity of malt used in German breweries. Subsequently, in 1915, further restrictions were imposed:

1. The manufacture of spirits for beverages from potatoes an grain was prohibited.
2. The manufacture of beer was restricted by 40 per cent.
3. The sale of intoxicants in mobilisation centres was forbidde
4. In Berlin the sale of spirituous liquors in restaurants was fo bidden between 9 P.M. and 9 A.M.

Austria-Hungary.—Similar restrictions on the manufacture spirits from potatoes and grain were imposed in Austria-Hungar during the continuance of the war emergency period.

Russia.—In Russia, the fact that a Government monopoly of th vodka trade had been established in 1894; enabled the Tsar to esta lish its total prohibition on the outbreak of the War. This state things continued under the Soviet *régime* until 1921, when the sal of wine in limited quantities was authorised, whilst the sale of bee was permitted without limitation.

In 1924, by a decree of the Soviet Executive Council, the sale vodka was permitted once more. The sales are restricted by a car system of control, under which each adult citizen is entitled to pu chase one bottle of vodka every 14 days through the agencies of th state spirit monopoly.

Finland.—The prohibition of vodka throughout the war perio applied also to Finland and to Estonia. The prohibition of be over 2¼%, of wine, spirits and stronger beverages was enacted i Finland in 1919, and is still in force.

Estonia.—In Estonia, however, legislation was passed in 192 for the repeal of prohibition and for the substitution of a "Check system for the controlled sale of alcohol, somewhat on the Swedis model.

Belgium.—On the outbreak of War in 1914 the Government too prohibitive measures against the sale of spirits which continued i force during the German occupation. In Aug. 1919 an Act wa passed prohibiting the sale and supply of spirits for consumption the premises in any place of public resort, including hotels, resta rants and workshops. The "off-sale" of spirits was authorised pr vided that at least two litres were sold at a time to each purchase This Act was a modification of a scheme of total prohibition whi had been promulgated by decree only when the Government had i seat at Havre in Nov. 1918.

In Poland in 1921 a law was passed introducing the local opti principle. In 1924 a Government monopoly of the liquor trade wa established under which the Government assumed the entire contr of the manufacture and sale of all spirits.

Latvia and Lithuania have adopted laws regulating hours and co ditions for the retail sale of alcohol.

For the supply of intoxicating liquor in mandated territories, *se* MANDATES.

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IV. THE UNITED STATES AND CANADA

The article on Liquor Laws in the United States (*see* 16.76 reviews legislation prior to 1910 in its historical developme and under the four chief types of state and local legislati control: (*a*) the licence system, (*b*) state prohibition, (*c*) loc option, a combination of licence and prohibition, and (*d*) publi dispensaries. It also covers Federal regulation of the liqu traffic: (*a*) in inter-state commerce, (*b*) in Federal territor such as the District of Columbia, military and naval st tions, Indian reservations, and in certain particulars in th insular possessions, and (*c*) the revenue laws where regulatio is frequently a dominant motive in tax policy. Since 1910 the have been hundreds of state laws, local ordinances and Federa laws, not directly related to the adoption of national prohibitio (*q.v.*) as well as many important decisions of Federal and Stat Courts. This further illustrates the great diversity of procedu and methods and the wide range of legislative experiment i dealing with the liquor traffic and its attendant evils, whic probably has no equal in any other country in the world or i any other period of history. It also reflects the very grea difficulties encountered in the enforcement of such legislatio and in correcting unforeseen evils arising as by-products o regulatory measures. A fairly complete and accurate descriptiv list of these measures will be found under "Chronology" in th Year Books of the Anti-Saloon League (pub. Westerville, O. especially the Year Book for 1919.

The 18th Amendment.—War-time prohibition became effectiv on July 1 1919, and the Prohibition (18th) Amendment t the Constitution was ratified Jan. 16 1919, effective Jan. 16 1920, d the combined War-time Prohibition Enforcement Code and e Constitutional Prohibition Enforcement Code, known as the National Prohibition Act” and, popularly, as the Volstead law, as adopted Oct. 28 1919, in part effective immediately and in rt relating to constitutional prohibition effective Jan. 16 20 (*see* PROHIBITION).

As far as state and local measures (1910–9) are concerned ere were no new devices for regulation, and nothing to show y serious departure from the types of regulation referred to ove, and discussed in the previous article. There was a notice- le trend away from the public dispensary and the many oposals to eliminate private profits from the industry or the ade, such as those involved in the Gothenburg system, which is widely discussed, and licensing non-profit trading companies. ere was also a marked and increasing trend in all sections of e country toward the extension of dry territory, the protec- n of dry areas under local option, and the extension of state- de prohibition.

State Prohibition in 1910.—In 1910 state prohibition was in ce in nine states. Large areas of local territory in other ates were dry under local option. It was difficult to protect is dry territory from violation through illicit trade aided and omoted by adjacent wet areas. Texas in 1910 passed a law aking the sale of liquors in no-licence territory a felony punish- le by from three to five years' imprisonment. All the prohibi- n states had tried in various ways to check the flow of liquor otected in inter-state commerce over which the Federal thority had exclusive jurisdiction and with which no state d any constitutional right to interfere. Congress had sought aid in this effort in the Wilson Act in 1890 to divest in- xicating liquors of their inter-state character by providing at “Liquors transported into a state . . . shall . . . on arrival in such state . . . be subject to the operation d effect of the laws of such state enacted in the exercise of its lice powers, to the same extent . . . as though such . . . uors had been produced in such state.”

Although the Wilson Act presented grave constitutional ficulties it was sustained by the Supreme Court in *In re hrer* in 1898 (140 U.S. 545) but the rule of the decision in- rpreted the phrase “upon arrival in such state” to mean at state control and regulation operated only “after the ship- ent had reached its point of destination and had actually been livered to the consignee.” This was not sufficient to stop e flow of liquor from wet areas outside the state. A Mis- uri statute imposing an inspection fee on all liquors shipped m other states into Missouri and offered for sale was upheld 1905 (190 U.S. 17) as an exercise of the police power of the te within the meaning of the Wilson Act, and the chief aim the Act was undoubtedly to increase the state's control over er-state shipments. The Iowa Legislature had in the pre- us year 1904 passed a resolution asking Congress to amend e inter-state shipment law to prevent the shipment of liquors m one state to the dry territory of another.

In the meantime the Supreme Court in *Delameter v. So. kota* (205 U.S. 93), decided March 11 1907, upheld a South kota statute imposing an annual licence charge upon the siness of soliciting orders for intoxicating liquors and its plication when orders were to be filled from liquors at the ne without the state. This was another method of checking er-state traffic from wet areas to dry and of enforcing state ulation or prohibition. Still another effort was made in the ne direction and this time with the direct assistance of Con- ss in the Act to codify, revise and amend the penal laws of United States approved March 4 1909. Section 238 forbade transportation company or its agents to deliver intoxicat- liquors in inter-state or foreign commerce to any fictitious son or to any other person than the consignee, unless up- written order of the bona-fide consignee, and Sec. 239 forbade collection by the transportation company or its agents of the chase price or in any manner acting as the agent of the buyer seller of such liquor, and Sec. 240 forbade the shipment in er-state or foreign commerce of any package containing intoxicating liquors unless “such package be so labelled on the outside cover as to plainly show the name of the consignee, the nature of its contents and the quantity contained therein.” Each of these sections provided heavy penalties for their violation.

The Webb-Kenyon Law.—With the passage of the Webb-Kenyon law, March 1 1913, Congress and the Federal Government took the first aggressive step in aiding effective state prohibition. The title of the Act, “An Act divesting intoxicating liquors of their intra-state character in certain cases,” indicates its broader scope and purposes as compared with the earlier Wilson Act which merely removed the bar of the Original Package decision (1890) to effective enforcement by holding that a state prohibitory law was inapplicable to sales of liquor in the original packages in which they were received from other states (*Leisy v. Harden*, 135 U.S. 100). The Webb-Kenyon Act removed another bar, namely, the Federal protection of inter-state commerce, from the exercise of a state's conceded powers over inter-state when applied to such inter-state commerce as Congress, in the exercise of its exclusive powers over inter-state commerce, has interdicted or from which it has removed the protection of inter-state commerce. Congress in this Act forbids the transportation of intoxicating liquors into a state by any persons interested therein “to be received, possessed, sold, or in any manner used, either in the original package or otherwise, in violation of any law of such state.” The Act presented grave constitutional difficulties, which led President Taft to veto it on purely constitutional grounds, and in this judgment he was supported by his able attorney-general, Mr. George W. Wickersham, and the ablest lawyers in the Senate. Nevertheless, Congress passed the Act over the veto of the President, and the Supreme Court sustained its view in the Clark Distilling Co. v. Western Maryland Railway Co., and Clark Distilling Co. v. American Express Co. and the State of West Virginia cases (242 U.S. 311) decided Jan. 8 1917.

Effects of Webb-Kenyon Law.—The immediate effect of the Webb-Kenyon law was to stimulate state prohibition. The year 1914 saw state constitutional prohibition amendments adopted by popular vote and substantial majorities in Arizona, Colorado and Washington, and rejected by substantial majorities in California and Ohio. A state-wide prohibition law in Oregon was adopted by a popular vote of 136,842 for, to 100,362 against, and in Virginia by a majority of 30,365 out of a total of 150,000 votes. A considerable extension of dry territory was secured under local option votes in many other states. That this rising tide of prohibition was not confined to the states is seen in the adoption for the first time in 1914 in either House of Congress of a resolution submitting a prohibitory amendment to the Federal Constitution. The Hobson resolution passed the House of Representatives Dec. 22 by a vote of 193 to 189, but did not receive the two-thirds majority required. In 1915 Alabama re-enacted a prohibitory law which was adopted in 1907 and repealed in 1911, and Idaho, Iowa, Arkansas and South Carolina adopted state-wide prohibitory laws, Idaho, in addition, submitting to the people of the state a constitutional amendment, which was adopted in 1916 to become effective Jan. 1 1917.

The year 1916 also witnessed constitutional state prohibition adopted in Michigan, Montana, Nebraska and South Dakota. In 1917 Congressional action again moved forward. The resolution for the prohibition amendment to the Federal Constitution received the necessary two-thirds majority in both Houses, and the amendment was submitted to the states for ratification. Congressional enactments also prescribed prohibition for the District of Columbia and for the territory of Alaska. A referendum on prohibition was provided for the I. of Porto Rico, which voted in July 1917 to adopt it by 99,775 for, to 61,295 against. Early in 1917 Congress enacted the anti-liquor advertising law with the so-called Reed “bone-dry” amendment, the whole being an amendment to the Post Office Appropriation Act. This was a drastic prohibition of the use of the mails for advertising, or soliciting orders for liquor in “dry” territory, and was, therefore, a further application of the principle of the Webb-Kenyon Act.

Among the states in 1917 Indiana, New Hampshire and Utah adopted state-wide prohibition statutes, and New Mexico a prohibition constitutional amendment. This made in all 25 of the 48 states, and, in addition the District of Columbia, Alaska and Porto Rico, which had adopted statutory state-wide or constitutional prohibition before the Federal Amendment was submitted for ratification; and in 1918, while ratification was proceeding, Florida, Nevada, Ohio, Texas and Wyoming adopted state-wide prohibition statutes. Utah adopted a prohibitory amendment to the state Constitution. Congress enacted a prohibition statute for Hawaii, and passed the War Prohibition Act as an amendment to the agricultural appropriation bill. A constitutional prohibitory amendment received a majority of 15,932 votes in Minnesota, but failed by 756 votes to receive the majority required by the state election law. A constitutional state prohibition amendment was defeated in Missouri by 300,354 votes against, to 227,501 for; and also in California. Other state measures extended dry territory, and in several states state constitutional amendments were submitted to be voted on in 1919. The war prohibition Federal legislation is noted under *After Ratification-Provisions for Enforcement* in the discussion of prohibition (*q.v.*).

State Action Since 1919.—From Jan. 10 1919, the date when the Federal Constitutional Amendment received the necessary ratification by two-thirds of the states, to 1926 state legislation in relation to prohibition, chiefly consisted in state enforcement measures of great variety based on the concurrent powers provided for in the amendment although in some states, a state constitutional amendment or state-wide prohibition statutes, previously adopted went into effect by their terms after Jan 1 1919. In all to date (1926), 47 of the 48 states (Maryland alone excepted) have adopted state codes or measures to enforce national prohibition. New York alone has repealed such a statute; and no other state has weakened its enforcement legislation by subsequent amendments, and several have repeatedly tried to strengthen their enforcement legislation.

THE LAWS IN CANADA

Liquor laws in Canada have followed closely in structure and in the forces determining their modification and enforcement those of the United States. They have not gone as far as to adopt national prohibition except for a brief period during the War, by Order-in-Council, March 11 1918, in force from April 1 1918 until Dec. 31 1919. Since 1910 local option with respect to licence extending to complete provincial prohibition of sale has been permissible under a Federal law, the Canada Temperance Act (1875). But under the British North America Act, which serves as the Constitution of the Dominion, only the Federal authority can prohibit the manufacture, importation, exportation and transportation of liquors for beverage purposes. On May 18 1916 a Federal Act "in aid of Provincial Legislation prohibiting or restricting the sale or use of intoxicating liquors" (6–7 Geo. V. Ch. 19) was adopted and penalised the transportation and delivery of intoxicating liquor or sale for transportation into a province in violation of the law of the province. This effort to remove "Federal protection" from manufacture and shipment, legal under Dominion law, of intoxicating liquors whose sale was prohibited under provincial law or local option votes, was similar to the Wilson and Webb-Kenyon Acts in the United States. This Act was amended Nov. 10 1919 (10 Geo. V. Ch. 21) to include manufacture for illegal sale; but an amendment, adopted on the same day, to the Canada Temperance Act (10 Geo. V. Ch. 9) added Part IV., "Importation and manufacture of intoxicating liquor," and provided an alternative plan which it was thought would be more effective and better applicable locally to accomplish the same purpose. It provided for prohibition of importation and of manufacture for illegal importation in any province by Order-in-Council after an approving referendum had been taken by the Dominion Govt. at the request of the provincial Legislature.

Referenda in All Provinces.—From Feb. 1 1921 to May 21 1923 seven of the nine provinces decided by referenda to prohibit importation. Similarly exportation of liquor from ar province, except by brewers and distillers, could be prohibit by Order-in-Council under a further amendment of 192 Four provinces in 1922 and 1923 invoked this law. Neither t importation nor exportation prohibitions were sufficient witho a real Federal prohibition law to enable the provinces to enfor satisfactorily their province-wide prohibition laws after t Dominion declared the War prohibition for the Dominion at end. So three of the seven prohibition provinces swung over state control, and there were in 1926 only four (Ontario, Ne Brunswick, Nova Scotia and Prince Edward Island) where prohibition of sale continues. In Feb. 1925 an amendment the Ontario Temperance Act permitted the sale of 4·4 bee which does not seem to have made the enforcement of the pr hibitory features of the Ontario Temperance Act any easi Government ownership and sale or state control take vario forms in the different provinces. The amount of liquor so seems to have increased each year since 1921, when Briti Columbia adopted the system of government warehouses a salesrooms with public liquor stores, only on a local vote whi has been favourable thereto, only in the larger cities and town and there is said to be little or no curtailment of illegal sale a the abuses therefrom. In Quebec, Manitoba, Saskatchewa Alberta and British Columbia liquor is sold under governme regulations.

See PROHIBITION and the authorities cited there in addition to t following: U.S. Bur. of Int. Rev., *Laws relating to National Prohi tion Enforcement* (1923); Laws of 65th and 66th Congresses relati to Liquor (contains text of laws of previous Congresses since 18 and Regulations No. 60, app. by Secy. of Treas. Jan. 16 1920, und Prohibition Enforcement Act, 1920; Anti-Saloon League Year Boo (1910–25); Ernest H. Cherrington, *Evolution of Prohibition in U.S.*, a chronological history (1920); *Prohibition and Its Enfor ment*, Annals American Academy of Political Social Science, v 109 (Phila., 1923); T. R. Powell, "The Webb-Kenyon Law a Decisions Thereunder," *Southern Law Quarterly*, April 1917.

(S. McC. L.)

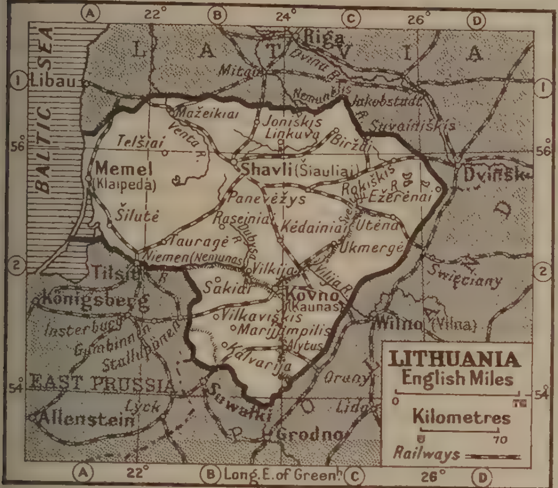
LISTER, JOSEPH LISTER, BARON (1827–1912), British ph sician (*see* 16.777), died at Walmer, Kent, Feb. 10 1912.

LISZT, FRANZ VON (1851–1919), German jurist, a young cousin of the composer, Franz Liszt, was born in Vienna Mar 2 1851. He qualified in 1875 as a teacher of criminal law Graz in Austria, was a professor at Giessen 1879, Marbu 1882, Halle 1889, and in Berlin in 1899. In 1912 he becar a member of the Fortschrittliche Volkspartei (Progressi People's party) in the Reichstag. Liszt's life work was t scientific foundation and reform of the criminal law of whi the basic principles are contained in his treatise *Der Zwe gedanke im Strafrecht* (1882). It opposes the principle of garding punishment as a reprisal and sets up the claim systematic prevention of a special nature. In the fight agai the law breaker, Liszt, together with the Dutchman Van Ha and the Belgian Prins, founded the *Internationale Kriminal tische Vereinigung* (International Criminalist Union) in 1889 which all reforms, which became the basis of modern crimi law, were initiated. Liszt's claims in favour of conditio sentence and pardon as well as postponement of punishm later passed into actual practice. At Marburg he created t Criminalist Seminary, which later in Halle and especially Berlin became a world-famed criminal institute at which stude from all lands met. Liszt was also a leading authority on int national law. He died at Seeheim June 22 1919.

His chief works are *Meineid und falsches Zeugnis* (1876); *Lehrb des deutschen Strafrechts* (1881, 21st ed. 1919); *Lehrbuch des Völk rechts* (1898, 11th ed. 1918); *Strafrechtsfälle zum akademisc Gebrauch*, 13th ed. (1922); *Strafrechtliche Aufsätze und Vortr* (1905). See also *Abhandlungen des Kriminalistischen Seminars* (18 etc.); *Mitteilungen der Internationalen Kriminalistischen Vereinig* (1890, etc.).

LITHUANIA (LIETUVA), an independent European repub and a member of the League of Nations (*see* 9.916). Lithuani territory includes the former Russian Govt. of Kovno (Kaunas parts of Suvalki and Vilna governments and the autonomo territory of Memel. The land frontiers are with Latvia he north, Poland on the east and the south, and East Prussia n the southwest. The Lithuanian seaboard is short, but is xtended by the addition of Memel. The town and territory of ilna (Wilno), claimed by the Lithuanians as part of their state, , incorporated in Poland (*see* VILNA). The area is (1926) 22,590 q. m. and the population, 1924 (excluding Memel), 2,203,312, of hom 83·9% were officially given as Lithuanians, 7·6% as Jews, ·2% as Poles and 2·5% as Russians.[1] The town of Memel inludes 24,000 Germans.

Lithuania is, on the whole, a low-lying country watered by the iemen ("Nemunas"—name of a heathen deity) and its tribuaries. The highest part is in the south and east, where the Baltic ills extend in crescent formation from Gumbinnen in East Prusa through Suwalki (Suvalki) and Vilna (Wilno) to Dvinsk. his chain of hills is broken by two valleys, that of the Niemen owing through Grodno and Olita (Alytus) to Kovno, that of the ilija (Nerys), flowing from Vilna to Janow (Jonaya) to its nction with the Niemen below Kovno. In the northwest is tuated another triangle of hills, the Telšiai-Shavli (Šiauliai)-asciniai. Between these two hilly regions lies the plain of the iemen with its two principal tributaries, the Nevežis and the ubysa flowing in from the north. The only other river of imrtance is the Šventoji, flowing southwest to join the Wilija ar Janow, and in the north the Muša, which joins the Aa ielupe) at Bauska in Latvia.



I. POLITICAL HISTORY

Early History.—(*See* 16.789.) The union between the kingdom of oland and the grand duchy of Lithuania was brought about on Feb. 1386 by the marriage of the Lithuanian Grand Duke Jogaila (Jagiel) to the Polish Queen Jadviga, and was confirmed by the subsequent acts of Vilna in 1401 and 1432, of Horodlo in 1413, of Grodno in 501 and 1512, and, parliamentarily, of Lublin in 1569. Thus was tablished a political combination in which Lithuania in point of rritory was three times the size of Poland. The contracting parties ere to retain their names, laws, administrative institutions, financial d military organisations. Through the fact, however, that from 501 onwards the Lithuanians and the Poles were ruled over by one vereign and from 1569 onwards had a common legislature, the thuanians, though ever anxious to break away, gradually sank into state of dependence. The Poles, past-masters in the art of political trigue, never lost an opportunity of imposing their hegemony. ccordingly the dual state was involved in a common downfall, and the three partitions of 1772, 1792 and 1795, to which it was subcted at the hands of Russia, Prussia and Austria, Lithuania fell a ey to Russia and Prussia. But, while the Tsarist régime, unable to nationalise a homogeneous population of a different religion and nguage, initially conceded a minimum of rights to the Polish nation, Lithuania proper from the outset an unrelenting system of tyranny s established which was designed to break by force every nonssian element in the country.

Russia had annexed the six Lithuanian governments between 1772 d 1795 and united them as the "Litovskaya Gubernia" in 1797, that is to say, before the Treaty of Vienna conceded her the kingdom of Poland in 1815. At the Warsaw diet of 1818, the liberal-minded Alexander I. still spoke of the reunion of Lithuania with Poland under constitutional forms. But the project lapsed because any measure of self-government by extending the power of the Polish "szlachta" (land-owning noble class) in Lithuania menaced Russia's influence in that country. Yet, under the influence of the Polish Prince Adam Czartoryski, Alexander I. encouraged education and enterprise. Under Nicholas I., the plan of the reunion of the two States was definitely rejected, his ukase of 1839 making Lithuania the "Syevero-Zapadni Krai" (northwestern Province).

As a result of the Polish rebellion of 1830, in which the peasantry, whether Lithuanian, Polish or White Russian, did not take so great a part as the upper classes, the Lithuanian Statute, which had remained the law of the land through four centuries of union with Poland, was replaced by the Russian code in 1840. Prominent Lithuanians were forced to emigrate or exiled to Siberia. As even the reign of Alexander II. brought no change in Lithuania, the revolutionary spirit led to the great rebellion of 1863.

This abortive insurrection, in which the Polish nobility and intelligentsia were primarily involved, though the Lithuanians also took a prominent part, led to the suppression of the printing of Lithuanian books by the dictator Gen. Muraviev, which measure was only abolished in 1904. Tsarist policy was henceforth perfectly consistent in that it strove to make Lithuania a genuine part of Russia and sought to extirpate Polish culture beyond the frontiers of the kingdom.

Period of Popular Representation 1905–14.—Russia's defeat in the Russo-Japanese War and the revolution which followed in its wake led, in Sept. 1905, to a measure of reform. The first National Lithuanian Assembly which, however, in the eyes of the Tsar's Govt. was merely a revolutionary body tolerated for the time being, met at Vilna. It consisted of 2,000 delegates who demanded an autonomy for the four governments of Vilna, Kovno, Grodno and Suvalki under a Diet at Vilna. It was the first modern attempt to define Lithuania ethnographically, to respect national minorities and continue the connection with Russia upon the federative principle. The electoral statute of 1905, by granting the four-class franchise (landowners, peasants, townsmen and workmen) favoured the rural population. Only Poles were elected to the first Duma of 1906.

As the Imperial ukase which followed the dissolution of the second Duma of 1907 conferred more power upon the great landowners, it was modified as regards Lithuania by a nationality clause which provided that the total of electors of each class should be in proportion to the amount of land possessed by the respective nationalities in the district. This measure, applied by Russian officials, was designed against the Poles and the Lithuanian Nationalists, for not even the Progressives who favoured autonomy for Poland contemplated its grant to Lithuania. In the third Duma the five delegates allotted to the non-Russian population of the government were all Poles who joined the Polish party; in Kovno three delegates were Lithuanians, one was a Pole and one a Jew.

The War Period.—The outbreak of the World War in 1914 led to a German invasion which, from midsummer 1915 until Aug. 1919, lay heavily upon the land. To further their own purpose, which was the lasting hold over Lithuania, the Germans after the military collapse of Russia allowed the phantom existence of a state. A Lithuanian conference met at Vilna (Sept. 18–23 1917) and, in negotiations which dragged until March 1918, petitioned the German Chancellor, Count Hertling, for the restoration of the country's independence under condition of a perpetual alliance between it and the German Empire (*Bundesverhältnis*). The German clerical party caused the "Taryba," or Council of State, which was then largely under the control of their army of occupation authorities, to offer the Lithuanian crown to Prince William of Urach, a younger member of the Württemberg reigning family. On July 11 1918 he accepted under the title of "Mindove II., King of Lithuania," choosing the style of a heathen prince of the 13th century who had fiercely resisted the Teutonic order. The German annexationists thwarted this candidature, which the Council of State eventually cancelled (Nov. 2 1918), but their delegates at the peace negotiations of Brest-Litovsk, in March 1918, upheld against Trotsky the authority of the Lithuanian Council of State. Their last argument rested upon this, that "Germany had recognised Lithuania's independence only on the condition that the conventions to be concluded among them the form of constitution and the choice of a ruler, shall correspond to German interests" (*Nordd. Allgem. Zeitung*, Aug. 1918). By the peace of Brest-Litovsk (March 3 1918), Germany forced Russia to abandon all claim on Lithuania.

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[1] *Economic and financial situation of Lithuania* (Lithuanian State inting Office, 1925).

By Nov. 1918, the magnitude of Germany's defeat being no longer in doubt, the Taryba, or Council of State, promulgated a provisional constitution under which it became the Lithuanian Parliament. The supreme power was vested in three persons, A. Smetona, J. Staugaitis and St. Silingas, who on Nov. 5 1918 invited Prof. Voldemaras to form the first independent administration on non-party lines, and reach an understanding with the national minorities within the still indeterminate frontiers, viz.: White Russians, Poles, Jews and Great Russians. Alone the Pan-Polish party reverted irreconcilably to the historic solution of union or federation with Poland. The initial difficulties of setting up an administrative machine on national lines were the greater as the troops of the occupying Power were affected by the revolution which had broken out in Germany. Although Kovno itself was evacuated in June 1919 and shortly afterwards Southern and Eastern Lithuania, the area Mitau-Shavli-Taurage remained in German hands until Dec. 13. Upon their final withdrawal, the Germans allowed the Bolshevik troops to march into evacuated zones at a mean distance of 10 kilometres. This was in direct violation of the terms of the Armistice, concluded with the Entente Powers on Nov. 11 1918.

The Voldemaras administration resigned on Dec. 26 1918, the new Premier, M. Slezevicius, widening the Cabinet. Prof. Voldemaras, whom the precarious situation of the country and the approaching Peace Conference called to Paris, served as Foreign Minister, M. Yčas as Finance Minister, M. Velykis as Minister of War. In Jan. 1919 the near approach of the Bolsheviks to Wilno caused the removal of the Government to Kovno (Kaunas) where the Provisional National Assembly recognised the Council of State ("Taryba") and the Slezevicius Cabinet as the regular Government of Lithuania. The Taryba voted the provisional constitution, elected A. Smetona President of the State and composed the statute for the election of the Constituent Assembly, on the basis of proportional representation. National defence began to be organised. The Bolshevik advance reached its culminating point in May 1919 when Kovno itself was threatened. Until Sept. 1919 fighting took place against the Soviet forces, which were cleared out of the northern districts of the country, and until Dec. against the so-called Bermondt troops. Meanwhile, the Poles also had attacked the Bolsheviks and in April 1919 captured Vilna, establishing themselves there.

On Dec. 8 1919 the Supreme Council of the Allies in Paris laid down a provisional eastern frontier for Poland, the so-called "Curzon line," which assigned to Poland most territories where the Polish element was in a majority, but excluded mixed and doubtful districts, the principal among which was Vilna, city and province, which fell to Lithuania. The Polish Govt. proposed to the Lithuanian Govt. joint action against the Bolsheviks, but the latter refused pending Lithuania's recognition as an independent State with Wilno for its capital.

The consequence was that the Poles embarked upon large scale military operations against Soviet Russia single-handed. But although their invasion of the Ukraine, in April 1920, was successful, the Bolshevik counter-offensive, in July 1920, compelled the Poles to retreat almost to the confines of Warsaw. The Lithuanians took advantage of the situation and reoccupied Wilno (July 14 1920) which had had a Polish garrison at the time when the Curzon line was laid down. But shortly afterwards the approach of a Red Army caused the Lithuanians to evacuate in all haste, which action laid them open to the reproach that they were not able to hold what they had so long claimed as their patrimony. The Poles believed that they were fighting not only in defence of their own newly resurrected country, but that they were stemming the tide of the Red invasion which threatened to overflow into Central Europe. They accused the Lithuanians of surrendering an important strategic centre and an important railhead, with the consequence that the left flank of the hard-pressed Polish army was exposed. But, as it happened, the face of the war changed and the Poles, turning on their Bolshevik pursuers, defeated them and drove them back into Great Russia. Immediately the Lithuanians reoccupied Vilna (Aug. 24 1920) but came into conflict with the Poles there and at Suwałki.

Meanwhile the Lithuanian Constituent Assembly, or "Seim," composed of 112 members, met on May 15 1920. The Presiden of the State, the National Council and the Cabinet resigned and all power passing to the Seim, the provisional government gav way to the permanent government. The state of war with Soviet Russia had been concluded by a Peace Treaty signed a Moscow, on July 12 1920, under which the Lithuanian claim t Vilna and Grodno was recognised by the Bolsheviks, and Lithuania received 3,000,000 roubles in gold and 100,000 hectares o forest land for exploitation. A Polish protest to the League o Nations on Sept. 5 1920 was followed by an agreement betwee the Polish and Lithuanian governments to refrain from hostilities and to respect the limits laid down for them by an Allie Military Commission. A line of demarcation agreed upon a Suwałki on Oct. 7, to come into force on Oct. 10, again left Wiln on the Lithuanian side. But the *coup de main* of Oct. 9 by th Polish so-called "rebel" Gen. Zeligowski (*see* VILNA) place Vilna in Polish hands. On March 14 1923 the Allies recognise the *fait accompli*.

The Lithuanians were compelled to remove their capital t Kovno (Kaunas) where it has since remained, but the Vilna disput continued to embitter relations between the two Powers. Th Conference of Ambassadors, in a note of June 2 1924, invite the Lithuanian Govt. to enter into diplomatic and consula relations with the Polish Government. The Lithuanian Gov countered with a proposal that the Allied Powers shoul call a conference at which their representatives would meet Polish and Lithuanian delegates to reopen the territorial questio The Conference of Ambassadors replied in effect that the frontie question could not be reopened. The Memel (*q.v.*) questio proved to be almost as difficult of solution, but the Lithuanians imitating the conduct of the Poles at Vilna, seized Memel o Jan. 15 1923 by a *coup de main*. The Convention signed at Par on May 8 1924 laid down that the Memel (Klaipéda) territor constitutes an autonomous unit under Lithuanian sovereignty

The *de jure* independence of Lithuania was recognised by Ge many on March 23 1918, by Soviet Russia on July 12 1920 an by Latvia and Estonia in Feb. 1921, and by the Argentine Republic in March 1921. The long-drawn Vilna dispute delaye formal recognition by the Allies and the United States of Americ until the end of 1922. Lithuania became a member of th League of Nations on Sept. 22 1921.

Constitution.—Under the provisional constitution of June 1920, the then President of the Constituent Assembly, M. Stulginskis, acted as Temporary President, his acts being cou tersigned by the Premier. His election was subsequently co firmed by the Seim. The definite constitution of Aug. 1 1922 pr vides for a President, elected by the Seim, and for a Cabinet wi a Premier responsible to the Seim. The Seim consists of 78 deputies, elected by universal, direct, secret suffrage on the basis proportional representation, the electoral unit being of 50,00 inhabitants.

Internal Affairs.—In the constituent Assembly, the majori was formed by the Christian Peasant party, which in 1921 carried an agrarian reform bill for the twofold purpose of breakin up large estates and of reducing the influence of the Polish gent who owned many of the biggest properties. In 1922 the firs Lithuanian Seim was constituted, but the German, Jewish an Polish minorities abstained from taking part in the elections the ground that the Government had treated them unfairly. that year the revival of trade caused exports to exceed import by nearly 500,000,000 marks, but the inflationary period in Ge many made it imperative for Lithuania to adopt a currency her own. Accordingly, the gold standard was established an maintained, on the basis of a Lithuanian litai (the litai to be 1/ of a dollar). The exploitation of flax was made a State monopol

The necessity of getting an absolute majority caused the diss lution of the Seim in March 1923. The new elections showed th state of parties as follows: Christian Democrats 40, People Party 15, National Minorities 14, Social Democrats 9. As a result coalition between the two first named returned the Galvanauska Cabinet to power, which continued in office until June 192

Then the Christian Democratic party took over the administra-ion, M. A. Tumenas becoming Premier. Once again friction oc-curred with the minorities, especially with the Jews, who make up 4% of the population. But Tumenas prevailed, and the Minis-ry for Jewish Affairs was abolished.

Foreign Policy.—The feud with Poland caused Lithuania to tand aloof from all negotiations for a Baltic alliance. The re-ulting isolation was accentuated by misunderstandings with ther Powers. First and foremost among these was France, the riend of Poland, which at the time of the Lithuanian *coup de main* against Memel maintained a small garrison in that town. urther, the Agrarian reform bill affected the proprietary inter-sts of "national minorities," Polish, German, Latvian, etc., which endeavoured to secure diplomatic protection outside the imits of Lithuanian territory. Again, the closing of the Niemen, which was an economic measure designed to exert political pres-ure, invited commercial retaliation, while friction arose within he State itself between the purely Lithuanian clergy and the lergy of Polish extraction and education, which for a time itiated diplomatic relations with the Holy See. Finally, he circulation of the "Ostmark," which had been issued during he German occupation and was not redeemed, was resented by he people, the more so as the German Reichsmark was legal cur-ency until 1922, with the result that the Lithuanian State suf-ered heavily by its depreciation. These troubles were, however, some extent counterbalanced by happy relations with Soviet ussia which culminated in a treaty of non-aggression imposing trict neutrality on both parties in the event of a conflict between ither and a third State. This treaty (as yet unratified) was ne-otiated in April 1926 by Prof. Reinys, Lithuanian Foreign inister.

In 1922 Lithuania concluded a commercial treaty with Great ritain; in 1924, commercial treaties with Germany and Czecho-ovakia. On May 19 1924 she agreed at the Conference of Kovno enter into a tariff and customs union with Latvia and Es-nia; and these three States also agreed to pursue a concerted reign policy, especially in the Assembly of the League of ations.

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(W. L. B.)

II. ECONOMIC AND FINANCIAL HISTORY

Lithuania is essentially an agricultural state. Of its total popu-tion (2,203,312 in 1923), nearly 80% live in the country. The ly large town is the capital Kaunas (Kovno), which had 92,446 habitants in 1923. The second town was Klaipeda (Memel) th 35,715 inhabitants; then came Panevezys (19,197), Siauliai havli) (21,387) and Ukmerge (10,604); the population of the ree last-named towns is, however, largely agricultural.

Education.—Thanks to the cultural conflict between the Rus-n Govt. and the Lithuanian people before the War, the olition of the monasteries at the end of the 19th century and Russianisation of elementary education, a large proportion of population is illiterate. According to the 1923 census 43·18% the men and 44·98% of the women could not read. Considerable orts were made by the Lithuanian Govt. to improve the ucational system of the country and the budgetary educational nts rose steadily from year to year. In 1924 there were over oo elementary and over 100 secondary schools. In Feb. 1922 a iversity was opened at Kaunas.

The economic organisation of the country on its present basis y be considered as beginning after the treaty of July 12 1920 h Russia; but progress was hampered by the protracted dis-tes over Memel (*q.v.*) and Vilna (*q.v.*).

Agriculture.—The estimated distribution of Lithuanian territory is as follows:—

	Hectares	% of Total area
Arable	2,595,000	46·2
Meadow and pasture	1,415,000	25·2
Orchards and gardens	169,000	3·
Woods and forests	909,000	16·2
Peat bogs	180,000	3·2
Uncultivated	349,000	6·2
	5,617,000	100·

The chief crops are rye, flax, oats and potatoes. The production of potatoes and rye would appear to have increased considerably since the War; but the returns are somewhat doubtful. The figures for 1924 and 1925 are given here.

	Area under Crops Hectares		Harvest (Quintals)	
	1924	1925	1924	1925
Rye	537,600	542,000	4,647,200	7,163,900
Wheat	84,900	112,000	903,200	1,461,000
Barley	196,000	205,000	2,028,600	2,562,500
Oats	325,000	345,000	2,697,500	3,415,500
Flax seed	61,500	76,000	338,300	458,400
Flax fibre			326,000	387,800
Potatoes	176,400	163,000	16,581,500	14,670,000

In spite of a recovery since 1920 the production per hectare of rye in 1923 was only 10·4 quintals, in 1924 8·6; wheat 9·9 and 10·6; barley 9·9 and 10·3. Efforts were, however, being made to improve agriculture with the help of the co-operative organisations. Experimental and model farms were started in different parts of the country, stations for cleansing grain set up and breeding stock imported. As in the other Baltic States co-operative societies play an important rôle. The most popular and numerous are, however, the consumers societies. Indeed, agricultural co-operatives for the marketing of goods only began to develop after the monetary reform at the end of 1922. Since the foundation of the so-called "Gamintojas" (Producer) or League of Agricultural Co-operatives early in 1923 with the object of organising the export of grain, flax, eggs, etc., and the import of fertilisers, implements and other agricultural requirements, the movement, assisted by the Government, made very considerable progress. In 1924 flax was the most important article of agricultural export, accounting for about 20% of the total value of all exports. Great hopes are, however, placed on the development of intensive dairy farming on Danish lines.

As under the Agrarian law (*see* LAND TENURE) no person may own more than 25 hectares of forest, nearly the whole of the forest area is exploited by the State; exclusive of the Memel district, 828,500 out of 872,000 hectares.

Timber.—In the 25 years preceding the War, however, very large districts were denuded of trees, and during the War the forests suffered heavily as a result both of deliberate destruction and of the abnormal demand for timber. It is officially estimated that about 2,200,000 cu. metres could be cut per annum without deforestating the country, granted adequate transport facilities. Timber and manufactured and semi-manufactured wood constitute the most important group of exports. From 1920 on the export of sawn timber made rapid progress as against that of unsawn timber, as shown by the following table:—

Amount in Cubic Metres (000's omitted)						
Principal articles	1920	1921	Jan.–Sept. 1922	Oct.–Dec. 1922	1923	1924
Wood: unmanufactured	317	244	226	19	44	48
Wood: manufactured	122	184	313	70	293	200

Industry.—No coal or mineral ore is mined in Lithuania, and such industries as exist are, therefore, mainly dependent upon agriculture. Industry suffered severely from the wars, and from subsequent political difficulties with Poland, the Memel problem, to some extent from the loss of the Russian market for metal manufactures and more recently from a banking and credit crisis. About half of the existing undertakings are occupied with the preparation of food products and beverages. The export of manufactured products is negligible.

Trade.—Owing to the system of valuation employed the trade statistics up to the end of 1922 probably somewhat exaggerated the magnitude of the imports. The total turnover has increased steadily from year to year.

Imports and Exports of Merchandise and of Bullion and Specie

Special Trade[1] Value in millions of litai						
Merchandise	1920	1921	1922	1923	1924	1925
Import . . .	72	95	75	157	207	253[2]
Export . . .	55	58	77	147	267	243
Balance[3]	−17	−37	+2	−10	+60	−10

[1] Imports for home consumption and exports of domestic produce.
[2] Provisional.
[3] Excluding the movement of bullion and specie.

The chief articles of export are: wood and wood products (about 25% of the total value of all exports in 1924), flax 20%, live stock 13%, eggs 7·5%, leather and hides 5·5%, and grain and flour 4%. In 1924 43% of Lithuania's total exports went to Germany and 28% to the United Kingdom. Of her imports, which are essentially miscellaneous in character, over 80% were derived from Germany in 1923 and about 63% in 1924.

Currency.—Since the autumn of 1922 Lithuania has had her own currency: the litai (one-tenth of a dollar). This unit of currency was adopted as, owing to the number of emigrants and the extent to which dollar notes sent from the U.S.A. had circulated in the country during the preceding years when the German Ost marks were depreciating in value, the population had become habituated to it. In connection with the monetary reform a central bank was established which has the sole right of note issue.

National Finance.—In 1923 the budget was balanced and from 1923–5 the proportion of total expenditure for military purposes and of total revenue derived from the felling of timber steadily diminished. The estimates for this period balanced at the following totals:—

	1923	1924	1925
Litai (in millions)	208·3	229·7	259·3

The actual receipts and expenditure in 1923 amounted to 176·9, and 171·8, and in 1924 to 241 and 232·3 million litai. On Jan. 1 1924 the total debt of the republic amounted to 72·8 million litai of which 2·6 million litai was domestic. Arrangements had been made with all creditor countries concerning the service of the foreign debt.

Communications.—The means of communication in Lithuania were constructed to meet the requirements of a province of the Russian Empire and are ill-adapted for present purposes. Thus Memel, which is the chief port for the whole country, can only be reached from Kaunas, either by an extremely circuitous route via Liaulian, Taurage and Papegiai, or over Latvian territory. For this reason the Lithuanian Govt. contemplated laying down two short lines linking Kaunas with Memel and giving northern Lithuania a direct outlet at Memel to the sea via Pelsiai. The length of the railways in 1925 was 1,138 km. large gauge, and 454 km. narrow gauge under State control, plus 48 km. of line under private management and the Highways Board and some 110 km. of private lines in Memel.

The Niemen, however, forms an important natural highway, being navigable for 419 km. and utilisable for the floating of logs for a much greater distance. The rivers Necys and Nevežys are likewise navigable for 20–30 kilometres. But these rivers are all frozen in winter when the transport of timber from the forests to the nearest clearing station is accomplished.

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LITTLE ENTENTE.—The Little Entente is a political organisation, created after the World War, which binds together three Central European States, Czechoslovakia, Yugoslavia and Rumania, for purposes of their common interest.

Origins under the Dual Monarchy.—Those nations had in the past been throttled by the Germanising and Magyarising system of the old Austria-Hungary; one of the objects of the Little Entente is to defend the freedom they won after the War against all attempts to restore the former régime. The Little Entente had its roots in a series of political acts and declarations dating back to the days of the old monarchy. In the Austrian half of the Habsburg Empire the representatives of the small nations in the Parliament at Vienna joined in opposition to the centralising system which opposed the non-German peoples. In the Hungarian half the oppressed Slovaks, Serbs, Croats and Rumanians met in 1848 and made a protest against Magyar imperialism; they did so again in 1895 at Budapest; and in 1905 10 non-Magyar deputies of the Budapest Parliament formed a club for a like purpose.

During the World War, when the Austro-Hungarian peoples revolted and helped the Western Entente to break the system of militarist imperialism, a common aim again produced comm action. In April 1918 a congress of the oppressed Austro-Hu garian peoples was held at Rome, and in the autumn of that ye the Central European Democratic Union was formed in Americ A year earlier a great meeting of representatives of the Austr Hungarian nations had taken place at Kiev in Russia and ha established a special committee to fight against German an Austro-Hungarian imperialism. A prominent place was taken all these actions by the Czechoslovaks, Yugoslavs and Rum nians, supported by Poles, by the Italians of " Italia irridenta and finally by Ukrainians. The co-operation of the first thr nations was particularly close, and toward the end of the W they undertook diplomatic action in common. The Little E tente was formed soon after the Peace treaties had been signe when attempts began to be made by various elements of the pr War régime to bring about a restoration of the Habsburg dynast

The Formation of the Little Entente.—The Czechoslovaks, Y goslavs and Rumanians knew that a return of the Habsbur would mean the restoration of the German-Magyar absolutis and the destruction of the freedom won by the political revol tion of 1918. The Habsburg intrigues were chiefly engineered Hungary, where the new régime in Central Europe was last to recognised and where intense propaganda was conducted for t recapture of the Slovak, Serbo-Croat and Rumanian territor The Habsburg menace led to corresponding defensive measur on the part of the threatened States. The Czechoslovak Forei Minister travelled on Aug. 13 1920 to Belgrade, where, on the f lowing day, a defence treaty, of which the broad outlines had ready been negotiated, was concluded between the kingdom the Serbs, Croats and Slovenes and the Czechoslovak Republ binding both States, in case of an unprovoked attack by Hu gary on either of them, to provide mutual aid the one to the othe and to refrain from making any alliance with a third Power wit out the consent of both. At Bucharest, whither the Czechoslov Foreign Minister proceeded from Belgrade, the basis was neg tiated on Sept. 17 for an analogous entente.

After all the questions of detail had been settled, that agre ment also was given the form of a defensive treaty, and conclud on April 23 1921. On Sept. 19 1920 Rumania informed bo those States that she recognised a similar obligation. She co cluded special treaties to that effect with Czechoslovakia April 23 1921, and with Yugoslavia in June of that year. T opportuneness of that defensive alliance was proved in April a in Oct. 1921, when two attempts were made to restore the Hab burgs. Those attempts failed only because they met with t combined armed resistance of Czechoslovakia, Yugoslavia a Rumania.

The European Side of the Little Entente.—The three Stat forming the Little Entente were aware from the beginning th mere defence measures would not suffice for the maintenance the new régime if the States concerned were themselves lacki in creative forces, or failed to attain the greatest possible deg of political and economic solidarity and an atmosphere of mut trust and fruitful co-operation throughout the whole area of C tral Europe. The ultimate and wider aim of the Little Entente therefore to educate Central Europe as to the advantages of u versal peace and European consolidation. The progress made the realisation of this policy is best seen in the political and e nomic spheres. The main political object was to persuade all t Central European States to work in peaceful co-operation with t new States, and much success has been achieved. Starting from t Treaty of Rapallo between Yugoslavia and Italy and the agr ments worked out on the occasion of the visit of the Czechos vak Foreign Minister to Rome in Jan. 1921, that policy b fruit in the Czechoslovak-Austrian agreement of Dec. 16 19 which bound both States to abandon hostile propaganda and settle all disputes by peaceful arbitration. The same princip were the basis of the Czechoslovak-Polish treaty of Nov. 6 19 which, although not ratified, created better relations between t two States, and, being followed by the Polish-Rumanian politi treaty, materially improved the relations of Poland with t Little Entente as a whole.

In the measures taken to save Austria from financial ruin Czechoslovakia had a large share, and did not hesitate to make sacrifices in the interests of mutual confidence. A like policy was ollowed by the Little Entente towards Hungary, despite the fact that it had been the nationalist elements of Hungary and heir Habsburg sympathies that had brought the defensive aliance of the Little Entente into existence. The latter knew from he beginning that correct and, as far as possible, friendly relaions between it and Hungary were essential to the complete pacification and consolidation of Central Europe. The States forming the Little Entente showed the best of good will in this espect, as is proved by the frequently repeated attempts of Czechoslovakia to negotiate with the Hungarian Govt. from as early a date as 1921. If those attempts were unsuccessful, t was because Hungary sought by an adventurous policy to avoid an understanding with her neighbours. The recent hange in this respect, clearly due to the failure of that Hungarian policy, is nowhere more welcomed than in the countries of the Little Entente, whose only wish is that the change be permanent, so that a new Hungary, consolidated both econonically and politically, may co-operate in the reconstruction of Central Europe.

Economic Policy.—The economic policy of the Little Entente tarts from the conviction that in Central Europe it is necessary not only to overcome the harmful results of the depreciated curency, the obstacles to trade connections and the disturbances in he industrial world, but also to make up for the consequences of he disintegration of the old monarchy, which had constituted an conomic whole. The basis of its economic policy, therefore, is he minimising of these results by the earliest possible establishment of commercial relations with each other and with the rest f the world. The political negotiations have therefore always been combined with economic negotiations, which have been the basis of a series of commercial treaties, at first between the States of the Little Entente and then with all the neighbouring ountries. Questions of common interest to all the States spring-ng from the former Austria-Hungary have been discussed with ood results at special conferences, *e.g.*, those at Rome and Porto-oso in 1921, and, later, the special conferences dealing with passport, transport and other problems. The results of this eco-omic co-operation have not of course been equally satisfactory in ach of the States concerned, nor have they been enough in them-elves to restore healthy conditions to those States whose eco-omic, financial and currency difficulties left them with no alter-ative to calling in international financial help.

Expansion of the System.—The increased activity and the de-ermined policy of the States forming the Little Entente have utgrown the limits of the simple defence treaties which consti-uted the original basis. On Aug. 31 1922 that formal basis was considerably enlarged by the conclusion of a new treaty, in the second article of which both Czechoslovakia and Yugoslavia recognised the treaties concluded by Czechoslovakia with Rumania, Austria and Poland on the one hand, and by Yugoslavia ith Rumania and Italy on the other. In the third article both arties agreed to put their economic, financial and transport re-tions on a firm basis by co-operation; and finally in a further ar-cle they undertook to support one another in their international political and diplomatic relations and to take common measures their common interests should be threatened.

The principles incorporated in that treaty reveal both the spirit nderlying the Little Entente and the basis of its future activity. mphasis is laid on the importance of economic co-operation and solidarity in international affairs; the periodical renewal and xtension of the existing system of commercial treaties, together ith the ever increasing moral weight of the Little Entente in the ouncils of Europe, prove that the statesmen of the Little En-nte have a firm grasp of both political and economic realities. t international conferences, such as those of the League of Na-ons, the representatives of the Little Entente have regularly poken as one man, and have therefore contributed to a considerable simplification of international relations; their behaviour is articularly noteworthy in that it is not only of a united but of a pacifist character. The future aim of the Little Entente will be still further to promote the pacification and the consolidation of Central Europe. *See* also CZECHOSLOVAKIA; EUROPE; RUMANIA; YUGOSLAVIA, etc. (E. BE.)

LITVINOV, MAXIM MAXIMOVICH (1876–), Russian politician, was born at Bielostok. When only 17 he entered military service as a volunteer and while in the army became interested in Marxism. When his term of service was completed, he devoted himself to propaganda, and became a member of the Kiev committee of the Social Democratic party. The president of that committee proved to be a police agent and the whole committee was arrested. After a year and a half in prison Litvinov with 11 companions escaped from gaol, went abroad and took an active part in the *Iskra*, the Social Democratic newspaper. When the split in the Social Democratic party occurred, Litvinov joined the Bolsheviks, or majority section, returned to Russia illegally in 1903 and worked there as a member of the central committee until the revolution of 1905. In that year he attended the London Congress as a delegate from the Riga Committee and took part with Gorky in founding *Novaya Zhizn* (*The New Life*), the first legal Social Democratic newspaper to appear within the boundaries of Russia.

During the succeeding years of reaction, Litvinov lived abroad, where he organised the sending of weapons to the revolutionaries in the Caucasus. He took part in the International Socialist Bureau which he left at the beginning of the World War after protesting against the entry of Socialists into bourgeois governments and in general against Socialist support of the War. After the November revolution (1917) in Russia he was appointed diplomatic agent of the Soviet Government in England. He was subsequently arrested as a hostage for Mr. Lockhart, for whom he was exchanged. He afterwards became one of the most important figures in the Soviet diplomatic service, as assistant commissar for foreign affairs taking part in the initiation of peace negotiations with Estonia, in negotiations at Copenhagen with England, in the Genoa conference and, as president of the Russian delegation, in the subsequent conference at The Hague. In 1925 he became a member of the Revolutionary military council of the Union and later chief-of-staff of the Red Army.

LIVERPOOL, England (*see* 16.804).—The population of Liverpool increased from 753,353 in 1911 to 802,940 in 1921. The municipal area was enlarged in 1913 by the inclusion of Allerton, Childwall, Little Woolton and Much Woolton to a total area (exclusive of 2,883 ac. of river bed) of 21,242 acres. The death-rate per 1,000 fell to 13·6 in 1924. The policy of slum clearance and the erection of large numbers of cottages followed by the council, which was begun before the War, has had beneficial results. Over 6,000 houses had been built by 1924 under municipal housing schemes on large estates at Larkhill, Allerton and elsewhere, and 460 ac. were acquired in 1925 for a further big scheme at Norris Green, just outside the city boundaries. Garston has become an important shipping and coal export centre. Since 1918 the borough has returned 11 members to Parliament.

Public Utilities, etc.—The total area of parks and open spaces is 1,396 ac., including the Harthill estate of 32½ ac. (1913), the Walton Hall estate of 130½ ac. (1913), the Woolton Wood estate of 62 ac. (1917) and the Allerton and Allerton Towers estates of 228 ac. (1924). Among important buildings erected since 1910 are the prominent Royal Liver and Cunard buildings, near the landing stage; an art gallery at Port Sunlight, erected in memory of Lady Leverhulme; and the Midland Adelphi Hotel. Recent monuments include a bronze statue of King Edward VII. in front of the Cunard buildings; one to the engine room heroes, erected by international subscription in 1916, overlooking Prince's landing stage; one to Sir A. L. Jones at the George pierhead; and the Cunard company's War memorial column. The proposed Liverpool War memorial is a cenotaph in front of St. George's Hall, in addition to the Cathedral War memorial, which is a cenotaph and includes the Roll of Honour. A holiday home for orphans was opened in 1924 as a memorial gift from the churches of the city.

A Merseyside municipal co-ordination committee was formed in 1922, with the object of improving local communications, particularly across the river. Negotiations for financial assistance from the Government were successful in 1924, and in Dec. 1925 the boring of the Mersey tunnel, which, it is hoped, will provide a solution of the very difficult traffic problem, was begun by the sinking of a shaft on the site of the old George's dock. When completed, the tunnel, 44 ft. across, will contain a roadway for heavy traffic 36 ft. wide, with footways on each side, and beneath one for lighter vehicles. There will be two approaches on the Liverpool side, one for heavy traffic at New Quay and one for lighter at Whitechapel. On the Birkenhead side there will be one approach, near the Woodside Hotel. The urgent need of an additional water supply led to plans for the construction of a third pipe-line from Lake Vyrnwy (to be followed by a fourth), and the crossing of the Mersey is to be effected by laying pipes in the river bed. Work was begun in 1925.

Cathedral.—The work of building the cathedral, practically stopped during the War, was resumed in 1920. Owing to the exigencies of the site on St. James' Mount the building lies north and south, the rubrical "east" thus pointing south. The general plan, which is marked by strong individuality of style, consists of a great central space (200 by 72 ft.) formed beneath a central tower by the crossings of two pairs of transepts, a choir in three bays and a nave—the whole to have an interior length of 480 feet. The principal portal of the cathedral will be at the west side of the tower, not at the traditional west end. The stone is Woolton red sandstone, which weathers to a greyish pink in a smoky atmosphere. The first section, which includes the Lady Chapel, was consecrated in 1910 and the choir, two transepts, and the chapter house were consecrated in July 1924. In the southeast transept is a memorial to the 55th division, and in the War memorial northeast transept there is a cenotaph. The building is heated by the hypocaust system. Work on the great central space and the west transept was begun in 1925. (*See* ARCHITECTURE.)

Markets.—A market was established at Garston in 1920, and in 1922 a general market was set up on the site of the wholesale vegetable market in order to do away with the holding of unauthorised markets on waste ground. In the same year the frozen meat market was acquired, as a preliminary to the building of abattoirs and a meat market on the site of the Stanley cattle market.

Port Improvement Schemes.—Large schemes for the improvement of the port have been in process of execution by the Mersey Docks and Harbour Board since 1906. They include the construction of a great vestibule dock, 1,070 ft. long and 130 ft. wide, with a river lock entrance and two branch docks, at the north end of the dock estate. A lock 645 ft. long and 90 ft. wide, opened in 1921, connects the new dock with the adjacent Hornby dock. These new docks will add 2¾ m. of quays to the port, and will be, it is said, the largest and best equipped in the world. Work was suspended during the War, but was afterwards pressed forward. Large extensions have been made to the electric equipment of the port, the landing stages enlarged to provide further facilities for the embarkation of passengers, and a wireless telephone installed from the Bar Lightship to the Harbour Board offices. About one-third of the total overseas trade of Great Britain passes through Liverpool, but since the War Liverpool has given place to London as the first port for wheat imports. To provide accommodation for the growing oil industry a large area of land, known as the Parkhill and Dingle estate, has been set apart at the extreme south end of the dock estate for the erection of oil tanks, with pipe-lines to berths in the Herculaneum dock. (O. J. R. H.)

LIVERPOOL, UNIVERSITY OF (*see* 10.43).—New chairs have been founded in classical archaeology, geography, commerce, civic design, social science, applied mathematics, organic chemistry, industrial chemistry (fats and oils), bacteriology, geology, oceanography, entomology, parasitology, tropical diseases of Africa, dental surgery, veterinary anatomy, care of animals (causation and prevention of disease), international law, engineering, electrical machinery, applied mechanics, civil engineering, metallurgy and naval architecture. New fellowships have been created for modern history, English literature, Celtic chemistry, anatomy, orthopaedic surgery, engineering. A number of scholarships have been instituted, in architecture, travelling, research (offered in the faculties of arts, science and engineering in rotation), chemistry, marine biology, medical subjects, engineering and law.

New buildings were erected for arts building extension, Students' Union and Gilmour Hall, engineering building extension, school of tropical medicine, chemistry school extension, department of geology, hall of residence for women extension, dental school extension, athletic pavilion, laboratory for research in tropical diseases (Sierra Leone). Residential buildings have been altered and equipped for accommodating the departments of education, geography, school veterinary surgery, metallurgy, school of social science, hostels for men, institute of archaeology. New departments have been instituted in civic design and town planning, poetry, music, art of the theatre, medieval history, analysis of observations, geology, cytology, pharmacology, radiology and electrology, orthopaedic surgery, parasitology, chemical physiology, public health chemistry and refrigeration. New degrees have been ordered for commerce, architecture, hygiene, orthopaedic surgery, veterinary science and philosophy, while diplomas have been instituted in radiology and electrology, tropical hygiene, archaeology, geography and social studies. In 1919 a tidal institute was established by the university in association with local shipowners. In connection with the department of oceanography, founded in 1919, a sea fisheries laboratory is maintained at Port Erin. Extensive researches are carried on in the local sea fisheries in regard to diseases of fish and kindred subjects.

Extramural Work.—The university extension board extended its influence to the Isle of Man, to Crewe in the south and to Blackpool and Carlisle in the north, at 23 centres, in co-operation with local committees and organising bodies. Christmas lectures for boys and girls have been inaugurated. A scholarship open to extramural students provides the holder with the means of proceeding to a degree course in the university. Free public lectures have become a feature in university life at Liverpool. Courses of lectures and single lectures are given almost nightly in the winter, in many subjects taught in the university.

Industrial Relations.—For some years advisory boards have been established in commerce and in science and engineering subjects, including representatives of commercial and industrial firms. The university has adopted special regulations for the proper conduct of what is termed "outside work." Facilities are offered by a large number of firms permitting students to visit works and examine processes, etc. Much is done in finding suitable posts for graduates on leaving the university.

Numbers of Students.—The following table shows the increase of students in 1924–5 as compared with the entries for 1910–11:—

1910 -1			1924–5		
Full time	Part time	Total	Full time	Part time	Total
919	279	1,198	1,651	400	2,051

The University in Wartime.—During the War the resources of the university (particularly of the science, engineering and medical departments) were devoted to national service, and accommodation in the university buildings was found for many Government departments. Research work was undertaken for the Government in chemistry (dyeing, edible oils, high explosives, etc.), insect pests, mathematics (Admiralty work and guns), optical instruments, engineering and medical science (particularly in tropical diseases, bacteriology, pathology, orthopaedic surgery and dentistry). The engineering staff organised classes for the manufacture of shells, and the staff and students made over 1,500 gauges. The inspection of high explosives for the Liverpool area was centred in the chemical laboratories, and over 250,000 tons of high explosives were passed there. Mem-rs of the university who served in the War (staff, students d servants) numbered 1,673 of whom 197 were killed in action died on service, and five gained the Victoria Cross (one th bar).

LLANDAFF, HENRY MATTHEWS, 1st Viscount (1826–1913), ritish politician, died in London April 3 1913.

LLOYD OF DOLOBRAN, GEORGE AMBROSE LLOYD, 1st aron (1879–), British administrator, was born on Sept. 1879, the son of Sampson Samuel Lloyd of Dolobran, Mont-meryshire, and was educated at Eton and Cambridge. He ecame a close student of politics and travelled widely in Burma, dia, Little Tibet, the Himalayas, Egypt, Morocco and Asia inor. In 1905 he was appointed attaché to the British Em-ssy at Constantinople, and in 1908 acted as special commis-ner for the British Govt. to inquire into and report upon the ture of British trade in Turkey, Mesopotamia and the Persian ulf. During the World War he saw service in Egypt, Gallipoli, ussia, Mesopotamia and with the sheriff of Mecca's forces in e Hejāz, gaining the D.S.O. in 1917. He was Conservative .P. for West Staffordshire from 1910 until 1918, when he was pointed governor of Bombay, a post which he held until 1923. e was created G.C.I.E. in 1918 and G.C.S.I. in 1924 when he as again returned to Parliament as M.P. for Eastbourne. In ay 1925 he was appointed high commissioner for Egypt, and Oct. was raised to the peerage.

LOCARNO, PACT OF.—Locarno is a fact of European signifince. If, therefore, we wish to treat of the particular outlook one nation or another it cannot be in relation to the great jectives shared by all, towards which the policy of Locarno as directed. The German people, indeed, have expressed their inion of the actual documents in which the results of Locarno e enshrined, in less unanimous terms than other nations, but may be said that in the overwhelming majority they are as nvinced as any nation of the desirability of those great aims.

It was not altogether easy to make it clear to German public inion that the problem of security was fundamental to any actical approach to these ends. The man in the street, seeing e harbours empty, the barracks deserted, the armament indus-es destroyed and the richest areas of his country overrun by reign troops, found it hard to understand that it was not his n security but that of his armed neighbours, old and new, at stood in need of a guarantee. The difficulties would, there-re, have been excessive had not Great Britain stepped in at rmany's suggestion and declared herself ready to throw the hole weight of her power into the scale in the defence of Ger-ny's western frontier, no less than eastern frontiers of France d Belgium.

It is too much to say that Great Britain's intervention, neficent as it was, amounted to a solution in itself. The path hich it opened was still encumbered by many obstacles. The ncerity of the German proposal was not everywhere realised th the same clear-sightedness shown by the British statesmen. rmany was credited with designing to secure a British guar-tee on the Rhine to enable her to effect a forcible rectification certain frontiers in the east which were not in harmony with cial justice and sound economics. It was feared, moreover, at a separate pact between the Great Powers interested in the hine would overshadow a pact concluded within the framework the League of Nations and undermine the prestige of the ague itself. It was by no means easy to remove the first urce of anxiety, despite Germany's sincere wish to develop r relations in the east along peaceful lines, since France, as land's military ally, could not be seriously regarded as an partial guarantor of German-Polish relations. The second ound of apprehension would, it seemed, vanish when Germany tered the League of Nations. She was, however, compelled demand that she should enter as a completely equal partner. was therefore necessary that consideration of the inequalities armament be secured beforehand.

An unusual measure of goodwill on the part of all concerned s needed to overcome these and other difficulties. Happily e hour of Locarno was favourable and the statesmen assembled there actually incorporated this goodwill in a high degree. Personal contact strengthened in each that determination to conquer the spirit of mistrust, which in such circumstances is the sole warrant of success. Accordingly, there was little delay in drawing up the documents which were signed in London on Dec. 1.

From the German point of view their immediate significance is clear and simple:—

1. They set Europe free from the nightmare of warlike complications in one of the danger-points of the Continent.
2. They substitute a system of objective legal procedure and amicable arrangement for high-handed militarism and the one-sided interpretation of treaties.
3. They pave the way for Germany's co-operation in the League of Nations, by ensuring that she shall not be involved against her will in conflicts for which she is unfitted by her geographical position and her military situation.

Even if it had no other than this immediate significance, the Pact of Locarno would be one of the most important documents of 20th century history. But it was recognised with a rare unanimity and, further, was emphatically laid down in the protocol of Locarno that its full import entailed further consequences. Everything in fact in this complex of treaties has a bearing upon the future.

The legal disputes, often of a very subtle order, which in recent years have stirred passions to a frenzy, will in future be referred to the calm atmosphere of international courts of equity, so that our generation may acquire a clear outlook, enabling it to co-operate in mutual confidence in the political, economic and cultural reconstruction of Europe. There is hardly any aspect of this infinitely complicated problem which will not sooner or later be made to feel the beneficial influence of this clarifying process. The particular problem, however, which will be most immediately and decisively affected is undoubtedly that of universal disarmament. Germany's practical interest in this issue is less than that of other countries. For the chief financial relief will be enjoyed by those countries which disarm, while the diminution of the military burden will benefit the Powers competing with them in armaments. For Germany, on the other hand, the effect is primarily a moral one in three ways.

Firstly, because disarmament will mean the beginning of the long-delayed fulfilment of a solemn promise, confidence in which brought the German people to lay down its arms; a promise which was solemnly reaffirmed to it in Versailles.

Secondly, because in the words of the distinguished statesman who represented Belgium at Locarno it is impossible "to keep a rich and powerful people disarmed by duress and in a one-sided way for an indefinite period, while its former enemies in Europe remain armed to the teeth."

Thirdly, because this is the best way of convincing the German people that the pledges which Germany has offered of her own free will, and under the guarantees of Great Britain and Italy, for the security of her Western neighbours, are appreciated at their full value by the latter. How could the German people be asked to believe in the security pact if the signatory Powers most immediately concerned continue to base their security exclusively upon heavy artillery, tanks and aerial bombs?

Regarded in this light, it becomes intelligible why public opinion in Germany more than anywhere else looks so eagerly for the realisation of what in Locarno was so justly styled the "logical outcome." Every recognition is due to the fact that the responsible statesmen on their return to the turmoil of their capitals from the calm and reflective atmosphere of Locarno have honourably striven without waste of time to bring about the realisation of a part of that "logical outcome." It must alike be recognised that before the full programme can be realised, time is necessary to prepare public opinion in each country. The document of Locarno is no prescription, merely needing the physician's signature, to allay the fever of mistrust. But in the last resort the prescription of Locarno will have to prove its efficacy by one fact alone: that no State shall ever again hold it necessary or even compatible with the Treaty to seek for the guarantees of its security by accumulating the machinery of violence on the territory of its neighbour. When that hour strikes, even those sections of German opinion, which are still skeptical of Europe's miraculous healing from the spirit of destructiveness, will no longer be able to stand aside. Then will the whole German people engage its ambition in being outdistanced by none in peaceful co-operation for the welfare of Europe. (*See* SECURITY.) (G. ST.)

LOCKJAW: *see* TETANUS.

LOCKOUTS: *see* STRIKES AND LOCKOUTS.

LOCKROY, EDOUARD (1838–1913), French politician (*see* 16.854), died Nov. 22 1913.

LOCKWOOD, WILTON (1861–1914), American painter (*see* 16.855), died at Brookline, Mass., March 20 1914. In 1912 he was elected a member of the National Academy of Design.

LOCKYER, SIR JOSEPH NORMAN (1836–1920), British astronomer (*see* 16.855), died at Sidmouth, Devonshire, Aug. 16 1920. In 1912 he became president of the British Science Guild.

LOCOMOTIVE: *see* RAILWAYS.

LÓCZY, LÁJOS DE LÓCZ (1849–1920), Hungarian geologist, was born at Pressburg (Bratislava) Nov. 2 1849. He studied at the Zurich Polytechnic, obtaining his engineer's diploma in 1874, and from 1877–80 travelled through India and China as geologist to the expedition of Count Bela Szechenyi. In 1886 he became professor of geology at the University of Budapest, and in 1908 director of the Hungarian Geological Institute. He completed geological researches in China, in Hungary and, during the World War, in Serbia. His principal work, *The Scientific Results of the Expedition of Count Bela Szechenyi to Eastern Asia* (1890), comprises the first scientific description of the mountains which connect the Kuen Lun chains with the North-east Indian chains behind the red basin of Szechwan. His researches concerning the steppe-formations of the Gobi and the northern Hwang Ho territory are also of great importance. His other important work, *The Results of the Scientific Research of the Balaton*, forms a great monograph of the Hungarian lake, in which the formations of the Balaton region are explained. His posthumous works are: *The New Geological Map of (pre-War) Hungary*, and *Geology of West-Serbia*, which revolutionised the geological knowledge of Serbia. He died at Balatonaracs May 13 1920.

LODER, BERNARD CORNELIUS JOHANNES (1849–), Dutch jurist. From 1873 to 1908 Loder practised as a lawyer in Rotterdam and from 1908 to 1921 was a judge of the high court of justice of the Netherlands. In 1905, 1909, 1910 and 1922 he represented the Netherlands at the diplomatic Sea Conferences at Brussels. He presided at the conference of the Scandinavian kingdoms, Switzerland and Holland, held in 1920. The Permanent Court of International Justice at The Hague appointed him its first president in 1922 and he retained this position until early in 1925.

LODGE, HENRY CABOT (1850–1924), American statesman and author (*see* 16.860), in view of his continuous service in the Senate since 1893 was recognised during the closing years of the Roosevelt administration and under Taft as one of the Republican leaders. This position he maintained at the time of the Republican-Progressive split which led to the election of Woodrow Wilson in 1912; his personal friendship with Roosevelt remained unbroken, but he held true to his long-established principles of party regularity. He was well equipped for leadership in opposition, for his talents were critical rather than constructive and he possessed the qualifications of a great parliamentary debater. His prime interest lay in foreign affairs and it was as a member of the Senate Foreign Relations Committee and later as opponent of President Wilson that he exercised his chief interest. This opposition was originally in no way personal, as has been frequently suggested.

In 1914 Lodge supported Wilson's demand for the repeal of the Panama Tolls exemption on the ground that the President had a right to expect such assistance as would enable him to conduct foreign affairs effectively; "the great responsibility," said Lodge "of initiating and shaping our foreign policy must rest with the Executive and cannot rest anywhere else." He lost confidence in Wilson, however, as a result of the President's handling of the Mexican problem in 1914, and thereafter becan one of his principal critics. He regarded him as a man of wor with no capacity for well-considered action: "I wonder if t future historian will find him out," he wrote in his diary. Th distrust increased after the outbreak of the World War. Lodge intense nationalism, which in the past had given him the reputa tion of being an Anglophobe, led him to protest strongly again the failure to protect American lives and property, wheth destroyed by Mexican revolutionaries or by German submarine He successfully opposed the Shipping Bill in Jan. 1915, oster sibly on the ground that it would lead to foreign complication chiefly, however, because he feared it would result in the pu chase of the German ships in American harbours, an act whic he regarded as unneutral and unfriendly to the Entente. H desired the United States to enter the War against German after the sinking of the "Lusitania," and warmly objected t every suggestion of placing an embargo upon the export American munitions, which he looked upon as a pro-Germa manoeuvre. He steadily opposed Wilson's Caribbean polic in Feb. 1914 he refused to support the treaty negotiated wit Colombia providing for the payment of $25,000,000 and expres ing regret for incidents connected with the United States reco nition of the independence of Panama and the acquisition of th Canal Zone; in Jan. 1916 he offered a resolution calling f armed intervention in Mexico. He advocated enthusiasticall a larger army and navy.

With the entrance of the United States into the War, Lodg called for non-partisan support of the President in all policie that might increase the War effort of the United States and i assistance to the Entente Allies, and he helped to carry throug many of the Administration's War measures, although he op posed one of the most important designed to organise wa making agencies, the Overman Act, on the ground that it gav unlimited power to the Executive. Wilson's peace policie Lodge neither understood nor approved. In 1915 and 1916 h had himself advocated a League of Nations and the principle compulsory arbitration, but he later confessed that he change his mind and saw in Wilson's proposals more danger tha advantage. In Aug. 1918 Lodge was elected Republican Floo Leader of the Senate, and as a result of the autumn election which gave control to the Republicans he became chairman the Senate Foreign Relations Committee. At the moment the opening of the Peace Conference he was thus titular an actual leader of the opposition to Wilsonian peace policies, post for which he was fitted by his convictions as well as h ability.

On Dec. 21 1918 Senator Lodge inaugurated what develope into a successful campaign against the Wilson peace plan by speech in the Senate in which he insisted upon the need of separating the League from the treaty. Under his guidance and tha of Senator Knox, both men of long experience in matters foreign policy, the Senatorial opposition to Wilson develope rapidly; it was not broken by Wilson's conference with th committee on Feb. 26 1919. "The President," recorded Lodge "answered questions for two hours about the draft of the constitution of the League of Nations, and told us nothing." O March 4, Lodge with 38 Republican Senators issued a declaration expressing disapproval of the Covenant in its existing for and its inclusion in the treaty of peace. Thus when Wilso finally returned from Paris in July 1919 he found a well-organised opposition to the Covenant, which capitalised the increasing protest against the President's alleged autocracy of metho and the dissatisfaction with various aspects of the Versaille Treaty, together with the discontent inevitably arising fron after-War conditions and directed against the party in power.

Lodge did not hope to defeat the treaty by a straight vote disapproval; the popular demand for peace was too compellin He did hope to attach a number of amendments or reservation which would attract the support of the die-hard enemies Wilson and the Covenant, and which would protect the "interests and safety of the United States." This policy he carrie through successfully, aided by the President's illness and hi

usal to consider any compromise. On Sept. 10 1919 Lodge
esented the report of the committee to the Senate, which
ally adopted 15 reservations to the treaty. When, on Nov.
., the treaty with these reservations was voted upon, 42 Demo-
its, of whom nearly all approved the Covenant and treaty
t objected to the reservations, voted against it. It was
cordingly defeated, 39–55. A motion for ratification without
ervations was lost, 38–53. Efforts to secure a compromise
lowed but proved unsuccessful. Wilson refused to accept the
dge reservations, and Lodge was able to hold his group firm
refusing to pass the treaty without reservations. His tactical
ccess was unquestionable when on Mar. 19 1920 the treaty,
ich had been reintroduced, failed to secure the necessary two-
irds vote of the Senate by seven votes, for it was lost through
e votes of Democratic Senators who voted against it at the
sh of the President. Senator Lodge himself was doubtless
cere in his willingness that the treaty should pass, with his
ervations attached, but he later expressed relief that it had
led; writing only a month before his death he seemed con-
ced that "the League cannot do anything to stop wars."

As the successful leader of the opposition to Wilson, Lodge's
estige was increased and his influence in the succeeding ad-
nistration was for a time great. He served as permanent
airman of the Republican National Convention in 1920, and
one of the four U.S. delegates at the Washington Conference
the Limitation of Armaments in 1921. Thereafter his in-
ence waned to some extent, especially after he opposed
rding's proposal for joining the World Court. He was re-
cted to the Senate in 1922 by a narrow margin; under Cool-
ge, although leader of the Senate, he did not work in close
-operation with the President. He died at Nahant, Mass., on
v. 9 1924 at the age of 74.

Senator Lodge was one of the great Congressional figures of
e last decade of the 19th and the first two decades of the 20th
nturies. Reputed cold and distant in manner, a "Boston
ahmin," he enjoyed the prestige indicated by his popular
pellation, the "scholar in politics," and held the respect of his
leagues on both sides of the Senate, who admired his ability
a debater, his tactical skill upon the floor, and the knowledge
d experience which he brought to prolonged and assiduous
our in committee. An historical writer of high reputation and
ductivity, fate denied him the opportunity to become re-
nsible for great legislative measures and forced him at the
ex of his career into the rôle of critic. (C. SEY.)

ODGE, SIR OLIVER JOSEPH (1851–), British scientist,
e 16.860). After 1910 Sir Oliver Lodge became increasingly
minent as a leader of psychical research and a strong believer
the possibility of communicating with the dead, and he dis-
guished himself more than any scientist of his time in the
ious endeavour to reconcile science and religion. Among his
blications dealing with this subject are *The Survival of Man*
09); *Reason and Belief*, 3rd ed. (1911); *The War and After*
15); *Raymond, or Life and Death* (1916), a memoir of his son
ed in the World War, with an account of communications
ieved to have been received from him since; *Christopher: a
dy in Human Personality* (1918). Early in 1920 he made an
ensive lecturing tour of the United States, having just pre-
usly retired from his post as principal of Birmingham University;
d a few years later he published a series of popular scientific
ks of which the best known are *The Making of Man* (1924),
her and Reality (1925), *Relativity* (1925), and *Talks about
reless* (1925). In 1919 he received the Albert Medal of the
yal Society of Arts for his pioneer work in wireless telegraphy.
was president of the British Association in 1913–4, and of the
dio Society of Great Britain in 1925, and had been an F.R.S.
ce 1902.

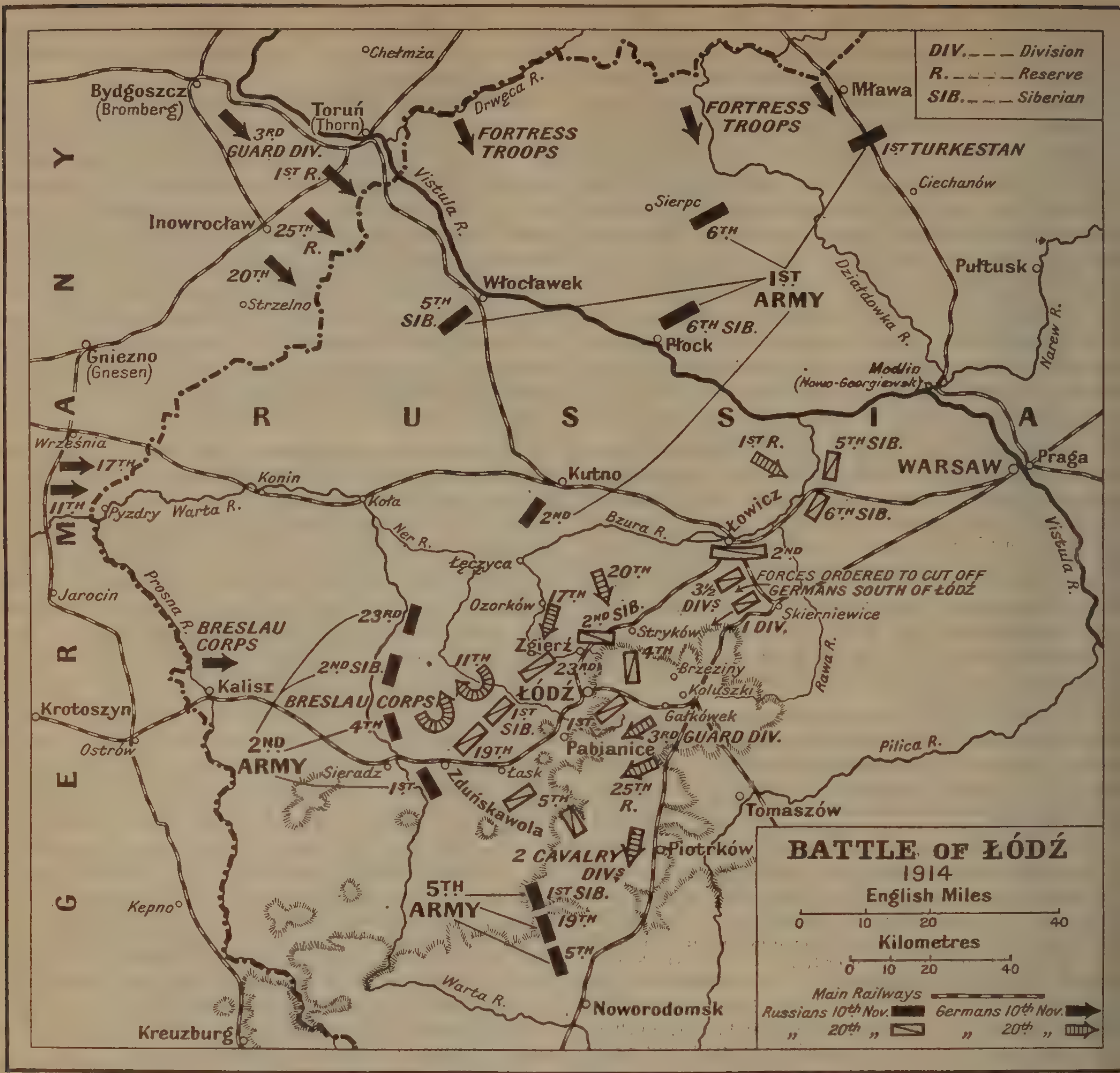
ÓDŹ, Poland (*see* 16.862), the most important centre of cotton
d woollen manufacture in the country before the World War,
been deprived of its former outlet in the Russian Empire,
cotton spinning and weaving remains its most important
ustry. Łódź had a population of 451,813 in 1921, of whom
% were Poles and some 180,000 Jews. An exchange has been
established, and a school of social and economic studies was opened in 1925. Work on the drainage system and gas-works was to have begun in 1924. Łódź became the seat of a Roman Catholic bishop in 1920.

ŁÓDŹ-CRACOW, BATTLES OF.—The repulse at the end of Oct. 1914 of their first offensive in Poland (*see* VISTULA-SAN) placed the Germans in a perilous position on the Eastern Front. The Austrian armies were again in retreat, and were rapidly becoming demoralised; the Germans themselves, on the northern part of the Eastern Front, were greatly outnumbered and could expect no considerable reinforcement till the Ypres battle in the west had been decided. The evident intention of the Russian Commander-in-Chief, the Grand Duke Nicholas, was to advance on the great industrial region of Silesia. In their retreat from Warsaw and Poland the Germans had done their best by elaborate destruction of communications to impose as slow a rate as possible on this advance; but their numbers were insufficient to stem the oncoming tide of Russia's hordes by a direct defence. Invasion of German territory might be slow, but it seemed inevitable.

Ludendorff's Plan.—The German High Command solved their portion of the problem by placing Hindenburg, commander of the IX. Army, in charge of all German forces on the Eastern Front (VIII. and IX. Armies and Woyrsch's detachment) and instructing him to do his best without immediate reinforcement. Hindenburg kept Ludendorff as his chief of staff, and the latter at once proposed a characteristically bold solution. This was to withdraw the IX. Army from central and southern Poland and, taking advantage of the excellent railway system, to transfer it north to a base between Posen and Toruń (Thorn), from which to strike a blow at the Grand Duke's communications as he advanced southwest on Silesia. The plan was an audacious one. In the first place it left the direct route to the enemy's objective, the province of Silesia, barred only by the unreliable Austrians and by weak German elements. Ludendorff trusted to the destroyed communications and to the customary Russian sluggishness of manoeuvre for time sufficient to carry out the contemplated counterstroke. Secondly, East Prussia, again threatened by invasion, would be further denuded of defenders, for Ludendorff proposed to call on the VIII. Army to furnish a quota to his striking force. Lastly, the manoeuvre involved thrusting a body of between five and six corps within reach of Russian forces twice that size, and the greater the success of the blow, the deeper the penetration into the Russian rear, the heavier would be the weight of the enemy masses concentrated on it. But the result of the battle of Tannenberg had been to persuade Hindenburg and Ludendorff that disparity in numbers could be largely discounted with the Russians as foes.

Disposition of the Russian Forces.—On the Russian side, the first fortnight of Nov. 1914 saw the high-water mark of that onward sweep towards Germany of Russia's exhaustless masses, on which the Allies had built such high hopes. There were at this time eight Russian armies deployed. The X. Army, which had replaced the defeated I. Army on the eastern frontier of East Prussia, had begun to move forward. The I. and II. Armies, to the northwest and west of Warsaw, protected the flank of the main advance by the V., IV. and IX. Armies; on the south, the III. and VIII. Armies covered the left flank by pressure on the Austrian main forces in the direction of Cracow. But progress was slow, hampered by difficulties of supply; and already the Russians were beginning to feel that shortage of munitions and of trained drafts which was to lead to their disasters of 1915. Their armies were strung out in linear formation and no central reserves were available.

The point of attack chosen by Ludendorff for the IX. Army under Mackensen, which now comprised $5\frac{1}{2}$ corps and two cavalry divisions, was the junction between the I. and II. Russian Armies. The Vistula and Warta rivers, to east and west, would protect the flanks of the German advance. To prevent any transfer of Russian forces from north of the Vistula, a detachment, mainly of fortress troops, was to advance on Mława, while another pushed up the right bank of the river towards Płock.


BATTLE OF ŁÓDŹ
1914
English Miles
0 10 20 40
Kilometres
0 10 20 40
Main Railways
Russians 10th Nov.
Germans 10th Nov.
" 20th "
" 20th "
DIV. Division
R. Reserve
SIB. Siberian
GERMANY
RUSSIA
Chełmża
Bydgoszcz (Bromberg)
Toruń (Thorn)
Drwęca R.
Mława
FORTRESS TROOPS
FORTRESS TROOPS
1ST TURKESTAN
3RD GUARD DIV.
1ST R.
Vistula R.
Ciechanów
Sierpc
6TH
Inowrocław
25TH R.
20TH
Strzelno
Włocławek
5TH SIB.
1ST ARMY
6TH SIB.
Płock
Działdowka R.
Pułtusk
Narew R.
Gniezno (Gnesen)
Modlin (Nowo-Georgiewsk)
Września
17TH
11TH
Pyzdry
Warta R.
Konin
Koła
Kutno
1ST R.
5TH SIB.
WARSAW
Praga
2ND
Bzura R.
Łowicz
6TH SIB.
Vistula R.
Ner R.
Łęczyca
2ND
FORCES ORDERED TO CUT OFF GERMANS SOUTH OF ŁÓDŹ
Jarocin
Prosna R.
20TH
3½ DIVS
Skierniewice
Ozorków
17TH
2ND SIB.
Stryków
1 DIV.
BRESLAU CORPS
23RD
Zgierz
4TH
Rawa R.
2ND SIB.
11TH
23RD
Brzeziny
Kalisz
BRESLAU CORPS
ŁÓDŹ
Koluszki
Krotoszyn
4TH
1ST SIB.
1ST
Gałkówek
3RD GUARD DIV.
Ostrów
2ND ARMY
19TH
Pabianice
Pilica R.
Sieradz
1ST
Łask
25TH R.
Zduńska Wola
5TH
Tomaszów
2 CAVALRY DIVS
Piotrków
Kepno
5TH ARMY
1ST SIB.
19TH
5TH
Warta R.
Noworodomsk
Kreuzburg

The Russian I. Army was spread over a wide front with three corps north of the Vistula between Mława and Płock and two corps south of the river—the V. Siberian at Włocławek and the II. Corps (lately transferred from the II. Army) between Kutno and Łęczyca. The II. Army was on the Warta, west of Lódź, directed on Kalisz. The V. Army was on the left of the II. and was approaching the upper Warta.

First Battle of Lódź.—Mackensen began his advance on Nov. 11. On the 12th the isolated Siberian V. Corps at Włocławek was overwhelmed and driven back on Płock. Two days later the II. Corps acting as a link between the I. and II. Armies about Kutno, and the XXIII., the right corps of the II. Army, were defeated by greatly superior numbers and driven south. Scheidemann, commander of the Russian II. Army, now tried to wheel his corps from their line on the Warta to a position northeast of Lódź, the chief manufacturing town of Poland. But the German movements were too sure and rapid for the ponderous Russian counter-march. The columns of the II. Army were attacked in turn as they came up and were thrown back on Lódź.

Meanwhile the two defeated corps of the I. Army, now joined by the Siberian VI. Corps from north of the Vistula, were forced back towards Warsaw and away from Lódź. Into the gap between the two Russian armies Mackensen thrust three divisions, the two of the XXV. Res. Corps and the 3rd Guard Div. a his two cavalry divisions, with instructions to pass round t right flank of the II. Army and encircle Lódź from the sou A corps formed from the Breslau garrison, which had now co up from the west, was to turn the left wing of the Russian Army, pinned in front by the attacks of the German XI., XV and XX. Corps. Ludendorff was aiming at a second Tann berg, in which Scheidemann's army was to fill the same rôle had the unfortunate Samsonov's. The I. Res. Corps meanwh was by persistent attack to prevent the I. Army from int vening.

By Nov. 18 the position of the Russian II. Army seemed we nigh desperate. It was being driven into a narrow semi-cir round Lódź with both flanks turned, and was becoming exhaust and dispirited. But help from the V. Army was now close hand. Plehve, its commander, on receiving orders to turn ba to the assistance of the II. Army, acted promptly and with res lution. He attempted to rail one division north to Skierniewi but only one regiment got through before Mackensen's caval cut the line. The rest of the division came into action Nov. 19, south of Lódź against the turning movement of t German XXV. Res. Corps. The whole of the remainder the V. Army marched north on the 18th, the gap it left on t

. Army's right being filled with cavalry. That same night the berian I. Corps relieved the pressure on Scheidemann's left by successful attack on the German XI. Corps. Next day the X. Corps routed the Breslau troops. This restored the situa- n on the west side of Łódź; but to the east and south of the wn Schaffer's XXV. Res. Corps and 3rd Guard Div. were still vancing. By the evening of Nov. 20 they had completely rned the right of the Russian II. Army and were attacking dź from the south.

During Nov. 21 Ludendorff persisted in a last effort to accom- sh the destruction of the Russian II. Army, but the attacks finitely failed. By the 22nd the tables had been turned, and haffer's force was itself completely surrounded. While part of ehve's army, after rescuing the left of the II. Army, turned to tack Schaffer's group south of Łódź, Rennenkampf, the com- ander of the I. Army, had been ordered to despatch forces om Łowicz and Skierniewice to gain touch with the II. Army d close the German line of retreat to the north. The Łowicz rce, which consisted of 3½ divisions, started on Nov. 20 and by e evening of the 22nd, in spite of three changes of command and different staff work, had captured Stryków and Brzeziny, and d apparently sealed the gap between the Russian I. and II. mies. The Russians actually ordered up 18 trains to remove e anticipated harvest of prisoners. The Skierniewice column a division and a regiment accomplished nothing.

Escape of Schaffer's Force.—In the evening of the 22nd, Schaf- r, heavily engaged with part of Plehve's army, south of Łódź, ceived a wireless order from Mackensen to cut his way out by zeziny. During the night of Nov. 22, in intense cold, he suc- eded in slipping from the grasp of the enemy opposing him and ncentrating his weary divisions to make their bid for release. known to him, the Russians had already opened a breach. e centre columns of the Łowicz force had marched on to Łódź, ving the left column, the Siberian 6th Div., isolated west of oluszki on the Warsaw-Łódź railway. This division fought llantly during Nov. 23 and repulsed all efforts of the XXV. s. Corps to escape. Further west, however, the 3rd Guard v. moving through the Galkówek forests, found the gap in e Russian net and captured Brzeziny in the early hours of ov. 24. Encouraged by this success, the XXV. Corps renewed efforts against the hapless Siberian 6th Div., whose appeals help were disregarded by other Russian formations within sy reach of the battlefield. Finally, the division, with both nks turned and overborne by weight of numbers, broke and t the way open for the XXV. Res. Corps to rejoin the 3rd ard Div. at Brzeziny. Schaffer's line of retreat was now ar, and on the 25th his whole force, moving by Stryków, re- ned Mackensen. He brought with him several thousands of soners and a number of captured guns.

Effect of the Battle.—Ludendorff's bold stroke had stopped the and duke's intended invasion of Silesia as effectively as Sir hn Moore, by a similar move, had halted Napoleon's incursion o Spain a little more than 100 years before. Never again ring the War were the Russians in a position to threaten Ger- n territory. The campaign shows well the value of mobility a strategical weapon. On Oct. 26 the IX. Army was engaged posite Warsaw during Hindenburg's first offensive. During e next fortnight it retired 120 m. destroying the communica- ns as it went; reorganised and repaired its losses; was trans- rred by railway across the enemy front; and deployed in com- te fighting trim for its new offensive on Nov. 11. This shows rman organisation and efficiency at its highest. The quality German leadership was also well-displayed, and was in strong ntrast with the irresolution and inertia shown by some of the ssian commanders.

Schaffer's exploit was a masterly one; within a few hours of ceiving his orders to retire, he had succeeded in breaking off ion and setting his columns in motion to seek a way to safety, ich his determination and the fine fighting spirit of his troops s to win. Compare this with the inaction of many of the ssian commanders, particularly the failure of the numerous dies within reach to come to the rescue of the Siberian 6th Div. on Nov. 23. Ludendorff had owed much to Rennenkampf's passivity for his victory at Tannenberg; here again Rennenkampf's inefficiency and lack of the will to victory saved him from the loss of Schaffer's force which his rashness and obstinacy had exposed. Yet Rennenkampf had been accounted a dashing leader of men before the War. The Grand Duke himself, Ruzski (the commander of the Northwest Front), and Plehve, who hid an iron will in a weak and wizened frame, all acted promptly and with determination to take advantage of the opportunity.

Second Battle of Łódź: Dec. 1–15.—At the end of Nov. Hindenburg received reinforcements of four corps from the west, released by the termination of the first battle of Ypres. He now advanced again and captured Łódź on Dec. 6 and Łowicz on Dec. 15. The Russians fell back to the Bzura-Rawka river line in front of Warsaw, which they were to hold until Aug. 1915. Meantime an attack by the Austrian II. Army towards Piotrków in the first week of Dec. had been repulsed.

Battles round Cracow: Nov. 15–Dec. 25.—While the fighting round Łódź was taking place in the north, fierce battles were being waged in southeast Poland and western Galicia between the Austrian main armies and the Russian left wing. These battles were indecisive in their results and have less interest, strategically and tactically, than the battles round Łódź.

After the fighting on the San and round Dęblin (Iwangórod) in the latter part of Oct. the Austrian I. and IV. Armies fell back gradually on Cracow, followed up slowly by the Russian IV. and IX. Armies. The Austrian II. Army (two corps), was railed north to fill the gap on the left of Woyrsch's force caused by the withdrawal of the German IX. Army for Hindenburg's counterstroke in north Poland. The front of the II. Army was taken over by the III. Army, which now held the line of the Carpathians as far east as the Uzsok pass. The eastern Carpathians down to the Bukowina were guarded by Pflanzer-Baltin's group. To defend western Galicia between the fortress of Cracow and the Carpathians, a group consisting of the XI. Corps and some cavalry was formed and took up station on the line of the middle Dunajec. The Austrian plan was to meet the expected attack towards Silesia of the Russian V., IV. and IX. Armies with Woyrsch's army and the I. Army, while the II. Army from the north and the IV. Army from the south wheeled against the enemy's flanks.

The Russian advance was slower and more cautious than had been expected; their V. Army had to turn about on Nov. 17 to rescue the II. Army at Łódź; while the IV. and IX. Armies on approaching Cracow halted for the III. Army in Galicia to come forward and invest the fortress. On Nov. 17, therefore, as soon as the Austrian II. Army had completed its detrainment and come up into line, the Austrian armies north of the Vistula took the offensive. A week of attack and counter-attack followed with little advantage to either side. Radko-Dimitriev's III. Army had meanwhile come up to the Dunajec; he passed one corps over to the north of the Vistula to enable the IX. Army to parry the thrust at its left flank of the Austrian IV. Army; with the remainder he drove back the Austrian XI. Corps to a defended position east of Cracow.

Final Encounters of 1914.—Conrad, the Austrian chief of the general staff, now planned a new combination. He passed part of the IV. Army over by rail to the left wing of the Austrian III. Army near Limanowa for a counter-stroke at Radko-Dimitriev's left. This was made on Dec. 3, and the fighting soon became general along the whole front between the Vistula and the Carpathians. Brusilov's VIII. Army, facing the Austrian III. Army along the Carpathians, sent a corps by Nowy Sacz to the assistance of Radko-Dimitriev, but was thereafter itself heavily attacked. On Dec. 15, after the loss of Łódź and Łowicz in the north, the Grand Duke issued orders for a general withdrawal in South Poland and Galicia to winter lines. The V., IV. and IX. Armies fell back to the Nida line, and the III. Army to the Dunajec. Brusilov's VIII. Army, however, on the extreme left, counter-attacked the Austrian III. Army between Dec. 18 and 25 and drove it back to its former position in the Carpathians (battle of Jasto). This brought to an end the campaigns of 1914.

The Russian "steam-roller," which the Allies in the West had so confidently expected to see smashing over its foes with irresistible, if deliberate, momentum, had come to a standstill for want of fuel. The Grand Duke's decision in the middle of Dec. to break off battle and retire was occasioned mainly by the shortage of munitions and the impossibility of keeping the ranks filled with trained drafts to replace the heavy wastage due principally to that very lack of a sufficiency of shells and other material of war. But the Russians had most loyally done their best under great disadvantages to live up to the expectations which their allies had formed of them. It was the machine, antiquated and behind the age, that fell short of the stern requirements of modern war.

BIBLIOGRAPHY.—C. von Wulffen, *Schlacht bei Lody, 1914* (1918); Sir A. W. F. Knox, *With the Russian Army, 1914–7* (1921); E. Ludendorff, *My War Memories* (1922); J. Daniloff, *Russland im Weltkriege, 1914–5* (1925). (*See* also WORLD WAR: BIBLIOGRAPHY; and article EASTERN FRONT with map.) (A. P. W.)

LOEB, JACQUES (1859–1924), American physiologist, was born in Alsace, France, April 7 1859. Graduating at Ascanisches Gymnasium, Berlin, he studied medicine in Munich and Strasbourg (M.D., 1884). He was assistant in physiology at the universities of Wurtzburg (1886–8) and Strasbourg (1888–90), working also at the Naples biological station from 1889–91. He went to the United States in 1891 and taught biology at Bryn Mawr for a year. He became assistant professor of physiology and experimental biology at the University of Chicago in 1892, being appointed associate professor in 1895 and professor in 1900. In 1902 he became professor of physiology at the University of California. From 1910 to the date of his death he was head of the division of general physiology at the Rockefeller Institute for Medical Research. He died at Hamilton, Bermuda, Feb. 11 1924. Dr. Loeb's work was chiefly directed to a pursuit of the real distinction between living and dead matter, the thesis upon which he worked being that all living things are chemical machines and that their workings are open to the same mechanistic explanation as are those of any machines made of inert matter. Among his published works are *The Heliotropism of Animals and Its Identity with the Heliotropism of Plants* (1890); *Physiological Morphology* in 2 vol. (1891–2); *Comparative Physiology of the Brain and Comparative Psychology* (1900); *Studies in General Physiology* (1906); *The Dynamics of Living Matter* (1906); *The Mechanistic Conception of Life* (1912); *Artificial Parthenogenesis and Fertilisation* (1913); *The Organism as a Whole* (1916); *Forced Movements: Tropisms and Animal Conduct* (1918).

LOEB, JAMES (1867–), American banker and philanthropist, was born in New York City Aug. 6 1867. On his graduation from Harvard College in 1888, he became a member of the firm of Kuhn, Loeb & Co., bankers, New York City, retiring from business in 1901. In 1905 he founded and endowed the Institute of Musical Art in New York City. He devoted much of his time to classical archaeology. He was the founder of the Loeb Classical Library of Latin and Greek authors, works which give text and translation on adjacent pages. The first volume appeared in 1912. He was instrumental in founding the Deutsche Forschungsanstalt für Psychiatrie, an institution in Munich for the systematic study of the causes of mental diseases. He translated from the French: P. Decharme's *Euripides and the Spirit of His Dramas* (1906), M. Croiset's *Aristophanes and the Political Parties at Athens* (1909) and P. L. Legrand's *Daos* (1917).

LOGIC (*see* 16.879).—The most important contributions to logic during the pre-War years, 1911–4, are to be found in two works of H. Driesch, *Ordnungslehre* (1912) and *Die Logik als Aufgabe* (1913), in the *Encyclopaedia of Philosophical Sciences*, vol. 1, *Logic* (1913), and in the new, enlarged edition of B. Bosanquet's *Logic, or the Morphology of Knowledge*, 2nd ed. (1911). J. M. Baldwin's *Genetic Logic*, vol. 3 (1911) only carried a stage further the work which was inaugurated five years earlier; Miss E. E. C. Jones' *New Law of Thought* (1910, etc.) was of limited interest; P. Coffey's *Science of Logic* (1912) was intended as a textbook for Catholic students; C. A. Mercier's *New Logic* (1912)
and F. C. S. Schiller's *Formal Logic* (1912) display more c
tempt than understanding for traditional logic.

Like other human pursuits logic suffered during the W
War. The years 1915–8 are almost a blank in the history
logic—J. Dewey's *Essays in Experimental Logic* (1916) be
mainly a collection of older essays, and A. E. Davies' *Textb*
of Logic (1915) being only a textbook.

WRITERS AND THEIR VIEWS

Driesch.—According to Driesch, logic is the theory of or
The theory of order results from self-reflection. Its most c
prehensive principle is that of the economy of assertions. T
principle is not merely a matter of convenience, but expres
the essential nature of thought. In this respect Driesch dif
from Avenarius and Mach. According to Driesch the fun
mental truth of philosophy is "I think something." Now wh
ever is thought is thought to be orderly; and the task of logi
to ascertain what makes experience orderly. Thought is alw
directed to problems, which it endeavours to solve by plac
them in some orderly system. It is with the help of thought t
life achieves progressive orderliness.

Royce.—Of the six essays on logic contained in the first v
ume of the *Encyclopaedia of the Philosophical Sciences* the m
important is that by J. Royce, who, like Driesch, tries to tr
logic as a science of order. In his account of induction, he den
that inductive reasoning is guided by the principle of the u
formity of nature, or by the principle of sufficient reason. Neith
helps the investigator to decide whether, or to what extent,
may generalise in a given case. According to Royce the valid
of induction rests on the assumption of some order in the obje
investigated, and the reliability of a "fair sample" as a mea
of judging a whole range of facts. A fair sample is one chos
without bias. Of such samples, he maintains, there are alwa
more that more or less resemble the whole than such as dif
widely from it; so that judging a whole range of facts by mea
of a random sample is more often approximately right th
wholly wrong. The chief advantage of mathematical sciences
that the mathematical results deducible from hypotheses needi
verification present a vast range of samples, and the precision
mathematical concepts renders it easy to decide whether
observed sample agrees with the anticipated result.

Bosanquet.—The new edition of Bosanquet's *Logic* contai
considerable additions. Book II., Chapter 8, deals with the cri
cism that his theory of judgment commits him from the sta
to metaphysical absolutism. If every judgment qualifies reali
by an abstract universal, and no combination of such universa
can confer particular individuality, there can be but one ultima
individual to which all predicates belong. This is absolutis
Bosanquet retorts that no finite individual is self-dependent
self-contained, that is, a real substance. Even the self finds
reality in something beyond itself. But an individual not se
complete can be predicated of the whole of which it is a par
Chapter 9 discusses criticisms of the coherence theory of trut
Bosanquet maintains that Truth is its own criterion—it ca
only be tested by more of itself. Any system can be tested fu
ther only by being made more complete. The view that truth
only an adaptation to vital needs, is claimed by Bosanquet
be the same view in principle. But while approving the attem
to claim for logic the realm of life and practice, and to apply th
general idea of natural selection to the development of though
Bosanquet protests against the narrow conception of practi
which limits it to external action.

Intimately connected with the coherence theory of truth
his subsequent book on *Implication and Linear Inference* (1920
According to this all inference is of the same type, namely, in
plication. The essence of implication is interrelation betwee
the parts of a system (or concrete universal), which makes mo
ification in some parts clues to the modification of others. Sy
logistic inference is linear, not systematic, and therefore not tru
inference. In true inference we survey a system of facts, see i
in its relation to the whole of reality, and read off the implic
tions. The inference is immediate if we can read off the implic

ions directly; it is mediate if we must construct this system rst. The starting-point of all inference is the realisation that o deny the truth of *all* propositions would involve self-contra-iction, denying this very denial. We must consequently believe *ome* propositions, even if we question the truth of this or that roposition. In true inference we transfer our certainty that *ome* propositions are true to the truth of the proposition inerred. In the last resort, all inferences may be reduced to the lternatives: "Either this proposition is true, or no proposition s." Within the system from which we start we read off conlusions the denial of which would shatter the whole world of ur experience.

Bradley.—The philosophical absolutism of Bosanquet is also mphasised in F. H. Bradley's *Essays on Truth and Reality* 1914) and in the new edition of his *Principles of Logic* (pubshed in 1922 with numerous additions). Bradley repudiates is previous assumption of ideas divorced from judgments, and f judgments divorced from inference. The concrete conceptual act is inference, of which mere ideas and simple judgments are are abstractions. Inference is the ideal self-development of a iven object taken as real. The given object is an ideal content efore us, and it is taken to be real as being in one with reality, r the real universe. The possibility of inference rests upon the act that the object is not only itself, but is also contained as an lement in a whole; in fact, it *is* itself only as being so contained. rom the nature of the case inference must always be incomplete, nd subject to unknown conditions. But this ultimate problem oes not concern logic.

Other Writers.—Among new editions of older books on logic nention may also be made of H. W. B. Joseph's *Introduction to ogic*, 2nd ed. (1916), W. Wundt's *Logik* (3 vol., 4th edition, 919–21), L. T. Hobhouse's *Theory of Knowledge* (1921) and . Höfler's *Logik* (1922). Wundt's *Logik* has not undergone any adical changes, and retains its important place. Hobhouse easserts his fundamental principles that the systematic interonnection of judgments is the true line of advance in the interretation of reality, and that the categorical judgment asserts a eality independent of itself. Höfler's *Logik* is practically a new ook. While excluding epistemology it includes a good deal of sychology and philosophy. More particularly it shows the nfluence of A. Meinong's *Gegenstandslehre*, which distinguishes existence" from "being," of which it is only one species. Vhatever is false has being, but not the being of what is true. n the whole, Höfler defends traditional logic, holding that the yllogism, for instance, formulates a kind of reasoning actually sed in practical life, even if there are also other forms of reasonng. One of the novelties of the book is the classification of udgments into four classes according to their evidence, namely,) those immediately evident and certain, (2) those mediately vident and certain, (3) those immediately evident and probable, nd (4) those mediately evident and probable. The book also ontains a number of essays on logistics by E. Mally.

Johnson —The most ambitious new work on logic during the eriod 1911–25 is that of W. E. Johnson. His *Logic* is planned four parts and is intended to cover the whole field. (Part I. ppeared in 1921, Part II. in 1922 and Part III. in 1924; Part V. has not appeared yet.) Logic is conceived to be concerned ith the analysis and criticism of thought, and it is considered npossible to draw a rigid distinction between logic and philosphy, or between logic and science. In thought he distinguishes vo aspects, an epistemic and a constitutive aspect. The conitutive aspect consists of the content of knowledge (which has self a logically analysable form); the epistemic aspect is that hich depends on the variable conditions and capacities for the cquisition of knowledge. The unit of logic is the proposition r that of which truth and falsity can be significantly prediated). In contrast with the rather common class-interpretation propositions, Johnson lays stress on the intensive aspect. Implication" is potential inference, and assumes different elations in different cases. There are two principles of deducve inference:—(1) The applicative principle states that a propsition of the form *All S is P* warrants the inference of a proposition of the form *The given S is P*. (2) The implicative principle states that a compound proposition of the form '*x*' *and* '*x implies y*' warrants the inference of a proposition of the form '*y*'. The syllogism involves both principles. The following argument may illustrate each of the two principles and their combination in the syllogism:

(1) Applicative principle	All quadrilaterals have their opposite sides equal, if they are parallel (every MP is p if m). ∴ The quadrilateral ABCD has its opposite sides equal, if they are parallel (the given MP is p if m).
(2) Implicative principle	The quadrilateral ABCD has its opposite sides paralled (the given MP is m). ∴ The quadrilateral ABCD has its opposite sides equal (the given MP is p).

Johnson distinguishes between the constitutive and the epistemic conditions of valid inference. The constitutive condition is that the premises must be *true* and must *imply* the conclusion. The epistemic condition is that the thinker must be in a position to *know* that the premises are true, and that they imply the conclusion, without having to know beforehand that the conclusion is true. But now, the two principles of deductive inference require universal premises. How are these obtained? Johnson says, by *induction*. But he uses the term induction in an unusually wide sense, namely:—for any process of starting from certain instantial premises and reaching a generalisation. He formulates four types of induction, namely:— (1) *intuitive*, (2) *summary*, (3) *demonstrative* and (4) *probable*. Of these the last corresponds to ordinary empirical induction; and *summary* induction corresponds to so-called perfect induction. By *intuitive* induction Johnson means the process by which we obtain the fundamental principles of inference and the axioms of pure logic, mathematics, etc. It is not suggested that these are merely empirical generalisations, but that they are obtained by reflection on particular instances of them. This may happen in two ways:— (1) the *counter-applicative* way, when we can see that what is true of this instance is true of any other instance, and (2) the *counter-implicative* way, when, having made a particular inference which is valid, we can see that its validity is due to a certain type of formal relation which holds between the premises and the conclusion. These modes of procedure cannot be safely applied without special insight into the subject-matter of the investigation.

Under *demonstrative* induction are included certain types of hypothetical syllogism in which the instantial premise leads to a universal conclusion. For example:— "Every specimen of argon has some the same atomic weight. This specimen of argon has atomic weight 39·9. Therefore, every specimen of argon has atomic weight 39·9." Under the same head Johnson also includes the familiar canons of induction as reformulated by himself in four figures of agreement, difference, composition and resolution. Of *problematic* induction there are two varieties. There is *pure generalisation*, that "All things which are *m* are *p*," if all the observed things which were *m* were also *p*; and there is *class-fractional* induction (usually called statistical generalisation), that "a certain proportion of things which are *m* are also *p*," that proportion having been noted in the observed cases. From all these forms of induction Johnson distinguishes under the name of *Eduction*, the argument from "certain instances of *s* which are *m* are *p*" to "the next *s* that is *m* will also be *p*." The discussion of various psychological and metaphysical problems is a striking feature of Johnson's *Logic*.

The only other contemporary attempt at a comprehensive logic is Th. Ziehen's *Lehrbuch der Logik auf positivistischer Grundlage*, etc. (1920). This treatise contains not only much that is psychological and metaphysical but also a history of logic, which is perhaps the most useful part of it.

On the whole, logic has not yet reached the stage of having clearly defined boundaries, and is apt to trespass on the domains of mathematics and psychology, of epistemology and ontology, according to the taste of the writer. Its state is like that of Israel under the Judges, every man doeth that which is right in his own eyes. There are signs, however, that the necessary differentiation may come about in another way. There is a marked tendency towards a greater division of labour, as may be seen from the number of treatises devoted entirely to special groups of logical problems, such as those of formal-symbolic inference (or logistic), the methodology of the sciences, the theory of knowledge (or epistemology) at the basis of science, etc.

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LOGUE, MICHAEL (1840–1924), Irish ecclesiastic, was born at Kilmacrenan, Co. Donegal, Oct. 1 1840. He was appointed professor of theology and belles-lettres at the Irish College in Paris, where he was ordained a priest in 1866. He became Bishop of Raphoe in 1879, archbishop of Armagh in 1887, and in 1893 was raised to the cardinalate. During the World War he deprecated participation by the clergy in Sinn Fein agitations, but in 1918 opposed conscription on moral grounds. In 1919 and 1921 he rigorously denounced the campaign of murder against the police and the military, at the same time criticising severely the policy and methods of the British Government. He died at Armagh Nov. 19 1924.

LONDON, JACK (1876–1916), American novelist, was born at San Francisco Jan 12 1876, and educated at the University of California. A born adventurer, he went to sea at the age of 17 and served before the mast. He went with the first rush to Klondike in 1897 and tramped across the States and Canada, being in gaol more than once as a vagabond. In 1904 he went to Japan as war correspondent, and in 1914 to Mexico in the same capacity. In 1906 he started on a voyage round the world in a 50-ft. ketch-rigged yacht and disappeared for two years. His novels, for the most part published first in London, reflect his wild, adventurous life, the best known being *The Son of the Wolf* (1900); *The Call of the Wild* (1903); *Moon Face* (1906); *Martin Eden* (1909); *South Sea Tales* (1912); and his last, *The Little Lady of the Big House* (1916). He died at Glen Ellen, Cal., Nov. 22 1916. See *The Book of Jack London* (1921), by his wife, Charmian London.

LONDON (*see* 16.938).—Greater London had, in 1926, a population of about 7,500,000 persons, but nothing has occurred in the years since 1910 to alter materially the story of its site, although under the heading of climate some diminution in the density of its fogs may be noted.

Divisions, Buildings and Communications

The characteristic divisions so well marked in the past have been gradually broken down since the close of the War, and for various reasons many large private houses have been converted into flats, maisonettes, boarding-houses, and, nearer the centre, business premises. The residential turnover is most marked in regions north and south of Hyde Park, while in boroughs such as Hackney or Stepney or those lining the south bank of the river the tendency is towards the intrusion of business. In the suburbs, after the complete cessation of house building, growth has been resumed, and has been fostered by the electrification of railways or the extension of railways previously electrifie and the development of motor transport. An interesting featur before the War was the establishment of the Hampstead Garde Suburb in the north of London, in which the houses were limite to eight per acre. A very important factor in the developmen of Greater London was the passing of the Unemployment (Relief Works) Act of 1920, designed to benefit ex-service men which permitted land required for new roads to be entered upo within seven days. Under this Act it was possible to provide i the outer area many of the urgently required main and relie roads before access to the centre was hopelessly blocked by th multiplication of housing schemes.

The period since 1910 included also some very important change in the aspect of the streets in the central area, the greates perhaps being the passing of Nash's Regent street and Quadrant All idea of a unified scheme for rebuilding was abandoned excep for the Quadrant itself, where an adaptation of the plan o Shaw's Piccadilly Hotel was followed. The widening of th Strand advanced considerably, and the Kingsway and Aldwyc improvement initiated in 1899 was brought appreciably nearer conclusion. Other improvements completed included the Woolwic Tunnel in 1912 and the opening from Trafalgar Square into th Mall by way of the Admiralty Arch. Cross-river communications were improved by the reconstruction of Southwark Bridge while the money for a new road bridge at Lambeth was vote by the London County Council. A movement that threatene completely to alter the appearance of the western districts wa inaugurated by the sale of the garden ground in Morningto Crescent and Endsleigh Gardens, a new building on a portio of the latter open space being finished in 1926.

Parks.—Parks and open spaces continued to be added to th amenities of the city and the outer areas, the most importan including the clearance and opening to the public of a portio of the river front at Shadwell and the preservation of Prince' Square, Stepney, in the built-up area. In the outer areas progres was made in the preservation for the public enjoyment of th wooded bastion of Shooters Hill to the south-east, and an important addition to Hampstead Heath and Parliament Hil Fields on the north was secured by the purchase of a considerabl portion of Lord Mansfield's estate known as Kenwood.

Monuments.—The historical monuments of the past wer not greatly interfered with during the period, although considerable perturbation was caused by the publication of a repor containing suggestions for reorganising the work of the Churc of England in the City of London that indicated the possibl sale of 19 churches, including many designed by Wren. Late still signs of weakness appeared in the foundations of Waterlo Bridge which led to a unanimous resolution of the London County Council to remove the entire structure, action bein only delayed on the urgent representations of a number of leading professional and learned societies. The report of the expert on the steps necessary for preserving the dome of St. Paul' Cathedral led to the closing to the public in 1925 of the whol space beneath the dome and the choir. Important works o preservation were also undertaken for the roofs of Westminste Hall and the Great Hall at Hampton Court Palace.

New Buildings.—The modern architecture of the metropolis was enriched by the addition of a number of striking buildings including (to mention only a few) the new London County Hal at the east end of Westminster Bridge, the Port of London Authority home in Trinity Square, Britannic House and Adelaide House in the City, Bush House at the end of Kingsway, Australia House in Aldwych, the Wesleyan Central Hall and the Middlesex Guildhall in Westminster, the Royal Automobile Club in Pall Mall, the new north frontage of the British Museum and the headquarters of the British Medical Association in Bloomsbury. A considerable impetus was given to the production of fine street architecture by the institution of a medal by the Royal Institute of British Architects for the best street façade completed each year. The first to win the award was the new Wolseley building in Piccadilly, and the next the Shepherds Bush Pavilion. The general tendency towards change was most arked in the City area, where the spires and towers of Wren at had so long dominated the view were slowly but surely gulfed in the rising tide of commercial architecture, the most otable instance being the almost total eclipse of the view of t. Magnus spire and the Monument from London Bridge by e erection of Adelaide House.

In the west end another marked transformation was the erec-on of a huge block of millionaire flats and shops on the site of evonshire House, Piccadilly. The monuments and memorials the metropolis were added to in a marked degree, though not ways as the result of the World War, for the period included e completion of the Queen Victoria Memorial before Bucking-am Palace and the King Edward VII. Memorial in Waterloo lace. Amongst the many war memorials should be mentioned e Cenotaph in Whitehall, the Grave of the Unknown Warrior Westminster Abbey, the memorial to London's soldiers in ont of the Royal Exchange, Belgium's Gratitude and the Air orce Monument on the Embankment, and the Artillery and achine Gunners' memorials at Hyde Park Corner. Work on e Guards' Memorial on the Horse Guards Parade was started 1925. Interesting additions to the nomenclature of London ere made in various districts, particularly the revival of the ame Aldwych for the crescent section of the Holborn to Strand nprovement, and that of Petty France to the roadway in West-inster passing under the shadow of Queen Anne's Mansions.

Communications.—Communications, as far as the trunk lines rving the metropolis were concerned, received no additions, ut a vast change was almost imperceptibly carried out by the rouping of the great companies. The introduction of electri-l working on many suburban lines was another feature of is period. Although no entirely new tube was opened, the construction of the old City and South London line was ken in hand and completed, with its junction with the Hamp-ead Tube at Camden Town, and work was started on an ex-nsion of the line to Morden. The Golders Green terminus was nnected with Edgware, and a new tunnel beneath the Thames om Charing Cross to Waterloo and Kensington was also start-l. A tube was specially constructed by the Post Office for nnecting up the various sorting offices, and private proposals r an even more comprehensive system for goods traffic con-cting the various termini were laid before the Ministry of ransport. Horse traction vanished finally from the tramway stems, now operated almost entirely by the London and Mid-esex County Councils, and the L.C.C. lines were extended a tle nearer the City by being carried over the new Southwark ridge, but no lines were actually permitted through the City West End, although proposals for this were discussed.

The principal change in traffic was, however, the enormous in-ease in the number of motor omnibuses plying in the streets, ought about by the appearance of numerous independent mpanies, popularly termed "pirates," while the London Gen-al Omnibus Co. ran more frequent services and operated any fresh routes, including some running right out into the rrounding country during the summer months; and many w and improved types of omnibuses were placed on the streets, cluding a few with covered tops. The chaotic conditions intro-ced by this great increase in the number of vehicles, and by e appearance of independent omnibus companies, combined times with the operation of a great number of road repairs, me no doubt delayed by the War, finally led to a great step rward in the control of traffic, which took the form of the pointment of a London traffic advisory committee, whose ties were to advise the Ministry of Transport on matters ating to London traffic.

An important addition to the continental facilities of London s the opening of daily Air Services to Paris, Brussels and nsterdam, connecting with other services to all parts of Europe d also to Africa.

POPULATION, EDUCATION AND AMENITIES

The population of Greater London in 1911 was 7,251,358, and 1921 7,480,201; while that of the administrative county was 4,521,685 in 1911, and 4,484,523 in 1921. That of the outer ring was 2,729,673 in 1911 and 2,995,678 in 1921, while that of the City was 19,657 in 1911 and 13,709 in 1921. Greater London increased by 10·2% between 1901 and 1911, and by 3·2% between 1911 and 1921, while the county of London had decreased by 0·3% and 0·8%. The statistics for the metropolitan boroughs are as follows:—

	Area in statute ac.	Population		Increase (+) or Decrease (−)
		1911	1921	
Battersea	2,163	167,743	167,693	− 50
Bermondsey	1,503	125,903	119,455	− 6,448
Bethnal Green	760	128,183	117,238	−10,945
Camberwell	4,480	261,328	267,235	+ 5,907
Chelsea	660	66,385	63,700	− 2,685
Deptford	1,564	109,496	112,500	+ 3,004
Finsbury	587	87,923	76,019	−11,904
Fulham	1,706	153,284	157,944	+ 4,660
Greenwich	3,859	95,968	100,493	+ 4,525
Hackney	3,287	222,533	222,159	− 374
Hammersmith	2,287	121,521	130,287	+ 8,766
Hampstead	2,265	85,495	86,080	+ 585
Holborn	405	49,357	42,796	− 6,561
Islington	3,092	327,403	330,028	+ 2,625
Kensington	2,290	172,317	175,686	+ 3,369
Lambeth	4,083	298,058	302,960	+ 4,902
Lewisham	7,015	160,834	174,194	+13,360
Paddington	1,357	142,551	144,273	+ 1,722
Poplar	2,331	162,442	162,618	+ 176
St. Marylebone	1,473	118,160	104,222	−13,938
St. Pancras	2,694	218,387	210,986	− 7,401
Shoreditch	658	111,390	104,308	− 7,082
Southwark	1,131	191,907	184,388	− 7,519
Stepney	1,767	279,804	249,738	−30,066
Stoke Newington	863	50,659	52,167	+ 1,508
Wandsworth	9,107	311,360	328,656	+17,296
Westminster, City of	2,503	160,261	141,317	−18,944
Woolwich	8,282	121,376	140,403	+19,027
City of London (County Corporate)	678	19,657	13,706	− 5,951

Health and Hospitals.—The birth-rate for the administrative county was 20·9 in 1922 and 20·1 in 1923 per 1,000 population. In Greater London the figures for the same years were 20·2 and 19·5. The death-rate for the same periods in the administrative county was 13·5 and 11·4 per 1,000 population, and for Greater London 12·5 and 10·7. In the hospital world great campaigns were instituted to place the leading institutions on a firm financial basis, and considerable alterations and improvements were carried out at Westminster and St. George's amongst others, while the removal of King's College Hospital to Denmark Hill was completed. During 1925 it was decided to rebuild the Middlesex Hospital. The growing share of women in the hospital work of London was illustrated by the existence of several hospitals entirely managed by them. The activity of the London County Council was notable in the direction of the improved treatment of tuberculosis and other virulent diseases, and in the campaign against infant mortality.

Water, Lighting and Heating.—The water supply of London was largely increased by the completion in June 1925 of the huge reservoir at Littleton with a capacity of 6,750 million gallons and a water surface of 723 acres. The estimated income of the Water Board for 1925–6 from all sources was £4,695,000, and the estimated expenditure £4,809,120, but as a balance was brought forward no precept on the participating authorities was needed. The policy of the board, adopted in 1916, to save coal by chlorinating raw Thames water, some 70,000,000 tc 100,000,000 gal. per day, was entirely successful both financially and from the point of view of the public safety. The treated water is allowed to flow by gravity down the Staines aqueduct instead of being pumped into the reservoir. Figures give but little idea of the size of the board's undertaking to the average person, but it may be stated briefly that in the average daily consumption of water (about 36 gal. per head), London would empty 2½ times daily a tank as large as Trafalgar Square (two and a half acres) and as high as the Nelson Column.

An important step in the lighting (and heating) of London was the appointment under the Electricity (Supply) Act 1919 of electricity commissioners to supervise the supply of electricity under the Ministry of Transport. The electricity district as determined extends well beyond the area known as Greater London, covering 1,858 sq. m.; the current in this area being distributed by 44 local authorities and 44 private companies. That there is plenty of room for both electricity and gas in supplying the metropolis with light and heat is evident from the fact that one of the largest of the gas companies in 1925 reported an increase of 24% in its sales during the preceding 10 years.

By the end of 1922–3 the cost of the fire brigade had risen to nearly £800,000 (including pensions), and the number of calls attended, other than chimney calls, during the same period was 3,845. The curve of value of insured property in London showed a marked increase in the preceding 10 years, the total reaching over £2,000 million.

Education.—The general trend of education in London is naturally in accordance with that of the whole country, but it is interesting to note that its total cost to London during 1922–3 amounted to over £12,000,000, of which, of course, approximately half was refunded by exchequer grants, so that the actual charge on the rates amounted to a fraction over 31d. in the £1. The London County Council is the statutory authority for the administrative county of London, and the education committee of 50 includes 12 co-opted members who must be persons of experience in education and of whom five must be women. In 1925 there were 17 women members altogether on the committee. The council had not in 1925 availed themselves of the power to extend the age for compulsory attendance at school conferred on them by the Education Act of 1921.

Recreation.—The museums, art galleries, etc., requisitioned for use during the War, gradually resumed their normal functions, and a new feature was introduced in the form of guide lecturers to conduct parties round the various sections. New rooms were added to the Tate Gallery, and the British Museum was greatly enlarged by the wing to the north opened in 1914. The London Museum, on the lines of the Musée Carnavalet in Paris, was removed from Kensington Palace to Stafford (now renamed Lancaster) House owing to the generosity of Lord Leverhulme, and a special museum illustrating the development of furniture making was opened in Hoxton in 1914 in the centre of the cabinet-making district of London.

Several new theatres were opened during the early part of the period under review, including the Winter Garden in Drury Lane, the Ambassadors and St. Martin's in Seven Dials and Princes in Shaftesbury avenue. A movement was started to reconstruct the old Sadlers Wells Theatre and open it on the same lines as the "Old Vic." After the War few new theatres were built, but on the other hand there was an enormous increase in the number and size of cinematograph houses, one of which, namely, that at Shepherds Bush, as already mentioned, won the medal for the best street frontage for the year offered by the Royal Institute of British Architects.

The demand for playing pitches for games of all sorts in public recreation and other open spaces increased exceedingly, and amongst other innovations many hard courts for lawn tennis were laid down by the London County Council. Professional football was largely supported also, and the construction of the British Empire Exhibition grounds at Wembley saw the removal of the Final for the Football Assn. Cup to the Stadium. "Saturday" starts in first-class cricket, and increased interest in county cricket generally, led to considerable additions to the accommodation for spectators at both Lord's and the Oval.

The Government of the Metropolis

At the elections to the London County Council in 1919 (postponed during the War) 68 Municipal Reformers, 40 Progressives, one Independent and 15 Labour members were elected. At the 1922 elections the figures were—Municipal Reformers 82, Progressives 25, Labour 17; and in March 1925, Municipal Reformers 83, Labour 35, Progressives six. In contested elections only, the number voting in 1919 was 16·6% and 36·8% in 1922. For the metropolitan borough councils the figur were—27·9% in 1919 and 36·4% in 1922. For the guardian elections the results were much lower, being only 7·7% in 19 and 22·8% in 1922. In Dec. 1924 there were no contested ele tions for the court of common council of the City of London.

The boundaries of all the London Parliamentary borough were re-arranged by the Act of 1918, except those of the City London, the total number of constituencies being 61, each retur ing one member and the City two.

Finance.—The financial government of London was n modified to any important extent during the 15 years, althoug some temporary measures had to be adopted during the Wa A 1d. rate over the administrative area was estimated to pr duce £207,555 for 1924–5 on the statutory assessable value the county which was computed as £49,813,091 on April 6 192 The average rate for the area was rather over 11s., the highe figure being 23s. in Poplar and the lowest 9s. 9d. in the city Westminster. The total net debt of London on March 31 192 was given as £122,988,798, and the total charge for interest an repayment was £7,492,473. One of the principal financial obl gations left by the War was the provision of working-class dwel ings, and the net debt on these throughout the county area the year 1922–3 stood at £20,160,004, with a charge of £1,174,78 The total net debt of London has increased by about £18,000,00 since the year 1918.

The history of London during the period under review ha really been the story of the interruption of its natural growth population, extent, wealth and progress and its gradual resump tion. In 1915 the City suffered from the first hostile attack launched against it for nine centuries, and it was remarkab that in spite of persistent attempts from the air the total mate rial damage throughout the whole area amounted to less tha one-fifth of that sustained in the Great Fire of 1666, while hardl a building of historical value was injured.

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(P. W. L.)

LONDON, CONFERENCES OF.—Five meetings of Allied statesmen for the purpose of adjusting matters arising out of the peace treaties which concluded the World War were held in London in 1921–2.

Feb. 21–March 14 1921.—The representatives of the principal Allied Powers here carried on alternately two separate sets of negotiations, one with the representatives of the Athens, Conantinople and Angora Govts. on the Near Eastern question e Turkey), and the other with the German Foreign Minister, . Simons. Both sets of negotiations were failures. A week er the conference dispersed the Greeks launched a new offen- e in their war with the Turkish Nationalists; while, a week fore the conference dispersed, sanctions were taken against ermany by the Allied military occupation of Düsseldorf, uisburg and Ruhrort, outside the area occupied under the ersailles Treaty, and by the impounding of German customs eipts and the establishment of a new customs cordon between cupied and unoccupied territory. The cause of these measures s the presentation by Dr. Simons of an unacceptable counter- oposal to the reparation demands which the Allied Govern- ents had put forward at the Paris Conference of the preceding n. 24–30 (*see* Paris, Conference of). Germany appealed ainst the Allied sanctions to the League of Nations, but the ague took no action.

April 29–May 5 1921.—Under Article 235 of the Versailles eaty, Germany was required by April 30 1921 to have made irst instalment of reparation payments in cash and kind to a al value of 20 milliard gold marks (approximately one mil- rd pounds sterling). As this period approached, it became ident to the reparation commission that Germany would be default under this head, and on April 29 the Allied statesmen, er a preliminary meeting on the 23rd and 24th at Lympne, t again in London to consider what should be done. New nctions against Germany were discussed, and an additional ss of the French Army was actually mobilised; but mean- ile, on April 27, the reparation commission had declared their imate of Germany's total liability, and the Allied statesmen ned their attention from the non-execution of Article 235 to e drawing up of a "Schedule of Payments describing the Time l Manner for securing and discharging the entire Obligation Germany for Reparation under Articles 231, 232 and 233 of e Treaty of Versailles." This document, which seems to have en drawn up by the heads of the Allied Governments, though ued in the name of the reparation commission, was sent to rlin on May 5, together with an ultimatum. Meanwhile the rman Govt. had fallen; but on May 11, one day before the imatum was due to expire, a new ministry accepted the Allies' ms with the sanction of the Reichstag.

Dec. 18–22 1921.—A meeting between Mr. Lloyd George and Briand (accompanied by M. Loucheur), in consequence of a laration by the German Govt. that it would be unable to pay two instalments next due under the schedule imposed by the imatum of May 5 1921, followed. The Prime Ministers decided call a meeting of the Supreme Council of the Allies at Cannes, l drafted, for submission to this meeting, a memorandum on reparation problem in which they proposed to grant Germany artial moratorium in exchange for an increase in the stringency Allied control over German finances. At this meeting the ntual convening of a general European conference on recon- uction was also foreshadowed (*see* Cannes, Conference of).

ug. 7–14 1922.—A meeting which arose out of the failure of rmany to carry out the schedule of reparation payments to ich she had pledged herself under duress on May 11 1921. e arrangement made between the German Govt. and the aration commission during the Cannes Conference (*q.v.*) had y postponed disaster, and since then the finances of Germany l gone from bad to worse. At the London Conference Poincaré brought forward, as conditions for granting Germany noratorium, proposals for "productive guarantees" which nad attempted to carry out next year after the Franco-Belgian itary occupation of the Ruhr. When these proposals were rred to an inter-Allied committee of experts, the French nd themselves in a minority of one, the other experts declaring t M. Poincaré's proposals would bring in diminishing returns. unter-proposals of a milder kind were put forward by the tish delegation, but as these in turn proved unacceptable to Poincaré the conference broke up without reaching a decision Reparations).

Dec. 9–11 1922.—A meeting to consider the conditions for granting a reparations moratorium to Germany, on which no agreement had been reached at the London Conference of the preceding August. At this meeting M. Poincaré again pressed his plan for "productive guarantees," which he expounded in greater detail than four months before. He made it clear that he would not consent to a moratorium without taking these pledges, which included the military occupation of the Ruhr. At the same time he countered the British plan for remitting a portion of Germany's total liability in return for the remission to France of part of her war-debt to Great Britain, by declaring that even in return for this *quid pro quo* he would only be willing to cancel "C" bonds, which were of merely nominal value. As these French terms were not acceptable to Great Britain the conference was adjourned. (A. J. T.)

LONDON, PORT OF (*see* 16.949).—On March 31 1909 the Port of London Authority became the chief body controlling the Port of London.

Before 1909, no public body had been charged with the duty of maintaining and improving the accommodation in the port. The City Corporation, Trinity House, and the Thames Conservancy had each exercised certain powers of conservancy, and the dock companies had enlarged their docks as and when it seemed profitable to them to do so. The outstanding change made by the Port of London Act of 1908 was that it set up a public body whose principal duty is to investigate the accommodation and facilities in the port and execute such works in the river and docks as are necessary to keep the Port up to a standard befitting the first port of the world. The main features of the Authority's policy have, therefore, been more concerned with the improvement of the Port than with the reorganisation of port methods and practice.

A comprehensive programme of new works was tentatively adopted in 1910. The principal works put in hand at once were:—

(*a*) the construction of a modern dock to the south of the Royal Albert Dock, 64 acres in extent with a length of quay of 12,700 ft., capable of receiving vessels of about 35,000 tons burthen.
(*b*) an extension of the Tilbury Dock.
(*c*) the rebuilding of the north quays of the East India and West India Docks.
(*d*) a river cargo jetty at Tilbury.

The World War delayed the completion of the new dock which was opened by George V. on July 8 1921. By the opening of this dock the total water area of the docks was increased to 704 acres and the length of dock quays to 156,450 feet.

Improvements.—An enormous amount of deepening and dredging of the river channels and docks has been carried out between 1909 and 1925. During 1924–5 alone, 3,897,000 cu. yd. of material were removed from the river, and the quantity of mud removed from the docks was 1,206,000 cubic yards. The result of the deepening operations in the river is that for the greater part of the 25 m. below Tilbury and for the 10 m. above Tilbury, the channel at low water had, in 1925, a minimum depth of 30 ft. with a width of over 1,000 feet. For the remaining 6 m. up to the King George V. Dock, the width of the channel is maintained at 600 ft., with a minimum low water depth of about 27 feet. At high water, these channels are wider, while the depths are from 17 to 21 ft. greater. The new works in hand in 1925 included a new dock in the Surrey Commercial system. Preparations were well advanced for a new dry dock, a new river entrance, and a passenger landing stage at Tilbury. Up to March 31 1925 the sum spent on new works by the Port Authority approximated £11,000,000.

Value of the Port Shipping.—The amount of merchant shipping entering and leaving the port was affected by the War, especially during 1918, when the tonnage was only 14,564,000 tons as compared with 40,080,000 tons in 1913. Since 1918, recovery has rapidly taken place, the figure for 1924 being 45,393,000. The total value of the overseas trade of the port for 1924 was £677,342,000, compared with £582,464,000 at Liverpool and £121,186,000 at Hull. Though the Port of London Authority provides most of the accommodation in the port, there is an important system of private riverside wharves and warehouses, where small vessels are discharged and warehousing business is carried on in competition with the Authority. Recent developments in the river below Barking Creek favour the establishment of industrial enterprises which expect to benefit by their easy access to Thames port facilities.

There have been several labour disputes in the port during the period 1910-25. A general strike for higher wages took place in the summer of 1911; a more serious strike occurred in 1912, when the question at issue was the employment of non-union labour. During the War, labour was comparatively quiescent, threats of trouble being averted by concessions of higher wages to meet the increased cost of living. Another strike took place in 1924, in resistance of a reduction of wages previously agreed upon. The minimum rate of pay in the port in 1925 was 12^s per day. The organisation of labour in the port has greatly improved since 1910. The administration of the port by the Authority may, on the whole, be regarded as successful. Dock charges are doubtless higher than they would have been had the dock companies not been dispossessed, but compensation for this is found in the more comprehensive treatment of port problems under the management of a body in which the traders using the port are in a majority. (J. G. B.)

LONDON, UNIVERSITY OF (*see* 27.772).—London University has problems which are directly related to its dual nature and to its immediate history. The first attempt to found a university in London was made by Sir Thomas Gresham in 1548 when seven professorships—divinity, music, physic, astronomy, geometry, law and rhetoric were endowed, but this project never attained full fruition. In 1825 Thomas Campbell, the poet, addressed a public letter to Brougham, as a result of which University College came into being and opened classes in 1828 in arts, law and medicine.

Creation by Charter.—On Nov. 28 1836 the University of London and University College, respectively, received charters. The university was constituted an examining body, while University and King's Colleges were constituted the teaching centres. The university was thus created as an examining body and as such undoubtedly achieved a great reputation for impartiality, thoroughness and high standard, so great being its prestige in medicine and surgery in particular that its degrees were and still are sought after even in preference to those of older universities, especially by students from the Dominions.

Teaching University Established.—The Cowper Commission (1894) submitted a report in 1894, embodied in the University Act of 1898, which forms the present constitution of the university. In accordance with statutes approved by Parliament in 1900, the teaching colleges were federated with the university but were not subject to any financial control. Indeed, the authority of the university is limited to the recognition, or refusal of recognition, as teachers of the university, of teachers in the colleges and to the approval of courses of study. Thus a dual university was established, combining the functions of examination with the functions of teaching in its federated schools.

All affairs appertaining to the teaching institutions of the university fall under the administration of the Academic Council, which reports directly to the Senate. This section of the university has become known as the internal side. All other functions not to do with teaching, which had been performed by the old examining body, fall under the administration of the Council for External Students which also reports directly to the Senate. This section of the work of the university is known as the external side, and the degrees granted to students examined by this body, but not taught necessarily in the schools of the university, are called external degrees. The Senate remains the executive authority to accept, to modify, or to reject as it wills the recommendations coming from these two great statutory councils thus constituted.

The Senate.—The Senate, as the executive and co-ordinating body, comprises three nearly equal sections. One represents the teaching or academic side (16 representatives chosen by the faculties), one represents the external side (16 representatives
chosen by the graduates constituting Convocation) and a t
section of 21 members consists of representatives chosen by
Crown and other outside electing bodies. The chancellor
chairman of Convocation, who are elected by the whole bod
Convocation, complete a Senate of 55 members. The th
section named above acts in some sense as a jury between
equal bodies representing the academic and external intere
Practically all the business of the university is conducted
committees. The Senate exercises its important functions
reception of reports from these committees, and has proved
practice a remarkably efficient instrument.

Incorporation of Colleges.—In 1905 University College
incorporated with the university. This was followed in 1908
the incorporation of King's College. The effect of incorporat
is difficult to estimate. Nominally the colleges are under
control of the university; in fact they are very largely in
pendent of that control. No other school has wished to sec
incorporation, while King's College has expressed the desire
cancel incorporation if this should be possible.

Royal Commission.—In 1909 a Royal Commission, over wh
Lord Haldane presided, was appointed with wide terms of re
ence and after taking evidence published its report in 19
The following significant remark was made by a commissio
on the first day of taking evidence:—

> My point is this: What is the use of a royal commission or
> other body attempting to organise university teaching, and
> elevate it and to enhance the value of the degree if the exter
> degree remains, if unrecognised colleges are doing as good work
> the recognised ones?

The Commission made recommendations which would res
in the complete extinction of external degrees in the more
less near future.

The Commission further recommended the constitution o
Senate of 15 members of whom two only were to be representati
of the teachers with one representative of graduates of Convo
tion, while the 12 others were to be appointed variously but
such a manner as to ensure bureaucratic control of the unive
ity. These drastic proposals met with very little public appro
and lapsed during the War. However, a departmental co
mittee was appointed by the Board of Education in 1924, wh
Lord Haldane was Lord Chancellor in the Ministry of
Ramsay MacDonald, for the purpose of preparing statutes
legislative approval to give effect to the recommendations
the Royal Commission. Vigorous protests have been ma
against the constitution of the departmental Committee.[1]

Progress and Development.—Notwithstanding the disturba
inseparable from these repeated Commissions, the univers
under its present constitution has prospered exceedingly. Si
1915, roughly speaking, the internal side has trebled and
external side doubled in the number of students. Inasmuch as
internal side started from zero it has naturally progressed a
greater pace than the external side. Twenty-five colleges ha
sought and obtained recognition as "Schools of the Universit
Faithful to its tradition of far-seeing initiative, the univers
has founded degrees in commerce, which have already prove
most notable success. New chairs have been founded—larg
by private munificence—in response to the ever-increasing co
plexity of modern science and industry. Research in every fi
of scholarship and science is sedulously encouraged. The u
versity library has been developed and improved.

More recently the university has solved the very difficult pr
lem of its relation with the Imperial College of Science and Te
nology. This college had long nursed the ambition to form
technological university giving its own degrees. It has no
by the adjustment of certain examinations, accepted who
heartedly the position of a "School of the University." T

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[1] The committee recommend—*inter alia*—the creation of a Cou
cil of the University to control finance, and of a Collegiate Coun
composed of members of the Senate. To give effect to these reco
mendations, which have been vigorously criticised, legislation will
required. Some financial control is unavoidable if co-ordination is
be secured, and to effect this without discouraging prospective or
noying actual benefactors will not be easy. (Ed. *E. B.*)

·eat medical schools with their splendid traditions, so much der than the university itself, have accepted the system of the ɔpointment of their professorial teachers by the university.

Very significant is the change that has taken place in the ·lations between the internal and the external sides. The :ternal side, threatened with extermination, was placed upon s defence, and a perfectly unnecessary feud between external ıd internal interests became thus accentuated. With the creasing prospect that the commission's report would never : carried into effect hostilities died down and when the Hal- ıne recommendations were revived by the appointment of the :partmental committee the two sides of the university joined a united protest which was submitted to the departmental ɔmmittee in an identical memorandum prepared by the aca- :mic and the external council respectively.

The secret of the increasing confidence of the schools in the ıiversity central administration is to be found in the lightness ıd tactfulness of the control exercised by that administration. he colleges are free institutions, voluntarily submitting to ıidance and leadership, but retaining essential independence. ny attempt to substitute for this system an encroachment ɔon the liberties of these federal institutions would spell saster.

The university has become the largest university in the :itish Empire. Indeed, it is an increasingly important link of tachment, for it accepts students from every part of it on terms :tirely equal. It still holds out an ever more helpful hand to e poor student unable to obtain a collegiate education. At e same time the number of its collegiate students, multiplied reefold in 10 years, testifies to the confidence which academic ɔdies repose in it. It continues to attract to its governing body en distinguished in every walk of life. (E. G. L.)

LONDONDERRY, CHARLES STEWART HENRY VANE-TEM-EST-STEWART, 7TH MARQUESS OF (1878–1915), British poli- :ian, was born in London May 13 1878. Educated at Eton and ındhurst, he entered the House of Commons in 1906 as Unionist ember for Maidstone. From 1914–9 he served in the World ar, being twice mentioned in despatches. Made a privy coun- lor for Ireland in 1918 and a K.G. in 1919, in 1920–1 he was der-secretary for air, and in June 1921 took office as Minister Education for Northern Ireland. From this position he signed Jan. 6 1926 and was succeeded by Viscount Charlemont.

His father, Charles Stewart Vane-Tempest-Stewart, the 6th ırquess (1852–1915) (*see* 16.969), was a prominent leader of : opposition to the Home Rule Bill of 1912 and was one of the st to sign the Ulster Covenant, Sept. 28 1912. He died at vnyard Park, Stockton-on-Tees, Feb. 8 1915.

LONG, WALTER HUME LONG, 1ST VISCOUNT (1854–1924), glish politician, born at Bath July 13 1854, was the eldest ı of Richard Penruddocke Long, of Rood Ashton, Wilts., and wife Charlotte, daughter of Fitzwilliam Hume Dick. He s educated at Harrow and Christ Church, Oxford. Being the r of an old county family with a tradition of Parliamentary vice, it was natural that he should contemplate a political eer. He entered Parliament in 1880 as Conservative member North Wilts, and sat in every House of Commons till he was ated a peer in May 1921, though he changed his constituency eral times. He obtained office early, and showed administra- e power and common sense in positions agreeable to a capable intry gentleman—Parliamentary Secretary to the Local vernment Board 1886–92, President of the Board of Agri- ture 1895–1900 and President of the Local Government ard 1900–5. His administration at the Board of Agricul- e was marked by the stamping out of hydrophobia through strict enforcement of a muzzling order for dogs; and the acity and resolution which he showed in carrying his policy ough, in the face of a violent agitation by many dog owners l dog lovers, raised him greatly in public esteem.

n March 1905 Mr. Long was chosen by Mr. Balfour to suc- l Mr. Wyndham, after the latter's breach with Irish Union- , as Chief Secretary for Ireland. He at once restored Unionist fidence by reducing the under-secretary Sir Anthony (afterwards Lord) MacDonnell, to definite subordination to himself as the responsible minister, and by the firmness with which he proceeded to enforce the law and repress agrarian intimidation. The impression which he produced in Ireland in the few months before Mr. Balfour's resignation was so considerable that he, an Englishman, was returned to Parliament in the general election of 1906 for a Dublin seat. In the years of opposition which followed he proved a vigorous opponent of Mr. Birrell's policy of *laissez-faire* in Ireland and of Mr. Lloyd George's proposals with regard to the land; and a more benevolent critic of the Government Old Age Pension scheme and of Mr. Burns's administration at the Local Government Board. When Mr. Balfour resigned the leadership of the Conservative party in Nov. 1911 he was the candidate of the more conservative branch of the party; but both he and his rival, Mr. Austen Chamberlain, agreed to stand aside in favour of Mr. Bonar Law.

With the other conservative leaders he joined the first Coalition Ministry in 1915, returning to his old post of President of the Local Government Board; and in the second Coalition Ministry (1916) he was Colonial Secretary. He had been hitherto a decided opponent of woman suffrage, but, along with Mr. Asquith and others, he was converted by the services of women during the World War, and in 1917 he introduced in the House of Commons the Franchise Bill, which became law in the following year, and under which women over 30 obtained the vote. When Mr. Lloyd George reconstructed his Ministry in the beginning of 1919 Mr. Long became First Lord of the Admiralty and had the difficult task of supervising the reduction to a peace basis of the gigantic navy which had been built up during the War. For some years his health had been periodically unsatisfactory, and in the spring of 1921 he resigned office. Mr. Bonar Law's break-down in health occurred almost immediately afterwards, and Mr. Long heartily supported the election of his old rival Mr. Austen Chamberlain to the leadership of the Conservative party. A few months later he was raised to the House of Lords, amid general approval, as Viscount Long of Wraxall. He did not hold office in either Mr. Bonar Law's or Mr. Baldwin's Government, and died Sept. 26 1924 at Rood Ashton, Wiltshire. He had married in 1878 Lady Doreen Boyle, daughter of the 9th Earl of Cork. His elder son, Brig.-Gen. Walter Long, C.M.G., D.S.O., fell in action Jan. 27 1917, and Lord Long was therefore succeeded in the peerage by his young grandson. (G. E. B.)

LONG, JOHN DAVIS (1838–1915), American lawyer and politician (*see* 16.974), died at Hingham, Mass., Aug. 28 1915.

LOOS, BATTLE OF, was fought between the British and German Armies, Sept. 25–8 1915. The British offensives in the spring of 1915 at Neuve Chapelle, Aubers and Festubert, and the French offensive against the Lorette ridge, made only small gains, at heavy cost, and by July the Arras front was again stabilised. A stalemate ruled on the Western Front for the rest of the summer.

Plans of French Headquarters.—Despite the non-success of their spring offensive, French Headquarters were not disposed to relinquish all efforts to break through the German lines in France until such time as the British could attack on a great scale. It was desirable to do something in the West to relieve the situation in Russia, which was steadily growing worse. Accordingly, Gen. Joffre laid his plans for a big effort in Champagne to be combined with a Franco-British attack in Artois, the French X. Army attacking the Vimy ridge, the British I. Army between Lens and the La Bassée canal. If both succeeded it was hoped to establish touch between them east of Lens, which was to be "pinched out," not attacked direct, and should this coincide with a real break-through in Champagne there might be a chance of intercepting the Germans in the great salient between Soissons and Arras.

Composition of British Force.—The British share was to be on a far larger scale than in May; for the main attack nine divisions were available, six others were to contribute by creating diversions elsewhere. Careful economy in ammunition and the greatly increased output from the factories at home had allowed the accumulation of a fair supply of shells, and the enemy's own weapon, gas, was to be employed. It was hoped that by using gas it would be possible to attack on a really wide front, much more extensive than would have been possible if the bombardment by the artillery had been the sole means of preparing for the assault.

To the main attack three corps were allotted: on the right, Sir H. Rawlinson's IV. Corps attacked from Loos to Hulluch; Sir H. Gough's I. Corps, on the left, making for the line Hulluch-Haisnes-Auchy. On both wings defensive flanks were to be formed under cover, of which the central divisions would push on towards the Haute-Deule canal, cross it at Pont à Vendin, and connect up with Foch's troops. The cavalry and the newly formed XI. Corps (Sir R. Haking), which included the Guards, making their début as a division, and the newly arrived 21st and 24th Divs., would support this advance.

Assault on German Front Line.—Four days' bombardment, of an intensity as yet unknown, preceded the assault, which was launched at 6.30 A.M. on Sept. 25. The bombardment was as effective as the limited amount of ammunition allowed, and the Germans' deep dug-outs greatly reduced its results by sheltering the trench garrisons, while unluckily the wind practically failed and the gas therefore proved a great disappointment. This was all the more serious because the artillery had been unable to do as much damage all over the wide front attacked as they had accomplished at Neuve Chapelle on the narrow frontage then attacked. However, over most of the front the wire had been well cut and the attackers carried the German front system and swept on towards their second set of trenches, about a mile in rear. On the extreme right the 47th Div. successfully established a defensive flank connecting their old line with Loos, which was reached and carried by the Scots of the 15th Division. The 15th's left, however, was exposed by the failure of the 1st Div's. right brigade, which found a long stretch of uncut wire covering trenches at Lone Tree, so that the left brigade which got in and penetrated to Hulluch, though after heavy losses, found its right uncovered and could not maintain its advanced position. The 7th Div., on the right of the I. Corps, carried its first objective after heavy fighting but could not pierce the German second system of defences in front of Cité St. Elie. On its left the 9th (Scottish) Div. took the Hohenzollern redoubt and Fosse 8, and a detachment reached the German second system but in insufficient strength to break through. The left division, the 2nd, attacking astride the La Bassée canal failed to take its objective.

Results of the Attack.—The attack had resulted in the capture of a long stretch of the German front line with 20 guns and many prisoners; losses, however, had been heavy, and though at several points the second system had been reached there was no touch between the different parties. These, moreover, had pushed beyond the range of effective artillery support, while neither Gough nor Rawlinson had sufficient reserves in hand to link up the different advanced parties; the XI. Corps was too far back to reach the front in time and the check to the 1st Div. at Lone Tree left the 15th's flank dangerously uncovered. As at Neuve Chapelle, there was an opening but there were delays. The Germans threw in their reserves, drove the advanced troops of the 15th Div. back to Hill 70, just east of Loos, ousted those of the 1st from Hulluch, got in after nightfall between the 7th and the 9th, and retook some quarries west of Cité St. Elie and made the 9th's centre recoil to Fosse 8. But at no point could they regain their old front line and they had to pay heavily for the ground they regained.

Second Attack.—On Sept. 26 an effort was made to break through between Hulluch and Loos, using the two "New Army" divisions of the XI. Corps. But the Germans were pressing so hard at the Hohenzollern redoubt and on Hill 70 that two brigades had to be diverted to those points, and the advance of the main bodies was greatly retarded by the congestion of the roads with transport, and other unforeseen delays. They could not reach their assigned position in time, and before the attack could be started a German counter-attack recaptured Bois Hugo, midway between Hulluch and Loos.
This point had been reached by the right of the 1st Div. lat
the previous evening, the dislodgment of the Germans at L
Tree having at last let it get forward but too late to do m
consolidation or link up with its left brigade at Hulluch or
the 15th Div. at Hill 70. Early in the morning a brigade of
21st Div. had taken over Bois Hugo but had barely don
before the counter-attack dislodged it. Moreover, the Bri
guns had been unable to register the German second line
fences and the bombardment of them was ineffective. The
Div. pushed forward across the Lens-La Bassée road but
enfiladed from Bois Hugo by machine-guns, found the Gerr
wire and defences practically intact, and fell back in s
disorder. The 21st Div. had already done the same after fai
to retake Bois Hugo, and the greater part of Hill 70 passed b
into German keeping, the defences being outflanked from
north as well as attacked in front. The I. Corps, too f
occupied in holding its ground, could make no progress.

Unsatisfactory Result.—By the evening of Sept. 28 the cha
of a break-through was gone. On Sept. 27 the Guards
regained much lost ground on Hill 70 and secured a better
from Bois Hugo to Hulluch, but this merely improved the
tical situation at an awkward point. Elsewhere, German p
sure was heavy, especially against the I. Corps. Fosse 8
lost and efforts to retake the quarries failed, and though
several days a hold was with great difficulty maintained on
Hohenzollern redoubt it, too, was lost on Oct. 3. Howe
a big German counter-attack on Oct. 8 all the way round f
Loos to the Hohenzollern, was decisively repulsed, and
days later the 46th (N. Midland T.F.) Div. covered par
the Hohenzollern, and the 12th (Eastern) Div. considera
improved the position nearer Cité St. Elie. This was the
attack on any large scale; the position in the salient which
been driven into the German lines gradually quieted down
before the end of Oct. had become as thoroughly stabilise
any other part of the fronts.

Long before the fighting on the British front had relapsed
normal "trench warfare" the French had abandoned t
Artois offensive. The German front line was cheaply ca
(Sept. 25), but though for some hours the German defences
the Vimy ridge were only scantily manned the French faile
reach them in time. Their plan of limiting their object
strictly meant that what they took they secured but it me
also delays in reaching the more distant objectives. By S
27 reserves had filled the gap and brought the French to a sta
still, Vimy remaining in German hands.

Thus, Loos, like Neuve Chapelle and the May offensive,
failed to produce any change in the strategical situation,
tactical gains made had been dearly bought and no really
stantial relief had been given to the Russians. Still, the
mans also had lost heavily, and the experience gained in
planning of so large an attack, far the biggest operation as
attempted by the British Army, had been most valuable.
Loos it had been attempted to apply the lessons and to a
the errors of Neuve Chapelle. There, chances had been
through over-deliberation and rigidity, through waiting
others were up level, so that all might go forward together
Loos, pushing on too deep, regardless of what others were do
had occasioned overrunning and ultimately losing posit
which greater deliberation might have secured. But
showed the Germans that the "New Army" divisions we
factor with which they must reckon seriously, that when
whole of the "New Armies" were in the field a great Bri
offensive would be a formidable danger.

See J. Ewing, *The History of the 9th (Scottish) Division, 191*
(1921); also *see* WORLD WAR: BIBLIOGRAPHY. (C. T. A

LOREBURN, ROBERT THRESHIE REID, 1ST EARL (18
1923), British lawyer and politician, was born at Corfu Ap
1846, and was educated at Cheltenham and Balliol Coll
Oxford, where he had a distinguished career, winning the Irel
scholarship in 1868. He was called to the bar in 1871, an
1880 entered politics as Liberal member for Hereford. In
he became a Q.C. and, having in 1885 lost his seat at Heref

ıs returned in 1886 for Dumfries Burghs, retaining the seat ıtil 1905. In 1894 he was for a few months Solicitor-General ıd was knighted, and during 1894–5 was Attorney-General. He ceived the G.C.M.G. in 1899, and from that year until 1906 he ıs counsel to the University of Oxford. On the formation of r Henry Campbell-Bannerman's Govt. in 1905, Sir Robert eid became Lord Chancellor, and was raised to the peerage as ıron Loreburn. To him, while Chancellor, the passage of the ourt of Criminal Appeal Act (1907) was largely due. In 1912 resigned on grounds of health. Lord Loreburn, who was eated an earl in July 1911, published *Capture at Sea* (1913) ıd *How the War Came* (1919). He died without issue Nov. 30 ı23, when the title became extinct.

LORENTZ, HENDRIK ANTOON (1853–   ), Dutch physicist, ıs born at Arnheim July 18 1853. In 1878 he was appointed a ofessor in the University of Leyden, a post which he held until ı23. From 1883 to 1895 he worked upon his electron theory ıd in 1892 published his *Théorie électromagnétique de Maxwell son application aux corps mouvants*. This was followed in 1895 the famous treatise *Versuch einer Theorie der elektrischen und tischen Erscheinungen in bewegten Körpern*. In 1909 appeared s *Theory of Electrons and its Application to the Phenomena Light and Heat*, which gives the résumé of Lorentz's researches ıd contains the lectures he delivered in New York in 1906. In ı02 he was awarded, with Pieter Zeeman, the Nobel Prize r physics. Among his other works may be mentioned *Text Book the Differential and Integral Calculus* (1882; German ed., 1900); *isible and Invisible Movements* (1901); *Abhandlungen über eoretische Physik* (1907); *The Einstein Theory of Relativity: Concise Statement* (1920); *Clerk Maxwell's Electromagnetic heory* (1924). From 1919 his lectures for the university courses ere published, under his personal supervision, with the title of *ssons on Theoretical Physics*, eight volumes of which had opeared in 1925.

LORENZ, ADOLF (1854–   ), Austrian surgeon, was born at idnava, Silesia, April 21 1854, of poor parents. He entered ienna University and studied surgery under Billroth, Nicoladini ıd Eduard Albert, afterwards becoming a demonstrator, and en a professor at the university. His best known studies are ose relating to club-foot and flat-foot. He published numerous udies on his special subjects, the most important being *Die hre vom ererbten Plattfusse* and *Ueber die operative Orthopädie s Klumpfusses*. Lorenz also invented the *deutsches Gipsbett* hich proved to be a great advance on Bradford's plaster beds hich had previously been in general use.

LORIMER, GEORGE HORACE (1868–   ), American editor, ıs born at Louisville, Ky., Oct. 6 1868. His early education ıs received at the Mosely High School, Chicago, whence he oceeded to Colby (Me.) and Yale universities. After being r a short time in business in Chicago, he turned to journalism, coming a reporter and correspondent on several newspapers. 1897 he became literary editor of *The Saturday Evening Post*, d in 1899 was made editor-in-chief. The remarkable success this periodical can be attributed in no small measure to Mr. rimer's keen appreciation of the public taste coupled with his ility to meet it. He adopted the policy of selling *The Saturday ening Post* at a price (5 cents) much below the cost of manucture, and thereby securing a circulation that made its pages extremely attractive advertising medium. He wrote *Letters om a Self-Made Merchant to His Son* (1902), which achieved eat popularity; *Old Gorgon Graham* (1904); *The False Gods* 906); *Jack Spurlock Prodigal* (1908).

LORRAINE, EARLY OPERATIONS IN: *see* FRONTIERS, BAT-ES OF THE.

LOS ANGELES, Cal., U.S.A. (*see* 17.12), had, at the end of 1925, population estimated at over a million and an area of 421·71 . miles. The population within the city limits increased from 9,198 in 1910 to 576,673 in 1920. There were 15,579 negroes, ,230 Japanese, Chinese and Indians and 112,057 foreign-born ıites. About 1920 began an influx of population to southern alifornia which surpassed even the movement of earlier years. ecause of its geographical position and the embryonic state of most of its industries, Los Angeles had no war-time inflation and consequently escaped the experience of post-War deflation. On the contrary, the influx of population and the discovery, at almost the same time, of rich new oil-fields in the vicinity, caused a "boom" which lasted through the first quarter of 1924, reaching its greatest intensity in 1923. Business generally fell off in 1924, and in the first half of 1925 an actual decrease of population was discernible, but this was more than made up by gains in the last six months of the year.

Communications.—In 1919 only six steamship lines made the port of Los Angeles regularly. In 1925 there were 60 lines handling general cargo, 35 tank lines and 35 lumber lines. The total number of ship arrivals in the year ending June 30 1925 was 5,901. The harbour had, at the end of 1925, 10 m. of wharves (6 m. owned and operated by the city) and more than 50 m. of municipal harbour belt-line railway tracks; the channels and basin in the inner harbour had a depth of 30 ft. at low tide; in the outer harbour, at more than a mile of wharfage, of 35 ft.; the main channel had been doubled in width, to 1,000 feet. The electric railways in 1925 operated over 1,508 m. of track, extending to a radius of 75 m. outside the city. A one-mile subway and a terminal building, constructed 1924–6, greatly improved the service between important residential sections and the business district.

Commerce.—Within a few years after the close of the World War the commerce of the port of Los Angeles rose to more than that of any other ocean port in America except New York. The total tonnage (imports, exports, coastwise and inter-coastal) was 2,380,622 short tons in the year 1918–9, 26,550,464 in 1923–4 and 22,268,421 in 1924–5, with a value respectively of $86,481,470, $643,221,303 and $671,406,570. Exports to foreign countries amounted to about $75,000,000 in 1925; imports from foreign countries, to about $35,000,000. The increase was due partly to the demand for lumber (most of it from British Columbia) and other building materials, and for crude rubber, but chiefly to the great increase in the production of oil. It was at first piped out through the harbour in a crude form. With the development of refineries a larger part of it (by 1924) was shipped in a refined state. Great Britain was the principal market for gasolene (162,615,222 gal. in the year 1924–5); China for kerosene; Chile for fuel oil.

Industries.—Between 1910–9 Los Angeles became an important industrial centre, and after 1919 its manufactures grew fully as fast as its population. Factory products, within the city limits, were valued at $68,586,000 in 1909; $278,184,000 in 1919; $313,589,985 in 1921; $417,654,081 in 1923. The Federal census of manufactures, however, limited to factory products, does not include motion-picture films, which until 1924 were the city's most valuable product, or such commodities as manufactured gas; and it does not include any plants outside the city limits. Tabulations by the Chamber of Commerce, including all manufactured products, give the following figures for the metropolitan area: (1919) $618,772,000; (1921) $800,926,641; (1923) $1,151,643,537; (1924) $1,202,677,004. The leading industries in 1924, with the value of their products, were petroleum products, $221,880,293; motion-picture films, $168,000,000 (estimated to be 75% of all produced in the U.S.); iron and steel machinery, $99,117,430; meat products, $67,987,146; lumber and planing-mill products, $64,327,685. Petroleum products occupied the leading position for the first time in 1924, having increased steadily each year from $83,867,716 in 1919.

Water and Power.—The Los Angeles aqueduct, 250 m. long, bringing water from the Owens river in the Sierras, in amounts to supply a population of 2,000,000, was placed in service in 1913. In the process of extending the city service to the vast new areas which had been annexed, new water mains were installed at the rate of over one mile a day during the year ending Sept. 1 1925, bringing the total in service to 2,654 miles. To provide for anticipated needs in the future, plans were already well advanced for constructing a still longer and larger aqueduct to bring water sufficient for a population of 7,500,000 from the Colorado river. A bond issue of $2,000,000 was authorised June 2 1925, to begin preliminary work and acquire the necessary rights of way. The Bureau of Power and Light (established 1909), owned and operated, by 1925, five hydroelectric power generating plants along the line of the aqueduct, producing a total of 110,000 h.p., which furnished 60% of the total amount of energy distributed by the bureau, the other 40% being purchased wholesale from a private corporation.

Public Buildings and Improvements.—A fine Hall of Justice was completed in Dec. 1925, including a county jail to replace the one constructed in 1902. In 1925 plans had been accepted and a site chosen for a new city hall; a new public library was approaching completion (cost $2,000,000); the first unit of the $12,000,000 project for a county museum was completed; also the Coliseum (seating capacity, 77,000) built by the city and county jointly; and the Patriotic Hall, built by the county as a memorial to the soldiers and sailors of the country's wars. A city-planning commission was set up in 1910. By 1925 the city had a plan covering its entire area, and including zoning provisions, major and minor highway system, park, boulevard and channel parkway system.

Education.—The public-school system included (Nov. 1925) 234 elementary schools, 11 special schools, 14 junior and 23 senior high schools, with 7,495 teachers. The University of Southern California (enrolment 12,007 in 1924–5) established about 1920 an extension division known as the Metropolitan University, which had an enrolment of 4,900 in the autumn of 1925.

Government.—A new charter, adopted in 1924 and operative from July 1 1925, provides for the initiative, the referendum, the recall and an executive budget. The mayor (the chief executive, with wide appointive powers), the city attorney, the controller and the seven members of the Board of Education are elected at large. The 15 members of the council (the legislative body) are elected by districts. The principal functions of government are entrusted to 16 commissions of five members each, appointed by the mayor and serving without salary, which in turn appoint and fix the salary of general managers for their respective departments.

LOSSKI, NIKOLAI ONUFRIEVICH (1870–), Russian philosopher, was born at Kreslavka, Vitebsk province. He was educated at Kreslavka and at the University of St. Petersburg (Leningrad) where he studied first science and then philology. From 1916 to 1921 he was professor of the same university, but in 1922 he was compelled to leave Russia and went to live in Prague. Losski is the representative of intuitionalism in epistemology. According to his views, knowledge is immediate contemplation (intuition). His intuitionalism differs from Bergson's in so far as he considers the ideal-rational forms to be elements of realities, intuitively cognisable. His kind of intuitionalism leads to concrete ideal-realism, his idealism being as concrete as realism. He assumes not only concrete real being, but concrete ideal being as well, *i.e.*, supra-temporal and supra-spatial substantial agents with creative force, which are the basis of spatio-temporal being. Abstract ideas obtain their significance and importance exclusively from the substantial agents, who create the real according to constitutive abstract ideas (*e.g.*, mathematical principles) and normative abstract ideas (*e.g.*, moral ideas, etc.). The doctrine of the creative force and superqualitativeness of substantial agents leads Losski to his teaching of the freedom of the will.

Among Losski's most important books are *Die Grundlehre der Psychologie vom Standpunkte des Voluntarismus*, published in Russian (1903), in German (1905); *The Intuitive Bases of Knowledge* (1904; Eng. trans., 1919); and *Handbuch der Logik* (1922), in German (1926). The titles of his untranslated Russian works may be given in English as follows: *Introduction to Philosophy; The World as an Organic Whole; Principles of Epistemology; Matter and Life; Freedom of Will.*

LOUCHEUR, LOUIS (1872–), French politician, was born at Roubaix Aug. 12 1872. After studying at the École Polytechnique he embarked upon a highly successful career as an engineer and contractor. Both in France and abroad he gradually developed an extensive business, and the advent of the World War with its necessities gave fresh prosperity to those industries concerned with the manufacture of arms and munitions. When in Dec. 1916 M. Briand decided to give certain offices to non-political men of high technical ability, he called upon M. Loucheur to be an under-secretary of state. In the Cabinet formed by M. Clemenceau in 1917, which lasted until Jan. 1920, he was Minister of Munitions. After entering Parliament in Nov. 1919 as deputy for the Nord Department, he became Minister for the Liberated Regions in the Briand Cabinet, Jan. 1921. In that capacity he negotiated with the German Minister of Reconstruction, Herr Walter Rathenau, the Wiesbaden Convention for facilitating payment in kind of part of the Reparations. During the two years which ensued, M. Loucheur distinguished himself by upholding before the Chamber, with great argumentative ingenuity, various schemes for remedying the financial situation. On Nov. 28 1925 M. Briand appointed him Minister of Finance in his new Cabinet. But he found every group in Parliament violently hostile to the seven proposals which he submitted for alleviating the financial crisis. The Finance Commission of the Chamber twice rejected five of these proposals and he therefore resigned Dec. 15, having held his portfolio exactly 17 days.

LOUIS III., ex-King of Bavaria (1845–1921), was born Jan. 7 1845 and assumed the regency in succession to his father (*see* 3.550) on Dec. 12 1912. In accordance with the bill passed by Bavarian diet he assumed the crown on Nov. 5 1913.[1] Af the proclamation of the republic on Nov. 7 1918, the King, w the Queen and his daughters, left Munich. The royal fam resided first at Berchtesgaden, and afterwards at a cas assigned to them on the shores of Chiem See. On Nov. 13 formally signed his abdication, and relieved all Bavarian offici officers and soldiers from their oath of allegiance. He died Sarvar, Hungary, Oct. 17 1921.

LOUISIANA (*see* 17.53).—The population of the state as es mated in 1926 was 1,918,591, compared with a census enume tion of 1,798,509 in 1920 and of 1,656,388 in 1910. Duri 1910–20 the negro population decreased from 713,874 to 700,2 or from 43·1 to 38·9% of the total. The population of New leans, the principal city, was estimated on July 1 1924 at 409,5 compared with a census enumeration of 387,219 in 1920 and 339,075 in 1910.

Agriculture.—The most important industry of the state h always been agriculture. The total value of all farm crops in 19 as reported by the Bureau of the Census was $231,506,000. T total number of farms in 1920 was 135,463, representing a gain 14,917 during the decade, but a slight decrease occurred in t following four years, there being 132,451 in 1925. Corn, cotto sugar-cane, rice and hay, in the order named, constituted t most important field crops. The boll weevil temporarily caus a sharp decline in the production of cotton, but with bett methods of combatting this pest and the stimulus of high pric the yield increased from 279,000 bales in 1921 to 501,523 bal in 1924. Another effect of the boll weevil has been the tre toward more diversified farming, with a consequent increase the yield of maize (Indian corn) which reached the maximu of 35,022,000 bu. in 1921. The yield in bushels in subseque years was as follows: 1922, 29,002,000; 1923, 24,702,000; 192 18,998,000. This decline was a result of low prices in this peri as compared with the price of cotton, which made the latter t more profitable crop. The livestock industry also gained in i portance as a result of this diversification, although the state 1924 still ranked only thirty-fourth in the value of livestock the farms. Louisiana leads all other states in the production rice, the yield over a period of years averaging nearly half t total raised in the United States. The crop of 1924 amounted 17,078,000 bu., with a value of $23,226,000. Practically all t cane sugar produced in the United States comes from Louisian The trucking industry has acquired considerable importance the vicinity of New Orleans, and the raising of strawberri has proved profitable on the cut-over pine lands of Livingst and Tangipahoa parishes. Citrus fruits are grown in considerab quantity along the Mississippi river below New Orleans.

Manufacturing.—The value of manufactured products, at fa tory prices, in 1923 was $624,682,620, a gain of 30·4% as co pared with 1921. The average number of wage-earners employ in factories during 1923 was 94,597, a gain of 11·1% over 192 The production of lumber and timber products is the leadi manufacturing industry of the state, both in respect to value products and number of persons employed. The total value lumber and timber produced in 1923 was $132,682,000, an i crease of 44·3% over 1921. Petroleum refining came second 1923 in value of products, with a total output valued at $102,40 962, representing a gain of 8·6% over 1921. Sugar refining ca third, with products in 1923 valued at $88,151,711 and showing gain of 66% over 1921, when the sugar industry was sufferi from severe depression. In spite of the increase in tariff duti on sugar in 1922 the Louisiana sugar industry is at a disadva tage in competing with tropical countries that are free from t hazard of frost and also enjoy the advantage of cheaper labou The number of sugar factories in the state decreased from 124 1921 to 82 in 1924. In 1924 many of these establishments shift from the manufacture of raw sugar to the production of syru the output of which amounted to 9,920,000 gal., compared wi 6,718,000 gal. in 1923.

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[1] King Otto, who had been kept in confinement as a lunatic, di on Oct. 11 1916.

Minerals.—Until 1924 Louisiana led all other states in the pro- ction of sulphur, but late in that year production in Calcasieu rish was suspended because of the exhaustion of the deposit. ıis came after 25 years of production with a total yield of about ,000,000 tons of sulphur. It was this deposit which made the ıited States the chief sulphur-producing country in the world, d the Louisiana product virtually displaced Sicilian sulphur, ıich at one time held first place in the world's markets. In 1923 uisiana ranked third in the production of rock salt and fifth that of all salt. The output in that year was 359,000 tons, mpared with 265,000 tons in 1920. The rock-salt deposits lie the extreme southern portion of the state, and yield a product unusual purity. Most of the petroleum produced in the state mes from the parishes of Caddo, Red River, De Soto and Clai- rne. The state's output in 1924 was 21,124,000 barrels. The cord output of 35,714,000 bbl. was attained in 1920 after the ening of the great Homer pool in Claiborne parish. Some of e wells in this district for a time yielded as much as 30,000 bbl. ily, but after 1920 production steadily declined.

Education.—The constitution of 1921 vests control of the pub- elementary and high schools and all other state educational stitutions except the state university in a Board of Education eleven members. School attendance is compulsory for 140 days each school year by all children between the ages of 7 and 14 ars. This law, however, has not been strictly enforced because the lack of school facilities, and in 1923 only 76·8% of the white ildren of school age, and 58·2% of the negro children were en- lled. Substantial improvement in school facilities, however, curred after 1919. In that year total school expenditures were ,702,000; by 1923 they had increased to $25,430,000. The aver- e salary for white male teachers in 1923 was $1,353, compared th $1,011 in 1919; for white female teachers $1,009 in 1923, com- red with $598 in 1919. Between 1919 and 1923 salaries of negro ıle teachers increased from $298 to $525, and of female negro ıchers from $217 to $408.

History.—Although the state is normally democratic, there s a temporary defection from the Democratic party after 1913 that section of the state where the production of cane sugar is chief industry. This was due to the unpopularity of the riff Act of 1913, enacted by a democratic congress and materi- y reducing the duties on sugar. By 1920 the breach in the rty was healed. The state ratified the Eighteenth (Prohibition) deral Amendment Aug. 3 1918. The industrial canal at New leans was opened to navigation Feb. 6 1923. This canal con- cts the Mississippi river with Lake Pontchartrain and gives pping more direct access to the sea than is possible by follow- the winding course of the river for 90 m. to its mouth. The ıal is 5½ m. long and was 5 years in building. The governors er 1908 were: Jared Y. Sanders (Dem.) 1908–12; Luther E. ll (Dem.) 1912–6; Ruffin G. Pleasant (Dem.) 1916–20; John Parker (Dem.) 1920–4; Henry M. Fuqua (Dem.) 1924–

(W. O. S.)

OUISVILLE, Ky., U.S.A. (*see* 17.63), lost one of its principal lustries through the elimination of its distilleries by the ghteenth (Prohibition) Amendment to the Federal Constitu- n. Its tobacco market was affected by the development of co- erative marketing and loose-leaf marketing of tobacco in ntucky. In compensation many new industries were added the already long list. The total output of the plants within the y was valued at $101,284,000 in 1909; $204,566,000 in 1919; 40,537,718 in 1923. In 1922 annexations of territory (11,000) increased the area to 36 sq. m., but important plants were l outside the corporate limits. The leading industries in the uisville district in 1925 were tobacco (value in 1923, $25,678,-), car works, sanitary plumbing fixtures, petroleum refining, ughtering and meat-packing. The population in 1920 was ,891 (91·4 males to 100 females), of whom 40,087 were negroes slight decrease since 1910) and 11,667 foreign-born (a decrease 34%). A special census in Dec. 1925, under the supervision of the U.S. Census Bureau, showed a population of 305,935.

Bank clearings increased from $667,947,515 in 1914 to 611,927,608 in 1924. Investment in building in the six years following the World War amounted to over $100,000,000, of which more than half was for 10,000 dwellings. Many of the characteristic low structures were replaced by apartment houses, hotels and tall business buildings. By 1925 sewer construction costing $4,600,000 was completed, and additional work of an equal amount was under way; the municipally-owned water company was beginning a four-year programme of expansion, to cost $4,498,000; construction of the war memorial auditorium was awaiting the outcome of litigation over the site; a new municipal highway bridge to Jeffersonville, Ind., was planned; work was begun on the elimination of grade crossings, and also on a hydroelectric plant (initial capacity 108,000 H.P.) at the Falls of the Ohio. Canalisation of the Ohio river from Pittsburgh to Louisville was completed in 1925, and completion of the project to Cairo is expected by 1929.

In 1910 the public schools were placed under the control of a non-partisan Board of Education. The University of Louisville (enrolment, 1925, 1,200) moved its school of arts and sciences to a new 55-ac. campus in Sept. 1925, and $1,000,000 was voted by the city in November for new buildings. Additions to the university include the Speed Scientific School (opened 1925); the Louisville College of Dentistry (formerly affiliated to Centre College); an Art Museum (under construction); and an extension centre for negroes (to be opened 1926). The Southern Baptist Theological Seminary also moved (Jan. 1926) to a new campus of 51 ac. and a fine plant built at a cost of $2,000,000.

LOURENÇO MARQUES, Delagoa Bay (*see* 17.65), has a population (1925) estimated at 22,000, including 8,000 Europeans. There is safe entrance to the harbour and the minimum depth of water in the Cockburn Channel is 25 feet. The port offers ample accommodation and facilities to shipping, including coaling and cold storage plant. Many of the leading merchants are British and most of the traffic of the port is transit trade with the Transvaal, whence it obtains its coal for export and bunkering.

Competition between the port and Durban for the Rand trade led to a convention (known as the Mozambique convention) being made with the Transvaal in 1909. Among other things it provided that 50 to 55% of the railway traffic in the "competitive area" of the Transvaal should pass through Delagoa Bay; the percentage going through the bay in 1914 was 48·79 and never exceeded that figure until 1922, when it was 52·86. The Union Govt. then denounced the convention, which lapsed on March 31 1923. The provisions it contained for the recruitment in Portuguese territory of native labour for the Transvaal mines and forbidding differential duties on merchandise passing between Lourenço Marques and the Transvaal were, however, preserved by a *modus vivendi*. Negotiations for a new convention had not, up to the middle of 1926, resulted in an agreement.

The value of goods in transit through Lourenço Marques was £4,547,000 in 1912; £2,334,000 in 1915; £5,176,000 in 1919 and £4,806,000 in 1923, in which year re-exports were valued at £1,244,000, as against £411,000 in 1912. Exports of local produce were valued at £162,000 in 1913 and at £789,000 in 1923. The number of vessels entering the port in 1924 was 644, the tonnage being 3,060,000 gross. In the latter part of 1925 the depreciation of the Portuguese currency and the abolition of the use of sterling currency caused serious difficulties to importers and led to strikes and disturbances which continued into 1926 when the position began to improve.

See the *Delagoa Directory, 1925* (Lourenço Marques and London) and the *South and East African Year Book* (London, annually).

LOUVAIN, Belgium (*see* 17.67), with a population of 40,693 in 1923, suffered very severely during the World War, and was given the Croix de Guerre in 1925. In Aug. 1914, after the German entry, about one-third of the town was burnt, including the whole of the Rue de la Station and the Place du Peuple, the Vieux Marché, the Palais de Justice, the Théâtre, and the famous Halles Universitaires, with its splendid library; the interior and roofs of the collegiate Church of St. Peter were seriously damaged, and the chimes destroyed. The elaborate Gothic Hôtel de Ville, damaged in 1890 and in process of restoration in 1914, was used as headquarters by the Germans, and was not further harmed; the restoration has since been completed.

Restoration Works.—Rebuilding, studiously on the old models, was started soon after the War, and early in 1925 few signs of the ruin done were outwardly visible, though much remained to be finished. The Place de la Station, where a number of civilians were killed and buried, has been renamed Place des Martyrs, and the rebuilt Rue de la Station is now called Avenue des Alliés. A striking War memorial has been erected. The university was reopened in 1919, with a larger number of students than before the War. The foundation stone of the new university library was laid in 1921, and the first wing opened in 1923. The building, in the Flemish style, is being paid for by American citizens, and books and fittings have been contributed by many nations. About 500,000 books had been collected when the new wing was opened, nearly 50,000 coming from the John Rylands Library, Manchester. The church of St. Peter was undergoing restoration in 1926.

LOW, SETH (1850–1916), American administrator and educationalist (*see* 17.72), died at Bedford Hills, N.Y., Sept. 17 1916.

LOWELL, ABBOTT LAWRENCE (1856–), American educationalist (*see* 17.73), built for Harvard at his own expense a president's house, which was finished in 1912. From the time that he became president (1909) he took great interest in the social life of the students (*see* HARVARD UNIVERSITY). President Lowell was a strong supporter of free speech among the members of the faculty. After the outbreak of the World War in 1914 he refused to accept the resignation of Prof. Münsterberg, who had defended the German cause. In 1915 Prof. Kuno Meyer, of the University of Berlin, sent a letter of protest because of the publication in one of the college magazines of a satirical poem, *Gott mit Uns*, by an undergraduate. In his reply President Lowell pointed out that freedom of speech was an important characteristic of American universities as distinguished from those in Germany. He was chairman of the executive committee of the League to Enforce Peace, and later was a strong supporter of the League of Nations. Lowell was the author of *Public Opinion and Popular Government* (1913), based on lectures at Johns Hopkins University; *The Governments of France, Italy and Germany* (1914), abridged from his earlier *Government and Parties in Continental Europe;* and *Greater European Governments* (1918), abridged from earlier works.

His brother, PERCIVAL LOWELL (1855–1916), American astronomer (*see* 17.73), died at Flagstaff, Ariz., Nov. 12 1916. In 1910 he lectured in London before the Royal Institute, and in Paris before the Association Astronomique.

LOWELL, AMY (1874–1925), American poet, critic and lecturer, was born Feb. 9 1874 in Brookline, Mass., being a sister of Abbott L. and Percival Lowell She came of a line of public-spirited lawyers and men of affairs, who for three generations had been, like herself, lovers and planters of gardens. She received her education from her mother, who was an accomplished musician and linguist, and from private schools; and she later travelled abroad extensively, visiting Greece, Constantinople and Egypt. After her father's death in 1900 she occupied herself with municipal affairs, until "about 1902," she writes, "I discovered that poetry . . . was my natural mode of expression. And from that moment I began to devote myself to it seriously." But she published nothing for nine years, when, in 1910, her first published poem appeared in *The Atlantic Monthly*. Her first volume, *A Dome of Many-Coloured Glass*, is dated 1912. Thereafter her books followed each other in rapid succession: *Sword Blades and Poppy Seeds* (1914); *Six French Poets: Studies in Contemporary Literature* (1915); *Men, Women and Ghosts* (1916); *Tendencies in Modern American Poetry* (1917); *Can Grande's Castle* (1918); *Pictures of the Floating World* (1919); *Legends* (1921); *Fir-Flower Tablets*, with Florence Ayscough (1921); *A Critical Fable* (1922); *John Keats* (1925); *What's O'clock* (1925); *East Wind* (1926). During all this period Miss Lowell contributed critical articles to various magazines, and lectured extensively. In 1920 she received the degree of Litt.D. from Baylor University. She had suffered from a serious malady for years, and on the eve of a visit England, during which she was to have lectured at Oxfo Cambridge, Eton, Edinburgh and elsewhere, it became acu and she died suddenly, May 12 1925, at Brookline, Mass.

Miss Lowell, during her later years, was the most striki figure in contemporary American poetry. Her vivid and pow ful personality, her intellectual vigour and independence, a her zest in life gave her a conspicuous and in some respects unique position. She was an acknowledged leader of the gro in America and England which called itself the Imagists. B through all her radicalism ran a strong conservative strain, a she never abandoned conventional verse forms, nor for so years before her death had she been affiliated with any scho Among her contributions to poetry must be reckoned the p fecting, in her best work, of the technique of "free" verse; h almost unrivalled command of the vocabulary of sensuous i pressions; the wide range of the themes to which she has giv poetical expression, and the clarity and restrained beauty many of her shorter poems. Her most important critical wo the result of long and devoted labour, is the biography of Kea which essays to reinterpret him as "a new generation of po and critics" regards him. (J. L. L.*)

LOWELL, Mass., U.S.A. (*see* 17.76), had in 1920 a populati of 112,759, an increase of 6·1% in 10 years. The foreign-bo population numbered 38,116 (including 10,180 French Ca dians), a decrease of 12·5%. In 1925 the state census showed decrease of the total population to 110,542. The factory outp had a value of $59,688,000 in 1909; $137,802,000 in 1919; $8 645,704 in 1921; $100,998,057 in 1923. Lowell was affected the long strike of the textile workers in 1922. The commissi form of government was adopted in 1911, but in 1920 the chart was again amended, providing for a mayor elected at large and city council composed of one member from each of the nine war and six elected at large. On Dec. 9 1925, 10 officials, includi the mayor and a former mayor, were arraigned on charge of co ruption. A beautiful memorial auditorium was erected (192 in honour of the men and women of the city who took part the wars of the country. Lowell has the usual characteristics a mill town—a preponderance of women in the population (92 males to 100 females, 1920), a high proportion of women a children at work (38·7% of all females 10 years of age and ov 8·8% of the children 10–15), a high infant mortality (1 deaths under one year per 1,000 births, 1923) and a low percen age of home ownership (26·1% in 1920), due to mobility labour.

See George F. Kenngott, *The Record of a City; a Social Survey Lowell, Massachusetts* (1912).

LOYSON, CHARLES (1827–1912), better known as Pè Hyacinthe, a famous French preacher, was born at Orléans. was educated for the priesthood and entered the Carméli order. His eloquence drew large crowds to his Advent sermo in Notre-Dame between 1865 and 1869, but his orthodoxy f under suspicion, and in 1870 he associated himself with Dölli ger's protest against the dogma of papal infallibility (*see* 14.51 20.67). Being excommunicated he broke finally with the Chur of Rome, and removed first to Geneva and then to London. married an English lady, Emily Jane Merriman, and settled Paris in 1877, where he founded an Old Catholic Church. died in Paris Feb. 9 1912.

LUCAS, EDWARD VERRALL (1865–), British man letters, was born at Brighton and educated at University Colleg London. He then started journalism, working first on a Suss newspaper, then in London with *The Globe*, and became a fr quent contributor to *Punch* and later its assistant editor. acted for many years as publisher's reader to the firm of Methue and became head of this company after the death of its found (1925). Lucas wrote a very large number of miscellaneous book but is best known as a light essayist in the vein of Elia, a published many collections of these essays. His edition of t *Letters of Charles and Mary Lamb* (1903–5) and his *Life of Lam* (1905) likewise showed how congenial was his talent with th of Elia. He was successful also as a writer of travel impression nong these being *A Wanderer in Holland* (1905), *A Wanderer : London* (1906) and *A Wanderer in Paris* (1909), and his books ı art showed powers of wide appreciation, as in *The British chool* (1913), *Vermeer of Delft* (1922), *John Constable* (1924). ight fiction, children's books, humorous skits and many ıthologies have also issued from his singularly fluent pen.

LUCAS, JOHN SEYMOUR (1849–1923), British painter (*see* 7.93), died in hospital at Southwold, Suffolk, after an accident, ı May 8 1923.

ŁUCK, or **LUTSK, BATTLES OF.**—Under this heading are scribed the Russian attacks on their southwestern front—hich extended from the Pinsk marshes to the northern frontier Rumania—during the summer and autumn of 1916. These tacks are generally known as "Brusilov's offensive." The riginal break-through of the Austrian front occurred near the own of Łuck (Lutsk), in Volhynia, on the river Styr, which ıus gives its name to the whole series of operations (*see* EASTERN UROPEAN FRONT: MAP).

General Situation in May 1916.—After the costly failure of ıeir attacks in March (*see* LAKE NAROCH, BATTLES OF), the ussian supreme command had set to work to prepare a large ale offensive on the front west of Mołodeczno, as their contri-ıtion to the great general Allied offensive which was to open on l fronts on July 1. Elaborate preparations were made during pril and May for this Mołodeczno attack, in which 26 divisions ere to carry out the initial assault. The Russian line was at is time divided into three fronts: the Northern, from the Gulf Riga to south of Dvinsk, containing 38 divisions; the Western, own to and inclusive of the Pinsk marshes, containing 58 divi-ons; and the Southwestern, down to the Rumanian frontier, ntaining 38 divisions. The Pinsk marshes also formed the viding line between the German and Austrian sectors of the astern front. In the German sector there were approximately German and two Austrian divisions; in the Austrian sector ere were 38 Austrian and three German divisions. Since the eat offensive of the Central Powers against Russia had come an end in the autumn of 1915, their forces on the Eastern ont had been considerably reduced. The Germans had taken oops for their Verdun offensive, and the Austrians during the ring had withdrawn formations for an offensive against Italy. ıe Russians, on the other hand, had recovered rapidly from eir disasters of the previous year; the ranks were full and muni-ons more plentiful than before.

Preparation of Brusilov's Offensive.—Gen. Brusilov suc-eded Ivanov as Commander-in-Chief of the south-western ont in March. He was a cavalry soldier and had commanded e VIII. Army since the commencement of the War with con-icuous success. He received instructions to prepare attacks on e south-western front to distract the enemy's attention from e main Russian effort at Mołodeczno. The four armies under usilov were: the VIII. (Kaledin) from the Kowel-Kiev rail-y near Rafałowka to about Kremenets, 11 divisions and ır cavalry divisions; the XI. (Sakharov) from Kremenets to ar Tarnupol, eight divisions and one cavalry division; the I. (Shcherbachev) from near Tarnupol to Potok, seven divi-ns and 3½ cavalry divisions; and the IX. (Lechitski) from tok to the Rumanian frontier, 10 divisions and three cavalry visions. There was one corps (two divisions) in reserve.

The Austrian IV. Army (Archduke Joseph Ferdinand), from ar Rafałowka to Dubno, with 10½ divisions and one cavalry vision, and the II. Army (Böhn-Ermolli, from Dubno to near emenets, with eight infantry and two cavalry divisions, were posed to Kaledin; the German Southern Army (von Bothmer) th one German and nine Austrian divisions and two cavalry visions, held a long front, corresponding approximately with ose held by the Russian XI. and VII. Armies; while the Aus-an VII. Army (Pflanzer-Baltin), with 8½ divisions and four valry divisions, opposed Lechitski. In the actual number of visions there was little disparity between the total forces at disposal of either side; the Russians had 38 divisions and 12 valry divisions to the Austro-German 37 divisions and nine cav-y divisions; but the Russian divisions were larger. The Austrian front had been strongly fortified and organised, and in spite of the removal of some of their most reliable divisions and much heavy artillery to the Italian front the Austrians were confident of being able to hold their ground.

About the middle of April, Brusilov had ordered each of his army commanders to select a sector of attack and to make preparations with the resources at his disposal within his own army to penetrate the enemy's front in that sector. Preparations were to be complete before the middle of May. These attacks were designed simply as aids to the main Russian offensive in the north, timed for July 1. On May 14, however, the Austrians began an offensive in the Trentino against Italy. The Italians appealed to the Russians to relieve the pressure by attacking the Austrians on their front. Brusilov accordingly launched his attacks on all four army fronts on June 4, without any expectation of a decisive break-through or arrangements for exploitation of success on a large scale.

The Break-through at Łuck.—The sector of attack chosen by Kaledin, commander of the VIII. Army, centred on the village of Olika, east of Łuck. The bombardment began on June 4 and the assault was made by the XL. and VIII. Corps early on June 5. The XL. Corps carried three lines of enemy trenches and penetrated over two miles, and the VIII. Corps, though less successful, made considerable progress. The advance continued on June 6 and on June 7 reached Łuck. By this time a wide gap had been made between the Austrian IV. Army and the II. Army further south, and a great opportunity for the numerous Russian cavalry seemed to have come. But of the four cavalry divisions allotted to Kaledin's army, two had been used to hold trenches so as to enable infantry to be concentrated for the assault and one was dispatched by Brusilov in a fruitless raid along the railway towards Kowel through marshes entirely unsuited for cavalry action. The one remaining division could accomplish little. Meanwhile the left wing of the VIII. Army occupied Dubno on June 9; on June 10 the front of the army lay along the line of the rivers Styr and Ikwa, from Rozyszcze through Łuck to Dubno.

Attacks of the XI., VII. and IX. Armies.—The attack of the XI. Army northwest of Tarnupol was a failure. Shcherbachev's VII. Army attacked in a sector on its extreme left near the village of Jaziowec. After two-days' bombardment the infantry assaulted early on June 6 and carried the enemy positions; next day the Austrians were driven behind the Strypa. The Russians crossed the river on the 8th and gained further ground during the next two days. Counter-attacks then arrested their advance for the time being. Lechitski's IX. Army attacked some 20 m. north of Czernowitz, near the village of Okna, with complete success. By June 10 the front was broken and the Austrians retreated in disorder behind the Prut. Czernowitz was captured on June 17.

Consequences of Brusilov's Success.—Thus by the middle of June the Austro-German front south of the Pinsk marshes was completely broken on both flanks, and two armies, the IV. and VII., were in full retreat. In the centre Böhm-Ermolli's and von Bothmer's armies still held, though their outer flanks had been driven in. On three-quarters of the whole Russian southwestern front their armies were moving forward. These entirely unexpected results of an offensive undertaken purely as a demonstration reacted instantly on the whole strategy both of the Russians and of the Central Powers. On the Russian side, the new situation demanded the immediate transfer of the principal reserves from the north, where they had been grouped for the Mołodeczno offensive, if Brusilov's success in the south were to be exploited. The decision was taken promptly enough, the Mołodeczno offensive was abandoned, Lesh's III. Army astride the Pripet was added to Brusilov's command and troops were hurried south as rapidly as the capacity of the railways would permit. Unfortunately for the Russians, the poverty and low efficiency of their communications gave the enemy time to concentrate sufficient reinforcements to restore their front before the full weight of the Russian reserves could give a fresh impetus to the advance.

For the Germans, the sudden reverse came at a difficult time, for they were fully engaged at Verdun and were expecting a Franco-British offensive at an early date; obviously, too, events might have a decisive influence on the attitude of Rumania. Reinforcements were at once collected to restore the situation; to close the principal gap, it was decided to stage a counter-attack on a large scale on both sides of the Kowel-Rowne railway. This attack was entrusted to von Linsingen, the German commander of the Austro-German Army holding the area of the Pinsk marshes opposite the Russian III. Army. He was reinforced by three German divisions from the northern part of the Eastern Front, four from France and two Austrian divisions from the Trentino. During the whole of the latter half of June, as these reinforcements arrived, he counter-attacked persistently towards Łuck and to the north and south of it. These attacks, though they brought the Austro-German forces little gain of ground, had at least the effect of limiting Kaledin's break-through. On July 4, the left of Lesh's III. Army, in conjunction with Kaledin's right, launched an attack in the bend of the Styr east of Kowel and drove von Linsingen's army back to the Stochód river. This put an end to the Austro-German counter-attacks, and there were no further important operations on this part of the front till the end of July.

Occupation of Bukovina.—Meantime, Lechitski in the south was completing the conquest of the Bukovina. After the capture of Czernowitz, part of the Austrian VII. Army retreated precipitately south to the Carpathians, pursued by the left wing of Lechitski's army, which occupied Kimpolung on June 24. His right wing, advancing between the Dniester and the Prut, won a victory on June 28 and occupied Kolomyja on the following day. At the beginning of July the Austrians in the south received reinforcements and made a series of counter-attacks opposite Kimpolung and Delatyn. These were defeated, and Lechitski's right wing occupied Delatyn on July 10. His army was now, however, enormously extended and had to halt to await reinforcements.

Reorganisation of Command by the Central Powers.—The German command, which had since the beginning of June sent 16 divisions to the front south of the Pinsk marshes, naturally claimed an increased influence on the direction of operations on this front. Very shortly after the first break-through at Łuck they had insisted on the removal from his command of the IV. Army of the Archduke Joseph Ferdinand and on the extension of von Linsingen's sphere of command southwards to the northern frontier of Galicia. The greater portion of Pflanzer-Baltin's VII. Army had also been transferred to von Bothmer commanding the German Southern Army. It was now proposed to appoint Hindenburg to the supreme command of the Eastern Front as far south as Lemberg; the remainder of the front, on both sides of the Dniester and in the Carpathians, was to be under the Austrian heir apparent, Archduke Charles Francis Joseph, with the German General von Seeckt as his chief of staff.

This arrangement was eventually brought into force early in August. The Archduke Charles had originally come from the Italian front at the beginning of July to command a XII. Army, which was to be formed from troops on the spot and fresh reinforcements, and was to deliver a counter attack on a large scale on both sides of the Dniester in a southeasterly direction. But as the incoming reinforcements had always to be thrown into the battle so soon as they arrived, the formation of the XII. Army and the proposed counter-offensive never took place. Instead, the III. Army command from Tirol took over the troops between the Carpathians and the Dniester. The Archduke's command thus comprised the VII., III. and Southern armies.

Battle of Brody.—During the latter half of July, while the VIII. and IX. armies on the flanks paused to await reinforcements, Brusilov ordered Sakharov's XI. Army, which had extended its front northwards to beyond Dubno, to take the offensive. It attacked near Boromel, southwest of Łuck, on July 16 and drove the enemy back across the Lipa. Sakharov then moved south on Brody, which he captured with 40,000 prisoners on July 28—a fine victory. Meanwhile Shcherbachev's VII. Army, in spite of repeated attacks northwest of Buczacz towards Monasterzyska, had failed to make much impression von Bothmer's Southern Army. Lechitski, however, at the e of July gained some ground towards Stanislau.

Attack on Kowel.—Towards the end of July the Russian Gua Army (I. and II. Guard Corps, I. Corps, XXX. Corps, Gua Cav. Corps) detrained from the north and took up a front b tween the III. and VIII. armies. The Guard had not be in action since the previous Sept. and had been careful trained and kept in hand for a great occasion. It was now d cided to use it to force the line of the Stochód river and captu Kowel. It is difficult to understand why this line of advan was chosen for a supreme effort. The terrain is mainly mar and advance is usually possible only on narrow causeways. T attacks, which commenced on July 28 and were continued up Aug. 10 resulted in a complete and costly failure. The Gua Army lost 55,000 men for a trifling gain of unimportant groun Brusilov thereafter abandoned the direct advance on Kow but continued up till the middle of Oct. attempts to enlar the Łuck salient in the direction of Włodzimierz Wolynski. these attempts ended in failure.

Conclusion of the Offensive.—In the south, Lechitski attack again south of the Dniester on Aug. 7 and drove back Köve III. Army. He occupied Stanislau on Aug. 10 and Nadwór on Aug. 12. On this latter date the VII. Army occupied Monaterzyska. Under the threat from this flank and pressure fro Sakharov's army south of Brody, von Bothmer now at last ga up the original line which he had held throughout all the turmo and withdrew towards Brzezany.

Austro-German counter-attacks in the Carpathians in t first half of Aug. had little success. On Aug. 20 the Russia reorganised their front so as to allow Lechitski's IX. Army have as its only task the forcing of the Carpathian passes b tween Delatyn and Kimpolung, in order to protect the rig flank of the Rumanians, who joined the Allies on Aug. 27. spite of severe fighting throughout Sept. little progress w made on this front. Nor was any appreciable advance ma elsewhere on the southwestern front in spite of repeated a saults. In Oct. the defeat of the Rumanians necessitated t transfer of troops to that theatre and the abandonment of fu ther offensive operations. The summer which had opened brilliantly ended in disappointment and failure.

Results of the Offensive.—Although Brusilov had recaptur practically the whole of the Bukovina and large portions Eastern Galicia and Volhynia and had taken some 350,0 prisoners and over 400 guns, the cost had been exceeding heavy. The casualties on the southwestern front were over million. These losses and those suffered in the abortive attac on the Northern and Western fronts in 1916, at Lake Naroc Baranowicze and Riga, were in the end the principal cause of t rapid infection of the army with anti-war propaganda when t revolution came. In fact the revolution itself was partly due disappointment at the outcome of the 1916 campaign, from whi so much had been hoped. The campaign showed the striki contrast in fighting qualities between Austrian, German a Russian troops. In spite of their lack of artillery and techni equipment, Brusilov's armies broke through the strongly for fied Austrian lines and would have completely destroyed t Austrian armies but for the presence of German troops, agair whom their assaults invariably broke down.

It is difficult to trace any strategical conception underlyi the Russian operations; the time and place for the various a tacks seem to have been chosen on purely local consideratio This was largely due to the unexpected nature of the succ and to the poor communications, which prevented the tim transfer of reserves from one portion of the front to anoth Hailed by her Allies as proof of the complete regeneration of t Russian Army, Brusilov's offensive was really its death-knell

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LUCY, SIR HENRY (1845–1924), British journalist, was born at Crosby, near Liverpool, Dec. 5 1845. Educated in Liverpool, he began life in a Liverpool merchant's office, but soon became a reporter for a Shrewsbury periodical. In 1870 he joined the staff of *The Pall Mall Gazette*, London, and in 1873 became pariamentary reporter to *The DailyNews*, with which paper he had a long connection in various capacities. In 1881 he also joined he staff of *Punch* and won a great reputation as the contributor of its parliamentary sketch signed "Toby M.P." He was knighted in 1909 and retired from parliamentary work in 1916. He published his autobiography, *Sixty Years in the Wilderness*, n 1909, and *The Diary of a Journalist* in 1920. He died Feb. 0 1924.

LUDENDORFF, ERICH (1865–), German soldier, was born at Kruszevnia, in the province of Posen, April 9 1865. When 18 years old, he entered the Prussian Army. In 1894 he oined the General Staff, and, except for an interval of two years s company commander, remained on it from 1894 to 1913, nder Count Schlieffen and the younger General von Moltke. As chief of the *Aufmarschabteilung*[1] since 1908 he played a prominent part in the mobilisation preparations. The last great ncrease in the strength of the army in 1913 was largely due to is initiative and energy. During the year preceding the outreak of the World War he commanded first the 39th Fusilier Regiment at Düsseldorf, and afterwards an infantry brigade at trasbourg.

At the outbreak of the World War Ludendorff was quartermaster general of the II. Army. His voluntary assumption in the eginning of Aug. of a decisive rôle at the capture of the fortress f Liége gave him his first great opportunity. He took over the command of the 14th brigade of infantry, in the place of General on Wussow who was killed, and, breaking through the ring of ortifications at its head, seized the interior of the town. He as rewarded on Aug. 22 by being made chief of staff to Hindenurg in the VIII. Army which was fighting in East Prussia.

Campaigns in East Prussia.—The battle of Tannenberg evealed his powers of generalship, for he there demonstrated he justice of the theory of annihilation. The victory of Tannenerg over the Russian Army of the Narew was more than another annae. For in this case there was not, as in former days on he Aufidus, merely one enemy to be dealt with. On the conary, the attempt was made to envelop the greatly superior ain body of Russians in the presence of a second enemy force reatening the rear. And the attempt proved successful. In e subsequent operations which led to the first battle on the asurian Lakes and to the heavy defeat of the Russian Army the Niemen, the enemy's right wing was supported on the ke, and so only an envelopment of the southern wing was ssible. The operations, therefore, took the form of an attack the enemy's front and on his exposed flank.

The strategic success lay in the liberation of East Prussia om the enemy. The German Army of the East became availle for the immediate support of the Austro-Hungarian ally, by is time in dire straits. This support was rendered in the brilnt Oct. campaign of the newly-formed IX. German Army rected through Southern Poland upon the Vistula. Its purse—to facilitate the Austrian efforts in Galicia by drawing upon the IX. Army the strongest possible body of Russian oops—was attained in a degree entailing grave danger to the tnumbered Germans themselves. The menace of envelopnt by a vastly superior enemy, pouring up from the direction Warsaw, was parried and beaten off by Ludendorff by means an exceedingly gallant defensive action, carried out during thdrawal. In Nov., after a rapid regrouping of the main Gern forces, an advance was made from the Wreschen-Thorn e against the right flank of the main body of the Russians, ng in West Poland. In the absence of sufficient strength a multaneous frontal attack was impossible. But even so, the ccess achieved in the battle of Lódź was great. The Russians re definitely relegated to the defensive—and, in the pursuit which followed, were flung back behind the Bzura and the Rawka.

During the fighting in Masuria in Feb. 1915 Ludendorff achieved the destruction of another Russian Army in the region of the Upper Bobr. This was followed by a period of relative inactivity on the German Eastern Front lasting for several months. Not before the middle of July 1915 did the army group of Hindenburg resume the war of movement. By an attack directed upon and beyond the Lower Narew it relieved, by means of a converging offensive, the army group of Mackensen which had advanced from Galicia into Southern Poland between the Vistula and the Bug. In the ensuing operations the Russian Army was driven out of the Vistula positions and out of the whole of Poland towards the East. After a brief resistance the fortresses of Warsaw, Nowogeorgiewsk (Modlin) and Kovno fell. But no decisive issue was reached, because General von Falkenhayn, Chief of the German General Staff, rejected the proposal of Hindenburg and Ludendorff, which was to advance with the German left wing in a northerly direction through Kovno and Vilna upon Minsk, thereby cutting the Russian railway communications, north of the Polesia. Had the operations been conducted in accordance with the views of Hindenburg and Ludendorff, the Russian Army might have been dealt a mortal blow in the summer of 1915. Later, in Sept., the attempt was made on the German left wing, but with inadequate forces, to embarrass the retreat of the section of the Russian Army withdrawing northwards from Polesia past Vilna; but the moment for success on a grand scale had gone.

After the victorious conclusion of the Balkan campaign in the winter of 1915-6 Ludendorff contemplated a great offensive into the heart of the Ukraine, with the object of breaking the back of the economic resistance of Greater Russia, which was already cut off from the sea. The offensive necessitated the occupation of Rumania; but General von Falkenhayn rejected this scheme, and chose Verdun instead of Kiev as the objective for operations. Accordingly in the year 1916 the Eastern Front of the allied Central Powers was assigned the duty of protecting the rear of the offensive movement in France. This task was amply fulfilled on the northern wing but on the southern wing, held by the Austrians, the front completely collapsed in June and July at Łuck and in Galicia. The balance in the East was restored with difficulty by the intervention of the German command.

On Aug. 29 Field-Marshal von Hindenburg assumed the office of Chief of the General Staff of the armies in the field, in the place of Falkenhayn, and Ludendorff became First Quartermaster General. In contrast with their predecessor's point of view, the two men still promised themselves triumph, but a triumph which could only result from a more vigorous conduct of the War by drawing upon the whole available strength of the country in wealth and population. The methods adopted for the utilisation of these resources were expressed in the so-called "Hindenburg programme" of war industries and in the so-called law of auxiliary services; and here Ludendorff could only co-operate by means of suggestions and demands. In his own sphere too, he found that, owing to the almost desperate military situation inherited from his predecessor, he was not at first able to put into practice Schlieffen's doctrine of annihilation. The result of the offensive against Rumania was that this new enemy was overthrown in the winter of 1916. This victory was of inestimable value to the Central Powers, for new sources of economic power were thereby opened up.

Submarine Warfare.—After the defeat of the Rumanian Army there remained but one further task. This was the frustration of the attacks of the enemy in the West, greatly superior in numbers and material. The restoration of the balance of strength thus aimed at was to enable the Central Powers later to deliver an offensive with decisive effect. A favourable diversion of this kind, however, could only be counted upon, if, during the strategical defence on land, England could be reduced to desperate straits. An intensified U-boat warfare in the blockade area round England was therefore adopted, a weapon, recourse to which had hitherto always been postponed on the score of political considerations. The disadvantage of this course was that it would give the United States a pretext for war on the side of the Entente; but regarding this as inevitable, Ludendorff hoped to render England disposed for peace before the Americans should be in a position to throw considerable forces into Europe.

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[1] The department which draws up plans for transport, disposition troops and advance.

Unrestricted U-boat warfare did not altogether fulfil expectations. The technical perfection of the enemy's defensive weapons and the ample scale upon which they had been completed contributed to this in a very material degree. On the other hand, without the adoption of unrestricted U-boat warfare the strategy of the Central Powers would have been altogether unable to hold the balance on land in suspense until, after Russia's collapse in the spring of 1918, there dawned a well-founded prospect of forcing a decision in France before the American forces on land became effective.

In the spring of 1917 in the Western theatre of war Ludendorff was enabled, by a timely withdrawal to the Siegfried position and by the elasticity of his defensive tactics, to impose a check upon the Allied attack carried out with a gigantic expenditure of men and material. Subsequently he had another opportunity of vindicating his theory of annihilation in the warfare on land. Under the blows dealt by the German hammer at Tarnopol, Riga, Dagö and Ösel, Russia fell. The reckoning with Italy followed in the autumn of 1917, but the situation in the West, particularly in Flanders where the fighting raged with undiminished fury, rendered it impossible for Ludendorff to secure a decisive victory.

The Offensive of 1918.—The German resolution to take the offensive in the spring of 1918 was rendered imperative by the general position. The psychological condition of the army peremptorily demanded that the rôle of anvil should be exchanged for that of hammer. Conditions at home called for a potent remedy against the threefold poison instilled by the hunger blockade, enemy propaganda and revolutionary agitation. Germany's hard pressed allies had for long rested their sole hopes of delivery on the efforts of Germany. Ludendorff saw only one road by which a tolerable peace, in harmony with the honour of the German people, could be reached, the road of military victory. This again could be attained solely by means of an offensive which should be decisive, and in taking this course he hazarded everything. A series of small attacks with limited objectives or a powerfully conducted defence would in favourable circumstances only have secured a temporary advantage, but could not prevent the enemy from finally giving full effect to his superior strength in a battle of annihilation. It is questionable whether the choice of direction for the offensive on French territory can be defended. Many critics would have preferred an offensive in Italy, but apart from the natural difficulties, even the destruction of the Italian Army could at best only have preceded the main decisive operations on French soil.

It has been questioned whether Ludendorff assembled adequate forces for the spring offensive of 1918. In March, at the beginning of this offensive, the Germans disposed of 193 divisions and three brigades in the Franco-Belgian theatre of war. The estimates of the forces commanded by the Entente in France and Belgium at the beginning of the spring offensive vary between 167 and 180 divisions. The Germans, therefore, enjoyed a slight superiority in the number of divisions. The original intention that a section of the Austro-Hungarian forces should take part in the decisive encounter in France was finally thwarted by the opposition of the Habsburg Emperor. Ludendorff accordingly chose the expedient of indirect assistance to be rendered by a relieving offensive carried out by the Austro-Hungarian Army in Upper Italy. This offensive, however, was undertaken much too late for the objective in view, in the middle of June, and, moreover, ended with a severe reverse. The occupation of Rumania called imperatively for four divisions and a greater number of Landsturm formations. The invasion of the Ukraine, carried out in Feb. and March, demanded about 20 weak divisions, including eight divisions of Landwehr and three of cavalry. It is disputable whether it would have been wiser to abandon the enterprise in the Ukraine. The secretary of state of the *Kriegsernährungsamt* urged with the utmost emphasis tha the economic resources of the Ukraine should be thrown ope to Germany. Failing this, the Austrians' system of food supplie would collapse. The delivery of meat was important for Germany, too, and the delivery of horses was, above all, a matter o the greatest urgency.

On political and military grounds Ludendorff had resolved t deal the first decisive blow in the West against the English. Fo this purpose he chose the southern flank, on both sides of St Quentin, as tactically the least defensible, with the intention o forcing his way through at this point and by advancing nort of the Somme towards the northwest, to roll up the whole fron gradually and press the English towards the sea. The souther wing of the German offensive was to guard his flank against relieving attack on the part of the French. This strategy becam subject to certain changes in consequence of the unexpecte magnitude of the initial success of the German southern wing which continued the offensive across the Somme and the Croza canal against the French, in order to effect a cleavage betwee the English and French at and beyond Amiens. This end wa not completely attained, and the result of the first offensive though great from the tactical standpoint was strategicall nugatory. A second attack on the Lys front, against the Englis and Portuguese, was made in the middle of April and was designed to gain possession of the commanding heights north Bailleul and to cut off the Ypres salient; its result, however, wa indecisive.

During the following months, in spite of successive brillian diversive attacks carried out against the French front, no furthe headway was made in forcing a decisive engagement in Flanders and the heavy toll of the spring offensives could not be mad good rapidly enough. And yet, prior to the last great attemp to break through on both sides of Reims in July 1918, ther still remained a prospect of final victory for the German arms The goal had nearly been reached—which was a proof that th strategy adopted might have succeeded and was, therefore, th right strategy. But the fortune of war was against Ludendorf His plans were revealed by treachery to the enemy, at a tim when everything depended on secrecy and surprise. The grea successes hitherto achieved had led to a wide extension of th German front, calling for the employment of disproportionatel large forces and offering in its many angles and salients dangerou surfaces to the enemy's attacks. These factors now made thei disastrous influence felt.

But the final cause of Ludendorff's inability to resume th initiative lay in the absence of a free command of reserves, du to the drying up of the sources of supply at home. When th German command fell back on the defensive before hosti attacks, Ludendorff realised that there was nothing to be don except to hold out until diplomacy succeeded in securing a to erable peace, or to perish with honour. On Oct. 26, however, h was overthrown by the Cabinet of Prince Max of Baden. Th collapse of Germany's allies, combined with difficulties at hom rendered hopeless any further resistance by the army in the fiel now thrown upon its own resources.

General Ludendorff was above all a man of action, and on who rated formation of character and the attributes of leade ship more highly than the acquisition of comprehensive learnin His resolution, his almost super-human and invincible powers work and action, his understanding of the moral factors in wa fare, inspired the German Army with boundless confidence his leadership and qualified it for mighty exploits. If like Hannibal and Lee he failed in the final issue, it was through no faul in generalship, but was partly due to slowness in realising tha his weapon had grown blunt and that the population at hom was no longer capable of the effort of endurance and the indispensable will to victory. His powers of leadership reflected hi character; brain, heart and will were all unsparingly enlisted i the service of one aim, the honour of his country. Along thi path he was impelled to travel, whether it led to victory o defeat.

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LUGARD, SIR FREDERICK JOHN DEALTRY (1858–), ritish administrator (*see* 17.115), was, on the completion of his erm of office as Governor of Hongkong, appointed in March 912 Governor of both Northern and Southern Nigeria, with nstructions to amalgamate the two administrations. The amalamation became effective on Jan. 1 1914, Sir Frederick being iven the personal title of governor-general. He guided the ffairs of Nigeria throughout the World War, retiring in 1919, nd was made a Privy Councillor in 1920. In 1922 he published *he Dual Mandate*, a book dealing with the duties of European owers in tropical Africa. In Nov. of that year he became a ember of the permanent mandates commission of the League f Nations (*see* MANDATES, NIGERIA).

LUKEMAN, HENRY AUGUSTUS (1871–), American ulptor, was born at Richmond, Va., Jan. 28 1871. He studied t the National Academy of Design, N.Y. City, and was a pupil f Launt Thompson and Daniel Chester French, perfecting his nowledge of anatomy by his year's study at Bellevue Hospital. n 1894 he spent a year in Paris studying under Falquière at the cole des Beaux-Arts, and on his return to the United States ettled in New York City. His work includes portraits, busts, tatues, memorials and bas-reliefs, among the best known being Mann, the Law Giver of India” for the Appellate Court uilding, New York City; the statue of President McKinley at dams, Mass.; “Genoa,” the figure of Columbus on the U.S. ustoms House, New York City (1905); The Soldiers' Monuent at Somerville, Mass. (1908); the group “Women of the onfederacy,” at Raleigh, N.C. (1912); the Soldiers' Memorial, ed Hook Park, Brooklyn, N.Y. (1920); the equestrian statue “Francis Asbury,” Washington, D.C. (1921). He was apointed in 1925 to succeed Gutzon Borglum as sculptor in arge of the Stone Mountain memorial near Atlanta, Georgia. *ee* ATLANTA.)

LUNACHARSKY, ANATOLY VASILIEVICH (1873–), ussian politician, author and dramatist, was born in the provce of Kiev of well-to-do parents. He joined the revolutionary ovement when still at college in Kiev, and afterwards studied tural science and economics at the University of Zurich. He egan his revolutionary activities in Russia in 1895 and was derted to Vologda in 1897, where he remained for three years, hieving a reputation as a brilliant writer and lecturer on Soalism. In 1903 Lunacharsky joined the Bolshevik or “majori” wing of the Social-Democratic party. He met Lenin in the llowing year, and also joined the editorial staff of the Bolshevik per *Vpered* (Forward). While doing literary work of a general ture he was chiefly concerned with social democratic propanda and with lectures and political meetings for Russian stunts and political refugees abroad. During the revolution of 05 Lunacharsky was imprisoned for his political activities, and hen the subsequent political reaction set in he left Russia and ent to live in Italy. Together with Gorky and Bogdanov, a ell-known Social Democrat, he formed the so-called “left-wing” Bolshevism (opposed to Lenin on certain theoretical points), d was one of the promoters of the Social Democratic party hools at Capri and Bologna.

From the outbreak of the World War Lunacharsky maintained determined internationalist attitude and disseminated violent ti-War propaganda in Paris and Switzerland, renewing closer ntact with the Lenin group after a temporary estrangement. the same time he made a careful study of educational probns in Switzerland, and this was to prove extremely useful to m later in his career. The revolution of March 1917 brought m back to Russia, and he immediately joined Lenin and Troty in their revolutionary opposition to the Provisional Governent. He was arrested after the Bolshevik rising in July; but s subsequently liberated and elected vice-president of the etrograd municipal board. In the initial stages of the Oct. volution and during the civil war, Lunacharsky proved himself one of the ablest political speakers of the new Soviet State, and was an energetic and successful emissary of the Military Revolutionary Council to the various war fronts. As people's Commissar for Public Instruction in the new Soviet Govt., Lunacharsky rendered inestimable services by ensuring the preservation of works of culture and art during the civil war. He devoted himself to the promotion of mass instruction, and of culture and art in Soviet Russia, while his especial concern for the welfare of the theatre did much to further the development of the Russian stage.

A man of exceptional culture, steeped in philosophical and scientific studies, Lunacharsky also won his spurs in the field of literature. He wrote 14 plays (published in 2 vol.), of which several were produced with conspicuous success in Russia and in Berlin. “Vasilisa the Wise,” “Faust and the City” and “The Magi” were translated into English by Leonard Magnus and published under the title of *Three Plays* (1923). He also wrote books on politics, economics, philosophy, literature and art.

LUNACY: *see* INSANITY.

LUND, TROELS FREDERIK (1840–1921), Danish historian (*see* 17.123), published in 1909 *Nye Tanker i det XVI. Aarhundreds*. In 1911–2 appeared his historical tales, *Tider og Tanker*. He died in 1921. See Knud Fabricius, *Troels Lund* (1921).

LUNG: *see* HEART AND LUNG SURGERY.

LUPU, NICHOLAS (1876–), Rumanian politician, was born at Arsura (Rumania) on Nov. 8 1876. He started his career as a country doctor and entered politics in 1905. He played an important part during the peasant revolt in 1907 when, as prefect of the Falciu district, he succeeded in pacifying the peasants without having recourse to violent measures. In 1913 he was elected deputy and in 1919 he entered the Vaida-Voevod Coalition Cabinet as minister of the interior, representing, together with Mihalache, the Peasant (Tsaranist) party, of which Dr. Lupu became one of the principal leaders. During the World War, Dr. Lupu visited Russia, France, England, Italy and the United States and carried on an active propaganda campaign on behalf of Rumania.

LUSCHAN, FELIX VON (1854–1924), Austrian anthropologist and ethnographer, was born on Aug. 11 1854 in Vienna. He studied medicine in Vienna, anthropology in Paris, became demonstrator in physiology at the university at Vienna, and in 1878 organised the Austro-Hungarian section for anthropology and ethnology at the World Exhibition in Paris. Whilst a military doctor in Bosnia, he studied anthropology and archaeology, and in 1880 travelled in Dalmatia, Montenegro and Albania. During the following 10 years he was often in Asia Minor and Egypt, and in 1883 excavated the ruins of Sendschirli in Northern Syria on behalf of the Berlin Oriental Committee. After a brief period as lecturer in anthropology in Vienna, he became directorial assistant at the Ethnological Museum in Berlin, of which he was director from 1904 until his death, on Feb. 7 1924. His works include: *Beiträge zur Völkerkunde der deutschen Schutzgebiete* (1897); *Die Ausgrabungen von Sendschirli*, 2 pts. (1893, 1898); *Beiträge zur Ethnographie von Neu-Guinea* (1899); *Beiträge zur Anthropologie von Kreta; Rassen und Völker* (1908); *Völker, Rassen und Sprachen* (1922); *Anthropological View of Race;* Papers on Inter-racial Problems communicated to the First Universal Race Congress (London, 1911); “The Early Inhabitants of Western Asia,” *Jour. Roy. Anth. Inst. of Great Britain and Ireland* (1911).

LUTHER, HANS (1879–), German statesman, was born in Berlin March 10 1879, and studied law in Berlin, Kiel and Geneva. After ending his studies he entered the local administration service. At first he was stationed in Charlottenburg, and from 1907–13, in the Magistrat in Magdeburg under the former minister of finance, Lenze. In 1913 he was elected secretary to the German and Prussian “Städtetag,” and thus was able during the World War to prove his high administrative abilities. On July 5 1918 he was elected burgomaster of Essen in the Ruhr district. In this responsible position he gained the reputation of being one of the best local administrative officials in the West of

Germany. On Dec. 2 1922 he entered the Cuno Cabinet, and became Minister of Food and Agriculture. He retained his post in Essen and, when the French marched into the Ruhr in Jan. 1923, he returned to Essen immediately. The episode is well-known of how the general commanding the troops marching into Essen wished to speak with the burgomaster at the door of the Rathaus (town hall). Dr. Luther sent a message that he was only to be seen in his office. The order was repeated twice, but at last the General was obliged to give way. This manly attitude of Dr. Luther earned him high esteem in the turbulent, warlike atmosphere in the Ruhr at that time.

After Cuno ceased to be Chancellor, Luther retained his office in the Stresemann Cabinet. In Stresemann's second Cabinet, he became Minister of Finance. As Finance Minister of the Reich, he was able to perform most signal services in stabilising the German currency (which had fallen into an abyss) and in restoring balance to the budget of the Reich. Dr. Luther kept his office in the Marx Ministry which followed, and had a share in the preparations for the Conference of London and the conclusion of the Dawes Agreement. In the autumn of 1924 he concluded the Dawes loan for Germany. He has himself given an account of his work in restoring the finances of Germany (see *Feste Mark—solide Wirtschaft, 1924*). After the elections in Dec. 1924, Marx, in spite of many endeavours, was not able to form a new cabinet, and Luther took over the task in the middle of Jan. 1925. A Cabinet was formed under him, which was the first since the revolution of 1918 to include members of the German National party. Luther carried through a great taxation reform, completed the revaluation legislation and made a provisional customs tariff which made it possible to commence negotiations for commercial agreements with some prospect of success for German economic life. This economic legislation was accompanied by the Locarno policy initiated by Stresemann with the essential agreement of Luther, who, as Chancellor, was responsible for the conduct of policy as a whole.

At the Conference of Locarno, the German delegation which initialled the clauses of the treaty, was led by Luther as Chancellor. After his return from Locarno, the German National party left the Government. In spite of this, the Cabinet found a majority for the policy of Locarno, and on Dec. 1 1925 signed the Rhine Pact and the Arbitration Treaties in London, after which it resigned. After tedious Government crises, Luther again received the mandate to form a Cabinet. As the Social Democrats forsook the Chancellor, there was nothing left but to form a Cabinet out of the moderate bourgeois parties. Dr. Luther was not a party politician, and often proclaimed his freedom from the parties in a pronounced fashion. While in charge of the affairs of the Reich he distinguished himself by extraordinary energy and sober clarity of political judgment, and the German people indubitably made important progress towards reconstruction under his leadership. On May 13 he resigned his office as chancellor. (*See* GERMANY.) (F. KLE.)

LUTHERANS (*see* 17.140).—The Lutheran churches of Europe were profoundly influenced by the War of 1914–8 and its aftereffects. The external changes were least marked in Sweden, Denmark and Norway, where the relation between the churches and their states has remained undisturbed; in Germany and the new national states they have been far-reaching.

I. IN THE OLD WORLD

German Lutherans.—The German revolution of 1918 put an end to the *Summepiskopat* (*see* 17.142) and the reorganisation of the German Empire aimed at the separation of Church and State. Since an immediate complete separation would be disastrous to the churches and not to the best interest of the state, the churches were guaranteed diminishing state support, with the ultimate purpose of divorcing them entirely from the state governments. By this arrangement the churches have, in part, the character of voluntary associations and, in part, that of state controlled institutions. To meet this new situation they have been obliged to reorganise. The forms of reorganisation have not been identical in all the states, but two tendencies have been generally observable—one, to increase the powers of the synods at the expense of the consistories (*see* 17.142), the other, to vest the spiritual oversight of the church in a single official, known as bishop, chief pastor, or some other equivalent title.

Two problems have presented especial difficulties. The one is the problem of aim and purpose. Is the Church to continue, under new forms of administration, to be the one recognised institution of religion for that state (*Volkskirche*), or is it to be an institution for the promulgation of a single doctrinal type of Christianty (*Bekenntniskirche*)? The second problem concerns the relation of the Church to the state schools. No fully satisfactory solution of either problem has been reached as yet, though the idea of the *Volkskirche* seems, for the present, to have the stronger following, and the general trend is toward a separation of the Church from the schools.

The acute economic depression of 1922–4 affected most disastrously those elements of the laity from which the greatest measure of church support was to be expected, and it subjected the clergy to severe privations. All the activities of the churches were impaired, and the great voluntary associations for Christian work—the societies for foreign and inner missions—were practically paralysed. Substantial financial support was furnished during this crisis by Lutherans of foreign countries, especially of America, and with the beginning of economic recovery the normal church activities were, by 1926, gradually being resumed.

Central European Countries.—The formation of the new national states of Poland, Latvia, Estonia, Czechoslovakia, Yugoslavia and Hungary has been followed by a new organisation of the Lutheran churches in those countries. The same tendencies that were operative in Germany have shown themselves in these lands. The churches have tended to organise with a large measure of self-support and self-government. Where entire independence of the state has not been feasible it has been apparent as the ultimate aim. An episcopal form of spiritual oversight has also been introduced into most of these churches. All of them have had to contend with economic difficulties similar to those in Germany.

Russia and Rumania.—In 1924 the Lutherans of Russia were permitted, for the first time in their history, to organise as a Russian Church with a synod and two bishops. In Rumania, on the other hand, the disestablishment of the Transylvanian Lutheran Church has caused severe, if temporary, hardships.

Organisation.—The membership statistics for the Lutheran churches of Europe are, as a rule, quite unreliable. This is especially true of those countries where the churches have been in organic connection with the state, and where all those who did not formally withdraw were counted as members of the state church.

On questions of doctrine the same divergences (*see* 17.142) continue to exist. The more conservative element has been organised since 1868 in the General Lutheran Conference (*Allgemeine evangelisch-lutherische Konferenz*), an international society for the maintenance of confessional Lutheran teaching. In 1922 the conference united with the American National Lutheran Council in the calling of the First Lutheran World Convention, held at Eisenach, Germany, in Aug. 1923. The members of the convention came from 20 different countries, including the United States and Canada, and effected a new international organisation, with an executive committee of six members, charged especially to secure co-operation among the Lutherans of the world in works of mercy, foreign missions and care for migratory Lutherans, and "in cases of emergency to speak for the whole Lutheran Church." The Lutheran Alliance is a society of ultra-conservative Lutherans, the members of which are drawn chiefly from the free churches of Germany.

II. IN THE NEW WORLD

United States and Canada.—In 1924 the Lutheran Church in the United States and Canada had 2,622,554 communicant members divided among 20 ecclesiastical bodies. The largest of these were the United Lutheran Church (856,180), the Missouri Synod (645,969), the Norwegian Lutheran Church (299,213), the Augustana Synod (217,616), the Iowa Synod (168,266), the Joint

nod of Ohio (161,021), the Joint Wisconsin Synod (139,226),
e Lutheran Free Church (30,320), the Danish Church in
nerica (20,045) and the Finnish National Church (20,000).
ie Synodical Conference, a consultative federation, comprising
e Missouri Synod, the Joint Wisconsin Synod and two smaller
dies, formed a single well-defined group with a membership of
ore than 800,000. The names of many of these bodies point
one of the reasons for their separate existence. At their
ganisation nearly all of them were expressions of the church
nsciousness of groups of immigrants from the Lutheran coun-
es of Europe, and they continue to perpetuate, to a greater
smaller degree, the religious tradition of the countries of their
gin. With the slackening of north European immigration
ward the end of the 19th century the nationalistic traits tended
become less marked, and the process of Americanisation was
eatly hastened by the World War. Since 1914 the foreign
iguages are rapidly being replaced in the services by English
d the separated bodies have been drawing closer together.

Organisation.—In 1918 the United Lutheran Church was
rmed by the union of the General Synod, the General Council
d the United Synod in the South. These three bodies repre-
ited a single line of American tradition reaching back to colo-
il days. Most of their synods owed their foundation, directly
indirectly, to the work of Henry Melchior Mühlenberg, the
eat colonial missionary (d. 1787). They had had doctrinal
ferences, but these were regarded as too small to keep them
iger apart. The Augustana Synod, a body of Lutherans of
edish origin, did not enter the union, though it had been a
rt of the General Council. In 1917 three bodies of Norwegian
therans united to form the Norwegian Lutheran Church in
ierica. Since 1921 discussions have been in progress looking
vards the union of other separated bodies. The National
theran Commission for Soldiers' and Sailors' Welfare was or-
iised in 1917 to minister to the spiritual welfare of the 400,000
theran men in the army and navy of the United States. Its
mbership included all the larger bodies except the Missouri
l Wisconsin Synods. It was dissolved in 1921. The National
theran Council was organised in 1918 by the same bodies that
l previously organised the commission. Its purpose was to
vide an agency for certain kinds of co-operative work. Its
st important task has been to extend aid to the Lutheran
irches of Europe during their period of reconstruction. Be-
een 1918 and 1925 it distributed among the Lutherans of 20
erent countries more than $6,500,000 in money and goods.

Doctrines.—Doctrinally, the Lutherans of America are pro-
inced conservatives. All of them subscribe to the Augsburg
nfession and the Small Catechism, and most of them accept
whole body of the 16th century Lutheran confessions. Their
ctrinal differences have been, at times, acute, but have usually
cerned the theological interpretation of the confessions. Their
m of government is theoretically congregational, but the
ole tendency in the larger bodies is towards a rather highly
tralised synodical administration. The most conservative
e of American Lutheranism is represented by the Synodical
nference. Its theological standards are those of 17th-century
hodoxy; it strongly opposes any recognition of or co-opera-
i with other churches, and it is vigorously hostile to the mem-
ship of its pastors and people in secret societies. The United
heran Church, though insistent upon the enforcement of
fessional standards, is less rigid both in theology and
ctice.

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(C. M. J.)

UTSK: *see* Luck.

LUTYENS, SIR EDWIN LANDSEER (1869–), British architect, was born in London March 29 1869. After a brief training in the South Kensington Schools and in architects' offices, he received his first commission at the age of 19. He afterwards designed a number of country houses, in which he gradually developed an individuality of design which was, however, tempered by a reticence which dissociated his work from any attempts at "originality." Much of his domestic work was done in connection with the restoration of old houses; the largest example of his powers in this direction is the treatment of Lindisfarne Castle, Holy Island (1903–12). He also executed much civic work, being responsible for the *Country Life* offices in London and for the British sections at the exhibitions in Paris (1900) and Rome (1911). The garden suburb at Hampstead, London, has many good examples of his treatment of small houses. It was as the architect of the New Delhi (*see* Delhi) that the culmination of his professional career was reached. He also designed the Cenotaph in Whitehall, London. Sir Edwin, who was knighted in 1918, became an associate of the Royal Academy in 1913 and was elected a full academician in 1920. The Royal Institute of British Architects awarded him its gold medal in 1921.

LUXEMBOURG (*see* 17.145), a neutral and independent Grand Duchy, in economic union with Belgium. Its area is 1,034 sq. m., and the population 267,447 (1922). Luxembourg was admitted to the League of Nations on Dec. 16 1920.

Invasion of 1914.—On Aug. 2 1914 the German armies invaded the Grand Duchy on the pretext that it was necessary to protect the German control and working of the Luxembourg railways against a French invasion. The main line of the railways of the Grand Duchy, which belongs to the railway company of *Guillaume-Luxembourg*, had been first worked by the French railway company of the East, but from 1872, by a condition of the Treaty of Frankfurt, by the German state railways. On Aug. 4 Herr von Bethmann Hollweg admitted to the Reichstag that the violation of Luxembourg neutrality was wrong, and promised reparation.

The invasion was a violation of the Treaty of London of May 11 1867, which had placed the neutrality of the Grand Duchy under the collective guarantee of Great Britain, Austria, France, Prussia and Russia. The Luxembourg Govt. and the sovereign protested against this violation, but the Grand Duchy remained in German occupation for the duration of the War. After the Armistice, the railways of Guillaume-Luxembourg were provisionally run by France.

After the evacuation of the country by the German troops, Luxembourg denounced its accession to the German Zollverein, to which it had belonged since 1842, and from Jan. 1 1919 it constituted an autonomous customs territory, while, by virtue of articles 41 and 268 of the Treaty of Versailles, it enjoyed the right of exporting to Germany for five years, duty free, goods equivalent in quantity to its average pre-War export to Germany.

The Dynasty.—Political complications decided the Grand Duchess, Marie-Adelaide, who had succeeded her father, Grand-Duke William, in 1912, to abdicate Jan. 10 1919, in order to save the independence of the Grand Duchy, and she was succeeded by her sister, Princess Charlotte, (b.1896). The latter married on Nov. 6 1919 Prince Felix of Bourbon-Parma, brother of the ex-empress Zita of Austria. Marie-Adelaide died Jan. 24 1924.

By the referendum of Sept. 28 1919 the Luxembourg people pronounced by 66,811 votes for the maintenance of the monarchy with the Grand Duchess Charlotte as sovereign, as against 16,885 votes for a republican régime, and by 60,133 votes for an economic union with France against 22,242 votes for an economic union with Belgium. Association with France would have helped the agrarian interest, while the vinegrowers stood to gain from association with Belgium.

Customs Union with Belgium.—After the occupation of Frankfurt, carried out jointly by French and Belgian troops (April 8 1920), the French Govt. made a declaration renouncing the negotiation of a customs union with Luxembourg in favour of Belgium. Relations with Belgium had been strained as a result of the plebiscite, but the new negotiations between

Belgium and Luxembourg culminated in a Convention (signed July 25 1921) establishing an economic union between the two countries which came into force May 1 1922, to last for 50 years. The chief stipulations of this treaty are as follows:—

1. The customs frontiers between Belgium and Luxembourg are abolished, commercial treaties in the name of the Union are to be drawn up by Belgium, Luxembourg adopts customs legislation and tariffs from Belgium, but preserves her own customs administration. The customs receipts of the two countries, as well as the yield of the taxes on beer, vinegar, sugar, tobacco, margarine, etc., with the exception of the tax on alcohol are pooled, and the total, after deducting a certain sum calculated according to the price of cereals, and devoted to the encouragement of the cultivation of cereals in the Grand Duchy, is divided between Belgium and Luxembourg in proportion to the population, approximately in the proportion of 28 to 1.
2. The paper currency in the Grand Duchy of State notes, resulting from the withdrawal of German notes after the Armistice, is reduced to 25,000,000 fr., and may only include notes not exceeding the value of 10 francs. The remainder of the note circulation of the Grand Duchy is made up of notes of the National Bank of Belgium, except a circulation of 6,250,000 fr. in notes of the International Bank of Luxembourg, which has the privilege of issue.
3. The Belgian State should share in working all the Luxembourg railways (standard normal gauge).[1]
4. Belgian consuls have charge of Luxembourg interests wherever there are no Luxembourg consuls. This provision leaves in force the agreement of Jan. 7 1880, between the Netherlands and Luxembourg, which placed Luxembourg political interests under the protection of Dutch diplomatic representatives, in all countries where Luxembourg has no diplomatic agents, except in Paris, Berlin and Brussels.

Constitution.—By a law of May 15 1919 the constitution of the Grand Duchy was revised in a more democratic direction. The powers of the sovereign were limited, universal suffrage, with proportional representation, was instituted, and the franchise was conferred on women. But the most interesting innovation was the creation of the law of April 4 1924, of five Chambers for traders, industrialists, agriculturists, artisans, private employees and workmen, election to the Chambers being by electors in these occupations above the age of 21, and maintenance by compulsory contributions by the electors. These Chambers have the power to create and maintain institutions, the right to propose bills which must be submitted to the Chamber of Deputies, and they have a right to be consulted before laws affecting their professional interests are passed by the Chamber of Deputies.

Population.—According to the census of 1922, the population of the Grand Duchy was 267,447, that is 101 persons per sq. km.; of these 33,436 were foreigners, chiefly Germans (15,500) and Italians (6,170), the latter being employed chiefly in the mining and metallurgical industries. According to the last census of occupations in 1907, 36·8 % of the population was occupied in agriculture and gardening, 41·7 % in industry and mines, 12·2 % in commerce and transport. Since then the proportion in industry and commerce has certainly grown at the expense of agriculture.

The chief towns of the Grand Duchy are, besides the capital, Luxembourg, with 46,709 inhabitants, the three centres of the iron industry: Esch-sur-Alzette, 22,100; Differdange, 13,728; and Dudelange, 10,400 inhabitants.

Production, Industry and Trade.—In 1925 Luxembourg produced 5,984,000 tons of iron ore against 7,333,372 in 1913. There were, in 1925, 47 blast furnaces, out of which only 37 were going, which produced 2,344,000 tons of pig-iron as compared with 2,547,861 tons in 1913. The seven steel foundries of the Grand Duchy produced in 1925 2,084,000 tons of steel compared with 1,182,227 in 1913. German capital, which before the War dominated the metal works of the Grand Duchy, has been replaced since by Luxembourg, Belgian and French capital. Besides the factories which they own in Luxembourg, the Luxembourg metal companies own or control mines, collieries, blast furnaces, steel works and factories for iron and steel manufacture principally in France, Belgium, Germany and in Brazil. Their branches are established in all quarters of the globe.

Besides the ancient industries of sole leather, slates, metal co structions, china, explosives, gloves, drapery, woven wear, brewi and tobacco, long established in Luxembourg, new industries ha grown up, and have made considerable way. These are the cement dustry, which produced 75,441 tons in 1924, the manufacture sparkling wines, fancy leather and brushes.

Finance.—In 1913 the public consolidated debt of the Gra Duchy was about 10,000,000 francs. In 1925 this debt had risen, consequence of the charges which the State had to assume duri the War to assure the feeding of the population and to meet t deficits in the budget caused by the upheavals during and after t War, to 196,000,000, plus a loan of 175,000,000 issued in Belgium 1922 and intended for the exchange of notes of the Luxembou State for notes of the National Bank of Belgium. Since 1924 t State budget has been balanced.

Railways.—On May 13 1924 a Convention between t Governments of Luxembourg and Belgium was signed at Bru sels. Under the terms of this Convention the entire railw system of Luxembourg will be administered by the Société d Chemins de Fer Prince Henri, under the control of the Gra Ducal Govt., conjointly in so far as questions of intere to Belgium are concerned, particularly as regards transit, wi the Belgian Government. This agreement was completed by final protocol signed at Brussels on Oct. 14 1924, which settl the economic and technical questions, relating to the Belgia Grand Ducal and French interests, raised by the separation of t Guillaume-Luxembourg railway system from that of Alsac Lorraine.

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(A. C.)

LUXEMBURG, ROSA (1870–1919), German Socialist, w born at Zamość, Russian Poland, Dec. 25 1870. Having tak up socialist political activities in Poland, about 1895 she m grated to Germany, where she married a German workman order to acquire German nationality. In 1898 she edited t Saxon *Arbeiterzeitung*, but shortly afterwards joined the staff the *Leipziger Volkszeitung*. She took part in the Russian rev lution of 1905, and on her return to Germany founded with Ka Liebknecht the Spartacus League. In 1914 she was sentenc to a year's imprisonment for inciting to insubordination a throughout the World War remained in preventive custod After the revolution she edited, with Liebknecht, the Co munist paper, *Rote Fahne*. They were arrested on Jan. 15 19 on the charge of instigating the street fighting in Berlin whi had taken place a few days earlier. Whilst being conveyed to t Moabit prison they were brutally attacked by the mob. Lie knecht was shot dead and Rosa Luxemburg died a few hou later from injuries received.

BIBLIOGRAPHY.—Her works include *Die Krise der Sozialdemocra* *Briefe aus dem Gefängnis* and *Briefe an Karl und Luise Kautsk 1896–1918*. See also G. Zinoviev, *Karl Liebknecht et Rosa Luxembu* (1919); C. P. A. F. Liebknecht, *The Murder of Karl Liebkne and Rosa Luxemburg* (1924).

LVOV, PRINCE GEORGE EUGENIEVICH (1861–), Russi statesman, belonged to the old Russian nobility. He spent t greater part of his life in Zemstvo, that is, local governme work (*see* 23.876), being a member of the executive board of t Tula Zemstvo from 1888 and president from 1902–5. In 19 he was elected member of the first State Duma and joined t right wing of the Constitutional Democratic party. During t Russo-Japanese and World wars he took an active part in t organisation of Zemstvos for the relief of sick and wound soldiers and in the latter war was president of the All-Russi Union. On March 14 1917 Lvov was elected Prime Minist and Minister of the Interior of the first Russian Provisional Go ernment. Unfortunately his Government proved a comple failure. A new Coalition Cabinet was formed on May 16 a Lvov again accepted the leadership of the Cabinet and t portfolio of the Interior, but he had no real influence in politic life, and he resigned from both offices on July 7. (*See* RUSSIA After the Bolshevist revolution in November, Lvov was arrest and imprisoned in Ekaterinburg but he escaped to Siberia a eventually settled down in Paris.

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[1] Long negotiations on the railways question ended in a convention, signed at Brussels on May 13 1924, under which the Luxembourg system is administered by a Luxembourg company, the Belgian Govt. acting conjointly with the Luxembourg authority where Belgian interests, particularly transit interests, were concerned. But this Convention was rejected by the Luxembourg Chamber of Deputies on Jan. 20 1925. Therefore the line is still under French control. The negotiations between Luxembourg, Belgium and France over the Luxembourg railway are still continuing.

YALL, SIR ALFRED COMYN (1835–1911), British writer
17.148), died in the Isle of Wight April 10 1911.

YAUTEY, LOUIS HUBERT GONZALVE (1854–   ), French
ier, was born at Nancy (Meurthe-et-Moselle) Nov. 17 1854.
ing passed through St. Cyr and the Staff College, he first
ed as a cavalry officer, and was then appointed in 1894 to the
of the troops in Indo-China, where he took part, under
eral Galliéni, in the operations against the pirates of Upper
gking. He accompanied General Galliéni to Madagascar,
re he distinguished himself by repressing an insurrection and
is able government of the southern part of the island. He
ied himself to working out and putting into practice new and
ently successful methods of colonial government. Having
rned to his regiment as its colonel, he was soon after ap-
ted to the command in the territory of Aïn Sefra, which was
g disturbed by incursions from Morocco. He was then
ed in command of the Oran division, and was entrusted with
carrying out of international agreements with regard to
occo. Having restored order on the Algerian-Moroccan
tier, as far as Moulouya and Guis, he took command of
X. Corps at Rennes.

April 1912, in view of the serious situation at Fez, the Gov-
nent decided to send him to Morocco as high commissioner
résident-général to quell disturbances and to consolidate the
ntly declared protectorate. Immediately on his arrival he
eeded in relieving Fez, and initiated the work of pacification
colonisation which was to result in a few years in the creation
well organised government on a solid basis. On the declara-
of the World War, although formally ordered by the Govern-
t to evacuate the interior of Morocco, so as to liberate the
ter part of his forces, he did not yield an inch of ground, and
ntained for four years a glorious struggle against all the efforts
enemy subsidised by Germany, while he actually increased
subjugated territory.

Dec. 1917 General Lyautey was appointed War Minister,
resigned after three months in order to return to Morocco.
n 1920 to 1924 he continued his work by conquering the At-
and by establishing a defensive barrier to the north of Ouer-
As a reward for these services he was made a marshal of
ce in Feb. 1921. In 1925 he organised a victorious resistance
e attacks of the Rifi under Abdel-Krim, and did not resign
ost of résident-général until order was completely restored.
work of Marshal Lyautey in Morocco was of considerable
rtance. Not only was the country pacified by the adoption
dicious methods of colonial government, but by construc-
work and fine organisation a province was built up with a
economic future (*see* MOROCCO). He was made a member
e French Academy in 1914, and wrote numerous articles on
ial administration. His letters from Tongking and Mada-
ar were published in 1920. (M. GU.)

NN, Mass., U.S.A. (*see* 17.172), increased in population
89,336 in 1910 to 99,148 in 1920, of whom 27,858 were for-
born, and 103,147 in 1925 (Massachusetts census). The
egate value of its manufactures rose from $71,503,000 in
to $160,906,000 in 1919, while the number of wage-earners
e factories remained unaltered. The effect of the post-War
ession and of the dispersion of the boot and shoe industry is
in the figures for 1923: value of products, $95,935,221;
ber of wage-earners, 22,506. From second place in 1905,
had fallen to sixth in 1923 in the manufacture of boots and
, ranking after New York, Brockton, St. Louis, Haverhill
Milwaukee. In 1917 a lock-out in the shoe factories (April
Sept. 20) affected 15,000 workers. The commission form
vernment, adopted in 1910, was abandoned in 1918 for a
ter providing for 11 councillors and for a mayor with large
rs.

ONS, SIR JOSEPH (1848–1917), British business man, was
in London Sept. 29 1848 and educated at a Jewish school.
arly life he studied painting and exhibited at the Royal
tute, but by 1886 he had turned to business enterprises,
njunction with the brothers Isidore (d. 1920) and Montague
kstein. This led to the foundation of the catering firm of J. Lyons and Co., Ltd., of which he became chairman. He began by catering at public exhibitions, and next opened tea-shops in London, the first in 1894. Twenty years later these numbered over 200 and provided cheap food for the large class of clerical workers and junior members of professions. Later he opened several restaurants of a more ambitious nature, as well as hotels on the no-tipping principle. He was knighted in 1911, and died in London June 22 1917. See Mrs. Stuart Menzies, *Modern Men of Mark* (1920).

LYONS, France (*see* 17.174), had a population of 561,592 in 1921. In 1922 about 140,000 persons were employed in the silk industry and several large factories were built in 1924. The manufacture of artificial silk is of growing importance. The international fair, first held in 1916, has shown a notable increase of business and aims at rivalling Leipzig. A permanent exhibition building on the banks of the Rhône was nearing completion in 1926, and space for exhibitors was also being reserved on both sides of the road on the left bank of the river and in the square near the main railway station. Poland and Soviet Russia were represented at the exhibition for the first time in 1923. The Wilson bridge over the Rhône was opened in 1918. From 1916, during the War, Lyons was a centre for the exchange of seriously wounded French and German prisoners. A syndicalist congress was held in the city in 1919.

LYS, BATTLE OF THE: *see* GERMAN OFFENSIVE.

LYTTELTON, ALFRED (1857–1913), British politician, was born Feb. 7 1857, the youngest child and eighth son of the 4th Lord Lyttelton. His mother, daughter of Sir Stephen Glynne and sister of Mrs. W. E. Gladstone, died six months after his birth. All the eight boys were brought up to be keen cricketers, the cricket ground at Hagley, Worcs., their home, being close to the house; all went to Eton, and six were in the Eton eleven. The eldest, VISCOUNT COBHAM (1842–1922), became a land commissioner and a railway commissioner; GEN. SIR NEVILLE LYTTELTON, G.C.B. (b. 1845), an experienced soldier, was governor of Chelsea Hospital; SPENCER LYTTELTON, C.B. (1847–1913), was three times private secretary to his uncle W. E. Gladstone when Prime Minister; the RIGHT REV. ARTHUR LYTTELTON, D.D. (1852–1903), was Bishop of Southampton; and the REV. EDWARD LYTTELTON, D.D. (b. 1854) was headmaster, first of Haileybury, and then of Eton.

Alfred was the most famous cricketer of them all. Indeed for nearly all ball games he had an extraordinary aptitude. He excelled in football of three kinds, and in fives, racquets and especially tennis—holding the amateur championship for tennis from 1882 to 1896. At cricket he was equally good as a bat and as a wicket keeper. He was four years, 1872–5, in the Eton eleven, and captain the last year; four years, 1876–9, in the Cambridge eleven, and captain the last year. Moreover, he played for England against Australia, and for the Gentlemen against the Players; and for some years was a notable member of the Middlesex eleven. The infectious joyousness of his nature, his sterling character, his solid, though not brilliant, intellect and his prowess at games gave him an undisputed lead among his contemporaries. He was king of the place before he left Eton; and when he went up to Trinity College, Cambridge, in 1875, he gained a similar ascendancy.

After taking his degree with a second class in history, he was called to the English bar in 1881. Here his reputation stood him in good stead; he soon obtained a considerable practice, and in due course became K. C. His thoughts turned early to politics. Though by family tradition and in idealistic outlook a Liberal, he found himself unable to support the Home Rule policy of his uncle, W. E. Gladstone, and so postponed any attempt to enter Parliament until after the latter's retirement. But in 1895 he became M.P. for Warwick and Leamington as a Liberal Unionist, retaining the seat till 1906, when he was defeated. After a few months' interval, he was returned for a London constituency, St. George's, Hanover Square.

He was appointed, in 1900, chairman of a commission to enquire into the various concessions which President Kruger and the Volksraad had granted to companies and private individuals in the Transvaal, and to report which should be maintained and which annulled. In pursuance of the investigation he spent the autumn of 1900 in South Africa; and he so impressed Lord Milner by his qualities that the high commissioner hoped to secure him as his successor. It was, however, as Colonial Secretary, in the Conservative Govt. of Mr. Balfour in 1903, that his South African experience was utilised. His tenure of office lasted two years and was marked by the drafting of a temporary constitution which should give representative institutions to the Transvaal until such time as it should be safe to concede responsible government. This constitution was never put in force, as Sir Henry Campbell-Bannerman's Ministry determined that they would risk the grant of responsible government at once. He incurred much odium by sanctioning the scheme for importing Chinese coolies into South Africa in order to remedy the shortage of native labour and to restart the mines and thereby the whole economic machinery of South Africa. When his party went into opposition he took an active sha resistance to the drastic Liberal policy, and especially to Welsh Disestablishment Bill, which was repugnant to him man of deep religious feeling and an earnest Churchman. also lent a helping hand to many social movements, and w decided supporter of woman suffrage.

His first wife, whom he married in 1885 and who died in was the brilliant Laura Tennant, sister of Lady Oxford an quith; his second wife, married in 1892, was Edith So daughter of Archibald Balfour. She, with a son, Captain O Lyttelton, and daughter, survived him. His death came unexpectedly, on July 5 1913, after an injury in a local cr match. Mr. Asquith, then Prime Minister, spoke of him i House of Commons as having come nearest, of all men o generation, to that ideal of manhood to which every En father would wish to see his son aspire. See Edith Lytte *Alfred Lyttelton*, 1917. (G. E.

McADOO, WILLIAM GIBBS (1863–), American lawyer and politician, was born near Marietta, Ga., Oct. 31 1863. He entered the University of Tennessee but did not finish his course. In 1882 he became clerk in U.S. circuit court of Chattanooga, read law and three years er was admitted to the bar. He began practice in Chatta-oga, but in 1892 removed to New York City. There he became erested in the problem of passenger transportation. In 1902 formed the New York and New Jersey Railroad Company, ich took over the abandoned Hudson river tunnel from Ho-ken to New York, and in March 1904 this tunnel was com-ted. In 1909 the tunnel under the Hudson river to down-vn New York was finished. In 1912 he was vice-chairman the Democratic National Committee. He was a strong sup-ter of Woodrow Wilson for president, and on the latter's ction he was appointed, in 1913, Secretary of the Treasury. this position he contributed largely to the working-out of the v Federal Reserve Banks system.

At the outbreak of the World War in Europe he favoured ict neutrality. After America's entrance into the War he was led upon to raise unprecedented sums of money. He was suc-sful in floating four Liberty Loans between May 1917 and t. 1918, amounting in all to more than $18,000,000,000. also secured the creation of a Bureau of War Risk Insurance shipping, later extended to include life insurance for soldiers d sailors in the World War. When the railways were taken er by the Federal Government in 1917 he was appointed ector-general. He favoured the League of Nations, woman frage and the prohibition amendment. He resigned the secre-yship of the Treasury in Dec. 1918, and the directorship of lways the following January. He then resumed the practice law in New York City. At the Democratic National Conven-n held at San Francisco, June 28 1920 and following days, Mr. Adoo was placed in nomination for the presidency, and on first ballot obtained the highest number of votes, 266; at the h ballot his vote ran to 399, but after that he lost ground, d J. M. Cox received the nomination on the 44th ballot. Mr. Adoo was again placed in nomination for the presidency at Democratic National Convention held at New York City June 1924. On the first ballot he obtained the highest number votes, 431½, on the 69th ballot he had 530, but after that his ength steadily declined, and on the 103rd ballot, when J. W. vis was nominated, he received only 12 votes. Mr. McAdoo rried, as his second wife, Eleanor Randolph, daughter of sident Wilson.

MACARTHUR, MARY REID (1880–1921), British politician, s born Aug. 31 1880 in Glasgow, where her father had a large pery establishment. Breaking with the Conservative tradi-ns of her family, in 1903 she came to London to be secretary the Women's Trade Union League, into whose work she athed new life. In 1906 she founded a new general trade un-for women—the National Federation of Women Workers. The ti-Sweating League, which she helped to found, and her evid-e before the Select Committee on Home Work did much to vince the public of the necessity of the Trade Boards Act, sed in 1909. It was mainly due to her efforts that boards were ablished in various sweated industries. In 1914 she became retary of the Central Committee for the Employment of men. Later she was instrumental in improving the condition he women War workers. In 1911 she married W. C. Anderson, was chairman of the Labour party in 1914 and M.P. for Atter-e (Sheffield) from 1915–8. In 1918 she unsuccessfully contested urbridge in the Labour interest. After her husband's death in 9, she lectured, mainly on peace, in the United States ch she again visited for the Labour Convention conference Washington. She died on Jan. 1 1921, leaving one child, a ghter, born in 1915.

ee M. A. Hamilton, *Mary Macarthur: a Biographical Sketch* (1925).

McBRIDE, SIR RICHARD (1870–1917), Canadian politician, was born at New Westminster Dec. 15 1870, and was educated first in that city and later at Dalhousie University, Halifax, Nova Scotia. He was called to the Canadian Bar in 1892, and entered the British Columbian parliament as member for Dewdney in 1898. In 1900 he became minister of mines and in 1902 leader of the Opposition. In June 1903 he became Prime Minister for the province and retained that position until 1915, when he became agent-general for British Columbia in London. He was made K.C.M.G. in 1912 and died in London Aug. 6 1917.

M'CARTHY, JUSTIN (1830–1912), Irish politician and writer (*see* 17.200), died at Folkestone, Kent, April 24 1912.

McCORMICK, ROBERT RUTHERFORD (1880–), American editor, was born in Chicago, Ill., July 30 1880. He graduated from Yale University in 1903, studied law at Northwestern University law school and was admitted to the Illinois Bar in 1908, commencing practice in Chicago. He was active in civic circles from 1904 to 1910. In 1910 he became associated with his cousin, Joseph Medill Patterson, as co-editor and publisher of *The Chicago Tribune*, being president of the Chicago Tribune Company. Under their direction the *Tribune* enormously increased both in circulation and the amount of advertising matter carried, becoming one of the most influential papers in the United States. In 1916–7 McCormick served as major in the 1st Illinois Cavalry on the Mexican frontier, and in 1917 was attached to Gen. Pershing's staff, A.E.F., in France. Later he was transferred to the 5th F.A. of the 1st Div., and promoted to the rank of colonel. In 1921 in conjunction with his cousin, he started in New York City a daily illustrated paper, followed in 1924 by *Liberty*, a weekly publication, both of which obtained immediate and large circulations. In 1912 they organised the Ontario Paper Co. to make paper for their newspapers, followed in 1924 by the Tonawanda Paper Co., to make magazine paper, the two producing in 1925 about 500 tons of paper a day.

MACCUNN, HAMISH (1868–1916), British composer (*see* 17.209), died in London Aug. 2 1916.

MACDONALD, JAMES RAMSAY (1866–), British politician, was born on Oct. 12 1866 at Lossiemouth, a little fishing village on the Moray Firth. His father was a labourer, his first home a "but and a ben." At Drainie Board School he received an elementary education and continued as a pupil teacher. Coming to London at 18, he worked at 12/6d. a week as a clerk. He continued his own education by evening classes, laboratory work and incessant reading. A breakdown in health ended his dream of a scientific career, and sent him to journalism.

MacDonald's experience and reading made him a convinced socialist. He joined, in 1894, the Independent Labour party, founded by Keir Hardie, and in 1895 stood, unsuccessfully, for Southampton. As a member of the London County Council he completed his training for public service, and, after his marriage, in 1896, with Margaret Ethel Gladstone, niece of Lord Kelvin, made frequent journeys abroad. In 1897 he paid his first visit to Canada and the United States; in 1902 he went to South Africa; in 1906, travelled through the Pacific to Australia and New Zealand; in 1910, visited India, whither he returned in 1913 and 1914 as a member of the Royal Commission on the Civil Service. At meetings of the Socialist International, he was the spokesman of British Labour on the Continent.

Stages of His Career.—Three main stages may be noted in his political career: the creation of the Labour Party, the War and the Labour Government. In the 'nineties, the great trade unions still stood aloof from politics, or were satisfied with a vague alliance with the Liberal party. The propaganda of the Independent Labour Party, with which he was prominently associated, was directed to convincing the Unions of the need of a political party for Labour; in 1899 the Trade Union Congress was induced to set up a committee to consider parliamentary action. Out of this came the Labour Representation Committee, of which Mr. MacDonald was secretary. Thanks to his energy, patience and tenacity, the hostility of some Unions and the apathy of others was broken down and a Labour party came into being in 1900. After the return of 29 M.Ps., run by the Labour Representation Committee in 1906, the battle was won; the party became an effective force. But it was in 1918 that Mr. MacDonald's ideas were fully realised. The party was reorganised and thrown open to all workers by hand or brain, and in 1925 had over 3,000,000 members.

Elected as M.P. for Leicester in 1906, by 1911 he was leader of the Labour party in the House of Commons. A constructive critic of Sir Edward Grey's foreign policy, he opposed, on Aug. 4 1914, the view that there was an "obligation of honour" to go to war. The speech was an agreed one, but the majority of the party broke away. He had already refused suggestions of office; he now resigned his leadership. He was denounced in public and private, and had to face the fact that his views were not accepted by the nation at war. In 1918 he lost his seat at Leicester, and in 1921 failed to get in for East Woolwich.

Although out of the House of Commons till late in 1922, his influence on opinion steadily grew. By 1922, the party took his view of the Peace Treaties, and resisted the tendencies that split nearly every Labour party abroad. In 1912, he had countered the demand for the substitution of industrial ("direct") for parliamentary action in *Syndicalism;* in 1919, when, under the stimulus of Russian events, this demand reappeared as the Communist doctrine of force, he wrote *Parliament and Revolution* and *Parliament and Democracy*, in which he gave a definite and logical lead against the tactics of violence and championed parliamentary democracy. The 1922 election registered his moral ascendancy. Labour, with 140 members, was the second party in the state, and he himself, returned for Aberavon, was chosen by his colleagues leader of the Opposition.

His leadership produced a marked change in public opinion, and focused general interest on himself and on Labour. He raised its claim to be fit to govern at the sudden election of 1923, and came back with 192 followers. The Conservatives had been defeated on the main item in their programme, and, at a great meeting in London, Mr. MacDonald declared that Labour would take office, if given the chance, in order to render national service. On Jan. 21 1924 he accordingly moved a vote of no confidence in the Unionists, which was carried with Liberal support. Next day the King called upon him to form a Government. The first Labour Cabinet was announced on Jan. 24, and on Feb. 12 the new Prime Minister set out its general programme in the House of Commons. In this, the first item was peace; with this supreme object in view, he took the post of Foreign Secretary in addition to that of First Lord of the Treasury.

The unsettled state of Europe, aggravated through the occupation of the Ruhr, was a primary cause of distress and unemployment in Britain. British prestige had fallen low: relations between Britain and France were bad, between France and Germany threatening. The Reparations question blocked the way. In letters to M. Poincaré, published on Feb. 4 and March 3, Mr. MacDonald, with firm friendliness, set out the British point of view, and had soon created a new atmosphere, one of confidence and hope. When, on April 13, the Experts Committee on Reparations issued a unanimous report, he at once accepted it on the part of Britain as a basis for settlement. In May, M. Poincaré was replaced by the Radical M. Herriot, who in June came over to London to discuss the European position with Mr. MacDonald. Friendship with Italy had already been established by the latter's action on Jubaland.

On July 16 1924 an Allied conference assembled in London, over which he presided, for the specific purpose of putting the Experts' Report into operation. Within a fortnight, agreement had been reached and the German delegates called in. On Aug. 16 the London Settlement, the first negotiated agreement since the War, was initialled. By mutual consent, the Experts' Plan was put in effect, and the Reparation problem thus lifted out of the political sphere. France, at the same time, agreed to evacuate the Ruhr within a year and certain towns at once. Negoti
tions for an Anglo-German Commercial Treaty, since signe
were initialled. In Sept. Mr. MacDonald and M. Herriot a
tended the Fifth Assembly of the League of Nations at Genev
and there submitted a plan, the Protocol, for the elimination
private war and the submission of all disputes to arbitratio
after general mutual disarmament.

In the House of Commons, meantime, the difficulties of t
Government's minority position were growing. Mr. Snowden
Budget met with general approval; a Housing Act was passe
and the machinery for the relief of unemployment improve
But when Mr. MacDonald sought to complete his peace work b
making treaties with Russia, whose *de jure* recognition had be
his first act as Foreign Secretary, the Liberals broke awa
In Oct. the Government was defeated on a motion, calli
for a select committee, on their dropping of the prosecuti
of a Communist named Campbell. In the general electio
then declared, the press was exceedingly hostile, and Labo
was identified with Bolshevism. The campaign culminated
the publication of a document purporting to emanate from
Zinoviev, president of the Moscow International, urging Briti
Communists to tamper with the army, and of a note from t
Foreign Office, issued without the signature or sanction of t
Secretary, animadverting on Russian propaganda. Polling to
place on Oct. 29; as a result the Conservatives came back wi
a great majority. The Labour vote went up by over a millio
but its representation was reduced to 150. On Nov. 4 Mr. Ma
Donald resigned, and resumed his leadership of the Oppositio
His party, in conference in 1925, confirmed his leadership wi
striking enthusiasm, and expressed its pride in the achieveme
of its first Government. In 1924, while Prime Minister, he w
given an LL.D. by Glasgow University, and made a freeman
Glasgow, and of Dundee. In 1925 Edinburgh made him a fre
man, and the university conferred an LL.D.

An Estimate.—The permanent significance in British politi
history of a man who had created a new political party and e
abled it to conduct a Government, is obvious. But Mr. MacDo
ald's contribution cannot be measured by this unless it is al
noted that he made the party the vehicle of a new political phil
ophy, which serves to give precision and content to the idea
democracy. His socialism, derived from wide study of men a
institutions, of science and history, has been expressed throu
writings and speeches which have modified opinion over a wid
range than that of professed adherents. In it, two main strea
may be detached—the scientific and the moral. Accepting t
design suggested by evolution, he postulates, instead of a ha
hazard and unwilling adaptation, or the resistance to chan
that provokes revolution, a conscious acceptance of its princi
through a planned social organisation based on commu
need and service—such an "organisation of things as invi
the co-operation of minds." Mind, in his view, is the instrume
consent the method, of social advance. Consistently rejecti
violence, he opposes war and revolution alike. A steadying
well as a constructive force in the British Labour movement,
realised that ideas are the moulding force in human developme
the moral element colouring his thought and action, gave to
appeal to the masses the accents of a gospel.

MacDonald's views on socialism can best be studied in his boo
Among them the more important are: *Socialism and Society* (190
Socialism and Government (1909); *The Awakening of India* (191
The Socialist Movement (1911); *Syndicalism* (1912); *The Social*
rest (1913); *National Defence* (1917); *Parliament and Revolut*
(1919); *Parliament and Democracy* (1919); *The Government of Ind*
(1919); *A Policy for the Labour Party* (1920); and *Socialism, Criti*
and Constructive (1921). In addition, his biography of his wi
Margaret Ethel MacDonald (1912); and a volume of essays a
travel pictures, *Wanderings and Excursions* (1925) may also
mentioned. See C. W. Mullins, *The Patriotism of Ramsay MacDon*
and Others (1916); L. N. Le Roux, *J. Ramsay MacDonald. Sa*
son œuvre et sa pensée (1919); "Iconoclast" (M. A. Hamilto
The Man of Tomorrow, J. Ramsay MacDonald (1923); *J. Ram*
MacDonald, 1923–25 (1925); H. Tracey, *From Doughty Street*
Downing Street. The Rt. Hon. J. Ramsay MacDonald, M.P. (192
J. Bardoux, *J. Ramsay MacDonald* (1924); G. Glasgow, *MacDon*
as Diplomatist (1924). (M. A. H.)

IACDONELL, SIR JOHN (1846–1921), British jurist, was
n at Brechin, Forfarshire, Aug. 11 1846, and was educated
he universities of Aberdeen and Edinburgh. He was called
he bar by the Middle Temple in 1873 and for some years
counsel to the Board of Trade and the London Chamber of
nmerce. In 1889 he was made a master of the supreme court
in 1912 was appointed king's remembrancer. In 1901 he
made Quain professor of comparative law in the University
ondon and he was president of the society of public teachers
law (1912–3), a member of several royal commissions, and
ior, for many years, of *The Journal of Comparative Legislation*
International Law. In 1913 he was elected a fellow of the
tish Academy and in 1914 was created K.C.B. Besides
ting the *State Trials* (1887), the *Civil Judicial Statistics*
om 1894) and the *Criminal Judicial Statistics* (from 1900), he
blished works on the subjects of capture at sea and the law of
ster and servant, and was the author of many papers on
ernational law. He was also for 40 years a leader writer on
Times, London. He died in London March 17 1921.

IACEDONIA (*see* 17.216), a territory embracing the former
rkish vilayets of Monastir and Salonika, and part of the
ayet of Kosovo, now divided between Greece and Serbia.

ll statistics of Macedonian nationalities must be received
h the greatest caution and have a very relative value. The
eace Handbook for Macedonia" states with considerable
idence that "before 1912 there were approximately 1,150,000
vs, 400,000 Turks, 120,000 Albanians, 300,000 Greeks,
,000 Vlachs, 100,000 Jews and 10,000 Gipsies." M. Palles
imates the population of Greek Macedonia as 43% Greek
ore the immigration of the Greek refugees and as 90%
eek in 1925. There is a movement among the Greeks of Greek
cedonia for local government; this is quite distinct from the
lgarian propaganda in favour of an "autonomous" Mace-
ia, which, like "autonomous" Eastern Roumelia in 1885,
ld be ultimately annexed to Bulgaria.

olitical History.—Since 1911 Macedonia has thrice become a
tlefield. When the first Balkan War of 1912 broke out, while
Bulgarians directed their principal efforts against the
rkish armies in Thrace, their Serbian and Greek allies ad-
nced into Macedonia. The great Serbian victory at Kuma-
vo left Skoplje, the capital of Dushan's medieval Empire, open
the victors, and the Greek successes at Sarantaporos and
nije-Vardar led to the occupation of Salonika. In 1913 the
arrel which arose out of the division of the Macedonian spoils
ween Bulgaria and her allies provoked the second Balkan
r, of which Macedonia was again the theatre. The Greeks
eated the Bulgarians at Kilkis and the Serbians routed them
Ovčepolje. But the retreating Bulgarians laid Seres, a flour-
ing town, in ashes, and the writer, visiting it a year later, saw
empty petroleum tin in every Greek house. Violence was
practised at Nigrita, Doxaton and Drama.

he third Treaty of Bucharest, signed Aug. 10 1913, divided
cedonia between Greece and Serbia; the Greek frontier
etched from the Mesta, thus including the rich tobacco
ntations of Kavalla, to Kenali near Monastir, which became
bian. Bulgaria was excluded from what had been to her
tionalists her "promised land," and King Constantine was
led at Athens as a second "Bulgar-slayer," the successor of
sil II. For the first time for five centuries Macedonia was
verned by Christian nations. As inevitably happens when-
r Turkish rule ceases there was everything to create. The
tors of the wars of 1912–3 took over a land neglected com-
tely by its Turkish governors; its marshes were undrained,
rivers unembanked, its ports undredged, its cultivable lands
th the exception of the tobacco fields) either uncultivated or
cultivated by the most primitive methods. Serbians and
eeks set to work upon this colossal task to the best of their
perience and limited means, but they had had no time to
ieve much when in 1914 the World War broke out, and in
5 Macedonia for the third time in three years became the
ne of Balkan conflicts and was soon converted into one of the
ropean cockpits.

The entry of Bulgaria into war against Serbia, on Oct. 14 1915, was speedily followed by the capture of Shtip, Radovište, Veles and Skoplje and the evacuation of Monastir, although the Serbians held the Babuna pass between Skoplje and Prilep for more than a week. Meanwhile, the Allied troops had landed at Salonika (*q.v.*) on Oct. 5, which thenceforth became the base of their operations in Macedonia. But they had to retreat from Doiran and Krivolak to the Vardar and thence to Salonika in Dec., while in May 1916 the strategic position of Fort Rupel, commanding the Struma valley, was, with the acquiescence of the Greek Govt., betrayed to the Bulgarians, who occupied Kavalla and all eastern Macedonia. At last, after the appointment of Gen. Sarrail as commander-in-chief, the Allied offensive began. The British advanced on Doiran and along the Struma; the French and the reconstituted Serbian Army retook Monastir, while Italian troops landed at Salonika and the Provisional Govt. of M. Veniselos, now established there, on Nov. 23 declared war on Bulgaria and Germany. When the spring campaign of 1917 began, fighting was resumed near Monastir and Doiran, and the French and Russians extended their front towards the lake of Okhrida, while the Greeks at the battle of Srka in 1918 contributed to the Allied victory. The Franco-Serbian offensive on the Vardar in Sept. of that year, combined with the Anglo-Greek attack near Doiran, where a monument now commemorates the British fallen, led to a complete rout of the Bulgarians, who on the 25th asked for an armistice, signed on the 29th, on the day when the French entered Skoplje. Next day Bulgaria surrendered unconditionally; Macedonia had contributed her share to the defeat and at last had rest.

The peace settlement of 1919 divided Macedonia between Greece and Yugoslavia, while Bulgaria was excluded alike from Macedonia and the Aegean. But that she will permanently acquiesce in that settlement may be doubted from a study of her past claims. Bulgarian *komitadjis* still threaten from time to time the danger zone where the three frontiers converge. Incidents such as that between Greeks and Bulgarians near Petritch in Oct. 1925, referred by both parties to, and settled by, the League of Nations, remind western Europe that Macedonia is still volcanic soil.

Greek Settlement in Macedonia.—The emigration of the Greek refugees from Asia Minor and Turkish Thrace after the Greek disaster in the Asia Minor campaign of 1922 has, however, completely changed the ethnographical situation, and has solved the racial question in Greek Macedonia, whose population, formerly only 43%, is now 90% Greek. Economically the change is equally striking. Thanks to the work of the Refugees' Settlement Commission, created by the League of Nations in 1923, and to the Refugee Loan of £10,000,000, issued under the auspices of the League, villages have arisen throughout parts of Greek Macedonia where there was not a house before. Competent judges believe that the refugees from Asia Minor will in time do for Macedonia what the expelled French Huguenots did for England, for they have brought new industries with them. It is calculated that when the Anglo-American concession for draining the Vardar marshes has accomplished its work, not only will malaria, the curse of Macedonia, be diminished, but also that country will supply the rest of Greece with cereals, now imported, and will thus improve the rate of exchange.

Railway Communications.—Since the opening of the last section of the Greek railway between Thessaly and the Macedonian system in 1916—a connection long refused by the Turks—Macedonia is traversed by the Simplon-Orient and Prague expresses to Athens, and an improvement of the permanent way will further shorten the journey. Difficulties between Greece and Yugoslavia have, however, arisen with respect to the portion of the railway between Salonika and the Yugoslav frontier station, Gjevgjelija, which belonged to a French company, now bought out by the Greeks. The Yugoslavs have obtained a "Serbian zone" in the port of Salonika, but, despite the fact that since Aug. 1925 Serbia has for the first time had direct railway communication with the Adriatic at Spalato, Serbian nationalism tends to regard Salonika—towards which the Croats and Slovenes are indifferent—as the natural outlet of Serbian Macedonia. The signature of the Bulgarian Minorities' Protocol by the Greek representative at Geneva was the occasion of the denunciation by the Yugoslavs of their alliance with Greece, and the subsequent negotiations for its renewal had (up to April 1926) failed, although the Greek Assembly refused to ratify the Minorities' Protocol. Meanwhile, considerable improvements have been made, notably in the railway stations of Serbian Macedonia, and the frontier question of the Monastery of St. Naum has been settled with Albania.

Production and Industrial Development.—But it would be impossible for Macedonia, after five centuries of Turkish neglect, to achieve a high grade of civilisation in 13 years. Nevertheless, Macedonia has already shown signs of an industrial future. Cotton is grown near Seres, woollen goods are produced and 17,000 tons of tobacco were grown in 1924, and 26,000 in 1923 in Macedonia and Thrace. The refugees have replaced the Turkish tobacco planters in Macedonia, and in 1924 they were cultivating 2,250 acres more than before. In 1923 the value of the tobacco exported from Kavalla reached three milliards of *drachmai*, and an American tobacco company is established there. The usual corollary of industrialism has made its appearance at Kavalla in the form of the labour disputes of 1924. Macedonia is, indeed, the only part of Greece where there are any signs of Bolshevism, a phenomenon to the growth of which the individualism of the Greek character is very unfavourable. The Greek peasant is naturally conservative, and it is only among the new elements of the Macedonian population, Greeks who in some cases speak only Turkish and have little to lose, that Bolshevik propaganda can find disciples.

Jewish Element.—Macedonia is the only Greek territory which furnishes a large Jewish element to the population. The Salonika Jews, settled there for centuries, probably preferred Turkish to Christian rule; but they have accepted Greek citizenship and formed a special electoral college for the elections to the new Greek Senate (still in abeyance). Their traditional business qualities contribute to the economic development of the province, now placed under a governor-general. *See* also Bulgaria.

Bibliography.—N. B. Many books on this subject have racial bias and are propaganda. See however: Peace Handbooks, vol. 4, No. 21, *Macedonia* (1920); Gen. M. P. E. Sarrail, *Mon Commandement en Orient, 1916–8* (Paris, 1920); William Miller, *The Ottoman Empire and its Successors, 1801–1922*, ed. 2 (Cambridge, 1923); R. F. H. Duke, *Report on the Industrial and Economic Situation in Greece for the Years 1923 and 1924* (London, 1925). (W. Mi.)

McGILL UNIVERSITY (*see* 27.775).—The position of McGill as providing exceptionally ample facilities for instruction and research in applied science has been maintained and strengthened since 1910 in many respects. A new wing giving additional space to the work in electrical engineering has been erected. A university clinic has been established under direction of the professor of medicine who is also chief medical officer of the Royal Victoria Hospital. In 1910 the Carnegie Corporation of New York gave $1,000,000 in recognition of McGill's science and sacrifice in the World War. In 1920 the Rockefeller Foundation gave $1,000,000 for the faculty of medicine, $1,000,000 was given by the Provincial Govt. for general purposes and $4,400,000 was raised from the graduates and citizens of Montreal as a general endowment. The income from investments is about $1,000,000. In 1923–4 the Rockefeller Foundation gave $500,000 for medical research, Lady Strathcona gave $120,000 to endow a chair of zoology, and other substantial gifts and bequests have been made to the university since 1910. After the World War Sir Arthur Currie, G.C.M.G., K.C.B., was chosen principal of the university.

MACH, ERNST (1838–1916), Austrian physicist and psychologist (*see* 17.232), died near Munich Feb. 19 1916.

MACHAR, JAN SVATOPLUK (1864–), Czech poet, was born at Kolin Feb. 29 1864. His early works, such as *Confiteor* consist of sentimental verses written under the influence of Lermontov, Heine and De Musset. He afterwards turned his attention to social and political satire, exemplified in such volumes as *Magdalena* (1894), and *Warriors of God* (1895–6). The most important phase of his poetical activity began, however, with the publication of *Golgotha* (1901), the first of a series of volumes in which the destinies of mankind are surveyed through sceptical and anti-clerical eyes. *In the Glow of the Hellenic Sun* (1906) and *The Poison from Judaea* are titles which sufficiently indicate the point of view from which Machar wrote his historical impressions. He traced, in the form of monologues, portraits and short dramatic scenes, the chief personalities in history, from the earliest times to the Napoleonic era and beyond. As a prose writer, Machar exhibits the same incisive qualities which distinguish his poetry. He attracted much attention by his book, *Rome* (1907) in which personal bias is fully expressed and by *The Jail* (1917–8), a graphic descript of his imprisonment by the Austrian authorities during World War.

MACHINE GUNS (*see* 17.237).—The machine gun is an au matic small-arm weapon, usually provided with a fixed mount and capable of sustained accurate fire. A heavy machine does not differ materially from an ordinary machine gun design, but as its calibre may be from 0·5 to 0·9 in. it is ne sarily of a heavier and stronger make. The weight of a mach gun, however, is limited by the consideration that by whate means it may be transported, it must in the last resort "man-handled" into position often over considerable tances and under difficult conditions. On the other hand lig ness and portability are desirable only in so far as they consistent with strength, for to a large extent it is on the streng and therefore, weight, of the mechanism that the ability o gun to sustain fire depends.

Ammunition.—Rifle ammunition can be projected by machine gun with incapacitating effect at ranges at which fire of the rifleman would be inaccurate and wasteful owing the big variation caused by the personal error. Theoretically might be desirable to have special machine gun ammuniti such as the long-ranging (6,000 yd.) streamline bullet us by the United States and Swiss armies; but in view of the en mous quantities of ammunition required for the small arms modern armies, it seems probable that any advantage wou be more than counterbalanced by the difficulties of supp organisation, etc., that would be involved in having differe types of ammunition for rifles and machine guns.

Mounting.—The fixed mounting with which the machine g is provided increases the accuracy of all ordinary shooting, a thus enables the gun to be used either for indirect fire, or fire over the heads of friendly troops, when supporting attack or covering a retirement. To support rigidly a machi gun weighing from 40 to 50 lb., the mounting must be strong a fairly heavy, otherwise the combination will be top heavy a unsteady, and the shooting in consequence will be inaccura The mounting must permit of the gun being traversed throu as wide an arc as possible, and also permit alterations in elev tion to be made. The tripod mounting of the American Browning machine gun has elevating and traversing dia graduated in degrees, etc., to facilitate "fire direction."

Fire Capabilities.—Machine guns for ground use normally ha a rate of fire of about 450–500 rounds per minute, but, owi to the necessary replenishment of empty belts or magazines, et the number of rounds actually fired per minute is much les In aircraft a higher rate of fire is desirable, and is usually o tained. By reason of its capacity for sustained fire the machin gun can provide prolonged supporting fire on the battlefie besides being useful for barrage work. The ability to fire sing shots is an advantage, because such shots do not disclose t identity of the machine gun and are useful for observation range, for testing the working and for keeping water-cool guns from freezing up in cold weather. There are also certa tactical advantages, especially in the case of detached units cavalry, whose ammunition is on pack transport and is ther fore limited.

Cooling Systems.—For sustained fire an efficient cooling syste for the barrel is essential. The higher the temperature of t barrel, the less its resistance to wear. There are three systems use, namely, radiation in air, a combination of radiation a draught of air and water-cooling. In the case of aircra machine guns no special provision for cooling is necessary as t barrel is exposed to the rush of cold air. Heavy barrels wi radiating rings are sometimes employed for ground use (*e.g.*, t French Hotchkiss). Such barrels are comparatively safe fro damage by ordinary usage or by small-arm bullets, but th suffer from the disadvantage that when they get hot, the heate air rising from them, known as "mirage," causes the target t appear to be in movement, and thus interferes with the aimin of the gun by eye. The radiation and the draught system employed in Lewis guns (*see* Rifles and Light Machine Guns 'he water-cooling system is the most common. The barrel, nearly the whole of its length, is surrounded by water con- ied in a casing which, in the case of recoiling barrels, is fitted n glands to prevent leakage. Inasmuch as prolonged rapid causes the water to boil, a steam escape is necessary. In l countries the renewal of the water given off as steam is n a serious difficulty, and in any case there is always the : of the escaping steam disclosing the position of the gun. ordingly a flexible tube is usually attached to the steam es- e whereby the steam is led into a portable condensing mber, and converted back into water for use again in the gun. cold weather guns having recoiling barrels may be put out action, except for single shots, by the water freezing, but no ance is known of a water-cooled gun being out of action by son of heat, provided the water-casing has been kept well plied. The water increases the weight of the gun by about b., and for this reason light machine guns rely on radiation their cooling.

lechanical Safety.—All automatic weapons are required to be echanically safe," that is, the design must be such that the cannot be fired unless the action is fully closed and the tridge properly supported. Even then, it should only be e to fire by means of the trigger mechanism, which itself must proof against heavy jarring. Safety catch (" applied safety ") ices are usually operated by a single, simple movement. be perfectly efficient, they should operate directly on the ng pin or striker, and should preclude the possibility of its r being able to reach the cartridge by accident.

Typical Patterns.—A few details of typical different patterns machine guns are given in the table at the bottom of the page. lgaria used a ·315 Maxim (tripod mounting and pack trans- t) and Switzerland a ·295 Maxim (tripod and reff carriage, k and man's back). In other details both guns follow the rman pattern. The Belgian Hotchkiss differs from the French calibre (·301), mounting (carriage with removable tripod) l mode of transport (limber). The Czechoslovak Schwarzlose dentical with the Austrian weapon.

For the automatic operation of machine guns power may be obtained in three distinct ways, viz.: from the gases generated by the explosion of the charge, from the recoil of the barrel and from the backward thrust of the cartridge on explosion. In some types of gun two of these principles of operation are combined.

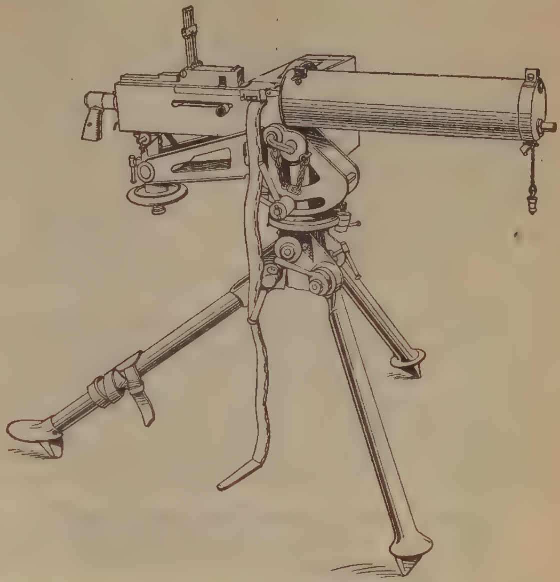

FIG. 1.—Browning water-cooled machine gun (U.S.).

Gas-Operated Guns.—Most light machine guns and the Hotchkiss, which is the primary machine gun of the French Army, are typical of the first method. The gas is diverted through a hole in the barrel near the muzzle to operate a piston or lever. In the Colt machine gun the gas issuing from a hole near the muzzle impinges

The Machine Guns of Six Countries

		Austria	France	Germany	Great Britain	Italy	U.S.A.
attern		Schwarzlose	Hotchkiss	Maxim (1908)[2]	Vickers Mk. I.[3]	Revelli	Browning
alibre		·315	·315	·311	·303	·256	·300
eight (lb.)	Empty	44	52 (1902) 55½ (1916)	40	28½	37½	30
	With water for cooling	49¾	. .	48½	38½	48½	37
ooling System		Water	Air	Water	Water	Water	Water
ow Operated		Cartridge projection[1]	Gas	Recoil assisted by gas	Recoil assisted by gas	Combination of recoil, inertia and cartridge projection	Recoil
ow Fed		Belt 250 rounds	Metal strips 30 rounds	Belt 250 rounds	Belt 250 rounds	Magazine 50 rounds	Belt 250 rounds[4]
ocking System		Inertia heavy breech action having elbow joint and strong spring	Link on bolt dropping to lock in recess in body	Toggle joint	Toggle joint	Rotating wedge temporarily locking two moving parts	Locking block rising to engage with breech block
Mounting		Tripod 43¾ lb.	Tripod 72 lb. (1907) 58 lb. (1915)	4-legged sledge 77 lb.	Tripod 48½ lb.	Tripod 47½ lb.	Tripod 54 lb. (1917) 50 lb. (1919)
ow Transported		Pack	One-horsed carriage and pack	Wagon or pack	Wagon or pack	Wagon or pack	Pack
ighted up to (yd.)		2,620	2,190	2,190	2,900	2,190	2,800

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[1] Rearward thrust of cartridge projects breech block to rear.

[2] During the World War the Erfurt gun was made. It was very similar to the 1908 gun, but weighed less—empty 31 lb., full 37 lb. Tripod ½ pounds.

[3] Mark II. gun is for aircraft. It is air-cooled and uses a metal disintegrating link belt (any length).

[4] Belts for aircraft are of metal disintegrating links.

on the front end of a lever hinged at its rear. The front of the lever, being blown down by the gases, revolves backward round its hinge and in so doing extends springs which operate the mechanism. This gun is now practically obsolete.

Barrel Recoil Only.—The U.S. Browning water-cooled gun (see fig. 1) operates by barrel recoil alone. On the explosion of the cartridge the barrel, barrel extension and breech block move backwards locked together for $\frac{5}{8}$ inch. The locking block for the breech block is then forced downwards, and, the action being unlocked, the breech block travels to the rear, compressing the return spring. An extractor pivoted to the breech block then withdraws a live round from the belt in the feed block. At the end of its rearward travel, it is forced down, so placing the new round in grooves on the face of the breech block and in line with the chamber. The empty cartridge case is knocked off the face of the breech block through the ejection opening underneath the gun. The return spring then pushes the breech block forward to close and load the gun. The cartridge belt is led into the feed block by the action of a slide carrying a pawl, which, engaging behind the leading round, forces it into position for the extractor to grip. In this way the belt is led through the gun. A pawl on the floor of the feed block prevents the belt from slipping backwards. The slide is worked to left and right by a lever operated by a stud working on a cam-shaped slot in the top of the breech block.

The firing pin, housed within the breech block, is cocked by the action of a pivoting lever during the backward travel of the breech block. The other end of this lever, engaging with ramps on the top of the gun, is caused to rotate round its pivot. When the breech block goes forward it is pivoted into position for the next cocking action. To release the firing pin to fire the gun, a trigger, when the breech block is fully forward and locked, engages with a sear which holds back the firing pin against its spring. In this way, the "mechanical safety" of the gun is secured. When the trigger is pulled, the sear disengages from the firing pin, which then flies forward to fire the round. So long as the trigger is pressed the gun fires automatically. A springed component called the accelerator is also embodied. Its function is to assist the recovery of the barrel and, cocked by the barrel extension moving backwards and released by the breech block going forward, regulates the timing of the locking of the latter.

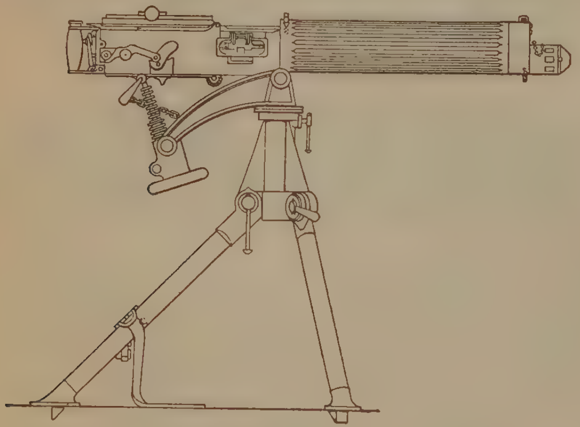


FIG. 2.—Vickers machine gun (Great Britain).

Recoil and Gas.—In the Vickers gun (see fig. 2) recoil of the barrel is assisted by the backward thrust of the gases partially trapped at the muzzle. The barrel projects through the front of the water casing, and on it is carried a muzzle cup. Surrounding this is a muzzle attachment, screwed to the water casing and having a small hole in it, through which the bullet passes. The gases following the bullet strike the front end of this attachment and rebound on to the muzzle cup on the barrel, so increasing the recoil energy of the latter. The barrel, with side-plates attached, recoils about one inch. The left side-plate operates a lever, which, with another, works a slide on the feed block, to the right on recoil and to the left on recovery. This feed block is above the breech. The slide has two pawls, which, when it is to the right, engage behind the new round in the cartridge belt and push it to the left into position, where it is withdrawn from the belt by the moving extractor on the lock.

On recoil the lock, locked to the barrel, moves with it. In the rear of the lock is the crank to which the lock is connected by the head of the side levers and connecting rod, in which the former engages. Bearings in the rear of the right and left side-plates carry the crank, the left one being detachable. On the right, outside the casing, is a crank handle. This handle has a curved rearward extension called the tail. Just clear of this tail on the side of the gun is a roller. On recoil, the curved part of the tail hits this roller and is caused to rotate. Being attached to the crank, the latter is rotated, thereby causing the lock to be unlocked and withdrawn from the breec during which movement the lock is cocked. There is, farther fo ward on the crank handle, a hump, which, when meeting the roll causes the crank and side-plates to move forward, so returning t barrel to its forward position. In the left axis of the crank is a reces into which a feathered lever called the fuzee engages. This, means of links, engages with the fuzee spring, which is secured to t left of the casing. When the crank rotates, the fuzee rotates, and th spring is extended. When the rearward rotation of the crank finished, the spring, working through the fuzee, rotates the crank the opposite direction, so causing the lock to go fully forward into t locked position against the breech, with its firing pin cocked. Th extractor is operated vertically on the lock face by side and extract levers. It has two flanges in which the cartridge rims ride and are held to it.

When the lock is fully forward, the extractor is at its highe point, and if a round be in the feed block, it is gripped by the extra tor. When the lock goes back, this round is withdrawn from th belt, and, after about $3\frac{1}{2}$ in. of travel, the extractor falls and plac the round in line with the chamber. When the lock goes forward th round is pushed into the chamber, and the extractor, rising agai grips another round in the feed block, there being then two round on the extractor, one in the feed block, the other in the chamber. Through the extractor is a hole, through which the firing pin protrudes to fire the round in the chamber when the extractor is in its highest position. On the recoil of firing, the flanges, still gripping the case in the chamber, withdraw it, and when the extractor drops again, this empty case drops through the bottom of the casing.

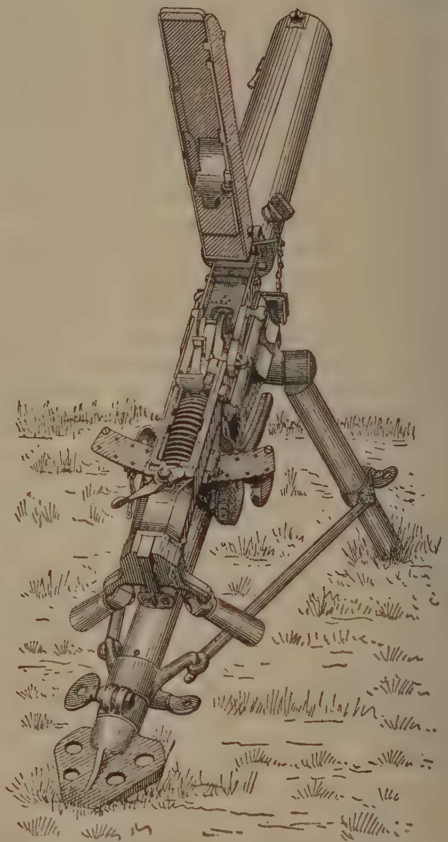


FIG. 3.—Schwarzlose machine gun (Austria).

Projecting from the top of the lock is the tail of the trigger. Along the cover of the gun is situated a spring-operated sliding trigger bar. The rear of this is connected by the trigger bar lever to the firing lever with thumb piece, which is carried on the rear crosspiece. When the thumb piece is pressed forward the trigger bar is drawn rearwards and pulls or trips the tail of the trigger projecting from the lock, thus releasing the firing pin and firing the gun. A spring-operated safety catch on the rear crosspiece prevents the operation of the thumb piece until disengaged by the fingers of the firer.

Cartridge Projection.—The Austrian Schwarzlose (see fig. 3) is operated on a principle known as "cartridge projection," *i. e.*, by the backward thrust of the cartridge driving the action to the rear. The barrel is fixed, and the moving parts are operated by the thrust of the cartridge head on the breech block. To ensure that the care does not grip the chamber after the explosion, and so retard its vard thrust, provision is made to oil each round entering the nber. On firing, the breech block is driven to the rear against a g spring, extracting the fired round from the chamber, and ing the crank and handle.

rear of and underneath the breech is the feed wheel, round which tuds. Underneath the bolt is a cam-shaped slot, in which each of studs ride in turn, thus causing a rotating movement of the feed el. At the front of the fore part are two sets of teeth. The belt is nto the gun between these teeth, which then engage the rounds ach end and lift them into position for withdrawal from the belt neans of a claw on the underside of the breech block. The round us drawn to the rear into a channel in the feed wheel. During withdrawal, the channel is rotated slightly to the left, so bring- he round into position in front of the breech block, which is now s rearmost position. The main spring then drives the breech k forward and the round enters the chamber, rotation of the feed el being also effected, and the next round being prepared for a lar operation.

jection is effected by a plunger on the right of the breech block A heavy firing pin protrudes through the breech block, and at ear is a solid arm that curves forward. This portion engages a suitably shaped similar arm in the crank, when the latter is ted during the backward travel of the breech block, thus with- ving the firing pin. When withdrawn, the bent of the firing pin ges with the sear on the breech block, and it is cocked. On the side of the solid arm of the firing pin is a pivoted arm, the trigger, ecting forward and downward. The front end of the trigger bar, ch is ramp shaped, is in front of this arm when the firing pin is ed. Its rear end is engaged with a trigger bar lever, operated by firing lever thumb piece, mounted on the rear cross piece. On humb piece is the safety catch. To fire the gun, the safety catch is sed towards the right and the thumb piece forward. This with- vs the trigger-bar, and the ramp at its forward end raises the ted arm, or trigger, until disengaging its bent from the sear on breech block, when the firing pin is free to fly forward to fire.

echanical safety is provided by (*a*) the cap of the cartridge not g in line with the firing pin hole till the breech block is fully ard, and (*b*) by the main spring bearing against the solid metal e rear of the firing pin, thus driving the breech block forward, so it is impossible for the firing pin to strike the cartridge cap if the ch block be not fully forward.

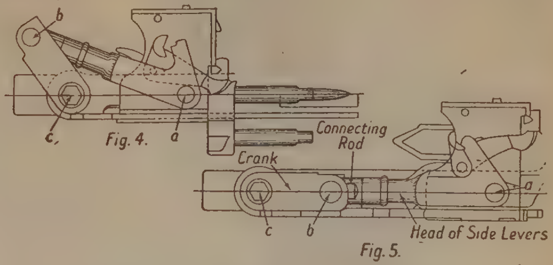
ecoil and Cartridge Projection.—The Italian Revelli uses a com- tion of barrel recoil and cartridge projection. At the rear of the el a sleeve is attached by means of ribs. Inside this sleeve is the ch block. When the gun is fired all three move together to the for a distance of 4 mm., after which the breech block goes on for about 6 in., compressing the recovery spring within it. This ng also operates the firing pin within the breech block. The bent he firing pin protrudes down through the breech block, and, when goes forward under the influence of the recovery spring, the bent ges with the right hand, or primary, of two sears projecting up- ds through the body casing. This sear is released by a spring nger connected to a thumb piece in the rear crosspiece, and is ngaged from the bent on the firing pin to fire the gun. By setting nall lever on the rear crosspiece, the spring plunger can be lated to give continuous or single shots. The secondary or left- d sear is to ensure "mechanical safety." If the sleeve and breech k are not fully forward, this sear continues to protrude and ges with the bent on the firing pin. It is operated by an arm truding from a rotary wedge underneath the sleeve. This wedge, spring, is rotated fully forward when the sleeve and breech block in their forward positions. Its arm then rises, and pressing up- ds the front end of the secondary sear, clears the rear end of this from the path of the bent of the firing pin.

he cartridges are contained in a magazine holding 50 rounds, e being 10 compartments, each with a platform and spring. As compartment is emptied, the magazine is moved to the right and next compartment is employed. The breech block, on going vard, takes the top round from the compartment and inserts it in chamber. The moving across of the magazine as the compart- ts are emptied is effected by a lever protruding from inside the y casing, and engaging in spaces in the magazine. This lever is t out of action by a spring plunger engaging with it, but, when the partment platform rises on being emptied, it disengages the ng plunger, so permitting the lever to function. The lever is on a ot, to one end of which is attached a strong spring. The other end his spring is connected to a system of levers working in short oves in the sleeve, every backward movement of which causes spring to extend and endeavour to produce the requisite motion he magazine lever.

echanical safety is further effected by means of a little rocking er on the left front edge of the breech block, into which one end jects. In the body casing is a recess for the other end of this er. The firing pin on going forward encounters the inner end and es the other end outward. Unless the breech block be fully for- d, the outer end is not in position to enter this recess in the body ing, and the firing pin is intercepted by the inner end of the lever, so preventing from protruding to fire the round. Ejection with gun is vertically upwards.

LOCKING ACTIONS

As the locking action is perhaps the most important part of the mechanism of any automatic weapon, a short description is given of the well-known method employed in the Vickers gun and also the unusual methods employed in the Schwarzlose and Revelli guns.



FIGS. 4 and 5.—Locking action of the Vickers machine gun.

The Vickers (see figs. 4 and 5).—The lock is connected to the crank by (1) the side lever head, whose axis is a, and (2) the connecting rod, whose axis is b. The axis of the crank is c. Fig. 4 shows the unlocked position with the lock back. Fig. 5 shows the locked position. In the locked position, axis b is slightly below axis a and c, and the crank, under b, bears hard on the crank stops. The rearward thrust of the cartridge on explosion thus passes through a, b and c. As b is lower than a and c, it cannot under pressure rise above the line ac and so unlock the action. It must tend downwards. However, the crank is already bearing on the crank stops under b, hence no movement here is possible and so the locking action is effected.

Except that the crank revolves downwards instead of upwards, the system of locking in the Maxim gun is practically identical with that employed in the Vickers.

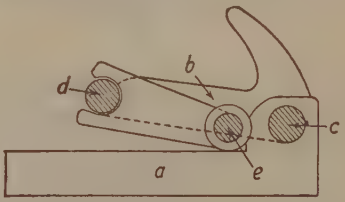
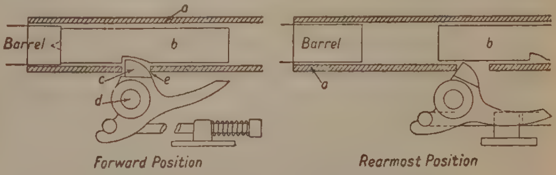


FIG. 6.—Inertia sealing of the breech in the Schwarzlose machine gun.

Inertia Sealing of the Breech in the Schwarzlose.—There is no positive locking in the gun, reliance being placed in heavy moving parts and a strong spring, to induce sufficient inertia to seal the breech. With a view to ensuring the exit of the bullet from the barrel before the inertia is overcome, the barrel is abnormally short.

The mechanism includes a massive, heavy breech block a (see fig. 6), connected by the crank link b (which is attached to it at axis c) to the upper axis of the crank, d. The lower axis of the crank e works in bearings in the body-casing of the gun and has no backward or forward movement. In rear is a strong spring pushing the bolt forward. The thrust on the face of the breech block pulls the crank link to the rear. It, in turn, pulls the crank to the rear.



Forward Position

Rearmost Position

FIG. 7.—Locking action of the Revelli machine gun.

However, owing to the set of the crank with reference to its non-recoiling axis e, considerable resistance to the rearward motion of the breech block is set up. Thus it is that, coupled with the heavy resistance offered by the strong antagonistic spring and the weight of the moving parts, sufficient inertia is created to prevent the breech from opening prematurely.

The Revelli.—On explosion, the barrel with sleeve a (see fig. 7) recoils, and the gases, acting through the cartridge head, impart a rearward movement to the breech block b. At this stage, the breech block and sleeve are locked together by a claw c, on a rotating wedge with axis d. The rearward movement of the breech block causes the wedge to rotate to the rear. In so doing, the claw, which passes through a slot in the sleeve, bears against the latter at the shoulder e, and helps to force the sleeve and barrel rearward. After a and b have moved about 4 mm., the claw is entirely disengaged from the breech block, which continues to the rear under its own momentum. The wedge in rotating compresses a strong spring, so the tip of the claw bears against the under side of the breech block, and is prevented from regaining its forward position. Hence the sleeve cannot do so until the recess in the breech block returns to within 4 mm. of its forward position.

The long arm of the wedge is that which engages with the secondary sear introduced for " mechanical safety " and referred to in the description of the gun. (H. R. A.)

MACHINERY: *see* AUTOMATIC MACHINERY; TEXTILE MACHINERY.

MACHINE TOOLS (*see* 27.21).—The sixteen years between 1910 and 1926 changed the character of machine tool equipment in many respects. For while the outward appearance may have retained the same general outline, there have been many developments in details that greatly affect productive capacity. Among these details are the use of heat treated alloy steels in spindles and gears, anti-friction bearings in many places, including the main spindle in a few instances, and the placing of the driving motor in the base of the machine itself. Add to these the growing use of individual motor drives, the speeding up of the machines and the tendency toward automatic or semi-automatic feeds, and the changes are very noticeable.

Mass production has been aided by the increasing use of more accurate gauges and better inspection methods. The new visual or projection methods of inspecting screw threads and other contours has enabled interchangeable work to be secured more rapidly. The use of optical methods has also made it much easier to obtain extreme accuracy whenever necessary.

Lathes.—There have been few changes in cutting tools since the advent of the tools suggested by the late Frederick W. Taylor although there is a tendency to use tools with greater top rake. Both A. L. De Leeuw and Dr. Hans Klopstock have advocated changes in tools shapes that, as shown by experiments, make a much higher cutting speed possible. The machines themselves have undergone distinct changes largely by the use of alloy steel shafts and gears, more and more ball or roller bearings and the introduction of automatic stops that put the lathe into the semi-automatic class. The use of multiple tools had also increased to a large extent.

The hand turret or capstan lathe has received much attention, both in making it more convenient to operate and in the methods of tooling. The tools have been simplified so as to enable a comparatively few standard tools to be utilised for a large variety of work, thus making the capstan lathe a more universal machine and materially reducing the cost of tools required for average work. Self-closing chucks, operated both by air and electric motor, are growing in favor where the work warrants. More attention is being paid to the proper lubrication of lathes as well as of other machines. Geared heads are run in oil and in some cases an oil pump forces oil to the main bearings, or to reservoirs, from which it is led to different bearings by suitable pipes. Convenience of operation has also been studied and much lost time eliminated in that way.

Boring and turning machines of the vertical type have advanced in design and in productive capacity. Continuous operation machines are more in evidence so as to avoid idle time while the work is being put in position. This is secured in the station type machine where the work indexes under the cutting tools, one station being left blank for loading the work. In other machines the work table continues feeding but there is sufficient time for the operator to remove the finished piece and replace it with a piece to be machined, before the tools feed into the work; or the feed can be tripped and again thrown in when the operator is ready. One of these, by the same maker as the Mult-au-matic, is called the Continu-matic. This is shown on the plate. There are now several machines built along these general lines.

Drilling and boring machines have been developed to a considerable extent by the demands of the automobile industry. These developments include the special multi-way, multi-spindle machines that drill a large number of holes in from three to five sides of a cylinder block, at one feeding of the drills. The number of holes drilled at once is limited only by the ability to get the spindles close enough together and by the power of the machine. Drilling machines are also made in the station type and many are semi-automatic in their action. In other cases a number of spindles are mounted in a row and work is passed from one to the other. The drills themselves have been improved to such an extent that higher speeds and more powerful motors are now necessary to secure maximum production.

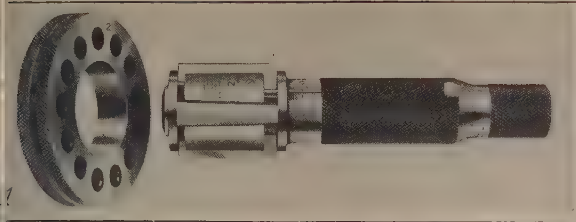
Milling Machines.—While there have been but one or two really new types of milling machines put on the market, the changes in design and capacity have been very marked. Machines are being built heavier and more rigid and the controls are being centralised for the convenience of the operator. Rapid power traverse is universal to save the time and labour of moving the tables or knees by hand. Anti-friction bearings have been largely used in the gear boxes and for thrusts, and now roller bearings are being applied to the main spindle in a few cases. Automatic feeds and stops are being largely used to increase the production and every endeavour is being made to make the cutting action continuous wherever possible. A development along this line is to hold the work on a revolving table that carries it past the milling cutters and allows a new piece to be put in place while the machine is running. These revolving tables are made both vertical and horizontal. With the table in a vertical position and horizontal milling spindles each side of the table, both ends of the piece can be milled at the same time. In one machine of this type the work is held firmly in place by a chain so arranged that the work runs under it before the milling cutters begin working and releases it after the work has passed the cutters. This is a very simple device but one which saves much time and greatly reduces the cost of clamping the work to the table.

The planer type of milling machine is being used more and more in railway shop work on connecting rods and in similar work. We are also learning that a milling machine is only as good as its cutter, and that the designing and making of an efficient milling cutter is an engineering problem. The effect of this cutter development has been to double the feed per minute in many cases and to remove an unbelievable weight of metal per minute. For small pieces the tendency is to use the continuous milling machine rather than the planer type on account of the time lost in loading. On long work however it is still holding its own and the milling machine along the lines of the openside planer is being considered for a variety of large work, too large to go between the housings. Continuous lubrication and the use of motors in the base are also now a part of the development of the modern milling machine. Machines of the knee type are being adapted to special manufacturing by the addition of one or more spindles in a special head, the extra spindles being driven from the main spindle. This head and the use of special fixtures turns a standard milling machine into a single purpose machine that can be used on other work by the substitution of another spindle head.

Automatic profiling machines as shown have also been greatly developed by the addition of an electric contact device for the follower that makes it possible to use a master of wood or plaster or common building cement. This electric contact device controls the action of the profiling cutter, and though the touch of the follower is very light and delicate, the profiling cutter can take as heavy a cut as the machine or the work will stand. This type of machine not only secures extreme accuracy in the reproduction of any desired pattern but also effects a remarkable economy over the usual methods of making dies or profiling work of any kind.

Grinding Machines.—Grinding machines have probably been more startlingly developed than any other class of machine. Beginning with being practically a polishing machine that removed very small amounts of metal, we now have grinding machines that are driving the grinding wheel with a 75 H.P. motor, and removing metal at a rate that compares favourably with machines and cutting tools of other types. One type of grinding now finding favour is the in-feeding or " plunge-cut " type where a wheel is used that is wider than the length of the work and fed straight against the work instead of being traversed along its

MACHINE TOOLS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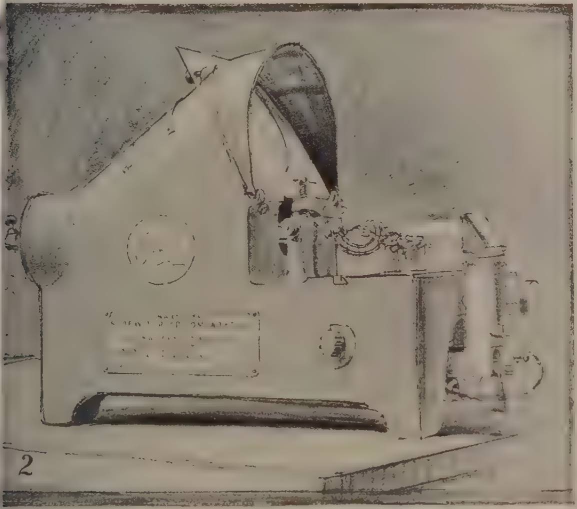
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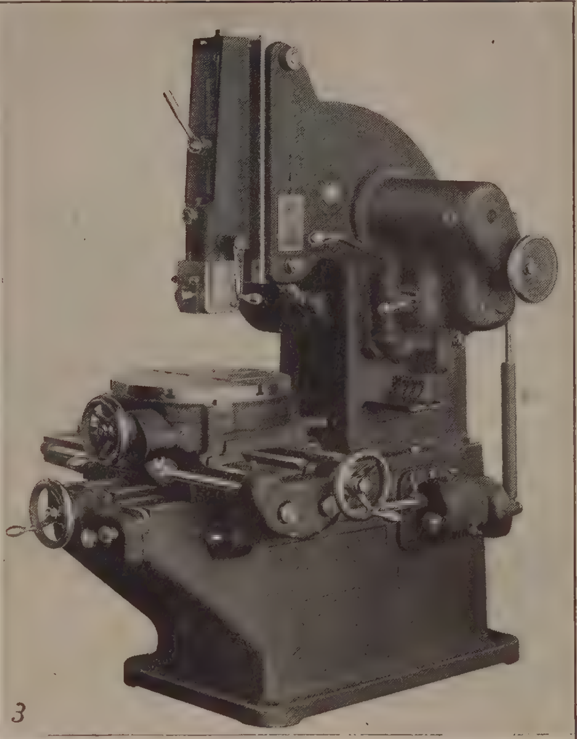
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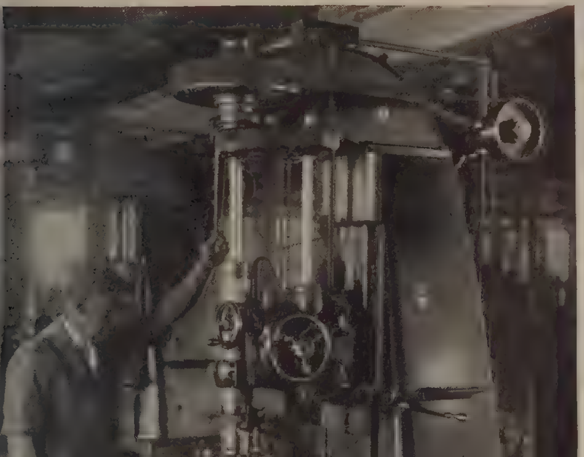
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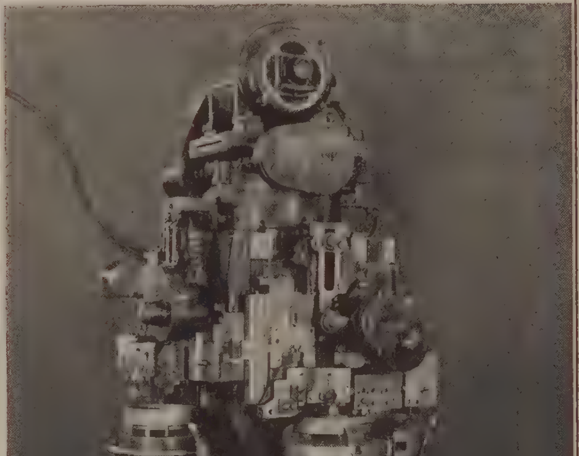
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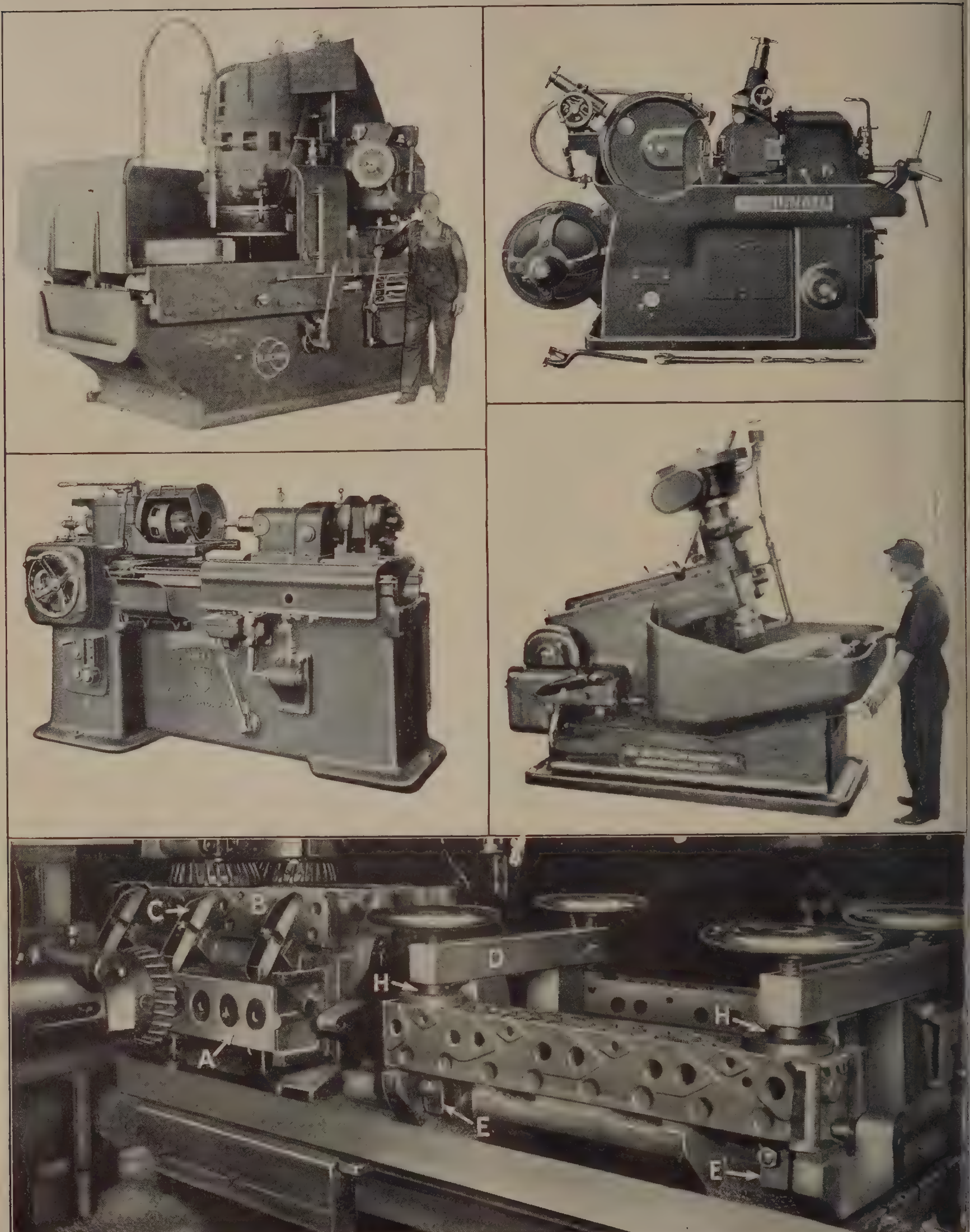
IG. 1. Bath Internal Micrometer for rapidly verifying bores to .0001″. FIG. 2. A beam of light is thrown on the screw which is to e examined. The shadow (enlarged by passing through a microscope) is reflected, from the back of the chamber, forward to the upper art of the instrument, where (if the screw is perfect) the shadow agrees with a translucent diagram mounted under the hood. The total agnification is 50 times. FIG. 3. Pratt & Whitney Vertical Shaper with inclinable ram. FIG. 4. Testing a Locating and Jig-boring achine, which locates centres to .0001″. FIG. 5. 4-spindle Contin-U-Matic chucking and turning machine, producing a fly-wheel for each complete cycle of operations. There are four chucks which revolve intermittently around the standard.

MACHINE TOOLS



Upper Left. Grinding machine. Wheel 27x7x23″; magnetic chuck 48″ diam.; capacity for work 60″ diam. x16″ high. (Other sizes up to 84″ diam. x 16″ high.) Upper Right. Centreless Grinder. Capacity: standard work up to 3″ diam. x 10″ long; longer by attachments. Lower Left. Internal Grinding Machine. Lower Right. Tilted Rotary Continuous Milling Machine. Foot. Detail of machine for milling automobile cylinder heads. A is milling bottom of one head, B is milling top of another head, both held by chucks C. Then these rough-milled heads are placed in fixture D (held by clamps E and pads H) and the sides milled by same cutters as machine bottom of A.

(Courtesy of American Machinist)

gth. The present limit seems to be a wheel 10 in. wide. The treless grinding machine has also made great strides both as the quantity of work produced and the accuracy obtainable. such work as automobile piston pins which are fed through machine in a continuous string, the diameter can be well hin a half-thousandth, and with a high production. These s are also remarkably round. It is also possible to grind ulder work on the centreless but in that case the work cannot fed through the machine but must be ground by revolving it front of the wheel in a fixed position. Centreless grinding chines are being used on work up to eight or 10 in. in diameter.

Another development is in the application of automatic sizing chanisms to cylindrical grinding, both internal and external, stly the latter. These machines rough grind the holes at a id rate, then automatically reduce the feed as the hole ap- aches the finished size, and finally finish the hole with a ht feed and stop when the hole is of the correct size. Here the accuracy is well within a half-thousandth of an inch on nmercial work.

Grinding machines are being used to remove metal to a greater tent than ever before not only on large and heavy surfacing rk but in such work as the grinding of the threads in taps. stead of merely finishing the thread of a taps that has been eviously chased and hardened, some are now grinding the com- ete thread from the solid metal, and at a remarkably rapid rate. ydraulic feed has been gaining in favour on several types of achines but has been applied to grinding machines to a greater tent than to any other. Some broaching machines are now draulically driven and the same type of feed has been used on ring and other machines. The idea has been lying dormant for number of years but recent developments seem to have made very successful in some of its applications.

Honing or lapping has gained in favour during the past few ars to a remarkable extent. Honing as applied in automobile linder work, is in reality a method of grinding instead of what e formerly knew as lapping or honing. The hones have several rips or blocks of abrasive materials, turned on the outside to it the bore of the cylinder. These are moved through the linder from end to end and revolved at the same time, so that is really a grinding process with motion different from that of e grinding wheel. Some revolve the hones rapidly and trav- se them slowly through the cylinder. Others reverse this, while me make both movements at about the same speed. In most ses the hones are used directly after a finish reaming operation d so eliminate the grinding operation. On a few of the higher iced cars however the honing is an additional operation that irtually polishes the surface and removes the "fuzz" left by the inding wheel.

The use of magnetic chucks is being extended into new lines of ork, but is confined largely to the grinding machine field. These re now made in many styles and shapes to suit individual con- itions and are a great aid to production by reducing the time re- uired for chucking any magnetic metal that can be held in this ay, to a minimum.

Planing Machines.—Planing machines include shapers and lotters, which also embrace the special types built for gear utting. All of these with the possible exception of slotters have een much improved, and the slotter has been developed as a tool oom machine. The driving mechanism of planers has been vastly mproved, which means better bearings, better gearing and im- roved lubrication of the whole machine. More convenient con- rols, rapid power traverse on all movements and more rigidity in he machine have added much to its cutting capacity and to he smoothness of the cuts that can be taken. This also applies to hapers, both for regular work and of the gear cutting type. Higher speeds are now possible than ever before and the work s also of better quality.

Broaching and Swaging Machines.—Both broaching and swag- ng machines continue to find new fields of usefulness. Where rregular surfaces are to be machined, or with internal surfaces that are hard to get at in any other way, the broach is found of great value, in many lines of industry. Broaches are in reality a series of cutting teeth, each cutting a very small amount as the broach is pushed or pulled through the work. The push broach seems to be growing in favour in some classes of work, presumably because of the lower first cost of the broaches and the corresponding lower loss when they break in service. Swaging machines have changed very little except to increase in size and in some cases to be used more on hot work than formerly. The accuracy of the work depends largely on the machine in which it is done and the way in which the machine is cared for and adjusted. Sewing machine needles, spinning frame spindles and much other work, including steel balls, hollow balls used in electrical pull chains and in jewelry, and many other parts, are manufactured by swaging.

The rapid development of machine tools during the last decade has made many first class machines of ten years ago entirely obsolete where low cost production is essential. In some cases machines of this highly productive nature become obsolete in two years, sometimes less. (F. H. C.)

MACKAY, CLARENCE HUNGERFORD (1874–), American capitalist, was born at San Francisco April 17 1874, being a son of John William Mackay (*see* 17.250). He received his education in Europe and at the age of 20 entered his father's office in New York. After his father's death in 1902 he succeeded to his large interests. He was elected president of the Mackay companies, organised in 1903, and owning all the capital stock of the Commercial Cable Co. and a majority of the stock of various cable, telegraph and telephone companies in the United States, Canada and Europe, including the Postal Telegraph Cable Company. In 1921 the Mackay companies operated some 350,000 m. of wires and 29,000 m. of cables, connecting with all parts of the civilised world. Acting under authority of a joint resolution of Congress of July 16 1918, President Wilson took over the wires as from Aug. 1 1918 and placed them under the control of Postmaster-General Burleson. Mr. Mackay opposed many of the Postmaster-General's policies on the ground that he was using War-time control to bring about government ownership of the wires. In Dec. Mackay was removed from control of the Commercial Cable Company. In March 1919 he was also removed from the presidency of the Postal Telegraph Cable Co., but was reinstated after the return of the wires to their private owners in 1919.

MacKAYE, PERCY (1875–), American poet and dramatist, son of Steele MacKaye, actor-dramatist, was born at New York City March 16 1875. He has lived chiefly in rural New England and in New York City. After graduating from Harvard in 1897, he travelled and studied abroad (1898–1900). By his varied imaginative works, he created new forms in native drama and literature and instigated national movements for community theatres, folk-plays and poetry. His outdoor choral masques, performed in stadium-theatres by thousands of actor-citizens, have drawn large audiences.

His many works include—in poetry: *Poems* (collected, 1916); *Dogtown Common* (1921)—plays: *The Canterbury Pilgrims* (1903); *Jeanne d'Arc* (1906); *Sappho and Phaon* (1907); *The Scarecrow* (1908); *Yankee Fantasies* (1901–12); *Washington* (1918); *This Fine-Pretty World* (1923)—operas: *The Immigrants* (1915)—masques: *Saint Louis* (10,000 citizen-actors, 1914); *Caliban* (Harvard Stadium, 1917)—essays: *The Civic Theatre* (1912)—folk-stories: *Tall Tales of the Kentucky Mountains* (1925)—biography: *Steele MacKaye, Genius of the Theatre* (1926).

MACKE, AUGUST (1887–1914), German painter, was born on Jan. 3 1887 at Meschede, Westphalia. His youth was spent in Cologne and Bonn, and he received his artistic training, from 1904, at the Düsseldorf Academy and later in Berlin with Louis Korinth. He was influenced particularly in his earlier work by the older Impressionists: Cezanne, Matisse, Renoir, Picasso; and the Cubists. During his student days he went to Paris, Holland and Italy for the purpose of study. The period of his independent creation embraces the years 1909–14. With Kandinski, Jawlenski and Marc, he was one of the most important representatives of the "Blauen Reiter," the group of painters from which Expressionism in Germany originated. His art combines the cherished tradition of French painting, its sense of the grace of movement and atmosphere in landscape painting, with the cosmic sentiment of German art, without losing itself in the subtle and problematical. A journey to Tunis which he undertook in the spring of 1914 inspired some of his most beautiful pictures. He was killed in the World War at Perthes-les-Hurlus, Champagne, in Sept. 1914. See Walter Cohen, *August Macke* (Leipzig, 1922).

McKENNA, REGINALD (1863–), British politician and financier, was born in London July 6 1863, and educated at King's College. He went up to Trinity Hall, Cambridge, as a scholar and graduated as senior optime in 1885. He also gained distinction as an oarsman, rowing in the university boat race in 1887. He was called to the bar in that year, and in 1895 was elected Liberal member for North Monmouthshire. When his party returned to power in Dec. 1905, he became Financial Secretary to the Treasury. In 1907 he was promoted to the presidency of the Board of Education, but was no better able than his predecessor, Mr. Birrell, to draft a bill which would satisfy the Nonconformists and yet pass the House of Lords. His tenure of the office was brief, as, on Mr. Asquith's succeeding to the Premiership in the spring of 1908, he was transferred to the Admiralty.

He entered on his new duties at a time when the country was profoundly stirred by the rapid increase of the German fleet, and was in doubt whether the preparations of the Admiralty were on a sufficiently extensive scale. At the same time a large number of Liberals were disposed to belittle the danger and to call a halt to building schemes in the interest of peace and economy. Mr. McKenna, relying upon the advice of his First Sea Lord, Lord Fisher, resisted the section of the Cabinet represented by Mr. Lloyd George and Mr. Churchill, who took this last view; and, supported by the Prime Minister and Sir E. Grey, he persuaded his colleagues to begin the building of four battleships of the dreadnought type in 1909, and to ask for power, if necessary, to prepare for the construction of four more a year later. This programme disgusted the Radical economists, but did not altogether satisfy public opinion. The Conservatives and other friends of a big navy carried on an agitation to the slogan, "We want eight, and we won't wait"; and eventually in July Mr. McKenna announced that the second four dreadnoughts would definitely be ordered. The estimates of 1909 had shown an increase of nearly £3,000,000; those of 1910 showed a further increase of £5,500,000, mainly due to new construction. A still further increase of £3,750,000 in 1911 made it clear that Mr. McKenna and the Admiralty were in earnest in their determination to maintain "a fleet sufficient to hold the seas against any reasonably probable combination."

Work at the Exchequer.—From the Admiralty he went in the autumn of 1911 to the Home Office, and, as Home Secretary, had charge of the Welsh Disestablishment Bill. On the outbreak of the War, it was his duty—a duty on the whole satisfactorily accomplished—to safeguard the country against the machinations of spies. In the first Coalition Ministry in 1915 he was made Chancellor of the Exchequer, and a still more difficult task was imposed on him—to find the money to carry on the War. By a 4½% War Loan a subscription of nearly £600,000,000 was obtained. In the autumn he introduced a supplementary war budget, providing for over £100,000,000 by new taxation. Income tax was raised 40%, and the abatement and exemption limits lowered; the rates of supertax were seriously heightened; all the old duties on sugar, tea, tobacco, cocoa, coffee, motor spirit and patent medicines were almost doubled; the import of luxuries such as motor cars, cinema films, clocks and musical instruments was restrained by an *ad valorem* duty of 33⅓%; and an excess profits tax of 50% was imposed. Other methods of financing the War which he adopted were War Savings Certificates, which realised over £40,000,000 in their first year; 5% Exchequer bonds, replaced after a year for a short time by 6% Exchequer bonds: but for current expenses he relied mainly on the sale of Treasury bills. In his 1916 budget he raised taxation still further. Income tax was increased to 5s. in the £ and excess profits tax to 60%; there were further increases on sugar, cocoa and coffee; higher duties were imposed on motor vehicles; there were new taxes on amusements, railway tickets, matches and mineral waters.

Mr. McKenna went out of office with Mr. Asquith in Dec. 1916, and, along with other Liberal leaders who had refused to serve under Mr. Lloyd George, lost his seat at the general election of Dec. 1918. A year later he accepted the chairmanship of the London City and Midland (now the Midland) Bank and speedily gained a position of authority in the city of London. At the same time he showed increasing detachment from party feeling, and was ready, as an anti-Socialist, to accept the Chancellorship of the Exchequer in Mr. Baldwin's first Ministry, had it been found possible to provide him a seat without a party contest. He married in 1908 Pamela, daughter of Sir Herbert Jekyll, and had two sons. (G. E. B.)

MACKENSEN, AUGUST VON (1849–), German soldier, was born in Hausleipnitz, Saxony, Dec. 6 1849. Educated at Torgau and the University of Halle, he was commissioned to the army in 1869. By 1903 he was commander of an infantry division; and in 1908 he was given command of the XVII. Army Corps. At the outbreak of the World War he was placed in charge of the IX. Army on the Eastern Front, where he conducted successful operations against the Russians at Kutno, Łódź and Łowicz. In April 1915 he became leader of the German forces in western Galicia and was largely responsible for the German break-through at Gorlice. On June 20 1915 he was made a field-marshal and in Aug. and Sept. of that year had further successes at Brest-Litovsk and Pinsk. In Oct. and Nov. 1916, as commander of the army sent against Serbia, he practically overran that country; and in 1916, with the composite army which invaded Rumania, he subjugated the Dobruja and by the middle of Jan. 1917 had to all intents and purposes occupied the country. He remained in Rumania till the Armistice; and on his retiring into Hungary he was interned by the French at Neusatz, where he was detained till the beginning of Dec. 1919.

MACKENZIE, EDWARD MONTAGUE COMPTON (1883–), British novelist, son of Edward Compton, was born at West Hartlepool Jan. 17 1883, and educated at St. Paul's School, London, and Magdalen College, Oxford. He saw a good deal of stage life before embarking on his literary career which began with *Poems* (1907) and a picturesque "costume" novel, *The Passionate Elopement* (1911). *Kensington Rhymes* and the novel *Carnival* followed in 1912, the long novel *Sinister Street*, characteristic of the quasi-autobiographical novels of childhood and youth which were then attracting some of the younger novelists. Mackenzie served with the Royal Naval Division at the Dardanelles, and held a staff appointment at Athens in 1916. After the War he lived on the Channel Island of Jethou. His work is characterised by a coloured and mellifluous style, picaresque action and humorous character study and, in some of his best work, a sympathetic portrayal of religious sensibility. This last, for instance, is to be seen in the trilogy *The Altar Steps* (1922), *The Parson's Progress* (1923) and *The Heavenly Ladder* (1924). *Guy and Pauline* (1915), *Sylvia Scarlett* (1918) and *Coral* (1925) were successful developments of the *Carnival* and *Sinister Street* milieu.

MACLEAN, SIR DONALD (1864–), British politician, the eldest son of John Maclean of Kilmoluag, Tireé, Scotland, was admitted a solicitor in 1887. After three unsuccessful contests, he entered the House of Commons in 1906 as Liberal member for Bath. He failed to hold his seat at the general election of Jan. 1910, but in Dec. of that year he was elected for Peebles and Selkirk, which he represented until 1918. He was member for Peebles and South Midlothian from 1918 to 192, when he lost his seat. In the absence of Mr. Asquith, later Earl of Oxford and Asquith, from the House of Commons, he became chairman of the Parliamentary Liberal party, 1919–22, and after Mr Asquith was returned as member for Paisley in 1920, he continued to take an active part in debate. He unsuccessfully contested Kilmarnock in 1923 and East Cardiff in 1924. He was deputy chairman of committee, House of Commons, 1911–8, and chairman of the London Appeal Tribunal, 1916–8.

ring the War he was chairman of the Enemy Debt Treasury mmission and of the House of Commons military appeal bunal. He was sworn of the privy council in 1916, and ated K.B.E. in 1917.

IACLEOD, JOHN JAMES RICKARD (1876–), British ysiologist, was born on Sept. 6 1876, near Dunkeld, Scotland, l was educated at Aberdeen Grammar School, Marischal llege, Aberdeen, and Leipzig University. From 1899 to 1902 was demonstrator in physiology and then lecturer in biomistry at the London Hospital, holding also from 1901–3 Mackinnon Research Scholarship of the Royal Society; and m 1903 to 1918 he was professor of physiology at the Western serve University, Cleveland, Ohio, subsequently becoming fessor of physiology and director of the physiological labora- in the University of Toronto in Canada. His most important rk was on the nature of the control of the metabolism of carbodrates in the animal body, and, together with Dr. Banting, h whom he shared the Nobel Prize for medicine in 1923, he ieved fame as one of the discoverers of insulin (*q.v.*) and of its ue in the investigation and treatment of diabetes (*q.v.*), and also connection with other problems of metabolism. He was elected R.S. in 1923, and received the Cameron Prize of Edinburgh iversity in the same year. He has become a member of many entific societies and was president of the Royal Canadian stitute in 1925. (*See* PHYSIOLOGY.)

His publications include *Practical Physiology* (1903); *Recent Adces in Physiology*, edited by Leonard Hill (1905); *Diabetes, its ysiological Pathology* (1913); *Fundamentals of Physiology* (1916); *ysiology and Biochemistry in Modern Medicine*, 4th ed. (1922); l numerous papers on insulin, etc., published in *The Journal of ysiology* and *The American Journal of Physiology*.

M'NEILL, RONALD JOHN (1861–), British politician, was rn April 3 1861, the son of an Ulster landowner, Edmund 'Neill, and was educated at Harrow and Christ Church, ford. He became a barrister, but found a career in journalism d from 1901 to 1904 was editor of *The St. James's Gazette*, erwards assisting Mr. Hugh Chisholm in the preparation of 11th edition of *The Encyclopædia Britannica*. Having made eral unsuccessful attempts to enter Parliament, he was, in 11, returned as Conservative M.P. for a division of Kent. As olitician he was for some years associated with Sir Edward rson and the more strenuous opponents of Home Rule. When r. Baldwin formed his first ministry in 1922, Mr. M'Neill was pointed Under-secretary for Foreign Affairs; he held that office til early in 1924 and returned to it in Nov. of the same year ain under Mr. Baldwin. In 1925 he was made financial secre- y to the Treasury.

MacVEAGH, WAYNE (1833–1917), American lawyer and lomatist (*see* 17.269), died in Washington, D.C., Jan 11 1917.

MADAGASCAR (*see* 17.270) has an area of about 228,000 m., and a population (1911) of 3,153,511; (1921) of 3,272,301. 1921 Europeans—nine-tenths French—numbered 19,359, iatics 8,135. Tananarivo (Antananarivo), the capital, had 459 inhabitants. The Comoro Islands (*see* 6.794) were nexed to Madagascar in 1914. They had (1921) 109,860 habitants.

History.—French policy in Madagascar since the appointnt of M. Picquié as governor-general in 1910 has been rected not only to material development and to attracting ench settlers to the island but also to the training of the tives to ways and outlook essentially French. The former minant race, the Hova, who had adopted Protestant forms of ristianity and had the largest number of educated persons, s deprived of all trace of political ascendancy, and special atntion was paid to the Sakavala, the Betsimasakara and other ibes. Nowhere, however, was a purely native rule under ibal chieftains allowed. At the same time, large numbers of tives were employed in the French administration and the few alagasy who became thoroughly assimilated were given French izenship (there were about 150 native French citizens in 1924). Notwithstanding these measures, the growth of a sense of alagasy nationality could be discerned. Among the educated natives dislike of French rule continued strong for many years after the conquest of the island in 1896. Their discontent culminated during the World War in the formation of an anti-French secret society, whose members included a large proportion of the native officials. The existence of the society which, it was alleged, plotted the simultaneous "removal" of the Europeans by means of poison was discovered early in 1916. The society was rigorously suppressed and hundreds of Malagasy were condemned to hard labour in the Comoro Islands. The death of Ranavalona III., the last Queen of Madagascar, in exile in 1917, was a blow to Hova aspirations. Gradually, conditions in the island improved. Gradually, too, a better class of European official was sent out. The number of French functionaries was, however, large and was a drain on the scanty colonial revenue.

Malagasy troops were employed in considerable numbers in France during the World War and subsequently in Morocco and in Syria. They formed, however, inferior fighting material and the influence of the returned soldiers on their countrymen was not good. Other disturbing factors were the spread of alcoholism and of malaria and pulmonary disease among the people, leading to a marked decrease in the number of Hova and other races.

A brighter prospect was, however, shown in the marked attention paid by the French to education, and largely by this means the party among the natives attached to the French connection was built up. Primary schools were established in the villages, education was made compulsory between the ages of 8 and 14, and in all schools the children had to learn French. Nearly 100,000 children were attending school in 1925. The primary schools were supplemented by excellent regional schools—where lads were trained to become officials—and at Tananarivo and other towns there were means for higher education, including medical and agricultural schools. Another method by which the class of natives supporting the administration was increased was the lavish grant of decorations, including the Dragon of Annam, the Star of Anjouan and the Étoile Noire, as well as grades of Honneurs (12 classes), and medals such as the *mérite agricole*, the *mérite indigène* and *la médaille du travail*.

M. Marcel Olivier, who became governor-general in 1924, adopted a policy of decentralisation of the administration—greater local autonomy and the employment of more natives and in more responsible posts. While there was no form of popular Government economic and financial delegations existed and the plan of the administration was laid before them. The programme for 1925 laid special stress on the need to increase means of education, promote public health and to guide the natives, who after 30 years of French rule were taking larger views of life—and incidentally dressing largely in European fashion—upon the right road. Relations between the Protestant missionaries and the administration, after a period of strain, had reached a generally satisfactory position, and a larger share of the work was undertaken by French Evangelical societies. The Protestant missions had to meet, however, increasing and sustained efforts by the French Roman Catholic missions.

Economic Conditions.—Development of the natural resources of the island, if somewhat slow, was real. The chief products are rice, coffee, manioc, cattle and graphite. Cultivation is mainly by Malagasy; the number of French settlers on the land is small. In 1924 white colonists were cultivating 150,000 hectares; natives 1,110,000 hectares. Although as the result of a protective tariff the great bulk of trade is with France, about one-seventh is with Great Britain and much British capital is invested in the island. A feature of the commerce is that exports exceed imports both in quantity and value. In 1910 the exports amounted to 80,000,000 tons and imports to 61,000,000 tons; in 1924 exports were 302,000,000 tons and imports 90,000,000. As to value, the difference in the exchange rates of the franc and the increased cost of commodities prevent exact comparisons. The figures show the external trade (imports and exports) at 78,875,000 frs. in 1910 and 646,605,000 frs. in 1924.

Means of communication were greatly improved by harbour works and the building of roads and railways. By 1925 there were 1,500 m. of first-class roads and 540 m. of railway. The chief railway (240 m. long), connecting the port of Tamatave with Tananarivo, was opened in 1918. From this railway a branch line goes northward, and from Tananarivo a railway (107 m. long) opened in 1923 runs south to Antsirabé. There is a road but no railway to Majunga, the chief port on the west coast. Canals have been made and irrigation works carried out. Public buildings are handsome and solid, built with an eye to future developments.

Revenue is derived mainly from customs and a poll tax; expenditure was largely on the civil service. The budget of 1913, the last normal year before the World War, balanced at 32,000,000 frs.; in 1924 the budget was balanced at 100,000,000 frs.; in effect, taxation and receipts had not increased. It was then realised that if economic progress was not to be checked, a revision of taxation was essential.

BIBLIOGRAPHY.—The standard work on the island is the *Histoire physique, naturelle et politique de Madagascar* (1875, etc.), in many quarto volumes by Alfred Grandidier (1836–1921) founded on his exploration of Madagascar in 1865–70 and subsequent researches. Besides this great work, of which the latest volume appeared in 1917, Grandidier edited a *Collection des ouvrages anciens concernant Madagascar* (1903, etc.), of which vol. 9 was published in 1920; see also James Sibree, *A Naturalist in Madagascar* (1915) and *Fifty Years in Madagascar* (1924); G. Grandidier, *Le Myre de Vilers, Duchesne, Galliéni. Quarante années de l'histoire de Madagascar, 1880–1920* (1923); Jean Lefranc, "La Prosperité et les Besoins de Madagascar," in *Renseignements Coloniaux* (Dec. 1925); *Guide-Annuaire de Madagascar et Dépendances.* (F. R. C.)

MADRAS, India (*see* 17.291), capital of the Madras Presidency, and the third largest city of India, had a population of 526,911 in 1921, very largely Hindu. Madras is rapidly growing; the suburbs are extending, and many of the gardens in the city itself have been divided to provide further building sites. Work was in progress on a drainage system in 1924, and new waterworks have much improved the health of the city. There are large industries (12 mills employing 19,000 hands in 1924). The municipality was reorganised in 1919; there are 50 councillors, 41 elected and five appointed by Government, under an annually elected president. A fine council chamber has been erected behind the Government secretariat. Proposals for the improvement of the port, including a new quay, were made in 1924. The present harbour accommodates 15 vessels drawing up to 30 feet. The harbour works act as a breakwater, and since they were built the foreshore has considerably extended.

MADRAS, UNIVERSITY OF (*see* 27.775).—Since 1912 a small teaching staff has been attached to the university, and by an Act passed in 1923 the reorganisation of the university as a teaching and residential university was authorised. It still exercises control over the quality of the teaching in its constituent and affiliated colleges. In 1923 it received Rs. 45,200 under the will of Sir William Meyer, G.C.S.I. Fifty-three institutions are affiliated to it and recognised in degree courses in the faculties of arts and science, education, law, medicine, engineering, agriculture and Oriental learning.

MADRID (*see* 17.292), with a population of 813,991 in 1923, is the capital of Spain and the largest city. Old Madrid is disappearing, and many of the alleys east of the Palace have been pulled down, whilst a number of massive and pretentious buildings have recently been erected. A cathedral is being built on the site of an old church in the Calle de Baileu, and an Anglican church was consecrated in 1925. A large bull ring and stadium have been opened and an underground railway, the first in Spain, was finished in 1924. Owing to violent speeches in criticism of the Government made there, the Athenaeum Club was closed in 1924 and handed over to the production assembly, a newly formed economic body. In 1925 the Rockefeller Institute gave £85,000 for the establishment of an institute of physics and chemistry. It was decided in 1925 to remove the Hippodrome racecourse to allow of extending a housing scheme and the Paseo de la Castellana. The cost of living in Madrid is notably high.

MAETERLINCK, MAURICE (1862–), Belgian essayist and dramatist (*see* 17.298), presents a marked contrast in his later work published during the 20th century, after he settled in France, to his earlier works, published before he left Belgium. Several of his pre-War essays, collected in *The Buried Tem* (1902), *The Double Garden* (1909), *Life and Flowers* (1907), a more particularly his book on *Death* (1912), are inspired by reaction against his early mystic and fatalistic tendencies. T same contrast applies to the spirit of such plays as *Monna Van* (1909) and *Mary Magdalene* (1909), in which the action is co centrated in a few important scenes, more according to t Racinian than to the Shakespearian method.

The keen interest displayed by Maeterlinck in Shakespeari drama is nevertheless shown in his essay on King Lear, *Life a Flowers*, and in the translation of Macbeth (1910), written fo special performance given in the Abbey of Sainte Wandril *The Blue Bird* (1910), produced in 1911, still increased the pop larity of the Belgian writer in English-speaking countries. was followed by *The Betrothal* (1919), produced in London 1921. From the technical point of view, these fairy plays ma a return to the poet's early symbolism. During the War Ma terlinck wrote a war play dealing with the German occupati of Belgium: *The Burgomaster of Stilemonde* (1920) produced London by Sir J. Martin Harvey. *The Miracle of St. Antho* and *Mountain Paths* appeared in 1919, and two more plays in modern setting, *The Cloud that Lifted* and *The Power of the De* in 1923. Most of the works of Maurice Maeterlinck have be translated into English by A. Teixeira de Mattos. After t latter's death Bernard Miall and F. M. Atkinson undertook th work.

MAGAZINES: *see* NEWSPAPERS; PERIODICALS.

MAGIC: *see* ANTHROPOLOGY; CONJURING.

MAGNESIUM: *see* ELECTRO-METALLURGY.

MAGNETISM (*see* 17.321). This subject may be studied fu ther in the articles CRYSTALLOGRAPHY, SPECTROSCOPY a TERRESTRIAL MAGNETISM.

Theories of Ferromagnetism.—Langevin's theory of parama netism has been extended by Weiss[1] to ferromagnetism by t introduction of a hypothetical molecular field H_2 proportion to the intensity of magnetisation I. This hypothetical force not necessarily magnetic. The relation between I and the ternal field H_1 is determined by the equations

$$I/I_0=\frac{\cosh a}{\sinh a}-\frac{1}{a}$$

$$a=\frac{MH}{RT},\ H=H_1+H_2,\ H_2=\lambda I,\ I_0=NM$$

where M is the moment of a magnetic atom, R the gas consta T the absolute temperature, λ a constant specific for the su stance, N the number of atoms per unit volume and I_0 t maximum possible intensity of magnetisation when all the ma netic atoms point in the same direction. These equations requ that in the absence of an external field ($H_1=0$) in general t intensity of magnetisation I will not be zero, but will have a de nite value given by eliminating a between the equations (1) a

$$I\ I_0=\frac{RT}{\lambda M I_0}a$$

and solving for I. This gives a single *intensity of permanent m netisation* which is stable, but disappears, and with it the fer magnetism, at a definite temperature, the *critical temperatu* given by $T_0=\lambda M I_0/3R$. If by means of this equation $R/\lambda M$ eliminated from (3) and the value of a thus obtained substitu in (1) the resulting equation is of the form

$$I/I_0=f(T/T_0)$$

where the function f is a purely algebraical function of the var ble T/T_0 the same for all substances. Thus if the intensity I permanent magnetisation is expressed as a fraction of the ma mum possible intensity of magnetisation I_0, and at the sa time the absolute temperature T is expressed as a fraction of critical temperature T_0, the theory leads to a characteristic eq tion for the intensity of permanent magnetisation (analogous the equation of state for a gas) which is identical for all ferrom netic substances. In the neighbourhood of the critical temperatu

$$(T-T_0)\,I=\frac{H_1T_0}{\lambda}$$

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[1] P. Weiss, *Journal de Physique*, vol. 6, p. 661 (1907).

here I is the actual intensity of magnetisation in an external eld H_1, so that if H_1 is kept constant the I, T diagram will be rectangular hyperbola. Curie's measurements with iron afford n approximate confirmation of (5).

An alternative theory of ferromagnetism has been put forard by K. Honda and J. Okubo.[1] This theory is largely a mathe- iatical working out of the older ideas of Ewing, and is developed y the authors with a special view to the examples of iron, cobalt nd nickel, metals which are known to consist of a mass of cubi- il crystals. In the natural stable configuration the axes of the ementary magnets are aligned parallel to the axes of the cubic ystals. The actual magnetisation is determined by the dis- lacements under the influence of the external field and of the elds due to the neighbouring magnets. To account for temperaıre effects some spinning of the elements has to be invoked. he theory is made to give a good account of hysteresis and a umber of other phenomena, but the thermal side of it appears ıther forced.

Honda[2] states that the investigation of the binary alloys ırming a solid solution with each other shows that an alloy of paramagnetic with a ferromagnetic metal can be obtained which as a susceptibility of any value lying between those of the vo metals. Hence the two classes cannot be sharply distin- iished by the magnitude of the susceptibility, but each class an extreme member of a series of which the intermediate mem- ers can merge continuously into each other. In high fields the isparity between the intensities of magnetisation of manganese id iron is very much less than in fields of the order required to roduce saturation in the iron.

Ewing[3] has recently changed his model to meet some objec- ons applicable to the older form.

Ferromagnetic Crystals.—The magnetic properties of crystals e of fundamental importance, because metals such as iron con- st of a mass of interpenetrating crystals. Individual crystals pyrrhotine,[4] magnetite[5] and iron[6] have been investigated. yrrhotine (Fe_7S_8) is a hexagonal crystal. It is very difficult magnetise along the hexagonal axis. Of the two perpendicular es one is called the axis of easy magnetisation: the properties the direction of the other are similar to those along the hexag- ial axis, but the difficulty of magnetisation is not so great. The ırve of magnetisation (I, H curve) along the easy axis is re- arkably simple. If a correction is made for the demagnetising ırce and some little allowance for the material irregularities hich are almost inevitable in most minerals the diagram re- ices to a rectangle. If the specimen is unmagnetised at first remains unmagnetised till the value $H_c = 15{\cdot}4$ of the coercive eld is reached, when the intensity of magnetisation suddenly ımps to the saturation value $I_s = 47$ gauss, at which it stays for l values of H between -15.4 and $+\infty$. At $H = -15{\cdot}4$ the agnetisation suddenly reverses and stays at -47 gauss for alues of H between $-\infty$ and $+15{\cdot}4$. The constancy of the itensity of magnetisation is actually verified by the experi- ients directly without any corrections over a range of H from bout 700 to 11,000. If the direction of H does not lie along one the axes the direction of I no longer coincides with it. The itensity of permanent magnetisation has been found to agree ith the equation of state (4) above for magnetite from $-79°$ C. $+587°$ C., at which temperature the ferromagnetism disap- ears (T_0). Other substances show a fair correspondence with is requirement, but the agreement is not precise. The value the molecular field deduced by Webster from measurements ith single crystals of iron is not only very small compared with ie values obtained for pyrrhotine, but is much less than one- iousandth part of the values which have been got by other iethods for iron in bulk. This discrepancy would seem to call r serious investigation.

Magnetisation in Iron, Steel, etc., a Discontinuous Process.[7]—If the induced currents used to measure the change of induction are highly magnified by amplifiers, and sufficiently rapid detectors, such as oscillographs or telephones, employed, the I, H curve is found to consist of a succession of vertical and horizontal lines like steps. This is apparently due to the sudden magnetisation of successive elements of the material. These may be of considerable size, but it is doubtful if they are single crystals.

Paramagnetism.—Curie's law

$$kT = I_0^2/3R = C(\text{Curie's const.}) \qquad (6)$$

where k is the susceptibility, has numerous exceptions. Some of these are doubtless due to the universally present diamagnetism, to change of molecular aggregation and the like. In the case of paramagnetic solids the law requires a general amendment, Kamerlingh Onnes and his collaborators having shown that at temperatures down to about 80°K it should be replaced by

$$k(T + \Delta) = C \qquad (7)$$

where Δ is a specific constant for each substance. Equation (7) is sometimes known as Weiss's law. This law breaks down at the very lowest temperatures, the deviations shown by different substances becoming very complicated and individual in character.[8]

Gyromagnetic Effects.—In 1907 O. W. Richardson[9] showed that a delicately suspended rod should spin about the axis of magnetisation owing to the turning of the electron orbits during the act of magnetisation, and calculated the magnitude of the effects to be expected. If U_z and M_z are respectively angular momentum and magnetic moment per unit volume generated for any axis O_z, N,n numbers of electrons per unit volume, M,m masses of electrons and A,a the respective mean areal velocities about the axis O (capital letters referring to positive and small letters to negative electrons), then

$$U_2 = 2(N\ M\ A + n\ m\ a) \qquad (8)$$

and

$$M_2 = N\ E\ A + n\ e\ a \qquad (9)$$

If the positive parts of the atom are stationary the ratio U_2/M_2 reduces to 2m/e, and in any event it should be independent of the strength of the field. A search made at the time did not succeed in satisfactorily separating the effect from parasitic disturbances. It was first clearly established experimentally by Einstein and de Haas[10] in 1915, and has since been carefully measured by a number of experimenters[11] for iron, cobalt, nickel, Heusler alloys and magnetite. Meanwhile, in 1914, S. J. Barnett[12] had established the existence of a converse effect, *viz.*, the development of a magnetic field along the axis of revolution of a body when made to spin in a field-free space. The intrinsic magnetic field which would give rise to an equivalent magnetisation is calculated as

$$H = 2\frac{m}{e}\omega \qquad (10)$$

when only negative electron orbits are considered, ω being the angular velocity. The experiments show that both U_2/M_2 and H/ω are very close to m/e and not equal to 2m/e. This implies that the motions of the positively charged parts of the atom must be considered. If twice as many quanta of angular momentum are assigned to the electrons as to the nucleus this so-called *gyromagnetic anomaly* is accounted for.[13]

A third gyromagnetic effect, viz., a magnetic intensity produced by a revolving perpendicular magnetic field, is anticipated, but has not yet been established experimentally.[14]

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[1] K. Honda and J. Okubo, *Phys. Rev.*, vol. 10, p. 705 (1917).

[2] K. Honda in Sir R. Glazebrook's *Dictionary of Applied Physics*, ol. 2, p. 519 (1922).

[3] J. A. Ewing, *Roy. Soc. Proc.*, A, vol. 100, p. 449 (1922).

[4] P. Weiss, *Journal de Physique*, vol. 4, p. 469, p. 829 (1905).

[5] P. Weiss, *Journal de Physique*, vol. 6, p. 667 (1907).

[6] Webster, *Roy. Soc. Proc.*, A, vol. 107, p. 496 (1925).

[7] H. Backhausen, *Phys. Zeits.*, vol. 20, p. 401 (1919); B. Van der Pol, *Proc. Acad. Amst.*, vol. 23, p. 637 (1921), p. 980 (1922); E. P. T. Tyndall, *Phys. Rev.*, vol. 24, p. 439 (1924).

[8] L. C. Jackson, *Phil. Trans. R. S.*, A., vol. 224, p. 1 (1924). This paper reports important additions to our knowledge of paramagnetic crystals.

[9] O. W. Richardson *Phys. Rev.*, (1), vol. 26, p. 248 (1908).

[10] A. Einstein and W. J. de Haas, *Berichte der Deutsch. Physik. Ges.*, vol. 17, p. 152 (1915); de Haas, *ibid.*, vol. 18, p. 423 (1918).

[11] *Cf.* Chattock and Bates, *Phil. Trans.*, A, vol. 223, p. 257 (1922); Sucksmith, *Roy. Soc. Proc.*, A, vol. 108, p. 638 (1925).

[12] *Phys. Rev.*, (1), vol. 6, p. 239 (1916); *Proc. Amer. Acad. Arts and Sciences*, vol. 60, p. 125 (1925).

[13] O. W. Richardson, *Roy. Soc. Proc.*, A, vol. 102, p. 538 (1922).

[14] J. W. Fisher, *Roy. Soc. Proc.*, A, vol. 109, p. 7 (1925).

The Magneton and Space Quantisation.—As a result of his observations of discontinuous changes in the apparent value of the Curie constant for magnetite, and for other reasons, Weiss[1] put forward the view that the magnetism of para- and ferromagnetic substances arose from a definite atom of magnetism. This *Weiss magneton* had a magnetic moment of $1{\cdot}85\times10^{-21}$ gauss × cm. The experimental evidence for the reality of this fundamental unit is very unconvincing. There is, however, according to the quantum theory (*q.v.*) a kind of fundamental unit of magnetic moment: the angular momentum of the electron orbits is limited to integral multiples of $h/2\pi$, h being Planck's constant, and we have seen above that the magnetic moment of such an orbit is proportional to its angular momentum. The value of this unit of magnetic moment, the "Bohr magneton" is $eh/4\pi m = 9{\cdot}23\times10^{-21}$ gauss × cm. Magnetic moment, however, is a vector quantity, so that the effect of compounding a number of such moments is more than a matter of mere addition. Thus no magnetic atom in the simple sense is to be anticipated. There should, however, be a tendency to certain discrete values owing to space quantisation.[2] In general if there is an axis of symmetry in the structure of the substance, or if such an axis is supplied by an external field, the quantum conditions require not only that the angular momenta about the polar axes of the orbits, but also their components about the axis of symmetry, should be integral multiples of $h/2\pi$. This double limitation restricts the orientation of the orbits to $m+1$ distinct planes where $mh/2\pi$ is the total angular momentum. The numbers of Weiss magnetons per atom have usually been deduced from the Curie constant C by the relation $C=\dfrac{n^2M^2}{R}\overline{\cos^2\theta}$ where M is the molar magneton (1123·5 gauss), R the molar gas constant, and θ the angle between the polar axis and the field, the average of $\cos^2\theta$ being taken on the assumption of equal probability for any direction. If, however, the averaging is confined to the discrete values just referred to, the number of Weiss magnetons which should correspond to the successive integral values of m from 0 to 6 are 0, 8·6, 14·1, 19·2, 24·4, 29·4, 34·4. There can be little doubt that the more reliable experimental values have a strong tendency to settle down at these numbers, and a plausible account can be given of such deviations as seem well established.[3] Gerlach and Stern[4] have shown that a fine beam of atoms when passed through a very inhomogeneous and powerful magnetic field is split into two in the case of Cu, Ag, and Au, into at least three in the case of Ni, and there is no effect in the case of Sn, Pb, and Fe. The splitting in the case of Cu, Ag, and Au, corresponds (the accuracy for Ag is about 10%) to a magnetic moment of $9{\cdot}23\times10^{-21}$. Thus this very important experiment establishes the reality at the same time both of space quantisation and the Bohr magneton. Some recently discovered changes with pressure in the susceptibility per unit mass of gases at low pressures are no doubt intimately connected with the phenomena discussed in this section.[5]

Magneto Optics.—Paschen and Back[6] have shown that in strong fields the complex Zeeman effects shown by multiple spectral lines in weak fields become simplified, the separations becoming integral multiples of the Lorentz-Larmor value. The change is a continuous function of the field strength. The magnetic response of multiplets as shown by their Zeeman effects is determined by their natural multiplicity, and there seems little doubt that this latter arises from the magnetic fields of the atoms. In an atom whose maximum permanent multiplicity is r and which is in an excited state such that its azimuthal quantum number is k, a good case can be made out that the maximum magnetic moment is equal to $(r+k-2)\dfrac{eh}{4\pi m}$. The magnetic moments so deduced show a reasonable agreement with those g from measurements of the paramagnetic susceptibilities of co responding ions. Each starts from zero, rises to a maximur and falls to zero again in traversing the successive elements the period from K through Fe to Cu, and there are other resen blances. One interpretation of the spectroscopic data requir that the magnetic moment of the atomic core should be twi as large as that calculated from the angular momentum, anomaly like that of the gyromagnetic anomaly already considere and capable of the same explanation.[7]

Permalloy.—H. D. Arnold and G. W. Elmen[8] describe a nicke iron alloy containing 78·5% Ni, which has remarkable magnet properties. The initial permeability is about 13,000, the ar of the hysteresis loop is $\frac{1}{16}$ that for soft iron and the maximu permeability 87,000 for B about 5,000. The saturation intensi of magnetisation is comparable with that for iron, and the allo approaches saturation in the earth's field.

See "Magnetic Measurements and Properties of Metals," in S R. Glazebrook, *Dictionary of Applied Physics*, vol. 2: *Electrici* (1922); P. L. Kapitza, "Production of High Magnetic Fields *Roy. Soc. Proc.*, A, vol. 105 (1924); L. W. McKeehan, "Ferroma netism," *Jour. Franklin Inst.* (May and June 1924). (O. W. R.)

MAGNETISM, TERRESTRIAL (*see* 17.353c). —Further deve opments occurring in various directions since 1909 in the stu of terrestrial magnetism are dealt with below.

Instruments.—The intercomparison of the magnetic instr ments of different countries has a recognised importance. Whi much was done before the World War by the Carnegie Instit tion of Washington, the comparisons between adjacent countrie which are specially desirable, have not been numerous. A dif culty increasingly realised is the uncertainty whether any ma netometer, even if never moved, can be considered invariab to the degree of accuracy usually aimed at, viz., 0·1′ in declin tion (*D*) and 1γ (0·00001 CGS unit) in horizontal force (*H*).

Trouble arises more particularly as regards the collimator magne moment of inertia and the "distribution constants" appearing the deflection formula $2mr^{-3}(1+Pr^{-2}+Qr^{-4})$. The use of a coil and electrical current promises increased accuracy in the measurement *H*, and coil magnetometers have been constructed in several cou tries, but the accuracy actually attained requires further investig tion. A coil instrument for the direct measurement of vertical for (*V*) would be of great value in high latitudes.

Surveys.—Observational work on land and sea has gone on c tinuously under the auspices of the Carnegie Institution of Washi ton, and many results have been published. Amongst recent s veys or resurveys which have been completed, there may be m tioned those of Belgium, the British Is., Japan and New Zeala There have also been numerous field observations in Canada, Fran Germany, India, the Scandinavian countries, Spain, the Uni States of America, and in a number of more restricted areas.

Eclipse Phenomena.—Special observations during solar eclip have been made at many places on a number of occasions, m especially by the Carnegie Institution of Washington, and a g many results have been published in *Terrestrial Magnetism.* consensus of opinion, however, has yet been reached, beyond the f that any systematic effect is certainly small. To demonstrate a sn systematic effect would require unusually quiet conditions ove period of days including the eclipse.

Sudden Commencements.—Another inquiry depending on operation has been into the simultaneity of the so-called "s den commencements" (S.Cs.) of magnetic storms. It has b suggested by S. Chapman and L. Rodés that the S.C. might associated with the engulfing of the earth in a jet or cloud of i emanating from the sun. If the ionic jet rotated with the su as Chapman suggests, its time to engulf the earth would be abo 30 seconds. If the ionic cloud were stationary, the process wo take some 6½ minutes. It seems fairly clear from the sev independent investigations which have been made that the di ence in the times of S.Cs., if any, is a question of seconds, of minutes.

Characterisation of Days.—Since 1906, an international sch has been in operation with its headquarters at De Bilt, Neth ands. Each co-operating station assigns to every day a “ charcter ” figure 0, 1 or 2, according as the day is quiet, moderately listurbed or highly disturbed. The arithmetic means of the igures so assigned are given in the annual De Bilt lists, so that ach day has an international character figure varying from ·0 to 2·0. Intercomparison of the character figures assigned at ifferent stations has confirmed the view that in ordinary latiudes disturbance is seldom if ever confined to one area.

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[1] P. Weiss, *Le Radium*, vol. 8, p. 301 (1911).

[2] *Cf.* A. Sommerfeld, *Atomic Structure and Spectral Lines*, Eng. trans. of 3rd ed. (1923).

[3] *Cf.* E. C. Stoner, *Phil. Mag.*, vol. 49, p. 1289 (1925).

[4] W. Gerlach and O. Stern, *Ann. der Physik*, vol. 74, p. 673 (1924); vol. 76, p. 163 (1925).

[5] A. Glaser, *Ann. der Physik.*, vol. 75, p. 459 (1925).

[6] F. Paschen and E. Back, *Ann. der Physik*, vol. 39, p. 897 (1912); vol. 40, p. 960 (1913).

[7] *Cf.* A. Sommerfeld, *op. cit.*, p. 384; *Zeits. für Physik*, vol. p. 221 (1923); *Ann. der Physik*, vol. 73, p. 209 (1924); La *Zeits. für Physik*, vol. 15, p. 189, vol. 19, p. 112 (1923); E. Stoner, *loc. cit.*; J. W. Fisher, *loc. cit.*

[8] H. D. Arnold and G. W. Elmen, *Jour. Franklin Inst.*, vol. p. 621 (1923).

The De Bilt character figures discriminate on the whole very atisfactorily between the days of the same month or season. But here is a natural tendency in the standard represented by 1 or 2 o vary according as the season is more or less quiet. To remove this ifficulty, F. Bidlingmaier suggested the use of “ magnetic activity ” efined as the mean value throughout the day of $^1/_8\pi(\alpha^2+\beta^2+\gamma^2)$, here α, β, γ represent the departures of the three rectangular agnetic components from their normal values. “ Activity ” in his sense exists and may be considerable on quiet days. Apart om the difficulty of assigning normal values, the amount of labour ntailed in the calculation of “ activity ” in the absence of some pecial mechanical means seems prohibitive. Various alternatives ave been proposed, including the daily ranges of one or all of the agnetic elements, the squares of the daily or hourly ranges, the ariation from day to day in the mean daily value of H, and the umber of intersections by the magnetic curve of a series of lines, arallel to the base line. In low latitudes disturbance is largely conned to H, and the character of the day may be fairly diagnosed on e H curve alone, but this is far from the case in high latitudes.

Twenty-seven-day Interval.—The existence of the De Bilt daily haracters has enabled the reality of a 27-day interval in magetic disturbance to be investigated without any possible prejuice. The phenomenon has been found to exist for quiet as well s for disturbed conditions. A day which follows a conspicuusly disturbed (or quiet) day after an interval of from 26 to 8 days has decidedly more than the average chance of being self a disturbed (or quiet) day.

Diurnal Variation.—The primary object of the international haracter scheme was the selection for each month of five quiet ays (commencing at Greenwich midnight) from which diurnal equalities of the magnetic elements should be calculated, ither additional to or in place of those derived from all days. f late years five international disturbed days a month have lso been selected at De Bilt, so that diurnal inequalities may be lculated from them as well. It has been found that in high latides the diurnal inequality is extremely sensitive to disturbance. his is illustrated by the vector diagrams (*see* 17.366 and 367) r the horizontal plane in fig. 1. They are for the equinoctial ason of 1912 at the two Antarctic stations Cape Evans (77°38′ uth, 166°24′ east) and Cape Denison (67°0′ south, 14°40′ st). The curves have been smoothed by the assumption that ey are true ellipses, with axes in and perpendicular to the eographical meridian. The hypothesis is certainly not much in rror, and it prevents the eye from being distracted by the irregurities inevitable in unsmoothed vector diagrams based on a mparatively few days. Starting from the centre in each case, e successive curves represent groups of days having for their ean international character figures 0·5, 0·15, 0·35, 0·65 and ·15. The curves are described in the direction of the arrows, e., anticlockwise.

Magnetic Poles.—Cape Evans and Cape Denison are on opposite sides of the south magnetic pole. Its position is not exctly known, somewhat conflicting results having been obtained y the different Antarctic expeditions. According to E. N. Webb the discussion of the results of the expedition led by Sir Dougs Mawson, the approximate position for the epoch 1912 was 1°·2 south, 150°·7 east. This is considerably to the northeast the positions assigned by the “ Southern Cross ” and “ Disvery ” expeditions (*see* 17.384). But all the expeditions agree placing the south magnetic pole near the direct line from Cape enison to Cape Evans. Accepting this as a fact, it may be own that a change of 4·5γ in the horizontal force vector is ughly equivalent to a shift of 1 km. in the position of the pole.

On this basis the curves of fig. 1 constitute independent estiates made at the two stations of the daily track of the south agnetic pole, on days of different international character, cording to the kilometre scale supplied. The subject has also been investigated for the north magnetic pole for the epoch 1904 by A. Graarud and N. Russeltvedt, using the observations of Amundsen's expedition. The principal base station, occupied by a magnetograph, Gjöahavn, had a dip of 89°17′, and in fixing the position of the pole use was made of four other stations with dips varying from 89°34′ to 89°52′. Thus the position found for the north magnetic pole in 1904, viz., 70°30′ north, 95°30′ west, cannot be much in error. This position differs by only 25′ of latitude and 1°16′ of longitude from that assigned in 1831 by James Ross (17.384), so there is no suggestion of rapid secular change.

On this basis Graarud and Russeltvedt calculated that a change of 3·2γ in the horizontal force vector answers to a shift of 1 km. in the position of the pole. The curve they give for its daily motion on the average day of 1904 is approximately elliptical, with minor and major axes respectively in and perpendicular to the geographical meridian. The extreme range from east to west is about 22 km., and that from north to south 13 kilometers. The curve, in short, is very similar to the Cape Denison curve for character 1·15, though slightly more elliptical. It is described, however, in the clockwise direction, as is natural for the northern hemisphere. The differences in sunspot frequencies, 42·0 in 1904 as against 3·6 in 1912, would naturally lead to a considerably larger amplitude in the earlier epoch.

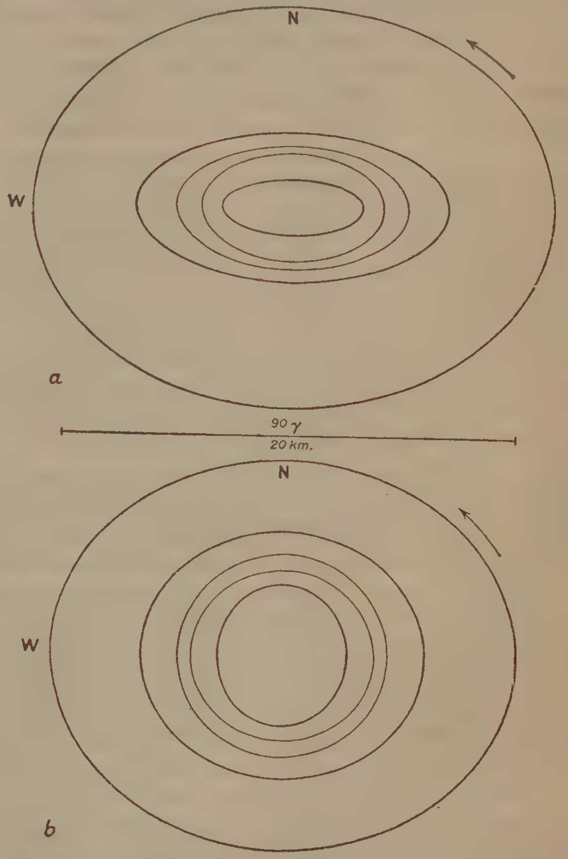

FIG. 1.—Vector Diagrams: (a) Cape Denison; (b) Cape Evans.

Variations of Disturbance with Latitude.—A comparison of the disturbances recorded in 1911–2 at the Scott Expedition's Antarctic station with those at observatories extending from Mauritius to Sitka, Alaska, showed a marked tendency for disturbance to be simultaneously great in high northern and southern latitudes, and to be less at intermediate stations, whether north or south of the equator. Again, comparison of auroras with magnetic character figures got out for individual hours, as well as for individual days, shows that an intimate relation exists between aurora and magnetic disturbance. While long accepted as true of large magnetic storms and aurora in countries where both phenomena are rare, this seems also true in the case of bright aurora in high latitudes. In the case of faint non-fluctuating aurora, magnetic conditions seem often practically unaffected. Faint aurora, in fact, seems the rule rather than the exception in high latitudes under conditions favourable to its visibility.

Theory of the Regular Diurnal Variation.—The derivation of the diurnal variation from a potential has been further considered. Assuming the derivation possible, the constants occurring in the potential have been calculated by W. van Bemmelen, S. Chapman, F. Bidlingmaier and J. Bartels. A. van Vleuten, who has examined the hypothesis critically, especially as applicable to quiet-day phenomena, has, however, concluded that the balance of evidence is against it. A difficulty in the way of any general theory of the diurnal variation is the varied influence of disturbance. This influence not merely differs at different places, but is not the same for the different elements. It also varies with the season of the year, and is not the same at the same season of different years.

General Theory.—These various phenomena—the synchronous occurrence of magnetic disturbance in different parts of the earth, its special development in high latitudes, the enhancement of the regular diurnal variation during disturbance, the association of disturbance with aurora, and the 27-day interval —all accord *in a general way* with the theory pretty generally held that magnetic disturbance and aurora are both due to the emission from the sun of some species of electrical radiation. The nature of this radiation, whether β or α rays, has been discussed more especially by Kr. Birkeland, C. Störmer and L. Vegard. Difficulties, especially the scattering to be expected from the mutual repulsion of ions, if all of one sign, have been discussed by A. Schuster, S. Chapman and F. A. Lindemann.

When approaching the earth, ions of either sign would naturally spiral round the lines of magnetic force, and so be concentrated in high latitudes. But for ordinary α or β rays the approach to the magnetic poles should be closer than auroral phenomena suggest. To explain the occurrence of aurora in comparatively low latitudes, Störmer has suggested the existence of a ring of ions in the magnetic equator, but no proof of its existence has been advanced. The presence of ions would naturally increase the electrical conductivity, thus enhancing the amplitude of the regular diurnal variation of the magnetic elements, supposing that due (as is generally believed) to electrical currents in the upper atmosphere. The fact that disturbance enhances the diurnal inequality relatively more in winter than in summer would follow naturally from the very probable hypothesis that ordinary solar radiation itself increases the conductivity of the atmosphere. In high latitudes we may suppose that in winter the electrical currents associated with aurora play the part which in summer is largely played by direct solar radiation.

In the simplified mathematical theory of aurora and magnetic disturbance developed by C. Störmer, the earth is treated as magnetised as it would be if only the first order Gaussian harmonic existed. Everything is then symmetrical round the axis of the first harmonic, whose north end according to J. C. Adams was in 1880 at 78° 24′ north and 68° 4′ west, but moving west through about 0°·1 per annum.

In a theory of magnetic storms, S. Chapman also assumes symmetry round an axis, regarded as magnetic latitude 90°. He has derived mean results from 40 storms recorded at 12 stations arranged in five groups according to magnetic latitude. Confining himself to storms having an S. C., he regards the "general storm" phenomena, *i.e.*, the phenomena not dependent on local time, as determined by the "storm time," or time elapsed since the S. C. The phenomena varying with local time, he regards as composed of the ordinary diurnal variation + a "local storm variation," determined like the general storm phenomena by the magnetic latitude. He discusses the electrical current systems supposed to "flow in more or less horizontal strata in the upper atmosphere" to which the magnetic changes he has arrived at may be ultimately ascribed. "The external currents will of course be accompanied by corresponding induced currents within the earth which will modify their effects." Taking what he considered an average storm, Chapman calculated that it called for the expenditure of energy at the rate of about 2×10^{18} ergs per second for 15 hours.

To many minds, theoretical researches of this kind are fascinating, but deductions from them, until confirmed by direct observation, are just as hypothetical as the theories themselves. Magnetic phenomena are much less simple than theories such as Störmer's and Chapman's suggest. The complete Gaussian analysis indicates in reality a considerable departure from symmetry round an axis. High latitudes, moreover, were practically unrepresented in the data used for calculating the Gaussian constants, while the asymmetry in the positions of the two magnetic poles suggests that the results of the analysis may depart most from truth in the very regions where aurora and magneti storms are most developed. The individual aurora or magneti storm shows no approach to symmetry round a magnetic axis The magnetic disturbance on a given occasion is of very differen amplitude at stations having the same magnetic latitude. Eve when there is a recognisable S. C. the sequence of events at given station varies much on different occasions.

In low latitudes the S. C. is a change mainly in *H*, almost invariably a rise. In higher latitudes it is usually oscillatory, and may be large in all the elements. The duration of the enhanced value i *H* following the S. C. is sometimes a few minutes, sometimes several hours. Following the enhancement there is generally a pronounced fall, bringing *H* well below its normal value. But the recovery from this depression may set in after a few hours and proceed almost uninterruptedly, a return to comparatively quiet conditions occurring within 12 hours, or there may be a succession of irregular movements, highly disturbed conditions lasting for one or two days The superposition following "storm time" of unsorted disturbanc curves may give us a storm such as never existed. Comparison o magnetic curves from Kew, Stoneyhurst, Eskdalemuir and Lerwick has shown that while the amplitude of magnetic disturbance in th British Is. almost invariably increases with magnetic latitude, th rate of increase differs widely on different occasions. On specia occasions there may be very large rapid movements in Lerwick which are hardly represented in the south of England. The averag intensity even of magnetic disturbance must be largely determined b other things than the magnetic latitude, as defined by Chapman Agincourt (Toronto) and Kew are of nearly the same "magneti latitude," but disturbance, at least in 1911–2, was almost invariabl much larger at Agincourt than at Kew.

Chapman's estimate of the energy of a magnetic storm is certainl much less improbable than the enormously higher estimate made i 1892 by Lord Kelvin on the hypothesis of direct magnetic actio between the sun and the earth, but it depends fundamentally o several assumptions, the degree of probability of which is at presen entirely a matter of opinion.

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MAHAFFY, SIR JOHN PENTLAND (1839–1919), Irish classic scholar (*see* 17.394), became vice-provost of Trinity Colleg Dublin, in 1913 and provost in 1914. In recognition of the ser ices of the college during the World War, he was in 1918 ma a G.B.E. From 1911 to 1916 he was president of the Royal Iris Academy. He died April 30 1919.

MAHAN, ALFRED THAYER (1840–1914), American nav officer and historian (*see* 17.394), died in Washington, D. Dec. 1 1914. His later works included *Naval Strategy Compar and Contrasted with the Principles of Military Operations on La*

1911); *Armaments and Arbitration* (1912) and *The Major)perations of the Navies in the War of American Independence* 1913).

See C. Carlisle Taylor, *The Life of Admiral Mahan* (1921).

MAH-JONGG.—This is a Chinese game, for four players, vhich was introduced into Europe and America about 1923. The ;ame is played with a number of pieces known as tiles. There are 44 tiles in all, comprising four "flowers," four "seasons," four vhite, four red and four green "dragons"; four each of north outh, east and west "winds"; and three "suits," namely characters," "bamboos" and "circles." Each suit consists of 6 tiles, made up of four lots numbered one to nine inclusive.

Each player plays independently, and the procedure is briefly s follows: The tiles are arranged in pairs face downwards in our sides of a square, each side, or wall, containing 17 pairs. he eight extra tiles are left in the middle of the table to be taken p by any player who draws a "flower" or a "season." The ank is allotted by a throw of dice, and the highest throw fixes lso the point at which the wall shall be opened. Each player is llotted a wind, the banker taking the east wind. Each player, tarting with the banker and working anti-clockwise, draws four iles at a time from the wall till each has drawn 12, then the anker draws one extra tile. Each player's object is to make a omplete hand of twos, threes, or fours of a kind, *e.g.*, three sixes f "characters" and sequences; or four, five and six of "bamboos."

The actual play commences when the banker discards a tile, lacing it face upwards on the table. Each player, playing in rder clockwise, then draws a tile from the wall and discards one rom his hand. Should he draw a "flower" or a "season" he xposes it and draws one of the eight extra tiles from the centre f the table. If a player discards a tile of which another player lready has two, such other player may cry "pung" and take the iscarded tile, at once exposing the three tiles on the table. The layers on the left of the discarder, by crying "chow," may imilarly take a discard to complete a sequence of three. A pung r a chow does not affect the order of drawing, nor does it count s a draw. A player punging a tile takes it in preference to a layer wishing to chow it. Finally, a player requiring a discarded ile to make his hand complete cries mah-jongg, and takes the ile in preference to all other claimants. A player can go mah-ongg either by claiming a discard, or by drawing a tile in the rdinary way, but such tile must complete his hand without urther discarding on his part. The hand finishes as soon as one layer goes mah-jongg

The scoring is somewhat complicated, and various conditions in hand entitle the player to double his score. The mah-jongg hand paid in full by all the others except the banker, who pays him ouble. If he is himself the banker, he is paid double by all. he other players pay differences to each other, the banker aying or being paid double as the case may be. The bank asses anti-clockwise for the following hand, unless the banker vent mah-jongg, when it remains with him.

MAHLER, GUSTAV (1860–1911), Austrian composer and conuctor, was born at Kalischt, Bohemia, July 7 1860. From 1885 nwards he conducted in Prague, Budapest, Hamburg and ondon, becoming director of the Vienna Opera in 1897. By nremitting zeal and tireless enthusiasm he brought the Vienese opera to a high state of perfection, but the strenuous ork which he exacted from all earned him the name of "the yrant" and made him many enemies, and in 1907 he was obliged o resign his post. He immediately received the offer of a onductorship in America, which he visited for three seasons, eturning to Vienna in 1911, where he died on May 18. Mahler eflected to some extent in his works the classical tradition herited from Schubert and Bruckner. In addition to his songs nd chamber music, he wrote no fewer than nine symphonies, lanned on a gigantic scale for an orchestra nearly doubled in trength. These lengthy works, though rarely performed, have evertheless had a certain vogue in Holland, chiefly owing to he zeal of the eminent conductor Mengelberg. See R. Specht, *ustav Mahler*, etc. (1913); P. Stefan, *Gustav Mahler, a Study of his Personality and Work* (1913); G. Adler, *Gustav Mahler* (1916); P. Bekker, *Gustav Mahler's Sinfonien* (1921).

MAHOMMED V. (MEHMED) (1844–1918), Sultan of Turkey, was born at Topqāpu Nov. 3 1844, a younger son of the Sultan 'Abdul Mejid (1823–1861). He led a quiet and retiring life, and suffered at times considerably from the jealousy and suspicion of his elder brother, the Sultan 'Abdul Hamid II. On the deposition of 'Abdul Hamid he was invested as caliph (May 10 1909). He was, for the most part, merely a tool in the hands of the committee of union and progress and, though he was supposed to dislike the pro-German policy of Enver Pasha, he was unable to take any effective steps to oppose him. He died at Yildiz July 3 1918, and was succeeded by his brother Vahid-ed-Din (b. 1861) as MAHOMMED VI., the latter resigned in Nov. 1922 and died at San Remo May 15 1926.

MAHOMMEDANISM (*see* 17.399).—Of all the great faiths that have been accepted by large masses of the human race, Islam is one of the most historical. For the details of the life of the Founder the reader is referred to the article MAHOMET. The faith he preached is Islam, *i.e.*, resignation, submission to an Almighty Will. It teaches abstinence from drink, personal cleanliness, and abhorrence of evil, and, above all, the value of human life. The world is a well-ordered creation, regulated and guided by a Supreme Intelligence overshadowing the universe, since "Everything is pledged to its own time." Yet the human will is free to work for its own salvation. The sympathy of Mahomet was universal, and he invoked the mercy of the Creator "on all living beings." He pronounced the saving of one human life to be tantamount to the saving of humanity.

His social conception was essentially constructive, not disintegrating. In his most exalted mood the Teacher never overlooked the sanctity of family life. To him the service of humanity was the highest act of devotion. His call to the Faithful was not to forsake those to whom they owed a duty; but in the performance of that duty to earn merit and reward. Monasticism was disapproved of as contrary to nature. Children were a trust from God, to be brought up in tenderness and affection; parents were to be respected and loved. The circle of duty embraced in its fold "kindred and neighbours, and the lowly and poor."

The Koran.—The Koran has, on mistaken analogy, been sometimes called the Mahommedan Bible. The Old Testament is a record of ancient Israelite traditions which have, in one form or another, become the common property of the three Semitic faiths that now rule over the consciences of masses of mankind. All these traditions have passed through numbers of hands and bear evident traces of revision and editing. The synoptic Gospels, which form the outstanding feature of the New Testament, were not compiled, at least in the shape in which they have come down, until long after the events they purport to record.

The Koran, as a human document, stands on a totally different footing. As such it is *sui generis*. It is a record of the outpourings of one single human heart to whom the Soul of the Universe had spoken, and it has escaped revision. It prescribes religious duties in precise terms. Since men owe gratitude to the Creator for His manifold blessings, he should be glorified daily at stated times, so that there may be no neglect in the performance of His Worship. Five times a day devotions are offered to the Lord of Creation. Man must approach Him in purity of heart and body; and the practice of the Prophet has consecrated the mode of physical lustration and the cleansing of the heart.

Abstinence was also made a part of the religious law. Every able-bodied man or woman is required to abstain from food and drink from sunrise to sunset for one lunar month. The only exceptions to this rule are students and soldiers engaged in defence of their religion or country, and invalids male and female. Charity was incorporated as a part of religion and every person possessed of a sufficiency was required to give a certain part of his income for the support of the indigent.

Social Regulations.—The status of women was raised beyond any known in contemporaneous history. Far from degrading women, the legislation of Mahomet raised her in the social scale. "Paradise," it was declared, "is at the feet of the mother." In his last sermon the Prophet enjoined his followers thus:—" Ye people, ye have rights over your wives and they have rights over you. Treat your wives with kindness and love. Verily you have taken them on the security of God."

The unrestrained polygamy of pagan times was drastically cut down; and the number of wives was limited to four and subjected to a condition which rendered it impossible under civilised conditions to practice polygamy without infraction of the rule. Owing to this condition in fairly-advanced Moslem communities polygamy has been much reduced.

Human chattelhood was forbidden; bondage was permitted only in the case of prisoners taken in " lawful " warfare in defence of religion; stringent rules were prescribed for the treatment of the unfortunate beings held in bondage; the child was not to be separated from its parents; no husband from his wife or one relative from another; and if a bondswoman bore a child to her master, she became at once a free woman and the child took the status of legitimate issue. The enfranchisement of people held in bond was an act of supreme merit with the Lord. Moslems were enjoined to " feed their slaves as they feed themselves, and clothe them with the stuff they wear."

The Sects of Islam

Islam, like Christianity, has been rent by schismatic strife and sectarian bitterness. The bulk of the Moslem population belong to the Sunni persuasion. Shiahs are found chiefly in Persia, but also in India. The Sunnis and the Shiahs differ greatly in their religious conceptions and doctrinal practices, and the difference extends from doctrines into the region of law, *e.g.*, the Shiah law of succession does not recognise agnacy, and daughters' children are not excluded by an uncle's son. Again, while the Sunni is enjoined to offer the prescribed prayers " congregationally " in a mosque, the Shiah may offer his orisons individually in the privacy of his house.

The principal divisions of the Sunni sect are mainly legal, according as the interpretations of the Hanafite, the Shafiite, the Maliki or the Hanbalite school are followed. Among the Shiahs, also, great jurists flourished who, deriving their inspiration from the medinite school, were liberal in their conceptions.

Wahhabiism.—Conformity was maintained in the Sunni community until the middle of the 18th century, when there arose a man in Central Arabia, named ʿAbdul Wahhab, who revived the Khariji cult in all its pristine Calvinistic bigotry. He welded the Arab tribes into a composite force and established his authority from the shores of the Persian Gulf to the Red Sea. The Wahhabis, as his followers have ever since been called, captured Mecca and Medīna, from which they were driven out by the forces of Ibrahim Pasha, the son of Mehemed Ali, the founder of the present dynasty which rules over Egypt.

Ibn Saʿud, the present chief of the Wahhabis of Nejd, emulated the achievements of his forbears by capturing again the Holy Cities from the hands of King Husain. In 1912 he had begun the formation of the new organisation of the Wahhabis under the name of Ikhwan or " brethren," and established colonies of them in various parts of Arabia, with the design that the settlers should sink their tribal rivalries in a communal religious life.

Senusis.—A religious movement closely connected with Wahhabiism was that of the Senusis, but though its teachings were practically identical, its organisation followed the usual lines of religious orders in the Mahommedan world. Founded in 1837, this order has achieved an immense expansion not only over the whole of North Africa from Egypt to Morocco and far to the south, but also in Mesopotamia and the Malay Archipelago. The order has been zealous in proselytising and has made many converts to Islam. Its activities were for a number of years a source of anxiety to the French as they appeared to be directed against the extension of European influence in Africa, and it took up arms against the Italians after the occupation of Tripoli in 1911, but in recent years has entered into friendly relations with them.

Shiahism.—Shiahism had no such auxiliary as Sunnism possessed in the form of organised political power to prevent its being rent with heresies, and consequently it has been distracted by constant schisms. Some owed their origin to dynastic rivalry; others to survivals of earlier cults in Western Asia.

Imamis.—The followers of the twelve Imams of the House of the Prophet (Ahl-ul-Bait) are commonly called Imamis. Ismail, the founder of the Safavid dynasty, made this branch of Shiahism the state religion of Persia, which character it has retained ever since. The Shiahs in India are also chiefly Imamis.

Zaidis.—The Zaidis are the followers of Zaid, a grandson of Husain, the martyr of Kerbalā. They differ from the general body of the Shiahs regarding the title of Abu Bakr, Omar and Othman to the Caliphate, and agree with the Sunnis on this point. The Zaidis are still found in the Yemen and North West Africa. The Zaidi Imam, Yahya, has recently consolidated his authority in Northern Yemen and is reported to be a ruler of great capacity.

Ismailis.—The Ismailis derive their name from Ismail, th eldest son of the Imam Jaʿfar as-Sadik, who pre-deceased his father. They hold that on the death of the Imam the religious headship devolved on Ismail's son Mohammed, whom they call al-Maktum (the " unrevealed " Imam), and not on his uncl Jaʿfar's second son, Musa al-Kazim, as believed by other Shiahs. Al-Maktum was, according to the Ismailis, succeeded by Ja'far al-Musaddak whose son, Mohammed al-Habib, was th last of the " unrevealed " Imams. The Ismailis achieved politica importance with the foundation of the Fatimid dynasty in North Africa in 909 and after the conquest of Egypt in 969 the Fatimids ruled over North Africa and Egypt for two centuries. In th realm of thought one of the most remarkable manifestations o Ismaili speculation is found in the treatises of the Ikhwan uṣ-Saf (the Brethren of Purity), a society of rationalists towards th close of the 10th century; they taught that individual souls ar part of the world soul, to which they return after the death o the body. Through various stages of emanation the whole universe proceeds from God, and the re-union of the soul with Go is effected through the reversal of this process and the purification of the soul from all grosser elements by asceticism, spiritua exercises and philosophy.

Assassins and Druses.—Two sects more permanent and mor highly organised, the Assassins and the Druses, still survive a offshoots of the Ismaili movement. The Assassins in 1090 established themselves in the fortress of Alamut, in the north of Persi and later in a number of other strongholds in that country an in Syria, and thence carried on an active propaganda, and thei devoted followers did not hesitate at the risk of their own liv to use the dagger to remove political opponents. Their politic independence was brought to an end by the Mongols, who destroyed most of their castles in the 13th century; but this sec still survives in a very altered form under the headship of H.H. th Aga Khan, whose followers in India number more than 127,00 in addition to adherents scattered throughout Syria, Persi Central Asia and East Africa. His followers in India are know as Khojas and a large number of them are descended from Hind converts and still adhere, in most important particulars, to th Hindu rules of succession.

A still more heterodox offshoot of the Ismaili sect is the community of the Druses, living in the Lebanon and the Anti-Leban and in the mountains of Hauran. They hold that God becom incarnate in man in every age, and that Hakim, the sixth Cali of the Fatimid dynasty in Egypt (996–1020), was the last incarnation of God; they believe that Hakim did not die and th he is only absent from human sight and will one day manif himself again.

Babis and Bahais.—Another outgrowth from Shiahism w the Babi, followed by the Bahai movement, but in their latitudinarianism they have so far diverged from any orthodox form Islam, that it is very doubtful whether they can properly reckoned among Mahommedan movements. The Bahais ha carried on an active propaganda in America and in certain par of Europe, and have drifted further and further from the Islan source from which they originally sprang.

The Ahmadiyya Sect.—In the year 1879 the founder of a ne religious movement, named Mirza Ghulam Ahmad, began reach in the village of Qadian in the province of the Punjab, ndia. He claimed to be not only the promised Mahdi but also he promised Messiah—personages generally held to be distinct ordinary Mahommedan theology. Another modification he in- roduced into Islamic doctrine had reference to the death of esus; the commonly-accepted belief maintains that Jesus was aken by God alive into heaven, while a phantom was crucified his place; in oppositon to this he declared that Jesus was actu- lly crucified, but was taken down from the cross while still alive y his disciples, was healed of his wounds and afterwards made is way into Kashmīr, where he finally died, his tomb being till in existence in the city of Srīnagar. Having thus removed he ground for any expectation of the second coming of Jesus om heaven to earth, he explained that he himself was the Messi- h, not as being an incarnation of Jesus (for he rejected the doc- rine of transmigration), but as having come in the likeness of esus—being Jesus for this generation just as John the Baptist as Elijah, because he came in the spirit and power of Elijah.

In proof that he had come in the spirit and power of Jesus, irza Ghulam Ahmad adduced the likeness of his own char- cter and personality to that of Jesus, his gentleness of spirit, e peaceful character of his teaching, his miracles and the ap- ropriateness of his teaching to the need of the age. In har- ony with this pacific claim, he expounded the doctrine of Jihad sually interpreted as meaning war against unbelievers) as a riving after righteousness. Mirza Ghulam Ahmad died in 908, and a few years after his death his followers split into two rties, one having its headquarters in Qadian, and the other in ahore. Both these sections of the community succeeded in en- sting the services of devoted, self-sacrificing men, who are nceasingly active as propagandists, controversialists and pam- hleteers. They control an extensive missionary activity, not nly in India, West Africa, Mauritius and Java (where their forts are mainly directed towards persuading their co-religion- ts to join the Ahmadiyya sect), but also in Berlin, Chicago and ondon. Their missionaries have devoted special efforts to win- ing European converts and have achieved a considerable meas- re of success. In their literature they give such a presentation Islam as they consider calculated to attract persons who have ceived an education on modern lines, and thus not only attract on-Moslems and rebut the attacks made on Islam by Christian ontroversialists, but win back to the faith Moslems who have me under agnostic or rationalist influences.

Modern Literature.—Indeed it has been characteristic of much the theological literature of the Mahommedan world for the st few decades, to adopt an apologetic tone and to shake off ose special features which have exposed it to hostile criticism; us polygamy, slavery and intolerance are declared to receive o sanction from the Koran, as rightly interpreted; in Islam the conciliation of religion and science is effected, and the demands the modern spirit of enlightenment are satisfied. Of such odernist literature there has been a considerable output, espe- ally in Egypt and India; it naturally appeals most to those aders who have come under European influences, and excites nsiderable opposition among more conservative orthodox rcles, who remain loyal to the traditional schools of thought s enumerated above) and resent the rejection of traditional, ediaeval theology by the modern thinkers. The older sects ntinue to flourish, and the new thought has not yet attempted organise itself on sectarian lines and has thus remained largely matter of individual opinion.

This lack of sectarian development is possibly in great meas- re due to the absorbing attraction that political problems dur- g recent years have exercised upon the Mahommedan world. nxiety as to the fate of Turkey after the Armistice, the with- awal of the Holy Cities from the control of the Caliph and the cupation of Jerusalem by unbelievers, the separation of the ltanate from the Caliphate (in 1922) and the abolition of the aliphate altogether (in 1924) were circumstances that profound- stirred the minds of pious Moslems all the world over and did t create an atmosphere favourable to the calm consideration purely dogmatic problems. Moreover in many Mahommedan countries some form of nationalism obscured the larger vision of a united Islamic world; in Turkey it took the extreme form of Pan-Turanianism, or Pan-Turkism, which aimed at the union of all sections of the Turkish race in one vast confederacy and sought to purge the national life from all foreign admixture, in language, literature and political institutions; in India nationalist feeling prompted the Hindu-Moslem Entente and gave birth to the oft-repeated sentiment, "I am an Indian first, and a Moslem afterwards"; among the Mahommedan populations of Russia the formation of Soviet Socialist Republics has evoked nationalistic movements which have temporarily thrust purely religious interests into the background; Bolshevik propaganda has also met with a response among the Mahommedans of Java.

But Islam is so closely bound up with every aspect of the life of a Mahommedan people that even a purely nationalist political movement may react strongly on the religious life. This has been notably the case in Turkey, where the Government, besides abolishing the Caliphate, has confiscated the religious endowments and suppressed the religious orders; polygamy has practically been made illegal; the date of Ramadan has been fixed in accordance with astronomical science instead of being made dependent on reports that the moon has been seen (as has been the immemorial custom in the Islamic world); and the discontinuance of the wearing of the veil by women and the adoption of hats by men, are typical of a changed attitude towards the established usages of Mahommedan society. The breach with the past has been nowhere so violent as in Turkey, but throughout the whole Mahommedan world there are indications of a changed attitude towards religious questions. The old orthodoxy still holds the allegiance of the masses, as well as many of the educated, but others, especially those whose education has brought them under European influences, are seeking a re-statement of their religion, more in harmony with their general outlook upon life. To those that seek a solution in the realisation of some nationalist ideal, there remains little save a sentimental attachment to Islam, while they deprive it of any control over law and social organisation; the reformers, on the other hand, claim for the precepts of Islam control over all the relations of human life, but seek to restore it to its primitive simplicity, believing that thus it can be brought into harmony with modern thought and modern conditions.

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MAINE (*see* 17.434).—The population of the state in 1920 was 768,014, in 1910 742,371, an increase of only 3·5%, as compared with 14·9% for the United States in the same period and 6·9% for Maine in the previous decade. There was a significant increase in urban population. The proportion living in places of 2,500 or more was 33·5% in 1900, 35·3% in 1910, and 39% in 1920. In 1910 the rural population was 480,123; in 1920, 468,445. The only one of the 16 counties showing a marked increase in rural population was Aroostook, which is one of the richest farming regions of New England.

The principal cities of the state, with their population of 1920 and 1910 and rate of increase, were as follows:—

City	1920	1910	Increase per cent
Portland . . .	69,272	58,571	18·3
Lewiston . . .	31,791	26,247	21·1
Bangor . . .	25,978	24,803	4·7
Biddeford . . .	18,008	17,079	5·4
Auburn . . .	16,985	15,064	12·8
Bath	14,731	9,396	56·8
Augusta . . .	14,114	13,211	6·8
Waterville . . .	13,351	11,458	16·5

Agriculture.—In Maine there were in 1920, 48,227 farms, valued with equipment at $250,000,000. Although the number of farms has decreased since 1910, the value of farm land has greatly increased; and in certain fields such as poultry there have been gains. The poultry co-operative marketing is being successfully conducted; and in other branches of agriculture newer methods of marketing are making up for decreased acreage. Maine's potato crop in 1924 totalled 41,475,000 bushels. Fifty-five per cent of all certified seed potatoes in the United States was grown in Maine in 1924. Figures for that year show 305 bu. of potatoes per ac.; 42 bu. of corn; 26 bu. of wheat; 37 bu. of oats. One of the chief agricultural industries is the production of sweet corn for canning. In 1924, 38,030 tons of corn were cut. Lately canned green peas are coming into equal popularity. In Washington county blueberry production is one of the staple industries. Maine's annual blueberry crop is valued at a million dollars. Hay still leads other crops: 1,432,000 tons in 1924 as against 1,326,289 tons in 1919. Maine has a very low percentage of mortgaged farms; in 1924, 67·5% were free from mortgage indebtedness as against the national average of 52%. Ninety-six per cent of Maine farms are owned by men who operate them. It is estimated that about one-third of the people living in Maine are engaged in, or are supported by, agriculture. But over one-half of the foodstuffs come from outside the borders of the state—a situation that has led to efforts encouraging the use of markets and the development in Maine of agricultural independence.

Forestry and Lumber.—During the past few years much attention has been given to afforestation. Nearly three-fourths the area of the state, 15,000,000 ac., is forest land. Very recently attention has been called to the abundance of hard wood in the Maine forests, a fact that had been overlooked in the unparalleled consumption of pulp wood. The total stand of timber, spruce and fir is estimated at 25,500,000,000 ft.; pine, 5,060,000,000 ft.; cedar, 2,780,000,000 ft.; hemlock, 880,000,000 ft.; hardwoods, 5,000,000,000 feet. The annual cut of lumber is approximately 1,000,000,000 feet. Figured on the basis of population Maine's forest lands amounted in 1925 to 19·5 ac. *per capita*, a ratio exceeding those of all other states east of the Rockies, except Florida.

Shipbuilding and Fisheries.—The shipbuilding industry was stimulated during the World War to a remarkable activity, which, however, subsided in the years immediately following. Bath, the chief shipbuilding city, attained, during the height of this boom, to a population of 15,000.

Manufactures.—In total value of products, paper and wood pulp manufacturing ranks first among Maine industries; cotton goods are second; boots and shoes third; and woollen goods fourth, followed by lumber and timber products. Maine leads all the states in the production of wood pulp; and Old Town leads the country in the manufacture of canoes. There is still much undeveloped water-power; the U.S. Geological Survey credits Maine rivers with a potential maximum of 1,300,000 electrical horse-power, of which 700,000 is undeveloped. The state still refuses to allow the exportation out of the state of water-power; but there are indications that this policy does not meet with as much popular support as it did a few years ago.

Administration and Finance.—Since 1910 there have been adopted 13 amendments to the state constitution, the total number of amendments numbering 47 in 1925. Of amendments adopted since 1920 the two most important provided for a bond issue of $3,000,000 for a bonus to Maine soldiers and sailors in the World War, and for voting by mail. Maine is fast becoming the summer playground of the country. It has been conservatively estimated that nearly a million tourists visit Maine annually; and the summer visitors furnish an important element in the business life of the state. There are 165 summer camps for boys and girls, with an attendance exceeding 7,500. The recreational advantages of the state were emphasised in 1925 by Gov. Brewster in his inaugural address; and an elaborate programme of publicity, based upon the examples of California and Florida, was undertaken under the auspices of the state and with funds provided in part by appropriations granted by the state.

Education.—During the decade 1915–25 much progress was made, particularly in the rural schools. A well-arranged programme providing for school buildings of modern construction was being carried out in cities and towns; and in rural communities the old-fashioned type of isolated, single school buildings was giving way to consolidated buildings, transportation being furnished to pupils from remote homes. In 1925 the total enrolment of pupils was 163,106, as against 154,604 in 1920; 132,853 were enrolled in the elementary schools, and 30,253 in the high schools and academies. Of the farm population of high-school ages, 49·3% was enrolled in high schools, as compared with 42·3% of the non-farm population. Maine claims to have the highest percentage in the country of farm boys and girls attending high schools. The state dept. of education also put into operation a well-devised plan for the gradual elimination of illiteracy through evening schools and adult classes. There were about 1,400 students in the six normal schools, and about 3,300 students in the state university and Bates, Bowdoin and Colby colleges.

History.—In 1911, for the first time since the Civil War, Maine had a Democratic governor, Frederick W. Plaisted, and two Democratic senators, Charles F. Johnson, of Waterville, and Obadiah Gardner, of Rockland. In 1912 Woodrow Wilson won the electoral vote of Maine by reason of the split in the Republican ranks. But in 1916 the split was healed and Maine in every election thereafter ran true to form as a Republican state. The consolidation of various newspapers with other changes in ownership left the minority party practically with no press. The chief contests consequently were in the primaries for the Republican nominations. In 1924 the choice for governor between Frank Farrington, of Augusta, and Ralph O. Brewster, of Portland, was so close that for some weeks the result was in doubt, a recount held by the governor and council finally giving the nomination to the latter. In view of Federal legislation on prohibition and woman suffrage it is interesting to recall that in Sept. 1911 the state of Neal Dow voted to retain the prohibitory amendment to the constitution by the extraordinarily close vote of 60,853 to 60,095; and in Sept. 1917, in a referendum, woman suffrage was overwhelmingly defeated, 38,858 voting "No" and 20,604 voting "Yes." In 1924 the Ku Klux Klan was a very active factor in politics and one of the most discussed issues in the state campaign. The agitation, however, largely subsided following the election of Brewster as Governor in Sept. 1924.

Governors since 1911: Frederick W. Plaisted (Dem.), 1911; William T. Haines (Rep.), 1913; Oakley C. Curtis (Dem.), 1915; Carl E. Milliken (Rep.), 1917; Frederic H. Parkhurst (Rep.), 1921; Percival P. Baxter (acting) (Rep.), 1921–3, elected 1923–5; Ralph O. Brewster (Rep.), 1925– . (K. C. M. S.)

MAIRONIS, (1862–), Lithuanian poet, whose real name was Jonas Maciulas, was born in 1862 at Pasandvaris, in the Kaunas (Kovno) district. After leaving the Kaunas high school, Maironis continued his studies at the University of Kiev and the Kaunas seminary. On graduating from the latter, he entered the St. Petersburg (Leningrad) theological academy, where he took the M. A. degree. He was for 15 years a professor in the academy and received his D.D. for a scholarly work entitled *De Justitia et Jure*. In 1909 he was appointed rector of the Kaunas seminary. He became in 1922 a professor and deacon of the theological faculty of the Kaunas University which he helped to found, and in 1923 was appointed professor.

Maironis began to write at an early age. His prose, *History of Lithuania*, went into four editions. As a poet he excels alike in dramatic, epic and lyrical composition. His *Song of Spring*, a collection of songs, elegies, sonnets, ballads and satires also run into several editions. Many of his songs have been set to music and are sung all over Lithuania. His famous poem *Young Lithuania* describes the national re-birth; *Our Sufferings* is poem descriptive of the Lithuanian national ripening and conquest of independence; his *Magdalen of Raseiniai* castigates the national vices, while his Polish poem *Znad Biruty* appeals to the Polonised Lithuanian nobility. His dramatic works include *Where is Salvation? The Death of Kestutis*, and *Vytautas with the Crusaders*, the two last being historical plays of the 14th century. Maironis also translated the Rigveda into Lithuanian.

MALARIA (*see* 17.461).—Malaria had long been recognised as a disease of world-wide incidence and the cause of a higher ickness and death-rate than any other disease. The finding of malarial parasites in the blood cell by Laveran at Constantine in 880, the demonstration of the life cycles of the quartan and ertian species of parasite by Golgi in 1885, and of the subtertian ever species by Marchiafava and Celli, and the discovery that he disease is transmitted through the agency of mosquitoes first rom bird to bird by Ronald Ross in India 1897–9, and later rom man to man, in conjunction with the investigations and eachings of Patrick Manson and other pioneers, were important actors in a great stimulus to the study of tropical diseases, both of men and of animals in general, and the whole of tropical anitation was powerfully affected.

Parasites.—Malaria is due to small protozoa or animal paraites which pass an asexual stage in man, living and developing n the red blood cells, dividing into young forms or fresh broods n two or three days' time and producing some male and female orms (gametocytes), which are drawn with the blood into the stomach of the female mosquito, and there conjugate and complete a sexual cycle. An oöcyst forms from the female gamete and n this a swarm of young sporozoites develop and, becoming free n the body cavity, pass to the salivary glands, whence they are njected at the bite of the mosquito and begin again the asexual stage in man.

The Parasites.—Malaria parasites are of three species: *Plasmodium falciparum*, *P. vivax* and *P. malariae*, the causal organisms of "subtertian," tertian and quartan fevers respectively. Following the teaching of Laveran, a small body of workers believed that there was but one species, a theory of unity, and on the other hand certain investigators, because of minute differences between examples of the same species, concluded there were even further species and gave names to them. However, as Professor Marchoux pointed out in a thorough review of the question at the First International Malaria Congress held at Rome in Oct. 1924, experimental research generally tended to support the idea of plurality and existence of the three species above named. This was supported by the difference and practically constant periods of evolution of each, the transmission of the same species to healthy subjects, the specificity of culture of the parasites of each of the three species *in vitro*, and by epidemiological studies.

Symptomology.—In malaria symptomology nothing of fundamental importance has been discovered in recent years. There has been advance on our knowledge of the cause and treatment of Blackwater Fever or Haemoglobinuria, the serious nature of which has called forth many investigations, especially in the particular and heavily infected regions where it occurs. Some nvestigators hold that this condition may arise not only in nfections with *P. falciparum*, but occasionally with *P. vivax* and exceptionally with *P. malariae*. The association of an unknown virus with the malarial parasite has been considered as the cause. J. Thomson's work in Rhodesia in 1923–4 gave strong evidence in favour of *P. falciparum* as the causal organism of all local cases and possibly elsewhere. He showed that *P. falciparum* can almost always be found in the blood; and that cases had been living in a district heavily infected by *P. falciparum*. He found one case after five months and another after 40 years' residence; he noted its occurrence only in people who had had attacks of malaria, though possibly unrecognised as such at the time, and had taken their quinine inadequately in amount and over an insufficient period of time. A similar observation was made in the cases which developed Blackwater Fever on their way home, or after they had left an endemic area even for some time. The finding of the other species of parasite, both of which tend more to chronicity and are readily found in the blood stream, may when present be, in Thomson's view, but an indication of a mixed infection.

Diagnosis.—In the diagnosis of malaria in endemic localities the estimate of inhabitants infected is based on the percentage rate of an enlarged spleen or of a positive blood finding amongst a proportion of the population. For the latter, the examinations of a thick and a thin film of blood are made. In the absence of the parasite an estimate of the relative number of large mononuclear (endothelial) cells to other white cells in the blood may be made in certain cases, but the evidence obtained is not conclusive. An increase above the basic figure of 15% endothelial cells of the total white cells was taken by Stevens and Christopher as indicative of actual or recent malaria in Europeans living in the tropics. Blood cell counts made at some time prior and subsequent to the finding of the malarial parasite did not show the presence of a constant relative increase of endothelial cells, nor was this a constant factor in latent malaria, even when the clinical diagnosis was obvious and the most reliable factor, an enlarged spleen, present. With regard to the finding of the parasite in the blood in these cases of "latent malaria in England" it must be remembered that but a small drop is taken and that parasites are not easily found except at the period of a relapse. The clinical signs of latent malaria most commonly found are, in order of frequency, an enlarged spleen, anaemia, functional disorders of the heart and enlargement of the liver. The tendency to chronicity and febrile relapses in malarial infections is very marked.

Distribution.—Malaria is a world-wide disease with endemic foci in all countries. It is most prevalent and extremely common in the tropics with the native population and high infection rate, constant heat, moisture and water for the breeding of the anopheline mosquito and requisite temperature for the development of the sexual stage of the parasite therein. As the poles are approached, the foci of endemicity gradually become less. For the development of the parasite in the mosquito an adequate temperature is necessary. On an average the three forms, *P. malariae*, *P. vivax* and *P. falciparum*, take 14, 11 and 6 days, respectively, the time varying with the temperature. In subtropical countries, malarial outbreaks follow the rainy seasons, when opportunities arise for the breeding of the mosquitoes. Norway and Sweden are examples of countries wherein anopheles are present but malaria absent.

In Great Britain malaria was formerly not very uncommon, but became rare until the return of many infected troops. Related to the presence of these carriers there were 235 indigenous cases in England in 1917, the number falling to four in 1924, thus corresponding with the cure of the malarial carriers. There exist in England three species of *Anophelinae* in which the parasites may develop and be transmitted from man to man, but with treatment of infected cases from abroad there is now practically an absence of the human carrier of the parasites, or at least of parasites with sufficiently numerous sexual forms in the blood, a minimum of 12 per cu. mm. of blood being considered necessary for development in the mosquito. Climatic conditions, particularly temperature and humidity, influence the endemic prevalence of malaria. A mean daily temperature exceeding 60° F. is necessary for its propagation for the full development of the parasite in the mosquito, *P. falciparum* requiring a very high temperature; *P. malariae* completing its cycle at a low one, and *P. vivax* over a wide range of low to high. This explains the seasonal incidence of the three types of malaria, the relatively high incidence of *P. falciparum*, the most malignant parasite, and the large number of infected inhabitants and high death-rate in the tropics and subtropics, and its rarity in indigenous cases in temperate climes, the presence of the endemic foci of *P. malariae* in the cooler hill country in the tropics and subtropics and the universal distribution of *P. vivax*.

Though *P. falciparum* is the most malignant and spreads most rapidly when anophelism is intense, because of its greater output of gametes in the blood, it does not tend to such chronicity in the absence of reinfection as do the other two forms. In the absence of reinfection *P. malariae*, by far the rarest form, is, however, the most resistant and *P. vivax* holds an intermediate place. Of 28,270 blood examinations made in England at one laboratory on cases of malaria contracted during the War, 777 were found positive, and of these *P. vivax* numbered 759, *P. falciparum* 14, *P. malariae* 4. There was a marked falling off as the time in England lengthened, and it was rare to find the parasite after the quarterly period of 12 to 15 months. Seven cases were found after 30 months all with *P. vivax*, one in a double insection with *P. malariae* after 39 months, and one case after 51, and another after 59 months; *P. falciparum* was found after three months in a double infection with *P. vivax* at the 11th month, once alone at the 12th month, and once in a triple infection at the 14th month. The third of the four cases of *P. malariae* had also been home a long time, namely, 16 months. In none of this extensive series was the parasite ever found after five years at home. It is not uncommon to hear a person settled in a non-infective country for many years accusing a temporary febrile attack or period of lassitude as a return of malaria which he once contracted abroad. Proof of this seems wanting. Though malaria has been transferred directly from man to man, the parasites infecting man have not been made to infect any animal. Entomologists have furthered their investigations into the bionomics and classification of mosquitoes and the determination of the species of anopheles that carry malarial parasites.

S. P. James and Dale have recently reported that quinine, quinidine and cinchonine possessed the same curative properties for all forms of malaria, and without difference in their toxicity save for the greater cardiac depressant action of quinidine. Fletcher at Kuala Lumpur has made a careful series of observations on this point.

Prophylaxis and Treatment.—The treatment of malaria is intimately bound up with prophylaxis. Particular reference may, however, be made to the recent therapeutic use of horse serum in the treatment of that severe form of malaria, Blackwater Fever, wherein this serum appears to inhibit the action of an auto-haemolysin and its destruction of red blood cells in the body.

Many clinicians strongly advocate in tropical regions intramuscular and intravenous injections of the bihydrochloride of quinine in serious cases, and injections do act quickly in severe, malignant, remittent and comatose cases, but in ordinary cases oral administration of the sulphate has been satisfactory. In acute attacks it must be borne in mind that 24 hours or more may elapse before the good effects of quinine become manifest.

The classical successes in the reduction of malaria at Ismailia, Hongkong, Havana and elsewhere have encouraged similar work in other localities, but there are few such examples as the long continued labours of Malcolm Watson in the Federated Malay States and the brilliant sanitary victory of General Gorgas and the Americans over both malaria and yellow fever at Panama. The work of Darling, Bass and others in southern United States and in the Islands must also be mentioned. The method of mosquito reduction against malaria, first suggested and tried under Ross in Freetown, Sierra Leone, in 1899, has not been followed as widely as anticipated, and local authorities too often dislike spending money on sanitation and hamper practical efforts of sanitarians by the attitude that it is better to prevent malaria by quinine or by the use of mosquito-nets, measures which are impractical in an uneducated native community. Local conditions must always determine the most suitable mode of prophylaxis, and it is important, as Étienne Sergent points out, to have several methods of control which may well be combined and include with specific measures an educational propaganda. Obviously there must be action to eliminate infection from all carriers of the parasite: in other words, to prevent the mosquito becoming infected, to destroy the species of anopheles in which the parasite may develop, and to prevent their biting and inoculating the parasite into the blood of man. Good results have attended well-applied efforts of this kind. Better health results and there are real economic returns for expenditure. The native must be looked after and enjoined to adopt some sanitary methods until he is taught to share in systematised efforts to protect and cure himself of malaria as of other endemic diseases.

Measures to rid carriers of the parasite are most difficult to put into practice. There is no settled or fixed dosage, or time of administration, of the specific remedy, quinine or other of the cinchona bark extracts. Acute attacks respond readily to quinine; each dose makes a reduction in the number of parasites, and this reduction occurs every day, until finally none of the parasites is left. Treatment must be continued for a long time. Empirically three months appear to be enough, but there are obstinate cases.

Standard Treatment.—For some years a standard line of treatment to procure disinfestation has been adopted by Bass in America and by Ronald Ross and his colleagues in Great Britain and the former has been recently introduced by J. Thomson in Rhodesia. The two former vary slightly. Ross gives 30 grains of quinine daily during the attack and for three days after, followed by 10 grains daily, just before or after breakfast, for three months; Bass ceases after two months. Success has attended these standard treatments, and it is well for administrative purposes that a standard be adopted in each country. It will not cure all cases, but the exceptions appear rare and when detected can be specially treated. Stevens found arsenic, after initial doses of quinine, of great value in helping to eradicate the parasite. Together with quinine or other drug therapy, the important factor of building up and maintaining the general health, so as to assist the natural forces of the body to eliminate the malaria parasite, must not be forgotten.

Regarding the value of quinine prophylaxis amongst carriers the results obtained at the malaria centres and camps during the War showed that any dosage under a total of 60 grains weekly proved insufficient for an adult male. Other salts of quinine, of hydrochloride and bihydrochloride, affect the digestion less and seem to be as satisfactory. The tannate has been much used in Italy, especially for prophylaxis among children. The daily small dose is more easily and therefore more certainly taken by patients (out of hospital) than larger occasional doses which cause some dyspepsia and headache and are therefore frequently postponed. Children can be given a larger proportion by body weight than adults, say, twice as much. Sir Ronald Ross has always felt that, to be effective, quinine should be continued in 10 grain doses daily for three months after a subject has left a malarial country.

Quinine prophylaxis has been of value on particular occasions such as in tiding a body of troops over a critical period of fighting or passing through a heavily infected area, in that it has kept off attacks of malaria during that time. Bodies of troops in Salonika who were given quinine daily remained free as long as they were taking it, but went down with malaria as soon as they stopped it, showing they were infected in spite of it.

Not all people bear quinine continued over a long period well and they may show symptoms of quininism. Occasionally an individual is hypersensitive to quinine and may show symptoms even following an initial dose. On the first appearance of quininism the drug should be stopped for a time, or arsenical treatment substituted. In the hypersensitive case some begin with very small doses to desensitise the patient. Certain investigators in the tropics consider that it is more difficult to eliminate the parasite by quinine therapy in cases that have been taking quinine consistently and who have become infected in spite of it. The cost of quinine and of its supervised administration has frequently rendered quinine prophylaxis impracticable in certain endemic areas.

Quinine prophylaxis should be supported by measures to prevent mosquito bites as far as practicable. In endemic areas and where there are many carriers the infection rate of the mosquito may be very high and frequent reinfection may occur.

The second measure of prophylaxis, *i.e.*, the reduction of anopheline mosquitoes and the prevention of bites, has received more general application. This is difficult and costly, but it results in a lessened sickness and death-rate from malaria, and in profit from the expenditure incurred.

In subtropical regions or where mosquitoes hibernate in dark places in rooms of homes, cellars, stables, outhouses and such places, often attaching themselves to cobwebs, they should systematically be killed directly or by fumigation. The breeding place of the mosquitoes is any still water on which they lay their eggs, and to kill the larvae and pupal forms through which they pass in development is the object in view. Much can be done by the filling in of small pools, cattle foot-marks, draining of rshes, clearing out of long grass and reeds from the sides of eams, the conversion of still to running water when in large sses, the clearing away of all cans and unnecessary water tainers and the covering by gauze of cisterns and tanks and like around the homes. A female mosquito lays about 250 gs at one time and seven to 10 days bring them to maturity. e young aquatic forms may be destroyed by larvicides such kerosene, waste oil, cresol or "paris green," which, when mixed h 100 parts of dust (1 c.c. of the mixture to 10 sq. metres of ter) and blown on to the water, distributed by the winds or pped from aeroplanes, kills the anopheline larva forms and es not injure the fish or the animals that drink therefrom. uable agents against larvae and pupae are the surface-feed- minnows, gambusia, stickleback and perch.

Anopheline mosquitoes do not attack until sunset, when one y remain as far as possible indoors in houses, bungalows and ts protected by close-mesh wire or netted windows and double ors; a bed or head net should cover any exposed part of the dy during sleep. In the early evening the wearing of puttees men and a paper lining under the stockings of women prents bites on the legs. Coolie lines should be placed when ssible a mile from the breeding places of the anopheles, ough this does not mean that the mosquitoes cannot fly much rther. There is little danger to be anticipated from breeding aces over a mile distant, if the mosquitoes have opportunities feeding close at hand (*i.e.*, from other mammals), and if the tervening space be raised, wind-swept and clear of all shrubs d trees. The knowledge that the mosquito will attack man or imal in its thirst for blood has raised certain questions regardg the preservation of game, but up to the present no practical udies on any extensive scale have been made.

Use in Psychiatry.—Following the observation of Wagner uregg in Vienna in 1917, that certain chronic conditions showed provement after malarial attacks, the therapeutic use of alaria in psychiatry has been extensively applied in many untries. Many cases of general paralysis have benefited, some fficiently to be able to return to family and social life. Time ust be given to determine the permanency or otherwise of the melioration. Its use in other cases of cerebrospinal syphilis d also in such mental diseases as *dementia praecox*, confusional sanity and *encephalitis lethargica* is under consideration. The arasite used is the *P. vivax* and it appears more satisfactory to oculate the patient by an experimentally infected mosquito an by infection with blood from a case of malaria. Thereby risks of other infection are avoided, a wise precaution, espeally in an endemic region where other species of the parasite cur. Infected cases are allowed to have 6 to 10 febrile attacks malaria and are then given quinine which in these experimenl cases readily cures the attacks.

War Malaria.—The following were the British War Office figures the number of cases admitted to hospital in four of the fighting reas during the War: Mesopotamia: 1916, 680; 1917, 744; 1918, ,202. Salonika: 1916, 31,059; 1917, 71,413; 1918, 59,087. East frica: 1917, 58,236; 1918, 20,015. Egypt: 1916, 1,423; 1917, 8,480; 918, 30,241.

Until the War spread to the eastern fronts British armies suffered ttle from tropical diseases. In the summer of 1916 an epidemic of alaria occurred among the troops on the Salonika front; and coninued until the end of the War.

Following the outbreak of malaria at Salonika, Sir Alfred Keogh, he Director-General, Army Medical Services, early in 1917 appointed special malaria hospital in each Command in the United Kingom, for the express purpose of finding a permanent cure if possible, nd of treating the thousands of men who were being returned home ick with malaria from the eastern fronts, Sir Ronald Ross being also ppointed Consultant in Malaria at the War Office. The fact that oderate doses of quinine will control actual attacks within a few ays was fully verified, and with very few exceptions. Almost every orm of treatment that had ever been suggested—enormous doses of uinine reaching 100 grains *per diem;* smaller doses continued for hree weeks or more; additional medication with arsenic and other rugs; continuous doses lasting for a month, and various kinds of nterrupted dosage—all proved uncertain. Thirty grains of quinine, ontinued every day for three weeks, proved a failure. Intramusular injections and even intravenous injections did no better. Men vho were presumed to be cured relapsed again after returning to uty; a large proportion of those infected with malaria became almost useless for further service. Numerous nostrums advocated for malaria proved valueless, the only exceptions being one or two arsenical preparations, which, however, were *no better* than ordinary quinine.

Now, in all these attempts, treatment had seldom been continued for more than one month and rarely or never for more than two months—owing, of course, to military exigencies. It was decided to deal with the large numbers of discharged soldiers by a longer period of treatment. In 1918 two whole divisions, full of malaria, had been brought from Salonika to France and were there subjected to a longer course of treatment preparatory to their being sent again into the firing-line. The regiments arrived in an extremely bad condition, were all placed in camps in the Dieppe region, and the men were given 15 grains of quinine in solution once daily for a fortnight, followed by 10 grains of quinine in solution daily for 2½ months more. The course, designed and carried out by Col. J. Dalrymple, had marvellous results, almost the whole of the two divisions being found fit for the front at the end of the three months. About the same time large malaria concentration-camps were established in England, where cases were given similar treatment, but for shorter periods; and it was found generally that: (1) doses of less than 10 grains daily did not suffice to prevent relapses even while they were being taken; (2) doses of 10 grains daily did so suffice, except in about 6% of the cases, most of whom, however, relapsed during the first days of the treatment; (3) 15 grains a day reduced the relapses still further, but only to about 4 or 5%.

The long-continued treatment of malaria was now proved to be satisfactory, and was extended to pensioners also. In one London clinic alone nearly 30,000 pensioners have been treated in this way. The results have been admirable, and probably very few men who have taken the treatment properly have returned. But the 10 grains of quinine must be taken religiously every day, and it is well to associate this with or follow it by a course of arsenic. Quinidine replaced the quinine in a small number of these cases. Good food and care in building up the general health are important factors in overcoming malarial infections. Empirically, three months appear to be enough, but in obstinate cases four months might be better. There are rare individuals who are hypersensitive to quinine or who may be desensitised prior to the introduction of the standard dosage. Even long courses of treatment will not necessarily cure people who are subject to reinfection during treatment; and it is even possible that they are not so effective during the first six months or the first year of infection as they are later. The results described above were obtained among returned cases in Britain. Other salts of quinine besides the sulphate were tried. The hydrochloride and bihydrochloride affect the digestion less and seemed to be as satisfactory.

The prevention of malaria on the battle-front was always difficult and sometimes impossible. Mosquito-reduction in the face of enemy fire is impracticable; quinine prophylaxis was under such conditions disappointing; and the armies were obliged to fall back upon mosquito-nets and mosquito-proof tents and bivouac shelters—which were carefully designed by the British War Office. Better results were obtained at the bases of operations, especially in Palestine; and a very successful campaign of mosquito-reduction was carried out by Col. J. C. Robertson at Taranto in Southern Italy.

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(R. Ro.; W. B.-A.)

MALAY STATES, FEDERATED (*see* 17.478).—For over 16 years all matters of common interest to the Federation have been settled by the federal council, a body created in 1909 in accordance with the general wishes of the individual rulers. The council consists of the high commissioner (president), the chief secretary to the Government, the four ruling Sultans, the four British Residents, the legal and financial advisers and eight nominated unofficial members; it meets generally three times a year and all Federal legislation is passed by it.

Population.—The growth of the population is the measure of the States' prosperity. According to the census of 1921, the population was 1,324,890, having increased since 1911 by 27·7%; it is still rising rapidly, and was estimated at the end of June 1924 to be 1,418,455. There are approximately 510,000 Malays, 494,000 Chinese, 305,000 Indians and 5,700 Europeans. The increase among Malays, especially in Selangor, is largely due to the influx of foreign Malays who have settled in the coast districts to plant rubber; and the increase in the Indian population also synchronises with the development of the rubber industry. There are indications that the immigrant races, who have done so much to develop the resources of the Federated Malay States, are ceasing to regard these States as a place of temporary sojourn and tend more and more to make them their permanent home.

Commerce and Industry.—An indication of the continued prosperity of the States is afforded by the fact that for the six years following the World War there was a considerable trade balance; and for the years 1919, 1923 and 1924, the estimated value of the exports, which consist chiefly of tin, rubber and copra, was well over twice that of the imports. The average value of the exports is over 200,000,000 dollars. The export of tin-ore reduced to a metallic basis and of block tin has averaged 40,000 tons, and the market for this commodity, as also for rubber, has been greatly assisted by the policy of withholding stocks against current prices. In the case of tin the holding or releasing of stocks was arranged by voluntary agreement between the Government, which held large stocks, and private holders.

Government assistance to rubber growers was given by the Export of Rubber (Restriction) Enactment, under which the percentage of release of stocks at the minimum duty rose or fell according to the ruling market price. By this means a fair price was obtained for growers, and many plantations were saved from the ruin that must have resulted from the premature tapping of trees. The Government continues to make a grant to the Rubber Growers' Association in connection with propaganda for new uses and markets for rubber. The establishment of a rubber research institute was approved in 1924, to be maintained by a special export duty on rubber. Important research work had been done, before this, on the deterioration of rubber in storage, which was found to be due mainly to surface oxidation, from which it is indicated that the slab form is preferable to the crêped form for storage. The mouldy rot disease (in Negri Sembilan) and the brown bast disease were further investigated. A Government experimental coconut plantation has been started. The commercial timbers of the country are in process of being scientifically investigated, and the distillation of native woods has also been made a subject of research.

Tin-mining continues to be the chief industry in Perak and Selangor and rubber the chief industry in Negri Sembilan and Pahang. Other ores produced are tungsten (wolfram and scheelite) and gold. The Raub gold mine in Pahang is the only gold mine now working in these States; but alluvial gold is recovered in various places. Coal also is produced, the tonnage averaging between 350,000 and 400,000 tons annually. Coconuts and rice are widely grown in Perak, Selangor and Negri Sembilan, in which last-mentioned state coffee is now but little grown, its place being taken by rubber. The timber industry is in process of development, and the whole question of the exploitation and conversion of timber is receiving the active consideration of the Government. Already there are some 5,000 sq. m. of forest reserves, and the areas are being extended.

Railways.—Communications in the Federated Malay States keep pace with the growing requirements of the tin and rubber industries. The total length of line now open to traffic under the Federated Malay States railway administration is over 1,000 miles. This includes the Johore state railway, which at Gemas branches into the west coast line to Prai and to the Siamese frontier; and the east coast line, which runs northward towards Tumpat. The Kelantan section is being extended southward to the east coast line to provide direct communication between Kelantan and Singapore. Through traffic, over the west coast line, with the Siamese state railways was opened in 1918, and between the Federated Malay States and Kelantan via the Siamese railway in 1921. The Johore causeway, which connects Singapore with the peninsula, was opened in 1924. The causeway carries two lines of rails and a roadway; its total length is 3,465 ft. and its average headway at low tide is 47 feet.

Education.—In 1919 important movements for the extension of education were set on foot, despite difficulties encountered in increasing the number of teachers and the improvement of the teaching standard. A temporary scholarship scheme for sending teachers to Hongkong University was set on foot, to serve until more training colleges were established and pending the opening of Raffles College, founded in Singapore. A Malay college is established at Kuala Kangsan; the Sultan Idris training college provide Malay vernacular teachers; and there are many Chines and Tamil vernacular schools.

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MALAY STATES, NON-FEDERATED (*see* 17.482).—These are Johore (*see* 15.475; this form of the name, rather than Johor has come into official and general use), Kelantan, Trengganu Kedah and Perlis. The populations according to the census of 1921 were Johore, 282,234; Kelantan, 309,300; Trengganu, 153,765; Kedah, 338,558; Perlis, 40,087.

Malaria is severe except in Trengganu, and infant mortality high, but both this and the general death-rate have been reduced with improvements in sanitation and provisions for medical service introduced under British supervision. To this, and to the more settled conditions brought about under it, is attributed in large part the substantial increase of the population recorded in all the States; although, as in Trengganu about 1920, the benefits to the commercial classes were not immediately reflected in improved conditions for the peasantry.

By an agreement made in 1885, the Sultan of Johore placed his foreign affairs under British Govt. control and undertook, when required, to receive a British agent at his court. No such appointment, however, was made until 1910. In 1914 a subsidiary agreement was concluded whereby a General Adviser was appointed with powers similar to those exercised by British Residents in the Federated Malay States. The other States, Kelantan, Trengganu and Kedah, came under British protection in 1909 by virtue of a treaty signed at Bangkok in 1909 under which the Siamese Govt. transferred to the British Govt. all its rights over them. The officer administering the government of the Straits Settlements is the British High Commissioner for all protected States in the Malay Peninsula.

Johore.—Most of the interior of Johore is covered with jungle, but already over 800,000 ac. have been alienated, chiefly in small holdings, for cultivation. Rubber plantations occupy half this area and coconut crops about 90,000 acres. Other agricultura products are padi, betel nuts, African oil palms, tapioca, sago palm, gambia, pineapples, tuba and patchouli. The chief minera resources are tin-ore and iron-ore. China-clay is worked, but owing to impurities, has not been found suitable for use in the Bombay cotton-mills. Good forest country exists north of Labis, and timber production averages 20,000 tons a year. The export trade is of the average annual value of $50,000,000, of which rubber represents three-fifths, copra, tin-ore, preserved pineapples, areca nuts and gambia, the greater part of the remainder. The Johore State Railway from Kuala Gemas to Johore Bahru is now leased to the Federated Malay States. The total length of roads maintained by the Government is over 600 miles.

Kelantan.—The dominating physical feature of Kelantan is the flat plain of 1,000 sq. m., extending behind the low sandy coastline. This plain is densely populated, and closely cultivated with rice, coconut and fruit trees. Of the total population in 1921 286,363 were Malays, for the most part born in Kelantan. Chinese numbered about 12,000. The broken hilly country south of the plain is thinly populated, but it contains the bulk of the foreign-owned estates. The staple produce is rice, most of which is grown for domestic consumption. Rubber, coconuts and betel nuts come next in importance. Other notable industries are fishing and weaving; but there is no mining worth mention, though tin mining is likely to develop with increased transport facilities. Recent prospecting indicates the possibility of gold being found in payable quantities. The total volume of trade is valued at about $9,000,000, of which exports represent about $5,500,000. The chief exports are gums and resins (mainly Para ubber), copra, dried betel nuts, dry and salted fish, poultry and attle, silk and cotton goods and dried hides.

Trengganu.—With the transfer to Great Britain of the Siamese uzerainty over the State of Trengganu in 1909, the sending of he triennial tribute of Bunga Mas (gold and silver filigree flowers) o the King of Siam ceased, and a British Agent with consular owers was appointed. In 1919, following the report of a commission of inquiry, the agent was replaced by a British Adviser, whose advice must be sought and followed in all matters of general administration and all questions other than those touching the Mahommedan religion. The soil and climate are suitable for the cultivation of Para rubber, coconuts, coffee and pepper; but the otentialities of the country lie in its mineral resources. Trengganu is the least opened up of the Unfederated States; but it is undoubtedly rich in minerals: tin (lode and alluvial) and wolfram are worked, and graphite, hematite, magnetite and monazite have been found. The total value of the trade of the State is about $9,000,000, of which exports represent nearly $5,500,000. The bulk of these, consisting of Para rubber, dried fish, tin-ore, and copra, go to Singapore. Agriculture employs over 48,000 people and fishing 9,000. About 95% of the population are Malays. Many of the Malay inhabitants show special commercial aptitude, and it is noteworthy that there are here intances, rare elsewhere, of Chinese trade financed by Malay apital.

The suzerainty of Kedah also passed to Great Britain in 1909 and the administration of the country was finally adjusted by a treaty signed at Singapore in 1923. The population in 1921 was 38,544, of whom 237,043 were Malays, 59,403 Chinese and 3,019 Indians. Only about 100 of the aborigines (Sakeis) are eft, these being mostly located in the forest region of the Muda iver. In North Kedah the people are mainly employed in ultivating rice, and in South Kedah, rubber, coconuts and apioca. The estimated annual value of the exports is about 21,000,000, over 50% of which represents rubber. There are everal good metalled roads communicating with Province Wellesley, Singgor and North Perak. The Federated Malay States railway administration has extended its service through Kedah into the independent and protected State of Perlis and rains have been running regularly since 1915. Bangkok and Singapore are now linked up by a connection through Perlis.

Perlis.—The principal industries in the small State of Perlis are rice cultivation and tin-mining. Most of the exports go to Penang, with which country there is regular and frequent steamer ommunication.

Survey and Land Settlement.—One of the principal reforms undertaken under British advice has been that in land settlement, the demarcation of property boundaries, and the issue of itles. To this end trigonometrical surveys have been underaken. In Johore by 1925 a Settlement Act was in force in the districts of Muar and Batu, but not in other districts owing to he want of surveyors. In Kedah the survey is expected to be inished in 1927, and the Survey Department of that State has also supervised the work in Perlis. In Trengganu a settlement enactment was passed in 1924. Education has also received lose attention. The new system in Johore, in which English s taught concurrently with Malay, promises success. The chief English school is that of Bukit Zohara at Johore Bahru. Educaion has also notably advanced in Kedah, where there are government English schools at Alor Star and Sungei Patani.

A notable inscription in Malay on a stone pillar, of date 1303, was discovered in 1923 near Kuala Trengganu. It has a strong admixture of Sanskrit and some of Arabic, and deals with certain phases of Islamic law. No example of this association of languages of earlier date than 1468 was previously known, and this inscription, which has been deposited in the Raffles Museum at Singapore, forms by far the earliest known record of the penetration of Mahommedanism into the Malay Peninsula.

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MALINES, Belgium (*see* 17.489), had a population of 60,429 in 1923. The town was bombarded three times during the World War, and much damage done. The old Palais de Justice, restored shortly before the War, the school of music and the picturesque houses round the Bailles de Fer were ruined, and the south side of the cathedral and the chimes badly damaged. The cathedral was in progress of restoration in 1926. The Cloth Hall, also restored before the War, is used as the town hall. In 1924 the conversations between the Archbishop of Malines, Cardinal Mercier, with some dignitaries of the Anglican Church about the cause of Christian Reunion brought Malines again into public notice.

MALLOCK, WILLIAM HURRELL (1849–1923), British author (*see* 17.492), died at Wincanton, Somerset, April 2 1923.

MALMÉDY: *see* EUPEN AND MALMÉDY.

MALTA (*see* 17.507).—The period 1910–25 comprises changes of paramount importance in Malta, of which the most important are consequent on the World War of 1914–8. The Maltese provided a garrison for Malta, many seamen and stokers for men-of-war and minesweepers, and labour battalions for Gallipoli and Salonika; and they did excellent service in the hospitals. These services contributed to the grant of responsible government, which was established by the constitution of 1921.

Constitution.—On June 12 1920 the governor, Lord Plumer, communicated the decision of the British Govt. to grant a form of self-government which provided for responsible control by the Maltese ministers of local affairs. The letters patent came into force on May 16 1921, and provided for the creation of a senate of 17 members, with a legislative assembly of 32, the latter elected by proportional representation and having control of its own ministers. Judges are to be appointed by the governor in council, and can only be removed by a joint address from both Houses of the Legislature. The police are under ministerial control. Each House makes its own standing orders and rules, and defines its privileges; such powers, however, are not to exceed those of the British House of Commons. Debates may be conducted in English, Italian or Maltese; but all official entries are to be in English or Italian. All persons are to enjoy full religious liberty, no person is to be subjected to any disability or exclusion from office on the grounds of religion. A covering despatch empowered the legislature at its first sitting to declare Roman Catholicism the state religion. English is declared the official language of the administration: Italian is to be the official language of record in the law courts. British subjects, not of Maltese birth, may claim to be tried in the English language.

By the new Letters Patent, power to make laws regarding reserved matters—including everything pertaining to defence, the control of foreign relations, coinage and external trade—remains in the hands of the governor and commander-in-chief, assisted by a nominated council consisting of the lieutenant governor and the legal adviser (as ex-officio members) with senior officers of the navy, army and air force.

Population and Emigration.—The civil population, including Gozo and Comino was estimated on Dec. 31 1924 at 223,088; according to the census of 1911 it was 219,311. The death-rate in 1924 was 23.22 per 1,000 as against an average of 22·57 during 1910. Economic conditions became critical after the cessation of the War. The number of unemployed was swollen in 1919 by the discharge of about 15,000 men by the naval and military establishments, whereupon organised emigration was necessarily resorted to in order to ensure a suitable outlet for Maltese labour. The number of emigrants in 1924 reached the total of 3,277. The distress prevailing among the poorer classes after the War caused the Government to continue the bread subsidy in 1920 and a grant in aid thereof amounting to £250,000 was made from Imperial funds. General want and discontent led to serious disorders and to loss of life by riots on June 7 1919.

Schools.—On Dec. 31 1924 the number of Government day schools was 597. There were 58 private schools with a total of 26,744 scholars. The estimated expenditure on all branches of education for the year 1925 to April 1 was £92,370, excluding buildings. The teaching of Italian in the infant schools and in the first and second year of the elementary schools was entirely abolished in 1923.

Finance and Trade.—The revenue for the year ending April 1 1925 was £773,015 and the expenditure was £757,966; as against, in 1910, revenue £436,200 and expenditure £458,012. The amount of British treasury currency notes in circulation on March 31 1925 has been estimated at £750,000.

The total number of acres under crops in 1924 was returned at 42,964. It is estimated that the agricultural produce of the islands could only support the present population for three months in the year; the balance of foodstuffs and necessaries has to be paid for by work done for the Imperial forces, for the dockyard and for visitors and tourists, and also by large remittances to relatives at home which are received from Maltese abroad; moreover interest from investments outside the islands, and accumulated capital furnish margins to adjust the adverse balance.

Trade (inclusive of goods by parcel post but exclusive of bullion and goods in transit) was as follows:—

	1914	1924
Imports	£2,510,934	£4,416,453
Exports	1,053,854	1,451,766

The exports in 1924 include £443,798 value of coal furnished to merchant ships. In 1924 the value of imports from the United Kingdom was £1,367,291. The number of British steamers calling (not including war vessels and transports) was 349, with the aggregate tonnage of 989,517, and of foreign vessels 411, tonnage 696,501.

Defence.—The increased importance of Malta as a naval base was developed considerably in 1925, producing a period of increased prosperity; a floating dock was installed in 1925 capable of lifting the largest ships. An aerodrome has been built at Hal Far, suitable for main line airways. The greater part of the fortifications has been made over for civil purposes, in view that the importance of aircraft has altered fundamentally the needs and methods of military defence.

Antiquities.—Palaeological investigations have been continuous and excavations at the cave of Ghar Dallam have yielded important results among which were the discovery of human teeth assigned to the Neanderthal period and remains of many species of animals. In the period of 1910–25 archaeology has been enriched by further excavations of neolithic temples, and by the announcement of Professor Keith that the collection of bones at Ghar Dallam are due to that locality having been adapted by the prehistoric inhabitants as a pitfall to catch elephants and other wild animals when Malta was part of an isthmus which connected Italy with Africa, and was in the neighbourhood of a fresh-water lake.

See M. H. Egan, *Notes on Malta* (1922); P. F. Bellanti, *Studies in Maltese History* (1924). (G. St.*)

MALVY, LOUIS JEAN (1875–), French politician, was born at Figeac Dec. 1 1875. In 1906 he entered the Chamber as a Socialist-Radical and was an under-secretary in the Monis and Caillaux cabinets (1911), Minister of Commerce and Postal Services under M. Doumergue (Dec. 1913) and minister of the interior in the Viviani Ministry (June 1914). He retained this post under M. Briand and M. Ribot. On July 22 1917 M. Clemenceau charged him with lax administration in dealing with defeatists and agitators, and he resigned on Aug. 31. In October M. Léon Daudet brought against him a general accusation of treason. A commission, appointed at M. Malvy's own suggestion, decided on behalf of the Chamber that the Senate, sitting as a high court, should pronounce judgment on all the stated charges. On Aug. 6 1918 the high court acquitted M. Malvy of the charge of treason, but found him guilty of culpable negligence in the performance of his duties as Minister of the Interior from 1914–7, and sentenced him to banishment for five years, which he passed in Spain. In 1924 he represented France at the Morocco negotiations which took place in Spain, and in Oct. of the same year became president of the finance commission of the Chamber. M. Malvy again became Minister of the Interior in the Cabinet formed by M. Briand in March 1926, but he resigned in the following April. (*See* FRANCE.)

MAN, EVOLUTION OF.—The late Sir E. B. Tylor, writing on the evolutionary theory of man's origin, made the following statement: "In one form or another such a theory of human descent has, in our time, become part of an accepted framework of zoology, if not as a demonstrable truth, at any rate as a working hypothesis which has no effective rival." When Sir Edward Tylor made this statement in 1910 he was in his 78th year; his memory could carry him back to a time when it was believed that man had come into the world as a special creation some 4,000 years before the birth of Christ and owed no kinship to other living things. He was 27 years of age when Darwin's *Origin of Species* was published in 1859; in 1865, two years after Huxley had issued his renowned treatise on *Man's Place in Nature*, he himself published a work which threw a new light on human history, *Researches into the Early History of Mankind and the Development of Civilization.* When Darwin's *Descent of Man* came out in 1871, Tylor's *Primitive Culture; Researches into the Development of Mythology, Philosophy, Religion, Art and Custom*, kept it company. By the end of the 19th century he had seen chair after chair in the universities of the world filled by men who were convinced that evolution was true; at his death in 1917, at the age of 85, he had seen another generation of inquirers grow up who, after applying Darwin's teaching to all departments of man's world—to his body, mind and culture—remained convinced that, as a working hypothesis, the doctrine of evolution had no rival.

SUMMARY OF THE EVIDENCE

Embryology.—No matter what aspect of man the student of to-day may select for study, the conviction that evolution (*q.v.*) is true is forced on him. If he investigates the development of the child in the womb he comes across a complicated series of appearances which can be explained only if Darwin's teaching is accepted.

Comparative Anatomy.—If he studies the structure of man's body he finds it framed on the mammalian plan, and if he compares it with that of anthropoid apes he finds the points of resemblance to be so numerous and so close that he cannot think that such a degree of resemblance could be a result of mere chance. If he inquires into the periods through which a newly born child passes to reach manhood or womanhood, he finds the animals which are most human in this respect are the great anthropoids—the gorilla, chimpanzee and orang. If he takes into consideration the diseases to which man is liable, he finds that human diseases are more readily communicated to the great anthropoids than to any other living animals. Particularly is he impressed by the fact that the blood of man and of the anthropoid apes, when tested against each other, react almost in the same way. To account for the presence of so many vestigial structures in man's anatomy, he feels impelled to suppose that man has come of an ancestry in which these vestiges were fully grown and useful. A child may be born with its body malformed; it may suffer from hare-lip, cleft-palate or many other kinds of deformity, including the presence of a tail; medical men cannot account for such malformations if they look on man as a special creation; they can give a rational explanation of their occurrence in man's body if they accept the teachings of evolution.

Palaeontology.—In recently formed strata of the earth fossil forms of man are found; those from the older strata are more ape-like than those from the newer. In still older strata are found fossil fragments of great anthropoids; in still more ancient, the remains of small anthropoids; deeper still in the earth's records no trace of anthropoid has yet been discovered. In these older strata occur fossil remains of small monkey-like primates. The geological records, so far as they are yet known, support Darwin's theory of man's origin; they are altogether against the belief that man appeared suddenly—a special act of creation.

Human Races.—More especially is the student of human races driven to Darwinism for an explanation of his many problems; even if he believed that man had appeared originally by an act of special creation he must formulate a theory of evolution in order to account for the divergent races now living.

Although in thought and deed man rises far above any member of the brute creation, yet students of his brain find that it is modelled, part for part, on exactly the same pattern as that of he anthropoid ape. Those who inquire into man's mental qualities, his emotions, his habits, his tendencies and his modes of thought, find much which can be explained only by supposing hat he has ascended from a lower order.

For these reasons all present-day students who are applying hemselves seriously to the unravelling of man's history accept he theory of evolution as a truth. This conviction has spread rom professional circles into the public thought of our time and altered the outlook of a large section of the lay mind; yet here still remain numbers of the public of Europe and of America who, impressed by the great and real differences which separate the mentality of the lowest grades of mankind from hat of the highest grade of ape, cannot believe that man has arisen from a lower form by any natural or evolutionary process. The State of Tennessee has passed a law forbidding, in state-supported schools, "the teaching that man has descended from a lower order of animals." In June 1925 Mr. Scopes, a school teacher, was prosecuted under this law, found guilty and fined $100. Since then certain other states have enacted similar laws.

Man's Genealogy

Darwin's Views.—Although there is a complete agreement among professional students that man is a member of that order of mammals to which Linnaeus gave the name "Primates" and that his lineage, when traced backwards, will be found to branch off from the primate tree, there is a sharp difference of opinion as to the exact point in the tree, and the approximate date in geological time, at which the human branch separates from those other main branches which represent the lineage of anthropoid apes and of monkeys. It is clear from statements made in the *Descent of Man*, that Darwin regarded the gorilla and chimpanzee as more nearly akin to man than other living primates and, on the evidence available in 1871, thought it probable that man and the African anthropoids were co-descendants of a common anthropoid which had its habitat in Africa (fig. 1). He regarded the catarhine type of monkey—the type exemplified by the monkeys of the Old World—as representatives of a still older ancestral form. Darwin traced the common anthropoid stock, which gave birth not only to the ancestral lines of man, the gorilla and chimpanzee, but also to those of the orang and gibbon, back to a common catarhine type. This catarhine type, he presumed, was the offspring of a still older common simian or monkey-like type, one which existed in the Eocene period of the earth's history and gave origin not only to the catarhine monkeys of the Old World but also to the platyrhine monkeys of the New World. Thus man's history, as Darwin saw it, did not begin until after the ancestral type of anthropoid had been evolved; the appearance of an anthropoid type from a common catarhine ancestor and this from a common simian stock, represent prehuman stages in the evolution of the higher primates. It is noteworthy that Darwin's mind remained open as to the exact point at which the human stock branched off from the general primate tree; more than once in the *Descent of Man* he writes as if the human lineage might have come off, not from the anthropoid stem, but lower down in the primate tree, from that of the common catarhine stock (fig. 1a).

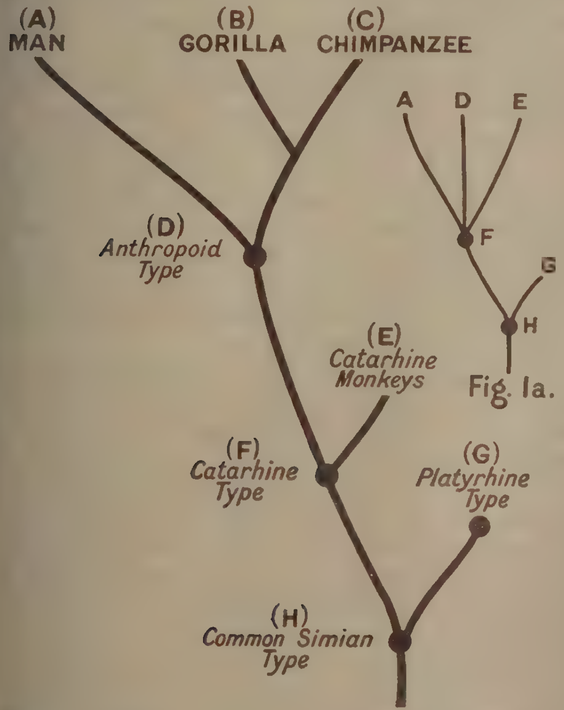

FIG. 1.—A diagram to illustrate Darwin's conception of Man's lineage.
FIG. 1a.—Another possible relationship, also mentioned by Darwin.

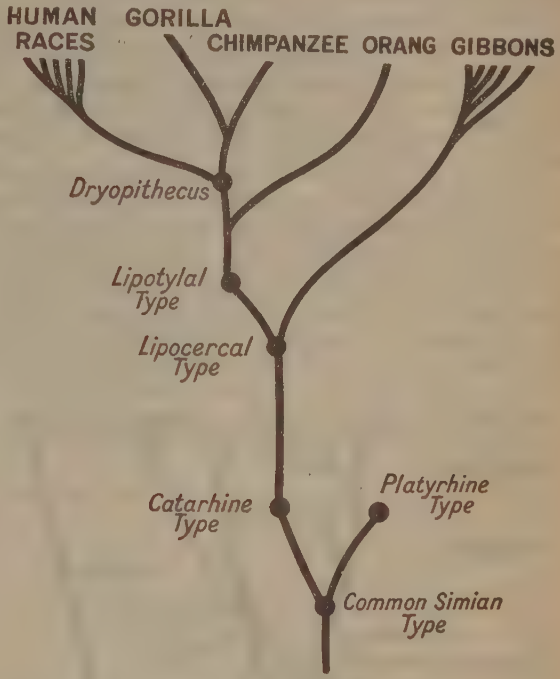

FIG. 2.—Haeckel's conception of Man's descent as illustrated by a phylogenetic tree, published in 1866.

Haeckel's Views.—On no occasion did Darwin throw his conception of man's lineage into a diagrammatic form. The first to construct an evolutionary tree of man's descent was Ernst Haeckel; this appeared in his *Generelle Morphologie* published in 1866, five years before Darwin's *Descent of Man* was issued. This pedigree is still worthy of study (fig. 2). Haeckel perceived that the small form of anthropoid ape, the gibbon, was more primitive and earlier in point of evolution than the three living great anthropoid apes (orang, chimpanzee and gorilla) and supposed that in the evolution of the great anthropoids from the ancestral catarhine type there was interposed a small anthropoid stage to which he gave the name Lipocerca (λιπεῖν, to lack, κέρκος, tail). This small anthropoid stock (Lipocerca) gave origin, he supposed, to gibbons and to the ancestral stock of the great anthropoids—for which Haeckel proposed the name Lipotyla (λιπεῖν, to lack, τύλη, cushion)—anthropoids which, unlike the gibbons, were destitute of ischial callosities or natural cushions on which gibbons and Old World monkeys seat themselves. This cushionless anthropoid stock (Lipotyla) he regarded as ancestral to the various races of mankind. From the Lipotyla, which gave origin to man, there also branched off, at an early stage, the ancestry of the orang and, at a later, the common ancestry of the chimpanzee and gorilla. Thus Haeckel regarded the gorilla and chimpanzee as more nearly related to man than other living anthropoids. It is also remarkable that he placed the extinct Miocene form of anthropoid ape, known as Dryopithecus, on the line which led up to the gorilla and chimpanzee on the one hand and to human races on the other. Thus it will be seen that in Haeckel's opinion man was the descendant of an anthropoid ape.

Later, he introduced considerable modifications into this family tree. In the third edition of his *Evolution of Man* (English translation, 1879) he interpolated into man's ascent from an anthropoid to a human state an intermediate stage represented by *ape-like* men—beings who were manlike in form and in gait but lacked man's power of speech. To such hypothetical beings he gave the name *Pithecanthropi.*

Modern Views.—In 1892 Prof. E. Dubois discovered in the island of Java the fossil remains of a being which answered very well to this hypothetical stage, and named this fossil form of evolving man *Pithecanthropus erectus.* Haeckel presumed that his pithecanthropi had lived in the Pliocene period; Prof. Dubois is of opinion that his transitional form of man lived in Java towards the end of the Pliocene period. Discoveries made by Dr. G. E. Pilgrim of the Geological Survey of India and by members of that survey in the latter part of the 19th century have proved that India, during the Miocene period and the earlier part of the Pliocene, was the home of great anthropoids of many and diverse kinds, several of them belonging to the type of Dryopithecus which Haeckel, at an early period, regarded as a possible ancestor to man. Others of these fossil Indian or Siwalik anthropoids show affinities to the orang, to the chimpanzee and to the gorilla, while still another—*Sivapithecus*—is regarded by Dr. Pilgrim as an early representative of the human family. Notwithstanding these revelations from India and taking all their bearings into consideration the majority of modern authorities (Dubois, W. K. Gregory, Elliot Smith, Keith), in constructing diagrams to illustrate the affinities and lines of descent for the higher primates, depict the human stem (fig. 3) as springing from the vicinity of the stem which gave rise to the gorilla and chimpanzee. The conception, first formulated by Haeckel, that a Miocene anthropoid of the type of Dryopithecus (fig. 3) may stand as a common ancestor to man and to the African anthropoids is still regarded as possible.

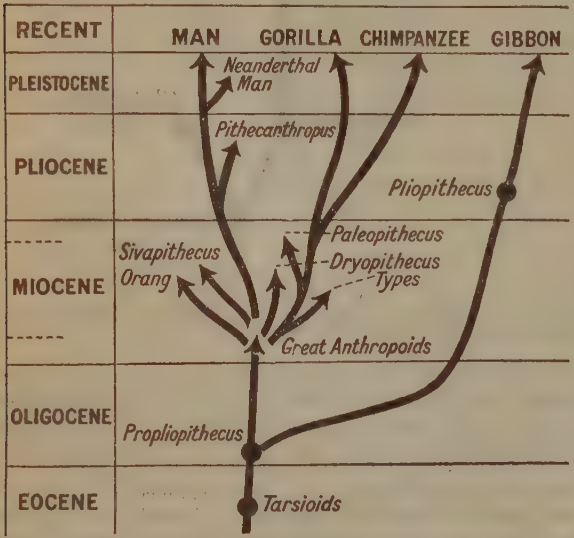

FIG. 3.—A phylogenetic tree of the higher primates (after W. K. Gregory, 1916).

Doubts Raised by the Occurrence of Parallel Evolution.—There is a line of evidence, accumulating at the present moment, which tends to undermine the confidence of those who have drawn up phylogenetic trees of man's descent. All who have inquired into the evolution of horses and elephants, by the study of fossil forms found in widely separated regions of the world, have become impressed by the fact that horses and elephants in America have passed through evolutionary changes of the same kind and in the same order as have done their representatives in the Old World. This tendency for the descendants of a common ancestry to undergo *parallel* or even *converging* evolution, has been very fully expounded in the published works of Dr. Henry Fairfield Osborn (*Origin and Evolution of Life*, 1918). That parallel evolution has been potent in the order of mammals to which man is assigned there can be no doubt. The monkeys of the New World parted company from those of the Old early in the Eocene period; it is probable that at the time of their separation they had only reached the stage represented by the Tarsioids, a family of monkey-like primates, which has now only one living representative—the Tarsier (*Tarsius spectrum*) of Borneo and other islands of the Malay Archipelago. Although parted thus early, New and Old World monkeys have acquired corresponding structural modifications—modifications of a kind which we cannot regard as having been present in their common ancestor. The brain of the South American spider monkey (Ateles), that of the Old World monkeys of the semnopithek type, and that of the small anthropoid or gibbon, have many common characters which could not have been present in the brain of their Eocene ancestor.

We may legitimately infer, however, that a bias or tendency to produce similar or almost identical modifications was latent in the common ancestor. If parallel evolution has been at work in one section of the order of primates it may have been at work in another, and we must therefore keep in mind the possibility that man and the gorilla may have acquired their many and striking points of structural similarity independently. Cope (1882) and Hubrecht (1897) supposed that human lineage had parted from that of the anthropoids near the base of the primate phylum; if this were so man would have an independent pedigree of immense length. In more recent times Prof. F. Wood Jones (*The Problem of Man's Ancestry*, 1918) has put forward the theory that man, because of the number of primitive and generalised features of his structure, is to be traced back to an independent origin from a tarsioid ancestor. Such a view entails the need of supposing that the multitude of structural similarities shared by man and the great anthropoids must have been acquired by each independently—a supposition which is unacceptable to the majority of those who have made a special study of the higher primates living and extinct.

Klaatsch (*Die Stellung der Menschen im Naturganzen*, 1911), (*Evolution and Progress of Mankind*, 1923) made a larger demand on the powers of evolution to reach the same end by diverse routes. This voluminous author traced the origin of mankind to an anthropoid ancestry, but supposed that the ancient inhabitants of Europe—Neanderthal man, known only from his fossil remains, and the living Negro peoples of Africa had arisen from the same stock as the gorilla and chimpanzee, while Mongolian peoples and men of the modern European type had sprung from the same lineage as the orang. Klaatsch believed in the polygenetic origin of human races, whereas nearly all modern authorities hold a monogenetic theory of man's evolution. They cannot believe that black and white races, which although outwardly dissimilar are yet structurally so alike and freely capable of interbreeding, could have sprung from different branches of the primate tree. They rely on the axiom that likeness in structure means similarity of descent.

Man an Aberrant Primate.—In charting the family tree of the Higher Primates modern authorities differ as to the position which should be assigned to man. Prof. Eugène Dubois represents the human stem as the main and direct continuation of the trunk of the primate tree (*Nature*, vol. 53, p. 245, 1896): from this main trunk all the other members of the primate order re made to come off as side branches. Man is given the central osition of his order; he forms the apex of the primate tree. Prof. lliot Smith (*Evolution of Man*, 1925) also gives the human amily the central position as a direct continuation of the main rimate stem. In reality man is the most aberrant member of is order; in brain and in the modifications of his lower limbs he as departed farther from the ancestral primate state, so far as e know that state by the study of fossil remains, than any member of the order; he has retained less of the structural organisaon of the original primate than all the others. Apparently in he evolution of the higher primates there has been the same endency as is to be noted in modern political parties—a tendncy for an extreme wing to move ever further from the central roup of conservatism. The human family represents the exreme wing in the order of primates; *Tarsius*, greatly modified s it is, retains the essentials of the central or conservative group.

MAN'S ZOOLOGICAL POSITION

Zoologists classify animals into families, sub-families, genera nd species, according to their degrees of structural likeness; hey presume, although fully aware that parallel evolution can nd does take place, that two animals, such as the gorilla and himpanzee, which are so similar in the structural details of their odies, owe that similarity to their descent from a common anestry. Darwin urged rightly that in settling the zoological elationship of one group of animals to another, more weight nust be attached to the points wherein they agree than to those n which they differ.

Huxley's Views.—In the masterly analysis of man's strucural relationships given by Huxley in *Man's Place in Nature* 1863), more stress was laid on the anatomical differences which eparate man from the gorilla than on the points wherein they gree. Huxley held that differences of a like kind and of an qual degree separated the gorilla from any form of catarhine or latyrhine monkey a critic might choose for comparison. He eld that if evolution could produce the structural gap which eparates a monkey from the gorilla it could also bring about the byss which divides the gorilla from man. Huxley's conclusions re still valid; indeed, the modern anatomist is convinced that he structural hiatus which lies between a baboon or any other orm of monkey and the gorilla is much wider than that which es between the gorilla or chimpanzee and man. When tested by nodern methods, the blood of the chimpanzee shows a much loser affinity in its reactions to that of man than to that of any Old World monkey; the blood of monkeys of the New World, hen submitted to the same tests, reveals a still more distant ffinity (Prof. G. H. Nuttall, *Blood Immunity and Blood Relationship*, 1904). Huxley included in one family the great anthropoids (gorilla, chimpanzee and orang), the small anthropoids siamang, gibbons), and the various genera of monkeys of the Old World; if we are to be guided by anatomical considerations e must give to each of these groups the rank of a family. The ame rank—that of a primate family—must be given to the ection which embraces all the various races and types of mankind, living and extinct. The various genera of New World nonkeys make up a fifth family of primates.

The Primate Families.—Thus in that part of the living animal ingdom to which man belongs, there are five families—the uman family, that of the great anthropoids, that of the small nthropoids, the family of catarhine or Old World monkeys and he family of platyrhine or New World monkeys. These families re separated by structural gaps of about equal magnitude. rom the platyrhine monkeys upwards, these families form an scending series in the sense that each succeeding family marks further departure from the ancestral tarsioid type, the point f highest differentiation being reached in the human family.

EVIDENCE OF MAN'S DESCENT

Anatomical.—The members of these five families of primates ave a common structural substratum—an inheritance from the ncestral stock from which they have all descended. Each amily in the course of evolution has come by anatomical features which are peculiar to itself. A full analysis of the structural details of man's body shows that about 30% of them are peculiar to himself. The corresponding characters of the gorilla number 16%; the gibbon has about the same proportion of features peculiar to its own family (Keith, *Rivista di Antropologia*, vol. 20, p. 1, 1916). As examples of man's peculiar characters we may cite his nude skin, his projecting nose with well marked wings, the size of his brain, the strength of his thigh, the form of his leg, the shape of his foot.

Common Characters.—Further analysis reveals in man's body a series of characters which he shares with only two other living animals—namely, the gorilla and chimpanzee. These amount to nearly 9% of the total points selected for comparison, but if we include in this group features which man shares with the gorilla alone or with the chimpanzee alone, then man has in his body about 26% of characters which he shares with gorilla and chimpanzee or with gorilla alone or chimpanzee alone. Such characters, we presume, are derived from a common ancestor which gave birth to man and to the great anthropoids of Africa. As examples of characters common to the three we may cite the air chambers which branch off from the nasal cavity. These have the same arrangement and are of the same number in man, gorilla and chimpanzee. Another example is to be found in the small bones of the wrist. Of the higher primates, only in these three has the *os centrale* disappeared as a separate unit from the carpus; yet in a foetal stage this bone is present in all three; and as a separate element in adults of all the other higher primates.

Descending still lower in the strata of human anatomy we encounter a group of characters which man shares with the three great anthropoids. We may speak of man and these three as the giant primates, for compared with the earlier types they are giants, or we may apply to this group Haeckel's convenient name—*Lipotyla*. Man shares with the other giant primates 10% of similarities of structural detail; to this we may add 5% which he shares with the orang and with the orang only, characters which the chimpanzee and gorilla have apparently lost or perhaps never possessed. Going still lower in our analysis, we find over 8% of characters which are common to the gibbon as well as to the great anthropoids. With the gibbon man shares 8% of structural features which are not to be seen in the bodies of the great anthropoids. In this case, again, we have to suppose that man and the gibbon came by those characters long after they separated from a common ancestor, or that the great anthropoids have lost them in the course of evolution while man and the gibbon have retained them.

Lower in the scale of our analysis we come upon features in man's body which he has apparently retained from a catarhine ancestry; at least, to find their counterparts we have to go to the bodies of Old World monkeys. In man's body there are 5% of such catarhine features; in the gorilla's body such features are three times as numerous. It is remarkable that platyrhine characters, features to be seen in the bodies of the New World monkeys, should be as numerous as catarhine in man's body.

There is a small residue of anatomical details in human anatomy attributable to a still more distant past, a heritage from a tarsioid or lemuroid ancestry. From the details revealed by anatomical analysis it is plain that evolution has not proceeded in an orderly or simple manner in shaping the bodies of the higher primates; characters are curiously scattered. Yet to explain the distribution of characters in the various families we must suppose that man's ancestry is linked closely to that of the African anthropoids—the gorilla and chimpanzee. In some instances we obtain help in explaining the distribution of characters by calling in the aid of *collateral* or parallel evolution; in other cases Mendel's discoveries in heredity assist us; further, we see that the body of man and of ape is a great mosaic work of structural elements and that progressive changes may occur in one set of units while retrograde changes affect another set.

In recent years the formation of the human embryo in the womb, the complicated changes which transform the embryo into a foetus and the elaborate processes which produce the organs of the ripe child from embryonic rudiments, have been studied by an ever-growing army of inquirers and by methods which show an ever-increasing precision. Embryologists find it necessary to assume that the law of evolution holds for man; unless they make this assumption they can offer no rational explanation of the complex changes which engage their attention. In its broad lines development pursues the same course in the human body as in that of all vertebrate animals. What Francis Balfour in 1885 saw taking place with diagrammatic clearness in the embryo of the dog-fish has given clues to the more complex and obscure processes now known to occur in the embryo of man.

The developing human egg, when it becomes established in the mother's womb, undergoes a series of elaborate and peculiar changes. The investigations carried out by the late Dr. Emil Selenka (*Menschenaffen. Studien über Entwickelung und Schädelbau*, 1898–1906) revealed the fact that only in the wombs of four other living mammals, the gorilla, chimpanzee, orang and gibbon, do the same changes take place. The process by which the placenta is formed, thus establishing a means of supplying the unborn child with nourishment, is exactly the same in man as in anthropoid apes. It is true that in *Tarsius* we see outlined the basal plan of placentation met with in the higher primates, but it is also true that in the placentation of the monkeys of the Old World and also in that of the New World we see a stage which leads on from the lower or tarsioid condition to the higher or anthropoid form. In the embryos of man and of the anthropoids an external jointed tail is produced in the fifth week of development; by the end of the eighth week it has shrivelled and become submerged, leaving a dimple at the point of the caudal region where it sinks below the surface. These are a few examples of some of the remarkable similarities which link the embryological history of man with that of the anthropoid apes.

Recapitulation, Interpolation, Adaptation.—When in the later decades of the 19th century anatomists applied themselves to unravelling the development of man's body, they expected it to recapitulate, in full detail, the various stages of his evolution. In this they have been disappointed, because in the growth of the embryo and of the foetus we see three different processes at work. We see recapitulation taking place; we also see new characters being interpolated from the time the embryo makes its first appearance until all the parts of a formed child are laid down; further we see at every stage the body of the embryo and of the foetus being adapted to a life within the womb. When gill-clefts appear in the neck of the human embryo towards the end of the first month of development we see a recapitulatory and very distant phase exemplified. When we look at the developing human foot, with the expectation of finding an anthropoid phase, we search in vain. The great toe is never a free and separate member in the human foot as it is in the adults of all other primates. There is a stage in the development of the feet of primates when all the digits diverge equally from the tarsal base; man and ape pass through this stage and man clings to it as it were, whereas all the other primates pass on to a final prehensile stage. Yet in the sole of the newly born child we see the same flexion lines as in that of the gorilla; we find the same muscles in the great toe of the human foot as in that of the gorilla; we find the joint at the base of man's great toe, especially in the foetus, moulded in the same form as the gorilla. We cannot explain these appearances unless we believe that the human foot has been evolved from one like that of the gorilla, more especially as the foot of the gorilla shows a curious blend of human and monkey-like features.

The human great toe does not recapitulate ancestral history; developmental changes which mould the great toe into the human pattern set in just when the simian ones are due; the human changes do not succeed but replace those that give the ape its prehensile foot. New changes have been intercalated in the evolutionary sequence. In a multitude of details the human embryo no longer recapitulates the series of changes gone through by its ancestors. It is true of every part of the human body; human characters begin to peer through its higher primate qualities before development is a month old.

Of the changes which affect the developing human body those which represent adaptations to life within the womb are the most important. The child draws its living from its mother's body; it is sheltered and kept warm; it has not to seek its living nor defend itself; such qualities need not be attained until the time of birth; until then nature is free to work out what experiments she will. It is a remarkable fact that many of man's distinguishing features are to be met with during foetal stages in the development of anthropoid apes. A stage which is transient in the foetal ape becomes permanent in man. We may take as an example the comparative hairlessness of man's body. A foetal chimpanzee, in the eighth month of development, resembles a human foetus of the same age; both have hair growing freely on their scalps, but the rest of their bodies, although provided with lanugo, appear to be nude. By birth the chimpanzee's body is covered with hair, but the human child retains the foetal state. Yet all known primates save man have their bodies thickly covered with hair; hairlessness is not an ancestral condition, but one made possible by the retention of the young in the shelter of the womb. The skin provides us with another example of foetal inheritance. In the fair or white stock of mankind the skin has become relatively free from pigment. In their earlier stages of foetal development apes are unpigmented; they darken as the time of birth approaches. White men have come by their colouring through the inheritance of a foetal condition, one which is certainly not ancestral.

Many examples might be cited of man coming by distinctive characters by retaining foetal states, but the following may be taken as representative. In all foetal primates the brain is relatively large and the jaws absolutely small; this is certainly not an ancestral state, for in all the older forms of primate the brain is small and the jaws large. Man is distinguished by the large size of his brain and the relatively small size of his teeth and jaws. How he compares with adults of great anthropoid apes may be seen from the following data. We may take the capacity of the cranial cavity to represent the size of brain and the area of the palate to represent the size of the jaws. In a well-grown adult European male we expect a cranial capacity of 1,500 c.c. and a palatal area of 25 sq. cm., there being 60 c.c. of brain space for every square centimetre of palate. The average male gorilla has a cranial capacity of 470 c.c., a palatal area of 72 sq. cm., that is 5·8 c.c. of brain space for every square centimetre of palate. The corresponding figures for the average male orang are: 412 c.c., 62 sq. cm., giving a cranio-palatal ratio 6·6:1; in the average male chimpanzee the figures are: 390 c.c., 46 sq. cm., giving a ratio of 8·5:1. There is a wide gap between the European cranio-palatal ratio 60:1 and that of the chimpanzee, 8·5:1. We may fill the gap somewhat by citing a Tasmanian skull with a capacity of 1,350 cc., a palatal area of 36·7 sq. cm., and a ratio of 36·7:1.

We find a still nearer approach to the anthropoid condition in the fossil skull of Rhodesian man in which the cranial capacity is 1,300 cc., the palatal area 41 sq. cm., the cranio-palatal ratio 31·7:1. Even this ratio is far above that of the chimpanzee, 8·5:1; but if we take a suckling chimpanzee, in which the cranial capacity is 260 c.c. and the area of palate 13·6 sq. cm., we obtain a ratio 19:1, an approach to the human proportion. If we take a still earlier stage, such as may be observed in a chimpanzee foetus during the eighth month of development, we find a ratio which is human in its magnitude. Man has come by his small palate by retaining a foetal anthropoid condition, and this is true of all the parts of man's skull which are concerned in mastication. This tendency to foetal inheritance is not confined to the human branch of primates; in certain genera of New World monkeys, particularly in Chrysothrix and Cebus, we see in their small jaws and large heads the same law at work.

The belief that many of man's foetal characters do not reflect ancestral stages, but foreshadow the trend of future evolution, was held by several anatomists in Germany towards the end of the 19th century, particularly by Ranke. The law of foetal inheritance, so far as it relates to man, has been greatly extended during recent years in a series of papers by Prof. L. Bolk of

Amsterdam (*Proc. of the Roy. Acad. of Sc. of Amsterdam*, 1921–5).

Embryological evidence, if it has failed to reveal the pithecoid states through which man has passed in his ascent, does provide conclusive evidence of his simian ancestry. In the development of his brain, for example, we see that the first fissures to appear are those which occur in the brains of the higher monkeys; the next are those which are found in the brains of the great anthropoids, and later still the secondary human sulci are formed; but never at any stage does the human brain correspond to that of monkey or of anthropoid. If embryology has failed to reveal the details of man's history, it has shown that the processes of evolution are at work on the foetal body; if the study of the foetus does not help us to decipher man's past, it does seem to provide a basis on which we may forecast the future of the human body. The brain of the gorilla, in the totality of its characters, is the most like that of man; these two are structural allies, yet evolution has moulded their bodies in opposite directions. During growth the gorilla replaces all its foetal characters by those of brutality and strength; in man the tendency has been to retain the delicate physique of the young and to shed those of a more brutal nature. Why the one fate overtook the gorilla and another fell to man remains an enigma.

BIOLOGICAL EVIDENCE OF MAN'S EVOLUTION

Blood Tests.—Not only are the bodies of man and anthropoid apes fashioned on similar lines, but, as was demonstrated at the beginning of the present century, their living tissues give like reactions. In 1900 Dr. Hans Friedenthal injected a small amount of human blood into the veins of a chimpanzee; its vital qualities were so similar to those of the chimpanzee that no disturbance followed the operation. When an equal amount of the blood of a macaque monkey was injected into the veins of the chimpanzee there was a slight reaction; the corpuscles of the macaque's blood were destroyed and ejected by the kidneys. When the blood of an ox was used a violent reaction was produced, the foreign blood being destroyed and thrown out.

Prof. G. H. F. Nuttall, of Cambridge University, thereafter elaborated a more precise method of estimating blood-affinities, by which very small quantities of blood can be tested against specially prepared antisera. In 1904 appeared his classical work *Blood Immunity and Blood Relationship*, containing the results of tests carried out on three species of anthropoid ape, 28 species of Old World monkeys, and nine species from the New World. The blood of all these species was tested against a human antiserum. The blood of the anthropoids gave a full reaction—100%; that of the Old World monkeys gave a lesser reaction or precipitation, one equivalent to 92% of the full; that of the New World monkeys 78 per cent. At the time Prof. Nuttall was making these investigations in England, Dr. Uhlenhuth was carrying out independent inquiries in Germany, and reached corresponding conclusions as to degrees of affinity. The tests devised by Nuttall and by Uhlenhuth utilise the fluid or serum of the blood. Recently Drs. Landsteiner and Miller (*Jour. Experim. Med.*, vol. 42, p. 841, 1925) have utilised the corpuscular elements of the blood and find that they give more delicate reactions than those given by the serum. They devised tests which serve to distinguish the blood of the chimpanzee from that of man, but which failed to discriminate the blood of the white man from that of the negro.

Disease Reactions.—The reactions of living tissue are also tested by disease. Man is peculiarly susceptible to syphilis; the animals most akin to him in this respect are the great anthropoid apes. Monkeys are difficult to inoculate with syphilis, and when they suffer, take the disease in its mildest form. Anthropoid apes are almost as suceptible to typhoid fever as man is. When chimpanzees are kept in confinement they are liable to that modern disease of man—appendicitis. Anthropoids react to stimulants, sedatives and poisons in the same manner as human beings. The brains of the great anthropoid apes are smaller and are less convoluted than is the case in man, yet when the living cortex is stimulated by electrical methods, be it in man or anthropoid ape, the same reactions follow when corresponding convolutions are excited. Surgeons have found that observations made by experimental physiologists on the brains of anthropoid apes afford reliable guidance when they have to operate on the brain of man. Thus the evidence supplied by vital tests bears out the conclusions forced on anatomists by similarity of structure—namely, that great anthropoid apes, in an evolutionary sense, are near akin to man.

EVIDENCE OF VESTIGIAL STRUCTURES

Nearly all the structures which have become greatly reduced or are mere vestiges in the body of man have undergone a similar fate in the bodies of the anthropoid apes. In them as in man the tail has disappeared, all save its basal part, which has sunk beneath the surface to form the coccyx. It is true that the vermiform appendix of man is smaller than that of any of the anthropoid apes, and that in half of the Europeans who reach the age of 70 its lumen has become closed, yet it is more than doubtful if this structure should be reckoned vestigial in the body of either man or anthropoid. The *palmaris longus*, the *plantaris*, the *pyramidalis*, muscles which are reduced or fibrous in man, are in the same state in anthropoid apes. Such evidence points to a common origin for anthropoids and man, but it throws no light on man's more immediate relationship to any member of the anthropoid group.

There are two muscular vestiges, however, which point to man's kinship to the African anthropoids. There is a muscle in the neck of monkeys which helps to lift the shoulder; it is called the *levator claviculae*. It has almost disappeared from man's body; it is met with only once in a hundred dissections. This muscle shows definite signs of reduction in the gorilla and chimpanzee, but not in the orang or gibbon. All monkeys have a strong muscle called the *latissimo-condyloideus*. When a monkey is climbing, and has seized a branch with its hand, it uses this muscle to pull the trunk upwards. It is a particularly strong muscle in the gibbon, well developed in the orang, somewhat reduced in the chimpanzee, partly fibrous in the gorilla, wholly fibrous in man, although in 5% of human bodies some muscle fibres may be detected. Lately Dr. A. H. Schultz, of the Carnegie Institution of Washington, has found a remarkable example of the persistence of a vestige in man's body (*Amer. Jour. Physic. Anthrop.*, vol. 7, p. 149, 1924). Lemurs, which branched off from the primate stem at a very distant geological period, have a tuft of touch vibrissae at the wrist. Monkeys were supposed to have lost these vibrissae; Dr. Schultz found them in foetal stages of monkeys both of the Old World and of the New. On examining the wrists of human foetuses in the second month of development he found a raised plaque at the spot where the touch vibrissae are situated in lemurs.

THE EVIDENCE OF FOSSIL REMAINS

Pithecanthropus Erectus.—The discovery which throws most light on the evolutionary progress of man was made in Java during 1891–2 by Prof. Eugène Dubois, then a surgeon in the colonial military service, and later professor of geology in the University of Amsterdam. In a stratum which contained the fossil bones of many extinct species of animals he obtained five fragments of a strange kind of being, one which he regarded as a transitional form between man and ape—a real missing link. He named it *Pithecanthropus erectus*, and assigned it to a separate family of primates—one lying on the borderline between anthropoids and man. (*Pithecanthropus erectus, eine menschenaehnliche Uebergangsform aus Java*, 1894.) The five fossil fragments found were: a skull cap which outwardly had the form which might be expected in a giant form of gibbon, a left thigh bone and three teeth. The most distant of the fragments were twenty paces apart. Later he added a sixth fragment—part of a lower jaw found in another part of the island but in a stratum of the same geological age. The skull cap is flat, low and has great eyebrow ridges; its characters are more simian than human, yet when Prof. Dubois succeeded in obtaining a cast from the interior of the skull cap, that cast bore on it the convolutionary pattern of the brain of Pithecanthropus, and that pattern proved to be altogether human. Pithecanthropus, the fossil man of Java, had a brain which was smaller, simpler and infinitely more primitive than that of the lowest living men.

By this discovery Prof. Dubois caught the human brain in the act of evolving. Certain cortical or convolutionary areas in man's brain are known to be concerned with sight, hearing and touch, and the reception of messages from other sense organs; a "motor" area is concerned in the initiation and control of voluntary movements. Between these primary areas of the cortex lie association areas which have to do with the memory and the interpretation of what is seen, heard or felt. The cortex of part of the frontal lobe—the prefrontal cortex—is concerned in the acquisition of skilled movements. These secondary or association areas of cortex, which lie between and separate the primary areas, are the basis of man's educability—his capacity to learn from experience. In the brain of Pithecanthropus the association areas are much less developed than in the brains of the lowest of living human races. Yet all the essentially human parts are represented. It is even possible that the owner of this brain was capable of speech.

A further study of the brain-cast has convinced Prof. Dubois that Pithecanthropus must be placed in the human family (*Proc. Roy. Acad. Sc. Amsterdam*, vol. 27, nos. 5, 6, 1924). The brain of this "fossil" man is now estimated to have had a volume of at least 900 c.c.; the largest-brained gorillas rarely rise above 600 c.c.; the lowest-brained of human beings occasionally falls below 1,000 cubic centimetres. Pithecanthropus in size of brain lies on the verge of humanity. His teeth, if large, are essentially human in form of crown and root; the socket for the canine, in the fragment of lower jaw, shows that this tooth was not massive and pointed as in anthropoid apes. The thigh bone is human altogether, and gives proof that Pithecanthropus walked as men do.

Pithecanthropus was assigned by Prof. Dubois, on reliable evidence, to a date late in the Pliocene period; others on weighing the evidence suppose that he lived early in the Pleistocene period. If we accept the duration of the Pleistocene as 250,000 years, and regard Pithecanthropus as representing the evolutionary stage reached by mankind at the beginning of this period, then we have to conclude that man's body had become adapted to its peculiar posture and gait before the end of the Pliocene period, and that the higher development of the brain took place in the ensuing Pleistocene period.

Eoanthropus.—The discovery which ranks next in importance to that of Pithecanthropus was made by Mr. Charles Dawson at Piltdown, Sussex, between the years 1911 and 1915. He found the greater part of the left half of a deeply mineralised human skull, also part of the right half; the right half of the lower jaw, damaged at certain parts but carrying the first and second molar teeth and the socket of the third molar or wisdom tooth. The lower jaw, on the region beneath the chin, had a bar of bone known as the "simian shelf," which until then had been regarded as a mark of the ape. Later a pointed upper canine tooth was added; its characters were simian rather than human. The stratum of gravel proved to have been laid down early in the Pleistocene period, and it is certain that the fossil fragments of this human skull were as old as the date of deposition. From the fossil fragments thus found, Sir Arthur Smith Woodward reconstructed an extinct genus of mankind, *Eoanthropus*, the dawn-man (*Quar. Jour. Geol. Soc.*, 1913–5). Subsequently (1915) in the deepest part of the gravel stratum there was found a remarkable bone implement hewn from the thigh bone of an extinct kind of elephant; in a neighbouring field two other fragments of a skull of the same kind came to light, and another molar tooth.

Some experts still doubt whether a lower jaw which resembles that of a chimpanzee in several respects should be assigned to a skull which is purely human in its characters. At first there were differences of opinion as to the size and characters of the brain of Eoanthropus. Amongst British authorities there is now agreement that the skull and jaw are parts of the same individual, and that the brain, as revealed by casts taken from the interior of the skull, is human in its size and in all its characters. If we divide living races into three classes according to the size of brain, the large-brained having a cranial capacity above 1,450 cu.c., the small-brained a capacity under 1,350 cu.c., then Eoanthropus certainly reached the upper limits of the small-brained class if not actually a member of the medium-brained group. The brain of Eoanthropus has risen many stages above that of Pithecanthropus; the bone implement affords evidence of manual skill and of inventive ability on the part of its owner. The eyebrow ridges of Pithecanthropus are shaped as in the gibbon, chimpanzee and gorilla; in Piltdown man they are fashioned nearer to the form seen in the skull of the orang. The discovery at Piltdown shows that at the beginning of the Pleistocene period a race of mankind had come by a brain that had reached a human estate, and that this race still retained certain definite simian characteristics in its jaws, teeth and face.

Neanderthal Man.—In 1857 while workmen were clearing out the Neanderthal cave near Düsseldorf, Germany, they found the vault of a fossilised skull and limb bones of a man who proved to be, in the light of further discoveries, a representative of an extinct species of man—*Homo neanderthalensis.* A fossil skull which was dug up at Gibraltar in 1848 is of the Neanderthal type. Fossil remains of the same kind have been found in Belgium (at Naulette, 1866, and at Spy, 1886), but the caves of France have proved the richest source of Neanderthal remains, particularly those in the valley of the Dordogne.

The evidence found at La Chapelle (1908), at La Ferrassie (1909), at Le Moustier (1908) and at La Quina (1911) made it quite clear that this extinct type of man, marked as he was by many simian traits of body, buried his dead with signs of respect. He worked flint implements with great skill, in the style or culture known as Mousterian. He was a hunter and lived in caves and rock shelters. His molar teeth were often shaped in a peculiar manner; his teeth have been found in cave deposits in Jersey (1911) and in Malta (1917). His remains have been found in Moravia (1906) and at Krapina in Croatia (1899–1906). His culture has been found in Italy and in England, but no trace of his body. Only once have fossil remains of Neanderthal man been found outside the limits of Europe, in a cave situated on the western shores of the Sea of Galilee (1925).

Neanderthal man appears to have been the sole occupant of Europe during the middle of the Pleistocene period—throughout the time in which the Mousterian culture prevailed in that continent. The date of this culture may be put down tentatively as extending from 40,000 B.C. to 20,000 B.C.; perhaps its duration was much longer. Remains of Neanderthal man rather more primitive in type, and found in strata older than the Mousterian strata of France, have been discovered at Taubach (1895) and at Ehringsdorf (1914), both of these sites being near Weimar, Germany. *The Heidelberg mandible* was found at a depth of 78 ft. in a sandpit at Mauer, ten miles to the east of Heidelberg, in 1907. The stratum in which it was found belongs to the deeper and older Pleistocene series; this fossil jaw thus represents a race which lived long before the men who practised the Mousterian culture. Yet so like is the mandible of Heidelberg man to that of Neanderthal man, in the majority of its characters, that we may safely regard him as an ancestral representative of the Neanderthal species. In Heidelberg man the canine tooth did not project above its neighbours as in Eoanthropus.

At one time it was believed that Neanderthal man represented an ancestral phase of modern man. Every bone of his body shows distinctive markings, many of these being of a simian nature. His eyebrow ridges were like those of the gorilla and chimpanzee; the roof of his skull was low like theirs, and yet in size of brain he equalled, if he did not surpass, modern Europeans. He had, however, certain specialisations of structure which modern or Neanthropic man does not possess. Besides, the archaeological evidence is now complete that he was replaced in Europe by the arrival of men of the modern kind—represented by people of the Cromagnon type. For these reasons Neanderthal man cannot be regarded as an ancestor of modern man. Neanderthal man and men of the modern type, however, have so much in common that they must be looked upon as descendants of a common ancestor.

Rhodesian Man.—The fossil remains of Rhodesian man which were discovered in the Broken Hill Mine, Northern Rhodesia, in the summer of 1921, also bear evidence to the truth of man's evolution. His fossil remains lay deep in a filled-up cave; he was probably alive in Africa when men of the Neanderthal type dominated Europe. His limb bones show that he was tall, quite 5 ft. 10 in. in height, and stoutly made, after the manner of modern man. His skull, which is complete save the lower jaw, possesses many primitive traits. His brain space was small (1,300 c.c.); in point of development the brain falls below that of Eoanthropus. The eyebrow ridges are extremely massive, and the face has features which recall those of the gorilla. Yet his teeth, although large, are human in every respect and were ravaged by caries. Rhodesian man might well stand as an ancestral type to modern man.

Cromagnon and Other Races.—The Cromagnon type of man and other forms which appear in Europe after the disappearance of Neanderthal man are fully developed men of the modern type; they differ from us only in robusticity of build and strength of jaw. The fossilised, capacious skull discovered at Boskop, Transvaal, in 1913, represents an extinct form of man of the Bushman type. The Talgai skull, derived from a Pleistocene deposit and described by Dr. S. A. Smith (*Phil. Trans.*, ser. B, vol. 208, p. 351, 1918), is of the same form as that of living Australian aborigines, but possesses additional primitive features. Prof. E. Dubois discovered a Pleistocene form of man at Wadjak, Java, one with a very large cranial capacity (*Proc. Roy. Acad. Sc. Amsterdam*, vol. 23, pt. 7, 1920). Such discoveries, although they bear out the truth of evolution, do not throw light on man's evolutionary pedigree.

GEOLOGICAL EVIDENCE OF MAN'S ANTIQUITY

Artefacts in Pliocene Deposits.—If we accept Pithecanthropus as representative of man's estate towards the end of the Pliocene period, then we must infer that man had come by his posture and his gait before the close of the Pliocene period, and that his brain underwent its greatest expansion in the earlier part of the Pleistocene period; an inference which postulates a rapid rate for human evolution. In size of brain Pithecanthropus was approaching the human minimum. It is difficult to conceive him as a maker of tools, yet in geological deposits which were laid down in East Anglia during the Pliocene period Mr. Reid Moir has found flints which must have been shaped by beings which possessed skilled hands (*Pre-Palaeolithic Man*, 1921, *The Great Flint Implements of Cromer*, 1923). Such evidence indicates that other genera of the human family may have marched towards the human goal more rapidly than Pithecanthropus.

The Early Anthropoids.—If man is a descendant of a great anthropoid, and the great anthropoid of a small, then a knowledge of the geological levels at which these two forms occur should throw some light on the date of man's evolution.

The oldest trace of a small anthropoid so far discovered comes from strata of the Fayum, Egypt, laid down in the earlier part of the Oligocene period. The half of a lower jaw with its teeth is all that has been found of this small anthropoid, which was described by Von Schlosser in 1911. He named it *Propliopithecus*, and regarded it as an ancestral form of gibbon (W. K. Gregory, *The Evolution of the Human Dentition*, 1922).

No fossil remains of great anthropoid apes have been found in strata older than those of the Miocene period. Of Miocene great anthropoids, at least nine species have been discovered; one of them, *Sivapithecus*, known from fragments of jaws and teeth found in the Siwalik deposits of India, is regarded as a possible ancestor of man by Dr. G. E. Pilgrim, but a full consideration of the evidence leaves the expert unconvinced. In 1922 a tooth was found in Pliocene beds of Snake Creek Quarry, Nebraska, which has been attributed to an anthropoid ape with human leanings to which the name *Hesperopithecus* was given by Dr. Henry Fairfield Osborn. Unfortunately, the tooth was worn and its true characters hard to decipher; the fact, however, that such competent authorities as Dr. Osborn, Dr. W. K. Gregory and Dr. W. D. Matthew are convinced that a trace of a humanoid anthropoid has been found in America will secure consideration for Hesperopithecus.

Early in 1925 Prof. Raymond Dart announced the discovery of the fossil skull of a young anthropoid ape, found in a limestone quarry at Taungs, on the eastern border of the Bechuanaland Protectorate, near the Transvaal frontier (*Nature*, 1925, vol. 115, p. 195). The geological evidence goes to show that this anthropoid, which Prof. Dart named *Australopithecus*, cannot be older than the beginning of the Pleistocene period, which eliminates it from any place in the line of man's ancestry. Its anatomical characters place it in the same group of anthropoids as that to which the gorilla and chimpanzee belong. In some respects Australopithecus is more human than either of the two living African anthropoids.

Summary.—Thus, taking all lines of evidence into consideration, anatomical, biological, embryological and geological, we are led to the conclusion that man has been evolved from a lower form, and that human races, as we know them to-day, are the products of evolutionary processes. There remain great blanks in the line of evidence which links the origin of modern man to an extinct form of anthropoid ape. Between the highest kind of anthropoid and the lowest type of man, represented at present by Pithecanthropus, there remains a great gap; the transitional forms which fill this gap still remain to be discovered. Yet the evidence as it stands, imperfect as it is, points to man's departure from an anthropoid status early in the Miocene period, certainly 1,000,000 years ago, perhaps more; that in the Miocene and Pliocene periods his body and limbs became adapted to a plantigrade posture; that his brain underwent expansion in the Pliocene, and particularly in the earlier part of the Pleistocene period, and that as the brain reached a full human status the coarser outward appearances of the ape were shed. Of the vital processes which brought about these changes we are as yet ignorant, but it is manifest that in his evolutionary progress man has tended to acquire and preserve in adult years states which appear at first as transient conditions in foetal or infantile stages.

It is becoming clear that the machinery of evolution is that which regulates development and growth, and in these matters knowledge is growing. Experimental embryologists have proved that one group of developing cells can and does regulate the growth and behaviour of a neighbouring group. The theory of hormones has thrown a flood of light on the machinery of evolution (Prof. Chas. R. Stockard, *Publications of Cornell University Medical College*, 1924, vol. 10; Keith, *Supplement to Nature*, Aug. 18 1923). It has been proved that substances or hormones are carried by the circulation throughout the living body from a series of glands which include those of reproduction, the adrenal, the thyroid, the pituitary and pineal, and that the substances thus liberated in the body do control its vital reactions and its structural form.

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MANAGEMENT: *see* SCIENTIFIC MANAGEMENT.

MANCHESTER, England (*see* 17.544), has an area of 21,688 ac. (including areas incorporated in 1910 and 1913), and an estimated population of 761,320. Since 1918 10 members have been returned to Parliament, and the city was brought entirely under one board of guardians in 1915 and one board of overseers in 1916. The birth-rate varied between 1·86 and 2·37 in 1921–5, and the death-rate between 1·36 and 1·44.

Housing and Improvements.—Several housing schemes, including a number of wide new roads, have been undertaken, the largest being at Blackley, Moston, Wilbraham Road, Anson and Gorton, but the house shortage was still acute in 1926, although more than 5,300 houses had been built by the municipality since 1919, besides those erected privately. The council aim at completing 10,000 more by 1930, and had under consideration the question of the purchase of a site of 4,500 ac. in rural Cheshire beyond and to the south of the city limits. In this area stand the Wythenshawe Hall and grounds (comprising 250 ac.), presented to the corporation for park purposes. A number of large parks and open spaces have been acquired, and include Cringle Fields, Burnage (54 ac.); Broadhurst Park, Moston (84 ac.); Fletchermoss Playing Fields, Didsbury (21 ac.); and Green Bank Fields, Levenshulme (24 ac.). New parks are planned for Withington (48 ac.) and Chorlton-cum-Hardy (37 ac.), which have grown rapidly since the World War.

New Buildings.—The Horsfall education museum, Ancoats Hall, has been transferred to the corporation; the old parsonage, Didsbury, was opened as a branch art gallery in 1923; and Platt Hall was handed over in 1925 as a branch art gallery and museum. A new art gallery, surrounded by a wide, open space, for which the design was approved in 1925, is to be built on the site of the old Royal Infirmary in Piccadilly. The infirmary has been moved to Oxford street, and several other hospitals have been built in its vicinity. A large Wesleyan hall and institute was opened in Peter street in 1910, the Y.M.C.A. building in 1911 and the Church House in Deansgate in the same year. The Exchange was extended and reconstructed in 1914–21; the historic Free Trade Hall in Peter street was bought by the corporation in 1921, and plans were made in 1925 for the extension of the town hall, to include the central library, then in temporary buildings on the Piccadilly site.

The new office being erected in King street in 1926 for the Ship Canal Co. will be the highest commercial building in the city. A textile institute, with its headquarters at St. Mary's Parsonage, was founded in 1910; and a British Cotton Industry Research Assn., with offices and laboratories at Didsbury, in 1919. Premises are to be built at Fallowfield for the grammar school. A radium institute, the first in the country exclusively for the use of radium in hospital treatment, was opened in Nelson street in 1921. A statue of King Edward VII. was unveiled in Whitworth Park in 1913, one of Abraham Lincoln in Platt Fields in 1919 and a large war memorial on the foundations of old St. Peter's church in 1924. Playing fields and a pavilion have been acquired at Stretford as a memorial to men of the Manchester Ship Canal Company.

Public Works.—Two additional pipe-lines have been laid from Thirlmere, and the North Cheshire Co.'s water undertaking was purchased in 1921. In 1925 a beginning was made with the large Haweswater scheme, to involve 84 m. of aqueducts, tunnels and pipes. It is hoped to finish the work by 1934. A new electric power station was opened at Barton in 1923, and in 1925 it was decided to double its capacity. Parliamentary powers were obtained in 1921 for the construction of a large gas-generating station at Partington, and the present stations in the city will eventually be used only for distributing. Parliamentary powers were also obtained, in 1911, for a comprehensive scheme to result in the whole drainage of Manchester being carried to works at Davyhulme. In 1925 the possibilities of an electric underground railway were under discussion.

Port Improvements.—In 1925 there were eight docks with a water area of 120 ac. and 5¾ m. of quays in the port. Trafford Wharf was rebuilt and re-equipped in 1924, and in 1925 the last five miles of the Ship Canal were being deepened to allow vessels drawing 28 ft. to come up to Ellesmere Port. Road and railway improvements were also in hand at Ellesmere Port, which is leased by the Ship Canal Co., more wharves are to be built, and the company have acquired 1,000 ac. of land for industrial development. The corporation have determined to undertake a comprehensive civic survey. When the survey has been completed, recommendations will be made as to future action in matters municipal, social, economic, housing, parks, recreation facilities, commerce, industry, communications, and transportation.

Though best known as the business and warehousing centre of the cotton industry, Manchester has also become a great manufacturing and distributing centre for chemicals and dyes, and is one of the chief ports for importing oil. Some of the greatest engineering workshops in the world are in the city or its immediate neighbourhood. Motor-cars and commercial vehicles are made, and rubber manufacture and the ready-made industry are extending. (O. J. R. H.)

MANCHESTER, VICTORIA UNIVERSITY OF (*see* 17.545).—The development of the University of Manchester during the 20th century, in common with that of the other English universities, has been greatly affected by the War. At the same time, valuable contributions both to the defence of the country and to knowledge were made, especially by the scientific, technological and medical staffs who were called upon to face problems raised by the War. The number of students, which had reached 1,691 in 1910, increased immediately after the conclusion of hostilities, and in 1920 was 2,900. It had in 1926 apparently stabilised itself at about 2,500. Perhaps the most significant feature of this increase was the continued growth of the number of women students—730 in 1926 as against 336 in 1910. The botanical and physical laboratories and the extensions of the museum and library, completed during the four years 1910–4, were followed by the erection of a building to house most of the departments of the faculty of arts (1919), while new accommodation was provided for the metallurgical department, and the medical school was internally reconstructed. The continued growth of the library, which contains over 200,000 volumes, led to further extension, and a bequest of Mr. Jesse Haworth made possible the erection of a new wing of the museum, to provide galleries for the exhibition of the valuable ethnographical collections made by the late Mr. Charles Heape and presented by him to the university in 1923.

Developments.—An appeal for funds in 1919 produced a sum of £250,000, and this made it possible to satisfy some of the needs rendered urgent by post-War conditions. New chairs have been instituted in Russian and Italian, in addition to a second chair of French. The lectureship in textile technology has been raised to the status of a professorship, and a similar development has taken place in psychology and in commerce and administration. A chair in English language has been instituted in addition to that in literature, and the second chair in law and the chair of comparative religion have been revived. The institution of a faculty of education in 1914, with a post-graduate degree of master in education, led to interesting researches in educational method and administration, and the faculty received a valuable addition by the endowment by Sir James E. Jones of a lectureship in the training of teachers of the deaf. The same donor also endowed a hall of residence primarily for the accommodation of women students preparing for the certificate instituted in that subject. A gift from the Carnegie United Kingdom trustees led to the establishment of a special library available for teachers and others interested in the education of the deaf.

The university athletic grounds have been extended. They now cover 28 ac. and possess a finely equipped pavilion. The facilities for the residence of the men students have been increased by the recognition of two more halls; while for women students three new halls have been recognised, and the existing Ashburne Hall has been extended to accommodate about 130 students. This extension, opened in 1925, includes a central block, providing a large hall, and beneath it a library in which have been placed the 8,000 volumes bequeathed by Lord Morley for the use of women students of the university. Closer relations between the university and the local education authorities have been established. There are three county and eight municipal authorities contributing annual grants.

The resignation of Lord Morley as Chancellor of the University took place just before his death in 1923. The Earl of Crawford and Balcarres was elected as his successor. Sir Henry A. Miers, previously principal of the University of London, and appointed vice-chancellor of the University of Manchester in 1915, retired during 1926. Mr. W. H. Moberly, principal of University College, Exeter, was appointed to succeed him.

MANCHURIA (*see* 17.552).—In 1911 an agreement was concluded by the "Four Nations" consortium, to finance the development of Manchuria, but was blocked by Russia and Japan until their participation under conditions which secured to them continuance in their privileged position had been conceded. A treaty in 1911 and an agreement in 1916 further strengthened Russia's position in North Manchuria, while the formal annexation of Korea by Japan in 1910 placed the numerous Koreans in Manchuria under Japanese consular jurisdiction. By the beginning of 1911 the "peaceful penetration" of Manchuria and Eastern Inner Mongolia was proceeding steadily and under conditions generally similar to those which had characterised Russia's forward policy from 1898 to 1905.

In 1912 the railway from Changchun to Kirin was opened to traffic. In May 1915, by the terms of a new treaty concluded by China as the result of the Japanese ultimatum accompanying the "twenty-one demands," the lease of the South Manchurian Railway and of the Antung Mukden line was extended to 99 years (*i.e.*, to 2002 and 2007 respectively). By the same treaty Japanese subjects became entitled to lease land for trade, manufacturing and agricultural purposes, and to reside and travel freely in South Manchuria. By notes exchanged as the result of the same "twenty-one demands" China was to permit Japanese subjects to open more mines in South Manchuria. No foreign loans were to be made for the construction of railways in South Manchuria and Eastern Inner Mongolia without the preference being given to Japanese capitalists; preference was to be given Japanese in employing foreign advisers in South Manchuria; and other promises were made favouring the Japanese. In 1917 the whole of the railway system of Korea was linked up with the South Manchurian Railway and placed under its administration. Under these conditions the activities and influence of the railway rapidly became dominant factors in the economic life of Manchuria. In 1916 Japan and Russia agreed by treaty to support each other's rights and interests in the Far East.

In Dec. 1915 a loan agreement was signed between the Chinese and Japanese Govts. for the construction of a railway from Ssupingkai (120 m. north of Mukden) to Chengchiatun; this line was completed in Dec. 1917. In Oct. 1917 a revision of the Changchun-Kirin loan agreement was concluded between the Chinese Govt. and the South Manchurian Railway Company, the result being a loan of 6,500,000 yen for a term of 30 years, during which period the management of the line is vested in the South Manchurian Railway, on behalf of the Chinese Government. In 1918 there were agreements with Japanese interests for the development of mines and forestry and for the construction of four railways.

Russo-Japanese Rivalry.—The disorganisation of the central Government in China and the collapse of Russia after 1917 served to increase the economic, financial and political ascendancy of Japan in Manchuria. For example, after China's entrance into the World War, some of the loans made to Japanese by the Peking Govt. had as security properties and resources in Manchuria. As a result, however, of the negotiations initiated by the United States in July 1918 for the establishment of a four-Power consortium to co-operate in Chinese finance, and of the subsequent *pourparlers* between the British and Japanese Govts. on the same subject, the latter finally agreed (May 1920)—with some important reservations—to withdraw the claims, previously put forward by the Japanese bankers, to exclude from the scope of the Consortium "all the rights and options held by Japan in the regions of Manchuria and Mongolia where Japan has special interests." Japan's power in South Manchuria, however, continues to grow, but at the same time the Chinese have by no means given up control, for they continue to form the great majority of the population, and the provincial organisation and administration are actively maintained. The dominant Chinese figure in Manchuria has increasingly been Chang Tso-lin. General Chang, in 1924 still in middle life, had once been connected with a band of Hunghutze, or bandits, but he had been taken into the service of the Chinese Govt. and in 1911 he was military Governor of Fengtien. From then on, his power grew until by 1920 he was one of the major figures in the Chinese political situation, and Manchuria had become virtually a semi-independent principality under his control. Russian influence, moreover, did not disappear with the collapse of the old régime. For a time it was weakened, but with the establishment of regular diplomatic relations between the Soviet Govt. and China in 1924, Russian power, while by no means fully restored, was again increasing.

Despite an agitation in Japan, the Japanese Govt. has maintained its policy of strict neutrality in the civil war—a policy reiterated by Baron Shidehara, the Japanese Minister for Foreign Affairs, in the Diet in Jan. 1926. Some alarm seems to have been aroused in Moscow by a contract given in April or May of 1925 by Chang Tso-lin to the South Manchurian Railway Company for the construction of a line from Taonanfu in Inner Mongolia to Tsitsihar in northwest Manchuria on the ground that it invades the old Russian sphere of influence in North Manchuria. Rapid progress was made by the Japanese with this railway which was expected to be open for traffic as far as the Nonni river by Aug. 1926. The Soviet authorities are also reported to have protested against the strengthening of the Japanese forces in North Manchuria in 1925 as a violation of the spirit of the Japanese-Soviet Treaty of 1924. (*See* CHINA; CHINESE EASTERN RAILWAY.)

Trade Statistics.—The economic progress achieved in Manchuria had been very rapid since 1912. This might have been expected in regions with vast undeveloped resources and with an increasing, industrious population. Much of the expansion of its trade and industries must also be ascribed to the enterprise shown by the Japanese in the development of mines, forestry and agriculture, and in improving transport, communications and currency.

Figures show the rapid increase of South Manchuria's trade and reflect the effects of the Russian débâcle upon the commerce of the northern province. In 1916 the maritime customs receipts in the northern provinces were 21 % of the total for Manchuria. In 1920 they were 12 % of the total, and in 1922 17 per cent. In 1919 the total direct foreign trade of Manchuria was taels (Hongkong) 299,523,736 and in 1922 it was 285,861,094. Dairen (Dalny) now ranks second only to Shanghai in the list of China's maritime ports. In 1922, 56·5 % of Manchuria's direct foreign trade passed through Dairen (Dalny). In 1908 the trade of Manchuria represented 11·5 % of China's total; in 1918 the proportion had risen to 16·8 %; in 1922 it was 17·5 per cent. Naturally the bulk of South Manchuria's foreign trade was with Japan. The anarchical conditions prevailing in Russia and Siberia after 1917 served to increase Japan's economic and financial influence in Northern Manchuria, the rouble note being replaced in many parts of the country by the yen notes of the Bank of Chosen, which in Jan. 1918 was given control of the treasury business of the Japanese Govt. in Manchuria. At the end of 1918 this bank had 18 branches operating in Manchuria (as against 10 in Korea), and notes in circulation to the amount of 30,000,000 yen. According to the statistics compiled by the South Manchurian Railway, the population of Manchuria in 1916 was 20,112,100. The post office estimate for 1922 was 22,083,434. (*See* CHINA.)

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(K. S. L.)

MANDATE.—The mandate system is a term applied to the conditions set up by the Treaty of Versailles for the administration of the former overseas possessions of Germany and Turkey. Mandatory Powers are those Powers which were selected by the Supreme Council of the Allies to administer these territories under mandate. The system is a novel experiment in the relations between a sovereign State and a country under its control, involving new departures in international law. It was created by Art. 22 of the Covenant of the League of Nations, which formed part of the Treaty of Versailles, and has thus gained the recognition of all States that are members of the League.

In its origin it was in the nature of a compromise. After the War the victorious Allies naturally wished to retain the German and Turkish colonies, in the conquest of which they had in most cases made great sacrifices. It was believed that these colonies had been subjected to misrule; pledges had been made to the native inhabitants, some of whom had taken part with the victors in the fighting, that they should not be handed over to the vengeance of their former masters; and finally, a misgiving existed lest, in case of rendition, Germany might use them as recruiting grounds for black armies, and their ports as bases for submarines in a future war. On the other hand the Allies had declared—more particularly in the pre-Armistice statement of Nov. 5 1918—that annexation of territory was not their aim in the War.

International control of some kind was the only alternative. Joint administration was condemned as impracticable and opposed to the interests of the people. Even as a condominium between two Powers only, it had given rise to friction in Egypt, Samoa and the New Hebrides. The only other course lay in the appointment of an individual Power in whom could be vested responsibility for the administration of each separate territory as an agent, or mandatory, of the League. For this course there were analogies in the delegation of quasi-sovereign powers to British and Dutch chartered companies and in the control of the Ionian Is. on behalf of the Powers by Great Britain in 1859. Individuals also had been appointed as mandatories of the Powers, as when King Leopold undertook control of the "International Free State of the Congo," or when Prince George of Greece was made Governor of Crete in 1898.

The main defect of these delegations of sovereignty was that they provided no machinery to ensure the due execution of the trust, and it is the distinctive feature of the mandate system that it attempts to remedy this defect. The League of Nations afforded just such a supervisory authority as was needed, and its supervision is exercised through the medium of a standing committee, known as the "Permanent Mandates Commission." The League had nothing to do with the assignment of the mandates or with their terms, or with the extent and boundaries of the territories. These were determined by the Supreme Council. The United States, not being a member of the League, was no party to this arrangement, and she insisted that as an Associated Power her consent was necessary. The mandates therefore were submitted to her, and approved on condition that "free and equal treatment in law and in fact was secured to the commerce of all nations." Where the mandate did not ensure this she negotiated separate treaties with the mandatory concerned.

Terms of the Mandates

The mandates were formed to give expression in detail to the principles embodied in Art. 22 of the Covenant (*q.v.*), and since that article prescribes that their character must vary with the varying conditions of each territory they were divided into three classes to correspond with the three paragraphs of that article.

Class A includes the former Turkish vilayets of 'Iraq, Palestine and Syria whose independence "can be provisionally recognised, subject to the rendering of administrative advice and assistance until they are able to stand alone." The two former were assigned to Great Britain, the latter to France.

Class B comprises the ex-German Central African colonies—Togoland, Cameroons, Tanganyika and Ruanda—in which the mandatory is responsible for the administration and undertakes to promote the moral and material welfare of the people. Tanganyika, and a small part of the Cameroons and Togo fell to Great Britain, the major portions of the two latter being assigned to France, while Belgium became responsible for Ruanda.

Class C territories include those which "can best be administered under the laws of the mandatory as integral portions of its territories, subject to the safeguards in the interests of the indigenous population" which are laid down for Class B. They are South-West Africa, Samoa, New Guinea, the islands north of the equator in the West Pacific and the tiny island of Nauru. For these respectively the Union of South Africa, New Zealand, Australia, Japan and the British Empire accepted mandates.

In the case of Nauru, Great Britain, Australia and New Zealand had by agreement in July 1919 (before the issue of the mandate), jointly acquired control of the phosphate deposits, which constitute the sole value of the island, and they jointly undertook the execution of the mandate. Since, however, the British Empire has no single code of laws, the administration was assigned by the two others to Australia for five years.

The "safeguards in the interests of the indigenous population" to which reference is made are: (1) freedom of conscience and religion, subject only to the maintenance of public order and morals; (2) prohibition of abuses such as the arms and liquor traffic and the slave-trade; and (3) prevention of fortifications, naval and military bases, and the military training of natives except for police and the defence of the territory.

The mandates were conferred by the Supreme Council of the Allies, and after acceptance by each mandatory were submitted to the Council of the League, which was charged with the duty of seeing that their terms were in accord with the Covenant. They were finally approved by the United States. The A class could not be issued until the Treaty of Lausanne came into force (Aug. 1924). Meanwhile an Arab government had been set up in 'Iraq, and a treaty had been concluded by Great Britain with it. On Sept. 27 1925 the Council formally accepted the undertaking of the mandatory to see that the terms of this treaty (which embodied the obligations of the Covenant) were adhered to, and this undertaking was substituted for the mandate. These long delays were very prejudicial to the welfare of the people of Asia Minor. The territories were, however, administered in accordance with the terms of the Covenant or under draft mandates. These terms are explicit. The mandate is a "sacred trust of civilisation" to be assumed by nations who (*inter alia*) "by reason of their resources can best undertake this responsibility and are willing to accept it." The altruistic nature of this pledge was confirmed in a reply to a German protest. "The Mandatory Powers," said the Allies, "in so far as they may be appointed trustees by the League of Nations, will derive no benefit from such trusteeship."

A mandated territory differs from a protectorate in that the protecting Power in the latter obtains rights over the population and against other Powers, whereas a mandatory in its capacity as guardian assumes obligations both toward the population and the League. These thus acquire rights as against the mandatory.

League Control.—The system, it has been said, differs from such partial precedents as have been cited, in that it attempts to set up machinery by which the proper execution of the mandate may be assured. This consists in the unqualified right of supervision vested in the League which imposes upon each mandatory the obligation to submit an annual report on its administration.

The Permanent Mandates Commission examines these reports in the presence of an accredited representative. The commission consists of nine members of the following nationalities: Belgian, British, Dutch, French, Italian, Japanese, Portuguese, Spanish and Swedish—to which has recently been added an "additional member" (Swiss). The majority are nationals of non-mandatory states. They are selected "for personal merit and competence" as private individuals, and not as representatives of their respective nations. They are nominated by their governments, but approved and appointed by the Council of the League, and may not hold any office under their government. A representative of the International Labour Office attends the sessions, and takes part in any discussions relative to labour. This international composition negatives any suspicion of bias, and gives to the commission the aspect of an impartial tribunal of practical men, whose object it is to promote co-operation while fearlessly exposing any breach of the Covenant. Its functions are purely advisory to the Council.

A permanent secretariat, under a director, collects and circulates all documents of interest concerning mandates and conducts the routine business. The duties of the commission are not confined to the annual review of the reports of the mandatories. It receives any petitions and memorials from inhabitants of the territories and others interested, and these, unless trivial or irrelevant, are forwarded to the mandatory concerned before examination by the commission, which also makes a special study of questions arising either in relation to the system or to the various problems of administration. Notes for guidance in preparing their reports are circulated to mandatories, dealing with such matters as slavery, labour, traffic in arms, liquor and drugs, liberty of conscience, the judicial system, military forces, economic equality, education, public health, land tenure, public finance and matters relating to general administration and the moral and material welfare of the people. The proceedings are conducted in French and English, and are generally held in private to facilitate freedom of discussion. Full minutes are printed, which, together with the memoranda on special subjects and all other pertinent papers, can be obtained from the League publication department, or from its agents in London and other European capitals. The Commission meets at least twice in the year at Geneva, and its procedure is governed by rules approved by the council.

The weak point in the system lies in the impossibility of independent verification of statements contained in the reports. This difficulty is inherent in the circumstances, for it would clearly be impossible either for the whole commission or any part of it to visit a mandated territory officially, and to sit in judgment on the policy of a Sovereign Power. Even an official visit for the purpose of acquiring information would be of doubtful wisdom, as tending to weaken the prestige of the mandatory and to afford opportunity for malcontents to manufacture grievances. For information not contained in the report, therefore, the commission must rely on those public bodies or individuals who interest themselves in the welfare of native races, and on such memorials and petitions as may be presented to it.

The sole means at its disposal—or at the disposal of the League—for compelling the proper execution of the mandate is the force of public opinion, though in case of deliberate violation of the mandate and of gross maladministration, the council could no doubt send a commission of enquiry, and in theory the legal possibility of revocation for failure on the part of the mandatory to fulfil its contract no doubt exists. In order to obtain more accurate information, the actual administrators now generally appear as the mandatory's representatives. Steps are also being taken to secure a wider distribution of the sessional papers of the commission, with a view to enlarging the orbit of well-informed public opinion and perhaps of exerting an influence on the standards of colonial administration.

Interpretation of Article 22.—The creation of the mandates system—though a task of enormous importance, involving issues new to international law and affecting the destinies of many millions of the human race and of property in every quarter of the globe worth many hundreds of millions sterling, was only one of the many preoccupations of the Versailles Conference. Owing to the circumstances of the moment many matters of less permanent and historic importance claimed an undue attention. Critical examination and practical experience have therefore detected many points which require elucidation or authoritative interpretation. In some particulars, for instance, the mandates do not strictly conform to the terms of Article 22. In the A mandates the treaty enjoins that "the wishes of the communities must be a principal consideration in the selection of the mandatory," and it is common knowledge that the communities concerned were never consulted. The paragraphs in Art. 22 on which the B and C mandates were framed do not contain any similar injunction, though explicit statements to the same effect had been made.

Military Service.—Again, the French mandates in West Africa —unlike the British mandates for portions of the same territories (Cameroons and Togo)—contain a clause to the effect that "troops thus raised" (*i.e.*, for purposes of local defence and police) "may in the event of general war be utilised to repel an attack, or for defence of the territory outside that subject to the mandate." It is difficult to reconcile this clause with the words of the Covenant. At the instance of the Mandates Commission the British Govt. was willing to go even further than the Covenant prescribes, and to agree to pledge itself not to enlist the natives of a mandated territory, even though they offered themselves for enlistment outside its frontiers—thus limiting its sovereign rights in adjacent territories not under mandate. The French Govt. has declared its willingness to accept the same restriction.

The original intention of the treaty would seem to have been to exclude all mandated territories and their inhabitants from participation in a general war; but the mandates for Palestine and Syria authorise the mandatory "to make use of the ports, railways and roads for the passage of its troops and of all materials, supplies and fuel," and local forces may be used for purposes other than defence. These countries thus automatically became involved in any war in which the mandatory may be engaged. It is not clear what is the position of the C mandates in this regard.

Liquor Traffic.—The Covenant enjoins the "prohibition of abuses such as the slave-trade, the arms traffic and the liquor traffic." Some have urged that these words mean the enforcement of total prohibition alike for natives and non-natives. The mandates, however, only prescribe a "strict *control* over the sale of spirituous liquors," and the St. Germain Convention (Sept. 1919), concluded soon after the Versailles Treaty by the same signatories, forbids the import of "trade spirits" only. Relying on these facts, others contend that the term "liquor traffic" is used in the Covenant in the technical sense in which it is usually employed in West Africa, and means the "importation of cheap, distilled liquors for sale or barter as an article of trade with the natives." The Mandates Commission has consequently asked the council for an authoritative definition of this and other ambiguous terms used in the Covenant.

In the matter of equal commercial opportunity for all nations, the Covenant itself failed to fulfil the expectations raised by the pre-Armistice declarations of the Allies. No obligation in this regard is imposed in the C mandates, while in the B class it is restricted to States which are members of the League.

Legal System.—The essential distinction between the B and C classes of mandates, in the terms of Art. 22, lay in the dictum that the latter "can best be administered under the laws of the mandatory, as integral portions of its territory," but the British and French mandates for Cameroons and Togo, and the Belgian mandate for Ruanda (all of the B class) contain a clause in identical terms.

Boundaries.—Yet another cause of practical difficulty is presented by the fact that in many cases the boundaries of the territories assigned under mandate were not defined, and it was apparently left to the individual mandatories to adjust them without reference to the League. In the case of 'Iraq this has led to an acute dispute with Turkey. In Palestine the boundaries of Trans-Jordania are still undefined. In Northern Syria the French, having, as it was understood, agreed to accept a mandate for Cilicia, abandoned it to Turkey without apparently any authority from the League to do so, and the frontiers are still indeterminate. So again in Ruanda, where an adjustment, involving the cession of a considerable area by Great Britain to Belgium, was effected and approved by the League. On the northern frontier of South-West Africa negotiations are in progress between the Union Govt. and the Portuguese.

Sovereignty.—Wider issues are raised by such questions as the nature and extent of sovereignty exercised by a mandatory and the international status of the inhabitants of a mandated territory. The former—which has been much debated by American publicists—is rather academic and juridical than of practical interest. It suffices for practical purposes that the mandatory has the absolute right to make and enforce laws, to raise troops, to set up tribunals, to appoint officials and to raise and spend revenues. Sovereignty was not ceded by the Treaty of Versailles to the League, but to the victorious Allies—indeed the highest court in South Africa has recorded the opinion that the territories were not ceded at all, but placed by Germany at the disposal of the Allies, to be administered under mandate—a status new to international law.

The mandatory's powers are exercised "in its capacity as such." It has, for instance, been satisfactorily established by the Mandates Commission that such terms as "crown (or state) lands" and *domains d'état*, where they appear in local ordinances, refer only to lands which are the property of the mandatory as such, in other words, to the mandated territory, and that any action on the part of the mandatory which had for its object (or would ultimately involve) annexation—as for instance the acquisition of large monopolistic rights, or of essential public services—would be contrary to the spirit of the Covenant and the mandate.

Status of Natives.—The status of the indigenous inhabitants of a B or C mandate territory has on the other hand been the subject of special definition. Obviously, since the country is not annexed, they do not become the subjects of the mandatory. The formula was therefore adopted by the Council that "they should be designated by some form of descriptive title which will identify them as such," viz., as "persons administered or protected under mandate." This confers no juridical status, and no privilege of citizenship, but Art. 327 of the treaty stipulates that they should be entitled to the diplomatic protection of the mandatory when outside the mandated territory, and individuals may if they so desire become naturalised subjects of the mandatory. Since residents in a British Protectorate cannot acquire British nationality, and since a person "protected under mandate" could not be placed in a more favourable position in such a matter than a resident in a British Protectorate it was decided at an Imperial Conference that the power of granting certificates of imperial naturalisation should be extended to persons resident in certain named protectorates, and in mandated territories. Extradition treaties with France have similarly been extended, the natives being regarded for this purpose as "assimilated" to those of a colony.

The application to mandated territories of special conventions, entered into by a mandatory Power, has also been the subject of investigation and recommendation by the Mandates Commission, in order to ensure that "persons protected under mandate" shall not be in a less favourable position in regard to their persons and property and their economic interests than the inhabitants of a protectorate or colony.

Permanence of Mandates.—The revocation of a mandate for maladministration, though theoretically possible, is in practice unthinkable. Voluntary transfer or abandonment (with the sanction of the League) is hardly more conceivable. The terms of the Covenant therefore contemplate self-government as the natural fruition of the mandate—in the case of the A class at no distant date. The new state—as is proposed in the case of 'Iraq—would then take its place as a member of the League, or perhaps, as in the case of South-West Africa, would be federated with the mandatory.

Conclusion.—The mandate system enforces, for the first time in history, the principle of trusteeship, and of public responsibility to a supervising authority for the obligations laid down in the trust deed in regard to mandated territories. The annual report forms an effective means of inviting a popular verdict on the fulfilment of the trust, and this supervision constitutes a fundamental distinction from annexation, whatever the degree of assimilation to other possessions of the mandatory. The League exercises supervision but not control, for the ultimate authority to which the stewardship of the mandatory is submitted is the public opinion of the civilised world. The standards of the Covenant must obviously in the future be regarded as principles of general application. The mandate system is an international acknowledgment of the responsibility which the advantages of a superior intellectual culture and twenty centuries of Christian ethics no less than the physical superiority conferred by the monopoly of firearms impose upon those Powers which have accepted control of backward races. *See* LEAGUE OF NATIONS.

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(F. D. L.)

MANGANESE (*see* 17.569).—The principal use of manganese is in the manufacture of iron and steel, about 95% of the world's production of manganese ores, manganiferous iron-ores, and manganiferous zinc residuum being consumed in metallurgical processes. Its chief chemical uses are as a constituent of oxidising agents and colouring materials, and as a flux in the smelting of silver and lead ores. Salts of manganese are used as fertilisers and massive rhodonite as an ornamental stone. Manganese is also used for medical purposes. Ores of the metal are widely distributed, but deposits of commercial importance are known only in a few countries. The principal of these are Russia (Caucasus), the ore of which consists mainly of pyrolusite; India, Brazil and West Africa. Minor producers of the metal are Italy, Spain, the United States, Cuba and Japan; while deposits are also known in Germany, Greece, Egypt, Canada, Mexico, Colombia, Chile and Queensland.

For many years before the World War, Russia was the main producer, the figures for 1913 being 1,234,900 tons. The Russian industry suffered severely during and after the War, however, and the export figures in 1923 had fallen to 407,401 tons. These figures, however, represent a considerable advance on those of the years immediately preceding. The circumstances which acted so detrimentally to Russia imparted great impetus to the Brazilian manganese industry, the United States absorbing practically the whole of the much increased output of the South American States. In 1916 the United States obtained 80%, and in 1917 83%, of its manganese ore from Brazil. In the Morro de Mina mine, in the state of Minas Geraes, Brazil has what is probably the largest manganese mine in the world.

Production in India began in 1892, in the Madras Presidency, but in 1899 rich deposits were discovered in Central India and from this date the industry in India assumed importance. The India ore is more suitable for blast furnaces than the softer ores of the Caucasus, and, owing to more careful selection, is exported in more uniform quality. Its main constituent is psilomelane, with an important amount of braunite.

In the Gold Coast, West Africa, large deposits of manganese were discovered at Dagwin, near Taquah. Work was commenced here in 1916, and the first shipment of 174 tons made in the same year. In 1923 the production had risen to 139,634 tons. The Dagwin mineral generally is psilomelane, though pyrolusite is occasionally found. The average percentage of manganese plus iron is 55–56.

Production of Manganese by Principal Leading Countries.
Quantity (long tons)

Country	1913	1918	1923
India	815,047	517,953	695,055
Gold Coast	..	30,292[1]	139,634[1]
Russia and Georgia	1,234,900	150,000[2]	407,401
Italy	1,596	31,383	9,451
Austria	16,280	177	23,647
Brazil	120,335	387,066	232,041
Spain	21,247	76,465	28,175
United States	4,048	305,869	31,500[1]
Japan	17,755	56.109	4,926

[1] Shipments. [2] Georgia only.

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MANGIN, CHARLES EMMANUEL (1866–1925), French soldier, as born at Sarrebourg, Moselle, July 6 1866 of a military amily, his father having been a general of division. ne of his brothers was killed on active service at Tongking; hile another, formerly a White Father but during the War a ergeant in the Senegalese Tirailleurs, died in the North African esert a few months after the Armistice. Mangin, himself, was ot unworthy of his family history. He left the École Spéciale ilitaire at Saint Cyr in 1888 for Africa, and with the exception f three years spent in Tongking, and 10 months in France, he emained for 26 years in different parts of Africa. In 1891 he ecame a lieutenant, in Nov. 1897 a captain, in Jan. 1900 the ommander of a battalion, in Dec. 1905 lieutenant-colonel, nd later, colonel. In Aug. 1913 he was promoted to the rank of eneral of brigade. His travels in Africa were extensive; he isited Dahomey, Senegal, the Sudan, the Congo, Morocco and ake Chad. He was a member of Marchand's expedition and vas one of the legendary company who were said to have narched "for three days without a halt." It was he who, at the ead of 5,000 men, routed the bandit El'hiba and all his followers n the plain of Ben Guerir and so relieved Marrakesh. His coniderable literary abilities, which he had rarely the leisure to xercise, were also devoted to Africa; and his book, *La Force oire* (1910) brought home to Frenchmen the immeasurable esources of their empire.

When the World War broke out General Mangin was 48 years f age. At first in command of the 8th Brigade and, after April 1916, of the 5th Infantry Division, he threw the enemy back pon Douaumont, which he reached on May 22. Five months ater, on Oct. 24, he hurled two divisions against the Germans and ook Douaumont and Vaux. In 1917 he was in command of the . Army, and in the following year at the time of the April ffensive the Supreme Command imposed upon him the hard ask of checking the German offensive directed against Comiègne. Eight fresh divisions were entrusted to him, and with hese 60,000 men he checked von Hutter's advance at Noyon. ubsequently he was entrusted with the X. Army and was rdered, in conjunction with General Degoutte, to break in the erman salient south of the Aisne. This he accomplished; the hemin-des-Dames, the Château de Coucy and Laon were uccessfully re-occupied. At the time of the Armistice, he would ave been the first to enter Metz at the head of his troops, in ompany with Marshal Pétain, had not an unfortunate accident t the last moment prevented this. For a year he commanded the rmy of Occupation on the Rhine. In June 1921 he was sent as mbassador Extraordinary to represent France at the celebrations f the centenary of Peruvian independence.

General Mangin held the Grand Cross of the Legion of onour, was a member of the Supreme War Council, was nspector General of the Colonial Forces, and presided over the upreme Council for National Defence. But his life work was to evelop to the maximum his country's African resources. He ied on May 12 1925, and was buried with military honours in he Montparnasse Cemetery. Above his head stands a simple tone bearing this inscription: "Ici repose un soldat français." (M. Gu.)

MANIPULATIVE SURGERY.—The earliest practitioners of bone-setting"—the old misnomer for what is now more corectly described as manipulative surgery—date back into very emote times, and Hippocrates, although not versed in a knowldge of structural anatomy, was the author of a treatise on disocations which will bear comparison with many presentlay publications on the subject. The history of the Roman epublic tells of successful practitioners of this ancient craft.

During the years when surgery was gradually being regularised and its seats of learning were being established, "bone-setters" were the only orthopaedic surgeons of those days, and the doctors apparently countenanced them as legitimate exponents of that section of therapeutics. The famous surgeon, William Cheselden, in the middle of the 18th century, who was a warden of "The Master Governors and Commonalty of the Art and Science of Surgeons of London" used to send cases to the bone-setters for treatment, and frankly admitted that he did so because he was not competent to treat them himself.

Hunter's Attitude.—The renowned surgeon, John Hunter, with great foresight and acumen, was amongst the first of eminent surgeons to realise the value of early movements in cases of sprains and joint injuries. He wrote: "Nothing can promote contraction of a joint as much as motion before the disease is removed, but when all inflammation is gone off . . . a little motion and frequently repeated is necessary to prevent healing taking place with the parts fixed in one position."

Paget's Advice.—The world of conservative surgery owes an unpayable debt of gratitude to Sir James Paget who, in his desire for the public weal and the true interests of science, wrote to *The British Medical Journal* in January 1867, urging his professional brethren to "learn what was good in the methods of the bone-setter, and eschew what was harmful." Paget stood on firm ground and spoke with unshakable certitude when he declared that "too long rest is by far the most frequent cause of delayed recovery after the injuries of joints, and not only to injured joints but to those that are kept at rest because parts near them have been injured." But notwithstanding the high position in the profession of this far-seeing practitioner, his exhortations passed almost unheeded and the tradition of rest persisted in spite of its frequently disastrous results.

Later, Dr. Wharton Hood, who had conceived the greatest admiration and respect for Robert Hutton, the bone-setter, and who recognised the false teaching of his profession in regard to many forms of joint injuries and derangements, made a thorough investigation of Hutton's methods, and after the bone-setter's death published a description of them in *The Lancet.* But Wharton Hood's motives were wrongly interpreted. He was accused of associating with a "quack," and prejudice once more dealt a heavy blow at the progress of science. But happily, the seed thus sown is to-day beginning to result in a harvest of delayed therapeutic methods which are of the greatest usefulness to crippled humanity, and the early pioneers who were so bitterly assailed and persecuted will find in posterity their full reward.

Types of Cases.—Flat-foot, with its distressing deformity and painful crippling of the patient, occupies a front place amongst those cases which yield most satisfactorily to skilled manipulative treatment. To commence to correct this abnormality in its early stages is important, though cases might be instanced of patients, even up to 60 years of age, making perfect recoveries. The time of puberty is the period at which the irregularity usually makes its appearance, and the progress of the trouble is usually rapid and the deformation very marked.

It is difficult to assign with certainty the predisposing factor in such cases, though heredity probably plays some part in its origin. As many as four members of one family have been known to suffer from the complaint. The hands of the operator—if sufficiently powerful—constitute a much more effective instrument for forcing the foot and ankle into their normal positions than the Thomas wrench which is largely used even now. Several corrections should be made at short intervals, followed immediately by certain exercises in place of the one or two adjustments which used to be considered sufficient. The encasement of the joint in plaster of Paris is secure immobilisation and rest in bed must on no account be recommended. The anatomical contour of the foot is palpably bettered even after the first manipulation, and each operation brings the patient nearer full recovery. Almost all cases of adhesive and acquired flat-foot should recover. Congenital cases are much less satisfactory, though even in these improvement can generally be looked for. The technique is difficult and should be taught by cinematographic pictures so slowly reproduced that students can follow each manipulation carefully.

The Shoulder Joint.—The habitual derangement of the shoulder joint—sometimes on the slightest provocation, such as sneezing, stretching or ordinary reaching—is a most troublesome affection and is usually attributed to a rent or tear in the capsule, brought about in the first instance by a severe wrench, although cases could be recorded where no history of accident can be remembered. The disability is probably more often caused by adhesive contracture of a section of the capsule with an accompanying exaggerated relaxation of the remaining portion which allows the dislocation to take place. Although surgeons frequently advise a surgical operation, certain manipulations bring about a condition of the capsule which will enable it to exercise normal control of the head of the bone followed by exercises designed to re-establish the surrounding weakened tissues. Out of a number of cases only 2 or 3 can be remembered as not having yielded satisfactorily to treatment—even after a repetition of the operation. The procedure, under an anaesthetic, is quite devoid of danger, and the after-effects are of brief duration and only slightly painful.

Subluxations and Dislocations.—The actual reductions of gross dislocations do not enter to any great extent into the purlieu of the manipulative surgeon. There is, however, a large number of conditions due to minor displacements which constitute an important branch of his work. Principal among these must be placed displacements and fracture-displacements of the semilunar cartilages of the knee-joint. This field is an enormous and most important one, for the number of persons of both sexes who sustain such injuries is legion. In original unreduced displacements, reduction must be carried out by appropriate manipulation at the earliest possible moment. In chronic or recurrent cases, manipulation is also very frequently effective in bringing about a cure of a very troublesome and disabling condition.

The brilliant results obtained in this type of case have been known for many years, but the underlying pathology has been a profound puzzle until it was recently shown:

(a) that by far the commonest type of injury of the internal semilunar cartilage is the complete longitudinal tear;

(b) that in this type of case, the outer portion of cartilage is nearly always found in the interior of the joint;

(c) that by appropriate manipulative technique this displaced fragment may be made to retrace its steps and come into apposition with the inner fragment;

(d) that when this has been effected, there is a good chance of repair occurring between the two fragments.

Cases with Adhesions.—These constitute another important class. It is essential first of all to make quite clear what we mean by the term " adhesion." It is probably known to most that an inflammatory process is usually accompanied by the exudation of lymph from the blood-vessels of the part. This lymph tends after a short while to become organised, *i.e.*, changed into connective tissue, or, as it is usually called, " fibrous tissue." Let us imagine, for example, that owing to a severe sprain of the knee the lining membrane of the joint has become inflamed. As a result there is an outpouring of this lymph by the blood-vessels of the membrane, and various folds and layers of this selfsame membrane tend to become adherent by this inflammatory exudate. When this has become converted into fibrous tissue, adhesions are actually present which may give rise to marked disability. It is characteristic of adhesions that, when pulled upon or stretched, severe pain usually results. Further adhesions give rise to a variable amount of limitation of some particular movement or movements of the joint, which is apt to be overlooked unless a most careful examination be made.

Swelling of the joint after exercise, muscular wasting, and a sensation of weakness and often an actual giving-way of the joint, are not infrequent characteristics of adhesions.

Danger of Rest for Joint Cases.—As previously stressed, the doctrine " rest inflamed structures " has been responsible for the formation of countless thousands of joints disabled by adhesions. However true the doctrine may be in certain other organs and structures of the body, and even this is debatable, in the case of a joint it is dangerous, for the function of a joint is movement and movement must always be instituted at the earliest possible moment in almost any inflammatory condition, except in those ultra-acute conditions where movement is impossible and in some cases of tubercular disease and of myositis ossificans. When a joint has become crippled owing to the presence of adhesions, how is the joint to be restored to its pristine health and vigour? The answer is manipulation.

It is obviously impossible, in a short article of this nature, to detail the various technical methods of manipulation that apply to the different joints. Anaesthesia, although not absolutely essential, is a valuable aid in many cases, owing to the complete muscular relaxation thereby attained. The cases that are attended with the greatest success are those in which the adhesions are slight and in which the subsequent reaction is negligible. In more marked cases much benefit often follows from a series of manipulations separated by short intervals.

Although particular emphasis has been laid on adhesion in connection with joints, it is most important to remember that this may occur in many other important situations, particularly in the vicinity of muscles, or in their sheaths, or between different groups of muscles. This may also occur in connection with tendons and their sheaths, and in fascial or connective-tissue structures.

Functional or Hysterical Cases.—These constitute an interesting and important group in which good results by manipulation are sometimes attained. It must be remembered that a functional case is primarily mental and this condition is particularly apt to occur after injury in a person of nervous temperament. Although there is no actual organic disease of the joint—at any rate in the early stages—yet it is extraordinary how a functiona condition of a joint may simulate some organic disability of the same joint. Great experience and clinical acumen are often required to form a correct diagnosis of such types.

The great value of manipulation in these cases is that a vicious circle is thereby broken, and, although an anaesthetic is not absolutely essential, yet, if some such anaesthetic as ga or gas and oxygen be given, it has a powerful suggestive effec upon the patient. It is usually found that, as soon as the patien is under the influence of the anaesthetic, the joint, which previously was held awkwardly and stiffly, becomes relaxed. Th surgeon places the joint in the position which was erstwhile impossible and retains it thus until the patient is fully conscious The patient is then shown the increased mobility and encourage immediately to move the joint through this increased range Much subsequently depends upon the patient being surrounde by an atmosphere of cheerfulness and encouragement, an everyone with whom the patient comes in contact must endeavour to play his or her part in the cure and to assure the patien of its completeness and finality. A great responsibility thus devolves upon friends and relations that the good work of th manipulator may not be subsequently jeopardised by misplace sympathy or injudicious advice.

It must be borne in mind that in cases of long standing, actua organic changes may occur in an hysterical contracture, and the contracture, which was previously due to muscular sprain, becomes fixed by scar tissue. It is therefore important that manipulation should not be delayed too long in these cases, especially as the mental state becomes more fixed and more difficult t treat with the passage of years.

Cases Relieved by Manipulation.—This large group includes a great many conditions due to disease rather than injury, the principal probably being the group of infections and intoxications usually known by the name " rheumatic," especially in its mor chronic forms. Here again it is obvious that those cases in which only a slight degree of stiffness of a joint is present are muc more satisfactory from the point of view of treatment tha cases of marked stiffness or cases in which well-marked destruction of the joint surfaces has occurred. It is important also to wait until all signs of activity have subsided and furthermore to eradicate the cause wherever possible before having recourse to manipulative measures. In nearly all cases of strains and sprains entle manipulation at the earliest moment is recommended be-use the reparative processes of nature act most effectually hen, as far as possible, no interference whatever with their unctions is resorted to. (H. B.*)

MANITOBA (*see* 17.584), a province of the Dominion of anada. By an Act of the Canadian Parliament passed in e session of 1911–2 the eastern boundary of Manitoba was xtended north to lat. 60° N. and northeast to the point where e meridian of 89° W. intersects the southern shore of Hud- on Bay. This gave the province possession of two ports n Hudson Bay—Fort Churchill and Port Nelson. The effect f the change was to increase the area of Manitoba to 251,832 q. m., of which about 13,500 sq. m. are covered by lakes. The opulation of Manitoba in 1921 was 610,118 an increase of 2·23 % over 1911. The rural population was 348,502 and the rban 261,616. The legislative assembly consists of 55 members ith an executive council of the premier and six members. The rovince is represented in the Dominion Parliament by 17 mem-ers of the House of Commons and six senators. There is an xcellent secondary and public school system. Higher education provided by the University of Manitoba which has affiliated ith it several church colleges and professional schools. The lanitoba Agricultural College, near Winnipeg, is supported by e province.

Production and Industry.—The following table shows the otal yield in bushels of the principal field crops for 1910, the nnual average 1922–4, and 1925:—

Crop	1910	Av. 1922–4	1925
Wheat	34,125,949	45,773,000	39,453,000
Oats	30,378,379	67,955,333	71,770,000
Barley	6,506,634	31,837,333	52,156,000
Rye	29,205	5,857,667	5,152,000
Flax	176,675	1,844,000	1,664,000

In 1925 the number of live stock amounted to: horses, 359,839 ttle, 720,745; sheep, 101,997; and swine, 298,507. Dairying ecame firmly established after 1915, and both production and port greatly increased. In 1924 the chief dairy products were reamery butter, 12,632,804 lb.; dairy butter, 9,285,464 lb.; heese, 500,633 lb.; and milk over 200,000,000 gallons. Large uantities of fish are obtained from Lakes Winnipeg and Mani- oba, principally whitefish, sturgeon, pike and pickerel. The nnual value of the fisheries during the post-War period exceeded 1,000,000.

Copper ore occurs in the Pas district. Gold has been found in ntiguous areas. A mottled limestone is quarried at Tyndall, east Winnipeg, and is in wide demand as building stone. Gypsum eposits are mined northeast of Lake Manitoba. Portland cement is anufactured at Winnipeg and Babcock. The average annual pro- uction of minerals from 1919 to 1923 was valued at over $2,500,000. he province possesses extensive water power resources. The avail- ble power at ordinary minimum flow is estimated at about 250,000 horse-power. The turbine installation in 1925 was only 69,325 horse-power. The chief industries are meat-packing and ur milling. In 1922, 768 manufacturing establishments with a pital of $84,662,378 gave employment to 13,789 employees, who ceived $17,891,064 in salaries and wages, and utilised $54,619,248 orth of material in producing goods valued at $94,417,608.

Communications.—Railway mileage increased from 3,221 m. in 910 to 4,521 m. in 1925. The transcontinental lines converge at innipeg. Branches have been constructed linking up these lines ith the area west of Lake Winnipeg and with Hudson Bay. Direct nes south to Minneapolis and St. Paul give connection with the nited States. Great progress was made in the construction of ads after the passing of the Manitoba Good Roads Act in 1914: 191 m. of roads had been authorised and $10,985,497 expended by he Government and municipalities between the passing of the Act nd Aug. 31 1924. (*See* CANADA.) (D. A. Mac. G.)

MANIU, JULIUS (1873–), Rumanian politician, was born t Simlaul Sylvanie (Transylvania). He studied at the uni- ersities of Cluj, Vienna and Budapest, and was for many years rofessor of law at the theological academy in Blaj. At the ge of 26 he joined the National Rumanian party of Transyl- ania. In spite of the bitter opposition of Count Stephen Tisza, Maniu was elected deputy and sat in the Parliament at Budapest from 1906 till 1910. When the World War broke out Maniu was sent to the front and in 1918 was fighting against Italy. When he realised that the collapse of the Central Empire was in sight, he went to Budapest, where a National Rumanian Council was formed, Maniu taking charge of military and foreign affairs. He then went to Vienna and organised the revolt of Hungarian regiments, composed of Rumanians of Transylvania, stationed in Vienna and Prague. On Dec. 1 1918 the Rumanian National Assembly at Alba-Iulia proclaimed the union of Transylvania and the Banat with Rumania and elected Maniu, president of the *Consiliul Dirigent* (local government) which took over administrative control throughout Transylvania. In 1919 Maniu was elected president of the National Rumanian party of Transylvania, which in 1925 coalesced with the Nationalist-Democratic party. Maniu became the chief of this new formation, which took the name of the National Rumanian party.

MANN, THOMAS (1875–), German poet and novelist, was born at Lübeck June 6 1875. At the age of 19 he went to Munich where he was at first employed in a fire insurance company, but wrote novels at the same time. He then abandoned his practical calling and attended lectures at Munich University in literature, history and the history of art. He visited Italy, and was afterwards, for a time, editor of *Simplizissimus*. His chief work, excellent in both style and construction, is the period novel, the plot of which is laid in Lübeck, *Buddenbrooks, Verfall einer Familie* (1903, Eng. trans. 1924). His other books include *Königliche Hoheit* (1915), *Der Zauberberg* (1925), and a number of shorter novels including *Der Tod in Venedig* (1912) and *Tonio Kröger* (1914). He also wrote one drama, *Fiorenza* (1906) and *Betrachtungen einer Unpolitischen* (1918), a declaration of Conservatism. See Fr. Leppmann, *Thomas Mann* (1916).

MANNING, WILLIAM THOMAS (1866–), American Protestant Episcopal divine, was born in Northampton, England, May 12 1866. He graduated at the University of the South, Sewanee, Tenn., and entered the ministry from the diocese of California, being ordained deacon 1889 and priest 1891. He became rector of Trinity Church, Redlands, Cal., 1892, and was appointed professor of theology in the University of the South, 1893. He became successively rector of St. John's, Lansdowne, Pa., 1896; rector of Christ Church, Nashville, Tenn., 1898; Vicar of St. Agnes's Chapel, Trinity Parish, New York City, 1903. In 1904 he was appointed assistant rector of Trinity Church, New York City, becoming rector in 1908. He was consecrated Bishop of New York May 11 1921. A constant advocate of Christian unity, he was prominent in promoting the World Conference on Faith and Order. In 1925 he inaugurated the public movement for the completion of the Cathedral of St. John the Divine, New York City.

MANOEL II., ex-King of Portugal (1889–), was born at Lisbon Nov. 15 1889, the younger son of Carlos I. by his wife Marie Amélie of Orleans. On the assassination of King Carlos and of the Crown Prince Luis, Duke of Braganza, Feb. 1 1908, Dom Manoel succeeded to the throne of Portugal, but he only retained it for a short time, as the revolution of Oct. 3 1910 forced him to flee the country (*see* PORTUGAL). He took refuge with his mother in England, and finally settled at Fulwell Park, Twickenham. On Sept. 4 1913 he married, at Sigmaringen, Princess Augusta Victoria of Hohenzollern, daughter of Prince Wilhelm of Hohenzollern. Dom Manoel supported the Portuguese Royalist risings of 1911 and 1912, and in the latter year met the pretender to the Portuguese throne, Dom Miguel, at Dover in order to concert a common plan of action. On the outbreak of the World War, however, he appealed to all classes of his former subjects to lay aside political feelings and unite against the Central Powers.

MANSFIELD, KATHERINE (1890–1923), British writer, was born at Wellington, New Zealand, the daughter of Sir H. Beauchamp, and spent most of her girlhood in New Zealand. She published *In a German Pension* (1911), and in 1913 married John Middleton Murry, the critic, with whom she had been associated in the publication of a literary review, *Rhythm*. Her brilliant talent for the short story form was displayed in a collection issued as *Bliss* (1920), and her acute critical powers in frequent contributions to *The Athenaeum*, then edited by her husband. This was followed by *The Garden Party* (1922), but a career of great promise, and small but perfect achievement, was cut short by death, after a long illness, at Fontainebleau Jan. 9 1923. Further stories, *The Doves' Nest,* appeared later in that year, also a volume of *Poems*, and in 1924, *Something Childish,* tales and fragments of minor interest.

MANSHIP, PAUL (1885–), American sculptor, was born at St. Paul, Minn., Dec. 25 1885. He studied at the St. Paul Institute of Art, the Pennsylvania Academy of Fine Arts at Philadelphia, and in New York City. In 1909 he went to Rome, having been awarded a scholarship at the American Academy there, and remained abroad three years. On his return to the United States his works quickly attracted attention by their individuality and his figures, exhibiting archaic traits skilfully coupled with intensely modern feeling, placed him in the front rank of American sculptors. In 1914 he was awarded the G. F. Widener Memorial Gold Medal at the Pennsylvania Academy of Fine Arts, obtaining also a gold medal at the San Francisco Exposition, 1915. He devoted himself chiefly to classical subjects, but executed two very striking portraits, " John D. Rockfeller " and " Miss Manship," the latter being a study of his daughter, aged three days, which is in the Metropolitan Museum of Art, New York City. Among his other chief works are the J. P. Morgan memorial in the Metropolitan Museum of Art; the " Infant Hercules " fountain in the courtyard of the American Academy at Rome; " Dancing Girl and Fauns " and " Indian and Prong-Horn Antelope " in the Art institute, Chicago; " Yawning," in the St. Paul Institute; and " Centaurs " and " Little Brother " (statuette) in the Detroit Museum of Art.

MAP (*see* 17.629).—Steady progress was made in all branches of map construction until the outbreak of the World War, when a type of map not hitherto in general use in warlike operations came into demand. With regard to normal topographical maps a useful landmark was the publication in 1908 by the U.S. Geological Survey of a book on *The Interpretation of Topographic Forms.* Three matters stand out as deserving of special attention—the revival and standardisation of the *International Map of the World;* the striking progress made in the few years immediately preceding the War with the mapping of the British Empire; and the great part which maps played, in all armies and in the fighting on all fronts, during the War, but especially on the Western Front. (*See* SURVEYING.)

International Map of the World.—The official title of this international undertaking is *Carte du Monde au Millionième*, and references to it will generally be found under this title. It owes its origin to the initiative of Prof. A. Penck, who put forward the project of a map of the world on a uniform scale at the Geographical Congress held at Berne in 1891. The scale proposed was one-millionth of nature, equivalent to 1 km. to 1 mm., or 15,178 m. to 1 inch. The scheme and the scale were accepted by the congress, and an international, but unofficial, committee was appointed for the purpose of prosecuting the idea. This committee reported to successive Geographical Congresses held in London in 1895, in Berlin in 1899 and in Washington in 1904, but not very much progress was made.

An important step was, however, taken at the Geographical Congress held at Geneva in 1908. At this congress the delegates of the United States made a proposal for the definite standardisation of the map and for the drawing-up of fixed rules to govern its production. The next step in its history is that the geographical section of the British General Staff took up the subject, and a promise was given at the Geneva Congress that, if possible, an official conference should be assembled to deal with the matter. This promise was carried into effect in the following year.

In Nov. 1909 an official conference assembled at the Foreign Office in London, on the invitation of the British Government. The countries represented were, in addition to Great Britain, Australia, Austria, Austria-Hungary, Hungary, Canada, France, Germany, Italy, Spain, Russia, the United States, *i.e.*, the British Empire and the other European and American Great Powers. The conference came to unanimous conclusions, and an account of it was published in a report issued by the British Government. The object of having an official, rather than a non-official or academic, conference was that experience had shown that without the support of the official map-making bodies, such as the great survey departments, little or nothing would be done in the way of actuallv producing the international sheets.

At the Geographical Congress at Rome in 1913 the scheme as formulated in London was accepted generally, but there was a feeling that a more comprehensive official conference was needed in order to put the matter before those countries not hitherto represented officially. Accordingly, after some correspondence between the British and French Governments, it was agreed that the latter should issue invitations to an official conference to be held in Paris in Dec. 1913. Thirty-four states sent representatives, and a very thorough examination was made of the London resolutions. In the main they were accepted, and the modifications made were not in matters of principle but of detail. The scheme had in fact got into a definite standard form, and the *Carte du Monde au Millionième* is now a world undertaking on lines accepted by practically all civilised countries.

The Paris Conference took an important step in approving of the establishment of a " *bureau permanent,*" comprising a central office to be located at the headquarters of the Ordnance Survey at Southampton, with a branch office in London, at the Royal Geographical Society, where visitors to London can obtain all information with regard to the international map and its progress.

Maps for War Purposes.—The Conference came to an end on Dec. 18 1913, but the report was not published when War broke out early in Aug. 1914. The effect of the War on the scheme was twofold. First, it resulted in the immediate cessation of all work on the map so far as the belligerent countries were concerned; but in the second place it led to a demand for maps on, or about, the one-to-a-million scale, and so in England and France, particularly the former, much official cartography was carried out on the million scale, and a large series of maps was produced by the initiative of the General Staff.

This important series comprises 90 maps extending from the Persian Gulf to the Arctic Ocean, and from the western shores of Ireland to beyond the Caspian Sea. Its sheets were selected by the Peace Conference for use in determining the new European frontiers. It differs from the regular international series in small technical details. The international map, interrupted by the War, has since been taken up again and satisfactory progress has continued to be made.

The trench warfare of 1914–8 in France and Belgium created a demand for maps on a larger scale than had hitherto been in general use by great armies, and large scale maps became indispensable for the operations of trench warfare particularly in connection with the use of artillery. With regard to that portion of the line which passed through northeast France, the 1:80,000 map, the best then available, was enlarged to 1:20,000 which made an unreliable map. Bit by bit, these enlargements were corrected and eventually all the maps of the Western Front were redrawn from special surveys, air photographs and revised cadastral manuscripts, the chief scale in use being 1:20,000. The map showed the enemy's trench system in detail, and all the maps were provided with a system of " squares," or co-ordinates, which enabled any point to be defined within a few metres. The use of " squares," or co-ordinates, is typical of modern military maps. An example of a typical trench map of the Western Front on the scale of 1:20,000 is shown on the plate[1]

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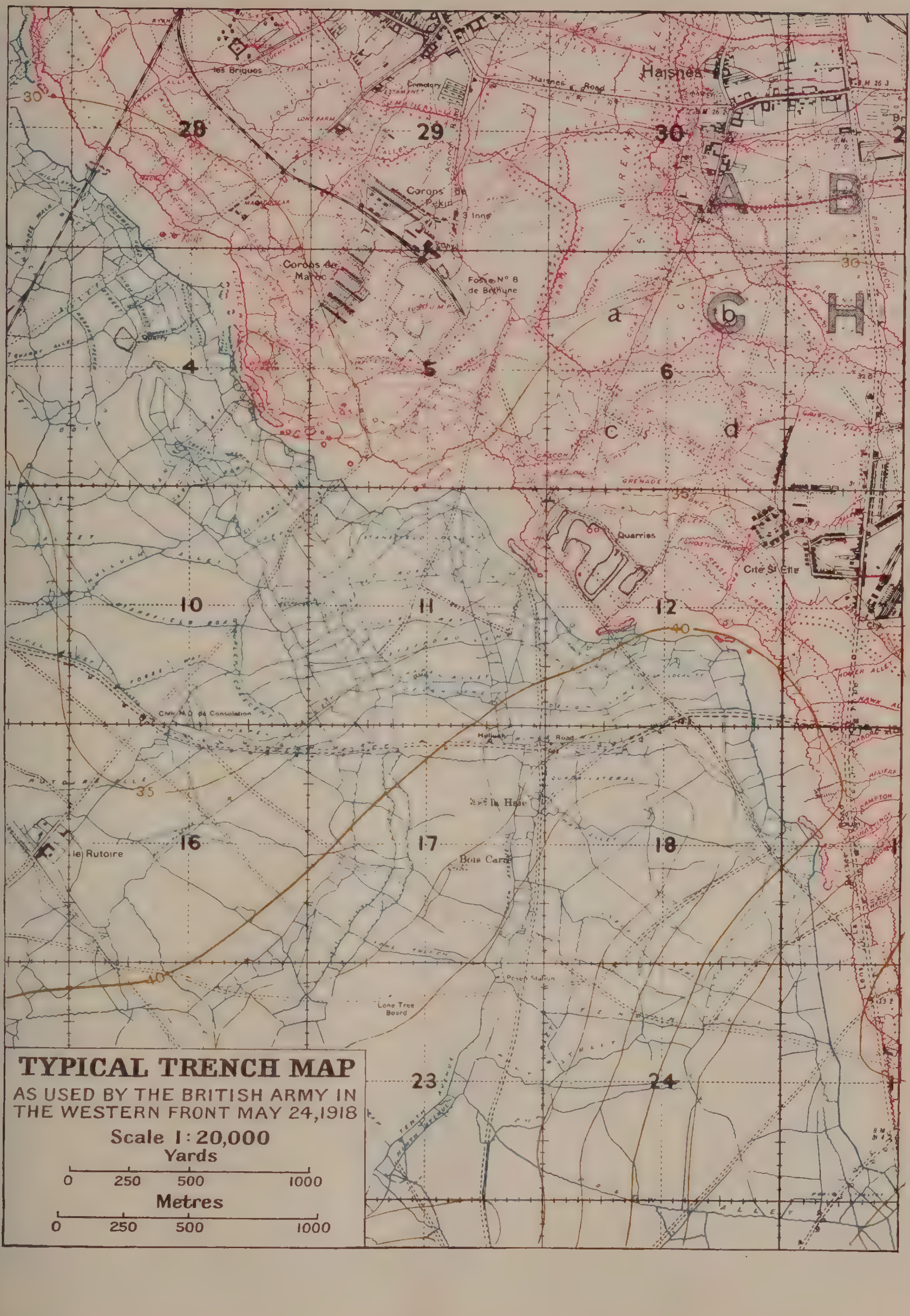
[1] 1. The large rectangles on the map lettered A, B, C, etc., are divided into squares, 1000 yd. side, which are numbered 1, 2, 3, etc. Each of these squares is subdivided into four minor squares of 500 yd. side. These minor squares are considered as letters a, b, c, d (see square No. 6 in each rectangle). A point may be thus described as lying within square B.6, M.5, b, etc.

2. To locate a point within a small square, consider the sides divided into tenths and define the point by taking so many tenths


les Briques
Cemetery
Haisnes
Haisnes Road
Lone Farm
Corons de Pekin
3 Inns
Corons de Maroc
Fosse No 8 de Bethune
The Dump
Quarry
Quarries
Cité St Elie
Chk. M.D. de Consolation
Hulluch Road
la Haie
Bois Carré
le Rutoire
Posen Station
Lone Tree Board
Grenade
28
29
30
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5
6
10
11
12
16
17
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23
24
A
B
G
H
a
b
c
d
30
35
40

TYPICAL TRENCH MAP

AS USED BY THE BRITISH ARMY IN THE WESTERN FRONT MAY 24, 1918

Scale 1 : 20,000

Yards
0
250
500
1000
Metres
0
250
500
1000

Progress of Cartography.—Modern topographical maps in- asingly use colour. The old black, engraved maps were beau- ul as specimens of engraving, but were never very easy to d, and in no case did they convey so much, or such accurate, ormation as do the modern topographical maps printed in e or six colours. But it is doubtful how long the modern col- red map will last; the paper is not nearly so durable as that ich is used for the printing of copper-engraved maps, and the ours are in some cases none too permanent. These remarks ply with special force to the "layered" maps; changes in the aes of the layers will greatly alter their character.

Topographical Maps.—In Great Britain the new popular ition of the ordnance map on the scale of one inch to one mile in colours with contours at 50 ft. intervals. It is completed England and Wales and is one of the best topographical ps in existence. The new quarter-inch ordnance map, in er form, is completed for Great Britain. An excellent map Roman Britain has been published by the Ordnance Survey. Canada an important series of topographical maps on the le of one inch to one mile is being published by the Dept. Militia and Defence. These maps have been in progress since 07. About 90 sheets have been issued covering an area of out 40,000 sq. m. in the provinces of Ontario and Quebec. e only complete series of topographical maps of the Union of uth Africa are those of the Orange Free State; these are on the ale of 1:125,000, or about half an inch to one mile. They were inted by the geographical section of the General Staff. There s been a marked improvement in the character of the topo- aphical maps of India. Up-to-date methods of colour printing ve been adopted with success. India, also, has produced the rgest block of sheets yet published of the regular series of the ternational map.

Ceylon is gradually being covered by an admirable series of e-inch maps in colour. The new one-inch map of the Federated alay States is a very satisfactory production. The mapping Kenya and Uganda, which has made good progress, was opped by the War and has not been resumed. Work is being rried on in the Gold Coast and Nigeria and in the Sudan.

The admirable and well-known series of maps of the U.S. Geo- gical Survey continues to be issued. The production of the borate French 1:50,000 series in colour was completely stopped ring the War; it is now being published in a simpler form. The alians are mapping Tripoli and Italian Somaliland on the 1:100,- o and 1:50,000 scales, and the map of Italy on the 1:100,000 th brown contours and vertical hachures is a clear and useful ap. The map of Spain on the 1:100,000 scale in colours, published by the Spanish General Staff, is in progress. There is an excellent series of maps of Denmark on the 1:400,000 scale, published in colours by the Danish General Staff, and some fine maps have been issued by Norway. A good start is being made with the mapping of Poland.

Bibliography.—For examples and criticism of various kinds of topographical maps, see A. R. Hinks, *Maps and Survey* (Cambridge, 1923); C. F. Close, *Text Book of Topographical and Geographical Surveying* (Stationery Office, London, 1925); see also R. D. Salisbury and W. W. Atwood (U.S. Geological Survey), *The Interpretation of Topographic Maps* (Washington, 1908). (C. F. Cl.)

MARC, FRANZ (1880–1916), German painter, was born at Munich July 4 1880, the son of the painter, Wilhelm Marc; his mother was of French extraction. He studied at the academy in Munich under Hackl and W. von Dietz. For the first seven years of his career as a painter he showed little originality. The decisive impulse came only when he got into touch with the group of painters including Kandinsky, Jawlenski and Macke who founded the "Blue Knight" (*Blauer Reiter*) in 1911. One of his most famous pictures entitled "Tierschicksale" (Destinies of Beasts) is characteristic of his whole work, which is singularly compact, not merely in choice of motive, but also in pictorial composition. A certain leaning towards metaphysics, towards abstraction from the world of reality, gives many of his pictures a problematic character. He also wrote a series of articles pleading the cause of the new painting. Marc was killed near Verdun on March 4 1916.

MARCH, FRANCIS ANDREW (1825–1911), American philologist (*see* 17.688), died in Easton, Pa., Sept. 9 1911.

MARCH, PEYTON CONWAY (1864–), American soldier, was born at Easton, Pa., Dec. 27 1864. He graduated from Lafayette College in 1884 and four years later from the U.S. Military Academy. He graduated from the artillery school in 1898, and on the outbreak of the Spanish-American War went to the Philippines, remaining there three years and rising to the grade of lieutenant-colonel of volunteers. After honourable discharge from the volunteers in 1901 he was appointed captain of artillery in the regular army. From 1903 to 1907 he was a member of the general staff and in 1904, during the Russo-Japanese War, was with the Japanese Army in Manchuria as observer. He was promoted major in 1907, lieutenant-colonel in 1912 and colonel in 1916. Soon after America's entrance into the World War in 1917 he was made a brigadier-general, U.S.A., and later major-general of the national army and in Sept. 1917, major-general of the regular army. In 1917 he was with the A.E.F. in France in charge of the American artillery forces. In March 1918 he was appointed acting chief-of-staff, and the following May chief-of-staff with the rank of general. On June 30 1920 his rank reverted to that of major-general, and at his own request he was retired from active service Nov. 1 1921. As chief-of-staff of the army, he reorganised the War Dept., consolidated the regular army, National Guard and national army divisions into a single army—the U.S. Army; and initiated and carried into execution a programme which landed in France, by the time of the Armistice, 2,000,000 men.

MARCHAND, JEAN (1883–), French painter, was born in Paris Nov. 22 1883. He studied at first with Bonnat and Merson (1902–6), after which he deserted conventional teaching, and exhibited for the first time at the Salon des Indépendants in 1908. He visited Russia and England on several occasions. Though Marchand came under the influence of cubism between 1910 and 1912, his work in general was not greatly affected by it. His human forms are treated with power and discretion, while his landscapes and still life are tinged with an intense melancholy. Exhibitions of his work were held at the Carfax Gallery, London, in 1915 and 1919. Among Marchand's pictures may be mentioned "Les Gueux" (1906); "Le Départ" (1910); "Suzanne au Bain" (1911); "Trois Baigneuses" (1912); "Le Carafe" (1913); "La Gardienne du Foyer" (1914); "Nocturne" (1915); "Le Soir" (1919).

MARCHAND, JEAN BAPTISTE (1863–), French general and African explorer, was born at Thoissey (Ain) on Nov. 22

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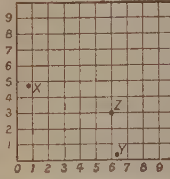
m W. to E. along southern side, and so many from S. to N. along stern side, the S.W. corner always being taken as the origin, and e distance along the southern side being always given by the first ure. Thus the point Z would be 63; *i.e.*, six divisions east and three visions north from origin.

3. When more accurate definition is wanted (on the 1:20,000 or 10,000 scale) use exactly the same method, but divide sides into o parts and use four figures instead of two. Thus 0847 denotes 08 rts east and 47 parts north of origin (see point X). Point Y is 03.

4. Use 0 but not 10; use either two or four figures; do not use actions ($8\frac{1}{2}$, $4\frac{1}{2}$, etc.).



The system of reference by squares shown the map and described above was used roughout the War by the British armies on e Western Front. Although clear and simple practice it was not ideal for gunnery pur- ses. For this reason it was decided shortly fore the Armistice to supersede it by another d more universally useful system.

Colours.—The topography was represented three colours. The detail including towns, uses, railways, roads, woods and grid lines and numbers, was inted in grey, water in blue and contours in brown.

Military details such as trenches, battery positions, mine craters, stacles, etc., were shown in blue (British) and red (German). ritish trenches were not shown *in extenso*, but only for such dis- nce from the front line as might be assumed to be already well sur- eyed by the enemy.

Conventional Signs.—The signs used for objects of military nature anged considerably during the War as the result of alteration of pes of defensive and offensive works.

1863. After four years' service in the ranks, he was, in 1887, appointed a sub-lieutenant. In 1889 he was on active service in Senegal, was twice wounded, and made a chevalier of the Legion of Honour. In 1898 he carried out his historic occupation of Fashoda (*see* 1.341), and for this he was promoted to commander in the Legion of Honour, having been previously raised to the grade of officer. In 1900 he became lieutenant-colonel, and was made colonel two years later. Shortly after the outbreak of the World War he was appointed to command the Colonial Brigade of the XIV. Corps, and in Feb. 1915 was promoted a temporary-general of brigade. In the following May he assumed command of the 10th (Colonial) Division. He was wounded in Sept. 1915, and was made a grand officer of the Legion of Honour. On March 25 1916 he was made a substantive-general of brigade. On April 4 1917 he was promoted general of division and confirmed as commander of the 10th Colonial Division. He retired from the army in 1919 and was given the grand cross of the Legion of Honour in the following year.

MARCONI, GUGLIELMO (1874–), Italian wireless telegraphy inventor, was born at Bologna on April 25 1874. His father, Giuseppe, was an Italian country gentleman who, in 1864, married Miss Annie Jameson, daughter of Mr. Andrew Jameson of Daphne Castle, County Wexford, Ireland. The issue of the marriage was two sons, of whom Guglielmo was the younger. He was educated privately at Bologna, Florence and Leghorn. As a boy he took a keen interest in physical and electrical science. In 1895 the idea became firmly rooted in his mind that a system of telegraphy through space could be provided by means of electric waves, the existence of which had been foreseen mathematically by Clerk Maxwell in 1864 and later investigated experimentally by Heinrich Hertz, Oliver Lodge, Righi and others. Interesting scientific experiments had been carried out in London and elsewhere with these electric waves, but Marconi was the first to devise the practical means by which they could be made to provide a new and revolutionary method of telegraphic communication.

In the early summer of 1895, Marconi conducted a number of experiments at his father's country house at Pontecchio, near Bologna. These experiments, made with crude and inefficient apparatus, soon began to give results which appeared to Marconi to be remarkable, communication being established in that year over distances in excess of a mile. The first considerable advance which he made was his discovery of the marked effect of the simultaneous use of elevated transmitting and receiving aerials connected to the ground through the generators (transmitters) and detectors (receivers) of electric waves. He discovered that by connecting one of the spheres of the spark-gap by means of a vertical wire to a metal plate buried in the earth, he was able to multiply many times the range of communication for a given amount of power.

In his receiver Marconi used the form of coherer, or sensitive detector, employing nickel and silver filings, connected to the earth and to an elevated conductor, in the same way as was done at the transmitting end, and provided with connections to a relay and other mechanical arrangements, which made it capable of receiving and recording the impulses of telegraphic signs transmitted through space from the sending station. In these early days, Marconi also discovered that the distance of communication increased very rapidly if the height above ground of the elevated aerials was increased. This fact was pointed out in his first patent and was also clearly described in a letter dated Nov. 14 1896 addressed by him to Mr. William Preece, afterwards Sir William Preece, engineer-in-chief of the British Post Office.

In 1896 Marconi came to England, and on June 2 of that year took out the first patent ever granted for wireless telegraphy based on the use of electric waves. He continued his experiments in London, and in the same year demonstrated his invention before officials of the Post Office and other representatives of British and Foreign Govt. departments. These demonstrations were first carried out on the roof of the General Post Office, St. Martin's-le-Grand, London. Later experiments for the Post Office were carried out on Salisbury Plain and acro the Bristol Channel from Penarth to Brean Down, near Westo super-Mare, ranges first of two, then of four, and afterwards nine miles were obtained.

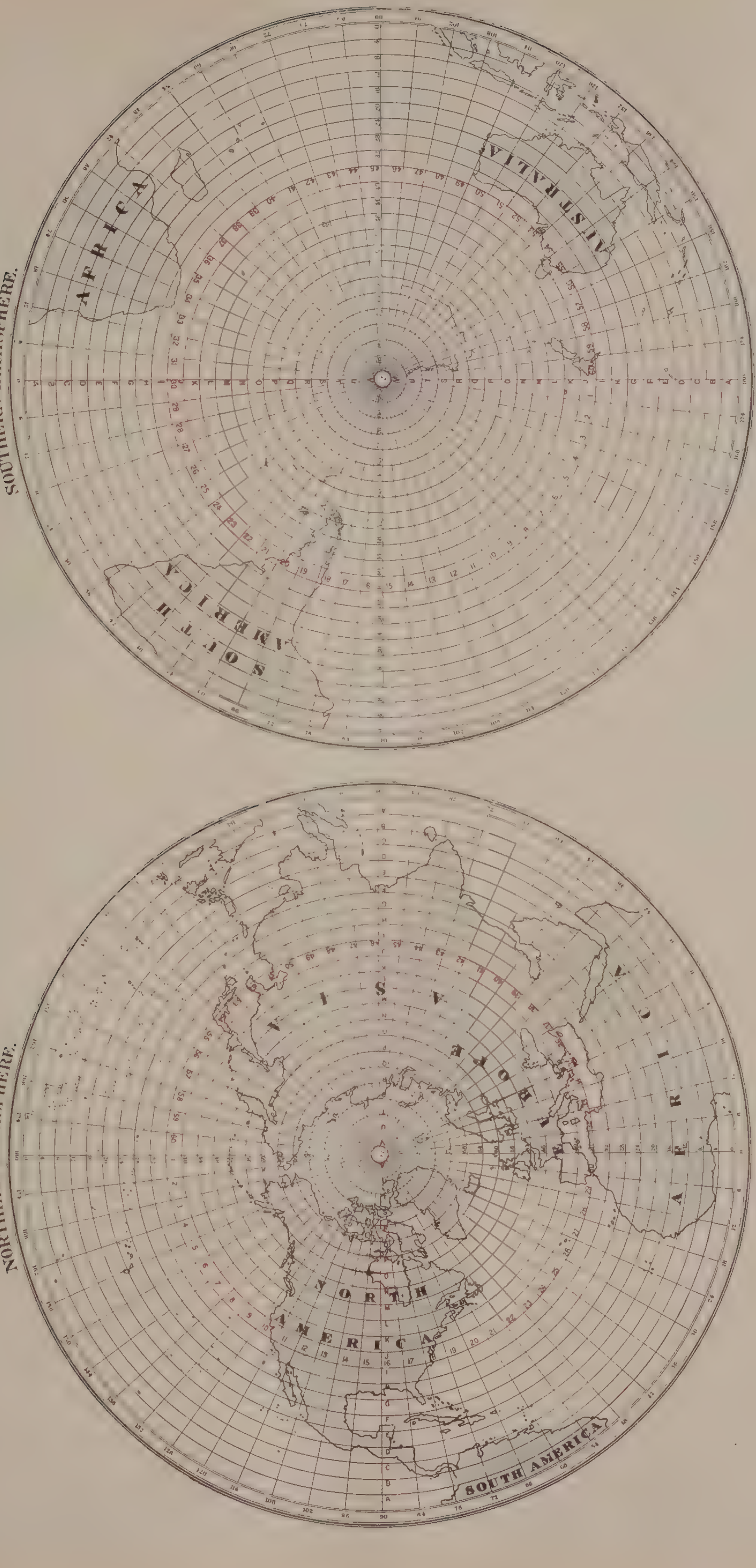
In June 1897, at the invitation of the Italian Gov Marconi went to Spezia, where a land station was erected an communication with Italian warships was established up to distance of 12 miles. He was then invited to demonstrate h apparatus in Rome, where successful tests were carried out the presence of the late King Humbert and Queen Margherit Other tests also took place at the Italian Chamber of Deputie

The time was now almost ripe for wireless telegraphy to h applied to commercial and utilitarian purposes, and in Jul 1897 a company was formed in London to acquire the Marco patents in all countries except Italy. This company was calle the Wireless Telegraph and Signal Company Limited, which i 1900 changed its name to that of Marconi's Wireless Telegrap Company Limited. For some time the company's efforts we confined to furthering Marconi's pioneer work. A number interesting tests and demonstrations were undertaken round th coasts of the British Isles and abroad. Permanent stations we erected at Alum Bay in the Isle of Wight and at Bournemouth this station being subsequently removed to Poole, 14 m. fro Alum Bay.

Wireless telegraphy was first used for commercial purposes i 1898, when the Kingstown regatta races were reported for *Th Dublin Express* by Marconi by means of wireless apparatu installed on a tug which followed the yachts in the Irish Sea In the same year, during Cowes week, Marconi was called upo to establish wireless telegraphic communication between Osborn House in the Isle of Wight and the Royal Yacht "Osborne," t enable the late Queen Victoria to communicate with the Prince o Wales, later King Edward VII. In this year also wireless teleg raphy was first employed as a means of communication betwee lightships and the shore by installations on the East Goodwi lightship and the South Foreland lighthouse, separated by a dis tance of about 12 miles. The utility of wireless in saving life at se was demonstrated for the first time when, on March 3 1899, tha lightship was run down by a steamer. The accident was at onc reported by wireless to the South Foreland, enabling life-boat to be promptly sent to the assistance of the light vessel. I March 1898 Marconi established communication across th English Channel between England and France. During thi year wireless was also first utilised in the naval manoeuvres fo communication between warships over distances of 74 miles The first military application of wireless took place during th South African War.

During this period numerous improvements embodied i patents taken out by Marconi were utilised. On April 26 190 he applied for a patent for "tuned or syntonic telegraphy a well as multiplex telegraphy with a single aerial." The importa novelty was the incorporation of tuned closed with tuned ope circuits in both the transmitter and receiver. This patent, th number of which was 7777, became famous in the history o wireless, and its validity was upheld in the High Court by a decision of Mr. Justice Parker. The principles on which this patent was based were fully described in a lecture given by Marconi on "Syntonic Wireless Telegraphy" before the Society o Arts in May 1901.

In Oct. 1900 the erection of a long distance wireless telegraph station in Cornwall was commenced by Marconi and preliminary tests were carried out up to a distance of about 20 miles. On Dec. 12 1901 Marconi, on his first attempt, succeede in transmitting and receiving signals across the Atlantic Ocean from Poldhu in Cornwall to St. John's, Newfoundland. This achievement completely confirmed Marconi's opinion that electric waves would not be stopped by the curvature of the earth and therefore could be made to travel any distance separating any two places on our planet, a view he had held for many years in the face of considerable opposition. The wireless conquest of the Atlantic may be regarded as the culminating point of Marconi's pioneer work.


SOUTHERN HEMISPHERE.
AFRICA
AUSTRALIA
SOUTH AMERICA
NORTHERN HEMISPHERE.
ASIA
EUROPE
AFRICA
NORTH AMERICA
SOUTH AMERICA

INDEX DIAGRAM OF SHEETS FOR THE INTERNATIONAL MAP ON THE SCALE OF 1:1,000,000.

n 1902 Marconi, during a voyage on the American liner S.S. hiladelphia," received messages up to a distance of 700 miles day and 2,000 miles by night, thus first discovering the now l-known fact that wireless signals can usually be received r much greater distances at night than during the hours of light. Marconi read a paper dealing with this phenomenon ore the Royal Society on June 12 1902. At the time his clusions were severely criticised and his results doubted, but r experience completely confirmed his observations. In 1902 rconi designed and patented a practical form of magnetic ector based on the effect of electrical waves on iron or steel n subjected to a varying magnetic field. This magnetic re- er replaced the receivers up till then in use, and for over ten rs remained the standard receiver on the great majority of -going vessels equipped with wireless.

n 1905 he took out his patents for the horizontal directional ial, which marked an advance in the design of long distance tions. During the same year, in a lecture delivered before the yal Institution, Marconi first pointed out that most probably eless transmissions right round the world to places near the ipodes would be carried out with greater ease and at lesser enditure of electrical energy than would be necessary to much rer places. Later results fully confirmed the correctness of se views. In 1910 Marconi, assisted by Mr. H. J. Round, re- ved signals and messages at Buenos Aires from Clifden (Ire- d) over a distance of about 6,000 miles. In 1912 he devised a method for generating continuous waves, commonly known "the timed spark system." This system was employed for eral years at many important long distance stations and by means Marconi sent the first messages ever transmitted by eless from England to Australia on Sept. 22 1918.

In 1916, during the World War, experiments were commenced Marconi in Italy with very short waves, with the object of ising a directive, or beam system, of wireless telegraphy for r purposes. This was a principle on which he had also worked ring his earliest experiments, but work on these lines had n put on one side in favour of the use of longer and longer ves combined with higher power. Later, in England, with the istance of Mr. G. S. Franklin, important results were obtained the use of 15-metre waves between London and Birmingham. e result of the tests with short waves carried out in 1916 d 1922 were fully described in public papers by Marconi and anklin in 1922. (*See* WIRELESS TELEGRAPHY.)

These anticipations of Marconi were fully justified by the re- ts obtained since that time with short waves by British and eign experimenters. Marconi was the first to discover in Oct. 24 that short waves of the order of 30 metres in length could transmitted and received over the greatest distances during ylight. Short waves have proved themselves capable, even en used with a minimum of power, of carrying out com- nications by night as well as by day over any distance, even the antipodes. Marconi demonstrated that short waves are ch more amenable to control than long waves and they have very great advantage over long waves that by the use of itable reflectors, or by an efficient system of directive aerial, ey can be directed in a beam as light waves are directed from lighthouse or searchlight.

Marconi stated publicly that this possibility of focussing and recting short electric waves would soon be applied universally d that except for broadcasting and shipping purposes it would longer be necessary to send out waves at random in every rection.

During the World War Marconi served in both the Italian my and navy. He also visited America as a member of the alian war mission to the United States Government. In 1919 e King of Italy appointed him plenipotentiary delegate to the ace Conference in Paris, and in that capacity he attended the eetings of that conference and signed on behalf of Italy the ace Treaties with Austria and Bulgaria. He also attended in e same capacity the meetings of the commission on mandates ld in Paris and in London, and in other ways rendered valu- le services to the Allied cause.

The value of Marconi's work has been recognised by governments, universities and learned societies all over the world. Amongst the many scientific awards granted to him may be mentioned the Nobel Prize for physics in 1909, the Albert Medal of the Royal Society of Arts, the Franklin Medal and the John Fritz Medal awarded to him in the United States for the "invention of wireless telegraphy." In the same year he was nominated by the King of Italy to be a member of the Italian Senate.

Every great invention, when it has become established, has given rise to controversy as to who was the real inventor. Doubts have been expressed as to whether Marconi was in fact the inventor of wireless telegraphy. In the interests of historical truth, therefore, it is worth while to make the following quotation from the judgment given by Judge William K. Townsend of the United States Circuit Court of May 4 1905, in the action Marconi Wireless Telegraph Company of America versus De Forest Wireless Telegraph Company:—

> "It would seem, therefore, to be a sufficient answer to the attempts to belittle Marconi's great invention that, with the whole scientific world awakened by the disclosures of Hertz in 1887 to the new and undeveloped possibilities of electric waves, nine years elapsed without a single practical or commercially successful result, and that Marconi was the first to describe and the first to achieve the transmission of definite and intelligible signals by means of the Hertzian waves.
>
> The exact contribution of Marconi to the art of spark telegraphy may be stated as follows: Maxwell and Crookes promulgated the theory of electrical oscillations by means of a disruptive discharge; Hertz produced these oscillations and described their characteristics. Lodge and Popoff devised apparatus limited to lecture or local experiments or to such impracticable purposes as the observation of thunder storms. Marconi discovered the possibility of making these disclosures available by transforming these oscillations into definite signals and, availing himself of the means then at hand, combined the abandoned and laboratory apparatus and by successive experiments reorganised and adapted and developed them into a complete system capable of commercially utilising his discovery.
>
> Other inventors, venturing forth on the sea of electrical movement, met the rising tide of the Hertzian waves and allowed them to roll by without appreciating that this new current was destined to carry onward the freight and traffic of the world commerce. They noted their manifestations, suspected their possibilities, disclosed their characteristics, and hesitated, fearing the breakers ahead, imagining barriers of impracticable channels and shifting sand bars. Marconi, daring to hoist his sail and explore the unknown current, first disclosed the new highway.

(F. G. K.*)

MARGARINE (*see* 17.704) was first made from fresh beef fat freed from tissue and digested at a temperature of about 110° F. with the pepsin obtained from pigs' or sheep's stomachs, rendered alkaline by a dilute solution of sodium carbonate. The process of manufacture was improved from time to time, and before the end of the War the product, particularly vegetable margarine, was so like butter in texture, flavour and appearance that it was difficult to distinguish from the product it was made to imitate. Generally speaking, three types of margarine exist: (*a*) animal margarine, (*b*) vegetable margarine and (*c*) mixed margarine.

Varieties of Margarine.—Animal margarine has as a basis the material called *oleo oil* which is made by pressing *premier jus* by hydraulic presses, so as to separate the liquid oil (oleo oil) from the hard fat (stearine). *Premier jus*, as the name implies, is the first running of fat obtained by heating the fatty tissues of the caul and the kidneys of cattle at a temperature not exceeding 100° to 120° Fahrenheit. This fat is washed with brine and allowed to crystallise or "grain," and is pressed to obtain the oleo oil.

The fatty basis of vegetable margarine usually consists of a hard fat mixed with a liquid vegetable oil. The hard fat in this case is usually either about 25% of hardened (hydrogenated) oil, or 65 to 70% of cocoanut or palm-kernel oil. As liquid oils, cotton seed, arachis, soya bean and many others are used in accordance with the price and quality of the product desired. All these materials are subjected to a very drastic process of refinement and deodorisation. In the case of mixed animal and vegetable margarine the solid fat is either *premier jus* itself or *oleo stearine* (*i.e.*, the residue left after pressing premier jus).

Whichever type of fatty basis is used it is subjected to a process of incorporation with milk. Skimmed milk is generally used for the purpose, not so much for the sake of saving the cost as because it is more readily obtained, and has greater bacterial purity than whole milk. The skimmed milk, previously pasteurised, is placed in vats (ripening tanks), and is there inoculated with a pure culture of lactic acid-producing organisms—mainly *Bacillus acidi lactis* Leichmann—which coagulate souring milk.

The temperature is carefully controlled and, in a scientifically organised factory, the souring to the required extent is arranged to take place by a definite time. Great care is taken to keep the culture free from adventitious organisms which would produce undesirable flavours and impair the keeping properties of the finished product. Mould fungi are specially undesirable as they produce an unpleasant rancid flavour in the margarine, particularly when made with vegetable fats.

When the milk has reached the desired state of sourness, it is churned with the fat, with or without artificial colouring matter, in specially constructed jacketed churns fitted with beaters for finely incorporating the previously melted fat with the soured milk. This churning process has to be carried out with great skill, care being taken to maintain the correct temperature and to stop the churning at the exact point when the emulsion reaches its maximum thickness, as continued churning causes the mass to become thin again. Various types of emulsifiers other than churns are in use, some of which are very efficient. When the emulsion has reached the desired state, the product is then finished by either the wet or the dry process.

Wet Process.—In the wet process the emulsion is projected against a violent spray of iced water, which causes the emulsified fat to solidify in fine globules; the solidified mass which is produced subsequently floats on a tank of cooled water, from which it is removed and mechanically worked until the desired consistency is obtained. Salt and preservative, if any, are incorporated into the mass together with more colour. About 30% of milk is used in the wet process.

Dry Process.—The dry process is more economical, and little more than half the amount of milk is then required. In this process the emulsion from the churns is run in a gentle stream on to large rolls cooled inside with brine. The emulsion, as it solidifies on the surface of the rolls, is scraped off by knives and then worked on tables, kneaders and rolls, in the same manner as in the wet process.

Admixture with Butter.—Margarine, like butter, must not contain more than 16% of water. The admixture of butter with margarine to the extent of more than 10% of the former is prohibited. This regulation is still in force, though it seems originally to have been made to dispel the fear of the farmer that butter might be adulterated with small quantities of margarine to make such an excellent product that his trade might suffer, and that the public might be defrauded. Modern methods of analysis are able to determine the percentage of butter fat in margarine to within comparatively narrow limits, which was not the case when margarine was first invented.

Margarine usually contains 0·25% of boron preservative, except the type termed "fresh-roll," in which no preservative is used; at present up to 0·5% of boron preservative is permitted, but under new British regulations which will come into force in 1927 no preservatives will be permitted. The nutritive value of margarine has long been a subject of discussion. The chemical composition of butter is very similar to margarine, which actually gives the same number of calories or heat units as butter, and an average margarine is as digestible as an average butter. The average butter is characterised by considerable vitamin content, whereas margarine is practically devoid of any such characteristic. (See W. Clayton, *Margarine*, 1920.)

(E. R. B.*; R. G. P.)

MARGATE, England (*see* 17.704), with an area of 2,961 ac. (including 468 ac. of foreshore), had a population of 46,475 in 1921. Parts of Garlinge and Northdown were added to the borough in 1913. A town-planning scheme, providing for an industrial zone at the back of the town and restricting the number of houses to the acre elsewhere, has been put into operation. The town is ver healthy, the death-rate being usually under 10 per 1,000. Th municipality owns over eight miles of seafront, with promenad along almost the whole distance. A pavilion and winter garde have been erected in a hollow on Fort Green, and a pavilion o the jetty; the path along the cliffs to Kingsgate has been made int a wide promenade, with a new bridge at Palm Bay; a seawall an undercliff promenade have been built, and a large bathing pavi ion is (1926) in course of erection. A wing for tuberculous e service men was opened at the Royal Sea-bathing Hospital i 1919, and a public library in 1923. The War Memorial is i front of Holy Trinity church. During the widening of the Mi ster-road in 1922 an Anglo-Saxon cemetery was discovere During the World War 156 bombs were dropped on Marga and 44 shells were fired from the sea; considerable damage wa done, but the casualties were few.

MARGHILOMAN, ALEXANDRE (1854–1925), Rumania statesman, was born at Buzeu July 4 1854. He studied law an political science in Paris. In 1884 he was elected a deputy as member of the Conservative party, of which he became leader i 1914. At the beginning of the World War, Marghiloman adv cated Rumania's neutrality and when in 1916 Bratianu offere him a portfolio in his cabinet, Marghiloman refused on th ground that he could not assume the responsibility of an insuf cient military preparation. He remained in Bucharest under th German occupation, where he organised the relief work for th population. He emphatically rejected the proposals of the Ge man commander to form in Bucharest a government for th purpose of concluding a separate peace. In March, 1918, Marg iloman went to Jassy at the request of the King and formed government which eventually signed the separate peace wit the Central Powers. This treaty, however, was never ratifie When the War ended Marghiloman ceased to play any part Rumanian politics and after his death in Buzeu, May 10 192 the Conservative party ceased to exist, its members joini Gen. Averescu's (People's) party.

MARGUERITTE, PAUL (1860–1918), French novelist (*see* 1 706), died Dec. 30 1918 in Paris. His later works included *Maison brûle* (1913) and *Jouir* (1918).

MARIE, Queen of Rumania (1875–   ), was born at Eas well Park, Kent, Oct. 29 1875, the eldest daughter of Alfre Duke of Edinburgh, second son of Queen Victoria. On Jan. 1893 she married Prince Ferdinand, afterwards King of R mania. From this marriage six children were born: Prin Charles, who married Princess Helen of Greece, Princess Eliz beth, married to the ex-King George of Greece, Princess Mar later Queen of Yugoslavia, the Princes Nicolas and Mirc (d. 1916) and Princess Ileana. The Queen was a Protesta but the children, in accordance with the Rumanian constitutio were brought up in the Orthodox faith. Queen Marie took great interest in the development of her adoptive country. R Cross and charity organisations were formed at her initiati and, as a Red Cross nurse during the World War, she looke after the wounded in hospitals and ambulances up to the firi line. Queen Marie devoted much of her time to writing, a her published works include *The Lily of Life* (1913), *My Coun* (1916), *Stealers of Light* (1916) and *Ilderim* (1925). Together wit King Ferdinand, Queen Marie was crowned at Alba Julia O 15 1922.

MARINE ENGINEERING (*see* 25.840c).—At the present ti there are three distinct types of marine engines, and these may grouped as follows: (1) steam-engines with coal-fired boilers; (2 steam-engines with oil-fired boilers; (3) internal-combustion en gines, such as the Diesel or semi-Diesel type. Of course, groups (1 and (2) may be reciprocating steam-engines, turbines (geared o otherwise) or combined turbine and reciprocating. The thre types are described below.

Reciprocating Marine Steam-engines.—To-day, all marin reciprocating steam-engines are stage expansion engines, that i the steam expands in stages from the highest pressure cylinde through the intermediate stages, and finally exhausts into th condenser. Modern stage-expansion engines may be grouped a lows: *Compound.*—In this type there are two cylinders, the h pressure and the low pressure. Steam performs its function the high pressure cylinder; from there it passes into the low ssure cylinder, completes its work on this cylinder and ally exhausts to the condenser. *Triple Expansion.*—In this gine, as its name implies, steam exerts its power in three stages ore exhausting to the condenser. *Quadruple Expansion.*—In s type the steam is used four times before exhausting to condenser, two intermediate cylinders being fitted.

No marked improvements have taken place in this type of me mover, except as regards engine refinements, the general ign remaining the same. The advent of the marine steam bine and the marine internal-combustion engine certainly led many shipbuilders to install one or the other of these es; but it is interesting to note that in some recent large amers, notably the Peninsular and Oriental "Naldera" and arkunda," the carefully balanced triple-expansion engine been installed. Experiments are being carried out to utilise am at a much higher pressure than formerly, and excellent ults are expected.

ombined Reciprocating Engines and Steam Turbines.—An ellent example of this arrangement is the White Star "Olym-." The arrangement has proved an economical one, and is as lows: Each wing propeller shaft is driven by a reciprocating gine, the low pressure cylinder of which exhausts into a Par-s low-pressure turbine driving the centre shaft; 21 double-led cylindrical boilers supply the necessary steam.

Marine Steam Turbines.—(*See* TURBINES, STEAM.) The advan-ges of this prime mover which has led to its adoption during past few years are as follows:—

a) Fewer working parts, as no slide valves, piston and connecting ls are required.
b) The steam is supplied direct from the boilers with no inter-ing loss.
c) Considerably less danger of breakdown.
d) Engines placed well down in vessel (a big asset in warships).
e) Less expenditure of lubricating oil.
f) No cylinder lubrication is necessary, and clean feed water is urned to the boilers.
g) Absence of vibration, a big factor in warships and passenger mers.
h) Smaller attendance required than in the case of reciprocating ines.
i) Superior governing, good parallel running and even turning vement.
k) Priming, which would fracture the cylinder covers of a steam iprocating engine, has no material effect on a turbine.
l) Overloading (forcing the engines) can be indulged in within sonable limits.
m) More economical except at the lowest speeds.

The large-sized turbines are more economical in steam per sepower developed than the best triple or quadruple expan-n engine, as the turbine is able to take full advantage of the ole of the expansive energy of the steam. The two types in neral use are the Parson combined impulse and reaction tur-e, and the Brown Curtis impulse turbine. There are, natu-ly, many modifications of these types.

eared Turbines.—These turbines are coming into favour re and more. The chief trouble with the marine turbine arose h the propeller. It is necessary that a turbine for maximum ciency should run at a high rate of revolution, whilst for ximum propeller efficiency, much lower rates of revolution necessary. The solution for this was by the introduction of ne form of gearing between the turbine and the propeller. eral forms of reduction gearing are being experimented with, h as the electrical, hydraulic and mechanical. Mechanical ring appears at present to show advantages over the other ms—an efficiency of over 98% being obtained in the case of gle reduction, and over 97% with double reduction. There is ctically no limit to the ratio of reduction. Double reduction ring finds favour for the following reasons: (*a*) the type per-s larger ratio between revolutions of turbines and propellers hout excessive size of gear wheels—higher revolution of tur-es permits, for the same power, smaller turbines, and increase the number of turbines for the same power further reduces the size of each unit; (*b*) high revolutions or greater blade speed are possible, resulting in a nearer approach to the point where the blade speed in relation to steam speed gives maximum economy; (*c*) a small turbine permits of a pivot thrust block being used, as the dummy can be omitted, and all unbalanced load taken by the block; (*d*) small turbines have small rotors and can thus be made of a much more robust construction; (*e*) variations in temperature for any single turbine are kept moderate, and these turbines are therefore suitable for use with superheated steam; (*f*) the parts being smaller, the turbines can be more easily overhauled, repaired or renewed. America favours the electric drive for her navy and mercantile marine.

Marine Internal Combustion Engines.—One of the principal reasons which has led to the adoption of the internal combustion engine for marine propulsion is the thermal efficiency of this prime mover. Compared with a steam engine (reciprocating), and coal-fired boilers, we find: Diesel 40% to 45% thermal efficiency, according to size; steam engine 20% to 25%. As regards running, the fuel bill is about half that for an oil-fired boiler ship fitted with geared turbines; very great saving of space occupied by the machinery; reduction of personnel.

Against these advantages we have the greater initial cost; complication of parts; a greater number of spare parts have to be carried; it is probable that the repair and upkeep bill will exceed that for steam units. Before a big reduction can be made in initial and upkeep costs, all parts must be standardised; and the engines should be built in combinations of various numbers of cylinders for various powers and revolutions. For a given power the Diesel compares unfavourably as regards weight with the steam turbines and oil-fired boiler combination, and the head-room is greatly limited (this, especially from a naval point of view, is a marked disadvantage). The possibilities of this prime mover are endless; but up to the present the Diesel has not been installed in the largest ocean-going liners or cross-channel mail packets. There is no doubt, however, when a speed of, say, 25 knots can be reached, combined with a reliable and simple design of engine, we shall see the mammoth type of internal combustion ship breaking the Atlantic records. The largest ship up to the present with Diesel engines installed has a length of 600 ft. and a breadth of 72 ft.; and another Diesel-engined vessel of 20,000 tons is under construction. The present types work on the two-stroke or on the four-stroke principle; but many competent authorities affirm that the marine oil engine of the future will be a double acting two-stroke with port scavenging—this design giving an engine of low initial cost and simple construction. The solid (or mechanical) injection of the fuel is likely to be generally adopted in preference to the air injection system, owing to the reduction in first cost that is obtained by its use. Experiments are now being carried out with geared Diesel engines, and these will be watched with interest.

Marine Boilers.—It is only within the last few years, comparatively, that the water-tube boiler has been seriously considered as a rival to the cylindrical, or water-tank, boiler. The experience gained after many years with the cylindrical marine boiler proved it to be undoubtedly a good, safe, easily understood generator and also comparatively easy to clean. This type may be said to be the principal boiler of the mercantile marine. For naval purposes, of course, there can be no question as to which type is suitable; but even with such highly trained engine-room ratings as the British Navy possesses the advent of the water-tube boiler was not looked upon at all with favour. Although water-tube boilers are being fitted in increasing numbers in the mercantile marine, their many advantages do not appear to be recognised to the extent they should be, this being due in part to the high initial cost and also to the fact that the fuel consumption is inferior to that of the cylindrical type. However, the outstanding features of the water-tube boiler (*i.e.*, they are much lighter and give greater horsepower for the same space) should further recommend them. The modern trend is toward much higher working pressures, higher temperatures and the more efficient burning of the fuel and generation of the steam in the boiler. There is no reason why pressures of 700 lb. or 800 lb.

per sq. in. should not be reached. Superheating of the steam, air preheating, increase in boiler feed water temperature and careful analysis of the funnel gases are all receiving due attention, as are also the best means to adopt to ensure the cleanliness of the internal surfaces and tubes, and thus prevent or retard corrosion. Zinc slab protection is, to a certain extent, being superseded by electrolytic protection. In this system electrolytic conductivity is produced in the boiler water by a current of electricity from a source outside the boiler to metallic anodes insulated from the boiler shell, the current being regulated at will.

Oil Burning in Marine Boilers.—Within the last few years oil fuel burning has made rapid strides, and but for the question of cost would be much more generally adopted. As an example of saving in boiler-room staff, after the Cunarder "Aquitania" was converted to burn oil, her firemen were reduced to 42 as against 320 when coal-burning. The advantages of oil fuel are: superior evaporative power per weight of fuel carried, giving increased radius of action—1 lb. of oil with a heat value of 19,000 B.T.U. will evaporate 15 lb. of water to and at 212° F., and 1 lb. of coal with a heat value of 14,500 B.T.U. will evaporate 10 lb. of water to and at 212° F.; ease of shipping into bunkers and putting into fires; less stokehold staff and bunker space required; absence of coal dust and ashes; no necessity to open furnace doors with consequent loss; proper regulation of combustion; capability of forcing the boiler. Against those advantages we have: uncertainty of obtaining supplies; complications of piping and machinery; possible leakage; special appliances are required for burning; liquid and solid impurities found in the oil; widespread contamination of water-ways.

Liquid fuel is atomised by one of three methods—steam, compressed air, pressure. The last method is generally adopted in modern marine practice due to the reliability and freedom from breakdown of pressure systems. The system as now adopted is very simple; oil is drawn from the bunkers and strained, which removes all solid impurities. The oil is delivered from the fuel pumps under pressure, an air vessel assisting in maintaining a steady supply. Next, the oil passes through cold filters and thence to the heaters. The heating process may form particles of carbon in the oil, which are removed by passing it through filters fitted on the delivery side of the heater. From these filters, called hot filters, the oil passes under pressure to the distribution boxes on the boiler front, and from there through the burners (where it is atomised) to the furnaces.

Marine Auxiliaries.—The great increase in the number of auxiliary engines now fitted in modern steamships necessitates as much attention as do the main propelling machinery. As regards design, the majority of auxiliaries follow accepted practice; but the following units call for special consideration.

Condensers.—The modern method is to insure high vacuum combined with reliability, and that the weight of the apparatus shall be as low as possible consistent with the work the condenser is called upon to perform. Separate air pumps are installed, one pumping out the feed water, and the other maintaining a high vacuum by pumping air from a cooler part of the condenser. Tube failure—through corrosion—is a frequent source of trouble, and the many experiments now being carried out with tube metal mixtures have not eliminated this.

Electrolytic protection has been adopted with good results. Metallic packing for the tubes, in place of the ordinary tape packing, has recently been introduced, and the results are excellent. In connection with modern condensers a system has been devised known as the "closed feed system." By this method the condensate is removed from the condenser and discharged to the boiler without exposure to the atmosphere; thus preventing air mixing with the feed water and causing boiler corrosion. Another method now coming into favour is the removal of the air in the feed water by mechanical de-aeration; and this method seems to possess advantages over the removal of the air by chemical means.

The Michell Thrust Block.—This block possesses marked advantages over the older form of multiblock. The device consists of one collar on the shaft, the thrust being taken by a series of
pads capable of a slight rocking movement. The pads maint
a continuous flow of oil between the metal surfaces, which
thus kept apart by as many oil wedges as there are pads to p
duce them. This block is essential to the satisfactory worki
of gears now fitted in many modern ships.

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(1924); R. Sennett and Sir H. J. Oram, *The Marine Steam Eng*
(1924). (F. J. D.)

MARINES (*see* 17.719). *Great Britain.*—Marine forces in so
instances constituted the whole or the main part of forces t
off for coastal descents, *e.g.*, the British expedition to Ostend
1914 and the Zeebrugge enterprise of 1918. In others they und
took emergency land operations for which no other military fo
was available, *e.g.*, in the case of the Royal Marine Bde.
Antwerp, 1914; or again, as in the case of the U.S. Marine Bde.
France, 1917–8; and the British 63rd (R.N.) Div., which
cluded marine units, in the composition of a land army in c
tinuous operations. In several instances the marines pro
formed a soldier nucleus for formations of which the princi
part was made up of sailors, as the British R.N. Div. and e
more so the German Marine Corps. France used improvis
battalions and brigades of sailors (Fusiliers Marins) in the sa
way, and a brigade of these under Rear-Adml. Ronarc'h w
undying glory by its defence of Dixmude during the first batt
of Ypres and the Yser.

The German Marine Corps was composed originally as
division partly of marines and partly of sailors, who were nume
cally far in excess of naval requirements. It took part in
siege of Antwerp and the advance through Flanders. Wh
stabilisation came the division was raised to the strength o
corps, and the corps commander (Adml. Schroder) was ma
responsible for the Yser front, for coast defence between Ni
port and the Dutch frontier, and for purely naval operati
based on the Belgian coast, having both submarines, surf
craft and aircraft under his command for the purpose. Final
the German corps formed a third mobile division which was s
to any point on the Western Front where reinforcements w
needed.

The Royal Marines, 1914–8.—Just before the outbreak of
World War the total strength (all ranks) of the British Corps
Royal Marines was 18,000. During the War, however,
strength of the corps increased steadily, until at the end
numbers had been more than trebled, due to the formation
new units within corps. In 1914 the R.N. Div. was formed; va
ous divisional units of Royal Marines were raised for service w
it, such as engineers (transferred to the Royal Engineers in 19
medical units and transport. The R.M. Submarine Min
(1917), the R.M. Labour Corps, the Home Service Lab
Corps (1917) and the R. M. Engineers (1918) were raised. Spe
units were also provided separately and compositely by
R.M. Artillery and the R.M.L.I. at various times.

In all naval actions, and in naval patrol duties, the Ro
Marine personnel took a part. In the early days of the War
sonnel of the corps served with the armoured cars operating fr
Dunkirk. Four battalions of the brigade took part in the defe
of Antwerp. Details from two R.M.L.I. battalions were invol
in the landing at Kum Kale and Sedd-el-Bahr (March 4 19
and marine artillery siege guns were used at Dunkirk. The co
sent a battery to Egypt in 1916 for coast defence duties. Deta
ments served also in Cameroon, in the Persian Gulf and
Adml. Troubridge in Serbia, and formed the nucleus of the he
batteries which were raised for service with Gen. Botha in Sou
west Africa and with Gen. Smuts in East Africa. The cor
furnished gun crews for armed merchantmen and garrisons
naval bases as at Scapa, Cromarty and St. Helena, and for t
coast defences at the North Foreland, in the West Indies
elsewhere. (X)

United States.—The United States Marine Corps is a separa
military organisation under the administration of the Na
Dept., and as such it forms a part of the naval establishment
the country. It was founded on Nov. 10 1775 when a resoluti
of the First Continental Congress authorised the raising of t

alions of marines to assist the continental navy in the de-
c of the colonies. In organisation, training and duties this
e was modelled after the British marines of that date. From
ı to the present the marines have continued to serve as an inte-
part of the U.S. Navy; although under the authority of con-
sional enactment portions of the corps have been temporarily
ıched for service on shore with the U.S. Army.

he laws provide that marines may be assigned to the follow-
luties: to garrison the different navy yards and naval stations
ıin and beyond the continental limits of the United States;
ırnish detachments to serve aboard the battleships and cruis-
of the fleet where they form one of the gun divisions of the
, perform military guard duties and act as a landing force
ı the fleet or squadrons as required; to act as expeditionary
ling forces for service with the fleet to capture and defend
ı positions as may be required as temporary naval bases for
fleet; to furnish the first line of the mobile defences of naval
ions and bases beyond the continental limits; and, when
ial conditions make it advisable, to be temporarily trans-
ed for service with the army.

he marines have taken a conspicuous part in every war in
ch the United States has been engaged and have also seen
h foreign service in the peace-time occupation of foreign
ntries for the protection of American citizens and property
ing revolutions and unsettled conditions, in furtherance of
diplomatic policies of the United States.

efore the Spanish-American War in 1898 the marine corps
sisted of 75 officers and 2,000 enlisted men, but was increased
eafter, and at the entrance of the United States into the
rld War in 1917 it consisted of 511 officers and 13,124 en-
d men, and during that War a total of 31,824 marines were
overseas for service with the A.E.F. The Fourth Brigade
larines formed a part of the Second Division of the A.E.F.,
re they served in many campaigns and battles with conspicu-
gallantry and gained many citations and decorations. The
ce-time operations of organisations of the marine corps have
uded expeditions to China, Cuba, Nicaragua, Mexico and
ama, for the protection of American interests, and the recent
ıpations of Santo Domingo and Haiti to insure the peace
stability of these countries under treaty obligations between
n and the United States. The mission of the marine corps
er the stated naval policy of the United States is: "To sup-
the fleet, or any part thereof, in the accomplishment of its
sion." The emblem of the corps is a hemisphere with the map
he Americas thereon, superimposed upon a foul anchor and
nounted by an eagle with spread wings. The motto of the
ps is "*Semper Fidelis.*" (D. W.*)

ARINESCU, GEORGE (1864–), Rumanian neurologist,
born at Bucharest Feb. 23 1864. He was educated at the
ılty of medicine of Bucharest and then went to Paris where
worked under Dr. Charcot at the *Salpêtrière*, carrying out
ıable researches on the histopathology of the nervous system.
ear later he went to Frankfort and worked with Professor
gert. He then continued his research work on nervous dis-
s in Berlin and Brussels. In the latter town he published his
k on the treatment of epilepsy for which he obtained a prize
n the *Académie Royale de Belgique*. In 1900 he was appointed
fessor of neurology at the University of Bucharest. In the
ımn of 1916 Professor Marinescu went to London where the
lical Research Committee made him a whole-time grant. At
L. C. C. Maudsley Hospital, Denmark Hill, in collaboration
ı Lt.-Col. F. W. Mott, F.R.S., he applied himself to an
ortant series of researches upon the microscopic structure of
ve cells and their changes in different phases of activity or
ıage. He also took an important part in the investigation of
nervous system in some cases of *Encephalitis lethargica*.

ARINETTI, FILIPPO TOMASO (1878–), Italian writer,
born at Alexandria Dec. 22 1878, and studied in Paris,
luating at the Sorbonne; in 1899 he also graduated in law
he University of Genoa. He was the founder of the futurist
ement, publishing the original futurist manifesto in the Paris
ıro on Feb. 20 1909. For a time he edited the international review *Poesia*, but his most characteristic work was *Mafarka le futuriste*, published in French in 1910. He also wrote for the stage *Le roi Bombance* (1905), a satirical tragedy, and other plays, and published a volume on the futurist theatre, *Teatro sintetico futuristo* (1916). In 1914 he wrote an extraordinary volume entitled *Zang-tumb-tuuum* on the Balkan war, and particularly on the siege of Adrianople. Other futurist essays are *Noi futuristi* (1917), *Manifesti del futurismo* (4 vol., 1920), *Democrazia futurista*. On the outbreak of the World War he was strongly in favour of Italian intervention, as he showed by his volume *Guerra sola igiene del mondo* (1915). *Otto amici in mia bomba* deals with war experiences; while in *Futurismo e fascismo* (1922) he expresses his support of the Fascist movement. Marinetti's futurism, though violent, exaggerated and sometimes ridiculous, is a quite genuine reaction against the excesses of the academic and hidebound tradition in literature and art.

MARKBY, SIR WILLIAM (1829–1914), Anglo-Indian jurist (*see* 17.730), died at Headington Hill, near Oxford, Oct. 15 1914.

MARKETING.—Marketing is essentially buying and selling. The central fact is the sale, but to secure sales the goods must often be assembled from the places where they were produced, graded when qualities differ, sorted when there are different varieties, moved to market and in many cases thence to the place of consumption.

I. IN THE UNITED STATES

Methods of Marketing.—The simplest form of marketing and the most primitive is the sale by the producer directly to the consumer. In the aggregate, sales made in this way even at present run into immense volume, although but a small part of the total of business. Modern business, the development of large cities, an increasing division of labour in industry, all tend to reduce this form of marketing. There is still a considerable amount of marketing of produce, particularly butter and eggs, direct from farmers to consumers, by parcel post and by direct sale. Again, certain specialities, complicated machines and machines requiring much attention and service after the first sale, usually are sold direct by manufacturers to consumers through the medium of speciality salesmen. The salesman is the representative of the producer in the marketing transaction. Again, if a retailing house does so large a business that it can advantageously engage in manufacturing some of the lines of goods it sells, it may combine production with distribution.

Most products of common use, such as foods, clothing, footwear, house furnishings, lumber, fuel and so on, are marketed through middlemen. The manufacturer of men's clothing or of shoes usually sells his product to retailers scattered over the country, who in turn sell to consumers. Manufactured food products, dry goods, drugs, hardware and house furnishings are generally sold first to wholesalers, who in turn sell to retailers.

Farmers' produce, fruits, vegetables, butter and eggs, are commonly marketed through local buyers, then to wholesalers or wholesale distributors, then to retailers and lastly to consumers.

Variations in Method.—Variations are introduced into marketing in many ways. The actual sale may be consummated through personal salesmanship either in the seller's place of business or in the buyer's. If the seller carries a line of goods he must have a store or shop, but even this may not keep him to one location. The old-time pedlar carried his store on his back. More recently grocery stores, meat shops, book and periodical shops and even dry goods and house furnishings have been put on wheels, on automobile trucks and sales routes laid out to be covered periodically, making sales direct to housewives and consumers. Again, the sales may be effected through retail institutions by mail. In the United States a gigantic business has been built up by a few large mail order houses which are really stores or shops selling retail to consumers. Some wholesale concerns selling only to retail dealers have developed enormous businesses founded on the mail order method of selling. In addition to these there is an unknown but certainly large amount of business transacted by ordinary retail and wholesale stores by mail, supplementing personal selling.

Wholesale Marketing

In the case of highly perishable goods, such as fruits, where no time may be lost in effecting sales in order that they may reach the consumer before spoiling, the auction system is used. Wholesale buyers and salesmen come together at a designated place at a set time and clear their transactions. The auction is a much more widely used mechanism of trade in England and in continental Europe, where large quantities of nearly all kinds of goods are thus sold, than it is in America, where the system is declining. In addition to its use in the marketing of perishable goods it occurs, to a limited extent, particularly in lines of known standards or qualities, which are bought and sold in wholesale quantities at certain dates each year, as carpets, rugs, wool, furs and fruits. It is also a common method of marketing second-hand goods, works of art, antiques and even real estate.

Variation in marketing occurs through variation in ownership of the goods to be marketed. To illustrate: producers or local buyers usually sell outright to wholesalers all goods marketed through the wholesaler-retailer channel of distribution; but in highly perishable goods, such as fruits, dressed poultry, live poultry, etc., and also in cases where the value of the goods runs very high in proportion to the value of the service rendered by the wholesale middleman—as, for example, finished textiles, real estate, commercial paper and stocks and bonds—the wholesaler (or dealer who takes his place) frequently, if not usually, merely sells or buys as the agent of the owner and secures a commission or brokerage instead of a profit for his services. This arrangement in the case of perishable goods relieves the wholesale dealer of the risk from loss, and, in the case of costly goods, of the burden of financing the goods. Such wholesalers are known variously as commission dealers and brokers.

Function of Speculation.—While goods are being gathered together in wholesale quantities and made ready for distribution to the retail trade other factors in marketing frequently enter in, factors of a speculative nature. Standardised goods that are not readily perishable, such as grain, cotton, wool, silk, provisions, coffee, sugar and so on, are likely to be bought purely for speculative purposes. Thus a lot of grain or cotton may be bought and sold several times before being moved to consumption. It is but another step for these speculators to make their ventures in hope of gain on what they think future prices will be. Hence "selling futures" is a common occurrence on the great exchanges that deal in the commodities named.

Under this system grain may be bought and sold long before it has been harvested or grown, or even before it is planted. (*See* GRAIN TRADE.) A flour-miller may quite legitimately ensure his future supply of grain at a certain price by buying "futures." But a great deal of opposition has been aroused at various times by speculation in the necessities of life. It has been charged that dealing in futures enables powerful speculators to combine unjustly to secure success for their ventures, in some cases tending to hold prices down and in others tending to hold prices up. As a result both producers and consumers are suspicious of such traders. The consensus of opinion among those who have studied the course of speculation on exchanges seems, however, to be that if manipulation of prices and monopoly can be kept out of the market, and if the laws of supply and demand are allowed to operate freely, the effect of speculation, particularly of dealing in futures, has a healthful balancing effect on the market. Under such conditions purchase and sale of commodities for future delivery tend to discount and equilibrate all conditions of supply and demand, so that changes of price are made much more gradually than they would be if buying and selling of such commodities were confined solely to the stock offered each day. Dealing in futures is an essential function of marketing, but it needs careful regulation to prevent unfair practices.

Methods of Marketing.—If producers are many and small, and are located far apart, it is almost certain that their products will have to be assembled by a local buyer of some kind; whereas if the producers are able to turn out large quantities they may be able to deal with wholesalers direct.

If consumers use small quantities or small lots of any product at one time it is almost certain that they must purchase from retailers. But a large consumer would be able to buy more advantageously direct from the producer.

Some articles cannot be sold more than once or twice in a lifetime to a customer. If it also happens that such articles require much demonstration and explanation, then the producer is almost forced to sell direct to the consumer or have his sales made by special representatives or agents. Subscriptions to high-priced periodicals, adding machines, life insurance and real estate are illustrations of goods that need such specialised attention.

Time is a very important element in the marketing of peri able goods. There must be no delay, and little time can be giv to the sale of any particular unit. An illustration of a perisha article is the daily paper, the weekly or monthly magazi Timeliness is the essence of their value. This makes necessa a highly specialised marketing organisation to carry papers magazines over the country and, in the case of magazines, place them on sale everywhere at the same time. Such specialis handling calls for expense not incurred in goods not perishab

A low-priced article with a small margin of gross profit to seller cannot be sold in the same way as an article that offer wide margin. In the former case the margin above costs production could not permit the article to be sold direct or to advertised and sold by itself by the mail-order method. It mu take its way to the consumer through the channels of tra followed by thousands of similar articles.

Competition.—The competition in the sales field of any arti might readily determine the channel of distribution that taken. Certain manufacturers of soaps, perfumes and toi goods have found it so difficult to place their products advan geously in drug stores and similar retail outlets because of number of competing lines that they have found it advisable sell, especially in country districts or small towns, direct consumers by means of agents and canvassers working on commission basis. A motor-car tire maker found it so diffic to break into the market through automobile dealers and gara that he sold his product to a mail-order house.

A new product must as a rule be sold through specialised m keting systems which may be abandoned after the public h begun to know the article.

THE COSTS OF MARKETING

Table I. contains figures compiled from actual records by Harvard Bureau of Business Research, Harvard University.

TABLE I. *The Retailing of Shoes: A Comparison of Costs*
Net Sales 100 per cent

	Lowest	Highest	Usual
	%	%	%
Independent shoe stores:			
Low priced shoes . . .	13·3	32·33	20·5
High priced shoes . . .	23·43	32·85	28·8
Chain shoe stores . . .	9·85	57·60	24·6
Department store:			
Shoe departments . . .	19·0	33·4	23·5

It is clear that the statistics do not prove that in the case of sh either chain stores or department stores can be conducted at expense than independent stores. It is true that the lowest fig for chain stores is considerably lower than any other, but the ch stores also show the highest costs. The average costs of selling chain stores seem to run a little higher than in independent lo priced shoe stores and in department stores.

Table II., showing cost of marketing,[1] is compiled and adapt from reports of the Harvard Bureau of Business Research, Nor western University Bureau of Business Research, several natio trades associations and personal studies.

Costs of selling through mail-order houses are not officially kno They are supposed to range from 18 to 30% of sales. But the kno edge of a general figure of this kind for a large mail-order house w many departments would be of little value even if correct. Costs selling vary from department to department in mail-order ho just as in department stores. To be of value in a comparison selling expenses, the figures should show the cost of selling shoes, example, by mail. All things considered, the general costs of runn a large mail-order house are probably somewhat lower than tho for a large department store handling similar classes of goods.

The mail-order establishment need not be in a shopping distri so that the rent or investment represented by its size is comparative small; the employees who fill orders do so more rapidly and for le pay than those who sell in a store; advertising is usually confi to the less expensive publications, and in the case of the larg houses the customers are much more numerous, running into m lions. Costs in the shoe department of a mail-order house should r lower than in a department store or speciality shop because in t mail-order house there is no time and labour lost in fitting sho

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[1] Costs of retailing in other lines of merchandise, so far as t figures are available, show about the same relationships. T example presented may be taken as typical.

TABLE II. *Marketing Costs*
Percentage on Sales

	Wholesale			Retail		
	Lowest	Highest	Usual	Lowest	Highest	Usual
	%	%	%	%	%	%
utomotive Equipment	16	26	23·5	15	29	24
othing	12	18	16	20	30	24
rugs	12	20	15	23	33	28
y Goods	11	17	14	15	30	23
ectrical Supplies	10	20	14	20	31	26
oceries	5	15	9	9	22	14
rdware	13	21	18	11	32	23
welry	15	20	18	24	40	32
oes	12	26	15	13	34	24
rniture				20	35	25
neral Merchandise				10	30	16
epartment Stores				18	32	28
ain Stores (Shoes)				10	57	24
ain Stores (5 and 10c)				..	..	26
ain Stores (Groceries)				..	..	16
ain Stores (Drugs)				..	..	28

s saving is counterbalanced somewhat by the number of shoes ch are probably returned. The lower costs of selling in the mail- r house, however, are offset in part at least by the costs of trans- ation and other expenses incidental to ordering by mail.

conomies in the Chain of Distribution.—A part of the com- tive battle for trade among these various types of institutions sists in the utilisation of large buying power. Large chain e systems, mail-order houses and large department stores uently purchase their goods direct from producers and secure prices usually given wholesale purchasers. In some cases a of these differences may be used in cutting the prices to sumers, but it would be a mistake to assume that the con- er gets all the benefit from purchases made at lower prices, hat this entire difference is gained for the dealers. Concerns go direct to the producers, and thereby eliminate the whole- rs, as a rule incur practically all the usual expenses of whole- ng, such as interest on the investment in the larger stock of ds, storage risks, buying expense in dealing with numerous ducers instead of a few wholesalers, extra record-keeping , with chain stores, reshipments to their various stores ughout the country.

he only real saving which buying direct from producers in- s is the eliminated profit of the wholesaler, with a possible ction of the expense for salesmen whom wholesalers must loy. Competition in buying has forced the joint creation by ll concerns of buying organisations which, united, represent arge a buying power as the chain or department stores. operation in buying certain classes of goods has strong ad- tages both for dealers and consumers. Buying in group at time may secure advantages, not only in price but also in sportation and handling, sufficient to cover the added ex- ses incurred in buying in quantity. Since 1920 there has been pid development in group buying by independent retailers ll kinds. The competition of chain-store systems wielding rmous buying-power advantages has forced independent lers, both large and small, to associate for the purchase of y items, and in some cases for the joint ownership of full- d wholesale houses.

omparing the various methods of retailing as exemplified in ordinary independent stores, the department stores and the l-order house, from such facts as are available, it does not n possible to assert positively that any one method presents ded general economic advantages over the rest. Each pre- s advantages in point of service, but the difference in service ears to be fully compensated in expense—that is, the public s for what it gets and in proportion to what it gets.

So far as the public is concerned, it seems safe to say that there are large classes who prefer and who will always continue to prefer to trade in those retail establishments offering them the highest developments of service, the department stores and the independent speciality shops. Other large classes prefer and will probably always prefer to buy in stores offering less service and proportionally lower prices. Undoubtedly there are many who find their greatest satisfaction in purchasing in the stores of the self-service kind, where they may look about and pick up on their own initiative whatever they may wish to buy. Institutions are built to serve people in the way that they want to be served. There is room, therefore, in the retail trade for many types of stores. Speciality shops, department stores, chain stores and mail-order houses will all continue to exist as long as there are numbers of people who want the services each institution offers. It seems impossible to believe that any one type will monopolise the retail business or crowd out all the others.

Avoidable Waste.—The following statements outline briefly a few of the details of distribution which it seems certain must receive attention in order to secure more economical distribution. No doubt many more could be added. Poor roads greatly increase the costs of bringing the farmers' crops and produce to market, costs that must be added to the price that consumers eventually pay. Inadequate railway transportation is another element that makes a considerable addition to the costs. Car shortages at crop-moving time, cars unsuited to the products to be hauled, excessive delays in forwarding, at terminals, on the way and at transfer points, are common sources of expense.

Delay in transportation as a factor of expense in distribution has not been given the attention that it deserves. Poor location of terminals makes a great deal of expensive cartage necessary. Congestion of traffic in city thoroughfares is a growing cause of increased costs in distributing goods. Inadequate, inefficient, poorly located storage facilities cause huge losses. Inadequate, unauthoritative and inaccurate collection and dissemination of market information such as is needed by producers, distributors and consumers is responsible for great wastes. Through lack of such information business in many lines now passes constantly from glut to famine and back again. Poor packing of merchandise, inefficient loading, rough handling and uneconomical methods of handling are causes of waste and therefore of higher costs of distribution.

To refer more specifically to the activities of marketing through wholesalers and retailers, there is a startling loss of the wholesale salesman's time in finding customers, in making appointments, in fruitless interviews. The time of both salesmen and buyers is lost. Probably less than a sixth of a salesman's time, averaging salesmen of all classes, is actually employed in selling or even in displaying and describing merchandise. Anything that can be done to improve this deplorable economic condition will increase efficiency and decrease costs. No one can even begin to estimate the losses resulting from poorly trained salespeople who fail to sell and who waste the time of their purchasers through lack of knowledge of their goods, their customers' wants and their business, or through lack of ability to use their knowledge properly. Owing to lack of incentive most employees give but a fraction of their ability to their work.

Advertising.—Advertising is or should be an invaluable aid to marketing. In the list of expenses of distribution it occupies a prominent place. There is certainly room for improvement in its administration. Much study has been given in some organisations to such problems as the proper selection of mediums and the right use of the space taken. No doubt much greater progress can and will be made in the future in these directions, but the greatest loss in advertising seems to be in the lack of faith of the public in the advertising. If people gave more credence to advertising, much less of it would be needed to secure the same result. The remedy, of course, lies in the direction of raising the standards and shutting out the dishonest advertiser. (*See* ADVERTISING.)

Duplication.—Duplication in delivery organisations by retail stores is a source of economic waste. There are many who think that there are too many retail stores. Would goods be sold for less if there were fewer? Probably not, because a large part of the competitive losses now occurring are borne by the dealers themselves in unpaid services. It may be argued that if their number were reduced the rentals for the locations that would be eliminated could be saved. This cannot be definitely checked by such experience as has been recorded in any public way. Concentration of retailing seems invariably to result in increasing rents. In fact, rents tend to increase faster than sales, so that the fewer the stores the higher the share of the landlord. More studies are needed to determine the exact effects of restriction of the number of stores on costs of distribution. There is further the fact that the store plant is unused for a large part of the time. Store hours are by custom and legislation steadily growing shorter. This means that the capital invested in stock and plant has fewer hours in which to produce.

Dishonesty.—Finally, there is undoubtedly an enormous loss due to unfairness and dishonesty, a loss that is now carried in large part if not wholly as an expense of distribution, being added to the price paid by the consumer. Failure to return containers lent by distributors seems a small item, but in such a business as milk distribution in large cities the loss to milk distributors due to non-return of empty bottles is enormous. Uncollectable debts and the cost of collecting delayed payments are important items in the expenses of distribution. Disregard of contracts in such matters as refusal of goods after placing orders, failure to deliver goods after orders are placed, abuse of the privilege to return goods, claims for adjustment and many other similar items make up large losses. Unfair competition, efforts made not to increase legitimate business but to impede or even to destroy competitors, commercial bribery, "graft" and the exercise of monopoly, all burden distribution expense far too much. A source of considerable loss is theft by employees, burglars and shoplifters. Some retail establishments count upon a fixed percentage on their sales representing losses due to this cause, a percentage that is added to the gross expenses which form part of the selling prices. Many of the losses of the distributive business, including theft, breakage, fire and so on, are covered by insurance, the cost of which is carried as an expense against the distributing process. Anything that can be done to reduce these losses will by that much reduce expenses of distribution and prices of goods.

Education in Marketing

The leaks and wastes enumerated above are certainly responsible for at least a quarter of the present costs of marketing. They may be responsible for a third or even more. Here, then, is a great field for reducing costs by improving present methods. The first general step towards such improvement is education. A beginning has been made. Before 1860 the apprenticeship system was general in England and to some extent in America, in retail, wholesale and importing houses. The apprenticeship system gradually decreased about the middle of the 19th century, and for years after no systematic training was provided for young people other than the haphazard effect of their experience. The first training of modern salesmen in America seems to have been by the subscription book houses that flourished during the 'seventies and 'eighties. Their canvassers or book agents were thoroughly drilled or schooled in the art of selling or in securing orders. During the 'nineties sales managers in speciality manufacturing concerns, notably the National Cash Register Co., of Dayton, O., began training their men in special schools held at the factory.

Training salespeople for retail stores seems to have begun in the 'nineties in such subjects as arithmetic, spelling and writing and, in 1905, in sales methods, under the auspices of the Women's Educational and Industrial Union in Boston. Educational service to salespeople and other workers is now commonly found in the better classes of both wholesale and retail stores. A beginning has been made also in education in distribution and marketing in American colleges and public schools. Several colleges offer courses in marketing, selling, sales management and advertising. Many high schools give similar but more elementary courses.

The main drawback to a rapid development of public education in marketing seems to be a shortage of teachers who can cond
such courses rather than lack of public interest. Such an orga
sation as the United States Chamber of Commerce in its relat
to distribution is largely a clearing-house for information a
educational ideas for its members. One of the notable thi
in the progress made in educational work for marketing is
growing conception of the relation of the sciences of p
chology and sociology when practically applied to the pr
lems of marketing.

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II. IN GREAT BRITAIN

Excepting the larger wholesale markets in England, situat
in Liverpool, Mincing Lane, E.C., and elsewhere, which han
cotton, wheat and certain other imported products, it may
asserted that much variety, extremely haphazard methods a
a considerable degree of inefficiency in organisation are
characteristics of the marketing process throughout the grea
part of England, Scotland and Wales. For this unsatisfact
condition many reasons may be given, not the least import
of which is the continued existence of market rights in the ha
of private individuals or joint stock companies or their assign
enjoyed under royal charter, Act of Parliament, or survivi
manorial rights.

Scarcely less important causes are the reluctance of the smal
British producers to form societies for co-operation in the s
of their output and the comparative ease with which, hither
a growing home market has absorbed an output which, especia
in the case of certain perishable products, has increased
rapidly than the demand. Again, improvements in meth
have not been necessary in the absence, until recently, of effect
competition from abroad in respect of most of the less import
commodities ordinarily handled in the provincial markets; w
the inability of many existing markets to cope with an incre
in the volume of business—an inability especially marked
some of the larger towns and arising mainly from the diffic
of reconciling numerous and conflicting vested interests—
rendered difficult any large-scale recasting of the marketi
process throughout the country.

*Location and Organisation of the Principal English Wholesale F
Markets: Fruit and Vegetables.*—The smaller centres of popu
tion have traditional and established market places originally
apart for the sale of produce direct from the growers to t
consumers. In the larger industrial towns these markets h
grown in importance (but not in physical dimensions) with t
growth of the towns themselves. Some have become re
markets whose continued existence it is not always easy to jus
on economic grounds; but others have become wholesale mark
especially in areas where local production is insufficient or err
and foreign imports are needed to ensure supplies, or again whe
transport facilities and favourable geographical situation h
permitted the extension of their spheres of influence and caus
them to become distributing centres for large areas. Many
these are well organised and are sensitive to price movements
other markets. Since, however, they draw a large proportio

. supplies direct from the producer, and these supplies are :e to fluctuation, they require an additional and a more re- e source from which to supplement the local output and from h special lines and imported supplies may be obtained to ıce demand.

ıis source they find in the central markets at important ports, especially in the Covent Garden market in London, which ecome a national distributing centre for fruit and vegetables. ately owned by the Covent Garden Estates Company, Ltd., market handles not only produce raised within carting dis- e of London, which is required for London consumption, but main crop produce in general demand, part of which is larly recodsigned to other distributing centres, and certain uce in limited demand or supply, such as glass-house produce h commands a high price and most of which is reconsigned her markets. Much of this reconsignment business is eco- ically indefensible; but it cannot be replaced entirely by t consignment to provincial markets until the latter become developed and price movements in them much less liable influenced by small alterations in supply and demand.

eat and Fish.—Wholesale meat markets are generally owned managed by local authorities, and exist only in those centres pulation (not more than 20 in number) where the magnitude ssible trade justifies their establishment and where retailers ssured of adequate supply with wide range of quality and s. In smaller towns the place of the municipally owned ket is taken by wholesale butchers who purchase live stock, ghter it and sell the meat to retail dealers; and in the City of field, where no meat market proper exists, the wholesalers t the slaughter-houses which they rent from the local author-

By far the largest and most important of wholesale meat kets proper is the London Central Market at Smithfield h in a single year handles between 400,000 and 500,000 tons, uding 40% of the total imports of meat into the whole try. Unlike Covent Garden, it undertakes practically no nsignment of produce to other wholesale markets; but its s for both home and imported meat (although not officially d under the imprimatur of the City of London Corporation, h is its owner and manager) are largely used as a basis for lesale dealings in other parts of Great Britain.

the foreign meat trade a network of depôts has been estab- d by certain large distributing firms in all the principal cities towns in the country. To them supplies of chilled or frozen meat despatched from the ports of entry. They, therefore, serve mall markets from which retailers can secure supplies with and promptness. The prices charged are fixed with reference mithfield and are, therefore, fairly uniform throughout Great ain; but local circumstances occasionally demand departure strict uniformity.

ish is handled at Hull, Grimsby, Fleetwood, Aberdeen and r ports, usually by Dutch auction, and is distributed by the lesale purchasers to their stalls and to representatives in in provincial fish markets (Birmingham, Glasgow, Liverpool, chester and others) and also to the very important Billings- market in London.

ereals.—Wheat is usually sold by sample in the local corn- ket nearest the producer's home. Certain of these small kets, however, attract a considerable quantity of grain from s outside their immediate neighbourhood, and some of the est dominate large tracts of country, frequently serving as ôts for the receipt of both home-produced and imported wheat for its export to other consuming centres. The purchasers hese local markets include millers among their number; but outright to merchants and sale by merchants or agents on mission are not uncommon, the latter being, perhaps, the l plan in Scotland. Producers' co-operative societies may be employed, which may sell direct to millers, or more uently to merchants whom the larger milling-firms find it e convenient to employ in their purchasing of home-grown at in bulk.

arley when sold for malting and distilling is usually sold in larger market-towns by merchants acting on a commission basis on behalf of the farmer. Oats are largely consumed on the farms of the growers, but direct sale by the producer to oatmeal millers is common. Merchants, however, frequently buy outright for sale to large consumers such as collieries and railway companies.

After wheat is milled it is usually sold direct to bakers, confectioners or other users, generally through travellers employed by the milling companies. Occasionally factors or wholesale dealers intervene, who purchase from millers for re-sale on their own account to small bakers in the more sparsely populated districts. Distribution by this method is uncommon, however, in the case of home-milled flour; although imported flour is nearly always handled by wholesale dealers of this kind.

At the next stage, that of baking, a few firms in several of the more important centres of population confine themselves to a purely wholesale trade. A fair number attempt to combine partial retail distribution with wholesale manufacture and usually possess retail shops where the bread is sold over the counter direct to the consumer or from which door to door delivery by van may be undertaken. The majority of baking firms, however, confine themselves strictly to retail trade, selling, in addition to bread, various forms of confectionery, such as cakes, sweets and biscuits, which may be either proprietary articles or manufactured by the bakers themselves; but certain difficulties, occasioned especially in the north of England by housewives buying bread at irregular intervals only, encourage distributors to cease manufacture themselves and to rely on wholesale baking firms entirely for the supplies which they need.

Poultry and Eggs.—Owing to the fact that British producers of poultry and eggs have no export trade to foreign markets, there is no obligation on them to conform to standardised methods in the disposal of their products. There is consequently great variety in the marketing of these commodities and the plan adopted by an individual producer depends partly on the scale upon which he is operating and partly on his situation relative to his market or his customers. Sale may take place (*a*) by private treaty in the producing area; (*b*) by auction in the producing area; (*c*) directly to distant distributors; (*d*) through commission salesmen in distant wholesale markets; (*e*) through co-operative societies. To the first of these classes may be assigned sales at local weekly markets of eggs and dressed poultry to local customers, sales by parcel post or rail direct to the consumer, sales from door to door often in conjunction with milk and vegetables, sale to local distributors in the nearest market town and sales at the farm. This latter plan is common throughout England and Wales, intermediaries known as higglers (also as cadgers and hagglers) going round in districts where the farms are scattered and distant from the larger consuming centres. The higgler calls at the farm with a vehicle once or twice a week, buys all the eggs and poultry available and pays cash without much regard to classification or to quality. He then resells privately or in open market to wholesale and retail distributors; but he may occasionally send consignments to wholesale markets for sale on commission.

The system of selling by local auction has been greatly extended in recent years. The Stirling live-stock mart is a good example, and the Kings Lynn market also is one that has lately made marked progress in this comparatively new development. For sale on commission the Smithfield and Leadenhall markets in London are utilised as well as the various wholesale markets in the provinces.

Costs of Distribution

The costs of distribution vary considerably with the nature of the commodity handled, the method adopted and the degree of efficiency in the market organisation available to the producer. In the case of cereals the fees paid by the farmers in the local corn-exchange are very small. Sixpence per day, one guinea per year, one penny on each occasion the market is entered, threepence per person entrance fee for sale by sample, are a few examples taken at random of the rentals and fees in actual operation at the present time. Cartage to the market or railway station is also the farmers' expense. This is reckoned at 1s. to 2s. 6d. per quarter of grain up to a distance of 8 to 10 miles. Merchants selling wheat on commission for growers are paid 9d. to 1s. per quarter or 2d. or 3d. per hundredweight. These figures are slightly higher in the cases of barley and oats. A rent ranging from 2 guineas to over 8 guineas per annum is charged to merchants who operate in the local exchanges and who require stands, desks or space on the market floor.

Fruit and Vegetables.—For fruit and vegetables the costs incurred in the complete marketing process are proportionally greater than in the case of cereals. Considerable expense arises in the preparation of produce for the market. Dressing potatoes for example costs 4s. to 5s. per ton. Cartage to railway station is estimated in Lincolnshire on the average to amount to 3s. to 4s. per ton. Railway charges are moderate and, on the whole, reasonable. In the distributive market itself porterage charges and market tolls are an additional burden and then there are the payments to the commission salesman for his services.

It is the practice of the commission salesman to supply the receptacles or containers needed by the producer and generally to act on the latter's behalf once the produce is despatched from the farm. When a sale has been effected the salesman remits to the grower the amount realised less the charges for use of containers, for transport, porterage, market dues and also a commission on the selling price for service rendered. The latter is nominally about 7½%, but actually in cases investigated by the Linlithgow Committee an average of 10 or 12% was found.

In its further passage towards the consumer the produce may find its way direct to the retailer from the commission salesman, or it may be sold to a commission buyer acting for a distant wholesaler, who in turn resells to the local retailers from whom the consumer buys. These agents who buy on commission may act merely on behalf of principals who cannot attend the market in person, or may themselves buy on their own credit and assume full responsibility for the produce and for bad debts, charging up goods at cost price, adding porterage-out and a flat-rate charge to cover labelling, consigning and the clearing of empties. In the former case they receive a flat-rate per package, handled (2d. in Covent Garden). In the latter they charge 2½ to 7½% on the cost price.

It is calculated that the wholesalers on whose behalf they act make a net profit of about 2% on their sales to retailers, and that the latter obtain a net profit of over 6% on the cost of the goods or a little under 4% on turnover. The diversity, however, of retail services demanded by the consuming public and the wide range of costs entailed cannot but make for uneconomic distribution of these products; it would not be correct to state that the middlemen actually engaged in the marketing process make profits that are unduly large.

Meat.—In the meat trade the following estimates taken from the Linlithgow Report exhibit well the costs incurred and prices paid and received in the passage of beef from the English farmer to consumers in larger industrial centres.

	£	s.	d
Farmer receives for one animal from dealer at local market	31	0	0
Farmer's expenses (tolls, etc.)		9	3
Farmer's net receipts	30	10	9
Dealer receives from wholesale butcher	32	10	0
Dealer's expenses (rail, tolls, feeding, etc.)		18	6
Dealer's net profit		11	6
Wholesale butcher receives from retailer	30	3	9
Wholesale butcher receives for hide and offals	3	10	6
Gross receipts of wholesale butcher	33	14	3
Expenses of wholesale butcher (slaughtering)		13	2
Wholesale butcher's gross profit		11	1
Retailer's receipts from consumers	36	9	10
Retailer's payment to wholesale butcher	30	3	9
Retailer's gross profit	6	6	1

The weight of meat sold in this instance was 690 pounds. The net price paid by consumer being £36 9s. 10d. and the receipt from offals being £3 10s. 6d. the difference between the net price received by the farmer and the total made by meat and offals is, therefore, the difference between £40 0s. 4d. and £30 10s. 9d., *i.e.*, £9 9s. 7d. The corresponding differences for Wiltshire bacon and for pork were £3 14s. 7d. and £1 16s. 6d. for weights of 140 and 148 lb. respectively.

The same Committee also collected figures showing the receipts from the sale of a forequarter of frozen beef weighing 187 lb. and costing £2 14s. 6½d. or 3½d. per pound. In this case £5 6s. 1½d. was realised, giving a gross profit of 48·6% on sales. In another case New Zealand lamb costing £1 17s. 4d. was retailed at £2 8s. 0d., leaving a gross profit of 22·2% on sales. When it is remembered that the expenses of the retailer in the case of frozen meat are substantially less than in the case of home-killed meat, owing to the absence of slaughtering and dressing costs, the very remunerative character of trade in foreign meat is readily perceived. Again, competition appears to be less active in the retail meat trade generally than it was before 1914, and this notwithstanding an increase in the number of establishments since that date. It would seem to be the case that butchers, having been encouraged to purchase collectively during the War period, still combine to keep down prices both of stock and meat; and further that retailers to a considerable extent agree on the prices consumers are required to pay and on the whole refrain from underselling one another in open competition.

In the distribution of bacon retailers usually purchase supplies of home-cured bacon direct from the factory; but in some cases they may buy from wholesale provision merchants. The margin obtained by the wholesaler is about 2½%. This is ample for the services he renders. The retailer's gross profit is more difficult to ascertain; for this trade is mainly undertaken by grocers who rarely separate it off from other departments of their business. It appears, however, that the profit on English bacon is from 10 to 14% of the sale price.

Poultry and Eggs.—In the selling of poultry and eggs at the lo market, apart from the cost of conveying the produce to the place sale, the vendor usually has to pay market tolls and, in the case sales by auction, the auctioneer's fee. The average tolls charg (by the local authorities who usually own the markets) are ½d. 2d. for poultry and from ¼d. per score to 6d. per 100 for eggs. Aucti charges generally range from 5 to 7½% of the price realised a consequently, are higher than those for selling livestock. This, doubt, is because of the smaller value of the individual lots put for sale. The higgler's profit in the districts where he flourishes from 1d. to 2d. per doz. on eggs. This is not excessive; but his ser ice, nevertheless, is not economical.

The dealer's business is more speculative, owing to the ra fluctuations in prices from day to day and from market to mark His average profit of from 2d. to 4d. per doz. on eggs is, therefo reasonable, especially as he provides boxes and pays transp charges. Commission salesmen's charge is 5% of the selling pri and wholesale dealers purchasing on their own account aim at gross profit on eggs of about 2d. per doz. and of 2d. to 3d. per lb. dead poultry. Probably it is in the retail section that profit margi in this trade are greatest and most open to question, 14% on e and 20 to 30% on poultry being the averages for the whole count Producers complain that the difference between the prices th receive for poultry and those paid by the public has increased d proportionately in recent years. The gross margin formerly cover profits and expenses of all intermediaries was roughly 1s. bird. The current margin is about 6d. per lb., which is approximat 1s. 6d. to 2s. 6d. per bird.

Co-operative Marketing

The organisation of producers on a co-operative basis for disposal of their produce and for the carrying out the proces involved in marketing is not a new development in Great Brita but the progress made is insignificant compared with what h taken place elsewhere. Figures in the returns furnished to Chief Registrar of Friendly Societies for the year ending Ma 31 1924, referring to societies operating only in England a Wales, establish the fact that roughly about 3½% of the to value of agricultural produce marketed in England and Wa was handled by co-operative marketing societies or co-operat societies with marketing branches. The following table wh is taken from No. 1, of the Economic Series published in 1 by the Ministry of Agriculture and Fisheries (Great Brita sets out in detail the position for the 12 months beginni April 1 1923.

The following table shows the number and turnover of agric tural marketing societies and certain other societies handling a cultural produce as part of their general trading during the per 1923–4. The table excludes turnovers in grain, hay, potatoes, e of general trading societies.

Commodity Handled	Number of Societies	Turnove
		£
Dairy produce	63	1,447,6
Eggs and poultry	43	349,26
Fruit and vegetables	18	301,9
Livestock[1]	9	375,1
Auction marts (livestock)	18	1,081,95
Slaughterhouses	11	415,2
Bacon factories	6	694,8
Wool	13	200,00
Total	181	4,865,9

[1] This entry covers societies selling livestock on behalf of memb otherwise than through an auction mart owned or rented by society.

[2] Turnover in respect of produce handled, and not necessarily to turnover of society.

[3] 1924 figures.

[4] Estimated value.

These 181 societies are widely distributed without any union centralising agency which might secure joint action or otherwise l after common interests. Attempts, however, have been made fro time to time to federate them or to institute an advisory body assist them to sell advantageously. The most recent project of th kind was the establishment in 1918 of the Agricultural Whole-sa Society with the object of buying and selling for such societi everything that is best bought or sold on wholesale lines. Th capital of this new wholesale body, however, proved inadequat and in consequence of a period of acute trade depression with insuffi cient resources and credit to enable it to surmount its difficulties i nt into liquidation in 1924. During its brief existence it seems to ve done more bulk purchasing of agricultural implements and ds than large scale marketing of produce; although it did set up a partment to market eggs and established a meat section to help co-operative slaughterhouses in their sales in Smithfield market. downfall involved the Agricultural Organisation Society in such ficulties that the latter body also succumbed a short time after.

Present Development.—The present trend is in the direction of several groups of societies forming their own trading federons on a commodity basis and thus falling into line with the neral course of development towards larger scale marketing d trade. One such central trading body is the English Farmers' con Agency. Another, the British Egg Producers, which took er the business of an earlier body of the same kind, has hardly t with the success it deserves; but a regional trading federation South Wales, called the South Wales Mutual Dairies, which a selling agency for four large dairy societies in Carmarthenre and Pembrokeshire, has had better fortune. There is also ather undefined union of fruit and vegetable marketing coerative societies of the counties of Worcester, Gloucester, arwick and those adjoining, which is growing into a trading leration; but, on the whole, the association of co-operative rketing societies for joint action in the conduct of the sale of eir produce is only very slightly developed in Great Britain.

Since 1900 many efforts have been made to establish trading ations between these agricultural producers' co-operative ornisations and the industrial co-operative movement. The 00 retail consumers' societies of the latter are said, approxitely, to feed one-third of the whole consuming population of eat Britain and are, therefore, in a position to offer an assured tlet for the produce of British farms. While some progress has en made in bringing the two organisations into closer reions it is obvious that the natural clash of interests between oducers and consumers must always make price-fixing difficult. this awkward point could be settled satisfactorily, much might done to eliminate the control now exercised by the many ddlemen in the marketing of agricultural produce. (*See* Co-ERATION, AGRICULTURAL.)

THE FOOD COUNCIL

The general dissatisfaction with retail prices during the years ceeding the period of War-time Government control resulted the appointment in 1922 of a departmental committee (the nlithgow Committee) of the Ministry of Agriculture and sheries to inquire into the methods and costs of selling and tributing agricultural, horticultural and dairy produce in eat Britain and to consider how the disparity between the ice received by the producer and that paid by the consumer uld be diminished. This was followed by a Royal Commission Food Prices in 1924 with terms of reference not very different. a result of the first (and only) report of the latter body a Food uncil was sent up to study current and future problems of eat and meat supplies and to issue periodical reports. This uncil is not endowed with any statutory powers. It seeks to rk by focusing public opinion on whatever it judges to be unsonable prices or unduly high profits; but it shirks definite ice-fixing and thus avoids many problems that presented emselves during the period of Government control and to ich no satisfactory solution ever was given.

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(J. G. SM.)

MARKHAM, SIR CLEMENTS ROBERT (1830–1916), British ographer (*see* 17.734), died in London Jan. 30 1916. The ncipal work of his later years was connected with the two tarctic expeditions under Capt. R. F. Scott. An important history of Arctic and Antarctic exploration by Markham was completed posthumously by Dr. F. H. H. Guillemard and published in 1921 under the title of *The Lands of Silence*. A *Life*, written by his cousin, Adml. Sir A. H. Markham, was published in 1917.

MARNE, FIRST BATTLE OF THE, the series of actions fought in Sept. 1914, when the French and British Armies turned at bay between Paris and Verdun and defeated the Germans, driving them back to the Aisne.

The Germans had hoped to bring France to her knees in six weeks, but when four weeks had expired France and England were still keeping their opponent at arms' length. The Germans were indeed slightly ahead of their time table, but they had insufficient troops to carry out their grandiose plan. Antwerp and Maubeuge had necessitated a subtraction of strength and the invasion of East Prussia had led to the dispatch of two corps from the German right wing in France. Further, the rapid advance had led to considerable wastage and the comparative breakdown of wireless was hampering the invaders.

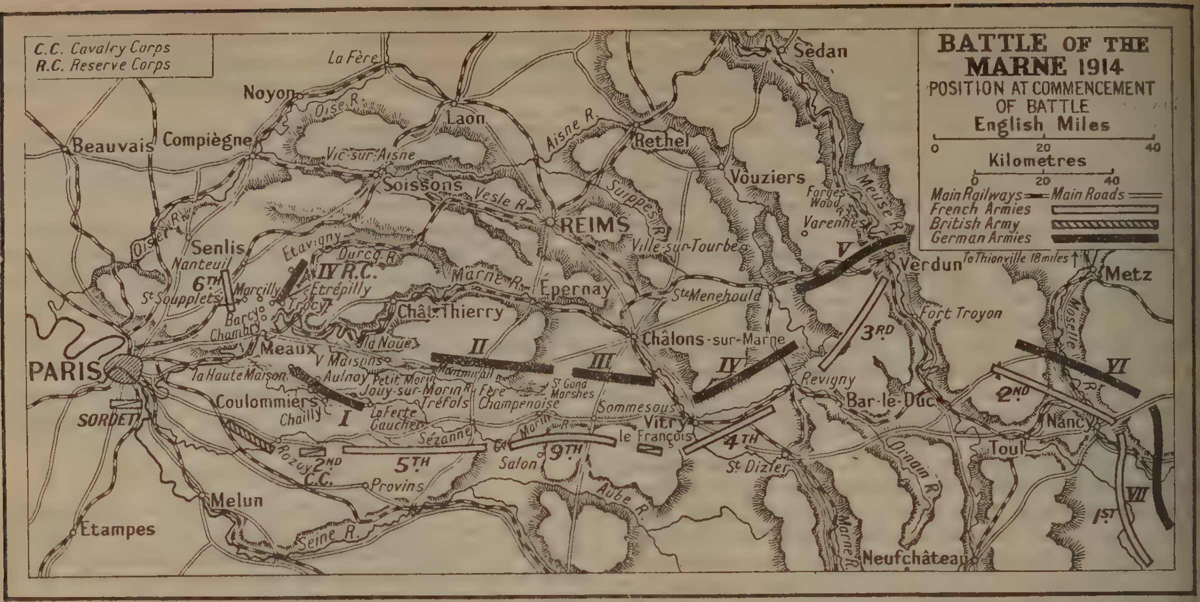
I. THE OPENING OPERATIONS

Advance on Paris.—The original plan had implied that if the French formed a great defensive flank resting on Paris, the capital was to be turned by forces pushed west and south of it; reserve divisions were to be dropped for the investment; and the five field armies, pivoting on Thionville, were to make a stupendous left wheel and to force the Allies against the Swiss frontier. By Aug. 28 this plan had begun to show signs of weakness. The German right wing was not strong enough and was too widely spread out. The II. Army was in comparative isolation and found itself committed to an advance against the great fortress of Paris.

This army was roughly handled by the French at the battle of Guise on Aug. 29 and its commander, Von Bülow, thereupon sent out urgent appeals to the I. and III. Armies on his right and left respectively to close in to his aid. These cries for help altered the whole course of the War. The commander of the I. Army was glad to switch off from the elusive British Army and decided to turn inwards. The hand of German supreme headquarters was now forced. They approved the scheme, although it meant giving up the advance on Paris. The new objective of the right wing was to be the flank of the French main forces opposite the II. Army. Envelopment was still held in view, but the net was to start its scoop east of Paris instead of west of it. Opposed to this wavering was the consistent policy of Joffre. An orderly retirement until he could gain the respite afforded by some topographical obstacle was his dominating thought. Here he proposed to reform and reorganise and then to assume the offensive at the earliest possible moment. The limits of the withdrawal were laid down as the territory immediately south of the rivers Seine, Aube and Ornain. A retirement so far would mean the isolation of Paris, but Joffre clearly realised that the fate of Paris would be decided in a battle fought, not under its walls, but in the open field.

Defence of Paris.—Paris was not undefended. It had, indeed, been proposed to declare it a *ville ouverte*, but the patriotism of its inhabitants decreed otherwise. The military governor was General Galliéni, who had under him four and a half divisions of *territorials*, some cavalry and field artillery, as well as 5,000 *fusiliers marins*. On Sept. 1 the newly formed VI. Army, some 60,000 strong, was placed under his command, and in addition he received Sordet's Cav. Corps, two reserve divisions and a particularly fine reinforcement in the shape of the 45th Div. from North Africa. Galliéni had therefore a respectable mobile force at his disposal, as well as garrison troops.

His first duty was the defence of the capital against which, so far as he knew, the German right wing was steadily advancing. The task was a difficult one, for the apathy and neglect of successive French governments had been reflected in the unreadiness of the fortress. By herculean efforts much was done in the limited time at his disposal, but Galliéni took a grave view of the situation. Then suddenly the whole situation changed. Up to the morning of Sept. 3 it seemed certain that the German right wing was advancing


C.C. Cavalry Corps
R.C. Reserve Corps
BATTLE OF THE MARNE 1914
POSITION AT COMMENCEMENT OF BATTLE
English Miles
0
20
40
Kilometres
0
20
40
Main Railways
Main Roads
French Armies
British Army
German Armies
Sedan
La Fère
Noyon
Oise R.
Laon
Aisne R.
Rethel
Beauvais
Compiègne
Vic-sur-Aisne
Soissons
Vesle R.
Vouziers
Forges Wood
Meuse R.
Varennes
REIMS
Suippes
Senlis
Nanteuil
Oise R.
Etavigny
Ourcq R.
IV R.C.
Ville-sur-Tourbe
V
Verdun
To Thionville 18 miles
Metz
6TH
St. Soupplets
Marcilly
Etrépilly
Trocy
Marne R.
Epernay
Ste Menehould
Barcy
Chambry
Chât. Thierry
Fort Troyon
Meaux
la Noue
II
Châlons-sur-Marne
3RD
PARIS
V. Maisons
Montmirail
III
IV
VI
la Haute Maison
Aulnoy
Petit Morin
Jouy-sur-Morin
Fère Champenoise
St Gond Marshes
Revigny
Bar-le-Duc
2ND
Coulommiers
Tréfols
Sommesous
Moselle R.
SORDET
Chailly
I
La Ferté Gaucher
Vitry le François
Nancy
Sézanne
Morin R.
Rozoy
2ND C.C.
5TH
9TH
Salon
4TH
Toul
St Dizier
Ornain R.
Provins
Aube R.
VII
1ST
Melun
Etampes
Seine R.
Marne R.
Neufchâteau

on Paris with the Senlis-Paris road as the axis of movement; by the afternoon information, transmitted by aeroplanes and cavalry patrols, clearly showed that the German I. Army had switched off from Paris and was heading south-east towards the junction of the right of the British and the left of the French V. Army.

The situation in which Galliéni now found himself was one which demanded exceptional powers of decision. On the one hand there was the German I. Army making a flank march across the north-east of Paris, "trailing its coat" under the very eyes of the garrison, and providing a temptation almost impossible to resist. On the other hand there was the fact that Joffre had declared that he did not wish to undertake an offensive until he had got his army behind the Upper Seine and Aube. At 9 A.M. on the 4th Galliéni, anticipating the sanction of the commander-in-chief, directed the commander of the VI. Army to hold his troops in readiness for an advance against Von Kluck's exposed right flank. Next he communicated with Joffre and Sir John French. All three were equally desirous of assuming the offensive at the earliest possible moment and any divergence of opinion was only on matters of detail.

Joffre's Offensive.—Little reflection was necessary to convince Joffre that a chance not often met with in war was now vouchsafed him. He determined to assume the offensive from where he stood and shortly before midnight he issued his orders stating that advantage was to be taken of the situation of the German I. Army to concentrate against it the efforts of the Allied armies of the extreme left. All preparations were to be carried out on Sept. 5 and the attack was to be made on the 6th.

Disposition of the Forces.—At this moment the position of the Allied armies in France resembled a ribbon attached at its ends to Paris and Verdun and sagging slightly by its own weight in the centre. At Paris was the French VI. Army and other available troops. Next came the British Army. Then in succession the French V., IX., IV., and III. Armies, the right of the latter joining up with the mobile forces of Verdun. The initial orders included the VI., British, V. and IX. Armies only. The first was to cross the Ourcq and make for Château Thierry. The British were to be ready to attack in the direction of Montmirail. The V. Army was, generally speaking, to attack from south to north, its right protected by the IX. Army. During Sept. 5 supplementary orders were issued to the IV. and III. Armies, the general trend of which was that they were to attack inwards and thus to bring about a double envelopment of the German armies.

Facing the Allies were the five German armies to which had been entrusted the great turning movement pivoting on Thionville, numbered I. to V. from right to left. The French, British and German Armies thus enumerated were those immediately concerned in the operations now known as the battle of the Marne. Further to the southeast, between the fortress of Toul and the Swiss frontier, the German VI. and VII. Armies had been heavily engaged with the French I. and II. Armies since the middle of August.

During the evening of Sept. 4 a new directive was issued to the German Forces. By it the I. and II. Armies on the right were now to face west towards Paris. On the left the IV. and V. Armies, by a determined advance south-east, were to open a passage across the Moselle, in which region a lesser Sedan might yet take place. The III. Army in the centre was to push south ready to assist either wing as required. Thus Von Moltke was forced to abandon the hopes founded on the great massive wheel of five armies pivoting on Thionville and instead was compelled hurriedly to assign to his armies three divergent axes of march towards the west, south and south-east. In the new scheme it was Von Kluck's task to remain between the Oise and Marne. Instead of doing so he continued pushing on over the latter river. As the French VI. Army had been ordered to cross the Ourcq and to advance towards Château Thierry a collision between it and the flank guard of the German I. Army was now but a matter of hours. Almost exactly at noon on Sept. 5 a battalion of the French VI. Army came under heavy shell fire from the German flank guard. Some very heavy fighting ensued and by evening the French had made good a little ground, although at the expense of heavy casualties.

II. THE ACTUAL BATTLE

The battle proper may be considered as starting on Sept. 6. The French VI. Army moved out to the attack with both of its flanks protected by cavalry. By then Von Kluck had begun to comply with orders by withdrawing his troops across the Marne. The bulk of the day's fighting took place opposite the right wing of the French VI. Army and especially against the extreme right. It was soon evident to Gen. Maunoury, the French commander, that the German flank guard was being substantially reinforced. Von Kluck could, however, only reinforce his right flank at the expense of his front, and, in consequence opposite the British there was a noticeable slackening in the advance of the German I. Army. Put briefly, the relative situation of that army had changed. What had been its right flank—consisting of the IV. Res. Corps and a cavalry division—was by successive reinforcements, to become the front; while the original front, by a corresponding diminution, was transformed o the left flank, and the army as a whole was to face west tead of south.

The hesitation observable in the German advance was soon owed by an unmistakable retrograde movement. The British no time in seizing the heights on the Grand Morin south Coulommiers, from which German heavy guns had during morning brought an effective fire to bear. Save for some nting early in the morning about Rozoy—an action brought by the Germans to cover their retreat—the British were not vily engaged, though a few prisoners and machine-guns were en. To the right of the British, the French V. Army, after a ck early in the day, had made a substantial advance, the Gern I. Army was now in the position of having to fight desperly to hold off the converging attack of the French VI., the tish, and the French V. Armies.

The fighting on the Ourcq on Sept. 7 was hard and bitter. en at the risk of weakening himself elsewhere, even of causing ap between himself and the II. Army, Von Kluck had to bring ry available man to the fight. The effect of his action was t a gap, soon to yawn into a gulf of 30 m., was opened between German I. and II. Armies. Into this gap the British and the of the French V. Army were steadily pushing. In other ds, Von Kluck found himself committed to an isolated action h his left and rear exposed. Unless he could hold off the Brit- and the French V. Army sufficiently long to enable him to pose of the French VI. Army he was defeated. But for his k he had neither the time nor the men.

After a day of hard fighting the French VI. Army had made e further progress, and its front ran generally from Chamy through Barcy and Marcilly to the high ground west of vigny. The British were now opposed merely by German alry reinforced by Jäger battalions and were enabled to push ir line to La Haute Maison-Aulnoy-Chailly and Jouy sur rin. The French V. Army likewise made good progress, ching the line La Ferté Gaucher-Trefois. Further to the right fighting had been severe, the left of Foch's IX. Army being vily attacked and forced to call on the V. Army for help.

A somewhat disquieting feature of the day was the apparent ntion of the Germans to make another effort to turn the is-Verdun line at Nancy and at Troyon, where a successful ust would very seriously discount the French efforts on the cq. Worse still, Maubeuge fell on Sept. 7, and the invaders only gained another rail line of communication but had another corps available for operations in the field. Against se drawbacks, however, could be set the fact that the gap ween the German I. and II. Armies had considerably widd, and into it, the British Army and the left of the French Army were now advancing with speed.

Sept. 8 was remarkable for the violence of the German attacks ng the Ourcq. Maunoury's plan was to attack with his right tre and left, while the VII. Corps in the centre was ordered to l its line at all costs. That corps was heavily attacked early he afternoon, and such was the severity of the fighting that a k later the streets of Etrepilly and Trocy were still blocked h the bodies of the slain. To the north the French outflanking vement was brought to a standstill, while even the superb antry of the Zouaves of the 45th Div. on the right centre ed to make any considerable impression on the enemy. Dur- the afternoon Galliéni visited the Commander of the VI. Army his headquarters at St. Soupplets and pointed out that the ater the resistance offered by the Germans on the Ourcq the opposition would the British meet with in their advance. vertheless, Maunoury considered it advisable to make argements for a possible withdrawal on the following day. anwhile the British Army was discounting the efforts which Kluck was making on the Ourcq.

ir John French decided that the best method of assisting French VI. Army implied the speedy passage of the Petit rin and Marne rivers, for after passing the latter the British y would be facing northwest and thus almost directly threatg the line of retreat of the German I. Army. Orders were ordingly issued for a general attack along the line of the Petit Morin, to begin early on Sept. 8. At first the march was undisturbed, but on reaching the Petit Morin it was soon realised that the German cavalry would not yield without a struggle, especially as the steep valley covered with small but thick woods distinctly favoured the defence. Some severe fighting ensued, but by evening the British had made good the Petit Morin and were on the line La Noue-Viels Maisons, where they joined up with the II. Cav. Corps of the French V. Army, the left corps of which extended to the southern outskirts of Montmirail.

Sept. 9 was to witness Von Kluck's last effort on the Ourcq. The French VI. Army, although it had been reinforced, was at the end of its strength and its left was pushed back. A superb effort, however, restored the day and then it was clear that Von Kluck had shot his bolt. During the day the British crossed the Marne and on its right the French V. Army seized Château Thierry. Thus on the extreme west of the great battle things had gone well for the Allies, and it is now time to turn to the doings in the centre of the field.

German supreme headquarters had ordered the I. and II. Armies to form front facing Paris, the former between Oise and Marne and the latter between Marne and Seine, Château Thierry to be the point of junction of the two armies. This order had at first been disregarded by Von Kluck, who had persisted in his passage over the Marne and in maintaining his position in front of the II. Army. Von Bülow, however, endeavoured to comply with the orders of his superiors, and did make an effort to wheel his army to the right with the object of taking up the line Château Thierry (exclusive)—Marigny-le-Grand. The net result of compliance with orders by one army commander and disregard of them by the other was that the right corps of the II. Army was squeezed out of the line by the left corps of the I. Army. In other words, the two armies were acting upon different plans; overlapping had arisen; and the confusion inevitable in such circumstances began to be revealed upon the evening of Sept. 5. This factor alone was bound to hamper the II. Army, and Von Bülow's task was not lightened by the subsequent conduct of his neighbour. When Von Kluck renounced his plunge southeast he did it with such thoroughness as to lead to the transfer of practically his whole strength to the Ourcq. On Sept. 7 he demanded back the III. and IX. Corps which he had lent Von Bülow but the day before. The withdrawal of these units to the Ourcq exposed Von Bülow's right flank; a great gap was thus opened between the II. and I. Armies and Von Kluck, who had, on Sept. 5, inconvenienced Von Bülow by his undue proximity, was now seriously embarrassing that commander by his aloofness.

III. THE GERMAN RETREAT

Retreat of Von Bülow.—Generally speaking, the task of the IX. Army under Foch for Sept. 6 was to support the advance of the V. Army with its left flank while maintaining a watching attitude along the rest of its front. Foch, however, found himself quite unable to carry out even the moderate programme he had drawn up. Von Bülow was endeavouring to wheel into position between Marne and Seine, and on his left the III. Army's orders were to push due south. As a result the French were attacked with considerable vigour all along the line for, although his right was becoming compromised, Von Bülow was able on the 7th to push on with his centre and left, the latter flank working in conjunction with the German III. Army. But owing to the determined resistance of the French IX. Army under Foch and to the assistance afforded him by the French V. Army on his left, the Germans made no great impression other than to deny the French IX. Army the possibility of making progress north and west. On the following day, Sept. 8, the Germans renewed the attack and a serious position developed for the right of the French IX. Army, which was forced to give ground. Foch refused, however, to be perturbed inasmuch as the news which came in of the course of the fighting east and west of him was reassuring.

On the 9th a sudden German attack told on the French left. Foch's reply was to move his reserve from his shattered left to join in a counter attack from his right, realising as he did that the danger of the German thrust was more apparent than real.

Reports as to the forcing of the line of the Marne by British troops during Sept. 9 forced Von Bülow to the conclusion that retreat was inevitable for Von Kluck, and that his own II. Army must fall back at once, if it were to avoid envelopment on its right flank. With the object of gaining time to get his long trains safely back over the Marne, the offensive by his left and centre was carried out with vigour during the morning, the French right being driven back to Salon; but early in the afternoon the German II. Army and the right of the III. Army were in full retreat, strong rear guards being left facing the French.

Verdun.—The fighting described up to the present, *i.e.*, that between the Ourcq and Fère-Champenoise, must not be allowed to overshadow the operations of the French armies between Vitry-le-François and Verdun. For nowhere on the whole front was the tenacity of the French III. and IV. Armies surpassed. It was towards the east that the Germans hoped to retrieve their failure elsewhere. Here they hoped to cut off Verdun from either side and to bring about a kind of minor Sedan in which the French I., II., III. and IV. Armies might be herded together and destroyed. The German VI. and VII. Armies were to advance eastwards across the Moselle; the IV., with its right passing through Vitry-le-François, was to bear down across Champagne, while the German Crown Prince with his V. Army was to proceed round the entrenched camp of Verdun. Fortunately for the French the Crown Prince based his advance upon a misconception. He assumed that Verdun would be left to its fate, whereas Sarrail commanding the French III. Army kept his right attached to it throughout and, further, on his own responsibility, ordered the fortress commander to use his troops to make an attack on the Crown Prince's communications.

German Retreat.—The attacks of the Germans brought the French into a serious position, especially the IV. Army of Langle de Cary. In fact, at one time there was a serious chance that its right might be rolled up. However, reinforcements from the extreme French right, that is to say the I. and II. Armies in the Vosges, restored the situation. Then, on Sept. 8, the III. Army was called upon to deal with a new peril. Fort Troyon was in serious difficulties and thus a very patent danger to the rear of the III. Army was suddenly revealed. The garrison, however, put up a stout resistance and the place was relieved by a French cavalry division from Toul on Sept. 10. The Germans renewed their attacks on the following day but they were without significance. From Verdun to Paris five German armies were in retreat. The great battle of the Marne had been fought and won.

It was not for several years after the battle that the world learnt how and why it was broken off by the Germans. The truth is that by Sept. 8 Von Moltke had completely lost his grip of the battle. In these circumstances a liaison officer, Lt. Col. Hentsch, was directed to visit the V., IV., III., II. and I. Armies in turn and to bring back a clear idea of the situation. Further, he was empowered to issue such orders as would close the gap between the I. and II. Armies should he find that retreat had set in upon the right wing. The critical point of his tour was his visit to the II. Army where he spent the night of Sept. 8–9.

Von Bülow was considerably disconcerted about the passage of the British over the Marne; he came to the conclusion that the retreat of the I. Army was inevitable, and that therefore his own II. Army must fall back if his right were not to be enveloped. Hentsch agreed and proceeded next day to the I. Army, where he interviewed Von Kluck's chief of staff. Although the latter considered that the I. Army could hold its own there was now no option but to order its retirement. Thus by the late afternoon of the 9th the whole right and right centre of the German Army was falling back. Supreme headquarters, in ignorance of the fact, were preparing for a continuance of the offensive but had to bow to the inevitable. During the 10th orders were issued for the retreat of the five armies behind the Aisne and Vesle. By the 16th the German front was thus traced out—the neighbourhood of Noyon, the plateaux south of Vic-sur-Aisne and Soissons, the tableland of Laon, the heights north and west of Reims north of Ville-sur-Tourbe, Varennes, and thence to the Meuse near Forges wood, north of Verdun.

Conclusions.—Thus tamely petered out the grandiose German plan, and thus ended the great and decisive battle of the Marne. Tactically indeed it was somewhat of a disappointment to the Allies. No part of the German host was annihilated or even immobilised for any length of time. The number of trophies and prisoners was inconsiderable. The Germans broke off the fight in their own time. No great pursuit, as had succeeded Jena, took place, and the Germans were able to retire, if not unscathed at any rate in fair order. From the strategic and moral aspects however, the battle was of immense importance. It marked for the Allies the definite turn in the tide of defeat, while for the Germans it marked, no less, the collapse of the plan with which they had entered on the War and on which the Great General Staff had been prepared to hazard the fate of the Fatherland. That plan had aimed at securing a rapid decision in France with the bulk of the German armies, and the subsequent and immediate prosecution of a second campaign against the more slowly mobilising strength of Russia. But by Sept. 10 1914 the Germans had definitely acknowledged defeat in France. It is significant that the Battle of the Marne has been called by the Germans themselves *der Wendepunkt* (the turning point) of the War.

BIBLIOGRAPHY.—A. Corbett-Smith, *The Marne and After* (1917); F. E. Whitton, *The Marne Campaign* (1917); K. von Bülow, *Mein Bericht zur Marneschlacht* (1919); A. von Kluck, *Der Marsch an Paris und die Marne-Schlacht (1914)* (1920). *See* also WORLD WAR BIBLIOGRAPHY. (F. E. W.*)

MARNE, SECOND BATTLE OF THE.—The second battle of the Marne developed between July 15 and Aug. 4 1918. Beginning with the German offensive of July 15, which was broken on the Champagne front between that date and July 18, it was concluded by the victorious counter-offensive of the French armies of July 18–Aug. 4, extending from the Marne to the Aisne. This was the prelude to the general offensive of the Allied Armies and their uninterrupted march to the victory of Nov. 11. A typical "defensive-offensive" battle, it demonstrated at once the will of the French high command to impose its preconceived plan upon the enemy, and the rare faculty possessed by the French soldier of passing direct from parry to riposte with an energy and vigour that recent ordeals seemed only to have strengthened. (*See* also GERMAN OFFENSIVE.)

I. INTRODUCTION

Two months earlier, Gen. Foch, Commander-in-Chief of the Allied Armies, had decided to take the initiative at the first possible moment,[1] and, true to the principle that "to make war is to attack," was determined to give the enemy no further respite once he had gripped him. The opportunity he sought was given him by a mistake on the part of the German supreme command, which, having crowded its forces into the pocket of Château-Thierry, was now to find the position made worse by the resounding check to the offensive in Champagne.

German Plans.—The Allies had had information at the beginning of July of two German plans of offensive: one on the French front in Champagne, the other on the British front from Arras to Ypres. It remained to be seen which would be launched first, for the enemy had not the necessary reserves and material for the execution of the two simultaneously on such extended fronts. It soon became known that the attack in Champagne would precede that in Flanders and would take place about July 9 or 10. As it turned out, the check to the first offensive was to prevent the enemy from executing the second. The enemy's plan was known in detail: he was to attack on either side of Reims, the principal effort being entrusted to the I. and III. German Armies, moving on Châlons, while the VII. Army crossed the Marne in the direction of Dormans and rejoined the main attack in the region of Épernay.

Foch's Preparations.—Meanwhile Foch was preparing the severe riposte that he was about to inflict on the enemy. To meet the essential requirements of the expected defensive battle in Champagne and, at the same time, to make provision for the counter-offensive which Pétain was preparing in the Soissonnais

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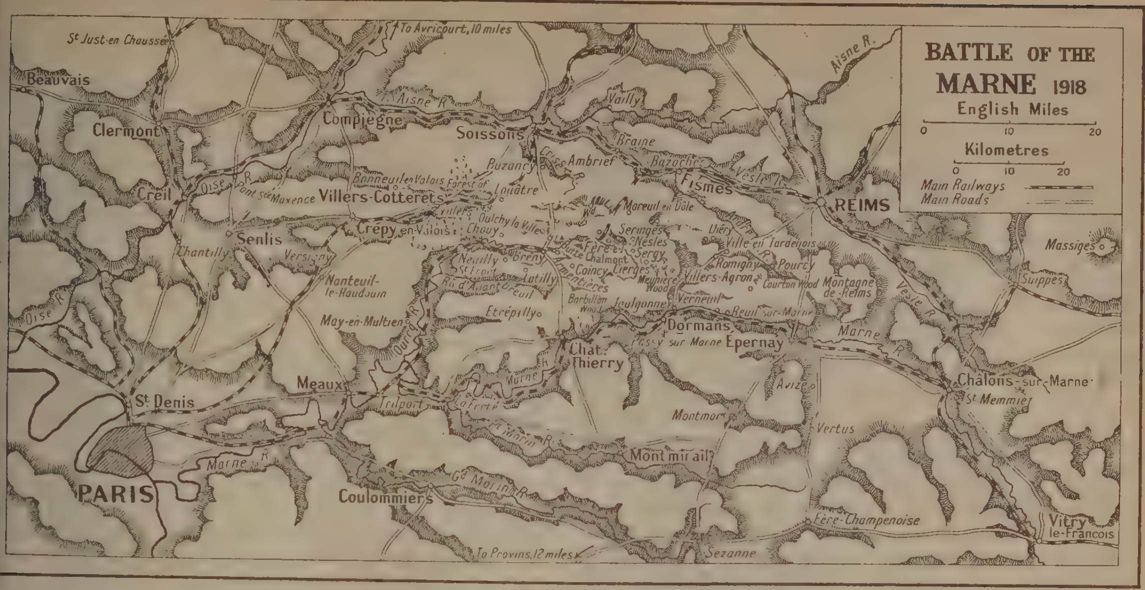
[1] Order No. 3 of Foch, May 20.


BATTLE OF THE MARNE 1918
English Miles
0 10 20
Kilometres
0 10 20
Main Railways
Main Roads
St Just-en Chaussée
Beauvais
To Avricourt, 10 miles
Clermont
Compiègne
Aisne R.
Soissons
Vailly
Braine
Ambrief
Bazoches
Vesle R.
Fismes
REIMS
Buzancy
Bonneuil en Valois
Forest of
Louâtre
Creil
Oise R.
Pont Ste Maxence
Villers-Cotterets
Oulchy la Ville
Chouy
Crépy en Valois
Senlis
Chantilly
Versigny
Moreuil en Dôle
Seringes
Nesles
Sergy
Ville en Tardenois
Romigny
Pourcy
Villers-Agron
Courton Wood
Montagne de Reims
Neuilly
Brény
Fère-en-Tardenois
Chalmont
Coincy
Cierges
Meunière Wood
Latilly
Nanteuil-le-Haudouin
Etrépilly
Barbillon Wood
Jaulgonne
Verneuil
Reuil sur Marne
Dormans
Marne
Epernay
Massiges
Suippes
May-en-Multien
Ourcq
Chat. Thierry
Passy sur Marne
Avize
Châlons-sur-Marne
St Memmie
Meaux
St Denis
Trilport
La Ferté
Montmort
Vertus
Petit Morin R.
Montmirail
PARIS
Marne R.
Gd Morin R.
Coulommiers
Fère-Champenoise
Vitry le-François
To Provins, 12 miles
Sezanne

rought together between the Oise and the Argonne a reserve ss of 38 infantry divisions (29 French, four British and five erican) and six French cavalry divisions. These strong reves were to be augmented at an early date by the arrival of American divisions, just in time for the critical moment n the adversary could only with difficulty maintain his forces. s, in the middle of July, the point was reached at which the nce between the forces became re-established and was ut to turn in the Allies' favour. This was the moment chosen Foch for taking the offensive.

omposition of French Army.—Before defining the part played the French Armies in the second battle of the Marne, it may s well to state that they comprised, at that time, 103 divisions, ded into three groups of armies under the command of Gen. ain, whose headquarters were at Provins.

TABLE I.

<table>
<tr><td colspan="4">Reserve Group
Gen. Fayolle, at Noailles</td></tr>
<tr><th></th><th>Commander</th><th>Head-quarters</th><th>Area</th></tr>
<tr><td>Army .</td><td>Gen. Debeney</td><td>Conty</td><td>Amiens region.</td></tr>
<tr><td>I. Army</td><td>Gen. Humbert</td><td>Clermont</td><td>St. Just-en-Chaussée region.</td></tr>
<tr><td>Army .</td><td>Gen. Mangin</td><td>Versigny</td><td>Villers-Cotterets region.</td></tr>
<tr><td colspan="4">Centre Group
Gen. Maistre, at Sézanne</td></tr>
<tr><td>. Army .</td><td>Gen. Degoutte</td><td>Trilport</td><td>Château-Thierry region.</td></tr>
<tr><td>Army .</td><td>Gen. Berthelot</td><td>Montmort</td><td>Reims and the south.</td></tr>
<tr><td>. Army .</td><td>Gen. Gouraud</td><td>St. Memmie</td><td>East of Reims.</td></tr>
<tr><td>. Army .</td><td>Gen. de Mitry</td><td>. .</td><td>Between VI. and V. Armies.</td></tr>
<tr><td colspan="4">Eastern Group
Gen. de Castelnau, at Mirecourt</td></tr>
<tr><td>II. Army</td><td>Gen. Gérard</td><td>Flavigny</td><td>. .</td></tr>
<tr><td>I. Army</td><td>Gen. de Boissoudy</td><td>Lure</td><td>. .</td></tr>
</table>

egoutte with his VI. Army was later placed under the orders of olle, in the reserve group of armies. De Mitry's IX. Army was ght in during the course of the battle.

hese forces held 600 km.—this being about two-thirds of the l Allied front.

General Organisation of the Offensive.—The general-in-chief had, on July 12, stated the mission of the two groups of armies to be: "to reduce the pocket of Château-Thierry by means of two lateral thrusts towards the plateau situated north of Fère-en-Tardenois . . . ." so as to bring about the junction in this region of the two groups of armies, the tactical limits for which were clearly marked by the line Château-Thierry (for the Reserve group), Fère-en-Tardenois (for the Centre group). He had, as early as July 8, settled the means that would be at their disposal, defined the action they were to take, and ordered the preparation.

But the Centre group of armies, against whom the imminent attack would be directed, had still first to break this attack and in due course re-establish the continuity and security of its front; after which it would immediately proceed to the counter-offensive with all the means at its disposal, and Gen. Pétain exhorted "the command of every échelon to set themselves resolutely to act on the principle of simple, audacious and rapid methods of attack."

II. THE GERMAN OFFENSIVE IN CHAMPAGNE

From July 1 onward the French IV., V. and VI. Armies were on the alert and ready to receive the assault. The IV. Army (Gouraud), to the east of Reims, occupying a highly organised front, was to make a completely successful test of the new method of disposition in depth, ordered by Gen. Pétain. It had finally been decided to leave nothing along the line of outposts (constituted by the Monts de Champagne) but "islands" of resistance, which would be required to sacrifice themselves for the purpose of dissipating the enemy attack and keeping it under the well-controlled fire of the main position established in the rear. The moral preparation was on a level with the organisation of the defensive, and General Gouraud was able to address his men in such terms as these: "The bombardment will be terrible. You will stand it without flinching. The attack will be formidable, delivered in clouds of dust, smoke and gas . . . . but you will break it and it will be a great day. . . ." It was not possible to prescribe a rigorous application of the principle of defence in depth (as in the case of the IV. Army) for the V. and VI. Armies, as their defensive organisation was recent; it was to be feared that in their case the manoeuvre would develop under less favourable conditions.

On the 14th, at 8 P.M., a *coup de main* by the IV. French Corps brought in 27 prisoners, who, on being questioned, revealed the fact that the German attack was to be launched that night, the artillery preparation being timed for 12:10 A.M. But before it began, the French counter-preparation and counter-battery fire opened on the whole of the enemy front. The enemy, though stupefied by the number of our batteries, carried on according to programme, and, between 4:15 and 5:30 A.M., the German infantry advanced to the attack on a 90 km. front, from Château-Thierry to Massiges (leaving out the Reims Salient). To the east of Reims, thanks to the steps taken by Gouraud, the attack suffered a complete reverse. The enemy infantry was broken up by French artillery fire and decimated by the machine-guns distributed along the outpost line before even reaching the main line of resistance, which, in spite of repeated assaults, they failed to break at a single point. To the west of Reims the situation was less favourable.

German Success at Dormans.—In front of the V. Army (Berthelot) the enemy made some progress between the Marne and the Ardre in the direction of Épernay, and the French Centre (V. French Corps and II. Italian) was thrown back on the second position along the line Pourcy-Belval-Reuil-sur-Marne. Lastly, the right of the VI. Army (Degoutte) was not able to stop the enemy from crossing the Marne on either side of Dormans, between Jaulgonne and Verneuil. The VII. German Army thus established a bridgehead south of the river, in front of the V. Army's left and the VI. Army's right; it also regained touch with the I. German Army on the slopes of the Montagne de Reims. On this side the situation was therefore serious, and Pétain decided to check the adversary's advance by reducing first of all the pocket which had just been formed. To this end he engaged, on the 16th, practically the whole of the Allied reserves intended for the defensive battle.

The French command was now confronted with a serious problem. It was still three days to the counter-offensive, which the Reserve group of armies had orders to carry out on July 18. The question was, whether to continue the preparations for this counter-offensive and risk losing the Montagne de Reims or to suspend preparations in order to parry the immediate blow. Foch decided to maintain his plan of offensive intact, and gave orders to proceed with the preparation. The general staff of the British XXII. Corps and the 51st and 62nd Divisions were already on the move; these divisions were to appear on the field of battle of the Centre group from the 19th onward. Following them on July 17th the British 15th and 34th Divisions were to march for the neighbourhood of Pont Sainte-Maxence and of Chantilly-Senlis respectively at Foch's disposal.

German Attack Checked.—The German attack had degenerated into local actions, disconnected and therefore useless, from July 16 onward. By vigorous counter-attacks the French had even recaptured some of the enemy's *points d'appui*, while our artillery and aircraft, by bombarding the Marne crossings, made it more and more precarious for him to obtain supplies. The only progress in the attack—to the southwest of Reims between the Vesle and the Marne, on July 16—remained fruitless, for it had cost the enemy too dear for him to repeat such sacrifices.

After two days of useless efforts, therefore, the German command stopped the costly " Friedensturm " operation, on which they had based their supreme hope, and on July 17 their army was on the defensive. The third grand offensive, which the enemy had carried out with even more powerful means than the two preceding ones (44 divisions on a front of 80 km.), had failed completely. On July 18 was to be launched the French counter-offensive, in which British and American divisions were to participate. Fortune had changed sides. The operations of the Centre group of armies for the clearance of the south bank of the Marne, the recapture of Château-Thierry and the disengaging of the Paris-Avricourt railway line, formed part of the general offensive action prescribed for the two groups of armies on July 12 and initiated by the Reserve group on the 18th, under conditions which will be dealt with later.

III. COUNTER-OFFENSIVE OF THE FRENCH

The French counter-offensive comprises two phases: (1) the first extends from July 18–28, and includes the victorious battles of Fayolle's main group of armies in the Soissonnais and on the Ourcq, and the closing stage of the defensive battle of Chan pagne and Reims during the same period, in which the Centr group under Gen. Maistre re-established its front and passed to th attack. This first phase, again, comprised three successive ma noeuvres: the breaking of the enemy positions by the Reserv group of armies on July 18 and 19; the re-occupation of Châtea Thierry and the south bank of the Marne by the Centre group armies, in combination with the right of the Reserve group, c July 20 and 21; and the co-ordination by the general-in-chi of the main effort of the two groups of armies on both bank of the Ourcq in the general direction of Arcy-Sainte-Restitu and Fère-en-Tardenois on July 23 and 24. (2) The second phas sometimes called the battle of Tardenois, extends from July 2 to Aug. 4, and includes the recapture of Soissons and the pus towards the Vesle.

French Preparations for Attack.—We have seen that, actin upon Pétain's instructions of July 12, Fayolle prepared a counte offensive for the 18th, which aimed at reducing the pocket Château-Thierry. These preparations were continued with th utmost secrecy while the Centre group of armies (Gen. Maistre were checking the last enemy offensive (July 15 and 16) an (from the 17th) arranging a counter-attack. In this connectio it is interesting to take stock of the means which Maistre was t have at his disposal for passing direct from parry to riposte an those which Fayolle, for his part, was assembling in silence in th region of Villiers-Cotterets on the right flank of the enemy Marne salient.

The counter-offensive of the Centre group was entrusted t two armies, the V. and the IX., the latter having been put int the front between the V. and VI. Armies. The V. Army (Berthe lot), which had been so heavily attacked at Reims, had eigh divisions in first line (including the Italian 3rd Div.), and on infantry and two cavalry divisions in second line. Three of it divisions, among them the Italian 8th Div., had been withdraw for reconstruction. At the same time the British 51st and 62n Divs. were now being held in reserve in the Vertus-Avize zon The IX. Army (de Mitry) had five divisions, including the Ame ican 3rd Div. in first line, one division in second line, and tw reserve divisions, including the American 28th Division. Tw other divisions were in course of reconstruction. On the 17t the mission of the two armies was confirmed: they were t regain all the ground lost between Reims and the Marne and t clear the south bank of the river at the same time as the Reserv group of armies launched its attack. The reserve group operate with the X. and VI. Armies. The X. Army, under Gen. Mangi (battle headquarters at Bonneuil-en-Valois), who was responsib for the main attack, had 10 divisions in front line, including th American 1st and 2nd Divs., placed on the flanks of the Moroc can Div. in the centre of the army, and six divisions in second li and the II. Cavalry Corps, making a total of 16 infantry divi sions and three cavalry divisions. In the rear of the army th British 15th and 34th Divs. were in reserve to the east of Pon Sainte-Maxence and Senlis. In addition, the army was given large number of tanks and strong artillery reinforcement The task which Mangin set before his troops was " to brea through the enemy front between the Aisne and the Ourcq an push straight on in the direction of Fère-en-Tardenois in liais with the offensive of the VI. Army."

On his right the VI. Army, commanded by Degoutte, whos own right was engaged in the defensive battle, had only seve divisions in front line—among them the American 4th an 26th Divs. (American I. Corps at la Ferté under Jouarre) and one division in second line. The battle headquarter was at May-en-Multien. Degoutte was to attack with his ow resources only, reinforced, however, by tanks. His orders we that " the main attack would take place between the Ourc and the Rû d'Alland with the object of reaching the line Neuilly Saint-Front—rounded hill of Breuil—and eventually of develo ing the attack in the direction of Coincy in liaison with the Army towards Brény-Armentières." He had further at his di posal the British 9th brigade of the Air Division, which wa to " support his attacks."

Secrecy of Concentration.—The operations of the Reserve group of armies had been prepared with infinite precautions for maintaining secrecy—the essential factor in a surprise. The reinforcing divisions were only brought up to the front during the last two days, their movements being carried out by night, between July 14 and 16, the mounted elements marching and the unmounted carried by motor transport. No more rapid and complicated concentration had ever been carried out. Pétain had issued an order on the 17th stating the conditions of the counter-offensive for the following day, which concluded with these words: "The general-in-chief expects that the ardour and energy displayed by all will make July 18 a glorious day."

A violent storm which burst noisily during the night of the 17th–18th intensified the darkness and made movements in the woods very difficult; but it was favourable to secrecy and by 4 A.M. on the 18th the X. and VI. Armies were in position and ready to move without any sign of uneasiness being shown by the enemy. At the same hour the Centre group of armies was preparing to counter-attack. At 4:35, without a single preliminary round, the whole of the French artillery opened fire from the Aisne to the Marne, and 16 front line divisions dashed forward with the tanks, while all the air squadrons went up. In the X. Army the infanry and tanks advanced without an artillery preparation behind a rolling barrage, turning the enemy's strong defensive positions and quickly gaining a footing on the plateau northeast of the orest 'of Villers-Cotterets. In the VI. Army, on the contrary, he attacking divisions continued their artillery preparation gainst the enemy's defensive position for 1½ hours, and only ttacked at 6:05.

The surprise was complete, and, along the whole front, the nemy lost practically all his advanced units and batteries. His resistance was only effective in two localities on the broken round from Louâtre to the Buisson de Hautwison, at which oint the XI. Army Corps, having no tanks, progressed only ith difficulty and to the west of Neuilly-Saint-Front, where he II. Corps came under oblique fire from the heights of Chouy. Mangin received information of the first results achieved towards o'clock, and exploited them without delay by the judicious use f his reserves. General Robillot's Cav. Corps had experienced xtreme difficulty in debouching from the forest of Villers-otterets, which was encumbered with troops and baggage, and ould as yet operate only with dismounted squadrons—the hour the cavalry had not struck! On the first day the enemy st 12,000 prisoners and 250 guns.

The battle raged through the night of July 18–19 and throught the day of July 19. The two French armies substantially tained their objectives, even in the difficult region of Louâtre-houy-Neuilly-Saint-Front, where the XI. and II. Corps comned their attacks to subdue the enemy resistance. The artilry and air force were both definitely superior to those of the emy. The artillery pushed its batteries forward and the bombg machines attacked the Marne crossings and the enemy contrations at Oulchy-le-Château and Fère-en-Tardenois.

The Central Group Reinforced.—While Fayolle's group of mies had, by means of heavy pressure and exploitation of the rprise, penetrated deeply into the enemy's positions, the Centre oup was preparing to clear the south bank of the Marne. t its units were exhausted by the resistance they had to put against the German attacks of July 15–18, and in order reinforce them with fresh troops the British XXII. Corps 1st and 62nd Divs.) was brought in to relieve the Italian rps. Pétain took care to insist that it was not a question of a nple relief. "It will be carried out on the move—that is to y, it will take the form of a surprise attack, carried out with e co-operation of the French units on either side."

Foch defined the character that the battle was expected to ke as follows: "The battle, when engaged, will be conducted th the utmost energy and without waste of time, in order to ploit the advantage gained by surprise." Nevertheless it s not until the 20th that the Centre group was able to push ward. On that day its IX. Army reached the south bank of e Marne, evacuated by the enemy during the night, while in the V. Army the British XXII. Corps was heavily engaged in the Courton wood, where it took several hundred prisoners.

The fighting continued to be very severe throughout July 21 and 22. On the two wings of the French disposition the enemy offered a stubborn resistance to the attacks of the X. and V. Armies which pressed on their flanks. It was evident that he wished to gain time for evacuating the material and troops that he had risked towards the Marne. At last, however, on July 21, at 7 A.M., the 39th Div. of the XXXVIII. Corps, attached to the VI. Army since that morning, reoccupied Château-Thierry. The American 3rd Div. crossed the Marne in its turn, to the east of the town, and entered the Barbillon wood. In the VI. Army the American I. Corps and the French VII. and II. Corps advanced on the plateau of Etrepilly and Latilly, and on the 22nd, at noon, the VI. Army re-established its communications by way of Château-Thierry. On the same evening elements belonging to the V. Army gained a footing north of the Marne, at Port à Binson and two battalions of the IX. Army crossed the river at Passy-sur-Marne.

Capture of Butte Chalmont.—From the 22nd onward the two groups of armies exercised continuous pressure upon the enemy, the Air Division co-operating in mass in the pursuit. But the whole interest of the battle was focussed, on July 25, on the heights dominating the Ourcq valley from the north—Orme du Grand Rozoy and Butte Chalmont. Once these heights were captured, the X. Army would be able to push on the Arcy-Sainte-Restitue and the VI. Army to move on Fère-en-Tardenois, skirting the wooded region on the north side, in conformity with the plan of the French high command. On July 25 the two divisions of the French XI. Corps took by assault Oulchy-la-Ville and Oulchy-le-Château and gained a footing on the west slopes of Butte Chalmont, thus depriving the enemy of all hope of re-establishing himself on the Ourcq. The two armies[1] lost no time in following up their success, as soon as they had concentrated all their available means and relieved those units which had been most severely tried. The VI. Army was indeed able to shorten its front and rearrange its disposition accordingly. A fresh division, the American 42nd, was also added to it.

Advance Checked at Fère-en-Tardenois.—The attacks went forward on the 27th. "Forward! . . . however tired the troops!" telegraphed Fayolle, and progress continued to be made on July 27 and 28 as follows: the VI. Army reached the Ourcq and gained a foothold in Fère-en-Tardenois; the V. Army reoccupied its positions of July 15, and the divisional cavalry pushed its patrols beyond the infantry's advanced guards. But from the 28th, at noon, the VI. and V. Armies met with a stubborn resistance and a barrage that was solidly established from Fère-en-Tardenois to Ville-en-Tardenois. The II. Corps was unable to debouch from Fère. The American I. Corps, which had advanced as far as Sergy, was violently counter-attacked there by a Guards Division. The village was taken and retaken four times and finally held by the American 42nd Div., though only at the cost of heavy losses.

The advanced guards of the V. Army could debouch neither on Villers-Agron nor on Ville-en-Tardenois. In the centre, therefore, the situation remained practically unchanged on July 29 and 30. On the two wings there was fierce fighting on the 28th, on the west towards Buzancy, where the British 15th Div. gained a footing in the village and was driven out again, but succeeded in holding the park of the château; and on the east, where the enemy made repeated counter-attacks and the Allies had to fight costly engagements in order to hold their recent gains. Only the right of the X. Army made definite progress. On the 28th the XI. Corps took Butte Chalmont, and on the 29th the XXX. and XI. Corps with the British 34th Div. occupied Grand Rozoy; but the divisions in line had reached the limit of their powers after several days of incessant fighting.

First Phase of French Offensive Complete.—The enemy had made heavy sacrifices to gain solid support for his flanks and cover his line of retreat towards the Vesle. The resistance that he offered everywhere made it clear that he was not to be underestimated but was capable of violent reactions, and it now became necessary to hasten his retreat by a direct action against the plateaux of the Tardenois. The first phase of the French counter-offensive was now at an end: the Marne valley and the Paris-Avricourt railway line had been completely cleared. This was the first of the "clearance" offensives laid down in the orders of July 24, which had been issued by Foch to the commanders-in-chief of the Allied armies. The second phase was now to begin, and Fayolle's appeal to the endurance of the troops was indeed timely, in view of the severe battles that lay before them without hope of respite before the winter.

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[1] The IX. Army had been withdrawn from the front since the 25th. The III. Army Corps had joined the V. Army.

The days of July 30 and 31 mark a pause in the progress of the French armies, which on July 29 received fresh instructions from Pétain for the combination of their attacks. The VI. Army, reinforced by the III. Corps and charged with the main action, was to "push vigorously, and without stopping, in the general direction of Fismes and Bazoches with its whole front, its left to establish itself in the region of Saponay so as to facilitate the debouching of the right wing of the X. Army towards Cramaille." The X. Army was to make every effort, by successive actions starting from its right (the south), to reach the line Bois d'Arcy, upper course of the Crise, and then by way of the Arcy-Sainte-Restitue plateau to work in the general direction of Braine. "The V. Army was to support the right wing of the VI. Army, making its effort in the direction of Romigny-Lagery-Crugny, along the heights on the south bank of the Ardre." It was to be kept in mind that the enemy, with his wings reinforced, might launch counter-attacks between the Oise and the Aisne or on the Reims salient. Considering the nature of the coming operations, it was not expected that the two cavalry corps would be used, and the commander-in-chief therefore withdrew them and moved them to the neighbourhood of Vitry-le-François and Beauvais in readiness for the two Franco-American and Franco-British offensives that were being prepared.

Redistribution of Troops.—Reliefs were effected within the armies. The VI. Army put considerable American forces into line: the 42nd and 32nd in the first line, the 4th and 28th in second line, while the 26th and 3rd were being reconstituted in the Marne valley.

In the X. Army, Mangin, convinced that he could obtain a decisive success in carrying the heights north-east of the Grand Rozoy, rested his troops on July 30 and 31 in view of this new effort. The V. Army withdrew the British XXII. Corps and replaced them by two French divisions. The VI. Army resumed its attacks on the 31st. The American 42nd Div. maintained its hold of Seringes-et-Nesles in spite of enemy counter-attacks, and the American 28th, 32nd and 4th Divs. entered Cierges and the Meunière wood. In this way the enemy's attention was drawn to the centre on the evening of the 31st, while the next morning (Aug. 1), at 4:45, the right of the X. Army attacked in its turn and, after severe fighting, occupied the whole crest that extends from L'Orme du Grand Rozoy to Saponay inclusive. On the same day the VI. Army, though it succeeded in capturing the Meunière wood, failed before Saponay on account of the extreme fatigue of its attack divisions. Its artillery gained a definite superiority of fire, however, and the air force reported numerous outbreaks of fire and explosions in the enemy's rear. Nevertheless an obstinate resistance was maintained throughout the night by the enemy.

German Retirement to the Vesle.—At dawn on Aug. 2 the three French armies found themselves facing a void. The enemy had fallen back on the Vesle, where he intended to establish himself firmly. The forward movement of the Allied divisions was preceded by advanced guards, which soon regained contact, and by evening the troops had reached the plateaux of Ambief, Mareuil-en-Dole, Dravegny and Lhery, reoccupying Soissons at 7 P.M. On the 3rd, the left of the X. Army reached the Aisne. Its right, together with the VI. and V. Armies, arrived in the immediate vicinity of the Vesle. Contact was established everywhere. All along the front the enemy artillery and machine-guns became very active. On Aug. 4 and 5 the
Allied troops lined the banks of the Vesle, the American 32
Div. entered Fismes and the advanced guards were even able
push some units north of the river at several points. But t
enemy reacted vigorously, and in view of this well-organised r
sistance Foch had to consider whether to carry on operatio
beyond the Vesle or to remain on the south side for the tin
being.

It was obvious that a passage could only be forced by a set ba
tle in great strength. At the moment, other Allied offensiv
were on the point of being launched in Picardy and Santerre
accordance with the plan made by Foch on July 24 in the mid
of the battle of the Marne. It was desirable to reserve any ava
able Allied troops to insure the success of this plan, which w
of so varied a character that the enemy, surprised by the poin
against which attacks were directed, would not have time
parry them. It was for this reason that the order was given n
to undertake any strong action north of the Vesle, but yet
keep the enemy under the impression that such an action w
in preparation, particularly on the date chosen for the Franc
British offensive, which would thus have more chance of a su
prise.

IV. RESULTS OF THE BATTLE

The second battle of the Marne was now over. After thr
weeks of bitter, vehement and uninterrupted fighting, in whi
the French armies exerted themselves at times up to the lin
of human endurance, the following results had been achieved
of great importance materially and of incalculable moral valu
The capture of 30,000 prisoners, over 500 guns, 200 trench mo
tars and 3,000 machine-guns; the shortening of the front by
km.; the restoration of the Paris-Châlons railway line and t
removal of the threat against Paris. But above all, the enen
morale was shaken while that of the Allies was strengthene
Finally, the initiative of operations had passed to the side of t
Allies, and, in addition, their numerical superiority was assur
from that time onward by the arrival of the American forces a
their inclusion in the battle, for the battle that was just finish
marked the actual entry *en bloc* of American divisions in the offe
sive battle.

It was not, could not be, a surprise to any Frenchman—a
still less to the enemy, who had had four years' experience of t
British armies—to see the four British divisions which we
fighting among the French divisions cover themselves wi
glory; but it was questionable whether the enemy had forese
that the young American divisions, going into the attack wi
their organisation only just completed and their training st
unfinished, would be able to make good both the one and t
other by their energy, dash and courage, and by the fine co
fidence and disdain of danger which is to be looked for in so gre
a nation.

It was in the height of this struggle that Foch, relying presum
bly on the results already achieved, forestalled events to so
extent in order to hasten them, and, calling together the co
manders-in-chief of the Allied armies, issued to them his famo
orders of July 24, of which it may be said that they covered t
rest of the campaign and contained the germ of victory. Amo
the so-called "clearance" offensives that he designed in or
to get possession of a base of departure for a general offensi
the one developed between the Marne and the Aisne had alrea
done what he required of it. In fact, the action of the troo
responded to the idea of the Chief with a rapidity which, so
say, emphasised the excellence of his plan and justified all hop

The battle whose scene was in the theatre of the Marne
the second time in less than four years thus marked a turn of t
tide in favour of the Allies, and, by associating British, Americ
and Italian forces with the glorious success of the French armi
formed an auspicious prelude to the general offensive. *See* VICTOR
ADVANCE TO.

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MARRAKESH, or Morocco (*see* 17.753), the southern capi-al and largest town of Morocco, had a population of 139,874 in 921, 1,956 being Europeans. A European town outside the old ity, at the foot of the hills of Geliz and near the military camp, as founded in 1913, and has wide roads planted with trees; it joined to old Morocco by the fine Avenue de la Koutoubia. here is also a new quarter, with shops and a public garden, in he city itself, and an hotel was opened in 1924. French and ranco-Arab schools have been started. The sub-division of orocco is under a French military governor, who is in charge of he municipal services, and it has a French court, with right f appeal to the court of first instance at Casablanca. There are ood roads to Mazagan, Mogador, Safi and Casablanca, where he trade of the city is handled; and one to Fez was in course of onstruction in 1925. There is connection by narrow-gauge ilway with Casablanca and the rest of Morocco, and a stand-rd-gauge line to Casablanca was under construction in 1926.

MARRIAGE LAWS (*see* 17.753).—It is obviously impossible ere to do more than refer very briefly to the more important hanges which have taken place in the marriage laws of civilised tates since the last article on the subject was published.

I. THE BRITISH EMPIRE

Marriage Abroad.—The object of the Foreign Marriage Act 892 was to provide that all marriages celebrated abroad—in ritish possessions outside the United Kingdom as well as in oreign countries—between parties one of whom at least is a ritish subject, before a "marriage officer" in the manner rovided by the Act, should be as valid as if duly solemnised the United Kingdom. Thus a marriage duly solemnised under he Act before a British Consul in France, although void by rench law, was held valid in England (*Hay* v. *Northcote* [1900] Ch. 262). But by the Foreign Marriages Order in Council 13, where a marriage according to the local law of a foreign untry would be valid by English law, the marriage officer ust be satisfied (*a*) that both the parties are British; or (*b*) if ly one is British, that the other is not a national of the country; (*c*) if one of the parties is British and the other a national of e country, that sufficient facilities do not exist for the solemni-tion of the marriage in the foreign country in accordance with e law of that country; or (*d*) if the man is British and the oman a national of the country, that no objection will be taken the authorities of the country to the solemnisation of the arriage under the Foreign Marriage Act. From the decision the marriage officer there is a right of appeal to the Secretary State.

Further, if it appears to the marriage officer that the woman British and the man an alien he must be satisfied (*a*) that the arriage will be recognised by the law of the country to which e alien belongs; or (*b*) that some other marriage ceremony, in ldition to that under the Foreign Marriage Act, has taken ace or is about to take place and that such other ceremony is cognised by the law of the alien's country; or (*c*) that the leave the Secretary of State has been obtained. Measures have en passed to give effect to these provisions in the Bahamas, ilbert and Ellice Islands, Gold Coast, Nigeria and Sierra Leone.

Recognition of Banns, etc.—The Marriage of British Subjects acilities) Act 1915 provides for the mutual recognition of rtificates, publications of banns, or notices of marriage issued the United Kingdom, and in any part of His Majesty's domin-ns outside the United Kingdom respectively, in the case of arriages intended to be solemnised in either, between British bjects resident in either respectively. These provisions may applied to any part of the dominions where the law makes e provisions for the publication of banns, or notices for mar-ges between British subjects intended to be solemnised or ntracted in the United Kingdom, and for the recognition of certificates for marriage. Reciprocal legislation in the dominions is a condition precedent to the issue of an order in council. Such legislation has been passed by the Bahamas, Barbados, Bermuda, British Solomon Islands, Cyprus, Gambia, Gibraltar, Gilbert and Ellice Islands, Gold Coast, Grenada, Hongkong, Mauritius, New Brunswick, New Zealand, Nigeria, St. Lucia, St. Vincent, Sierra Leone, Straits Settlements, Uganda and Victoria.

By the Marriage of British Subjects (Facilities) Amendment Act 1916, however, where the marriage is to be solemnised or contracted in the dominions, and no notice of the marriage under the law in force there is required, the Act of 1915 may be applied to that part of the dominions by order in council. By special statute any marriage celebrated abroad (either in British possessions or in foreign States) and being of doubtful validity may be validated here. There are many instances of this procedure, *e.g.*, the Marriages in Japan (Validity) Act 1912.

Deceased Wife's Sister, etc.—Marriage with a deceased wife's sister has been legalised in the Falkland Islands, Fiji, Jamaica and the Leeward Islands, and also, subject to the proviso that misconduct with the sister makes the marriage void, in Nigeria, St. Lucia, St. Vincent, Straits Settlements, Trinidad and Tobago; the Union of South Africa Act of 1920 legalises such marriages in Natal and the Transvaal, and the Marriage Decree 1915 in Zanzibar.

The Deceased Brother's Widow's Marriage Act 1921 legalises the marriage of a woman with her deceased husband's brother, including the half-blood. The same freedom is accorded in British Guiana, the Isle of Man, Jamaica, Leeward Islands, the Union of South Africa and Western Australia. Legitimation by subsequent marriage is allowed in New Brunswick and British Columbia.

Divorce.—The English divorce law has been modified by the Matrimonial Causes Act 1923 under which a husband's adultery committed since July 18 1923 entitles the wife to divorce without proof of other matrimonial offences.

In New Zealand the Divorce and Matrimonial Act 1908 has been amended by the Act of 1912, which reduces to seven years the period of detention in an asylum as a ground of divorce, while the Act of 1919 provides for the custody of children by the wife of a person of enemy origin. By the Marriage Amendment Act 1920 the allegation that persons are not lawfully married or that children are illegitimate is made a punishable offence on summary conviction by a fine of £100. The Act of 1920 extends the grounds for divorce to failure to comply with a decree for restitution of conjugal rights, and grants a divorce on a petition after three years from a degree of judicial separation or separation order or deed of arrangement or separation by mutual consent. Detention in an institution for insane persons, whether situate in New Zealand or in any other part of the British Dominions, is also a ground for divorce.

In Queensland, by the Act of 1923 lunacy for a period of five years is made a ground for divorce. The Tasmanian Marriage and Divorce Act 1919 enables a husband to petition on any of the following grounds: adultery, desertion for four years, habitual drunkenness and neglect during three years, imprisonment, violent assault, lunacy. The Victorian Marriage Act 1923 amends the Marriage Act 1915, the Marriage (Maintenance) Act 1919 and the Divorce (Insanity) Act 1919. The following are grounds for divorce: wilful desertion by either for three years, habitual drunkenness of husband with lack of maintenance of, or cruelty to, the wife, and habitual drunkenness and neglect of wife, imprisonment, violent assault, adultery of husband in the conjugal residence, or coupled with circumstances or conduct of aggravation, or of a repeated act of adultery, or lunacy, and adultery by the wife.

By the Divorce and Matrimonial Causes Act 1912 of Western Australia the grounds for divorce are adultery of the wife and adultery, sodomy or bestiality of the husband, desertion by either for five years, habitual drunkenness for four years of husband and lack of support of wife, and habitual drunkenness and neglect of wife for like period, imprisonment, violent assault and lunacy. By the Divorce Amendment Act 1919 incontinence by either before marriage is added, provided the woman was pregnant at the time of the marriage. The Married Women's Protection Act 1922 repeals the Summary Jurisdiction (Married Women) Act 1896 and provides protection to a woman whose husband is guilty of cruelty to her or her children, adultery, desertion, wilful neglect to provide reasonable maintenance for her or her children. In Zanzibar a decree of 1912 regulates marriage. The Marriage (Scotland) Act 1916 provides for the joint application of the spouses for a warrant to register an irregular marriage.

II. OTHER COUNTRIES

Baltic States.—In Estonia, Latvia and Lithuania civil marriage is now compulsory.

Belgium.—Marriage between a brother-in-law and a sister-in-law, whether legitimate or illegitimate, is prohibited by the law of 1920, where the marriage which produced the relationship has been dissolved by divorce, but it is legal where the previous marriage has been dissolved by death.

Cuba.—The Spanish civil code 1889–99 has been amended by the Act of 1918, by which marriage is a civil contract, and is only legally effective if celebrated in accord with the code. Separation and divorce are established by the law of 1918. The grounds for divorce are adultery, prostituting the wife or children, grave injury by violence, words, or conviction for crime, grave crime against the wife or children, habitual drunkenness, confirmed gambling, desertion, failure of husband to maintain the home, contagious disease and mutual consent. A divorced husband is not freed from his obligations to his children.

France.—Marriage between a brother-in-law and sister-in-law, whether legitimate or illegitimate, is prohibited by the law of 1919, where the marriage which produced the relationship has been dissolved by divorce, but it is legal where the previous marriage has been dissolved by death.

Italy.—By the law of 1919 a wife may, without her husband's consent, make a gift *inter vivos*, alienate, or mortgage her real property, make a contract of loan, transfer or collect moneys, enter into a contract of guarantee, compound or appear in court with regard to these affairs, be a trader or accept a mandate.

Mexico.—By the Law of Family Relations 1917 marriage is a civil contract by which the spouses are bound by a dissoluble bond. Community of goods is abolished, subject to any settlement. The impediments to marriage are habitual drunkenness, impotence, syphilis, insanity, and any other chronic and incurable infirmity. The following are causes for divorce—adultery, attempt to prostitute the wife, or make the other commit a crime, or corrupt the children; contraction of syphilis, tuberculosis, incurable insanity or other chronic or incurable disease; unjustified desertion for six consecutive months; absence of husband for more than a year, coupled with the obligations inherent in marriage; ill-treatment; false accusation of crime; commission of crime; incorrigible drunkenness; mutual consent. Adultery of the husband is a sole ground for divorce only in certain circumstances. Upon divorce either spouse may remarry. The custody of the children is granted to the innocent spouse. All proceedings are *in camera* and on the intervention of the Attorney-General.

Norway.—By the law of 1909 a marriage may be dissolved where either spouse unknown to the other at the time of the marriage suffered from bodily defect, epilepsy, leprosy, venereal disease, mental disease, or the wife was pregnant by another man. If divorced, the woman may not remarry within 10 months from judgment or licence.

Portugal.—By decree of 1910 marriage is a civil contract and is evidenced by civil registration, and all contracts under the name of betrothal or engagement are void. Divorce may be granted for complete abandonment of the home for three years, or absence for four years or separation *de facto* during 10 consecutive years, lunacy, contagious disease, incurable disease, conviction of homicide.

Sweden.—Separation and divorce are regulated by the law of 1920. Grounds for the former are mutual consent, neglect, drunkenness or debauchery; for the latter judicial separation for one year, three years' separation, two years' absence, bigamy, adultery, venereal disease, plot against life of spouse or imprisonment.

Switzerland.—By the Swiss civil code, which came into force Jan. 1 1912, the marriage laws were made uniform throughout Switzerland. The legal status of women is raised almost to an equality with that of men. The marriageable age for women has been raised from 16 to 18 and that of men from 18 to 20, but for both sexes under 21 the consent of parents or guardians is necessary. Mentally diseased persons are incapable of marriage. The betrothal, for breach of which damages may be awarded, is followed after publication by a civil marriage. Grounds for divorce are adultery, plot against life of spouse, abuse, gross insult, crime, desertion, mental infirmity or ruin of marital relationship. The guilty spouse may not remarry within the period prescribed by the Court.

Judicial separation may be temporary or permanent. If it has lasted for three years either spouse may sue for divorce. The father of an illegitimate child may be compelled to contribute to its support until the age of 18 in proportion to his social position. The chil of a marriage which is declared null are legitimate even neither spouse contracted it in good faith.

Turkey.—The civil code of 1926 is an adaptation of the Swiss, radically changes the legal status of women, who obtain *inter* equal rights with men in divorce.

United States.—The minimum age for marriage has fixed at 15 in Missouri, 16 in Arizona, and 18 in Tenne whilst in Montana marriage between first cousins and per either of whom is feeble-minded is forbidden. In North Da marriage with a degenerate (if a woman under 45, if a ma any age) is prohibited. New York has reduced the period wi which a guilty spouse may not remarry from five to three y and Tennessee has made a ground for divorce such cruel o human treatment of the husband by the wife "as rende unsafe or improper for him to cohabit with her."

III. DOMICILE AND MARRIAGE

Desertion.—The rule was laid down in *Mesurier* v. *Mesu* (in 1895) A.C. 517 and affirmed in the House of Lords in *Advocate* v. *Jaffrey* (1921, A.C. 146) that matrimonial statu governed by the law of the domicile of the parties. Thus domicile for the time being of the spouses affords the only test of jurisdiction to dissolve the marriage. This domicil that of the husband. In *Att. Gen. for Alberta* v. *Cook* (1926 T.L.R. 317) the Judicial Committee of the Privy Council clared that under British law a wife, even when judicially s rated from her husband, still retains his domicile and car acquire a domicile of choice.

But in certain cases of desertion the wife has been permi to sue in the domicile from which the desertion took place, thus was not compelled to follow her husband to his new do cile: *Armytage* v. *Armytage* (1898 p. 178); *Ogden* v. *Ogden* (p. 46); *Statathos* v. *Statathos* (1913 p. 46); *De Montaigu* v. *Montaigu* (1913 p. 154). This undoubtedly is a departure f what has always been the rule of law and practice in G Britain and Ireland—viz.: that the wife's domicile is the band's domicile, whatever that may be. But, as Lord C said in *Lord Advocate* v. *Jaffrey*, there is no doubt authority the proposition that "the husband will not be allowed to se his own wrong as an argument for prejudicing his wife's righ This proposition has been made statutory in some of the colon By the Victorian Marriage Act 1915 "a deserted wife wh domiciled in Victoria at the time of desertion shall be deer for the purposes of this Act to have retained her Victorian do cile, notwithstanding that her husband may have since desertion acquired a foreign domicile." The Western Austra Act of 1912 and the Tasmanian Act of 1919 are to the sa effect.

India.—It was decided in *Keyes* v. *Keyes et Gray* (1921 204) that the courts in India had no jurisdiction to grant div to parties not domiciled in India, though the marriage was c brated and the parties were resident there. By the Indian vorce (Validity) Act 1921 divorce may be granted where proceedings were commenced before the Act. By the Ind Divorce Amendment Act 1926 relief is restricted to par domiciled in India.

United States.—Throughout the United States matrimo status is governed by the law of the domicile of the parties o up to a point. This point is reached when the wife separ from the husband for a just cause (*i.e.*, any act of his w would entitle her to a limited or absolute divorce) or where t agree in writing to live apart; the wife may acquire a sepa domicile and may obtain a divorce in the State of her domi In a nullity suit, since there never was identity of domicile, wife retains her own domicile. This rule obtains also in Engla

Domicile and Validity.—The general rule that a marr valid by the law of the place of celebration is valid everyw is usually subject to the condition that it is also valid by law of the nationality or domicile of the parties. In New Y State the guilty spouse, if divorced, may not remarry du the lifetime of the other but it seems that by changing his domicile he or she may remarry, and that by the general such marriage will be valid in New York. To prevent such esult, Massachusetts has passed an Act providing that if a son residing in or intending to reside in Massachusetts is bled by the law of that State from marriage, and marries in ther State, such marriage is void in Massachusetts. And if erson residing in another State is married in Massachusetts, marriage is void if it would have been void in the State re such person is domiciled. Louisiana has also passed an providing that marriages contracted between persons, one oth of whom are domiciled in Louisiana and forbidden to ry in that State, shall be deemed to be invalid, even if valid where.

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ARS: *see* ASTRONOMY.

ARSEILLE (*see* 17.766) is the second largest city in France, a population of 586,341 in 1921. Housing conditions were bad, dwellings which were condemned before the World being still inhabited in 1920, and manufacturers in consence experienced considerable difficulty in procuring labour. re was an influx of workers during the War, when there considerable industrial development, largely in the provision odstuffs and in metal manufacture. Part of the harbour me a British base, and many Indian, Australian and can troops passed through, together with refugees from pe and the East; after the Armistice an American embarkacamp was established.

efore the War Marseille was extremely prosperous, but ng it trade collapsed, and there was less military activity in the western ports. A period of great difficulty in indusand shipping has since been faced. In 1923 the total of s discharged at Rouen, where little was shipped, exceeded total of discharges and shipments at Marseille, hitherto the ing French port. The figures in 1926 were still below those re-War years. During the War basins in the harbour were ened, and a new one has since been taken in hand. A ay now runs along the coast for 60 km. as far as L'Estaque. h work has been done on the Marseille-Rhône canal. A l port has been built at its opening into the Gulf of taque; land has been assigned for industrial development, industrial suburbs are arising along the bank of the canal e, protected by embankments, it runs along the coast and es the Lave by a tunnel 7,000 metres long. It is hoped improved navigation on the Rhône, and the extension of ort to include the lakes of Berre and Caronte, will bring ge influx of trade to Marseille.

ARSHALL, ALFRED (1842–1924), British economist (*see* o). In 1890 he published his *Principles of Economics* h went through many editions and was translated into a number of foreign languages. He retired from the chair litical economy at Cambridge in 1908 in order to devote elf to writing. His next volume, *Industry and Trade*, a stic study of industrial organisation, appeared in 1919, and was followed in 1923 by *Money, Credit and Commerce*. He in Cambridge on July 13 1924.

arshall may be said to have been in the lineal descent of reat English economists—Adam Smith, Ricardo and J. S. Like their chief works, his *Principles of Economics* has me a classic. It was distinguished by its profound and matic methods of analysis, and introduced a number of concepts of great importance to the science. Although years elapsed between the publication of the *Principles conomics* and that of his next two works, much that was important in them, especially in regard to the theory of y, has been transmitted orally in his lectures at Cambridge, has influenced thought both in England and in other countries. While Marshall never tried to found a school of economic doctrine, his genius for stimulating the minds of a long succession of pupils and the example of his methods of reasoning have had a profound effect upon the development of economics in England, the British Dominions and the United States. Further information on his life and writings and a detailed bibliography of his works are to be found in the *Memorials of Alfred Marshall*, edited by A. C. Pigou.

MARSHALL, THOMAS RILEY (1854–1925), American politician, was born at North Manchester, Ind., March 14 1854. He was educated at Wabash College (A.B. 1873; A.M. 1876) and was admitted to the bar in 1875. From 1876 to 1909 he practised law in Columbia City, Ind., and from 1909 to 1913 was governor of Indiana. He was nominated for vice-president on the ticket with Woodrow Wilson at the Democratic National Convention in 1912 and was elected. He was again nominated with President Wilson in 1916 and elected for the term 1917–21. For almost two years after the outbreak of the World War he urged strict neutrality, but in 1918 publicly expressed regret for this attitude. In 1919 he welcomed the King and Queen of Belgium on their visit to Washington during the illness of President Wilson. He was a strong advocate of the League of Nations, but did not favour woman suffrage. He served on the U.S. Coal Commission in 1922. He died in Washington, D.C., June 1 1925. His memoirs, *Recollections of Thomas R. Marshall*, were published posthumously in 1925.

MARX, WILHELM (1863–), German politician, was born at Cologne Jan. 15 1863. He entered the political branch of the Civil Service and became a judge. In 1899 he was elected to the Prussian Diet and in 1910 entered the German Reichstag, where he soon became prominent among the leaders of the Centre. He was elected president of the Centre party in 1921, and on Nov. 30 1923 succeeded Stresemann as chancellor of the Reich. In Aug. 1924 he took part in the Conference of London which determined the acceptance of the Dawes Plan (*see* GERMANY). In the autumn of 1924 Marx dissolved the Reichstag in the hope of getting a government majority, and after the elections retired from the post of chancellor. In Feb. 1925 he became Prussian Minister-President for a short period. After the death of Ebert he stood as candidate for the post of president of the Reich, but was defeated by Hindenburg. In Jan. 1926 he became Minister for Justice and Occupied Territories in the second Luther Cabinet and later in the same year succeeded Luther as Chancellor.

MARY (1867–), Queen Consort of England, daughter of the Duke of Teck and Mary Adelaide, daughter of Adolphus, Duke of Cambridge, seventh son of George III., was born at Kensington Palace May 26 1867, and was baptised as Victoria Mary Augusta Louise Olga Pauline Claudine Agnes. She was affianced in 1891 to Albert Edward, Duke of Clarence, eldest son of Edward VII., who died Jan. 14 1892. On July 3 1893 she married George, Duke of York, and when he succeeded to the Throne, on the death of Edward VII., was crowned with him in Westminster Abbey June 22 1911. Both as Princess of Wales and as Queen she took a prominent part in public life, showing special and well-informed interest in all that concerned the welfare of women and children. This was particularly notable at the outset of the World War, when the organisation of relief, as well as the promotion of the women's part in public service, claimed and received her constant attention. By the universal testimony of those who came into direct contact with her through those anxious years, no one showed a more practical appreciation of the problems to be solved than the Queen. In the first month of the War she inaugurated (Aug. 20) the "Queen's Work for Women Fund" to provide employment for as many as possible of the women thrown out of work by the outbreak of war. Over 70 special relief workrooms were opened, through which about 9,000 women passed before Feb. 1915; after that date, the need became less as the women were gradually absorbed into munition making and other industries. On Aug. 10 1914 the Queen also inaugurated "Queen Mary's Needlework Guild" for the purpose of "organising a collection of garments for those who will suffer on account of the War." On March 11 1921 the

Queen showed her sympathy with the higher education of women by visiting the women's colleges at Oxford and responding generously to their appeal for funds. The interest shown by the Queen in the work of the hospitals and the welfare of the nursing profession during the post-War years was especially signalised when she opened the new College of Nursing (the gift of Lord and Lady Cowdray) in London on May 31 1926, and in other ways. (*See* GEORGE V.)

MARYLAND (*see* 17.827).—The population in 1920 was 1,449,661, as compared with 1,295,346 in 1910, an increase of 11·9% as opposed to 9% in the previous decade. In 1920 the urban population (that is, residents of towns of 2,500 inhabitants or more) was 869,422, while the rural population was 580,239, or 60% urban instead of 50·8% in 1910. A part of this increase of urban population may be accounted for by the annexation of portions of Baltimore and Anne Arundel counties to Baltimore City in 1918 (*see* BALTIMORE), by which the population of Baltimore received more than the normal increase for the decade.

The population of those cities in Maryland having more than 11,000 inhabitants and the percentage of increase for the decade was as follows:—

	1920	1910	Increase Per Cent
Baltimore	733,826	558,485	31·4
Cumberland	29,837	21,829	36·6
Hagerstown	28,066	16,507	70·0
Annapolis	11,214	8,609	30·3
Frederick	11,066	10,411	6·3

The greatest percentage of increase was the 70% (11,559 in number) of Hagerstown, an important railway and manufacturing centre of the Cumberland valley.

Agriculture.—In 1910, 48,923 farms occupied 5,057,140 ac., or 79·5% of the total land area of Maryland, of which acreage 3,354,767, or 66·3%, were improved lands. The slow transition of the state from an agricultural to a manufacturing community is manifested in a comparison of these figures with those for 1920, in which year there were reported 47,908 farms, taking up 4,757,999 ac., or 74·8% of the total land area, and showing 3,136,728, or 65·9%, in improved lands. There were 1,015, or 2·1%, fewer farms in 1920 than in 1910, a decrease of 5·9% in total acreage and 6·5% in the acreage of improved land.

In the same period the value of all farm property in the state rose from $286,167,028 to $463,638,120; of the average value of a farm from $5,849 to $9,678. The total farm value in 1920 comprised $386,596,850 in lands and buildings, $28,970,020 in implements, and $48,071,250 in live stock. The average number of acres per farm decreased from 103·4 in 1910 to 99·3 in 1920. The average value per acre of all farm property in 1920 was $97.44, instead of $56.59 as in 1910, and of land alone was $54·62, instead of $32.32. Of the total number of farms, 41,699 were operated by white and 6,209 by coloured farmers, a decrease in the first class of 2%, in the second class of 2·6%.

Of domestic animals on farms in 1920, the total value was $43,784,464. The number of horses in 1924 on farms was estimated at 135,000; of mules 33,000; of milch cows 196,000; of other cattle 103,000; of sheep 96,000 and of swine 299,000. The total value of livestock had decreased to $33,686,000 in 1924, a decline due partly to a decrease in the number of horses and partly to smaller prices prevailing for some classes of animals. The total farm value of Maryland dairy products in 1919, exclusive of products consumed on the farm, was $13,407,526, as against $5,480,900 in 1909, an increase of 144·6%.

The total area in crops in 1923 was 1,934,000 ac., as opposed to 1,927,000 in 1909. The peak year was 1918, when the total area was 2,245,000 acres. The total value of field crops in 1923 was $67,560,000. The corn acreage of Maryland was 647,000 ac., in 1909 (value of crop $11,015,000), and in 1923 the acreage was 642,000, the production 25,231,000 bu., the value of the crop $20,689,000. The wheat acreage was 589,000 in 1909, 664,000 in 1919, 543,000 in 1923. In the last year 10,426,000 bu. were raised, worth about $1.00 a bushel. Hay was grown on 398,892 ac. in 1909; 662,939 in 1919; 400,000 in 1923. In the last year 4 000 tons were raised, which was about one-half less than in preceding year. In 1923, 59,000 ac. were sown in oats, prod ing 1,758,000 bu. valued at $949,000. In barley 4,000 ac. w sown producing 132,000 bu.; 17,000 ac. in rye, producing 269, bu.; 9,000 ac. in buckwheat, producing 199,000 bu.; 49,000 in Irish potatoes, producing 3,920,000 bu.; 9,000 ac. in sw potatoes, producing 1,170,000 bu.; 24,000 ac. in tobacco, p ducing 19,008,000 lb., with a value of $4,182,000.

The apple crop in 1923 amounted to 2,300,000 bu., with a va of nearly $2,000,000; the peach crop 631,000 bu., with a valu $946,000; the pear crop 374,000 bu., worth about $1.00 a bus The tomato crop was very important in 1923; 44,230 ac. w devoted to the crop, which produced 243,300 tons, worth $3,7 000. Most of the tobacco raised is exported to France and ot European countries. In 1923, 10,420 ac. devoted to strawber produced 20,840,000 qt. and Maryland excelled all other sta except Tennessee, in the total number of carloads shipped. wool crop for 1923 amounted to 467,000 pounds.

Minerals and Manufactures.—The value of the products of mines and quarries in Maryland in 1909 was $5,782,045, an 1919 $9,698,577, an increase of 67% in the decade. Of amount, bituminous coal amounted to $8,195,667, or 84· The production of granite amounted to $627,625; of slate, $6 142. In addition, considerable amounts of limestone, mar clay, asbestos and iron ore were produced. The coal minin in the western counties of Alleghany and Garrett. The iron- produced is used entirely in the manufacture of metallic pai In 1919, 5,628 persons were employed in 126 mining industr

The total value of Maryland manufactures in 1909 was $ 669,150, and in 1919 $873,944,774, a sum which placed the s 17th in the Union in value of manufactured goods. Of amount named, $677,878,492 was the product of Baltim plants alone. In the entire state, there were in 1919, 165, persons engaged in manufacturing industries and $619,606, invested in them. In the period 1914–9, the value of Maryl manufactures advanced 131·4%. The following table shows value of the products of certain industries in 1914 and 191

Products	1919	1914
Men's clothing	$72,589,000	$39,048,0
Copper, tin and sheet-iron products	40,636,000	25,491,0
Canning and preserving	30,566,000	18,029,0
Lumber and timber products	18,744,000	11,911,0
Foundry and machine products	31,581,000	10,659,0
Meat	43,228,000	17,100,0

By 1919 there had been added to this list: cars and general s construction and repairs, for steam railways, $22,837,000; pr ing and publishing, $23,835,000; fertilisers, $37,014,000. S 1914 there has been a large increase in the number of manu turing establishments and in capital invested in manufact in Baltimore, so that the 57% which in that year was the co bution of that city to the value of manufactures in the st has been increased. Outside of Baltimore, the chief manu turing centres are the western Maryland cities, Cumberland Hagerstown.

Fisheries.—A decreased output in fishery products, resul from a lack of regulation of the taking of oysters from the nat beds, having been recognised, the state created, in 1916, a servation commission. This commission was replaced by a servation dept. in 1922. In spite of the attempt of the stat increase the supply of oysters, in 1923 it had further diminis to 3,440,810 bu., as opposed to 4,967,433 bu. by April 15 1 before the close of the season. In Feb. 1925 an exhaustive in tigation proved the healthful condition of the Maryland oys

Communications.—Beginning with the passage of the "S maker, or State Aid" Act in 1904, the state entered upon a gramme of road construction, the prosecution of which has vided it with one of the best road systems of any state. In the state roads commission was created by the Legislatur construct all state roads and state-aided roads, and as the re of its activities there have been built of both classes 1,585 m

acadam, concrete and other surfaced roads on the foundations
the once privately owned turnpikes and the unmetalled con-
cting county roads.

Education and Religion.—The development of Johns Hopkins
niversity is given in that article. The small colleges of the
te, such as St. John's at Annapolis, and Western Maryland
Westminster, have been engaged in important and successful
mpaigns for the increase of their endowments. In 1920 the
gislature passed an Act merging the University of Maryland
altimore), with its schools of law and medicine, and the Mary-
d State College of Agriculture (College Park, Md.) under the
me of the University of Maryland, and under the control of
oard of regents. In secondary education, the further better-
nt of the school system throughout the state was provided
by the reorganisation of the state Board of Education by
islative enactment of 1916.

History.—A series of Acts passed since 1910 indicates a pro-
ssive quality in the administration of the state. These Acts
ated the Public Service Commission (1910), the state Indus-
al Accident Commission (1914), the Conservation Commission
16), the state Board of Prison Control (1916), the state Tax
mmission (1914), the state Roads Commission (1908) and the
rganisation of the state Board of Education (1916). In 1916
budget system was adopted, and in 1920 a merit system for
te employees was put in operation.

n 1922, largely through the efforts of Gov. Ritchie, the gov-
ment of the state was reorganised so as to consolidate and
rrange the executive and administrative departments of the
te under 19 divisions. A state purchasing agent now secures
plies for these state departments. Four great military estab-
ments were located in Maryland during the World War; the
erdeen Proving Grounds, the Edgewood Arsenal, Camp Meade
Camp Holabird. Because of their good location and con-
ience to Washington, these establishments have been re-
ned for military purposes by the War Department.

Maryland was the sixth state to ratify the prohibition amend-
nt, but never ratified the suffrage amendment. Recent gov-
ors have been: Austin L. Grothers (Dem.), 1908–12; Phillips
Goldsborough (Rep.), 1912–6; Emerson C. Harrington
m.), 1916–20; Albert C. Ritchie (Dem.), 1920–6. The latter
re-elected by a plurality of 40,400 votes in 1923. In 1924
ryland decided to cast its electoral vote for Coolidge by a
rality of 14,350.

f late, Maryland has usually been Republican on national
es, but Democratic at state elections. Through the efforts
Gov. Ritchie, a constitutional amendment was passed pro-
ing for the election of state officers at the same time as
election of national officers. This reduced the term of many
te officers then elected, from four to three years, and pro-
ed for a three-year intermission in the meeting of the Legis-
ire. Beginning with Jan. 1927 the Legislature will meet
nnially again, and the members of the two Houses will be
ted for four-year terms at the same time as the governor.

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IASARYK, THOMAS GARRIGUE (1850–), first Presi-
t of Czechoslovakia, was born on March 7 1850 in the Mora-
n border-town Hodonin. His father was a coachman em-
yed on one of the Austrian Imperial estates, a native of Kop-
y in Slovakia (Slovakia then being a part of Hungary); his
ther came from a semi-Germanised Czech family of Hustopeč,
he Moravian plains. In his boyhood Masaryk was taught
ch and a smattering of German, and was educated at a Czech
ol in Čejkovice. His parents sent him for two years to the
er German Realschule of Hustopeč, with the intention of
ing him a teacher.

The object being abandoned, he became first a locksmith's apprentice in Vienna, then a blacksmith at Čejč. In 1865 his former schoolmaster induced his parents to resume their first idea of making him a teacher, and in that year Masaryk passed the entrance examination to the second grade of the "gymnasium," and began studying at Brno. He supported himself, as did many poor students, by tutoring. He developed a rebellious disposition, disagreed with some of the dogmas of the Roman Catholic Church and refused to go to confession. As a result he had to leave the gymnasium, and he continued his studies in Vienna, where he graduated first from the gymnasium with honours, then from the University, where in 1879 he became a lecturer in philosophy. He spent a year in Leipzig, where he met his future wife, Miss Charlotte Garrigue, daughter of the President of the Germania Insurance Co. of New York. In 1881 he published in German his first great sociological work, *Suicide as a Phenomenon of Modern Civilisation.* In 1882, when the University of Prague was divided into two parts, the one Czech, the other German, he was appointed to one of the Czech professorships. In 1885 he published his larger work on *Concrete Logic*, a study of the methods of classification of sciences, in which he attempted to work out a natural system of all knowledge.

In 1883 Masaryk founded a critical monthly review *The Athenaeum*, which soon sprang into prominence by becoming the battle ground on which the famous MSS. of Krláové Hradec and Zelená (Koeniginhof and Gruenberg) were attacked and proved to be forgeries, manufactured in the early 19th century by two well-meaning men, whose object was to provide text for the theory that in the Middle Ages there had been a high standard of literary culture in Bohemia. The authenticity of the MSS. had before been doubted by Slav philologists, but it was not until 1886, when Masaryk invited the great Czech philologist Gebauer to analyse the MSS. philologically, himself analysing them sociologically, that they were conclusively proved to be forgeries. The fight over the MSS. was the real beginning of the so-called "realist" revolution in Czech politics, literature and philosophy, the guiding principle of which was the application of the scientific method to letters and politics. While at Prague University Masaryk founded in 1893 a monthly review *Naše Doba* (Our Epoch). He became a member and instructor of the "Sokols." He started lecturing in Prague clubs and societies on unconventional subjects and published unpopular books. His sociological work led him to a study of Marxism, whose historical materialism he criticised in his great work *The Social Question* (1898, in Czech and in German).

Masaryk's political career started in the early 'eighties. In 1887 his friends founded a fortnightly paper *Čas* ("Time"), which two years later he took over and transformed into a political weekly. At that time the so-called Old Czech (Conservative) party was losing ground, and Masaryk, invited by the Young Czech (Liberal) party to be a candidate, was elected to Parliament in 1891. He soon resigned his seat in Parliament (1893) to devote himself to a crusade of moral education among the Czech people. He created for the Czechs what he called the philosophy of a small nation taking up the thesis of Palacky, the great Czech historian, who regarded the period of the Hussites and the Bohemian Brethren as the culminating point of Czech history, and drawing the moral that in the long traditional struggle between Slav and Teuton, which formed the main substance of Czech history, the Czech nation preserved itself by an intense love of culture and by a high standard of morality.

Although his opinions on nationalist questions were unpopular—an unpopularity which increased when in 1899 he fearlessly withstood a popular anti-Semitic superstition as manifested in the so-called "ritual murder trial" of a Jew named Hilsner—his ideas made a deep impression. They became the rallying cry of the younger generation not only of the Czechs, but of the Yugoslavs and other Slavs who flocked to Prague.

In 1900 his followers founded a political party which was officially named the "Progressive party," but which continued popularly to be known as the Realist party. The programme was founded on the principles enunciated in Masaryk's books. As a candidate of the Realist party he was re-elected to Parliament in

1907. In Parliament he soon began to criticise Austria's passive subjection to Germany and her own aggressive policy in the Balkans, especially as manifested in the annexation of Bosnia-Hercegovina. In the notorious "high treason" trial of Agram (1909), by which the Austrian Foreign Minister Count Aehrenthal tried to justify his annexation policy, and in the Friedjung trial (1909) which followed, Masaryk played a decisive part. He proved, on the basis of his private investigations, that the case for the Crown rested on documents forged at the Austro-Hungarian Legation in Belgrade. His fearless disclosures in the Austrian Reichsrat (May 1909) and in the Austro-Hungarian delegations (1910) forced the proceedings in the Agram trial to be quashed, compelled Friedjung to retract his accusations against the Serbs, and unmasked the methods of Austro-Hungarian diplomacy. Masaryk incurred the intense displeasure of the official and court circles in Vienna, but made a reputation abroad which proved useful to him during the War of 1914–8.

During the World War he developed his case against Austria-Hungary in detail, and at the end, in his work, *The New Europe*, characterised it as a corrupt, imperialist, militarist, pretentious and senseless relic of the Middle Ages. When the War broke out he was still a member of the Austrian Parliament. In Dec. 1914 he escaped from Austria, and in the following four years conducted a political and propagandist campaign in Switzerland, France, England, Italy, Russia and the United States on behalf of Czechoslovak liberation from Habsburg rule. He founded the propagandist journals *La Nation Tchèque*, which was edited in Paris by Ernest Denis, and *Československa Samostatnost* (Czechoslovak Independence), which was produced in the small town of Annemasse in Savoy, and he was one of the original Board of Dr. R. W. Seton-Watson's *The New Europe*, which was founded in London in 1916.

Masaryk's stand against Austria was publicly proclaimed in his Hus Anniversary speech made in Geneva in July 1915, and reaffirmed in his revolutionary manifesto, issued by him with the sanction of the Czech political leaders at home, on Nov. 14 1915. The signatories of that manifesto, who included representatives of Czech residents in France, Great Britain, America and Russia, formed a central revolutionary committee called the Czechoslovak National Council, of which Masaryk acted as President and Dr. E. Benes as Secretary. Finding his work in Switzerland hampered by enemy spies, he settled in London, where, at the invitation of Dr. Ronald Burrows, principal of King's College, he joined the staff of that college. Here he worked for two years combating, with the help of his friends, Mr. Wickham Steed and Dr. R. W. Seton-Watson, the German-Magyar propaganda, and familiarising Western opinion with Czechoslovak aspirations.

The Russian revolution of 1917 enabled him to go to Russia. Several thousand Czech soldiers—prisoners of war—had gone over to the Russians, and wanted to organise themselves into active military units. After some difficulty Masaryk induced the revolutionary Russian Govt. to agree to the formation and equipment of an independent Czechoslovak Army (92,000), whose exploits as they marched eastwards from Siberia to Vladivostok were one of the impressive later episodes of the War. He transferred some of them to the Western Front. He went to the United States in May 1918. The result was the Lansing declaration (May 29 1918) of sympathy with the cause of Czechoslovak and Yugoslav independence. The Allied Govts. associated themselves with that declaration on June 3 1919. The ice being thus broken, the Allied Powers and America recognised Masaryk's National Council as the *de facto* Government of the future Czechoslovak State. Masaryk was elected first President of the Czechoslovak Republic on Nov. 14 1918 and re-elected on May 27 1920. He had been sentenced to death *in contumaciam*, and in 1923 occurred the death of his wife, largely the result of the persecution to which the Government had subjected his family. For his work as President of the Republic during the years 1918 to 1926 *see* CZECHOSLOVAKIA.

Masaryk ranks equally high as a philosopher and as a statesman. His philosophical treatises were the result of his study of Czech history. His pronounced realism was a reaction both against the Teutonic idealism which developed moral specu tion without reference to the practical affairs of life and agai the Tolstoyan Slav philosophy of non-resistance to evil. Masar as philosopher, stands for a unified conception of life, in wh the spiritual and the religious take their place with the intell tual and the political as aspects of an integral whole. The lowing are the chief of his many philosophical, sociological a political works:—

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MASEFIELD, JOHN (1875–), British poet and noveli was born in Liverpool and spent his early years in many cou tries and occupations, serving before the mast at sea, and earni a living as best he could in America. The activity of these yea was reflected in his work from the first, as *Salt-Water Balla* (1902) or *Ballads* (1903), in spite of their obviously Kiplingesq inspiration, show. His early novels, *Jim Davis* (1911), *Capta Margaret* (1908) and *Multitude and Solitude* (1909), had me as tales of action and spirit, but it was in narrative poetry a drama that he found his natural expression. *The Everlasti Mercy* made something of a sensation in 1911; it was follow quickly by *The Widow in the Bye Street* (1912); *Dauber* (1913 and *The Daffodil Fields* (1913), all narrative poems in a key stern realism. Meantime Masefield had made some successf experiments in drama, with *The Tragedy of Nan* (1909) a *Pompey the Great* (1910), the first allied in subject and setting his long poems of village life, the second historical in them *Lollingdon Downs* (1917) included a noteworthy sonnet sequenc and *Reynard the Fox* (1919) proved one of the most successful his verse narratives. Later work included *Collected Poems* (1923 *A King's Daughter*, a verse tragedy (1923); *Sard Harker*, novel of adventure (1924); *The Trial of Jesus*, a play (1925 *Odtaa*, a novel (1926). He published some able prose War sketch in *Gallipoli* (1916) and *The Old Front Line* (1917).

MASON, MAX (1877–), American educationist and i ventor, was born at Madison, Wis., Oct. 26 1877. He graduat from the University of Wisconsin in 1895, continuing his studi at the University of Göttingen (Ph.D., 1903). After bei instructor in mathematics at the Massachusetts Institute Technology 1903–4, he became assistant professor of math matics at the Sheffield Scientific School, Yale University, in 19 He was appointed professor of mathematical physics at the U versity of Wisconsin in 1908. He also lectured at Harvard U versity 1911–2. During the World War he was a member of t staff of the Naval Experimental Station, New London, Con and also on the submarine committee of the National Resear Council 1917–8. He invented several devices for the detecti of submarines. In Aug. 1925 he became president of the U versity of Chicago.

MASPERO, SIR GASTON CAMILLE CHARLES (1846–1916 French Egyptologist (*see* 17.848), died in Paris June 30 191 During his second term of office as director-general of the servi of antiquities at Cairo he was made K.C.M.G. (1909). He retir in 1914.

MASSACHUSETTS (*see* 17.850).—The population in 1920 wa 3,852,356, an increase of 485,940 or 14.4% since 1910, as again

% in the preceding decade. Nearly one-third of the state's abitants lived in metropolitan Boston. Less than 1·3% were roes; 28% were foreign born, of whom 24·4% came from nada. The average density of population in 1920 was 479·2 sq. m., as against 418·8 in 1910. The urban population (in places of more than 2,500) was 94·8% of the whole, as inst 92·8% in 1910. According to a census taken by the e in 1925, the population was 4,144,205. The Census Bureau mated the population as of July 1 1926 to be 4,197,288. The ulation of the 12 chief cities was:—

Cities	1925	1920	1910	Increase % 1920–5
oston	781,529	748,060	670,585	4·5
orcester	192,242	179,754	145,986	6·9
ringfield	142,224	129,614	88,926	9·7
ew Bedford	120,494	121,217	96,652	– ·5
ll River	129,662	120,485	119,295	7·6
owell	110,542	112,759	106,294	–1·8
mbridge	120,053	109,694	104,839	9·4
nn	103,147	99,148	89,336	4·0
merville	99,206	93,091	77,236	6·5
wrence	95,136	94,270	85,892	·9
ockton	65,731	66,254	56,878	– ·7
olyoke	60,892	60,203	57,730	1·1

griculture.—The total number of farms in 1925 was 33,454 ompared with 32,001 in 1920 and 36,917 in 1910. Farm perty in 1925 was valued at $293,405,059, including live k valued at $21,758,276. The average acreage of farms is easing, being 70·8 in 1925 as against 77·9 in 1920, but the rage value per acre is increasing, being $107.53 in 1925 as pared with $99.25 in 1920.

he principal crops were as follows, in bushels:—

Crops	1924	1919	1909
rn (maize)	425,780	1,921,607	2,402,738
ts	82,668	1,515,933	2,029,381
ckwheat	11,847	23,238	32,926
neat	4,028	33,253	2,404
tatoes	1,734,210	1,885,655	2,946,178
bacco (pounds)	14,058,156	14,282,589	9,549,306
e	9,947	46,261	59,183
ples	3,006,120	3,187,211	2,550,259

-thirds of the cranberry yield of the United States in recent s was raised in the bogs along the southeast coast of the state. live stock on farms in 1924 included 43,537 horses, 192,131 le (of which 145,631 were dairy cows) and 63,810 swine.

ineral Products.—During the past 15 years there was a increase in the production of building-stone, crushed rock road and street-making, and sand. The value of marble, and stone work in 1923 was $11,285,444. The value of products of the state increased from $1,647,362 in 1908 to 38,354 in 1923, of which latter amount $3,045,638 was the e of common brick. The total value of mineral products in was $15,725,000 as compared with $12,411,708 in 1920 and 77,370 in 1910.

anufactures.—Massachusetts, with a limited local market ts manufactured products, scanty resources in the form of materials, and a declining trans-Atlantic commerce, has added to its railway and terminal facilities. Only four states are ler in area: yet in 1921, only five states exceeded it in the e of its industrial output. Its advantage has lain in having rplus of capital, in its unsurpassed supply of skilled labour in the superior organisation of its factories. In its earlier lopment it utilised its local water-power, of which it had a al supply. Then it became largely dependent on coal for imported at increasingly high cost. In 1910 the total e of products of manufacturing establishments was 0,527,386; in 1921, $2,849,413,516; in 1923, $3,571,348,398. e the increase in value is largely to be accounted for by the ased prices, the state as a whole made commendable industrial progress. In textiles (cotton, worsteds and woollens), ots and shoes, boot and shoe cut stock and findings, rubber wear and in fine writing paper, Massachusetts in 1923 was oremost state.

The following table deals with the chief manufacturing industries as ascertained by the census of 1923:—

Industry	No. of establishments	Average number of wage-earners	Wages	Value of products
Cotton goods	191	113,707	$115,080,841	$415,922,838
Boots and shoes	595	69,397	82,916,416	290,674,403
Worsted goods	83	45,806	51,833,609	258,035,615
Electrical machinery and supplies	130	26,350	34,482,705	117,575,926
Foundry and machine-shop products	533	24,660	36,267,289	114,929,133
Dyeing and finishing textiles	75	14,074	16,099,333	101,824,142
Woollen goods	103	19,036	24,356,203	94,100,430

The value of boots and shoes and cut stock in 1923 was 36% of the country's output, New York ranking second with 18·9%. In 1923 the textile industries employed 33% of the manufacturing wage-earners, the products being 28% of the total industrial output. Over two-fifths of this was in cotton goods and formed 22% of the output of the whole country, North Carolina being the next largest producer of cotton goods. The output of woollen and worsted goods in 1923 was about 30% of that of the whole country, Pennsylvania producing the next largest amount. The increase in value from 1900 to 1923 was 536%. The increase in the value of boots and shoes and cut stock for the same period was 154%. Boston and Worcester were the principal centres for foundry and machine-shop products. Other industrial products were: rubber goods, $84,098,920; tanned, curried and finished leather $71,098,478, in the manufacture of which Massachusetts was second among the states; paper and wood pulp, $93,641,621; printing and publishing, $117,436,792, of which $61,326,221 was the value of newspapers and periodicals; cordage, twine and jute goods, $28,477,768, in which the state was second only to New York; furniture, $34,691,239; jewellery, $30,436,712; and confectionery, $48,618,574, in both of which Massachusetts was third among the states.

The state is also noted for its fishing industry, the fleets visiting the Newfoundland Banks being important, with Gloucester and Boston as chief centres of the trade. The value of products in 1920 was $7,596,905. Cod were valued at $2,311,011; haddock, $2,655,303; mackerel, $748,682; and halibut, $518,598.

Education.—In 1925 the total number of pupils enrolled in the public schools was 713,926, the amount expended on education being $71,941,986. In 1910 the figures were 538,441 and $17,110,327 respectively. Several fundamental changes were made in the organisation of the educational enterprises of the state in 1919. Among the most important were: the consolidation into a new department of education of several related activities, the abolition of the Board of Education, and the creation of the Advisory Board of Education, consisting of six members and the Commissioner of Education, who is *ex officio* chairman. In vocational education rapid progress occurred in the period 1909-23 the number of schools in which vocations are taught increasing from six to 80, and the enrolment in vocational classes from 1,400 to 11,870.

Another significant development was in university extension. In the year ending Nov. 30 1923, 5,075 students were receiving instruction by correspondence. In the five years ending Aug. 1923, 27,658 were registered in adult immigrant classes and 27,313 in other extension classes. In 1911 the Teachers' Registration Bureau was established, a free agency which has proved very successful; three years later a retirement system was put into operation, with membership compulsory, and provision for retirement at 60 years of age under certain conditions or by compulsion at 70. The Legislature of 1921 made several notable changes, among which are the following: Compulsory transportation from towns where there is no high school, with provisions for state reimbursement a provision compelling every town with a valuation of $1,000,000 or more to employ a school nurse, and the requirement of physical training in both elementary and high schools.

The state department may now grant the degree of Bachelor of Science in Education to any person completing a four-year course in a state normal school—one school giving it in the commercial course only, one in household arts, one in art and two in regular courses. Regular public-school teachers cannot be paid less than $750 a year. Reimbursements to small towns and cities are provided, with special arrangements for those of low valuation, enabling them to have good teachers. Civics and history are required to be taught in elementary and high schools, and since 1923, the Constitution of the United States. Pupils 14–16 years of age must have completed the requirements of the sixth grade before being certified for employment.

Finance.—The receipts of the state in 1909 were approximately $14,700,000, and those in 1923 approximately $41,000,000, or nearly three times as much. These figures represent receipts for revenue purposes only, and do not include receipts from the issue of bonds or notes. The payments in 1909 were about $17,100,000, and in 1923 about $42,507,914. These represent governmental cost and include no payments of money borrowed. In 1923 the funded debt of the state was $53,673,740, and the total debt $126,269,911.

Transportation.—There were 4,950 m. of steam railway in 1924 and 2,551 m. of electric street railway. Great attention has recently been given to the highways, and during 1924 nearly 149 m. of highway were constructed. The total length of state highways at the end of 1924 was 1,521 m.; and the amount spent on new roads in that year, about $2,000,000; repairs and maintenance, $4,798,000.

Banking.—The resources in 1923 of the national banks within the state were $1,227,367,000. There were 634 banking institutions and agents under state law, with resources of $2,488,606,935, divided as follows: 196 savings banks, $1,215,244,815; 105 trust companies, $1,076,114,436; 190 co-operative banks, $154,879,638; three savings and loan associations, $2,399,791; Massachusetts Hospital Life Insurance Co., $30,918,328; one foreign banking corporation, $1,838,749; 60 credit unions, $2,791,165; 77 steamship agents, receiving deposits of $3,187,506; one state bank, $1,132,507.

History.—During the years 1910–25 the most important laws enacted by the Legislature were the following: In 1912 a minimum-wage board was established with the right to determine wages of women and children. The inheritance law was amended so that only the real estate of a deceased non-resident is taxed, personal property taxes going to the state of residence. A law of 1913 provided for the establishment and maintenance of continuation schools and instruction for working children. A number of pure-food laws were enacted; also, a law providing for mothers' pensions. The election law was so amended that on application signed by 1,200 voters in any senatorial district, or by 200 voters in any representative district, asking for the submission to the voters of any question of instruction to Senators or Representatives, the Secretary of the Commonwealth shall determine if such a question is one of public policy, and, if so determined, he shall place such question on the official ballot to be used at the next state election. In 1914 a measure was passed submitting to the people a constitutional amendment giving suffrage to women, suffrage being finally granted June 25 1919. In 1916 the civil and criminal jurisdiction of district or municipal courts was extended so that their process runs throughout the state and makes them courts of superior and general jurisdiction. An income tax was enacted, and a law was passed to prevent misstatements in advertising. An Act forbidding the sale of narcotic drugs, except by prescriptions carefully regulated, was passed in 1917. Massachusetts on April 2 1918 ratified the Eighteenth (Prohibition) Federal Amendment, being the eleventh state to do this. That same year a budget system was adop The Legislature in 1919 made absentee voting possible for th in military or naval service and for others who made pro arrangements. It also passed a law making all Acts approved the executive, unless subject to referendum, take effect 30 d after formal enactment. Emergency laws take effect u passage. The permissible maximum amount of deposits savings banks per person was raised to $4,000. Manufactur corporations were enabled to provide for representation of th employees upon the board of directors if more than half employees so decide by secret ballot. Industrial accident co pensation was increased. The income tax was revised. An reorganising the executive and administrative functions of state Government, approved July 23 1919, established n departments, consolidated the 100 odd departments under heads, and a metropolitan district commission was authoris with general supervision over the metropolitan area. T Legislature of 1920 passed a law providing for a state constab lary. Motion-pictures within the state were censored. Wom were allowed to hold office. Suits were permitted by a against voluntary associations. Important "blue sky" leg lation was enacted. In 1921 a law was passed making a scient study of criminals mandatory on the courts in certain cas Examination is required by the Dept. of Mental Diseases, a the results are admitted as evidence of the mental conditions the accused. The opening on July 29 1914, of a canal acr Cape Cod shortened by 70 m. the distance by water from N York to Boston.

The governors for the past 15 years were: Eugene M. F (Dem.), 1911–4; Davis I. Walsh (Dem.), 1914–6; Samuel McCall (Rep.), 1916–9; Calvin D. Coolidge (Rep)., 1919– Channing H. Cox (Rep.), 1920–4; A. T. Fuller (Rep.), 1924–

(F. A. Cl.)

MASSENET, JULES ÉMILE FRÉDÉRIC (1842–1912), Fren composer (*see* 17.866), died in Paris Aug. 13 1912, having co posed an opera, *Panurge*, just before his death.

MASSEY, WILLIAM FERGUSON (1856–1925), New Zealan statesman, was born at Limavady, Co. Derry, Ireland, March 26 1856. His parents emigrated to New Zealand when was six, and eight years later he joined them at Tamaki. After elementary education, he went on the land, and 20 years lat as president of the Auckland Agricultural and Pastoral Socie began to play a prominent part in public life. He enter Parliament in 1894 as member for Waitemata, and in 19 became leader of the Conservative Opposition to Mr. Seddon a Sir Joseph Ward. At first his following was small, but he gain ground to such an extent in the elections of 1911 that in the f lowing year he was able to defeat the Mackenzie Ministry a form a Cabinet. Thereafter he played a dominating part in t Dominion's affairs. His strong personality, sterling honesty purpose and administrative ability commanded universal r spect, and during the World War, at the head of a strong Coa tion Ministry, which included his lifelong opponent, Sir Jose Ward, Mr. Massey led New Zealand with conspicuous abili and foresight. And, just as he had not hesitated to introdu conscription without reference to the people, so he had t courage, when peace came, to enforce unpopular economi He was a member of the Imperial War Cabinet in 1917–8 and 1919 was the representative of New-Zealand at the Peace Co ference in Paris. Shortly after the Imperial Conference of 19 his health gave way and though he recovered sufficiently carry on his work for a time, he died on May 10 1925.

MASSINGHAM, HENRY WILLIAM (1860–1924), Briti journalist, was born at Old Catton, Norfolk. Educated Norwich Grammar School under Dr. Augustus Jessopp, he b gan to work for *The Eastern Daily Press* at the age of seventee In 1883 he came to London and for some time was on the st of the National Press Agency. Five years later he became assis ant editor of *The Star*, which he edited from July 1890 to Ja 1891. In 1892 he joined the staff of *The Daily Chronicle* literary editor, and was editor in chief from 1895 to 1899, wh he resigned owing to his inability to support the war again

Boers. He had made his mark as an influential champion he Radical wing of the Liberal party and as the pioneer of rary criticism in the daily Press. After a brief connection *The Manchester Guardian* and *The Speaker*, and a mission South Africa in 1905 for *The Daily News*, he, in 1907, began ng association with *The Nation*, which he edited till the end 923. He was a severe critic of the World War and the Peace aty of 1919 and advocated co-operation between the Liberal- Labour parties. An early member of the Fabian Society, ssingham ultimately joined the Labour party, though on cal, rather than economic, grounds, and his last journalistic k was done for *The New Statesman*. He died at Tintagel, nwall, on Aug. 28 1924. One of the best all-round journalists is day, he was a trenchant writer on politics and a discerning c of literature and the drama. He published in 1892 *The don Daily Press*, and contributed an introduction to the norial edition of the works of Mark Rutherford 1923. *W. M. A Selection from the Writings of H. W. Massingham*, ed by H. J. Massingham (1925), contains highly appreciative mates by G. Bernard Shaw and various eminent associates.

ASSON, LOUIS CLAUDE FRÉDÉRIC (1847–1923), French orian (*see* 17.870), died in Paris Feb. 19 1923.

ASS PRODUCTION.—The term mass production is used escribe the modern method by which great quantities of a le standardised commodity are manufactured. As com- ly employed it is made to refer to the quantity produced, its primary reference is to method. In several particulars term is unsatisfactory. Mass production is not merely quan- production, for this may be had with none of the requisites ass production. Nor is it merely machine production, which may exist without any resemblance to mass production. s production is the focussing upon a manufacturing project e principles of power, accuracy, economy, system, continuity speed. The interpretation of these principles, through ies of operation and machine development and their co-ordina- is the conspicuous task of management. And the normal lt is a productive organisation that delivers in quantities a l commodity of standard material, workmanship and design inimum cost. The necessary, precedent condition of mass uction is a capacity, latent or developed, of *mass consumption*, ability to absorb large production. The two go together, in the latter may be traced the reasons for the former.

I. THE ORIGINS OF MASS PRODUCTION

origin mass production is American and recent; its earliest ble appearance falls within the first decade of the 20th ury. The mere massing of men and materials is a procedure d as the pyramids. Basic industries, like weaving, domestic ng, house construction and wooden ship building, are carried with only superficial changes, much as they were in ancient pt. Cottage manufactures and handicrafts moulded the prac- of industry until the invention of the steam-engine. With coming of power machines the seat of industry was removed the homes of the people and a new work centre, the fac- , was established. Much harsh criticism has been uttered nst "the factory system," but it is perhaps fair to say its first effect was to emancipate the home from being a adjunct to the loom or bench, and its later effect was to ide the home with means to develop the dignified status h it has now attained.

e Factory System Giving Way.—The early factory system uneconomical in all its aspects. Its beginning brought great- sk and loss of capital than had been known before, lower s and more precarious outlook for the workers, and a de- e in quality with no compensating increase in the general ly of goods. More hours, more workers, more machines did mprove conditions; every increase did but enlarge the scale llacies built into business. Mere massing of men and tools not enough; the profit motive, which dominated enterprise, not enough. There remained the scientific motive which eventually into what is called mass production.

e new method came after the failure of the mercantile and financial emphasis in manufacture. The advent and progress of financial control of industry were marked by two developments, the corporation and the labour revolt. Artificial combination of industrial plants into vast corporations for financial purposes was the first movement toward *mass* in industry. It proceeded on the theory that complete financial control would automatically bring complete profit advantage. The theory ignored many vital principles of business and its fallacy became apparent, but not before serious social hostility had been incurred.

However, it was out of the social strife thus engendered that the idea began to emerge that possibly the difficulty lay in the neglect of scientific manufacturing principles. Industry was conceded to be necessary and useful; the service it rendered was regarded as of sufficient value to afford fair compensation for all engaged in it; it was therefore urged that the attention of management should be more directly focussed on the actual labour processes that were employed. This led to what was known early in the 20th century as the "efficiency movement" with its accompaniments of time-study and similar methods, although its roots were laid in the experiences of sound industrial observers as early as 1878. It cannot be said, however, that the efficiency experts did more than direct attention to the problem, by showing, in selected instances, how the then current methods were wasteful of men's earning power, and how their correction and improvement could lead to greater production, hence higher wages, and therefore a general betterment of labour relations. They emphasised a more intelligent management of methods than was then in use; they did not see that a wholly new method was possible which would simply abolish the problems of which the old method, under the most intelligent management, was inevitably prolific. For example they dealt with methods which enabled labourers whose task was to load 12½ tons of pig-iron a day, to load 47½ long tons a day for an increase in the day's pay from $1.15 to $1.85. They did not see that another and better method might be devised which would make it unnecessary for a working-man to carry 106,400 lb. of pig-iron to earn $1.85. Mass production was not in their view, but only the alleviation of the worst errors of competitive factory practice.

The Motor Industry Leads the Way.—To the motor industry is given the credit of bringing mass production to experimental success, and by general consent the Ford Motor Co. is regarded as having pioneered in the largest development of the method under a single management and for a single purpose. It may, therefore, simplify the history of mass production and the description of its principles if the experience of this company is taken as a basis. It has been already suggested that mass production is possible only through the ability of the public to absorb large quantities of the commodity thus produced. These commodities are necessarily limited to necessities and conveniences. The greatest development of mass production methods has occurred in the production of conveniences. The automobile represents a basic and continuous convenience-transportation.

Mass production begins, then, in the conception of a public need of which the public may not as yet be conscious and proceeds on the principle that use-convenience must be matched by price-convenience. Under this principle the element of service remains uppermost; profit and expansion are trusted to emerge as consequences. As to which precedes the other, consumption or production, experiences will differ. But granted that the vision of the public need is correct, and the commodity adapted to meet it, the impulse to increased production may come in anticipation of demand, or in response to demand, but the resulting consumption is always utilised to obtain such increase of quality, or such decrease of cost, or both, as shall secure still greater use-convenience and price-convenience. As these increase, consumption increases, making possible still greater production advantages, and so on to a fulfilment that is not yet in view.

The commodities that conduce to civilised living are thus far enjoyed by only a small fraction of the world's inhabitants. The experience of the Ford Motor Co. has been that mass production precedes mass consumption and makes it possible, by reducing costs and thus permitting both greater use-convenience and price-convenience. If the production is increased, costs can be reduced. If production is increased 500%, costs may be cut

50%, and this decrease in cost, with its accompanying decrease in selling price, will probably multiply by 10 the number of people who can conveniently buy the product. This is a conservative illustration of production serving as the cause of demand instead of the effect.

II. THE PRINCIPLES OF MASS PRODUCTION

As to shop detail, the keyword to mass production is simplicity. Three plain principles underlie it: (*a*) the planned orderly progression of the commodity through the shop; (*b*) the delivery of work instead of leaving it to the workman's initiative to find it; (*c*) an analysis of operations into their constituent parts. These are distinct but not separate steps; all are involved in the first one. To plan the progress of material from the initial manufacturing operation until its emergence as a finished product involves shop planning on a large scale and the manufacture and delivery of material, tools and parts at various points along the line. To do this successfully with a progressing piece of work means a careful breaking up of the work into its "operations" in sequence. All three fundamentals are involved in the original act of planning a moving line of production.

This system is practised, not only on the final assembly line, but throughout the various arts and trades involved in the completed product. The automobile assembly line offers an impressive spectacle of hundreds of parts being quickly put together into a going vehicle, but flowing into that are other assembly lines on which each of the hundreds of parts have been fashioned. It may be far down the final assembly line that the springs, for example, appear, and they may seem to be a negligible part of the whole operation. Formerly one artisan would cut, harden, bend and build a spring. To-day the making of one leaf of a spring is an operation of apparent complexity, yet is really the ultimate reduction to simplicity of operation.

A Typical Operation Described.—For its illustrative value let us trace the course of a spring leaf after it has progressed from iron ore through ingot, bloom and billet stages, and is rolled into strips. (1) Beginning as a strip of steel prepared by the steelmill, it is placed in a punch press for cutting and piercing. The workman puts the strip into press until it hits a stop, then trips the press. The cut-off and pierced piece falls on a belt conveyor which runs along the loading end of a series of heat-treating ovens. (2) A second workman takes the pieces from belt conveyor and places them on conveyor which passes through the furnace (in which temperature is automatically controlled); thence they are deposited at a certain temperature by this conveyor at the unloading end of the furnace. (3) The heated piece is lifted with tongs by a third operator and placed in a bending machine which gives the leaf its proper curve and plunges it in oil, the temperature of which is maintained at a definite degree by apparatus beyond the operator's control. (4) As the bending machine emerges from the oil bath, the same operator takes out the leaf and sets it aside to air-cool. (5) The leaf is then drawn by a fourth operator through molten nitrate kept at a regulated temperature. (6) A fifth workman inspects it.

As a set of springs on the Ford automobile requires on an average 17 leaves, and 25,000 springs are an average day's output, this operation must be visualised as employing a great battery of lines similar to the one briefly described. As all the leaves in a spring are of different length and curve, from the bottom or master leaf to the top leaf, this operation must be visualised as one of many carried on simultaneously by different batteries of machines, each battery working on its own special size. All of these lines, with their various machines and operations, are converging on the point where the leaves are assembled into springs. The leaf whose progress we are describing is the simplest one.

We now continue the operation. (7) A sixth workman removes the leaf from the conveyor which carries it from the molten nitrate, and inserts a bolt through this and the other leaves required in the spring. (8) A seventh workman puts the nut on the bolt and tightens it. (9) An eighth workman puts on the right and left hand clips and grinds off the burrs. (10) A ninth workman inspects it. (11) He hangs the spring on a conveyor. (12) The spring passes the tenth workman, who sprays it with paint, and the conveyor carries the spring above the ovens where it was originally heated, and the radiated heat "force dries" the paint. (13) The conveyor continues to the loading dock, where the eleventh workman removes it.

One workman under the old system could attend the leaf through all these phases, or even make a complete spring, but his production would be limited. Where large quantities of the same article are to be made, the simplest operation may involve the whole time of one man: A one-minute operation will require one man a full day of eight hours to accomplish it on 480 pieces. Now this simple part, a spring leaf, must be identical in strength, finish and curve w millions of others designed to fulfil the same purpose, and t becomes a complicated and delicate procedure requiring automa machinery, the most accurate of measuring devices, pyrometer c trols, "go" and "no go" gauges—in fact, the best facilities that be provided by modern management. The leaf described, which a minor matter when compared with the whole great process, comes a major matter when considered by itself; it must have own supply of material delivered in sufficient quantities at indica places—for example, steel at 1; heat at 2; power and oil at 3; mol nitrate at 5; bolts at 7; nuts at 8; clips at 9; paint at 12. In t process the secrets of many arts and trades are employed.

The story of this minor part illustrates what is meant by orde progression of the article through the shop. It goes to meet ot parts of the motor-car which have come from other parts of plant by similar processes. The story illustrates also what is mea by delivering the work to the workman: every workman's task prepared for him by some other workman, and delivered to his ha The third principle also is illustrated—the analysis of a single into its constituent operations. The simplicity of the part h described should not be permitted to exclude from view the mu tude of other operations, ranging from the heaviest forgings to lightest manipulations in bench assembly of delicate electrical struments. Some gauge inspections involve measurements to ten-millionth part of an inch.

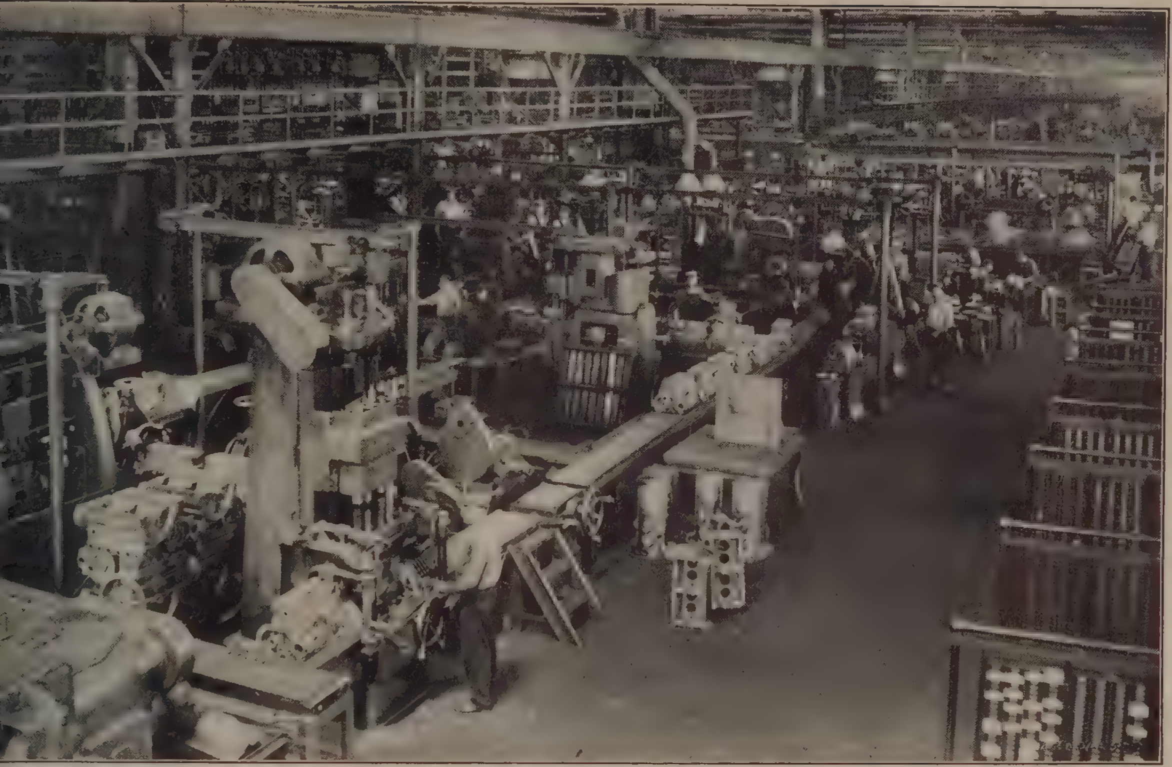
The economies arising from this method are obvious. The n chinery is constantly in use. It would be economically impossible maintain all this equipment for the service of men occupied in entire operation of making springs. Presses, furnaces, bending n chines, oil baths would be idle while the workman progressed fr operation to operation. Under mass production it is the work th progresses from operation to operation. Use-convenience in commodity would be lessened, while price-convenience would destroyed. Economy in machine hours is, however, only one e ment; there is also economy in time and material and labour. Ma production justifies itself only by an economy whose benefits m be transmitted to the purchaser.

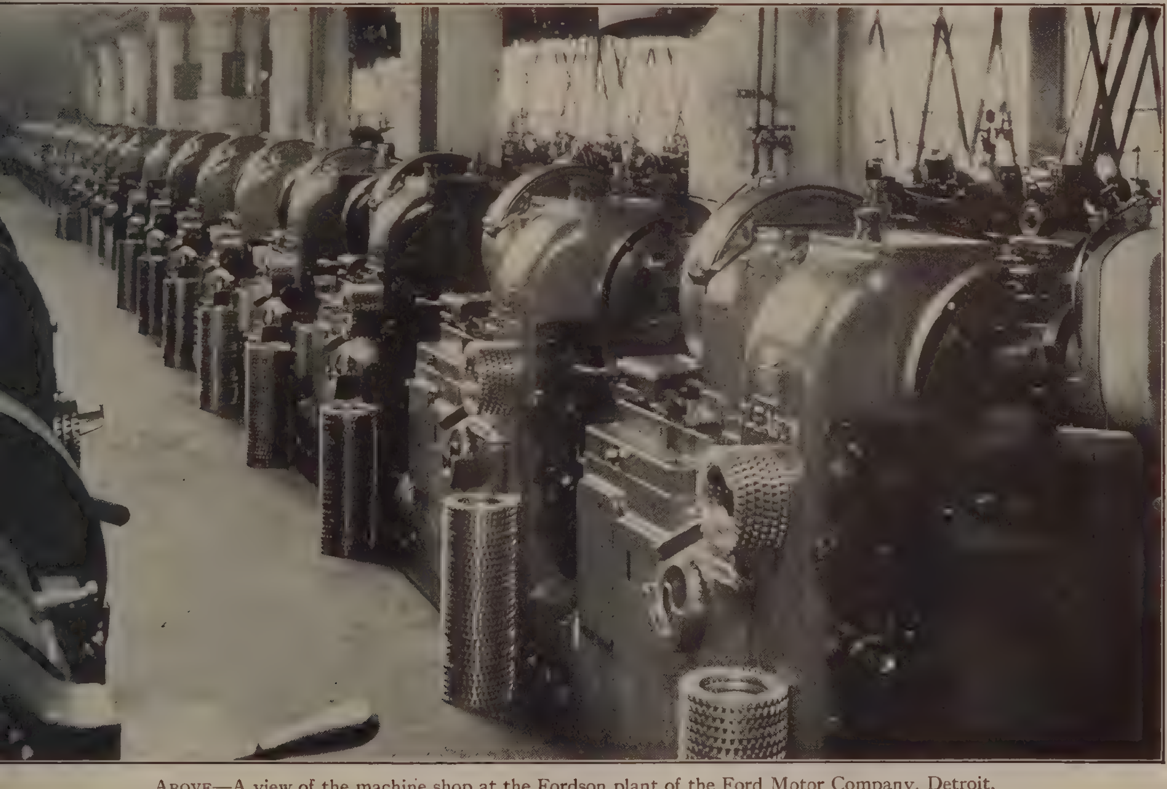
III. THE EFFECTS OF MASS PRODUCTION

But it is not the history and principle of mass production whi provoke the widest discussions; the *effects* of it have been plac under scrutiny. What have been the effects of mass producti on society?

(1) Beginning with management, where unquestionably ma production methods take their rise, there is a notable increase industrial control, as distinguished from financial control. T engineer's point of view has gained the ascendancy and this tre will undoubtedly continue until finance becomes the handma instead of the mistress of productive industry. Industrial co trol has been marked by a continuous refinement of standard sation, which means the instant adoption of the better meth to the exclusion of the old, in the interests of production. Fina cial control was not, in its heyday, marked by a tendency make costly changes in the interests of the product. The eco omy of scrapping the old equipment immediately upon t invention of the better equipment was not so well understood. was engineering control, entrenched in mass production metho that brought in this new readiness to advance. In this way ma agement has been kept close to the shop and has reduced the offi to a clearing house for the shop. Managers and men have be brought into closer contact and understanding. Manufacturi has been reduced to greater singleness of purpose.

(2) The effect of mass production on the product has been to gi it the highest standard of quality ever attained in output of gre quantities. Conditions of mass production require material the best quality to pass successfully through the operatio The utmost accuracy must control all these operations. Eve part must be produced to fit at once into the design for which it made. In mass production there are no fitters. The presence fitters indicates that the parts have been produced unfit for i mediate placement in the design. In works of art and luxu this accuracy is achieved at the cost of careful handiwork. introduce hand methods of obtaining accuracy into mass pr duction would render mass production impossible with any refe ence to price-convenience. The standard quality of the produ is guaranteed by the fact that machines are so constructed th a piece of work cannot go through them unless it exactly accor with specifications. If the work goes through the tools, it mu be right. It will thus be seen that the burden of creation is

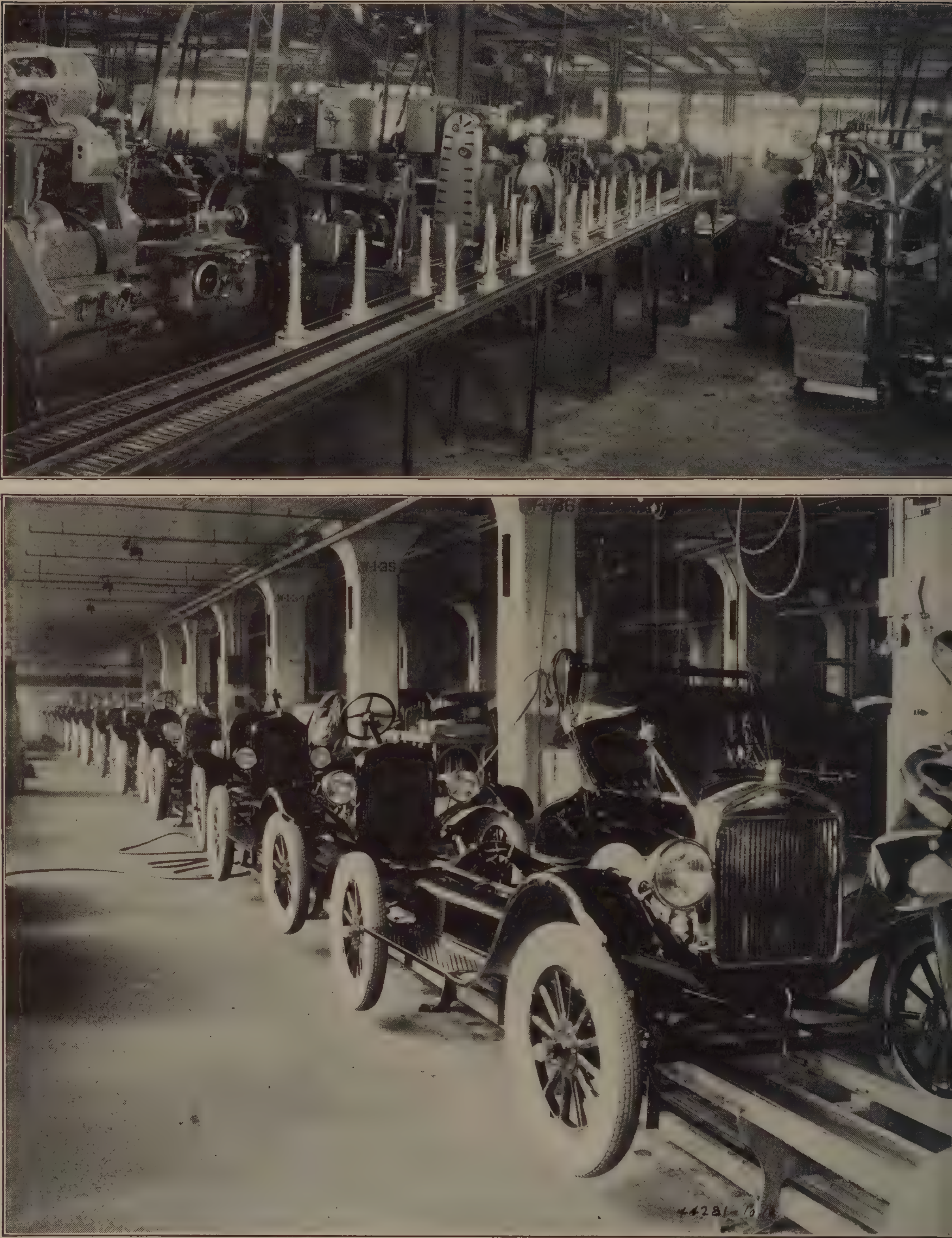




ABOVE—A view of the machine shop at the Fordson plant of the Ford Motor Company, Detroit.
BELOW—A view of the ring gear department at the Highland Park plant of the Ford Motor Company, Detroit.

Plate II.

MASS PRODUCTION



Above—One type of conveyor lines in the Highland Park plant of the Ford Motor Company, Detroit.
Below—Final assembly line in the Highland Park plant of the Ford Motor Company, Detroit.
Bodies and chassis having been completed separately, the body is dropped on the chassis as it advances. The chassis in the foreground is just about to receive the body which is seen, slung by chains from the overhead yoke, at the right.

ınagement in designing and selecting the material which is to be
oduced by the multiple processes utilised in mass production.
(3) The effect of mass production on mechanical science has
en to create a wide variety of single-purpose machines which
t only group similar operations and perform them in quan-
y, but also reproduce skill of hand to a marvellous degree.
is not so much the discovery of new principles as the new com-
ıation and application of old ones that mark this development.
ıder mass production the industry of machine making has
reased out of all comparison with its previous history, and
e constant designing of new machines is a part of the produc-
e work of every great manufacturing institution.

(4) The effect of mass production on employees has been vari-
sly appraised. Whether the modern corporation is the de-
uction or salvation of arts and crafts, whether it narrows or
oadens opportunity, whether it assists or retards the personal
velopment of the worker, must be determined by observable
ts. A cardinal principle of mass production is that hard work,
the old physical sense of laborious burden-bearing, is wasteful.
e physical load is lifted off men and placed on machines. The
urrent mental load is shifted from men in production to men
designing. As to the contention that machines thus become
e masters of men, it may be said the machines have increased
n's mastery of their environment, and that a generation which
ceaselessly scrapping its machines exhibits few indications of
chanical subjection.

The need for skilled artisans and creative genius is greater
der mass production than without it. In entering the shops
the Ford Motor Co., for example, one passes through great de-
rtments of skilled mechanics who are not engaged in produc-
n, but in the construction and maintenance of the machinery
production. Details of from 5,000 to 10,000 highly skilled
isans at strategic points throughout the shops were not com-
nly witnessed in the days preceding mass production. It
been debated whether there is less or more skill as a conse-
ence of mass production. The present writer's opinion is that
re is more. The common work of the world has always been
ne by unskilled labour, but the common work of the world in
dern times is not as common as it was formerly. In almost
ry field of labour more knowledge and responsibility are re-
red than a generation or two ago.

ome Criticisms Answered.—Mass production has also been
died with reference to what has been called the monotony of
etitive work. This monotony does not exist as much in the shops
in the minds of theorists and bookish reformers. There is no
n of work without its hardness; but needless hardship has no
ce in the modern industrial scheme. Mass production lightens
k, but increases its repetitive quality. In this it is the opposite of
mediaeval ideal of craftsmanship where the artisan performed
ry operation, from the preparation of the material to its final
n. It is doubtful, however, if the mass of mediaeval toil was as
oid of monotony as has sometimes been pictured, but it is abso-
ely certain that it was less satisfactory in its results to the
ker. In well-managed modern factories the tendency to mo-
ony is combatted by frequent changes of task.

he criticism of mass production as a means of reducing employ-
nt has long since been out of court. The experience of the Ford
tor Co. is that wherever the number of men has been reduced on
nufacturing operations, more jobs have been created. A con-
ious programme of labour reduction has been paralleled by a con-
ious increase in employment. As to the effect of mass production
wages and the relations between managers and men, there is
e need to speak. It is perhaps the most widely understood fact
ut mass production that it has resulted in higher wages than any
er method of industry. The reason is at hand. The methods of
ss production enable the worker to earn more and thus to have
re. Moreover, the methods of mass production have thrown so
ch responsibility on the craftsmanship of management, that the
method of financial adjustment by reduction of wages has been
ndoned by scientific manufacturers. A business that must
nce by drafts out of the wage envelopes of its employees is not
ntifically based. It is the problem of management so to organise
duction that it will pay the public, the workmen and the concern
lf. Management that fails in any of these is poor management.
turbed labour conditions, poor wages, uncertain profits indicate
ses in management. The craftsmanship of management absorbs
energies of many thousands of men who, without mass produc-
methods, would have no creative opportunity. Here the mod-
method broadens instead of narrows individual opportunity.

(5) As to the effects of mass production on society, the increasing supply of human needs and the development of new standards of living are the elements to be estimated. The enlargement of leisure, the increase of human contacts, the extension of individual range, are all the result of mass production in various fields. (H. F.)

MASTERS, EDGAR LEE (1868–), American writer, was born at Garnett, Kan., Aug. 23 1868. At the age of 21 he entered Knox College, Galesburg, Ill., but left after one year to read law. He was admitted to the bar in 1891 and practised thereafter in Chicago, being for some years associated with Clarence S. Darrow. The book that first brought him public notice was *Spoon River Anthology* (1915), an extraordinary collection of epitaphs on members, in all walks of life, of a midwestern town. Within three years 50,000 copies were sold.

His other works include: *The New Star Chamber, and Other Essays* (1904); *Blood of the Prophets* (1905); *The Great Valley* (1916); *Toward the Gulf* (1918); *Starved Rock* (1919); *Domesday Book* (1920); *The Open Sea* (1921); besides several plays, *Maximilian* (1902); *Althea* (1907); *The Trifler* (1908); *The Locket* (1910); and *The Bread of Idleness* (1911).

MASURIAN LAKES, BATTLES OF THE.—The terrain of East Prussia is described in some detail under the heading TANNENBERG. It was the lake barrier which had proved the undoing of the Russians in their advance into East Prussia, and twice again was it to bring about their defeat when the Germans in their turn assumed the offensive. Jilinsky had failed to combine the action of his two armies, urging one forward to intercept what he thought to be a beaten enemy and dispatching the other on a subsidiary objective. The disaster to the II. Army had come to him as a crushing surprise, and in his fear that Rennenkampf would share the fate of Samsonov, he ordered the I. Army to halt and act on the defensive until fresh troops could be brought up from the centre of Russia. All chance of catching the Germans at a disadvantage during their temporary disorganisation after the fighting at Tannenberg was thus lost.

I. THE SUMMER BATTLE

Ludendorff was not long in deciding what was to be done after the destruction of Samsonov. Even before the fighting at Tannenberg was over, on Aug. 29 1914, he had commenced moving troops northwards to meet Rennenkampf. He was strongly urged to move southwards to the support of the sorely tried Austrians, but this would have meant leaving a strong and undefeated enemy directly in his rear, whilst attempting to traverse the self-same desert area which had tried Samsonov so greatly. From the German point of view it was more important to free East Prussia from the invader at once, and the Austrians must therefore wait their turn.

Position before the Action.—All the German divisions had received their first reinforcements and were flushed with victory and full confidence in their leaders. Two fresh corps had arrived from the west. Rennenkampf did not appear to be on the move and was evidently commencing the blockade of Königsberg. Lötzen, the little fortress holding the main gap in the centre of the line of lakes, was still in German hands. Everything therefore seemed favourable for a German offensive.

Ludendorff's plan for his advance was in outline as follows: (1) Von der Goltz with 2½ divisions was to check any advance on the part of the Russian II. Army from Poland; (2) Von François with three divisions and a cavalry brigade was to move round the southern end of the lakes at Johannisburg with the primary object of turning Rennenkampf's left, and at the same time dealing with any Russian forces assembling to the south of the lakes; (3) Von Mackensen with two divisions and two cavalry divisions was to cross the Lötzen gap and join with Von François in the attack against Rennenkampf's left; (4) the main body of eight divisions was to move direct on the Insterburg gap; (5) the Königsberg garrison was to make a demonstration against the blockading troops.

Rennenkampf had commenced withdrawing on Aug. 30, and on Sept. 2 he issued orders for a position to be taken up for defensive action from the sea near Libau to Angerburg at the northern end of the lakes. This position offered many advantages from a defensive point of view, running as it did behind the rivers Deime, Alle and Omet, but it was too extensive for the force of 12 divisions which Rennenkampf had at his disposal, the distance from flank to flank being 60 miles. Moreover, the left flank was exposed to attacks coming from the Lötzen gap and the southern end of the lakes. But it was chiefly in the manner in which he proceeded to occupy this position that he erred. He had no idea where the Germans were or what they had been doing in the interval since Tannenberg. He only had persistent rumours that the Germans were sending billeting parties to Königsberg. Instead of maintaining strong forces in front of his chosen position, in order to discover the enemy's intentions, Rennenkampf committed his troops at once to a linear defence of the line. He placed four of his divisions along the Deime on a front of 18 m., while keeping seven divisions to hold the remainder of his line of 42 miles. A single division was placed opposite the Lötzen gap to the east of the lakes.

It will thus be seen that from the very start of their manoeuvre the Germans had succeeded in out-generalling Rennenkampf. On the left of their line they were containing four Russian divisions with garrison troops, equivalent to about a division. In the centre they were opposing eight divisions to seven Russian divisions. On the right they were advancing with no less than five divisions and two cavalry divisions against a single Russian division.

German Attack.—Von der Goltz attacked and took Mława on Sept. 4, and thereafter kept in check any of the units of the Russian II. Army which attempted to advance. By the night of Sept. 5 Von François was approaching the southern end of the lakes. By the 6th he had taken Johannisburg and Nikolaiken, driving back the few Russian troops opposing him. By the 7th he was through the lakes and had captured Bialla and Arys. The Russian troops opposing him had been hurried up without proper artillery support and were dispersed in disorder. Eleven Russian battalions were thus dissipated without result. On the 8th Von François turned northwards against the Russian flank. Sept. 9 was to be a fateful day for the Germans. Von Mackensen had commenced his crossing at Lötzen during the 8th, but he could not enlarge the bridge-head. His troops attacked at 5 A.M., 12 noon and 8 P.M. on this day without success and that evening he reported no progress to Von François.

Von François' attack against Soltmahnen on the morning of the 9th came as a complete surprise to the left flank of the Russians opposing Von Mackensen. By noon the Russians were in hopeless rout, leaving 5,000 prisoners and 60 guns in the hands of Von François. The German enveloping movement had met with complete success. Rennenkampf's left flank division had been destroyed and about 8,000 men of the Russian X. Army concentrating about Augustówo and Osowiec had been placed out of action. The left flank of Rennenkampf's army now lay open to the attack of five German divisions. A second Tannenberg seemed more than probable.

Ludendorff had employed the 5th, 6th and 7th in bringing his eight divisions in line facing the Insterburg gap and, on the 8th, contact was gained with Rennenkampf's outposts. On the 9th, coinciding with Von François' attack, the Germans moved forward along the whole front. Little progress was made anywhere, and on the right the Russians made a determined counter-attack which completely held up the German advance. This check seems to have paralysed Ludendorff temporarily, for he ordered his right under Von François and Von Mackensen to hold fast and even to close in to the centre for fear of disaster. But Rennenkampf had taken fright at the menace to his left and had decided to withdraw. That night he ordered a general retreat. He had been just too quick for the Germans. When Ludendorff allowed his right to move forward again, nothing further than cutting off the streams of disorganised transport and breaking up the Russian rear-guards was possible. Rennenkampf had pushed his retreat with desperation. Two of his corps had covered 58 m. in 60 hours. By the 13th he was safe from annihilation, and by the 14th his exhausted troops had crossed the East Prussian frontier between the forest of Rominten and the river Niemen.

Results of the Battle.—Although the Russian I. Army had not been surrounded, it had suffered almost as much as the II. Army. Casualties since Sept. 6. had amounted to 125,000 men and 150 guns. Two corps had been destroyed and the whole army was out of action as a mobile force through lack of transport. The chief credit for this success must lie with Von François. In his march round the southern end of the lakes his men had covered 77 m. in the four critical days Sept. 6–9, and there had been severe fighting on two of those days. Had Ludendorff been quicker to realise that Rennenkampf's counter-attack on the 9th was made in order to disengage himself, and had his orders to Von François for the 10th and 11th not been so cautious, there can be no doubt that Rennenkampf's army would have been all but destroyed.

II. THE WINTER BATTLE

During their 28 days' invasion of East Prussia the Russ had lost some 310,000 men from the flower of their army and guns. Their offensive had been completely defeated and t had been thrown on the defensive. It was not till late in winter of 1914–5 that they began to show signs of activity more. From the German point of view it was importan prevent another Russian invasion of East Prussia and it therefore decided to upset by a strong offensive any Rus plans that were in existence.

German Dispositions.—In Jan. 1915 the German VIII. Ar under Von Below, was holding a line from the frontier south of Spirding, along the line of lakes to Angerburg, and thence a the Insterburg gap between Insterburg and Gumbinnen to the Memel. Some 100,000 Germans, for the most part of the Landw and Landsturm, were facing 200,000 men of the Russian X. A under Siewers. To the south there were indications of a Russian Army being assembled between Modlin (Nowo Georgiewisk) Thorn (Toruń). Four fresh corps had been allotted for the offens making a total of some 250,000 men. In outline the German was as follows: (1) The X. Army (eight divisions and one cava division, under Von Eichhorn, was to envelop the Russian ri moving southwards from the Insterburg gap. (2) The right of the VIII. Army (three divisions), under Von Litzmann, was to velop the Russian left by moving round the southern end of lakes. (3) The remainder of the VIII. Army (four divisions) wa hold the enemy in the centre.

Orders for the advance were issued on Jan. 28. The attack in south was to commence on Feb. 7, with a view to drawing the att tion of the Russians to this quarter. The main attack was ther come from the north on the 8th. Conditions were very differ from those of the advance in Sept. of the year before. The weat was bitterly cold and the whole country was deep in snow. La numbers of sleighs had been collected and the scale of clothing food greatly increased. The German administration left noth undone which could be thought out beforehand.

German Line Advanced.—Von Litzmann's advance found marshy country in front of Johannisburg almost impassal and the attack of the 7th came to little. Many of the units to force their way through blinding snow storms, and it was till the 8th that the Russian positions on the Pisseck were reach and taken, and by the 9th the end of the lakes was passed. T diversion served its purpose well, for the attack of the Germ X. Army in the north came as a complete surprise to the Russi in their winter quarters, leisurely thinking of an advance in spring. They were given no time in which to readjust their li and reserves had to be thrown in piece-meal to save the situati On the 10th, a determined stand was made by four Russ divisions on either side of Eydtkuhnen, but by evening th resistance had been broken. Everywhere the effect of the Germ heavy artillery was decisive. Despite the difficulty of bring forward the heavy wheeled vehicles, which broke through frozen crust of the ground, the Germans never failed to supp their infantry at the decisive point. By the 12th, Von Belo army had reached a line stretching from the forest of Romint to Ludwinow.

Meanwhile, the German centre had moved forward to keep touch with the southern wing. Russian resistance in the sou seemed to centre round the town of Lyck, and Litzmann reinforced by a fourth division for its capture. From the 1 to the 13th the fighting round Lyck was desperate. Often opposing sides could not distinguish each other in the blizza which swept over them, and owing to the difficulty of ammuniti supply the infantry were unsupported by artillery fire of a sort, and fierce hand to hand fighting ensued. Casualities both sides were therefore heavy and the Russians also lost o 8,000 prisoners and 14 guns. By the night of the 13th Russians had been forced from their positions and the to was in German hands.

Position after the Battle.—By the 14th, the German line from Rajgród in the south, through Suwalki, to Sztabinki in north, in a semi-circle round Augustówo, at a distance of fron to 10 m., from the town. The wooded and close nature of country made concerted attacks very difficult, but everywh the superior individual training of the German soldier triumph over the more ignorant Russian. The Russians fought w speration to maintain their positions and it was not till the th that Siewers finally gave the order to abandon Augustówo. e succeeded in escaping envelopment by abandoning most of s transport and ammunition columns and retiring in disorder on rodno. By the 20th the Germans were no longer in touch with e retreating Russians.

In the winter battle the Russians lost 110,000 prisoners and o guns, and the X. Army, like the Russian I. and II. Armies, s placed *hors de combat* for several months as a mobile force. neir defeat was certainly greatly due to the superior leadership the Germans, for they had been caught unawares in winter arters, without proper protection and with an inferior inligence service. Had the Germans been able to bring up the ole of their guns and ammunition on Feb. 14 they might have cceeded in surrounding Augustówo, but this the weather prented them from achieving.

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(W. E. I.)

MATERIALS: *see* RAW MATERIALS.

MATERIALS, STRENGTH OF (*see* 25.1007; also CRYSTALGRAPHY; METALLOGRAPHY; METALLURGY; METALS, FATIGUE TESTING MACHINERY).—The present article only attempts describe some of the more important advances which have n made since 1910, and to indicate the trend of modern work.

athematical Analysis of Complex Stress Systems: Stresses in s.—In the Eleventh Edition it was stated that when a bar ubjected to a simple pull applied axially—that is to say, so t the resultant stress passes through the centre of gravity very cross-section—the stress may be taken, under ordinary ditions, as (sensibly) uniformly distributed over any section near a place where the form of the cross-section changes. design of a tie of specified material to withstand a specified l is thus, as regards the greater part of its length, an easy ter; but it is essential that suitable forms of end attachment levised, equally able to withstand the imposed load.

he most usual method of connection is by pins or rivets, rted through the tie in such a way as to operate in virtue heir resistance to "shear"; and in consequence the problem tress-distribution in the neighbourhood of holes has received h attention. C. E. Inglis[1] has obtained a mathematical tion appropriate to a single elliptical hole, and the special of a circular hole has also been treated by K. Suyehiro.[2] more difficult problem of stress-distribution in an "eye " has been attacked by E. G. Coker[3] with the aid of transnt models of xylonite and the use of polarised light. Fairly plete information is thus available regarding the distribuof stress in tension members, so long as the elastic limit of material is nowhere exceeded; but a problem of greater tical importance is to proportion the eye ends so that their *king load* (after ductility has operated to equalise the stresses) be equal to that of the main portion of the tie. This lem has been attacked experimentally by W. A. Scoble,[4] has interpreted his results in terms of practical rules for gn.

rength of Straight Members in Compression (*Struts*).— tion was made in 25.1022 of Euler's investigation of the psing load of an ideal strut, perfectly straight and uniform, centrally loaded; also of a semi-empirical formula which been proposed, to allow for the fact that a short strut may by simple crushing. Since 1910 considerable progress has made in the theory of this and of allied problems. It was gnised by T. von Kármán[5] and (later, but independently) . V. Southwell[6] that crushing of the material is not the alternative to collapse by buckling under stresses within the elastic limit, because plastic distortion may bring about conditions of instability under stresses which are far below the compressive strength of the material, and which Euler's analysis also would indicate to be perfectly safe. An interesting extension of mathematical theory was made by the authors cited, in a formula which modified Euler's result to allow for the new conditions; and the experimental work of A. Robertson[7] has shown that this formula agrees closely with actual results. The whole subject of strut failure, and advances in theory and experiment, have been reviewed by R. V. Southwell.[8]

Collapse of Tubes by External Pressure.—A similar possibility of collapse exists when a circular tube (such as the flue of a steam boiler) has to withstand fluid pressure imposed upon its *external* surface. Distortion of the circular cross-section into an oval form, whilst it involves an increase in the strain energy due to bending, also involves a decrease in the potential energy of the applied pressures; the circular form will thus be unstable when the pressures are sufficiently high.

This phenomenon was investigated experimentally by W. Fairbairn as early as 1858,[9] and has attracted much attention since; an extensive bibliography was compiled by G. Cook for the British Association in 1913.[10] Recent experiments by A. P. Carman,[11] R. T. Stewart,[12] and G. Cook[13] afford satisfactory confirmation of G. H. Bryan's theoretical formula for long tubes[14] and of a more general formula proposed by R. V. Southwell,[15] who investigated the influence of end constraints upon the resistance to collapse.

Other Problems of Elastic Stability.—The general theory of these problems of "elastic stability" has been developed by G. H. Bryan,[16] R. V. Southwell[17] and W. R. Dean.[18] Among other examples of the class may be noticed the collapse of thin tubular struts, in which instability makes its appearance by wrinkling of the tube wall, and of flat plating under forces which involve compression in its own plane. The strength of tubular struts acquires great practical importance in aircraft construction, and has received much attention both in theory and experiment; bibliographies relating to these two aspects may be found in papers by R. V. Southwell[19] and A. Robertson.[20] The stability of flat plating has importance for the design of deep plate girders, and has been studied from this aspect, theoretically by G. H. Bryan[21] and S. P. Timoshenko,[22] and experimentally by W. E. Lilly[23] and others; two special cases—the stability of a long flat strip under uniform shearing actions in its plane (theoretically treated by R. V. Southwell and S. W. Skan[24]) and of a circular disk under forces which tend to twist it in its plane (theoretically treated by W. R. Dean[25]) have recently been made the basis of a suitable "acceptance test" for the thin sheet steel used in the construction of metal aircraft.[26]

"*Whirling*" *and Vibration of Shafting.*—Elastic instability is also likely to occur in a long rotating shaft, because any curva-

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[14] *Proc. Camb. Phil. Soc.*, vol. vi, p. 287 (1888).

[15] *Phil. Trans. Roy, Soc.* (A), vol. 213, pp. 187–244 (1913), and *Phil. Mag.*, May 1913. *Cf.* also R. von Mises, *Zeits. d. Ver. deutscher Ing.* (1914).

[16] *Proc. Camb. Phil. Soc.*, vol. vi, p. 199 (1888).

[17] *Phil. Trans. Roy. Soc.* (A), vol. 213, pp. 187–244 (1913).

[18] *Proc. Roy. Soc.* (A), vol. 107, pp. 734–760 (1925).

[19] *Phil. Trans. Roy. Soc.* (A), vol. 213, pp. 187–244 (1913).

[20] *Loc. cit.*

[21] *Lond. Math. Soc. Proc.*, vol. 22, pp. 54–67 (1891) and vol. 25, pp. 141–150 (1894).

[22] *Der Eisenbau*, vol. 12, pp. 147–163 (1921). *Cf.* also S. P. Timoshenko and J. M. Lessells, *Applied Elasticity*, chap. 10 (1925).

[23] *Jour. Jun. Inst. Eng.*, vol. xviii, pp. 72–81 (1907); *Engineering*, Feb. 1 1907.

[24] *Proc. Roy. Soc.* (A), vol. 105, pp. 582–607 (1924).

[25] *Proc. Roy. Soc.* (A), vol. 106, pp. 268–284 (1924).

[26] Nat. Phys. Lab., *Annual Report* (1924).

ture of the axis will be intensified by centrifugal force, which may be sufficient to overcome the restoring effect of the flexural stresses. When this happens, the shaft is said to "whirl." The calculation of "whirling speeds" is evidently a matter of great practical importance (since it would be unsafe to allow a shaft to run at these speeds for any length of time), and various methods have been propounded.[27] Torsion or end thrust, acting upon the shaft, will combine with rotation to promote instability; a theoretical discussion of the problem, taking all three actions into account, has been given by R. V. Southwell and B. S. Gough.[28]

It can be shown that the whirling speeds of a shaft are identical with the frequencies of its free transverse vibrations in the absence of rotation; as the speed increases, these "natural frequencies" decrease, becoming zero at the whirling speeds. The difficult question of stability in the immediate neighbourhood of the whirling speeds has been examined by F. B. Pidduck.[29]

Other Problems of Vibration.—The influence of rotation upon the natural frequencies of free vibration has been examined in two other cases of practical importance: (1) the vibrations of a rotating rod (such as an airscrew blade) have been studied theoretically by R. V. Southwell and B. S. Gough,[30] and experimentally by A. Fage[31]; (2) the vibrations of a spinning disk (representative of the rotor of a steam turbine) have been investigated by H. Lamb and R. V. Southwell.[32]

A problem of greater complexity is presented by the vibrations of a railway bridge under the periodic forces imposed upon it by the "hammer-blow" (the effect of the eccentric weights employed to balance the reciprocating masses) of a locomotive as it passes. The period of these forces may synchronise with the natural period of the bridge, and considerable deflection is then produced; but account has to be taken of the fact that only a few blows are delivered during the transit, so that the problem is not one of "resonance" in the ordinary sense. A formal solution of the idealised problem (in which the bridge is taken to be a uniform girder, and a single travelling load is assumed) has been given by S. P. Timoshenko,[33] and an elaborate investigation of cases representative of practical conditions by C. E. Inglis.[34]

Approximate Methods of Stress Calculation.—A general tendency of the period now under review has been towards the development of approximate methods of solution for problems which cannot be treated by exact theory. The original impetus came from Lord Rayleigh, in relation to the calculation of natural frequencies of vibration;[35] but his methods have since been extended to a wide range of problems.[36]

"Experimental" methods of solution have also been developed, based on analogies obtaining between the equations of elasticity and those of other branches of physics. Thus the deflection of a membrane of uniform tension is governed by equations identical with those which define the distortion of cross-sections in a twisted prism; and this fact[37] has been utilised by G. I. Taylor and A. A. Griffith,[38] who have shown how to solve, by measurements made on a flat soap-bubble, Saint Venant's problem of torsion[39] for shapes of cross-section which are mathematically intractable.

Photo-elastic Methods.—Important advances in the solution
two-dimensional systems of stress have been made by the use
"photo-elastic" methods. Various transparent materials un
the action of stress possess double refracting properties—th
is, they split up plane polarised light into two rays. The int
ference obtained by the recombination of such rays produ
colour bands which may be viewed on a screen or photographe
the colour varies according to the difference of the princi
stresses, and the stress-difference at any place in the mater
may be estimated by matching it with the colour produced
a tension piece strained by a known and uniform stress. T
sum of the principal stresses may be deduced from measu
ments of the lateral contraction of the specimen. By th
methods, E. G. Coker, L. N. G. Filon, W. A. Scoble and A.
Low have determined the distribution of stress in many ca
intractable mathematically, which possess great practical imp
tance.[40] The "stress-optical" properties of xylonite have be
studied from this aspect by Coker and K. C. Chakko,[41] and t
underlying principles of the method have been critically
amined by Filon.[42]

Extension of Theory to Problems of Plastic Distortion.—So
general interest attaches to the formula, mentioned abo
which extended Euler's analysis for elastic struts to cases
which elastic break-down precedes collapse, since this appe
to be the earliest application of mathematical theory to mater
in the plastic state. The study of plastic distortion (*i.e.*,
tortion which does not disappear when the load is remove
and its representation by mathematical equations, have attrac
much attention among continental workers; reference may
made to the proceedings of a special conference on this subje
held at Prague in 1924.

Limitations of Mathematical Theory, as applied to the Ela
Failure and Fatigue of Metals.—Such methods of representat
have this feature in common with the older theory of elastici
that they presuppose the quality of *continuity* in the id
material with which they deal. Employment of differen
equations and the methods of the calculus are not strictly leg
mate unless the properties of the material can be assumed
be unaffected by subdivision carried to any extent. Now
ordinary materials of construction are known, from microscop
examination, to be crystalline aggregates of great complex
if subdivision were carried far enough, we should be left w
fragments consisting of single crystals, and therefore hav
properties certainly aeolotropic, and probably non-elastic. T
the classical theory of elasticity, as applied to actual materi
must be regarded merely as a method of statistical treatme
valid only to the extent that actual materials may be taken
be "statistically isotropic,"[43] and it would seem that the m
recent extensions to the plastic state must have the sa
restricted interpretation. The foregoing considerations serve
explain why theory has given good results when applied to pr
lems of elastic stability or of vibrations (where the result depe
upon the general distortion of the whole body), but has
been so successful in its application to questions of elastic fail
or fatigue. Suggested criteria of yielding under compound st
(such as those of Rankine, Saint Venant, Guest and Haig
which involve the principal stresses as calculated by the ordin
mathematical theory cannot be expected to provide an ultim
explanation of occurrences which must depend largely upon
actual microstructure of the material at the point considere

Modern Tendencies in the Study of Elastic Failure and
Fatigue.—The outlook of earlier investigators, which tacitly
supposed a degree of continuity, in actual materials, compar

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[27] *Cf* S. P. Timoshenko and J. M. Lessells, *op. cit.*, chap. xi; R. V. Southwell, *Phil. Mag.*, vol. xli, p. 419 (1921); S. Dunkerley, *Phil. Trans. Roy. Soc.* (A), vol. 185, p. 279 (1894).

[28] Report of the Complex Stress Committee, *Brit. Assn. Report*, 1921.

[29] *Proc. Lond. Math. Soc.*, vol. xviii, p. 393 (1920).

[30] Aeronautical Research Committee, *R. and M.*, No. 766.

[31] *Proc. Roy. Soc.* (A), vol. 107, pp. 457–469 (1925).

[32] *Ibid.*, vol. 99, pp. 272–280 (1921), and vol. 101, pp 133–153 (1922).

[33] *Phil. Mag.*, vol. xlii., p. 1018 (1922).

[34] *Proc. Inst. C.E.*, vol. ccxvii., p. 225 (1924).

[35] *Theory of Sound*, vol. 1 (1877).

[36] *Cf.* J. Prescott, *Applied Elasticity* (1924); and S. P. Timoshenko and J. M. Lessells, *op. cit.*

[37] The analogy was pointed out by L. Prandtl, *Phys. Zeitschr.*, Bd. 4 (1903). *Cf.* A. E. H. Love, *Mathematical Theory of Elasticity*, § 224.

[38] *Engineering*, vol. 104, pp. 655–699 (1917).

[39] *Cf.* A. E. H. Love, *op. cit.*, chap. 14.

[40] *Cf.* bibliographies by A. Morley, *Strength of Materials*, chap.
and by E. G. Coker, Reports of the Complex Stress Commit
Brit. Assn. Reports, 1921 and 1924.

[41] *Phil. Trans. Roy. Soc.* (A), vol. 221, pp. 139–162 (1920). *Re*
1921.

[42] Report of the Complex Stress Committee, *Brit. Assn. Repo*

[43] *Cf.* a paper by R. V. Southwell and H. J. Gough, *Phil. M*
Jan. 1926.

[44] *Cf.* 25·1007 to 23 and B. P. Haigh, Reports of the Com
Stress Committee, *Brit. Assn. Reports*, 1919 and 1921.

ith that of the ideal material of elastic theory, has been modified y increasing knowledge of the inner structure of metals, as evealed by microscopical study at the hands of Sorby, Ewing, osenhain, Humphrey, Beilby, Osmond and Arnold. In all the rdinary tests of material for engineering purposes, in the assical "stress-strain diagrams" of Eaton Hodgkinson and hers, even in the notions of the "yield point" and of "ductility," we see a general tendency to analyse *resultant* effects, oserved in a specimen of considerable size, as though these ere due to *continuous* strains (the word is used in the mathe-atical sense) in a structureless material. Even in the work of auschinger, Muir and others, who investigated the phenomenon "recovery" under prolonged rest or gentle heating, there is othing which demands a mental picture of the inner mechanism which the results are produced; and the extent to which e older ideas suffice for explaining the behaviour of materials om an engineering standpoint is shown by C. F. Jenkin's ccessful derivation of all the ordinary phenomena of low-eed tests from a conceptual "model" characterised merely a resistance to distortion due in part to elastic resistance d in part to "solid friction."[45] But to explain the first occur-nce of elastic failure, and the circumstances which attend the enomena of fatigue and ultimate fracture, it is becoming creasingly evident that attention must be concentrated upon e actual structure of the crystalline aggregate.

Thus, A. A. Griffith[46] has been led, by discrepancies found to st between theory and experiment in regard to stress-concen-tion in the neighbourhood of scratches and flaws, to propound heory of rupture, for brittle materials, which takes account the surface energy generated in the formation of cavities or cks; and he has verified the consequences of his theory by oducing fibres of fused silica exhibiting strength of a quite normal order. Attention is now concentrated upon ductile terials such as soft iron, copper and aluminium, which are gregates of small crystals arranged, in general, with random entation. The methods of X-ray analysis developed by W. H. W. L. Bragg have provided a powerful means of investigat- the structure of the individual crystal,[47] and the discovery, H. C. Carpenter, C. F. Elam[48] and others, of methods whereby gle crystals of aluminium and other metals can be produced izes such that they may be subjected to ordinary engineering s, has led, at the hands of G. I. Taylor and C. F. Elam[49] others to more exact understanding of the way in which h crystals distort under static or alternating loads.

he stress which a single crystal of aluminium can withstand hout suffering permanent distortion is markedly low as com-ed with the strength of the crystalline aggregate, and it thus ears that we must look to the crystal boundaries (where atoms presumably have a more random distribution, owing he conflicting requirements of the adjoining crystal lattices) an explanation of the relatively high resistance which the egate can oppose. This view is supported by the increased ngth which accompanies a reduction in the size of individual tals, under the influence of hardening processes such as heat tment or "cold work." It is, of course, in agreement with concept of the "amorphous phase" propounded by Ewing, enhain and Beilby (*see* 25.1018); but it remains for further stigation, using the more powerful methods which are now lable, to give precision to ideas which have proved so ul in the past, for correlating the manifold phenomena lastic distortion and fatigue. Ultimately, of course, static ning and fatigue must be explained on some common basis METALS, FATIGUE OF).

ngineering Tests.—Rosenhain's theory of "lattice distor-" propounded in his May lecture to the Institute of Metals 923 as an explanation of the hardening effects of alloys, exemplifies the new outlook which has been made possible by the discoveries since 1910; it is to microscopical, chemical and X-ray investigations that engineers are looking for a solution of the ultimate problems of fatigue. But understanding of the properties of materials is only one side of the problem of engineering design, and it is unlikely that the practical rule, that the working stress must be kept within the elastic limit, will lose its validity. The other side of the problem is stress-calculation, and stresses, in the crystalline aggregate, can only be determined in statistical fashion. So the older tests, on specimens large in comparison with the crystal structure, have not ceased to be useful, or reached the limit of their development.

A full account of experimental results will be found in R. G. Batson and J. H. Hyde's *Mechanical Testing* (1922). Considerable attention has been directed to the improvement of experimental technique and of the interpretation of results: thus W. E. Dalby[50] has introduced an improved type of specimen and a calibrated weigh-bar for the measurement of loads; A. Robertson and G. Cook,[51] by means of special apparatus designed to eliminate the effects of inertia in the testing machine, have shown that the observed inflection of "autographic" records at the "yield point" of ductile materials (*see* 25.1014) really masks a *reduction* of stress, which in some metals may be as great as one-third of the stress at which yield commences; T. E. Stanton and R. G. Batson[52] have done much to systematise the results of "impact tests"; B. P. Haigh[53] has developed an electrical machine whereby a sinusoidal wave of simple tension and compression may be impressed upon a specimen, and has conducted interesting investigations into the generation of heat during the progress of fatigue tests; W. S. Farren and G. I. Taylor[54] have made accurate determinations of the heat generated during plastic extension in a static test; C. F. Jenkin[55] has developed apparatus with which fatigue tests can be conducted at speeds up to 5,000 cycles per second.

It is impossible in this article to include any summary of experimental results. The reader is referred to a recently published treatise by H. J. Gough,[56] in which a very clear and exhaustive account may be found, covering all aspects of fatigue as developed up to the latter part of the year 1924. (R. V. S.)

MATERNITY AND INFANT WELFARE.—The period 1910–26 was marked by an increasing consciousness in all civilised countries of the importance of decreasing the heavy losses to the community due to the high death-rate among women at childbirth and among infants under one year of age. There is a considerable body of new legislation intended to supplement and assist welfare agencies and to provide definite state assistance.

I. THE UNITED KINGDOM

The Maternity and Child Welfare Act 1918 gives wide and comprehensive powers to local authorities for taking action designed to preserve maternal and infant life. The passing of this Act consolidated the work commenced in 1906 by the St. Marylebone Health Society. Like nearly every other movement to fight disease, modest experiments by groups of social workers pointed the way to larger state and municipal action.

In 1910 there were 90 infant welfare centres in Great Britain, and by 1914 the number had risen to 400. Owing to the great impetus given to this service during the War, and to the passing of the Maternity and Child Welfare Act in 1918, there were in 1925 no fewer than 1,363 infant welfare centres under the local authorities and 759 voluntary centres, as well as 133 maternity institutions recognised by the Ministry of Health.

Legislation.—The various enactments bearing on the subject are the Factory and Workshops Act of 1901, which endeavours directly to protect the woman who has recently given birth to a child; the Midwives Act of 1902, which laid the foundation of a safe and efficient system of practice by midwives; the Notification

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roc. Roy. Soc. (A), vol. 103, pp. 121–138 (1923).
hil. Trans. Roy. Soc. (A), vol. 221, pp. 163–198 (1920).
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[50] *Phil. Trans. Roy. Soc.* (A), vol. 221, pp. 117–138 (1920).
[51] *Proc. Roy. Soc.* (A), vol. 88, pp. 462–471 (1913).
[52] *Proc. Inst. C. E.*, vol. 211, pp. 67–100 (1921).
[53] *Engineering*, Nov. 22 1912.
[54] *Proc. Roy. Soc.* (A), vol. 107, pp. 422–451 (1925).
[55] *Ibid.*, vol. 109, pp. 119–143 (1925).
[56] *The Fatigue of Metals* (1924).

of Births Act of 1907 and the extension of the Act in 1915, which Miss Margaret Llewelyn Davies described as "nothing less than a welcome by society to each of its newly-born citizens, and a signal of help and a message of hope to every mother in the land." Under this Act the father or doctor or midwife must notify the public health authority within 36 hours of the birth of a child. Advice and help, free of charge, are then given by a woman health visitor. The National Health Insurance Act provides a maternity benefit of 40s. for an insured woman or the wife of an insured man.

The Ministry of Health, formerly the Local Government Board, encouraged local authorities to extend and develop their maternity and child welfare services. In a circular letter to local authorities issued in 1914 the board stated that an estimate had been laid before Parliament for a grant to be distributed to local authorities and voluntary agencies in respect of institutions or other provision for maternity and child welfare, that more extended and systematic measures than had hitherto been generally adopted were necessary. Sir Arthur Newsholme, in a report on maternal mortality in connection with childbearing, published in 1915, stated that "the present report is intended to draw attention to this unnecessary mortality from childbearing, to stimulate further local inquiry on the subject and to encourage measures which will make the occurrence of illness and disability due to childbearing a much rarer event than at present." His successor, Sir George Newman, 10 years later (1924), in his preface to Dr. Janet Campbell's *Maternal Mortality*, referring to the fact that approximately 3,000 mothers had died each year at childbirth for the previous 10 years, stated: "That is a serious and largely an avoidable loss of life at the time of its highest capacity and in its most fruitful effort."

Administration.—The local authorities carrying out maternity and child welfare schemes are the county councils, county borough councils and the councils of certain of the larger county districts—as a general rule those having a population of more than 20,000. These are in the main the authorities which adopted the Notification of Births Act referred to above, under which some work for mothers and babies was already being done before the passing of the Act of 1918. The regulations under which a grant is payable by the Exchequer of 50% of the approved net expenditure of local authorities, set out the services which may and should be comprised in a maternity and child welfare scheme, and from them the scope and content of the services may readily be understood.

1. The salaries and expenses of inspectors of midwives and of health visitors and nurses engaged in maternity and child welfare work;
2. The provision of a midwife for necessitous women and for areas insufficiently supplied with this service;
3. The provision, for necessitous women, of a doctor for illness connected with pregnancy and for aid during the period of confinement;
4. The expenses of a centre, *i.e.*, an institution for providing medical supervision and advice for expectant and nursing mothers and for children under five years of age, and medical treatment at the centre for cases needing it;
5. Arrangements for instruction in the general hygiene of maternity and childhood;
6. Hospital treatment for complicated cases of confinement and for children under five years of age found to need in-patient treatment;
7. The cost of food certified as being necessary to expectant and nursing mothers and for children where the case is necessitous;
8. Expenses of crèches and day nurseries and of other arrangements for attending to the health of children under five years of age whose mothers go out to work;
9. Accommodation in convalescent homes for nursing mothers and for children;
10. The provision of homes and other arrangements for attending to the health of children under five years of age of widowed, deserted and unmarried mothers;
11. Experimental work in relation to maternity and child welfare work;
12. Contribution by a local authority to voluntary institutions.

Exchequer grants on the same scale are also paid to voluntary agencies which carry out certain services to the satisfaction of the Minister of Health.

The annual expenditure on maternity and child welfare servic
provided by local authorities is approximately £1,500,000,
addition to which exchequer grants are made to voluntary age
cies. If to these figures is added the £1,500,000 paid in materni
benefit under the national health insurance scheme, a total of ov
£3,000,000 is spent each year on these services, without takin
account of the total expenditure of the voluntary agencies,
other benefits paid from health insurance funds and of the volu
tary hospital services.

Infant Mortality.—The services given at the centres by bo
lay and professional workers helped to secure the reduction
the infant mortality rate from 154 per 1,000 births in 1900 to
per 1,000 births in 1924. This gratifying result means that (c
culated on the average infant mortality of 1901–10) there was
1924 a further saving of 39,000 infant lives. "It also implies
better physical condition in children from one to five years
age, and a more enlightened understanding of personal and pu
lic hygiene" (Sir George Newman). While this saving of infa
lives is all to the good, it is disturbing to find on an analysis of t
statistics that the reduction in the infant mortality rate has
curred almost entirely subsequent to the first few weeks of
and that the death-rate of infants up to the age of four weeks
remained almost stationary, being 33 per 1,000 births in 1924
against 40 per 1,000 births for the period 1906–10.

Maternal Mortality.—So, too, in the case of maternal mortali
notwithstanding that Sir Arthur Newsholme reported in 1
that "800 mothers die each year in England and Wales as the
sult of childbearing whose lives would be saved if the experie
of the rest of England and Wales were as favourable as Londo
and that there would be a further saving of 1,100 lives of moth
secured annually in England and Wales if puerperal fever were
be eliminated "as it has been substantially from the experie
of many lying-in hospitals." Dr. Janet Campbell, 10 ye
later, writes that "avoidable maternal deaths are a matte
everyday occurrence," and that "puerperal infection leads
more deaths and more injury than any other complication
childbearing."

It has been shown that the mortality rate of very young ba
is nearly as high as it was early in the century. On examining
statistical returns of maternal mortality it is seen that while
death-rate of mothers at childbirth was 3·74 per 1,000 births
the period 1906–10, it was 3·70 per 1,000 births in 1924.

Here then is the problem. Improvements in general sanita
and public health services, a better education in public and
sonal hygiene, the maternity and child welfare services, the
vices provided under the National Health Insurance sche
have had no visible effect upon the vital statistics relatin
childbearing. Comparing the period 1906–10 with the year 19
that is to say, the period prior to the establishment and deve
ment of maternity and child welfare services by the local auth
ties with the latest complete figures available—it is seen
taking the 1906–10 period as 100, the relative mortality rates
1924 are:—

Maternal mortality	98·9
Infants under four weeks	82·5
Infants from four weeks to one year	54·5

It seems perfectly clear that the saving of the lives of the mot
and very young babies is one and the same problem. "The u
pected loss of the mother is a tragedy to the family. It is no
frequently associated with the death of the infant for whom
maternal life has been sacrificed, and is often followed by the
paired health and nutrition of the remaining children"
Janet Campbell).

Disability Among Married Women.—It has been pointed
that the mortality returns "reveal only a part of the total d
age and disability, and that an incalculable amount of unrepo
and often untreated injury and ill-health results from pregna
and labour." Statistics relating to the comparative heavy
dence of sickness amongst married women were presented to
Royal Commission on National Health Insurance which repo
in March 1926. In Appendix A to the report the Governn
actuary states:—

18. Another matter calling for attention, and in this case calling irgently, is the excess of the claims of married women over those of the unmarried.

\t the important groups of ages, 20–25, 25–30 and 30–35, the narried woman's rates of sickness are found to represent the folowing percentages of those of the unmarried class:

Ages	1921	1922	1923
	%	%	%
20–25	242	284	299
25–30	174	198	242
30–35	158	171	198

'he majority report of the Royal Commission recommended the rovision of improved maternity services "as and when funds re available to meet the cost." The minority report, however, eclared that "the high maternal death-rate and the great mount of sickness amongst mothers clearly prove the need of eorganisation and extension of maternity work," and recomnended that medical benefit under the Health Insurance scheme hould include medical attention at confinement and should be xtended to include the wives and dependants of insured men. 'he provision of more adequate services for women at childirth is a matter of urgent necessity. "If a woman can rely upon ecuring the services of a careful up-to-date practitioner, or upon ne attendance of a well-trained midwife who is able to obtain rompt and competent medical assistance in case of need, nearly l other conditions become of minor importance" (Dr. Janet ampbell).

Effect of Environment.—The development of antenatal serv-es appears to afford the most likely solution to the problem. egional distribution of the mortality does not point to industrial ctors as being the chief causes of deaths. At the same time, is not without significance that nine of the 10 county boroughs ving the highest rates of maternal mortality in the four years 19–22 were in Lancashire and Yorkshire, and seven of those ne towns, viz.: Halifax, Rochdale, Huddersfield, Bury, Oldham, ewsbury and Blackburn, in the report of 1914–5 are among the unty boroughs which exact "the heaviest toll of life from others in childbearing." Industrial areas can, however, be und with extremely low rates of mortality; the predominatingly orking class district of West Ham actually had in 1919–22 the west rate of maternal mortality of all the county boroughs. The same county borough had the lowest rate among the metpolitan boroughs in 1914. In the counties of Lancashire and rkshire it is the practice for a considerable proportion of mard women to be employed in the textile mills, and it is difficult resist the conclusion that the nature of their employment, tother with the strain of managing the household and bearing ge families, is in no small degree responsible for the unenviable sition which the towns occupy and have occupied for so many ars. The puerperal death-rate in Wales has always been higher an that in England, and, until recently, than in Scotland. at is probably due, not so much to any special cause peculiar to les, as to the fact that, broadly speaking, the whole country either extremely rural or highly industrial. The services availe in most rural areas leaving much to be desired, and the exdingly hard life associated with the mining industry, must factors contributing to the high maternal mortality rates closed.

An enlightened public opinion would encourage and, where essary, compel the local authorities to provide the services sidered by the experts to be essential. The medical profession the knowledge; administrators, local and national, are capaof creating the administrative machinery; there is no lack of intary helpers; the provision of the necessary finance and the operation of the mothers are the two factors which depend n education.

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II. THE UNITED STATES

The most important development in this field was the passage by Congress in 1921 of the Maternity and Infancy Act, popularly known as the Sheppard-Towner Act. This Act authorised an annual appropriation of $1,240,000 for a five-year period, of which a sum not to exceed $50,000 may be expended by the U.S. Children's Bureau for administrative purposes and for the investigation of maternal and infant mortality, the balance to be divided among the states accepting the Act as follows: $5,000 unmatched to each state, and an additional $5,000 to each state if matched; the balance to be allotted among the several states on the basis of population and granted if matched.

The national administration of the Act is lodged with the Children's Bureau of the U.S. Dept. of Labor; local administration in the states is in the child-hygiene or child-welfare division of the state agency of health or, where such a division does not exist, the agency designated by the state. In 1925, 43 states—all except Connecticut, Illinois, Kansas, Maine and Massachusetts—had accepted the benefits of the Act, and approximately $1,000,000 was being expended by the national Govt. in subsidies to the states. In 1924 the benefits of the Act were made available to the Territory of Hawaii, which has also accepted and matched the funds available.

Results of the Act.—The report for 1925 of the activities undertaken by the states under the terms of this Act shows continued progress as old activities have spread over a greater territory and new activities have been initiated. These have for their object: (1) better infant care through the teaching of mothers; (2) better care for mothers through education as to the need and value of skilled supervision during pregnancy, childbirth and the lying-in period; and (3) more widespread medical and nursing facilities so that adequate maternity and infancy supervision will be available to all who need it. Children's health centres or conferences and pre-natal or maternity centres or conferences are everywhere recognised as the best agencies for teaching the hygiene of maternity and infancy. An objective in most of the states is the state-wide establishment of permanent, locally supported centres. Demonstration conferences have been held and intensive pieces of work undertaken by the states when there was evidence of special need. In the main these activities have been for the benefit of rural communities and small towns.

State reports of the work during the fiscal year 1925 show 10,802 child-health conferences held by 43 states administering the Federal funds, with 278,016 infants and children of preschool age examined, and 622 children's health centres established through the efforts of the states. Since 1920 child-hygiene or child-welfare divisions or bureaux have been organised in the departments of health in 14 states, so that in all except one state (Colorado) these departments now have an organised agency promoting child health.

Ten states have been admitted to the United States birth-registration area since 1920. At present (1926) 33 states and the District of Columbia (all except Alabama, Arizona, Arkansas, Colorado, Georgia, Idaho, Louisiana, Missouri, Nevada, New Mexico, Oklahoma, South Dakota, Tennessee, Texas and West Virginia) are in the birth-registration area, comprising 75·9% of the total population of the United States. In 1915 the infant mortality rate for the birth-registration area was 100; in 1920, 86; and in 1924 (provisional figures), 72. A general reduction during the five years 1920–5 in the rates in both rural and urban areas is indicated.

On the face of the figures, maternal mortality from all causes appears to have been increasing in the United States. Analysis of the statistics shows that the certification of the causes of deaths has improved during the last 20 years. If allowance is made for the probable effect of this improvement in certification, the mortality from puerperal septicaemia has fallen throughout the period instead of increasing up to 1911 and falling since that time, as the figures, if taken at their face value, would indicate, and the mortality from other puerperal causes has been approximately stationary. After allowances are made for the margin of errour in the statistics of the United States and of other countries, it seems probable that the rate in the United States is actually considerably higher than in most foreign countries. The maternal death-rate, per 1,000 live births in the birth-registration area of the United States, was 6·6 in 1924, with only five states having a rate below 6.

Great emphasis is being placed on pre-natal supervision by the state bureaux of maternal and infant hygiene, but the programme of work was only just getting under way in 1926. Reports of activities undertaken under the Maternity and Infancy Act show 3,781 pre-natal conferences with more than 36,000 women in attendance, and 65 permanent pre-natal centres established. More than 400 midwife classes were held in 20 states, with an enrolment of more than 10,600 midwives, of whom more than 8,000 completed a somewhat formal course of instruction. Most of these were negro midwives who had had little or no previous training. Women in isolated rural districts are being reached by "pre-natal letters" and itinerant conferences. More generally accessible hospital care during confinement is also receiving consideration.

In 1925, 22 states—Arkansas, Arizona, Colorado, Florida, Idaho, Iowa, Kansas, Kentucky, Louisiana, Massachusetts, Minnesota, Montana, Nebraska, Nevada, New Hampshire, New Jersey, North Carolina, Pennsylvania, Rhode Island, South Carolina, Utah, Virginia—and the District of Columbia have laws making medical inspection of schools mandatory, although in some of these states the examination is required only in case of infectious disease. In 8 states—Alabama, Connecticut, Georgia, Indiana, Maine, New York, West Virginia and Wyoming—it is mandatory for certain districts. Five states—Iowa, Kansas, South Dakota, Nevada and Utah—have laws specifically requiring examination of the teeth of school children; and in 12 other states and the District of Columbia it is included in the requirement of a complete examination. Thirty-three states—all except Arizona, Arkansas, Colorado, Florida, Kansas, Louisiana, Montana, Nebraska, New Hampshire, New Mexico, Oklahoma, South Dakota, Texas, Vermont, Wyoming and the District of Columbia—have laws with reference to physical education in elementary schools which are either mandatory or mandatory in effect. The teaching of health and health habits as distinguished from either medical inspection or physical education has greatly increased in recent years.

In 1923 two private national organisations, the American Child Hygiene Assn. and the Child Health Organisation of America, united to form the American Child Health Association. This association has made an important survey of child health in 86 cities having a population of from 40,000 to 70,000 and has supervised the demonstrations in child hygiene for The Commonwealth Fund and done general educational work in the field of child health.

BIBLIOGRAPHY.—*Child Hygiene*, by S. Josephine Baker, M.D., D.P.H.; *Reports of the Administration of the Maternity and Infancy Act*, 1923 to 1925, Children's Bureau, U.S. Dept. of Labor; *Birth Statistics* (annual), Bureau of the Census, U.S. Dept. of Commerce; *A Health Survey of 86 Cities*, by the Research Division of the American Child Health Assn., 1925. (G. AB.)

MATHEMATICS (*see* 17.878).—In the great *Principia Mathematica*, published in 1911, mathematics is rigorously deduced from a few primitive propositions of logic. Since then, not to speak of improvements of detail effected by Sheffer and Nicod, the *Principia* has been subjected to fundamental criticisms which have induced many workers to abandon altogether its line of approach.

I. MATHEMATICAL LOGIC

Theory of Types.—In attempting to provide a firm logical basis for the theories of infinite aggregates and irrational number developed during the 19th century by Cantor and Dedekind,
the chief theoretical difficulty is to avoid the famous parado
of the theory of aggregates. These are direct contradictio
which arise as a result of pursuing apparently ordinary and legi
mate mathematical arguments. Such a state of things is intole
able, and shows that there must be something radically wro
with our fundamental ideas. Whitehead and Russell discover
that behind each contradiction lay a "vicious-circle fallacy
due to neglecting the fundamental principle that what involv
the whole of a given totality cannot itself be a member of t
totality. In order to avoid such fallacies they put forward th
Theory of Types, which consisted of two rather different par
The first part asserted that things were of different logical typ
and that for any predicate there was only one type of subje
of which the predicate could significantly be predicated; a
plying it to a subject of any other type would give not falseho
but literally nonsense. According to this principle many of t
paradoxes consist of sentences, which, though grammatica
correct, are nevertheless strictly meaningless, and the cont
dictions are thus completely removed. But not all the pa
doxes could be dealt with thus, and the others required the seco
part of the theory of types, which distinguished further differe
orders of predicates applicable to the same type of subject.

For instance, the quality of having all qualities of a certa
sort cannot itself be a quality of that sort, or it would be involv
in its own definition, but must be a quality of a higher ord
So, in order to avoid vicious circles, we must never speak of
qualities generally, but only of all qualities of a certain ord
If all statements of this kind are made precise as to the order
qualities involved, all the paradoxes which escape the first pa
of the theory of types in their turn disappear.

Axiom of Reducibility.—The theory of types is thus co
pletely successful in avoiding the contradictions, but this is o
half the problem. The arguments leading to contradiction m
be invalidated, but this must be done without also invalidati
the arguments used in accepted mathematics; and in this Whi
head and Russell failed, for the restrictions imposed by the s
ond part of the theory of types upset an enormous part of or
nary analysis, and this catastrophe was only averted in *Princi*
by the introduction of the axiom of reducibility. This axi
asserts that for any predicate of higher order there is a predic
of the lowest order having the same extension (*i.e.*, applying
the same subjects) as the one of higher order. This implies t
any class defined as the extension of a higher order predicate
also be the extension of a lowest order predicate; so that thus
totality of classes, whose members are of a given type, can be
tained from the totality of lowest order predicates applicable
that type and will be a legitimate totality. In this way the the
of irrational numbers and the other parts of mathematics thre
ened by the theory of types can be saved, if we are prepared
accept the axiom of reducibility. But this axiom cannot possi
be regarded as self-evident, and there is really no reason wh
ever for supposing it to be true, so that anything which can o
be proved by assuming it cannot be regarded as proved at all

Intuitionist Views.—This point was especially emphasi
by Weyl in *Das Kontinuum* (Leipzig, 1918) who went so far a
reject not merely as unproved, but as evidently unprova
much of the general theory of real numbers, bounds, limits
continuous functions, to say nothing of more recent advan
He proposed to confine mathematics to the narrower body
truth, which could be proved not merely without the axiom
reducibility but without using higher order predicates at
Since then Weyl has moved still further from the standpo
of *Principia Mathematica*, and in his latest work (*e.g.*, in *Ma*
matische Zeitschrift, 1921) he appears as a follower of Brou
who is regarded as the leader of the "intuitionist" school.

The Excluded Middle.—Brouwer's principal thesis is his de
of the law of excluded middle, which may be illustrated by a
of the following kind. Suppose we wish to establish the existe
of a number having a certain property; then we may argue th
A certain condition, say p, must either be fulfilled or not; if
true, we can make a construction which will give a number of
required kind; if p is false, we can also make a construction

uch a number, though a different construction from the previous ne. So we shall conclude that in either case there exists a num- er having the required property. Such an argument would, ccording to Brouwer, be illegitimate, because if, as often hap- ens, we could not tell whether p were true or false, we should ot know how to set about actually constructing the number in uestion. It would be wrong, he thinks, to argue by the law f excluded middle that, because it could not be true in either ise that all numbers have not got this property, there must be ne number at least which has it.

This criticism, which is supported by several eminent authori- es, would annihilate considerable portions of modern mathe- atics. There are, however, many thinkers to whom Brouwer's iticism seems to have no force whatsoever, and who are deter- ined to find a theory of the foundations of mathematics which ill not involve the rejection of any generally accepted parts of e subjects; and of their views we must now give some account.

Axiom Systems.—There are first Zermelo, Fränkel and others, ho are working at the construction of axiom systems for the eory of aggregates; they propose to cease using the word class aggregate in its ordinary sense, whatever that may be, but mean by it anything satisfying certain axioms; these axioms ll be constructed so as to permit the deduction of all the ordi- ry theory of aggregates, but avoid all the contradictions. But om a philosophical point of view this shirks the real problem, ich is to clear from contradiction the notion of class and other ied notions which occur in mathematics, when, for instance, we eak of the class of prime numbers, as well as outside it.

Formalists.—The most prominent opponents of the intuition- s are, however, the formalists, of whom Hilbert (see especially *athematische Annalen*, 1922) is the leader. This school regards thematics as consisting of meaningless symbols manipulated cording to formal rules, thus reducing it to something of the ture of a game of chess. Such an account of mathematics is olly inadequate; since if " two " and " three " were meaning- s marks on paper there could be no difference in meaning ween " two shillings " and " three shillings." But the formal- attitude, although hopeless philosophically, may be useful dealing with particular questions, and the essential novelty of bert's work consists not in his formalist theory, but in the positions he has proved or hopes to prove about mathemati- formulae. The chief of these propositions is that it is impossi- to deduce a contradiction by permissible operations from the oms of mathematics, including the law of excluded middle.

This demonstration is only required to convince the sceptics intuitionists, who will not be satisfied with the simple argu- nt that the axioms are true and that therefore no contradiction be logically deduced from them. Hence it is essential not use in the demonstration any principle which the sceptics ibt. This appears to be possible, since, owing to the finite ure of any piece of mathematical reasoning, in proving that it s not lead to contradiction we shall only have to employ the of excluded middle for finite ranges, for which everyone nits its validity. The science on which Hilbert is now (1926) aged, which takes for its subject matter the meaningless for- lae of mathematics, he calls *metamathematics*, and believes it to apable of establishing many important results relating to the tiplicative axiom or axiom of selections and to the continuum blem. Interesting, however, as his work is, it does not offer satisfactory account of the foundations of mathematics as ience, but only deals with it as a game, and contributes no e to the solution of the main problem than does the annihilat- scepticism of the intuitionists.

athematical Induction.—So that, in view of the bankruptcy ll other proposals, it would seem that the true account of the ter must be on the lines of that of Whitehead and Russell, ough this cannot be correct in detail owing to the unsatis- ory nature of the axiom of reducibility. Of great interest this point of view is the new work in the second edition of *cipia Mathematica* (vol. i, 1925) and in particular the new ry of mathematical induction, which by most ingenious ments is established without using the axiom of reducibility. Unfortunately the authors do not see their way to constructing a similar account of Dedekindian Series, for which and for all that part of analysis which depends upon it we are left without any justification.

In this new edition of *Principia Mathematica* some use is made of the theories of *Tractatus Logico-Philosophicus* by Ludwig Wittgenstein, which, although mainly concerned with more purely philosophical problems, also contains contributions of fundamental importance to our subject. Of one of the principal problems in particular he has given an original and possibly final solution; but in order to understand this it is necessary to go back a little.

Mathematics and Logic.—One of the chief objects of the work of Frege and Russell was to reduce mathematics to logic, to show that all mathematical concepts could be defined in terms of " logical constants," and that all mathematical propositions could be deduced from those of formal logic; so that mathematics and logic became one and the same subject. Granting the validity of this reduction, doubt still remains as to what is the peculiar characteristic of logical or mathematical propositions, and how they differ from all others. This question Russell answered in 1903 by saying that logic or mathematics consisted of all true propositions, which were hypothetical in form and contained no constants except logical constants; this amounts practically to saying that any completely general true proposition is a proposition of logic. It subsequently became clear that this definition was much too wide, and that it was necessary to distinguish the propositions which could be stated in purely logical terms and were in fact true, from those which logic alone could assert to be true, which form the science of logic and mathematics. And the distinguishing characteristic of this smaller group of propositions which logic can assert to be true had yet to be found.

Wittgenstein's Work.—This problem Wittgenstein has probably solved; his answer is complicated by the fact that he does not accept the reduction of mathematics to logic, and gives different accounts of the propositions of logic and those of mathematics. Of these his theory of logical propositions is the more important; and if, as is quite possible, his criticisms of the reduction of mathematics to logic are unsound, it would entirely supersede his theory of mathematics, which is given only in barest outline.

Wittgenstein's account of the propositions of logic is that they are tautologies, in a sense of which a precise definition is given in terms of his theory of propositions in general. Any proposition, he maintains, is the expression of agreement and disagreement with certain ultimate possibilities, the possibilities of existence and non-existence of atomic facts. A proposition which agrees with every possibility is a tautology; one which disagrees with every possibility is a contradiction. An ordinary proposition asserts something to be the case and is true if it is the case; a tautology on the other hand asserts nothing but agrees with every possibility and is therefore true unconditionally. This account can be made to cover not only what are called in *Principia Mathematica* " elementary propositions," but also general propositions which involve apparent variables.

Symbolism.—But the importance of Wittgenstein's work does not only consist in his having defined the propositions of logic, and hence possibly those of mathematics, but also in his theory of symbolism, which seems capable of far-reaching applications to the theory of types. The theory of symbolism may indeed be expected to be relevant for the following reason. There is an obvious division of the paradoxes into two groups, which is entirely overlooked in *Principia Mathematica*. The first group of contradictions, such as those about the class of classes not containing themselves and the greatest ordinal, can be stated in purely logical or mathematical terms. They would actually occur in a mathematical treatise if it investigated the problems in question. The remaining contradictions, such as Richard's paradox, involve, besides mathematical terms, terms drawn from psychology or epistemology, such as knowing, asserting, naming or meaning. These contradictions are not therefore purely mechanical, and the responsibility for them need not, as must that for the first group, lie with faulty mathematics or logic, but may lie in faulty ideas of knowledge and symbolism. This was the view taken of them by Peano; but it cannot be regarded as satisfactory until an adequate explanation is given of where exactly the fault lies. The probability that it lies in the epistemology and not in the mathematics, is strengthened by the fact that this grouping of the contradictions into purely mathematical and mixed coincides with their grouping according to whether their solution in *Principia* requires the first or second part of the theory of types. So that the first part of the theory, which is undoubtedly sound, will suffice for the purely mathematical contradictions, and if the mixed contradictions can be shown to be due to the epistemological element, there may no longer be any need for the second part of the theory of types, which requires the axiom of reducibility and is so responsible for the whole trouble.

By using the work of Wittgenstein a solution has been constructed along these lines, on which the theory of types is so modified that all need for an axiom of reducibility disappears, and mathematics consists entirely of tautologies in Wittgenstein's sense.

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II. THEORY OF NUMBERS

In the article NUMBER (19.847) an excellent summary is given of the classical theory. Modern mathematics has seen the rise of a new theory, the " analytic " theory, which has developed with great rapidity, and has almost monopolised the attention of arithmeticians.

(*a*) *Theory of Primes.*—The modern developments of the theory of numbers depend in the main on the application to the theory of the ideas of the theory of functions of a complex variable (*see* 11.301). It was in the theory of the distribution of primes that these ideas first bore fruit.

It is usual to write $\pi(x)$ for the number of primes less than x. It has been known since Euclid that the number of primes is infinite, that is to say that $\pi(x)$ tends to infinity with x. The central problem of the theory has been the determination of the order of magnitude of $\pi(x)$ when x is large, and its solution is embodied in the *Primzahlsatz*, or " prime number theorem," expressed by the formula

$$\pi(x) \sim \frac{x}{\log x}$$

where the symbol $\sim$ expresses the fact that the ratio of the two functions tends to unity. This theorem, conjectured by A. M. Legendre (1798) and C. F. Gauss (about 1792), was first proved by J. Hadamard and Ch. J. de la Vallée Poussin in 1896. The real founder of the modern theory, however, was B. Riemann, who, in a famous memoir published in 1859, first indicated the road along which subsequent research has progressed. Riemann did not prove the prime number theorem; strangely enough, he did not mention it, his object being to obtain, not an asymptotic formula for $\pi(x)$ but an exact expression in the form of an infinite series. Nor did Riemann attain the goal at which he aimed, his analysis, profound and beautiful as it is, being altogether incomplete and inconclusive. But it was Riemann who first recognised where the key to the solution lay, viz., in the study of the " Riemann zeta-function,"

$$\zeta(s) = \zeta(\sigma + it) = \Sigma n^{-s} = \Pi\left(\frac{1}{1-p^{-s}}\right)$$

(where $n = 1, 2, 3, \ldots$, and p runs through the series of primes), considered as a function of the complex variable s. Riemann established some, and conjectured others, of the properties of $\zeta(s)$; one famous conjecture, that all the complex zeros of $\zeta(s)$ lie on the line $\sigma = \frac{1}{2}$, remains unsettled to this day.

Riemann's memoir bore no fruit for over 30 years, when the way was cleared by the researches of Hadamard in the theory of analytic functions (*see* FUNCTION, 11.301 *seq.*). These researches led Hadamard himself, de la Vallée Poussin, and other writers, to a proof not only of the prime number theorem but of very much more. Thus de la Vallée Poussin proved that the logarithm integral $\mathrm{Li}x = \int_2^x \frac{dt}{\log t}$ represents $\pi(x)$ with an error of lower order than $x(\log x)^{-k}$, where k is any number however large. He also investigated the distribution of primes of a linear form $am+b$ or a quadratic form $am^2+bmn+cn^2$ where a, b, c are integers without common factor, showing, for example, that the primes are, on the average, equally distributed between the various arithmetical progressions $am+1$, $am+2$, $\ldots$, as had been conjectured long before by P. G. Lejeune Dirichlet. There is a corresponding theory for the " prime ideals of the " corpus " associated with any algebraic number. The ar logue of Riemann's zeta-function was discovered by R. Dedekin but it is only recently that, in the hands of E. Hecke and E. Landa the development of the theory has been pushed to a point cor sponding with that of the ordinary theory.

The outstanding unsolved problem of the theory is that of t determination of the order of the *difference* $\pi(x) - \mathrm{Li}x$. This proble is bound up essentially with Riemann's unproved hypothesis co cerning the zeros of $\zeta(s)$. If Riemann's hypothesis is true, the ma imum order of the difference differs from that of $\sqrt{x}$ by logarithn factors only. In any case the difference assumes values *of eit sign* which tend to infinity with x. This theorem, proved by J. Littlewood in 1914, disposes of the old conjecture of Gauss a B. Goldschmidt that $\pi(x)$ is always less than $\mathrm{Li}(x)$.

Apart from applications to the theory of primes, there is a lar literature connected with the pure theory of $\zeta(s)$. It has been sho by H. Bohr, E. Landau and F. Carlson that (to put it rough nearly all the zeros lie very near the critical line; by G. H. Har and J. E. Littlewood that (equally roughly) a considerable prop tion lie actually on it. But the hypothesis itself remains unprov

(*b*) *Additive Theory.*—The " additive " theory of numbers cludes Combinatory Analysis (*see* 6.752), Partitions (*see* 19.86, the theory of the representation of numbers by sums of squar cubes, or higher powers, and so forth.

The central problem is that of determining (exactly or appr imately) the number of representations of an arbitrary positi integer n in the form $a_1+a_2+ \ldots +a_s$, where the a's are nu bers of some special type (*e.g.* squares), and s may be fixed or u restricted, according to the particular problem envisaged. There i fundamental difference between the " additive " theory and wh may be called the " multiplicative " theory, in which the cent idea is that of the resolution of a number into prime factors. Analy cally, this difference expresses itself as follows: the multiplicati theory depends on the theory of " Dirichlet's series " of the ty $\Sigma a_n n^{-s}$, the additive theory on that of power series $\Sigma a_n x^n$. A gre deal of the additive theory is purely algebraic, and is intimat bound up with the theory of elliptic functions. This side of the theo (founded by L. Euler) has been developed to a high pitch by Engl mathematicians, notably A. Cayley, J. J. Sylvester, and P. A. Ma Mahon, while more recently the methods of complex function theo have been applied to the theory and an " analytic additive " theo has been founded. Among many curious results we may mention t theorem of S. Ramanujan, that the numbers of the unrestrict partitions of numbers of the forms $5m+4$, $7m+5$ and $11m+6$ divisible by 5, 7 and 11 respectively.

One of the most remarkable problems of the additive theory " Waring's Problem." It was asserted by E. Waring (1782) that a number n is the sum of at most 4 squares, 9 positive cubes, 19 fou powers, and, generally, $g(k)$ powers, where $g(k)$ is a number pending on k alone and not on n. This problem—in so far as it sim asserts the existence of *some* such number $g(k)$—was solved by Hilbert in 1909. J. L. Lagrange (1774) proved that $g(2)=4$ (a number is the sum of 4 squares, and some numbers not of les and E. Wieferich (1909) that $g(3)=9$ and $g(4) \leqq 37$. Only a fin number of numbers (probably only 23 and 239) require more cu than 8 (E. Landau, 1908), while an infinite number require 4 at lea and only a finite number of numbers require more than 19 fou powers (G. H. Hardy and J. E. Littlewood, 1924), while an infin number require 16 at least; and asymptotic formulae for the numb of representations have been found. But our knowledge of t field is still extremely incomplete.

The " empirical theorem " of Chr. Goldbach, that every ev number is the sum of two primes, has also received a considera amount of attention, but is still unproved. Among other unsolv problems of the same character may be mentioned that of prov the existence of an infinity of primes of the form m^2+1 or (m generally) am^2+bm+c. This problem is not to be confused with t problem of primes $am^2+bmn+cn^2$, solved by de la Vallée Poussin.

(*c*) *Miscellaneous Investigations.*—The work of Dirichlet a L. Kronecker on the approximation of irrational numbers rationals has led to extensive investigations lying on the bor line between arithmetic and analysis, developed above all H. Minkowski under the titles of *Diophantische Approximati* and *Geometrie der Zahlen*. The central idea in this theory is th of the lattice (*Gitter*).

A lattice point (*Gitterpunkt*) in space of any number of dimensi is a point with integral co-ordinates, and most difficult and fascinati problems arise when we consider the number of lattice points wh lie within a volume of specified form in n-dimensional space. Th Minkowski proved that any convex figure in space of two dimensi with symmetry about a centre, its centre at a lattice point, and area 4, includes other lattice points besides its centre; with a wh series of corresponding theorems concerning more general configu tions. Another class of lattice-point problems is exemplified by t

" circle " problem of Gauss and W. Sierpinski, that of determining approximately the number of lattice points inside the circle $x^2+y^2=n$ when n is large. A first approximation is naturally given by πn, the area of the circle, but the estimation of the error is a problem of exceptional difficulty. This problem and the analogous problem for the hyperbola $xy=n$ (Dirichlet's divisor problem) were connected with the theory of $\zeta(s)$ [see (*a*) *supra*] by Landau. These problems also are susceptible of manifold generalisation. And in all these problems, we observe the dominating and irresistible tendency of modern higher arithmetic, the tendency to abandon its ancient tradition of isolation and assimilate itself so far as possible to the theory of functions, in order to utilise the immensely powerful weapons which the latter theory alone can provide.

There is one famous problem in which no such reduction of arithmetic to analysis has been effected. " Fermat's last theorem " asserts that there is no integral solution of $x^n+y^n=z^n$ (other than the trivial solution $x=z$, $y=0$) for any value of n greater than 2. t was the attempt to prove this theorem that led to the whole development of the theory of algebraic numbers; but, in spite of the wide-spread attention which it has excited, and the extreme impor-ance of the general theories of which it has been the starting point, he theorem itself remains unproved, though important additions have been made recently to our knowledge by A. Wieferich, D. Mirimanov, L. E. Dickson, and H. S. Vandiver. Thus Wieferich proved hat the theorem holds for odd prime values of n, and values of x, , z, not divisible by n, unless $2^{n-1}-1$ is a multiple of n^2.

One old conjecture has been definitely disposed of. Mersenne sserted that 2^n-1, where n is a prime not exceeding 257, is prime when, and only when, $n=1, 2, 3, 5, 7, 13, 17, 19, 31, 67, 127, 257$. This statement contains at least four errors, relating to the values 1, 67, 89, 107; and it need no longer be taken seriously.

BIBLIOGRAPHY.—An indispensable work for the serious student of igher arithmetic (on any of its sides) is L. E. Dickson, *History of e Theory of Numbers*, 1920. This work is not, however, specially oncerned with the analytic theory.

For general accounts of the theory of primes see the article " Die euere Entwicklung der Analytischen Zahlentheorie " by H. Bohr nd H. Cramer in the *Encyklopädie der Mathematischen Wissenchaften* (2C8); E. Landau, *Handbuch der Lehre von der Verteilung der rimzahlen* (1909), and *Einführung in die elementare und analytische Theorie der algebraischen Zahlen* (1918).

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Comparatively little of recent work is accessible in a connected rm, and the study of the original memoirs is indispensable.

III. THEORY OF SERIES

The most striking modern developments in the theory of ries (*see* 24.668; 10.753; 12.956) have also been suggested by he development of the theory of functions.

The theory of functions of a real variable has been revolution-ed by the ideas of E. Borel and H. Lebesgue, and this has in-ired a corresponding revolution in the theory of Fourier's ries and " series of orthogonal functions " generally.

A system of functions $\phi_m(x)(m=1, 2, 3, \ldots)$ is said to be *thogonal* if

$$\int_a^b \phi_m(x)\phi_n(x)dx=0(m\neq n) \qquad (1)$$

he simplest examples are obtained by taking $\phi_m(x)$ to be cos mx sin mx and the interval (a, b) to be $(0, 2\pi)$; or $\phi_m(x)$ to be Legen-e's polynomial $P_m(x)$ and (a, b) to be $(-1, 1)$. There is then a mple procedure by which we may endeavour to expand an ar-trary function $f(x)$ in the form of a series $\Sigma a_m\phi_m(x)$, viz., by mul-lying this series by $\phi_m(x)$ and integrating over the interval (a, b): e formula thus suggested is

$$f(x)=\Sigma a_m\phi_m(x),\ a_m=\left(\int_a^b f(x)\phi_m(x)\,dx\right)\Big/\left(\int_a^b \phi^2{}_m(x)\,dx\right) \qquad (2)$$

A more accurate analysis of this procedure raises a multitude of ofoundly interesting and difficult questions. On the one hand we ay start from a series with arbitrary coefficients a_m, and inquire hether there exists a function which stands to it in the relation pressed by the equation (2). In particular, given a trigonometrical ies $\Sigma a_m\cos mx$ or $\Sigma b_m\sin mx$ or, more generally $\Sigma(a_m\cos mx$ $b_m\sin mx)$, with arbitrary coefficients, we may ask whether it is Fourier's series, that is to say, whether there is a function $f(x)$ such at a_m and b_m are given by Fourier's integral formulae. On the her hand, we may start not from an arbitrary series but from an bitrary function $f(x)$, form the coefficients (a_m or b_m) by Fourier's mulae or the more general formulae (2), and then inquire whether e formal development thus obtained is convergent, and whether, if nvergent, it represents the function $f(x)$ and so forth.

The problems thus raised are among the most difficult of modern thematics; and a very cursory examination of them is enough to show that the methods of the older analysis are not sufficiently powerful for their solution. It is essential that we should enlarge our conceptions, on the one hand, by taking account of the modern generalisations of the notion of an integral, and, on the other, by adopting a broader view as to what is meant by the " sum " of an infinite series.

The modern theory of functions of a complex variable (*see* 11.301) points to the same conclusion. A function $f(z)$ of the complex variable z, regular for $z=z_0$, is defined throughout a certain circle whose centre is z_0 by a power-series $\Sigma a_n(z-z_0)^n$; but the region of existence of the function is very generally more extensive than the circle of convergence of the series; and this fact has led, during the last generation, to a mass of work on the problem of " analytic continuation." This problem is that of discovering analytic representations of the function, whether by integrals, or by continued fractions, or by series of a different form, which are valid throughout a wider region than that in which it is represented by the original power series. Here also we are confronted by the need for a scientific theory of divergent series.

There are passages in the older analysts (*e.g.*, in L. Euler) which suggest a half-conscious anticipation of modern ideas. But it is roughly true to say that they did not concern themselves with the precise meaning of the infinite series of which they made such effective use. A. L. Cauchy and N. H. Abel were the first to give a precise definition of the " sum " of a series $a_0+a_1+a_2+\ldots$ or Σa_n, viz., as the limit of $s_n=a_0+a_1+\ldots+a_n$ when n tends to infinity $(n\to\infty)$. Such a series as $1-1+1-\ldots$ has then *no* sum, for s_n is alternately 1 and 0; and it was the tendency, for many years after Cauchy and Abel, to banish such series from analysis entirely. A school of mathematicians survived, among whom one may cite A. de Morgan, who viewed this tendency with obvious discontent, but there was no escape from the conclusion that the followers of Cauchy and Abel were right. It is impossible to say " the sum of Σa_n is so-and-so " except after framing an accurate definition of " sum "; the definition of Cauchy and Abel was the only definition; and, until some new and wider definition was offered, that was the end of the matter.

We may define the meaning of a mathematical word or symbol as we please, provided only that the definition is free from contradiction. Given a sequence of numbers $a_1, a_2, \ldots$ we may associate with the sequence a number s in any manner that we please, and we may say, if we like, that s is the " sum " of the series. We might say, for instance, that the " sum " of every infinite series is, by definition, zero. This definition would be perfectly legitimate but futile, because it would reduce all equations involving infinite series to the trivial form $0=0$; and confusing, because it would conflict with Cauchy's definition. Cauchy's definition is only one among many, but it is admittedly the most important, and a new definition is only likely to be of value if it is consistent with the standard definition. It must satisfy what is called the *condition of consistency*; it must apply to all convergent series, and give a " sum " equal to their sum in the ordinary sense. Its value for analysis will then be measured by the extent and importance of the class of non-convergent series to which it attributes a " sum."

The simplest and most important of the definitions which have been given is that of the " first arithmetic mean." Suppose that $s_n=a_0+a_1+\ldots+a_n$ and $\sigma_n=(s_0+s_1+\ldots+s_n)/(n+1)$, the arithmetic mean of the first $n+1$ values of s_n. If s_n tends to a limit, σ_n tends to a limit also, and the two limits are the same; but σ_n may tend to a limit when s_n does not. For example, if $a_n=(-1)^n$, $s_{2n}=1$ and $s_{2n+1}=0$, and s_n does not tend to a limit; but σ_n tends to the limit $\frac{1}{2}$. If now we agree to call the limit of σ_n, whenever it exists, the " sum " of the series Σa_n, our new definition is in perfect accord with Cauchy's definition, but is applicable to an extensive class of series for which Cauchy's definition fails. It therefore fulfils the conditions required for a theory of divergent series.

The most striking illustration of the importance of these ideas is to be found in the theory of Fourier's series (*see* 10,753). The Fourier's series of a *continuous* function $f(x)$ is not necessarily convergent; further conditions on $f(x)$, of a much more artificial character, are required to ensure convergence. It was, however, shown by L. Fejér that the Fourier series of any continuous function is " summable " by the procedure indicated above; that is to say, that the arithmetic mean σ_n tends to a limit equal to the value of the function; and this fundamental result has been the starting point of a mass of modern research.

Another important definition attributes to the series as " sum " the value of the limit of the power series Σa_nx^n when x tends to 1 through positive values less than 1. A third (of particular importance in complex function theory) was advanced by Borel; and all of these definitions have entailed a host of still more general definitions.

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IV. THEORY OF FUNCTIONS

The theory of functions (*see* 11.301, 14.53) has two great branches, the real and the complex theories. Recent advances in the complex theory, important as they are, have been of too technical a character for rapid summary. The real theory, on the other hand, has been remodelled from its foundations. The older form of the theory was cumbrous and unattractive. The modern theory has the aesthetic character required of a first-rate mathematical science, and its development has been perhaps the most striking achievement of modern analysis.

1. *Sets of Points.*—The theory of functions of a real variable is based upon the theory of aggregates (*see* 19.847–850) and in particular the theory of " sets of points." A set of points S is an aggregate of real numbers x, such as the aggregate of rational numbers, or of irrational numbers, in the interval $(0, 1)$. A number ξ is said to be a " limit point " (*Häufungstelle*) of S if every " neighbourhood " of ξ, that is to say every interval $(\xi-\epsilon, \xi+\epsilon)$ including ξ, contains points of S other than ξ itself. A limit point of S may or may not belong itself to S. Thus every number of $(0, 1)$, rational or irrational, is a limit point of the set S of rationals of $(0, 1)$. If every limit point of S belongs to S, S is *closed*. If every point of S is a limit point, S is *compact* or *dense*. A set which is both closed and compact is *perfect*. The continuum, the aggregate of all real numbers, is perfect.

An idea of dominating importance in the theory of functions is that of the *content* or *measure* of a set of points. Suppose, for simplicity, that the set S in question is contained in $(0, 1)$. Then Cantor defined the content of S as follows:—Divide $(0, 1)$ in any manner into a *finite* number of intervals δ, and these intervals δ into two classes δ_1 and δ_2, according as they do or do not include points of S; and let $c(\delta)$ be the sum of the lengths of the intervals δ_1. Then the *content* of S is the limit of $c(\delta)$ when the intervals δ tend to zero, if this limit should exist.

There is a striking defect in this definition, the full implications of which were first perceived by E. Borel. *The content of the sum of two sets is not generally the sum of their contents.* Thus the rationals of $(0, 1)$ have content 1 (since every δ is obviously a δ_1), and likewise the irrationals. The sum of the contents is 2, whereas the content of the sum is 1. The rationals of $(0, 1)$ cannot be included in a finite set of intervals whose aggregate length is less than 1. If we abandon the restriction that the set of intervals must be *finite*, the situation is completely changed. Thus Borel observed that we may include the rational p/q in the interval $\left(\frac{p}{q}-\frac{\epsilon}{q^3}, \frac{p}{q}+\frac{\epsilon}{q^3}\right)$, and that the sum of all these intervals may be made as small as we please by choice of ϵ; and this simple remark has revolutionised the theory of functions. The first step was to frame a satisfactory definition of *measure*, and this concept, which has entirely superseded Cantor's " content," is now defined as follows. We consider sets S included in $(0, 1)$. Let S be enclosed, *in any manner whatsoever*, in a system σ of intervals δ; let $m(\sigma)$ be the sum of the intervals of σ; and let m_e be the lower bound (or " inferior limit ") of the aggregate of values of $m(\sigma)$. Then m_e is the *exterior measure* of S. The *interior measure* m_i is $1-m'_e$, where m'_e is the exterior measure of S_1, the set complementary to S, *i.e.*, the set of points of $(0,1)$ which do not belong to S. If $m_e=m_i$, the set S is *measurable*, and its measure is m, the common value of m_e and m_i. This definition (due to H. Lebesgue) is of extreme generality, and no example of a non-measurable set is known.

Measure, thus defined, has the properties which measure ought to have, but which Cantor's content lacked. In particular the sum of two mutually exclusive and measurable sets is measurable, and its measure is the sum of the measures of the component sets. The measure of any enumerable set, and in particular of the rationals, is zero. The definition may be extended to sets in space of any number of dimensions.

2. *Integration.*—The new theory of measure has led to new theories of integration, in the light of which the older theories are of historical or didactic interest only. The most important of these theories are due to H. Lebesgue and W. H. Young.

(*a*) Lebesgue's definition of an integral is as follows. A function $f(x)$, defined in an interval (a,b), is *measurable* if the set of points $S(A)$ for which $f>A$ is measurable for every A. All known functions are measurable. We now suppose that f is bounded, so that (say) $h<f<H$, and we divide up the interval (h, H) into a finite number of intervals (l_i, l_{i+1}) or δ_i. It is this subdivision of the range of variation of $f(x)$, instead of (as in the older theory) that of x, that is characteristic of Lebesgue's procedure. The set of points for which $(l_i \leqq f < l_{i+1})$ is measurable. If we denote its measure by m_i, write $J = \Sigma l_i m_i$ and suppose that the intervals δ_i tend to zero. Then J tends to a limit I, and we write

$$I=\int_a^b f(x)dx$$

The integral so defined is a *bona-fide* generalisation of the integra of Riemann, for it exists whenever Riemann's integral exists and agrees with it in value. But it is far more general: thus the function $f(x)$ which is unity when x is a rational of $(0,1)$, and zero otherwise has no Riemann integral, but has a Lebesgue integral equal to zero The definition is capable of many-sided generalisation, to unbounded functions, and functions of many variables; it throws entirely new light on the relations between integration and differentiation; and it has proved itself adapted for a mass of analytical applications of the most far-reaching importance, in particular in the theory of Fourier's series and the theory of integral equations.

(*b*) A different definition was proposed by W. H. Young. He adheres to a subdivision of the range of variation (a,b) of the independent variable; but, instead of dividing it into a finite number of intervals, divides it into a finite or infinite number of measurable sets This procedure leads to results roughly equivalent to those of Lebesgue's theory; but it is somewhat more general and is certainly a more natural development of the older theory of measure.

3. *Geometrical Applications.*—Those new theories have led inevitably to a searching re-examination of the concepts of " curve," " surface," " length," " area," and so forth, which were generally accepted without question by the older analysts on the supposed evidence of geometrical intuition. This unreflective attitude has now been abandoned, and it is recognised that analysis is in no sense dependent upon geometry. The notion of a *curve* was first made precise by C. Jordan. A curve is a set of points (x,y), that is an aggregate of pairs of real numbers x, y, where x and y are functions of a single variable t, subject to appropriate restrictions. A simpl closed continuous curve is a curve for which (1) $x=x(t)$ and $y=y(t$ are continuous for $t_1 \leqq t \leqq t_2$; (2) $x(t_2)=x(t_1)$ and $y(t_2)=y(t_1)$, and (3 it is false that $x(t')=x(t'')$ and $y(t')=y(t'')$ for any pair of values t' t'' other than t_1, t_2. A fundamental theorem, due in substance to Jordan, asserts that such a curve C divides the plane into two " regions D and D′ separated by the curve. Two points which lie in the sam region can be connected by a continuous curve which has no point in common with C; but points which lie in different regions cannot be thus connected. We thus define the *inside* and *outside* of a closed curve in strictly analytical terms. A similar account has been given of the concepts of *area* and *length*. In particular the simple closed continuous curve C has both an area and a length if $x(t)$ and $y(t$ are functions of "bounded variation."

4. *Integral Equations.*—Among the remaining developments of modern analysis, perhaps the most remarkable are in the theory of integral equations. The typical integral equation is

$$f(x)=\int_a^b K(x,t)\phi(t)dt \qquad (1$$

where $f(x)$ and $K(x,t)$ are given and the unknown function $\phi(t$ is to be determined. This equation is called an integral equation of the first kind; but it has been found that equations of the form

$$\phi(x)=f(x)+\lambda\int_a^b K(x,t)\phi(t)dt \qquad (2$$

known as equations of the second kind, are better adapted for the foundation of a general theory. It was shown by I. Fredholm that if f and K satisfy certain conditions, there is in general one and only one continuous solution $\phi(t)$; the exceptions arise when λ is a zero of a certain transcendental function $D(\lambda)$. When λ has one of these exceptional values, the equation

$$\phi(x)=\lambda\int_a^b K(x,t)\phi(t)dt$$

has a continuous solution other than the obvious solution $\phi(t)=0$ otherwise this is the only solution. The theory has been widely developed by Fredholm, D. Hilbert, V. Volterra and other writers

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MATHEWS, SHAILER (1863–), American educationist and theologian, was born at Portland, Me., May 26 1863. He graduated from Colby College (A.B., 1884; A.M., 1887) and continued his studies at Newton Theological Institution and the University of Berlin. He was associate professor of rhetoric (1887–9) and rofessor of history and political economy (1889–94) at Colby College. In 1894 he went to the University of Chicago as associate rofessor, and in 1897 became professor of New Testament his- ory and interpretation. In 1908 he was made dean of the ivinity school. In 1912 he was president of the Federal Council f the Churches of Christ in America, and he visited Japan in 1915 s representative of that body. From 1903 to 1911 he was editor f *The World Today;* from 1913 to 1920, of *The Biblical World.*

He has written a number of books including *The French Revolution* 1901); *History of New Testament Times in Palestine* (1908); *Social Teachings of Jesus* (1910); *Spiritual Interpretation of History* (1916); nd *Faith of Modernism* (1924). (*See* BAPTISTS.)

MATISSE, HENRI (1869–), French painter, was born at ateau (Nord) Dec. 31 1869. He studied at the École des eaux-Arts, and under Gustave Moreau. He soon showed revo- utionary tendencies, and was recognised as the boldest member f the group known as “ les fauves.” Though a painter of light, e did not treat it as the impressionists had done, by means of he juxtaposition of minute touches of colour, but by employing ure tones on a large scale. In this way he produced the effect f modelling, and, by the contrast of values, was able to give the lusion of space. He was particularly successful in his use of xpressive distortion. Matisse spent two years in Morocco, but ost of his work was carried on in southern France, at Collioure nd Nice. Later, he reduced the size of his canvases, painting ill life and landscapes, as well as small feminine figures and rilliantly illuminated interiors. He is entitled to be considered s the most eminent master of the contemporary French School. n his drawing he exhibits sometimes a nervous restrained man- er, and by his use of shadow succeeds in reproducing the actual ulk of bodies without having to insist on their contour. Ma- sse's lithographic work is also of considerable importance.

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MATSUDAIRA, TSUNEO (1877–), Japanese diplomat, as born in Tōkyō. He joined the Imperial University of Tōkyō s a student of economics, and in 1902 he entered the Foreign ffice. His first experience abroad was gained in Peking where e was a secretary of legation. His determination, however, oupled with his wide theoretical knowledge, pushed him for- ard until he became first secretary in London and later in aris; but his criticism of the extreme nationalism of many his countrymen stood in the way of his receiving imperial onours. From 1918–9 he was Japanese high commissioner in beria and in 1920 was appointed director of the bureau for uropean and American affairs at the Foreign Office in Tōkyō. 1921–2 Matsudaira was chief secretary of the Japanese dele- tion to the Washington Conference. In 1924, after the dip- matic blunder committed by the Japanese Ambassador to e United States, Mr. Hanihara, it was considered that some eans must be found to improve the situation. As a result, in 25 Matsudaira was appointed ambassador and he undertook s duties with the avowed intention of bettering American- panese relations.

MATSUKATA, MASAYOSHI (1835–1924), Japanese statesman *e* 17.890), was from 1917–22 keeper of the privy seal, and on signing from this post was created a prince. He died in Tōkyō ly 2 1924.

MATTEI, TITO (1841–1914), Italian musician and composer, as born at Campobasso, near Naples, May 24 1841. He became an early age a professor at the Santa Cecilia academy of music Rome, and subsequently had several successful European urs as a pianist. In 1863 he finally settled in London, where he mained for the rest of his life. He composed several hundred ngs and pianoforte pieces, many of which became very popular. e died in London March 30 1914.

MATTER (*see* 17.891).—Since 1910 advances have been made hich give much more precision to our knowledge of the consti- tion of matter. The atomic theory of matter, which for long peared to be of necessity unverifiable by direct experiment on count of the minuteness of the atom (*q.v.*), received almost direct proof in a number of ways. Methods have been developed, for example, to detect the electrical effect of a single α particle from radium, and a single swift electron (*see* GASES, ELECTRICAL PROPERTIES OF).

The α particle has been shown to be a charged atom of helium projected with high velocity; the number of α particles from a given quantity of radium have been counted, and the volume of helium which they produce has been measured. In this direct way it has been shown that about $2\cdot7\times10^{19}$ particles or atoms of helium are required to form one cu. cm. of helium gas at normal pressure and temperature. Not only is it feasible to detect the effect of a single atom of matter in special circumstances but also to show the path of a swift α particle or electron through a gas. This has been made possible by the discovery of C. T. R. Wilson that under suitable conditions the charged ions produced in gases by α or β rays become centres for the condensation of water vapours, and are thus rendered visible as the nuclei of visible drops of water. The photographs of these droplets show in a most striking way the track of the particle through the gas, and illustrate with extraordinary detail the main effects produced by the passage of ionising radiations through gases.

The essential correctness of the kinetic theory of matter, which assumes that the molecules of matter are in vigorous but irregular motion, has been clearly demonstrated by the experiments of Perrin and others on the motion and equilibrium of small spheres of matter in suspension in fluids which show the Brownian movement. At the same time the atomic or discrete nature of electricity, which had been implicitly assumed in many theories, has received complete experimental verification, and the magnitude of this fundamental unit of charge has been measured with precision. The most accurate experiments on this subject have been made by Millikan by measuring the electric field required to support a small, charged droplet of oil or mercury. The charge on the drop was varied by ionizing the gas in its neighbourhood. In this way he has been able to show that the charge always varies by integral multiples of a fundamental unit. The charge given to a drop by friction or any other method is always an integral multiple of this unit charge. This fundamental unit is the same both for positive and negative electricity, and is numerically equal to the charge carried by the negative electron, the positive and negative ions produced in a gas by X-rays, and also to the positive charge carried by the hydrogen atom in the electrolysis of water. The magnitude of this unit charge, combined with electrochemical data, gives a most reliable method of measuring a number of important and molecular magnitudes. The value of the fundamental unit of charge and thus the mass of the individual atoms of matter are now known with an accuracy of certainly within one per cent and possibly within one-tenth of one per cent. The data found by Millikan are given in the following table:—

Fundamental unit of charge .	$e=4\cdot774\times10^{-10}$ electrostatic units
The Avogadro Constant, *i.e.*, the number of molecules in one gramme molecule	$N=6\cdot062\times10^{23}$
The number of molecules per c.c. of any gas at 0°C. and 760 mms.	$n=2\cdot705\times10^{19}$
Mass of hydrogen atom in grammes	$m=1\cdot662\times10^{-24}$

From these data the number of atoms in one gramme of any element can be determined. While the average distance apart of the atoms or molecules can at once be deduced, the actual dimensions of the molecules or sphere of action of the molecules can only be approximately estimated with the aid of other and much less precise data.

Structure of the Atom.—Since the proof that the negative electron of small mass is a constituent of all atoms of matter, there has been a vigorous attack on the fundamental problem of the structure of the atom. After passing through a number of phases the general ideas on this subject have crystallized into a fairly definite form, and it is now generally believed that the atom is composed of a massive positively charged nucleus of minute dimensions surrounded at a distance by a compensating distribution of negative electricity in the form of negative electrons. Since electricity is atomic the resultant positive charge on the nucleus must be an integral multiple N of the fundamental unit of charge e and is given by Ne. In order for the atom to be electrically neutral it must be surrounded by a distribution of N negative electrons. The value of N for each of the atoms is a fundamental constant, for on it depends the magnitude of the electric field surrounding the nucleus and the arrangement of the external electrons which in turn determine the main physical and chemical properties of the atom. The idea of the nuclear structure of atoms arose initially from a study of the scattering of α particles in their passage through matter. On account of its great energy of motion the charged α particle penetrates the structure of some of the atoms and comes under the influence of the intense repulsive field of the nucleus. Assuming that the law of force is that of the inverse square the α particle describes a hyperbolic path, and the angle of deflexion depends on the nearness of approach to the nucleus. From a close study of the scattering of α rays by Geiger and Marsden it was concluded that the number of α particles scattered through different angles was in close accord with the idea of the nucleus atom, while the actual number scattered through a given angle gave information on the magnitude of the charge carried by the nucleus. The preliminary experiments indicated that for the heavier atoms the value of N was about half the atomic weight in terms of hydrogen.

A notable advance was made by the fundamental experiments of Moseley on the X-ray spectra of the elements. He found that the X-ray spectrum was similar for all elements, and that the frequency of vibration of corresponding lines in the spectrum was proportional to the square of a number which varied by unity in passing from one element to the next. He concluded that the nuclear charge in fundamental units was equal to the atomic or ordinal number of the elements when arranged in increasing order of their atomic weights. On this view the lightest element, hydrogen, has a nuclear charge 1, helium 2, lithium 3, and so on up to the heaviest element, uranium, of ordinal number 92. This is a generalisation of great importance and simplicity which has guided all subsequent work on the structure of atoms. The essential correctness of Moseley's conclusion has been directly verified in the case of a few representative elements, by Chadwick by accurate measurement of the nuclear charge based on the scattering of α rays. Moseley showed that with few exceptions all values of the nuclear charge between 1 and 92 were represented by known elements. Moreover, when the atomic weight of the element in Mendeleeff's classification was replaced by its ordinal number certain irregularities were removed. For example, the positions of argon and potassium cobalt and nickel, iodine and tellurium were interchanged—a result in complete accord with their chemical properties (*see* CHEMISTRY).

The elements missing in the Moseley classification were of atomic numbers 43, 61, 72, 75, 85, 87. Since the X-ray spectra of these elements could be calculated with accuracy, it seemed likely that these missing elements, if present in appreciable quantity in the earth's crust, should soon be detected. The first element discovered by its X-ray spectrum was number 72 which was called hafnium by Hevesy and Coster. In a similar way, elements of number 43, 75, have been recently found in certain platinum minerals by Nonnack and Tacke, but have not yet been isolated. Thus the number of missing elements from hydrogen to uranium is reduced to three, viz., numbers 61, 85, 87.

It thus follows that the main physical and chemical properties of an element are defined by a whole number which represents both its nuclear charge in fundamental units and the number of external electrons. The atomic weight of an element is in a sense a secondary property, for, as we shall see, elements can exist of the same nuclear charge but of different atomic weights. The number and position of the external electrons, on which the ordinary chemical and physical properties of an atom depend, are defined by the nuclear charge. The mass of the atom which resides mainly in the nucleus exercises a subordinate effect on the external arrangement of the electrons.

Isotopes (*q.v.*).—On Moseley's classification only 92 elements of ordinal numbers 1 to 92 are possible, assuming that uranium (92) is the last of the elements. We shall now briefly discu some recent advances which clearly show that in some cas several elements can exist with the same nuclear charge but different atomic masses. Information on this point was first ob tained from a study of the radioactive bodies. It was early ob served that a number of products which showed different radi active properties were inseparable from one another by ordinar physical and chemical methods. For example, ionium and tho ium, radium and mesothorium, radium D and lead cannot b separated from each other, and appear to be identical in chemic properties. Elements so closely alike in chemical properties we called "isotopes" by Soddy, since they appeared to occupy th same position in the periodic arrangement of the element Viewed from the standpoint of the nuclear theory isotopes a elements of the same nuclear charge but of different atom masses. As we have seen, the nuclear charge controls the ord nary physical and chemical properties of the atom, and the mas which resides almost entirely in the nucleus has only a secon order effect. On the other hand, the property of radioactivit depends on the structure and stability of the nucleus, which ma be very different for atoms of the same resultant nuclear charg

In the article on RADIOACTIVITY attention is drawn to th remarkably simple relation which exists between the chemic properties and radiations of the series of radioactive element With the aid of this relation we can at once write down the ord nal numbers and masses of the long series of elements whic arise from the transformation of uranium, thorium and actiniu and can follow the origin of the numerous isotopes which aris One of the most striking results of this generalisation was the prediction that the end product of the uranium and thorium serie should be an element of the same ordinal number as lead but c atomic masses 206 and 208 respectively, instead of the mass 20 found for ordinary lead. This result has been directly confirme by atomic weight determinations of uranium-lead and thorium lead, and was the first definite proof of the existence of isotope of a non-radioactive element.

It seemed probable that in a similar way many of the ordinar elements might consist of a mixture of isotopes, *i.e.*, element with the same nuclear charge but different atomic masses. Thi has been confirmed in a number of cases chiefly by the work c Aston. The masses of the positively charged atoms present i the electric discharge in a vacuum tube are examined by bendin the rays in a combined magnetic and electric field. In this wa it was found that neon consisted of two isotopes of masses 20 an 22 and chlorine of isotopes of masses 35 and 37. The relativ proportions of the two isotopes in chlorine was in good accor with that to be expected from the ordinary atomic weight of th mixture of isotopes, viz., 35·45.

This new method of analysis had, up to 1925, been employe for more than half of the elements and had yielded results o great interest. Some of the elements, like carbon, nitrogen an oxygen, give no isotopes, and are thus to be regarded as "pure" elements where the atoms have all the same mass and nuclea charge. Others, like chlorine, argon, krypton and mercury, ar composed of a mixture of two or more isotopes. In cases lik krypton and mercury as many as six well-defined isotopes hav been detected. With few exceptions the masses of all the isotopes are expressed by a whole number in terms of O=16 wit an accuracy of about 1 in 1,000. For example, the isotopes o neon are 20·00 and 22·00. This important conclusion, which ha been verified in a number of cases, affords a strong indicatio that the masses of the parts composing the nucleus have a mas either of one or a multiple of one, and are not direct multiple of the mass of the hydrogen atom which is 1·008 where O=16 The reason of this will be discussed later. In a few cases, however, for example tin and xenon where the isotopes can be obtained together on the same record, Aston has pointed out tha the whole-number rule obviously breaks down. It will be o great importance to determine the mass of all the isotopes wit the greatest exactitude as the departure of the masses fron whole numbers may provide valuable information on the structure of atomic nuclei.

While the ordinary physical and chemical properties of iso- pes are closely similar, it is to be expected that they should fer in all qualities which involve directly the mass of the atom, ., the coefficients of diffusion and specific gravity. In a similar y second-order effect is to be expected in the rate of vibration the external electrons, *i.e.*, in the light spectrum of the ele- ent, and a small effect has been observed in several cases. The ost obvious method of partial separation of isotopes is by the ocess of diffusion or evaporation. In this way a partial sepa- ion into light and heavy fractions has been shown in the case neon, mercury and chlorine. No evidence of the separation isotopes in nature has been so far observed except in the case uranium-lead and thorium-lead already referred to. For mple, chlorine obtained from widely different sources shows difference in the relative proportions of its component isotopes.

Distribution of Electrons.—We have seen that the atom is to regarded as an electrical structure in which a positively arged nucleus is surrounded by a number of electrons. The gnitude of the nuclear charge and the number of the external ctrons are known for each of the elements. In considering distribution of the external electrons round the nucleus, we at the outset faced by the great difficulty that no possible angement can be permanently stable on the basis of the class- l dynamics. For example, an electron in motion round the cleus must on the classical theory radiate energy and fall into nucleus. To overcome this fundamental difficulty Bohr has roduced a conception, based on the quantum theory (*q.v.*), which radiation only occurs in definite quanta. This concep- n further developed by Sommerfeld and others has been al- st completely successful in describing the properties of the plest atom (hydrogen) with only one electron. It yields not y its natural frequencies but also the detailed changes which y undergo under the influence of electric and magnetic fields. n atoms with more than one electron, success has so far been complete. This is probably not entirely due to the mathe- tical difficulties of the classical problem of three or more at- cting bodies (almost insuperable as these are) but even more deep seated inadequacies in the modifications of classical ory required by atomic theory. The simple modifications roduced by Bohr with success for hydrogen await further elopment. In spite of this, however, the theory in its present n has already won marked successes. It has accounted suc- fully for the general structure of the spectra of all atoms and ir resemblances to the spectrum of hydrogen, for the general ngement and actual magnitudes of their X-ray spectra, and the close analogies which these exhibit to optical spectra. as enabled the grouping of the electrons in all atoms to be ermined, with rough estimates of the size of the orbits to ch they are confined. The later developments of the theory in-Smith, Stoner) seem to present the details and subgroups lectrons in the atom with some approach to finality, in har- ny with all the physical and chemical evidence.

he theory has succeeded in accounting naturally for the form he periodic table of the elements, especially the occurrence of transition groups of elements ending at copper, silver and l, and for the occurrence of the chemically similar rare-earths. as therefore already played a great part in the simplification co-ordination of facts of value. Its developments seem likely upersede suggestions as to the grouping of the electrons in atom which have been advanced previously from time to e—notably by Kossel, Lewis, Langmuir, J. J. Thomson, certain measures of success in explaining the periodic table he elements and the methods of chemical combination. These ier theories were, however, for the most part descriptive er than qualitative in character—to a far greater extent the theory initiated by Bohr. The whole problem of the ribution and motion of the electrons in a complex atom is a difficult one. While definite progress had been made by , and great advances between 1921 and 1925, much still ains to be done before we can hope to specify with any degree uantitative completeness the motion, position and mode of ation of the electrons in any atom of two or more electrons.

Structure of the Nucleus.—While it is difficult to estimate the dimensions of atomic nuclei, the general evidence indicates that the nucleus of a heavy atom like uranium, if assumed spherical, has a radius of less than 10^{-11} cm. or less than 1/1000 of the radius of the external atom. No doubt the dimensions of a nucleus depend on its complexity and are much smaller for the lighter atoms. From experiments on the passage of α particles through hydrogen, it has been calculated that the dimensions of the helium nucleus of mass 4 is of the order 10^{-12} centimetres.

The most direct evidence on the constitution of the nucleus is derived from the study of the radioactive transformations. The disintegration of an atom is accompanied either by the expulsion of an α particle, *i.e.*, in helium nucleus, or the release of a swift electron from the nucleus. This shows that the nucleus of the radioactive atoms contains both positively charged masses and negative electrons, and that the nuclear charge represents the resultant charge. It is natural to conclude that the helium nucleus of mass 4 is one of the secondary units which make up the structure of a complex nucleus. This is supported by the observation that the atomic mass of many atoms is expressed by 4^n where n is a whole number. It is clear, however, from the work of Aston on isotopes that, in addition to the helium nucleus, an element of mass 1 or integral multiple of 1 enters into the structure of all nuclei. This fundamental unit of structure has been named "proton," and its atomic mass is 1 or very nearly 1 in terms of $O=16$. On this view the nuclei of all elements are made up of positively charged protons and electrons. The mass of the atom measures the number of protons in the nucleus. This is in a sense a return to the famous hypothesis of Prout according to which all the atoms are supposed to be built up of hydrogen as the fundamental unit.

It seems clear that if a proton could be removed from an atomic nucleus it would prove to be the hydrogen nucleus carrying a unit positive charge. In fact, Rutherford and Chadwick have shown that the hydrogen nucleus can be liberated from certain light atoms by bombardment with swift α particles. It remains, however, to explain why the proton in a nucleus has a different mass from the free hydrogen nucleus. The latter has a mass 1·008 in terms of $O=16$ while the proton in the nucleus has a mass unity, or nearly unity.

While the negative unit of electricity exists in the form of the electron of very small mass, no evidence has been obtained that its counterpart, the positive electron of very small mass, exists. The unit of positive electricity has never been found to be associated with a mass less than that of the hydrogen atom. This has led to the view that the hydrogen nucleus is the *positive* electron, and that its mass is about 1,845 times that of the negative electron. This difference in mass between the units of positive and negative electricity appears to be fundamental, and offers an explanation of the asymmetrical distribution of positive and negative electricity in the structure of atoms.

Since the helium nucleus has a mass 4 and charge 2, it should be composed of four hydrogen nuclei and two electrons. Its mass, however, is less than that of four free hydrogen nuclei. Such a change of mass in the very close combinations of positive and negative nuclei is to be expected. According to the theory of relativity energy has mass, and the loss of mass m of a system is numerically given by $E=mc^2$ where E is the energy liberated and c the velocity of light. On this view the combination of the positive and negative electrons to form the helium nucleus is accompanied by a large release of energy. From the difference between the mass of the helium nucleus and that of four hydrogen nuclei, it can readily be calculated that the helium nucleus is such a stable combination that an amount of energy corresponding to four or five α particles from radium would be required to dissociate it. The difference between the masses of the protons in the nucleus and free hydrogen nuclei is thus to be ascribed in general to the close packing of the positive and negative units composing the nucleus.

On the views outlined above the number of electrons in any nucleus can at once be calculated. For example, oxygen of nuclear charge 8 should be made up of 16 positive units and 8 electrons. For such a nucleus to hold together it seems clear that the forces between the charged units at such small distances must be different from that of the inverse square. While it has been experimentally shown that the law of the inverse square holds at any rate approximately close to the nucleus of a heavy atom like gold, this law breaks down in very close collisions of light atoms where the nuclei approach very close to each other. For example, it has been found that the number of hydrogen atoms which are set in swift motion when α particles pass through hydrogen is very different from that to be expected if the nuclei behave as point charges repelling each other according to the law of the inverse square.

By studying the scattering of α particles by the light elements, aluminium and magnesium, it has been found that the law of the simple inverse square no longer holds close to the nucleus. The experimental information at present available is too indefinite to hazard more than a guess as to the nature and magnitude of the forces that come into play when nuclei approach very close to one another, as they must do in the structure of the nucleus of a heavy atom.

Stability of Atoms.—Apart from the heavy radioactive elements which belong to a class by themselves, and two other elements—potassium and rubidium—which spontaneously emit swift electrons, the atoms of the ordinary elements appear to be very stable structures which cannot be broken up by ordinary chemical and physical agencies. In considering the possibility of the disintegration of elements it should be borne in mind that the loss of one or more electrons from the outer electronic system has no permanent effect on the atom, for other electrons ultimately fall into the atom to fill their place. In order to produce a permanent transformation of the atom it appears necessary to remove a positively charged particle or an electron from the nucleus of the atom. This can only be effected by agencies which are able to penetrate the nucleus or to pass very close to its structure.

A number of experiments have suggested that possibly helium and hydrogen may be liberated by the passage of an electric discharge through gases, but on account of the presence of these elements in many materials it is difficult to prove definitely that they arise from artificial transformation. During the last few years there has been a vigorous attack on the question whether transformation of nuclei can be effected by the action of intense electric discharges through gases or vapours. By passing a heavy current through mercury vapour, it is claimed that gold is produced in appreciable quantity. By a similar mode of procedure it is stated that lead can be converted into mercury. For obvious reasons, it is very difficult to be certain that the elements observed were not originally present in some form in the material subjected to the electrical discharge. In the cases mentioned above, we should have expected that the gold or mercury would have a different atomic weight from ordinary gold but definite evidence on this point is not yet available. The whole question whether transformation of atomic nuclei can be produced in such a comparatively simple way and on such a large scale is still *sub judice.* The energy of the electrons in the discharges used is in general small compared with that of the α particle, with the aid of which transformations on a minute scale were first shown.

The α particle expelled from radium is one of the most concentrated sources of energy known to us, and on account of its speed should be able to penetrate the structure of the nuclei of many of the lighter atoms, and still retain sufficient energy to disrupt the bonds that hold the parts of the nucleus together. In the case of an atom of high nuclear charge the α particle may lose so much of its energy in approaching the nucleus that it may be unable to effect its disintegration. It has been found that when α particles pass through hydrogen or any material containing combined hydrogen, some of the particles pass so close to the hydrogen nucleus that they set it in swift motion. These swift hydrogen atoms can be detected by the scintillations they produce on a zinc sulphide screen. This is purely a case of collisions of atomic nuclei, and the speed of the H atom set in motion can be calculated by the ordinary laws of mechan The maximum range or distance of penetration of such a part is about four times that of the incident α particle.

In a similar way other nuclei must be set in swift motion their collision with α particles, but it can be calculated that most cases such nuclei are unable to travel as far as the α pa cle, and thus remain undetected amid the great number of i dent α particles.

Rutherford showed that when a strong beam of α partic passes through oxygen or carbon dioxide, only a few H atoms a penetrating type are present and these appear to have th origin in the radioactive source. When, however, the rays p through dry nitrogen, a much larger number of penetrat particles is observed. By bending these particles in a magne field, it is clear that these swift particles are not charged ato of nitrogen but projected hydrogen nuclei. These H partic are detected by the scintillations they produce in falling o screen of zinc sulphide, and progress in this line of work has b much facilitated by the designing of special counting microsco of wide aperture which have a large field of view. Rutherf and Chadwick found that in addition to nitrogen, swift H pa cles are liberated from boron, flourine, sodium, aluminium a phosphorus. By a variation in the method, similar H partic but of lower speed, were observed from neon, magnesium, s con, sulphur, chlorine, argon and potassium. Kirsch and Pett son claim that H particles are also liberated from carbon a oxygen, but this question is still *sub judice.*

It seems clear that these H particles are liberated from nuclei of these elements by the bombardment of α particles a in a sense we may say that these nuclei have undergone a nucl transformation with the ejection of a proton at high speed. I elements like B, N, Na, Al, P, the velocity of expulsion of the particles is in all cases greater than that for a free H atom i close collision with an α particle. For example, using α partic of range 7·0 cm. in air, ordinary H atoms can not travel furt than 30 cm. of air. On the other hand, the H particles liberat from nitrogen travel 40 cm. and from aluminium 90 cm. It thus certain that H particles observed from the elements giv above cannot be due to the presence of ordinary hydrogen an impurity. In the case of aluminium, a few of the H partic are released with more energy than that of the α particle whi effects their release. No certain evidence has yet been observ that other types of particles are set free in these disintegrati collisions. It might have been expected that nuclei of mass 2 3 or 4 should also appear in some cases, as there is some eviden that secondary units of this kind go to build up atomic nuclei.

It is of interest to note that the protons set free by the α p ticles appear to be ejected equally in all directions, although th speed is somewhat greater in the forward direction of the α p ticle. This difference is no doubt due to the fact that the bo barded nucleus is set in motion by the collision.

It is difficult to be certain of the mechanism of these collisio and in particular whether the bombarding α particle is captur by the nucleus when the proton is liberated. By photographi several hundred thousand tracks of α particles in nitrogen by t Wilson method, Blackett has observed a number of collisio involving the escape of a high speed proton. There is, howev no trace of the α particle after the collision, indicating that it captured by the nucleus. If this be the case, the nucleus gai an α particle of mass 4 and loses a proton of mass 1. No defin evidence of the mechanism of the collision is as yet available f the other "active" elements.

It should be borne in mind that the disintegration observed this way is on an exceedingly small scale. Not more than particles in a million get sufficiently close to a nucleus to relea an H atom. It seems clear, however, that while the ordina atom is undoubtedly very stable, its disintegration can be broug about by the aid of sufficiently powerful agencies which are ab to penetrate its structure. As already pointed out, there a strong reasons for believing that the helium nucleus is a ve stable structure which cannot be broken up even by the swifte α particle at our disposal.

While it is reasonable to suppose that all the elements have een built up by combinations of protons and electrons, there as in 1925 little evidence to throw light on the conditions neces- ary to lead to the formation of complex nuclei. No doubt, how- ver, this process of aggregation has gone on in the past, and may ill be in progress under favourable conditions, if not on this arth, at any rate in some of the stars. (E. Ru.)

MAUDE, SIR FREDERICK STANLEY (1864–1917), British oldier, son of Gen. Sir Frederick Maude, V.C., was born at ibraltar June 24 1864. He entered the Coldstream Guards in 84, took part in the Suakin operations, 1885, and joined the aff College in 1895. In the South-African War, as brigade- ajor of the Guards Brigade, he took part in the advance to retoria. After a spell in Canada as military secretary to the overnor-general, he took an active part in the development of e organisation and training of the new Territorial Force. On obilisation in Aug. 1914 he was posted to the staff of the III. rmy Corps and served in France until June 1915. In Aug. he as hurried out to the Dardanelles to take up command of the th Division. There he played a conspicuous part in the evac- tions of Suvla and of Helles, and in 1916 his division was dis- tched from Egypt to Mesopotamia to aid in the relief of Kut- -Imara. They arrived in time to bear a share in the final esperate endeavours to save the doomed stronghold, but the ort came to naught and after the surrender of Kut-al-Imara, aude and his division remained facing the Turks on the Tigris. e was advanced in Sept. to the position of army commander Mesopotamia.

Realising that victory in this theatre of war must hinge on ective organisation and adequate preparation, Maude spent ree months at Basra, ensuring that when the time came his ld army should be capable of acting with vigour and decision. en, when all was ready early in Dec., he suddenly pushed rward and within a few weeks had driven the Turks in con- sion out of their entrenched camp around Kut. Moving re- tlessly on, and making great captures, he occupied Baghdad arch 11. He spent the next few months consolidating his sition and preparing plans for a fresh offensive. He was, wever, struck down by cholera, and died at Baghdad Nov. 18 17. His conquest of Mesopotamia and his transformation of a pressing situation into one of signal triumph ranks as one of e finest feats in modern military history. (*See* MESOPOTAMIA, ERATIONS IN.) See Maj.-Gen. Sir C. E. Callwell, *Life of Sir nley Maude* (1920).

MAUNOURY, MICHEL JOSEPH (1847–1923), French soldier, s born at Maintenon (Eure-et-Loir) Dec. 11 1847. Com- ssioned to the artillery from the École Polytechnique in 1869, saw service in the Franco-German War, and in 1883 was ced on the staff at the military school of St. Cyr. He retired 1912, having been military governor of Paris and a member the Conseil Supérieur de la Guerre. On Aug. 19 1914 he was en charge of the army improvised in Lorraine from the erve divisions, and was entrusted with the investment of tz. On Aug. 24 he made a brilliant attack on the left flank he V. German Army; and when, on Aug. 26, a new VI. Army s assembled on the Somme, the command was given to Gen. unoury. It was this army, which, on Sept. 4, was launched inst the flank of Von Kluck's I. Army—an action which opened exercised a decisive influence on the battle of the Marne. unoury continued to command the VI. Army throughout development of the Aisne line of battle and in the early ses of trench warfare. On March 15 1915 he was severely nded, and thereafter held no active command. From v. 1915 till March 1916 he was Governor of Paris. He died March 28 1923 and was created marshal of France post- nously.

AURA, ANTONIO MONTANER (1853–1925), Spanish states- , was born in Palma de Mallorca May 2 1853. He was cated at Valencia and Madrid where he studied law. Though pronunciation of Spanish was first defective, by perseverance force of personality he became in later years a great forensic parliamentary orator. Elected deputy for his native city in 1881, he joined the Liberal party; but his instincts were conservative and in 1901 he went over to the Conservative party of which he eventually became leader. He was a constructive statesman, and though the chaotic state of the Spanish political fabric inspired in him a desire for reform, he always regarded the constitution as sacred. In 1903 he became Prime Minister, and his zeal for reform made him many enemies among the corrupt political factions of Spain. He negotiated with France on the subject of Spanish rights in Tangier and Morocco and with Great Britain concerning the *status quo* of the seas. In 1913 he resigned the leadership of the Conservative party, but, in response to appeals from the king, he formed governments in 1918, 1919 and 1921. True to his constitutional ideals, he refused to make common cause with the Directorate of 1923 which superseded parliamentary government in Spain. He died Dec. 13 1925.

MAUREL, VICTOR (1848–1923), French singer (*see* 17.907), died in New York Oct. 23 1923.

MAURICE, SIR FREDERICK BARTON (1871–), British soldier, was born Feb. 1 1871, and was commissioned in the Sherwood Foresters (Notts. and Derby Regiment) in 1892. He saw service in the Tirah campaign 1897–8 and the South African War 1899–1900 and from 1904 until 1914 held a series of general staff appointments, the last year as instructor at the Staff College. On the outbreak of the World War he was appointed General Staff Officer (1st grade) to the 3rd Div., British Expeditionary Force. He became brigadier-general, general staff, in 1915 and the same year he was advanced to the post of Director of Military Operations at the War Office. Here he was, during the middle period of the War, the intimate and valued assistant of Sir William Robertson, until the latter's resignation early in 1918. After the spring disasters Maurice wrote a letter to the Press challenging the accuracy of ministerial statements, considering them an attempt to shift the responsibility on to the army when several hundred thousand troops were retained in England to guard against a hypothetical invasion. By this act of moral courage he fulfilled his sense of honesty at the sacrifice of his career. Retired for the breach of discipline he became a military correspondent, and after the War, as Principal of the Working Men's College, St. Pancras, London, and Vice-President of the British Legion, was prominent in social work. His publications include *Forty Days in 1914* (1920); *Lord Wolseley* (with Sir George Arthur, 1924); *Robert E. Lee, the Soldier* (1925). (*See* WESTERN FRONT.)

MAURITANIA (*see* SENEGAL, 24.643).—This region of French West Africa, between the Senegal river and Rio de Oro, was constituted a colony in 1921. The area, including Saharan regions, is 154,000 sq. miles. The population, mostly Moors, *i.e.*, tribes of mixed Berber and Arab descent, is 280,000. Port Etienne, on Lévrier Bay, Cap Blanc, created since the occupation of the country by the French, is the seat of a growing fishing industry.

MAURITIUS (*see* 17.912).—A British crown colony in the Indian Ocean, 500 m. east of Madagascar. Its area is 720 square miles. The estimated population at the end of 1923 was 381,678. An influenza epidemic swept the island during the months of May, June, July 1918 when 11,000 persons died, the death-rate in that year reaching the high figure of 64·9 per thousand. Primary education is free but not compulsory. The total number of primary schools in 1919 was 148, of which 57 were Government schools and 91 schools receiving state aid. The number of pupils on the registers was 22,120. Of the state-aided schools 67 were Roman Catholic, 10 Church of England, two Mahommedan and one Hindu. In all schools under government inspection the teaching of elementary hygiene and sanitation is compulsory.

Finance and Trade.—The highest figures for the revenue of the colony were reached during the financial year 1920–1 when the total revenue was rupees 40,168,210; expenditure in the same year was Rs. 24,729,510. Figures for subsequent financial years were:—

	1921–2 Rs.	1922–3 Rs.
Revenue	25,599,994	23,547,734
Expenditure	26,307,658	22,031,176

At the close of the financial year 1923 the public debt of the colony was £1,265,724.

Sugar production remains the principal industry of the colony, the total average under sugar cultivation being in excess of 175,923 acres. A record sugar crop was produced during the crop year 1918–9 when the output of the sugar factories was 252,772 metric tons; the output for 1923–4 was 195,356 metric tons. The production of aloe fibre ranks next to sugar in order of importance; rum, copra, coconut oil are other products that have shown an increase. Increased attention has been given to tobacco growing and the cultivation of tea has progressed. Lectures and demonstrations in modern agricultural methods are given by the Government agricultural instructor. The total trade of the colony reached record figures during 1919 when the combined values for the year were Rs. 174,843,348—imports Rs. 47,037,024, exports Rs. 127,806,321. Imports for 1923 were valued at Rs. 76,835,565 and exports Rs. 69,841,935.

The total mileage of the railways on the island in 1923 was 144 miles. The Mauritius Govt. railway main line gauge is 4 ft. 8½ inches. The short Bois Chéri light railway has a 2 ft. 6 in. gauge. The mileage of telegraph lines in 1923 was 415½ m., and of telephone lines 169¼ miles. Cable communication is maintained with Zanzibar, Australia, Réunion, Madagascar, Durban and other places.

See A. Macmillan, *Mauritius Illustrated* (1914); also *Colonial Office List* (Annual Series, London); *Mauritius Blue Book* (Annual, Mauritius). (H. C. WA.)

MAURRAS, CHARLES (1868–), French writer and politician, was born at Martigues, Provence, of a royalist family. He first became prominent through his literary criticisms in the *Revue Encyclopédique* and the *Gazette de France*. He was at first the only Royalist on the staff of the *Action Française*, but soon converted almost all his colleagues. After visiting Greece and Italy he published *Trois idées politiques* (1898); *Les amants de Venise* (1902); and *L'avenir de l'intelligence* (1905). This was his most productive period, during which his royalist propaganda exerted a powerful influence; he assisted Léon Daudet in transforming the *Action Française* into a daily paper, which took place in 1908, and soon became engrossed in journalistic work. In his *Kiel et Tanger* (1910) he criticised French foreign policy, while *Le dilemme de Marc Sangnier* (1906) dealt with religious problems. Though an avowed atheist, Maurras somewhat paradoxically favoured an alliance with the Catholic Church which he regarded as closely connected with the monarchy. And indeed the *Action Française* lost considerable influence when the French clergy withdrew their support and defeated Daudet during his candidature for Parliament in 1923 and 1925.

During the War Maurras worked for the disintegration of Germany and for an overwhelming victory for France. His war articles appeared in eight volumes entitled *Les conditions de la victoire* (1915–20). Though his polemical writing injured his literary fame, Maurras nevertheless gained the reputation of being one of the most accomplished of modern French authors; and his critical works, such as *L'ètang de Berre* (1915); *Le conseil de Dante* (1920) and *L'allée des philosophes* (1924) are written in restrained but powerful prose. His poems, often of great beauty, were collected in *La musique intérieure* (1925). Though the writings of Maurras produced a profound effect on French thought, his influence on practical politics has been but slight; for his political theories suffer from extremism and exaggeration, both characteristics of his race. His nationalist ideas failed to take deep root in his own country, but they triumphed in Italy; and *L'Idea Nazionale* with its fascist doctrines owed much to the *Action Française*. The French movement with which the name of Maurras is associated may be regarded as an inchoate Fascism; a minor intellectual revolution, which has not developed into any great political upheaval. Among Maurras' many works may be mentioned the following: *Jean Moréas* (1891); *Le chemin de paradis* (1894); *Anthinéa* (1901); *L'enquête sur la monarchie* (1900–9); *La politique religieuse* (1912); *Quand les Français ne s'aimaient pas* (1916).

MAX, ADOLPHE (1869–), Belgian politician, was bo in Brussels Dec. 31 1869. From 1894 to 1903 he was successive provincial councillor of Brabant, councillor of the Commune a alderman of Brussels, and finally burgomaster (1909). In 19 when the German troops entered Brussels he refused to perfor his duties under the authority of the German governor, a demanded complete freedom of action. He protested vigorous against the abuses of the army of occupation, and fought wi indomitable energy for the rights of his fellow subjects, and f the reduction of the heavy taxes and requisitions which we imposed on the town. He further founded a central committee deal with supplies which, under the name of *Le Comité Nation* rendered invaluable services to his countrymen. But the Germ authorities soon took exception to his spirited resistance, a on Sept. 26 1914 he was arrested and imprisoned in the fortre of Namur, and from there was sent into Germany, where he w closely confined. On Nov. 13 1918 he succeeded in escaping a returned to Belgium, where he was welcomed with delirio enthusiasm. M. Max was elected to the Chamber of Represen atives in 1919; he was made minister of state on Nov. 21 191 and was also elected member of the Belgian Academy.

MAXIM, SIR HIRAM STEVENS (1841–1916), Anglo-Americ engineer and inventor (*see* 17.918), died in London Nov. 24 191

MAXIMILIAN (1867–), Prince of Baden, born June 1867 at Baden-Baden, was a son of Prince William of Bade As the nearest agnate to the reigning grand duke, of whom he w a cousin twice removed, he was heir presumptive to the gra ducal throne. From 1907 to 1918 he was president of the Fir Chamber of the Baden Diet. During the War Prince Max d much to improve conditions for British prisoners in German as also for German prisoners, especially in Russia. On Oct. 1918, when the old military and political system in Germany w on the verge of collapse, he was appointed Imperial Chancello It fell to his lot to initiate the negotiations for the Armistice, a also to carry through in hot haste those alterations in the o constitution which had long been demanded by the Liberals a the Socialists, but which now came too late to avert the fate the Empire and the Prussian Monarchy. It also became his dut to put pressure upon the Emperor in order to induce him abdicate. As the Imperial decision was delayed from day to da and the revolution became imminent, he declared on Nov. 1918 the abdication of William II. as German Emperor and King of Prussia. It was clear that the Hohenzollern dynast was doomed; and Prince Max handed over the Government the majority Socialist leader Ebert, who became the presider of the German Reich. He continued, after the abdication of th grand duke, to reside at Karlsruhe. (*See* GERMANY.)

MAXSE, SIR IVOR (1862–), British soldier, was bor Dec. 22 1862 and was commissioned in the Royal Fusiliers i 1882, transferring to the Coldstream Guards in 1891. He serve in the Sudan campaigns 1897–9, during which he gained th D.S.O., and in the Boer War 1899, as staff officer to Mounte Infantry and as commander of the Transvaal Constabular after the capture of Pretoria. From 1902–10 he was regimenta commander of the Coldstream Guards, and on the outbreak the World War he went to France in command of the 1st Guard Brigade, which he led during the retreat from Mons and in th battles of the Marne and the Aisne. In Oct. 1914 he was pro moted to the command of the 18th Division. He brought thi division to France in 1915, and his unique training methods bor fruit in the battle of the Somme, where the 18th Div. obtaine an opening success in brilliant contrast to the fate of othe divisions on the tragic July 1 1916. As a consequence his pro motion to command of the 18th Army Corps followed in Jan 1917, and this he led with distinction down to, and including, th St. Quentin battle in March 1918. In 1917 he was created K.C.B

The British Army was so sorely shattered in resisting th German offensive of 1918 that its reconstruction and trans formation into the irresistible striking force of the autum appears almost a miracle. In the glory of this achievement Si Ivor Maxse has a notable share. The need for a unified direction of training was realised and he was chosen to be inspector-genera training to the British Armies in France. By the development of the new tactics of infiltration and manoeuvre, by the proved co-operation between the different armies, and by new elasticity of tactical handling, his work is engraved in the ounding success and low casualty list of the army during the vance to victory. After the War, at the hand of the Northern mmand 1919–23, Maxse's influence in recasting the training infantry and in making tactics intelligible to the novice was marked as his practical achievement in the reorganisation of depôt system. Dynamic in thought and energy, receptive to as, and generous in his support of youthful ability, he had a ius for training which was reminiscent of the influence of John Moore, a century before. Sir Ivor contributed to this cyclopædia the article INFANTRY.

IAYO, CHARLES HORACE (1865–   ), American surgeon, born at Rochester, Minn., July 19 1865. After studying at Rochester High School, Northwestern University and the cago Medical College (M.D. 1888), he began the practice of gery at Rochester, Minn., and with his brother became sur- at the Mayo Clinic. He made a special study of goitre, as a result succeeded in reducing the death-rate in this class ases by half. He has published a number of papers on surgical cs in medical journals. He was elected president of the nesota State Medical Society in 1905, president of the ical section of the International Tuberculosis Congress in 3, and president of the American Medical Assn. in 1916. He appointed Mayo Foundation professor of surgery in 1915. ing 1917–8 he was president of the examining board of icants for commissions in the Medical Corps, having super- on over several states, including Minnesota. In 1918 he was ointed colonel in the Medical Reserve Corps, U.S.A., and a year was associate chief consultant for surgical service. nning with 1912, graduate courses in medicine were offered he Mayo Clinic in Rochester. Early in 1915 he and his her incorporated the Mayo Foundation for medical educa- and research at Rochester, and to it the brothers gave 00,000. In June of the same year, by mutual agreement, the s and resources of the foundation were placed under the ction of the regent of the University of Minnesota for promot- "graduate work in medicine and research in this field." Sept. 13 1917 the Foundation, with its fully-equipped staff, ratories and clinics in Rochester, became a department of university. (*See* SURGERY.)

AYO, WILLIAM JAMES (1861–   ), American surgeon, was at Le Sueur, Minn., June 29 1861. He was graduated in cine from the University of Michigan in 1883 and began the ice of surgery in Rochester, Minnesota. A small hospital organised under the local branch of the Sisters of St. cis, which developed into St. Mary's Hospital. Here he, his younger brother, Charles Horace, developed the Mayo c (organised 1889), which became famous throughout the l for the number and success of operations performed. The ds of operations have been so carefully and accurately and preserved that they form a valuable asset to medical ce. Though the clinic has contributed no discovery of new ods or new cures for diseases, all modern methods have covered and reduced to their ultimate accuracy. Accuracy een the keynote to the Mayos' success. Goitre, gall bladder, ndix and gastro-intestinal operations constituted the great ity of the cases, and the proportion of deaths to the total er of patients operated upon was remarkably low. Dr. Mayo specialised in the surgery of the stomach, and pub- a large number of papers on gastric surgery and kindred . He was elected president of the Minnesota State Medical y in 1895, and in 1907 was appointed a regent of the Uni- y of Minnesota. He was elected president of the Society for al Surgery in 1911, and the following year president of the ican Surgical Association. On America's entrance into the l War he was appointed a colonel in the Medical Corps, Army, and chief consultant for surgical service, alternating his brother, C. H. Mayo, in this capacity. In 1919 he was led the medal for distinguished service. (*See* SURGERY.)

MAYOR, JOHN EYTON BICKERSTETH (1825–1910), British classical scholar (*see* 17.937), died at Cambridge Dec. 31 1910.

MEAD, LARKIN GOLDSMITH (1835–1910), American sculptor (*see* 17.945), died at Florence, Italy, Oct. 15 1910.

MEASLES: *see* INFECTIOUS FEVERS.

MEASUREMENTS (*see* 18.134).—The science of measurement is in practice restricted to mean measurement of the three fundamental quantities, mass, length and time, from which all other quantities, such for example as volume, density, velocity, acceleration, force and power, are derived. The problem of measurement of these three fundamental quantities presents itself primarily as a question of providing suitable units of reference against which other quantities whose values it is desired to measure may be compared.

Importance of Metrology.—On the purely scientific side all other scientific quantities are ultimately definable in terms of the three fundamental quantities with which metrology deals, and every quantitative determination resolves itself in the last resort into a measurement of one or other of these quantities. If "science is measurement" then without metrology there is no science. Even in its most direct application it covers a very wide field (*see* MENSURATION [15.134]; SURVEYING; GEODESY; EARTH, FIGURE OF THE [8.801]; MICROMETER [15.38]; TOOL, PART 13 [27.43]; MEASURING INSTRUMENTS; TIME [26.983]; CLOCKS [6.536]; WEIGHTS AND MEASURES [25.477]; WEIGHING MACHINES [25.468]; METRIC SYSTEM [15.299]). The question of the time standard, moreover, is particularly an astronomical one.

The specification of any quantity involves two factors. If we speak of three pounds, two metres, or 24 hours, in each case the complete statement consists of firstly a pure numeric, and secondly of a unit of measurement which is either the fundamental unit of reference, or a definite multiple or submultiple of it. The reference units in themselves are entirely arbitrary. There is no "absolute" standard; all measurement is relative.

Problems Involved.—The problem of metrology is twofold. First to provide and maintain unaltered the standards of reference by which other quantities are compared and measured; and Secondly to provide means by which the comparisons may be made with accuracy sufficient for the particular purpose in view. The demands of science and industry at the present day require, for certain purposes, an extremely high degree of accuracy in these fundamental comparisons, so that what, at first sight, would appear to be a fairly simple problem becomes in fact one of great difficulty, involving the most expensive and elaborate apparatus. No measurement is ever absolutely correct. Some degree of experimental error is always necessarily present, and the approximate degrees of accuracy at present attainable in certain of the more fundamental operations in metrology, are as follows:—

Comparison of two platinum-iridium copies of the International Prototype Kilogramme: 1 part in 100,000,000.
Comparison of ordinary chemical weights: 1 part in 1,000,000.
Comparison of smaller masses by micro-balance: 1 part in 100,000,000.
Comparison of two yard or metre (line or end) standards: 1 part in 10,000,000.
Comparison of end standard with line standard: 1 part in 1,000,000.
Determination of volume and density for very special work: 1 part in 1,000,000.
Determination of volume and density, ordinary: 1 part in 10,000.
Calibration of set of end standards (not less than 1 in. in length): 1 part in 1,000,000.
Calibration of subdivisions of graduated yard or metal scale in terms of whole length: 0·000005 in. or 0·0001 millimetre.

STANDARDS OF LENGTH

The history of standards of length is one of varying ascendency of three principal competing types. A length may be defined by the distance, under certain specified conditions, either between the two end surfaces of a material standard bar, or between two suitable marks engraved upon it. Alternatively reference may be made to some "natural" standard. The standard yards of Henry VII. and Elizabeth preserved in the Standards Department of the Board of Trade, are end standards, incisions marking subdivisions of the yard being secondary only. The

Elizabethan yard was superseded by one defined by the distance between two small dots on gold plugs inserted in it. When this bar was legalised in 1824, it was provided that in the event of loss it should be replaced by reference to a "natural" standard, the length of the pendulum beating seconds in the latitude of London. It so happened that within a very short period this standard was in fact destroyed by the fire in the Houses of Parliament in 1834.

The commission charged with its replacement found, however, that it was impossible to reproduce the seconds pendulum with so high an accuracy as the length of the bar itself could be reproduced by means of direct comparison with other bars which had previously been compared with the lost standard. The legal prescription was therefore abandoned, and the new standard yard, which is that legal at the present day, is a line standard constructed by comparison with other bars, without reference to any control provided by a natural standard. The metre was originally intended to be the 10,000,000th part of the earth's meridional quadrant. But it was soon found that not only was the determination of this natural standard an extremely laborious undertaking, but the accuracy attainable was less than that possible in the comparison of material standards, and the material Mètre des Archives, a platinum end standard, became the accepted standard of reference for the metric system until superseded in 1889 by the present International Prototype Metre, a platinum iridium line standard (*see* WEIGHTS AND MEASURES).

Wave Lengths as Natural Standard.—At the date of construction of the present Imperial Standard Yard, and the International Prototype Metre, sound judgment was exercised in the choice of material line standards as affording the greatest prospect of accurate comparison and reproduction and in the legal provision made for their replacement, if necessary, by reference to other similar standards periodically compared with them. Recent developments, however, have appreciably changed the situation. In the first place the experiments of Michelson, followed by those of Fabry and Perot (*see* INTERFERENCE OF LIGHT, 14.685) have finally established a natural standard (the wave length of the red line in the spectrum of cadmium) which is reproducible with accuracy at least as great as that attainable in the comparisons of material standards, which is definitely free from the suspicion of possible secular variation inevitably attaching to all material standards, and by means of which the material standards necessarily employed in everyday practice can be verified in any part of the world without the risk of accident or damage involved in the periodical transport of material national reference standards to and from the international century laboratory for purposes of comparison with the prototype. Secondly, such improvement has been effected during the last few years in the production of flat-ended standards that bars with accurately parallel ends of the quality of optical mirrors are now available, whose lengths can be more directly determined by the method of optical interference than is the case with line standards, and which are also more accurately comparable with each other than the latter.

The International Committee on Weights and Measures, at its meeting in 1923, decided in principle on the eventual adoption of a wave-length standard of length subject to the determination by experiment in the various national laboratories, of the best method of realising such a standard and the conditions necessary to ensure the greatest degree of constancy in its reproduction. Such experiments are proceeding and it is to be anticipated that within the period beginning in 1925 or 1926 a very important change may be made in the ultimate basis of reference for all measures of length.

Use of Material Standards.—Whatever ultimate basis of control may be selected, for practical purposes, in everyday measurement, material standards will always be needed. Both line standards and end standards will always be required for different purposes. So long as material standards are used for the ultimate reference the primary importance attaches to secular stability of the material. There is evidence to suggest that the present imperial standard yard has probably shortened by about
0·0002 inch since it was originally constructed in 1844; but h
remained unchanged for the last 40 years. So far as is known, t
international prototype metre has remained unchanged since i
verification (1875–9). The evidence for this rests partly
subsequent recomparison with various national copies construct
in the same manner at the same time, and partly on two dete
minations, by different methods, at an interval of about
years, the first by Michelson and Benoit, and the second
Fabry and Perot, against the wave length of the red line of ca
mium. These metre standards are all made of an alloy of 90
platinum and 10% iridium, which is now regarded as the mo
satisfactory alloy for the construction of a material standard f
purposes of ultimate reference. Its cost, however, would
prohibitive for any other purpose.

Temperature Conditions.—All materials change in size to
greater or less degree with variation of temperature. It is ther
fore essential to specify exactly the temperature at which t
material standard defines the unit of length, and further eith
to control the standard exactly to this temperature when maki
comparisons with it, or at least to ascertain its temperatu
exactly, and make allowance for its known expansion betwe
that temperature and the standard temperature. The Imper
Standard Yard is correct at 62° F., the International Prototy
Metre at 0° Centigrade. Some confusion of thought frequent
arises on this point. Each of these bars serves, at its own stan
ard temperature, to define a simple unit of pure length, that is,
absolute extension in space. These units themselves, once det
mined, are entirely independent of temperature. It is not corr
to say that either of the fundamental reference standards is
yard, or a metre, except at its appropriate temperature of defi
tion, 62° F. or 0° C., respectively, nor that a length of any oth
material is a yard or a metre solely because at 62° F. or at 0°
it agrees with the fundamental standard. A length of any ma
rial is a yard or a metre, at whatever temperature it may be, if
that particular temperature the length is equal to the unit
fined by the standard bar when the latter is at its own tempe
ture of reference. There is a definite numerical relationship
tween the two principal units which has been twice accurately
termined: in 1895 by Chaney and Benoit, with the result 1 metre
39.370113 in.; and more recently (1922–5) at the National Ph
sical Laboratory, with the result 1 metre = 39·370137 inch
The two results may be said to be in agreement within the
perimental error of the various observations involved, and
all practical purposes the simple ratio 1 in. = 25·4 mm. (equi
lent to 1 metre = 39·370079 in.) may be taken as sufficient
exact.

The use of this ratio implies that the two objects, being co
pared, are both simultaneously at their common temperature
employment. For all everyday purposes of measurement, as
example in measuring a piece of work in an engineering wo
shop, it is unnecessary to bring the object to be measured to t
standard temperature. If the work and the gauge with whi
it is being measured are made of materials having the same
efficient of expansion, and the former has been compared wi
the reference standard at the standard temperature, it is o
necessary, when comparing the work with the gauge, to ensu
that both are at the same temperature (not necessarily the stan
ard temperature) to ensure that the work will be correct
measured.

Use of Invar.—For many purposes where very precise mea
urement is involved, it is of great advantage to have a mater
with a very small thermal expansion. Two such materials ha
been discovered. The first, known as "Invar," is a nickel-ste
alloy, containing 36% of nickel, invented by Dr. Ch. Ed. Guillau
of the Bureau International (Sèvres). Different samples ha
coefficients ranging from about 1.5×10^{-6} per 1° C., for lar
bars, down to zero, or even slightly negative values, for small
bars, pendulum rods, drawn wire or rolled tape. These figur
are to be compared with 11×10^{-6} per 1° C. for steel, and 18 × 1
per 1° C. for brass. Invar, unfortunately, has one very serio
defect as a standard of length. It grows longer, rapidly at fi
and subsequently more slowly but continuously, so that aft

o years the length of a bar of invar will still be increasing at a ıte of about 1 part in 2,000,000 per annum. More recently r. Guillaume has introduced a slightly different alloy, contain- ıg a percentage of chromium in addition to the nickel, which is escribed as "stable" invar. This alloy grows at an appre- ably slower rate than ordinary invar, but still cannot be regarded constant. Invar therefore is principally useful in a laboratory, work where temporary constancy of length is the primary nsideration, or in circumstances, as for example in the case of pes and wires used for geodetic surveying, where the accurate certainment of temperature presents considerable difficulty. these cases it is necessary to return the tapes or wires to the boratory periodically for reverification. For the reasons indi- ted above, in everyday workshop measurements, gauges or ales should be made of material having a similar coefficient expansion to the work to be measured, and invar therefore ould not ordinarily be used for the construction of workshop ndards.

Fused Silica.—The other material which has a very low co- icient of expansion is fused silica, which expands only $0{\cdot}4\times10^{-6}$ r 1° Centigrade. A metre standard constructed of fused silica, in form of a tube, with parallel plates fused in at the ends on the tinised surfaces of which the defining lines are ruled, has been de and kept under observation at the National Physical boratory since 1913. So far as can be detected, no change occurred in its length.. Such a standard is extremely fragile, for this reason would hardly be adopted either as a funda- ntal reference standard or for everyday use, except in a metro- ical laboratory.

Vatural Crystal Quartz.—Reference should be made to the ent work of Perard, at the Bureau International, on end ndards of natural crystal quartz. Such standards cannot, course, be of the full length of the yard or metre. But they sent several great advantages. Firstly, since the material is of at age and the molecules of which it is composed are arranged ıcturally in definite crystallised array, there seems little pos- lity of any secular change. Secondly, it lends itself to perfect ical finish of the defining end planes, which enables direct ermination of length to be made in terms of light waves, with remely high precision resulting in a proportional accuracy no than is at present obtained in the comparison of yard or re line standards, although the largest available specimens rystal quartz, as well as the method of use, only enable such ndards to be made and verified up to a length of about 4 es.

ine Standards; Mode of Comparison.—The comparison of two line dards is effected as follows: The bars are placed side by side, on one of two parallel girders contained in a water bath, which ounted on a carriage capable of being moved in a direction endicular to the length of the bars. The bars are constructed their graduations on polished surfaces in the neutral plane eir cross section, and each is supported on two rollers spaced ıch a distance apart that the distance between its graduation ks has a maximum value. Under these conditions any changes e flexure of the bars due to slight errors in the positions of the orts can have no effect on the measured distances between graduations. Two micrometer microscopes (*see* MICROMETER, 81) are rigidly held in brackets supported in such a manner be unaffected by the motion of the carriage. Each girder independent adjustments by means of which the lines on the can be brought into focus in the field of the microscopes. The r in the bath is stirred and the temperature read by means ccurately calibrated thermometers. Readings are taken by ıs of the microscopes alternately on the defining lines of each and the mean of several independent readings is taken. The arison is repeated with each of the bars turned end for end in in order to overcome any effect of asymmetry in the illumina- of the graduation marks, and the bars are then interchanged on wo girders and the whole repeated once more, making eight lete sets of readings in all, from which the difference in length een the two bars is finally computed. In an important deter- tion several bars (say six or eight) may be included, and each e completely compared in the manner described above, against e others, the best values for the differences between all the us bars being then computed from the individual observed ences by the method of least squares (*see* PROBABILITY, 22.376), esidual errors serving to indicate the degree of accuracy which een attained in the work.

Calibration.—The calibration of the subdivisions of a divided scale is done in a similar way, except that in this case the carriage of the comparator moves in the direction of the length of the bar. The microscopes are fixed successively at a series of suitable intervals apart, for example, 1 dm., 2 dm., 3 dm., etc., and each principal interval of 1 dm., 2 dm., etc., is compared with every other interval of the same magnitude throughout the metre. By computation from the results so obtained the value of each decimetre is determined in relation to the whole length of the scale. In a similar manner each centimetre of one decimetre is compared with every centimetre of another decimetre, and as a result the value of each centimetre is found in relation to the whole of the other decimetre, and so in turn, in relation to the whole length of the metre. Millimetres are derived from centimetres in the same way, and so on. The complete calibration of a divided scale will be seen to be a very laborious process involving an enormous number of observations. The process is, however, simplified by the fact that the whole of the measurements are made on the one bar, so that, provided reasonable precautions are taken to ensure constancy of temperature, exact temperature measurements are not important.

The apparatus used to determine coefficients of expansion is similar to the transverse comparator, but has two independent water baths mounted on the carriage. One of these, containing a bar preferably of invar, is kept at a constant temperature, while the other, containing the bar under examination, is brought successively to a series of suitable temperatures. The two bars are compared under the microscopes at each temperature of the second, and so the variations of its length with temperature are determined.

A number of machines of different types, and varying sensitivity, are available for comparing end standards by contact measurement, or, if the end faces are of sufficiently perfect finish, they may be directly compared by the method of optical interference. In the latter case the two bars are brought in turn between two semi-silvered optically flat glass surfaces, and the number of wave lengths in the small spaces at either end between the measuring surface of the bar, and the semi-silvered surfaces of the optical flats are determined by direct measurement of the angular diameters of the interference rings formed by monochromatic light. This enables the fraction of a wave length to be determined with exactness, and if several different wave lengths are used in turn, whose mutual ratios are known, the whole number of waves is easily determined by deduction, as only a particular set of corresponding whole numbers will give fractions agreeing in every case with the series actually observed.

In the mechanical contact type of measuring machine the bar is measured between two opposed anvils, one of which may either be fixed, or may be movable by means of a micrometer screw, while the other is capable of a small movement operating some form of sensitive indicator. The two bars to be compared are inserted in turn between the anvils, and if the whole difference between them is sufficiently small the movement of the indicator over a calibrated scale may suffice to determine it. If the difference is greater, the indicator must be brought to a fixed mark by an adjustment of the moving anvil, the difference in length being then ascertained by the difference in reading of the micrometer wheel.

Mode of Calibration of End Standards.—The calibration of a set of subdivisional end standards is effected by taking them together in pairs of nominally equal added lengths, and comparing their sums, in the manner just described. In the last 20 years there have been developed, first by the firm of C. E. Johansson, Sweden, and later at the National Physical Laboratory, England, and by Hoke in America, methods of producing short flat ended gauges of such perfection that any two of them if put together will adhere firmly to each other by "wringing." The process of wringing is not yet fully understood, but appears to depend essentially on the presence of a very minute trace of liquid (grease or moisture) between the surfaces of the gauges. These gauges are usually made in series, *e.g.*, 1 in., 0·9 in., 0·8 in. . . . 0·1 inch. Suppose we wish to calibrate such a series, of which the 1 in. is supposed to be already known as the result of some previous calibration. For convenience we will assume that we have available a duplicate set of pieces, which we denote by 0·1′, 0·2′, 0·9 foot. To determine, for example, the value of the 0·7-in. gauge, we wring up in turn all the various nominally equal combinations indicated below, and compare them in a suitable measuring machine, the small observed differences being indicated by

0·7		=		0·7	0	0·7	0·5	=	1·0	0·2	5
0·7	0·1	=		0·8	1	0·7	0·6	=	1·0	0·3	6
0·7	0·2	=		0·9	2	0·7	0·7	=	1·0	0·4	7
0·7	0·3	=	1·0		3	0·7	0·8	=	1·0	0·5	8
0·7	0·4	=	1·0	0·1	4	0·7	0·9	=	1·0	0·6	9

Adding up all these equations we see that the sums of the second columns on either side cancel out, and we get

$$10\times0{\cdot}7 = 7\times1{\cdot}0 \quad {}^{9}_{0}$$

or

$$0{\cdot}7 = \frac{7}{10}\times1{\cdot}0 \quad \frac{1}{10} \; {}^{9}_{0}$$

The sizes of each of the other pieces may be determined in a precisely similar manner.

It may be noted that in the determination of sizes in this manner, the length of each gauge is automatically associated with the thickness of one wringing film, which, for clearness in conception, may be regarded as representing half a film thickness on either end surface, so that when two gauges are wrung together a whole film is established between them. As the gauges are normally used in this manner, this result is logically what is required. The wringing films, moreover, are in any case exceedingly thin. When initially formed, their thickness depends to some extent on the viscosity of the liquid of which they are composed, but if a sufficient length of time is allowed to elapse they tend to thin down to a limiting thickness which is less than 0·000001 in. for all liquids.

There is one more fundamental operation which, whatever may be the nature of the ultimate standard adopted, will always be required in its practical application to everyday requirements, and that is the determination of the length of an end standard in terms of the corresponding line standard, or vice versa. This is a matter of considerable difficulty, and several methods have been employed for the purpose. Probably the best method is that introduced by Mr. H. L. P. Jolly, formerly of the National Physical Laboratory, and now of the Ordnance Survey Department, Southampton. It involves the use of an intermediate end standard, and of two special parallel faced end blocks, which can be wrung on to the ends of this standard.

Each of the end blocks carries graduation marks as shown on its polished upper surface. The composite bar is compared in the ordinary way in a comparator, with the standard line bar. Each of the end blocks is turned round in turn, and re-wrung on the end of the bar, and the comparison repeated. We thus obtain the four results:—

$$\begin{aligned} L \quad a_2 \quad b_1 &= S_L \quad 1 \\ L \quad a_1 \quad b_1 &= S_L \quad 2 \\ L \quad a_1 \quad b_2 &= S_L \quad 3 \\ L \quad a_2 \quad b_2 &= S_L \quad 4 \end{aligned}$$

or, adding and dividing by 2

$$2L \quad a_1 \quad a_2 \quad b_1 \quad b_2 = 2S_L \quad \tfrac{1}{2} \quad 1 \quad 2 \quad 3 \quad 4$$

Each of the end blocks is then removed in turn and the other wrung centrally on the end of the bar, the new combinations being compared in a measuring machine with the end standard end bar, with the results

$$\begin{aligned} L \quad a_1 \quad a_2 &= S_E \quad 1 \\ L \quad b_1 \quad b_2 &= S_E \quad 2 \end{aligned}$$

or adding

$$2\,L \quad a_1 \quad a_2 \quad b_1 \quad b_2 = 2\,S_E \quad 1 \quad 2$$

From this equation, and the one previously found, we obtain the result

$$2\,S_L \quad \tfrac{1}{2} \quad (1 \quad 2 \quad 3 \quad 4) = 2\,S_E \quad 1 \quad 2$$

which gives us the desired value of the line standard S_L in terms of the end standard S_E or vice versa.

To complete our survey of the fundamental operations involved in length measurement, reference must be made finally and very briefly to the process of verifying longer measures, such as are used in surveying. In the first place a long bar, graduated in multiples of the standard length unit, is required. This is compared, yard by yard, or metre by metre, with the standard line bar, in a large comparator. This bar in turn is compared either with suitable reference marks engraved on metal studs let into a mural base at intervals corresponding to the length of the bar, or else directly with the divisions of a graduated tape. The tapes or wires after verification, either directly, or by comparison with the mural base, are used to determine base lines in the field, by comparison with temporary bench marks set up at intervals apart roughly equal to the length of the tape.

Standards of Mass.—No attempt has so far been made to define a unit of mass by means of any natural standard, though a standard of this kind, *e.g.*, a definite multiple, say, of the atomic mass of helium, would not be inconceivable. Prior to the discovery of the radioactive elements mass was regarded as the essentially constant attribute of matter, and there was no reason to anticipate any change in a material standard of mass except by actual damage due to abrasion, oxidation, hygroscopic absorption or other similar causes. And there still remains a reasonable choice of materials, which, given due care in preservation and handling, may be expected with considerable confidence to exhibit constancy of mass.

Platinum and Platinum-Iridium.—Our predecessors, ignorant of radioactive processes, were fortunate in the choice of platinum and platinum-iridium (10% iridium) as the materials of construction for the ultimate reference standards of mass, the Imperial Standard Pound, and the International Prototype Kilogramme, respectively. The degree of consistency (within 1 part in 10^8) with which recomparisons of various national copies of the kilogramme, made after the lapse of many years, have i general repeated the original determinations, speaks convincingly, not only as to the suitability of the standards themselves but as to the perfection of the balances used in the comparisons The relation between the two units, according to the best ascertained determination, is 1 kg. = 2·2046223 pounds. This valu received legal sanction.

Crystal Quartz.—Another material presenting a high degree c constancy of mass is crystal quartz. This, however, has the disadvantage of having a comparatively low density. In comparin two standard weights, masses in air, allowance must be made fo the upward buoyant effect due to the volumes of air whic they respectively displace. The less the density of the mass, th greater will be the buoyancy correction. The accuracy attaine in the intercomparison of a series of platinum-iridium standard is no doubt attributable to a considerable degree to the fact tha they all have comparatively high, and very closely equal, densities, so that the net buoyancy corrections are very smal and a comparatively rough determination of the air density consequently suffices to give the correction with negligible erro In comparing a number of masses differing appreciably in density, *e.g.*, platinum, quartz and brass, the accurate determinatio of the buoyancy correction presents much greater difficulty, an several attempts have been made to overcome it by actuall conducting the weighings *in vacuo*. This involves enclosing th whole balance in an air-tight case, and manipulating the weight entirely by mechanical means from outside, without opening th case. Leakage at the glands where the operating spindles ente the case has, however, so far proved an almost insuperable obstacle to successful weighing *in vacuo*. Everyday weighings fo commercial purposes are of course necessarily conducted in ai but the differences in buoyancy between the weights used, an the goods weighed, are negligible for this purpose. It is nece sary, however, to provide a basis for the periodical reverificatio by inspectors of weights and measures of traders' weights, whic may be of iron, brass or other materials. For this purpose "commercial" standard is employed. This standard is of bra (of density 8·143) adjusted to agree *in vacuo* with the Imperi Standard Pound of platinum. Inspectors' standards are al of brass, and all verifications of these standards, and thus ind rectly of traders' weights, are made by comparison, *in air*, wi the commercial brass pound.

Use of the Balance.—Even when weighings are not conducte *in vacuo* the construction and manipulation of a balance for t accurate comparison of primary standards of mass are distinct elaborate. It is necessary for the greatest care to be taken preserve constancy of temperature, in order to maintain a stea zero reading of the balance. For this reason the room containi the balance must be thermostatically controlled, and the observ either works entirely from outside the room, or, if he ente it, must remain at a distance from the balance, all the manip lation of the weights being effected from outside the balance ca by mechanical control operated by means of long rods, and t movement of the balance beam being observed either through telescope, or by the movement across a scale of a spot of lig reflected by a small mirror attached to the beam.

Consecutive Weighings.—To eliminate any effect due to slig inequality in the lengths of the two arms of the balance, the same time to minimise the effect of any small residual dr of zero due to a gradual change in temperature conditions a to obtain a determination of the sensitivity of the balance at t time of weighing, consecutive weighings should be made to t following order:—

Left-hand pan	Right-hand pan	Mean Reading
A x	B	p_1
A	B x	p_2
B	A x	p_3
B x	A	p_4
B x	A	p_5
B	A x	p_6
A	B x	p_7
A x	B	p_8

Here A and B are the two masses being compared, and x a small known weight which serves to determine the sensitivity. Each mass is weighed an equal number of times on each pan of the balance, and the mean time of all the weighings of each mass on each pan is the same, so that the effect of any steady temperature drift is eliminated. In weighing, the balance is not brought to rest, but the pointer, or spot of light, is observed while swinging, and the extreme positions of several successive swings to right and left are noted. From these the mean readings or rest points corresponding to each arrangement of weights on the scale pans are calculated. If, for example, four successive readings are 1 2 3 4, then, allowing for the effect of the gradual reduction in the amplitude of the swing, due to damping, the corresponding rest point, p, is $\frac{1}{8}$ (1 3 2 3 3 4).

If p be the rest point when two *equal* masses of values nominally equal to A and B are on the pans, then we have

$$\begin{aligned} A-B\quad x&=k(p_1-p) & B-A\quad x&=k(p_5-p)\\ A-B-x&=k(p_2-p) & B-A-x&=k(p_6-p)\\ B-A-x&=k(p_3-p) & A-B-x&=k(p_7-p)\\ B-A\quad x&=k(p_4-p) & A-B\quad x&=k(p_8-p) \end{aligned}$$

whence

$$\begin{aligned} 8\ (A-B)&=k(p_1\quad p_2-p_3-p_4-p_5-p_6\quad p_7\quad p_8)\\ 8\ \cdot x&=k(p_1-p_2-p_3\quad p_4\quad p_5-p_6-p_7\quad p_8)\\ \text{or } A-B&=x\,\frac{p_1\quad p_2-p_3-p_4-p_5-p_6-p_7\quad p_8}{p_1-p_2-p_3\quad p_4\quad p_5-p_6-p_7\quad p_8} \end{aligned}$$

Usually of course several masses will be compared each with each n turn, and the best values for the differences between them finally omputed by the method of least squares from all the observed ifferences obtained in the above manner.

The construction of the balance must be such as to ensure that fter each successive arrestment of the beam and pans, the knife dges are brought into exactly the same relationship with the planes, nd to secure this it is necessary to support the pans by means of a eries of crossed knife edges below each terminal knife edge on the eam. If the weighings are not conducted *in vacuo*, the air density ust be calculated for each weighing from observations of temperaure, pressure and hygroscopic state of the air, and each observed ading corrected for air buoyancy, allowing for the effect of temerature on the volumes of the weights.

The volumes, and hence the densities, of the weights are determined by weighing them, first in air, and then immersed in distilled ater, against other weights always in air. The density of the air ust be calculated as usual from its temperature, barometric essure and humidity, and that of the distilled water is known om its temperature. The difference between the two weighings, he allowance being made for the air buoyancy corrections on all e weights involved, is equal to the difference in weight between e quantities of water and air at the observed densities of each, ich would fill a volume equal to that of the weight being examined. for any reason it is considered objectionable to immerse a standard eight in water, it is possible to determine its volume, though somehat less accurately, by means of a volumenometer, which is an paratus for observing the change of pressure of the air enclosed thin a given space, when a definite change is made in its volume, stly when it is filled with air alone, and secondly when the weight enclosed within it.

The calibration of a set of fractional or multiple weights in terms the original unit can be effected by weighing together in groups of minally equal sum by a process precisely analogous to that deibed above for a set of fractional end standards.

Ordinary brass weights usually exhibit a certain variability of ss, which is probably attributable to variations of surface condin depending on the degree of humidity of the surrounding atmosere. Care should, of course, be taken to see that the metal of ich weights are made is free from porosity, and weights intended precision work should be made solid, without screwed-in tops ering holes containing adjusting material. The surfaces of high ss weights are frequently electro plated with gold or platinum, h the object of minimising the effects of oxidation and hygroscopic ion on the surface. Of the two, platinising is the preferable ocess, but weights coated with either gold or platinum have been nd to exhibit instability to a certain degree, though usually less n in the case of unplated weights. The success of gilding or tinising depends upon the care exercised to obtain a firm and hard osit.

o minimise the effects of temperature upon the action of a ance, a beam of invar may be used. But it must be remembered t invar is to a certain extent magnetic, and if results of high preon are required, care must be taken with such a beam as to ensure t it is completely screened from any possible magnetic influence. e balance should preferably be entirely enclosed within a sheet case.

or weighing very small quantities, and in particular for coming the densities of small quantities of gases, micro-balances concted entirely of fused quartz have been used. Such balances e been made both with knife edges, and preferably, with the m torsionally supported on a thin horizontal quartz fibre at t angles to its length, and the pans supported from its ends by ns of other fibres fused directly to it. The weighings are usually made by arranging a small bulb or similar contrivance at one end of the beam, counter-balanced by solid quartz at the other end. The two ends of the beam are therefore differently affected by the buoyancy of the air, and weighings are made by adjusting the pressure of the air in the balance case until the buoyancy just restores the beam to balance. The air pressure is read by means of a suitable manometer, and serves to measure the weight of the object under examination. With such balances loads as small as $\frac{1}{10}$th gramme have been weighed to an accuracy of 1 part in 10^8).

STANDARDS OF CAPACITY

Theoretically, the unit of capacity should be the same as the unit of volume—that is, the volume of a cube each of whose sides is equal to the unit of length. In practice, however, it is extremely difficult to construct such a cube with accuracy, and still more difficult to measure the internal volumes of vessels of different shapes in terms of the unit of length. Practical necessity has therefore ordained the use of a unit of capacity based on the unit of mass, rather than on the unit of length. In the metric system the kilogramme was originally intended to be the mass of one cubic decimetre of pure distilled water when at its temperature of maximum density (4° Centigrade).

Although great care was taken in the construction of the original kilogramme from this definition, and the result attained was closer than might have been anticipated in view of the difficulty of the problem, it has been found by very careful experiment that the litre, which is now defined as the volume occupied by 1 kilogramme of water at 4° C., actually equals 1·000027 cubic decimetres. The gallon is somewhat similarly defined as the volume occupied by 10 lb. of pure distilled water at 62° F. when weighed in air at a barometric pressure of 30 in. of mercury, against brass weights. As the weighing has to be made in air, and the density of the brass weights is not prescribed by the Act (Weights and Measures Act 1878) there is a certain ambiguity about this definition. On reasonable assumptions it has been calculated that 1 gallon = 4·5459631 litres.

It will be noted that in the case of the litre the definition refers to the kilogramme *mass*—that is to say, the weighings are to be reduced to vacuum, by applying a suitable correction for the difference of the air buoyancy on the distilled water and on the weights used for weighing it. This entirely eliminates the difficulty mentioned as regards the exact definition of the gallon. Much confusion of thought has, however, arisen from the preference of some chemists for the use of the so-called "Mohr's litre," which is defined, on the same lines as the gallon, as the volume occupied by 1 kg. of distilled water, when weighed in air, against brass weights, at a temperature which has never been explicitly laid down. Roughly, a Mohr's litre equals 1·002 true litres. It is very unfortunate that the term litre should have been appropriated to a unit so vaguely defined and which differs from the true litre by an amount that, although small, is too great to be negligible. For most purposes the difference between the millilitre and the cubic centimetre can safely be neglected.

Commercial Purposes.—For commercial purposes the gallon and the litre are both represented by material standards of capacity, constructed as nearly as possible in accordance with their respective definitions. These standards are in the form of cylindrical metal vessels with flat brims, and are filled exactly to their brims by the aid of flat glass "strikes." Comparisons with other vessels are made by transfer, the vessel under comparison being first filled and emptied to compensate for the amount of water left behind in the standard when the latter is emptied into the vessel being tested.

Scientific Purposes.—For scientific apparatus, such as flasks, burettes, pipettes, etc., where higher accuracy is needed, it is found necessary as a rule to base the verification directly on the original definition by actually weighing the quantity of pure distilled water contained in, or delivered from, the vessel, making due allowance for the temperature of the water at the time of weighing and for the buoyancy of the surrounding air. In the case of vessels, such as burettes and pipettes, which are intended to deliver, and not to contain, definite quantities of liquid, it must be remembered that after delivery the walls are left wet to an extent which depends not only on the rate at which delivery is effected and the time allowed for subsequent drainage but also on the viscosity and surface tension of the liquid being measured. The rate of delivery is of more importance than the drainage time, and provided it is sufficiently slow the quantity of liquid delivered will be reasonably constant. Suitable delivery times and error allowances are scheduled in a pamphlet on testing volumetric glassware issued by the National Physical Laboratory.

BIBLIOGRAPHY.—The literature of metrology is somewhat scattered. The best collected account will be found in a series of articles contained in the *Dictionary of Applied Physics* (1922–3) (and in particular vol. 3 thereof), edited by Sir R. T. Glazebrook, K.C.B., F.R.S., and published by Macmillan, London. Many detailed references are given in these articles. For full descriptions of the more fundamental operations the various volumes of the *Travaux et Mémoires du Bureau International des Poids et Mesures* (Paris, Gautier-Villars) should be consulted. In addition, consult the annual reports of the Standards Department, Board of Trade (H.M. Stationery Office, London); Miller, *Phil. Trans.*, 146 (1856), on the construction of the new standard pound; Airy, *Phil. Trans.*, pt. 3, p. 17 (1857), on the construction of the new standard yard; Kaye, "A Silica Standard of Length," *Proc. Roy. Soc.*, A85 (1911); Michelson, *Light Waves and Their Uses* (Chicago University Press); C. E. Guillaume et Benoit, *La Mesure rapide des Bases géodésiques* (1908); and Guillaume, *Les Applications des Aciers au Nickel* (Paris, 1904); and *Proc. Phys. Soc.*, 32, 374; Sears, *Precise Length Measurements*, Cantor Lectures, Royal Society of Arts (1923).

(J. E. SE.)

MEASURING INSTRUMENTS.—The World War was responsible for a considerable development and improvement of apparatus intended for the measurement of engineers' gauges and products. (*See* MEASUREMENTS.)

Whitworth Gauges.—Improvement in accuracy of measurement necessarily goes hand in hand with improvement in accuracy and perfection of manufacture of the articles to be measured. The original measuring machine of Sir Joseph Whitworth would have been of little value apart from the system of accurate standards (both end gauges and cylindrical gauges) which he produced for use with it. If an object is not regularly formed to a certain degree of accuracy, it cannot be said to possess a definite measurement to that degree of accuracy, and it is useless to employ measuring apparatus capable of yielding results of still higher accuracy. On the other hand, while there is no great difficulty in designing highly sensitive indicating devices, it is practically impossible to calibrate them in the absence of standards measurable to the degree of accuracy aimed at.

Johansson's Gauges.—The first substantial advance in accuracy subsequent to Whitworth's work was the introduction by the Swedish firm of Johansson, in 1908, of flat parallel faced slip and block gauges of such perfection of workmanship that any two of them, when cleaned, would "wring" together. The gauges were made in series differing by definite small amounts, so chosen that by wringing together a suitable combination of pieces, any desired size, to the nearest 0·0001 in., could be produced. To ensure this accuracy, it is necessary that the individual pieces should each have a guaranteed accuracy of (say) 0·00001 in., in order that the cumulated error of a group of four or five should not exceed 0·00005 inch. And in order to assert with confidence that this degree of accuracy is, or is not, in fact attained in an individual piece it is necessary to be able to measure with an accuracy of the order of 0·000001 inch. When the Johansson gauges were first introduced no appliances were available which could be relied on to give measurements of this accuracy. Three entirely different methods have since been developed, however, which enable it to be done, and which, with due precautions, give mutually consistent results. These are:—

Tilting Level Comparator.—(*a*) the "tilting level" comparator, due to A. J. C. Brookes, in which the two gauges, or groups of gauges, to be compared are stood side by side on a level surface plate, and the difference in their heights is determined by the reading of a highly sensitive level, which rests by point contact upon their upper surfaces, through two ball feet.

Millionth Comparator.—(*b*) the "millionth" comparator, due to J. E. Sears, jun., wherein measurements are made between two flat parallel anvils, giving a local surface contact, the one anvil being fixed, and the other connected, through a series of spring suspensions designed to eliminate all frictional effects, with a sensitive tilting mirror which causes a spot of light to move across a scale, giving a magnified image of the displacement of the anvil on a scale of abou 30,000 to 1.

Optical Interference.—(*c*) the method of optical interferenc developed at the Bureau of Standards, Washington, wherein th whole surfaces of the gauges under comparison may be inspecte being marked out into contours of approximately 0·00001 in. difference in height by the alternate light and dark bands forming th interference pattern.

MEASUREMENT OF INTERNAL DIMENSIONS

Another matter of fundamental importance which has bu lately found a satisfactory solution is the measurement of inte nal dimensions. The transference from external to interna measurement constituted a considerable difficulty; and the size of such objects as ring gauges, either plain or screwed, wer usually estimated by the nature of their fit upon correspondin plug gauges. As the fit depends to a very marked extent upo the amount and nature of the lubricant used, considerable un certainty existed as to the correct interpretation of the observe results. If well finished and liberally lubricated with thic grease, a cylindrical plug gauge will enter and pass through ring gauge definitely smaller than itself without damage to eithe Two instruments have now been produced for the measuremen of internal diameters of either plain or screwed rings, which giv results mutually consistent, if due care is taken, and the wor being measured is sufficiently uniform in its dimensions, to th order of 0·00001 inch.

Chord Contact Type.—In the "chord contact" machine, du to G. A. Tomlinson, the diameter of the ring is deduced b calculation from the measured displacement, in a direction pe pendicular to its length, of a double ball-ended distance piece known length, which is allowed to make contact inside the rin first on one side, and then on the other side, of the diameter.

Displacement Machine.—In the "displacement" type of in ternal measuring machine, due to J. E. Sears, the position of th ring is so adjusted that measurements are made exactly acros the diameter. The ring is mounted on a carriage, which can b moved bodily in the direction of the diameter being measure by means of suitable micrometers. Contact is made first o one side of the ring, and then on the other, with a double-ende stylus attached to a sensitive indicating mechanism, and th micrometer readings are taken when the indicator reads zer The same is done in turn with a standard plug substituted f the ring, provision being made for withdrawing the stylus tem porarily as the plug passes across. If x_1 y_1 x_2 y_2 are the four m crometer readings, the displacements d_1 and d_2 are equal to x_2- and y_1-y_2 respectively, and it is to be noticed that the pressu on the stylus is in the same direction when both x readings a taken, and also when both y readings are taken, so that an possible errors due to backlash or flexure in the indicating mec anism are eliminated. The transition from external to inte nal measurement is thus directly accomplished, and the fin result is given by the equation

$$R - d_1 + d_2 - P = (x_2 - x_1) + (y_1 - y_2) - P$$

SCIENTIFIC PRINCIPLES

The question of the general geometrical principles underlyi the correct design of instruments intended to give the highe accuracy of measurement has received greater attention in rece years. Questions of the proper application of the theory kinematic constraint to ensure definite and repeatable regi ter of parts, of eliminating backlash and friction effects, of pr venting components of errors due to inevitable imperfectio of workmanship (*e.g.*, in sliding ways) from becoming effe tive in the actual direction of measurement, of the design an relationing of parts so that elastic deformations due to chan ing distributions of load do not affect the results, and so o are all involved here.

Travelling Microscope Comparator.—These various poin have been fully considered in the "travelling microscope com parator" designed by J. E. Sears, jun., for the Metrology D partment of the National Physical Laboratory. The long l of an L-shaped carriage, which bears two microscopes, is su ported on two wheels running in a V-guide along the upper side of the machine bed, so that whatever position is taken up by the carriage its form is undisturbed. The focal points of the two microscopes are arranged to lie in the extension of the axis of the micrometer screw, and the object to be measured is supported on an independent carriage which, by means of a small weight attached to a cord passing over a pulley, is held permanently in contact with a stud at the end of the screw abutment. Thus errors of straightness in the V-groove are non-effective, and so is any distortion of the base of the machine proper, due to the movement of the microscope carriage. Advantage is taken of the simple ratio 1 in. = 25·4 mm. (which is correct to within 1½ parts in 1,000,000) to obtain simultaneous readings of equal accuracy in either British or the metric system, by means of suitable gearing in the compound micrometer head. The verniers read to 0·00001 in. and 0·0001 mm. respectively. The instrument can be used either with one microscope for making direct measurements against its own calibrated micrometer screw, or, using the two microscopes as a comparator, for determining the values of the sub-divisions of short scales. It has been found of considerable value in measuring the spacing intervals of diffraction gratings.

Screw Gauges.—In the course of the War the necessity for rapid measurement of large numbers of screw gauges led to the development of special machines for the measurement of both pitch and effective diameter of screw threads. E. M. Eden, then of the National Physical Laboratory, was largely instrumental in this work and in the development of the optical projection method of examining profiles of gauges, both screws and flat templets. For the latter, he found lens combinations capable of giving an undistorted magnification of 50 times over a field of initial diameter approaching two inches. These combinations were incorporated in the now well-known "horizontal projector." For screw gauges the "vertical projector" was designed, in which the path of the light is vertical, and the image-forming rays are reflected back from an optically flat mirror overhead on to a specially prepared thread-form diagram placed on the table of the machine. The screw in this case is mounted in a carriage provided with two horizontal micrometer traverses in directions parallel and perpendicular to its axis, respectively, so that measurements of pitch and diameter can be made at the same time as the accuracy of the thread form is examined.

Wilson Projection Gauge.—Mention should also be made of the Wilson projection gauge, in which the optical system is duplicated, so that the two opposite sides of a screw can be projected simultaneously on to the screen, in such a manner that the two images of the thread intermesh, and if the screw is of direct form and size, and the apparatus correctly adjusted, exactly meet. If the screw is small a space is left between the images of its two sides; if large they overlap.

The projection method has naturally proved of great value in a number of other ways. In particular, it has been used in connection with the measurement of gear wheels and gear cutting hobs. Machines for this purpose have been designed by G. A. Tomlinson, and depend for their use on the accurate reproduction of the profiles of the teeth of the gear or hob, in the form of traces made on smoked glass, by a needle point attached to a specially designed pantograph. One of the machines is also fitted with a device for recording, in a similar manner, the relative velocities of rotation of two gear wheels when in mesh. In both cases the smoked glass, bearing the record, is put into the projection apparatus and magnified 50 times at the screen. It is found that the traces are quite sharp in the magnified image, and measurements can be made corresponding to an accuracy of about 0·0001 or 0·0002 inch on the original.

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(J. E. SE.)

MEAT: *see* FOOD SUPPLY.

MECCA (*see* 17.950), capital of the Hejaz, had a resident population of about 70,000 in 1916, including some 12,000 Indians. The annual pilgrimage brings normally at least 200,000 visitors to the city, of whom pilgrims from British India and the Malay States may number 25,000. Pilgrims have been fewer during and since the World War, owing to disturbed conditions in the Hejaz. Mecca was taken by the Arabs in 1916, and bombarded by the Turks, who damaged the Great Mosque. The Grand Sherif of Mecca, Hussein ibn Ali, of the Hushimite dynasty, proclaimed the independence of the Hejaz in 1916, and assumed the kingly title. In May 1924 he proclaimed himself Caliph, but shortly afterwards was driven from Mecca and forced to abdicate in Nov. of the same year by Ibn Saud, Sultan of Nejd, who invaded the Hejaz and entered Mecca without opposition. The holy places were not damaged by Ibn Saud and his Wahabis, who performed the customary rites in the Great Mosque.

The general aspect of Mecca, as observed during the War, had changed but little, though some modern buildings had sprung up; there were a number of stately residences, including the new royal palace of six storeys, and a considerable display of wealth. The sanitation and water supply, previously very bad, had been improved. There was telegraphic communication between Mecca and Jidda, and between Mecca and Taif, the summer residence of the king, 75 m. to the southeast. Representatives of foreign powers live at Jidda, since non-Moslems are not allowed to enter Mecca.

MECHNIKOV, ILYA (1845–1916), Russian biologist, was born at Ivanovka, in the province of Kharkov, May 15 1845. At the age of 17 he entered the Kharkov University and two years later went to Germany. In 1867 he returned to Russia and was a *dozent* in zoology both at Odessa and St. Petersburg, becoming in 1870 professor ordinarius of zoology and comparative anatomy at Odessa. In 1882 he went to Messina and there began his studies into the nature and habits of microbes. Henceforth he devoted himself to pathological study and in 1888 went to Pasteur in Paris, who gave him a laboratory in the École Normale. By 1892 his views on the essential importance of phagocytosis were firmly established. In that year he published *The Comparative Pathology of Inflammation*, followed in 1901 by his chief work, *Immunity in Infectious Diseases*, and a more popular treatise, *The Nature of Man* (1903). In later years he made a special study of the bacteria infesting the alimentary canal of man. In 1908 he was awarded the Nobel Prize for medicine. He died in Paris July 16 1916. See *Life* by his wife, Olga Mechnikov (1920), trans. by Mrs. R. L. Devonshire (1921).

MEDALS AND DECORATIONS (*see* 18.2; 15.860).—These may be divided into two classes, personal and service. Personal decorations are awarded to the individual (Victoria Cross, etc.); service decorations are awarded to all persons who participate in a common service (war medals, etc.). As a result of the World War the issue of medals and decorations was the widest ever recorded, and, of these, the best known is the Victory medal.

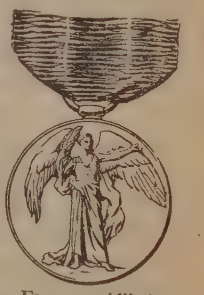

FIG. 1.—Allied Victory Medal.

In 1918 the Allies agreed to issue a collective and distinctive medal to commemorate the War. The advantages of this were that it was symbolical of the one purpose which animated the Allied troops, and that it obviated the separate issue by each nation of its own war medal to allied forces which had served with them in their own territories. Each country designed its own medal, the stereotyped features being that each medal is bronze and has on the obverse the figure of Victory, and on the reverse the inscription "The Great

War for Civilisation." The ribbon is coloured in the form of two rainbows joined together, symbolising the calm after the storm.

The following are some of the chief decorations and medals issued since 1910:—

BELGIUM.—Service. War medal, bronze, shaped like a bell or a label. Ribbon, yellow, red edges with inner separation line of black. Victory medal, Obverse, figure of Victory; reverse, Arms of the Allies.

FRANCE.—Personal. Croix de Guerre. Established 1915. Bronze cross with crossed swords in angles. Ribbon, green, seven narrow red stripes. *Service.* War medal. Bronze. Ribbon, red and white stripes. Clasp, " Engagé volontaire " to non-conscripts. Victory medal. Obverse, figure of Victory; reverse, inscription (see above).

GREAT BRITAIN.—Since 1910 the following have been issued: *Personal.* Distinguished Service Medal (Navy), 1914. Ribbon, blue, two white bars in centre. Military Cross (Army), 1914. Ribbon, white, central purple stripe. Military Medal (Army), 1916. Ribbon, dark blue, in centre two crimson and three white alternate stripes. Distinguished Flying Cross, 1918. (Royal Air Force). Ribbon, violet and white broad diagonal stripes. Distinguished Flying Medal, 1918. (R.A.F.). Ribbon, violet and white narrow diagonal stripes. (The above two decorations are for active flying against the enemy.) Air Force Cross, 1918. (R.A.F. and civilians.) Ribbon, red and white broad diagonal stripes. Air Force Medal, 1918. (R.A.F. and civilians.) Ribbon, red and white narrow diagonal stripes. (The above two decorations are for distinguished service to aviation in actual flying.) Recognition Medal. Silver and bronze medals were issued to allies who had rendered service to British Prisoners of War and others behind the enemy lines. Ribbon, yellow; red, white and black edges, blue central stripe. *Service.* Naval General Service Medal, 1915. Ribbon, white, crimson borders and two crimson stripes in centre. African General Service Medal. New issue 1916. Ribbon, black, green and yellow (never seen without a clasp). 1914 Star. Bright bronze. Ribbon, red, white and blue, shaded and watered. Clasp, " 5th Aug.—22nd Nov. 1914." 1914–5 Star. Similar to above, same ribbon, no clasp. War Medal, 1919. Ribbon, orange, narrow stripes of white, black and blue at each edge. Clasps sanctioned for navy, but not for army. Victory Medal. Obverse, figure of Victory; reverse, inscription (see above). Oak leaf on ribbon for one or more mentions in despatches. Mercantile Marine War Medal. Bronze. Ribbon, green and red, separated by narrow white central stripe. Territorial War Medal. Bright bronze. Ribbon, yellow, two green stripes. Special Constabulary Long Service Medal. Bright bronze. Ribbon, red, white and black. Clasp, " The Great War, 1914–1918." General Service Medal (Post War). Ribbon, purple, with green central stripe; clasps for service in Persia, 'Iraq and Kurdistan.

ITALY.—Service. War Medal. Bronze. Eighteen stripes of red, white and green. Clasps bearing date of each year. Victory. Conforms to standard specification.

JAPAN.—Service. Victory Medal. Obverse, a Japanese figure of Victory.

RUMANIA.—Service. War Medal. Cross in black bronze, relieved in bright bronze. Ribbon, green with three blue stripes. Victory Medal. Conforms to specification.

UNITED STATES.—Personal. Distinguished Service Cross, Army, 1918. Ribbon, blue; red and white edges. Distinguished Service Medal, Army, 1918. Ribbon, white; red edges, narrow blue separation line. Distinguished Service Medal, Navy. Ribbon, blue, narrow yellow central stripe. Navy Cross. Ribbon, blue, narrow white central stripe. *Service.* Victory Medal. Bright bronze. Obverse, figure of Victory; reverse, design with shield and fasces and names of Allies. Battle Clasps are awarded. The only Service Medal issued by the United States to commemorate service in the World War. (A. V. W.-H.)

MEDICAL EDUCATION (*see* 18.23a).—A sound general education is necessary for the medical as for all other professions.

I. IN GREAT BRITAIN

In Great Britain before admission to a course of training a boy or girl is required to show in an examination of matriculation, character and standard that he or she has acquired a respectable knowledge of English, a language other than English, mathematics and some other school subjects of the candidate's own selection. Latin is no longer exacted by the General Medical Council (G.M.C.) although in certain universities it is compulsory for students who desire to obtain a medical degree. But the ordinary school subjects are not the only instruments available for the development of intelligence. Physics, chemistry, biology, when well taught also strengthen the mind and develop the faculty of observation which for a doctor is of paramount importance.

The General Council of Medical Education and Registration does not determine directly the requirements of the various licensing bodies, but exercises a measure of control over the doctor's training by deciding the conditions precedent to registration, first as a medical student and finally as a qualified practitioner. Since 1922 the G.M.C. has required an examination in physics and chemistry be passed by him before registration. The gain is two-fold. His school work more efficiently prepares the boy for his profession, and more time is made available in the brief five years, which is the most that can be exacted as a minimum between registration as a student and registration as a qualified practitioner. The council also allows the student to pass the examination in biology immediately after registration. The curriculum recognised as medical carries the student through a succession of stages which merge insensibly one into the other, until his accumulated knowledge and steadily increasing skill justify the conferring upon him of a degree or diploma which admits him to all the responsibilities of medical practice. It is impossible to over-emphasize the statement that the several steps " merge." They are not stepping stones. No subject is left behind when the passing of an examination qualifies a student to approach the next. The examination tests his fitness to approach subject B whilst still carrying forward subject A.

Stages of the Education.—These stages may be defined as (1) The study of the structure of the body and of its behaviour in health, anatomy (*q.v.*) and physiology (*q.v.*), to which two years are assigned. (2) The study of the behaviour of the body when perturbed by abnormal conditions, by malformations, by injury (*see* PATHOLOGY), by the invasion of parasites (*see* PARASITOLOGY) ranging from ultra-miscroscopic " germs " (*see* FILTER-PASSING MICROBES) to intestinal worms, an extension of physiology into the domain of disease. (3) The study of physiological changes which result from the administration of various chemical substances, " drugs," already anticipated by the study of the " drugs " which, in health, various organs pour into the circulation, internal secretions (*see* ENDOCRINOLOGY). (4) The study of the possibilities of modifying the behaviour of the body, when diseased, in a beneficial way by administration of drugs. (5) The proper management of the body in health, preventive medicine. (6) The care of the sick and of women in childbirth.

At all periods medical education has been adapted to the knowledge and practice of the age. Since Pasteur revealed the true cause of the large majority of diseases—the invasion o the body by micro-organisms—the science of medicine may al most be said to have come into existence. Corresponding modi fications of the medical curriculum have consequently been called for, and many have been adopted—always with a certain lag. Since 1910 much has been done in adapting training to the new knowledge and new needs. An important change is the dis appearance from the curriculum of the subject known as *materia medica*, a subject which used to make a painful demand upon the student's memory. Long after the date at which doctors ceased to make up their own medicines, compounded of a variety of ingredients, with all the mystery of a professional secret, or wrote equally complicated prescriptions in Latin, incomprehen sible to anyone but a druggist, the student was required to know the methods of preparation and the composition of the drugs of the pharmacopoeia. He was also required to produce a certifi cate of having attended a course of instruction in dispensing at a hospital or with a qualified medical man or pharmacist. Modern pharmacology (*see* PHARMACOLOGY) recognises that the body's perturbations may be restrained by certain definite chemica substances, many of them produced synthetically. Of these th practitioner's armamentarium contains relatively few. Fo flavouring and colouring matters he no longer has much use.

The Object of Medical Training.—With the exception of th changes already referred to, developments in medical educatio are rather in the manner of presenting knowledge than in th selection of subjects to be studied. When so much of value mus be omitted, every subject included in the curriculum should b taught in the most practical way. It must be made a part of th practitioner's outfit, which he can never afford to lose. Hi knowledge of the anatomy of the living body must enable him to see its organs in their relation to one another as clearly as if it were transparent. In some degree dissecting room work has given way to surface anatomy and the study of models and frozen sections; although training in the use of scalpel and forceps is still the only means of acquiring dexterity in the surgeon's craft. In physiology, during the first year, the student is in most schools given more practical work than formerly. Beginning with the frog and passing on through isolated mammalian organs to the decerebrate mammal, he is brought in his second year more closely into contact with the human body. He learns to use methods and apparatus with which, later, he will investigate the physiological condition of the organs in disease.

The greatest changes have been introduced in the third and fourth years of the curriculum. Physiology has been extended into pharmacology, an ever-growing body of exact knowledge derived from the study, with instruments of precision, of the effects produced upon guinea-pigs and rabbits by chemical compounds of which some, like caffeine and morphine, are vegetable products, whilst others, such as phenacetin, have been prepared synthetically in the laboratory for the express purpose of modifying the behaviour of the body. When used to correct undesirable habits, these various chemical substances, with the apparatus which has been designed for the purpose of studying their effects, belong to the sphere of therapeutics (*q.v.*).

At about this stage in the student's training, bacteriology (*q.v.*), a science which is growing so rapidly as to be for the most part relatively new, claims his attention. The micro-organisms which cause disease present biological problems of the highest interest. Every medical man needs to be expert in the methods of making preparations for identification with the microscope (*see* MICROSCOPY), of preparing media and of cultivating the various organisms *in vitro*. And since the effects upon the fluids of the body which they induce can be recognised chemically, a new name, "bio-chemistry" (*q.v.*), is usually applied to the department of science in which ascertained facts are grouped together. To the physiologist and physician have been opened up the two provinces of serum and vaccine therapy and immunology (*see* IMMUNITY). Provision is made for teaching the principles of various kinds of drugless therapeutics, such as treatment with ultra-violet light (*see* HELIOTHERAPY) and with radium massage, and the demonstration of the results obtained in special clinics. Pathology (*q.v.*), formerly the post-mortem examination of patients the course of whose illness had been watched in the wards, has become more of a science. As experimental pathology, it is the study of the physiology of disease. Disturbances of function, their causes and progress, are followed by the same methods as if they were variations in the performance of the several organs during health. Autopsies confirm or modify views expressed during life regarding tissue changes which were taking place.

Clinical Units.—The most notable improvement in medical education made during recent years is the organisation of clini- l units. Physicians and surgeons still go round their wards at ated hours—usually in the early afternoon—followed by troops students to whom they point out the features of each case, expound the nature of the malady and explain the reasons for e treatment adopted. But no longer, as formerly, is the student dependent upon "walking the wards," attending lectures and reading about the illnesses of which the cases he has seen e illustrations. The clinical unit is a far more efficient training ntre. Its staff consists of a director and three or four assistants. Either the director himself or one of his assistants is a whole- me officer of the university. To the unit are assigned a number beds—usually 60 or 70—in suitable wards with adequate boratory accommodation in their near vicinity and an ample pply of apparatus for the examination of the patients and for sting their reactions. An out-patient department is included the unit. In short, it is a school in the sense in which a phys- ogical institute is a school.

Students examine chemically and microscopically the blood d excreta. They make every kind of measurement, and as the wards are open throughout the day they have the opportunity of seeing how patients should be treated, nursed and cared for in every respect. As the teachers of physiology, bacteriology, pharmacology and other subjects visit the clinic from time to time, the student learns under ideal conditions how all that he has been taught combines to fit him for his life-work, the care of the sick and their restoration as speedily as possible to health. When cared for by a clinical unit patients recover more rapidly than they used to do, and in consequence the efficiency of the hospital is increased.

The Former System Contrasted.—Until comparatively recent times students were required to attend a certain amount of hospital practice during their first two years, usually six months. This was a relic of the apprenticeship through which aspirants for admission to medical, as to legal and other professional guilds, were required to pass. In Britain, this tradition is obsolete at last. No longer is a student required, or even allowed, to listen to bedside disquisitions on maladies of which even the names may be unfamiliar, in terms which carry little meaning to his mind, or to watch the physical examination of organs of which he knows but vaguely the form and situation, and to hear of their perturbations before he knows how they function normally. Not until he knows how the body works in health is he shown how disease may disturb its harmony, or taught the remedial measures which should be adopted with a view to aiding nature to set it right. Too early contact with patients inevitably led to confused thinking and false inferences which had to be corrected by subsequent reading and observation and, it may be added, developed in the tyro a conviction that medical practice consists in "spotting" the disease and administering the drug which will "cure" it. The progressive opening-out of knowledge with the synchronous revelation of ignorance, which is the aim of the modern curriculum, avoids loss of time and secures the highest degree of qualification for the exercise of the medical profession which the limited period of training allows.

Post-graduate and Specialist Work.—As a result of the careful allocation of his time the modern student finds that he has less opportunity than his forerunners of paying special attention to any branch which may attract him. Diseases of the eye, of the throat, of the ear, of the nervous and other organs, are treated with sufficient fullness for the equipment of general practitioners, but not with the thoroughness necessary to make specialists. The student who proposes to specialise must continue his studies after graduation. An increasing number of graduates who do not propose to devote themselves to a single speciality, but wish to make themselves proficient in particular branches of their work, such as gynaecology for example, defer going into practice, or return from time to time to a medical school in order to keep abreast with advances in knowledge and technique. Post-graduation courses are more numerous and better organised than they were before the War, but they are not yet, in Britain, as complete or as intensive as they might be.

Other Countries.—In the universities of Canada and Australia and of most foreign countries, progress has followed the same lines as in Britain. A logical sequence of studies and their integration in the curriculum has been the reformer's aim. In Japan the sequence of studies is much the same as in Britain; but the minimal length of the purely medical curriculum is four years, following on a course in the preliminary sciences. French medical schools still adhere to the system which they regard as "natural." Their students are encouraged to attend clinics from the date of their inscription in the faculty, and the relegation of all lectures and laboratory work to the afternoons almost compels them to devote the mornings to attendance in the wards and out-patient departments.

BIBLIOGRAPHY.—For detailed information consult *Recent Advances in Medical Education in England*, a memorandum addressed to the Minister of Health by Sir George Newman, Chief Medical Officer; and *Medical Education, a Comparative Study*, by Abraham Flexner.

(A. HI.)

United States.—In 1900 there were in existence in America 160 medical schools, mostly in fact, if not in form, private ventures; even the few schools of high grade possessed meagre endowment and inadequate facilities. By a process of natural selection, the number of schools was rapidly reduced, having fallen in 1925 to 80, and there were grounds for the belief that this number would in the near future be still further reduced. The organisation, endowment and facilities for instruction showed a notable advance. In 1910 few medical schools actually controlled the hospitals in which their teaching was done. Subsequently there was a distinct tendency to give the university medical schools exclusive and adequate control of hospital facilities for clinical teaching and research. Harvard, Yale, Washington and other universities thus came into much more intimate relations with the hospitals in which the clinical staffs teach. The city of Cincinnati built one of the finest public hospitals in the United States and amended the city charter so as to give the University of Cincinnati (a municipal institution) complete control of the hospital for its medical school.

On the financial side, public opinion was brought to realise that the university school of medicine is an expensive enterprise, for which large investments must be made by the public in both facilities and endowment. Mr. John D. Rockefeller gave the General Education Board approximately $35,000,000 to be used primarily for the purpose of co-operating with institutions in raising large sums for the development of their medical schools, and the late Mr. Joseph R. DeLamar gave $5,000,000 each to the medical departments of Harvard, Columbia and Johns Hopkins. Upwards of $12,000,000 was raised for the establishment of a new medical department at the University of Rochester, Rochester, N.Y., and $8,000,000 was raised for the reorganisation of the medical department of Vanderbilt University, Nashville, Tennessee. Columbia University is building a new medical school, and the Presbyterian Hospital, the Sloane Hospital and the Vanderbilt Clinic are providing new clinical facilities for the use of the school, the whole involving a prospective investment of $13,000,000; so at Cleveland an admirable school and laboratory building has been constructed on a new site on which university hospitals are already being located. In this movement the state universities have participated—notably the University of Iowa, which is completing a new plant—laboratories and clinics—at a cost of $5,000,000. Many other endowed institutions also procured considerable sums for improved laboratory and teaching facilities.

In respect to organisation the main change in the period was the introduction of the full-time plan corresponding to the English unit system in the teaching of the clinical subjects. The aim and purpose of this movement are the same in both countries, but in neither had sufficient time elapsed to allow a final verdict to be passed on the merits of the system. The complete satisfaction of the Johns Hopkins Medical School in the working of this plan is shown by the fact that the system, which originally included medicine, surgery and pediatrics, has been extended so as to include gynaecology, obstetrics and ophthalmology. The system has also been adopted in the main clinical branches by the medical departments of Washington University (St. Louis), Yale University, Vanderbilt University, University of Chicago, University of Rochester, the medical clinic of Columbia University, the psychiatric, pediatric and obstetrical clinics of the University of Iowa and the neurological clinic at Harvard.

China.—Through a subsidiary board (the China Medical Board) the Rockefeller Foundation of New York has established in China a modern medical school. The Rockefeller Foundation has furnished funds amounting to $8,000,000 to build and equip the Peking Union Medical College, and in addition it was in 1921 supporting the institution on the basis of a budget for the year amounting to $500,000. The institution furnishes two years of pre-medical work, and intended to develop a four-year medical course. The China Medical Board also aids four other medical schools in China carried on by other organisations.

Belgium.—The University of Brussels had in 1921 planned a complete reorganisation of its medical department. The city, the state and the university co-operated in maturing plans for a modern teaching hospital, and new, well-equipped laboratories on a single site. (A. F*.)

MEDICAL LEGISLATION.—Since 1911 statutes have bee passed in many countries creating or reorganising the centr public health authority. The Ministry of Health for Englar and Wales created by the Act of 1919, took the place of the Loc Government Board with all its powers and duties and, as r gards public health, also those previously exercised by the Boar of Education and other departments. Power was further create to transfer from the Ministry duties which were not incident to health.

Ministries of Health have also been established in Canac (1919), the Union of South Africa (1919), Poland (1919 New Zealand (1920), France (1920) and Rumania (1923). Dept. of Public Health for the Commonwealth of Australia wa created in 1921, and a General Directorate of Public Health i Spain, by a Royal Decree of 1922.

Zymotic Diseases.—In Australia, New Zealand and the Unio of South Africa comprehensive regulations regarding the not fication and control of infectious diseases were included; simila regulations were issued in Austria (1913), the Straits Settlement (1915), Peru (1916), Chile (1918), Sweden (1919), Brazil (192 and Venezuela (1921). A Polish law of 1920 created the offic of Special Commissioner for dealing with epidemics, and a Frenc decree of 1920 instituted a mobile unit equipped with laboratories, etc., for instant dispatch to parts of the country sufferin from or threatened with a disease epidemic.

Vaccination.—By a law of 1914, vaccination against smal pox (*q.v.*) becomes compulsory in Siam whenever the healt administrator deems it necessary; in the Straits Settlement (1915) it is compulsory, and re-vaccination also can be mad compulsory in the face of danger; in France (1915) vaccinatio and re-vaccination can be made compulsory by decree, bu (1918) vaccination is compulsory for state officials. Chile (1918 has compulsory vaccination in the first, 10th and 20th years c age; in Venezuela (1921) there is infant vaccination and re vaccination every seven years, failure to comply barring fror a large number of employments. In Poland (1919) there i compulsory vaccination for infants, and again at seven years In Tunis (1922) vaccination against smallpox is compulsory and also against typhoid, cholera and plague, if there is dange of an epidemic. Uruguay (1923) has compulsory vaccination i the first six months, and again in the 10th and 20th years. A Polish law of 1920 makes vaccination against typhoid fever an cholera compulsory for doctors, nurses, employees at waterwork and for those engaged in other specified callings.

Tuberculosis.—Anti-tuberculosis legislation has been put int force in various directions. Tuberculosis schemes and th legislation involved are discussed in the article TUBERCULOSIS The Milk and Dairies (Consolidation) Act, 1915, provided, *inte alia*, for the registration of dairies and the inspection of dairie and herds; and prohibits the sale for human consumption c milk from a cow with tuberculosis or other specified diseases c the udder. The Milk (Special Designation) Order, 1922, of th Ministry of Health instituted the licensing of classes of milk namely, certified, Grade A (tuberculin tested), Grade A (non tuberculin tested) and pasteurised; and prohibited the sale c milk under a designation to which it is not entitled.

The Public Health Act, 1925, section 62, authorises a court o summary jurisdiction to order the removal to a suitable hospita or institution, of any person suffering from pulmonary tuberculosi in an infectious stage, when a source of danger to others, eithe from lack of proper accommodation or from failure to observ sanitary precautions. In Denmark, laws of 1912, 1918 and 191 made compulsory the notification of pulmonary and larynge tuberculosis by the doctor in attendance, who is also required t instruct those in charge of the patient as to sanitary precautions

A Japanese law of 1919 gives power to examine any perso whose calling might make him a source of transmission, to forbi the exercise of a particular calling by such, and to forbid o restrict trading in old clothes, old books and other articles which might carry infection. In Denmark, compulsory isolation of infectious cases is also empowered with certain limitations; anc laws of 1918 and 1919 provided for the use of public funds t support hospitals for tuberculosis, sanatoria and convalescent establishments. A French law of 1916 instituted public dispensaries for treatment and for giving instruction in anti-tuberculosis measures. A decree of 1920 laid down regulations for the establishment, working and supervision of sanatoria. An Italian royal decree, 1919, instituted a central anti-tuberculosis committee, and a Swedish royal decree, 1912, regulated subventions to hospitals for treating tuberculosis.

Venereal Diseases.—The English Venereal Diseases Act (1917) prohibits treatment by unqualified persons in areas to which it s applied, when gratuitous treatment has been provided and approved, and prohibits all kinds of advertisements of quack remedies for such diseases. In Sweden (1912) an affected person is obliged to obtain and complete medical treatment; the same applies to the Union of South Africa (1919), where it is also an offence for an infected person to follow certain employments, or to ngage such a person in the employment; and to Czechoslovakia, where an infectious person may also be removed compulsorily to hospital if necessary, and an examination by a doctor can be nforced where there is reason to suppose that a person is infected with such a disease. In the state of Rio Grande do Norte, Brazil, by a decree of 1921, a special service for the prevention of venereal diseases was created, and provision was made for action gainst charlatans and for diffusing information regarding modern methods of avoiding the contagion. In Italy, a royal decree, 923, approved of regulations for the prevention of venereal diseases, including the examination and treatment of prostitutes. A Danish law of 1922 obliges a person suffering from venereal disease, in a stage when it may be communicated or transmitted, o inform the other party to a proposed contract of marriage, nd this party must be instructed by a doctor before contracting. The parties must make a declaration of freedom from such isease. The same procedure must be adopted if one of the parties uffers from epilepsy. When there is reason to believe that one f the parties may have disease or weakness of the mind such arty must present a medical certificate of mental health and make a declaration as above mentioned.

Housing.—The British Housing Act, 1925, *inter alia*, makes a duty of the local authority and the medical officer of health o inspect houses, prohibits the erection of back-to-back houses, nd gives power to close and demolish houses deemed unfit for uman habitation. The Public Health Act, 1925, gives a local uthority power to cleanse, disinfect or destroy articles infested ith vermin in dwellings, and to oblige a landlord or tenant to eanse the dwelling; powers are granted for cleansing of the erson also. A Belgian law of 1919 instituted the National ociety for Housing, amongst its powers being that of destroying nhealthy dwellings; a revising law of 1921 gave power to expropriate such houses and sites as are required. Similar powers were ranted to authorities in France by a law of 1915. A law of 1922 odifies the laws relating to working-class dwellings. A Peruvian w of 1916 obliges landowners to remove and prevent conditions n their land which are deemed to favour the existence of malaria.

Infant Welfare.—The British Notification of Births (Extension) Act, 1915, extended the Act to areas in which it had not en adopted. A Belgian law of 1919 instituted the national ork for infant welfare. In France a law of 1917 provided financial help for necessitous women in connection with child-birth, d when the mother nurses the child assistance continues for a riod of 12 months. In Germany (1922) help is given to women the same circumstances, insured and uninsured. An English t of 1920 regulates the employment of children, young persons d women in industrial occupations; and a Peruvian law of the me year is a similar measure.

Food.—The English Public Health (Milk and Cream) Regulations, 1912, prohibited the addition of any preservatives to lk intended for sale for human consumption, any thickening cream or preserved cream or any preservatives to cream with s than 35% of milk fat; the only permissible preservatives in eam intended for human consumption are boric acid, borax, a xture of these, or hydrogen peroxide. By an order, 1917, no ore than 0·4% of boric acid may be added and the cream must be sold as preserved cream and labelled as unsuitable for infants and invalids. Public Health regulations, 1923, fixed the minimum percentage of milk fat in dried milk of various descriptions, and that of milk fat and total solids in condensed milks. Containers must declare the contents, and skimmed milk be labelled as unfit for babies.

Drugs.—Most countries have legislated to restrict the use of opium, cocaine and related substances. The English Therapeutic Substances Act, 1925, regulates the manufacture, sale and importation of serums, vaccines, salvarsan, insulin, etc. Other countries have legislated similarly. (R. Sc.)

MEDICAL RESEARCH.—Progress in medical research since 1911 can be subdivided according to the branch of medical science into which it falls most naturally. An arbitrary classification, however, has the drawback that many subjects might be discussed equally well under other headings than those in which they are presented.

ANATOMY

First place in this section must be given to the collections of specimens illustrating war injuries and diseases that have been formed by certain museums, notably that of the Royal College of Surgeons of England. Extending to many thousand specimens these collections present a picture of the medical and surgical effects of war in the widest sense, that has never been equalled. Other anatomical researches of note were upon the distribution of the absorbents from the lower intestine and upon the caeco-colic sphincter tract. The former offers explanation of many peculiarities of disease in this region and is of value surgically; the latter is a new conception, likens the tract in question to the stomach and supports this contention by numerous references to several species of lower animals.

PHYSIOLOGY

Hormones.—Bier found reason to believe that a chemical stimulus (hormone) secreted by the retina initiates the formation of the lens in the larva of Triton, and that a hormone formed from bone-marrow underlies repair of bone. From this he argued that repair in general is dependent upon special hormones formed at the seat of the injury according to the type of tissue needing repair. The part played by the nervous system in repair still remains obscure.

Shock and Blood Transfusion.—A large amount of work was done upon shock and allied conditions. Shock is of great complexity but sudden removal of large quantities of fluid (blood) with the resulting disturbance of the circulation is a fertile cause. In correspondence with this, treatment by transfusion (*see* BLOOD TRANSFUSION) is of the greatest value and the methods of transfusion as well as the substances to be used were made the subject of numerous inquiries. Broadly speaking, for surgical shock and loss of blood by haemorrhage, injection of solutions of gum arabic are of great value, particularly if a small amount of glucose be added. Volume of injected fluid and rapidity of action are fundamental considerations, composition of the injected fluid is a matter upon which some latitude can be allowed, and use of blood is by no means obligatory. On the other hand where transfusion is performed for anaemia (*see* ANAEMIA) due to disease the character of the injected fluid is of first importance. Here, use of human blood is indicated and it is necessary, by careful examination of patient's blood and donor's blood to ensure that they belong to blood groups that are not mutually antagonistic.

Muscle Tone.—Physiological research of unusual importance was carried out (Sherrington, Magnus and others) upon muscle tone in the decerebrated animal by means of which tendon and other reflexes received a clearer explanation and afforded information upon many reflex postural responses to stimuli that appear to be voluntary. This line of research supplements experimental psychology, a branch of investigation that has made strides during the past two decades (*see* PSYCHOLOGY).

Respiration.—In the province of respiration, the relation of lactic acid and muscular exercise to the respiratory quotient has been investigated. Under exercise a lactic acid maximum of 0·3% in the muscles can be reached in about 30 sec., and this, or rather less, is the longest time that maximal exertions can be kept up. For these short maximal efforts there is reason to believe that carbohydrate alone is used by the muscles. Regulation of rhythmic respiration, from experiments carried out on cats, appears to depend upon the action of an inspiratory mechanism, the apneustic centre, at the level of the striae acusticae, an expiratory mechanism just below it, both of these centres being controlled by the pneumotaxic centre which is situated in the upper half of the pons. The actual stimulating agent is carbon dioxide.

Other Discoveries.—Very many subjects of inquiry must be passed over here, *e.g.*, discovery of rhythmic contractions of capillaries discovered by means of a special modification of the microscope; the behaviour of the spleen in poisoning by carbon monoxide; the action of lead upon red blood corpuscles; researches on bilirubin and urobilin and other pigments in relation to jaundice; on "buffering" of blood whereby the addition of a given amount of acid to blood is represented by a smaller change in reaction than would occur in simple watery solutions because of the existence of weak basic salts of carbonic and phosphoric acid, especially in the red corpuscles; and numerous investigations upon the action of insulin upon blood sugar and other constituents of the body as well as upon the interaction of insulin and other endocrine secretions.

Energy Expenditure.—Of more general interest is a research carried out upon the energy expenditure in sewing with a machine and hemming by hand. Careful measurements were made by means of the respiration calorimeter, but one most instructive result is that influenza exerts a depressant influence on energy output during rest when the patient has apparently recovered completely. In the case of the woman made the subject of measurement for five weeks after her apparent complete recovery, with the body weight returned to normal, energy expenditure was 4% lower than before the illness.

Tissue Culture.—Minute portions of chick and duck embryo heart have been cultivated in special glass cells. Under suitable conditions these portions of tissue live, grow and beat rhythmically in the culture medium for prolonged periods. If two portions of heart from the same species are placed in the same culture cell, each beats rhythmically at an independent rate until the masses fuse by growth when the beats become synchronous. If in the experiment the two portions are chick and duck, fusion by growth may occur but independence of rhythmic contraction persists (*see* also article TISSUE CULTURE).

As an example of information obtainable only by use of apparatus of extreme accuracy, Katz showed from a study of the curves of right and left intraventricular pressure and of aortic and pulmonary artery pressure that during normal experimental conditions right and left ventricular systoles and also their ejection phases neither begin nor end simultaneously and are, as a rule, of unequal duration.

BIO-CHEMISTRY

Insulin.—Much of the research falling into this category is concerned with the minute physical chemistry of the cell and therefore is of a fundamental character though hardly suitable for analysis in this place. An important practical result of laboratory work consisted in a simplification of the method of preparing insulin (*q.v.*) whereby a larger amount of the material of a higher potency was prepared from a given amount of raw material in less time and at smaller cost. Insulin forms a picrate when freshly ground pancreas is mixed with solid picric acid. The insulin picrate is extracted by means of acetone. By this discovery the cost of insulin treatment of diabetics has been reduced to one-third or less.

Vitamins.—Perhaps the most striking subject upon which biochemical investigations have been conducted during recent years has been that associated with accessory food factors (vitamins) and food deficiency diseases. Investigation of *beri-beri*, a nutritional disease associated with various nervous and paralytic symptoms, which occurs in man and can be induced i pigeons by feeding exclusively on polished rice, showed tha addition of a minute quantity of the milling was sufficient t prevent onset of the disease or cure it if in existence. The followed investigations into the causation, prevention and cur of scurvy and inquiries into the factors underlying growth of th body generally or of special systems (*e.g.*, bone in rickets). I cannot be said with certainty that rickets depends exclusivel upon absence of a special vitamin, for other factors, such as sufficiency of calcium and phosphorus, are necessary. Moreover sunlight, particularly the ultra-violet portion of the spectrum, i no less essential than due provision of the requisite vitamins fo production of that normal growth of the body of which norma growth of bones is but a part. As a result of the entire series o investigations upon accessory food factors, it may be said tha at the present time fat-soluble vitamin A and water-solubl vitamin B are regarded as being bound up with processes o growth and in addition there are anti-scorbutic and anti-beri-ber vitamins. These vitamins have been found in a great variet of animal and vegetable substances and the amounts presen vary within very wide limits. Their nature is unknown, and th most certain points in connection with them are the minutenes of quantity in which they are present and the potency of thei activity. As to their origin the suggestion has been put forwar on experimental grounds that they are compounds of high energ content produced by the influence of ultra-violet light, but thi hypothesis cannot be regarded as proved, indeed, some experimental observations are against it.

DIAGNOSTICS

Radiology (*see* RADIOTHERAPY AND RÖNTGENOLOGY).—On it diagnostic side, quite apart from the use of contrast meals an injections opaque to the rays, it is now possible to produce fa better radiographs with exposures measured in fractions of second than were possible at the beginning of the century wit exposures lasting minutes. This is largely due to the employmen of X-ray tubes in which the anticathode is a mass of tungsten heated by an independent current. For treatment, in order t approximate the wave-length of rays emitted by the X-ray tube to the wave-length of the gamma rays of radium, apparatus has been produced with a voltage in the region of 200 kilovolts. So far this type of apparatus is employed chiefly in the treatment of cancer. During the routine examination of large numbers o cases various anatomical peculiarities have been observed and some hitherto unknown morbid processes in bone have been described. Radiology has also proved useful in study of the physiology and pathology of the heart and great blood vessels, in pulmonary conditions, notably tuberculosis and bronchiectasis, in diagnosis of renal and biliary calculi, and it has been suggested as a means of diagnosis when perforation of a gastric or intestinal ulcer is suspected. The intentional injection of oxygen or air into the peritoneal cavity as an aid to radio-diagnosis has been employed somewhat extensively; it is stated to be devoid of risk and renders diagnosis of fluid or solid masses relatively easy. The use of radium (*see* CANCER; RADIUM) is confined chiefly to the treatment of cancer, but in some conditions of skin, *e.g.*, naevi, and in certain uterine conditions it has a well recognised applicability.

Therapeutic Use.—Other forms of radiant energy, sunlight (Heliotherapy), mercury-vapour quartz lamp, carbon arc, radiant heat, all of which depend upon the presence of ultra-violet light in the first instance and warmth in the second, are employed therapeutically to an increasing extent. A disadvantage under which X-ray and ultra-violet forms of treatment labour is the absence of a satisfactory standard of dose. Sabouraud's pastille is only reliable for "soft" radiation. The "skin erythema dose" is unsatisfactory because as used in France it is two and a half times as great as the "Hauterythemdosis" of the Germans. Even in German institutions the erythema dose varies between 285 R units and 1,120 R units (Martius).

Effects of Radiation.—Numerous researches have been made on the effects of radiation, particularly the gamma rays of radium, upon cells and tissues of the animal body, plants, seeds, bacteria, protozoa. It has been shown that the cell in division is more vulnerable than the cell at rest and that there exists a wide range of radiosensibility amongst animal cells and tissues. Amongst the most radiosensitive are the lymphocytes. So far as composite tissues are concerned the intestinal mucosa is highly radiosensitive, exposure of the abdomen to unduly heavy dosage eading to excessive formation of mucus, mucoid degeneration, ntestinal haemorrhage, paralysis of intestinal muscle, desquama-ion of large tracts of mucosa and death from toxic absorption. While there is universal agreement that, directly or indirectly, ays produce injurious effects upon cells there is doubt whether maller doses do not stimulate the activity of cells. Opinions are ivided upon the point, but the failure to observe any but in-urious effects may depend upon the fact that the experimenters ave not reduced the amount of radiation they employed to ufficiently low limits. In the case of Ascaris ova increase in rate f division was not observed until the amount of radiation re-eived by the eggs was reduced to that derived from about one en-millionth of a milligram of radium bromide for a period of bout 30 hours.

PATHOLOGY

Histology.—Morbid histology has been in some measure at a andstill, although during the War it was employed extensively striving to unravel the pathology of war nephritis, gas gangrene, gas poisoning and, indeed, of any novel pathological condition. Its most striking success was in reference to the mode of xtension of gas gangrene from the seat of infection. The action f the toxin secreted by the infecting bacilli extends along the uscle bundles far in advance of the bacilli themselves, produces assy changes of the muscle fibres correlated with a loss of con-actility that can be demonstrated on the operation table and a necessary precursor to advance of the bacilli themselves by ultiplication. These observations were the prelude to a radical odification of the surgery of the condition and a definite im-rovement in results.

Bacteriology.—In bacteriology (*q.v.*) a useful step was taken by e Medical Research Council in forming the national collection type cultures at the Lister Institute. Begun in 1920 it now ntains more than 2,000 living strains of bacteria, protozoa and ngi, available for workers in widely different lines of research. Experiments upon the conditions under which bacilli, particu-rly the sporing anaerobes of tetanus and gas gangrene, exert thogenic activity showed that if washed clear of toxin and oculated without contaminating substances they remained ert. Multiplication, followed by manifestation of the ordinary sease phenomena, occurred only if they were injected along th toxin (not necessarily their specific toxin) or with some lid particles such as lime or silica. In other experiments the esence of silica exerted an important influence on the multiplication of tubercle bacilli in the tissues.

Diphtheria.—Important observations were conducted in many untries upon the so-called Schick test as a means of diagnosing sceptibility to diphtheria (*see* INFECTIOUS FEVERS). If a nute quantity of diphtheria toxin, highly diluted, were injected tradermally in man there occurred a patch of redness locally out 2 cm. in diameter in certain persons, whereas in others e injection was without effect. Heating of the toxin destroys power of producing this effect. Further search indicated that those persons who are negative, diphtheria antitoxin is present the blood serum, whether naturally, or as the result of having ssed through an attack of diphtheria, or of gradual immunisa-n owing to the fact that the person is a diphtheria carrier. In hick-positive persons there is absence of antitoxin and there-e the injected toxin is not neutralised and produces its thological effect. Subsequent examination on a large scale owed that the reliability of the test was of a high order. The tural corollary is that during an epidemic all Schick-positive rsons should receive a prophylactic treatment with diphtheria titoxin. Later work showed that diphtheria "anatoxin," *i.e.*, xin detoxicated by addition of formaldehyde and exposure to a temperature of 37° C. for a few weeks, was equally efficaciou in producing immunity.

Scarlatina.—By a similar process of reasoning the two Dicks in America introduced an intradermal diagnostic test for scarlatina, the toxin being derived from broth cultures of a variety of haemolytic streptococcus found in the throats of scarlatina patients and believed by some to be the cause of the disease. So far the Dick test is not on such firm ground as the Schick test. Nevertheless some authors have expressed their view that the test is of much value in determining susceptibility or insusceptibility to scarlatina and that an anti-scarlatinal serum prepared by means of the haemolytic streptococci is in many instances efficacious in immunising the Dick-positive individual and rendering him negative on subsequent intradermal tests.

Tuberculosis.—A further extension of the principle has been applied in the case of tuberculosis (*q.v.*), but the work is still in its earlier stages and the time is not ripe for dogmatic statement. From time to time papers are published indicating that antibody formation is not a universal function of the tissues but that there are special sites for its formation. So far there is no consensus of opinion on the subject nor are the instances adduced sufficiently marked to be convincing but it is certain that variations occur in local resistance of the tissues to infection. The most recent suggestion is that antibody formation is a function of the reticular endothelial system.

Tularaemia.—A hitherto unrecognised disease was described by McCoy in 1912 when investigating ground squirrels in Tulare county, California, that had been attacked by a plague-like disease not caused by *B. pestis*. Since that time it has been found widely in the United States and was definitely recognised as affecting man in 1914. Since 1914 tularaemia has occurred in at least nine laboratory workers engaged on investigations with *B. tularense.* The micro-organism is an exceedingly minute cocco-bacillus and it is considered that infection in man was by inhalation or by a blood-sucking fly. Transmission from rabbit to rabbit occurs by the rabbit louse and the rabbit tick, neither of which bites man.

Dental Caries.—A bacillus (*B. odontolyticus acidophilus*) has been isolated from carious teeth and in pure culture forms sufficient acid to dissolve the enamel. Undecayed teeth placed in such pure cultures for a period of weeks show loss of enamel at spots and local growth of the bacilli along the dental tubules. Microscopically the appearance of this artificial caries is identical with that of natural caries.

Botulism.—Numerous papers have been published upon botulism, a form of severe food poisoning (*q.v.*) dependent upon an anaerobic bacillus (*B. botulinus*). The nervous system is profoundly attacked by the toxin, difficulty of vision, dilated pupils, ptosis and paralyses being among the earliest symptoms. The toxin differs from other toxins in being pathogenic when administered orally; it is absorbed in the stomach and upper duodenum. An antitoxic serum has been prepared and is useful in treatment. This form of food poisoning was originally associated with sausages but occurs in connection with a great variety of foods. Most of the recorded cases have occurred in America.

Spirochaetes.—During the War there occurred in Flanders amongst the men in the trenches a severe form of disease associated with jaundice and haemorrhage which was traced to a spirochaete similar to or identical with *Sp. icterohaemorrhagica*, which in Japan infects rats and is transmitted by them to man. The same organism was found in the rats infesting the trenches.

Syphilis.—In the case of another spirochaetal disease, syphilis (*see* VENEREAL DISEASES), Brown and Pearce succeeded in transmitting the disease to rabbits by intratesticular inoculation and showed the close resemblance of the pathological and clinical manifestations to those met with in man. By a prolonged series of experiments on rabbits Pearce answered in the negative the long debated question whether yaws and syphilis are manifestations of a single disease. Much work has been done on the Wassermann reaction. All doubts are not set at rest nor is the behaviour of the reaction completely understood, but it has stood the test of time and is considered of some diagnostic value.

In the investigation of spirochaetal diseases caution in deduction from experiment is shown by the fact that spirochaete-like bodies are to be found in the lateral ventricles of normal monkeys, rabbits and guinea-pigs. Only after animals that had been injected long previously with material from disseminated sclerosis (which is regarded by most authorities as of syphilitic origin) had been found to present these bodies in their lateral ventricles, was their existence in normal animals also discovered.

Typhus.—In typhus and trench fevers minute parasites were discovered belonging to the group now named Rickettsia. For a short time the relation of the Rickettsia to the disease was in doubt, but largely owing to the work of Bacot, an eminent entomologist who contracted typhus during his investigations and died therefrom, it is now recognised that both diseases depend upon the presence of varieties of Rickettsia, and that these parasites are conveyed from patient to patient by body lice. One of the most delicate manipulative operations ever attempted, and actually carried out with brilliant success by Bacot, was the filling of the rectum and intestine of lice with Rickettsia-infected blood by means of a fine capillary glass tube.

Bacteriophage.—An interesting phenomenon called after d'Herelle, its discoverer, has attracted much attention. When working with certain cultures of intestinal bacteria d'Herelle observed that on occasions culture apparently failed, the broth remaining quite clear. Subsequently he found that addition of a minute quantity of one of these clear fluids to a culture tube, cloudy with growth, was followed by clarification of the latter; as little as one part in a million was sufficient. He considered that he had obtained evidence of a filter-passing "microbe bactériophage" and obtained the phenomenon by successive culture from intestinal contents, sewage, soil extracts. This clarifying power is a property of leucocytes, tears, nasal mucus, eggwhite and other substances.

From the first the filter-passing microbial explanation met with opposition, many authorities regarding the phenomenon as being due to the action of an autolytic enzyme, or a catalyst causing the micro-organisms to produce autolytic ferments. Later, Fleming described a somewhat similar phenomenon by means of a special micro-organism that he isolated (*M. lysodeikticus*). This organism in thick suspension is in a few minutes completely dissolved by tears in a 1–9,000 dilution and using it as an indicator he found evidence of the lytic principle in nearly all tissues of the body, but not in urine, cerebrospinal fluid or sweat. In the vegetable kingdom he found it in the turnip alone. It is doubtful whether there is a single lytic substance or more than one. The essential difference between this and d'Herelle's phenomenon is that the former cannot be transmitted in series. Fleming therefore speaks of it as a "lysozyme," and points out that some bacteria are sensitive to lysozyme action and others not, thus raising the speculation whether the pathogenicity of bacteria may be determined by the absence of lysozyme.

Filter-Passing Microbes.—Since 1905 papers have appeared from time to time in medical literature on the "filter passer" or "filterable virus" (*see* FILTER-PASSING MICROBES). A series of morbid conditions is now recognised with more or less certainty as being due to a virus so minute that it passes through the pores of a porcelain filter, or in some cases is beyond the lowest limits of microscopic vision. Of these diseases rabies, vaccinia and perhaps, variola are the best known. In lethargic encephalitis and herpes evidence is tending in that direction but is not conclusive owing to the discovery that laboratory animals mainly used for this type of work (monkeys, rabbits) may under normal conditions present appearances in their brains that have been regarded as evidence of experimental transmission from man.

Dengue has been added to the list, while the so-called mosaic disease of the tobacco and tomato plants (*see* PLANT PATHOLOGY) is stated to be due to a filterable virus, and distemper in dogs may show a like origin. In addition a transmissible filter-passing virus has been recognised in the rabbit; at first this virus was thought to be the cause of varicella but it is now recognised to be the cause of a naturally occurring infection of the rabbit.

Gye and Barnard have described and photographed by mear of ultra-violet light, respectively, a filterable virus derived fror certain malignant tumours, following in this direction th pioneer work of Rous on chicken sarcoma. Finally, in the opinio of some authorities the cause of influenza (*see* INFLUENZA) is nc Pfeiffer's *B. influenza*, this being merely a usual concomitan but is in reality a filter-passing virus that has not yet been dete mined with certainty.

OBSTETRICS AND GYNAECOLOGY

Eclampsia.—The exact pathology of eclampsia has not ye been solved. Obata, as the result of injecting mice with extract of human eclamptic placenta, considers that it is an intoxicatio by placental poisons made possible by a weakening in its norma capacity of neutralisation on the part of the maternal blooc Treatment of the condition on conservative lines has recentl gained ground against more radical measures, and control of cor vulsions by hypnotics with venesection and administration c oxygen have replaced operative procedures. Under these cor ditions the previous mortality has been reduced by more tha 50 per cent.

Fibroids.—The chief direction in which change of view is tak ing place among gynaecologists is that of the treatment c uterine fibroids. The old method of curetting has given plac in large measure to hysterectomy, which in turn may be destine to give place to radiological treatment in a large proportion c cases. In several important gynaecological clinics on the Cor tinent surgical treatment of uterine fibroids is the exception i an uncomplicated case.

MEDICINE

Anaemia.—In pernicious anaemia (*q.v.*) it has been shown tha one of the cardinal features is an increase in the mean diamete of the red cells which is independent of the degree of the anaemi and persists through the course of the disease. On the othe hand anisocytosis increases with the anaemia. In the remission which occur naturally or after splenectomy, though the haemo globin may rise there is little change in the diameter of the re cells. In treatment transfusion has been found of little value but benefit has resulted in some cases from removal of a portio of the bone marrow from the tibia. Apparently removal of som of the bone marrow acts as a stimulus to regeneration of marrov and therewith of the blood cells that are needed by the body Purpura is described as being of two varieties (1) that which i dependent upon destruction of blood platelets; (2) that whicl occurs in anaphylactic conditions and is due to direct injury c blood vessels. In the platelet variety a blood platelet antiserun has been prepared and is of therapeutic value.

Heart Diseases.—Diseases of the heart and great blood vessel have been studied by means of the electrocardiograph anc numerous conditions, particularly heart block and those i which the nervous mechanism of the heart beat is concerned have been investigated. Systematic examination of recruits i whom cardiac symptoms developed during early training resultec in a clearer perception of those abnormalities of heart actior which were transient and of little importance as distinguishec from those which were significant of disease.

Cerebrospinal Meningitis.—Cerebrospinal meningitis (*q.v.*) anc lethargic encephalitis (*q.v.*) have received much attention. I cerebrospinal meningitis it has been shown that three, possibl four, different types of meningococcus occur and that antiserun treatment to be successful must be homologous. Epidemic could usually be traced to a carrier and the chance of thei occurrence was greater where men were confined in a relativel narrow space, *e.g.*, barracks. A special method of treating carrier by means of inhaling chloramine-T was instituted with som success. In the case of lethargic encephalitis, it appears probabl that the cause will be found to be a filter-passing virus.

Herpes.—In the case of herpes in rabbits and herpes in man including herpes zoster, it has been found possible to transmi keratitis and some other special conditions from animal t animal and man to animal by means of a filter-passing virus

Vhen this has occurred microscopical appearances are found in he nervous system apparently identical with those met with in ethargic encephalitis. The whole question, therefore, is in an nsettled condition.

Liver Cirrhosis.—An interesting observation is that a form of rogressive degeneration of the lenticular nucleus occurs which associated with hepatic cirrhosis. Since its first description by Vilson in 1912 over 70 cases have been described but the pathogical agent remains completely unknown, though there are ndications that the liver is the seat of the primary pathological rocess. Clinically the symptoms are chiefly cerebral and the epatic cirrhosis which is so constantly found at autopsy is sually latent.

General Paralysis of the Insane.—In the case of general aralysis of the insane, a form of treatment that has been dvocated is inoculation with benign tertian malaria which is en treated with quinine. Maniacal and early cases have been und to respond to this treatment best. Intelligence, articulaon, writing and equilibrium improve markedly, but defects of aracter and manners remain. Some cases may even be able return to responsible duties. Advanced cases merely remain ationary. The idea underlying this treatment is that the alarial parasites stimulate the body to the formation of irochaetal anti-substances.

Respiratory Diseases.—In the province of respiratory diseases, s poisoning necessitated urgent investigation from the comencement of 1915. An intense oedema was produced which ocked the finer air passages and in its minor degrees led to a despread bronchopneumonia. Variations were met with as e nature of the gas used was changed, but from the respiratory int of view at least the phenomena were fairly constant. In eumonia, experimental work on monkeys showed that four pes of pneumococcus occur and do not protect against one other.

Asthma.—Work on asthma has shown that in a large proporn of cases, if not in all, the disease is of an anaphylactic nature, intense reaction being produced in the bronchial mucous embrane of a person sensitised to some particular substance of otein origin. Determination of the particular substance in any lividual case may be lengthy, but if it be determined there is a ssibility of successful treatment by gradual immunisation.

Tuberculosis.—In tuberculosis (*q.v.*) two important methods treatment have been suggested. In one, an endeavour has en made to increase the antagonising cells in the body by eated irradiation of the spleen. This organ is a storehouse for nphocytes and it is known that the lymphocytic content of blood can be raised by repeated small doses of X-rays. The thod has not as yet a great following. The other method is administration of a gold salt $[Au(S_2O_3)_2Na_3]$ named "sanosin" by Möllgard, originator of the method. The underlying a is not purely chemotherapeutical for it is held that the poison- action of the organisms killed *in vivo* by chemical means is tralised by an antiserum. The experimental work was ried out in Denmark and has been confirmed and extended his country. Careful selection of cases must be made when lying sanocrysin to man as the reaction in pulmonary erculosis may be very severe, but with due precautions great efit may accrue.

Diabetes.—In the case of diseases of endocrine origin the outnding example of advance is afforded by the insulin (*q.v.*) tment of diabetes (*q.v.*). The pathology of the condition was ly well known but the great achievement of Banting and his aborators was that they succeeded in isolating the material ufficient quantity for therapeutic purposes. Numerous reches have been undertaken in the endeavour to simplify the tment but it still remains necessary for insulin to be injected avenously and repeatedly in severe diabetes.

oitre.—The relation of iodine to endemic and to exophthalmic re (*q.v.*) has been investigated. A close relation between the ılar condition of the thyroid and the amount of iodine has n demonstrated and it is held that relative or absolute deficy of iodine is the immediate cause of simple goitre however this deficiency may be occasioned. Treatment by internal administration of iodine has met with much success. Success has also been claimed for radiological treatment and for surgery in cases in which iodine and other medical treatment has failed.

Paratyphoid—Description has been given of a paratyphoid epizootic in a flock of sheep with a consequent human epidemic of paratyphoid (40–50 severe cases with four deaths) that occurred in the Essen district. *B. paratyphosus B.* was isolated from the sheep's flesh and from the patients' stools. It was not here a case of contamination but the sheep suffered from the same disease as the human beings.

A peculiar disease has been occurring since July 1924 among the fisher folk of the Frisches Haff, the great freshwater lagoon of East Prussia. Many suggestions were put forward as to its aetiology but finally it was traced to arsenic freely contained in the waste water of two cellulose factories which was pouring into the Haff in large quantities.

Racial Blood Indices.—On the basis of observed peculiarities of group II. and group III. red blood cells, another research would group mankind according to their racial blood index (*see* RACES OF MANKIND). Analysis of the large amount of material accumulated since 1919 suggests that so far as blood groups are concerned races fall into six divisions strikingly different in type. These six divisions are European, Intermediate, Human, Indo-Manchurian, Afro-South-Asiatic and Pacific-American. No better indication could be given, than this last example, of the wide range covered by medical research. (W. S. L.-B.)

MEDICAL SERVICE, ARMY (*see* 20.19).—An Army Medical Service (*service de santé*, Fr.; *Sanitätsdienst*, Gm.; *servizio sanitario*, It.; *eisei kimmu*, Jap.) is an indispensable technical branch of the military organisation. On its efficiency the man-power of an army to a great extent depends. Its duties include the care of sick and wounded, the prevention of disease and the preservation of health, the medical examination of recruits, the invaliding of men unfit for further service, the supply of medical and surgical material, the administration of military hospitals and the command, education and training of a personnel for all these purposes. In time of war the collection, evacuation and distribution of battle casualties and the strategical and tactical employment of a variety of medical units for these duties are additional functions of an army medical service.

Administration.—The army medical service of the British forces is administered by a director-general in the adjutant-general's branch of the War Office, with a staff for personnel and mobilisation services, for preparation of statistical reports and consideration of professional questions, and for the supply of medical and surgical material, together with two new directorates of hygiene and pathology which were instituted after the World War in consequence of the lessons of the War and of the scientific advances in the domain of medical research. The director-general also administers the nursing services and the Army Dental Corps, the former through a matron-in-chief and the latter through an inspector of dental services at the War Office. He is represented in commands at home and overseas by deputy directors and assistant directors with deputy assistant directors for hygiene and pathology. A similar form of administration exists in other armies. In the United States the surgeon-general controls not only the medical, dental, nursing and a new corps, the sanitary corps, but also the veterinary corps.

Advisory Boards.—These are composed of military and civil members and are associated with the British Army medical administration. They meet from time to time at the War Office for consideration of general professional policy, questions of hygiene and of pathological research, nursing services and the co-operation of voluntary aid in war.

Personnel.—The estimated peace establishment of the Royal Army Medical Corps in 1926 was 584 officers and 3,579 other ranks. They serve in all stations at home and overseas where there are British troops, including India. Their work there is supplemented by assistant-surgeons of the Indian Medical Dept., formerly the Indian subordinate medical department, and by natives of an Indian Hospital Corps, formerly the army hospital corps and army bearer corps, who with soldiers trained for hospital duties from combatant regiments formed the subordinate staff of British military hospitals in India before the War. A separate body of officers, the Indian medical service and sub-assistant-surgeons of the Indian Medical Dept. served until the World War with Indian regiments and in regimental hospitals under much the same conditions as the British regimental medical services of earlier days. Since the World War, station hospitals for Indian troops have been instituted.

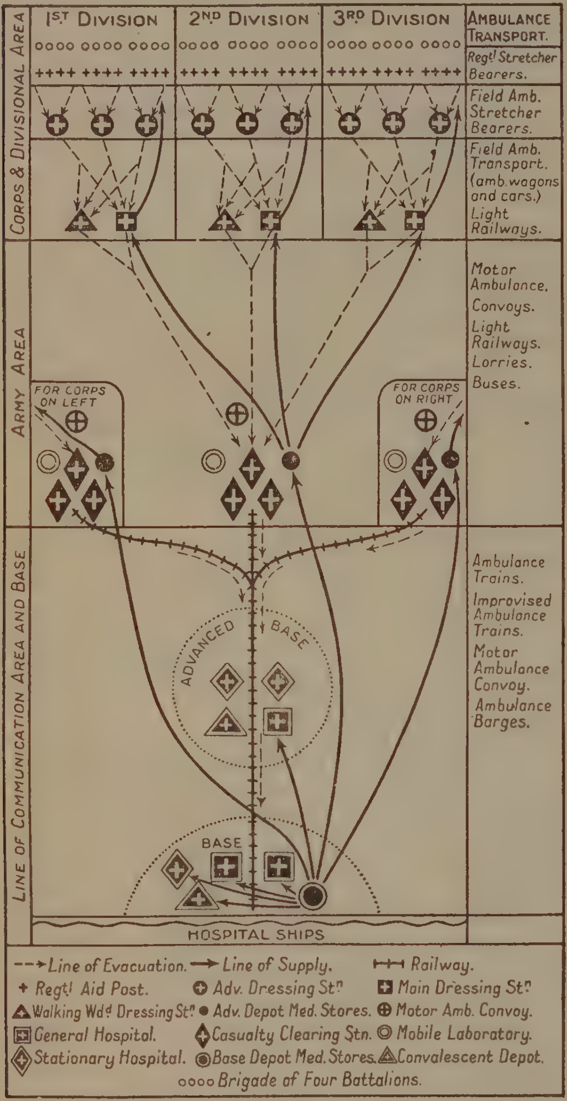
Corps & Divisional Area
Army Area
Line of Communication Area and Base
1st Division
2nd Division
3rd Division
Ambulance Transport.
Regtl Stretcher Bearers.
Field Amb. Stretcher Bearers.
Field Amb. Transport. (amb. wagons and cars.)
Light Railways.
Motor Ambulance.
Convoys.
Light Railways.
Lorries.
Buses.
For Corps on Left
For Corps on Right
Ambulance Trains.
Improvised Ambulance Trains.
Motor Ambulance Convoy.
Ambulance Barges.
Advanced
Base
Base
Hospital Ships
Line of Evacuation.
Line of Supply.
Railway.
Regtl Aid Post.
Adv. Dressing Stn
Main Dressing Stn
Walking Wdd Dressing Stn
Adv. Depot Med. Stores.
Motor Amb. Convoy.
General Hospital.
Casualty Clearing Stn.
Mobile Laboratory.
Stationary Hospital.
Base Depot Med. Stores.
Convalescent Depot.
oooo Brigade of Four Battalions.

FIG. 1.—Diagram of the organisation of Medical Services, from a corps front of three divisions in an army to a sea base.
(From "History of the Great War" [Medical Services], Vol. II. By permission of the Controller, H.M. Stationery Office, London.)

The army dental corps, with an establishment of 71 dentists, is estimated to provide one dentist for every 600 recruits or for every 1,500 troops in a command. (*See* DENTISTRY.)

Queen Alexandra's Imperial Military Nursing Service (Q.A.I.M.N.S.) has an establishment of 270 nurses and the Queen Alexandra's Military Families Nursing Service (Q.A.M.F.N.S.) an establishment of 91 nurses. They serve in the larger military and families hospitals at home and overseas, except India.

Territorial Army Royal Army Medical Corps.—The personnel is organised in peace to provide a regimental service, one field ambulance for each division of the Territorial Army, eight casualty clearing stations, three general hospitals and eight sanitar sections. These are field service units and form a cadre for th training of the R.A.M.C. (T.A.). Previous to the World War th Territorial Force had three field ambulances, one casualty clear ing station and one sanitary section for each division, togethe with 23 general hospitals. The reduction therefore in Territoria Army R.A.M.C. units since the War has been considerable.

Military Hospitals Reserve.—An establishment of 2,000 othe ranks is organised to provide trained personnel to staff militar hospitals in England on the outbreak of war when the regula Royal Army Medical Corps personnel is withdrawn, and t furnish reinforcements for an expeditionary force.

Service.—The number of medical officers (1924) was 939, c dentists 155, of nurses 675 and of veterinary officers 124. I continental armies with conscript service the fixed establish ments for medical services cannot be computed for purpose c comparison on the same basis as those of the British and Ameri can voluntary armies.

Training.—Officers of the R.A.M.C. attend preliminary an post-graduate courses at the Royal Army medical college, an military training with the men at the R.A.M.C. depôt at Alder shot, where there is also an army school of hygiene. In Americ an army medical centre was opened in 1923, at Takoma Par near Washington, District of Columbia. It consists of schoo for the training of the medical, dental, nursing and veterinar corps. There is also a medical field service school at Carlisl Pennsylvania, and a school of aviation medicine at New Yor In Italy, there is an army medical school at Florence, and i France, at Lyons, in addition to the post-graduate school a the Val-de-Grâce, for student candidates.

Military Hospitals.—In the British Army, military hospital and small depôt hospitals are established in all commands. I America, there are garrison hospitals and eight large genera hospitals, similar to some of the larger military hospitals i England. In continental armies there are also garrison hos pitals, but in France, military sections of the civil hospitals tak their place to a great extent.

Army Medical Stores.—In some continental armies most c the medical and surgical material is or was prepared in arm medical laboratories and factories. In Great Britain and Americ it is distributed from army medical stores, that for the Britis Army being at Woolwich.

War Organisation.—A regimental medical service, fiel ambulances, casualty clearing stations, general hospitals, cor valescent depôts, advanced and base depôts of medical store motor ambulance convoys, ambulance trains, hospital ship sanitary sections and squads, and mobile hygiene, bacteriologica X-ray and dental laboratories come into being for service with British Expeditionary Force on the outbreak of war; there ar equivalent units in other armies under different names an organisation. To complete their personnel on mobilisation th medical and nursing reserves are called up. For this purpos there is a regular reserve of R.A.M.C. retired officers and me liable to be recalled to service, a supplementary reserve c officers, a home hospital reserve of the St. John Ambulanc Brigade, the Territorial Army R.A.M.C. and the Voluntary Ai Detachments (under T. A. County Assn.) of the British Re Cross Society, the St. John and the St. Andrew Ambulanc Associations. There are also important reserves of the Q.A.I.M N.S. and the Territorial Army Nursing Service. But in a grea war, practically the whole of the country's medical resources ma be enrolled within the limits of age. In the World War, the peac establishment of the R.A.M.C. thus expanded to 15,000 officer and 120,000 ranks; while in the U.S.A. the medical service ex panded to 30,591 officers and 264,181 other ranks. A similar va expansion occurred in nursing personnel and in the number c medical units. Military hospital beds, for example, reached total of 637,746 for the British forces and 353,887 for thos of the United States.

The various units are distributed in the war zone, from fron to base, in divisional, corps, army and lines of communication areas of command, according to the nature of the functio or which they are organised. The regimental medical service onsists of an officer and four men of the R.A.M.C. with 16 men f the regiment as stretcher bearers and nine as sanitary detach-nent. In battle, a regimental aid post (*poste de secours*, Fr.; *Truppenverbandplatz*, Gm.; *posto di medicazione*, It.), to which hey collect the wounded, is established. Each division has three eld ambulances (the equivalent of the medical regiment of a J.S.A. division, the *groupe sanitaire divisionnaire* of the French, nd the *Sanitätsbattalion* of the German organisations). A field mbulance is composed of a headquarters and two companies, ach company consisting of a bearer and a tent division, repre-enting the bearer company and the field hospital respectively of he time of the South African War and previous equivalent nits of the continental army divisions. With a cavalry division here is an organised field ambulance for each cavalry brigade.

Working of the Systems.—In battle, the tent division opens an dvanced dressing station at a point to which its wheeled am-ulance transport can be brought, and a main dressing station urther back. The bearer company removes the wounded from ne regimental aid posts to the advanced dressing station, and ne transport brings them from there to the main dressing sta-on. The motor ambulance convoys (*section sanitaire auto*, Fr.), omposed of 50 motor ambulance cars each and with one convoy each corps, bring the wounded from the main dressing stations the casualty clearing stations (evacuation hospital, U.S.A.; *ôpital d'évacuation*, Fr.; *Kriegslazarett*, Gm.) which are estab-shed in the proportion of one to each division, at or near rail-ays and at the head of the lines of communication. From there, hen fit to travel, the sick and wounded are taken in ambulance ains to the general hospitals, which are units of 1,000 or less eds placed at sea bases or other convenient centres. Hospital ips transfer the patients to home ports, whence they are dis-ibuted to hospitals throughout the country.

Such is the normal system of collection, evacuation and dis-ibution of sick and wounded in a war zone. It is liable to odification according to circumstances and the nature of the rrain, especially as regards methods of transport by road, il, river, canal or air. It worked well in the World War, where e test was severe. During the battles of the Somme, for exam-e, the British field ambulances collected 316,073 wounded etween July 1 and Nov. 30 1916, including 26,675 in the st 24 hours; 304,285 were transferred to the base hospitals, and one day, July 6, 10,112 arrived in hospital ships at South-npton and Dover.

The mobile laboratories and advanced depôts of medical stores e usually placed with or near the casualty clearing stations. or sanitary duties a sanitary section, of 25 men, is allotted to ch division and base, and sanitary squads of five men each to nall posts, such as railheads. Their influence and that of edical research had remarkable results during the World War preventing disease. Enteric and typhus fever, the scourge of mies in past wars, became negligible quantities in the British d American forces, and fatal gangrene of wounds and trench ver, for long a cause of much inefficiency, were brought under ntrol. Indeed, the two outstanding features of the army edical service of the present day are its power of controlling sease and its power of systematically, rapidly and effectually inging battle casualties under life-saving surgical and hospital eatment.

In this beneficent work it is assisted by voluntary aid organisa-ons. Amongst all civilised nations there are national Red oss societies (*see* RED CROSS) organised as auxiliaries of their my medical services in time of war. They are of special value distributing voluntary gifts and comforts, such as are not sup-ed through official sources, to the various hospitals in the home rritory and in the war zone, in organising auxiliary hospitals d in various other activities. Those recognised by their vernments, together with the whole of the personnel and units the medical services of armies, are protected and become the cipients of special privileges under the Geneva Convention 1906, should they fall into the power of the enemy during war.

(W. G. MA.)

MEDICAL SERVICE, NAVAL.—In Great Britain the Royal Naval Medical Service is administered by the medical director-general, an officer selected from the list of surgeon rear-admirals. He is responsible to the Board of Admiralty for the efficiency of his department. The work of the medical department includes questions regarding the personnel of the Naval Medical Service, the supply of surgical instruments, drugs, medical material, etc., assessments arising from invalidings and claims for compensation, the hygiene and sanitation of ships, hospitals and establishments, preparation of estimates for the medical vote, nursing and sick-berth reserve forces and publication of the medical statistics of the navy.

Conditions of Service.—The medical director-general superintends all professional and administrative details of naval medical establishments and the practice of medical officers. Candidates for cadetships and for commissions in the navy are physically examined at his department. He also nominates the appointments of all naval medical officers which are submitted to the board for confirmation. The existing ranks date from 1919, and are: On entry, surgeon lieutenant; after six years' satisfactory service, surgeon lieutenant-commander; after six years' service in the latter rank, surgeon-commander, providing the necessary promotion examination has been passed; the senior ranks of surgeon captain and surgeon rear-admiral are reached by selection.

Until the outbreak of the War candidates were entered by competitive examination, but, owing to the lack of applicants since the War, these examinations have not yet been resumed, and for the time being officers are entered for temporary service, engaging for three years with the option of turning over to the permanent service if considered suitable. Officers senior to the rank of surgeon-commander do not normally serve afloat, but are employed in hospitals and depôts. Conditions of service, etc., are published in the official monthly *Navy List.*

All ships, except the smallest, carry medical officers, larger ones carrying two, In view of the fact that ships are frequently on isolated service, the medical officer, in addition to his ordinary medical and surgical duties, has to fulfil the function of medical officer of health, and consequently has to advise his commanding officer on all questions relating to the protection of the health of the crew, and suggest any measures considered necessary for this purpose. He must acquaint himself with the conditions of health prevailing at the ports the ship is likely to visit, and veto the introduction into the ship of any water or food likely to carry disease. It is his duty to instruct the ship's company in "first aid" and personal hygiene, with special reference to venereal diseases and the evils resulting from the abuse of alcohol. In fleets and squadrons the hygienic responsibilities are, as far as is compatible with efficiency, relegated to the senior medical officer of the flagship, who is designated the fleet or squadron medical officer as the case may be. This arrangement does not, of course, absolve individual medical officers from responsibilities concerning their own ships. The Royal Naval Dental Service was inaugurated in 1920, and is supervised by a dental officer of commander's rank attached to the staff of the medical director-general. The sick-berth nursing staff, instituted in 1884, has a complement of 1,100 highly trained men who carry out their duties both ashore and afloat.

Equipment and Hospitals.—The special accommodation which is allocated for the sick in all ships is termed the "sick bay." These places, in spite of the fact that all serious cases are, for their own comfort, transferred to hospital on the earliest convenient occasion, are specially equipped for the comfort of patients and for all medical and surgical contingencies. The larger ships have special operating rooms. Also, for the greater safety of the wounded in action, spaces are reserved in the most protected part of the ship. These are known as "medical distributing stations." The nursing on board is carried out by the sick bay staff. The naval hospitals are: Haslar, Chatham, Plymouth, Portland, South Queensferry, at home; and Malta, Hong-Kong, the Cape, Bermuda, Wei-Hai-Wei, abroad. In addition, there is a naval mental hospital at Great Yarmouth.

All these hospitals conform in every way to the most modern requirements of medicine, surgery and hygiene.

Auxiliary Services.—These include the medical officers of the Royal Naval Volunteer Reserve, Queen Alexandra's Royal Naval Nursing Service Reserve and the Royal Auxiliary Sick-Berth Reserve. The personnel of these services is called up for periodical training and would be mobilised on the outbreak of war.

Foreign Navies.—The organisation in the principal foreign navies is similar to the British. Medical officers of the French navy—instead of being selected from candidates qualified in the ordinary way, as is the practice in the British, Italian and Japanese navies—are professionally educated at special naval medical colleges, and subsequently hold purely professional titles of rank. Italian naval medical officers, in common with other non-executive officers of that navy, hold military in contradistinction to naval rank. The medical organisation in the Japanese navy is almost identical with the British.

The World War.—At the outbreak of the War the naval medical service was expanded by mobilisation of its retired, emergency and Royal Naval volunteer reserve officers. Later, a large number of temporary surgeons were entered for general service, and also medical students were taken in for service in destroyers under the title of surgeon probationers. Queen Alexandra's naval nursing service was more than trebled by the mobilisation of the reserve sisters and the sick-berth staff, supplemented by the naval auxiliary sick-berth reserve.

Except under abnormal climatic conditions, and during epidemics of influenza, the health of the navy during the War was remarkably good. This satisfactory state of affairs can be attributed to:—

(*a*) The careful supervision of the personnel by the medical officers and the strict quarantine precautions enforced.

(*b*) The care exercised concerning food, water and victualling arrangements, both in ships and establishments.

(*c*) Preventive inoculation against enteric fever.

(*d*) The comparative isolation of the fleets lessening the chance of venereal infection and abuse of alcohol.

(*e*) Lectures given to the men on personal hygiene.

(*f*) Measures taken to lessen the monotony of ship life in war time.

Casualties.—As compared with land warfare, the number of men killed outright in action was striking, and this, combined with the numbers of deaths from immersion, made the ratio of killed to wounded far higher in the navy than in the army. For instance, at Jutland, out of 6,688 casualties there were 6,014 either killed or drowned. The higher proportion of fatal wounds was due to the conditions of modern warfare—explosion of large shells in closed compartments. In comparison with the wounds in the trenches, where the clothing and skin were ingrained with filth, wounds in the navy were less disposed to become septic. Burns formed a high proportion of the casualties, and were chiefly caused by the ignition of our own cordite or from the momentary flash of a high explosive shell in a confined space. A considerable number of casualties arose from gas poisoning, caused by the explosion of shells, the most lethal factor in these cases being nitric oxide gas. (G. L. B.)

United States.—In 1926 the Medical Corps of the U.S. Navy consisted of 38 medical directors, 4 of which had the rank of rear-admiral and 34 of captain; 66 medical inspectors with the rank of commander; 320 surgeons, with the rank of lieutenant-commander; 217 past assistant surgeons, with the rank of lieutenant; and 147 assistant surgeons, with the rank of lieutenant (j.g.). The Dental Corps consisted of 66 dentists, with the rank of commander; 71 past assistant dental surgeons, with the rank of lieutenant; and 22 assistant dental surgeons, with the rank of lieutenant (j.g.).

The medical and dental officers are admitted to the corps after passing satisfactory examinations and as vacancies occur. Above the rank of lieutenant-commander promotion to each grade is by selection and examination. All medical officers receiving their appointment to assistant surgeon are given a course at the Naval Medical School in Washington, after graduation from which they receive their assignments to different posts of duty, either on board ships, at naval hospitals as internists or at other naval bases. The health and hygiene of the navy personnel are entrusted to the medical and dental officers of this branch of the service. Fully equipped hospital ships with an efficient personnel and skilled medical officers, including specialists, accompany all large fleets.

The Hospital Corps consists of pharmacists, pharmacist mates, first, second and third class, and hospital apprentices, as well as a corps of trained female nurses who serve on special hospital ships and in hospitals ashore. The enlisted men in the Hospital Corps are given special training and instruction at the various pharmacist and pharmacist mate schools throughout the country. During the World War those members of the Hospital Corps who had enlisted or had been drafted into it were put through a special course of training in civilian hospitals. The Naval Medical Reserve is composed of officers taken from civilian life and from among ex-naval medical officers. They receive a certain amount of training each year, are examined annually, and are promoted according to precedence, as in the regular service. They are ready to be called upon in any emergency.

The surgical instruments, medicines and dressings are all supplied, in great part, from the Navy Medical Supply Depot in Brooklyn, New York, and from the Medical Supply Depots in Mare Island, California, and Canacao, Philippine Islands. The entire Naval Medical Corps is under the direct supervision of the surgeon-general of the U.S. Navy, who is appointed by the President for this duty, for a term of four years, after which he may be reappointed. This duty carries with it the rank of rear-admiral.

3,093 commissioned officers of the Medical Corps of the U.S. Navy served in the World War, together with 24,587 enlisted men in the Hospital Corps. (C. C. B.)

MEDICINE, GENERAL.—Since 1910 the progress of medicine has been much influenced by the four years of the War, which, while interfering with steady research, brought with it urgent problems, caused diseases previously rare or unrecognised to become matters of common knowledge, and produced epidemics on an enormous scale, thereby calling forth much investigation and new knowledge.

Influence of the World War.—Trench fever and a special form of kidney affection, called trench nephritis, were practically new diseases; and the serious condition of epidemic (lethargic) encephalitis (*q.v.*), though it may have existed previously, for the first time became common and was recognised during the War. Certain industrial forms of poisoning, namely of trinitrotoluene among munition workers, and of tetrachlorethane among aeroplane makers, were temporarily in evidence, and an impetus was given to research into the conditions modifying efficient performance of labour. Deficient diet caused scurvy, especially in 'Iraq, and other "deficiency diseases" came into evidence, especially in central Europe. Cerebrospinal ("spotted") fever became for the first time epidemic in Great Britain (*see* SPINAL MENINGITIS); as a result of the depressing conditions and the lowered bodily resistance, influenza (*q.v.*) became pandemic all over the world in 1918–9; and a fatal form of infective heart disease (*endocarditis lenta*) became much more frequent in discharged soldiers. A form of infective jaundice (*spirochaetosis icterohaemorrhagica*), formerly known as Weil's disease, became prevalent in Flanders, and its true nature, namely, an infection with an animal microbe, akin to that of yellow fever (*q.v.*) (*Leptospira icteroides*), was found in Europe to be identical with that described in Japan in 1914. Paratyphoid fevers (*see* INFECTIOUS FEVERS) A and B, though of course known before, became much more familiar during and after the War, and it may be noted that the distinction between the forms of enteric fever known as typhoid and paratyphoid was not recognised in the Boer War (1899–1902), when the disease exacted a relatively heavier toll than in the World War, when the troops were eventually extensively protected by T.A.B. vaccination. Dysentery (*q.v.*), as in past wars, became prominent, as did malaria (*q.v.*) in the eastern areas of the campaign. The influence of a Sanitary Corps in the prevention of disease among the Allied Armies was a noticeable feature (*see* MEDICAL SERVICE, ARMY). Much progress has also been made in the prevention of tropical diseases (*see* THERAPEUTICS and TROPICAL MEDICINE).

Mental Diseases.—The War provided a tremendous field for he observation of the mental perturbations commonly desig-ated as "shell shock," due to the psychical effects of long-con-nued bombardment, mental strain and anxiety, repression or e active forgetting of terrifying experiences, and of fear. Inci-entally it gave an opportunity for testing the opinion of the ore advanced followers of Sigmund Freud of Vienna, who, on e assumption that the sexual instinct is stronger than those self-preservation and of the herd, have increasingly tended to fer mental symptons akin to those of shell shock to the conflict sulting when some sexual experience had, in obedience to the onventional influences, been repressed and thus removed out the zone of consciousness. The value of Freud's contribution morbid psychology (*see* Psycho-Analysis) in the conception mental conflict resulting from the active forgetting or repres-on of unpleasant experiences is undoubted, but to refer them ainly to sexual causes was shown by war experience to be too arrow a view, and the treatment by psycho-analysis and inter-etation of dreams, and the patient's "associations" aroused uch opposition. On the other hand curative measures on psy-o-therapeutic lines, such as sympathetic analysis, re-education d occupational therapy, met with success and approval (*see* sychiatry, Psychoses, Psychotherapy).

Orthopaedic Surgery (*q.v.*).—Orthopaedic surgery also made eat advances as the result of the numerous cases of injury ring the War, and remedial gymnastics and exercises have us been of great use in furthering recovery in such cases.

Preventive Medicine (*q.v.*).—The prolongation of life and dim-ution of infant mortality in Great Britain have both improved about 50% in the last half century, and in the United States America the average age at death has advanced from 40 in 55 to 58 years at the present time. This has coincided with proved conditions of hygiene and environment, and has stim-ated active measures in the prevention of disease—the ideal medicine. The establishment in 1919 of the Ministry of ealth in Great Britain was a far-seeing advance for the im-ovement of the national health and the prevention of disease e Therapeutics). In America regular periodic examination healthy, or supposedly healthy, persons has been begun, and statistical experience of life-assurance companies has already oved that this practice exerts a beneficial effect on the mor-ity of those adopting this course. The prevention of disease s been greatly assisted by the Rockefeller Foundation in New rk, which has undertaken a world-wide campaign with this ject on very broad lines through its International Health ard, its Division of Medical Education and its China Medi- Board. In 1913 the Rockefeller Sanitary Commission, nded in 1909 for the eradication of hookworm disease (*q.v.*), s incorporated as the International Health Commission lled the International Health Board after 1916) of the then ently established Rockefeller Foundation, and since then has ried out campaigns against yellow fever (*q.v.*) in South Amer-, which have practically exterminated it and incidentally led Noguchi's discovery of the cause (*Leptospira icteroides*) of the ease, against malaria (*q.v.*) and tuberculosis (*q.v.*) (*see* also erapeutics). In connection with the National Insurance (1911) the Medical Research Committee (now Council) s created, and research workers have been financed and an rmous impetus given to the advancement of medicine and so the diminution of disease.

ndustrial Health.—The special conditions bearing on health factories and industries, particularly the dangerous trades, e attracted specialised attention, particularly in America, ere a School of Industrial Medicine has been instituted in nection with Harvard University.

nsanity.—The prevention of insanity by early treatment in chiatric clinics, usually attached to general hospitals and n part of the neurological department, has been an important in the prevention of mental disorder (*see* Psychiatry). It onnected with the social service and after-care movements. 1908 the American Council of Mental Hygiene was founded, 1918 a similar council was started in Canada, in 1920 the French League of Mental Hygiene was inaugurated and in 1922 the British National Council for Mental Hygiene was established. This is evidence of the awakening interest in health of the public at large since the War, as is also shown by the Society for the Prevention of Venereal Disease, the League of Health and the British Empire Cancer Campaign.

Comparative Medicine.—The increase of experimental research has been followed by the study of comparative medicine and pathology, whereby human and veterinary medicine may mutually help and benefit each other; an Institute for research in the pathology of animal diseases and a professorship were established at Cambridge in 1923, and the study of experimental epidemics has been undertaken in laboratories at the Rockefeller Institute, New York, and at Manchester.

Statistical Methods.—Biological, anthropological and statistical methods are now being more formally utilised in medicine than in the past, and exact measurements and skilled calculations are being employed. An individual's constitution, or "the aggregate of hereditary characters, influenced more or less by environment, which determines his reaction to the stress of environment" (G. Draper), was present to the mind of Hippocrates and others, but the rise of bacteriology diverted attention from the internal to the external factors of disease. Anthropological measurements, formerly used for the recognition of the racial characters of mankind, have now been applied by Draper of New York to patients suffering from certain diseases, and the data thus obtained analysed by biometrical experts.

Applied Physiology.—Applied physiology was extensively developed and utilised during the War, for example in aviation, the transfusion treatment of surgical shock and haemorrhage, and the relief of gassing, and has advantageously been continued since on other lines, such as ventilation, the effects of sunlight and ultra-violet rays on bacteria, infections, general health and rickets (*see* Public Health). Following on the established value of open-air treatment of tuberculosis and other infections, the beneficial influence on bodily resistance induced by sunlight (heliotherapy) and ultra-violet rays has been utilised. Heliotherapy (*q.v.*), practised for 20 years at Leysin by Rollier in surgical tuberculosis, has been adopted in Great Britain. Sunlight prevents and cures rickets, and its relation to the anti-rachitic vitamin D is an addition to knowledge, possibly of potential importance in connection with other "deficiency diseases." Ultra-violet rays act on a complex alcohol, cholesterol, present widely in the body and also in the skin, so as to confer on it the anti-rachitic action of the vitamin; they also raise the amount of calcium, iron, iodine and phosphorus in the blood, increase its bactericidal power and accelerate the healing of wounds. The tungsten-arc and mercuric-vapour arc lamps are employed to provide artificial ultra-violet rays. Diathermy or the application of a special form of intensive heat has been employed in cancer, pneumonia and other infections (*see* Electrotherapy).

Biochemistry.—Closely associated with applied physiology, of which it is really a part, *biochemistry* (*q.v.*) has developed out of physiological chemistry and has risen rapidly to an authoritative position. At Cambridge the Sir William Dunn trustees have built and equipped a fine institute and endowed the professorship held by Sir Gowland Hopkins, who has 40 advanced students carrying out research under his direction. The Rockefeller Foundation, New York, has provided similar laboratories at Oxford and University College, London.

Metabolism.—Biochemistry is specially concerned with the changes always going on in the body and described by the name metabolism. The basal metabolism means the average minimal chemical changes compatible with life taking place in the body during complete rest and when food is not being digested and absorbed, and corresponds with the minimal heat-production 18 hours after a meal of a mixed dietary—the working expenses, so to speak, of the resting body. This is estimated directly by measuring by respiratory calorimeters the heat evolved, or indirectly, and more easily in practice, by chemical analysis of the respiratory exchange, and has been shown to be remarkably constant in normal conditions. In disease the metabolic rate may be altered; for example, in myxoedema it is lowered and all the vital processes are on a lower plane; whereas in fever and exophthalmic goitre it is accelerated. In the last-named disease the condition of the patient can be judged by the degree of increase in the metabolic rate. Knowledge of the chemical processes underlying metabolism is rapidly growing in exactness.

Vitamins.—The recognition of the *accessory food factors* or *vitamins* (*q.v.*) has opened a new chapter in nutrition and in the causation and prevention of disease. They are present in food in minute quantities, which greatly contrast with their power, and are essential for health, growth, especially of bone and teeth, and in other ways. New knowledge of the effects of their absence and of the (deficiency) diseases thus caused has accumulated, but more may be anticipated. The vitamins each have their special actions; one prevents scurvy (anti-scorbutic), others rickets (anti-rachitic or vitamin D), beri-beri or polyneuritis (anti-neuritic), and recently, it would appear, one is essential for normal reproduction, the absence of which, at least in female rats, produces sterility. Starvation, partial or complete, and an unbalanced diet entail a corresponding degree of avitaminosis and deficiency disease; war or famine oedema, which resembles the " wet " form of beri-beri, has been ascribed to a diet largely composed of cereal and deficient in protein food.

Blood-Chemistry.—From improved technique chemical examination of the blood for non-protein nitrogen (in kidney disease), sugar and gases, cholesterol, calcium, phosphates, chlorides and bilirubin has become a method of clinical laboratory routine and essential for correct diagnosis and treatment. Much work has been done on the hydrogen ion concentration of the blood and the conditions of (1) acidosis, or diminution in the alkali reserve of the blood, which occurs in two forms, ketosis, as in diabetes mellitus, and another due to retention of phosphates, as in renal disease, and (2) of alkalosis or alkalaemia in which the alkalinity of the blood is increased, as in forced breathing when carbonic acid gas is removed in unusually large quantities from the lungs. Alkalosis has, like a fall in the calcium salts and the poisonous effect of guanidine, been thought to cause a convulsive state—tetany, which forms part of the condition called spasmophilia seen in children.

Bacteriology (*q.v.*) has revealed the organism responsible for a number of diseases and so opened the way to specific treatment and the prevention of the infection. In the case of scarlet fever (*see* INFECTIOUS FEVERS), ascribed to haemolytic streptococci, G. F. and G. H. Dick have elaborated a test (the Dick test), analogous to the Schick test in diphtheria, whereby those susceptible to the disease can be detected and so artificially protected against it by an antitoxin. The recognition of tularaemia (due to a cocco-bacillus), a disease of rodents and transmitted to man by the bite of the horse fly, and of melioidosis also a disease of rodents and due to the *Bacterium whitmori*, in which the exact method of its transmission to man is uncertain, bear on the desirability of the closer correlation of the human with veterinary medicine. Invisible viruses or ultra-microscopic organisms, also called filter-passers (*see* FILTER-PASSING MICROBES), because they are so minute that they pass through the fine pores of a Chamberland or other filter, have attracted much attention and many diseases in man and animals are with a fair degree of certainty or probability ascribed to their agency.

Cancer.—The outstanding discovery of the ultra-microscopic organism of cancer (*q.v.*), which is active only in the presence of a " specific factor," by W. E. Gye and J. E. Barnard, opens possibilities of cure and prevention, for which the medical world has been at work for many years.

Bacteriophage.—D'Hérelle described a phenomenon, previously noted by Twort in 1915, often known by D'Hérelle's name, which he interpreted as the existence of an ultra-microscopic virus which lives as a parasite upon living bacteria and leads to their destruction and solution. The general opinion about the active substance responsible for these changes in bacterial cultures, and called by D'Hérelle the *microbe bacteriophage*, is that it is not an ultra-microscopic virus, but an enzyme or ferment produced by the undoubted bacteria themselves.

Protozoan infections (*see* PROTOZOOLOGY) are the cause of
number of diseases, such as yellow fever (*Leptospira icteroides*)
a form of infective jaundice (*Spirochaeta icterohaemorrhagica*)
rat-bite fever (*Spirochaeta morsus-muris*), and seven-day feve
in Japan (*Leptospira hebdomadis*), and probably sandfly feve
(*q.v.*) (a leptospira resembling that of yellow fever). Thus thei
prevention and the employment of curative antitoxins has bee
rendered possible.

Immunity (*q.v.*).—After a fever the individual usually become
immune and protected against another attack, this is acquire
immunity; the blood of such a person contains antibodies whic
antagonise the cause of that disease, and advantage has bee
taken of this to inject the blood serum of patients convalescen
from measles into persons who have not had the disease so a
to render them immune.

Anaphylaxis.—The reverse of immunity is hypersensitivenes
(anaphylaxis, allergy) which is shown by idiosyncrasies an
forms the underlying factor in asthma and other diseases spoke
of as " toxic idiopathies; " the substances responsible for th
symptoms can be detected by skin tests and the appropriat
treatment thus employed. Protein shock therapy is also em
ployed for asthma and chronic arthritis. The importance o
" focal infection " such as dental disease (*see* DENTISTRY), is no
much more fully recognised (*see* THERAPEUTICS).

Exact studies upon the chemical activities of bacteria now i
progress are beginning to throw light on the actions of toxins an
the chemical factors involved in immunity reactions.

Radiology (*q.v.*).—In radiology there has been a steady advanc
in the methods of diagnosis and treatment; technique has bee
elaborated and special methods have been introduced. Dye
opaque to X-rays have been employed in various direction
thus lipiodol has been injected into the bronchial tubes to dem
onstrate dilatation of their lumen, into the spinal column t
show the position of tumours, and even into the pregnant uter
to detect pregnancy. The condition of the gall bladder and th
presence of gall stones can be made evident by organic com
pounds of iodine and bromine (tetra-iodo-phenol-phthalein an
tetra-brom-phenol-phthalein), which after being taken by th
mouth are excreted in the bile and show up under X-rays (cho
ecystography). Injection of air into the peritoneal cavity e
ables a clearer X-ray picture of the abdominal viscera to
obtained. The skiagrams of the jaws, showing the presence
absence of infection of the apices of the teeth and of the sku
showing the condition of the sella turcica, have facilitated th
detection of focal sepsis and of pituitary disease respectivel
The improvement of technique has made advances in treatme
possible. By intensive X-ray exposures, following the Erlange
practice, the remedial therapy of deep-seated malignant growt
has been pursued. The radium treatment of cancer in positio
where the radium (*q.v.*) can be brought into close contact wi
the growth, is now carried out with increasing frequency, a
team work in this treatment of cancer of the uterus has bee
adopted in a number of hospitals. Side by side with advanc
in treatment the effect of X-rays on the tissue cells has been i
vestigated experimentally; the results have a very definite bea
ing on the methods and dosage employed in treatment, for t
destructive changes induced in the cells may give rise to gra
symptoms and even death. It appears that the action of X-ra
may set up secondary ultra-violet radiations in the tissues a
so cause severe changes.

Diseases of Function.—Functional disorder and the invest
gation of the early stages of disease, before the physical signs
gross structural changes appear, have attracted increasing atte
tion and are intimately wrapped up with the ideal of medic
science, the prevention of disease, proverbially a higher aim th
its cure. The first manifestation of disease is commonly disord
of function, which shows itself by symptoms unaccompanied
any structural change. Clinical observation was specially
rected to the detection of the earliest signs of disease by the la
Sir James Mackenzie, who in 1919 started team work in th
direction at the St. Andrews Institute for Clinical Researc
where laboratory tests were fully utilised as an aid to the caref

alysis of the patient's symptoms in an intense search for a real
derstanding of the familiar manifestations of undue fatigue,
laise, shortness of breath on exertion and pain. Tests for
order of function—some physical, as in disorders of the circu-
ory and respiratory organs, others chemical, such as exami-
tion of the blood and the ability of the organ to excrete coloured
es, for example, phenol-sulphone-phthalein, as in disease of
e kidney and the liver, others psychological, as in nervous dis-
ler—have recently been much elaborated and multiplied, and
l fair to facilitate more accurate and early diagnosis and treat-
nt on scientific lines.

Psychology (*q.v.*).—Experimental psychology, once regarded
an academic pursuit, has been the means of great economic
ing in industry, and the results of research work and tests
ve led to the introduction of rest pauses and other modifica-
ns, with the result of an increased output of work on the one
nd and benefit to the worker on the other. The Industrial
igue Research Board was set up during the War, and The
tional Institute of Industrial Psychology, established in
eat Britain after the War, ensures continued practical guid-
e for employers and employed (*see* INDUSTRIAL PSYCHOLOGY).

Endocrinology (*q.v.*). *Ductless Glands.*—The part played by
ductless or endocrine glands in the production of disease has
racted increasing discussion, especially on the questions (1)
he endocrine balance, meaning thereby that when one gland
disordered the equilibrium which normally exists between
m as a whole is upset, and (2) of the effects of disease of more
n one of these glands—pluriglandular disorder. This last
blem has on the one hand, from the difficulty of positive
of, aroused scepticism as to its existence, and on the other
d stimulated exploitation of commercial preparations of
nbined glandular extracts, the activity of which, as regards
e of the constituents, is open to serious doubt. The out-
nding advance in the medicinal use of endocrine preparations,
l indeed in therapeutics generally, is the introduction of in-
n (*q.v.*) for the treatment of diabetes mellitus (*q.v.*) (*see* THER-
UTICS).

The use of the endocrine preparations proved to be active is
sing out of the qualitative stage into the further one in which
y are being so standardised that the proper dose can be ad-
istered; this has been done for insulin, adrenalin, thyroid and
athyroid extracts. The interstitial cells of the testis ("inter-
ial gland") has attracted much research in connection with
influence on the secondary sex characters and in insanity.
perimental ligature of the duct of the testis (vasectomy) in-
ses the prominence of the interstitial gland and is followed
rejuvenation (Steinach), and with this object the operation
been often performed on men, as has grafting of testes of
n or chimpanzees (Voronoff) (*see* REJUVENATION).

ardiology and Circulatory Organs.—The work of the late Sir
es Mackenzie and Sir Thomas Lewis has so revolutionised
knowledge of the heart that there is a new cardiology (*see*
ART, DISEASES OF). By the electrocardiograph, which is
cially valuable in showing the condition of the heart muscle,
is showed that the extreme irregularity of the heart in cardiac
re, called by Mackenzie nodal rhythm, is due to auricular
llation; a circus movement instead of the normal contrac-
; it is in this condition that digitalis is of value. By means of
graphic methods the irregularities of the heart have been
sified.

ngina Pectoris.—Cardiac murmurs have been shown not
essarily to be of grave importance, and much work has been
e on angina pectoris. The symptoms—status anginosa—of
den obstruction of the coronary arteries which supply the heart
e been defined, and the cause of angina pectoris has been
rred to the failure of the heart muscle (Mackenzie), and to
ase of the first part of the aorta (Allbutt); in accordance with
last view operative division or removal of its nerves has been
ctised and found to relieve the pain, but not otherwise to
ct the disease. Bullets embedded in the heart-wall have been
oved, and a contracted (mitral) valve has been remedied by
ical measures (*see* HEART AND LUNG SURGERY).

Blood-Pressure.—The existence of high blood-pressure without kidney disease or hyperpiesia (Allbutt) has been established, and it has been suggested that table salt and, probably with more reason, guanidine raise, and that hepatic extract lowers blood-pressure. The state of the capillaries—microscopic vessels—their power to contract, and their influence on blood-pressure have been investigated and much new knowledge has been acquired. The prevention of rheumatic heart disease and the responsibility of tonsils and other sites of focal infection have received considerable attention both in Great Britain and in America.

Bronchoscopy.—In diseases of the lungs the trial of new methods of treatment has gone on, such as specific or chemical remedies, and the production of artificial pneumothorax (*q.v.*) (*see* THERAPEUTICS). As the presence of adhesions inside the chest interferes with the production of a curative pneumothorax, they have been divided by a cautery, the process being watched through a hollow tube, illuminated by electric light, passed into the chest (Jacobaeus' thoracoscopy). Bronchoscopy for the detection and removal of foreign bodies from the air-passages has, in the hands of Chevalier Jackson, become a fine art; the importance of an early removal of these bodies before they have set up destructive changes in the lungs, which in the past have proved obscurely fatal, has now been fully recognised. In the abdomen a method, laparoscopy or coelioscopy, by which the contents can be seen by an arrangement similar to that of thoracoscopy, has been employed; but neither of these difficult methods is likely to come into general use.

Fractional Test Meals.—The adoption of fractional test meals as a more exact method of determining the constitution and variations of the constituents of the gastric contents has, thanks to Rehfuss, superseded the single examination made one hour after a test meal. Absence of hydrochloric acid, a normal constituent of the gastric juice, has been shown to favour the onset of pernicious anaemia (*see* ANAEMIA). Aspiration of the bile by a duodenal tube, after Oddi's sphincter, which closes the lower end of the common bile duct, has been relaxed by a spray of magnesium sulphate, enables a microscopical, chemical and bacteriological examination of the bile to be made, and also does good by drainage in cases of infection and inflammation of the biliary tract.

Tests for Hepatic Efficiency.—The search for tests to estimate the functional capacity, or the way the liver is doing its work, has been carried on with energy, and a number of tests for the individual functions have been introduced; but no one test for them as a whole is satisfactory, and another difficulty is that the liver, like the heart and other organs, has a great reserve, so that it can, although much damaged, discharge its functions so well that tests do not reveal any failure of the compensated condition; this is especially true in chronic disease. By means of a blood test—the Hijmans van den Bergh reaction—obstructive jaundice can be distinguished from other forms.

Neurology.—The physiology and pathology of the nervous system has steadily progressed; the researches into the factors presiding over equilibrium and posture have yielded valuable information; disease of what is called the extra-pyramidal system has attracted attention; acute infections of the nervous system, acute poliomyelitis, encephalitis epidemica ("sleeping sickness") and cerebrospinal fever were more prominent in the conditions of war than before; much valuable scientific research into the method of actions of poisons on the nervous system has been carried out.

Panel Practice.—The conditions of medical practice in Great Britain were profoundly modified by the introduction, as the result of Mr. Lloyd George's National Insurance Act (1911), of the "Panel system," whereby 15,000,000 insured persons are now looked after by practitioners paid at a yearly rate of a sum which has averaged about ten shillings a year, paid partly by insurance contributions and partly by the state; this enormous undertaking is part of National Insurance and is under the control of the Ministry of Health. No one medical man is now allowed to have more than 3,500 persons on his panel. At the time of its initiation the panel system met with great opposition from the medical profession, but this collapsed, and on the whole the system works well, and is certainly an improvement on the old system of clubs. (*See* Health Insurance, Medical Aspects.)

Diplomas in Special Subjects.—The enormous advances in medicine have made specialism necessary and inevitable, and as evidence of the general recognition of this need diplomas in these special subjects are granted by the universities and licensing bodies. The General Medical Council in 1922 revised the regulations for one of the oldest diplomas, that of Public Health (D.P.H.), and ordained that two years, instead of one year as formerly, must elapse from the date of a candidate's obtaining a registrable qualification in medicine, surgery and midwifery before his admission to Part II. of the examination for diplomas in sanitary science, public health or state medicine. There are diplomas in psychological medicine, in tropical medicine and hygiene, in ophthalmic medicine and surgery and in laryngology and otology, and since the War the universities of Cambridge and Liverpool have given diplomas in radiology. (*See* Medical Education.)

Group Medicine.—The specialisation of medicine and the elaboration of technique prevent any one man from being master of the whole field of medicine, and accordingly there has been a tendency for men to combine in team work or group medicine, especially in America. A group of men expert in their own lines may work together or under a general physician or surgeon who, in consultation with them, correlates the collected evidence and comes to a final decision on the whole matter. These diagnostic clinics, which are exemplified by the Mayo Clinic, Rochester, Minn., are commoner in America than in Great Britain. They should have the advantage, from the patient's point of view, of providing for a fixed inclusive fee all the special examinations that may be necessary at a lower cost than in ordinary practice would be required for such a number of tests.

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MEDICINE, PRE-SCIENTIFIC (*see* 18.41).—The aim of primitive medicine, like that of primitive religion of which it at first formed an inseparable part, was to safeguard life, using the same means to attain their common end.

Main Causes of Disease.—Modern investigations reveal that savage races still attribute disease to three main causes:—

(*a*) The projection of some foreign substance into the body;
(*b*) The abstraction of something from the body;
(*c*) A sympathetic process operating on some part of the body or on some object that has been in contact with the victim.

As the supposed results are ascribed to the agency of men or spirits, their machinations have to be circumvented or their wrath diverted. Many practices illustrate these points. Thus suction is a common ceremony, performed upon the sick by many peoples, to extract the offending object. To discover the source of the evil, divination is employed. In many cases the native conception of the nature of the lesion associated with disease is very concrete. Thus certain Australian tribes look upon it as due to the abstraction of adrenal fat. In Melanesia it is held that removal of part of the soul, due to spirits, is the cause of many symptoms. The treatment of disease by savage folk can only be understood in reference to their pathological theory.

Trephining.—Among the most remarkable of the forms of treatment is trephining, which was performed from a very early date with stone implements before the introduction of metals. A decompressive trephining for epilepsy or other disorders of the brain, real or supposed, is still practised among the Aymaras of Bolivia and the Guichuas of Peru. The beliefs at the back of the process are still not clear.

Primitive Surgery.—The surgical measures of uncivilised man are not always as inadequate as might be supposed. Some savage folk have developed more than a rudimentary idea of bone-setting. Moss, fresh leaves, ashes or natural balsams are used to dress wounds, which, when poisoned, are treated by sucking or cauterisation. Among surgical instruments we note horns for cupping, a sharp thorn for opening an abscess, saws of stone and bone for amputations and special instruments for letting blood. The latter operation is very widely practised.

The Medicine Man.—The position of the medicine man
doubtless very similar among savages of to-day to what it
with early races. He exhibits a gradual differentiation from
priest. In Indonesia the medicine man is now quite disti
from the priest, but in Polynesia and North America the relati
ship is often so close that the two may be indistinguishable.

Survivals.—The remains of the savage's mode of treat
disease survive with peculiar persistence even in centres
Western civilisation. Belief in magic and in the efficacy
charms still plays a considerable part in the attempted prevent
and cure of many ailments in Europe and America. Thus,
instance, the mountaineers of southwestern Virginia and east
Tennessee believe that an iron ring, worn on the third fin
of the left hand, will drive away rheumatism. This pract
shows a persistence of the very ancient belief in magical prop
ties of the third finger and of iron. A modern English herb-doc
will peel the bark of an elm *downwards* if a cold has to be dra
down from the head, and peel it *upwards* if it has to be drawn
from the chest. Warts are rubbed at regular intervals with a g
ring. The persistence of colour as a significant factor in fo
medicine is shown by the use of red flannel as a bandage for s
throats and whooping cough, a case of sympathetic connect
between the redness of inflammation and the redness of mater
Finsen's red-light treatment to prevent pitting in smallpox
been said to trace back to the same folk-custom, employed
the case of the son of Edward II. In Ireland homeopathic d
tors give for jaundice yellow medicines, such as saffron, turme
sulphur, even yellow soap.

Egyptian Medicine.—Of the pre-scientific systems of medic
of the ancient civilisations, the best known is that of Egy
Ancient Egyptian medical treatment, chiefly magical, include
large number of traditional practices which had survived fr
very early times. For long the art of healing was in the hands
the temple priests. These men formed an organised body wit
sort of physician-in-chief at its head. They concentrated
hygiene and diet, advising abstention from many vegetable foo
especially beans and onions, the latter a supposed aphrodis
which also provokes thirst and tears, from mutton and po
from certain milks and from salt which produces drunkenn
and gluttony. On three days out of every 30, emetics or clyst
were to be taken. Among hygienic measures, dwelling hou
were to be kept clean and fumigated with resin and myrrh,
body was to be frequently bathed and suitably clothed a
gymnastic exercises were recommended. Ointments, potic
and poultices were in use. Among drugs were honey, incen
salt, cedar oil, sycamore bark, nitre, sulphate of copper, alum,
brains, liver, heart and blood of various animals, stag's horn a
oil of camomile for frictions. Fever patients were wrapped
woollen stuffs to promote perspiration.

Ebers Papyrus.—The Ebers papyrus mentions a number
symptoms and diseases (some difficult to identify) such as int
tinal worms, inflammation in the region of the anus, haem
rhoids, disorders at the pit of the stomach, fluttering of
heart, pains in the head, urinary affections, dyspepsia, angi
and about 30 different affections of the eyes. Among the ren
dies are blood-letting, sudorifics, diuretics, drugs to prod
sneezing, copper salts and oxymel of squills to produce vomiti
castor oil given in beer as an aperient and pomegranate seeds
the expulsion of worms.

Edwin Smith Papyrus.—The Edwin Smith papyrus, not
fully described, seems to suggest skill in surgery in advance
that of any of the contemporaries of ancient Egypt. It sugges
too, rather more anatomical knowledge than had hitherto b
considered likely among the Egyptians.

Statues of Healing.—On the purely magical level were
Statues of Healing. These were placed in rectangular bas
upon which texts and images were carved. The water t
flowed through the basins acquired magical properties throu
contact with the statues and thus became curative for all rep
bites. The water, either taken internally or used as a lotion,
all-sufficient; it was even unnecessary to repeat the ma
formulae carved on the garments of the statue or on the basi

nese remedies were therefore more especially used by the terate. Statues of *Horus on the Crocodiles* were the most dely-spread and most efficacious instruments of protection ainst and cure for the bites of scorpions, serpents and crociles, their use probably going back beyond the XIX Dynasty.

Coptic Medicine.—During the last few years our knowledge of medicine of the Copts has been considerably extended by publication oi a long and important text and by several nor finds. The Coptic material exhibits a rapid recession of ancient Egyptian element. Coptic *materia medica* reveals nistakable Greek and Arabic influences and magic is of ondary importance. The mouse, goat, wolf, hyaena, and other mals are all mentioned in prescriptions, but the greater num- of medicaments are of vegetable or mineral origin and lude, as in all early writings, emetics and purgatives. Eye-ubles were always rife in Egypt. It is thus not remarkable that out half of the 237 prescriptions contained in the Cairo papy- (c. 9th century A.D.) deal with these conditions. For the jority of the ophthalmic remedies there is no indication of the dition for which they were applied. There are, however, 13 cataract, 18 for dimness of vision, three each for abscesses and ammation, 13 for trachoma and two for amauroses. Among skin and scalp affections prescribed for are melanoderma, pes, itch and lichen. We read of remedies for abscesses, boils, es, cuts and bites, ulcers, gangrene sores and swellings. nmin ground with moistened rue is taken for three days for er. Opium, calf's fat and milk melted together and applied m cures earache with such rapidity that the physician is ised to collect his fee in advance! A mixture of red and yellow iol and alum is recommended for toothache. Two formulae the extraction of teeth are of interest, for though dental caries alveolàr abscesses have been found in mummies of the raonic period there is no evidence of the extraction of teeth hat early time. Considerable knowledge of and skill in sur- may be gathered from a Coptic surgical instrument case in Cairo Museum, the space allotted for knives and scalpels wing that operations were no simple affair.

Iesopotamian Medicine.—The civilisation of the valley of the hrates and the Tigris had reached an advanced degree of de-pment about 4,000 B.C. Babylonian medicine was purely irical. It occupied, however, a less important rôle in the art ealing than magic. The liver was regarded as the central n for the blood, the true life principle, which was divided into kinds, blood of the day and blood of the night. Disease was emon that entered the body and must be expelled. The rmacopoeia made use of mineral, vegetable and animal sub-ces. Among remedial agents were honey and syrup of dates, s, blood-letting, use of cups for drawing blood to the surface he body, cold shower and warm baths, clysters, various es, friction with oil. An ointment composed of plants cooked rease, or a decoction of copper-ore in beer, was used in cases phthalmia, a very common complaint in Mesopotamia also.

ssyrian Medicine.—The more northern Assyrian medicine the same foundations and followed the same methods as the hern Babylonian. Therapy was exorcism and incantation prophylaxis, although the accounts of surgical procedure in Code of Hammurabi imply an elementary knowledge of omy. We gather hints, however, from the medical texts the physicians of Nineveh may have been less ignorant has been supposed. Some 250 vegetable drugs and 120 min- drugs were known, as well as 180 derived from other uniden- sources, making a total of 550. The names of these drugs r many thousands of times in the medical texts. To the e must be added remedies consisting of various alcohols, oils, honey, wax and various kinds of milk. Among the es most frequently met with in the texts are: pine and fir entines, rose, cedar, darnel, marigold, heliotrope, asafoetida, arisk, liquidambar, storax, mustard, galbanum, henbane, , myrrh, arnoglosson, castor oil plant, mint, tragacanth, el, cypress, nightshade, millet, poppy, fig, laurel, pome-ate, wheat flour and mandrake. The mandrake seems to entered medical magic from Babylonian sources.

Persian Medicine.—Iranian medicine became laicised in Zoroaster's time when the "mages" were superseded by the physicians whose business was to restore health. It bears points of resemblance to ancient Hebrew medicine which may be dependent on it. Treatment of the sick consisted of incantations, vegetable drugs and the use of the knife. Hygiene was one of Zoroaster's main preoccupations: "A healthy man is a moral man."

Indian Medicine.—Hindu conceptions concerning the causes of disease were very confused. The confusion may be the result of the mixed origin of Indian pathology. The earlier Indian physicians utilised the senses of taste and smell as well as inspection, palpation and auscultation for purposes of diagnosis. Hygiene and diet played an important part in the life of the people. The pharmacopoeia of India is very rich, the great majority of drugs belonging to the vegetable kingdom. Charaka (pre-Buddhistic period) knew of 500 plants that possessed remedial virtues, Susruta mentions 760, of which cinnamon, pepper, cardamons, spices and sugar were native. He also gives lists of drugs classed according to their action into lists of cerebral sedatives, emetics, purgatives, anodynes, etc. Diabetes mellitus was first described by Indian physicians who noticed that flies and other insects were attracted to the urine of patients suffering from this malady.

In surgery the ancient Hindus were probably superior to any of their oriental neighbours. Susruta mentions eight kinds of surgical operations. Fourteen different kinds of surgical dressings were in use; cotton, woollen, linen and silk for bandages. Special splints of withes of bamboo were employed in cases of fracture and dislocation. These were later adopted in the British army as the "patent rattan cane splint." It is regrettable that it continues impossible to assign dates to ancient Indian medical documents with any degree of confidence.

Deteriorated Remains of Scientific Medicine.—It has become increasingly evident that the culture of many savage and semi-savage tribes is in fact little but decayed civilisation. This is particularly true in the department of medicine. Researches, for instance, on Anglo-Saxon medicine have shown it to be little but the system of the classical peoples corrupted, deteriorated and misunderstood. In view of this "derivative" character of much so-called "primitive" medicine, a reinvestigation of the medical customs of savage peoples is demanded.

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MEDINA (*see* 18.64).—Before the World War, Medina was less known to Europeans than Mecca, although it was described by the earlier travellers, Burckhardt and Burton, and by Wavell, who visited it in 1908. Before the World War the normal resident population was estimated at 40,000, of whom a large proportion were aliens who had settled after pilgrimage. The Turks deported about three-quarters of the inhabitants during the blockade, and, allowing for further decrease by disease, the population in 1920 was well under 10,000. Much new information regarding existing conditions in the city was obtained as a result of the War operations. The dimensions of the city were overestimated by earlier writers, the walls actually measuring not more than 1½ m. in circumference, with the longest diameter a little over ½ m. east and west. The Hejāz railway has its terminal station outside the city walls at the Bab el 'Ambari, the gate on the southwest through which runs the road to Yenbo'. There are normally three trains weekly from Damascus, and the journey takes 5½ days. During the War a branch was carried from the main line, through a breach in the walls on the northwest side, to the outskirts of the *Haram* or Great Mosque, which was used as a munition store and was intended to serve as an inner citadel in case of siege.

At the outbreak of the revolt in June 1916 the Arabs, unable to take the city by assault, withdrew and began a blockade, which —as they were unwilling to bombard the city for fear of damage to the holy places and refused to cut the water supply conduit— lasted until the Turks surrendered the city in Jan. 1919. In 1917 Fakhri Pasha, commander of the garrison, devised a scheme for the rebuilding and modernisation of Medina, but all that happened was the destruction of a great number of houses for the sake of the beams and woodwork to feed the railway locomotives. Extensive palm plantations outside the walls, east and northeast, were also ravaged for the same purpose. Large palm gardens which formerly occupied much space within the wa were in great part built over, and the Barrel Manakha, or cent open space, was encroached upon. Sherif Ali, son of King H sein, became emir of Medina in 1925. In the later part of th year the city was invested by Wahhabi troops.

MEDITERRANEAN SEA (*see* 18.67).—In 1910 the lands wh bound the southern and eastern parts of the Eastern basin the Mediterranean were under real or nominal Turkish contr In theory, that is to say, the Sultan of Turkey was suzerain the area extending from the frontier of French Tunisia, that from the Gulf of Gabes, to the Gulf of Alexandretta, and own also the island of Cyprus. At the present time Tripoli, whi abuts on Tunisia, is Italian; Egypt forms an independent ki dom; the mandated territories of Palestine and Syria are attach to Britain and France respectively, and Cyprus has been nexed to Britain. From the whole of this long stretch, therefo the Turk is now excluded.

Political Changes.—In the northern part of the Eastern ba and in its connected subsidiary seas, conditions were more co plicated. The whole of Asia Minor was and remained politica Turkish: from the ethnic and economic standpoint indeed was more definitely Turkish in 1926 than it was in 1910. the changes in the European littoral of the Aegean Sea w great. In 1910 Greece was but a small state, though at the sa time Greeks were widely distributed around all the shores of Aegean and within the adjacent lands and had great econor influence there. Crete was still Turkish, as was the whole Thrace, together with the region vaguely called Macedon this meant that politically the Aegean was chiefly a Turk sea. In 1926 Crete was Greek, and Turkey had also lost whole of Macedonia and all but an eastern fragment of Thra In other words, Greece in 1926 included almost the whole the European littoral of the Aegean, and to her previou existing ports had been added that of Salonika, which had quired great significance. The interchange of populations tween Greece and Turkey in 1923–4 meant further that acquired area was in process of becoming ethnically more Gr than it had been in the past. On the other hand, Greek influe in western Asia Minor disappeared, and with it the port Smyrna lost much of its former trade.

The changes on the Adriatic littoral and on the adjacent pa of the Ionian Sea had been great. In 1910 Turkey held in Epirus area a frontage on the Ionian Sea and had also a w window on the Adriatic. The extension of Greece to the no and the establishment of the independent State of Albania, w territorial changes which preceded the outbreak of the Wo War; but that War resulted in others of even greater importan Prior to its outbreak, Austria-Hungary, which had anne Bosnia-Herzegovina from Turkey in 1908, held the eastern co of the Adriatic, from the edge of the very narrow strip wh was Montenegrin to beyond the Isonzo. The Peace Trea gave the greater part of the littoral to the Serb-Croat-Slov State, and the smaller part to Italy, and left a cause of disc between the two in regard to the fate of the port of Fiumè.

In the Western basin, save for agreements in the case Morocco, there were no territorial changes: a certain amount political equilibrium had been reached there long prior to period under consideration. On the other hand, the new posit within continental Europe generally brought about by the lead to fresh developments within the Mediterranean zo France, Italy and, to a minor extent, Spain made definite tempts to develop their trans-Mediterranean possessions, and establish themselves more firmly on the shores of that sea.

Since Spanish action was limited to a coastal belt in Moroc it may be briefly dismissed. In 1912, the year in which French protectorate was accepted by the Sultan of Moroc France and Spain reached an agreement as to the limits of th respective zones within that country. Spanish attempts to ma occupation effective in their own zone were probably influen primarily by the French advance: other influences were the of the remnants of the former colonial empire of Spain and continuous emigration to Algeria, which had acquired a la

anish element in its population. The convention of 1923 be-
een Great Britain, Spain and France in regard to Tangier,
en placed under a régime of permanent neutrality, indicated
growing importance of France in the Western basin of the
editerranean. The refusal of Italy to recognise the agreement,
the ground that she was not represented at the convention
s similarly an indication that that State, now freed from
xiety as regards her northeastern frontier, was directing her
icy more and more definitely towards Mediterranean affairs.
French Policy in the West.—If the developments in Morocco
re the chief events in the West since 1910, yet other signs were
wanting of the new orientation of French policy there. As
ntrasted with Italy and even with Spain, there is in France no
rplus population seeking new lands for settlement. Thus the
t that the North African territories, particularly Algeria,
e opportunities for European colonisation is not of much
ect importance to that country. On the other hand, there is
at need of man-power, particularly for the army. Though the
ritories of the Mediterranean littoral are not densely peopled,
y do form a recruiting ground, and Algeria, Tunisia and Mo-
co all furnish divisions to the French Army. But these lands
but the margin of a vast area which, interrupted politically
y by smaller *enclaves*, and physically by the Sahara desert,
w extends to the Gulf of Guinea and, further eastward, to far
yond the equator. Parts of this area contain a virile coloured
pulation, whose members make good soldiers. In this con-
ction it may be noted that Senegalese regiments have formed
art of the French Army since 1911, and that in 1919 the na-
e element in the army was greatly increased.

The bearing of these facts is twofold. In the first place it is
ential that facilities for transverse traffic between the French
the North African coast opposite should exist in peace, and
t so far as possible the safety of the routes should be assured
time of war. Secondly, schemes are in contemplation for
rcoming the obstacle presented by the Sahara, in such a way
to ensure easy land communication between the littoral
ssessions and those further south, in order that the two may
velop in combination. A railway connecting French West
ica directly to the Mediterranean coast would have great
ategic importance in time of war, while the feasibility of
tor communication had already been demonstrated. These
ssibilities increase the significance of the Mediterranean ports.
erta, Algiers and Oran are already important naval stations
submarine bases, and the French are making great efforts
develop and strengthen all the ports on this littoral, as centres
trans-Mediterranean traffic. This emphasis on cross-routes
ot only significant in itself, but is something entirely modern.
New Rôle of the Mediterranean.—Previously, as is well shown
the long-drawn-out row of British stations at Gibraltar,
lta and Aden, the Mediterranean was primarily of impor-
ce as a longitudinal thoroughfare. Up till the post-War
riod, between Malta and Aden, there was in Egypt a country
der British influence. With the establishment of an inde-
dent kingdom there, and the changes just noted, it is obvious
h that Great Britain's position in the Mediterranean has been
akened, and that a new set of traffic routes is being super-
posed on the old. It may be added that if, as is sometimes
ted, French withdrawal from Egypt in 1883 was due to the
r of renewed attack on the northeastern frontier of France,
en French acceptance of the mandate in Syria is an indication
t this reluctance to extend her extraterritorial commitments
s ceased to exist under the new conditions.

Italian policy in the Mediterranean area since the War had
en influenced by somewhat different motives. Italy has a
adily increasing population and the emigration laws in the
ited States tended to restrict one of the pre-War outlets for
surplus. Thus Italian policy was directed towards attempts
promote home industry and commerce in order to attract a
rt of the dense rural population from the land, and also to find
w areas of possible settlement. The latter motive led to
orts to develop Tripoli, obtained from Turkey in 1912, while
former affected Italian policy in the eastern part of the
Adriatic. By the acquisition of the peninsula of Istria, with the ports of Trieste, Pola and Fiume, and of Zara and the island of Lagosta, Italy obtained both complete protection for the eastern coast of the peninsula and opened up possibilities of notable commercial developments. The Italian advance meant that Austria and Hungary lost all outlets on the Adriatic, and thus had no direct access to the Mediterranean Sea.

The collapse of the former Ottoman empire resulted in the rise in the eastern Mediterranean of states which were either actually new, as are the Kingdom of Egypt, Yugoslavia and the much smaller State of Albania, or, as in the case of Turkey and Greece had undergone such radical modification—territorial, political and ethnical—as to be to all intents and purposes new. Such states were for the most part characterised by a strongly nationalistic spirit which retarded economic recovery from the effects of the War. The result was that the chief ports at first showed decay rather than advance. This was particularly true of Constantinople and Smyrna, and even Salonika, where the Yugoslav state had had a free zone since 1923, did not make notable progress. Despite their long Adriatic littoral also, the Yugoslavs were not able to develop an adequate outlet there. By an agreement reached with Italy in 1924 the port of Fiume became Italian and the adjacent one of Port Baross, Yugoslav. The friendly adjustment of this difficult question is probably an indication of future closer economic connection between the two Powers.

This summary account of conditions up to 1925 makes it clear that political developments, especially in the southern and eastern parts of the Mediterranean area, took place between 1910–25 with a rapidity all the more startling in view of the long antecedent period of complete or partial stagnation. But the apparent suddenness of the political and territorial changes was due to the fact that they were the consequences of cumulative economic changes which had been going on for a long period of time. In particular, the increased production of cereals for export in central and eastern Europe, and the discovery and working of oil-fields alike along the Carpathian border and in the Caspian region, gave to outlets to the eastern Mediterranean an importance which they did not possess in earlier times, and made readjustments inevitable. The Mediterranean Sea was no longer what the opening of the Suez Canal and the associated growth of European influence in the Far East had made it—primarily a thoroughfare for world commerce. It was becoming also an important outlet for the developing lands round its southern and eastern shores.

Present strategic conditions in the Mediterranean region are discussed in D. H. Cole's *Imperial Military Geography* (London, 1925). See also M. I. Newbigin, *Geographical Aspects of Balkan Problems* (London, 1915); I. Bowman, *The New World: Problems in Political Geography* (London, 1925). (M. N.)

MEHTA, SIR PHEROZESHAH MERWANJI (1845–1915), Indian municipal reformer, was the son of a Bombay merchant. Educated at the Elphinstone College, he was the first Parsee M.A. of Bombay University and coming to London to read at Lincoln's Inn was also the first Parsee to be called to the English Bar (1868). With Dadabhai Naoroji he founded the organisation which grew into the East India Association. Returning to Bombay he rapidly made a name as an advocate. Appointed in 1869 as Justice of the Peace, he served on the new Bombay Corporation from 1872 till his death. He also served for over 30 years on the Bombay legislature. For the last few months of his life he was vice-chancellor of Bombay University. Created a C.I.E. in 1894, he was advanced to the knighthood of the order 10 years later. He died in Bombay Nov. 5 1915.

See the political biography by H. P. Mody, *Sir Pherozeshah Mehta*, 2 vol. (1921). Much light is thrown on Mehta's services to his native city in *Rise and Growth of Bombay Municipal Government* (1913), by his most intimate co-worker, Sir Dinshah Edalji Wacha.

MEIEROVICS, ZIGFRIDS (1887–1925), Latvian statesman, was born Jan. 24 1887, the son of a country doctor in Courland, and was educated at the Riga Polytechnic. He first worked in an insurance company and afterwards in an agrarian bank.

This training gave him an insight into financial problems and prepared him for the prominent part he was to play in the stabilisation of Latvian currency. In Nov. 1918 he became the first foreign minister of independent Latvia and, as delegate to the Peace Conference, he secured Latvia's recognition and later succeeded in gaining her admission to the League of Nations. From 1918 until his death he held office almost continuously as foreign minister and was once prime minister. He was killed in a motor accident on Aug. 22 1925.

Shortly after this date a well-known student of the movement for independence in the Baltic States expressed the opinion that of all the leaders of that movement in the various states involved, Zigfrids Meierovics was at once the most statesmanlike and the most influential. He was a man gifted with an unusual power of looking ahead; and he was able to recognise the real problems facing the Baltic States in the years immediately following the World War with probably greater facility and clarity than any of his colleagues in leadership. One of the foundations of his foreign policy was the conviction that Estonia, Latvia and Lithuania possessed many interests in common and should therefore endeavour to co-operate for the common good of all three states. The confidence which he inspired in his own countrymen is abundantly proved by the insistence with which the latter kept him in office from 1918 onwards.

MEIGHEN, ARTHUR (1874–   ), Canadian statesman, was born at Anderson, in the county of Perth, Ontario, June 16 1874, the son of Joseph and Mary Meighen. He was educated at St. Mary's Collegiate Institute and at Toronto University, and became a barrister-at-law. He married in 1904 Jessie Isabel Cox, daughter of the late Charles Cox of Granby, Quebec. His political career began in 1908 when he was elected to the House of Commons as the Conservative member for Portage la Prairie in the province of Manitoba. His talent as a debater was at once recognised. In 1913 he became solicitor-general in the Government of Sir Robert Borden; and in Oct. 1917 secretary of state and minister of mines. Later he became minister of the interior. In 1918 he accompanied the Canadian Prime Minister to England to attend the Imperial Conference, and on Sir Robert Borden's retirement Mr. Meighen became Prime Minister and secretary of state for external affairs on July 10 1920. In June 1921 he attended the conference of prime ministers in London, where his representations were said to have had a notable effect upon the political groups in Canada. Mr. Meighen held the office of Prime Minister until the general elections in 1921, when the Conservative party was defeated; he then became the leader of the Opposition, and for four years was a vigourous opponent of the Liberal Government. He supported the disarmament resolution introduced by the Prime Minister, Mr. Mackenzie King.

The Military Service Act, under which conscription was enforced in 1917, was largely, in so far as its legal preparation was concerned, the work of Mr. Meighen, and the vigour with which he supported it in Parliament drew upon him the hostility of all those opposed to that measure. As the sentiment against conscription was especially strong in Quebec, the feeling against him in that province was intense, and prevented the policy of his party from receiving the due consideration of the electors. Mr. Meighen consistently repelled the personal attacks made upon him as the enemy of the French Canadians, but without much success. In the elections of 1925 the Conservatives, under the leadership of Mr. Meighen, were overwhelmingly victorious in Ontario and the maritime provinces, but with a practically solid Quebec against him it was impossible to obtain a majority, and the Government remained in the hands of the Liberals. In June 1926, on the resignation of Mr. Mackenzie King, Mr. Meighen took office as Premier, but his government was immediately defeated and a general election took place.

The adoption by the United States of protection, as well as the great industrial development of that country, placed Canada, in Mr. Meighen's view, at a disadvantage. He therefore strongly advocated protection for his own country, in order to prevent the United States from capturing the home markets. He was c vinced also of the necessity for preserving the natural resour of Canada, particularly the almost unlimited water power envied by the bordering states, as well as the products of forests. He resisted all attempts made by the United States secure for their territories electrical power generated from wat courses in Canada. Mr. Meighen made constant efforts bring about a fusion of the diverse elements in the Canad population. He was made a member of the Imperial pri council in Oct. 1920. (A. G. D.)

MELBOURNE, Victoria (*see* 18.90), the temporary seat the Federal Govt. and the capital of Victoria, Australia, w a population of 816,800 (852,850 including suburbs), conta more than half the population of the whole State, and grown with great rapidity. The formation of a Greater Melbou council was decided upon in 1925. The city has been much i proved in appearance by the planting of trees on the banks the river and in the chief streets. There were 71½ m. of elect tramways in 1923, and the suburban railways have be electrified. In 1916 a mint for silver and bronze coins established here. In 1924 it was decided to build a large tem in a commanding position in the city as an Australian W Memorial. In 1917 a Commonwealth Shipping Board, with interstate headquarters at Melbourne, was set up to deal wi all questions concerning shipping, but it was not altogether success. Melbourne has a large trade, and 35% of the total w export of Australia is dealt with in sales. Large sums have be spent on dredging and reclamation of land in the river and ba

MÉLINE, FÉLIX JULES (1838–1925), French statesman (18.94), died in Paris Dec. 21 1925.

MELLON, ANDREW WILLIAM (1855–   ), American bank and public official, was born in Pittsburgh, Pa., March 24 18 After graduating from the University of Pittsburgh, he enter the banking house of Thomas Mellon and Sons, and later beca a partner. The business developed into three large institutio the Mellon National Bank, the Union Trust Company and t Union Savings Bank, all of Pittsburgh. Mr. Mellon was elect president of the first mentioned in 1902, and was vice-preside of the other two. He was interested in the development of t coal, coke and iron industry of Western Pennsylvania and w often associated in various enterprises with Henry C. Frick. founded the town of Donora, Pa., and established a large ste mill there. Another of his enterprises was to promote the bui ing of the first independent pipe-line, in competition with t Standard Oil Co., through Pennsylvania. He was a director numerous corporations, and was a conservative Republica opposing the League of Nations. In 1921 he was appointe Secretary of the Treasury in the Cabinet of President Hardin and continued to hold this office under President Coolidge. H was chairman of the Pennsylvania delegation to the Republica National Convention held at Cleveland, O., June 10 1924.

As chairman *ex-officio* of the World War Foreign Debt Con mission Mr. Mellon had a large share in formulating the polic of the United States in regard to funding the war debts of foreig governments owed to the U.S. Government. He stressed th importance of debtor nations preserving the sanctity of the respective obligations but laid down that no nation can be aske to pay to another government sums in excess of its capacity and further, that no settlement which is oppressive and retard the recovery and development of the foreign debtor is to the bes interests of the United States or of Europe. In this spirit h conducted negotiations with the various European debtor State which resulted in funding agreements being arrived at wit Belgium, Czechoslovakia, Estonia, Finland, Great Britain Hungary, Italy, Latvia, Lithuania and Poland. The principa obligations funded under these various agreements amounted t $6,383,411,669, in addition to accrued interest, $1,006,502,331

In the management of the large internal debt of the U.S Govt. resulting from the World War, Mr. Mellon was equally successful. He laid down and rigidly adhered to a policy o providing for debt redemption annually out of current revenues As the floating debts and the Liberty Loans fell due they were i ırt paid off, in part refunded, at a lower rate of interest. As a sult the U.S. national debt fell from $24,330,889,731 in 1920 to 20,298,358,156 in 1925. Mr. Mellon was a strong advocate also tax reduction, especially in the case of the surtax rates on comes, maintaining that these should not exceed a maximum 20% and that such reduction would be a great aid to general isiness and promote widespread prosperity. Under Mr. ellon's prompting, Congress gradually lowered the income x rate until in 1926 the surtax was reduced to 20%, yet without ıy corresponding fall in the amount of tax receipts. Mr. ellon, who has written for this *Encyclopdæia*, is the author of *axation: The People's Business* (1924).

MEMEL (*see* 18.104), a port on the Baltic coast at the mouth the river Memel or Niemen, with an economic hinterland tending across Lithuania into Poland and Soviet Russia, the incipal export being timber floated down the waterway. ɔlitically, Memel is now an autonomous district of Lithuania. ıe population of the town, approximately 25,000, is almost tirely German, and has been so since the 13th century, when emel, like Riga and Revel, was founded as a German trading ation.

Before the World War the town of Memel, with a strip of rritory east of the river, belonged to Germany, while the nterland belonged to the Russian Empire. Under the Verilles Treaty (Article 99), Germany ceded all her territory east the river to the Allied and Associated Powers and undertook accept whatever disposal they made of it. Upon the ratificaon of the Treaty the Allies occupied the territory and took er the administration. This provisional régime lasted three ars, owing to the dispute between the two new states of thuania and Poland over Vilna (Wilno) (*q.v.*), and the conseent delay in the official recognition of the Lithuanian Governent. The Conference of Ambassadors did not take up the question Memel till the autumn of 1922, and meanwhile it had been ggested that Memel might be given a status in regard to thuania like that which had been given to Danzig in regard to land. This was unacceptable to the Lithuanians, since the pulation of the country districts of Memel territory was thuanian in nationality, while the port was almost the only ssible maritime outlet and inlet for Lithuania herself. Accordgly the Lithuanians, imitating the conduct of the Poles at lna, seized Memel by a surprise attack on Jan. 15 1923, and rced the French garrison to surrender and evacuate.

On Feb. 16 the Conference of Ambassadors proposed that the lies should transfer the sovereignty over the territory to thuania, subject to local autonomy and to freedom of transit Poland. In the working out of the details so many difficulties re raised by both Poland and Lithuania that in Sept. 1923 the se was referred to the League of Nations. The council appoint- a commission of enquiry under the chairmanship of an nerican citizen, Mr. Norman Davis, and the proposed conntion for giving Memel autonomy within Lithuania with edom of transit for Poland, as revised by the Davis Comssion, was eventually accepted by all parties, and signed in ay 1924. In March 1924 the commission presented a draft nvention to the Council. This Convention constituted the emel territory as a unit within the sovereignty of Lithuania h a clearly defined measure of administrative and financial tonomy and with a governor to be appointed by the Presiıt of the Lithuanian Republic. The port was defined as a rt of international concern to which the provisions of the ague's Barcelona transit conference apply, and was placed der a harbour board including a technical expert of neutral tionality appointed by the League.

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MEMORIALS: *see* ARCHITECTURE; SCULPTURE.

MEMPHIS, Tenn., U.S.A. (*see* 18.107), developed into a disbuting centre covering the entire South after the reopening the Mississippi river transport by the establishment of the Federal Barge Line in 1918. The population in 1910 was 131,105; in 1920, 162,351, of whom 61,181 were negroes and 5,844 foreign-born; and in 1925, 174,533, this being the census bureau estimate. Annexations in 1919 (4·6 sq. m.) and 1925 (1·2 sq. m.) brought the city area up to 26·5 square miles. The output of factories within the city limits was valued at $30,242,000 in 1909; $117,718,000 in 1919; $95,537,305 in 1923. By 1925 there were 900 industrial plants in or near Memphis, with an output estimated at $200,000,000. The greatest industrial development during the period from 1910 has been in hardwood products, cotton-seed products, heavy bags, steel and iron and automobiles, including an assembly plant of the Ford Motor Co., established in 1924, with a daily capacity of 350 cars.

Noteworthy improvements include the municipal rail and water terminal (1913); the Harahan bridge (1917); the Union Belt Railway; a new water pumping station (1923–5), multiplying by four the potential supply; a municipal auditorium seating 12,000 (1924); and the improvement and expansion of the electric service. Hydroelectric power will be available from the Muscle Shoals district of Alabama and the White river project in Arkansas. A city planning commission, created in 1921, secured the preparation of a comprehensive plan and the adoption of zoning ordinances. The cost of living in Memphis is high. The West Tennessee State Teachers College was established at Memphis in 1912. In Sept. 1925 Southwestern College, a Presbyterian institution, founded in 1875, moved from Clarksville to Memphis.

MENCKEN, HENRY LOUIS (1880–), American critic, was born at Baltimore, Md., Sept. 12 1880. He attended the Baltimore Polytechnic Institute, and in 1899 became a reporter on the Baltimore *Morning Herald*. He left that paper as editor in 1906, and joined the staff of the Baltimore *Sun*, to which he continued to be attached while engaged in many additional literary activities. In 1908 he became literary critic for *The Smart Set*, and was also joint editor 1908–23. In 1921 he became contributing editor of *The Nation*, and in 1924 was one of the two founders of *The American Mercury*, of which he became sole editor in 1925. He is a satirist rather than a critic, and represents the viewpoint of the extreme anti-academic element in the literary world. Among his numerous publications are *George Bernard Shaw: His Plays* (1905); *The Philosophy of Friedrich Nietzsche* (1908); *A Book of Burlesques* (1916); *Damn; a Book of Calumny* (1917); *A Book of Prefaces* (1918); *The American Language* (1918); *In Defence of Women* (1918); *Prejudices* (five series, 1919–26); and *Americana* (1925). He has also written critical prefaces to the works of Brieux, Swift, Stephen Crane, Cabell, Nietzsche, Ibsen and Wilde. (*See* AMERICAN LITERATURE.)

MENDELISM (*see* 18.115).—The progress in physiological science made possible by Mendelian methods is described in the articles GENETICS and SEX. In the present article the influence of those discoveries on the development of biological thought and their application to the practice of breeding are considered.

Analysis.—Modern genetics introduces into biology a factorial or analytical conception of organisms, which are now recognised as largely possessing attributes behaving as units, and as such capable of being detached and transferred to any other type with which cross-breeding can be effected. The limits governing this principle of segregation and recombination are still undetermined.

Phenotype and Genotype.—In former considerations of biological problems no account was taken of the consequences of the fact that each of the higher organisms is, in modern language, *diploid*, that is to say, a double structure containing factorial contributions derived respectively from the *haploid* or simple male and female cells which in fertilisation united to produce it. Since some of these factors inhibit the effect of others, and since some give no sign of their presence in the organism unless other complementary elements are also present, the appearance of an organism is an imperfect guide to its genetic potentialities. We have thus to distinguish the organism as it outwardly appears to be from that which it actually is by genetic composition, a distinction which Johannsen has conveniently expressed by the use of the terms *phenotype* for the former and *genotype* for the latter. Systematic or classificatory works, both zoological and botanical, abound with errors arising from want of appreciation of this fundamental distinction, which must constantly be remembered, especially, for instance, whenever the significance of varietal or intermediate forms has to be estimated.

Variability.—Evidence formerly regarded as proof of abundant contemporary variability in the species of animals and plants must be submitted to searching tests before it can be so accepted. Observations of variability once deemed adequate are now seen to be capable of quite different constructions. Proof that an observed departure from type is a contemporary genetic variation can only be obtained in exceptional cases which have been critically observed under experimental conditions. Putative variation is commonly nothing but the recurrence of a recessive form, or the emergence of some other segregant, from a stock genetically impure; more often still the direct product of a cross. The existence, therefore, of a multitude of varietal forms, so far from simply providing a convenient basis upon which a theory of the evolution of species can be erected, becomes itself an antecedent problem; and instead of asking, as they used to do, how the species have been built up out of the varieties, biologists are rather concerned to discover whence and by what process these variations have come to exist. The belief that substantial genetic change commonly accrues by summation of impalpable differences has been generally abandoned as devoid of evidential foundation. Such differences are mostly fluctuational, largely dependent on circumstance rather than on genetical units and hence not transmissible. Summation, when a genuine phenomenon, is a consequence of purification or the attainment of homozygosis. The idea that a characteristic could in any other way increase as a result of selection is out of place in an exact or even a logical science.

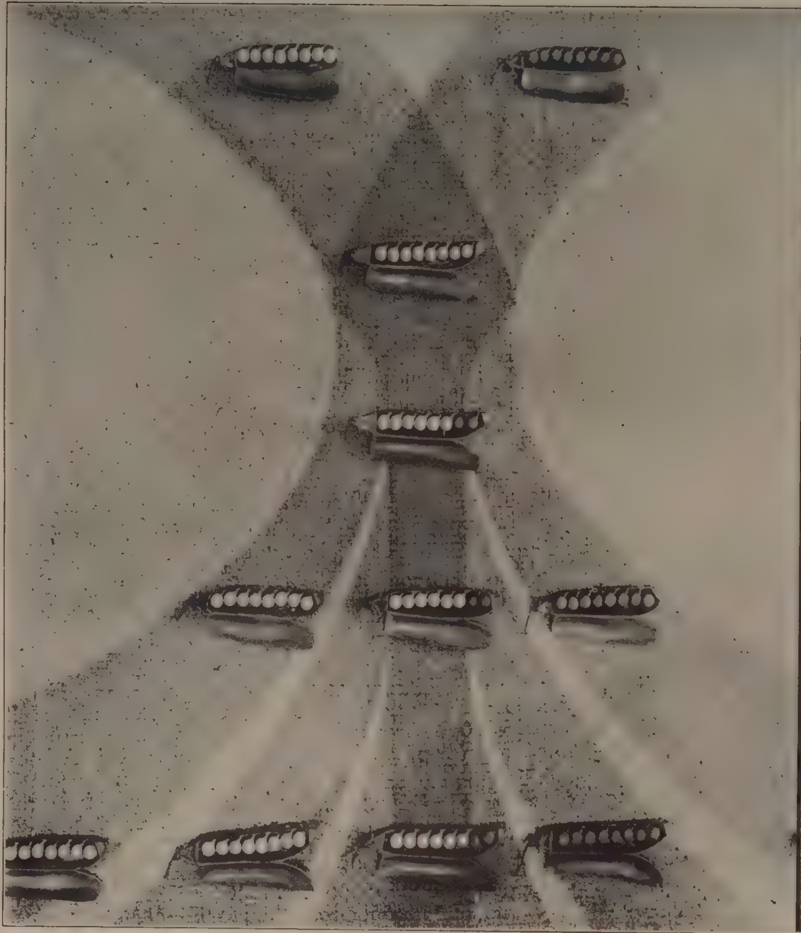
Variation by Loss and by Addition.—Whether the evidences of authentic variation remaining after the deduction of spurious testimony has been made, suffice as a basis of evolutionary theory has been questioned by competent naturalists. Lotsy, for example, maintains that we have no proof of contemporary variation arising otherwise than as a consequence of crossing; and apart from such extreme announcements it is noticeable that as regards varieties of animals and plants anciently domesticated, modern authorities usually incline to ascribe a multiple origin even for forms like wheat, the fowls, pigeons, sheep, horses, etc., which used formerly to pass for derivatives from single types, a belief now felt to be inconsistent with what is known of the limits of variability. Distinction must be made between recessive and dominant variations, arising respectively by loss and by addition. As regards recessive variations arising by loss of elements few will doubt the adequacy of the records (*e.g.*, in the sweet pea, *Primula sinensis*, etc.). As regards the *de novo* appearance of dominant characters the evidence is less abundant. Morgan and the American geneticists have made prominent several instances of this kind in Drosophila (fruit fly), of which the spontaneous origin of " eosin " (a new and peculiar pink) eyes in a white-eyed strain may be cited. Admitting provisionally these examples as free from objection they are, nevertheless, extraordinary events and not common occurrences. Were the dominant in question one already familiar we should hesitate to believe in its spontaneous origin. That a pea genetically wrinkled, having the characteristic starch of the wrinkled varieties, should without crossing produce a variety with " round " starch-grains would in modern lights appear not much less improbable than the spontaneous generation of life.

With plausibility a number of human malformations, such as praesenile cataract, claw foot-and-hand, etc., which have been regarded as descending as dominants, may be interpreted on these lines as in reality due to loss. From almost the beginning of Mendelian studies surprise has been felt that so many curious abnormalities in man, of which at least some 30 may be enumerated, should behave as dominants, seeing that novel characters most frequently are demonstrably recessive. Inasmuch as these " dominants " are so abundant in man, though otherwise rare, something no doubt remains to be explained; but we may avo the difficulty of interpreting them all as factorial additions, f with equal probability the normal may be represented as po sessing an element which, when homozygous, maintains develo ment in its proper and normal course. Mohr and Wriedt, di cussing the inheritance of a new type of shortened digits, recent made the suggestion that we have here to do with a charact which, in the homozygous state, is *lethal*. In other words, if o element of " normality " only be present the individual exhibi the peculiarity, but if both elements of normality are wanti the consequent malformation is so extensive that the embr perishes at some early stage of development. The normal el ment would then be recognised as the positive contribution, a in the absence of at least one such contribution the embryo non-viable. Some slight evidence is already adduced in suppo of this view; and since lethal contributions certainly play a gre part in genetical histories, we should be prepared for a wide a plication of this principle, especially to the descent of deformit

But, as explained in the article GENETICS, nothing absolute forbids us from inverting the representation of positive and neg tive factors by extension of the conception of inhibitors, of whi many are familiarly known; so that we may express the appare addition of a new element as a loss of one which when prese had repressed the new attribute. This symbolism, though a mittedly objectionable when dominance is complete, does wit out strain apply to all cases in which the heterozygote is inte mediate, and a large range of alleged new dominants can covered. In so far as this conception applies, evolution is co ceived of as a process of unpacking, a progress consisting in t loss of component elements.

Mutation.—The term *mutation* introduced by de Vries, is no generally accepted to denote definite genetical variations whi are sensibly discontinuous. Though contemporary exampl which satisfy all tests are not abundant, there is no question th they occur and have occurred in most of the forms of life. The are indeed part of the occasional experience of most breeders animals and plants. The special example, the Oenotheras, which de Vries mainly founded his own theory, was singular unfortunate and must, as explained in the article GENETICS, now discarded as inapplicable. Mendelian analysis was on lately made known, and the group of discoveries comprised the term genetics were in an incipient stage; nor had the criter of genetic purity, which must be applied to a parental for before the production of new types from it can be accepted proof of original mutation, been clearly established. The Oen theras which produce the presumed mutations are now prove to be no pure genotypes, and the suggestion that they were in " period of mutation " arose from a misunderstanding of th nature and consequences of heterozygosis.

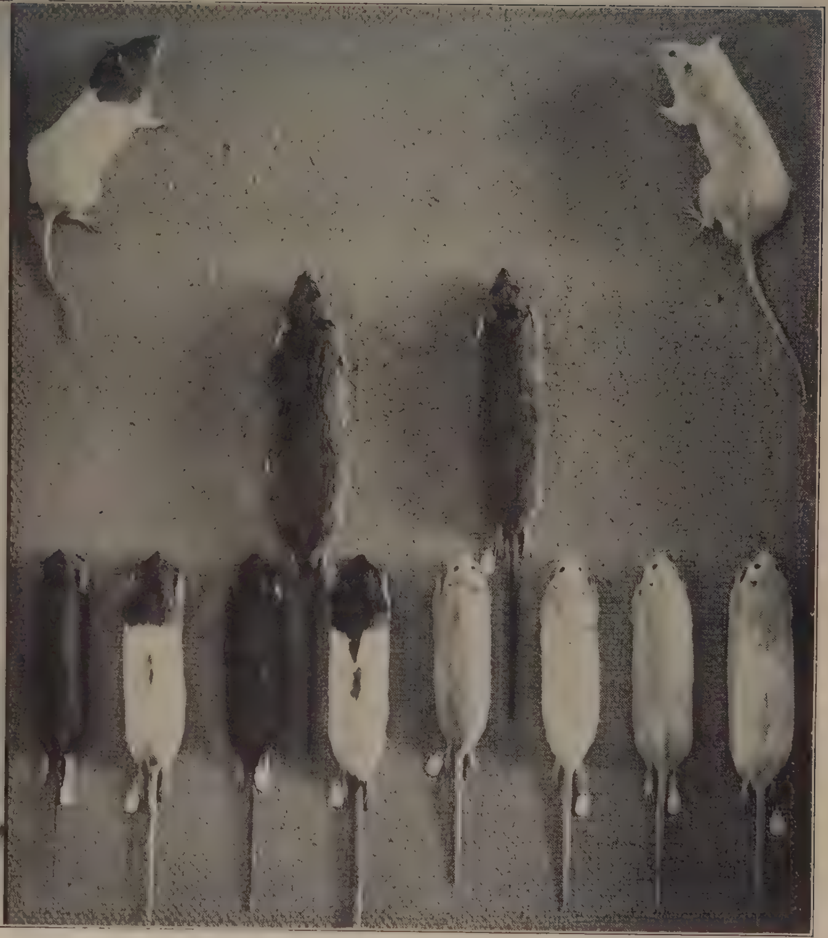
Inter-specific Sterility.—The new forms whose productions w witness are never new species. In *Primula sinensis* about pairs of factorial differences have been determined, which their several combinations present an amazing polymorphism A systematist, if he met these forms in nature, might and pro ably would quite justifiably take many of them for distin species. But interbred, they and their products are perfect fertile. Polymorphism like this is, even in a state of nature, f more abundant and far greater than the evolutionists of the la century imagined, yet it avails us little as material out of whi true specific differences can be supposed to develop. Th conspicuous defect in the evidence for the origin of species common descent remains. Though much is known as to the inc dence of variation, not rarely of a magnitude which might nat rally be claimed as constituting specific difference, no one h yet raised types from a common origin which when interbre produce sterility of the kind and degree forming one of the co monest attributes of crosses between natural species. By wha ever concatenation of arguments theories of evolution have be constructed, the most essential link has never been supplie The lapse of time is occasionally invoked in the hope of rectifyi this and similar evidential defects, a strain which has been mai tained distinct for a long period being thought more likely to sho



Courtesy of the American Museum of Natural History.

SIMPLE COLOUR INHERITANCE IN THE SEEDS OF THE COMMON GARDEN PEA

When yellow-seeded and green-seeded peas are crossed, all the second generation has yellow seeds, but in the third generation three-fourths of the seeds are yellow, one-fourth green. In the second generation the green is latent, or recessive, being overshadowed by the dominant yellow. If plants from the green seeds of the third generation are crossed green seeds always result. The apparently similar yellow seeds may be pure yellow or hybrid (part yellow, part green). If yellow-seeded plants from any generation are crossed, one-third will breed pure yellow, and two-thirds will breed hybrid yellow, giving in the next generation three yellow to one green.



Courtesy of the American Museum of Natural History.

HOW THE OCCURRENCE OF A NEW SPORT VARIATION MAKES POSSIBLE THE MULTIPLICATION OF EXISTING VARIETIES

In 1911 a yellow rat (a previously unknown variety) was caught in England. It was mated with black-hooded individuals, a recognised tame race which breeds true. The offspring were all brownish-grey like wild rats, but the grandchildren exhibited eight different varieties.

As the crossing of a constant strain with a variant from another and perhaps variable strain gives so many varietes of offspring, it is readily seen that where both the strains crossed already differ in many minor characteristics, there will be (as is observed in actual life) an almost infinite number of small variations from individual to individual.

interracial sterility when crossed with its progenitor than one newly separated. Reasoning of this kind, plausible enough in scholastic days, is not acceptable in an age of chemistry, nor may we suppose that that which is never begun will be attained by mere efluxion of time. The more genetical experience extends, the more serious does this hiatus in the evidence become.

Evolution.—In allusion to this and other difficulties, which genetic research has forced into prominence, the question is sometimes asked whether the theory of evolution holds its place so firmly as it did, or, more crudely put, whether Mendelian discovery has not "upset Darwinism." It should therefore be stated explicitly that in spite of all the objections with which the doctrine of the origin of species by descent is now seen to be beset—objections of which the strength is far more clearly known than before—and though as to the manner by which new species have come into existence geneticists adopt for the most part an agnostic attitude, yet all agree that the lines of argument converging to support the theory of common origin are so forcible and so many that no alternative can be entertained.

The geological record is conclusive.

The following may be taken as a cogent instance of this: if Angiosperms had existed in the carboniferous age their remains must have been preserved; therefore Angiosperms have arisen since that time, and we cannot conceive whence they came if not by descent from the pre-existing plants. Common descent, though rarely if ever a proposition demonstrable in any detail, ranks as an axiom. For Darwin and any other evolutionist before or after him this is a concession of the main claim. Parts of the apparatus by which the validity of that claim was enhanced have fallen into desuetude. In particular the modern geneticist assigns to *natural selection* a subordinate and inconsiderable rôle. Organisms are to be considered as co-ordinated systems. That each particular structure or instinct comprised in the system, which shows permanence or definiteness makes a contribution to the success of the system equivalent to the cost of its production is recognised as a fallacy. We are also reluctant to apply to the interrelations of the collective properties of organisms arguments which would be out of place in similar considerations of the attributes of unorganised substances. We no more look for utility in the details of a peacock's feather than in the iridescence of a Roman bottle or in the regularity of basaltic prisms.

Adaptation.—It is not merely in regard to the mode by which species have arisen that agnosticism has prevailed. While unwilling to accept adaptation, with Darwin, as a summation of happy accidents, we have no alternative to offer, nor is there in the attempts of various experimenters to find that organisms transmit to their posterity structural emendations in response to parental experience anything which sensibly alleviates the difficulty. Most of these claims are obviously faulty and few require serious notice.

Each step in the progress of this branch of science has rather compelled the recognition of genetic determinism; and the hope that by change in the conditions of life or by any external influences significant alteration can be induced in succeeding generations, whether of organisms amenable to experiment or of the human population, must be abandoned.

Classification.—The full implications of factorial analysis in relation to biological classification are not yet appreciated. The fundamental idea of the systematist, that animals and plants can be grouped into species, and that the distinctions between species are of a different order from those characteristic of varieties, is now scarcely open to question. Nevertheless, the belief held very widely by systematists, that certain classes of differences are important as being more fixed, and others trivial as being more liable to variation, is scarcely consistent with genetical knowledge. The frequency and amplitude of variation and the perfection of segregation must be empirically determined for the various organisms and for the various characters. No general rules can be predicated. Anthropologists, for example, are accustomed to regard special features of anatomy as comparatively sure guides to racial origin (*see* RACES OF MANKIND). Knowing what we now do of segregation and recombination we suspect that no characteristic is incapable of segregation and so of transference to another race: given the possibility of cross-breeding, the shape of the skull or other bodily peculiarity may be transferred in its entirety to individuals descending through another parent from a different race, and hence to a resulting population, more slowly but not less completely than a language or a custom.

The classificatory dichotomies in common use in the systematic arrangement of animals and plants have no prerogative significance except for mnemonic or demonstrative purposes; the number of the dichotomies is merely an enumeration of the pairs of factorial differences; and the order in which they are taken into account, though often treated as a matter of cardinal importance, is purely arbitrary. Peas, for instance, are divided first into tall varieties and dwarf varieties, then into round and wrinkled, yellow and green, etc., but it would be logically as sound and physiologically as justifiable to divide them first into yellow and green, then into early and late and so on. If the races of men could be crossed under experimental conditions we should find the same principles governing their distinctions.

Applications.—The applicability of genetic discoveries to the betterment of the human race is discussed in the article EUGENICS, but progress in the art of breeding animals and plants is also possible by the development of Mendelism. The use and consequences of crossing in the search for new forms of economic value are now apparent. The reasons for preserving the first generation (F_1) though it may present no valuable feature and the desirability of raising from it as many individuals (F_2) as space will accommodate, are obvious. The breeder now knows what he is about and is able to interpret countless phenomena previously meaningless. Granting that the chief breeds of animals now in the keeping of civilised man are not capable of much amelioration, experience has shown that enormous improvements can be made by applying accurate knowledge to the breeding of even such old-established crops as wheat, oats, tobacco, etc. If this is true of the crops which have for ages been the object of unremitting care, it will be understood that the cultivated plants of tropical regions offer limitless possibilities.

The breeding of coconut, rubber, jute, cacao and many more has scarcely begun. These are all still raised from seed gathered almost promiscuously, the result of uncontrolled fertilisation, and the product is what we should see if our orchards were raised from seeds and those seeds gathered at random from garden varieties and from wildings in the hedgerows. At first, selection and fertilisation under control will suffice to make great progress. Even at that stage some genetic knowledge will be of value, but when the more difficult task of making genetic recombinations of desirable qualities is begun the breeder will require skill in the management and interpretation of the generations and the various terms in the series of forms which only accurate knowledge of principle can supply. Genetic science shows primarily what can be expected, provides the breeder with an aim, and also indicates how it may be attained. For example, a crop of sugar beet often contains 4% (sometimes many more) of plants which "bolt" or flower in the first year making no "bulb," and so worthless. This state of things has long been accepted as inevitable.

But when the geneticist finds that the annual habit is a recessive, he suspects that the plants which produce the bolters are heterozygous in that respect, and that if he can raise plants homozygous in the biennial habit he will have eliminated bolting. The breeder, whether scientific or practical, ignorant of genetics, would never suspect the nature of the fault, still less could he devise a cure. Common sense in the art of seed-raising is an imperfect guide. Apart from any question of making new races, the purification of existing varieties and their maintenance in a state of purity are exacting tasks. What has been done in these several phases of the industry, in ignorance of principle, is remarkable, but we may confidently foresee that the application of scientific method will, in the case of the breeder's art, effect a change in magnitude no less than that which has been witnessed in the other industries.

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MENENDEZ PIDAL, RAMÓN (1869–), Spanish philologist, was born March 13 1869 at Corunna, and studied at the universities of Madrid and Toulouse. In 1899 he was appointed to the chair of romance philology at the University of Madrid. Menendez soon acquired a great reputation as a master of his subject and lectured in South America and the United States. In 1907 he was member of a board created in that year for the development of university education in Spain and in 1913 was appointed counsellor of public instruction for the kingdom. His grammar, text and vocabulary of the *Cantar de Mio Cid* (1908) opened out new possibilities not only to Castilian philology but to historiography in general. Menendez Pidal became the leader of the *Centro de Estudios Históricos*, the main house of learning in philology and historical matters in Spain, and the editor of the *Revista de Filología Española*. His other works include *Primera crónica general* (1906); *L'épopée Castillane à travers la littérature espagnole* (1910); *Gramática Histórica Española* (1914); *Un aspecto en la elaboración del Quijote*, 2nd ed. (1924).

MENÉNDEZ Y PELAYO, MARCELINO (1856–1912), Spanish scholar and critic (*see* 18.128), was at the time of his death working at the second edition of his *Historia de los heterodoxes españoles*. He died at Santander May 19 1912.

See A. Donoso, *Menéndez y Pelayo y su Obra* (1913); Bonilla y San Martín, *Menéndez y Pelayo 1856–1912* (1914); and A. G. de Amezua y Mayo, *Nota bibliografica de Menéndez y Pelayo* (1918).

MENTAL DEFICIENCY.—Mental deficiency, or amentia (*a*, without, *mens*, mind), has been defined as that state in which the mind has failed to attain normal development, as distinguished from dementia (*de*, down from, *mens*, mind), mental defect occuring subsequently to mental development. Legislation both in England and abroad has recognised the essential difference between these two forms of mental disease, and the class of so called "mental defectives" is generally dealt with by laws differing from those affecting the insane. These laws are based mainly on a recognition of (*a*) the educational, (*b*) the social and racial problem created by the presence of large numbers of uncontrolled mentally defective persons in the community.

I. GREAT BRITAIN AND THE BRITISH EMPIRE

In England the Mental Deficiency Act of 1913 was the outcome of the Report (1912) of the Royal Commission on the Care and Control of the Feebleminded appointed in 1908, and embodied a considerable number of its recommendations.

The Elementary Education (Defective and Epileptic Children) Act, 1899, gave to local education authorities power to provide special schools (day or residential) for mentally defective children between the ages of 7 and 16 who, not being either dull or backward or idiots or imbeciles, were capable of benefiting by the education provided in such schools. Under the Elementary Education (Defective and Epileptic Children) Act of 1914 these powers were made compulsory, and both Acts were embodied in Part V., sections 51–9 of the Elementary Education Act 1921. Attendance at such schools may be enforced by a magistrate, provided it is clearly for the child's benefit that he should attend a special school. Owing to the War and to the relatively high cost of these schools many authorities have failed to provide sufficient, in some cases, any, special schools; there is practically no school provision for defective children in rural areas. The estimated number of defective children is calculated at 8 to 10 per thousand of the school population. The latter figure is probably the more accurate. This gives a total of 50,240 defective children to be provided for, but provision has only been made for 16,392 children in 174 day and 21 residential schools. In addition, the local education authorities must notify to the local control authority children who are incapable of benefiting from education in special schools or who need institutional care on leaving school. In urban areas there are 88 occupation day centres for children excluded from schools, run for the most part by local voluntary mental welfare associations; after-care committees and the above associations look after the children who have left special schools, try to find them employment, supervise them at home and establish handicraft centres for them.

The Mental Deficiency Act.—The Board of Control, a section of the Ministry of Health, administers the Lunacy and the Mental Deficiency Acts. The local control authorities are statutory mental deficiency committees of county and county borough councils, whose duty it is to provide for defectives,[1] only when they can be certified as idiots, imbeciles, feebleminded or moral imbeciles, and who in addition are either (*a*) neglected, without visible means of support, cruelly used, etc.; (*b*) found guilty of any criminal offence, and liable to be sent to or actually sent to an industrial school or prison; (*c*) notified by the local education authorities as ineducable or as needing institutional care on leaving a special school; (*d*) having given birth to or being pregnant of an illegitimate child whilst in receipt of poor relief. The duty of the authority is to (*a*) ascertain the defectives they must deal with; (*b*) provide supervision by visiting and watching over the defective at home. This supervision is in a large number of areas carred out by local mental welfare associations affiliated to the Central Association for Mental Welfare, who supply visitors for defectives living in the community. If this supervision is insufficient the authority may (*c*) send defectives to a certified institution under orders, or (*d*) place them under guardianship under orders, *i.e.*, under the charge of an individual having the powers of a parent over them. This order is made by a magistrate on a petition supported by two medical certificates. Orders are renewable by visiting justices at the end of each of the first two years, then every five years. So long as the order lasts the defective can be compulsorily detained, but defectives can be discharged by a commissioner of the Board of Control at any moment. The parents of defectives, if they oppose the making of the order, must prove that it is for the benefit of the defective that he should remain at home.

Local authorities are required to provide certified institutions for defectives; they can also send defectives to institutions provided by other committees. The War prevented the development of institutions, and a considerable number of poor law institutions have been approved for the reception of defectives under orders. The Royal Commission estimated that there were 4·6 per 1,000 defectives in the population. Some 48,778, or 1·29 per 1,000, have been ascertained, but only 19,076 defectives were in institutions under the Act in Jan. 1926, many being found in institutions and homes as rescue cases, paupers, etc.

The difficulties are: incomplete ascertainment of defective children, which handicaps preventive measures; lack of special educational facilities for training defectives; lack of institution accommodation for adult defectives; and lack of recognition of mental defect in cases coming before the courts. Greater efforts are being made to safeguard the community and the defective by segregating all with anti-social tendencies in institutions.

Scotland.—The Mental Deficiency Act for Scotland, 1913, does not differ very materially from the English Act but the local authorities are local boards of control and the parish councils. There were 2,452 certified mental defectives on Jan. 1 1925. A Scottish Association for Mental Welfare was established in 1922. There is also an active voluntary movement on foot for the establishment of a large colony for the feebleminded.

Ireland.—The Mental Deficiency Act does not apply to Northern Ireland. There was in 1926 but one institution for efectives in the whole of Ireland, but certain religious communities propose to open others.

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[1] For definitions see the Mental Deficiency Act.

British Empire.—Legislation in other parts of the British Commonealth is generally modelled on the English Mental Deficiency Act. In South Australia, a Mental Deficiency Act was passed in 1913; n Tasmania, in 1920. The Mental Deficiency Board then establshed published in 1925 a report on a mental survey of the prisoners n Hobart Gaol. In Melbourne and Sydney special schools and lasses for mentally defective and backward children are being stablished.

The Mental Disorders Act of 1916 regulates the care of defectives n the Union of South Africa. A national council for the care of the eebleminded watches over the interests of individual defectives, and uides public opinion.

In Canada a Federal Act dealing with immigration prohibits the ntry of mental defectives into the country. Each provincial governent provides grants for the organisation of special classes for mental eficients in school attendance, and in Jan. 1926 there were approxiately 140 such classes. Ontario, Alberta, Saskatchewan, Manitoba nd Nova Scotia have made institutional provision for approxiately 1,500 mental defectives, the largest at Orillia, Ontario, having ccommodation for 1,200 cases. Several of the larger cities, including oronto, Winnipeg and Vancouver, provide routine mental examations for schoolchildren and for juvenile court cases, and since 918 the Canadian national committee for mental hygiene has been onducting surveys throughout the Dominion to determine the revalence and significance of the problem.

In New Zealand, the Mental Defectives Act of 1911 and the ducation Act of 1914 are the Acts under which day schools, one or wo residential schools and some institutions are established. A ommittee of enquiry (1925) under the Ministry of Health recomended the establishment of a eugenic board for the compilation of a egister of mental defectives, and made recommendations for the erilisation of certain mentally defective persons.

II. THE UNITED STATES

Americans have given a great deal of study to the proper iagnosis and training of mentally defective persons and to the ugenic aspects of the problem, and there is a very widespread nd efficient organisation in many of the States. Each State as its own legislation. There are numerous special day schools, alled auxiliary classes, residential schools and institutions. Iany of the institutions are on a vast scale, and have thus peritted interesting experiments. One of the pioneers of the work, e late Dr. Walter Fernald, developed the Waverly Institution Mass.) into a highly successful training colony. One of Dr. ernald's principles was "paroling," and a very large number of atients, especially men, did remarkably well on "parole" from he institution. Institutions equally interesting are the Rome tate School (New York) and Vineland (New Jersey), where r. H. Goddard and Dr. S. D. Porteus have carried out numerous xperiments in the measurement of intelligence. Psychiatric inics are attached to many hospitals, and afford considerable pportunities for the study of mental defect. Segregation has been ied on a wide scale in several of the States, and for some years ertain States have had laws allowing the sterilisation of mental efectives. Special attention has been directed to the whole roblem of defect in its relation to delinquency amongst children nd adults. The national committee for mental hygiene and the int committee on methods of preventing delinquency, the udge Baker Foundation, Boston, Mass. (which publish nuerous monographs) and other kindred associations have done ioneer work in this connection.

III. EUROPEAN COUNTRIES

The work among mentally defective persons in other countries llows much the same lines as are indicated in the description ven below. The classification of defect differs somewhat in fferent countries, and a class of "moral imbeciles" is not niversally recognised. Almost all countries have now made me provision for mentally defective persons, but the problem still inadequately met.

France.—In France, mental defectives are dealt with under the w for "aliénés" passed as long ago as 1838, which has not been mended. Under this law persons can be placed in institutions at e request of their families, or by order of the prefect, if they are onsidered dangerous or in need of protection. Some difficulty is und in dealing with cases needing treatment but not institutional care, but the work of treating the feebleminded at psychiatric clinics is likely to develop since the establishment of a clinic at Paris in 1921. A law passed in 1919 recommends special classes for children, but does not make them compulsory. No statistics as to the incidence of defect are available. Some French institutions have a fine reputation, notably perhaps the Hospice de Bicêtre, near Paris, which is attached to a general hospital, and has accommodation for about 1,000 males (mostly idiots and imbeciles) and about 217 girls. Seguin, one of the pioneer teachers of defectives, worked at the Bicêtre.

Italy.—In Italy, the class "imbecili morali" is recognised. No exact figures are available as to the number of defectives. A general law on the protection of children was in preparation in 1926. There are only eight institutions set aside for the mentally defective, accommodating 761 persons. Madame Montessori's educational methods (q. v.) were based on the experience gained among defective children at Rome. She made the startling discovery that a mentally defective child taught on her methods was in some instances actually able to attain a higher standard than normal children taught on other methods. She has applied to the teaching of normal children the empirical methods so effective with defectives, and her work has reacted in favour of improved methods for both classes of children.

Belgium.—Another educational pioneer, Dr. Ovide Decroly of Brussels, similarly first interested himself in the study of defectives, and later adapted his methods in use in his special school in Brussels to the teaching of normal children. His normal school in Brussels reveals its purpose by its title, "École pour la vie par la vie," and his methods have been adopted in many of the elementary schools in Brussels. Belgium has a remarkable institution, the colony at Gheel, whose origin goes back to the 6th century, when a shrine was built to St. Dymphna, a martyred Irish saint. At least as early as the 13th century she came to be considered the special saint of "aliénés." From that time through the centuries the work has grown until today Gheel is a place of some 20,000 inhabitants caring for 2,000 "aliénés," including insane and mentally defective, with a school for 160 defective children. The principle of the colony is freedom and home-life in the families of the citizens. Other similar colonies have been founded in the country.

Holland.—The institutional care of the feebleminded is almost entirely in private hands, but special schools exist in the towns.

The Scandinavian countries have a good system of special schools and several institutions, and considerable attention has been given to the training of defectives.

Denmark.—It is estimated that there are in Denmark between 6,000 and 7,000 mentally defective persons in a population of 3,500,000, but there are no exact statistics. There are four large institutions, accommodating about 3,450 persons, and private homes taking 350 patients. Special schools are not compulsory, but they are established in most large towns such as Copenhagen, which has a school for 700. A Marriage Act is on the statute book prohibiting marriage with a mentally deficient person.

Austria.—Developments in Austria have been considerable since the War. There are special schools and classes for 2,794 children, and 20 institutions for the care and instruction of 1,498 mentally defective and epileptic children.

Germany.—Germany has a fine special school system, with schools in about 600 different places. These schools are in some instances very small, more than 200 having only one class, and 150 only two classes. There are in all about 3,500 classes in these schools, with accommodation for 67,000 children. Most of the special schoolchildren have had two years' trial in the elementary school, and those who are not able at the age of six to profit by the elementary school can attend a "Vorklasse" before being drafted into a special or normal school according to their development. In Mannheim since the beginning of the century, and later in Charlottenburg, Frankfurt-on-Main and other towns, a system of so called "Förderklassen" has been established for the backward child whose mental difficulties may be due to exterior or physical causes and not to mental defect. In other towns there are classes for those who in the later years of school life remain backward.

Switzerland.—The Institut J. J. Rousseau in Geneva has been of inestimable value in the scientific study of the child. The founder, Prof. Ed. Claparède, has proceeded on the principle that the abnormal and normal child should be studied at the same time, and the institute has now become a laboratory for the study of the child in all his manifestations. The care of the feebleminded is very well organised in Switzerland. In 1918 preparatory classes were established for the children who cannot keep up with the lowest class, and in some schools there are "crammer" classes with more handwork than in the ordinary classes, for children whose backwardness is due to "neglect," and who are probably able to return later to the ordinary classes. There are also "work-classes," which have more manual work even than the special schools. The employment schemes in institutions are admirably organised. The Basle institution, opened in 1916 for the paid employment of defectives has been most successful, and is being enlarged so as to serve the needs of defectives from any area. A work and welfare home for girls, with similar aims, was opened in 1924 at Komtz, near Berne.

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MERCIÉ, MARIUS JEAN ANTONIN (1845–1916), French sculptor and painter (*see* 18.152), died in Paris Dec. 12 1916.

MERCIER, DÉSIRÉ (1851–1926), Belgian cardinal, was born Nov. 21 1851 at Braine-l'Alleud in the Walloon part of Brabant, of a bourgeois family. He studied at the episcopal college of St. Rombaut, Malines, and at the lesser seminary of that town. On April 5 1874 he was ordained priest after following the courses of the larger seminary, where he made his first acquaintance with the philosophy of St. Thomas Aquinas. After two years at the University of Louvain, he was appointed professor of philosophy at the lesser seminary of Malines (1877). In 1880 Leo XIII., who wished to promote the study of Thomism, invited Cardinal Dechamps, Archbishop of Malines, to found a chair of Thomist philosophy at Louvain. The choice of the Cardinal fell on the young Abbé Mercier, who was appointed in 1882. Before assuming his new duties, the new professor studied in Paris under Charcot. While teaching psychology, logic, criteriology, metaphysics and ontology to his Louvain students, including a large number of laymen, he followed closely the research work of his colleagues, according to the tradition of the scholasticists, who combined theological and scientific studies.

In 1886 the Pope conferred a Roman prelateship upon him, and in 1888–9 issued two briefs urging the necessity of founding an Institut Supérieur de Philosophie at Louvain. This institute was finally opened in 1894 and included, besides the chair of philosophy held by Mgr. Mercier, chairs of cosmology, physics, sociology, etc., held first by his colleagues and later by the pupils he had formed. The institute published the *Revue Néo-scolastique* and became the centre of Neo-Thomism which exerted considerable influence on Catholic thought all over the world. In 1906 Mgr. Mercier was appointed Archbishop of Malines, and in 1907 he was created a cardinal. He used his influence with his priests and his flock to break down the barriers existing between the members of the clergy and the laymen, to eliminate all class distinctions between the Catholic bourgeoisie and the labourers, and to bring about a better understanding between Catholics and non-Catholics.

On Aug. 20 1914, while the Belgian Army was retreating upon Antwerp and the Germans were entering Brussels, the Cardinal was abruptly summoned to Rome to take part in the election of a successor to Pius X. Shortly after his return to Malines, he issued a pastoral letter, "Patriotism and Endurance," in which he protested against the burning of Louvain and the other excesses committed by the German Army, and in which he defined the position of the Belgian people towards the occupying Power. While, according to him, the Belgians owed, in soul and conscience, neither respect nor allegiance to this authority, which was not lawful, they had to accept German regulations so long as they did not violate their duty to their country, the army alone having the right to resist openly the invaders' power. In spite of the pressure exerted upon him by the German authorities, he maintained the same attitude throughout the period of occupation, protesting publicly in his sermons and pastorals against the arbitrary decrees of the governor-general, especially concerning the deportation of workmen and the administrative separation of the country, urging the people, at the same time, to remain confident in the final victory of their just cause. In Jan. 1916 the Cardinal took a second journey to Rome where he was received with enthusiasm, and brought back with him a most cordial message from the Pope. He proclaimed, in his next pastoral letter, that "The moral triumph of Belgium, i the eyes of civilisation and history, is already an accomplishe fact." In Oct. 1918, on the eve of the retreat of the Germa troops, the Cardinal received a message from the Governo greeting him as the "revered spiritual leader of the Belgia people" and announcing to him that political prisoners an deportees would shortly recover their liberty.

After the War, the name of Cardinal Mercier was associate with informal conversations which took place at Malines following the "appeal to all Christian people" issued by the Lambet Conference of 1920. He took a prominent part in these friendl discussions between representatives of the Roman and Anglica Churches. The first conference took place between Cardina Mercier, Mgr. van Roey (his successor as archbishop of Malines) and Abbé Portal, on the one side, and the Dean of Wells, th Bishop of Truro (Rev. W. H. Frere) and Lord Halifax on th other. Bishop Gore, Dr. B. J. Kidd, Mgr. Batiffol and Abb Hemmer took part in the third Conference, held in 1923. A fu account of these conversations, which concentrated on doctrina and historical rather than on administrative questions, wa issued by the Archbishop of Canterbury at the end of the sam year. In the spring of 1924 Cardinal Mercier celebrated th jubilee of his ordination. He died in Brussels, after an operation on Jan. 23 1926. (E. Ca.*)

MERESJKOWSKY, DMITRI (1866–), Russian man o letters, was born in St. Petersburg (Leningrad), the son of court official, and graduated from St. Petersburg University He married Zinaida Hippius, the poet. His first volume of poem appeared in 1888 and was followed by more poetry, *Vera*, *Sakya Muny*, *Avakum*, *Black Angel*, etc., by translations from Euripide and other Greek classics, by literary essays on Russian and foreign writers, old and new, *Eternal Companions* (1897), and trilogy of historical novels under the general title *Christ an Antichrist* (1902–5); *Julian the Apostate* (1895), *The Renaissanc of the Gods*, *Leonardo da Vinci* (1902), *Antichrist*, *Peter an Alexis* (1905). After the "trilogy" came the novels *Alexande I.* (2nd ed. 1913), *December 14*, and—in connection with th Tutankhamun excavations—*The Birth of the Gods*. Abou 1900–2 Meresjkowsky evolved a mystic, neo-Christian o apocalyptic teaching based on the equal sanctity of flesh an spirit as opposed to the cult of the flesh as represented by paganism, and the cult of the spirit as revealed by ecclesiastica Christianity. His other writings include works of literary criticism, *Tolstoy and Dostoievsky* (1901). He also wrote on religious political and social questions, and published several plays After the revolution Meresjkowsky left Russia and went to liv in Paris, where he continued his literary activities.

Meresjkowsky's collected works were published in 24 vol. i 1914. The following were translated into English: *The Death of th Gods* (1901), *Peter and Alexis* (1905), *December 14* (1923), *The Forerunner* (1924), *The Birth of the Gods* (1925). See also Jean Chuzeville *Dmitri Meresjkowsky* (1922).

MERRIMAN, JOHN XAVIER (1841–1926), South African politician, was born March 15 1841 at Street, Somerset, England His family moved to South Africa in 1849, and John Xavier was educated at the Diocesan College, Rondebosch, and later at Radley College, England, returning to the Cape in 1861 Merriman entered politics in 1869. Three years later, despite his opposition, the Cape obtained self-government, and in 1875 he joined the Molteno Ministry as commissioner of public works When in 1877 war with the Galeka Kaffirs broke out Merriman became virtually Secretary for War in the Cabinet.

Merriman came into office again in the Scanlen Ministry (1881–4), again as commissioner of public works. The dubious attitude of the newly-formed Afrikander Bond to the British connection alienated him from the Dutch extremists. The Bond had caused the fall of the Scanlen administration because the Ministry opposed the attempt of the Transvaal Boers to seize Bechuanaland; and when Rhodes formed a Ministry in 1890 Merriman joined it as treasurer-general. Meanwhile the Bond had adopted a constitutional programme, and 1890 saw a drawing together of the Dutch and British elements at the

Cape. But the Uitlander troubles in the Transvaal became acute, ınd in 1893 Merriman resigned. He was chairman of the Cape parliamentary committee which inquired into the Jameson raid of 1895, and drew up its report. The general election in Cape Colony in 1898 gave the Bond a very narrow victory, and W. P. Schreiner became Prime Minister, with Merriman treasurer-general again, though the latter was not a member of the Bond. Merriman was among the ministers who in 1900 opposed the neasure to disfranchise the Cape rebels, and this led Schreiner o tender the resignation of the Cabinet. At the general election of 1904 Merriman was defeated, but was returned shortly afterwards at a by-election. In Jan. 1908 he succeeded Dr. ameson as Prime Minister and treasurer-general (*see* 5.247). Merriman was a member of the national convention which ıammered out the new constitution. On the establishment of he Union in 1910 he did not join the Union Ministry under Botha *see* SOUTH AFRICA), remaining a somewhat detached member of he South African party. He opposed the disruptive policy of Hertzog as strongly as he had formerly supported the independ-nce of the Boer republics. He died Aug. 2 1926.

MERRITT, WESLEY (1836–1910), American soldier (*see* 18.-73), died at Natural Bridge, Va., Dec. 3 1910.

MERRY DEL VAL, RAPHAEL (1865–), Spanish ecclesias-ic and diplomat, was born Oct. 10 1865 in London, where his ather was secretary to the Spanish Legation. He was educated t Baylis House, near Slough, and at Ushaw College, near Dur-am. Ordained priest in 1888, he began at an early date to spe-ialise in diplomatic work for the Vatican. In 1892 he became laster of the Robes and acting private chamberlain to Pope Leo XIII., of whom he was a great favourite. In 1897 he was sent to anada to report on the difficult Manitoba schools question, nd accomplished this mission with conspicuous success. In 900 he became Archbishop of Nicea. He was Secretary of the acred College of Cardinals during the election of Pius X. (July 903) under whom he became Cardinal and Secretary of State. n Jan. 12 1913 he succeeded Cardinal Rampolla as Archpriest f the Basilica of St. Peter's, Rome, and in the following year as appointed Secretary of the Supreme Congregation of the oly Office by Benedict XV. In Dec. 1920 Cardinal Merry del al became Camarlingo of the Holy Roman Church.

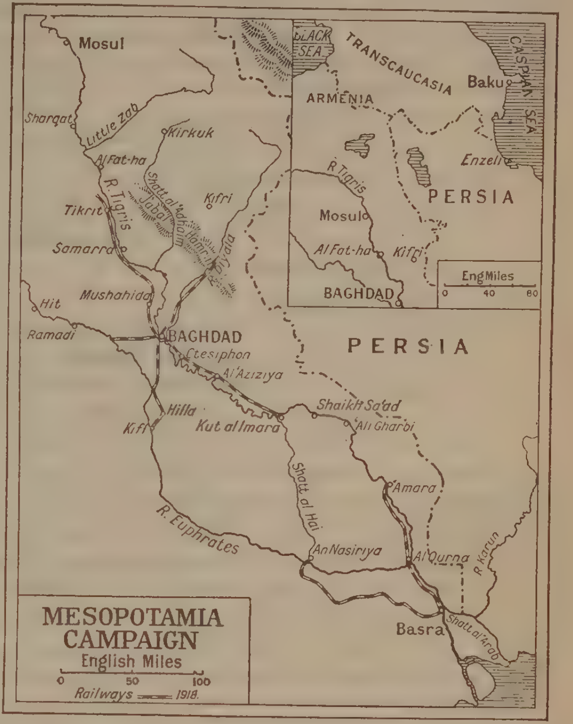
MESOPOTAMIA: *see* ʻIRAQ.

MESOPOTAMIA, OPERATIONS IN.—The Anglo-Indian opera-ons of 1914–8 in Mesopotamia were in their initial stages con-eived on comparatively speaking modest lines. The object at e outset was merely (1) to protect the Anglo-Persian oil instal-tions, (2) to occupy the greater part of the Basra vilayet so as to cure possession of the Shatt al ʻArab and the districts imme-ately round the head of the Persian Gulf, and (3) to impress e Arabs and others in this region and in the territories inter-ening between the Ottoman Empire and India. Steps had al-ady been taken before relations between the Entente Powers d the Porte were actually broken off, and a brigade of the 6th dian Div. had been dispatched to an island near the head of e Persian Gulf. Then, on Nov. 7, two days after the British claration of war on Turkey, these advanced troops appeared their transports at the mouth of the Shatt al ʻArab.

The fort guarding the entrance was taken, and the brigade camped some miles up the stream on the right bank. On arning this, the Turks hurried all available forces down from asra; but, the rest of the 6th Div. having arrived under Sir Barrett, they were on the 17th attacked and overthrown. asra fell on the 21st, and Barrett then promptly pushed troops to Al Qurna, which was taken on Dec. 9. As considerable rkish reinforcements were arriving from Baghdad, he was not together comfortably situated; but the Osmanlis were not in aggressive mood, and the invaders were little interfered with ring the first three months of 1915. The Indian Government March decided to raise the expeditionary force to the strength an army corps by adding the 12th Indian Div., and early in ril Sir J. Nixon took over command from Sir A. Barrett, who d made the most of the limited means at his disposal, General wnshend at the same time taking over the 6th Division.

I. THE BRITISH ADVANCE UP THE TIGRIS

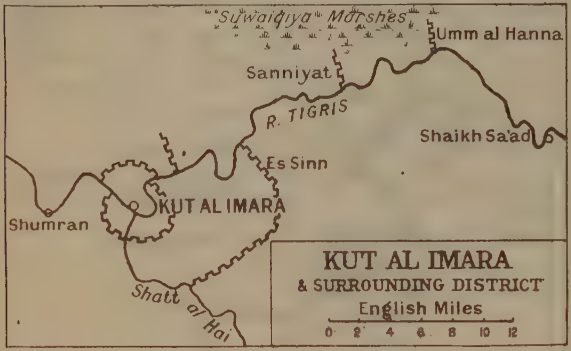
During the latter part of April the Turks showed a marked increase of activity; but all their offensive efforts were frustrated, and Nixon, encouraged by these successes, decided to occupy Imara, 60 m. north of Al Qurna on the Tigris. The task was entrusted to Townshend, who carried it out by making free use of water transport for moving his troops, and who made himself master of the place on June 3, capturing 17 guns and 1,800 prisoners. Nixon now resolved on a blow against An Nasiriya, on the Euphrates, and the 12th Div. took possession of that town on July 25, capturing another 17 guns and 1,000 prisoners. The expeditionary force could then claim that it had effectually achieved the object for which the campaign had originally been undertaken, and its triumph was all the more creditable in view of the lack of transport and the inadequacy of its administrative service. The military organisation of India had not in pre-War days been framed with the idea of prosecuting martial operations overseas on an ambitious scale, and, as it was, the Government had accepted heavy commitments in Europe, in Egypt and in East Africa, in addition to the undertaking in lower Mesopotamia. There was a lack of reserve, the medical service had been starved, and the necessary military resources for an extension of the Mesopotamian operations were in reality deficient.



Occupation of Kut.—The authorities at Simla had unfortunately been inspired, by Barrett's and Nixon's successes, with the desire for adopting a more ambitious programme than that contemplated at the outset. They readily fell in with Nixon's proposal to advance up the Tigris to Kut al Imara—180 m. up-river into the heart of the enemy's country—and early in Aug. Townshend, with the 6th Div., began pushing forward from Imara. On Sept. 15 he drove an advanced Turkish force out of a position on the right bank of the Tigris about 15 m. from Kut, and on the 28th completely defeated the enemy a little farther on at Es Sinn, taking 1,650 prisoners, 13 guns and much war material. Kut was occupied, and the cavalry pursued the fleeing Osmanlis as far as Al ʻAziziya, half way to Baghdad.

Kut was a place of strategical importance, because at this point the Shatt al Hai, issuing from the Tigris, created a link with the Euphrates near An Nasiriya, and provided the line of communications which would naturally connect Turkish forces on the lower Euphrates with Baghdad. It was furthermore the most populous spot between Imara and An Nasiriya on the one hand, and Baghdad on the other. But almost the whole of the expeditionary force, apart from detachments on garrison duty lower down, had now been projected into an isolated situation far within the enemy's territory, and it depended upon a long line of water communication—the Tigris—while it was served only by a restricted number of steamers and of smaller craft.

Still, the idea of pushing on to Baghdad had already taken shape even before the occupation of Kut. The Aug. discomfiture in the Gallipoli Peninsula (*see* DARDANELLES CAMPAIGN), coupled with a belated realisation that the Dardanelles venture would not succeed, had rendered the British Govt. eager for some dramatic achievement in Mesopotamia. The Indian Viceroy had advocated an advance on Baghdad when the start up the Tigris from Imara was materialising, and Townshend's triumph acted as a powerful stimulus to such aspirations. Nixon intimated early in Oct. that he could open a road to Baghdad, under the circumstances then existing, but could not hold the city if it were taken. The military authorities at home, while admitting the possibility of capture, regarded permanent retention as out of the question with the limited numbers available, and they declared that if the place was to be held Nixon must be reinforced by two divisions. But, influenced by political considerations, the Government became more insistent, and in the end, although no reinforcements could be sent him immediately, and although they could not have taken part in the operations had they been sent, Nixon was told on Oct. 31 that he might advance on the city.



First Baghdad Offensive Fails.—Townshend, who had pushed a large part of his force on to Al ʻAziziya while the matter was being debated, found that the Turks were less disorganised than had been supposed, and that his own troops were tired and short of establishment; and he had serious misgivings. He, moreover, was unable to move for a fortnight, even after receiving the order to advance, owing to shortness of supplies and the need of organisation for the hazardous effort. He advanced from Al ʻAziziya on Nov. 11, and on approaching Ctesiphon some days later he found the Turks to be assembled there in strong force and expecting reinforcements. He attacked them on the 21st and was at first successful; but additional Ottoman troops arrived during the fight and recovered much of the lost ground, Townshend's losses in the action proving very heavy. During the next three days Townshend prepared to retreat, and on the night of the 25th he moved off.

No great difficulty was experienced at first; but, in consequence of the flotilla of supply transports and fighting craft being delayed by shoals, a halt had to be called on the 29th. Next day the pursuing Turks came up and delivered a resolute attack which was however beaten off, and after that the sorely tried little Anglo-Indian army was not seriously interfered with on its way to Kut, which was reached on Dec. 3. So, for the moment, ended the ill-advised Baghdad adventure. During the discussions of Oct. the Turks had been strongly reinforced from the northwest, and, by the time that Townshend had advance from Al ʻAziziya, his adversaries had already grown so form dable that there was little prospect of his opening a road to t city. There never had been any prospect of his being able hold the place even if he got there. Seldom has a military for been committed to an undertaking that seemed so difficult attainment.

II. The Siege of Kut

With the approval of the Home and Indian Government Nixon decided that Townshend was to remain where he wa although if he did so he was bound to be invested. They assume altogether too readily, that he would be relieved before his su plies ran out. So his sick and wounded, his cavalry, most of t flotilla, and a portion of his animals were sent off down the Tigr (although the civilian population was unfortunately allowed stop), preparations for standing a siege were put in hand, and Dec. 8 Kut was hemmed in on all sides. Its situation, in a de loop on the left bank of the Tigris, rendered the place readi defensible against assault or siege approach, and the Germa Field Marshal von der Goltz, who had just taken supreme co mand of the Ottoman forces in Mesopotamia, realised that unle it fell to an early assault the main Turkish task in this regi would be to guard against a relief. Nur-ed-Din, the Turki commander on the spot, had four divisions at his disposal, a on Dec. 10, 11 and 12 he delivered unavailing onsets upon t narrow front that was not covered by the river. After that t siege became a blockade, part of Nur-ed-Din's troops mov down the river some distance so as to confront any relievin force that might try to approach, and fortifications designed meet such a contingency were erected.

Attempts at Relief.—Meanwhile the 7th and 3rd Indian Di sions had been detached from the Western Front in Europe, a began arriving in the middle of Dec. in the Shatt al ʻArab. Ge eral Aylmer took charge of the troops who were to underta the relief of Kut, and units as they disembarked were push on to Imara with all speed and proceeded thence up the Tigri Owing to a miscalculation as to the length of time that K would be able to hold out, the operations of relief were duri their early days hurried more than was necessary, with the r sult that the force under Aylmer was during its operations Jan. less well organised than it might have been. There was grievous lack of heavy artillery, as well as a grave deficiency water transport. Nevertheless the Turks were driven out their advanced position at ʻAli Gharbi, were again defeated Shaikh Saʻad and, after a further defeat, fell back to the lin of Umm al Hanna, 20 m. from Kut on the left bank of t Tigris, at the entrance to a very awkward defile caused by t extensive Suwaiqiya marshes, which here approach to within short distance of the river. The relieving force had hither triumphed over every obstacle; but when on Jan. 21 it essay the storming of the Umm al Hanna position the effort faile and so numerous were the casualties that Aylmer felt compell to pause in his offensive and to await reinforcements. Abo the same date Sir P. Lake succeeded Sir J. Nixon in the chi command.

Improvement of Organisation.—Lake set himself to place A mer's line of communication on a better footing, to improve t medical arrangements and to develop the wharves at Al Qur and Basra. Material of all kinds was, however, deficient, and t Turks were in the meantime developing their lines of defence both banks of the Tigris below Kut, rendering the task of a r lieving force more and more difficult. The British Governme had, on receipt of the bad news about Umm al Hanna, order the 13th Div. to proceed from Egypt to Mesopotamia; but move these troops from Suez to the front of the Tigris necessari took some weeks, and it was moreover now too late to expa the water transport sufficiently to meet the needs of the growi Anglo-Indian force. Aylmer attempted no forward moveme during Feb.; but on the night of March 7–8, without waiting the 13th Div., he advanced from near Shaikh Saʻad against t Es Sinn position, intending a surprise.

This was on the right bank of the Tigris, less than 10 m. from ut, considerably higher up than Umm al Hanna and the defile aused by the Suwaiqiya marshes on the farther bank; but owing the Turks holding that defile Aylmer's flotilla was prevented om advancing above Umm al Hanna. The operation involved long march in the dark; when day broke part of the force had ot arrived, and, although the enemy was surprised in the first stance, the attack was delayed. When the assailants advanced gainst the reinforced Turks, they were beaten back and had to tire to Shaikh Saʿad.

Surrender of Kut.—The garrison of Kut was already on much duced rations; but Gen. Gorringe, who had succeeded Aylmer, ould make no fresh attempt for nearly a month owing to transort and supply problems. On April 5, however, the 13th Div. nder Gen. Maude stormed the Hanna lines and penetrated ell into the defile on the left bank of the Tigris; but, when rst the 7th Div. and then the 13th Div. attacked the Sanniat lines at its farther end, they were in each case repulsed. ut could now only hold out a few days longer, so Gorringe ied to advance by the right bank. After its making some rogress on the 17th, in spite of almost insuperable difficulties aused by floods, this movement was, however, brought to a andstill. A final effort was made by the 7th Div. on the 22nd gainst Sanniyat, which nearly succeeded. Finally, on the ght of the 24th, a steamer loaded with provisions tried to run e blockade but failed, and on the 29th Kut, with its garrison 9,000 British and Indian troops, surrendered. The efforts to ve it had cost 24,000 casualties, but had it been known in n. and Feb. that the place could have held out so long, the lieving army would have enjoyed a better prospect of achievg its object.

British Opinions.—The tidings of this very grave mishap gave se to profound dissatisfaction in Great Britain, a dissatisfaction gravated by information gradually leaking out with regard to e sufferings of the sick and wounded after the retirement from tesiphon. A Royal Commission was set up a few months later inquire into the operations that had taken place in Mesopomia, and its conclusions were to the effect that the undertaking a campaign on so ambitious a scale without adequate foreought and efficient preparations was worthy of blame; it also imadverted in strong terms on the very unsatisfactory charter of the medical arrangements during the early stages of the nture. In the meantime it was decided that Kut must if posble be reoccupied. But the hot season was at hand. The oops had suffered exhausting trials and had met with cruel sses. Water transport, as well as artillery and other war matel, remained totally inadequate. There could be no question resuming the offensive on the hand-to-mouth lines on which e advance from Imara had been initiated in the previous ar, and which General Lake had been obliged to continue when iving against time to relieve Townshend. A prolonged pause erefore became inevitable.

No reference has been made hitherto to the Russian forces in rsia. These, based on the Caspian, were actually in occupaon of a considerable area of the Shah's northern territories. ut they were weak in numbers, were operating in a region of de extent, and the avenues leading towards the Mesopotamian ain traversed rugged and unproductive uplands. Military ntingents so situated could afford no direct help to the Anglodian army during the critical months which followed Townsnd's advance to Kut, nor did their activities at any time withaw an appreciable proportion of the forces under Von der Goltz om the theatre of war on the Tigris.

III. THE BAGHDAD OFFENSIVE

Great developments took place on the Anglo-Indian line of mmunications, and at the base during the summer. A reanable amount of heavy artillery was gradually accumulated. additional division arrived from India. Landing facilities at e ports were vastly improved. A change, moreover, took place the chief command, for, after replacing Gorringe in charge of e forces at the front in July, Gen. Maude a few weeks later became commander-in-chief *vice* Sir P. Lake, whose health had broken down. Maude realised that there was yet much to be done before his army could hope to act with effect in this peculiarly conditioned theatre of war, and he set to work with indomitable energy to perfect his arrangements. He organised four divisions at the front up the Tigris as two army corps, and from Sept. to the end of Nov. he laboured unceasingly at the base, enjoying full support from the War Office in London, which had definitely taken over charge of the campaign from the Indian authorities. By the beginning of Dec. he had been furnished with enough river craft, his supply system was sufficiently advanced, and he had the necessary war material at his command, to justify his embarking on offensive operations of a far-reaching kind, and on Dec. 13 he struck suddenly and with signal success.

Disposition of the Forces.—Von der Goltz had left Mesopotamia, and Khalil Pasha was now in command of the Turks. They had withdrawn from Es Sinn and had established an entrenched camp nearly all around Kut, while holding on to Sanniyat, and in view of their dispositions Lake had begun a railway-line to run from Shaikh Saʿad to a point near Es Sinn. It must be pointed out that Maude started his offensive with a force four times the strength of that which, under Townshend, had advanced to Ctesiphon a year earlier. His army astride of the Tigris was of necessity disposed in échelon, with its left (the II. Army Corps under Gen. Marshall) about Es Sinn, and its right (the I. Army Corps under Gen. Cobbe) facing Sanniyat. Maude's plan was to push his left yet farther forward, to clear the right bank of the Tigris to well above Kut, and, when these dispositions should in due course have taken effect, to force the lines of Sanniyat with his right.

Marshall opened the offensive by forcing the Shatt al Hai after a night march, and by capturing some of the Turkish defences which formed a bridge-head south of Kut. During the struggles that ensued, which lasted some weeks, Khalil's troops offered a stout resistance, so that although Maude's operations on the right bank of the Tigris were almost uniformly successful, they proceeded slowly and by successive stages. By the middle of Feb. the whole of the Turkish entrenched camp on that bank was in Anglo-Indian hands, and the Ottoman troops had all withdrawn to the farther side of the great river. No sooner had this part of the programme been accomplished than Cobbe on the 17th attacked Sanniyat. The effort failed for the moment; but when the assault was repeated five days later, it proved completely successful, and after a desperate contest in which the Turks lost very heavily, the formidable lines were at last carried. On the same day Marshall by a brilliant feat of arms forced a passage across the Tigris at Shumran, and no course was then left open to the Ottoman commander but to abandon Kut and retire in haste up the left bank of the river. Maude's flotilla, hitherto blocked by Sanniyat, pushed up at once past Kut, and the Anglo-Indian army could claim to have won a victory that went far towards wiping out the discomfitures of the previous year.

Turkish Retreat from Kut.—With his supplies guaranteed by the arrival of the water transport, Maude pressed on along the left bank of the Tigris on the heels of the fugitive Osmanlis. The river channel between Kut and Al ʿAziziya has many loops and bends, making it difficult for a naval force and a military force to act in concert; but on Feb. 26 the British gunboats after a smart action destroyed or captured practically the entire Turkish flotilla. Great prizes in war material and prisoners were at the same time being made by the advancing army, and the question of proceeding to Baghdad now arose. The army commander had from the outset contemplated the capture of that city after he should have expelled the enemy from Kut, and now received permission to carry out his plan. He found himself obliged to halt for some days at Al ʿAziziya, however, for fear of outrunning his supplies. On March 4 the Anglo-Indian army resumed its advance, and it was found that the Turks had fallen back behind the Diyala. This river presented a serious obstacle, and when an attempt was made to force the passage the effort proved in the first instance unsuccessful. But Maude promptly threw a bridge across the Tigris, passed the cavalry and Cobbe's corps over to the right bank, and by March 11 Baghdad was in British hands.

The Turks had withdrawn northwards, but Maude allowed no pause in the offensive to take place. Cobbe pushed up the right bank of the Tigris along which a stretch of railway ran from Baghdad as far as Samarra, heavily defeated an opposing force at Mushahida, while Marshall conducted a most successful campaign on the Shatt al 'Adhaim. Cobbe, moreover, completed the operations on the right bank of the Tigris by the capture of Samarra. Then, having secured possession of a wide area of fertile territory to the north of Baghdad and driven the enemy in confusion into the deserts and uplands beyond, Maude was at last able to afford his victorious troops rest—just as the hot weather set in.

Further Progress Northwards.—The virtual conquest of Mesopotamia in a four and a half months' campaign had been brought about by the resolute execution of a plan of operations that was based on correct calculation of requirements—by a triumph of forethought on the part of a chief who always relentlessly followed up his successes in the field. Neither the stout resistance offered by the Ottoman troops, nor the formidable defence works which they had elaborated around Kut, had in reality proved the greatest stumbling block in Maude's path. The vast extent of the theatre of war, and the fact that his army must almost inevitably adhere to the line of the Tigris, which constituted one long military defile, had interposed even greater obstacles in the way. But those obstacles had been overcome by effective preparation.

A railway was constructed from Kut to Baghdad, sanitation and policing were established in the capital, comforts and recreation were provided for the troops, and effective steps were taken to tap the supply resources of the fertile tracts that were in occupation of the army. A division that had been in reserve at An Nasiriya was brought up to the front. Great efforts were also made for a time to arrange for co-operation with the Russian forces in Persia; but the untoward influence of the revolution in Petrograd of March made itself more and more felt in that quarter as the weeks passed, and before long it became manifest that little was therefore to be hoped for in that direction. The situation in Armenia was indeed becoming such as to cause Maude some anxiety, for in the late summer it appeared that the Turks under German instigation were contemplating an effort to recover Baghdad. This made Maude the keener to resume the offensive, and on Sept. 28 he struck his first blow by the capture of Ramadi on the Euphrates. This victory was followed up by successful operations in clearing the Jabal Hamrin, and by the occupation of Tikrit on the Tigris at the beginning of November. A few days later, however, the army commander was struck down by cholera, and he died on the 10th. He was succeeded by Sir W. Marshall.

IV. OPERATIONS IN 1918

The country traversed by the Tigris above Tikrit and extending north for a long distance is a sterile tract, hilly and broken at some points; the ordinary route from Baghdad to Mosul does not therefore follow the river but takes a direction to the east through Kifri and Kirkuk.

Maude's Plan.—Maude had intended to conduct his main advance by this line, but his death just at the moment when the project was to be put in execution created some delay; his successor, however, set troops in motion through the Jabal Hamrin in Dec., and by these Kifri was occupied in Jan. 1918. Having secured that point, Marshall suddenly set his extreme left wing on the Euphrates in motion in the middle of Feb., with the result that Hit was captured and the Turkish division which had retired up the river was surrounded, 5,000 prisoners and all its guns being taken. Transport difficulties were hampering the advance beyond Kifri on the other flank, but on April 29 the Ottoman forces were heavily defeated on the road to Kirkuk, losing 3,000 prisoners, and a week later Kirkuk was taken. Marshall, however, decided to withdraw his advanced troops in this
quarter to Kifri, and active operations then practically ceas
for five months. The collapse of Russian fighting power in A
menia had enabled the Ottoman staff to move some troops fro
there down to Mosul and northern Mesopotamia, and scarce
any assistance had been received from Persia; but Marshal
first campaign had nevertheless been remarkably successful a
his position to the north and north-west of Baghdad had be
effectually consolidated.

The British Mission to Persia.—In the meantime a spec
British mission, sent off in Jan. under charge of Gen. Dunst
ville, and originally intended to proceed to Tiflis with the obj
of co-ordinating the resistance of the Armenians, Georgians a
Russians to the Turks threatening Transcaucasia, had be
trying to maintain satisfactory relations with the Russians
Persia. But great difficulties were placed in Dunsterville's w
by the Russian officials, who were tending towards Bolshevis
while open hostility was displayed by certain of the Persi
tribesmen. Some Russian troops, however, remained loyal
the Entente, and co-operating with these, small bodies of Briti
troops were gradually pushed north so as to establish a line
communications between the Anglo-Indian army in Mesop
tamia and the Caspian Sea at Enzeli. Resistance to the Tur
in Transcaucasia was gradually breaking down during the ea
summer, and at the beginning of July the last of the Russi
detachments in Persia proceeded thither by ship. The Ottom
troops appeared before Baku shortly afterwards and Dunst
ville with a brigade of infantry therefore sailed for that city
August.

He found the Armenian garrison to be unreliable and the at
tude of the Russian officials to be suspicious. The lines constru
ed for the defence of the place were of such extent as to requ
a large force to man them, Bolshevik armed craft afloat on t
Caspian were a source of danger, and it soon became appare
that the safety of Baku depended entirely upon the meag
British force that had been thrust into it, for the Armeni
soldiery displayed but little stomach for combat. Dunstervi
and his men did what they could to save the place for a few wee
but on Sept. 14 the Turks broke through the outer defences, a
that night the British re-embarked and returned to Enz
whereupon Baku passed into the enemy's hands. A somew
hazardous venture had failed; but it had at least prevented t
dispatch of some of the Ottoman troops in Transcaucasia
confront the Anglo-Indian army in northern Mesopotamia.

Closing Stages of the Campaign.—The fall of Baku occur
just when the season had again become suitable for active ope
tions on and about the Tigris, and Marshall was now direct
to occupy Mosul, an undertaking for which he had been prep
ing all the summer. The best of the Turkish divisions were
this time assembled astride of the Tigris at Al Fat-ha, the poi
where the river breaks through the Jabal Hamrin range of hi
Here a naturally formidable position had been strongly fortifi
and another position a few miles higher up the river had likew
been prepared for defence. Realising that a frontal attack wou
be hazardous and that a tactical turning movement was vir
ally out of the question, Marshall decided to throw an adequ
force across the Ottoman communications between Al Fat-
and Mosul. He entrusted the conduct of the operations as
whole to Gen. Cobbe, and arranged for a column to adva
simultaneously from Kifri by Kirkuk towards Mosul.

Surrender of Ismail Hakki.—The final campaign in Mesopo
mia began on Oct. 23 and it lasted only one week. Two caval
columns, that with the shorter distance to cover being acco
panied by some infantry, crossed the Jabal Hamrin many mi
to the east of Al Fat-ha, passed the Little Zab a long way abo
its junction with the Tigris, and hit off that river several miles
the rear of the Turkish positions at and above Al Fat-ha.
the meantime the 17th Div. operating on the right bank and t
18th Div. operating on the left bank of the Tigris moved forwa
from above Tikrit. Finding himself threatened by the caval
forces which were approaching the river between him and Mos
Ismail Hakki Pasha, who commanded the Turks, now withdr
from the Al Fat-ha position to the one higher up at the co

ience of the Little Zab, followed up by the two Anglo-Indian
visions. But the 18th Div. advancing on the left bank of the
gris, forced a passage across the Little Zab on the 25th, thus
rning Ismail Hakki's left flank, and the Pasha thereupon trans-
rred those of his troops that were on that side of the Tigris
ross the river and broke up his bridge.

On the 27th the 17th Div. was pressing the Turks, who were
w all collected on the left bank of the river, and on the same
y one of the cavalry columns forded the stream and began
oving down that side of the channel against the enemy's rear.
e 17th Div. was heavily engaged on the 28th before it finally
ade itself master of Ismail Hakki's position at the confluence
the Little Zab. That commander thereupon retreated to Shar-
t, but on the morrow the last hope of the trapped Turkish
ce was destroyed, when a relieving column that was approach-
; from Mosul was defeated by Cobbe's cavalry. All that day
nail Hakki resisted the advance of the Anglo-Indian forces on
arqat. On the morning of Oct. 30, however, just as the 17th
v. was about to launch a final attack, the white flag was dis-
yed within the Turkish lines, and the whole of one Ottoman
ision, together with the bulk of another one, surrendered,
000 prisoners, 51 guns and imposing stores of war material
ing into the victor's hands.

The Kirkuk column had in the meantime been steadily work-
its way forward towards Mosul, almost unopposed, and
bbe's forces were about to advance on the city from about
arqat, when tidings came to hand of the signing of the
nistice. Mosul was occupied a week later, but the Otto-
n power of resistance in this theatre of war was in any case
ttered as a result of Marshall's final blow. Thus the long
wn-out struggle in Mesopotamia, which had proved so con-
ently favourable to the Anglo-Indian arms since Maude had
nched his offensive at the close of 1916, ended in a blaze of
mph two years later, concurrently with what constituted the
st sweeping tactical success that had been gained by either
e during the course of the campaign.

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(C. E. C.)

IEŠTROVIĆ, IVAN (1883–), Yugoslav sculptor, was born
'rpolje in Slavonia, the son of Croatian peasants. The rudi-
nts of his art were taught him by his father and at the age
3 he was apprenticed to a marble cutter at Split (Spalato),
three years later entered the Vienna Academy where he
died under Hellmer until 1904. During the succeeding years
exhibited at the Vienna Secession, at the Austrian Exhibi-
at Earl's Court, London (1906), at Munich, Venice and
is—where he attracted the notice of Rodin. He was largely
onsible for the formation of a nationalist artistic movement
ch included the sculptors Rosandić and Dujan Penić, the
ter Rački and the architect Plečnik, and which culminated
he exhibition at Zagreb in 1910 and the Rome international
bition of the following year. His work at this period centred
fly around a projected Temple at Kosovo, for which he
e a model for the building and a large number of figures of
oslav heroes—Marko Kraljević, Miloš Obilić, Banović Stra-
a and Srdj—caryatid figures and groups and single figures
nourning widows. In 1915 an exhibition of his sculpture
held at the Victoria and Albert Museum, London.

esides the naturalistic works designed for the Temple,
trović made a large number of religious reliefs and figures
alnut, of which two Pietà reliefs, one in the National Gallery
ritish Art and one in private possession, are typical of his
cutting and great powers of design. His portraits include
e of his mother (1908), Madame Banac (1913 and 1915),
wife (1915), Sir Thomas Beecham (1915, in the National
ery of British Art), Lady Cunard (1915) and Miss St.
rge (1915). Among his later works the most important are
richly decorated Raćić Memorial Chapel at Cavtat, near
Dubrovnik (Ragusa), Dalmatia (1920–2), the designs for the projected mausoleum of Bishop Petar Petrović Njegoš, the Montenegrin poet, to be erected on the summit of Mount Lovćen (1924), and figures of St. Francis of Assisi and "The Artist's Mother in Prayer" (1925). In 1924 exhibitions of his work were held at the Fine Art Society in London and the Brooklyn Museum.

See M. Curčin, *Ivan Meštrović, a Monograph*, with bibliography and list of works (1919). For details of the Raćić Chapel, see *Deutsche Kunst und Dekoration*, LII. (1923).

METALLOGRAPHY (*see* 18.2b).—Metallography is the study of the internal structure of metals and alloys, and of its relation to their composition and their physical and mechanical properties. Beginning with the use of the microscope for the examination of polished and etched surfaces of metals by Sorby in 1864, the scope of metallography has been widened to include other methods for the examination of the internal constitution of solids, such as the measurement of changes of volume and of heat content, and of electrical resistance, magnetic quality or behaviour towards X-rays.

The properties of metals and alloys, like those of other solids, depend partly on their chemical composition and partly on the internal arrangement of their constituents. It is possible for two specimens of metal, taken from the same homogeneous mass and identical in chemical composition, to have widely differing properties if they have been subjected to different thermal or mechanical treatments. Since this important fact has become generally recognised, other methods of examination must supplement chemical analysis in the control of materials for engineering and similar purposes, and in recent years there has been a great development of metallographic methods, together with a greatly increased application of them in industry, so that the microscope has become as indispensable as the balance in metallurgical works, whilst dilatometers, magnetic and electrical measuring instruments, and accurate pyrometers are becoming more and more frequent items of the equipment of a laboratory for the control of materials by manufacturers or users.

Preparation of Specimens.—The improved microscopical technique of the present day, and the use of high magnifications, make it necessary to prepare the surfaces of specimens with a very perfect polish. Polishing by hand on fine emery papers is preferred to the use of a machine, except in the last stage, when a rotating disc covered with cloth is used, the finest polish being given by levigated magnesia, although for low magnifications alumina is quite satisfactory. Steels are best etched by a 4% solution of picric acid in alcohol to which a small quantity of nitric acid may be added to bring out the boundaries of the crystal grains. Stainless steel and other highly alloyed steels require special reagents. Many tables are now published giving the most suitable reagents for the etching of the commonly occurring metals and alloys. Much light has been thrown on questions of metallurgical importance by the use of high magnifications, and progress is being made in this direction. It is important to observe the conditions of accurate microscopy by making a suitable choice of objective and eyepiece for the work. Mere magnification without higher resolution gives no information of value. The internal structure of martensite in hardened steel is a severe test of the resolving power of a microscope, and has been studied in detail with some success. The inverted type of microscope, in which the specimen is placed with its polished face downwards on the stage, has many advantages in convenience and rapid working, and has become popular in metallographic laboratories, in spite of certain optical disadvantages due to the larger number of reflections.

Macroscopic Etching.—In another direction, the examination of etched specimens with little or no magnification has proved of great practical value. For this macroscopic etching the surface to be examined is roughly polished and then deeply etched, acid solutions of copper salts being mostly used for steels, the copper which is deposited at first being completely removed by washing. Segregation is revealed by differences of etching, a very distinct pattern being produced, which may be recorded by photography or by the method employed long ago by Sorby in making "nature prints," and temporarily forgotten, of using the etched surface as a printing block, rubbing printer's ink into the depressions, and transferring to paper by pressure. Macroscopic etching has proved of value in the detection of defects in ingots and castings, and also in following out the treatment of a metal during such processes as forging, the direction of the flow during working being shown by the curving of the lines representing small differences in composition in the original mass. This method is employed in some works as a regular means of control in the forge.

Strain Etching.—In 1921 a method of etching was described by A. Fry, having as its object the detection of plastic strain in mild steel. The steel to be examined is polished, care being taken to avoid any distortion, and is then annealed for a short time at about 200°C., after which it is etched in an acid solution of cupric chloride. Clearly defined dark bands make their appearance where the crystals have been deformed, and much information as to the distribution of plastic movement is obtained from a study of the figures. Rather strangely, whilst some mild steels give well defined patterns with ease, others of almost identical composition give no result, and it has not been possible to trace any connection between the composition and the degree of success of the etching. The method has therefore so far a limited value, but it is almost certainly capable of further development. On a microscopic scale, the mechanism of deformation has been studied by many investigators. Metals and alloys vary greatly in the degree of apparent confusion in the crystalline structure produced by deformation. Cupro-nickel is remarkable for its property of undergoing severe cold-working and continuing to give perfectly sharp and definite structures when etched, and this alloy, together with pure aluminium and an alloy consisting of tin to which 1·5% of antimony has been added, have been largely used in the study of the cold-working of metals and of the microscopic changes which occur on subsequent annealing.

Plastic Deformations.—The nature of plastic deformation being of such great importance to the engineer, this part of the subject has attracted much attention. A mass of metal, such as a forging, consists of an immense number of crystalline grains, the axes of which are directed at random, so that for practical purposes the metal is commonly regarded as isotropic, the individual differences being lost in the aggregate. At the bounding surfaces of the grains there is a discontinuity of properties, the origin of which is a subject of controversy. The failure of metals by fatigue (*see* FATIGUE OF METALS) under rapidly alternating stresses, cannot be explained by any assumption of isotropic character, and it becomes necessary to take into account the stresses in the individual grains. The problem is simplified by the comparatively recent discovery of methods for the preparation of single metallic crystals of such large size that they may be tested in an ordinary testing machine, the microscopic and other changes being observed. Aluminium has been studied in detail in this way by Carpenter and Elam; tungsten (in the form of wire) by Goucher and zinc, tin and bismuth by Polanyi and Weissenberg. In these instances the direction of slip and its relation to the crystalline structure have been determined.

The influence of the crystal boundary is studied by using test pieces composed of two crystal grains, a boundary crossing the specimen. Beyond the fact that the boundary offers an obstacle to slip, little has yet been established in regard to this factor, although the hypothesis of a layer of amorphous material between the grains has been applied with great ingenuity and success by Rosenhain to explain many of the facts of deformation and also of chemical attack on metals. The low tensile strength of metals, as compared with the theoretical cohesion calculated by indirect means, has led to the suggestion by A. A. Griffith that all ordinary solids contain innumerable minute flaws, and this hypothesis has attracted the attention of mathematical physicists, who have applied it with some success. By special devices, vitreous silica and glass have been prepared in an unstable condition in which the strength is of the order of the theoretical cohesion, but this has not been attained with metals.

X-ray Analysis.—Some departments of metallography h
been transformed by the introduction of the methods of X-
(*see* X-RAYS) analysis. The use of X-rays for the penetratio
large masses of metal for the detection of blowholes and ot
defects is obvious, and whilst useful in practice has no theoret
significance; but the refined methods of crystal analysis due
Laue and to Bragg are far-reaching in their effects. The arran
ments of the atoms in a space lattice (*see* CRYSTALLOGRAP
and the absolute dimensions of that lattice have now been de
mined for most of the important metals, and many interest
results have been obtained, amongst others the fact, establis
by Westgren, that α and β iron below 900° C. and δ iron ab
1,410° C. have the same space lattice, a body-centred cube, wh
γ iron between 900° C. and 1,410° C. has a face-centred cubic
tice, and this conclusion is in harmony with the physical pro
ties of these modifications of iron. The same method provi
an accurate determination of the direction of slip in single c
tals during straining, whilst the examination of drawn wires
of rolled sheets has shown that there is a tilting of the sp
lattices of the individual crystal grains, leading to a more or
parallel direction of one of the crystal axes throughout,
"fibre structure" being similar to that which the X-rays
show to be present in natural fibres. Studies of this kind
throwing much light on the question of the mechanical stren
of materials.

Thermal Analysis.—The methods of thermal analysis h
undergone comparatively little change. To ensure a unif
rate of cooling, the specimen of metal may be suspended i
furnace in which a steady temperature gradient has been est
lished by winding a metal tube with resistance wire suitably i
lated, and making the windings closer at the upper part.
specimen is then lowered through the furnace at a uniform
by a mechanical device. It has been shown that the speci
should have a spherical or pear-shaped form in order to ob
sharply defined points on the heating and cooling curves. T
mo-couples are almost invariably used for the measuremen
temperature, although the platinum resistance thermome
used in the early and extremely accurate work of Heycock
Neville, has great advantages. Japanese workers, investiga
the alloys of iron, have made much use of magnetic determ
tions as a means of fixing temperatures of transformation,
curves having much the same form as those derived from t
mal observations; whilst other investigators have used
changes in electrical resistance with temperature for the s
purpose. Several types of dilatometer have also been devi
in which the changes of length of a rod of the metal or alloy
ing heating and cooling are measured directly or by compar
with a standard or with a rod of vitreous silica with neglig
expansion. Where the change of length is indicated by the
ing of a mirror, this method is susceptible of very great accur
It has proved of value in the study of hardened steels, an
now making its way from the research laboratory into techn
practice.

Practical Applications.—The higher standards of strength
endurance demanded of metallurgical products by the mod
motor and aeroplane industries (*see* AERO-ENGINES) and by
other branches of engineering as the manufacture of st
turbines (*q.v.*), have been responsible for the interest now b
taken by engineers as well as by metallurgists in the stud
metallography. Alloy steels, and many of the higher qual
of plain carbon steels and of non-ferrous alloys, have to be "h
treated" to develop their maximum toughness or other desi
properties. To determine whether the treatment has bee
correct one the methods of the metallographic laboratory
be applied. Moreover, the engineer is concerned with such p
lems as that of fatigue (*see* FATIGUE OF METALS), and with
general nature of mechanical deformation beyond the limit
which the theory of elasticity is applicable.

The methods devised for the study of metallic alloys
proved to be of value in the scientific examination of other so
Whilst the original idea of the examination of metals by m
of the microscope occurred to Sorby in consequence of his ea

roduction of microscopical petrography, the technique of tallography has been applied to opaque minerals, and has de possible the detailed study of mineral veins and ore de- sits. The work of the Geophysical Laboratory at Washington the equilibrium in rock magmas (*see* PETROLOGY), with its thods of accurate measurement at high temperatures, is also sed to a great extent on experience gained in the study of tallic systems.

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IETALLURGY (*see* 18.203).—Progress in metallurgy after I was profoundly affected by the World War. Modern war- e is so entirely dependent upon the products of metallurgy t the effort to secure military victory to some extent resolved lf into a struggle for supremacy in metallurgical output, in ard to steel products such as guns and shells, ship-plates and our, etc., to copper and its alloys, to zinc, to lead and anti- ny, and, in a special degree, to aluminium.

uring the war period, therefore, the progress of metallurgy ame mainly a relentless struggle for output in which, in some ctions, quality was sacrificed and heavy "war risks" were erfully taken. After the termination of the War, industrial con- ons became extremely unsettled and difficult; the shortage of s was followed by acute industrial disturbances, particularly in land. The Continental nations only slowly resumed their normal vities, and were gravely hindered on all sides by the direct and rect economic consequences of the Treaty of Versailles. As the lt of continued political and financial uncertainty, recovery in metallurgical industries remained slow, except perhaps in gium, until 1925. Towards the end of that year, following the roved atmosphere resulting from the Locarno Pact, signs of im- vement began to set in. Meanwhile, however, the metallurgical stries of America experienced a period of special prosperity, and relative rate of development in metallurgical practice in the tern and Western hemispheres must be in part ascribed to these ors.

DIVISIONS OF THE SUBJECT

he whole period under review thus falls into three main divisions: r to 1914, the War period and the post-War period. The influ- e of the War has left important traces in certain directions but line of development appears to be tending towards a simple inuation of pre-War lines. Thus, very great efforts in England in certain of the British Dominions to render those countries allurgically self-supporting were made either as the result of ct governmental encouragement and support or on account of abnormally high prices ruling for some of the metals. This led he development of properties and processes which were, under e normal conditions, uneconomical, and these—with govern- tal support unavoidably withdrawn and prices at a less abnor- level, have necessarily been abandoned. An important exception e great development in the zinc industry in Great Britain and tralia, in which, thanks to real metallurgical advances, permanent omic success has been achieved.

a totally different direction, however, war conditions led to a xation of the severity of specifications, particularly for steel lucts.

fter the War, steel makers claimed that their difficulties were ost as great as ever. It was suggested that the relaxed specifica- s had led to no disastrous results and that, therefore, they might afely continued. The British Engineering Standards Associa- adopted a compromise course and, while rejecting the extreme xations accepted under War conditions, also refrained from a rn to full pre-War severity. It has resulted that "War time lucts" are looked upon with grave suspicion. A steady tendency ards increasing stringency in specifications, particularly in the direction of higher requirements as to the purity of metals and alloys, is now (1926) making itself felt. A similar tendency appears to exist also in America, but the methods of applying specifications and tests in that country are so widely different from those adopted in England that direct comparison is liable to be misleading.

Another effect of the War, and of the subsequent strong movement towards disarmament, has been the need for industrial rearrangements and reconstructions on a large scale. At the end of 1918, the metallurgical and allied industries were entirely devoted to armament and munitions and had then to find different outlets for their activities. The engineering reconstruction work required in the devastated regions of Europe proved no adequate outlet and in many cases, particularly in England, great works had to close down. In America, with an enormous home market the conversion of armament and munition works to peaceful output was carried through successfully on a large scale. Consequently, the industrial "slump" in that country was comparatively slight and brief.

I. IRON AND STEEL

Prior to 1914 iron and steel metallurgy showed a tendency towards the development of very large plants and larger individual units, both in regard to furnaces and rolling-mills. The tendency towards increased size made itself felt in the blast furnace, particularly in American practice; progress, however, also included development in the direction of furnaces with walls and external water-cooling, such furnaces being driven very hard.

Pre-War Progress.—In the period prior to 1914, considerable attention was given to drying the blast, and it seemed at one time that this would become universal practice. Under war conditions this development was checked, at all events in England, and has not been resumed since 1918.

Increased attention has, however, been given to the utilisation and cleaning of blast furnace gases. This became particularly important in England during the War on account of the shortage of potash, a substantial recovery of this material being obtainable from the flue-gases of furnaces in which the charge included potash-felspar. At the same time satisfactory cleaning of the gas very much increases its efficiency in stoves and under boilers, owing to the absence of fouling with dust. On the other hand, a degree of cleaning which will render the gas fit for direct use in gas-engines is a much more expensive matter, and not so obviously economical. The cleaning processes adopted are mainly of two kinds; one of these depends upon the electrostatic deposition of the dust by the method first suggested by Lodge and developed in America by Cottrell (*see* FUME PRECIPITATION). The other method depends upon filtration of the gas through fabric bags which are kept in a state of agitation, as in the Halberg-Beth system. Although, under normal conditions, potash recovered from flue-dust could not compete with the product of Continental mines, yet cleaning of blast-furnace gas will be continued. The dust itself may be utilised for the recovery of iron contained in it, by briqueting the dust by a modification of the Schumacher process, in which a weak solution of ferrous sulphate is used as binder. A further proposal is to concentrate the iron-content by some adaptation of the flotation process.

The application of flotation processes (see below) to finely divided iron-ores had not been found necessary or practicable up to 1926, but methods dealing with finely divided ores (both ferrous and non-ferrous) have been considerably developed. In addition to the Schumacher process already mentioned, reference must be made to the Dwight-Lloyd process, in which the ore is mixed with a small proportion of finely divided carbon and pressed into briquettes which are then heated to a moderate temperature. A partial reduction of the ore takes place, leading to a sintering of the briquette which thus acquires the necessary strength.

In the production of steel, the open-hearth furnace has made very great progress and appears likely to displace the Bessemer converter, although the latter seems to be holding its own to a certain extent. The steady increase in the application of basic open-hearth steel tends to give the large open-hearth furnace, particularly when working one of the continuous processes, a very great advantage.

War Period.—In the first place it became necessary, particularly in England, to make use of ores and other materials very different from those for which particular furnace plants had been designed, while the supply of operative labour became very difficult. In consequence of these and other difficulties, relaxation of quality, already mentioned above, became inevitable, particularly in regard to those grades of steel which were required in very large quantities.

Apart from the demand for enormous supplies of steels of ordinary grades, War conditions also caused great demands for steels of the highest quality for special purposes. The production of guns was one of these, and much difficulty was encountered both in England and America with defects—known as "snow flakes" or "gun measles"—occurring particularly in nickel-chrome steels. Reversion to the use of a simple nickel-steel for such purposes followed, but this entailed a serious disadvantage, if only on account of the greater difficulty experienced in securing satisfactory heat-treatment. This difficulty was also encountered in connection with the gearing used for the propelling machinery of turbine-driven ships. High-quality steels, mainly alloy steels, were also required in relatively very large quantities for purposes of air-craft construction, principally for the working parts of aero-engines. This demand led to a great development in the production and treatment of alloy steels.

Here, and generally in the production of the better grades of steel, the electric furnace played a remarkable part. A large number of furnaces, mostly of the arc-resistance type, were installed, particularly in Sheffield. Their value lay in the super-refining of steel, sometimes produced in a basic open-hearth furnace, sometimes obtained by the direct remelting of alloy-steel scrap. Probably the power of the electric steel furnace to deal satisfactorily with such scrap, even when in the form of workshop swarf, constituted its greatest value during the War. Since the end of the War, however, the demand for such steel has almost disappeared, with the result that the greater number of the electric furnaces, both in England and America, became idle. None the less, there must be, in the future, a definite use for a certain number of electric furnaces in steel metallurgy.

Alloy Steels.—In regard to alloy steels, while nickel-chrome and nickel steels have found by far the widest application, particularly for war purposes, other alloy steels have also assumed importance.

Nickel-chrome steel in particular, in addition to the difficulties already mentioned, has been found to be subject to a defect known as "temper brittleness." Alloy steels, in order to assume their most desirable physical condition, require specific heat-treatment, which, as a rule, consists of quenching in oil, or more rarely in water, from a temperature above the critical range of the steel, followed by "tempering" or reheating to a temperature considerably below the critical range. In the majority of steels, the rate of cooling subsequent to tempering is of little importance, but in a certain number of nickel-chrome steels slow cooling after tempering leads to a form of brittleness which is entirely removed if the steel is cooled very rapidly (quenched) after tempering. The cause of temper-brittleness has received much investigation, and the results indicate that it is due to a change or "transformation" which occurs in the steel at or near 300° C.; it appears to be favoured by certain impurities, notably phosphorus.

Further, acute controversy has arisen as to the importance or otherwise of such "temper brittleness" on the ground that it can only be detected by a particular form of test—the "notched bar impact test." Hatfield has repeatedly suggested that this test measures a property of no practical importance, and that therefore temper brittleness is only "apparent" and not "real." This view, however, has not been generally accepted, since a number of investigators (Rosenhain, Greaves and others) have found a very distinct correlation between a low value under the notched bar impact test and cases of actual failure in service.

Chromium Steels.—For certain purposes, where simple nickel steels are not found adequate, a chrome-vanadium steel has been extensively used. The fact that vanadium plays a really important rôle in such steels has come to be recognised, but there are still difficulties in its metallurgical applications. For quite a different range of purposes a steel containing relatively large amounts of chromium (about 13%, Brearley) has found wide applications. Its best-known application is to the production of "stainless" cutlery, which has proved extremely successful in practice, and in spite of the relatively high cost has come into extensive use as a labour-saving device (*see* RUSTLESS STEEL). Some difficulty was at first experienced in hardening this material satisfactorily; it requires a higher quenching temperature than cutlery-hardeners have been accustomed to employ (Hatfield), and, as a consequence, the earlier products were insufficiently hardened, and gave rise to the complaint that such cutlery would not keep its edge. Later practice has overcome this defect, although the fact still remains that "stainless" knives, not being automatically sharpened by daily polishing, req careful sharpening from time to time.

New applications of this steel to other purposes where res ance to corrosion is important are being found almost da Incidentally, it was found that this steel is capable of resisting severe conditions which occur in the service of an exhaust-va in aeroplane engines, although a high-tungsten steel (1 tungsten) has been found to be slightly better. More recen special alloy steels for use at high temperatures have been veloped both in England and in Germany. These contain c siderable proportions of both nickel and chromium, while some cases tungsten is also present. Unlike the simple chromi steels, these new materials retain a considerable degree strength at temperatures well above 700° C., particularly tested in tension at ordinary rates of loading. Testing un prolonged loading—known as "creep stress testing"— however, been developed to furnish more reliable data wh material is exposed to continued load at high temperatures, it is as yet difficult to find any material which shows a hig "creep stress" than two tons per sq. in. at 800° Centigra This figure is attained both by some of the steels just mentio and by a non-ferrous nickel-chromium alloy (80% nickel, 2 chromium). This whole subject is attracting much attentio view of the tendency towards the use of higher temperatures pressures in both steam and internal combustion engines.

While the simple chromium steels of the "stainless" type hold the field for cutlery and similar purposes where hardnes essential, their powers of resisting corrosion have been surpasse a surprising degree by the recently developed alloy steels contai considerable proportions of both nickel and chromium, with, h ever, very little carbon. These are "austenitic" steels, *i.e.*, t consist mainly of what is known as "gamma" iron, are n magnetic and very tough and ductile. They cannot, however hardened by quenching, although they frequently exhibit a tende to harden very markedly under the action of cold working. manganese steel of Sir Robert Hadfield, which proved so valua as a material for shrapnel-proof helmets during the War, is extreme example of this kind, as this steel becomes intensely h when subjected to cold working, even if this only takes the form surface abrasion. The high nickel-chromium steels do not harde anything like the same extent, but sufficiently so to make th difficult to machine.

Like manganese steel in the quenched or "toughened" condit they are non-magnetic, but their outstanding feature is resistanc corrosion. The best of them remain unaffected by most liquids, cluding sea-water, solutions of magnesium chloride and even str nitric acid. Strong hydrochloric acid alone attacks them. Th remarkable materials have only recently (1925) become c mercially available, but their application is already develop rapidly. Their good physical properties, combining high stren and great ductility, make them desirable materials for many kind structural work, but applications on the very large scale are hindered by their relatively high cost.

High-speed Steels.—In the metallurgical progress of the per under review, the development of high-speed cutting st occupied an important place, their possibilities having b steadily exploited to an increasing extent, their developm being naturally accompanied by an evolution of machine-t capable of utilising the high cutting powers of the new ste Under war conditions the great demand for tool-steels of kind created a relatively enormous demand for tungsten, considerable developments in the mining and production tungsten took place. Efforts to replace tungsten by other me were also made, and very great claims were advanced for a hi speed steel in which molybdenum in combination with vanadi was used in place of tungsten (Arnold). The action of cutt tools has received careful study by a number of investigat largely under the auspices of the Cutting Tools Research C mittee of the Institution of Mechanical Engineers.

In connection with high-speed steels, mention may here be m of a type of alloy which has been used, with considerable success place of such steel. This, known as "stellite," consists, accordin a reliable analysis, mainly of cobalt 56%, chromium 34%, tungs 9%, carbon 1%. Tests with this material have shown that capable of cutting rather faster than the best tungsten steel, vided that the cut is smooth and regular, but that for roughing c where the tool is subjected to sudden shocks and jars, the allo unsuited, as it is too brittle and the tool frequently breaks ese alloys, originating in America, have received much attention l development in Germany. In England the hardness and in- rodibility of these alloys has led to their use as a substitute for tinum for such purposes as standard weights.

Cobalt Steel.—The great development of cobalt production at dbury in Canada has made this metal available and has at- cted interest to its possible uses. A high-speed tool-steel, taining cobalt has been produced in Sheffield, which has been ccessful in general use and has the remarkable property that it es not undergo distortion during hardening. Great difficulty sted under war conditions in the production of accurate parts uch as those of shells and fuses—which were required to be ictly interchangeable. This difficulty extended back to the ges and master-gauges used for the checking of such parts l ultimately in many cases to the cutting-tools used in their duction. In other cases, the steel of which the gauges them- ves were made gave much trouble owing to distortion during rdening, requiring considerable adjustment by " lapping " of hardened article.

A cobalt steel has also become important for permanent gnets. Made in the first place of hardened carbon steels, the uirements particularly for the magnetos used for ignition pur- es in aircraft engines led to the use of special steels containing ut 6% of tungsten. A Japanese invention, based upon ex- sive researches carried out in that country (Hondo), has duced a cobalt magnet steel which, in its best examples, gives prising results, combining an exceptionally high coercive force h a relatively large remanence. By the use of this steel a ch smaller and lighter magnet suffices for a magneto of given ver. The steel is expensive, and when supplied in quantity pears to vary in quality, while there is also some difficulty in workshop manipulation.

Case Hardening.—Processes for the surface hardening of tough l have come into increasing use, and methods for securing hardness of the case, with a tough core and good gradation ween the two, have been developed. More recently a method urface hardening has been worked out in Germany (Krupp) ch entirely avoids the necessity for quenching and its attend- distortion. A special steel, containing both chromium and minium, is employed, and the surface is hardened by the mation of a layer of intensely hard nitride, produced by pro- ged heating at about 500° C. in a gas consisting mainly of monia.

Welding.—One of the most remarkable developments (metal- gical in the wider sense) during the period under review has n that of autogenous welding, (*q.v.*) both by the oxyacetylene ne and by the electric arc.

oth these processes afford a relatively cheap and simple means of king joints in metal, particularly in iron and steel, and as the joint sists of " the same metal " as that which is being joined there is a cious suggestion that the joint is " perfect " in the sense of being ood as the unjointed material.

lthough it is quite possible to obtain welded test-pieces which ak, under a tensile test, away from the actual joint, the joint lf can never be regarded as equal in strength and toughness to unjointed steel. The reasons are that the material in the weld lf has solidified from fusion and is at best equal in properties to same steel in the cast condition, while the rest of the plate itself been immensely improved in quality by forging and rolling and sibly by heat-treatment. Further, adjacent to every such weld e is a region of steel which has either been severely overheated or little farther away—which has been heated to a temperature just w the critical range. In both these regions the steel is seriously kened, and it is in the latter that test-pieces generally break.

he most serious difficulty, however, is that of being sure that any ogenous weld is truly sound. Examination of many welds has wn that complete soundness is difficult to secure, and that it is exception rather than the rule, even in careful practice. Also, it ot possible to ascertain by any external examination of a weld ther it is sound or not. Examination by the aid of a powerful ay installation can sometimes be employed to assure the sound- of an important weld, but as a rule this is not feasible. It ld seem, therefore, that there is grave doubt whether welded ts can be relied upon to carry severe working stresses or whether should be employed in vital parts unless an exceptionally heavy or of safety can be allowed.

xperience in aeroplane construction supports these doubts, and a struction in which steel tubes are joined together by pinned and soft-soldered joints has been found more reliable than autogenous welding, provided that the working stress on the solder is kept to a low value. On the other hand, the welding processes afford a ready means of making joints and effecting repairs where no other process could be used, and under war conditions particularly rapid repairs were frequently executed with great success. At the same time, welded joints should not be compared with the unjointed material but rather with joints made in other ways, such as riveting; and there the comparison is much more favourable except for the serious element of uncertainty. The application of welding, and particularly of electric arc welding, to such purposes as ship construction, has, however, found considerable acceptance.

Cast Iron.—This metal has received much attention, both on the practical and the research sides. In Germany this is strongly indicated by numerous patents and scientific papers and in Great Britain by the formation and growth of the Cast Iron Research Association. One of the most striking developments is that of so-called " Pearlite " iron, in which the rate of solidification is adjusted, by suitable preheating of the sand moulds, to the thickness of the casting and the silicon content in such a way as to secure desirable (pearlitic) microstructure and specially good physical properties. Special furnaces suitable for the production of cast irons low in total carbon, or specially desulphurised, have also been developed.

In America the production of malleable castings on a large scale has progressed, with the introduction of electric furnace melting for the iron and malleable-annealing in continuous furnaces of the tunnel-kiln type. The casting of grey iron castings in permanent metal moulds has also been developed, the chilling effect of the iron mould being avoided by the interposition of a hard layer of relatively non-conducting refractory material. The exposure of cast-iron to increasingly high temperatures has revived the problem of the " growth " of this metal, particularly on repeated heating and under the influence of superheated steam. The view that growth is essentially due to oxidation occurring in the graphitic pores of the iron is still held, but it is recognised that this action is not solely due to silicon and that it may be as much dependent upon the treatment of the iron and its consequent structure as upon its chemical composition.

II. NON-FERROUS METALS

Flotation Process.—The outstanding feature in the progress of non-ferrous metallurgy is summed up in the one word " flotation." Published scientific research (Langmuir, Sulman and Picard, Edser) has gone far towards the explanation of this process which has made enormous progress and has revolutionised the practice of the extraction of many non-ferrous metals, particularly those occurring in the form of sulphide minerals, such as galena, zinc-blende and the various pyritic copper ores. Its effects have been direct in superseding most gravitational methods of separation, and indirect in view of the fact that flotation deals primarily with very finely divided material, including the " slimes " which were the greatest difficulty of the pre-flotation metallurgist. Not only has this affected ore-grinding and handling practice, but it has brought about a great change in smelting practice also. Thus the treatment of copper concentrates is being carried out to a rapidly increasing extent in the reverberatory furnace to the steady exclusion of the blast furnace.

The Principles of the Process.—The principles of flotation do not appear to be entirely understood, as there is considerable divergence of opinion whether flotation phenomena are the result of purely " surface tension " forces or whether electrical forces play the most important part. The operations involved are, however, sufficiently clearly defined and consist essentially of three steps which may overlap or merge into one another. The first of these may be described as the " oiling " process, which consists in adding to the pulp or mixture of finely ground ore and water some " oiling " reagent. This may be either an essential oil or one of a great range of chemical substances, generally organic in character. Only a very small amount of such a reagent is used, since the addition of larger quantities produces entirely different effects due to the formation of oil films of appreciable thickness.

The minute amount of oil reagent, on the other hand, appears to produce some change on the surfaces of certain minerals having a metallic or semi-metallic character—zinc-blende being a typical example—which makes them less readily " wetted " by the liquor of the pulp, or, put in another way, increases the angle of contact between these surfaces and the liquid. The gangue of the ore is less affected or not at all affected by the oiling reagent, but in many cases it is necessary artificially to increase the difference between mineral and gangue by the addition of some “gangue modifying reagent” which renders the gangue more readily wetted by the aqueous liquid of the pulp. These “gangue modifiers” are as a rule alkalis or mineral acids.

The third step in the process consists in adding to the pulp some substance which causes the ready production of a stiff and lasting froth when air is introduced, either by agitation or by blowing or drawing it through the liquid in a finely divided state. Very frequently the “oiling reagent” also serves as the froth-producer. When the pulp thus prepared is treated so as to produce a froth, the oiled mineral particles adhere to the air-bubbles very firmly, the mineral-air surfaces evidently being the seat of less potential energy than the mineral-water surfaces and consequently the buoyancy of the combined bubble with its mineral burden causes it to float to the surface, where it accumulates as a very stiff mineralised froth which can be mechanically separated in various ways. A further action appears to take place, which is related to the flocculation of the mineral particles by the oil emulsion in contact with air-bubbles. This results in the attachment to each bubble of the finest mineral particles in large and heavy agglomerations, thus greatly increasing the efficiency of the whole process.

The flotation process has found its largest application in the concentration of various types of sulphide ores, and, on this ground alone, has attained very great industrial and technical importance. Its application to other minerals has, however, been actively pursued and in a great many cases with considerable success. Minerals having a more or less metallic character are particularly suited for flotation, so that native metals constitute an obviously promising application. For the treatment of finely divided gold-bearing ores the older cyaniding processes in their modern forms continue to hold their own, but a few large mines have adopted flotation. In some cases, where graphite has interfered with cyaniding, a little agitation with oil is serviceable in rendering the graphite harmless.

Application to minerals of the oxidised type is less simple, and here it seems to be necessary, in many cases, to submit the ore to a previous “activating” treatment. Considerable success in the treatment of ores of this kind has been attained by the use of sodium xanthate as a flotation reagent. Preliminary roasting in a reducing atmosphere in the hope of producing a more or less metallic surface coating upon the ore particles has been tried, while “sulphidising” by exposing the finely ground ore to the action of hydrogen, ammonium or organic sulphide has also been used with great effect in some cases. Another problem is that of “differential flotation” for the purpose of separating different metalliferous minerals in a complex ore, such as the separation of zinc-blende or sphalerite from galena. In a certain number of cases, oiling reagents have been found which act differentially upon different flotable minerals, but every particular case still requires extensive research which does not always lead to a satisfactory industrial solution.

Smelting.—Beyond its immensely important direct effects in rendering possible the economic concentration of a number of ores and in cheapening the concentration of others, the development of flotation has also profoundly affected smelting practice, since the product of flotation, being very finely divided, differs widely from the product of gravity concentration. The concomitant progress of the reverberatory furnace has been accompanied by the development of the use of powdered coal as fuel, which has attained very wide extension.

Extremely finely divided coal is blown or otherwise forced into the combustion-space of the furnace, where it burns with a flame very similar to that of a jet of gas. The obvious advantages of such a system are that the loss of heat involved in the gasification of coal in producers is saved, together with the labour and the technical difficulties involved, while most of the advantages of gas-firing can also be secured by burning powdered coal. As against this must be set the cost of grinding the coal sufficiently fine and of injecting it into the furnace, while disadvantages also attach to the fact that the ash of the coal is introduced into the furnace and thence into flues, regenerators, etc. The question of the manner in which the coal is to be powdered and conveyed into the furnace receives rather different treatment in different forms of the process, but it is coming to be recognised that extremely fine grinding is advantageous, and in one process the coal is made into an “emulsion” of coal-dust and air which is said to flow and to be capable of being pumped like a dense liquid. The coal particles appear to become coated with a closely adherent (probably “absorbed”) layer of air, and as soon as the temperature becomes high enough very rapid combustion takes place.

The use of coal-air mixtures or “emulsions,” however, implies the introduction into the furnace of a relatively large amount of cold air, and this materially affects the question of regeneration or recuperation of the heat of the waste gases of the furnace. This is also affected by the presence of the fine ash-dust which tends to clog or even to flux the tubes or chequer-work. In some furnaces, where an extremely high temperature is not required, the problem can solved by dispensing with regeneration or recuperation entirely utilising the heat of the waste gases for raising steam, etc. Anot point to be borne in mind is that a suspension of coal-dust in air r be a powerful explosive and must be treated with the care due such substances. The use of oil fuel for firing metallurgical furna has also assumed large dimensions, and rivals the extension powdered coal firing. It possesses many advantages in regard to points just discussed, so that the relative merit of the two proce becomes mainly a question of cost.

In the methods for the extraction of non-ferrous metals, d ing the period under review, there has also been an import development in an entirely different direction. This is the gr advance in hydrometallurgical processes, such as direct leach and electrolytic treatment of ores. The elimination of the G man zinc smelters during the War, so far as supplies of zinc o from the British Empire and the Allied countries were c cerned, undoubtedly supplied a stimulus to this developme which has been particularly marked in connection with extraction of zinc from its ores. The treatment of many ot ores has also come within reach of “wet way” methods, a these promise to play a large part in metallurgical extracti

III. COPPER

The effect of flotation, powdered-coal firing and the advance hydrometallurgical methods on the metallurgy of copper ha already been referred to, but mention may be made of t leaching of alkaline ores with solutions of ammonia and a monium carbonate which has been developed at the Calum and Hecla mines. Leaching methods are employed by the larg individual producer of copper—in the Belgian Congo. In rega to the metal itself, there is an increasing tendency for the exc sive employment of electrolytic copper. In part, this arises fr the increased supplies of this quality of metal, but more from t increasing demand for high purity. “Best selected” and “toug (arsenical) copper are still in demand for some purposes, pa ticularly for locomotive fireboxes and stays. The value of t arsenic has been found to lie in a certain neutralisation of t effects of oxygen; where more complete deoxidation is possi the value of arsenic is more doubtful.

With regard to finished copper, much attention has been paid certain anomalies which occur during severe cold-working, such wire-drawing, while the effect of heating the metal in a reduci atmosphere has also been further studied. A particularly interesti case of failure in copper when heated in a bath of fused sodium ch ride has been studied by the Bureau of Standards at Washingt This material became brittle and broke with a typical inter-cryst line fracture. It was shown that this arose from an electrolytic effe produced by the contact of the copper with the iron containin vessel in the presence of the fused electrolyte (Rawdon). Metal sodium is formed in contact with the copper and appears to pen trate between the crystals of the metal. A case has also been d scribed where molten solder (lead-tin) acted in a similar mann when in contact with a particular kind of brass, the so-called “ma ganese bronze” (Dickenson).

Copper Alloys.—With regard to copper alloys, some progre has been made in the difficult question of nomenclature. A co mittee appointed by the Institute of Metals has issued a n menclature report which defines the old terms “brass” a “bronze.” The former is defined as any alloy of copper wi zinc containing more than 50% of copper; if other elemen besides zinc and copper are present, they are to be named as prefix to the term “brass.” Thus an alloy containing 2% ti 28% zinc and remainder copper would be termed a “tin brass Bronze on the other hand is defined as implying an alloy of copp with tin, containing more than 50% of copper, with the sa convention in regard to additional elements. Thus an alloy co taining 10% tin, 2% zinc, and remainder copper would be call a zinc bronze. An attempt is also made to systematise nomencl ture of more complex alloys. So far as brass and bronze a concerned, these two terms are now rarely used except with the definitions named.

An immense amount of experiment and research has been devot to copper alloys. A considerable number of special alloys are n known, each possessing valuable properties. The aluminium ma ganese copper alloys have been very fully described in the nin

ort to the Alloys Research Committee of the Institution of
echanical Engineers; these include alloys capable of attaining
sile strengths as high as 52 tons per square inch. Other copper
minium alloys—known as aluminium bronzes—with or without
addition of iron, have found considerable industrial application
America, mainly as forgings, sometimes of considerable size. In
eat Britain small die-castings of such alloys are used for parts of
ctrical switch-gear. Other alloys of special strength have been
nched under various proprietary names.

For war purposes a most important part was played by the cupro-
kel alloys, containing either 15 or 20% of nickel, remainder cop-
. The production of this alloy on the very large scale required for
war revealed difficulties arising mainly from casting-defects in
slabs used for rolling. The remarkable power of this material to
lergo severe cold-working, without becoming excessively brittle,
gests that it is likely to have other useful applications beside
let envelopes, but for industrial purposes these alloys have not
n widely exploited. On the other hand, the much more expensive
nel metal has been widely pushed and has found considerable
ctical application, mainly on account of its valuable combination
great strength with great resistance to corrosion. This alloy is
nufactured "direct" by the reduction of ores from the Sudbury
rict in Canada, and special virtue is claimed on the ground that
a "natural" alloy and has not been melted together in the foun-
. It has been shown that such a claim cannot be substantiated.

orrosion.—In connection mainly with copper alloys, a large
ount of study has been devoted to corrosion, under the
pices of the Corrosion Research Committee of the Institute of
tals. The results have been embodied in a series of extensive
orts, and serve to throw new light on the corrosion, partic-
rly, of marine condenser tubes. This is ascribed, essentially,
he formation on the surfaces of the tubes of an adherent, but
no means impervious, deposit of basic salts. By restricting
circulation of water in contact with the metal under these
osits, they lead to the formation of solutions containing a fair-
high concentration of cupric chloride, and such a solution
idly attacks brass, with the resulting formation of pits and
mately of holes. It is considered that the brass as a whole is
olved under these deposits, but that in certain conditions the
per is redeposited as a spongy mass, thus leading to the
arent "dezincification" of the brass at such points. The
blem is there to prevent such adherent deposits.

he production of protective coatings on metals as a means of
venting corrosion has received much attention, the use both of
mium and of chromium plating for this purpose having been de-
ped. Cadmium plating is used chiefly for the protection of
ninium, but chromium is applicable alike to steel, copper, brass
other metals. The deposition takes place from an electrolyte of
mic acid and requires a high current density. The deposit is
ht, has a bluish white lustre and remains untarnished in the air
in many vapours. Owing to its great hardness as well as its
nical inertness, chromium plating is much superior to nickel or
r plating. The finish, however, is not yet quite as good.

he theoretical aspect of corrosion has also received much
ntion, and special research on this subject has been initiated.
ady, however, a new theory of electrochemical corrosion has
ceeded in uniting the views of those formerly advocating
rgent views (Bengough, Evans, Bancroft). The scope of the
arches undertaken by the above-mentioned committee has
n extended to include fresh-water (land) condenser plant, and
pecial sub-committee has been formed to study the whole
stion of the corrosion of aluminium alloys, while a parallel
stigation into atmospheric corrosion has been undertaken
he Non-ferrous Metals Research Association.

regard to the corrosion of aluminium alloys and its prevention,
ortant progress has been made by the development of the
odic oxidation" process. The metal is suspended as anode in an
trolyte and rapidly becomes covered with an oxide or hydroxide
ing which stops the passage of the electric current. This coating
rong and flexible and serves as an excellent protection against
osion, the protective effect being further enhanced by allowing
surface to absorb a coating of lanoline. The treated metal and
ys resist both fresh and salt water and a salt spray. The coating
be applied to alloys of aluminium so long as they do not contain
h more than 4% of copper.

IV. PLATINUM, ZINC, ALUMINIUM, ETC.

latinum.—The metallurgy of the noble metals has not under-
e any striking development during the period under review
er in regard to extraction or uses.

The cyaniding process has undergone a series of more or less minor improvements, and it was at one time thought that aluminium dust would replace zinc-dust as the precipitant for pregnant solutions. Zinc-dust, however, still predominates, and the same remark applies to the proposed method of precipitating the metal electrolytically. In regard to platinum, there has been an ever-increasing scarcity, enhanced by the complete upheaval in Russia. The Russian supply, however, is potentially the largest in the world, and production has slowly increased. Some new discoveries of platinum have been made in the Waterberg and Lydenberg districts in South Africa. Here some 60% of the metal is too fine to be caught on corduroy strakes, and some other method, such as flotation or smelting with lead, will ultimately have to be used. Another source of platinum whose importance tends to increase is the refining residue of copper and nickel.

The great rise in the price of platinum has led to the study of possible substitutes, and a number of such materials have been put forward. Thus for the "breaks" used in the magnetos of internal combustion engines, tungsten sparking points have been substituted for platinum. For chemical purposes various alloys, some containing gold and palladium, have been tried, but only with partial success, since none of them really possess the combination of properties—chemical resistance and very high melting point—which renders platinum so valuable. A number of special alloys, in which tungsten and chromium generally play an important part, also exhibit great chemical resistance, but in these cases the hardness and brittleness of the material are generally a serious difficulty. For use in chemical work on a large scale, however, a considerable number of alloys have been produced which attain a fair measure of success. Silicon itself has many advantages for some of these purposes, but in the impure form, generally met with, it is relatively weak and brittle. Platinum itself has been prepared of much higher purity than was formerly attainable, owing to contamination by calcium derived from the lime crucibles in which it was melted.

Zinc.—The metallurgy of zinc received much attention during the War. Reference has been made above to the general questions relating to zinc extraction, but mention may be made here of the growth of the enormous electrolyte plant at Risdon, near Hobart, Tasmania, where 33,000 H.P. are employed in dealing with the products of the Australian smelters, producing zinc 99·95% pure, as well as over 150 tons yearly of cadmium. There has also been great development at the United States centre at Picher, Oklahoma. Efforts are being made in Norway and Germany to obtain high recoveries of zinc from lowgrade and complex ores by electro-thermic smelting with a silicide reducing agent.

On the Allied side during the War there was at one time considerable shortage of zinc, and substitute alloys were studied for all purposes which should avoid the use of zinc. The shortage then disappeared, and at a later stage alloys consisting mainly of zinc were tried as substitutes for brass and for certain aluminium alloys. Some of these zinc alloys proved to possess remarkable properties, tensile strength exceeding 20 tons per sq. in. being obtained in cast alloys containing about 3% of copper and 7% of aluminium, remainder zinc. It was further found that these alloys could be extruded and, under certain conditions, rolled. Unfortunately, alloys of this type, when they contain both aluminium and copper, are unstable and undergo serious changes of volume, accompanied by great loss of strength, even at the ordinary temperature if kept for any considerable time.

On the German side, while there was never any shortage of zinc, this metal and its alloys were extensively employed as substitutes for other metals. Pure zinc was widely used in place of copper for electrical purposes, while zinc alloys with copper and aluminium were also largely used. Apparently, cases of failure due to the instability of these materials passed unnoticed under the stress of war; at all events, German metallurgists have described these "war bronzes" without mention of such deterioration with time, except as the result of corrosion. It may be mentioned, however, that alloys rich in zinc, which contain either copper alone or aluminium alone, do appear to be free from the trouble in question.

Aluminium.—Aluminium and its alloys have played a particularly conspicuous part and have undergone remarkable developments since 1910. Prior to the outbreak of War, aluminium itself had become relatively very cheap (below £100 per ton), and this fact stimulated interest in its use. During the War, on the other hand, while the metal itself became scarce and very dear, its applications for military purposes grew very much in importance and raised its alloys for the first time to the rank of important materials of engineering construction. Its uses arose mainly in connection with aircraft, and became increasingly important in the closing years of the War.

This rapid development of aluminium alloys under war conditions was to a considerable extent the result of progress which had been made prior to 1914. One step in this progress was marked by the section on light alloys contained in the Ninth Report to the Alloys Research Committee (Rosenhain and Lantsberry), published in 1909; but the discovery, by Wilm of Berlin, of the possibility of hardening aluminium and its alloys, when a small percentage of magnesium had been added to them, led to the next and most important forward step.

The application of this discovery to the best of the alloys, described in the above-named report, led to the production of the now widely known and used alloy " duralumin." This contains from 3 to 5 % of copper, about 1 % of manganese and about 0·5 % of magnesium. As rolled, this material has a tensile strength of about 18 tons per sq. in., but if heated to a temperature of 480° C. to 500° C. and quenched, it gradually acquires much greater strength—rising to about 26 tons per sq. in., the ductility remaining the same at about 16 to 18 % elongation on two inches.

Such a material, possessing the strength of a very mild steel combined with a density as low as 2·8, constituted a remarkable advance in wrought aluminium alloys. At quite an early stage in its history this alloy was employed for the construction of Zeppelin airships. The manufacture of the alloys was taken up in England under licence from the German patentee, and the alloy has been extensively used in the construction of British rigid airships. Its use has, however, not been free from difficulties and disadvantages, and great efforts have been made to arrive at better alloys by research in Great Britain. As a result, a series of new aluminium alloys for use in the wrought form have been developed.

The most important of these is one developed at the National Physical Laboratory and known as " Alloy Y," having the composition: copper 4 %, nickel 2 % and magnesium 1½ %. This alloy, when quenched from a temperature of 530° C. after previous cold-rolling, can be made to attain a tensile strength of 28 tons per sq. in. combined with an elongation of 20 % on two in.; its density is 2·8, and it possesses two very important further properties, viz., remarkable resistance to corrosion, and a relatively very high resistance to fatigue (repetition stresses), particularly at slightly elevated temperatures. Forgings of this alloy have been successfully used as connecting-rods in high-speed internal combustion engines, and it is finding a constantly widening range of engineering uses. More recently, a German alloy—" lautal "—in which the alloying elements are copper and silicon, has been produced industrially. It is not superior to alloy Y or duralumin.

Aluminium Alloys.—Important as are the results achieved with the wrought alloys just described, results of more immediate importance have been achieved with casting alloys of aluminium. At first these were employed mainly on more or less subsidiary castings, such as crank-cases, and for that purpose an alloy containing from 12 to 14 % of zinc and about 2½ % of copper (generally known by the number of the British Air Board Specification as " L 5 ") was very widely used. Efforts were soon made, however, to employ light-alloy castings for more important parts in aeroplane engines, viz., cylinders and pistons. Here the value of these materials lies not so much in their specific lightness as in their high thermal conductivity. In the case of the cylinder castings of air-cooled engines particularly, this is valuable in preventing distortion arising from unequal cooling of the windward and leeward sides, while in the pistons it reduces the temperature of the compression space and thus increases the density of the indrawn charge, and at the same time allows of the employment of higher compression ratios. The effect of these advantages is to increase very appreciably the power output of an engine of given size and weight, while also reducing the petrol consumption (*see* AERO ENGINES).

The alloys first and most extensively used were those of aluminium with copper, a 12 % alloy being particularly popular. Another widely used alloy contains 7 % of copper with 1 % of zinc. These alloys, although initially not as strong as some of those containing zinc, do not lose their strength so rapidly when heated, so that at the working temperature of an aluminium-alloy piston (about 250° C.) they are stronger than such an alloy as " L5." Even these alloys, however, are relatively very weak when hot—they register a tensile strength of about six to seven tons per sq. in. at 250° Centigrade. Recently, researches at the National Physical Laboratory have shown that the alloy already referred to above as "Y "—containing copper 4 %, nickel 2 %, magnesium 1½ %—is particularly strong at high temperatures, even in the cast state. It is, further, amenable to hardening by quenching and ageing even in the form of castings, and when thus treated attains a tensile strength as high as 26 tons per sq. in. at the ordinary temperature and 13 tons per sq. in. at 250° Centigrade. Many important applications are opened up as the result of the remarkable properties of this alloy.

An important development in aluminium alloys is the advent
of the " modified " alloys of aluminium with silicon, known
" alpax," " silumin," etc. It has been found that an alloy
aluminium with from 10 to 14 % of silicon solidifies with a rath
coarse, nearly eutectic, structure containing some primary cr
tals of silicon. If, however, just prior to casting, the alloy
treated either by the addition of a small amount of metal
sodium or by reaction with a flux containing sodium compoun
such as the fluoride or the hydrate, the resulting structure
profoundly altered; the eutectic structure becomes exceedin
fine and the alloy now shows primary aluminium—*i.e.*, t
eutectic concentration appears to have been altered. T
" modified " alloy shows physical properties much superior
the untreated material, particularly in regard to an exceptio
degree of ductility. The alloy yields castings having very go
clean, bright surfaces, although the avoidance of internal u
soundness is not always easy. For castings in which good appe
ance, ductility and absence of porosity is important, wh
strength is a lesser consideration, these aluminium silicon allo
offer great advantages.

Important progress has also been made in improving the soundn
of aluminium alloy castings and ingots by the recognition of the f
that gases, and particularly hydrogen, dissolved in the molten me
give rise to pin-holing and unsoundness in castings, particula
when cooled at moderate rates. It has been shown (Archbutt) th
most of the deleterious gas escapes from the metal if it is allowed
solidify very slowly, as for instance by cooling in the furnace. Su
sequent rapid remelting does not allow it to reabsorb much gas, a
castings can then be made from it of exceptional soundness. Simi
observations in regard to copper were made simultaneously
Edwards and Prytherch. A less expensive method of removi
hydrogen or other deleterious gas is that of bubbling nitrogen throu
the molten metal prior to casting (Rosenhain). This process h
proved as successful as presolidification and is coming into use.

An important process for the electrolytic refining of aluminiu
was worked out in 1925 by Edwards and his collaborators
America. Molten aluminium, to which copper has been add
to raise the density, lies at the bottom of the bath; upon it floa
the molten cryolite electrolyte, and on this again floats the pu
aluminium. The lowest layer is anode and the top layer catho
and by electrolysis the top layer of high purity metal increas
at the expense of the bottom layer. Aluminium has in this w
been obtained of more than 99·95 % purity, and the propert
of this high purity metal are distinctly different from those
the purest commercial metal previously obtainable (99·7 %).
Magnesium.—During the latter part of the period unc
review, this metal began to acquire technical importance. Hi
price and great corrodibility had formerly prevented its use, b
the price has been much reduced and, if the demand increas
sufficiently, this may become lower than that of aluminium,
satisfactory raw materials are plentiful and the reduction proc
could be rendered equally economical. As regards corrosion, t
production of metal of higher purity, and especially free fr
chlorides derived from the electrolyte, shows much better resi
ance to atmospheric corrosion than the older material.

The mechanical strength of magnesium and its alloys never a
proaches that of the better aluminium alloys, but their greater lig
ness offers some advantages. Magnesium and some of its allo
have been successfully used, particularly in France, for pistons
internal combustion engines and for other special purposes. T
thermal conductivity of these materials, however, is decide
inferior to that of aluminium alloys, and this is likely to lessen t
advantages to be gained from extreme lightness. As further impro
ments are made, however, magnesium alloys are likely to prove
increasing technical importance.

Berylium or glucinum metal has been produced in reasona
quantities, although still at a very high laboratory cost. T
combination of great lightness, considerable resistance to c
rosion, high strength and high melting point found in t
metal may render it technically interesting provided that t
cost can be made reasonable and that it can be produced in
malleable form. The latter has not, so far, been done.
Nickel.—This has received a wide range of new applicatio
partly as the result of the need of the nickel industry to fi
new uses when the principal older use—for armament purposes
came practically to an end after the Washington Conference.

Among the more important developments are the alloys for use at ry high temperatures. Alloys of nickel and chromium containing rious amounts of iron and manganese have been known for a con- lerable time as " Nichrome," and proved valuable for such uses as ctric resistance heaters for temperatures not much above 1,000° entigrade. More recently these have been improved upon by a gh-purity alloy consisting solely of nickel and chromium (80 % Ni., % Cr.), and this alloy also exhibits remarkable strength at high mperatures (up to 800° Centigrade). In this respect, however, it is t appreciably superior to the best of the special " steels " which ve been developed for use at very high temperatures. These ually contain large amounts of both nickel and chromium, to which ngsten is sometimes added, the proportion of iron in some cases ling as low as 54 %. The increasing use of very high temperatures engineering practice lends special importance to these materials.

Other Metals.—Developments in the remaining metals are mostly a minor nature. Progress has been made in connection with *cobalt.* s use in steel and in certain special alloys has already been men- ned, but it has also been shown to give a more adherent and more rable electro-plate coating than nickel, and it is important to note at its resemblance to nickel is not nearly so close as was previously pposed. In regard to *lead* and its alloys, a remarkable develop- ent has been that of alloys with the rare-earth metals, particularly cium and barium. These confer a remarkable degree of hardness lead, and a special alloy of this kind is finding application as a aring metal.

V. PHYSICAL METALLURGY

Side by side with, and to a great extent furnishing the basis for, e development in the treatment and use of metals and their oys, there has been a very great development of metallurgical ence in the direction of " Physical Metallurgy."

Alloy Systems.—A very large amount of work has been de- ted to the further and more detailed study of the constitution alloy systems. A number of the somewhat rough preliminary terminations of the equilibrium diagrams of most binary alloy stems previously made, have been revised and rendered more curate. In ferrous alloys, the iron-carbon system has received ich further study, particularly in regard to the critical points iron itself. Important work at the Bureau of Standards, U.S.A. urgess and Crowe), has firmly established the three well- own critical points, A_1, A_2 and A_3, and has shown that pre- ous attempts on the one hand to discredit the very existence A_2 (Carpenter), and on the other to show that it was a double int (Arnold) were based on experimental error. On the other nd, German investigators (Ruer, Hanemann) have estab- ied the existence of a higher critical point, which in pure iron curs at a temperature very close to 1,400° Centigrade.

In connection with the critical points, considerable attention has en devoted to the whole question of allotropy. A Dutch school of restigators (Cohen) have sought to show the existence of numerous otropic transformations in many metals, but their conclusions are sed on extremely slight evidence derived from determinations of nute irregularities in density changes. On the other hand, the panese school (Hondo) seek to show that the A_2 transformation in n is not allotropic in character, and this view is confirmed, to a tain extent, by strong evidence that the passage through this nt does not involve any change of crystallisation—evidence which s recently been confirmed by X-ray methods. The matter, how- er, turns upon the definition of allotropy.

In addition to the iron-carbon system, the iron-nickel, iron- romium, the manganese-carbon and nickel-carbon systems have en carefully investigated. The systematic study of the alloys of n, in the first place free from carbon, has been begun at the tional Physical Laboratory under the auspices of a special com- ttee. The production of iron, chromium, manganese and silicon a very high state of purity and a study of the iron-oxygen system some of the results already obtained. In non-ferrous alloys, nsiderable attention has been given to the alloys of zinc, a portion the ternary system copper-aluminium-zinc (alloys rich in zinc) ving been very fully worked out (Haughton, Bingham).

The allotropy of zinc itself has also been very thoroughly studied enedicks, Bingham) and the reality of the transformations estab- ned. Great advances have been made in the knowledge of the uilibria of several of the important alloy systems in which alu- nium is the predominant metal. The ternary systems aluminium- c-copper, aluminium-iron-silicon and aluminium-magnesium- con (Hanson, Gayler) have been fully worked out so far as the oys rich in aluminium are concerned. For the representation of the ults of such investigations a new type of model has been devised osenhain) in which the various equilibrium surfaces are repre- ted by systems of wires coloured to indicate the phases concerned each transformation.

The Aluminium-magnesium-silicon System.—The study of the aluminium-magnesium-silicon system has proved particularly important, throwing light on the age-hardening properties which are found in many aluminium alloys containing magnesium. The magnesium in these alloys is present as a compound Mg_2Si, which is more soluble in solid aluminium at high temperatures than at the ordinary temperature. Quenching such an alloy from a temperature just below its solidus retains the compound in solid solution and in this state the alloy is soft. Gradually, however, at the ordinary temperature and more rapidly at slightly higher temperatures, this super-saturated solid solution deposits the excess of dissolved compound in an extremely finely divided condition, accompanied by a gradual hardening of the alloy.

This process is strictly analogous to that which can be brought about in certain alloy steels which can be rendered (or kept) completely " austenitic " (homogeneous solid solution) by quenching; they are then soft and ductile, and do not undergo hardening while at rest at the ordinary temperature. If the temperature is raised so as to bring about " tempering " the solid solution breaks down in precisely the same way as indicated above and the steel becomes hard (and also magnetic). It would thus seem that hardening as the result—direct or indirect —of quenching is due to the separation from solid solution, in a state of extremely fine division, of a phase the formation of which had been suppressed by quenching.

According to the theory of amorphous metal (*see* below) each of the minute crystallites of the phase thus separated will be surrounded by a zone of amorphous metal, which is itself very hard. If the minute crystals thus separated are sufficiently small and numerous, the result will be that a considerable proportion of the whole alloy will be thrown into the amorphous state, extreme hardness resulting. On this view, the martensite of hardened steel should consist mainly of minute crystallites of alpha-iron embedded in an amorphous matrix consisting of iron and carbon (or carbide) in solution in it. This suggested constitution of martensite readily accounts for its hardness and for the fact that it is magnetic, and—in view of the intimate manner in which the minute crystallites of alpha-iron are embedded in unyielding and un-magnetisable amorphous metal—accounts also for the magnetic hardness of the martensitic steel. This view is further confirmed by the observation that the chemical behaviour of quench-hardened steel is in certain respects closely similar to that of the same steel hardened by cold work and thus rendered partially amorphous (Whiteley). Finally, it has recently been shown by X-ray methods that the space lattice typical of alpha-iron is present in martensitic steel (Westgren).

Theory of Amorphous Metal.—The theory of amorphous metal just mentioned has played an important part in scientific metallurgical thought during the period under review.

The conception that metal could be rendered amorphous by mechanical disturbance of its crystalline structure was originated by Beilby, in the first instance, to account for the phenomena observed by him and others in connection with the polishing of metals and other substances. Beilby further applied the conception to explain the hardening which metals undergo as the result of plastic deformation (cold work) by suggesting that layers of amorphous metal are formed on the surfaces on which internal slip occurs during plastic straining. Both these theories are widely but not universally accepted in England and America, but find opposition on the Continent. More recently Rosenhain has brought forward a conception which has already been present in the minds of many other investigators (notably Osmond) in a less definite form, that a film or thin layer of amorphous metal exists in the inter-crystalline boundaries of all metals, quite apart from any effects of strain. This view has been vigorously contested, but experimental evidence in its confirmation has been steadily accumulated.

The most striking series of facts supporting the " amorphous cement " theory is connected with the behaviour of the inter-crystalline boundaries under stress. In normal circumstances these boundaries are stronger than the crystals themselves, so that fractures of metals generally occur by breaking through the crystals and not by pulling them apart. It has, however, been shown that at a high temperature near to, but definitely below, the melting point, pure metals can be easily caused to break with a perfectly inter-crystalline fracture (Rosenhain and Ewen). This is ascribed to the greatly decreased viscosity at such temperatures of the inter-crystalline amorphous metal, which is regarded as possessing the properties of a viscous under-cooled liquid. The actual viscosity, however, depends very much upon the nature of the metal and upon the temperature—the farther a metal is below its normal melting-point the higher the viscosity of the amorphous phase.

Accordingly, in some of the softer metals and alloys the amorphous material is sufficiently mobile to allow of sensible movement in relatively short times. Thus, an alloy of zinc with copper and aluminium has been discovered which, in the cold-worked state when it is partially amorphous, behaves very much like pitch; it will bend to any desired extent if allowed to do so gradually, but breaks short if rapid bending is attempted. Similarly, the inter-crystalline cement in certain metals and alloys, although it proves stronger than the crystals when the metal is loaded at any normal rate, appears to be capable of giving way by some form of viscous or visco-elastic movement under very prolonged loading such as that due to internal stresses.

Season Cracking.—Much attention has been devoted to the study of fractures occurring in various metals as the result of the application of internal or other prolonged stresses. In brass these phenomena have become known by the misleading term "season cracking," but strikingly similar phenomena have been found in a number of other metals, including certain alloys of aluminium, platinum and steel (Rosenhain and Archbutt). In the case of brass, steel and aluminium alloys, certain types of chemical reagents which act preferentially upon the material in the crystal boundaries contribute to the occurrence of such fractures, which are typically inter-crystalline (Moore and Beckinsale). At the same time in the case of the aluminium alloys at all events such chemical action serves to accelerate the fractures, but is not essential to it since it occurs, although more slowly, in high vacuum or in an atmosphere of pure dry hydrogen (Rosenhain and Archbutt). In the case of brass it seems probable that "season cracking" can occur without the intervention of any chemical action.

Similar types of cracking which have been discovered in mild steel, however, appear to be very closely associated with the effects of certain chemicals, such as concentrated solutions of alkalis, fused ammonium nitrate, etc. While there are still some metallurgists who refuse to think in terms of an amorphous inter-crystalline cement (Hatfield, Tammann), the great majority of investigators are agreed that, directly or indirectly, this conception serves to explain the occurrence not only of inter-crystalline fractures under prolonged loading but also a number of other phenomena associated with the crystal boundaries.

Intimately connected, also, with the nature of inter-crystalline boundaries are the important phenomena of recrystallisation and crystal growth, which are of fundamental importance with all annealing and heat-treatment operations, and have been studied in great detail. One of the most striking features is the relatively rapid formation of large crystals in certain conditions. Thus in an oblong piece of metal which has been severely strained, and is then heated in such a way as to be well above the usual temperature of recrystallisation at one end and well below it at the other, a zone is found in which very large crystals are formed; this may occur either as the result of a temperature-gradient being applied to a uniformly strained piece of metal or of the application of a suitable uniform temperature to a piece of metal in which there is a strain-gradient.

The explanation appears to be that for a given degree of previous plastic strain there is a temperature most favourable to rapid crystal growth (Jeffries). An interesting practical application of the ideas derived from the study of these phenomena is the production of wires of certain metals, notably tungsten, which have been so treated as to consist, for considerable lengths, of single long crystals. This result is achieved by drawing the cold-worked wire into an annealing furnace at a suitable temperature, at precisely the right rate. The tungsten wire thus produced is particularly valuable for the manufacture of electric lamp filaments (*see* ELECTRIC LIGHTING), and it has also been shown to possess interesting elastic properties (Wartenberg) which are readily accounted for by the absence in such material of any amorphous inter-crystalline material the viscous or visco-elastic properties of which affect the behaviour of the wire.

Much study has also been devoted particularly to the recrystallisation of aluminium after cold-working, and as a result very large single crystals of aluminium have been produced (C penter and Elam). This has opened the way for the study single crystals under strain (Taylor and Elam) and unc fatigue (Gough and Hanson), (*see* FATIGUE OF METALS). It also given the impulse for the production and study of sin crystals in other metals (Davey, Bridgeman, Czochralski). T general result emerges that in most respects single cryst behave very much like aggregates, but possess greater du tility and, in the case of copper, have an appreciably high conductivity. Their mode of deformation under strain and tigue is found to confirm the original theory of deformation slip on crystallographic planes (Ewing and Rosenhain), extensive research on fatigue phenomena both in single cryst and crystal aggregates (Moore, Jasper, McAdam, Gough, Je kin) has as yet failed to produce a satisfactory explanation fatigue failure. The fatigue range, however, has been dissociat from the "elastic limit" and found to be related rather to ultimate strength.

The application of X-ray methods of crystal analysis to t study of the atomic structure of metals has received mu attention. The normal crystal lattices of almost all the kno metals have been worked out, as well as those of a number alloys (W. H. and W. L. Bragg, Hull, Bain, Wyckof, Westgre Debye, Scherrer, Wever, Owen and Preston and many other (*See* CRYSTALLOGRAPHY; X-RAY.) The majority of metals ha either a face-centred or body-centred cubic lattice; a few (zi cadmium, etc.) have a close-packed hexagonal structure, wh the more brittle metals show structures of lower symmetry. T lattice structures of solid solution alloys are found to be those the parent or solvent metals often either expanded or contract by the addition of the dissolved metal. On the basis of th structure a general theory of the properties and behaviour solid solutions has been worked out (Rosenhain) which affor satisfactory explanations of their behaviour on melting a freezing, their hardness and electrical conductivities and t power of different metals to form solid solutions.

X-ray methods have also been used, as already mentioned, very important work on the behaviour of metal under strain a fatigue. The effect of cold working on the atomic structure h been particularly fully investigated, and it has been show (Polanyi, Mark, Körber, Sachs) that cold working, such as co rolling, not only elongates the crystals of a metal and sets disturbances of the lattice structure, but sets the crystals in orientation which tends to place one of their axes in the directi of rolling. Annealing, although it rapidly brings about recrysta lisation into equi-axed crystals, does not necessarily abolish th oriented structure, probably because the newly formed crysta tend to assume the orientation of their predecessors. Th directional structure—called by German workers the "fibre structure of cold worked metal—is completely removed only b annealing at very high temperatures.

VI. ORGANISATION OF THE INDUSTRY

Certain institutions and organisations have attained impo tance as factors in metallurgical progress. The Imperial Mi eral Resources Bureau, merged in the Imperial Institute, ha published a large amount of information, mainly in regard to th mineral resources of the British Empire. The continued progre and growth of the Institute of Metals has been a marked featu of metallurgical activity; this body has now attained a membe ship of over 1,700. In America an Institute of Metals has bee formed on different lines, as part of the Institute of Mining an Metallurgical Engineers.

The British Engineering Standards Association, formerly th Engineering Standards Committee, exerts a powerful influen on the metallurgy of those metals which form the materials engineering. The issue of standard specifications for a lar number of non-ferrous metals has been undertaken. In conne tion with the British Government Department of Scientific an Industrial Research, a Non-Ferrous Metals Research Associa tion has been formed and has carried out important research particularly in connection with copper, brass, aluminium, th ointing of metals, die-casting, etc. The British Cast Iron esearch Association has been mentioned.

This brief summary of the developments of metallurgical ience deals only with a few points of outstanding interest.

BIBLIOGRAPHY.—For iron and steel metallurgy, industrial as well scientific, the *Journal of the Iron and Steel Institute*, London, ould be consulted for original publications and abstracts which ver the literature of the whole world on this subject. In addition, cellent abstracts will also be found in the metallurgical section of e journal of the *Society of Chemical Industry*, and in such journals *Stahl und Eisen*, the *Revue de Métallurgie* and *The Metallurgist* upplement to *The Engineer*). In addition *The Iron Age, the Iron d Coal Trade Review* and similar journals may be mentioned. For neral metallurgy, see the annual volumes of *Mineral Industry* and *he Journal of the Institution of Mining and Metallurgy*. For the on-ferrous metals, see *The Journal of the Institute of Metals* (ab- racts as well as original papers), *Revue de Métallurgie* and several erman journals, *Zeitschrift für Metallkunde, Metall und Erz, Zeit- hrift für Anorganische Chemie*, and the appropriate section of the *nerican Institute of Mining and Metallurgical Engineers* (Ameri- n Institute of Metals). The publications of the U.S. Bureau of andards (Washington) and of the National Physical Laboratory eddington, England) are important. The Faraday Society (Lon- n) has published in its *Transactions* several "general discussions," cluding particularly one on *The Failure of Metals under Internal d Prolonged Stress*, another relating to metallurgical microscopy, e on the application of X-rays and one on *The Physical Chemistry Steel Making*. (W. RN.)

METALS: *see* ALUMINIUM; ANTIMONY; COPPER; FATIGUE OF TALS; LEAD; MANGANESE; MICA; NICKEL; TIN; ZINC.

METCALF, WILLARD LEROY (1858–1925), American artist *e* 18.257), died in New York City March 9 1925.

METEOROLOGY (*see* 18.264).—Since 1910 considerable ad- nces in meteorological knowledge have been made both on e observational and the theoretical sides.

The Upper Atmosphere.—During the years before the War servations on the temperature and humidity of the air strata re rapidly accumulating, more particularly from a network of tions spread over Europe, and since the W. and N. of Europe subject during the winter to the passage of many deep cy- nic depressions, the conditions of temperature in cyclones d anticyclones up to a height of some 20 km. (12½ m.) had come known. The brief tables which were all that were ilable to Cleveland Abbe in 1909 had been supplemented by ch information, drawn up and arranged for the European ults by Lt.-Col. E. Gold (M.O.No. 210e, *Geophysical Memoirs*, . 5), by Dr. Wegener for the Continent (*Die Temperatur- hältnisse in der freien Atmosphäre*, III. Band, Heft 2/3, Leipzig, 9) and for Russia by Dr. Rykatchew (*Meteorologische Zeit- rift*, Jan. 1911). In 1916 a summary of the information ilable about the upper air was drawn up for the Meteoro- ical Office but not published. It quoted freely from Gold's er but included the results of observations up to 1916. This nmary together with certain theoretical matter was published 1919 under the title "Characteristics of the Free Atmos- ere" (M.O. 220c, *Geophysical Memoirs*, No. 13), and from it following abstract summarising our present knowledge of strata from 0 to 20 km. is mostly taken.

emperature.—As the surface of the earth is left the temperature of air decreases with increasing height, and when the great varia- ns of climate and of the conditions prevalent in different parts of earth are considered it is remarkable how uniform is the fall of perature, now commonly called the lapse rate. The height to ich it extends is variable, but in all places in which observations e been made, the lapse rate up to 8 km. has been found close to C. per kilometre. This holds between 2 and 7 km. not indeed ctly but approximately, for summer and winter and for places as apart as the equator and the Antarctic in lat. 78° S. Thus in avia the lapse rate up to 8 km. is 6·1° per km.; at Petrograd it ·8°. In England in the winter it is 5·8°, in the summer it is 6·0°. ese are means, but the rule holds quite well even for the individ- case, for if in one part of the 8 km. the lapse rate is small this is ally compensated for by its being large in the other part. The y important exception that has been found so far is in regions and times where the temperature is extremely low, as in Siberia or ada or the Antarctic in the winter. In such instances the bot- layer is unduly cold and the lapse rate is negative over the first m., so that the rule would make the upper air temperature too low. it must be remembered that the daily variation of temperature s not extend upward more than one or two km., so that the mean for the day rather than the precise temperature at the moment should represent the surface temperature. This layer, in which temperature falls with increasing height, is called the *troposphere*.

At a certain height, which varies with the latitude, with the barometric conditions, and with the season, the fall of temperature ceases, and the air up to the greatest heights that have been explored remains at a nearly uniform temperature in the vertical direction. This upper part in which there is no lapse rate is called the *stratosphere*. The boundary between the two parts is found at about 16 km. near the equator and at 10 km. in northern Europe. Over England its mean height is 10·5 km., falling to rather below 10 km. in the winter, and rising to over 11 km. in the summer. In the centre of a deep cyclone the value may easily fall to 8 km.; in an anticyclone it may exceed 12 km.

The temperature of the stratosphere is below 200° A. over the equator and in tropical regions; it is above 220° A. in northern Europe. In Canada it seems to be lower in the summer than in the winter. These anomalies are roughly expressed by the rule that the mean temperature of the air column taken with regard to height from 0 up to 19 km. is approximately the same in all parts of the earth. There is probably a physical reason for this, and it explains the unexpectedly low temperature above 14 km. over the equator and the curious reversion of temperature between summer and winter over Canada (Toronto) where the seasonal range is very large.

The annual range of temperature in the troposphere does not differ very greatly from the range at the surface; in island and coastal climates like England it is rather greater in the upper parts than at the surface; in continental climates the surface has the greatest range. In the stratosphere the range is much reduced and, as already stated, appears in Canada to be reversed although enough observations are not yet available to make this absolutely certain.

Whether or not there is any regular diurnal change of temperature above 2 km. height is uncertain; all that can be said is that if there be any its amplitude is certainly less than 1° Centigrade.

The mean annual temperatures are given in the accompanying Table I. In Europe the probable error of any value is about 1° C.; for Canada and the equator owing to paucity of observations it is greater, especially above 15 km., where it may reach perhaps 3° Centigrade. Over Europe the mean temperature does not change from 14 to 20 km. and does not change much over Toronto. Over the equator the lowest temperature, which is about 193° A., is not reached under 16 or 17 kilometres.

TABLE I. *Mean Atmospheric Temperature*

The values are in the Absolute scale with the first "2" omitted. 273·0° = 0° C. = 32° F.

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strasbourg	Vienna	Pavia	Mean for Europe	Toronto	Equator
14	23·5	22·0	20·5	18·7	18·9	19·1	17·9	19·6	17·7	19·1	12·5	3·0
13	23·4	21·8	20·6	19·3	18·7	19·3	17·6	19·6	16·4	19·2	14·0	11·0
12	20·7	21·6	20·0	18·3	18·8	19·5	16·8	18·3	16·1	18·4	16·2	19·0
11	20·0	20·5	20·9	19·2	19·6	20·2	18·1	18·4	18·5	19·1	19·3	27·0
10	21·3	21·2	23·2	21·9	22·2	24·3	22·3	21·8	22·7	22·2	23·2	35·0
9	24·4	24·8	28·2	26·8	27·5	30·0	27·8	26·9	27·3	27·2	29·3	43·0
8	29·8	30·2	33·8	33·1	33·6	36·9	34·8	33·6	33·9	33·4	35·9	51·0
7	37·1	38·0	40·2	40·8	40·7	44·3	42·1	41·2	41·2	40·7	43·5	58·0
6	43·3	45·0	47·0	47·9	47·8	51·4	49·3	48·8	49·4	47·8	50·9	65·0
5	49·8	52·0	53·8	54·8	54·8	58·1	56·1	55·6	56·2	54·6	57·7	72·0
4	55·7	58·4	60·4	61·0	61·7	64·3	62·4	61·9	62·9	61·1	64·1	79·0
3	61·3	64·0	66·6	66·9	67·7	69·8	68·4	67·6	69·2	67·0	69·6	85·0
2	66·7	70·3	71·7	71·7	73·2	74·5	73·8	73·0	75·1	72·4	74·8	90·0
1	71·0	75·3	77·0	76·8	78·0	78·5	78·2	77·6	80·7	76·8	78·3	95·0

Pressure and Density.—The temperature of the air having been found by observation, the pressure and the density are easily found up to the height to which the observations extend. In the same way the mean pressures and mean densities can be determined from the mean temperatures without appreciable error provided the mean pressure at the surface is known.

In the lower strata the pressure at any particular height is naturally most dependent upon the surface pressure, but since the air is lighter, bulk for bulk, when it is warm the pressure decreases less rapidly than usual in a warm area, and the pressure at any given height depends more and more upon the temperature of the underlying air as that height increases. Thus it comes to pass that in the hot regions of the earth, say in the belt included between the two tropics, the pressure at the height of 9 km. is very much greater than it is at the same height over temperate latitudes, and the pressure gradient which causes the prevailing westerly winds of the cirrus level is thus produced. At a height of 20 km. the surface pressure has ceased to have much effect, and it requires a rise of nearly 20 mb.[1]

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[1] The average pressure of the atmosphere at sea-level being reckoned as 1 bar = 1000 millibars (mb.). 1 mb. = 0·0295306 in. mercury at 32° F. in lat. 45°.

in the surface pressure to produce a rise of 1 mb. at 20 km., whereas a change of 1·5° C. in the temperature of the air column will produce that effect. It has been stated that the mean temperature of the air column up to 19 km. is much the same in all parts of the world, and it follows that the same level is one of nearly uniform pressure.

The pressures are given in Table II. at various stations for heights up to 20 kilometres. The values for Canada and the equator at heights above 15 km. are not very reliable owing to paucity of data.

The densities are given in Table III. The variations in the density became of great consequence during the War on account of their influence on the range of projectiles; they depend on the connection which has been found to exist between temperature and pressure.

Statistical Methods.—Statistical methods have been much in vogue of late years, and it is necessary to indicate how the method of correlation has been used for forecasting and for elucidating meteorological problems. A large number of correlation coefficients have been determined between various meteorological events, and the values of many of them are given in the *Computer's Handbook*, M.O. 223, Section V.—Tables, published by the Meteorological Office.

The advantage of a correlation coefficient in estimating the connection if any between two events, is that it expresses the connection as a decimal, which must lie between 1 and −1, and thus renders the connections between different pairs of events comparable with each other. The velocity of the wind and the steepness of the barometric gradient may be taken as an example. The actual connection is obvious from the daily weather charts; on some it is well marked, on others badly, but the fact that there is a connection is quite apparent from even two or three charts. The correlation coefficient is about 0·70.

TABLE II. *Mean Pressure of the Atmosphere*
(Millibars)

Height km.	Petrograd	Scotland	Manchester	Berlin	England, S.E.	Paris	Strasbourg	Vienna	Pavia	Mean for Europe	Toronto	Equator
20	55·0	55·0	55·2	54·8	54·9	56·0	54·7	55·0	54·8	54·9	. .	53
19	64·0	64·2	64·6	64·0	64·1	65·6	64·0	64·4	64·0	64·1	. .	63
18	74·5	74·8	75·4	74·8	75·0	76·6	74·8	75·2	75·0	75·0	. .	75
17	87·0	87·3	88·0	87·4	87·5	89·6	87·6	88·0	87·6	87·8	. .	90
16	101	102	103	103	102	105	102	103	103	102	. .	107
15	118	118	120	120	120	123	120	121	121	120	120	128
14	138	138	140	140	140	143	141	142	142	140	142	152
13	161	161	164	164	164	167	165	165	165	164	167	178
12	187	187	192	192	192	195	193	193	194	192	195	209
11	218	219	224	225	224	228	226	226	227	225	228	244
10	255	256	261	262	261	266	263	263	264	262	266	283
9	297	299	302	305	303	309	307	306	307	305	309	327
8	346	348	352	354	352	357	355	354	356	353	358	376
7	400	402	407	408	407	412	410	409	412	408	413	430
6	461	464	468	470	469	473	472	471	474	470	475	491
5	529	532	537	538	538	541	540	539	542	538	543	558
4	606	608	613	614	615	617	616	615	618	614	618	632
3	692	694	698	699	699	701	700	700	703	699	703	713
2	787	787	793	795	795	796	794	795	797	794	798	803
1	896	894	898	900	900	900	900	900	901	899	903	903

TABLE III. *Density, Grammes per Cubic Metre*

Height km.	England, S.E.	Europe	Canada	Equator
20	87	87	88	96
19	102	102	102	113
18	119	119	121	135
17	139	139	144	162
16	162	162	169	191
15	191	191	198	225
14	223	223	233	261
13	261	261	268	294
12	305	307	314	331
11	355	358	365	374
10	409	411	415	419
9	463	467	470	469
8	524	528	528	522
7	589	590	592	581
6	658	661	662	645
5	735	735	733	714
4	819	819	815	789
3	909	913	905	871
2	1014	1017	1011	968
1	1128	1128	1134	1067
0	1253	1258	1258	1174

The application of the method of correlation to forecasting ca hardly be looked upon as very successful. Two highly correlate events are required happening with a definite time interval betwee them. A correlation coefficient may be high accidentally if it b founded on too small a number of instances, but genuinely hig coefficients between meteorological events occurring with more tha a few days' interval between them are hard to find. The most successful instance is perhaps the forecast of the monsoon rain c India by Sir G. T. Walker from the correlation between it and sundr other events occurring in the spring of the same year or earlier. I this case the correlation coefficients on which the forecast is base have values of about ·50; if values of ·80 or ·90 could be obtaine very much greater success would be secured. There are a fe coefficients of from ·70 to ·80 between the rainfall at various perioc and the subsequent yield of sundry crops. Thus in the easter counties of England if April and May be wet it is a practical ce tainty that there will be a large hay crop, and if the autumn be dr there will almost certainly be a large crop of wheat the next yea Mr. R. H. Hooker has calculated a most interesting set of figure relating to the correlation between the weather and the crops, an the problem has been re-analysed by R. A. Fisher and W. A. Mackenzie, *Quart. Jour. R. Meteor. Soc.*, July 1922. Similar work ha been done for the potato crop in America by J. Warren Smith, an many correlation coefficients relating to agricultural matters ar available from Sweden and elsewhere.

The case is different where correlation is resorted to for the pu pose of elucidating some physical process in the atmosphere; here small coefficient is just as likely to give information as a large on But the interpretation of the meaning of the coefficient is ofte difficult, and in many cases the value obtained is quite different fro that which most meteorologists would have expected.

Sir G. T. Walker in addition to his statistical work on the mo soon rain has published several sets of correlation coefficients, ar amongst them a set of 100 showing the correlation between tl sunspot number and the temperature at 100 stations well distribute over the earth's surface. The correlation is negative and sma but it is large enough to be significant and to prove that during tl 40 or so odd years considered the temperature of the earth as whole was lower at the time of the sunspot maxima than at the tin of the minima. It is commonly supposed that the sun is giving o most energy when its surface is most disturbed, and this idea h been confirmed by direct observation of the radiant heat. A pe fectly satisfactory explanation is at present wanting. Walker al correlated between sunspots and rainfall, and found the coefficie too small to be significant. However, in none of these cases has tl work been wasted, since important conclusions have been establishe

For high correlation coefficients one must take data relating to tl upper air. The relation between pressure and temperature is remarkable and has such a close relationship to the theory of cyclor and anticyclones that it will be treated separately. The correlati coefficients between the thickness of the troposphere, a height co monly denoted by H_0, the surface pressure, the temperature of t stratosphere and other variables often exceed 0·70, and the ge erally high values show quite plainly that there is an ordered s quence in the processes going on above, which is strikingly abse from the surface phenomena.

Cyclones and Anticyclones.—In a cyclone the troposphere is co and the stratosphere warm, in an anticyclone the reverse is t case; in a cyclone the tropopause is low, in an anticyclone hi Thus as an area of low pressure passes across the map the followi changes occur in the various air strata above. The deficiency pressure is about the same from the surface up to some 10 kn

bove which it falls off rapidly until the normal value for the height
s reached at about 18–20 kilometres. The temperature from about
to 8 or 9 km. falls, and from 10 to 20 km. it rises. The height at
hich the lapse rate ceases, the limit of the troposphere falls. These
tatements are based on the very high correlation coefficients that
re found to exist between pressure and temperature. It will be
een from the accompanying Table IV. (which gives the correlation
efficients) that close to the surface the correlation is low, but it is
ery high from 4 km. to 8 kilometres. There are probably two rea-
ons for this. The surface temperature is governed by many consid-
rations—the time of day, the state of the sky, the strength and direc-
on of the wind; higher up these disturbances do not apply, for, as
as been already stated, the diurnal variation is very shallow and
e correlation between the components of the wind and the tempera-
re is surprisingly small above a few km. height. Secondly, it may
ell be that the chief item in determining the temperature is the re-
nt vertical motion of the air, and a systematic vertical flow of air
ther up or down is plainly impossible quite close to the surface. The
e and fall of the tropopause (H_c) and the regularity with which it
curs is shown by the high correlation, ·84, between it and the pres-
re at 9 km. height. There is hardly a single instance of observa-
ns made in Europe at a time of really low barometer in which H_c
s not been found well below its average value. The dependence
the temperature of the stratosphere on the barometric conditions
not so close, the correlation being only ·50; but based on some
ndreds of observations as these correlation coefficients are, ·50
amply significant. Still the importance of a correlation in general
pends upon its square rather than upon itself, and the significance
·50 is very different from that of ·90 or ·85.

TABLE IV. *Correlation Between Pressure and Temperature*

Height, km.	0	1	2	3	4	5	6	7	8	9	10	11	12	13
Jan.–March	−·02	·54	·82	·79	·86	·85	·84	·87	·91	·81	·35	−·32	−·38	−·37
April–June	·14	·28	·49	·79	·89	·89	·92	·87	·81	·45	·20	−·12	−·24	−·01
July–Sept.	−·02	·31	·56	·72	·75	·81	·83	·87	·87	·88	·43	−·08	−·41	−·19
Oct.-Dec.	·33	·56	·76	·77	·83	·87	·85	·85	·86	·78	·29	−·24	−·34	−·50
Means	·11	·42	·66	·77	·4	·85	·86	·86	·86	·72	·32	−·19	−·36	−·28

One noticeable result of this high correlation between pressure and
nperature is that the density is not subject to much variation
'e close to the surface, for a high pressure and a high temperature
upon the density in opposite ways, and since they occur together
density remains comparatively unchanged. (*See* also below, *The*
cting of Air Masses from Different Climates.)

Stability for Vertical Displacements; Available Energy.—The
e of decrease of temperature with height is normally less
n the 10°, C. per km. by which clear ascending air is cooled by
iabatic expansion. Consequently a small portion of air, if
cibly raised or depressed, usually tends to return to its original
el. The periodic time T of its vertical oscillation, if undamped,
been calculated by Väisälä (*Soc. Scient. Fennica, Comm.*
ys. Math, II., vol. 19, p. 38) to be

$$T=2\pi\sqrt{\frac{\theta_0}{g(\gamma_0-\gamma)}}$$

ere θ_0 is the absolute temperature of the air in the equilibrium
el, g is the acceleration of gravity, γ is the actual decrease of
perature per unit increase of height, γ_0 the adiabatic value of
Thus at a height of three km. T is normally about ten min-
s, while in the stratosphere T is about five minutes.

ny energy that there may occasionally be in a vertical col-
n available for producing thunderstorms or other local dis-
bances has been made conspicuous by Sir Napier Shaw, who
plotted upon a special chart observations of temperature
inst those of pressure at the same height, so as to produce,
hout calculation, the entropy-temperature-diagram familiar
ngineers. Fig. 1 is a simplified sketch of it showing the ob-
ation for Benson, Oxfordshire, on July 5 1923, 7 P.M. He
rds the dry air as the working substance and calls its en-
y the "realised entropy," while the moisture he regards as
ely a reservoir of latent energy.

et A and B be two points where the curve representing the
ervations cuts the same adiabatic for cloud. If a sphere of
mass of cloud at A is pushed up it will follow this adiabatic.
e may assume that the surrounding air, in descending to
the place of that which has risen, does so by a very small
lacement spread over a large horizontal area, and in such a
that unit mass descends across each level surface, then
t has occurred will apparently be indistinguishable, as far
nergy changes are concerned, from the passage of a unit mass
round the thermodynamic cycle from A *via* the adiabatic to B and back by the observed curve. Then, from the known properties of the entropy-temperature-diagram, the mechanical energy will be proportional to the area enclosed between the curves, and will be consumed or given out according as the observed curve lies below or above the adiabatic.

Actually two diagrams are employed, in order to represent humidity as well as temperature and pressure.[1]

Radiation in the Form of Electromagnetic Waves.—Just as a point has no parts and no magnitude, so a single direction contains no radiant energy. To mark off a definite flux of energy we must have two areas not in the same plane. For simplicity let us think of two square centimetres placed one metre apart and both normal to the line P Q joining their centres P and Q. We are now able to define the "intensity of radiation" in the direction P to Q as being 10^4 times the amount of energy that goes through both square centimetres in the order P to Q in one second.

The intensity of radiation $K_\nu d\nu$ in the range of frequencies of vibration between ν and $\nu+d\nu$ has been shown to have the following value inside a black enclosure at a uniform temperature θ absolute centigrade,

$$K_\nu d\nu=\frac{2h\nu^3}{c^2}\left(e^{\frac{h\nu}{k\theta}}-1\right)^{-1}d\nu$$

where c is the speed of light, $h=6\cdot55\times10^{-27}$ erg sec, $k=1\cdot34\times10^{-16}$ erg degree^{-1}. (Planck, *Vorlesungen über die Theorie der Wärmestrahlung*, Barth, Leipzig.) This is known as the "full" radiation. Further it was proved by Kirchhoff that if a portion of air absorbs a fraction α of the energy in a ray of frequency ν then that portion emits in the direction of that ray the same fraction α of the full radiation, $K_\nu d\nu$, corresponding to its temperature θ.

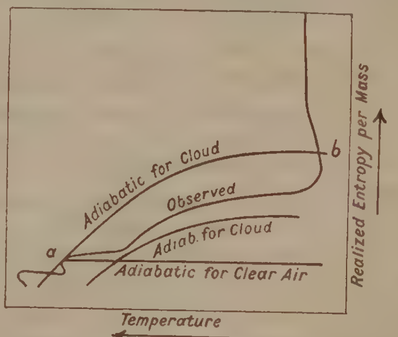

FIG. 1.—Diagram of "air" entropy.

Through any sphere of one centimeter diameter in the atmosphere radiations of various frequencies are passing simultaneously in all directions without blocking each other's paths. A division at a wave-length of three microns has nearly all the energy of solar origin on the short side of it and nearly all the energy of terrestrial origin on the long side.

When a ray passes through a centimetre length of atmosphere its energy is in general divided into three parts. One part, almost unchanged in wave-length, is turned aside and scattered in most directions. Another part is absorbed, that is to say—changed into heat-energy of the air. Whatever is left goes straight on unchanged in wave-length. The fraction that is scattered in unit length of path depends on the wave-length and the presence of dust and cloud particles. Even air molecules scatter, and more so in the shorter wave-lengths. Hence we see a yellowish sun in a blue sky (Rayleigh). The fraction that is absorbed in unit length of path depends on the wave-lengths and the various gases present; N_2, O_2, O_3, CO_2, H_2O, each absorbing strongly characteristic wave-lengths. At the same time each small sphere of atmosphere is sending out, at the expense of its heat energy, long-wave radiations equally in all directions.

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[1] See the report of the meeting of the International Commission for the Investigation of the Upper Air, held in London 1925 (M.O. 281 published by H.M. Stationery Office, London).

With such an abundance of processes going on simultaneously the difficulty of the observer has been to separate that one which he wished to observe; and the difficulty of the theorist has been to include them all without making his theory too cumbrous.

"Long Wave" Radiation.—W. H. Dines (*Geophysical Memoirs of the Meteorological Office*, No. 18) has measured the radiation which will not go through a glass plate and which reaches the earth from different zones of the sky. He finds that the intensity of radiation from a thick fog is within a few per cent. of that from a "full" radiator at the same temperature; whereas the intensity of radiation from a clear zenith sky at sunset ranges from about 0·65 of that from a grass meadow in December to 0·74 of it in September. The meadow was practically a full radiator. From the way in which the intensity increases as the zenith distance increases, W. H. Dines concludes that there must be at least two groups of radiation differently absorbed; one group comprising two-thirds of the energy is half absorbed in passing normally through a horizontal layer of clear air 100 millibars thick, the other group, comprising one-third of the energy, is only $1/20$ absorbed in this way; whereas 100 millibars of thick fog absorb eight-tenths or nine-tenths of all the incident energy. The sum of the radiations received by a horizontal square centimetre from all parts of the sky amounts to 500 gr.-cal. per day on the average for clear skies, or 700 for fully clouded skies, while at 10° C. a full radiator gives out 711 of these units.

A similar but not identical account is given by A. Angström (*Quar. Jour. Roy. Meteor. Soc.*, April 1924). He divides the energy sent out by a full radiator into three groups of wave-lengths comprising one-fourth, one-half, one-fourth of the whole energy. For the first group a clear moist atmosphere is almost perfectly transparent. The second group is almost totally absorbed in the first 30 metres above ground when the vapour pressure is 10 mm. of mercury. The third group has a variable absorption chiefly dependent on the amount of water-vapour present.

"Short Wave" Radiation of Solar Origin.—A square centimetre placed outside the atmosphere normal to the sun's rays would receive, according to the extensive researches of Abbot, 1·94 gr.-cal. per minute. The question of natural fluctuations about this mean is still in debate (*vide* the *Monthly Weather Review*, July and Aug. 1925). When the sun is in the zenith of a clear sky a unit of incident energy is divided roughly as follows: 0·78 comes to earth in the direct beam, 0·06 is scattered to space, 0·06 is scattered to earth and 0·10 is absorbed, warming the air. When the sun is nearer the horizon the scattering and absorption are much greater relative to the transmission. Abbot states that clouds reflect about 0·65 of the solar radiation falling upon them. Much further information will be found in the Smithsonian publications, in L. V. King's paper in the *Phil. Trans. Roy. Soc.*, A, vol. 212 (1913), and in recent papers in the *Meteorologische Zeitschrift*. The absorption by ozone is now being studied by Dobson and Harrison (*Quar. Jour. Roy. Meteor. Soc.*, 1925).

Turbulence and Diffusion.—A statement that the wind has a velocity of so many metres per second customarily refers to some mean value taken over say 10 minutes or more. Actually portions of air are moving faster or slower than the mean, as well as up and down and horizontally to and fro across the mean track. These deviations are well shown on the records of pressure-tube anemometers. The wandering portions carry qualities with them. Thus fragments coming from a rapid, damp, hot, smoky current into an adjacent slow, dry, cool, clear layer would bring with them some of the momentum, moisture, potential temperature and dust characteristic of the layer in which the
had previously journeyed. The motion of such fragments is to
intricate to be analysed in detail; but its general effect can b
summed up by a statistical coefficient representing the averag
rate of transfer of the quantities mentioned. The theory o
diffusion, originally worked out by Fourier for the diffusion o
heat in metals, and applied by Fick to the diffusion of salts i
liquids, has been extended to eddy-diffusion in the atmospher
by Åkerblöm, G. I. Taylor (*London Roy. Soc. Phil. Trans.*
A, vol. 215, pp. 1 to 26), Hesselberg and Sverdrup, and W
Schmidt and others.

If χ be the concentration of the dust or other diffusing sub
stance it has become customary to assume that the changes pro
ceed in accordance with an equation of Fick's type such a

$$\frac{\partial\chi}{\partial t}+\bar{u}\frac{\partial\chi}{\partial x}+\bar{v}\frac{\partial\chi}{\partial y}+\bar{w}\frac{\partial\chi}{\partial z}=\mathrm{K}\left(\frac{\partial^2\chi}{\partial x^2}+\frac{\partial^2\chi}{\partial y^2}+\frac{\partial^2\chi}{\partial z^2}\right)$$

where x, y, z, t are rectangular co-ordinates and time; $\bar{u}$, $\bar{v}$ and
are the components of the *mean* velocity, and K is the diffusivit
This view of the process has led to K being observed under
variety of circumstances, by the increase of wind aloft, by th
rate at which water vapour finds its way upward to the cloud
by the scattering of smoke or of balloons or of volcano ash.
has thus become known that K is of the same order of magnitud
whether the diffusing substance be momentum, dust, moistu
or potential-heat. It has further appeared that in the first thre
kilometres K is roughly proportional to the speed of the mea
wind, and is decreased when the static stability of the atmospher
increases. But the variation of K which overwhelms all other
is that dependent on the size of the portion of atmospher
which is observed. Thus if the air is confined to a capillary tub
K is about 0·2 cm.^{2} sec.$^{-1}$, if the portion is a few metres across
is of the order of 10^3, if a few hundred metres K is about 10^5, if
thousand kilometres across K is of the order of 10^{11} in the sam
units (Defant). We may explain this by saying that diffusivit
is a compensation for neglect of detail, and that the amount
compensation increases as the things neglected include in su
cession molecular motion, gusts, squalls and cyclones. In othe
words, the mean-velocity $\bar{u}$, $\bar{v}$ and $\bar{w}$ takes on a new sense whe
ever the size of the portion of the atmosphere under observatio
is enlarged, and this enormously affects K. See a paper by
F. Richardson in the *Roy. Soc. Proc.*, A, 1926.

A vertical gradient of mean wind tends to produce eddies, sta
ical stability tends to damp out eddies. The condition in whic
these effects just balance has been formulated by L. F. Richar
son (*Phil. Mag.*, Jan. 1925). Rayleigh's theory of unstable tem
perature gradients has been brought into meteorology by
Brunt (*Meteor. Magazine*, v. 60, 1925, p. 1).

The Heat Balance of the Atmosphere.—Gold (*Lond. Roy. So*
Proc., A, vol. 82, 1909, and simultaneously Humphreys (*Astr*
phys. Journ., vol. 29, 1909, p. 14) showed that the existence of th
stratosphere could be explained if it were in radiative equilibriu
The discussion as to the atmosphere generally has been continue
by Emden (*Sitz.-ber. d. Akad. Wissensch. Wien*, 1913, p. 55
W. H. Dines (*Quar. Jour. R. Meteor. Soc.*, April 1917), W
Schmidt (*Akad. Wiss., Wien, Mat.-Nat. Kl.*, 127–75, 1918), Chap
man (*Quar. Jour. R. Meteor. Soc.*, April 1925) and others, and h
joined with theories of radiative equilibrium in stars. (See
A. Milne, *Phil. Mag.*, Nov. 1922. It is, however, doubtf
whether the horizontal transport of heat can be neglected
comparison with that in the vertical.

There are seemingly four methods by which an appreciab
vertical flux of heat energy is produced in the atmospher
(1) Convection, which carries heat upwards from the earth's su
face; its action does not extend beyond the first few kilometre
(2) The latent heat set free by the condensation of aqueo
vapour, which carries upwards to the regions where clouds a
formed the solar heat which has evaporated the water from th
sea or wet land surface; this acts in just the same region as co
vection. (3) Radiation, which mostly carries heat upwards fro
a lower to a higher stratum. These three methods present
difficulty, but it must be pointed out that "convection" he

neans local convection, *i.e.*, heat carried by an ascending cur-
ent that is produced by local warmth, not heat carried by an
ir current or by eddy motion due to the general circulation.
This distinction, however, is difficult to maintain, because even
rictional eddies behave as thermodynamic engines. (4) Stirring
y eddies in the wind *i.e.*, turbulence. W. Schmidt has made an
stimate which shows that the amount of heat carried down-
vards across the 2 km.-level in Europe by this cause to be 50 gm.
alories per sq. cm. per day.

An important conclusion follows. Since above the region of
he formation of heavy clouds neither convection nor the supply
f latent heat by condensation is efficacious, the actual lapse-rate
here must represent the balance of two opposing tendencies,
ne radiation, tending toward an isothermal condition, and the
ther mixing, tending to an adiabatic lapse rate.

Dynamics of Wind.—In the upper air it has been shown by
old that the wind velocity approximates to the ideal "geo-
trophic wind" which is imagined as blowing parallel to the
obars with a speed v given by

$$v.2\omega\rho \sin\phi = \partial p/\partial x$$

here ω is the earth's angular speed, ρ is the air density, ϕ is the
titude, p is the pressure, and x is horizontal distance normal
the isobars. In the first kilometre this simplicity is modified
y eddy-viscosity. Elaborate theories on the dynamics of wind
ntinue to develop.[1]

The Meeting of Air-Masses from Different Climates.—Dr. J.
jerknes writes as follows:—

> Cold currents in the temperate zone can be traced back, more or
> ss directly, to polar regions; in winter also to cold continents. On
> eir way they are heated by contact with the ground and become
> istable, provided that no adequate heating takes place in higher
> yers. Polar currents in temperate latitudes therefore frequently
> ve cumulus or even cumulo nimbus with showery weather.
>
> Warm currents in the temperate zone can be traced back to sub-
> pical regions; in summer also to warm continents. On their way
> rthward they are cooled in contact with the ground and become
> ble. If the cooling continues to the dewpoint then stratus clouds
> fogs are formed.
>
> Where cold and warm currents border each other, in typical de-
> essions or elsewhere, precipitation is usually formed. In cases
> ere the warm current gains terrain (warm front) it climbs upwards
> a gently inclined wedge, say 1/100, formed by the underlying cold
> rrent. Impervious cloud-sheets are formed in the climbing warm
> rrent, low clouds close to the warm front and higher clouds farther
> ward. Precipitation is usually falling from the whole extensive
> ud system, but that falling from the higher parts evaporates be-
> e reaching the ground. In cases where the cold current displaces
> warm (cold front) the precipitating clouds are likewise formed in
> rising warm air. The advancing cold wedges are frequently so
> ep that violent ascending motion and correspondingly strong pre-
> itation results. On the other hand, such precipitation is mostly
> nfined to a narrow belt along the cold front.
>
> Extratropical cyclones examined individually show a great variety
> types. Usually the young cyclones consist of two oppositely
> ected currents, one cold occupying a little more than the half of
> area and one warm current covering the remaining area—the
> varm sector." During the development of the cyclone, air from
> warm sector ascends and is replaced at the ground by the cold
> This motion transforms potential energy into kinetic energy,
> ich appears in the increasing winds and deepening of the depression.
> er a couple of days all the air from the original warm sector is
> ed off the ground, but can still be found aloft (occluded cyclone).
> ring the ascension the warm air is cooled adiabatically, and finally
> eaches a level where it finds surrounding air of its own temperature,
> that the buoyancy can lift it no farther. Having reached this
> ge the cyclone is maintained merely by the inertia of the circulat-
> air masses. If no new energy is supplied the cyclone decays grad-
> y.

riginal papers on this subject will be found in Oslo, *Geofys-
Publikationer*, and elsewhere. For the relation between the
rce of air and its temperature see C. K. M. Douglas, *Quart.
r. R. Meteor. Soc.*, July 1925.

ntarctic Meteorology.—Great additions to our knowledge of
meteorology of the Antarctic regions were made by the publi-
on of the results of Scott's Antarctic expedition of 1910 to
2. The observations were taken mostly by Dr. Simpson, who has worked them up and discussed various problems left in a more or less uncertain condition by previous expeditions. He has greatly extended our knowledge both from the observational and theoretical sides. Amongst other matters Dr. Simpson has established the anticyclonic character of the weather in the Ross Sea area, and has shown that the blizzards are not parts of the circulation about the centres of cyclones moving from west to east over the Antarctic Ocean.

New Methods of Observation.—Upper wind was observed during the War (1) at night by pilot balloons carrying candles, (2) by shell bursts observed by two mirrors, (3) by sound-ranging on a balloon that exploded. Subsequently a method has been developed for observing wind above fog by shooting spheres upward. Particulars of such things will be found in the *Computers' Handbook* or the Professional Notes of the Meteorological Office. Clouds can be photographed by moonlight (Oslo, *Geofysiske Publikationer*, vol. 3, No. 12). The amount of water in thin clouds can be measured (*Quart. Jour. Roy. Meteor. Soc.*, Jan. 1925). The upgradient of temperature near the ground can be measured by thermocouples (*Phil. Mag.*, Jan. 1925) and by an optical method (*Quar. Jour. Roy. Meteor. Soc.*, April 1925). Upper air temperature is regularly measured from aeroplanes, and can also be observed by balloons that explode at a prearranged temperature (M.O. Prof. Note 19). For radiation instruments see *Dictionary of Applied Physics*, vol. 3.

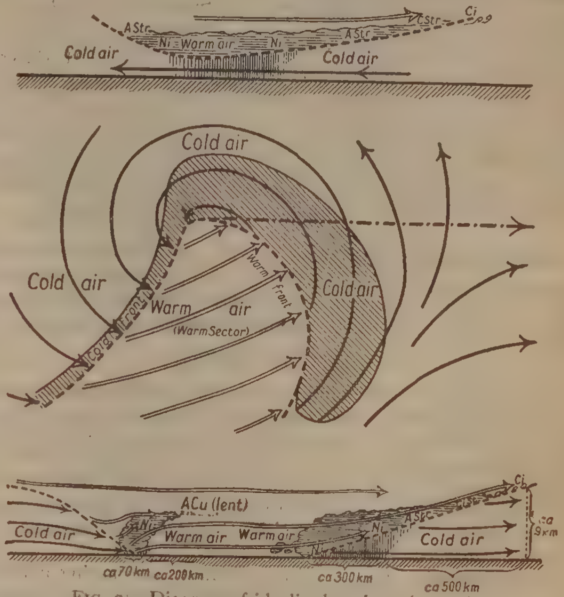

FIG. 2.—Diagram of idealised cyclone (young).

(From "Life Cycle of Cyclones, and the Polar Front Theory of Atmospheric Circulation." J. Bjerknes and H. Solberg, *Geofysiske Publikationer*, Vol. III., No. 1.)

Weather Forecasts.—Forecasts for one or more days ahead continue to be made by the process of drawing a map to represent weather observations received by telegraph from an area some thousands of km. in diameter. The accumulated and classified experience of what usually does follow such a distribution of pressure, temperature, cloud and wind is then employed to form the forecast. The Smithsonian Institution is progressing in its studies looking toward weather forecasts based on solar radiation observations.

Organisations.—The International Meteorological Committee and its subcommissions in 1925 reattained their fully international character, which was destroyed by the War. A post-war restricted organisation known as the International Union for Geodesy and Geophysics has a section for meteorology which is active.

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[1] See papers by J. Bjerknes, Oslo, *Geofysiske Publikationer;* Brunt,
Mag., Feb. 1926; Jeffreys, *Quar. Jour. R. Meteor. Soc.*, Jan. 1926;
books by Exner, Richardson and Shaw.

Weather (1912); Dr. Julius v. Hann, *Handbuch der Klimatologie* (3rd ed., 3 vol., 1911); *Lehrbuch der Meteorologie* (3rd. ed., 1915); V. Bjerknes and others, *Dynamische Meteorologie und Hydrographie* (Carnegie Institute of Washington, 1912); H. N. Dickson, *Climate and Weather* (1912); Dr. Alfred Wegener, *Thermodynamik der Atmosphäre* (1911); M. W. Campbell Hepworth, *National Antarctic Expedition 1901–1904* (London, Roy. Soc., 1913); *Ice Observation, Meteorology, and Oceanography in the North Atlantic Ocean*, Report on the work carried out by the S. S. "Scotia" (1913); C. G. Abbot, F. E. Fowle and L. B. Aldrich, "New Evidence on the Intensity of Solar Radiation outside the Atmosphere," *Smithsonian Miscellaneous Collections*, vol. 65, No. 4; Sir Gilbert J. Walker, "Correlations in Seasonal Variations of Weather," *Memoirs of the Indian Meteorological Department*, vol. 20 and 21; Anders Ångström, "A Study of the Radiation of the Atmosphere," *Smithsonian Miscellaneous Collections*, vol. 65, No. 3 (1915); G. C. Simpson, *British Antarctic Expedition 1910–1913, Meteorology*, 3 vol.; W. J. Humphreys, *Physics of the Air*, Franklin Inst. (1920); F. M. Exner, *Dynamische Meteorologie*, 2nd ed. (1925); R. G. K. Lempfert, *Meteorology* (1920); L. F. Richardson, *Weather Prediction by Numerical Process* (1922) (the *Geophysical Memoirs*, pub. by the Meteorological Office); the *Meteorological Glossary* (fourth issue, M.O. 225.11, the Meteorological Office); *The Dictionary of Applied Physics*, vol. 3.

For *original papers* see the Bibliography issued by the Royal Meteorological Society, the bibliography published monthly in *The Monthly Weather Review* (Washington), also references in text.

(W. H. Di.; L. F. R.)

METER: ELECTRIC AND GAS (*see* 18.291).—Meters are used to measure the amount of electricity or gas supplied to the customers of the company concerned. In the case of electric meters these register the number of units supplied for light, heat or power.

I. ELECTRIC METERS

These meters include induction-motor, mercury-motor and commutator meters, which register the revolutions of a disk or other armature caused to revolve, by the action of the current, at a speed proportional to the amperes or watts passing through the meter, and electrolytic meters in which the current or a shunted fraction of it passes through an electrolyte and decomposes it, the rate of decomposition being proportional to the current employed.

Induction-motor Type.—In the Ferranti alternating current watt-hour meter, a series coil of a few turns of thick wire carrying the main current is arranged below, and a shunt coil of many turns of fine wire is arranged above a horizontal rotary disk of aluminium. This disk is situated in the gap between the poles of a permanent magnet and the lower bearing of its vertical spindle is a sapphire carefully selected to reduce friction to a minimum. The magnetic fields due to the shunt and series windings produce a resultant rotating or shifting field which interacts with eddy currents, induced in the disk so as to exert a driving torque proportional to the watts. A retarding torque is produced by the action of the permanent magnet also causing the speed of the disk to be proportional to the watts. A worm on the spindle drives the registering train; the registering dials are of the clock pattern, or of the cyclometer pattern.

To read the meter is a simple operation. In the clock pattern, starting from left to right, the figure last passed by the thousands pointer in its revolution is written down and the same procedure is followed for the hundreds, tens and units pointers in succession, the tenths registered on the small lower dial being read only when testing the meter. In the cyclometer pattern, the figures are written down just as they appear on the register. The cyclometer figure wheels are actuated by a falling weight; thus, the changing of the figure wheels does not throw any extra load on the meter.

Mercury-motor Meters.—In the Chamberlain and Hookham direct current ampère-hour meter, a copper disk is caused, by the action of the current, to rotate in a mercury chamber subject to the influence of a magnetic field due to a large permanent magnet. The vertical spindle of the disk, arranged to rotate with the minimum friction, is connected to the registering train with its series of clock dials. The peripheral wall of the mercury chamber is formed by a leather-lined metal band which is readily removable to permit inspection and refilling with mercury.

Commutator Meters.—Commutator meters have a wound armature connected in parallel with a shunt and arranged to rotate in the field of a permanent magnet.

Electrolytic Meters.—In the Reason syphon-tube meter, a solution of a mercury salt is hermetically sealed in a container, a the top of which are arranged a mercury anode and a cathode During the operation of the meter, mercury is liberated at th cathode and collects in a syphon tube in the container; this tube when full of mercury, discharges into the lower part of the container. Close to the right limb of the syphon tube is a vertica scale which registers the mercury level; in one form of the meter this scale reads from 0 to 200 units. Below the scale is anothe which registers the level of the lower mercury column; this scal may read from 0 to 4,000 units. When reading the meter, bot scales are read and the sum of the readings is taken. The Reaso single-tube meter has one vertical mercury tube, which is rea like a thermometer. In both forms, the mercury can be use repeatedly, the meters being re-set by tilting; the container flexibly mounted to facilitate this operation.

In the Bastian electrolytic meter, acidulated water is decomposed by the action of the current, and the amount of wate decomposed is read off on a vertical scale.

II. GAS METERS

There are two main types of gas meters, viz., wet meters an dry meters. A wet gas meter has a strong iron case containin water, which is normally at a definite level called the "wate line." Inside the case is a rotary drum divided into compartmen and mounted on a horizontal spindle geared to a vertical spind operating the registering train. The drum is rotated by the u balanced elastic pressure of the gas admitted to each compar ment in turn on the surface of the water. After leaving the drun the gas passes to an outlet pipe which delivers it to the burner In order to maintain the level of the water, when loss occu through evaporation or other causes, most wet meters are pr vided with means for automatically making good the loss; the are called compensating meters. In most of them, the water make good the loss is delivered from a water reservoir within t meter case and communicating with the main body of water.

Dry Meters.—In an ordinary dry gas meter, the upper part the meter case forms the registering chamber in which are sit ated the registering train and the valve box, which is sh off from the registering chamber and contains gas inlet a gas outlet valves. The registering chamber is separated by horizontal partition from a lower and larger chamber, which divided by a vertical partition into two equal chambers. In eac of these a bellows of concertina shape, with flexible leather side works to and fro horizontally; the vertical partition forms t fixed base of each bellows. Arrangements of levers and cran transmit the motions of the bellows to the valves in the valve b and also to the registering train. When the meter is in operatio gas from the main supply pipe enters one of the bellows a inflates it, while the gas in the corresponding chamber is expell through a delivery pipe to the burners; at the same time, gas being expelled from the other bellows by the pressure of admitted into its bellows chamber. Working in this way, meter supplies gas continuously to the burners, and the valves the valve box are opened and closed at the proper times requi by the flow of the gas. At the same time the registering train operated continuously.

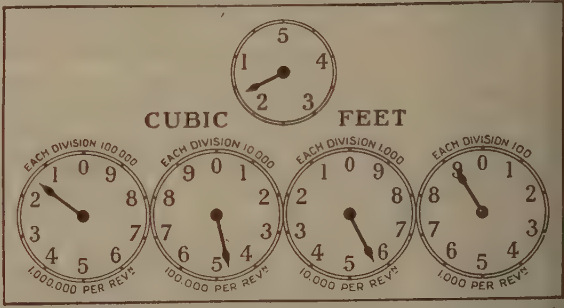

FIG. 1.—Diagram illustrating the registering dials of a 10-lig dry gas meter.

Automatic or Prepayment Meters.—Prepayment gas meters are itted with a box containing mechanism which operates when coin is passed through a slot in the box and controls the supply f gas to the meter. The value of the inserted coin or token letermines the automatic cutting-off of the gas supply.

Reading a gas meter is a simple operation. Fig. 1 represents the egistering dials of a 10-light dry gas meter. The registering train is eared so that the hundreds pointer revolves 10 times while the housands pointer revolves once, the thousands pointer revolves 10 imes while the tens of thousands pointer revolves once, and so on; lso, adjacent pointers revolve in opposite directions. Starting from ight to left, the figure last passed by the hundreds of thousands ointer in its revolution is written down and the same procedure is ollowed for the tens of thousands, the thousands and the hundreds ointers in succession; thus the reading in fig. 1 is 1,459 hundreds. ssuming that this was the reading at Michaelmas and that 1,356 undreds was the reading at the preceding Midsummer, then the mount of gas consumed during the summer quarter would be 45,900 minus 135,600 or 10,300 cubic feet.

The small upper dial is not usually read. It records the flow of nall quantities of gas and can therefore be used for ascertaining hether all pipes and gas fittings are gas-tight, or what amount of as is consumed by any of the burners. (T. E. L.)

METHODISM (*see* 18.293).—The official returns of world-ide Methodism presented to the oecumenical conference at oronto in 1911 showed that there were 55,808 ministers; 98,121 y preachers; 8,768,616 church members; 99,497 churches, orth over 100 million sterling; 90,124 Sunday schools, with 8,722 officers and teachers and 8,273,809 scholars. The de-iled table below shows the position in 1925.

The numerical strength of Methodism is not to be gauged the number of members. To the members must be added a ry large body of communicants and worshippers. About 10% the population of Great Britain are Methodists. In Canada ethodists are 11% of the population; in Australia, 12%; in New Zealand 6%; in South Africa, including Rhodesia, 7%; and in the United States, 20%.

I. IN GREAT BRITAIN

British Methodism has faced with courage and with a large measure of success the new problems of the 20th century. It has consolidated its sections and, in addition to its ordinary routine of work, has given special attention to three great issues—the reunion of Methodism, temperance reform and foreign missionary enterprise.

At least 450,000 officers and men of the Wesleyan, the Primitive, and the United Methodists fought in the World War, of whom 40,000 fell. Methodism cared for its people and materially assisted its members by its war emergency and sustenation funds, for augmenting ministerial allowances and helping circuits suffering from the higher cost of living. In spite of the serious effect which the War has had upon the spending power of the people, the incomes of the Methodist church funds have largely increased. In all the churches the salaries of the ministers have been considerably advanced. There are no unemployed Methodist preachers, and no dearth for candidates for the ministry.

Missions.—The British Foreign Missionary Societies working under the direction of the three Methodist Conferences also have a record of expansion and success. The Wesleyan Missionary Society has erected and equipped 12 colleges with 5,031 students, and also 36 high schools with 6,068 scholars, in addition to 16 theological and normal training institutions for native preachers. Important Medical, agricultural and industrial hospitals and schools have also been established in West Africa, South India and China. These societies work in close co-operation with other branches of Christendom by adopting the apportionment of regions of missionary enterprise. They develop a missionary

Denomination	Ministers	Lay Preachers	Church Members and Probationers	Sunday Schools	Officers and Teachers	Sunday Scholars	Churches Etc.
Vesleyan Methodists:—							
Great Britain	2,537	18,651	515,139	7,318	119,596	840,205	8,580
Ireland	183	599	29,137	322	2,217	22,929	410
Foreign Missions	748	10,343	255,753	2,802	10,200	161,152	4,750
French Conference	33	69	1,607	13	106	736	116
South African Conference	277	5,198	163,541	1,107	3,253	44,982	4,673
rimitive Methodists	1,107	13,634	216,597	4,020	55,230	407,571	4,593
nited Methodist Church	755	5,602	187,405	2,236	38,171	264,796	3,055
Vesleyan Reform Union	24	456	9,871	194	2,410	22,770	203
ndependent Methodist Churches	391	..	10,384	166	3,183	24,758	165
ustralasian Methodist Church	1,083	8,218	160,911	3,680	25,887	204,174	4,706
lew Zealand Methodist Church	199	766	24,214	396	3,129	31,008	880
nited States:—							
Methodist Episcopal	21,406	15,914	4,711,994	36,893	414,175	4,847,735	29,487
Methodist Episcopal, South	8,076	5,403	2,478,623	17,570	162,439	2,053,173	17,615
Methodist Protestant	1,356	..	186,275	1,965	18,970	191,270	2,379
African Methodist Episcopal (coloured)	7,000	6,330	650,000	7,200	29,996	320,000	7,500
African Methodist Episcopal Zion (coloured)	3,962	..	412,315	2 092	16,245	193,000	2,716
Coloured Methodist Episcopal	3,039	2,590	366,315	2,543	18,884	193,000	3,824
Free Methodist	1,483	1,673	34,751	1,346	9,648	103,676	1,259
Wesleyan Methodist	666	..	21,000	521	3,442	30,133	675
Primitive Methodist	85	73	9,986	87	1,524	16,807	86
Congregational Methodist	500	.	21,000	182	1,146	8,785	352
New Congregational Methodist	27	..	1,256	27	143	1,298	24
Union American Methodist Episcopal (coloured)	205	105	18,812	67	321	2,531	267
African Union Methodist Protestant (coloured)	260	..	3,750	49	441	3,088	58
Reformed Zion Union Apostolic (coloured)	79	..	10,000	36	212	1,508	58
Reformed Methodist Union Episcopal (coloured)	52	..	2,126	18	204	1,792	29
British Methodist Episcopal (coloured)	20	6	700	18	125	..	21
Coloured Methodist Protestant	33	..	1,967	24	..	1,016	26
African American Methodist Episcopal	35	..	5,811	25	..	934	27
nadian Methodist Church	2,475	1,946	414,047	3,807	43,333	351,633	4,797
pan Methodist Church	234	..	29,000	..	..	44,000	
Totals	58,330	97,576	10,954,287	96,724	984,425	10,359,452	103,331

spirit among the native Christians and the creation of a native ministry. Thus, there is a large number of native preachers and generous financial support is given to their missions by the native churches. In 1913 the Wesleyan Missionary Society held its centenary and raised £280,000 as a special fund for development. The women's auxiliary of the society has largely increased, and a plan is being developed for realising closer co-operation with the parent society.

Educational and Social.—The decline in the number of Sunday school teachers and scholars has given serious concern to the conferences. Efforts have therefore been made to increase the efficiency and the attractiveness of the Sunday schools, the work of which is not limited to Sunday, nor to school methods. The boy scouts, girl guides and life brigade movements, summer schools and Bible study circles supplement the work of the Sunday schools. The Wesley Guild and Christian Endeavour societies in British Methodism, and the Epworth League in America are doing much to consolidate the work among young people.

The Wesleyan Church has largely transferred its day schools to the county education authorities under the Acts of 1870 and 1902, and has now only 392 day school departments, with 32,847 scholars. But the same Church has largely developed its higher and secondary educational work. The two Wesleyan training colleges for teachers—for men at Westminster and for women at Southlands (Battersea) have attained a very high standard of efficiency. An increasing number of the students take university degrees. The teachers thus trained hold many of the most important posts as headmasters and mistresses in the London and provincial day and secondary schools and also in the British Dominions.

In addition to a number of important educational institutions, the three British Methodist Churches have six theological colleges for training candidates for the ministry, which are being more and more brought into line with the curriculum of the various universities. In 1926 Oxford celebrated the bi-centenary of the election of John Wesley to a fellowship of Lincoln College, and, to honour the occasion, conferred the degree of Doctor of Divinity upon the Rev. John H. Ritson, the president of the mother conference, a scholar and graduate of Balliol College, and the first Oxford man elected to the chair of John Wesley.

Another department of British Methodism is its home missionary work in the villages and city centres. Wesleyan Methodism has its connectional and lay evangelists. Open air evangelistic services are regularly held, and in many places the theatres and public halls are utilised for extra services. New central halls take the place of down-town churches. The London Mission of Wesleyan Methodism is doing a great work at Westminster, Kingsway, Clerkenwell and other centres. Primitive Methodists have four halls in the poorest parts of London, the principal ones being in Whitechapel and Southwark.

The British Methodist churches have been impressed with the economic and social results which have followed prohibition (*q.v.*) in the United States. Each of the sections has an active temperance and social welfare department. In 1920 the Wesleyan Conference declared that the sale of intoxicating liquors as a beverage was "definitely opposed to the best interests of the State and to the Kingdom of God," and recommended the Methodists everywhere to work and pray for the total and permanent prohibition of the common manufacture and sale of alcoholic drinks. The three Churches have adopted a progressive temperance policy—first of local option, secondly, the complete extension of magisterial licensing authority to all political and social clubs, rich and poor alike; and, thirdly, the entire Sunday closing of all drinking bars in England and Wales.

The Methodist Brotherhood works in unison with the Dominion agents in London, who assist emigrants to the United States, Canada, Australia and South Africa, arrange their passages, and secure them employment. The Brotherhood embraces all Methodist churches, and it has met with conspicuous success in assisting the Methodist emigrant and maintaining his association with Methodism in his new country.

Methodist Union.—Methodist union transcends in importanc all other movements in Methodism at the present time, and it i probably fraught with more momentous issues to the churche concerned than anything since the death of Wesley. A grea impetus was given to this movement by the decennial gathering of the Methodist Oecumenical Conference, which, instituted i 1881, meets alternately in London and America. It consists 600 delegates from all parts of the world, half of whom ar ministers and half laymen. Each assembly has been followe by some decisive step forward along the path of union, and i all cases the ministry has loyally accepted the decisions of th majority. The results of union have far exceeded the antic pations of the churches, and there has been a great increase i the membership and financial resources.

In 1913, the Wesleyan Methodist Conference appointed committee to collect information on the subject of union and t report to the next Conference. A final scheme of union was su mitted to the yearly conferences of the three Churches in 192 and was adopted by a very large majority. The scheme, whic has presented no serious difficulties, will be again presented t the three conferences of 1926 together with the drafts of th proposed Parliamentary Enabling Act of Union and of th proposed Chapel Model Deed of the new United Methodis Church of Great Britain. If these are approved an applicatio will be made to Parliament, and there is every prospect of th union of the three Churches in one British Methodist Churc being effected in 1928.

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(R. W. P.*; J. E.*)

II. IN AMERICA

The noteworthy changes in American Methodism since 19 include (1) the steady growth of all its major branches; (movements toward the organic union of various units with the Methodist group and with other evangelical churches; ar (3) educational advances resulting in liberalising tendencies theology, a higher appreciation of non-Christian religious grou with a consequent new approach to the problem of wor evangelisation, the further democratisation of Episcopal Meth dist Churches and an increasing zeal for social justice, inte racial understanding and the application of the teachings Jesus to all human relationships and affairs, in politics and s ciology as well as to purely personal conduct and belief.

Church Union.—The year 1925 saw the consummation the Union of the Methodist, Presbyterian and Congregation Churches of Canada in the United Church of Canada. The Met odist Church, as the largest of the three denominational uni went into the United Church with 100% of its constituency, whi at the time of the merger included 2,475 ministers, 1,946 l preachers, 414,047 members, 451,636 church-school pupils, wi 43,333 officers and teachers. In the United States a plan for t organic reunion of the Methodist Episcopal Church and t Methodist Episcopal Church South failed (1925) by a narr margin of the combined votes of lay and ministerial membe of the southern church. The vote in the Methodist Episcop Church at the same time was overwhelmingly in favour of t union. The vote of the Methodist Episcopal Church Sout while rejecting the specific plan submitted, did not close t issue, which was to be considered again at the next session of t respective General Conferences of the two bodies. In Gre Britain the union of the Wesleyan Methodists, the Primiti Methodists and the United Methodist Church was also neari its consummation.

Educational Advances.—The educational advances to which nust be attributed certain tendencies already summarised nclude the following (1) an increase, commensurate with the rowth in church membership of, in the number, enrolment and nancial support of secondary schools and colleges; (2) a rapid ise, especially in the United States, from the previous low aver- ge educational preparation and professional training of minis- ers, together with a corresponding advance in the curriculum tandards for collegiate and theological institutions; (3) in- reasing attention to religious education through the church- chool with the extension of the programme of religious educa- on to include week-day instruction; (4) the widespread distri- ution and use of religious-educational literature in text-book nd periodical form, the total regular circulation of which xceeds the combined total membership of all Methodist hurches.

Episcopal Methodist Churches.—The coloured Methodist piscopal Church, an offshoot from the Methodist Episcopal hurch South, leads all branches of Episcopal Methodism with creases of over 60% in membership and over 100% in church- hool enrolment in 15 years. The Methodist Episcopal Church 1916 adopted the Episcopal area system with a flexible limit the residence of a bishop in any one area. A World Service ommission since 1924 acts as an overhead co-ordinating agency r all benevolent boards. The educational activities of the hurch have been consolidated in one board of education with parate departments for colleges, negro education, church- hools and the Epworth League. During 1920–5 the centenary the organisation of the foreign missionary enterprise was ebrated by Episcopal Methodist Churches, notably the ethodist Episcopal Church and the Methodist Episcopal urch South, by a five-year financial campaign, which has adrupled the annual missionary offerings of the participating urches.

See Methodist Year Books; Disciplines, Proceedings of Confer- es, General Oecumenical Conferences; Methodist periodical rature.

(H. H. M.)

METROLOGY: *see* MEASUREMENTS.

MEUSE-ARGONNE: *see* VICTORY, ADVANCE TO.

MEXICO (*see* 18.317), a federal republic of North America, has area of 767,198 square miles. In 1912 the estimated population s 15,501,684, of which about 20% were whites. Political disturb- es have resulted in a movement towards the cities for safety, across the frontiers for employment and political asylum. s is reflected in the 1921 census, which gave a population of 234,852. The population of Mexico City, the federal capital, 633,367; Guadalajara, 110,468; Puebla, 96,121; San Luis osí, 85,000; Monterey, 85,000; Vera Cruz, 48,633.

I. POLITICAL HISTORY

n Sept. 27 1910 Porfirio Diaz was re-elected president for a enth term. The closing years of his rule were marked by nomic depression, crop failures, excessive importation of lstuffs and political restlessness, ill-concealed by the festivi- of the Centennial of Independence. Since 1908 various tical activities had indicated a demand for a change in the idential office. Conspicuous in this demand was Francisco Madero, who supported a nationalistic programme. His *sion presidencial en 1910* attacked the administration mildly; as his adherents increased in number, he became more out- ten. He was arrested on charges of sedition and was im- oned at San Luis Potosí. Escaping to San Antonio, Texas, ssued the *Plano de San Luis Potosí* demanding electoral re- s, division of agrarian property and the resignation of Diaz. rmed revolt was planned for Nov. 20 1910, but there were erous premature outbreaks. Against these a reign of terror initiated, but resistance spread. By Dec. there was armed lt in a dozen states. Diaz attempted to meet disaffection by nises and belated reforms. After minor reverses the northern s took Ciudad Juarez May 10 1911, thereby showing the ary impotence of Diaz. This success, with others at Pachuca Cuernavaca, induced Diaz to assent to the demand for his resignation. It was agreed that Francisco de la Barra should assume a provisional presidency and call a new election. Diaz resigned May 25, and left the country next day. On June 7 Madero entered Mexico City in triumph. He really controlled the country, De la Barra having scant power. The ensuing election resulted in an overwhelming majority for Madero, who was inaugurated as president on Nov. 6 for a term to end Nov. 30 1916. He soon found himself opposed by reactionary politicians, several of whom he had appointed to his Cabinet. His government was characterised by neglect of the demands of the revolution, by financial blunders, by quarrels with State governors, and by weakness towards the opposition. Revolt by former supporters began at the time of his inauguration. Emiliano Zapatas in Morelos, Bernardo Reyes in the north, Pascual Orozco in Chihuahua, and other rebels were in the field. In the fighting, many foreigners were killed. Conditions were chaotic in 1912. On March 14 President Taft prohibited shipment of arms to Madero's opponents. Americans, advised to leave the country, departed by thousands. The north generally was in anti-Government hands.

Huerta Seizes Executive Power.—On Oct. 12 Felix Diaz revolted in Vera Cruz; he was captured and was confined in Mexico City. On Feb. 9 1913 he and Reyes (who also had been imprisoned) were set free by disaffected soldiers. Gen. Victoriano Huerta, head of the Government troops, turned traitor and imprisoned Madero and Pino Suarez, forcing them to resign. Huerta on Feb. 19 seized the executive power through constitutional forms. Three days later Madero and Pino Suarez were executed. President Wilson rebuffed Huerta's efforts to obtain recognition, believing that he did not represent the will of the people, and that he was responsible for the political executions; President Wilson demanded a general election in which Huerta should not be a candidate. The demand was rejected. On Oct. 10 Huerta seized the legislative and judicial power, arresting 110 members of Congress for inquiring into the mysterious death of Senator Belisario Domingues, who had harshly criticised him.

Meantime revolt, led by Governor Venustiano Carranza of Coahuila, appeared in both the north and the south. In the *Plano de Guadalupe* the rebels declared Huerta a usurper. They won numerous successes, among them the capture of Torreon in March 1914. Following the outbreak of revolution, American war vessels had been observing events in Mexican harbours. At Tampico a boat's crew from the "Dolphin" were arrested on a military reserve. The American commander demanded a salute to his flag for the incident and was supported by President Wilson. Huerta refused unless the Mexican flag were similarly saluted, and the Americans seized Vera Cruz on April 21. Huerta had been embarrassed by the mission of John Lind, whom Wilson sent as a personal representative to induce Huerta to assent to his own elimination. Though unable to effect foreign loans or to make peace with the Carranzistas, and in spite of advice by the foreign diplomats to yield to Wilson, Huerta ended diplomatic relations with the United States on April 22. Argentina, Brazil and Chile proffered their good offices; representatives of these nations met representatives of Huerta and the United States (Carranza holding aloof) in conferences at Niagara Falls, Canada, but the representatives failed to agree on a provisional president. Huerta was finally forced to resign July 15 1914, and was succeeded by Francisco Carbajal, who held office less than a month.

Carranza, though he did not support the Zapata programme, and quarrelled with Villa, still headed the Constitutionalists; after obtaining control of the capital, he set in motion plans for a presidential election. He was unable to control the generals summoned to a nominating convention, and they moved from Mexico City to Aguascalientes, where they nominated Gen. Gutierrez, an adherent of Villa, as provisional president. Villa drove Carranza out of the capital, the latter occupying Vera Cruz as the Americans evacuated that port Nov. 23. Villa and Zapata alternated in control of Mexico City and no fewer than four factions claimed the executive power in 1915. In that year Villa, who had shown strength in the north, was defeated by

Gen. A. Obregon. A conference of Argentina, Brazil, Chile and other American Powers, seeking to stabilise the situation on Oct. 19, recognised Carranza as *de facto* president.

Villistas Murder Americans.—Villa ignored the settlement, and on Jan. 10 1916 a band of his adherents assassinated 18 Americans taken from a train near Santa Ysabel. On March 9 he raided Columbus, N.M., killing 17 Americans. A punitive expedition of 12,000 United States troops, led by Gen. Pershing, invaded Mexico. It penetrated to the vicinity of Parral, but failed to capture Villa, who was reported dead. Carranza had grudgingly acquiesced in the invasion, but now protested, stating that the movement of American troops in any direction other than northward would provoke attack. On June 20 American negro cavalrymen moving eastward were attacked at Carrizal; several were killed and about a score were captured, but were released upon a sharp demand by the United States. The expedition was finally withdrawn Feb. 5 1917. In Sept. a commission attempted to make an agreement for policing the international line, but failed because Carranza denied the right of the United States to pursue raiders into Mexican territory.

In 1917 a new constitution was proclaimed. It incorporated in Art. 27 the principle of nationalisation of subsoil resources, chiefly as a means of controlling the petroleum industry. Decrees attempting to force the oil companies to observe the constitution were protested by foreign powers as confiscatory and subversive of rights acquired under the prior constitution of 1857. During 1919 the controversy was bitter. The companies, threatening cessation of production, forced Carranza in Jan. 1920 to concede the privilege of operating without compliance with the decrees but without prejudice to the final adjudication of the difficulty.

During 1919 rebel activities against Carranza were widespread, and many acts of violence were committed against foreigners and Mexicans by both Government and rebel partisans. A conspicuous case was the abduction for ransom of W. O. Jenkins, U.S. consular agent at Puebla, Oct. 19. He was alleged by the Mexican Govt. to have been implicated in his own abduction, but was released Dec. 5 1920. During the World War Mexico's "rigid neutrality" was highly pro-German. The famous Zimmermann note, by which Germany tried to align Japan and Mexico against the United States, was intercepted and published in March 1917.

Obregon Elected President.—The presidential campaign began in 1919, Carranza's power then reaching its zenith and afterwards rapidly declining. There was corruption in the army, banditry throughout the country and non-enforcement of the constitution Amid widespread unrest two generals, A. Obregon and P. Gonzales, conducted presidential campaigns, while Carranza supported a civilian candidate I. Bonillas, who had been Mexican minister to Washington. When Carranza's efforts to control state administration for the election of Bonillas led him to attempt a military invasion of Sonora, the home of Obregon, armed revolt broke out. On April 9 that State declared its secession until it could be assured of its sovereignty. The defection spread quickly through the north and west. By the end of the month Carranza was isolated in Mexico City. Adolfo de la Huerta was set up by the rebels as provisional president. Carranza attempted to move his Government to Vera Cruz, but his trains were broken up, and when he left them to make his way over the mountains to a Gulf port, he was murdered on May 21 at Tlaxcalantongo. Obregon entered the capital May 8. On May 25 de la Huerta was made substitute president for the unexpired term by the reassembled Congress. In Sept. Obregon was elected president with only nominal opposition. His inauguration Dec. 1 1920 was attended by large delegations from the United States, but by no one representing the Government though many Latin-American and European diplomats were present. Recognition by the United States was delayed by the non-solution of the petroleum controversy and the general spirit of labour unrest.

The distinguishing features of Obregon's presidency were his efforts to obtain recognition and to carry out the revolutionary programme. The two policies were in direct antagonism at many points. The Association for the Protection of American Rights in Mexico demanded that American vested interests, menaced by the new constitution and subsidiary legislation, be protecte by a special treaty. The demand was grounded on the realisatio that congressional legislation was subject to reversal and tha the decisions of the Supreme Court were more in accordance wit political exigency than with the principles of jurisprudence The Obregon Govt. remained firm in its determination to d everything compatible with national integrity to restore harmonious relations, but refused to enter into the proposed treaty In pursuance of this policy Obregon on July 13 1921 invited th European nations having claims against Mexico to send representatives to a permanent Mexican Claims Commission. Thi invitation was accepted in Nov. by France, Great Britain, Italy Spain and the Netherlands. In Sept. of the same year negotiations were begun with a committee of international banker looking toward a refunding of the national debt.

In June 1921 the U.S. Secretary of State (Hughes) describe the fundamental issue as resting on a construction of the confiscatory enactments, which would declare that recognise American property titles must not be invalidated. The decisio of the Mexican Supreme Court in 1922 that Art. 27 was not to b construed retroactively, paved the way for a presidential decre to the same effect. Secretary Hughes announced an informa commission composed of Charles B. Warren and John B. Payn to confer with Ramon Ross and Fernando Gonzales Roa concerning agreements preliminary to recognition. The conference begun May 14 1923, were facilitated by promulgation, on Apr 26 preceding, of a new petroleum law recognising the validit of concessions made prior to May 1 1917, although it require concessionaires to revalidate their claims within three year Elimination of land difficulties was attempted by legislatio increasing the size of individual holdings exempt from partitio and relieving from expropriation large irrigation companies wit colonisation contracts. But the provision that land expropriate should be paid for in bonds threatened a deadlock. The Mexica position was weak on this point, as the old legislation ha prescribed compensation prior to expropriation.

Despite all difficulties, however, the commission reached final agreement on Aug. 15. By its terms subsoil mineral righ acquired and developed before May 1 1917 were recognised valid, and the provisions of Art. 27 of the Mexican Constitutio it was agreed, should apply only to later acquisitions. Americ properties expropriated by the Mexican Govt. in carrying o its agrarian policy were to be paid for at their equitable valu The U.S. Govt. reserved all rights to which it was entitled und international law in respect of titles acquired by its nationa before May 1917 to properties which were supposed to petroleum yielding but which had not been developed a proved. Provision was also made for a Special Claims Co mission for the settlement of American claims created since 191 and a General Claims Commission for settlement of Americ and Mexican claims since 1868. The conventions calling for the commissions were ratified in Feb. 1924. The special commissi was composed of Ernest B. Perry, Fernando Gonzales Roa a Dr. Rodrigo Octavio of Brazil, and the general commission Nathan L. Miller, Aquiles Elurduy and Dr. Cornelis v Vollenhoven of Holland. The special commission held prelimina meetings in Mexico City in Jan. 1925, but postponed regular s sions until September. Claims must be presented before it with two years from the date of its first meeting, with a possible gra of six months. The general commission held preliminary meeti in Washington in 1924. Claims were admissible before it with one year, with six months' possible grace. Following the agr ment upon these conventions, the United States extended for recognition to Mexico, Aug. 31 1923. France shortly follow suit, Great Britain showing reluctance because of the indefi status of her oil interests.

Papal Delegate Expelled.—The general plan for refunding Mexican debt, agreed upon in Paris in April 1922, was c cluded in New York in May by Secretary of the Treasury Ad de la Huerta and the bankers' committee. Mexican reb headed by Felix Diaz, made unavailing efforts to prevent c summation of the debt agreement. Mexico assumed full obli

ion for all the foreign debt principal, about $500,000,000, for
ome $200,000,000 interest, and for certain internal debts held
utside Mexico. Payments were to begin Jan. 2 1923.

The bandit Villa, who had been bought off by the Provisional
ovt. in 1920, was assassinated in 1923. Another outstanding
ncident of the year was the expulsion of the papal delegate Mgr.
ilippi, who had incurred the displeasure of the Government by
ssisting at the open-air dedication of a shrine at Cubilete
uanajuato. Open-air religious exercises were prohibited by a
tate law, though the dedication took place on private property.
he episode evoked protest from the Vatican and from Catholic
ocieties throughout Mexico and the American continent.

Preliminary manoeuvring in anticipation of the presidential
lection set for July 6 1924 began in 1923. The president is con-
itutionally barred from succeeding himself, and there had been
“ gentlemen's agreement ” by the Sonora triumvirate, de la
uerta, Obregon and Calles, that Calles should succeed Obregon.
evertheless there was decided opposition to this programme in
e Co-operatist party, which had been formed by the triumvir-
te and had a majority in the Chamber of Deputies. On Sept.
4 de la Huerta, possessing wide prestige because of the success
his financial negotiations, resigned from the Cabinet to conduct
campaign on his own behalf. Meanwhile Calles, as the friend
Obregon, was canvassing for the Co-operatist nomination.
his, however, went to de la Huerta, on a programme promising
e extension of Co-operatist ideas in industry, prior indemnifica-
on of landholders for expropriations, and guarantees of munici-
l autonomy. Calles, disappointed at not receiving the Co-
eratist nomination, was put forward by the radical National
grarians, pledged to carry out their programme and protect
e rights of labour. The campaign became exciting when
bregon and the new Minister of Finance, Alberto Pani, accused
la Huerta of extravagance in office and of misrepresentation
ncerning arrangements whereby a bank of issue was to have
en created and a loan secured. Recriminations were mutual.
he de la Huerta faction alleged that Co-operatist adherents in
ongress were menaced with massacre by troops under Gen.
nulfo Gomez. Meantime the state elections, coloured by the
tional campaign, caused numerous frays.

On Dec. 5 the de la Huerta movement resorted to a plan of
mpaign called the *Plano de Vera Cruz*. The military forces of
e States rebelled under the leadership of generals Estrada and
adalupe Sanchez. At least six additional States speedily
ned the movement, the conservative elements, the labourites
d the agrarians generally supporting de la Huerta. Obregon
k the field, conducting a campaign on three fronts. Rebel
ccesses soon showed that the Government was in a precarious
ndition. Its chief weakness was lack of war materials, of which
exico produces none. Application was made to the U.S.
vt. for the purchase of arms, munitions, airplanes and war
ssels. Arms, munitions and airplanes were supplied. President
olidge by proclamation forbade export of arms to the rebels,
d their attempts at blockading and mining ports were in Jan.
25 forbidden under threats of naval action. American as-
tance thus turned the tide. During the closing days of Dec.
vernment forces had retaken Puebla and driven back the
position lines which had been concentrating on the capital.
ring Jan. honours were even, but in Feb. large hostile areas
re retaken by the Government. Several rebel armies dispersed
d their leaders sought refuge in exile.

The direct intervention of the United States was given in
s case because of the recent recognition and a desire to protect
visible agency of the international agreements. The stand
the American Govt. was justified by Secretary Hughes on the
und that it protected constitutional procedure; he added that
must not be held to constitute a precedent, as every instance
intervention must be decided by its individual circumstances.
was in all essential aspects a continuation of the policy initiated
Woodrow Wilson in 1913. The Aguila (British) oil interests
re accused by Obregon of assisting de la Huerta; on the other
d, E. L. Doheny, an American oil prospector, announced
t he had advanced a loan of $5,000,000 to Obregon.

Election of Calles.—In the presidential elections Calles emerged successful. His Conservative opponent, Gen. Angel Flores, who fell ill during the campaign, received relatively few votes. Rumours of his prospective rebellion were not realised. The announced programme of Calles was to obtain for Mexico the economic and social advantages enjoyed by the American people. From the time of the inauguration of Obregon the labour situation had been steadily growing worse, but a firmer attitude toward labour was seen when Calles federalised the railway service, reducing the likelihood of strikes. Recurrent street railway strikes in Mexico City had marked the rule of Obregon; the first of them to occur under the presidency of Calles demonstrated the precarious position of capital under the existing strike legislation.

During the spring of 1925 Calles ruled illegal a strike by the Tampico Federation of Labour Unions, whose members were employed by the Huasteca Petroleum Co., because the difficulty was between unions, not between employers and labour. Firm presidential action prevented a national sympathetic strike. The Union of Bank Clerks in May 1925 made such demands on the banks that they threatened to close their doors. The Labour leader, Luis Morones, refused to support the Union. The Labour party under the leadership of Morones definitely split with the Agrarian party in May because the Labourites declared that the Agrarian programme was injuring not only agriculture but business and industry as well, and hence the labouring people.

Church and State.—The hostility to the Roman Catholic Church became evident with the promulgation of the constitution of 1917. During 1925 a separatist movement by means of an organisation known as the Mexican Apostolic Church was attempted. During March Separatists and Catholics came into conflict in Guadalajara, Aguascalientes and Queretaro. In Mexico City the Separatists seized the church of La Soledad and ejected its priest. Calles declared the act unconstitutional, but closed the church to worship and declared the Catholic parishioners rebels. Foreign priests were debarred, March 19, from preaching in Mexican churches. Numerous churches were closed because of disorders. The constitution provided that ministers practising religion must be of Mexican birth, and limited the parishioners of each to 1,000.

The troubles between church and state were accentuated by events in 1926. On May 15, George Caruana, the papal delegate, was ordered to leave the country, and on July 3, the Government issued a decree to enforce and strengthen the orders against the clericals. Heavy penalties were specified for any infringement of the regulations. Many Roman Catholics declared their intention to resist and Pope Pius XI. declared Aug. 1 1926 as a day of prayer for intervention in Mexican affairs.

Conditions on the American border, never satisfactory, grew worse after the passage of the law limiting immigration into the United States. In May 1925 a treaty was negotiated covering smuggling of drugs and aliens, migration, deportation, hunting, fishing, and health problems. The terms facilitated the disposal of American undesirables who had infested the Mexican side of the boundary. The treaty controlled also the movement of labourers into the United States. It was estimated that 500,000 Mexicans entered California in 1924.

Public interest was aroused in June by the declaration of Secretary of State Kellogg, made public through the Press, that conditions in Mexico were not entirely satisfactory, and that the United States would support the Government of Mexico only so long as it protected American lives and rights and complied with its international obligations. The statement referred to seizures of American property at the unreasonable demand of Labourites, and was felt in some quarters to have been inspired by friends of Calles himself in order to strengthen his hand against the demands of his radical supporters. The unusual character of this announcement called to public attention the existence of a new treaty between Japan and Mexico which permits settlement of Japanese from California on the west Mexican coast, and concedes special status to Japanese vessels in Mexican waters. It also accentuated the fact that American diplomatic protests concerning land seizures had met with scant attention.

On Aug. 28 1925 relations with Great Britain, severed because of difficulties culminating in the assassination near Puebla of Mrs. Rosalie Evans, were resumed and accredited representatives were exchanged.

Defence.—Military service in the active army or in the National Guard is compulsory. The normal strength of the army has been settled at 50,000. A school for the training of aviators has been established and progress has been made towards organising an air force. The five gunboats, which comprised the Mexican navy, have been reinforced by the addition of a small coastal defence boat bought in 1924.

Education.—Government education in Mexico is compulsory and secular. In 1923 there were 14,231 primary schools with 1,187,407 pupils. A number of private schools conducted by religious societies of the Roman Catholic Church were obliged to close in 1926. In 1925 the National University in Mexico City, which was refounded in 1910, had a student body of more than 6,000. The expenditure on education in 1923 was $24,500,000.

II. ECONOMIC AND FINANCIAL HISTORY

Finance.—On July 1 1922 the public debt of 1,056,973,713 pesos (1 gold peso = $0.4985) included 583,280,887 pesos of pre-revolutionary debt and 473,692,826 pesos of post-revolutionary debt. Revenues and expenditures 1921–5 were, in pesos:—

	Revenues	Expenditures
1925	145,000,000[1]	143,199,686[1]
1924	289,959,500[1]	(2)
1923	278,110,300[1]	347,006,719[1]
1922	277,567,019	267,137,468
1921	279,832,932	258,312,774

[1] Estimated.

[2] No estimates of 1924 expenditures were published. The Federal Govt. derives its largest income, outside of petroleum production and mining, from import duties: second in importance is the stamp tax: and third, taxes collected in the Federal district and territories. The income tax was introduced in 1924 in face of marked and widespread opposition.

Production and Industry.—Mexico possesses 30,027,500 ac. of cultivated lands well suited for agriculture. The agrarian reforms, begun in 1915, whereby lands of large estates have been expropriated are responsible for a noticeable decrease in agricultural production. In April 1925 President Calles reaffirmed his campaign pronouncements on the agrarian and labour problems, asserting that land distribution would be continued legally, but that it must not move in advance of means of development. In Aug. 1925 it was announced that one-third of the Government's land division programme had been fulfilled. It was estimated that since 1915, 12,000,000 ac. had been given to small farmers. The grazing lands of the republic are estimated at 120,444,200 ac.; and forest lands at 43,933,200 acres. Estimates of chief crops of 1924 were: corn (maize), 106,293,000 bu.; wheat, 13,962,000 bu.; raw cane sugar, 186,964 short tons; cotton, 138,000 bales (of 478 lb. net). Other important crops are beans, coffee, tobacco and henequen. The census of 1923 showed livestock as follows: horses, 512,336 valued at $20,455,109; mules, 300,960, valued at $18,713,476; cattle, 2,363,427, valued at $95,622,494; sheep, 1,196,098, valued at $5,777,605; goats, 2,106,044, valued at $7,714,330. The decrease in livestock since the enumeration of 1902 was 60%.

Petroleum.—A new petroleum law, published July 20 1925, was pending before Congress during September. It had received presidential sanction as adequately interpretative of Art. 27 of the constitution. It gives the chief executive sole and complete authority to concede and regulate rights to explore for and exploit oil-fields; it confirms leases and concessions as well as titles perfected, if dated prior to May 1 1917. The petroleum industry is defined as a public utility, and the principle is reasserted that the nation exercises direct and permanent ownership of the subsoil.

The total production of petroleum from 1901–23 inclusive was 1,055,257,562 barrels valued at $828,241,710. The peak of production, attained in 1921, was 193,397,587 barrels, about 28% of the world production and worth $182,936,817. In 1922 ther were produced 182,278,457 barrels, about 21% of the worl production, worth $167,397,872; in 1923, 149,529,088 barre worth $142,916,885, 14·7% of the world production; in 192 139,587,000 barrels, 13·8% of the world total. In 1923 Mexica production was second to that of the United States. Som 15,000 ac. were under exploitation. In May 1925 it was est mated that foreign investments in petroleum concerns totalle $350,000,000. Consistent progress was made in the exploitatio of the petroleum-bearing areas, which are known to be mor widely distributed than the present development would indicat During the first 10 months of 1924, 247 new producing wells wer brought in with an initial daily production of over 800,000 ba rels. At the end of Oct. 1924 there were 1,016 producing well their initial daily production running more than 3,344,00 barrels. Most of the producing wells were in the Panuco field From Jan. 1 to March 25 1925 new wells numbered 74; the maximum daily production was 364,367 barrels, exceeding th amount produced by new wells during the first three months 1924, which was 218,596 barrels. In March 1925 the petroleu companies agreed to an added tax of one cent per gallon on ga olene the proceeds from which, estimated at 8,000 pesos daily, a being applied to road construction.

Production of light and heavy crude oils for the first six month of 1925, totalling 65,369,987 barrels showed a decrease of 8,911 376 barrels from the corresponding period in 1924. All the lo was in heavy crude oil, the light crude oil showing an increas of 2,145,172 barrels. Continued salt-water intrusion in the Totec holding of the Mexican Seaboard diminished their productio in 1925; salt water also reduced production in the Cacalila fields.

Mining.—There was marked resumption of mineral productio in 1918 and 1919. Practically all the established mining com panies operated continuously during 1924, some of them extend ing mining and milling facilities so as to increase production an improve metallurgical recoveries. Prospecting and developmen work increased, notably in Chihuahua, Sonora and Zacateca The de la Huerta revolt did not seriously interfere with th operation of established mines. Taxation continued upon th 1923 basis, being so high that the average mine paid as much i taxes as it produced in net profit. Freight rates were approx mately 50% higher than those of 10 years earlier. Labou conditions were chaotic because of numerous State laws, an caused much misunderstanding between companies and em ployees. These conditions discouraged new mining investment but good prices for lead and silver offset them, and earnings fo 1924 were good. Productions of the chief minerals for 1922– was (in kgm.):—

	1924	1923	1922
Gold	24,647	24,162	23,276
Silver	2,844,104	2,824,599	2,521,832
Copper	49,113,194	53,371,482	26,977,786
Lead	164,140,130	155,720,342	110,455,912
Zinc	18,936,336	18,481,271	6,141,937

Antimony, tin, tungsten and arsenic are produced in conside able quantities. For the first time in several years quicksilve was exported in June 1925; there was promise of continuou increase. The movement was of 600 kilos shipped from Tampic and produced by a cinnabar mine in Zacatecas. Numerous filing of claims in Chihuahua for gold and silver locations, reopening old workings in the Santa Barbara district of that State, and th development of electrical power in Durango for mine operation indicated in 1926 that mining prospects continued good, in spit of the political unrest.

Commerce and Industry.—Notwithstanding political an economic difficulties, trade showed gratifying stability. Mexic sold to the United States in the first 10 months of 1924 product to the value of $167,087,305, or 19·2% over the figures for 192 and bought from the same source goods worth $135,076,703, a increase of the same percentage. Increased production of lea copper and silver, with greater shipment of vegetables to Amer can winter markets, permitted purchase of larger quantities of utomotive vehicles, agricultural implements, mining machinery nd railway equipment.

For the year ending June 30 1913 Mexican imports were 95,857,000, and exports $149,752,000. For 1921 they were espectively $178,775,221 and $203,273,450. Imports from the Jnited States in 1921 were 74·6% of the total, and exports to he United States 88·3%. In 1923 Mexican exports of all classes vere: animal products, $2,019,486; vegetable products, $32,782,-61; minerals except petroleum, $80,213,217; petroleum $237,-13,698; miscellaneous, $2,109,872. Petroleum constituted 67% f the total exports. Minerals reached 22·5%, constituting with etroleum 89·5% of the 1923 exports. Agricultural exports to he United States were 14% of the trade with that country, etroleum 38% and other mineral products 45%. Canadian xports to Mexico were in 1920, $410,825; in 1921, $1,086,197; n 1922, $1,197,597, and in 1923, $3,291,098, and in the year nding March 31 1925, $2,856,409. Imports from Great Britain, igh in 1920 and 1921, dropped to pre-War level in 1922–3. The novement of trade has been steadily away from the Gulf ports owards towns on the American border, which in 1923 handled ver 42% of the volume. There were 108 mills operating, em-loying 38,232 hands. The annual production of boots and shoes vas over 700,000 pairs. In 1923, 235 sugar-mills produced 121,000 netric tons.

Labour.—Conditions in labour have been disturbed since the volution began. Strikes and financial losses have been as llows:—

	No. of Strikes	No. of Strikers	Financial Loss	
			To Employers	To Employees
1922	197	63,000	$4,134,680	$2,983,610
1923	146	54,396	3,694,324	1,479,055
1924	138	29,244	4,627,385	1,805,191

abour troubles at Vera Cruz caused the chambers of commerce transfer their business to Tampico in Nov. 1924. In March 25 a federation of land and sea workers, comprising 17 Vera uz unions affiliated with the Mexican Federation of Labour, ve up political activities and agreed not to strike without deration approval.

Communications.—In the de la Huerta revolt the railways in bel hands were badly depleted in stock. In March 1924 an icial report of the ownership of railways showed that the ational Railways (51% of whose stock is held by the Govern-ent) had 13,205 km.; Government railways, 517 km.; private es 7,529 kilometres. The total in operation was 21,251 km. 13,197 miles. The Mexican Railway, a British concern, has m. between Mexico City and Vera Cruz; it was in Government nds from 1916–20. The Tepic-La Quemada line of the Southern cific was completed April 1926. It connects Mexico City with gales. During 1925, 45,000 men were employed on the 100 m. the road, 17 tunnels having been constructed before June. e new wireless station erected on the Island of Lobis, near the ast of Tampico, affords facilities to the petroleum companies to nmunicate with ships at sea. There are wireless stations at exico City, Tampico, Vera Cruz and on the Pacific Coast at azatlan.

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(H. I. P.)

MEXICO CITY, capital and metropolis of the Republic of Mexico (*see* 18.344), had a population of 615,367 at the census of 1920 (271,956 males and 343,411 females) of whom 23,668 were foreign-born; estimate for 1924, 880,000. Between 1910 and 1925 several new residential suburbs (*colonias*) were created, which grew rapidly by the cutting up of adjacent estates (*haciendas*) into building lots; many squat buildings of colonial days in the business districts were replaced by sky-scrapers; new streets were cut; dirty squares were transformed into neat flower-decked plazas and the magnificent National Theatre begun in 1900 was partially completed, 12,000,000 pesos having been expended on it up to 1922. The Legislative Palace, however, was still unfinished in 1925, and was about to be torn down instead of completed. In 1923 the area of the city was about 15 sq. m., divided into eight sections (*cuarteles* or *demarcaciones*), and sub-divided further into about a thousand squares (*manzanas*). There were over 200 m. of tramways, and the tram service, furnished by an English company and managed by English and Canadians, was efficient. At different times the official names of many streets were changed, either to commemorate recent events and heroes, or in the interest of convenience; *e.g.*, all the streets in one section received names of trees and flowers, in another names of foreign cities, so that the character of the name of the street would give a general idea of its location.

Industry and Commerce.—Manufacturing, still relatively unimportant, was represented in 1925 by some 215 establishments, with an annual output valued at 10,000,000 pesos, and employing about 10,000 workers, most of whom were Indians and half-breeds (*mestizos*). The leading products were tiles, cigars and cigarettes, textiles, drugs and chemicals, oils and extracts, shoes and other articles of clothing, various articles of food, beer and other beverages, furniture, iron and steel, mosaics and jewelry. Of greater importance were trade and finance. In Mexico City are the headquarters of most of the business carried on in the country, and it is the principal distributing centre of the republic. Deposits in the banks on Oct. 31 1923 (64,278,894 pesos) were 53% of the total for the country. About 30% of all the imports into the republic are received in the capital. The annual sales of the commercial establishments of all kinds were estimated in 1925 at over 250,000,000 pesos. The textile industry was largely in French hands; hardware, cutlery, chemicals and drugs, in German hands; the oil and mining interests were chiefly English and American; banking, predominantly Canadian; retail trade, predominantly Spanish; but both banking and trade were shared by French, Spanish and Americans, and by 1925 there was a successful National Bank of Mexico. The National Railways of Mexico were returned to private management on Jan. 14 1926, under the so-called Pani-Lamont agreement.

Social Conditions.—An increasing number of automobiles, higher wages, and a decreasing number of bare feet, indicated some advance in prosperity; and a brighter outlook for public health was given by President Calles's firm support of clinics, dispensaries and similar improvements. But the general standard of living of the population was still very low; beggars were exceedingly numerous and very importunate; business was "nervous"; and foreign capital was not available in the amounts needed. The organisation of labour advanced rapidly after the foundation in 1918 of the *Confederacion Regional Obrera Mexicana* (usually referred to as "CROM") by L. N. Merones, an electrician, who became Secretary of Industry and Commerce in the Calles Administration. In the demonstration of May 1 1925, in Mexico City, 93 unions, with 100,000 members, took part.

By 1925 collective bargaining was the rule, and it was claimed that "CROM" had effected an increase in the average weekly wage from 50 centavos to 3 pesos.

Education, etc.—By the constitution of 1917 elementary education was made free, compulsory to the age of 15, and secular, but pending the provision of enough secular schools many of the old schools under religious auspices continued to function. The national university, which had been suspended for half a century, from the time of Maximilian, was re-opened in 1910. A summer school was established in 1922, designed especially to attract foreign students for the study of Spanish. The World War increased the interest of Mexicans in reading, and as a result several new periodicals, of a superior quality, were established in the city, which had the first printing press in the new world and the first regularly issued newspaper. Mexico City was the scene of riots during the revolutionary disturbances of 1910 and 1911. On June 7 1911, the day on which Madero made his triumphant entry into the city, there was a severe earthquake, which cost many lives. In Sept. 1921 the centennial of Mexican independence was celebrated with great pomp.

MEYER, EDUARD (1855–), German historian, was born at Hamburg Jan. 25 1855. He was educated at Bonn and Leipzig, where in 1879 he qualified in ancient history. He afterwards became professor of ancient history at Breslau (1885), Halle (1889) and Berlin (1902). Meyer realised the great importance of folklore, historical monuments and numismatics as aids to the study of ancient history, and the value of his original methods in treating the subject was recognised by the universities of Oxford, St. Andrews and Freiburg from which he received honorary degrees.

Meyer's principal works are: *Geschichte des alten Aegypten* (1887); *Forschungen zur alten Geschichte* (1892–9); *Wirtschaftliche Entwicklung des Altertums* (1895); *Die Entstehung des Judentums* (1896); *Zur Theorie und Methodik der Geschichte* (1902); *Geschichte des Altertums* (3rd. ed. 1909); *Caesars Monarchie und das Principat des Pompeius* (2nd ed. 1919); *Preussen und Athen* (1919); *Ursprung und Anfänge des Christentums* (3 vol. 1921–3).

MEYER, MARIE PAUL HYACINTHE (1840–1917), French philologist (*see* 18.349), died at St. Mandé, near Paris, Sept. 8 1917.

MEYERHOLD, VSEVOLOD EMILIEVICH (1873–), Russian theatrical producer, was born in Moscow and from 1898–1905 was well known as one of the most distinguished actors of the Moscow Art Theatre. He then began to produce plays, adopting a new convention in opposition to the "true-to-life" ideas of Stanislavsky, in which the actor and the stage setting presented a complete harmony. After the Revolution he carried these methods to an extreme, using no curtain and a bare stage with purely formal scenery. He managed the Revolutionary Theatre, Moscow, and also acquired a theatre of his own, and in both produced political propaganda plays. His views are set forth in his book, *The Theatre* (St. Petersburg, 1913).

MEYNELL, ALICE (1849–1922), British poetess. By her marriage in 1877 Alice Thompson became Alice Meynell. She had the fortune to find herself in that mid-Victorian era which still held freshly to its heritage from Keats and Shelley, from Wordsworth and Coleridge. It felt its heart torn by the griefs of the Brontës, stirred by their glories; and almost clung to the hand of Elizabeth Browning. Eagerly awaiting every recurring sign of Tennyson's fertility, it yet respected the long pause of Patmore; and took for its own the volumes of Dante and Christina Rosetti, warm from the press. With these two women of song, Elizabeth and Christina, Alice Meynell's name is now commonly tripled. But it was not they who moulded her thought or her expression. Her aloof independence was proof against all precedents; and of her prose it may be noted that, notwithstanding her love for Lamb and Landor, only the American, James Russell Lowell, is mentioned by her as in any way her master in style. She was her very own spiritual and intellectual self as both woman and writer. That was the secret of the singleness of her personal influence while she lived, and secures an enduring freshness and originality in the work she bequeathed.

Mistress Anne Killigrew had been told by Dryden "thy fathe was transfused into thy blood." That girls alike with boys inherit from fathers as from mothers, was the theme of a vers where Alice Meynell, after the desolations of the European War gave the comforting signal:—

> The crippled world! Come, then,
> Fathers of women with your honour in trust,
> Approve, accept, know them daughters of men,
> Now that your sons are dust.

Her own father, having left Cambridge and unsuccessfull contested two costly elections for Parliament as a free trade became very much a citizen of the world. After his marriag with Christiana Jane Weller, a beautiful and accomplished gi to whom her adoring friend Charles Dickens fitly introduce him, he made his home much in Italy, devoting himself to th liberal learning of the two daughters: Elizabeth, the elde afterwards Lady Butler, famous as a war painter; and Alic who early began to put her rhymed thoughts shyly upon pape Despite the affectionate appreciativeness that ruled her hom (usually an English one) her composition remained mostly he own secret until an American friend, to whom they were confided, encouraged her to show, and then print, them.

The volume of *Preludes* was issued (for the girl wh an association) by Tennyson's then publisher, Mr. Henry King, on the word of his "reader"—later his successor—M C. Kegan Paul, who, not trusting his own judgment all the wa read some of them aloud to George Eliot, receiving her decidi approbation. The critics were mostly silent; and even tho who praised hesitated. But the volume made its own quiet wa Ruskin in all ways first in his soaring praises: "The last verse that perfectly heavenly 'Letter of a Girl to her own Old Age,' th whole of 'San Lorenzo's Mother,' and the end of the 'Sonnet to Daisy,' are the finest things I have yet seen or felt in mode verse." Rossetti, too, spread the news of the young poet advent, reciting "Renouncement" by heart to his friends, an saying that it was "one of the three finest sonnets ever writte by women." Browning, having read a brief quotation buried a halting press appreciation, "conceived the desire to read th rest for myself," and found its beauty "even beyond what th indifference of the reviewer should have prepared me for. The volume brought her many a friend—and more. For th reviewer in *The Pall Mall Gazette*—a paper to which she w later to be a conspicuous contributer—quoted the sonnet "M Heart shall be thy Garden," and found for it a reader whom reached revealingly. A consequent introduction to the sonnete by a common friend was followed by a marriage that fulfilled f him Crashaw's "heaven-on-earth" for 45 years.

On Mrs. Wilfred Meynell, as she then (1877) became, fell long silence as a poet. The muse does not ordinarily leave car on the happily and busily married; the domesticities and th "sweet sense of providing" are not the fashioners of tho "sweetest songs" that breed from "saddest thoughts Eight children were born, one of whom died in infancy: a gri that put into poetry the dread reminder that the giver of life also the giver of death: "and she who slays is she who bears, w bears." A like sensitiveness to life's cruelties put her, for all h reticence, on political platforms, and marched her in multit dinous processions, in favour of the granting of votes to wom and the opening of long closed professional doors. Compassi was the companion of all her walks abroad, for the over-burden man and animal; for the beggar-woman to whom she cried wi her gift, in Portuguese fashion, "Have patience, little saint"; f the underfed in London slums which she at one time sedulous visited; and for the beast in the shambles, in shame for who martyrdom she refused to eat meat until, after persuasion, s sought by more impersonal methods to further laggard reform

Her married life matured her vigilance as a mistress of pros In W. E. Henley of *The Scots Observer* and *The National Observ* she encountered an editor who heartened her by his boisterou welcomes: "That woman's taking her place at the steeri wheel" was one of his recorded acclaims. Later, in *The P Mall Gazette* of Harry Cust's editorship, she was accorded weekly column which left her a large range in the choice of subjects. George Meredith, reading here her “princely journalism,” sought with her an acquaintance that soon became a “dearest friendship.” In a magazine—those were still the days of the magazines—he spoke of her words as having the “living tremor in them,” just as he had before said that Carinthia's had the “throb beneath them.” Of her essays, he wrote: “The surprise coming on us from their combined grace of manner and sanity of thought is like one's dream of what the recognition of a new truth would be. They leave a sense of stilled singing on the mind they fill. The writing is limpid in its depths.”

Coventry Patmore, too, her yet warmer admirer, published, when Tennyson died, his unavailing plea for her succession to the laureateship. Her close friendship for such seniors coincided with that for her contemporaries, and for her juniors, chief among whom was Francis Thompson, who addressed to her his exquisite sequence of poems *Love in Dian's Lap*, of which, Patmore said, Beatrice or Laura might have been proud. Of the homage paid to her, another chosen friend, J. L. Garvin, has well said: “Alice Meynell was in herself a person of her age, ure, as I think, of perpetual remembrance, even if half a dozen of her shining contemporaries had not competed in vain to spoil her with praise. It was what no one could do: recognition only made her humble.” And these contemporary praises otwithstanding, G. K. Chesterton predicts: “She was deserved-y famous; but I will venture to prophesy that her fullest fame is yet to come. The whole modern world must immeasurably nlarge itself before it comes near the measure of her mind.” he died in London on Nov. 27 1922.

Alice Meynell's *Preludes* (1875), long out of print, re-appeared n a volume of *Poems* (1893) including new ones; and these, ogether with yet later verses separately issued as *A Father of Women* (1917) and *Last Poems* (1923), are all assembled in the omplete volume of *Poems* (1923) now in circulation. Of her rose, several small volumes of essays in the eighteen-nineties—*The Rhythm of Life* (1893), *The Colour of Life* (1896) and *The pirit of Place* (1899)—were followed by *Ceres' Runaway* (1909), y *Hearts of Controversy* (1917), by *The Second Person Singular* 1921) and finally by the standard volume of selected *Essays* 1914)—the selection being her own. Other books were *John Ruskin* (1900), *The Children of the Old Masters* (1903), *Mary, e Mother of Jesus* (1912) and *London Impressions* (1898). Two anthologies give her choice among poems—*The Flower of e Mind* (1897) and *The School of Poetry* (1923), the first in-uding Notes and the second Commentaries. She prefaced ditions of *The Sonnets from the Portuguese* and Christina ossetti's *Poems* (1910), as well as a decade of volumes “The Red Letter Library”; she introduced in 1903 a volume of eproductions of Sargent's Portraits; and she made for English aders a Selection from the Poems of J. B. Tabb (1906).

Bibliography.—Reference may also be made to the critical hapters concerning her in Alfred Noyes' *Some Aspects of Modern oetry* (1924); in John Drinkwater's *The Muse in Council* (1925), nd in Katherine Brégy's *The Poets' Chantry* (1912); as well as to ch notable articles appearing at the time of her death as J. L. arvin's in *The Observer*, J. C. Squire's in *The London Mercury* and . K. Chesterton's in *The Dublin Review;* articles that quickened e desire for the authorised biography now (1926) in preparation.

(W. Me.)

MIAMI, Fla., U.S.A. (*see* 18.354), in the centre of the 200-m. rip of the “East Coast” which is dotted with winter resorts, as a focus of the rush to Florida which began about 1922. he population in 1910 was 4,571; in 1920, 29,571; in 1925, cording to the state census, it was 69,754. In Sept., after nexations of territory, it was estimated at 100,000 within e corporate limits, and at 150,000 within six miles of the urt-house. Between 1914 and 1924 bank deposits increased er 3,000%; post-office receipts and property valuation each er 600%; the value of buildings for which permits were issued, er 2,500%, and the total of such permits for 1924 was doubled the first eight months of 1925.

At the opening of the winter of 1925–6 all kinds of shelter ere at a premium, and tent colonies sprang up until they presented a serious sanitary problem. For the moment, speculation in land was the leading occupation (a third of the members of the Chamber of Commerce were dealers in real estate), but there were solid foundations for future prosperity. Though later in 1926, the value of land fell to some extent. The Federal Govt. had begun work on harbour improvements. Draining of the Everglades by the state was opening to agricultural settlers thousands of acres of rich swamp land, forty-five varied industrial plants were already in existence, and a sugar-mill and refinery were in operation 16 m. out on the Miami canal.

Miami Beach, across Biscayne Bay, one of the most luxurious winter playgrounds of the country, was a mangrove swamp in 1910. Coral Gables, a separately incorporated residential suburb adjoining Miami on the south, was developed in Spanish and Moorish architecture with six miles of Venetian waterways. This was created in a few years by the magic of immense investments of capital, modern engineering and far-sighted planning including a tract for the University of Miami, chartered April 5 1925 which had in view an endowment of $15,000,000.

MICA (*see* 18.355).—The three main contributors to the world's supply in order of importance are the United States, India and Canada. After the outbreak of the War the stoppage of the mica imports to Germany had a depressing effect on the mica industry; but, on the other hand, the large amount of mica required for munition purposes, gas-masks, etc., caused both the Allies and the United States to import increasing quantities of sheet mica from Argentina and Brazil. In the United States the mica mined is mainly muscovite, occurring as irregular masses, sheets and lenses in pegmatite veins traversing metamorphic rocks. The principal producing states are North Carolina and New Hampshire, but Virginia, South Dakota, Georgia, Alabama, Idaho and Colorado also produce considerable amounts.

The chief mining centres in India are the great Bihar mica belt, about 60 m. by 12 m., traversing the Menghyr, Hazaribagh and Gaya districts in the province of Bihar and Orissa; and the Nellore district in the Madras Presidency. Less important areas occur in Ajmer Merwara in Rajputana. The Canadian mica is almost entirely phlogopite. The deposits occur chiefly in Quebec to the north of Hull, and in the townships of North Burgess and Loughborough in Ontario.

The World's production figures in long tons for 1913, 1918 and 1923 were as follows:—

	1913	1918	1923
India (exports)	3,124	2,998	3,948
Canada	986	667	2,331
Other U.K. countries	118	51	127
United States (chiefly sales)	5,511	2,780	8,112
Madagascar	6	4	162
Argentina (exports)	6	169	100
Other foreign countries	10	190[1]	587[2]

[1] Including Brazil 112 tons.

[2] Including Japan 424 long tons.

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(N. M. Pe.)

MICHELSEN, PETER CHRISTIAN HERSLEB KJERSCHOW (1857–1925), Norwegian statesman, was born at Bergen March 15 1857, the son of a prominent merchant and shipowner. After completing a university education in 1879, Michelsen settled in Bergen as a lawyer and at the same time entered the shipping business in which he achieved considerable success. Known as an administrator, he entered the city council of Bergen and later the Storting where he took his seat in 1891 and quickly became one of the most prominent members. In 1894 he withdrew from politics, returned to Bergen, resumed his activity as a shipowner and re-entered the city council of which he became the chairman. The general elections in 1903 by which he returned to the Storting as a member for the country district outside Bergen initiated the crowning period in Michelsen's public career. Appointed Prime Minister in the spring of 1905 Michelsen played a leading part in the events which resulted in the dissolution of the union with Sweden and the establishment of the new kingdom of Norway. In 1907 he definitely retired from politics and died near Bergen June 29 1925.

MICHELSON, ALBERT ABRAHAM (1852–   ), American physicist, was born in Strelno, Germany, Dec. 19 1852. His parents moved to San Francisco, Cal., where he studied in the public schools. He graduated from the U.S. Naval Academy in 1873, and was instructor in physics and chemistry there during 1875–9. He was then for a short time in the *Nautical Almanac* office. From 1880 to 1882 he studied in Berlin, Heidelberg and Paris. He resigned from the navy in 1881. In 1883 he was appointed professor of physics at the Case school of applied science, Cleveland, O., and six years later accepted a similar position at Clark University. In 1892 he was appointed professor and head of the department of physics at the University of Chicago. He early directed his researches to the velocity of light, and while in Cleveland invented his interferometer (*see* 14.693), which enabled him to measure distances by means of the length of light-waves. His researches enabled him to revise and improve upon the achievements of Fizeau in respect of the velocity of light. He perfected the methods for experimenting, and determined the rate at which light travels, with an error not exceeding $\frac{1}{10}$ of 1% of the quantity measured. Through one of his experiments it was demonstrated that the speed of light is the absolute superior limit of the rate at which matter can move, because the mass of a body depends upon its velocity —mass diminishing as velocity increases—and a body would vanish completely if it exceeded the velocity of light.

Michelson measured a metre in terms of the wave-length of cadmium light for the Paris Bureau Internationale des Poids et Mésures. The consequence is that the metre bar, hitherto carefully safeguarded in Paris, can easily be replaced, since its length is known in terms of an absolute unit. In 1892 he was a member of the Bureau Internationale des Poids et Mésures and in 1897 of the International Committee of Weights and Measures. He was made president of the American Physical Society in 1901 and of the American Society for the Advancement of Science in 1910. He received medals and prizes from many learned societies, and in 1907 was awarded the Nobel Prize for physics. During the World War he rejoined the naval service and devoted his entire time to new devices for naval use. His range-finder was adopted as part of the U.S. Navy equipment. In 1920 he was able to demonstrate by means of light-interference that the diameter of Alpha Orionis was 260,000,000 miles. This was the first computation ever made of the size of a star. He was the author of *Velocity of Light* (1902); *Light Waves and Their Uses* (1903), and numerous papers contributed to scientific journals. In 1921 he was awarded the gold medal of the Society of Arts, London. (For the "Michelson-Morley experiment" in interference of light, with its bearing on the Einstein theory, *see* RELATIVITY.)

MICHIGAN (*see* 18.371).—The population of Michigan in 1920 was 3,668,412, an increase of 30·5% over 1910. The estimated population as of July 1 1926 was 4,395,651. Of the total population in 1920, 1,670,447 were of native parentage; 1,204,545 of foreign or mixed parentage; 726,635 were foreign-born and 60,082 were negroes. The following cities in 1920 had 50,000 inhabitants or over: Detroit (993,678); Flint (91,599); Grand Rapids (137,634); Lansing (57,327); and Saginaw (61,903). A special census of Detroit on May 31 1925 gave its population as 1,242,044 on that date.

Education.—In 1920 there were in the state 1,048,390 persons of school age, of whom 710,341 (67·8%) were attending school. The illiteracy rate was 3% in 1920 as against 3·3% in 1910. In many of the public schools vocational courses were added in recent years. At the institutions of higher education, attendance greatly increased. Some of the colleges with church connections shared in this growth; but the chief enlargement was at the University of Michigan (*see* MICHIGAN, UNIVERSITY OF) and the Michigan Agricultural College. To add to the facilities for higher education, "junior colleges" with curricula covering two years of college work, were established in Detroit, Grand Rapids, Muskegon, Pontiac and Highland Park, in connection with their secondary school systems.

Agriculture.—In 1925 there were 192,334 farms in Michigan, a decrease of 14,626 as compared with 1910. During the 15 years all farm land decreased from 18,940,614 ac. to 18,036,700. During the same period the average acreage per farm increased from 91·5 to 93·8. The average value of land and buildings per ac. in 1925 was $71.41. In 1925 a total of 9,671,670 ac. was under cultivation, on which crops valued at $268,674,000 were raised. The farming area of Michigan continues to be concentrated mainly in the southern part of the lower peninsula of the state. In the upper peninsula, farms comprise less than 10% of the land area. The area nominally in woodland, including farm woodlots as well as forests and cut-over lands, comprises nearly two-thirds of the state; but of this area not more than about 5,000,000 ac., nine-tenths of which lies in the upper peninsula, now bears timber worth cutting. Most of the rest has come to be stump lands, on which the recurrence of fires prevents any spontaneous reforestation. The barrenness of the sandy soil and the shortness of the growing season have hindered the reduction of land to cultivation, and some 10,000,000 ac. (more than one-fourth o the total surface of the state) are thus a deforested desert Several thousand acres of it revert to the state each year i default of taxes. These reverted tracts, comprising 566,850 ac in 1918, are administered by the Public Domain Commission (created in 1915) with a view to the sale of such as can be used a agricultural homesteads and to the setting aside of the rest a forest reserves. These forest reserves (648,000 ac. in 1923) ar under state forest management for the prevention of fires and fo systematic reforestation.

Minerals.—In mineral production no new resources of importance were developed during the period 1910–25. Th mining of iron-ore continued vigorously, that produced in 192 amounting to 14,069,938 tons. The production of copper wa pushed to the fullest capacity during the World War; but th severe decline of the market after the Armistice caused a sharp reduction of output. The amount of copper produced in 1923 wa 138,304,680 pounds.

Manufactures.—The manufactured products in 1923 wer valued at $3,870,434,000, as compared with $685,109,000 i 1909, an increase of nearly 465%. This advance was mainly du to the extraordinary growth of the automobile industry and it concentration in the state. The value of automobiles manufactured increased from $7,996,534 in 1904 to $96,651,451 in 1909 and to $1,551,990,000 in 1923. In more recent years this industry has continued its rapid expansion. It is estimated tha more than two-thirds of the automobiles manufactured in th United States are made in Michigan. The number of wage-earners engaged in the making of automobiles and their parts i 1914 was 67,538, constituting 24·9% of the total number o wage-earners in the state; these were increased to 149,296 i 1923, their proportion to the whole being 29·6%. Foundries an machine shops with an average number of 34,080 wage-earner in 1923 produced products to the value of $165,736,521. Furniture ranked next, with 20,665 wage-earners and products value at $93,039,416. Other industries, including logging and sawmi operations, engines and water-wheels, paper and wood pul substantially increased. Michigan led all other states in output of chemicals, drugs, engines, threshing-machines, furniture and efrigerators.

Finance.—In 1923 the assessed value of property in Michigan was $5,929,615,241, on which the state levied $25,880,702 in axes ($6.58 *per capita*). In the same year the funded and loating debt of the state amounted to $70,613,011, with a net lebt of $65,655,186, or $16.69 *per capita.* Appropriations by the Legislature, $5,929,306 in 1909, advanced steadily to $9,610,553 n 1915, and then much more rapidly, standing at $28,302,639 or 1926–7. The volume of the general property tax, which omprised nearly all the state's revenue, lagged behind the ppropriations at the close of the decade 1910–20, and the rospect of a treasury deficit in 1921 caused the passage of a law or a tax on corporation franchises as an emergency recourse. n 1921 accounting and purchasing were centralised under the tate Administrative Board. The result of these measures was hat a deficit of approximately $6,000,000 in 1921 was replaced y a surplus on July 1 1925 of $2,292,411.

Legislation and Administration.—Amendments added to the evised constitution of 1908 provided for popular initiative and eferendum on constitutional amendments and in legislation 1913); for the recall of elected officials (1915); for prohibition 1916); for woman suffrage (adopted in 1917 after having been uccessively rejected in 1912 and 1913), and for the issue of state onds to the amount of $50,000,000 for the improvement of ighways (1917). The provisions for initiative, referendum nd recall have as yet found little utilisation, but the issue of ighway bonds facilitated a marked improvement in roads. n increase of the licence charges on automobiles has also in- eased the road funds, the application of which is largely deter- ined by an Act of the Legislature (1915) establishing a system of ate trunk roads. A further increase of road funds resulted from acing in 1924 a tax of two cents per gallon on gasolene. This elded a substantial sum.

Among other noteworthy enactments by the Legislature are the idicature Act of 1915, consolidating and revising the laws of vil practice and procedure; the "blue-sky" law of 1913 and e creation of the Michigan Securities Commission in 1915 to gulate the sale of securities; the provision for juvenile courts 911); the creation of a Board of Mediation and Conciliation to al with labour disputes (1915); a Dept. of State Police (1919); budget commission (1919); and a state Administrative Board, nsisting of all the elective state officials (1921). This board was trusted with a general supervisory control over the functions d activities of the administrative departments, each of which, reorganised and consolidated, continued to operate separately th an appointive official at its head. The preparation of the dget and matters of state expenditure were placed directly der the control of the board. Michigan ratified the Eighteenth rohibition) Federal Amendment Jan. 2 1919.

Political History.—Since 1910 there generally have been ge Republican majorities in state and national elections, with- t appreciable representation of any other parties in the state gislature. In the presidential election of 1912, however, ichigan gave its electoral vote to the Progressive ticket, and in 12 and 1914 it elected a Democrat as governor and in 1923 cted the same man to the U.S. Senate. The governors of ichigan, 1911–25, were: Chase S. Osborn (Rep.), 1911–3; oodbridge N. Ferris (Dem.) 1913–7; Albert E. Sleeper (Rep.), 17–21; Alexander J. Groesbeck (Rep.), 1921–5 and 1925– . a conspicuous contest in 1918 Truman H. Newberry (Rep.), s elected to the U.S. Senate by a narrow majority over nry Ford (Dem.). Charges of excessive expenditures in this npaign were brought against Senator Newberry and numerous ociates, and they were convicted in the U.S. District Court 20) and were sentenced to two years' imprisonment. The S. Supreme Court set aside the conviction May 2 1921; on . 12 1922 the U.S. Senate decided by a vote of 46 to 41 that wberry was entitled to his seat. In the ensuing senatorial ction, however, he was decisively defeated at the polls, whereon he resigned the seat. (U. B. P.)

MICHIGAN, UNIVERSITY OF (*see* 18.378), has continued the promise of its earlier period as the first conspicuously successful state university. The faculty increased from 350 in 1907–8 to 797 in 1925–6, while the student enrolment grew from 5,013 to 12,312 (6,010 in the college of literature, science and the arts; 1,716 in the colleges of engineering and architecture; 536 in the medical school; 541 in the law school; 85 in the college of pharmacy; 358 in the college of dental surgery; 483 in the school of education; 23 in the school of business administration; 758 in the graduate school; 190 in the training school for nurses; and 3,147 in the summer session). On July 1 1925 there were 36,500 living graduates.

Among the buildings erected between 1910 and 1925 were Hill auditorium (1913) bequeathed to the university by Regent Arthur Hill, of Saginaw, seating 5,000 persons; the Natural Science building (1916); the university library (1919), containing approximately 400,000 vols.; the Michigan Union (1919), a student club-house, costing $1,250,000, the gift of students and alumni; the engineering laboratories (1923); the Wm. L. Clements Library of American History (1923), containing one of the three largest collections of Americana in the United States, the gift of Regent Wm. L. Clements, of Bay City; the Yost Field House (1923); James Burrill Angell Hall (1924); the Lawyers club and dormitories (1924), the gift of W. W. Cook, of New York; the physics building (1924); the university high school (1924); the medical building (1925); the university hospital (1925), accommodating 700 patients. Four dormitories for women students were also erected during this period as well as a home for nurses, the gift of Senator James Couzens, of Detroit. A new building for the College of Architecture is in course of construction and a new museum will be built in 1927. A stadium, seating 70,000, will also be completed in 1927.

The income of the university in 1925 was $12,465,160. Of this amount $3,000,000 was derived from the state from the ⅝ mill tax; $2,683,855 was appropriated by the State of Michigan for buildings, and $1,240,889 was received from student fees. Over 12,000 graduates and students of the university were enlisted in the U.S. Forces during the World War. Of these, 237 lost their lives.

Upon his resignation in 1909, President James Burrill Angell was succeeded by Harry Burns Hutchins, dean of the Law School. President Hutchins resigned in 1920 and was succeeded by Marion Leroy Burton, who had been president of Smith College (1910–7) and of the University of Minnesota (1917–20). Upon his death in 1925, Clarence Cook Little, formely president of the University of Maine (1922–5) was inaugurated sixth president of the university.

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(W. B. S.*)

MICROBE: *see* FILTER-PASSING MICROBES.

MICROPHONE.—The term microphone, originally used by Hughes to describe a loose contact device extremely sensitive to vibration, has been generalised to mean any piece of apparatus for converting rapid vibrational energy into electrical energy with similar vibrational characteristics. A number of such devices are now known; some are of scientific interest only, others are used very extensively in industry.

Microphones Proper.—A loose contact between any two conductors is microphonic—that is to say, when subjected to vibration there is no sharp definition between completely open circuit and completely closed circuit. In between these two states there is a condition where varying pressure alters the resistance, and if one or both of the substances making contact are subject to vibratory pressure, the vibration is reproduced as a varying current. The characteristic between pressure and current is only linear over small limits.

The action at the point of contact is not exactly known. When the current passing through the contact while in the microphonic condition is examined it is found not to be absolutely constant, and this lack of constancy makes itself evident as a hiss in a telephone receiver. The discharge through a vacuum valve has a very similar sound when amplified.

The change of resistance with pressure varies greatly with materials used. Carbon in one form or another is universally recognised as the best material, in that the transitory stage between open and closed circuit is more marked than with other materials. This does not mean, however, that it gives the greatest change of resistance for a given change of pressure. A contact between gold electrodes by delicate adjustment can be put in a sensitive condition, and in the adjustment gives greater changes than carbon for the same change of pressure. A considerable amplification can be obtained with microphonic contacts, the output vibratory electrical energy being many times that of the input mechanical energy.

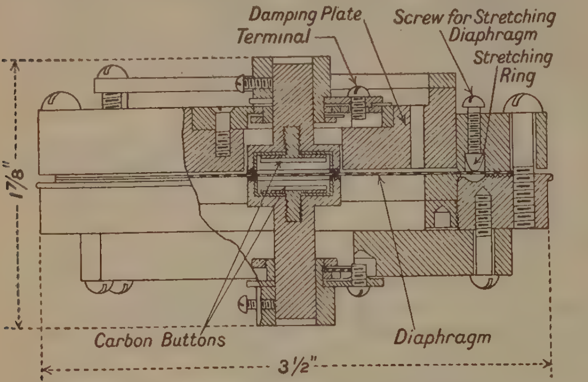
Damping Plate
Terminal
Screw for Stretching Diaphragm
Stretching Ring
1 7/8"
Carbon Buttons
Diaphragm
3 1/2"

FIG. 1.—Western Electric carbon Microphone.

To Edison, Berliner, Hughes and many others we owe the introduction of the contact microphone and its development as a practical device, and microphones to translate noises and music have been produced in many forms. The inventive drift has been towards multiple contacts, and practically all contact microphones are now formed of prepared anthracite granules, the sound pressure being applied in various ways, usually by means of a diaphragm. In later years a more accurate study of the response of microphones to sound pressure has been made, and two modern forms in which the response is practically independent of frequency have been made.

In the first form, the Western Electric carbon microphone (fig. 1), a diaphragm of duraluminium is stretched to a natural period well above the frequency it is required to reproduce. A type of air damping is applied to the diaphragm, and it is allowed to rest on carbon granules. The resulting currents are practically independent of frequency. In a second form, known as the Reisz microphone (fig. 2), a diaphragm is practically dispensed with, and a layer of carbon granules is laid on a heavy non-conducting block such as marble, being held in position by some materia such as silk or thin rubber. The current response is obtaine at right angles to the direction of application of pressure.

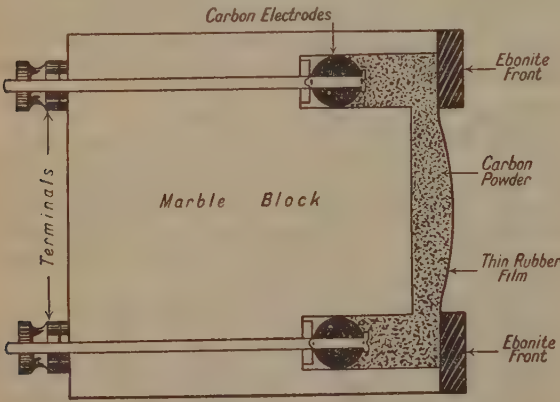
Carbon Electrodes
Ebonite Front
Carbon Powder
Terminals
Marble Block
Thin Rubber Film
Ebonite Front

FIG. 2.—Diagram of the Reisz Microphone.

The carbon granule-air system of a thickness of about 2 mm forms a system of a very high natural period in depth, als damped by the natural friction of the carbon. The resultin response is similar to that of the stretched diaphragm type d scribed in the last paragraph. Lowering the period of the dia phragm or thickening up the layer of carbon granules in thes two types has similar results. These high quality microphone are not sensitive and have to be used with a valve amplifie In commercial telephony this amplification is not usually pe missible, at least to such an extent, so that it is usual greatl to increase the sensitiveness by forgoing some of the accurac of response.

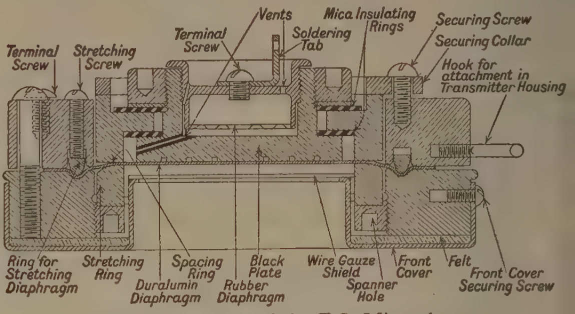
Terminal Screw
Stretching Screw
Terminal Screw
Vents
Soldering Tab
Mica Insulating Rings
Securing Screw
Securing Collar
Hook for attachment in Transmitter Housing
Ring for Stretching Diaphragm
Stretching Ring
Spacing Ring
Duralumin Diaphragm
Black Plate
Rubber Diaphragm
Wire Gauze Shield
Spanner Hole
Front Cover
Felt
Front Cover Securing Screw

FIG. 3.—Diagram of the E.S. Microphone.

Fortunately the human voice can be considerably distorte without lack of intelligibility, and by giving the diaphragm the microphone a natural period in the middle of the importa frequency ranges (about 800 cycles) amplifiers can be dispense with owing to the increased response; music, however, cannot b reproduced with anything like fidelity. These microphones a also used well outside their range of linear response. Granu microphones all suffer to some extent from "packing"—that is, tendency for the carbon to set itself in a hard contact conditio where change of resistance with pressure is least, and much tim has been spent in an attempt to overcome this difficulty. Th commercial solid back microphone is one of the best forms, bu occasional shaking is still necessary.

Other Response Devices.—The best known of non-contact d vices is the E.S. microphone, developed into an instrument precision by the Western Electric Co. Ltd. (fig. 3). Here th same principle is used as in the carbon microphone. A hig natural period diaphragm, air damped, forms one plate of condenser, the other being a solid insulated metal piece spac a few mils from the diaphragm. The chief use of this instrume is for measurement and for broadcasting. The amplificatio required is large. Various magnetic microphones have be

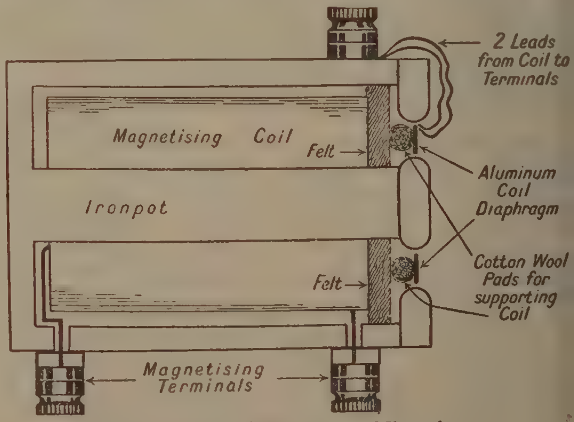
2 Leads from Coil to Terminals
Magnetising Coil
Felt
Ironpot
Aluminum Coil Diaphragm
Felt
Cotton Wool Pads for supporting Coil
Magnetising Terminals

FIG. 4.—Diagram of the Sykes Microphone.

nstructed; in fact, the first Bell microphone was practically e present receiver. The response with frequency is, however, complex curve, although it is more linear with amplitude than contact device. Moving coil devices have been produced by kes, Siemens-Halske, etc., the later forms of instrument being nstructed so that the moving coil is the diaphragm.

In the Sykes microphone (fig. 4) an annular ring of aluminium l or wire is suspended in a magnetic field, and the response sufficiently large to enable the method to be used for broadsting. The law of response with frequency, although not arly so correct as the electrostatic instrument, can largely corrected for in the amplifier.

Thermal Devices.—Hot metal wires have been used for microone purposes. The response is, however, small except for very v frequencies, which property has been used by Tucker for n-ranging usually in connection with a resonance chamber.

Gas Discharge Devices.—Dr. Thomas, of the Westinghouse ectric Co., and others have investigated the use of point disarges, but these devices have not come into general use. A me carrying a current is sensitive to sound, but the effect is small for practical purposes. The piezo electric effect has o been used, but not with much success, except for very high quency work. See H. M. Dowsett, *Wireless Telephony l Broadcasting* (1923). (H. J. R.)

MICROSCOPY (*see* 18.392).—The modern microscope is entially a working tool used in every form of scientific and ustrial research. Specialised applications have led to the lution of instruments designed for robust usage as factory pliances, and at the other end of the scale we have the new e of biological research microscope initiated by Mr. J. E. rnard, F.R.S., F.R.M.S., and manufactured by Beck. In h types there is a marked tendency to forsake the older table form of stand used in normal laboratory practice and ke use of a massive optical bench or lathe bed type of stand. s gives enormously increased rigidity, and freedom from ration, enables the accessory lighting and condenser systems to permanently adapted to the optical axis of the instrument, permits quick change from visual observation to photograph ording without disturbance of adjustments.

Denne Microscope.—In the microscope designed by Mr. M. T. nne, F.R.M.S., for photomicrography, the whole system of minant, condenser, filter, substage condenser, stage and ective are all mounted on a triangular optical bench. This in n is carried on a carriageway or lathe bed on which it is free nove. No conventional coarse or fine adjustment is fitted to microscope, and the place of the body is taken by a camera. coarse and fine focusing are operated by crank handles ring screw rods in the bed. These control handles are situated he focusing screen end of the camera. For visual observation whole optical system is brought up to the camera, which is scoped, the focusing screen is swung to one side and an eyee is inserted in its place. The complete apparatus is mounted a wheeled pedestal carriage, and the operator manipulates whole from a chair at the focusing screen end of the bench.

ptical Problems.—In biology research has been directed to nding the limits of microscopic resolution by the use of ochromatic light of short wave-length. The limit of resolu—that is to say, the power to see a body composed of two as two separate dots in ordinary white light—is reached standard apparatus, when the distance separating the two is reduced to half a wave-length of ordinary light (say 0·2 Bodies far smaller than this can still be perceived as vague s of light, but the eye cannot distinguish form or structure. re is in theory no limit to the smallness of a body which can nade visible, provided that enough light falls upon it, but image we see of it is simply a series of diffraction disks, and give us no further information than that something is there. duction in the length of the wave-length of light employed be looked on as increasing the separation between the two ts in a body. Thus an object easily visible, but just too small e resolved, by ordinary light with a proportion of the long rays in it, may be resolved and seen by monochromatic light from the blue end of the spectrum. As we pass toward the violet end we find that the eye is not sensitive to the violet, and that both distinct vision and accurate focusing become increasingly difficult. This band of light is, however, suitable for photography, and, although visual observation may be imperfect, photographs taken with this light reveal unseen detail and structure (*see* PHOTOGRAPHY).

In 1904 Dr. Köhler of Jena experimented with the use of ultraviolet light. This band of light is of very short wave-length—275μμ—and possesses great resolution, but is invisible. He employed an optical system of quartz lenses, as glass stops these rays, and projected the image on a fluorescent screen where it could be examined with a glass eye lens and focused for photography.

Ultra-violet Ray Illumination.—In Great Britain the use of ultra-violet ray illumination has been applied by Mr. J. E. Barnard, F.R.S., and the technique simplified and developed. In the Barnard instrument quartz lenses, slide and coverglass are used, but in place of the older method of focusing on a fluorescent screen the object is first focused visually by means of a special form of dark ground illumination.

Dark ground illumination is entirely different from the normal illumination by transmitted light, in that the object is illuminated solely by rays of light so oblique that they cannot enter the objective of the microscope. The only light which enters is that reflected or scattered by the object itself. Objects viewed in this manner appear self-luminous against a dark background, and extremely tenuous and transparent material which would display no structure and be almost invisible when examined by transmitted light reveals material detail. Mr. Barnard's method was to focus the object first by means of visual examination against the dark ground. This focusing was necessarily crude, as the smallness of the objects only allowed them to be seen as disks of diffusion, not as distinct objects. It then becomes necessary to adjust the focus for photography with transmitted ultra-violet light. To effect this, the fine adjustment screw of the microscope is fitted with a disk head graduated in wave-lengths. Visual focus having been determined in light of known wave-length, rotation of the graduated head to the degree indicated for light of any other wave-length automatically adjusts the focus. The eyepiece is replaced by a camera body and dark slide. The dark ground illuminator is so contrived that it can be instantaneously changed over to a direct light condenser without disturbance of adjustment, and the lighting arrangement is arranged so that a beam of ultra-violet light of 275μμ from a cadmium arc can be directed into the optical axis. The photograph taken of the objects indistinctly discerned shows them in actual form and with considerable detail.

Special Difficulties.—Many difficulties have had to be met in this new technique. Bacteria are killed by exposure to ultraviolet rays, and search has had to be made for bands in the invisible spectrum whose effect is not immediately lethal. The most important published results to date are those connected with filter-passing organisms associated with cancer research (*q.v.*) by Dr. Gye, but the normal application of the apparatus may find fuller scope in the exploration of the structure of known bacteria of larger size. These are usually only visible under dark ground illumination when alive, and in order to render them visible for examination by transmitted light they are stained with aniline dyes. Staining kills the bacteria and alters structure. With ultra-violet light methods it becomes possible to examine the structure of living bacteria, for the different elements composing the cell present different degrees of absorption or transparency to the rays, and are as well differentiated on the negative as stained preparations (*see* BACTERIOLOGY).

The standardised model of the Barnard microscope will be approved and available as a commercial product for scientific workers. In the meantime experimental work is being done on the utilisation of even shorter wave-lengths in the Schumann region of the far ultra-violet. These rays have little penetrative capacity through air, and apparatus is being constructed to work in vacuum which may lead to a still further advance in our means of photographically investigating minute structure beyond our present human range of vision with the best of microscopes.

Use in Applied Science.—The extension of microscopic resolution by the use of light of short wave-length and quartz optical systems has not yet found application in other than biological research. The tendency is, however, to apply high power examination to crystal structure in metallurgy, and branches of research dealing with opaque material which cannot be examined by transmitted light. Modern design has endeavoured to simplify the problems of the illumination of metallurgical and similar specimens. Devices embodying a parabolic mirror surrounding and integral with the ordinary objective have proved to be too cumbersome and heavy to be satisfactory in practice. In the same way the claims for the nominal "super microscope" devices, which consist of a primary low power microscope coupled to a second microscope of lower power whose function is to magnify the image given by the first system, have not received general endorsement. The results have been in accordance with optical theory, and have not yielded any increase of resolution. For the observation of incandescent bodies or micrometric measurements at a distance, an achromatic lens of short focus carried in a tube fitting the substage is useful. It acts as a short range telescope, producing an image in its focal plane which can be examined by a low power objective of the microscope, with satisfactory magnification, and gives a convenient depth of focus useful in the examination of large objects with uneven surfaces.

Use in Metallurgy.—For routine metallurgical work the inverted microscope with duplicate tubes for simultaneous visual and photographic work has largely superseded the older types of instrument. With the inverted microscope the specimen of metal is viewed from beneath. Light from an arc or "Pointolite" lamp is led into a vertical illuminating system beneath the objective and projected on to the specimen. The principle is the same as in simpler metallurgical microscopes, but in the newer type a very wide variation of illumination method is possible. Plain glass reflectors, silvered circles, half circles or strips or even parabolic mirrors can be used in the vertical illumination system of the inverted type of microscope. In addition to this convenient command of illumination, the focusing system has only to carry the weight of the objective and is relieved of the conventional tube. This enables a very fine and precise adjustment of focus to be simply obtained. The change from visual observation to the camera is attained by pushing an intercepting prism out of the optical axis of the apparatus.

Use in Engineering Work.—As the microscope is increasingly used as a purely workshop tool in mechanical engineering practice, there has been a demand for simple robust devices consisting of a low power objective and an eyepiece with a simple scale or graticule in its focal plane. These tools have a linear magnification of ×16 or ×20, and enable the tool maker and mechanic to achieve a very high standard of precision. In general, no focusing device is provided for the simpler types, the instrument simply being placed on the flat surface under examination. More complex devices are available for the study of fine screw threads, and the more elaborate types of workshop microscope are fitted with an electrical vertical illuminating device in permanent adjustment. In general these simplified tools may be looked on as precision measuring devices rather than instruments for microscopic investigation. The use of the high power microscope for the examination of the microstructure of metal has led to a realisation of the basic fact that the mechanical properties of metals and alloys, such factors as hardness, ductility and tenacity, are inter-related with the microstructure. The microscope alone does not afford an explanation of many of these properties, but when microscopical examination is used in conjunction with equally accurate chemical and thermal analyses, the behaviour of individual constituents can be determined and information of the greatest possible value has already been gained.

Other Industries.—In the textile industries the microscope is used from the first to the last stages. It is the weapon of the economic botanist studying the insect and fungus pests which attack the plants furnishing the raw material, and it is used by the dye chemist studying the ultimate detail of the decoration of t finished product. Each industry evolves its own particul detail of technique, but, in general, the normal research does n involve special apparatus and the conventional microscope co mon to all laboratories serves.

Colloid Chemistry.—The research chemist who deals wi colloids, a subject of increasing importance, has to meet probler concerning suspensions of ultra-microscopic particles. For th the apparatus known as the ultra-microscope is used. In th the power of resolution is neglected and the design is to ma visible rather than to define extremely small ultra-microscop particles. The ultra-microscope is essentially a dark-grou illuminating device, employing an intense illumination syste and using magnifications up to ×1500, and the particles are se as diffusion disks. The simplest form is the Siedentopf "Ca dioid" condenser, which is a paraboloid dark ground illuminat applicable to the ordinary microscope substage.

It is, however, used with special quartz slides, as the intensi of the illumination is so high that glass fluoresces and destro the darkness of the background. In order to estimate the quan ty of particles present in a given volume, the quartz slides us with the cardioid condenser are similar to those used in t haemacytometer. A central table surrounded by a groove ground down to a lower level than the surface of the slide, that a known depth of liquid can be enclosed between cover a slide.

A more precise form of ultra-microscope is the Siedentop Zgismondy slit ultra-microscope, in which a beam of light fro an arc is passed through a condenser and focused on an adjustab slit, similar to that used in a spectrometer. The image of the s is reduced to a quarter size by a second condenser, and focus by an independent microscope objective on a small quartz wi dowed tank containing the liquid under examination. As t length and breadth of the slit can be adjusted and the reducti is known, the volume of the illuminated portion of the liqu under observation can be accurately estimated. The area of t illuminated zone observed is controlled by an eyepiece stop, a it is possible to count the number of particles in a known volu of solution. If a larger known volume of the solution is evaporat and the residue weighed, the total mass of particles can calculated and the mass and, if its density is known, the volu of a single particle is estimated.

The limitations of the ultra-microscope are those of the fractive index of the objects observed. Cellulose, starch a other low refracting bodies can only be observed in relative large particles, but metallic colloidal solutions of high refracti index have given extremely favourable results. Colloidal g particles as small as $1{\cdot}7 \times 10^{-7}$ cm. in diameter can be observ as separate entities.

Modern Apparatus.—These more recent types of resear apparatus, the ultra-violet ray microscope, the inverted met lurgical microscope, and the ultra-microscope, are specialis instruments and will not supersede the standard instrume for ordinary work. The design of the latter may be looked on stabilised, and no great advance has been made. The modific tions introduced in practice are those of detail and convenie rather than material alteration of type. The increasing use microphotography as a recording device has made the narro bodied microscope of Continental design relatively obsole The best modern instruments have body tubes of two inc or more in diameter.

Improvements in binocular microscopes have now reache point where binocular eyepiecing can be used with the high powers and oil immersion objectives. The advantages of t binocular system are a stereoscopic effect and a great relief fro ocular fatigue. In the past, the old-fashioned Wenham pri type binocular was the only satisfactory system, and it was o applicable to very low powers and to the old "long tube" sta Attempts to adapt a binocular prism system to the higher pow were not successful, and various shortcomings such as unequ light distribution in the tubes have hitherto proved insuperab The new eyepiece systems have now been adopted by the leadi ritish and American makers and have proved satisfactory in ractice. Monocular and binocular bodies are detachable and terchangeable on the same stands. Eyepiece focusing for disarity of vision between the eyes and interocular width adjustent are provided for.

As a result of research, and in a measure as the outcome of artime needs, Great Britain is producing the highest grades of ptical glasses according to tests carried out by the National hysical Laboratory. This mastery of material (*see* OPTICAL LASS) has reacted on the microscope manufacturers, and British icroscope objectives are being adopted for the most critical search work.

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(H. B. C. P.)

MIDDLESBROUGH, England (*see* 18.412), with an area of 4,159 res, had a population of 131,070 in 1921. The town was given eparate court of quarter sessions in 1910. The efforts of the rporation to deal with the housing shortage have been notable: addition to 1,283 houses contracted for, of which 877 were ished in 1925, two large buildings were converted into flats, and umber of hutments were erected at Marske-by-the-Sea for the commodation of Middlesbrough families. The corporation rchased the omnibus and tramways undertakings in 1921. rton, an estate of 136 acres, was presented for use as a public k in 1924. The sum of £40,000 was given by Mr. J. Constane for a technical college in 1916, but, owing to the War and rise in costs, the work could not be proceeded with until a ther £40,000 was given by his widow and family. The Constane Technical College was under construction in 1925. Docks for all vessels and a landing stage were being built in 1926, and area prepared for extensions of the docks.

IIDLETON, WILLIAM ST. JOHN FREMANTLE BRODRICK, EARL OF (1856–), British politician (*see* 18.419), did not nain long out of Parliament after his defeat in the general ction of 1906, as in the following year his father died, and he ered the House of Lords as 9th Viscount. He took a considere share in the work of that House, and played an active part ind the scenes in Conservative politics, without returning to ce. He had meanwhile become especially prominent as leader he southern Unionists of Ireland, in virtue of his position as a downer in County Cork. In the Irish Convention of 1917–8 and a band of Southern Unionists separated themselves from Ulster standpoint and expressed a readiness to concede a tary Home Rule Government for Ireland, subject to provisions safeguarding the minority of loyalists. At the beginning of o he was created an earl.

IIGRATION (*see* 18.427).—The general characteristics of the vement of population between 1909 and 1924 were:—

ince the opening of the 20th century most states had begun to t a positive control in questions of migration; its enormous ease made state regulation of overseas migration unavoidable.

Vith the improvement of communications, many migrants have ntention of settling permanently and becoming naturalised over-. The annual figures of repatriation from the United States e frequently amounted to more than half of those of immigration. s is no longer due solely to the difference between conditions of g in the countries of emigration and immigration; rather, and ncreasing degree, to the more or less conscious efforts of the ntries of emigration to preserve their nationals' love of their es, or those of the countries of immigration to assimilate the elements. The countries of emigration encourage, as far as pos-, temporary migration, to which, however, even before the War countries of immigration raised economic and social objections. uring and after the War, in addition, national and political ts of view began to influence migration policy decisively. In the ntries of immigration, especially the United States, legislation rning selection became more stringent, and later a numerical was imposed on immigrants. The European states were no er able to divert their surplus population overseas so copiously efore; even in the case of racially kindred nations, or the British governing Dominions. These Dominions too, under the pressure conomic depression, seek to retard immigration.

Migration has diminished, since the supply of emigrants does not tally with the demand in respect of nature and quality (race, sex and age).

The one-sided interference with immigration by the opposing groups of states results in social conflicts within those states and friction between their respective governments.

A peculiar characteristic of recent years is the increasing importance of continental migration within Europe. The social problems arising in the countries concerned are regulated in many cases by inter-state treaties (Migration Treaties, properly so-called, going beyond the International Labour Agreements) and if possible international agreement. This is the only way to avert dangers which threaten peace, and to further the social policy of the world in positive fashion.

The immediate problem is that of successfully settling Europe's surplus urban industrial population in the colonial agricultural areas of overseas countries; the lasting and general world problem is, however, how peoples of different habits and different standards of living and of radically different race (white and coloured), may be distributed evenly over the earth without endangering the peace and progress of mankind.

It is no longer enough to treat immigration purely as a demographic phenomenon occasioned by the decision of those immediately concerned. In order to understand the causes and effects of this phenomenon it is necessary to include in our survey the national and international measures which have been taken in the interests of the community.

I. PROGRESS OF STATISTICS

As early as the first International Labour Conference in Washington in 1919 the International Labour organization (I.L.O.) created under the treaty of Versailles passed various "recommendations" dealing with equal treatment of alien labourers and with collective recruitment of foreign workers, and appointed an international emigration commission, which produced a systematic programme of action at its session in Geneva in 1921. The 4th International Labour Conference of 1922 adopted a "recommendation" relating to the collection and improvement by the I.L.O. of statistical and other information on migration. In addition to current monthly publications of the most important data, the I.L.O. issued in 1925 a first annual report on the statistics of 60 countries and territories, *Migration Movements 1920–1923* (Geneva, 1925). This report embodies the results of exact and uniform statistical inquiries and provides an international co-ordination of statistics. The numbers and details of the migrants (sex, age, profession, nationality, country of last and future permanent residence) have been classified for the first time, in eight homogeneous groups: (1) oversea emigration of nationals, (2) continental emigration of nationals, (3) oversea immigration of nationals (repatriation I.), (4) continental immigration of nationals (repatriation II.), (5) oversea emigration of aliens (generally returning to their country of origin), (6) continental emigration of aliens (generally returning to their country of origin), (7) oversea immigration of aliens, and (8) continental immigration of aliens.

In giving these figures the report explains the very frequent variations in the method of compiling them, and definition of the "migrant" and also draws attention to the gaps and deficiencies of international comparisons. Migration movements during the periods 1909–1913–1914 had a transitional character, but those during the periods 1915–9 and 1920–4 can be illustrated comparatively. The tables on p. 908 show the overseas emigration and immigration (repatriation I.) of nationals in the chief European countries and the overseas immigration and emigration (repatriation II.) of aliens in certain countries of the world.

II. CHARACTER OF MIGRATION MOVEMENTS

Overseas migration has perceptibly declined since the War.

As regards the European countries of emigration the annual average (before the War 1,349,251 and 669,574 after the War), so far as proper statistics are available has decreased by 50·38%. In the countries composing the former Austro-Hungarian monarchy emigration has sunk to 70·4% of its pre-War figures: emigration from Italy 58·8%, emigration from Finland, 56·8%, and Portugal, 51·6% is less than ⅔ of what it was; the percentages for Great Britain are 43·6, for Spain 39·6, for Sweden 38·3, for Norway 34·7, for Belgium 31·6, and for Denmark 29·5%. Emigration has increased

TABLE I. *Overseas Emigration of European Nationals*

(With Repatriation Figures for Great Britain and Ireland, Italy and Spain)

Years	Austria-Hungary	Belgium	Denmark	Finland	Germany	Great Britain and Ireland		Italy		Netherlands	Norway	Portugal	Spain	Sweden		Switz erlan
	Emigration	Emigration	Emigration	Emigration	Emigration	Emigration	Repatriation	Emigration	Repatriation	Emigration	Emigration	Emigration	Emigration	Emigration	Repatriation	Emi gra- tion
1909	259,145	3,650	6,782	19,144	24,921	288,761	149,068[2]	399,282	134,210	2,939	16,152	38,146	111,058	18,894	4,988	4,91
1910	258,816	5,580	8,890	19,007	25,531	397,848	164,139	402,779	161,148	3,220	18,912	39,457	160,936	24,647	4,735	5,17
1911	165,522	4,586	8,303	9,372	22,690	454,527	192,718	262,779	218,998	2,638	12,477	59,399	139,683	16,770	4,558	5,51
1912	251,743	4,402	8,636	10,724	18,545	326,959[2]	59,681[4]	403,306	182,990	2,155	9,105	88,592	194,443	14,689	5,181	5,87
1913	313,621	7,590	8,846	20,057	25,843	389,394	85,709	559,566	188,978	2,330	9,876	77,227	151,000	17,224	4,917	6,19
Average 1909–13	249,769	5,162	8,291	15,661	23,506	371,498	130,263	405,542	177,265	2,656	13,304	60,564	151,424	18,445	4,876	5,53
1914	73,067[1]	..	6,203	6,474	11,803	214,393	104,462	233,214	219,178	2,174	8,522	29,806	66,596	10,006	4,864	3,86
1915	..	..	3,302	4,041	528	76,911	92,388	66,517	167,925	1,074	4,572	22,848	50,359	4,672	3,223	1,97
1916	..	..	4,265	5,325	326	52,926	57,931	74,140	39,039	911	5,212	14,957	62,247	7,488	3,159	1,46
1917	..	..	1,614	2,773	9	10,004	12,254	13,013	16,885	867	2,518	..	43,051	2,571	2,478	65
1918	..	..	793	1,900	..	10,621	8,772	4,010	9,025	1,160	1,226	..	20,168	1,498	1,630	30
1919	..	1,967	3,341	1,085	3,223	146,935	93,023	105,833	89,833	2,439	2,432	21,614	69,472	4,008	3,573	3,06
Average 1914–9	..	328	3,253	3,600	2,635	85,381	61,471	82,788	90,314	1,437	4,080	14,871	51,982	5,040	3,154	1,88
1920	60,303	9,384	6,300	5,595	9,194	285,102	86,055	211,227	78,498	5,978	5,581	46,410	150,566	7,093	5,601	9,27
1921	76,031	2,200	5,309	3,557	24,135	199,477	71,367	194,320	92,212	3,286	4,627	17,915	62,479	5,881	4,605	7,12
1922	72,119	927	4,094	5,715	36,527	174,096	68,026	121,410	54,282	2,158	6,456	29,037	64,119	8,985	3,237	5,78
1923	75,717	2,256	7,601	13,835	115,416	269,680[3]	58,143	177,853	39,680	5,648	18,287	30,792	93,246	26,559	2,433	8,00
1924	41,131	2,922	6,319	5,429	58,637	174,451	68,614	130,779	60,676	3,366	8,492	22,279	86,920	8,401	2,539	4,14
Average 1920–4	65,061	3,538	5,925	6,826	48,498	220,561	70,041	167,118	65,070	4,087	8,689	29,287	91,466	11,384	3,683	6,86

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[1] Hungary only.

[2] The figures for the years 1909 11 refer to British passages: the figures after 1912 are for true British emigrants.

[3] Including the figures for the Irish Free State (13,396 in 1923).

[4] The figures for the year 1912 refer only to the last nine months (April to December).

TABLE II. *Overseas Immigration into Certain States*

(With Figures of Repatriation of Immigrants [Emigration] in Certain Cases)

Years	United States		Canada	Brazil	Argentine		Australia		New Zealand		South Africa		Cuba	Mexi
	Immigration	Emigration	Immigration	Immigration	Immigration	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration	Emigration	Immigration	Imm gratio
1909	683,594	195,035	93,285	84,090	231,084	94,644	83,609	54,676	38,650	33,931	..	..	31,286	..
1910	966,324	167,879	178,489	86,751	289,640	97,854	95,692	58,145	35,769	32,361	..	..	37,764	..
1911	801,868	245,830	219,260	133,575	225,772	120,709	141,909	72,609	41,389	37,189	..	..	38,053	16,93
1912	758,944	299,151	255,661	177,887	323,403	120,260	166,958	83,217	44,660	35,733	..	..	38,296	19,83
1913	1,112,164	260,218	303,087	190,333	302,047	156,829	141,906	87,131	44,588	30,369	14,251	..	43,507	17,80
Average 1909–13	864,579	233,623	209,956	134,527	274,389	118,059	126,015	71,156	41,011	33,917	2,850	..	37,781	18,19
1914	1,117,727	269,796	85,010	79,232	115,321	178,684	110,701	..	37,646	32,506	9,047	..	25,911	6,18
1915	232,145	180,198	11,600	30,333	45,290	111,459	70,436	..	25,551	22,476	5,158	..	32,795	4,29
1916	178,850	113,521	13,985	31,245	32,990	73,348	59,140	..	21,799	21,163	3,846	..	55,121	6,47
1917	172,135	46,471	7,760	30,277	18,064	50,995	53,036	..	15,649	13,869	2,079	..	57,097	9,42
1918	59,642	41,900	16,987	19,793	13,701	24,075	33,018	..	11,906	11,660	3,644	..	37,321	5,23
1919	53,532	94,796	67,680	36,027	41,299	42,279	59,980	..	20,931	19,877	9.038	..	80,488	8,43
Average 1914–9	302,338	124,447	33,837	37,818	44,444	80,140	64,385	..	66,647	20,258	5,352	..	48,122	6,67
1920	287,615	274,041	98,636	69,042	87,032	57,187	85,237	77,012	44,062	32,924	22,095	9,846	174,221	12,39
1921	702,153	236,557	67,840	58,476	98,086	44,638	80,316	63,105	41,882	28,559	20,933	13,476	58,948	19,76
1922	243,195	187,947	46,690	65,007	129,263	45,993	92,054	55,490	35,233	28,389	13,235	12,675	25,993	15,95
1923	342,140	76,015	117,013	84,549	195,063	46,810	92,859	55,319	36,488	29,668	11,641	12,666	75,461	19,82
1924	416,870	72,262	108,122	96,052	159,939	46,105	103,667	59,918	39,815	30,593	16,409	13,445	85,288	..
Average 1920–4	398,395	169,364	87,660	74,625	133,677	48,147	90,827	62,169	39,496	30,027	16,863	12,422	83,962	16,98

since the War by 107·5 % in Germany, 53·9 % in the Netherlands, 24·1 % in Switzerland. Thus the proportion supplied by each country to the total of emigrants has altered. Before the War the proportion of the total overseas emigration from different European countries was: Italy 30·05 %, the United Kingdom 28·86 %, Austria-Hungary 18·51 %, Spain 11·22 %, Portugal 4·48 %, Germany 1·74 %, Sweden 1·36 %, Finland 1·16 %, Norway 0·98 %, Denmark 0·61 %, Switzerland 0·41 %, Belgium 0·38 %, Holland 0·19 %. It now runs: United Kingdom 32·94 %, Italy 24·95 %, Spain 13·66 %, territory of the former Austro-Hungarian Monarchy 9·71 %, Germany 7·29 %, Portugal 4·37 %, Sweden 1·7 %, Norway 1·30 %, Switzerland 1·03 %, Finland 1·02 %, Denmark 0·88 %, the Netherlands 0·60 %, Belgium 0·53 %.

The statistics of immigration show the annual average immigration as falling from 1,720,703 in 1909–13 to 942,711 in 1920–4, five years after it, a decrease of 45·21 % falling to 46·1 % of pre-War figures in the U.S.A., 41·75 % in Canada, 40·76 % in Argentina, 55·47 % in Brazil, 87·50 % in Australia, while the figures for Mexico (6·6 %) and New Zealand (3·69 %) remained practically unchanged, immigration into Cuba rose by 122·29 % and into South Africa by 18·33 %. Formerly the United States took the largest proportion of mmigrants with 50·25 % of the total, Argentina had 15·5 %, Canada 12·20 %, Brazil 7·82 %, Australia 7·33 %, New Zealand 2·38 %, Cuba 2·20 %, Mexico 1·06 %, South Africa 0·83 %. Now the list runs: U.S.A. 42·26 %, Argentina 14·20 %, Australia 9·63 %, Canada 9·30 %, Cuba 8·91 %, Brazil 7·82 %, New Zealand 4·19 %; Mexico 1·80 %, South Africa 1·79 %.

Differences of direction (nationality of immigrants and country of ast and of future residence) are even greater than those of the total volume. This is shown by the following table for the U.S.A., which s still the most important country of immigration:

Immigration of aliens into the United States by principal countries of origin, 1913–4, 1920–1 and 1922–3.

Countries of origin	Numbers of immigrants admitted			Per cent of total		
	1913–4	1920–1	1922–3	1913–4	1920–1	1922–3
Northern and western Europe . .	164,133	138,551	156,429	13·4	17·2	29·9
Southern and eastern Europe . .	915,974	525,548	153,674	75·2	65·3	29·4
British North America .	86,139	72,317	117,011	7·1	9·0	22·4
Mexico . .	14,614	30,758	63,768	1·2	3·8	12·2
Other countries	37,620	38,054	32,037	3·1	4·7	6·1
Totals . .	1,218,480	805,228	522,919	100·0	100·0	100·0

The table above shows two tendencies. First, there is a reduction, lready considerable before the new system came into force, of total nmigration into the United States as compared with 1913–4, becom-ig more marked in the year 1922–3 under the influence of the new uota law. Secondly: in 1922–3 less than one-third of the immigrants ame from southern and eastern Europe, as against three-fourths in 913–4. The number of immigrants from northern and western urope, which was formerly about one-eighth of the total, became early one-third.

In the year 1923–4 the number of immigrant aliens increased to 06,896. The proportion of northern and western European peoples" increased from 20·8 % of the whole in 1913–4 to 55·7 % the year 1923–4 and the proportion of southern and eastern uropean "peoples" decreased from 75·6 % of the whole in 1913–4 only 27·2 % in 1923–4.

Not only the volume and direction of overseas migration move-ents, but also the character of the migrants has changed greatly. amily migration is on the decrease, outside the British Empire. he preponderance of males is greater than before the War. Accord-g to statistics from 13 countries of emigration, males composed 5·6 % of the total in 1922, 63·7 % in 1923. The same increase in the eponderance of males may be seen from the statistics of the chief untries of immigration (54·2 % and 62·4 %). This increase is due to e fact that in 1922 the states of western and northern Europe ill made little use of their quotas of immigration to the United ates, while recently the southeastern states, where family emi-ation was most common, have not been able to send the wives and ildren to join the heads of their households so frequently as before. ercentage of male immigrants to the United States was 48·4 % in 22, 58·8 % in 1923.) Even emigration from the United Kingdom as affected as regards the general proportion of the two sexes 1·9 % of males in 1922, 59·6 % in 1923). The sexes of immigrants ere most evenly distributed in South Africa and New Zealand, most evenly in Cuba, the Argentine and the other South American ates, owing to seasonal migration and the greater risk in settling. e decrease of the percentage of child migrants from 1922 to 1923 milarly points to a decrease in family migration. In the United ates the percentage of immigrant children dropped from 20·6 to 14·6; in Argentina it was only 10·4 %, in Cuba only 6·3 %. In the British Dominions the proportion rises to 22·5% (New Zealand 23·2%). Jewish immigration into Palestine has a more family character (26·7 % children in 1922, 26·9 % in 1923). Of able-bodied adults, the young are more numerous than the elderly.

The countries of emigration and immigration complain even more of the alteration in distribution of occupations. Before the War up to two-thirds of the overseas emigrants from Europe were engaged in agriculture, in 1922 and 1923 only 14·6 % and 14·0 % respectively of the total emigrants from 14 European countries were of this class. Even if domestic servants and day labourers are counted in, this class hardly amounts to a third of the total. The statistics of countries of immigration place the percentage but little higher.

In consequence of the difficulties and restrictions on immigration and unfavourable economic conditions in Europe, repatriation home of previous overseas emigrants has decreased greatly (according to Table II. with 31·96 %) and ever more rapidly. In the five years after the War repatriation to Great Britain was 18·3 % less than before the War; to Sweden 24·5 % less, to Italy actually 63·3 % less.

The loss of population through migration per 100,000 inhabitants, arrived at by calculating the difference between figures of immigrants and emigrants, gives the following table for European countries (1920–3): Portugal −1,936, Great Britain and North Ireland −1,429, Italy −1,135, followed at a distance by Spain, Sweden, Czechoslovakia, Poland and Rumania.

The figures for the five overseas countries which have recorded both emigration and immigration show that the gain in population through migration per 100,000 inhabitants is highest in New Zealand (3,906), followed by Argentina (1,826), the United States (758), South Africa (116).

III. RESTRICTION OF IMMIGRATION

The universal depression consequent on the World War could not of itself have brought about, except in a certain degree, the decrease of emigration and its change of direction. The history of migration movements, especially in the United States, shows that for a century past periods of economic depression have coincided with the lowest figures of migration. The supply of emigrants in the European countries remained greater than the overseas labour markets, especially those of the United States, could have absorbed.

United States.—The depression which set in after a brief post-War boom, in the United States as elsewhere, in 1920–1, and the great increase in immigration in 1919–20 increased the apprehension with which organised labour, in particular, had come to regard unregulated immigration even before the War. Moreover, during the War American objections on national grounds to immigrants from south and eastern Europe, who are only assimilated with difficulty, acquired decisive importance, and public opinion was converted by motives of patriotism to a policy of restriction. The clause in the consolidated Immigration Law of Feb. 9 1917 under which persons over 16 years of age who are unable to read are not admitted, proved ineffectual in reducing the undesired element and emergency legislation for the restriction of immigration combined with national discrimination was finally approved on May 19 1921, and came into force on June 2. The number of alien immigrants, in the case of each nationality, was limited to a maximum of 3 % of the number of foreign-born persons of that nationality who were resident in the United States at the time of the census of 1910. Certain categories of persons were, however, exempted from these quota.

This emergency law was to operate until June 30 1924 when the Immigration Act,[1] 1924, came into force. The earlier law had already reduced the proportion from southeastern Europe of the total immigrants by one-third. The effect of this reduction was, however, partially annulled because such persons were allowed to immigrate from the countries bordering on the United States and unaffected by this law (Mexico, Canada) even of alien origin, if they had been settled there for two years in the one case, five in the other. Thus the total immigration from Canada and Mexico rose from 66,361 for the financial year of 1922 to 290,026 for 1924. The total of immigrants had therefore not decreased. Economic depression also forced the countries of northwestern Europe to make full use of their high quotas. Clandestine immigration of southeastern Europeans by land and sea is estimated by the best authorities at 150,000 annually. Public opinion, at one with Albert Johnson, Chairman of the Committee on Immigration of the House of Representatives, in the opinion that "the melting pot was to have a rest," welcomed the new law.

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[1] See Immigration Laws and Rules of Feb. 1 1924, issued by the U.S. Bureau of Immigration (Washington, 1924).

The law distinguishes three categories of persons:—

1. The old emigration is wound up under the first group; unmarried children under 16 and wives of previous emigrants, now naturalised, and certain other individual desirable types are allowed to immigrate *outside* the *quota*. Immigrants from the American continent do not come under the law at all. Persons who were not born there can no longer, under any circumstances, be accepted outside the quota of the country of origin.

2. As regards immigrants on the quota, the law adopts the following drastic principles for the first three years of its validity. The annual quota of any nationality shall be two per centum of the number of foreign-born individuals of such nationality resident in continental United States as determined by the United States census of 1890. After July 1 1927 the total number of immigrants is to be fixed at 150,000, the quota of each nationality being determined by the relationship between the number of inhabitants having that national origin to the total population of the United States in 1920.

On this basis the annual quotas from the principal countries are as follows:—

	1921–2	1924–5
North and West Europe		
Belgium	1,563	512
Denmark	5,694	2,789
France	5,729	3,954
Germany	68,059	51,227
Great Britain and North Ireland	77,342	34,007
Irish Free State	..	28,567
Netherlands	3,607	1,648
Norway	12,202	6,453
Sweden	20,042	9,561
Switzerland	3,752	2,081
South and East Europe		
Czechoslovakia	14,282	3,073
Italy	42,057	3,845
Poland	25,827	5,982
Rumania	7,419	603
Russia	34,275	2,248
Yugoslavia	6,426	671

3. Finally, persons ineligible as citizens of the United States fall into a separate group. This provision excludes the Japanese, the only Eastern Asiatics who had not already been excluded from the possibility of immigrating by the earlier special "Law of Exclusion" (China), or by the clause on the "barred zone" of Asia adopted into the law of 1917.

The most important result of the new immigration legislation, as compared with the period before the War, is that immigration from the most important European countries of emigration (Italy, the territories of the previous Austro-Hungarian Monarchy and Russian Empire) had been reduced by nine-tenths. The quotas from Sweden, Norway, Denmark and Switzerland have also been reduced by half; those for Germany and the Irish Free State remain practically unaltered. All other countries of emigration, including Great Britain, whose annual quota is now only 34,007, must now in increasing measure seek their outlet in other overseas countries.

Other Countries.—But South American and other countries have adopted similar restrictions on immigration for similar reasons. Before the War these countries—Brazil, Uruguay, Argentina—and others still encouraged white immigration, but they can no longer afford to do so. Not only have they paid more attention to selecting the right class of immigrant, but at times immigration has been suspended altogether. The bad conditions have led to some outbreaks of the proletariat in several ports, these being aggravated by the failures who drifted back from up-country. So in South America too only settlers with capital and able-bodied country labourers are welcomed. No state still grants free land. The minimum capital required, even by Brazil and Argentina, is too high for the unemployed of Europe, and they cannot make their way as unskilled labour in hot countries against the competition of the native coloured population (the North of South America, North and Central Africa, Asia Minor, etc.). Especially intellectuals who have tried their luck in these districts have very often come to grief.

IV. MOVEMENTS OF POPULATION IN THE BRITISH EMPIRE

Great Britain has long endeavoured to divert her surplus population from the United States, and has tried where possible to find it an outlet in her own Empire. The motives and results of these efforts, prosecuted with increased zeal since the War may be regarded as typical of the migration crisis, since the Empire contains countries of emigration and immigration which are naturally complementary, and the official interpretation of the term "migration" denotes internal movements from one of these territories to another.

Empire Settlement Act.—The importance of the settlement question for the maintenance and consolidation of the British Empire was strongly emphasised by the Dominions Royal Commission, 1911–7, but although since 1890 the theory of state subvention has often been mooted, it was not until 1921 that a scheme for state-aided imperial settlement was adopted by the Imperial Conference of that year. The Empire Settlement Act passed by the British Parliament in 1922, implemented the scheme. An Overseas Settlement Office was set up under the supervision of a Colonial Office Committee, and in 1925 a new Under-Secretaryship of Dominion Affairs was constituted, with complete charge of migration and settlement policies. Emigration departments were opened by the Dominion Governments in London. England's share of the cost of carrying through any one measure was not to exceed 50%, and the obligation to grant subsidies was not to extend beyond 15 years. The total which might be expended in one year under this was £3,000,000, exclusive of receipts from interest or repayments in later years. The scope of the law could be extended to other parts of the Empire, but in 1926 this had not yet been done. As shown by Table II., emigration to the Dominions was still less than before the War, when the broad, thinly-populated expanses of the overseas portions of the Empire had already begun increasingly to attract the stream of emigration from Great Britain in default of other labour markets. Between 1891–1900 only 28% of English emigrants went to the Colonies, the majority to the United States; between 1901–12 63% went to the Colonies, 1919–23 64%. When the American quota was reduced in 1921 84,261 out of a total of 91,262 overseas emigrants from Great Britain and Northern Ireland went to parts of the Empire.

The comparatively small financial part taken by certain Dominions in carrying through this scheme is due to economic and social difficulties. These districts need mostly agricultural settlers and labourers and female domestic servants willing to live in the country. Great Britain is, however, rather short of these classes, while the Dominions object to the immigration of the superfluous skilled industrial labourers, in view of the unemployment in their own industries and the necessity of protecting the standard of living of their own population. Objections are also raised to agricultural settlement, on the ground that this increases the agrarian losses provoked by the considerable fall of prices of agricultural produce. Then it is feared that most of the former urban elements will soon leave the land again and increase the over-preponderance of the towns which is already very great. The first step should be to settle the urban unemployed of the overseas districts on the land, since they are already used to local conditions. And so all these states, although some have had satisfactory experience with immigration, have imposed strict conditions of selection of human material from the mother-country, or insist on suitable preliminary training for settlers. Families and juvenile emigrants are much preferred. New Zealand and Canada have been comparatively accommodating. Canada, however, has not an exclusively Anglo-Saxon population to increase and makes efforts to attract agricultural labour from other European states as well. South Africa is in general opposed to all European immigration, as she is suffering particularly from unemployment and has native labour to spare.

The British Problem.—The school of Mr. J. M. Keynes holds that the present unemployment in Great Britain is intensified by the fact that 1,000,000 persons remained in Great Britain during the War who would otherwise have emigrated, and considers that the maintenance of the standard of living in the mother-country could only be ensured—imperfectly—by increasing emigration, or more safely, by reducing the birth-rate; but other experts (Sir William Beveridge and Professor A. L. Bowley) are more optimistic—they calculate that after 1931 the decline in births during the War will result in a shortage of productive labour in England, on the assumption that emigration again reaches its pre-War dimensions, the death-rate remains unaltered and the participation of women in the work of the community remains constant. The Overseas Settlement Committee think that it will be possible to secure an adequate outlet by emigration within the Empire for the surplus industrial workmen of the mother-country, although used to a high standard of living and the state unemployment allowance, as soon as world conditions have got back to normal and the agrarian crisis has been surmounted. The financial assistance of emigration by the mother-country should, in any case, further the industrial development of the Dominions and help the overseas portions of the Empire to become self-supporting.

V. LEGISLATION ABOUT EMIGRATION

Before the War freedom of emigration was almost general. Judging by the legislation of the most important countries of emigration, such as Italy, the general character of emigration policy was as follows: emigration was only restricted in the case of persons who had to be kept in the country on account of military service, criminal records or immaturity. Further, persons were prevented in their own interests from emigrating if they did not fulfil the conditions of the countries of immigration, if they possessed insufficient means or ran the risk of getting into an unfavourable position by paid passages or other concessions. In order to protect the emigrants only such shipping companies were allowed to carry them as were under supervision, so as to avoid the activities of secret agents. A special emigration fund was maintained out of various sources which created an emigration authority with local and foreign branches and established or supported special welfare institutions in the ports and elsewhere (emigrants' homes, labour registries). But according as the character and social spirit of the government was more or less democratic, so, in practice, there was more or ss hostility towards emigration. These principles of emigration olicy were upheld in post-War legislation, and supplemented by fiscal measures and by various restrictions in the recruiting emigrants.

The impoverished countries of the continent of Europe encountered even greater difficulties than did the British Empire om the attitude of the countries of immigration. In spite of the eat and constantly recurring unemployment, it was impossible let millions emigrate, as had been generally expected after the War. The governments of the emigration states were themlves at first swayed by contradictory motives. Where the military motive no longer weighed in the balance, they were xious not to increase the price of labour through emigration, as not to hamper their export trade, or they wished to settle eir surplus population at home by agrarian reform. People were mistrustful, and expected, too, a great economic wave of osperity. Soon, however, certain countries were forced by eir great surplus of population to give direct state encouragement and assistance to emigration, but everywhere they found ors shut against them. The example of conscious national igration policy is Italy. So long as she is forced to place her our at the service of foreign economic systems, she tries nerally to get a suitable return for it (policy of valorisation), increase the value of her labour by suitable training, in rticular not to permit collective recruiting of emigrants except der conditions dictated by the state, to protect the interests of emigrants against the transport companies and other agents ring and after emigration, to preserve the sense of nationality by suitable organisations in the country of immigration (policy of schools, clubs and voting) and finally to place the whole organisation of emigration under a state general commissariat for emigration and its organs.

A whole series of countries of emigration have copied Italian legislation more or less closely since the War in their new emigration legislation. As passports and visas are still compulsory, it is possible to regulate emigration policy towards the different states. All European countries are endeavouring more or less to get their own unemployed industrial labour out of the country where possible, and to shut themselves off from foreign labour at the same time.

Statistics show that countries of emigration have been able to divert their surplus population overseas most easily where the movement is favoured by racial kinship and political interests. Most of the Germanic and Nordic states of Europe were still able to turn to the United States up to 1924 even in greater measure than before the War. The Latin and Slav countries, being almost excluded from North America, compensated themselves mostly in the South American states. So, to take 1924 as an example, 52·5% of the Italian, 44·7% of the Spanish, 37·4% of the Czech emigrants went to the Argentine. The attempts of the Italians and Greeks to get a footing in the British Dominions and South Africa had, however, very little success.

VI. MIGRATION OVER LAND FRONTIERS

Overseas emigration would never have succeeded in satisfying the urgent demand for emigration. Fortunately the European states were able to find an outlet in a few European countries, especially France, Belgium and Luxembourg.

Immigration into France.—France was impoverished in man power, and her labour market, in consequence of the work of reconstruction and the increase in her export industry resulting from the fall of the franc, was able to absorb foreign labour to an extent which varied, but on the whole increased. Statistics of continental migration are still very imperfect, but show great changes since the War. Before the War Germany received about a million continental immigrants, France comparatively very few. This immigration to Germany was almost entirely agricultural and mostly seasonal and non-permanent. In 1924, however, Germany admitted no foreign industrial labourers and only 29,196 agricultural workers, while French national statistics, taken on the frontiers and certainly some 50% too low, show the figure of continental immigrants at 262,877 in 1923 and at 223,495 in 1924. The great majority came from Italy, which now sends two-thirds of its emigrants to France; but there is hardly a country in Europe which has not sent labourers, mostly industrial, in large numbers to France in recent years. Continental migration has the advantage for the countries of emigration that it easily alters its character and often helps to increase technical knowledge.

Regulation.—But the countries of immigration are confronted not only with difficult economic and social problems, but also with problems of national health and security arising out of these mass immigrations. It has proved especially necessary to regulate the national labour market as elastically as possible, so that at any given moment only so much foreign labour as is barely necessary remains in the country. It has proved possible to adapt *collective* migration to the needs of the present labour markets by means of state treaties, and to regulate the legal and social position of those concerned in a proper way. But the good results thus attained have been largely nullified by the insufficient regulation and supervision of individual migrants. The pressure of unemployment has also caused the Central European countries to put severe limitations on the entry and settlement of foreign labour. Certain countries even expel labourers who have long been resident in the country. The resultant insecurity and the rise of prices increases the difficulties of reconstruction caused by tariff policy, etc.

Continental emigration, for example, into undeveloped Russia, is only permitted to agricultural settlers with capital ready to form model settlements in the north. On the other hand, emigration out of European Russia into Siberia has assumed extraordinary dimensions since the War. The chances of normal continental exchange of labour would have been much greater but for the emigration to Western Europe of Russian refugees. Japan and China are now themselves largely reduced to continental migration within Asia, since their only overseas outlet is now South America. Continental migration in the interior of Africa has also assumed very great importance, and in South Africa especially, the various states have regulated it from a one-sided point of view.

There must be general state regulation for crossing of frontiers and settlement of foreigners. Great Britain, thanks to her insular position has been most successful in this since the introduction of compulsory passports. The German "Labour Centre," which works by compelling foreign hired labour to obtain permission and register, has been much less successful. France is only now beginning to attack the problem by a more exact control of identification cards, unification of the administration (Commission de la main et l'oeuvre étrangère 1924) and a long-promised legal regulation of conditions of immigration.

VII. GENERAL INTERNATIONAL REGULATIONS

The recognition of the necessity of reconciling conflicting interests in migration has led those European states which are subject to continental exchange of labour to make a beginning and conclude comprehensive migration treaties (France with Czechoslovakia, Poland and Italy). But the experience so gained is not enough to allow one simply to apply these methods of regulation internationally to world migration. The development appears here to overlook the regulation of social-political questions of detail. The International Labour Office, which has been entrusted with this task, has declared in principle for equal treatment for foreign labourers in all respects, and in detail has begun by regulating for equal treatment of foreign workers as regards workmen's compensation for accidents during work (1924). The social-political regulation touches on many other questions, notably protection of migrants (especially women and juveniles) and the regulation of the labour market. The programme worked out by the International Emigration Commission 1921 was widened and revised in many respects by the technical Interstate Conference summoned in 1924 by the Italian Govt. and attended by delegates from 57 governments. The Protocol of this conference shows the great number and variety of these problems. The agenda dealt mainly with technical matters; the transport of emigrants, hygiene and sanitary services, assistance at the ports of embarkation and disembarkation, assistance for women and children, information on employment in the countries of emigration, and the principles to which migration treaties should conform, etc.

The actual conditions of emigration and immigration in the different states touch the sovereignty of the states so nearly that most governments at present refuse to admit international regulation. This was shown very clearly by the United States House of Representatives when passing the Immigration Law of 1924. Even the different international federations of Trades Unions have not succeeded in arranging mutual co-operation. It may, however, yet prove possible to secure the collaboration of the states whose interests conflict, and thus eliminate dangers to the peace of the world. Private leagues for the protection of the emigrants are already doing good work towards bringing about a rapprochement of public opinion in different countries on questions of migration. These leagues joined in a common international conference held at Rome in May 1924.

The increase of open and secret emigration from Canada and Mexico into the United States shows that unless continental migration be regulated, the intentions of legislation regarding overseas migrants will merely be paper regulations. Either America must make up her mind to establish an effective frontier police, to register and keep continual track of foreigners, or she will not be able to stop the impulse of the peoples to immigration. In the former case her attraction for the already assimilated elements of Canada and Mexico will grow and the number of territorial disputes over this question will increase; in the latter there will be an intensification of the shortage of labour and high wages.

The Oriental Question.—The problem of Oriental immigration into the United States is of special urgency. Under the "Gentleman's Agreement" of 1907 freedom was given to the Japanese Govt. to issue passports to Japanese labourers who had been resident in the United States before the conclusion of the agreement and were seeking re-entry, and also to parents, wives and minor children of Japanese already resident in the country but the Japanese Govt. pledged itself not to issue passport to all other Japanese nationals seeking entry into the Unite States as labourers. This pledge appears on the whole t have been loyally observed by the Japanese Govt., but i practice it afforded certain loopholes for evasion; the numbe of Japanese residents continued to rise steadily and the agitatio in California against their entry increased.

The Gentleman's Agreement was superseded by the Immigration Act of 1924, which declared that no "alien ineligibl to citizenship" should be admitted to permanent residence i the United States with the exception of certain specified categories, comprising approximately the classes contemplated unde the Gentleman's Agreement. It was decided by the Suprem Court that all aliens who are not white and of European origi or black and of African origin—*i.e.*, essentially all Asiatics—ar ineligible to citizenship, excepting those specifically exempted b the Act itself. The political effect of this measure was profound It substituted a unilateral action based on domestic legislation fo an international agreement, and Japanese national honour wa wounded by an action which directly discriminated agains the Oriental races. The Japanese Govt. protested strongl and proposed that Japanese immigration should be regulate like that of other foreign countries by the quota system. Thi proposal was rejected by the United States Senate, and th discrimination was upheld. After a brief period of acute agitatio in Japan excitement subsided, but the problem remains.

In British Columbia, Japanese immigration is still regulate by a Gentleman's Agreement, but there has grown up an agitatio in favour of legislation on the model of that passed in th United States. The British Empire is thus acutely concerned i this question. The British Empire had its own very delicat inter-Imperial problem arising out of the attitude of the popula tions of certain Dominions towards Indian immigration Australia views any settlement of Asiatic peoples with dis favour, while in South and East Africa the discrimination in th treatment of Indian nationals under domestic legislation ha seriously prejudiced political relations between these countrie and India.

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MIHALACHE, ION (1882–), Rumanian politician, wa born March 3 1882, of a poor peasant family. He became village school teacher and distinguished himself as an organise of the Village School Teachers' Federation, of which he wa eventually appointed president. In 1914 he entered politics, and after the World War founded the Peasant (Tsaranist) party first in Bessarabia, and then extended its organisation to the rest of the country. In the first elections held after the War in 1919, the Peasant party won 70 seats in the Chamber of Deputies and Mihalache was appointed Minister of Agriculture in the Vaida-Voevod Cabinet, which office he held until March 1920, when Vaida-Voevod resigned with the entire Cabinet. Mihalache distinguished himself during the World War in which he served with the rank of captain. In addition to the highest Rumanian military decoration (Michael-the-Brave) he was awarded the Legion of Honour, the Order of St. Stanislas and other foreign decorations.

MILAN (*see* 18.437), the second largest town in Italy and the most progressive commercially and industrially, had a population of 712,844 in 1921. The old quarters are giving way to blocks of new buildings, and the circumference of the city in 1926 was about eight miles. Barracks have been erected and exercise grounds made outside. The manufacture of motor-cars and artificial silk are growing industries. A free university was opened in 1924. In 1918 the royal palace to the south of the cathedral was presented to the municipality by the Crown. The Home of Rest for musicians, established by Verdi, has been transformed into a Verdi Museum, and a statue of the composer was unveiled in front of it in 1913. The Museo del Teatro, opened in the building of the famous Della Scala theatre in 1913, contains a collection relating to its history. A larger station, fronting the Piazza Doria, to replace the central railway station, was under construction in 1926.

MILES, NELSON APPLETON (1839–1925), American soldier (*see* 18.442), died at Washington, D.C., May 15 1925.

MILFORD HAVEN, LOUIS ALEXANDER, 1ST MARQUESS OF (1854–1921), British sailor, was born at Gratz May 24 1854, the eldest son of Prince Alexander of Hesse, by his morganatic marriage with the Russian Countess, Julie Thérèse von Haucke. As Prince Louis of Battenberg he was naturalised as a British subject in 1868 and entered the royal navy in the same year. In 1884 he married Princess Victoria, daughter of the Grand Duke Louis IV. of Hesse. From 1891 to 1894 he was naval adviser to the inspector-general of fortifications and in 1900 was appointed assistant director of naval intelligence at the Admiralty, being made director in 1902. In 1904 he was promoted rear-admiral and after serving as second in command in the Mediterranean was made vice-admiral in 1908. After commanding the Atlantic and Home Fleets, he was in 1912 appointed First Sea Lord of the Admiralty, but in Oct. 1914 he was compelled to resign from this position owing to public resentment at his German origin, which persisted in spite of his fine record of service. In 1917 he relinquished his German title, assumed the surname of Mountbatten and was elevated to the peerage as marquess of Milford Haven. In the following year he retired from the active list of the navy. He became an admiral of the fleet in 1921 and died on Sept. 11 of the same year.

MILITARY RAILWAYS: *see* LIGHT RAILWAYS, MILITARY.

MILK AND DAIRY PRODUCTS.—The dairy industry is in many countries the chief agricultural industry and in all countries s of the utmost importance to agriculturists. The fact that this s recognised by agriculturists themselves is evident from the rapid expansion in some countries of the dairy herds. The following statistics give some indication of such expansion and of the state of the industry in various countries:—

The Production of Milk

Great Britain.—In 1924 the total milk production was approximately 1,300 million gal. (less milk used for calf rearing). Of this, 500 million gal. were consumed as liquid milk; 500 million gal. were consumed in the manufacture of butter and cheese; 35 million as condensed milk and 61 million as cream, etc. The dairy herd numbered 3,111,000.

Australia.—In 1921, 267 million lb. of butter and 32½ million lb. of cheese were produced. The dairy herd numbered 2,343,221, with an average production per cow of 343 gallons.

Canada.—In 1921, 236½ million lb. of butter and 149¼ million lb. of cheese were produced. The dairy herd numbered 3,736,832.

New Zealand.—In 1924, 71½ million lb. of butter and 161 million lb. of cheese were exported. The dairy herd numbered 1,291,000.

United States.—In 1923 the total milk production was 109,736 million lb., of which 54,614 million lb. were consumed as liquid milk. 39,106 million lb. were consumed in the manufacture of butter, and 12,714 million lb. in the manufacture of cheese, condensed milk, ice cream, etc. The dairy herd on Jan. 1 1924 numbered 24,675,000, but this number had decreased in 1925 to 20,965,423.

Argentine.—In 1918, 41,863,000 lb. of butter and 14,177,000 lb. of cheese were exported. The dairy herd numbered 2,378,000.

Denmark.—Denmark is the main European exporting country of dairy products. In 1921, 199,500,000 lb. of butter were exported; the dairy herd numbered 1,184,268.

The Consumption of Milk

The consumption of milk and dairy products varies as much as production. In a survey of 68 American cities which have populations of over 100,000, the consumption of fluid milk was found to be ·66 pt. per head daily. In 1924, in the New York Metropolitan district, where there is a population of about 8·7 million the consumption per head was ·75 pt. daily, an increase of 85% during the preceding 30 years, due largely to improved quality. The following statistics collected by the United States Department of Agriculture give the annual average consumption per head of liquid milk, butter and cheese in various countries:—

Annual Consumption per head of liquid milk (In American Gallons).

Denmark in 1914	68·5 gal.
America in 1925	53 gal.
Canada in 1916	26 gal.
United Kingdom in 1918	22 gal.

Annual Consumption per head of butter.

Canada in 1911	27·7 lb.
Australia in 1913	25·6 lb.
New Zealand in 1914	21·7 lb.
Denmark in 1914	19 lb.
United Kingdom in 1914	17 lb.
United States in 1919	16 lb.
Argentine[1] in 1915	1·8 lb.

Annual Consumption per head of cheese.

Denmark	12·3 lb.
United Kingdom	11·2 lb.
United States	4·2 lb.
Australia	3·63 lb.
Canada	3 lb.
New Zealand	3 lb.
Argentine	2·9 lb.

[1] Factory butter only.

Production and Consumption in Great Britain.—It will be seen from the figures given above of the consumption of milk in the various countries that Great Britain's consumption is low compared with that of other nations. In 1918 the returns of the consumption of liquid milk were obtained through the local food control committees and it was found that these varied from as low as 0·10 pt. in Inverness to 0·31 pt. in London, an average for the whole area being 0·25 pint per head per day. Actual consumption would be above these figures as milk produced and consumed on farms does not appear, whereas the figures include the total population. The London figures would be approximately correct but the production of milk in Great Britain in recent years has not kept pace with the increase in the human population nor with the demand by the latter for milk products. This is shown by the following table extracted from the report of the Astor committee:—

	1871	1914	Increased Percentage
Population	26,100,000	41,700,000	60
Numbers of cows and heifers	2,091,000	2,937,000	40
Weight of cheese imported; cwt.	1,216,400	2,373,091	95
Butter imported; cwt.	1,334,783[1]	3,882,116	304
Margarine imported; cwt.	. .	1,501,520	. .
Condensed milk imports; cwt.	352,332[2]	771,239	128
Dried milk imports; cwt.	. .	30,601	. .
Total weight of Dairy produce Imported—cwt	2,903,515	8,558,567	235

[1] No separate statistics for butter and margarine before 1888.

[2] No separate statistics for condensed or dried milk before 1888.

The relative consumption of milk in Great Britain is much lower than is desirable in the national interest. This is probably due to the fact that it is known that the quality, as regards cleanliness, has been gravely defective and there is no doubt that the larger consumption in other countries is primarily due to a cleaner supply. During the past few years, however, there has been a distinct improvement in the methods both of production and distribution in Great Britain, and as a result it is safe to say that the consumption of milk is gradually increasing and there can be little doubt but that the educational work which has been carried on since 1915 is beginning to have its desired effect.

Imports of Dairy Produce Into Great Britain.—The value of dairy produce imported into the United Kingdom has also steadily risen for the last 50 years until in 1914 it reached a total of £38,000,000. Of this over £27,000,000 was paid to Denmark and Russia for butter and Holland for cream, cheese and condensed milk, whilst the balance, amounting to over £10,000,000, was paid to Australia and New Zealand for butter and to Canada and New Zealand for cheese. It will therefore be seen that Great Britain is anything but self-supporting in its dairy industry whilst many other countries have an exportable surplus. The reasons for the relative importance of dairying probably differ from country to country but in addition to any particular reasons which any country may have there has undoubtedly been a widespread recognition in most lands of the great value of the dairy cow as a producer of human food. As land, labour and feeding stuffs have increased in price, the dairy cow has more and more displaced the strictly meat-producing farm animals as an economical agent for the conversion into human food of those field crops which are not suitable for direct human consumption.

PURITY OF SUPPLIES

Importance of Milk as a Food.—Most dietetic authorities are satisfied that milk is the most important individual foodstuff and that an abundant supply of milk of good quality is an important factor in the health of a nation, and especially of city dwellers. Milk contains all the nutritive constitutents required by the body—proteins, fats and carbohydrates—in a readily assimilable form, and possesses special properties which promote growth and maintain the body in a healthy condition. It is therefore a valuable food for all classes of the community and especially for children. These special qualities in milk were first made known by Prof. F. G. Hopkins of Cambridge and have since been the subject of research by numerous investigators, notably Professors T. B. Osborne and L. B. Mendell of Yale University and Prof. E. V. McCollum of Johns Hopkins University. The exact nature and composition of these growth-promoting substances or vitamins is at present unknown, but their existence is inferred from the effects produced in respect of growth and health by feeding animals on special and carefully controlled diets.

Investigations into this subject indicate the existence of at least three vitamins, all of which are present in milk. These have been termed: (1) The ricket-preventing vitamin (or fat soluble A) which is necessary to promote growth and to prevent rickets in young animals.[1] The fat of cream and butter are amongst the richest known sources of this vitamin. (2) The anti-neuritic vitamin (or water soluble B) which is also necessary to promote growth, and in addition is essential to prevent the occurrence of the disease known as beri-beri. This vitamin is found in the germ and in the bran or outer layers of certain grains and in milk. (3) The scurvy-preventing vitamin. This vitamin is found in fresh, untreated cow's milk and in fresh fruits and vegetables.

There is no evidence that heating of milk destroys the vitamins described in (1) and (2), above. The scurvy-preventing vitamin (3), above, is however sensitive to exposure to heat, and therefore dried, pasteurised, boiled or condensed milk may be regarded as inferior in varying degrees to raw milk in scurvy-preventing properties. Skimmed or separated milk is deficient in the ricket-preventing vitamin referred to in (1), above, and the development of rickets may follow from its extended use in the feeding of young children unless the deficiency be made good. Attention may here be called to the inferiority in this respect of margarine to butter as a source of fat in the diet of growing children. Margarine is, as a rule, manufactured largely from vegetable oils. These are deficient in the ricket-preventing vitamin and the nutritive value of margarine made from such oil is therefore inferior to the nutritive value of butter. Although vegetable fats and oils are deficient in this vitamin which is also essential to growth, yet the green parts of plants are the chief ultimate source of this vitamin. For this reason the diet of cows, especially of those whose milk is to be used for infant feeding, should contain an abundance of the green parts of plants and there is evidence[2] showing that the milk given by cows in the summer, when the diet consists of fresh, green pasture, is richer in vitamins than in winter when the chief foods are hay, straw, roots and concentrates.

Need for Healthy Cattle.—Healthy cattle are the first requisite for a safe milk supply. Physical inspection by a competent veterinary surgeon will go far towards the elimination of those cows suffering from obvious disease but cannot be relied upon for anything like complete protection. The tuberculin test is more searching with reference to this particular disease. There are only two practical ways in which tuberculosis may be eradicated from a herd, namely, (1) the slaughter of all reactors; (2) the isolation of reactors and the separation after birth of calves born of reacting cows. Both methods raise many practical difficulties and it is therefore worth noting that the English Ministry of Agriculture has reintroduced the tuberculosis order giving compensation for cows slaughtered when suffering from this disease. Although it is admitted that a "considerable amount of tuberculosis of childhood is to be ascribed to infection with bacilli of the bovine type transmitted to children in meals consisting largely of the milk of the cow,"[3] at the same time it is not desirable to create unnecessary alarm by exaggerating the extent of human tuberculosis due to bovine infection. There can be little doubt that much infantile debility, leading to susceptibility to many diseases, including tuberculosis, is due to inadequate milk consumption. All reacting cows do not necessarily give tuberculous milk, and risk from tuberculous milk may be negatived by efficient pasteurisation (see *Lancet*, Jan. 30 1926).

Milk Grading Rules.—There is no question that the adoption in America of the principle of grading milk has resulted in a great improvement in the general supply. As supplied under the regulations of New York City four grades of milk are permitted. Grade A Raw includes the so-called certified milk which is produced under permit and certification by the county medical association. It also includes any other milk meeting the requirements, the principal requirement being the tuberculin test. The other grades do not require tuberculin tests and have progressively less stringent requirements as to bacterial content (taken as a measure of general cleanliness), cooling and age. Grade B is not recommended for children but is considered safe for adults. Grade C is sold to bakers and others for use in cooking. The effect of the grading rules, under which the producer receives more money for the higher grades, has been to raise the general standard of the city supply without arbitrarily cutting off the lower grades from their proper market.

In England the grading of milk has also been adopted, and table on p. 915 gives the standards required under the terms of the Milk Special Designations Order, 1923, for the various designations which it is illegal to use in connection with the sale of milk except under licence granted by or under the authority of the Minister of Health.

The clean milk competitions which have taken place in Great Britain have had a very great influence in improving the production of milk and the standard of production is probably as high in Great Britain as elsewhere. The first clean milk competition was held in Essex in 1920, and in 1925 no fewer than 33 counties

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[1] E. Mellanby, *Jour. Phys. Proceedings*, 52, 11 and 12, 1918; *Lancet*, March 15 1919

[2] Barnes and Hume, and the *Lancet* of Aug. 23 1919.

[3] Report of the royal commission appointed to inquire into the relation of children to animal tuberculosis, 1911, p. 39.

British Definitions of Grades of Milk

Designation	Herds	Bacterial content		Other conditions
		Maximum number of bacilli per cubic centimeter	Coliform bacillus	
Certified	Tuberculin tested and physically examined at regular intervals	30,000	Absent in 1/10 cubic centimeter	Bottled on the farm, name of farm, day of production and word "Certified" on each bottle cap
Grade A Tuberculin Tested	Tuberculin tested and physically examined at regular intervals	200,000	Absent in 1/100 cubic centimeter	Delivered to consumers in (a) the bottles or the sealed containers as received from the farm; (b) suitable containers of not less than two gallons capacity; (c) bottles with the name of the dealer by whom the milk was bottled, the address of the licensed bottling establishment, the day of production and the words "Grade A Tuberculin Tested" or "Grade A" on each bottle cap
Grade A	Physically examined at regular intervals			
Pasteurised Milk				
Grade A Pasteurised	Grade A milk that after pasteurisation, as required by the Minister of Health, contains not more than 30,000 bacilli per cubic centimeter and no coliform bacillus in 1/10 cubic centimeter. All other conditions as required for Grade A milk			
Pasteurised	Any milk that after pasteurisation, as required by the Minister of Health, contains not more than 100,000 bacilli per cubic centimeter. No requirement for bottling			

ndertook such competitions. More would have done so had not been for the outbreak of foot-and-mouth disease.

THE DISTRIBUTION OF MILK

While improvements in production have taken place during ne last few years methods of distribution have also shown proression, and this has been due mainly to two factors—pasteuriation and bottling.

Pasteurisation.—No reasonable amount of inspection or boratory control over a raw milk supply can provide a sufficient afeguard against the transmission of disease through milk. his fact is emphasised by milk-borne epidemics which have neir sources in carriers or unrecognised cases of disease—hence ne use of pasteurisation. Pasteurised milk has now been defined y the Ministry of Health as milk which has been heated to a mperature of not less than 145°F and held at that temperature r at least 30 min. and afterwards immediately cooled. The merican cities, however, have adopted a minimum temperature 142° F for 30 minutes. If milk be overheated the line of dearcation between the cream and the milk becomes indefinite nd the milk is then less attractive to the consumer. Pasteurisaon must never be regarded as a substitute for clean milk roduction and cleanliness in handling milk, which are the most nportant of all conditions affecting the milk supply, yet it does ve an added safeguard to the consumer in protecting him from ose diseases which may be milk-borne from human sources.

Bottling.—The second most important advance made in disibution is the delivery of milk in sealed bottles. The improveent in delivery resulting from this method will be still more arked when the present draft order, made by the Minister of ealth under the powers of the 1925 Milk and Dairies Act, rbidding the bottling of milk elsewhere than in a properly uipped dairy, becomes law. There is still room for the educaon of milk producers, milk distributors and consumers, and the ntinuance of clean milk competitions is of the greatest imrtance as a means of educating the farmer to the necessity of) healthy and clean cows, (b) healthy and clean milkers, (c) operly sterilised equipment and (d) covered milking pails. ne need for the provision of free instruction to the general blic of the value of milk as a food, the influence of a good or d supply of milk on the life and health of children and the mmunity as a whole, and the best methods of handling and oring milk in a consumer's home, is still urgent. Had the neral public been educated in the past in this respect there ould now probably be a greater demand for milk, produced d handled under better conditions, and, with the demand, a llingness to pay for milk of guaranteed cleanliness. Such ucational work should be on the principle of enlightening, and t frightening the general public.

Condensed and Evaporated Milk.—Sweetened condensed milk, the condensed milk of commerce, is officially defined in the United States as the production resulting from the evaporation of a part of the water from whole milk. It must not contain less than 28% of milk solids, including not less than 8% of milk fat. It usually contains about 40% of added cane sugar. Evaporated milk or unsweetened condensed milk must contain not less than 25·5% of total solids including 7·8% of fat and no added sugar. In Great Britain, under statutory rules and orders made by the Minister of Health, full-cream unsweetened condensed milk must contain 31% of milk solids including not less than 9% of milk fat. Full-cream sweetened condensed milk must contain the same percentage of milk solids and of milk fat. Skimmed unsweetened must contain 20% of milk solids and skimmed sweetened 26%, while all skimmed milk must be labelled "unfit for babies." The amount of imports of condensed and evaporated milk into Great Britain has increased from 26¾ million pounds in 1888 to 251 million pounds in 1925 and, unfortunately, a very large proportion of this increase is due to the importation of condensed skimmed milk.

Dried Milk or Milk Powder.—Dried milk or milk powder is a dehydrated product of milk containing about 5% of moisture. It is used as a substitute for milk in the kitchen and extensively by bakers and confectioners. Either whole milk or skimmed may be desiccated, but the skimmed milk powder will keep almost indefinitely, whereas the whole milk powder has a tendency to become rancid. It is reported that in most processes of manufacture this difficulty has been overcome. The milk is evaporated upon revolving metal drums, internally heated, or by being sprayed into a chamber through which hot air is blown. The drum processes are carried out however at normal atmospheric pressure or in partial vacuum. In Great Britain dried milk is subject to the following requirements: milk described as dried full-cream milk must contain not less than 26% of milk fat. Milk described as dried ¾-cream milk must contain not less than 20%, milk described as dried ½-cream milk must contain not less than 14% and milk described as dried ¼-cream milk must contain not less than 8%.

BIBLIOGRAPHY.—*International Crop Report and Agricultural Statistics* (Rome, monthly). See also the official statistics of Great Britain, the United States, Australia, Canada, Denmark, etc.

(E. B, PH.; A. D. A.)

MILLAY, EDNA ST. VINCENT (1892–), American author, was born at Rockland, Me., Feb. 22 1892, and was educated at Vassar, graduating in 1917. Her work, distinguished by delicacy of sentiment, placed her in the front rank of American contemporary poets. She was awarded the Pulitzer Prize in 1923 for her poem *The Harpweaver*.

She published *Renascence and Other Poems* (1917); *Figs from Thistles* (1920); *Second April* (1921); *Aria da Capo* (1921); *Two Slatterns and a King* (1921); *The Harp-Weaver and Other Poems* (1923); *Lamp and the Bell* (1923); and *Distressing Dialogues* (1924).

MILLER, JOAQUIN (1841–1913), American poet (*see* 18.464), died at Oakland, Cal., Feb. 17 1913. In compliance with his last wishes his body was cremated and the ashes taken up into the Sierras and cast to the winds.

MILLER, OSKAR VON (1855–), German engineer, was born in Munich May 7 1855. After studying electrical technology he became director of the Deutsche Edison Gesellschaft (German Edison Company) from which developed the Allgemeine Elektrizitäts Gesellschaft (the A.E.G., or General Electric Co.). He advocated the full utilisation of electricity by means of propaganda in connection with long distance cables, and wrote articles on the supplying of towns with electricity (1896–1903). He was director of the electrical exhibition, Frankfort-on-the-Main, held in 1891 when the first high tension alternating current power-transmission apparatus was installed. The transmission was accomplished over a distance of 180 km. (from Lauffen on the Neckar to Frankfort) and with only 25% loss. These experiments were of the highest importance in the development of modern electric-technology. He promoted the development of Bavarian water power as well as a systematic electric supply for that country, and was the founder and organiser of the German museum for natural and technical science in Munich.

MILLERAND, ALEXANDRE (1859–), French politician (*see* 18.465). M. Millerand, now only a private member, threw himself into his work as a barrister, and appeared in many important civil cases. In the Chamber he was a fierce opponent of the Combes ministry, which succeeded that of Waldeck-Rousseau; for he objected to its narrow and fanatical anticlericalism. In July 1909 he became Minister of Public Works in M. Briand's first Cabinet, his principal achievement at this time being the re-organisation of the state railways. Together with M. Briand he took strong measures to suppress the railway strike of Oct. 1910. In Jan. 1912 he was appointed Minister of War under M. Poincaré. His promotion surprised no one, for he had always taken a keen interest in questions of military organisation; and when the menace of Germany increased, he devoted himself to strengthening the national defences. He re-organised the higher command, and by the Act of May 29 1912 he gave a definite status to military aeronautics for the first time. In Jan. 1913 a personal incident brought about his retirement. On Aug. 25 1914 he was invited by M. Viviani to take the place of M. Messimy as Minister of War; and during the terrible situation which then prevailed he had constantly to take the initiative, for example, in attempting to remedy as far as possible the shortage of munitions. He was accused, however, of being too slow in providing the necessary heavy artillery, and he resigned with the other members of the Viviani cabinet at the end of Oct. 1915. In 1918 he was elected a member of the Académie des sciences, morales et politiques.

A few months after the conclusion of hostilities, on March 21 1919, M. Millerand was appointed commissioner general for Alsace-Lorraine. The problem of reuniting with the mother-country two provinces which had been torn from her in 1871 was a most serious one. For 50 years they had been under an administration widely different from that of France. A period of transition, therefore, was essential, alike from the point of view of political expediency, administration, economics and finance. The first French officials sent to Strasbourg had not been equal to their task; and for this reason it was essential to appoint a statesman of eminent authority with power to act, who would keep in constant touch with the Government. This post was filled by M. Millerand with complete success. In an important speech delivered in Paris on Nov. 15 1919, on the eve of the elections, he outlined the policy of the coalition which, under the name of the *bloc national*, was returned to power. On the resignation of M. Clemenceau, Jan. 18 1920, M. Millerand was chosen to form a Cabinet, and became both Prime Minister and Minister for Foreign Affairs. His main activities were in regard to the application of the Treaty of Versailles; and in orde to force Germany to fulfil her obligations, he ordered the provisional occupation of Frankfort. He was present at the inter-allied conferences at San Remo and Spa, in April and July 192 and in Aug. of the same year he met Mr. Lloyd George a Hythe. The situation in regard to Poland, who had been attacked by the Bolsheviks, now became grave, and M. Milleran therefore sent to Warsaw a contingent of French officers unde General Weygand. With this assistance the Poles gained a complete victory over the Bolsheviks. M. Millerand about this tim officially recognised the anti-Bolshevik government of Gen Wrangel, who was soon after completely defeated. In Franc itself, in May 1920, he frustrated various attempts, especiall by the railwaymen, to organise revolutionary strikes.

In Sept. 1920 M. Deschanel, President of the Republic, wa forced by ill-health to resign. M. Millerand was elected as hi successor, and out of 892 votes cast, no fewer than 695 wer given in his favour. During his candidature, he made it know that if he were elected, he intended to exert a more powerful influence on the policy of the Government than his predecessor had done. He refused to admit that his office of President force him to comply with a tradition of which he disapproved, by remaining absolutely neutral in politics. He made it clear that h intended to watch closely the foreign policy of the Government and made no secret of his wish to strengthen the power of th President by a revision of the constitution which would modif the conditions of his election; and he put his ideas into practice by frequently intervening in diplomatic negotiations. Durin the inter-allied conference at Cannes in Jan. 1922 he despatche a telegram expressing dissatisfaction at the conduct of affairs which caused M. Briand to return to Paris, and, in fact, brough about his resignation. Working on the same lines, he summone to the *Elysée* the prefects, or chief administrative officers of eac department from all over France. In a powerful speech at Evreu in the Spring of 1923 he declared that he would not agree t the re-introduction of the *scrutin d'arrondissement*, and showe marked favour to the adherents of the *bloc national*, who ha been in the majority in the Chamber since the elections of Nov 1919, and against whom the radicals and socialists were the carrying on a campaign of public meetings.

M. Millerand's conception of the rôle of President of the Republic brought him into collision with the radical and socialis majority, which, under the name of the *cartel des gauches*, wa successful in the elections of May 11 1924. He was violentl attacked by the radical socialist press, which accused him o having exceeded his powers by intervening in the party struggle and called for his resignation. M. Herriot, the leader of th *cartel des gauches*, when asked by M. Millerand to succeed M Poincaré as Premier, announced that he would do so only o M. Millerand's resignation. The latter replied that he had bee elected for seven years, and that the alteration of the party i power could in no way affect his constitutional position no abrogate his rights. But he made it clear that he had not th slightest intention of obstructing the new Government, an that its leader could count on his impartiality. M. Herriot, however, remained immovable; and M. Millerand therefore invite the Senator M. François-Marsal, who had been his Ministe of Finance in 1920, to form a Cabinet. M. François-Marsal declared in the Chamber that the attacks on M. Millerand wer contrary to the constitution, and that it was in order to uphol the latter that he had agreed to take office. His Government however, was immediately defeated; and M. Millerand tendere his resignation, protesting meanwhile against the illegality of th action taken against him. The attitude of the party in powe dissatisfied the Senate, which, as a result, voted with the opposition and elected M. Doumergue as M. Millerand's successor instead of M. Painlevé, the candidate of the *cartel des gauches.*

Some months later through a by-election, M. Millerand was elected Senator for the department of the Seine. He then became president of a group formed to denounce the policy of the *cartel des gauches* throughout the country. His success as an orator was apparent both in the courts and in Parliament. (P. B.)

MILLET, FRANCIS DAVIS (1846–1912), American painter *see* 18.466), was drowned in the "Titanic" disaster April 15 912.

MILLIKAN, ROBERT ANDREWS (1868–), American hysicist, was born at Morrison, Ill., March 22 1868, and re- eived his education at Oberlin College (A.B., 1891; A.M., 1893) vhere he was instructor in physics 1891–3. He then proceeded o Columbia University (Ph.D., 1895), and the universities of 3erlin and Göttingen (1895–6). In 1896 he was appointed assist- nt in physics at the University of Chicago, with which institu- ion he continued to be associated for the next 25 years in the lepartment of physics, being professor from 1910 to 1921. In 921 he became director of the Norman Bridge laboratory of hysics and chairman of the executive council of the California nstitute of Technology at Pasadena, California. He was vice- hairman of the National Research Council, Washington, D.C., 1 1917, and chief of the science and research division of the ignal Corps, U.S.A., with the rank of lieutenant-colonel. In 922 he was the first exchange lecturer to Belgium on the .R.B. Foundation.

The best known of his researches were the "oil drop" experi- nents, undertaken with the view of making measurements of ndamental electrical quantity. They proved conclusively at all electrons are alike. He also undertook researches into hotoelectric effect. Later research of his has tended definitely to ridge the gap between light and X-ray phenomena. He was warded the Nobel Prize in physics in 1923 for his work in olating and measuring the electron, and in making the first xact photoelectric determination of the light-quant. In the me year he received the Edison Medal for especially meritorious ork in the field of electricity, and the Hughes Medal of the oyal Society in recognition of his determination of the elec- onic charge and other physical constants. (*See* PHYSICS.)

Millikan was the author of the following, among other works:— *echanics, Molecular Physics and Heat* (1901); *Electricity, Sound d Light* (1908); *The Electron* (1917); *Practical Physics* (1920); *cience and Life* (1923); in addition to numerous contributions to chnical periodicals.

MILLS, ROGER QUARLES (1832–1911), American legislator *ee* 18.475), died at Corsicana, Tex., Sept. 2 1911.

MILNE, SIR GEORGE FREDERICK (1866–), British gen- al, was born Nov. 5 1866 and joined the Royal Artillery in 85. He served in the Nile Expedition of 1898, and the South frican War (1899–1902). In 1913 he became commander of e artillery of the 4th Div., with which he went out to France 1914. He was given, in July 1915, command of the 27th Div., hich, three months later, he took out to the Salonika theatre. t the end of the year he was placed in charge of an army corps ere. In May 1916 Milne was advanced to the command of e British forces in Macedonia, and he occupied this responsible sition under the orders of three successive French commanders- -chief until the end of the struggle. During the ensuing two ears, the situation scarcely lent itself to effectual offensive opera- ons, and the British military authorities at home were opposed the using-up of resources in this theatre. Milne, however, led a difficult position with unfailing tact and sound judgment, d, when a general advance at last took place in the autumn 1918, after Bulgarian powers of resistance had waned, the rces under his personal command contributed appreciably to e bringing about of the final victory. He remained in charge the British forces in the Near East and about the Black Sea til 1920, and on return to England was appointed to the East- n command. In Feb. 1926 he succeeded Lord Cavan as Chief the Imperial General Staff. Possessed of exceptional strength character and decision, an eye so keen in its perception of eaknesses as to be proverbial in the army, these qualities were ended with a sympathetic understanding of men and a marked nse of humour. Even more significant, for an era of military ansition, was his known receptiveness to new ideas.

MILNER, ALFRED MILNER, VISCOUNT (1854–1925), British atesman (*see* 18.476), occupied himself mainly, after his return om South Africa, with business interests in the City of London. But, though he took up a somewhat detached attitude with regard to ordinary domestic politics, he was active on behalf of causes which appealed to him from the imperial side; and he made several speeches in different parts of the country in the next few years on behalf of Tariff Reform and Colonial Preference. He paid a visit to Canada, where he himself and his gospel of imperialism were well received. He was roused, however, by Mr. Lloyd George's budget of 1909, and he advised the House of Lords to reject the Finance Bill, and, as he said at Glasgow, to "damn the consequences." He made several speeches in the next 12 months in defence of the Lords' position; and when the Parliament Bill came up to the House of Lords in 1911, he was a leading spirit among the "Diehards" who advised resistance to the end. He did not take a very prominent part in the opposition to the Irish Home Rule Bill; but he aptly described the state of affairs in Ireland in the early summer of 1914 as "smouldering war," and he urged the remodelling of the Amending Bill so as to reassure the Ulstermen.

The World War confirmed all his fears as to the disadvantages under which Great Britain and the Empire would labour during hostilities through the practice of unlimited Free Trade by the mother-country for over half a century. He gladly accepted in the summer of 1915 the chairmanship of a committee of technical experts and practical agriculturists, appointed by Lord Selborne as President of the Board of Agriculture, to consider the means of maintaining and increasing food production in England and Wales. The committee reported that farmers should be encouraged to grow more wheat by a guaranteed minimum of 45 s. a quarter for the four years following the harvest of 1916. Mr. Asquith's Coalition Govt. did not think the situation serious enough for this drastic remedy. Lord Milner became critical of this "wait and see" attitude; and especially reprobated on several occasions the policy of concealing disagreeable facts. "Truth all round," he said at Canterbury on Oct. 30 1915, "is the most fortifying thing in the world;" Englishmen could not brace their nerves and steel their hearts to win through by emulating the ostrich. Similarly he did his utmost, in April 1916, to induce doubting ministers to accept the policy, which the country demanded, of universal compulsory service, as absolutely necessary under the circumstances.

Mr. Lloyd George, when he formed his ministry in the following Dec., at once turned to this resolute statesman, the only British administrator who before 1914 had directed a war from the civil side, and constituted him one of his principal colleagues in his War Cabinet of four (or five including Mr. Bonar Law). Considering the attitude of the two men at the time of the South African war, the offer and acceptance argued magnanimity on both sides. From this time to the cessation of hostilities their relations were close, and, after Mr. Lloyd George, Lord Milner took the largest share in the civilian conduct of the War. In vigour, resolution and readiness to take responsibility they resembled each other; but Lord Milner's experience, scholarship, steadiness and somewhat bureaucratic habit of mind supplied an invaluable complement to his chief's daring, impatience of precedent, quickness of apprehension and intellectual agility. In Feb. 1917 he attended, on behalf of the British Govt., a conference of the Allies in St. Petersburg (Leningrad), the object of which was to improve the co-ordination in the prosecution of the War between the Government of the Tsar (then in its last weeks of existence) and the Western Powers.

He devoted himself to his duties in the War Cabinet, never making speeches in the country, and seldom in the House of Lords, where his appearances were mostly in explanation of the policy of the Government in regard to food production and control. In June 1917 he announced that ministers had added between 70,000 and 80,000 men to the people available for agricultural work. In Feb. 1918 he vigorously defended Lord Rhondda's administration at the Food Ministry against ignorant criticism, and said that in regard to food Britain was in a better position than any other country except the United States. Except for what was necessary for the conduct of the War, everything must give way to food supply. The corn production bill of 1917, and the acceptance by the Government of the principle of Imperial Preference, and of the conservation of the raw materials of the Empire, owed much to his influence and support. He worked heartily for inter-Allied co-operation in the conduct of the War, and with Mr. Lloyd George attended meetings of the Supreme War Council at Versailles. He was in France as the representative of the British Cabinet at the time of the victorious German advance in the last 10 days of March 1918; and it was largely owing to his influence that Gen. Foch was appointed at Doullens on March 26 Generalissimo of the Allied forces in France. It being vital to have a man of unusual capacity and vigour at the War Office in this critical spring of 1918, Lord Milner was given the seals of Secretary of State for War on April 19; and it was he who presided over the Army Council during the succeeding months of the year which ended with victory.

In the reconstruction of the Ministry after the general election, Lord Milner left the War Office and became Colonial Secretary, a position for which his lifelong interest in the Empire peculiarly qualified him. In that capacity he attended the Paris Peace Conference as one of the British plenipotentiaries, and was a signatory to the Treaty of Versailles; and he subsequently helped to deal with a number of difficult questions arising under the treaty out of the disposal of the German colonies conquered in war. But his colleagues utilised his services also in other directions. His financial authority was invoked to defend ministerial finance in the House of Lords; and when a serious revolutionary outbreak took place in Egypt in 1919, he was sent there, as the author of *England in Egypt* (1892), at the head of a special mission to inquire into the causes, and to report on the form of constitution best calculated to promote Egyptian peace and prosperity. The mission arrived at Cairo in Dec. and remained till March; then in the summer of 1920 Lord Milner and his colleagues had long conferences with Zaghlul Pasha, the leader of the Nationalists, in London; and ultimately in Nov. they issued a memorandum recommending the recognition of Egyptian independence. Great Britain was to guarantee the integrity of Egypt against aggression; she would have a privileged position in Egypt and would maintain a garrison in the canal zone. The capitulations were to be abolished, and the veto on legislation affecting foreigners would be vested in the High Commissioner. The new constitution, of which these were to be the principal features, had not yet been adopted when Lord Milner, who had only accepted office because of the national need, resigned in Feb. 1921, and his great services were fittingly recognised by the Order of the Garter. Before the end of the month he married Lady Edward Cecil, the widow of Lord Edward Cecil, formerly Miss Violet Maxse.

Lord Milner returned to his business interests in the city, and during the remaining four years of his life, though he took an active part in the work of the Rhodes Trust, and also published his views (*Questions of the Hour*, 1923), he only once showed any disposition to resume public work. When Mr. Baldwin, in the autumn of 1923, boldly appealed to the country for a mandate to introduce Protection, Lord Milner accepted the chairmanship of a committee to advise the Government as to the proposed tariff. As the electorate rejected Protection, the committee proved abortive. In the winter of 1924–5 Lord and Lady Milner paid a private visit to South Africa, where he renewed old friendships and received a warm welcome from those who appreciated the great services which he had rendered to that country. Shortly after his return he was attacked by sleeping sickness and died on May 13 1925 at his residence Sturry Court, near Canterbury. His death coincided with his unopposed election to the chancellorship of his old university, Oxford; and funeral services in Canterbury Cathedral and Westminster Abbey gave expression to the public sorrow and respect. There was found among his papers, and published shortly after his death, an impressive document containing his *Credo* (1925). (G. E. B.)

MILOVANOVIĆ, MILOVAN (1863–1912), Serbian statesman and diplomatist, was born at Belgrade on March 2 1863, and was educated there and in Paris, where he was the first Serb to take his degree as doctor of law and was awarded a gold medal for his
thesis. On returning home he was appointed professor of inte
national law at Belgrade University and soon acquired the po
tion of one of Serbia's leading jurists. He was mainly responsib
for drafting the new Serbian constitution of 1888; and, becomin
secretary of the central committee of the Radical party, he e
tered politics and held successively the portfolios of Justic
Commerce and Finance during the closing decade of last centur
In 1901 he went to Rome as minister, and retained his post aft
the revolution of 1903. In 1907 he represented Serbia at t
Second Hague Conference, and was appointed a member of t
international court of arbitration. In July 1908 he was ma
Foreign Minister in the Vetimirović Cabinet, and thus had
guide Serbian policy through the difficult period of the Bosni
annexation crisis.

In 1911 he succeeded Păsić as Premier, and, being less of a pa
ty man than his old Radical colleagues, was able to bridge man
gaps, and to acquire within a short space of time a unique pos
tion among the politicians of Serbia. Even in foreign politics
showed signal moderation, and though a confirmed Russophi
initiated negotiations for a commercial treaty with Austria-Hu
gary and actively favoured good relations with Turkey. He w
one of the chief founders of the Balkan League, the decisive st
towards the creation of which was taken at a meeting betwee
Milovanović and the Bulgarian Premier, Gueschov, on Oct.
1911. Secret negotiations continued throughout the winter an
led to the conclusion of the Serbo-Bulgarian Treaty of March
1912 (*see* SERBIA). Discussions were still pending between th
various Balkan capitals for a more precise and comprehensiv
project of alliance when, on July 1 1912 at Belgrade, Dr. Mil
vanović died suddenly of heart failure. His removal at so critic
a juncture was a grave blow to the cause of peace and moderatio
and also deprived Serbia of her ablest statesman since the deat
of Prince Michael.

MILWAUKEE, Wis., U.S.A. (*see* 18.492), had a population i
1920 of 457,147 (100 males to 100 females); in 1925 the censu
bureau estimate was 509,192. If suburbs within 10 m. are in
cluded the total for the metropolitan district is over 600,00
Between 1910 and 1920 the number of negroes, though sti
comparatively small (2,229), increased 127%; the number o
foreign-born decreased slightly, to 110,068, of whom 39,771 wer
born in Germany and 23,060 in Poland. Natives of German
constituted only 8·7% of the total population in 1920, as com
pared with 18·9% in 1900.

The assessed valuation of all taxable property in the city ha
risen to $810,509,504 in 1925, more than four times the figure
years earlier. Adding to this the value of property exempt fro
taxation (about $144,000,000) and of public utilities assessed b
the Wisconsin Tax Commission (about $102,000,000), a tota
value for all real estate and assessable personal property of ove
1,000 million dollars was indicated. Ranking 13th in populatio
among the cities of the United States in 1920, Milwaukee ranke
12th in the value of its manufactured products in 1919 and 11t
in 1923 ($576,161,000 and $514,591,065 respectively, compare
with $208,324,000 in 1909), leading all others in the productio
of cranes and hoists, large shovels, excavators and dredges
steam and water turbines, large hydraulic electric units, roc
and ore crushers and many other kinds of machinery, sil
stockings, wheelbarrows and work-shoes. Progress in cit
planning included the preparation of a comprehensive pla
(1917), the enactment of zoning ordinances (1920 and 1924), and
the acquisition by the city of the greater part of the lake front
and of land for a civic centre.

Effect of Prohibition.—The large brewing industry was dissipated by national prohibitory legislation. Some of the companies used part of their plant for manufacturing "near beer," ginger ale and other "soft" drinks, or leased part of it for other industrial purposes, but a large part of the investment in the breweries was still lying idle in 1926.

MILYUKOV, PAUL NIKOLAYEVICH (1859–), Russian politician and historian, was born near St. Petersburg (Leningrad) Jan. 27 1859. He studied history and humanities at the University of Moscow, and received the degree of master in story for a learned work on the *State Economics of Russia in e First Quarter of the 18th Century.* His liberal opinions brought m into conflict with the educational authorities, and he was smissed in 1895 after one of the ever-recurrent university riots." After the meetings of the Zemstvos in 1905 he became e political editor of an important liberal paper, the *Retch*, d took an active part in the formation of the Constitutional emocratic party (Cadets). Milyukov became the leader of at party, although he was not elected a member of the first the second Duma. When the Tsar dissolved the first Duma was one of the principal prompters of the "Viborg mani- to," in which the members of the assembly declared them- ves ready to follow the people in resisting arbitrary rule. ilyukov did not sign, however, as he was not a member of the ıma, and escaped the persecution which accompanied the olypin reaction. He was elected to the third and the fourth ıma, and played the part of a leader of the opposition, system- cally criticising the policy of the Government.

When the World War broke out he stood for a policy of tional union and active co-operation with the Entente, but e corruption of the War Office drove him into an attitude of reasing hostility. Milyukov took office in Prince Lvov's ovisional government as minister of foreign affairs. Later he ongly disapproved of Kerensky's policy, and when the lsheviks seized power he escaped to Kiev then occupied by the rmans and gave up the cause of the Allies as lost. After Armistice Milyukov went to London and subsequently to ris, where in 1921 he directed a journal (*Last News*) in which advocated an alliance with patriotic Socialists.

MIMICRY: *see* COLOURS OF ANIMALS.

MINELAYING AND MINESWEEPING.—Explosive contrivan- were moored and used against ships, as early as 1800. It was , however, until the American Civil War that the sea mine ame an accepted weapon of naval warfare; nor did it prove a ent danger to the capital ship until it played an all-important t in the siege of Port Arthur some 40 years later.

I. MINELAYING

mongst the decisions of international conferences at The gue it was agreed, and ratified by the Great Powers (other n Russia), that mining in war should be limited to operations hin territorial waters. The unfortunate result of this was to the British Admiralty into a false sense of security, and the ing service thus became a side issue. The German Carbonit e, used by the Germans throughout the World War had n originally offered to the British Admiralty. It was refused the plea of expense; and, in its place a mine of about one- rter the cost was manufactured and supplied to the naval ice. The Hague agreement was torn to pieces within a few rs of the outbreak of the World War, and as the War pro- sed the necessity for constant minelaying became evident.

lements of Mining Warfare.—Three factors are necessary successful mining warfare—the strategic function, the opera- of laying the mines and the technical efficiency of the mine f. The first of these factors is woven into the main strategy naval war. The stronger fleet, in its anxiety to seek out and roy its enemy, desires a clear sea; and, to obtain this, must re that such a means of attrition as the mine is reduced to utmost. On the other hand, the weaker fleet will use the mine usely in an endeavour, by attrition, to reach an equality of e: and it will also use this weapon against merchant ships, icularly when they belong to a belligerent dependent on its iage of foodstuff from overseas. This was the initial stage of l strategy in the World War; and to some extent it explains pre-War application of the Germans to mining. The second or is the operation of laying the mines. To be successful, this t be governed by the element of surprise, and be expeditiously ormed; it requires for its purpose a ship of exceptional speed, ne which, by disguise or subterfuge, can carry out the work olested. The value of merchant ships for minelaying was gnised, and the Germans had such ships ready at the reak of war and speedily augmented the number of them.

The third factor is purely one of technique. No type of mine that does not meet the following requirements is efficient. It must be safe until it is laid. When laid, it must take up and maintain its required depth, throughout all kinds of weather, for an appreciable length of time. It must be immune from mechanical failure when required to function. In the interest of all belligerents, it must automatically render itself safe should it break from its moorings. Mines that fail in any of these respects may become a greater danger to friend than to foe. The German Carbonit mine answered these tests except in the last requirement. The early British mine was unfortunately only fully efficient in the last requirement. Considerable importance attaches to the design of a minefield. A simple straight line of mines is easily and quickly laid, but presents little difficulty to the minesweepers once it is located. Lines of mines laid in zigzags, particularly when spaces of water are left clear, present the greatest difficulty to removal. On the other hand, such patterns will necessarily cover a larger sheet of water, and will require very accurate plotting, if subsequently the vicinity of the mined area is to be approached by the sea forces of the minelayer. An existing apparatus termed "taut wire gear" proved a great aid to accuracy in positioning a minefield.

German Practice.—German submarine minelayers usually confined their mines within an area of two or three sq. miles, laying them in groups of four, or even less. The position chosen was most frequently near some focal point, buoy or lightship, or at the entrance to a naval base or commercial port. For instance, during the War, over 450 mines were laid by German submarines within a mile of the Shipwash Light vessel, a position necessarily passed by all traffic up and down the east coast war channel, by the convoys to and from Holland and by Com. Tyrwhitt's destroyer flotillas whenever they left or returned to their base at Harwich. The Germans also allotted to each of these submarines a particular stretch of the British coast. The flotillas working from Flanders covered the coast from Flamborough Head south about to the Clyde, also the northern French coast; the high sea, or large boats, working from the Elbe, were responsible for the rest of the English and Scotch coasts, and the whole of Ireland. Each commander being restricted to work in his individual area, the danger of striking previously laid mines was minimised. The commanders, moreover, by this arrangement, got quickly into touch with the local movements of the traffic, the method and capacity of their opposing minesweepers and the coastal navigation within their beats. In most cases after some 10 to 14 days a commander would not hesitate to pass over a position where he had previously laid mines. He would be confident that his mines had been discovered and cleared if shipping had been seen in the area.

Moored mines could be laid in any depth up to 100 fathoms, or even more in tideless waters, and they could be regulated to lie at any depth below the surface. Deep mines were used against submerged submarines, and shallow ones against surface shipping. In a strong tide, with a long mooring-rope, the mine will bend over to the tide; so that the mines, under strong tidal conditions, always lay too deep to be harmful to surface ships. In a position such as the Pentland Firth, mines were in fact only a danger at slack water, a period of minutes only. Again, the difference in height between high and low water was an important matter. If, for instance, the tidal range was exceptionally large, as in the Bristol Channel or Bay of Fundy, all types of ships could pass over a minefield at high water in perfect safety, provided no mines had been seen at low water on the surface.

British Minelaying Resources.—At the outbreak of hostilities in 1914 the British Navy possessed seven old cruisers (Latona class) fitted as minelayers. These had a speed of only 14 knots. Shortly afterwards four merchant ships were added; and in the second part of the War a considerable number of submarine minelayers and fast destroyers were used. On Oct. 2 1914 the first line of 1,264 mines was laid by the old cruisers in an area 10 m. north of Ostend. This had the effect of forcing neutral shipping to pass through the Downs. Unfortunately, the British mines then in use proved so defective that for a time minelaying had to cease; and although in 1915, after some technical improvement, some 15 more minefields were laid, it was not until 1916 that attention was concentrated on providing a mine of the calibre of that used by the Germans.

British Activities from 1916 Onwards.—One of the principal British minelaying operations of 1916 was a coast barrage, consisting of a double line of deep mines, running for 40 m. from the Belgian coast, at a distance of 12 m. from the shore. It was supplemented by mine nets laid by the Dover drifters. The work took five weeks to complete; but only one submarine seems to have been accounted for by it. The end of the year saw the institution of a mining school at Portsmouth for research and development.

On the assumption that the Belgian coast barrage had been effective, a similar barrage was completed in Feb. 1917 across the Straits of Dover; but the mines dragged and had to be swept up. It was, however, relaid by the end of July 1917. In Jan. 1917 it became essential to encircle the Heligoland Bight and thus to surround all exits from German ports; but the shortage of mines at the time caused the operation to be postponed, nor was the British mine considered suitable for it. However, towards the end of 1917 the "Abdiel" and five minelaying submarines had laid nearly 16,000 mines in the German Bight; and these accounted for a certain number of German destroyers and minesweepers. The mine used in the later stages of this operation was the new British H2, which, except for its method of taking depth, was similar in principle to the German Carbonit mine.

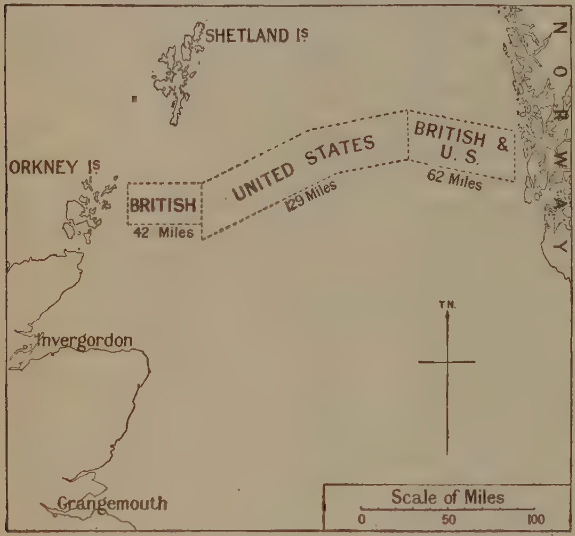

Fig. 1.—Plan of the great northern mine barrage, consisting of 63,117 mines. Laid in 1918 by British and U.S. submarines.

The German method of depth-taking was for the mine, attached to the sinker, to drop to the bottom, where, after a short interval for the purpose of safety, the mine released itself from the sinker and rose to the depth for which it was set. In the British method the mine did not go to the bottom; it did not, in fact, go below the depth for which it was set. The sinker regulated the depth while the mine was still on the surface; then, in sinking, pulled the mine down to its required position. An advantage of the British system was that heavy water pressure on the mine-case was obviated; but, on the other hand, it did not obtain the exceptional accuracy in depth-taking which was noticeable in the German method. In due course the new H2 mine was delivered in sufficient quantity for the long-delayed defensive minefields to be begun by the British, and an extensive new barrage in the English Channel was then completed. Between Folkestone and Cape Gris Nez 9,500 mines were laid in 20 parallel lines, the shoals of the Varne and the Ridge dividing the area into three sections. This barrage effectively closed the Channel exit to the German submarines, nine of which were l in attempts to pass it.

Minelaying by the United States.—The entry of the Uni States into the War admitted of a large augmentation in mi and in minelayers; and an attempt was made to close the nor ern exit from the North Sea by a mine barrage between the O neys and the Norwegian coast (see fig. 1). This operation undertaken by both British and U.S. minelayers. The lat formed a base at Inverness, and supplied ten large minelay with a total carrying capacity of over 5,500 mines. The Uni States used a mine of a novel type. It carried the usual cha of 300 lb. of tri-nitro-toluene, but from each mine there exten antennae for a distance of 35 ft. which, if touched by a me ship, exploded the mine. The result was that the danger z was largely increased.

The vast area covered by mines can best be appreciated b reference to the plan, which gives an idea of the work carr out by the U.S. minelayers. Difficulties were encountered the operation proceeded. A proportion of the American mi exploded prematurely; while a number of British mines took a shallower depth than intended, and had to be swept up a relaid. The complete operation, however, was finished by Ju 1918. It must not be supposed that the whole water availa for a submarine was effectively covered by this minefield; the dangerous area was greatly increased and an effect on morale of the Germans quickly produced. In July German s marines began to creep past in Norwegian waters; but the N wegians closed this coastal lane to both belligerents by mi fields of their own. Of the mines laid in the Northern Barr 56,571 were American and 13,546 British. All this time encircling of the Bight had been going steadily on, and some 000 mines were in place by the date of the Armistice. During period of the War, approximately 160,000 mines were dropp in the North Sea and Channel by the British and Ameri minelayers, the very great majority of which were laid dur the last 18 months of the War.

II. MINESWEEPING

Before the outbreak of War in 1914 the British Navy had, some extent, realised the possibility of a mining offensive on part of their enemies; and, largely due to the foresight of late Admiral Lord Charles Beresford, trawlers had been tes and had proved efficient minesweepers as early as 1907. A traw reserve purely for minesweeping was instituted shortly aft wards. Thus, by Aug. 8 1914, 96 hired trawlers had put to sea sweep up enemy mines, and within a fortnight another 100 tra ers had been requisitioned and were fitting out. The traw minesweeper, however, did not entirely cover the requiremen as it was too slow to sweep the water ahead of a moving fle and this had been realised, and to some slight extent, cate for, by training a flotilla of eight old torpedo-gunboats. Th ships were capable of towing the sweep at 12 knots, which double the speed at which the majority of the trawlers co operate. This gunboat flotilla moved north from Dover on J 31 1914, and, with sweeps out, actually covered the track o which the Grand Fleet passed. They were necessarily mu overworked in the first six months of the War, as, whene practicable, they swept the waters through which the fl moved, and were also constantly required to search areas wh mines were expected to be laid. Fortunately no mines were l near the bases of the fleet until much later, when this sm flotilla had been considerably augmented.

Methods of Sweeping.—At the outbreak of War, the Brit system of minesweeping was for two vessels to tow a stout w between them, the wire being kept at the required depth means of water-kites. The towed wire, termed the sweep, th came into violent contact with the mooring-rope of a mi which it generally broke, causing the mine to come to the su face, when it could be sunk by rifle-fire. In some cases, howe the sweep would strike a horn of the mine, and explode it. Th occasionally led to the parting of the sweep and consequent del while a new wire was passed. The most serious drawback w if the sweep failed to break the mine wire, when the mine would be towed along, more often than not unknown to the sweepers. This latter trouble caused many of the early minefields to be scattered far beyond the limits in which they were laid, and constituted a serious danger. The eventual safeguard was to heave the sweep slowly in, and to sight the whole wire and water-kites on the surface before slipping it, when a mine holding to the wire would be seen and reswept afterwards. The innovation of a serrated form of sweep wire eventually reduced the difficulty to a considerable extent. This simple method of minesweeping stood the test of the whole War, and its simplicity had the great advantage of reducing the training period which would have been necessary had a more complicated apparatus been used.

The French towed from a single vessel two sweeps, one on either side, each kept out by an otter similar to the usual otter used in trawling, but regulated for depth by attachment to a large torpedo-shaped float, the depth at the other end being regulated by a water-kite. Along each wire was distributed a series of small mechanical and explosive wire-cutters. The "shooting" of these sweeps caused trouble unless the crews were adept, and the speed at which the apparatus could be towed was limited to six to seven knots. The spread of the British system was 400 to 500 yd. per pair according to the type of minesweeper, that of the French system not more than 200 yards. In the latter part of the War the Americans adopted the French method, which had by then been somewhat simplified.

The German system was akin to the British, excepting that, in order to cover the route of their fleet more quickly, they instituted a very light form of sweep which could be towed at 20 knots. Directly this apparatus met with an obstacle it was automatically slipped, thus giving notice of the obstruction, whereupon the slower type of sweepers were hastened to the spot to clear it. In practice this system constantly led the fast sweepers to report mines when they had only encountered wrecks or some other harmless obstruction, and little confidence was therefore placed in the reports of mines by this fast flotilla.

Under ordinary cruising conditions, searches by sweepers were made whereby only a small percentage of the water was covered—sufficient, however, to allow a strong probability of the presence of mines being discovered in good time. The introduction of the "paravane," which protected the ship herself, very much reduced the mine danger; but men-of-war were not fitted with this device until 1917, nor by the end of the War was it general in merchant ships. The paravane is an apparatus which, for assured efficiency, requires skilled handling. There are situations where its use is impracticable, and it has not replaced the necessity for the minesweeper.

Early Difficulties.—The War was only a day old when the first mining operation was undertaken by the Germans. An armed merchant ship, the "Königin Louise," laid a large minefield off Southwold, at a distance well outside British territorial waters. The "Königin Louise" was sunk, but H.M.S. "Amphion" struck a mine after the action. This minefield caused considerable loss to merchant ships, many of which were neutrals. It also led to early losses of minesweeping trawlers, in which the mortality was heavy. Throughout the War, an average of half of the crew of a trawler was lost when one was mined. For the first two months of the War, for every two mines swept one trawler was lost. Improved method and greater experience later minimised the losses, until an average of one loss for every 80 mines was achieved in 1918; but the effect on shipping in the early days was such that any form of flotsam was reported as a mine.

The outcry for minesweepers became universal, and more trawlers were requisitioned. In Great Britain there was no lack of volunteers from the fishermen, nor of officers from the Naval and Naval Volunteer Reserves; but all of these were untrained in minesweeping, efficiency in which was proving so essential. By Sept. 1 1914 little had been done with the Southwold-Aldeburgh minefield, other minefields were suspected, insurance rates were rising, and the situation had become grave. A rear-admiral was appointed as Admiral of Minesweeping on the East Coast. The immediate situation was dealt with by the institution of a channel close to the coast, buoyed adequately and swept continuously. Merchant shipping was instructed to pass close to the line of buoys; but the organisation requisite to insure this information reaching all the ships, and the difficulties of enforcing obedience, were not overcome for a considerable time. The losses were reduced to a slight extent, however; and when this channel was extended from Dover to the Firth of Forth, and the organisation was perfected, losses by mine were the exception. Against the British Fleet no mines were laid during the first year of War; but the situation in mined localities had emphasised the necessity for a larger Fleet Sweeping Flotilla, and a number of special vessels, termed sloops, were laid down.

Details of Minefields.—The actual minefields laid by the Germans between Aug. 5 1914 and Aug. 5 1915 were as follows:—

1914	Aug. 5	Aldeburgh-Southwold	180 mines
1914	Aug. 26	off Humber	200 mines
		Tyne	194 mines
1914	Oct. 26	Tory I. (Ireland)	200 mines
1914	Nov. 3	Smith's Knoll	130 mines
1914	Dec. 16	Scarborough	100 mines
1915	April 4	Swarte and Indefatigable Banks	360 mines
1915	May 16	E. Dogger Banks	480 mines

These mines were all laid by surface vessels, and accounted for a heavy toll in merchant vessels and minesweepers.

At the entrance to the Dardanelles minesweeping had to be carried out under heavy shellfire. At first only slow trawlers were available, and night clearing was never a practicable operation.

Growth of the British Minesweeping Force.—In British home waters the augmentation of the minesweeping force was less difficult than abroad. Light-draft excursion (paddlers) were requisitioned in addition to the newly built craft already mentioned, and by April 1915, over 150 vessels purely for minesweeping were distributed as follows: Grand Fleet—6 gunboats, one new sloop and 10 trawlers. Scotland—47 trawlers. Humber—6 paddlers, 30 trawlers. Lowestoft—47 trawlers. Harwich—33 trawlers. Dover—12 trawlers. South Coast—24 trawlers. West Coast—4 trawlers. Clyde—6 paddlers. In the Dardanelles 8 cross-channel steamers had augmented the trawler force, and destroyers had been fitted for minesweeping.

The Submarine Minelayer.—Up to June 1915 all minefields had been laid by surface vessels; but in this month came the first effort of the submarine. A small type, termed U.C. boats, working from Zeebrugge, with Bruges as a mine-depôt, commenced laying batches of 12 mines held in vertical shoots, at first between Dover and Harwich, and later over a wider area. During 1915 54 cargoes (648 mines) were laid in this manner. The effect was a serious increase in British losses by mine, which comprised 5 supply ships, one hospital ship, 2 Trinity House vessels, 34 British steamers, 24 neutrals, 19 fishing boats, and 15 minesweepers, a total of 100 vessels. A useful form of night-sweep came into use against this menace, consisting of a light wire, a depth float kite and explosive grapnel. It was to some extent similar to the German high-speed sweep, and prone to the errors of the latter. No fully efficient minesweep for use in the dark hours was evolved in the War, although this light wire served for searching purposes on several occasions when shipping was forced to arrive at a port at daybreak. In June 1915 the Germans had also extended their minelaying to Archangel, where a unit of six British trawlers was dispatched to assist the Russians. They destroyed 150 mines in this locality under severe conditions of service.

Mining Against the Grand Fleet.—The first mining offensive against the Grand Fleet occurred in Aug. 1915, when 380 mines were laid in the entrance to the Moray Firth, distributed over lines which totalled nearly 70 miles. A large portion of the fleet was at Invergordon at the time. The results were negligible, the losses being confined to minesweepers and one destroyer. A channel was found to be clear on the northern side of the Firth, which was at once used as an exit for the fleet. On the southern side, however, a channel was cleared, but an area of mines was purposely left to form a defensive barrier and so limit the water necessary for patrol and minesweeping. On Jan. 1 1916 the area west of Scapa Flow was mined by the "Moewe" on her passage into the Atlantic. In this field 252 mines were laid, endangering an area of 40 sq. m., which resulted in the loss of H.M.S. "King Edward VII." before the presence of mines was realised. Once located, this area was treated in the same way as the Moray Firth.

Progress in 1916.—By the beginning of 1916, 14 sloops had joined the Grand Fleet, and 35 hired paddlers were in action. The success of this latter type led to 24 being laid down by the Admiralty, and also a new type of twin-screw sweeper, known as the "Hunt" class. The value of these ships lay in their seakeeping qualities and shallow draught. The paravane also passed its test in 1916, and by the end of the year had been supplied to 180 of H.M. ships. Shaped like a torpedo, it contained mechanism for accurate depth keeping at any appreciable speed, and was capable of carrying a heavy wire cutter on the nose, or, when used against a submarine, an explosive charge. As a mine-protection it was towed from a sliding "shoe" which worked up and down the stem of the vessel. The paravane automatically ran out from a ship under way, stretching the wire rigidly at an angle of about 50 degrees to the fore and aft line of the ship. Towed from the point of greatest draught, the wire protected the whole of the ship from a mine; for, on coming in contact with a mine mooring, this wire deflected the mooring until it entered the cutter on the paravane, which instantly functioned. The mine then came to the surface clear of the ship. A modified form of this apparatus was fitted in merchant vessels; and, by the end of the War, 2,740 merchant ships had been fitted. Paravanes in H.M. ships cut 55 mine moorings, but the number cut by merchant ships was less.

The number of German submarine minelayers increased in 1916, and there were larger boats operating over a still wider area. These carried 18 mines. As further construction improved, the number of mines carried rose to 24, and in 1917, to 36. The larger boats worked from the Elbe, and the smaller from Flanders. On May 29 1916, U75 laid her 18 mines close to Marwick Head, off the northwest coast of Orkney. The operation was part of the pre-Jutland submarine actions of the enemy. It is understood that a mining operation on the western exit from Scapa was intended, with a view to crippling the Fleet should it use that exit. The contour of the coast near Marwick and that off the western entrance to Scapa, a few miles to the southward, are very similar, and a mistake in the landmarks was possibly made by the submarine commander. In view of the time elapsing between the laying of the mines and the sailing of H.M.S. "Hampshire" from Scapa Flow for Russia, it would seem obvious that the position chosen is not susceptible of a tactical explanation. Sixteen mines from this batch were swept up directly afterwards in this position, and one was recovered set for a depth of seven metres. (It transpired, after the War, that all these mines were set for this depth.) The tide was appreciable, causing sufficient "mine dip" to insure the mines at this depth being innocuous even to a heavy-draught ship, except at low slack water, and with considerable motion on that ship. The period of slack water was extremely limited. The "Hampshire," proceeding in a sudden gale, and hugging the shore to obtain less sea, struck one of the mines at low-slack water. By this curious conjunction of all these factors, the career of Lord Kitchener was brought to a tragic close. Except for a determined offensive by the Flanders submarines against the Channel Ports, the mine was not extensively used in the latter part of 1916. It would appear that the Germans were then husbanding their resources for unrestricted submarine and mine warfare.

Changes in the British Service.—The reorganisation of the British naval staff in May and June 1917 led to considerable changes in the minesweeping service. The rear-admiral, who had throughout 1916 been very fully employed in concentrating on the paravane and other improvements of minesweeping material, now took over the Dept. of Torpedoes and Mines, which included the technique of minesweeping devices. The control of operations was therefore entirely separated and delegated to a captain on the naval staff, who, in Oct. 1917, became Director of the Minesweeping Div. under the assistant chief of the naval staff. The whole of the minesweeping, then so greatly extending in area, was thus co-ordinated under a central control at the Admiralty.

The intensity of minelaying and expansion of areas in the first half of 1917 was difficult to meet with the minesweepers available; and the climax was reached in April, with a loss of one minesweeper per diem for the greater part of that month. Probably no other service had a more severe strain placed on its personnel during this month and those immediately following. Every available and suitable paddle steamer and motor fishing boat had to be requisitioned; and those incapable of towing a heavy sweep were fitted with a light one, and used for search. Aircraft and motor launches were also used for low-water searches for mines, in order to reduce losses of sweepers; and improvements in traffic organisation and still closer co-operation between adjacent areas were gradually effected. Further protective minefields were laid in certain suitable positions, but the opening of new areas was constantly necessary; and, by the end of 1917, the coastal waters of Great Britain and Ireland, over 1,000 m. in extent, were being swept every day for mines. The war channel was also extended to the Firth of Forth, and merchant ships only released from a night shelter when they could proceed in freshly swept water. One hundred new vessels of the "Hunt" class were laid down, and 300 new drifters put out to contract, so as gradually to replace and release trawlers for patrol and anti-submarine work.

Synchronous mining of adjacent British ports was resorted to by the Germans, which raised many sudden problems in traffic control. The convoy system had now been introduced, and the sweeping of convoys into certain ports often became essential. Particular difficulties arose in regard to Liverpool owing to the shallowness of the channel and narrow entrance; mines swept up, and sunk without exploding, causing serious danger to heavy draught ships by their proximity to the ship when resting on the bottom.

The south coast of Ireland was seriously and continuously mined, and even the bays on the west coast of Ireland did not escape. The year closed with a total of 3,989 German moored mines swept up in home waters, at a cost of 170 Allied and neutral merchant ships sunk and 28 damaged. This total of mines for the year exceeded the combined totals for the previous years of the War. Nevertheless, the outlook was more hopeful. Although the intensity of minelaying had become so much greater, the losses had only been increased by nine ships over those of the previous year: and progressive success in the destruction of submarines and their personnel made it evident that the same intensity and efficiency of the minelayers could not be continued much longer. New construction and greatly improved material for minesweeping had already made their mark. The only fear was that the minesweep would be defeated by some innovation of the enemy. This fear, however, never materialised; although a delayed action (intentional or otherwise) for releasing the mine from its sinker some hours after it was laid was observed on several occasions.

While minelaying had, in home and Mediterranean waters, now been confined to submarines, the "Wolf," a surface raider with 458 mines, succeeded in breaking through the patrols into the Atlantic. Her voyage lasted 15 months. Rounding the Cape of Good Hope, she cruised in the Indian Ocean, then proceeded south of Australia to New Zealand and Fiji; and returning by New Guinea, the Dutch East Indies and the Cape, she reached the Cattegat again in safety. Her mines were distributed all over the globe; and, although the losses caused by them were comparatively light, it was very difficult to obtain suitable sweepers in the various areas to locate and destroy them. It was, in fact, not until the Armistice that all the localities were defined.

End of the Mining Offensive.—The beginning of 1918 saw the defeat of the great mining offensive completed; and by the end of hostilities no more than a dozen efficient German minelaying submarines existed. Their losses had by then completely outstripped new construction, and a well-trained or experienced personnel was entirely lacking. Of the many factors which, taken together, finally killed the minelayer, the most important were: (1) the great efficiency of relaid Dover barrage; (2) the deep minefields in localities regularly used by minelayers; (3) improvements in anti-submarine methods of hunting; (4) co-operation between the Intelligence and Minesweeping divisions; and (5) the distribution of information. In 1918 the average time elapsing from the receipt of the news of a new minefield to its distribution to every base, and to all vessels within the area of wireless communication, was 75 minutes. As a result of these improvements, the total losses by mine during 1918 in home waters were reduced to an average of just two over Allied or neutral merchant ships per month.

Early in 1918, an appreciation of failure led the Germans to concentrate their efforts in minelaying in two directions only. The first was a grandiose scheme, which, commencing in January, was only concluded in late September. It consisted of batches of 36 mines, laid at regular intervals of 10 m, apart on a semicircle 45 from. m the Bell Rock, the result being a complete ring round the entrance to the Firth of Forth. This operation fulfilled a two-fold purpose. It menaced the exit and entry of Norwegian convoys, which were then working from Methil in the Firth of Forth; it also menaced every possible course taken by the Grand Fleet when leaving or entering its base at Rosyth. The scheme, however, was barren of results to the Germans, although methodically carried out in every detail. It was appreciated and countered after the third batch of these mines was discovered, the result being that each of the successive groups of mines was located and cleared immediately; and this was done without the Germans realising that any of these groups had been removed. The other concentration took the form of a field of 400 mines, also laid gradually by submarines. It was directed against the Dutch convoys, and was laid close to the Dutch coast to cover the approaches to the Maas and Ijmuiden. This position was such that any attempts at clearance exposed the minesweepers to a flank attack from enemy vessels. There were some losses by mine, particularly to destroyers escorting the convoys; but the convoys sailed as before, and the losses, on the whole, were very trivial.

Minesweeping after the Armistice.—When the hour of the Armistice struck, a minesweeping force was waiting at the gate of the Dardanelles; and, within 24 hours, 600 British and enemy mines had been removed to clear the way for the fleet to Con-tantinople. For one year after the War, mineclearing was ontinuous in every area where British or German mines had been laid. Under the difficult conditions which immediately ollowed the War, a special minesweeping force had to be en-olled. It consisted of some 600 officers and 15,000 men. Over 13,000 Allied mines and some 70 German mines were cleared rom the sea by British minesweepers. No loss of a merchant hip by mine occurred during that period; and exactly one year o the day from the institution of this force the seas round Britain, her colonies and in the Mediterranean were reported clear. A fine performance in this respect was the clearing by the Ameri-ans of the mines laid between Orkney and the Norwegian coast. The Germans also commenced to clear the heavily mined areas in he Heligoland Bight, and later in the Baltic; but this work of learance was not completed until 1923. Other nations concerned leared their own coastal waters.

BIBLIOGRAPHY.—Rudyard Kipling, *The Fringes of the Fleet* (1915); V. MacNeile Dixon, *The Fleets Behind the Fleet* (1917); L. C. Cornford, *The Merchant Seaman in War* (1918); W. Wood, *Fishermen in Var Time* (1918); D. W. Bone, *Merchantmen-at-Arms* (1919).

(L. PR.)

MINERALOGY (*see* 18.509).—During the war period of 1914–8 nuch attention was given in all countries to the development f home resources of various minerals of economic value, and to neet new circumstances new sources of supply were developed. urther, there was an increased demand for certain kinds of ninerals, for example those which yield the rarer metals used n the hardening of steel. Much of the mineralogical literature f the period was therefore of an economic character, and many ecent text-books gave prominence to the practical uses of minerals. Fortunately, however, pure science was not altogether neglected. Many new facts have been recorded, and new methods of investigation have been devised.

X-Ray Examination of Minerals.—The X-ray method of investigating the internal structure of crystals has been applied with much success to the study of minerals (*see* CRYSTALLOGRAPHY). The material for examination has usually been prepared as definitely orientated crystal plates, but it is found that the results can be obtained with a fine powder; *i.e.*, an aggregate of minute crystals or fragments of crystals with all possible orientations. The method can therefore be used for the purpose of distinguishing between the crystalline and the amorphous or colloidal states. Since each crystallised mineral gives a more or less characteristic series of bands on the photographic film, the powder method may also be used for the recognition of the minerals present in intimate mixtures, such as fine-grained rocks, ores, clays and soils.

X-rays have also been employed in a method of spectrum-analysis for detecting the presence of the various chemical elements present in minerals. For example, hafnium has been detected, and the amount approximately estimated, in many zirconium minerals.

Microscopical Examination of Opaque Minerals.—A method for the investigation of opaque minerals borrowed from metallography (*q.v.*), in which polished sections are examined under the microscope in reflected light, has proved to be especially useful for the study of metallic ores. It consequently finds an economic application in the valuation of ore deposits. The several mineral species of which the ore is composed can be distinguished, and their relations to one another determined; *e.g.*, the order of their deposition, and whether they are of primary or secondary origin.[1]

The process of grinding and polishing the sections presents certain difficulties owing to the extreme differences of hardness of the several minerals that may be present. The prepared section is illuminated vertically by means of a right-angle prism placed in the tube of the microscope above the objective. Details of structure can be brought out by etching the section with various chemical reagents. The several characters (colour, hardness, relief) of the minerals, together with their behaviour towards reagents, help in their determination. But in many cases ordinary simple tests made on fragments detached from the polished surface are more reliable. Electrical tests can be made with quite simple apparatus: for example, the electrical conductivity can be determined with a dry cell and voltmeter using needles as terminals on the polished surface. Certain optical determinations can also be made in reflected polarized light.

One result of this study of opaque minerals is to draw attention to the extremely intimate association and intergrowth of many of the ore-minerals; this is well shown in the numerous photo-micrographs published by American workers in economic geology. What to all appearances by ordinary methods is a homogeneous mineral may be found by the new method to be really heterogeneous; and, in fact, several supposed mineral species have been proved to be mixtures, and well-developed crystals have in certain cases been found to contain enclosures of other minerals. The method is thus of use for ascertaining the degree of purity of material collected for exact chemical analysis when the formula of a species is to be established. The long-debated question as to how silver exists in argentiferous galena (lead-ore) has been studied by this method. Galena containing 0·10 to 0·35% of silver shows definite spots of tetrahedrite and argentite, whilst specimens containing more silver show evidence of later addition of proustite or pyrargyrite in the form of veinlets.

Mineral Transformations.—In synthetical mineralogy a large amount of experimental work has been done, especially in the Geophysical Laboratory of the Carnegie Institution at Washington. Many minerals and allied compounds have been prepared artificially in silicate and salt fusions. The conditions necessary for their formation and their ranges of stability—either when alone or when in the presence of other compounds—have been studied in detail. One important result obtained by experimenting over wide ranges of temperature has been to show that practically all compounds known as minerals exist in several polymorphous forms.

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[1] The technique of the subject (called mineralography or mineragraphy) is dealt with in the text-books: J. Murdoch, *Microscopical Determination of Opaque Minerals* (New York, 1916) and W. M. Davy and C. M. Farnham, *Microscopic Examination of the Ore Minerals* (New York, 1920.)

The work has shown that silica (SiO_2) undergoes a remarkable series of changes in its crystalline structure and physical characters when it is submitted to different degrees of temperature. The changes with increasing temperature are:—

α-quartz (rhombohedral trapezohedral), passing at 575° C. into
β-quartz (hexagonal trapezohedral), passing at 870° C. into
β-tridymite (hexagonal holohedral), passing at 1,470° C. into
β-cristobalite (cubic) melting at 1,625° C.

These transformations are reversible, but with falling temperature they take place very slowly. Molten silica unless cooled very slowly solidifies as a glass. β-tridymite when quickly cooled undergoes a change at 163° C. (β_2-tridymite to β_1-tridymite), and at 117° C. passes over into α-tridymite, which is optically biaxial and probably orthorhombic in crystallisation, being identical with the naturally occurring tridymite. Similarly, β-cristobalite when quickly cooled changes at about 180°–270° C. into α-cristobalite, which is optically biaxial (pseudo-cubic) and identical with the cristobalite occasionally found in volcanic rocks.

Now these and many other similar changes give information as to the conditions of temperature under which various minerals were formed in nature, thus providing a "geological thermometer." For example, the presence of tridymite, or of pseudomorphs of the more stable quartz after tridymite, establishes that the rock in which they occur must have been formed at a temperature between 870° and 1,470° C. The quartz of certain veins and that of granite present differences in structure which indicate that the former was formed below 575° C. and the latter above this temperature. Or again, the presence of orthorhombic copper-glance (β-Cu_2S) as a pseudomorph after cubic α-Cu_2S proves that the ore-deposit in which it occurs was formed at a temperature higher than 91° C.

Chemical Composition.—The chemical composition of many minerals is still imperfectly understood, and even for some quite common species there are doubts as to the correct empirical formulae, especially as to the silicates, a satisfactory classification of which is still wanting. Many attempts have within recent years been made to gain some idea as to the constitution of the silicates; there has been much experimental work and plenty of speculation, but with no very definite results. In certain groups, *e.g.*, the feldspars and the garnets, the composition can be satisfactorily expressed on the assumption of the isomorphous mixing of different chemical molecules. But attempts to extend this principle to all silicates often lead to highly complex hypothetical molecules, the existence of which can only be regarded as doubtful. Alternative suggestions have been put forward, such as the "mass effect" of large molecules and the "solid solution" of certain other substances in the main mass of the crystal. Experiments with silicate fusions show that various substances can be taken up, or dissolved, in certain amounts, giving on solidification apparently homogeneous crystals.

Radioactivity.—The strong radioactivity (*q.v.*) of uranium minerals affords a ready means of recognising these valuable ores in the search for them by prospectors. The mineral may be wrapped up with a photographic plate, which is afterwards developed; but a simpler and quicker test is that with a quite simple (home-made) gold-leaf electroscope. A piece of the mineral to be tested is placed on the cap of the electroscope, which is then charged with electricity, readily developed by rubbing with glass or vulcanite (say the mouthpiece of a tobacco-pipe): if the mineral contains uranium (and consequently radium), the gold leaves will soon come together. It is always well to make a comparative test, timing the rate of collapse, with a piece of ordinary stone.

Determinations of the ratio of the amount of uranium to the amounts of the various products of its decay (radium, helium, lead, etc.) present in various radioactive minerals give (knowing the rate of the decay) some idea of the period of time during which these products have been accumulating. In this way estimates have been made of the age in years of these minerals and even of the age of the earth; but, of course, many unknown factors must have been omitted from such calculations. Lead of radioactive origin, or isotropic lead—the final product of uranium decay—is found to vary slightly in its atomic weight (*q.v.*) according to the uranium mineral from which it is extracted.

To radioactivity is ascribed the well-known "pleochroic haloes"—tiny spots or borders of deeper colour surrounding microscopic inclusions—long ago observed in certain rock-forming minerals (cordierite, andalusite, mica, etc.) when microsections of rock are examined in polarised light. The long and continued emission of X-rays from zircon or other mineral grains has caused a change in colour of the surrounding mineral for distances varying from 0·002 to 0·4 millimetre. A study of these has again given some information as to the age of the minerals In this connection it may be mentioned that much experimental work on the coloration of minerals has been done within recent years by exposing the minerals to the action of radiations of various kinds, including ultra-violet rays, cathode rays, X-rays and the rays emitted by radium salts. For example, some diamonds acquire a green colour and fluorspar becomes blue when placed in contact with radium bromide.

Some New Minerals.—In descriptive mineralogy a considerable number of new minerals have been named, but unfortunately in many cases not completely determined and described A few of the more prominent and well-established of these are:—

Carnotite.—Hydrated vanadate of uranium and potassium $K_2O{\cdot}2UO_3{\cdot}V_2O_5{\cdot}nH_2O$, occurring as a canary-yellow crystalline powder impregnating sandstones over a wide area in western Colorado and the adjoining portions of Utah and New Mexico. In Colorado it has been collected on a large scale for the extraction of vanadium uranium and radium. It has also been found in South Australia and in Pennsylvania; and an allied mineral (tyuyamunite, containing calcium in place of potassium) is known from Tyuya-Muyun in Russian Turkestan.

Germanite.—A sulphide ore mineral containing copper, iron and the rare elements germanium (5–8 %) and gallium ($\frac{1}{2}$–$\frac{3}{4}$ %). As a massive, reddish-grey mineral intermixed with tennantite it is found in some quantity at Tsumeb in South West Africa.

Kasolite.—A hydrated silicate of uranium and lead, $PbO{\cdot}UO_3{\cdot}SiO_2$ H_2O, forming radiating groups of small, ochre-yellow, monoclinic crystals. Together with several other new but imperfectly defined minerals, it occurs as an alteration product of pitchblend at Kasol in Katanga, Belgian Congo.

Lorandite.—Sulpharsenite of thallium, $TlAsS_2$, forming transparent, monoclinic crystals with a carmine-red colour and adamantine lustre. It is found with realgar at Allchar in Macedonia, and is one of the few minerals that contain the rare element thallium as an essential constituent (Tl 59·5 %).

Mullite.—Recent experiments have shown that the only aluminium silicate that can be prepared artificially is the compound $3Al_2O_3{\cdot}2SiO_2$, and not $Al_2O_3{\cdot}SiO_2 = Al_2SiO_5$ (fibrolite) as formerly supposed. The same compound, as minute orthorhombic crystals has been found in slates fused by igneous rocks in the Island of Mull Scotland, and has been named mullite.

Patronite.—Vanadium sulphide, VS_4, forming dark greenish-black compact masses. It occurs abundantly at Minasragra, Cerro de Pasco, Peru, where it is a valuable ore of vanadium. It weather very readily with the production of various highly coloured vanadium compounds; even on material kept in collections there is a slow growth of blue and green efflorescences.

Spencerite.—Hydrated basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2$ $3H_2O$, forming pearly white, scaly cleavage masses and small monoclinic crystals. It has been found in some abundance forming large stalactites in a cavern near Salmo, British Columbia.

Tarbuttite.—Basic zinc phosphate, $Zn_3(PO_4)_2{\cdot}Zn(OH)_2$, forming colourless, or faintly coloured green or red, anorthic crystals, with a perfect cleavage in one direction. It has been found in considerable quantity at the Rhodesia Broken Hill Mine in Northern Rhodesia.

Thortveitite.—Silicate of scandium, yttrium, etc., $(Sc, Y)_2O_3{\cdot}2SiO_2$ occurring as large orthorhombic crystals of prismatic habit in pegmatite in southern Norway and Madagascar. This is the only mineral known to contain the rare element scandium in large amount.

BIBLIOGRAPHY.—Details of descriptive mineralogy are collected in Appendices 1–3 of Dana's *System of Mineralogy* (New York, 1899–1915); and numerical data respecting the constants of minerals are tabulated in the international *Tables annuelles de constantes et données numériques*, 6 vol. (Paris, 1912 etc.). A work of comprehensive character is C. Doelter, *Handbuch der Mineralchemie*, 4 vol (Dresden and Leipzig, 1912 etc.). An advanced textbook on new lines is P. Niggli, *Lehrbuch der Mineralogie* (Berlin, 1924, with two more volumes to follow). A number of elementary textbooks have been published, *e.g.*, G. A. J. Cole, *Outlines of Mineralogy for Geological Students* (London, 1912); A. F. Rogers, *Introduction to the Study of Minerals* (New York, 1912); E. H. Kraus and W. F. Hunt *Mineralogy, an Introduction to the Study of Minerals and Crystals* (New York, 1920); H. Buttgenbach, *Les minéraux et les roches* (Paris and Liége, 1924). A popular book with coloured plates is L. J. Spencer, *The World's Minerals* (London, 1911, 2nd ed., New York 1916). Books of an economic character are H. Ries, *Economic Geology* (5th ed., New York, 1925); T. Crook, *Economic Mineralogy a Practical Guide to the Study of Useful Minerals* (London, 1921) B. Dammer and O. Tietze, *Die nutzbaren Mineralien* (2 vol., Stuttgart, 1913–4). *Special Reports on the Mineral Resources of Great Britain* have been issued by the Geological Survey, London, since

1915; and a long series of pamphlets, *The Mineral Industry of the British Empire and Foreign Countries* by the Imperial Mineral Resources Bureau, London, since 1920. New journals are *Fortschritte der Mineralogie, Kristallographie und Petrographie*, issued by the German Mineralogical Society, Jena, since 1911; *Beiträge zur Kristallographie und Mineralogie*, ed. by V. Goldschmidt (Heidelberg, since 1914); *Schweizerische Mineralogische und Petrographische Mitteilungen*, Zürich, since 1921. A review of the recent scientific literature is given in the Mineralogical Society's series of *Mineralogical Abstracts*.

(L. J. S.)

MINERS' PHTHISIS (*see* 18.541b).—Almost any dust inhaled in sufficient quantity may cause chest trouble of some kind or another, but certain dusts are related to the occupational disease variously known as miners' phthisis, pneumonokoniosis, grinders' rot, potters' rot, stonecutters' rot, etc.

Phthisis-producing Dusts.—Dusts with this association are often referred to as phthisis-producing dusts because pulmonary tuberculosis plays a more or less important part in this disease and is always associated with a fatal termination and usually with disablement. Prof. E. L. Collis has shown that the phthisis-producing dust of far the greatest importance in industry is dust of free silica (SiO_2) and the disease is often known as "Silicosis." For a dust to be phthisis-producing it must be comparatively nsoluble and inert and the particles must be minute, say from ive microns downwards, or about the size of the common pathogenic micro-organisms. Owing to their minute size these particles may be present in air in dangerous concentration without being visible to the eye or in any other way noticeable to the senses, so in a phthisis-producing industry it is expedient to sample the air for dust as one samples for gas in a "gassy" mine.

The Lungs and Dust.—The lungs have a very considerable power of ridding themselves of inhaled particles, and some dusts, ike coal-dust, are much more readily got rid of than others while, n the case of a phthisis-producing dust, accumulation readily gets ahead of elimination, so quite small quantities of air-borne dust may be dangerous. It is owing to this cumulative factor hat duration and continuity of exposure are of importance as well as concentration in the air. While the average incidence f miners' phthisis on the gold-mines of the Witwatersrand is nder 3% per annum of the underground population the incience rises as high as 10% per annum in the case of miners of 13 ears' service and over.

Dust Cells.—A certain proportion of the fine dust inhaled runs he gauntlet of the upper respiratory passages and gets right own into their minute blind extremities, the alveoli. In silicosis s in pulmonary tuberculosis "lesion means arrest" and the ust particles are arrested by being taken up by certain cells nown as dust cells. The dust cells are a variety of the phagoytes of Metchnikoff and, when dust-laden, they aggregate toether forming small masses or pseudo-tubercles. These pseudoubercles may be found on the alveolar walls, under the pleura nd in the lymphatic channels which they obstruct. The dustontaining cells forming the pseudo-tubercles tend to degenerate nd become fibrous tissue thus forming the fibroid nodules charcteristic of the early stage of silicosis.

Prevention.—It is the fine dust that matters and, in mines here a phthisis-producing rock is dealt with, the chief sources f fine dust are blasting and rock-cutting with machines. From e point of view of prevention, in industries where blasting is ractised, the workers should not return to the working-place ntil after all dust and fume have been blown away. Ventilation ith good currents of dust-free air is the great safeguard because, y treating the air-borne dust as a gas, it can be diluted down wards a safe level. What is a safe level? When one has to deal ith daily exposure over many years, perhaps about one milliamme of dust per cu. metre of air. The fine dust is only a small oportion by weight of the total air-borne particles, but inudes the majority of particles by enumeration. A sample of r-borne dust of 2 milligrammes per cu. metre as determined by e method in use on the Witwatersrand corresponds to about o particles of fine dust per cu. cm. of air (counted by Kitze niometer). The other great safeguard is "working wet" and e chief source of the dust associated with machine drilling is "sludging" with air. When it is practicable to sludge with water only, machines raise much less dust. Water-sprays should be in continuous use and the roof, walls and floor of the working-place kept wet. All broken rock should be thoroughly wetted before moving (*see* MINING).

A machine may be in good order for rock-cutting and in bad order for dust-control and should be inspected from the latter point of view as well as the former. A hand-drill is more difficult to keep in order for dust-control than is the larger machine and it is doubtful if it is possible to secure safe conditions if hand-drills are used dry when cutting phthisis-producing rock. In all phthisis-producing industries, apart from working wet, it is wise to think of the fine air-borne dust as a gas and make every possible use of exhaust-hoods and abstractors; while sources of dust escaping to the air should, as far as possible, be located and enclosed.

There are two important factors in the severe forms of miners' phthisis:—

(1) The phthisis-producing dust.

(2) The tubercle bacillus.

Carriers.—The modern view of pulmonary tuberculosis as met with in the adult population of civilised countries is that it is related to re-infection by the obvious route of inhalation. Under experimental conditions the presence of dust in the air, together with the tubercle bacillus, renders the susceptible animal much more liable to infection by inhalation. It is on account of this association that, in a phthisis-producing industry, one must strive not only to eliminate dust but also to eliminate the tubercle bacillus. The only practicable step towards the latter ideal is to detect and remove the "carrier," *i.e.*, the sufferer from open tuberculosis. For the sake of others as well as for their own, sufferers from tuberculosis should not be allowed to work at a phthisis-producing industry. Tuberculosis, of course, is not a compensatible occupational disease, but it might well be so regarded in a phthisis-producing industry for, although pulmonary tuberculosis is not miners' phthisis, practically all grave miners' phthisis is associated with pulmonary tuberculosis.

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(A. MAV.)

MINING (*see* 18.528).—Since 1910 there has not been much change or development in the methods of working as applied to the extraction of mineral ores and other substances from veins and stratified deposits. This is, perhaps, more particularly the case in regard to coal and stratified deposits than of metalliferous ores occurring in veins. The development in respect of the former lies chiefly in the direction of the machinery used in the mines and its application, more particularly at the working face, and especially that used in the getting and transporting the coal at the faces.

In the working of metalliferous veins, while the standard methods of extracting the ore by overhand or underhand stoping have changed little, a more definite classification than existed formerly has grown up respecting the application of these methods to given local conditions. Comparatively thin veins, with a steep pitch (dip), are developed by a series of drifts (levels), and above each of these overhand stopes are opened for extracting the ore, the working being advanced upward. The broken ore is run through chutes (mills or passes) to the level below, in which it is conveyed in trams by hand or mechanical power to the shaft or through an adit (tunnel) to the surface. For thicker veins, especially those with a steep dip, underhand stoping is occasionally employed, the advance being forward and downward toward the haulage level. In the case of flat veins or of bedded deposits breast-stoping is used, the details of which much resemble those of underhand stoping. In all of these methods, the roof of the deposit (hanging wall) is supported by pillars of ore, by props, balks of timber (stulls), by "square-set" timbering or by masses of waste ore and rock (filling) carried by stulls. Sometimes stopes are completely filled with waste.

Shrinkage Stopes.—There are a variety of overhand stopes which have been more widely employed than formerly for both narrow and wide steeply dipping veins. In these stopes the broken ore accumulates until the stope is complete, thus making artificial support for the walls of the stope unnecessary. Since rock when broken increases in bulk, from 25 to 40% of the ore is drawn from the stope as it advances to leave room at the top for the miners, who stand on the broken ore while drilling. This method is applicable only to those cases where the inclination and width of the vein are great enough to allow of the broken ore sliding down freely to the stope floor (footwall). Finally, after all the ore has been drawn off, the stope is allowed to cave in or is filled with waste. In principle, the shrinkage stope is identical with the "battery-breast," commonly used in fairly thick coal seams, when the pitch exceeds about 35° to the horizontal.

Caving Systems.—The prototype of these, long employed in certain British iron mines, is known in the haematite iron ore mines of Lancashire and Cumberland as the caving system. In the United States caving was first used for the soft iron ores of northern Michigan. More recently, it has been extensively applied to the iron deposits of the Mesabi district, Minnesota, and to some large copper deposits in the south-west of the United States. The chief requisites for the successful application of caving methods are: (1) massive deposits of relatively cheap minerals; (2) ore-bodies of large horizontal dimensions, overlaid by a capping varying in character from earthy soil or glacial drift to firm rock; (3) large-scale work. There are three distinct methods: top-slicing, block-caving and sub-level caving. The salient features of all are: (*a*) horizontal subdivision of the ore-body into floors; (*b*) subdivision of each floor into small slices or blocks which are mined separately; (*c*) delivery of the broken ore through chutes to the haulage-ways below and thence to the shafts; (*d*) as the ore is removed, the overlying capping must gradually cave in and settle.

The period 1910–25 was marked by a wider application of the slicing and caving methods, especially for large low-grade deposits of disseminated copper ore. More deposits of this type have been developed and worked in recent years than ever before, many variations in details being introduced to suit the dimensions of the ore-body, its depth below the surface and the character of ore and of the super-incumbent strata or capping. All this has brought a more definite understanding of the applicability and limitations of the caving systems, as determined by existing local conditions.

Some prominent examples of the newer mines, in which different forms of slicing and caving have been adopted, follow.

Inspiration Mine, Arizona.—The ore-body is a massive deposit of disseminated sulphide of copper (calcopyrite), containing about 100,000,000 tons of low-grade ore, and overlaid by a valueless capping, 30 to 350 ft. thick. A variation of the caving system is used, known as "block-caving." The ore-body is intersected at vertical intervals of 150 ft. by main haulage levels, connecting with the winding shafts (fig. 1). Above the haulage levels are long chute-raises, inclined at 50° to the horizontal, from which numerous short secondary raises ("finger-raises") are driven to a system of sub-level drifts, 35 ft. apart vertically and 50 ft. horizontally. The ore developed by the sub-level drifts is thus divided into small "blocks," which are undercut and broken up by blasting out the supporti pillars between the drifts. The broken ore is drawn down throug the branching finger-raises underneath, into the main raises a thence to the haulage levels, the flow being controlled by gates. the upper part of the ore-body is thus removed, the capping cav in on top of the solid unmined ore below. (For full details, see *Tran Amer. Inst. Mining Eng.*, vol. 55, p. 218; vol. 59, pp. 299, 305; v 66, p. 127.) Block-caving, similar to that of the Inspiration mine, also used by the Ohio Copper Co., Bingham, Utah, and the Neva Consolidated Copper Co., Ely, Nev.

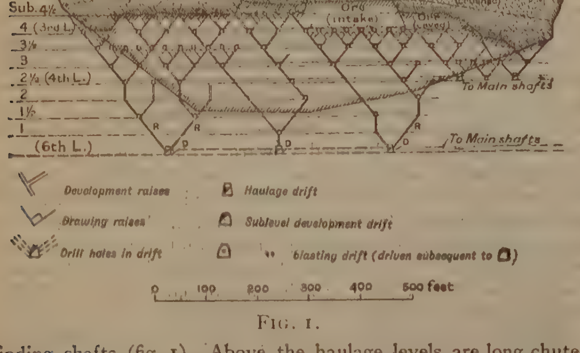
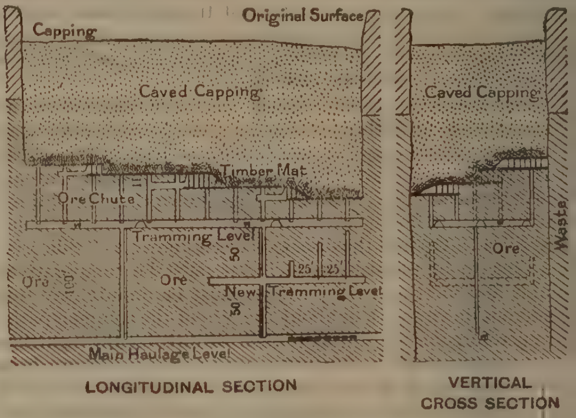


FIG. 1.

Arizona Copper Co.—A top-slicing method (fig. 2) is applied large bodies of soft ore, carrying 2 to 4% copper. A main haula road is driven near the bottom of the ore-body, and above it a intermediate working levels, 50 to 60 ft. apart vertically. The comprise a rectangular system of tramming drifts and cross-cu from which chute-raises are made into the ore above at 25 to 30 intervals. Starting from the tops of these raises, horizontal slices ore, 7 to 15 ft. thick, are blasted out and the broken ore is run do through the raises to the tramming level. Thence it is conveyed the nearest main raise, connecting with the haulage road belo (For details of the slicing operations and the manner in which t overlying capping caves in as the successive slices are removed, 18.532.)



LONGITUDINAL SECTION

VERTICAL CROSS SECTION

FIG. 2.

These modifications of top-slicing consist chiefly in making rais from the intermediate tramming levels at short intervals, to minim the labour cost of handling the ore mined in the slices. In one of t Arizona Copper Co.'s mines a further saving has been effected omitting the tramming levels and the small raises from them. main drift is driven longitudinally through the axis of the ore-bod just below the roof or capping, and from it, at right angles, cro cuts, 40 ft. apart, to the walls. The panels or blocks of ore betwe the cross-cuts are sliced back from the walls of the ore-body towar the main drift. On each side of the latter a pillar is left, which finally sliced back from its end, in completing a floor. While o floor is being mined, the next, 11 ft. below, is in preparation. Th method of panel slicing has recently been adopted successfully in t Herman gold mine, California. The vein dips 45° to 60°, and t panels are laid out at an inclination of 52°, across the ore-body. To slicing is also used in many massive deposits of low-grade copper o for example: Cumberland-Ely, Nev.; Cananea, Mexico; Mia Ariz.; Bingham, Utah; and mines of the Calumet & Arizona Mini Co., Arizona. At the last-named property, the older caving meth has been replaced by a modification called the Mitchell top-slici system, found economical in reducing the shovelling required.

Other Variations.—In a number of important mines working la ore-bodies, special conditions have been dealt with by combining t or more of the methods referred to above. Examples are to be fou in the mines of the Braden Copper Co., Chile; New Jersey Zinc C Franklin, N. J.; Utah Copper Co. (Boston mine); Ray Consol. Co per Co., Ariz.; Homestake Gold-Mining Co., S.D., and the De Bee Mining Co., South Africa. In most cases, operations begin by shri age stoping, after which the intervening pillars are mined by to slicing, block-caving or sub-level caving, the object aimed at bei the getting of as high a total tonnage extraction as possible, that obviating loss occasioned by leaving ore in permanent pillars through mixture with waste material.

Stripping Superficial Ore Deposits.—This old mode of attac ing shallow deposits of large horizontal area was oftener resort to in the period 1910–25 than previously, and was applied deeper ore-bodies than formerly were considered capable being mined by stripping.

Standard Methods.—Standardisation of methods of worki when practicable probably promotes efficiency and economy

peration. Seams of coal and some regular bedded deposits
f the base metals, owing to their comparative uniformity of
eological occurrence, can be worked to a greater degree by
tandardised methods than most metalliferous deposits, which
ary greatly in their physical characteristics. A notable instance
o the contrary is perhaps that of the Banket deposits of the
Rand, Transvaal, which are in the nature of highly inclined beds
f conglomerate. (See the useful discussion by C. A. Mitke,
Mining Methods of the United Verde Extension Mining Com-
any, Arizona," *Trans. Amer. Inst. Mining Engs.*, vol. 61, p. 188.)
n the three years 1922–5 a "Committee of One Hundred"
f the Amer. Inst. Mining Engs. (comprising 13 sub-committees)
ollected and published descriptions of the mining methods in
he principal districts of the United States. It was planned to
assify these data, with a view still further to standardise mining
ractice for the different kinds and shapes of ore deposit.

In many mining operations there is a stronger tendency
oward standardisation of details. Thus, some mining companies
ave adopted standard "rounds" of holes for shaft-sinking,
rifting, cross-cutting, raising and stoping. The foremen are
rnished with instruction sheets which specify the position,
epth and charge of explosive for each hole. The miners are
equired to follow these instructions instead of doing their work
accordance with their own individual ideas. The adoption of
ch methods has been assisted by the greater attention now
ven to what may be termed efficiency engineering. Many
rge mines have "efficiency engineers," who study in detail the
erformance of both men and machinery, thus improving the
uality and amount of work done. In Great Britain too, quite
tely, attention is being directed in some enlightened quarters
the psychological side of mining with a view to ensuring
eater efficiency.

Directed toward this end also are the movements inaugurated by
veral mining companies to instruct their employees in the best
ethods of doing their work. Thus, an education department is
aintained by the Phelps-Dodge Corp., of New York, which oper-
es a number of mines in the southwest of the United States. Lec-
res are delivered to the miners on practical mining topics, followed
examinations. The North Butte Mining Co., of Montana, has
so standardised the details of many underground operations. The
st of these education departments is considerable, but is amply
stified by the results. A wholesome spirit of rivalry is encouraged
nongst the miners and their ambition is aroused; hence, better
rk is done, the *morale* of the whole force is raised, and better rela-
ns are established between the employees and the mine manage-
ent. The principles of standardisation have also been increasingly
plied to the design of mining appliances and machines.

Blasting.—Explosives for blasting rock and ores underwent
nsiderable change in composition during 1915–25, and tests
ve supplied valuable data respecting the disruptive and
opulsive forces and the sensitiveness of the types and grades of
namite, leading to a better understanding of their suitability
different kinds of service. Explosives for coal-mines, especially
ose in which dangerous gases occur or which are dry and
sty, must be so constituted that ordinary charges will not
oduce a flame of sufficient intensity and duration to ignite
plosive mixtures of gas and air. These comprise the tested
ermitted explosives," lists of which are published in coal-
ning countries and revised from time to time, to keep them up
date. In Europe their use under certain conditions—condi-
ns which exist in the majority of the coal mines—is required
law. In the United States the lists appear in publications of
Bureau of Mines. The bureau can only recommend them,
ugh legal requirements exist in some of the states.

" Permitted explosives" have certain characteristic ingredi-
s: (*a*) ammonium nitrate; (*b*) salts containing water of crys-
isation, which, being liberated and vaporised by the heat of
losion, reduces the flame temperature; (*c*) organic nitrates
er than nitro-glycerine, *e.g.*, nitro-starch; (*d*) nitro-glycerine,
ed with free water or an excess of carbon. It was formerly
umed that nitro-glycerine compounds and other detonating
losives were not suitable for collieries, because, due to market
uirements, excessive shattering of coal is undesirable (except
coke-making); but low-strength, "short-flame" dynamites are now being satisfactorily used. While no explosive can be absolutely safe in gassy mines, those in the "permitted" lists are relatively safe. The standard tests vary as between countries; that of the United States, which is now given, is less drastic than that operative in Great Britain. In the U.S.A. an explosive is accepted for the list when a charge of 680 gm. (1½ lb.) does not ignite gas or coal-dust; it is not accepted if a charge of 250 gm. does cause ignition. In 1912 the permitted list of the U.S. Bureau of Mines comprised 96 kinds and grades of safety explosive; in Jan. 1924 the number had increased to 158, many being almost identical in composition. The United States is the largest user of "permitted explosives" in the world, the quantity consumed having more than doubled in 1912–25.

Blasting methods in the United States have been improved by the introduction of "delay action" electrical fuses. In work like tunnelling (cross measure or stone drifting) and shaft-sinking, where rounds of charged holes are best fired in volleys, these special fuses save time, as the miners need not return to the working place after each volley to prepare for the next. The entire round is wired, as if all the holes were to be fired simultaneously, and there is but one application of the current. The groups of holes explode successively, in the desired order and at intervals of about one second, by using "no-delay" fuses for the first group and "first-delay" and "second-delay" fuses for the following groups. In British coal-mining, volley firing of charges is not permitted by the laws regulating the industry.

Construction of Delay Fuses.—The platinum bridge in the cap shell, between the terminals of fuse wires, is not embedded in the fulminating charge itself, so as to explode it directly, but ignites a short piece of slow-burning ordinary fuse, which in turn explodes the fulminate. The delay interval depends on the length of ordinary fuse used. Another new device for the same purpose is the electric fuse-igniter. A special electric cap contains a small charge of fine-grain black powder, beyond which is a piece of ordinary fuse, with a cap on the end to be placed in the dynamite cartridge. For blasting with black powder, no cap is put on the ordinary fuse.

Mine Hygiene.—Improvements made in the years 1910–25 were chiefly in five directions: (1) better ventilation of mine workings; (2) enforcement of dust-prevention regulations and of regulations requiring the adulteration of coal-dust in the mine by the admixture therewith of inert dust; (3) introduction of new types of blasting explosives, so constituted as to minimise the quantity of deleterious gases evolved; (4) adoption of precautions with the object of producing more perfect combustion of explosives, and the consequent reduction or prevention of the formation of the poisonous carbon monoxide; (5) study and better understanding of special miners' diseases and their treatment. (*See* INDUSTRIAL WELFARE.)

Ventilation.—Formerly, artificial ventilation by fans or blowers was provided only for collieries, to dilute and sweep out gases emanating from the coal and surrounding strata. In recent years, mechanical ventilators have been increasingly applied in the ventilation of metalliferous mines also.

About the year 1902 the high mortality amongst the miners of some districts, especially on the Rand, South Africa, began to attract attention. Investigation showed that acute lung trouble ("miner's phthisis" or silicosis) is caused by inhaling dust from drilling in dry silicious rock or ore. In 1903 a Government Commission was appointed to study the conditions in the Transvaal gold-mines. Their report led to a demand for better ventilation of the mine workings, and the adoption of water-spraying devices to allay the dust arising from the operation of drilling. Revised and more stringent regulations were enacted in 1913. Other governmental investigations were made in Cornwall and the ganister mines of the Midlands, England, Australia and New Zealand, and in the United States by the Bureau of Mines. In 1911 one of the large gold-mining companies in the Transvaal, the Rand Mines (Ltd.), established a department of sanitation, to deal in general with miners' living and working conditions and diseases. The department's activities now cover a large number of the mines of the district, employing between 55,000 and 65,000 men, and marked benefits have resulted from this important movement, which is gaining in strength.

Tests of the gases from blasting explosives have revealed the extent to which they may vitiate mine air. One pound of standard dynamite produces about 10 cu. ft. of gas, which, due to incomplete detonation, often contains 25 to 30% of carbon monoxide. Since, for safety, this actively poisonous gas should be diluted to about 0·01 of 1%, it is evident that natural ventilation cannot always be relied upon, and mechanical ventilators have been installed for many metalliferous mines. Several new types of high explosives have recently been introduced, so compounded that they produce much less carbon monoxide (CO) and methane (CH_4) than the standard ("straight") dynamites. They are therefore particularly useful in poorly ventilated mine workings, as headings where, in order to secure ventilation (in coal mines), bratticing or air pipes are necessary. Furthermore, there has been increased insistence on the use of high-strength caps or detonators, since imperfectly detonated explosives of all kinds produce an excessive amount of carbon monoxide.

Explosions in Coal Mines.—Advances have taken place in the appliances for fighting mine fires, in the modes of preventing and dealing with gas and dust explosions in collieries and in the design of safety lamps. Coal dust explosions are generally much more serious in bituminous than in anthracite mines. Most explosions in anthracite mines are of gas, sometimes aided by presence of dust. Many investigations of coal-dust explosions have been made in Europe since 1880, but some of the phenomena attending their initiation and propagation have long been imperfectly understood.

Since Professor Galloway (afterwards Sir William Galloway) first drew attention, about 1880, to the dangers arising from coal dust and the brothers Atkinson (Inspectors of Mines) wrote their book on colliery explosives, Sir William Garforth, after the Altofts explosion in Yorkshire, described the arresting effects of stone-dust on the explosive blast, and thereafter the Mining Association of Great Britain established a plant near Altofts for carrying out large scale experiments and did excellent work. Eventually the Home Office took over the plant and, transporting it to Eskmeals in Cumberland, added to it and extended the scale of the experiments.

The results of the elaborate work of the Home Office committees, extending over the period 1910–4, was published before the World War, and after the War a comprehensive set of regulations was established by the British Govt. for the purpose of reducing the accumulations of coal-dust in the mine and rendering such dust as remains uninflammable by reason of the admixture of inert and innocuous dust in stated proportions and of a specified fineness. Experiments were also carried out at the Liévin testing station in France, commencing in 1907, and later in Belgium and in Germany, and by the U.S.A. Bureau of Mines at their testing plant and Brunton experimental mine, near Pittsburgh (since 1909). Amongst the facts demonstrated are:—

(*a*) The blasting of a single hole, charged with long-flame explosive (gunpowder or high explosive), may cause the ignition of coal-dust; (*b*) respecting the initiation of an explosion, if enough dry coal-dust is present, it is immaterial whether the air at the point of origin is quiescent or moving in either direction; (*c*) quantities of dust as small as ⅕ oz. per cu. ft. of space (or 1 lb. per linear ft. of an ordinary roadway in the mine) will propagate an explosion; (*d*) in presence of sufficient dust, an explosion may be produced at will in a roadway, even when the roof, sides and floor are wet to the touch owing to the presence of dry dust on the timbers, etc.; (*e*) the force of a coal-dust explosion usually increases in violence as it is propagated through a mine working and may reach its maximum after travelling 500 to 800 ft. from the place of origin; (*f*) pressures as high as 120 lb. per sq. in. have been measured at right angles to the direction of movement of an explosion, the pressure in the line of advance being doubtless much greater.

Stone-dust Barriers.—Stone-dust barriers, for checking or preventing the propagation of coal-dust explosions, were devised by J. Taffanel and modified by G. S. Rice, of the U.S. Bureau of Mines, but constitute a doubtful safeguard. They consist of series of wide shelves, set across the mine gangway near the roof, each loaded with rock-dust. The shelves are tripped mechanically by the advance force waves of an explosion, being set to operate at certain air velocities produced by the explosion. From two to three tons of rock-dust are thus discharged in a dense cloud, in front of the advancing explosion wave, and, mixing with the coal-dust-laden atmosphere of the gangway, prevent propagation of the explosion.

It would appear that the only really safe precaution to take the thorough admixture with the coal-dust of the fine stone-dus It was until quite recently considered that the presence of 30 of inert dust secured safety, but the most recent experiments Professor Wheeler, of the British Mines Department of Safety the Mines' Research Board, shows that this may prove insufficie with coal-dust of high volatile content, and that as much as 50 or more may be necessary in some cases. Great interest "stone dusting" is now being manifested in mining circle See the publications issued by the British Mines Departme and the U.S. Bureau of Mines, *Bull.* No. 225 (1924).

Gas Helmets, etc.—Gas helmets and oxygen breathing-appar tus, long used in mine rescue work, have undergone conside able improvement in point of construction, though no ne principle can be said to have been evolved.

Winding Engines.—Power plants (frequently hydroelectr except in the case of Great Britain) have been established many mining districts, and supply electric current at cheap rates than are possible for equivalent steam power. Electri driven winding engines are consequently used in much great numbers than formerly and in Great Britain, though electrici is seldom obtainable from water power, electric hoists ha increased in use at collieries which have in some instanc established large power plants, *e.g.*, at Powell Duffryn Collie in South Wales. The control mechanism of electric winders is perfected that these engines are as manageable as the best stea winding engines. The large variations in load, unavoidable winding operations, and very disadvantageous for electric tran mission of power, are successfully dealt with by the "equalisi systems" of winding or hoisting, the first of which, the Siemen Ilgner, was introduced just previous to 1906. Modificatio of it, based chiefly on the mode of control, are the Westinghou and the Ward-Leonard. The design and operation of all of the devices are based on the principle that, when a motor receiv electric current, it will deliver mechanical power; conversel when driven by mechanical power, the motor becomes in effe a generator and furnishes electric current. The alternating cu rent usually supplied to a mine is first reduced to about 500 vol and then goes to a motor-generator set, comprising a shunt induction motor, which drives a direct-current generator a a heavy fly-wheel, all on a common shaft. This set is in consta motion, though not at constant speed. From the generator t current goes to a winding engine motor, which drives a pair drums on the drum shaft.

At the beginning of a winding cycle, the winding engi motor receives current from the motor-generator set; but, aft the descending cage has reached a point where the trip can completed by the weight of the rope, the winding engine motor driven by the drum, and therefore supplies current to the gener tor of the motor-generator set. Thus, part of the recovered pow is stored in the fly-wheel, while the remainder is expended driving the induction motor as a generator, thereby causing to deliver current to the external circuit or power service. T fly-wheel cuts down the peaks of the load curve. Since 1915, number of these plants have been erected; they are costly a suitable only where the hoisting is nearly continuous and hig peak loads are heavily penalised in the power service.

Underground Haulage.—For locomotive haulage, the electr trolley system was in 1925 still first in importance, though t use of this system is not permitted in gassy and dusty coa mines in Great Britain; next to this were the compressed-a locomotives, very rarely used in Great Britain, if at all. Storag battery locomotives, though invented many years ago, we rarely used until about 1911 and in 1925 were employed to a li ited extent only in the mines of the United States and the co tinent of Europe; their use in British coal mines is at the prese time under consideration and a prize was recently offered for safe and practical locomotive.

Their construction is simple, and, as they carry their pow with them, they have the advantage of being able to opera herever a rail track is laid, without the necessity of erecting a rolley wire. They are best suited to short distance haulage and ght service, as for gathering individual tubs or cars from the orking places and making them up into trains or sets on the ain haulage roads, or what is termed "secondary haulage." he maximum speed is about five miles per hour and easy track radients are necessary. Their chief disadvantage is high first ost. A few combined trolley and storage-battery mine locomoves have been built, but they are unlikely to have a wide pplication. Gasoline locomotives were introduced in the U.S.A. ines before 1905, but were not much used until about 1912. ike storage-battery and compressed-air locomotives, they have he advantage of carrying their own power. Ordinary speeds ange from four to ten m. per hour. Although reasonable in first ost and running expenses, gasoline locomotives can be employed underground only where there is freedom from inflamable gas and dust and where there is abundant and active entilation, because their exhaust usually contains enough arbon monoxide gas to require a large amount of dilution. Their onsumption of gasoline at full load is, say, 0·7 to 1·2 lb. per .P.; considerably more at half speed and load. (U.S. Bureau of Iines, *Bull. No. 74.*)

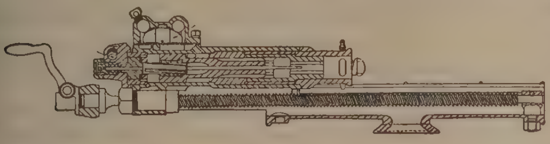


FIG. 3.

Shovelling Machines.—These were introduced in the U.S.A. bout 1907 for loading broken coal or ore underground. The onditions obtaining in British coal-mines do not permit of the echanical shovelling of coal at the face. The first was the hew machine, a dipper shovel of small size, operated by elecicity or compressed air and suitable for use in stopes in a flating deposit or in a tunnel. A later design, the Myers-Whaley, onsists of a large scoop, which is thrust into the pile of broken e or rock, then lifted and dumped backward on to a short avelling belt conveyer, for loading into a mine car in the rear. his machine occupies but little space. In 1915 two of them were stalled in a long haulage drift, 14 ft. wide by 10 ft. high, in the rown mines, Transvaal. Interest in the subject has been stimated by the high wages now prevailing in most mining regions. here wages are low, however, they cannot compete with hand ading. The use of mechanical loaders has increased enormously the United States since 1915 and new designs frequently apear. A monograph of 638 pp. on *Mechanical Underground oading in Metal Mines*, by C. E. Van Barneveld, of the Bureau Mines, was published in 1925.

Machine Drills.—Important changes were made during 1910–25, pecially in the further development of the "hammer" drills hich for many kinds of service have largely replaced standard pes of piston machines. In the hammer drill, the bit is held ationary in the front end of the machine, and is struck a rapid ccession of blows by the reciprocating piston-like hammer. s the bit does not reciprocate, its cutting edge being always contact with the rock, except during the slight rebound caused each blow of the hammer, automatic means must be provided r removing the sludge and thus keeping the hole clean while illing. Hammer drills therefore use hollow bits, through which a jet of compressed air or water is discharged at the bottom of the hole, thus driving out the cuttings. When compressed air is used, and the rock is dry, the dust discharged from the hole is annoying and hurtful to the drill-runner. Hence, a water jet is in common use. The water is delivered under pressure from a 15-gal. to 18-gal. tank, through a short length of hose. Pressure in the tank is produced by connecting it by another hose with the compressed-air pipe.

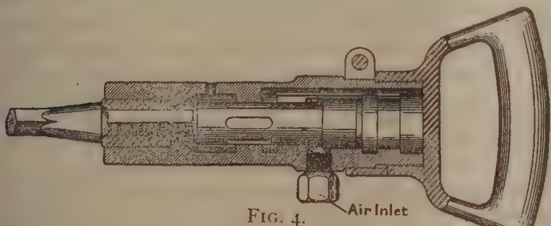


FIG. 4.

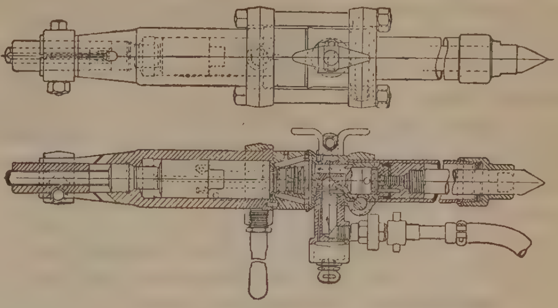


FIG. 5.

Hammer drills are of three types: (*a*) Large machines (fig. 3), corresponding in size and weight with ordinary piston drills, mounted on tripod or column and used for the same kinds of work; (*b*) the small D-handle and cross-handle drills for making holes pointing downward, as in shaft-sinking (fig. 4); (*c*) machines having an automatic air-feed standard, used chiefly for holes directed steeply upward, as in most stoping operations (fig. 5). Machines of classes (*b*) and (*c*) have the advantages of lower first cost, of being operated by one man instead of two, and of eliminating the time lost in cleaning out the hole and in "setting up," as for the standard piston drills and class (*a*) hammer drills. In most rocks and ores, these hammer drills, therefore, do faster work than piston drills. The hammer drill is also applied to the breaking down of coal, and is used with advantage at many European coal mines.

Deep Boring.—In recent years, for prospecting by boring, there has been a great increase in the use of the "churn drill"; that is, a drop drill, suspended by a rope from the operating machinery on the surface, and similar in many respects to the standard oil-well drilling plant. For deep boring, the oil-well "rig," the churn drill and the diamond drill divide the field among them. During the decade 1915–25, many oil and natural gas wells were bored to depths of 4,000 to 5,000 ft., and a few exploratory holes (in Pennsylvania and West Virginia) reached depths of 7,000 to 7,350 feet. For holes of a few hundred ft. in depth, and when cores are desired, the rotary "shot-boring" method, based upon the old Davis Calyx drill, has continued in use to some extent.

For rotary boring in the softer strata, the "fish-tail" bit, with two cutting edges somewhat resembling those of a large carpenter's auger, has come into much wider use for oil and gas wells. In 1908 the Sharp and Hughes cone-bit (fig. 6) was introduced for boring in hard rock, and has been widely used in some of the petroleum and natural gas-fields. It consists of a pair of hardened

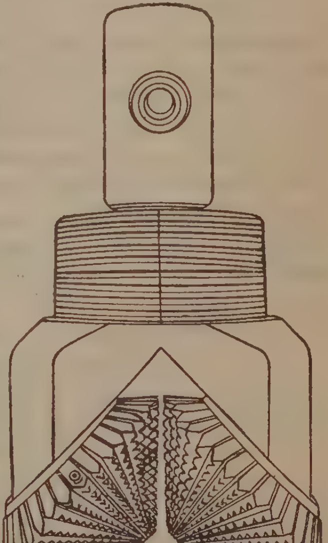


FIG. 6.

steel cones, with serrated or toothed surfaces, revolving on bronze bearings. As the drill rod rotates, the cones roll under pressure upon the rock, crushing and chipping it away. When dull, the cones are readily replaced. These bits in some cases bore as much as 100 ft. of hole in 24 hours. In boring oil wells through soft strata or shattered rock, the sides of the hole often cave before the lining or casing pipe is put in. To overcome this difficulty, "mud-laden" water has been used in the boring operations instead of the ordinary wash-water. Finely divided, clayey material that will remain in suspension for a considerable period of time is employed. The mixture of mud and water should have a specific gravity high enough to afford a counter-pressure that will aid in supporting the walls of the hole; a specific gravity of about 1·33 is usually sufficient. The pressure in the bore-hole is thus kept in approximate equilibrium until the hole can be lined with piping (casing) or screens are set in the oil-bearing strata and cemented in place. This method was introduced in Europe, about 1895, for sinking cylindrical mine shafts in unstable, water-bearing soil by boring. About 1901 it was adopted for boring oil wells in Texas and Louisiana, and since 1906 has been successfully used in a large number of cases. (*See* COAL; COPPER; EXPLOSIVES.)

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MINNEAPOLIS, Minn., U.S.A. (*see* 18.546), increased in population from 301,408 in 1910 to 380,582 in 1920, and 425,435 (Census Bureau estimate) in 1925. Among the 88,248 of foreign birth (1920), Swedes (26,515) and Norwegians (16,389) predominated. The total value of manufactured products was $165,405,000 in 1909; $491,383,000 in 1919; $338,329,208 in 1923. Flour-mills (output, 1924, 11,679,130 bbl.) and grain elevators (capacity, 1925, over 56,000,000 bu. kept their dominating place in the city's industries, but the reduction of freight rates *via* the Great Lakes to approximately the pre-War basis, while all-rail rates to the East remained 65% higher, was resulting in the transfer of some of the milling business to Buffalo and other points in the East.

Ranking next to flour in 1923 were motor vehicles and bodies and parts; linseed oil, cake and meal; bread and other bakery products; and knit goods. The vast lumber industry dwindled, with the gradual exhaustion of the pine lands, from a maximum of 600,000,000 ft. sawed in 1899 until in 1920 the last mill went out of existence. Minneapolis is the seat of the ninth Federal Reserve Bank. Bank deposits on Jan. 1 1925, were $319,388,000. The combined manufacturing and wholesaling market in 1924 was estimated at $1,300,250,000.

Navigation of the Mississippi river up to the heart of the city was opened on July 3 1917, when the first steamer passed through the recently completed lock. In Nov. 1925, seven motor-bus companies, operating over 2,000 m. of state highways to the north and west, were merged in an auxiliary of the Great Northern Railway. The Great Northern passenger station, which is used by a majority of the railway lines, superseded, in 1914, the older union station.

Registration in the University of Minnesota reached 18,
in 1924–5; its Memorial Stadium, seating 50,200, was opened
1924. Enrolment in the public schools increased 70% betw
1910 and 1925, while the increase in population was 41%. T
park system by 1925 included 4,722 ac.; a playground for ea
sq. m. of residential area; five golf courses; and 56 m. of bou
vards encircling the city, the so-called "Grand Rounds,"
section of which is the Victory Memorial driveway (dedicat
1921). In the summer of 1925 the stream supplying Minneha
Falls, which had been failing for several years, gave out entire
To restore the supply deep wells were dug, from which wa
can be pumped into the creek when necessary.

Minneapolis has a low general death-rate, a low infant m
tality, a high percentage of home ownership and a low percen
age of illiterates and of children engaged in wage-earning occ
pations. Cost of living is below the average for American citi
The non-partisan system of nomination for city offices was p
into effect in 1912. A city-planning commission was establish
in 1919, and a zoning ordinance adopted in 1924. In 1925 a n
charter, providing for a city manager appointed by the legislati
body (the city council) and for a school and library board, w
prepared for submission to the voters.

MINNESOTA (*see* 18.548).—The population of the state in 19
was 2,387,125 as against 2,075,708 in 1910, an increase of 311,41
or 15% for the decade. The total white population was 2,368,93
of whom 1,882,772 were natives and 486,164 foreign bor
Negroes numbered 8,809 and Indians 8,761. The density w
29·5 per sq. m.; 25·7 in 1910. The estimated population in 19
was 2,651,306. The urban population (in places having ov
2,500 inhabitants) was 1,051,593, or 44·1% in 1920; 41·0%
1910. The rural population was 1,335,532, or 55·9% in 191
The following table gives the population and the percentage
increase of cities having more than 15,000 inhabitants in 1920:—

Cities	1920	1910	Increase %	Estimate 1925
Minneapolis . . .	380,582	301,408	26·3	425,435
St. Paul	234,698	214,744	9·3	246,001
Duluth	98,917	78,466	26·1	110,502
Winona	19,143	18,583	3·0	19,459
St. Cloud	15,873	10,600	49·7	18,860
Hibbing	15,089	8,832	70·8	17,955

Agriculture.—There were 188,215 farms in Minnesota in 192
These farms covered 30,040,933 ac., two-thirds of which was in
proved. The total value of farm land and buildings in 1925 wa
$2,396,005,328. The final stage in the state's progress fro
pioneer to diversified farming was marked by the decline
wheat from second to third crop. In the years following 192
the total corn and oat crop was consistently more than fou
times as great as the total wheat crop, both in quantity an
value. The northern part of the state showed a rapid develop
ment in stock-raising and dairying.

Minerals.—About 60% of the output of iron ore in the Unite
States is mined in the three great iron ranges of northern Mi
nesota. The Mesaba range, 110 m. in length, embraces 130 activ
mines. The Vermillion and Cuyana ranges combined form a
additional iron belt of about 50 miles. A total of 44,556,053 ton
of ore, valued at $158,402,788, was shipped from Minnesot
mines in 1923.

Manufactures.—In 1923 Minnesota ranked twelfth among th
states in the value of its manufactures. In the 3,902 establish
ments (not including hand industries) then existing, the averag
number of persons employed was 103,344 and products valued a
$968,476,565 were manufactured. There was a falling off i
manufacturing from 1919, the peak year. The state's five mos
important industries, in the order of the value of products i
1923, were the flour- and grist-mill, slaughtering and meat-pack
ing, dairy and creamery, the manufacture of cars and genera
shop construction and repairs by steam railways and lumber an
timber industries. In flour and butter Minnesota's product
exceed those of any other state. Following 1910 the slaughterin

and meat-packing industries, centred at South St. Paul, showed rapid growth. Because of the depletion of her forests Minnesota dropped from third place among the states in lumber manufac-ure in 1900 to sixteenth place in 1920; but, though lumbering declined, timber manufacturing increased. Iron ore is now worked in huge iron and steel plants on the St. Louis river near Duluth, and farm machinery is manufactured increasingly.

Transportation.—The railway mileage in Minnesota in 1924 was 9,096 an increase of 7·8% since 1908. In 1924 there were 80·2 m. of electric lines, exclusive of city street railways. With the growth of motor traffic, the demand for good roads greatly increased, and the state engaged in road building on an xtensive scale. An amendment to the constitution (1912) uthorised the levy of a one-mill tax, the proceeds to be distrib-ted among the counties and used for road building and main-enance; another amendment (1920) authorised the issue of onds and provided for the taxation of motor vehicles in order to nance a system of state trunk highways covering 7,000 m.; a hird amendment (1924) authorised a tax on gasolene used in motor vehicles and to add the proceeds of the tax to the highway und. There were in 1922 about 107,103 m. of public roads in the tate. The U.S. Govt. completed in 1920 the construction f a dam in the Mississippi between St. Paul and Minne-polis, which by means of locks makes the latter city the ead of navigation on the river. An attempt is being made to evive freighting on the river, between Minneapolis and St. ouis; and the Ford Motor Company's northwest plant, estab-shed in St. Paul and using hydroelectric power from the overnment dam, is both shipping and receiving goods by water.

Education.—In 1923–4, there were 431 high schools, 746 grade chools, 354 consolidated schools and 6,607 rural schools with ,900 teachers and 78,000 pupils, and these schools received, in ddition to local support, state aid. During 1923–4, $59,316,000 as expended on public education. There are six state teachers' olleges and 12 private institutions of collegiate grade. The niversity of Minnesota at Minneapolis comprises 13 colleges nd schools. A noteworthy development in the medical school as its affiliation with the Mayo Clinic at Rochester. In 1915 William J. and Charles H. Mayo, the famous surgeons, estab-shed the Mayo Foundation for Medical Education and Re-arch, endowed it to the amount of $1,500,000 and gave it to the niversity. The university was thus placed in control of prac-cally all medical instruction in Minnesota. In 1924–5 the niversity had 12,736 students, 673 faculty members and 253 uildings. An extensive building programme covering a period 10 years was initiated in 1919, when the Legislature ap-ropriated $5,600,000 for this purpose.

Government.—In 1925 the state government was reorganised combining the existing state boards and commissions into velve departments and creating two new departments, the ecutive council (consisting of the governor, attorney-general, uditor, treasurer and secretary of state), and the Department of dministration and Finance, under the control of a commission three appointed by the governor and removable at pleasure. he three commissioners—the comptroller, commissioner of the dget and commissioner of purchases—have general super-sion and control of the expenditures and personnel of state partments and agencies. The placing of the state's charitable d penal institutions under the Board of Control was com-eted in 1917, and the board in 1925 had charge of 18 in-tutions including the recently established asylum for the in-ne with a special ward for inebriates at Willmar, the state formatory for women at Shakopee and the colony for epileptics Cambridge. The new state prison buildings at Stillwater, mpleted in 1912, cover 22 ac. in a tract of 1,000 acres. Among e duties of the new Department of Conservation are forest nservation, reforestation, and the management of the 20 state rks, eleven of which have areas greater than 100 acres. In dition this department manages the Pillsbury state forest, ss county and the Burntside state forest, St. Louis County. vo Federal forest reserves are also located in the state: Su-rior National Forest in St. Louis, Lake and Cook counties; and Minnesota National Forest in Itasca, Cass and Belltrami counties.

Finance.—On June 30 1925 there were 1,375 banking institutions in Minnesota, of which 1,027 were state banks, 21 trust companies, 7 savings banks and 320 national banks. There are also in the state 85 building and loan associations and one credit union. The Federal Reserve Bank for the ninth district is located in Minneapolis. All banking institutions other than national banks are under the supervision of the commissioner of banks of the State Department of Commerce.

History.—The most important political movement of recent years was the growth of agrarian unrest manifesting itself first in the Non-Partisan League and later in the Farmer-Labour party. From 1919–23 this movement was particularly active and two members of this party were elected to the U.S. Senate—one to fill an unexpired term. In 1924, however, the tide was ebbing; at the presidential election the state was carried by the Republican party, and a Republican replaced one of the Farmer-Labour senators. The membership and power of organised labour fluctuated in a way roughly proportional to the fortunes of the Farmer-Labour party. Two important pieces of legislation in 1910–25 were the primary law (1912), which provides for nomination and election on a non-partisan ballot of all state and local officers except the state executive officers, the railway and warehouse commissioners and the clerk of the Supreme Court and the so-called tonnage tax (1921), a 6% tax on the net value of mined ore. Minnesota ratified the Eighteenth (Prohibition) Federal Amendment Jan. 20 1919. The following governors held office after 1909: Albert Olson Eberhart (Rep.), 1909–15; Winfield Scott Hammond (Dem.) (died in office), Jan.–Dec. 1915; Joseph A. A. Burnquist (Rep.), 1915–21; Jacob A. O. Preus (Rep.), 1921–5; Theodore Christianson (Rep.), 1925– (S. J. B.)

MINORITIES.—Groups of population differing by race or religion from the nation of which they form part. One of the most remarkable characteristics in the evolution of modern nations is their tendency to develop political communities increasingly extensive and increasingly homogeneous. In certain countries, such as France, this assimilation is practically accomplished and there is no longer any question of national minorities. But in some cases fusion does not proceed without resistance, and it may be said that the problem of national minorities arises at the moment of the emergence of important groups of persons differing from the majority by race, language or religion, who aspire to an independent life with regard to that majority. These aspirations may vary from the desire for a simple freedom to develop their own intellectual aims and their own traditions to a demand for administrative autonomy, or even a more highly developed political status, on the model of the Swiss cantons.

Historical Survey.—The modern problem of national minorities is identical with the idea of the " National State " which emerged after the break-up of feudalism. Indeed, from the moment when political unity arose on the basis of national unity, every nation which became conscious of a distinct nationality necessarily aspired to the advantages of a more or less complete political independence. Then at the same period, the exhaustion resulting from the religious wars of the 16th and 17th centuries and the advance of toleration were very favourable to the aspirations of homogeneous people for a certain measure of independence. These aspirations found expression from the 16th century onward in international law in the clauses of certain treaties in virtue of which the contracting parties obtained in favour of subjects whom they had been compelled to detach from their rule, or even for certain peoples of the same religion as their own, guarantees for the free exercise of their religion. (For examples see the Capitulations granted by the Sultan Solyman II. to Francis I. in favour of the Eastern Christians, 1535; the Peace of Augsburg, 1555; Treaty of Westphalia, 1648; Treaty of Oliva, 1660; Treaty of Paris, 1763, etc.). The liberation of the English colonies in America, the Declaration of Independence (1776) and the French Revolution with the Declaration of the Rights of Man (1789), crystallised, to some degree, the modern philosophy of nationality which is translated by the formula, " the right of peoples to self-determination."

In the 19th century this was strengthened by a series of brilliant successes: the achievement of independence successively by the Spanish and Portuguese Colonies in America; the liberation of Greece 1821–30; and of Belgium, 1831–2; the gradual elimination of the Turks from Europe in favour of the Christian peoples of the

Balkans; a series of conferences and of treaties (London, 1830; Paris, 1856; Berlin, 1878, etc.) which contained clauses in favour of certain religious minorities.

THE WORLD WAR AND ITS CONSEQUENCES

The War of 1914 caused a formidable awakening of national aspirations. Italy and Rumania entered the War against the Central Powers in order to realise their national demands; Irish agitation was intensified under war conditions. In 1916 an important congress of nationalities met at Lausanne. As early as Jan. 22 1917 President Wilson laid down as the principle of the future peace:—

> That no nation should seek to extend its polity over any other nation or people, but that every people should be left free to determine its own polity, its own way of development, unhindered, unthreatened, unafraid, the little along with the great and powerful.

Nevertheless, the distribution of the nationalities in Europe is so complex, notably in certain regions where the ethnical elements vary from village to village, that it was evidently impossible in the peace settlement to apply in its integrity the principle of self-determination; it was inevitable that some minorities should remain under the domination of majorities. On the other hand, some majority populations before the War became minorities.

A summary table of European minorities appears in next column.[1]

In Russia there are some 40 different nationalities the statistics of which are ill authenticated. The Union of Soviet Socialist Republics has granted to many nationalities a large measure of autonomy, and comprises at present a great number of republics and autonomous territories.

THE RIGHT OF MINORITIES

In Europe alone the multiplicity of minorities, aggravated by the triumph of certain minorities immediately after the World War, has created an extremely dangerous political situation which is a constant source of disturbance. The Peace Treaties of 1919 sought to alleviate this danger by creating wide and fundamental rights for minorities.

The documents sanctioning these rights are of four kinds:—

1. Special articles in the Peace Treaties concluded by the principal Allied and Associated Powers with Austria (St. Germain, Sept. 10 1919); Bulgaria (Neuilly-on-Seine, Nov. 27 1919); Hungary (Trianon, June 4 1920) and Turkey (Lausanne, July 24 1923).
2. Special Minorities treaties concluded by the principal Allied and Associated Powers with Poland (Feb. 13 1920); Czechoslovakia (Sept. 10 1919); The Serb-Croat-Slovene State (Sept. 10 1919); Rumania (Dec. 9 1919); Greece (Aug. 10 1920). All these treaties have been placed under the Guarantee of the League of Nations.
3. Engagements entered into by certain states with the League of Nations to observe toward their minorities, or certain of those minorities, obligations more or less identical with those laid down in the minority treaties: by Finland and Albania, 1921; Lithuania, 1922; Latvia and Estonia, 1923.
4. Bilateral conventions between certain states: Treaty of Brünn between Austria and Czechoslovakia (June 7 1920); convention between Poland and Danzig (Nov. 9 1920); convention between Germany and Poland (May 15 1922).

The great innovation common to these international engagements is the intervention, for the assurance of the protection of minorities, of a supernational power, hitherto unknown, the League of Nations. Obligations with regard to minorities are henceforth conceived no longer as simple assurances of goodwill of a state towards its subjects of another race, but as international obligations which should be recognised by the state concerned as "fundamental laws," which cannot be contradicted by any other laws, and which are placed under the guarantee of the League of Nations. The Council of the League of Nations has been invested with juridical powers to intervene with the Govt. in case of infringement, or menace of infringement of their obligations with regard to minorities; finally, disputes on questions of law or fact which may arise in the carrying out of the

Country	Majority	Minorities
Belgium . .	7,482,100	Germans, 40,000
Germany . .	61,000,000	Danes, Poles and Wends
Poland . . .	17,667,000	Germans, 1,550,000 Jews, 2,520,000 Ruthenes, 4,220,000 Russians, 1,135,000 Lithuanians, 72,750 Various, 50,000
Lithuania . . (incl. Memel)	7,702,000	Jews, 153,700 Germans, 29,200 Poles, 65,600 Russians, 50,500
Latvia . . .	1,159,300	Great Russians, 91,500 Jews, 79,300 Germans, 58,000 Little Russians, 66,000 Poles, 52,200 Lithuanians, 25,500 Estonians, 8,700
Estonia . . .	969,900	Russians, 91,200 Swedes, 7,800 Germans, 18,000 Jews, 4,500 Various, 15,000
Finland . . .	3,500,000	Swedes, 380,000 Russians, 6,000
Austria . . .	5,360,000	Czechs, 245,000 Hungarians, 88,500 Jews, 270,000 Serbs-Croats-Slovenes, 117,500
Czechoslovakia .	8,760,000	Germans, 3,123,000 Magyars, 745,000 Ruthenes, 461,800 Poles, 75,800 Jews, 180,800 Various, 260,000
Hungary . .	7,147,000	Germans, 551,200 Slovaks, 141,800 Rumanians, 23,700 Serbs-Croats-Slovenes, 53,900 Jews, 60,000
Italy . . .	41,000,000	Germans, 280,000 French Vaudois, 85,000 Slovenes, 250,000 Croats, 150,000 Albanians, 80,000 Greeks, 25,000
Yugoslavia . . (Serb-Croat-Slovene State)	9,971,600	Magyars, 472,400 Germans, 518,400 Albanians, 441,500 Rumanians, 229,000 Bulgars and other Slavs, 174,000 Italians, 12,800 Various, 212,000
Albania . . .	817,800	Some thousands of Greeks
Rumania. . .	11,576,000	Magyars, 1,650,500 Germans, 804,000 Ukrainians, 1,100,000 Ruthenes, 793,800 Jews, 770,000 Bulgars, 251,000 Serbs, 62,300 Turcs and Tartars, 230,000 Various, 579,000
Bulgaria . .	3,441,000	Greeks, 48,300 Gipsies, 115,700 Jews, 43,500 Rumanians, 78,000 Turcs and Tartars, 454,700 Various, 676,000
Greece . . .	5,157,000	Albanians, 162,000 Jews, 110,000 Rumanians, 486,700 Turcs and Tartars, 59,000 Various (Slavs, etc.), 500,000
Turkey . . .	8,518,000	Armenians, 40,000 Greeks, 220,000 Gipsies, 23,500 Jews, 68,600 Various, 2,413,000

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[1] Figures furnished by a minority rarely agree with those given by the majority. The figures marked with an asterisk in this table are derived from the official statistics of the states concerned. Others are taken from recent authoritative works of reference.

said obligations may be referred to the Permanent Court of International Justice, whose decision is final.

Generally speaking, the treaties, conventions or declarations concerning minorities give these guarantees to the minority populations:—

1. Rights equal to those of any nationals of the country to protection of life and liberty and the free exercise of their religion;
2. A special right to the acquisition of the nationality of the country in question and to the exercise of civil and political rights;
3. Free use of their mother tongue in private life, in trade, in religion, in the Press, in publications, in public meetings and in the courts of law; and
4. The right of maintaining at their own expense charitable, religious or educational institutions.
5. In districts in which the minority constitutes a considerable proportion of the population, instruction in the primary schools of the state shall be given in the language of that minority and the minority shall be assured an equitable share in the sums provided by the state and municipal budgets for educational, religious or charitable purposes.

The conditions under which minorities may raise a complaint, and the procedure to be followed by the Secretariat and the Council of the League of Nations are laid down by precise regulations which have been several times revised (Tittoni Report: Resolutions of the Council of Oct. 25 1920; of June 27 1921; of Sept. 5 1923, and June 10 1925; resolutions of the 3rd and 4th Assemblies). An essential condition is that every application which is admitted as being in order is communicated in the first instance to the Govt. of the state against which the complaint is directed for its observations; the second is that every application definitely admitted as in order is examined by the President of the Council assisted by two members of the Council. But the Council is not assumed to be legally and officially informed until one of its members takes it upon himself to draw the attention of the Council to the case in question. When this takes place, the Council "may proceed in any manner and give any instruction that appears to it appropriate and effective in the circumstances."

As a result of this cautious procedure, many complaints transmitted to the Council have not been considered. This failure has caused serious disappointment and has given occasion for numerous grievances. But on the whole the essential rights of minorities are certainly respected, and even the possibility of the bringing of a complaint of the minorities before the Council or the Assembly of the League of Nations inevitably disposes governments to be prudent and moderate in their attitude towards their minorities. Moreover, certain minorities have obtained important advantages through the procedure adopted by the Council. In conclusion, the modern law of minorities as it emerges from the treaties, conventions and declarations enumerated above, has incontestably exercised on the fate of minorities a moderating influence, the great significance of which can hardly be exaggerated.

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MINSKY (1856–), the pen name of Nicolas Maximovich Wilenkine, Russian man of letters, was born Jan. 21 1856 at Glubokoe, Vilno (Wilna) province, and was educated at Minsk. He graduated in law at St. Petersburg University, but soon devoted himself wholly to a literary career. His first volume of poems was published in 1877, but was confiscated by the Government and was not re-issued until 1887. It was during the 'eighties that he became well known as a poet of social revolt. In the 'nineties, however, he became one of the leaders of the Russian symbolists. In 1905 he edited with Gorky the socialist paper, *New Life*. Minsky's philosophic ideas are expressed in *In the Light of Inner Revelation* (1890) and *The Religion of the Future* (1905). He also wrote many sonnets, lyrics and a number of plays. His poetical works were published in four volumes in 1907 and appeared in German in 1923. A volume of his works entitled *Echoes* has been translated into English by D. MacAlister (1923).

MINTO, GILBERT JOHN ELLIOTT-MURRAY-KYNYNMOND, 4th Earl of (1845–1914), British politician (*see* 18.564), died at Minto House, Hawick, Scotland, March 1 1914.

MIRBEAU, OCTAVE HENRI MARIE (1850–1917), French dramatist and journalist (*see* 18.574), died in Paris Feb. 16 1917.

MIŠIĆ, ŽIVOJIN (1855–1921), Serbian statesman, was born July 7 1855 at Struganik near Valievo, the son of well-to-do peasant parents. He passed through the old Artillery school in Belgrade and served in the Serbo-Turkish War of 1877 and the Serbo-Bulgarian War of 1885. During the Bosnian annexation crisis he became assistant chief-of-staff to Gen. Putnik, and in this capacity made his name in the first Balkan War, being promoted general. He further distinguished himself in the Bregalnitsa operations during the second Balkan War of 1912–3. When the World War broke out and the Austrians invaded Serbia in Nov. 1914, Mišić was appointed to the command of the I. Army. Mišić's simple and unaffected heroism inspired his soldiers with confidence: his spirit spread to the whole Serbian Army and found expression in the decisive victory of Rudnik early in Dec. by which the Austrians were driven out of Serbia.

Mišić, who had been created voivode after Rudnik, again served with distinction during the retreat of the Serbian Army in the winter of 1915. After a long interval spent in recovering from the strain of the campaign, he resumed command of the I. Army on the Salonika front in Aug. 1917, and in June 1918 was made chief-of-staff. In this position he played a pre-eminent part in elaborating the plan to which the piercing of the Bulgarian front was due. As a convinced believer in the idea of Yugoslav unity, he did all in his power to promote the efforts of the exiled Yugoslav committee to organise Yugoslav legions on every front. He died on Jan. 20 1921.

MISSIONS (*see* 18.583).—The developments of outstanding interest in missionary work since 1910 have been the new spirit of independence in the churches in the mission field, the growth of the spirit of co-operation, and the new educational demands on missionary schools. The first of these tendencies led to considerable transfers of authority from the missions to the churches established by them. The indigenous church rather than the foreign organisation became increasingly responsible for the direction of Christian activities. In the face of the rising spirit of nationalism, evident in so many quarters, it became essential that Christianity should as little as possible bear the character of a foreign religion.

National Christian Councils.—The impulse of the World Missionary Conference held in 1910 quickly extended itself to the mission field. A visit to Asia by the chairman of its continuation committee, Dr. John R. Mott, in 1913–4 led to the formation in India, China and Japan of bodies representative (with one or two exceptions in the case of Japan and China) of all the Christian forces other than Roman Catholicism. These, by a process of evolution, became national Christian councils, and in China and India, in particular, became an active and influential force. While in their beginning missionary initiative played a considerable part, leadership passed increasingly into the hands of Chinese and Indians, who formed in 1925 half or more than half of the members of the councils in their respective countries. A national Christian convention held in Shanghai in 1922 and attended by Chinese Christians and missionaries of all denominations from every part of China, afforded striking evidence of the reality, strength and indigenous character of the Christian movement in China. It was presided over with remarkable ability by a Chinese Christian, Dr. Cheng Ching-yi, and other Chinese Christians took part in guiding the proceedings.

A corresponding growth of co-operation took place among the missionary societies within their own various political boundaries. The Conference of Missionary Societies in Great Britain and Ireland, meeting for the first time in 1911, united all the principal missionary societies in the United Kingdom and Ireland and led to a marked growth in mutual understanding and fellowship and in practical co-operation in many directions. The Foreign Missions Conference of North America (including the United States and Canada), while of older date, made notable progress on similar lines. National missionary organisations were also formed in the Scandinavian countries, in Holland and in Switzerland, the German Missions-Ausschuss being of older date. Internationally, the continuation committee appointed by the World Missionary Conference gave place to the International Missionary Council, the members of which are appointed by the different national missionary organisations.

Education.—Everywhere in the mission field the position of Christian schools was affected by the rapid extension of Government systems of education. The missionary societies recognised that they had to do with an entirely new situation, and endeavoured to meet it by a thorough examination of the new conditions and the demands made by them. In 1919–20 an education commission was sent to India to investigate the problems of rural education and issued a report entitled *Village Education in India*, which exercised a considerable influence on missionary opinion and policy. Two years later a strong commission under the chairmanship of the late Dr. E. D. Burton, president of Chicago University, visited China and produced a valuable Report entitled *Christian Education in China*. In 1921 and 1924 an Education Commission, under the joint auspices of the missionary societies and the Phelps-Stokes Fund, visited, first, West and South Africa and then East Africa, and its two reports, *Education in Africa* and *Education in East Africa*, were recognised not only in missionary but in Government circles as furnishing much needed guidance in regard to the kind of education best suited to Africa. Effective co-operation in education between missions and Government in the British colonies in Africa was furthered by the appointment by the British Secretary of State for the Colonies in 1923 of a permanent Advisory Committee on Native Education in Tropical Africa, and the setting up in most of the colonies of similar advisory bodies on which the missions are represented.

The World War led to the cessation of the work of German missions in most of the territories under the control of the Allied Powers, but in the British Empire in 1925 the restrictions were being relaxed and German missionaries had begun to return to their former fields. In the *World Missionary Atlas* published in March 1925, the numbers of missionaries were given as follows: ordained missionaries from the United States and Canada 3,713; from Great Britain 2,058; from other countries 1,515; laymen, United States and Canada, 1,963; Great Britain 947; other countries 407; unmarried women, United States and Canada, 4,793; Great Britain 2,503; other countries 1,116. It may be interesting to compare the 1925 figures with those for 1907, though these were from another source: the total number of communicant members was 3,614,154 in 1925 as contrasted with 1,817,450 in 1907, while the total Christian community was returned as 8,342,378 as compared with 4,361,138. The total number under instruction in all types of mission schools was 2,440,148 as compared with 1,302,965. The total income of the Protestant missionary societies was given as £14,958,102 (of which the United States contributed £9,736,084 and Great Britain £2,869,353) as compared with £4,473,933 in 1907. The foregoing figures reveal a remarkable increase in the proportionate share of North America in missionary effort.

Roman Catholic Missions.—The figures for Roman Catholic missions for the year 1908 may be compared with those for 1923 published at the Vatican Exhibition, Rome, the earlier ones being shown within parentheses: European priests 8,617 (7,033); native priests 4,095 (5,837); lay helpers 4,018 (5,270); sisters 24,102 (21,320); catechists and teachers 65,641 (catechists 24,524); number of Catholics 12,964,147 (native membership only, 7,441,215); catechumens 1,534,446 (1,517,909); students and children in schools 1,800,000 (906,000); schools 22,358 (24,000); churches and centres 110,932 (71,000). The World War was the cause of a considerable decrease in the number of missionaries, since the various services claimed many of them and a large proportion of these were killed. The possessions of the Allied Powers being closed to German missionaries in the years immediately following the War, the former fields of German societies thus affected were in nearly all cases transferred to other congregations while fresh fields were found for the expelled societies. A regrouping of Roman Catholic missions thus took place on a considerable scale.

An important encyclical (*Maximum illud*) dealing with missionary work was issued by Pope Benedict XV. in 1919, in which extended directions were given for the conduct of missionary work, exaggerated expressions of nationalism were severely condemned, and great emphasis was laid on the importance of developing a native clergy. The first native bishop was to be consecrated in Japan in 1925.

Considerable changes took place in organisation in Europe. The headquarters of the Society for the Propagation of the Faith, the great collecting society of the Roman Catholic Church, were transferred from Lyons to Rome and put expressly under Papal auspices, while its governing body was made fully international. Two other organisations which were established on an international basis under Papal direction are the Society of St. Peter for the training of a native clergy in mission lands and the Missionary Clergy Union, which in 1925 had a membership of 165,000 priests. A notable development after the War was a wider distribution of missionary support among different countries; the pre-eminence of France being no longer so marked as it was. Increased support for missions was forthcoming in Ireland, Holland, Belgium, Switzerland, Spain and Italy, and there was also a revival of missionary interest in Portugal, Bohemia, Hungary and Poland. The financial contributions of the United States grew remarkably and in 1925 exceeded those of any other country, though the number of American missionaries was considerably below that of a good many other countries. Advantage was taken of the presence of many pilgrims in Rome during the Holy Year of 1925 to organise a great missionary exhibition in the grounds of the Vatican. (J. H. O.)

MISSISSIPPI (*see* 18.599).—In 1920 the total population was 1,790,618, being a decrease of 6,496 from the figures for 1910. The negro population was 935,184, or 52% of the total, as compared with 1,009,487, or 56·2% of the total in 1910. The foreign born whites in 1920 numbered 8,019. The density was 38·6 per square mile. The urban population (in places of over 2,500) was 13·4%. The six cities having a population of over 12,000 in 1920, in comparison with the figures of 1910, and their estimated population as on July 1 1925 were:—

	1920	1910	Increase	July 1 1925
			%	Estimate
Meridian	23,399	23,285	0·5	24,312
Jackson	22,817	21,262	7·3	23,098
Vicksburg	18,072	20,814	−13·2	. .
Hattiesburg	13,270	11,733	13·1	14,034
Laurel	13,037	8,465	54·0	15,513
Natchez	12,608	11,791	6·9	13,070

Agriculture.—In 1925 the number of farms in the state was 257,228, of which 107,095 were operated by whites and 150,043 by negroes. There was a decrease both in the number of farms and the farm acreage as compared with 1920, when there were 272,101 farms embracing an acreage of 18,196,972. Farm values also declined during the same period, the total value of farm land and buildings being $459,936,535 in 1925 as compared with $780,896,778 in 1920, giving an average value per farm of $1,788 in 1925, and $2,003 in 1920. The average size of the farms also decreased from 66·9 in 1920 to 62·4 in 1925. Cotton continues the most important crop but the acreage of cotton decreased from 2,948,387 in 1919 to 2,036,766 in 1924. The livestock on the farms on Jan. 1 1925 comprised 141,952 horses, 330,080 mules, 938,024 cattle and 729,165 swine, having a total value of $62,858,000.

Manufactures.—The value of the output from factories increased from $79,550,095 in 1914 and $114,083,861 in 1921 to $178,581,729 in 1923, Mississippi then ranking 34th among the states in the value of manufactured products and 32nd in number of wage earners, the latter numbering 64,452. The capital invested in manufactures increased from $81,005,484 in 1914 to $154,117,337 in 1920, and $197,746,087 in 1923. The chief manufactured articles are lumber and timber products, cottonseed oil and cake, cotton goods, turpentine and rosin and fertilisers. The chief manufacturing centres are Meridian, Jackson, Greenville, Columbus, Laurel, Hattiesburg, Natchez and Vicksburg. The mineral production of the state is small, its total value in 1922 being $1,600,393, composed chiefly of clay products, sand and gravel.

Education and Charities.—Higher education is taken care of by the University of Mississippi at Oxford, the Mississippi State College for Women at Columbus and two Agricultural and Mechanical Colleges. State normal schools are situated at Hattiesburg and Cleveland, in addition to which there are 175 public high schools and 6,800 elementary schools. Separate schools are maintained for the white and coloured children. Education is state supported, being free to all and compulsory between the ages of 7 and 16. The most important development in education was the establishment in 1908 of county agricultural high schools. Every county may establish one for white children and one for negroes, or two counties may combine and create one set of schools for the two counties. These schools receive state aid on the basis of the number of boarding pupils. The total amount expended for education during the year 1923–4 was estimated at $17,837,000, including a state appropriation of $8,837,404. An industrial training school for delinquent and abandoned children was established at Columbus in 1916, and there are also schools for the deaf and dumb and for the blind at Jackson.

Administration and Legislation.—The constitution of 1890, enacted to ensure white supremacy, has been amended with the object of putting the government more within the direct control of the people. In 1916 the initiative and referendum were adopted by an amendment under which an initiative petition must be supported by 7,500 qualified electors, and a referendum petition by 6,000. Any law bill resolution, constitutional amendment or any other legislative measure is a proper subject for such petition. The judiciary consists of the Supreme Court of six judges elected for eight years and circuit and chancery judges elected for four years. A majority of nine jurors may return a verdict in all civil cases in the circuit and chancery courts. The Legislature is elected for four years and meets in regular session biennially. All financial appropriations are made for two years.

The Torrens System of registration of land titles has been in force since 1915. In 1914 a state department of banking was created with a board of bank examiners consisting of three members elected for four years. Bank deposits are guaranteed by the state. A very comprehensive child labour law was passed in 1912. Under its provisions no child under 12 may be employed in any mill or factory and no child under 16 may be employed for more than eight hours per day. No employee is permitted to work in any mill or factory more than 10 hours per day. The enforcement of this law is placed in the hands of the county health officer. In 1916 a pardon board of five members appointed by the governor was created for the purpose of advising on all petitions for pardons. All such petitions must be published for 30 days in the county where the crime was committed. The board can act only in an advisory capacity, the governor being free to follow their advice or not as he may deem best. A state highway commission was also appointed in 1916.

Mississippi was the first state to ratify the Eighteenth (prohibition) Amendment, doing so Jan. 8 1918. The Legislature, however, refused to ratify the Nineteenth (woman suffrage) Amendment in 1919, and it took no action on the proposed Twentieth Amendment regarding child labour.

In 1926 the state was represented in the U.S. Senate by Hubert D. Stephens and Pat Harrison. The following have been governors since 1910: Edmund F. Noel (Dem.), 1908–12; Earl Leroy Brewer (Dem.), 1912–6; Theodore G. Bilbo (Dem.), 1916–20; Lee M. Russell (Dem.), 1920–4; Harry L. Whitfield (Dem.), 1924–

MISSISSIPPI RIVER (*see* 18:604).—The U.S. Govt. continued work on the various engineering projects connected with the Mississippi and its tributaries, the Missouri and Ohio, during the years 1910–26. On the upper Mississippi the reservoirs at the headwaters numbered six, namely Winnibigoshish, Leech, Pokegama, Sandy and Gull lakes and Pine river, which have a combined storage capacity of nearly 95,000,000,000 cubic feet. Between St. Paul and Minneapolis the original plan for two low dams has been changed to one high dam (36 ft.) with provision for water-power development. The project was in 1925 practically completed, and the power development was leased to Henry Ford for a large assembling plant now in operation.

On the main upper Mississippi river the plan is to obtain a six-foot depth by contracting the width by brush and stone wing dams, by closing chutes and by revetting banks where necessary, supplemented by dredging. Special treatment by locks and dams is given to two localities—Rock Island Rapids and Des Moines Rapids. At the former point a lock and lateral canal at Leclaire, Ia., overcomes the fall of the Upper Rapids, and a lock and lateral canal at Moline, Ill., overcomes the fall of the Lower Rapids. The project at this point is practically completed. The open channel through both rapids is still maintained. At Des Moines Rapids (Keokuk) private interests have built a water-power dam, concentrating the entire fall of the former canal and locks into a single lock. The project is completed. There is little navigation on the upper Mississippi, but prospects for revival appear encouraging. On the middle Mississippi between the Missouri and the Ohio, the plan is for six-ft. depth above St. Louis and eight ft. below, obtained by contraction and by closing chutes with permeable pile dikes, and by revetting banks where necessary, supplemented by dredging. In that part of the river below St. Louis there is considerable revival of navigation. On the lower Mississippi river, from the Ohio river to the Passes, the plan is for nine-ft. depth, to be obtained by revetting banks, supplemented by dredging.

In 1917 Congress passed the Flood Control Act providing a certain amount of money to be expended by the Mississippi River Commission for improving the river between Cairo and Head of the Passes, and for flood control between Rock Island and the Passes. In 1923 a second Flood Control Act extended the commission's jurisdiction to all tributaries between Rock Island and the Passes, in so far as they are affected by floods in the Mississippi river. As regards the Passes, or mouths of the river, the plans adopted in 1902 having proved inadequate, additional works were authorised in 1916, which have secured a channel through southwest Pass with a controlling depth of not less than 35 feet. The controlling depth in South Pass is approximately 34 feet.

The Missouri.—On the part of the river above Kansas City there is no definite depth to be attained, the project being simply to remove snags and boulders, leaving the natural depth and width of channel, and to revet the banks at certain localities where encroachment threatens great damage. On this part of the river there was in 1926 little commerce. On the section of the river below Kansas City, there is a definite six-ft. project, adopted by Congress in 1910 and being regularly carried out. Here too there was little navigation, but prospects for revival were encouraging.

The Ohio.—A comprehensive project for canalising the Ohio so as to provide a channel nine ft. deep was adopted by Congress in 1910. Slight modifications have since been authorised. As it stood in 1926, the project provides for 50 locks and dams, all of the movable type, except the one immediately below Pittsburg, Pa., which is a fixed dam, completed in 1921, for the purpose of improving conditions in Pittsburg harbour. Of these dams 42 were completed and in operation, and the other eight were under construction, with the probability that the project will be entirely completed by 1929. The type of dam, together with the relatively low head, does not lend itself to the development of power on a commercial scale. There is one exception to this general statement, at Louisville where the existing navigation dam is being replaced by a power navigation dam eight ft. higher, thereby creating a head of 37 feet.

The total tonnage shipped *via* the Ohio river in 1924 was 10,867,000 tons of which 54% was coal. Commerce on the river has been increasing steadily, particularly on the completed part and many terminals for handling coal have been constructed. A destructive flood occurred in March 1913, and, on that part of the river between Wheeling and Cincinnati and on the tributaries entering from the north in this reach of the river, higher flood stages were reached than had been recorded prior to that date. The flood was particularly destructive in the Miami valley, and, to guard against a recurrence, extensive flood-control works have since been constructed. (H. T.*)

MISSOURI (*see* 18.607).—Since 1910 Missouri continued her transition from the period of frontier influences, of rapid growth of population and development of natural resources, to the stage of industrial development and growth of urban population. In 1925, however, the interests of the state were still primarily agricultural. The total population in 1920 was 3,404,055 as compared with 3,293,335 in 1910, an increase of 110,720, or 3·4%. The percentage of urban population (in centres of 2,500 or more) increased from 42·5% in 1910 to 46·6% in 1920. The total population in 1926 was estimated by the U.S. Bureau of the Census at 3,498,143. Of the total urban population 79·7% in 1920 was in the three cities of St. Louis, Kansas City and St. Joseph. The rural population showed an absolute decrease in both 1910 and 1920. The population of the six chief cities was as follows:—

Cities	1920	1910	Increase %	Estimate 1925
St. Louis	772,897	687,029	12·5	821,548
Kansas City	324,410	248,381	30·6	367,481
St. Joseph	77,939	77,403	0·7	78,342
Springfield	39,631	35,201	12·6	42,140
Joplin	29,902	32,073	−6·8	
Sedalia	21,144	17,822	18·6	22,745

Agriculture.—In 1924, 32,637,043 ac., or 79·1% of the total area of the state, was in farm lands. The average size of a farm was 125·3 acres. The number of farms operated by owners decreased during 1920–5, from 185,030 to 174,390. In 1919 cereal and hay and forage crops continued to lead. Cotton gained from 96,527 ac. in 1909 to 110,027 ac. in 1919 and 475,729 in 1925. Fruit, primarily apples, continued an important crop. After 1909 the acreage in Indian corn decreased to 5,567,079 ac. in 1919, and 5,479,379 in 1924, while the acreage in wheat decreased from 4,564,990 ac. in 1919 to 1,441,071 ac. in 1924. The total value of all farm crops in 1924 was $351,017,000. Indian corn was valued at $163,768,000, wheat at $32,756,000 and oats at $21,290,000. Increasing progress is ensured by the extensive drainage operation in the southeast, and by the increased interests in improved farming methods and in co-operative organisations. The Agricultural College of the state university in co-operation with the Federal Govt. has been very active in agricultural extension work; on Jan. 1 1926 farm-agent work was established in 64 counties. On Jan 1 1925 there were on the farms 714,154 horses, 390,046 mules, 1,657,682 beef cattle, 788,311 dairy cattle, 1,181,000 sheep and 3,584,399 swine.

Mines and Quarries.—The slight increase from 1909 to 1919 in the value of these products of only 5·4% to a total of $33,365,694 was due largely to the post-War depression of the latter year, when it was little more than one-third of the production of 1917, the peak of the War-time stimulation. Lead and zinc continued to be the leading products, of a value of $15,879,177 in 1919, giving Missouri second rank among the states in its production. She ranked third in clay products, with a value of $1,420,585, and second in barytes ($527,817). The other important products were coal ($12,077,845) and limestone ($2,355,736). Since 1923 there has been a marked recovery both in amount produced and in value of mine and quarry products, especially in lead and zinc.

Manufactures.—In 1921 the total value of manufactured products was $1,162,006,299, whereas in 1923 the figures were $1,547,167,429, representing an increase of 33·1%. Sixteen industries in 1923 had a product valued at more than $30,000,000 each. Slaughtering and meat-packing continued to furnish the largest single item—$152,916,678 of the total; motor vehicles were second with $137,447,034; boots and shoes third with $121,830,354. Other important industries were foundries and machine shops $44,086,595, railway cars $38,191,307 and bread and bakery products $40,888,216. The two cities of St. Louis and Kansas City gave employment to over half the wage-earners and produced two-thirds of the total values of the state, St. Louis contributing over half the latter item.

Government.—The movements to adjust the conservative constitution of 1875 to the problems of a modern state were the chief developments. Of 42 constitutional amendments submitted 1910–8, only one, permitting pensions for the blind, was adopted. The opposition to state prohibition (defeated in 1910, 1916 and 1918), and to the single tax (defeated in 1912 and 1918), contributed to the distrust of all amendments. But in 1920 nine amendments out of 13 proposed were adopted, including a provision for a constitutional convention; in 1921 all the three proposed, including the soldier bonus of $15,000,000, in 1922 two out of three, and in 1924 one of four, were adopted.

The executive department was expanded by legislation by the creation of a Food and Drug Commissioner, 1909, a Public Service Commission, 1913, a State Highway Dept., 1917 and a Tax Commission, 1917. The Public Service Commission with real powers of regulation marked a departure from the earlier Missouri practice of leaving the regulation of public utilities to local city boards. Consolidation of executive departments, urged by Gov. Hadley and begun in 1917, was enacted on a comprehensive scale, including a Budget Dept. in 1921, but all the laws were defeated by referendum in 1922.

Constitutional Convention.—The Convention, approved by popular vote in 1921, and elected on a bi-partisan basis in 1922, was in session 266 days between May 15 1922 and Oct. 5 1923. It formulated and submitted to a special election on Feb. 26 1924, 21 constitutional amendments, embodying a comprehensive revision of the constitution. All the more important proposals were rejected by the people. Of the seven amendments adopted, all but one dealt with very minor or special problems. This one was a revision of the Article on the Legislative Dept.; the main changes were the division of the state into senatorial districts by the governor, secretary of state, attorney-general, auditor and treasurer, instead of by the General Assembly; increase of pay of state legislators; authorisation of the pensioning of mothers, and (by cities) of disabled firemen and policemen, and of a workingmen's compensation law. Missouri ratified the Sixteenth Amendment to the Federal Constitution (income tax) in 1909, the Seventeenth (direct election of U.S. Senators) in 1911, the Eighteenth (Prohibition) and the Nineteenth (woman suffrage) in 1919. Missouri remained conservative in social legislation; and a workmen's compensation law in 1920 and 1921 was defeated by the referendum. It was again defeated when proposed by the initiative in 1924. A fairly comprehensive but very moderate Act was passed in 1913 for the health and safety of employees, including limitation of hours for women. The compulsory school-attendance law of 1919 incidentally limited child labour.

Revenue.—The revenue, inelastic through constitutional limitations, proved increasingly inadequate after 1910, until the unpaid current obligations in 1917 totalled over $2,000,000. Attempts to secure relief for special purposes such as schools and good roads by constitutional amendments had all failed. The Assembly of 1917 passed new indirect taxes, a state income tax, a corporation franchise tax, a direct inheritance tax, "soft" drinks stamps and wholesale liquor dealers' licences, which yielded together nearly $2,400,000 in 1917–9. To secure reater uniformity in taxation and increased revenue the basis f assessed valuation was raised in 1921 to a (nominal) 100% f actual value.

Education.—Missouri appropriates one-third of the general evenue to the support of public schools, amounting to $1,618,- 41 in 1910 and $3,219,163.35 in 1925. To this must be added 187,040, the interest on the state's common school fund of 3,159,000. The estimated total expenditure for public schools rom state and local sources rose (1910–25) from $13,905,188 to 48,760,059. The permanent county, municipal and township chool funds increased from $9,825,991 in 1910 to $12,720,879 in 925. The average daily attendance at the public schools rose rom 490,374 in 1910 to 595,305 in 1925. Although the public chools continued to lack sufficient revenue, there was much onstructive legislation, especially as to the rural schools. dditional aid was given to rural schools (1909, 1911, 1915) and high schools (1913) in the poorer districts. The requirements r teachers' certificates was raised in 1911 and 1921, and pro- ision made for the training of teachers in the high school (1913). n effective compulsory attendance law was passed in 1919. he enrolment in the state university at Columbia and Rolla creased from 3,083 (165 at the School of Mines at Rolla) in 911 to 5,604 (506 at Rolla) in 1925. An Extension Division as organised in 1913; and a School of Commerce in 1914, which as expanded in 1916 to include Public Administration.

Roads.—The state highway system dates from the Hawes Act 917), passed to take advantage of Federal aid, and the Centen- ial Road Act (1921). The latter outlined the system and pro- ided for the expenditure of a $60,000,000 bond issue approved by opular vote in 1920. Automobile fees (1922) and a gasolene x (1924) provided additional funds. Of the total mileage of ,640 projected, on Jan. 1 1926, 33% had been hard-surfaced and 7½% graded preparatory to surfacing. The work completed presents an expenditure of $73,540,686.

History.—Gov. Hadley was a leading supporter of Roosevelt r the Republican nomination in 1912, though supporting Taft the election. Wilson that year received 330,746 votes, Taft 7,821, Roosevelt 124,371. In 1916 Wilson defeated Hughes by 3,693, but the Democratic candidate for governor defeated the epublican by only 2,263. In 1918, however, Folk, the Demo- atic candidate for U.S. Senator, ran 35,283 behind Spencer Rep.). The disorganisation in the local Democratic party as increased by the opposition of Senator Reed to the League of ations and, with the general national reaction, resulted in 1920 the election of a Republican state administration and a epublican majority in both Houses of the Assembly for the st time since 1870, and in a presidential majority for Harding ver Cox of 152,363. Senator Reed (Dem.) was re-elected in 22, but in the presidential election of 1924 Coolidge defeated avis by 75,733, and Baker defeated his Democratic rival for e governorship by 5,872.

Recent governors have been Herbert S. Hadley (Rep.), 09–13; Elliot W. Major (Dem.), 1913–7; Frederic D. Gardner Dem.), 1917–21; Arthur M. Hyde (Rep.), 1921–5; Sam A. aker (Rep.), 1925– (J. Vi.)

MISSOURI RIVER: *see* MISSISSIPPI RIVER.

MISTRAL, FRÉDÉRIC (1830–1914), Provençal poet (*see* .616), in 1906 published a Provençal translation of *Genesis* nd *Olivades* in 1912, a collection of Provençal poems. His emoirs appeared, under the title *Mes Origines*, in 1906. He ed at Maillane, near Marseilles, March 25 1914.

See P. Brousse, *Frédéric Mistral* (1903); E. Lefèvre, *Bibliographie istralienne* (1903); H. J. Boeken, *Frédéric Mistral* (1910); J. rochet, *Frédéric Mistral* (1910); J. Charles-Roux, *Le jubilé de Fr. istral* (1912); E. Ripert, *La versification de Frédéric Mistral* (1917); Lasserre, *Frédéric Mistral* (1918); J. Vincent, *Frédéric Mistral: sa e et son influence* (1918).

MITCHELL, PETER CHALMERS (1864–), British zoolo- st, was born at Dunfermline Nov. 23 1864, and was educated Aberdeen University, Christ Church, Oxford and at Berlin nd Leipzig. From 1888–91 he was university demonstrator in mparative anatomy at Oxford, and for the next two years was organising secretary for technical instruction to the Oxfordshire County Council. He subsequently occupied posts as lecturer in biology at Charing Cross Hospital and at the London Hospital, and was in 1903 appointed secretary to the Zoological Society of London. He also did much useful work as a member of the committees on fishery investigations and on sleeping sickness. During the World War he was attached to the Imperial General Staff and in 1918 acted as liaison officer to the War Office and to the British War Mission. He was elected F.R.S. in 1906. His publications include *Outlines of Biology* (1894), *The Biological Problem of To-day* (1896), *Thomas Henry Huxley* (1900), *The Nature of Man* (1904), *The Childhood of Animals* (1912), *Evolution and the War* (1915) and various scientific memoirs in *The Anatomical Journal*, *The Quarterly Journal of Microscopical Science*, etc.

MITCHELL, SILAS WEIR (1830–1914), American physician and author (*see* 18.618), died in Philadelphia, Pa., Jan. 4 1914. After 1910 he published *John Sherwood, Iron Master* (1911), *Westways* (1913) and *Complete Poems* (1914).

MODERNISM: *see* FUNDAMENTALISM.

MODJESKI, RALPH (1861–), American engineer, was born at Cracow, Poland, Jan 27 1861, his mother being the actress, Helena Modjeska. He graduated at the École des Ponts et Chaussées, Paris, with high honours, and settled in the United States. From 1892 he practised as consulting bridge engineer at Chicago and as a designer and builder of bridges he did distinguished work. Among his best known bridges are the Govt. bridge over the Mississippi at Rock Island; the McKinley bridge at St. Louis; the bridges over the Mississippi at Thebes, Ill., and at Memphis, Tenn.; the Northern Pacific bridge over the Missouri at Bismarck, N.D.; also bridges over the Columbia and Willamette rivers in Oregon. He was a member of the Quebec Bridge Commission, and consulting engineer for the Ohio river bridge at Metropolis, Ill., for the Chicago, Burlington and Quincy Railroad, and the Thames river bridge at New Haven, Conn., for the New York, New Haven and Hartford Railroad. He was chosen chief engineer and chairman of the board of engineers on the Philadelphia-Camden bridge over the Delaware river, which, on its completion, in 1926, was the longest suspension bridge in the world.

MOHAMMEDANISM: *see* CALIPHATE; MAHOMMEDANISM; PAN-ISLAMISM.

MOHN, HENRIK (1835–1916), Norwegian meteorologist, was born at Bergen May 15 1835, and was educated at the Cathedral School in that town and at the University of Christiania (Oslo). In 1861 he became observer at Christiania University, where in 1866 he was elected professor of meteorology and from 1866–1913 was director of the Norwegian meteorological institute which he had been largely instrumental in founding. He carried out much valuable meteorological work, collaborating in 1876–8 with the mathematician Guldberg in a study of the dynamics of the atmosphere and subsequently extending his investigations to the subject of storms, the meteorology and oceanography of the northern Atlantic, the climate of Norway, and use of the hypsometer. Mohn also worked out and published the meteorological observations of various polar expeditions, including those of Nansen and Amundsen. He died at Christiania Sept. 12 1916.

MOLESWORTH, MARY LOUISA (1839–1921), British writer (*see* 18.660), died in London July 20 1921.

MOLNÁR, FERENCZ (1878–), Hungarian dramatist, was born Jan. 12 1878 in Budapest. After studying in that city and at Geneva, he entered journalism and attracted notice by writing short stories, novels and some brilliant farces. His best novel is *The Pál-street Boys* in which child life is portrayed with much humour and power of characterisation. His chief *métier*, however, was the drama. His first successful play, *The Devil* (1907), was exported and, produced in Turin by Zacconi, led to a great demand abroad for modern Hungarian plays. The principal features of Molnár's dramatic works are a keen romantic sense of composition, brilliant technique and a witty and satirical representation of humble life. During the World

War Molnâr was a prominent war correspondent of the Central Powers. His plays include *Liliom* (1910); *The Lifeguardsman* (1911); *Carneval* (1917).

MOLTKE, HELMUTH VON (1848–1916), German soldier, was born in Gersdorf, Mecklenburg, May 23 1848, being the nephew of the famous Count von Moltke (*see* 18.677). From 1902 to 1904 he commanded the 1st Div. of the Guards Corps and in 1906 became chief of the general staff of the army. At the beginning of the World War he was the principal director of the German operations, and it is now known that his plans were based principally on the teachings of his predecessor, General von Schlieffen. His modifications of the latter's plans seem to have been, on the whole, unwise, and on him has been placed the responsibility for the German defeat at the battle of the Marne. On Nov. 3 1914 his health being seriously impaired, he was relieved of his post to make way for General von Falkenhayn and was appointed chief of the home general staff in Berlin. He died suddenly, during a function in the Reichstag building, Berlin, June 18 1916. The following works by him were published after his death: *Erinnerungen, Briefe, Dokumente, 1877–1916* (1922), *Aufzeichnungen, Briefe, Schriften, Reden* (1923).

MOMBASA (*see* 18.682), the chief port of Kenya Colony, East Africa, had a population (1921) of 36,846, of whom 656 were Europeans and 7,574 British Indians. In 1924 the population had increased to 42,000 (821 Europeans). Mombasa harbour takes vessels up to 30 ft. draft, but is used mainly by coasting steamers and dhows; the principal harbour is Kilindini, at the southwest end of Mombasa island.

Spacious and land-locked Kilindini accommodates vessels of any size and takes all the traffic of the Uganda railway. A deep-water wharf with two berths provided with all facilities for loading and unloading, built by the Government at a cost of over £1,000,000, was completed in 1926. Much of the cargo had still, however, to be handled by lighters and the administration acquired large areas for development purposes. Steamers entering Kilindini in 1924 numbered 372 (226 British); over 1,400 sailing vessels, mostly Arab dhows, entered Mombasa harbour. See *The East African Red Book* (Nairobi, 1925).

MONACO (*see* 18.684), had a population in 1913 of 22,956. In 1911 Prince Albert of Monaco granted the principality a constitution, providing for a national council of 21 members, elected for four years by universal suffrage and *scrutin de liste*. Government is in the hands of a Ministry assisted by a council of state, acting under the authority of the prince; and legislative power rests with the prince and the national council. The territory of Monaco, which has an area of 8 sq. m., is divided into three communes: Monaco, La Condamine and Monte Carlo, each of which is administered by a municipal authority. On June 26 1922 Prince Louis II. (b. 1870) succeeded his father, Albert, as Prince of Monaco.

The principality exports olive oil, citrons, oranges and perfumes, importing in exchange coal and wine. The principal part of its revenue still comes, however, from the gaming tables. In 1917 £80,000 was paid to the Govt. by the concessionaires; and a scale was arranged providing for the payment of £90,000 in 1927 and £100,000 in 1937.

MONASH, SIR JOHN (1865–), Australian soldier, was born in Melbourne June 27 1865, and educated at Scotch College and Melbourne University. He graduated in arts, engineering and law, and became a successful engineer. He was also interested, as a volunteer, in military work, and at the outbreak of the World War held the rank of colonel. He went to the front in command of the 4th Bde. of the A.I.F.; took part in the landing at Gallipoli on April 25 1915, being thrice mentioned in dispatches; and after the evacuation on Dec. 19 1915, served in the Suez Canal zone till April 1916. He was then given a brigade in France and commanded the 3rd Div. which fought at Messines and Passchendaele. In May 1918 he succeeded Sir William Birdwood as commander of the Australian Army Corps. Although not a professional soldier, he showed a thorough grasp of the principles of the new warfare, and by his brilliant leadership materially contributed to the failure and final collapse of the German offensive of 1918. This campaign he lucidly describe in *The Australian Victoriesin France, 1918.* He was mad K.C.B. in 1918 and after the War became manager of Victoria Morwell electricity scheme.

MOND, SIR ALFRED MORITZ (1868–), British politicia was born at Farnworth, near Widnes, Lancs., Oct. 23 1868, th son of the famous chemist Ludwig Mond (*see* 18.693). He wa educated at Cheltenham and St. John's College, Cambridg and afterwards at Edinburgh University. In 1894 he was calle to the Bar, and afterwards joined the North Wales and Chest circuit. He entered the firm of Brunner, Mond and Co., becom ing a director in 1895, and also became chairman of the Mon Nickel Co. and a director of the South Staffordshire Mond Ga Co. and various other companies. He was elected to Parliamen in 1906 as Liberal member for Chester, losing his seat in 191 but the same year was elected for Swansea and created a barone In 1913 he was sworn of the privy council. On the formation Mr. Lloyd George's Ministry in 1916 Sir Alfred Mond becam First Commissioner of Works, and in 1921 Minister of Healt He lost his seat at the general election of 1923, but was returne for Carmarthen in Oct. 1924. In Jan. 1926, owing to his pr found disagreement with the principles embodied in Mr. Lloy George's land policy, Sir Alfred Mond seceded from the Liber party and declared his intention of transferring his allegiance t the Conservative party. He published many articles on th alkali trade in scientific and economic journals, besides a volum of essays, *Questions of To-day and To-morrow* (1912).

MONEY MARKET (*see* 17.732).—In no direction were the e fects of the World War more striking or far reaching than i the London money market: the great increase in banking d posits, partly as the result of inflation, was but one of the man effects produced by the War upon its dimensions, machinery an general status. Even at the end of 1925 the market was still in transition state, though in such matters as the size of the floatin debt and the value of sterling as related to New York currenc there were not wanting signs of a return to more normal con ditions.

It has always been regarded as an essential point in the Londo money market that the Bank of England, while constitutin the centre and pivot of the system, should remain a private an independent central institution without State control. In prin ciple, that position was still maintained in 1925, but there wer many influences operating during the War which at times mad the distinction between a state bank and a private central ban somewhat difficult to determine. The introduction of currenc notes, the great size of the floating debt, the growth in the Na tional Debt, and, not least, the fact that shortly after the out break of war the State, through the Bank of England, discounte practically all foreign commercial bills in Lombard Street "with out recourse," were all developments tending in that direction as leading to a domination of the money market by the Stat owing to the magnitude of its financial operations. Some ide of the closeness of relations between the State and the Ban during the War and post-War periods may be gathered from th fact that on more than one occasion the Chancellor of the Ex chequer was asked questions in Parliament relating to Ban Rate policy, as though that policy had been inspired by th Government rather than by the Bank Court. On each occasio the Chancellor very definitely disclaimed such responsibility but it was none the less recognised that of necessity the connection between the Treasury and the Bank of England was more intimate than it had been before 1914.

Following the virtual disappearance of the commercial bil during the war period came the huge flotations of Governmen Treasury Bills. The effect of this was to make Governmen operations still further dominate the course of the money marke at the expense of the normal power of the Bank of England. The potential power to create credit through borrowings o "Ways and Means" was among the factors which, during th War, gave the Government almost complete control over the money market, and which in the post-War period greatly retarded its return to normal conditions. The *de facto* abandonmen f the gold standard at the beginning of the War and the unre- tricted issue of currency notes were further circumstances ma- erially affecting the London money market, particularly the ower of the Bank to exert its normal control over the situation hrough movements in Bank Rate. With the inflation of the urrency the Bank Rate lost its power to attract gold, and the xchanges fluctuated widely.

Market Conditions.—While no actual change took place during he period 1910 to 1925 in the general construction of the money arket, and while the Bank of England continued to be the ivot of the monetary system, there were many important espects in which the money market was still abnormal at the nd of 1925. In at least three important respects money market onditions were wholly abnormal when compared with the pre- Var period. In the first place, the volume of commercial bills Lombard Street was small as compared with the pre-War eriod. This was only partly due to trade depression, for the isarrangement of international credit machinery by the War, e fact that for many years international commercial transac- ons were conducted more or less on a cash basis, and, in smaller easure, the growth of the New York money market, were also sponsible.

In the second place, there existed an outstanding volume Treasury Bills to the amount of about £635,000,000 as mpared with a standing total in the pre-War days of under 0,000,000. This huge volume of Government floating debt, gether with the annual service of the National Debt, which proached £400,000,000 (including the sinking fund) as com- red with the pre-War figures of about £23,000,000 and the eatly increased national expenditure, which was about £800,- 0,000 as compared with £200,000,000 previous to the War, ercised a dominating influence upon the course of the money arket. This, in its turn, brought the State and the Bank of ngland into still closer relation, and heavy borrowing by the overnment at certain periods of the year to pay interest on bt increased the difficulty of making the Bank Rate effective. the third place, although Great Britain had returned to the ld standard, there was, in addition to the Bank of England te circulation regulated by the Act of 1844, a Government rrency note issue to the extent of about £300,000,000, of which ly a small part was covered by Bank of England notes, which ercised a disturbing influence upon the normal relations be- een the Bank of England and the outside money market.

THE POSITION OF LONDON

Previous to the War London held unchallenged the position both the leading monetary centre and of the world's banker. Three- urths of international bills of exchange were drawn upon Lon- n, but, by reason of Britain's wealth and the supremacy of r banking system, London was the centre in which foreign untries raised their permanent loans. As a result of the War ese conditions were greatly modified, and for the time being nerica may be said to have challenged London's position of ief lender to foreign countries. During the War dealings in ls of exchange were almost suspended, international transac- ns being effected on a cash basis through the foreign exchanges, d, with New York as the one free gold centre during the War, ere was a tendency for international transactions to take dollar her than sterling form. Also, by reason of the favourable de balance obtained during the War years, her gold accumu- ions and her improved banking system, the United States t only became independent of banking aid from London, but, h the return to more normal conditions after the War, be- me the country with the largest margin of surplus resources ailable for foreign investment.

Nevertheless, it was the London money market which took e lead, under the auspices of the League of Nations, in financ- the reconstruction of certain of the Central European States. th a view to maintaining the level of sterling exchange, how- er, a semi-official restriction was placed for a period upon itish loans to foreign countries, and it was not until the end 1925 that the embargo on foreign loans was completely removed. It was, however, more in the direction of long-dated loans than in general money market facilities that relations between London and other centres were temporarily modified; and, while there was a great reduction in bills of exchange dealt in in Lombard street, foreign exchange dealings, which assumed colossal dimensions in the post-War period, tended to centre in London.

Relations with other Money Markets.—A further circumstance, however, which materially affected the relations of the London money market with other centres, and more especially with European centres, was the chaotic condition in many of the European countries after the War. This naturally disturbed the whole international credit system throughout Europe, of which London may be said to have been the centre. Not only, however, were there indications at the end of 1925 of an increase in the general volume of European international trade, but it was also clear that the London money market was holding its old premier position in financing such operations. It should also be noted that, in unison with New York, London was responsible for reconstructing and setting in motion once again the banking and financial machinery at other European centres, notably in Germany and Austria.

RESULTS OF THE WORLD WAR

In considering the conditions under which the money market was working after the end of the World War, the changed economic position of Great Britain in relation to other nations, and especially in relation to the United States, must be borne in mind. With a large visible adverse trade balance, with huge gold accumulations in the United States, with an improved banking system in America as compared with the pre-War period, and with America as a large lender to other countries, it had yet to be demonstrated how far and how quickly the London money market would be able to resume its position, not only as the leading monetary centre but as the centre most able to control the foreign exchanges by movements in the Bank Rate. Viewed from the standpoint of actual figures as measured by the wealth of America and of Great Britain, and measured also by the general movements of trade, the task seemed to be an impossible one. Measured, however, by the actual progress made by Great Britain during the post-War period, in spite of the enormous strain suffered, the problem wore a more hopeful aspect. Great Britain is still in the position of one of the largest, if not the largest, holders of foreign securities, while her shipping and financial activities contribute powerfully to her invisible exports. By general consent a great step forward towards a return to normal conditions in the money market was achieved by the return to the gold standard in 1925; but much depended upon whether, in addition to the activities of the London money market and Lombard street, the industrial activities of the country were so organised and arranged as to enable Great Britain to hold the position in international trade which she had occupied before the War and upon which the prosperity of the money market was largely based.

The Discount Houses.—The discount houses and the bill brokers remained a very important part of the money market, though their business, especially as regards the discount houses themselves, was somewhat less strictly confined to bills even before the outbreak of the World War. The deposit business of the discount houses grew materially in the post-War years, and in the matter of fixed deposits they competed somewhat keenly with the banks, upon whom, however, they were still largely dependent for regular weekly loans. During the period of the War, and as a consequence of the virtual disappearance of the ordinary commercial and bank bills, the business of the discount houses and bill brokers may be said to have been confined to Treasury Bills, and, owing to that fact and the abandonment for some years of the gold standard the expert knowledge both of bills and of international financial conditions was probably less required than at any time in the history of the London money market. With the gradual diminution of the volume of Treasury Bills, the growth in the supply of commercial bills and the return to the gold standard, the need for this expert knowledge reasserted itself, and there was little doubt that in the future the discount market would continue to exercise its old and important functions in the London money market. This, indeed, was the more probable by reason of the fact that, in spite of the improvement in the banking system in the United States, the discount market at New York had not assumed any great importance.

Meanwhile, however, owing to the fact that the growth in the volume of commercial bills had not been commensurate with the decline in the supply of Treasury Bills, the London discount market earned no small amount of its profits by jobbing in short-term Government securities on the Stock Exchange. Moreover, the fact that the joint stock banks during 1924 and 1925 charged the bill market for weekly loans at a level of 1% below Bank Rate, whereas for many years the custom was to make the charge 1½% below Bank Rate, somewhat adversely affected the discount houses and bill brokers. In one respect, conditions in the discount market had not altered greatly from the pre-War period, namely in the dependence of the market, and especially of the bill brokers, upon the Bank of England for assistance at the end of each half-year. On these occasions the joint stock banks call in heavily their short loans from the discount market, and, in connection with what has been described as half-yearly window dressing in the shape of the half-yearly and annual balance sheets, it has become customary for the discount market to have to borrow from the Bank of England during the closing days of each half-year something like £30,000,000. The loans are usually for a period of a week to 10 days, and are almost invariably repaid within the prescribed period (*see* also BANKING; CURRENCY; STOCK EXCHANGE).

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MONGOLIA (*see* 18.711).—In inner Mongolia the most important political development is the Japanese claim to the eastern section as part of her sphere of influence. The history of Outer Mongolia, however, has been extremely chequered. In the main, there have been, as for a number of years past, three factors at work: Mongol restlessness under foreign control, and China and Russia. Both of the latter, no matter what their Government, have persisted in an ambition to control the country.

At the time of the revolution in China, in 1911, there was a growing unrest among the Mongol princes against San-to, the Manchu Amban at Urga, for the latter had adopted a vigorous policy of resisting Russian influence and of increasing the power of China through the promotion of Chinese immigration and trade and the strengthening of Chinese garrisons. The Mongol princes therefore took advantage of the disorder occasioned in China by the overthrow of the monarchy to oust the Amban and his subordinate (Dec. 1911), to declare their independence, and to set up the Urga Hutukhtu (Living Buddha) as their ruler. This gave Russia her opportunity, and on Nov. 3 1912 an agreement was signed between the Tsar's Govt. and that in Urga, whereby the former pledged its assistance in maintaining the independence of the latter, and the privileges of Russians in Mongolia were confirmed and extended. China naturally was dissatisfied with this arrangement, and negotiations followed between China and Russia. These resulted, Nov. 5 1913, in an exchange of notes whereby China recognised Mongolian autonomy and Russia recognised Chinese suzerainty over Mongolia. On June 7 1915, after nine months of negotiations, there was signed at Kiakhta a tripartite agreement between Russia, China and the Urga Government. By the terms of this agreement Chinese suzerainty was to be represented at Urga by a resident-general with deputies at three other places, but Outer Mongolia was to remain autonomous under the virtual protectorate of Russia.

Upon the collapse of the old régime in Russia the Chinese took steps to increase their power in Mongolia, and in 1919 Hsu Shu-tseng (" Little Hsu," assassinated Dec. 1925) was appoint " Defence Commissioner." He arrived in Urga in Oct. 19 and within a few weeks coerced the Mongols into a cancellati of their autonomy. The tyranny of his rule, however, creat unrest. Hsu lost his position after the overthrow at Peking of t clique to which he belonged, the Anfu Club, in the summer 1920, but the feeling against the Chinese continued, and af one unsuccessful attempt in Oct. 1920 Baron Ungern von Ste berg, leading a force made up of several nationalities and profe ing bitter antagonism to the " Reds " of Russia, early in F 1921 drove the Chinese out of Urga. The Living Buddha n returned to Urga, and an independent Mongol Govt. was p claimed with the Hutukhtu as ruler and Ungern as chief milita adviser. Ungern, who was probably mentally unbalanced, w extremely cruel to his enemies, and it is not surprising that was defeated by Red forces, suffered from a revolt of his troo was captured by Mongols (Aug. 1921) and executed by t Soviet authorities. Red troops now organised a government Urga, and although the Living Buddha (died May 20 1924) w acknowledged as spiritual chief, and Russia technically recognis the new government as independent, Soviet troops remained Urga. A treaty of Nov. 5 1921 provided for Russian influen The Chinese naturally objected to this renewal of Mongoli independence under Russian " protection," and the situati became an obstacle in the negotiations between China and t Soviet Government. In the agreement between China and Russ signed May 31 1924, Russia recognised Outer Mongolia as integral part of China and agreed to withdraw her troops. 1925 the Soviet Govt. announced that the withdrawal had be completed, but the influence of Russia was still far greater th that of China. (*See* CHINA.)

BIBLIOGRAPHY.—M. P. Price, *Siberia* (1912); *Outer Mongoli Treaties and Agreements* (Carnegie Endowment for Inter. Peac Div. of Inter. Law. Pamphlet 41 (Washington, 1921); W. Kar muishev, *Mongolia and Western China: Social and Economic Stu* (La Libraire Française, Tientsin, 1925). (K. S. L.)

MONGOLIA, PALAEONTOLOGIC DISCOVERIES IN (*see* 20.579 —An important new chapter in palaeontology and geology, in t life history of the earth, has been opened by the discoveries the Mongolian expeditions of the American Museum of Natur History under the leadership of Roy Chapman Andrews. T most recent discoveries of 1925 reveal Man in three or four cultu levels of the Stone Age. During the year 1924 Andrews project a new five-year expedition, to be known as the Central Asiat Expeditions of the American Museum of Natural History, ad ing to the staff a botanist, an archaeologist and three expe topographers. With the full consent of the Mongol officials the Urga Govt., the Expedition of 1925 completed a su vey of outer Mongolia, extending their reconnaissance northwe in the direction of Uliassutai.

Palaeontologic Discoveries, 1922–5.—Central Asia, especiall the region east and south of Chinese Turkestan, had long remaine the *terra incognita* of geography, geology and palaeontology. 1900 the present writer predicted that this unknown regio rather than the well-known Asiatic provinces of the south, suc as the Siwalik Hills of India explored by Falconer (1831–42 would prove to be the chief centre of mammalian origin and di tribution, from which radiated waves of mammalian life to th continents of Europe and of North America. The exploratio of the American Museum of Natural History have not onl completely verified this prediction but have revealed the centr Asiatic plateau as the chief home of the terrestrial dinosauria reptiles of Cretaceous time. The epicontinental geologic colum of Mongolia, heretofore an entire blank, has been largely fille by the geologists Berkey, Morris and Granger during three sea sons of explorations, 1922–3 and 1925, and in the remainin three years of the Central Asiatic expeditions the remainin blanks may be successfully filled. The palaeontologic column as it is known in 1925, is shown in Table I.

Through these discoveries the Quaternary, the Tertiary an the Cretaceous epicontinental formations, corresponding alto gether with the unique " Han-Hai " beds of Richthofen (1877

MONGOLIA: Palaeontological Discoveries In

PLATE I.

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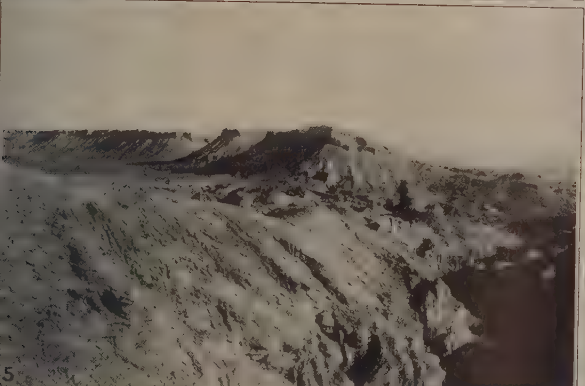
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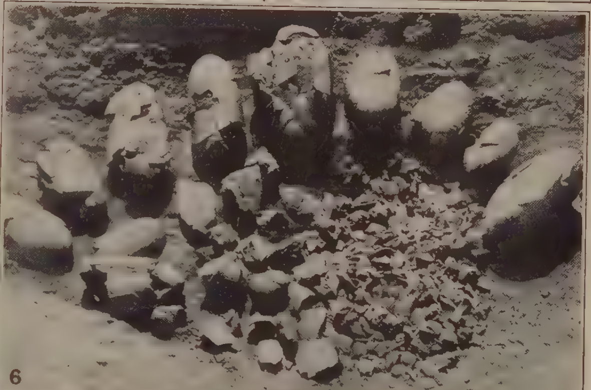
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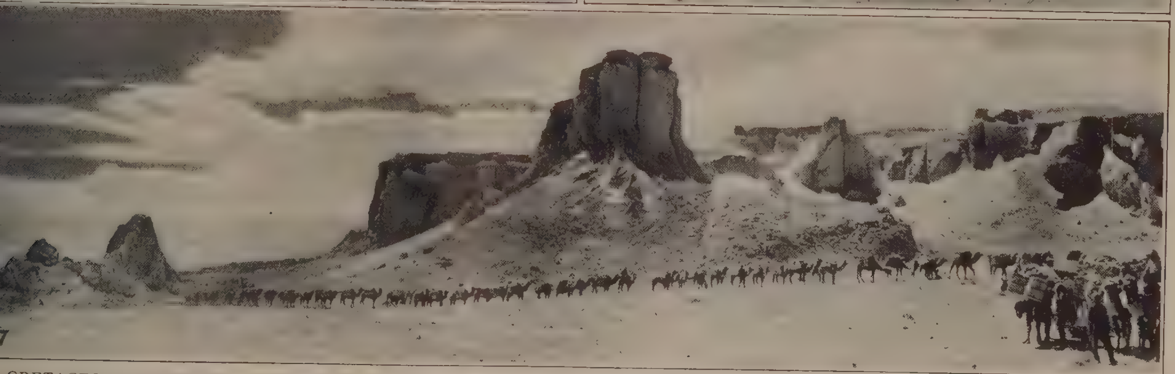
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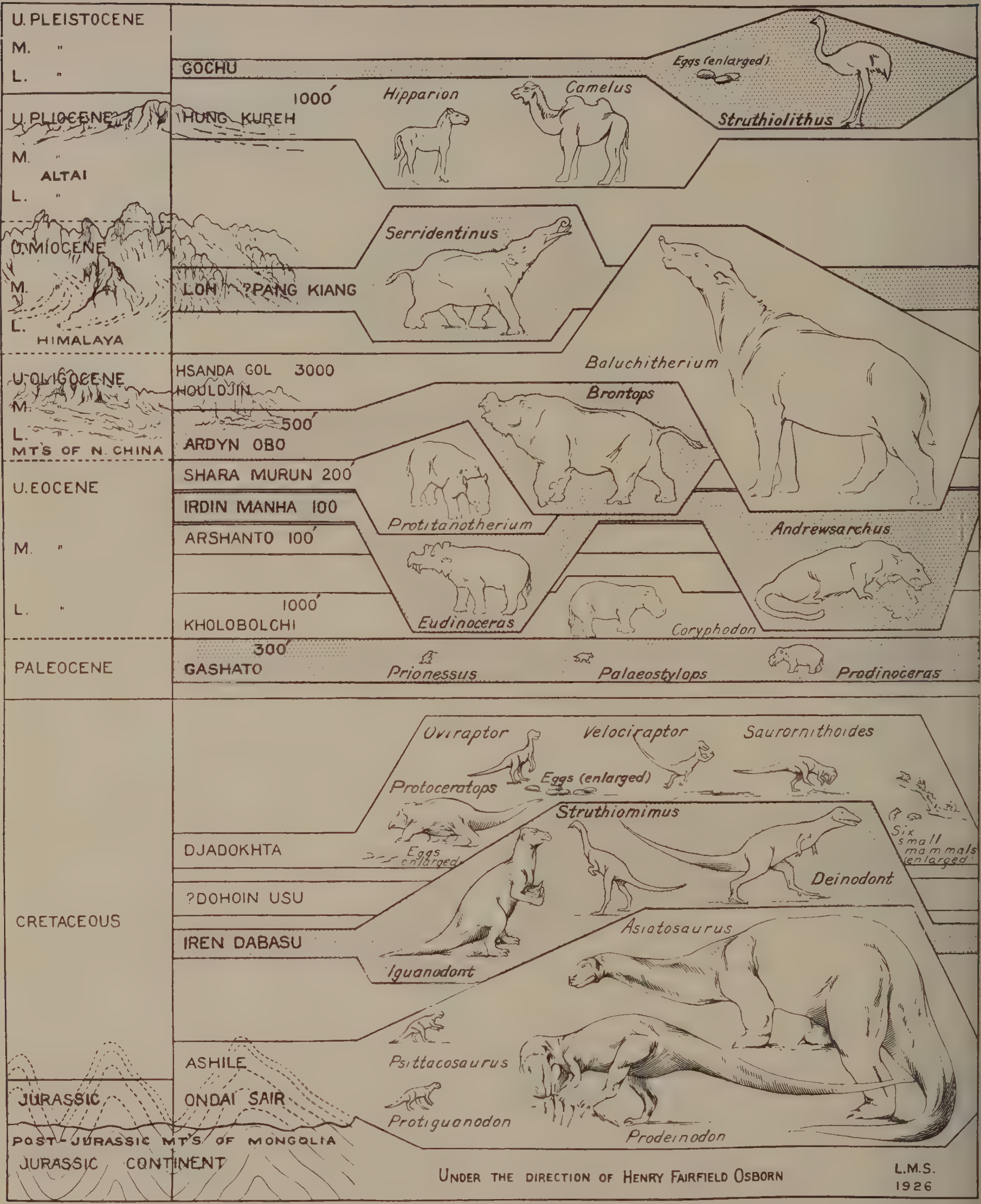
CRETACEOUS AND TERTIARY FORMATIONS, GOBI DESERT, AS DISCOVERED BY THE CENTRAL ASIATIC EXPEDITIONS UP TO 1926

G. 1. Hsanda Gol formation, Tsagan Nor basin. Altai Mountains in the distance; in the foreground, ravine where skull of the giant *Baluchitherium grangeri* was und. FIG. 2. Ardyn Obo formation of Lower Oligocene age. *Brontops gobiensis* life-zone, on the Uliassutai Trail. FIG. 3. Shara Murun formation, *Protitanotherium ongoliense* life-zone, of Upper Eocene age. Near Ula Usu, on the Uliassutai Trail. FIG. 4. Same as Fig. 2. American Museum camp at the left, at the foot of the carpment. FIG. 5. Ashile formation, Oshih basin. *Psittacosaurus* life-zone of Upper Jurassic age. FIG. 6. Djadokhta formation. *Protoceratops andrewsi* life-zone, Middle Cretaceous age, where forty nests of fossilised dinosaur eggs were discovered. Eastern Altai Mountains. FIG. 7. The Flaming Cliffs of Shabarakh Usu. Dinosaur beds of the Djadokhta horizon, containing the fossil nests (see Fig. 6 above). Camel transport of the Central Asiatic Expeditions, 1925, in the foreground.

MONGOLIA: Palaeontological Discoveries in


U. PLEISTOCENE
M. "
L. "
GOCHU
Eggs (enlarged)
Struthiolithus
1000′
Hipparion
Camelus
U. PLIOCENE
HUNG KUREH
M. "
ALTAI
L. "
U. MIOCENE
Serridentinus
M.
LOH ?PANG KIANG
L.
HIMALAYA
Baluchitherium
U. OLIGOCENE
HSANDA GOL 3000
HOULDJIN
M.
500′
L.
MT'S OF N. CHINA
ARDYN OBO
Brontops
U. EOCENE
SHARA MURUN 200′
IRDIN MANHA 100
Protitanotherium
ARSHANTO 100′
M. "
Andrewsarchus
L. "
1000′
KHOLOBOLCHI
Eudinoceras
Coryphodon
PALEOCENE
300′
GASHATO
Prionessus
Palaeostylops
Prodinoceras
Oviraptor
Velociraptor
Saurornithoides
Eggs (enlarged)
Protoceratops
Struthiomimus
DJADOKHTA
Eggs enlarged
Six small mammals enlarged
?DOHOIN USU
Deinodont
CRETACEOUS
IREN DABASU
Asiatosaurus
Iguanodont
Psittacosaurus
ASHILE
JURASSIC
ONDAI SAIR
Protiguanodon
Prodeinodon
POST-JURASSIC MT'S OF MONGOLIA
JURASSIC CONTINENT
UNDER THE DIRECTION OF HENRY FAIRFIELD OSBORN
L.M.S.
1926

REPTILIAN and MAMMALIAN LIFE SUCCESSION in the GOBI DESERT as discovered by the Central Asiatic Expeditions to the end of the year 1925. Left to right, first column: Four periods of mountain uplift. (1) Post-Jurassic mountains of Mongolia, forming by erosion the chief floor of the present Gobi desert; (2) probable Tertiary uplift of the mountains of northern China bordering the Gobi on the south; (3) Uplift, probably culminating in Miocene time, of the Himalaya Mountains bordering the central Asiatic plateaux on the southwest; (4) Upper Pliocene uplift of the Altai Mountains in the middle of the central Asiatic plateau. Second column: Ten Tertiary formations extending from Lower Pleistocene to Paleocene time, also five Cretaceous formations extending from Middle Cretaceous to Upper Jurassic time. Third column: Animals, reproduced to uniform scale, chiefly characteristic of each formation and life-zone, some of which are represented by complete skeletons, others by skulls, still others by highly characteristic teeth (*e.g.*, the giant sauropod *Asiatosaurus* and the theropod *Prodeinodon*).

TABLE I. *Stone Age, Tertiary and Cretaceous Formations of Mongolia*
In Descending Order

Regions	Formations and Thickness Estimated in Feet		Probable or Estimated Geologic Age	Human Culture, Mammal and Reptile Life-zones
Altai piedmont	Shabarakh Usu	50′+	Upper Palaeolithic	?Azilian-Campignian
Altai piedmont	Orok Nor	5′–40′	Middle Palaeolithic	?Aurignacian-Mousterian
			Lower Palaeolithic	?Acheulean or ?Eolithic
Orok Nor Basin	Khunuk	27′–120′	Lower Pleistocene	?*Equus.* ?*Mastodon*
Tsagan Nor Basin	Tsagan Nuru	50′±	Lower Pleistocene	?*Equus.* ?Struthiolithus
	Gochu	1000′±		
Eastern Altai Mts.	Hung Kureh	1000′±	Upper Pliocene to Lower Pleistocene	*Hipparion. Camelus* zone
Iren Dabasu Basin	Pang Kiang	500′	?Miocene; age doubtful	Rodents. ?*Ochotona*
Eastern Altai Mts.	Loh	100′–1000′	Middle Miocene	Mastodon (*Serridentinus*) zone
Eastern Altai Mts.	Hsanda Gol	3000′	Middle to Upper Oligocene	*Baluchitherium grangeri* zone
Iren Dabasu Basin	Houldjin	30′–50′	Middle to Upper Oligocene	*Baluchitherium grangeri* zone
Orok Nor Basin	Elegen	0′–200′	?Middle to Upper Oligocene	?Mammals undetermined
Uliassutai trail	Baron Sog	5′–30′	?Middle Oligocene	?Large titanotheres
Uliassutai trail	Ulan Gochu	2′–60′	?Lower Oligocene	?Large titanotheres
Uliassutai trail	Ardyn Obo	500′	?Lower Oligocene	*Brontops gobiensis* zone
Uliassutai trail	Shara Murun	200′±	Summit of Eocene	*Protitanotherium mongoliense* zone *Amynodon mongoliensis*
Shara Murun Basin	Tukhum	50′+	Upper Eocene	?Titanotheres
Iren Dabasu Basin	Irdin Manha	?100′	Upper Eocene	Eudinoceras, *Andrewsarchus* zone
Iren Dabasu Basin	Arshanto	40′–100′	?Middle Eocene	Lophiodonts, *Schlosseria* zone
Kholobolchi Nor Basin	Kholobolchi	1000′±	?Lower Eocene	*Coryphodon* zone
Eastern Altai Mts.	Gashato	300′	Basal Eocene (Paleocene)	*Prodinoceras* zone, *Palaeostylops*
Eastern Altai Mts.	Djadokhta	500′	Middle Cretaceous	*Protoceratops Andrewsi* zone
N. E. of Shabarakh Usu	Dohoin Usu	200′±		*Dinosauria, Crocodilia; Chelonia* ?zone
Iren Dabasu Basin	Iren Dabasu	180′	Lower Cretaceous ?Wealden	*Iguanodont. Ornithomimidae*
Oshih Basin	Ashile	2000′	Upper Jurassic	*Psittacosaurus* zone *Asiatosaurus* *Prodeinodon*
Tsagan Nor Basin	Ondai Sair	500′	Upper Jurassic	*Protiguanodon* zone

ıd the “ Gobi Series ” of Obruchev (1892–1909), have been sub-
vided by the American Museum party into from 15 to 23 dis-
ıct geologic formations more or less rich in animal life, con-
ected with either Western Europe or North America, the Ter-
ary with a total estimated thickness of from 6,500 to 9,000 ft.
ıd the Cretaceous with an estimated thickness of 3,380 ft., as shown in Table I. This table includes results up to the end of the season of 1925, in which the most welcome discovery was abundant evidence of the Stone Age in Mongolia, below the Iron, Bronze and the Neolithic, namely, culture levels of Upper Palaeolithic (?Azilian-Campignian), of Middle Palaeolithic (?Mousterian) and of Lower Palaeolithic (?Acheulean) time. No

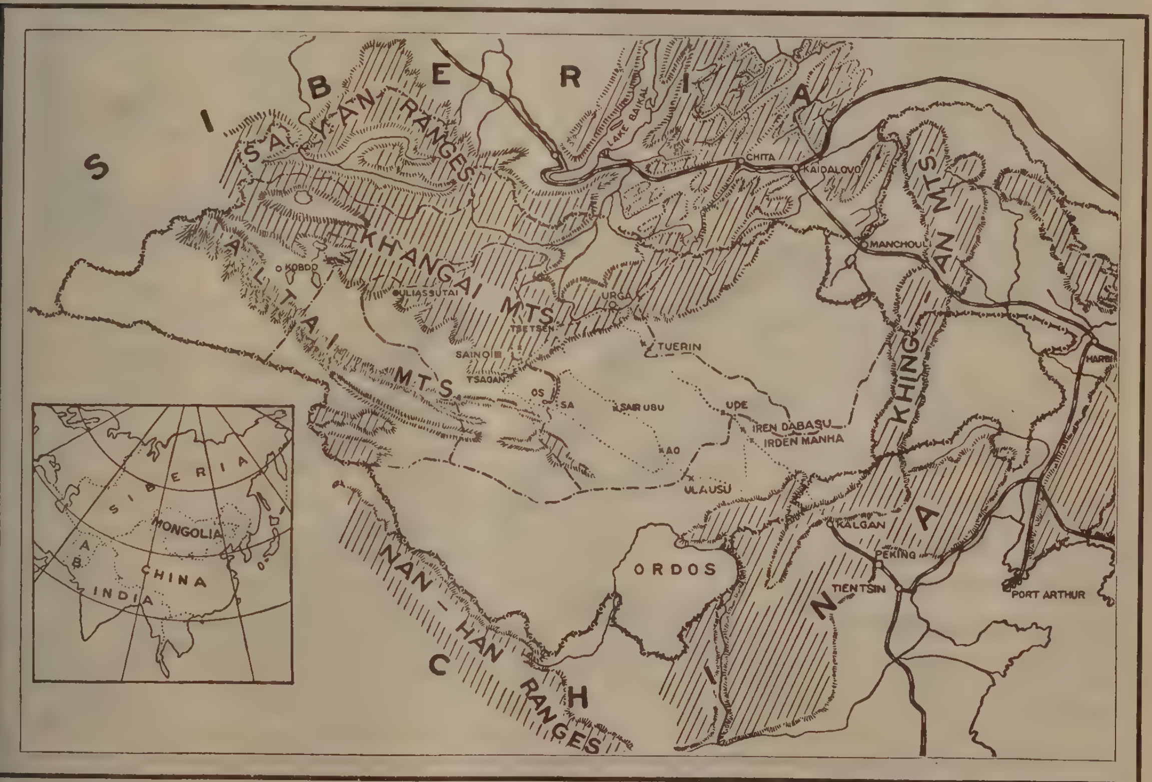


FIG. 1.—Map of Mongolia showing the routes of the Central Asiatic Expeditions of 1922–3. Slanting lines indicate mountain areas; the unshaded area is the Gobi desert.

human fossils were found; the industrial levels are not as yet precisely determinable, but the chief anthropological fact is established that Stone Age tribes spread over the southern Gobi Desert region during Pleistocene time. This accords with the prior discovery (1923) by Licent and Teilhard of the Mousterian industry in the Ordos region of China.

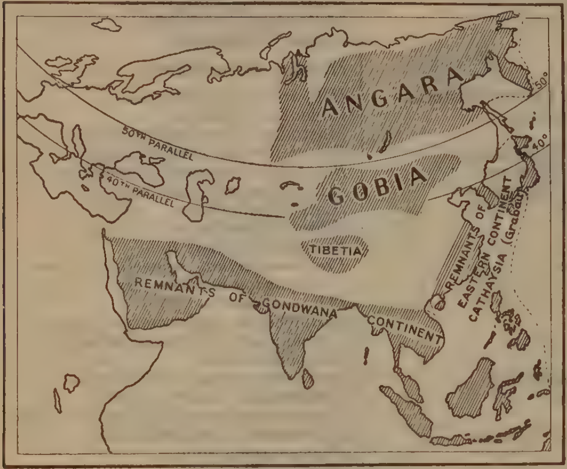

ANGARA
50th PARALLEL
40th PARALLEL
GOBIA
TIBETIA
REMNANTS OF GONDWANA CONTINENT
REMNANTS OF EASTERN CONTINENT CATHAYSIA (Grabau)
50°
40°

FIG. 2.—GOBIA (Grabau), a theoretic Upper Jurassic Continent in the heart of Central Asia. To the extreme south, the GONDWANA Continent (Suess). To the north, the theoretic Continent of ANGARA (Suess).

Equipment, Personnel and Itinerary.—It was in 1920 that R. C. Andrews first crossed the broad level Mongolian plains and conceived the plan of a camel caravan for heavy transportatio of gasolene and supplies, with light and heavy automobiles fo detour and reconnaissance work. The camel caravans, compose of from 150 to 250 animals under Mongol drivers, averaged fro 12 to 15 m. a day; the automobile trains proved capable of 10 time this speed, carrying an American party of from eight to 12 mem bers, 12 Chinese helpers and an equal number of Mongol The expedition had the advantage of speed over the work of pr vious explorers, who had entered or crossed the desert with can els only, namely, Raphael Pumpelly (1864), Ferdinand vo Richthofen (1871–2) and V. A. Obruchev (1892–1909). Th American palaeontologists and geologists, Granger, Berkey an Morris, also had the advantage of prolonged experience in th fields and geologic formations of the western United State which between the 50th and 40th parallels of latitude preser conditions remarkably similar to those in the desert of Gol (*see* map on p. 943).

In the easterly region of the Gobi desert, previously declare unfossiliferous, in which Obruchev found only a single frag mentary "rhinoceros" tooth, the expedition, leaving Kalga April 15 1922, discovered on May 3, 260 m. northwest of Kalga rich strata near Iren Dabasu of probably Lower Cretaceous ag full of large iguanodonts, megalosaurs and also ostrich-mimickin dinosaurs. Overlying this deposit (Iren Dabasu formation) we discovered much more recent Tertiary formations of Upper E cene (Arshanto and Irdin Manha formations) and Upper Olig cene (Houldjin) age, which correlate very closely with the class Upper Eocene formations of Cuvier in France and similar foss beds in Utah, Wyoming and Nebraska of the Rocky Mountai region. These Mongolian formations immediately establishe the Gobi region as a great central life zone, half-way betwee Europe and the Rocky Mountain region, according to the theor of 1900.

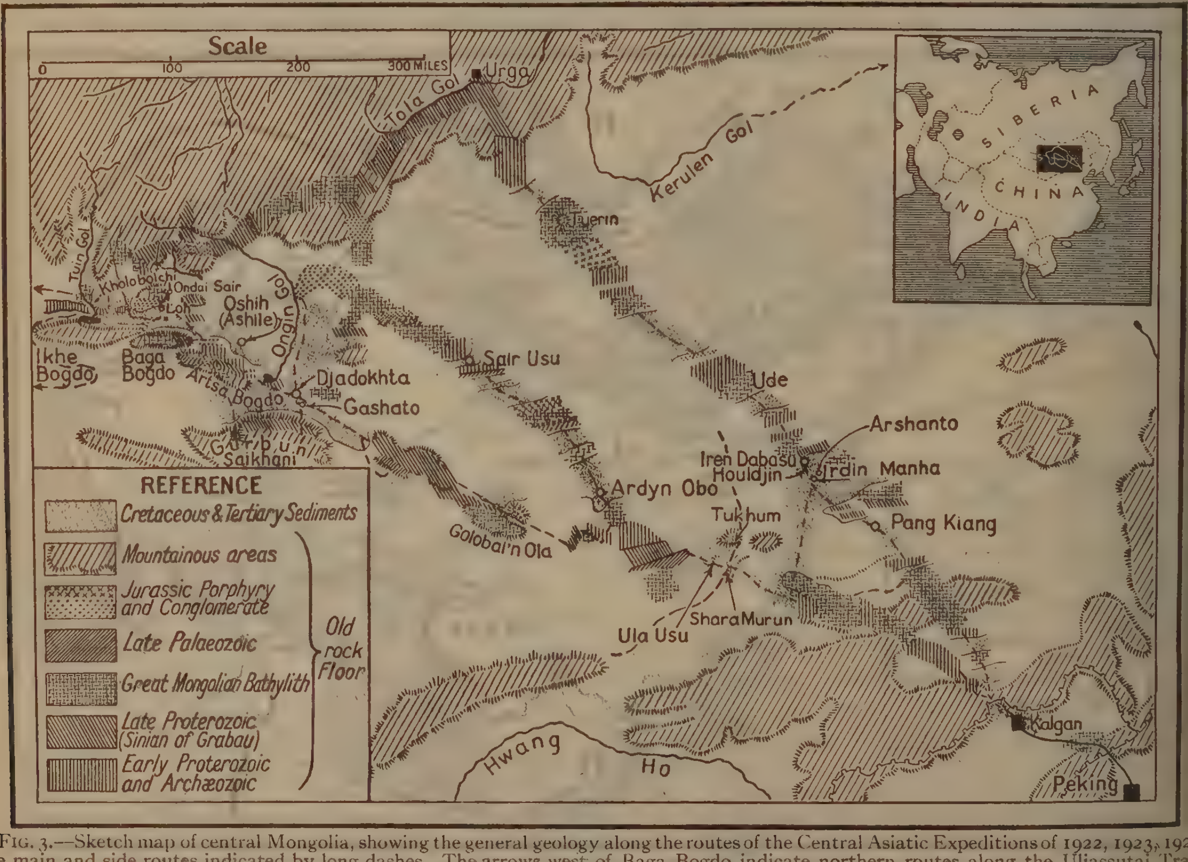

Scale
0
100
200
300 MILES
Urga
Tola Gol
Kerulen Gol
Tuerin
Tuin Gol
Kholobolchi
Ondai Sair
Loh
Oshih (Ashile)
Ongin Gol
Ikhe Bogdo
Baga Bogdo
Artsa Bogdo
Djadokhta
Gashato
Sair Usu
Ude
Gurbun Saikhan
Arshanto
Iren Dabasu
Houldjin
Irdin Manha
Ardyn Obo
Tukhum
Pang Kiang
Golobai'n Ola
Shara Murun
Ula Usu
Hwang Ho
Kalgan
Peking
SIBERIA
CHINA
INDIA
REFERENCE
Cretaceous & Tertiary Sediments
Mountainous areas
Jurassic Porphyry and Conglomerate
Late Palaeozoic
Great Mongolian Bathylith
Late Proterozoic (Sinian of Grabau)
Early Proterozoic and Archæozoic
Old rock Floor

FIG. 3.—Sketch map of central Mongolia, showing the general geology along the routes of the Central Asiatic Expeditions of 1922, 1923, 192 the main and side routes indicated by long dashes. The arrows west of Baga Bogdo indicate northern routes along the Uliassutai Trai Finely stippled areas indicate location of chief Cretaceous and Tertiary formations listed in Table I. Hung Kureh and Gochu lie S. of Loh.

Encouraged by this brilliant initial success of 1922, the American Museum party made a 3,000-m. reconnaissance to the north as far as Urga, the capital of Mongolia, and southwest to the Altai mountains where five additional fossil horizons (Ondai Sair, Ashile, Hsanda Gol, Loh and Hung Kureh formations) of Upper Jurassic, Upper Oligocene, Miocene and Pliocene age were discovered; then southeast along the Altai mountains, where in the Djadokhta formation of Middle Cretaceous time the now famous dinosaur eggs were found, together with marvellously preserved series of dinosaur skeletons, chiefly of herbivorous types such as *Protoceratops* and of small carnivorous types. Thus the 1922–3 expeditions virtually circled the entire desert of Gobi east of the Altai mountains (fig. 1). On the return, toward Kalgan in north China, three additional Tertiary fossil horizons (Gashato, Ardyn Obo and Shara Murun) were discovered and a few representative fossils from each were brought back.

The types of dinosaurs, and of mammals which chiefly characterise these formations or horizons, are diagrammatically nown in Plate II., which displays the ancient "life zones" of Mon-olia as we descend from Lower Pleistocene into Upper Jurassic me. The animals represented in this life zone chart are known ither by complete skeletons (*e.g.*, *Protoceratops*, *Protiguanodon*, *sittacosaurus*) or by complete skulls (*e.g.*, *Baluchitherium*, *Pro-tanotherium*) or, finally, by highly characteristic teeth (*e.g.*, *siatosaurus*, *Prodeinodon*). In all of the Cretaceous horizons he correlation with Europe and with North America is provi-onal; in all the Tertiary horizons, excepting the ?Miocene Pang uang, the correlation is either absolute or fairly close.[1]

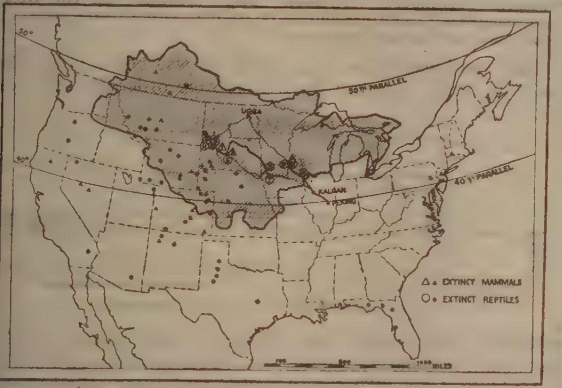


FIG. 4.—Areal map of Mongolia, projected upon map of United tates of America. Similar 50° and 40° parallels of latitude. △, ○, = hief fossil localities of central Mongolia discovered to the end of he year 1925. ▲, ●, = chief fossil localities of terrestrial dino-aurs and mammals of the United States. This map demonstrates nat the Mongolian and North American faunas occupied similar sothermal regions in central Asia and central North America from pper Jurassic to Tertiary time.

In the season of 1923 the expedition explored intensively the ossil beds visited in 1922, and returned with the camel caravan eavily loaded from the 15 or more horizons extending from he Upper Jurassic (Ondai Sair, Ashile) to the very summit of he Upper Pliocene (Hung Kureh).

These discoveries have established Mongolia as a treasure ouse of the life history of the earth from the close of Jurassic me onward to the close of Pleistocene time, *revealing especially e hitherto unknown high continental life of Cretaceous and Tertiary mes.* Consequently, the outstanding geologic discovery of the pedition is, first, that *GOBIA* (fig. 2) since Jurassic time has een a central Asiatic continent extremely favourable to the olution of reptiles, mammals, insects and plants hitherto nown only along the Cretaceous shore lines of Europe and the retaceous sea borders of the centre of America, and second, at this now terribly desert region, traversed by the gazelle and the wild ass, was certainly luxuriant with life throughout Cretaceous and Tertiary time, sparsely forested, with limited rain supply like the high plateau region of Africa to-day.

These upland conditions of Mesozoic and Caenozoic time, also favourable to the origin of the human race itself, led to the further generalisation by H. F. Osborn, on returning from Iren Dabasu in 1923, that the ancestors of man occupied this region during Caenozoic time and are likely to demonstrate the central Asiatic theory of human origin. This generalisation was partly verified during the year 1925.

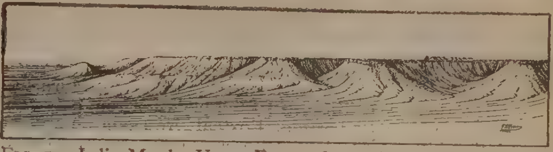


FIG. 5.—Irdin Manha Upper Eocene formation of the Iren Dabasu Basin, eastern Mongolia. Rich in titanotheres and other large mammals of American Upper Eocene affinities. (Compare fig. 3.)

TABLE II. *Human Culture, Mammalian and Reptilian Life Zones in Descending Order*

1. *Mongol graves* of early historic time.

2. *Iron and Bronze ages* represented by monuments and graves in the Gobi desert.

3. *Neolithic* represented in the upper levels of Shabarakh Usu deposits; pottery, etc., ostrich eggs (*Struthiolithus*).

4. *Uppermost Palaeolithic of Shabarakh Usu.* Indurated sands containing flints, resembling those of the ?Azilian and Campignian industries of Europe; eggshell ornaments made of *Struthiolithus* and of fossilised dinosaur eggs. The "dune-dwellers" of prolonged occupation. True Upper Palaeolithic not found.

5. *Lower Palaeolithic.* Near Orok Nor, 20 m. from Kholobolchi Nor. Flint industry of possible Aurignacian age; flints certainly of Mousterian age, of IV. Glacial and pre-Glacial time resembling those of the Ordos.

6. ?Acheulean or ?Eolithic flints of uncertain age.

7. *Tsagan Nuru, Gochu.* Regarded as base of the Pleistocene. The Gochu, 1,000 ft. in thickness, overlies the Hung Kureh at the foot of the Altai range Baga Bogdo. The sands of Tsagan Nurud contain *Equus* and *Struthiolithus.*

8. *Hung Kureh.* Lower Pleistocene and Upper *Pliocene.* Containing in lower levels, a true Upper Pliocene horizon, *Hipparion*, *?Elephas*, *Cervus*, *Castor*, *Camelus*, *Gazella*, rhinoceros, ?Coelodonta. Compare Plaisancian-Astian of France and Italy.

9. *Loh.* These gravels and clays, directly overlying the Hsanda Gol, are apparently of Middle Miocene age. Containing a mastodont, *Serridentinus mongoliensis*, and a diminutive baluchithere, *Baluchitherium mongoliense.* Compare Lower and Middle Miocene Burdigalian-Helvetian of France.

10. *Hsanda Gol.* Great formation 3,000 ft. in thickness, of Middle to Upper Oligocene, or Stampian to Aquitanian. Containing abundant remains of *Baluchitherium grangeri*, a skull having been found in 1922 and a leg and feet in 1925; small rhinoceros; very large small-mammal fauna, several thousand jaws belonging to 30 genera of rodents, creodont carnivores, true carnivores, insectivores related to *Tupaia* (the tree shrews) and *Macroscelides* (the jumping shrews). The prevailing affinities of this fauna are with the Quercy Phosphorite of France; there are also distant affinities to modern African rodents and insectivores; relationship to North American and the Middle Oligocene White River fauna is less close, except in the wide-ranging carnivores like *Hyaenodon.* The larger rhinoceros *Baluchitherium* resembles that of Baluchistan (Forster Cooper) and the *Indricotherium* (Borissiak) of Turkestan.

A formation of similar age in the Iren Dabasu basin is the *Houldjin*, where Obruchev discovered his "rhinoceros" tooth, probably a baluchithere.

Apparently intermediate between the well-determined Hsanda Gol and the Ardyn Obo formations, there were found in 1925 three other horizons in which the faunas are still to be determined, namely, *Elegen*, Middle to Upper Oligocene, *Baron Sog*, Middle Oligocene and *Ulan Gochu*, Lower Oligocene.

11. *Ardyn Obo.* 500 ft. thick. On the Uliassutai trail. Contains rich Lower Oligocene (Sannoisian) fauna, chiefly of ungulates, including giant titanotheres (*Brontops gobiensis*, *Menodus mongoliensis*) broad-skulled and long-skulled titanotheres similar to those of South Dakota and Colorado; also an amphibious rhinoceros, *Cadurcotherium* mongoliense, intermediate in character between *Cadurcotherium* of the Lower Oligocene of France and the American *Metamynodon.* The creodont carnivores include *Hyaenodon* and aberrant oxyaenids ancestral to Hsanda Gol forms. Compare Infra-Tongrian, Ronzon, Quercy.

12. *Shara Murun.* Richly fossiliferous formation on the Uliassutai trail, representing the very summit of Eocene time. Contains

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[1] To clearly understand the above description the reader should refully examine Plate I., correlation chart, and Table II., faunal ccession.

imposing titanothere fauna (*Prototitanotherium andrewsi, P. mongoliense, Dolichorhinus*), quadrupeds extraordinarily similar to those of Utah in the Rocky Mountain region. Here occur the amphibious amynodonts, also a long-limbed rhinoceros ancestral to *Baluchitherium*, and numerous smaller odd-toed ungulates suggestive of *Tapirus* and the cursorial *Colodon* (*Deperetella*), all of strong American resemblance. Most important is the pro-ruminant *Archaeomeryx*, in all respects ancestral to the higher ruminants (*Cervidae*, etc.). The carnivores of this horizon (*Hyaenodon, Pterodon*) are again of Franco-American affinities. Compare Ludian stage of France, Gypse de Montmartre.

Tukhum is another formation discovered in 1925, which has not yet been fully studied. It directly underlies the Shara Murun.

13. *Irdin Manha.* In this great flood-plain horizon, only 100 ft. in thickness but of vast horizontal extent, we again observe very close relationships to the Upper Eocene of the Rocky Mountain region. Outstanding types are the titanotheres (*Dolichorhinus, Protitanotherium, Mesatirhinus*); the giant *Eudinoceras*, four-horned and tusked, comparable to *Dinoceras* Marsh of the Rocky mountains; finally, the giant *Andrewsarchus*, a primitive creodont carnivore named after Andrews, the leader of the Central Asiatic Expeditions.

14. *Arshanto.* A little-known formation directly underlying *Irdin Manha*, probably of Middle Eocene age, containing small lophiodonts.

15. *Kholobolchi.* In this newly discovered horizon occur animals similar to the *Coryphodon* of the Suessonian of France and the Lower Eocene Wasatch of the Rocky mountains.

16. *Gashato.* Rich fauna of Paleocene age, including *Palaeostylops*, an herbivore related to a South American genus as determined by Matthew; also the long-tusked amplypod *Prodinoceras*, ancestor to *Eudinoceras* and related to a smaller form in the Rocky Mountain region.

No horizons have been discovered representing the close of Cretaceous time but the beginning of Upper Cretaceous time is probably represented by the famous *Djadokhta* horizon containing *Protoceratops* and the nests of fossilised dinosaur eggs.

17. *Djadokhta.* These flaming red cliffs of aeolian sand apparently preserve the entire reptilian fauna of this locality, which appears to have been a nesting ground of the primitive horned dinosaur known as *Protoceratops*. The delicate red sand contains in nearly perfect condition nests of eggs varying from 12 to 20 in number, belonging chiefly to *Protoceratops*, representing at least three species or genera of dinosaurs. This primitive horned dinosaur is represented by nearly seventy growth-stages, from the tiny skeleton within the eggshell to skulls about two feet in length. Small carnivorous dinosaurs, *Velociraptor* and *Saurornithoides*, are found, also the ornithomimoid *Oviraptor*, so named because its skeleton rested directly upon a nest of dinosaur eggs. Most remarkable were small mammals of the size of mice and shrews, represented by six skulls, related to small creodont carnivores and to insectivores.

18. *Dohoin Usu.* A fossiliferous basin, the fauna of which has not yet been examined.

19. *Iren Dabasu.* A very rich horizon in eastern Mongolia containing dinosaurs of Lower Cretaceous, possibly Wealden, age; *Iguanodont* equal in size to the *Ibernissartiensis* of Belgium; also a carnivorous dinosaur, possibly resembling *Deinodon* of the American Middle Cretaceous; finally, a toothless ostrich resembling *Struthiomimus* in size.

20. *Ashile.* In the Oshih basin, containing small parrot-beaked iguanodont dinosaur known as *Psittocosaurus mongoliensis;* the giant sauropod *Asiatosaurus*, resembling *Camarasaurus* of the American Upper Jurassic Morrison horizon; and *Prodeinodon*, resembling *Allosaurus* of the Morrison of Wyoming. This fauna appears to be of sub-Wealden age and to represent the close of Upper Jurassic time.

21. *Ondai Sair.* A small parrot-beaked leaf-eating iguanodont *Protiguanodon mongoliense*, more primitive in tooth structure than *Psittocosaurus*, remotely related to Huxley's *Hypsilophodon foxi* of the Wealden of England. This horizon contains a rich insect fauna.

Bibliography.—The scientific and semipopular literature is already extensive. In *Asia Magazine*, which helped to finance the expeditions and which owns the copyright of many of the photographs, has appeared a series of narrative articles (1922–5) by the leader of the expeditions, Roy Chapman Andrews, which are being republished in his volume, *On the Trail of Ancient Man* (1926). Preliminary scientific papers by the geologists and palaeontologists of the expeditions, Messrs. Berkey, Morris, Granger, Matthew and Osborn, have appeared chiefly in the American Museum *Bulletins* and *Novitates* and are collected in a volume entitled *Preliminary Reports of the Central Asiatic Expeditions*, vol. i., which has been distributed to 100 of the chief scientific institutions of the world. More mature scientific publication is projected in a series of 12 volumes, of which vol. ii., *Geological Reconnaissance in Mongolia*, by Charles P. Berkey and Frederick K. Morris, will appear first.

(H. F. O., R. C. A.)

MONITOR.—Almost immediately on the outbreak of the World War it became apparent that the German occupation of Belgium could be to a certain extent out-flanked along the coast by bombardment of the ports which were being used as bases for torpedo boat destroyers and submarines. As the water is very shallow fo a considerable way out, it became necessary to have vesse drawing very little water, and soon after the outbreak of war th British Navy took over three river monitors, built by Messr Vickers for the Brazilian Govt., with a view to using them o the Belgian coast. These were only small vessels, renamed th " Humber," " Mersey " and " Severn," mounting 6-in. and 4·7-i guns, and it soon became evident that vessels of the monito type, with heavier guns and better protection, would be ver useful. An interesting account of how the suggestion arose t add big gun monitors to the fleet in 1914 is given by the the First Lord of the Admiralty, the Rt. Hon. Winston Churchil in his book " The World Crisis 1911–4."

At a conference with Lord Fisher and Mr. Schwab concernin submarine contracts, Mr. Schwab offered to supply to the Admiralt four turrets, each mounting two 14-in. guns, which had been almo completed for the Greek battleship " Salamis," then building i Germany for Greece. This offer was accepted, and Mr. Churchil remembering the good work done by the three small ex-Brazilia monitors " Humber," " Mersey " and " Severn " off the Belgia coast, suggested monitors should be built to carry these 14-in. gun close inshore to attack the enemy.

Thus the idea of the 14-in. monitors was born, and in Nov the four vessels to carry these guns were ordered, the " Abercrombie," " Havelock " and " Raglan " from Messrs. Harlan and Wolff, and the " Roberts " from Messrs. Swan and Hunte

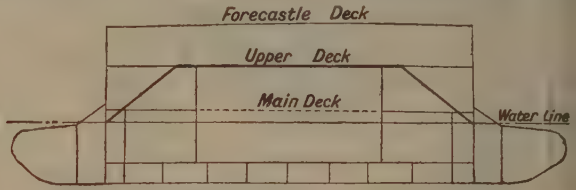

Fig. 1.—Section of a typical monitor.

Main Features.—The characteristics of these monitors wer shallow draught and very good under-water protection by mean of a complete bulge, and a typical section of a big gun monito is shown in fig. 1.

The fact that both these qualities diminished very greatl the risk of successful torpedo attack brought to the fore the great possibilities. So highly thought of, in fact, were thes possibilities that additional guns were sought to provide th armament for further vessels of this type, and this was done b using two 15-in. gun turrets, which were ready for battleship under construction, stripping the old " Majestic " class of battle ship of their 12-in. turrets and the " Powerful " and othe vessels of their 9·2-in. guns. With these guns around which t design the monitors swift progress was made.

Toward the end of 1914, eight vessels were ordered to carr the 12-in. guns, followed by further orders early in 1915 for tw vessels to carry the 15-in. guns, 14 to carry the 9·2-in. and five t carry the 6-in. guns.

The names of these various types were as follows, and th tables below give the detailed particulars:—

14-in. Monitors: " Abercrombie," " Havelock," " Raglan " an " Roberts."

12-in. Monitors: " Lord Clive," " General Crauford," " Earl o Peterborough," " Sir Thomas Picton," " Prince Eugene," " Princ Rupert," " Sir John Moore " and " General Wolfe."

15-in. Monitors: " Marshal Ney," " Marshal Soult " and two of later type, " Erebus " and " Terror."

9·2-in. Monitors: M.15 to M.28.

6-in. Monitors: M.29 to M.33.

A typical profile of a big gun monitor with a 9·2-in. gun is show in fig. 2 and the detailed particulars of the various vessels ar given in table on p. 945.

The 9·2-in. and 6-in. vessels were designed for river work an for manoeuvring in closed waters, and were not bulged.

Machinery.—In the construction of all these monitors tim was essential, and in several cases the big gun monitors wer launched within four months of the keel being laid, and completed ready for service within just over six months. It wa

Type	Length between perpendiculars	Length over-all	Breadth ext.	Load draught mean	Displacement	S.H.P. of Engines	Speed at load drght.	Fuel capacity	Armament
	ft.	ft. in.	ft.	ft.	tons		knots	tons	
14-in.	320	334-6	90	10	6,150	2,000	6–7	400 coal	2–14-in. 1–6-in.
12-in.	320	335–6	87	10	5,900	2,300–2,500	6–7	350 coal	2–12-in. 1 to 4–6-in.
15-in.	340	355–8	90¼	10¼	6,670	1,500	6–7	235 oil	2–15-in. 8–4-in.
9·2-in.	170	177–0	31	6	540	480–800	12–13	30 oil	1–9·2-in. 1–3-in.
6-in.	170	177–0	31	4	355	400	10	45 oil	2–6-in. 1–6-pdr.
"Erebus" "Terror"	380	405–0	88	11	8,000	6,000	12	750 oil	2–15-in. 8–4-in.

eccessary, therefore, to take, in many cases, whatever machinry happened to be available, and in consequence the machinery nstallations varied somewhat. The 14-in. and 12-in. monitors ll had either quadruple or triple expansion reciprocating enines, but the 15-in. vessels, "Marshal Ney" and "Marshal oult," had twin sets of internal combustion engines, originally esigned for oil carriers. All the 6-in. monitors were twin screw ith steam engines and oil-fired boilers. The oil engines in the wo 15-in. monitors were never quite satisfactory, and this, ombined with the somewhat bluff form of the boats, gave ather a poor speed on service, and after a time it was decided to uild two larger and faster vessels to carry these 15-in. guns to etter advantage. This decision was modified owing to various ther conditions which arose, and it was ultimately decided to ake out the guns from the "Marshal Ney" and to provide in ddition a new twin 15-in. mounting to complete the two sets of uns necessary for the two new vessels.

The "Erebus" and "Terror."—These vessels had special ulge protection of an improved type, and with their more powrful machinery of 6,000 H.P. and improved form had a speed of 4 knots. Ordered in Sept. 1915, and completed in 12 months, ney proved very efficient on service, and although both were eavily struck by German torpedoes, neither was seriously damged and the repairs were quickly effected.

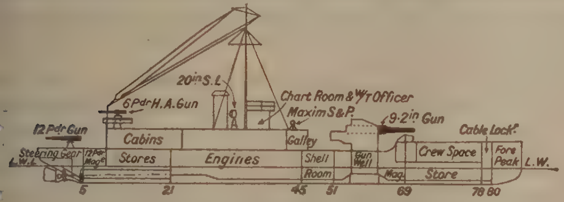

FIG. 2.—Profile section of monitor mounting a 9·2-in. gun.
From Brassey's *Naval and Shipping Annual.*

Two other vessels, although not of the true monitor type, were onverted for similar service to that on which monitors were nployed.

"Glatton" and "Gorgon."—The "Glatton" and "Gorgon" ere armed with two 9·2-in. guns and six 6-in., together with everal smaller. Originally the coast defence vessels "Bjorgrin" nd "Nidoros," building for the Norwegian Govt. by Messrs. rmstrong and Whitworth, they were finally put into commission oward the end of 1918 after the fitting of bulge protection.

The "Glatton" was unfortunately lost in Dover Harbour oon after her completion owing to an explosion on board causing n outbreak of fire. To prevent possible further explosions it was ecided to sink the vessel at anchor, and owing to the bulge proection, it took three torpedoes at close range to do this, and nese caused the vessel to sink slowly.

With the exception first mentioned of similar monitors originally designed and built for the Brazilian Govt. which were taken over by the British Govt., none of the foreign powers appear to have developed this type of vessel to any extent during the War, although the Italian Govt. mounted some heavy guns on a kind of barge, but these were much more of the nature of an improvisation than the British vessels, and there appears no question that this type of vessel is only needed for very special work in shallow waters, and no more have been built. During the Gallipoli campaign several of the monitors were sent out there and did good work in bombarding the Turkish lines at long range.

Quite at the end of the War it was decided to mount two very big guns on three of the 12-in. monitors, and an 18-in. gun was mounted on the "Lord Clive," the "General Wolfe" and the "Prince Eugene." Only two of these vessels were completed with their 18-in. mountings before the end of the War, but they fired a good many rounds of this huge projectile into the German lines in the neighbourhood of Bruges.

Of all these vessels produced during the War with such great expenditure of money and concentrated energy, only three of the big-gun type now remain on service. These are the "Erebus" and "Terror" and "Marshal Soult," all of which are the 15-in. gun type, and these are at present being used as drill ships. Of all types of warships carrying heavy calibre guns the monitors were in action far more often and for longer periods than any other type, whether battleship or battle-cruiser, and the losses, as shown below, were correspondingly heavy.

"Raglan," 14-in. type. Sunk by gunfire of the German battle-cruiser "Goeben" in action off Imbros on Jan. 20 1918.

M.15, 9·2-in. type. Torpedoed by a German submarine off Gaza on Nov. 11 1917.

M.21, 9·2-in. type. Mined off Ostend on Oct. 20 1918.

M.25, M.27, 9·2-in. type. Lost during operations on the Dvina river, north Russia, on Sept. 17 1919.

M.28, 9·2-in. type. Sunk by gunfire of the German battle-cruiser "Goeben" in action off Imbros on Jan. 20 1918.

M.30, 6-in. gun type. Sunk by Turkish batteries in the Gulf of Smyrna, on May 13 1916.

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MONOD, GABRIEL (1844–1912), French historian (*see* 18.730), died at Versailles April 10 1912.

MONOPLANE: *see* AEROPLANE.

MONRO, SIR CHARLES CARMICHAEL (1860–), British soldier, was born June 15 1860, and joined the army in 1879. In 1897–8 he saw service at Malakand, in the Mohmand country, in Bajour and in Tirah and he was on the staff in South Africa (1899–1902). He was afterwards commandant of the School of Musketry at Hythe, Kent. Having commanded the 2nd Div. in the first fighting in 1914, Monro was, at the end of 1914, placed in command of the I. Army Corps, and on a III. Army being organised in July 1915, he was given charge of this. He was chosen in October to take over the command of the Mediterranean Expeditionary Force and to decide whether the campaign in the Gallipoli Peninsula was to be continued. Monro acted with rare decision. Although the Govt. was disposed to cling to the peninsula, he insisted upon its abandonment, and he was, after some delay, allowed to have his way, with the result that the forces were withdrawn from a most dangerous position without appreciable loss. He returned to the Western Front to succeed Sir Douglas Haig in command of the I. Army, but in Oct. 1916 he was selected to be commander-in-chief in India.

In his new sphere Sir Charles Monro proved himself to be a military administrator of the first rank. By untiring energy and skilful organisation he succeeded in adding substantially to the strength of the native army, in creating a number of fresh regiments and in greatly developing the non-combatant and hospital services on progressive lines. The consequence was that he was enabled to dispatch considerable and badly needed reinforcements to Mesopotamia and to Egypt and Palestine. In Sept. 1923 he was appointed to the position of governor and commander-in-chief of Gibraltar.

MONS, BATTLE OF: *see* FRONTIERS, BATTLES OF THE.

MONTAGU, EDWIN SAMUEL (1879–1924), British politician, second son of the 1st Lord Swaythling (head of the financial firm of Samuel Montagu and Co.), was born Feb. 6 1879 and educated at the City of London School and at Trinity College, Cambridge. At Cambridge he was president of the Union and acquired a considerable reputation for ability. When he entered Parliament in 1906, as Liberal member for the Chesterton division of Cambridgeshire, he was chosen by Mr. Asquith, then Chancellor of the Exchequer, as his parliamentary secretary, and continued in that position when his chief succeeded to the premiership. Early in 1910 he was appointed Under-Secretary for India, under Lord Morley, and remained in the post, under Lord Crewe till 1914; and so made his first official acquaintance with India under the influence of Lord Morley's reforms and Lord Crewe's Durbar changes of 1911. As both his chiefs were in the Lords, he was the spokesman of the office in the Commons, and he acquitted himself well. That he might equip himself the more completely for his duties, he took the unusual course of visiting India in person.

After holding during the World War the posts of Financial Secretary to the Treasury—where he had much to do with the introduction of War Savings Certificates—Chancellor of the Duchy of Lancaster (1915) and Minister of Munitions (1916), he returned in 1917 to the India Office as Secretary of State and began a tenure of that post which will always be memorable in Indian annals.

He visited India in the following winter for the second time, and held prolonged conferences with the Viceroy, Lord Chelmsford, the leading members of the Indian Civil Service, ruling princes and native politicians, and along with the Viceroy received deputations and memoranda from all classes. Ultimately in July 1918 there was published an elaborate report, signed by the Viceroy as well as by the Secretary of State, recommending a series of constitutional reforms which should give the Indian peoples a large and real share in their own government. The report was received so cordially in the House of Commons that Mr. Montagu was able to claim at the end of the debate as "a remarkable fact" that all speakers admitted the principle of self-government for India. In Dec. 1919 he had the satisfaction of passing through Parliament the Government of India bill, which established in India, in accordance with the report, what was called a "diarchy," a partition of the powers of Government between the civil service and the native population.

Unfortunately, by the time the Act was passed the situation in India had become grave. The Rowlatt Sedition bill had provoked alarm and excitement throughout the country; Mr. Gandhi had organised passive resistance; serious disorders had broken out in Delhi and other places and in the Punjab had become something like open rebellion, in the course of which there had been a tragedy on April 13 1919 at Amritsar, where General Dyer's troops in dispersing a mob had killed nearly 400 persons. Inquiry was instituted and Dyer had to retire; but much ill-feeling remained, and Mr. Gandhi started a non-co-operation movement as the new councils began to work. Mr. Montagu's policy lost its attractiveness for a large section of the House of Commons, and in the debate on the address in 1922 he was attacked on account of the unrest and crimes in India. In March he had to resign his office for having published, without the authority of the Cabinet, a telegram from the Government of India urging the advisability of pursuing, in India's interest, a more friendly policy towards Turkey. He defended his action by maintaining that Cabinet responsibility had been destroyed by Mr. Lloyd George's dictatorial methods. At the general election of 1922 he lost his seat in Parliament, and went into the City, becoming vice-chairman of the De Beers Co. He had married in 1915 Beatrice Venetia, youngest daughter of the 4th Baron Sheffield, and he died in London Nov. 15 1924.

MONTANA (*see* 18.752).—In 1920 Montana had a population of 548,889, an increase of 172,836, or 46%, during the decade. The urban population was 172,011, or 31·3%; the rural 376,878, or 68·7%. In 1910 the ratio was 35·5% urban and 64·3% rural. The relative increase of rural inhabitants over urban was c largely to the immigration of an agricultural populatic particularly to the eastern part of the state. The total numb of foreign-born whites in 1920 was 93,620. In 1920 there were cities with a population of 5,000 or more, of which six had ov 10,000. These six, with their increase in the preceding decad were as follows:—

	1920	1910	Increase
			%
Butte	41,611	39,165	6·2
Great Falls	24,121	13,948	72·9
Billings	15,100	10,031	50·5
Missoula	12,668	12,869	−1·6
Helena	12,037	12,515	−3·8
Anaconda	11,668	10,134	15·1

Agriculture and Irrigation.—In 1910 there were 26,214 farr with a total acreage of 13,545,603, of which 3,640,309 ac. we improved. In 1920 there were 57,677 farms with an acreage 35,070,656, of which 11,007,278 ac. were improved. Of the lar improved, about 4,000,000 ac. were under tillage. In 1925 t number of farms had decreased to 46,896. In 1920 abo 1,700,000 ac. were irrigated; many new projects were und way, and in 1925 nearly 2,000,000 ac. were irrigated. In 19 about 3,000,000 ac. were planted to wheat, the most importa crop, and the crop was estimated at 51,668,000 bushels. Fla hay, sugar beets, oats, beans, potatoes, corn and peas ra next in order of value, but wheat in 1924 was worth more tha all other crops combined. The total value of crops in 1924 w $144,463,000. During the period from 1910 to 1925 the op range was superseded by the fenced ranch. The number sheep declined from 5,381,000 in 1910 to 2,083,000 in 192 but increased to 2,536,000 in 1925. In 1910 there were 943,0 cattle; in 1920, 1,269,000; and in 1925, 1,505,000 (estimated In 1925 there were 220,000 milch cows, and dairying has becon an important industry. In 1910 there were 316,000 horses; 1920, 669,000; and in 1925, 593,000. All livestock in 1925 w valued at $94,000,000.

Forests.—In 1923 the national forests in Montana include 15,881,715 acres. The state owned 566,000 ac. of forest lan and there were 5,000,000 ac. in private hands. A part of th forest area is valuable also for agricultural land and will be used when the timber is removed. The remainder will be r forested as the old trees are cut.

Mines.—The World War gave a great impetus to the pro duction of copper and other metals, but after the Armistic the output declined acutely. In 1910 the production of coppe was 283,000,000 lb.; in 1916, 352,000,000 lb.; and in 192 49,000,000 pounds. Since then it has increased to 224,000,0 lb. in 1923 and to 249,000,000 lb. in 1925. In 1918 the productio of zinc was 104,624 tons; and in 1922, 59,535. The productio of lead dropped from 18,568 tons in 1918 to 11,565 tons in 192 increasing to 21,226 tons in 1924. Silver production has remaine steady at about 12,000,000 oz. per year, but gold dropped fro 158,704 oz. in 1918 to 80,145 oz. in 1922. The output of coal i 1924 was estimated at 2,700,000 net tons. In 1915 oil wa discovered in the state, and the output has steadily increase until in 1924 it was estimated at 2,781,000 barrels.

Manufactures.—The vast supplies of water-power in Montan give hopes of great industrial development. The hydroelectr plants in 1923 had a capacity of 400,000 H.P., an increase o 120,000 in three years. Much of this was used for the operatio of electric trains. The potential hydroelectric developmen is estimated at 4,000,000 horsepower. In 1920 Congress passed bill authorising the Secretary of the Interior to lease the undevel oped power-sites, and the completion of such enterprises will ad greatly to the electric power available. In 1909 the total valu of manufactures was $73,000,000; in 1923 it had increased t $174,874,000. In 1920 there were 195 lumber-mills, 75 flour-mills 31 creameries, 7 cheese factories, 2 canning factories. The mos promising field for manufacture appeared to be products o copper and wood. One plant for turning out copper rods and wire had a capacity of 6,000,000 lb. of copper per month.

Education.—In 1920 the Russell Sage Foundation of New York ranked the Montana schools first among all the public-school systems of America. The public-school fund belonging to the state amounted in 1924 to about $20,000,000, the income to nearly $1,000,000 per year. The total expenditures for schools n 1924 was $14,878,000. In 1924 there were 118,000 pupils in elementary and high schools out of a school population of 157,745. In 1912 President E. B. Craighead, of the State University, started a campaign for the consolidation of all the state institutions of higher education into one university. His plan was defeated, but all the institutions were placed under one administrative head called the chancellor.

Legislation.—The state has made steady progress in labour egislation. In 1911 the Legislature provided an eight-hour day or miners. In 1914 the state limited the working day for women n factories, laundries and stores to nine hours, and in 1917 reduced this to eight hours. In 1915 a Workmen's Compensation bill was enacted. In 1915 provision was made for state inpection and grading of grain, and a Farm Loan Act was passed. In 1917 the state provided insurance against hail for farmers. In 1911 the Legislature authorised cities to adopt the commission form of government, and in 1917 sanctioned the commission-manager plan. In 1912 the people established through he initiative a system for direct primaries to nominate all state and local officials and to express their preference for presidential andidates. They also passed a rigid Corrupt Practices Act imiting campaign expenses, providing for their publicity and orbidding electioneering on election day. In 1914 the people atified a constitutional amendment for woman suffrage. The mportant social legislation in recent years included a Mothers' Pension law; a Teachers' Retirement Pension law; and an Act to provide for the establishment and maintenance of county braries. In 1921 Gov. Dixon proposed an income tax, an ineritance tax and a tax on the production of oil wells and of coal and metal mines. The Legislature opposed these recommendaions as radical, but finally agreed to a small tax on oil and coal production. In 1924, however, the people passed an initiative measure providing for a graduated tax of from 0·25% to 1% n the gross product of metal mines. In 1923 the Legislature assed an effective inheritance tax law.

History.—Montana entered upon the second decade of the 0th century under very prosperous conditions. A new railway ad just been built across the state. Mines were operating uccessfully, and there was a growing demand for Montana umber. Great irrigation projects were under way, and in many ections of the state dry-farming was proving a success. The World War stimulated the mining and lumber industries, but t put a stop to the great reclamation works. During the later ears of the decade drought seriously hampered the dry-land armers and there was a decline in farm production. State politics have largely hinged upon matters of taxation, particulary the taxation of mines. The constitution provides that mines shall be taxed at the price paid the United States therefor," lthough the " net proceeds . . . shall be taxed as provided by w." The mining interests maintain that, since mining is a peculative business and the mines are being gradually exausted, the net proceeds should be taxed at no higher rate han real estate or personal property. Their opponents maintain hat since practically no tax is imposed on mines as such, the ax on " net proceeds " should be much higher than the property ax. The constitution limits taxes for state purposes to two mills n the dollar unless increased by special vote of the people. This as adequate during the early years of the state's history. ince 1910, however, due to greater demands upon the state overnment, this constitutional restriction has produced a serious eficit. In 1920 the deficit amounted to about $2,500,000; une 30 1924 it was $3,595,558; and June 30 1925 it was 3,817,402. In the fall of 1925 the metal mines tax provided an ncome of approximately $500,000, and through the death of V. A. Clark the inheritance tax produced about $900,000.

In 1914 Jeanette Rankin was elected representative to ongress as a Republican, the first woman to be a member of that body. During the World War the Non-Partisan League spread over the state. It started first among the farmers, but soon extended among the labour groups. In 1918 it elected a number of members of the state Legislature. In 1920 the farmers and labour men went into the Democratic primaries and nominated a former U.S. district attorney, Burton K. Wheeler, for governor. The merchants and other business interests organised the Montana Development Assn. to oppose the Non-Partisan League. This organisation supported Joseph M. Dixon, former Senator and manager of Roosevelt's campaign in 1912, for governor on the Republican ticket. The Republican platform declared for a conservative programme, and the entire Republican ticket was elected. Gov. Dixon's demands for the taxation of mines, and for other special taxes, however, lost him the support of the larger business interests. In 1924 he was defeated by John E. Erickson who announced a programme of economy and no increase in taxes.

The governors of Montana after 1910 were as follows: Edwin L. Norris (Dem.), 1909–13; Sam V. Stewart (Dem.), 1913–21; Joseph M. Dixon (Rep.), 1921–5; John E. Erickson (Dem.), 1925– .

See Helen F. Sanders, *History of Montana* (3 vol., 1913); Tom Stout, *Montana, Its Story and Biography* (3 vol., 1921); Montana Dept. of Agriculture, Labor and Industry, *The Resources and Opportunities of Montana* (9 vol., 1912–22); *Montana Farm Review* (1922–). (P. C. P.)

MONTELIUS, OSKAR (1843–1921), Swedish archaeologist, was born in Stockholm Sept. 9 1843. He studied at the University of Stockholm, and took the degree of Ph.D. in 1869. In 1888 he was appointed a professor in the Museum of National Antiquities, Stockholm, and in 1913 became state archaeologist. As an archaeologist his aim was to utilise and develop the typological method explained by him in his book *Die Typologische Methode* (1903). His numerous other works are devoted principally to Swedish and Italian archaeology and include *The Civilisation of Sweden in Heathen Times* (1888); *Les temps préhistoriques en Suède et dans les autres pays Scandinaves* (1895); *Kulturgeschichte Schwedens* (1906); and *La civilisation primitive en Italie depuis l'introduction des métaux*, 3 vol. (1895–1910). Montelius died in Stockholm Nov. 5 1921. See *Oscar Montelius in Memoriam* (Stockholm, 1922).

MONTENEGRO (*see* 18.766), a territory included in Yugoslavia, formerly an independent kingdom. The area of the district which corresponds to the old Kingdom is 3,733 sq. m. and the population (1921) 199,857.

Montenegro as a Kingdom 1910–8.—In 1910 Prince Nicholas took advantage of an apparent lull in the Balkan situation to proclaim himself King, a step welcomed in Vienna as a reversion to the old position of two competing Serb dynasties. But the unrest in Turkey soon forced Montenegro once more into close alliance with Serbia, and Nicholas, so far from resisting the current, was the first to embark on war in Oct. 1912. His lack of heavy guns and the imperfect discipline of his gallant troops compelled him to resort to Serbian military aid on a considerable scale before Scutari could be reduced in April 1913. Austria-Hungary insisted upon the surrender of Scutari to the new Albania, and threatened war. Nicholas only yielded to an international naval blockade of the Montenegrin coast, and Serbian troops were withdrawn from the Adriatic. The first Balkan war gave Montenegro and Serbia a joint frontier, the former Sanjak of Novi Pazar being partitioned between them; and Montenegrin troops joined Serbia against Bulgaria in the second Balkan war. Early in 1914 the Montenegrin statesman, Miušković, began serious discussions with Pašić for a financial and customs union between Serbia and Montenegro, a fusion of the two armies, a joint foreign policy and diplomatic representation, but retention of the two dynasties.

These negotiations became known to Vienna, who warned Petrograd that " Austria-Hungary would not remain a silent observer," and regarded union as a challenge to her Adriatic interests. On this, Sazonov advised Pašić to postpone the negotiations. But the movement for union was rapidly becoming irresistible when the World War broke out and the two States found themselves side by side in resistance to Austria-Hungary. Prince Nicholas and his sons were, however, jealous and reserved, blocking the action of the Serbian General Janković, who had been sent at Russia's instance to reorganise the Montenegrin Army. In May 1915 Prince Peter had a secret meeting in Dalmatia with the former Austro-Hungarian military attaché, Hubka, and in Nov., during the invasion of Serbia, Crown Prince Danilo, through his friend Baron de Kruyff in Sofia, made overtures to the Central Powers, offering to cut off the Serbian retreat to the coast in return for territorial concessions to Montenegro in western Serbia and northern Albania.[1]

During the retreat the attitude of the Montenegrin dynasty remained highly equivocal and the key position of Mount Lovćen was surrendered to the Austrians almost without a struggle. Parliament voted unanimously in favour of holding out to the end with Serbia, but the King negotiated on his own initiative without authorisation from his government, and on Jan. 1916 addressed a telegram of submission to Francis Joseph. Failing to obtain the terms which he had hoped, he and his family, with the Premier Miušković, fled to Italy. During the next two years his second son, Prince Mirko, intrigued in Vienna and was connected with various Austrophil projects for a vassal Yugoslav state under the Petrović dynasty; he died in 1918 in an Austrian sanatorium. Meanwhile, King Nicholas resided in France and tried to silence criticism from the Left by making Radović his Premier. But when the latter advocated the formal proclamation of union and a simultaneous abdication of Nicholas and Peter in favour of the Prince Regent Alexander, Nicholas threw himself definitely into the arms of the anti-unionists, and by the end of the War found his court reduced to a tiny clique of personal dependents and adventurers.

Union with Serbia.—When Austria-Hungary collapsed in Oct. 1918 and national councils were erected in all the Yugoslav provinces, the current in Montenegro set more strongly than ever in favour of union. A National Assembly was convoked on Nov. 12 at Podgorica and proclaimed the deposition of the Petrović dynasty and the union of Montenegro with Serbia. On the death of Nicholas the royal title fell into abeyance, as Crown Prince Danilo did not wish to assume it and his nephew Michael was a minor.

Even before the Balkan wars Montenegro was desperately poor, and in normal years had to import grain for its scanty population; only the dynasty had grown rich by its arbitrary methods. The long strain of war increased the misery tenfold, and acute discontent was aroused by the bad administration, favouritism and centralist tendencies of Belgrade. There were numerous cases of brigandage and party vengeance which were conveniently misrepresented abroad as a movement for independence. In 1924, however, a marked improvement began. In the summer of 1925 King Alexander paid his first official visit to Montenegro, and the remains of his great-great-grand-uncle the Vladika Peter (the greatest of Serbian poets) were transferred to a mausoleum built at the King's expense on the summit of Lovćen by the Dalmatian sculptor Meštrović. (*See* BALKAN WARS; SERBIA.) (R. W. S-W.)

MONTERO RIOS, EUGENIO (1832–1914), Spanish politician, was born at Santiago de Compostela, Corunna, Nov. 13 1832. He was originally intended for the priesthood, but became a barrister and a teacher of ecclesiastical history. In 1864 he was appointed professor of canon law at the University of Madrid, and in 1869 entered the Cortes. He followed Ruiz Zorilla and as Minister of Justice in General Prim's Cabinet he introduced a number of important judicial reforms and drew up the act of abdication of King Amadeo. In 1881 he helped to found the Radical party and became Minister of Justice in 1889. From 1894–5 he was president of the Senate. He was chief of the Spanish delegation which negotiated the Treaty of Paris with the United States at the close of the Spanish-American War of 1898. In 1899 he was again president of the Senate. In 1903 he was elected leader of the Liberal party and in 1905 became Pri
Minister. He resigned the leadership of the Liberal party
1906 and was president of the Senate for the third time fr
1909–14. He died at Madrid May 12 1914.

MONTESSORI, MARIA (1869–), Italian educationi
was born at Chiaravalle near Ancona. She studied at t
University of Rome and graduated in medicine in 1894, bei
the first woman in Italy to do so. She then took up the subj
of educating defective children. From the experience th
acquired, she came to the conclusion that similar metho
might be applied to normal children of a lower age, and af
a series of experiments on a small scale she extended them
a large number of children in certain private and public infa
schools in Rome. Dr. Montessori encountered a good deal
opposition from advocates of orthodox methods in educati
who regarded her system as destructive of discipline. At t
same time she was warmly supported by a certain number
enthusiastic reformers, experienced and otherwise. Her syste
was applied on a larger scale in countries where elementa
education was not under rigid state or municipal control a
not carried out according to fixed programmes. From 1900
1907 Dr. Montessori lectured on pedagogical anthropology
the University of Rome and in 1922 was appointed Governme
inspector of schools in Italy. Her ideas on education are s
forth in *The Montessori System* (1912), which has been tran
lated into English and other languages. (*See* EDUCATIO
MONTESSORI SYSTEM.)

MONTESSORI SYSTEM.—The Montessori system of educ
tion aims at self-education by the pupils themselves. The
are no time-tables, no set lessons, no classes. There are no
wards or punishments of the ordinary kind. The pleasure
succeeding and gettings things right is the only incenti
" Each child is doing what, for the time being, pleases him be
When he is admitted to the school he sees small groups of ch
dren playing at various ' games,' and he joins the group whi
happens to take his fancy. Then and there his education begi
All kinds of interesting ' occupations ' are going on, and wherev
he goes he will get help and guidance from the teachers. If
gets tired of playing at this thing he goes off and plays at tha
But he is never idle, for whatever he does interests him." A
paratus, elaborately devised by Dr. Montessori, is provided f
the educational games by which the children acquire knowledg
and this " didactic material " constitutes a distinctive part
the originality of the system.

The first stage is to develop the senses of touch, sight a
hearing; both by games of various sorts and by guiding t
attention systematically to the association of things, names a
ideas. When a child washes his hands, for instance, he is giv
first cold and then hot water, and led to observe and unde
stand the difference; the distinction of rough and smooth
emphasised by the different cards for fingering and sorting. T
child to know the words, " hot," " cold," " rough," " smooth
and thus the knowledge of language is extended in all directio
(" high," " low," " thick," " thin," " round," " oval," etc.) b
fore any question of writing or reading arises. Ideas of form a
colour are given precision by games with blocks, cylinders, et
of varying sizes, to be fitted into frames, or with shades of si
to be arranged to match; touch is practised by playing t
games blindfold; hearing is developed by the " silence " lesso
and by the use of small cylindrical boxes containing stones, san
and different substances to be rattled by the children, wh
arrange them in order of intensity of sound and so forth. Sk
and neatness in the use of the fingers and movement of lim
are stimulated partly by the mobility of the light furnitur
which the children rearrange for their own comfort, and part
by games at tying and untying, hooks and eyes, dressing a
undressing, waiting on one another at table, washing up a
so on. Many of these occupations are preliminary to writing a
reading, and lead naturally up to both.

Writing comes essentially before reading, on the Montesso
system. Emery-paper letters gummed on cards are provide
with which the child is familiarised by games of hide and see

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[1] Telegram of Tarnowski, to Burián, No. 1449, Nov. 11 1915, transmitting Danilo's wire to Kruyff.

tc., so that, without any active teaching of the alphabet, he nows them by sight, by name and by feeling. He learns how to nitate them, partly by a touch game of passing the fingers over ne paper letter, thus making the actual motion of writing, and artly by playing at pencilling and colouring with specially de-ised cards on which an outline is given. The child learns to rite before he knows that "writing" is what he is learning; the ounds and shapes of the letters being known it is a natural tran-tion to build up the letters and their sounds into words.

The next thing is for the child to "read"—not merely to e-translate into sound a word he has translated into symbol, hich goes with the acquisition of "writing," but to extract previously unknown idea from written or printed symbols of ne same sort not put together by himself. At any rate in so honetically spelt a language as Italian, this is very quickly earnt. Numbers of words, well known to the children, are written n cards, and various games are played in identifying them with neir objects; and from single words the children pass to phrases nd sentences, the teacher writing on the blackboard, for instance, uestions or orders which form part of a game. Arithmetic is ntroduced to the children's minds by the employment of count-ig games, in which an apparatus of striped poles, counters, etc., used. The whole curriculum is devised for the content and appy employment of the natural energies of the child, who is ft free to respond to his own impulses, under the influence of didactic material," rather than under the discipline of a teacher.

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MONTEVIDEO (*see* 18.778), the capital city of Uruguay, ad a population on Dec. 31 1923 of 407,249. The municipal evenues increased from $2,850,000 in 1916 to $4,590,000 in 1921, nd for 1924–5 were estimated at about $5,342,000. Extensive ort improvements by the Government deepened the entrance nd part of the harbour in order to admit the largest ocean-going essels, which formerly had been obliged to anchor outside. ocks, warehouses and loading equipment also were much improved. Three large meat packing plants (*frigoríficos*), two of hem American and one British, were added to the industrial tablishments of the city. Manufactures, though still relatively nimportant, included flour, paper, cigars and cigarettes, soap, ndles, shoes, textiles and knitted goods; there were also tan-eries, breweries and a sugar refinery. The general appearance the city was improved by new buildings and the extension of aving and lighting. The University of Montevideo had in 1922 4 teachers and an enrolment of 1,615 students.

MONTREAL, Canada (*see* 18.790), the commercial metropolis nd the largest city of the Dominion of Canada, had an area of bout 50 sq. m. and a population of 836,304 in 1924. The popu-tion at the Dominion census in 1921 was 607,063, and was more an half French and about three-quarters Roman Catholic; ws, who have increased largely in number in recent years, num-er about 6%.

The port is the second largest in America, with eight miles of eep water and wharfage with berths for a distance of 17 m.; 18 essels of 1,000 ft. in length can berth at the same time. A large heme of harbour improvements has been undertaken in recent ears, including the reclamation of 30 ac. of land for a new dry ock, the electrification of the water front, the building of a huge evator, wharves, warehouses, etc. The improvements to navi-tion in the gulf and river of St. Lawrence have resulted in a rge increase of tonnage; 1,194 ocean-going vessels of 3,932,637 ns passed through the harbour in 1922, as compared with 820 2,690,535 tons in 1913. Over a quarter of the total export trade Canada passes through Montreal, which is the greatest grain rt of the world. There were 2,820 factories in the city in 1924, cluding very large flour-mills. The form of municipal govern-ent underwent several alterations in the decade following 1911, nd eventually the control of municipal affairs was placed in the hands of an administrative commission of four, appointed by the provincial government.

The construction of a tunnel under Mt. Royal and the centre of the city by the Canadian Northern Railway Co., was an important engineering feat completed in 1918. The company (since merged in the Canadian National railway system) built an imposing new terminal station in the centre of the city at the tunnel head, supplanting its old Moreau street station. Electric trains running through the tunnel to the northwestern side of Mt. Royal caused the growth of a new suburb on that side of the mountain.

Education.—Important educational buildings erected since 1911 include the McGill Medical building, a magnificent structure that replaced the building destroyed by fire in 1907, the Macdonald Engineering building of McGill University; a large and finely equipped technical school in connection with Laval University; a new high school; a public library; an art gallery, and a fine pile of buildings to house Loyola College, a Jesuit school of high standing.

McGill University, benefiting by gifts from Sir William Macdonald, was able to develop further its faculty of music, to establish new degrees in law, commerce and household science, and to extend some of its departments. A school of physical training was opened in connection with the university, and a department of social service was inaugurated. The McGill stadium, one of the finest athletic amphithéatres in North America, was opened in 1918. After the death of Sir William Macdonald in 1919, provision was made for the further endowment of Macdonald College at Ste. Anne de Bellevue, the university's agricultural centre, and in 1924 Lady Strathcona gave £24,000 for a zoological department. The administrative buildings of the Montreal branch of Laval University were destroyed by fire in the autumn of 1919. A movement, that had been gaining strength for some years, to separate the Montreal branch from Laval University at Quebec, culminated in the foundation of the University of Montreal, the buildings of the old branch of Laval being taken over by the new institution. A number of new courses were added, including social and political science, and the faculty of applied science was further developed. Considerably over $3,000,000 was raised by public subscription as a building fund.

MONYPENNY, WILLIAM FLAVELLE (1866–1912), British journalist, was born in Ulster Aug. 7 1866. Educated at Trinity College, Dublin and Balliol College, Oxford, in 1893 he joined the editorial staff of *The Times* (London), and early in 1899 became editor of the Johannesburg *Star* in the Transvaal. He played a useful part, as a publicist, on the side of the Reform party there, and when war came he joined the Imperial Light Horse and was one of the defenders of Ladysmith. Returning afterwards to his position on the *Star*, he did much to promote Lord Milner's work of reconstruction, but resigned in 1903 owing to his hostility to the introduction of Chinese labour into the mines. He was then entrusted by *The Times* with the task of writing the official biography of Disraeli, and also did other work for that paper, becoming in 1908 a director of the company. Owing to ill health the first volume of the *Life of Benjamin Disraeli, Earl of Beaconsfield* (ultimately extending to six volumes) did not appear until 1910, and the second shortly before his death. It was completed in 1920 by Mr. G. E. Buckle, formerly editor of *The Times*. Monypenny died in the New Forest, Hampshire, Nov. 23 1912.

MOODY, WILLIAM VAUGHN (1869–1910), American poet and playwright, was born at Spencer, Ind., July 8 1869. He was educated at Harvard University and was assistant in English there 1894–5. From 1895 to 1907 he was at the University of Chicago as instructor and, after 1901, as assistant professor. He died at Colorado Springs Oct. 17 1910. Moody was the author of the *Masque of Judgment* (1900); *Poems* (1901); *The Fire-Bringer* (1904); *The Great Divide* (1907) and *The Faith Healer* (1909). He compiled (with Robert M. Lovett) *A First View of English and American Literature* (1902), and edited *The Complete Poetical Works of John Milton* (1899, Cambridge ed.) and (with George Cabot Lodge and John Ellerton Lodge) *The Poems* *of Trumbull Stickney* (1905). His complete works were edited with an admirable introduction by Prof. John M. Manly (1912).

MOOKERJEE, SIR ASUTOSH (1864–1924), Indian jurist and educationist, son of a medical practitioner, was born at Bhawanipur, Calcutta, on June 29 1864. Graduating at the Presidency College, Calcutta, in 1885, he gained the doctorate in laws in 1894. He wrote much for learned societies on mathematical subjects, and his "Geometry of Conics" (1892) and other papers were incorporated in text-books for Cambridge University. He became a fellow and syndic of Calcutta University in 1889, and was appointed to the Tagore law professorship in 1898. From 1904 until his resignation in 1923 he was a judge of the Bengal high court, and won a great reputation as a jurist. He was knighted in 1911. His spare time from the Bench was devoted with unflagging zeal to the affairs of Calcutta University. He was a member of the Calcutta University Commission 1917–9, and signed the report without dissent, but afterwards offered strong opposition to the projected legislation. Though advanced in some matters of social reform, he lived very simply as an orthodox Brahman. He died at Patna on May 25 1924. His *Addresses, Academic and Literary*, were published in 1915.

MOORE, GEORGE (1852–), Irish writer (*see* 18.808), broke fresh ground in 1916 with *The Brook Kerith*, a work of fiction based on the Gospel story. He had professedly taken leave of literature in three remarkable volumes of quasi-reminiscences, entitled *Ave* (1911), *Salve* (1912) and *Vale* (1914). Later he produced two privately printed volumes de luxe, *Avowals* (1918) and *A Story Teller's Holiday* (1920), and retold the story of *Abélard and Héloïse* (1921). In 1922 he published *In Single Strictness* and 1926 *Ulick and Lorachal*.

MOORE, JOHN BASSETT (1860–), American jurist, was born at Smyrna, Del., Dec. 3 1860. He graduated at the University of Virginia in 1880, studied law in an office in Wilmington, Del., and was admitted to the Delaware bar in 1883. Two years later he entered the Dept. of State as a law clerk, and in 1887 was appointed third assistant secretary of state. He was secretary to the conference on Samoan affairs in that year and U.S. secretary at the conference on the North Atlantic fisheries, 1887–8. He was appointed professor of international law and diplomacy at Columbia University, 1891, frequently being granted leave of absence to accept appointments in the national interest. On the outbreak of the war with Spain in 1898 he was appointed Assistant Secretary of State, and he acted as secretary and counsel to the U.S. Peace Commissioners at Paris at the close of the War. Among the later official positions which he filled were those of U.S. agent before the United States and Dominican Arbitration Tribunal, 1904; U.S. delegate to the Fourth International American Conference at Buenos Aires, 1910; special U.S. plenipotentiary to the Chilean Centenary, 1910; U.S. delegate to the International Commission of Jurists, Rio de Janeiro, 1912; counsellor to the Dept. of State, 1913; a member of the Permanent Court of Arbitration at The Hague, 1913; U.S. delegate to the Pan-American Financial Congress, 1915. He was appointed in 1921 a judge of the Permanent Court of International Justice. He was also the U.S. delegate and chairman of the International Conference on rules for aircraft and radio in time of war held at The Hague 1922–3.

Moore's publications include *Extradition and Interstate Rendition* (1891); *History and Digest of International Arbitrations*, 6 vol. (1898); *American Diplomacy: Its Spirit and Achievements* (1905); *Digest of International Law*, 8 vol. (1906); *Four Phases of American Development* (1912); *Principles of American Diplomacy* (1918); *International Law and Some Current Illusions* (1924); and *The Permanent Court of International Justice*, a pamphlet (1924).

MORALE: IN WAR.—Modern conditions of war are gradually extending the domain of *morale* and increasing its influence. For, among belligerent nations, war affects a greater number of people and does so with methods of increasing violence.

I. THE SOLDIER IN THE RANKS

In battle, an enemy's long-range guns make their effects felt as far back as 5, 10 or 15 m., and, as they are capable of rapid firing, their effects become formidable to troops even at those dis-
tances. Difficulty in seeing their objective does not limit th
powers, for they are aided by aeroplanes which inform them co
cerning the situation of their objective and the results of th
fire. At lesser distances they are supported by light artillery
large numbers, mobile, and capable of making the most a
vantageous use of chance features of the ground over the who
of the area at their command; and further support comes fro
machine-guns, which, of light weight and slender dimensio
can penetrate everywhere to equip in a short time the whole
the terrain.

Range of Fire.—It follows, then, that the soldier who a
proaches the battlefield and advances to carry the enemy po
tion, finds that, at great range and over an extremely wi
extent, that is to say during a long space of time, he is expos
to a heavy fire, the effects of which are multiplied in severity t
further he advances to the position. Frequently, before bei
able to advance, he is forced to wait until, thanks to supplies
material, cannon, trench mortars and machine-guns, his arn
has gained a mastery of the fire, and the destructive capaci
of the adversary has been thus reduced.

In this time of waiting hours succeed hours, nights follo
days and weeks go by, always under the rain of steel from t
enemy. It is under incessant bombardment that the march
victory has to be resumed and continued. Rarely is the batt
decided in one day. And the nervous tension, the crisis impos
on the combatant, lasts the same time. During all this weari
period he must fulfil, automatically and often left to his ow
resources, his function as soldier, marksman, machine-gunne
pioneer, link in the chain of intelligence, carrier of supplies a
so on. That is to say this function must be part of his own n
ture, and to fulfil it he must have received a serious training.

Interception of Supplies.—Furthermore, bombardment sprea
its havoc no less widely on the rear of the battle-front, cu
communications, prevents the arrival of supplies. Not only h
the combatant to show a bold face to the danger which threate
him, but he often finds himself reduced to a most precario
existence; along with the rigours of nights in the open, he has
put up with shortage of supplies. And thus physical exhausti
comes to be added to nervous shock, and the severity of th
ordeal is heightened.

Tenacity and Endurance.—In the wars of the past, moveme
and enthusiasm, the qualities of dash and courage and person
pride, could suffice the soldier in a moment of intoxication
meet, with brilliance, the crisis of collision with the enem
But to-day, if he is to traverse the long road of the hell which
the modern battle and reach a decision, he must possess an u
breakable tenacity and an energy ready for any sacrifice, an
both must be unwavering for long days on end. To what grea
ness of soul must we not appeal, then, to see the emergence
virtues so solid, so tenacious, so generous? We must leave th
answer to the soldiers of the Marne and Yser, Ypres and Verdu

Further, who can forget the moving spectacle of the Britis
leave-trains returning to the front during the War? The me
were accompanied to the station by a silent throng composed f
the most part of women and children. A few handkerchie
furtively sought the eyes of those who were left behind, especiall
when the train began to move off. On board the vessel at Dove
the returning men donned their life-saving waistcoats, and stoo
closely crowded together on deck, imprisoned in their ow
thoughts. If, from a group here and there, came a song or
noisy demonstration, it was from young soldiers going out to th
front for the first time. The others remained impassive, silent
gloomy, and their eyes gave token of the cold energy and th
spirit of savage resolve on which they had fallen back. It was t
the cry of "*Lusitania!*" that they would soon be marching t
attack. Experience had taught them that mere knowledge o
their duties and a fine, fleeting ardour would not suffice to bea
the long and bitter ordeal of the modern battle. They require
a spirit which must be imbued with the highest feelings, and
quickened with them, a spirit proved in the crucible of disciplin

The soldier of our national armies has drawn the spirit o
sacrifice, the sentiment of discipline and duty, from love of hi

ountry, from attachment to the family as to the race, and from ie indispensable military training, which left its strongest impres- on. Of this he gives proof in action by strict obedience to orders. ut let there be no mistake; he conserves and maintains these rtues in lasting fashion only in proportion as the commanders ave won his confidence by the care with which they surround s daily life; only in proportion as they know how to conserve at life by their vigilant economy of his blood.

As a whole, the war of the present day demands of the soldier moral greatness, and a professional training, both developed very high degree. The conservation of those forces, a conserva- on which alone can assure victory, is incumbent on the com- anding officers. And in this way the rôle and responsibility of e officer expand in an exceptional degree, and grow sharply efined, especially in battle.

II. THE OFFICER

In the course of any action of necessarily long duration, the ficer can conserve the value of his unit, section, company or ttalion, only by protecting it from the disasters which are ntinually menacing it, and by leading it step by step to the al, to the final objective which has been assigned to it by the gher command, and the gaining of which constitutes for it e victory. He cannot confine himself to being a daring soldier, perior to his subordinates by his courage and personal example. e must show himself to be constantly dominated and impelled ' a double preoccupation: to avoid the destruction of his unit d to bring it nearer its objective.

Avoidance of Loss.—To avoid its destruction, because he is in e presence of an armament capable, by suddenly inflicted sses, of destroying the unit, or at least of shattering its *morale* r a long time, if adequate precautions have not been taken in me. Hence springs the necessity that he should be familiar th the dispositions appropriate to this continual menace, and at he should be able to order and put readily into practice ese dispositions, which by his selection of rendezvous, his ctical formations, by hastily constructed earthworks or by any her procedure, keep the troops halted under cover from the servation, projectiles or poison-gas of the enemy.

How many long hours will not troops have to pass in waiting, preparation, before seeing the moment for action arrive? ow often has not the officer to provide for these secure dis- sitions? Yet in this situation the slightest negligence is un- rdonable. At that moment will appear all the vigilance and the power of decision which the officer must bring to the field action, in addition to the acquired knowledge and the experi- ce, necessarily incomplete though this be, of manoeuvres. hat is required of him, even at these moments, is the all-embrac- g eye, the sense of fitting opportunity and the gift of decision.

Precision in Attack.—Then, the moment of action having rived, the operations of the unit must be carried out without sitation or disturbance, in the presence of an adversary who, nging all his resources again into action, may be able to regain me of his preponderance, to restore to his armament its rmidable strength. That is to say, the operations must have en directed in all their details by a commanding officer who has eviously assured himself of the participation of neighbouring oops, and has gauged as exactly as possible the position of the emy which he is approaching.

To sum up, together with the feeling of readiness for action lled up by the receipt of orders, but before the moment for tion has come, it is by foresight and precision that an officer ould be inspired and guided in his procedure. Without these steps into imprudence, and he draws his troops along with him. hey run the risk of not returning. He, and he alone, is to blame.

Value of Experience.—Without going into the increased need r technical knowledge resulting from the employment of ma- rial, at once more various and more potent and also more deli- te, the art of bringing troops on to the battlefield has assumed our day a capital importance. Every officer ought to concern mself with this, and shape himself for it in time of peace as lly as he devotes himself to the instruction of his men, so that he may be able, when the great day comes, to present himself armed with a certain peace-time experience, and armed above all with faculties well maintained, developed, and turned ever on the alert in the direction of the march toward the objective. He must be ready on that day to resolve the difficulties of this march, difficulties which only the actual conditions will reveal to him, for peace gives no complete idea of the effects of modern weapons on a body of troops. War will bring him face to face with new problems, and will demand that he possess, over and above his professional knowledge, the habit of reflection and prompt decision on fresh circumstances. It is a habit which he will need to have acquired during peace-time.

It is needless to remark that these faculties of foresight, of adaptation to new problems, ought to be developed the more fully in an officer the higher his rank and the greater the instruments of control which are in his hands. For in this case his orders cover vast spaces, are laden with more far-reaching consequences, and are more difficult to modify in their execution. The moral forces and the capacities which the commander must bring to war, if he is to act in such a way that negligence or imprudence, both always disastrous, may be avoided, have increased in notable proportions, even for the lower ranks.

III. THE NATION

But war, to pursue the theme further, does not confine its material and moral effects to the battlefields and the invaded regions. It extends them toward the rear, to populations which were formerly kept aloof from it by the barrier of distance. It spreads them overseas in every direction, even to non-belligerents, and produces the most complete upheaval.

The Non-Combatants.—In the rear, not to speak of refugee populations fleeing before the ravages of invasion, and terror systematically loosed in defiance of the laws of humanity, it is the women, the children and the aged who live in the emotions of the struggle, as a result of the facility and speed of communications; who undergo on occasion the stress of hostile bombardment from the air; who in any case suffer privations of every kind. This means that the field is open, in the heart of the country itself, to the most opposed sentiments and passions, as also to nervous shock and physical exhaustion. But, despite these difficulties, the interior of the country must hold firm to the end, and, what is more, must maintain in foodstuffs, arms, and munitions and support in energy of spirit, those who fight at the front. In its united aspects, the country becomes and must remain by its sentiments and its productive activity the source of the warring capacity of the armies.

Thus, in the old Europe, each country is perforce the near neighbour of powerful states, sees its warlike resistance measured by the degree of union between the interests and sentiments which it comprises, by its jealous watch over its independence, by its progress toward that moral unity which is the essence of a nation, and consequently by the depth of its national sentiment. Only in these moral factors is to be found the energy which will resist concussions of every kind, and will pursue, through ever-increasing sacrifices and through all the vicissitudes of the struggle, the success of the enterprise which will liberate it, once and for all, from all its anguish.

And if, among the states of the New World, where menace is less direct, the immediate danger does not demand the organisation of territorial defence, a blow struck against the principles whereby they live will awaken the apprehensions of the peoples and, in community of sentiments, will arm them for the safeguarding of their free civilisation. In short, a sturdy sentiment which binds the entire people as one, imposing itself upon them by the justice of their cause and the necessity for defending it, is indispensable to the success of a modern war, for that alone is capable of obliging them to the privations and sacrifices which war entails.

IV. THE GOVERNMENT

To maintain and guide this sentiment during the days of the struggle, to exploit it and to extract victory from out of it—

such is the task of the Government. In these days the Govt. must not be simply the representative of the interests of the country, but rather the expression of the passions which are animating it, and to that end, the organiser of defence, the creator of the material resources, the arms, munitions, foodstuffs essential to the struggle, and the motive and inspiring power and of the forces assembled on the field of operations. It must show itself a "war government," with an active and effective policy, taking a wide view of the ends which it is possible to attain, bearing in mind the means at its disposal. And it must be animated by the will always to augment those means to hasten those ends, while still maintaining, in the interior of the country, the spirit which does not disarm.

It is obvious, then, that war calls for peculiar qualities in the statesmen who preside over it. Without these, it must inevitably end in impotence, or even defeat.

V. CONCLUSION

To sum up, whether we are dealing with the soldier, the high command, the nation or the Govt., in each of these divisions war demands an ever-increasing share of the moral forces whose close union and wise combination are alone capable of producing victory. It is to the insufficiency of certain of these forces, or to the lack of cohesion between them, that we must look to grasp and explain the collapse, in the course of the last war, of certain Great Powers, and likewise of armies of formidable repute, which in themselves certainly did not fall short of that repute.

Bibliography.—The most important works to be consulted are those of Marshal Foch himself: *Des Principes de la guerre* (1903) with English translation by Hilaire Belloc (1918); *De la conduite de la guerre*, 3rd ed. (1915); *Préceptes et Jugements du Maréchal Foch; extraits de ses oeuvres, précédés d'une étude sur la vie militaire du maréchal par A. Gasset* (Nancy, 1919), with English translation by Hilaire Belloc (1919). See also J. R. (ancien élève de l'école supérieure de guerre), *Foch. Essai de psychologie militaire* (1921), and Émile Mayer, *La psychologie du commandement: Avec plusieurs lettres inédites du Maréchal Foch* (1924). (F. Fo.)

MORANT, SIR ROBERT LAURIE (1863–1920), British civil servant, was born at Hampstead April 7 1863. He was educated at Winchester and New College, Oxford, and on leaving the university was for a few years a schoolmaster. Later he went to Siam as educational adviser, and was entrusted by King Chulalongkorn with preparing a scheme of education for the whole country. In a few years he returned to England, and after some experience of social work in the East End of London, was appointed in 1895 to assist in the direction of the office of special inquiries and reports in the Board of Education. He became private secretary to successive ministers, and on him devolved a great deal of the preparation of Mr. Balfour's Education Act of 1902. In 1903 he was appointed permanent secretary of the Board of Education. In this capacity he proved himself a most efficient administrator, and in 1907 he was created K.C.B. In 1912, on the introduction of the National Insurance bill, Morant was appointed chairman of the Insurance Commission, a position which led naturally to his appointment as secretary to the Ministry of Health on its formation in 1919. He died in London, after a few days' illness, March 13 1920.

MORE, PAUL ELMER (1864–), American author, was born at St. Louis, Mo., Dec. 12 1864. He was educated at Washington University and Harvard, and he was assistant in Sanskrit at Harvard, 1894–5, and associate lecturer in Sanskrit and classical literature in Bryn Mawr College 1895–7. He was literary editor of *The Independent* 1901–3, and of the New York *Evening Post* 1903–9, and editor of *The Nation* 1909–14. In 1915 he was elected to the American Academy of Arts and Letters.

He is the author of *Shelburne Essays* (11 vol., 1904–); *Life of Benjamin Franklin* (1900); *Platonism* (1917); *The Religion of Plato* (1921); *Hellenistic Philosophies* (1923); and *The Christ of the New Testament* (1924), in addition to a number of translations from the Greek.

MORESNET: *see* Eupen and Malmédy.

MORET Y PRENDERGAST, SEGISMUNDO (1838–1913), Spanish politician, was born at Cadiz June 2 1838. He was educated at the Central University, Madrid, and became pr fessor of political economy there. In 1863 he entered the Cort as a Liberal, took part in the revolution of 1868 and in the co stituent assembly of 1869. Colonial Secretary in 1870 und General Prim, and later finance minister, he was for a few mont in 1872 Spanish ambassador to Great Britain, and after resigni this post accepted the directorship of a large London bank. year later he returned to Spain. He re-entered Parliament 1879, and helped to found the Democratic dynastic party. was Minister for Foreign Affairs under Sagasta in 1885 and aga in 1893–4, Minister of the Interior 1885–8, and Minister Colonies 1897. In this capacity he advocated the grant of auton my to Cuba and Porto Rico, and was opposed to the war wi America of 1898. He was Prime Minister in 1905–6 and aga in 1909, and at the time of his death in Madrid on Jan. 28 191 was president of the Chamber. He had a cultivated mind ar a noble spirit but was not sufficiently resolute for the difficu political times in which he lived.

MORGAN, ARTHUR ERNEST (1878–), American eng neer and college president, was born at Cincinnati, O., June 1878. He received his early education in the high schools St. Cloud, Minn., and then spent three years in Colorado various occupations, including a short term at the Universit of Colorado. Returning to Minnesota, he worked for his fathe a land surveyor, and studied engineering at night. In 1902 commenced practice for himself at St. Cloud, making a speci study of floods and flood control. In 1907 he became supervisin engineer of U.S. Govt. drainage investigations, but in 190 founded the Morgan Engineering Co., of which he became pres dent. His firm undertook many reclamation projects in th southern states. In 1913, after the Dayton flood, he was co sulted on behalf of the sufferers with a view to prevent a recu rence of the disaster, the result being the formation, unde special statutory powers, of the Miami Conservancy Distric consisting of all cities, towns and land within the flood area, an the necessary work was done under his supervision as chief engi neer. In 1921 he acted as chief engineer to the Pueblo Conserv ancy District, formed to protect Pueblo, Colo., from floods. H planned and superintended a large number of projects for wate control, and drafted or assisted to draft drainage codes for number of states. In 1921 he was appointed president of Anti och College, Yellow Springs, O., which was reorganised, unde his inspiration, in order to carry out a comprehensive experi ment in the correlation of cultural and industrial education (*se* Antioch College).

He was the author, among other works, of *The Drainage of th St. Francis Valley in Arkansas* (U.S. Govt. 1911); and *The Miam Valley and the 1913 Flood* (1917).

MORGAN, JOHN PIERPONT (1837–1913), American financie and banker (*see* 18.834), died in Rome March 31 1913. I Jan. 1913 he sailed from New York for Egypt, where he becam seriously ill. He was carried to Italy but never recovered. Hi will provided that after the distribution of enumerated bequest amounting to about $17,000,000, chiefly to his family, th residue of his estate should pass to his son, John Pierpon Morgan. In 1916 the estate was finally appraised at $69,499,73 He left only some $700,000 to charities; but while living h had been a generous giver, and in his will suggested that hi son continue certain accustomed annual contributions. Hi works of art and books were left to his son without restrictions although in his will he said: "It has been my desire and inten tion to make some suitable disposition of them or of such portio of them as I might determine, which would render them per manently available for the instruction and pleasure of th American people." In the summer of 1913 most of the ar collection was placed as a loan exhibit in the Metropolita Museum of Art, New York City. Later, some items, mostl replaceable, were sold. The remainder, consisting of over 3,00 pieces, was presented to the museum by the son in Dec. 1917 and a new wing was added to the building to house the permanently. This was opened in June 1918. This collection covered all periods and included matchless bronzes, enamels, orcelains and tapestries. The library (dedicated by the son y public charter in 1923 as an institution of research for cholars and provided with liberal endowment, in memory of is father) was appraised at $7,500,000, and consisted of about ,000 volumes of illuminated manuscripts, early printed books, xamples from famous presses and association copies.

MORGAN, JOHN PIERPONT, JR. (1867–), son of John Pier- ont Morgan (1837–1913), succeeded his father and continued as ctive head of J. P. Morgan and Co., and of its associated anking houses in Philadelphia, London and Paris. He was orn at Irvington, N.Y., Sept. 7 1867, prepared for college at t. Paul's School, and graduated from Harvard in 1889. He eceived the honorary degree of LL.D. from Cambridge Uni- ersity in 1910 and from Harvard in 1923. In 1891 he became member of the firm of which his father was the head, and ter spent 12 years with the London house of J. S. Morgan and o., now Morgan, Grenfell & Co. Within 16 months after Mr. lorgan succeeded his father in 1913, as head of the house, the 'orld War began. Almost immediately the finance department the City of New York became confronted with a grave tuation. Owing to the dislocation of the foreign exchanges, e City of New York found itself unable to meet its obligations aturing in London and Paris, aggregating upwards of $80,000,- o. Thereupon Mr. Morgan undertook the organisation of a ccessful bankers' syndicate for $100,000,000 gold, through the eration of which the city's credit was maintained intact.

Within a year the British Govt., followed by the French ovt., enlisted the services of Mr. Morgan and his partners undertake the vast work of co-ordinating and finally pur- asing in the United States their all-important supplies of odstuffs and munitions. The purchases which the firm made r the British and French governments aggregated several lion dollars, and the work which the Morgan firm accom- shed in organising sources of industrial supply in America oved of great service to the United States Govt. when, o years later, in 1917, it undertook to secure its supplies on a huge scale for the prosecution of its part in the War. fore America's entry into the War, Mr. Morgan under k the work of financing a great part of the Allies' require- nts for credits in the United States of America, and prior to ril 1917 had arranged total loan issues to the British and ench governments of $1,550 million. During the period of rld reconstruction following the War, Mr. Morgan continued ive; the publicly issued loans which his firm arranged to eat Britain, France, Belgium, Italy, Austria, Germany, itzerland, Japan, Argentina, Australia, Cuba and Canada gregating between April 1917 and April 1926 approximately 700 million. During America's participation in the War, Mr. rgan served as a member of the Liberty Loan and other ortant committees. For five years he was a member of the visory council of the Federal Reserve Board. In 1922, at request of the reparations committee, he served at Paris n a committee of bankers whose report, laying down the entials of the German reparations problem, was an important liminary to the work of the Dawes committee two years r.

n 1920 Mr. Morgan presented his residence at Prince's te, in London, to the U.S. Govt. for an embassy. In 3, by public charter, he dedicated his father's library (to ch he had made important additions) as an institution research for scholars, at the same time providing liberal owment for it. Under the terms of the gift it will be pre- ved intact as a complete unit for the period of 100 years n March 31 1913, the date of his father's death.

ORLEY OF BLACKBURN, JOHN MORLEY, VISCOUNT (1838– 3). British statesman and author (*see* 18.840), continued to the seals of the India Office till Nov. 1910. One of his last ial acts had been to resist the appointment of Lord Kitchener he vice-royalty, pressed strongly upon ministers by King ard just before his death. Lord Morley remained in the inet in the less onerous position of Lord President of the ncil, and was one of the four counsellors of state to administer the kingdom during King George's visit to India for the Delhi Durbar in the winter of 1911–2.

In the critical period of domestic politics which began with the budget of 1909 he played a somewhat prominent part. He defended that budget in the great debate of Nov. 1909 and, while admitting that the Lords had the legal right of rejection, said that to assert it was a "gambler's throw." Owing to the temporary failure of Lord Crewe's health, Lord Morley led the House of Lords during most of the session in which the Parliament bill, which he warmly supported, was passed; and it was he who read out to the House on the last night of debate that definite assurance from King George of his assent to a creation of peers which finally secured the exiguous but adequate majority of 17. He not only took charge of the India Office during Lord Crewe's illness, and of the Foreign Office in Sir Edward Grey's short holidays, but he was an outstanding figure in the Home Rule debates of 1913 and 1914.

The entrance of Great Britain into the World War brought Lord Morley's official career to an abrupt termination. He felt that his pacifist outlook was sufficiently well-known to make it unnecessary for him to give reasons for resigning; and he withdrew to the retirement of his Wimbledon villa, where he occupied himself with writing two most interesting volumes of *Recollections*, which were warmly welcomed on their publication in 1917. In 1921 his publishers brought out a complete edition of his works in a handsome *format;* and he was generally regarded, during his last years, as sharing with Mr. Hardy the position of *doyen* of English men of letters. He died at Wimbledon, London, after a somewhat long period of ill health, on Sept. 23 1923. See Viscount Morley, *Recollections*, 2 vol. (London, 1917).

MOROCCO (*see* 18.850), a state of Northern Africa. The district of Tangier (*q.v.*) is internationalised; the northern zone is a Spanish protectorate; the remainder a French protectorate. The approximate area is 231,500 sq. m. (Spanish zone, 18,360 sq. m.; Tangier, 200 sq. m.). The estimated population (1925) is: French zone, 4,410,000; Spanish zone, 500,000; Tangier, 70,000. The reigning Sultan in 1925 was Mulai Yusef.

I. POLITICAL HISTORY

In Oct. 1910 there was a general rising of the tribes round Fez against Mulai Hafid, who had become unpopular owing to his dependence on the French and the exactions of his grand vizier. Fez was besieged in March 1911. In April and May French troops were sent to occupy Fez and pacify the district. This action, although its necessity had been notified to the Powers, was resented by Spain and Germany. In June Spain occupied El Qsar and Larache (El 'Araish). On July 1 the German Govt. suddenly dispatched the gunboat "Panther" to Agadir, nominally to protect the interests of German subjects (*see* EUROPE). The situation was so critical that war seemed imminent; but Great Britain declared her intention of standing by the entente, and her formal objection to Germany's obtaining territorial influence in Morocco. France and Germany signed a treaty on Nov. 4 1911; in return for territorial cessions in the Congo, Germany recognised France's political protectorate (the word was used in the letters accompanying the treaty, although not in the treaty itself) over Morocco, economic equality between the two countries being reaffirmed.

The Franco-Spanish Treaty.—On Nov. 27 a Franco-Spanish treaty was concluded. This arranged such debated points as customs, the management of the projected Tangier-Fez railway and the appointment of the Sultan's *khalifa* (deputy) at Tetuan. It slightly revised the Franco-Spanish boundaries determined by the convention of Oct. 3 1904. The boundary of the northern Spanish zone follows the Muluya from its mouth to near Meshra 'Klila; thence, turning west, it runs immediately north of the Wad Wergha R. to Jebel Mulai bu Shota; thence it strikes northwest to the Wad de Kkus, follows its course, and, afterwards, Lat. 35° N., to the Atlantic coast. Both banks of the Lekkus and El Qsar and Larache fall within the Spanish zone. The treaty also recognised the rights of Spain in the south over the enclave of Ifni, bounded to north by the Wad bu Sedra, to south by the Wad Nun, to east by a line about 15 m. from the coast. The negotiations of 1911–2 between the Powers resulted in the internationalisation of the Tangier zone, consisting of Tangier, its environs and the territory of the El Fahs tribe to south and west of it—about 100 sq. m. in all. By this understanding Tangier was "to be given a special régime to be agreed upon later."

In 1913 a commission sat to determine the nature of this régime; but its findings were not accepted by Spain, and the outbreak of the World War shelved the question. A convention determining the new régime was drawn up on Dec. 18 1923 (*see* TANGIER). On March 30 1912 Mulai Hafid signed a treaty with France accepting the protectorate, which was subsequently recognised by the Powers, who withdrew their diplomatic representatives. General Lyautey was appointed resident-general.

On Aug. 12 1912 the Sultan Mulai Hafid abdicated, appointing as his successor his brother, Mulai Yusef. (E. G. S.)

II. ADMINISTRATIVE HISTORY

General Lyautey's Administration.—The history of French Tangier from 1911 to 1925 was largely military (*see* MOROCCO, CAMPAIGNS IN). France was fortunate in possessing a remarkable administrator in the resident-general, General Lyautey, who was assisted by remarkable subordinates: Generals Poeymiran, Henrys, de Sumothe, Colonel Huot, etc. Instead of evacuating the interior of Morocco during the War, Lyautey was able to extend his control in it, and even to continue public works and hold fairs and exhibitions to maintain confidence. By the end of the War he was well on the way to becoming master of "le Maroc utile," that is, such parts of the country as possessed a real military, political or economic interest. The pacification was complete in 1923; but in April 1925 the Riff outbreak in the Spanish zone extended to the French zone. Lyautey resigned on Sept. 29 1925. Regret was unanimous, and was freely expressed by Sultan Mulai Yusef and the natives, who remembered the "generosity and broadmindedness" which had been the ideal and practice of his policy. Few, if any, Christians had enjoyed such a privilege as he: all Morocco prayed for him in the mosques during his illness in 1923. His successor, M. Theodore Steey, who had successfully filled the post of Governor-General of Algeria, was appointed on Oct. 3 1925.

The Sultan's Govt.—In his difficult task Lyautey enjoyed the loyal co-operation and help of the Sultan, who generally resided at Rabat, the seat of government. Close attention was paid to the maintenance of the Sultan's prestige, and his authority and initiative were carefully respected in internal affairs, the measures decided by him being, however, always taken in accord with the French authorities,[1] by application of the treaty of Fez (March 30 1912). Mulai Yusef, on succeeding to his brothers Abdel Aziz and Hafid, immediately continued and completed the reforms, already begun, of the *Maghzen* (Central Govt.), especially in the matter of native justice and religious land property (habus). He worked regularly with his viziers (the Grand Vizier and the ministers of Justice, Domains, Habus, Public Instruction, and the presidents of the High Sherifian Tribunal and the Tribunal of Appeal of the Chraa (Mussulman law), seven in all, taking a special interest in educational matters. The competency of the local judge, the Kadi—*i.e.*, in reality, a religious magistrate, civil matters relating to marriage, the family and inheritance, etc., being regulated by the Koran—has been maintained towards Europeans in the matter of the acquisition[2] of land property (Articles 11 of the Madrid Convention, July 3 1880) and 60 of the Algeciras Act (April 7 1906). Hence the importance of the Ministry of Justice and of the tribunals.

The Sultan remains the head and tutor of all the members of the Sherifian house. He appoints a special Sherif (the "mezuar" or "naquib") in all the principal towns, who settles disputes between the Shorfa Alauites (*i.e.*, the above members) and watches over their
conduct. He has four "Khalifas" in Fez, Marrakesh, Tiznit ar
the Spanish zone, whose rôle is of a representative character. Tl
civil list amounts to 5,250,000 fr., *plus* 2,200,000 fr. for the Sultar
special negro bodyguard.

Pashas in the towns and Kaids among the tribesmen in the cou
try represent the temporal authority of the Sultan, as opposed
the Kadis (*see* above), and are in charge of criminal justice and jud
also in cases where movables and commercial matters are concerne
In the principal towns they are controlled by the French officials
the Protectorate acting as commissaries of the Government. Ca
has been taken to preserve as far as possible among the Berb
tribes the customs (izref) to which they are deeply attached. The
Kaids are judges in penal and commercial matters; disputes as
personal status, property, etc., being settled by the djemaas (popul
assemblies) according to custom and not by the Kadis.

Native Representation.—Arrangements were made for taking t
advice of the natives on certain questions. The programme of tl
monthly meeting of the Council of Government is communicate
not only to the Maghzan but, through the French "contrôleurs,"
week beforehand, to the native sections (created by a *dahir* of Ja
20 1919) of the chambers of commerce and agriculture, who, as occ
sion offers, deliberate either separately or concurrently with t
French sections. They are also represented in the municipal counc
presided over by the pashas in the principal towns. In both cas
they are appointed by the Government.

French Administration.—The administration is under the autho
ity of the "Commissaire" Resident-General (decree of June
1912), assisted by a delegate and a secretary general of the Prote
torate. The central government comprises the secretariat gener
to which are attached the following services: civil control, personn
legislative studies, general security, general administration, per
justice and the special direction of native affairs and the intelligen
service. The other central services are divided up between the f
lowing Directions générales: 1. Finances and public domair
2. Public works (with the mines, ports, mercantile marine and t
post, telegraph and telephone office; 3. Agriculture, commer
(and industry) and colonisation (with the forests and the la
registrations and survey); 4. Public instruction, fine arts a
antiquities; 5. Public health. The "exterior services" are class
by regions, Shawiya, Rabat, Gharb, Ujda, etc.), and distribute
between 22 controls (and their annexes) or municipalities in the ci
territory; and eight regional bureaux, with their 14 circles, in t
military zone. The French judicial organisation, which comes in
play whenever Frenchmen or Europeans are concerned, compris
12 civil courts; three tribunals (Casablanca, Rabat, Ujda and
court of appeal (Rabat).

In order to ensure "a constant and regular collaboration betwe
the Government and French colonists," the presidents of the cha
bers of commerce and agriculture of Rabat, Qnitra and Casablan
and of the mixed chambers of Marrakesh, Mazagan, Ujda, S
Meknes and Fez (whose members are elected), assemble once
month in a Council of Government, the agenda of whose sittings
always communicated a week in advance. There is a municipal co
mission in each important town (the same as above), theoretica
presided over by the Pasha, representing the Sultan, and practica
by the French chief of the municipal services. They have a cons
tative voice, except in Casablanca, where it is deliberative.

Public Instruction.—In 1916 there were 140 schools under Frer
supervision, with 470 masters and 14,834 pupils. In 1924 the scho
numbered 199 (90 French; 67 Franco-Arab; 42 Franco-Jewish a
Jewish), the masters 938 and the pupils 29,030—417 for higher
struction; 2,822 for secondary education; 23,327 for primary edu
tion; 1,029 for the technical schools and 1,435 for the evening cour
in two or three big towns. A distinction is drawn between the p
mary schools for the sons of "notables" and the other prima
schools. The teaching of housekeeping (Écoles menagères) has b
started for native girls. There are two Mussulman colleges, in Ral
and Fez, where selected pupils from the special schools for the s
of notables receive, in a course of studies of six years, higher educat
in Arabic (language and literature) and Mussulman religion and la
with the elements of French, mathematics, general geography a
practical science. Those studies are completed in the institute
higher Moroccan studies at Rabat (also open to French pupi
where Arabic literature and language are taught thoroughly, as w
as the special history and geography of Morocco, the Berber c
toms and dialects, ethnography, French and Mussulman law, a
lectures on the administrative organisation of the country. It is
seminary for officials and interpreters. There is also an importa
Sherifian scientific institute (10 laboratories) in Rabat. An ind
trial and commercial school exists at Casablanca (232 pupils) w
evening courses (360 pupils). There are official workshops (atelie
for apprentices in the principal towns, and also a few for girls (carp
making, etc.), and technical schools for Europeans in Casablar
and Ujda. A special service is in charge of the historical monumer
both Roman (Volubilis, etc.) and Moorish. Local laws, inspired
the French director of the service, protect the artistic remains in
towns, and some restorations have been undertaken. Special lo
ings and studios have been provided in the most interesting to
for European painters and architects, who can come and study
the country.

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[1] The link is secured by the French councillor to the Sherifian Govt. (decree of May 19 1917).

[2] After they have been *immatriculated*, land properties fall under the new land laws and French tribunals.

III. ECONOMIC HISTORY

Population.—The 1921 census, completed (1924) by the latest official statistics, gives an urban population of 612,987 for French Morocco. The rural population is not really known, certain parts of the country being still outside French administration, and others very lightly administered. The estimated total is 4,410,000 inhabitants. There are three principal towns: Marrakesh (145,000), Fez (124,500), Casablanca (110,900). The next in order of importance are Meknes (38,000), Rabat (33,000) and Safi (25,800). Then come Sali (24,300), Ujda (22,200), Mazagan (22,000) and Mogador (19,500).[1]

Frenchmen numbered (1924) 51,889 (24,799 in Casablanca, 7,218 in Rabat, 4,400 in Ujda, 2,800 in Fez, 1,700 in Marrakesh, etc.); Europeans 32,320 (17,487 in Casablanca; 5,000 in Ujda, etc.). The Jews total 73,400 (in the towns, descendants of immigrants from Andalusia). There are also a few Jewish converts among the Berbers in the country. Spaniards rank first among the Europeans, Italians come next.

In 1923 (official figures) 23,473 passengers arrived at Casablanca, of whom 5,133 came to stay (3,682 Frenchmen, 532 Spaniards, 382 Italians, 63 British, etc.) Of these, 660 came for commerce, 424 as engineers, contractors or as workmen for the building trade, etc.; and 1,200 tourists visited Morocco. On the other hand, about 30,000 natives (including a certain number of Riffans) crossed over to Algeria as harvest labourers; 4,596 Moroccans went to France as labourers; 1,250 returned the same year, bringing back over 2,000,000 fr. savings.

French Colonisation and the Land Question.—At the end of 1913 French properties numbered 1,127, representing 1,073,000 ac., lying principally in the El Gharb region (north of Rabat—about 250,000 ac.); the Shawiya (south of Casablanca), the environs of Rabat and Ujda coming next. Other European properties numbered 117 (Spanish 28, Italian 39, English 20, etc.), covering 52,700 acres. Farms of less than 100 hectares (250 ac. represent 44·8 % of the total surface in European hands; large farms (over 1,250 ac.), 14·3 %. The rest (40·9 %) varies between 250 and 1,250 ac. (*colonisation moyenne*). Of the total surface, 179,000 ac. had been given away by the official colonisation system (sales), and the rest bought directly from the natives. About half the French colonists come from Algeria and Tunisia and are already familiar with local conditions.

The establishment of French power brought about a great change n economic and social conditions in agriculture as elsewhere. Both he soil and the climate are, in many parts of Morocco, far more avourable to settlement than to nomadism. The feebleness of the central native power (Maghzen) and continual intertribal strife used o render private property (*melk* lands) almost illusory. But, especially since 1919, in the pacified parts, the natives have settled on he land which was, before, "common" land (*arch*), inalienable ccording to Mussulman law and custom. It is both wise and just o reserve a part of them (it is estimated that about 5,000,000 ac. an be cultivated instead of being left for sheep grazing) for French nd other colonists, who can put them into far better value.[2] There re also maghzen and habu (religious property) lands that can be etter utilised. Land registration has been introduced in Morocco ince 1913, and 5,826 titles had been registered at the end of 1923, n which, at that date, 186,000,000 fr. had been borrowed on mortage. Natives are also beginning to register their lands.

The colonists cultivate the same crops as the natives: wheat durum principally), barley, oats, beans, etc.; the olive tree, flax or seed). There have been a few experiments in growing castor-oil eed and in cotton and hemp since the War. Orange culture in the egions of Meknes and Marrakesh is promising. Vineyards only ccupy a few hundreds of acres; and for the moment the raising of arly vegetables (so successful in Algeria) is confined to the uburbs of a few big towns for their European inhabitants. Stock ising (sheep especially) is also carried on, sometimes in association ith natives; the number of sheep was estimated in 1924 at about 0,000,000, of which 7,200,000 paid the tax tertib, and about 100,000 ere in European hands. The amelioration of the local breed, both om the point of view of the flesh and the wool,[3] is being steadily ursued; as also the study of several other important agricultural roblems in the official farms and experimental fields.

Budget.—The 1924 budget foresaw 312,629,000 fr. ordinary ceipts; of which, customs produced 83,000,000 fr.; tertib, 66,000,000; xes on consumption (sugar, tobacco, etc.), 60,000,000. The 2,442,000 fr. of expenses were principally distributed as follows: ublic debt, 62,000,000; justice and general administration, 72,000,-0; services of economic interest (public works, agriculture and commerce, etc.), 91,000,000; services of social interest (education, health, etc.), 29,000,000, etc. The total actual debt of the Protectorate amounts to 705,624,000 francs. Morocco contributed (1924) 46,000,000 fr. to the French military expenses in the country. At the end of the same year France had spent 4,271 million fr. since 1907 in Morocco. But if the ordinary garrison expenses (not special to Morocco) are deducted—2,501 million fr., or 63·6 % of the total—the total cost proper of Morocco to France represented at that date 1,431,000,000 francs.

Railways and Public Works.—The 1,300 km. of narrow gauge military railways existing in 1923 registered that year 61,620,000 kilometric-passengers and 67,750,000 kilometric-tons of merchandise. They are gradually being replaced by the standard gauge, 400 km. of which were already in operation in 1926, and which will be partly electrified when the Casablanca central power station is finished. Including the Tangier-Fez line (310 km.), the new system will have a total length of about 1,000 kilometres. The admirable phosphate region of El Boruj-Wed Zem is already linked up with the port of Casablanca, which now possesses a length of 425 metres of quays for big ships (depth 48–50 ft.) under the protection of a jetty over a mile long (2,000 metres). The other ports are Qnitra, Rabat, Fdala, Mazagan, Safi and Mogador.

The network of roads consisted (end of 1923) in 2,665 km. of principal and 577 km. of secondary roads, and 933 km. more were being constructed or projected. There existed at the same date 12,300 km. of telegraph lines. Besides the sea postal service, Casablanca is in daily postal connection by aeroplane with Toulouse, by Algeciras, Barcelona and Perpignan.

The year 1925 marked important progress in the value of Moroccan commerce: 1,754,000,000 fr. (imports, 1,189; exports, 565), as against 139,0,000,000 fr. in 1924, and 850,000,000 in 1923. Figures in tons are still more decisive.

	1923	1924	1925
Exports	339,236	815,160	982,921
Imports	448,293	426,572	569,640
Total (tons)	787,529	1,242,732	1,552,560

The great growth in exports is due to the progress in the exploitation of the magnificent phosphate beds of Wed Zem (finer than those of Tunisia): 720,000 tons exported in 1925. By far the greater part of Moroccan commerce is centred in Casablanca (1,135,600 tons, 1,082,000,000 francs). The two ports ranking next are Qnitra (138,700 tons) and Safi (90,600 tons). Fdala is last on the list. Commerce by land with Algeria (Taza-Ujda) amounted to 77,860 tons. On Jan. 1 1924 there were 615 industrial establishments in European hands in Morocco, employing 7,223 hands and 22,868 horsepower. The capital invested amounted to 273,600,000 francs. Electricity heads the list; flour-mills, slaughter houses, lime and cement factories come next. Casablanca comes first (140,000,000 fr. invested). Rabat, Marrakesh, Fez, Qnitra and Ujda rank afterwards, in the order named.

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III. SPANISH MOROCCO

The Spanish zone in Morocco extends over an area of 18,360 square miles. Accurate returns of the population are impossible. The civil population in the towns in 1923 was estimated at 118,305, of whom the majority were Mahommedans. Tetuan, the capital of the Protectorate, had an estimated population of 23,447 in 1923. Other towns were Melilla, 60,000; Larache, 15,430; Alcazarquivir, 12,368.

Education in Spanish Morocco is conducted under the auspices of the different creeds. Catholics, Mahommedans and Jews have their own schools. The budget of the Protectorate provides the salaries of professors at the university in Tetuan. There were 175 primary schools, of which 74 were specially for Moorish children. The total number of pupils attending the primary schools in 1923 was 24,679.

Administration.—By a royal decree of Jan. 18 1924 the direction of affairs in Spanish Morocco was entrusted to the Premier of Spain, with the exception of military matters, which were confided to the Ministry of War. The Spanish Govt. is represented in the Protectorate by the High Commissioner, who presides over the Civil Services. A royal decree of March 1925 fixed the limit of the Spanish forces in the Zone at 80,000—65,000 Europeans and 15,000 natives. The intermediary between the higher command and the Moorish troops is the officer known as the *Caid Interventor*.

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[1] "Urbanism" was a great feature under Lyautey. If Casablanca certainly an overgrown town, the plans for the extension of the incipal towns (drawn up by M. Henri Prost) are remarkable, and refully preserve the native quarters.

[2] In Tunisia, for instance, in 1921, the 190,000 ac. cultivated in heat by Europeans produced 68,000 tons, whereas the 1,250,000 . in native hands only gave 120,000 tons. In Morocco, where a ench colonist loses 7 % of his sheep stock, a neighbouring *Kaid* will e 48 %—a case of direct observation.

[3] Wool of the *Abudia* commercial type, of the Beni Hassen, is eady of a superior quality; it is perhaps the original *merino*.

The reverse suffered by the Spanish arms in 1921 through the defection of a friendly tribe, when Gen. Silvestre was killed, precipitated a political crisis in Spain, which culminated in the proclamation of the Military Directory in Sept. 1923. The policy of the President of the Directory, Gen. Primo de Rivera, was to establish a single front, to effect which the army was withdrawn from portions of the occupied territory and a number of positions were evacuated.

Spanish subjects in the Protectorate enjoy all the civil rights recognised by the law in Spain; foreign residents enjoy the same rights subject to certain provisions. All residents, whether Spanish subjects or not, must conform with regulations relating to the police and public security. The budget for the Zone for 1924–5 was 15,607,500 pesetas. The total trade values, in pesetas, for 1922 were: imports, 4,367,401; exports, 7,080,413—a favourable trade balance of 2,713,012 pesetas. Agriculture in the Spanish Zone has made progress since 1923, and of the 330,000 hectares of land available for cultivation in the eastern zone 120,000 have been taken up for production. Lemons, oranges, olives and many cereals are grown. The *Agrupación agraria* at Alcazarquivir has inaugurated a new era of agricultural progress.

The Spanish Zone is served by three railways: Ceuta-Tetuan, Nador-Titztutin, Larache-Alcázar, with a total mileage of 90 miles. Public highways have been constructed in the central, eastern and western regions.

MOROCCO, CAMPAIGNS IN.—The colonisation of Morocco has always been attended by violent encounters with the numerous tribes inhabiting that country. Since 1910 France and Spain, the two protecting powers, have both had to contend afresh with native hostility, encouraged and assisted to some extent by agents of Germany. The following account of this aspect of Moroccan history is given under three headings, namely, I. Spanish Campaigns; II. French Campaigns; and III. Franco-Spanish Campaigns. The last deals with the combined action of France and Spain against the tribes of the Rif.

I. SPANISH CAMPAIGNS

The history of Spain in the Rif has been one of intermittent warfare ever since, at various dates in the Middle Ages, she obtained possession of and occupied her "Presidios" on this coast of North Africa—Melilla, the Zaffarin Islands (Islas Chafarinas), Alhucemas, Peñon de la Gomera and Ceuta. Confined to the narrow limits of these possessions, it was ever Spain's desire to obtain more breathing-room so as to be able to put them to a greater utility than mere penal settlements. At various periods, for instance after the Spanish Moroccan War of 1859–60, the Spanish Government had demanded and obtained some territorial expansion at Ceuta and Melilla, but the other points, rocky islands off the coast, remained at the mercy of the tribesmen of the mainland and could only with difficulty be provisioned. As was only natural the relations between the Spanish and the Rifis were difficult.

Spanish Expansion.—The loss of her colonies at the end of the 19th century caused Spain to seek compensation in Africa; and the Franco-Spanish Treaty of 1912, to which Great Britain was a consenting party, gave her the opportunity she sought. By this treaty the Spanish zone in Morocco was delimitated and Spain's hands were freed to undertake its occupation. Already in 1909 she had fought a costly campaign in the Melilla district which had left a comprehensible desire in the Spanish Army for revenge. In 1912 the occupation of various parts of the Spanish zone was begun and in that and the succeeding years Tetuan, Larache, El Qsar (Alcazar), and Arzila were reached and the neighbouring districts occupied. At the same time Spanish forces marching south and westward from Melilla succeeded in penetrating some distance into the Rif without meeting with serious resistance.

Effect of the World War.—The Spanish task was at first much facilitated by the World War, during which the Spanish zone was used by the Germans as a base of active propaganda and action against the French Protectorate. Money was lavishly distributed amongst the tribesmen for the purpose of raising Ri forces for inroads into French territory, and Rifi attention was largely withdrawn from the more imminent danger of Spanish invasion. The end of the war put a stop to this anti-French action and the Rifis, who had received from the Germans large sums of money and no small quantity of arms, turned against the Spaniards. In 1919 General Berenguer, the Spanish High Commissioner, was forced to open a campaign in the Jibala highlands which led, in the following year, to the occupation of Sishawen (Sheshuan). Raisuli, sherif and ex-brigand, whose influence amongst the tribes was great, facilitated on this occasion Spanish action.

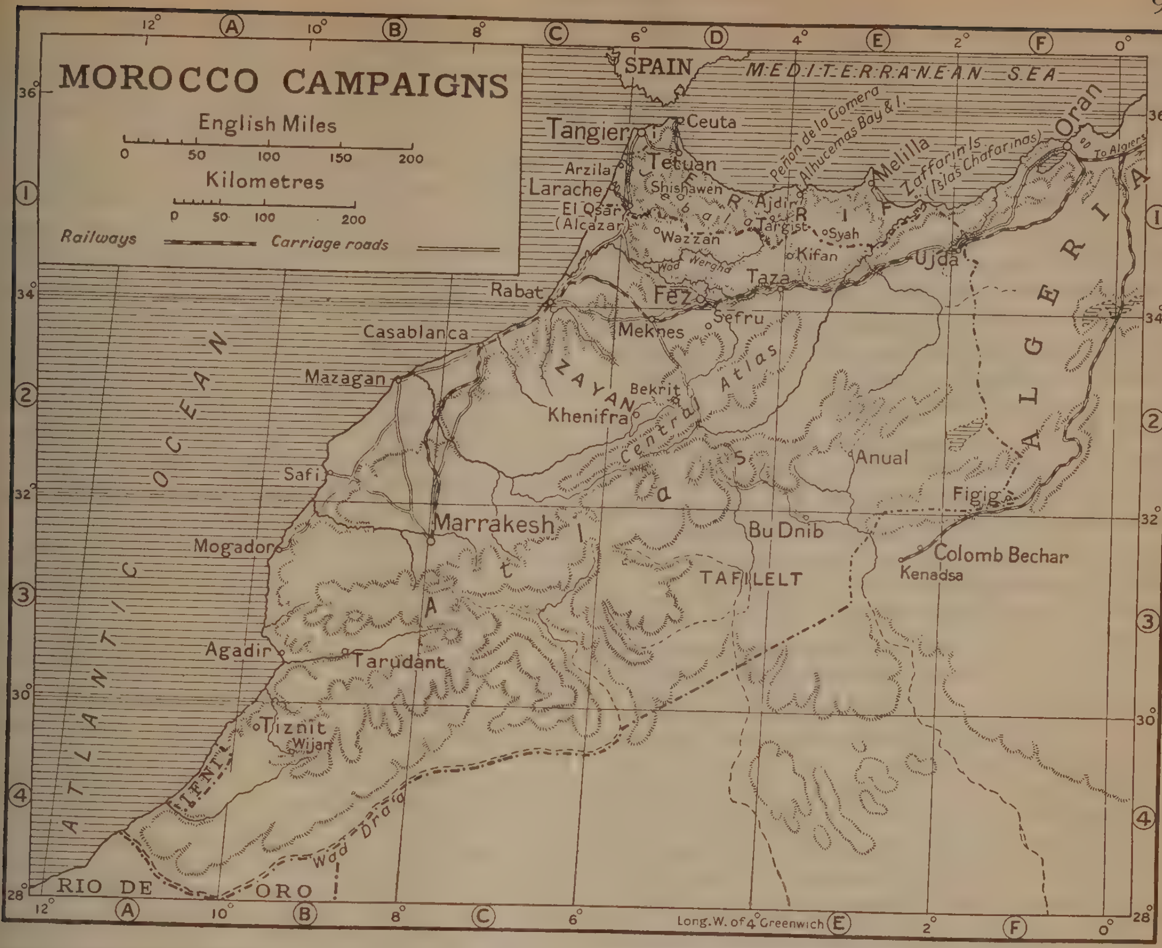
'Abdel Krim.—Further east 'Abdel Krim, the son of a Ben Uryaghel (Ouriaghel) chief, had deserted the Spanish servic and was stirring up resistance to the Spaniards in the Rif. I 1921 a Spanish Army of nearly 20,000 men holding the country between Melilla and Alhucemas was annihilated by the Rifis This disaster, which began with the fall of the advanced post o Anual and the death of General Silvestre, leading to a subsequen panic, ended in the loss to Spain of all that had been acquire in several years of campaign and diplomacy. At least 10,00 soldiers were killed, after the perpetration upon many of them of every kind of atrocity. Melilla itself was for a time at th mercy of the tribesmen, but for some unexplained reason the did not enter the town.

These Moroccan events led to a crisis in Spain and in Sept 1923 the Constitutional Government was replaced by a Militar Directory under Gen. Primo de Rivera. The situation in Afric was serious. The outlying Spanish positions, often cut off alto gether, were threatened in every direction and the president o the directory recognised that immediate action was necessar if the Spanish garrisons and Spanish prestige were to be saved He decided upon the wise and courageous course of a genera withdrawal from the front, including the evacuation of Shishawen It was not until the autumn of 1924 that this difficult manoeuvr was accomplished, after considerable loss in men, in artiller and in arms and ammunition. New lines were occupied, passin from the immediate south of Tetuan to the frontier of the Tangie zone and thence southward to near El Qsar and the frontier o the French Protectorate. The road from Tangier to Tetuan wa preserved as a couloir, strongly guarded on both sides, throug enemy country. The evacuation by the Spaniards of thos extensive regions added not a little to 'Abdel Krim's influenc and prestige. Raisuli, ill and bedridden, was taken prisoner b the Rifis and died a few months later, a captive at Adir, 'Abde Krim's headquarters. (W. B. H.)

II. THE FRENCH CAMPAIGNS

The Fez rising which took place in Oct. 1910 (*see* MOROCCO was followed by continued trouble in the Fez-Sefru distric during the autumn of 1911. A new pretender, Hamed el Hiba occupied Marrakesh in Aug. 1912, but he was expelled in Sept and therepon fled south. In Oct. Gen. Lyautey occupie Agadir. Fighting in Western Morocco continued for som months; but this district and that of Fez were occupied by th spring of 1913, and the French concentrated their attention o Eastern Morocco. The important strategic point of Taza, whic commands communications with Algeria, was occupied in Ma 1914, Khenifra captured in June.

The World War Period.—On the outbreak of the Worl War, the French commander received telegraphic orders from th Ministers of Foreign Affairs and of War (July 27–28 1914) " reduce the occupation to the principal points on the coast," a " the fate of Morocco would be settled in Lorraine," and askin


MOROCCO CAMPAIGNS
English Miles
0 50 100 150 200
Kilometres
0 50 100 200
Railways
Carriage roads
SPAIN
MEDITERRANEAN SEA
Tangier
Ceuta
Tetuan
Arzila
Larache
El Qsar (Alcazar)
Shishawen
Djebala
Peñon de la Gomera
Alhucemas Bay & I.
Ajdir
RIF
Targist
Syah
Melilla
Zaffarin Is (Islas Chafarinas)
Oran
To Algiers
Wazzan
Kifan
Wad Wergha
Ujda
Rabat
Fez
Taza
Sefru
Meknes
Casablanca
Mazagan
ZAYAN
Bekrit
Khenifra
Central Atlas
ALGERIA
ATLANTIC OCEAN
Safi
Anual
Figig
Marrakesh
Bu Dnib
Colomb Bechar
Kenadsa
TAFILELT
Mogador
Atlas
Agadir
Tarudant
Tiznit
Wijan
IFNI
Wad Dra
RIO DE ORO
Long. W. of 4° Greenwich
12° 10° 8° 6° 4° 2° 0°
36° 34° 32° 30° 28°
A B C D E F
1 2 3 4

yautey to send all available men and material to the French
ont. Lyautey immediately dispatched 37 battalions and
ther troops; but refused to evacuate the interior. The tribes
und Taza, and the Zayan in the west, promptly rose, but
e *kaids* of the Atlas and the *bashas* of Tarudant and Tiznit
the south near Agadir remained friendly, the latter keeping
l Hiba's forces in check. The Spanish zone was used by the
ermans as a basis of active propaganda and action against the
ench Protectorate. The tribesmen received lavish donations
arms and money from the Germans. Throughout 1915
d 1916 chiefs in German pay conducted a campaign along the
ad Wergha. Nevertheless, the small French force more than
ld its own. In May and June 1917 Abd el Malek was driven
om Taza. On March 24 1917 El Hiba was severely defeated
Wijan; his force was finally dispersed in the following spring.
ne Tafilelt was definitely occupied at the end of 1917. In
ug. 1918 a revolt began among the Aid Atta, which was sup-
essed by April 1919 with the help of El Glawi.

French Activity, 1918-23—After the War the French continued
eir operations, taking the offensive, now on one, now on the
her, of their four fronts: the Northern (Spanish zone; Djebala
d Rif tribes), the Berber (Central Atlas), the front of the big
ids (El Glawi, M'tongi, Goundafi) and the Southern front
ut Aissa, Tafilelt). In 1919 the 80,000 French troops were
ccessful in the Bu Dnib territory in the southeast (Jan.–March),
the Wenah (northwest) in April, in the Taza Corridor (June–
t.). In 1920 the chief activity was in the Central Atlas until
pt., when Wazzan, in the north, was taken, and operations
gan in Nov. north of Agadir. For 1921 the main operations
re again planned for the Berber front, but in Feb. the Djebalis,
aded by Kacem ben Salah and Abd el Malek, again rose unexpectedly. Though reinforced by the Beni Mestara and the Beni Mesguilda, they were put down by General Poeymirau in April. General Aubert settled the Beni Waghrain question in June, and Poeymirau once more filled up the Bekrit "pocket" in the Zayan country in the autumn. By the end of 1923 the French zone was pacified, 1923 being especially devoted to wiping out the Taza "stain" (*la tache de Taza*). The last French operations were largely dictated by the need of gaining control, for irrigation and other purposes, of the "Water Castle" of the Central Atlas. Meanwhile the anti-French subventions ceased and the Rifi, now well-armed and financed, turned against the Spaniards. (H. Br.*)

III. THE FRANCO-SPANISH CAMPAIGN

Until April 1925 the Rifi had been at war with Spain alone; but the gradual occupation by the French of the northern limits of their Protectorate, which reaches as far as the southern borders of the Rif, brought a new factor into the field.

'*Abdel Krim's Offensive.*—'Abdel Krim considered that his country was threatened by this advance and in April he launched a furious attack upon the French front to the north of the Fez-Taza-ujda road, the great highway between the Moorish capital and Algeria. Under this unexpected blow the French front collapsed. The Rifi penetrated far behind the lines, forced or persuaded the surrounding tribes to rebel and pillaged and massacred when obedience was refused. The situation became critical. For some reason the French Govt. hesitated to send the reinforcements necessary until the campaign had taken an importance which might have been avoided had more troops been at once available. Wazzan and Taza were threatened and European women and children were withdrawn to places of safety.

By the end of June, Fez, the capital, was in danger. The Sultan, in order to give confidence by his presence, arrived there in the latter days of that month. The efforts to save Fez were successful but many of the rich agricultural districts of this northern part of the French Protectorate were overrun and pillaged. Wherever it was possible the more distant military posts were evacuated, but many, with their garrisons killed, fell into the hands of the enemy with such artillery and arms and ammunition as was in them, immensely increasing the Rifis' war material. In July the French Govt. decided to send Marshal Pétain to take supreme command of the French Army, which now numbered over 160,000 men. Marshal Lyautey remained in charge of the political and administrative Government. A month was lost in the reorganisation which this new decision necessitated. Meanwhile immense quantities of material, artillery, mechanical transport, aeroplanes and all the implements of modern warfare arrived on the front.

Franco-Spanish Alliance.—Realising the common danger the French and Spanish Govts. held a conference at Madrid and drew up a programme for combined political and military action in Morocco. Monsieur Painlevé and Gen. Primo de Rivera offered peace to 'Abdel Krim on generous terms. The Rifi leader refused, demanding in return the absolute independence of the Rif. It was agreed at the conference that while the French Army should advance northward from its base the Spaniards should undertake a landing in Alhucemas Bay and thus occupy the region of Ajdir, which formed 'Abdel Krim's headquarters. On Sept. 8 and subsequent days a Spanish Army of 15,000 men was successfully disembarked while, at the same moment, French forces marched northward from their base at Taza, via Kifan. A junction was carried out at Syah between these French columns and Spanish contingents advancing westward from the Melilla district.

There is no doubt that the objective of this combined force was to reach Ajdir by land and join up with the Spanish troops which had been disembarked at Alhucemas, but the autumn rains broke and the united columns found themselves in difficulties. The tracks through this inhospitable country became quickly impassable and there was an imminent risk of isolation. The French troops retired 18 m., and all along the front winter-quarters were prepared. Pétain returned to France and Lyautey resigned. M. Steeg, who had been Minister of Justice and Governor-General of Algeria, was nominated high commissioner.

The active phase of the Franco-Spanish combined action against the Rif came to a close with the advent of winter weather and such French troops as could be spared from the front were sent to more hospitable quarters—Fez, Meknes and Rabat. The campaign had been marked by no incidents of military importance. The French had succeeded at great cost and at considerable loss of life in retaking the districts they had evacuated, but neither security nor tranquillity were assured. The mobility of the Rifis made them largely immune from the results of artillery attack, and long experience in the Spanish zone had taught them how to take cover from aerial bombardment. Their losses were thus comparatively small. The absence of all war impedimenta rendered their mobility most disconcerting to troops educated on the European battlefield. In short the methods employed by the French were in many respects quite unsuitable to this kind of colonial warfare, and the hoped-for results had not been achieved when rain put an end to the autumn campaign. The constant penetration of the French lines by groups of natives who, uniting in the rear, became formidable bands, caused constant anxiety. Convoys and posts were attacked; peaceful country was invaded and farms and villages burnt.

Rifi Activity: Winter 1925.—It had been 'Abdel Krim's desire and intention, by intense propaganda to raise rebellion amongst the Protectorate tribes further south; but although at one moment there were signs of hesitation, and even of disloyalty, amongst some of the nearer Berber tribes, the spirit of rebellion was suppressed almost before it had become apparent. It was a proof of France's admirable administration in Morocco that with the exception of the tribes which inhabited the borderlands of the Rif, and thus fell directly under Rifi influence, the rest Morocco remained loyal.

As soon as the French and Spanish troops, on the breaking the weather, withdrew to winter quarters, 'Abdel Krim bega the reorganisation of his forces. The Spanish disembarkation a Alhucemas was a heavy, but apparently only temporary, blow t his prestige, though it necessitated the abandonment of his vi lage capital of Ajdir. But he was able to withdraw to a place safety within the mountains his artillery and stores of war ma terial. Only a very few of his guns fell into the hands of th Spaniards on their landing. Moving his headquarters to Targis south of Ajdir, he set to work to prepare for a renewal of th campaign. His first action was to obtain a moral revenge for th Spanish landing at Alhucemas, and for this purpose he despatche four cannon to the mountains that overlook Tetuan, the capit of the Spanish zone and the residence of the high commissione

By almost superhuman efforts the Rifis dragged these gu over the rugged mountains to a spot within nine km. of Tetua and set them up in caves situated at least 2,000 ft. above the tow and valley. From this vantage ground they opened on Sept. 28 desultory bombardment of the capital, which was still bein continued in December. The skill with which these guns ha been mounted and could be withdrawn into the caves after ever shot protected them from the fire of the Tetuan batteries. T send an expedition to destroy them was considered unduly costly The moral effect, however, was important and a large number the civil population left the town.

Close of 1925.—In Dec. 1925 the French and Spanish armie were in comfortless and insecure winter quarters, difficult t provision, and very trying to the health of the troops. 'Abd Krim was organising his army in preparation for a continuance attacks upon his enemies during the winter and for a new cam paign in the spring of 1926, which appeared inevitable unles meanwhile a settlement by negotiation could be brought abou

Peace Negotiations: April 1926.—Early in 1926, however, th prestige which 'Abdel Krim had established over the tribes the Rif began to wane and his position was much weakened by th readiness with which various tribes contemplated the cessatio of hostilities. In these circumstances 'Abdel Krim, in the firs days of April, offered to negotiate with the Franco-Spanis Governments. An unofficial armistice came into being, and meeting of French, Spanish and Rifi delegates was arrange for the third week in April. The French and Spanish Govts reached an agreement as to the terms on which they wer prepared to negotiate for peace. (W. B. H.)

On May 30, 'Abdel Krim surrendered unconditionally at Taz to General Boichut, the French commander in Morocco. I a manifesto addressed to the Rifi tribes, M. Steeg said that hi fate would be decided by Mulai Yusef, the Sultan of Morocc The French losses during the campaign were 2,162, exclusive the casualties among native troops.

The close of the Rif campaign left some questions for solutio between France and Spain, and conversations began at once be tween M. Steeg and the Spanish high commissioner, Genera Sanjurjo. Apart from the future of the Rif itself, the two triba federations in the west, in the Djabala and the Chomara remained to be dealt with; even the French zone had not bee fully occupied. (*See* 'ABDEL KRIM.) (ED. *E. B.*)

MORRIS, EDWARD PATRICK MORRIS, 1ST BARON (1859–) Newfoundland statesman, was born at St. John's, Newfound land, May 8 1859. Educated at St. Bonaventure's Colleg and the University of Ottawa; in 1884 he was admitted a solicitor and in 1885 was called to the bar. The same year he was electe to the legislature of Newfoundland as the representative of St John's in the Liberal interest. From 1890 to 1895 he was actin attorney-general for Newfoundland, and from 1893 to 1906 wa a director of the Newfoundland Savings Bank. In 1898 Morri left the Liberal party and was leader, first of the Independen Liberals and later of the People's party (1908–19). In 1902 h became attorney-general and subsequently Minister for Justic He was knighted in 1904. In 1909 he became Prime Minister retaining this office until 1918, and representing Newfoundlan at various Imperial and other conferences. In 1913 he was made K.C.M.G., and in 1917 was a member of the Imperial War Conference. He was raised to the peerage in 1918, having been since 1911 a member of the Privy Council. Lord Morris edited an edition of the Newfoundland law reports from 1820 to 1905, usually called *Morris's Reports*.

MORRISON, GEORGE ERNEST (1862–1920), British journalist and traveller, was born at Geelong, Australia, and educated at Melbourne University. From 1882 he travelled extensively in the South Sea Islands, where he studied the Kanaka labour question; in Australia, which he crossed on foot from the Gulf of Carpentaria to Melbourne; and in New Guinea. He took his M.D. degree in 1887 and after journeys to the United States and the West Indies he worked in his medical capacity in Spain, Morocco and Australia. In 1893 he abandoned medical work and set off on extensive travels in the Far East. In 1895 he was special correspondent of *The Times* (London) in Siam and two years later became Peking correspondent of the same journal. In this capacity he visited every province and dependency in the Empire, with he exception of Tibet, and gained an intimate knowledge of men and affairs. In 1911 at the outset of the revolutionary movement n China he proclaimed his sympathy for the programme of Dr. Sun Yat-sen and the Cantonese Radicals. In 1912 after the abdiation of the Emperor he resigned his *Times* appointment and became political adviser to Yuan Shih-K'ai, president of the newly formed Chinese Republic. Dr. Morrison's published works include *An Australian in China* (1895). He died at Sidmouth, Devonshire, May 30 1920.

MORTON, LEVI PARSONS (1824–1920), American banker nd politician (*see* 18.882), died at Rhinebeck, N.Y., May 16 920.

MOSBY, JOHN SINGLETON (1833–1916), American soldier *see* 18.890), died in Washington, D.C., May 30 1916.

MOSCOW (*see*. 18.891), the capital of the Union of Socialist oviet Republics, called by the Russians Moskva, had in 1925 a opulation of 1,845,000. The great increase in population was ue to the transfer of the seat of government from Petrograd to Moscow after the Revolution. It fell during the famine period, ut increased by 716,000 from 1920 to 1924 owing to the return f many who had left the city and to the increase in the number of fficials and of traders. The natural increase (the excess of irths over deaths) is about 25,000 per annum. The records howed in 1925 270,000 persons engaged in government offices, chools, trade unions and co-operative organisations, etc., 35,000 mployees in private trading concerns, 150,000 factory and mill orkers, and about 37,000 home craft workers.

The great influx of population created a serious and dangerous ousing situation, intensified by the circumstances of the famine eriod when many wooden houses were destroyed for use as fuel, nd by the cessation of building and of ordinary repairs. In 920–1 25% of the already inadequate houses were derelict. uarters were requisitioned, and the great apartment houses of ntral Moscow were run by house committees which allotted oor space to occupants, charging only the costs of repairs, lightg, cleaning, etc. The New Economic Policy was followed by a turn to a more normal rent system. Houses were put in order, avements restored, and a considerable amount of new buildings as put in hand in 1923 and 1924. In 1912, with a population of 618,000 Moscow had 281,500 apartments; in 1925, with a poption nearing 2,000,000 she had 200,000 apartments. The presre of population led the Soviet Govt. to transfer certain comissariats to Leningrad in 1925. The streets of Moscow, diating from a common centre, have an excellent tramway sysm which makes the suburbs easily accessible; in 1925 a certain mber of English motor-buses were running. The tramways rried 394,000,000 passengers in 1925 as against 257,000,000 in 13. Part of the suburban train service is in process of electrifition. Power is supplied to Moscow from a power station burng the soft coal of the Moscow district. A new electric power tion, the largest in the U.S.S.R., which burns peat fuel, has en erected at a cost of 28,000,000 rubles, and began to supply wer to the Moscow industries in 1926. The principal industries of Moscow, textiles, engineering, food, had not recovered their pre-War output in 1925.

Moscow has always been an important trade centre, and its position in the home market became steadily more important after the establishment of the headquarters of the various state trusts in the city. The Moscow Goods Exchange, established by the Trade Commissariat registered a turnover of 2,991,000 rubles in 1924–5. It is stated that only 5 or 6% of this is private capital.

Even with the opening of private shops and the repair of streets and buildings Moscow had not recovered its former busy aspect; the general poverty of the people prevented that. Some of the former palaces of the Moscow aristocracy and merchants have been turned over for public purposes, or for the use of foreign legations and missions. Many of the principal streets have been renamed after revolutionary personages. The city still remains an important literary and artistic centre, and the Moscow theatres are still among the first in Europe in the variety and beauty of their productions.

MOSELEY, HENRY GWYN-JEFFREYS (1887–1915), British physicist, was educated at Eton and Trinity College, Oxford. As lecturer in physics in Rutherford's laboratory at Manchester University, and subsequently as John Hartling fellow, he carried out a brilliant series of researches, proving the existence of a simple relationship between the X-ray spectrum of an element and its atomic number, and establishing a new and valuable method of chemical analysis. He was killed in Gallipoli Aug. 10 1915.

MOSLER, HENRY (1841–1920), American artist (*see* 18.898), died at New York City April 21 1920.

MOSUL (Vilayet) (*see* 18.904).—This former vilayet of the Turkish Empire now forms part of 'Iraq. It includes the hivas of Mosul, Arbil, Kirkuk and Sulaimaniya making an area of 35,130 square miles. Its boundaries are Syria on the west, 'Iraq on the south and southwest, Persia on the east and on the north the disputed Brussels Line dividing it from the Bitlis vilayet. As regards the ethnographical details of the population, the estimates provided by a pre-War Turkish census and those compiled by British officials in 1921 differ widely. The total population appears to be roughly 750,000, nine-tenths of the inhabitants being Moslems. In the town of Mosul and the surrounding plain the Arabs are the predominant race; in the mountains, the Kurds. The League of Nations Commission (1925) stated that the district was inhabited by Kurds, Arabs, Christians, Turks, Yezedis and Jews in that order of importance. Upon the corn grown in the plains round Mosul a wide area extending to Lakes Vrumia and Van depends for its sustenance, while the almost impregnable mountain ranges give Mosul a strong strategic position in regard to 'Iraq. The great rivers of 'Iraq have their headwaters in Mosul, and he who is master in Mosul is also master of 'Iraq's most vital necessity, being capable of threatening the safety of the vast oil resources of 'Iraq.

By the Armistice of Mudros, hostilities were suspended between Great Britain and Turkey from midday Oct. 31 1918. Nevertheless on Nov. 3 General Cassels informed the Turkish authorities that he had been ordered to advance beyond the Armistice line and occupy the town of Mosul. This apparent violation of the Armistice terms was subsequently declared to be justified by Article 7 of the Armistice—"dans le cas où il surgirait une situation qui menacerait la sécurité des Alliés, ceux-ci auront le droit d'occuper tout point stratégique." The Turks on the other hand maintained that no such menace existed, and protested strongly against this action on the part of Great Britain. Later on further advances were made by the British forces; on Sept. 30 1924 a provisional frontier, known as the Brussels Line, was proposed by the League of Nations and accepted by both Great Britain and Turkey, pending a final settlement of the dispute. This Brussels Line was at its nearest points no less than 150 km. north of the Armistice frontier. It ran from the Hazil to the Khabur river, then across the mountains north of the valley of the Great Zab and then due east to the Persian frontier. Roughly speaking it runs on the crest of the mountains cut through by the three rivers named.

The question of the vilayet figured prominently in the discussions at the Lausanne Conference. Clause 3 of the Treaty of Lausanne provided that the dispute between Britain and Turkey should be brought before the League of Nations unless settled by agreement within nine months; the Turks had agreed to this on Lord Curzon assuring them that " the decision of the Council, upon which the Turkish Govt. will be represented, will have to be unanimous, so that no decision can be reached without your consent."

Sir Percy Cox carried on fruitless negotiations in Constantinople (May 19–June 15 1924); but the Turks refused to abate their claim to the whole of the former Mosul vilayet. In Aug. the matter came before the League, which appointed a commission to study the question. In Sept. the Turks crossed the provisional frontier and drove some 8,000 Assyrians to take refuge in 'Amadiya where they were supported by the 'Iraq Government. Thereupon at a special meeting in Brussels in Oct. the League defined a provisional frontier, the Brussels Line, which Turkey agreed to accept as a *status quo*. The Commission reached Baghdad in Jan. 1925 and reported in Aug. that the historic right was with Turkey; but suggested that Mosul should be left to Turkey if Britain intended to withdraw from 'Iraq in 1928, but assigned to 'Iraq if Britain was willing to undertake a mandate for 25 years.

Turkey contended that the League could not give a binding decision; the question was referred to the Hague Court, and was still pending when further military movements by the Turks in the neighbourhood of the Brussels Line in Sept. 1925 resulted in the violent deportation into the interior of Turkey of Christians living immediately to the north, and in some cases even to the south of the provisional frontier, while some 3,000 Chaldeans took refuge in a destitute condition in 'Iraq. The League appointed a second Commission to examine the complaints on both sides and report any violations of the frontier.

This report was presented to the League in Dec. and left no doubt as to the harshness with which the refugees had been handled by the Turks. The ruling of the Hague Court—that an arbitral decision was binding—had already been received; but the Turkish delegate refused to accept the decision of the League and withdrew. Turkey, however, renewed her proposal of a plebiscite of the Mosul population, and further offered (1) a four-nation Pact (Britain, Turkey, 'Iraq and Persia) which should guarantee the integrity and independence of 'Iraq, (2) the cession of the valuable Syale basin containing some of the oil-fields of the vilayet and the main sources of 'Iraq's irrigation. In the absence of the Turkish delegate, the League awarded Mosul to 'Iraq under certain conditions which were accepted by the British House of Commons five days later.

The inclusion of Mosul in 'Iraq was finally agreed by the treaty signed on behalf of Great Britain, 'Iraq and Turkey at Angora on June 5 1926. By this treaty Turkey accepted the Brussels line with small modifications as the frontier between Turkey and 'Iraq, the exact line to be determined by a mixed commission an the spot. A pact of security for ten years was agreed between Great Britain, Turkey and 'Iraq. Turkey enjoys a share in the royalties on Mosul oil for a period of 25 years. Subsequently an agreement was reached on the compensation to be paid for Turkish public works in the former vilayet. An exchange of notes following the treaty gave Turkey the option of capitalizing her share of the oil royalties at a present value of £500,000. This was an important event both for politics and oil. (*See* League of Nations.)

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MOSUL (City) (pop. 40,000), capital of the former vilayet of Mosul (*see* 18.904), has acquired importance since the World War. On Nov. 18 1918 (that is, 19 days after the signature of the Mudros Armistice), the city was occupied by British troops.
The advent of the railway, which now reaches a point only som
70 m. distant, Sharqat, will doubtless help to revive the indus
trial prosperity of Mosul, which at present possesses practicall
no industries, not even its once famous manufacture of muslin
deriving its name from the town. The population exhibits a
amazing intermixture of races and creeds; but in the cit
of Mosul the Arabs have a clear preponderance.

Several churches of great architectural interest are foun
amongst those belonging to the various sects, Nestorians
Jacobites, Uniate Chaldeans, Syrians, Catholics (also Uniate
and that strange remnant of the Gnostics, the so-called " Chris
tians of St. John." A promising field for antiquarian researc
lies in the great mound of Nebi Junus, on the opposite bank o
the Tigris, which covers the ruins of Esar-Haddon's palace. Thi
site, hitherto closed to the excavator, may probably be rendere
more accessible under the new Government. The exploratio
of the neighbouring mound of Tell Quoyunjuk produced unde
Layard and others the well-known relics of Sennacherib'
palace now in the British Museum. See H. C. Luke, *Mosul an*
its Minorities (1925).

MOTION PICTURES (*see* 6.374c).—This article will deal, first
with the rise and development of motion pictures, second, wit
the technology of film production and the exhibition of the pic
ture and, third, with the motion pictures as a distinctive forn
of art.

I. HISTORY

While the commercial history of the motion picture cover
only 30 years, beginning in 1894–5, the screen springs from root
which reach into the unrecorded past, with the earliest effort
at the re-creation of events. This effort, guided and controlle
chiefly by the facilities and tools available, led variously to th
evolution of pantomime, sign languages, rituals, drama and lit
eratures. The motion picture, as the complete visual re-creatio
of the desired event, came as soon as adequate materials an
technology were evolved.

Early Investigation of Scientific Principles.—Scientific invest
gation leading up to the motion picture was definitely begun b
Peter Mark Rôget, secretary of the Royal Society of Grea
Britain, who in 1824 investigated the laws of vision with refe
ence to objects in motion. That year he read before the Roya
Society a paper entitled *Persistence of Vision with Regard*
Moving Objects. Several scientifically minded persons were inte
ested, including Sir John Herschel, and among them was evolve
a device consisting of a bit of cardboard bearing a picture of
bird on one side and a cage on the other, so mounted on a strin
that when the card was twirled the bird appeared in the cag

Michael Faraday followed Rôget's observations with a lon
series of experiments. On the Continent Dr. Joseph Antoin
Ferdinand Plateau, at the University of Ghent, and Dr. Simo
Ritter von Stampfer, in Vienna, engaged in experiments on th
persistence of vision. Simultaneously they arrived at an ident
cal device for viewing hand-drawn pictures representing successiv
phases of motion. The pictures were mounted in sequence on th
rim of a disc and were observed through corresponding slits
a parallel disc revolving on the same axis. This was the fir
motion-picture machine. Baron Franz von Uchatius, an Au
trian artillery officer, in 1853 combined the disc device with th
magic lantern and projected the pictures on a screen. Willia
George Horner, of Bristol, England, built a toy on the princip
of Plateau's machine, mounting pictures on the inside of
cylinder in such a manner that they could be inspected throug
slits in the opposite side of the revolving cylinder. In 1860 o
Desvignes improved upon it and patented a similar device.

The Kinematoscope.—In 1860 Coleman Sellers, of Philade
phia, a mechanical engineer, attempted to apply photograph
to the creation of motion-picture effects. He photographed pos
of motion and presented the resulting pictures on the blades
a paddle-wheel device, viewed directly by the eye. This machi
was patented in the United States as the Kinematoscope Fe
5 1861. Louis Arthur Ducos du Hauron, in France, April
1864, filed a patent application which was in effect an almo

complete anticipation of the motion picture. Ducos' ideas were all on paper; he did not achieve material results.

The Phasmatrope.—Henry Renno Heyl, of Philadelphia, on Feb. 5 1870 presented projected photographic pictures, made by the Sellers method of posing the figures for the camera, which still required time exposures. Heyl's machine was called the Phasmatrope. It carried small prints of the successive pictures, transparencies made on glass plates, mounted on the rim of a wheel which presented them, with an intermittent motion, to a beam of light cast by a magic lantern. Heyl used 6 poses, repeated 3 times, giving 18 images, or the equivalent of slightly more than one foot of modern film pictures. Photographic pro- ection had come, but the camera could not yet record rapid motion.

Rapid Motion Photographs.—In 1872 Leland Stanford, a railway magnate of California, determined to investigate the gaits f the horse. He engaged Eadweard Muybridge to endeavour o make photographs recording the postures of the horse in motion. Muybridge's first efforts, made at Sacramento, were nsuccessful, due to the inadequacy of the camera and the photo- raphic materials then available. His labours were interrupted or the time by a domestic tragedy. Meanwhile Stanford, im- atient with the unsatisfactory results, had assigned the photo- raphic problem to John D. Isaacs, a young engineer employed n the technical staff of the Central Pacific Railway. Isaacs con- rived a system using a battery of cameras with shutter controls ctuated by a series of electrical circuits. The shutter mecha- isms were improved and the speed of the photographic emulsions ncreased. His device permitted the making of the first real hotographic records of objects in rapid motion. Exposures as rief as one two-thousandths of a second were made. When Muybridge resumed activity he used the Isaacs' equipment nstalled at Palo Alto. Subsequent writings and tradition have rroneously credited the method and machinery to Muybridge.

Stanford while visiting Paris met Jean Louis Meissonier, the ainter, then engaged in a controversy with French academicians ver the postures of horses in his pictures. Meissonier found ndication in Stanford's photographs from Palo Alto and pre- ailed upon the latter to send Muybridge to France. Meissonier onfronted his critics with these pictures. He also synthesised e appearance of motion by projecting transparencies made om these pictures on a machine similar to the Heyl Phasma- ope. Muybridge renamed the machine the Zoopraxinographo- ope and hastened to Great Britain to deliver lectures. The ame suggests a relation to the similar contemporary machine vented by Émile Reynaud, a French physicist, under the name the Praxinoscope. Reynaud used hand-made pictures.

An era of motion-picture photography on glass plates followed, th slight refinement of methods but no important increase in ope. All motion-picture records, made with series of cameras, hen projected, gave the illusion of the moving object standing ll with the adjacent scenery sweeping past. Wallace Goold evison, of Brooklyn, N.Y., devised a camera which obviated is difficulty by presenting successive plates in one camera, aking all the pictures from a single point of view.

Edison Kinetoscope.—In 1887 Thomas A. Edison, of New rsey, having perfected the phonograph, wished to supplement it th an accessory device which should present an optical record gether with the sound. The first efforts recorded pictures of croscopic size in spirals upon a cylinder, after the manner of e phonograph record. Later strips of film were constructed collodion, and experiments were made with strips of heavy luloid. In Aug. 1889 samples of the first Eastman Kodak n made on a nitro-cellulose base were obtained by Edison. is material resulted in the completion of the motion-picture chine. On Oct. 6 1889 demonstrations of the Edison Kineto- ope were made in the laboratory at West Orange. It was the peep- ow device for viewing the motion pictures recorded by the ison camera, named the kinetograph. The film strips were out 50 ft. in length and an inch in width. Each photographic age occupied one-sixteenth of a foot of this film. Forty-eight posures were made to record each second of action. In the kinetoscope the pictures were viewed by transmitted light through a magnifying lens in the peep-hole of the machine Only one person at a time could view the picture.

The Edison machine was commercially presented to the public for the first time in New York, April 14 1894. Hundreds of these machines were sold in the open market, and they carried the motion picture to the principal capitals of the world. The first motion pictures made at the Edison plant were records of portions of prize-fights, fencing matches, dances and vaudeville skits. The camera was immobile and limited in its range. The pictures could record only about 15 sec. of action.

A demand then arose for a machine which would project the film pictures on a screen, making them available to a large audience. Edison demurred for commercial reasons, believing that screen showings would exhaust the novelty market too rapidly. Meanwhile experimenters in other parts of the world were engaged in the problem of combining the kinetoscope with the magic lantern to produce screen pictures. Edison held dormant the projection efforts of his own laboratories. He failed to patent his motion-picture devices in foreign countries.

The Cinématographe.—Feb. 22 1895, Woodville Latham, father of Otway and Gray Latham, kinetoscope exhibitors, demonstrated a projector using a kinetoscopic film in New York City. The device was highly imperfect and was given prematurely to the public, May 20 1895. A better projector known as the *Cinématographe* was produced by Louis and Auguste Lumière, photographic manufacturers, of Lyons, France, who were inspired by an Edison kinetoscope exhibition in Paris. They took out a French patent Feb. 13 1895, and demonstrated their machine March 22 1895 in Lyons.

The Modern Projector.—In June 1895 Thomas Armat of Washington, with whom C. Francis Jenkins was for a time associated as an experimenter, arrived at the principle of the modern projector, a device in which the film, moving intermittently, has periods of rest and illumination in large excess of the period of movement from image to image. This machine was shown to the public first in Sept. 1895 at the Cotton States Exposition at Atlanta, Georgia. In London, Robert W. Paul, maker of scientific instruments, was called upon to make duplicates of imported Edison kinetoscopes, and in sequel made a camera early in 1895 to supply the machines with film. In Feb. 1896 he demonstrated a projection machine. Several other projectors of slightly later date and less influence on the development of the art were evolved, resulting in an endless conflict of claims of priority. The new projection machines introduced the screen motion picture largely through the vaudeville theatres beginning in London and New York, and by lecture and demonstration tours in which the Lumières were especially active. The motion picture was still only a novelty.

In the autumn of 1897 the young industry in America was thrown into a complex and violent war of litigations over patents, which continued for a decade. In Europe the art long suffered disfavour as a result of the Charity Bazaar fire in Paris, May 4 1897, in which 180 French notables died. The fire was traced to the motion-picture machine.

Improvement of Films.—Films gradually attained greater length than the 50 ft. of the peep-show subjects. March 17 1897, Enoch J. Rector exposed 11,000 ft. of film photographing the Corbett-Fitzsimmons fight at Carson City, Nevada. In the autumn of that year Rich G. Hollaman, of Eden Musee in New York, staged a version of the "Passion Play" on a roof and pictured it in about 3,000 feet. Important elements of camera technique were evolved in the pictures of feats of magic made by George Melies of the Theatre Robert Houdin in Paris, involving expedients of double exposure, fade-outs, dissolves and other now familiar optical effects used in photoplay construction.

In 1903 Edwin S. Porter of the Edison studios in New York produced "The Great Train Robbery," about 800 ft. in length, which, with some latitude of interpretation, may be considered the parent photodrama. In this picture the screen achieved narration. It produced a sensation in the yet small world of the motion picture. Many similar screen narratives followed, known to the trade as “ story pictures ” to differentiate them from the mere record and novelty pictures of the earlier period.

The Nickelodeons.—“ Story pictures ” resulted quickly in the rise of the motion-picture theatre. Sporadic efforts at the operation of theatres devoted solely to the screen had appeared for several years. In Nov. 1905 Harry Davis of Pittsburgh, real-estate operator and proprietor of a stage theatre, opened a five-cent show in that city with “ The Great Train Robbery ” as the first programme. It was tremendously profitable and a wave of five-cent theatres, commonly called “ nickelodeons,” swept over the United States, with the foci of development in the polyglottic foreign labour centres of the manufacturing zones, where the universal language and art of the screen found its most eager and abundant market.

Increased demand from the screen theatres forced the picture-makers to the erection of large studios and the organisation of stock companies of actors to enable an increased output and steady flow of film. Commercial expediency resulted in a truce in the patent wars and the ultimate formation of the Motion Picture Patents Co. in New York, Dec. 18 1908. It was in effect a cross-licensing system, and included all American producers.

The standard motion picture of the period was a sensational action story of one reel in length. Pictures were rented to theatres on a quantity and age basis, a normal programme being about 28 reels a week supplying a daily change of programme of four reels.

Censorship.—The motion picture early began to encounter censorship restrictions. In 1895 the police of Atlantic City, New Jersey, forbade the exhibition of a film showing a dance, brought to the United States from Cairo. Occasional local agitations occurred in later years. In 1907 national attention was attracted to the matter, and in Nov. of that year Chicago put motion pictures under police censorship control. In New York in the same period the Children's Society prosecuted exhibitors for showing pictures of “ The Great Thaw Trial ” to audiences of young children. In Dec. 1908 New York's motion-picture theatres were ordered to be closed pending an inquiry by the mayor, with subsequent injunction litigation. The result of this controversy was a licensing system and the establishment of the National Board of Censorship by Charles Sprague Smith and others of the People's Institute, a disinterested civic organisation. This censorship body continues, in unofficial status, as the National Board of Review of Motion Pictures, to which the picture-makers voluntarily submit their films. Beginning in 1911 with Pennsylvania, a number of American states, including Kansas, Ohio, Maryland and New York, passed motion-picture censorship laws. As a sequel to the defeat of James Jeffries for the heavyweight championship of the world by John Arthur Johnson, a negro, at Reno, Nev., July 4 1910, the Sims Bill forbidding interstate traffic in prize-fight films was enacted by Congress in 1912.

Sweden established a national censorship in 1911, Spain in 1912, Italy in 1913–4 and France in 1916. Russia and Japan exercise film censorships. Canada has various provincial censorships. In Great Britain the Cinematograph Exhibitors' Assn. established a censorship, with the approval of the Home Secretary, following the Cinematograph Act of 1909 which put screen theatres under licence, and in 1920 made submission of pictures to the Board of Censors compulsory for members.

The direct influence of censorships upon motion pictures has been on the whole slight as compared with the extent of the agitation. As internal standards of the art have improved, censorship movements have tended to lose vigour.

Development of Stage-craft.—In 1908 D. W. Griffith, an actor from the stage, entered the service of the American Biograph Co. in New York, as a writer of scenarios, and in the ensuing four years had an important influence in the development of the art of screen narration. He wove the facilities of the camera and its effects of manipulation, such as close-ups, dissolves, fadeouts and the like, into the syntax of screen story-telling. In 1909 Gladys Smith, a child actress from the melodrama stage, now known as Mary Pickford, was employed by Griffith.

By 1911 a tendency to increase the scope of the picture beyond its orthodox one-reel length of 1,000 ft. began to appear, notab through the importation of some pretentious European effort among them Homer's “ Odyssey ” and “ The Fall of Troy A kindred American effort was made with a like saga in “ T Life of Buffalo Bill,” pictured in three reels. In 1912 Adol Zukor, a New York motion-picture exhibitor, in alliance wi Edwin S. Porter, Daniel Frohman and others, imported “ Que Elizabeth,” a four-reel picture with Sarah Bernhardt in the tit rôle. This picture, made by Louis Mercanton of Paris, was t forerunner of a new era of longer and more pretentious multip reel dramas, known in the trade as “ features,” to differentia them from the one-reel programme pictures of the nickelodeon George Kleine, a member of the Patents Co. group, in th period imported and exploited with sensational success Italian production of “ Quo Vadis.” In the next few years t “ feature ” movement remade the screen industry and increase the screen audience. The motion picture now became a re competitor of the drama of the stage.

Picture Theatres.—The first large and pretentious screen the tres arose in California and Australia because there the film a shipped in a can, could overcome the obstacles of geographic remoteness. In 1914 with the opening of the Strand Theatr on Broadway in New York, a new order of film presentation a showmanship appeared. Late in 1913 Charles Spencer Chapli a British actor and pantomimist, was employed in Californ for Keystone comedies under the direction of Michael Sinnot better known as Mack Sennett, founder of the slapstick scho of screen comedy. Chaplin's extraordinary ability made hi world-famous within a few months. In 1916 he was employed John R. Freuler of the Mutual Film Corp. at $670,000 a yea Chaplin with other major stars, including Miss Pickford a Douglas Fairbanks, outgrew pay-rolls and presently becan independent producers. D. W. Griffith in 1915 presented “ T Birth of a Nation,” a tale of the American South of Reconstru tion days, based on *The Clansman*, a novel by the Rev. Thoma Dixon, and again a new standard of screen narration and spect cle presentation was set.

American Dominance.—The cessation of production activiti in Great Britain and on the continent of Europe resulting fro the outbreak of the World War left the screen art and indust almost entirely to America, where it developed intensively wi an increasingly War-prosperous public. The post-Armisti period found the American film industry with a 90% dominati of the world market, with the corporation interests of the indu try extending themselves in terms of theatre control in the mo important foreign fields, including France, Germany, Englar and the Far East.

The prestige value acquired by pictures shown in the metr politan theatres of the Strand type early led the picture-make to the acquisition of theatres for “ Broadway first runs,” exten ing presently into key cities in all parts of the United State Competitive results led in turn to the acquisition of chains theatres, pooling booking power and taking box-office profi direct. This development found its most marked expression the formation of Public Theatres, Inc., in New York, a federati of the theatre interests of Balaban & Katz of Chicago and tho of the Famous Players-Lasky Corporation, headed by Adol Zukor, which is credited with control of approximately 800 th atres in the United States. The motion-picture industry, li other industries, as a whole tends toward vertical trust form tions, beginning with the plays and novels and ending with t screen and theatre box office. A group of three major corpor tions dominates the world industry.

Organisation of Trade Interests.—The early era of violent co petition found those engaged in the industry slow to recogni a common interest. The first efforts in this direction were e pressed in the formation of the Motion Picture Board of Tra in New York in 1915, followed two years later by the Nation Assn. of the Motion Picture Industry; this soon lost pow within the industry and status with the public. Growing abus of the trade, involving credits and contracts, salacious produ tions, destructive competitive selling and the like, together wi a series of disastrous scandals involving allegations of grave misconduct on the part of important screen figures and executives, led at last to the formation (March 5 1922) of the Motion Picture Producers and Distributors of America, Inc., headed by Will H. Hays, who resigned as Postmaster-General of the United States to take the post. The Hays organisation is in effect a trade association with broad powers which affect merchandising practice, selection of photoplay subjects, international trade policies and public relations in general, with special attention to problems of taxation and censorship. Its activities have exerted a marked effect in improving the status of the motion picture in the public mind and the clarification of internal problems. A minority organisation, opposed to the Hays organisation, was formed under the name of the Independent Motion Picture Assn. of America with I. E. Chadwick as president.

Economic Effects.—A new international phase of the motion picture began to be apparent in 1925 with the discovery that American control of the screen with its presentation of the fashions and equipments of American life was exerting an important influence on world trade in fields as varied as the adoption of American shoes in France and American motor-cars in Java. Various national agitations followed, marked by parliamentary debates and proposals for embargoes, tariffs and ratio laws governing importation of the American screen product, all calculated to encourage indigenous screen industries. Great Britain, Germany, France and Italy, were the countries most concerned.

To meet this condition American producing interests showed a tendency to internationalise their productions both by the importation of foreign stars and directors and by the making of pictures for the world with American stars working on foreign locations. It was planned in this way to evade the quota and ratio restrictions in other countries, while still retaining the American market. With this development a readjustment of picture values began. From the beginning of the World War, for a period of nearly 10 years it was the accepted basis of film calculations that the United States market represented 80% of the value of a picture. With the economic readustments of Europe a new world-market for the screen developed with the prospect that the foreign rights of a picture might ultimately equal the domestic American value.

Trade Figures.—In 1925 it was estimated that there were in he whole world 50,000 screen theatres, of which 20,000 were in he United States. Statistics prepared under the auspices of the Hays organisation gave, 1924:—

Total number of persons permanently employed	300,000
Average number of feature pictures produced yearly	700
Admissions paid annually at theatres	$500,000,000
Salaries and wages at studios, annually	75,000,000
Annual advertising expenditure in newspapers and magazines	5,000,000
Expenditure for posters, photos and like accessories of advertising	7,000,000

Few foreign productions have proved successful in the Amerian market. In 1922 a total of 425 foreign features were offered he American trade, but only six were accepted. The American uccess of a European film has always been followed immediately y American acquisition of the star and director concerned, as n the adoption of Pola Negri as an American star following her uccess in the German-made film "Du Barry," retitled "Pason" in the United States.

A steady increase in the working life of motion pictures has haracterised the evolution of the art, from the days of the nickeldeon theatres, with their programmes of single-reel pictures hanged daily, to the feature period where in typical theatres in rge centres week runs and more were given to a single picture. n the nickelodeon period films were sold according to their age, epreciating in value day by day for 30 days, after which they ere classed as "commercial" and rented at as low as 50 cents reel a day. Under present conditions theatre runs are often r months, and the working life of a picture may continue several ears. "The Birth of a Nation" continues with an earning ower more than 10 years after initial presentation.

Present Policy.—Production policy, long dominated by nickelodeon influences, tends away from programme or volume production toward the treatment of each picture as an individual enterprise, separately produced and individually exploited, first as a "road show" following metropolitan presentations in New York, London and Paris, after the pattern of stage-play practice, with subsequent "release" for general distribution to screen theatres, as in the instances of "The Covered Wagon" and "The Ten Commandments."

The motion picture which began in 1894 as peep-shows in films 50 ft. long costing $25 each has reached the length of a full evening's entertainment of perhaps 12,000 ft. of film, with costs ranging into the millions.

Technological Improvements.—Technological developments in the art of the motion picture have added little save refinement to the product since the years of invention. Edison produced so-called talking pictures as early as 1895 with a synchronised peep-show and phonograph. Various devices have appeared periodically since, but with no evidence of public interest. Stereoscopic motion pictures were produced in the first decade of the screen and several systems of producing the steroscopic result have been achieved, all entailing the use of a viewing device which limits the effect and appeal. Coloured motion-picture processes were begun in the Edison plant in 1896 with hand-coloured prints. Various artificial tinting processes have been evolved, the most successful being the Pathé stencil colour method used in France. Natural colour photographic researches for the motion picture were begun in England by Edward Turner, under the patronage of Charles Urban. Turner died in the midst of his labours and the work was carried on by Urban and G. Albert Smith, of Brighton, resulting in kinemacolor, presented in 1910. Kinemacolor pictures used a two-colour process of recording through filters and reproduced by projection through corresponding filters, the process resulting in a screen synthesis of the colours. More recent processes, notably Prizma, evolved by William Van Doren Kelley, and the Technicolor process which now dominates colour work for the screen, translate the camera's colour record into pigments and tones embodied directly in the film, making it available in any standard projection machine.

The use of panchromatised negative film, which is sensitive to a greater range of colour and tonal gradation than ordinary film stock, has markedly increased, thereby improving photographic quality on the screen. Also especially sensitised film reacting only to the infra-red rays of the spectrum became available in 1925, enabling various special manipulations, important among them the production of "night effects" by daylight.

The cost of making motion-picture positives for projection has decreased with lowered cost of raw film and the development of machine-finishing processes replacing costly hand labour until prints in 1926 cost approximately one-half the production price of the early years. An increased use of motion-picture films outside the amusement field for general commercial purposes and in the home tends to follow this development.

Bibliography.—Hopwood, *Living Pictures* (London, 1915), origins and mechanical aspects; Talbot, *Moving Pictures* (Philadelphia, 1923), with special attention to camera technique; Croy, *How Motion Pictures Are Made* (New York, 1918), historical and technical, with anecdotes; Griffith, *When the Movies were Young* (New York, 1925); Ramsaye, *A Million and One Nights* (2 vol., New York, 1926), and "The Romantic History of the Motion Picture," *Photoplay Magazine*, April 1922–March 1925. (T. R.)

II. TECHNOLOGY

Motion-picture work is technically a branch of photography. The general principles which cover the production of photographic images therefore apply to it, and the article on Photography should be consulted. The manufacture of the film is dealt with under Photography.

The Film.—The film is supplied in rolls 35 mm. (1·38 in.) wide and 200–400 ft. long in the case of the negative films, which is used in cameras. The positive film, on which the prints are made, is frequently supplied in rolls 1,000 ft. in length in order to diminish the necessity for making joins. Negative film is generally supplied in two speeds, known as *Par-speed* and *Super-speed*, while a variety, sensitised by means of dyes, is known as *panchromatic* film. On the edge of the film are perforations by means of which it is moved through the apparatus, and the exact dimensions of the film and of the perforations are very carefully standardised. Fig. 1 shows the standards adopted by the American Society of Motion Picture Engineers.

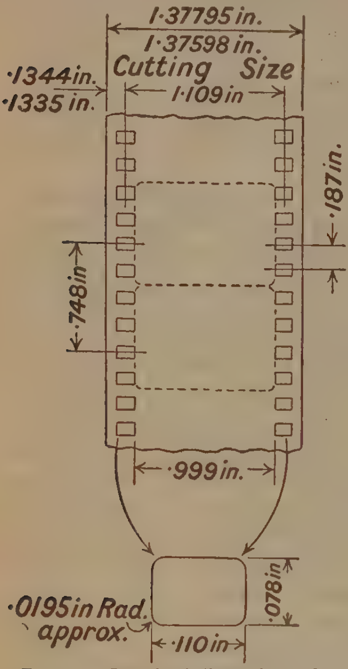

FIG. 1.—Standard dimensions of 35 mm. film. Specifications, with tolerances, allowed for cutting and perforating standard motion picture positive film.

The Camera.—The motion-picture camera (fig. 2) is arranged to move the film step by step through the *gate*, in which it is exposed to the light coming through the lens, the intermittent movement being accomplished usually by means of a claw, which is operated by a cam. The commonest form uses a triangular cam known as the *Lumière* cam because of its introduction by A. and L. Lumière of Lyons, France. By means of a sprocket, the film is fed continuously from the magazine in which it is held to the claw, and after passage through the gate is wound on to another magazine by the same or a second sprocket. Between the lens and the gate there is fitted a rotating shutter which protects the film from the light while it is being pulled down by the claw and then exposes it while it is stationary.

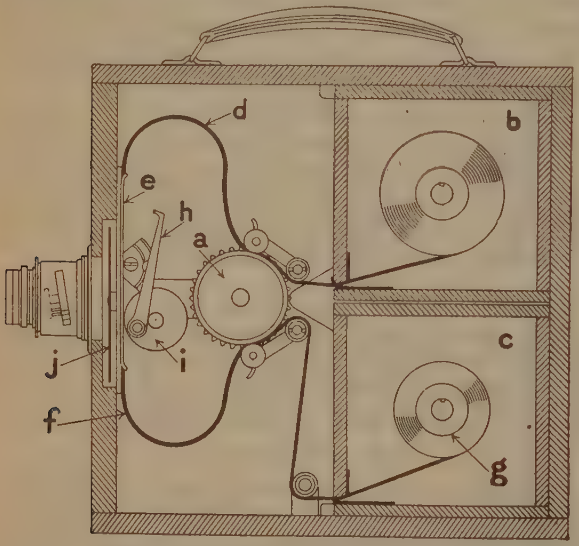

FIG. 2.—Diagram of motion picture camera, and Lumière cam. *a.* sprocket; *b.* upper film magazine. *c.* take-up magazine; *d.* unwind loop; *e.* film gate; *f.* lower loop; *g.* take-up (driven by belt); *h.* pull down claw; *i.* crank (operating pull down claw); *j.* shutter.

Lenses.—The lenses used on motion-picture cameras are of short focus and large aperture, the general focal length being 50 mm. (1·97 in.), with a relative aperture of f/3·5. Not infrequently apertures approximating f/2 are used. The operator ca thus control his exposure by adjusting both the opening of th shutter and the aperture of the lens. By using these lenses th pictures are taken at a uniform speed of 16 pictures a secon so that if the shutter opening is 180°, the exposure of each fram is $\frac{1}{32}$ of a second.

Development.—After exposure the negative film is develope each scene being usually treated separately so that the best po sible results can be obtained. It is customary to cut a shor length from the end of the scene, which is purposely made to long, and to develop this by trial. The film is then wound on rack and developed for the time which has been found bes In this way exposures corresponding to different contrasts i the subject may be developed to give uniform negatives. Th racks on which the film is developed are of the type shown i fig. 3. The development is carried out in deep tanks, the film being moved carefully in order to reduce possible marks to minimum and prevent air bubbles remaining on the film. Th fixing, washing and drying of the negatives are carried on wit the greatest care, since they are extremely valuable owing t the cost of the production and must be preserved for man years. It is usual to use two cameras for each scene.

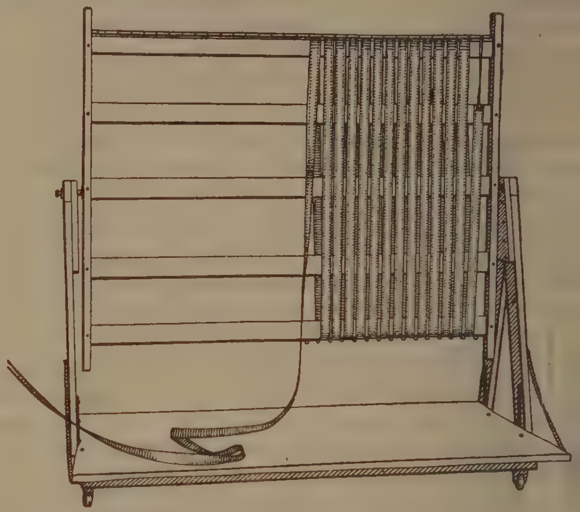

FIG. 3.—Developing racks. Wooden rack with the film being woun on it between the separator pins.

Printing.—After development a first print is made from the negative. These first prints, known as *rushes*, are viewed as soon as possible so that any scenes that have to be remedied can be retaken at once. The negatives are then assembled and a first print is made which is passed over to the producing company to be *cut* and assembled in a form corresponding to the finished picture.

The printing of the negative is performed on a printer which may take one of two forms: in one, the two films are moved intermittently through a gate just as in the camera, the positive film being printed through the negative by means of

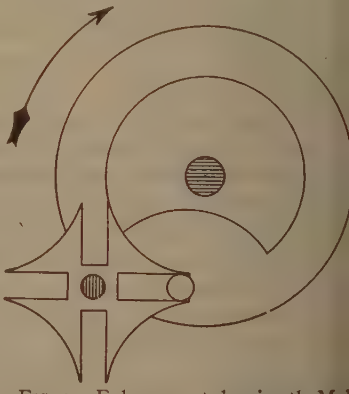

FIG. 4.—Enlargement showing the Mal tese cross movement. The continuousl moving wheel pulls the cross through 90 when the pin on the wheel enters the slo on the cross. The cross is attached to sprocket, over which the film passes and as this sprocket moves intermittent ly it pulls the film down in the gate.

light which is cut off by a shutter while the films are being moved. In the other form of printer, the negative and print are moved continuously past a narrow opening and are printed in contact while moving. In both forms it is necessary that the intensity of the printing light should be modified from scene to scene according to the density of the negative. To effect this, a chart is made showing the exposures which it is necessary to give to each scene, and the negative is notched so that as the notches come into place in the gate they will operate a contact mechanism which, acting through a solenoid system, will change the intensity of the printing lamp. Sometimes these changes are produced by the operator.

Automatic Development.—The positive film can be developed in the same way as the negative, being wound on racks for this purpose, but in modern practice it is more usual to develop it on an automatic machine, of which there are several types. In one the film passes through a number of tubes in which it travels from the top to the bottom and then up again, tubes being assigned in succession to the operations of developing, fixing, rinsing and washing, after which the film passes through a drying cabinet, from which it emerges ready for projection. In another form of continuous machine, tanks are used in place of the tubes, the film travelling in a spiral through the tanks. These continuous machines have a great capacity, it being quite usual for a machine to process as much as 20,000 ft. a day. Machines are generally erected in batteries.

After processing, the film is usually treated with wax or other lubricant to facilitate its passage through the projector. Much of the film used is made upon tinted base, the colour being applied to the base during its manufacture. This use of tinted base has supplanted the older method of dyeing the finished print, partly because it was difficult to apply the dye evenly and partly because many of the dyes used made the gelatine brittle. Not infrequently also the image is toned by different processes, so that by a combination of tinting and toning very pleasing results can be obtained upon the screen. A small proportion of film is coloured either by hand or by the use of stencilling machines, while a growing amount is produced by the processes of natural colour photography (*see* PHOTOGRAPHY).

Projection Machines.—The projection machines are essentially of the same type as the camera; that is, they evolve an intermittent movement of the film during which the light is cut off by a shutter, but this intermittent movement is usually accomplished by means of what is known as the Maltese cross or Geneva movement (fig. 4). This moves intermittently when the operating wheel carrying the pin which enters the cross is moved continuously, and the movement has the advantage over the claw and cam system that it is very robust and can be made to work immersed in oil. The shutter has three blades, only one of which is used to cut off the light during movement of the film, the other two interrupting the light while the film is still and thus diminishing the flicker seen on the screen.

Sources of Light.—The light sources used for projection are chiefly arc lamps. In modern theatres either high intensity arcs having carbons loaded with chemicals are used or mirror arcs in which the crater of the arc is turned away from the gate and the light from it is thrown forward by a large concave reflector. For projection at a short distance or with small screens good results are obtained by the use of high intensity incandescent lamps. The projectors are installed in a special projection-room fitted with ports through which the light beams are thrown and with arrangements for protection against fire. A great deal of work has been done on continuous projectors in which the film moves through the gate continuously and the image is kept stationary upon the screen by means of some optical system of rectification, such as a rotating ring of lenses which compensate for the movement of the film or a prism or mirror which holds the image still. These machines have not come into general use though some of them appear to be satisfactory mechanically.

After projection the film must be rewound and should be examined carefully and all damaged portions or weak places repaired. (C. E. K. M.)

III. THE MOTION PICTURE AS ART

From a toy, the motion picture developed into an industry in accordance with two major principles: the scientific, leading to perfection of the instrument; and the commercial, tending to the maximum of financial return in the shortest possible time. There was little energy to spare for the consideration of the third, the aesthetic, principle. The two preceding divisions of this survey have discussed those phases of the motion picture which created it and made it popular. It is the function of this third section to deal more with possibilities than with actualities; what the motion picture can become, artistically, being of far greater significance than what it is.

Natural Potentiality.—A logical critic, observing the machinery in complete ignorance of its history, would say that the name itself, especially in the common form of "moving pictures," told nearly the whole story; a camera taking pictures and a projector giving to those pictures the sense of action—movement governed by light. Assuming that the result was to be an art, this critic would hold essential the independence of the motion picture; just as music cannot always be "incidental music" or painting only illustration, the motion picture would have to develop a separate existence, drawing inspiration, perhaps, from the other arts, but fundamentally independent. It would share with painting its communication through the eye; with sculpture its power to create forms; with the dance the interest of movement. These three relations, it is understood, derive from the nature of the instrument rather than from any use to which the instrument may be put; they do not imply that the motion picture must be sculptural, pictorial or choreographic; only that it may be all of these without violence to its inner nature. They do imply as the essence of the picture that it must be all visual: the use of light and movement in the creation of visual images is the essence of the motion picture as an art form.

The Value of the "Absolute" Film.—Thirty years after the birth of the motion picture this essence is the goal of a few experimenters, chiefly in France and Germany. Theorists and experts are trying to create the absolute film, as far removed from the commercial film as a fugue of Bach is from "Il Trovatore" or a cubist painting from "The Doctor." The variation in rapidity as groups of inanimate objects or forms are shown in movement is calculated, in these experimental films, to produce a psychological effect; the relations between geometric figures, changing their proportions, fading into and displacing each other—abstract visual effects—intend the same. In the reel made by Fernand Léger and Dudley Murphy (1924) the most effective portion, emotionally, was that showing a woman carrying a burden up hill; at the final moment, as she reached the crest, the scene shifted back again to the bottom of the hill, and this was repeated again and again. There was no suggestion of narrative; the effect was purely kinematographic: but it was notable that the presence of a human figure more readily evoked emotion than any pure relation of forms. Yet there can be no doubt that the absolute film, abstract to the last degree, like music without melodic interest or like abstract painting, is a legitimate end for the motion picture. It is, in fact, the only goal so far suggested which proposes to utilise the instrument in all of its capacities and does violence to none; it is also the only one which makes proper use of the science, and is unaffected by the industry, of the motion picture.[1]

If between the absolute and the commercial, there should occur a third type, the art film, the absolute film will have the function of annulling the errors made necessary by commercial exploitation, the first error being a misconception of the nature of the instrument itself. The machinery of the motion picture was quite properly accepted as a supremely credible record of the actual; scenes, events, phenomena, were made visible and the screen became an aid to education, an invaluable record of history, and even an instrument of discovery in the natural sciences. It was put into the service of phenomenal truth, and functioned perfectly.

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[1] The abstract film created by Comte Etienne de Beaumont and his collaborators lacked "human interest" entirely, but managed perfectly to convey emotions. Changing shapes, changing speeds, and objects seen out of their normal relations, gave both thrill and beauty to *A quoi rêvent les jeunes fille.* It is notable that these, the advance guard of films in one direction, are psychologically very close to the early melodrama; so more obviously is "Caligari." Speed is substituted for pursuit, and so on, the abstract for the specific, but the appeal to the eye is essentially the same.

It was only when this service, in all its perfection, was employed in place of the imagination, in the domain of art, that it became a disservice. The motion picture always transposes its material, either mechanically, as a phonograph does, or imaginatively, as an artist does. The impressive fact that the camera could reproduce the actual, led to its use, almost from the start, as an instrument of photographic realism, against creativeness. This was natural in a civilisation devoted largely to mechanical progress and in a country negligent of the imaginative arts; but it neglected a prime value in the instrument itself, to wit, its capacity to transpose, to distort, to displace the object upon which its eye was trained. The motion picture was, in its very beginnings, used by magicians as a new trick, a new way to create " illusion." Almost at once, however, this use was abandoned; the real magic of the picture was suggested—and forgotten.

Persuasiveness, a Prime Quality.—The power of the picture lay in its exceptional persuasiveness. It gave its spectators the primary pleasure wrongly called recognition—the ordinary sense of identifying known things presented without disguise. The actual pleasure of recognition which implies that the artist has rendered, and the spectator penetrated to, an object is one of the qualities we associate with the arts; and these, lacking mechanical perfection, fail, if they ever try, exactly to reproduce the object. The motion-picture machinery comes close to this perfection in reproducing, and the response of the spectator was a natural consequence. " This is so " was followed by " this must be so " when the motion picture took its decisive step and, by false analogy, entered into rivalry and collaboration with the theatre.

The Place of " Story."—In the absolute film, " story " is anathema; in the commercial film it is everything; the art film can only ask that the story be appropriate to the instrument and be rendered entirely by the instrument. When, as early as 1908, the French Academy and the *Comédie française* collaborated for the screen, it was in the sense of filming an actual stage production; later the idea of famous players (stage actors) in famous plays became the basis of the organisation now pre-eminent in the manufacture of commercial films. Materials consecrated by public approval were taken over with almost complete disregard of their suitability to the new medium and the motion picture became an illustrated supplement to novels and plays. Acting, a form of expression adapted to the stage, using gesture in direct relation to the spoken word, was reproduced with slight modification, in the soundless medium of the film. An acted plot became the accepted definition of the moving picture—the fusion of two borrowed elements in a crucible which was itself, if one were aware of it, a magic cauldron.

These acted plots remain in 1926 the chief interest of most producers, although the close relation between stage and screen has been interrupted. The motion picture had so much vitality that in spite of the ignorance of its masters it asserted itself. The famous players (none of whom was a player specifically for the screen) failed and an obscure actress, without developing a real screen technique, yet more naturally adaptable to the screen by reason of her meagre experience of the stage, became a world's favourite: Mary Pickford. At the same time the melodrama, the thriller, the spectacle and the slapstick comedy all succeeded; in a small way the motion picture began to develop its own resources. It is this process which at present holds the greatest promise; and makes one regret that the lapse into association with the stage should so irremediably have left its mark on the motion picture in the form of scenario and acting.

Importance of Movement.—The melodrama and the thriller were important because, whatever their story, they expressed it all in movement, rather than in gesture, facial expression or subtitles. The scenarios were such as needed movement, utilising the screen's capacity to present simultaneous parallel activities, bringing them together in climax. The formula was lacking i adaptability, the material was intellectually contemptible; bu the expression was completely kinematographic, not literary not theatrical. This was true also in the spectacle films. Th difference between the poetic beauties of " Cabiria " (on a scena rio by Gabriele d'Annunzio) and the non-literary, kinemato graphic excellence of " The Birth of a Nation " (which wa adapted with exceptional propriety from a bad novel) is marked In the latter (1915) D. W. Griffith exploited the characteristi quality of the American spectacle film; its use of the melodra matic element of suspense in direct connection with the spectacl itself. The " last minute rescue " has always been well manage by American directors, generally by subdividing it into parts— the victims, the attacker, the rescuers—and alternating thes in scenes of accelerating rhythm. This is " good movie " an distinguishes the American spectacle from the German, whic often handles masses better, creates the sense of multitudes o expanse with none of the gross lavishness of second-rate Ameri can directors, but lacks excitement proportionate to its duratio and scope. The spectacle had little to learn from the stage; fron fiction (specifically from Dickens, if one accept the Griffit version) came alternating sequences, cutbacks and other device for keeping several incidents simultaneously in development.

From the still camera came the close-up, an unhappy devic not only because of its inherent ugliness, but because it definitely breaks the precious continuity of a picture, whereas the othe devices, even the subtitle, only suspend continuity and allow interest to remain cumulative.

Economy and Effect.—It was in the thriller and the melodram that the American moving picture learned also to unroll its plo succinctly. Padding is common enough; but no one comparing the average American and the average European film can fail t note that, when they want to, American directors are able t present their effects with superior conciseness and economy There is also, in American films, an appreciable working up t climax and, their chief virtue, a neatness of execution, in which phrase may be included a multitude of technical devices, cleverness in general methods, discovery of settings which lend themselves to dramatic action, expertness in camera work, absolute clarity of the projected film, ingenuity, inventiveness. Even in their sum these qualities fall short of the meanest artistic stature they are good qualities none the less. They were, or most o them, inherent in the silly Westerns and serials of the picture's earliest day.

The Right Road.—It is the writer's belief that the first halting steps of the motion picture were along the proper, the kinematographic, road from which it has since been diverted, to which it must return, enriched by experience, if it is to have a future. Another early type fortifies this belief: the slapstick. It is no accident that the one figure in the pictures to which some degree of immortality is universally accorded should have come from slapstick: Charlie Chaplin. These comedies, especially in their beginnings, were close to the type of the *commedia dell'arte,* they were almost all improvised before the camera. In them developed a type of playing which was purely kinematographic, and could be related to the stage only by way of American burlesque. Slapstick was remarkable also because it instantly saw the motion picture as a medium for fantasy, grotesque no doubt, but in essence fantastic. The properties of the physical world, all reality, were annihilated by the tricks of the camera for specific comic effect; retarded and accelerated motion, the repertory of the stopped camera, all suspended the mind of the spectator, as a pun might or a paradox, between the intellectual certainty that a thing is impossible and the visual certainty—it is here that the credibility of the camera becomes significant—that it has just happened. The thriller employed what was hazardous or difficult; slapstick brought to the film the impossible and the unreal. Fantasy appeared elsewhere as dream and as fairy-tale, with no impropriety but, except in rare instances (Crainquebille among them), without imagination. In slapstick, fantasy was built out of the elements of common life and flourished with extraordinary imaginative vigour. Whether the material was worthy of this treatment has been debated; to some observers slapstick shows an honest vulgarity far more endearing than the pretentiousness, the intellectual fatuity, the errors of taste, the bad manners of its more serious counterparts in the films.

Dangers of Realism.—The use of indifferent materials in the usual American feature film was made doubly dangerous by the pedestrian realism of the direction. The motion picture seemed in 1920 to be destined forever to photography, to lack all bearing on created art. (It is worth noting that except for scientific purposes the motion picture cannot be exact; absolute fidelity in photographing "He walked six miles before breakfast" would result in unbearable tedium.) Fore-shortening, indirect suggestion, the creation of images capable of evoking the desired emotion—all the processes of the arts must find their counterparts in the films and will be governed, after the ruling direction of the mechanism, by the physiology of the eye, and by the psychology of attention; that is, if the picture is an art in the old sense. There are critics, wholly favourable to the motion picture, who consider that its real future is in developing outside of the sphere of the fine arts and in conscious hostility to their precepts. The break in 1920 came with the exportation of a German film, the famous "Cabinet of Doctor Caligari."

Without immediate effect on public or producers, this film is memorable because of its effect on the critics; it may be said that "Caligari" created motion-picture criticism in England and America. French critics hold it in low esteem because of its elaborate scenario; yet even they allow its chief virtues: that it worked chiefly through the camera (although the subtitles in the American presentation were lengthy and frequent) and broke entirely with realism on the screen. The change was marked by the use of cubist and expressionist settings in place of actual built or discovered "locations." The settings were psychologically correct for the story; the picture was perfect in the moments when its chief players, Conrad Veidt and Werner Kraus, so played before the distorted backgrounds as to give the whole picture a logical, complete, acceptable rhythm of its own, a life of its own, recognisable not as reality, but as a possible reality, an escape from or transposition of reality. "Caligari" was notable because it was artistically right in showing that the picture was most effective when it was not photographic; it was psychologically right because it brought the imagination of the spectator into play. It has been shown in Europe for six years (and finally made into play); it is in no sense a failure. That it failed in America may be ascribed, by critics hostile to the naturalistic film, to the stultification of popular taste in the preceding 10 years of the film's wanderings on the wrong road. "Caligari" means that the motion picture must be created, not photographed; painted backgrounds are incidental.

Five years later another German film, superficially less striking, claimed universal attention: "The Last Laugh" ("The Last Man" is another name for it). Films without subtitles had appeared before; the distinction of this one was that everything the picture had to say, and it said some subtle things, was said by means of the camera. What is more, the correlation of scenes was perfect, the separate sequences held together, and needed no connection or explanation. The American director, aware of American distaste for long series of pictures without subtitles, is prone to let his story hang loosely, trusting to its titles to draw it together. The slower-moving Scandinavian and German films are closely knitted in the sequences of the picture and can give psychological explanations which the faster American films skip or explain in words.

Importance of Imagination.—The artistic film will be characterised by imagination and will express itself visually, *i.e.*, through the camera. Ingenuity has already used the camera, notably in the excellent trick films presented for the trick alone; the news pictures have also learned kinematographic methods well. Creation has lagged behind, partly because there have been so many temporarily acceptable substitutes. The imaginative communication of emotions in "The Last Laugh" may prove a failure; but a few thousand dollars invested in a railway wreck is likely to make a picture a success. The director, at present the most interesting figure in the motion picture, has always known this. The future of the picture depends upon his capacity to free himself from tricks, from detailed scenarios, bad acting, "screen personalities" and other misfortunes. More, it depends upon his intelligence to see that the completed film must be a unit, not a series of separate scenes which a scenario-writer has invented and an editor-cutter will piece together for a title-writer to render reasonable as a plot. The motion picture conceived as a unit will have internal growth, development, rhythm; the relation between its parts and between the durations of its parts will have purpose; the bearing of the parts on the whole will be effective; the picture will have both style and form. At present few directors have manners so definite that their work can be identified without recourse to their tricks. Actual style, a personal way of expressing something experienced or observed, is almost entirely lacking, and that a picture as a whole should have form is a heresy still unheard in Hollywood.

Style and Form.—The future of the picture as an art depends, nevertheless, on the growth of elements of style and form, such as, with natural differences, distinguish the other arts: economy of means, sobriety, seriousness of purpose—all the other tests for an artistic creation are certain to vary with the individual artist, but the moving picture will not begin to be an art until it is conceived as the communication of a precise emotion or experience (communication by a group of artists or by a director through a group of interpreters of his vision). The expression of such a personal vision in a highly personal style distinguishes Chaplin as actor; a bluntness of perception, an imperfect sense of form, make him less than supreme as a director. But one looks vainly elsewhere for more than the beginnings of his qualities. Perhaps a half-dozen directors in America, twice as many in all Europe, seem at moments to approach the question of the motion picture as an art, but none offers a solution to it.

Except for striving for the film which shall have the illusion of depth, science seems satisfied with the motion picture. (The twin mistakes—the film synchronised with a talking-machine and the colour-film—may be perfected; but as each relieves the director of an obligation, instead of compelling him to fulfil one, they are not necessary developments of the film as art.) At the same time, the film as commerce may become stabilised; the pioneer days when companies were hastily organised to make the most of a nine days' wonder are over. With these two effective agencies reduced to secondary places, the moving picture as an art may flourish. So long as it remains a popular art, it will require novelty. Its greatest novelty, at the moment, must be an artistic one. (G. SE.)

MOTORING.—From 1910 onwards the development of all types of motor vehicles was wonderfully rapid. In 1911–2 the charabanc, the motor omnibus and the smaller passenger and goods van, used in town and country alike, began to make an impression on the travelling public of Great Britain, and though before the outbreak of the World War such traffic was of small dimensions compared with its present volume, the tramways and railways had already begun to feel the competition. The public at once showed its preference for the new method of locomotion, and students of transport admitted that free-wheeled vehicles, flexible in traffic, able to put passengers down on the pavement and not in the middle of the road, less noisy and more comfortable, more convenient and cheaper, would become formidable rivals to transport on rails. The railway companies were at first contemptuous of the new competition, but year by year not only were more and more passengers travelling by road, but much of the short distance goods traffic began to leave the railway. Between large centres of population not more than a few miles apart, such as the numerous large towns existing in the north of England, and between London and its immense suburbs, the public found it cheaper as well as quicker to go by road rather than by rail to their daily work.

In 1910–1 the dust nuisance became really acute throughout the United Kingdom. The main roads, which had been repaired for years with friable stone or dusty gravel, broke up under the increasing strain of traffic, resulting in muddy surfaces in winter and much dust in summer. Roadside dwellers, who complained with reason, had a real grievance in that they had to keep their windows shut most of the day, while their food was liable to become gritty and their children were smothered in dust while playing by the roadside or in the cottage gardens. The Road Board, first established in 1910 in accordance with the Budget of 1909, devoted its first efforts to making roads dustless, and a year or two later much of the mileage of the main roads near or in towns and villages had been tarred or bituminised. Various local authorities all over Great Britain began to send in applications for grants for making roads dustless and for special purposes. By the Act of Parliament establishing the Road Board the money raised from motor-car taxation was to be allocated solely to improvements, and it was specially stipulated that no ordinary maintenance was to be considered. The Road Board's revenue for the first year was estimated at £750,000. Sixteen years later (1926–7) the revenue from motor vehicles was estimated at £21,600,000, and it is likely that even this huge sum will be exceeded every year for many years to come, though there are already nearly 2,000,000 motor vehicles on the roads, and 2,250,000 driving licences issued.

Improvements in Design.—In the motor-car trade, the years 1911 and 1912 were memorable for the beginning of the "American invasion." As the American cars were cheap in virtue of mass production and the elimination of every needless part, and were fitted with new and attractive devices in the shape of dashboard fittings, screens, self-starters, etc., they rightly scored a success in Great Britain and all over Europe. They taught British makers a much needed lesson, and stimulated the brains of British inventors, designers and constructors. In the earliest days of motoring covered cars did not exist, but a tendency towards closed instead of open bodies soon developed, and became more pronounced year by year. Nowadays (1926) the open car is the exception rather than the rule, and though in the smaller classes there are still many open cars, all are provided with efficient hoods, which have been much improved. Bodywork also has become much more comfortable, and in the more expensive types the luxurious interior of closed cars is a credit to the motor coachbuilder.

The development of cylinders from 1910 onwards is also interesting. Originally (1898–1900) De Dion built his engine with only one cylinder. Then two, and in a few cases three, cylinders came into use. Eventually the four-cylinder engine became the usual type, and by 1919 was practically the only kind to be built. With the Otto cycle (*i.e.*, one power stroke for every four movements of the piston) the four-cylinder engine gives an even torque. But Napier and Rolls-Royce preferred six cylinders, and for the more powerful types this system soon prevailed. Even eight cylinders have sometimes been used, but the six-cylinder engine has been found by experience to be the best type for everyday use. The four-cylinder car is still commonest, however, on account of its cheapness and its light weight.

The gradual development of British automobilism from 1910 up to the beginning of 1914 was much helped by successive shows at Olympia and in many of the provincial towns, which became every year more popular. Racing, too, has played its part in developing speed and reliability. Year after year new speed "records" were set up, and with each year came the destroying of the previous year's recorded speeds. The chief long distance race was for the Gordon Bennett Cup, held on the European continent (except in 1903 when it was run in Ireland), but a road race has never been run in Great Britain owing to the tortuousness of the roads, the congested state of the traffic and the strong public sentiment against speed contests on highways. Brooklands, the first great motor racecourse in the world, was constructed in 1907, entirely through the public spirit and enterprise of Mr. Locke-King. Here regular meetings on the lines of horse-race meetings were organised, provision was made for scientifically accurate timing, and Brooklands began to be one of the most useful institutions in the development of the motor-car.

The motor-car with its internal combustion engine has been the pioneer of many inventions. The aeroplane, of course, is by far the most notable of these, but among land-travelling vehicles the first place belongs to the "caterpillar" type of machine, which includes many varieties adapted to widely different purposes, from the little Citroens which have crossed the sands of the Sahara desert to the gigantic tanks that came into being during the World War. The "caterpillar" system, where the vehicle runs on an articulated endless steel band attached to the vehicle itself, is likely to be of great use in undeveloped countries where there are no roads, and where soft ground, dense grass or reeds or sand make ordinary wheeled traffic impossible.

The motor-car engine continues to improve. The super-charger has been evolved, which increases the pressure of any given engine by supplementing the vacuum created by the descending piston by actual pressure, thereby enabling a greater amount of the explosive mixture to enter the cylinder before the explosion and power stroke takes place. In regard to the number of revolutions, at the Paris show of 1902 an engine was exhibited which attained the then unprecedented rate of nearly 2,000 per min.—an impossibility, according to a high scientific authority, who asserted that no engine could ever run at more than about 1,500 revolutions, as the big ends and crank pins would fly apart owing to the great centrifugal force developed, with the result that the engine would be wrecked! Nevertheless, since then in the Grand Prix races engines have been used and have functioned well which attained 6,000 to 7,000 revolutions per minute! Engines of small cubic capacity have been designed which produce great and unexpected power in proportion to their size. Progress in the science of metallurgy has also contributed to the efficiency of modern engines and gears. Steels of wonderful hardness and strength have been produced to comply with the needs of the modern explosive engine, and further developments are taking place. Before long also we shall no doubt have an infinitely variable gear, superior springing and other improvements. There is food for thought in the fact that, while railways have just celebrated their centenary, the motor-car has had at the most 27 years of active life—about a quarter of that time. When our descendants celebrate the centenary of the motor-car it is probable that the vehicles of to-day which we think so wonderful will have been improved beyond our knowledge or imagination.

Goods Transport.—The development of the motor-lorry has also been considerable, and it may be said without fear of contradiction that the British lorry is recognised as the most efficient and convenient, in addition to having a better appearance than the heavy vehicles produced in any other country. An increased road transport trade has grown up between big centres of industry, especially where manufactures are carried on within a short distance of a seaport, such as in Lancashire, where raw cotton from the ship's side is taken up to the mills by lorry, and finished manufactured goods are taken back as a return load. There has also been a considerable development in the lighter loads, most trading concerns using small lorries and vans for the collection and distribution of their goods. In the country districts the old carrier's horsed cart has been replaced by the carrier's motor-car, running the same journeys in far less time, with greater comfort to the passengers than formerly. There is also in many countries a network of village-to-village and town-to-town services. For agricultural purposes also, not only are motor ploughs being used to a greater extent, but mechanical vehicles are taking the place of the farmer's gig and even his wagon.

Another significant increase has been in the number of motor cycles, of which over 500,000 are running on the roads of Great Britain in 1926. The increase, however, has been somewhat checked by the coming of the small cheap car, which is used by all classes of the community.

United States.—As regards the position in other countries, there are now (1926) in the United States about 20,000,000 motor vehicles, or about one to every six of the population. In many of the large American towns the street cars have become almost deserted, and the workman proceeds to work in his own small cheap car. The growth, too, of roads in the United States has been very remarkable, and new highway construction is proceeding apace, tens of thousands of miles being made every year. The Lincoln Highway now extends right across America from New York to San Francisco, via Pittsburgh, Chicago, Cheyenne and Salt Lake City. The Dixie Highway runs South from Sault Ste. Marie on the Canadian border to Miami, Fla., via Chicago. A number of other important main trunk roads were under construction in 1926 and rapidly approaching completion. In the neighbourhood of New York alone £60,000,000 was being spent in 1926 in abolishing level crossings, making bypass roads and in generally improving the exits from the city.

Europe and the East.—In France, though the number of motorcars has increased since the War, there has not been the same comparative increase as in other countries, the total number being still under 500,000, as against 1,500,000 in Great Britain. In Germany, Austria, Italy, Hungary and the rest of Europe the general increase has been retarded by the comparative poverty of the population over large areas. In India the country roads are being improved for motoring. In China 4,000 m. of main roads have been made to accommodate the increase in motor traffic.

The Future.—The only serious bar to the future increase in motor vehicles in some of the older countries is that all governments are inclined increasingly to consider them as luxury vehicles, and therefore a fit subject for extra taxation. In reality, the day is long past when the ordinary motor vehicle can be considered to be an example of luxury. Ninety-nine per cent of motor vehicles are used for professional, trade, business and other purely utilitarian purposes. There is also the problem which has yet to be solved, namely, how to accommodate in towns the vehicles of those who are employed or occupied for a short or long time during the day. There is no room in the streets, as a rule, to enable this to be done with safety or convenience, and the garage accommodation is wholly inadequate. (*see* MOTOR VEHICLES: ROAD CONSTRUCTION: TANKS: TRAFFIC PROBLEMS.) (M. OF B.)

MOTOR TRANSPORT, MILITARY.—Transport by motor vehicles has profoundly modified the art of war. Their employment enables a commander, despite the unwieldiness of modern armies, to achieve surprise effects which give him victory. In the following account, illustrated by practical examples taken from the use of motor vehicles during the operations of the Allied Armies on the French front, there will be discussed the general principles underlying (1) transport of troops, (2) transport of *matériel* and (3) intensive traffic on roads.

I. TRANSPORT OF TROOPS

The Vehicle.—Troops have sometimes been carried in ordi-ary touring cars. During the battle of the Marne (Sept. 9 1914), t the moment when the French Army of Gen. Maunoury was nassing outside Paris, there were grouped together all available axicabs to take direct to the front the infantry of a division vhich, arriving by rail from the Vosges, was detraining in the tations of the northern suburbs of Paris. This method can only e employed in exceptional cases, because the car or taxicab has o small a carrying power, requiring one driver for every three r four combatants carried, while such vehicles for the most part iffer in speed. On the other hand, such motor vehicles as are esigned to convey a larger number of passengers in peace-time, .g., motor-omnibuses or *chars-à-bancs*, are eminently serviceable.

The ideal vehicle is the common motor-lorry (or truck, as mericans call it). It is necessary to adapt it, *i.e.*, to place in it novable benches, which can be very rapidly installed when it is ecessary to carry men, and can be removed without difficulty vhen it is necessary to carry *matériel*. In accordance with the apacity of the body, which itself partly depends on its load apacity, the lorry can carry from 16 to 25 men with their arms nd equipment.

During the World War not only were units of infantry transorted but also artillery formations; likewise, in some exceptional ases, cavalry with their horses. When horses are to be carried he body of the lorry must be as large and the bottom as low as ossible, to make the loading more easy, and the ceiling must be high enough to prevent the horses from being injured by striking their heads. The horses may be placed either lengthwise or crosswise. But they should be close to one another, to save them from bumping; and there should be no difficulty of access to where their heads are, in order that they may eat and drink on the road. These precautions taken, it has been found that horses travel as well by motor-lorry as in a railway wagon.

Organisation of Lorries.—Lorries move grouped in formations of varying importance, but two essential conditions must be observed: efficient control and effective maintenance. The basic unit, the smallest formation to be placed under the orders of an officer, should be formed of 15 to 30 vehicles. The officer who commands this unit is the veritable sheep-dog of his troop of lorries; he must himself have a touring car (which should be open and not too fast), so as to allow him to follow his lorries when they are on the move, and above all when they are formed into a large column. The officer ought not to lead himself, but be able to keep his attention free, and to jump quickly from his car and speak to his drivers. Next above the basic unit, the "section," is placed the "company" or the "group," normally comprising three or four sections. The commander of the group or company is no longer the sheep-dog of his lorries; he is the shepherd. It is he who guides them in their itineraries, places them in billets and allots them to their work.

The second point in an organisation is to ensure effective maintenance. Automobiles require constant care on a long journey, *e.g.*, 200 kilometres. Some will have breakdowns, some even fall out, too seriously damaged to go on. Minor casualties must be attended to, however, as soon as possible. That is the rôle of the workshops. If the workshop is to move with the group, it must be on lorries, and have a stock of tools and spare parts.

As soon as large transport movements have to be carried out, higher control above the group must be organised. The transport of the infantry of a division requires 12 groups. Placed in a column on the road, this would make a file 36 km. in length, a reasonable distance for each group being 3 kilometres. This mass would be formless and incapable of manoeuvring unless vivified by organisation. It is a common saying that the action of a commander ought to be limited to directing four immediate subordinates and no more. Experience of large demands on transport during the War shows, however, that six groups could be united under one control, if the commander in charge was supported by a fully qualified staff. Such was the composition of the grouping in the French Army; such or something very near it was the composition of the "Bus Park" of the British Army. The grouping of six groups had a capacity for 6,000 infantry; the automobile service of the French Army comprised 25 groupings in 1918.

Organisation of Troop Transports.—Let it be supposed that a grouping is ordered to carry out the transport of 6,000 infantry, to take them up in their billeting area, and to bring them to the field of battle some 100 km. from billets. To accomplish this mission efficiently the staff must first fix the embarkation-points, *i.e.*, the points at which the infantry will be loaded into lorries. In order that this operation may be quickly carried out there must be many loading-points functioning at the same time; to embark one battalion (1,000 men) into a group (80 lorries) requires from 20 to 30 minutes.

When the commander of an automobile grouping has prepared the organisation of his embarkation-points, he must come to an agreement with the infantry headquarters concerned as to the time and place of embarkation of each battalion. The work which devolves upon the command of the lorry grouping in the disembarkation of the troops is generally similar to the above; but there is an additional difficulty, caused by uncertainty as to the exact points of disembarkation, which often depend at the last moment on the military situation. Nevertheless, the procedure must be arranged as early as possible, in close touch with the higher staff which has to fix the disembarkation zone; and an understanding must be arrived at with headquarters as to the probable alternatives, between which a decision will be made later, when the lorries are quite near to the arrival zone. The itinerary between the two zones must be **reconnoitred** and marked out. This is the duty of the officer assisting the commander of the grouping. The " route officer," with his own staff, marks the itinerary by posting up placards (and, for night work, hanging lanterns) bearing the distinguishing mark of the grouping and an arrow indicating the direction of the march and the route to take. Further, the commander of a grouping must organise the movement of his service lorries, supply lorries, work lorries, etc.

Transport of Complete Divisions.—An interesting example occurs when, together with the infantry of a division, it is necessary to transport all or part of their artillery with its horses. With horse-drawn artillery it may be a very serious matter for a general of a division not to be able to bring up to the battlefield, in support of his infantry, the artillery who are accustomed to manoeuvre with him. It is thus very desirable to be able to transport artillery with horses. The loading of guns and limbers on lorries does not present any special difficulty; it is sufficient to have fixed rules for putting the *matériel* in place, and these are the same as the loading-rules for the same *matériel* on railway wagons.

II. TRANSPORT OF MATÉRIEL

Lorries are not specialised for the transport of *matériel*. The same type is employed as for troops, and therefore, the organisation is similar. A lorry-group capable of moving a battalion of infantry can alternatively move 100 tons of *matériel*. Experience in the World War has shown that, during the periods of active operations, a division requires an average of 200 tons per day in foodstuffs and ammunition. This is equally true in the case of defensive areas, as at Verdun; in offensive actions of the type of the Somme battles in 1916; or those of July, Aug. and Sept. 1918, on the Marne. Two groups are therefore required for the supply of a division, subject to the distance from the railway being, at furthest, within a radius of 40 kilometres. Four groups are necessary if the division is 70 km. from a railway. An average of 3 hours must be reckoned for loading at the stations; with allowance for difficulties arising amid intensive operations, 7 or 8 hours are taken up on the journey and 2 hours in unloading. This gives about 13 hours for work, and leaves 11 hours per day for the maintenance of *matériel*, feeding and rest. If the traffic operations are to be continued for a number of days, any more than this cannot be demanded of the personnel or of the *matériel* without risking excessive wastage. On the day after a journey with loads the vehicles return empty, and on the day after that they recommence the journey loaded. As 200 tons a day are required for a division there must be a double set of two groups, with a total capacity of 400 tons.

Non-Specialisation of Matériel.—At a general mobilisation like that at the opening of the World War, the resources available for transport are necessarily limited not only by financial conditions, but by the number of vehicles in existence in the country capable of being requisitioned, and by the maximum production of the manufacturing firms. On the other hand, there is no limit to the requirements in lorries, because no general worthy of the name thinks he has a large enough stock of transport at those critical times when every addition means an increase in his power of manoeuvre. During the 20 days which intervened between May 27 and June 15 1918, the lorries of the French Army had to transport about 800,000 tons of foodstuffs and munitions, in order to ensure the supplies of those armies which were making headway against the German attack. And yet, during this same period, the French Headquarters Staff had transported by automobile the infantry of 63 divisions. It was necessary also to make numerous evacuations of public records, civil populations, hospitals and engineer parks. This wonderful effort was only possible because in the French Army the principle of non-specialisation was adopted. Every lorry was controlled by the motor transport service of the armies, and was utilised by it for any form of transport needed. No vehicle was specially or permanently attached to this or that higher or lower formation. When a higher formation, such as a division, had need of transport, the automobile service arranged the transport, but as soon as it was finished the lorries employed on this service returned and were available for other transport service In short, the lorry capital never remained unproductive.

The Use and Duties of Depôts.—The reasons for avoiding t wastage of lorries apply likewise to avoid wastage of movement The carrying-out of " detail " transport is the principal cause low efficiency. In the battle of Verdun, March 1916, the supp of munitions was taken by rail to Bar-le-Duc and to Baudo villiers. Trains of munitions arrived daily at these two statio to supply the artillery of the 10 divisions deployed arou Verdun, some 60 km. from the stations. If, to supply each these divisions, there had been allotted a motor formatio which could come to load up at the stations and go as f as the batteries, bringing munitions, the efficiency would ha been mediocre and uncertain. An accident at a depôt, an inte rupted road, an advance or a check at the front, would set ba the whole time-table of the formation, and one would have se them arriving in the station for loading their lorries in twos a threes in disorder, and at different hours. There can never efficiency unless there is regularity of movements. It is nev possible to have regularity unless the traffic of the back area which can be regular, is definitely separated from the traffic the front areas, which is always uncertain. This separation ca be effected by the creation of depôts depending on the lines-o communication authorities, and supplied by them where th formations from the front areas come to refill exactly as the would refill from the railway if there were stations at these front

III. INTENSIVE TRAFFIC ON THE ROADS

The Route Gardée.—For the organised employment of automobiles on the roads, like that of railway trains, the essentia condition is to be master of the road. If all and sundry are pe mitted to put columns of troops or vehicles on a road, it is useles to attempt to carry out important movements. It is an absolut rule, based on experience, that it is not possible to launch a bi transport movement involving several hundreds of lorries without being absolutely certain of the complete freedom of the road during the whole time that the movement will last. Hence th organisation of the *routes gardées*, with their personnel of guard and their traffic orders.

A *route gardée* is not necessarily reserved exclusively fo automobiles. But in every case there must be a responsibl authority, having power to give orders and have them carrie out. In the French Army, during the War, this authority was motor regulating staff (C.R.A.). In the British Army, the contro of traffic in France was part of the duties of the provost marsha (A.P.M.). The organisation of the route, on a railway model, i based on the block system. The route is divided into a series o districts, each of which is under the direction of a district chief having assistants for supervision. The district chief is in constant touch by telephone with the neighbouring districts, an with the office of the C.R.A.; he knows all the movements which affect his district, and also keeps a record of all movements which occur there and all the incidents of the traffic. Thus at the offic of the C.R.A. it is always known what the state of the traffi may be on every *route gardée*, and the necessary arrangements for launching an important movement can be made in give time. The route orders for the *routes gardées* are more or less drastic according to the breadth of the road, and whether or not there are relief routes.

The length and the importance of the districts on a *rout gardée* depend, obviously, on special difficulties to be overcome, *e.g.*, the number of adjacent routes, the localities traversed, narrow passages, etc. Between Bar-le-Duc and Verdun there were six "districts" varying in length from 5 to 10 kilometres. It is quite unnecessary to control in this permanent fashion a route over which there is not continuous traffic. Whenever such a road is needed, for the time being, for an intensive transport, it is sufficient to occupy it immediately and transform it into a *rout gardée*. This requirement leads to the C.R.A. (or any corresponding organisation) being given a territorial zone of operation. In each zone it is the immediate business of the C.R.A. concerned to guard any portion of the road over which the transport will be moving. For this purpose the C.R.A. had at its disposal specially organised personnel, which may be fairly accurately designated "mobile districts," and which, being in the habit of operating in this way and supplied with the means of rapid installation, can, in two or three hours, make themselves masters of the traffic on whatever part of the road is entrusted to them.

Maximum Efficiency over a Road System.—When one is master of "circulation" throughout a given region, one is free to aim at maximum efficiency. Formerly, when the staff proposed to carry masses of troops to a theatre of operations it traced the greatest number of parallel and serviceable roads which led to the zone of action decided on, and there was thrown on each of these roads a column of all arms scientifically echeloned in depth. Thus it was that Napoleon moved from the Rhine to the Main in 1805; thus, also, Moltke moved from the Sarre to the Moselle in 1870. When this system is applied to present-day conditions the efficiency of the road system is low, because the increase of speed due to the automobile is not turned to account. All modern armies have tractor-drawn heavy and automobile light artillery, and possess the means of transporting the bulk of their infantry by motor lorry. There remain the horse columns, on which it is no longer necessary to impose the speed limitations of marching infantry. In consequence, in co-ordination with the movements made by railway, the movements by road ought to be organised in the form of special itineraries, on each of which move columns of elements that are homogeneous from the point of view of speed. Thus combination of movements can be worked out in which much time is saved, as compared with the old methods.

The existence of regulating commissions in charge of zones of movement and masters of the traffic, considerably eased the French problem. But the regulating commissions must have control not only of automobile traffic, but of all traffic; in their zones no movements must occur without their having received notice and taken the necessary measures to facilitate the execution of the movements in question. They must be able to arrest all false movements in good time. And they must be in close touch, so as to form a complete network, covering the whole area over which it may be necessary to move any column. It was by the functioning of an organisation of this nature that the French Army was able to make its concentrations of considerable numbers of troops at very short notice in March, May and July 1918.

Strategic Transport by Road.—As the automobile has brought on the road again the tourist who had deserted it since the middle of the 19th century, so transport by motor lorry has brought into use again strategic movements by road. And, for the production of surprise effect, by adding the roads to the railways, it has been possible to put to full use all available means of communication. The air alone has not been utilised; but in the future it may be utilised for the quick transport of combatants. In order that movements by roads should be serviceable, it is necessary for them to be rapid and powerful; this is attained by applying the same principles as in rail movements—that is to say, the temporary break-up of large units for transport.

Combined Use of Railway and Motors.—In the majority of cases use is made of railways and roads in combination. The end to be attained is always a rapid move of powerful forces; the staff should therefore make use simultaneously, and as efficiently as possible, of every means of transport which it possesses. One must never lose sight of the fact that the efficiency of the railway s much superior to that of the road; a train of 50 wagons is equivalent to 150 lorries. At a speed of 30 kilometres an hour, and with four departures an hour, one has four trains in a length of 30 kilometres, or the equivalent of 600 lorries. We have seen hat 600 lorries form on the road a length of 20 to 25 kilometres. Railway and road have therefore very nearly the same output. But the lorries, going 15 kilometres an hour, are only half as quick. Further, at the end of 100 kilometres it is necessary for he lorries to stop in order to rest the drivers, for, save in exceptional cases, relief crews are out of the question. The weak point n transport by rail really lies in the necessity of having stations or embarking and for disembarking. Save in quite exceptional ases it is an absolute technical necessity to load and unload in stations, and, even so, only in those where there are sidings sufficient to take the military trains so as to leave free the main line during the times of embarking and disembarking. Without this precaution all the traffic will be blocked. Further, when it is a question of loading *matériel* it is necessary to place it on the platforms. While special platforms or docks are indispensable on the railway, it is always easy, on the road, to find or organise quickly loading-places for lorries.

Big movements by railway can be made only from a zone A to a zone B, if the two zones A and B are equally rich in loading-places. But—apart from those points which come into the initial concentration scheme, and on which, therefore, work can be done in peace—it is impossible to ensure, in the large movements which military operations may necessitate at any given moment, that the beginning and the end of rail transports shall take place in zones that are rich in loading-places. On the other hand, it is generally possible to find, within a radius of 50 to 100 kilometres in the zones A and B under consideration, one or more regions rich in loading-places. The normal combination consists therefore in utilising motor transport to prolong railway transport, and to carry the troops or *matériel* (1) from their stationary zone to the places of embarkation, and (2) from their places of disembarkation to the zone of operations. The relatively short movements (50 to 100 kilometres) it requires are those in which the efficiency of the lorry is at its greatest. And between the two zones of loading thus actually used, the efficiency of the railway will equally be a maximum.

Naturally, other combinations are also practicable; for example, that by which, on Nov. 20–21 1917, three French divisions were to be carried from Meaux and Château-Thierry to Péronne; the infantry, with their machine-guns and cooking-carts, being conveyed in motor lorries, and the artillery by train. The object of these movements, very quickly ordered on Nov. 19, was to reinforce the successful British attack in front of Cambrai with the first use of tanks in mass, and had overwhelming results. While the embarkation of the artillery was proceeding at railway stations in proximity to the divisional billets on the Marne, the C.R.A. of Meaux and Château-Thierry loaded up on 3,000 lorries the infantry, etc., of the three divisions.

There are many details which complicate considerably the task of the transport officials; such as the question of food supply for the troops during their transportation and at their disembarkation, and the question of moving troops simultaneously with the building-up of the munition dumps which they will require. One last remark should be made: transportation by automobile and by railway, which, we have seen, supplement one another happily in regard to distance, is equally satisfactory in regard to time. Large movements by railway require concentration of *matériel*, often difficult to achieve; and, in the case of moves decided on in a hurry, the possibility of motor transport on a large scale assumes very great importance, since it takes four or five days for the railway to show its full powers.

Conclusion.—The experience of the War shows the rôle which transport by motors is called upon to sustain becoming more and more important. The Allied Armies, together, placed on the French front about 20,000 motor vehicles in Oct. 1914; four years later the number exceeded 200,000. At the time of the Armistice, the inter-Allied transports reserve, the creation of which had just been decided on, was of a size to transport simultaneously 10 divisions of infantry complete, with all their means of fighting, machine-guns and artillery included. This was a fighting mass of more than 100,000 men, which the Higher Command was able to pick up at short notice and carry at the speed of 100 kilometres a day to any point where it was required.

As regards the transport of *matériel* at the end of the War, it had become possible—independently of the resources just mentioned—to keep supplied with food and munitions 40 divisions at a distance of 100 kilometres from the railways.

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MOTOR VEHICLES (*see* 18.914).—The greatest industrial development of the first quarter of the 20th century was that of the motor road vehicle. Development of the self-propelled, petrol-engined vehicle began in Germany in the eighties with the work of Daimler and Benz, and was carried forward particularly energetically in France for more than a decade, from 1895 on.

I. HISTORY OF MOTOR VEHICLES

About 1910 the United States assumed the leadership in the production of this type of vehicle. Transport and other conditions naturally favoured the use of motor vehicles there. American manufacturers cut down their production costs materially below those in Europe, in spite of the higher wages paid by them, and thus sold their cars at very reasonable prices. By 1925 more than one half of all the families in the country had their own car and more than 83% of all the cars in the world were owned in the United States. Registration figures showed that on Jan. 1 1926, there was one vehicle to every 5·7 persons in the whole country, while in California, the state with the greatest "motor density," there was one to every 2·8 persons. Motor-vehicle manufacture had become the greatest manufacturing industry in the country, in point of value of output.

Economic Reasons.—While the World War accelerated production of motor-cars in the United States and retarded it in those European countries which were engaged in the conflict from the start, the chief reasons for the pre-eminence of the United States as a motor-using country are of an economic nature. America is a land of magnificent distances; in many sections towns and cities are far apart, and long trips must often be made over the public roads, for which purpose horse vehicles are quite unsatisfactory. Petrol (in the United States called gasolene), the fuel commonly used for motor vehicles, is a native product, comparatively cheap and plentiful. The *per capita* wealth is greater than in most countries and well distributed.

Not all conditions were favourable to the introduction of motor-cars, however. The industrial countries of Europe had magnificent systems of hard-surfaced roads, which were practically non-existent in the United States at the beginning of the motor era. This, though a handicap, did not prove a serious obstacle. In the early years of motor-car development the private passenger car was generally regarded as a means of pleasure, and in Europe this remained its chief function. But in the United States and Canada (where the proportion of motor-cars to population was not much less than in the United States) it became a great factor in business life. In New York City, for instance, a very large proportion of the street traffic in 1925 was by motor, and in the main thoroughfares horse vehicles were almost a rarity. Such agricultural states as Iowa and Nebraska had relatively more cars than the industrial states, and the farmers used their cars chiefly for business purposes. As the substitution of the motor-car for the horse came about gradually, it did not greatly impress the general public; nevertheless, it profoundly influenced modern life.

Bus and Jitney Services.—In the cities of the United States the once familiar horse cabs and hansoms had disappeared before the motor-propelled taxicab by 1925. Numerous bus services competed with the tram services, particularly in outlying districts, and even cut heavily into the local passenger business of the railways. About 1915, many owners of private cars began carrying passengers in competition with tram lines, their vehicles being known as jitney buses (jitney, a Russian coin about equal in value to five cents, then the common tram fare). These jitneys did much business, especially during the "rush" hours when people go to work and return home, as their passengers avoided the crowding of the street-cars and the annoyance of frequent stops. In some sections of the country conditions were made rather hard for the jitney owner by legislation, and the business shrank or ceased entirely; while in others, and particularly in Detroit, it was still thriving in 1926.

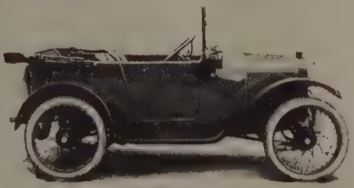
Freight Haulage.—Motor-trucking and the haulage of freight by motor vehicle began to assume importance in the United States only about 1910. This branch of the industry up to then had been more successful in Great Britain and Germany. From 1910, however, it consistently increased in the United States, where under war conditions the motor-lorry even entered into competition with the railways. An enormous amount of motor freight traffic grew up over certain routes between important industrial cities, as between Detroit, Mich., and Toledo, O., and between Akron and Cleveland, Ohio. One large tire manufacturing company in Akron, O., with cotton mills in Boston, Mass., over 600 m. away, established a fast freight service, between these two cities, of motor-trucks on pneumatic tires. Some of this development was evidently due to the abnormal conditions which made railway freight service inadequate during and immediately after the World War. Military operations gave a great impetus to motor-truck development. In addition to the urgent demand for trucks for military purposes there was also a strong demand for business purposes, owing to the intense industrial activity and to the breakdown of the railways under the war strain.

Advantages.—The substitution of the motor-car for the horse was beneficial in various ways. In the first place the car is much more speedy and more comfortable for transport. With a motor-car a physician, for instance, can extend his practice over a much wider territory; contractors can oversee more thoroughly a number of projects under way at the same time; stores and factories can deliver goods in the country, at distances of 30 m. or more, in their own vehicles, while horse delivery was limited to the city. Stables, always a nuisance and a breeding place of disease, have been practically eliminated from cities, and street-cleaning has been rendered much easier. Real estate remote from railways has in many instances considerably appreciated in value as a result of the advent of the motor-car, rendering it accessible to the city man.

In the foregoing the utilitarian aspect of the motor-car has been specially emphasised. While cars are still being built that can properly be classed as vehicles of sport and luxury, they form a small proportion of the whole production. In New York City an annual show was established for this class of car; it started as the Importers' Salon, but during the World War, when the importation of European cars was very difficult, it gradually changed its character and became a show of high-grade domestic as well as imported cars. At the salon in Nov. 1920, there were exhibited cars selling at upward of $20,000, whereas a serviceable five-passenger car could be bought for as low a price as $550. The luxury cars exhibited at these shows were characterised by high power and high speed, elegant body finish, fine upholstery and superior equipment.

European Conditions.—In 1910, Great Britain had the leadership among European countries as regards the number of cars in use, whereas France led in respect to volume of production. About one-half of the number of cars produced in France at that time were exported. In continental Europe the introduction of motor-cars was hampered by heavy taxation on the cars themselves and on the fuel. The use of motor-trucks, on the other hand, was encouraged by the so-called subsidy system, by which purchasers of trucks suitable for military purposes were offered by their governments a bonus on the purchase price and also on the upkeep cost, in consideration of their keeping the trucks always in fit condition and agreeing to turn them over to the Govt. in case of war. Great Britain, France and Germany had such subsidy systems before the war; Japan adopted the same policy later. As soon as war was declared the motor-car factories were set to work for the war departments, either making trucks or other vehicles for the transport corps or else manufacturing aero-engines or munitions. Soon all the petrol available was needed in war service, and the use of motor vehicles by private parties practically ceased.

In England some use was made during the War period of town gas for motor fuel; this was carried in a collapsible bag of rubberised fabric, on the roof of single-deck omnibuses, for instance. With this fuel it was possible to obtain about 85% as much power from an engine as with petrol, and a satisfactory mileage on one filling was secured. Under normal conditions the gas would have



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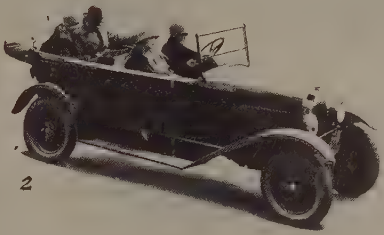

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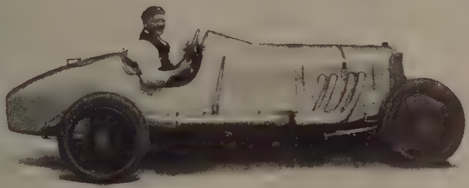

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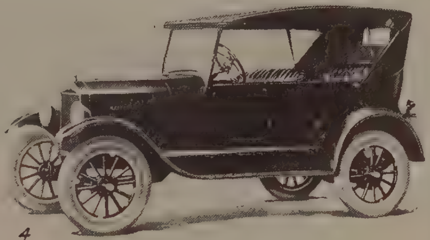

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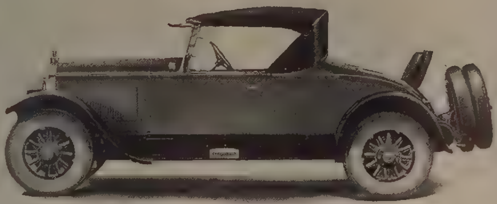

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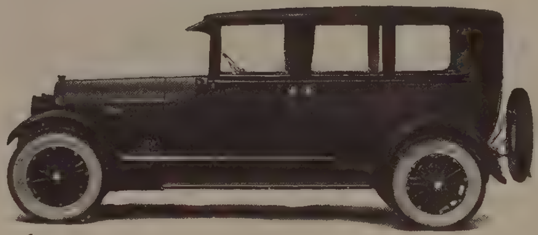

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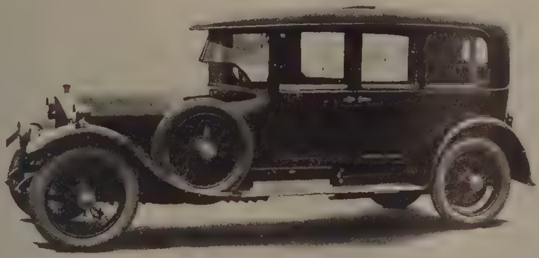

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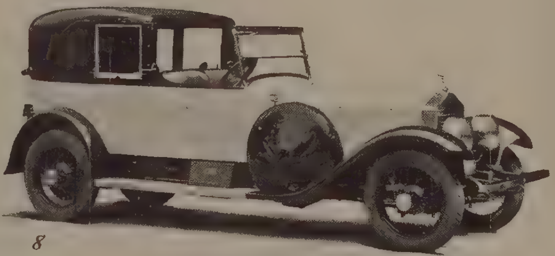

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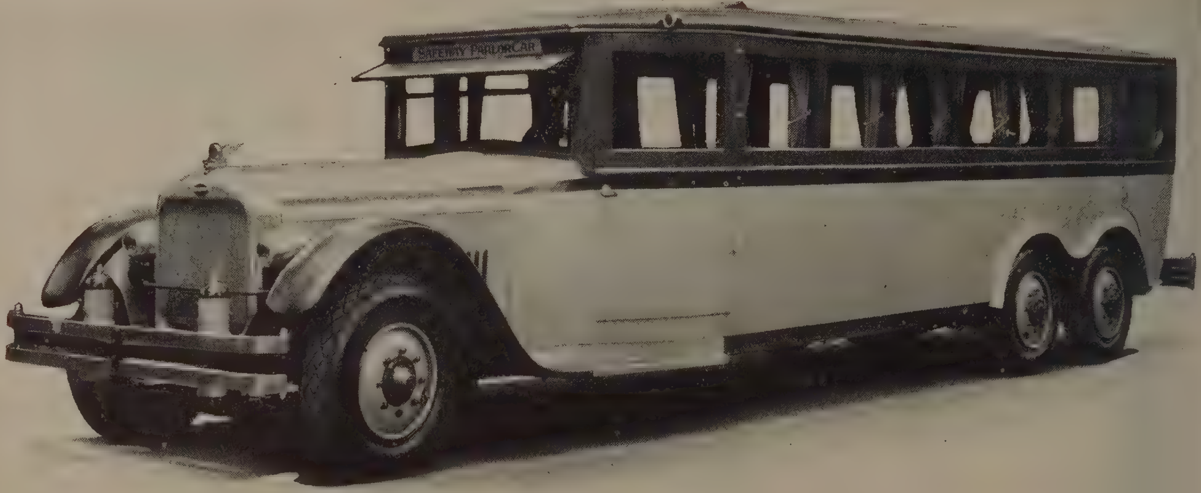
FIG. 1. Austin (British) light car. FIG. 2. Citroen (French) open car. FIG. 3. Mercedes (German) racer. FIG. 4. Ford (American) touring car. FIG. 5. Buick (American) roadster. FIG. 6. Cadillac (American) 7-passenger car. FIG. 7. Napier (British) limousine. FIG. 8. Rolls-Royce (British) Salamanca cabriolet.

PLATE II.

MOTOR VEHICLES


SAFEWAY PARLOR CAR

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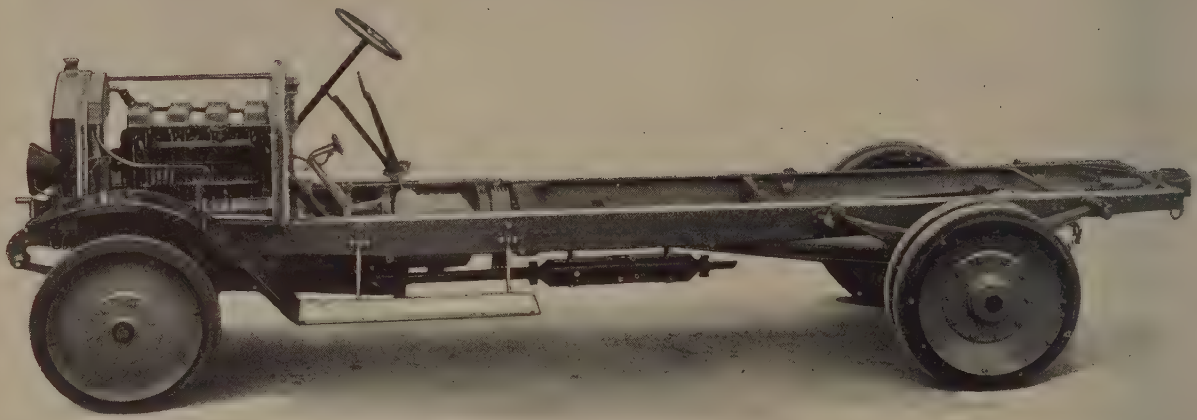

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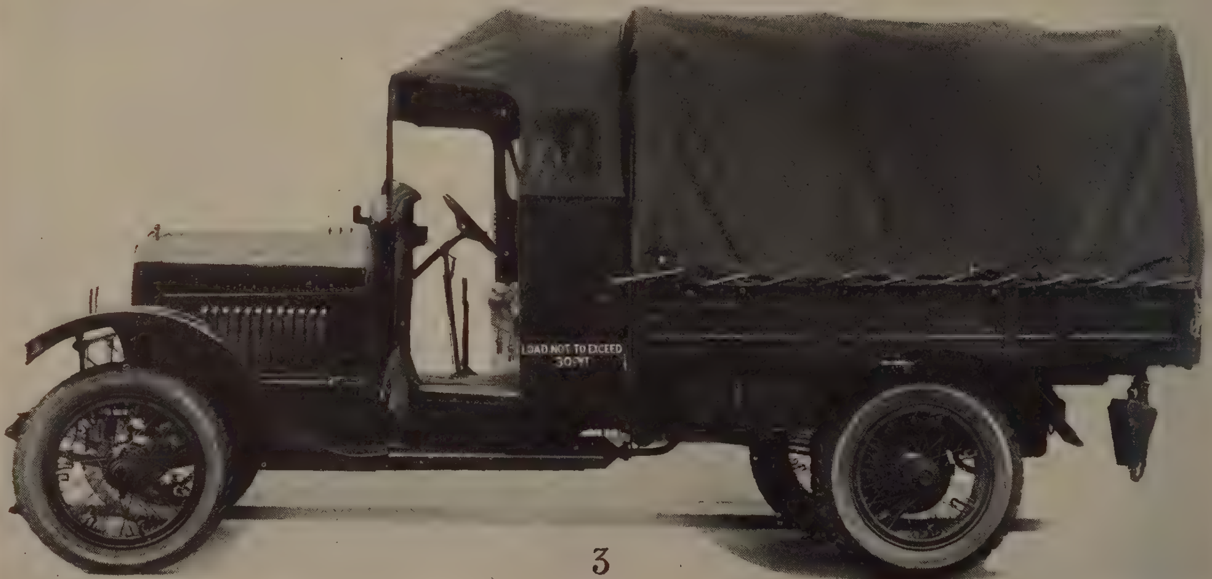
LOAD NOT TO EXCEED
30 CWT

3

FIG. 1. Six-wheel luxury type coach. FIG. 2. Benz (German) 5-ton truck chassis with Diesel Engine. FIG. 3. Crossley (British) subsidy type 3500 lb. truck with War Dept. type body.

been carried in steel bottles under high pressure, but owing to military requirements no steel could be spared for this purpose. The Central Powers suffered much more from fuel shortage than did the Allies, and extensive researches on substitute motor fuels were carried out in Germany. After their petrol supply ran low the Germans used benzol, petroleum mixtures, benzol-alcohol mixtures, alcohol, wood alcohol, tar oil, gas oil and shale oil, as well as fuels produced synthetically from water gas by catalytic hydrogenation under high pressure and at high temperature.

Registration in Great Britain.—According to an announcement by the Minister of Transport, Great Britain, on March 31 1920, had 185,700 private passenger vehicles and 71,400 public-service vehicles. The numbers of lorries and motor-cycles in service on that date are not available, but during the period Jan. 1—March 31 1921, licences were issued for 15,000 motor lorries and 278,500 motor cycles. How rapidly the use of the motor vehicle increased during the next four years may be judged from the following figures issued by the same authority as on May 31 1925: licences issued for private passenger cars, 532,909; for motor cycles, 518,457; for commercial goods vehicles, 216,966; for hackneys, 92,024; trade vehicles, 13,018, and official vehicles, 14,912.

Registration in the United States.—The figures given in Table I. are based on information furnished to *Automotive Industries* by the registration officials of the different states. Allowances were made for re-registration of cars sold by their owners during the registration year and for registration of cars by non-residents, and the table is believed to give as accurately as possible the number of cars in service in each state during the years mentioned, by residents of the respective states.

TABLE I. *U.S. Registrations*

	1924	1918	1912
Alabama	157,262	46,155	3,385
Arizona	57,828	23,875	1,624
Arkansas	141,983	41,458	2,250
California	1,321,480	337,878	88,699
Colorado	213,247	80,000	8,950
Connecticut	214,318	84,902	24,101
Delaware	35,136	12,955	1,732
District of Columbia	91,726	47,514	1,732
Florida	194,196	47,059	1,749
Georgia	209,300	99,160	19,120
Idaho	69,225	32,282	2,500
Illinois	1,123,724	389,135	68,073
Indiana	650,219	227,160	54,334
Iowa	620,906	327,500	47,188
Kansas	410,891	189,952	22,000
Kentucky	231,784	65,884	5,147
Louisiana	178,000	39,760	7,000
Maine	127,178	44,572	7,743
Maryland	195,581	78,146	10,487
Massachusetts	672,315	193,497	50,132
Michigan	868,587	261,547	39,579
Minnesota	502,987	203,727	29,000
Mississippi	134,547	40,000	2,895
Missouri	544,635	187,646	24,379
Montana	79,695	51,050	2,000
Nebraska	308,713	175,370	33,861
Nevada	18,387	8,160	900
New Hampshire	71,929	24,904	5,764
New Jersey	504,190	154,870	43,056
New Mexico	41,750	16,893	911
New York	1,412,879	457,924	107,262
North Carolina	305,756	72,300	6,178
North Dakota	117,061	71,687	8,997
Ohio	1,244,000	417,400	63,066
Oklahoma	342,982	120,300	6,524
Oregon	192,629	66,607	10,165
Pennsylvania	1,228,586	393,972	59,357
Rhode Island	90,652	30,595	8,565
South Carolina	163,382	55,400	10,000
South Dakota	142,280	86,121	14,481
Tennessee	204,680	65,000	9,973
Texas	834,040	250,201	35,187
Utah	79,233	27,204	2,576
Vermont	61,179	22,550	4,283
Virginia	261,643	72,228	5,760
Washington	294,812	119,905	13,990
West Virginia	190,134	38,600	5,349
Wisconsin	525,221	196,844	24,578
Wyoming	43,639	16,150	1,300
Totals	17,726,507	5,113,999	1,007,882

Registration in Canada.—The following table shows that during the period 1910–5 the number of cars registered in Canada increased more than tenfold and that during the following four- and five-year periods, although the proportional rate of increase was less, the absolute increase was far greater.

Province	1910	1915	1919	1924
Ontario	4,200	42,346	144,804	306,770
Saskatchewan	531	10,225	56,855	69,895
Quebec	786	10,112	33,547	82,982
Alberta	423	5,832	34,000	48,255
Manitoba	1,524	9,225	30,118	44,015
British Columbia	1,026	8,360	22,420	52,325
Nova Scotia	148	1,841	10,290	20,610
New Brunswick	299	1,900	8,306	19,794
Prince Edward I.	..	35	790	2,577
Yukon	..	69	89	..
Totals	8,937	89,945	341,219	647,223

TABLE II. *Registration of Passenger Cars, Lorries and Motor cycles in Different Countries at the End of 1924*

(In round number)

	Passenger Cars	Lorries	Motor-Cycles	Total
United States	15,597,000	2,142,000	139,000	17,878,000
Great Britain	625,000	217,000	518,000	1,360,000
France	460,000	115,000	102,000	677,000
Canada	576,000	63,000	8,000	647,000
Germany	132,000	61,000	98,000	291,000
Australia	180,000	18,000	55,000	253,000
Italy	72,000	28,000	38,000	138,000
Argentina	120,000	5,000	3,000	128,000
Spain	56,000	10,000	7,000	73,000
Holland	24,000[1]		36,000	60,000
Norway	13,000	5,000	7,000	25,000

[1] Includes both passenger cars and lorries.

II. TECHNICAL DEVELOPMENTS

A most desirable feature in a motor car is flexibility, that is, the ability to pass from a low to a high speed by merely opening the throttle valve. This is secured by using an engine of great power in proportion to the combined weight of the car and load. American cars have been specially noted for their flexibility, due to the use of very large engines, notwithstanding the fact that the high fuel consumption per mile travelled tends to increase with the displacement of the engine. As motor fuel was much more expensive in Europe, European designers could not ignore the factor of fuel economy as American engineers could.

Engine Design.—In engine design the constant endeavour is to get greater output from an engine of given piston displacement. Horsepower output depends upon two factors, the mean effective pressure upon the piston head and the linear speed of the piston. It was not possible to increase greatly the mean effective pressure; in fact, changes in the character of the fuel used for motor cars, by which some very much less volatile fractions were included than in motor fuel of the earlier period, made it necessary to operate with lower compression, which resulted in a lower mean effective pressure. However, improvements in combustion chamber design and other changes more than balanced this loss. A great gain was made by increasing the speed of operation. In 1905 the average engine speed corresponding to maximum engine output was about 1,000 ft. per min.; in 1926 it was approximately 2,500 ft. per min. for passenger-car engines and over 4,000 ft. per min. for racing engines. The first step to increase engine speed was enlargement of valve ports and passages, enabling the engine to draw in a normal amount of charge at a higher speed. The valve timing was also changed, the exhaust valve being given a greater lead and the inlet valve a greater lag.

Next, the reciprocating parts (piston and connecting-rod) were lightened, so as to reduce the inertia forces on them and the bearing pressures resulting therefrom. This led eventually to the adoption of aluminium alloy pistons. Aluminium has a higher co-efficient of heat expansion than cast iron, so that the aluminium piston must be given a greater clearance in the cylinder, which tends to result in unpleasant piston slap when the engine is cold, and also in "oil pumping," that is, transfer of lubricating oil from the crank chamber to the combustion chamber, with consequent smokiness of the exhaust. These difficulties were overcome in later designs by the use of the split-skirt or constant clearance type of piston, in which the skirt or lower part is separated from the upper part or ring belt all around and is saw-slotted longitudinally so that when the aluminium expands the saw-slot will become narrower and the clearance between piston and cylinder wall remain substantially the same. In a few instances magnesium alloy pistons and heat-treated duralumin connecting rods were used, magnesium having a specific gravity about two-thirds that of aluminium, and duralumin, an aluminium alloy responsive to heat treatment, having the strength of mild steel with only one-third its specific gravity. Special means were resorted to in attempts to build ultra high-speed engines, as for racing and similar purposes. These included the use of two inlet and two exhaust valves per cylinder, the use of two simultaneous ignition sparks in each cylinder, and the use of crankshafts in which each individual throw was counterbalanced.

Cylinder Development.—By increasing the number of cylinders above the one or two employed in the first machines, engines can be reduced in weight, and the objectionable vibration can be minimised. In 1926 the four-cylinder engine was the foremost type for use on vehicles of a strictly utilitarian character; the six-cylinder was the luxury type in Europe, while in the United States it was the preferred type for passenger cars of intermediate and higher grades. Most of the more expensive passenger cars in the United States then were fitted with eight-cylinder engines. The twelve-cylinder or twin-six engine enjoyed a spell of popularity during and immediately after the War but disappeared from the market as a motor-car power plant in 1923. In a petrol engine the torque impressed upon the crankshaft is always non-uniform, no matter how many cylinders there are, but the fluctuations decrease with an increase in the number of cylinders. In a four-cylinder engine there is, as with one or two cylinders, a reversal of the torque; that is, just before the end of each stroke the flywheel not only supplies all the power delivered by the engine, but also some of the power necessary for keeping the crankshaft and pistons in motion. Six cylinders are the smallest number delivering continuous torque at the crankshaft; but while continuous, the torque is still far from being uniform; with eight cylinders the torque fluctuations are reduced, and with twelve they are still smaller.

Arrangement of Cylinders.—Four and six-cylinder engines were always arranged vertically, with all cylinders in a row; eight-cylinder engines were originally built in V form, but in 1926 the majority of the makes had all eight cylinders in line. In an eight-cylinder V engine with the two cylinder blocks at an angle of 90°, and with a single plane crankshaft there is an unbalanced periodic inertia force in the horizontal plane, the period of which is equal to the time of one-half a crankshaft revolution. By placing the two cylinder blocks at an angle of 60° a uniformly rotating unbalanced inertia force of constant value is obtained, of a magnitude considerably less than the maximum value of the unbalanced force in the 90° V, and this led two makers, Lincoln and Wills, to use this arrangement of the cylinders, which, incidentally, suffers from the disadvantage that the explosions are not evenly spaced but come at 60° and 120° intervals. A method of completely balancing an eight-cylinder 90° V engine was discovered by Prof. Archibald Sharp and described in his book on *The Balancing of Engines*, issued in 1907. It was first practically adopted by the Cadillac Motor Co. in 1923. Instead of having all four throws of the crankshaft in a single plane, the throws are arranged in two planes making an angle of 90° with each other, and the crankshaft is provided with two heavy balance weights, as shown in fig. 1, which represents the Cadillac crankshaft. In deciding upon the form of the crankshaft of a multi-cylinder engine and the angle between cylinders in a V engine two objects are aimed at, namely, to ensure uniform spacing of explosions and inherent balance of reciprocating parts. Both objects can be attained in six and eight-cylinder engines; in a four-cylinder vertical engine there is an unbalanced reciprocating force in a vertical plane, causing vibration of the engine. This can be overcome only by the use of an anti-vibrator, invented by F. W. Lanchester, consisting of an unbalanced mass directly below the crankshaft and driven from the latter at twice its speed.

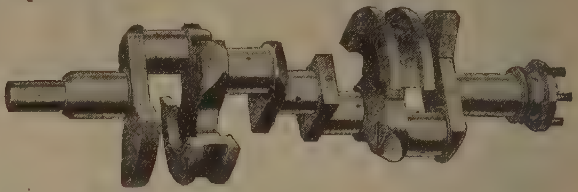

FIG. 1.—Balanced crankshaft for 90° V-type eight-cylinder engine (Cadillac).

When multi-cylinder engines were first used the cylinders were generally either cast separately or in pairs; later it became the practice to cast all cylinders in one row in one block. This greatly simplified the outward form of the engine, as with such a cylinder block only one pipe connection each need be made for the cooling-water inlet, the cooling-water outlet, the combustible charge from the carburetter and the exhaust. Some manufacturers even cast the top part of the crankcase integral with the cylinder block and made the lower part a steel pressing. This construction lent itself well to quantity production. Most makers of the higher-priced cars, produced in smaller numbers, cast all parts of the crankcase of aluminium. Cylinder heads were generally cast separate from the cylinder block and fitted to the block with a gasket of sheet copper and asbestos between. This construction facilitated manufacturing operations, and when the engine was in service permitted decarbonising the combustion chamber by scraping without removing the cylinder. It also made it possible to machine completely the combustion chambers, and thus to get all the chambers in one engine of exactly equal volume.

Combustion Problems.—As the speed of automobile engines increased it became necessary that the combustion of the fuel mixture charge be completed in a shorter period of time, in order that the maximum fraction of the heat energy might be converted into mechanical work. Racing engines in 1925 operated at speeds above 5,000 r.p.m., at which the time of one complete piston stroke is less than $\frac{1}{160}$ sec., and combustion should be completed before the end of the stroke. Prof. Bertram Hopkinson observed in 1912 that the rate of flame propagation through a combustible mixture can be increased by producing turbulence in the mixture (in the experiment, by means of a revolving fan in a closed vessel containing the mixture). In order to obtain a similar effect in the combustion chamber of an engine, Harry Ricardo has suggested the use of a "turbulence cylinder head," as illustrated in fig. 2. The compression space is in the form of a pocket in the cylinder head, mainly over the valves, which are located in a side pocket, but partly over the cylinder itself. At the end of the compression stroke the piston approaches very close to the flat portion of the cylinder head, and this produces a lateral rush of the combustible gases into the compression pocket, causing turbulence. Compression heads of this general form were widely used in 1926.

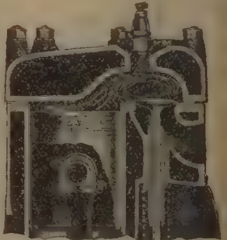

FIG. 2.—Turbulence type cylinder head.

The compression space should be as compact as possible, so that for a given volume its surface area and the distance from the spark points to the remotest portion of the charge are both a minimum, as this tends to promote rapid combustion, to prevent detonation (excessive explosion pressure and resulting phenomena) and to reduce the loss of heat energy to the cylinder jacket. Recognition of these relationships led to the gradual abandonment of the T head type of cylinder (with inlet and exhaust valves in pockets at opposite sides) and to the wider adoption of the valve-in-head engine, which latter in 1926 was used on racing cars to the exclusion of all other types. Valves in the cylinder head can be operated either from a camshaft in the crankcase through tappet rods extending up the side of the cylinder and tappet levers on top, or from an overhead camshaft. The overhead camshaft design reduces the weight of the valve reciprocating parts, and with given valve spring pressure makes possible the use of higher engine speeds. Racing and air-craft engines (*see* AERO-ENGINES) were generally fitted with overhead camshafts. On the other hand, in passenger car engines valves in the cylinder head were generally operated through long tappet rods, as it was found difficult to obtain the desired degree of silence with overhead camshafts.

Marmon, in the United States, used a cast aluminium cylinder block for a passenger car engine for a number of years prior to 1920, but gave it up because it proved impossible to keep the cylinder bores true. Cast-iron sleeves were inserted in the blocks to form bearing surfaces for the pistons, and the valves were located in cast-iron cylinder heads. The trouble was evidently due to distortion of the aluminium castings under the high temperature of operation. It was later found that distortion of aluminium engine castings in service can be prevented by subjecting them to a heat treatment after machining, at a temperature slightly higher than the maximum they reach in service. Some years after the War, German engineers became interested in aluminium engines, and at the Berlin automobile show of 1923 there were exhibited six makes of car with such engines.

Fuels.—The continual lowering of the volatility of the fuel used caused both manufacturers and users of motor cars a great deal of trouble, particularly between 1915 and 1920. When motor cars were first used, the fuel sold consisted of a comparatively narrow range of highly volatile hydro-carbons. When sprayed into air at atmospheric temperature in the required proportion of about one part by weight of petrol to 15 parts of air it vaporised readily. The fuel supplied in the United States in 1920 had an end point of nearly 475° F., that is, the least volatile constituents, when under atmospheric pressure, boiled only at that temperature. Hence, in order to vaporise this fuel completely it was necessary to supply heat to the mixture or to the components before they were mixed. When trouble from incomplete vaporisation was first experienced the carburetters were provided with a jacket through which hot water from the engine jacket was circulated. When this no longer sufficed, the air for the carburetter was drawn through a muff surrounding a part of the exhaust manifold, and to prevent recondensation after the mixture was formed, the inlet manifold was so arranged that it was completely surrounded by hot water.

This also proved inadequate, and then the hot spot or exhaust-heated manifold was introduced. When the fuel is incompletely vaporised the liquid particles tend to separate out of the mixture at the bends in the manifold, and it is very difficult to insure that all cylinders get mixture of the same composition. Those portions of the manifold wall where the liquid particles tend to accumulate are then made to form parts of the exhaust manifold wall also, so that they are constantly kept at a high temperature, and the liquid particles upon striking them flash into vapour. The change in the character of motor fuel between 1916 and 1919 is strikingly illustrated by the diagram (fig. 3) of distillation curves of the fuels purchased in Detroit, Mich., at various times during that period. Later the fuel improved again slightly and a survey made by the U.S. Bureau of Mines on Jan. 1 1925, showed an average end point for petrols sold in different parts of the country of 425° Fahrenheit.

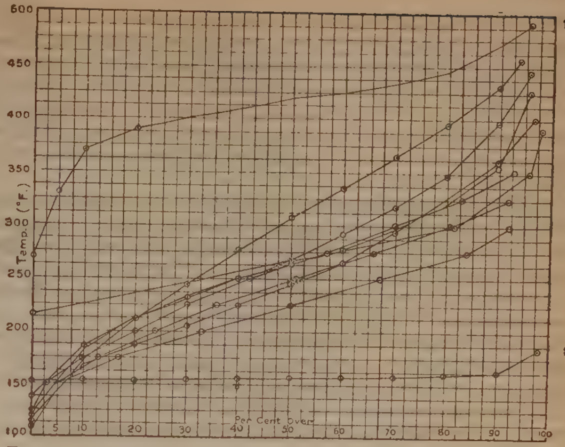

FIG. 3.—Distillation curves of motor fuel sold in Detroit, Mich., from 1916 to 1919. The data for each curve are as follows:—

Curve No.	Fuel	Date of Purchase	Baumé
1	Petrol	4/5/16	60·5
2	Petrol	7/10/16	57·5
3	Petrol	9/11/16	56·8
4	Petrol	6/9/17	56·8
5	Petrol	1/24/19	57·3
6	Petrol	4/30/19	55·7
7	Petrol	6/18/19	55·0
8	Alcohol	10/18	42·2
9	Cal. Dist,	18	51·4
10	Paraffin	18	40·0

Carburetters.—Numerous improvements in carburetter design were made between 1910 and 1926. Decreased volatility of the fuel necessitated the provision of special means to facilitate engine starting, particularly in cold weather. American engineers, who were confronted with the problem first, generally made use of a choke valve in the air inlet, which is closed when it is desired to start. This greatly increases the suction on the fuel nozzle and results in a great excess of fuel being drawn in. As only the most volatile part of this fuel will be vaporised, this excess of fuel assures the formation of an ignitable mixture. Another scheme, which originated in Europe, consists in the provision of a special starting nozzle delivering fuel into the carburetter passage above the throttle valve.

For starting, the throttle is closed and the effect on the starting nozzle is then the same as that on the main nozzle when the choke valve is closed. Most of the earlier carburetters had the fault of delivering an impoverished mixture in case the throttle valve was opened suddenly, causing the engine to halt and even to stop. With later carburetters the fuel-metering orifice is placed at the bottom of the carburetter instead of at the top of the spray nozzle. Between it and the top of the nozzle an accelerating well is provided which filled with fuel when the engine was stopped or throttled down to a low speed. Then, if the throttle were opened suddenly, the contents of the well were discharged into the induction system almost instantly, and the richness of the mixture was maintained.

Another improvement that came into wide use on carburetters between 1920 and 1926 was the economiser. Research work on carburetters and engines showed that for best all-round results the strength of the mixture must be varied with the demand on the carburetter. Maximum power is obtained from the engine with a petrol-air mixture of about 1:12·5, whereas the maximum fuel economy is obtained with a mixture of about 1:16. At extremely low speeds the mixture should be comparatively rich, because the fuel then is not sprayed very energetically and not all of it is vaporised, and only the vaporised fuel counts in the mixture. Throughout the greater part of the range in demand the carburetter should furnish the maximum-economy mixture, for obvious reasons. However, if the throttle is opened wide, the driver wants either the maximum torque (as in ascending very steep hills), or else the maximum power (as in a burst of speed), and in that case the carburetter should deliver the maximum-power mixture. This is accomplished by making the stem of the throttle valve, when approaching the position of maximum opening, change the setting of the fuel metering devices in such a way as to enrich the mixture.

Air Cleaners.—About 1920, American manufacturers began to use air cleaners on passenger car engines, to prevent road dust from getting into the cylinders and causing abnormal wear. The cleaners used were of either the centrifugal or the strainer type. With the former the air is set in rotation in a cylindrical chamber by being drawn in by the engine suction through tangential or helical passages. Centrifugal force caused the heavy dust particles to collect on the cylinder wall and to drop out into a collector, often a glass jar, while the air, deprived of its dust content, is drawn off at the centre of the cylinder. With the strainer type the air is drawn through a large area of filtering felt.

One difficulty encountered in the use of exhaust heat for vaporising the fuel is that the heat supplied does not vary in accordance with the needs when the load on the engine is varied. When the engine is heavily throttled and runs under light load at low speed, the suction on the spray nozzle is small, and consequently the fuel is not finely sprayed. Relatively more heat is needed to ensure the vaporisation of the larger globules of fuel, but under these conditions of operation the exhaust does not supply a great amount of heat. A device designed to overcome this difficulty was developed by the Packard Motor Car Co., and is known as the fueliser. With this (see fig. 4) a variable fraction of the mixture prepared in the carburetter mixing-chamber is shunted around the throttle valve and through a heating jacket of the carburetter, where it is kept burning by a constant stream of sparks delivered by a sparking plug. The products of combustion are combined with the main stream of combustible charge and pass on into the cylinder. When the throttle valve is fully open there is very little resistance to the passage of the combustible mixture past it, and very little then flows through the by-pass or heating jacket; on the other hand when the throttle is nearly closed the passage through it offers much more resistance, and a much greater proportion of the fuel charge passes through the heating jacket, which is in accordance with the requirements.

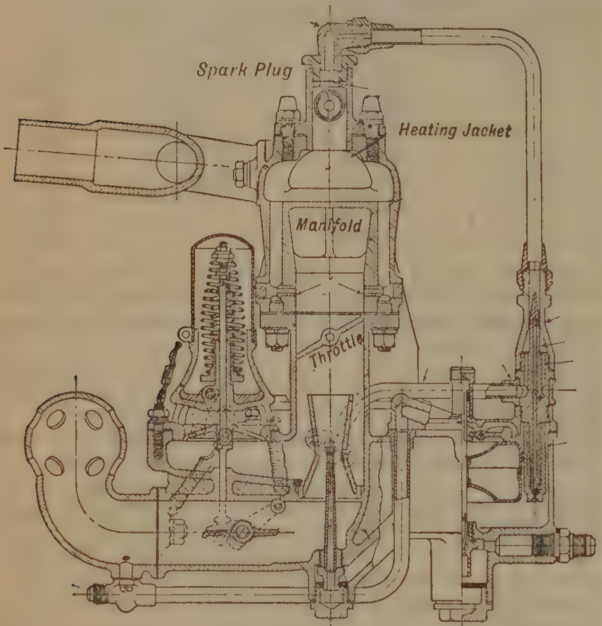

FIG. 4.—Cross section of Packard fueliser.

Feed Systems.—In early cars the fuel tank was almost invariably located in the front seat, and the fuel was fed by gravity to the carburetter. Later the bodies were constantly lowered, partly to secure greater stability and partly for the sake of appearance, and at the same time the carburetter had to be raised in relation to the engine, owing to the lessened volatility of the fuel. The result was that sometimes when the car had to ascend a steep grade and there was little fuel in the tank there was no head on the fuel, and none would flow to the carburetter. Some of the earlier high-class cars were provided with a pressure fuel feed system, by which gas under pressure, taken through an "adapter" from the engine cylinders, was made use of to force petrol from a tank carried on the frame at the rear to the carburetter. There were two major objections to this system of feed: carbon particles from the engine cylinder often got into the fuel tank (in spite of the gas being passed through a fine-mesh wire-gauze strainer) and thence into the carburetter jet, which sometimes became clogged; besides, every time the fuel tank was filled the compressed gas escaped, and to get an initial flow it was necessary to obtain pressure by a hand air-pump. By placing the fuel tank under the cowl instead of in the front seat, sufficient head for gravity feed was generally obtainable, but the cowl tank usually had an awkward shape and was of rather small capacity.

The solution was found in the vacuum feed system, developed by the Stewart-Warner Speedometer Corp., Chicago, by which (fig. 5) the suction or vacuum in the inlet pipe of the engine was used for transferring the fuel from a rear tank to an auxiliary tank mounted on the forward side of the dashboard, as high as possible. The auxiliary tank had two compartments, upper and lower. Into the upper compartment the fuel was drawn by the vacuum, and it was periodically transferred to the lower by a float valve. Thence it flowed to the carburetter by gravity. There was always sufficent fuel in the carburetter float chamber and in the auxiliary tank to start the engine after the main tank had been refilled.

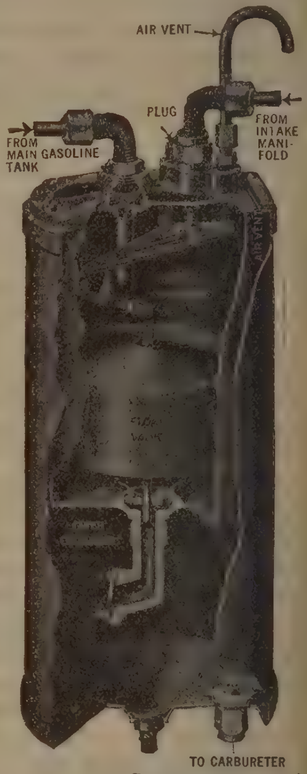

FIG. 5.—Cut-away view of Stewart vacuum tank (fuel feed system).

Ignition.—In 1910 ignition on practically all motor-cars was by high-tension magneto. In 1926 all American passenger cars, with the exception of the Ford (which had a flywheel type of magneto of the maker's own manufacture), had battery ignition. In European countries, on the other hand, although a beginning was made with the replacement of the magneto with the battery and coil system, upon the adoption of electric starting and lighting the movement was soon checked, and in 1925 only 16 out of 133 British models had battery ignition, while in France battery ignition was even less popular and in Germany it was practically non-existent. What led American engineers to change from magneto to battery ignition on passenger cars was the adoption of electric lighting and starting during the period 1912–4. Any car so equipped had an electric generator and a storage battery; consequently there was a constant and plentiful supply of current available, and there was no need for an additional current generator in the form of a magneto. As compared with the early coil and battery systems, the only differences consisted in the use of a plain coil instead of a vibrator coil and of a mechanical interrupter instead of a timer. Sometimes safety devices were provided for automatically opening the circuit or reducing the current flow if the operator should forget to open the switch when the motor stalled.

Use of Thermostats.—No fundamental changes were made in the cooling system, with the exception of the introduction of the thermostat for the control of the circulation. This instrument is connected in the cooling circuit in such a manner that it prevents circulation through the radiator until the jacket water has attained a certain predetermined temperature, generally about 170° Fahrenheit. The result is that in starting from cold the engine reaches normal working temperature in shorter time, and trouble due to incomplete vaporisation of fuel is reduced. The thermostat used, known as the sylphon, consists of a corrugated copper cylinder filled with a liquid which vaporises at the temperature at which the thermostat is to act (fig. 6). An alternate system consisted in the provision of a set of radiator shutters, thermostatically controlled. Many passenger car radiators are fitted with a radiator thermometer in the filler cap, which is a help to the operator in trying to keep his engine running at its best temperature and gives an early indication of incipient overheating.

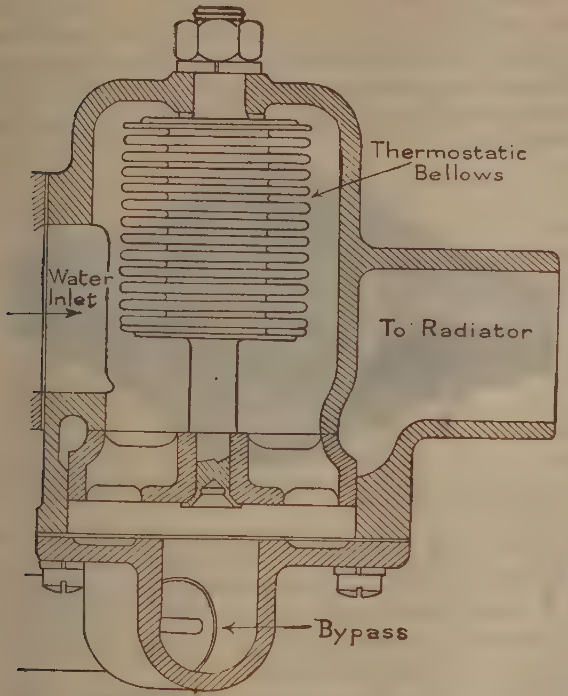

FIG. 6.—Thermostatic valve for control of engine temperature.

Lubrication.—As regards engine lubrication two basic methods came into use, the circulating-splash and the force-feed or "drilled crankshaft" system, as well as combinations of the two. Both systems were employed on early cars, but the force-feed system came into much more extensive use with the development of the high-speed engine. The problem of engine lubrication was rendered much more difficult by the change in the character of the fuel used. A good deal of the fuel entered the cylinder in the unvaporised state, and some of it leaked past the pistons into the crankcase, where it diluted the lubricating oil. In 1920 it was a common experience to find a fresh supply of lubricating oil lose much of its viscosity, and hence of its lubricating value, during the first 100 m. of running. Heating of the crankcase oil also reduces its viscosity, and to reduce this heating many British engines were cast with cooling flanges on the bottom of the oil sump.

Starting and Lighting Gear.—One of the greatest advances in motor car practice was the development of electric starting and lighting systems. The first such system on a car in regular production was on the Cadillac in 1912, and was the design of C. F. Kettering. Electric lighting alone had been used on petrol cars for some years previously, in fact ever since the advent of the tungsten filament bulb. At first the lamps were supplied with current from a storage battery only, which had to be recharged periodically from electric mains; later they were fed with current from a generator and storage-battery installation. The adaption of an electric generator to storage-battery charging on a motor car presented considerable difficulties, for the reason that the petrol motor runs at widely varying speeds, and that the voltage of the generator, therefore, tends to vary within wide limits, whereas a substantially constant voltage is needed for charging.

Many systems of regulation were used with more or less success, but finally the so-called third-brush system was adopted by a majority of the manufacturers of electrical equipment. In this system the generator field was provided with a winding similar to a shunt field winding, but instead of connecting the positive commutator and negative brushes it was connected between one of these brushes and an auxiliary brush, so that only a fraction of the voltage generated in the armature was applied to the field coils. This system of control did not give a constant generator voltage, but with a storage battery connected to the generator it kept both the voltage and the charging current within permissible limits of variation.

In connection with the electric starter the main problem was that of the drive to the engine crankshaft. After trying various devices nearly all manufacturers in the United States and a good many in Europe settled upon the use of the Bendix drive (fig. 7), developed by Vincent Bendix of Chicago. On an extension of the starter armature shaft was loosely mounted a sleeve, which was placed in driving connection with the shaft through a coiled spring. The spring had a coarse, square thread cut on its outside, and on this was mounted the driving pinion, the hub of which was cut with a corresponding female thread. When current was applied to the starting motor, which was always of the series wound type, the armature started to revolve at great speed, carrying along the threaded sleeve on its shaft. Owing to its inertia the pinion lagged behind, and was screwed along the shaft and thus shifted into mesh with a gear-ring on the flywheel rim. Upon abutting against a collar it became fast upon the sleeve, and the starter then cranked the engine, the shock being relieved by the coiled spring.

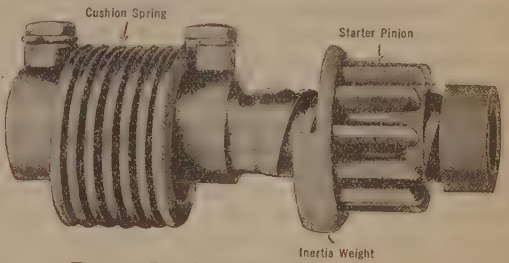

FIG. 7.—Bendix drive for electric starters.

As soon as the engine began to pick up its cycle the flywheel ran ahead of the driving pinion, and the latter was automatically thrown out of mesh by being forced along the screw. Fig. 8,

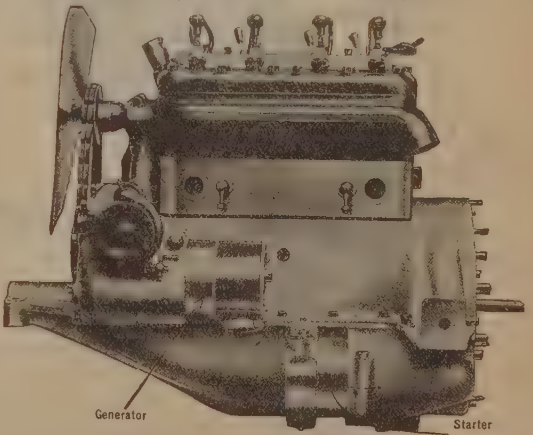

FIG. 8.—Fiat (Italian) engine, showing method of mounting electric generator and starter.

illustrating the Fiat motor car engine, shows one method of mounting the generator and starter. A necessary part of practically all motor car electric equipments was a battery cut-out, which automatically disconnected the battery from the generator when the engine speed dropped so low that the generator voltage was less than the battery voltage, and connected it on increasing engine speed when the generator voltage surpassed the battery voltage. Ground return wiring was very much used, all electric appliances having one insulated and one grounded connection. The standard voltage for motor car electric systems in the United States was 6 v., while in Europe a pressure of 12 v. was much used.

Superchargers or means for forcing into the cylinders a greater mass of charge per cycle than they can draw in by their pumping action received a good deal of attention during the latter part of the War as a means of maintaining the power of aircraft engines at high altitudes. In 1926 the supercharger was commonly used on racing engines and permitted of greatly increased output from an engine of given displacement. On one make of stock car, the Mercedes, the supercharger was fitted as standard equipment. An air-pump of the Roots blower type was mounted at the forward end of the engine and driven from the crankshaft through a friction clutch, which latter was controlled by the accelerator pedal. As long as the throttle was not fully opened the clutch was disengaged and the supercharger therefore idle. A further movement of the pedal after the full-open position of the throttle had been reached, closed the clutch, set the supercharger in action and gave an increase in maximum power of about 65%.

Gears.—Unit-power-plant construction, that is, the combination of the engine, clutch and change-speed gear in a single unit, became very popular, and in the United States was the almost universal practice for passenger cars. About 1910 the dry-disk type of clutch (fig. 9) began to displace the multiple disk-in-oil and the cone type. It was very similar to the lubricated type of disk clutch in construction, but one set of the metal disks was faced with disks of asbestos fabric on both sides. Its advantage over the lubricated disk clutch was that its operation was not affected by changes in atmospheric temperature, as was that of the latter. Most of the earlier dry-disk clutches were of the multiple-disk form, but from 1920 on the single-disk type gained constantly in popularity and in 1926 was used with engines of as much as 70 horsepower. This differs from the multiple-disk form not only in having only a single driven disk, but also in having a set of reducing levers which make the thrust on the throw-out collar about one-quarter the pressure between the disks, whereas in the multiple-dry-disk design illustrated in fig. 9 the two forces are equal. There were no important developments in the design of gearsets or transmissions; nearly all manufacturers of passenger cars used the selective sliding pinion type, and this type was also used on most commercial vehicles.

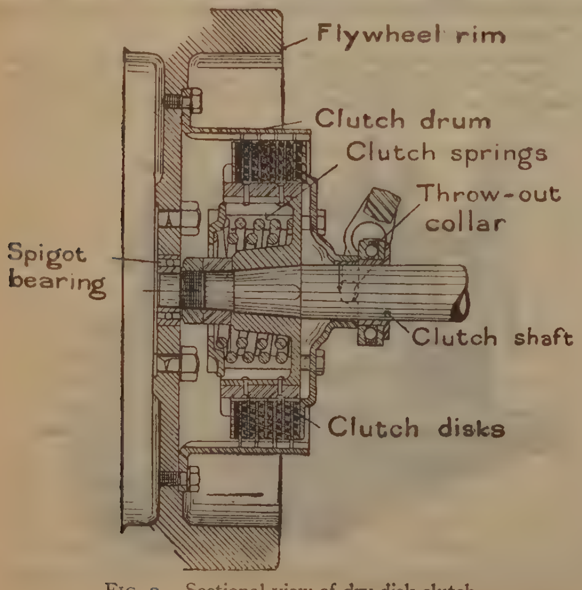

FIG. 9.—Sectional view of dry-disk clutch.

Chain drive was almost entirely discarded, except on trucks in continental Europe, and shaft and bevel-gear drive became the standard for passenger motor cars throughout the world. But two important improvements were made in this drive. One was the substitution of spiral bevel for straight bevel gears, to secure quiet operation, and the other the partial substitution of disk universal joints for the metallic type, the former requiring no lubrication. The spiral bevel gear (fig. 10) was made possible by a gear-cutting machine developed by the Gleason Works of Rochester, N.Y., and the fabric disk universal joint (fig. 11) by a fabric structure originated by Ed. J. Hardy & Co. of Coventry, England. Practice in regard to final drives for motor lorries remained in a chaotic state in 1920. In continental Europe the chain was still predominant, while in Great Britain and the United States the worm drive was in most extensive use. Of the lorry models manufactured in Great Britain in 1926 50% had worm drive, 5% chain drive, 12% bevel gear drive, 1% internal gear drive, and 25% the double-reduction drive, or drive by one pair of bevel and one pair of spur gears enclosed at the middle of the axle. In the United States the most popular drive next to the worm, for trucks of over $1\frac{1}{2}$ tons capacity, was the internal gear drive, in which there was a first reduction by bevel gears at the middle of the axle and a second by internal gears at the driving wheels.

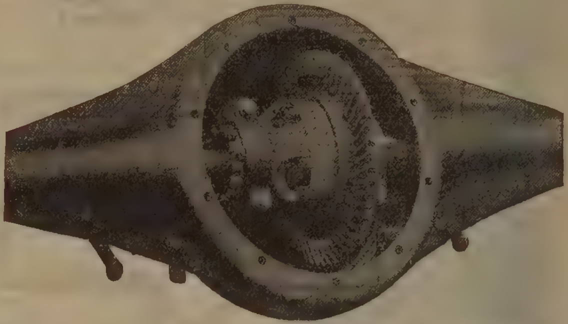

FIG. 10.—Central part of a rear axle with inspection cover removed, showing spiral bevel gear.

FIG. 11.—Thermoid-Hardy fabric universal joint.

Axles and Springs.—In connection with lorry axles, mention should be made of the development and use, mainly in the United States, of so-called non-stalling differential gears. A vehicle fitted with this type of differential would not lose all traction when one driving wheel gets on slippery ground; on the other hand, in turning corners the drive was entirely through the inner wheel. A type of body suspension spring that gained much in popularity between 1910 and 1920 was the cantilever type first used by F. W. Lanchester in England. The most extensively used type in 1926 was the half-elliptic. Many attempts were made to solve the problem of furnishing the springs with effective means of lubrication, to make them as supple as possible and to prevent squeaking, and in England the practice of enclosing the springs in leather gaiters gained some ground. In the connection between the rear axle and the frame, provision must be made for taking up the driving thrust necessary to overcome the air resistance and the resistance encountered by the front wheels, as well as the reaction to the rear-wheel driving torque, which tends to turn the axle housing in the direction opposite to that in which the wheels are turning. In the Hotchkiss drive, both the drive and the torque reaction were taken up on the body springs, which were securely clipped to the axle housing and directly pinned to the frame at their forward end. This pattern became very popular in the United States for both passenger cars and lorries, and was successfully used even on heavy military lorries.

European designers, on the other hand, favoured the torque-tube construction for passenger cars. In this the propeller shaft was surrounded by a torque tube, which was rigidly secured to the housing at the centre of the rear axle, and at its forward end had either a forked or a spherical connection to a cross member of the frame or the rear end of the transmission case. In the United States one manufacturer after another adopted the plan of mounting the steering post on the left side, realising that in a country where the " right-hand " rule of the road obtains, the balance of advantages rests with the left-hand drive. Left-hand steering fits in well with brake and gear-shift levers mounted in the centre of the car, as the driver can use his right hand to operate them. In Great Britain, where the rule of the road is to " keep to the left," right-hand steering has the same advantages as left-hand steering in other countries.

Wheels.—The wheel equipment of the earlier cars was almost entirely of wood-spoked type. Woods suitable for rims and felloes became rare, however, especially in Europe, and a strong tendency toward the use of metal wheels then set in. In fact, with one exception, all British manufacturers of passenger cars fitted metal wheels as regular equipment on their 1925 models. There were three types of metal wheels for passenger cars, viz.: wheels similar in shape to wood-spoked wheels, made of two steel pressings welded together (chiefly used in England), wire-spoked wheels and disk wheels (figs. 12, 13 and 14). An improvement in wire-wheel design, which was a great factor in rendering these wheels practical for heavy, powerful vehicles, was the triple lacing due to John V. Pugh of England.

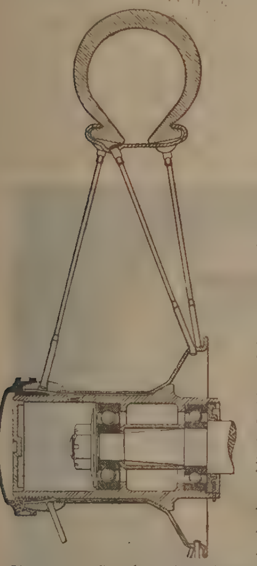

FIG. 12.—Section of Rudge-Whitworth demountable wire wheel with Pugh triple lacing.

Disk wheels came into extensive use during the War; they may be divided into single and double disk types. To secure the necessary lateral stiffness with a single disk it was customary to cone the disk, and, moreover, the disk was usually reduced in thickness from the hub toward the rim, either by turning in the lathe or by rolling.

All motor-vehicle wheels are provided with steel rims designed to take the pneumatic or solid rubber tires (*see* TIRES). The original type of motor-vehicle rim for the double-tube pneumatic tire was the clincher rim, the edges of which are formed into clinchers to hold the beaded edges of the tire cover. This type of rim remained the standard in Europe, but American manufacturers early adopted the detachable rim, which permits of the use of a steel cable core in the edges of the tire cover to make it inextensible. In the earlier detachable rims one flange of the rim was removable, and the tire could be stripped off sideways after the flange had been detached. Some of these detachable flange rims could be used with both clincher and straight-sided tires, and were therefore known as universal rims. Later, when the clincher tire was given up by American manufacturers for all except the smallest sizes, a different type of detachable rim was introduced, in which there is a joint in the circumference of the rim. After opening the locking mechanism of this joint the rim can be contracted sufficiently to pass through the tire. In order that detachable rims may always be free-working the rims must be thoroughly rust-proofed, and care must be taken in handling the rim not to distort it.

Tire Repairs.—In the early years of the motor-car, when a tire was punctured or otherwise defective, the operator was obliged to make a repair on the spot, or at least remove the tire cover, insert a new tube, replace the cover and inflate the tire anew. The difficulty was overcome by the adoption of the demountable wheel in Europe and the demountable rim in America. American motorists thereafter carried one or two spare rims fitted with fully inflated tires, and in case of a puncture merely removed the rim with the defective tire and replaced it with a spare rim and inflated tire, an operation usually requiring from 10 to 15 minutes, leaving the repair of the damaged tire to be done at home or at a tire service station. European motorists carry spare wheels with inflated tires in the same way. The advantage of the demountable rim over the demountable wheel is that the spares weigh less; the advantage of the demountable wheel is that it weighs less than a wheel with a demountable rim, and especially that with it there is less weight near the circumference of the wheel, where it has a strong flywheel action. Moreover, with the detachable wheel the detaching mechanism is at the hub, farther removed from rust-promoting influences.

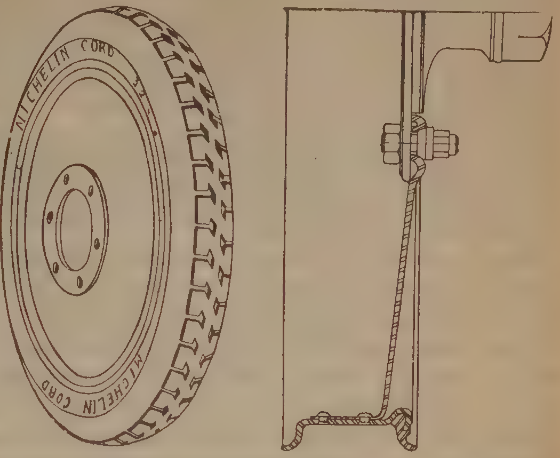

FIG. 13.—Michelin disk wheel, outside view and section.

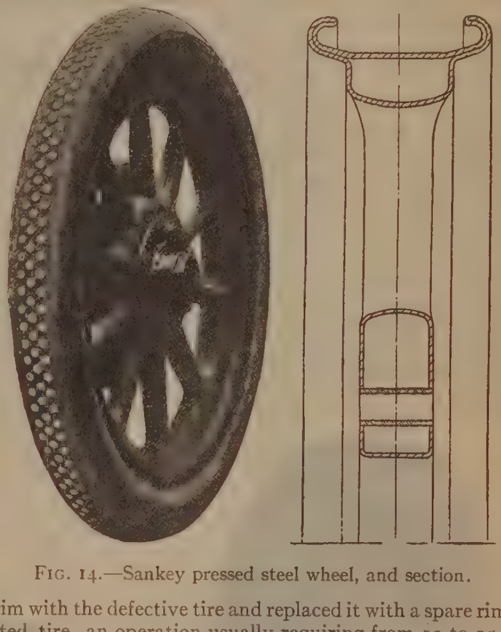

FIG. 14.—Sankey pressed steel wheel, and section.

The structure of demountable rims may be briefly described as follows: forced over the felloe of the wood wheel is a steel felloe band with a wedge surface on its outside, and an inward flange on one edge through which end the wood felloe pass the felloe band bolts. Over this felloe band is passed the rim carrying the tire, which is formed with a wedge surface on its inside, adapted to engage the wedge surface on the felloe band. Rim lugs with wedge-shaped projections are threaded over the ends of the felloe band bolts, and the nuts on the bolts are then screwed up, forcing the wedges into the space between the felloe band and the rim. In this way the rim is subjected to both radial and lateral pressure and is centred and firmly held on the felloe band. Both clincher and detachable rims can be used in connection with demountable rims.

Solid rubber tires are vulcanised on to the steel base bands, and wood wheels to be fitted with such tires have a steel felloe band shrunk over them. The tires are then mounted on the wheels in a demountable way by means of wedge rings, side flanges and bolts. Cast-steel wheels generally have one wedge ring cast integral and do not need a side flange on that side.

Brakes.—Practically all the cars manufactured up to the end of the War had brakes acting on the rear wheels only, but from that time on a rapidly increasing number were equipped with brakes acting on all four wheels. Four-wheel brakes were pioneered by Henri Perrot, engineer of the Argyll Motor Car Co., of Glasgow, in 1910. They permit of making a stop in substantially one-half the distance as with rear-wheel brakes, thus adding to the safety of automobile travel. The minimum stopping distance depends upon the pressure against the ground of the wheels through which the brakes take effect, and when the brakes are applied there is a decrease in the ground pressure of the rear wheels and an equal increase in that of the front wheels, which tends to make the front-wheel brakes particularly effective. In the application of brakes to the front wheels certain conditions must be met. Setting of the brakes must not prevent steering motion and, *vice versa*, the deflection of the wheels in steering must not change the setting of the brakes. Moreover, it must be practically impossible to lock the front wheels by means of the brakes, because the car will not respond to a steering motion if the wheels do not revolve.

Two general types of four-wheel brake were worked out. In one the power necessary for the application of the brakes was transmitted entirely by mechanical means, which in the case of the front wheel brakes involved some difficulty, owing to the relative motion between brake drum and axle. It was necessary to provide a universal joint in the shaft of the brake-expanding cam or the brake-band-contracting lever, whose centre lay in the axis of the steering knuckle pivot, so that steering motion of the wheels would not affect the setting of the brakes. The brakes on all four wheels were linked to the brake pedal. To obviate the danger of locking the front wheels, some designers divided the force of brake application unequally between front and rear, usually about 40% to the front brakes, while in the Perrot design the linkage was so arranged that as the front wheels were swung around in turning there was a tendency for the brake on the outside front wheel to release automatically, thus preventing locking of this wheel and consequent loss of control. As regards equalisation there was absolutely no uniformity of practice in 1925. In some systems the force of application was equalised between front and rear and between right and left, while others used no equaliser at all. A mechanically operated front-wheel brake is shown in fig. 15. A is the lever to which the brake rod or link attaches; B, the cam-shaft; C, the cam; and H, the means of adjustment for wear.

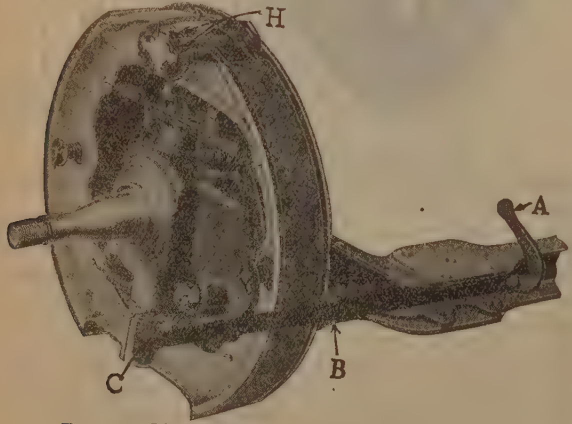

FIG. 15.—Mechanically operated front wheel brake.

In the other type of brake referred to, the force of application was transmitted by means of a confined liquid, this type being known as the hydraulic brake. The brake at each wheel comprised a cylinder in which there were two pistons which acted upon the brake bands, or shoes, through bell cranks. These cylinders communicated through heavy hydraulic hose and copper tubing with a master cylinder within which there was a piston that was connected to the brake pedal. The whole system was filled with a liquid (a castor oil and alcohol mixture) that does not congeal in winter and does not attack the rubber hose. Pressing on the pedal forced some of the liquid from the master cylinder through the tubing into the brake cylinders, thereby forcing the two pistons in each brake cylinder apart and applying the brake. The slight loss of liquid from the system, by leakage, was made up by pumping additional liquid into it from a reserve tank on the dashboard, provided with pump and shut-off valve. One feature of the hydraulic brake was that it was always fully equalised.

With otherwise equal construction four-wheel brakes require substantially twice the effort on the part of the operator to apply them, hence persons of limited physical strength, particularly women drivers, found it hard to apply the brakes to the locking point. This led to the development of so-called servo brakes, in which the momentum of the car was utilised to reinforce the effort of the driver in applying the brake. The simplest form of servo brake is a band brake anchored off centre, and after the adoption of four-wheel brakes most band brakes had the band so anchored that the section which tended to wrap up on the drum when checking forward motion of the car was considerably longer than the other (unwrapping) section. The principle of the mechanical servo brake may be very simply explained as follows: Imagine a drum mounted on a shaft which is positively geared to the rear axle. Let a rope be wound around the drum, one end of the rope being connected to the brake pedal and the other to the lever of the brake-expanding cam. Then, if the operator presses on the pedal and thereby exerts a pull on the forward end of the rope and assuming the rope to be wound around the drum in the right direction, the resulting friction between rope and drum will multiply the tension in the rear end of the rope and the pull on the brake lever will be several times as great as if it were connected directly to the pedal. With internal or expanding brakes a servo effect was obtained by providing a floating shoe, which was pivoted to the free end of the anchored shoe. If only these two shoes were provided the brake would have very little effect in holding the car against reverse motion, and for this reason the Bendix-Perrot brake, illustrated in fig. 16, was made with three shoes, the third shoe being depended on mainly for checking reverse motion. Some cars, notably the Fiat in Italy and the Studebaker in America, were fitted with an hydraulic servo mechanism. This consisted of an oil pump combined with the transmission gear, which was always running as long as the car was in motion. Normally the oil was by-passed from the delivery to the suction port of the pump, and no effect was produced, but by closing a valve between these two ports by means of the brake pedal, a pressure was set up in the system which moved a piston connected by mechanical linkage to the different brakes. If the hydraulic mechanism failed to work for any reason (owing to leakage of oil, for instance), by pressing the brake pedal down farther than required to operate the hydraulic system, the operator could apply the brakes directly by foot pressure. A diagram of the hydraulic servo mechanism used on Fiat cars is shown in fig. 17.

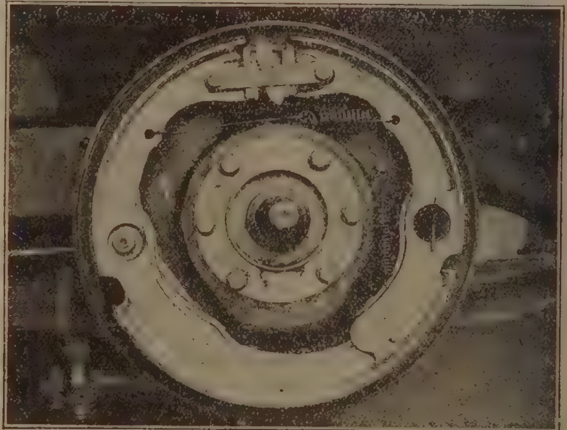

FIG. 16.—Bendix-Perrot three-shoe servo brake.

III. EQUIPMENT

There is one notable difference in the commercial practices of American and European motor-car manufacturers. In the

United States it is customary to sell cars complete with bodies and all necessary equipment, so that upon being filled with fuel and water they can immediately take the road. The equipment usually includes such items as wind-screen, lamps, speedometer, jack, tire pump and tools. European manufacturers, on the other hand, previous to the World War, often made it a practice to sell only the bare chassis and let the customer arrange for the body with a coach-builder and select the equipment himself. After the War they began to follow the American practice, especially with low-priced cars.

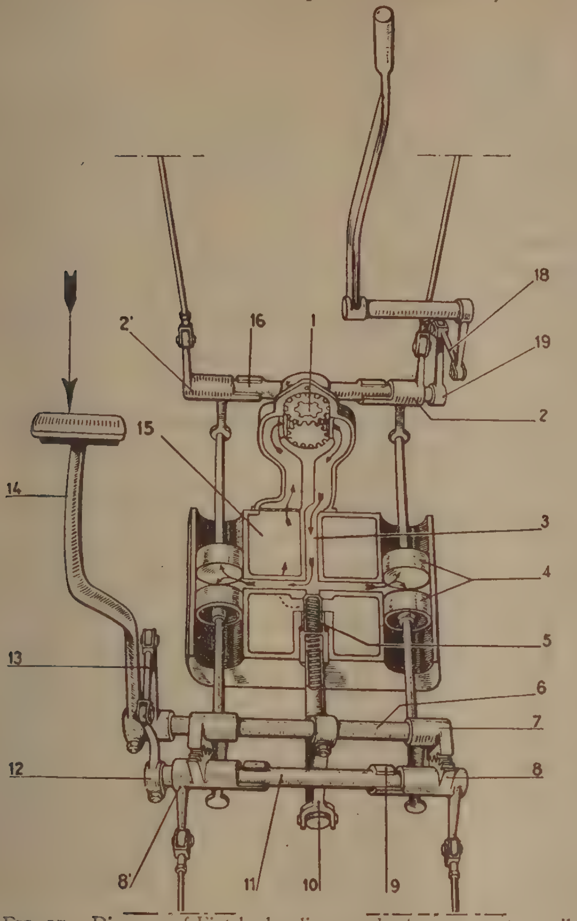

FIG. 17.—Diagram of Fiat hydraulic servo brake: 1, gear type oil pump; 2, 2′, floating levers in front wheel brake linkage; 3, delivery passage of pump; 4, servo pistons; 5, servo control valve; 6, brake pedal shaft; 7, gear sector on brake pedal shaft; 8, 8′, gear sectors on floating levers in rear wheel brake linkage; 9, nose on shaft 11 which engages with corresponding nose on hub of floating lever; 10, lever on brake pedal shaft to which servo control valve is connected; 11, cross shaft connected to brake pedal through lever 12 and link 13; 14, brake pedal; 15, oil by-pass; 16, cross shaft operated from brake hand lever through link 18 and lever 19.

Mass Production.—Many of the cars produced in the United States were made on what is known as the assembling plan; that is, the various major components, such as engine, clutch, gearset, axles, frame, springs and steering gear, were all manufactured in different factories by concerns specialising in these products, and were assembled into a complete car in the assembling plant. The advantages of this plan are obvious and include the possibility of intensive development of design and the economy of quantity production. The extent to which assembling was practised may be judged from the following figures: Of the American passenger-car models for 1920, 92% were fitted with stock carburetters, 75% with stock steering gears, 66·7% with stock clutches, 65·1% with stock rear axles, 58·7% with stock transmissions and 42% with stock engines, all these stock parts being made by specialists. In the field of commercial vehicles the practice of assembling was even more prevalent.

Bodies.—After the War the use of closed cars increased very rapidly in the United States. Previous to that time a limousine or any other of the closed types then in use cost substantially twice as much as the corresponding open model, and this naturally limited sales. Moreover, most of the earlier closed cars were of the chauffeur-driven type, in which the driver's seat is partitioned off the passengers' compartment. Endeavours to reduce the cost of production of closed bodies resulted in greatly widening the possible market for this type of car. A new low-cost design known as the coach was evolved and popularised by the Hudson Motor Car Company. It promptly met with great favour and was soon offered by a large number of manufacturers. The coach is essentially a five-passenger closed car with only two doors. The seat adjacent to the driver's folds forward, thus giving access to the rear seat through the door on the right-hand side (with left-hand drive). Coaches in some instances sold at prices lower than those of the corresponding open models, this being made possible by the fact that the particular maker had a much larger production on the former than on the latter. The growth in popularity of the closed car in the United States may be judged from the fact that the proportion of closed cars in the total production rose from 1.5% in 1915 to 17% in 1920, and had attained 56% in 1925.

On open or touring cars the collapsible top was to a large extent superseded by the California type or permanent top. It was found that repeated raising and taking down was quite injurious to the folding top, causing it to crease and appear shabby, and this difficulty was eliminated by the permanent construction, which also prevented sagging between bows, a common fault of old folding tops. A number of British and German makers provided a compartment in the body into which the top disappeared when folded, but generally the appearance with the top up was not all that could be desired. Many attempts were made to produce double purpose or convertible open and closed bodies. In the early types the whole superstructure was removable as a unit, but this did not prove successful in the long run. In England the "all-weather" type of body became very popular. One of the first British cars to be equipped with an "all-weather" body was the Standard, and after 1920 many other British makers fitted it.

As made in England, the "all-weather" body comprised a regular open body with folding top and more or less rigid, transparent panels which could be used to close the sides during periods of inclement weather, these panels taking the place of the flexible side curtains with transparent inserts previously used. The transparent medium was either glass or celluloid. Usually there were a number of fairly rigid frames of flat steel, covered with fabric leather and secured to the doors and the sides of the body. The transparent element was of smaller dimensions than the supporting frame and the space in between was filled with fabric leather, hence there was no possibility of the glass being broken by distortion of the body frame communicated to the panel frame. The panels on the doors swung open with the latter, but in some cases they were secured by snap fastenings to valances on the top, and these fastenings had to be loosened first. At the front the panel was joined to the windshield pillar, and endeavours were made to have this joint rain- and draught-proof. Similar joints were made between the upper edge of the panels and the top. Usually there were three panels on each side, but sometimes there was a fourth at the side of the rear seat. Some of these panels were so designed that they could be used as rear wind-screens when the top was down, being entirely independent of the top for support. Provision was made for storing the panels inside the car, either in a tray under the front seat or in a compartment in the rear cowl.

The Weymann Type.—A type of closed body that was distinguished by light weight, low cost of construction and freedom from squeaks was brought out by Weymann in France. It had a framework of $1\frac{1}{2}$-in. square wooden members which, however, were joined together by means of comparatively light metal strips bent to angle shape and secured with wood screws. Thus the wooden members did not come in contact with each other and the cause of squeaks was eliminated. The seats were made separate from the body and supported directly on the chassis frame, which caused the passengers to be seated lower and permitted the body to be lower. The framework was covered with fabric leather, which was painted the same as the metal panelled body. Another advantage claimed for this construction was that it entirely eliminated "drumming," an objectionable feature of practically all closed bodies with metal panels. According to Weymann, a four-passenger saloon body for a 130-in. wheelbase chassis built on this plan need not weigh more than 440 lb., including fenders, valances, running boards, spare-wheel carrier and tool box, which is a great deal less than the weight of the usual open body for a car with this length of wheelbase. A disadvantage of the Weymann pattern limited the designer practically to straight lines, and some of the early Weymann bodies were of rather severe appearance.

Numerous items of equipment added to the comfort and convenience of driver and passengers. In the United States it was customary in 1926 to equip closed cars with exhaust heaters for use in cold weather. Ventilators were provided in the cowl and in the roof, or ventilation was effected by slightly raising the windshield. The windows in the doors and sides of the car could be raised and lowered at will, and with all the windows down the passengers were as much in the open air as with an open car, while under all conditions the vision was as good as from an open car with the top up. With windows closed it was impossible for the driver to give the usual signals to drivers behind by extending his arm, and this was rendered unnecessary by providing the cars with a stop light at the rear which lit up automatically whenever the brake was applied.

In case of rain or snow a section of the windshield in front of the driver's eyes was kept clear by means of a windshield cleaner, consisting of a swinging metal arm carrying a rubber squeegee, which was operated by hand on some of the lower-priced cars and by a vacuum engine (connected to the inlet manifold of the car engine) or by an electric motor in the majority of the models. A visor over the windshield protected the driver's eyes against direct sunrays. The button for the signalling horn was located at the centre of the steering wheel; depressing this button sounded the horn, and by turning it slightly around its axis the headlights could be dimmed to prevent annoyance from glare to on-coming drivers and could be brightened again when no one was approaching. All control instruments, sometimes including an engine thermometer and a fuel-tank gauge, were conveniently and neatly arranged on the instrument board. Many of the items of equipment enumerated were also furnished on open cars. Many owners had their cars fitted with bumpers at both front and rear, as a protection of the exposed parts, such as headlights, fenders, radiator, etc., in case of a minor collision.

Body Finish.—A new method of finishing motor-car bodies was introduced by one of the large American makers during the summer of 1923, and came into wide use in the industry within a short time. It consisted in giving the bodies a finishing coat of a lacquer of which pyroxylin was the base.

Previous to that time all the bodies built partly or wholly of wood were finished in varnish, which was open to the objections that the process of finishing was very tedious, owing to the fact that a long time had to be allowed for drying after each coat had been applied, and that the surface obtained was not sufficiently proof against scratching. Bodies constructed entirely of metal were generally "flowed" or sprayed with enamel and baked in ovens. This overcame both of the disadvantages experienced with varnish, but most of the bodies had a wooden frame and these could not be enamelled, as the wood would have been injured by the high temperature of the baking process; besides, with enamelling, the finish could be had only in black, as colours would have been affected by the baking heat. Pyroxylin base lacquer had been used previously; but its applications had been limited, owing to certain difficulties which were overcome in 1923.

The first lacquer of this type to come on the market was known as Duco, but it was soon followed by many other brands. When finishing a body with pyroxylin base lacquer, the same priming and surfacing coats are applied as with varnish. Usually the body is given either two or three coats of the lacquer. When the last coat of lacquer has dried it presents a so-called egg-shell finish, and a polish is then obtained by rubbing the surface with pumice and rottenstone and applying a coat of polishing wax. A glossy surface can be obtained by giving the surface a coating with a clear lacquer of a pyroxylin base. To the car manufacturer the advantage of the pyroxylin finish resides chiefly in the cutting down of the time required for the finishing process. Aside from this saving in time and the consequent saving in the manufacturing process, pyroxylin finish makes it possible to obtain a colour finish at a moderate price, and the surface is exceedingly hard and cannot be scratched or chipped easily, while the life of the finish is several times that of a varnish-finished surface.

IV. THE SMALL CAR

Owing to high licence fees (taxes) and the high cost of fuel, European makers after the War paid particular attention to the small car, as a means of reducing the cost of motoring. In the United States in 1926 the smallest car built had an R.A.C. rating of 15·6 H.P. and very few models rated at less than 20 horse-power. Of the 145 British models in production that year six had a rating of less than 10 H.P. and considerably more than one-half rated at less than 15 horse-power. The cars were also built narrower. Practically all American cars, even the smallest, had the standard tread of 56½ in., or at least approached it very closely, while about one-half of the British models had a tread of 50 in. or less, the minimum being about 43 inches. Practice on the Continent resembled that in Great Britain. The average British car of 112–115-in. wheelbase had a H.P. rating of 12, and as the annual tax was £1 per H.P., the saving on this item was quite considerable, as compared with the average American car of the same wheelbase, which had a rating of 22 or 24 horse-power.

With the smaller engine the fuel consumption for the same weight of car is also appreciably less, due to the fact that the load factor of the engine is higher (the average load carried is a greater fraction of the maximum output of the engine), and the efficiency of the engine increases with the load factor. On improved roads very good speeds could be made even with the small engines, which were always of the high-speed type (sometimes called high-efficiency type). Of course, acceleration was not so good, and more of the running had to be done on the lower gears, which involved more frequent gear shifting. Some of the smallest cars, like the Austin 7 H.P., approached a motor-cycle with side-car in power, weight and other characteristics. This vehicle had a four-cylinder engine of 55 mm. bore and 75 mm. stroke and weighed complete with 2-passenger body 790 pounds. The chief demand, however, was for the type of car rating at between 10 and 14 horse-power. Among the most popular smaller cars in 1925 were the Morris in England and the Citroën in France.

Ford Cars.—A unique position in the American motor-car industry has been occupied by the Ford Motor Co., whose annual production for several years constituted about one-half that of the whole industry. This company in 1909 developed a passenger car which sold for the next 17 years without material modifications in design except as regards the body and equipment. This stability of design made possible production on an unequalled scale and at remarkably low cost. In 1925 the price of the two-seater (22.5 H.P., R.A.C. rating) was $260, and that of the open 5-seater $290 f.o.b. Detroit. This, however, was without the self-starter and battery lighting equipment, which were taken by practically all purchasers and which made the cost per car $85 higher. The company operated a plant at Manchester, England, at which 90% of all the work of manufacture on the cars sold in Great Britain was said to be done. It also had a factory in Lyons, France, and assembling plants at Copenhagen, Denmark and Antwerp, Belgium. In 1925 the company stated that it had delivered more than 12,000,000 vehicles, and that it was then producing 7,000 per day.

V. PRODUCTION, STANDARDISATION AND MARKETING

Amazement is often expressed at the enormous capacity of the American market for absorbing cars. Calculations of the limiting market were sometimes made on the premise that a certain minimum income (say $1,500 annually) was necessary in order to enable a person to keep a car, and from income-tax records the supposed number of possible owners was then determined. However, these predeterminations of the so-called "saturation point" practically always erred on the conservative side. Three main factors made it possible for the American people to maintain substantially 20,000,000 cars in 1926—roughly two cars for every three families (1) a great reduction in prices made possible by improved manufacturing processes; (2) the introduction of the time-sales plan and (3) the practice of many

TABLE III. *Statistics of the Development of the American Industry*

	1909	1914	1919	1924	1925
Capital invested	$173,837,000	$407,730,000	$1,802,302,862	$1,691,050,112	$1,888,028,810
Cars and lorries produced[1]	127,731	569,045	1,974,016	3,617,602	4,336,754
Value of products	$249,202,000	$632,831,000	$2,506,834,594	$3,168,588,146	$4,210,174,963
Persons engaged in mfg.	85,359	145,951	651,450	629,563	711,442[2]
Wages and salaries	$58,173,000	$139,453,000	$813,731,856	$547,215,700	$649,668,829[3]

[1] From U.S. Census. Based on statistics of complete car production gathered by National Automobile Chamber of Commerce and on the assumption that the parts and accessories business grew in same proportion. [2] 361,442 in motor-car and lorry plants, the rest in parts and accessories (exclusive of tires) plants. [3] In motor-car and lorry plants alone.

well-to-do motorists of buying a new car every second or third year and trading-in the old machine, which depressed second-hand values to a very low point.

TABLE IV. *Statistics of the American Industry for 1925*[1]

Number of passenger cars produced	3,839,902
Number of lorries	497,452
Number of open cars	1,676,171
Number of closed cars	2,163,131
Wholesale value of passenger ears	$2,523,642,558
Wholesale value of lorries	$454,262,275
Parts sold by motor-vehicle manufacturers	$308,830,130
Replacement parts and tires	$923,440,000
Total wholesale value of vehicles and parts	$4,210,174,963
Number of motor vehicles exported	536,741
Registrations of passenger cars	17,512,638
Registrations of lorries	2,441,709
Total registrations	19,954,347
Number of motor-vehicle dealers	48,555

[1] From *Facts and Figures of the Automobile Industry*, published by the National Automobile Chamber of Commerce. The production figures given apply to the U.S. and Canada combined, practically all of the producing establishments in Canada being branches of U.S. firms.

The large numbers in which particularly the lower-priced American cars were manufactured made possible very economical methods of production. Many parts that were formerly made of sand castings were made in the form of sheet metal pressings or die castings. Both these methods of production are very much more economical, if a large number of duplicate parts is required, although the initial investment for equipment, such as dies, presses, etc., is very high. In drilling the bolt holes in engine blocks, as many as one hundred holes, from top, bottom and both ends, were drilled in a single operation in a multiple spindle drill press. All the cylinder barrels of six or eight cylinder blocks were bored at the same time, and the flat surfaces on the outside of the block were finished in large milling machines, to the tables of which a large number of blocks could be strapped at the same time. Machine tools of the automatic and multiple station type were largely introduced, the latter having indexing tables making it possible to load and unload the machine at one station while work was going on at one or more other stations, so that no stops were required for reloading. All the sheet metal parts, such as fenders, aprons, etc., when finished were hung on a conveyor which automatically dipped them in tanks of japan and carried them through a baking oven, so that the only hand work in the finishing process consisted in hanging the parts on the conveyor and taking them off again.

Assembling of the car also is done on a conveyor, or moving line. The work of assembling begins with the frame, which is pulled along rails by means of the conveyor chain at the rate of 5 or 6 ft. per minute. After the axles, springs and wheels are assembled, the chassis is turned over by means of a hoist, and thenceforward is moved along on its wheels, while the rest of the parts are put on. Some of the major components, such as the engine, transmission, steering gear, etc., are previously assembled on separate lines and brought to the proper point at the side of the main assembling line by means of conveyors. Large use is made of gravity conveyors, that is, inclined planes made up of closely spaced steel rollers, which eliminate the necessity of lifting heavy parts by workmen. This is only a small selection of the methods adopted by American motor-car manufacturers which enabled them to cut down the man-hours required in the manufacture of a complete car from 1,460 in 1904 to 641 in 1914 and to 435 in 1924.

The first two of the foregoing figures are based on U.S. Census reports, while the last is based on statistics of the National Automobile Chamber of Commerce, a work-year in each case being taken equal to 2,500 work-hours. This does not take into account the fact that about one-half of the 1924 cars were of the closed type, as compared with an insignificant proportion in 1904, and all carried much more equipment. The great drop in automobile prices after the War is best illustrated by some figures gathered by the National Automobile Chamber of Commerce according to which the cost of cars at the beginning of 1925 was 71% that in 1913, whereas the cost of living was 167% and the cost of erecting frame buildings 196%.

Standardisation (*see* MACHINE TOOLS; MEASURING INSTRUMENTS).—A great help to the motor-car industry in the United States was the standardisation work of the Society of Automotive Engineers, concurrent with specialisation in the manufacture of parts. One of the first things standardised was fine-pitch screw threads. It was found that the former standard threads, such as the U.S.S., Whitworth, etc., were too coarse for motor-car work, and manufacturers began devising their own fine-thread standards; if this had continued it would have led to the use of many different pitches for screws of the same diameter, which would have been most annoying to the user. In order to obviate this, the S.A.E. screw thread was evolved, and soon came into common use. A great deal of the standardisation work was concerned with the joints or connections between parts made in different factories. Thus the mountings, on the engine, of carburettors, battery ignition units, magnetos, electric generators, starters and tire pumps were standardised, as were flywheel housings, shaft fittings, spring mountings, etc. At the end of 1924 there were more than 200 separate motor-car standards on the records of the S.A.E. Great Britain had a similar technical society, the Institution of Automobile Engineers, but motor-car standardisation work was carried on by a sub-committee of the British Engineering Standards Committee, on which both the Institution of Automobile Engineers and the Society of Motor Manufacturers and Traders were represented. There was also a technical society in Germany, the Automobil und Flugtechnische Gesellschaft, but it had not been active. During the World War engineering standardisation work was begun in Germany by a general organisation covering the whole engineering trade, and after the war motor-car standardisation was continued by the Reichsverband der Automobil-Industrie.

VI. DEPRECIATION AND INSURANCE

A private car naturally is most enjoyable during the first years of its life, while it is still fairly representative of the highest advance of the art, while its finish is unmarred, its mechanism runs smoothly and quietly and while the chances of breakdowns on the road are at a minimum. Therefore, many American motorists "trade in" their cars every second or third year for new ones. The average American automobile built prior to 1920 had a life of about 7 years, so the average depreciation was slightly less than 14%, the car having still some "junk" value at the end of its useful life. However, during the first few years the depreciation was much greater. The "used-car problem" became a great bugbear to the American industry and trade. Very few cars of the better grades were operated by their original owners until worn out, hence in the case of practically every sale of a new car an old one had to be taken in, and in their eagerness to effect a sale, dealers often made a greater allowance than the condition of the car and the state of the market warranted.

This was reflected in the high rate of "mortality" among automobile dealers, which reached 25% in 1922 and 26% in 1923 but declined to 21% in 1924. For the guidance of dealers the Chicago Automobile Trade Assn. published an index of used car values which circulated throughout the country. From this it was found that the values of a car at the end of successive years of service formed substantially a geometrical series and that the value at the end of the year on the average was only slightly more than 50% than at the beginning of the year. After the first few years the higher grade cars depreciated somewhat less rapidly than the lower grades. In the following table are given the valuations of the 1919–24 models of three makes of car—high, medium and low-priced, respectively—during the second quarter of 1925.

Used-Car Values

Year of Manufacture	1924	1923	1922	1921	1920	1919
Original cost	9,000	7,000	7,000	9,000	9,500	. .
Value in May 1925	. . .	2,300	1,700	1,200	850	150
Original cost	965	1,195	1,395	1,795	1,595	. . .
Value in May 1925	385[1]	275	185	175	75	35
Original cost	510	525	525	525	795	. .
Value in May 1925	255	150	90	50	25	10

[1] This exceptionally high depreciation was due to the fact that the particular model was discontinued by the manufacturer. The rate of depreciation in general also was affected by the fact that from 1920 on new car prices decreased materially.

The above table shows that the item of depreciation during the latter years of a car's service is very small.

The life of a car naturally is a matter of considerable moment to both the owner and manufacturer. The assertion has been made that there is no limit to the possible life, as all parts are interchangeable, and any part that wears out can be replaced by a new one. There is an element of truth in this statement, and it is quite possible to obtain phenomenal mileages if that is desired above everything else. In practice users find that after a car has given a certain amount of service it is best to "scrap" it and get a new one. With increasing age the cost for repairs increases rather rapidly, the car becomes "rattly" and therefore less pleasant to operate, it usually becomes shabby in appearance, and besides, it does not possess the improvements of the newer models making for increased comfort and convenience of the occupants. When a certain state of depreciation and obsolescence has been reached, the car therefore usually goes to the "auto-wrecker," who takes it apart and sells some of the parts for repairs to other old models and the rest for scrap metal.

Since there are available in the United States fairly accurate statistics of annual production, registrations (cars in use), exports and imports, it is possible to calculate quite closely the average age of the cars which have been scrapped. Each year there are newly put into service a number of cars which is equal to the number produced in the country that year, minus the number exported, plus the number imported. If no cars were scrapped, then the total number of registrations would be increased in the course of the year by the number newly placed in service. Actually the increase in registrations will be less, and the difference between the number of cars newly placed in service in any year and the gain in registrations during that year is the number of cars scrapped during the year. The average life is then substantially equal to the interval between the one-year period during which an equal number of cars was newly placed in service and the year during which the cars went out of service. Some correction must be made for the fact that the going into service of all cars does not coincide with the beginning of the year in which they were first registered. By the use of this method it was found that the average life of all cars which were scrapped in the United States during the three-year period ending with 1923 was 6.9 years.

Car Thefts.—After the War the loss of motor-cars by theft became a serious hazard, which is partly accounted for by the fact that by that time cars had become so numerous that practically the whole of the younger generation had the opportunity to learn their operation.

There were two general forms of automobile thievery. One form, indulged in particularly by irresponsible youngsters, consisted in taking a car that was left by its owner at the curb, going for a "joy ride" and leaving it at the roadside wherever the fuel supply ran out, an accident occurred or something else intervened to compel the abandonment of the trip. The more serious form was theft of cars with a view to their sale to the public. The division of the United States into a large number of states, each with its own laws and police powers, facilitated this nefarious business, and there grew up a regular traffic in stolen cars that were driven over the border into a neighbouring state and there disposed of by unscrupulous dealers. The matter became so serious that the Federal Govt. in 1919 passed the Dyer Act, which made it illegal to transport or assist in the transportation of a stolen car from one state into another.

Another measure that hit at the root of the evil was the enactment, by several of the states, of laws requiring an abstract of the title to be filed with the authorities, as in the case of real-estate transfers. All cars were provided with locks, which acted as more or less efficient theft retardants. The ignition type, which came into use first, proved of little value, as a man skilled in electrical work and familiar with the particular car could readily make or unmake the necessary connections to render it ineffective. Locks on the transmission were more dependable, but when these were introduced it was found that owners often failed to lock them, as they were generally rather hard to get at. It was then suggested by the insurance underwriters that "concurrent" locks be fitted, acting on both the ignition switch and on the transmission, which the owner was compelled to lock if he wanted to shut down his engine, and these were coming into use in 1925. In 1924, 10,064 cars were stolen in New York City, of which 7,101 were recovered.

Insurance.—Motor-car insurance had grown to a very large business in 1925. The insurance companies wrote policies covering five principal hazards, namely, fire, theft, collision, liability for personal injury and liability for property damage, but usually several or even all of these were covered by a single policy. Reductions were made on the premium for carrying certain equipment which had been approved by the Underwriters' Laboratories. For instance, a reduction on the premium on fire insurance was granted if a portable fire-extinguisher was carried on the car; on theft insurance, if the car had an approved lock and on collision insurance, if it was fitted with approved bumpers. According to *The Insurance Field*, the total premiums paid in the United States under the five principal hazards during 1924 amounted to $297,005,029, and the total losses reported were $123,292,454.

During the period when the "jitney" business was increasing rapidly and many taxi-cabs were operated by individual owners, the operators often caused serious accidents and then were unable to pay the damages awarded by the courts to the injured. Many cities and states then passed legislative measures requiring all operators of public-service vehicles to be bonded or to carry insurance. Later, attempts were made to extend this compulsory insurance plan so as to apply also to drivers of private vehicles, and in 1924 bills to that effect were introduced in the Legislature of six states, but none passed that year. Switzerland and Denmark at that time had compulsory insurance of motor-car operators. In Switzerland any applicant for a driver's licence was compelled to take out first a liability insurance policy for a minimum indemnity of 30,000 fr. to a single person and 100,000 fr. to several persons. For motor-cycles the amount was 20,000 francs. Under the Swiss law the driver and not the owner of the vehicle involved was held responsible for the damage done. However, the burden of proving intention, negligence or imprudence rested with the claimant.

An attempt was made while the bill was under discussion to make motorists directly responsible for all damage done by their cars, the same as in the case of the railways, but this was strongly and successfully opposed by the motoring interests. Tourists when entering Switzerland were compelled to arrange for insurance for the duration of their stay in the country. The Danish law went into effect in 1918 and was amended in 1921. Under it, motorists were compelled to take out a policy for 20,000 crowns and motor-cyclists for 10,000 crowns. The objection was raised to the compulsory insurance scheme that it would have the effect of making drivers careless. Insurance companies opposed it because most of the plans involved the feature of state insurance.

VII. ACCIDENTS AND LEGISLATION

A rather unpleasant chapter in motor-car history is that of accidents. With the constantly growing number of cars on the road and the increasing speed of their operation, it is natural that accidents should have increased, but after the World War the figures became appalling. Many measures were taken to reduce the hazards, and a certain degree of success was achieved, in that the number of accidents in proportion to the number of cars in service decreased, but still the total number increased from year to year. At first a large proportion of the accidents occurred in the cities, as most of the cars were then owned there, and many factors, such as congestion of traffic, lack of playgrounds for children, etc., contributed to the hazards. Means of traffic regulation were introduced which not only tended to prevent accidents but greatly speeded up traffic (*see* TRAFFIC PROBLEMS).

In all of the large cities in 1925 a large proportion of the police force was detailed to traffic duty. They were stationed at all main street intersections, and let the traffic pass alternately in the two directions. Safety zones and isles of safety were marked off by lines painted on the pavement, or by other means, where people could wait safely for tramcars or take refuge in crossing wide streets. Some of the narrower streets were reserved for traffic in one direction only. In the smaller places, where the expense rendered it impractical to station traffic policemen at important crossings, beacon lights were placed on the ground at the centre of the crossing, some of them so arranged that they became extinguished automatically in broad daylight, and later automatic traffic signals were installed which, by showing red and green lights alternately in the same direction and simultaneously in the two directions at right angles to each other, served the same function as the traffic officer and were sometimes referred to as silent policemen. A large number of (usually very serious) accidents occurred at railway crossings, and relief from this hazard was sought by the elimination of level crossings and by providing guards at points of intense traffic and more effective warning signals at others.

Notwithstanding all these safety measures and the institution of campaigns of education the number of automobile fatalities in the United States increased from 9,097 in 1917 to 12,370 in 1921 and to 17,345 in 1924. These figures are of the same order as the American losses in the World War, and the comparison was made use of to bring home the seriousness of the situation. Fatalities per 100,000 cars in service in the three years mentioned were 178, 118 and 98 respectively. Automobile grade-crossing fatalities increased from 1,791 in 1920 to 2,149 in 1924, or at a lower rate than automobile fatalities generally. In European countries there was a similar increase in accidents, although, on account of the lesser density of motor traffic there, the figures are less striking. In Paris, for instance, the number of street accidents increased from 70,715 in 1922 to

126,867 in 1924. An analysis of the causes of accidents involving motor-cars was made by the Motor Vehicle Dept. of the State of Connecticut in 1923. Out of a total of 15,170 accidents, 70·5 % were the fault of the operator, 22·8 % the fault of other persons, 4 % were due to defective equipment and 2·7 % to all other causes combined. Of 834 accidents in Connecticut in Jan. and Feb. 1924, for which the operators were held responsible, 36·8 % were due to failure to give right of way (disregard of the rules of the road); 13·7 % to skidding; 13·5 % to inattention; 6·7 % to failure to signal; 6 % to careless backing; 5·4 % to excessive speed for the conditions; 5·3 % to allowing too little headway; 3·1 % to driving on wrong side of road; 2·4 % to confusion; 1·8 % to cutting in; 1·7 % to inexperience; 1·1 % to intoxication; 1 % to cutting corners; 1.5 % miscellaneous. Dr. C. H. Dickinson of the Bureau of Standards suggested as one rule of safe driving that the speed should never be so high that the car cannot be stopped within the assured clear course ahead.

Legal History.—During the first decade of the 20th century the development of the motor-car industry in the United States was hampered to a certain extent by attempts to enforce recognition of an alleged basic patent on vehicles propelled by liquid hydrocarbon engines, which was issued to George B. Selden, of Rochester, N.Y., in 1895, after having been in the Patent Office since 1877, but in Sept. 1911 the U.S. Circuit Court of Appeals for the Second Circuit held that, although the patent was valid, it was not infringed by the defendant, the Ford Motor Co., which implied that it was not being infringed by any of the car manufacturers in production at that time. The Assn. of Licensed Automobile Manufacturers (A.L.A.M.), consisting of the manufacturers who had recognised the patent prior to its defeat in court, then reorganised as the National Automobile Chamber of Commerce, which came to be recognised as representative of the entire automobile industry, although the Ford Motor Co., the largest manufacturing concern, never joined it. All the national motor-car shows in the United States from that time till 1925 were held under its auspices, and it looked after the interests of the industry also in other ways, particularly through its legal, traffic and patent departments. Patent litigation in the industry was practically entirely prevented by a cross-licensing agreement involving all members of the chamber. Similar organisations in other countries are:—

Great Britain.—Society of Motor Manufacturers and Traders.
France.—Chambre Syndicale de l'Automobile et des Industries qui s'y rattachent.
Belgium.—Chambre syndicale de l'Automobile.
Germany.—Reichsverband der Automobil-Industrie.

VIII. MOTOR RACING AND SHOWS

During the years immediately preceding the World War France had the greatest export business in motor-cars, built up by consistent technical development and skilful sales propaganda, chiefly in the form of road-racing. A series of international races held during the first decade of the century, known as the Gordon Bennett Cup Races, came to an end because the French objected to the stipulation in the Deed of Gift of the cup that in the race each country should be represented by a team of three cars, which gave a country with a small industry practically the same chance of winning as a country with a large industry.

In 1911 began a new series of races for the *Grand Prix* of the Automobile Club of France in which each manufacturer was allowed to enter up to three cars, and there was no limit to the number of manufacturers of any one nation. In fact, the race was not on the basis of national team against national team, but on that of manufacturer against manufacturer. This race was held four years in succession (1911–4) and was revived in 1921. Owing to the continued improvement in engines and the increased speeds made possible thereby, it was repeatedly necessary to reduce the limit on the piston displacement of competing cars. Originally the displacement was limited to that of a four-cylinder engine of 110-mm. bore and 200-mm. stroke (7·6 litres), but in 1921 the limit was 3 litres, in 1923 it was reduced to 2 litres and in 1925 to 1·5 litres (for the 1926 season).

In England and Scotland racing on the public roads was prohibited, and the only road races in the British Is. were held in the I. of Man. In the United States a number of important races were held in the East during the early years of the automobile movement, but owing to frequent fatalities a strong public sentiment grew up against them, and race promoters were compelled to shift the scene of their activities first to the South and then to the Middle West and Far West.

Between 1910 and 1914 a number of racing-tracks with high banking, most of them 2½ m. in circumference, were built in the United States after the model of the Brooklands track in England. The first and most successful of these was the Indianapolis Speedway. It was at first attempted to hold races on these tracks at frequent intervals, but they soon began to pall on the public. Later the plan of a single annual race was adopted, European contestants were secured, and large cash prizes were offered to the winners, and from that time the Indianapolis races have always had an enormous attendance. It is worthy of note, however, that practically none of the large manufacturers of America entered cars in the later races. In earlier years competition in races was regarded as a form of sales propaganda, and the expenses were charged to advertising, but the public gradually came to realise that to win a race at close to 100 m.p.h. required an entirely different car from that needed by the average family, and that it would not be safe to base conclusions regarding the quality of a company's stock cars on the performance of its special racing machines. Track-racing then became a form of entertainment, expenses being met out of gate-money. The Indianapolis Speedway 500-m. race held on Decoration Day, 1925, was won by Peter DePaolo on a 2-litre (122 cu. in.) eight-cylinder-in-line Duesenberg racing car with supercharger, at an average speed of 101·13 miles per hour.

Shows.—An important influence on the rapid development of the motor-vehicle industry must be ascribed to the motor-car shows held annually (except for interruptions due to the World War) in such centres as Paris, London, Brussels, New York and Chicago, under the auspices and control of the motor-car manufacturers' associations of the respective countries. The Paris show, the oldest and for a long time the largest as regards number of exhibitors, was resumed after the War, 1919. But in 1920 the show was suspended, because at the time when preparations would have been made trade conditions seemed to make it unnecessary. It was again suspended in 1925. London shows were held at Olympia. Owing to the fact that Great Britain was one of the greatest markets for motor-cars, importing more than any other country in Europe, the Olympia show always had a strong international flavour. There was a special show for commercial cars at Olympia in 1923, shortly after the passenger-car show. In the United States also, truck shows had been held separately for several years. National motor-car manufacturers' associations previous to the World War had an international federation with headquarters in Paris. In 1920 the original international federation was dissolved, and a new allied federation took its place.

The Automobile Association.—A unique organisation of motorists, the Automobile Association, exists in Great Britain, and in 1925 had over 300,000 members. When the association was organised in 1905, motorists were using their vehicles under considerable difficulties, and the police authorities of practically every county in the United Kingdom made a special point of seeing that the speed limit of 20 m.p.h. was strictly adhered to. Among the services which this organisation rendered to members were the following: free assistance by its patrols, which were found on 20,000 m. of the main highways of the country; free legal defence in proceedings under the Motor-Car Act and the Roads Act in any court of summary jurisdiction in the United Kingdom; free use of roadside telephone boxes at any hour of the day or night; free legal advice on any matter arising directly out of the use of motor-cars or motor-cycles; free advice and assistance by the home and foreign touring departments of the association; access to roadside motor fuel supply stations; engineering advice on matters appertaining to the purchase, repair and maintenance of cars and motor-cycles; officially appointed agents and repairers, as well as hotels, in practically every town in Great Britain, where the facilities and accommodation offered had been inspected and approved by the association. The uniformed patrols of the A.A., which saluted every passing member (but failed to salute if they wished to give a warning or communicate with the member for any reason) are a familiar sight on British highways. The association also had an industrial vehicle section which, among other services, endeavoured to secure return loads for motor-lorries making deliveries to remote points.

IX. MOTOR TAXATION

In nearly all countries motor vehicles are subject to an annual tax based upon the rated horse-power of the engine. Great Britain did not impose such a tax until Jan. 1 1921. The rate was then £1 per horse-power, determined by the following equation:—

$$\text{H.P.} = \frac{Nb^2}{2{\cdot}5}$$

where N is the number of cylinders and b the bore in inches. The same formula, known in Great Britain as the Royal Automobile Club formula, was used in most states of the United States, where it was known as the A.L.A.M. formula. Since the War the U.S. Govt. levied an excise tax on all cars turned out by the manufacturers as well as on repair parts and tires sold. This tax in 1924 netted the Govt. $101,123,621·75 from passenger cars, $10,335,369·14 from commercial vehicles and $27,742,764·12 from parts, tires and accessories. Vehicles for hire also were subject to a Federal tax, which netted $2,013,839·00, making the total Federal receipts from motor vehicles in 1925, $141,215,594·01. Registration fees, including drivers' licence fees, which were collected by the states, totalled $225,492,252·00 (an average of $12·82 per car). Some of the states collected a tax on petrol.

It was estimated by the U.S. Bureau of Public Roads that personal property taxes on motor vehicles amounted to $90,000,000, and by the National Automobile Chamber of Commerce that municipal taxes of $15,000,000 were levied, making the total taxes derived from motor vehicles by the Federal, State and Municipal governments in 1925, $551,442,336·01. Annual taxes are much higher in Great Britain. For a total of 1,393,000 licences current on March 31 1925, aggregate fees of £13,437,000 were paid, or an average of a little less than £10. This average figure, however, is greatly influenced by the large number of lightly taxed motor-cycles licensed. The average fees paid on public-service vehicles amounted to £31 9s.; for commercial goods vehicles, £21 1s. 6d.; for motor-cars taxed on a horse-power basis, £15 8s., and for motor-cycles, £2 13s. 6d. Several other classes figure in the tax records, including motor-ploughs, and motor-tractors, but they are taxed rather lightly.

X. WORLD COMMERCE

During the early part of the World War the American motor industry furnished large numbers of motor-lorries to the British, French and Russian governments, as reflected by the export returns, which showed an increase in the number of trucks exported from 784 in 1914 to 21,265 in 1916. At the same time the foreign demand for American passenger cars increased greatly, because the belligerent European countries could not make deliveries. In 1918, when the United States threw its full strength into the War, motor-car exports suffered a material decline, but they jumped ahead again immediately after the Armistice, an increase of 79% being shown in 1919. That year the exports o passenger cars, lorries and parts together exceeded $100,000,000 in value, yet the passenger cars exported were hardly 4% of the total production, while the exports of commercial vehicles amounted to 4·9%.

TABLE V. *U.S. Motor-car Exports (including Passenger Cars, Lorries and Parts except Motor-car Engines and Tires)*

Exported to	1924	1919	1914
Belgium [1]	9,472,635	364,004	160,659
Denmark [1]	8,930,388	4,443,302	184,951
France	4,980,144	22,243,042	1,103,481
Germany	2,927,029	..	1,272,600
Great Britain	10,305,752	9,760,430	7,159,074
Italy	2,245,575	215,417	293,275
Norway	545,525	2,102,757	124,083
Russia	167,826	8,292	917,859
Spain	6,322,196	1,426,650	71,024
Sweden	3,432,040	689,998	260,228
Canada [1]	27,824,520	22,062,779	9,583,655
Argentina	17,842,193	4,492,522	1,121,474
Brazil	10,204,507	1,033,831	370,043
Chile	2,313,463	2,606,047	192,342
British India	2,363,963	543,393	439,968
Dutch East Indies	1,399,961	4,498,397	238,322
Japan	5,710,461	6,416,928	137,522
Australia	33,594,710	5,358,336	855,637
New Zealand	5,406,913	2,589,166	1,089,951
Br. So. Africa	7,627,583	2,568,790	1,506,668
Other countries	41,765,611	20,272,577	6,215,990
Totals	205,382,995	113,696,658	33,298,806

[1] Exports to these countries in 1924 consisted largely of parts which were there assembled into cars of which a considerable proportion were exported to neighbouring or politically allied countries.

After the War the tide of international motor-car commerce showed great fluctuations. As soon as shipping connections became re-established there was a heavy demand, particularly from the neutral countries of northern Europe. In 1919 only the United States was in a position to export large numbers of vehicles, because it took the motor-car industries of the European belligerents a long time to get back to a peace basis. After a short time, however, the low rates of continental exchange and embargoes on motor-car imports in several countries, including Great Britain, France, Germany, Italy, Denmark and Norway, cut down the exports from the United States. Even when the embargoes were lifted, imports were restricted by high customs duties, as, for instance, 70% in the case of France. The German embargo was lifted on Oct. 1 1925 but imports of cars were subject to an import duty, which, starting with rather high rates, was to be reduced every six months until in 1928 it was to be stabilised at substantially the pre-war rates.

TABLE VI. *British Motor-vehicle Imports*

	1925	1924	1920	1915	1910
	£	£	£	£	£
Cars	6,322,121	3,028,427	10,490,012	3,128,229	1,440,586
Chassis	2,204,443	1,759,321	4,254,949	1,135,146	1,670,969
Parts [1]	2,734,284	3,342,255	8,713,684	2,183,184	2,023,273
Totals	11,260,848	8,130,003	23,458,645	6,446,559	5,134,828

[1] Exclusive of tires.

TABLE VII. *British Motor-vehicle Exports*

	1925	1924	1920	1915	1910
	£	£	£	£	£
Cars	5,065,308	3,685,054	3,929,455	1,129,717	1,380,190
Chassis	2,347,284	1,176,006	2,474,877	186,691	213,378
Parts [1]	2,009,147	1,652,506	1,986,410	557,869	1,012,835
Totals	9,421,739	6,513,566	8,390,742	1,874,277	2,606,403

[1] Exclusive of tires.

The number of motor-cars, lorries, chassis and parts imported into Great Britain in 1925 was 50,339; the number exported 29,051.

According to a report made by the Society of Motor Manufacturers and Traders to the Board of Trade early in 1926, about 1,000 concerns were then engaged in the manufacture and the wholesale distribution of motor-cars in Great Britain, and the amount of capital invested in the British industry was about £50,000,000. The number of retailers was placed at 12,000.

For a number of years previous to 1925 Germany had special agreements with Austria and Italy whereby she allowed a certain number of motor-cars to be imported from these countries in return for permission to export to them German motor-car parts, such as magnetos and ball-bearings. Imports of cars from other countries were made possible by special permits, but permits for only four cars per make per month were issued. Imports into France were rendered practically impossible by the high duty, while Great Britain continued to absorb large numbers of foreign cars even during the period the McKenna duties were in force. The removal of these duties by the Labour Govt. subjected the British industry to a severe strain, especially on account of competition from the United States, but it was observed by German commentators in 1925, who then feared a similar ordeal for their home industry, in view of the contemplated lifting of the embargo, that the British industry had successfully met this competition.

XI. COMMERCIAL MOTOR VEHICLES

Up to 1920 motor-omnibuses were developed chiefly for city transport, and the two largest operating companies at that time were the London General Omnibus Co. and the corresponding

Paris corporation, The Société des Transports en Commun, the former operating a fleet of 2,500 vehicles. Omnibuses for city use are generally of the double-deck type, designed to carry a maximum number of passengers at a moderate speed but to have good accelerating power. In 1926 the London General Omnibus Company, in alliance with the Associated Equipment Company, placed on the streets a new series (200 vehicles) which was fitted into a covered top and was therefore specially designed and sprung to meet the police regulations. This type was 13 ft. 10¾ in. high, 25 ft. long, 7 ft. wide and had a wheel base of 15 ft. 6 in. The vehicles are licensed to carry 50 passengers, 24 inside and 26 outside. In the United States the Yellow Coach Mfg. Co. turned out a double-deck 'bus for 67 passengers, which had a wheelbase of 200 in. and a tread of 73½ in., a chassis weight of 7,313 lb. and carried a four-cylinder 4 by 6-in. engine. Omnibuses with petrol engines and electric drive came into extensive use in the United States in 1925. Two hundred of these were placed in service by the street railway management of Philadelphia, and smaller numbers by operating concerns in other cities.

'Buses and lorries with electric drive without the use of a storage battery had long been made by Tilling-Stevens, Ltd., of Maidstone, England, and in the United States the General Electric Co. had been working on the problem. One disadvantage of the earlier designs was that, owing to the slowness of an electric generator to "pick up," that is, to attain its full voltage, if the throttle of the engine were opened quickly the engine would be without appreciable load for an instant and would race, which would result in vibration very unpleasant to the passengers. This was overcome by providing a separate exciter for the generator, the field of the exciter being supplied with battery current. An advantage of the electric drive in urban omnibus service, where frequent starts and stops must be made, is that acceleration is much smoother, there being no interruption due to gear-shifting. The strain on the driver is much less, as practically all speed control is effected by means of the throttle. Shocks to the mechanism due to "grabbing" of the clutch when shifting gears are avoided, and it was also claimed that better schedule time could be made than with a similar omnibus with mechanical drive.

Development in the United States; New Types.—A great extension took place in rural omnibus services between 1920 and 1925. In the United States this was strongly influenced by the rapid extension of the network of improved roads, which made it possible to operate the vehicles at lower cost, but there were parallel developments in many other parts of the world. The earlier omnibuses generally were shod with solid rubber tires, had stiff chassis springs designed to withstand the shocks sustained on rough roads and generally had a high centre of gravity, which features combined to make riding in them rather uncomfortable. About 1923 a new type of omnibus, referred to as a safety coach, made its appearance. It was mounted on pneumatic tires, had a wide tread and a very low-hung chassis, sometimes was equipped with air brakes and had sufficient power for speeds up to 60 m.p.h. on smooth, level roads. Some of these vehicles were as luxuriously equipped as, and afforded all the comfort of, the finest private closed cars, while others, for a different class of service, were of less pretentious construction.

One development in the omnibus field that came to the front in 1924 was the six-wheeler. These 'buses had double axle rear trucks and were driven and "braked" on the four wheels. Distribution of the total weight on six wheels facilitated the use of pneumatic tires. With the increase in size and speed of the 'buses, increased power was required, and whereas most of the earlier omnibuses in rural service had four-cylinder engines (they were actually, for the most part, adapted lorry chassis), in 1925 more than one-half of the omnibus models offered by American manufacturers had six-cylinder engines, which offered advantages also from the point of view of reduced vibration. The frame height of the loaded omnibus from the ground generally varied between 22 and 26 in., and most of the larger and faster vehicles were equipped with four-wheel brakes. Rural omnibuses were generally of the one-man type, passengers entering through a door at the front and depositing their fare in a coin box near the driver, while entering or leaving. The door was of the safety type which could be opened and closed only by means of a lever within convenient reach of the driver's seat. A mirror in front of the driver enabled him to observe the passengers without losing sight of the road ahead for more than an instant. Electric buttons at the sides of all seats enabled passengers to signal the driver when they wanted to get off, and at night the interior of the vehicle was usually brilliantly lighted. In the ordinary low-fare 'buses the seats were often of the plain, cane-covered type, while those for a more exclusive service generally had deeply upholstered or even air-cushioned luxurious seats and sometimes revolving chairs.

In 1925 it was estimated that there were 60,000 motor-omnibuses in service in the United States, including 31,100 by independent common carriers, 3,250 by tramway companies, 20,000 by schools, 1 500 by sight-seeing and tourist undertakings, 2,900 in various lines of business (real estate, department stores, apartment houses, garages and factories), 1,000 by hotels and 250 by railway terminal companies. The motor-omnibus was responsible for important changes in the educational system. In 1924, 1,424 consolidations of schools took place, and that year some 470,000 pupils were daily carried to and from school in motor vehicles.

Lorries.—Motor-trucks must be equipped with engines able to take them fully loaded up the steepest grades which occur on regularly travelled highways. When operated in comparatively level districts they always have a surplus of power, and it was found advantageous when operating under such conditions to use one or two trailers with the truck. The advantage is greatest where the merchandise to be transported is very bulky. This plan results in considerable economy, as from two to three times as much load can be carried on one trip as with the truck alone, with little extra expense. In continental Europe there was usually a helper on each trailer to look after the load and apply the brakes, but the use of helpers greatly reduces the gain in economy, especially where wages are high, and in the United States it was not usual to employ an extra man.

It was realised that in order to make it possible to stop in an emergency the trailers as well as the truck must be braked; but the problem of braking the trailers from the truck had not been definitely solved although at least one system of air brakes and one system of automatic mechanical brakes applied through the drawbar had been worked out. Another combination for heavy merchandise transportation consisted of a road tractor, which was merely a foreshortened truck chassis, and a semi-trailer. This semi-trailer was a two-wheeled construction, the forward end of which was supported on the tractor frame by means of a swivelling fifth wheel. This end of the semi-trailer could be supported by means of jacks while loading and unloading, and the tractor did not need to stand idle while these operations were going on. A particular form of semi-trailer was the pole trailer—the length of which could be varied—used mainly for transporting lumber, pipes, steel sections, etc.

Electric and Steam Vehicles.—In 1925 electric and steam passenger vehicles formed an insignificant fraction of the whole number in use. Previous to the War the electric passenger car had considerable vogue as a ladies' car, especially in cities with comparatively level streets, like Los Angeles, Chicago, Cleveland and Buffalo in the United States, but the introduction of the electric starter, and, to a lesser extent, the demountable rim, removed the last obstacles to the use of petrol cars by women drivers, and thereafter the electric passed into the background. On the other hand, electric lorries had found a definite place in city haulage, particularly in New York, where at the beginning of 1925 3,274 such lorries were in service. Owing to the low power of their motors the depreciation of these lorries was low and the cost of transportation with them on a ton-mile basis was somewhat less than with petrol lorries, but on account of its greater independence and its materially greater speed, most users preferred the petrol lorry even for city haulage.

A new type of electric commercial vehicle, known in the United States as an industrial truck, but perhaps better described as a floor truck or a low-wheel truck, came into extensive use, especially during the War period. These industrial trucks take the place of hand trucks on steamship piers and railway-station platforms, in factory buildings and paved yards. Petrol industrial trucks have also been developed, but as they are not admitted to steamship piers on account of the fire hazards, the electric has an undisputed field there. There was great inducement in Europe during the War, when petrol was exceedingly scarce, to develop the electric vehicle for both passenger and commercial traffic. In Germany a scheme was worked out for a system of goods transport in large cities by electric lorries with interchangeable batteries, and a few sample trucks were built, but the Armistice intervened and the scheme was dropped.

The steam vehicle also retrogressed as a factor in transportation. In 1925 the manufacture of steam passenger cars had almost entirely ceased, but considerable numbers of steam lorries were still being manufactured in England. The petrol motor had definitely gained the ascendancy over steam and electric motors, and supplies for it could be found and repairs to it had in almost every town. In the United States, for instance, there were, at the beginning of 1925, 65,674 repair shops (besides 58,206 garages), and all these repair shops were equipped to cater to owners of petrol cars, but only a few to owners of steam and electric vehicles, giving a tremendous advantage to the former.

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MOTTA, GIUSEPPE (1871–), Swiss statesman, was born at Airolo Dec. 29 1871. He studied law at the universities of Fribourg and Munich and at Heidelberg and became a successful barrister, establishing an extensive practice in Ticino and the neighbouring cantons. He served on the Great Council from 1895–1911 and was a national councillor from 1899–1911. He led the Catholic Conservative party in the Ticino from 1900 to 1911 and on Dec. 14 of the latter year was elected a member of the Federal Council by the Federal Assembly. In 1915 and 1920 he was president of the Swiss Confederation. He directed the financial administration of the Confederation 1912–9, and in 1920 assumed charge of the Federal dept. of foreign affairs. Motta was chief of the Swiss delegation to the League of Nations in 1920 and presided over the fifth Assembly of the League in 1924.

MOTTL, FELIX (1856–1911), German conductor (*see* 18.931), died at Munich July 1 1911.

MOULTON OF BANK, JOHN FLETCHER MOULTON, BARON (1844–1921), British lawyer, was born at Madeley, Salop, Nov. 18 1844. Educated at Kingswood School, Bath, and St. John's College, Cambridge, he had a brilliant career, becoming senior wrangler and first Smith's prizeman in 1868. He was elected a fellow of Christ's College, and in 1874 was called to the Bar. He specialised in patent law, for which his conspicuous scientific abilities peculiarly qualified him, and rapidly acquired a large and lucrative practice. In 1885 he became a Q.C. and entered Parliament as Liberal member for the Clapham division of London. In the following year, however, he lost his seat and was out of Parliament until 1894, when he succeeded Sir Charles Russell, Q.C. (Lord Russell of Killowen), as member for South Hackney. He was unsuccessful at the general election of 1895, but in 1898 he was elected for the Launceston division of Cornwall, a seat which he retained until his appointment as a lord justice of appeal in 1906. In 1912 he was made a lord of appeal in ordinary with the title of Lord Moulton of Bank. He died suddenly in London, March 9 1921.

Owing to his combination of gifts, Moulton's position at the patent Bar was unique. He had no rival and has had no successor. As a judge his success was less pronounced, perhaps in consequence of the extreme specialism of his career as a practitioner. On the other hand, during his years on the bench, he rendered distinguished scientific service to the country. He was first chairman of the medical research committee under the National Insurance Act (1912) and during the World War he was chairman of the committee on chemical products and high explosives and director general of explosive supplies in the Ministry of Munitions. He also was chairman of the British Dyestuffs Corporation (1919).

MOUNET-SULLY, JEAN (1841–1916), French actor (*see* 18.936), died in Paris March 1 1916. His *Souvenirs d'un Tragédien* was published in 1917.

MOUNTAINEERING (*see* 18.937).—The most important event of the period 1910–25, was, of course, the assault on Mt. Everest, which is the subject of a separate article. Everest, however, did not monopolise the attention of Himalayan explorers. Useful work was accomplished by the Workmans during 1911 and 1912 in the Karakoram, by C. F. Meade in the Garhwal Himalaya and by Kellas who reached a height of 22,700 ft. on Kangchenjhau.

The American continent has witnessed a series of campaigns which for energy and success have seldom been equalled. Outstanding exploits have been the conquest of Mt. McKinley in Alaska (20,300 ft.) by Belmore Browne, A. Aten, M. La Voy in 1925 and H. C. Parker; the conquest of Mt. Logan (19,850 ft.) in 1925 and the ascent of Mt. St. Sandford, the highest peak in the Selkirks by Howard Palmer and Professor Holway with Swiss guides in 1912. In 1924 Canadian climbers registered no less than 30 important first ascents, including Mt. King Edward.

The main exploration of the New Zealand Alps was completed before 1910, but Harold Porter's two expeditions (1923 and 1925) proved that interesting pioneer work still awaits the explorer. The Caucasus have been a closed book to mountaineers since the War. A British expedition in 1914 made a number of new ascents. Norway still offers the prospect of virgin ascents. Stedtind, described by Cecil Slingsby as "probably the most natural obelisk in the world and the greatest prize in all Scandinavia", was climbed in 1910 by C. W. Rubenson and friends. Two Oxford expeditions to Spitsbergen in 1922 and 1923 accomplished some excellent work.

Alpine Climbing.—In the Alps every peak worthy of the name had been ascended by 1910, nearly all of them from various sides. But Alpine exploration is not a closed chapter, and new routes even on well-known peaks may excite as keen an interest as the conquest of peaks in unclimbed ranges. Technically, the best work done in the Alps attains a higher standard of difficulty than elsewhere. The problems which call for solution in great ranges such as the Himalaya, are the problems of exploration rather than of climbing, in the more restricted technical sense of the word. A Himalayan explorer has to organise transport, handle native porters, plan a route through unmapped country, and—in the final stages—struggle against mountain sickness, but cragsmanship and ice-craft of a high order are seldom called into play.

In the Alps, the progressive elimination of unclimbed routes, implies a rising standard of difficulty among those that still resist attack. As an example of the thoroughness of the exploration of the Alps, it is interesting to note that 16 different passes have been made across the range at the head of the Lauterbrunnen Valley on a front of less than eight English miles. The technique of rock climbing has developed more rapidly than the technique of ice-craft. The contrast between modern achievement in the period under review and the period which closed with the seventies, is far more marked in cragsmanship than in ice craft.

Alpine Ascents by Britishers.—Another change is noticeable. The earlier exploration of the Alps was, in the main, the work of British mountaineers with Swiss guides whose technique their employers helped to develop. Since 1910 the prizes have often fallen to continental mountaineers, though no individual climber has a longer list of successes to his credit than G. W. Young. In 1911, with Professor H. O. Jones (killed soon afterwards in the Mont Blanc range), he completed the ascent of the Brouillard ridge of Mont Blanc and achieved the first complete traverse of the great west ridge of the Grandes Jorasses and the first descent of the ridge that stoops to the Col des Hirondelles. With Professor Jones and Todhunter, he made the first ascent of the Mer de Glace face of the Grépon, and just before the War climbed the Gspaltenhorn by the terrible west ridge, perhaps his finest performance. His leading guide on all these climbs was Joseph Knubel of St. Niklaus. Among other first-class climbs by British mountaineers may be mentioned the conquest of the south face of Mont Blanc by Oliver and Courtauld with the brothers Aufdenblatten in 1923, and the first crossing of the north face of the Dent d'Hérens by a guideless party led by George Finch. The direct ascent of this face was achieved by Welzenbach and Allwein in 1925. The guideless conquest by Raeburn and Ling of the north face of the Disgrazia also deserves mention, for the British mountaineers with new climbs to their credit during this period have almost been content to divide the credit with their guides. On the other hand the Everest expeditions were guideless, and some of the work done on the American continent by men of the Anglo-Saxon race has been guideless.

Among other fine Alpine climbs of this period may be mentioned the north Arête of Piz Badile by A. Zurchner, led by the guide Walter Risch, perhaps technically as exposed and difficult a climb as had yet been done. The ascent of the north face of the Lauterbrunnen Breithorn by Chevet and Richardet, and the variation route taken by Lauper and Liniger up the north face of the Mönch, rank among the great mountaineering exploits, involving as they did, difficult work both on rock and ice. Richardet, Lauper and Chervet were members of the Akademisher Alpen Club, Berne. The students of the Berne and Zürich universities have long been known for their mountaineering exploits. One of the last classic problems of the Oberland, the ascent of the Mittellegi ridge of the Eiger, was also solved during this period by a Japanese climber, Yuko Maki, led by the great Grindelwald guide F. Amatter. Artificial aids were employed for this climb.

French Guideless Climbing.—A great feature of post-War mountaineering has been the revival of French guideless climbing. Before the War, French climbers of the type of Fontaine were few. Since the War the "Groupe Haute Montagne" of the French Alpine Club—a guideless group—have to their credit a consistent record of brilliant work, combining the spirit of adventure with the same British tradition. The "Groupe" has been engaged in cairning the last untouched pinnacles of Mont Blanc, and among its most brilliant achievements may be mentioned the ascent of the north face of the Aiguille du Plan by Lagarde, de Lepiney and de Segogne in 1924.

German Mountaineering.—In the Dolomites and the Kaiser Gebirge German and Austrian climbers have done some very remarkable climbs, but their successes have been paid for by an increasing death roll. There is a grave tendency among German climbers to take chances, to risk bad weather and impromptu bivouacs. Their exceptionally heavy death roll is caused by the fact that these young climbers, fired by a spirit of emulation, often forget the penalty for too risky procedure. British climbers, have proceeded with equal skill but with greater circumspection, and if, in the Alps at any rate, they have fewer new ascents to their credit since the War, they have avoided the accidents which have been so common among German and Austrian climbers. The same may be said of rock climbing. There is nothing to choose in severity between the various climbs achieved by the Germans and Austrians and the new routes which have been exploited in Cumberland, but comparatively few lives have been lost on our British hills.

Several of the British climbing clubs have shown great activity since the War. Mention must be made of the imaginative enterprise of the Fell and Rock Climbing Club in purchasing for the nation the summit of Great Gable as a war memorial for those members of the Club who fell in action. Rubber soled shoes have given to the cragsman greater security and made it possible to accomplish more climbs than could ever have been achieved in the nailed boot epoch. During this period, the conquest of the Alps by ski-runners has been practically completed. Scarcely any peak of importance has not been ascended either partially or entirely on ski. The best period for mountaineering on ski is undoubtedly the late spring. Summer ski-ing is growing in popularity and provides mountaineers with the opportunity of making ascents during prolonged periods of snowy weather.

The Canadian Alps.—Exploration of the Canadian Alps has been very active, aided by the Alpine Club of Canada and its very energetic director, Mr. A. O. Wheeler, and the provision of Swiss guides by the Canadian Pacific Railway and later by the Canadian National Railway.

The following are the principal ascents:—

1913. First ascent of Mt. Robson culminating summit in the Canadian Alps (12,972 ft.) by A. H. MacCarthy and W. W. Foster with the Austrian guide Conrad Kain.

1915. First ascent of Mt. Edith Cavell (11,033 ft.) by Professor Holway and Dr. A. J. Gilmour.

First ascent of Mt. Louis (8,800 ft.) the most difficult rock climb in the Canadian Alps by A. H. MacCarthy with Conrad Kain.

1919. First ascent of Mt. King George (11,226 ft.) by V. A. Fynn with R. Aemmer (guide).

First ascent of Mt. Douglas (11,174 ft.), Mt. Joffre (11,316 ft.) by J. W. A. Hickson with E. Fenz, Jr. (guide).

1920. First ascent of Mt. Ferenitz (10,573 ft.) by A. Howard Palmer and Allen Carpe.

1922. First ascent of Mt. Queen Mary (10,600 ft.) and Mt. Birdwood (10,160 ft.) by F. M. Waterman and C. F. Hogeboorn with R. Aemmer (guide).

First ascent of Mt. Apex (10,625 ft.) by Allen Carpe and H. G. Hall.

First ascent of Mt. Barnard (10,780 ft.), Mt. Trutch (10,690 ft.), Nanga Parbat (10,780 ft.) and Gilgit (10,300 ft.) by Howard Palmer and J. Monroe Thorington with E. Fenz, Jr. (guide).

1923. First ascent of Mt. Saskatchewan (10,964 ft.) and North Twin (12,085 ft.) by J. Monroe Thorington and W. S. Ladd with Conrad Kain (guide).

First ascent of Mt. Clemenceau (12,000 ft.) by De Villiers-Schwab's Guideless party.

First ascent of Mts. Brazeau (11,250 ft.), Unwin (10,550 ft.) and Henry MacLeod (10,600 ft.) by Howard Palmer, Allen Carpe and W. D. Harris.

First ascent of Mt. Spring-Rice (10,745 ft.) by J. W. A. Hickson with E. Fenz (guide) and of Mt. Rhondda (10,625 ft.) by the same and A. Geoffrion.

1924. Exploration in the Cariboo group and ascent of eight new peaks ranging from 10,000 to 11,750 ft. by Allen Carpe and R. Chambertin with W. D. Harris and A. L. Withers of Jasper.

First ascent of South Twin (11,675 ft.), Mt. Outram (10,670 ft.) and two other unnamed peaks by W. O. and F. V. F. Field with E. Fenz, Jr. and Jos. Biner (guides).

First ascent of Mts. Oates (10,200 ft.), Kain (10,000 ft.), Hooker (10,782 ft.) and Simmen Peak (10,899 ft.) by J. Monroe Thorington, M. Strumia, A. Ostheimer with Conrad Kain (guide).

First ascent of Mt. Erebus (10,234 ft.) and two other unnamed peaks by L. Coolidge, G. Higginson and J. Johnson.

First ascent of the often attempted difficult Mt. Geikie (10,854 ft.) by the famous Alpine veteran V. A. Fynn, C. G. Water and M. D. Geddes and of Mt. Barbican (10,100 ft.) by the same party.

First ascent of King Edward (11,400 ft.) by H. Palmer and J. W. A. Hickson with Conrad Kain.

1925. First ascent of Mt. Logan (19,850 ft.) by a joint party of Canadian and American mountaineers led by A. H. MacCarthy.

First ascent of Mt. Alberta (11,784 ft.) by Yuko Maki of Tokyo and five other Japanese with H. Fuhrer and H. Kohler, and Mt. Woolley (11,170 ft.) by the same party.

There are still several unclimbed peaks in the Selkirk Range. The following ascents are notable:—

1910. First ascent of Grand Mountain (10,832 ft.) by E. W. D. Holway and Howard Palmer.

1911. First ascent of Mt. Austeritz (10,960 ft.) and Mt. Holway (10,000 ft.) by the same.

1912. First ascent of Mt. Sir Sandford (11,590 ft.) by the same with E. Fenz, Jr. and R. Aemmer (guides) and of Mt. Adamant (10,980 ft.) by the same.

1913. First ascent of Mts. Beaver (10,644 ft.) and Duncan (10,548 ft.) by E. W. D. Holway with E. Fenz and Ch. Häsler (guides).

1917. First ascent of Mt. Moloch (10,198 ft.) by J. W. A. Hickson with E. Fenz, Jr. (guide).

1924. First ascent of Mt. Inconoclast (10,646 ft.) by Dr. Cora J. Best's party with Ch. Häsler (guide).

The Southern group or Purcell range has been much visited since 1910.

1910. First ascent of Mt. Nelson (10,772 ft.) by C. D. Ellis.

1911. First ascent of Mt. Gleason (10,550 ft.) and Mt. Monica (10,060 ft.) by C. D. Ellis and E. W. Harnden.

1913. First ascent of Mt. Sir Charles (10,830 ft.) by E. W. Harnden and party.

1914. First ascent of Mt. Farnham (11,075 ft.), Farnham Towe (10,850 ft.) by Mr. and Mrs. A. H. MacCarthy with Conrad Kain (guide).

First ascent of Delphine Peak (10,975 ft.) by A. A. McCoubrey with E. Fenz, Jr. (guide).

First ascent of Mt. Bruce (11,090 ft.) by E. W. Harnden and party.

1915. First ascent of Mt. Ethelbert (10,450 ft.), Jumbo Peak (11,125 ft.), Commander (10,950 ft.), St. Peter (10,750 ft.), Spearhead (10,500 ft.) and Peacock (10,525 ft.) by Dr. and Mrs. W. W. Stone, the MacCarthys, H. O. Frind with Conrad Kain (guide).

1916. First ascent of Howson Spires (10,900 ft.), Bugaboo Spires (10,250 ft.) by the MacCarthys, Frind with Kain.

1924. First ascent of three peaks of over 10,000 ft. at the head of Hamill Creek by the McCoubreys with E. Fenz, Jr. (guide).

1925. First ascent of Mt. Coppercrown (10,218 ft.) by A. A. McCoubrey with E. Fenz, Jr. (guide).

Generally speaking no mountain in the Canadian Alps approaches in technical difficulty a first-rate expedition in Europe. There is less risk of avalanches and the glaciers are much less complicated—on the other hand long distances have to be traversed, while the arranging of transport and camps is a big and expensive business. There is still much exploration to be done.

Useful work is being done by the Associated Mountain Clubs of America in exploring the less accessible regions, opening trails therein and securing protective legislation for them.

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MOUNTAIN WARFARE.—The difficulties attending the prosecution of a campaign in mountains arise primarily from the physical features of the theatre of operations; and secondly, in a marked degree, from the effect those features have in moulding the character of the inhabitants.

Lack of Communications.—A mountainous district is, as a rule, undeveloped; and the means of communications, where any exist, are indifferent or bad. An invader is tied to certain existing roads or tracks as the only method of advance, and has little scope for effecting surprise by means of alternative routes. The observation which the defender can obtain from the hill tops is as good as, and in some ways better than, can be obtained by the invader from aeroplanes. As a result, the invader's intentions can be grasped almost from the start, and the uncertainty common to war in normal theatres is largely discounted. The country is usually barren, and all supplies and stores for the invading force have to be carried into the country. Since communications usually consist of mere tracks, or of some boulder-strewn dry river bed, "pack" is the only possible means of transport. Consequently the invading commander is burdened with the guarding of long lines of slow-moving pack animals, and, owing to the fact that they have to convey their own and their drivers' food, they are able only to carry a relatively small useful load.

The climatic conditions in mountains tend to extremes of heat and cold. Changes in weather conditions are also sudden. The melting of snows or the bursting of a thunderstorm in the mountains may mean the flooding of the valley forming the route of advance, and the washing away of the line of communications "road," which has often been cut out with great labour.

Characteristics of the Inhabitants.—The nature of their surroundings reacts, as elsewhere, on the characteristics of the inhabitants. Their life consists of a struggle with nature. The ease and luxury of the plains is absent. They live scattered in small hamlets close to such patches of ground as will yield to cultivation. Industries are based on the village system, and the local weavers, potters, carpenters and so on supply the needs of the small community. There is no centralised life as in the plains. The inhabitants of a given area (probably emanating from a common stock) usually own a tribal allegiance to each other, but are often again sharply divided into subtribes, the boundaries of which are the valleys which they inhabit. Life is hard, and the only physically fit survive early childhood.

As a result the characteristics of mountaineers are exceptionally sound physique, bravery, great powers of endurance and ability to thrive on the bare necessities of life. They are, moreover, usually intensely patriotic (for it is a curious and almost universal fact that the wilder a man's country the more attached he is to it). Finally, they fight in mountains in their own element, on ground to which they are accustomed, and which confers on them a mobility twice as great as that of the invading plainsmen.

The above are valuable military attributes. But they are to some extent offset by others. The highly individualistic life in mountains, whilst leading to an admirable independence, also leads to a lack of centralised purpose and interest. Whilst patriotism for the clan is great, patriotism for the sub-tribe is sometimes greater. There is consequently a tendency toward absence of cohesive effort if the operations be going adversely. This lack of cohesion renders them peculiarly averse to night operations, the success of which against mountaineers is noteworthy throughout history, though it must be added only when most carefully organised and prepared. Nevertheless, mountaineers have always been difficult opponents to overcome.

Operations of Two Kinds.—The consideration of operations in a mountain theatre falls naturally under two heads. First are operations in an area such as the Austro-Italian frontier. There, though the mountains exist, the area has been considerably opened up. Communications are relatively good; heavy stores can be brought up. The forces on both sides are possessed of all the appliances of war. Better theatres for operations exist on the flanks of the mountains, and it is there that the real struggle will be fought out. Neither attacker nor defender is in reality a true mountain race, for national armies are taking part. As a result, the operations tend more and more to take the colour of normal operations in the plains, modified, no doubt, but lacking most of the characteristics of campaigns against true mountaineers. Second are operations in an undeveloped mountain theatre against semi-civilised inhabitants. It is in such a case that the true attributes of mountain fighting are best brought out. In describing them the theatre of the North West Frontier of India is taken as an instance.

Frontier Warfare in India.—The inhabitants of this area possess all the characteristics noted above. As regards supply during operations, they normally carry seven to 10 days' food on them, and consequently are untroubled by anxiety about their line of communication. They are armed only with rifles and knives. But the rifles are modern for the most part; and it is for consid-ration whether the power of mobility conferred by such an armament and supply system does not largely compensate for the bsence of artillery and other arms. A commander entrusted with he subjugation of a frontier tribe has a difficult task before him. t may be possible to overawe the tribe by air action alone. But targets for aerial attack are limited in such a form of society, nd if the opposition of the tribe be determined, air action alone, vill seldom suffice; an advance over the ground will, as a rule, e necessary.

Planning the Campaign.—The first difficulty is to select the bjective. It can be said at once that the true objective is to ring the enemy to battle. But how is it to be done? Owing to absence of lines of communication, the enemy's strategical mobility always superior. Owing to his upbringing, his tactical mobility also superior, except against the best hill troops. Normally, threat against an enemy's capital forces him to interpose, and rings on a battle. Here, the enemy may not consider any of his amlets worth defending resolutely. He may prefer to adopt a urely guerilla attitude, to be ubiquitous, and to worry the dvance. That is the most difficult problem to deal with. As a ule he is ready to oppose an advance with resolution in measure s his hopes stand high. If defeated, he tends towards more uerilla methods.

A commander therefore has usually to select the line of advance most likely to produce massed resistance. In doing so he an advance as one column, or by several columns up several alleys. The first method has the advantage of simplicity and of viting the enemy to concentrate. But the larger the force on he track the slower the movement, and so, if the enemy seeks avoid decisive battle, the less hope there is of achieving it. move in several columns has the advantage of speed, and gives reater hope of cornering an elusive enemy. But it involves a eries of lines of communication, and is attended by all the difficulties of co-operation and mutual support between columns hen separated by mountain ranges.

Progress of Operations.—Whatever the plan the method of onducting operations follows a fairly uniform course. The force dvances up a valley protected by a strong advanced guard. his advanced guard throws out detachments to seize and hold actical points on the hills flanking the valley, and so securing he advance of the column below. These detachments (or "piquets") are withdrawn by the rear guard when the column has assed. Since all commanding ground within rifle range must be enied to the enemy, it is clear that piquets often have to establish themselves 2,000 yd. from the column, and to climb 1,000 ft. r more. The process is therefore laborious and slow, and limits he length of march possible in a day.

Defence at Night.—For the night, all-round defence is essential gainst so ubiquitous an enemy. Arrangements therefore take he form of a central camp, protected by self-contained piquets osted on tactical points round the camp. These piquets must e sufficient in number, and be placed far enough out, to prevent he enemy firing into camp at night. But since complete protection against such sniping is impossible, a considerable amount f protection against fire has to be provided within the camp. he camp itself has also to be designed and organised to resist ssault. It will be realised that there is, in consequence, an immense amount of heavy work to carry out at the end of an exhausting day's advance. Moreover, it is of primary importance that all movement shall have ceased and the camp be made entirely secure before dark. Because, though (as stated above) organised ight operations frequently prove successful, unorganised movements are disastrous in face of a ubiquitous enemy who holds the itiative.

It is frequently necessary to raid and destroy villages in order induce the enemy to stand and fight. Such raids need careful rganisation in order to insure that the work is efficiently done in he time available. Raids are usually carried out in various directions, radially, from some semi-permanent camp, the force going ut early and returning to camp before dark. The retirement is most always followed up, and it is in harrying a retirement that he enemy is most dangerous. A running fight (with all its disadvantages) is unavoidable, because the enemy has no columns or guns moving on a road to deploy, but merely follows up deployed. The art of conducting such a retirement consists in the careful and timely laying out of troops in successive positions, so that the retreat of the rearmost is always efficiently covered and in the skilful co-operation of fighting aeroplanes.

For the defence of the line of communication the system is a chain of piquets in assault proof posts dominating the route. These posts, often 2,000 ft. above the valley, have to be strongly built of dry stone, wired and the garrisons supplied with food and water for (say) 10 days. It is obvious that the work involved is laborious. At suitable intervals on the line of communication larger posts are established capable of accommodating the convoys passing through. These posts also contain the mobile reserve for their section of the line of communication.

An Example.—Perhaps a small example will best illustrate the difficulties which beset a commander in mountain warfare. A force of four battalions (and attached troops) camps for the night. It is found necessary to use one company per battalion for camp piquets. Next morning the advance continues, but owing to the necessity for an early start it is impossible to relieve the piquets before moving. They must be withdrawn by the rearguard and rejoin units later. So the advance begins with all battalions only three companies strong. "A" battalion gives two companies as advanced guard, one available for piqueting. "B" is allotted entirely for piqueting. "C" heads the main body. "D" finds two companies for rearguard and one as baggage escort. In the advance it is found that piqueting is heavy, that an average of a company to a mile is needed. The force advances four miles (which means that the remaining company of "A" and all "B" battalion are used up on piquet) and is confronted by 1,500 enemy in position. In theory, a brigade is confronted by 1,500 men. In practice 1,500 men are being faced by the two advanced guard companies and the three companies of "C" battalion, perhaps actually some 500 or 600 in all; for that is all that the commander has immediately available. The above crude example is typical of the dispersion of resources inherent in mountain warfare.

Two Lessons.—As regards mountain warfare in general, history appears to point to two main lessons: firstly, that the true subjection of mountaineers can only be arrived at by opening up and developing the country. Short of that, they may be overawed and pacified for a time, but a change in the undeveloped and individualistic conditions of life is essential to their permanent pacification. Secondly, that if the operations for their primary subjugation are to be quickly and successfully carried out, the forces engaged must be definitely trained to the task, and the personnel composing the force should, as far as possible, be composed of men bred in mountains. (J. P. V.-S.)

MOUNT STEPHEN, GEORGE STEPHEN, 1ST BARON (1829–1921), Canadian financier (*see* 18.942), died at Brocket Hall, Hatfield, Herts., Nov. 29 1921.

MOZAMBIQUE (*see* 22.163) has a population (1923) of about 3,500,000, including some 10,500 Europeans (mostly Portuguese and British) and about 6,000 Indians. The country is divided into (*a*) the province of Mozambique, governed directly by Portugal, with Lourenço Marques (*q.v.*) as capital, (*b*) the territory of the Mozambique Company (capital Beira), (*c*) the territory of the Nyassa Company. The companies administer their territories under charter. The charter of the Nyassa Company was for a period ending in 1927. Negotiations for its renewal were conducted in 1926.

History.—Although Portugal had been in nominal possession of the country for some 400 years, it was not until 1912 that fairly effective control was obtained over all the hinterland, while in 1915 there was a widespread revolt in the Zambezi valley. In 1918 the region north of the Zambezi was ravaged by the Germans under Von Lettow-Vorbeck. This region had been marked, before the World War, for exploitation by the Germans. Early in 1914 German capitalists had obtained control of the Nyassa Co., the Anglo-German agreement of 1913 (never signed) having recognised German economic interests as paramount in that area (*see* AFRICA). The World War put an end to this project. In 1919 the "Kionga Triangle," formerly part of German East Africa, was added to Mozambique—it gave Portugal the right bank of the Rovuma to the sea.

The Portuguese since 1910 have made serious efforts to improve the administration. In 1914 a measure of autonomy, enlarged in 1920, was granted to the province. In general the treatment of the natives was satisfactory, but labour conditions left much to be desired. Compulsory unpaid labour in the province of Mozambique was not abolished until 1925. Early in 1926 the Portuguese Government appointed a commission of enquiry with instructions to see that nothing was permitted which gave colour to the charge that slavery in a disguised form still obtained.

Economic Conditions.—Economic development was considerable in the province and in the Mozambique company's territory. The Portuguese, however, lacked capital to carry out large enterprises, while the constant ministerial changes at Lisbon and the financial embarrassment of Portugal reacted unfavourably on Mozambique. Development was most marked where British interests were concerned and British capital was forthcoming. The transit trade was large, Lourenço Marques serving the Eastern Transvaal, and Beira being the chief port for Rhodesia, Katanga and British Nyasaland. A railway from Beira to the Zambezi completed in 1922, was built with British capital to meet the needs of the Nyasaland protectorate. This railway superseded the route by the Zambezi and in consequence the British concession at Chinde, at the mouth of the river, was given up in 1925. The Beira-Zambezi railway also opened up rich tracts suitable for sugar, cotton and other crops. Moreover it brought a step nearer the exploitation on a large scale of the coalfields on the north side of the Zambezi near Tete. Another railway, from Inhambane to Delagoa Bay (280 m. long), built in sections, was nearing completion in 1926. This line also serves fertile regions. Great progress was made in sugar growing, and sisal, cotton and maize were increasingly cultivated. The chief exports are sugar, copra and ground nuts.

The three administrations have different systems of keeping accounts, but, approximately, the trade figures for the whole country in 1911 were: Imports £8,520,000 (including £6,800,000 in transit); exports £2,720,000. In 1923 the value of trade in the province of Mozambique was, roughly £10,000,000, including transit trade valued at £4,800,000. In the same year the external trade of the Mozambique Company was valued at £11,000,000 including goods in transit £2,200,000. In the Nyassa Company's territory imports in 1924 were valued at £90,000 and exports at £111,000. A valuable export, which does not appear in the trade returns, is that of native labourers to the Transvaal mines.

Revenue is derived mainly from Customs, a hut tax (for which in 1925 a poll tax was substituted) and a tax on labourers who emigrate; the last source is not available in the territories of the chartered companies. In Mozambique province in each year between 1908–9 and 1920–3, except in the first two years of the War, there was a surplus over estimated revenue. In 1923–4 the revenue collected was 50,957,000 escudos. In 1925 the exchange problem was acute and the province suffered severely. In the Mozambique Company's territory, where accounts are kept in sterling, revenue in 1923 was £361,000 and expenditure £281,000. (*See* AFRICA).

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MUIR, JOHN (1838–1914), American naturalist and writer, was born at Dunbar, Scotland, April 21 1838. In 1849 he went to Fox River, Wisconsin. When 22 years old he entered the University of Wisconsin, teaching and working on farms during vacation. After finishing his course he began wanderings on foot through the United States and elsewhere. In 1868 he first entered the Yosemite Valley which for many years after formed the base of his continued expeditions. In 1876 he joined the U.S Coast and Geodetic Survey, and in 1879 discovered the Alaska glacier that now bears his name. In 1881 he took part in th expedition in search of the De Long party in the Arctic regior It was largely due to his efforts that the Yosemite region was se aside as a national park in 1890. He died at Los Angeles, Cal Dec. 24 1914.

He published, among other works; *The Mountains of Californi* (1894); *Stickeen* (1909), the story of a dog; *The Yosemite* (1912 and *The Story of My Boyhood and Youth* (1913). In 1888 he edite *Picturesque California.* The following appeared posthumousl *Unpublished Prose and Letters* (1915); *A Thousand-Mile Walk to th Gulf* (1916); *The Cruise of the Corwin* (1917) and *Steep Trails* (1918)

MULCAHY, RICHARD JAMES (1886–), Irish politiciar was born in Waterford, and began his career in the engineerin department of the Dublin General Post Office. He took part as lieutenant in the Irish rebellion of 1916, and was afterward interned in Frongoch. In Dec. 1918 he was returned as Sin Fein M.P. for the Clontarf Division of Dublin and retained hi seat until 1922. He played a prominent part with Michae Collins in the reorganisation of the Irish Volunteers, of which h had become chief-of-staff in 1918. He sat in the Dáil fror 1921–3 as a member for the Northwest Division of Dublin, an after the Treaty of 1922 became minister of defence for the Iris Free State. He succeeded Gen. Michael Collins, after th latter's death in 1922, as commander-in-chief of the Free Stat forces, and had the chief conduct of operations until the cease fire order of 1923, in which year he was returned to the Dáil fo Dublin city north. He resigned office in the spring of 1924 upor the executive requiring the resignation of three of his principa officers in connection with troubles arising out of demobilisatio and reorganisation.

MULHOUSE or MULHAUSEN (*see* 18.960) was restored t France after the World War. The population was 99,226 i 1921, and a later estimate gives 105,000. A busy factory tow and port on the Rhone-Rhine Canal, it is thoroughly French i character. The French occupied Mulhouse on Aug. 8 1914, bu evacuated it two days later. They were again on the outskirt on Aug. 20, but the reverses in the north compelled a retreat and the town was ruled as hostile territory by the German during the World War. The French re-entered Mulhouse i Nov. 1918.

MÜLLER, HERMANN (1876–), German politician, wa born May 18 1876 at Mannheim. From 1899 to 1906 he wa editor of the Socialist newspaper the *Görlitzer Volkszeitung*, an from 1906 onwards was a member of the directing board of th German Social Democratic party. From 1916 to 1918 he was member of the Reichstag. On Aug. 1 1914, he went to Pari with the object of finding out whether international action b the Socialists of France and Germany could be initiated i order to avert the World War. His mission was unsuccessful and he had great difficulty in making his way back to German through the French lines. His report did much to determin the attitude of the German Social Democrats in voting in th Reichstag for the first war credit. On June 21 1919 he wa appointed Minister for Foreign Affairs—under the chancellorship of Gustav Bauer—and in this capacity went to Versaille and with the Colonial Minister, Dr. Bell, signed the Peac Treaty for Germany on June 28 1919. After the resignatio of the Bauer Ministry, which followed upon the Kapp Putsch (March 1920), Müller was appointed Chancellor of the Reich an office which he held till the following June, when the resul of the general elections for the Reichstag necessitated th formation of a Coalition Ministry with Fehrenbach of th Catholic Centre party as Chancellor. Thereafter Müller continued to play a leading part in the affairs of the Social-Democratic party.

MUMMY: *see* ARCHAEOLOGY: *Egypt.*

MUN, ADRIEN ALBERT MARIE DE, COUNT (1841–1914), French politician (*see* 19.1), died at Bordeaux Oct. 6 1914.

MUNCH, EDWARD (1863–), Norwegian painter, was born Dec. 12 1863 at Löten, Hedemark. He went to Christiania (Oslo) at an early age and studied at the royal school of drawing under Krohg by whom he was introduced to the naturalistic school of painting. The inborn genius of Munch however reacted against this teaching. He was more inclined to express feelings inspired by a troubled mind than impressions engendered by reality, and did not hesitate to go his own way as an artist. The most famous work of this early period is "Spring" (1899), justly considered one of the gems of the National Galery at Oslo. In the beginning of the 'nineties, the undercurrent of mental agitation broke through in all its power, and in a number of works (mostly in the Oslo National Gallery), Munch revealed an extraordinary sensitiveness, displayed alike in the ubjects of his pictures and the artistic method of execution which he employed. From the beginning of the 20th century Munch's art assumed a more realistic character. This is paricularly evident from his landscapes of this period, the outtanding features of which are vigorous plainness and impressive colouring. In 1913 Munch completed the fresco decorations of he University Festival Hall at Oslo; he also established his eputation as an etcher of ability.

MUNDELEIN, GEORGE WILLIAM (1872–), American cardinal, was born in New York City July 2 1872. He received his education at the Manhattan College, and St. Vincent Seminary, Beatty, Pa., subsequently proceeding to Rome and studying heology at the Urban College of the Propaganda in that city. He was ordained priest June 8 1895, at Rome, and became secreary to Bishop McDonnell of Brooklyn, N.Y., being made chancellor of the diocese in 1897. He was appointed auxiliary Bishop of Brooklyn, with the titular see of Loryma, Sept. 2 1909. He became Archbishop of Chicago, Nov. 30 1915, and was created a cardinal by Pope Pius XI, March 24 1924. He was a prominent igure at the Eucharistic Congress held in Chicago in June 1926.

MUNICH (*see* 19.5), the capital of Bavaria, Germany, with a population of 630,711 in 1919, took a prominent part in the evolution of 1918, when Bavaria became a republic (*see* BAVARIA). Housing conditions were very bad after the World War; in 1919 there were 7,919 applications for 23 houses available. A school of infantry is permitted under the provisions of the Treaty of Versailles. The War Memorial was unveiled in 1924; 4,000 citizens of Munich fell in the War. A German museum was opened in 1925, and a transport exhibition was held in the ame year. The factory of the Deutsche Werke, formerly artilery workshops of the German Army and subsequently converted o the manufacture of agricultural machinery, has been acquired by the municipality.

MUNICH, UNIVERSITY OF (*see* 19.6).—Between 1910 and 912 seven new chairs were founded. No further developments ook place till 1920, since when 12 new chairs have been created, ncluding those in Egyptology and race hygiene. The number of students averaged 6,800 up to 1914, and remained below this igure till 1916–7, when it amounted to 7,900. It rose in 1918–9 o 9,823, and to 10,333 in the summer of 1921. There has been a decline since that date, and in the summer half of 1925 there were 8,006 students, of whom 938 were women.

MUNICIPALITY: *see* CITY GOVERNMENT.

MUNITIONS OF WAR.—Under this heading the production of munitions during the World War by the United Kingdom and he United States is dealt with.

I. THE UNITED KINGDOM

The Problem.—When the British Army of six divisions took he field in 1914 it possessed about 900 field guns, less than 200 ield howitzers, about 60 heavier weapons of 6-in. and upwards and perhaps about 200 obsolescent types, such as the 4.7-in. and the 85-pdr. howitzer, a reserve of ammunition of less than 1,000,000 rounds weighing some 20,000 tons and less than 2,000 machine-guns. By the end of 1918, the army had received 10,000 field guns, 6,000 other light guns, over 3,000 field howitzers and 7,500 heavier guns and howitzers; 217,000,000 rounds of artillery ammunition, weighing 5,500,000 tons and nearly 225,000 machine-guns.

During 1914 the War Office limited its orders to Government factories and the armament firms. In 1915 a few small contracts were placed with other firms, but on the appointment of the armaments output committee at the War Office, and a week later of the Treasury committee under Mr. Lloyd George, further extensions took place. Foreign orders were extensively placed in the U.S.A. and Canada. The passage of the Ministry of Munitions Act in June 1915 and the Munitions of War Act in July 1915 and the transfer Sept. 1915 of the ordnance factory at Woolwich to the Ministry of Munitions placed the Minister (Mr. Lloyd George) in a position to organise effectively production on the largest scale possible—by the most modern means—of the enormous quantities of material required and to deal with labour problems without delay.

Rifles.—The rapid development of the army was impeded by difficulties in supplying rifles—weapons of precision manufactured by highly skilled labour with specialised machinery. Old pattern rifles were repaired and rifles were borrowed from Japan. Orders were placed in America, but the rifles were not available till the summer of 1916 and then needed adjustment. By this time the home supply was adequate.

Guns.—Heavy artillery was needed to break down the German defences, and a programme was drawn up in June 1915 by Mr. Lloyd George on a basis of 100 divisions with proportion to reserves. Wastage was heavier than was expected. Aircraft defence developed; merchant ships had to be armed; tanks (*q.v.*) had to be equipped. Nevertheless at the middle of 1918 the output of guns sufficed to meet all these requirements.

Ammunition.—To provide adequate supplies of shells, with explosives, propellants, fuses, grenades and the score of other elements, national factories were built and proved highly efficient and economical. Large orders were placed in America and Canada. Fitting factories were built, and intensive research at Woolwich produced a satisfactory fuse.

Explosives and Propellants.—Lord Moulton presided over a committee appointed in 1914 to organise the supply of explosives. Cordite was at first a propellant. The supply was fairly ample owing to the foresight and the policy of the Admiralty. The new programme increased the demand for H.E. Trinitrotoluol (T.N.T.) was mixed with amatol (ammonia citrate). Out of about 625,000 tons of explosive supplied, only 210,000 (of which 3,500 tons were imported) was T.N.T., less than 80,000 tons prussic acid and the rest ammonia citrate. The production of cordite was limited by supplies of acetone, and eventually a nitro-cellulose powder manufactured by Messrs. Dupont of America was adopted. The Gretna propellant factory, which cost £8,000,000 to build, made nearly one-fourth of the cordite required at a great saving of cost. Imports and home products are shown below.

Trench Mortars and Trench Ammunition.—The total number of trench mortars delivered during the War period amounted to 19,096, and the output of trench-mortar ammunition to over 17,000,000 rounds. The total number of grenades delivered amounted to 100,103,000, and of aerial bombs to 4,738,000. Of the 5,316,000 rifles manufactured, 3,954,000 were made in Great Britain, and the army was entirely armed with rifles of

TABLE I.

	Trade	National Factories	Imports
Picric acid	92 %	6½ %	1½ %
T.N.T.	21	63	16
Ammonium nitrate	65	30	5
All explosives	53	39	8
Cordite	47	38	15
Nitro-cellulose	..	2	98
All propellants	26	22	52

TABLE II. *Guns and Gun Ammunition*

	New Guns and Howitzers					Filled Ammunition (in thousands)				
	Light	Medium	Heavy	Very Heavy	Total	Light	Medium	Heavy	Very Heavy	Total
Up to June 30 1915	802	242	6	31	1,081	1,877·3	389·0	26·5	14·0	2,306·8
1915 2nd six months	1,895	493	4	33	2,425	4,461·7	976·7	134·4	74·5	5,647·3
1916 1st six months	1,180	969	205	116	2,470	10,287·1	2,919·2	432·1	213·8	13,852·2
2nd six months	1,045	679	495	258	2,477	25,204·3	8,392·6	2,492·7	1,654·7	37,744·3
1917 1st six months	1,547	408	570	253	2,778	30,004·2	9,887·1	4,480·6	2,145·8	46,517·7
2nd six months	2,488	603	762	450	2,303	22,556·7	9,528·8	6,693·1	2,381·1	41,159·7
1918 1st six months	3,990	966	1,164	264	6,384	18,474·6	8,363·1	6,734·6	1,625·4	35,197·7
2nd six months	3,056	797	875	270	4,998	19,067·7	6,421·0	7,647·3	1,479·5	34,615·5
	16,003	5,157	4,081	1,675	26,916	131,933·6	46,877·5	28,641·3	9,588·8	217,041·2

The classification is that adopted by the Inter-Allied Munitions Council. In the case of Great Britain it includes under "light" field guns (13-pdr. and 18-pdr.), mountain guns (2·75-in. guns and 3·7-in. howitzers), anti-aircraft guns (13-pdr., 3-in. and 4-in.) and tank and other miscellaneous small guns. The medium guns include the 60-pdr. gun and 4·5-in. howitzer. The heavy include the 6-in. howitzer and gun and the very heavy include 8-in., 9·2-in., 12-in. and 15-in. howitzers and guns.

TABLE III.—*Production of Rifles, Machine-Guns, Small-Arms Ammunition, Aeroplanes, Aero-Engines and Tanks*

	Rifles	Machine-Guns	Small-Arms Ammunition (Thousands)	Aero-Engines	Aeroplanes	Tanks
Up to June 30 1915	364,246	1,486	507,758	1,025	902	
1915 3rd quarter	173,317	1,719	395,881	730	692	..
4th quarter	198,641	3,133	570,029	1,015	948	..
1916 1st quarter	217,631	5,582	626,566	1,569	1,137	..
2nd quarter	267,759	7,245	738,355	1,615	1,537	..
3rd quarter	457,732[1]	9,572	811,476	2,054	1,939	110
4th quarter	416,564[2]	10,801	803,607	1,989	2,020	40
1917 1st quarter	793,350[3]	16,637	697,536	2,704	2,730	100
2nd quarter	717,000[4]	19,836	250,878	3,567	3,640	324
3rd quarter	324,423	18,958	355,280	4,342	3,720	506
4th quarter	323,542	24,007	401,408	6,052	4,742	347
1918 1st quarter	294,947	29,124	597,006	8,261	7,154	260
2nd quarter	293,039	33,884	954,362	7,873	7,870	507
3rd quarter	287,096	31,437	866,262	8,016	8,558	369
4th quarter	186,990	26,419	596,241	7,119	7,200	255
Totals	5,316,277	239,840	9,172,645	57,931	54,789	2,818

[1] Including 186,000 "Acceptances" of U.S.A. rifles.
[2] Including 154,000 "Acceptances" of U.S.A. rifles.
[3] Including 462,000 "Acceptances" of U.S.A. rifles.
[4] Including 391,000 "Acceptances" of U.S.A. rifles.

home manufacture. A total of 240,000 machine-guns were delivered. The total number of rounds of small arms ammunition manufactured amounted to 9,172,645,000, nine-tenths of which was manufactured in Great Britain.

The number of aeroplanes manufactured amounted to 54,789. The number of aero-engines was 57,931. The first tanks were delivered in the third quarter of 1916 and numbered 110. Owing to changes in design, etc., only 40 were delivered in the following quarter and 100 in the first quarter of 1917. The total number of tanks manufactured amounted to 2,818.

Mechanical Transport, Railway Material, etc.—The Ministry became responsible for the supply of motor vehicles on Sept. 1 1916. From this date to the end of 1918 there were delivered 33,000 heavy lorries, 2,500 four-wheel-drive lorries, 4,000 light lorries, 4,700 motor-cars, 1,700 ambulances, 4,100 Ford cars, 1,400 Ford ambulances, 12,000 Ford vans, 2,200 caterpillar tractors, 27,700 motor-cycles, 7,000 motor-cycle combinations and 185 armoured cars. The Ministry of Munitions from Oct. 1916 supplied 2,300 m. of 75-lb. rails, 4,200 m. of light rails, 750 standard gauge locomotives, 800 locomotives for other gauges, 13,000 petrol tractors and 33,000 railway wagons of various types.

During the War, Great Britain kept Italy and France supplied with coal, with substantial supplies of iron and steel, with benzol, and Italy with T.N.T., picric acid and other explosives. As regards finished munitions there was a certain amount of interchange between the various countries. For instance, Great Britain receiving aero-engines and some anti-aircraft guns from France and motor-cars from Italy, and supplying heavy artillery and ammunition, incendiary and other special small arms cartridges for use in aeroplanes and machine-guns. British assistance to Russia took the form almost entirely of finished products, including machinery.

II. THE UNITED STATES

No accumulation of war materials in excess of the amounts required for the regular army, which numbered 127,588 on April 6 1917, was made by the United States in anticipation of entry into the World War. The national army, 19 months later (Nov. 11 1918), numbered 3,757,624, of whom 2,086,000 had been transported to France.

War Operations of Americans, 1917–8

Men in France fighting	1,400,000
Men in France behind lines	600,000
Men in army in United States	1,700,000
Men in navy	550,000
Men in War work	7,150,000
Women in War work	2,250,000
Men, women and children not in War work	91,350,000
Total	105,000,000

The total number of American troops placed in the field was larger than could have been equipped with material of American manufacture. The European Allies guaranteed their surplus for the use of American troops, and thus ensured an earlier and more numerous American participation upon the firing line.

A large part of the munitions needed for maintaining an army of 4,000,000 men could be produced in the United States without difficulty. Such articles as shoes, socks, uniforms, blankets, food and food containers, camp utensils and equipage required only the drafting of specifications and the speeding-up of industry to produce the requisite amounts.

The Engineer Corps handled 3,225,121 tons of supplies during the 19 months of War; 1,303 locomotives and 18,313 freight cars were shipped to France; 1,002 m. of standard-gauge railroad track were constructed there. Most difficult of all was the problem of manufacture of delicate or heavy ordnance, siege guns, field artillery, machine-guns, rifles, aircraft, tanks and

Clothing, Etc., Produced and Shipped to the A.E.F. Between April 1917 and Nov. 11 1918

	Produced	Shipped
Blankets	19,419,000	3,127,000
Coats	22,603,000	7,294,000
Drawers	71,884,000	14,701,000
Undershirts	69,764,000	15,693,000
Shirts	22,198,000	6,401,000
Stockings	89,871,000	29,733,000
Shoes	26,423,000	9,136,000
Breeches and trousers	17,342,000	6,191,000
Overcoats	7,748,000	1,780,000

motor transport, in which quantity production depended upon slow and painstaking preparation of the preliminary processes, upon the supply of labour and raw materials, and upon the wise selection of designs and types to be manufactured. Considerable experience in the manufacture of ordnance and other munitions had been gained by private firms during the period of American neutrality through the fulfilment of contracts placed in the United States by the Allied belligerents. Most of the private capacity to make explosives, rifles, machine-guns and cannon was in use. The experience thus gained was an asset for the United States, but few of these resources could be diverted to the supply of American armies without endangering the supply of Allied armies already on the firing-line in the common cause.

General Munitions Board.—The advisory commission of the Council of National Defence early recognised that new factories must be erected for the construction of guns, aircraft and other munitions of the elaborate type, and that a preliminary determination of standards must precede this in order that the types put into production should be as few in number and as useful as possible. On March 20 1917 the Munitions Standards Board came into existence to advance this work as a sub-committee of the Council of National Defence. On April 9 it was reorganised as the General Munitions Board. Within a few weeks of the declaration of war numerous special bodies were created to carry on parts of the munitions work.

Ships.—The growth of shipping under the American flag (in vessels of 500 gross tons or over) was as follows:—

	Ships	Gross tons
Strength April 6 1917	1,614	3,569,675
New construction to Nov. 11 1918	704	2,287,034
Ships otherwise acquired to Nov. 11 1918	95	274,366
Enemy ships seized in United States	97	648,894
Dutch ships requisitioned	87	354,278
Total to Nov. 11 1918	2,597	7,134,247
Ships lost April 6 1917–Nov. 11 1918		
By enemy action	103	313,569
By other causes	213	416,578
Strength Nov. 11 1918	2,281	6,404,200

Aircraft.—Prior to April 6 1917 the United States had acquired n all 224 aeroplanes. The appropriations of Congress for mili-ary aviation were as follows:—

1912 6	$ 900,000
1916–7 (Urg. Def. bill)	500,000
1917 (Army approp.)	13,281,666
1917 (Milit. aeronautics)	10,800,000
July 24 1917	640,000,000
1917–8 (Urg. Def. bill)	43,450,000

The policy adopted by the air service was to design a standard ype of aeroplane engine, put it into quantity production, and ave ready for the campaign of 1918 a fleet of 22,000 effective eroplanes. By July 4 1917 the first experimental "Liberty Motor," as the standard engine was named, had been con-tructed. After further refinement of design it was turned over or production to the manufacturers of automobiles in the bsence of large aircraft industries in the United States. The rst finished Liberty engines were delivered in Dec. 1917, and 15,572 more followed within the next year. The first American squadron completely equipped by American production was reported by General Pershing to have crossed the German lines on Aug. 7 1918. The A.E.F. was provided by the French Govt. with 2,676 aeroplanes, and received from the United States 1,379 planes of the De Havilland type. The delivery of aeroplane engines of all types to the Government in the United States began with 66 in July 1917 and rose to 5,297 in Oct. 1918, with a total of 28,509 to the end of 1918.

Gas Manufacture and Shipment

1918	Toxic materials produced (in tons)	Grenades, shell, etc., filled	Toxic materials shipped overseas (in tons)	Shell, etc., shipped overseas
Jan.	10	..	..	..
Feb.	61	..	..	..
March	211	..	..	..
April	399	..	..	..
May	697	..	..	..
June	993	..	..	..
July	1,351	73,201	..	..
Aug.	1,548	354,962	..	..
Sept.	1,911	374,968	..	..
Oct.	2,726	459,895	..	..
Nov.	910	151,043	..	..
Total	10,817	1,414,069	4,278	868,664

Heavy Ordnance.—Only six government arsenals and two private plants had had experience in producing heavy ordnance before 1914; by Nov. 1918 there were nearly 8,000 plants at work upon ordnance contracts, light or heavy. Up to the Armistice 1,102 guns (from 3-in. to 9.5-in.) and 14,623 forgings (from which the finished guns are turned and bored) were made in the United States for the Allies. Fifteen additional heavy-gun factories were equipped to meet the American need, and the rate of production for Oct. 1918 was above 24,000 guns per year. In mobile field artillery the French 75-mm. gun was accepted for the standard in quantity production, and its designs, with those for its intricate recuperator, were redrawn to meet American conditions in manufacture. The tolerances, which the French were in the habit of working out in the assembling plant, were reduced to figures and gauges in order to permit the American method of manufacture of separate interchangeable parts. In Oct. 1918 464 complete artillery units (guns, carriages and recuperators) were produced and delivered to the army by American manufacturers, with an accumulated total of 2,058 units to the end of the year. But no 75-mm. guns or 155-mm. howitzers of American manufacture were on the front at the date of the Armistice. The French Govt. provided the A.E.F. with equipment of this sort sufficient for 30 American divisions.

Production of Rifles

		1903 Springfield	1917 Enfield
1917		128,475	302,887
1918	Jan.	31,570	153,499
	Feb.	9,370	170,857
	March	540	160,142
	April	2,631	167,485
	May	3,970	181,034
	June	6,759	191,354
	July	16,879	231,193
	Aug.	28,617	191,769
	Sept.	33,583	199,635
	Oct.	39,176	187,477
	Nov. (1–9)	11,308	56,097
Total		312,878	2,506,307

Machine-Guns.—An American gun, invented by Col. I. N. Lewis, "was a revelation when it came to the aid of the Allies early in the Great War," and capacity for its manufacture was developed in private American plants on Allied order. In May 1917 the machine-gun board tested and adopted two newly designed guns, one heavy and one light, both the work of John M. Browning. During Oct. 1918 the War Department accepted 14,639 heavy and 13,687 light Browning guns. By the end of the year 226,557 machine-guns of all types had been accepted by the United States.

Naval Ordnance.—Much delicate experimentation was done in search for new rangefinders and submarine detectors, various listening devices being brought forward for the latter purpose. The construction of the North Sea mine barrage called for the development of a new mine and anchor. Orders were placed for 125,000 mines, of which 56,611 were laid in the barrage by American mine-layers operating from bases in the north of Scotland, near Inverness. The whole barrage included 70,263 mines, of which 13,652 were British laid, covering a zone of sea from 15 to 35 m. in width, and to a depth sufficient to prevent submarines from diving under it. The complete barrier was in place by July 29 1918, although it was much tightened thereafter. The barrage is known to have destroyed 17 submarines and to have closed the North Sea outlet, particularly after Norway announced a determination to mine her own territorial waters adjacent to the barrage.

MUNSEY, FRANK ANDREW (1854–1925), American publisher and newspaper proprietor, was born at Mercer, Me., Aug. 21 1854. He was educated in the public schools and became a telegraph operator in Augusta, Maine. In 1882 he went to New York City and established *The Golden Argosy*, a magazine for children, later changing this to *The Argosy*, a magazine for adult readers. In 1889 he founded *Munsey's Weekly*, replaced two years later by *Munsey's Magazine*, the first monthly of its class to sell for the popular price of 10 cents. He also founded *The All-Story Weekly* (1904) and *The Railroad Man's Magazine* (1906) and purchased *The Baltimore News* (1908), *The New York Press* (1912) and the New York *Sun*, both morning and evening issues (1916). He merged the *Press* in the *Sun*. In 1920 he bought from the executors of James Gordon Bennett's estate the New York *Evening Telegram* and *The New York Herald*, together with its Paris issue. He combined the *Herald* and the morning *Sun* as *The Sun and the New York Herald*, but in Oct. 1920, changed the name to *The New York Herald*, at the same time continuing the evening paper as *The Sun*, thus perpetuating intact two names famous in American journalism. He died in N.Y. City Dec. 22 1925. By his will, after providing for relatives, he left the residue of his estate, estimated at $40,000,000 to the Metropolitan Museum of Art, New York.

MUNSTERBERG, HUGO (1863–1916), German-American psychologist (*see* 19.12), died in Cambridge, Mass., Dec. 16 1916.

Among his later publications were *American Problems from the Point of View of a Psychologist* (1910); *Psychology and Industrial Efficiency* (1913); *American Patriotism and Other Social Studies* (1913); *Psychology and Social Sanity* (1914); *The War and America* (1914); *The Peace and America* (1915); *The Photoplay: A Psychological Study* (1916) and *Tomorrow: Letters to a Friend in Germany* (1916).

MURAL PAINTING (*see* 19.16).—France more than any other country has maintained a continuous and vigorous tradition of mural decoration in recent years, and this despite economic difficulties and the vagaries of modern art. The annual Salons furnish an index to mural work though the final fruit does not necessarily appear in them.

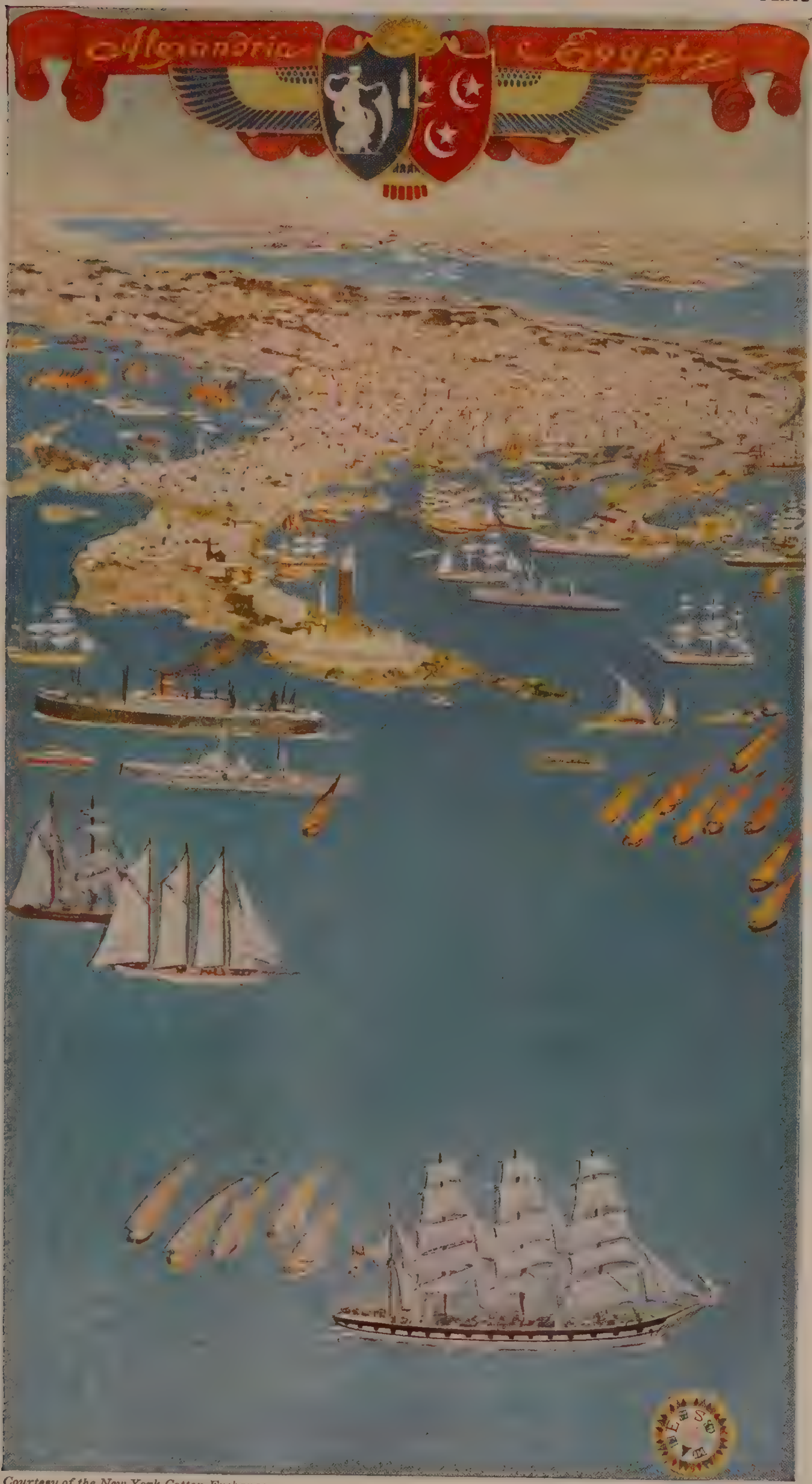
French Examples.—Nearly every year murals have been among the most admired works of the Salons. In 1910 at the spring Salon it was the "Luncheon" by Aman-Jean, a large panel for a room in the Museum of Decorative Art which attracted all visitors. The autumn Salon of the same year was particularly rich in mural paintings. M. Denis, who had already won with his decorations of the chapel of Vésinet, the position of France's leading decorator, left vacant by the death of Puvis, exhibited a series called "Florentine Evening," in which he combined with the chaste dignity of Puvis a Florentine sensitiveness suggestive of Fra Angelico and Botticelli.

Alongside these decorations hung four ingenious panels by P. Bonnard, with dancing figures in fanciful fountained courts and gardens and with fantastic irregular borders ornamented with silhouetted monkeys and birds. At the spring Salon of 1911 Aman-Jean's exhibit of two more figured panels for the same museum room was overshadowed by a great section of ceiling decoration for the Théâtre-Français in which A. Besnard gave a monumental presentation of the garden of Eden with various subsidiary figures, genii and writers. Even more admired, because of their simple subjects, lucid composition and idyllic charm, were three decorative paintings by Denis: "Sunny Sands," "September Evening," and "First Steps." The following autumn Salon contained two outstanding murals by J. Flandrin, "Summer" and "Fountain," both calm and spacious, and modern in matter as well as manner. The spring Salon of 1912 brought new laurels to Denis and Aman-Jean. The latter eclipsed his previous works with a decoration for an amphitheatre of the new Sorbonne, "The Elements," elaborate in symbolism, clear in pictorial conception and accomplished in execution. Denis filled his five staircase panels, "The Golden Age," with bathers, lovers, dancers, vintagers and the like in a vague enchanting paradise. In these panels he gave pictorial expression to what he has expressed in words: *L'art est la sanctification de la nature.* He revealed here his spiritual kinship to St. Francis of Assisi, whose Fioretti he has feelingly illustrated. In the spring Salons of 1913 and 1914 a series of decorations called "Garden Games" drew attention to another able mural painter, J. P. Laurens.

In 1913 the Théâtre des Champs-Elysées opened. Of its extensive wall paintings the most important are by Denis, though E. A. Bourdelle, E. Vuillard, K. X. Roussel, H. Lebasque, and Jacqueline Marval also contributed. Denis painted the frieze around the dome, consisting of four panels and four medallions. Two of the panels, "Dance" and "Musical Drama," are each more than 50 ft. long, and the other two, "Symphony" and "Opera" more than forty. While these four panels illustrate both the principal forms of music and the successive stages of its history its technical means are shown by four intervening medallions, "Orchestra," "Choir," "Organ," and "Sonata." Of their relation to the large panels it has aptly been said: *ce sont comme des reflexions intimes entrecoupant les grandes affirmations publiques.* The crowning panel directly above the stage, "Dance," distinctly recalls Ingres.

After the interruption of mural painting by the War, the French began again with remarkable precision exactly where they had left off. If any effect of the War on mural painting, other than impoverishment, was observable in the Salons of 1919 and succeeding years, it was a greater emphasis on subject and a greater demand for religious paintings. As before Denis was prominent. In the spring Salon of 1919 he exhibited a glorious "Annunciation," and in the autumn Salon of that year a "Jesus at the House of Mary and Martha." Another religious mural prominent in the autumn Salon was the "Ex-voto to Ste. Geneviève" by G. Desvallières. The following spring Salon contained L. Simon's diptych for the church of Notre-Dame-du-Travail in Paris, conspicuous because it is one of the few successful decorations inspired by the War. The energetic ascent to Calvary and the touching Mass of the dead soldier are modern, but reflect the grand style of religious painting of the 17th century; this adherence to the traditions of religious painting accounts for the compact composition, which makes the diptych seem crowded to eyes accustomed to the usual loose composition of modern murals. The post-War spring Salons were enriched by the decorations for the Conseil d'Etat at the Palais Royal by H. Martin.

The Paris Exposition of Modern Decorative Art of 1925 occasioned much mural painting, which was, however, not representative of all phases of contemporary work. P. Baudoüin's *Corporation de la Fresque* did many frescoes directly on the wall (instead of paintings on canvas attached to the wall, the now all but universal practice), among which "The Poet" by J. Adler and "Music" by L. Toublanc on the Cour Bouchard were outstanding. H. Marret was also represented by two frescoes on the exterior of the Pavillon Ruhlmann, though he commonly works on canvas; his principal contributions among many were four large paintings on the Cour des Métiers ("Traffic," "Sports," "Street" and "Architecture") and an "Annunciation" in the village church, to the decoration of which Desvallières contributed a retable and Denis a great Calvary, which served to reaffirm his supremacy. Deserving of mention also were the murals of G. L. Jaulmes and J. Dupas, who with his followers decorated the Pavillon du Collectioneur.


Alexandria Egypt

Courtesy of the New York Cotton Exchange

VIEW OF THE PORT OF ALEXANDRIA, EGYPT
Photographed in colour from the painting by Ezra Winter

Work in other Countries.—Compared with the French, the murals by artists of other European countries represented in the Paris Exposition were of minor importance; this corresponds to the minor importance of mural painting in those countries. The fervent nationalism throughout eastern Europe has given rise to ambitious patriotic decorations, such as those of A. Mucha for Prague, but not to mural painters of the first rank. East of France the most important figure of recent years was F. Hodler (d. 1918), a Swiss active also in Germany. Among his later works was the dignified "Unanimity" for the Rathaus at Hanover, exhibited at the autumn Salon of 1913.

Thus, while Hodler may be considered an offshoot of the figure tradition of France, Walser seems to be inspired by the luscious sign paintings of the Tyrol. Another interesting eddy somewhat like that of pre-Raphaelitism, is occupied by B. Goldschmitt, who completed in 1911 a droll cycle of frescoes representing the Tyrolese legend of King Laurin's rose garden for the Hotel King Laurin at Bolzano. The vigour of modern Spanish painting is attested by its power to propagate itself across the Atlantic whither two of its most representative mural series have migrated; the decorations by D. Rivera for the Ministry of Education in Mexico City and the 14 paintings of the provinces of Spain by J. Sorolla y Bastida for the Hispanic Society in New York.

An Anglo-American Tradition.—Britain and America have co-operated to such an extent in mural painting that one may speak of an Anglo-American tradition based partly on pre-Raphaelitism, and point to the American, J. S. Sargent (*q.v.*), and the Englishman, F. Brangwyn (*q.v.*), as its exemplars. This Anglo-American mural painting is the closest rival to that of the French school. It makes less use of landscape and poetry than the French and greater use of man and his material achievements. It is local and realistic where the French is idyllic. Its abstract figures are usually allegorical rather than mythological. The last murals by Sargent were those of the stairway and rotunda of the Museum of Fine Arts, Boston.

The decoration of the Missouri State Capitol is the largest current effort in mural painting in America. The following list of painters besides Brangwyn represented there is an indication of the size of the undertaking and of the number of mural painters in America: R. E. Ball, T. P. Barnett, O. E. Berninghaus, A. Blondheim, F. G. Carpenter, C. Hofbauer, R. Kissack, R. E. Miller, F. Nuderscher, R. Ott, H. Reuterdahl, E. Wuerpel and N. C. Wyeth. The paintings of the Wisconsin State Capitol were undertaken about a decade earlier and represent the work of another group of artists mainly older: the sensitive and distinguished stylist, J. W. Alexander, who died in 1915, H. Ballin, E. H. Blashfield, who has been the most prolific of American mural painters, Kenyon Cox (d. 1919), E. E. Garnsey, and F. D. Millet. Quaintly illustrative and very personal are the murals by Violet Oakley in the Pennsylvania State Capitol. (*See* also PAINTING.) (J. SH.)

MURKLAND, WILLIAM URWICK (1842–99), American divine, was born Nov. 17 1842 in Demerara, British Guiana. When a child he moved with his parents to Petersburg, Va., and later to Richmond. In 1857 he entered Hampden-Sidney College, but on the outbreak of the Civil War enlisted in the Confederate Army. He was captured at Laurel Hill but was paroled, and returned to Hampden-Sidney College, where he graduated with first honours in 1862. Having meanwhile been exchanged, he again entered the Confederate Army. After the close of the war he entered the Union Theological Seminary of Virginia. After his ordination as a Presbyterian minister in 1869, he was pastor of Centre Church, Cumberland Co., Va. In Jan. 1870, he was called as assistant to the Franklin Street church, Baltimore, Md., and the following June was chosen pastor, which position he held until his death, May 13 1899. In 1890 he was a delegate to the World's Peace Congress in London. Dr. Murkland was one of the prominent figures in the Presbyterian Church in the United States.

MURMANSK, Russia, the Russian port on the Kola peninsula, has been connected with Leningrad (St. Petersburg) by rail since 1917. The line runs across the base of the Kola peninsula and along the coast of the White Sea, joining the Leningrad-Vologda line about 75 m. east of Leningrad. Owing to swampy ground, the line is almost unworkable in some parts of the summer months. A British flotilla was stationed at Murmansk in 1917, and after the Russian collapse, in order to maintain a hold on the coast, two cruisers and a battleship and 5,000 troops were sent in 1918. In that year N. Tschaikowsky overthrew the rule of the Soviets, and set up a provisional government with the help of the British forces; but after their evacuation in 1919 Murmansk came again into Bolshevik hands.

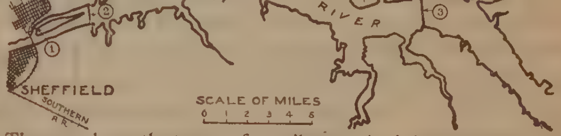
MURPHY, JOHN FRANCIS (1853–1921), American landscape painter (*see* 19.38), died at New York City Jan. 30 1921.

MURRAY, GEORGE GILBERT AIMÉ (1866–), British classical scholar, was born at Sydney, N.S.W., Jan. 2 1866, but left Australia at the age of eleven. Educated at Merchant Taylors' School, London, and St. John's College, Oxford, he at once established his reputation as the most brilliant classical scholar of his day, winning the Hertford and Ireland scholarships (1885), the Craven scholarship (1886), the prize for Latin verse (1886) and the Gaisford prizes for Greek verse and prose (1886–7). He was elected to a fellowship at New College, Oxford, in 1888, and next year to the professorship of Greek at Glasgow University, a position he held till 1899. In 1908 he was appointed regius professor of Greek at Oxford. In 1889 he had married Lady Mary Howard, daughter of the 9th Earl of Carlisle. Professor Murray's sympathies were always strongly shown on the advanced Radical side in politics. He was parliamentary candidate for Oxford University at the general election of 1918 and at a by-election in 1919, but was unsuccessful. During the World War he prominently espoused the cause of conscientious objectors, and later identified himself with efforts to ameliorate economic conditions in the enemy countries. In 1923 he was elected president of the League of Nations Union. He published a *History of Ancient Greek Literature* in 1897, but is more widely celebrated for his incomparable renderings of the plays of Euripides into English verse. Several of his versions were acted in England and America. He also published *The Rise of the Greek Epic* (1907; 2nd ed., 1911, 3rd ed., 1924) and *Four Stages of Greek Religion* (1913). Amongst his works on other subjects are *The Foreign Policy of Sir Edward Grey* (1915); *Faith, War and Policy* (1918); *Religio Grammatici* (1918); and *Problem of Foreign Policy* (1921). *See* GREEK LITERATURE: ANCIENT.

MURRAY, SIR JAMES AUGUSTUS HENRY (1837–1915), British philologist (*see* 19.40), died at Oxford July 26 1915, when *The New English Dictionary* had reached its 10th volume.

MURRAY, SIR JOHN (1841–1914), British geographer and oceanographer (*see* 19.42), was accidentally killed near Kirkliston, Scotland, March 16 1914. In conjunction with Dr. Johan Hjort he published in 1912 *The Depths of the Ocean.*

MUSCLE SHOALS.—The section of the Tennessee river, U.S.A., known as Muscle Shoals, extends from the head of Brown's Island, a short distance below Decatur to Florence, Ala., a distance of 37 m., in the course of which the river falls 134 feet.



The map shows the twenty-five mile stretch of the Tennessee river immediately above Florence, Ala., embracing the shallower section of Muscle Shoals. (1) the small dam affording a navigation approach to the Wilson dam. (2) the Wilson dam, the largest masonry dam ever built. (3) the contemplated third dam, which, when built, will render navigation for commercial purposes feasible at all times.

The depth of the channel varies considerably, but in places the minimum depth at low water is less than two feet, and commercial navigation at such levels has never been practicable. As early as 1827 preliminary surveys were made by the U.S. Govt. with a view to improvement, but nothing of permanent value was accomplished in the 19th century.

War Development.—Various proposals were made for power development between 1903 and 1912, but nothing definite was attempted till the outbreak of the World War, when the urgent need for nitric acid for use in explosives induced the U.S. Govt. to construct two large nitrate plants at Sheffield near the lower end of the Shoals, to be operated by hydroelectric power. Plans were accordingly prepared in 1916 for a joint navigation-power scheme, involving the construction of three dams on the Tennessee river, and work was commenced early in 1918 on the major feature of the project, viz.: Dam No. 2, officially known as the Wilson dam. The work of construction was started immediately and the dam was completed in 1926.

Details of the Dam.—It is located a short distance above Florence and is a monolithic concrete structure, 4,500 ft. in length, 95 ft. high from the river bed to the crest, 140 ft. high from foundation to the level of the operating bridge and 105 ft. thick at the base. The structure contains about 1,353,000 cu. yd. of masonry, making it the largest masonry dam in the world—the Aswan dam on the Nile, its nearest competitor, having 1,179,000 cu. yards. It is equipped on the north side with two navigation locks, each having a lift of 46 ft. 6 in. at mean stage, and on the south side is the power-house, forming an integral part and continuation of the dam itself. The latter contains a spillway section 2,660 ft. long in the shape of an overfall dam with a heavy concrete apron and 58 steel floodgates to discharge excess water. Each floodgate is 18 ft. high and weighs about 33 tons. These gates are capable of passing a flood of 900,000 cu. ft. per second. On the top of the structure is a concrete arch bridge, supporting the floodgates and carrying a highway and a standard gauge railway track.

Power Installation.—The power-house is 1,250 ft. long, 160 ft. wide, and 134 ft. high, built of concrete with a steel trussed roof and designed for an ultimate installation of 18 hydroelectric units providing 612,000 H.P., the installation in 1926 consisting of eight hydraulic turbines generating 260,000 horse-power. Four units of this latter installation were placed in operation on Oct. 1 1925, the resultant power being leased to the Alabama Power Co. under a temporary contract, terminable on four weeks' notice. The water-power, when the full machinery has been installed and is utilising the natural flow of the river, will produce on an average 700,000,000 kw. hours of primary power per annum, *i.e.*, power which is available every hour of the year, and 1,490,000,000 kw. hours of secondary power per annum, *i.e.*, power that is available a portion of the year only. The total cost of the dam as it stands, including the present turbines, amounted to approximately $51,000,000, and at the peak of construction, 4,500 men were employed on the work.

Navigation Problems.—Dam No. 1, a small work also constructed by the Federal Govt., is situated three miles below the Wilson dam. It is 300 ft. long, having a lock with a lift of 17½ feet. Its only purpose is to provide a navigation approach to the lower lock of the Wilson dam.

These two units of the combined navigation power scheme do not in themselves solve the navigation problem, inasmuch as the Wilson dam only overcomes 96 ft. of the fall of the river at the Shoals, and the navigation pool provided by it only extends about 15 m. upstream. Consequently it does not eliminate the upper stretch of shoal water. To effect this object Dam No. 3 was designed, located 14 m. above the Wilson dam. When constructed it will overcome about 40 ft. of the fall of the Tennessee, provide above it a navigation pool some 84 m. in length and, combined with the Wilson dam, will eliminate the Muscle Shoals as an obstacle to transportation. In March 1926 nothing had been done in regard to this dam beyond some preliminary surveys and borings.

In Nov. 1918, when the Armistice was signed, the nitrate plants had not been completed. Units, however, were ready to start operations in Oct. 1918, temporary power being supplied by the Alabama Power Co. from its plant on the Warrior river, 90 m. south of Muscle Shoals, and the first ammonium nitrate was produced a fortnight after the Armistice. By this time the emergency had passed and the final work was not done till the summer of 1919. They have not been operated since. Their total construction cost amounted to $83,500,000. The future of the whole project was the subject of much discussion in Congress. Finally bids were asked for by the Government. On July 8 1921 Henry Ford made an offer but no action was taken in regard to it and Mr. Ford subsequently withdrew his offer. No action had been taken by March 1926.

MUSEUMS (*see* 19.60b).—The normal progress and development of museums in Europe since 1910 was rudely interrupted and gravely affected by the War. From 1914 to 1918 no government was in a position to spend much money on acquisitions, and many of the usual channels of supply were cut off. Staffs were depleted by the claims of war service; and although museums continued to play a not unimportant part as an element of refreshment in the strain of war, public interest was inevitably diverted from them. In addition, in certain cases, and notably in respect of the great museums and galleries of London and Paris, special measures of precaution had to be taken, which constitute a remarkable chapter in their history.

War Precautions.—The record of these precautions would need an article by itself. It would relate the hurried removal from Paris of a portion of the collections of the Louvre and other museums (principally pictures, but including the Venus of Milo) at the critical time when a German occupation of Paris seemed far from improbable; the measures taken to protect those which remained from the risks of bombardment; the further removals at the time of the German advance in the spring of 1918. In London it would have to record the protection by sandbags and by removal to basements of the chief treasures of the British Museum, the National Gallery, the Victoria and Albert Museum, the Wallace Collection and other galleries during the early months of the War; the closing of certain galleries in 1916 by the Govt. on grounds of economy; and particularly the great removals at the beginning of 1918, when the principal contents of all the great London collections found refuge in an underground tube railway, in the National Library of Wales at Aberystwyth and elsewhere. In Italy it would have to tell of extensive removals and protections at Venice and other northern towns. The experiences of Belgium and of the towns of northeastern France would also have to be recorded. Materials exist for such a record, and it is an episode in museum history of no little interest, one remarkable feature of which is the extremely slight injury caused by the hurried process of dismantling invaluable collections of most fragile objects.

The Functions of Museums

Leaving aside, then, the special subject of museums in war time, the purpose of this article is to trace the principal features of the development of the museum service and especially to indicate the progress that has been made in making the museums perform more efficiently the services which they are intended to render to the public. The main objects of museums are threefold: (1) to preserve the historical and artistic relics of past ages—the acquisition of objects; (2) to render them readily accessible to scholars—adequate housing and the publication of catalogues and reproductions; (3) to educate the general public—arrangement, display, labelling, guide-books, cheap reproductions, lantern slides, lectures.

Museum Extensions.—With regard to the first two of these heads there is not much to say. In spite of the grave financial difficulties in post-War Europe, new museums have continued to be built, and old museums have been enlarged. Among the more important may be mentioned the London Museum, opened at Kensington Palace in 1912, and transferred to Lancaster House in 1913; the Museum of Eastern Art at Cologne (1914); the Wellcome Historical Medical Museum in London (1913); the new wing of the British Museum (1914); the National Museum of Wales, founded at Cardiff in 1912, of which a part has been opened; a new wing of the Fitzwilliam Museum, Cambridge (1921); the Museo Petriano at the Vatican and the Museo Nuovo on the Capitol in Rome (1925). A new Science Museum was in 1926 in process of erection at South Kensington, and in the galleries vacated by it the War Museum was temporarily and inadequately housed. Paris has a Bibliothèque et Musée de la Guerre, besides a special Museum at the Invalides; in other countries more attention appears to have been paid to War Libraries than to War Museums. In Russia several museums and institutions, principally of science but also of ethnology and Russian mediaeval art, have been founded or extended since the Revolution.

In America, unhampered by war expenditure and enriched by the munificence of many private benefactors, new galleries have sprung up like mushrooms; and endowments on a large scale have been lavished, of which the most magnificent was the bequest of some £9,000,000 by Mr. Munsey to the Metropolitan Museum of New York.

Organisation of Expeditions.—Meanwhile, whether in new buildings or in old, the acquisition of fresh objects has gone on continuously. It is quite impossible to give particulars of even the most important; but mention should be made of one branch of collecting activity, namely, the organisation of expeditions by the greater museums for excavation and for natural history research. In this branch of museum work America, with its great pecuniary resources, has led the way. The American Museum of Natural History has continued to despatch expeditions to various parts of the world, the most notable being that to Siberia, which made remarkable discoveries of the eggs of dinosaurs. The Metropolitan Museum of New York has continued its very thorough and elaborate work in Egypt; the Museum of the University of Pennsylvania has had expeditions in Egypt, Palestine and Mesopotamia; the Field Museum of Natural History at Chicago has made large collections of natural history and ethnography; the Heye Museum of the American Indian investigated sites in New Mexico and elsewhere. These are but examples of the fruitful activity of American museums in this direction.

European museums have not been in a position to do so much, nor has the direct conduct of excavations been a common form of activity on the part of continental museums, though, in accordance with the national laws of antiquities, the museums of Italy, Greece and Egypt have profited largely from the researches undertaken, whether by their own countrymen or others, in the soil of these countries. In England the British Museum has undertaken archaeological excavations at Carchemish in Asia Minor and in Mesopotamia; and the Natural History Museum has taken part, in greater or less measure, in expeditions in Australia, East Africa and elsewhere. This is a form of activity which seems likely to increase, owing to the fact that several areas of great importance, especially for archaeology, have been made more accessible in consequence of the War. It has, moreover, stimulated public interest in such research, and may be reckoned as a contributing cause towards the development of public interest in museums generally, which is one of the notable characteristics of the period under review.

It is, in fact, in the relation between the museum and the general public, and in the development of the museum as an instrument in the general education of the nation, that progress has been most marked; and in any consideration of the future of museums this is a point of prime importance.

Educational Uses.—The earlier conception of a museum regarded it as in the first place a storehouse of objects of antiquity for the benefit of the student, and in the second as an old curiosity shop for the amusement and edification of the intelligent visitor. Its value as a means of education for the general public was not realised until late in the 19th century. In Great Britain the recognition of this function at first took the form of a great mprovement in the labelling of the collections and the provision of illustrated guide-books suitable for the intelligent reader who was not a specialist, and serviceable even outside the museum as handbooks to the subject with which they dealt. At the British Museum this reform was mainly connected with the names of Sir Edward Bond and Sir Edward Maunde Thompson; and Sir William Flower at the Natural History Museum was a strenuous advocate and exponent of the popularisation of museums.

Museum Lectures.—In America a new departure was made in he provision of oral instruction in the galleries by official guide-ecturers or docents, the example being set by Boston in 1907. It was taken up in England in 1911, when the first official guide-ecturer was appointed at the British Museum; it quickly took root there (and at the Natural History Museum, which is governed by the same trustees); and thence, largely owing to the trenuous and persistent advocacy of Lord Sudeley, it spread to he other national museums and galleries, until now it can be aid that the practice of itinerant lectures in the exhibition galeries by highly educated men and women, to chance audiences who assemble to hear them, is thoroughly established as a ecognised branch of museum service. In smaller museums, where the attendance is not sufficient to provide daily audiences for a lecturer, similar work is nevertheless frequently undertaken in the form of advertised courses of lectures.

Improved Guide-books and Reproductions.—The educational value of museums has also been greatly increased by the development of methods of photographic reproduction. Guide-books can be made more attractive by plentiful illustration; and photographs, especially in the popular picture-postcard form, can be obtained very cheaply. These can be rendered far more useful for educational purposes if issued, as at the British Museum since 1914, and subsequently elsewhere, in sets dealing with special subjects. Fifteen postcards in monochrome, or six in colours, with a leaflet of information, can be sold profitably for a shilling, and furnish an interesting and attractive introduction to a subject. The danger is lest the productivity of a museum should be diverted overmuch into these popular and profitable productions, at the expense of those contributions to learning which every great museum is rightly expected to make.

This development of the educational and popular sides of museum work is not by any means confined to the great metropolitan collections. It is characteristic of museum work as a whole throughout England and America. Every active-minded curator is anxious to make his museum a living centre of intellectual interest; and the future of museum development depends mainly on the answers to be given to the question, How can museums be made more serviceable to the nation?

Research and Scholarship.—A distinction must be drawn between the great museums of the largest towns and the most important universities and the municipal museums of provincial towns in general. The former, while never forgetting the service which they owe to the general public, must not sacrifice to it their duty to scholars and researchers. For these, quantity is often as essential as quality. It is sometimes supposed that the great museums contain masses of objects with which they could well dispense, and which could more profitably be distributed among, or at least lent to, the smaller museums. It is, in fact, seldom and to a very small extent that this is true. The scholar who is investigating a particular subject needs to have under his eye, for examination and comparison, a great mass of material. He needs many editions of an author, many examples of the work of an artist, many specimens of Greek vases or Chinese porcelain, of birds, beasts, fishes, insects, fossils, minerals or flowers. His work would be ruined if he had to search for these in many different collections; and it would be exasperating to find that the objects which he had the right to expect to find in a particular museum had been scattered on loan among a score of provincial collections.

What the curator of such a museum has to consider is, not whether he has in his collections a finer example of a certain class, but whether a particular object is needed for the scientific study of the class to which it belongs. At times, no doubt, a specimen once useful may have lost its value and can be dispensed with, but this happens comparatively rarely. Nor is there much danger lest the museum curator should be led away by the lust of acquisition. Purchase grants are not so lavish that he can afford to buy anything that he does not really want; and in most great collections the demands for accommodation are so pressing that he will gladly dispense with anything that is really superfluous.

THE IDEAL MUSEUMS

The need of great museums, then, is proper provision for (*a*) the student, (*b*) the general public. The difficulty here is mainly structural. There was a time—a time when most of the museums in Europe were built—when there was no great difficulty in putting all the collections of antiquities on exhibition without overcrowding. That time is long past, and what is needed now is to apply to antiquities the method which has always been applied to books and prints and often to natural history specimens, namely, to exhibit only a small selection to the public, while providing facilities for students to examine the mass of the collections in convenient circumstances.

The ideal museum—an ideal realised in some of the latest—is a succession of public exhibition rooms in which a small number of the best specimens are well spaced out and adequately labelled, and another series of rooms in which students can sit down to the examination of a large number of specimens, or the intensive study of a few, according to the need of their study. The general public will have a better chance of appreciating without fatigue the charms of Greek vases or mediaeval enamels from 50 good specimens well displayed than from 1,000 ranged in serried rows of shelves. What most of the older museums need, and what architects have seldom been asked to provide, is ample storage accommodation. They would then be able to discharge the double duty—each so important—which rests upon them.

Provincial Museums.—For the provincial museums the balance of responsibilities is different. Although they can often give important aid to research, their first duty is usually to the general public. Here the educational function is paramount. Few general laws can be laid down, because museums differ so greatly in their possessions and their opportunities. A provincial museum can seldom aim at universality, but it can do much by a wise cultivation of its own particular garden. One duty is incumbent on all, to create interest in, and to diffuse knowledge of, the localities in which they are situated. The history of the town, the records of its buildings and its eminent citizens, the geology, fauna and flora of the surrounding country, the principal arts and industries of the neighbourhood—these are subjects which all active museums now regard as their proper sphere, and which they strive to illustrate with all the materials that they can acquire. On these subjects they are entitled to aim at being exhaustive. On more general subjects they can only hope to be able to give partial representations, and each must cut its coat according to its cloth.

One general counsel can be given—to vary the exhibitions as much as possible, to seize opportunities of giving them topical interest, to add to their educational value by lectures, leaflets and photographs, and generally to cultivate an air of alertness and change rather than sameness and monotony.

Loan Collections.—In this connection the question of loans is of importance. It is clear that provincial museums would be much assisted in provoking interest and in spreading education if their permanent resources were reinforced by temporary exhibitions of loan collections. It is here that a gap exists in the museum system which could be filled with great profit. It has already been indicated that not much help in this direction is to be expected from the great national collections. Local museums might help one another, to some extent, by temporary exchanges of exhibitions on subjects in which each happened to be strong. In some cases also permanent exchanges might be arranged.

Central Depository.—But a very real service to the education of any country would be rendered by the creation of a strong central depository of loan collections. In England a service of this kind, designed in the interests of craftsmanship, was a prominent feature of the original plan of the South Kensington Museum. In the department of classical archaeology, experiments in this direction have been made in England, Ireland and America (see H. Browne, *Our Renaissance*, 1917, pp. 184–281). But a stronger, better supplied, state-supported central organisation is required, which need not be costly, since it would receive subscriptions from the local institutions which had recourse to it. Taking the country as a whole, there will be a great economy in a central circulating collection as compared with a large number of local museums, each trying to add to its permanent collections of non-local objects. The central collection would not need to indulge in expensive purchases, since it would not aim at acquiring objects of the first rank; and it would receive such objects as the national museums were able legitimately to spare.

The main needs of the museum service, then, certainly in England and in varying degrees also elsewhere, are: for the greater museums, restricted exhibition to the public and fuller accommodation for the student and for storage; for local museums, centralisation, co-operation and devotion to the education (in the broadest sense) of the local public.

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MUSIC (*see* 19.72).—The purport of the present article is not that of a *catalogue raisonné* of modern music; its intention is to put forward certain general principles that seem to have become more clearly manifested since 1910. Any works and composers that are mentioned will be selected merely as the first convenient illustrations of these principles; and the convenience will be avowedly accidental. This method has, in the past history of criticism, always proved to give results far more interesting than those of an attempt to catalogue and estimate contemporary events and works; nor does the dearth of names and titles detract greatly from its interest. The greatest art takes ample time before its impulses reach the main stream of historic tendency, so that the contemporary view of the main stream is naturally, and not unjustifiably, preoccupied with work that will not interest posterity; while, on the other hand, future historians will, as often hitherto, have great difficulty in finding any historic importance in the works which prove immortal.

But we are on solid ground if we fix our attention on prevalent tendencies shown by large bodies of work and of criticism, and on the conditions in which the work is produced and enjoyed. There are periods of artistic transition in which tendencies are too vague or too involved to be distinguished by the contemporary observer. If perhaps this was so in the beginning of the 20th century, things had become clearer by its second decade; and it was possible to draw an emphatic distinction between what is real and what is unreal in the music of the day.

I. INTRODUCTION

Defects of Contemporary Criticism.—It will be convenient first to deal with the unrealities. The most formidable of these arise from the unnatural conditions on which the modern musician acquires his reputation. At no period in history has an artist been able to make his living solely by his highest line of work; but the hardships of the classical artist's life were at all events not unnatural. They were average effects of human nature, and not of an inflated self-consciousness among art critics. It has always been hard to struggle against a depressing prevalence of dull or vulgar tastes and pedantic conventions; but such a struggle is life, and victory in it is health. Far less certain is it that life and health can be found in the struggle for musical reputation under modern conditions; especially for reputation as a composer.

The grounds on which new music is commonly criticised are no longer grounds of healthy and intelligible discussion. The critics, conscious of the proverbial persecution of genius by contemporary pedants and upholders of convention, are now unanimous in condemning all that is under suspicion of being "correct," and are desperately anxious that no *soi-disant* revolutionary tendency shall miss acclamation and that no dangerous outbreak of normality shall escape damnation. The music that is most written about and talked about is the music about which it is the easiest to say clever things. The clever things must be or seem to be intelligible to the general reader; and this means that they must not be musical facts, for musical facts are involved in musical technicalities. Yet the clever sayings must be impressive. The result is a special psychological jargon, mostly unknown to psychologists, which the general public believes to be a musical jargon. The public finds it fairly amusing, especially when the critics, having exhausted their stock of new musical discoveries and revolutions, are reduced to discussing each other. But it may be news to the public that the jargon is almost wholly unintelligible to real musicians, and nowhere more unintelligible to them than where it employs musical terms.

Meanwhile real music struggles into existence, and even occasionally into recognition, while fashion follows the journalists and awards fame without popularity 10 times a year to musicians of perfectly respectable character and intellect who are driven to pose as lunatics lest sanity should earn them the reputation of prigs. In such conditions it is not surprising that there is more genuine musical life in provincial districts than in the metropolitan cities. The musical life of the provinces is their own; the metropolitan public is so anxiously watching the jumping of the critical cat that even the formation of coteries is conditioned more by diplomacy than by enthusiasm. Popularity and healthily good music are driven to meet on new ground. Theatre music, apart from opera, is in Great Britain still in a state of squalor, which must remain hopeless as long as British theatregoers maintain the habit of drowning the musical *entr'actes* in talk. But the cinema produces a remarkably perfect silence in spectators, and in its not always fresh atmosphere many an excellent player finds a livelihood which he can ill afford to exchange for a good position in a permanent orchestra. The London music hall, especially since the advent of the great Russian Ballet dancers, has drawn into its sphere of influence many a serious musician, among composers as well as performers; and the composers to whom it is still a strange environment may sometimes find that more than a pot-boiler impulse and technique are required of them if they are to distinguish themselves there.

At all ages there have been heartsearchings as to the border lines of "legitimate" art, and the origins of the highest classical art forms have far more often been popular tendencies than critical doctrines. The health and fruitfulness of permanently valuable art demand two conditions: first, that artists shall have the inducement of a living wage for producing it; secondly, that audiences and spectators shall be accustomed to receive it so attentively as to induce the artist to refine his style. Art does not thrive in a state of public opinion and critical jargon in which nothing is allowed a right to exist except works of devastating genius; and genius itself stands less chance of recognition in such a state than in any other. A good period of art is that in which the ordinary styles are so good that the sensibilities of a child of genius are not starved or disgusted by them before he has had time to outgrow them as a genius must. Nothing good can be expected for genius or philistine from a state of art in which every style is ostentatiously paradoxical.

Between the fruitful and the unfruitful tendencies in contemporary music, the questions at issue are not primarily matters of taste or tradition. It may be assumed that vital art has deep foundations of taste and tradition, even if it professes to revolt from them all; but the signs of its vitality are neither in revolt nor in conformity, but simply in the variety and the coherence of the art in itself. And the variety and coherence are matters of discoverable fact. Principles which make for them are likely to be sound; principles which destroy them are, if correctly stated or imputed, certain to be unsound. We must, however, bear in mind that the creation of a work of art is an altogether different process from criticism and analysis. The craziest theory may be accepted by a composer as being his method of work, and it will do him not the slightest harm so long as it keeps his attention so poised that the depths of his mind are free to express themselves. But the same theory will be disastrous to most of his disciples, hough some may share his luck with it. The classical art forms were not, in their origin and maturity, crazy theories, but shrewd eneralisations from familiar experience. As that experience ecomes remote the art forms lose their vitalising expressive ower. But there is more vitality in remote experience than in one at all; and a mere arbitrary contradiction of old artistic heories is, one would think, the most obvious sterilising procedure that could be devised for future art.

II. MODERN MASTERS AND THEIR WORK

Scriabin's Harmonic System.—The procedure is seen at its worst when it is applied to some all-pervading category of music, uch as harmony. Whatever may be the merits or the fecundity f the composer, we may be absolutely certain that when he xplicitly promulgates a new system of harmony he is talking onsense. Scriabin (1871–1915) began his career as a brilliant 0th century Chopin, with an unmistakable power of composition n large and free form, besides a happy vein in the tiniest of reludes. In time, certain harmonic mannerisms developed: the composer was inspired to write for orchestra; his vigorous talent for composition not only stood the strain of this larger medium but remained traceable in works based each on some single artificial chord of which the original meaning is obviously a Wagnerian progression, but which was expounded to the gasping interviewer as the most perfect chord in music. And so the gasping interviewer went on his way rejoicing in the possession of a profound technical mystery worthy of revelation together with the composer's theosophic doctrines and other matters of popular interest. There is no reason for doubting the composer's sincerity either in his theosophy or in his harmony. Artists are seldom also men of science, and even men of science keep some region of their minds in a state of holiday wherein they may be perfectly arbitrary and self-centred. Art originates from such regions of the mind, but it will be stifled, and those regions will be starved, unless it emerges and forages in the wide world of human life. Egocentric as is the nature of art, the confines of one personal life are not enough for sane self-development; and the personal note of the artist who retires into the recesses of his arbitrary domain will not long retain its power.

The untimely death of Scriabin left his art just at the point where it was beginning to alienate his enthusiastic supporters. Contemporary enthusiasm and hostility on theories of harmonic style may be left to the theosophists. The important fact is that Scriabin did, while he lived, produce compositions with a large flow and climax: nor do we know that his power to do so was likely to fail him. But the lesson of three harmonic revolutions, distributed over five centuries of musical history, is that wherever a composer becomes preoccupied with harmonic ideas his power of composition is in greater danger of dwindling than when his interests lie in other categories of his art. Scriabin himself complained at last that all his harmonic efforts had not carried him essentially beyond the dominant seventh; and herein history repeats itself, for the complaint is substantially that with which Philipp Emanuel Bach refuted the harmonic theories of Rameau, saying to Burney that he could conceive nothing more childish than this notion of the "fundamental bass," inasmuch as it "would reduce all music to a series of full closes." The truth is that all purely harmonic ideas first become intelligible by gravitating towards a full close; just as all verbal ideas gravitate towards the form of a subject, a predicate and a copula.

Nor do harmonic ideas escape their fate by being based on conceptions which deny the aesthetics of classical polyphony and attempt to treat chords as pure sensations without relation to the melodic progression of their individual notes. Sooner or later the composer will awaken to their possible meaning in a polyphonic scheme. Thus Walford Davies has sealed the fate of the "whole-toned scale" (once believed to be the anti-polyphonic backbone of Debussy's art) by pointing out that it is not a scale at all but a chord, which, properly distributed in different octaves, can resolve in six enharmonically different ways, none of which have anything to do with the sceptical and mechanical train of thought which tries to base harmonic systems on the limitations of the equal-tempered pianoforte with its 12 semitones to the octave. It is not worth while attempting to catalogue the systems of harmony evolved at the pianoforte by composers who continue to imagine that chords can be built up in fourths or in other *a priori* ways as rhythmless and unmelodic entities. Whatever the reader's indignation at finding in this article no treatment of the dozens of harmonic and musico-metaphysical topics he hears of to-day, he may comfort himself with the certainty that nobody will have heard of most of them next year. One might as well discriminate between the fashions which dye the hair green and those which dye it blue.

In all the chaos of recent experiment with discord and disordered rhythm, two questions alone are capable of permanently significant and truthful answers: the one concerns the composer and the other the listener. To the composer we may address Brahms' rude query, "Do you find this fun?" Of the listener we may ask, "Can you find a sufficient variety of coherent definite elements, events, qualities and forms in this art, quite irrespective of any question of novelty?" This question must be answered with regard to all the elements of the art from the oldest to the newest, and it is one of the few sound artistic questions which concerns an artist's whole output as well as individual works, *e.g.*, whatever may be thought of Scriabin's last harmonic obsessions, his smallest preludes, early, middle or late, could not have been created by a composer who could do nothing else. It is an accident that his work made a new sensation: it is an essential fact that he is a composer. Without the power of composition a new sensation cannot last, even if it can make its mark at all. With power of composition everything in art must some day find wide recognition, if it escapes physical destruction; for no composer attains such power without being driven by strong human impulses. Epigrams are not enough. Human experience vividly presented never loses point.

Stravinsky and the Ballet.—But the chances of producing permanently living work are heavily weighted against the composer if he concerns himself only with things which he alone can understand. The Russian Ballet gave abundant vital impulses to music so long as it dealt intelligibly with drama, fairy tale, fable and life; and the young Stravinsky of *L'Oiseau de Feu* found in it inspiration for music that remains brilliant and intelligible apart from the ballet. In *Petrouchka* he still makes rhythmic and instrumental sounds that faithfully follow and enhance the moods of a fascinating pantomime; but the concert-goer who, knowing nothing of the ballet, affects to be moved by the music in an orchestral concert, is little wiser than the man who would rather say he preferred the wrong end of his asparagus than admit that he did not know which was the right end. The ballet is to the composer an easier and therefore more dangerous art form than the opera; in both cases the listener will always give the music credit for all the qualities of the scenario if the composer only manages not to interfere with them.

Self-deception, loss of vitality, decadence and dry-rot set in when the designers of the ballet themselves retire into the arbitrary kingdom of abstractions which they call symbolic, and which common sense calls nonsense. There is a real kingdom of nonsense, and it will have none of your owlish aesthetic solemnity about morbid twists of mind. Lewis Carroll, trained logician, leaves it to later commentators to identify his Snark with the Absolute, or with the company promoter; his and Edward Lear's wonderland of nonsense is a school of manners in the light of which any explicit social satire and many fantastic flights of modern musical imagination appear almost equally convicted of grossness and heavy incongruity. For music, as for all arts, the fruitful path, and that which leads even to the sublime as well as the imperishable, is a path of unselfconscious childlike enjoyment of the matter in hand, with no petulant preoccupation with the stupidity of the outsider. Erik Satie is amusing enough with his *Vraies préludes flasques pour mon chien*, his *Aperçues désagréables*, and all the rest of it; his works are announced with the challenge, as to *les Aplatis*, *les Insignifiants* and other more Rabelaisian nonentities who will not enjoy them, "*qu'ils avalent leurs barbes! qu'ils se marchent sur le ventre!*" English patriotism cannot but feel flattered by this contrast with the perfect manners, perfect scholarship and perfect art with which Holst has made a fairy tale of all the operatic styles in musical history in *The Perfect Fool*.

Gustav Mahler.—Prominent among the eternal questions which agitate the contemporary critics of all arts at all periods is the proportion of means to ends. The modern orchestra grows easily with the demands of the modern composer, for, in spite of local and temporary difficulties, it is to the interest of players that orchestras should increase as well as multiply; but the most extravagant modern composer has never yet faced the problem of designing music for which the band and chorus of a Crystal Palace Handel Festival would really be to the purpose. In other words, the Handel Festival exists; but the music for an organisation of even half that size has never yet been composed.

Here, then, is material for a real aesthetic development; and herein lies the significance of the recent vogue in Holland of the enormous works of Gustav Mahler. That great Viennese orchestral conductor died almost a generation ago, and his symphonies owe much of their recognition to the personal zeal of their apostle, the eminent conductor Mengelberg. It is improbable that the music-lovers of other countries will ever readily receive these huge volumes of naïve sentimentality and boyish grotesqueness. But the works nevertheless demonstrate at least three vital things: first, that it is still possible for a composer to pile up structure of illimitable extent in the most unsophisticated harmonic and melodic style; secondly, that, whereas taste cannot even begin to express itself without some technique, an immense amount of technique may be learnt from work which cannot be said to show any taste at all; and thirdly, that whatever may be objected to Mahler's taste and form in this direction, he undoubtedly fulfilled his set purpose of working out the pioneer aesthetic and technical principles of music designed for 1,000 performers and upwards. And this is no decadent proposition.

Decadence lies rather in the performance of classical music on a scale for which it was never remotely conceived. The real problems of music for 1,000 performers are, as Mahler perceived, problems for a severely disciplined and accurate imagination; and nothing can be further removed from the world of arbitrary artistic egoism. They are not to be mastered by the methods of that kind of extravagance which now and then displays a revulsion in some absurd economy, like Meyerbeer's old trick of thin and inadequate harmony for one voice supported insecurely by one horn and a spasmodic gurgle on a solo violoncello. With much of Meyerbeer's "best-seller" qualities, Mahler nevertheless has none of Meyerbeer's worldly wisdom, and in his special field there is as yet no greater and more masterly idealist. In vocal music he often attains great beauty and purity of style.

Schönberg.—The main stream of music still flows within the Wagner-Strauss limits, and seldom requires 150 instrumental players. Arnold Schönberg's *Gurre Lieder* (a large vocal and choral cycle, the great success of which is held by his disciples to be a serious hindrance to the spread of his later gospel of *a priori* harmonic revolution) requires a huge orchestra; but the very fact that the score often employs 50 staves proves that Schönberg is by no means imagining the aesthetics of an unprecedented scale of performance; the polyphony that requires 50 staves for its notation implies detail rather than bulk.

Max Reger and Classicism.—The life work of Max Reger presents a strange study of artistic vitality working on methods the reverse of vitalising. At first sight his productivity seems enormous; and since Orlando di Lasso in the 16th century we have had no other conspicuous instance of a composer who seems always able to sit down before a pile of blank music paper with a blank mind and work himself up into genuine inspiration by sheer interest in the weaving of rich musical texture. To the present generation of German musicians Reger is the last of the classics; but there are few things in music less classical than Reger's art forms, rigidly orthodox though they seem. They are the direct result of extraordinary docility in the pupil of the most systematic musical scholar of recent times, and anyone who has groaned in spirit at the sight of one of Hugo Riemann's editions of a piece of classical music may easily recognise in Reger the traces of his teaching. Every external feature of the classical art forms is present without any trace of the classical reasons for it. Everything has been worked out from one detail to the next, without any first principles to account for the whole procedure.

A facile contrapuntist, Reger writes untold numbers of fugues, all on one mechanical plan, mostly with some combination of subjects, but never a combination between subjects sufficiently contrasted to give it point. His instrumental works are for the most part cast in sonata forms; except for the incessantly modulating and chromatic style, the whole collection of works contains neither an unorthodox procedure nor the slightest reason for its orthodox procedures. Bach wrote great works for unaccompanied violin, and Reger does likewise. But he shows no sense of the principle that Bach's unaccompanied melody is its own bass; Reger's melodies cry loudly and ambiguously for harmonic support. You might as well cut out with scissors a full-face portrait of a judge in his wig and expect it to be recognisable as a silhouette.

Whatever is to be learnt from Reger, it is not the meaning of classical art forms. And much is to be learnt from Reger. His texture is inevitably thick, for his rigidly systematic completeness vetoes that suggestiveness which is one of the secrets of the greatest art. But it is astonishingly sonorous, and, in its heavy literal-minded way, effects its purpose in the fewest possible notes, numerous though they be. Every instrument is profoundly studied and developed on the basis of its natural technique; and while the player who claims that he can read Reger at sight is probably mendacious, he will enjoy his instrument all the better for playing Reger well. Nor is this the only or the most important non-egotistic reality in Reger's work. The reality of Reger is that he is a consummate and impassioned rhetorician. His unreal art forms hinder and help him no more and no less than the alphabetical acrostic hindered and helped the poet of the *Lamentations of Jeremiah*. He extemporises on paper, and is profoundly attentive to the nature of his instruments and to whatever text he is setting in his vocal music. In the history of art there can be no more conspicuous example of the difference between analytcal theory and the practical conditions of creative work.

Bantock, Holst and Boughton.—The only things that matter to the composer and to his posterity are the things that help or hinder him in creating his works. Posterity will not inquire whether Sebastian Bach, Granville Bantock, Richard Strauss, Busoni—whosoever you will—were reactionaries or revolutionaries, whether they followed classical forms, misunderstood them or abolished them. Nor will posterity pay any attention to the questions we so often ask as to whether such and such a composer's work has led to further developments or hindered them. This is a totally different question from that which is often conused with it, the question whether certain principles (such as a evolutionary but disciplinarian theory of harmony) do or do not interfere with a composer's capacity to write coherent and fluent works. On the sane musician the effect of the achievements of Wagner or Strauss is to enlarge his ideas of the range of his art. He is not obliged to cover that whole range himself; and the musician who, not being Wagner or Strauss, dooms himself to ailure by working on their huge scale with inadequate resources, oes not thereby show that his artistic balance would lead him o better success on a smaller scale. All great art may be accused f "leading to a blind alley," inasmuch as its achievements are lways individual and unique. Yet every achievement that lives and many live, like the works of Domenico Scarlatti and Couperin, that cannot well be called great) is a source of inspiraon to right-minded artists. It is not a matter of taste; nor need be an incitement to handle any particular art form or to mitate the style that has inspired the artist with Correggio's onviction "*Anch'io son pittore!*" It would be difficult, for nstance, to name any composer whose style shows the influence f Granville Bantock; just as it is difficult to trace in his style, therwise than by merely technical measurements, the influence f Strauss and of the schematic purity and brilliance of Russian rchestration. Yet there is probably nowhere in Europe a more adiant source of musical health.

Another striking example of artistic vitality commands attenon in the work of Gustav Holst, an English composer whose terest in oriental subjects is (like Bantock's) no whim for *inoiseries* but a true expression of the nostalgia of the West r the East. In every direction his work is masterly, independent nd indisputably real. *Savitri* is an oriental opera written with e slenderest of instrumental resources and with much singing at is not only unaccompanied but unharmonised. Holst has so produced beautiful songs for the strange combination of a lo voice accompanied only by a violin. At the other end of e scale we have his orchestral work *The Planets*, in which shows his full musical freedom. Probably the work in hich his design most accurately and tersely fills its space is s setting of the sublime ancient Byzantine *Hymn of Jesus*. ere the music seems indistinguishable from the text; and its rimitive and drastic harmonic logic, which technically could ot have been written before the time of Debussy and Ravel, no more suggestive of the fashions of to-day, or of any day, than the awe-inspiring Eucharistic text which reverberates through it. No modern music is more utterly unsuggestive of outward and technical resemblance to the classics, and none rests on deeper foundations of musical scholarship.

Among the most significant signs of life in English music we must mention Rutland Boughton's remarkable musical festivals at Glastonbury, where (until interrupted by the World War) he produced English opera on a small scale, ranging from Purcell to his own and other contemporary works, several of which have since become famous.

Strauss's Later Work.—It is easy to ask what effect the World War has produced on music. The wisest answer is negative. The ascertainable effects of the War upon the arts are blankly destructive. Few, if any, of the works written avowedly to commemorate the War can possibly succeed in meaning what they say or saying what they mean. And of the losses to music, who shall discriminate between the talents that had been given time just to reveal their promise and those that were cut off yet sooner? What now of Russia, where in 1921 world-famous composers were living in starvation without even paper to write on? If any musical work is destined to impress posterity as a noble expression and reaction of the World War, the choice might fall on Richard Strauss' *Die Frau ohne Schatten*. His *Alpen-sinfonie*, which, designed before the War, appeared in 1915, was a great disappointment, amiably commonplace in "programme" and sentiment, and hardly more than automatic in its characteristic "road-hog" technique.

As regards *Die Frau ohne Schatten*, the style of Richard Strauss is no longer a new sensation, and it cannot be easily proved to be less automatic here than it is in the *Alpen-sinfonie*. The intention of the work as a whole must be ascribed to the poet Hofmannsthal; but this does not minimise the importance of what Strauss can achieve at the height of his power and inspiration. His mastery of composition and texture has never been seriously in dispute, whatever exception may have been taken to the extremes and licences of his style; and as the poet's intention is noble, the composer has made its realisation vivid as no one else could imagine. From the twilight of 19th century and recent erotic art, and from its always selfish and sometimes abnormal sexual preoccupations, *Die Frau ohne Schatten* breaks away, and its plea for love is nature's plea for life. Musically it is, more copiously than any of Strauss' former works, an occasion for beauty; as a dramatic spectacle it is a gorgeous fantastic pantomime, of which the allegorical meaning leaves it hardly less childlike than *Die Zauberflöte*, which it in some points intentionally resembles. It is altogether a noble and heroic work, unassailable by any cavil that does not condemn itself as ignoble.

III. THE FUTURE OF MUSIC

A New Pianoforte.—In the early summer of 1921 a new kind of double keyboard for pianofortes, invented by the eminent Hungarian composer Emanuel Móor, and manufactured by Messrs. Schmitt-Flohr of Berne, was demonstrated in Berne to large audiences. Two things stand in the way of its development as the most important invention in musical instruments since the pianoforte itself; first the commercial difficulty in promoting an improvement that cannot be simply added as an extra apparatus to an existing pianoforte; and secondly, the tendency to expound it as a device that makes existing feats of pianoforte technique nugatory, a policy which merely infuriates the pianoforte virtuoso. The real importance of the invention lies in its entirely new resources. The principle is simple and might just as well have been discovered when the pianoforte was first invented: in which case Mozart's pianoforte-technique would have begun considerably beyond the point where Beethoven's now leaves off. Two manuals are placed, the one so slightly raised above the other that a perfect *legato* in rapid passages is obtainable between them by one hand. The second manual is an octave higher than the first. Thus the normal stretch of one hand is two octaves instead of one; and with the cultivation of a new set of movements of the hand, backwards and forwards as well as laterally, the possibilities of pianoforte-writing already seem limited only by pure musical aesthetics. But this is not all; the two manuals can be coupled together by a pedal, so that the instrument possesses much of the property of the organ and also of the harpsichord, in the power of doubling a whole mass of harmony or any part thereof in "four-foot tone." The restoration of harpsichord effects is completed by a lever which operates a kind of sordine, producing a somewhat crudely generalised harpsichord tone which later improvement may make very valuable.

There is a vast new technique awaiting long study and exploration; but the merest rudiments of it produce astonishing results in a short time, for the pianist who gave the first public demonstration did so within six days of setting eyes on the instrument. Doubtless it will develop its own vices as well as resources, but it begins by depriving pianists of occasion for four-fifths of their worst habits, and sets a premium upon a Bach-like and Mozart-like cultivation of polyphonic *cantabile.* Many composers use the pianoforte in the act of composition far more than they are willing to admit. They know it to be a bad habit, because it tends to cramp their invention in two directions: it confines phrasing to the obvious sequences that muscular memory best grasps, and it confines part-writing to the compass and convenience of the hands. The second limitation is now removed, and those composers who suffer from "pianistic" habits may learn from it a greater freedom in their writing for other instruments and for orchestra. Thus there is no region of music unrelated to Emanuel Móor's duplex coupler pianoforte, and this instrument should become a very important source of interest and inspiration in the music of the future.

Wireless and the Future.—The development of wireless broadcasting is effecting, in music as in other matters of entertainment and education, changes which only future generations will be able to estimate. The industrial revolution it will create in the lives of musicians will need wise guidance if it is to be beneficial to music. The function of the large orchestra in the public hall will never become obsolete, for the sounds that reach the ear from the dispersal sources of an orchestra have an acoustic perspective which no improvement in "loud-speakers" can impart to a transmitter or phonographic recorder which emits all sounds from one place. The simple experiment of putting the hands around the ears while listening to an orchestra in a concert-room will convince the listener that a "gramophone effect" is little more than the result of cutting off the waves that reach the ear from other than frontal directions. Apart from the improvements of technique that are rapidly making the transmission of timbre and balance of tone more satisfactory, the development of "wireless" music is already arousing millions to attention without arousing the inhibitions and excitements of crowd-psychology. The very defects of transmission are stimulating pianists (whose instrument suffers thereby more than most) to the study and broadcasting of intimate early keyboard music in which the plain melodic and polyphonic sense demands almost nothing from the special character of the instrument, but appeals to fireside audiences who would find it unintelligibly thin in the concert-room. Moreover, a new fact in musical aesthetics is the extraordinary beauty of microphonically magnified tones of very faint instruments, such as the clavichord.

We may be nearer than we think to a still more subversive revolution by means of the microscopic study of the wave-lines of phonographic records. There is nothing to prevent the possibility of producing music directly in terms of those lines. The limitations of music so produced would no longer be those of instruments, but would be determined solely by the precision with which it may become possible to model any sound-wave required. The composer will imagine and prescribe any producible timbre at any pitch he pleases, and will perhaps have no more to do with the craftsman who models the phonographic wave-lines than the violinist has to do with Stradivarius. The crudest beginnings of this new art will be of enormous importance, but its highest development will still leave the human handling of instruments supreme as the inexhaustible source of musical inspiration.

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MUSICAL COMEDY (*see* 8.533).—Although musical comedy i one of the most popular entertainments of the English-speakin races, it has always been passed over by writers on music as to unimportant for discussion, and books of reference have hither to maintained a curious silence on its origin and character. Ye musical comedy and its off-shoot, revue, occupy a distinct plac in the history of the modern theatre.

Character and Origins

What is musical comedy, and what is its line of descent fron the recognised forms of light opera? Clearly it bears no relatio to the classical *opera buffa* of Italy. That had no spoken dialogu and its place was taken by *recitativo secco,* a formal and rhetorica delivery of the words, supported by the lightest accompaniment Mozart's *Figaro* and Rossini's *Il Barbière* are good examples o *opera buffa.* Nor has musical comedy any real connection wit the German *Singspiel* except that spoken dialogue was use instead of *recitativo secco.* In France the *singspiel* develope into *opéra comique.* But the French comic opera was not neces sarily comic, but was so called merely to differentiate it fron grand opera. It was not considered necessary, indeed, that a *opéra comique* should include a single comic scene or character but whatever the style of its drama might be, its dialogue ha to be spoken. Since the dawn of the 19th century *opéra comiqu* has been a favourite form of composition with French musicians but one may look to the popularity of the *vaudeville,* after th French Revolution, as being a more direct ancestor of moder musical comedy as far as the style of the play was concerned But the *vaudeville* was written in verse, and musical comed employs only lyrics for musical setting, the play itself bein carried on by spoken dialogue.

A much closer analogy is to be found in the French *opér bouffe,* which is not in any way akin to the Italian *opera buffa* In the former, spoken dialogue alternates with light music, an in the play itself there were generally topical or satirical allu sions. It was a kind of *opéra comique* in little. From the *opér bouffe* and *vaudeville* sprang the operetta: at first, as its nam implies, a short opera of one act which was employed to lengthe the evening's entertainment. Gilbert and Sullivan practicall founded their operas on the operetta and *opéra bouffe,* but, ex cept at first, they cast them into two acts of sufficient length t fill the bill.

On its formal side, the English ballad opera may be con sidered one of the models for musical comedy. Sentimenta songs are introduced with the same irrelevance. The Englis ballad operas came into being as a protest against the Italia operas of the 18th century. The English works were even com posed in the Italian manner, *recitativos* taking the place of dia logue. But they did not have much success until Gay wrot *The Beggar's Opera,* for which Dr. Pepusch adapted the bes English and Scottish melodies that could be discovered. Th opera had a great success in 1728, and when a modern version o it was produced at the Lyric, Hammersmith, in 1920, it ran fo 1,463 continuous performances, being beaten only by *Charley' Aunt* (1,466) and *Chu Chin Chow* (2,238). *The Beggar's Opera* was afterwards revived and did well. The success of *The Beggar's Opera* led to the production of *Polly* at the Kingswa

Theatre (1922) and of *The Duenna* (1924). This revival of interest in ballad operas suggests that this typically English form of musical entertainment may have a future. A revival of Isaac Bickerstaff's *Lionel and Clarissa* at the Hammersmith Lyric Theatre in Oct. 1925, proved fairly popular. All these 18th-century ballad operas have been retouched and to some extent modernised, but the work has been done so well that they have not lost their antique character. But neither they nor the Gilbert and Sullivan operas have anything in common with musical comedy. Their popularity is evidence, however, that there is a large public interested in music of a light character.

The *genre* of musical comedy, then, is in direct descent from the *opéra bouffe* and the *vaudeville* of the French combined with our own ballad operas. But it must be remembered that in very few instances is one form of art purposely modelled on what has gone before. Makers of musical comedy have not been at pains to imitate and adapt to present needs former works of light music. Sir Arthur Sullivan is, perhaps, an exception, for the earlier examples of the Savoy operas do show that he had taken the French operetta as his model. Musical comedy, as it is known in London and New York, is an expression of a love of boisterous and farcical humour rather than of the high comedy of the operetta. In its present form it is peculiarly an expression of the English-speaking races. Its humour is broader, more farcical and more eccentric than anything to be found in light French or Viennese opera, and the student will find curious evidence of this in the change which French or Viennese light operas undergo when adapted to the British or American stage as musical comedies. André Messager's *Véronique*, for instance, was first performed in London by a French company (1903) as a light opera. When it was produced, shortly afterwards, in an English version, the comedy part of the florist was developed by Mr. George Graves into an eccentric low comedian. This had the effect of changing the character of the piece, although, of course, the original music remained.

Much the same change had happened to the Viennese light operas which, from 1910 almost to the present day, gradually ousted English musical comedy from the London and New York stage. The public patronises musical comedy because it is fond of music, and it soon became fascinated by the finish and skilfulness of the compositions by Oscar Straus, Leo Fall, Jean Gilbert and Franz Lehar. But to all the light operas of those composers the farce of recognised musical comedy had to be added. This is a relic of the old-fashioned Gaiety burlesque. Those burlesques were more in the nature of what afterwards came to be known as *revue* in London and New York than of the musical comedy with a plot and sentimental scenes. Gradually the Gaiety burlesque developed into the Gaiety musical comedy, the music written by Lionel Monckton, Howard Talbot, Ivan Caryll, Paul A. Rubens and others. These musical comedies always contained big parts for the low comedians, and in the second half of the entertainment the plot was held in abeyance while the low comedy was developed. The gradual popularity of Viennese light opera, adapted to the London stage as musical comedy, with big parts for the low comedians, swept all before it down to 1914. The plots of the foreign light operas gave better opportunities for sentimental scenes and their composers were able, by superior musicianship, to make the best of their ideas through clever orchestration and skilful ensembles. Occasionally light musical pieces which are neither light operas nor musical comedies are produced on the London American stage. The British *Maid of the Mountains* (1917) is but described as romantic melodrama combined with musical comedy. *Lilac Time*, first produced in America as *Blossom Time* (1921), is a light opera founded on Schubert's songs and instrumental pieces. Such pieces are, however, exceptional.

THE RISE OF REVUE

Musical comedy for some years suffered severely from the rivalry of the revue. In Paris the revue had a special character of social satire and topical interest. Very few attempts have been made to acclimatise the French revue to the London stage, the most successful being Mr. C. B. Cochran's series of intimate revues, beginning with *Odds & Ends* in Oct. 1914, at the Ambassadors Theatre. The revue, as we have known it, has been a *mélange* of songs, sketches, low comedy, ballets and pageants strung together without any apparent aim. Many of them have begun with a satirical idea, but the satire has never been carried out. The secret of making a successful revue is known only to those who achieve success. It appears to be based, however, on an instinctive sense of contrast between the different "turns" of the entertainment.

It is often stated that the haphazard style of disconnected "turns" was sympathetic to the war-mind. That may be a reason for the popularity of the revue during the World War and immediately afterwards, but it must be pointed out that this form of entertainment had become popular at least a couple of years before the War. Mr. George Grossmith, who had taken such a large part in the Gaiety musical comedies, was the first to adapt the revue from France. In 1910 he had made a great success in Paris in a Folies-Bergères revue with *Ip-i-addy-i-ay* from one of the Gaiety pieces. In Oct. 1912, he produced the first English revue at the Alhambra. It was entitled *Kill that Fly*, and the music was written by Melville J. Gideon. This was followed at the same theatre in May 1913 by *Eightpence a Mile*. In Nov. 1912, we find that a specimen of the new entertainment, *From Broadway to Paris*, had found its way to the New York stage. Long before the War, the revue was seriously affecting musical comedy in London. Soon after war broke out it became even more the staple musical entertainment in London, for the reason that all the most successful composers of musical comedy were enemies and their works were no longer performed on the stage. Mr. George Edwardes was interned in Germany and could not exercise direct control of the Adelphi and Gaiety theatres. By the end of 1914 only two musical comedies were to be seen in London: *A Country Girl* at Daly's theatre, and *The Earl and the Girl* at the Lyric theatre. Revues became more and more spectacular, and gradually the best of these entertainments included ballets and pageants of great beauty. In a sense, that type of revue was a throw-back to the masque. With the popularity of revue, syncopated or "jazz" music found its way to the stage from the variety halls. From revue it gradually crept into musical comedy, and the long continuance of the War, which automatically put an end to the domination of the Viennese school of musical comedy or light opera, gave this modern musical fashion full scope.

How far foreign musical comedy had gradually come to dominate our stage may be seen from the following list of the principal musical comedies produced in London and New York from 1910 to a few years after the outbreak of the War. The nationality of the composer is placed in brackets, but it must be remembered that in all cases the musical plays were very freely adapted for the countries in which they were performed. But however much low comedy may be imported into them, a foreign musical comedy always retains something of its original character. It is impossible to mistake a musical comedy by Leo Fall for one by Cuvillier, although in every respect the "book" and characters may have been Anglicised or Americanised.

The following list is not, of course, exhaustive, but it is sufficiently complete to show the different fashions of pre-War musical comedy.

1910. LONDON: *The Balkan Princess* (British), *The Girl in the Train* (Viennese), *The Chocolate Soldier* (Viennese), *The Quaker Girl* (British).
NEW YORK: *The Arcadians* (British), *The Girl in the Taxi* (Viennese), *King of Cadonia* (British), *Madame Sherry* (American), *Our Miss Gibbs* (British).

1911. LONDON: *Peggy* (British), *The Mousmé* (British), *Nightbirds* (adaptation of Johann Strauss's *Die Fledermaus* (Viennese).
NEW YORK: *The Slim Princess* (British), *The Balkan Princess* (British), *A Country Girl* (British, revival), *The Dollar Princess* (Viennese), *Girl of My Dreams* (American), *Gypsy Love* (Viennese), *The Kiss Waltz* (Viennese), *Little Boy Blue* (German, original title Lord Piccolo), *The Quaker Girl* (British).

1912. LONDON: *Princess Caprice* (Viennese), *Gipsy Love* (Viennese), *The Girl in the Taxi* (Viennese), *The Dancing Mistress* (British), *The Sunshine Girl* (British).

NEW YORK: *The Count of Luxembourg* (Viennese), *The Merry Countess* (Viennese, *Die Fledermaus*), *Oh, Oh, Delphine* (British-American), *Peggy* (British), *The Wedding Trip* (American), *The Charity Girl* (American), *Tantalising Tommy* (Viennese).

1913. LONDON: *The Pearl Girl* (British), *The Girl from Utah* (British), *The Girl on the Film* (German), *The Laughing Husband* (German), *The Marriage Market* (Viennese), *Oh, Oh, Delphine* (British-American).

NEW YORK: *Sweetheart* (American), *The American Maid* (American), *The Beggar Student* (German), *The Doll Girl* (Viennese), *Lieber Augustin* (German), *The Marriage Market* (Viennese), *Sunshine Girl* (British).

1914. LONDON: *A Country Girl* (British), *The Earl and the Girl* (British), *The Cinema Star* (Viennese), *Toy Ride Lady* (Viennese), *M'selle Tra-la-la* (Viennese).

NEW YORK: *The Belle of Bond Street* (British), *The Girl from Utah* (British), *The Girl on the Film* (German), *The Only Girl* (American).

1915. LONDON: *The Only Girl* (American), *Betty* (British), *To-night's the Night* (British, founded on *The Pink Domino*), Revivals of *Floradora*, *Véronique*, *The Arcadians*, *Chinese Honeymoon*, *The Dairy Maids* and *The Girl in the Taxi*, Big spectacular revues, produced by Albert de Courville and Wal. Pink.

NEW YORK: *Princess Pat* (American), *Alone at Last* (German), *The Blue Paradise* (Viennese), *To-night's the Night* (British), *Watch your Step* (American jazz musical comedy), Several big American revues.

1916. LONDON: *Chu Chin Chow* (British), *High Jinks* (British adaptation of French farce *Les Dragées d'Hercule*, Music by various British composers and Rudolph Friml), *The Happy Day* (British), *Mr. Manhattan* (British), *My Lady Frayle* (British). At end of the year no fewer than 9 theatres were devoted to *revue* and only 3 to musical comedy.

NEW YORK: *Betty* (British), *Follow Me* (American), *The Girl from Brazil* (German-American), *Katinka* (Viennese), *Miss Springtime* (German), *Step This Way* (American), *Very Good, Eddie* (American).

1917. LONDON: *The Maid of the Mountains* (British), *The Boy* (British), *The Beauty Spot* (British).

NEW YORK: *Canary Cottage* (American), *Chu Chin Chow* (British), *Leave It to Jane* (American), *May-time* (German), *Oh, Boy* (American).

1918. LONDON: *The Lilac Domino* (French), *Going Up* (American), *Yes, Uncle* (American), *Very Good, Eddie* (American).

NEW YORK: *The Grass Widow* (American), *Going Up* (American), *The Maid of the Mountains* (British), *Oh, Lady, Lady* (American), *Oh, My Dear* (American), *The Rainbow Girl* (American).

1919. LONDON: *Who's Hooper?* (British), *Baby Bunting* (British), *His Little Widows* (American), *Afgar* (French), *Monsieur Beaucaire* (French), Revival of Gilbert and Sullivan's operas.

NEW YORK: *The Royal Vagabond* (German-American), *Apple Blossoms* (Viennese), *Good Morning, Judge* (*The Boy*, British), *La, la, Lucille* (American). A number of other musical comedies of American origin were produced.

It will be seen from the foregoing list that after 1914 the stage had to rely for the most part on British and American musical comedies, until peace was declared, but towards the end of the War some works of enemy origin were produced. One of the most successful of these American musical comedies was *Irene*, produced at the Empire Theatre in 1920. There has been no great change in the type of musical comedy since the War, except that towards the end of 1925 American musical comedies, (of which *No No Nanette*, *Mercenary Mary* and *Rose Marie* are the chief examples) with their efficient production and lively syncopated music, gradually took the place of British musical comedies.

In Paris, the home of revue, the musical comedy of the English-speaking races was always an alien form of entertainment. The differences between the operetta and opéra bouffe and musical comedy are slight, but nevertheless very real. They consist partly of the kind of sentiment expressed, of the general character of the music, and, especially, of the type of humour. The light opera of the modern Viennese school, when adapted as American or British musical comedy, had, and, to some extent, still has a vogue in Paris, but even before the War Parisians had grown tired of it, and during and since the War it has never regained the popularity it once had. (E. A. B.)

MUSICAL INSTRUMENTS, MECHANICAL.—In the history of mechanical musical instruments the years 1910–26 are significant chiefly because of the remarkable advance made in reproducing the touch of the human performer. Most of these keyboard instruments are known as reproducing or re-enacting pianos, and a discussion of their mechanical details necessarily concentrates largely upon the field of the modern pianoforte (*see* 21.573).

THE PLAYER PIANO

By 1910 the foot-pumped player piano had already reached a high point of development, and there were a number of elaborate devices for lending expression to its music. Ways had been found of emphasising the melody and subduing the accompaniment, at the pleasure of the player. The control of tempo had also undergone various improvements. Some of these devices had brought about an elaborate system of controlling levers, which the human player could operate with considerable skill. But the chief source of expression still rested in the feet, with most of the shading secured through the varying rapidity and suddenness of the actual foot-pumping. The foot-pedalled player piano permits its "pedipulator" to enjoy the feeling of being actually an interpretative, perhaps even a creative, artist.

The principle of the player piano rests upon the laws of atmospheric pressure. William Braid White, in his authoritative book on *Piano Playing Mechanisms*, gives a fairly simple explanation of what happens when a mechanical piano is made to play. He first shows how "a state of reduced pressure, or, as it is called, 'partial vacuum,' is induced in a small bellows called a 'pneumatic,' one of which is attached in some operative manner to each section of the action of a piano." He continues: "When some of the air has been pumped out of such a pneumatic, the outside pressure pushes up its moving wall, and the motion of this wall constitutes the movement required to set in motion the corresponding action and hammer on the piano." He further explains that "the velocity of motion of the pneumatic in thus collapsing will depend upon the difference between the exterior, or atmospheric pressure, and the reduced pressure inside the pneumatic. The greater the difference between the two, the more effective will be the work of the atmosphere, and the higher the velocity of the pneumatic's motion. Thus it appears that the power exerted on the piano hammer (corresponding to the work of the fingers on the keys) by the pneumatic varies as the rapidity of reduction of air-pressure inside it. It is therefore plain that if we can keep this process of pressure-reduction under control we can vary our tone-strengths as required. Control of this sort is, of course, essential to the artistic rendering of music."

Refinement of Control.—The up-to-date reproducing piano has gone far beyond the ordinary player or pianola in the gradual refinement of such control. The difference is vastly greater than the mere substitution of electric power for foot-pumping. By various methods of controlling pressure-reduction, represented by different instruments, the human touch has generally been approximated, and in a few cases actually duplicated. The ideal of all experimentation with the reproducing piano has been to strike any note at any time with any degree of force used by the actual pianist. Fundamentally this becomes a problem of weight and pressure, which is all that we really mean by "touch." But it was discovered long ago that in attaining subtlety of expression and "tone-colour," the pedalling (soft, damper and sostenuto) was a very important element, and that certain effects depended not only upon such blending of tone but upon the actual overlapping of the tones themselves, and the smooth passage from one to another, in the course of a "crescendo" or "diminuendo," with a scarcely perceptible difference in volume.

The reproducing piano of the highest type permits the duplication of every detail of expression as recorded by the great pianists. (This instrument, however, still allows the amateur to experiment with his own ideas of expression by eliminating the mechanical control and substituting the manipulation of levers or buttons under his own control.) With the discovery that the human touch could be duplicated came the invention of various recording machines, so that by 1926 every pianist of note could be heard through his records as well as in concert performance.

Recording Processes.—Processes for recording are, by most manufacturers, veiled in absolute secrecy, for obvious reasons. The results, however, depend not so much on the method of recording as on the ability of the reproducing mechanism to duplicate the effects indicated by the artist. Some records made in Europe in the early days of the reproducing piano have been successfully adapted to the later perfected instruments, and actually give a far finer performance than would have been possible when they were first made. In general the recording pianist simply sits at a regular keyboard and plays in his usual style. Electrically connected with his piano, and invisible to him, is a recording machine carrying an endless roll of paper, on which both the notes and the expression are marked as he plays the instrument.

The old player-pianos had their rolls made by mathematically following the sheet-music and with no attempt at variety of expression and interpretation. Some of the newer recording machines also perforate directly from the playing of the artist, but in these cases a careful system of editing is required before the record can be heard in public. The opportunity for editing is offered also in those machines which do not perforate immediately, but in which the start and finish of each tone are clearly indicated by pencil marks, with the exact action of the pedals and every slight variation of pressure. In fact, the possibility of revision and editing is most important in the creation of completely satisfactory recordings. There are always some mistakes to be corrected, and an artist generally finds various details which he wishes to emphasise or subdue, so that the final recording may truly represent his playing at its best.

Some Reproducing Pianos

The pioneers in the manufacture and marketing of the modern reproducing piano were M. Welte & Son, of Freiburg, Germany, and Ludwig Hupfeld, of Leipzig, both of whom were active as early as 1904. The name of Welte-Mignon, which originated at that time, was by 1926 best known in America through pneumatic actions distributed under a license issued by the owners of the Welte patent rights. The inventions of Charles Fuller Stoddard were developed independently, and the instrument which he perfected put on the market by the American Piano Co., under the trade name of the Ampico. Another type of reproducing piano was subsequently developed by the Aeolian Co. from the pianola, and given the name of Duo-Art. The latter may be attached to the Steinway, Weber, Steck and Stroud pianos, while the Ampico may be had in the Chickering, Knabe, Mason & Hamlin, Haines, Fischer and Marshall and Wendell pianos, besides the Willis in Canada, and the Broadwood and others in England. The Welte mechanism is used with the Steinway and other instruments in Europe, and (as licencee) in a great number of American pianos.

Features of Mechanism.—The mechanism of each of these types deserves separate consideration. All three are alike in the general arrangement of pneumatics and in the division of the keyboard, for convenience, into two halves, treble and bass, each controlled by special expression pneumatics. All three possess a device for automatically rerolling a record, and repeating it by the setting of a lever if desired. They also permit the elimination of recorded expression and the substitution of human control. In every case the piano can be used as such, even while a record is in progress.

The Welte.—The original Welte first appeared as a cabinet containing a separate action, operating on the keys of the piano, but by 1926 was generally found as an interior action in grand and upright pianos. The power plant consists of an electric motor and a suction pump. Including "on" and "off," 18 holes in the tracker bar are devoted to expression purposes, ten on the right side and eight on the left, the rest sounding the notes. The bass and treble sections of the action are controlled by separate expression pneumatics, each closing at two definite rates of speed, slowly for crescendo, and fast for accents. There are also pneumatics to lock the expression pneumatics in a mezzo-forte position and other details for increasing expression.

The Duo-Art.—The Duo-Art Pianola differs from other reproducing pianos of the grand type by having its note-sheet driving mechanism and tracker bar placed behind the fall-board, directly over the keys themselves, the case being extended to make the necessary room. Its expression system is divided into a melody or "theme" regulator and an accompaniment regulator, with the melody always slightly stronger. Two sets of four pneumatics each, known as the "accordion dynamics," permit as many as 16 degrees of volume.

The Ampico.—The Ampico has both a crescendo pneumatic system and an instantaneous accent pneumatic system, which it can use in combination to control the air-tension behind the hammers. These systems may be operated independently for their separate effects, or concurrently for their combined effects, thus producing an unusual smoothness in crescendo and diminuendo, as well as a delicate shading. There is also an "amplifier" for special effects of volume, and the extended perforations in the music-sheet produce the greatly desired "singing" quality of tone. Seven holes on each side of the tracker bar control expression, with an extra one on the right for the re-roll. In the Ampico grand, the note-sheet mechanism is in a drawer, while the electrically driven pump is slung under the body of the piano.

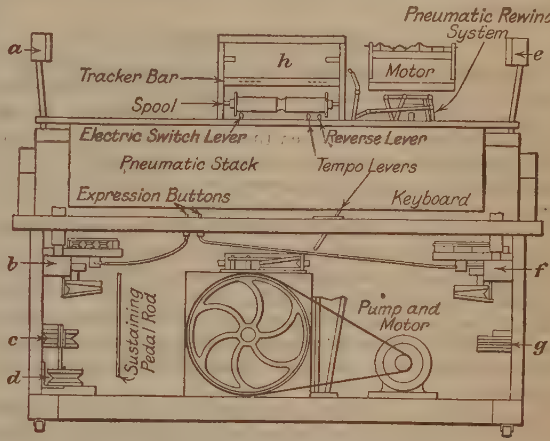

FIG. 1.—Reproducing Piano, showing the principal features of the mechanism, which are described at length in the text.

From a drawing by H. S. Smith, C.E. in Piano Playing Mechanisms, by W. B. White, Ed. L. Bill, Inc. N.Y.

Ampico Upright.—A typical reproducing piano (Ampico upright) consists of (*a*) bass equaliser; (*b*) bass regulator system, connected by tube with (*c*) crescendo pneumatic and (*d*) soft pedal pneumatic; (*e*) treble equaliser; (*f*) treble regulator system, connected by tube with (*g*) crescendo pneumatic (right side) (fig. 1).

The recording sheet is hung in place at *h*; it has a metal ring at the end of the paper caught by a pin upon the spool, so that the perforations in the note-sheet will pass over the holes in the tracker bar, which is connected by tubes with the pneumatic stack and the expression system. When the pump and motor are electrically started, air is sucked through the holes in the tracker bar, causing the individual pneumatics to set the corresponding hammers in motion exactly as by the touch of the pianist on the keys. At the same time, the crescendo, accents and various pedals are similarly set in operation through special "expression holes" in the tracker bar, corresponding to perforations on the edges of the note-sheet. The expression buttons in front of the keyboard permit the human manipulator to introduce his own ideas of shading. He can also vary the tempo at will, and do his own pedalling, if desired, the automatic expression being in that case temporarily turned off. A small motor serves to keep the note-sheet in motion and to rewind it rapidly when the playing of a record has been completed.

Research Work.—All the companies manufacturing these instruments publish instruction books for mechanicians, and the mechanically inclined reader is referred to these publications for further information. An elaborate research laboratory has been for some time in operation in New York, under the direction of Mr. C. F. Stoddard, and here the minutest details of musical expression, including dynamics, pedalling, touch, tone quality and tempo, have been scientifically analysed, so that a beauty of mechanical playing is possible that was formerly undreamt of. In this laboratory also have been developed scientific methods of recording the performance of a pianist to a degree of accuracy which permits not only the determination of the audible loudness of every note struck, but shows differences in touch that are indistinguishable by the human sense of hearing. This work has made it possible to measure scientifically the technical ability of a pianist.

Practical Uses.—The place of the reproducing piano is now fully established in the field of music on educational as well as aesthetic grounds. Distinguished artists have used these instruments in public performance, directly comparing their own playing with that of their recordings, sometimes alternating with the latter in most astonishing fashion; and recorded accompaniments have proved most valuable for singers, violinists, etc., in concerts as well as for private practice. Schools, colleges and conservatoires of music are coming to recognise the reproducing piano as an indispensable part of their equipment, particularly for teaching the appreciation of music; and teachers of the pianoforte welcome its authoritative recordings as models for their pupils.

Some Other Instruments

Concerning other mechanical keyed instruments little need be said. There are, of course, coin-operated electric pianos, which have proved themselves adequate for entertainment in restaurants and taverns, and often these are reinforced with organ pipes, drums and other orchestral effects. Essentially they are built on the principle of the player-piano, although the need of expression can practically be disregarded.

The Pipe Organ.—The pipe organ itself is thoroughly adaptable to mechanical playing, for its effects have little to do with the human touch, and can be produced at will by the electric control of stops and pipes. All the great organs can be played with the help of rolls, which are either entirely mechanical in their control of expression or permit a human agent to manipulate the stops, while the tones themselves are mechanically produced.

In conclusion, no matter how perfect a mechanical musical instrument may be, the fascination of personally producing tonal beauty will never be entirely lost, and human performance will continue to be popular, with its amazing duplication by scientific means in no sense a discouragement to personal endeavour, but rather a priceless ally to the cause of music on those occasions and in those places where individual skill and talent are not always available (*see* also PHONOGRAPH).

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MUSIC HALL: *see* VARIETY THEATRE.

MUSSOLINI, BENITO (1883–), Italian statesman and journalist, was born July 29 1883 at Dovia, in the commune of Predappio (province of Forlì). His father, Alessandro Mussolini, was a blacksmith of internationalist revolutionary and anti-religious opinions, and played an active part in the local Socialist movement, while his mother, Rosa Maltoni, was a school teacher of deep religious convictions; the views of both parents affected young Mussolini in different ways at different stages of his career. He was sent to the Salesain college of Faenza, where he showed considerable intelligence but a passionate, insubordinate spirit. Later he went to the normal school at Forlimpopoli, and eventually qualified as a school teacher at the age of 18, obtaining an appointment at Gualtieri (province of Reggio Emilia). As a youth he developed a love of literature and read widely, and soon became interested in the Italian Socialist movement. But he tired of teaching, and determined to go to Switzerland to improve his education. There he earned a precarious livelihood by manual labour of various kinds, but managed to attend the courses at the Universities of Lausanne and Geneva, and secured a diploma as teacher of French. He lived mostly among the working classes, and, born organiser as he was, he founded trade unions and even promoted strikes, with the result that he was expelled from one canton after another, and finally from the Confederation. After performing his military service in the Bersaglieri, he returned to teaching, but found time to improve his knowledge of the classics. In 1908 he was involved in the political agrarian conflicts in Romagna, was arrested, tried and condemned to 10 days' imprisonment, and afterwards was under police surveillance as a dangerous revolutionary.

At the end of 1908 he went to Trento, where he had been summoned by the local chamber of Labour as secretary, and he also joined the staff of the local Socialist paper *L'Avvenire*. But when he realised that the Trentino Socialists, in their loathing for the national idea, took their cue from the Vienna Govt., Mussolini went over to the *Popolo*, a paper edited and founded by Cesare Battisti, also a Socialist, but above all an Irredentist patriot who was afterwards to serve in the Italian Army during the War, be captured by the Austrians and hanged as a traitor. Here Mussolini took up the study of German literature, and became deeply interested in philosophy, especially in that of Nietzsche. His association with Battisti first inspired him with Irredentist ideas, and after publishing an article stating that "the Italian frontier does not end at Ala" he was arrested and expelled from Austria. On returning to Italy he published an essay of Irredentist tendencies on "The Trentino as seen by a Socialist" in *La Voce*, a periodical printed in Florence which gathered around it some of the most brilliant young *littérateurs* of the day.

The Tripoli Campaign.—The next period of Mussolini's life was wholly devoted to Socialist activity. In 1910 he founded and edited a paper at Forlì called *La lotta di classe*, but while he vigorously supported the ideals of Socialism, he deplored the materialism, as he considered it, of the bourgeois spirit into which the Italian Socialist party had degenerated. He drew further and further away from Marx and Lassalle, feeling more sympathy with the ideas of Baboeuf, Blanqui, Prudhon, and above all with the syndicalism of Sorel. An opponent of parliamentarianism, he reproved the Italian Socialists for compounding with the bourgeois parties in order to secure seats in the Chamber and lucrative contracts for bogus co-operative societies; he not only advocated direct action, but also put it into practice whenever he saw a chance of securing real advantages for the proletariat thereby, and, unlike other Socialist leaders, he was ever ready to lead his followers and run personal risks.

When Giolitti's Government decided to send a military expedition to Tripoli, although not rejecting the idea of war in general, Mussolini opposed this policy because, as he said, unlike the Nationalists, who wanted a vast Italy, he preferred an Italy that should be well cultivated, rich and free. On Sept. 25–27 1911 he therefore organised a popular movement at Forlì against the Tripoli expedition, inciting the mob to resist the authorities. He was in consequence arrested and condemned to five months' imprisonment. At the congress of Reggio Emilia in 1912, when Bissolati and Bonomi were expelled from the party for supporting the Government's African policy, Mussolini remained one of the die-hard revolutionaries, and in December of that year was made editor of the *Avanti!*, the official organ of the party. Under his able editorship the circulation rose from 40,000 to 100,000, and his vigorous leaders gave the paper an entirely new character. He insisted particularly on the necessity for improving the economic and social conditions of the southern provinces, which other Socialist leaders neglected because their inhabitants gave few votes to the party. During the so-called "Red Week" in the Marche and Romagna (June 7–14 1914), Mussolini was one of the most active leaders of the outbreak. It was on this occasion that he lost many illusions concerning his fellow Socialist leaders, whom he found ever ready to incite the mob to violence while taking good care for the safety of their own persons. He also realised that the masses were anything but ripe for revolution.

The World War.—The great crisis of Mussolini's life came with the outbreak of the World War. From the first he strongly opposed Italy's intervention on behalf of the Central Powers. After Italy's declaration of neutrality he still hesitated, for the conflict was raging within him between the Socialist and the Italian; but it was as a Socialist that he favoured war in the belief that it would end war and re-establish the principles of right and justice, while as an Italian he doubted if his people were ready to enter the fray. In the autumn the tendency in favour of intervention had gained ground, and he wrote that Italian unity must be completed; later he gave his approval to the Government's military measures, as he realised the danger of keeping Italy alone unarmed amid the general conflagration. But he felt that his views were ever less in harmony with the official creed of his party, and he expressed the hope that if Italy did intervene her international status would be raised and an economic and social revolution promoted. He deemed it necessary to resign the editorship of the *Avanti!*, and on Oct. 25 appeared before the Socialist assembly at Milan to justify his conduct. The audience howled at him, with imprecations of "traitor, hireling, assassin!"; but instead of defending himself he violently attacked the other Socialists for their *petit-bourgeois* spirit and insincerity. He ended by confirming his belief in Socialism, and saying, "You hate me because you still love me."

He now founded a new paper of his own, *Il Popolo d'Italia*, and his enemies spread about the rumour that Mussolini had received money from the French Embassy to support the Allied cause, whereas the sole capital of his new venture was 4,000 lire advanced by advertisers. The *Popolo d'Italia* first appeared on Nov. 15 1914, and in the leading article Mussolini asked: "Do we wish to drag out a miserable existence under present conditions, content with the *status quo* of the monarchy and the bourgeoisie, or do we wish instead to break up this wretched combination of intrigue and cowardice?" He concluded with stirring appeal in favour of war. The paper led a precarious xistence in miserable premises, and was hardly able to pay the taff. But it gathered around it a number of brilliant young writers fired with enthusiasm for the national cause, although many were Republicans and Socialists.

Audacity was its keynote, and while the *Idea Nazionale* and D'Annunzio appealed to the older and more intellectual middle lasses, Mussolini influenced the younger generation and the orkers, and he reached the less educated masses through his iend the Syndicalist Filippo Corridoni (afterwards killed in ction), editor of the weekly *Battaglie sindacali*. But he still elieved in revolution, and in April 1915 he was arrested for dvocating his views at a public meeting; ten days later he was ightly wounded in a duel with the orthodox Socialist Claudio reves. When on May 24 war was declared he wrote in the *opolo d'Italia*: "From to-day onwards the nation is called to rms. From to-day onwards we are all of us Italians and only alians. Now that steel has to meet steel, one single cry issues om our breasts, *Viva l'Italia!*"

In the Trenches.—In Sept. 1915 Mussolini was called up, and rved as a private in the Bersaglieri in the trenches along the onzo and on the Carso. He did his duty gallantly until he was riously wounded by the explosion of a trench mortar on Feb. 1917. He spent many months in hospital, and on recovery turned to his work on the *Popolo d'Italia*. He wrote a graphic count of his war experiences in his *Diario di Guerra*. As early the beginning of 1917 he realised the gravity of the propaganda hich the Socialists and neutralists were able to conduct owing the feebleness of the Government, especially of the Minister of the Interior, Signor Orlando, and after resuming his editorial chair he uttered warnings which were disregarded, as were those of Gen. Cadorna. After Caporetto he was one of the few who, in the depths of national depression, never lost heart and in the columns of his paper he issued daily messages of encouragement.

After the Armistice Mussolini opened a campaign in favour of a dignified foreign policy at the Peace Conference, and of adequate recognition for the services of the demobilised men. In reply to the first manifestations of Bolshevism in which the Socialists indulged in consequence of the relaxation of the censorship, Mussolini founded the first "Fascio di Combattimento" on March 23 1919 at Milan (*see* FASCISM); and although the first programme of the new group contained many demagogic demands, the patriotic note was predominant, and Mussolini continued to combat Bolshevik doctrines. With regard to Fiume, he insisted that its Italian character must be secured. When D'Annunzio occupied Fiume the *Popolo d'Italia* lent him its full support.

Mussolini was now bitterly hated by the Socialists, and when at the elections of 1919 he stood as a candidate for Milan, he secured only a few votes and was described by the *Avanti!* as a corpse to be buried in a ditch. A few days later Nitti had him arrested on a charge of "armed plotting against the security of the State" (in connection with his support of D'Annunzio), but did not dare to maintain the arrest, and he was soon liberated. Mussolini now worked harder than ever at his paper, whose circulation increased rapidly; his relaxations were writing plays and playing the violin, and he also took to motoring and aviation, in which sports he showed the same disregard of danger as in war and politics.

Fascist Discipline.—The seizure of the factories by the workmen in the autumn of 1920 did not meet with Mussolini's disapproval, as one would have expected; he regarded their action as a form of practical syndicalism breaking away from the pusillanimous policy of the official Socialist party. But when the Communists proceeded to organise political murders at Bologna, Modena and Ferrara, Mussolini and his Fascists became the nuclei of the national anti-Bolshevik reaction; it is due to him that the whole Communist-Socialist domination collapsed, first in the Po valley and then throughout Italy. But Mussolini was now coming to the conclusion that it was not enough to defeat and disperse the Reds. The Italian people, he argued, were to be made free to recover, to work and produce undisturbed, to fulfil their higher destinies; the incompetent governing caste, ready to compromise on everything, must be swept away and its place taken by the virile youth of the country who had won the War. Fascism was spreading rapidly, and in Nov. 1921 it was organised into a political party, but its discipline still left much to be desired. Mussolini now proceeded to reorganise it and establish it on a strictly hierarchical basis, until its discipline surpassed that of any other organisation in Italy. All ranks of society he regarded as necessary, for he did not wish to repudiate the past. He was, moreover, becoming ever more keenly interested in foreign politics. "I hold that, having broken the pride of Bolshevism, Fascism should become the watchful guardian of our foreign policy." But the movement was extending to every sphere of national life—internal affairs, finance, labour, industry, agriculture. At the elections of May 1921 Mussolini and 37 other Fascist candidates were returned, and together with their allies the 10 Nationalists played an active part in the debates.

During the next 12 months Fascist influence consolidated itself throughout Italy, and the obvious breakdown of the old political parties convinced Mussolini that the time for bold action was fast approaching. At first he thought only of the possibility of a coalition Government comprising Fascist elements, but by the summer of 1922 he felt that a predominantly Fascist Govt. was conceivable and indeed necessary. The strike of Aug. 1 1922, promoted by the revolutionary Alleanza del Lavoro, was broken by the Fascists, and this fact showed the increasing weakness of Signor Facta's Govt., which was no longer able to resist any really energetic action from the right or from the left. In the meanwhile, Mussolini had been shedding the last traces of demagogic ideas, and at a Fascist gathering at Udine on Sept. 29 he openly pronounced himself an upholder of the Monarchy, thereby securing the sympathy of many non-Fascists and of the army. He now made no secret of his intention of seizing power, and said so openly at the Fascist meeting in Naples in October. The march on Rome (*see* ITALY, *History*) was organised and directed by Mussolini, and indeed it shows the Mussolini touch in every phase. When the Facta Cabinet resigned the King first sent for Sig. Salandra, who tried to form a coalition Government, but Mussolini refused to lend the scheme his support, and Salandra threw up his mandate, whereupon the task was entrusted to Mussolini himself. He formed his Ministry within seven hours, a record for Italy, where, especially during the post-war years, every cabinet crisis had lasted for many days and even weeks. He chose several non-Fascists as Ministers, but refused to contract an alliance with the parties to which they belonged.

His Reforms.—From the moment he assumed office he set to work with his accustomed energy to overhaul and reform the whole administration, to eliminate inveterate abuses, and infuse a new spirit into the State. He himself assumed the portfolios of Foreign Affairs and the Interior, although the work of the latter he left largely to the under-secretary Aldo Finzi. In June 1924, after the Matteotti affair, he appointed Sig. Federzoni Minister of the Interior, but in the following spring, on the resignations of Gen. Di Giorgio and Adml. Thaon di Revel (April 3 and May 5), he assumed the portfolios of War and Marine, and also that of the new Air Ministry; while leaving great latitude to the under-secretaries, he gradually welded the three ministries into a single department of National Defence. He also kept in close touch with all the other departments, and many questions of great national interest, such as the development of public works in southern Italy, for the purpose of bringing that area up to the level of the more progressive north, the so-called "battle for wheat" engaged to intensify wheat production, the reformed electoral law, the various reforms of a constitutional character, etc., are due to his initiative. As a Socialist Mussolini was an anti-Parliamentarian, and even later did not regard the Parliament as the sole organ of national life. His object was to make Italy powerful, prosperous and efficient, in as short a time as possible. But in order to make these reforms lasting he determined that the whole body politic shall be imbued with the Fascist spirit—*fascistizzare la nazione*, as he described it—and he therefore inserted Fascism into every activity of the country.

As a Minister, Mussolini's activity was prodigious. Even when he was seriously ill in the spring of 1925, he surprised his friends and disconcerted his adversaries by continuing very largely to conduct his business of government from his bed, and by his quick recovery. While he was immensely popular with the great majority of the people who appreciate the far-reaching benefits of his rule, he had many enemies among the members of the old governing caste, the Socialists, Communists and Republicans and the anti-national freemasons, whose influence he destroyed. At the end of Oct. 1925, a plot to murder him was discovered by the police, and the would-be murderer, the Socialist ex-deputy Tito Zaniboni, was arrested in the very act; other persons were arrested in connection with the affair, notably Gen. Capello, a leading freemason. The news of the plot aroused general indignation, and Mussolini received a plebiscite of enthusiastic congratulations. On April 7 1926, as he was leaving the Capitol, where he had inaugurated a surgical congress, an Irishwoman, the Hon. Violet Gibson, fired at him with a revolver, slightly wounding him in the nose. The would-be murderess appeared to be demented. The wound did not prevent him from sailing for Tripoli the following day according to programme.

Mussolini is not a finished orator in the classical sense; he has no rounded periods and he seldom introduces apt quotations. But every speech bristles with facts and ideas, each sentence is like a hammer-stroke on the anvil emitting vivid sparks, and each phrase, seemingly independent of the others, contributes to build up the central idea which he wishes to assert. On innumerable occasions an apparently difficult, even insoluble, situation has been solved by one of his vigorous speeches. Besides innumerable articles in *Il Popolo d'Italia*, *Avanti!*, *Gerarchia*, etc., he has published *Il mio Diario di Guerra 1915–7* (Milan, 1923), and his speeches have been collected in several volumes. A selection of them has been published in English edited by Baron Quaranta, *Mussolini as revealed in his political speeches, Nov. 1914 to Aug. 1923* (1923). His biography was published in English by Margherita Sarfatti (Butterworth, 1925). See also Antonio Beltramelli's *L'uomo nuovo* (18). (L. V.*)

MUSTAFA KEMAL (1880–), Turkish soldier and statesman, was born in comparatively modest circumstances in Salonika. His father was a customs officer who afterwards entered the timber trade and died when Mustafa was yet a small child. The boy was brought up and educated by his mother, who appears to have been a woman of character and ability. He completed his primary education in Salonika and entered a secondary school in the same place; but, having been maltreated by his Arabic teacher, he left school, against his family's wish, and secretly entered the military preparatory school.

There he proved to be an exceptional student, especially in mathematics, and attracted the attention of his fellow-students and teachers. His teacher in mathematics, who was also named "Mustafa," gave him the distinctive surname of "Kemal" (an Arabic word meaning "perfection"), as a tribute to his unusual ability. The extent to which he won the esteem and affection of his companions while at the military academy is indicated by the fact that, although he already took an active interest in politics and bitterly criticised the despotism of Abdu 'l-Hamid, he was never denounced.

In 1904 he was gazetted a lieutenant, but on the same day he was placed under arrest, taken to Yildiz Palace, and detained there for weeks under cross-examination. Finally he was banished to Damascus. In this provincial capital he had an opportunity to observe the deplorable condition into which the civil and military organisation of the Empire had fallen. He also found followers here, and founded in 1905 the secret political society "Vatan" ("Fatherland"). From Damascus he was transferred to Jaffa, and from there with the help of his friends, he made his way secretly to Salonika in order to organise a similar political movement in the European provinces. The association which he founded at Salonika was afterwards affiliated to the Union and Progress Society. By this time the Constantinople Govt. had got wind of his secret activities, and it sent orders for his arrest both to Salonika and to Jaffa. With the help of his friends at Salonika, Mustafa Kemal was smuggled on board a steamer sailing for Jaffa, and at the same time the military commandant at Jaffa reported to Constantinople that Mustafa Kemal was on duty on the Egyptian frontier. For a time he was forgotten by the Government in Constantinople. In 1907 he was promoted and sent to Salonika, where he again devoted himself to the work of revolutionary organisation.

When the revolution of 1908 re-established the constitution of 1876, Mustafa Kemal found himself in serious disagreement with the leaders of the Union and Progress Party who were now in power. His political views were more radical than theirs and he protested, though in vain, against the participation of the army in politics. In consequence he abandoned politics for the time and turned his whole energy into his military career. From this time onwards, he was appointed to a number of important military posts, in each of which he gave evidence of his ability and his powers of leadership. In 1910 he was sent to France to follow the army manoeuvres. He was loved and respected by the younger officers, but some of his superiors looked askance at him on account of his uncompromising attitude. In 1911 he went to Tripoli *incognito* in order to take part in the war against the Italians, and there he was promoted to the rank of major. He was still in Tripoli when the first Balkan War broke out in Oct. 1912 (*see* BALKAN WARS). He started at once for Turkey, but the news of his country's defeat and the fall of Salonika reached him in Egypt. In July 1913, however, during the second Balkan War, he was appointed chief of the staff to the newly-organised army corps on the Gallipoli Peninsula, and here for the first time he made a detailed first-hand study of the problem of defending the Dardanelles. After the restoration of peace between Turkey and Bulgaria in the same summer, he was appointed military attaché at Sofia, with the rank of colonel, and held this post until after the intervention of Turkey in the World War in the autumn of 1914.

Mustafa Kemal believed that Turkey had entered the War prematurely and that Germany was doomed to eventual defeat. Possibly it was on this account that his desire to return to active service was not encouraged; but, on his insistence, he was appointed commander of the forces at Rodosto, and afterwards (in 1915) at the Dardanelles. He was the moving spirit on the Turkish side in the defence of the straits against the British attack; and it would not be an exaggeration to say that the situation was saved through his personal skill, insight and bravery when the Turkish high command had actually lost hope. During the final British assault he was struck by a splinter of shell right over the heart, but the splinter was intercepted by his watch and he thus escaped with his life.

After the evacuation of the Gallipoli Peninsula by the British, Mustafa Kemal was sent to the Caucasus front, where he was promoted to the rank of Pasha and recovered Bitlis and Mush from the Russians. In 1917 he was posted to the Hejāz, but after stopping at Damascus to study the general situation, he proposed to recall all the forces in the Hejāz in order to reinforce the Syrian front. This prudent proposal was not carried out, but later in the same year he was appointed to the command of the VII. Army Corps in the force which the German general Von Falkenhayn was organising with a view to the recovery of Baghdad. At this time Germany's intervention in the internal affairs of Turkey had reached its height, and Mustafa Kemal Pasha put himself at the head of the opposition to it. He sent n a succession of reports adverse to the Baghdad expedition, which he thought would end in another disaster, and when his advice was ignored he resigned. He was then transferred to the Second Army Corps, but abstained from taking up his command owing to his disagreement on questions of principle with General Headquarters. While on leave in Constantinople he was sent on a mission to the German G.H.Q. with the heir apparent Vahydu'd-Din Efendi. There, in the presence of Generals Hindenburg and Ludendorff, he expressed outspokenly his pessimistic views regarding the outcome of the War. In 1918 he yielded to the insistance of Vahydu'd-Din Efendi, who had meanwhile succeeded to the throne as Sultan Mehmed VI., and accepted the command of the VII. Army Corps in Palestine, but by this time all chance of taking the offensive, or even avert-ng disaster, had disappeared. Mustafa Kemal again distinguished himself, however, in keeping together the remnants of his corps on the retreat which followed General Allenby's great victory, and before the end of Sept. he was appointed Commander-in-Chief of all the corps constituting the so-called Yildirim group.

When the Turkish Govt. negotiated the armistice of Mudros (Oct. 30 1918), Mustafa Kemal was opposed to the policy of complete surrender, and after the arm-stice he retired to Constantinople and began studying the new situation at his leisure. There was nothing to be done in Constantinople, but his opportunity was given to him by two events: the Greek landing at Smyrna on May 16 1919, which reawakened the Turkish nation, and his own appointment by the Ottoman Govt. in Constantinople as Inspector of the X. Army Corps in north-eastern Anatolia. His mission, as conceived by the Sultan and the Grand Vizier, Damad Ferid Pasha, was to execute the armistice terms by superintending the disarmament and demobilisation of the Turkish army in his remote district. Mustafa Kemal's intention was to create a nucleus of national resistance against the partition of the coun-ry, and he therefore accepted with alacrity the position offered him by the unsuspecting Government. As soon as he landed at Samsun he began to organise his new movement locally at Amasia, Tokat and Sivas, and to correspond secretly with other parts of the country. The Sultan's Govt., awaking too late to what he was doing, recalled him to Constantinople, but instead of obeying he went on to Erzerum and sent in his resignation to Constantinople. He next convened two congresses, one at Erzerum in July, and the other at Sivas in Sept. 1919. Both congresses endorsed his programme of fighting for national existence to the bitter end, and they appointed a standing executive committee under his chairmanship. Thereupon he was outlawed by the Constantinople Govt., and relations between the capital and the interior of Anatolia were broken, but all the efforts of the Constantinople Govt. and the Allied Powers to frustrate Mustafa Kemal's activities were unavailing. They simply strengthened his conviction, and that of the people round him, that he had taken the right path.

The political and military history of the new Turkish Nationalist movement, commonly called the "Kemalist" movement, after its founder, is given elsewhere (*see* GRECO-TURKISH WAR; LAUSANNE, TREATY OF; TURKEY), and in this article it can only be touched upon in so far as Mustafa Kemal's personal career is directly concerned. Mustafa Kemal was in favour of the Nationalists participating in the general election at the close of 1920, but decidedly opposed to the meeting of the Assembly at Constantinople, and his judgment was borne out after the event by the high-handed action which the British military authorities and the Sultan's Govt. took in March and April 1920 respectively. On April 23 1920 Mustafa Kemal gathered together at Angora the Nationalist members of the late Parliament who had escaped from Constantinople, and was elected unanimously as president of this new National Assembly.

During the 2½ years which followed, Mustafa Kemal was the heart and soul of the Turkish national resistance, in circumstances in which all but the most determined characters would have despaired. He knew how to make the most of the fact that this time the nation was fighting for its homeland, and not for some distant alien province like the Yemen or Albania. He succeeded in evoking the utmost powers of his followers, and his firm conviction of final victory, his exceptional military ability, his keen intellect and his persuasive oratory carried his countrymen through their ordeal. During the summer campaign of 1921, which was the supreme crisis of the Greco-Turkish War, the Angora assembly appointed Mustafa Kemal generalissimo of the Turkish forces, with unlimited power, and he took personal charge at the front during the 22 days' and nights' fighting of the battle of the Sakaria. During the battle his horse was wounded and the general broke a rib in falling, but he never left the front. After this battle the assembly gave him the rank of field-marshal and the traditional title of "Ghazi" (the victorious).

The great events which followed—the destruction of the Greek army, the peace settlement at Lausanne, the abolition of the Sultanate, the declaration of the Republic and the abolition of the Caliphate—were the direct work of Mustafa Kemal. On Oct. 29 1923, the date on which the Republic was proclaimed, the great national assembly unanimously elected Mustafa Kemal as the first President of the Republic. The wide constitutional powers which he thus received were enormously enhanced by his personal force of character and by the unique hold which he had obtained over the hearts and minds of his countrymen through the astonishing services which he had rendered to the national cause. Indeed, Mustafa Kemal became a dictator in fact, though not in constitutional theory, and this fact dominated the political situation of Turkey as she emerged from the War. In some ways Mustafa Kemal's virtual dictatorship was advantageous and perhaps even necessary to Turkey, since the period of reconstruction which now began was hardly less critical than the foregoing period of war and revolution. Undoubtedly Mustafa Kemal displayed the same energy, audacity and radicalism in setting out to "win the peace" as he had displayed in winning the War.

On the other hand, after the external menace to the existence of Turkey had been removed, the internal unity of the nation naturally began to relax, and different parties arose with different policies for securing the national welfare. This was a healthy symptom, and an outside observer would be inclined to criticise Mustafa Kemal, during this phase of his career, for not allowing sufficiently free play to these opposition elements. His somewhat repressive policy towards his political opponents had the unfortunate effect of depriving Turkey of certain talents and abilities which she could ill afford to spare, and there was a perceptible increase of factiousness and embitterment in the internal politics of the country. Nevertheless, at the time of writing, President Mustafa Kemal's position in Turkey remained substantially unimpaired. (A. J. T.)

MUTSUHITO (1852–1912), Emperor of Japan (*see* 19.100), died at Tōkyō July 30 1912. He was posthumously styled the Emperor Meiji, according to the custom of Japan.

MYCOLOGY (Gr. μύκης, a mushroom; λόγος, discourse): the scientific study of fungi. The two decades from about 1890 to 1910 were remarkable in the history of mycology, for the many interesting discoveries made in the morphology and physiology of the fungi, especially in regard to their reproductive processes and the problems of sex and nuclear fusions. The results obtained have been since then exhaustively investigated, and have been, in large measure, confirmed, and upon the foundations thus laid our knowledge of the fungi has, during recent years, been extended in all directions.

Many new aspects of study have been opened up, life histories have been more fully elucidated, the study of pure cultures has added much to our knowledge of the physiological activities involved in parasitism, saprophytism and symbiosis; and the physiological effects of light, heat and the chemical and other changes taking place in the substratum during the growth of a fungus are more clearly understood. Knowledge of plant diseases (*see* PLANT PATHOLOGY) has, especially in the tropics, been vastly increased; and the establishment by the Govt. of an "Imperial Bureau of Mycology" has already, in conjunction with the valuable mycological work carried on at Kew and the British Museum, profoundly influenced phytopathological research in the empire.

Classification.—In the classification of the fungi, although much has been done to elucidate the life histories of a large number of different forms, there are still so many gaps in our knowledge that anything like a satisfactory natural classification is impossible. Many new schemes have been proposed, but so far the most useful classification is that which maintains the three great classes with their subdivisions: (1) Phycomycetes (Zygomycetes, Oomycetes), (2) Ascomycetes (including Laboulbeniaceae) and (3) Basidiomycetes (Ustilaginaceae, Uredinae and Basidiomycetes proper), together with the *Fungi Imperfecti*, the members of which are probably stages in the life histories of forms belonging to the Ascomycetes and Basidiomycetes, and the lichens, the majority of which are Ascolichens, a few being Basidiolichens. As regards phylogeny, evidence is gradually accumulating that the derivation of the primitive fungi such as the Chytridineae is to be traced to a protozoan ancestry (*see* PROTOZOÖLOGY).

Many of these primitive forms, and notably that curiously interesting species *Polyphagus euglenae*, have much in common with Protozoa, and we have also to consider, in this connection, the mycetozoa and bacteria, which, although they have some of the characteristics, are not regarded as true fungi. As regards the higher fungi, notwithstanding our increased knowledge of their structure and reproduction, any conclusions as to their algal ancestry, although not impossible, cannot at present be substantiated.

Recent Investigations.—Among the more generally interesting investigations of recent years are those on the symbiotic relationships of the fungi to higher plants, as exemplified by the endotropic mycorhiza of *Calluna vulgaris*. Evidence has been brought forward to show that the presence of the fungus is so necessary to the well-being of this plant that no development of the seedling can take place unless it is infected by the fungus, and this infection is brought about by hyphae in the seed coat. Further, although seedlings may be satisfactorily infected from artificial cultures, yet, if the culture is too vigorous and the seedling weak, the fungus behaves as a parasite. This raises important problems still under discussion concerning the relations of mycorhiza and symbiosis to parasitism and saprophytism.

Many new observations have been made upon the cell contents of the fungi. Among these may be mentioned metachromatin, chromidia, mitochondria, coenospheres or coenocentra and elaioplasts. The distribution and staining properties of these bodies have been carefully studied, but we are still far from a clear understanding of their significance.

Some attention has been paid to the colouring matters of the fungi. The orange coloured fatty globule in the zoöspores of Chytridineae probably plays the part of an eye spot. Most of the brilliant colouring of the fungi is due to colouring matters in the cell walls, or in the mucilaginous layers of the cell membrane. Many of these when extracted in water and alcohol exhibit a beautiful blue or blue-green fluorescence.

The stimuli of light and gravity play an important part in the orientation of the fungi. Light exerts not only a directive but also a formative influence on their growth. Positive heliotropic response occurs in many of the Agaricineae, in the asci of certain Discomycetes and in the sporangiophores of various Mucorineae, by which they are brought into the best position for the discharge of their spores. Response to the stimulus of gravity is shown during the growth of the fruit bodies of the Hymenomycetes, and is on all-fours with what takes place in higher plants. The perceptive region is located in the stipe, the upper part being the most sensitive. The gills show a very pronounced positive response to gravity.

There is very little to add to our knowledge of the sexuality and nuclear fusions in the fungi beyond what was known in 1910. In the Phycomycetes functional sexual organs and the fusion of male and female nuclei have been discovered in many species in which they had not previously been found, and the presence of functional sexual organs has been definitely established in the Saprolegniaceae. In the Ascomycetes and Basidiomycetes the significance of the nuclear fusions in the ascus, teleutospore and basidium is still not understood, and the existence of two nuclear fusions in the life histories of certain Ascomycetes is still a matter of controversy. Very conflicting accounts are given of the nuclear behaviour in such classical species as sphaerotheca and pyronema, and until some quite definite agreement as to the facts is forthcoming it seems impossible to arrive at anything like a satisfactory explanation. In that interesting group the Laboulbeniaceae, there is evidence that sexual fusion takes place by a method somewhat similar to that described for the lichens by means of a trichogyne and spermatia. The fusion has not actually been observed, and the fate of the spermatia is unknown.

In the Basidiomycetes proper a number of observations have been made to show that the phenomena of heterothallism and homothallism, as in the Mucorineae, occur here also. The criteria for this conclusion are the behaviour of cultures of monosporous mycelia as contrasted with those of bisporous or polysporous mycelia in the production of fruit bodies; and the formation of clamp-connections. Thus, *Coprinus fimentarius* is stated to be heterothallic on the following grounds: in a monosporous culture no clamp-connections were found, the nuclei remained unpaired and the mycelium was sterile. When two monosporous cultures were brought together clamp-connections were formed, the cells became binucleate and fruit bodies were produced. The presence of clamp-connections is stated to be "invariably associated with the conjugation of the nuclei." It is suggested that this criterion affords a means of determining whether a species is homothallic or heterothallic.

These conclusions are so important that the data on which they are based should be subject to the most critical confirmation, especially in view of the facts that contradictory statements concerning them have been made, and that they have been used as a basis for important conclusions upon the Mendelian segregation of sex in these forms. It is essential that we should have definite confirmation of the function suggested for the clamp-connections, and of the transference of nuclei from one cell to another in the anastomoses that take place in the mycelia, before any satisfactory advance can be made in this new field of study. (H. W.*)

MYSLBEK, JOSEF VÁCLAV (1848–1922), Czech sculptor, was born at Prague July 21 1848. He was a pupil of Václav Levý and worked under Trenkwald at the academy of fine arts in Prague. He sprang into prominence when in 1871 he carved two symbolical figures for the exterior of the National Theatre in Prague. The statues are distinguished by a Slav lyricism and delicacy, combined with a masculine strength and a monumental feeling. After a brief residence in Paris he was in 1885 appointed professor at the school of arts and crafts in Prague, of which he became a director in 1893. All Myslbek's work presents a blend of idealism with a precise and balanced realism and exhibits his endeavour to cope with the fundamental problems of art. His statues "Devotion" (1884, Modern Gallery, Prague), and "Steadfastness" (1884, Vienna Parliament) notably unite a powerful idea with a complete mastery of the material. His "Crucifix" (1888–9), installed in the Sacré Coeur at Paris, bears comparison with the works of old masters, although it is conceived in the modern spirit, expressing human suffering and divine resignation. The statue of Cardinal Schwarzenberg (1895) is a masterpiece of portraiture, but the highest attainment of Myslbek's art is the monument to St. Václav, a work of 30 years, in St. Václav's Square in Prague, which embodies all his monumental qualities as an artist and attains a level which entitles it to a place among the great works of European statuary. Myslbek died at Prague in 1922.

MYSTICISM (*see* 19.123).—The 20th century has seen a remarkable revival of interest in mysticism. Several causes have contributed to this. First, the inevitable reaction against 19th century rationalism, with its excessive emphasis on the ethical and neglect of the transcendental in religion. Next, the disturbance of traditional theology by textual criticism and historical and scientific research, forcing many religious minds to look elsewhere for the grounds of belief. Thirdly, the application of the comparative method to records of religious experience, especially that intensive form which claims direct intuitive apprehension of God (and this is the kernel of mysticism) disclosed remarkable unity between them; and the development of psychology brought within the range of that science many "mystical phenomena" which had formerly been dismissed unexamined, as the products of superstition or of mental disease.

The fresh material brought in from the study of Oriental religions has also supported the claim of mysticism to be regarded as a genuine form of human experience. Finally, in opposition to the merely moral and humanitarian view of Christianity popularised by Liberal Protestantism and social reformers, this century has produced a number of records of contemporary mystical experience. Thus there have been both additions to the material accessible to students, and advances in the proper arrangement and understanding of facts. No well-informed person now identifies the substance of mysticism with trances, ecstasies or other psychophysical phenomena, or regards it as necessarily hostile to dogmatic theology.

Modern Study.—Modern study of the subject may be said to begin with Dean Inge's Bampton Lectures on Christian Mysticism (1899). It has since been pursued along the parallel routes of psychology, history and philosophy of religion. These aspects of mysticism cannot rigidly be separated, or indeed understood in isolation; each being of vital importance to the rest. The peculiar triumph of the greatest modern writer on mysticism, Baron Friedrich von Hügel, consists in the synthesis effected between the historical, philosophical and intuitive aspects of man's experience of God.

The Psychology of Mysticism

The serious study of mysticism, especially from the psychological point of view, and attempt to discover its relation to other forms of consciousness, originates in William James's epoch-making Gifford Lectures on *The Varieties of Religious Experience* (1902). Although based on material chosen from too restricted a field, the publication of this book revolutionised the attitude of students towards religious psychology. The conception of the subconscious was now first used to provide an explanation and sanction for the ecstatic and other abnormal phenomena found in connection with mysticism, and an attempt was made to distinguish the accompaniments of genuine religious apprehension from their pathological imitations.

These researches have continued vigorously, especially in America and France. Pratt's *Religious Consciousness* (1921) represents the matured result of the movement started by James. Considerable advance has been made towards the correlation and better understanding of such types as the prophet, visionary and religious revivalist, in all of whom a strong mystical impulse is commonly at work. The hostile study of mysticism from the psychological standpoint has its chief exponent in J. H. Leuba; whilst an approach midway between the philosophical and psychological is provided by Bucke's *Cosmic Consciousness*, a curious work which has exercised considerable influence.

Realisation of the close correspondence between the abnormal phenomena of mysticism and those connected with other forms of mental exaltation, healthy and diseased, has caused an attempt to distinguish the essence of mysticism—intuitive experience of absolute reality—from the ecstatic states often accompanying it. This may be the line along which the apologetic of the future will move. Characteristic of the revival is the important part taken by French writers. Effective criticism of mystical phenomena has come from experimental psychologists such as Pierre Janet. Delacroix's sympathetic but penetrating analyses of the evolution of the great mystics have shed much light on the psychological characteristics of religious genius. Valuable studies of the nature of mystical contemplation, and restatement in modern terms of its processes, have been produced by Roman Catholic scholars; the best being those of Père Poulain, S.J. These works have a practical as well as a scientific objective. On the whole, the general result of the application of psychological criteria to mystical experience has been to establish the claim of psychology to explain the special methods and characteristics of the mystic, and disestablish the claim of certain schools of psychology to explain away the reality of his experience.

The History of the Movement

The modern psychological study of mystical phenomena has illuminated many historical problems; especially those connected with prophecy and the origins of religious movements. It has also stimulated interest in the records of empirical religion in its intensest form—the lives and writings of mystical seers and saints. The contribution of mystical experience to the religious outlook of such apparent intellectualists as, *e.g.*, St. Augustine or Aquinas is beginning to be understood; together with the great part played in religious history by mystics and their articulation to the corporate religious life. The treatment of the subject in such works as Heiler's *Das Gebet* and *Der Katholizismus* or Brémond's monumental *Histoire du Sentiment Réligieux en France*, is symptomatic of the changed outlook. Material available for students of historical mysticism has been much enriched. Good texts and translations of many masterpieces of European mysticism have appeared, with valuable studies such as those of Abbot Butler and Rufus Jones, based on the historical method. Sūfī mysticism, once only known to Oriental scholars, can now—thanks mainly to the work of Reynold Nicholson—be compared with that of the West. Such studies are seen to have an important bearing on the history of ideas; and the substantial identity of experience which they reveal has proved that mysticism must be regarded as an enduring type of human apprehension.

The changed outlook of physical science, the new understanding of its limitations and the marked revolt from 19th-century materialism, have brought about a *rapprochement* between mysticism and philosophy. There is a tendency alike in monists, critical realists and exponents of the "philosophy of value" to consider seriously the claims and findings of the mystic, which are congenial to the pantheistic temper of modern religious thought. On the other hand, those hostile to pantheistic doctrine find in the mystic's intuition of God a warrant for transcendentalism; and even show some willingness to reinstate in suitable disguise the ancient concept of Supernature. Inge's *Philosophy of Plotinus* (1918) and Otto's widely discussed essay *Der Heilige* (The Idea of the Holy, 1924) show different aspects of the reaction of philosophy to mysticism. But this is also felt in the pure metaphysics of Wittgenstein, and in the inimical attitude of Croce and his school. The greatest and ultimately most influential expositions of the place of mysticism in theistic philosophy, and its limitations and rightful relation with other aspects of knowledge, are Von Hügel's *Mystical Element of Religion* and *Eternal Life*. These books have affected all modern religious thinkers, and may provide the starting-point of a critical realism harmonising the mystical, moral and intellectual approaches to reality. In America, Hocking's *Meaning of God in Human Experience* is probably the most important philosophic contribution to this subject.

Modern Mystics.—The first quarter of the 20th century saw, especially in France, a revival of genuine Christian mysticism; possibly the beginning of what later historians may recognise as a "mystical epoch." Its most impressive document is the *Spiritual Journal* of the lady known as Lucie-Christine (1844–1908), a record which bears comparison with the historical classics of mysticism. Its most striking product is the career of the hermit saint of the Sahara, Charles de Foucauld (1858–1916). These stand up among a number of more obscure personalities, such as Elizabeth de la Trinité (1880–1906) and Madeleine Sémer (1874–1921), all of whom claim and describe with a conviction and sobriety compelling respect the characteristic mystical experience and certitude. From India, the autobiography of the saintly Hindu theist Maharshi Devendranath Tagore (1817–1905), and the experiences of the Christian convert Sadhu Sundar Sing (born 1889), whose career and personality have made a widespread impression, provide unspoilt examples of first-hand mysticism, and deepen the sense of unity in the spiritual intuition

The revived interest in mysticism has had popular results i several directions. It has seemed to endorse the shallow eclecticism in which many escape the difficulties of belief. Its superficial peculiarities have been exploited by theosophists and othe apostles of eccentric religiosity. It has produced numerou bastard cults, mostly hailing from America though often wearin Oriental disguise; cults mainly compounded of pantheism, quietism and crude autosuggestion, and offering a "mystical religion to those seeking a spiritual home full of modern convenience and devoid of discipline. On the other hand, its spirit has affecte for good the literature and activity of the organised Churche shifting the emphasis from tradition to experience, and bringin back into focus those mysterious realities which religious symbol and institutions seek to express.

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NAIROBI, the capital of Kenya Colony, British East Africa (*see* 19.155). In 1923 the population was: Europeans 3,071, Asiatics 8,356, Africans 12,666, total 24,093. Nairobi is the seat of the Kenya Legislature and the headquarters of most of the European organisations in the colony. Nearly all the whites are British, and the town has most of the amenities of a European city. Both the standard and the cost of living are high. Laid out on a large scale, Nairobi was still in the transition stage in 1926, but had many fine private and public buildings. The main thoroughfares are Government road, in which numbers of shops and offices are owned by Indians, and Sixth avenue. Parklands is a residential suburb for Europeans. A Natural History Museum, in Kirk road, was opened in 1922. The Indian bazaar covers nine acres. The natives occupy a separate location. A branch railway runs to the foot of Mt. Kenya. Nairobi is governed by an elected municipality, with separate franchise rolls for Europeans and Indians.

NAMUR, Belgium (*see* 19.159), with a population in 1923 of 31,044, has been called the Sheffield of Belgium, because of its large cutlery industry. Tanning and glass-making are also carried on, and the town has a considerable trade, and six lines of railway. An athletic sports ground was laid out and a fine open-air theatre built before the World War in the park on the Citadel Mount. Namur was bombarded for two days in 1914, before it was taken by the Germans, and after their entry a number of houses were burnt and looted. The Place Leopold and Place d'Armes suffered severely in the bombardment and the town hall was destroyed. The forts were repaired by the Germans after the capture of the town, which formed their cavalry headquarters during the War. The railway station was bombed by the British shortly before the Armistice (*see* BELGIUM, INVASION OF).

NANKING, China (*see* 19.162), had an estimated population of 380,900 in 1923. Since it became the terminus of a railway line to Shanghai, and the line to Tientsin, terminating at Pukow, on the opposite bank of the Yangtze Kiang river, was opened, the trade has increased, but the city has little commercial importance. A short railway line has been opened to Hsiakwan, the port of Nanking a few miles to the south. A grand industrial exhibition, the first in China, was held in the city in 1910, and again in 1921. Only a portion of the ground enclosed by the 20-mile circuit of the walls is inhabited, but the area has been opened up by roads and shops, offices and government buildings in Western style have been erected. The city possesses a naval college, an arsenal, an agricultural experimental station, a Government mint and a university. The last was formed by the union of three independent mission schools in 1911, and includes a college of arts and sciences and one of agriculture and forestry; a hospital and library; senior, junior and primary schools, etc. Two-thirds of the surplus from the American China Relief Fund was presented to the university in 1922 for research, particularly in connection with famine prevention. Good work has also been done in the production of silkworm eggs immune from disease. A number of the large silk stores in Nanking were burnt and looted by Chinese soldiery in 1924, and American marines had to be landed to protect the foreign population.

Nanking was the scene of much fighting during the revolution of 1911, and the Tartar city was burnt. It became the seat of a provisional Government, which hoped to make it the capital city, but in 1913 an armed rebellion took place and the city was bombarded for a fortnight by the troops of the Government. Hsiakwan was burnt down, but was rapidly rebuilt with new and wider streets.

NANSEN, FRIDTJOF (1861–   ), Norwegian scientist, explorer and statesman (*see* 19.162). After Dr. Nansen's return rom the North Polar expedition in 1896 a professorship of zoology was established for him at the University of Christiania. Here he was engaged in working up the results of his expedition and in general scientific research, especially in physical geography and oceanography. In the summer of 1900 he took part in an Arctic oceanographic expedition in the S.S. "Michael Sars," headed by Dr. Johan Hjort, and became director of the International Central Laboratory in Christiania for the Research of the Sea. In 1902 he published *The Oceanography of the North Polar Basin*, and in 1904 *The Bathymetrical Features of the North Polar Seas.* In 1905 Nansen actively intervened in politics for the first time. He issued a manifesto and many articles in connection with the crisis between Norway and Sweden. His attitude may be summarised by the last words of a short work published later in the year: "Any union in which the one people is restrained in exercising its freedom is and will remain a danger" (*Norway and the Union with Sweden*, London, 1905). On the establishment of the Norwegian monarchy Nansen was appointed minister to England (1906), and in the same year was created G.C.V.O. In 1908 he retired from his post and returned to his scientific work as professor of oceanography at Christiania University. He devoted all his time to oceanographic research, and in co-operation with his friend Professor Bjorn Helland-Hansen, of the Bergen Museum, wrote *The Norwegian Sea, its Physical Oceanography* (*Report* on Norwegian Fishery and Marine Investigations, vol. 2, 1909).

In 1910 Nansen made an oceanographic cruise in the "Frithjof" through the northeastern North Atlantic from Ireland to Iceland and back to Norway, and published the results in *The Waters of the Northeastern North Atlantic* (*Internationale Revue der gesammten Hydrobiologie und Hydrogeographie*, Leipzig, 1913). In 1911 he published *In Northern Mists* (2 vol.) on the exploration of the northern regions from early times up to the beginning of the 16th century. In 1912 he made a further oceanographic cruise to Spitsbergen and the waters to the north in his yacht the "Veslemoy," and described it in *En ferd til Spitzbergen;* the scientific results of the cruise are contained in *Spitzbergen Waters* (Society of Science, Christiania, 1915). The following year he made an expedition through the Arctic and the Kama Seas to the mouth of the Yenisei river and through Siberia and the Amur region, recounted in *Through Siberia, the Land of the Future* (London, 1914).

In 1914, jointly with Professor Bjorn Helland-Hansen, Nansen made an oceanographic expedition in the eastern North Atlantic to Portugal, Madeira and the Azores and back to Norway, the important scientific results of this expedition being published by the two scientists in *The Eastern North Atlantic* (Geophysic Publication, Academy of Science, Oslo). During the World War further oceanographic expeditions—Nansen's absorbing interest—were impossible. In 1917 he was appointed head of a Norwegian Govt. commission to the United States, and secured a satisfactory agreement with the American Govt. in regard to the import into Norway of essential supplies. After the Armistice (1918) Nansen threw himself with vigor into the work of repatriating prisoners of war, and under him, as Commissioner of the League of Nations, and with the executive assistance of the national Red Crosses, about 500,000 prisoners of war were repatriated from Siberia, China and other parts of the world. This work was financed largely by the governments participating in the International Committee for Relief Credits, Paris, of which Lord Bradbury was chairman.

In 1919 Nansen conferred with Hoover regarding the possibilities of assisting the Russian people, and suggested to President Wilson and the members of the Supreme Council an organisation for Russian relief on the lines of the Belgian Relief Commission. The Supreme Council supported the proposal on the condition that all hostilities in Russia cease. As this was at the time when Kolchak in the east and Deniken in the south were advancing towards Moscow the project was abandoned. In 1921 Nansen was asked by an international conference in Geneva of delegates of 48 Red Cross societies and 12 governments to put himself at the head of the relief work for famine-stricken Russia, and on Aug. 27 in the same year he signed an agreement in Moscow with Chicherin, the Soviet Foreign Minister, regarding the method of furnishing relief on an important scale, and visited the areas of famine. In Sept. Nansen endeavoured unsuccessfully to induce the League of Nations to assist the starving millions in Russia by raising, under safeguards, an international governmental relief loan. Failing here, he visited the chief capitals of Europe, and as a result largely of his intensive propaganda the European Red Crosses fed and clothed at one time at the peak of the Russian famine over 1,600,000 inhabitants of the Volga and South Ukraine regions. His publicity campaign undoubtedly had influence in America, which under Hoover's inspiration and direction fed at one time 10,000,000 Russian sufferers. Nansen's mission in Russia continued to conduct two agricultural demonstration estates in the former famine areas. In 1923 Nansen published *Russia and the Peace* setting out the economic position of Soviet Russia. As high commissioner for refugees to the League, he accepted responsibility for the protection and settlement of Russian, Armenian and Greek refugees, and the following is the appreciation of the Assembly of the League of this work:—

> The Assembly feels it its duty to pay a whole-hearted tribute to the high commissioner, Dr. Fridtjof Nansen, both for his unceasing devotion, of which for more than four years he has given proof, in assisting refugees of every nation, and for the high qualities which he has displayed in the carrying out of his onerous duties. The Assembly would record the fact that with the very limited means at his disposal Dr. Nansen has saved from misery and often from death hundreds of thousands of human beings, and would render him the grateful thanks due to him as a benefactor of humanity.

In 1923 Nansen was awarded the Nobel Peace Prize, which he gave to the furtherance of the Nansen agricultural demonstration estates and model farms in Saratov and Ekaterinoslav Governments, Russia. In his early manhood Nansen was a great athlete, and by his writings was largely responsible for popularising ski-ing in the Alps, and evidence of his enthusiasm for sport is his work on *Sport in the Polar Regions* and *Wild Norway* (1925). Nansen, as delegate for Norway to the League of Nations, made an impassioned intervention protesting against the occupation of Corfu by Italy in 1923, and at the Fifth Assembly in 1924 he conducted the first informal negotiations that took place concerning the entry of Germany into the League of Nations. Nansen's interest in education has been evidenced by his campaign in favour of Russian professors and universities. In 1925 he was elected Lord Rector of S. Andrews. (*see* POLAR REGIONS; REFUGEES.) (J. H. Go.)

NAOROJI, DADABHAI (1825–1917), Indian politician (*see* 19.167), died at Versova, near Bombay, June 30 1917.

NAPLES, Italy (*see* 19.178), the second largest city in Italy, had a population of 772,405 in 1921. To improve the sanitary condition of the city an opening has been made through the squalid Pendino quarter, and a new approach to the castle from the Strada San Carlo. The quarter of Santa Lucia has grown largely. A fine art collection was presented to the city in 1925, and will be housed in the Villa Floridiana.

The museum, which houses the Pompeian collections, shaken by the building of a tunnel, was found to be in danger of collapse; the walls were temporarily shored up pending its repair. Excavations in 1913 led to the discovery of the old port of Pompeii, and further discoveries in Pompeii itself were opened to the public in 1915. The Neapolitan University was closed in 1925, owing to riots between Fascists and non-Fascists. A metropolitan electric railway was opened in 1925, with seven stations, the terminus being at Pozzuoli; another station will be built at Bagnoli. The work on port improvements was temporarily suspended in 1924. Fears were expressed in 1925 lest the Orient Line would cease to use Naples as a port of call, owing to the new regulations for third-class passengers. Naples is now the third port of Italy: the number and tonnage of vessels entering the harbour are greater than at Genoa, though the amount of goods is less.

NAQUET, ALFRED JOSEPH (1834–1916), French chemist and politician (*see* 19.236), died in Paris March 12 1916.

NARES, SIR GEORGE STRONG (1831–1915), British explorer (*see* 19.240), died at Surbiton, Surrey, Jan. 15 1915.

NAREW, BATTLES OF THE.—The battles on the river Narew northeast of Warsaw, in July and Aug. 1915, were a part of the great offensive planned by Falkenhayn against Russia. (*See* EASTERN FRONT and map.) During May and June, Mackensen had driven the Russian armies in Galicia from Tarnów on the Dunajec to the east of Lemberg (*see* DUNAJEC-SAN; LEMBERG). In July the group of armies under his command was directed northeast towards Brest-Litovsk against the communications of the Russian forces which still held the Warsaw salient (*see* BREST-LITOVSK). Hindenburg, who commanded the group o armies on the northern part of the Eastern Front, was now ordered to strike a blow on the north side of the salient. Falkenhayn hoped thus by driving in the flanks of the salient to cut off large numbers of Russians in its apex about Warsaw. The realisation of this hope depended of course on the rapidity with which the flanks could be forced.

Rival German Plans.—The operation against the Narew line is of interest because of the controversy it provoked between the two men who had most influence on German strategy during the War, Falkenhayn and Ludendorff. The former was at this time chief of the German Great General Staff, and thus responsible for the supreme direction of the War; the latter was chief of staf to Hindenburg. Ludendorff had long cherished the idea of a Napoleonic manoeuvre against the Russian rear by Kovno and Wilno on Minsk, and considered the proposed Narew offensive as timid and ineffectual, Falkenhayn, with heavier responsibilities on his shoulders, mistrusted both the feasibility and the expedience of the Wilno adventure. He could not afford to become so deeply involved in the Eastern theatre as to be unable to withdraw formations to meet the coming offensive in the West After a discussion of the alternative plans held in the presence of the Kaiser, Falkenhayn's views were approved; and Hindenburg was ordered to carry out the Narew attack.

A formidable water barrier protects Russian Poland against invasion from East Prussia. From Kovno to Grodno it is formed by the Niemen; from near Grodno it is continued by the Bobr the Narew and the lower course of the Bug to the fortress o Nowo-Georgiewsk (Modlin); thence the Vistula flows northwest to the frontier. The Russians had fortified this river line. Besides the fortresses of Kovno and Grodno on the Niemen, Osoweic on the Bobr, Lomza on the Narew and Nowo-Georgiewsk at the confluence of the Bug and Vistula, there were fortified bridge heads on the Narew at Ostrołęka, Rozan, Pułtusk and Zegrze. Though the river was fordable in the summer at many points, marshes along its length increased its effectiveness as an obstacle.

The German Attack.—Gallwitz's army, which was to make the attack, comprised six corps (14 divisions). It extended from the river Szkwa, northeast of Ostrołęka, to the Vistula. Opposite to it, from Jednorozec, on the river Orzec, to near Płock on the lower Vistula, lay the Russian I. Army (Litvinov) with three corps and a cavalry corps.

The tactical details of the fighting are not of any special interest. On July 13 Gallwitz delivered his first attack on the approximate line Przasnysz-Ciechanów, aiming at Pułtusk. The Russians, over-weighted both in numbers and heavy artillery at once fell back more than half-way to the Narew line. They were attacked again on July 15, and during July 18 and 19 withdrew across the river, the Russian XII. Army on their right conforming to the movement. Reinforcements had now arrived and resistance stiffened. Though the Germans stormed the bridge-heads of Pułtusk and Rozan on July 23, and secured crossings over the river, their further progress was limited by violent Russian counter-attacks, and they were unable to reach the line Wyszków (on the lower Bug)–Ostrów, at which they were aiming. An attempt to force a passage further east at Ostrołęka on July 30 failed, and it was not until Aug. 4 that this bridge-head fell. Losses were heavy on both sides; but the Russians had secured time and space sufficient to evacuate the Warsaw salient without danger.

Hindenburg and Ludendorff naturally claimed that the result of the battle vindicated their opinion on the mistaken strategy of the Supreme Command. Falkenhayn retorted that the operations would have had the desired effect of intercepting the Russian retreat had Hindenburg used the full force available and given Gallwitz 20 divisions instead of fourteen. It seems doubtful, however, whether the communications would have allowed the effective employment of so large a force.

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(A. P. W.)

NAROCZ, BATTLE OF LAKE.—Lake Narocz, in Lithuania, 62 m. E.N.E. of Wilno (Vilna), gives its name to a great offensive by the Russian II. Army in the spring of 1916 (*see* EASTERN FRONT and MAP).

General Situation on the Eastern Front.—The river Pripet formed the dividing line between the German and Austrian commands. At the beginning of March there were 42 German and two Austrian divisions on the front north of the Pripet, the total length of which was about 250 miles. The Russians had organised their armies into three groups: the Northern (XII. and V. Armies) on the Dvina, the Western (I., II., X., IV., III. Armies) extending to south of the Pinsk marshes and the Southwestern (VIII., XI., VII., IX. Armies) up to the Rumanian border. Their main strength was concentrated on the Northern and Western fronts, where it had been decided that the principal efforts of the year should be made. The losses of 1915 in men and material had been made good; guns and munitions were available on a larger scale than previously, though still insufficient for the requirements of trench warfare.

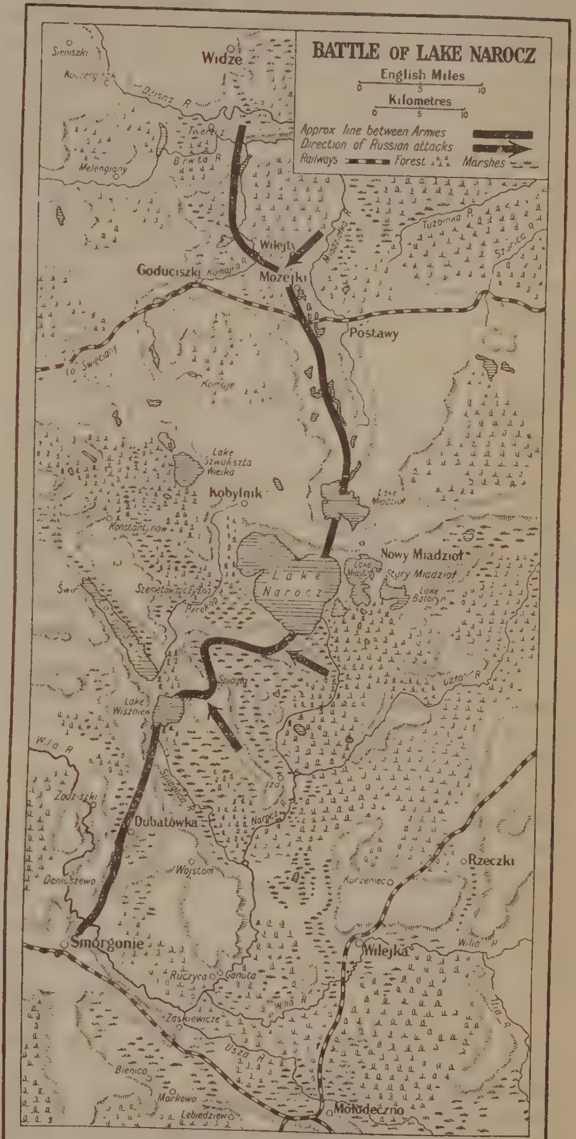
Plan of Operations.—The general idea of the battle was for the II. Army to attack on either side of Lake Narocz, where the German line formed a slight salient; the two wings were eventually to join at Swieciany and to continue their advance westwards to Panevežys (some 80 m. north of Wilno (Vilna) and 100 m. west of the original line), where the V. Army, which was to attack from the Jakobstadt bridgehead on the Dvina, was to join them. The operation seems to have been planned originally o take place later in the year, when all the Allies proposed to attack simultaneously. But on Feb. 21 the German assaults on Verdun began, and the Russians chivalrously hurried on their preparations and attacked to relieve the pressure on the French, at the worst possible time of the year, when the annual thaw, which renders all communications practically impossible for a period, might be expected at any moment.

Description of the Terrain.—Lake Narocz (eight m. by six m.) is the largest of a whole series of small lakes in which the tributaries of the Wilia and the Dzisna rise. It drains into the river Narocz, which flows south to join the Wilia east of Smorgonie. The greater part of the trench line between Dvinsk and Smorgonie (over 100 m. in a straight line) was protected by lake, tream or marsh, and stretches of dry ground wide enough for a arge scale offensive were few. On either side of Lake Narocz, owever, were gaps of four m. or so in the water line, where the errain was comparatively favourable for attack, though communications were poor. The northern gap was 10 m. to the orth of Lake Narocz, between the villages of Wilejty and Możejki; the southern was between the lake itself and Lake Wiszniew.

Dispositions of the Opposing Forces.—The II. Army, which was o carry out the attack, was divided into three groups: the right roup, under Gen. Plyeshkov, opposite the northern gap, con- sted of three corps and a cavalry corps; the centre group, under en. Sirelius, of two corps; and the left group, under Gen. Baluev, three corps. Four corps were available behind these groups to ploit any success gained. The right and left groups were to tack the north and south faces of the salient respectively, hile the centre group assisted by minor assaults and demon- rations. The army commander, Smirnov, went sick just before e battle and his place was taken by Gen. Ragoza.

The II. Army was opposed by Von Eichorn's X. Army, which extended from the river Dzisna to Krewo, south of Smorgonie, a front of some 85 m., and comprised 11 divisions and two cavalry divisions. The Germans were aware of the Russian concentration. Just before the attack, Gen. Von Hutier, commanding the XXI. Corps opposite the Lake Narocz front, was reinforced by one division, and other reserves were held in readiness to support him.

The Russian Attacks.—A thaw set in on March 17, but the offensive was nevertheless begun on the 18th. After a bombardment of several hours, massed infantry attacks were made both by Plyeshkov's group north of Lake Narocz and by Baluev's group in the south. In the thickly wooded and enclosed terrain the insufficiently trained Russian infantry soon lost cohesion, and their assaults were ill-timed and disjointed. Though the German first-line trenches were in several cases occupied, they could not be held under the concentrated fire of the German artillery, which was extremely skilfully handled. By nightfall the Russians were back in their original positions, having suffered very heavy casualties without result. After two days of further


BATTLE OF LAKE NAROCZ
English Miles
0
5
10
Kilometres
0
5
10
Approx line between Armies
Direction of Russian attacks
Railways
Forest
Marshes
Sieniszki
Widze
Dzisna R.
Twerecz
Brwta R.
Melengiany
Tuzorka R.
Wilejty
Goduciszki
Mozejki
Postawy
Swieciany
Komaje
Lake Szwakszta Wielka
Kobylnik
Lake Miadziol
Konstantynow
Nowy Miadzioł
Lake Miastro
Stary Miadzioł
Lake Batoryn
Lake Narocz
Świr
Szeretów
Perekop
Spiagla
Lake Wiszniew
Wilia R.
Uzla R.
Zodziszki
Dubatówka
Narocz R.
Wojstom
Rzeczki
Danuszewo
Kurzeniec
Smorgonie
Wilejka
Wilia R.
Ruczyca
Gonuta
Zaskiewicze
Bienica
Usza R.
Markowo
Lebiedziewo
Molodeczno

artillery preparation and minor attacks intended to mislead the enemy, renewed heavy assaults were made on the nights of March 19–20 and 20–21.

On Plyeshkov's front no ground was permanently gained, in spite of terrible losses, but Baluev's group in the south had some measure of success, and made an advance of over a mile on a front of about 2½ miles. The weather conditions were by now terrible; it thawed from the 17th to the 22nd, and the whole area of operations became a sea of mud. The battle was, however, continued till March 27, when the Russians at last desisted from their fruitless and costly attacks. In April a German counter-stroke retook all the ground gained by Baluev. Meanwhile, the attacks of the V. Army from Jakobstadt, March 21–6, were equally unsuccessful and almost equally wasteful of life.

Results of the Operations.—The operations resulted in a complete and disastrous failure for the Russians. Their losses were over 100,000 and they accomplished nothing. The offensive did not cause the Germans to move a single man from the Western Front, and so brought no relief to the French. The operation was mismanaged in every way. Both time and place were ill-chosen; the staff work was bad; and the artillery, in spite of a greater concentration of heavy guns on a narrow front and a more liberal expenditure of ammunition than ever before, failed to give proper support to the infantry, who as usual paid the price in terrible losses. The result was, in fact, a bitter disillusionment to the Russian high command, to the Russian soldier and to the Russian people.

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NASH, PAUL (1889–), British painter, was born in London May 11 1889, and educated at St. Paul's School and at the Slade School. His first exhibition was given in 1911, but he was comparatively little known until an exhibition of his Western Front war pictures (1918), the fruit of his work as an official artist 1917–8; several of these are in the Imperial War Museum, London. He then attracted attention as a landscape painter of individuality and charm, a somewhat mannered technique giving way gradually to a freer expression; he gave an important exhibition in London in 1924. He also produced some interesting woodcuts and book illustrations, such as the wood engravings, "Genesis" (1924). He was instructor of design at the Royal College of Art, South Kensington.

His brother, JOHN NORTHCOTE (1893–), worked on similar lines, and was also an official war artist during 1918.

NASHVILLE, Tenn., U.S.A. (*see* 19.246), had a greater business development between 1910 and 1925 than is indicated by the growth of its population within the city limits: 1910, 110,364; 1920, 118,342 (of whom 35,633 were negroes and 2,412 foreign-born, both of these groups being smaller than in 1910); 1925, 136,220, as estimated by the Census Bureau, and probably 150,000 if suburban population which is a part of the economic unit, were included. The value of products manufactured within the city limits increased from $29,650,000 (1909) to $83,041,583 (1923); postal receipts and bank clearings increased threefold, savings deposits and the value of new buildings constructed even more. During the World War the U.S. Govt. established the "Old Hickory" powder plant in the wilderness across the Cumberland river, constructing a village for 30,000 residents. Plant and village were bought after the War by a local corporation formed for the purpose of salvaging the property for an industrial centre. By 1925 a large factory for the production of rayon (artificial silk) was in operation on this site, and the location of other industries was assured. Vanderbilt University, with grants of $8,000,000 from the General Education Board and the Carnegie Corp. thoroughly reorganised its medical school (1919–25) and built for it an adequate modern plant, which was occupied in 1925. Nashville, Davidson county, and the State of Tennessee united in erecting a beautiful memorial building in honour of the men of the state who lost their lives in the War. In 1913 Nashville adopted the commission form of government.

NATAL (*see* 19.252), the smallest and most densely populated province of the Union of South Africa. Its area (including Zululand) is 35,284 sq. m. and the population (1921) 1,429,398, of whom 136,838 were whites, 141,649 Asiatics, 1,139,804 Bantu and 11,107 of mixed or other race. Since 1911 the white inhabitants had increased by nearly 39,000; the Asiatics by 8,210, the Bantu (natives) by 186,000. The density of population per sq. m. was 40.51. The chief towns are Durban and Pietermaritzburg (*qq.v.*). Next in size is Ladysmith with (1921) 6,783 inhabitants (3,221 whites).

The change from the status of a self-governing colony to a province of the Union affected Natal politically more closely than any other province, since in it alone were the great majority of the white inhabitants of British descent. The firm attachment of Natalians to the British connection continued an unchanging factor in the South African situation. Provincial administration was, however, largely carried on upon non-party lines. The first administrator, Mr. C. J. Smythe, had previously held office as Colonial Secretary and as Prime Minister of Natal. Mr. Smythe, who was reappointed for a second term in 1915, died in 1918 and Mr. (later Sir) G. T. Plowman succeeded to the post, which he still held in 1926. Revenue, derived chiefly from transfer duties and licences, increased from £118,000 in 1912–3 to £413,000 in 1922–3, the subsidies from the Union Govt. rising from £361,000 to £563,000. About 70% of the total expenditure was on education, the sums spent for that object rising from £169,000 in 1912–3 to £695,000 in 1922–3.

The Indian Problem.—Natal was deeply interested in the question of Indians in South Africa. Of the 161,339 British Indians in the Union in 1921, no fewer than 141,336 lived in Natal, where they had rendered possible the development of the sugar, tea and wattle industries, as well as provided labour for the coal-mines, railways and other public works. Besides labourers, there were many Indians engaged in professions and commerce. White South Africans in general opposed the further increase of Asiatics in the Union; while, in 1911, the Indian Govt., long dissatisfied with the attitude of Natal to Indians, prohibited the recruitment of indentured coolies. The Indians both in Natal and the Transvaal complained of many grievances, and their cause was championed by M. K. Gandhi, then resident in South Africa. Arising out of the agitation, riots and disturbances occurred in Natal in 1913. In 1914 the Union Govt. passed legislation intended to prevent Indian immigration into South Africa and to prevent Asiatics already in the Union leaving the province in which they lived. The so-called Smuts-Gandhi agreement of the same was designed to guard the vested interests of Indians already in the Union. The attitude of the white inhabitants of Natal was shown by the Borough Ordinance passed by the provincial council in Jan. 1924, debarring Indians in future from acquiring the municipal franchise. This ordinance was held up by the Union Govt. for consideration, but in Dec. 1924, assent to its operation was given. The parliamentary franchise was, with a few special exceptions, already confined to whites. In 1925 there were 38,547 parliamentary electors, of whom only 24 were Indian.

A notable element in the progress of Natal has been the development of coal-mining. The output, which in 1910 first exceeded 2,500,000 tons, had increased to 4,302,000 tons in 1923. Natal coal is of excellent quality. The quantity of coal bunkered and exported in 1924 exceeded 2,700,000 tons.

The Offical Year Book of the Union of South Africa (Pretoria) gives list of government publications dealing with the Asiatic question and provincial administration. *See* SOUTH AFRICA, UNION OF. (F.R.C.)

NATHAN, ERNESTO (1845–1921), Italian politician, was born in London, the son of an Englishman, Joseph Nathan, and of an Italian mother, Sara Rosselli, both Jews. In 1858 he settled in Pisa with his mother and attended the university there. Soon afterwards they had to repair to Switzerland on account of Sara Nathan's republican sentiments; it was then that Ernesto Nathan became acquainted with Mazzini, whose views became thenceforth his chief inspiration and cult. A violent anti-clerical, he soon joined the Freemasons and was elected "Grand Orient" for Italy in 1899, but resigned in 1905 owing to internal disagreements. He became an Italian citizen, and although he had been a republican in his early years, he gradually accepted the monarchy as the best *régime* for Italy. He showed great activity in organising the "Unione dei partiti popolari" in 1900, a *blocco* of the various radical and anti-clerical parties in Rome, and when at the municipal elections of 1900 the clerical administration fell, Nathan was chosen as mayor. Re-elected in 1910, he fell when the *blocco* broke up in 1913. On the outbreak of the World War, in spite of his 70 years, he volunteered for the army and actually served as a lieutenant of infantry for a time. He was editor of the national edition of Mazzini's works. Nathan died in Rome April 9 1921.

NATIONAL DEBT: *see* DEBTS, INTER-ALLIED; GREAT BRITAIN: FINANCE.

NATIONAL PARKS AND GAME PRESERVES.—Under the influence of President Roosevelt's great interest in outdoor life and faith in the value to the people—moral, physical and educative—of contact with nature, the early years of the present century saw in the United States a wonderful advance in the movement for national parks and nature conservation. The momentum gathered was not lost when the administration of President Wilson came, but passed into a new constructive period under his Secretary of the Interior, Franklin K. Lane, a man of imagination and high enthusiasm for the public service and under the latter's friend, Stephen T. Mather, the inspiring head of national park accomplishment in recent years in the United States.

The National Park Service.—At the creation in 1916 of the National Park Service the separate park units created by the Federal Govt. were gathered into a logical system whose aims were clarified and placed upon the highest basis, and a foundation was established on which the future could be safely built. Its establishment, with the unified control it gave, marks the most important advance made since 1910 in national park development in America, whose influence has been widely felt.

Since 1910 a change fundamentally altering the national park problem and incalculably increasing its importance has come into the life of the American people. From being relatively stationary they have become to an extraordinary extent a nation n movement, owing to the automobile, multiplying many times the travel to the national parks and their opportunity for service, but presenting, equally, new difficulties in the organisation and care of motor-camps, the building of roads and the provision or great multitudes of visitors. The aim of the National Park Service as it has crystallised has been to have each recreationally mportant feature of the country's landscape typically repreented in the national system, so that a traveller visiting in urn the various parks may see the country illustrated through upreme examples and learn of the characteristic life—plant and nimal—inhabiting its regions.

To this educational aspect of the national parks constantly reater emphasis is being given. They form wonderful natural xhibits and outdoor museums, illustrating, in each section here they lie, the regional life and landscape. With the wide ravel to them which the automobile is causing they are becoming lso conservational factors of prime importance in arousing nterest in the preservation of the nation's irreplaceable wild fe inheritance and native beauty.

Parks Established.—During and since 1910 the following national arks, a magnificent group supplementing in extraordinary variety e earlier units, have been established by Congress in the United tates: Glacier National Park (1,534 sq. m.) in Montana in 1910; ocky Mountain National Park (397 sq. m.) in Colorado in 1915; awaii National Park (186 sq. m.) in the territory of Hawaii in 16; Lassen Volcanic National Park (126 sq. m.) in California 1916; Mount McKinley National Park (2,645 sq. m.) in Alaska in 17, in its present stage a game preserve and mountain reservation ther than a park in the true sense; Grand Canyon National Park 58 sq. m.) in Arizona in 1919; Lafayette National Park (12 sq. m.) on Mount Desert I. off the coast of Maine in 1919; and Zion ational Park (120 sq. m.) in Utah in 1919; while a bill to create two hers in the Great Smoky Mountains of Tennessee and North Carolina and in the Blue Ridge Mountains of Virginia was before Congress in 1926 and was being strongly urged.

National Monuments.—Intimately related to the national parks in the United States are the national monuments, whose first establishment in 1906 was one of the farsighted conservational acts of President Roosevelt's administration. Created by presidential proclamation for the preservation of outstanding features of historic, antiquarian or scientific interest, their number has steadily increased since 1910, until in 1926 they constituted, supplementing the national parks and administered in connection with them or with the national forests, a true museum of the out-of-doors, preserving battlefields and historical sites, prehistoric dwellings, fossil forests, rare botanical exhibits and striking geologic features.

Parks in Canada.—In Canada the older national parks—the Rocky Mountains National Park (2,751 sq. m.) in Alberta, by Banff; the Yoho National Park (476 sq. m.) in British Columbia; Glacier National Park (468 sq. m.) in the Selkirk Mountains; Jasper National Park (4,400 sq. m.) in northern Alberta; and Waterton Lakes National Park (220 sq. m.), adjoining across the national boundary the United States Glacier Park, have all been extensively added to since 1910, and the following have been created: Revelstoke National Park (100 sq. m.) in British Columbia, dedicated in 1919 and the westernmost in the chain of Canadian National Parks; and Kootenay National Park (587 sq. m.), created in 1920, on the western slope of the Rockies, adjoining the Yoho and Rocky Mountains National Parks.

In South America.—In South America plans for an international park centring about the celebrated cataract of L'Iguazu on the boundary between Argentina and Brazil were in 1926 under consideration but had not then been embodied in definite shape. Far to the south in Argentina, near the Chilean boundary in the Andean region, lies the Nahuel-Huapi National Park amid lakes and snow-clad mountains of the Cordillera range, the first of actual establishment south of the United States.

In Europe.—In Europe, Switzerland led the way in national park creation by establishing in the years before the World War a national park and botanical reservation among the Alps that lie between the Lower Engadine and the Italian border, in the Canton of the Grisons, rich in alpine flowers and in scenic beauty. Italy, since the War, has followed with the establishment of a national game preserve, Il Gran Paradiso, in the Alps of Piedmont, for the protection of the few remaining ibexes, and of a national park in the Apennines, northeast from Rome: the National Park of the Abruzzi. Originating in a royal hunting park established for Victor Emmanuel when united Italy became a kingdom, it includes the highest mountain in the Apennine range, Il Gran Sasso d'Italia, and ancient woods of beech and oak that also are the refuge of wild life in vanishing species. But it is a park still in the making, for the future to develop.

One other area in Europe claims attention as the scene of activity in national and international park creation—the Eastern Carpathian and High Tatra mountains, along whose summits lies the boundary between Czechoslovakia and Poland, where extensive parks were planned in 1926, culminating in the Tatra International Park, cresting the range in a magnificent domain of wild and rugged scenery.

In Australia.—In Australia no Federal park system has yet been established, but state reservations, notably Centennial Park, Sydney, N.S.W., have been made which the Commonwealth may make the basis for one later, as wealth and population grow. The unique flora and fauna and continental character of the country make the opportunity remarkable. New Zealand, also, has opportunity for the creation of a wonderful park system in the southern hemisphere and is moving fast toward it through the development of her sea-borne tourist trade.

Game Preserves.—The swift destruction of wild life now taking place in the United States and Canada through increasing population, the ready invasion by the motor-car of regions till now the secluded habitats of wild life, and the drainage of marshlands, has led to a widespread movement for the enactment of protective Federal legislation and the increased establishment of national game preserves.

To these the United States has largely added, both in extent and number, since 1910, and, national park areas apart, which are absolute sanctuaries, has now the following: Wichita National Game Preserve (91 sq. m.) in Oklahoma; the Grand Canyon National Game Preserve (1,384 sq. m.), co-extensive with the Kaibab National Forest, in Arizona; the National Bison Range (29 sq. m.) in Montana; the Elk Refuge National Game Preserve (4⅓ sq. m.) in Wyoming; the Niobrara National Bird and Wild Life Reservation (25 sq. m.) in Nebraska; the Pisgah National Game Preserve (120 sq. m.) in North Carolina; the Cherokee Federal Game Reserves in Georgia and Tennessee; and an extensive area bordering the Upper Mississippi, in process of acquisition in 1926 under a congressional appropriation, for a national bird and wild life reservation.

In Canada since 1910 the following national game preserves, bearing the name of parks, have been established in addition to the one, Buffalo National Park (161 sq. m.), which then existed; Elk Island National Park (51 sq. m.) in northern Alberta; Nemiskam National Park (8½ sq. m.), an antelope preserve in southeastern Alberta; and Point Pelee National Park (4 sq. m.) jutting out into Lake Erie from Ontario, a bird sanctuary at the most southerly point in Canada, which is an important resting-place for many migratory birds.

Elsewhere, apart from the big game reserves of Africa and seal protection areas, little has been done for game protection through national preserves. Much, however, has been done besides, in Anglo-Saxon lands, by Federal states and provinces, and much by associations, of which outstanding examples for bird protection exist in Louisiana, administered partly by the state and partly by the National Audubon Society, and in New Zealand, where Stewart I. (665 sq. m.) has been set aside as a sanctuary, while it is to be remembered that all game protective laws, Federal or State, have the effect, if enforced and well conceived, of creating reservations to the extent of the territory they cover and the protection they afford, and are complementary in this sense to special game preserves.

In Great Britain the constant vigilance and activity of the Royal Society for the Protection of Birds and the Selborne Society have secured legislative and administrative protection for birds. Sanctuaries have been established on properties of the National Trust and in scheduled public parks and commons. The Selborne Society provides nesting boxes for private gardens. The Farne Islands have been purchased and given to the National Trust as a sanctuary for sea birds. The Royal Society for the Protection of Birds has established a Watchers' Committee which does invaluable work against depredations by collectors, by pollution of the sea by oil, by overhead wires and rat plagues. The bird nests and perches at four selected lighthouses have been the means of saving many migratory birds. The Society keeps constant watch for evasions of the Plumage Act (1921) and develops its propaganda by lectures to schools, by competitions and by the issue of a special journal, *Bird Notes and News*. (G. B. D.)

NATURALISATION (*see* 19.275).—In the period 1910–26 there were many and important changes throughout the world in the laws respecting naturalisation, owing in part to the growth of national feeling, in part to the World War.

The consolidation and amendment of the British law of nationality and naturalisation was recommended in 1901 by a departmental committee of the Home Office, but it was not until 1914, just before the outbreak of the World War, that the principal recommendations of the committee were embodied in an Act of Parliament. This was the British Nationality and Status of Aliens Act, 1914, subsequently amended by Acts of the same name passed in 1918 and 1922, which, while not disturbing the general principles of the Act of 1914, contain important supplementary provisions. These statutes, as their title implies, are comprehensive and deal with the law as to natural-born British subjects, British subjects by naturalisation and aliens within British jurisdiction. In the second of these categories, the new statutes make three important innovations, viz.:

1. They abolish all legal distinctions between natural-born and naturalised subjects. A naturalised British subject, so long as his certificate remains in force, has the same rights and duties as if he were natural-born.
2. A certificate of naturalisation may be revoked by the Secretary of State upon proper cause appearing to his satisfaction.
3. Without prejudice to the power of the self-governing Dominions to grant local naturalisation on such terms as they may see fit, the statutes lay the foundations of a scheme of Imperial naturalisation by providing for the adoption of Part II of the principal Act (as amended) by the Dominions. Part II has (1926) been adopted by Canada, Australia and South Africa.

Grant of Naturalisation.—In respect of the conditions precedent to the grant of a certificate of naturalisation to an alien, the Act of British Nationality and Status of Aliens Acts 1914, 1918 and 1922, do not substantially depart from the provisions of the Naturalisation Act, 1870. The applicant must satisfy the Secretary of State (a) that he has either resided in His Majesty's dominions for not less than five years, or has been in the service of the crown for not less than five years within the last eight years before the application, (b) that he is of good character and has an adequate knowledge of the English language, and (c) that he intends to reside in His Majesty's dominions or to enter or continue in the service of the crown. The residence required is at least one year's residence in the United Kingdom immediately preceding the application, and previous residence for four years, either in the United Kingdom or some other part of His Majesty's Dominions within eight years of the application. These conditions as to residence, however, do not apply to a British-born woman who has become an alien by marriage and who, after the death of her husband or the dissolution of her marriage, seeks re-admission to British nationality; and the Secretary of State may also in his discretion grant a certificate of naturalisation to a minor who has not complied with the prescribed conditions.

But a certificate of naturalisation is not a matter of right. The Secretary of State may grant, withhold or postpone it in his absolute discretion and there is no appeal from his decision. A certificate does not come into effect until the oath of allegiance to His Majesty has been taken. The names of minor children of an applicant for naturalisation may be (and in practice usually are) included in the certificate. The children thereby become British subjects, but on attaining their majority they may divest themselves of their allegiance by a declaration.

Revocation of Certificate.—Under the Naturalisation Act, 1870, a certificate once granted was irrevocable, even if it afterwards appeared that the grant had been obtained by fraud. The Act of 191 cured this defect by giving the Secretary of State a discretionary power to revoke a certificate obtained by false representations o fraud, and the Act of 1918 converted the discretion into an obligatio to revoke and considerably extended the principle of revocation Section 7, as amended, is as follows:—

(1) Where the Secretary of State is satisfied that a certificate o naturalisation granted by him has been obtained by false representation or fraud, or by concealment of material circumstances, or tha the person to whom the certificate is granted has shown himself b act or speech to be disaffected or disloyal to His Majesty, th Secretary of State shall by order revoke the certificate.

(2) Without prejudice to the foregoing provisions the Secretar of State shall by order revoke a certificate of naturalisation grante by him in any case in which he is satisfied that the person to whon the certificate was granted either—

(*a*) has during any war in which His Majesty is engaged unlawfully traded or communicated with the enemy or with the subjec of an enemy state, or been engaged in or associated with any business which is to his knowledge carried on in such manner as t assist the enemy in such war; or (*b*) has within five years of th date of the grant of the certificate been sentenced by any court i His Majesty's dominions to imprisonment for a term of not les than twelve months, or to a term of penal servitude, or to a fine c not less than £100; or (*c*) was not of good character at the date c the grant of the certificate; or (*d*) has since the date of the grant c the certificate been for a period of not less than seven years ordinarily resident out of His Majesty's dominions otherwise than as representative of a British subject, firm, or company carrying o business, or an institution established, in His Majesty's dominion or in the service of the crown, and has not maintained substantia connection with His Majesty's dominions; or (*e*) remains accordin to the law of a state at war with His Majesty a subject of tha state; and that (in any case) the continuance of the certificate i not conducive to the public good.

(3) The Secretary of State may, if he thinks fit, before makin an order under this section refer the case for such inquiry as i hereinafter specified, and in any case to which subsection (1) o paragraph (*a*), (*c*) or (*e*) of subsection (2) of this section applies the Secretary of State shall, by notice given to or sent to the last known address of the holder of the certificate, give him an opportunity of claiming that the case be referred for such inquiry, and

the holder so claims in accordance with the notice the Secretary of State shall refer the case for inquiry accordingly.

(4) An inquiry under this section shall be held by a committee constituted for the purpose by the Secretary of State, presided over by a person (appointed by the Secretary of State with the approval of the Lord Chancellor) who holds or has held high judicial office, and shall be conducted in such manner as the Secretary of State may direct:—

Provided that any such inquiry may, if the Secretary of State thinks fit, instead of being held as aforesaid be held by the High Court, and the practice and procedure on any inquiry so held shall be regulated by rules of court.

A committee appointed under this section shall have all such powers, rights, and privileges as are vested in the high court or in any judge thereof on the occasion of any action, in respect of the following matters:—

(a) the enforcing the attendance of witnesses and examining them on oath, affirmation, or otherwise, and the issue of a commission or a request to examine witnesses abroad; and
(b) the compelling the production of documents; and
(c) the punishing persons guilty of contempt;

and a summons signed by one or more members of the committee may be substituted for and shall be equivalent to any formal process capable of being issued in any action for enforcing the attendance of witnesses and compelling the production of documents

The revocation of a certificate of naturalisation, however, does not affect the status of the wife or minor children of the person concerned unless the Secretary of State so directs, and no such order can be made against a British-born woman unless the Secretary of State is satisfied that if she had held a certificate in her own right it could properly have been revoked under section 7. It is to be observed that no distinction is made between minor children who have acquired British nationality through their father's naturalisation and minor children who are natural-born subjects. The anomalous result follows that the British-born children of an alien are in a better position than the British-born children of a naturalised person.

There are other difficulties involved in the construction of the Act of 1918, the language of which is in many places very obscure, but they have never been the subject of judicial discussion. The committee constituted has, however, given certain rulings which have a quasi-judicial force. Thus, it has been held that innocent misrepresentation is "false representation" within the meaning of section 7 (1). Again, the use of the present tense in paragraphs (a) and (e) of sub-section (2) have been interpreted to mean that action under these paragraphs can only be taken during the continuance of a state of war. (D. Ca.)

II. THE UNITED STATES

In the Fourteenth Amendment to the Constitution of the United States it is provided that "All persons born or naturalised in the United States, and subject to the jurisdiction thereof, are citizens of the United States and of the State wherein they reside." This Amendment was proclaimed July 28 1868, but the method of naturalisation had been prescribed previously.

Only a natural-born citizen may become President of the United States, but naturalised citizens may hold every and any other office. The practice in naturalisation is set forth in the Naturalisation Act of June 29 1906 and its amendments; that of expatriation in the Expatriation Act of March 2 1907.

Naturalisation has two stages. The first is a declaration of intention on the part of the alien to become a citizen of the United States, the second is a petition for admission which must be filed not less than two years nor more than seven years after the declaration of intention. Every applicant must reside five years within the jurisdiction of the United States, although an occasional absence with intent to return does not break the continuity of residence. The last year of the residence must be in the state or territory in which naturalisation is to be acquired. Two witnesses are required to the fact of residence and of good character.

The general statute dealing with naturalisation applies only to white persons and persons of African race, hence the nationals of other races are not held eligible to citizenship under the naturalisation laws of the United States. (*United States v. Bhagat Singh Thind*, 261 U.S. 204; *Ozawa v. United States*, 260 U.S. 178.)

Naturalisation is perfected by the decision of a judge of a Federal or state court of record, the applicant taking an oath of allegiance to the Government and renouncing absolutely and forever all allegiance to the foreign country of which he was a citizen or subject.

The advantage of a declaration of intention was supposed to lie in testing the applicant's devotion to American institutions. The disadvantage is in the disagreeable, if not equivocal position in which he finds himself in the interval between the declaration of intention and final naturalisation. The government of origin naturally loses interest in such a person, who, if he wishes a passport, must apply to its representative in the United States. Congress, however, has been unwilling to drop the provision, although frequently requested to do so by the Executive Department of the Government. To obviate the disadvantages of the situation, the Secretary of State was authorised by the Expatriation Act of 1907 to grant temporary passports to foreigners who had declared their intention to become citizens, under such regulations as he should prescribe. This portion of the Act was repealed June 4 1920.

The Act of 1906 expressly mentions the intention on the part of the applicant to reside in the United States as an essential to legal naturalisation, and the absence of the intention may be proved as a fact in legal proceedings, or presumed from leaving the United States within five years. In the case of *Luria v. United States*, 231 Reports, 9 (1913), it was decided, however, that the intent was presumed in previous statutes.

The Govt. of the United States persistently maintained the right of expatriation, interpreting it, however, rather as the right of a foreigner to become a citizen of the United States without the consent of his government, than as a right of an American citizen without the consent of his own government to become a citizen or subject of a foreign nation. The first statute of expatriation affecting American citizens as well as foreigners was the Expatriation Act, passed March 2 1907. It provides that an American citizen, natural or naturalised, renounces his American nationality by becoming naturalised in a foreign country, or by taking an oath of allegiance to a foreign state. This became important in the World War when many American citizens enlisted in foreign armies, arrayed against the Central Powers. They had in all cases been obliged to take an oath of allegiance on entering the military service, and upon their return to the United States they were held to have ceased to be American citizens. To remedy this situation a statute was passed on May 9 1918 allowing such individuals to become American citizens upon taking an oath of allegiance to the United States.

The United States has been a party to treaties by which it was provided that a naturalised citizen might forfeit his American citizenship by residing a certain number of years in the country of his origin. The Expatriation Act generalises that provision by stipulating:—

When any naturalised citizen shall have resided for two years in the foreign state from which he came, or for five years in any other foreign state it shall be presumed that he has ceased to be an American citizen, and the place of his general abode shall be deemed his place of residence during said years.

The Act also stipulated that an American woman marrying an alien acquired his nationality, and that a foreign woman marrying an American citizen acquired American nationality. It further provided that minor children became naturalised through the naturalisation of their parents. Finally, the Act permitted American citizens who had returned to the land of their origin to overcome the presumption of renunciation of American citizenship by registering in the American Consulate; and also required that Americans born in foreign parts should register in an American Consulate.

The statutes provide easy terms of naturalisation of persons serving in the land and naval forces of the United States, provisions which were amplified during the World War. The great change, however, was made in the law of citizenship by the Cable Act of Sept. 22 1922, which provided that a foreign woman marrying an American citizen did not become an American citizen by the act of marriage; and that an American woman marrying a foreigner did not, by the act of marriage, lose her American nationality. It facilitated the reacquisition of American nationality by American women who had married foreigners before the passage of the Act, be reducing residence in the United States to one year before taking an oath of allegiance. From this privilege, however, was excluded the American woman who had married a foreigner who could not become a citizen of the United States under its naturalisation laws. The Act is in accordance with the tendency to recognise the personality of married as well as of single women, but it occasions inconvenience in the absence of treaties with foreign countries in the matter of passports from countries where the nationality of a wife depends upon and follows that of the husband.

III. GERMANY

The German Imperial and State Citizenship Law of July 22 1913 which went into effect Jan. 1 1914 has been much criticised. It contains two sections, 13 and 25, which have been considered generally objectionable to non-German countries. In view of the importance of the articles they are quoted:—

Sec. 13. A former German who has not taken up his residence in Germany may on application be naturalised by the state (of Germany) of which he was formerly a citizen, provided his case fulfils the requirements of Nos. 1 and 2 of paragraph 1 of Section 8; the same applies to one who is descended from a former German or has been adopted as a child of such. Prior to naturalisation a report must be made to the Imperial Chancellor; if he raises objections, naturalisation does not take place. (The text of section 8 of the law referred to in the section just quoted is as follows: "1. If he is legally competent in accordance with the laws of his former home or would be legally competent in accordance with the laws of Germany; or if the application is made by his legal representative or with the latter's consent in accordance with the second sentence of paragraph 2 of section 7. 2. If he has led a blameless life . . . .")

Sec. 25. Citizenship is not lost by one who before acquiring foreign citizenship has secured on application the written consent of the competent authorities of his home state to retain his citizenship. Before this consent is given the German consul is to be heard.

The Imperial Chancellor may order, with the consent of the Federal Council, that persons who desire to acquire citizenship in a specified foreign country may not be granted the consent provided for in paragraph 2.

The only comment necessary on provisions of this kind is the statement that by Article 278 of the Treaty of Versailles of June 28 1919, Germany was obliged to declare the provisions in question as null, void and of no effect.

IV. OTHER COUNTRIES

An examination of the laws of other countries dealing with naturalisation shows that there have been many and important changes since 1910, because the provisions were either in themselves deemed to be inadequate, or not in accord with the newer conditions of the century. In the next place, new states had come into existence, and as they were without legislation on the subject, it was necessary that laws should be passed regarding the acquisition and loss of nationality. Instead of attempting a summary of provisions which are in their nature local and therefore diverse, the principal constitutional and statutory provisions on the subject since 1910 are set forth:—

Argentine Republic.—Law of Nov. 27 1911, granting nationality to alien officers, etc., by virtue of law of July 14 1911; *Annuaire,*[1] 1911.

Austria.—Law of Oct. 17 1919, *Annuaire,* 1920:266; Decree of Aug. 20 1920, relative to acquisition of nationality by option, *BFS*[2] 113:879; Constitution, 1920, *BFS* 113:883, 886, Arts. 6, 11 (i).

Belgium.—Law of May 26 1914, on renunciation of Belgian nationality by persons who have acquired the same under law of 1909, *BFS* 107:587; Law of May 11 1918, granting fresh term for acquisition of nationality by descendants of inhabitants of territories ceded in 1839, *BFS* 111:652; Law of Oct. 25 1919, concerning right of option, *BFS* 112:989; Law of May 15 1922, concerning acquisition and loss of nationality, *BFS* 116:643.

Bulgaria.—Constitutional amendment, 1911, *BFS* 107:619, Art. 55; Law of Dec. 8 1911, amending law of Dec. 31 1903, *Annuaire.* 1911:765.

China.—Law of Nov. 18 1912, *Annuaire,* 1912:625; Law of Dec. 30 1914, *BFS* 114:667.

Costa Rica.—Constitution, 1917, Arts. 40–44, 60, 99 (10), 105; *La Gaceta,* June 13 1917.

Denmark.—Law of Nov. 27 1916, providing for naturalisation of persons of no nationality, *BFS* 110:838; Law of Sept. 5 1920, *BFS* 114:705; Constitution, 1920, Art. 50, *BFS* 114:715.

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NATURAL RESOURCES, CONSERVATION OF.—The term conservation came into common use and was given special significance about 1908, when President Roosevelt inaugurated a movement in the United States to check the destructive exploitation and wasteful use of many of the most important natural resources. The underlying purpose of the movement was to make the resources render their highest service in the economic, industrial and social upbuilding of the nation. Productive use of agricultural land, continuous production of forests, economy in the use of mineral resources, skilful development of waters coupled with the protection of their sources, the building up of fisheries, the increase of useful wild life and the proper handling and safeguarding of recreation resources are examples of conservation. Use of natural resources without waste, economic development to secure from them a maximum service, continuous production of renewable resources and permanence of industries and of community life lie at the basis of the conservation principle.

The National Conservation Commission.—The idea of handling all natural resources with a view to their highest economic and public service in the long run was new in the United States. The great destruction of the American forests by fire and wasteful exploitation brought the question to the front, and it was Gifford Pinchot, then Chief U.S. Forester, who enlisted the interest of the President in this problem and the broader aspects of conservation of all natural resources. The first important step taken by President Roosevelt was to call a conference of governors of the states, which assembled at the White House in May 1908. This was the first time the governors of the states had met in conference. As a result of the meeting, a National Conservation Commission was appointed by the President, and 42 states appointed state commissions to study the problems of natural resources, to assemble data regarding their quantity and condition, and to formulate a policy for their conservation. In 1909 the National Conservation Commission made its report to Congress. In the same year President Roosevelt invited the governor-general of Canada, the governor of Newfoundland and the president of Mexico to appoint commissioners to discuss, with commissioners representing the United States, the principles of conservation as applied to the continent of North America.

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[1] *Annuaire de législation étrangère* of the *Société de legislation comparée,* Paris.

[2] *British and Foreign State Papers.*

[3] H. L. McBain and Lindsay Rogers, *The New Constitutions of Europe* (1922).

[4] *American Journal of International Law, Supplement.*

[5] Clunet, *Journal du droit international.*

[6] *Revue de droit international privé.*

[7] C. E. Martin and W. H. George, *Representative Modern Constitutions* (1923).

Legislative Action.—The movement inaugurated by President Roosevelt led to a radical change in public policy with reference to the resources owned and controlled by the Government. Not only were the National Forests and Parks placed on a permanent basis of protection and administration, but legislation was later enacted providing for the proper use under Federal control of the lands still under public ownership which contained coal, oil, phosphates or potash or which were valuable for water-power development. The movement led further to action ensuring the conservation of fisheries, game and bird life. The influence of the conservation movement has spread far beyond the handling of Federal properties. It has been the factor leading to action by many individual states. The greatest progress has been made by them in the protection of forests from fire, although many of the states are not yet doing what is needed to attain this end.

Since the World War there has been increasing appreciation of the significance of natural resources as a primary factor in the industrial strength and prosperity of nations. The older countries have by very force of economic conditions been obliged to give attention to the careful husbanding of their resources. Many of them have already been through the process of wasteful exploitation and have learned the lesson of conservation. The newer countries are still exploiting their forests without proper measures of replacement, still using wasteful methods of developing oil, natural gas and coal, still overstocking the cattle and sheep ranges, still using crude methods of agriculture, still failing to protect their natural supply of useful wild life.

Exhaustion of Resources.—In many countries, as the United States, which have been naturally endowed with an abundance of natural resources, the most accessible and most cheaply produced of the raw materials are rapidly being exhausted. Vast resources still remain, but the difficulties and cost of their exploitation are constantly mounting. This situation is of very real importance to those nations which have to look abroad for raw materials. The exhaustion of the accessible bodies of virgin softwood timber in North America will be felt by importing nations which will be obliged to pay higher and higher prices for this class of material or go without. Necessarily there will be in the near future a world shortage of softwood timber of the better grades (*see* FORESTRY). In the same way the wasting of oil, coal and minerals in one country becomes a matter of international consequence.

Government Action.—Since the War the conservation of natural resources has been given larger attention in many countries. Great Britain has embarked on an ambitious plan of reforestation and has already held two imperial conferences to discuss problems of timber supply and forestry as affecting the entire empire. The forthcoming World Forestry Congress at Rome is an event of very great significance in international conservation. Various countries are adopting a liberal policy of developing their water-power resources with a view to greater independence in power for manufacturing, transportation, heat and light, and already there has been an important water-power conference of an international character in London. The Institute of Agriculture at Rome is a vital force in the development of the resource of greatest importance in most countries, and its work is directly in the interest of conservation. Very gratifying also is the increased interest in the conservation of game and other wild life in those countries which heretofore have given little attention to the value of wild life. This is evidenced by the projects to conserve the big game in Africa and elsewhere, the progressive steps in many countries to stock the streams and lakes with fish, and the new interest in European countries to protect the native insectivorous birds which are so important to agriculture.

Agriculture.—In agriculture it is usually recognised that private ownership of farms is from every standpoint desirable. The objective is to develop a nation of small land proprietors. Government, however, gives assistance to farmers in a great variety of ways—through loans on liberal terms, through aid in co-operative buying and selling, through highway development, through research and education, through help in securing seed at reasonable cost, etc. On the other hand, it is generally recognised that the public should have control of as large an area of forest land as possible, particularly those areas in the mountains where the forests should be well handled in order to protect the watersheds and to conserve the sources of streams. Most countries early in their history adopted a policy of distributing their forest lands to private individuals, and what they now own represents the residue after this policy of distribution was stopped; and most of them are endeavouring to recover by purchase what they once owned and never should have disposed of. In France 34·5% of the forests are publicly owned; in Germany 52·7%; in Sweden 23·6%; in Great Britain 3·6%; in the United States 21 per cent.

Some countries are obliged to impose restrictions upon private owners to prevent public injury to watersheds and to insure productive use of the land. As a rule, also, the public co-operates with private owners in forestry. In some cases, as in Great Britain, a subsidy is actually given for reforestation. The United States has adopted a policy of retaining control of the publicly owned water-power sites, with a view to ensuring full development and use, and of preventing possible abuse through monopolies. The United States is retaining also in public control the coal, oil, phosphate, potash, sodium and certain other resources which are located on the public domain. How far the public will go in regulating the privately owned coal in the United States remains to be seen. The present system results in great wastage, at least in the bituminous fields; and the interruption of service to the public through strikes and other causes has resulted in serious public injury. Other countries, as Great Britain, are facing a similar problem (*see* COAL). Broadly speaking, government takes part in conservation as far as may be necessary to prevent public injury. Where such control is not necessary the aim is to secure the desired results by co-operation, education and research.

Scientific Research.—A factor of very great importance and significance in conservation is scientific research. Never in history has there been such a clear recognition of this fact; never has there been such liberal support of research by Federal and State Legislature, by the industries, by the great universities of the country and by contributions from benevolent foundations and private individuals. The foundations of conservation rest upon sound scientific research, and the work now being done holds out high promise for the future. The co-operation of nations in research in matters relating to natural resources is likely to lay the foundations for consideration of the problems of distribution of raw materials and many other problems of mutual economic interest. The countries which adopt an effective policy of conservation of their natural resources are strengthening the foundations of their industrial progress and national strength and they are rendering a service to the whole world. See D. Drake, *America Faces the Future*, chap. 23 (1922); also COAL; FORESTRY; OIL; etc. (H. S. G.)

NAURU or PLEASANT ISLAND, an atoll in the South Pacific, midway between the Marshall and Solomon Islands, with an area of about 5,400 acres. The population in 1923 was 110 Europeans, 603 Chinese and 1,296 Nauruans and other South Sea Islanders. The island is valuable on account of its phosphate deposits, which were worked before the War by a German company the rights of which were sequestrated during the War and vested in an English company. A German possession, placed under the German administration of New Guinea, the island surrendered to the Australian Navy in Sept. 1914, and was placed by the Supreme Council under British mandate on May 7 1919. Side by side with the mandate assigning the island to the British Empire arrangements were made for Australia and New Zealand to share with the United Kingdom in the administration and the products of the phosphate industry, which together were to supply the necessary funds for the exploitation of the island resources. The first administrator was to be appointed by the Australian Government. The Nauru Agreement Act was ratified by the three Parliaments concerned, and received the royal assent on Aug. 4 1920, subject to the provisions of Art. 22 of the Covenant of the League of Nations.

The Phosphate Deposits.—The deposits were discovered in 1900, and were worked by the Pacific Phosphate Co., which also worked the deposits on Ocean Islands. The deposits in these two islands were estimated at about 100,000,000 tons. The interests of the company in these two islands were bought out in 1919 by the British, Australian and New Zealand Govts. according to the terms of the Agreement at a cost of £3,500,000 subscribed in the proportions 42, 42 and 16. The deposits are worked by a phosphate commission of three members appointed by the governments and the output is divided in proportion to the investments of the parties. The pre-War output (1913) was 350,000 tons; the output in the first 10 years of the commission's management was over 360,000 tons a year. Though the islands do not compete in quantity with the enormous output of Northern Africa, 2,000,000 tons, or of Florida and other United States yields, 4,000,000 tons, the deposits are of exceptionally high quality

See the *Reports on the Administration of Nauru* issued by the Australian Govt.; particulars of the Mandate are given in the *Year Book of the Commonwealth of Australia* (1923).

NAVAL ACADEMY (*see* 27.736).—The expansion of the Naval Academy in the period 1910–25 began before the entry of America into the World War. In 1912 the six-year course (including two years at sea as midshipman) was discontinued, and midshipmen were commissioned ensigns immediately upon graduation from the academy. By Acts of Congress in 1916 and 1917, the number of annual appointments to the academy allowed to each senator, representative and delegate in Congress was increased from two to five; presidential appointments from 10 to 15, and appointments of qualified enlisted men from 15 to 100. Thus the total number of authorised appointments reached 3,126; and the number of midshipmen increased from 758 in 1910 to 1,230 in 1916 and in 1923 to about 2,500. The Naval Appropriation bill of 1924 provided for the pay of three midshipmen for each senator, representative and delegate in Congress in lieu of the five authorised by law. After 1920 physically qualified candidates were allowed to enter either by examination or by certificate from a recognised school. Commencing with 1925 candidates for admission by certificate were required to pass a brief examination in mathematics and English.

As a war measure, the class of 1917 was graduated in March of that year, and the class of 1918 in the following June. The course was reduced to three years; but by cutting down examination periods, holidays and reviews, and increasing the academic year to nine months, practically the same work was covered. In 1919 the four-year course was resumed. Between Sept. 1917 and Jan. 1919 five reserve officer classes, composed chiefly of former enlisted men who were graduates of technical schools, were quartered at the academy for periods of about three months' training. In this way 1,622 officers were added to the service as temporary ensigns.

The post-graduate school for officers, established in 191 in the former marine barracks near the Academy, was suspended during the World War, but reopened in 1919 with about 50 student-officers. These spend a half-year or year at the post-graduate school before continuing their studies in civilian technical institutions. In 1918 two wings accommodating 1,100 additional midshipmen were added to Bancroft Hall, an extension to the Marine Engineering building was completed in 1919 and a new Seamanship building in 1920. In 1919 the civilian corps of instructors was reorganised with increased pay and systematic promotion. The staff of the academy increased from 146 officers and civilian instructors in 1910 to nearly 300 in 1921 with a subsequent reduction to about 218 in 1925. In 1925 aviation training was included in the curriculum of the academy.

(L. McC. N.)

NAVIGATION (*see* 19.284) has progressed considerably in some departments since 1910, as the result of scientific discoveries and inventions. The advance made in the science of wireless telegraphy has been of considerable assistance to navigators; and it is probable that when directional wireless telegraphy is further developed, the methods whereby the position of a ship can be fixed by this means will come into more general use. Astronomical navigation, that is the fixing of the position of a ship by observations of the heavenly bodies, alters little, and during the period 1910–25 no new methods were introduced. The use of position lines, however, came into more general use, and calculations have been simplified by the compilation and publication of special tables for finding the zenith distance.

Old and New Methods Compared.—The accuracy of the position of a ship obtained from observations of heavenly bodies depends almost entirely on the accuracy of the time shown by the chronometers carried on board the ship. To enable the exact error of the chronometer to be obtained and the daily rate deduced, it was formerly necessary to obtain the accurate time at ports where a visual time signal was installed, or by a series of observations made with sextant and artificial horizon at places the longitude of which was accurately known. In those ships which are fitted with wireless telegraphy wireless time signals enable navigators to obtain accurate time daily in most parts of the world. At the end of 1925 there were over 50 stations working on various wave-lengths and situated in different countries for transmitting the time daily. The majority of these signals are sent by means of an automatic arrangement operated by the pendulum of a standard clock which is electrically connected with the transmitter. Greater reliance can be placed on the accuracy of signals transmitted in this manner than on those which are sent by hand. The signals are, in many cases, transmitted according to the international system; it is, however, desirable to refer to the relevant publications for details of procedure.

The term Greenwich mean time (G.M.T.) is considered to be the standard time of the meridian of Greenwich commencing at midnight and reckoned throughout the 24 hours. Both civil and astronomical time are, therefore, reckoned from midnight instead of from midnight and noon respectively. In the Nautical Almanac (abridged for the use of seamen) for 1925, and following years, the elements which prior to 1925 were given for every 2 hours of the astronomical day, which then began at noon, are given for every 2 hours of G.M.T. commencing at midnight.

To avoid confusion a system of time zones for time-keeping at sea is in force in the navies of most countries. This system has been adopted so that vessels at sea, within certain defined limits of longitude, shall keep the same time as that used on land. The world is longitudinally divided into 24 zones of 15° each, the centre of the system being the meridian of Greenwich. This centre division lies between the meridians of $7\frac{1}{2}^\circ$ East and $7\frac{1}{2}^\circ$ West and is known as the Zero Zone, or Zone 0; the zones lying to the eastward being numbered in sequence with a minus (–) prefix; those to the westward being similarly numbered with a plus (+) prefix. The limits of the zones on land are modified somewhat according to the geographical configuration of the country concerned. By this system the same time is kept whether on land or sea throughout each zone except during the periods of summer time.

Directional Wireless.—Determining the position of a ship at sea by means of directional wireless telegraphy (*see* WIRELESS) became of importance during the World War and is of inestimable value to ships in thick weather, when approaching the land. The bearing of the shore station from the ship can be obtained either by means of a directional receiving apparatus carried in the ship, or by the system whereby the bearing of the ship is determined by one or more directional receiving sets on shore; the result being communicated to the ship. Owing to the cost of the installation and the necessity for great skill on the part of the operator, the former method is seldom used. To enable the latter method to be of use to ships wireless direction finding (D/F) stations are established in many parts of the world. The procedure varies to some extent for different stations and in different countries. A ship requiring a bearing calls up the station or stations concerned and finally receives her bearing from one or more of these stations. The position of the ship can thus be determined.

The accuracy with which the bearing can be taken depends on several factors; bearings have sometimes been found to be unreliable at night and when the direction runs approximately parallel with the coast-line. Experiments have been made with a wireless beam which revolves in a similar manner to the beam from an ordinary lighthouse, the beam revolving through 360° at a constant rate in a definite time. Wireless waves travel along the arc of a Great circle, this being the shortest distance between any two points on the surface of the earth. It follows, therefore, that the true bearing of the ship from the station, or *vice-versa*, must be corrected for convergency to obtain the mean mercatorial bearing which is required if a chart on Mercator's projection is in use. A simple formula given in text-books enables this to be done. On a chart constructed on the gnomonic projection D/F bearings can be laid down without any correction for convergency, since Great circles appear as straight lines on this projection. If, however, a compass "rose" is used it is necessary to have one on the chart for each D/F station, to compensate for the angular alteration of the projection at that station.

Other Systems in Use.—Sound ranging (*see* SOUND RANGING) also enables the position of a ship to be determined with accuracy at a considerable distance from the land. The pressure wave generated by the detonation of a submerged explosive charge is received in hydrophones placed along a base line. This distant explosion affects the hydrophones in turn, and with the aid of time-recording instruments the position of the explosion can be deduced. To obtain accuracy at great distances it is necessary for two or more stations to co-operate. Although this method was used with success during the War no stations at the close of 1925 had been installed as aids to general navigation. It was not at that time considered probable that this method would come into common use, partly owing to the expense of installing and maintaining the stations, and partly on account of the necessity for ships to carry explosive depth charges. The combination of D/F and sound ranging would be of considerable value to navigation, especially when approaching the coast in thick weather.

The Leader system assists vessels to enter or leave harbour or to pass through narrow channels in thick weather. A submarine electric cable is laid along the channel, the shore end being connected to a station producing an alternating current. A simple and inexpensive receiving apparatus on board the ship enables the signals to be heard in telephones, or other form of amplifier, placed at or near the position from which the ship is usually conned. Two sets of coils are fitted, one on either side of the ship out of the water, and so arranged that they can each be connected up to the receiving telephones. By connecting first one set of coils and then the other, to the receiving telephones, it is an easy matter, when within range, to determine whether the cable is to port or starboard. With practice the distance of the cable can be estimated with comparative accuracy, because the signals become stronger as the cable is approached, the maximum intensity of the signals occurring when the ship is close to, but not vertically over, the cable.

The same cable enables one ship to enter and one to leave harbour at the same time, provided of course the navigable channel is of sufficient width; it is a simple matter for each ship to steer to keep the cable a reasonable distance away on her port side, so that the two ships pass safely port to port. If space permits it is possible to lay two cables, one for entering and one for leaving, the signals produced in each cable being distinctive by their note and character. This system, which proved of value during the War, had not come into general use in 1925, owing presumably to the somewhat heavy initial cost and the cost of maintenance. In channels where frequent dredging is necessary to maintain the depth the presence of a submarine cable would of course cause some inconvenience.

Echo sounding (*see* SOUNDING), by which the depth of water is obtained by the acoustic method, is of value in cases where the depth of water, or the speed of the ship, makes sounding by direct measurement unreliable. To obtain an accurate sounding by this method, complete and sensitive apparatus is required. The apparatus consists of two microphones, one of which registers the emission of a sonic signal and the other the arrival of the echo reflected by the bottom of the sea. A specially constructed time recorder capable of reading to one-thousandth part of a second is connected to the microphones and enables the depth to be deduced. Sound travels through sea water at an average velocity of 4,900 ft. per second. Consequently, by the acoustic method, very great depths can be reached in a brief space of time and the depths normally required for navigational purposes will be reached in a small fraction of a second.

The Gyro compass (*see* GYROSCOPES) is used in many ships. Owing to the masses of iron and steel used in the construction of modern ships and the presence of dynamos and other electrical machines, the position in which to place a magnetic compass in a ship requires careful consideration, to avoid undue loss of directive force and the consequent large errors which would require correction. The gyro compass does not depend for its action on the earth's magnetic field, but on gravitation and the earth's diurnal rotation round its axis. A suitable position below is selected for the master-gyro; and repeater dials, connected with the master, can be placed in any desired position in the ship. These repeaters need not be placed with the dials horizontal, they can be fixed vertically or in any other desired position. The introduction of the gyro compass has made automatic steering possible. An efficient automatic steering apparatus will keep a ship on a fixed course with greater regularity than can be accomplished by a skilled helmsman. For the navigation of the air *see* AIR NAVIGATION.

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(J. E. T. H.)

NAVY (*see* 19.299).—The most constant factor in naval affairs in modern times has been the predominance of the British Navy in relation to the forces of other maritime countries, as they have successively risen and declined. But in the evolution of national policies a counterpoise has always existed, with the result that the British Navy has seldom been, in fact, supreme. In the closing years of the 19th century the balance of power was maintained by France and Russia, while, in the Pacific, the United States and Japan, which were then emerging as naval Powers of the first rank, supplied an additional check on British predominance.

I. GREAT BRITAIN AND GERMANY

German Navy Acts.—These were the conditions which existed when the first German Navy Act was passed in 1898, to be replaced by a more ambitious measure two years later, which became known as "the Navy Act." This measure introduced a new factor in the situation. It provided for the creation of a fleet of 20 battleships, supported by eight coast defence ships, 12 large cruisers and 29 small cruisers, with a second line of older ships. Whereas British policy had always been based on the maintenance of exiguous military forces, but a strong fleet on the two-power standard, Germany already possessed an army, if not larger, at least reputed to be more formidable and efficient, than that of any other country. France and Russia, with frontiers running parallel with those of Germany, were already making the maximum effort their finances and man-power permitted to neutralise the strength of Germany as a military Power, Austria-Hungary, with not inconsiderable military resources, being Germany's "brilliant second." Neither France nor Russia, though each was vitally concerned to keep open its ocean communications and to defend its territories from invasion by sea, was in a position to make an adequate rejoinder to the menace which the German Navy Act suggested; Japan was rendered increasingly nervous as to her position in the Far East, in view of German political and economic activity, while the United States was anxious to avoid any embarrassment in the Pacific, in order that she might watch events in Europe (*see* GERMANY: *Naval Policy*).

Effects of German Expansion.—In these circumstances the whole naval situation gradually underwent a complete change. A widespread feeling of nervousness led to "understandings," or treaties, by which each country which considered itself threatened by the growing naval strength of Germany re-insured its interests. An alliance was concluded between Great Britain and Japan in Jan. 1902 which was strengthened three years later; Great Britain and France began to draw closer together towards the close of 1903 and eventually these two countries, in association with Russia, formed "a diplomatic group," which led to discussions between the several naval staffs with a view to the possibility of common action by sea and eventually also by land; and the United States and Japan signed a treaty pledging each country to respect the other's territorial interests.

It thus came about that as amendments to the Navy Act were carried in the Reichstag in subsequent years, all of them authorising further expansions of the German Navy than had hitherto been provided for, as well as of its resources for repair (of which the creation of the dockyard at Wilhelmshaven, the enlargement of the Kiel Canal and the development of Krupps's establishments at Essen, were the most notable), the tendency was for the other naval Powers to pool, in some degree, their naval interests. This movement reacted powerfully on the British Navy. A concentration of forces in the North Sea was begun at the expense of the squadrons in the Mediterranean, the Pacific and other distant seas, and British shipbuilding policy was adapted to the new situation which was rapidly developing; while France withdrew most of her ships from her Channel ports in order to increase her strength in the Mediterranean; Russia at the same time improved her position in the Baltic.

Coming of the Dreadnought.—By 1910 the rivalry between the navies of Great Britain and Germany had become the dominating factor not only to those two countries, but to every other country. Since Germany, though not neglecting the building of cruisers, was concentrating her attention on the creation of a great battle fleet, obviously, from the limited radius of action of the vessels, intended for service in the North Sea, the British Admiralty had also for some years turned its attention increasingly to the perfection of battleship design. Germany was rising to a condition of parity in modern ships of the line in 1905, when, on Lord Fisher's initiative, the all-big-gun ship—commonly known as the "Dreadnought"—was evolved, being of two types—the battleship and the battle cruiser. Germany, her policy thrown into confusion, felt herself compelled to follow the new policy, but as dreadnoughts were of greater beam than the ships of about 14,000 tons displacement which she had hitherto been building, she became involved in a complete reconstruction of the Kiel Canal, entailing an expenditure of £11,000,000, while further large sums had to be spent on deepening her shallow harbours.

The German naval authorities had assumed that the British forces would continue to be dispersed over the seas and oceans of the world. When that assumption proved unfounded, the German plans for naval expansion were repeatedly varied; the final development taking place in 1912. This amendment of the German Navy Act, providing for a large fleet always in commission, was interpreted by the British Govt. as a direct challenge to British naval power. Mr. Winston Churchill, the First Lord of the Admiralty, made a speech which revealed the anxiety with which the British Cabinet, reflecting public opinion, regarded the situation. He stated that the two-power standard no longer accorded with the conditions at sea which were rapidly developing and that in future the Admiralty intended "to develop a 60% superiority in vessels of the 'Dreadnought' type over the Germany Navy on the basis of the existing Fleet Law," with "other and higher standards for the smaller vessels." He also let it be known that for every additional keel laid down in Germany, over and above those already provided for, two would be placed in position in British yards. It was revealed later on that the British naval authorities, having already discarded the 12-in. gun, which was mounted in the original "Dreadnought," in favour of the 13·5-in., had decided to introduce a new 15-in. gun, firing a projectile twice as heavy as the 12-in. weapon. Germany, which had for many years been satisfied with the 11-in. gun, had in recent designs provided for nothing more powerful than the 12-inch.

These and other developments revealed the intensity with which the contest between the two countries was being pursued. Informal conversations in Berlin with a view to a "naval holiday" had proved fruitless. In the succeeding two years there was consequently no slackening of activities, either in the dockyards or at sea, in anticipation of a war, which Lord Fisher, studying the progress of the enlargement of the Kiel Canal, prophesied would not occur at any rate until 1914. On that calculation, as was subsequently revealed, British plans of naval development rested. The following statement shows the number of ships built and projected from the introduction of the dreadnought design.

TABLE I.

Year		Capital Ships	Protected Cruisers	Destroyers
1905–6 . .	Great Britain	4	. .	18
	Germany	. .	. .	. .
1906–7 .	Great Britain	3	. .	14
	Germany	2	2[1]	12
1907–8 .	Great Britain	3	1	17
	Germany	3	2	12
1908–9 .	Great Britain	2	6	16
	Germany	4	2	12
1909–10 .	Great Britain	8	6	20
	Germany	4	2	12
1910–1 .	Great Britain	5	5	20
	Germany	4	2	12
1911–2 .	Great Britain	5	4	20
	Germany	4	2	12
1912–3 .	Great Britain	4	8	20
	Germany	2	2	12
1913–4 .	Great Britain	5	8	16
	Germany	3	2	12
1914–5 .	Great Britain	4	. .[2]	. .[2]
	Germany	2	2	12
1915–6 .	Great Britain	4	. .[2]	. .[2]
	Germany	2	2	12
1916–7 .	Great Britain	4	. .[2]	. .[2]
	Germany	3	2	12
1917–8 .	Great Britain	4	. .[2]	. .[2]
	Germany	2	2	12

[1] Germany also laid down an armoured cruiser—the "Blücher."

[2] No provision had been made in the programme for protected cruisers or destroyers.

II. THE NAVIES OF OTHER COUNTRIES

During the years when the two naval protagonists were strengthening their fleets in feverish haste, the older navies of Europe suffered a decline of relative strength which in the circumstances was inevitable. France, Italy and Russia, even if they had had the will to do so, could not, owing to the necessities of the military situation which occupied the minds of their Governments, keep pace with the rapid and costly developments which were taking place on either side of the North Sea.

France.—From the time when, in 1908, Adml. Germinet left the Ministry of Marine, the naval policy of France lacked definite purpose and continuity. There were frequent changes of ministers, at the rate of about one a year, and each one, being a civilian, became the instrument of one or other of the rival schools of naval thought, while in the Chambers, senators and deputies increasingly lost confidence in the administration of the naval service, both ashore and afloat, with the result that supplies demanded by the expert advisers were repeatedly denied. Gradually the naval policy of the country became more and more based on defensive ideas. The *guerre de course* gained an ascendancy over the minds of those concerned with naval defence, with the result that the offensive ideal of warfare no longer dominated policy, and attention was concentrated on small craft.

The French Navy, which had ranked for many years as second only in strength to that of Great Britain, was consequently surpassed in strength, first by Germany, and then by the United States, although sums had been voted for its support (1896–1911) which were 50% larger than the amounts spent on the German fleet. In 1909, as the result of an inquiry carried out by a Parliamentary Committee, an organic law was at last adopted for the expansion of the French naval forces. But it came too late to change the situation, and on the outbreak of the World War the navy, though inspired by a new purpose, was still suffering from lack of continuity of policy, and in consequence all new construction was frequently delayed by repeated changes of design.

Russia.—Simultaneously with the decline of French naval prestige, the Russian fleet also suffered. The recently constituted Duma, established in 1905, refused to approve of measures for strengthening the navy on the ground that the Admiralty and all the naval departments urgently required reorganising. When a building scheme was at last adopted, the decision that new vessels, instead of being built in foreign yards as had hitherto been the custom, should be constructed in Russia, and as far as possible of Russian materials, proved a further handicap to progress. In these circumstances, the Russian fleet, which had sustained heavy material losses in the war with Japan, failed to recover either its prestige or its material strength. Though naval expenditure was maintained at a high level, the Russian fleet continued to decline owing largely to the failure to carry out reforms in the naval administration, which were recognised as being essential if a higher standard of efficiency was to be attained.

Italy.—In contrast with the misfortunes which sapped the strength of the allied fleets of France and Russia, the Italian naval authorities pursued a consistent and methodical policy. The increased attention which the Austro-Hungarian Govt., on the urgent representations of Germany, was devoting to naval affairs, was responsible, in no slight degree, for the energy displayed in Italy, which had ceased to evince any enthusiasm for the Triple Alliance, of which she was nominally a member.

Navies in 1914.—In these circumstances the balance of naval power in European waters underwent a dramatic change as the Anglo-German contest for naval power pursued its course, larger and larger sums being devoted each year by these two countries to ship construction, the maintenance of bigger fleets at sea, and manoeuvres for the training of officers and men. Whereas British naval expenditure had been £26,000,000 in 1900, in the spring of 1914 the House of Commons voted nearly £44,500,000. The outlay in Germany over the same period rose from £8,000,000 to over £23,000,000. A new standard of naval efficiency was set up in these two opposing fleets, and the deficiencies of the French and Russian fleets became more conspicuous in contrast, while Italy, watching with growing suspicion the course of naval events in the Austro-Hungarian Empire, occupied an ill-defined position between the two groups of naval Powers. In 1914 the strength of the fleets in Europe was as follows, the letters G.B. representing Great Britain, G. Germany, A.H. Austria-Hungary, I. Italy, F. France and R. Russia. The abbreviation Bt. indicates "built"; the abbreviation Bg. indicates "building."

TABLE II.

	G.B.		G.		A.H.		I.		F.		R.	
	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.	Bt.	Bg.
Battleships:—												
Modern	21	13	13	7	2	2	3	4	8	10	2	7
Battle Cruisers	9	1	4	4	..	..	..	..	..	..	..	4
Older Battleships	38	..	20	..	9	..	8	..	13	..	6	..
Total	68	14	37	11	11	2	11	4	21	10	8	11
Cruisers:—												
1st Class	38	..	9	..	1	..	9	..	18	..	6	..
Light	72	17	39	6	6	3	7	4	12	..	8	8
Total	110	17	48	6	7	3	16	4	30	..	14	8
Destroyers	218	20	142	10	19	..	36	10	83	4	105	36
Torpedo Boats:— 1st and 2nd Class	70	..	47	..	58	27	70	5	153	..	25	..
Submarines	76	20	27	12	10	4	18	2	70	23	25	18

A leading naval authority—Count Reventlow—who was in close touch with the naval authorities in Berlin, afterwards stated that when the War broke over Europe in 1914 the German fleet was not ready. "In 1906," he stated, "came the dreadnought revolution in shipbuilding which quickly rendered worthless all ships built before that time (pre-dreadnoughts) and compelled tremendous enlargements of wharves, harbours and canals, gigantic extensions of organisations, etc. The work of completing the German fleet would have extended far beyond the year 1920 under these conditions." British policy in this respect, as well as in regard to the political "understandings" with France, Russia and Japan, which enabled the main British squadrons to be concentrated in the North Sea, completely upset all the calculations on which German naval policy had been based in the early years of the 19th century.

Eastern Waters.—During these years naval conditions in the Pacific and adjacent waters also underwent marked changes. Great Britain and the other European Powers reduced their forces to the lowest level compatible with the naval plans of Germany. While neglecting the Mediterranean and Atlantic, these plans embraced a powerful cruiser squadron in China waters, which, in view of the high standard which it achieved in gunnery, became a considerable factor in the naval situation in the Far East. Public sentiment in Japan and the United States having been somewhat reassured by the treaty of non-interference with each other's territorial interests, these two countries continued to increase their naval forces, but the movement was marked by no such political unrest as was being exhibited on the two sides of the North Sea.

The Japanese Govt., which had placed reliance upon the Anglo-Japanese alliance for the preservation of the *status quo* in the Pacific, slowly adjusted itself to the new conditions which British preoccupation in the North Sea had made inevitable; while the United States, occupying a position of complete detachment from the troubles which were coming to a head in Europe, began to occupy a position of some importance at sea. The world cruise of the American fleet, which had begun at the end of 1907 and lasted 14 months, had given the American people a new conception of their concern with naval affairs. Rear-Adml. Sperry, when his ships had made their furrow of 45,000 m.

in the seas and oceans of the world, had stated that "this cruise marks an epoch in our naval annals, for the fleet has found itself—being welded into a unity." Events in later years were to supply ample confirmation of this statement.

III. THE WORLD WAR AND AFTER

During the years of the World War, both the United States and Japan embarked upon schemes of naval expansion.

United States.—In 1916 Congress adopted an Act "for the purpose of further increasing the naval establishment of the United States," which, in its methodical character, somewhat resembled the successive German Navy Acts. It provided for the construction of the following vessels: 10 first-class battleships, six battle cruisers, 10 scout cruisers, 50 torpedo boat destroyers, nine fleet submarines, 58 coastal submarines, three fuel ships, two destroyer tenders, two ammunition ships, two gunboats, a repair ship, a transport, a hospital ship and a fleet submarine tender. Provision was also made for improving the Navy Yards at Puget Sound, Philadelphia, Norfolk, New York, Boston, Portsmouth, Charlestown and New Orleans, the work to be completed within five years. This Act provided for nothing less than the construction of a new American fleet and foreshadowed an expenditure far larger than any country had hitherto contemplated. It also contained clauses which attracted little attention at the time outside the borders of the United States, though the words pointed to ambitious hopes for the limitation of naval armaments.

> It is hereby declared to be the policy of the United States to adjust and settle its international disputes through mediation or arbitration, to the end that war may be honourably avoided. It looks with apprehension and disfavour upon a general increase of armament throughout the world, but it realises that no single nation can disarm, and that without a common agreement upon the subject every considerable Power must maintain a relative standing in military strength.
>
> In view of the premises, the President is authorised and requested to invite, at an appropriate time, not later than the close of the War in Europe, all the great Governments of the world to send representatives to a conference which shall be charged with the duty of formulating a plan for a court of arbitration or other tribunal to which disputed questions between nations shall be referred for adjudication and peaceful settlement, and to consider the question of disarmament and submit their recommendations to their respective Governments for approval.

The Act also laid down that, if a conference succeeded in attaining the purposes for which it had been called, the constructive plans might be varied in accordance with any engagement into which the United States had entered. The War in Europe was to continue for upwards of two years after the passing of this measure, and consequently keels were laid in American shipyards in accordance with the terms of the Act, and the United States was definitely committed to this great programme of naval expansion before the Treaty of Versailles had been signed.

Japan.—The course of events at sea confirmed the importance of sea-power to an island state. Japan had for several years entertained the project of building 16 capital ships, eight battleships and eight battle cruisers, none of which should at any time exceed eight years in age. On the assumption that such vessels possessed an effective life of about 24 years, Japan contemplated having at her disposal, in time, 16 capital ships of the latest design and constructions and 16 bordering upon obsolescence, with a similar number occupying a position midway between these two groups. The plan embraced the expansion of the dockyards and other establishments ashore, as well as provision of the necessary trained personnel. With the approval of the Imperial Diet, this programme of expansion was taken in hand in 1916. At that time Japan was spending £15,000,000 annually on her navy; it was estimated that the votes might rise to nearly £60,000,000 by 1920, although the Government declared that whatever other nations might do Japan would not exceed the eight-eight programme, which it was proposed to carry out gradually as the financial position of the country might render possible.

A New Rivalry.—In place of the rivalries in naval armaments which had persisted in Europe for so many years, a new race for naval power had begun between the United States and Japan while the World War was still in progress. Even after the United States had intervened in the struggle, the activities in the government and private yards continued with unabated energy, while, on the other side of the Pacific, the Japanese people settled down to the task of building up their fleet to the eight-eight standard, with all that was implied in cruisers, destroyers, submarines and other auxiliaries. Not only was the American programme really more ambitious than that of Japan, but the United States possessed within her own borders practically all the raw material necessary for the creation of a fleet, while Japan was confronted with the problem of obtaining from overseas no mean proportion of the steel and other material which she needed. On the other hand, the Japanese, in virtue of their conscriptive law, were in a position to obtain all the officers and men which the larger fleet would require, drawing freely upon a seafaring population, but the United States was faced with the problem of competing in the labour market for recruits, which experience had proved were not always forthcoming in adequate numbers.

Post-War Situation in Europe.—When the World War came to an end, the whole naval situation in Europe had undergone a complete change. The German Navy, by the surrender of all its modern units, had been reduced to the status of a third-class sea Power, and denied the possession of either submarines or aircraft of combatant types. The Russian fleet, after the revolutions, had, to all intents and purposes, ceased to be of any importance. France and Italy had been so preoccupied in supporting their armies, tasks which necessitated the concentration of all their industrial activities on the provision of military munitions, that neither country had had either the man-power or the material available for the construction of new ships. The British fleet, which had borne the main burden of the War on the Allied side, had been forced by the compelling circumstances of the naval situation to pursue a policy of expansion embracing capital ships, cruisers and every type of auxiliary craft. It emerged from the struggle, in spite of the heavy losses which had been sustained, as the only first-class naval force in European waters.

Limitation of Armaments.—When President Harding in the year following the signing of the Peace of Versailles issued an invitation to the leading naval Powers to a conference at Washington to discuss the possibility of limiting armaments, the United States was already potentially the leading naval Power of the world. All the battleships, battle cruisers and scout cruisers of the 1916 programme, as well as no mean proportion of the auxiliaries, including five destroyers, five fleet submarines, and 37 smaller submarines, were under construction. The British naval authorities had inherited from the War a great fleet, but, except for the battle cruiser "Hood," none of the battleships embodied any of the lessons enforced by the struggle at sea, while the cruisers had for the most part been designed for service in the North Sea, and, owing to their limited radius of action, were unsuited for ocean work. In these circumstances the British Admiralty, urged to economy, had entered upon a vigorous scrapping policy, one firm alone buying 113 war-ships, on the understanding that they should be broken up. At the same time provision was made in 1920 for laying down four new battleships, to displace 45,000 tons, as well as a submarine and a minelayer. Japan had in hand three of her new battleships, as well as two battle-cruisers, eight cruisers, 10 destroyers and 15 submarines.

A new phase in the competition in naval armaments had begun, involving the United States, Great Britain and Japan in vast expenditure. The Washington Conference (*q.v.*) arrested this movement, so far as the principal battle fleets of the world were concerned. The United States Govt. suggested that all the battleships then under construction should be forthwith scrapped. As the result of discussion, the American scheme was slightly varied. Japan made good her claim to retain two post-Jutland ships of the latest design, and the same liberty was accorded to the United States, while freedom was accorded the British naval authorities to lay down two new capital ships of 35,000 tons, which on completion should replace four older vessels. It was stipulated that no other capital ships should be laid down before 1931, and that gradually the British and American battle fleets should be brought to a condition of parity with a standard of displacement of 525,000 tons, Japan being allotted 315,000 tons and France and Italy 175,000 tons, a balance of power calculated on the same proportions applying to aircraft carriers. The treaty also provided that no capital ships built in replacement of older vessels from 1931 onwards should exceed 35,000 tons or carry a gun with a calibre in excess of 16 inches. While no restrictions were placed on the number of cruisers which might be built, it was also stipulated that no vessel of this type should exceed 10,000 tons displacement or mount any weapon of larger calibre than eight inches. No limits were placed, on the other hand, on the building of destroyers or submarines.

Strength of Navies.—In these circumstances the Naval Treaty was signed at Washington and was subsequently implemented by the Governments of the United States, Great Britain and the British Dominions, Japan, France and Italy, the French Govt. making sundry reservations. In subsequent years great activity developed in the construction of cruisers, destroyers and submarines in all the shipyards of the world. At the beginning of 1926 the strengths of the fleets in completed ships were as follows (vessels building or projected are shown in parenthesis), the letters B.E. representing the British Empire, U.S. the United States, J. Japan, F. France and I. Italy:—

TABLE III. *Ships Built and Building*

	B.E.	U.S.	J.	F.	I.
Battleships .	18 (2)	18	6	9	7
Battle Cruisers	4	..	4	..	..
Cruisers . .	47 (15)	32 (8)	31 (8)	15 (9)	14 (5)
Cruiser Minelayers . ..	.. (1)	..	3	.. (2)	..
Armoured Coast Defence Vessels and Monitors . .	3	1	..	..	..
Aircraft Carriers	8 (1)	1 (2)	2 (2)	.. (2)	1
Flotilla Leaders	17	..	..	2 (20)	11
Destroyers .	172 (2)	309 (12)	103 (24)	54 (36)	52 (24)
Torpedo Boats	..	..	..	..	54
Submarines .	56 (10)	120 (8)	53 (26)	45 (58)	42 (20)
Sloops . .	34	...	..	8	..
Coastal Motor Boats . .	6	..	2	2	12
Gunboats and Despatch Vessels . .	.. (4)	12	6	49	12
River Gunboats	18	6 (6)	8	6	2
Minesweepers .	61	44	4 (2)	29	40 (6)

All the naval Powers were maintaining in 1926 a large measure of secrecy as to the designs of the cruisers, destroyers and submarines which were being built, and everything pointed to a continuation of an active policy of construction. In the summer of 1925 the British Admiralty announced details of a five-year shipbuilding programme (1925–30) embracing nine cruisers of 10,000 tons displacement, seven cruisers of smaller size, 27 destroyers, 24 submarines, five gunboats, four motor launches, two submarine depôt ships, a net-layer and a repair ship, as well as a large floating dock to be stationed at Singapore, on the development of which work had been begun the previous year.

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(A. Hu.*)

NAVY DEPARTMENT (*see* 1.201).—Since 1910 the U.S. Navy Department has been reorganised to some extent in accordance with requirements found necessary to meet fully the demands of the World War, and likewise as a result of lessons learned during that war. On Aug. 29 1916, closely following the U.S. Govt.'s ultimatum of April 18 to the Imperial German Govt. with regard to unrestricted submarine warfare, an Act of Congress established a naval flying corps, a naval reserve force, reorganised the navy on a basis of immediate preparation for war, and authorised the construction of 10 battleships, 6 battle cruisers, 10 scout cruisers, 50 destroyers, 9 fleet submarines, 58 coast submarines, 2 gunboats and 12 auxiliary ships.

The naval consulting board, composed of leading scientists and inventors, was provided for on the same date. Not directly concerned with the reorganisation of the Navy Dept., but affecting the mobilisation of U.S. military power, was the authorisation by Congress, also on Aug. 29, of the Council for National Defence, with the secretaries of War, Navy, Interior, Agriculture, Commerce and Labour as members, for the purpose of correlating the factors of preparedness for war.

The Navy After the War.—Since the World War, the U.S. Navy has been reduced to a peacetime basis. Its limitation as to strength was prescribed in certain respects by the Washington Treaty for the limitation of naval armament. The Washington Treaty was ratified by the five great naval Powers concerned on Aug. 17 1923, following a conference of representatives of the United States, the British Empire, Japan, France and Italy, which was convened Nov. 12 1921 at the invitation of the American President in Washington, and which ended on Feb. 6 1922, after the representatives had signed the terms of the treaty. The efforts of the representatives of the United States were directed towards the limitation of total tonnage in each type of combatant naval craft.

The treaty as finally ratified limited the total tonnage of capital ships (battleships and battle cruisers) and large aircraft carriers; restricted the individual tonnage displacement of warships; fixed a limit to the size of naval guns; prohibited reconstruction of capital ships and aircraft carriers except as provided by treaty; fixed the *status quo* with regard to fortifications and naval bases of certain outlying possessions of the United States, the British Empire and Japan; specified the capital ships that each of the five Powers could retain; provided a schedule of replacement of capital ships; and indicated the capital ships which were to be scrapped. (*See* WASHINGTON, TREATY OF.)

Plans of Navy Department.—Certain other changes subsequent to the Armistice in 1918 affected the plans and organisation of the Navy Department. On May 28 1919 the General Board of the Navy recommended that the 1916 building programme for new ships be completed. This recommendation was carried into effect until the restrictions imposed upon new construction by the Washington Treaty were ratified. The joint army and navy board, established July 17 1903, was reorganised to some extent in July 1919. This board, composed of three naval and three army officers, confers upon and reaches conclusions regarding problems in all matters calling for the co-operation of the two services, and has direct power of approval of reports submitted by the joint planning committee, the joint aeronautical board and the joint munitions board. The bureau of aeronautics was added to the Navy Dept. by authorisation of Congress, July 12 1921. It is of interest here to note that the national advisory committee for aeronautics, which supervises and directs the scientific study of aviation in the United States, was established through the Naval Appropriation Act of March 3 1915. The latest contemplated change of any importance in the reorganisation of the Navy Dept. is the addition of an assistant secretary for naval aviation.

Organisation.—The U.S. Navy in 1926 may be considered to consist of the following: the Navy Dept. at Washington, the U.S. fleet and detached naval forces, and the naval shore establishment. The Navy Dept. at Washington is the directing agency, operated, under the direction of the President of the United States, by the Secretary of the Navy. In deciding upon details of naval policy, the Secretary is advised by the assistant secretary of the navy, the joint army and navy board, the chief of naval operations, the general board of the navy, the major-general commandant of the marine corps and by the chiefs of the following technical bureaux: navigation (personnel), engineering, ordnance, construction and repair, aeronautics, supplies and accounts, yards and docks, medicine and surgery. The judge-advocate-general furnishes legal advice. The chief of naval operations is by virtue of his position the senior admiral of the navy (*see* STAFF, NAVAL).

The office of naval operations, which was established under Act of Congress March 3 1915, operates the fleet and detached naval forces, develops and maintains the plans for their use in war, and in general co-ordinates under the direction of the Secretary the work of the eight technical bureaux in the development of the navy. The general board makes recommendations on important questions of naval policy. The marine corps is operated by its major-general commandant. The assistant secretary supervises the preparation of the annual estimates, administers the navy yards and performs such other duties as may be assigned to him by the Secretary of the Navy. During the absence of the Secretary of the Navy from Washington, the assistant secretary becomes the acting Secretary, and in the event of the assistant secretary's absence, the chief of naval operations becomes the acting Secretary of the Navy.

Divisions of the Navy.—The fleet and detached naval forces, other than those assigned to naval districts, are organised as follows: the U.S. fleet, the naval transportation service, the Asiatic fleet, naval forces in European waters and the special service squadron. The U.S. fleet comprises the greater part of the naval forces based on home ports. This fleet is divided into four parts—the scouting fleet in the Atlantic, the battle fleet in the Pacific, the control force in the Atlantic and the fleet base force in the Pacific.

The duties of the U.S. fleet are confined to training for the development of the fleet to its maximum strength as a fighting force. The naval transportation service carries the fuel and other supplies from supply ports to the theatre of operations, where its cargoes are turned over for use or distribution to the fleet base force. The Asiatic fleet is composed of a cruiser acting as flagship, some destroyers, submarines, gunboats and a small air force; this fleet protects U.S. interests in the Far East. The naval forces in European waters protect American interests in Europe and the Near East. The special service squadron protects U.S. interests in the Central and South American republics.

The third component part of the navy, the naval shore establishment, consists of 14 naval districts, each of which has a commandant, who, as a representative of the Navy Dept., has general supervision over all naval activities in his district. These 14 naval districts include in their territory the United States proper and its outlying possessions. Each district has a navy yard, naval base or naval station, where the commandant has his headquarters and staff. These yards and stations carry out such important repairs and alterations to ships as are not performed by the forces afloat. (C. D. Wi.)

NEAL, DAVID DALHOFF (1838–1915), American painter (*see* 19.320), died in Munich, Germany, May 2 1915.

NEBRASKA (*see* 19.323) had in 1925 a population of 1,355,371 (U.S. Census Bureau estimate); in 1920, 1,296,372; in 1910, 1,192,214. The increase from 1900–10 was 11·8%; from 1910–20 8·7%. In the decade 1910–20 the foreign-born whites decreased from 176,662 to 149,652. In 1920 the urban population (in places of 2,500 or more) was 405,306 or 31·3% of the whole; in 1910 310,852, or 26·1%. The rural population in 1920 was 891,066, or 68·7%; in 1910 881,362, or 73·9%. The drift of population to the larger cities has continued strongly during the period 1920–5. The five cities having in 1920 a population over 10,000 are given in table in next column.

In the decade 1910–20, 33 out of 93 counties showed a decrease in total population, and 43 (chiefly the older counties) showed a decrease in rural population. The irrigated districts in the Platte valley and the cities of 10,000 or more have absorbed practically all the increase in population from 1910–25.

	1920	1910	Increase %
Omaha	191,601	124,096	54·4
Lincoln	54,948	43,973	25·0
Grand Island	13,947	10,326	35·1
Hastings	11,647	9,338	24·7
North Platte	10,466	4,793	118·4

Agriculture.—The number of farms in 1925 was 127,731; 67,764 were operated by owners, 669 by managers, and 59,298 or 46·4% by tenants. The farm acreage was 42,024,129, of which there were 23,109,624 ac. of improved land. The average acreage per farm was 329. The value of farm land and buildings was $2,523,306,303 in 1925 as compared with $3,712,107,760 in 1920; the average per farm was $19,755 in 1925, $29,836 in 1920. In 1920 Nebraska ranked sixth among the States in area of cultivated lands. It was first in production of hay, second in winter wheat, third in corn (maize), third in combined production of wheat, oats and maize. About 1,000,000 ac. were in woodland, of which half or more had been planted by settlers. Production of principal crops for the years 1920 and 1925 is shown in the following table:—

	1925		1920	
	Ac.	Bu.	Ac.	Bu.
Maize	9,100,000	236,600,000	6,699,450	160,391,314
Wheat	2,676,000	34,150,000	4,429,156	57,843,598
Oats	2,699,000	73,953,000	2,029,740	59,819,545
Barley	233,000	5,662,000	211,242	4,405,323
Rye	205,000	2,552,000	359,926	3,259,390
	(tons)	(tons)	(tons)	(tons)
Hay	4,648,000	5,867,000	4,798,363	5,307,702
Sugar beets	61,000	816,000	54,486	554,646

Domestic animals on farms in 1925, 1920 and 1910 included the following:—

	1925	1920	1910	Jan. 1 1925
Horses	863,152	961,396	971,279	857,000
Mules	119,874	99,847	79,652	116,000
Cattle	3,314,342	3,154,265	2,567,392	3,301,000
Swine	4,279,824	3,435,690	3,435,724	4,545,000
Sheep	. .	. .	. .	726,000

Industries.—Slaughtering and meat-packing, the chief manufacturing industry, in 1919 employed 10,122 wage-earners in 16 establishments, and the products were valued at $303,849,000. Wage-earners employed in all industries numbered 36,521, as compared with 24,336 in 1909.

Minerals.—Of the pumice produced in the United States 97% is mined in Nebraska. Production of limestone, sand and gravel for cement industries and road building increased rapidly. Potash is found in alkali lakes in the sandhill region of western Nebraska. The World War shut out importation from Germany, and commercial potash rose to 10 times its former price, with the result that a new industry sprang up, but died out after the War, when importation from Europe was resumed.

Finance.—By Act of the Legislature (1921), assessment of property was changed from one-fifth to full value. In 1925 the assessed value was $3,156,307,123. Total levies for all State purposes (1925) were 2·35 mills. Total State and local taxes for all purposes (1924) were $53,447,375, about $41 *per capita.* There is no State debt. The total debt of all sub-divisions of the State on Jan. 1 1926 was $107,000,000. The revenue in 1924 was $12,498,432 and the disbursements $12,890,046.

Roads and Transportation.—The amount expended on roads from 1920 to 1925 was approximately $8,000,000. In 1925 there were 5,960 m. State roads and 3,514 m. improved State roads. In 1925 farm-owned motor-cars were 122,910, or 40% of the whole number in the State, 301,716; farm-owned motor-trucks were 16,112, or 43·5% of the whole, 37,003. One of the great changes since 1920 has been the entrance of motor-buses and motor-trucks into rivalry with railways. This began actively in 1923 and has rapidly expanded, and railways have since noted a large falling off in local business. In 1924 there were 6,441 m. of steam and 215 m. of electrical railway track.

Education.—Nebraska is second in literacy among the States. The 1920 U.S. census found 13,874 persons over 10 unable to write in any language. The Nebraska law requires attendance of all children between seven and 16. In 1924 there were 7,120 schools, with 327,417 enrolled pupils; teachers, 14,284; total school expenditure, $32,508,108. Foreign languages in the schools became a political issue as a result of the World War. About 200,000 Nebraskans were German-born or children of parents born in Germany. Through the efforts of the German-American Alliance, the Mockett law was enacted in 1913, providing for teaching the German language in the common schools upon petition of school patrons. After the declaration of war, the Mockett law was repealed, and the Siman law passed forbidding the use of any foreign language as a medium of instruction. On appeal to the U.S. Supreme Court, the Siman law was held unconstitutional.

History.—The chief political issues were the introduction of prohibition, woman suffrage, initiative and referendum and the reconstruction of the State government, all of which were adopted in 1920. The Legislatures of 1919–25 granted $9,000,000 for the construction of a new State Capitol. The governors since 1910 were Chester H. Aldrich (Rep.), 1911–3; John H. Morehead (Dem.), 1913–7; Keith Neville (Dem.), 1917–9; Samuel R. McKelvie (Rep.), 1919–23; Charles W. Bryan (Dem.), 1923–5; Adam McMullen (Rep.), 1925– .

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(A. E. S.*)

NEBULA: *see* ASTRONOMY.

NEGRO (*see* 19.346).—The Negro population of the United States as enumerated in 1920 was 10,463,131, an increase of 635,368, or 6·5% over 1910. The rate of increase was less than in any preceding decade and less than three-fifths of that between 1900 and 1910, the smallest up to that time. As in the white population the rate of increase between 1910 and 1920 was less than in any preceding decade, it might be thought that the fall in the increase among Negroes conformed to the trend of population change. But this would be an error. The rate of increase of Negroes in 1900–10 was about ·5 and in 1910–20 about ·4 of that of the whites. That this deviation in the rates of increase had been maintained for a long period appears from the following figures:—

Period	Increase				Ratio of Negro per cent of increase to White (100)
	Amount in thousands		Per cent		
	Negro	White	Negro	White	
1800–20	770	3,560	76·8	82·7	93
1820–40	1,102	6,329	62·2	80·5	77
1840–60	1,568	12,727	54·6	89·7	61
1860–80	2,139	16,481	48·2	61·2	79
1880–1900	2,253	23,289	34·2	53·9	64
1900–20	1,629	28,012	18·4	41·9	44

Increase.—The numerical increase of Negroes was larger in the later periods, rising to a maximum in the last 20 years of the 19th century. The rate of increase, on the contrary, diminished steadily. At each period the rate of Negro increase was less than that of the white. Apparently the immediate result of the Civil War and emancipation was to raise the relative rate of Negro increase between 1860 and 1880 from ·6 to nearly ·8 of that of the whites. But since 1880 the rate of Negro increase has fallen rapidly, and Negroes, who in 1800 were 18·9% of the country's population, in 1920 were only 9·9%. If each race should increase through the present century as it did between 1900 and 1920, the population of the country in 2000 A.D. would be over 400,000,000, of which about 20,000,000, or one-twentieth, would be Negro. The rate of increase of each race is likely to fall, but the difference in favour of the white race is not likely to diminish.

Areas.—The region in which the increase of Negroes since 1900 has been greatest is shown by the following facts. The five states with the greatest amount of Negro increase between 1900 and 1910 were all southern states. The increase in them was nearly one-half (49%) of that of the whole country. The five states which occupied a similar position between 1910 and 1920 were Pennsylvania, Ohio, Illinois, North Carolina and New York, four of them northern states, and the increase in them was nearly three-fifths (58%) of the whole. These four northern states are highly urbanised. The facts suggest a migration to industrial centres. The conjecture may be tested by computing the percentage of increase of urban population both negro and white. From 1900 to 1910 the whites in cities having 2,500 inhabitants or more increased 39·1% and the Negroes 34·2%; from 1910 to 1920 the percentage of increase decreased for each race, but among the whites it fell by 10·5% to 28·6%, and among Negroes it fell by 1·6% to 32·6%, so that between 1910 and 1920 Negroes in cities increased at a higher rate than the whites.

Migration.—The large amount of Negro migration to northern cities between 1910 and 1920 and the comparatively slight migration in 1900–10 appear from the following table:—

City	Negro population in 1900	Increase of Negroes	
		1900–10	1910–20
Chicago . . .	30,150	13,953	65,355
New York . . .	60,666	31,043	60,758
Philadelphia . .	62,616	21,846	49,770
Detroit . . .	4,111	1,630	35,097
Cleveland . . .	5,988	2,460	26,003
St. Louis . . .	35,516	8,444	25,894
Total . . .	199,047	79,376	262,877

The preceding figures are for the cities in which the Negro population increased by 25,000 or more between 1910 and 1920. All lie outside of the southern states. The Negro population of these six cities increased between 1900 and 1910 by 39%, and between 1910 and 1920 by 95%. As the increase of Negroes in all northern states between 1910 and 1920 was 444,635, nearly three-fifths (59%) of that increase was in these six cities.

Births and Deaths.—The remarkable fall in the rate of Negro increase and the rapid distribution of Negroes to other parts of the country than the South, especially to certain northern cities, are the striking changes revealed by the fourteenth census. How is the fall in the rate of increase to be explained? Has it any connection with the growth of interstate migration? These questions are elucidated by turning from the census figures of living population to the registration figures of births and deaths. The following table shows the registered births and deaths of Negroes in each of 30 states arranged in the order of increasing proportion of deaths to births:—

States with a Natural Increase of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
North Carolina . . .	1917–22	143,367	77,758	54
Mississippi . . .	1921–2	44,940	24,574	55
South Carolina . . .	1919–22	95,110	53,372	56
Virginia . . .	1917–22	119,435	77,775	65
New Jersey . . .	1921–2	6,779	4,771	70
Maryland . . .	1916–22	45,871	40,245	87
Massachusetts . .	1915–22	8,846	7,870	89
Wisconsin . . .	1917–22	657	597	91
New York . . .	1915–22	34,502	32,126	93
Delaware . . .	1921–2	1,248	1,200	96
Michigan . . .	1915–22	7,603	7,453	98
Connecticut . .	1915–22	3,890	3,868	99
New Hampshire . .	1915–22	86	85	99
Total . . .		512,334	331,694	65

States with a Natural Decrease of Negroes

State	Period covered by registration	Negro births	Negro deaths	Deaths to 100 births
Illinois	1922	3,704	3,786	102
Pennsylvania	1915–22	45,311	48,207	106
Ohio	1917–22	21,719	23,940	110
Rhode Island	1915–9 and 1921–2	1,522	1,684	111
California	1919–22	2,688	3,054	114
Indiana	1917–22	8,758	10,377	119
Nebraska	1920–2	564	685	122
Kansas	1917–22	5,956	7,286	122
Utah	1917–22	128	158	123
Kentucky	1917–22	24,180	30,343	125
Vermont	1915–22	29	38	131
Oregon	1919–22	100	154	150
Minnesota	1915–22	913	1,388	152
Washington	1917–22	424	738	174
Montana	1922	20	40	200
Wyoming	1922	17	39	229
Maine	1915–22	84	194	231
Total		116,117	132,111	114

If Negro deaths had exceeded births in the 17 states of the last table between 1910 and 1920, and if there had been no immigration of Negroes to this group of states, the number of resident Negroes would have been less in 1920 than in 1910. In fact, it increased from 852,120 to 1,113,940, or 30·7%. The total immigration to these states for the decade was probably not less than 300,000.

There are seven southern states for which we have births and deaths reported, and all but Kentucky had an excess of births over deaths. The Negro population of these states increased between 1910 and 1920 about 1%. On the basis of the figures for 1919 and 1920 there was a natural increase of about 35,600 annually, or 356,000 for the decade. As the decennial increase of Negroes was about 40,000, these states must have lost by emigration more than 300,000.

The bureau of the census has supplied figures of Negro births and deaths between 1915 and 1923 in the urban and rural districts. They are as follows:—

	Births	Deaths	Deaths to 100 births
Urban	266,380	269,631	102
Rural	517,945	309,243	60

These show that during these eight years in the cities of the United States for which the facts are known there were 3,251 more Negro deaths than births, but that in the country districts there were 208,702 more births than deaths. The figures of each class are given separately below for North and South.

	Births	Deaths	Deaths to 100 Births
Northern urban	155,972	151,118	97
Northern rural	33,245	40,294	121
Northern total	189,217	191,412	101
Southern urban	110,408	118,513	107
Southern rural	484,700	268,949	55
Southern total	595,108	387,462	68

Conclusion.—These figures show that the rural districts of the North are least suitable for Negro increase, that the urban districts of the South are almost as unfavourable, that the cities of the North show a slight excess of Negro births, and that the great reservoir for Negro increase is the rural districts of the South. The cause for the low rate of increase between 1910 and 1920 is found in the migration from the country districts of the South both to the North and to southern cities, and to their exposure to conditions climatic or economic which raised the death-rate and lowered the birth-rate. Urban conditions in the South as well as in the North bear far more lightly upon the whites, who thrive and multiply in American cities. In this regard urban Negroes in the United States are in a position like that of European and American whites living in cities a century or more ago, when cities were parasites upon the adjacent country districts, at whose expense alone they could maintain their population.

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(W. F. W.)

NEGRO LITERATURE: *see* AMERICAN LITERATURE; FRENCH AFRICAN LITERATURE.

NENOT, PAUL HENRI (1853–), French architect, was born in Paris, and when only 13 years old was placed in the studio of M. Lequeux as architectural pupil, coming there under the influence of J. L. Pascal. Thence, when 15, he went to the École des Beaux-Arts. After serving in the Franco-Prussian War of 1870, in which he gained the Military Medal, he continued his course at the Ecole des Beaux-Arts, and in 1877 gained the Grand Prix de Rome. While holding this prize in Rome, he competed for the Victor-Emmanuel monument in that city, receiving for his design the premium of 50,000 fr., the work itself being entrusted to an Italian. On his return to France he entered for the great competition for the rebuilding of the Sorbonne, in which he was successful, and commenced in 1885 a work that was to occupy him for the next 17 years. The building forms a parallelogram of over 900 ft. in length by 325 ft. in width, and its plan is brilliantly conceived, taking as its dictating condition the retention of Richelieu's chapel of the Sorbonne. Nenot relied steadfastly on the assistance of the sculptor and the painter, and the grand amphitheatre gave him the opportunity he absolutely insisted on of employing for its decoration Puvis de Chavannes, whose mural painting of the "Sacred Grove" is his masterpiece. The hall itself, used as a *salle des conférences*, is an admirable example of the D-plan carried by a series of alcove recesses to an ultimate development. His other buildings, mostly in Paris, include the Institut Océanographique, the offices of the Compagnie Générale and those of the Compagnie Nationale des Wagons-Lits. He received many distinctions, becoming a member of the Institut in 1895, and being later elected president of the Société des Artistes Français. He was awarded the gold medal of the Royal Institute of British Architects in 1917.

NEPAL (*see* 19.378).—The relations between the British Govt. and Nepal were for more than a century regulated by the Treaty of Segowlie of 1815, which, among other provisions authorised the appointment of a British Resident at Katmandu. On Dec. 21 1923 a fresh treaty of friendship was signed between the two countries, confirming the old treaty and making certain fresh provisions, the most important of which (at any rate from the Nepalese point of view) is the recognition by the British Govt. of the complete independence of Nepal. The old quinquennial mission to Peking has fallen into desuetude.

Slavery, which was an institution in the country from the time of the Gurkha conquest, has now been abolished by the Nepal Govt. and all slaves have been manumitted with the general consent of the slave owners and of the population of the country generally. This liberal measure was due to the initiative of the Maharajah, Sir Chandra Shamsher Jang.

Services in the World War.—During the World War, Sir Chandra Shamsher Jang gave signal proofs of his loyalty and friendship to the British Empire. Immediately after the outbreak of the War he placed the whole resources of his country at the disposal of the Allies. From March 1915 to the end of the War a force of some 10,000 men of the Nepalese Army served in India and on the Indian frontier. The normal number of Gurkha battalions (20) in the Indian Army was doubled, and it is estimated that over 200,000 Nepalese subjects left Nepal to serve with the Indian Army during the course of the War.

The Nepalese Govt. contributed sums amounting in all to 13,500,000 rupees (nearly £1,000,000) for various war funds, etc. (exclusive of the Maharajah's numerous subscriptions to military hospitals and charitable funds in connection with the War), cardamums to the value of 130,000 rupees; tea to the value of some 32,000 rupees; over 8,000 hill blankets, and other articles of clothing; various gifts of timber, including 200,000 broad-gauge sleepers for the Indian railways, and 31 Vickers-Maxim machine-guns—a magnificent contribution from a small and poor country. Many decorations were bestowed upon the troops who served with the Indian Army, and upon the various members of His Highness' family who organised and commanded them. During the short Afghan War in 1919, the Maharajah dispatched a force of 2,000 men of the Nepalese Army, which assisted the Indian Govt. in guarding the Northwest Frontier stations.

Route into Nepal.—The only portion of Nepal (with the exception of some portions of the tarai country which lies at the foot of the hills), ever visited by Europeans is the Valley of Katmandu, and even this can only be entered by special permission of the Nepal Government. The road to Katmandu starts from Raxaul, a small junction on the Bengal North Western Railway situated close to the frontier, due south of the capital, in the district of Champaran in Northern Behar. Hence to Katmandu is a distance of 75 m., the first 50 of which lie across the alluvial plain of the tarai and through a sal forest to the foot of the hills, whence the road follows the beds of rivers and across low ridges till the small hamlet of Bhimpedi is reached. Up to this point the road is practicable (at least during the cold weather) for wheeled traffic, and it is indeed possible to drive a motor-car over it, and it is gradually being improved and rendered fit for wheeled traffic all through the year. From Bhimpedi there is only a mountain track, which crosses two bridges (elevation about 8,000 ft.), and reaches the valley of Katmandu some seven miles from the city, whence a fair carriage road is available. A ropeway has been constructed from near Bhimpedi to the Katmandu valley, and will be operated by electricity from the power station in the valley, which also supplies electric light to the city. (*See* INDIA.) (W. F. O'C.)

NERNST, WALTER (1864–), German physicist, was born on June 25 1864 at Briesen, West Prussia. He studied at the universities of Zürich, Berlin, Graz and Würzburg and became an assistant at the University of Leipzig, subsequently going in this capacity to Göttingen, where he later became a professor. In 1905 he was appointed ordinary professor of physics in the University of Berlin. He became known through a technical invention in the sphere of electric lighting, which falls within his Göttingen period. In the glow-lamps named after him, the filaments are made of the rare earths, arsenate of zirconium, thorium, magnesium and others, which, in the cold state, do not conduct electricity (second-class conductors) but do so if heated to a temperature of 600–700° Centigrade. In comparison with the carbon filament lamps that were generally used at the time these Nernst lamps offered the advantage of a considerably lower consumption of current, but the complication of the heating device soon reduced their popularity, especially as it was about this time that Auer succeeded in producing glow-lamp wires out of osmium, which after further development led to the metal filament lamps of to-day. Nernst is further known for the statement of the so-called third law of thermodynamics. In 1920 he received the Nobel Prize for physics.

He is the editor of the *Jahrbuch der Elektrochemie*, the *Zeitschrift für angewandte Chemie*, and the *Zeitschrift für Elektrochemie*. His *Experimental and Theoretical Applications of Thermodynamics to Chemistry* appeared in English (1907).

NETHERLANDS (KONINKRIJK DER NEDERLANDEN) (*see* HOLLAND, 13.587), a kingdom of Western Europe. The land area is 12,618 sq. m. and the population (Dec. 31 1924), 7,298,043.

I. POLITICAL HISTORY

Although she did not take part in it, the World War was the greatest event in Holland's history between 1910 and 1925.

Neutrality.—The fact itself of her having succeeded in maintaining her neutrality seems little short of a miracle. Holland's situation has always been a perilous one, not only because she is surrounded on all sides by the nations whose wars convulse Europe, but because important waterways, on which her neighbours' trade depends, flow out into the sea across her territory. In the years before the War, when it was already casting its shadows ahead, more than one acute controversy between the two opposing groups of European Powers had centred round the position of Holland. First, Belgium had been used in an attempt to make Holland give up her attitude of detachment. The Dutch-Belgian *rapprochement*, which was so much talked about in those years, did not proceed from the Dutch-speaking Flemings, but from Francophile circles. It never went very far, and it was forgotten in the outcry raised over the proposal to fortify the mouth of the Schelde which was submitted by the Dutch Govt. to the Chamber in 1910. The contention, however, that Holland was obliged, or even that it had the right, to allow Entente forces to use the Dutch part of that river in case of a German threat to Antwerp was quite untenable. The Entente Governments tacitly recognised the correctness of Holland's behaviour, and in 1911 and 1912 official visits of President Fallières to The Hague and of Queen Wilhelmina to Brussels and Paris made it plain to the World that there was no ill-will between Holland and the Entente.

Probably, indeed, a desire to allow Germany no possible pretext for an attempt to occupy the Dutch ports in case of an Anglo-German conflict had as much to do with the decision to fortify the mouths of the rivers as any idea that the fortifications might ever actually be used against Great Britain. While English and French newspapers were protesting against this scheme, Holland was also remodelling her system of land defence to excellent effect. The German general staff were so much impressed with these reforms that they thought it necessary to rearrange their plan of operations for the event of a war with France. From Von Moltke's memoirs it appears that at the time of his predecessor, Von Schlieffen, the German staff intended to violate Dutch as well as Belgian territory, trusting that when they rushed their armies westward through the Dutch province of Limburg (which juts out to the south, covering part of the eastern frontier of Belgium), the Dutch Army would remain inactive behind the "water line," the inundated area, which protects only the western part of the country, the most densely populated part, including the provinces of North and South Holland, in which all the largest and economically and politically most important towns are situated. Von Moltke, realising that the Dutch Army was made mobile and would be used to strike, even if only the outlying province of Limburg were violated, decided to respect Dutch neutrality, although the détour necessitated would delay the German advance from Crefeld by some precious days.

Holland's attitude, then, in those crucial years was strictly and impartially neutral. The sympathies of the public could less easily be controlled. The memories of the Boer War had already lost much of their bitterness, largely owing to the grant of self-government to the late Boer Republics and the consequent appeasement in South Africa itself. The economic prosperity of the country was to a certain extent bound up with the tremendous development of the German hinterland since 1870, but the Dutch people felt oppressed by the militarist temper and the blatant imperialism which appeared to possess their powerful eastern neighbour. On the outbreak of war in 1914, it was the violation of Belgian neutrality and the subsequent acts of repression in the occupied territory which made the deepest impression and determined the attitude of Dutch public opinion. Only when the pressure of the British blockade began to be severely felt could the small group of German sympathisers command some attention, without, even then, ever swaying public opinion.

The Government at once proclaimed, and rigidly maintained to the end, strict neutrality. Inevitably there were times when each group of belligerents felt Holland's neutrality, however impartially administered, as a burden. The British Navy was able to see to it that Holland did not provide Germany with the food and other materials she wanted from overseas, but the enforcement of the blockade gave rise to a good deal of friction. Moreover, Holland's neutrality undoubtedly had the effect of covering Germany's right flank. On the other hand, the closure of the Schelde, once Antwerp had fallen, was all to the advantage of Great Britain, as Germany was thus prevented from using Antwerp as a submarine base.

Disputes about particular points were practically continuous, but the sincerity and reality of Dutch neutrality were recognised on both sides, and neither attempted to use violence against Holland. The efficiency of Holland's defence forces contributed to this. The army, 450,000 strong, had been mobilised without a hitch in the last days of July 1914, and was kept on a war footing, at a great cost financially and morally, till 1918. It had to cope with no serious incidents. Some thousands of Belgian and British troops were interned after the fall of Antwerp. German and British aeroplanes sometimes strayed on to Dutch territory. The naval forces occasionally had to intern a submarine or a destroyer, and to them fell the dangerous work of mine-sweeping along the Dutch coast. The Government carried out its international obligations as a neutral with consistent firmness and moderation. Mr. Loudon, the Minister for Foreign Affairs, had from the first adhered rigidly to international law, and he strove honestly to see that all the Government's actions in the carrying out of the decree of neutrality were guided by its precepts.

The Blockade.—Unfortunately, frequent cases arose in which the vague principles of international law could be variously interpreted. Great Britain, for instance, protested when Holland excluded armed merchantmen from her harbours, contending that the article in Holland's original proclamation of neutrality to which Mr. Loudon appealed had been drawn up at a time when Germany's resort to unrestricted submarine warfare could not be foreseen; and it was in reply to those utterly illegal methods that Britain had started arming her merchantmen. In this case Holland maintained her attitude. The sand and gravel dispute, which dragged on throughout 1917 and 1918, was more acrimonious, and at one time endangered Holland's neutrality. The Entente Govts. protested against Holland allowing the Germans to use her waterways for the transport of sand and gravel to Belgium for use in the construction of a new kind of ferroconcrete dugouts. Both belligerents put the severest pressure on Holland, Great Britain penalising her for concessions to Germany, Germany threatening her for concessions to Britain. Mr. Loudon at last consented to ration this traffic on the footing of pre-War statistics; but in the spring of 1918, when Germany was making her final offensive, Ludendorff wanted this arrangement to be used as a pretext to overrun Holland and make a dash for the Dutch ports. An ultimatum was actually presented, and only the determined intervention of representatives of the civil power in Germany prevented Ludendorff from having his way.

The most real difficulties, however, were economic; and these began to be of the most tragic importance to the Dutch people in 1915. For Holland international commerce is not a luxury but a necessity. It directly supports an important part of the community, Dutch industries are dependent on it for most of their raw materials and their coal, while four-fifths of the grain supply comes from abroad. Seaborne trade was gradually extinguished as the War went on. The Germans began by laying mines in front of the English ports. The British retaliated by laying a minefield in the North Sea. In order to make their blockade of Germany effective they exercised an ever more stringent control over imports into the adjacent states, regardless of the provisions of the Declaration of London.[1] They proscribed to neutral traffic a route along the south coast of England, so as to be able to examine cargoes at leisure. The Germans then proscribed the route round the North of Scotland, and declared the Channel area an area of war. In March 1915 the *Entente* Powers did away with all distinctions between legitimate and contraband trade, and prohibited the import into Holland of all goods, whatever their nature, which could be suspected of being destined for transmission to Germany. All goods imported into Holland had to be consigned to an unofficial body (the Netherlands Oversea Trust), which possessed the confidence of the *Entente* authorities and undertook that they should go no further.

The Allies gradually assumed control of the entire economic life of Holland, allowing her the bare necessities of life, withholding anything that could be used to replace goods sent to Germany. Even Holland's trade with her own colonies was subject to this control. As Holland depends on Germany for certain indispensable articles, *e.g.*, coal, she was driven to export food which she really could not do without, in order to obtain them in exchange. Meanwhile in 1915 Dutch vessels had begun to fall victims to German U-boats. After the unrestricted submarine war had been proclaimed early in 1917, practically all overseas traffic ceased. Food scarcity became almost as serious in Holland as in Germany itself, certainly more serious than in England. Bread was severely rationed. Meat was very scarce, as the lack of imported fodder had necessitated the slaughtering of stock. Factories began to close down in 1917 for lack of raw materials and coal. In the last stages of the War Holland's industrial life was at a complete standstill.

Holland greeted the Armistice with relief; but the peace had many disappointments in store for her, and Mr. Van Karnebeek, who had become Minister for Foreign Affairs when a new Government was formed shortly before, was not to have a much easier task than his predecessor.

One big surprise was the discovery that Belgium proposed to advance at the Peace Conference certain claims involving Dutch sovereignty. In the first months of the War, when the Germans advanced through Belgium, a stream of Belgian refugees, which swelled to a flood when the invaders reached Antwerp, had sought safety on Dutch soil, where they were hospitably received. At one time their number exceeded 1,000,000, and their support, the provision of food and shelter, was an exceedingly heavy charge. Hundreds of thousands went back to their country when things had settled down under the occupation. Hundreds of thousands remained till the end of the War, and the way in which they were cared for by a nation which was itself soon to suffer very heavy privations is one of the redeeming features of the history of the War. But all this kindness and generosity seemed to have been forgotten, and Holland found herself decidedly unpopular in some of the Allied countries. The firm refusal of the Dutch Govt. in 1920 to surrender the ex-Emperor William, who had taken refuge there in Nov. 1918, gave rise to excited denunciations of Holland's alleged tenderness for the Hohenzollerns. Holland's attitude in the War was widely represented in the most unfriendly light.

THE QUESTION OF THE SCHELDE

On this matter Belgium declared that Holland's claim to sovereignty over the Schelde mouth, and her action in closing it against the Allied forces, had made the defence of Antwerp impossible, while her possession of the province of Limburg had hindered the defence of Belgium's eastern frontier, which ought to have been based on the River Maas. It has been argued above that Holland's action in the War had really benefited the Allied cause, but the opposite contention was made by the Belgian "*Comité de politique nationale*," which advocated annexation of the disputed regions. It claimed that Belgium should be given sovereignty over Dutch Flanders, on the left bank of the Schelde, and over Dutch Limburg, on the ground that the treaties of 1839, guaranteeing the neutrality of Belgium, having lapsed, these territories were necessary for her protection and development. With the same object in view, exaggerated complaints of an economic nature were made against the Dutch régime on Antwerp's waterway to the sea. The relations between the *Comité* and the Belgian Govt. were intimate, and Belgium initiated a discussion of these questions at the Peace Conference in Paris, claiming they arose out of the discussion of the treaties of 1839. Holland claimed that this revision should not in any case prejudice Dutch interests, and that any discussion of claims involving Dutch sovereignty was inadmissible, as Holland had not been a party in the War and had honourably fulfilled her obligations as a neutral. Mr. Van Karnebeek consented, however, to go to Paris to explain this point of view to the Supreme Council, who heard M. Hymans on May 20 and Mr. Van

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[1] This declaration has never been ratified.

Karnebeek on June 3 1919. The Powers created an international commission to deal with the question, asking them to submit "proposals which involve neither transfer of territory nor international servitudes." The question was eventually referred to direct negotiations[1] between the two countries.

These negotiations on new arrangements for the régime on the Schelde, on the Ghent Terneuzen Canal, etc., were, however, carried on in a somewhat unfavourable atmosphere. Dutch public opinion was greatly irritated. The populations of Limburg and Dutch Flanders protested their loyalty to the Dutch fatherland. Meanwhile the annexationist agitation in Belgium went on, and was still supported by the Government, as was proved when a secret circular, emanating from the Belgian Foreign Office to "Belgian agents" in Dutch Limburg, was disclosed by Flemings friendly to Holland. Yet the Dutch Govt. was prepared to go far to meet Belgian wishes. Although not admitting that the régime of 1839 had been harmful to Belgian interests, and maintaining that she had always administered it in a fair and friendly spirit, Holland declared her readiness to make important economic concessions, which she looked on as the price to be paid for good political relations.

Early in 1920 a treaty in which several Dutch concessions were laid down was ready for signature, when a new dispute arose, about the sovereignty of the Wielingen Channel, which connects the Schelde estuary with the open sea. Although that channel runs along the Belgian coast within the three-mile limit, Holland had exercised sovereign rights over it since mediaeval times, and the two delegations at the beginning of the negotiations had agreed to leave the Wielingen question on one side. When agreement had been reached on other matters it was arranged that each side was to present its case with regard to the disputed point in order to safeguard its claims for the future, but without any intention of arriving at a solution for the time being. Yet when the Dutch Note embodying the case of Holland with respect to sovereignty over the Wielingen was handed in, the Belgian Govt. regarded it as a new and unacceptable claim, and used it as a pretext to break off the negotiations; or such was the view taken in Holland, where it was believed that M. Hymans at the last moment shrank from facing annexationist criticism with a treaty containing nothing but economic concessions. When conditions everywhere grew more stable, and the annexationist programme of the *Comité de politique nationale* looked less capable of realisation, M. Hymans, who had again become Belgian Minister of Foreign Affairs after a period out of office, approached Mr. Van Karnebeek, and the treaty of 1920, was, without Holland having changed her attitude towards the Wielingen question, signed at The Hague on April 3 1925.[2]

Its ratification by Holland was, however, delayed by the prolonged political crisis; and meanwhile it was subjected to lively criticism. In 1919 and 1920 Holland had been willing to make economic concessions to avoid a threat to her sovereign rights; and Mr. Van Karnebeek's conduct of the delicate negotiations had been generally admired. When in 1925, however, the treaty was at last published in its entirety, the danger which loomed so large five years before seemed altogether negligible, and the proposed concessions were scrutinised entirely on their merits. The result was widespread dissatisfaction with the one-sided character of the treaty.

Criticism centred round two main points. Firstly, there are the provisions for a new Dutch-Belgian *régime* on the Schelde. The prosperity of Antwerp during the last years appears the best reply to the suggestion that Dutch control of the lower course of the river threatened Antwerp with ruin. Yet public opinion in Holland admits that the machinery provided by the 1839 treaty for carrying into practice the mixed commission's recommendations is cumbrous. It is greatly disturbed, however, at the provision in the new treaty by which Holland's obligations with respect to the works for keeping the river in a navigable state are defined afresh. It is feared that Holland may have to spend millions in technically unsound attempts to keep the elusive Schelde channel in the same place. A clause exempting vessels bound for Antwerp, during their transit of the Dutch part of the Schelde, from any examination or delay upon any ground whatever arouses criticism as an infringement of Holland's sovereign rights. The provision, by which pilots' fees from the open sea to Antwerp are expressly limited to the amount payable from the open sea to Rotterdam, although the first distance is three times the latter, while nothing is said to prevent the Antwerp fees from being fixed at a lower level, is thought to favour Belgium unduly.

The second point criticised is that containing Holland's consent to the construction over her territory of canals from Antwerp to Moerdyk and from Antwerp to Ruhrort. These canals are obviously intended to deflect part of the Rhine trade from its natural course down the river to Antwerp; a plan which is naturally deeply resented in Rotterdam. It is argued further that the treaty would not eliminate all matters for dispute between the two countries; but that it contains the germs of endless new quarrels. Furthermore, the Flemings, who play an increasingly important part in Belgian political life, are friendly towards Holland and will, it is hoped, understand her refusal to be bound by arrangements made during the ascendancy of the *Comité de politique nationale*, although at the same time the interests of Antwerp, the Flemish metropolis, are very particularly involved. Certain points were discussed afresh between the two governments, and at least interpretative concessions on the part of Belgium were expected.

Domestic History Since 1910.—In 1907, for the second time in the century, a Cabinet was formed out of the coalition of the parties of the Right, that is, of the two Protestant parties, the Anti-Revolutionaries and the Christian Historicals, and the Roman Catholic party. This coalition, which may at first sight appear an unnatural one, sprang from the fact that Catholics and orthodox Protestants were equally opposed to the ruling Liberalism, and in particular to the educational system developed by the Liberals. Only the State's own schools, which were strictly "neutral" as regards religion, received grants of public money. The orthodox Protestants and the Catholics both complained that as taxpayers they had to help in supporting schools to which conscience forbade them to send their children, while as parents they had also to maintain their own private denominational schools. This situation at length, and in spite of the traditional enmity between the two creeds, led to a coalition of the Calvinist parties and the Roman Catholic party.

In 1910 Dr. Abraham Kuyper formed the first Coalition Government. Himself a Calvinist, chief of the anti-revolutionary party, he succeeded in finding "one root of faith" from which both Catholics and Protestants sprang, and divided the Dutch nation into "Christians" and "Paganists." But the political situation in 1907, when the second Coalition Govt. was formed, did not permit Dr. Kuyper's strong personality to be included, and when in 1909 the general election led to further disaster for the Liberals he nevertheless remained discarded. Mr. Heemskerk was the leading member of this Government, which was somewhat too moderate in its religious policy for the more fanatical Kuyperians, whose zeal for social reform was gratified by the grandiose scheme for state disability and old age insurance on which the Minister of Labour, M. Talma, worked strenuously. The scheme, however, had not yet been carried into effect when the defeat of the Coalition at the polls in 1913 hung it up indefinitely.

The parties of the Left proved unable, in 1913, to assume the responsibilities of government. The once powerful Liberal party was now broken up into several sections, of which one was really anti-clerical conservative, while another was radical. Moreover, the Socialist party, which made a big advance in 1913, now claimed a large proportion of the forces of the Left, and there was little sympathy between it and the so-called Old Liberals. An attempt was made, nevertheless, to form a coalition of the

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[1] See H. W. V. Temperley, *History of the Peace Conference in Paris*, vol. ii., pp. 192 *seq.* (London, 1920).

[2] In spite of the signature of the Convention, neither side abandoned the original contention with regard to the Wielingen Channel, the Belgians basing their claim on the three-mile limit, the Dutch on ancient rights of possession.

Left, under Dr. Bos, the Radical leader, on a programme that included universal suffrage. The Old Liberals agreed to this programme, but the Socialists, although their leader, Mr. P. J. Troelstra, was in favour of accepting, refused to co-operate.

In this difficulty an extra-parliamentary Cabinet was formed by Mr. Cort van der Linden. In conformity with the verdict of the electors it bore a decidedly "Left" character, but it attempted to find final solutions for both the questions which had long paralysed Dutch political life. Mr. Cort van der Linden and his colleagues proposed to bring about a revision of the Constitution (for which purpose a two-thirds majority of the Chamber is required) by an agreement of all parties. In it the Clerical groups would find the solution of the school problem and the Liberals, Radicals and Socialists the final extension of the suffrage.

Although faced with the problems arising out of the World War, the Government persevered with this task, and indeed the quickened sense of national solidarity helped it rather than otherwise. In 1917 its programme was carried out. Universal suffrage and proportional representation were introduced; at the same time, the principle of absolute equality with regard to the public exchequer of "public," undenominational or a religious education and "private" denominational education, was conceded in full and written in the Constitution.

The first elections held under the new suffrage law (June 1918) resulted in further disaster for the Liberal groups. The Cort van der Linden Administration resigned and another Calvinist-Catholic Cabinet was formed. The Premier, Mr. Ruys de Beerenbrouck, was a Catholic, a thing without precedent in Dutch history. This Government's mandate was confirmed by the elections of 1921, when the Coalition parties increased their number of seats to 60 out of the 100 which constitute the Second Chamber. At the elections of 1925 they lost some ground, but still retained the majority, and when Mr. Ruys retired, Mr. Colÿn, leader of the Calvinist anti-revolutionary party, formed another Coalition Cabinet. In Nov. 1925 internal disagreements compelled that Government to resign. Each of these elections since proportional representation came into force meant a further stage in the disintegration of the Liberal parties, of which only the Radical group held its own. The Socialists, on the contrary, made a big advance in 1918, and although they suffered a setback in 1921 they more than retrieved their fortunes in 1925. They then numbered 24 members and were the second largest party in the Chamber after the Catholics with 32. The 1921 election was the first at which women's suffrage was in full working order. Six out of the 100 seats were occupied by women in the Chamber of 1925.

The years of Coalition Govt. through which Holland passed after the Armistice can be divided into two very distinct periods. The years 1919 and 1920 were feverish ones, when a fallacious sense of prosperity stimulated enterprise in business and politics alike. It is not perhaps unfair to connect the zeal for social reform which characterised those days with a certain nervousness which remained after the "November days" of 1918. Mr. Troelstra, the Socialist leader, his imagination fired by the spectacle of the German revolution, toyed with the idea of imitating it among his own people. The attempt was a ludicrous failure. The Government took strong measures and the people rallied to them, and after an excited week quiet was restored on Nov. 21 1918. The Socialist party, which had been far from unanimous about this adventurous policy, re-entered the path of constitutionalism, and Mr. Troelstra, who resigned the leadership in 1925 owing to ill-health, never regained his old prestige. Yet the affair probably helped to create the spirit in which the Government tackled social problems. Mr. Talma's insurance scheme, of which the Cort van der Linden Cabinet had carried out only a small part, was taken up again, and in Dec. 1919 a comprehensive Disability Insurance Act was passed. Large sums of money were voted in aid of building societies and building schemes of municipal bodies. Not only were housing conditions greatly improved, but as architecture has again become a living art in Holland, and the best architects were called in, the new quarters of many a Dutch town afford fine examples of modern building, and have been studied and admired by the experts of other countries. A piece of legislation with which Holland was in advance of all other countries was an Act restricting the hours of labour to 45 a week.

But the fictitious prosperity was succeeded by a severe depression. Shipping and shipbuilding particularly felt the effects, and no place suffered more from the occupation of the Ruhr area and from the preference granted by France to her own and Belgian commerce than the great port of Rotterdam. When international conditions improved in 1924, economic conditions in Holland soon felt the effect. Yet unemployment remained still a drain on Dutch resources. The one really bright spot in the picture was the prosperity of the East Indian "cultures."

Meanwhile, the stress of the times occasioned a radical change in the Government's policy. Economy came to be the cry. The building subsidies were cut down. In order to enable Dutch industry to compete with the countries with debased currencies, dispensations from the Act restricting the hours of labour were freely granted. On yet another point a revulsion of feeling manifested itself against legislation passed almost without opposition a few years previously. The new Cabinet of the Right had to carry into practice the general provision of financial equality for denominational education which their predecessors had written into the Constitution. It was now felt that the multiplication of small State-subsidised schools, which resulted from Dr. De Visser's (the Minister of Education 1918–25) measures, overburdened the taxpayer.

During the years 1922–4 Dutch politics centred round the financial situation. In the early summer of 1923 the Government strengthened itself with a new Minister of Finance, Mr. Colÿn, who two years later was to succeed Mr. Ruys in the premiership. Mr. Colÿn, a strong personality, was expected to carry out a programme of ruthless economy. All salaries paid by the State were indeed cut down by one-fifth, a measure which naturally occasioned a good deal of discontent. Socialist and Radical critics complained that economies in other directions were neglected, while at the same time, by the raising of the general import tariff from 5 to 8% *ad valorem*, the introduction of a tax on bicycles (which are more numerous in proportion to population in Holland than in any other country), and the raising of the duty on tobacco, the burden of taxation borne by the mass of the community was not inconsiderably increased. The object of Mr. Colÿn's policy, at all events, was reached: in the course of 1925 the budget was balanced. An improvement in the yield of direct taxation, as a consequence of the economic revival, contributed towards this event.

In spite of this success, Mr. Colÿn's Govt. soon was unable to carry on. It was freely predicted at the time that the elimination of the education grievance would soon bring about the dissolution of the Coalition, and that thus the way would become clear for a more natural grouping of parties on economic and political lines. In Oct. 1923 it was thought that the knell of the Coalition had been sounded when 10 Catholics joined the parties of the Left and the bill for the strengthening of the naval defences of the Dutch East Indies, which the Government, in spite of their zeal for economy, and in spite of the effect which the Washington treaties might be supposed to have on the situation in the Pacific, considered indispensable, was rejected in the Second Chamber by 50 to 49 votes (Oct. 26 1923). After a crisis of several months, however, the Coalition was patched up and the elections of June–July 1925 were fought on the old lines. Mr. Colÿn formed a new Government in July. The new crisis was occasioned by a question of far less intrinsic importance, but more serious as a sign of the progressing disintegration of the Coalition.

In spite of the prolonged comradeship in office, one at least of the two Protestant parties, the Christian Historical party, never ceased to look upon the Roman Catholics without a certain watchful suspicion. Of late years, owing to their excellent organisation and also to their constant participation in the government of the country as a consequence of the Coalition, the growth of Catholic influence and self-confidence, which started in the 19th century, had been accelerated, inducing a certain uneasiness and irritability in Protestant circles, which the Christian Historical party, for all its loyalty to the Coalition, could not ignore. In those circumstances a motion, introduced by an independent Christian Historical member of the Chamber, to abolish diplomatic representation at the Vatican, which had been introduced during the War by the Cort van der Linden Govt., assumed an importance quite out of proportion to its intrinsic merits. The whole Christian Historical party voted for it, and the motion was carried. The Liberals, Radicals and Socialists, while caring little for the question itself, had voted for the motion in order to show up the unreality of the Coalition. The Catholic Ministers in Mr. Colÿn's Cabinet resigned on Nov. 11 1925, and the next day the Premier offered the resignations of himself and all his other colleagues.

Co-operation between the Christian Historicals and the Roman Catholics had now become exceedingly difficult, but the hopes of those who wanted to see the Coalition give way to a new grouping of parties were disappointed. Radicals and Socialists have long aspired to an alliance with the Catholics, among whom democratic tendencies are strongly, although by no means exclusively, represented. An attempt (Nov. 24–Dec. 1 1925) on the part of the Radical leader, Mr. Marchant, to form a democratic Ministry, however, met with a unanimous refusal from the Catholics, in spite of Mr. Marchant's offer to rescind the vote against the Vatican legation. The result was that Dutch parliamentary politics appeared to have reached an absolute deadlock. After a crisis of unprecedented duration, Jonkheer de Geer, therefore, on March 3 1926 formed a non-parliamentary Cabinet with a programme of all-round economy, including reductions in the army and navy and productive state works for the unemployed. He announced his intention of resigning as soon as a parliamentary majority had been formed.

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II. ECONOMIC AND FINANCIAL DEVELOPMENT

Although Holland remained neutral during the World War, the War itself and the subsequent years left their impress upon its economic and financial development. Some of these influences were of a temporary nature, such as the effects of the crisis of 1920–1 upon Dutch economy. The permanent changes chiefly regarded public finance. In the economic sphere the War accelerated the expansion of national industries and the process of banking concentration. The foreign capital holdings of the people were affected by the loss of Russian securities, representing an estimated value of £100,000,000, and by the realisation of a considerable number of American securities. Against these losses, there was a large increase in the extent and value of the Dutch capital invested in the Dutch Indies, and further a large increase in internal investment within the country.

Population.—The War had little effect on the growth of the population, which increases by approximately 100,000 per annum, a relatively high figure as compared with other countries, the result of a persistently favourable birth-rate (24·1 per 1,000 in 1925) and an extremely satisfactory death-rate (9·6 per 1,000 in 1925). It was only in the influenza year 1918 that the death-rate increased to 17·2 per 1,000. The population was 5,945,115 in 1910; 6,865,314 in 1920; and approximately 7,400,000 in 1925.

Agriculture.—A sound adaptation of the various branches of agriculture and cattle-breeding to the nature of the soil, the advantages of cultivation by the individual owners and an increasingly marked preponderance of small holdings, favourable market facilities and technical skill stimulated by co-operation and State encouragement—all have contributed to the development of agriculture.

The home production was only 154,000,000 kg. of wheat or about 21·8 % of the total consumption (708,000,000 kg.); on the other hand 32·5 % of the total output from dairy-farming was available for export. After the War the export trade recovered quickly. Exports of butter, which had ceased entirely during the last years of the War, attained their pre-War figure in 1924 (£5,800,000); cheese exports actually increased threefold (£6,200,000); whilst meat exports during the same year amounted to £6,300,000 or 30 % more than in 1913.

Industry.—A number of new industries are increasing in importance, for example, the chemical and electric lamp industry. The first blast furnace was started at Velzen near the North Sea coast. The coal mining industry, whose beginnings date from the end of last century, now satisfies two-thirds of the requirements of the country. The output of coal rose from 300,000 tons in 1900 to 1,000,000 tons in 1910 and 6,800,000 tons in 1925. An approximate idea of the industrial position in 1923 can be derived from the statistics of production.

	Yield of the various branches of industry in Holland £
Foodstuffs	25,000,000
Textile industry	20,800,000
Metal industry	19,600,000
Luxury articles	8,300,000
Clothing and boots	5,400,000
Wood industry	5,200,000
Chemical industry	5,200,000
Miscellaneous	18,800,000
	£108,300,000

The value of the total agricultural output in this year was £87,-900,000.

The unemployment figures showing the percentage of workers unemployed among trade unionists give an idea of the general economic situation in recent years. Whilst in 1913 the highest figure was 8·8 (Dec.), the summer average 4·1 and the winter average 8·0, the corresponding figures for 1924 were respectively 19·7 (Jan.), 5·8 and 10·5. Generally speaking the highest level was reached in 1923. Since then the figure has fallen, but was still unsatisfactorily high in Dec. 1925—13·8.

Trade and Shipping.—Trade statistics were reorganised and improved in 1917. As a result, however, no comparison of figures of values is possible while even figures of quantities before 1917 can only be used with great reserve.

	1913	1925
	kg.	kg.
Imports	21,302,000	25,500,000
Exports	5,848,000	12,336,000

The direction of Dutch trade has changed considerably:—

	Germany		England		United States		Belgium		France		Dutch East Indies	
	1913	1925	1913	1925	1913	1925	1913	1925	1913	1925	1913	1925
Imports	28·9	24·2	8·7	15·9	1·31	11·2	9·01	11·1	0·8	4·4	3·5	5·6
Exports	27·9	25·9	22·2	25·9	3·9	3·8	11·0	9·0	1·0	4·7	5·3	7·4

(The figures represent percentages of the total)

The system of virtual free trade—duties of 5 % being levied on a number of "finished articles"—remained practically unchanged during the War and even during the subsequent period of currency disorder in several states of Europe; only in the case of the shoe and cigar industries special temporary prohibitive measures were introduced with a view to restricting dumped imports. The tariff was increased to 8 % on July 1 1925, and the list of dutiable commodities was somewhat extended, principally on revenue grounds. In 1925 47 % of the total exports of £146,200,000 consisted of foodstuffs and 35·7 % of manufactured goods. The total imports in that year amounted to £204,200,000.

The importance and development of shipping can be gauged from the following figures for ocean-going shipping in the port of Rotterdam:—

Loaded ships, net tonnage registered: 1900	5,452,000
Loaded ships, net tonnage registered: 1910	8,898,000
Loaded ships, net tonnage registered: 1913	11,638,000
Loaded ships, net tonnage registered: 1925	13,903,000

The amount of Dutch high-seas shipping in 1925 was 1,319,534 net tons registered, so that Holland took the seventh place in the high-seas shipping of the world, being only surpassed by Norway in the tonnage per head of population. In 1913 the tonnage amounted to 687,635, and Holland then also stood seventh on the list.

The Monetary System and Banking.—The following figures show the extent of banking transactions:—

	1913	1920	1924
Capital and reserves	£ 12,600,000	£ 37,700,000	£ 82,400,000
Other assets	32,200,000	133,300,000	83,200,000
"Debtors"	15,600,000	75,900,000	47,900,000

Throughout this period the Dutch guilder (florin), thanks largely to the policy followed by the Netherlands Bank, maintained its position as one of the highest-valued currencies of Europe. The gold standard was officially re-introduced on April 28 1925 when the prohibition on the export of gold was cancelled. On the same day similar steps were taken by Great Britain and by the Netherlands East Indies. The amount of bank notes in circulation at the end of 1925 was £72,900,000, as against £25,900,000 at the outbreak of the War. The gold reserve increased during the same period from £13,000,000 to £37,000,000. In addition to the bank note circulation the "giro" systems of transfer through the intermediary of the Netherlands Bank and of the Post Office are becoming increasingly important. But the cheque and clearing system of the large banks has not developed much in Holland.

State Finances.—Before the War the state finances were satisfactory. The total of "ordinary" expenditure had increased from £12,400,000 in 1900 to £16,400,000 in 1910 and £18,300,000 in 1913. The increase is evidence of the tendency in Holland, as elsewhere, towards increased state activities: but it should be remembered that the general rise in prices during the period 1900–13 amounted to 16%, and the increase in population to 19%.

The position of the Dutch public debt was very satisfactory before the War. In 1840, after the end of the war with Belgium, it amounted to approximately £117,000,000. By Jan. 1 1914 it had fallen to £95,700,000, although large public works (railway construction) had been undertaken in the interval. The war and subsequent years made very high calls upon the state funds. Mobilisation cost £101,400,000; the supply of the population with material necessities during the War—the system of distribution involved subsidies from the public funds—cost £47,100,000; and the housing subsidies which were charged against the extraordinary budget cost £54,700,000. The ordinary expenditure also increased considerably as a result of increased state activities and rising prices: the highest figure reached was £52,700,000 in 1924. The deficit for the period of crisis, which terminated in 1924 as far as the state finances are concerned—after deduction of such exceptional taxation as the tax on war profits—was £183,500,000. Of this amount £175,000,000 have been funded. Although the sinking fund continued to operate in the interval, the debt rose to a record figure on Jan. 1 1925 with £244,100,000, falling to £239,300,000 on Jan. 1 1926. The ordinary expenditure for both 1925 and 1926, which can again be regarded as normal years, amounted in round figures to £50,000,000 and is wholly being met out of the revenue. 36·2% of the total expenditure was met out of the proceeds of direct taxation in 1925 as compared with 23·7% in 1913.

The above-mentioned increase of expenditure is reflected in the position of the Treasury. Whilst before the War it was very rare for more than £4,000,000 to be required for Treasury needs, the floating debt amounted on Jan. 1 1922 to not less than £71,500,000 (consisting chiefly of Treasury bills). Against this amount there stood £40,000,000 of claims, composed for the most part of advances made to the colonies. It was only owing to the exceptionally liquid state of the money market that the State was able to raise such sums. The floating debt was reduced by Jan. 1 1926 to £25,500,000, owing to various funding operations undertaken in successive years; but against this figure there are claims of the State amounting to £24,100,000, mostly against foreign countries.

The burden of taxation—viz.: of all taxes, including those of the provinces and communes—increased from £3 5s. per head in 1913 to £13 4s. in 1921 (including tax on war profits), but had been reduced by 1924 to £7 12s. per head of the population.

	Index Numbers Wholesale Prices	Imports £ million for home consumption	Exports £ million of domestic produce	Netherlands Bank Yearly average	
				Notes in circulation £ million	Domestic credits £ million
1913	100	..	..	26·1	13·3
1914	109	..	..	34·6	21·5
1915	146	..	..	44·6	15·4
1916	224	..	..	58·2	12·8
1917	276	90·2	69·8	68·0	13·2
1918	376	50·7	31·9	82·0	21·7
1919	304	235·5	117·6	85·6	32·4
1920	292	278·0	141·8	87·5	37·0
1921	182	186·7	114·1	85·1	34·5
1922	160	169·0	101·8	82·0	27·1
1923	151	167·4	108·6	81·9	28·3
1924	156	197·0	138·4	79·7	27·0
1925	155	204·6	150·6	..	..

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(G. W. T. B.)

NEUILLY, TREATY OF.—The Bulgarian Treaty was signed at Neuilly on Nov. 27 1919, and came into force on Aug. 9 1920. In the main it is the same as the Austrian Treaty. But there were important differences in the military and naval clauses, and also in regard to reparation and finance.

As regards the territorial clauses, the only serious changes were to the west and south. The Serb-Croat-Slovene kingdom obtained several strategic ratifications. The two most important are that the Strumitsa salient in the extreme south-west has been flattened out, the western half being ceded to the Serbs; also, and more important, in the Nish-Pirot area the town of Tsaribrod has been taken from Bulgaria and a line drawn whereby an advance on Nish would be rendered more difficult. The frontier, however, confers no offensive advantage on the Serbs, and is thus a sensible one. A loss more serious in another sense is that to Greece of the district of Western Thrace, lying between Xanthi and the Maritsa river. This was ceded to Greece on her obtaining Eastern Thrace and Adrianople. Bulgaria, for ethnic reasons, received a slight extension of territory west of Adrianople. The expulsion of Greeks from Adrianople and East Thrace by the Turks has, however, not caused the Allies to change their minds about Western Thrace, which remains annexed to Greece and is denied to Bulgaria. But, though these losses are humiliating to the pride of the Bulgars, it cannot be said that they seriously injure their strength or prosperity. Dedeagach, which she lost to Greece with the whole of Western Thrace, is really unsuitable as a port and also at a great distance from Sofia.

With the view of giving Bulgaria access to the Aegean, Veniselos offered, during the negotiations, to build a railway connecting the fine Greek harbour of Kavalla with the Salonika-Constantinople railway, which now runs to Sofia up the Struma valley, though with a break of gauge. This offer, though doubtless quite sincere, has never been acted upon, though in article 48 the Principal Allies undertake to ensure the economic outlets of Bulgaria to the Aegean Sea.

Bulgaria had always asserted claims to that part of Macedonia now in Serbian hands, and also to Eastern and Western Thrace. In the former area her ethnic pretensions are better founded than in the latter. But Serbian Macedonia is in the hands of a formidably armed and militarily strong nation. Greek Macedonia and Thrace are now populated by hundreds of thousands of Greek refugees from Asia, and contain over 80% of a purely Greek population. It would seem, therefore, that both districts are irrecoverably lost to Bulgaria, and that her strength must rest purely on her own resources. In population, she has only lost some 300,000 persons, of whom some are not Bulgars.

Part IV. The military, naval and air clauses have some special points. Bulgaria is allowed 20,000 regulars, 10,000 gendarmes and 3,000 frontier guards, or 33,000 in all. This number is insufficient to maintain order in a turbulent Balkan State, and the subsequent serious disturbances in Bulgaria are due directly to this fact. It is increased by the difficulty of applying the voluntary long-service system of 12 consecutive years to a nation of peasants. In an agricultural country it is practically impossible to get men to leave their farms for 12 years, and the army is always likely to be dangerously below strength, and the less regular formations dangerously above it. The naval clauses do not differ from those of the German or Austrian Treaty. All Bulgaria's navy has now been destroyed, and she is left with four torpedo-boats, of which three are damaged, and six motor-boats, of which four are damaged.

Part V. (*Prisoners of War and Graves*) and

Part VI. (*Penalties*) are the same as in the Austrian Treaty (*see* ST. GERMAIN, TREATY OF).

Part VII. (*Reparation*). This contains the most novel and interesting feature of the Treaty, and is, in fact, the only serious attempt to get reparation on to a business basis. It contained three features of great interest.

(*a*) Contrary to the practice in the German, Austrian and Hungarian Treaties, there was no attempt made to seize or distribute the Bulgarian commercial fleet on the "ton-for-ton" or "class-for-class" principle.

(*b*) It fixed the amount to be paid at the lump sum of £90,000,000.

(*c*) It created a Reparation Commission consisting of French, British and Italian representatives, with power to reduce this amount by a simple majority vote (not by unanimity as is the systematic rule), on the suggestion of the inter-allied Commission.

The general scope and powers of the Reparation Commission are drawn in such a manner as to control the finances of the country sufficiently to obtain reparation, without offensive interference. In the end, the Reparation Commission, after examining the question on the spot, has practically remitted three-quarters of the total of £90,000,000. The annual sum now required to meet the charges on the 550,000,000 gold francs of the debt is well within the capacity of the new Bulgarian State, and is being punctually paid. None of the remaining clauses of the Bulgarian Treaty have any special features of interest or importance.

Conclusion.—Viewing the Bulgarian Treaty as a whole, it is the fairest and most practical of all the Treaties imposed on the enemy Powers. There has been little diminution of territory or population, and no vindictiveness shown. Bulgaria was protected by the Principal Allies, first from occupation of her territory by Serbs or Greeks, next from the seizure and distribution of her commercial fleet, and finally from the financial anxieties and confusion consequent upon an unfixed liability, and from the difficulties of a too-powerful and too-obtrusive Reparation Commission. The reason is that the Principal Allies, while not strong enough to withstand the public demand for severity in the German, Austrian and Hungarian treaties, were strong enough to resist the Serb, Greek and Rumanian claims in the Bulgarian Treaty. The result is that Bulgaria is more relatively prosperous than any other ex-enemy state, and has been able to pay her liabilities without making the League her receiver and manager, like Austria and Hungary, or adopting a disguised form of this liquidation like Germany under the Dawes scheme. Bulgaria has shown herself more willing to accept new conditions, and it is not impossible that she may enter ultimately into some form of alliance with the Serb-Croat-Slovene kingdom. (*See* BULGARIA; PEACE CONFERENCE; REPARATION, etc.)

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NEUROMUSCULAR SYSTEM (*see* 19.44).—Briefly, recent contributions have dealt largely with the anatomical nerve-supply of the striate (so-called "voluntary") skeletal muscular system, the discrimination of the different functions of muscle substance, and the integration of neural and muscular activity. From consideration of the action of the simplest neuromuscular unit, prosecution of the subject leads us by consecutive and logical steps to matters of deep interest and significance in relation to the function of the nervous system as a whole and to age-old questions such as the meaning of "the will." The problems of the neuromuscular system may be approached from various viewpoints; it is natural to commence with that of morphology.

Anatomical Considerations.—The striate skeletal muscular system is supplied by efferent motor nerves from the anterior or ventral horns of grey matter in the spinal cord; the course and distribution of these nerves, and, conversely, the representation of individual muscles in the nerve-cell groups of the anterior spinal horns, are all well known. When a motor spinal nerve enters a skeletal muscle at its so-called "motor point" its fibres divide up and ramify to the various component muscular fibres of the muscle, ending on these latter structures by "motor-nerve end-plates." According to the views of Langelaan, each motor nerve-fibril is in communication with the sarcoplasm of the muscle fibril which it is supplying.

In addition, however, to this accepted spinal nerve supply, close study has been given in the period under review to the question of a sympathetic nerve supply to the skeletal musculature (apart, of course, from the familiar sympathetic innervation of non-striped, visceral muscles). Suspected long ago by Ranvier and others, and held in more recent times by Fano, Botazzi and Pekelharing, the notion of the duality of nerve-supply to the "voluntary" muscles has been set on a firm histological basis especially by the work of Boeke, Kulschitsky, Dusser de Barenne, Agduhr, Hunter, Latham and a number of other investigators. Even so, we are still confronted with the question whether spinal and sympathetic motor nerve fibrils end in the same, or in different, muscle fibrils. On the determination of this point much will depend. While Boeke and others claim that both kinds of nerve end in the same muscle fibre, Hunter and his collaborators contend that as there is a double neural supply, so there are two distinct sets of muscle fibres, each having its specific function, and they maintain, in consequence, that each skeletal or "voluntary" muscle is anatomically and physiologically a couple, a doubled structural and functional unit, and that by experiment or by disease one of these may be destroyed and the other left. Their theories of muscle function are based on the histological claim that the actual innervation of muscle fibres is single, not dual, the sympathetic system sending its fibrils to muscle fibres *not* linked to the spinal motor system, that is, not furnished with spinal motor-nerve end-plates. In his most recent work, on the other hand, Langelaan takes the view that the sarcoplasm of one and the same muscle fibril is reached anatomically from *both* spinal and sympathetic sources, though he distinguishes the function of the two. Since the question has an obvious physiological bearing, it may also be approached from that standpoint.

Physiological Considerations.—Among the problems of the functions of muscle substance one has emerged more definitely in recent years as being of fundamental significance, viz., the relation of the function of contraction to that of maintenance of muscle tone. We owe largely to the work of Sir Charles Sherrington our current conceptions of muscle tone, according to which it is commonly understood as being that condition of contraction of a resting muscle which exists without "voluntary" innervation and is also present though the limb is passively supported, since the muscles do not then "sag" or hang flaccid. Tone gives a shape to muscles, and is in evidence both in resting (static) and in moving (kinetic) states of the musculature. Sherrington has shown that tone is in reality postural contraction, that is, it is a mild contraction of muscle-fibres produced reflexly by sensory excitations arising in peripheral sensory end-organs substantially those of the muscles themselves, the impulses passing therefrom by sensory paths to the spinal grey matter and back to the muscles by spinal motor nerves. This is the proprioceptive reflex arc of Sherrington, and interruption of it at any point is followed by loss of tone in the muscle concerned. In virtue of this reflex contraction, further, a muscle can adapt itself to its varying length; in other words, whether its fibres are as a fact in a shorter or longer anatomical state the reflex contraction is maintained. This property was described by Sherrington as "plasticity," whence the term "plastic tone."

Plasticity.—The exact sense in which the expression "plasticity" is employed is of importance, for others have understood it somewhat differently. When an ordinary nerve-muscle preparation is taken from such an animal as the frog it must by definition be absolutely toneless, since it is separated from the tone-maintaining proprioceptive arc, and cannot therefore exhibit that quality of tone described as "plasticity." In his recent communications, however, Langelaan states that the preparation, though contraction-less, possesses "plasticity," signifying thereby a property of having its form modifiable slowly by external force. Most physiologists and neurologists follow Sherrington in regarding "plasticity" as being a muscle property derived solely from somatic proprioceptive arcs in a condition of integrity.

Movement and Posture.—It is now commonly declared that a distinction is permissible between "contractile tone" and "plastic tone"; more especially during the last decade a hypothesis has gradually taken shape, to the effect that movement can be legitimately distinguished from posture, that these are subserved by different mechanisms, and that whether initiation of movement and maintenance of posture are "active" ("voluntary"), or "reflex" ("involuntary"), each is the expression of a neural activity different from that of the other. In respect of reflex activity, the form the hypothesis takes (according to the late Irvine Hunter, one of its chief supporters) is that "postural tone"—the mild postural contraction defined above as being of reflex proprioceptive origin—is in reality compounded of two subvarieties, acting together but distinct, viz., "contractile tone" and "plastic tone." When in response to suitable stimuli a muscle or muscular group in a limb contracts reflexly, that is, when the limb or a limb-segment changes from one posture to another, this is effected by the contraction of muscle fibres which are innervated by the spinal (somatic) nervous system; such fibres are considered to be responsible for "contractile tone," the tone that is in evidence during contraction. When, next, a posture reflexly assumed comes into being at the end of a reflex movement, that posture is held or maintained by the action of a different set of muscle fibres, whose postulated function, in Hunter's view, is to remain at a given fixed length, once movement of the contractile fibres has ceased, thus immobilising the muscle for as long as may be. These are thought to be responsible, therefore, for "plastic tone." At this point we revert to the considerations in the first section, since Hunter argues that it is the sympathetically-innervated fibres which develop "plastic tone," and the spinal fibres which underlie the manifestations of "contractile tone." Further, he states that the former are essentially *non-contractile;* he assumes their length is passively altered during the contractions of the contractile set.

Dual Theory.—The dual theory of the neuro-muscular system, as it may be termed, has had in recent years various other exponents whose views by no means harmonise with those of Hunter outlined above. Reference may be made to one or two pertinent considerations. Re-examination by Langworthy of Vulpian's phenomenon (1862) would seem to show the possibility of muscular contraction via the sympathetic nervous system. Langworthy has found that stimulation of the lingual nerve (containing bulbar autonomic fibres) leads to slow, wavy contractions of the tongue muscles after complete degeneration of the hypoglossal nerve end-plates by previous section of that nerve. It is more than doubtful, therefore, as regards Hunter's theory, whether *non-contractile,* sympathetically-innervated muscle fibres actually exist. Not a little can be said in favour of the view, however, assigning some function connected with the tension of muscular tissues to a sympathetic innervation, seeing that the actuality of a sympathetic supply to striped muscles cannot be gainsaid. Langelaan, for instance, considers that the sympathetic supply to muscle sarcoplasm maintains the latter in a state of appropriate tension such as to facilitate within it the passage of an innervating current of somatic motor-nerve origin.

Movement Analysed.—Other arguments go to show that a rigorous and schematic differentiation as between movement and posture can scarcely be sustained. Movement is in reality a continuous series of changes of posture, and Sherrington has demonstrated that no clear-cut distinction can be drawn physiologically between reflexes of posture and reflexes of movement. From still another standpoint, experiments with the string-galvanometer have proved that an action-current exists in a healthy muscle when at rest and in a state of normal tone, and that no *qualitative* difference can be detected between it and the action-current when the same muscle is either actively ("voluntarily") innervated or passively moved (Von Weizsäcker, Wachholder, Mann and Schleier). Such data favour the view that tone and contraction are identical and that no fundamental or essential distinction is to be drawn between them; and they militate against any conception of neuromuscular activity which entails the existence of completely separable neural mechanisms for posture and for movement.

Automatic Action.—A second aspect of the problem furnished by the activities of the neuromuscular system concerns reflex or automatic action. Speaking generally, "voluntary" action has always been thought, for seemingly cogent reasons, to contrast specifically with "involuntary" action. The experimentalist and the clinician have long been familiar with so-called spinal automatisms, with co-ordinated grouping in action of neuromuscular units, forming a "pattern" which has an apparent meaning or purpose. In the "spinal animal," for example, following transection of the neuraxis at the level of the junction of medulla and spinal cord, numerous reflex activities can readily be demonstrated, of which the "scratch reflex" is a classical variety. Similarly, in suitable cases in man (of which the War furnished us with many instances) it is quite simple to demonstrate that the isolated spinal cord can live by itself and that it possesses capacities for activity in a co-ordinated form, primitive neuromuscular mechanisms usually hidden in health but capable of expressing themselves in the form of release-phenomena when the cord is separated by disease from higher physiological levels.

The apparently purposive character of many of these reflex activities (automatic emptying of the bladder, attempts at spinal walking or stepping, biologically old reflexes connected with the genital apparatus, etc.) is of considerable importance and significance, for they are entirely independent of conscious control and of intelligent guidance, since in the given circumstances (gunshot wounds of the cervical cord, experimentation) the cord with its neuromuscular patterns is physiologically severed from the brain. Thus muscular action of a strictly reflex kind, produced solely by appropriate stimuli at the same low physiological level, may, and does, exhibit outward characters which render the discrimination from "voluntary" action not a little arduous—as far, that is to say, as externals are concerned.

Neuromuscular Functions at Higher Levels.—Pursuing this line of investigation, the physiologist is led to examine the neuromuscular functions of the animal in which transection is performed at higher levels than the spinal. During the last few years a whole series of apparently purposive reactions superficially indistinguishable from combined movements of the order usually called "voluntary," have been demonstrated by Prof. R. Magnus, of the University of Utrecht, and his colleague, Prof. de Kleijn, and other collaborators, to occur in the higher animals through the agency of mechanisms that are purely and rigidly automatic. Magnus and de Kleijn's method has been to study the reflexes and reactions of the "spinal" animal; then to take the "midbrain" animal (transection at the level of the corpora quadrigemina of the mesencephalon) and observe what additional functions it is capable of executing; they next take the "thalamus" animal (separation from cerebral cortex and corpus striatum at the level of the internal capsule) and investigate its functions. They then argue for the localisation of the mechanisms underlying these respective additional functions within the corresponding limits of the respective additional areas of the neuraxis above the upper spinal cord. They have thus been able to demonstrate with precision that a large group of seemingly purposive movements, by which man and the higher animals balance their bodies, maintain normal postures and adjust themselves to forces disturbing equilibrium, are as a fact nothing else than reflex actions of ascertained neuromuscular mechanisms.

Static and Stato-kinetic Reflexes.—Under the former are included: (1) Standing reflexes. The head influences the posture of the body by means of tonic neck-reflexes acting on the limbs. When the position of the head in relation to the body is passively altered, specific corresponding changes take place in the attitude of the limbs. If the head is fixed in its relation to the body, and then its position in space altered, the musculature of body and limbs is correspondingly modified by means of tonic labyrinth-reflexes. (2) Eye reflexes of compensation. For each position of the head in space there is an appropriate reflex setting of the eyes in the orbits, effected both by tonic neck-reflexes and labyrinth-reflexes, acting on the eye musculature. (3) "Correcting" or "righting" reflexes. Animals whose midbrain is intact are capable of reassuming correctly a normal attitude, through reflex action, from which they have been passively deflected. The machinery for this reflex "righting" is complex, there being at least four different sets of reflexes.

The discoveries of Magnus and de Kleijn have made a large addition to the long series of automatisms of which the physiologist has been cognisant. Into them no element of choice enters. Activities hitherto considered intelligent must be relegated to the category of automatisms, of reflexes, almost, indeed, of tropisms.

Cerebral Motor Cortex.—Finally, in respect of the cerebral motor cortex itself, recent investigations indicate that revision here also is required. Classifying in a general way as belonging to the "old motor system" the motor reactions of infracortical physiological levels (*cf.* supra), the neurologist has been in the habit of regarding as the "new motor system" that comprised in the electrically excitable motor area of the cortex with its corticospinal prolongation to the motor cells of the anterior cornua of the spinal cord. This corticospinal system (with its analogues) is usually understood to be the "voluntary" motor system and to exercise a controlling influence on infracortical motor centres. In some respects it is unquestionably the master system, yet in other respects this is no more than a *façon de parler.* The writer has shown (Croonian Lectures before the Royal College of Physicians of London, 1925) that many of the "involuntary" movements of diseased conditions, *e.g.*, those of chorea, are as a fact identical in all essential respects with "voluntary" movements of cortical origin, except that the patients' "volition" neither initiates nor is able to inhibit them. They constitute cortical reflexes, the expression of activity of neuromuscular mechanisms whose anatomical site reaches to the cortex and which are nevertheless outside "volitional" control. Other recent work points in the same direction. Monakow, for example, has come to the view that the function of the pyramidal areas seems to be in the class of reflex activity. Lashley, who has done much experimental work on cerebral function, concludes that the conception of "volitional" activity is too vague to have any scientific value, while years ago Hughlings Jackson taught the neurological world that, in respect of movements, "voluntary" and "automatic" were not terms of differentiating quality, that gradations existed between the two, and that the progression is in reality from "least automatic" to "most automatic."

Conclusions.—The conclusion from this very brief survey of recent developments in the field of the neuromuscular system cannot, however, be expressed in any definite form. On the one hand, some will hold that these accretions to knowledge widen the gap between intelligence and automatism, even though they appear to bring that gap higher up in the scale of motility. Others will argue that if some part, at least, of cortical motor activity is shown to be "non-volitional," then "volition" is driven further back, physiologically, to a transcortical level, and that it can be little else than transcortical inhibition.

(S. A. K. W.)

NEUVE CHAPELLE, BATTLE OF.—The German failures at Ypres in Oct.–Nov. 1914 had caused them to alter their strategy. They abandoned the effort to obtain a decision in the west, adopting a defensive attitude there, and concentrated their strength on crushing the Russians, who were isolated, short of equipment and munitions, and in consequence unable to utilise fully their vast resources in men. In the west the Germans could profit by all the factors which so greatly favour the tactical defensive in modern warfare, barbed wire and machine-guns in particular; they could hold their lines lightly and yet keep occupied Allied forces much stronger than their own.

The Allies, to whom the expulsion of the Germans from France was an urgent necessity, economically as well as politically, were impelled to pit themselves against the German defences before adequate measures could be devised for neutralising the special sources of the defensive's strength. In selecting the locality of their attacks they were directed to Artois by the fact that the German lines in Artois covered the main railways by which the German armies on the Western Front were supplied at their most vulnerable point, the plain of Douai. A break through in Artois therefore offered special advantages.

The Various Plans.—While the winter months saw incessant local fighting, at the Allied Headquarters more ambitious projects were being contemplated. Neither Sir John French nor Gens. Joffre and Foch would admit that the German lines could not be broken, and both entertained hopes of a substantial strategic success. Joffre's chief project was the recovery of the Lorette and Vimy ridges as a preliminary to an advance in force into the plain of Douai. Sir John French was particularly keen on recovering the Aubers ridge and so getting his right centre out of the water-logged Lys valley; success here, moreover, would threaten the German hold on Lille and might open the way to effective co-operation with French operations nearer Arras. Actually, owing to the diversion to the Dardanelles of the 29th Div. which had been earmarked for relieving French troops at Ypres, the first serious offensive of 1915 was undertaken by the British alone, the French X. Army being unable to co-operate unless this relief could be carried out.

Opening of the Attack.—The British offensive took the shape of an attack on Neuve Chapelle, where a nasty salient had been driven into the British line when the Germans captured that village in Oct. 1914. To recapture Neuve Chapelle would greatly improve the position tactically, and might lead to gaining a foothold on the Aubers ridge, an indispensable preliminary to any major operation on the I. Army's front. The attack delivered on March 10 began well. The Germans, far from expecting it, had thinned their forces opposite the British and had only three battalions on the frontage attacked. The bombardment had been effective and, except on the extreme left, the wire was well cut. The centre of the attack reached and captured Neuve Chapelle without much difficulty, but the uncut wire on the extreme left held up the flank of the 8th Div., which only secured its final objective after several hours' delay. On the extreme right also one battalion of the Indian Corps lost direction and found itself separated from the rest by a stretch of untaken trenches in which Germans were resisting. Here also there was delay, and the diversion of supports and reserves to help overcome the obstacle.

Meanwhile the centre was held up until the flanking brigades could get up level, though had it pressed on at once, regardless of its exposed flanks, it seems doubtful if there was anything at hand to stop it. But it was considered essential that there should be no advancing with unprotected flanks and the centre had to wait. When at last the flanking brigades came up, the opportunity had gone, for sufficient German reinforcements had arrived to man the redoubts in their half-finished second line. On the right two Gurkha battalions reached the Bois de Biez about nightfall, but being too much in advance of other troops were withdrawn, and on the left the leading brigade of the 7th Div. passed through the 8th, but too late to make much progress before darkness stopped its advance. One main cause of delay had been difficulties in transmitting accurate information from the front line to the higher commanders and in forwarding orders back to the front; another was the holding back of reserves until the situation was accurately known.

Second and Third Days.—Next day (March 11) saw efforts made to push on, but with little success. Mist hindered the observation of artillery fire, the interruption of communications with the front line hampered co-operation between artillery and infantry and caused much of the precious ammunition to be ineffectively expended. German reinforcements arrived in sufficient numbers to secure the second line and even to counterattack in force early on March 12. There was very heavy fighting, ending in the repulse of the Germans with great slaughter, and the 7th Div. profited by this chance to storm a strong redoubt north-east of Neuve Chapelle. Elsewhere, however, no progress could be made and on March 13 it was decided to suspend the attack. The advantage of surprise was lost, the Germans were

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[1] It was calculated that in May 1915 the Germans had under 2,000,000 men on the Western Front, a force considerably inferior to the French alone, while the British then numbered nearly 500,000.

now in force on the front, the ammunition expenditure had exceeded expectations and used up the available supply.

Sir Douglas Haig was anxious to renew the offensive without delay and to recover the advantage of surprise by attacking at a new point. Unfortunately, the ammunition shortage forbade this and postponed any renewal till a fresh reserve had been accumulated, and the delay allowed the Germans to strengthen their defences greatly, and remedy defects in them which the battle had revealed. (*See* WORLD WAR: BIBLIOGRAPHY.)

(C. T. A.)

NEVADA (*see* 19.450), a State of the United States of America. The population in 1920 was 77,407, a decrease of 5·5% compared with 1910 as against an increase of 93·4% for the preceding decade. The native white population in 1920 numbered 55,897; foreign-born whites 14,802; Indians, 4,907. The density of population in 1920 was 0·7 per square mile. The urban population (in places of more than 2,500 inhabitants) was 19·7% and the rural 80·3 per cent. Reno, with a population of 12,016, an increase of 10·6% over 1910, was the only town having more than 5,000 inhabitants.

Agriculture.—The number of farms in 1920 was 3,163. The value of farm property increased in 1910–20 from $60,399,365 to $99,779,666. The value of crops more than doubled between 1915 and 1920, largely owing to higher prices. Since 1919 the value of agricultural products has surpassed that of mineral production. Sheep and cattle are Nevada's chief assets. The average wool clip from about 1,000,000 sheep is 7,500,000 pounds. The chief crops are hay, potatoes, wheat, barley and corn. Turkeys are raised, and cantaloupes (melons) are grown extensively on the Truckee-Carson Irrigation Project, while dairy-farming is the chief industry near Reno.

The better utilisation of the water supply for irrigation and power is one of the most pressing needs, as the old laws gave vested rights in water to those who used it for irrigation; but marked progress has been made, through court decisions, in the adjustment of water rights for the Truckee, Humboldt, Carson and Walker river systems. The next step is the development of storage projects, of which the Newland Irrigation District is the first unit. The Walker River Irrigation District is a state project which has reclaimed over 150,000 acres. An appropriation was made by Congress in 1925 for the Spanish Springs Reclamation Project, near Reno.

Minerals.—From 1907 metal production steadily increased until it reached its peak in 1917, in which year gold, silver, copper, lead and zinc were produced to the value of $54,424,580. From 1918 to 1921 production steadily decreased, the decline of 1919 being more than 50% of the figure of 1918. A further fall took place in 1919 and again in 1921, in which latter year the mineral output was only valued at $12,137,000. Increased operating costs and low prices for metals because of accumulated war stocks, together with exhaustion of ore and scarcity of labour, were the prime causes. The Pittman Silver Purchase Act of Congress kept the silver industry in better condition until the expiration of the Act in June 1923. In 1922 the output increased in value to $18,374,023; in 1923 and 1924 metal production again showed an increase, reaching about one-half the normal output.

Production for 1924 was valued at $23,800,000 and the output gradually improved, the production of base metals—copper, lead and zinc—becoming the most important. Nevada contains valuable tungsten deposits which were not at first profitably worked because of foreign competition, but which, in 1925, were advantageously operated in several places. Other minerals commercially developed are quicksilver, antimony, manganese and platinum. The production of non-metals, such as gypsum, borax, lime, fluorspar, diatomaceous and fuller's earth, alum, potash, sulphur and other rock products has increased. Large quantities of pure rock salt exist. A shale-oil plant near Elko produces oil and a large number of by-products. Opals and turquoises of value are mined.

Industries.—Manufacturing industries are of little importance. The value of all manufactured products increased by 77·5% between 1909 and 1919, but the value added by manufacture in 1919 showed a decrease from 1914 of 5·7%, due to the decrease in the smelting and refining of copper. The most important works are for grist, flour, dairy products, the making and repairing of cars and the smelting of ores.

Transport.—Since 1910 the Western Pacific Railroad has acquired a part of the Nevada-California Oregon line and has altered it to broad gauge, thus making connection with Reno. In 1925 a new line was completed from the Idaho line to Wells, where it connects with the Southern Pacific and the Western Pacific. In 1924 there were over 2,000 m. of railway in the State. The Las Vegas and Tonopah Railway discontinued operation from Beatty to Las Vegas in 1918: the Legislature of 1919 designated the line as part of the State highway system, and the Highway Dept. converted the road bed into a modern highway. Between 1916 and 1925 Nevada expended over $7,000,000 on road building.

Government, Education and Finance.—State social service has been extended through numerous commissions and a few new departures, such as the industrial school and the grant to the Florence Crittenton Home. Nevada was one of the first States to have industrial insurance. Counties are permitted to arrange for mothers' pensions and old-age pensions. An extensive building programme for state institutions was begun in 1917, and included new prison and asylum buildings, a Heroes' Memorial Building, additions to the Orphans' Home and the Nevada School of Industry and several new buildings at the University of Nevada.

State recreation grounds are being developed on the sites of the prehistoric cities in Clark and Nye counties, at the Chloride Cliffs near Beatty, at the Lehman Caves and other points of interest in White Pine county, and at the Valley of Fire in southern Nevada. Illiteracy, mainly among the Indian population, was reduced from 6·7% in 1910 to 5·9% in 1920. In 1924 there were 319 elementary public schools and 46 public high schools in the State. The bonded debt on Jan. 1 1925 was $1,660,000, and state-owned bonds had a value of $3,055,357. The total assessed value of taxable property in 1924 was $201,292,000.

History.—In 1912 the Progressive party polled a vote second to that of the Democrats. The Democratic party continued in undivided power until the election of 1920 gave many important offices to Republican candidates. Emmet D. Boyle, Democrat, was elected governor in 1915 and was re-elected in 1919. James G. Scrugham, Democrat, was elected to the same office in 1923. The most important amendments to the constitution of Nevada were those of 1911 and 1913 for the recall and for female suffrage. A state prohibition law was enacted, pursuant to a direct vote of the people cast Nov. 5 1918. The legislature ratified the 16th Amendment (income tax) to the Federal Constitution in 1911, the 17th (direct election of senators) in 1913, the 18th (prohibition) in 1919 and, in 1920, the 19th (woman suffrage).

(J. E. W.*)

NEVILL, LADY DOROTHY FANNY (1826–1913), British writer, was born in London April 1826, the daughter of Horatio Walpole, 3rd Earl of Oxford. She married in 1847 Mr. Reginald Henry Nevill (d. 1878), a grandson of the 1st Earl of Abergavenny. She travelled widely, and had a very large circle of acquaintances, including Disraeli, of whom she was a great admirer, Richard Cobden and Joseph Chamberlain. She was noted for her amusing conversation and powers as a hostess, was a member of the first committee of the ladies' branch of the Primrose League, and was the author of various volumes of entertaining reminiscences; *Reminiscences of Lady Dorothy Nevill* (1906); *Leaves from the Notebooks of Lady Dorothy Nevill* (1907); *Under Five Reigns* (1910); *My Own Times* (1912). She died in London March 24 1913. Her daughter, Meresia Dorothy Augusta Nevill (1849–1918), was born Dec. 14 1849 and was also a devoted and energetic worker for the Primrose League. She died in London Oct. 26 1918. The *Life and Letters of Lady Dorothy Nevill* (1919), were edited by her son Ralph, author of *Sporting Days and Sporting Ways.*

NEWARK, N.J., U.S.A. (*see* 19.460), began in 1914 to develop its waterfront on Newark Bay as a shipping terminal and industrial centre. About 1,100 ac. of meadow land on the west shore of the bay were bought, an approach channel was dredged from the government channel in the bay, which leads out through the Kill van Kull into New York Bay, and the adjacent land was reclaimed. On the entrance of the United States into the World War in 1917 the War Dept. leased 133 ac. of the newly filled land for one of its largest army supply bases, spending $12,000,000 on docks, warehouses and equipment for handling freight; and the U.S. Shipping Board established here a $30,000,000 shipyard, employing 17,000 workers, where 150 steel cargo vessels were constructed by the Submarine Boat Corporation. At the close of the War the army base (including nine warehouses with 2,000,000 sq. ft. of floor space) became a commercial terminal, and the city resumed its original programme. With aid from the Federal Govt. the channel was deepened to 31 ft. and widened to 400 feet. Additional land was reclaimed, making available over 200 industrial sites.

The aggregate value of the products manufactured within the city limits was $201,888,000 in 1909; $577,609,000 in 1919; $336,809,458 in 1921; and $448,172,394 in 1923, when there were 1,863 plants, with 70,056 wage-earners. The leading industries, measured by value of output in 1923, were electrical machinery, apparatus, and supplies, leather, jewellery and chemicals. Ninety new factories were established in the Newark industrial district in the year ending Oct. 1 1925. Important improvements in the city's equipment include the public service terminal at Park Place, opened for street railway operation April 30 1916; a trunk sewer, constructed in co-operation with Paterson and 13 other municipalities, to collect the sewage of towns in the Passaic valley, carry it across Newark Bay, and discharge it in upper New York Bay; doubling of the water supply by development of the Wanaque watershed, a new public market and a city stadium, seating 12,000. A magnificent group of bronze statuary, "The Wars of America," by Solon Borglum was placed in Military Park in 1925. At a special referendum election held Oct. 9 1917 the commission form of government was adopted. Population (1910), 347,469; (1920) 414,524, of whom 16,977 were negroes and 117,549 foreign-born; (1925), according to Census Bureau estimate, 452,513.

NEW BEDFORD, Mass., U.S.A. (*see* 19.462), took first place in 1919 in the manufacture of cotton goods, as measured by value ($177,058,520), ranking above Fall River. The aggregate value of all its manufactured products rose from $53,238,000 in 1909 to $210,773,000 in 1919; dropped to $110,014,358 in 1921; and rose to $149,998,694 in 1923. The number of wage-earners in factories was 26,566 in 1909; 41,630 in 1919; 37,917 in 1923. The population increased to 121,217 in 1920; but in 1925 was 120,494 according to the Massachusetts state census, indicating that the loss during the period of depression had not yet been recovered. The proportion of women and children employed was exceeded in 1920 only by Washington and Fall River respectively. Housing conditions, severely taxed during the War, were studied by a special commission in 1919. A thorough survey of the public-school system was made by its own personnel (1921–2) under the direction of an expert, resulting in a programme of "principles, policies and plans," which was adopted by the school committee. A state pier, 750 ft. long, with 25 ft. of water on all three sides, was an important addition to the harbour facilities. New Bedford is the spot cotton market of the north.

NEW BRUNSWICK (*see* 19.464), a province of the Dominion of Canada. The population in 1921 was 387,876, an increase of 35,987 since 1911. Of the total 70% was rural; 30% was of French extraction. The towns having over 5,000 population in 1921 were St. John (47,166), Moncton (17,488) and Fredericton (8,114). The Government consists of a lieutenant-governor and a legislative assembly of 48 members; an executive council consisting of the Premier and eight other ministers is formed from the legislative assembly. The province is represented in the Federal Parliament by 10 senators and 11 members of the House of Commons.

Education.—Primary education is free and undenominational, being supported by legislative grants supplemented by local taxation. In 1924 there were 2,195 schools, 2,395 teachers and 72,713 pupils. A noteworthy fact, however, is that in 1921 12·46% of the population were illiterate, the highest percentage of any province in the Dominion.

Production and Industry.—Agriculture is limited chiefly to the production of potatoes, hay and clover, oats, turnips and buckwheat, this order representing production value in 1924. The area under wheat showed a steady decline between 1920 and 1925. The total area under crops in 1925 was 900,033 ac., as compared with 1,335,118 ac. in 1919, the highest on record. The total value of field crops in 1925 was $25,681,100. Farm livestock greatly decreased during the years 1922–3, the number of horses falling from 70,152 in 1922 to 50,644 in 1923, cattle from 303,115 to 212,901, sheep and lambs from 236,031 to 157,808, and swine from 85,260 to 66,182. From 1923 to 1925 numbers remained steady. The total value of livestock in 1924 was $15,390,800. The production of butter and cheese is relatively unimportant, the total value of both in 1924 amounting to $592,605.

The forest area of the province comprises about 15,000,000 ac., one half of which are crown lands. Of the timber cut in 1924, amounting to 362,000,000 superficial ft. 27% consisted of fire-killed spruce, cedar and fir, and 20% of spruce and fir killed by the bud-worm. The average annual value of the lumber output in the years 1917–21, not including wood used by settlers, was $13,235,128: in 1924 lumber production was valued at $12,407,262. Reseeding of the burnt-over lands was commenced in 1924. There were five pulp-mills in 1923, with a production of 111,126 tons valued at $6,986,208. The first paper-mill was put in operation in 1923.

The total value of the fisheries in 1923 was $4,548,535, as compared with $6,298,990 in 1918. The province possesses some mineral resources, coal, gypsum and oil being the most important. The manufacturing industry of New Brunswick has shown sustained progress. In 1922 there were 885 establishments with a capital of $81,789,934, employing 14,199 persons and having a total production valued at $64,614,137. In 1923 the total value of manufactures had increased to $70,114,006. Of the 120,000 H.P. available some 45,000 H.P. had been developed by 1925. The development of Grand Falls, the largest undeveloped water power in eastern Canada, was postponed owing to a change of government.

Communications.—There was a marked improvement in the roads of the province during the post-War period: 1,100 m. out of a total of 1,763 m. of main road were reconstructed. The policy followed in 1924 involved an expenditure of $860,000 or $2.20 *per capita* on roads. The province had 1,947 m. of railway in operation in 1923, most of which is controlled by the Canadian National Railways. St. John is the eastern terminus of the Canadian Pacific Railway. (*See* CANADA.) (S. LE.)

NEWCASTLE-UPON-TYNE, England (*see* 19.472), with a population of 275,009 in 1921 and an area of 8,452 ac. (including the town moor of 927 ac.), maintained a large output of ships, guns and munitions during the World War, but suffered subsequently from trade depression. Since 1918 the city has returned four members to Parliament. The port is constantly being improved; the channel from Newcastle to the sea has been dredged to a depth of 30 ft., and to 25 ft. for a distance of 11 m. westward from Northumberland dock. A quay extension, providing three berths, was opened in 1924. In 1925 schemes for further quay extensions, for a new road through the centre of the city, for the purchase of the Tyneside tramways, and for lifts from the quay to a new bridge across the Tyne (then in course of construction), were submitted to a vote of the ratepayers, but only the last mentioned scheme met with approval. A large extension of the Royal Victoria Infirmary was opened in 1920, and the Princess Mary maternity hospital in 1923. A War Memorial in Eldon Square, and a monument at Barras Bridge to commemorate the raising of several battalions, were unveiled in 1923. A memorial to men of the 6th Battalion Northumberland Fusiliers was erected in 1924 (*see* DURHAM, UNIVERSITY OF).

NEWFOUNDLAND (*see* 19.478), a Dominion of the British Empire. The area of the Island is 42,734 sq. m., and its population at the census of 1921 was 259,259. The total population of the colony, including its dependency of Labrador (*q.v.*), which has an area of about 120,000 sq. m., was 263,259.

I. POLITICAL HISTORY

The inauguration in 1912 of the Fishermen's Union, which established large trading stores in all the principal outposts and had as its political object the safeguarding of the interests of the fishermen by means of representation in the Legislature, was the outstanding political event of the immediate pre-War period. In the elections of Nov. 1913, although the Government of Sir Edward Morris was re-elected, the candidates of the Fishermen's Protective Union (F.P.U.) won all the constituencies in the north and northeast. On the outbreak of the War a Newfoundland regiment was formed and served overseas in Gallipoli, Egypt and France. Altogether some 6,500 men joined up for service during the War. In 1917 the Morris Government was enlarged into a National Government by the inclusion of the opposition, in order to expedite measures dealing with war requirements. At the end of 1917 Sir Edward Morris resigned, and was succeeded by Mr. (Sir) William Lloyd, the former leader of the Opposition.

In 1919 Sir William Lloyd attended the Peace Conference as the representative of the Colony. During his absence his Government was destroyed by internal dissensions, and Mr. (Sir) Michael Cashin became Premier. The elections of Nov. 1919 were marked by extreme bitterness, religious feeling being introduced to a great extent. A considerable turnover of votes resulted, and the Government was defeated by a party led by Mr. (Sir) Richard Squires, consisting of his own supporters and those of Mr. (Sir) William Coaker, the leader of the Fishermen's Protective Union. The year 1920 was marked by a dispute with Quebec over the Labrador boundary, and the question was finally referred to the Privy Council.

The Government was re-elected in 1923, but shortly afterwards Sir Richard Squires resigned as a result of grave charges preferred against him in the Legislature, including, amongst others, the receipt of money from private corporations and the diversion of Government funds to persons occupying high official posts. Subsequently these charges were investigated by Mr. T. Hollis Walker, K.C., Recorder of Derby, England, who was obtained to act as a commissioner for this purpose, and his finding was adverse to Sir Richard Squires on certain points. Thereupon a criminal indictment was preferred against the latter in the Supreme Court, but the grand jury found "no bill," and the Crown did not pursue the matter further. The Attorney-General, Mr. William Warren, had assumed the leadership, but on the opening day of the legislative session of 1924 his ministry was defeated. It was reconstructed, but without avail, and then Mr. Albert Hickman, with the backing of the F.P.U., formed a ministry and went to the country. The leading political issues were the reorganisation of the public services and a greater honesty in the Government, and the election resulted in a victory for the party led by Mr. Walter Monroe, which assumed office in 1924.

II. ECONOMIC AND FINANCIAL HISTORY

The colony enjoyed considerable prosperity between 1910 and the outbreak of the War. Fishing, mining, paper-making, etc., made marked progress, but after 1914 the financial difficulties of the European countries in which these products were marketed, coupled with difficulties of transport, brought about a serious depression, which was followed by a financial crisis. Later the food requirements of Southern Europe sent the price of codfish to a record figure, and the war demands for timber and fish resulted in a period of great prosperity, which continued until 1920. A reaction then set in, with disastrous consequences to the whole commercial community and to the economic stability of the island. In the effort to overcome this, the Government attempted a policy of control over the marketing of colonial fishery products in foreign markets, but it could not be enforced, and ultimately had to be abandoned after severe monetary losses. Sales of iron ore were likewise hampered by the economic poverty of customers, and the depression in the paper market compelled wage reductions, which were followed by labour troubles which seriously affected the output of the mills. After 1923, however, a slow but sure recovery was being made to pre-War conditions of industry and trade.

Fisheries.—The cod fishery continued to be the chief industry, and the years 1924 and 1925 were marked by fair catches and good prices. The seal-hunt, owing to over-fishing, yielded not much more than 100,000 pelts annually, against twice that number annually before 1914. The lobster fishery, for the same reason, suffered such decline that a "close season" for three years was put in effect in 1924. The herring fishery considerably improved during the post-War period. The salmon fishery also yielded better returns, and the whale fishery showed a slight improvement. Efforts are being made to improve the curing and marketing of these products, to develop the canning industry and encourage the fishing for other species, heretofore neglected, but which it is believed could substantially augment the annual catch. The total value of the fishery products exported during the fiscal year ending June 1924 was $10,867,496.

Forest Products.—The development of the forest resources was very marked during the period 1910–25, notably in paper-making. The mills of the Anglo-Newfoundland Development Co., at Grand Falls, first designed to produce 200 tons of newsprint paper daily, were enlarged to produce another 75 tons, the additional mechanical pulp required being pumped through underground pipes from a subsidiary mill at Bishop's Falls, 9 m. distant. In 1923 still larger mills were begun at Corner Brook on the Humber river, with a capacity of 400 tons of "newsprint" daily, by the Newfoundland Power and Paper Company. These mills were completed and officially opened in Aug. 1925. A third mill of similar capacity, to be located on the Gander river, on the east coast, was projected by the Reid Newfoundland Co. in 1925. Mills for the manufacture of mechanical pulp were also projected, and the island seems destined to develop into a great paper-producing centre. Lumbering on a small scale, entirely for local consumption, is also practised. The total value of the exports of paper, pulp, etc., in 1923–4 was $5,955,725, as compared with $428,459 in 1909–10.

Minerals.—Mineral development has been mainly connected with iron ore. The mines at Bell Island, which are estimated to contain 15% of the world's total available supply, were only partially operated during the War years, and during the post-War period, owing to chaotic financial conditions in Europe, suffered considerably in their sales. After 1922, however, the export exceeded 1,000,000 tons annually, four-fifths going to Germany and the remainder to Nova Scotia. The total value of the mineral export in 1923–4 was $1,281,929. Mining otherwise has been on a small scale and without any substantial results.

Finance and Trade.—With its population only slightly increased since 1911, while its burdens have been almost doubled by War outlays and post-War reconstruction, Newfoundland has realised the necessity of encouraging other industries in order to avoid the former dependence on the fisheries. Hence the efforts to stimulate paper-making, mining, etc., and the adoption of tourist and other policies. Substantial success is being attained, so that emigration from the Island, which was very great in the immediate post-War period, had virtually ceased by 1925, while a surplus revenue and swelling bank deposits attested the greater prosperity of the resident population. Trade has considerably improved since 1921–2, as is shown by the table below. The increase in the value of imports for the year 1924–5 was due

Year	Funded Debt	Revenue	Expenditure	Imports	Exports
	$	$	$	$	$
1919–20 .	43,033,035	10,597,561	9,247,005	40,533,388	34,865,438
1920–1 .	49,033,767	8,438,039	10,949,053	28,909,727	22,441,267
1921–2 .	55,030,027	8,269,680	9,127,542	18,209,853	19,478,417
1922–3 .	54,957,765	8,876,772	9,552,301	19,321,824	20,956,863
1923–4 .	60,456,965	8,401,669	10,022,137	27,677,182	21,071,571
1924–5[1] .	68,964,665	9,783,188	9,436,185	36,374,674	23,590,186

[1] This amount includes an issue of $2,500,000.00 in Dec. 1925.

to the great demand for raw materials for development schemes, including the Corner Brook paper mill, the extension and repairs to the dry dock at St. John's, and the re-laying of a section of the railway.

Communications.—The railway system, over 900 m. in length, with 10 subsidiary steamers covering in-bay and coast routes, proved a great boon to trade during the War, but ceased to be profitable after hostilities ended because of the increased cost of commodities and services. Annually recurring deficits, in some cases exceeding $1,000,000, proved too great a strain for the resources of the Reid Newfoundland Co., which was operating the entire system under a 50-year contract of which about 20 years had expired, and in 1923 the Government bought out the Reid interests for a payment of £2,000,000 and took over the railroad and the steamers. Since then, these public utilities have been operated under direct Government control. The telegraph system, which is being gradually extended all over the seaboard, is similarly operated, and the wireless service has also been extended. The ocean steamship services have been gradually improving, and in 1925 the Government constructed a new steamer for the service which connects the Newfoundland railway system at Port-aux-Basques with the Canadian National Railway system at North Sydney. In the same year the Government decided on a policy of constructing modern highways, suitable for motor traffic, to link up the best scenic and sporting areas in the Island, and also secured the construction of a new modern hotel in St. John's.

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(P. T. M.)

NEW GUINEA: *see* PAPUA.

NEW HAMPSHIRE (*see* 19.490); a State of the United States of America. The population in 1920 was 443,083, a gain of 12,511 since 1910, or 2·9%, as against 4·6% in the preceding decade. The urban population was in 1920, 279,761, or 63·1% of the whole, as against 59·2% in 1910. The estimated population in 1925 was 450,175. The population of the eight cities having more than 10,000 inhabitants was:—

	1910	1920		1910	1920
Manchester	70,063	78,384	Portsmouth	11,269	13,569
Nashua .	26,005	28,379	Dover .	13,247	13,029
Concord .	21,497	22,167	Keene .	10,068	11,210
Berlin .	11,780	16,014	Laconia .	10,183	10,897

Agriculture.—The statistics for farm property, showing the changes from 1910 to 1920, are as follows:—

	1910	1920
Number of farms	27,053	20,523
Value of farm property . . .	$103,704,196	$118,656,115
Average acreage, all land . .	120·1	126·9
Average acreage, improved land .	34·3	34·2
Av. value per ac. (farm property) .	$31.91	$45·57

Farms of from 100 to 499 ac. constituted 42·9% of the whole: farms of 20 ac. or less had the greatest proportion of land improved, 67·4%, and farms of over 1,000 ac. had the least—13·5%. Of all farms 90·6% were operated by owners, 2·7% by managers, and 6·7% by tenants, these percentages being without substantial change from 1910. Native farmers decreased from 24,347 in 1910 to 20,509 in 1920. The table at top of next column shows the increase in agricultural production between 1909 and 1919. In 1925 livestock included 32,000 horses, 121,000 milch cows, 32,000 other cattle, 18,000 sheep and 28,000 swine.

	1909	1919
Dairy products sold	$5,130,057	$9,627,286
All crops	12,112,260	23,509,665
Cereals	879,631	1,456,628
Hay and forage	7,847,148	13,616,378
Vegetables	2,276,176	5,228,489
Potatoes	1,204,620	2,952,351
Miscellaneous crops	200,845	480,804
Orchard fruits and grapes . .	730,703	2,420,837
Maple sugar and syrup . . .	182,341	440,250

Forestry, Highways and Motors.—The biennial report of the forestry commission for the period ending June 30 1924 shows a total of 47 state reservations containing 20,538 acres. The estimate of forest-bearing land in the State is 4,434,793 ac., of which the Federal Govt. owns 9·42% and the state 46%. The total acreage of tree-bearing land is valued at about $95,000,000. The legislature of 1925 provided for the purchase of Franconia Notch, and its dedication "as a memorial to the men and women of New Hampshire who have served the nation in times of war." The policy of establishing and maintaining state highways has been continued with increased scope. During the year ending Dec. 31 1924 the number of motor registrations was 71,929. In 1923 there were 1,239 m. of steam railway in the State: electric railways totalled 261 m. in length in 1924.

Manufactures.—According to the census of 1919 the nine leading industries, according to value of products, were: cotton goods, boots and shoes, paper and pulp, woollen goods, boot and shoe stock, lumber and timber products, worsted goods, foundry and machine shop products, and leather (tanned), ranging in value from $85,986,000, for the products of the first of these industries, to $7,309,000 for the last. The number of wage-earners increased, 1914–9, from 78,993 to 83,074; female employees from 23,115 to 83,074; workers under 16 from 485 to 859; wage-earners in the group "48 hours and under" from 5·7% to 65·6%. Manchester has the most wage-earners in the State, 25,512, Hillsborough county, containing Manchester and Nashua, has 44·6% of the total and manufactures 45·1% of the products. The tendency noticed in 1914 toward the diminution of the number of small establishments and of the number of wage-earners in them continues. The following table shows the development from 1909 to 1919:—

	1909	1914	1919
Establishments . . .	1,961	1,736	1,499
Employees . . .	84,191	85,013	90,332
Salaries and wages .	$ 40,391,440	$ 46,523,733	$ 92,538,743
Value of products .	164,581,019	182,843,863	407,204,934

Legislation.—Important Acts were those establishing a state Board of Conciliation and Arbitration; providing employers' liability and workmen's compensation; regulating child labour and hours of labour; providing for medical and surgical devices in factories; for safety and health of employees; and for reporting of occupational diseases. The legislature of 1917 enacted a law prohibiting the manufacture and sale of spirituous liquors. The law took effect May 1 1918, superseding local option.

Finances and Taxation.—The following figures show the increase in expenditures:—

	1910	1920	1924
Revenue	$1,694,636.54	$4,344,322.20	$5,176,948.75
Payments	1,662,694.07	5,198,534.62	4,296,724.69
Debt	1,293,209.33	3,040,524.17	181,966.65
Bonded Debt . . .	1,071,070.00	2,589,500.00	1,619,500.00

The increase in expenditures was on account of increased cost of maintaining public institutions and for highways. The increase in the bonded debt was nearly all due to the World War. In 1918 the State issued $500,000 of bonds to assist the Federal Govt. in the War; and in 1919 it issued $1,489,000 in order to increase the war service recognition from $30 to $100 for those who served. The total valuation of property for purposes of taxation in 1924 was $585,422,877; amount of taxes assessed was $14,599,100. The average rate was $2.49 per $100. Poll taxes assessed were 235,765 in number. The total valuation of all public utility companies was $51,252,200. The tax on the income of intangibles for two-thirds of the year was about $220,000.

Education.—Important work was done in 1918 by the state committee on Americanisation. In the parochial elementary schools the principle was established that instruction in designated branches and in administration should be exclusively in English. In the large industrial plants the plan was largely carried out by evening schools for adults. The system of public instruction was reorganised by the legislature of 1919. In the bill "the work of Americanisation is hereby declared to be an essential part of public-school education." The legislature of 1923 changed the name of the New Hampshire College of Agriculture and the Mechanic Arts to the University of New Hampshire, and the legislature of 1925 provided for it a stable annual revenue of one mill on every dollar of assessed valuation.

History.—The Ninth Constitutional Convention, held in 1912, submitted to the voters 12 amendments, of which four received the necessary two-thirds vote, namely, defranchisement for treason, bribery and deliberate violation of the election laws; the substitution of plurality for majority vote in the election of governor, councillors and senators; extension of the jurisdiction of police courts; the substitution of a basis of population for that of property in the election of councillors. In 1915 the office of assistant attorney-general was created, and the number of bank commissioners was reduced to three, and in 1925 to one, and their term of office was made six years. The Railroad Commission became the Public Service Commission in 1911, its powers were enlarged, and the term of office of the three members was made six years. In 1913 the Fish and Game Commission was reorganised, and the number of commissioners reduced from three to one. The Department of Public Instruction was reorganised in 1913, so that the superintendent holds office indefinitely; it was again reorganised in 1919.

In 1913 the Department of Agriculture was reorganised with a commissioner instead of a board, and in 1915 it was further reorganised. In 1911 the name Board of Equalisation was changed to Tax Commission; the members were reduced from five to three, and the tenure of office was extended from two to five years. The Bureau of Labour was reorganised in 1911, and in 1913 a Board of Arbitration and Conciliation was organised to work with it. In 1913 the License Commission was reorganised, in 1915 it was again reorganised and its name was changed to Excise Commission. The Highway Department was reorganised in 1915 with a highway commissioner at its head appointed by the governor for five years. A Department of Institutions was created in 1913 and reorganised in 1919. The State institutions were managed by seven trustees, consisting of the governor and one member of the council, *ex officio*, and five appointed trustees. The institutions governed by the department were the prison, the hospital, the sanatorium, the industrial school, and the school for feeble-minded children. The legislature of 1925 vetoed bills to abolish the direct primary, and to limit the working hours of women and children to 48 per week, and permitted absentees to vote for President of the United States, made examination of the finances of the state institutions, and revised the salaries of state officers.

The governors after 1910 were: Robert R. Bass (Rep.), 1911–2; Samuel D. Felker (Dem.), 1913–4; Rolland H. Spaulding (Rep.), 1915–6; Henry W. Keyes (Rep.), 1917–8; John H. Bartlett (Rep.), 1919–20; Albert O. Brown (Rep.), 1921–2; Fred H. Brown (Dem.), 1923–4; John G. Winant (Rep.), 1925– .

(E. J. B.)

NEW HAVEN, Conn., U.S.A. (*see* 19.499), enlarged its boundaries to include 22·4 sq. m. by 1925. Its population grew to 162,537 in 1920 (of whom 4,573 were negroes and 45,686 foreign-born), and was estimated by the Census Bureau at 178,927 in 1925. The varied output of its factories was valued at $50,870,000 in 1909; $125,455,000 in 1919; $113,924,862 in 1923, when there were 483 establishments, employing 26,108 wage-earners. The Cedar Hill classification yard of the New York, New Haven and Hartford Railroad Co., covering 1,160 ac., had a capacity of 11,000 cars in 1925. Additions to the park system, including a large acreage with a bathing beach at Lighthouse Point, brought the total area to 1,549 acres. There were 59 public grade schools, a manual training school, two high schools (one for commercial training) and two junior high schools, with a total enrolment of 34,315 pupils. New construction included hotels, industrial and commercial buildings, a railway station, and buildings for Yale University (*q.v.*).

NEW HEBRIDES: *see* OCEANIA.

NEW JERSEY (*see* 19.501), a State of the United States of America. In 1920 the population was 3,155,900, as against 2,537,167 in 1910, an increase of 618,733, or 24·4%. The population in July 1925 was estimated at 3,506,428. The density of the population, exceeded in the United States only by that of Rhode Island and Massachusetts, averaged 426 to the sq. m. in 1925. The proportion of people living in places of 2,500 or more inhabitants increased from 75·2% in 1910 to 78·7% in 1920—the urban population in 1920 being 2,482,289; the rural, 673,611. The 10 largest cities, with populations in 1925 as estimated by the census bureau, are as follows: Newark, 445,606; Jersey City, 312,157; Paterson, 140,637; Trenton, 129,705; Camden, 126,399; Elizabeth, 106,251; Bayonne, 86,582; Hoboken, 68,166; Passaic, 68,045; and East Orange, 58,284.

Agriculture.—The State is steadily developing its industries, and is tending towards specialisation in agricultural production, particularly the production of fruits and vegetables. Between 1910 and 1925 the number of farms decreased at the rate of about 1·5% per annum. Vocational training in agriculture in the public schools was made possible by Acts of 1914 and 1917. County farm demonstrators have been established since 1913 in 18 of the 21 counties in the State. The years 1920–5 witnessed a rapid extension of the highway systems, and the motor-truck has developed into the chief transportation unit for agricultural products. In 1925 there were 39 farmers' co-operative organisations in the State. The dairy industry is confined mainly to the production of milk for consumption in New York, Philadelphia, and other large cities. The variation in the number of the chief farm animals from 1920–5 was as follows:—

Livestock	1925		1920	
	No.	Value	No.	Value
Swine	113,000	$ 1,978,000	139,000	$ 3,503,000
Dairy Cows	153,000	11,475,000	148,000	18,944,000
Horses and Mules	73,000	8,035,000	79,000	12,201,000

Livestock products were worth about $20,000,000 in 1920, and approximately $15,000,000 in 1925. There are about 2,750,000 chickens on farms, and considerable numbers in urban districts, producing nearly 15,000,000 dozens of eggs each year, worth about $6,000,000. Poultry products other than eggs bring the total value up to about $10,000,000.

The State ranks among the leaders in the commercial production of many crops, viz.: peaches, sweet corn for market, sweet potatoes, asparagus, string beans, lima beans, tomatoes, early Irish potatoes, peppers and egg-plants. The most important single crop is hay, although it is not raised for sale to any extent, being largely used for feeding livestock on the farms. The total value of the tame hay crop in 1925 was $8,584,000. The corn crop of 1925 was worth over $7,820,000 and was produced on about 206,000 acres. The value of the wheat crop in 1924 exceeded $2,100,000. The oat crop is gradually declining in importance, the climate being too warm for the highest yields; in 1924 the crop occupied approximately 67,000 ac., and the product was worth about $1,372,000. Rye, grown on 65,000 ac., was valued at $1,286,000, and buckwheat at about $250,000. The total net value of New Jersey's agricultural production each year is nearly $100,000,000, as compared with manufactured and mineral products worth over one and three-quarter billion dollars.

Mining.—The output of zinc ore in 1923 was 584,891 tons. The iron-mining industry, which from about 100 mines attained a maximum output of nearly 1,000,000 tons in 1882 and then declined, has revived, and the post-War annual production was about 400,000 tons. Eight iron mines were actively operated in 1923. Raw clay production in 1923 was 375,854 tons: the total value of clay and clay products in 1923 was $47,618,171, of which $23,836,455 was for pottery. The State possesses in the green sand (marl) deposits vast stores of potash, 10,656 tons of which, valued at $131,123, were mined in 1923 and used chiefly for softening water.

Manufacturing.—About 17% of the population is actively engaged in manufacturing. It ranks first in the list of States in the smelting and refining of copper, in the refining of oil, in shipbuilding, in dyeing and finishing textiles, and in the manufacture of paving materials, phonographs and upholstering materials; second in the manufacture of linoleum and silk goods; third in the manufacture of iron and steel, pottery and electric fixtures; and fourth in the manufacture of electrical machinery and paper goods. In 1923 the value of the products of the State's 8,766 manufacturing establishments was $3,321,301,524; wages paid to 447,948 employees amounted to $578,999,234.

Education.—The Russell Sage Foundation, after an exhaustive examination of the public-school systems of the various States, ranked New Jersey in 1920 first among the States east of the Mississippi river, and fourth in the whole country, and added that it was "the only State in the eastern division that has gained in relative rank during a period of 28 years, 1890–1918." The State Board of Education, which had consisted of eight members, was enlarged in 1921 to 10, of whom at least two must be women. In 1923–4 the total enrolment of pupils was 715,877, an increase of 136,946 over 1916. The number of teachers was 22,693; of school buildings, 2,210. Nearly 310,000 pupils received manual or industrial training of some sort, and 16,000 some form of vocational training. The current expense for operating the schools during the year 1923–4 was $63,528,320, an increase over that of 1918–9 of $38,077,241. Of this total more than $38,500,000 was for salaries of teachers, superintendents and principals, the average salary being $1,757. The Catholic parochial schools numbered 201 in 1924, with about 91,000 pupils. A legislative Act of 1917 designated the State college (Rutgers) which in 1923–4 had 2,663 students, as the "State University of New Jersey." A college for women affiliated with it was opened in Sept. 1918. Stevens Institute of Technology in 1924 had an attendance of 529; Princeton, of 2,446 (*see* PRINCETON UNIVERSITY).

Legislation.—For more than two generations New Jersey had sedulously fostered the aggregation of capital in corporate form, but this policy was reversed by the passage in 1913 of the series of Acts widely known as the "Seven Sisters," the purpose of which was the elimination of the power of trusts to create monopoly, limitation of production, price-fixing and restraint of trade. In 1920 the legislature proposed and the people ratified an issue of bonds to the amount of $28,000,000 for the construction of a bridge across the Delaware and a tunnel under the Hudson river. Bonds subsequently authorised for the highway system and water-supply conservation brought this total, in 1925, to $76,000,000.

The laws governing elections were radically changed in 1911 and subsequently, by provisions extending the application of the direct primary law and providing the blanket ballot and safeguards against frauds. In 1911 also, the commission form of municipal government was introduced. The Practice Act of 1912 is noteworthy as simplifying procedure in the courts. The legislation of this period further embraced the following subjects: the regulation and control of public utilities; jury reform; employers' liability; workmen's compensation; conditions and hours of labour; labour of women and children; juvenile courts; sanitary and safety conditions; motor vehicle control; a State system of highways; inheritance and bank stock taxation; regulation of insurance; water supply; food laws and storage of food; civil service in state and municipalities; state administration of municipal sinking funds; and the establishment of a police force.

Political History.—Woodrow Wilson was elected governor in 1910 as candidate of the Democratic party, receiving a plurality of 49,056; in 1912 Wilson secured a plurality of 24,873. He lost the State to Hughes in 1916 by 57,964 plurality. In 1924 Coolidge (Rep.) received 675,162 votes; Davis (Dem.) 309,743. In the elections for the State executive the Democratic party was successful from 1910–25 with the exception of the election in 1916. From 1914 the Republicans controlled both branches of the Legislature. In 1925, of the 21 Senators, 18 were Republicans, 3 Democrats; in the Assembly there were 13 Democrats; the other 47 were Republicans. Despite the predominantly Republican complexion of recent New Jersey politics, no Republican governor was elected later than 1916, a fact largely due to the anti-prohibition stand of the Democratic party in the state.

New Jersey's governors were: Woodrow Wilson, 1911–3; James P. Fielder (acting), 1913; Leon R. Taylor (acting), 1914; James P. Fielder, 1914–7; Walter E. Edge, 1917–9; William N. Runyon (acting), 1919–20; Edward I. Edwards, 1920–3; George S. Silzer, 1923–6; A. Harry Moore, 1926– (W. N. R.)

NEW MEXICO (*see* 19.520), a State of the United States of America. The estimated population in 1925 was 379,074. The population in 1920 was 360,350, as against 327,301 in 1910, an increase of 33,049, or 10·1%. The urban population (in places of 2,500 inhabitants or more) in 1920 was 18% of the total. The average number of inhabitants per sq. m. in 1920 was 2·9. The following table shows the growth of the principal cities for the period 1910–20:—

City	1920	1910	Increase %
Albuquerque	15,157	11,020	37·5
Santa Fé	7,236	5,072	42·7
Roswell	7,033	6,172	13·9
Raton	5,544	4,539	22·1
Clovis	4,904	3,255	50·7

Agriculture.—During the period 1910–25 the number of farms decreased from 35,676 to 31,687. Farm-land increased from 11,270,021 ac. in 1910 to 24,409,653 ac. in 1920, or 116·6%; improved land from 1,467,191 ac. to 1,717,224 ac. or 17%. The value of farm property rose from $159,447,990 in 1910 to $325,185,999 in 1920. The average acreage per farm in 1920 was 817·9; in 1910 it was 315·9. The average value of land per acre decreased from $8.77 in 1910 to $8.04 in 1920. Of the 29,844 farmers in 1920, 25,756 were owners, 433 managers and 3,655 tenants. The figures in respect to the chief agricultural products in the years 1909 and 1924 are shown in the following table:—

Crop	Year	Area	Production	Value in $
Corn	1924	210,000 ac.	4,200,000 bu.	4,620,000
	1909	85,999	1,164,970	984,052
Wheat	1924	163,000	2,551,000	3,188,000
	1909	32,341	499,799	508,726
Beans	1924	110,000	559,000	2,090,000
	1909	20,766	85,795	232,023
Hay and forage	1924	175,000	309,000 tons	4,759,000
	1909	370,596	433,504	4,493,918

Of livestock on farms Jan. 1 1925 it was estimated that there were 167,000 horses, valued at $6,179,000; 21,000 mules, valued at $1,218,000; 1,009,000 beef cattle, valued at $21,694,000; 47,000 dairy cattle, valued at $2,115,000; 60,000 swine, valued at $660,000; and 2,360,000 sheep, valued at $18,172,000. The production of wool in 1924 was estimated at 12,408,000 lb., as against 15,076,000 lb. in 1919. In 1920 the number of farms irrigated was 11,390; the area irrigated was 538,377 ac., or 31·4% of the improved land in farms. The capital invested in irrigation enterprises was $18,210,412 in 1920, as against $9,154,897 in 1910.

Manufactures.—Between 1914 and 1919 the capital invested increased from $8,984,000 to $15,226,000, or 69·5%; and the value of products of manufacturing establishments increased from $9,320,000 in 1914 to $20,422,126 in 1923, or 119%. The operation of steam-railway repair shops is the leading industry, as measured either by the number of wage-earners or by the value of the products.

Transportation.—In 1923 the railway mileage of New Mexico was 2,959, excluding switches and sidings. The Atchison, Topeka and Santa Fé railway owned almost half of the total.

Mineral Products.—The total value for 1922 was $18,038,022, as compared with $40,631,024 in 1918. The chief products in 1922 were: coal, 3,100,000 (in 1924, 2,550,000) short tons; copper, 31,937,207 (in 1924, 78,145,629) lb.; silver, 752,240 (in 1924, 783,338) oz.; gold, 19,964 (in 1924, 24,207) oz.; also zinc and lead. In addition, granite, marble, limestone and sandstone are quarried.

Education.—On June 30 1924 the total school enrolment was 80,368. The number of school houses was 1,551, made up as follows: 1,358 public elementary schools, 164 public high schools, 26 Indian schools and three public normal schools. The University of New Mexico, at Albuquerque, founded in 1889, had in 1923 457 students and 23 professors. The Museum of New Mexico, established at Santa Fé in 1909 in the historic palace, built about 1630, of the governors of the old Spanish province, contains a notable library of works on general linguistics and a remarkable collection illustrating American archaeology. The Archaeological Institute of America maintains there a special school of American research.

Finance.—For the first seven years of statehood—Dec. 1 1911 to Nov. 30 1918—the aggregate State expenditure was $15,573,817, and county expenditure $34,227,143, making a total of $49,800,960. State receipts amounted to $16,520,448, and county receipts $34,235,224, making a total of $50,755,672. At the end of that period the bonded State debt was $3,385,500; county, $2,972,335; city, town and village, $3,250,000; school, $1,800,000, making a total of $11,407,835. The total assessed valuation of property was $360,961,891. In 1923 this total valuation had fallen to $313,065,248, upon which taxes were levied amounting to $1,493,625, being $7.03 *per capita* of the population. At the close of 1923 the funded debt amounted to $4,035,500, the net debt being $3,947,875, or $10.61 *per capita.*

Legislation.—In 1917 a workmen's compensation law was enacted. In 1919 legislative acts included the establishment of State mounted police; a child's welfare bureau; an annual franchise tax on corporation; state inheritance and income taxes; provisions, on petition, for the teaching of Spanish in high schools; and the establishment of night schools for illiterates. In 1918 an amendment to the constitution prohibited the manufacture and sale of intoxicating liquors after Oct. 1 1918 (28,732 for, 12,147 against). In 1919 the State Legislature ratified the prohibition amendment to the Federal Constitution, and in 1920 the amendment extending the right of suffrage to women.

History.—The most important historical fact concerning New Mexico during the period 1910–25 was its admission into the Union, Jan. 6 1912, as the 47th state. Following the Enabling Act, passed by Congress June 20 1910, the territorial governor ordered an election of delegates to frame a constitution. The election was held Sept. 6 1910; the convention, consisting of 71 Republicans and 29 Democrats, assembled Oct. 3; and the adopted constitution was approved by the people Jan. 31 1911. The vote was 31,742 for and 13,300 against. The chief opposition came from the voters who favoured the inclusion of state prohibition. In 1916 the Elephant Butte Dam, under active construction since 1910, was completed by the United States Reclamation Service at a cost of about $5,000,000. It is situated 12 m. west of Engle, Sierra county, and, built across canyons of the Rio Grande, governs the entire flow of the river and is one of the largest storage irrigation reservoirs in the world. The average width of the reservoir is 1¼ m.; maximum length 45 m.; area of water surface when full, 40,080 ac.; shore line, 200 m.; average depth, 66 ft.; and maximum depth near the dam, 193 feet. When full it holds 115,498 million cu. ft., or 862,200 million gallons. It irrigates 185,000 ac. of land lying in New Mexico, Texas and Mexico.

The last territorial governor was W. J. Mills (Rep.), 1910–2. State governors were: W. C. McDonald (Dem.), 1912–7; Ezequiel de Baca (Dem.), Jan. 1–Feb. 18 1917; W. E. Lindsey (Rep.), 1917–9; A. Larrazolo (Rep.), 1919–21; M. C. Mechem (Rep.), 1921–3; James F. Hinkle (Dem.), 1923–5; A. T. Hannett (Dem.), 1925– .

NEW ORLEANS, La., U.S.A. (*see* 19.526), increased in population 14·2% in the decade after 1910, reaching 387,219 in 1920 (of whom 100,930 were negroes and 25,992 foreign-born), and 414,493 in 1925 according to the Census Bureau estimate. Foreign commerce grew from 3,754,705 net tons in 1911 to 9,239,546 in 1923; coastwise commerce from 733,021 net tons to 4,385,166; and the Mississippi-Warrior river Federal Barge Line, established in 1918, handled 849,503 tons of cargo in 1924. Harbour facilities and equipment were much improved. The state commission which administers the port had by 1925 built wharves, steel sheds, public cotton warehouses, a grain elevator, a coal and ore tipple and a bulk commodity handling plant, along six miles of the 41 m. frontage on the Mississippi river. Railway terminals, U.S. Govt. wharves and the private wharves and warehouses of over 30 industries, brought the total improved frontage to about nine miles, with berthing space for 90 vessels 500 ft. long.

The board of port commissioners constructed (1918–23), at a cost of about $20,000,000, the Inner Harbour Navigation canal, commonly called the Industrial canal, 5½ m. long, which crosses the city from the Mississippi to Lake Pontchartrain, serving as an inner harbour with still water, a navigation artery with advantageous industrial sites on its banks and on the banks of its proposed laterals, and which will eventually, after the construction of the necessary channels, provide a shorter route to the sea. The output of the manufacturing establishments within the city limits was valued at $135,184,088 in 1923, as compared with $78,794,000 in 1909. For the entire industrial area, with some 1,200 factories instead of 648, the value would be perhaps double that amount.

By 1925 about $39,000,000 had been expended on the water drainage and sewerage system begun in 1903; there were 661 m. of water mains and 547 m. of sewers. The death-rate, though still high (17·7 per 1,000 in 1923), had decreased appreciably. Enrolment in the public schools (1924) was 59,954; in Tulane University, 2,605; in Loyola University, established in 1911, 870. Public improvements and important new buildings under construction in Oct. 1925, or planned for the immediate future, represented a valuation of about $200,000,000. The cost of living is relatively low (93·2% of the average for 31 American cities, Dec. 1924). The commission form of government was adopted in 1912. The governing body is the commission council, consisting of the mayor and four other commissioners, elected for four years.

NEWPORT, Monmouthshire, England (*see* 19.533), with an area of 5,020 ac. and a population of 92,369 in 1921 has developed into one of the chief ports of Great Britain. Over 7,000,000 tons of goods were dealt with in 1913, and trade is now again expected to increase. A number of large factories have been erected in recent years on and near the Usk, and the national cartridge and box repairing factory was established here during the World War. Shipbuilding has increased in importance. A sea lock, with a length of 1,000 ft. which gives direct access to the Bristol Channel and brings the port 1½ m. nearer to the sea, was opened in 1913, and has resulted in the calling of an increased number of large ships. The town has grown rapidly under a town-planning scheme, and extensive building has been carried out at Somerleyton and St. Julian's. The electricity and water services are being extended. The diocese of Monmouthshire formed in 1921, has the church of St. Woolos, Stow Hill, as its pro-cathedral. The parishes of St. Matthew, St. Julian and St. Andrew have been formed, largely out of that of Maindee. In 1924 it was decided to remodel the town market. The ruins of a castle on the Usk were given to the corporation in 1924, on condition that they should be restored and preserved.

NEW SOUTH WALES (*see* 19.537), a state of the Australian Commonwealth. Its area of 309,432 sq. m. had in 1925 a population of 2,271,944, 67·8% of which was urban, an increase of 625,210 since 1911.

Political History.—In 1910 the first Labour Government of the State was returned, with Mr. J. S. T. McGowen as Premier, followed by another Labour Government in 1913–14, with Mr. W. A. Holman as Premier. In the latter year the Liberals and Moderate Labour formed a coalition Government which held office until 1920. Between 1920 and 1925 power alternated between Labour and the Nationalists supported by the Progressive party. Industrial legislation passed after 1918 included provision for a basic wage and a 44-hour week. The Lang Labour Government in 1925 was the first Government in Australia to carry a measure providing pensions for widows. An attempt in 1926 to abolish the Legislative Council was defeated by the Council. A movement for the formation of new States within New South Wales gained much prominence during the post-War period. The movement aims at decentralisation from Sydney by the opening up of deep-sea ports north of Sydney served direct by railways from the producing centres.

Production.—New South Wales produces nearly one-half of the wool, one-fourth of the agricultural products, two-thirds of the minerals and some 45% of the manufacturing output of the Commonwealth. Whilst wool was still the principal product in 1925, agriculture had made great progress. A vigorous State-aided migration policy between 1910 and 1914 brought large numbers of settlers from Great Britain for work on the land. The area under wheat increased from 2,128,000 ac. in 1911 to 3,543,000 ac. in 1925 and the yield from 27,913,000 bu. to 59,785,000 bushels. Bulk handling of wheat was introduced in 1920. Dairy production also steadily increased, and in 1921 the output was more than 100,000,000 pounds. The industry is highly organised, the butter factories being run on a co-operative basis under the strict supervision of Government experts.

Irrigation.—Irrigation schemes carried out by the New South Wales Govt. are playing a big part in the development of the State. The Murrumbidgee Irrigation Scheme, the main feature of which is a storage dam across the Murrumbidgee river at Burrinjuck to retain the flood waters, will ultimately serve water to an area over 200,000 ac. in extent devoted to fruit and vegetable growing, dairying and stock-raising: the district is one of the greatest fruit-producing centres of the State and has a large output of fresh, canned and dried fruits. A fruit-canning factory has been erected and is operated by the Government, which processes fruit grown by the settlers. The Government is also co-operating with the Commonwealth, Victorian and South Australian Governments in the scheme to lock the waters of the River Murray.

Minerals and Manufactures.—Broken Hill is the great centre of silver production in Australia. In 1913 the output of ore from its mines amounted to the record figure of 1,744,000 tons. In 1923 the production of ore was 878,537 tons, from which 7,233,236 oz. of silver, 124,570 tons of lead and 41,153 tons of zinc were produced. New South Wales is the principal coal-producing State, the output in 1923 exceeding 10,000,000 tons, and is the centre of the iron and steel trade. In 1923 the Lithgow Iron Works produced from local ores 94,350 tons of pig iron. The Newcastle Iron and Steel Works, established by the Broken Hill Proprietary Co. in 1915, produced in 1924 327,809 tons of pig iron and 302,384 tons of steel ingots. The works are capable of producing from 8,000 to 10,000 tons of ingot steel weekly. The total value of the manufacturing output of New South Wales in 1924 was £146,359,260 of which metal works and machinery accounted for £38,121,600, food and drink, etc., £40,789,000 and clothing and textile fabrics £13,684,000. In 1924 there were 11 woollen and tweed mills in the State, besides a large number of hosiery and knitting mills. In 1923 the first up-to-date mill for the manufacture of cotton goods was erected in Sydney for the treatment of Australian-grown cotton. In 1924 the value of the output was £361,773.

Besides undertakings of a national character, such as the Murrumbidgee Irrigation Works and the Walsh Island Dockyards, the State has engaged in various industrial enterprises since 1911, when the brick works at Homebush and metal quarries were established. In 1913 the State took over the Monier Pipe Industry. All three enterprises were operating profitably in 1925. Other enterprises, such as the state bakery, state timber yards and state trawlers, were established but ultimately abandoned as unprofitable.

Sydney, the capital and principal port, had at Dec. 31 1924 a population of 1,012,000, 45% of the total for the State. Other towns of importance are Newcastle, the coal-mining centre; Broken Hill, silver Zinc and lead mining; and Tamworth, Bathurst, Goulburn, Wagga and Albury, pastoral and agricultural centres. (*See* AUSTRALIA.)

NEWSPAPERS (*see* 19.544).—The outstanding feature of the newspaper world during the years 1910–25 is the remarkable change that has come over the Press in Great Britain during that period by the formation of great newspaper trusts and amalgamations, the elimination of the financially weaker journals and the enormous expansion of the popular illustrated newspapers.

I. PRESS ENTERPRISE IN GREAT BRITAIN

At the beginning of 1910 there were 2,331 newspapers in the United Kingdom, distributed as follows: London, with the postal area, 414, of which 23 were morning dailies and 7 evening dailies; the English provinces, including localised issues, 1,342, of which 46 were morning and 76 evening dailies; Wales, 118, including 4 morning and 4 evening dailies; Scotland, 258, including 8 morning and 10 evening dailies; Ireland, 183, including 10 morning and 7 evening dailies; the British Isles, 16, of which 5 are dailies.

After 26 years the newspapers, in spite of the addition to the population, had decreased owing to amalgamations and cessations, to 2,149 in Great Britain and Ireland, distributed as follows: London, 406, of which 23 were morning, including specialist papers (*Jewish Express*, in Hebrew, *Jewish Times*, *Lloyd's List, and Lloyd's Daily Index*), and three evening dailies (and the *Jewish Evening News*, published in Whitechapel). The newspapers in the English provinces and Wales, including localised issues, numbered 1,330, of which 37 were morning and 79 evening dailies; Scotland, 235, including 7 morning and 9 evening dailies; Ireland, 166, including 8 morning and 6 evening dailies; the British Isles, 16, of which 5 were dailies.

While the number of newspapers has decreased, the sales in the period have more than doubled. Up to the year of the World War the halfpenny newspaper gained in popularity and prestige. Following upon the unprecedented success of *The Daily Mail*, which had become a national newspaper, with simultaneous publication in London and Manchester begun during the Boer War, other newspapers had come down to a halfpenny, including the old established *Daily News* and *Daily Chronicle*. These papers appealed to a new and wider public and were made interesting to the masses.

The new class of readers included women and young people, who had hitherto been only occasional patrons of the daily Press. Space was devoted to social news, personal gossip, magazine features and serial stories, which had a stabilising effect on sales. The late Lord Northcliffe was the first journalist to see the significance of women readers. Not only did the attraction of women readers mean a wider public, but it stimulated advertising. The remarkable success of *The Daily Mail* was due primarily to the influx of advertisements which appealed specially to women.

The introduction of the half-tone pictures to illustrate the news of the day was another new element in extending the sphere of the daily Press and in popularising it. The continued journalistic and commercial success of the halfpenny newspaper had created a revolution in the newspaper world and made it increasingly difficult for the old-fashioned provincial newspapers to prosper.

The World War brought other changes. At first, like all other industries, except those concerned with the production of munitions or in some way associated with catering for the forces, the Press was disorganised. The Government recognised that the Press was an essential element in national effort, and facilities were granted to newspapers, both in regard to obtaining materials and in retaining man power. For the first time also, war correspondents became more than camp followers, were granted uniforms and became officially attached to armies. Many papers suffered losses in the earlier years of the World War, but adapted themselves to the emergency, and made up in profits on sales for what they lost in advertisements. In the boom period after the War their prosperity increased amazingly. The post-War period brought more amalgamations and organisation of syndicates.

Picture Papers.—Encouraged by the support which he received from women readers of *The Daily Mail* and of his many weekly variety papers, Lord Northcliffe issued a newspaper which was to be edited by women for women. He produced *The Daily Mirror*, intended to be a higher type of paper than *The Daily Mail*, and to appeal more to the interests of serious-minded women. It was stillborn. It was Lord Northcliffe's greatest failure. It was a lucky failure. The paper which was intended to be the women's *Times* was transformed into the first illustrated daily newspaper, and became, with its offshoot, *The Sunday Pictorial*, as great a financial success as *The Daily Mail*.

A new type of paper was thereby added to daily journalism. Other picture papers were started, and every newspaper was by-and-by led to introduce half-tone illustrations: *The Times*, *The Daily Telegraph* and *The Morning Post* were the last to adopt the new feature. Press photographers became as indispensable as reporters; photo-engraving was a new big industry associated with the Press.

The first phase in the popularisation of the Press was the growth of the halfpenny paper which began with *The Morning Leader* in 1892, followed by *The Daily Mail* in 1896. Next came the establishment of the illustrated paper beginning with *The Daily Mirror* in 1903. Another development has been the introduction of features specially for children, which, in the case of the illustrated dailies, has become a big factor in circulation. There has been a general adoption of a system of insurance, the object of which is to keep up sales, and, for the same reason, cross-word and other puzzles and competitions are introduced, including competitions in connection with sport.

The Evening Press.—One of the more remarkable developments of the post-War period has been the great progress of the evening Press in its earning capacity and its circulation. In these respects it has gone ahead in the provinces. The average man in provincial cities has little time to read the morning paper, but devotes his leisure to the evening sheet when his day's work is finished. Thus it comes about that the conditions of modern life favour the evening Press, which is accordingly in a state of increasing prosperity. The local evening paper is not subject to the competition from national newspapers from which the provincial morning papers suffer. Some of the latter have gone under, others are kept alive by evening papers issued under the same ownership. The trend of events indicates that before many years there will not be in England more than a dozen provincial morning newspapers run on a commercial basis. The demand for net sales forced by Lord Northcliffe, and taken up by the Association of British Advertising Agents, has had a prejudicial effect on country morning newspapers with small sales, although the value of publicity cannot always be measured by numbers. Much depends on the class of paper and the nature of the goods advertised.

London has fewer evening papers per head of the population than any city in the world. There were once nine evening papers in the metropolis. In 1919 there were six. In 1926 there were three. The old-established *Globe* was absorbed by *The Pall Mall Gazette* which in 1924 was taken over by *The Evening Standard* when the latter was acquired by Lord Beaverbrook, while *The Westminster Gazette* retired from the evening field, in which it occupied a distinctive and influential position, and joined the morning newspaper journals among which competition was intensely keen. The three existing evening papers, which have a monopoly of circulation in a population of over 10,000,000 living within 10 m. of Fleet street, are *The Evening News*, belonging to the Rothermere Press, *The Evening Standard*, controlled by Lord Beaverbrook, but in which Lord Rothermere has a 49% interest, and *The Star*, issued by *The Daily News*. Glasgow, with a population of a little over 1,000,000 publishes three evening newspapers—two belonging to *The Glasgow Herald*—which contain far more news than the London evening Press. Indeed, the provincial evening newspapers, as a rule, contain more reading matter than their London contemporaries.

The Sunday Press.—The colossal growth in the sale and prosperity of Sunday newspapers since the World War is of particular significance in the light which it throws on the changed outlook of the nation towards its duties, moral and ethical. A few of these journals show continual improvement in make-up and matter; but the big circulations are practically monopolised by those which pander to the more sordid tastes of the masses. The Sunday newspaper is a national paper. By special trains it is circulated all over the country. In order to reach the uttermost parts early editions are printed on Friday night. Sunday newspapers represent almost the best, and certainly the worst, of English journalism. If we exclude the Sunday illustrated papers, which are of a special type, the less creditable productions have the largest sales. *The Observer* and *The Sunday Times* are in a category by themselves and consist chiefly of Saturday's news home and foreign and special features. Following upon these, but of a more popular type, come *The Sunday Express*, *The Weekly Dispatch* and *The Sunday News*, while the large sellers give more space to the news of the week, or of the world, selecting the most sensational stories of crimes, and serving up the reports of unsavoury law cases, although several days old. The majority of the Sunday papers give such full accounts of Saturday's news and sport that they make inroads into the former news province of the Monday paper. On April 16 1926 a bill was introduced by Sir Evelyn Cecil and supported by the Government for restricting the publication of the reports of judicial proceedings "in such a manner as to prevent injury to public morals." The second reading was carried by a majority of 222 to 3.

The General Strike and the Press.—A development of the coal dispute in England, which came to a head at the end of April 1926 was a general strike organised by the General Council of the Trades Union Congress. It began on May 3, being precipitated by the action of members of the National Society of Operative Printers and Assistants in the office of the London *Daily Mail*, who objected to the opinions expressed in an editorial article. As the editor refused to accept their dictation, the men left work, although other sections of trade unionists, including the compositors, process engravers and telegraphists employed in the office did not then join the strike. Stoppages of other newspapers, before the general strike was formerly declared, followed, and for the same reasons, viz.: that the National Society of Operative Printers and Assistants objected either to opinions expressed or to certain items of news.

The strike developed quickly and paralysed newspaper production. It was the direct cause of the break off in negotiations by the Government for the settlement of the coal dispute. Interference with the freedom of the Press was considered by the Government to be an overt act and they called upon the Trades Union Council to withdraw the strike notices, as a condition precedent to the resumption of the negotiations. The trade union leaders did not accept this suggestion and the strike became general. The policy adopted was not consistent in regard to newspapers, nor was the suppression of the Press complete. While *The Daily Mail* of Monday, May 3, was suppressed in London it was permitted to appear in Manchester and was circulated throughout the country. In some towns the employees of newspapers were not in agreement with the general strike policy and resumed work.

Newspapers began to appear in the first instance mostly by photographic processes, but in two or four diminutive pages which were gradually increased in size as voluntary labour was obtained. *The Times* appeared as a four-page paper two days after the strike took place. The Government issued an official paper, *The British Gazette*, containing all news relating to the strike, describing the action of the Government to meet the national emergency, and appeals to all classes to help in maintaining the supremacy of Parliament and constitutional action. The Trades Union Council, which was placed in charge of the strike, produced an official organ entitled *The British Worker* by trade union labour. The newspaper and periodical business probably suffered more by the strike than any other industry, as a considerable proportion of the staff had to be retained and heavy general expenses incurred. The general strike was called off under the Government's original conditions, on Thursday, May 13, and after negotiations the newspapers resumed normal publication on Tuesday the 18th. One condition of the settlement was that "there shall be no interference with the contents of newspapers owned by members of this association" (*i.e.*, the association of newspaper proprietors), and other conditions were agreed to by both parties which considerably reduced the powers hitherto exercised by trade unions without, however, modifying the policy of collective bargaining.

The Era of Amalgamations

The great change in the British Press was begun by Lord Northcliffe in promoting limited liability companies to take over Harmsworth Bros., and afterwards *The Evening News*. Amalgamations and groupings of papers followed. Referring to this phase of newspaper development Sir Robert Donald, in an address at York, as president of the Institute of Journalists in 1913, said: "combination has been the chief characteristic of industry all over the world, and the Press could not remain outside this tendency. One company sometimes owns or controls a series of newspapers. There have been absorptions, amalgamations and alliances, with the result that vast aggregations of capital have been built up in which thousands of shareholders are interested. These agglomerations, piling up power and wealth, are controlled by the same forces which operate in other fields of industrial activity." He also predicted that the future would see combinations increase; there would be fewer newspapers and "colossal circulations would continue to grow." The newspaper run as a luxury and for a mission, and not as a business enterprise, would be squeezed out of existence. There would, therefore, be fewer newspapers, but the total circulations would be greater.

These predictions, made a year before the World War, have been fulfilled; but no one foresaw that the Press combinations would reach such gigantic proportions, or become so immensely profitable. The War expedited and facilitated the rise of the Press syndicates. The movement for consolidation received its chief impetus since the War, and more especially since the death of Lord Northcliffe. The *Daily Mail* Trust, Ltd., was incorporated on Sept. 27 1922 to purchase the 400,000 deferred (controlling) shares in Associated Newspapers, Ltd. sanctioned by the court. The price paid was £1,600,000, which was met by an issue of 7% first mortgage debentures. Early in 1923 the Trust purchased 49% in the *London Express* Newspaper, Ltd. A little later it purchased the large newspaper business of E. Hulton and Company, Ltd., and paid for it by a second issue of £8,000,000 7% debentures, liquidating out of the proceeds the former issue of £1,600,000 debentures. At the same time the Trust acquired 49% interest in *The Evening Standard*. In the same year the Trust sold the greater portion of the Hulton Press to the Berry brothers for more than the original purchase price, while retaining possession of *The Daily Sketch*, *The Sunday Herald* and new printing works; these three assets being subsequently promoted and sold for £1,600,000 under control of Lord Rothermere. The Trust paid £4 for the deferred shares in Associated Newspapers, Ltd. They appreciated almost as much again. The Trust in two years discharged a debenture obligation of £9,000,000. Its financial success enabled it to benefit by premiums and to issue bonuses. The marketing price of one share (2/- paid in 1925) was £2 10·0. A bonus of 5/6 per share was allotted out of reserves to the ordinary shareholder in Nov. 1925. The capital was £810,450 and £1,158,779 debentures but these were being redeemed.

The Rothermere Group.—*The Daily Mail* Trust is controlled by Lord Rothermere through *The Daily Mirror* and *The Sunday Pictorial*, which in turn control Associated Newspapers, Ltd. In 1925 Lord Rothermere sold the Glasgow *Daily Record* and *The Sunday Mail* to the Berry group. The chief combinations at the end of 1925 were Associated Newspapers, Ltd. (capital of £3,000,000 increased by the gift of bonus shares and capitalisation of reserves), proprietors of *The Daily Mail*, *The Evening News* and *The Weekly Dispatch; Daily Mirror* Newspapers, Ltd. (capital £1,110,000); proprietors of *The Daily Mirror*, associated with which is *The Sunday Pictorial*, Ltd. (capital £1,370,000); and *The Daily Sketch* and *Sunday Herald*, Ltd. (capital £1,710,000). The above newspapers form the Rothermere group. Debentures are included in the capital. The combined sale of the daily papers in the group in 1925 was about 3,500,000 and of the weeklies nearly 3,000,000. In addition to these newspapers the Rothermere group, through the *Daily Mail* Trust, owns 49% of the ordinary capital in *The Daily Express*, *The Sunday Express* and *The Evening Standard*. Lord Rothermere's companies also own very large paper-making works in England and Newfoundland. He is also proprietor of *The Continental Daily Mail*.

The Berry Group.—Then there is Allied Newspapers, Ltd., capital £8,157,015, and Allied Northern Newspapers, Ltd., capital £4,000,000, including £3,000,000 debentures. These companies form the Berry group, so called because Sir William Berry and Mr. Gomer Berry are the controlling shareholders, and consist of a large number of properties including the following daily and evening newspapers: *The Financial Times*, *The Daily Graphic*, *The Daily Despatch*, Manchester, *The Evening Chronicle*, Manchester, *The North Mail*, Newcastle, *The Glasgow Daily Record*, *The Newcastle Evening Journal*, *The Glasgow Evening News*. They also own *The Sunday Times*, *The Sunday Chronicle*, *The Empire News* (*Manchester*), *The Sunday Sun* (*Newcastle*), *The Sunday Mail* (*Glasgow*). The Berry group have also acquired a large interest in *The Sheffield Daily Telegraph*, *The Sheffield Evening Telegraph*, and *Star*, *Weekly Telegraph* and associated publications. Among the other properties of the Berry group may be mentioned Kelly's Directories, a group of technical and trade papers, fashion journals, the old publishing business of Cassell, the weekly *Graphic*, *The Bystander* and large printing works.

The Beaverbrook Group.—The Beaverbrook group, in which Lord Rothermere has a minority interest, consists of *The Daily Express*, *The Sunday Express*, owned by London *Express* Newspapers, Ltd. (capital £539,439), and *The Evening Standard*. The policy of Lord Beaverbrook has not been to distribute dividends on the ordinary shares, but to extend plant and building, reduce capital and organise a future impregnable position.

United Newspapers (*1918*), *Ltd.*—This company (capital £2,000,000) owns *The Daily Chronicle*, the northern edition of which is printed in Leeds, *The Sunday News* and *The Edinburgh Evening News*. It also controls *The Yorkshire Evening News*, and *The Doncaster Gazette*.

The Cowdray Group.—A widespread association of newspapers is described as the Lord Cowdray, Sir Charles Starmer, and Rowntree group. Its nucleus was the *Northern Echo* of Darlington. It expanded rapidly and includes the following morning and evening newspapers: *The Birmingham Gazette* and *The Evening Dispatch*, *The Nottingham Journal* and *The Evening News*, *The Sheffield Independent* and *The Sheffield Mail*, *The Northern Echo* and *The Northern Evening Dispatch* (*Darlington*), *The Swindon Evening Advertiser* and *The Islington Daily Gazette*. Lord Cowdray, who had for some years been supporting the group, added *The Westminster Gazette* as a morning newspaper to the combination. At least 12 weekly papers throughout the country are under the same control, and also a Sunday paper, *The Sunday Mercury and News* (Birmingham).

The foregoing represent the national owning syndicates. There are a number of other combinations among newspapers. *The Glasgow Herald* owns two evening papers and one morning paper in Glasgow. *The Liverpool Daily Post* and *The Echo* have acquired interests in *The Liverpool Daily Courier* and *The Liverpool Evening Express*. There have been a number of local concentrations as in Aberdeen, Dundee, Plymouth and other cities, where, in each case, all the morning and evening newspapers are under one proprietory.

The increased prosperity of newspapers is due partly to improved organisation, but chiefly to the fact that the selling price has been doubled and the rates for advertisement trebled, which more than covers the extra cost of production.

The weekly literary and political reviews have lost ground, and so have the monthlies. On the other hand, the illustrated weekly press shows a remarkable vitality. The six chief illustrated newspapers, *The Illustrated London News*, *The Sphere*, *The Sketch*, *The Tatler*, *The Illustrated Sporting and Dramatic News* and *Eve*, all belong to Sir John Ellerman, the shipping magnate.

Organisations.—A net-work of organisations exists for employers and workers. In the newspaper business collective bargaining is the rule. On the employers' side, there is the Newspaper Proprietors Association, which represents the London Press, the Newspaper Society for the provincial Press, the Scottish Newspaper Proprietors' Association, and the Irish Newspaper Society. There is also the British Trade and Technical Trade Journals Organisation.

Since 1913 the position of the working journalist has been vastly improved by the continued activities of the Institute of Journalists, and more especially by the influence exercised by the National Union of Journalists, which is organised on trade union principles and was the means of raising the standard in the lower ranks of newspaper workers and of establishing the principle of the minimum weekly salary to all ranks of journalists.

On the side of the manual workers there is also a complete net-work of organisations. The chief federated societies are the Typographical Association, representing compositors throughout the country; the London Society of Compositors; the National Society of Operative Printers and Assistants and Printing Machine Managers. Press telegraphists; correctors of the press; electrotypers and stereotypers; pressmen; paper-makers and others engaged in connection with newspapers, all have their unions. Beyond the federated Societies is a large number of affiliated federations covering Great Britain.

Advertisers have organisations also, including advertising managers, circulation managers, and, indeed, every one associated with the production and distribution side of the press. Newsagents combine chiefly in the Federation of Wholesale Newsagents and the National Federation of Retail Newsagents.

Another organisation which represents not only the Press of Great Britain but of the Dominions, is the Empire Press Union, which was the outcome of the first Imperial Press Conference held in 1909. It represents newspapers, either by proprietors or responsible members of the staff. It has branch sections in the overseas Dominions and keeps a permanent supervision over such questions affecting cable services and charges, and matters of common interest to the Press as a whole. The second Imperial Press Conference was held in Canada in 1920, and the third in Australia in 1925. The first president of the Empire Press Union was the first Lord Burnham, and he was succeeded by his son, the present Lord Burnham, who is also president of the Newspaper Proprietors Association. The Chairman of the Council from 1915–26 was Sir Robert Donald, who was succeeded by Mr. J. L. Garvin. The Empire Press Union has insisted continuously on better and cheaper communications with the overseas Dominions and has devoted particular attention to the promotion of Empire wireless. After many years delay the first Empire wireless station began to operate in Jan. 1926 in the super-station at Rugby. A series of stations was erected, which began to operate in the same year for communication to and from the Dominions.

Cheaper Communications.—Cheaper and quicker means of communication and distribution of news is always in process of evolution. What are known as "loaded cables" have been laid down, increasing enormously the capacity and speed by which messages can be transmitted by cable, the advantages of which newspapers will share. In the address to the Institute of Journalists in 1913, to which reference has already been made, Sir Robert Donald visualised a time when news would be collected by wireless telephone and the reporter would always have a portable telephone with him, with which to communicate with his paper without the trouble of going to the telephone office, or writing out a message. The competitor, he said, to the national newspaper would not be another national newspaper, but a method of circulating news by means of some scientific mechanism for transmitting the spoken word. He predicted that all the news of the day would be laid on to houses and offices, just like gas and water. During the years 1924 and 1925 the development of broadcasting brought this vision within the region of realisation. Newspapers look on this development with a watchful eye, lest it should, in addition to supplementing their functions, arrest their progress.

Subordination of the Editor.—Compared with 50 years ago, the most marked change in the personal side of British journalism has been the ascendancy of the proprietor and the subordination of the editor. This is reflected in the now prevailing habit of referring to the Northcliffe Press, the Rothermere Press, the Beaverbrook Press and the Berry Press. There are now only a few well-known editors whose personalities are impressed on the public mind. First, there is Mr. C. P. Scott, the veteran editor of *The Manchester Guardian*, who is also controlling proprietor of his paper. Mr. Scott represents the finest type of editor-proprietor in England, while his journal, distinguished for its honesty and consistency, stands for the highest ideals of journalism and has acquired a great international reputation and influence. It has been under the control of Mr. Scott for over half a century. On the occasion of the centenary of *The Manchester Guardian* in May 1921, King George congratulated Mr. Scott on his 50 years' association with the paper which, "under your courageous and high-minded guidance, has secured for itself a position of such eminence and esteem in the world of journalism."

The other great personality in English journalism is Mr. J. L. Garvin, editor of *The Observer*, who is pre-eminent as a writing editor, brilliant and independent. He is a recognised authority on foreign affairs, who has exercised an influence on world politics for many years. In 1926 Mr. Garvin took on new responsibilities, becoming editor of *The Encyclopædia Britannica* and chairman of the Empire Press Union. Four editors of London papers who were controlling policies before and during the World War lost their posts, partly through proprietorial changes. Mr. H. W. Massingham, who had been editor of two daily newspapers and, afterwards, of *The Nation*, died in 1924, soon after he was displaced from the editorship of that journal; Mr. A. G. Gardiner, of *The Daily News*, Mr. J. A. Spender, of *The Westminster Gazette*, and Sir Robert Donald, of *The Daily Chronicle*, who had all for many years been controlling editors, left their positions during these years.

The proprietor who pushes himself before the public occasionally prints signed articles in his papers. He uses them as vehicles for expressing his personal views. One effect of the change, accentuated by the syndication of newspapers, is that consistency is not so well maintained and editorial responsibility is very much weakened. The old conception of an anonymous entity, who regarded a newspaper as a public trust and took responsibility seriously, has been dispelled. One individual may be in financial control of several or many newspapers; but as organs of opinion they either become a "gramophone Press," or different interpretations are given to the same policy in papers under the same ownership. The mass production of public opinion does not carry weight.

The changed system of ownership has unseated most of the old newspaper dynasties. The Press families no longer in power include the Lloyds (*Daily Chronicle*, etc.); Hulton (*Daily Dispatch*, etc.); Ingram (*Illustrated London News*); and Borthwick (*Morning Post*). The Walter association with *The Times* is maintained, but the family control has gone. There remains, however, *The Daily Telegraph*, in control of the second Lord Burnham, representing the third generation of the Lawson family. *The Times* has reverted to its traditional policy, as the first newspaper in the world, occupying its place with easy dignity. Its scholarly editor, Mr. Geoffrey Dawson, maintains anonymity, while the controlling proprietor, Hon. J. J. Astor, M.P., maintains the reserved tradition of the Walters. The change has, however, assured *The Times* the position of independence as a national newspaper. When *The Times* Holding Company, Ltd., acquired Lord Northcliffe's controlling interest in the newspaper, special restrictions and conditions were introduced, which provided that none of the shares may be transferred to any person other than Major Astor or Mr. John Walter, unless or until such person shall have been approved as a proper person to hold ordinary shares in the company by a resolution of the committee which the articles of association appointed. The same restriction applies to a corporation. The committee consists of the persons who for the time being are Lord Chief Justice of England, Warden of All Souls College, President of the Royal Society, President of the Institute of Chartered Accountants and Governor of the Bank of England. The decisions of this committee must be by a majority of votes, the chairman to have a casting vote. In exercising their decision in regard to the transfer of shares the committee must have regard to the importance of maintaining the best traditions of *The Times* newspaper, and national rather than personal interests, and eliminating as far as reasonably possible questions of personal ambition and commercial profit.

Sir William Berry and Mr. Gomer Berry carry on their vast and varied interests in a business spirit without bringing their personalities before their many millions of readers. An arresting personality in the British Press is Lord Beaverbrook—controlling proprietor of *The Daily Express*, *The Sunday Express* and *The Evening Standard*. He went into the newspaper business during the World War and it was not long before he showed striking gifts for the particular kind of journalism which he took up. He has the news and the political sense highly developed and if he frequently annoys he always interests.

Popular Weeklies.—The popular periodicals during the last 30 years attained great sales, pushed up artificially by means of prizes, competitions and the insurance system. The period, which may be described as the era of popular journalism, was begun by the late Sir George Newnes over 40 years ago with *Tit Bits*. Two men who had been contributors to his paper followed his example. Alfred Harmsworth started *Answers*, and C. Arthur Pearson, *Pearson's Weekly*. These three little weekly papers were the foundations upon which arose three great publishing and newspaper businesses. The George Newnes publishing business expanded in several directions. Sir George Newnes himself made excursions into newspaper journalism. He founded as a political organ *The Westminster Gazette* and other papers which did not survive. C. Arthur Pearson (afterwards Sir Arthur Pearson), besides building up a big periodical business, also entered the newspaper world, but was not commercially successful. The Newnes business is now amalgamated with Pearson's, and publishes a large number of popular information and entertaining weekly papers.

The one man who attained unprecedented success, both in the periodical and newspaper field, was Alfred Harmsworth (see NORTHCLIFFE, VISCOUNT). His creation, Amalgamated Press Ltd., is to-day the biggest business of its kind in the world. Its publications appeal to all classes, and in recent years it has been expanding and appealing to a higher class of reader, publishing a number of very useful encyclopaedias, histories and reference works of various kinds, issued in very attractive form.

II. THE BRITISH DOMINIONS

Irish Free State.—Newspapers in the Irish Free State are settling down to Dominion conditions, but it cannot be said that the new political freedom has stimulated newspaper enterprises. The Dublin morning papers are now *The Irish Times* and *The Irish Independent*, and the evening papers, *The Herald* and *The Dublin Evening Mail*. In 1910 there were four morning papers and three evening papers in the Irish capital. The historic *Freeman's Journal* passed through many vicissitudes, and finally disappeared in 1923, after 160 years of existence. There are two morning papers and one evening paper in Cork. British newspapers, daily and weekly, have a considerable sale in the Irish Free State.

Canada.—There are no more independent newspapers than those published in the British Overseas Dominions. They are comparatively free from Government influences, and are not subject to the domination of syndicates or trusts. The Press of each Dominion has its own characteristics. Canadian newspapers not unnaturally reflect the style and appearance of American newspapers, while retaining some of the more sedate qualities of English journalism. There are no Sunday newspapers in Canada, although American Sunday newspapers are sold at railway stations and at hotels throughout the Dominion. The evening Press is more important than the morning Press. Such evening papers as the *Montreal Star* and the *Toronto Globe* have very large sales and are second to none in enterprise. The Canadian Press publishes a great deal of British news and carries American magazine features.

There are no national newspapers in Canada, as the Dominion is too vast for papers to circulate beyond the area of one province, but there are several newspapers of national reputation and wide political influence, such as *The Manitoba Free Press*, *The Montreal Gazette*, *The Toronto Globe*, *The Vancouver Daily Province*, and *The Halifax Chronicle*. In merit, such newspapers stand high, and Canadian journalists are continually being tempted to cross the border to fill important posts on the American Press, and in recent years have been drawn in greater numbers to London. In some towns, such as Ottawa, the same papers have morning and evening issues. There is a healthy French Press in the Quebec province. *La Presse* of Montreal claims to have the largest sale of any newspaper in Canada, French or English. Every town in Canada, even if its population does not exceed 5,000, has a daily newspaper, as is the case in most communities in other British dominions. The trade and technical Press of Canada compares well with similar papers in other countries. Monthly publications are at a disadvantage because of competition from the excellent cheap magazines and Sunday supplements from the United States, which regard the Dominion as a dependency for periodical literature. The small town of St. John's, population 38,645, in the large island Dominion of Newfoundland, prides itself in having one morning and three evening newspapers.

Australia and New Zealand.—In Australia, two-thirds of the population are concentrated in cities. The evolution of the Press in Australia has led to the building up of very prosperous newspaper properties. There are not many newspapers per 1,000,000 population. Competing newspapers and cable agencies send a very full service of news from Great Britain, and the place occupied by an Australian newspaper is determined chiefly by the volume of British news which it contains and by the literary quality of its editorial articles. The Australian daily Press combines the dignified appearance and solid qualities of British papers like *The Times*, *The Daily Telegraph*, *The Manchester Guardian* and *The Glasgow Herald*. Without exception, they are prosperous and are efficiently equipped mechanically. In Melbourne, which with its suburbs has a population of nearly 1,000,000, there are only two morning newspapers—*The Age* and *The Argus*—a pictorial paper, founded in 1922; and one evening paper, *The Herald*. The selling price of each is 1½d. In Sydney, the parent city of Australia, with 1,000,000 inhabitants, there are four morning newspapers and two evening newspapers. Sydney has the cheapest newspapers in the world. *The Morning Herald* and the Sydney *Daily Telegraph* are larger than *The Times* or the London *Daily Telegraph*, and are sold at 1d. Brisbane has two morning and three evening papers, all 2d. each. Adelaide has two well-known morning newspapers, *The Advertiser*—" from 96 to 252 columns daily,"—and *The Register*, selling price 1½d. There is one evening newspaper.

Australia possesses a healthy weekly Press which devotes special attention to the farming industries and several national journals, notably *The Sydney Bulletin*, which is read throughout the island-continent, and *Truth*, described as " the most virile organ of democracy." There are Labour daily and weekly papers in Australia. An Act has been in operation for some time in Australia, which provides that during a Federal electoral campaign all articles on reports or news dealing with political matters must be signed by the writer. A similar law has been adopted in South Africa.

Wealth is well distributed in New Zealand among its population of 1,000,000 and the trade statistics per head is exceptionally high. This state of things is reflected in the prosperity of the New Zealand Press. The daily Press is even more characteristically English than are the Australian newspapers. The capital, Wellington, with a population of less than 100,000, has three daily newspapers.

South Africa.—With a white population of 1,350,000 divided racially between the British and the Dutch, the Union of South Africa makes a good showing in the matter of the Press. All branches of the newspaper business are well organised. The leading English papers are well known outside the Union, such as *The Cape Times*, *The Cape Argus*, *The Rand Daily Mail* and *The Star* of Johannesburg. There are four well-conducted daily papers in Natal. *The Friend* of Bloemfontein and *The Diamond Field Advertiser* of Kimberley are also influential organs. The leading Dutch papers are *Die Burger* and *Ons Land* of Cape Town and *Volkstem* of Pretoria. It is customary for many newspapers in South Africa to be sold by subscription. There are newspapers in the smaller towns throughout the Union and in every British settlement of a few thousand people in all African colonies.

India.—The part played by English newspapers in India cannot be measured by the copies which they sell. In Calcutta, with a population of nearly 1,500,000, is published the oldest newspaper in India, *The Englishman*, and also the most popular, *The Statesman*. *The Times of India* (Bombay), *The Madras Weekly Mail*, *The Pioneer* of Allahabad, *The Civil and Military Gazette* of Lahore, are the best-known papers and organs of opinion. There are quite a number of official journals in India. The vernacular papers are growing in number and in influence, and some of the Nationalist organs are published in English—as, for instance, the *Amrita Bazar Patrika* of Calcutta. Some papers are published in two languages, in English and vernacular.

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(R. D.)

III. THE UNITED STATES AND S. AMERICA

The newspapers in the United States tend with the passing years to become more and more economic products. They offer two things for sale: to the reader they sell news, editorials and other interesting reading matter, and to the advertiser they offer white space at so much per inch. Economic complications are numerous because these two joint products must be marketed in the same container—the white paper on which the news is printed and on which the advertising is displayed.

The Economic Side.—In other economic products the cost of the container is relatively small in comparison with the cost of the product itself; the paper which wraps a cake of soap may well serve as an illustration. In the newspaper business the cost of paper is the largest bill the publisher must pay. The increase in the cost of newsprint paper, especially during the World War, forced an increase in subscription price. During certain war years this high cost necessitated a curtailment of the privilege of returning unsold copies, compelled some newspapers to limit the number of their pages, required editors to present news in condensed form and reduced in many instances the size of headlines. Those publishers who, having during this period a liberal supply of white paper from their own mills, were able to maintain pre-War sizes, often printed issues nearly as valuable for waste paper as for news media—from the financial point of view. Since the War the increased subscription price has for the most part been maintained.

After the outbreak of the War economies in newspaper production were secured through pools and combinations. Pools in cable tolls came with the advance in rates for trans-Atlantic messages. London newspapers resold their news to American newspapers, and obviously, after the declaration of hostilities, news from London was wanted more in detail. Consequently when the New York *World*, the New York *Times*, and the New York *Tribune* pooled their interests and let one cable dispatch serve all, each saved two-thirds in tolls.

The War Period.—When the United States, after entering the War, made preparations to send troops overseas newspapers combined to save expense in war correspondence. Such combinations are seen in the accredited correspondents who were permitted to accompany the first Expeditionary Force to France and who represented the following: The Associated Press, The United Press, The International News Service, The Associated Papers, The Newspaper Enterprise Assn., the Philadelphia *Ledger* syndicate, the Munsey group of newspapers, the New York *Times* and group of newspapers, the New York *Herald* syndicate, the Chicago *Tribune* and group of newspapers, the New York *World* and group of newspapers, the New York *Tribune*, the Philadelphia *North American* and group of newspapers, the Denver *Post* and *Collier's Weekly*. The Hearst string of newspapers was represented by The International News Service. It will be noticed that most of these newspaper combinations were headed by either a New York or a Philadelphia newspaper. American troops overseas soon had their own newspaper, *The Stars and Stripes:* its publisher was Richard H. Waldo, formerly business manager of the New York *Tribune*. *The Stars and Stripes* was run as a commercial proposition, was entirely self-supporting, and, *mirabile dictu*, had, when it ceased publication, a large surplus.

Press censorship in the United States during the War may be dismissed with few words. A Committee on Public Information, appointed by President Wilson, consisted of the Secretary of State, the Secretary of War, the Secretary of the Navy and one civilian, George Creel. Its two principal purposes were first, to be a clearing-house for the news of the various departments at Washington; second, to act as censors for war intelligence received from overseas. In practice it limited its activities principally to the dissemination of information. But it did publish a pamphlet, similar to that issued by the Press Censor of Canada, to aid American newspapers in voluntary censorship. (*See* CENSORSHIP.)

The War favoured the evening papers in the presentation of the news and the reason may be found in the difference in time between Europe and America. If correspondents filed their cable dispatches promptly and if they wrote their accounts so that little, if any, work was required by the official censors there was time enough to record the hostilities of the day before the late editions of the evening newspapers went to press. Previous to the War there was a marked tendency on the part of the evening papers to present the day's news more or less in bulletin form and to devote most of the contents to special features, to regular household departments and to comic strips. There were notable exceptions to this tendency, but they were the exceptions which prove the rule. War, for the time being at least, put the news back in the evening papers.

The editorial page, which had been steadily declining in influence since the days of Greeley of the New York *Tribune*, Dana of the New York *Sun*, Godkin of the New York *Post*, Medill of the Chicago *Tribune*, Waterson of the Louisville *Courier Journal*—to mention only a few—came to be a necessity for thoughtful readers. To them the news from overseas needed not only presentation, but also interpretation. This interpretation, plus the tremendous increase in the amount of foreign news, gave an international character to the American newspaper never found before.

Facts and Figures.—Census figures collected by the U.S. Govt. about newspapers, while technically accurate, are somewhat misleading. Among daily newspapers, for example, they include the dailies published by undergraduates at various universities, such as *The Daily Californian*, the Yale *Daily News*, the New York *University Daily News*, *The Harvard Crimson*, *The Columbian Spectator*, the Wisconsin *Daily Cardinal*, etc.—to say nothing of the daily trade bulletins issued in the interests of various industries. The statistics compiled for *The Interna-*

tional Year Book by *The Editor and Publisher* are more reliable. Its figures for 1925 show that there were in the United States 427 morning newspapers with a daily circulation of 12,440,387; 1,581 evening newspapers with a daily circulation of 21,208,982; and 548 Sunday newspapers with a weekly circulation of 23,354,622. These figures mean that there was one and one-third ($1\frac{1}{3}$) newspapers for every family in the United States and one Sunday paper for nearly every home. The number of weekly newspapers has declined almost steadily every year from 1910 to 1925. At the close of the latter year the United States had 13,176 community weeklies. Of these a little over 11,000 might be considered as small town newspapers. The number of weekly newspapers serving special sections of cities has increased and doubtless will continue to do so as cities expand. Since the War country newspapers have shown a decrease of something like 3,000. But what rural newspapers have lost in quantity they have made up in quality.

The Associated Press, the great co-operative news-gathering organization, in 1910 was furnishing its service to 826 papers; at the close of 1925 it had on its list 1,211. During this period its annual cable tolls increased from $87,187.46 to $147,912.18. Facts and figures about *The New York Times* illustrate from the business side the making of a leading metropolitan newspaper. The paper consumption increased from 24,421,082 lbs. in 1910 to 160,230,367 lbs. in 1925. Advertising, measured by lines, grew from 7,550,650 to 28,200,444. The average number of pages for a daily issue in 1910 was 18·6 and in 1925 was 40·5. For the Sunday edition the average number of pages was 74·6 (1910) and 173·0 (1925). The 646 employees in 1910 were distributed as follows: business, 158; editorial, 159; mechanical 329; the 2828 in 1925 were thus divided among the various departments: business, 757; editorial, 418; mechanical, 1,653. To visualize these figures it may be said that if all the printed matter, including advertisements and illustrations, of an entire Sunday edition of *The Times* could be pasted on a ribbon a column wide this ribbon would circle the globe twelve times.

Amalgamations.—The movement in the American Fourth Estate is unquestionably toward consolidation. Space does not permit mention of the amalgamations of smaller papers, but important changes in metropolitan fields may be noted. Frank A. Munsey before his death in 1925 had in New York City merged *The Press* with *The Sun* in 1916, later in 1920 he purchased the New York *Herald* and *The Evening Telegram.* Discontinuing *The Morning Sun* he transferred that title to *The Evening Sun* with which in 1923 he merged *The Globe.* At about the same time he purchased *The Evening Mail* which he consolidated with *The Evening Telegram.* He then sold (1924) *The Herald* to the New York *Tribune*, now published under a joint title. In Boston *The Herald* (morning) took over (1912) *The Traveler* (evening) and continued it as its evening edition. Later (1917) *The Herald* absorbed *The Journal* (morning). In Kansas City W. S. Dickey bought (1921) *The Journal* (morning) and (1922) *The Post* (evening). He continued *The Journal* as a morning paper and *The Post* as an afternoon, with joint publication on Sunday, with a flat subscription price for both papers. In this he followed the example of *The Star* which since 1901 has been printing *The Times* as its morning issue, with both papers going to the same subscribers.

In Philadelphia Cyrus H. K. Curtis became on Jan. 1 1913 the publisher of *The Public Ledger* which he purchased from Adolph S. Ochs. On Sept. 14 1914 he started *The Evening Public Ledger* with which he united (1918) *The Evening Telegraph.* In 1920 he purchased *The Press* to unite with *The Public Ledger* and in 1925 he did the same with the Philadelphia *North American.* In Chicago *The Record-Herald* purchased (1913) *The Inter-Ocean* and appeared as *The Herald* which later was purchased by W. R. Hearst and united with his Chicago *Examiner.* In Cleveland *The Plain Dealer* absorbed *The Leader* and in St. Louis *The Globe-Democrat* purchased *The Republic*, one of the oldest daily papers in Missouri.

New Developments.—Newspapers showed in 1925 a most marked improvement over those of 1910 in mechanical make-up. Especially has the change for the better been noted in the arrangement of material on the first page, where attempts have been made to give that page something like an artistic balance. A few papers have conducted expensive experiments to determine the kind of type that is easiest for the reader. Headlines, even during the World War, were kept within legitimate bounds and did not, even in the case of accounts of big battles, approach the streamer monstrosities printed in the days of the Spanish-American War. Illustrations, especially for Sunday supplements and for special Saturday issues, were by the more influential newspapers grouped together and printed on a finer grade of paper by the rotogravure process. Seventy-seven papers have (1925) rotogravure photographic supplements as a part of their Sunday or other editions. Improvement in speed of production may be seen in the modern Unit-Type press of 12 units which can print 180 m. of paper in an hour.

Radio has, at least up to 1926, supplemented rather than supplanted the newspaper. In almost every daily newspaper it has created a special department to list the attractions of broadcasting stations. In some it has created a special section—occasionally printed in tabloid form as a supplement. People hearing over the radio, like the people in the audience, have wanted to see what the press printed about the address. News broadcast in condensed form has awakened an interest for details to be found in the paper of the morrow. Pictures by radio, still in their infancy, promise much by way of making newspapers more timely in illustrations. In 1925 the United States had 68 newspapers owning or operating a radio station or studio.

Tabloid Newspapers.—The introduction of tabloids may be explained, in part, by the passing remark of Lord Northcliffe, "If some American does not start one I shall have to come over to do it." The first in the field was *The Illustrated Daily News*, established in New York City June 26 1919 by the Chicago *Tribune.* At the close of 1925 it had the largest circulation of any American newspaper, over a million copies daily. Its success doubtless led W. R. Hearst, publisher of the New York *American* and the New York *Evening Journal*, to establish (1924) *The Mirror* and make over his Boston *Advertiser* (est. 1813) into a tabloid. The third tabloid in New York is *The Graphic* (1924). Philadelphia has two tabloids. The first, the Philadelphia *Daily News*, was started March 31 1925 and is as sensational as any in New York. The second, the Philadelphia *Sun*, came two months later and, under the ownership of Cyrus H. K. Curtis, has followed more after the London tabloids. Others are *The News* of Washington, D.C.; *The Post* of Baltimore, Maryland; *The Daily News* of Los Angeles, California; *The Ledger* of Newark, N.J.; *The Daily Tab* of Miami, Florida; and *The News* of St. Petersburg, Florida. Pictures, features and contests constitute the stock in trade for tabloids which, together with motion pictures, doubtless put picture pages into conservative newspapers of standard size.

Adless Newspapers.—Los Angeles, California, attracted some attention in 1912 when it made an attempt to publish a weekly municipal newspaper. *The News*, a copy of which was left without cost at every home regardless of the wishes of the tenant, was controlled by three municipal newspaper commissioners appointed by the mayor. Any political party polling 3% of the vote of the city was entitled to a column in each issue. A space of half a column was available for the mayor, or any member of the city council in all issues. After the appropriation set aside by the city had been expended the paper was discontinued. A publicly owned daily newspaper, however, may be one of the papers of to-morrow.

Two advertisement-less daily newspapers have appeared. Chicago, on Sept. 28 1911, saw the first appearance of *The Day Book* which printed no advertisements. Its circulation increased until in 1916 it was averaging over 20,000 daily. The latter year witnessed its suspension because of the increased cost of white paper. *The News-Post* (1912–4), an adless newspaper in Philadelphia, was edited by Marlen E. Pew. Adless newspapers, lacking the bargain sales of department stores, will never be popular with women. Adolph S. Ochs, publisher of the New York *Times*, once remarked that a full page advertisement of a department store was more extensively read than an address by the President of the United States, when both appeared in the same paper.

The foreign language press has shown the largest decrease in number of papers, especially those printed in German. The stricter immigration laws have doubtless reduced most materially the audience to which such a newspaper addresses itself. Consequently numerous papers have begun to insert departments printed in English and possibly have in mind the time when still more space, if not the entire paper, must be given over to material in English. The decrease in foreign language papers has been most marked in New York and Chicago.

Legal Enactments.—Two government regulations, both of Aug. 24 1912, need passing mention. The first provided that all periodicals should " file with the Postmaster-General and the postmaster at the office at which said publication is entered, not later than the first day of April and the first day of Oct. of each year a sworn statement setting forth the names and post-office addresses of the editor and managing editor, publisher, business managers and owners, and, in addition, the stockholders, if the publication be owned by a corporation; and also the names of known bondholders, mortgagees, or other security holders; and also, in the case of daily newspapers, there shall be included in such statement the average of the number of copies of each issue of such publication sold or distributed to paid subscribers during the preceding six months."

The other Act provided that " all editorial or other reading matter published in any such newspaper, magazine or periodical for the publication of which money or other valuable consideration is paid, accepted or promised shall be plainly marked 'advertisement.' " These two regulations have made circulation statements more truthful and have made American newspapers more ethical from the advertising point of view. Incidentally, it may be said that the most remarkable change in American journalism from 1910 to 1925 may be found in the advertising columns where truth in advertising has been promoted both by state statutes and by support of the Associated Advertising Clubs of the World. The Association of National Advertisers has gone definitely on record as being opposed to black squares, circles, sweeping curves and the follow-the-arrow lines—all of which smudge the typographical appearance of newspapers.

Advertising, the economic background of the newspaper, has with slight fluctuations steadily increased in volume since 1910. A remarkable fact is that newspaper advertising in 1925 was double that of 1914 and 5% more than that of 1924. Advertising rates for newspapers in metropolitan cities have advanced with increases in circulation. But carefully collected statistics indicate that in smaller cities and towns the increase in advertising rates have been in proportion to increased operating expenses. Mention has already been made of the ethical advance in advertising copy. An unusually high standard has been set by the New York *Times* in order to prevent the printing of fraudulent and misleading advertisements. Where advertising offered has exceeded the space available, *The Times* and other newspapers have favoured advertisements that had news value.

Overseas Newspapers.—A postscript paragraph may be inserted about American journalism overseas, the Paris edition of the Chicago *Tribune* and the European edition of the New York *Herald*. The latter, the first in the field, was started in Paris in 1887 merely to gratify a whim of the late James Gordon Bennett. It was the only newspaper in English and one of the few in any language to publish in Paris when the Germans were practically battling at the gates. In the latter half of 1918 and the first half of 1919 this *Herald* reached its largest circulation (400,000). The sale of the New York *Herald* to Mr. Munsey included its Parisian namesake; he put in charge of it as managing director Laurence Hills, who remained in control when the paper in 1924 was again sold to the New York *Tribune*. The Paris edition of the Chicago *Tribune* was something of a war enterprise and was started on July 4 1917 with Joseph Pierson as editor. As the number of American troops increased the circulation grew and at Armistice time it numbered around 100,000. The managing editor (1926) is Bernhard Ragner.

Magazines.—New York City has, if anything, strengthened its claim of being the publishing centre of the periodical press, except possibly for agricultural publications and religious journals. To be more exact, the editorial offices are in New York City, but the periodicals themselves are being printed in plants often outside even of the State of New York. While technical journals have not experienced consolidations to the extent found in the newspaper field, they have tended to drift to the larger publishing corporations to save overhead charges and permit economy in composition and in the purchase of paper. In technical and trade magazines the improvement in the literary quality of material and in the mechanical make-up of pages has been especially noticeable since 1910. Industrial journalism is yielding greater profit than ever before in its history—profits that have come for the most part from increased advertising.

Popular magazines have seen a much more radical change than newspapers. Dime novels have taken on a new dress and now appear nicely printed as magazines with three-colour covers. Clean and wholesome for the most part, these magazines of adventure have done little harm compared with the sex-story magazines of which the United States has had enough and to spare. The epidemic of questionable magazine fiction must be left for explanation to the pathological expert. Fortunately, the decline in questionable fiction seemed at the close of 1925 to be in sight. Three magazines now published consist almost entirely of reprints of short story classics; they are *The Golden Book*, *The Famous Story Magazine* and *Ainslee's Magazine*. The first two are new publications and the last was formerly a short story magazine which had done much to develop new writers. It introduced O. Henry, for example, to America. Feeling the competition, some of the popular magazines changed their editorial policy and limited their contents exclusively to fiction. *Everybody's Magazine* and *Munsey's Magazine*, at the close of 1925, illustrate this change. Of the literary trio, *Harper's*, *The Century* and *Scribner's*, the last only has remained unchanged. *Harper's* and *The Century* now appear without illustrations for their special articles and have materially changed the character of the fiction which they print. It must be frankly admitted that news stands do not offer purchasers the same quality of goods in 1926 as they did in 1910.

The brighter side of the picture for 1926 may be found in that *The National Geographic Magazine* of Washington has a circulation of nearly 1,000,000 and that *The Atlantic Monthly* has the largest circulation in its history. *The North American Review* has become a quarterly and now competes with *The Yale Review* which was started in 1911. *Current History Magazine*, started by the New York *Times* in 1914, presents each month an intelligent discussion of public affairs. *The World's Work*, though a trifle more popular in its mode of treatment of articles, has not departed from its high standards. The sophisticated reader is having his needs met by *The American Mercury*. *The Nation* has changed from a conservative to a somewhat radical organ and *The Independent* after several ups and downs—chiefly the latter—has moved from New York to Boston where it seems to be regaining its old popularity. *The Weekly Review* and *The Freeman* are no longer published. They disappeared about the same time as *The Unpopular Review*.

The periodical having the largest circulation in the United States (2,436,734) is *The Saturday Evening Post* of Philadelphia which, both in its fiction and special articles, is addressed to men. Publications designed to appeal primarily to women have since 1910 witnessed a remarkable growth in circulation. *The Ladies' Home Journal* of Philadelphia, *The Pictorial Review* of New York and *McCall's Magazine* of New York have each a circulation exceeding 2,000,000, while *The Woman's Home Companion* of New York has one nearly reaching that figure and *The Delineator* of New York has a circulation of over

1,000,000. Mr. Hearst has purchased *The Cosmopolitan*, *Good Housekeeping* and *Harper's Bazar*. With the first mentioned he combined in 1925 *Hearst's International Magazine*.

Radio and motion pictures have added to the periodical press numerous technical and popular journals. The introduction of the magazine section into the Sunday newspaper explains to some extent the disappearance of articles from popular magazines. The pictorial and rotogravure sections of the Sunday newspaper account, in part, for the disappearance of *Harper's Weekly* and *Leslie's Weekly* and the changing in contents of *Collier's Weekly*. The suspension of *The Bellman* of Minneapolis was deeply regretted by its readers. Among the new periodicals the success of *Liberty*, edited in New York and published in Chicago, is somewhat startling. Established in 1924 it had at the end of 1925 a circulation of over 1,000,000. In conclusion, it must be frankly said that the average American reader is seeking entertainment and amusement rather than education and enlightenment in his periodical literature.

SOUTH AMERICA

The two leading newspapers, not only in Argentina but also in South America, are *La Prensa*, founded Oct. 18 1869 by Dr. José C. Paz, and *La Nación*, founded Jan. 4 1870 by Gen. Bartolomé Mitre, of Buenos Aires. For 56 years (1926) both papers have remained in the families of their founders. Each compares favourably with any other newspaper in any country. Both specialise in printing foreign news; possibly *La Nación* pays more for cable tolls than any other newspaper in the world. Classified advertisements are usually a safe index as to character of newspapers because they represent local opinion. Judged by such a yardstick, *La Nación* resembles the New York *Times* and *La Prensa* the New York *World*. The editorial page of *La Nación* is always dignified in subject-matter and serious in mode of treatment. Its Sunday supplement contains contributions from the best writers, not only of Argentina but also of Spain. Much material later appears in book form. *La Nación* had (1910) a circulation of 80,000: its sworn statement of daily average for Aug. 1925 was 192,007: its average Sunday circulation for the same month was 238,000. At the first Pan-American Congress of Journalists held in Washington in April 1926 Dr. Jorge A. Mitre had the honour of responding to the address of welcome by the President of the United States. He is a grandson of the founder of *La Nación* who was the first constitutional president of the Argentine Republic.

To campaign for civic righteousness seems to be the editorial policy of *La Prensa*. Its evening competitor, *La Razón*, established in 1905, once spoke of it as being a safe and serene guide in the difficult task of creating a public conscience. *La Prensa* widens its influence through syndicating to some 175 provincial papers a weekly feature supplement for Saturday or Sunday editions. *La Prensa* operates a free clinic, offers free legal advice to the poor, pays for a free industrial and agricultural bureau, opens its library to the public and awards 1,000 pesos annually to the person teaching the largest number of illiterates to read. The oldest evening paper in Buenos Aires is *El Diario* (est. 1881). The oldest of all is the English paper, *The Standard* (est. 1861) which competes with *The Herald* (est. 1876). In 1925 Argentina had about 1,000 newspapers and other periodicals.

Crossing the Andes, one finds the newspapers of Chile next in influence. First comes *El Mercurio* (est. 1827) of Valparaiso with separate publication in Santiago and Antofagasta. Its chief competitor is *La Union*, which also publishes a paper of the same name in Santiago. In the city last mentioned are the rather influential *La Nación* and *El Diario Ilustrado*. The total number of newspapers and periodicals published in Chile (1925) is about 500. In Peru the three leading papers are *La Cronica*, *La Prensa* and *El Comércio* of Lima.

In Brazil the most influential paper is probably *O Estado* of São Paulo. *Fanfulla*, the Italian daily of that city, wields considerable power through the State of São Paulo. The oldest and best known daily in Rio de Janeiro is the *Jornal do Commercio* (est. 1827), an extremely conservative paper of limited circulation. Two other influential morning papers are *O Paiz* and *Correio da Manha*. Newspapers in Brazil are often the personal organs of owners to whom they are useful for political purposes. At the fall of the Empire Brazilian journals numbered about 600. In 1910 the total exceeded 1,000, since when the increase has been about 100 to a decade. The more influential papers in Mexico are limited to the capital city and frequently contain features obtained from American syndicates. They include *El Universal*, *El Nacional* and *El Democrata*.

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To South America, rather than to its sister continent to the north, belongs the honour of printing the first sheets of news in the Western Hemisphere. Not only in contents but also in mechanical make-up they followed the pattern set by the sheets of Southern Europe. This relationship was further emphasised by a similarity in titles for these precursors of printed newspapers: *Gazeta Diario*, *Mercurio*, *Relación*, etc. But these stray sheets lacked regularity of publication and continuity in presenting news. The first newspapers, in the technical sense of that term, for the countries of South America may be listed as follows:—

Mexico. *Gazeta de México* (1679).
Guatemala. *Gazeta de Goatemala* (1729).
Peru. *Gazeta de Lima* (1744).
Cuba. *La Gaceta de la Habana* (1764).
Colombia. *La Gaceta de Santa Fé* (1785).
Ecuador. *La Gaceta* (1785).
Argentina. *El Telégrafa Mercantil* (1801).
Haiti. *La Gaceta del Cabo* (1804).
Uruguay. *La Estrella del Sur* (1807).
Brasil. *Gazeta do Rio de Janeiro* (1808).
Venezuela. *La Gaceta de Caracas* (1808).
Chile. *La Aurora de Chile* (1812).
Panama. *Miscelanea del Istmo* (1822).
Bolivia. *El Condor de Bolivia* (1825).
Paraguay. *El Paraguay Independiente* (1845).

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IV. NEWSPAPERS IN OTHER COUNTRIES

Freedom of the Press did not accompany the introduction of democratic institutions and universal suffrage. The Press laws in the new countries of continental Europe usually begin with the declaration that the Press is free and then follow with provisions which can be used to muzzle or suppress the newspapers. Nevertheless there has been a significant growth of newspapers representing Social Democrats, Socialists and Communists, and so long as they do not openly advocate revolution and direct action for upsetting the social order they are tolerated. In Germany, the Social Democratic Press has gained in strength as the parties are well organised and associated with the trade union movement. It is the same in Czechoslovakia and Austria. In France, where the trade unionists are loosely organised and undisciplined, there has been no notable increase in journals representing the extreme Left in politics. In all the new countries there are papers representing agrarian interests as well as democratic. All parties have their newspapers and governments have organs which are more or less official.

Germany.—Under the old German Empire, especially when Bismarck was the power behind the throne, the Press was not respected, but it was exploited by the Government for its own purposes. There was liberty of the Press within reason and a few independent voices were raised; but, as a rule, most papers were obliged, for one reason or another, to accept inspiration from the Foreign Office. In domestic affairs they reflected the opinion of political parties. Journalists did not enjoy a high standing, but before 1914 they had begun to conquer positions in the political world. To-day the Press has complete freedom and is independent of the Government. The German Press is the most serious in Europe. There are few sensational newspapers. Newspapers do not sell because of sport and "stunts." Journals which cater to the working classes discuss economic problems. Literature, the drama, art, music and economics occupy a greater proportion of space in German newspapers than in the Press of any other country.

The journalistic characteristics of the German Press—apart from the greater freedom which it now enjoys—have not changed since the War. The former national organs occupy relatively the same positions, but there has been a shifting of ownership, not due to the political revolution but to the effects of inflation. During this period of inflation many of the old family newspaper owners, particularly in the provinces, were unable to survive and sold to industrialists. Hugo Stinnes, the industrial magnate, was able to create a great newspaper trust, which was, however, broken up after his death, when his mushroom millions were dispersed. There are few afternoon papers in Germany. A new syndicate, financed by industrialists, is the Hugenberg Press, which owns a string of country newspapers. It has its own news agency. It is a new political force representing Nationalist feelings. While the Nationalist newspapers are controlled largely by industrialists, the organs of the Centre or Roman Catholic party are under strict party control and owned by party men. The Centre represents about a third of the population of Germany, but its Press, although vigorous, consists of papers which have not big circulations. The most influential are the *Germania* of Berlin, and the *Volkszeitung* of Cologne. Another group of papers which has increased in prestige since the War is the Democratic and Social Democratic Press, powerful factors in political life.

The German Government has no longer an interest in newspapers as in the days of the Kaiser, when the Foreign Office directed or swayed the policy of several political journals. Its connection with the Press is now confined to its participation in Wolff's Agency, which is parallel to the Havas Agency in France.

Among the most independent and influential papers in Germany are the provincial organs, *Frankfurter Zeitung* and the *Kölnische Zeitung*, known throughout the political world as the *Frankfurter* and the *Kölnische*. The chief papers in Berlin are the *Börsen Zeitung* (non-party), the *Lokal Anzeiger* (Popular), *Der Tag* (Nationalist), the *Berliner Tageblatt* and *Vossische Zeitung* (Democratic), *Allgemeine Zeitung* (Nationalist), the *Tägliche Rundschau* (Patriotic), *Deutsche Tageszeitung* (National and Agrarian), the *Morgenpost* (Democratic) and the *Vorwärts* (Social Democratic) and a Communist paper, *Die Rote Fahne* or *Red Flag* (sale, 65,000). The more popular papers in Berlin have sales exceeding 250,000. Among the most widely circulated papers outside Berlin are the *Erzgebirgischer Volksfreund* (Democratic), which has a daily circulation of over 100,000. The *Düsseldorfer Nachrichten* (Independent-National), which reaches the same figure, the *Frankfurter General-Anzeiger*, 115,000, the *Hamburger Anzeiger*, 110,000, the *Leipziger Neueste Nachrichten* (Patriotic), 175,000, the *Münchner Neueste Nachrichten* (National), 145,000, the Dortmund *General Anzeiger* (non-party), 122,000, and the *Dresdener Neueste Nachrichten* (Liberal Democratic), over 100,000. There are a number of Communist journals, including, besides the Berlin *Rote Fahne*, papers in the following cities: Breslau, the *Arbeiterzeitung*, sale 15,000; Chemnitz, *Der Kampfer*, 75,000; Bochum, the *Westfälischer Arbeiter Zeitung*, 22,000; Essen, the *Ruhr Echo*, 47,000; Hamburg, the *Volkszeitung*, 25,000; Leipzig, the *Sächsische Arbeiterzeitung*, 30,000.

There are several newspapers which occupy a status and exercise an influence in German journalism and public life which cannot be measured by sales. The *Frankfurter Zeitung*, already mentioned, is perhaps the most powerful. It has 19 issues a week—morning and afternoon. Of a similar type is the *Kölnische Zeitung* and the *Hamburger Nachrichten*, founded in 1792. The *Jenaische Zeitung* has been in the same family since it was founded in 1674. A still older paper, the *Königsberger Hartungsche Zeitung*, dating from 1640, keeps its flag flying in the Eastern outpost on the Baltic. Papers published in districts which are inhabited by Germans, although not now under the German flag, are intensely Nationalist, such as the *Saarbrücker Zeitung*, papers in Polish Upper Silesia, Danzig and other territories formerly included in the Empire.

In Germany, no general newspapers are published on Monday, except two or three in Berlin. Sunday is a day of rest to newspaper workers. The provincial morning papers in Germany issue three editions during the day, the contents varying more or less. In Berlin, two editions are issued.

According to the *Politischer Almanach* there are over 100 important newspapers in Germany, and 38 serious political journals, representing all shades of political opinion. There are 24 large news agencies in Berlin, with branches in the chief cities. All the political parties have their Press agencies. Among the best-known German Reviews are the *Preussische Jahrbücher*, *Deutsche Rundschau*, *Neue Rundschau*, *Süddeutsche Monatshefte* and the *Neue Zeit*.

France.—In no other country is the political influence of the Press so great, or its literary merits so high, as in France. In France, journalism is literature and literature is journalism. Journalism and politics are also inextricably mixed. Presidents of the Republic, Prime Ministers, Colonial Governors, Academicians and others who attain high positions in national life, graduate through the Press. When they retire, they return to their muttons. The most famous journalistic statesman was Georges Clemenceau, the great War Premier. He retired a year after the Treaty of Peace was signed, and at the age of eighty was an unsuccessful candidate for the Presidency. He did not profess disappointment at his failure but consoled himself with the observation: "What matters; with good pen and paper one could be king of the world." While the literary reputation of the French Press stands high, its commercial and political morality is not on the whole quite so commendable. Many newspapers are run for, or by, ambitious politicians, or in some interest, and nearly all of them accept inspiration from the Foreign Office. Ministers change frequently but the system remains. It is like part of the constitution. The smaller papers—and there are many of them—farm out their financial and advertising columns to agencies.

The French Press has been little changed by the World War. During the War many newspapers temporarily disappeared, owing to the lack of staff, or of means, or shortage of paper. All papers were under a severe censorship and, more than ever, were the servants of the Government.

In 1926 there were 227 political journals published in Paris, of which 48 were political dailies. This total does not include papers dealing with technical subjects or sport. There were 127 sporting newspapers, of which five were dailies. The number of newspapers published in the provinces was 3,076, including publications of all descriptions. Morning and evening dailies numbered 256.

France was the first country to have national newspapers with sales of over 1,000,000. The sale was stimulated more by two serial stories run by each paper than by news, but since the War news has become conspicuous in such very widely circulated papers as *Le Petit Parisien* (1,200,000), *Le Journal* (1,000,000), *Le Matin* (900,000) and the *Petit Journal* (800,000), which may be described as the "Big Four of the Paris Press." Following upon these in point of sales comes the *Echo de Paris* (800,000). The better-known political papers are *Le Temps*, the venerable *Journal des Débats*, *La Liberté*, *L'Oeuvre*, *L'Humanité* and the *Ere Nouvelle*. The *Figaro* maintains its unique position. Characteristics of all the popular Press are signed articles and serial stories. There is a popular daily illustrated paper, *Excelsior*, established 1910, and numerous dailies devoted to sport, finance, the drama, motoring, etc. Four daily papers are published in Paris in English; *The Daily Mail*, *The New York Herald*, *The Chicago Tribune* and *The Evening Times*. Every phase of politics is represented in the Paris Press, from Legitimist to Communist, and every trade and interest has its organ. The provincial Press is more independent politically than the Paris papers and several journals, such as the *Dépêche* of Toulouse, the *Progrès*, of Lyons, the *Petit Marseillais*, *La Petite Gironde* of Bordeaux, have national reputations. The small local Press exercises an independent influence during elections.

Improvements have taken place in the mechanical equipment of the French Press in recent years, and there has been a marked increase in illustrated weeklies and monthlies. The best known weeklies are the dignified *Illustration* and the gay *Vie Parisienne*, which flourished during the War, the literary *Annales Politiques et Littéraires*, and a light variety paper *Nos Loisirs*. The *Revue des Deux Mondes*, the *Mercure de France* and the *Revue Hebdomadaire* are the best known monthlies. The sale of the French Press is pushed all over Europe. The chief news agency, Havas, has official support. There is also a universal wireless service which broadcasts news and propaganda. It is a subsidiary of the wireless company, which holds a concession from the State.

Italy.—Until the fascist régime of Mussolini, the Italian Press laws were based on a Royal decree of 1848. In July 1924 a decree was issued which made newspapers liable to suppression and editors to punishment if they published "tendencious news" which might embarrass the Government in foreign or domestic affairs; and an elastic interpretation of these powers has enabled the Government to suppress all newspapers which ventured to offer any independent criticism to such an extent that in the early part of 1926 the freedom of the Press no longer existed. The most famous newspapers in Italy suffered punishment, and were only tolerated on condition that they refrained from hostile criticism. Where the Press was not muzzled there was a forced change of proprietorship in harmony with Fascist policy. This was the case with the well-known *Corriere della Sera* of Milan, for some years the most powerful organ in Italy. The *Stampa* of Turin, although never strongly anti-Fascist, was tamed; the same fate overtook the influential journal in the south, the *Mattino* of Naples. The complexion of the best-known papers in Rome has been changed. The only journals which enjoy a certain restrained independence are the semi-official organs of the Vatican. A number of newspapers have ceased to exist, and the journalists' associations have been placed under the control of Government Commissioners. There were only 68 daily newspapers in Italy in 1926.

The Press in New Countries.—The rebirth of nations after the World War was followed by a revival in journalism. Every new State had its crop of new journals. Although freedom was not complete, the influence of political parties led to the maintenance of rival organs. Under the three Empires out of which it was carved, Poland's Press existed on sufferance. Now, there are nine daily papers in Warsaw—two of them official, one in Polish and one in French. There are four dailies in Cracow and several in other cities. Besides exponents of the various national political policies there are Zionist, Ukrainian and German papers in Poland, but the authorities sometimes suppress non-Polish journals.

In Czechoslovakia there is a greater measure of freedom and there are far more newspapers. The Press of Yugoslavia has not yet developed a full sense of responsibility. It represents all races, policies and languages. New Turkey now possesses a democratic Press which can speak its mind within limits. The new Baltic States have a Press which is creditable for the small populations for which it caters. In these states and in other territories, where under old conditions there were German interests, newspapers in German are still published. The Press of new Rumania is largely concentrated in the capital, Bucharest, with 24 dailies, of which one is in French and three are in German. In Hungary the popular papers are in the Magyar language—*Az Est* and *Az Ujsag*—and the most influential in German—the *Pester Lloyd* and the *Neues Pester Journal*. The Austrian Press—still headed by the *Neue Freie Presse* of Vienna—is free, but not flourishing under the narrowed limits of the country. Under the new Austrian Press laws power is given to the educational authorities to prohibit the sales of newspapers which "by exploiting youthful impulses may endanger the normal health of young persons."

Russia.—Freedom of the Press has been completely suppressed in Soviet Russia. In Tsarist Russia censorship was severe, but a measure of toleration existed. In Soviet Russia censorship is applied before the matter is printed, which has to be submitted to an official editorial Board known as the Gosizdat. There is a further check on the publication of news and expression of opinion, as newspapers are only published under the auspices of the governing authorities and are thus practically all official organs.

In 1914 there were 17 dailies in the capital, some of them of international reputation, such as the *Novoe Vrèmja*, and the *Retch*, and five in Moscow. In 1910 there were 52 daily newspapers in Russia, of which 13 were in St. Petersburg (Leningrad), and four in Moscow, exclusive of papers in Finland and Polish Russia. In 1926 almost all the Press was concentrated in Moscow. There were 11 morning and evening papers in Moscow, but only two of any importance, the *Izvestia* and the *Pravda*. In Leningrad there were only two morning papers, the *Pravda* and the *Krasnaya Gazeta*. The number of daily newspapers in Russia was, in 1926, eighteen.

Belgium.—Belgium possesses a vigorous Press, published in French and in Flemish. Although the chief Paris papers circulate all over Belgium, the Belgian Press nevertheless enjoys a large sale, and the popular journals are highly prosperous. There are 17 daily papers published in Brussels and nine in Antwerp. There are a number of Socialist journals, the chief organ of the party being *Le Peuple*. The success of the Socialist Press is due largely to its association with the co-operative movement. *La Libre Belgique*, which appeared regularly during the War in occupied Belgium in spite of the vigilance of the Germans, now exists as a daily newspaper. In Belgium, the Press laws have not been changed for many years and the Press enjoys almost unlimited freedom.

The Netherlands.—The Netherlands, with a population of over 7,000,000, possesses a healthy Press, including journals which enjoy a high reputation for their literary merits and as organs of opinion. The chief among these are the *Nieuwe Rotterdamsche Courant*, *De Telgraaf* and the *Algemeen Handelsblad*, of Amsterdam. There are eight daily papers in Amsterdam, seven in The Hague and five in Rotterdam, and these circulate throughout the country.

Scandinavia.—The newspapers in the Scandinavian countries appeal to a highly intelligent reading public and are among the best written and the best produced on the Continent. The three kindred races can understand each others' newspapers.

Spain and Portugal.—There is little progress to record in the Spanish Press, and circulations are small. The illustrated *A.B.C.* is the most popular paper. The *Imparcial* is an important political organ. The *Heraldo* and the *Liberal* are other leading Madrid journals. *El Sol* was founded in 1917 by the Spanish Paper Trust. There are 20 daily papers in Madrid and 17 in Barcelona, and about 200 dailies of sorts in Spain. The principal Portuguese papers are the *Diaris Noticia* (founded 1820) and the *Jornaldo Commercio*, both published in Lisbon.

Switzerland.—Switzerland, owing perhaps to its small population, has few papers known outside the country. In 1926 there were 38 daily newspapers published in German, 19 in French and two in Italian. The best known are the *Journal de Genève*, read in France, the *Neue Zuercher Zeitung* and the *Zuericher Post*, which have a considerable circulation in Germany.

China.—By no means the least result of the Chinese revolution of 1911 was the amazing expansion of the vernacular press. Actually the movement had begun some years earlier, but after the revolution it developed into a portent. Native newspapers sprang up in all parts of the Empire in a night, as it were, and it is not surprising that the Chinese Press exhibits most of the undesirable attributes of a mushroom growth. The general quality is poor. Most of the papers are run for political or personal ends, the news supplied by them is untrustworthy and their standard of journalistic ethics low. This is the more to be regretted as their multitude testifies to the interest which awakened China takes in affairs and their influence on public opinion is beyond doubt enormous; but little improvement is to be expected until political conditions become more settled. As things are it is only fair to say that, with all its irresponsibility and corruption, the Chinese Press is on the whole liberal and patriotic in intention if not always in fact. It may be noted that Chinese periodical publications are on a much higher level than the newspaper press.

Between twenty and thirty European and American newspapers are published in China, more than half of them at Shanghai. The majority are British, including the *North China Daily News* of Shanghai which, founded in 1864, is the oldest foreign daily in China. Other British morning newspapers are *The Shanghai Times*, *The Central China Post* (Hankow), *The Peking and Tientsin Times*, *The Hongkong Daily Press* and *The South China Morning Post* (Hongkong), The principal British evening papers are *The Shanghai Mercury*, *The North China Daily Mail* (Tientsin), *The Hongkong Telegraph* and *The China Mail* (Hongkong). There are three American morning dailies, *The China Press* (Shanghai); *The Peking Leader* and *The North China Star* (Tientsin)—and three French, *L'Echo de Chine* (Shanghai), *Le Journal de Pékin* and *L'Echo de Tientsin*. In addition there are a number of Chinese and Japanese-owned journals published in English.

Japan.—The restraint of the Press which was common to all belligerent countries during the World War was maintained much longer in Japan than elsewhere, and it was not until 1922 that the War-time regulations were repealed. Nevertheless the period 1911–25 was marked by steady progress and a great expansion of the circulation of the more important newspapers, and while there is no Japanese journal that can be said to belong to the first class in the world's Press, there are several that rank high in the second class. The most widely read newspapers are the *Osaka Asahi Shimbun* and the *Osaka Mainichi Shimbun*, each of which has a circulation of 700,000 daily. The leading Tokyo papers, such as the *Jiji Shimpo* and the *Tokyo Nichi Nichi Shimbun*, are influential but have a far smaller circulation. The most notable feature of Japanese newspaper enterprise during the period under review was the growth of the evening Press. Formerly there was but one evening paper, the *Maiyu Shimbun* of Tokyo, and even now there are, strictly speaking, only two, the *Tokyo Mainichi Shimbun* having been converted into an evening paper in 1918, but practically all the principal morning dailies publish evening editions.

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NEW TESTAMENT: *see* BIBLICAL CRITICISM.

NEW YORK CITY (*see* 19.610).—The population of New York City in 1925, according to the State census, was 5,873,356, as against 4,766,883 in 1910, an increase of 1,106,473 or 23·2%. The population of the separate boroughs was: Manhattan, 1,945,029 (in 1910, 2,331,542); Bronx, 872,168 (in 1910, 430,980); Brooklyn, 2,203,235 (in 1910, 1,634,351); Richmond, 138,277 (in 1910, 85,969); Queens, 714,647 (in 1910, 284,041). The average number of inhabitants per acre was: Manhattan, 139·0; Brooklyn, 48·5; Bronx, 32·9; Queens, 10·3; Richmond, 3·8; whole city, 30·6. In 1924 the average death-rate for the city was 11·8 per 1,000, as compared with 15·98 per 1,000 in 1910. The reduction of the general death-rate has been due mainly to special activities in the prevention and control of communicable diseases, especially those of childhood.

I. PUBLIC SERVICES

Finance.—The city's budget grew from $163,130,270 in 1910 to $399,618,885 in 1925. Important items were $95,099,162 for education and recreation; $59,068,521 for protection of life and property; $60,255,956 for health, sanitation and care of dependents; $106,487,232 for debt service and tax deficiencies. The assessed values on which taxes for 1925 were levied were $11,901,348,553 real estate and $239,507,540 personal property, or a total of $12,140,856,093. In 1910 the total assessed value of taxable property, real and personal, was $7,416,837,499. The net funded debt of the city as of March 1925 was $1,262,736,066, the gross funded debt being $1,969,515,440.

Water Supply.—The most notable extensions to public services made since 1909 include the development of additional water supply from the Esopus and Schoharie watersheds in the Catskill Mts., and extending rapid transit facilities throughout the city. The two watersheds have an area of 571 sq. m. and a safe minimum yield estimated at 515,000,000 gal. daily. The flow of the Schoharie creek is intercepted by a temporary diversion dam through the Shandaken tunnel, 18 m. long, to join the water of Esopus creek, which discharges into the Ashokan reservoir. The Gilboa dam, under construction in 1925, was designed to form the Schoharie reservoir with a storage of 20 thousand million gallons. The main reservoir of the system, the Ashokan, is located about 92 m. from the northern boundary of New York City. Its estimated available storage capacity amounts to 130,400 million gallons. Other features of the Catskill system are the Kensico dam, the Catskill aqueduct and city tunnel and the Hudson river crossing. The Kensico dam is one of the great masonry structures of the world, containing nearly 1,000,000 cubic yards of masonry and at its highest point rising 307 ft. above the rock foundations on which it rests. The Catskill aqueduct includes 69 m. of plain concrete grade aqueduct and tunnel, 17 m. of reinforced concrete pressure tunnel and 6 m. riveted steel inverted siphons. The Hudson river crossing comprises a 14-ft. tunnel driven in granite rock 1,114 ft. below the sea-level. The total cost of the completed Catskill supply will be about $180,000,000. Other supplies, together with the Catskill, provide a safe yield estimated at approximately 1,000 million gal. per day. Water consumption during 1925 reached 865 million gal. per day, thus indicating the need for developing additional supply in the near future.

Rapid Transit Development.—As a means of meeting the demand for additional rapid transit facilities, the city, in March 1913, entered into separate contracts with the Interborough Rapid Transit Co. and the New York Municipal Railway Corporation, for the construction, equipment and operation of a system of rapid transit lines known as the dual system. At that time the Interborough Rapid Transit Co. operated the subway lines in Manhattan, the Bronx and Brooklyn and under lease the elevated lines owned by the Manhattan Railway Company. The New York Municipal Railway Corporation was formed in the interests of the Brooklyn Rapid Transit Co. for the operation of various lines constructed or to be constructed as outlined in the dual plan. The New York Railway Co. and Third Avenue Railway Co., which operated most of the surface lines in Manhattan and the Bronx and the surface lines of the Brooklyn Rapid Transit Co. were the only large traction systems in the city not included in the dual system. The operating contracts made with each company run for a period of 49 years (dating from Jan. 1 1919 in the case of the Interborough; and from Aug. 1 1920 for the Brooklyn Co.), at the end of which time all leases and agreements will terminate and the city will have complete ownership and control over the construction included in the dual plan. Provision is made for the sharing of profits with the city after the operating company has paid all necessary expenses and taken out an amount designated as a preferential. The contracts also specify that the fare for a continuous ride shall be five cents.

The dual plan provided for the construction of about 325 m. of new tracks, making the total mileage of the completed system 618·4. While the plan as outlined approximately doubled the existing mileage, it tripled the facilities then available, as the third tracking and extension of existing elevated railways materially increased the carrying capacity. For the Interborough these extensions comprised subway construction north and south of 42nd street, Manhattan. North of 42nd street, the new subway extended up Lexington avenue and connected with the existing Fourth avenue subway. New subway construction south of Times Square extended the west side subway down Seventh avenue to lower Manhattan and by tunnel under the East river and to South Brooklyn. This construction provided independent through north and south rapid transit lines for the east and west sides of Manhattan Island. The addition of third tracks and extension of existing elevated lines have brought the route mileage to 115·4, and the total track mileage for the Interborough system to 333·3.

The main feature of the extension of the lines of the New York Municipal Railway Corporation was the subway beginning at the Queensboro Bridge and extending west by 59th and 60th streets to Seventh avenue, thence south by Seventh avenue, Broadway, Vesey street, Church street and Trinity place to a connection with a tunnel under the East river at Whitehall street. This construction and other extensions make a total of 99·4 route m. and a total track mileage for the New York municipal railway system of 274·3 m. now in operation. A continuous ride of 26·63 m. for five cents is available on the Interborough system and one of 18·5 for the same fare on the Brooklyn lines. Up to June 30 1925, expenditure by the city and the operating companies for rapid transit construction and equipment, exclusive of the cost of the privately owned lines of the old Manhattan elevated structures, amounted to approximately $537,000,000. Of this amount the city's part was about $327,000,000 and the operating companies' $210,000,000.

Communications.—Two important enterprises in providing additional direct lines of communication with New York City are the New York connecting railway across the East river and the vehicular tunnel under the North river. The New York connecting railroad provides direct rail connection with the New York, New Haven and Hartford line for the boroughs of Queens and Brooklyn. The main features include a reinforced concrete arch viaduct extending from the connection with the New York, New Haven and Hartford railroad in the Bronx to a point on Ward's Island, in the East river, a steel arch spanning that secion of the East river known as Hell Gate, and connecting with a similar reinforced concrete viaduct in the Astoria section of Queensborough. Surface construction provides direct passenger rail connection with the Sunnyside Yard of the Long Island railroad and thence access to the Pennsylvania railroad terminal in Manhattan, while another branch for freight only extends to the Bay Ridge section on the water-front of South Brooklyn. The entire length of the connecting railway is 12 miles. The total amount expended was approximately $30,000,000. The bridge tself (Hell Gate), having the largest steel arch in the world, cost $18,500,000. Its massive granite piers rise to a height of 240 ft. and are 1,017 ft. apart. The steel arches which support the deck of the bridge rise 300 ft. above the water, and the clearance for vessels at mean highwater is 135 feet. The bridge carries four racks, two of them for both passenger and freight service.

The Holland vehicular tunnel beneath the North river connecting Manhattan Island and Jersey City was to be open for raffic during 1926. Its construction is under the joint jurisdicion of the New York Interstate Bridge and Tunnel Commission and the New Jersey Interstate Bridge Commission, and the cost was to be shared equally by the two States. The estimated traffic capacity of the tunnel is 15,000,000 vehicles per annum. The unnel section, the construction of which was completed Oct. 1 1925, comprises two tubes each 29 ft. 6 in. outside diameter and approximately 9,500 ft. in length. The tubes are constructed of cast-iron segments and reinforced concrete and were built by the Shield method of construction. Each tube includes a 20-ft. roadway to accommodate two lines of traffic moving in the same direction and a 3-ft. sidewalk for pedestrians. The greatest single engineering difficulty involved was that of providing an adequate system of ventilation. That adopted was the so-called transverse system, under which fresh air is forced into the tunnel structure through air ducts under the roadway and ejected into the tunnel section through apertures along the roadway curb at each side. The foul air is discharged through air ports in the tunnel roof section, and thence forced through air ducts to the ventilation shafts and the outer air.

Other Public Improvements.—Growth of the city and the great development in the use of motor vehicles have produced serious traffic congestion which has necessitated extensive street widening and the construction of new thoroughfares. Notable examples of new construction are the Varick street extension of Seventh avenue, Manhattan, the extension of Flatbush avenue, Brooklyn, and the construction of the Jamaica Bay boulevard in Queens. The removal of elevated railway structures from 42nd street and Upper Sixth avenue and the construction of a viaduct carrying Park avenue over 42nd street at Grand Central Station have aided in relieving traffic congestion at those points. Progress has been made in relieving the waters of New York Harbour from sewage pollution by the construction of sewage screening plants along the North and East rivers and at other points.

There have been marked changes in the use of property, particularly in Manhattan, since 1909. The principal shopping district has shifted northwards, until in 1926 its boundaries, broadly speaking, were 34th street, Broadway, 59th street and Madison avenue. In the vicinity of 42nd street there has been an extensive development of office buildings. The buildings formerly housing the Knickerbocker, Holland House and Manhattan hotels and two famous restaurants—Sherry's and Delmonico's—have been replaced by office buildings. Notable building construction from 1909–25 includes the Woolworth building (792 ft.), the highest structure in the world excepting the Eiffel Tower, Bankers' Trust (539 ft.), City Investing (487 ft.), Equitable (485 ft.), Adams Express (424 ft.), Whitehall (424 ft.), Bush Terminal (419 ft.), American Express (415 ft.), American Telephone and Telegraph (403 ft.), and the new Telephone building (400 ft.). Height restrictions and set-back provisions in the city zoning ordinance have offered the opportunity for considerable variation in the architectural treatment of high buildings constructed during recent years, which have resulted in securing more artistic effects than were formerly possible. Among the newer hotels are the Pennsylvania, with 2,200 rooms, the largest hotel in the world; the Commodore; the Ambassador; and the Roosevelt. Madison Square Garden, an historic structure used for amusement purposes and as a place of public assembly, was demolished in 1925, a 28-storey office building being erected on its site.

II. COMMERCE AND INDUSTRY

Port of New York.—During 1924 the tonnage of vessels entering the Port of New York direct amounted to 18,280,975, while ships clearing from the port carried 18,858,693 tons. The value of the imports received during 1924 aggregated $2,047,759,136, representing an increase of 130% over 1909. Exports for 1924 amounted to $1,685,562,079, an increase of 169% over 1909, but a decrease of 52% from those made during 1920. Improvements in port facilities made since 1909 include the completion of the Ambrose Channel work and deepening of the East river channel by the Federal Govt. and the reconstruction and extension of the Erie canal by the State. Eight canal terminals have been built at various points along the North and East rivers together with a modern grain elevator with a capacity of 2,000,000 bu. located at the Gowanus Bay terminal. Expenditures on the canals up to 1925 aggregated $167,123,774. The most noteworthy port development works carried out by the city since 1909 include the North river, Staten Island and Jamaica Bay projects. Along the North river two 1,000-ft. piers were built between 44th and 50th streets, and by 1925 two others had been planned. The completed construction, which cost approximately $5,500,000, including real estate, provides 285,000 sq. ft. additional dock space. The construction of a steamship pier 1,000 ft. long and 174 ft. wide above the Holland vehicular tunnel, involving an estimated expenditure of $2,500,000, was planned. A railroad pier costing about $900,000 and providing 92,000 sq. ft. additional dock space, was completed during 1925 at Pier 2, North river. Three piers providing 568,500 sq. ft. dock space were built along the East river during 1916 at the foot of 29th, 30th and 35th streets respectively, South Brooklyn, and subsequently there was extensive bulkhead improvement of both the Manhattan and Brooklyn waterfronts along the East river. Remodelling High Bridge over the Harlem river and straightening of the alignment of that waterway was also accomplished. In 1919 the city initiated the Staten Island improvement project involving the construction of 12 modern steamship piers with terminal warehouse facilities. This improvement, built at a cost of about $30,000,000, includes over six miles of wharfage and 1,800,000 sq. ft. dock space. Through its connection with the Baltimore and Ohio railroad, opportunity was provided for track railhead connections between these piers and all but two of the railways entering the Port of New York. The facilities afforded by this improvement exceeded, in 1926, those available for similar purposes on the island of Manhattan.

The Jamaica Bay project constitutes the most important development undertaken by the city in recent years. Jamaica Bay has an area of about 26 sq. miles. In 1909 the State of New York ceded to the city all of the State's ownership in the Bay, amounting to about 16,000 acres. The Federal Govt. adopted a project to dredge a channel through Rockaway Inlet and from Barren Island to Cornell Basin, to an ultimate depth of 30 ft. and to a width of 1,000 feet.

In 1923 the Department of Docks laid out in the middle of Jamaica Bay a scheme for the construction of two islands, to be made by dredging a channel 2,500 ft. wide and 30 ft. deep around the bay. The islands will contain 6,500 ac., and will have a quay wharfage of about 28 miles. At an expenditure of about $1,250,000 the department has completed an embankment 550 ft. wide and more than two miles long. This embankment provides a roadway of 150 ft., which is the Cross Bay boulevard, over the island and in addition gives the city about 2,000 building lots. The two islands, will provide homes for about 400,000 people.

Port Authority.—In 1921, on recommendation by a joint commission appointed in 1917 by the governors of New York and New Jersey to investigate conditions at the Port of New York, a treaty was entered into between these two States providing for the creation of the Port of New York District and the establishment of the Port of New York Authority. This treaty was subsequently ratified by Congress; and the Port Authority was appointed, consisting of six commissioners, three from each State, serving for overlapping terms. In Dec. 1921 the Port Authority presented to the legislatures of New York and New Jersey a comprehensive plan for the development of the port, which was adopted by the legislatures and ratified by Congress. The principal features of the plan are a series of belt lines and marginal railways, a freight tunnel from Greenville, N.J., to Bay Ridge, Brooklyn and an automatic electric system of freight transportation for serving Manhattan and union inland terminal stations on Manhattan Island.

In 1924 the states of New York and New Jersey made appropriations for and granted authority to the Port Authority to make surveys and borings for two bridges across the Arthur Hill from Staten Island to New Jersey. In 1925 the legislatures provided for the building of these bridges by the Port Authority, the States contributing a total of $4,000,000 toward the cost, to be eventually repaid from the collection of tolls, and the balance of the cost is to be financed by the issuance of bonds, to be amortised from the tolls collected. In 1925 the legislatures also provided for studies for a bridge across the Hudson river from Manhattan, in the neighbourhood of 178th street, to Fort Lee, New Jersey.

Manufactures.—The New York City Metropolitan District (a district of 616,928 ac., including in addition to New York City the neighbouring cities and towns both in New York State and New Jersey) is by far the largest industrial district in the United States. In 1919 there were 32,590 manufacturing establishments in New York City with a total number of 825,056 persons engaged in the industries. Of these 638,775 were wage-earners; 35,101 were proprietors and firm members; 36,894 were salaried officers, superintendents and managers; and 114,286 were clerks. The sum of $326,171,741 was expended for salaries and $805,822,451 for wages. The total value of the products manufactured was $5,260,707,577, and the amount of capital invested in industries in the whole city was $3,038,557,492. The clothing industry ranked first in importance, the total value of men's and women's clothing manufactured being $1,346,839,946 or 57 % of the value of clothing produced throughout the entire country. Printing and publishing ranked second, with products valued at $206,585,376.

Art.—The additions to the Metropolitan Museum of Art during the years 1910–25 have made it rank with the large museums of the world. Among the notable bequests have been those of Francis L. Leland, $1,000,000; Joseph Pulitzer, $900,000; Benjamin Altman, collection of paintings, sculpture, Chinese porcelains, etc., with a fund for their care; William Henry Riggs, collection of arms and armour; Harris B. Dick, collections and funds over $1,000,000; Isaac D. Fletcher, collection of paintings and objects of art and fund over $3,400,000; John Hoge, over $1,000,000; and Frank A. Munsey, the bulk of an estate estimated at $40,000,000.

III. LOCAL POLITICS

Mayor Mitchel's Administration.—During the administration of Mayor Gaynor, which began in 1910, there arose an increased interest in city affairs. The mayor who in consequence of an attempt to assassinate him had gained a hold on popular sympathy, died on Sept 10 1913 while on a voyage to Europe. Adolph L. Kline (b. 1858), president of the Board of Aldermen, succeeded to the office for the remaining few months of the term. A fusion ticket, led by John Purroy Mitchel (1879–1918), who had made an enviable record in public office as Commissioner of Accounts, Collector of the Port and president of the Board of Aldermen, easily defeated the Tammany ticket. Mitchel, but 35 years of age, undertook a complete reorganisation of administration and obtained remarkable results, making his mayoralty a period of unprecedented efficiency in the city's government. Of special note were the improvements in police, street cleaning, charities and corrections and the establishment of high standards and expert service in taxation, purchasing and the selection of personnel.

The Tammany Reaction.—Though admittedly efficient, economical and honest, this administration saw itself at the end of four years buried under the greatest majority for Tammany on record. John F. Hylan (b. 1868), a candidate from Brooklyn, led a complete Tammany ticket into office, with a platform of outspoken opposition to almost everything the Mitchel administration had done. Subsequently, however, upon the election of the president of the Board of Aldermen, Alfred E. Smith, to the governorship of the State and the death in office of the president of the borough of Manhattan, Republicans were elected to the vacancies.

In 1921, largely as a result of the enactment of legislation sponsored by Gov. Miller which seriously curtailed New York City's powers over local rapid transit matters, Mayor Hylan was renominated and again elected by a substantial majority, together with a complete Tammany ticket. During both terms of Mayor Hylan's administration there was practically continual wrangling among the members of the Board of Estimate and complete lack of co-operation with other public agencies. These conditions, together with the general character of appointments made by the mayor, resulted in a distinct lowering of the morale of city employees and a disturbance of administrative machinery that interfered seriously with the public service. Particularly in providing for much-needed rapid transit facilities the demagogic attitude of Mayor Hylan and to a less degree that of the other members of the Board of Estimate in refusing to work with the transit commissioners, brought about a virtual *impasse* that for seven years prevented action necessary to afford public relief. Finally, in 1924, the Board of Estimate filed charges against the transit commissioners with Gov. Alfred E. Smith, and the latter appointed the Hon. John V. McAvoy, Supreme Court Justice, Appellate Division of the State of New York, a commissioner to investigate the charges. Commissioner McAvoy's report, presented early in 1925, placed responsibility for the transit situation directly on Mayor Hylan. The administrative incompetence of Mayor Hylan and his subservience to Mr. William Randolph Hearst, publisher, were factors in causing many influential Tammany leaders to withdraw their support and in Sept. 1925 he was soundly defeated in the primaries as a candidate for mayor by James J. Walker. The Republican nominee was Frank D. Waterman, a prominent manufacturer. Walker was easily elected in the Nov. elections.

Home Rule.—Important legislation affecting New York City since 1910 included the Home Rule Act of 1924 and the Home Rule Transit law. Under the provisions of the Home Rule Act the power to enact local laws in New York City is conferred on a bicameral body known as the "municipal assembly" consisting of the Board of Estimate and Apportionment and the Board of Aldermen. The Home Rule Transit law provided for the establishment of a Board of Transportation to have jurisdiction over the regulation of existing rapid transit lines and gave the board broad powers for providing additional transit facilities together with the right to undertake municipal operation of such lines.

(R. B. F.)

NEW YORK STATE (*see* 19.594), a State of the United States. The population in 1920 was 10,385,227 as compared with 9,113,614 in 1910, a gain of 14%. The average population per sq. m. in 1920 was 217·9 as compared with 191·2 in 1910. The urban population (in cities with 2,500 or more inhabitants) was 8,589,844, or 82·7%. The native white population was 7,385,915, of whom 3,668,266 were of native parentage; 2,844,083 of foreign parentage; and 873,566 of mixed parentage. The foreign-born white population was 2,786,112.

In 1920 there were 28 cities with populations of over 20,000, of which the chief were:—

Albany	113,344	Rochester	295,750
Binghamton	66,800	Schenectady	88,723
Buffalo	506,775	Syracuse	171,717
New York	5,620,048	Utica	94,156
Niagara Falls	50,760	Yonkers	100,176

Government and Political History.—The constitution of 1894 was frequently amended during the period 1910–25, but the amendments did not alter fundamentally the system of government. Among the most important constitutional changes were the adoption of woman suffrage in 1917, the establishment of a literacy test for new voters in 1921 and the granting of home rule to cities in 1923. An important constitutional amendment providing for the consolidation of numerous state administrative establishments (187 in 1919) into 20 departments was approved in Nov. 1925.

On Oct. 6 1910 Gov. Hughes resigned to accept a position on the U.S. Supreme Court, and was succeeded by Horace White, the lieutenant-governor. In the election of Nov. 1910 the Democrats carried not only the State but also the Legislature, and John A. Dix was elected governor. The 1911 Legislature adopted a compromise direct primary law, which retained the party convention for the selection of candidates for state-wide offices. The Wagner-Levy election law limited independent nominations to registered and enrolled voters, made registration days uniform and provided for personal registration in rural districts for voters who had not voted in the previous election. It also prevented a candidate's name from appearing more than once on the ballot, and thus made fusion tickets and independent voting difficult. In the fall elections the Republicans regained control of the Assembly. The Legislature of 1912 allowed party organisations to substitute the assembly district for the election district as the unit of representation. This caused absurdly long ballots and tended to discredit the direct primary system. The hours of labour for minors in factories were restricted.

The Democrats again carried the State and the Legislature in Nov. 1912, and Sulzer became governor. The Legislature of 1913 passed laws insuring greater safety in factories, providing for an eight-hour day for employees on public works, and a 54-hour week for women and children under 16 in certain industries. In April 1913 Gov. Sulzer sent a special message to the Legislature urging a direct primary law that would abolish party conventions. The Legislature refused to enact the primary bill, and the governor vetoed the legislative substitute. When the Legislature recessed on July 23 the governor declared the special session adjourned, but the Legislature reassembled on Aug. 11. Two days later the assembly voted to impeach the governor; on Oct. 17 he was removed from office and Martin H. Glynn, lieutenant-governor, succeeded. In the elections of Nov. 1913 Sulzer was elected to the Assembly. A constitutional amendment authorising a workmen's compensation law was adopted by a large majority. The special session of the Legislature which had impeached Gov. Sulzer reassembled on Dec. 18 and adopted a direct primary law abolishing conventions; a modified office group ballot law; measures to carry out the 17th amendment providing for the popular election of U.S. senators; a resolution submitting to the voters the question of calling a constitutional convention; and the adoption of a workmen's compensation law for certain hazardous employments.

The Republicans were successful in the elections of Nov. 1914, and Whitman became governor. The new Legislature passed a widowed mothers' pension law; reorganised the inferior criminal courts of New York City by creating a board of city magistrates, the judges of which were given the right to sit in special sessions and to dispose summarily of minor misdemeanours; and authorised parole commissions in cities of the first class. In Nov. 1916 Gov. Whitman was re-elected, the Assembly continuing Republican; in the presidential contest, also, the Republicans carried the State. State legislation of 1917 was strongly influenced by the entrance of the United States into the World War. The woman-suffrage amendment was ratified by a large majority.

In the Nov. election, 1918, Alfred E. Smith (Dem.) was elected governor. Most of the other state officers and the Legislature, however, remained Republican. One of the most important laws of the year was the one providing for an income tax of from 1% to 3%. The Federal prohibition amendment was ratified. Shortly after his inauguration Gov. Smith appointed a non-partisan reconstruction commission to investigate the problem of reorganising the state government. This commission in its report of Oct. 10 1919 recommended an executive budget and the consolidation of the numerous administrative agencies. The most constructive work of the session was the passage of several laws for the relief of the housing situation.

In the elections of 1920 the Republicans carried the state by large majorities, and their candidate for governor, Judge Nathan Miller, was elected. The Legislature passed a law placing all public utilities, except transit in New York City, under the jurisdiction of one state commission. A state prohibition enforcement law was adopted. The direct primary was abandoned and the convention system restored for the nomination of state and judicial officers. The state industrial commission and the state tax commission were reorganised, and a board of estimate and control created.

The 1922 Legislature authorised life-insurance companies to invest 10% of their assets in new buildings for dwelling purposes; extended the emergency rent laws to 1924 and fixed assessments as the basis for determining the reasonableness of rents. Women were given representation on county party committees. A home rule amendment was adopted. Under the law passed the previous year the candidates for state office were nominated by party conventions in 1922. The election resulted in the election of Alfred Smith as governor. The 1923 Legislature provided for a commission to study the problem of bringing the state laws into conformity with the home rule amendment, which the Legislature again approved. Some progress was also made in carrying out the governor's consolidation programme for a constitutional amendment providing for consolidation of the numerous administrative agencies into 20 departments. The Mullan-Gage prohibition enforcement Act was repealed, and Congress was memorialised in favour of liberalising the Volstead law.

In the fall elections the voters approved by large majorities two constitutional amendments. One authorised a bond issue of $45,000,000 to pay a bonus to World War veterans. The second amendment extended to cities a large measure of home rule. The referendum on a bond issue for $50,000,000 for new hospitals was likewise approved. The Republicans increased their majority in the assembly. The Legislature of 1924 passed a bonus law awarding $10 for each month of service to all active participants in the World War who were residents of the state; the maximum payment was fixed at $150. The emergency rent laws of 1920 and the following years were extended to 1926. An important measure of the session was the Home Rule Enabling Act, designed to carry out the amendment adopted the previous year. This law, drafted by the state home rule commission, was adopted unanimously by both Houses of the Legislature. The New York amendment differs from constitutional provisions in some other states in that it grants powers in general terms. In the presidential election of 1924, the Republicans were successful. Gov. Smith was re-elected, but the Republican candidates for the other six elective state offices were successful, and the Legislature became more strongly Republican.

Agriculture and Stock-Raising.—In 1924 New York, with crops valued at $303,812,600, ranked eighth among the states in the value of all crops and first in the production of hay and potatoes. In 1923 the number of farms in the state was 190,000 and the total acreage 20,300,000. The U.S. Census of 1920 placed the value of all farm property at $1,908,483,201. In 1924 7,327,000 tons of hay; 24,519,000 bu. of corn; 6,840,000 bu. of wheat; 34,056,000 bu. of oats; 6,900,000 bu. of barley; 935,000 bu. of rye; 5,363,000 bu. of buckwheat; 46,620,000 bu. of potatoes; 1,820,000 bu. of beans; 23,800,000 bu. of apples; 2,178,000 bu. of peaches; 2,100,000 bu. of pears; 80,000 tons of grapes; and 2,350,000 lb. of tobacco were produced. In 1923 there were 532,000 sheep in the state, and the wool production was 2,968,000 pounds. The dairy business was one of the most important.

Minerals.—In 1923 mineral products valued at $89,975,134 were produced. The average value for the years 1919–23 was $62,243,270. In 1923 clay products were valued at $25,226,187; cement, $12,834,471; gypsum, $10,344,745; stone $9,610,324; salt, $7,431,155; sand and gravel, $7,291,076; petroleum, $4,140,000; natural gas, $3,739,000; and iron ore, $3,320,004.

Manufactures.—According to the United States report on manufactures for the year 1923, the value of the products of manufacturing establishments in the state was $8,960,693,000, as compared with $6,973,506,000 for 1921, a gain of 28.5%. The number of establishments in 1923 was 38,187; in 1921, 38,107; in 1919, 49,330; and in 1914, 48,203. The decrease in number is partly accounted for by the fact that the last two reports did not include establishments which reported products under $5,000 in value. The wage-earners in 1923 numbered 1,150,901 as compared with 1,000,414 in 1921, an increase of 15%. The wage payments in 1923 amounted to $1,582,006,000. The industries whose products were valued at more than $100,000,000 in 1923 were:—

Clothing	$1,636,529,625	Paper and wood pulp	$140,468,586
Printing and publishing	503,411,143	Furniture	137,328,234
Foundry and machine shop	273,933,262	Cigars and cigarettes	129,659,423
Bread and bakery products	236,546,477	Chemicals	128,376,073
Knit goods	230,525,505	Steel works and rolling mills	122,964,813
Millinery, lace	197,627,982	Silk	105,018,097
Boots and shoes	195,082,384	Confectionery and ice cream	103,215,335
Electrical machinery	192,224,937		

The chief manufacturing centres and the values of their products in 1921 were: New York City, $4,328,187,499; Buffalo, $431,383,131; Rochester, $291,117,230; Syracuse, $109,061,617; Yonkers, $107,182,668; and Albany, $41,171,786.

Transportation and Commerce.—In 1925 the operated railway mileage in New York was 8,401. In 1925 there were 4,792 m. of electric railways. There were 81,878 m. of highways in the state, 18,566 m. of which were surfaced. Of the $75,000,000 appropriated by Congress to the states for highway building in the year 1924–5 under the Federal aid system, New York received $3,663,105. The Erie Barge Canal was opened from Troy to Buffalo in 1918. The Champlain and the Oswego Barge canals have also been completed. In addition to the canalised rivers and lakes (382 m.) the state has a canal mileage of 525.

Education.—The University of the State of New York, a supervising and examining institution, is the State Department of Education, and controls the educational system of the state. It is governed by 12 regents, one elected each year for a 12-year term at a joint session of the two Houses of the Legislature. The board of regents elects the president of the university, who is the commissioner of education. The regents apportion the state educational funds. In 1924 there were 62,401 teachers, and 1,610,076 enrolled pupils. The cost of school maintenance in that year was $250,553,776.

Finance.—On June 30 1925 the total debt of the State was $318,456,000. The sinking funds, however, amounted to $87,123,821. Approximately one-half of the total debt was incurred for canals. Highway bonds amounted to $98,800,000, and World War bonus bonds to $45,000,000. The general revenue receipts for the year ending June 30 1924 amounted to $146,587,656, and the disbursements to $146,456,708. (E. D. G.)

NEW ZEALAND (*see* 19.624), a Dominion of the British Empire and a member of the League of Nations. The area of the Dominion proper is 103,285 sq. m., but if outlying islands are included the total area is 103,862 square miles. In addition New Zealand is responsible under the mandate of the League of Nations for the administration of the Western Samoan group, and shares with Great Britain and Australia the administration of the former German island of Nauru. Also, since 1923, the Governor-General of New Zealand is responsible for the administration of the Ross Sea area in the Antarctic. In Feb. 1926, at the invitation of the British Govt., New Zealand took over the administration of the Tokelau or Union group of islands in the Pacific. The population of the Dominion proper, according to the census of 1921, was 1,271,664. By letters patent dated May 11 1917 the designation of the representative of the British Crown in New Zealand was altered from Governor and commander-in-chief to governor-general and commander-in-chief.

I. POLITICAL HISTORY

The year 1910 saw the Dominion recovering from the financial crisis of 1908. Political control was in the hands of the Ward Ministry, which, with incidental cabinet changes, had carried on the Liberal-Labour Govt. and régime of the late Mr. Seddon, who himself had been Prime Minister without intermission for 13 years. Political interest had centred largely around the system of Crown Land tenure; amendments to industrial legislation; the passing in 1910 of the National Provident Fund Act; and questions of military and naval defence. The government was being assailed by Mr. Massey's already growing party with the proposal to relinquish the remaining remnants of leasehold principles, and to permit the sale outright, under certain safeguards against monopolistic holdings, of Crown lands. A Defence Act, embodying the principle of universal service within certain ages, had been passed in 1909, though it had not been put into operation; and in 1910 Lord Kitchener, at the invitation of the New Zealand Govt., visited the country, and, after slight alterations had been carried out at his suggestion, the system was introduced in Jan. 1911. In the naval sphere an arrangement had been made in 1909 with the Home Govt. under which it was understood that the Dominion's "gift" battle-cruiser, the "New Zealand," should be the flagship of a new China unit, and that seven vessels of the unit should be stationed in peace time in New Zealand waters, the ships to be manned as far as possible with New Zealand officers and men.

The general election of 1911 was disastrous to the Ward government. The Liberal-Labour combination, which had held together for 21 years, had for some time been showing signs of disruption, while the Conservative opposition, now known as the Reform party, had improved its organisation. The polls gave the latter an apparently slight advantage, though the issue was still in doubt. In the recess the Ward Ministry resigned because of internal discord, and a new Liberal Cabinet was formed under Sir Thomas Mackenzie. The latter was defeated on a no-confidence motion two weeks after the new Parliament met; and on July 10 1912 Mr. W. F. Massey became Prime Minister.

The Reform Régime.—The new government in its first session passed the necessary legislation to enable holders of Crown leases in perpetuity to acquire the freehold. Another important measure passed placed the control of the public services largely under commissioners. No important changes in general policy were made. Nevertheless, there was ample work for the government. For some time, aided by agitators from abroad, sections of labour had shown considerable restlessness and dissatisfaction with the Arbitration Act, and this culminated in 1913 in a strike of all transport workers, seamen, and miners, who, cancelling their registration under the Arbitration Act and thus being able to strike without incurring penalties, ranged themselves under a federation of Labour. The strike, one of the most extensive in the history of New Zealand, was a grave menace to the country, for at the time it took place produce from every part of the Dominion was in store at the ports awaiting shipment to Great Britain. The government took firm measures to deal with the situation. A new Waterside Workers' Union was established under the Arbitration Act, and all temporary workers, chiefly farmers' sons and employees, joining it were given security by the police and special constables from interference; ultimately the ships, manned by volunteer crews, were dispatched with their cargoes. The strike ended after a protracted struggle. As one result of it the Labour Disputes Investigation Act was passed in the same year; it applied to workers or societies and to employers not bound by the Conciliation and Arbitration Act.

The remainder of the parliamentary session was devoted chiefly to amending legislation, and in this connection useful, if not outstanding, work was done. To the amended land laws of the previous session was added a further provision giving the same privilege of purchase to those possessing similar leases of Settlement Lands, *i.e.*, lands which had been purchased by the State and leased. Acts were also passed to provide funds to assist irrigation and also the fruit industry. A board of agriculture was established to act in a consultative and advisory capacity to the Lands Department. In this session also the second Ballot Act was repealed.

In 1913 the Minister for Defence, Finance and Education, Mr. (Sir) J. Allen, visited England, at the wish of the government, to confer with the British Admiralty and War Office in regard to New Zealand's military and naval defence, and also to attend to certain matters of general finance. Arrangements were completed with the War Office in regard to the strength and composition of the voluntary expeditionary force authorised under the Defence Act of 1909; but the negotiations with the Admiralty were not very satisfactory. It had been found necessary by the Admiralty to depart from the previous arrangement, and station the ships designed for the China Seas in English waters; and the only offer to New Zealand was of two obsolete vessels of the old Australian and New Zealand squadron. New Zealand then asked that the vessels to be sent should be of the "Bristol" type, but this could not be done. In the same year, 1913, the Naval Defence Act was passed: it provided for the establishment of a New Zealand naval force by voluntary enlistment. A New Zealand division was inaugurated in 1914, but the outbreak of war stopped the scheme of training.

During his return trip to New Zealand via Canada, the Minister, who had been instructed to purchase in Britain a stock of small arms for the Dominion's newly constituted territorial army, but had only been able, owing to a shortage, to obtain a small quantity, bought a large number of ·303 Lee-Enfield rifles—discarded by Canada for the Ross rifle—which were destined not only to serve for the training of New Zealand's expeditionary forces for the first two years of the War, but to become, many of them, the weapon of the New Zealanders in Gallipoli.

The War Period.—A considerable programme of important legislation had been arranged for 1914, but Parliament had not been in session very long before war broke out. It was, however, possible to pass, amongst other measures, an Education Amendment Act, under which there was a complete reorganisation of the educational department and the system of education control. At the declaration of hostilities neither government nor people displayed any hesitation as to the course New Zealand would pursue. Secret preparations had been made for the mobilisation of an Expeditionary Force of approximately 8,000 officers and men, and these preparations were immediately put into operation. But first, at the request of the British Govt., a force of 55 officers and 1,358 men was mobilised, and on Aug. 15 dispatched to capture German Samoa, a feat accomplished without fighting. The first expeditionary force for the actual scene of war, consisting of 360 officers and 8,139 other ranks, sailed on Dec. 14 1914. The preparation of reinforcements was meanwhile proceeded with, and also the necessary organisation for a sustained war effort.

New Zealand maintained her war effort on a scale considerably greater than that involved in her first arrangement with the War Office; her infantry division in France and mounted force in Palestine were kept at full strength with necessary reserves to the day of the Armistice, and by the close of hostilities she had sent overseas (out of a population of 1,089,825) 100,444 trained troops. In addition, 12,000 were mobilised and preparing for service when hostilities terminated. The financial cost of an undertaking on such a scale was extremely heavy. The budget of 1914 was already in print when the declaration of war was received, and authority was therefore given by Parliament to raise £2,000,000 by Treasury bills to meet immediate expenses. Afterwards loans were arranged according to requirements. Meanwhile, in Dec. 1914, the Parliamentary elections were held and Mr. Massey was returned with a small majority. Subsequently, in Aug. 1915, a National Govt. composed of the two chief parties, Reform and Liberal (the small Labour section declining representation), was formed; Mr. Massey remained Prime Minister, with Mr. (Sir) J. Allen as Minister of Defence and Sir Joseph Ward as Minister of Finance. A complete party truce was declared.

New Zealand shipped to Britain during the War produce and other supplies to a value of £160,000,000, which were sold to the Imperial Govt. at prices fixed by mutual arrangements. On three occasions during the War the Prime Minister and the Finance Minister attended Imperial Conferences in London, and on such occasions the Defence Minister, as Acting Prime Minister, combined their duties with his own. Though the country was wholeheartedly behind the war effort, problems naturally followed in the wake of the compulsory enlistment enactment, for which in 1916 the majority of the people had themselves agitated. One serious coal-miners' dispute at the West Coast mines also required settling. But whatever sectional and temporary difficulties arose, the nation as a whole supported the policy of the government.

The ability of the Dominion to ship its produce at satisfactory prices overcame the difficulties of financial provision. The output increased considerably, and extra taxation was met without inconvenience. Up to 1917, comparatively small portions only of loans authorised were raised in London, and the rest in New Zealand, an innovation so far as the Dominion was concerned. After 1917, New Zealand provided her own financial requirements. The actual fighting costs of the troops in the field were advanced to New Zealand by the Imperial Govt. on a *per capita* basis (which fluctuated according to the engagements in which the New Zealand units participated). The total cost of the War to the Dominion was assessed in 1921 at £81,538,570, and of this amount £55,198,325 had been raised in New Zealand.

Post-War Years.—The National Govt. came to an end in 1919 by the withdrawal of the Liberal Party from the Ministry. At the general elections which ensued late in the same year the Reform party was returned with a heavy majority. Labour also showed a considerable accession of strength, and, for the first time for many years, became a distinct party in the House. The government turned its attention with concentrated effort to the repatriation of the returned soldiers, seeking particularly, under special legislation that had been passed, to place satisfactorily on the land all those who so desired. Financial assistance was also given, chiefly by loans on easy terms, to men who desired houses of their own, or wished to start in business, etc. Each case was carefully investigated by special repatriation organisations, and in every possible respect the government sought to provide for the future of each individual soldier who presented himself. In the case of those seeking land occupations, suitable areas were purchased by the government, sub-divided, and resold or leased to the men under special legislative provision at easy terms of interest; or the money was advanced as a first mortgage, with essential safeguards, if a man desired any particular farm.

An abnormal demand for land was created, and naturally, assisted by the enhanced values of produce, land values became inflated. House properties also went up greatly in value, and the shortage, since but few had been built during the War, became very acute. Altogether 9,388 men were assisted to obtain rural homes and properties, and 10,890 in securing homes in towns; 61,254 were placed in employment, trained in some future livelihood or financially assisted to re-establish themselves—a total altogether of 81,532 men. The cost to the country by July 1922 was £28,718,578. The problems of repatriation and others following in the wake of the War were in the forefront of the new government's duties. Fortunately during the later War years there had been heavy surpluses of revenue over expenditure, and these were available for partial application to repatriation needs.

The immediate post-War years were years of high prices and prosperity, but in 1921 the prices of produce, especially of wool and meat, on the British market rapidly fell. Land values in New Zealand were too high and there had been extremely heavy over-importation, largely due to merchants and manufacturers abroad being able to fulfil long-standing orders. The country was faced with an immediate crisis. Taxes were already at a high level, and there were cries for easement to meet the strain of financial calls. The country's ordinary current expenditure had grown tremendously, and it was impossible to afford much relief. The Prime Minister decided at once on a policy of the most rigid economy. Departmental expenditure was closely examined by a specially appointed commission; war bonuses were attacked, and, since a fall was shown in the cost of living, deductions were made accordingly.

As a result of its measures for economy, the popularity of the government was seriously affected. There was much unemployment, but it was possible, by pushing forward the public works programme, to offer manual labour to those able to undertake it. Meanwhile, the overseas marketing problems were tackled, reductions were obtained in freights, insurance, storage, etc., and by the middle of 1922 a recovery in market returns abroad was in evidence. The meat producers of the Dominion had tackled their own marketing problems, and had set up an organisation under which the whole industry was able to seek reasonable terms in all matters of costs from the farm to the overseas markets; the dairy producers had taken the preliminary steps for a like movement. The government was in close touch with these developments and, in the case of the meat producers, passed the necessary legislation.

The vexed question of heavy taxation was seriously disturbing the community, the commercial interests especially desiring a change in the incidence of taxation. The government then set up a commission to investigate the whole matter. By the middle of 1922, however, the general situation had considerably improved. Towards the end of the year, while the government was still unpopular owing to its drastic economies, a general election became due. The result was not unexpected. Mr. Massey could not muster a sufficient number to provide an absolute majority over the Liberal and Labour parties, the latter of whom had increased their strength to 17, the largest representation they had ever had. But when the new Parliament met in 1923, three Liberal Independent members, who had given pledges to vote against Labour, ranged themselves on the side of the government, and saved a defeat.

The year 1923 was remarkable for the recovery of the New Zealand produce markets in Britain, for the State revenue revival, and for various taxation burden remissions the government was able to institute. Income tax was greatly reduced, penny postage was reinstituted, reductions were made in telegraph rates, the income tax on revenue from farm products was removed, and a sum of approximately £2,000,000 was provided for the aid of soldier settlers who were unable to carry on under the burden of the high value at which their land had been purchased, and for further pension assistance. The incidence of taxation was also altered in some particulars, and a policy of progressive reduction of income tax was instituted, the maximum rate falling from 7s. 4d. to 4s. 6d. in the £, and the minimum from 1s. to 7d. Substantial reductions were also made in the rates of land tax. Exemptions in respect of children were increased.

An energetic policy of development was also undertaken. Legislative provision was made for the State Advances Department to extend its security for advances to 75% in the case of farming land, and to 95% for workers' houses, and legislation was passed to authorise the necessary borrowing to provide the money. For a number of years the payments from borrowers under the scheme had provided sufficient revenue to meet all applications for advances. The customs tariff was also revised, the chief features being the increase of British preference, and a separate reciprocal tariff with Australia. In 1924 the Old Age Pensions Act was improved, further beneficial amendments were made in the education legislation, the Companies Act was altered to enable the issue of "labour shares," and Acts were passed to permit the dairy, honey, fruit and poultry farmers to exercise control over their industries similar to that enjoyed by the meat producers, though differing in some essential details. Legislation was also passed making registration of electors for general election purposes compulsory.

On May 10 1925 the Prime Minister, the Right Hon. W. F. Massey, died at Wellington. Sir F. H. D. Bell, the first New Zealander born in the Dominion to occupy the office, was appointed Prime Minister on May 14, and was succeeded on May 30, following a reorganisation of the Executive Council, by Mr. J. G. Coates, previously Minister for Public Works and Railways and Postmaster-General. The session closed without any legislation of outstanding importance. In Nov. a general election was held, and resulted in an overwhelming victory for the Reform party under Mr. Coates, which secured 57 seats as against 11 held by the National (Liberal) party, and 12 by Labour.

Defence.—New Zealand's attention since the War has been directed chiefly to additional naval security. In 1919 Admiral Jellicoe of the British Navy visited New Zealand, and presented a report making recommendations and suggestions for the naval defence of the Dominion. In 1926 the Dominion maintained a training ship and two modern light cruisers. The cruisers were loaned free of charge by the Imperial Govt., the Dominion being responsible for all payments for the ships and their personnel, a considerable number of which consisted of New Zealanders. A naval oil-tank vessel is also maintained, and at the naval base at Devonport, Auckland, one oil-tank had been erected while another was under construction in 1925. The amount provided in the Estimates for 1925–6 as the Dominion's contribution to naval defence was £538,325. All matters relating to the naval forces of the Dominion are administered by a Naval Board, constituted in 1921.

The military forces consist of the Permanent Forces, the Territorial Force and the Senior Cadets. The Permanent Forces, excluding the Air Force, contain 101 professional officers who are charged with the training of the forces and the administration of all matters connected therewith. The strength of the Territorial Force in 1925 was 699 officers and 15,481 other ranks. The strength of the Senior Cadets was 427 officers and 26,515 other ranks. Rifle clubs exist throughout the Dominion. All male inhabitants of New Zealand who have resided therein for six months and are British subjects are liable to be trained in the Senior Cadets from 14 years of age, or the date of leaving school, to 18 years of age, or, in the case of those who at the age of 18 are attending a secondary school, to the date of their leaving school; or in the Territorial Force to the age of 25. The New Zealand Permanent Air Force, with an establishment of five officers and 19 other ranks, is a unit of the military forces.

Public Finance.—The gross national debt, which at March 31 1910 stood at £74,890,645 (£72 6s. 10d. per head of population), had increased to £201,170,755 (£162 12s. 9d. per head) at March 31 1920; at March 31 1925 it amounted to £227,814,647 (£165 2s. 11d. per head). This is the gross amount, and against it are accumulated sinking funds amounting to £13,462,839, leaving the net indebtedness of £214,287,128. With the exception of that portion incurred for war purposes, the greater portion of the borrowings has been for productive and developmental purposes, resulting in revenue-producing assets such as railways, hydroelectrical installations, telegraphs and telephones. The war debt to the Imperial Govt. had been funded and repayment was already well advanced by 1925.

The following table shows the revenue and expenditure for each financial year from 1910 to 1925:—

Year ending Mar. 31	Revenue	Expenditure	Excess of Revenue over Expenditure
	£	£	£
1910 .	9,238,917	8,990,922	247,995
1911 .	10,297,273	9,343,106	954,167
1912 .	11,061,161	10,340,368	720,793
1913 .	11,734,271	11,082,038	652,233
1914 .	12,229,661	11,825,864	403,797
1915 .	12,451,945	12,379,803	72,142
1916 .	14,507,530	12,493,107	2,014,423
1917 .	18,355,194	14,058,770	4,296,424
1918 .	20,206,222	15,120,288	5,085,934
1919 .	22,352,372	18,673,599	3,678,773
1920 .	26,081,340	23,781,524	2,299,816
1921 .	34,260,961	28,068,730	6,192,231
1922 .	28,127,007	28,466,838	− 339,831
1923 .	27,579,443	26,263,760	1,315,683
1924 .	27,960,370	26,148,005	1,812,365
1925 .	28,643,000	27,399,200	1,243,800

These tables show that revenue from taxation increased very considerably from 1914 to 1921, but fell heavily from 1921 to 1925. The public services (chiefly railways and post and telegraphs) increased their revenue after 1921, while the costs of their administration were reduced, showing the excellent results of the severe and continued economies instituted in the services' administration during the post-War period.

The movement of direct and indirect taxation from 1914 to 1925 is shown in the following table:—

Year ending Mar. 31	Customs and Excise	Land tax	Income tax	Death duties
	£	£	£	£
1914 .	3,553,785	767,451	554,271	613,751
1917 .	4,037,628	713,118	4,262,126	570,040
1921 .	8,769,251	1,688,979	8,248,945	1,106,925
1922 .	5,554,334	1,637,816	6,002,987	1,512,754
1925 .	8,339,576	1,335,251	3,386,052	1,520,749

Education.—In 1914 the whole of the law relating not only to public, but to secondary, technical, and special schools was recast. The principal changes involved the reorganisation of the Department of Education and the inspector-general of Schools became the director of education. Provision was also made for the constitution of fewer education districts, and by an Act of 1915 nine were created from the existing 13. A council of education was also constituted, with statutory duty to report to the Minister and advise upon any matters in connection with education referred to it, or which it may consider advisable to introduce into New Zealand. By the Education Amendment Act 1921–2 the registration of all private schools was made compulsory, and teachers in all schools were required to take the oath of allegiance. The Education Amendment Act 1924 included provisions for the establishment of junior high schools, for the amalgamation of the governing bodies of secondary and technical schools and for the creation of a teachers' register.

The number of scholars receiving instruction in all educational institutions in 1911 was 194,325, and in 1924 289,033. The following table shows the advance in the state primary schools (including district high schools):—

Year	No. of schools	Pupils at end of year	Average attendances
			%
1913 .	2,255	172,168	89·2
1918 .	2,365	194,934	88·7
1924 .	2,574	216,190	90·7

The number of teachers in the public schools in 1913 was 4,262; in 1924, 5,822. In 1915 there were 11,958 children receiving secondary and technical instruction at all classes of schools; in 1924 there were 23,276. Free places at secondary schools are granted to suitably qualified pupils. There are also liberal national scholarships. Control of higher education is vested in the New Zealand University, which by Royal charter is entitled to grant degrees. In 1921 the degrees of bachelor of science in forestry and doctor of philosophy were instituted. There is a liberal scholarship system in connection with the universities.

The following table shows the increased expenditure on education:—

	Expenditure from public funds	Expenditure per head of mean population
	£	s. d.
1909	980,000	19 7
1915	1,378,000	24 1
1921	3,224,000	51 6
1924	3,247,000	48 8
1925	3,643,000	53 7

Chief Sources of Revenue and Expenditure

Year ending Mar. 31	Taxation	Railways	Post and Telegraphs	Crown Lands	Other Sources	Total
1914 .	£5,918,034	£4,028,739	£1,269,922	£262,846	£750,120	£12,229,661
1921 .	22,184,414	6,918,492	2,478,532	319,641	2,359,882	34,260,961
1925 .	16,172,306	7,105,106	2,706,882	211,749	2,446,957	28,643,000

The details of expenditure for the same years were:—

Year ending Mar. 31	Working Railways	Post and Telegraphs	Education	Interest, etc., on Public Debt	Other Expenses	Total
1914 .	£3,004,181	£1,170,883	£1,206,678	£2,887,981	£3,556,141	£11,825,864
1921 .	6,211,011	2,588,360	2,633,977	7,831,593	8,803,789	28,068,730
1925 .	5,636,583	2,413,436	2,777,271	8,862,644	7,709,266	27,399,200

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(J. AL.)

II. POPULATION AND SETTLEMENT

Population.—The census figures for 1911, 1916 and 1921, and the estimated population on Dec. 31 1925 were as follows:—

	1911	1916	1921	1925
Europeans	1,008,468	1,099,449	1,218,913	1,335,719
Maoris	49,844	49,776	52,751	54,768
	1,058,312	1,149,225	1,271,664	1,390,487

The actual gain in population in the decade 1911–21 (excluding Maoris) was 210,445, or 20·87%. Taking the two census periods, the gain from 1911–6 was 90,981, or 9·02%, and from 1916–21, 119,464, or 10·87%. Three factors influenced the comparatively small increase:—

1. Immigration during the War years was severely restricted;
2. Emigration figures were swelled by the inclusion of over 100,000 members of the Expeditionary Force, thousands of whom did not return;
3. The rate of natural increase was reduced owing to the absence of so many thousands of men.

In 1911 the birth-rate per 1,000 was 25·97, and in 1924, 21·57. In the same periods the death-rates per 1,000 were 9·39, and 8·29 respectively. The proportion of females to males, excluding the War years, is steadily increasing. The number of females to 1,000 males in 1911 were 896; in 1916, 993; in 1921, 956; and in 1925, 959. The population is chiefly centred in the North Island, and the " drift " that way, largely due to the development of the dairy industry, is growing. In 1911, 55·90% of the people resided there; in 1916, 59·22%, and in 1921, 60·81%. The Maoris, who are not included in these percentages, chiefly reside in the North Island. The census statistics of 1921 classed 56% of the population as urban.

In 1921, 98·43% of the inhabitants, exclusive of Maoris, had been born in the British Empire, an increase of ·51% as compared with 1911. Of the total in 1921, 74·39% were born in New Zealand, 19·54% in the United Kingdom and 3·94% in Australia. A certain number of those born in foreign countries were of British parentage or nationality, and including these the proportion of the population owning British nationality in 1921 was 99·35%. The number of aliens steadily diminished—from 12,050 in 1911 to 7,901 in 1921. Of the 7,901, 2,712 were Chinese, 1,013 Americans and 857 Yugoslavs. Certain restrictions are placed upon the entry into the Dominion of race aliens, a classification implying persons of other than European race. Of the total population in 1925 43·66% were members of the Church of England, 25·42% Presbyterian, 13·93% Catholics and 9·53% Methodists.

The Maori race increased in numbers from 49,844 in 1911 to 54,768 in 1925, and continued to preserve their individuality and strength. The above 1925 figure includes 7,352 half-castes, the majority of whom live as Europeans. There are 125 native schools, with an average daily attendance of 5,610 scholars.

Immigration.—The immigration policy of the New Zealand Government is to provide assistance, by free or reduced passage rates, to desirable immigrants from Great Britain. Assistance is restricted to persons who are nominated by permanent residents of the Dominion, or by bona fide New Zealanders visiting Great Britain, provided such persons are healthy and under 50 years of age. In the case of a married person, nomination must include the wife and family, except where a judicial separation exists, or desertion is proved. The nominator must undertake to make provision for the maintenance and employment of the nominee, and guarantee that residence will extend to at least five years. The quota of such assisted new arrivals is fixed from period to period. From shortly after the War until 1925 the quota was 10,000 per annum, but early in 1926 it was extended to 13,500. Exceptions to the nomination rule are single domestic servants and farm workers, for both of which classes there exists an unsatisfied demand.

Very complete arrangements, under the direction of the Immigration Department, which in turn is responsible to the Minister for Immigration, exist for the care and comfort of immigrants both at their departure and arrival. Assisted immigrants are required to pass severe medical tests, and to present certificates of good character. These, and all allied matters, are administered by the High Commissioner for New Zealand in London. The reduced rates of passage from Great Britain to New Zealand in 1926 were as follows:—

	£
Married or widowed adults	11
Single adults (males)	13 15s. od.
Single adults (females)	11
Farm labourers	11
Domestic servants	Free, with a £2 bonus
Boys, over 17 and under 19 years of age, not travelling with their parents	5 10s. od.
Children under 19 years travelling with parents	Free

In addition to the general immigration scheme, there exist special arrangements for British public schoolboys between the ages of 17 and 19 years. If satisfactory they are provided with passages at a cost of £7 10s. od.; they travel in groups under a prefect, and on arrival are placed with specially selected farmers at fixed rates of wages and taught farming. In 1924, 208 boys went to New Zealand under the scheme, and about an equal number in 1925. A large section of the sheepowners of the Dominion also have a fund of over £200,000, allocated out of wool profits of the War period, for training sons and daughters of sailors of the navy and mercantile marine who were killed or incapacitated during the War, the lads in farming at a special institution in New Zealand, and the girls in domestic and light farming work at another. Free passages are provided by the Government of New Zealand, and the children are provided with suitable employment after training. Both schemes are under the scrutiny of the Minister for Immigration and both have operated with entire success and satisfaction. The British Govt. co-operates with the Dominion in its assisted migration and provides a share of the passage money.

The following table shows the number of assisted immigrants entering New Zealand for each year from 1911 to 1924:—

Year	Number	Year	Number
1911	3,070	1918	421
1912	3,535	1919	3,569
1913	5,151	1920	7,615
1914	3,716	1921	8,085
1915	1,300	1922	7,773
1916	695	1923	6,181
1917	231	1924	8,091
		1925	8,236

Land Settlement.—The total area of the Dominion is 66,390,262 ac., and the following is the condition of the land in 1925:—

	Acres
Held on freehold	21,068,660
Reserved for public purposes	14,425,181
Crown lands leased	18,226,492
Crown lands yet available for disposal	2,925,410
Lands held by the native race	5,881,571
Unfit for settlement (including rivers, lakes, roads, etc.)	3,862,948
	66,390,262

It is impossible, in the absence of available statistics, to give a comparative table for the year 1910, but other statistics show that individual holdings increased from 73,876 in 1911 to 85,977 in 1925, and areas held from 40,238,126 ac. to 43,632,372 acres. These figures disclose the extent of new lands taken into occupation, and also the sub-division that has taken place. Of the 43,632,372 ac. of occupied land in 1925, 18,510,558 ac. were in cultivation as follows:—

Grain and pulse	699,844
Grasses and clover (for hay and seed), and green and root crops	1,068,459
Fallow	124,459
Grasses and clover (permanent pasture)	16,450,625
Vineyards and orchards	27,749
Market goods, etc.	4,998
Private gardens and grounds	63,206
Plantations	71,218
	18,510,558
Unimproved land	25,121,814
	43,632,372

The unimproved land was divided up into 54,814 ac. under flax; 14,470,990 ac. of tussock and native grasses; 4,054,760 ac. of fern, scrub, etc.; 4,331,333 ac. of standing virgin bush; and 2,209,917 ac. of barren land. The Wellington and Auckland provinces possess the greatest flax areas, and Canterbury and Otago the tussock land (used for sheep grazing); the fern and scrub areas are well distributed; Westland and the Auckland provinces contain the chief forest lands; the barren lands mainly consist of the mountain areas of South Island. The remaining Crown lands are being thrown open as rapidly as possible. In the 1924–5 financial year 168,748 ac. were offered for selection under the various tenures provided by the Land Act 1924, Land for Settlements Act 1908, and Education Reserves Amendment Act 1910. There is provision in the legislation for compulsory prevention of aggregation in large areas and for sub-division if such is desirable.

The Advances to Settlers Act 1894, was embodied in the State Advances Act 1913 under which money is lent to settlers on first mortgage of lands and improvements held under certain specified classes of tenure. The Government has authority under the Act to borrow money for these advances. The scheme has proved very successful and from 1917–21 repayments exceeded advances. In 1923 its application was widened to enable larger amounts to be borrowed and increased advances to be made; as a result the loans authorised in the two succeeding years were greatly increased. In 1924–5, 3,321 loans amounting to a total of £4,289,875 were authorised, £3,516,130 advanced, and £846,771 repaid.

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(W. S. N.)

III. ECONOMIC HISTORY

Agriculture.—New Zealand is primarily a grazing country, large-y because better financial returns are obtained from the pastoral ndustries. Of the total area of 18,510,558 ac. under cultivation n 1924–5, 699,844 ac. were in grain and pulse crops; the area nder crops intended for threshing was only 371,944 acres. Grain crops, principally oats and wheat, are chiefly grown in he eastern and southern districts of the South Island; barley is lso grown, but to a very much smaller extent. Before the 915–6 season agricultural statistics were rarely correct, owing to he unsatisfactory methods of collecting returns.

The table below clearly shows the decline in the area under grain crops, particularly wheat. The decrease in production necessitates grain imports in some years and in 1924–5, 4,181,422 bu. of wheat were imported from Australia. About 14,000 persons were engaged in agriculture in 1925. Linseed is grown mainly in Canterbury, South Island. Its cultivation increased rapidly after 1916–7, when only 1,431 ac. were sown until 1923–4, when 12,119 ac. were sown; the acreage fell, however, to 6,679 in 1924–5. The area under potatoes in 1924–5 was 23,092 ac., yielding a return of 122,184 tons. Other root crops are grown on a large scale for winter feed and for stock fattening purposes. Turnips are a most important crop in a sheep breeding country such as New Zealand; in 1924–5 the area under the crop was 452,894 acres. The cultivation of mangolds is increasing, with 15,111 ac. under the crop in 1924–5, and the value of lucerne cultivation is being realised.

The Department of Agriculture, under a director-general with divisional heads controlling chemistry, livestock, dairy fields and horticulture sections, is concerned mainly in advancing the interests of primary production. The sum allocated to this department in 1925–6 was £368,297. While the service is mainly educational, it also is responsible for the inspection and grading of all produce exported from the country. Experimental farms and horticultural stations are maintained in various localities, and farmers are assisted by visits and letters of advice. A Board of Agriculture was established in 1913 to advise the Minister for Agriculture upon matters relating to the development of agricultural and other rural industries.

Pastoral Industry.—The number of dairy cows in the Dominion in 1910 was 804,078, while in 1925 it had risen to 1,323,432. The dairy industry is largely conducted upon a co-operation basis, and the most up-to-date mechanical aids are used. In 1925, 15,561 milking plants were in operation, milking 705,000 cows each day, and 44,656 cream separators were in use on the farms. There were 156 butter, 267 cheese, and 69 dual (butter and cheese) factories. Over 76,000 persons were employed in the industry. Pastoral products comprised over 90% of total exports in 1925. The great advance made in the dairy industry is shown by the following table of comparative percentage increases in export quantities and values for the decade 1914–24.

	Value	Quantity
	%	%
Butter	398	192
Cheese	174	85
Frozen meat	62	−1
Wool	64	−6

During the post-War period two very important branches of the dairy industry were developed: the manufacture of casein, and of dried (or powdered) milk. In 1925, 43,908 cwt. of casein were exported, valued at £110,171, and 12,598,321 lb. of dried milk, valued at £390,045. Preserved milk was also exported to a value of £35,693. The decrease in the dairy output in 1925 (as shown in the export trade table) is attributable chiefly to an extremely unfavourable season and a shipping strike.

The number of sheep and lambs in the Dominion in 1925 was only some 500,000 more than in 1910. There was a normal increase in the flocks until 1918, when a total of 26,538,302 was

Acreage and Yield of Principal Crops, 1915–25

Season	Wheat		Oats		Barley		Maize		Peas and Beans	
	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.	Area Thous. Ac.	Quantity Thous. Bu.
1915–6	329	7,108	213	7,653	30	820	8	340	9	163
1916–7	218	5,051	178	5,371	30	738	6	274	12	243
1917–8	281	6,808	156	4,943	19	569	8	368	12	313
1918–9	208	6,568	173	6,885	19	711	10	414	18	506
1919–20	140	4,560	180	6,968	23	816	9	406	14	369
1920–1	220	6,872	148	5,225	47	1,587	15	501	14	355
1921–2	353	10,565	171	6,753	33	1,152	11	488	13	339
1922–3	276	8,395	143	5,688	17	598	20	506	24	698
1923–4	174	4,175	64	1,964	21	597	8	406	19	363
1924–5	167	5,448	147	5,707	25	798	9	427	14	411

reached, but heavy exports followed in the next three years, and in 1922 the number had fallen to 22,222,259. In 1925 a recovery had been made to 24,547,955. Only a comparatively small proportion of the frozen meat exported from New Zealand is beef, for the price of frozen beef on the British market is very low owing to competition with the chilled article from South America. As a result of this competition markets other than Britain are being sought. Shipments of frozen pork are rapidly increasing. In 1924 there were 46 meat freezing and preserving works in the Dominion, employing 7,361 hands.

Co-operation.—One of the greatest aids to the development of the primary industries has been the application of the principle of co-operation, particularly in the case of the dairy industry. The farmers have their co-operative companies, arrange their own finance, and receive monthly cheques—based on a percentage of the prices current on the British market, any surplus over the amounts paid out being subsequently distributed proportionately as a bonus. This system largely obviates the necessity for extensive capital.

After 1922 co-operative marketing was put into operation by the meat producers. Under the Meat Export Control Act 1921–2 the meat industry obtained powers to set up a board, elected by all the sheep and cattle farmers in the Dominion, to supervise the industry, shipment and marketing of the produce. The board consists of eight members, five representing the producers and one the stock and station agents, while two are appointed by the government. Since its inception much useful work has been done, chiefly in regard to the marking of parcels, grading of meat, loading and discharging, regulation of shipments and in arranging satisfactory rail and sea freights and freezing charges. The dairy producers obtained power under the Dairy Produce Export Control Act 1923, to set up a similar board, but the Act was not in full operation by the end of 1925. Both bodies have representation in London, the former by a manager, and the latter by a board consisting of three members and a manager. The fruit and honey producers also have similar organisations governing their export affairs.

Afforestation.—A very active and progressive policy is pursued in reafforestation. The first organised attempt with imported trees, chiefly European larch, Austrian pine, Corsican and western yellow pine and a variety of eucalypti, was made in 1896, when an afforestation section of the lands department was formed. This work continued with more or less progress until 1919, when a separate forestry department was set up, and was reorganised in 1920 as the State Forest Service. Then in 1921–2 the Forests Act was passed defining the forest authority as the Minister of Forestry, the Director of Forestry, with a secretary, five conservators, a milling expert, an engineer in forest products, a grazing specialist and various sub-officials. The total personnel in 1925 was 95. At March 31 1925 the area dedicated to forestry and conservation was 7,485,590 acres. Over 100,000 ac. were acquired by purchase between 1920–5. In 1923 a national forest inventory and stock-taking took place and a great deal of valuable research work in regard to the New Zealand timbers was accomplished. The total expenditure on State afforestation up to March 31 1925 was £701,675, the area of state plantations being 62,945 acres. In the year 1924–5 local bodies, owners of private lands, tree and planting companies, etc., developed great afforestation activities, and to these the state has supplied some 13,670,000 trees. The area of private and company plantations and shelter beds was about 9,000 ac. in 1925.

Fisheries.—Although New Zealand possesses a most valuable asset in the great quantities of edible fish in the seas around her coasts, very little had been done up to 1925 in the systematic exploitation of the industry. In the year ending March 31 1925 some 330,000 cwt. of fish, valued at over £400,000, were brought in from the fishing grounds. In addition, the produce of the oyster fisheries was valued at £23,268, and of the whale fisheries at £15,000. Exports in 1924 totalled £67,896 in value, including fish, £58,417; whale oil, £6,515; and ambergris, £2,000. The whale fisheries declined considerably from 1920–4. In 1924, 2,921 persons were employed in the fishing industry.

Minerals and Mining.—The gold-mining industry has declined in importance: up to 1924 the total value of gold exported was £91,414,828, the value for 1924 being £551,788. Work on a scheme for obtaining gold from the bed of the Kawarau river, running from Lake Wakatipu (in Otago), by damming the exit of the waters from the lake, was well advanced in 1925. Silver is obtained in small quantities: up to 1924 total exports were valued at £2,904,651. The exploitation of iron ore and iron sand, of which there are plentiful deposits of the best quality, has not greatly progressed, though in 1924–5 enterprise revived. During the World War, tungsten ore mining became very active, but the fall in prices during the post-War period caused a collapse in the industry: the output of sheelite (tungsten ore) fell from 266 tons in 1916 to 15 tons in 1924. Copper, manganese ores platinum cinnabar, tin and sulphur are also found. Coal is mined for local consumption. The deposits are very extensive, the proved resources amounting to 610,000,000 tons: in 1910 2,197,362 tons were produced, and in 1924, 2,083,207 tons. Kauri gum, the fossilised resin of the Kauri tree, is classed as a mineral, and during 1924 5,261 tons of gum valued at £443,576 were exported. The total quantity of gum exported to the end of 1924 was 389,052 tons, valued at £21,108,085.

Secondary Industries.—Manufacturing industry had been but little developed up to 1925. The principal branches of industry, however, advanced considerably after 1910, with a tendency to greater diversity in production as the population increased. Owing to changes in system of collecting industrial data, and in the classification of industries made in various periods, together with the fact that the statistical data available include the dairy produce and meat handling establishments, it is not possible to give accurate tables to indicate the progress made. Including small-scale establishments, the Dominion had about 100 distinct manufacturing industries in 1925. Woollen factories supplied a large proportion of the internal requirements: much ready-made clothing is manufactured locally, and also furniture and footwear as well as other commodities.

Engineering and the manufacture of metal products are increasing in importance. Motor and cycle engineering, motor body building and the manufacture of chemicals, brushware and glassware are comparatively new industries which are making rapid headway. The government, through an Industries and Commerce Department, encourages and assists secondary manufacture, and the Customs tariff is scientifically arranged to foster such industries as are capable of development. The total number of employees engaged in factories in 1923–4 was 77,661. The value of the products of manufacturing industries in 1924 was £77,000,000. This sum includes semi-primary industries engaged in the preparation of agricultural and pastoral produce for export with products valued at £32,000,000.

Water Power.—The Public Works Act 1908 vested in the Crown the sole right to use the water power of the Dominion, subject to any existing rights, and gave the government the right to develop such power. The Aid to Water Power Works Act 1910 empowered the state to establish hydroelectric supply installations. The Lake Coleridge scheme to supply Christchurch was the first undertaken and was completed in 1915; in 1925 it was being extended to supply 27,000 kilowatts. At the close of the War a policy of concentration on works to supply the whole Dominion was adopted. The Mangahao system to supply Wellington and the Wellington province came into operation in 1925. Under legislation passed in 1918, and later amendments, 39 Boards were set up to administer and finance the supply of power in created districts. The full development of the schemes in progress in 1926 will give the following results, though each scheme is capable of greater development:—

North Island	H.P.
Mangahao (Wellington province)	24,000
Waikaremoana (East Coast)	40,000
Arapuni (Auckland)	96,000

South Island	H.P.
Coleridge (Canterbury)	36,000
Waipori (Otago)	25,000
Monowai (Southland)	16,000

The progress of development (in H.P.) was as follows:—

1910	1915	1921	1925
18,353	43,016	51,114	70,143

The total cost to March 31 1925, including capital outlay, stocks, and debit balances on trading accounts, was £4,010,666; statutory authorisations existed for £10,830,000. In 1925 there were 56 power distributing stations and a net profit was shown of 1·31%. The total water power resources are estimated at 4,109,950 horsepower.

Trade.—The external trade of New Zealand rapidly developed after 1910, particularly in the post-War period, as is shown in the following table:—

Year	Exports	Imports	Total trade
1910	£22,180,209	£17,051,583	£39,231,792
1914	26,261,447	21,856,096	48,117,543
1918	28,516,188	24,234,007	52,750,195
1922	42,726,249	35,012,561	77,738,810
1923	45,967,165	43,378,493	89,345,658
1924	52,612,711	48,527,603	101,140,314
1925	55,262,272	52,456,407	107,718,679

The *per capita* value of exports in 1910 was over £21, and in 1925 £39. The imports *per capita* in the same years were £16 and £38 respectively. (Imports are valued at the current domestic value in the country of export plus 10% to cover "charges, freight and insurance"; exports are valued f.o.b.)

The following tables show the values in thousands of pounds and quantities in thousands of hundredweight or pounds, of the principal exports for certain years:—

Exports: Values and Quantities (000's omitted)

Year	Wool		Frozen Meat		Butter		Cheese		Skins, Hides and Pelts
	Value £	Quantity lb.	Value £	Quantity cwt.	Value £	Quantity cwt.	Value £	Quantity cwt.	Value £
1910	8,308	204,369	3,851	2,654	1,812	357	1,195	452	1,129
1914	9,318	220,473	5,863	3,230	2,339	434	2,564	864	1,318
1922	11,882	321,533	8,387	3,518	9,042	1,120	4,687	1,161	2,054
1923	10,905	217,566	9,013	3,044	10,689	1,250	6,870	1,441	2,380
1924	15,268	206,190	9,490	3,159	11,642	1,269	7,023	1,594	3,144
1925	17,739	. .[1]	11,215	3,349	10,240	1,245	5,801	1,377	. .[1]

[1] Not available.

The successful application of refrigeration to the sea-carriage of apples and eggs opened up great possibilities, and the volume of exports is rapidly increasing. In the 1926 season some 600,000 cases of apples were shipped to Britain; in 1925 the quantity was only 200,000 cases, the value of which was £116,101. Honey exported in 1925 totalled 1,822,043 lb. valued at £53,156. Increasing markets for these small lines are of very great importance to New Zealand, because as industries, either allied or run separately, they provide local people and immigrants with limited capital and opportunity to start in land occupations. It is impossible for the Dominion to consume the whole output, and success is dependent upon markets overseas, the chief of which is Great Britain. There are many localities in New Zealand eminently suitable for apple growing, and the industry is capable of very great development.

Other exports of minor importance and their values in 1925 were: hemp, £516,466; sawn timber (chiefly to Australia), £573,879; kauri gum, £414,901; gold, £472,364; grass seed, £113,046; and silver, £60,773. The following table shows the value of goods exported to each of the chief markets in 1925:—

	Value	Per cent of total
To Great Britain	£44,073,717	80
To United States of America	4,531,153	8
To Australia	2,502,113	5
To Germany	1,614,090	3

The principal import groups are: clothing and textiles, metals and machinery, sugar, tea, alcoholic liquors, tobacco, paper and stationery, oils, motor vehicles and accessories, chemicals, drugs and timber. Imports of motor-vehicles and oils (including motor spirits) have increased very rapidly: before 1911 their value was less than £300,000 annually, but in 1924 the amount was £4,567,496. The following table shows the imports for 1910 and 1925 from Great Britain, other British countries and foreign states:—

Year	Great Britain	Other British countries	Foreign countries
	£	£	£
1910	10,498,771 (61·57%)	3,967,053 (23·27%)	2,585,759 (15·16%)
1925	25,535,332 (48·68%)	12,726,269 (24·26%)	14,194,806 (27·06%)

In 1910 the figures represent the countries of shipment, whereas those for the second period are of the countries of origin. In 1910 imports from Australia were valued at £1,520,000, and in 1925 £5,238,773; imports from the United States were £1,399,737 and £8,977,840 respectively.

Customs Duties.—In 1915 changes were made in the rates of duty levied on certain articles to meet the extraordinary expenses of the year, and in 1917 additional War impositions were made, these rates remaining in force until the coming into operation of the 1921 revised tariff. The revenue from customs duties in 1910 was £2,954,989, and in 1924, £7,480,947. The Dominion's system of Imperial preference extends to all British countries. The principle was greatly extended in 1921, when 425 items in the 644 subject to duty were made subject to the preference. At the same time, the average preference was raised from 10 to 15%. Australia has a special reciprocal tariff agreement with New Zealand, arranged in 1922, and does not come under the general British preferential provision. In 1924 about one-half the total imports from the British Empire were admitted free of duty.

Communications and Transport.—Considerable progress was made in state railway communication after 1910, as is shown by the following table:—

	Length open (miles)	Revenue (gross)	Expenditure
		£	£
1910	2,717	3,249,790	2,169,474
1920	2,996	5,752,487	4,105,067
1925	3,085	7,112,524	5,545,416

The net receipts in 1925 represented £3 11s. od. on capital costs. The capital value of the railways (including unopened lines and assets) was £50,833,500. The state builds its own rolling stock and locomotives, and in 1925 was providing extensive new railway workshops. In 1924 the whole control of managerial organisation was changed, the affairs being placed under the control of a board responsible to the Minister.

Important railway works were carried out during the post-War period. The North Main Trunk was extended from Auckland to beyond Whangarei; sections were constructed on the east coast of North Island, and a tunnel (5¼ m.) through the Southern Alps at Arthur's Pass, to link up the railheads in the

Westland and Canterbury provinces, was completed and electrified in 1923. Railway extension work has been slow and costly, as the sections of country requiring linking-up are of a mountainous character. Duplications have been made in city suburban areas, and works are in progress to obviate the heavy grades running out of Wellington City.

In 1925 there were 64,625 m. of roads in the Dominion, 28,553 m. of which were metalled. By the Main Highways Act (1922) main highways are under the administration of a Highways Board which is responsible for their upkeep. This step has been rendered necessary by the heavy increase that has taken place in motor traffic.

Banking.—There are six banks of issue operating in the Dominion, two of them, the Bank of New Zealand and the National Bank of New Zealand, being incorporated by special Acts of the general assembly of the Dominion. In 1925 the Bank of New Zealand had branches and agencies within the Dominion numbering 219, and the other five between them 259, making a total of 478.

Development of Banking 1910–24

	Deposits	Advances	Assets	Liabilities
	£	£	£	£
1910 .	24,968,761	18,439,999	26,398,927	26,742,081
1920 .	59,405,341	38,241,932	56,111,433	67,818,469
1921 .	49,397,411	50,607,541	68,701,282	58,808,439
1922 .	45,913,394	44,768,178	61,779,570	53,868,834
1923 .	49,039,482	43,322,242	59,641,235	56,204,292
1924 .	49,502,499	44,559,661	61,325,865	57,131,235

The number of open accounts in the Post Office Savings Bank at the end of 1910 was 380,585; at the end of 1915, 509,085; and at March 31 1925, 735,148. In 1910 (calendar year) the proportion of open accounts to the total population was 1 in every 2·76; in 1925 (March 31) the proportion was 1 in every 1·88. The deposits and withdrawals in the calendar year 1910 were £10,708,939 and £9,695,515 respectively; and in 1925 (March 31) £29,582,897 and £30,413,609 respectively. The amount standing to credit of all accounts in 1910 (Dec. 31) was £14,104,990, and in 1925 (March 31) £46,948,628.

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NICARAGUA (*see* 19.642) has an area of 49,200 square miles. Nicaragua declared war on Germany, May 7 1918, and acquired membership in the League of Nations 1920. The western half of Nicaragua contains three-quarters of the population, mostly of mixed Spanish and Indian blood. There are many Nicaraguans of pure Spanish descent. In the east the inhabitants are mostly Zambos and Caribbean Indians and negroes. There are also a few Americans. Estimated population in 1923 was 700,000: Managua, the capital, 60,342; Leon, 47,234; Matagalpa, 32,271; Granada, 21,925.

I. POLITICAL HISTORY

On the flight from Nicaragua of President Zelaya on Dec. 24 1909 Dr. José Madriz, one of his supporters, succeeded him as provisional President. The United States refused to acknowledge the succession, and Madriz was superseded in 1910 by Juan M. Estrada, a member of the artisan class, who was supported by the Conservatives and a few Liberals. He was recognised by the United States and relations were resumed; but a fresh outbreak of factional quarrels amongst the political parties obliged Estrada to resign. The United States intervened, and Adolfo Diaz was elected provisional President in 1910, being elected to a second term of office in 1913. During the first term of office of President Diaz a private loan was negotiated in 1912, the currency reformed, and the customs collections placed under American control. A claims commission, sitting from 1911 to 1914, scaled down and adjusted claims. A revolt of the old Zelaya party, led by Gen. Mana, was unsuccessful in its effort to seize power in opposition to American reform of finances. After Dec. 1914 the Government was supported by American marines stationed at the legation. In Feb. 1913 a treaty was signed whereby Nicaragua gave to the United States for $3,000,000 exclusive inter-ocean canal rights through her territory together with accessory control over the entrances on the Corn Is. and in the Gulf of Fonseca. Protests by Costa Rica and Salvador on the ground that this treaty infringed their sovereignity were sustained by the Central American Court of Justice, but the decision was ignored by both parties to the treaty.

The maintenance of the Chamorro family in the presidency (Emiliano 1917–20, Diego M. 1921–3), while securing peace, caused continuous dissatisfaction. Nicaragua rejected the Central American Union of 1921, fearing that its operation would affect her status with reference to the Canal Treaty, though American official opinion denied this possibility. Crimes by U.S. marines in 1921 and 1922, arising from feuds with Nicaraguans, resulted in several courts-martial and the policy of frequent changes of personnel in the legation guard.

There were border revolts in 1921. The movement of rebel troops upon Managua in 1922 led to a conference on Aug. 22 on board the U.S.S. "Tacoma," in the Gulf of Fonseca, attended by the presidents of Nicaragua, Honduras and Salvador, for the purpose of securing united action in stopping revolutions fomented by political immigrants. This conference renewed the acknowledgment of the Treaty of Amity of 1907, and invited Costa Rica and Guatemala to reiterate their adhesion also; they declined on the ground that the pact was still in force. The Washington Conference of 1922-3 was called at the solicitation of the republics which were parties to the "Tacoma" conference. Nicaragua had before mid-Aug. 1925 approved the first 13 of the Washington agreements.

Diego M. Chamorro died in 1923, and was succeeded provisionally by Dr. Bartolo Martinez. In Jan. 1925 Carlos Solorzano took office as President The United States, Nov. 14 1924, expressed a desire to withdraw its marines in Jan. 1925, but Nicaragua asked that they be retained until the new Government should be installed after an election to be held under a new electoral law framed by Dr. H. W. Dodds. They were ultimately withdrawn on Aug. 3 1925 and replaced by native constabulary under an American officer. In 1924 claims of Mosquito Indians for land title adjustments under the British cession of 1906 were adjudicated by the British and American consuls sitting with the Minister of Foreign Relations.

Defence.—Military service is obligatory between the ages of 17 and 55 years. Active service is for one year. Under the convention for the limitation of armaments signed at Washington on Feb. 7 1923 Nicaragua agreed to limit its standing army to 2,500 of all ranks. In war time the army may be increased to 7,000. Beyond a single small boat, stationed on the Pacific coast, Nicaragua possesses no navy, and by the 1923 convention is pledged to acquire no more than 10 serviceable aeroplanes.

Education.—Primary education is compulsory and free. Secondary education, which is conducted under private auspices, is neither free nor compulsory. Fifty per cent of the population is estimated to be illiterate. In 1923 there were 344 state elementary schools with 730 teachers and 21,651 pupils. There were three secondary schools, five provincial schools, two normal schools and 160 private and municipal schools. The total school population was 29,864. There are universities at Managua, Leon and Granada and a national industrial, commercial and scientific museum at Managua.

II. FINANCIAL AND ECONOMIC HISTORY

Finance.—The revenues and expenditures of the Government were, in cordobas:—

	1925	1924	1920
Revenues . . .	2,772,640	2,211,706	3,147,752
Expenditures . .	2,772,640	1,580,000	1,528,077

The surplus was used each year until July 1924 for public works and on treasury bills; the treasury bills being then paid, the surplus was thereafter used for Government purposes. Customs collections for the five years 1920-4 were, in cordobas: 1920, 2,055,989; 1921, 990,168; 1922, 972,024; 1923, 1,591,131; 1924, 1,988,865. The report of the Collector-General of Customs for 1924 showed a sound financial condition for the republic; the public debt of 32,236,223 cordobas in 1911 was reduced to 7,390,590, March 31 1925.

Production and Commerce.—Agriculture continued to expand throughout 1924, though retarded by labour shortage. Bananas on the east coast constitute an important crop, and coconuts, oranges, pineapples and yucca are raised. Rice, wheat and tobacco also are grown on the east coast. Coffee, the most important crop of Nicaragua, showed export values in cordobas (1 cordoba = 1 U.S. gold dollar), as follows: 1920, 2,874,141; 1921, 2,352,487; 1922, 2,300,572; 1923, 3,937,833; 1924, 7,321,784. The total commerce for 1924 was over 20,000,000 cordobas, twice the average of 10 years previous. The increase was due to the excellent coffee crop, which was the largest in the history of the republic, and its high price. The other principal products exported—gold, mahogany, bananas and sugar—showed a slight decrease. In the west, beans, corn, cheese, lard and sugar are exported. Important lumber exports go from both coasts, as well as dye woods, gums and medicinal plants. The gold export in 1921 was 989,973 cordobas; in 1922, 1,065,733; in 1923, 823,554; in 1924, 771,375 cordobas. Operations were curtailed in 1924 and several mines closed.

Leading exports for recent years were (in cordobas):—

	1924	1923	1920
Cotton goods	2,504,670	2,276,781	5,242,189
Iron and steel mfr.	676,727	471,638	754,075
Leather and mfr.	244,973	242,321	370,804
Flour	439,294	383,852	665,660

Since 1916 the United States has supplied from 73 to 84% of Nicaraguan imports. For the same period the United States has taken from 62 to 85% of the exports, save in 1924 when it took 57%. Proposals to reduce import duties on manufactures used in development were pending in March 1925. A convention between Nicaragua and Guatemala, Sept. 10 1924, provided for free trade for five years in natural products or those manufactured with native raw materials.

The trade movement for the four years 1921–4 was:—

	1924	1923	1922	1921
All Countries				
Imports	$8,806,896	$7,268,432	$5,123,505	$5,309,903
Exports	12,990,025	11,028,309	7,903,446	8,070,949
United Kingdom				
Imports	£ 349,223	£ 235,773	£ 114,425	£ 150,549
Exports	112,324	82,728	75,119	97,707
United States				
Imports	$5,453,167	$5,509,254	$4,127,205	$3,857,202
Exports	6,250,499	7,896,177	5,617,507	6,264,531

Communications.—Most of the roads in the country are nearly impassable in the winter season, but construction has been carried on as follows: from Managua through Matagalpa to Jinotega, 104 m.; Managua to Diriamba 35 m.; Leon to Matagalpa, 80 m.; Puerto Diaz through Juigalpa to La Libertad, 50 miles. Construction on these roads is intermittent. The Pacific railway of Nicaragua has a total length of 146 miles. It runs from Corinto *via* Leon, Managua and Granada to Diriamba. The total railway mileage is 172. The government has contracted for the installation of wireless stations at Managua, Cabo, Gracias a Dios and Bluefields. The station at Managua was under construction in 1925.

Banking.—A new monetary unit was introduced in 1912, the *cordoba*, equivalent to the United States dollar and containing 1·672 gr. of gold $\frac{9}{10}$ fine. Provision was made by law for a gold coinage of 10·5 and 2½ cordobas, but no gold coins have been minted. Cordobas in circulation amounted to 2,379,254 in Nov. 1923. In 1912 the National Bank of Nicaragua was established in Managua, the nominal capital being $300,000.

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NICHOLAS (1841–1921), King of Montenegro (*see* 19.651), was the last member of his house to reign over a separate Montenegrin realm. The story of the last 20 years of his life is very largely the contemporary history of Montenegro. His grant of a constitution in 1905 was followed by a period of violent internal conflict between him and his opponents, whose position had been strengthened by the elections to the Skupshtina, whom he sought to discredit by the Cetinje bomb plot mystification. His assumption of the kingly title in 1910 marked a further stage in the evolution of his plans, of which it constituted a public notification, and aroused hostile comment among his own people as well as in Serbia. The Balkan wars resulted in a marked *diminutio capitis* for Nicholas, who failed to play a conspicuous part in them and was forced to call in Serbian aid before Scutari. At this time already the survival of a Montenegrin throne appeared a doubtful problem. In the World War the breach between him and his people was complete, and even before the final act the old monarch was apostrophised derisively as Nicholas the first and Petrovich the last. He died at Antibes March 1 1921, and was buried at San Remo.

NICHOLAS (1856–), Russian Grand Duke and soldier. Nikolai Nikolaievich was born Nov. 6 1856, the grandson of the Emperor Nicholas I. and first cousin of the Emperor Alexander III. Educated at the school of military engineers, he received his commission in 1872, and in the following year, at the early age of 16, entered the military academy. In the war of 1877–8, as a general staff officer for special service, he joined the staff of his father, the very popular Grand Duke Nikolai Nikolaievich (Senr.), who had been appointed commander-in-chief of the Russian forces. At the crossing of the Danube at Zimnicea on April 15 1877 he was awarded, for his courage, the Cross of St. George, 4th Class. In the attack on the Shipka he acted as chief of staff to one of the columns, and received the distinction of the Golden Sword.

After the war the Grand Duke joined the Guard Hussar Regiment, in which the Emperor Nicholas afterwards served, and passed through every stage as officer till appointed commander in 1884—a position he occupied for 6½ years. He then commanded in succession a brigade and a division, and in 1895 was appointed inspector-general of cavalry. He held this post for 10 years, a period which is regarded as a bright epoch in the history of the Russian cavalry, for he carried through fundamental reforms in training and in the organisation of the cavalry schools, of the cavalry reserves and of the remount service.

In 1905 Nicholas was appointed commander-in-chief of the St. Petersburg military district, a post he held till the outbreak of the World War in Aug. 1914. Here, as elsewhere, he gave proof of his zeal for efficiency. Setting himself the task of instilling the lessons of the Japanese war, he encouraged musketry and work in extended order, but at the same time allowed no slackness in ceremonial. To help him in his work he called from the Far East men like Generals Ivanov, Lesh and Lechitski, who were of comparatively humble origin but had made their reputation in the field. The appointment of such men to high command in the Imperial Guard was characterised in his diary at the time by another Grand Duke as "revolutionary," but the men selected justified their choice in the World War.

In the same year (1905) as he was appointed commander-in-chief of the St. Petersburg military district, Nikolai Nikolaievich became the first president of the newly created council of national defence, and he held this position till 1908, when the council was abolished. During this time the Emperor seems to have hesitated between the final adoption of a military system analogous to that of Germany, under which the chief of the general staff, as well as the minister of war, should have the right of access and of direct report to the Sovereign, and of the system in vogue in countries with a constitutional government, under which that right was confined to the minister of war. On the council the Grand Duke worked in close co-operation with General Palitsin, who, in 1908, on the Emperor's decision in favour of the latter system, gave way to General Sukhomlinov as chief of the general staff, the latter, in the following year, replacing General Rediger as minister of war.

From 1908 to 1914 Nicholas took no part in the strategical preparation for the War, the work being delegated by the Emperor to General Sukhomlinov and his nominees on the general staff. At the outbreak of war the Emperor first intended to take command himself, and actually appointed the Grand Duke Commander-in-chief of the 6th (Reserve) Army at St. Petersburg (Leningrad). It was only on the evening of Aug. 1, the day of Germany's declaration of war, that he yielded to the entreaties of his ministers and decided to hand over the supreme command to the Grand Duke.

Services During the War.—The position the commander-in-chief was called upon to fill was a peculiarly difficult one. He was responsible for carrying out a plan which he had no hand in drawing up, a plan which was dependent on promises previously made, without his cognisance, to the French general staff. He had to work in accordance with the "Regulations for the Direction of the Army in the Field," a new edition of which had been issued on the very eve of the War, handing over much power to the two group commanders. Finally, he was compelled, by the Emperor's directly expressed personal wish, to take as his chief of staff and general quartermaster, Generals Yanushchkkevich and Danilov in preference to Generals Palitsin and Alexeyev, whom he would have preferred.

The plan of the Russian general staff consisted of the invasion of East Prussia by a right group (I. and II. Armies), while a left group (IV., V., III. and VIII. Armies) operated against the Austrians in Galicia, and a centre group (IX. and X. Armies) assembled at Warsaw to advance on Posen. It was owing to the decision of the Grand Duke that this centre group was broken up, the X. Army being sent north to fill the gap left by the failure in East Prussia, and the IX. Army sent south to overwhelm the Austrians in southern Poland.

When the Germans came to the rescue of their discomfited ally by advancing in Oct. 1914 to the outskirts of Warsaw, the transfer of the Russian Armies from left to right in rear of the Vistula, and the concentration of superior forces on the enemy's left or northern flank which compelled his retreat, were masterly movements. If the next German advance, culminating in the operation of Łódź owing to mistakes by Russian army commanders, definitely removed all possibility of an invasion of Posen, the Russians held on through the winter of 1914–5 to the line of the Narev-Vistula-San-Carpathians, and were only compelled by lack of munitions in the spring and summer of 1915 to retreat to a line that they held substantially throughout 1916–7. With the cause of this retreat from Poland and the lack of munitions the Grand Duke had nothing to do, but to him must belong the credit for the harmonious carrying out, without incurring a Sedan, of this movement with such skill that the Russian Armies, when they reached the line on which they were to rest for the winter, were still a fighting force with confidence in their commander.

There was no demand from the fighting men at the front for the change at G.H.Q. which occurred on Aug. 21 1915, when the Emperor announced that he would assume the supreme command. It is said that Rasputin had prophesied that the Russian armies would continue to be defeated till the Emperor placed himself at their head. Certainly the impostor had no reason to love the Grand Duke Nicholas. A story repeated among the soldiers relates that he had applied to the commander-in-chief for permission to come to the front "to bless the troops," and the latter had telegraphed in reply two Russian words which being translated run—"Come, I shall hang you."

The Grand Duke was appointed viceroy and commander-in-chief in the Caucasus. Up to that time the brunt of the fighting against Turkey had been borne by the British in Gallipoli, the Sinai Peninsula and Mesopotamia. The advent of the new commander put new life into the Russian forces. He pushed forward an expeditionary force under General Baratov through Enzeli and Hamadan to screen Persia from further German penetration, and to establish touch with the British troops in Mesopotamia. He collected guns and stores, and raised and trained efficient troops, and, in spite of immense difficulties in supply, ably assisted by Generals Yudenich and Prjvalski, occupied in three successful offensives all Armenia, including the fortress of Erzerum, the port of Trebizond and the town of Erzinjan.

The revolution of March 12 1917 found the Grand Duke still in the Caucasus. The Emperor's last official act was to nominate him to be once more supreme commander-in-chief. His journey from the Caucasian headquarters at Tiflis to the headquarters at Mogilev was in the nature of a triumphal procession, patriotic demonstrations and crowds of people greeting him at every station on the way. Twenty-four hours after his arrival at Mogilev he received a telegram from Prince Lvov, the chief of the provisional government, cancelling his appointment. The next two years the Grand Duke spent in the Crimea, taking no part in politics. At last, in March 1919, he left Russian soil on the British Cruiser "Marlborough," and went to live quietly near Paris.

Nikolai Nikolaievich was, before everything, a patriot with a strong sense of duty. Though destined by birth to great wealth and high position, he devoted himself to the scientific study of his chosen profession of arms. His active career showed that he possessed the qualities of a real leader of men. Of commanding stature, and extraordinarily handsome, he was gifted with boundless energy, a strong will and the power of rapid decision. Every form of intrigue was absolutely foreign to his nature. That he had the broad mind of the true statesman was proved by his conciliatory proclamation to the Poles at the commencement of the World War. He possessed to an extraordinary degree the power of inspiring love and trust. His sense of justice made him treat general and soldier exactly alike, and the many stories of his doings told by the peasant soldiers of the Russian Army showed that he was regarded as a sort of legendary champion of Holy Russia in the struggle against Germanism and court corruption. They felt that, though he was a strict disciplinarian and very exacting in his demands on their strength, he would ask from the private soldier no greater effort than he did from his general or imposed upon himself. (*See* EASTERN FRONT CAMPAIGNS). (A. W. F. K.)

NICHOLAS II. (1868–1918), Tsar of Russia (*see* 19.655).—In view of the tragic end of the Tsar Nicholas II. and his family in the Russian revolution, it may be noted that, even in the lifetime of his father, Alexander III., his mind had been deeply imbued by mystic belief in divine rights and providential guidance, and he was prepared to suffer and to endure, if necessary, in carrying out the duties of his office. His intellectual preparation as heir to the throne was very insufficient. As the second son he had been left in the background for some time, and even when it became clear that his elder brother, George, was doomed to untimely death by consumption, no special efforts were made to prepare him for his task by any elaborate teaching. An English tutor, Mr. Heath, taught him excellent English, and inspired a love of sports and healthy exercise, while a Russian general, Danilovich, supervised his military training, but there was no attempt to provide him with the comprehensive knowledge required from one whom fate had destined to rule an immense empire. The only occasion which was offered to the young Tsarevich to acquaint himself with the problems of the world was his journey to the Far East, so abruptly cut short in Kyoto by the sabre cut of a Japanese fanatic.

It is not strange that Nicholas II.'s range of ideas was not very wide or profound, although he was by no means unintelligent, and possessed in high degree the royal habit to move with ease and tact in complicated personal surroundings. His disposition towards fatalistic mysticism made him particularly amenable to the promptings of superstitious and irrational suggestion. He told Stolypin on one occasion, when he had to take an important decision, that he was loath to do so, because he was sure that his interference would be accompanied by bad luck; he saw a warning in the fact that he had been born on May 6, the day when the Church honoured the memory of Job; he was predestinated to say with Job: "As soon as I apprehend a danger, it occurs, and all the misfortunes dreaded by me come over me." He wedded Princess Alix of Hesse at the deathbed of his father; at the festival of his Coronation more than 3,000 people were crushed to death through the negligence of the officials who had to arrange a distribution of bounties; and during the Coronation itself the imperial chain on his breast fell to the ground. Such impressions contributed strongly to inspire him with a mystic resignation, especially unsuitable for a monarch who had to lead the nation through times of great crisis at home and in foreign affairs.

Nicholas II.'s political outlook was dominated by a kind of theocratic or hieratic spirit; he was looking back for inspirations to the ideas and customs of the Moscovite period; he was induced to impersonate the figure of Alexis Mikhailovich, the father of the western reformer Peter the Great; in 1913 the tercentenary of Michail Feodorovich's accession to the throne after the "Great Troubles" was celebrated with much splendour and emphasis. Pilgrimages were performed with great devotion and circumstance.

The courtiers and bureaucrats in the immediate surroundings of the Tsar, men like Sipiaguin, Nicolas Maklakov and Sabler, took advantage of these prepossessions in order to keep up a constant hostility against progressive reformers and western adaptations. But the most dangerous representative of mystic reaction was the Tsar's consort, the Empress Alexandra Feodorovna. Of German descent on her father's side and of English descent on the side of her mother (Princess Alice, the daughter of Queen Victoria), she had received her education in England, but, on coming to Russia, she surrendered completely to the most extreme form of theocratic exaltation.

While her sister, the widow of the Grand Duke Sergius, killed by a terrorist, had devoted herself to a simple life at the head of a community of hospital nurses, Alexandra Feodorovna, highly strung and hysterical, sought providential guidance in the midst of unbalanced women and false prophets like the French medium Philippe and the famous Rasputin. The latter obtained a hold on her through the hypnotising influence he exercised over her son, the Tsarevich Alexis, a boy affected by the rare disease of hereditary haemophilia. But the crafty peasant had contrived to obtain gradually a psychical domination over the Empress and her friends which made it possible for him to distribute political favours and to have his say in the most important affairs of State. The Empress considered him as the God-sent representative of the Russian nation, of that mass of peasants which, as she was convinced, was the firm mainstay of autocracy in Russia. And in the later years of Nicholas II.'s reign, the years of great trial and danger, Alexandra Feodorovna stepped in more and more often to direct the Tsar's choice of his ministers and to prevent him from making concessions to the spirit of the time.

The suspicion that Alexandra Feodorovna was secretly favouring the cause of Germany and revealing military secrets to the Kaiser—a suspicion often expressed abroad and popularly accepted in Russia—is, according to most competent witnesses, devoid of any basis in fact. The Empress was intensely patriotic in her own way, opposed to the aggressive policy of the Hohenzollerns, and never advocated a treacherous compromise with the Central Powers. A former lady-in-waiting, Princess Vassiltchikov, who towards the close of 1916 brought the project of such a compromise from Germany was promptly ordered out of St. Petersburg (Leningrad). Nevertheless, Alexandra Feodorovna proved to be the evil genius of the Russian dynasty, by her blind and obstinate support of reactionary tendencies and of worthless adventurers, at a time when a wise and firm policy of reform was more needed than ever. All the better representatives of the dynasty—the Dowager Empress Maria Feodorovna, the Grand Duke Nicholas Mikhailovich, the Grand Duchess Victoria, warned the Empress Alexandra Feodorovna of the imminent danger of that régime of fleeting ministerial shadows which set in after the catastrophe of the War Office in 1915.

The Emperor remained passive as commander-in-chief at headquarters while the Empress Alexandra spurned all advice with contempt and continued to pull the strings by dismissing men like Sazonov and Palivanov, and appointing timeservers like Sturmer, Protopopov or Galitzin. The assassination of Rasputin did not frighten but enraged her; she erected a kind of shrine over the body of the prophet and sent the Grand Duke Dmitry Pavlovich, who had taken part in the murder, into exile. Her power was broken only by the revolution.

The thread of the Romanov dynasty was cut without much resistance. When in March 1917 the Emperor received at headquarters a telegram from the president of the Duma informing him of the events of St. Petersburg and demanding his abdication, and MM. Gutchkov and Shulgin arrived with the act of abdication itself, he submitted with fatalistic composure. He refused to give up his crown to his son with Grand Duke Michael as regent, because he did not wish to trust the boy to the danger of a political storm; and his abdication was made in favour of the Grand Duke Michael, who in his turn refused to accept the crown unless it was tendered to him by the will of the people. The last chance of a régime of constitutional monarchy was cut short. Proposals were made on behalf of the British Govt. to allow Nicholas II. and his family to take up their abode in England; but the Provisional Govt. in St. Petersburg did not accede to that plan. Kerensky and Milyukov declared that the imperial family were in safety in Russia. Later on the Emperor submitted meekly to be transferred from Pskov to Tsarskoe Selo and thence to Tobolsk, where he was interned with his family—his wife, his son and his four daughters—for months.

The life in Tobolsk has been described by a French tutor, M. Gillard, who followed the imperial family into exile. All the qualities of the unfortunate prisoners of state came to the fore in these sad times. The Tsar taught his son history and Russian literature, the family circle assembled in the evening to read and converse, they prayed and attended the church services with touching devotion. In Ekaterinburg, where they were transferred by the Bolsheviks in 1918, their captivity assumed an oppressive form. They were huddled together in an apartment consisting of two bedrooms and one sitting-room. Their guard consisted mainly of Lettish soldiers, while Russians were kept on the outskirts of the house; they had to listen to the uproar and the ribald songs of their watchmen; the walls of the sitting-room were covered with obscene drawings and inscriptions; the head gaoler, Yourkovsky, was a fanatical communist, a Jew, who harboured feelings of fierce hatred against the potentates of Holy Russia.

The end came in connection with Kolchak's advance on the Ural in 1918. The Soviet of Commissaries in Moscow enjoined the greatest vigilance to the Ekaterinburg commissar, Yourkovsky, and the commander of the guard, Medvediev, without indicating any means for removing the prisoners from the threatened zone. The communists of Ekaterinburg held a secret meeting in which they decided to put the Tsar and his family to death, and sent an order in this sense to Yourkovsky. The latter demanded that it should be duly signed, and 16 signatures were affixed to it. On the night of July 16 Yourkosvky roused the prisoners and conducted them into a cellar of the house. Medvediev, with the Lettish guards, entered the room while some Russian soldiers were looking in from the staircase. Yourkovsky placed the seven doomed persons at one end of the room and read the sentence hurriedly by torchlight. The Tsar stepped forward and said something indistinctly, when Yourkovsky drew his revolver and shot him in the head. A general fusillade followed, and, not content with this, the executioners pierced the bodies with their bayonets and struck them with the butt-end of their rifles. The Grand Duchess Tatiana is said to have recovered consciousness for a while, but she was struck down once more and forever. Besides the seven members of the imperial family four of their attendants were probably slaughtered the same night. In the course of the next few days the corpses were removed to an isolated spot in the neighbourhood of Ekaterinburg and destroyed by fire, after having been soaked with petroleum. A few objects of apparel were later picked up on the spot. (*See* Russia.) (P. Vi.)

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NICHOLSON, WILLIAM GUSTAVUS NICHOLSON, 1st Baron (1845–1918), British soldier, was born March 2 1845, and joined the Royal Engineers in 1865. He served in the Afghan War, 1878–80, and in the Egyptian campaign of 1882. He next served as chief of the staff in the Tirah campaign, and as adjutant-general in India. In 1899 he went out to South Africa as military secretary to Lord Roberts, but on arrival he was placed at the head of the transport service. Early in 1904 he went to the Far East as chief military attaché with the Japanese forces. At the end of 1905 he was appointed quartermaster-general; in 1908 he was transferred to the post of Chief of the Imperial General Staff, which he held during the important period of the Haldane reforms. He was promoted field-marshal in 1911 and, on vacating his appointment at the War Office in the following year, was raised to the peerage as Baron Nicholson of Roundhay. In 1913 he was chairman of a commission on Indian military expenditure, and in 1916–7 he was a member of the Dardanelles commission; this was his last public service. He died in London on Sept. 13 1918. Lord Nicholson was a man of high intellectual attainments and, although somewhat given to controversy, a successful military administrator.

NICHOLSON, MEREDITH (1866–), American writer, was born at Crawfordsville, Ind., Dec. 9 1866. He was educated in the public schools of Indianapolis, and engaged in journalism from 1885 to 1907, being reporter and later editor on the Indianapolis *News*. His works include the following novels: *The Main Chance* (1903); *The House of a Thousand Candles* (1905); *The Port of Missing Men* (1907); *The Little Brown Jug at Kildare* (1908); *The Lords of High Decision* (1909); *A Hoosier Chronicle* (1912); *The Madness of May* (1917); *Broken Barriers* (1922); *The Hope of Happiness* (1923); *And They Lived Happily Ever After* (1925); also a volume of *Poems* (1906); and four volumes of historical and critical essays, including *The Valley of Democracy* (1918) and *The Man in the Street* (1921).

NICKEL (*see* 19.658).—The world's chief source of nickel is Canada: in 1913 she contributed 69% of the world's production. The great need of nickel for armaments during the World War caused the Canadian output to increase, and by 1918 it had risen from 20,000 tons in 1914 to 41,000 tons in 1918, which latter figure represented 87% of the world's production for that year. The highest percentage was reached in 1920, when Canada produced 88% of the world's supply. As a result of the market being congested with large stocks and accumulated scraps at the end of the War, Canadian production declined, reaching its lowest ebb in 1922, when less than 8,000 tons of Canadian nickel were mined. When the congested supplies had been absorbed, the industry quickly revived; demand soon exceeded production, and a steadily increasing output has since been maintained. The world's output in 1923 was estimated at about 30,000 tons, of which approximately 27,000 tons was produced from the nickel mines in Canada, including a relatively small quantity of nickel recovered as a by-product from the cobalt-silver ores in that Dominion.

With regard to foreign producers of nickel, the most important is the island of New Caledonia, a French possession about 1,250 m. northeast of Australia. This island's output, in spite of the increased demand for the metal between 1914 and 1918, has since then gradually fallen, being in 1921 only about 14% of the world's output.

Norway, which in the earliest days of the industry held a monopoly of the world's supply, closed down her mines in 1921 for economic reasons. In the United States the nickel deposits are nowhere being worked for the metal, though a small quantity is incidentally recovered there each year in the process of electrolytic refining of blister copper. Under the exigencies of war Germany produced from her own low-grade mines a small tonnage of nickel ore, but since the close of hostilities she has reverted to the practice of importing refined metal. Besides the above, there have been obtained from time to time small supplies of ore from Greece, Tasmania, Sweden, etc.

Practically the whole of the Canadian output is obtained from the Sudbury district in the Province of Ontario, relatively small quantities being obtained from the deposits 150 m. due north of Sudbury in the Temiscaming district, and from the cobalt-silver area in the same province. Other occurrences are known in the townships of MaCart, Munro, Strathy and near Lake Shebendowan in the district of Thunder Bay, Ontario, and nickeliferous pyrrhotite associated with copper occurs in the Gabbro copper mines, Vancouver Island, British Columbia.

World's Production of Nickel Ore
Long Tons

	1913	1918	1923[4]
Canada . . .	22,177	41,298	27,881
Germany . . .	267	1,841	3[3]
Greece . . .	943	658	. .
Norway . . .	492	238	61
Sweden . . .	. .	24	. .
New Caledonia[1] .	8,098	2,666	2,624
U. S. A.[2] . . .	214	394	89

[1] Exports. [2] Produced as by-product in electrolytic refining of copper. [3] Ore, nickel content not stated. [4] Italy produced 44 tons in this year.

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(N. M. Pe.)

NICOLL, SIR WILLIAM ROBERTSON (1851–1923), Scottish Nonconformist divine and man of letters (*see* 19.663), died at Hampstead, London, May 4 1923. After 1910 he published *The Problem of Edwin Drood* (1912); *Dickens' Own Story* (1923); *Memories of Mark Rutherford* (1924); as well as a devotional work, *Reunion in Eternity* (1918).

NIEDERLE, LUBOR (1865–), Czechoslovak archaeologist and anthropologist, studied at Prague, Munich and Paris. In 1891 he became a lecturer and in 1904 a professor of archaeology and ethnology at the Charles University in Prague. In 1905 he organised the collections in the Czechoslovak ethnographical museum. By his work *Slavonic Antiquities* (Prague, 1904) Niederle became the recognised leader of Czech research on the history of the ancient Slavs. Among his other works are *Mankind in the Prehistoric Period* (Prague, 1893–4), and *On the Origin of the Slavs* (Prague, 1896). In 1898 he founded and directed the *Bulletin of Slavonic Antiquities*, and, from 1901 onwards, the *Bulletin of Slavonic Anthropology and Antiquities.* Professor Niederle became a member of many Slavonic learned societies, and received numerous foreign distinctions.

NIGERIA (*see* 19.677).—This British colony and protectorate has three main divisions: (1) the Colony, up to 1906 called Lagos colony, (2) the Southern Provinces and (3) the Northern Provinces. The provinces form the protectorate, but for descriptive purposes the Colony may be regarded as part of the Southern Provinces. The total area is about 335,000 sq. miles. The native population, based on the 1921 census returns and partly estimated is slightly over 18,000,000; and the European population about 4,000. The capital is Lagos (*q.v.*). There are over 20 other large towns.

I. POLITICAL HISTORY

In 1911 Nigeria consisted of two very different, and for political purposes distinct dependencies of the Crown. Southern Nigeria (that is, the Colony and Protectorate of Southern Nigeria), with an area of about 76,000 sq. m., stretched inland from the Guinea coast through a tropical belt of generally dense forest land to a line irregularly corresponding with the latitude of 7′10″ N. Northern Nigeria, with an area of 255,700 sq. m., composed largely of open prairie, hill country and dry desert plains, extended from the latitude of 7′ 10″ to the frontiers of the French and Zinder territory on the north, to French Dahomey on the west and to the German Cameroons on the east. The population of Southern Nigeria was about 8,000,000 and the population of Northern Nigeria, with more than three times the area, was about 9,000,000. In both divisions primitive and very backward races had been overrun and influenced by civilisations of a higher type. In the south the new civilisation had been European and Christian; in the north, Arab and Mahommedan.

The interdependence of these two regions was obvious, and their amalgamation had long been urged upon the Imperial Government. It was not, however, until 1911 that the Secretary for the Colonies, Mr. L. V. Harcourt, determined to adopt the policy. Sir Frederick Lugard, who had been the first high commissioner for Northern Nigeria, was asked to initiate and carry out a scheme of amalgamation, being in 1912 appointed governor at the same time of both Southern and Northern Nigeria. The preliminary work was completed in about 18 months, and on Jan. 1 1914 the governments of Southern and Northern Nigeria were formally amalgamated, Sir Frederick Lugard receiving the personal title of governor-general. The geographical divisions of north and south were maintained. Two lieutenant-governors were appointed, one for the northern and one for the southern province, an administrator was appointed to the Colony, the jurisdiction of the legislative council was now confined to the narrow limits of the Colony's 1,400 sq. m. and the governor-general retained, in his central secretariat, services necessarily general to the whole. These were intentionally limited, and as much responsibility as possible was delegated to the two lieutenant-governors.

At the time of amalgamation Northern Nigeria was divided into 12 provinces, the native communities being for the most part each under its native ruler, the five principal native States being known as first-class emirates, while each independent chieftainship, however small, retained its treasured liberty, and this system of government was maintained. The southern provinces at that period, consisted of three divisions under provincial commissioners. They were the territories east of the Niger, west of the Niger and the hinterland of Lagos. The native races in the hinterland of Lagos and to the east of the Niger were in a much less advanced state of tribal organisation than were the tribes in the north and scarcely fitted for any form of enlightened self-rule. Fetish worship, cannibalism and barbarous practices were rife. On the west of the Niger, however, three native states, Yoruba, Egbe and Benin, were strongly organised. They were induced to renounce the exceptional position they enjoyed, under treaties made with Great Britain, and to accept conditions similar to those of the first-class emirates of the north. The introduction of the new system was accompanied by some difficulty, and in 1918 an easily suppressed rising in Egbeland gave momentary uneasiness. Indirect rule has now been fully accepted in both Egbeland and Yorubaland and the report of 1924 especially mentions that it is working admirably in Benin. The way for the extension of such indirect rule as might be found possible, was prepared by the division of Southern Nigeria into nine provinces (later increased to ten), each under a British Resident, as in the North.

The World War.—The outbreak of the World War within seven months of amalgamation postponed the consolidation of the new system. Patriotic sentiment in the Protectorate ran high. Every department was depleted by volunteers for active service, and it was with difficulty that the administrative machine was held together with the remnant of overworked staff retained. For four years, the first thought of every Englishman in Nigeria was given to the War. And not of the Englishmen only. The War served at once to test and to exemplify the solid results of British rule. Throughout the War period the great native chiefs of the North were constant and unflagging in their loyalty. They contributed liberally to Red Cross and other war funds. They prayed for British victory in their mosques. They joined in public thanksgiving when victory was won, and they rendered the great service, when the country was practically denuded of troops, of maintaining absolute tranquillity in their dominions.

The native troops of the West African Frontier Force did gallant service, both in the arduous campaign carried out under the leadership of Generals Dobell and Cunliffe in the Cameroons, and in what was to them foreign service in East Africa. The Cameroons campaign which opened in Aug. and Sept. 1914, with reverses all along the British line, at Mora (Aug. 25) and Garua (Aug. 29) in the north, and at Nsanakang (Sept. 6) in the south, lasted until Feb. 1916. It was a severe test for the troops engaged. The fighting was heavy, but they stood it well. Early in 1915 the campaign, in which French troops took an active part, was reorganised. British Forces in the north were placed under the command of General Cunliffe, and the final taking of Garua and the storming of Banyo Hill under his leadership on Nov. 6 1915, in face of a hail of dynamite bombs, was a feat of which any regiment might be proud. The conquered territory was divided between France and Great Britain, to be administered under mandate according to the provisions of the Treaty of Versailles. The portion taken by Great Britain was 31,000 sq. m., with an estimated population of 600,000 (*see* CAMEROONS).

Reforms.—While the War, by arresting material development also delayed the application of schemes for the moral welfare of the native population, some progress was made. The judicial and legal systems of the two Protectorates were, on amalgamation, combined. One Chief Justice for the whole of Nigeria, with four puisne judges, were appointed, and each lieutenant-governor was provided with a legal adviser. The reorganisation of the two systems and the revision of the laws of the two Protectorates, was a long and heavy job. The first reforms were initiated in 1914. After 10 years of working, the system introduced had been found to be generally beneficial and acceptable. Notwithstanding the difficulties of the moment, an education ordinance was promulgated in 1916, having for its object the reform and co-ordination of the systems of the North and South. It set a definite standard, of which the principal aim was to substitute self-discipline and the formation of character, for set examinations in literary subjects, and generally to fit local education to local needs. A forestry ordinance of the same year (1916) dealt with the rapid destruction which was taking place of the forests that constitute the principal wealth of the Southern Provinces, and its provisions have safeguarded this asset of the country for future development.

Not the least achievement of the War period was the elimination of the traffic in foreign "trade spirits" on which the revenue of the southern provinces had largely depended. It was the declared policy of the amalgamated Government to kill this trade by gradually raising the duty. Conditions of war hastened the process. Before the War the revenue from this traffic formed 34.26% of the revenue of Southern Nigeria. By the end of the War it had fallen to a proportion of 1·23. It was held that this result established two important conclusions. First, that the Government of Nigeria could dispense with revenue derived from spirits, secondly, that the produce trade could be conducted successfully without them. As from Feb. 1 1919 the importation of trade spirits was formally prohibited in all the West African Colonies and Protectorates.

Constitutional Changes.—Sir Frederick Lugard retired at the end of the War, and Sir Hugh Clifford succeeded him as governor of Nigeria in July 1919. It was an era of material prosperity, and at the close of his five years of governorship, Sir Hugh Clifford had the satisfaction of leaving behind him a country in which great economic progress had been made under his rule. In other respects Sir Hugh's tenure of office was notable for two modifications in the system of administration. The first was the extension and reorganisation of the central secretariat, a step which in practice tended to curtail the responsibility and initiative of the lieutenant-governors and residents of provinces. The second was the abolition of the advisory Nigerian Council established under the amalgamation scheme, and the restoration of the jurisdiction of the legislative council for the Colony over the whole of the southern provinces. In the new and enlarged council the elective principle was introduced. The introduction of this elective principle, of which experience in the West Indies has not been altogether encouraging, was new to West Africa, though it is now also applied to Sierra Leone and the Gold Coast. The new council still has an official majority, but includes three elected unofficial members representing the municipal area of Lagos, and one elected unofficial member representing the municipal area of Calabar. The first elections for this council were held in Sept. 1923, and the council was inaugurated by the Governor on Oct. 1 1923. The governor retains the power to legislate for the northern provinces, but the council may discuss affairs of interest to any part of Nigeria.

The last year of Sir Hugh Clifford's period of office was marked by an incident which gave profound pleasure alike to the native population and the Europeans. This was the visit of the Prince of Wales, the first heir to the Throne who had ever visited the tropical regions of West Africa. He landed at Lagos in April 1925, and visited the principal native towns, where he was everywhere received with demonstrations of enthusiastic loyalty. In Sept. 1925 Sir Hugh Clifford was succeeded as governor by Sir Graeme Thomson.

II. ECONOMIC CONDITIONS

Railways and Mines.—Trade development has depended largely on the increase of communications. The Western Railway from Lagos to Kano, save for the bridging of the Niger at Jebba, was completed in 1911. (The river was bridged in 1914.) Meanwhile the Udi coalfields, on the left bank of the lower Niger, had been made known and working was begun in 1912. A suitable site for a new port had been found on the Bonny river, and from this place, named Port Harcourt, it was determined to build a railway to the coalfields. This development may be viewed as the inauguration of a recognised railway policy. A new capital of the Northern Provinces had been established at Kaduna, in the province of Zaria, where the railways from Lagos and Port Harcourt reach, and thus constitute it the centre of the system. The total railway mileage of Nigeria at the end of the War was 1,110 miles. The principal development since the War has been the continuation of the Udi line towards Kaduna, of which a section of 141 m. to the Benue was opened for traffic on Aug. 1 1924. By Feb. 1926 railhead had reached Jaginde, over 100 m. further north. In 1925 the building of a line from Zaria, northwest to Gusau (120 m.), tapping a rich cotton and ground nut area was sanctioned.

The development of the Udi coalfields was satisfactory. The railway reached Udi in May 1916 and the first truck of coal was delivered at Port Harcourt in the last week of that month. The discovery of this supply of fuel was of first importance to the development of local transport. By the end of the War the output of the field was already substantial. In the *1924 Report* it is given as 201,923 tons for the year. The coal is of excellent quality, equivalent for steam-raising purposes to 80% of best Welsh. The tin mining industry in the Bauchi Highlands, well established before the War, increased its output from 4,140 tons in 1913 to 9,000 tons (valued at £1,425,000) in 1924.

Agriculture, etc.—The chief wealth of Nigeria is, however, sylvan, agricultural and pastoral. The figures of the ground nut trade illustrate the value of the railway in creating trade. Before the Lagos-Kano line was built there were no exports of these nuts. In 1913 19,000 tons were exported. In 1918 the bulk had increased to 57,500 tons. In the railway report 1924–5 the nuts carried are given as 100,724 tons, of which the value was £434,445.

But the most important export of Nigeria continued to be palm kernels and palm oil; the oil palm being abundant in the Southern Provinces. The administration, however, sought to broaden the basis of production and gave encouragement to the cultivation of cocoa and cotton, supplementing with regard to cotton the efforts which the British Cotton Growing Association began in 1903. The introduction of a long stapled American variety of cotton in the Northern Provinces gave excellent results. By 1919–20 the industry was well established, the season's export being 3,500 bales; for the 1924–5 season it was 21,000 bales. The cocoa industry also proved successful, the shipments in 1924 being 4,375 tons.

Trade.—The external trade suffered as a result of the War, but towards its close a general recovery was noticeable. An interesting change took place in the direction of some of this trade. Trade with Germany, which had ceased with the outbreak of the War, was to a great extent absorbed by the United States. In 1913 trade with Germany was valued at £3,885,000 and American trade was practically nil. In 1917 the position was reversed. German trade was nil, and American trade was valued at £1,812,000. After the War, however, German competition revived. In 1924 Germany took 13% of the total trade and the United States but 5%. In the year named Great Britain supplied 71% of the imports and took 60% of the exports. Besides the products indicated—palm kernels, palm oil, ground nuts, cocoa, cotton lint and tin—hides and skins and timber are important exports. The principal imports are cotton goods, hardware, cutlery, iron, steel and machinery, coopers' stores, bags and sacks, tobacco, grain, flour, kola, nuts and salt. Spirits have become a negligible quantity. The following statistics show the progress made and the influence of the War on trade:—

Year	Value of Imports	Value of Exports	Total Value of Trade
	£	£	£
1913 .	6,331,751	7,197,646	13,529,397
1914 .	6,276,957	6,420,461	12,697,418
1915 .	4,983,728	4,946,228	9,929,956
1916 .	5,174,474	6,029,546	11,204,020
1917 .	5,808,592	8,602,486	14,411,078
1918 .	7,423,158	9,511,971	16,935,129
1919 .	10,798,671	14,675,789	25,474,460
1920 .	25,216,000	16,987,000	42,203,000
1921 .	10,550,287	9,655,915	20,206,202
1922 .	10,689,000	10,421,000	21,110,000
1923 .	11,457,000	11,672,000	23,129,000
1924 .	12,635,866	15,004,874	27,640,740

The mid years of the War show the lowest figures touched. In the two years succeeding the War a great boom carried the total of trade to the unprecedented figure of £42,203,000. The boom was followed by a slump of some severity. Nevertheless, it will be observed that under the more normal conditions reached the total trade of Nigeria in 1924 was slightly more than double the total trade of 1913. The increase in the price level of commodities must be taken into account, but even so the advance is considerable.

Revenue.—Revenue moved largely in correspondence with trade. Taking 1913 and 1923–4 (in 1921 the accounts were altered to make the financial year end by March 31) the figures of revenue and expenditure were: 1913, revenue £3,362,000, expenditure £2,916,000; 1923–4, revenue £6,260,000, expenditure £5,501,000. There was at the end of the year 1920 an excess of assets over liabilities of £3,296,789, a surplus which fully justified the issue in Oct. 1921 of a loan of £3,000,000 for the continuation of the Eastern Railway and the carrying out of public works.

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NIKISCH, ARTHUR (1855–1922), Hungarian conductor (*see* 19.690), died in Leipzig Jan. 23 1922.

NILE (*see* 19.692).—Although the geographical problems connected with the origin of the river have been solved, the Nile continues to offer problems of extraordinary interest in connection with the conservation and distribution of its waters. The energy formerly directed to exploration has only been diverted to a closer and more scientific study of the hydrography of the river, with a view to determining how the available flow of water in its various tributaries can be most advantageously and economically protected from dissipation and wastage in the swamps of the upper river, and stored in reservoirs for utilisation as required. These studies have mostly been directed by the Egyptian Govt. towards increasing the flow of the river in the early summer months, when its natural flow falls short of requirements for irrigation in Egypt; it has come to be realised that the control of the Nile waters is not wholly an Egyptian question but concerns the rapidly developing countries higher up the river.

The Aswan, Gebel Aulia and Makwar Dams.—The original Aswan dam, which was opened in 1902, was raised in height by seven metres in 1912 and the storage capacity of the reservoir increased from 1,000 million cu. metres to 2,250 million cu. metres of water. Following on Sir William Garstin's famous report on the basin of the Upper Nile (British Blue Book, *Egypt, No. 2 1904*), schemes for constructing a large reservoir on the lower White Nile by means of a dam at Gebel Aulia some 20 m. south of Khartum, and for a canal to irrigate the great Gezira plain between the Blue and White Niles, began to take definite form about 1913. Progress with these schemes was necessarily suspended during the World War, and in the meanwhile the increasing tendency towards the development of an independent existence by the Sudan caused all schemes for the control of the river beyond the limits of Egypt proper to be viewed with some apprehension and mistrust in Egypt. The general position was summed up to date by the then adviser to the Egyptian Ministry of Public Works, Sir Murdoch MacDonald, in *Nile Control* (published by the Egyptian Govt. in 1920), and an international commission was appointed by the Egyptian Govt. to report on the proposed works.

The commission reported favourably on the general scheme outlined in *Nile Control*, and pointed out that under a carefully considered scheme of control there was sufficient water to meet any possible developments in both Egypt and the Sudan for many years to come. Financial considerations, complicated by the political position, again led to the temporary suspension of the works and to the preparation of further reports on the irrigation programme by Mr. C. E. Dupuis, formerly adviser to the Egyptian Ministry of Public Works (published by the Egyptian Govt. in 1925). The construction of the Gezira canal was then actively resumed by the Sudan Govt., and the canal, with its great dam and reservoir, with a capacity of nearly 500,000 million cu. metres of water, at Makwar, near Senaar, on the Blue Nile, was completed to the extent necessary for the irrigation of 300,000 ac. in 1925, and formally opened in 1926. The Egyptian Govt. also actively pressed on the construction of the Gebel Aulia dam and reservoir on the White Nile, with a storage capacity of about 2,500 million cu. metres of water, and is taking up again the scheme for the canalisation of the river through the swamps, on which some preliminary work was done between 1904 and 1913. (*See* DAMS; IRRIGATION.)

Lake Albert.—It is further recognised that to be fully effective this canalisation of the river must be supplemented by further storage works higher up the river, presumably by the conversion of Lake Albert into a reservoir, but this scheme has not yet emerged from the stage of preliminary consideration. The most recent information concerning the physical conditions and régime of the great lakes forming the basin of the upper White Nile, essential to the consideration of this project, has been collected in a report on *The Lake Plateau Basin of the Nile* by Mr. H. E. Hurst (published by the Egyptian Govt. in 1925.)

Lake Tsana.—The study of the possibilities of Lake Tsana as a reservoir for the Blue Nile, originally reported on by Mr. C. E. Dupuis in 1903, has been continued by expeditions visiting the lake under Mr. A. B. Buckley in 1916–7, and under Mr. G. W. Grabham in 1920–1. The results of all these studies have been published by the Egyptian Govt. and the *Report of the Mission to Lake Tsana in 1920–1* by Messrs. G. W. Grabham and R. P. Black is particularly full and interesting. All reports agree in emphasising the extreme suitability of Lake Tsana for conversion into a reservoir of a capacity of between 3,000 and 4,000 million cu. metres. The political questions arising from the gradual conversion of the Nile from a natural river into an artificially regulated stream, whose flow is controlled by reservoirs at various points on its course in several different countries, are only just beginning to make themselves felt, and a comprehensive solution of the resulting difficulties has yet to be found.[1]

Navigation and Water Power.—From the point of view of navigation and trade no new developments have taken place on the Nile in recent years. The river remains a most useful highway for local traffic in the various sections into which its length of 4,000 m. is divided by the occurrence of falls and rapids; but the nature of these breaks is such that the development of through traffic on any scale is never likely to be economically possible. There are considerable possibilities for the development of water-power on the Nile, especially at the Ripon and Murchison falls in Uganda; and the utilisation of the large amount of power running to waste at the Aswan dam has been repeatedly considered and discussed; but the localities in which these opportunities occur are remote, and no useful application of them to practical purposes has yet been devised; in the case of Aswan the intermittent character of the power obtainable, which though very large when the reservoir is full in the early part of the year is practically nil during the flood season, has hitherto proved an insurmountable objection to economic utilisation. (C. E. D.)

NILSSON, CHRISTINE (1843–1921), Swedish singer (*see* 19.701), died at Copenhagen, Denmark, Nov. 22 1921.

NITROGEN, FIXATION OF (*see* 19.714).—Extensive developments in the fixation of atmospheric nitrogen have taken place in the period under review, the War serving as a primary cause and fertiliser requirements continuing the need of production. The older process of heating air to temperatures over 2,000° in order to obtain oxides of nitrogen has been definitely overhauled by the synthetic production of ammonia by direct union of nitrogen and hydrogen in presence of a catalyst, many technical difficulties in dealing with gases at fairly high temperatures and decidedly high pressures having been overcome. The energy required in effecting combination of nitrogen and oxygen at the temperature of the electric arc is very high and as the yield is always below that theoretically obtainable, it is unlikely that the process can be exploited economically except where water-power can be obtained at a very low cost.

Direct Synthesis of Ammonia. (*q.v.*).—In these processes, a mixture of 1 volume of nitrogen and 3 volumes of hydrogen is compressed and the reaction, $N_2+3H_2 \rightleftarrows 2NH_3$, brought about by sending the gas over a heated catalyst. The reaction is driven from left to right by increase of pressure, whilst increase of temperature sends it from right to left. The ammonia produced (5 to over 20%) is subsequently condensed as anhydrous liquid or absorbed in water.

Haber-Bosch Process.—The Haber-Bosch process, worked by the Badische Anilin-und Soda-Fabrik, is carried out at about 200 atmospheres and a catalysis temperature of about 500°. According to Waeser (*Luftstickstoffindustrie*, 1922, p. 364), a three-stage compressor is used and the reaction is carried out in tubular vessels (the autoclave shape having been abandoned) constructed of special steel. The heating of the incoming mixture is effected, once the operation is started, by the heat of the outgoing gases, the reaction proceeding exothermically. The gases leave the catalyst with an average ammonia content of 10%, and after thorough cooling are brought in contact with water under pressure. A 20-25% ammonia solution is thus produced whilst the issuing mixture of nitrogen and hydrogen is mixed with the fresh supply and returned to the catalyst plant. The other processes for effecting the synthesis of ammonia also depend on heating a stoichiometric mixture of the reacting elements with a catalyst under pressure.

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[1] Under the Anglo-Abyssinian Treaty of May 15 1902 the Emperor Menelik undertook not to construct or allow to be constructed any work across the Blue Nile, Lake Tsana or the Sobat which would arrest the flow of their waters into the Nile except in agreement with the British and Sudan governments. An agreement between Great Britain, France and Italy, signed on Dec. 13 1906, provided for the co-operation of the three powers in maintaining the political and territorial status quo in Abyssinia as determined by the series of previous agreements, including the Anglo-Abyssinian Treaty referred to above. The recently concluded exchange of notes between the British and Italian governments provides for mutual support in connection with British rights and interests in the Nile waters, and Italian rights and interests in railway construction as defined in the Tripartite Agreement of 1906.

American Process.—The American process of the General Chemical Co. works at approximately 100 atmospheres, the lower pressure being possible owing to the use of a very active catalyst. The removal of the ammonia is effected by liquefaction at −40°, this low temperature being necessitated by the small concentration of ammonia resulting at the low pressure of 100 atmospheres.

Claude Process.—On the other hand, Claude uses pressures of 600 to 1,000 atmospheres. This displaces the equilibrium so far in the direction of ammonia formation that it is possible to use higher temperatures at which catalysts are more active and less sensitive to poisoning. Thus, with a comparatively poor catalyst, concentrations of over 20% can be attained and on cooling the issuing gases, the ammonia is for the greater part liquefied and may be removed in the anhydrous condition. No special refrigeration is required as in the American process.

With the large concentration of ammonia obtained, converters can be used in series, the ammonia being liquefied and removed after each passage and the residual gas rejected. A combination of series and circulating systems has been used, the gases from the high stage compressors being passed through two converters in series and ammonia removed after each exit. The residual gas from the second condensation is then returned to an intermediate compressing stage where it is mixed with fresh gas.

Casale Process.—In the process of Casale, pressures of 300 to 600 atmospheres are employed and a circulating system is adopted. Again, the ammonia is removed by cooling and consequent liquefaction. The process adopted in England appears to be an adaptation of that of Haber. The mixture of 1 volume of nitrogen and 3 volumes of hydrogen is obtained in one of two different ways. In the first of these, the initial materials are coke, water and air; in the second, nitrogen, isolated from the air, is mixed with electrolytic hydrogen. When the cost of electrical energy is sufficiently low, the latter process is preferable as the hydrogen is practically free from impurities.

Heater Gas.—The first process (Bosch) utilises a mixture of water-gas and producer-gas. Water-gas is made in the usual manner. Air is blown through a generator containing a coke fire, the air is shut off and steam blown through, the reaction $C+H_2O=CO+H_2$ then taking place. The mixture obtained in practice contains about 50% of hydrogen and 42 to 45% of carbon monoxide, the small balance being chiefly carbon dioxide and nitrogen.

Producer-gas.—Producer-gas, obtained from air and coke, contains H_2, 5–15; N_2, 65–50; CO, 20–30; CO_2, CH_4, etc., 5–10 per cent. By mixing these gases in suitable proportions one may obtain a gas with 22–23% nitrogen and a combined percentage of hydrogen and carbon monoxide rather over three times this amount. By passing this mixture with an excess of steam through a heated converter containing a catalyst, most of the carbon monoxide is oxidised to dioxide and an equivalent of hydrogen liberated. $CO+H_2O=CO_2+H_2$. The reaction is not complete; the resulting mixture contains about 17% of nitrogen, 52% of hydrogen, 27 to 29% of carbon dioxide and 2 to 4% of carbon monoxide, together with small amounts of argon, methane, etc. The carbon dioxide may be reduced to 0.1 to 1% by water scrubbing under pressure, and the remainder by washing with cold alkali solution. Removal of carbon monoxide and residual sulphur compounds is essential since they are catalyst poisons; for the former, a solution of cuprous ammonium carbonate (or formate) can be used.

Treatment of the gases with ammonia is also employed (*e.g.*, Synthetic Ammonia and Nitrates Ltd., Slade and Parkes, *Brit. Pat.* 240350; Casale, *Brit. Pat.* 231417) whilst de Jahn states that scrubbing with liquid ammonia usually renders further purification unnecessary (*Brit. Pat.* 251789). Finally moisture must be removed, the greater amount by refrigeration, the remainder by a drying agent. In the alternative process of mixing nitrogen with electrolytic hydrogen, the former can be obtained by liquefaction of air and fractional distillation. The Claude plant at Muscle Shoals is stated to give nitrogen of 99.995% purity. Electrolytic hydrogen is obtained by electrolytic processes described in the article ELECTRO-CHEMISTRY.

Catalysts, etc.—Catalysts (*q.v.*) for the reaction between nitrogen and hydrogen are usually of iron with a basic oxide as promoter, the latter being introduced on fusion. A suitable electric furnace is described by Larson (*J. Ind. and Eng. Chem.*, 17, 1925, 971). Apparently a ferrite is formed during fusion and Synthetic Ammonia and Nitrates, Ltd. (Brit. Pat. 237394) claim the preparation of calcium ferrite from iron oxide and lime in the electric furnace which gives a more active catalyst on subsequent reduction. A low temperature method of catalyst production is suggested by Technical Research Works (Ltd.) and Lush, pure iron being anodically oxidised in an alkaline carbonate solution (Brit. Pat. 241278).

AMMONIA FROM NITRIDES, CYANIDES AND CYANAMIDE

In the Serpek process, ammonia is obtained by the reaction between aluminium nitride, AlN, and caustic soda. Peacock proposes to heat aluminium hydride with nitrogen above 400°, so obtaining aluminium nitride and ammonia (*U.S.P.* 1,521,708). The Bücher process, employing synthetic sodium cyanide, has been operated by the du Pont Company. A description of their plant, which utilises soda-pulp mill "black liquor" as the source of the necessary soda and carbon, is given by Chickering (*Chem. and Met. Eng.*, 1924).

Nitrates and Nitrites.—The production of oxides of nitrogen from air ($N_2+O_2 \rightleftarrows 2NO$) at the temperature of the electric arc is only economical with cheap and plentiful electric energy. Where water-power is not available, it is cheaper to prepare oxides of nitrogen by the combustion of ammonia, a process in which great improvements have been effected. The reaction, $4NH_3+5O_2 \rightleftarrows 4NO+6H_2O$, can be brought about on platinum gauze; other catalysts, *e.g.*, activated iron oxide, may also be used. The subsequent oxidation of the nitric oxide to nitric acid, nitrates and nitrites follows the lines adopted in the case of arc processes. (*See* 19.714.) The collection of nitrogen peroxide as a liquid and absorption of oxides of nitrogen by silica gel are notable developments. (See Perley, *J. Ind. and Eng. Chem.*, 17, 1925, 258.)

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(J. T. H.)

NITTI, FRANCESCO SAVERIO (1868–), Italian statesman, was born at Melfi (Potenza). He had already become known as a barrister and as professor of financial science at the university of Naples when he entered Parliament in 1904. He made his reputation as an authority on economic and financial questions, and was minister of agriculture, industry and trade in the Giolitti Cabinet of 1911–4. When the United States entered the World War in 1917, he was entrusted with an economic mission to that country, and certain of his utterances and acts in this connection were severely criticised. He became minister of the treasury in the Orlando Cabinet from Oct. 1917 to Jan. 1919. On the fall of the Orlando Ministry, which he helped to bring about, he succeeded as Premier, but his administration was exaggeratedly timid, and he allowed the Socialists and Communists practically a free hand in their acts of criminal violence. In his reaction against what he regarded as the war spirit he was closely associated with the policy of *svalutamento* of Italy's victory and of renouncing the fruits of it. He was determined to secure the support of the Socialists and the Popolari at all costs, and dared not resist the wave of Bolshevik madness with which a part of the population was affected, and which he believed stronger than it actually was. He enacted a series of demagogic financial measures and refused to suppress the costly bread subsidy, thereby increasing the budget deficit by several milliards.

Nitti's adoption of the system of proportional representation resulted in an important increase in the Socialist and Popolari deputies at the elections of Nov. 1919, but he failed to conciliate either group. The indignation aroused by his weakness in dealing with the epidemic of revolutionary strikes and disorders, his contemptuous treatment of the army, his decree amnestying deserters and his failure to effect a settlement of the Adriatic problem, seriously weakened his position, and he felt forced to resign on March 12 1920. But no other statesman being willing to assume the succession, he reconstructed his Cabinet; defeated in the Chamber after the San Remo meeting of the Supreme Council presided over by him, to prepare the peace with Turkey, he resigned a second time but reconstructed his Cabinet. The arrest ordered by him of the Dalmatians and Fiumani in Rome provoked further irritation, and while he at first reduced the bread subsidy for financial reasons, he revoked the decree immediately afterward from fear of the Socialist menaces, and resigned for the last time on June 9 1920, leaving the door open for Giolitti's return.

On retiring from office he returned to journalism and business. In Parliament he opposed Giolitti, but was still more hostile to the Fascists. He was re-elected in 1921, but did not stand in the 1924 elections held under Mussolini's auspices. He was particularly hated by the Fascists for his anti-patriotic and demagogic policy, and his house in Rome was broken into by a band of Fascist hotheads and some of the furniture wrecked. He subsequently went abroad to lecture and write in the foreign Press on political affairs, attacking both the Fascist Govt. of Italy and the peace treaties.

Nitti wrote several books on economic questions, including one entitled *Nord e Sud* (1900), dealing with what he regards as the unfair treatment of South Italy by the wealthier North, and *L'Italia all' alba del secolo XX.* (1901). Among his other works, the following have been translated into English: *L'Europa senza pace* (Eng. tr. 1922); *La Decadenza dell' Europa* (Eng. tr., 1923); *La Tragedia dell' Europa* (Eng. tr., *They Make a Desert*, 1924). In 1925 his son Vincenzo Nitti published a vindication of his father's policy, *L'opera di Nitti.* (L. V.*)

NIVELLE, ROBERT GEORGE (1856–1924), French soldier, was born Oct. 15 1856 at Tulle, Corrèze. He entered the Polytechnic in 1876 and left two years later to join the artillery. He became a lieutenant on Oct. 1 1880 and a captain on July 12 1887; with this rank he took part in the Chinese expedition of 1900. The greater part of his later career was spent in Algiers, where he was appointed commander of a battalion on July 12 1901 and lieutenant-colonel on Sept. 24 1908. When the World War broke out he had been a colonel since 1911, was an officer of the Legion of Honour and commanded the 5th Artillery at Besançon. With the VII. Corps he took part in the Alsace engagements and the battle of the Ourcq.

Appointed a general of brigade on Oct. 24 1914, he fought successfully on the Aisne, and in Jan. 1915 took a prominent part in the attack on Quesnevières. On Dec. 23 1915 he was placed at the head of the III. Corps, and in March 1916 was sent to Verdun, where after some remarkable fighting he succeeded in checking the Crown Prince's first attack. On May 2 he succeeded General Pétain in the command of the II. Army, and definitely held the enemy before that glorious citadel. It was he who, in orders which have become famous, made the unforgettable declaration: "Ils ne passeront pas." On March 12 1916 he succeeded General Joffre as commander-in-chief of the armies of the north and north-east. In conjunction with the British armies he prepared the great offensive of April 16 between Soissons and Auberive, which, however, was not entirely successful. After this semi-defeat he was replaced by General Pétain in the command of the French armies. On May 15 1917 he was appointed commander of the armies "chargé de mission," and on Dec. 23 1917 took over the French troops in North Africa.

On Oct. 14 1918 General Nivelle was confirmed in his command despite the rules of superannuation, and on Jan. 30 1920 was nominated a member of the Supreme War Council. On March 5 1920 he gave up the command of the XIX. Corps, and in Nov. 1920 he was ordered to represent France in the United States at the tercentenary of the arrival of the "Mayflower" which had in 1620 carried the Pilgrim Fathers to New England. He afterwards visited the southern and western cities of the United States. He was placed on the retired list on Oct. 11 1921; he held the Grand Cross of the Legion of Honour and had received the Médaille Militaire and died suddenly of double pneumonia on March 23 1924. (M. Gu.)

NOBLE, SIR ANDREW, (1832–1915), British physicist (*see* 19.730), died at Ardkinglas, Argyllshire, Oct. 22 1915.

NOGI, MARESUKE, Count (1849–1912), Japanese general (*see* 19.733). As a sign of their devotion he and Countess Nogi committed suicide on Sept. 13 1912 when the state funeral of the Emperor Mutsuhito was taking place. Their memory is deified in the Nogi Shrine in Kyoto.

NOGUCHI, HIDEYO (1876–), Japanese bacteriologist, was born in Inawashiro, Yama, Fukushima, Japan, Nov. 24 1876. He received the degree of M.D. in 1897 from the Tokyo Medical College and subsequently did post-graduate work in the United States and Europe, becoming connected with the Rockefeller Institute for Medical Research in New York in 1904. He was the first to obtain pure cultures of the spirochete of syphilis and to establish the syphilitic nature of general paralysis and *tabes dorsalis* by demonstrating the organism in the cells of the central nervous system of persons dying of these diseases. He has done considerable work on the analysis of the Wassermann reaction for the diagnosis of syphilis and has devised a skin test for syphilis and a method for the detection of syphilitic and other pathological conditions in the spinal fluid. One of the first to recognize the germicidal properties of certain compounds of unsaturated fatty acids for acid-fast micro-organisms, *e.g.*, the tubercle bacillus, he discovered the parasite of yellow fever in 1918 and prepared a prophylactic vaccine and a curative serum for combating this disease. He has isolated the parasite of Oroya fever and Verruga peruviana. His published works include *Snake Venoms* (1909) *Serum Diagnosis of Syphilis and Luetin Reaction* (1910) and *Laboratory Diagnosis of Syphilis* (1923).

NORDAU, MAX SIMON (1849–1923), German author and philosopher (*see* 19.739), published *Biologie der Ethik* in 1921. He died in Paris Jan. 22 1923.

NORDICA, LILIAN (1859–1914), American operatic singer (*see* 19.741), died in Batavia, Java, May 10 1914.

NORFOLK, HENRY FITZALAN HOWARD, 15th Duke of (1847–1917), British statesman (*see* 19.744), died in London Feb. 11 1917. He was succeeded by the son of his second marriage, Bernard Marmaduke Fitzalan Howard (b. 1908).

NORFOLK, Virginia (*see* 19.747), had a period of intoxicating prosperity during the World War, due at first to heavy shipments of orders for the Allies, and after 1917 to the establishment by the Federal Govt. of the army supply base (at a cost of $25,000,000) and the Hampton Roads naval operating base. After the War, with the closing down of the army base, the transfer of the fleet to the Pacific coast, and the reduction of the naval training station to a skeleton organisation, the deflation was severe, but the following years saw foundations laid for a healthy commercial and industrial development. On Jan. 1 1919, the charter of 1918, which established the commission manager form of government, came into effect.

Within the next five years the city invested $6,000,000 in a water supply system which is expected to meet all needs for 50 years; leased the army base piers from the Federal Govt. and created a port commission; built a municipal grain elevator and a city market; protected the milk supply; reorganised the police force and the fire department; established a juvenile and domestic relations court and a detention home; enlarged the system of parks and playgrounds; improved the public school system in many respects, connected the city thoroughfares with county highways; established the budget system in the city's business; annexed territory with a population of 30,000 and taxable values of $30,000,000; established a city-planning commission (1919), and set out to develop a city plan.

The population grew 71·6% between 1910 and 1920, to 115,777 (107·6 males to 100 females), of whom 43,392 were negroes and 6,998 foreign-born; and was estimated at 166,000 in 1925. The area increased from 5·5 sq. m. (1910) to 7·5 in 1920 and 27 in 1923. Manufactures within the changing city limits were valued at $10,341,000 in 1909; $29,231,739 in 1923. An assembly plant of the Ford Motor Co. and a large plant of the Virginia Portland Cement Co. were opened in 1925. Exports moving through the port of Hampton Roads (Norfolk and Newport News) increased from $15,162,855 in 1914 to $168,664,547 in 1925, reaching the peak ($325,023,090) in 1921; imports, from $7,105,822 to $16,551,835, with the peak ($22,402,477) in 1918. Exports of tobacco increased from 10,444,485 lb. in 1918 (only 1·6% of the total for the United States) to 293,743,817 lb. in 1924, which was 51% of the total. Hampton Roads is the tidewater terminus of three of the principal coal-carrying railways. An average of over 1,000,000 tons is dumped each month, and the total handled in the record year 1920 was 21,644,328 tons. It is also an important oil-bunkering port, having a storage capacity of 2,432,500 barrels. Truck farming around the Roads brought returns estimated at $10,000,000 in 1924, chiefly from shipments to New York.

NORMAN, MONTAGU COLLET (1871–), British financier, was educated at Eton and King's College, Cambridge. He served in the South African War 1900–1 and was awarded the D.S.O. He afterwards became connected with the financial side of business, and his active association with the Bank of England began during the World War. In 1918 he was appointed deputy-governor and in 1920 governor of the Bank of England. He was re-elected for the seventh time in 1926, having held the post for longer than any previous governor. In 1922 he accompanied Mr. Baldwin, then Chancellor of the Exchequer, to the United States to arrange for the funding of the British war debt. The outstanding event of Mr. Norman's governorship was the restoration of the gold standard. In 1923 he was made a privy councillor.

NORRIS, WILLIAM EDWARD (1847–1925), British novelist (*see* 19.757), died at Torquay Nov. 19 1925. His later works were *Not Guilty* (1910); *The Rt. Hon. Gentleman* (1913); *Barbara and Company* (1914); *Proud Peter* (1916); *The Fond Fugitives* (1917); *The Obstinate Lady* (1919); *The Triumphs of Sarah* (1920); *Tony the Exceptional* (1921); *Sabine and Sabina* (1922); *Next of Kin* (1923); *The Conscience of Gavin Blane* (1924); and *Trevalion* (1925).

NORTHAMPTON, England (*see* 19.767), had a population of 90,895 in 1921 and an area of 3,469 ac. in the borough, which has included since 1914 the parishes of Abington, Dallington, Duston and Kingsthorpe. Northampton has returned only one member to parliament since 1918, instead of two. A town plan, which includes large schemes for by-pass roads and road widening, was brought forward in 1925. A new public library building was opened in Abington street in 1910, and a post office in St. Giles street in 1917. A large girls' secondary school was opened in September 1915. It stands on St. George's avenue, and has playing fields attached. In 1924 Weston Favell House was given to the Northampton Crippled Children's Fund for use as an orthopaedic hospital.

NORTH CAROLINA (*see* 19.771), a state of the United States of America. The estimated population in 1925 was 2,759,014 as compared with 2,559,123 in 1920, a gain of 199,891, or 7·2%. About one-third were negroes; the foreign-born whites had not increased notably from the 7,099 present in 1920, North Carolina still having less foreign admixture than any other state. In 1920, 490,370 persons were living in cities of 25,000 or more, 240,753 in villages and 1,828,000 in the open country. The state was thus predominantly rural, 71% of the population living outside of incorporated towns as against 76% in 1910. The chief towns in 1925 and their populations were Winston-Salem, 65,806; Charlotte, 52,049; Wilmington, 36,390; Asheville, 30,934; Greensboro, 45,000; and Durham, 40,000. The death rate steadily decreased after 1914, and in 1924 was only 11·9 per 1,000; the birth rate in the same year was 31·6 per 1,000.

Agriculture.—The period from 1920 to 1925 saw considerable shrinkage in agricultural values, and, in some crops, in the yield. The tendency noted in 1910 and 1920 toward smaller holdings continued; in 1920 the number of farms was 269,763 as against 253,725 in 1910. The following table presents the more striking figures for 1924 as estimated by the United States Department of Agriculture:—

Crop	Acres	Yield (bu.)	Value
Corn	2,473,000	44,514,000	$55,197,000
Wheat	462,000	5,544,000	8,870,000
Oats	258,000	4,644,000	3,901,000
Rye	71,000	852,000	1,269,000
Potatoes (Sweet)	101,000	2,292,000	9,664,000
Potatoes	59,000	6,195,000	6,938,000
Tobacco	497,000	278,320,000[1]	71,807,000
Hay	738,000	728,000[2]	15,288,000
Cotton	1,901,000	765,000[3]	86,000,445
Peanuts	181,000	7,400,000	10,706,000

[1] Pounds. [2] Tons. [3] Bales.

The value of all crops in 1924 was estimated to be $320,485,000, as against $412,374,000 in 1920. Trucking and fruit growing continued to show marked increase, especially peaches and strawberries. The following table shows the numbers and values of livestock in 1920 and 1924:—

Farm Animals	1924		1920	
	Numbers	Value	Numbers	Value
Mules	260,000	$30,680,000	236,000	$44,840,000
Horses	158,000	15,484,000	183,000	27,999,000
Milch cows	383,000	15,320,000	328,000	25,584,000
Other Cattle	253,000	4,123,900	394,000	13,908,000
Swine	1,000,000	12,000,000	1,575,000	31,500,000
Sheep	82,000	508,400	144,000	1,368,000

Manufactures.—In 1914 the industrial capital of the state was $253,842,000 and the value of manufactured products was $289,412,000; in 1920 the industrial capital was $669,144,000 and in 1923 the value of manufactured products rose to $951,911,000. Textiles led with a value of $363,000,000, followed by tobacco with $295,000,000, and furniture with $40,000,000. In 1920 there were about 550 cotton mills in operation with 5,321,450 producing spindles, which increased to 5,773,244 in 1924. The volume of the tobacco industry can best be estimated from the fact that for the year 1923–4 the Federal stamp tax yielded $136,892,475. The syndicating of cotton mills was a pronounced movement during the years 1916–24 following upon the the syndicating of tobacco factories, fertiliser plants and cotton-oil mills. Steam power was generally employed in the decade, 1910–20, but there was an ever-increasing use of hydroelectric power. In 1924, 431,500 H.P. had been developed, with 816,000 H.P. estimated as available for development.

Forest and Mines.—The total value of lumber and timber products in 1914 was $39,631,573. It increased largely in the years which followed, and, in spite of the ruthless lumbering operations of past years, it was estimated in 1920 that there was timber standing ready for the saw to the value of $167,450,000, with young growth valued at $192,500,000. Mining products, valued in 1917 at $5,246,391, had increased by 1923 to $10,020,559, the more important being stone, clay products, sand and gravel and feldspar.

Transportation.—Railway development in the state was checked in 1914 and stopped completely in 1917 by the World War. Only 357 m. of new line and 217 m. of sidings were built, making a total mileage in 1920 of 4,997, which had increased by 1924 to 5,222 miles. In 1917 there were 172 m. of electric road in operation, which decreased to 155 m. in 1924. The legislature of 1921 undertook the creation of a great state system of highways and authorised for the purpose bonds amounting to $50,000,000, and the legislatures of 1923 and 1925 increased it by $15,000,000 and $20,000,000 respectively. By 1925, 2,776 m. of improved highways had been built and nearly a thousand miles more was under construction.

Finance.—The revenue for the year ending June 30 1925, exclusive of the proceeds from bonds, was $6,215,656, while county, city and school taxes in 1922 yielded $44,147,000, and have since increased. The bonded indebtedness of the state in 1924 was $108,847,600, of the counties $87,062,352, and of the cities $97,563,114, making a total of $293,473,066. In addition to bonds totalling $85,000,000 authorised for highways, mentioned above, the legislatures of 1921, 1923 and 1925 authorised $5,000,000 for a state-aid loan fund for consolidated schools, and $20,242,000 for permanent improvements in the state's hospitals and institutions of higher learning.

The legislature of 1919, in order to reform the ineffective and inequitable system of taxation, passed a law providing for assessment of all real and personal property at its actual value. A constitutional amendment authorised a general income tax, limited the rate of combined state and county taxes on property to $0.15 per $100 of valuation, permitted a segregation of taxes for state purposes, and abolished the existing equality between the tax rate on property and the poll tax. The requirement of payment of poll tax as a prerequisite for voting was abolished. Revaluation was accomplished in 1920 and the property of the state was assessed at $3,539,000,000. More than a million acres of land not hitherto on the tax books were included. The *per capita* wealth was increased 183%. Marked reaction came in 1921, and many of the good results of revaluation were lost. The assessed valuation of all property in 1924 was $2,694,508,000

Education.—The State made educational progress between 1910 and 1925. The public schools funds increased from approximately $3,000,000 in 1910 to $15,066,487 in 1920 and to $35,000,000 in 1925. Teachers' salaries continued to rise, and teachers were better trained. The most notable educational achievement was the rapid growth of a state high-school system. The state institutions of higher learning received more substantial support and their growth was steady. Wake Forest College came into possession of a large bequest. Trinity College, receiving from James B. Duke the sum of $6,000,000 for building and an annual income of more than half a million dollars from a trust fund, established by him, became in 1925 Duke University.

History.—The state Government throughout the period 1910–25 was under the undisputed control of the Democratic party. In 1913 Locke Craig succeeded William Walton Kitchin as governor. Thomas Walter Bickett became governor in 1917, and Cameron Morrison in 1921. The latter was succeeded in 1925 by Angus Wilton McLean. The legislature at every session had large Democratic majorities. One Republican member of Congress was elected in 1914. So confirmed was the Democratic faith of the people of the State that alone of all the States it increased the party majority in the election of 1920. The party majority was again increased in 1924. (J. G. de R. H.)

NORTHCLIFFE, ALFRED CHARLES WILLIAM HARMSWORTH, Viscount (1865–1922), British newspaper proprietor was born July 15 1865 at Chapelizod, Dublin, the eldest of a family of fourteen. His father, Alfred Harmsworth (1837–1889), descended from an old Hampshire family, was a barrister-at-law of the Middle Temple. His mother, Geraldine Mary, who died Aug. 29 1925, a woman of remarkable intellect and strong character, was a daughter of William Maffett.

Of the seven sons, the two eldest, Alfred and Harold, became members of the House of Lords as Lord Northcliffe and Lord Rothermere respectively; the third, Cecil Bisshopp (b. 1869), ecame in 1915 under-secretary for home affairs and in 1919 nder-secretary for foreign affairs, having entered the House of Commons as Liberal M.P. for Droitwich (1906–10) and subequently sitting for S. Beds; while the fourth, Robert Leicester b. 1870), who was created a baronet in 1918, entered the House f Commons in 1900 as Liberal M.P. for Caithness, a seat which e retained till 1922. The other three sons were Hildebrand ubrey (b. 1872), from 1901 to 1904 editor of *The New Liberal Review*; St. John (b. 1876), the creator of the Perrier mineral ater business; and Vyvyan George (b. 1881).

Early Journalism.—It was in 1867 that the Harmsworths oved to London, and the family means were then small. Alfred was exceptionally energetic and thoughtful. At 11 he went to Stamford grammar school and at 13 to Henley House school, West Hampstead, where in 1878 he started the first of his journalistic adventures, a school magazine. This was originally issued in MS. but was afterwards printed and sometimes set up by himself in his spare time. At 15 he did some work for Mr. Jealous, then editor of *The Hampstead and Highgate Express.* In 1881 he began to work under a tutor for Cambridge, while contributing to *The Bicycling News; Globe* and the publications issued by James Henderson for boys and girls. As secretary and companion to one of the third Lord Lilford's sons, he travelled extensively in Europe. On his return to London Sir William Ingram (of the *Illustrated London News*) made him assistant editor of his paper *Youth* and he continued "freelance" work for the Press, contributing leading articles to various newspapers, among which was *The Morning Post*, and articles to the *St. James's Gazette*, where his work attracted the attention and praise of Frederick Greenwood.

But his health temporarily broke down in 1884. Ordered to live out of London, he went to Coventry in 1885 and worked for the firm of Iliffe and Sons, owners of many publications. With them he remained till 1886, and he then went back to London and joined a general publishing business. Among other ventures he started on June 16 1888 *Answers to Correspondents*, a weekly periodical intended to be a more popular form of *Notes and Queries.* As *Answers* it laid the foundation of what eventually became the largest periodical publishing business in the world, the Amalgamated Press. Alfred Harmsworth had already been joined by his second brother, Harold (*see* Rothermere, Viscount), to whom he ascribed a great share of the success of the undertaking, particularly on the business side. He himself wrote much, outlined serials, trained young editors, discovered new writers and artists and revolutionised the current methods of periodical journalism. The profits of the accumulated publications soon soared to £50,000 a year. In the next few years Alfred Harmsworth travelled much in Europe, India, Africa, Canada and the United States; he was a good athlete, excelling in lawn tennis, and in the days before the motor car, which as far back as 1894 became one of his chief interests, was a great lover of horses, fond of cycling and devoted to fishing. On April 11 1888 he had married Mary Elizabeth, daughter of Robert Milner, a West Indian merchant, and to her sure judgment and quick brain he attributed much of his success.

On Aug. 31 1894 he and his brother Harold acquired the London *Evening News*, in which the Conservative party had sunk some £300,000. It was then losing money heavily, but it was at once reorganised with such effect that the first working week yielded a profit of £7, and the first year one of £14,000. In the same year he fitted out an Arctic expedition under Mr. F. G. Jackson, which explored Franz Josef Land. In the general election of 1895 he stood unsuccessfully as a Conservative candidate for Parliament at Portsmouth.

The Daily Mail.—On May 4 1896 a new halfpenny morning paper, *The Daily Mail*, was launched, "the busy man's newspaper," as he called it. It embodied many innovations, a very full service of cables, the employment of numerous famous writers, condensation of unimportant topics, and costly and daring enterprises of various kinds. A comparison of past files of the London Press shows how it revolutionised daily journalism. The most rapid machinery was used; a system of arrangement was introduced which enabled the reader to know where to find the news he wanted. It was characteristic of his foresight that one of the three leading articles in the first number dealt with the then almost unknown motor-car, in the future of which Alfred Harmsworth had a firm belief, being himself already a qualified driver. *The Daily Mail* attained a sale of 600,000 copies a day in the Boer War, and this gave him great influence on policy at home and abroad.

In 1903 he founded *The Daily Mirror;* it was at first a complete failure, losing £1,500 a week but after being transformed from a penny paper for women into a halfpenny illustrated morning journal, became as signal a success. In 1905 a

Continental edition of *The Daily Mail* was established, with headquarters in France. In 1904 Alfred Harmsworth was created a baronet, and in 1905 he was raised to the peerage as Baron Northcliffe. In 1906 he and his brothers acquired for their companies about 3,000 sq. m. of forest land in Newfoundland, with lakes, rivers and water transport, for the manufacture of paper and wood pulp, the result being the formation of the Anglo-Newfoundland Development Co., a gigantic enterprise with its works at Grand Falls, and two lines of railway, a port and Atlantic and other steamers.

In 1908 Lord Northcliffe obtained control of *The Times*, to own which had always been one of the aims of his life. New machinery was installed, and the size of the paper greatly increased; in March 1914 he reduced the price to one penny, with the result of a large increase in circulation, though the enormous rise of 600% in the cost of paper during the World War forced a subsequent increase in price. Meanwhile Lord Northcliffe had acquired *The Weekly Dispatch;* disposed of the Sunday *Observer*, which he for some time owned; and sold *The Daily Mirror* to his brother, Lord Rothermere. Among the reforms which Lord Northcliffe introduced into newspaper management were the five-day week for editors, subeditors and reporters, a more generous payment of journalists and a system of profit-sharing by the chief members of his staffs.

From 1900 onwards, through his newspapers, he had exercised an ever-increasing influence on politics. He had at one time been anxious, like Edward VII. and Cecil Rhodes, to obtain a friendly understanding between England and Germany, but the Boer War caused him to abandon that idea as impracticable. His newspapers consistently pleaded the cause of a strong navy, and as consistently warned the nation for 20 years of the peril from Germany. From 1902 he sought to effect an entente with France, and also to promote agreements with Russia and the United States, whose sentiments and prejudices he had learnt in many visits. He opposed in 1911 the Declaration of London—a code of sea law which most naval officers condemned as "made in Germany"—and finally assisted in securing its rejection. Through *The Daily Mail* he gave large prizes for airmanship, in which, from 1906 onwards, he took the warmest interest; the offer of a prize of £10,000 in 1906 for the first aeroplane flight from London to Manchester was received in some quarters with a good deal of derision, which vanished, however, when in 1910 the prize was won. His maiden speech in the House of Lords was devoted to the pressing claims of aircraft. He was a strong believer in the future of flying and a daily advocate of the value of aircraft in war. He was also interested from the first in submarines, in one of which craft he made an early and hazardous descent.

The World War.—In the World War he took the lead in advocating almost every measure of reform that was carried through in Great Britain, usually weeks or months before it was introduced. He was indeed described by Mr. L. J. Maxse as "the great driving force in our country during the War" (*National Review*, July 1917). He aimed at the most vigorous possible conduct of the struggle, and was from the first of opinion that the War would be long and desperately contested. The chief newspaper campaigns which he carried out, always with the aims of victory and close union between the Allies, were: (1) for the organisation of the munition supply and provision of high-explosive shells in April and May 1915, when he did not hesitate to lay the responsibility for the shortage of ammunition on Lord Kitchener in leading articles written by himself in *The Daily Mail* of May 19 and 21, the second of which was publicly burned on the London and other stock exchanges; (2) this campaign was one of the causes of the formation of the Coalition Ministry by Mr. Asquith; (3) throughout 1915 and early 1916, in the teeth of storms of abuse, he urged the necessity of introducing compulsory service; (4) he protested continuously against the excessive optimism of Mr. Asquith's Govt. and of its Press supporters, and against the whole system of official secretiveness by which grave failure was concealed; (5) he called for the strict enforcement of the blockade and the stoppage of the supplies which were reaching Germany through neutral countries; (6) so far as the censorship would allow, he resisted the "side-shows," such as the Dardanelles and Salonika campaigns, which absorbed so large a part of the national forces; (7) he continued his pre-War demand for the construction of aircraft—and "the right kind of aircraft"—on the largest possible scale, and he called for effective measures against zeppelins and for warnings in the case of imminent air-attacks; (8) he urged the necessity of creating a strong naval war staff and taking offensive measures against the enemy submarines; (9) he insisted on the need for a system of compulsory food rationing.

While always active with his pen and through his Press, he went repeatedly to the various battle-fronts, British, French, Belgian, Italian and American, and kept in close touch with the various staffs. Thus in 1916, at the crisis of the battle of Verdun, he visited Verdun (March 4), conferred with Gen. Pétain, watched the struggle, and the same night motored back to Paris and wrote a long dispatch which was reproduced in whole or part by 3,000 Allied or neutral newspapers. He paid other visits—to Spain, whence he sent warning of the activity of the German propaganda, and to Switzerland, where he investigated the condition of the British interned prisoners. With his daily assistance, Sir R. Hudson raised through *The Times* fund a sum of approximately £21,000,000 for the British Red Cross, while Lady Northcliffe (who in 1918 was created G.B.E.) maintained a private hospital and took a prominent part in the control of Red Cross finance and operations. So wide was Lord Northcliffe's influence and so greatly feared by the Germans that they published a special periodical, the *Anti-Northcliffe Mail*, devoted entirely to attacks upon him as the chief Allied stimulus in the War. In Dec. 1916 he gave his support to Mr. Lloyd George in the political crisis which led to the fall of Mr. Asquith's Government, and dealt the final thrust which brought that Government down, though after the Armistice, by reason of his objection to the long-drawn-out after-war negotiations with the Germans, he became Mr. Lloyd George's most persistent critic. He was offered office but declined, believing that it was his duty to keep his hands free and hold the Government up to the mark.

Work in New York.—Before the United States entered the War he was offered and declined the post of British ambassador at Washington. He received, however, an urgent call to go the United States on May 30 1917. The War Cabinet had greatly desired him, after conference with leading Americans, to go to the United States as chairman of the much-needed British War Mission. He accepted this appointment, though with some reluctance. After an audience with the King, he left England on June 2, arriving in New York on June 11, with the understanding that he should not remain more than three months. During the next few months he co-ordinated the work of the numerous British departmental missions; controlled an expenditure of £10,000,000 to £15,000,000 a week, and maintained the closest and most friendly relations with President Wilson and the American Govt. He returned to London on Nov. 12 1917, when he was created a viscount, as Viscount Northcliffe of St. Peter-in-Thanet, for his services.

In a letter dated Nov. 15 1917 he declined Mr. Lloyd George's offer of the post of Air Minister, but on Feb. 13 1918, on the distinct understanding that he was to remain free to criticise and suggest, he accepted the office of Director of Propaganda in Enemy Countries. To pave the way for operations among the nationalities subject to the Habsburgs, he secured an agreement between the Yugoslavs and the Italian Govt., which played an important part in the defeat of the Austrian Army and was subsequently embodied, in substance, in the peace terms. The evidence of numerous German generals, statesmen and writers is that the skilful direction of his propaganda against Germany helped greatly to destroy confidence in the German people and weaken the German Army on the eve of its last offensive (July 15 1918), when it seemed on the verge of decisive success. Gen. Ludendorff himself says: "Lloyd George knew what he was doing when, after the close of the War, he gave

Lord Northcliffe the thanks of England for the propaganda which he had carried out. Lord Northcliffe was a master of mass-suggestion." The deadliness of his propaganda lay in its veracity. An account of his work was given in Sir Campbell Stuart's *Secrets of Crewe House* (1920), Crewe House being the London headquarters of the organization.

Last Days.—At the Armistice Lord Northcliffe was ill, suffering from an adenoma of the thyroid gland, for which, in June 1919, he underwent a serious operation, and it was only after some months that he recovered. During the Peace Conference his Press and the *Continental Daily Mail* in particular exerted a powerful influence on the British Govt., extracting from Mr. Lloyd George a promise to fulfil his election pledges and striving to maintain the closest and most cordial relations with France. In July 1921 he went for a prolonged tour of the world, as he was medically advised to take a rest cure. Unfortunately his journey tried him to the utmost. He visited the United States, Canada, Honolulu, Australia, New Zealand, China, Japan, Indo-China, India, Egypt and Palestine, but when he returned in early 1922 his friends were deeply anxious for his health. He looked worn and tired. A complete breakdown followed, and after a long illness he died on Aug. 14 1922 of ulcerative endocarditis. It may be said with confidence that he never recovered from the severe strain which the War and his activities during it imposed on his delicate constitution.

In golf and motoring Lord Northcliffe found his main relaxations in later life, and he remained a keen and skilful fly fisherman and salmon angler. He was the author of volumes in the Badminton series on *Motors and Motor-Driving* (1902) and *Tarpon Fishing* (1895), and he also published a collection of letters, telegrams and accounts of his visits to the various fronts (*At the War*, 1916), of which 60,000 copies were sold. A selection from his letters to his family during his last tour was edited in 1922 by his brothers Cecil and St. John and published under the title *My Journey Round the World*. Simple and direct in style, his own writing was always marked by pugnacity and humour. Throughout his newspaper organisations he was accustomed to insist on economy of words and the employment of straightforward Anglo-Saxon diction. (H. W. W.)

NORTH DAKOTA (*see* 19.779), a state of the United States of America. The population in 1910 was 577,056, and in 1920, 646,872, the increase in the decade being 69,816, or 12·1%; in the decade 1900–10, the increase was 257,910 or 80·8 per cent. The United States' census bureau estimate of the population in 1925 was 686,424. The state remains essentially rural, as is indicated by the population of the chief cities in 1920: Fargo, 21,961; Grand Forks, 14,010; Minot, 10,476; Bismarck, 7,122; Jamestown, 6,627; Devils Lake, 5,140. The percentage of urban population (in places having 2,500 inhabitants or more) was 13·6 in 1920, 11·0 in 1910 and 7·3 in 1900. In 1920 the foreign-born white population numbered 131,503; its sources were chiefly Norway (38,190), Russia (29,617), Germany (11,960) and Sweden (10,543).

Agriculture.—There were 75,969 farms in 1925 (U.S. Census Bureau estimate), as compared with 77,690 in 1920 and 74,360 in 1910. The average farm in 1920 comprised 466·1 ac., with 316·2 ac. improved; the value of all property of the average farm was $22,651; the value of land and buildings, $19,160. The average mortgage debt on farms owned wholly by the operators was 28·5% of the value of the land and buildings in 1920, and 22·4% in 1910. The total acreage in chief crops (000's omitted) was as follows:—

	1924	Average 1914–8	Average 1909–13
Wheat	8,685	7,511	8,108
Oats	2,746	2,484	2,208
Barley	1,350	1,638	1,162
Rye	1,129	760	50
Maize	1,137	557	278
Flax	1,129		
Potatoes	130	81	50
Tame hay	1,024	1,028	692

The acreage in flax in 1923 was 1,349,000; the average acreage in 1916–20 was 793,000. The value of all livestock on farms for the years 1919–23 averaged $121,000,000; on Jan. 1 1924 it was $88,000,000.

Education.—A state normal school was opened in Minot in 1913 and another at Dickinson in 1918. The number of children of school age in 1924 was 212,872; the number enrolled in public schools, 174,797; the average daily attendance, 144,263.

Finance.—The state bonded debt July 1 1925 was $27,859,000. The receipts for the biennium ending June 30 1925, were $20,646,922.75, and the expenditures, $16,566,560.21. For the year ending June 30 1925, the income tax yielded $402,530.43. New sources of revenue created after 1911 were: inheritance tax, capital stock tax, oil tax, motor-vehicle licence tax and gasoline tax.

Government.—The state Supreme Court was by constitutional amendment increased to five members in 1908, and by a further amendment adopted in 1918 the power of the court to declare legislation unconstitutional was limited to cases in which four of the five judges concurred. In 1914 by constitutional amendment the initiative and referendum were made applicable to all legislation, and provision was made that a constitutional amendment could be initiated by popular vote. Other amendments gave the legislature power to exempt from taxation all personal property and to levy an acreage tax on farm land to provide funds for a state system of hail insurance.

History.—Serious abuses in grain grading and marketing had been pointed out by the state Bankers' Assn. as far back as 1906. An amendment to the constitution, ratified by popular vote in 1912, made it legal to provide a state-owned terminal grain elevator. A second amendment for a terminal elevator within the state became effective in 1914. In the spring of 1915 a movement was begun to organise the farmers politically (in the Non-partisan League) upon the following platform: (1) state ownership of terminal elevators, flour-mills, packing houses and cold-storage plants; (2) state inspection of grain and grain dockage; (3) exemption of farm improvements from taxation; (4) state hail insurance on an acreage basis; (5) rural credit banks operated at cost.

The movement was so successful that by Nov. the membership of the league was 26,000. The first state convention of the league was held at Fargo, March 28 1916, and a full state ticket was nominated. At the primary election in June all the nominees supporting the league were elected, with the exception of the state treasurer. The legislature (1917) was divided; the House was controlled by the supporters of the league, the Senate by its opponents. The legislature provided for: (1) state grain grading; (2) Torrens land title registration; (3) state guarantee of deposits in state banks; (4) reduction of assessments on farm improvements to 5%; (5) a state highway commission; (6) a tripling of the former appropriation for rural schools.

In 1918 the Non-partisan League elected the governor and a majority of both branches of the legislature. The measures passed at the legislative session of 1919 were in accordance with the pledges made by the party leaders. There was created in 1919 an Industrial Commission, (1) to manage, operate and control all state-owned utilities, industries and business projects created by law; (2) to purchase or lease sites for these industries; (3) to sell all such property and to fix prices of all products of these industries; and (4) to provide funds by the sale of bonds for the carrying on of the state-owned industries and other business undertakings. The State Bank of North Dakota began business on July 28 1919 as an institution founded, owned and controlled by the state, which therefore guarantees all deposits in this bank and also all bonds that are handled by the state.

The recall election of Oct. 28 1921 resulted in the recall of the three Non-partisan League Officials who composed the Industrial Commission; the governor, the attorney-general, and the commissioner of agriculture and labour. At this election, however, the constitutional amendments and initiated laws which were proposed for the purpose of changing or overturning the programme of the Non-partisan League were all defeated by substantial majorities. The recalled governor, Lynn J. Frazier, was elected U. S. Senator in 1922.

The state governors from 1907–25 were: John Burke (Dem.), 1907–13; L. B. Hanna (Rep.), 1913–7, Lynn J. Frazier (Rep.), 1917–21; R. A. Nestos (Rep.), 1921–5; A. G. Sorlie (Rep.), 1925– (O. G. L.)

NORTHERN TERRITORY (*see* South Australia, 25.492), a territory of the Australian Commonwealth. Its area is 523,620 sq. miles. The total population in 1925, exclusive of aborigines, was 3,597, of whom 2,250 were whites and the remainder Asiatics, mainly Chinese. The white population reached its maximum in 1919 with 3,767 persons; after that date it declined, mainly owing to the closing of the meat works at Darwin. The total number of aboriginals in the territory was estimated at 20,700 in 1924.

History.—The Northern Territory Acceptance Act, 1910, transferred this territory from the jurisdiction of the State Government of South Australia to that of the Commonwealth Government, as from Jan. 1 1911. The territory is governed by a resident administrator who is responsible to the Federal Minister for Home and Territories. The seat of administration is at Darwin. The administrator is vested with supreme authority in internal affairs, with the exception of railways, posts and telegraphs, customs, taxation, public works, which are controlled by the appropriate Commonwealth authority. The Northern Territory Representation Act, passed in 1922, provided for the election of one member to represent the territory in the House of Representatives. The member is entitled to take part in any debate in the House, but not to vote. In March 1926 the Commonwealth Parliament passed the Northern Australia Bill providing for the division of the territory at the 20th parallel, the northern part to be known as North Australia, and the southern as Central Australia. The seat of administration of the former will be temporarily at Darwin and ultimately at Newcastle Waters. The seat of administration of Central Australia will be at Alice Springs. Under the Act a commission of three members is to be appointed, with full control over the railways, roads, etc., to prepare and carry out schemes for the development of North Australia. A resident and advisory council will also be appointed.

Production.—Agriculture had made little progress in the territory by 1925, although it had been found that rice, tobacco, coconuts, mangoes, cotton, various fodder plants and peanuts thrive well. The cattle industry made considerable progress, and in 1924 there were over 843,000 head in the territory. Great impetus was given to the industry in 1917 by the opening of extensive meat works at Darwin. Chiefly owing to labour troubles the works closed down in 1920 and the practice was resumed of overlanding surplus stock to neighbouring states. For various reasons sheep raising has not been successful, but horses thrive well, and in 1924 there were about 44,600 horses in the territory. Minerals to the value of £18,856 were produced in 1924, tin ore accounting for £12,855, gold £2,988 and mica £2,718. Production fluctuates considerably: in 1922 it was at its lowest ebb, amounting only to £9,959; in 1920, it was £80,101 which included wolfram to the value of £45,648, tin ore £27,610 and gold £5,282.

The problem of developing the territory depends largely on the development of means of transport and communication. The only railway line in the territory in 1925 was from Darwin south to Emungalan—198½ miles. The line to connect up with Oodnadatta, South Australia, 1,012 m., had been surveyed, and the construction of the section southwards to Daly Waters, 160 m., authorised; the section running northwards from Oodnadatta to Alice Springs, 297 m., was agreed upon early in 1926 (*see* Australia).

NORTHUMBERLAND, ALAN IAN PERCY, 8th Duke of (1880–), was born April 17 1880, a son of the 7th Duke. He succeeded to the title in 1918 as the eldest surviving son of his father, his elder brother Henry Algernon George, Earl Percy (*see* 19.788) having died prematurely in Paris Dec. 30 1909. As one of the largest coal-owners in the north of England, he was summoned to appear as a witness before the Sankey Coal Commission (1919) and came much into public notice owing to his prolonged controversy with Mr. Robert Smillie, the leader of the miners, and subsequently to his anti-Communist campaign. In 1924 the Duke acquired an interest in *The Morning Post* newspaper when Countess Bathurst sold that journal to a company of which he became chairman. He married in 1911 Lady Helen Magdalen Gordon-Lennox, youngest daughter of the Duke of Richmond and Gordon.

His father, Henry George Percy, the 7th Duke (1846–1918), was born May 29 1846 and succeeded to the title in 1899. He sat in the House of Commons as Conservative member for Northern Northumberland from 1868 to 1885 and died at Alnwick May 14 1918.

NORTHWEST TERRITORIES (*see* Canada, 5.142), territories of the Dominion of Canada. In 1912 that part of northwest Canada known as Ungava was incorporated in the province of Quebec, and the area of Kewatin south of 60° N. latitude was divided between Manitoba and Ontario. The Northwest Territories in 1926 consisted of the provisional districts of Kewatin, Franklin and Mackenzie, and included that part of Canada north of the 60th parallel, N. lat., between Hudson Bay on the E. and the Yukon on the W., including the islands in James Bay, Hudson Bay, Hudson Straits and other northern waters. The extent of these territories is estimated at 1,242,224 square miles. Of this area 34,298 sq. m. are covered with water. Many of these northern regions are uninhabited; parts are even unexplored. In 1921 the population amounted to 7,988. Of this number 3,873 were Indians, 3,242 Eskimos, 473 of British stock and 258 French.

The territories are administered by the Northwest Territories' branch of the Department of the Interior. The government is carried on under the direction of a commissioner and five councillors. Law and order are enforced by members of the Royal Canadian Mounted Police.

Fur is an important product: for the season 1922–3, the number of pelts purchased by traders amounted to 287,698 valued at $2,171,424. The territories have been widely searched for oil and other minerals, and oil in paying quantities has been discovered in the Fort Norman area. Agricultural possibilities are limited to the Mackenzie district, where cereals and vegetables have been successfully grown.

Two routes lead into the Mackenzie district, the one from McMurray, to which a railway has been constructed, via the Athabasca, Slave and Mackenzie rivers, the other *via* the Peace, Slave and Mackenzie rivers. Boats ply on these rivers during the summer, and in winter travel is confined to dog trains. Radio communications now keep the trading posts in touch with the outside world. (*See* Canada.) (D. A. MacG.)

NORWAY, or Norge (*see* 19.799), a kingdom of northern Europe and a member of the League of Nations. Its estimated area is 124,495 sq. m. and the population (1920) 2,649,775, including 19,328 Laps, 7,399 Finns and 2,814 Lap-Finns.

I. POLITICAL HISTORY

1910–1914.—The dissolution of the union between Norway and Sweden in 1905 was followed by new elections in the following year; these, for the first time, being direct elections by constituencies. There were no great political issues; the programme of the Coalition Govt. was a proclamation of trust in the Michelsen Cabinet and its willingness to "safeguard and consolidate the results of 1905." The Labour party had, however, now entered the field. The elections gave it 10 seats, the Conservatives 36, the Liberals and Left parties 77. Party dissension began to appear and weaken the coalition. After Michelsen resigned (Oct. 1907) he was succeeded as Premier by his Minister of Foreign Affairs, R. Jörgen Läland. Most of the Left then reorganised as the Consolidated Left under Gunnar Knudsen, who became Premier in March 1908. Knudsen's administration carried through the "concession laws," making it impossible to buy waterfalls of more than 1,000 H.P., forests, mines and other real property, without a concession from the government.

The Conservative parties sharply opposed these laws, as too severe an encroachment on private property; especially the proviso that concessions should not be granted for more than 60 years, and that on their expiration all waterfalls, power stations, etc., should become national property without compensation to the owners. In March 1909 a group of the old Liberals reorganised as the Liberal Left. In the general elections of Oct. 1909 the Conservatives and Liberals secured 63 seats, as against 47 Radicals, 11 Socialists and two Independents, and on Feb. 1 1910 formed a Coalition government under the old Liberal leader Wollert Konow. In 1911 the government passed a new taxation law introducing compulsory declaration of income and limiting rights of municipal taxation. Owing to persistent friction on the *landsmål* question (*see* NORWEGIAN LITERATURE), Konow resigned (Feb. 1912), and was succeeded by the Conservative leader Bratlie. But this friction had weakened the coalition; the elections of 1912 returned 76 Radicals against 24 Conservatives and Liberals and 23 Socialists. Knudsen again became Premier, with Castberg the leading member of his Cabinet. Controversy centred round the so-called "Castberg laws," giving illegitimate children equal rights of inheritance with legitimate, except in the case of peasants' farms, and imposing on the fathers increased obligations to protect their illegitimate children and the mothers of them. The laws were passed in 1915 by the radical majority, after Castberg had left the Cabinet. In 1914 the centenary of the Norwegian constitution was celebrated.

1914–1918.—A controversy with Sweden concerning the suzerainty over a group of submarine skerries, Grisebaaerne, was decided by The Hague Tribunal in 1908. The World War brought the three Scandinavian countries closer together. On Aug. 1 1914 they proclaimed strict neutrality in the conflict between Austria-Hungary and Serbia; on Aug. 4 this declaration was repeated and extended to form a general rule of conduct during the War. On Aug. 8 a separate Norwegian-Swedish agreement was signed to remove any possibility of either country preparing hostile actions against the other. On Dec. 18–19 the three Scandinavian kings with their premiers and foreign ministers met in Malmö to discuss joint action regarding the diplomatic and international questions raised by the War. Similar conferences of the Scandinavian premiers and foreign ministers were held in Copenhagen (March 1916), in Oslo (Sept. 1916), in Stockholm (May 1917), Copenhagen (June 1918), Stockholm (May 1919), Oslo (Feb. 1920) and in Copenhagen (Aug. 1920).

After the first panic at the outbreak of war, both public and private enterprises made vast profits and incurred extravagant expenditure. Wages and salaries rose rapidly; the shipping companies paid huge dividends; all sorts of new financial and industrial enterprises were started; imports reached an enormous height. The War elections of 1915 returned the previous government with an increased majority; 80 Radicals were elected, 20 Conservatives, 19 Socialists and 4 Independents. The government received extraordinary powers. A victualling commission controlled prices and imports, and a price directorate controlled retail prices. In 1916 grains and cereals, meat, sugar, coffee and tea were rationed. Temporary prohibition was enforced in Dec. 1916, making all trade in liquors and brandies a penal offence. In June 1917 all trade in wines of an alcoholic strength of over 12% was prohibited. In July 1916, as the result of a violent struggle in the labour market, an emergency measure was passed—under protests from both Labour and Conservatives—prohibiting strikes and lock-outs and enforcing public arbitration in industrial conflicts. In spite of extraordinary revenues, however, the national debt, thanks to the needs of defence and bonuses to officials, rose from 362,300,000 kroner in 1914 to 736,600,000 kroner in 1917 and 1,008 million at the end of 1918.

The new elections in the autumn of 1918 brought a strong reaction. The Radicals lost 26 seats, the Socialists lost one, the Conservative-Liberals gained 30. These elections threw into relief the unfair electoral system, which had hitherto secured the Left a number of seats out of all proportion to the votes cast for them. The Conservatives, assisted by Labour—where the moderates were losing power in consequence of the impossibility of achieving results by Parliamentary methods—were now able to introduce and pass proportional representation. The Knudsen cabinet tendered its resignation in Jan. 1919, but as the Conservatives had no working majority it continued to sit till June 1920, when Otto Halvorsen, the Conservative leader, succeeded Knudsen as Premier.

1920–1925.—Halvorsen's Cabinet was immediately faced with the most formidable labour troubles. The Norwegian Labour party had been organised in 1882 but remained unimportant until after 1905. The first Socialist members of the Storting represented, not the industrial workmen, but the fishing population of the north against the big fish merchants and exporters. After 1906 more Socialists entered the Storting and gained rapidly in influence. They collaborated closely with the trade unions. The first of these had been organised in 1872; in 1889 existing trade unions were merged into the National Federation of Trades Unions under a central committee, elected partly by the trade unions, partly by the Labour party. The trade unions were similarly represented in the executive committee of the Labour party. From 1912 on a Radical minority became prominent; under the influence of the Russian revolution of 1917 it gained the upper hand at the party congress and in the executive committee in 1918; in 1919 the Norwegian Labour party joined the Third International, and sent a member to the executive committee in Moscow. The moderate leaders then left the Labour party and founded the Social Democrat party.

A wave of revolutionary feeling spread over Norway, the fruits of which were the "revolutionary" railway strike of Dec. 1920 and the national strike of May 1921. The Cabinet met both strikes successfully; the railwaymen (who were State employees) capitulated unconditionally after 17 days, and the national strike proved a fiasco and caused much bitterness against the radical leaders and Moscow. The Conservative position was strengthened; yet in June 1921 the Government was defeated on the prohibition question and resigned.

In Oct. 1919 a referendum had sanctioned the temporary prohibitions of 1916 and 1917 by 489,660 votes cast for prohibition to 305,241 against, over 410,000 votes not being cast. The Norwegian constitution does not provide for a referendum; but all parties felt the force of this expression of popular opinion. Yet the Conservatives were unwilling to legalise prohibition before reaching an arrangement with the wine-exporting and fish-importing countries of Southern Europe. The result of the prohibition policy was a trade war with Spain and Portugal, which cost Norwegian shipowners and the whole fishing population heavy losses. Moreover, the moral results of prohibition were very disappointing. Before it, Norway had been a very sober country; local prohibition was widespread and the liquor trade under control; the consumption the lowest in Europe, except Finland, and smuggling unknown. Now smuggling increased enormously, as did secret home distilling. The prohibitionists, supported officially by the Left, Labour and Socialists, were passing through severer laws and stricter control.

The elections of 1921, on the revised basis, gave 57 seats to the Conservative-Liberal coalition, 39 to the Left, 29 to the Labour party, 8 to the Socialist, 17 to the new Farmers' party. The Government, although it had lost seats and votes, remained in power, the Left holding the balance between Conservatives and Labour. Otto Blehr, who had succeeded Halvorsen, was unable to come to terms with Spain and Portugal while maintaining prohibition. The cabinet was voted down on March 2 1923. The second Halvorsen Govt. came in, and on the 17th the prohibition laws were revised and the importation of port and sherry allowed. A few days later a new treaty was concluded with Portugal, and the commercial war with Spain came to an end. The importation and sale of wines and brandies is now a monopoly under government control. The shareholders get 6%, the surplus (in 1925 5,000,000 kroner) goes to public funds. The temporary measure enforcing public arbitration in industrial disputes expired in April 1923 and was not renewed.

Halvorsen died suddenly May 23 1923. He was succeeded as Premier by his Minister of Finance, Berge. Berge had an insecure majority, but the public desired stability in the financial crisis which was overtaking banks and municipalities. But in July 1924 Berge wanted prohibition replaced by a well-controlled sale of highly taxed brandies, pointing out that smuggling had increased enormously, while drunkenness had but little diminished since prohibition. The Left, Labour and some of the Farmers' party, however, desired another referendum before abolishing prohibition. Berge resigned, and was succeeded by J. L. Mowinckel.

In Oct. 1924 there were new elections, the Left losing three seats. The Labour party had split again in the preceding autumn; the Norwegian party had withdrawn from the Third International; whereupon their left wing organised the Communist party, which remained affiliated with Moscow. The elections gave the Social Democrats 8 seats, the Labour party 24 and the Communists 6. The Left came in with 36, the Conservative coalition with 54 and the Farmer's party with 22. The Conservative parties thus had a majority of two in the new Storting; but as the Farmers' party refused to form an active coalition the Mowinckel Govt. retained office till March 1926, when they were defeated on the budget and succeeded by a Conservative Cabinet under Lykke. The municipal elections of Nov. 1925 also brought victories to the " bourgeois " parties at the expense of the Labour party, and even more the Communists.

The Spitsbergen archipelago had from time immemorial been under the suzerainty of Norway, but when the discovery of coal on them gave them a new value certain complications arose, resulting in various international conferences in Oslo; the Versailles Treaty gave this group of islands and Beeren Island to Norway, who solemnly took them over in the summer of 1925. On March 4 1920 the Storting resolved that Norway should join the League of Nations. In the following years there was some friction between Norway and Denmark concerning Greenland, which had belonged to Norway until the union with Denmark was severed in 1814. Norway had always resented the loss of Greenland, and its east coast had been regarded as the fishing and hunting ground of the Norwegian west coast population. Denmark's request in 1919 for recognition by the Powers of Danish suzerainty over the whole of Greenland renewed the question and led to a separate agreement between the two countries, neither giving up its principal contention, but both agreeing to regard the east of Greenland as no-man's-land *vis-à-vis* the other. Treaties of unconditional arbitration were concluded with various Powers (Germany, Uruguay, etc.) from 1924 and onwards.

Defence.—The army is a national militia with universal and compulsory service from the ages of 18 to 55; men are called up at the age of 20 and belong to the line for 12 years, but the period of service is short: from 48 to 102 days according to the branch of the service, with four subsequent periods of 24 days each. The strength of the permanent establishment, which includes the General Staff, the Guards battalion, army schools and garrison troops, in 1924 was 5,801 all ranks; the numbers trained in that year were 19,280. In event of mobilisation, a further 300,000 men would be available. The navy is designed only for coast defence duties, and comprises four small battleships, three destroyers, 29 torpedo boats and six submarines. Its permanent establishment is about 1,200 all ranks. All seafaring men between the ages of 20 and 44 are enrolled on the lists of the active fleet, and are liable to service.

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(C. HA.)

II. FINANCIAL AND ECONOMIC HISTORY

The confidence engendered by the new political situation in Norway led to a remarkable expansion in all fields from 1905 on. Many large new industrial undertakings were founded with foreign capital, and smaller concerns for the home market. During the three years 1911–4 the export trade became important, and a substantial rise in international freight prices brought an influx of capital which completely changed the Norwegian money market. Both prices and wages rose substantially; indeed, in 1913, the contrast with the general tendency elsewhere grew disquieting. During the first half of 1914 there was a heavy contraction of the markets on which Norwegian exports chiefly depended; but conditions in the home market were not impaired. In July 1914 the resident population was approximately 2,471,000 an increase of about 88,000 since the census of 1901 in spite of an emigration, mainly to the United States, which aggregated 31,500 in 1911–3. The chief increase of population was in the industrially developing regions of the north, south, east and Trondhjem; in the inland peasant districts and on the south and west coast the population was stationary or declining.

Agriculture and Forestry.—In 1907 the cultivated area was officially estimated at 2,200,000 ac.; since then about 150,000 ac., chiefly in west and north Norway, had come under plough. Small holdings, occupied with root crops and cattle raising on modern methods were on the increase. The average annual value (1904–14) of the products of forestry (exports only) exceeded £400,000. Forestry made important progress, thanks to the efforts of the State and the Norwegian Afforestation Association (founded 1898) which up to 1913 had planted 104,000,000 new trees; nevertheless, the annual lumbering exceeded the growth.

Fishing Industry.—The fisheries were changing character from coastal to modern deep-sea concerns. In 1914 the Norwegian fishing fleet consisted of about 550 registered vessels (above 25 gross tons for steamers and 50 for sailing boats, most of which were now provided with motors). The Antarctic whaling industry initiated in 1906 was growing rapidly; in 1913 there were 54 whaling companies with 160 vessels, 36 floating factories and 30 permanent stations. The capital invested in whaling exceeded £2,220,000. In 1914 the output of Norwegian mines was 1,200,000 tons, over three-quarters being iron ore and sulphuric pyrites. The production of iron ore was increasing, and in 1915 reached the record figure of 715,000 tons; but sank later owing to extraordinary difficulties.

Commerce.—Between 1897 and 1914 the number of industrial workmen rose by 100 %, wages by 225 %. The mercantile marine evolved rapidly from sail to steam; in 1914 Norway possessed a fleet of 1,973 steamers and 1,106 sailing vessels with gross tonnages of 1,793,227 and 687,968 respectively with a total value of £19,000,000. From 1911–3 inclusive the value of imports rose from £26,000,000 to £30,680,000, and of exports from £16,600,000. to £21,800,000. Great Britain supplied most of the imports, Germany took most of the exports; but there were signs that this position would be reversed.

Effect of the World War.—The outbreak of war brought a sudden check and temporary panic, followed by great prosperity up to the entry of the United States into the War in 1917. After this event the restrictions on neutral trade became very oppressive and seriously curtailed Norwegian business profits. Meanwhile the general expansion continued. The arable area was extended, and the corn crop rose from 290,000 tons in 1917 to 4,400,000 in 1918. In these two years official investigations were conducted to determine the limit to which cultivation could be extended; and this limit had been reached by 1925. The area covered with forest was approximately 28,422 sq. m. in 1917, or 22·9-7 % of the total area of Norway. Between 1916 and 1920 the average annual export value of pulp and paper products was about 321,900,000 kroner.

The revenues that are derived by the state from the fisheries were very satisfactory up to 1916; in that year the revenue from the large cod fisheries was 70,800,000 kr., which decreased to 41,000,000 kr. in 1917 and 30,000,000 kr. in 1918; the value of the herring fisheries dropped from 71,500,000 kr. in 1916 to 60,600,000 in 1917, 51,700,000 in 1918; trade restrictions, shortage of petrol, and floating mines were serious difficulties. In 1919 the Storting adopted the Government Bill on the establishment of a Fishing bank for safeguarding the interests of the fishing population. The whaling industry declined throughout the War, many vessels being diverted to the general freights. Norwegian whale oil had been 78% of the world's output in 1913; in 1918 it was only 43·5 %.

Shipping.—The chief fluctuations were in the shipping trade. The heavy demand for tonnage by the belligerent powers brought an early and very rapid rise in freights which continued throughout the War and gave rise to unparalleled speculation. The annual profits of Norwegian shipping 1914–8 were about 500,000,000 kroner. But the gross freightage profit did not rise proportionately with freights on the open market, partly owing to the depreciation of sterling, partly to hampering restrictions, rising expenses and heavy taxation. Eight hundred and twenty-nine vessels with an aggregate gross tonnage of 1,250,000, and 1,162 lives were lost during the War. Norway escaped the first decline in the international market after the War, owing partly to the depreciation of the kroner, partly to the sustained demand for products of the wood-refining industry. In 1920 conditions grew gloomy, especially in shipping, the bottom having been knocked out of freights. The State and the municipalities were borrowing heavily, and bank loans rose by 300,000,000 kr. in the year to over 4,000,000,000 kr., while deposits rose only by 100,000,000 kr. to 3,400,000,000, and foreign credits of Norwegian banks were reduced from 152,000,000 to 17,000,000 kroner.

Foreign Exchange.—In 1921 the kroner dropped heavily, weakening the position of Norwegian exporters, especially in the pulp and paper industry. Many works closed down or worked short time. By midsummer 1,400,000 tons of the mercantile fleet were lying idle. The trade balance, however, improved as regards exports. From 1922–5 conditions improved gradually in spite of the banking crisis of 1922-3. Thirty-four joint stock banks were put under public administration; 10 will definitely be wound up; the fate of the rest will be settled in 1926. The chief problems of to-day are the exchange owing to the over-rapid rise of the kroner in 1925, and the public debt which has been swollen by recent passive budgets.

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NORWEGIAN LITERATURE (*see* 19.815).—The first decade of the 20th century marks the passing away of the four great classics of the preceding age: Ibsen, Björnson, Lie and Kielland. Thereby the field of fiction was thrown open to a new generation of authors, who found themselves confronted with problems essentially different from those which had taxed the attention of the former generation.

Norway was no longer the country of consuls, shipowners, vicars, rectors, chamberlains and estate owners, representing official views and opinions against which persons not "made of that self metal" occasionally revolted, and always with deplorable result to their own social interests; nor was Norway the country of women suffering in silence under slow torture of an apparently correct marriage, or a country of workers imbued by a patriarchal respect to their employers, based on personal connections from generation to generation. On the contrary, thanks primarily to the claim of the right of personality which had been raised so energetically and consistently by the authors of the preceding age, Norway had gradually developed into a community in which democracy had established itself on a broad basis, and in which, generally speaking, a remarkably tolerant spirit prevailed. At the same time, a number of social and economic questions had come to the forefront in consequence of the extraordinary industrial development which had taken place, especially since the beginning of the 'nineties. It might have been expected that all these facts and features, which should be taken into consideration for a fair judgment on the position of Norwegian literature on the eve of the new epoch, would have contributed to bring about a new departure in literature, but nothing of the kind happened.

Drama.—As far as the drama is concerned, its flourishing age came to an end with the age of Ibsen and Björnson. Their younger contemporary, Gunnar Heiberg (1857–) who after their death was considered the greatest dramatic author in Norway, did not, however, develop any further in this line, and as a whole the Norwegian drama since Ibsen and Björnson has followed more fortuitous lines. This applies, by way of example, to *The Happy Election*[1] (1914) by Niels Kjaer (1870–), in which this author, who is considered one of the most accomplished writers of modern Norwegian prose, deals with certain contemporary phenomena of Norwegian politics, among them the language question, in a very clever and realistic way. Another example is Oskar Braaten (1881–) who has scored great success on the stage with his comedies *The Kird* (1911) and *The Wholesale Christening* (1925), written in the characteristic language of the industrial population in the vicinity of Oslo and dealing with its life and manners. A dramatist of an entirely different type is Hans E. Kinck (1865–), whose remarkable drama *The Cattle Dealer* (1908), in the opinion of many critics, is unrivalled in Norwegian literature since Ibsen's *Peer Gynt.* This drama, which is too unwieldy for the stage notwithstanding its intrinsic merits as a work of fiction, has never been performed, contrary to his Italian drama *Agilulf the Wise,* which was acted at the National Theatre in the spring of 1910, when it gave rise to a lively discussion engendered primarily by the sovereign way in which the author disregarded the conventional rules of rhythm and stanzas.

Fiction.—An examination of the history of the Norwegian novel during the same period leaves a more satisfactory impression for the very simple reason that this special form of art had not reached the same state of perfection as the drama at the end of the preceding period and, accordingly, contained possibilities of a further development. By that time some 20 years had passed since Hamsun had made his appearance in literature. Within this period he had produced a number of works, generally written in an exquisite style and filled with an exuberant vitality, of which *Pan* (English translation) 1895, ranks particularly high. Compared with this work, the *Growth of the Soil* (1917; English translation 1920), by which Hamsun has become famous all over the English-speaking world, does not approach it in range of passion and in mystic grandeur. The former is a consummate work of fiction and art. The latter is an exceedingly fine novel, inspired by the cooler views of the more mature years as well as of a more prosaic age. In the struggle between the ideas of agriculture and the ideals of industrialism, Hamsun, like the rest of his contemporaries, sides with the representatives of the "mother trade of the country" notwithstanding the marvellous industrial transformation of Norway during the last generation, or perhaps we should rather say because of it. This even applies to Kinck, who is anything but prepossessed in favour of the peasants.

Kinck, who is by all critics admitted to be an author of rare gifts, has not yet received general recognition either at home or abroad. Yet by his daring metaphors, his exuberant passions, his deep psychology supported by extensive historical studies, he is one of the most intimate guides to the depths of the Norwegian mind. His Hardanger novel, *The Avalanche* (1919–20), is considered his greatest work, but generally speaking he is at his best in the short story. Another classic writer is Trygve Andersen (1867–1920), a self-controlled author with a limited production but whose work is stamped by a keen psychological insight and imaginative inspiration and moulded in an exquisite and transparent style.

Besides these three poet-artists and classics should be mentioned Johan Bojer (1872–) whose novels notwithstanding their fame in the English-speaking world and elsewhere are not considered by Norwegian critics as revealing any particular feature typical of the Norwegian mind. A more intimate author is Peter Egge (1869–), a conscientious writer with an artistic style which adds to his original gifts as a narrator and psychologist.

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[1] In this article the titles of books are translated into English for the convenience of the reader, although unless otherwise stated the books themselves have not been so translated. (Ed. E. B.)

One of the chief characteristics of Norwegian literature during the last generation is the ever-increasing number of local authors who, substituting particular districts for the country as a whole, have given rise to local literature, partly written in the literary tongue of the country known as the *Riksmaal,* partly in the *landsmaal* (*see* 19.818) or in a *riksmaal* coloured to a marked degree by some local dialect. The most conspicuous of these authors are Oskar Braaten, Hans Aanrud (1863–) who scored success as a playwright of broad humour in the 'nineties, and Johan Falkberget (1879–)—all typical East Norway novelists. Braaten's literary domain, not only as a playwright but as a novelist, is the industrial quarters in the immediate neighbourhood of Oslo. Aanrud is a keen observer of life and manners in the midland countries round Lake Mjösen. Falkberget is intimately acquainted with the miners of the mountain districts of the valley of Österdalen, whom he has depicted vividly in surroundings of an overwhelming nature.

Gabriel Scott has, in an idyllic novel *The Source* (1918), found an exquisite expression of the typical Sörland (literally Southerland) nature and Sörland temper as they reveal themselves all through the charming coastland. West Norway country life has been ably sketched by Jens Tvedt (1857–), who writes in the *landsmaal.* The particular district of the North Trondhjem country, known as the valley of Namdalen, has in Olav Duun (1876–), whose works all deal with life and manners in his native valley, produced the most gifted author of modern times writing in the *landsmaal.* Another significant author in the same language is Kristofer Uppdal (1878–), originally a navvy whose works in prose and poetry are imbued by the ideals of the labour movement. This tendency in the direction of developing a special county or district literature, as it were, is intimately connected with the national current which in 1905 brought about the dissolution of the Union with Sweden and which since then has given rise to a rather voluminous literature dealing with the local history, of which Madame Sigrid Undset may be considered the chief exponent.

Poetry.—In the noble art of poetry Nils Collett Vogt (1864–), who already in the 'nineties was known as a highly gifted lyric poet, continued to proclaim his emotions in stanzas of vigorous and beautiful metaphors. Olaf Bull (1882–) combines to a rare degree a refined versification with silent resignation and lofty enthusiasm. Herman Wildenvey (1885–) a genial troubadour talent, sings out his joys, his cares and his whims in easy verses and metaphors, striking by the felicity of phrase. Simultaneously with this lyric flourishing in the *riksmaal,* no adequate revival has taken place in the *landsmaal.* The gem of lyric poetry in that tongue is Haugtussa (1895), a lasting tribute to the genius of Arne Garborg (1851–1925), by whose death the *landsmaal* literature was left temporarily without any first rate lyric poet. (S. C. H.)

NORWICH, England (*see* 19.819), is extending and enlarging its industries. Its banking interests are less localised than formerly, owing to amalgamations, but it is the headquarters of the Norwich Union Life Office and the Norwich Union Fire Office, which societies have been under one control since 1925. The area of the borough is 7,923 ac., and the population was 120,661 in 1921. The chief magistrate was created lord mayor in 1910. The church of St. Luke's, New Catton, was consecrated and given a parish in 1915.

The house in which George Borrow resided with his parents when in Norwich is now a Borrow Museum, presented by Mr. A. M. Samuel, M.P., in 1913. Stuart Gardens, bequeathed to the city by the late Mrs. James Stuart as a memorial to her husband, was formally presented in 1922, in which year the Strangers' Hall, a 15th-century house on Charing Cross, was given as an English folk museum by Mr. L. G. Bolingbroke. In 1921 Sir Eustace Gurney presented to the city the Lazar House, a fine Norman relic contemporary with the cathedral, for the purpose of a branch public library, and as such it was opened in 1923. The City Bridewell, a fine old, flint-faced building, was presented by Mr. H. N. Holmes in 1923, and after restoration was opened in 1925 as a museum of local industries, past and present. In 1925 Miss Ethel M. Colman, the first lady in the country to hold the office of lord mayor (1923–4), and her sister, Miss Helen Colman, restored and presented to the city Suckling House (14th century), together with the adjoining Stuart Hall, which was erected by them as a memorial to their sister, Mrs. James Stuart, to be used for educational purposes. In the same year the famous Samson and Hercules House on Tombland, and the adjoining Augustine Steward House, were opened as a Y.W.C.A. centre, and the ancient and almost unique bishop's throne in the cathedral was restored by the bishop, (the Rt. Rev. Bertram Pollock).

In Jan. 1925, Prince Henry laid the foundation stone of a new children's block at the Norfolk and Norwich Hospital, and this was opened in Jan. 1926. The Maddermarket Theatre, an exact model of an Elizabethan theatre, in a building once a Roman Catholic chapel, was opened in 1921 for performances by the Norwich Players, an amateur dramatic company. Considerable developments in town planning have taken place, and several new arterial roads have been made. In 1923 the new Carrow Bridge over the river Wensum was formally opened by the Prince of Wales, and in 1925 Wensum Park was opened on the site of a refuse ground.

See Ian Hannah, *Heart of East Anglia* (1914); G. A. Stephen, *Guide to the Study of Norwich: a Bibliography,* 2nd. ed. (1919).

NOSE: *see* EAR, NOSE AND THROAT, DISEASES OF.

NOSKE, GUSTAV (1868–), German politician, was born in Brandenburg July 9 1868. He became a writer for Social Democratic papers and from 1897–1902 worked on the staff of the *Königsberger Volkszeitung* and later the *Volksstimme,* at Chemnitz. Returning to Brandenburg in 1902, he was elected to the municipal council, and in 1906 entered the Reichstag. Throughout the World War Noske belonged to the majority Socialists. In Nov. 1918 he accompanied the secretary of state to Kiel and arranged a suspension of the mutiny then prevailing. He remained in Kiel as governor till Feb. 11 1919, when he returned to Berlin as minister of national defence. In his book *Von Kiel bis Kapp* (1920) he gives an account of his difficulties in organising an army for home defence. On the occasion of the Kapp coup of March 1920 Noske was unable to prevent the occupation of the capital by Gen. von Luttwitz and fled with Ebert and Bauer to Dresden and later to Stuttgart; but after the suppression of the Kapp troubles it was impossible for him to resume office, owing to his lenient treatment of the military reactionaries, coupled with his ruthless suppression of Communist rioters.

NOTTINGHAM, England (*see* 19.826), with an area of 10,935 ac. and a population in 1921 of 262,624, has several flourishing industries, although the lace trade is less prosperous than formerly. Cycles, drugs and hosiery are made here in large quantities. The leather trade expanded greatly during the World War. Since 1918 the city has returned four members to Parliament.

In 1921 Wollaton Hall, a magnificent example of Elizabethan architecture, with the park of 750 ac. that surrounds it, was bought by the corporation from Lord Middleton. A portion of the land is to be used for building purposes, but the greater part of the park will remain an open space. Municipal schemes have provided a number of new houses since 1918. The new churches and parishes include St. Cyprian (1910), St. Christopher, Sneinton (1910), St. Faith, North Wilford (1914) and St. Michael and All Angels (1914). The William Woodsend Memorial Homes were opened in 1913 and the William Booth Memorial Hall in 1915; the Natural History Museum was transferred from University College to Carlton road in 1920. New buildings contemplated include one for municipal purposes overlooking the market place, a large power station and a public library. A railway line to Mansfield, leaving the London & North Eastern a few miles north of the town, was opened in 1917 and gives access to the docks at Immingham.

The most important development is the erection, at the cost of Sir Jesse Boot, of new buildings for University College. These are on the western side of the town, on a site of 220 ac. called

Highfields, part of which has been devoted to recreation grounds for the public and the students. A large open-air swimming bath was opened near the estate in 1924 and a new road connecting it with the city has been made. In 1926 the work of doubling the width of Trent Bridge was completed, a slum area of 400 houses being demolished to make a new road to the bridge. Sir Jesse Boot has given 16 ac. to complete the Victoria Embankment.

NOVÁK, VÍTĚZSLAV (1870–), Czech composer, was born at Kamenice in Bohemia. He completed his studies at the Prague conservatoire of music, of which he became director in 1919. Early in his career he came under the influence of Dvořák, Brahms, Schumann and others, but he soon revealed his own individual method of expression, which was marked by powerful phantasy and boldness in musical resources. His early piano compositions, consisting of overtures and songs, are lyrical, phantastic and passionate by turns, but romanticism forms the basis throughout. Later he turned his attention to the popular music of Moravia and Slovakia, by which his subsequent compositions were strongly influenced. These include many of his best works, such as the symphonic picture *In the Tatra*, Slovak Suite, two Valach dances, the symphonic poem *Legend of Yearning*, Moravian songs, Czech suite, gypsy melodies, as well as a number of compositions based upon national ballads. Among his earlier works may be mentioned the overtures *The Corsair* and *Manfred*, *Memories*, serenades, eclogues and barcaroles. Of his orchestral works the most noteworthy are *Toman and The Wood Nymph* and *The Storm*. Novák also composed some operatic works, the best of which is *The Lantern*, based upon a play by A. Jirásek and exhibiting his art in its maturest form.

NOVA SCOTIA (*see* 19.830), a province of the Dominion of Canada. The population, which includes the island of Cape Breton, was 523,837 in 1921. This showed an increase of 6·4% since 1911; of the total 56·98% was classed as rural. About 80% of the inhabitants are of British descent. Halifax, the capital (pop. 58,372) and Sydney (pop. 22,545) are the chief commercial and shipping centres. The Government consists of a Lieut.-Governor, a legislative council of 21 members appointed for life, a legislative assembly of 43 members elected on general suffrage; an executive council of Ministers is appointed by the Premier. The province is represented in the Federal Parliament by 10 senators and 14 members of the House of Commons.

Education.—Each county in the province has a high school or an academy. Among the degree-granting institutions of the province the most important are Dalhousie University at Halifax (including by affiliation since 1922, King's College, Windsor). Acadia University at Wolfville and St. Francis Xavier at Antigonish. The school districts are subdivided into school sections, each administered by a board of three trustees, elected by the ratepayers. Local taxation is supplemented by legislative grants, the total expenditure on education in 1923 being approximately $3,500,000. There were then 114,458 pupils and 3,237 teachers in the schools under public control.

Production and Industry.—The acreage under crops, and consequently the quantity and value of agricultural products, greatly declined during the post-War period. In 1919 the total value of the principal field crops was $63,357,000; in 1924 this value had fallen to $16,359,000, but a slight increase occurred in 1925. The average annual yield, in bushels, of the chief crops for the period 1922–4 was: wheat, 233,533; oats, 4,094,667; barley, 195,700; and buckwheat, 188,100; the average yield of potatoes was 3,372,800 hundredweight. The production and export of apples, for which the Annapolis and Cornwallis valleys are especially suitable, has become a leading industry. The average annual crop exceeds 1,500,000 barrels. The provincial Govt. maintains 35 model orchards in various parts of the province. In 1925 there were 291,912 cattle, 273,499 sheep and lambs, 53,480 swine and 53,352 horses in the province. Dairying has increased in importance; the chief dairy product is butter, the output of which increased from 320,763 lb. in 1911 to 4,094,282 lb. in 1924. Travelling dairy schools giving instructions to farmers throughout the province have been instituted.

The forest area of Nova Scotia is estimated at over 12,000 sq. m., more than half the area of the province. The value of the lumber cut in 1923 was $2,281,949. The production of pulpwood for 1923 was valued at $838,358. The fishing industry is of vital importance: in 1924 there were 18,721 persons employed in the various branches of the industry, and the total value of the products amounted to $8,777,251.

Coal, iron, copper and gold are found, but only coal is produced to any large extent, the output being 4,973,184 tons in 1924. The production of gold has greatly declined, and only 750 oz. was produced in 1924. Colchester County contains valuable oil shales. The total value of mineral products in 1925 was $38,720,000. Extensive manufactures of iron and steel are carried on at Sydney and other parts of Cape Breton Island. The shipbuilding industry has declined steadily, except for the temporary stimulus provided by the exigencies of the World War. Other manufacturing industries of the province include sugar refineries, pulp and paper mills, canneries, textile and boot and shoe factories. The total capital invested in manufacturing industries was $107,000,000 in 1923, the number employed 17,179, and the gross value of production amounted to $82,000,000.

Trade and Communications.—Imports entered for consumption in 1924–5 amounted to a value of $22,068,108. Exports during the same year were valued at $43,487,392. Of 15,190 m. of roads in 1924, 1,255 m. were of gravel. The total expenditure on the highways in 1924 amounted to $1,728,894. The Canadian National Railway system is the chief means of internal communication; the railway mileage in 1925 was 1,434. (*See* CANADA.) (S. LE.)

NOVELLI, ERMETE (1851–1919), Italian actor and playwright (*see* 19.838), died at Naples Jan. 29 1919. His tragedy *La Masque* written in collaboration with Signor Bonaspetti, was produced in 1911.

NURSING.—The science and art of nursing has, like surgery and medicine, made enormous strides since 1910, partly due to the War, but largely owing to the general development of science in this country. Modern nursing had its origin with Florence Nightingale, and she set the standards that have been followed since. But in later years there has been a change in the manner in which the nurse is regarded. She is now looked upon, both as the possessor of a great vocation for which she has to be qualified by years of training, and as a professional woman whose loyalty to that profession should be as true as that of the doctor, and whose duty is to add to her knowledge and professional skill both for her own sake and for that of the profession to which she belongs.

I. IN GREAT BRITAIN

Training of Nurses.—In Great Britain the training of the nurse is regulated by the state through the Nurses' Registration Act of 1919. This Act was only carried into law after years of controversy, which ended with the outbreak of War, when a truce was declared and loyally maintained. The profession has now the right of self-government. There is a General Nursing Council for England and Wales and another for Scotland, and 16 of the 25 members of the English Council must be registered nurses elected by persons registered under the Act.

In addition to the ordinary registration of nurses with a general training (which occupies three or four years) there are five supplementary registers for male, mental, fever, mental defectives and sick children's nurses. Nurses usually begin their general training in recognised training schools at an age not less than 21, though for certain kinds of training (such as those for nurses of fever or sick children) probationers are taken earlier. The nurses usually live in the hospital or in hostels near it; and as a rule, those who remain in hospital retire about the age of 50 or 55, when a pension is frequently provided with or without contribution. Post-graduate teaching is developed in the best schools, as is the system of providing tutor-nurses. There is not as yet much connection with the universities though the University of Leeds grants a diploma in nursing.

Hospital training has thus become highly developed in Great Britain, and the matron of a great hospital holds a very important position as regards her staff, which is divided into sisters, staff nurses and probationers. There are specialists in electric and other technical work, but these have usually first completed their general training. Strenuous efforts have been made to reduce the hours of service and to increase the salaries, which for many years have been extremely low. There is still room for improvement in both these matters.

College of Nursing.—In the year 1916, a college of nursing was established with the view of forming a centre for all nursing activities, improving the nursing service as a whole and the conditions under which nurses work. In 1925 it had a membership of 24,000 with 42 branches and sub-branches throughout the United Kingdom. Connected with it are a student nurses' association for nurses in training, a section for sister tutors and a section for public health workers. It is recognised by the Ministry of Health as an approved centre for the training of health visitors.

Although a large number of nurses serve in hospitals, these are regarded mainly as training schools, where the young nurse is carrying on her studies as well as gaining practical experience. The difficulty with the present hours of duty is to provide the necessary time for her studies and for preparing for frequent examinations, state and hospital. In early days, the importance of the training was not fully recognised, and the nurse was regarded as one who simply performed certain useful functions. Now, the doctor or surgeon looks to the nurse for assistance in his work; he can only see the patient at intervals but she has him always under observation, and the accuracy of her observation and report is a matter of vital importance. It is probable that during the strain of War the matter was pressed home on those in control of hospitals as it never was before. Nurses have become an essential part of the social and economic life of the country and their functions are continuing to increase. It may be well to enumerate the most important of them.

District Nurses.—On completing her general training, usually of four years, a nurse may take her district training and be placed on the roll of the Queen's nurses, which are supervised from head-quarters but supported locally. There are still "cottage nurses," with a short training, but those with a higher standard are rapidly increasing, more especially as they are eligible to do county health work under the medical officer of health. Those who hold the certificate of the Central Midwives Board are frequently employed in infant and child-welfare work. Before many years have elapsed every parish or district should have its own nurse.

Public Health Work.—In addition to child welfare work many nurses are employed under county, burgh or city schemes. The education authorities require a large staff for following up the cases of children who have been inspected by their medical officers. Nurses are also required for fever and isolation hospitals. Poor Law infirmaries give excellent training and have certain advantages over hospitals, which are also training schools for the medical profession. There will probably be changes in Poor Law administration before long.

Private Nursing.—This form of nursing has expanded enormously and though some visiting nurses come in for the day, they are mainly residential. Nurses who undertake this work are to be had either from a hospital which sends out their nurses after they gain their certificates, or from an institution, possibly a co-operative institution or home. Nurses are employed in many private nursing-homes for the well-to-do.

Mental Nurses.—The training for mental nurses is usually conducted in a recognised institution for the treatment of mental disorders where the candidate serves for three years, and enters for the state examination for mental nurses. The nurses and attendants are of both sexes, but women are being increasingly employed even for male patients.

Midwives and Maternity Nurses.—Midwifery is controlled by a Central Midwives Board, established in London, with jurisdiction in England and Wales, and there are separate boards for Scotland and Ireland. The number of midwives now on the roll in England and Wales is approximately 77,791. These boards regulate the issue of certificates and the conditions of admission, and have also the power to remove names from the roll. It was only in 1910 that it was forbidden to any person to attend women in childbirth for gain (otherwise than under the direction of a qualified medical practitioner) unless certified under the Act. An incorporated Midwives Institute has done splendid work in promoting the interests of midwives. Many trained nurses take the midwives' certificate, for which they have to have a six months' special course while a twelve months' course of midwifery is necessary for those who are not trained nurses.

Masseurs and Masseuses.—The Chartered Society of Massage and Medical Gymnastics grants a certificate to those who have taken a prescribed training at a recognised school and have passed an examination. After June 1927 examination on massage as a single subject will cease.

Various Services.—A voluntary advisory nursing board was established in 1921 under the Prison Commission of the Home Office, and trained nurses are now appointed for the care of sick prisoners. A nursing service deals with hospitals under the Ministry of Pensions, and a matron-in-chief is at its head.

The Overseas Nursing Association sends trained nurses to the Crown Colonies and small British communities abroad. There is also an Indian nursing service for Europeans in India.

Queen Alexandra's Imperial Military Nursing Service originated in 1902. A nursing board advises the Secretary of State on matters connected with the service. A matron-in-chief is at its head and principal matrons, matrons, sisters and staff nurses are subordinate to her.

In the first year of the World War there were 2,323 fully trained reserve nurses, in addition to the regular service, and by 1918 the number reached 10,304. There is likewise a service called Queen Alexandra's Military Families Nursing Service. The Territorial Army Nursing Service, established in 1907–8 in connection with the Territorial Army, supplied the largest number of British nurses available on the outbreak of the World War. The probable number required is about 4,000, but the territorial nurses are only called up in case of necessity. Like the Territorial Army, they enrol with overseas obligations.

Queen Alexandra's Royal Naval Nursing Service is a small one, which also has a reserve. The Royal Air Force Nursing Service was established in 1921 and has the same formation—matron-in-chief, matrons, sisters and staff nurses—as the others. (See MEDICAL SERVICE, ARMY.)

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(E. S. H.)

SCIENCE AND TECHNIQUE

Nurses now work for shorter hours, they have greater freedom, optional out-door uniform, a rational and comfortable indoor uniform, better food, private bedrooms, a dining hall and comfortable sitting rooms. They are encouraged to take healthy out-door exercise, to play games for their hospitals, to join musical or literary societies. There has been a further reduction in the minimum age (to 19 years in many hospitals) at which probationers are engaged, in order that girls leaving good schools may pass on to a nursing training without loss of time, and find their position in that nursing training to be on a par with that of their friends, who have passed on to a university.

The standard of living for the patient also has greatly improved. The modernisation of hospital wards, singular 15 years ago, is now an almost universal fact. The introduction of up-to-date apparatus, such as steam heat, electric light, gas or electric cookers, heaters and sterilisers, electric hot air baths, adjustable beds, heated food trolleys, rubber floors, electric lifts, wheeled stretchers, high power reflector lights for operating rooms, powerful magnets, etc., is an advantage; there is a marked improvement in the quality of the patients' bedding, linen, crockery, hospital food and its service, although, in the last respect, England has something to learn from Scandinavian countries. There is a greater personal liberty for patients: in many hospitals, since the World War, smoking is permitted to the men patients within certain hours, and visitors have greater access to their sick friends.

Entirely new methods of treatment have been evolved for diseases and conditions such as diabetes, eclampsia, uraemia, phthisis, cardiac disorder, etc., necessitating, in many cases, complicated and exact diet regulated by an exact knowledge of the chemical constituents of the blood and other fluids. In other cases treatment such as immobilisation of a lung, or measurement of the air capacity of a lung, is regulated by the results of frequent bacteriological and other tests. Again, treatment by means of graduated exercises for the heart, the re-education of muscles and nerves that have lost their power, and the re-education of the brain itself, have been developed and depend for success on careful nursing.

Surgical Cases.—The advance in surgery is illustrated in delicate operations in brain surgery; plastic operations on the face; blood transfusion; tendon transplantation; periscopic examination of the abdominal and other cavities; examination of the intestinal tract, kidneys, spinal canal and brain cavities by means of opaque drugs and X-rays; bone grafts and all the skilled manipulations of orthopaedic surgery; plaster and splint work; and advances in many other special branches of medicine and surgery. In all these investigations and achievements doctors require the intelligent and skilled co-operation of nurses. The education of modern nurses has been widened and deepened to fit them for their task. (E. E. MacM.)

II. IN THE UNITED STATES

The rapid development of the nursing profession in the United States has been due in large measure to the three national nursing organisations established by the nurses themselves, in the belief that they were responsible for the ethics, standards and educational developments of their profession.

American Nurses' Association.—The "American Nurses' Association" was founded in 1896, according to its charter, "to establish and maintain a code of ethics; to elevate the standard of nurses' education; to promote the usefulness and honour of nurses; to distribute relief among such nurses as may become ill, disabled or destitute; to disseminate information on the subject of nursing by publications in official periodicals or otherwise; to bring into communication with each other various nurses and associations and federations of nurses throughout the United States." This association has been active in legislative measures affecting nursing interests, and since 1917 has been in constructive co-operation with the National League of Nursing Education. *The American Journal of Nursing*, a monthly magazine published continuously since 1900 by the American Nurses' Association, is also the official organ of the "National League of Nursing Education."

The National League.—The "National League of Nursing Education" was organised in 1893 by 18 women superintendents of hospitals to promote nursing education and to raise educational requirements for the profession. Its membership is now open to heads of schools for nurses, teachers of nurses and heads of nursing services, all of whom are also members of the American Nurses' Association. The League has initiated many distinctive movements, the most notable of which are: in 1896, the extension of the hospital training course to three years; in 1903, the inauguration of state registration of nurses, now compulsory in the 48 States of the Union; in 1907, the establishment of a department of hospital economics at Columbia University; in 1917, the publication of a standard curriculum, designed to ensure a minimum standard for all schools of nursing, and now almost universally adopted; in 1925, the classification and grading of training schools, a task now under way. In addition, the League has during the 33 years of its existence published numerous pamphlets and reprints of value in nursing education.

The National Organisation.—The National Organisation for Public Health Nursing was organised in 1912, to establish standards in public health nursing, and to promote a general intelligent understanding on the part of the laity, as well as the nurses, of the needs and importance of well-planned preventive work in the field of public health. It publishes a quarterly journal, *The Public Health Nurse.*

Each of the three national organisations maintains ample headquarters, with secretaries and reference libraries, and in diverse ways lends its support to the body of nurses and their educational experiments. The distinctive service in America performed by these associations because of their special knowledge and experience accounts for the remarkable progress made in the nursing field in the past 30 years.

The American Red Cross.—In 1904, by Act of Congress, the reorganisation of the American Red Cross was effected, and provision thereby made for a flexible nursing reserve, with chapters in every State, ready to provide nurses from the ranks of the profession in times of emergency. The Red Cross has also initiated a peace programme for rural visiting nursing, which has developed into a national service of public health nursing. In 1919, it appropriated $115,000 for scholarships to enable graduate nurses to equip themselves more thoroughly for this service.

Army Nursing Service.—The Army Nursing Service was established by Act of Congress in 1901; the Navy Nursing Service, in 1908. In 1918, the Army School of Nursing was established on progressive lines, with hospital affiliations to give its students the experience necessary for their complete training.

U. S. Public Health Service.—The United States Public Health Service, a branch of the Treasury Dept., employs a staff of nurses under the direction of a woman superintendent, to assist in carrying out its extensive public health programme in hospitals, in foreign and domestic quarantine and in various sanitation projects.

University Courses.—At Teachers' College, New York, the first collegiate course for nurses was established in 1899 through the efforts of the nurses themselves. To-day there are in the United States 22 universities or colleges providing training for nurses. In 1909, the University of Minnesota made its school of nursing a professional school of the university, the principal being responsible to the dean of the medical school, and a member of the medical faculty. Five-year courses have been established by several colleges in order to combine liberal arts with professional training.

In 1919, through the generosity of the Rockefeller Foundation, a study was made of the conditions of nursing and nursing education. As a result of a report based on this study, Yale University established a school of nursing open only to college graduates, to be maintained as an experiment for five years by the Rockefeller Foundation. The ideal of this school is to increase the number of teachers and leaders for new lines of work.

Development of Public Health Nursing.—Perhaps the most unique contribution to nursing in the United States has been the development of public health nursing. The term "public health nurses," originated in 1893, emphasises the community responsibility of the nurse. There are to-day 12,000 public health nurses in the United States actively engaged in public health nursing, which, as now understood, proclaims the twin service of ministration and education, and includes the care of the sick in the homes and the teaching of preventive health measures. Many types of specialised work in the public health field have been developed: school nursing, municipalised in 1902, and now supported by public or private funds throughout the country; work with the tuberculous; maternity clinics; milk stations; infant health centres; prenatal clinics; clinics for the pre-school child; care of cardiac cases; industrial nursing; hospital social service; and treatment of venereal diseases.

Hospital Social Service.—The germ of Hospital Social Service, now highly developed, originated in 1879, when the Ethical Culture Society of New York employed a nurse to associate herself with a visiting physician affiliated with the dispensary. The Massachusetts General Hospital of Boston in 1905 placed new emphasis upon carrying the treatment from the hospital to the patient and utilising the opportunity of education in the home, systematising the co-ordination of the treatment and the complete rehabilitation of the family through public and private agencies. Many hospitals now employ a staff of social workers and nurses for follow-up work among their patients' families and among discharged patients. The nurses in the United States have written most of the text-books used in the schools and in public health nursing, and publish many leaflets, articles and local journals. In this they are encouraged and aided by the medical profession.

Educational Tendencies.—The present tendency in nursing education is to replace the apprenticeship system of training by professional university schools administered independently of hospitals, but affiliated with them to give ward experience to their students.

Statistics.—In 1925 the number of registered nurses in the United States was 250,000, of whom approximately 220,000 were active private-duty nurses, 11,000 public health nurses and 5,000 were in institutions or engaged in teaching. The number of training schools was 1,800, the number of graduates annually 15,000, and the number of colleges giving training courses 22. The growth in number of training schools is striking; in 1873 there were four schools, in 1883 22, in 1900 400, in 1910 1,100, in 1920 1,800. According to the 1920 census, there are 150,000 untrained nurses in the United States.

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NYASALAND PROTECTORATE (*see* 4.595).—Area about 40,000 sq. miles. Population (1924 estimate): Europeans 1,462; Asiatics 669; natives 1,210,344. The increase in the native population (10,410 since the 1921 census) was wholly due to immigration from Portuguese Nyasaland.

The five years before the World War were marked by steady progress, notably in the advancement of the natives. In 1913 Mr. (later Sir) George Smith was appointed governor, a position he held for 10 years, guiding the affairs of the protectorate with conspicuous ability. During the War the northern part of the country was invaded by the Germans from East Africa (Sept. 1914) and there was stiff fighting around Karonga on Lake Nyasa. Later, Nyasaland was one of the bases of General Northey in his operations against the Germans. Practically every European of military age joined the Nyasaland Volunteer Reserve; the Nyasaland battalions of the King's African Rifles rendered good service, while over 150,000 natives were employed as carriers.

Chelembwe's Rebellion.—Early in 1915 there was a revolt of some 500 natives in the Shire Highlands. The rebels were led by John Chelembwe, a negro, trained as a teacher by the American Baptist Mission, who had taken a university course in the United States and had subsequently built a church in Nyasaland and preached the independence of Africans. Chelembwe and his followers attacked a planter's house and killed three white men. One, a Mr. Livingstone (a descendant of David Livingstone), was decapitated, and Chelembwe preached in his church with Mr. Livingstone's head placed on the pulpit. The rising was quickly suppressed by volunteers and native soldiers. Chelembwe fled, was tracked by native police and shot dead (Feb. 1915). This revolt, a symptom of Ethiopianism, was no reflection of the attitude of the natives generally. Under the guidance of Christian missions—of which the principal are the Church of Scotland Mission, the Livingstonia Mission of the United Free Church and the Universities Mission—the natives, naturally progressive, made marked progress, both in education and industries. The doyen of the missionaries, Dr. Robert Laws, of the Livingstonia Mission, who exercised a powerful influence throughout the protectorate, celebrated the jubilee of his work in Nyasaland in 1925.

Economic Progress since the War.—A considerable number of white men who came from South Africa or Great Britain during the War settled in Nyasaland as planters. But the development of the country was greatly impeded by the lack of adequate means of exporting produce, and both European and native cultivation suffered severely, though 1924 proved a good year for trade. The shallowness of the Shire and Zambezi made river transport hazardous. To overcome this difficulty a railway, completed in 1915, was built from Port Herald, on the Shire, to Chindi, on the north bank of the Zambezi, and in 1922 another railway, from Beira to the southern bank of the Zambezi, was opened. Until, however, the Zambezi was bridged (which had not been done up to 1926) this means of communication was unsatisfactory. Moreover, as the railway from Port Herald stopped at Blantyre, there was only road communication with Lake Nyasa and the produce of the northern part of the protectorate had practically no outlet.

Most of the whites live in the Shire highlands, the climate rendering the greater part of the country unsuitable for Europeans. As stated by the governor, Sir Charles Bowring, in 1924, "the prosperity of the protectorate depends on the development of its tropical agricultural resources, partly by a limited number of European plantations, but principally by the natives themselves with European instructors." The natives, particularly the Yaos, the Amatonga and the Angoni, are keen agriculturalists, and with the provision of ocean outlets the prosperity of Nyasaland will be assured.

Coffee growing has been almost abandoned, and the chief exports are tobacco, cotton, tea and fibres. Imports, which in 1910–11 were valued at £111,000, had risen to £548,000 in 1924. Exports were valued at £97,000 in 1910–1 and at £583,000 in 1924. Revenue, which was £76,000 in 1909–10, was estimated at £285,000 in 1924–5, while expenditure rose in the years named from £108,000 to £305,000. Revenue was burdened by railway charges under guarantees given to the companies, the net railway revenue being insufficient to meet interest and sinking fund charges.

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OAKLAND, Cal., U.S.A. (*see* 19.935), increased in population 44% in the decade after 1910, reaching 216,261 in 1920, of whom 49,895 were foreign-born (including 4,536 from China and Japan). The Census Bureau estimate for 1925 was 253,700. After the World War there was a period of great industrial expansion. Over $150,000,000 worth of building was done in Oakland in the five years 1921–5. Bank debits nearly doubled between 1919 and 1923, increasing from $751,947,000 to $1,450,856,000. The number of ships which docked at the Oakland harbour in 1924 was 7,870. Factory products were valued at $22,343,000 in 1909; $134,756,000 in 1919; $122,491,778 in 1923. Hydro-electric power was furnished by two competing companies. The water supply (from the adjoining Berkeley hills) was still in the hands of a private corporation, but a project had been undertaken by the city, in co-operation with adjacent municipalities, for bringing a supply from the Sierra Nevada mountains (at a cost of $39,000,000) and its completion was expected by 1928. Additions to the public buildings included a city hall, a municipal auditorium, high schools, a health centre and a public library. There were 57 playgrounds, covering 290 ac., with 418 ac. additional in parks, a boulevard skirting Lake Merritt and two municipal camps in the Sierras.

OBERLÄNDER, ADAM ADOLF (1845–1923), German caricaturist (*see* 19.946), died in Munich May 29 1923.

OBSTETRICS (*see* 19.962).—Since 1910 a striking change has occurred in the science of obstetrics and its practice, chiefly as the result of its invigoration by the spirit of preventive medicine.

The term "preventive medicine" does not connote any special creed or peculiar doctrine in medicine. It is, in fact, merely an attitude of mind, which has developed slowly, but with increasing momentum during this century. Lip service has always been given to the ancient platitude that "prevention is better than cure," but till a knowledge of the causes of disease and the manner of its spread was obtained, the translation of these words into action was scarcely possible. With concrete examples, such as those afforded by the adoption of Listerian principles in surgery and midwifery, and generally by the lessened incidence of contagious and infectious diseases as their causation was worked out, the development and diffusion of preventive ideals throughout the whole of medicine has become easier and more general. This fresh mental attitude has produced a change of method throughout medicine, which might be described as the observation of the bodily functions in health and watching for the first sign of departure from the normal, rather than waiting till disease develops. Its first object is to seek out the causes of disordered function and remove them before they can become operative and, in the second place, when these causes are unknown, to detect the early signs of deviation from normality and restore the normal before trouble arises. The maintenance of physiological function in all bodily systems is its aim so that the cure or relief of established disease becomes the final resource of medicine and marks the failure to attain its earlier objectives.

If obstetrics is regarded from this point of view the difference between the new and the old practice will become obvious. Its immediate purpose will be to secure normal reproduction by detecting and removing all known causes of disorder of function and by observing the healthy pregnant woman from conception onwards to discover any sign of departure from the normal. Though a physiological state, pregnancy imposes a strain on the efficient working of every system of the body, and the thorough examination of the state of health of mind and body of the woman early in her pregnancy and further observation to see how she is standing the test seem but reasonable precautions. Apart from those who have some organic weakness and may break down under the strain, there are disorders of function that may develop in those previously of sound physique. A special strain falls on the excretory organs, and the kidneys and the liver may be affected and lead to acute or chronic disease. Hence the need for the routine and repeated examination of the urine. The good health of the mother throughout childbearing increases her resistance to infection (*e.g.*, puerperal fever) and her efficiency in the rearing of her family.

The care of the pregnancy itself is likewise a matter of greater concern than in the older obstetrics, not only because of the loss of prospective life, but because miscarriage is a prolific cause of operative interference, during or after its occurrence, and of infective and other diseased conditions of the reproductive tract and thus of subsequent disability. Premature labour results in the birth of weakly infants difficult to rear and is a prominent factor in the persistent high mortality among new-born infants. Another important object of the supervision of the pregnant woman, that of foreseeing and avoiding difficulties and complications during labour, provides the simplest illustration of the changed outlook in obstetrics.

Earlier Methods.—The usual custom of a generation ago was for the woman to retain her doctor for attendance on her confinement and for the doctor to do little more than note the expected date on which his services might be required. Unless consulted by the patient because of some disturbance of health, he might not see her again until summoned at the onset of labour. He then made a thorough investigation to see if all was straightforward or if there was any malpresentation or other difficulty, and was prepared to do his best to remedy any untoward condition that might be present or arise later, often being exceedingly ingenious and resourceful in so doing. His obstetric training as a student had been directed largely toward teaching him the management of normal labour, the emergency treatment of abnormal presentations and obstructions to the passage of the foetus through the birth canal and other complications during labour, and his reputation as an accoucheur was largely determined by his capacity to cope with emergencies.

New Methods.—The training of the modern student is conducted on other lines, and whenever a complication occurs the first question discussed is, "Could this have been foreseen?" and if so, the next question is, "What should then have been done?" and a comparison of the case as he has seen it with what it might have been had the emergency been anticipated is used to impress on him that the sole criterion of sound obstetrics is the securing of natural parturition and the prevention of unexpected difficulties and complications so far as the present state of our knowledge allows.

To avoid difficulties in labour, examination is begun about six weeks before the expected date of confinement in order to determine that the child is presenting normally and that there is sufficient accommodation in the bony pelvic canal to allow of its easy passage. This examination is repeated two or three times to make sure that no change has occurred in the presentation and position and that the child does not become unduly large to pass readily. For the most part these matters can be determined with a fair degree of accuracy by the ordinary methods of obstetric examination, but in difficult and special cases examination under anaesthesia and by X-rays may be required. Should it be discovered that even at six weeks before full time there will be difficulty in the child being born by the natural passages, because of rickety or other deformity of the pelvic bones, the question arises whether it is better to resign all hope of the delivery of a living child by the natural passages and perform Caesarean section or to induce labour and learn if the natural powers can effect the delivery of a small and premature infant.

If there does not appear to be any obstruction at the time of the first examination but at a later one there is evidence of a tight fit, labour should be brought on then to avoid the risk of the child becoming too large to be born without difficulty. By eliminating difficulties due to disproportion in size between the child and the mother's pelvic canal and such malpresentations as cross births and brow-presentations (which if allowed to remain instead of being changed would result in complete obstruction) most of the serious difficulties in labour can be obviated in some way or other. The change in presentation and position of the child can be effected by manipulation through the abdomen, if done before the child is too large to be moved readily, and in favourable cases and under anaesthesia sometimes even up to and after the onset of labour, but if left until the waters have broken or labour is advanced, requires internal operative procedures with their additional risks of injury and infection.

In these instances the cause of difficulty can be anticipated and removed before labour begins, but there are also many conditions of which the cause is unknown so that the obstetrician must fall back on the second line of defence, that of discovering the earliest signs of disturbance, taking them as a warning of danger ahead and making the best possible dispositions. Premature detachment of the after-birth commonly shows itself by haemorrhage and all pregnant women whilst under supervision are warned to report at once any bleeding, so that immediate measures may be taken to lessen the chances of serious consequences. Albuminuria, discovered by frequent examination of the urine, oedema, excessive vomiting and visual disturbances are warnings of possible complication.

Prematernity supervision is in its infancy, but with experience of its working much more will be possible in the way of prevention. Many of its problems have scarcely begun to be worked out and an example of one of the most outstanding of them is worth a little consideration as an example of the problems that obstetrics has to face.

Merely to accept the principle that its primary objective is to secure natural reproduction is not sufficient to change practice. It is also necessary to show where the methods hitherto adopted are harmful. By the infusion of preventive ideals the vision is widened beyond the treatment of the individual case and the nation's maternal and infantile mortality and disability are brought under review. The success of obstetric methods must be tested by asking what price the nation pays in maternal mortality and disability for its new lives, and whether it obtains full value in new lives for the price paid.

When those wider questions are looked into, there is little ground for complacency among those responsible for the obstetric practice of the country. There has been no reduction in maternal mortality equivalent to the drop in the general death-rate or to the remarkable fall in the infantile mortality, which has been halved since the beginning of this century. Further analysis of the registrar-general's figures in England and Wales shows that septicaemia, a form of blood-poisoning practically eliminated from general surgery by the antiseptic and aseptic technique, is still too prevalent and still causes (as puerperal sepsis) about a third of the deaths in childbearing. The annual rate of maternal deaths per 1,000 live births registered in England and Wales is a little under four mothers. In the bad years immediately after the War, the rate was over four per 1,000. This may not appear large but it means that about 3,000 women in the prime of life die in childbearing with the loss of their maternal care to many more young children, and of these mothers over 1,000 die from puerperal sepsis, a preventable disease. Its prevention is a more complicated matter than, and a somewhat different problem from, that of surgical sepsis, because septic organisms may be present in the lower genital tract and spread upwards and into the blood stream, apart from any question of failure of aseptic technique on the part of the attendant.

The statistics of all maternity hospitals show that fever in childbed increases with all complications and difficulties calling for internal manipulation, all of which tend to the introduction or upward spread of infective organisms. The more prolonged and the higher up the tract the manipulation, the greater is the incidence of fever. By far the commonest operative interference is delivery by the forceps because it is advocated by many merely in order to shorten the patient's suffering. Instead of trying to secure natural delivery in cases of weak uterine action, a substitute for the uterine power is adopted in the shape of the muscular power of the attendant exerted through the obstetric forceps. The causes of weak uterine power are difficult to determine and often impossible to foresee, but here is a direction in which investigation is necessary. What is the meaning of the enormous increase in artificial deliveries, and, is the shortening of her time of pain worth the price of the additional risk?

Particularly calling for solution are the questions, how far modern social conditions have lessened the power of the woman of to-day to stand the hardship, fatigue, and mental and physical strain of child-birth and rendered her less capable of completing the expulsion of the child naturally than the mothers in the days before anaesthesia and frequent forceps delivery; what are the factors tending to produce this lessened capacity; and, how far are they removable?

The obstetrical centre of gravity has thus been shifted backwards from the care of labour to the supervision of pregnancy and a wider outlook over the reproductive cycle is taken so that the part played by obstetrics is seen as but part of the wider subject that is concerned with securing the health of the new generation at the minimum of cost to the old. The prematernity supervision looks forward to the nursing of the child and the rearing of the family. It anticipates the natural feeding of the infant by removing all causes that may interfere with breast feeding. It has an educational side and endeavours to inculcate sound principles of hygiene in the preparation for, and the care of, the babe when born, because success in this direction will mean a better start for the new generation. The observation of the developing child falls to paediatrics and the two subjects, as maternity and child welfare, have become a duty and charge to local health authorities, and as such are well known to the public.

In conclusion a tribute should be paid to the late Dr. Ballantyne of Edinburgh, as the advocate of prematernity supervision and the pioneer of the antenatal clinic, which more than anything else has served to further the permeation of obstetrics by the spirit of preventive medicine. *See* J. S. Fairbairn, *Gynaecology with Obstetrics* (1926). (J. S. Fa.)

OCEANIA or Oceanica (*see* 19.988).—This name, in either form, is conveniently and not uncommonly used to cover all the small islands of the South Pacific Ocean which are not closely neighbouring to any of the larger lands, such as eastern Asia and New Guinea. The name is thus approximately equivalent to the former title South Sea Islands. The previous general survey of these islands is given under the heading Pacific Ocean (*see* 20.436).

The War Period.—Oceania was not wholly free of incident during the World War. Very soon after the outbreak (Aug. 30 1914) a New Zealand expeditionary force occupied the former German island of western Samoa; in Sept. Nauru surrendered to a vessel of the Australian Navy; and in Sept.–Oct. the Japanese occupied the German Caroline and Mariana Islands. German vessels of war were at large in the Pacific at this time, and on Sept. 7 1914, a landing party from the "Nürnberg" wrecked the Pacific "all red" cable station on Fanning I.; but communication was restored by the operator. Moving eastward across the ocean, the German vessels bombarded Papeete, capital of the French island of Tahiti, on Sept. 22. Later, the South Pacific was outside the range of naval operations, and the remoteness of some of the islands was exemplified when Lord Jellicoe on H.M.S. "New Zealand" found in Oct. 1919 three Europeans confined on Christmas I., and ignorant of the cessation of the War.

Apart from the occupation of Samoa and the Carolines, certain changes in government took place during the period of the War. The Commonwealth Govt. of Australia took over the administration of Norfolk I. in 1914, and the executive council was made in 1915 to consist of six elected members and six members appointed by the administrator. The Gilbert and Ellice Is., previously a British protectorate, became a colony in 1916. Ocean, Fanning and Washington Islands were included later in that year, and Ocean I. became the seat of government. Christmas I. was included in 1919. The Wallis and Horne Islands, previously a French protectorate, were declared a colony in 1917. This annexation had been proclaimed four years earlier, but opposition was fomented in Fotuna (Horne Is.) by

Roman Catholic missionaries; and even in Uvea (Wallis), where the native chiefs had asked for annexation, French law could be only gradually introduced.

The so-called four-power treaty signed on Dec. 31 1921 by Great Britain, the United States, France and Japan at the Washington Conference, defined the mandated territories and the respective sovereignties in Oceania (Japanese in the Caroline and Marshall groups; Australian in the former German New Guinea and islands east of it; British over Nauru) and specified those areas in which no further fortification should take place. Japanese proceedings in the Carolines under military administration had previously evoked a good deal of criticism, especially in Australia, partly on account of their secrecy and partly on strategic grounds. The civil administration was established under the mandate in April 1922. A substantial influx of Japanese immigrants has taken place.

An administrative system which, it was hoped in some quarters, might be modified in course of the settlements after the War, but was not, was the Anglo-French condominium over the New Hebrides. Opinion has been freely expressed in Australia that the system is cumbrous and makes against progress, and that the French interest should be abolished by purchase or exchange, and the islands brought within the British sphere, under the Imperial Govt. or that of the Commonwealth.

Population.—The populations, according to recent census figures or estimates, of the principal groups covered by this notice are as follows:—

Caroline, Mariana, Marshall and Pelew Is. (Japanese), 52,222 including 3,671 Japanese (1920).
Cook Is., Niué and other oceanic islands belonging to New Zealand, 13,209 (1921).
Easter I. (Chile), est. 300 (1922).
Fiji (British), 157,266 (1921), including 3,878 whites and 60,634 Indians.
Gilbert and Ellice Is. (British), 29,897 (1921).
Marquesas Is. (French), under 3,000 (1923).
Nauru (British), 2,166 (1922), including 110 whites and 900 labourers recruited from other islands, and Chinese.
New Caledonia (French) 47,505 (1921), including 16,794 whites and 3,611 Asiatics. Nouméa, the capital, had 9,614 inhabitants, including 6,238 free whites and a penal element of 600.
New Hebrides (Anglo-French condominium), 55,000–60,000 natives; 275 British, 709 French, Indo-Chinese coolies and other immigrants, 1,032 (1923).
Tuamotu (Paumotu) Archipelago (French—the first is the proper form of the name), 3,715 (1924).
Samoa (New Zealand), 37,299 (1924): (American), 8,194 (1922).
Society Is. (French, including Tahiti), 7,145 (1924).
Tonga (British protectorate), 24,935 (1921).
Tubuai Is. (French), about 3,000.
Wallis Is. (French), about 4,500.

The decrease of native population continues in most of the islands; from whatever cause, the islands under French control, especially the Society, Tuamotu and neighbouring groups, appear to be specially affected. The French administrations have been criticised for lack of care for the wellbeing of the natives: in New Caledonia they are said to make little effort to put native labour to use, and indeed their control is not wholly effective. There was a small native rising there in 1917. Japanese, Tonkinese and Javanese labour is imported. The Fijians and the Gilbert and Ellice islanders also diminish in numbers. In the latter colony the Govt. enforces the prohibition of alcohol; but it is still urged that the adoption of European clothing, as the natives become better educated, weakens their resistance to pulmonary diseases. And not only here, but in many parts of Oceania, an influenza epidemic in 1918 caused many deaths—4,000, for example, in Tahiti, and 1,000 in Tonga.

Nevertheless, there are exceptions to these unhappy conditions. Thus American Samoa was free of the epidemic, and the native population is estimated to have increased over 40% during 22 years of American control. Native education has in some instances become a matter more of government concern and less exclusively in missionary hands. Thus down to 1916 education in Fiji was almost entirely a missionary organisation; but the Govt. then passed an Act rendering all schools which comply with certain conditions eligible for state aid. The Gilbert and Ellice Govt. introduced a new system in 1920, and the New Zealand administrations have taken similar action.

Among immigrant Asiatic peoples, apart from the Japanese, the most important group is that of the Indians in Fiji. Indentured Indian labour was stopped in 1916, though free labourers could still be admitted. Under indenture the general condition of the Indians was good, though isolated abuses gave rise to private philanthropic interference from Australia. But many Indians in Fiji have entered into trade and become well-to-do, and having (on the whole) benefited by residence in the colony proceeded to strikes and seditions, the unrest in India having been reflected in Fiji and fomented by imported agitators. Stern measures by the Govt. have been effective.

Trade.—Copra, phosphates and fruits are the chief articles of export from Oceania. Some of the islands are leased to coconut companies, and in many the industry flourishes, but not in all. The cost of importing labour and collecting the produce proves too heavy in some instances, as for example Christmas I., which has changed ownership more than once, and in 1923 employed only two Frenchmen and 18 Tahitians under a British company. Some of the copra-yielding islands are liable to occasional hurricanes which may almost wreck the industry—there was one such in Niué in 1915; but as a practical method of celebrating the end of the War 15,000 nuts were planted there. Drought also may be a deterrent of the copra industry. Thus in the Gilbert Is. in 1915–8 there was a shortage of rainfall, with only 14 in. in the driest year; the normal ranges from 80 to 140 in. annually. The fruit-growing industry of the Cook Is. is believed capable of great expansion. Fiji exports principally sugar and molasses, copra, bananas and trocas shell. Rubber is grown, but the industry could not withstand the low prices of 1920–1. An interesting attempt to acclimatise the mocora palm is contemplated in Niué, with a view to making Panama hats from the fibre; the natives are skilled weavers of pandanus hats, but the trade has declined.

Nauru is the chief producer of phosphates (*see* NAURU). The excellent quality of the nickel and chrome ores of New Caledonia has attracted attention, but there is no great development owing to difficulty in obtaining labour, and only companies established under French law are permitted. Makatea in the Tuamotu group has become a phosphate ground of some importance, and is administered separately from the rest of the group. But the trade of the eastern French islands generally is somewhat stagnant, and the development of Tahiti as a holiday resort from America (an attractive consideration being the absence of prohibition) has been seriously discussed. (*See* ARCHAEOLOGY: *Oceania*; GUAM; FIJI.)

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(O. J. R. H.)

OCEANOGRAPHY (*see* 19.967).—In 1912 the results of the South Polar expeditions became known. Roald Amundsen landed on the great Antarctic Ice Barrier (at the Bay of Whales, in south lat. 78°, and west long. 165°) and travelled over the land towards the Pole, which he reached on Dec. 14 1911. Capt. Robert Scott had left England before Amundsen and in ignorance of the intention of the latter to seek the South Pole. Scott took his previous route, *via* the Beardmore Glacier, towards the Pole, not the easiest way, but much the most interesting one from the scientific point of view. The party (Scott, Wilson, Oates, Bowers and Evans) reached the South Pole about a month after Amundsen and, on their return, encountered a series of blizzards in which all perished.

After Scott's last voyage Shackleton made two further expeditions to the south polar regions. In the first one he left England in the "Endurance" (in 1914); reached south lat. 76° 34′, drifted north, was beset in the ice and lost his vessel, the crew being landed on Elephant Island (in south lat. 62° and west long. 55°). This voyage is famous for the fine boating cruise made under the command of Capt. Worsley. A small party left Elephant Island in a whaleboat and, after a voyage of 14 days, reached South Georgia from where they sent assistance to the wrecked crew of the "Endurance." Shackleton again sailed for the Antarctic in Sept. 1921, in the "Quest" but died (of angina pectoris) at South Georgia on Jan. 4 1922. These voyages have roughly fixed the notions at present held about Antarctic geography (*see* POLAR EXPLORATION).

An important expedition set out (Oct. 1925) for the Antarctic regions on Scott's old vessel, the "Discovery," strengthened and refitted for special work. This is the eighth exploring vessel bearing that name—the first one having gone to Hudson Bay in 1602. The voyage is primarily intended for the investigation of the whaling industry and it will be supplemented by the continuous work of a laboratory on the Island of South Georgia. The cost of this well-found expedition is largely borne by the Government of the Falkland Islands, and important scientific results are confidently expected (*see* WHALING).

Arctic Expeditions.—The first and most notable Arctic expedition since 1913 is that of Stefansson, who left Alaska in 1913 with a vessel called the "Karluk." Stefansson demonstrated, for the first time, how Arctic investigators could trust themselves freely to the ice, finding food there and being able to keep themselves perfectly healthy (*see* ARCTIC RESOURCES). He investigated part of the Beaufort Sea, the huge inaccessible region of frozen ocean lying between the Pole, Alaska and Western Siberia. He explored some of the Parry Islands and supplemented Nansen's observations on the drift of ice in the North Polar Ocean: this takes place in a large cyclonic eddy having its centre in north lat. 83° 50′ and west long. 160° tending to leave the Arctic region through the wide passages between Greenland and Iceland and between Iceland and Europe.

It is now known (though no formal results have yet been published) that important fishery and oceanographic investigations have been made by the Russian Govt. on the Siberian Continental Shelf. Off the coast, from Novaya Zemlya to the Behring Straits there is an enormous region of flat shallow water (the greatest in the world) and some great rivers (such as the Lena, Obi and Yenesei) open into the sea here. It is stated that the fishing grounds in the neighbourhood of these estuaries are unusually productive. An American expedition (the Macmillan one) is working in the Arctic regions.

Roald Amundsen made an attempt in 1925 to reach the North Pole by aeroplane. Starting from Kings Bay, in Spitsbergen, a small party reached north lat. 87° 44′ (in west long. 10° 20′) but were then forced to descend. After abandoning one of the planes, they returned to Spitzbergen in the other. A small expedition led by Algarsson left Liverpool for Arctic investigation in 1925 but returned after some three months. Two small but very successful expeditions to Spitzbergen were organised by some Oxford scientists. Thus there have been several investigations during the post-War period, but these have added little to our knowledge of the oceanography of the North Polar Ocean beyond that resulting from Nansen's highly productive voyage with the "Fram" in 1895.

A good deal of general marine biological and oceanographical investigation is now being carried on in the shallow seas of the north-west of Europe by the various maritime states. This work is mainly concerned with questions of the productivity of the sea fisheries, with the search for new trawling grounds and with the investigations necessary for the elaboration of regulations of methods of fishing both within the territorial waters and on the high seas.

Physical Oceanography and Geodesy.—The tendency in oceanographical investigation is towards research into the physics and geology of the ocean floor; towards the physical and mathematical study of currents and tides; and towards the investigation of oceanic meteorology.

Permanence of the Ocean Beds.—There has always been much discussion as to whether or not the great oceanic depressions have always been permanent features of the face of the earth. In the latter half of the 19th century, this was generally believed. Nowhere on the dry land are there any sedimentary rocks that appear to have been deposited at the bottoms of oceans comparable in depths with those we know—that is, there are no formations known that resemble, for instance, the Globigerina Ooze now being deposited on the Atlantic floor. On the other hand the geographical distribution of many species of plants and animals points very decidedly towards the existence in the past of land connections between the various continents, and this evidence cannot be put aside. It is now believed that, in the North and South Atlantic, in the central part of the Indian Ocean, and possibly in the central part of the Pacific, there were, during the Mesozoic period, extensive land regions that have now subsided. Thus there are indications that large regions of continental land have been depressed to form the floors of deep oceans, but there are no clear indications that deep ocean beds have ever been elevated to form dry land. It is possible that the quantity of water on the surface of the earth has been increasing throughout geological time. It is known that fluid heated rock (volcanic magma) contains much water and it is probable that, in the course of geological time, large quantities of water have thus reached the surface as these magmas, are extruded, cool down and weather away (*see* GEOLOGY).

Age of the Oceans.—Fairly satisfactory data now exist for the formation of estimates of the age of the oceans. The evidence comes partly from the study of radioactivity (*q.v.*): it is known that helium and lead are the end-products of radioactive disintegration of certain minerals and from the ratios of these materials to their parent substances it is believed that a period of several thousands of millions of years must have elapsed since the first solid and cool earth-crust was formed. Some cosmographic investigations (due mainly to Jeans and Jeffreys) suggest pretty clearly that at least about 1,300,000,000 years have elapsed since the first oceans were formed.

Formation of the Ocean Floors.—Oceanic soundings are gradually accumulating (though they are still very few in comparison with what are needed) and a general idea can now be made as to the forms of the great oceanic depressions.

Geosynclines.—In general an ocean bed is a great, flat plain and there are few marked elevations or depressions on it. But, in general, the marginal regions are deeper than the central ones and there is a tendency for the arrangement of mountain chains running parallel to the ocean coast (as along the whole western sides of North and South America). Also the marginal regions of oceans tend to be regions of volcanic and earthquake disturbance. (The coast of Japan and the coastal part of California, for instance.) Jeffreys has shown how very probable it is that the central part of the earth has still a very high temperature; that a relatively thin outer shell is cold and has ceased to contract and that the hot central mass is still losing heat to the outside. Therefore the ocean floors must warp downwards at the margins, but must tend to rise slightly at their central regions. Our knowledge of oceanic depths supports this conclusion. In the Pacific notably, but also in the Atlantic and Indian Oceans, the "deeps" (that is, the regions of over 3,000 fathoms in depth) all tend to be situated near to the continental lands.

Relative Ages of the Oceans.—These features of high mountains, formed by foldings of the earth, and running parallel to the oceanic margins, are well exhibited on the American side of the Pacific. On the Asiatic side we have chains of islands (the Aleutians, Kuriles, Japanese, Philippines, etc.) which form the natural boundaries of the ocean bed. In many places these islands (the "insular arcs") can be shown to be formed by earth-foldings. They are often volcanic and earthquake regions. Thus the Pacific Ocean is bounded by geosynclines—that is, the coastal mountain foldings and, outside of these, the marginal oceanic depressions. These geosynclines exhibit great activity, which is indicated by faulting of the strata, earthquakes and volcanic eruptions. Therefore the Pacific Ocean is still in the making, so to speak. Indeed among the island archipelagoes there are evidences of continued subsidence. The Atlantic is a much older ocean for, except in the West Indian region, there is not much evidence of activity as in the Pacific, while the geosynclinal land elevations and depressed marginal oceanic deeps show signs of being smoothed out. The Indian Ocean is probably still older, in the geological sense.

The Theory of Isostasy (*see* ISOSTASY).—When the intensity of gravity was measured at many places on the surface of the earth, some remarkable results were obtained. The measurements are made by observing the rate of swinging of a standard pendulum (on the land) or by observing the barometric pressure simultaneously with the temperature of boiling water (on the sea). Where necessary corrections are made, the intensity of gravity is everywhere the same (with the exceptions of small deviations). Yet it ought to be less over the ocean bottom (where some two to three miles of earth crust are replaced by water) than over the continental land. Therefore, again, the materials of the earth crust must be heavier on the ocean floor than on the continental plateaux. At a certain depth beneath the surface all rocks are exposed to such enormous pressures that they are in a potentially self-crushed condition so that "flowage" of their materials must take place when there are stress-differences. There is a continual adjustment of pressure so that when shallow sea regions near the land are loaded with sediments from great rivers, material beneath this loaded region flows to underneath the continental plateau (which has undergone erosion).

The Wegener Hypothesis.—Connected with the theory of isostasy is Wegener's hypothesis of the mode of origin of the oceanic and continental earth-features. Beneath the continental plateaux and the ocean beds there is the "plastic," crushed, earth-crust layer, and the hypothesis is that the great continental land elevations actually slip on this crushed layer. The Atlantic has been formed, it is stated, by the slipping westward of the Americas and when the outlines of Western Eur-Africa and eastern North and South America are compared it is seen that the one continental land mass would approximately fit into the other. The coastal mountain ranges on the Pacific margin of the Americas are said to have been formed by the crumpling of the crust under the horizontal pressure set up by the westward drift of the American continents, and so on. The hypothesis requires that there should be evidence of progressive change of longitude. This has been claimed but the observations are doubtful. It also requires a motive force—some stress-difference under which the continental land masses yield and shift place relative to the earth-axis. This is difficult and no satisfactory verification of the Wegener hypothesis has been made (*see* GEOLOGY).

Tidal Investigations (*see* TIDES).—Much fine work, both on the theory of the tides and on the methods of tidal prediction has been done at the Liverpool Tidal Institute. The methods of prediction have been greatly improved and methods of forecasting deviations from the predicted results (which may be due to winds) are being worked out.

Long-period Tides.—The work of Otto and Hans Pettersson on the occurrence of long periodic variations in the tide-generating force due to the sun and moon has important oceanographic consequences—should the theory be confirmed and established. The Petterssons have shown that there are absolute maxima of tide-generating force recurring at intervals of about 1,600 years. The last maximum was in 1433 A.D. and the next will be in 3300 A.D. Important effects preceded the last maximum—thus the coast of Greenland was relatively free from ice during the period of the Norse voyages related in the Sagas. Iceland was nearly free from volcanic eruptions during the period 800 to 1250 but such phenomena were relatively frequent during the period 1290 to 1348. During the 13th and 15th centuries, the Baltic was frequently frozen over between Denmark, Germany, Sweden, Gothland and Esthonia. About 1287 the Zuider Zee was formed. The Pettersson Theory relates many of these occurrences to the changes in the North European ocean current system set up by the high tides during the periods of maximal force (that is, at intervals of 1600, 93, 19, 9 and 4½ years).

Marine Biology.—The most important result of oceanic biology during the post-War period is the completion of Dr. Johs. Schmidt's fine investigations on the life history of the freshwater eels. It has now been demonstrated that all the eels of Europe and America migrate out into the region of the Atlantic Ocean roughly coincident with that of the Sargasso Sea. There they spawn and, after this single reproductive act of their life-times, they die. The eel-larvae, or *Leptocephali* take several years to migrate towards the continental shores where they undergo metamorphosis into the well-known elvers and then ascend the rivers. Having attained maturity after 4 to 7 years they return to the Atlantic Ocean to spawn and die.

References to most of the matters treated in this article will be found in J. Johnstone, *Introduction to Oceanography* (Liverpool, 1923). (J. J.)

OCHS, ADOLPH SIMON (1858–), American newspaper proprietor, was born in Cincinnati March 12 1858, of Jewish parentage. His father, who had left Bavaria for the United States in 1846, settled in 1865 with his family in Knoxville, Tenn., where the son studied in the public schools and during his spare time delivered newspapers. At the age of 15 he became a printer's devil on a Knoxville paper. Advancing rapidly in newspaper work, he moved to Chattanooga in 1877 and in 1888 gained control of the reorganised Chattanooga *Times*, which soon assumed a high position among the papers of the South. He was one of the founders of the Southern Associated Press and served as president. In 1896 he obtained control of *The New York Times*, then in financial difficulties and with circulation greatly diminished. He formed the New York Times Co., and having placed the paper on a stronger financial foundation after four years became the majority stockholder. With a daily issue on Aug. 18 1896 of 18,000 (of which over half was returned unsold), the circulation increased rapidly, reaching an average of 392,695 in 1926, (360,000 daily and over 600,000 on Sundays). The annual receipts exceeded $22,000,000 in 1925, probably equalling those of any other American paper. In 1926 the staff of *The New York Times* numbered 2,800. It was classed as an independent Democrat publication, an advocate of sound money and tariff reform, and consistently opposed William Jennings Bryan in his presidential campaigns. By the fairness and comprehensiveness of its presentation of news, editorial moderation and ample foreign service, it made secure a high place in American journalism, becoming widely read and influential throughout the country.

The *Times* has been a pioneer in many fields of newspaper publishing: in the introduction of rotogravure printing to the United States, in the reception of a new service by wireless, in the improvement of advertising typography and in the censoring of advertising to protect its readers from dishonest and misleading offers. It is also worthy of note that in an age of syndication, or exchange of news features among a great many newspapers, the *Times* has pursued a wholly different course, preparing its news and other articles solely for its own columns. The *Times* Co. also publishes the *Book Review and Magazine* (sections of the Sunday edition); the *Annalist*, a financial review appearing on Fridays; the *Times Mid-Week Pictorial* on Wednesdays; *Current History Magazine*, a monthly, started during the World War. The *Index* of the *Times*, begun in 1913 and published quarterly, forms an invaluable guide to contemporary events, to be compared only with the similar Index to *The Times* of London. In 1901 Mr. Ochs became proprietor and editor of the Philadelphia *Times*, later merged in *The Philadelphia Public Ledger*, of which he was sole owner from 1902–12, when he sold it to Cyrus H. K. Curtis. The Times Co. also has in the Wide World service a news photograph agency covering the entire world. (L. WI.)

O'CONNELL, WILLIAM HENRY (1859–), American cardinal, was born at Lowell, Mass., Dec. 8 1859. He graduated from Boston College in 1881, and then went to Rome where he studied theology at the North American College (1881–4), being ordained priest June 8 1884. He became rector of the North American College in 1895 and was consecrated Bishop of Portland, Me., May 9 1901. In 1905 he was selected as special papal envoy to the Emperor of Japan. He was appointed co-adjutor to Bishop

Williams of Boston, Mass., Feb. 8 1906, taking the titular archbishopric of Constantia. He became Archbishop of Boston Aug. 30 1907, and was created cardinal by Pope Pius X., Nov. 27 1911.

ODER (*see* 20.2), a European river. The Oder rises in Czechoslovakia, flows through the mining area of Upper Silesia, and crosses Germany, receiving a number of tributaries, of which the chief are the Warthe and the Netze,[1] both rising in Poland.

It is utilised by three main currents of traffic; traffic between Berlin and Stettin; goods transported to or from the mining area of Upper Silesia (this traffic has diminished since the partition of Upper Silesia between Germany and Poland); and traffic to and from Poland via the Warthe and the Netze, thence by the Bydgoszcz (Bromberg) canal and the Brda (Brahe) river towards the Vistula. Poland has placed on the navigation of these two tributaries certain restrictions based on her conception of their legal status.

Problem of International Status.—The Oder and all the navigable portions of its system, which provide natural access to the sea for more than one state, were declared international under Article 331 of the Treaty of Versailles. Article 341 places the Oder under the administration of an international commission consisting of three representatives of Prussia, and one each of Poland, Czechoslovakia, Great Britain, France, Denmark and Sweden. Under Article 343 it was the duty of this commission at once to prepare an act of navigation. As the commission failed to reach an agreement regarding the territorial extent of its powers, the British Govt. on Aug. 23 1924, brought the dispute before the League of Nations, in virtue of Article 376 of the Treaty of Versailles.

The advisory committee of the communications section of the League appointed a commission of inquiry consisting of M. J. Hostie, president, Gen. H. O. Mance and Prof. L. Babinski, which studied all the legal aspects of the question and also examined the situation along the Warthe at Poznań (Posen), along the Netze (Notéc) at Nakło, and along part of the Old Netze between Nakło and Lisi-Ogon. The majority of the commission reported that "Oder" in the sense of Article 341 should be taken to mean the whole international system; moreover it was of opinion that although Article 331 only includes in the system the navigable parts which naturally provide more than one state with access to the sea, the sphere of territorial application had been extended as a result of Article 338, which provides that the provisional definition given in Article 331 shall ipso facto be replaced by the general definition of the Barcelona Convention on the régime of navigable waterways of international concern. As regards consideration of fact, the Warthe, from its junction with the Oder as far as Pogorzelice, indubitably fulfils the conditions of the general definition laid down in the Barcelona Convention. The Warthe, as far as Luban, carried considerable traffic before the War. It was navigable for craft of 400 tons, which could proceed with full cargoes at mean water level. The sector between Luban and Pogorzelice was navigable for craft of 150 tons and carried an appreciable amount of traffic, although mainly of local character. The Netze, which has been canalised between Kreuz and Nakło, is navigable for craft of 400 tons. In pre-War years this waterway carried a considerable amount of traffic—mainly transit traffic proceeding from or towards the Bydgoszcz canal. The commission considered that the Netze below Nakło should be regarded as naturally navigable; the portion of this river above Nakło should not be presumed, in its natural condition, as being navigable in the sense of the Barcelona Convention.

Transit Committee's Suggestion.—The committee for communications and transit suggested on Nov. 27 1924, that the jurisdiction of the international Oder commission should extend upstream on the Warthe to and above Poznań (Posen), and upstream on the Netze as far as Ujście (Usch), from which point as far as its confluence with the Vistula through the Bydgoszcz canal, the waterway should be subject to the régime of the Barcelona Convention. In the opinion of the committee this solution, while it takes account as far as possible of the various legal and technical standpoints, is also in the general interests of navigation. The choice of the limit on the Warthe needs no comment; for purely technical reasons the limit on the Netze might have been Nakło, but this would have represented in fact a decision regarding the legal controversy. The committee preferred to reach an agreement on a practical basis. Thus Ujście was chosen; but on the other hand, realising the importance before the War of the transit traffic over the junction between the Oder and the Vistula, the committee desired to guarantee to international navigation, including floating, the benefits of an international régime on this waterway. Existing treaties guarantee to Germany freedom of transit across Poland, along all means of communication for traffic to and from East Prussia. Consequently, for a certain category of traffic, this waterway already enjoys an international régime as regards transit. It was thought that under the circumstances the proposed extensions of the international régime would not encounter any serious opposition.

However, at its eighth session in July 1925 the advisory and technical committee felt bound to note the fact that the opinion given with a view to conciliation had been accepted by all the governments represented on the Oder commission except those of Germany and Poland. The German Govt. expressed no opinion, while the Polish Govt. definitely refused to accept the solution. (R. Rn.)

ODESSA (*see* 20.3), in the Ukrainian Soviet Republic, had a population of 434,857 in 1920 as compared with 631,040 in 1912. The city was bombarded several times by the Turks during the World War, taken by German forces in 1918 and occupied by the Bolsheviks in 1920. A new mole and a special ice-breaker were built for the harbour before the War, but Odessa's share in the trade of Russia was then declining and plans had been made for further improvements in the harbour. A scheme was reported to be again under consideration in 1925, whereby it is proposed to construct a grain harbour, an additional mole and warehouse accommodation. Ground was being reclaimed and dredging carried on in 1925 and Odessa was made a free port by the Russian Govt., in the hope of improving trade. The quay accommodation in 1926 allowed 12 or 13 steamers to unload at once.

O'DONOVAN, WILLIAM RUDOLF (1844–1920), American sculptor and painter (*see* 20.9), died in New York City April 20 1920.

OFFICE APPLIANCES.—Many office tasks, being of a repetitive character, naturally adapt themselves to the principle of "division of labour," and consequently to the use of machinery also. But these facts alone are not sufficient justification for the purchase of appliances. Four purposes are considered by good office management in deciding when the use of machinery is advisable. These are:—

Objects of the Appliances.—1. To save labour. This saving should be evidenced in a reduced pay-roll. Hypothetical savings of "half a man" are seldom realised.

2. To save time. In many cases this is more important than the saving of labour; to speed up a slow routine, extra expenditure is often an economic advantage.

3. To promote accuracy. Mechanical methods are advisable when accuracy is vitally important and otherwise difficult to obtain.

4. To avoid monotony. The substitution of a machine for manual repetitive movements will usually achieve this.

Inventive skill and genius have not been lacking to meet these needs, and the list of available devices is very long, machinery being now extensively used.

Adding and calculating machines are largely used for the promotion of accuracy, and save time by avoiding extended search for errors. The ordinary clerk is usually incapable of correctly handling a large amount, even of simple calculations, with a fair degree of accuracy by the mental-manual method, and these machines have therefore become a practical necessity for the modern business office.

Adding Machines.—All adding machines may be used for addition, subtraction, multiplication and division; but as certain types are better adapted for multiplication and division, a technical distinction has grown up in the trade between adding and calculating machines, the latter being used more extensively for multiplication and division.

There are two principal types of adding machines: those which print on paper the amount being added, and those which do not—the former being known as listing, and the latter as non-listing machines. The listing machines are again divided into two classes, the first being the full keyboard model carrying a row of keys numbered from 1 to 9 for each column, and the machine of the second class having 10 keys arranged in two or three rows. Each of these keys represents a digit, and the depression of a key for an item automatically causes progressive columnar position. Thus, if 23 is to be added, the 2 is first depressed, then the 3, and the mechanism takes care of the numerical order. The items are printed either on a roll of narrow paper or on a wide form held in the carriage of the machine.

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[1] The Netze is a tributary of the Warthe.

Some models have two sets of adding dials—one for accumulating individual totals, the other for accumulating a grand total. On some machines a "split" feature provides for splitting the printing mechanism into two or more sections, so that several columns may be listed and added at the same time and the total of one or more columns printed. On others, subtraction is accomplished by means of complementary numbers, a "complement" being any number which, added to another, makes a full number. Thus if the digits are changed to 9's—as 9, 99, 999 and so on—and a 1 then added, we can convert any number into a full or complementary number on the keyboard of any adding machine. The complementary numbers are usually indicated by small figures on the keys, the two digits on a key, if added, invariably making nine. Other machines perform subtraction by depressing a subtract key. Multiplication is consecutive addition. Thus, if 26 is to be multiplied by 5, it is merely added five times. For division, the divisor is subtracted from the dividend as many times as it is contained in that dividend, the number of subtractions being automatically registered on the counting wheels as a quotient. There is also a small portable adding machine, weighing about seven pounds, operated with a pull-down lever keyboard. A very small adding device, known as a vest pocket machine, is operated by inserting a pick, or stylus, in positions for the amounts.

Calculating Machines.—Where rapid addition, multiplication, subtraction and division are required, and no need for a printed record exists, calculating machines are used. They do not print a record of the items, but indicate the result on total dials. One type, known as the key-driven, causes the items to appear immediately on the dials when the keys are depressed, the operation of a crank clearing the figures off the dial faces again. As with adding machines, the four arithmetical operations are all performed as variations of simple addition. In another type, known as the key-set, the amounts are first set up on the keyboard and operation of the machine, either by hand or by motor, effects the calculation. The total dials, located in the laterally moving carriage above the keyboard, show the total in addition, the product in multiplication, the minuend or remainder in subtraction and the quotient in division. Proof dials, located in, above or below the carriage, show the multiplier in multiplication and the divisor in division. An extra set of dials is sometimes provided, which furnish an additional check for accuracy by showing the amounts set up on the keyboard. The dials are cleared by various means, distinctive with each make of machine.

For subtraction, the amount from which the deduction is to be made is set up, the operation of the machine causing that figure to appear on the total dials. The figure to be subtracted is then set up and the machine operated, and the answer appears on the total dials. Multiplication is consecutive addition, though in some models multiplication is by means of a plus bar; in others, by means of an extra row of multiplying keys. Division is consecutive subtraction, some models dividing by means of a minus key, while another model provides for setting up amounts by means of levers pulled down to the desired numbers, this machine otherwise conforming to the key-set type.

Book-keeping Machines.—The so-called book-keeping machine is in reality a device for posting on loose ledger sheets or cards. The amount is not merely entered to the account as in hand book-keeping—to be added and balanced at a specified period—but a balance is struck each time a posting is made. The original entry from which the account is posted is usually a sales ticket, credit slip or copy of the invoice (*see* BOOK-KEEPING).

All such machines are designed to print and add an old balance, print and add debit items, print and subtract credit items and compute the new balance, in some cases printing it automatically, in others showing it in the adding and subtracting mechanism so that it may be copied in the proper column by the operator. Proof of the correctness of posting varies with the type of machine. One type is an adding machine which subtracts directly; it is equipped with means for printing dates, folio numbers, characters and abbreviations, and with a tabulating carriage which moves automatically to the next column as each amount is computed and printed, and in some cases returns automatically to any required position on the printing line. Both vertical and horizontal columns are added, subtracted and computed. Items are set up as on an adding machine, the operation of the motor causing them to be printed, added or subtracted. When a new balance is printed, the accumulator clears, ready for the next operation. Some models have two counters, thus making it possible to compute individual balances and accumulate a total of all postings. The keyboard may be split into two sections so that both ledger and statement can be inserted in the carriage and posted at the same operation—that posting being automatically repeated.

The design of a second class of book-keeping machine embodies a typewriter—on which any description may be typed—and a calculating machine, built as one unit. Some machines add and subtract in vertical columns; others compute amounts across the sheets as well. The typewriter carriage moves to correct column positions by means of a decimal tabulator. Typing the amounts on the number keys effects addition or subtraction. The amounts are visible in registers or totalisers placed either on the carriage truck, in positions corresponding to the columns to be added or subtracted, or at the front of the machine below the keyboard. In posting, a new balance is computed, and the operator types in the proper column the amount appearing in the register which functions to compute across the sheet. If the typing is correct, this register clears. Ledger and statement are made at the same time, in some cases by means of a carbon and in others by the split-platen method, one machine of this class being unique in that its typewriter section is mounted on a carriage which moves from left to right across a flat printing surface on which the forms are held, a back and forward motion providing line spacing. Registers are mounted on the rear of the typewriter section, and ledger and statement are posted at one operation by means of carbon.

A third class of machine carries, below the typewriter keyboard, a 10-key keyboard which controls the calculating mechanism. Here the split-platen method is used for making ledger and statement at the same time. Still another class, used for ledger posting and instalment accounts, follows cash register design, amounts being set up on a push-in key-set keyboard, and turned into the mechanism by the operation of the motor. There is a sliding printing table on which the forms to be posted are inserted. Two forms may be posted at the same time, the amount being printed on one and repeated on the other. This machine automatically computes and prints the amount of the balance outstanding on each account. Debits and credits are classified and a total of each is accumulated, as many as 18 individual and two group totals being obtainable. A detailed record of all postings is printed on a strip of paper inside the machine.

Billing Machines.—The writing of an invoice for goods sold, by means of a carbon duplication, can be made to serve other purposes also, and it is quite common at one writing to make the invoice, the original sales record, the shipping notice, the shipping record and other memoranda required for various kinds of business. By means of calculating devices, the amounts of the items may be computed, and totals accumulated for controlling accounts. Combination typewriters designed to do this work are known as billing machines. These are designed to write, at one operation, the several necessary copies of orders, invoices, bills of lading and other forms, and in some cases to compute amounts as they are written. Cut forms, printed and padded in individual sets so that each set is torn off and loose carbon inserted between the sheets to make the necessary copies, are used with some machines. Others use continuous-length forms, which provide multiple copies of the same or related forms, in rolls or folded flat, these forms being fed through the machine with the carbon interleaved between the copies, so that it is not necessary to insert new forms after writing each set.

Among the billers which write, but do not compute, is an ordinary correspondence typewriter equipped with an inbuilt carbon-changing device which removes the carbons from a set of continuous-length forms just written and inserts them in another set. Another non-computing biller has a standard keyboard typewriter mounted on a carriage which moves from left to right across the flat writing surface over which the forms are fed. Cut forms may be used with this machine, and it may be equipped to add in vertical columns and to cross compute as well. Book-keeping machines which combine a typewriter with a calculating mechanism have been adapted to billing work which requires the adding or subtracting of amounts as they are typed. One such has an inbuilt carbon-changing device which provides for the use of continuous-length forms; another uses cut forms and may be equipped with a split cylinder so that billing and ledger posting can be done simultaneously.

Still another embodies a typewriter and a calculating mechanism which handles addition, subtraction and multiplication, and is operated from a separate 10-key keyboard below the typewriter keyboard. By means of a split-platen, billing and ledger posting can be done at the same time.

Accounting and Tabulating Machines.—The preparation of statistics requires, first, the sorting of data, and, second, the accumulation, by classes, of the amounts involved. Machines for this work were first used by the U. S. Census Bureau, but are now being rapidly adapted to business uses, such as cost work, sales analysis and similar work.

Cards printed with vertical columns numbered from 0 to 9, or from 0 to 12, and separated into fields of one or more columns, each field representing an item, such as department, job number and so forth, form the basis of two systems. Facts are expressed in figures, letters or symbols, and are recorded by perforations on the card at the proper numerical positions, made by a punching machine which operates like a typewriter. The cards are then arranged by a sorting machine, according to a predetermined classification. Contact—electrical or mechanical, depending on the make of the machine—sets the mechanism in motion. The cards are next fed through the tabulating machine, which makes a printed final report, in multiple if so desired. Contact through the perforations causes the machine to designate and add what has been perforated into the cards—listings, sub-totals, totals or grand totals being obtained, depending upon the arrangement desired for the report. When detailed listing and printing is not required, a non-printing tabulator registers the quantities in counters which accumulate the totals, the figures being posted by hand to report forms.

Another type of machine is built on the same principle as the book-keeping machine of cash-register design. Twenty-seven keys, each representing a classification, accumulate individual totals, and as many as three grand totals can be obtained and the number of items in each classification counted. A continuous permanent record of all operations is made within the machine on a roll of paper called a visible audit sheet, and notations may be hand-written opposite any printed item. This record may be used as a posting medium, a proof sheet or a permanent record. A ticket may be issued on any operation, showing the date, serial number, identifying numbers, symbols for the totals used and the amount. It may be used as a voucher, pay ticket, receipt, requisition, or posting medium, or for filing purposes. The same information may be printed on any form inserted in the printing-table.

Duplicating Machines.—In offices there is much need for devices that will quickly produce multiple copies of typewriting or handwriting, for the time and labour thus saved is an important economy. Sometimes only a few copies are needed; sometimes many. For a limited number of copies, say up to five or six, the carbon method of duplication is perhaps the cheapest in most cases; but where from 5 to 100 copies are required, the hektograph process is preferable.

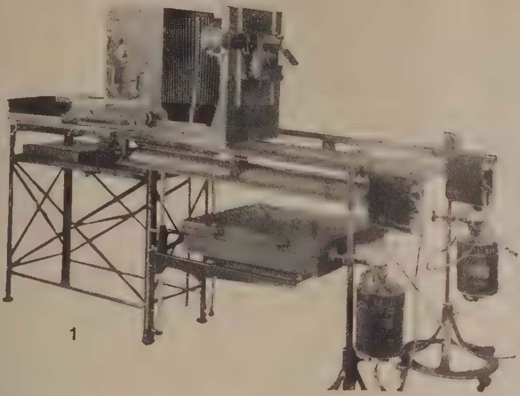
Stencils.—For a still larger number of copies, the stencil methods and type methods are available. With the former, the stencil was originally made on a sheet of wax-covered paper, which was written upon either with a stylus or with a typewriter from which the ribbon was removed—a system that had many defects. The modern method utilises a specially prepared sheet of tough, flexible tissue, which can be filed away after using and used many times. One manufacturer provides a glass-topped, electrically illuminated table for making stencils by hand with a stylus. Typewriting, handwriting and drawing may all be combined on one stencil sheet. The duplicator consists of a hollow revolving cylinder, partially covered by an ink pad, over which the stencil is fastened. Each revolution brings the stencil sheet in contact with the paper, and the ink, passing through the characters or design, makes the impression. From 1,500 to 5,000 copies can be made in an hour, depending on whether the model is hand- or motor-operated and whether it is automatically fed.

Hektographs.—The hektograph is many years old, and its operation is based on the principle of absorption. The original writing is done on a sheet of hard bond paper with a water-soluble ink or with a typewriter ribbon impregnated with such ink. This sheet is then placed in contact with a moist surface of gelatin or clay composition, and the writing is absorbed from the paper and appears in reversed form on the gelatin or clay surface. Then, by placing a sheet of blank dry paper on this moist surface, the impression is transferred to the paper. The gelatin was originally used in flat tin pans, and in this form the hektograph was of little use in the office, as registration was difficult. The clay form of hektograph was, and is, extensively used for the reproduction of drawings by architects and draftsmen, because it is a simple matter to prepare this composition for large sizes of work. The modern hektograph uses the old principle, but the gelatin is coated on a long band, a small portion of which is exposed at a time. This band runs over a flat iron surface. Registration is accomplished by a special feeding device. The unique feature of the hektograph duplicator is its use in routines of order or billing systems, in which from 10 to 15 copies of the same writing (or any portion of it) may be transferred to sheets of various sizes and shapes. Such copies are much clearer than carbons, and the paper does not have to be thin. The hektograph can also be used for bulletins of which 100 or less copies are desired.

Type Reproduction.—There are several devices which duplicate from type, the principal feature of most being a simple method of setting the type, which does not require a trained typesetter, the printing also being simplified by means of a revolving drum. The style of type most used is the imitation typewriter face, and the chief use is for the reproduction, through a ribbon, of facsimile typewritten letters, there being also a special device which may be used for the reproduction of the signature. A printing-ink attachment makes possible the use of printer's type and of electrotypes or stereotypes curved to fit the drum. Some models are hand-fed and operated; those which are automatically fed and motor driven attain a speed of 2,400 to 4,800 pieces an hour. Another machine produces letters from typewriter type cast on a linotype machine, at the same time filling in the name, address and salutation from slugs—one for each name on the mailing list—which change automatically as each letter is printed through a ribbon, the slugs being filed for future use. The speed is 1,000 letters and envelopes an hour, the latter being addressed from the same slugs. Certain machines which print from typewriter type are really small presses adapted to the printing needs of the layman, and print from printer's type, electrotypes, linotype, monotype, flat zincs and half-tones.

Automatic Typewriters.—The automatic typewriter is designed to produce actual typewritten letters at three times the average speed of a typist. Its mechanical movements are controlled by a paper roll, similar to that of a player-piano, in which perforations representing characters on the typewriter keys are made by a perforator. When an entire letter has been thus perforated, the paper is cut from the roll, and its ends are cemented together to form an endless belt, which is then placed over the drum of the automatic typewriter. The operator writes by hand the name and address and starts the automatic device. Pins dropping through the perforations into slots, as the roll is carried forward by the revolution of the drum, actuate the typewriter keys, causing the typing of the words; when all the perforations have passed over the drum, the operator removes the finished letter and then repeats. Insertions of special words or sentences may

OFFICE APPLIANCES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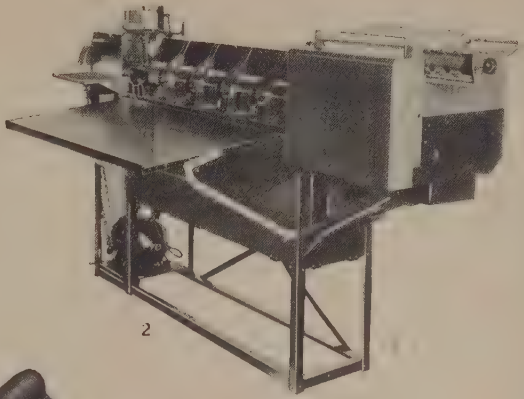
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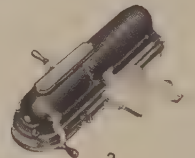
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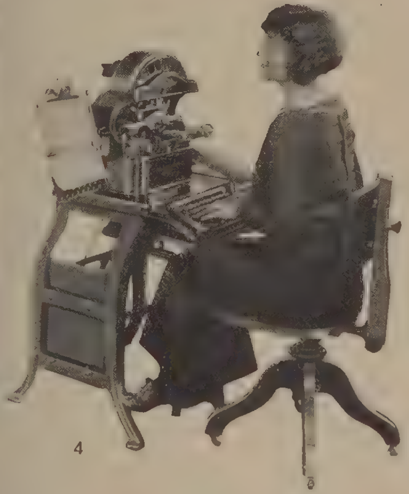
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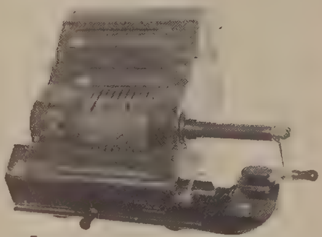
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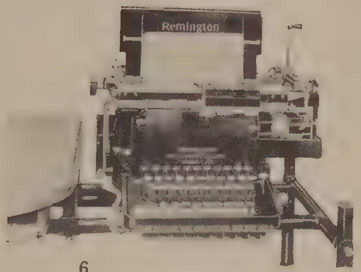

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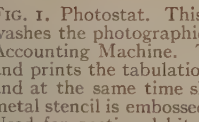
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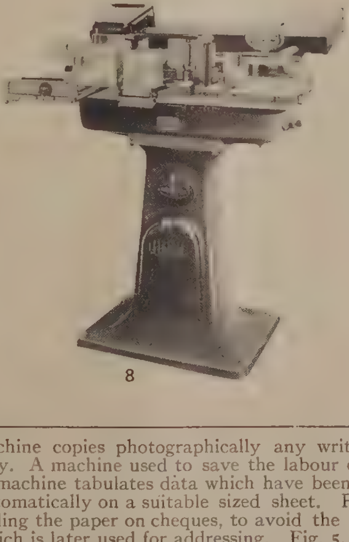
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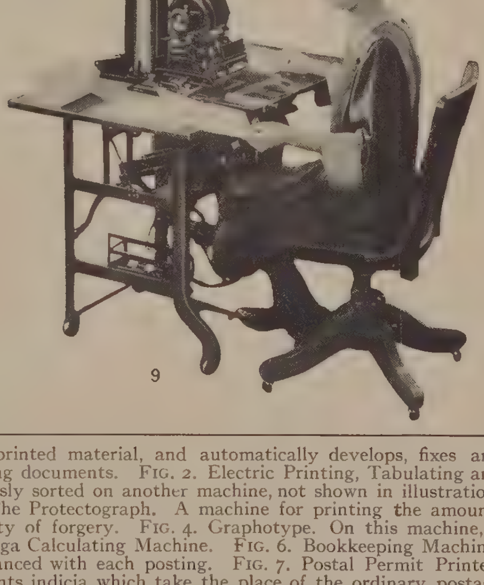
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FIG. 1. Photostat. This machine copies photographically any written or printed material, and automatically develops, fixes and washes the photographic copy. A machine used to save the labour of keeping documents. FIG. 2. Electric Printing, Tabulating and Accounting Machine. This machine tabulates data which have been previously sorted on another machine, not shown in illustration, and prints the tabulation automatically on a suitable sized sheet. FIG. 3. The Protectograph. A machine for printing the amount, and at the same time shredding the paper on cheques, to avoid the possibility of forgery. FIG. 4. Graphotype. On this machine, a metal stencil is embossed, which is later used for addressing. Fig. 5. Brunsuiga Calculating Machine. FIG. 6. Bookkeeping Machine. Used for posting debit and credit items on ledger sheets. Accounting is balanced with each posting. FIG. 7. Postal Permit Printer. FIG. 8. Postage Meter Machine. A device which seals the envelope and prints indicia which take the place of the ordinary postage stamp. The meter is locked by the postmaster, and postage is paid for the amount shown on the meter. FIG. 9. Addressograph. Prints from metal stencils made by the Graphotype. Addresses envelopes, statements and the like automatically.

be made by hand at any desired point. One operator can, without difficulty, control three or four machines.

Photocopying Machines.—A special photographic machine, in which a roll of sensitised paper coated on rag stock is used as a negative, photographing directly without the intervention of plates, has of late years been highly developed and used extensively as an office device. It offers a means of quickly producing a fac-simile copy of any document, and has therefore to a great extent eliminated the laborious hand copying of records, deeds, insurance applications, contracts and the like. The equipment consists of a large camera combined with a developing machine, so that after an exposure is made the sensitised paper is carried first to the developing bath and then to the fixing bath. Dials and levers control all operations, and the machine is so scientifically adjusted that an office boy can turn out perfect copies. The colours are reversed in the first print, called a "black print;" that is, the whites in the original are black and the blacks are white. As the photograph is made through a reversing prism, the letters appear exactly as in the original. A white positive print is made by re-photographing the black print. By continuing to photograph the original, as many black prints as desired can be made; and as many positives as required can be made by photographing the black prints.

Addressing Machines.—These are in reality devices designed for duplicating small pieces of writing. Originally designed for duplicating names and addresses—hence the name—they now have many other uses, such as the making of invoices, statements, receipts and other office records. They are of especial value in businesses where the same list of names and addresses must be repeatedly used. Each name and address must first be impressed upon a metal plate, cut on a fibre stencil or set in type, according to the character of the machine. The metal plate is prepared by an embossing machine operated by hand or electric motor; a blank plate is inserted in the machine, and the required characters are selected by an indicator and stamped into the metal. Some embossers have a typewriter keyboard, the embossing being performed by depressing the keys. Some metal plates carry a name card and others a record card for recording relevant data. A fibre stencil consists of a frame in which is mounted a panel of semi-transparent paper coated with a gelatinous material, some frames having spaces for the insertion of relevant data. The name and address are cut by means of a typewriter from which the ribbon has been removed, a special device holding the stencil while it is cut. When printer's type is used, slugs with the names and addresses are cast on a linotype machine.

Addressing machines, despite many structural differences, operate on the same general principle. The metal plates, stencils or slugs are fed from a magazine to the printing point where the envelope or other matter to be addressed is placed either by hand or by a mechanical device. Directly over the printing point is a stamping arm which comes down on the envelope when the machine is operated, thereby bringing it into contact with the plate, stencil or slug either directly, in case ink is used, or through a ribbon. As the arm rises, another plate comes to the printing point, the one just used passing to a receiving machine, where it re-files itself in original order. Models are hand, foot-treadle or motor operated, the speed varying from 1,000 to 15,000 impressions an hour. Special models are designed for publishers addressing on large envelopes, on mailer strip or directly on the margins of newspapers and magazines. The adaptability of addressing machines is greatly increased by attachments, some of which are so common as to be considered standard equipment. The metal plates and fibre stencils are filed like index cards in drawers kept in cabinets, slugs being filed in galleys and stored in cabinets. One machine is unique in that its metal plates are linked together to form an endless chain; they pass to the printing point from a reel on which they are wound and they are then re-wound on another reel, the reels being stored in cabinets.

Hand Stamp Affixers.—Stamps provided in rolls of 500 by the post-office are locked in a stamp affixer and applied to envelopes by the downstroke of a plunger, moisture being applied in some cases to the stamp, in others to the envelope. Extra containers, allowing for quick change from one denomination to another, are furnished with some models. Some machines are spring-locked; others are key-locked to guard against unauthorised operation; still others furnish the further protection of counting the stamps used, the number appearing in figures on a recorder.

Sealing Machines.—These are designed for the rapid sealing of large quantities of envelopes. The envelopes are fed to the machine one at a time, either by hand, semi-automatically by holding them against revolving feed rollers or automatically from a hopper—depending on the type of machine. The gummed flaps come in contact with a moistening device—a wick, a roller or a metal disk—which receives its water supply from a reservoir or by a position feed suction. The envelopes then pass between sealing rollers and are ejected from the machine.

Permit Mailing Machines.—An office having occasion to mail a thousand or more letters a day could greatly expedite their passage through the routine of mailing if the office were permitted to cancel the stamps or to print some indication that postage was paid. For this purpose, a U.S. Post Office regulation, passed in 1920, provides for the printing of the permit, or indicia, as it is called, directly on the envelope in the office of the mailer. Permit mail is of two kinds—metered and non-metered; for either, the licence must be obtained from the Post Office Dept. through the local postmaster, the mail being delivered to the post-office by the sender, as such mail is handled separately. Machines which handle non-metered mail print the indicia, seal the envelopes and count the pieces. The impression must show the postmark—city and state, month, day and year, denomination and sender's permit number. The number shown in the counter of the machine after a mailing is completed, multiplied by the denomination, gives the amount of postage to be paid. Payment is made either with each individual mailing or by a cash balance carried at the post-office. Certain machines will print the indicia without sealing, seal without printing, or count without either sealing or printing.

The basis of the meter system is a printing and recording mechanism demountable from the machine with which it is used, so that it can be taken to the post-office to be set for a given number of impressions, payment being made at that time, and the mechanism locked and sealed. Two sets of registers indicate how much postage has been used. A separate meter is used for each denomination, and any number of meters can be secured for one machine. The indicia are the same as those printed by the non-metering type, except that the sender's meter number is shown. The speed of such machines varies from 150 to 200 a minute. One type of machine is adapted for use with either the metered or the non-metered system. In 1924 the U.S. Post Office Dept. issued a regulation permitting first-class mail to be sent out with pre-cancelled stamps attached. The stamps, obtained in coils from the post-office, are applied by a hand stamp-affixer and the envelopes are then passed through a non-metering permit machine which seals and counts them and prints the postmark and additional cancellation required. Where bulk of mail does not warrant a permit machine, the postmark and additional cancellation are applied by a rubber stamp bearing a changeable date. One sealing machine is adapted to metered, non-metered and pre-cancelled systems, without mechanical alteration.

Cash Registers (*see* 5.446).—Motor-driven models are now available.

Autographic Registers.—On many occasions it is necessary to make by the carbon method several copies of pencil memoranda. The autographic register is a device for making at one writing an original and from one to six copies of sales slips, bills of lading, requisitions and other business records on continuous forms. These, interleaved with carbon, are retained within the register and fed across a writing table or platen. Some registers use rolled forms, one roll for each copy of the record; others use flat folded forms. Various type of registers have various methods of aligning the several copies that make up a set. As a written set is issued from the register, either by pulling out by hand or by the turn of a crank, and is torn off against a knife edge, another set, automatically leaved with carbon, is brought into a writing position.

Coin-handling Devices.—In all business houses where large amounts of coin are handled and packaged daily, the use of mechanical devices for sorting, counting and packaging saves time and labour. Coin-counters simply sort mixed coins into denominations. The usual type of machine has a disk revolving in a hopper, and the coins are carried by the disk to a rail finger from which they roll by gravity and are sorted by dropping through slots of various diameters into separate boxes. From 1,000 to 12,000 coins can be separated in a minute, depending on whether the model is hand or motor operated. Coin-counting and packaging machines count the coins and deliver them into bags or wrappers, and, in specific cases, check pre-determined amounts into bags. One denomination of coin is dumped into the machine and a revolving disk throws the coins to the outer edge of the hopper, where they pass under a register which counts them.

In some models the coins fall through a stem into a tubular wrapper which the operator has previously placed there; other models wrap with continuous rolls of paper, fed down as the coins are counted; when the required number of coins are in place, they are carried over to the paper and tightly wrapped, the machine automatically locking off further passage of coins. Coin-counters and separators serve the dual purpose of counting and sorting coins of mixed denominations at the same operation. The registering devices of some machines provide for a totalled sum in connection with each separate adding counter; others have a sub-total and a total register. Other coin-handling devices are bag-loading machines; proving and bagging machines which recount and bag coins that have been previously separated; continuous counting and bagging machines, which count and bag coins at a high rate of speed; counting machine heads, which handle one denomination at a time and handle metal tokens also; manual counters and packagers, which combine in one operation hand-counting and wrapping.

Dictating Machines.—By means of the cylinder phonograph the time of a stenographer taking notes may be saved. The executive who uses this system speaks into the mouthpiece of a small machine which records his voice by engraving on a revolving wax cylinder. He may pause in his dictation, correct an error, and at any time listen back to what he has said. When the cylinder is full, a typist puts it in a transcribing machine placed alongside her typewriter, and the reproduction of what has been dictated is carried to her by receivers placed over her ears, she typing the words as she hears them. The engraved surface of a used cylinder is removed by a shaving machine so that it may be used again and again.

Typewriters (*see* 27.501).—One machine which has been on the market a comparatively short time is practically noiseless in operation, because the principle of pressure printing instead of percussion printing is utilised. Another is electrically powered and can be operated either from a direct or an alternating current; the keys are touched lightly—about one-quarter of an inch depression—and electricity takes up the burden. Portable typewriters serve the need of the individual for a personal writing machine. Their construction embodies many features of standard office typewriters. The machine is usually secured to the bottom of the case in which it is carried, a permanent base being thus provided, making its use convenient under all conditions. The weight varies from 7 to 12 pounds. A wide selection of special keyboards and type arrangements for engineers, doctors, chemists and all those requiring special symbols and extra characters is available.

Cheque Writers and Protectors.—Besides writing the permanent and unchangeable amounts on cheques, thereby protecting, as far as it is mechanically possible, against losses from raised and forged cheques, these devices save time and labour in concerns which issue large quantities of pay-roll cheques and in banks and establishments which issue dividend cheques periodically. Protection is afforded by printing, by shredding or by perforating the amount, using acid ink in one or two colours. The amount is written in words, in figures or in words and figures. Certain models protect the payee's name as well, by "crimping" or shredding an un-inked design over it. After a cheque is inserted in the machine, the amount to be written is selected by slide levers set in vertical columns, by a hand wheel or by an indicator on the dial, depending on the type of machine. Some models require one stroke of the operating handle for each word or number; others print the whole amount at one operation. In some models the amount is visible before and after printing, and in certain cases the name of the user is also printed. Repeated writing of the same amount on a number of cheques, without change of set-up, is a feature of some cheque writers. An interesting development is the cheque writer with many combinations of foreign denominations for use in foreign banking.

Cheque Certifiers.—These devices print a form of acceptance on cheques, either through a ribbon from a bronze die or from steel wheels inked by a felt pad. Some number the cheques with consecutive serial numbers. Certain models are locked against unauthorised operation.

Cheque Endorsers.—Motor-driven machines are used for endorsing large numbers of cheques. Impressions are made from either a rubber or a metal die inked from rollers and having movable type for dates and batch numbers. Cheques are fed by hand, one at a time, to those models designed for use alongside an adding machine, so that as each cheque is listed for clearing-house, transit, or deposit, the operator turns it over and drops it into the endorser, which prints the endorsement and places the cheque in its original order in a tray beneath the machine. Other models provide for feeding a large number of cheques held at the feeder guide by the operator's hand.

Cheque Cancellers.—Enduring and inerasable evidence that a cheque has been paid, together with the date of payment, is provided by machines which perforate the cancellation through cheques, and if desired, the bank's American Bankers Association number. Dating of deposit slips, notes, mortgages, and other papers may also be done. Hand models cancel from 100 to 225 cheques a minute; motor-driven models are speedier.

Cheque Signers.—Pay-cheque signing is speeded by devices which sign from five to 10 cheques at once. A sheet of cheques is placed on an extension table under a writing frame to which are attached five to 10 fountain pens controlled by a monitor penholder. As the operator signs a sheet of cheques they are pushed into a tray and another sheet is brought into position.

Finding and Filing Devices.—Simplification of filing and locating data compiled in digest form is achieved by three mechanical devices differing in construction, operation and purpose. The purpose of one is to find a single card by number. It is a metal, desk-like affair, in the top of which are 10 trays, each holding numerically filed cards numbered from 0 to 999—1,000 in all. A card is found and filed according to its number. By depressing the proper number-keys of the finding mechanism, the corresponding card is instantly raised above the others in the file. In filing a card, the operator raises the card immediately following to indicate the filing position. Means are provided for finding misfiled cards.

Another device finds a single card by means of the general class or name under which it has been classified. This system uses a steel drawer, on the front of which are two rows of keys marked with the classifications, such as "Farm Lands," "West Side Property," etc. The keys are connected with rods extending back through the drawer. One card can be filed under many classifications, by means of clips placed in position along its lower edge, which correspond to the classifications desired. Pressure on the proper key raises the desired card, together with all those having a clip corresponding to the key. A tap returns the card to position.

A third system provides for the automatic selection and segregation of cards according to any number of classifications, the basis of the system being the card. The top carries a brief summary of the record, or can be extensive enough for a posting record. The body of the card is perforated, two vertical perforations constituting a "position" to which some classification is assigned. Each card is prepared for automatic selection by converting the two holes of significant positions into a slot by means of a hand-operated slotting punch. The cards are placed in a file drawer, which has a brass front perforated to conform to the cards. If, for example, the device is used for a list of garages, and all garage cards are to be selected, a steel rod is placed in the position designating garages. If all garages having service stations for a particular motor-car are to be selected, another rod is placed in the position designating that information. The more rods, the finer the classification. The drawer is then inverted, and the cards that are suitably slotted drop down. A rod inserted at the bottom of the drawer locks them in place, and when the drawer is held upright, the desired cards are held above the others in the file. When the work is finished, the locking rods are removed and the cards fall into place.

Visible Index Systems.—An operation on a card system may be divided into several parts: (1) locating and removing the card; (2) making the record or noting the information; and (3) returning the card to place. If the second part is a small proportion of the whole time required, the total operation may be greatly simplified by using the so-called visible system.

The cards are usually mounted on panels in such manner that they overlap, showing only the title line, a slight lifting movement revealing the whole card. The panels are housed in several ways. Sometimes they fit into steel cabinets and may be pulled out at a convenient angle for posting or removed entirely. In other cases, the panels—with cards inserted on both sides—are hung vertically, either on a circular track which rotates at the touch of a finger to bring the panel with the desired card before the eye or on a straight track so that they turn like the pages of a book. Another type of visible index is in book form, the cards being either held on panels inserted between the covers or fastened into the binder, as in a loose-leaf binder. Still another kind, which looks like a card drawer with the sides and ends cut down, consists of an aluminium tray in which cards tabbed at different heights so that a portion of each tab is always visible are held by a lock rod. Aluminium guides permit indexing. Pulling forward a guide exposes the tabs of a group of 24 cards, and the full surface of any one is visible when the intervening ones are thrown over. With each type of visible index colour signal systems may be used to call attention to pertinent facts.

Electric Paging Systems.—By audible code signals sounded throughout the premises, this equipment immediately locates individuals who are away from their desks. The central station is usually located near the telephone switchboard, and the telephone operator sends the signals.

Telegraph Typewriter.—An electrically operated typewriter used in hotel offices, banks and other businesses where information is daily transmitted to distant points, transmits messages in written form to any number of distant stations. As the message is typed on the sending typewriter, the words are written simultaneously and automatically by the distant receiving typewriter. The paper is fed from a roll mounted on a frame behind the typewriter. Tabulated forms and duplicated copies can be written. The telautograph is used for a similar purpose, but the message is handwritten instead of typed.

Credit Authorising Systems.—Three distinct types of systems are used for transmitting to a department making a charge sale, the credit department's O.K. on the sale. One is an electric telephone system with a switchboard in the credit department and a telephone in each sales department. As the sales person calls the credit department, she places the slip in an aperture in the telephone, and the credit authoriser causes his approval to be printed on it if the sale is approved. (W. H. L.*)

OFFICE MANAGEMENT.—The office is that part of an enterprise which is devoted to the direction and co-ordination of the various activities of the enterprise. It is characterised by the gathering, classification and preservation of data of all sorts; the making, using and preservation of all kinds of records; the analysis and utilisation of these data in planning, executing and determining the results of operation; the preparation, issuing and preservation of instructions and orders and the composition, copying and filing of written messages.

Though clerks and clerical work have existed for centuries, and large groups of clerks for decades, it is only in recent years that the management of clerks, or office management, has become a problem of importance. This is wholly due to the rapidity of industrial change, which is best shown in the United States. In 1880, when there were but 172,575 clerks in that country, mostly book-keepers and accountants, the problem might be considered as practically non-existent; but in 1920, when the number of clerical workers of all kinds had grown to 2,951,008, it assumed proportions that could not be ignored. In 1920, one in 10 of all persons engaged in "gainful occupations" was a clerical worker. The change was necessitated by the exigencies of an ever-growing large-scale industry. While business organisations were small, and direct contact existed between producer and consumer, beyond simple bookkeeping few records were required, there was little written communication between sections of an organisation, and consequently few clerks were needed. All this has changed, and to-day the office has attained a position of major importance in business.

Many offices employ more than 100 clerks each, and a considerable number employ several thousands. Evidently the employment of such numbers of workers requires management of a high order, yet it is only recently and among the most progressive companies that the subject has received the attention it deserves. Ingenious systems of record keeping and filing have been invented, scores of clever appliances and marvellous office machines are available (*see* OFFICE APPLIANCES), but the problem of securing the greatest result for the least expenditure of effort has not been given the attention in the office that it has in other lines of endeavour. This is due to the newness of the problem, but there are signs that this condition is sure to change as time passes.

Frederick Winslow Taylor (*q.v.*), the "father of scientific management," was himself probably the first person to apply—at least in a limited measure—scientific principles to office work. In Copley's biography of Taylor is shown a "Time Note," dated about 1885, giving "piece-work" rates on 17 clerical operations, the implication being that Taylor had at least studied these operations, found the best method of performing them and controlled them to the extent that he offered an incentive wage for their accomplishment.

THE HUMAN ELEMENT

The major divisions of office work are given herewith, but not necessarily in the order of their importance.

Organisation.—The most essential factor here is clearly defined lines of authority, and its lack is the greatest defect to be found in many companies. In the struggle for advancement it seems difficult to prevent officers from claiming more authority than is granted them, and where confusion of this kind exists, loss of morale invariably results. Functionalisation—one of the leading principles of scientific management—is as efficacious in the office as elsewhere. The office manager himself holds a functional position—that of managing clerks, wherever located. Where this principle is fully carried out, work, instead of being departmentalised, will be functionalised, and therefore performed much more effectively. Thus, a stenographer employed exclusively in taking notes and transcribing letters, will do much more effective work than one who also keeps and files records, answers telephone calls and performs other miscellaneous work. Functionalisation, however, is to its fullest extent only feasible in large offices. It is uneconomical to have too many departments under the charge of one officer. A chart of the organisation, and an organisation diagram, both giving not only the position of each individual in the office but his duties and relation to others, are necessities. Also there should be standard methods for performing each task, and written standard practice instructions so that the carefully devised methods may be perpetuated. Otherwise great loss of output will result.

Personnel Methods.—Progressive records of each employee's performance are necessary as they serve as a basis for future advancement. Special tests for ascertaining the ability of new employees will prevent to a large extent the great wastage of continuous hiring and discharging. Many psychological tests, special ability and trade tests have been prepared, extensively used and found advantageous (*see* INTELLIGENCE TESTS). While there are many clerical positions which demand the very highest intelligence, all clerical work does not, and much of the simpler clerical work is found irksome when allotted to those capable of a higher grade of activity. Training is extremely important, though often sadly neglected. In some offices the various lines of promotion are laid down and made known to all employees, so they can prepare themselves for advancement. Some offices also have officers who devote their activities wholly to employment, and all persons who are to be discharged are referred for final adjudication to this officer—the employment manager. The advantage here is that competent employees are not lost to the organisation solely because of the personal pique of some hasty or temperamental officer. The employment manager also ascertains by tactful questioning the reasons why employees leave, and by a careful, classified record of such reasons is enabled to check bad practices, and to determine any other causes for dissatisfaction.

Turnover.—The "rate of turnover," that is, the ratio of employees leaving to those on the pay-roll, is a most important factor in good office management. An average cost of over $100 is represented in the training of a new employee who replaces one who has left, so that it is evidently desirable to retain employees for long periods. Turnover is dependent upon many factors. If employees are not properly selected, many replacements will be needed; if salaries are not right, physical conditions bad, or the relations of officers not as they should be, there will be many voluntary separations. A minimum turnover is considered to be about 10% annually. Length of service depends upon much the same conditions as rate of turnover.

Routines and Methods.—A routine is a collection of separate operations through which a piece of work successively passes. Division of labour has been highly developed in office work, and few operations are complete in themselves. Routines as a rule are seldom consciously developed but come into existence gradually through the use of machinery combined with hand-work. As a result, operations wholly or partially useless and of little or no value to the "finished product"—the result desired—are frequently found. Methods also have generally speaking a similar evolution, and yield great results from scientific research. Unless both routines and methods are carefully studied, there is apt to be much waste.

Control of Output.—To secure maximum results for minimum effort, a continuous and uninterrupted flow of work is necessary, and this is one of the most difficult achievements in office work. In the manufacturing of any material commodity the work can be precisely scheduled, step by step, and the maintenance of a steady flow is largely a mechanical problem, as every piece of similar character goes through precisely the same steps. But in the office there is the added difficulty that office work of similar character does not always take the same course; and even in some work of exactly the same nature, the flow is governed by conditions beyond the control of the office manager. Because of this fact it was, until very recently, considered impossible to plan and schedule office work. Peaks, that is, periods demanding intensified and additional work, were handled either by overtime work, or by the permanent maintenance of a sufficient force of clerks to handle them, both plans being evidently wasteful. Analysis of this matter, however, showed that in many cases they could be adequately met by pre-planning. The office force should be well balanced, and sufficiently large to handle average conditions; but a sufficient number of clerks should be trained in several operations. Then by utilising the idea of the "flying squadron"—a selected group of clerks that can be used almost anywhere in an emergency—most of the minor peaks can be handled without difficulty. Major peaks can be dealt with by a re-adjustment of working force and the employment of extra clerks for positions which require only a minimum of training.

Clerical Output.—On this subject all the major factors of office management converge, and all have a bearing upon it. Under conditions where all factors have been scientifically studied, clerical output is invariably much greater than in organisations in which they are largely ignored. Thus in the office of the latter character the average output of a stenographer will rarely exceed 100 sq. in. per hour, while in a scientifically managed office this particular output will be increased to an average of 200 sq. in. per hour. The maintenance of the latter rate does not depend alone upon the skill and application of the stenographer—for 200 sq. in. per hour is but 30 words a minute, while the world's typewriting record is over 800 sq. in. per hour—but largely upon other factors outside the control of the operator and decidedly within that of the office manager. As with typewriting, so it is with all other clerical operations; the output usually depends much more upon the efforts of the management than upon those of the individual clerk. The effort should not be to obtain the highest possible output from any individual, but that which should be expected from a first-class worker.

The Incentive Wage.—Still another factor which aids in obtaining a high clerical output, is an incentive wage of some kind, wherever it is possible to measure the work. The various methods of incentive wage used in other lines of business endeavour have all been tried in the office, some with considerable success, others with disastrous results. In the cases of failure the main causes generally are that (1) work was not properly standardised; (2) not properly measured; (3) steady flow not obtained; (4) work not properly controlled; and (5) no adequate check upon its quality. Piece-work in the office is not so generally applicable, because the worker must have a guaranteed minimum wage, and it is not always possible to supply him with sufficient work to make that wage on a piece-work basis.

THE MECHANICAL SIDE

The preceding factors deal almost wholly with the management of the human element, and now other factors must be considered—those physical factors without which efficient management is not possible.

Arrangement.—The physical arrangement of an office affects all other factors of management. As most offices are in large cities, rentals are high, and therefore space must be conserved. For this reason the cubicles of the old-fashioned office are giving way to the open office. Departments having relations with each other should be contiguously located, and the seating of the workers in each department be regulated also on this principle. Work should flow in straight lines. Adequate light, both daylight and artificial, should be provided, the standard of the latter being placed by experts at not less than 10 foot-candles (*see* ILLUMINATION ENGINEERING). The totally indirect system, in which the light is thrown from its source to the ceiling, and from thence reflected down, is considered the best. Ventilation is an important matter also. Experiments show that the best ventilating system is that which brings in fresh air from the outside without altering it in any way, this being superior to the elaborate washed and heated air systems (*see* HEATING AND VENTILATION). Excessive noise is also detrimental to good work, and noisy machines, if numerous, should be segregated.

Equipment.—Under this head are included desks, tables, chairs, filing cabinets and similar furnishings. The old-fashioned roll-top desk is being rapidly eliminated, and as the present tendency is to the extended use of small loose-leaf books and cards, the high-standing book-keeper's desk has largely disappeared. At present the usual office desk is too large and contains too many drawers, and as clerks have little need for more than one or two drawers, a table is generally preferable. The size of a desk depends naturally upon the character of the work, but a desk larger than 54 in. x 30 in. is rarely needed, though no desk should be smaller than 40 in. x 30 inches. Chairs to be comfortable require designing to fit the human anatomy in an upright seated position. A few good anatomical chair types are available, but most of the others are uncomfortable.

Office Machinery.—Here the greatest development has taken place, office appliances being now available for almost every occasion (*see* OFFICE APPLIANCES). There was a tendency to use machines to the exclusion of competent brainwork, but office managers are beginning to see that this is a mistake.

Correspondence.—This is naturally an extremely important part of office management, not only between the company and outside correspondence, but within the organisation itself. The present tendency is toward brevity and clarity, and the florid style and redundant expressions of the so-called "business English" are in process of elimination.

Filing.—The vertical system of filing has almost entirely superseded the old-fashioned flat file, and elaborate systems have been greatly simplified. Its greatest present misuse is the filing of valueless and superfluous material. The filing problem requires not only adequacy in equipment and system, but also accuracy, which necessitates adequately trained operators, for misfiled papers may easily cause great loss.

Stock-keeping.—In a large office the maintenance and issue of an adequate stock of all forms in use becomes a problem in scientific stock-keeping. Order and neatness are necessary, and an adequate location system, so that material can be found with a minimum loss of time. Stores should be classified according to some well-devised system, and there should be a perpetual inventory and a systematic method of issuing stores to, or on the order of, authorised persons.

Intercommunications.—This factor is a most important one in large offices. The telephone is of course the most common method, but there is usually a large transfer of papers from one part of the organisation to another, and this must be taken care of by well-organised messenger systems with regularly scheduled trips. In many offices automatic belt systems or other forms of conveyors are used. Mechanical devices of other kinds are automatic signalling systems, automatic telephones and so forth.

Forms.—Most office work is performed by writing upon some kind of blank form, whether they be detached or loose-leaf forms. The quality of paper selected for any form should be governed by the use to which it is put. If it is to be written upon with pencil it is wasteful to use a high-grade paper designed for writing with ink. When forms have a temporary value only, the paper should be of a cheaper quality than that of forms to be kept for a number of years. Selecting standard qualities of paper for these various purposes requires considerable study. A large variety of colours should not be used, as many of them—particularly the reds and blues with their varying shades—are difficult to read under artificial light. Not more than nine standard sizes of forms are usually needed.

Salary Standards.—In most offices salaries vary widely and often unreasonably, clerks doing similar work frequently receiving widely different salaries. Some of the best-managed organisations have made a careful gradation of salaries, with a maximum and minimum for each class of worker. The minimum is that salary which a clerk is entitled to as soon as he is assigned his position, and the maximum the highest salary which the company can afford to pay for that type of work. Such gradation eliminates gross inequalities, gives more equitable payment for results and minimises dissatisfaction among the office force.

SUMMARY

Office management is highly complicated, and requires a specialist—a manager of high order who at the same time thoroughly understands clerical work. The scientific approach to the factors of office management may be briefly defined. First it is necessary to define thoroughly the purpose of any work about to be undertaken, for if this is neglected the path of the subsequent investigation is likely to follow incorrect lines. Then the problem should be carefully analysed by dividing it into its factors. These preliminary steps, though simple in a statement, are by no means so simple in fact. The next step involves a careful search for all the facts in the situation which govern each and every factor in the analysis. It is a very common oversight to gather an abundance of facts on one part of a problem, and ignore or minimise other parts. To infer, without investigating, is a most prolific source of error, the method of actual test being by far the best. These three steps are precisely those of experimental science, and may be called the scientific method of thinking out a problem. By its use, the office manager can correctly approach each problem and devise the right method, otherwise known in management as "the one best way." With the best method secured, it is then necessary to select the person best fitted to perform it, for all cannot be equally proficient in the same things. The person best fitted for any particular task will invariably produce better results than the so-called "average" person. When found, it then becomes necessary to teach the person who has been thus selected.

These six steps constitute the basic procedure in any form of scientific management and lead up to the seventh, which is planning. Without careful planning, all the scientifically designed work which has gone before will be wasted. Finally, to secure the best results it is vitally important to win the co-operation of the workers. An office force labouring without interest or enthusiasm will accomplish some results, but certainly not of the type desired by a competent office manager. The management which does not and cannot secure co-operation is necessarily defective. These eight steps cover the basic principles of scientific management in all activities. There is also a considerable tendency toward the simplification of office methods and the entire elimination of much that has been done in the past, on the ground that it is either superfluous or not worth the effort expended. These tendencies are continuously accelerated by economic conditions. Scientific management will be the principal means of reducing the numerical growth of office workers.

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OHIO (*see* 20.25), a State of the United States of America. In 1924 Ohio had a population of 6,219,330, an increase of 20·8% in the decade 1910–20 or of 30·5% since 1910. The density of population rose from 117 per sq. m. in 1910, to 141·4 in 1920. There was a marked increase in the negro population of the cities owing to migration from the South, and also of the foreign element. More significant was the drift from rural districts to cities. In 1910 the urban population in cities and incorporated villages of 2,500 inhabitants or more, formed 55·9% of the total; in 1920 it was 63·8%. In 1925 eight cities had a population in excess of 100,000.

Cities with 100,000 Inhabitants or Over (1925).

Akron	208,435[1]	Columbus	292,222
Canton	114,648	Dayton	178,642
Cincinnati	418,792	Toledo	288,792
Cleveland	922,864	Youngstown	159,870

[1] 1924.

Communications.—A flood in 1913 wrecked the two principal canals, the Miami and Erie from Cincinnati to Toledo, and the Ohio and Erie from Portsmouth on the Ohio river to Cleveland: They had not been restored by 1926. The lower part of the Muskingum river and that part of the Ohio bordering the State has been canalised. The chief development in transportation has been the expansion of interurban traction service and the establishment of motortruck lines. In 1919 there were 4,223 m. of electric railway. In steam-railway mileage there was no significant change between 1900 and 1920. In order to meet the demand of the motor-car for improved roads large State expenditures have been made, and in 1918 31,800 m., or 36·8% of the rural public roads had been surfaced.

Agriculture.—The total value of all farm property in 1920 was $3,095,666,336, as against $1,902,694,589 in 1910, an increase of 62·7%. The total value of live stock in 1920 was $287,655,118. In 1919 the value of all crops was $607,037,562, an increase of 174·6 over 1909. The following table shows the quantity and value of the chief agricultural products according to the United States Census.

Agricultural Production 1919

Crop	Quantity in bushels	Increase % over 1909	Value in $	Increase % over 1909
Corn	149,844,626	−4·9	217,274,709	163·9
Oats	46,818,330	−18·7	39,795,590	71·4
Wheat	58,124,351	89·6	127,873,574	311·0
Hay and forage	7,661,890[1]	..	130,187,929	..
Tobacco	64,420,472[2]	−27·3	13,528,302	50·3

[1] Tons. [2] Pounds.

The total acreage harvested in 1919 was 11,780,554, an increase of 3·1% over 1909.

Mineral Products.—From 1900–18 there was an increase in the annual output of bituminous coal from 16,900,000 to 40,900,000 short tons; in 1923, 40,546,433 short tons were produced. The coal of Ohio is produced mainly in the southeastern part of the State. The fire-clay mines of Tuscarawas, Jefferson, Columbiana Stark and Carroll counties supply the raw material for a rapidly rising industry. In 1917 3,694,302 net tons of coke were produced: in 1918 the output of natural gas was valued at $24,234,741. The production of crude petroleum has fallen; the total for 1918 was 7,285,005 bar. with a value of $23,465,197 (*see* PETROLEUM).

Manufactures.—According to the preliminary report of the biennial census of manufactures, 1923 (Dept. of Commerce), the manufactures of Ohio have nearly returned to the War-time level. The table below gives the development from 1914–23. The most notable advance was in the production of motor-cars and in the manufacture of motor-car tires. The value of all tangible property in Ohio was estimated in 1922 at $18,489,000,000. The *per capita* wealth increased from $1,076 in 1890 to $3,048 in 1922.

History.—The chief political advance has been the progress in adapting the constitution and the system of administration to the new needs of the State. At the election of 1910 a general constitutional convention was approved by a large majority. Delegates were chosen in Nov. 1911, and the convention sat Jan.–June 1912. The delegates, of whom the majority were Democrats, represented the progressive elements of both major parties. Forty-two amendments were submitted to the voters on Sept. 3 1912, of which 34 were ratified; among those defeated were the abolition of capital punishment, woman suffrage, and a $50,000,000 bond issue for a state system of roads. The tax-reformers secured for the general assembly the power to impose inheritance, income and franchise taxes as well as taxes upon the production of coal, oil, gas and other minerals. A tax commission created in 1910 succeeded in bringing out for taxation the property of corporations at something near a true valuation, and in obtaining the adoption of the 1% rule as the maximum rate for taxation. The League for Direct Legislation secured the initiative and the referendum, the liquor interests a licensing system. In 1918, on the eve of Federal prohibition, an amendment incorporated state prohibition in the state constitution.

A law of 1910 centralised the taxing power in a small state tax commission, bringing to an end an expensive system of decennial boards of equalisation. The following year all the charitable and penal institutions were placed under a board of administration. In 1911 the old railroad commission became the public service commission. The act of 1911 gave the public service commission the same power over public utilities in general which the railroad commission had had over railways and telegraphs. In 1913 the legislature changed the public service commission to a public utilities commission. At the same session of the general assembly a state industrial commission was created to assume the functions of the older boards of awards, departments of inspection, etc. In 1911 the Workmen's Compensation Act substituted "a system of compensation for industrial accidents, which compensation is to be paid out of a state insurance fund, to which both employers and employees contributed (90% and 10% respectively) in lieu of the civil action for damages." A law of 1913 made compulsory the system of state insurance. Employers were required to guard the safety of employees and also to arrange reasonable hours of work. Ohio under the Act maintains its own state insurance fund. By 1918 the premium income to the state fund amounted annually to $9,000,000. At a cost of $4\frac{1}{2}$% of the premium receipts the industrial commission gave protection to more than 1,500,000 workmen.

In 1913 the Department of Agriculture, the State Experiment Station and the College of Agriculture, together with the dairy and food commissioner and the fish and game commissioner, were brought under an agricultural commission with four members. Two years later, the legislature undid the reform in part, making the experiment station and the agricultural college independent institutions, and restoring the large Board of Agriculture of 10 members without a salary. A change in political parties occurred again in 1917 and the legislature, while retaining the large Board of Agriculture, made its functions those of an advisory council. The position of Secretary of Agriculture was created.

One of the constitutional amendments of 1912 instructed the legislature to make provision for a state-wide public-school system, and substitute for the commissioner elected by the people a superintendent of public instruction, appointed by the governor. In 1914 the legislature enacted a Rural School Code; and in 1917 created a State Board of Education. The reorganised Department of Education was instructed to emphasise rural agricultural education, and to co-operate with the Federal Govt. in vocational education. The old State Board of Health was reformed at the same session. In the Act of 1917 a State commissioner of health was supported by an advisory public health council of four members. A statute of 1919 created a state-wide system of municipal and general health districts and the powers of the Department of Health were greatly increased. The General Assembly in 1915 created a state highway commissioner, and in an Act of 1919 authorised the development of a state system of highways and co-operation with the road-making enterprises of the Federal Government.

In 1921 an Act was passed which combined the numerous departments and commissions into nine departments—finance, commerce, public works, agriculture, health, industrial relations, examinations, education and public welfare. If the Act stands the test of constitutionality Ohio will have a system of administration analogous to that of the Federal Government. Other legislation included a children's code (1913), providing a state-wide juvenile court and a mothers' allowance system, and a pension system for teachers in the public schools (1919). In 1921 the legislature authorised a World War compensation fund of $25,000,000, and the establishment of co-operative marketing associations. In 1925 it once more undertook, with only slight success, to adjust an antiquated tax system to modern conditions.

A disastrous flood in 1913, affecting especially the inhabitants of the Miami, the Scioto and the Muskingum river valleys, led to a measure for the protection of the river valleys from future damage of the kind. By 1921 the Miami Conservancy District had practically completed a series of dry reservoir dams costing $25,000,000.

Governors since 1913 have been Judson Harmon (Dem.), 1909–13; James M. Cox (Dem.), 1913–5 and 1917–21; Frank B. Willis (Rep.), 1915–7; Harry L. Davis (Rep.), 1921–3; Victor A. Donahey (Dem.), 1923– . (E. J. B.*)

OHIO RIVER: *see* MISSISSIPPI.

OHNET, GEORGES (1848–1918), French novelist and man of letters (*see* 20.35), published in 1908 *La route rouge*, and in 1912 *La serre de l'aigle*. His last work was *Journal d'un bourgeois de Paris pendant la guerre de 1914* (1914–5). He died May 5 1918.

OIL: *see* PETROLEUM.

OILS AND FATS (*see* 20.43).—Long experience in the construction and use of hydraulic presses led to something approaching a state of perfection early in the present century. The process of extraction of oils by means of solvents is, however, a more recent introduction into the industry.

I. THE MANUFACTURING SIDE

Solvent Processes.—In the earlier extraction plants losses of solvent were often high, extraction of oil from seed was incomplete, and the oil obtained was of inferior quality and frequently unsuitable for edible purposes. The methods of construction and operation of extraction plant have been improved to such an extent that the losses of solvent (generally light petroleum spirit) only amount to about 1% of the weight of seed treated. The oil content of the residual meal can easily be reduced to 2%, or even less, and oil of excellent quality is produced, the oil being quite equal to that prepared by expression.

There is, therefore, at the present time but little to choose between pressing and solvent extraction, and the choice of the process rests

	1914	1919	1921	1923
Average number of wage earners	510,435	730,733	494,288	699,031
Wage payments	$317,923,000	$944,651,000	$627,033,000	$979,660,000
Value of products	$960,811,000	$5,100,308,000	$3,300,693,000	$5,046,504,000

rather on the kind of seed to be treated than on grounds of cost of working or efficiency. Where the maximum yield of oil is desired, and the residual meal is not required to contain more than traces of oil, solvent extraction is obviously better. In a good many cases seed is pressed first and the residual cake afterwards extracted by solvents. In the oil seed crushing industry it has always been an aim to devise continuous methods of operation. Several machines for the continuous expression of oil seeds have been devised and patented, but so far only one such machine, the Anderson "expeller," appears to have met with commercial popularity. Patents have also been taken out for continuous processes of solvent extraction, but it does not seem that any of these have been put into actual commercial operation.

Refining and Bleaching.—Many of the chemicals formerly used or proposed are not now employed. In practice treatment of certain oils (*e.g.*, linseed and rape oils) with sulphuric acid is effective, while treatment with caustic soda, which neutralises free fatty acids, and in many cases also removes colouring matter and other impurities, is largely employed. The use of caustic soda for neutralising oils has certainly increased in late years with the growing use of oils for edible purposes. Outwardly the principles of the process are simple, neutralisation of free fatty acid by soda and the removal of the soap formed from the neutralised oil. Actually the problem is one of some complexity from the physico-chemical point of view, involving as it does the formation of emulsions.

Various processes have been devised with a view to obtaining better or more rapid separation of the soap from oil, and also to lowering the loss of neutral oil carried away with the soap, such as that of C. Baskerville (*J. Ind. Eng. Chem.* 8, 118, 1916) in which about 2% of prepared cotton fibre is added with the soda to the oil, enabling the soap (and cotton) to be separated from oil by means of a filter press. In other processes a vacuum is employed to assist removal of water after neutralising, so as to obtain the soap in a dry form, which can be separated from oil by filtration.

Filtration.—The methods of removal of insoluble suspended impurities from crude oils have been improved, and the use of filter presses, which assist filtration and also cause clarification of the oil, is common. High speed centrifugal clarification is in many cases advantageous, while the introduction of a new type of filter—the Hele-Shaw "stream-line" filter—may have far-reaching applications. Considerable advances in the methods of "bleaching" oils by means of various decolourising materials such as natural fullers earths, chemically treated earths, and charcoals, have been made and the use of such materials, particularly in the edible oil industry where freedom from colour is desirable, has undoubtedly increased.

Activation.—Methods of "activating" vegetable carbons so as to render them highly efficient as decolourising agents which can compete with animal or bone charcoal, formerly the most efficient variety of decolourising charcoal have been developed. The methods of activating vegetable decolourising charcoals owe a good deal to the investigations carried out during the War on methods of producing vegetable charcoal with a high absorptive capacity for gases such as was required in gas masks. The nature of the physical reactions of carbon treated in various ways was thus elucidated. While the removal of colour is due chiefly, if not entirely, to physical adsorption of the colouring matter, further investigation is desirable, both in the direction of elucidating more fully the *modus operandi* of the decolourising effect and also towards further improvement of decolourising agents.

Chemical methods of bleaching oils and fats generally involve treatment by oxidising agents, and are seldom, if ever, employed in bleaching oils for edible purposes. Oils for technical use, *e.g.*, for soap manufacture, are still generally bleached by air or by bichromate and acid or by hypochlorites, but various other oxidising agents such as certain organic peroxides and metallic per-salts are also used.

Deodorisation of Oils.—Practically all processes depend on the passage through the heated oil of a current of steam, which carries off the more volatile substances to which odour is due. In the earlier processes steam at comparatively low temperature was employed, and as much as 2 lbs. of steam was often required to deodorise 1 lb. of oil. Deodorisation is still to some extent regarded as a trade secret, but modern development has all been in the direction of employing superheated steam and higher temperature of oil assisted by high degree of vacuum. Deodorisation is now much more efficient than formerly, both in degree and in consumption of steam. The use of inert gases, such as carbon dioxide or hydrogen, in place of steam has also been tried.

Artificial Oils and Fats.—The conversion of hydrocarbons from petroleum into fatty acids by processes of oxidation has attracted a good deal of attention, by reason of the large difference in price between hydrocarbon oils and fatty acids (which may be converted to oils by reaction with glycerol). Fatty acids undoubtedly can be produced from hydrocarbons, but so far it does not appear that any process has been devised which shows a likelihood of commercial success.

Fatty acids are in many cases by-products of the oil industry; they also frequently exist in a free state mixed with neutral oils in crude oils, and have to be removed before the oil can be used for many purposes. The conversion of fatty acids into neutral oil by esterification with glycerol is the subject of certain patents. Technically the conversion of fatty acids into neutral glycerides has been suggested. (1) for the purpose of converting fatty acids of low value into neutral oils of higher value, (2) for the neutralisation of free fatty acids naturally present in crude oils, (3) for the production of glycerides having certain desirable properties, *e.g.*, mixed triglycerides containing definite fatty acids. Esterification has certainly been carried out technically but, owing to the reticence of manufacturers, it is not possible to indicate its technical importance.

Hydrogenation of Oils.—In principle the process is one of great simplicity, involving the combination of hydrogen with a liquid oil containing unsaturated fatty acids, the resulting product being a solid fat containing saturated fatty acids. Thus liquid olein, the triglyceride of oleic acid, a common constituent of liquid oils, is converted to solid stearin, the triglyceride of stearic acid, according to the chemical equation $C_{17}H_{33}COOH + H_2 = C_{17}H_{35}COOH$.

This reaction is effected by bringing the liquid oil into contact with hydrogen gas in presence of small amounts of catalytic metals. Metals such as platinum and palladium are active hydrogenation catalysts at low temperatures, even at ordinary atmospheric temperature, but these metals are too expensive to be used on the large scale demanded by modern requirements, and have been displaced in the oil industry by nickel catalysts. Many patents dealing with the production of suitable catalysts, machinery for carrying out the reaction, and other details, have been taken out. The process consists as a rule in heating the oil and nickel powder catalyst to 150–200° C., in a closed vessel with hydrogen under pressure of 50 lb. per sq. in. or more, thorough agitation being effected either by stirring gear or circulation of hydrogen through the oil by pump or by both these means. After hydrogenation to the desired degree, *i.e.*, after sufficient hydrogen is combined to produce an oil of the required hardness, the mixture of oil and catalyst is run out of the reaction vessel and the catalyst removed by filtration.

The catalyst most usually employed is a mixture of nickel and some inert material such as kieselguhr (siliceous earth), the latter being used to afford a large surface of catalytic material. The catalyst is produced by precipitating an insoluble nickel salt in presence of the inert material; nickel carbonate is commonly employed and this is formed by adding the requisite amount of sodium carbonate solution to a suspension of the inert material in a solution of nickel salt (generally nickel sulphate). The precipitated nickel salt, etc. is collected and washed in filter presses until free from soluble salts; it is then dried and reduced in a current of hydrogen, generally at a temperature of 300° C. or over. After reduction the catalyst is kept from contact with air either by admixture with oil or by keeping in an atmosphere of inert gas.

The reduced catalyst powder has generally a content of nickel of about 20 per cent. In the hydrogenation of oils of good quality an addition to the oil of as little as 0·1% of actual nickel is sufficient to bring about hydrogenation, but lower grades of oil may require considerably more, while very low grades of oil cannot be treated economically owing to the presence of impurities which "poison" or render the catalyst ineffective. This powder catalyst process has been developed to a very high degree of efficiency, and the process of hydrogenating oils has grown to a very large extent.

The powder process is not continuous and the powder catalyst must be removed from the oil by filtration. Further the nickel catalyst can only be recovered for re-use by costly processes. By a recently developed process metallic nickel in the form of fine turnings is employed as catalyst. These turnings are packed permanently in cages which fit into the reaction vessels. In this process of hydrogenation the oil flows continuously through heated reaction vessels containing cages of nickel turnings in presence of hydrogen; and hydrogenated oil entirely free from nickel and requiring no filtration is delivered from the plant. The degree of hydrogenation is readily controlled by the rate of flow of oil, while the nickel catalyst is regenerated without loss in weight, and at low cost by a simple process of electrolytic oxidation (*Eng. Pat.* No. 203,218).

The process of hydrogenation has led to much important work on the mechanism of the reaction, the effect of "poisons" on catalysts, and the nature of the catalytic action of metals. Oils hydrogenated under such conditions as obtain in technical practice as a rule contain considerable amounts of iso-oleic acid, a solid unsaturated acid isomeric with ordinary liquid oleic acid. This facilitates the identification of hydrogenated oils in compounded oils (K. A. Williams and E. R. Bolton, *Analyst*, vol. 49, p. 460 1924), which was otherwise difficult or even impossible.

Speaking broadly, the hydrogenation of oils may be looked upon as the most important advance in the oils and fats industry during the present century, and hydrogenated or hardened oils are used to a very large extent chiefly in edible oil and in soap manufacture. By it liquid oils may be converted into solid fats of any desired degree of hardness and many oils which are of low value on account of odour and flavour, such as fish and whale oils, can be rendered odourless and tasteless.

Oil Analysis and the Constituents of Oils.—The general tendency has been to increase the delicacy and reliability of the various tests, and from increased knowledge obtained as to the "constants" of various oils to render more easy the detection of admixtures or adulterants. The task of the analyst has increased considerably in difficulty owing to the improved methods of refining oils employed in commercial practice, to the increased complexity of mixtures of blended oils and to the widespread use of hardened oils. Much work has been done on the nature of the fatty acids present in oils and fats, and the relative proportions of the different fatty acids occurring (as neutral glycerides) in commercial oils and fats are now generally known with a desirable degree of exactitude.

There is a lack of information as to the exact forms of triglycerides existing in most oils and fats. Mixed triglycerides, such as oleodistearin, have been separated from natural fats, but so far such substances can only be separated by tedious methods of fractional crystallisation, which do not afford accurate quantitative evidence. The importance of mixed triglycerides is certainly great, for example, their influence on the consistence and general physical properties of fats. The inner structure of the molecule of various fatty acids has received attention, by the application of the X-ray spectrograph (*e.g.*, A. Müller, *Chem. Soc. Trans.*, vol. 123, p. 2043 1923).

New Constituents of Oils.—In the liver oils of certain sharks and other marine animals large amounts of unsaponifiable matter, consisting of highly unsaturated hydrocarbons, have been discovered, thus spinacene—$C_{30}H_{50}$—was isolated from the liver oils of *Centrophorus granulosus* and *Scymnus lichia* by A. C. Chapman (*Chem. Soc. Trans.* vol. 111, p. 56 1917). Similar or identical hydrocarbons have been obtained from many other marine animal oils by A. M. Tsujimoto.

Soap (25.296).—An interesting example of the application of scientific methods to the technique of soap making is the work of K. Maclennan (*Chemistry and Industry*, 1923, 393 T) dealing with the microscopical character of the soaps of individual fatty acids, and with the structure of the soap during different stages in the manufacture.

A general improvement in technique and machinery is evident. Machines for artificial cooling of soap enable the soap to be obtained in the form of solid slabs ready for cutting in about two hours, compared with the four or five days formerly necessary when spontaneous cooling in frames was employed. The oils used by the soap maker in recent years have to some extent changed, and the increased demand for oils for edible purposes (*e.g.*, margarine) has caused a rise in price in some cases, and such oils have consequently been replaced by other cheaper oil for soap making. Soya bean oil has proved useful to the soap maker as a substitute for more expensive materials. Hardened oils have also come into use in soap making, while full use has been made of the increasing quantities of by-products obtained as a result of the removal of free fatty acids in the refining of crude oils for edible and other purposes (*see* under REFINING).

In refining oils with caustic soda the soap formed together with any excess of caustic soda and associated neutral oil is deposited as soap stock; this forms a useful raw material for the soap maker on the spot, if not used in the same factory the soap stock is generally converted into "acid oil" (by treatment with an excess of mineral acid) so as to obtain a more homogenous material and to save cost of transport by removal of water. The production, improvement and use for domestic as well as technical purposes of dry soap in the form of powder or flakes; are noteworthy. Investigations into the colloidal and other physical properties as well as to the chemical nature of soap and soap solutions, have resulted in a better understanding of many problems connected with soap; for example, methods have been devised for measuring the detergent action of soaps.

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(E. R. B.*)

II. THE DISTRIBUTING SIDE

The trade in oils and fats has always been important, but it was not until the War period that any systematic attempt has been made to compile statistics. During the War industry was brought temporarily under Governmental control in Great Britain, in Germany and some other countries, and the need for more accurate information as to available supplies was acutely realised. The International Institute of Agriculture, Rome, began to collect statistics from the various producing and exporting countries, and these have been published in *Oleaginous Products and Vegetable Oils.*

Figures dealing with production are in most cases largely guesswork. The bulk of the oilseeds are shipped from tropical countries, many of which are still in a primitive state of development. Moreover, a considerable proportion of the production is consumed in various ways in the countries of origin, and in most of them are numerous small native mills producing oils for local use, and using up in many cases as much as half the total crops. The difficulties therefore in the way of obtaining complete statistics are very great. Since the War, however, a considerable advance has been made in the method of estimating crops, and Government reports for the principal producing countries are now issued at regular intervals for most of the oilseeds prominent on the international markets.

The pioneers in the oilseed industry were the soap manufacturers, who, as they found their supplies of raw material being encroached upon by the demands from the edible oils trade—demands which steadily increased with the development of better refining methods—were driven to search in new directions. The effect of the War was to arrest this expansion, to divert available supplies to Allied countries, and to favour those sources of supply which lay nearest to hand. The blockade cut out Germany as an importer, and many seeds and nuts which previously had gone mainly or exclusively to the Continent, such as groundnuts, sesame seed, palm kernels and copra, were diverted to Great Britain. Moreover, economy of freight space being essential, and oil occupying much less room than seed, a considerable stimulus was given to the erection of oil-mills in countries of production, and to the development of the export from there of oil in bulk. Particularly was this the case with copra and coconut oil. In both the Philippines and Dutch East Indies extensive crushing plants were put up, and shipments of oil increased in the one case from 5,000 tons in 1913 to 140,000 tons in 1919, and in the other, from 1,000 tons in 1913 to 75,000 tons in 1919. After the War former conditions were gradually restored, though Great Britain continued to import palm kernels, copra and groundnuts to a much greater extent than before.

The War helped the development of refining processes. The vital necessity of finding supplies of oils and fats for the armies and the civil population gave a great impulse to research, and many oils which had hitherto been regarded as purely industrial, became available for edible purposes as a result of improved methods of refining and deodorising; rape oil, which had previously been used for burning and lubricating, and palm oil for soapmaking, took a place in the list of important potential edible oils. Another process—hydrogenation, whereby a liquid oil is enabled to absorb hydrogen and is hardened—was greatly developed. This process brought whale oil to the margarine manufacturer.

The general effect of these changes has been to increase very considerably the interchangeability of oils. While each oil may be said to have a particular purpose for which it is most suited, it can be readily turned to other purposes if the price factor is right. Whereas previously there were wide differences in prices the tendency now is for all refined oils to approximate in value.

The production of oilseeds is liable to very considerable fluctuations, but in a normal year the following estimates of the main crops may be taken as approximately correct:—

Product	World's Production Oilseeds	Exportable Surplus from Producing Countries	Approximate Oil Equivalent of Exportable Surplus
	Tons	Tons	Tons
Linseed	4,000,000	2,000,000	600,000
Cottonseed	11,000,000	900,000	162,000
Ground Nuts	2,500,000	800,000	280,000
Rape and Mustard	1,500,000	380,000	133,000
Sesame	600,000	300,000	135,000
Soya Beans	4,500,000	1,000,000	100,000
Sunflower	2,000,000	30,000	9,000
Copra	1,500,000	600,000	390,000
Palm Kernels	500,000	450,000	202,000
Castor Seed	300,000	150,000	63,000
	Oil		
Olive Oil	700,000	120,000	120,000
Total			2,194,000

Linseed.—The main producing countries are Argentina, India, U.S.A., Canada and Russia. About 50% of the total is now produced in Argentina, where expansion has been steady over the last 20 years, and was largely unaffected by the War. The seed is mainly exported to the crushing mills in Europe, though America imports considerable quantities, varying according to the fluctuations in the home crop. Production in Canada and the United States has varied largely. Normally America consumes about 1,000,000 tons of seed and any deficiency in the home production has to be made good by imports of seed from Argentina or of oil from Europe. In 1922, 64,000 tons of linseed oil were exported from Europe to America. In India, flax is cultivated for the seed and not the fibre. Production of linseed amounts to from 500,000 to 600,000 tons, of which about 80% is exported, almost entirely to Europe. With the increasing competition from Argentina there has been a tendency to diminish production. Russia as a producer and exporter of linseed was practically eliminated during the War and subsequent revolution, but is now again resuming exports. Production in 1925 reached 600,000 tons, which is about normal. Pre-War exports amounted to approximately 150,000 tons a year.

Cottonseed.—The main producing countries are the United States, India and Egypt, but cultivation has extended to other countries, *e.g.*, South America (Brazil, Peru, Argentina), East and West Africa (Nigeria, Uganda, Sudan) and Australia. With the increasing demand from the textile industry for cotton, a great expansion in cultivation is inevitable and with it the production of cottonseed, one of the greatest sources of edible vegetable oil. Up to 1870 cottonseed in the United States was a useless encumbrance to the planter. With the discovery and development of refining, numerous oil-mills were erected, and now some 4,000,000 to 5,000,000 tons of seed are crushed annually, producing about 600,000 tons of oil. Up to a few years ago 150,000 tons of oil were exported annually to Europe, but owing to increasing home consumption the exportable surplus has now diminished to about 28,000 tons, with every probability of a further decrease.

Europe has had to depend for its supplies of cottonseed mostly on Egypt and India, though with the extension of cultivation to other countries many varieties are now coming on to the European market. Egypt normally produces about 600,000 tons and exports to Europe 400,000. India produces rather over 2,000,000 tons, but exports only from 200,000 to 300,000 tons. Figures relating to China are difficult to obtain, but it is estimated she produces about 1½ million tons, practically all of which is consumed locally. The striking fact about cottonseed is that out of a total production of about 11,000,000 tons of seed, only some 900,000 tons find their way to the international markets, the rest being disposed of at home.

Groundnuts.—The main producing countries are India, West Africa China and the U.S.A., the two first being the principal sources of supply for the world markets. In all areas production is continuously expanding to meet the demand both for the purposes of oil production and for direct use as food. The chief importing country is France, which takes about 500,000 tons annually.

India produces well over 1,000,000 tons, more than half of which is retained for home consumption. The nuts are shelled before exporting. West Africa produces well over 500,000 tons and exports about 350,000 tons, practically all in shell. Figures are not available for China, but production is probably very large. Exports amount to only about 60,000 to 70,000 tons. The U.S.A. consumes all it produces, viz.: about 350,000 tons.

The pre-War export trade in ground-nut oil was confined mainly to France, the Netherlands and China. During the War French and Dutch exports were reduced to a minimum, and China became the chief source of supply, increasing its export from 15,000 tons in 1913 to 75,000 tons in 1919—mainly to America. Since then the pre-War position has gradually been restored.

Rapeseed.—India produces four-fifths of the world's supply, the remainder being grown in Japan, Rumania, Russia and other European countries. European cultivation has decreased considerably. The great bulk of seed produced in India is consumed locally, exports even before the War showing a marked tendency to diminish. In recent years exports have fluctuated widely, varying from 56,700 tons in 1921 to 271,500 tons in 1924 and 165,000 tons in 1925.

Soya Beans.—The chief producer of soya beans is China, the normal crop being estimated to be between four and five million tons. The soya bean has long been one of the staple foods of the East; since 1904 when the first shipment was made to Europe there has been a very rapid expansion in trade. Some 500,000 tons are now exported to Europe, a similar quantity being exported locally—mainly to Japan. In addition, a large number of mills have been erected in Manchuria to crush the soya bean, the oil being exported mainly to Europe and the cake to Japan for use as a fertiliser for the rice crop. Exports of oil amount to over 100,000 tons a year.

Sunflower Seed.—This is produced mainly in Russia, but to an increasing extent in Rumania, Hungary, Bulgaria and Poland. In 1913 some 180,000 tons of oil were produced practically all of which was consumed locally.

Copra.—The two main zones of cultivation are the Southern Asiatic, including Dutch East Indies, Philippines, Ceylon and Malay States, and Oceania, comprising the various Pacific Island groups. The former is the more important, supplying about four-fifths of the total. During the War the export trade to Europe in copra suffered severely. In the case of the Dutch East Indies, exports fell from 230,000 tons to 65,000. The United States, however, increased its imports both of copra and coconut oil. A marked revival took place in 1919, total exports amounting to 650,000 tons of copra.

Palm Kernels.—West Africa holds practically a monopoly of the production, although plantation cultivation is being extended to other tropical countries, notably the Dutch East Indies. Practically the whole of the production is exported to Europe. The War diverted supplies from Germany to Great Britain. In 1909 only about 20,000 tons were brought into England, as against 240,000 tons to Germany. After the War Germany gradually recovered her position. In 1924 the respective figures were 280,000 as against 102,000 and in 1925 226,000 against 225,400 tons.

In addition to palm kernels, West Africa produces large quantities of palm oil, *i.e.*, oil from the palm fruit. It is difficult to estimate total production owing to the large local consumption. The method of producing the oil is still primitive, and the free, fatty acid content is high. The oil, therefore, is used principally for soapmaking in importing countries, though the best qualities can be made edible by refining. About 180,000 tons are exported annually to Great Britain, the Continent and America.

In the same group of oil nuts may be mentioned the cohune, babassu, ucuhubu, all of which have only come on the international market so far in small quantities. The producing country is Brazil, which is known to be rich in oil seeds.

Castor Seed.—India has practically a monopoly. During pre-War years the average export amounted to about 120,000 tons, the chief importing countries being Germany and Great Britain. During the War Brazil began to cultivate this seed, and in 1918 exported 4,000 tons and in 1924 15,000 tons. After the War exports from India fell heavily, due to the accumulation of Government stocks in Great Britain. Since then recovery has set in and in 1925 100,000 tons were exported. The United States has become one of the chief importing countries. Small quantities are also exported from Dutch East Indies and Portuguese West Africa.

Olive Oil.—Cultivation of the olive has not undergone any material change during the last 25 years. The principal producing countries border on the Mediterranean, *i.e.*, Spain, Italy, Greece, Algeria, Tunis, and, to some extent, France and Turkey. Annual production amounts to 700,000 tons, of which over 100,000 tons are exported, mainly to Argentina, the U.S.A., Great Britain and Germany. The War reduced the exports of Italy, Greece and Tunisia and doubled those of Spain. As much as 87,000 tons in 1916 and 110,000 tons in 1919 were exported from Spain. Pre-War conditions however eventually re-asserted themselves.

Animal Fats.—In addition to the vegetable oils, considerable quantities of animal fats, such as lard and tallow, are produced for edible and industrial purposes. The United States produces some 700,000 tons of lard, of which about one-half is exported. The main exporting countries for tallow are Argentina and Australia, which between them account for about 100,000 tons. The United States consumes practically all its production which amounts to about 170,000 tons.

Marine Oils.—The principal marine oil is whale oil. These oils were used only for burning until the hydrogenation process was developed; since that time all the whale oil is used in soap and margarine manufacture. The total production of marine oils is approximately 200,000 tons, whale oil accounting for about 130,000 tons (*see* WHALING).

See International Institute of Agriculture, Rome, *Oleaginous Products* (1923); *International Crop Report and Agricultural Statistics* (monthly.) (J. W. P.)

OKLAHOMA (*see* 20.57).—A State of the United States of America. The population in 1920 was 2,028,283; in 1910 it was 1,657,155; an increase of 371,128, or 22·4% as compared with 866,764 or 109·7% in the preceding decade. The urban population increased from 320,155 in 1910 to 539,480 in 1920. During the same period the density of population increased from 23·9 per sq. m. to 29·2. Indians decreased from 74,825 to 57,337. Negroes increased from 137,612 to 149,408. The population in 1920 of the larger cities was:—

Oklahoma City	91,295	Okmulgee	17,430
Tulsa	72,075	Enid	16,576
Muskogee	30,277	Shawnee	15,348

The population of the State in 1925 was estimated at about 2,250,000 persons.

Mineral Production.—The most important development between 1910 and 1920 was in the production of oil and gas. In 1924 there were 50,900 wells producing either oil, or gas, or both, and 43 counties were classed as oil and gas producers. Tulsa is the centre of the oil and gas area of the State: its population increased from 18,000 in 1910 to 72,075 in 1920. The production of oil increased from 52,028,700 bbl. of crude oil in 1910 to 161,000,000 bbl. in 1924, and its value from $19,227,000 in 1910 to $279,000,000 in 1924. In 1924 Oklahoma produced 3,500,000 tons of coal, 178,000,000,000 cu. ft. of gas, 67,000 tons of lead, 242,000 tons of zinc, 290,000 tons of gypsum and 2,000,000 bbl. of Portland cement. The total value of Oklahoma's mineral production increased from $33,000,000 in 1910 to $410,600,000 in 1924.

Agriculture.—The total area of farm land in 1910 was 28,859,353 ac. of which 17,551,337 ac. were improved; in 1920 the total area was 31,951,934 ac. of which 18,125,321 were improved. The value of farm property in 1910 was $918,148,882; in 1920 it had increased to $1,660,423,544. In 1909 the total value of all crops was $131,522,220. In 1919 it was $550,084,742, but, owing to the drop in prices, in 1924 the total value was only $427,934,000. Dairy products in 1924 were valued at $25,000,000, as against $20,878,920 in 1919. The following tables show the quantities and values of cereal production in 1909, 1919 and 1924, and the numbers of live stock in 1910, 1920 and 1924:—

Cereal Production

	1909	1919	1924
Wheat: quantity	14,008,334 bu.	65,761,843 bu.	54,870,000 bu.
Value	$13,854,322	$140,730,350	$68,048,000
Corn: quantity	94,283,407 bu.	53,851,093 bu.	65,600,000 bu.
Value	$48,080,554	$72,698,979	$58,384,000
Oats: quantity	16,606,154 bu.	45,470,191 bu.	38,880,000 bu.
Value	$7,172,267	$36,376,150	$20,606,000
Kafirs: quantity	4,658,752 bu.	17,901,096 bu.	29,614,000 bu.
Value	$2,531,036	$23,271,427	$22,803,000
Barley: quantity	127,641 bu.	1,781,839 bu.	4,675,000 bu.
Value	$75,059	$2,049,119	$3,273,000
Rye: quantity	37,240 bu.	705,124 bu.	518,000 bu.
Value	$30,364	$1,022,434	$523,000

Live Stock

	1910	1920	1924
Horses	786,700	790,670	633,000
Mules	258,152	358,200	330,000
Dairy Cattle	1,765,346	870,690	565,000
Other Cattle		1,284,753	1,044,000
Sheep	49,157	106,024	8,300
Swine	..	1,366,722	841,000

The chief industries are the manufacture of flour and meal, smelting, oil refining and meat packing. The following table prepared by the U.S. Census Bureau gives a comparative summary for 1914 and 1921:—

	1914	1921
Number of establishments	2,518	1,398
Proprietors and firm members	2,464	1,262
Salaried employees	2,793	5,443
Wage-earners	17,443	22,241
Capital	$ 65,477,654	..
Salaries	3,202,332	$ 11,801,000
Wages	11,011,043	29,532,000
Cost of Materials	70,969,750	203,803,000
Value of products	102,005,693	283,764,000
Value added by manufacture	31,035,943	79,961,000

Education.—During the period 1910 to 1924 great progress was made in education. The enrolment of pupils in 1910 was 415,116, and in 1924–5 it was 654,742. The number of accredited four year high schools increased from 29 in 1912 to 508 in 1924. The total expenditure for public schools in 1910 was $8,600,450.32, as against $30,187,233 in 1924–5. Similar growth has been shown in the higher educational institutions supported by the state. The six state teachers' colleges, the Agricultural and Mechanical College and the secondary agricultural schools as well as other State secondary schools have made progress. The University of Oklahoma, which in 1907–8 had 40 instructors and 790 students, had in 1924–5 264 instructors and 5,561 students, inclusive of the summer session, but exclusive of correspondence and extension work. In 1916 the industrial institution at Chickasha was re-organised and renamed the Oklahoma College for women. It is the only school maintained by the state that is not co-educational.

History.—At the time of its admission in 1907 Oklahoma contained more than one-third of the Indian population of the United States. These Indians came from numerous tribes that had moved to Oklahoma in the 19th century, and their absorption into the general body of citizens has proceeded increasingly since 1910. The Indians of Oklahoma had by 1920 practically no separate history, and such tribal organisations as were maintained were not for governmental purposes, but were business corporations for the control of tribal property. The great mineral output has made many of the Indians extremely wealthy. The Osage tribe in particular continued to hold much of its land as tribal property, and its members receive very large royalties. This was not true of certain other tribes, as the lands assigned to them are valuable only for grazing purposes, and the individual allotments under such circumstances bring small incomes. The fact that a large part of the land, especially in the eastern half, has been allotted to the Indians, serves to account for the large number of tenant farmers in a state. The governors of Oklahoma between 1910 and 1925 were Lee Cruce (Dem.), 1911–5; Robert L. Williams (Dem.), 1915–9; James Brooks Ayres Robertson (Dem.), 1919–23; John Calloway Walton (Dem.), 1923; Martin Edward Trapp (Dem.), 1923– .

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OKLAHOMA CITY, U.S.A. (*see* 20.61), the capital of the State of Oklahoma and its commercial centre, continued to grow rapidly after 1910, reaching a population of 91,258 in 1920 (of whom 8,241 were negroes and only 3,477 foreign-born), and 139,947 on Jan. 1 1925, according to an official census made by the city.

In a zone 50–100 m. from Oklahoma City lie (1925) most of the 250 producing oil-fields of the state. The nearer territory, within a radius of 50 m., is believed to contain oil far below the surface, and its development may be expected with the exhaustion of the more accessible supplies and improvement in methods of reaching lower levels. In 1924 the assessed valuation of taxable property in the city was $119,000,000; bank clearances amounted to $1,283,152,000; building permits represented a value of $8,060,845; the volume of wholesale business was estimated at $175,000,000; and freight originating in or destined for the city amounted to 1,880,426 net tons. The value of products manufactured within the city increased from $7,868,000 in 1909 to $69,971,000 in 1919. In 1925 there were 431 manufacturing establishments with an output valued at $150,000,000, the principal industries being packing, flour-milling, cotton-pressing and ginning.

The commission form of government was adopted in 1911. By 1925 a new water supply system costing $5,500,000 had been completed; and 2,200 ac. had been laid out in public parks and playgrounds. Oklahoma City University (established in 1911 and superseding Epworth University) had a roll of over 1,300 students.

OKUMA, SHIGENOBU, MARQUESS (1838–1922), Japanese statesman (*see* 20.61), emerged from his retirement in 1914 to become Prime Minister, in which capacity it was his fortune to guide the country through the opening months of the World War. In Oct. 1916, Count Okuma retired from office owing to his failing health. In the same year he was raised to a marquessate. He died at Tokyo Jan. 10 1922.

OLD AGE PENSIONS: *see* INSURANCE, SOCIAL.

OLDENBURG, SERGEI FEDOROVICH (1863–), Russian orientalist, was born Sept. 14 1863 at Bjankino, Siberia, of a family of German origin. Oldenburg learnt Greek and Latin at a secondary school in Warsaw and later entered the University of St. Petersburg (Leningrad) to study oriental languages. He specialised in Indian dialects under Professor T. P. Uinajer, graduated in 1890 and went to England where he did research work at Cambridge. In 1894 he published his *Buddhist Legends.* In 1903 became a member of the Academy of Sciences, of which in the following year he was elected permanent secretary. In this capacity he controlled the official and scientific correspondence of the academy, its publications and their exchange, the academical archives, the scientific expeditions and the regional surveys of the country. He also became director of the Asiatic Museum, founded by the academy in 1818, which contains many valuable oriental manuscripts. Oldenburg took a leading part in two archaeological expeditions to Chinese Turkistan, which discovered a whole library of ancient Mss. buried in sand among ruins of a deserted town. He was appointed professor at the University of St. Petersburg in 1895 and still occupied the chair of Indian languages and literature in 1926.

OLD TESTAMENT: *see* BIBLICAL CRITICISM.

OLLIVIER, OLIVIER ÉMILE (1825–1913), French statesman (*see* 20.89), died at St. Gervais-les-Bains, Savoy, Aug. 30 1913.

OLNEY, RICHARD (1835–1917), American statesman (*see* 20.91), died in Boston, Mass., April 8 1917. He declined, in 1913, President Wilson's offer of the ambassadorship to Great Britain.

OLYMPIC GAMES (*see* ATHLETIC SPORTS, also 2.846).—The modern revival of the Olympic Games of ancient Greece is due to a Frenchman, Baron Pierre de Coubertin, whose personal admiration of the English public school and English ideals of sport determined him to impart those ideals both to France and to the rest of the world by organising an amateur meeting of all nations in athletic rivalry every four years. The Baron succeeded in his efforts so far that by the fourth celebration of Games in 1908 he saw collected in London the representatives of 20 different nations competing in 20 different forms of sport, involving more than 100 separate events, with a complete illustrated code of rules for each of them, accepted by more than 2,000 athletes. In 1924 he saw in Paris an even longer programme, in which 45 different nations contributed a total of competitors three times as large as that of 1908.

As it is therefore clear that the modern Olympic Games have become, in all human probability, a permanent feature in the world's calendar of sport, it would serve no good purpose to say more concerning recent developments than that they appear to be more warmly welcomed by the Americans and by other nations in Europe and elsewhere than by the population of Great Britain as a whole, which has been for long accustomed to an annual round of organised competitive sport quite unfamiliar to any other country.

Early Meetings.—It was by the British Olympic Committee, headed by Lord Desborough and the Rev. R. S. de C. Laffan, that the first real organisation of these Games was sucessfully carried through in 1908 in London. Previous meetings, though recorded, were neither representative nor properly organised. The third celebration at St. Louis in 1904 had attracted hardly any competitors from outside the United States. The second, in Paris in 1900, had suffered from inadequate preparation and control. The first of the revival, appropriately held in Athens in 1896, where the famous Marathon Race was standardised, was made possible by the munificence of a private citizen (M. Averoff); but the marble stadium built at his expense, though splendidly adapted to local festivals, did not permit of a running-track suitable for the athletic championships of the world.

After the success of the London meeting in 1908, that of Stockholm in 1912 carried on the movement with all the enthusiasm to be expected from the compatriots of Sir Viktor Balck; and their wonderful stadium combined with thoroughly skilful organisation in all directions to make the future of these Games still more firmly assured. The meeting of 1916, originally fixed for Berlin, was impossible owing to the World War; and it was the opinion of many that neither Belgium nor the rest of the world were ready for the Games of 1920 in Antwerp. The Belgians were unable to produce the usual official report, and therefore certain details about the Games of 1920 cannot here be given; but both in the total of entries and in the standard of achievement these Games maintained an unexpectedly high level. The Games of 1924 were again celebrated in Paris.

Organisation.—Of the International Olympic Committee Baron Pierre de Coubertin was for many years president, being succeeded by Count Baillet-Latour. It is the central body by which the general policy of the Olympic movement is (or should be) controlled. In 1910 the representatives of the United Kingdom were Lord Desborough, the Rev. R. S. de Courcy Laffan and Sir Theodore A. Cook. In 1924 they were Lord Cadogan, the Rev. R. S. de Courcy Laffan and Brigadier-General R. Kentish, C.M.G., D.S.O. The American members in 1924 were Professor Sloane, Mr. W. M. Garland, General Charles Sherrill and Dr. David Kinley. Forty-four nations are represented by one or more delegates each. It is hoped that by degrees this influential committee will crystallise such ideals as a world-wide amateur definition which will cover every sport; an Olympic programme restricted to those first-rate forms of sport in which at least half the competing nations have personal experience; a prize schedule of permanent medals and certificates alone, with an official list of properly constituted challenge cups; a universally accepted code of laws to govern every competition in the Games; and a body which will appoint juries and officials with power to inflict penalties that cannot be evaded.

Besides this central committee, on which all nations are represented, each nation has its own Olympic association and its own Olympic council. The British Olympic Council, which may be taken as typical of the rest, contains one or more representatives of every association governing every sport in Great Britain, and a few other co-opted members chosen for their special knowledge or experience in organisation. Through this committee the association controlling each sport selects the best representatives in that sport. By this committee the funds necessary for British participation in Olympic meetings are collected.

Finance.—The Olympic Games in Great Britain are not assisted by any grant of public money, as is the case with nearly every other competing nation. It was necessary in 1908, for instance, to build a stadium in London that would hold 70,000 spectators, and would contain a first-class cinder track with three laps to the mile, a cement cycle track outside it, a swimming bath inside it 100 metres long by 50 ft. broad and 12 ft. 6 in. deep; and a central oval of turf 700 ft. by 300, suitably laid out for all the different contests arranged in it. In this stadium 27 athletic events were decided; and six other forms of sport, archery, fencing, cycling, gymnastics, swimming and wrestling, also took place. The cost of this stadium was over £60,000 in 1908. The marble erection in Athens may have cost more. The permanent stone stadium in Stockholm cannot have cost much less. As an indication of the rise in expenses since the War, it may be added that the huge stadium built at Wembley in 1924 cost over £500,000. The Games were planned to be held in Holland in 1928 and in the United States in 1932, and these two countries had thus to incur this particular expense. But there is gradually rising throughout Europe a series of permanent buildings, fitted for Olympic Games, which will by degrees greatly reduce this item of expenditure in the organising country.

Those countries, however, which are not obliged to build a stadium have always before them the expense of sending teams, totalling from about 50 to as many as 500, to the country in which the Games are being held. The problem of these expenses has not been satisfactorily solved, but the shortening of the programme has been suggested as one solution. There were 109 first prizes in 1908, 102 in 1912, 100 in 1920 and 111 in 1924. In addition to the sports mentioned as taking place in the London Stadium in 1908, there are such events as lawn tennis, shooting of every kind, rowing, yachting, football and boxing. This by no means exhausts any possible list. In 1924 a whole series of winter sports was added to the Paris programme of 111 events. Clearly the Games should not be confined to track and field events in athletics alone. It is equally clear that some standard programme must be laid down for the future by the international committee.

Records.—A comparison of the events to which most importance is popularly attached in the various Olympic Games from 1896 to 1924 will show the following Olympic records, (Table I.) to which the world's records have been added in a separate list (Table II.) for purposes of comparison:—

TABLE I. OLYMPIC RECORDS.

Race	Date	Place	Winner	Country	Time or Distance
(1) 100 metres	1912	Stockholm	D. F. Lippincott	U.S.A.	$10\frac{3}{5}$ sec.
	1924	Paris	H. M. Abrahams	Great Britain	$10\frac{3}{5}$ sec.
(2) 200 metres	1904	St. Louis	A. Hahn	U.S.A.	$21\frac{3}{5}$ sec.
	1924	Paris	J. V. Scholz	U.S.A.	$21\frac{3}{5}$ sec.
(3) 400 metres	1924	Paris	E. Liddell	Great Britain	$47\frac{3}{5}$ sec.
(4) 400 metres relay	1924	Paris	U.S.A.	U.S.A.	41 sec.
(5) 800 metres	1912	Stockholm	J. E. Meredith	U.S.A.	1 min. $51^{9}/_{10}$ sec.
(6) 1,500 metres	1924	Paris	P. Nurmi	Finland	3 min. $53\frac{2}{5}$ sec.
(7) 1,600 metres relay	1924	Paris	U.S.A.	U.S.A.	3 min. 16 sec.
(8) 3,000 metres steeplechase	1924	Paris	W. Ritola	Finland	9 min. $33\frac{3}{5}$ sec.
(9) 3,000 metres team	1924	Paris	Finland	Finland	8 min. 32 sec.
(10) 5,000 metres	1924	Paris	P. Nurmi	Finland	14 min. $31\frac{1}{5}$ sec.
(11) 10,000 metres	1924	Paris	W. Ritola	Finland	30 min. $23\frac{1}{5}$ sec.
(12) 10,000 metres walk	1912	Stockholm	G. H. Goulding	Canada	46 min. $28\frac{2}{5}$ sec.
(13) Marathon	1920	Antwerp	H. Kolehmainen	Finland	2 hr. 32 min. $35\frac{4}{5}$ sec.
(14) Hurdles (110)	1920	Antwerp	E. J. Thomson	Canada	$14\frac{4}{5}$ sec.
(15) Hurdles (400)	1924	Paris	F. M. Taylor	U.S.A.	$52\frac{3}{5}$ sec.
(16) High jump	1924	Paris	H. M. Osborne	U.S.A.	6 ft. 5·95 in.
(17) Long jump	1912	Stockholm	Gutterson	U.S.A.	24 ft. $11\frac{1}{4}$ in.
(18) Pole jump	1920	Antwerp	F. K. Foss	U.S.A.	13 ft. 5 in.
(19) Weight	1912	Stockholm	Macdonald	U.S.A.	50 ft. 4 in.
(20) Hammer (16 lb.)	1912	Stockholm	M. J. McGrath	U.S.A.	177 ft. 7 in.
(21) Javelin	1920	Antwerp	J. Myrra	Finland	215 ft. $9\frac{3}{4}$ in.
(22) Discus	1924	Paris	C. Houser	U.S.A.	151 ft. $5\frac{1}{16}$ in.
(23) Hop, step and jump	1924	Paris	A. W. Winter	Australia	50 ft. $11\frac{3}{16}$ in.

It should be noted that 100 metres = 109·3 yards; 200 metres = 218·7 yards; 400 metres = 2·6 yards less than a quarter of a mile; 1,500 metres = 119·6 yards less than a mile. 110 metres (hurdles) is nearly 11 inches over 120 yards. The Marathon Race is 42·263 kilometres or 26 miles 385 yards.

TABLE II. WORLD RECORDS.

Race	Date	Winner	Time or Distance
(1) 100 metres	1921	C. W. Paddock	$10\frac{2}{5}$ sec.
(2) 200 metres	1921	C. W. Paddock	$21\frac{1}{5}$ sec.
(3) 400 metres	1924	E. Liddell	$47\frac{3}{5}$ sec.
(4) 400 metres relay	Metric world's record not available.		
(5) 800 metres	1917	J. E. Meredith	1 min. $51^{9}/_{10}$ sec.
(6) 1,500 metres	1924	P. Nurmi	3 min. $52\frac{3}{5}$ sec.
(7) 1,600 metres	Metric world's record not available.		
(8) 3,000 metres steeplechase	1924	W. Ritola	9 min. $33\frac{3}{5}$ sec.
(9) 3,000 metres team	1924	Finland (P. Nurmi 1st)	8 min. 32 sec.
(10) 5,000 metres	1924	P. Nurmi	14 min. $28\frac{1}{5}$ sec.
(11) 10,000 metres	1924	P. Nurmi	30 min. 6 sec.
(12) 10,000 metres walk.	Metric world's record not available.		
(13) Marathon	1924	C. de Mar	2 hr. 29 min. $40\frac{1}{5}$ [sec.]
(14) Hurdles (110 metres)	1920	E. J. Thomson[1]	$14\frac{4}{5}$ sec.
(15) Hurdles (400 metres)	1924	F. M. Taylor	$52\frac{3}{5}$ sec.
(16) High jump	1925	H. M. Osborne	6 ft. $8\frac{1}{4}$ in.
(17) Long jump	1925	de Hart Hubbard	25 ft. $10\frac{7}{8}$ in.
(18) Pole jump	1925	C. Hoff	13 ft. $10\frac{1}{2}$ in.
(19) Weight	1909	R. Rose	51 ft.
(20) Hammer (16 lbs.)	1913	P. Ryan	189 ft. $6\frac{1}{2}$ in.
(21) Javelin	1924	H. Lindstrom	218 ft. $7\frac{1}{4}$ in.
(22) Discus	1925	G. Hartranft	157 ft. $1\frac{5}{8}$ in.
(23) Hop, step, and jump	1924	A. W. Winter	50 ft. $11\frac{1}{4}$ in.

[1] In 1920 E. Thomson set up a World's record of $14\frac{2}{5}$ sec. for 120 yards over 10 flights of 3 ft. 6 in. hurdles.

The division of victories, as opposed to records, in the 23 events given above since 1896, has been as follows:—(1) U. S. A. 1896, 1900, 1904, 1912, 1920. Great Britain 1924. South Africa 1908. (2) U. S. A. 1900, 1904, 1912, 1920, 1924. Canada 1908. (3) U. S. A. 1896, 1900, 1904, 1912; Great Britain 1908, 1924. South Africa 1920. (4) Great Britain 1896, 1900, 1920, 1924. U. S. A. 1904, 1908, 1912. (5) Great Britain 1896, 1900, 1912, 1920. U. S. A. 1904, 1908; Finland 1924. (6) Finland 1912, 1924. France 1920. (7) Finland 1920, 1924. U. S. A. 1904, 1908. Greece 1896. South Africa 1912. (8) U. S. A. 1896, 1900, 1904, 1908, 1912, 1924. Canada 1920. (9) U. S. A. 1900, 1904, 1908, 1920, 1924. (10) U. S. A. every year. (11) U. S. A. every year except 1920, Sweden. (12) U. S. A. every year. (13) U. S. A. every year except 1920, Finland. (14) U. S. A. every year. (15) U. S. A. every year except 1896 and 1900, no contest. (16) U. S. A. every year. (17) U. S. A. every year except 1920, Sweden. (18) U. S. A. every year. (19) U. S. A. every year except 1920, Finland. (20) U. S. A. every year except 1896, no contest. (21) Sweden 1908, 1912, Finland 1920, 1924. No contest in 1896, 1900, 1904. (22) U. S. A. 1896, 1904, 1908, 1924, Finland 1912, 1920. Hungary 1900. (23) U. S. A. 1896, 1900, 1904. Great Britain 1908, Sweden 1912. Finland 1920. Australia 1924.

These 23 events all occur in the department of athletics, which is only one division of the Games. In 1908, the United Kingdom, with 839 entries, scored 57 first prizes and five more went to the Dominions; the United States, with 160 entries, scored 22 first prizes. The remaining 22 first prizes went to the 1,529 entries from all other nations. In 1912, the United Kingdom, with 526 entries, scored ten first prizes and eight more went to the Dominions; the United States, with 572 entries, scored 24 first prizes; Sweden, the organising country, with 881 entries scored 24 first prizes; the remaining 36 first prizes went to the 3,651 entries from all other nations. Sufficient records were not kept of the next two Games to continue the comparison in full. But in 1920 the United States won 22 first prizes; Great Britain took eight; the Dominions four; Belgium, the organising country, one; and the remaining 65 first prizes were divided among all the other nations. In 1924, with 424 entries, the United States won 27 first prizes; Great Britain, with 443 entries, won six; and the Dominions, four; France, the organising country, won four. The remaining 69 first prizes (without counting winter sports, in which Norway won easily with Finland second) were divided among all the other nations. These figures are not taken from victories in the athletic sections only; but from the full programme.

Some Reflections.—On these statistics a few words of explanation are necessary. There is not supposed to be a winning nation of any particular Olympic year. But human nature insists on classification of results, and this may be roughly obtained by scoring ten for a first prize, five for a second and four for a third. Even then, it is clear that the Marathon Race is really worth more than the 100 metres; or a sculling-race than a miniature rifle. The Americans have done wonderfully well by specialising in athletics, and their all-round ability is shown by the fact that at Paris in 1924 H. M. Osborne won the Decathlon comprising ten events, and also set up a new world's record for this particular competition.

But the country that has made the most extraordinary progress of all is Finland. In estimating the percentage of victories to entries it must be remembered: (1) that not all athletes entered were actually competing, (2) that gymnastic and other teams absorb a large number, (3) that women have entered, since 1912, for certain events like swimming and lawn tennis, (4) that some (though few) athletes compete in two or more events, (5) that the organising country in which the Games are held can invariably count on producing, if she desires, the full number of competitors legally permitted to enter for every event.

The art competitions have not been considered in these statistics. But it may be noted that in 1920 the silver medal in literature was awarded to Sir Theodore Cook (Great Britain) for his poem on "Pindar and the Olympic Games," and in 1924 the same prize was won by Miss D. Margaret Stuart (Great Britain) for her "Sword Songs." For the guidance of future organisers, it may be added that out of £27,183 available for the expenses of the British team of 1924, a surplus of £1,458 was left in hand on Dec. 31 of that year for the purposes of the British Olympic Association.

The Games in 1924.—The winter sports began at Chamonix on Jan. 25 1924, and 39 entries represented Great Britain. There were 14 events in all, in skating (speed and figure), ice hockey, curling, bobsleighing and ski-racing. The programme in Paris was opened at Colombes on July 5 1924 and consisted of athletics (27 events), swimming (ten events for men and seven for women), boxing (eight events), cycling (six events), wrestling (two styles, 13 events), shooting (eight events), lawn tennis (five events, including ladies), gymnastics (two events), fencing (four events), rowing (seven events), weight lifting (five events), the modern Pentathlon and polo. Association football was held in Paris from May 15 to June 9 1924, Uruguay beating Switzerland by three goals to nil in the final. Rugby football was held in Paris from May 3 to 18, the United States defeating France in the final by 17 points to three. Neither baseball nor cricket has been included in the Games. In 1924, in polo, Argentina won four games, the United States three, Great Britain two, Spain one and France none. Many other sports were omitted. The programme was very much too long for practical purposes, and a standardisation of the Games, in this and other directions, became a pressing necessity for the Olympiad of 1928 in Holland. The Games of 1932 will be held in the United States (*see* ATHLETICS).

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(T. Co.)

OMAHA, Neb., U.S.A. (*see* 20.98), 34th city in size in the United States, and the principal retail trading centre between Chicago and Denver, ranked first (1924) in the production of dairy butter and of pig lead, first as a primary grain market and disputed with Kansas City for second place in packing-house products and as a live stock market. South Omaha, the site of the Union stock yards (*see* 25.514), which had a population of 26,259 in 1910, was annexed in 1915; Benson, Florence and Clontarf in 1917; thus increasing the area to 37 square miles. The population was 191,601 in 1920, of whom 35,381 were negroes and 35,645 foreign-born; and the census bureau estimate in 1925 was 211,768. The products manufactured within the city limits were valued at $60,854,000 in 1909; $452,237,000 in 1919 (when South Omaha was included); $315,971,430 in 1923; and, according to a local compilation, $388,018,541 in 1924. The 550 wholesale and retail houses distributed merchandise valued at nearly $500,000,000.

The packing industry, employing 14,000 persons, dealt with 70% of the 8,697,690 head of live stock received in the city in 1924, producing an output valued at $198,392,582. Industries next in importance were smelting, principally of lead and silver (value of products, $42,708,485); butter and other dairy products ($24,331,395); automobiles, trucks and accessories ($19,007,475); flour and grist-mill products ($11,180,808). Omaha is the headquarters of the Union Pacific system, central station of the transcontinental air-mail route, and national headquarters of the air-mail branch of the postal service. It is an important centre for insurance. The percentage of homes owned is high and increasing: (1910) 39·8%; (1920) 48·4%; (1925) 55%. The public schools included 58 "grade" and five high schools in 1925, representing an investment of $20,000,000 and an annual expenditure of $4,000,000. The combined budget of the philanthropic institutions financed by joint appeal was about $400,000. With the completion of projects under way in 1926, the parks will comprise over 2,000 ac. and the city will have 50 m. of boulevards. A new "home rule" charter was granted by the Nebraska legislature in 1923.

OMAN, SIR CHARLES WILLIAM CHADWICK (1860–), British historian, was born at Mozufferpore, India, the son of a tea planter, Jan. 12 1860. Educated at Winchester and New College, Oxford, he distinguished himself at both seats of learning, and in 1883 was made a fellow of All Souls College. In 1905 he became Chichele professor of modern history at Oxford and he was chosen a fellow of the British Academy in the same year. He was president of the Royal Historical Society 1917–21. In 1919 he was elected M.P. for the University of Oxford and in 1920 he was knighted. As a historian Oman won his spurs by his studies on the art of war, the result being his *History of the Art of War in the Middle Ages* (1898, new ed. 1924). His other works include a *History of Greece* (1890); *A Short History of England* (1895, new ed. 1920); and six volumes of a *History of the Peninsular War.* Sir Charles is an authority on coins, on which subject he writes in this Encyclopædia.

OMAN (*see* 20.99) roughly comprises the extensive and mountainous promontory which forms the eastern extremity of Arabia, extending from Ras Musandam on the Gulf of Oman to the eastern limits of Hadhramaut at Ras Sajar (*lat.* 16° 8″ N.) on the Indian Ocean. Its capital, Muscat (*see* 19.43), was before the

War an important centre of the traffic in arms, which was in 1912 subjected to control by the establishment of a warehouse at the instance of the British Government. The Sultan of Muscat, Saiyid Taimur, who succeeded his father, Saiyid Faisal ibn Turki, in 1913, enjoyed a nominal authority over the whole of Oman, but his rule is effective only on the coast.

The tribes of the interior are practically independent under the loose control of an Imam of the ʻIbadi sect, whose centre is at Rustaq. A rising of the ʻIbadis in 1913–4 against the Sultan resulted in the occupation of Bait al Falj near Muscat by a British Indian force, which remained there throughout the War, defeating the rebels in 1915. Since the War the Sultan's administration has given rise to much dissatisfaction and in 1920–1 the British Govt. intervened to patch up an understanding between him and the ʻIbadi Imam. Shortly afterwards the Sultan had to agree to the creation of a sort of council of regency for the administration of the State and since then he has taken no active part in the government of his dominions, residing partly in India and partly on his personal estates. The administration is controlled by the Govt. of India. (*See* ARABIA.)

O'NEILL, EUGENE GLADSTONE (1888–), American dramatist, was born in New York City Oct. 16 1888. His early education was received at Roman Catholic schools and at the Betts Academy, whence he proceeded to Princeton University, remaining for one year. At different times he worked as sailor before the mast, actor and reporter. In 1914–5 he attended Harvard University. He rapidly became the most conspicuous of the younger American dramatists, and twice was awarded the Pulitzer Prize: in 1920 for his play, *Beyond the Horizon*, and in 1922 for *Anna Christie*. He finds his dramatic material among simple people, often sailors, and he deals in terms of tragedy with their conflicting passions and dreams and inner questionings. Among his works are: *Thirst and Other Plays* (1914); *The Moon of the Caribbees and Other Plays of the Sea* (1919); *Emperor Jones* (1921); *Straw* (1921); *Gold* (1921); *The Hairy Ape* (1922); *Welded* (1924); *All God's Chillun's Got Wings* (1924); *Desire Under the Elms* (1924). A complete edition of his plays in two vol. was published in 1924. His *Fountain* and *The Great God Brown* were produced in 1926.

ONNES, HEIKE KAMERLINGH (1853–1926), Dutch physicist, was born in Groningen Sept. 21 1853. He studied mathematics and physics in his native town, where in 1879 he took his doctor's degree on presenting a dissertation entitled *New Proofs of the Earth's Rotation.* He became professor of experimental physics at Leyden in 1882, and devoted himself especially to the study of properties of matter at low temperatures. As director of the Cryogenic Laboratory, founded by him at Leyden, he succeeded, in 1908, in liquefying helium. He later carried out important investigations on the influence of low temperatures on nickel and manganese iron alloys. He also demonstrated that the resistance of electric conductors disappeared suddenly at a certain temperature and that electric current could exist without electromotive force. In 1913 the Nobel Prize for physics was conferred on him. He became a foreign member of the Royal Society in 1916 and a corresponding member of the Prussian Academy of Sciences at Berlin in 1923, the year in which he resigned his chair at Leyden. His published work includes *Algemeine Theorie der Vloeistoffen* (*General Theory of the Fluids*, 1881). He died at Leyden Feb. 21 1926. See J. P. Kuenen, *De Toekenning van den Nobelprys aan H. Kamerlingh Onnes* (*Chemisch Weekblad, 1913*).

ONTARIO (*see* 20.113), a province of the Dominion of Canada. Through the addition in 1912 of Patricia, formerly part of the northwest territories, the area of Ontario was increased to 407,262 sq. m., of which 41,382 sq. m. are water. In 1921 the population was 2,933,662, an increase of 16·08 % in the preceding decade. Sex distribution showed an excess of 30,118 males over females: 77 % of the population were of British, 8·4 % of French and 4 % of German origin. The number of Indians in the province in 1921 was 26,654. The chief towns and their populations in 1921 are Toronto, the capital of the province, 521,893; Hamilton, an important manufacturing centre, 114,151; Ottawa, the federal capital, 107,843; and London, 60,959. The Government consists of a lieutenant-governor and a legislative assembly with a single chamber, the term for members being four years. The province is represented in the Federal Parliament by 24 senators, and by 82 members of the House of Commons. Women may vote, and are eligible for election to the Legislature.

Education.—The increased range of compulsory attendance and the more efficient enforcement of the law provided for in the provincial Education Act of 1919 led to increased numbers of pupils, especially in the secondary schools. The school age having been raised from 14 to 16, increased attention was devoted to technical education, which has shown considerable progress. In 1924 there were 7,022 elementary schools, with an enrolment of 610,322, an increase of nearly 10,000 over the preceding year, 189 continuation schools, and 183 high schools and collegiate institutes, with an aggregate enrolment of 66,784. The University of Toronto and its affiliated colleges had a total staff of 583 in 1924.

Agriculture.—Ontario is the chief mixed farming province in the Dominion. The value of all field crops in 1918 was $363,909,778, but by 1924 it had fallen to $260,534,000. The table below shows the yield in thousands of bushels and value in thousands of dollars of the principal field crops in 1922–5.

Dairy farming has steadily increased in importance, the gross revenue of dairy products reaching a value of $71,000,000 in 1918 and $95,005,000 in 1924. An intensive programme of agricultural education has been carried on by the provincial Government. Live stock in 1924 included 2,917,000 cattle, 1,807,903 swine and 870,279 sheep; horses numbered 673,371 in 1923.

Forests and Lumber.—The total area of forests in Ontario in 1924 was estimated at 240,000 sq. m., the chief timber being spruce, pine and poplar. The production of lumber, laths, and

Ontario. Yield of Principal Field Crops (000's of bushels)

Crop	1922		1923		1924		1925	
	Yield	Value	Yield	Value	Yield	Value	Yield	Value
Wheat	19,893	20,131	18,537	17,789	23,346	29,711	25,205	30,649
Oats	116,034	46,404	103,485	45,850	114,249	58,794	118,100	51,288
Barley	13,972	7,932	13,523	8,063	14,570	11,287	14,917	10,070
Rye	2,500	1,900	2,011	1,592	2,300	2,331	1,784	1,445
Peas	2,077	2,907	2,031	2,912	2,456	3,771	2,607	3,592
Buckwheat	4,266	2,993	5,012	3,727	6,449	5,401	5,579	4,098
Mixed grains	21,270	12,255	23,881	13,971	26,403	18,149	28,246	17,696
Corn for husking	12,306	9,599	12,861	11,318	11,141	12,924	9,736	8,763
Potatoes	12,210[1]	10,989	11,479[1]	14,560	14,980[1]	13,278	9,429[1]	15,652
Turnips, mangolds, etc.	23,381[1]	8,885	21,126[1]	10,047	24,283[1]	7,772	21,611[1]	8,644
Hay and clover	5,568[2]	69,049	5,799[2]	62,671	5,615[2]	60,803	5,233[2]	62,013
Alfalfa	629[2]	7,266	788[2]	8,980	1,068[2]	12,119	1,398[2]	17,706
Fodder corn	4,413[2]	19,197	3,651[2]	16,284	3,977[2]	19,527	3,614[2]	13,228
Sugar beet	190[2]	1,500	216[2]	1,401	334[2]	2,268	417[2]	2,549

[1] Cwts.

[2] Tons.

shingles in 1922 was valued at $25,687,380. Pulp production in 1923 was 877,921 tons, valued at $33,481,035; the manufacture of paper is increasing in importance.

Fur and Fisheries.—The fur trade of Ontario is the most important in the Dominion. In 1922–3, 838,249 pelts were purchased by traders at a value of $3,616,692. The fisheries of Ontario, due to its wealth of lake shoreline and inland waters, were valued at $3,159,427, which was just $1,000,000 greater in value than the fisheries of Quebec.

Mining.—Northern Ontario has become increasingly notable as one of the world's great mining areas. The production of petroleum fell from 226,165 bar. in 1913 to 154,317 bar. in 1924. Construction materials, including Portland cement, and stone, increased in value from $5,866,775 in 1913 to $10,833,670 in 1924.

Ontario. Quantity and Value of the Chief Minerals Produced in 1913 and 1924

Product	1913		1924	
	Quantity	Value $	Quantity	Value $
Gold	220,837 oz.	4,558,518	1,241,728 oz.	25,669,303
Silvet	29,724,931	16,579,094	10,699,684	7,233,078
Copper and Copper Sulphate	. .	. .	17,422,888 lb.	2,275,597
Cobalt (metallic, oxides and salts)	1,188,526 lb.	420,386	686,295	1,421,826
Nickel (metallic and oxide)	232,255	13,326	37,574,414	7,379,260
Arsenic, white	2,450,758	64,146	3,596,165	309,108
Natural Gas	15,558,400 cu. ft.	2,362,021	7,370,914 cu. ft.	4,076,014

Manufactures.—Ontario is the leading manufacturing province of Canada, 9,174 establishments in 1922 employing 237,319 persons with an annual production of $1,274,424,000. The leading manufactures are pulp and paper, textiles, iron and steel, boots and shoes, and sugar refining. The rapid expansion of the industrial activity of Ontario has been greatly stimulated by the development of hydroelectric power, chiefly at Niagara Falls. The Queenston-Chippawa development, begun in 1917, was completed in 1925 at a cost of over $60,000,000; there are eight units, totalling 440,000 horse-power. On Feb. 1 1924 the available 24-hour power at 80% efficiency at ordinary minimum flow was 18,225,316 H.P.: the developed water power was 1,445,480 horse-power.

Communications.—The province is well provided with railways for internal communication and for connecting all the leading industrial centres with neighbouring provinces and with the United States. There were 10,956 m. of steam railways in operation on Dec. 31 1923; several electric railways were also in operation. The greater part of the 117·2 m. of canals of Canada are situated in Ontario, the most important system being that which connects Port Arthur with Montreal through the Great Lakes. While the number of Canadian vessels using this system has shown a steady increase since 1917, the number of American vessels has declined proportionately, as also has the freight originating in the United States. Ontario possesses the best road system in the Dominion. Of its 64,258 m. of highway in 1924, 22,127 were of gravel, 11,446 were macadamised, and 185 were of concrete (*see* CANADA). (S. Le.)

OPERA (*see* 20.121).—In spite of the World War, the first quarter of the 20th century was fruitful in the production of new operas. But there is a distinct cleavage between the works of the pre-War period and those written after the War. Before the War restlessness and impatience with the old methods were the exception. They became the rule after 1919. Opera which conforms to the commonly accepted rules and standards is found only in the case of composers who belong more properly to the preceding era, like Boito, Puccini and Stanford. The general tendency is towards innovation and experiment—innovations of a radical nature affecting not only the technique of musical composition but also the whole conception of opera, and experiments in which the relation between the component parts, their worth and usefulness are questioned.

There are examples of opera in which music appears to have resigned all claims in favour of poetry, and examples in which both poetry and music give precedence to some far-fetched idea of scenic presentation. The change cannot be ascribed to the War. The most famous modern composer before 1914, Richard Strauss, never found one form of composition more congenial than another; he turned from the sonata to the symphonic poem, from symphonic poem to Biblical and classical opera, from opera to ballet, and from ballet to comedy. But this restlessness, like the innovations of Strauss, pales by comparison with the impatience and the boldness of the post-War generation.

The war, naturally, exercised a disastrous effect on opera. In Great Britain operatic enterprise was, during these years, entirely in the hands of Sir Thomas Beecham, who did much to raise the standard of opera in English. Beecham and the British National Opera Company (formed on his retirement) are mainly responsible for the production of the new British operas—Dame Ethel Smyth's *The Boatswain's Mate*, Gustav Holst's *The Perfect Fool* and *At the Boar's Head*, and Vaughan Williams's *Hugh the Drover*. These ventures attracted considerable attention, and various schemes were suggested for establishing British opera on a less precarious footing. The full international season was resumed at Covent Garden in 1924, when a German company was readmitted for the first time since the War.

Opera in Germany

Strauss.—Richard Strauss's first essays in opera came when he was at the height of his fame, and audiences were ready to accept and to welcome anything he chose to give them. The remarkable success of *Salome* and of *Elektra*, however, does not seem likely to stand the test of more critical days. Certainly neither of these, nor *Ariadne auf Naxos* (revised version in 1916), has increased his reputation. *Der Rosenkavalier* (1911) based on a libretto by Hugo von Hofmannsthal, is more likely to stand the test of time. That certain scenes are coarse rather than immoral cannot be doubted, but the skill shown in the drawing of characters is beyond question. The librettist has provided a comedy of manners which gives Strauss every opportunity to display his special genius for portraying comic and pathetic situations.

Although he has evolved no new theories, Strauss has given us in *Der Rosenkavalier* a whole gallery of characters every one of which is drawn with extraordinary felicity, varying from the sketch of a negro page boy to that of the provincial baron—the gross and material Ochs von Lerchenau; from the full length portrait of the heroine to the caricature of the adventurers who seek her patronage. Light comedy has induced him to adopt a frankly melodic style, often in waltz rhythm, which stands at the opposite pole to the declamatory style of *Elektra*. The dance melodies are as fluent as those of Johann Strauss, and much more subtle. It is Strauss's greatest asset that he can turn from laughter to tears, revealing at once the pathos that underlies laughter and the oddities and whimsicalities of a quasi-dramatic situation. The librettist may not convince us that the sorrows of a heroine who has resigned her lover to a younger rival and who trembles at the thought of a lonely old age are very deep or undeserved. The musician, however, is perfectly convincing, and just as in his symphonic poems he asked us to sigh for as well as to laugh at Don Quixote, so in *Der Rosenkavalier*, he depicts humanity in its pathetic and its ludicrous aspects. The scene which describes the arrival of the Rosenkavalier bearing the token of betrothal to the bride, like the ensemble of the third act, is an admirable example of his power to describe different emotions at the same time.

Die Frau ohne Schatten (1919) tempted both composer and librettist (Hofmannsthal) into obscure symbolism, which, perhaps, cannot be expressed effectively in terms of music. While making the fullest use of his great skill in instrumentation, Strauss sought here as in *Ariadne* and in the ballet *Joseph's Legende* to make use of broad, diatonic melodies. These, owing to their gorgeous orchestral colour, may seem impressive at first, but soon betray inherent weakness and artificiality.

Some success attended the performance in Germany of two operas by Hans Pfitzner, *Das Christelflein* and *Palestrina*—both produced in 1917. These, like the operas of Erich Wolfgang Korngold—*Der Ring des Polykrates*, comedy in one act; *Violanta*, opera in one act (1917); and *Die Tote Stadt* (1920), and of Franz Schreker, *Der Ferne Klang* (1912), *Das Spielwerk und die Prinzessin* (1913), *Die Gezeichneten* (1918) and *Der Schatzgraber* (1920) leave the main problems of opera untouched. More originality was shown by Walter Braunfels in his adaptation of the "Birds" of Aristophanes (1920).

Busoni.—The contributions to opera of Ferruccio Busoni are intended for the German stage, and must be taken in conjunction with the art of Germany rather than with that of Busoni's countrymen the Italians. This remarkable artist was 46 years of age when he first turned his attention to the theatre. Two short operas—*Turandot*, founded on Gozzi's fairy play, and *Arlecchino*, based on a libretto written by himself—added considerably to his reputation as composer. But his most remarkable contribution is *Doctor Faust*, the libretto of which, dealing with the legend from an entirely new point of view, was first published in 1921. The music unfortunately was not finished at the time of his death in 1924, but the score was skilfully completed by Philipp Jarnach, and performed in Dresden in May 1925. It made a deep impression, both on account of the ideas embodied in the play and of the manner in which they were presented.

Busoni's *Faust* differs from Goethe's, as it differs from Marlowe's, in that the central idea is not the strife between good and evil, but the continuity of the human effort towards a goal which, hidden from our knowledge, is embodied in a Divine Will incompatible with the traditional conception of God and the devil. This idea is presented in a set of scenes derived from an old puppet play, and connected by unity of style and a single purpose. The music is not a symphony on which the action has been imposed, but it springs from the same source as the words and the action. Considered apart from the play, it reveals an instinct for classic dignity combined with the freedom of a modern. Although he never falls into extravagance, Busoni's power of suggesting atmosphere, mood and emotion is as considerable as the variety and resource of his orchestration. His profound knowledge of the classics gives breadth and depth to a style which is never heavy or unduly complex, but alert, elastic and free from the influence of prevalent schools. Whether in time *Doctor Faust* will rank with the acknowledged masterpieces, or whether its finer points must escape the average theatre audience, may be doubted, but Busoni is certainly the musicians' musician.

Opera in Italy

The composer who in some ways most nearly approaches Busoni, is Arrigo Boito, whose *Nerone*, first begun when the composer was a young man, was left unfinished at his death in 1918. It was completed under the supervision of Arturo Toscanini, and performed at La Scala, Milan, in May 1924. There is one important point of divergence between Busoni and Boito. Busoni was first and foremost a musician who wrote his own libretto because of the obvious advantages to be gained by unity of control. Boito was equally pledged to both poetry and music. The profound learning found in Busoni's music and in Boito's poetry resulted in an entirely different conception of music drama. In *Nerone* Boito attempted to place on the same level all the arts which constitute opera. He meant it to be spectacular enough to please the audience by a striking stage picture; he devoted great care, skill and an extraordinary wealth of information to the writing of the libretto, so that poetry should be duly honoured; he restrained the lyrical impulse in music with the double object of allowing complete freedom to scenic and poetic art and of giving prominence to the dramatic effects of a musical accompaniment which was in the main descriptive.

It may be questioned whether the idea of perfect equality between sister arts originated in Boito's mind, or whether he arrived at it after balancing the claims of other systems. He was a close observer of artistic movements, and it is possible that he became early acquainted with Moussorgsky's *Boris Godnov*, which is the best example of this theory. But while Moussorgsky adopted it because it seemed the only possible form for a musician of his temperament, Boito's lyrical reticence may have been the outcome of deliberate choice. It is not surprising, however, that opera based on the equality of the arts should have some of the faults of the ideal state based on the equality of men. However admirable, logical and just the theory, the practice is likely to result in a weakening of power and interest. So far, the greatest operas have been those in which music predominates.

The musical value of *Nerone* is far from negligible. The scene in which the early Christians learn the doctrine from the lips of their leader Fanuel has a delicate beauty that is very rare in Italian music, and there is a poignant pathos in the death scene of Rubria. On the other hand, in almost the whole of the first and second acts there is little genuine musical interest, apart from the adaptability of the music for the stage. The libretto has many lines of good poetry, and the historical learning amassed in its few pages constitutes probably a record of compression. Unfortunately, much of this is inevitably lost when put to the test of the theatre. The demands made on stage appliances make it impossible to contemplate a performance in any theatre not equipped with modern resources. If the system has proved far from flawless, the opera leaves us in no doubt as to the genius of a composer whose chief failing was the inability to choose between the claims of two arts he loved with equally deep devotion—music and poetry.

Puccini.—A less thoughtful and more popular composer, Puccini, after the early successes, touched the lowest point of his career with a comic opera *La Rondine* (1917), and rose to the highest with the comedy *Gianni Schicchi* (1919), which revealed a freshness and humour hitherto unsuspected in his music. Neither the failure nor the success owes anything, however, to a development of artistic ideals. *Gianni Schicchi* marks if anything a return to the old system, and contains a typical *aria* or two of the old pattern which won the warmest approval of his admirers. His technique shows a great advance on his previous work.

Pizzetti.—From the point of view of the development of music drama, the work of Ildebrando Pizzetti is more interesting. He began by accepting the criterion of his Italian contemporaries, and then, dissatisfied with what he conceived to be the dramatic ineptitude of lyricism, evolved a style which seeks to give to the melody of the singer beauty, but consistent with greater freedom than is possible in music which aims entirely at lyrical expression. In this he comes near to *Pelléas et Mélisande*, but with the important reservation that while Debussy envelops the drama in an atmosphere of mystery and shadows, Pizzetti expresses himself with absolute directness, and asks of music only that it should have the pliability, if not the swiftness, of words. These theories are exemplified in *Fedra* (1915) and perfected in *Debora e Jaele* (1922).

Malipiero.—More daring but also more questionable are the theories advanced by G. Francesco Malipiero, and exploited in works representing a complete reaction from all accepted ideas of opera. In *Pantea* the singers are not seen, and the action is expressed in the movement and gesture of a dancer whose mimicry is stressed by the music. *Sette Canzoni* consist of episodes unconnected by anything like a plot, and relying for their appeal not in any development of events but in the contrast between the characters or between the moods of each picture. Greater prominence is given to the musical elements in *Le Baruffe Chiozzotte*, a free adaptation in one act of Goldoni's comedy for which Malipiero has evolved a "spoken" recitative, while the duty of the orchestra is to provide mood and atmosphere. *Orfeo* is satire, uncompromising in its music and in the action. The value of such works is negative, but it shows clearly enough the trend of musical ideas in Italy.

Wolf-Ferrari.—Quite traditional, on the other hand, are the operas of Ermanno Wolf-Ferrari, whose best work is comedy. A lurid melodrama, *I Gioielli della Madonna*, has made Wolf-Ferrari known beyond Italy and Germany; it is not equal to *Il Segreto di Susanna*, or to the charming arrangements of Goldini's comedies, *Le Donne Curiose* and *I Rusteghi*. Wolf-Ferrari combines some of the virtues of the Germans, such as solid, well-balanced workmanship, with an Italian bias for lyrical expression. This combination is not without its drawbacks, and is inclined to blunt the individuality of his music.

THE ENGLISH REVIVAL

The general revival of interest in music in Great Britain has had a remarkable effect on opera, and operas by native composers written and performed in the first quarter of the 20th century exceed in number and in interest those of any other period in the history of English music. Although the greatest musician of the time, Sir Edward Elgar, has never written for the theatre, a group of gifted musicians has sprung up not only willing to devote themselves to a form which still offers scant chances of performance and reward, but also, in some cases, determined to make it the vehicle of new and individual expression.

Stanford and Ethel Smyth.—Sir Charles Stanford belongs on the whole to an older generation, yet his last work (which he did not live to see performed) was an opera, *The Travelling Companion* (1914: produced at Liverpool, 1925), in whose fantastic adventures some trace may perhaps be seen of the influence of the Russians. Dame Ethel Smyth, devoted to opera from the early days of her career, was writing for the theatre at the beginning of the century. But it was only with the comic opera *The Boatswain's Mate* (based on a story of W. W. Jacobs, performed by the Beecham Company during the War) that she made her mark. It has been pointed out that her music lacks unity of style, and the charge cannot be easily brushed aside. But, whatever its defects, the opera has the rare merits of speedy action, a whimsical story, and music which, however indebted it may be to other sources, has intense vitality and comic verve. Another work, *Fête Galante*, had a favourable reception when first performed at Covent Garden in 1923.

Boughton.—High hopes were aroused by Mr. Rutland Boughton's *The Immortal Hour*, which, performed first at the Glastonbury Festival in 1914, did not come into its own till eight years later, when it was given in London with considerable success—first at the "Old Vic." Theatre, and later at the Regent and Kingsway theatres. The unusual story, steeped in Celtic romanticism, the easy flow of the melodic themes, the genuine, glowing passion of the love scenes, the well-built choric sections, made a deep impression, and led some to expect even better things from Mr. Boughton.

These expectations, however, were not realised in the immediate future. Mr. Boughton's next essay was more ambitious, for it meant nothing less than the translation into opera of the *Alcestis* of Euripides in the English version of Professor Gilbert Murray. It is much to the composer's credit that he refused to be bound by archaeological considerations, and aimed rather at music which could bring home to a modern public the rich pathos and humanity of the Euripidean drama. In this he partly succeeded. The chorus is treated with skill and sympathy, and many scenes have great beauty. There is a delicate tenderness in the account given by the Handmaid of the grief and resignation of the dying Queen; the funeral procession moves to a strain that is at once expressive and dignified; and the music of Herakles lacks neither vigour nor originality. Yet on its performance at Covent Garden (1924) the work was found, on the whole, disappointing. An inadequate performance, and still more, the barrenness of the orchestral setting, may be held partly responsible for this impression. But the revival of a Greek play in a modern theatre is apt to show to disadvantage the vaunted resources of the modern stage. The intimate relation possible between spectator and performer in an amphitheatre becomes impossible as soon as the modern stage sets up its barrier. This becomes all the more evident when music inevitably retards the course of the action and the speed of the words. No doubt for this reason *Alcestis* was found much more impressive accompanied by the piano in a small hall at Glastonbury than at Covent Garden, where the composer had at his service a vast stage and a large orchestra. A somewhat riper dramatic style was shown by Mr. Boughton in *The Queen of Cornwall*, a musical version of a play by Mr. Thomas Hardy.

Perhaps greater musical accomplishments are to be found in Mr. Granville Bantock's *The Seal Woman* (Birmingham, 1914), a "Celtic" opera which unfortunately suffers from a libretto which is neither convincing nor well constructed.

Holst.—The greatest interest was aroused by the performance of Mr. Gustav Holst's one-act opera *The Perfect Fool* at Covent Garden (1923), soon after the composer had made a great reputation with the symphonic suite "The Planets." The libretto (written by Mr. Holst) is highly fantastic. The value of *The Perfect Fool*, however, lies not in the text or in the story, both of which reveal obvious inexperience, but in music which lacks neither ingenuity nor dramatic expression. The choral writing is exceedingly effective, and thus well in keeping with the high traditions of British choral music. Such a chorus as that of the peasants flying the country ravaged by the Magician and his imps compares not unfavourably with the great choruses of *Boris Godunov*. Mr. Holst's mastery of instrumentation, the marked individuality of his orchestral colour, stand him in good stead and give considerable point to every bar of the score, irrespective of the action which takes place on the stage.

The libretto, were it to be extended to three or four acts, would be wholly inadmissible, and even in its present form it is not free from errors of construction as well as instances of verbal infelicity. But the music bears evidence to a dramatic talent which, directed to a more worthy purpose might, in the end, produce something more important than *The Perfect Fool*. Originality is evident in both text and music. But the originality of the music is easy; it is part of a temperament; its influence permeates every component element—harmony, counterpoint, orchestration. The originality of the story is purely negative, and contributes nothing to the success of the opera.

If the weakness of *The Perfect Fool* is a libretto unworthy of its music, the weakness of Mr. Holst's next opera, *At the Boar's Head* (1925), is a libretto to which music can add little or nothing. *At the Boar's Head* consists of various scenes from Shakespeare's *King Henry IV.*, with Falstaff as the central character. Mr. Holst, out of reverence for the poet, has adopted every word without alteration or excision, and also without allowing sufficient latitude for the inevitable retarding effect of music applied to words. Perhaps he hoped to neutralise this defect by the adoption of folk melodies, most of them derived from Chappell's *History of Popular Music in England*, or from *Country Dance Tunes* and *Morris Dance Tunes* (edited by Cecil Sharp), and the Folk Song collection of G. B. Gardiner. He has also deliberately given music a less important part than has been the custom of the great opera composers and, with considerable ingenuity, made the words bear the very lightest of musical burdens. In conformity with this purpose, the orchestra has been reduced in numbers, and there are not a few pages in which the vocal part proceeds unaccompanied or is reduced to a recitative, enabling the singer to pronounce his words with the greatest speed. Of actual action there is practically none, and the dramatic interest is limited to such traits of characterisation as these brief scenes reveal.

The value of *At the Boar's Head* lies for us in the extraordinary skill with which Mr. Holst has woven together some forty folk-tunes and in the novelty of an opera where the usual relation between words and music is reversed. In spite of care and cleverness, there are moments when the listener cannot but feel that the notes are holding back the pace of the dialogue. When one good joke caps another, or when a period of prose makes for a definite climax, even the lightest music becomes an impediment. Mr. Holst's stimulating and vigorous freshness and ingenuity are never absent from his music. But they are the gifts of the musician in general rather than of the composer of opera in particular.

Vaughan Williams.—In the libretto of *Hugh the Drover* Dr. Vaughan Williams was more fortunate, for Mr. Harold Child has provided him with a story which possesses human interest, moves swiftly and logically to an appointed end, and is told in words which are never too sublime or too homely for musical treatment. It was produced in 1924 by the British National Opera Company, and made an immediate appeal. It is based, like the music of Mr. Holst's *At the Boar's Head*, on folk tunes. Dr. Vaughan Williams has used them very deftly to emphasise the simple and direct nature of the story. It may be said here that the use of folk songs in opera by these British composers owes more to the researches of Mr. Cecil Sharp than to the example of continental musicians. Abroad the general tendency has been to add splendour and brilliancy to a folk-tune used in opera. Mr. Holst and Dr. Vaughan Williams appear to be mainly concerned with keeping fresh the fragrant flavour of these native wood notes wild. The question of the fitness of a subject has to be considered afresh when the musician means to draw his raw material largely from the vast wealth of folklore. It is obvious, for instance, that such a play as "Othello" would gain nothing if it were set to music derived from popular melodies. *Hugh the Drover*, on the other hand, is admirably adapted for such treatment.

Mention must yet be made of the graceful light work of Mr. Nicholas Gatty, whose *Prince Ferelon*, first produced at the "Old Vic." theatre in 1921, has been repeatedly performed since with conspicuous success by the Carl Rosa Company.

Revivals.—Characteristic of this period is the number of revivals. J. S. Bach's *Phoebus and Pan* has been revived and prepared for stage presentation by the company of Sir Thomas Beecham. Later the same composer's *Coffee Cantata* was put on the stage by the British National Opera Company. Cambridge witnessed a revival of Handel's *Semele* in the form of opera, and to Oxford must be given the credit for the first performance in England in modern times of Monteverde's *Orfeo*. Most fortunate of all was the revival of Gay's *The Beggar's Opera*, which had a run of three and a half years in London, during which 1,453 performances were given. Its sequel, *Polly*, has also been produced, though not with the same good fortune.

Opera in other Countries

France.—Apart from Debussy's *Pelléas et Mélisande*, which remains an isolated example of individual genius, French contributions to modern opera are, generally speaking, copious rather than notable. The promise of Gustave Charpentier's *Louise* was not maintained in the sequel *Julien*. The operas of Alfred Bruneau, of Charles Marie Widor and Gabriel Fauré are little known abroad, where Massenet and Thomas remain the representative composers of French music drama. A far more brilliant achievement is Maurice Ravel's one-act opera *L'Heure Espagnole*, the orchestral score of which may be described without exaggeration a marvel of wit and skill. Indeed, its worth is mainly in the felicity and deftness of the scoring. The plot and the scenic action are nothing more than a *jeu d'esprit* of typical Parisian flavour. At the opposite pole stands Vincent d'Indy, who attempted a new compromise between opera and oratorio in *La Légende de St. Christophe* (1920). In this a narrator is made to tell the story of St. Christopher, who is shown in various scenes, embodying, at first, pleasure, then repentance and ending with death. D'Indy's music, like his text, offers the strongest possible contrast to Ravel's. While the former is severe and restrained the other is wordy and whimsical; Vincent d'Indy stands for the classics and, in particular, for the traditions of César Franck, while Ravel is the apostle of modernity, intolerant of restrictions and of scholastic canons. Both in France and out of France Ravel has the larger following.

Of the novelties produced later at the Opera in Paris the most notable is perhaps Albert Roussel's *La Naissance de la Lyre* (1925), the music of which has a certain distinction, not however without artificiality.

Russia.—The only important addition to Russian opera since the death of Rimsky-Korsakov has been Igor Stravinsky's *Nightingale* (1914), which is described as a "lyrical tale." There is, however, as little "lyricism" in the music as there is in the story, which is derived from Hans Andersen's well-known tale. It belongs to the kind of opera of which the finest example is Rimsky-Korsakov's *Golden Cockerel*. The *dramatis personae* are no more than puppets, and the purpose of the musician is not so much to bring home the pathos or wit of a dramatic or comic situation as to emphasise the artificial nature of the story, and in this the highly sophisticated music of Stravinsky succeeds admirably. The atmosphere is cold and unemotional, the play appears to evolve at considerable distance from the spectator, who is asked not to follow in sympathy the adventures of the characters, but to admire the artistry and the aptness of the performance. The action is reduced to a minimum. Stage pageantry takes the place of stage action, and *The Nightingale* may be placed, as an entertainment, half way between opera and ballet. It is true that the actors sing and do not dance. But if the action were to be presented by mimes or marionettes and the singers used as a complement to the orchestra the loss would be trifling.

The opera aroused at first keen interest on account of its music and of the novelty of its scenic presentation. However much we may doubt the real value of innovations which tend to deprive opera of its surest means of appeal—that is, dramatic action—there is no questioning the extraordinary skill and ingenuity of Stravinsky in the domain of harmony and orchestration.

United States.—America has made so far no contribution to international opera, nor can it be said that a school of national opera is already firmly established, even though some original works have been produced with fair success. The conditions are undoubtedly favourable. The nation as a whole appears to be passionately devoted to its music; musical institutions are supported with a generosity which has no parallel in Europe, and every effort is made to keep the public constantly in touch with the best that the Old World produces. If the results have not fully justified the hopes of the patrons who more than once have offered valuable prizes for American operas, the reason probably is to be found in the fact that the absence of a tradition or of national schools adds considerably to the difficulties of the composer. Having nothing of this nature to guide him in the choice of model or style, even the comprehensive knowledge of other schools which may otherwise nourish his mind and individuality is apt to leave him perplexed, and to suggest a hopeless attempt to balance their virtues and combine them in himself. Such, for instance, is the case of Mr. De Koven's, in many ways, able opera *The Canterbury Pilgrims* (pub. New York, 1917), the style of which owes something—on the composer's own admission—to Verdi, to Wagner and to Massenet. Genius, no doubt, is not to be hired, and the inducements which it is in the power of patrons to offer are, at best, a poor substitute for friendly rivalry and example.

But if there are no American operas of the first rank, works have been produced which deserve attention and are of good omen for the future. The accomplished conductor of the New York Symphony Society, Mr. Walter Damrosch, has written a musical version of Rostand's *Cyrano de Bergerac* which was received on its first production (New York, 1913) with every mark of favour. Horatio William Parker aroused unusual expectations with *Mona* (New York, 1912) and *Fairyland* (Los Angeles, 1915). Other composers have produced operas of some merit, amongst them C. W. Cadman (*Shanewis* New York, 1918); J. A. Hugo (*The Temple Dancer*, New York, 1919) and V. Herbert (*Natomah*, Philadelphia, 1915). (F. Bo.)

OPHTHALMOLOGY (*see* 10.91 and 28.130).—The science of ophthalmology deals with the processes by means of which the images of external objects are brought to our consciousness. It is therefore concerned:

(*a*) with the eye itself; (*b*) with the nerve paths and tracts which convey visual impulses originating in the eye, through the different parts of the brain to the brain cortex, where these impulses are converted into conscious impressions; (*c*) with the eyelids which cover and protect the eyes; (*d*) with the tear glands and ducts; (*e*) with the muscles that bring about the movements of the eyes and keep them trained in the desired direction; (*f*) with the nerves and their complicated cerebral connections which supply these muscles; (*g*) with the bony walls which comprise the boundaries of the orbit; (*h*) with the blood-vessels and lymph paths which maintain the nutrition of all these structures.

It concerns itself with diseased conditions of these parts and derives particular importance from the fact that many diseases of the central nervous system and many general constitutional diseases of the body manifest themselves by some derangement of function or structure which is to be discovered by the various means of investigation which are available to the ophthalmic surgeon.

Many of these investigations are capable of an accuracy and a minuteness which is possible with no other structure in the body, and the eye, as an organ, is unique in the body in the important particular, that its retina is, in essence, a portion of the brain itself which is available to minute examination by means of the ophthalmoscope, and is the only portion of the brain which is available to inspection during life. The arteries and veins which supply the retina can also be minutely examined during life, the diseases of them observed and followed in all their changes, and they are the only arteries and veins in the body which can be seen clearly during life. The value of these observations is enhanced by the fact that the eye itself acts as a sort of low-power microscope, providing a magnification of about 15 diameters for the examination of these structures. The eyes are the subject of a number of hereditary diseases, and form one of the most convenient media for the study of transmission of such diseases.

Affections of the Eye.—The whole function of the eyeball itself is to provide that a clear image of external objects shall be formed upon the retina, but, considered as an optical instrument, in certain cases it departs from the normal, with the result that the acuity of sight is lowered. Thus it may be too long, so that the retina comes to be behind the point at which the images of external objects are formed; this condition is known as myopia or short-sightedness, and may be compensated by the wearing of concave lenses in the form of spectacles.

In other cases, the eyeball is too short, so that the retina comes to be placed in front of the point at which the image of external objects is formed. This condition is known as hypermetropia or long sightedness; this can be compensated by the use of the focusing muscle of the eye, making the lens more convex; or, what is preferable, by the wearing of appropriate convex lenses in the form of spectacles. In astigmatism the refractive power of the eye varies in different axes, so that, for instance, in an extreme case the vertical axis may be myopic whilst the horizontal axis is hypermetropic.

Normally the visual axes of the two eyes are parallel, so that images of external objects are formed upon corresponding points of each retina. This arrangement is largely responsible for the phenomenon of stereoscopic vision, which enables us to judge the position of objects in space with great accuracy. Should this parallel arrangement of the two eyes become upset by any means, such for example as paralysis of some of the muscles, the power of stereoscopic vision is lost and double vision usually arises.

Eyeball and Camera Compared.—The eyeball may with considerable aptitude be likened to a photographic camera. Roughly speaking it is globular in shape and is an inch long in all dimensions. The front part, or cornea is curved, is perfectly transparent and functions as a lens. Behind it is a chamber filled by the aqueous humour—little more than water. Further back is the iris—the coloured part of the eye—which in infants, up to about three months of age, is always of the same bluish-grey colour, and afterwards attains the different tints and colours which produce the blue, the grey, the green or the brown eye. The hole in its centre forms the pupil, and by contraction or dilation of the tissues of the iris the pupil can be varied in size through a wide range; it may be compared to the stop in the camera. In bright lights the pupil is small, and it becomes large in dull illumination. The iris rests behind upon the lens.

The lens is bi-convex, its back surface having a greater curvature than the front. It is perfectly transparent, and the focusing of the eye for near or distant objects is brought about by alteration in its curvatures by contraction of the ciliary muscle. Here is an essential difference between the eye and the photographic camera, whose focus is adjusted by shifting the position of the lens. As age proceeds, opacities frequently develop in the lens, until at the age of 60 very few individuals have lenses which are entirely free of opacities; almost everyone, then, at the age of 60 or over may be said to have the beginnings of cataract, though the sight is quite unaffected thereby. When, however, these opacities have so increased as to involve markedly the central part of the lens, and so render sight very imperfect, the term of cataract becomes applicable to the condition; in such a case the cataract can be removed by operation and the sight restored.

Vitreous Chamber and Retina.—Behind the lens is the largest chamber of the eye, the vitreous chamber, which is occupied by a perfectly transparent, colourless substance, much like the white of an egg. Clothing the back part of the eye, and extending forward some distance in front of its equator, is the retina. It rests upon a highly vascular membrane which is responsible for the nutrition of the greater part of it, namely the choroid; in man, however, the retina has blood vessels of its own, which are seen with great distinctness by means of the ophthalmoscope. These vessels supply the inner parts of the retina with their nutrition. The retina is the sensitive layer of the eye and may be likened to the sensitive plate of the camera for upon it images are formed which initiate impulses which, when conveyed to the cortex of the brain, give rise to the sensations of sight. Its sensitive layer is placed posteriorly, and is composed of very delicate structures known as the rods and cones.

At the central spot or yellow spot of the retina, the point of distinct vision, cones alone are present. The rods are believed to be concerned with lights of lower intensities, and in accordance with this they alone are present in night-flying birds (*see* COLOUR VISION).

Optic Nerves.—The nerve fibres from all these tissues converge upon the optic disc, and leave the eye by means of the optic nerve, which traverses the orbit to enter the skull. Inside the skull the two optic nerves meet and each is divided into two parts, one part continuing to the mid-brain on the same side, the other part crossing over to the opposite side. This crossing forms what is known as the chiasma; in many animals, the birds for instance, the whole of each optic nerve crosses over in this way. Beyond the chiasma the nerve fibres are again collected into a compact bundle known as the optic tract, which terminates in the mid-brain. From here nervous impulses are relayed in two chief directions; some connect up with the nerves which control the movements of the eyes and others, forming the so-called optic radiations, make a long sweep backwards to reach the cerebral cortex, where, as already stated, the impulses are transformed to sensations of sight.

Cerebral Cortex.—The exact area of the cerebral cortex, in which these fibres end, is known with great accuracy and forms the visual cortex. It is placed at the extreme hind end of the brain, and the adjoining mesial surface of each hemisphere, in the region of the calcarine fissure (*see* 4.408). Should a minute portion of this cortex be cut out as the result of injury or blocking of its blood supply, the precise area of the defect which will be found in the vision can be stated with certainty. This accurate localisation was much advanced as a result of observations made during the War.

Amongst the general diseases of the body in which important manifestations occur in connection with the eye a few may be mentioned.

Clinical Symptoms.—In brain tumours or abscesses, swelling of the optic disc is seldom absent, and forms perhaps the most important sign in the diagnosis of the condition. In addition the ocular nerves may have their functions interrupted, so that the movements of the eyes are interfered with, they no longer move in unison and double vision occurs. If nothing can be done for the brain tumour the optic nerve atrophies and blindness ensues. In advanced renal disease changes in the retina develop and convey a particularly grave prognosis, for patients seldom live so long as two years after their discovery. In diabetes a similar change may also arise, which may greatly spoil the sight, and although of less serious import than in renal cases, it must be considered a bad omen. Syphilis frequently attacks the eye, whether in the early or late stages, and is perhaps the most prolific single source of blindness. Tuberculous disease occasionally occurs. In diseases of the blood in general, eye signs are very common, and there are many other diseases where the diagnosis may be greatly assisted by the discovery of changes in some part of the ocular apparatus. The introduction of what is known as the " slit lamp " has made many investigations possible which previously were quite outside our scope.

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OPIUM, TRAFFIC IN (*see* 20.130).—It was first realised in 1906 that if the Chinese Govt. were to be able to suppress the opium evil, she must be assisted by other nations. In 1909 President Roosevelt proposed that an international investigation should be made. As a result an international opium commission met that year at Shanghai at which 13 Powers were represented. The recommendations made at this meeting formed the basis of the First Opium Convention, which was drawn up at The Hague in 1912. The articles of this convention may be summarised as follows:—

1. The distribution of raw opium to be controlled and the use of prepared opium to be gradually suppressed.
2. The export of raw opium to countries prohibiting its entry to be stopped and its export to countries restricting its import to be controlled.
3. The export and import of prepared opium to be prohibited except to those countries not yet ready to suppress its use.
4. The use of alkaloids of opium and its derivatives to be confined to medical and legitimate purposes: a Government licence to be obtained by all persons engaged in the manufacture, sale, distribution, import and export of the drugs.
5. The last chapter of the convention consisted of clauses dealing with assistance to China and with certain obligations undertaken by China herself.
6. Before the convention came into effect the adherence of the 34 non-signatory Powers in Europe and America was required.

International opium conferences were held at The Hague in July 1913 and June 1914, at which a number of Powers ratified the convention. During the War all action in this connection was suspended until the Paris Peace Conference in 1919. In the peace treaties of 1919–20 the signatory Powers agreed that the ratification of these treaties should constitute a ratification of the convention of 1912 and the protocol adopted by the Third Opium conference of 1914 (according to which the convention should come into effect upon its ratification regardless of the non-signatory Powers).

Opium and the League of Nations: Appointment of Advisory Committee.—Under the Covenant (Article 23 c), the duty of supervising the execution of agreements with regard to the traffic in opium and other dangerous drugs devolved upon the League of Nations. In order to carry out this obligation, the first Assembly of the League constituted a committee on opium and other dangerous drugs to be advisory to the council. This committee consisted of representatives of the countries chiefly concerned in the production of raw opium or manufacture of the drug, assisted by three assessors appointed for their special knowledge of the opium question. To the governments originally invited to nominate members, *i.e.*, Holland, India, Siam, Great Britain, Japan, Portugal, France and China, have since been added the United States of America, Bolivia, Germany, the Kingdom of the Serbs, Croats and Slovenes and Switzerland. The first assessors to be appointed were Sir John Jordan, Mrs. Hamilton Wright and M. Brenier.

The advisory committee, which sits only once a year, except in special circumstances has obtained certain important and definite results, such as additional ratifications to the Hague Convention (56 states have now ratified, 50 of these states being members of the League) and the adoption by a very large number of countries of an import certificate system. Under this system no government may allow the export from its territories of any dangerous drugs covered by the Hague Convention, except on the production by the exporter of a licence from the importing country, certifying that the drugs in question are required for legitimate purposes. The committee also encourages the use of the secretariat as a centre for the exchange of information concerning seizures of drugs within the territories of the different states. As a result, it is more possible to know the extent of the illicit traffic which takes place and the main sources and centres of the traffic. The committee receives and examines annually reports from the states as to the exports and imports which have taken place in the current year and of the amounts manufactured.

Annual Requirements of Drugs for Legitimate Purposes.—The council, on the recommendation of the advisory committee, invited the governments and the members of the League to prepare an estimate of total annual requirements for the inhabitants of their territories for medical, scientific and other uses with a view to proposing at some future date to the states concerned a new distribution of production which would limit the total output of raw material to the amount required for legitimate medical and scientific purposes.

The representative of the United States of America urged on the advisory committee the recognition of the principles that the use of opium products for other than medical and scientific purposes is illegitimate and they further urged the necessity, in order to prevent the abuse of these products, of exercising the control of the production of raw opium in such a manner that there would be no surplus available for non-medical and non-scientific purposes. The advisory committee expressed its agreement with this view, the representative of India, however, stating that, in the opinion of the Indian Govt., the use of raw opium according to the established practice in India and its production for such use are not illegitimate under the convention. The council and the assembly also approved the principles laid down by the representative of the United States of America.

International Opium Conferences of 1924 and 1925.—A number of replies had been received from governments giving estimates of their annual requirements of drugs for legitimate purposes when the committee decided to recommend to the council the calling of two international conferences. One, at which the producing and manufacturing states were to be represented, was to deal with the limitation of the production of raw opium and cocoa leaf for export to the amount required for medical and scientific purposes, and with the limitation of the amounts of morphine, heroin and cocaine to be manufactured; the other was to be a special conference to consider the suppression of opium smoking. The council forwarded this proposal to the assembly without comment, and after discussion by that body it was decided to ask the council to take the necessary action to put these resolutions into effect.

The assembly suggested, when forwarding the recommendation to the council, that the conference which was to deal with the problem of raw material and manufactured drugs should include all countries who are members of the League and parties to the convention of 1912, and not only representatives of producing and manufacturing States. This proposal was approved. The two conferences met during the latter part of 1924 and the early months of 1925, the conference on the use of prepared opium sitting first. This included representatives of the British Empire, China, France, India, Japan, Netherlands, Portugal and Siam.

The following 41 states attended the second conference: Albania, Australia, Belgium, Bolivia, Brazil, Bulgaria, Canada, Chile, China, Cuba, Czechoslovakia, Danzig, Denmark, the Dominican Republic, Egypt, Finland, France, Germany, Great Britain, Greece, Hungary, India, the Irish Free State, Italy, Japan, Luxembourg, the Netherlands, Nicaragua, Persia, Poland, Portugal, Rumania, the Serb-Croat-Slovene Kingdom, Siam, Spain, Sweden, Switzerland, Turkey, United States of America, Uruguay and Venezuela. The United States and China withdrew before the close of the conference, as they were unable to obtain the support of the conference on certain principles which appeared to them to be vital.

The Agreement of 1924.—The 1924 conference did not find it possible to recommend the immediate complete suppression of the use of prepared opium, but drew up an agreement which embodied the substitution of government monopoly for other systems in force. No general agreement could be reached regarding any provisions for registering or rationing addicts, nor was it found possible to embody in the agreement provisions for uniform prices or uniform penalties for the infraction of law or for the limitation of imports. It was held by the majority of members of the conference that no rationing could be enforced or total suppression imposed so long as a large illicit supply of opium remained uncontrolled. To this the representative of China objected, protesting against the refusal of the majority to take immediate steps to suppress opium-smoking until producing countries should find it possible to control smuggling. The conference, in a protocol to the agreement, decided to take any necessary measures not already taken for the entire suppression within a period of 15 years of the consumption of prepared opium in the territories under their authority, this period to begin so soon as the effective execution of the measures required to prevent illicit exportation of raw opium from their territories had been undertaken by the poppy-growing countries. Provision under the agreement is made for a League Commission to decide when these measures have been effectively executed. The agreements reached took the form of an Agreement, a Protocol and a Final Act. Instruments of ratification have been deposited by Great Britain, France and India only.

The Convention of 1925.—The result of the deliberations and discussions of the conference of 1925 was a convention providing for the more effective restriction of the production and manufacture of narcotics, and establishing stricter control and supervision of the international trade. This convention has been ratified by the following states: Australia, Great Britain, India, New Zealand, Sudan, Union of South Africa and the Govts. of Egypt Rumania and Salvador have adhered to it.

Among the more valuable suggestions were the creation of a central board, whose task it would be to follow the course of international trade, and the general acceptation of the export and import certificate system. The conference also drew up a protocol by which the signatory states, recognising their obligations to establish such control over the production, distribution and exportation of raw opium as would put a stop to illicit traffic, agreed to take within five years of the date of the coming into force of the protocol such measures as might be required to prevent the smuggling of opium seriously interfering with the effective suppression of the use of prepared opium in those territories where such use is temporarily authorised. A Final Act, containing further recommendations, was drawn up. Among these special mention may be made of a request to the council to consider the possibility of sending a commission to various opium-producing countries to study the difficulties connected with the limitation of the production of opium in those countries, and to advise as to what measures should be taken to make it possible to limit the production of opium in those countries to the quantities required for medical and scientific purposes. The result of this Final Act is shown in the League of Nations commission of enquiry sent to Persia to report on the possible substitution of crops for the existing opium crops. Half the money for this investigation was contributed by the League of Nations, the remainder by the American Social Hygiene Bureau.

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OPPENHEIM, HERMANN (1858–1919), German physician and neurologist, was born Jan. 1 1858 at Warburg in Westphalia. He studied at Göttingen, Berlin and Bonn and graduated in 1881 with a thesis: *Beiträge zur Physiologie und Pathologie der Harnstoffausscheidungen*. From the beginning of his scientific career Oppenheim devoted himself especially to investigations concerning illnesses following upon dreams and to the rebuilding of the central nervous system. His monograph *Die traumatischen Neurosen* (1889, 2nd ed. 1892) attracted wide attention, but also evoked much opposition from Charcot, Schulze, Seeligmuller, Mendel and others. In 1894 appeared his *Lehrbuch der Nervenkrankheiten* which has been translated into English (1910) and other languages and is a work of international importance. It was followed by two other highly important works: *Die Encephalitis und der Hirnabscess* (1894) and *Die Geschwülste des Hirns* (1896). Oppenheim was the first to initiate the use of operative methods in the treatment of abscesses. His investigations in connection with spinal abscesses were very successful. Here his mastery of diagnosis stood him in good stead. The World War turned his attention anew to traumatic neuroses, and he published *Die Neurosen infolge von Kriegsverletzungen* (1916), *Beiträge zur Kenntnis der Kriegsverletzungen des peripherischen Nervensystems* (1917) and *Stand der Lehre von den Kriegs und Unfallsneurosen* (1918). Oppenheim died in Berlin May 26 1919.

OPTICAL GLASS (*see* 12.87).—Although prior to 1914 the manufacture of optical glass in Great Britain had been steadily, but very slowly, making headway, the research work carried out by Abbe and Schott at Jena, stimulated by the facilities afforded by the German Govt., resulting in a lengthy list of glasses both suitable and available for optical purposes, did not encourage any other European maker to take any decisive steps towards exhaustive scientific investigation of the supply of optical glass.

War Developments.—The ready supply thus afforded by Germany at the beginning of the War found the belligerent nations other than Germany unprepared both with information and supply for military needs. In 1914 there was one maker only in Germany; in France and in Great Britain, and although the quality of the British glass even then was beyond question, yet the small list of British glasses available at the outbreak of hostilities with the still smaller list in France, made decisive action on the question of manufacture imperative. At that time only 26 optical glasses were listed by the British maker, a number quite insufficient for the needs of the modern optical instrument maker, whereas the list of the same manufacturer now shows over 112 varieties. Dense barium crown glasses are now made in England, possessing more extreme properties than any ever before made. Progress has also been made in the fluor crown varieties.

In addition excellent material is produced in England in sufficient quantities and varieties to meet a world demand. Undoubtedly the necessity for the use of good optical glass in military, naval and aerial operations stimulated its manufacture both in England and France and it is unlikely that in future contingencies either of these countries will be found unprepared. British manufacture of optical glass owes much to the very strong financial support and encouragement given by the British Government.

Features of Manufacture.—Optical glass differs from other commercial and domestic purpose glass in that it is not produced in large masses and rolled out in sheets as is window glass, but is melted in smaller quantities in crucibles, allowed to cool, the crucible cracked, the resultant mass broken up and certain comparatively small pieces selected and approved. It differs from commercial and domestic glass in the need of care in its manufacture and the many factors which tend to make the results uncertain. Variation in results in commercial glass or those required for domestic purposes are of little importance; but with optical glass, even when every care is used in the batches and the meltings, the occurrence of double-refraction and iridescence causes the resultant mass when annealed and examined by a refractometer sometimes to show variations which make final selection of each piece necessary before the results of the batch can be classified. Optical glass is much more costly, ranking from 7s. a lb. in the case of barium crown glasses to about 40s. a lb. for some flint crowns. For some optical instruments large pieces or slabs of perfect purity, homogeneity and durability are necessary, as in the case of two 41-in. disks for the large telescope made in Great Britain since the War.

Economic Difficulties.—Its manufacture by small firms, as is possible in the case of glass used for domestic purposes, is not feasible and rarely successful. Access to special sands for the silicate constituents, the services of a highly specialised chemical laboratory staff and substantial financial resources are requisite. Such restrictions obviously confine its production to very large firms with unusual technical resources. In Germany the list of useful glasses issued by Schott of Jena has been extended, and the Sendlinger Works have also placed certain glasses on the market. Conditions in France have prevented any extension by other firms than the Paris works of Parra-Mantois. In America, although other firms, such as the Spencer Lens Co., entered upon its manufacture, the bulk of optical glass is made by Bausch and Lomb of Rochester. Most of the ophthalmic spectacle glass used in the United States is made in England, by the firms of Chance Bros. of Birmingham, the Parsons Glass Co. of Derby and Barr and Stroud of Glasgow.

During the War the manufacture of optical instruments, especially range-finders, binoculars and telescopes, fulfilled all requirements. Since the War, their production has naturally decreased, although there is still a large field of useful work being done in surveying instruments and especially in research against disease. Notable improvements have been made in the manufacture of refractometers, ophthalmic instruments and slit-lamp microscopes (*see* MICROSCOPY; TELESCOPE).

Anti-actinic Material.—But by far a greater field has been explored in Germany, America and Great Britain in the development of glasses suitable not only for refraction purposes, such as lenses and prisms, but in the important direction of anti-actinic and anti-caloric material.

Although certain research work has been done on the Continent in this direction, it was not until Sir William Crookes turned his attention in 1909 to the question of adding various metallic oxides to the constituents of glass, in an endeavour to discover a combination which would absorb the invisible rays of the infra-red and ultra-violet regions of the spectrum without obscuring too much light or materially affecting the colours of objects seen through the glass when fashioned into spectacles, that this question of anti-actinic glass began to receive serious consideration. The result has been that a series of crown glasses of index 1·523 has been made with a very appreciable ultra-violet and heat cut-off, transmitting at the same time about 88% of light, and yet without imparting any appreciable unpleasant tint to the glass.

Special Varieties.—Until recent years spectacle manufacturers were content to use good quality white ordinary glass, but the demand for such special varieties as bi-focal, tri-focal, aspherical and special ophthalmic lenses has been so enormous as to result in the production of a large variety of glasses with definite indices and dispersions.

Other Developments.—Improvements have also been made in the transparency of certain glasses for the ultra-violet spectrum, perhaps one of the greatest advances made in recent manufacture, due to the research work carried out on glass annealing. Formerly more or less a lengthy and uncertain process, due to a tendency to fracture and double refraction unless a lengthy time of about 14 days for a period of cooling was given, the annealing period has now been reduced to about three days. The quality of the glasses has been improved, so much so that since the War it has been possible for a British manufacturer to introduce the first anastigmatic lens, having the hitherto unheard of aperture of F.2, which makes it possible to photograph a stage scene without flashlight and with the help of ordinary stage lighting (*see* PHOTOGRAPHY). One of the principal economical strides made in the manufacture of optical glass has been the possibility of moulding small plates of glass to practically any desired size and thickness, or into flat disks or disks with specified curves. *See also* GLASS.

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OPTOPHONE.—The optophone is an instrument for enabling totally blind people to read ordinary letterpress, such as a printed book or newspaper, without the necessity of printing it in raised type to be read by touch. The instrument was invented in 1914 by Dr. E. E. Fournier d'Albe, then a lecturer in physics in the University of Birmingham. It is based upon the properties of selenium, an element which is a better electrical conductor in light than in darkness. A beam of light is rendered intermittent by the interposition of a revolving siren disc and is then concentrated into a small bright point on the paper to be read. If the point on the paper is white, it will reflect the light; if it is black it will not. A selenium cell placed close to the paper, on receiving the reflected beam of intermittent light, will respond to each flash by a change in conductivity, and if the frequency of the flashes is of the "musical" order (between 30 and 30,000 per second), a telephone receiver connected with the selenium and a battery will sound a musical note. A blind person could thus tell whether the paper is black or white.

That is the principle of the optophone. In practice a small row of luminous points is substituted for a single point, and each point in the row is given a different frequency by suitably perforating the siren disc. The row, usually of five or six points, just fills up the size of the tall letters of the print to be read. When the whole row falls upon the black stem of a letter there is silence in the telephone. As the letters pass their various shapes are indicated by the sounding or silence of the different notes, and after some practice the blind person learns to recognise letters from their sounds, and so to read ordinary type.

The first reading test was given by the inventor in March 1917, the matter read being a leading article in *The Times*. In Aug. 1918, Miss Mary Jameson, a blind pupil from Norwood, gave the first public reading demonstrations, reading an unknown page from a book at a speed of about two words per minute. Later, with an improved instrument, she attained a speed of about 20 words per minute. A new type of optophone was brought out in 1920 by Barr & Stroud, of Glasgow. In this instrument two selenium cells were used, balanced against each other in such a manner that white paper produced silence, and the black letters themselves made the musical sounds. Reading demonstrations were also given with this instrument, a maximum of 85 words per minute being attained by a blind reader at the meeting of the British Association in Liverpool in 1923. The new type is known as the "black-sounder," and the original type is termed the "white-sounder." The latter type was approved by the Inventions and Research Committee of the National Institute for the Blind in 1921 after an exhaustive series of tests. The optophone is intended to place the world's printed literature once more within reach of the blind. It is applicable, without special preparation, to any language, and can also be used for reading typescript, but not handwriting.

See "A Type-reading Optophone," *Roy. Soc. Proceedings* (1914); "The Optophone," *Journal of Roy. Soc. of Arts* (1921); "The Optophone," *St. Dunstan's Review*, No, 55 (1921). (E. E. F. D'A.)

ORANGE FREE STATE (*see* 20.151), since 1910 a province of the Union of South Africa. The area is 49,647 sq. m.; according to a recomputation made in 1924, the population (1921) was 628,827, of whom 188,758 were whites, an increase in the white population since 1911 of 13,381. Of the non-whites, only 395 were Asiatics. Agriculture, including stock raising, is the chief occupation of the people, the Orange Free State being essentially a pastoral region. There are, however, diamond fields, including the Jagersfontein and Koffyfontein mines, and coal mines by the Vaal river near Vereeniging. The only big town is the capital, Bloemfontein (*q.v.*). The great majority of the inhabitants are of Dutch descent.

Dr. A. E. W. Ramsbottom was the first administrator, being succeeded by Mr. (later Sir) Cornelis Wessels. Both had been members of the Ministry during the brief period (July 1907—May 1910), when the province had been a self-governing colony. In 1924, on the death of Sir. C. Wessels, Senator E. R. Grobler was appointed administrator. Education occupied much of the attention of the provincial council. In 1912 the provincial council adopted, in the main, the proposal suggested by the Union Parliament that up to standard IV. instruction in the schools should be given in the "home language" of the scholar. In 1920 an ordinance was passed recognising "Afrikaans," *i.e.*, South African Dutch, as equivalent to Netherlands Dutch as a medium of instruction. In most respects the provincial administration was progressive. For the provincial system *see* CAPE PROVINCE.

The province was the stronghold of the Dutch Nationalists. Up to his death in 1916 ex-President Steyn, who lived near Bloemfontein, though he held no office, exercised very great influence on public affairs. In the crisis caused by the World War Steyn opposed operations against German Southwest Africa. There followed the rebellion of General De Wet, the Free State being the principal theatre of the campaign. General Hertzog, the parliamentary chief of the Dutch Nationalists and, after Steyn's death, their undisputed leader, was supported by the Free State in the general elections of 1915, 1920, 1921 and 1924. (*See* SOUTH AFRICA, UNION OF.)

ORCHESTRATION (*see* 20.168 and INSTRUMENTATION, 14.651).—The orchestration of the 19th century is dominated by the names of Berlioz, Liszt, Wagner and Strauss, and it is not without significance in regard to the continuity of its evolution that the last of these re-edited the treatise written on the subject by the first. Berlioz was in fact the true creator of the orchestra employed by Strauss, and even the tendency to increase its dimensions was initiated by him. This tendency in the end became its weakness. Beyond a certain point it was still possible to increase the richness of an orchestra, but only at the cost of merging its individual hues, so that, however polyphonic the invention of the composer, its orchestral expression tended towards a more highly coloured homophony. To a certain extent this was consistent with the ideals of the Romantic movement, which were generally best served by the blending of tone-colours, and only in special situations welcomed their sharp impact one upon another.

Rimsky-Korsakov's Orchestral Theory.—Even in the 19th century this tendency in orchestration was not allowed to pass unchallenged. The founders of the Russian school were not at first differentiated, except in idiom, from the general trend of European music, but their less sophisticated colour sense, and congenital delight in bright and sharply defined colours, were bound to affect their orchestral method. Thus arose a new movement, at the head of which stands, so far as orchestration is concerned, the name of Rimsky-Korsakov. His method is imperfectly expounded in a treatise, but is clearly discernible in the numerous examples from his own works. So far from aiming at the harmonious fusion of the various timbres of the orchestra, he is often at considerable pains to prevent it, and make them stand out clearly one from another.

The first step in this direction was the dispersal of the groups. Though there had been considerable freedom in the orchestration of the Romantics, they were still almost instinctively disposed to regard the principal homogeneous groups, of strings, wood-wind and brass, as the three manuals of an organ, to be used alternately or combined (*tutti*) as opportunity arose. The occasional soli were mere incidents in the flow of sound. With Rimsky-Korsakov and his followers, on the other hand, it is the occasional use of homogeneous groups that is incidental, the general conception of the orchestra being that of an assemblage of solo instruments. That, at least, appears in the light of recent developments to have been the end towards which Rimsky-Korsakov was striving, though he only partially attained it. His method spread to other countries, mainly through the medium of Debussy, who quickly influenced the entire French school. It has been consciously or unconsciously assimilated by the majority of modern composers in England (*e.g.*, Holst) and elsewhere, and is now in such general use that for the first decades of the 20th century it may be regarded as the new orthodoxy in succession to that of the 19th. This, of course, does not preclude the existence of many intermediate methods. In orchestration most composers are, and will always be, eclectics. Hence any too rigid classification of methods would be confronted with a multitude of contradictory instances.

The most important outcome of the Rimsky-Korsakov orchestration is the impetus it gave to the study of individual timbres and the corresponding instrumental idioms. Compared with other branches of musical technique this study had proceeded slowly. In the 18th century composers did not discriminate very strictly between instruments. There are numerous examples, by Bach and others, of works which exist as piano concertos and also as violin concertos. Even more frequent is the indication "flute or violin." But though in the 19th century composers were more definite in assigning to particular instruments everything they wrote, in adapting their ideas to the respective instruments they were more often guided by considerations of executive technique than by the implications of timbre. Some characteristics, such as those of the oboe and its relatives, were too marked to escape notice and there are passages in Wagner which cannot be imagined as conceived for any other instrumental medium. But in general usage a passage was entrusted in turn to any instrument on which it was practicable. It is in the fullest sense a modern discovery that for each timbre there is a corresponding dialect of the melodic language, into which the musical idea should be translated if it is to be adequately expressed. The procedure of composers being mostly empirical, this matter still awaits the investigation of the theorist but it will most likely be found dependent upon the relative intensity of the overtones, which varies in each timbre. Already J. M. Hauer has published some interesting speculations bearing on the point.

The Reaction Towards Counterpoint.—The most prominent composer who has proceeded on these lines is Stravinsky. Starting from the basis of Rimsky-Korsakov's teaching, he soon began to explore the idiomatic qualities of individual instruments and the world-wide reputation he enjoys for clever scoring, even among those who do not appreciate his music, largely rests upon this feature of his practice. He is not content that a passage should be effective, for instance, on the clarinet, but he demands that its inflections should be those implicit in the tone-colour of the clarinet and foreign to any instrument not akin to it. This led him at first to advocate an enlargement of the wind sections of the orchestra, to permit of full harmony in any timbre, while the strings were to be reduced on the ground that the duplication of parts, though increasing their tone, weakened their character. The question of balance he regarded as a matter involving the orchestral skill of the composer. Soon, however, he found that the assertion of the individual character of an instrument made much of the background superfluous, and this led him to turn from harmony to counterpoint, and from large orchestras producing the former to small combinations of contrasted timbres producing the latter. Thus originated the newer tendency, still regarded as heterodox in relation to the prevalent allegiance to Rimsky-Korsakov, but possibly destined to take the place of the latter, just as that has succeeded to the Berlioz-Wagner-Strauss tradition.

Though the name of Stravinsky is most prominent in this connection, the same principles are behind many contemporary manifestations, such as Schönberg's *Pierrot Lunaire*, and have gained many adherents. The younger French composers, among whose critics one encounters the term *art dépouillé* (*i.e.*, music stripped of its harmonic envelope), Hindemith and many others in Germany, Bliss in England and, in general, the younger generation everywhere, have come under the spell of this movement, which replaces the multiplication of instrumental means by the intensive exploitation of small numbers. It is a strange coincidence that this tendency, which set in two or three years before the World War, should develop in a period of general impoverishment, whereby an economy of means which was originally dictated by artistic considerations has become financially expedient. As, however, the spread of new musical forms is always very slow, the larger and more expensive orchestra is, despite adverse conditions, still the standard.

A further result of the contrapuntal character of the new orchestration is that it has added a kind of neo-classicism, which consists in a return to old, pre-romantic conventions. It is, for instance, safe to say that never since the 18th century have so many composers been attracted to the older type of instrumental concerto. Schönberg's chamber-symphony for solo instruments came before this revival, but in its instrumental complexion it is prophetic of much that has followed. In 1926 there is a growing literature of *concerti grossi* revealing a somewhat sophisticated affinity to the period of Bach and Handel.

At the same time, a corresponding "stripping" of the texture has affected the normal orchestra, especially when used by composers of the same school, such as Auric in France and Rieti in Italy. It generally produces an impression of austerity, not to say acidity, a deliberate casting away of all orchestral brilliance as too liable to distract attention from the music. This new sobriety, curiously enough, has led in some instances to a qualified reinstatement of the old grouping system. The wheel has come full circle, and it looks as if we shall presently be practically where we were rather more than a century ago, but with a vast fund of technical experience garnered in the interval and a medium of expression more sensitive to the creative impulse than could ever have been foreseen by the classics. It is no exaggeration to assert that, thanks to this experience and the teaching based upon it, any student of average talent leaves a good conservatoire to-day as proficient in this one subject of orchestration as any of the great masters. (E. Ev.)

ORDERS OF KNIGHTHOOD: *see* KNIGHTHOOD AND CHIVALRY.

ORDNANCE (*see* 20.189).—The chief developments in ordnance that have occurred since 1911 are in the nature of increased range and shell power. To these must be added the new guns required to meet the special conditions of the World War: the anti-aircraft gun, the tank and anti-tank guns, the trench mortar and the long-range guns.

I. THE GUN

Gun Construction and Design.—The period since 1911 shows a tendency towards the use of steels of a higher yield point and a consequent increase in the use of alloy steels. The immense demands for alloy steels during the War and the difficulty of obtaining sufficient supplies led to a reversion to the use of carbon steel for small and medium guns with a consequent shortening of the life of these guns. Since the War, however, there has been a demand for increased range without increase of weight of the equipment. To meet this it is necessary to use steels of great strength such as nickel chrome molybdenum and chrome vanadium. The general design of guns has altered but little. Great Britain retains the wire wound gun for almost all types, with a slight modification in breech end construction. Fig. 1 is typical of present day British practice. Continental nations retain the all-steel system of construction.

Manufacture.—The great expenditure of ammunition and consequent rapid wear of guns in modern warfare renders the question of rapid and easy repair of guns a matter of paramount importance. British wire wound guns from 4 in. calibre upwards are fitted with removable liners known as inner "A" tubes, a feature which increases the weight of the piece, but facilitates repairs. Other European nations retain the all-steel designs on the lines of the French or Krupp systems (*see* 11.217). These, on account of the heavy shrinkages necessary, are difficult to reline. Many expedients have been adopted to speed up manufacture and repair. The British 60 pdr. and similar guns were manufactured without inner "A" tubes, being subsequently bored out and fitted with the latter. Short liners were fitted extending from the rear of the chamber, and over the worn region of the bore. These were, however, unsatisfactory and were abandoned. The French in some cases adopted the system of boring out worn-out guns to a larger calibre. A 145 mm. gun was bored out after its first life to 155 millimetres.

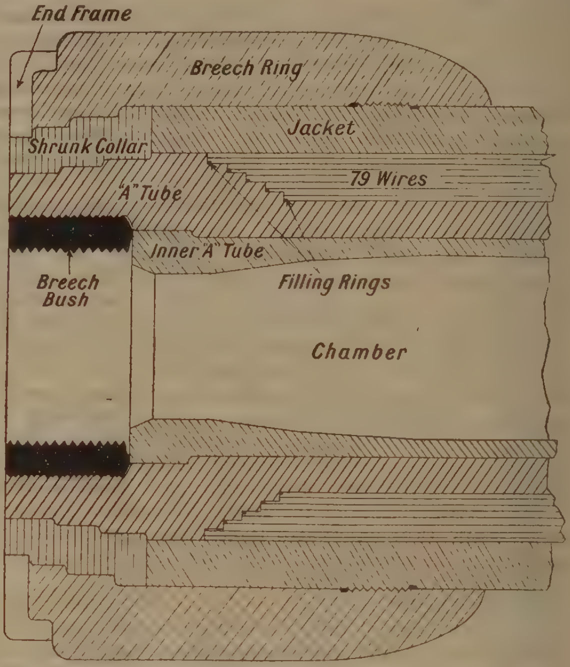


FIG. 1.—Sectional view of breech end of B.L. 15-in. gun.

Auto-frettage.—A new method of building a gun termed "auto-frettage" (self hooping) has been tried by various nations. In a single tube gun pressure applied to the bore produces a tension in the various layers of the wall. This tension is at a maximum on the inside and decreases continually towards the outside of the tube. The successive layers will be deformed, the greatest deformation taking place at the surface of the bore. If the elastic limit of the steel is exceeded the deformation will be permanent. The metal of the layers least deformed, *i.e.*, those at a greater distance from the axis of the bore, acts elastically on the layers beneath, producing a graduated shrinkage on those layers.

It is argued that if a pressure equal to, or less than, that which has caused the deformation is subsequently applied to the gun no further deformation will take place. In the auto-frettage system the wall is permanently deformed by the application of hydraulic pressure to the bore. The advantage claimed for this system is that it will be possible to make small and probably medium guns of single tubes, thereby effecting savings in time, skilled labour and material. It is possible that the process may be applied to the relining of existing types, and to the manufacture of large guns, using two or three tubes. The limiting factor appears to be the size of sound forging that can be produced.

Trench Mortars.—The trench mortar was a weapon originally designed for the destruction of wire, and short range bombardment in the siege of fortresses. Prior to 1914 these weapons had been developed only by Germany which used them with considerable success when trench warfare commenced on the Aisne in Sept. 1914.

The ordnance plants of the Allies being fully occupied in the manufacture of guns, it was necessary to turn to the ordinary engineering firms for the supply of mortars. This necessitated a simple design capable of speedy manufacture with existing machines. Three types have been employed:—

1. The stick bomb type firing a large spherical bomb with cylindrical stalk from a smooth bore gun of small calibre. This type was used by the British and German armies, but was discarded on account of its inaccuracy.

2. Smooth bore mortars either muzzle or breech loading. The Stokes mortar is of the former type, and the French 165 mm., in which the bomb is loaded from the muzzle while the propellant charge is loaded from the breech in a small case, is of the latter.

3. Rifled muzzle loading mortars. These were much used by the Germans but require the use of special plants in their manufacture.

The conditions of the War tended to crystallise the trench mortars into two main types: (*a*) a heavy mortar for bombardment purposes and (*b*) a light mortar to accompany attacking infantry for dealing with machine-guns and providing smoke screens. The former has been practically discarded under the conditions of mobile warfare contemplated by European nations; the value of the latter is a matter of controversy, but it is retained in some armies.

Long-Range Guns.—In 1918 Germany produced a gun of 21 cm. calibre which shelled Paris at a range of 45 miles. Similar guns of great range were constructed by various nations. These guns must be of great length which results in excessive wear and stripping of the copper driving band. Shell for the German guns were provided with steel ribs to take the rotational thrust in addition to a gas check driving band. The effect of these guns was almost entirely moral. Owing to their great cost and short life it is unlikely that they will be extensively employed in future wars.

Breech Mechanism.—With the introduction of the breech loading 6 in. 26 cwt. howitzer in 1916, a new type of mechanism known as the Asbury type (see fig. 2) was introduced. It was subsequently adopted for the majority of medium and heavy guns in the British Army. The breech screw is of the Welin type with arm carrier. The rotation of the breech screw is effected by a vertical lever with crank connection to the breech screw. It is claimed for this mechanism that the lever is more conveniently situated for operating the breech than in the normal type with horizontal lever. The obturator is positively unseated by a special cam on the breech face, and the breech screw is positively locked when the breech is open. Semi-automatic mechanisms were introduced owing to the advent of aeroplanes and coastal motor-boats which demand guns that can fire extremely rapid bursts to counter them. The speed of loading these guns is increased by automatic ejection of the fired case and automatic closing of the breech.

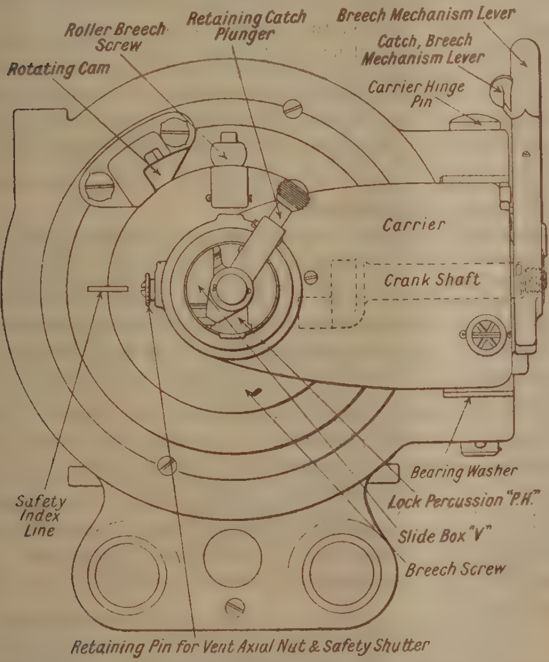


FIG. 2.—General arrangement of breech mechanism of B.L. 6-in. 26 cwt. howitzer.

These mechanisms are usually of the sliding block type; as the gun returns to the firing position a rod on the mounting fouls a pawl on the crank shaft of the mechanism, causing the latter to rotate and the breech to open; at the same time a spring is compressed. The spent case is ejected by the extractors which engage with the block and hold it open. On the loading of the next round the rim of the cartridge clears the extractors from the block which is then closed by the spring (see fig. 3).

Obturators.—Prior to 1914 the German Army relied solely on the quick firing (Q.F.) system in which the charge is contained in a brass cartridge case which effects the obturation. The British and French Armies used the quick firing system for light guns and the "B.L." or de Bange system for medium and heavy guns. The large expenditure of ammunition in the World War rendered the supply of brass cartridge cases a matter of great difficulty, so that an increasing tendency towards the "B.L." system is noted. Germany still retains the "Q.F." system as the sole method of obturation.

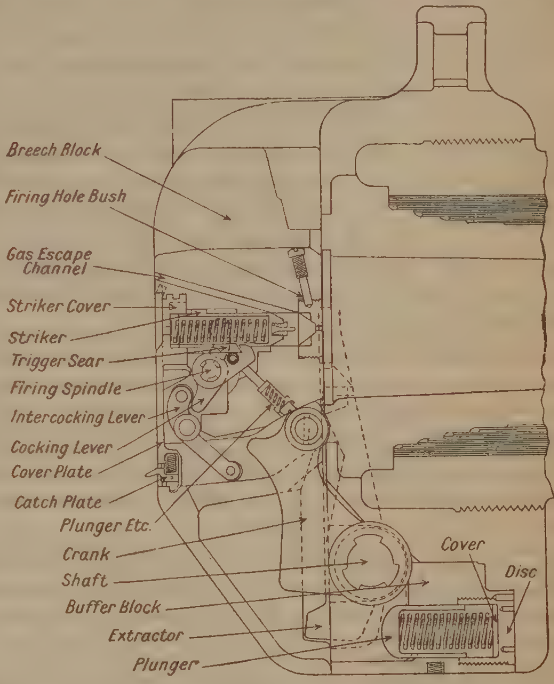


FIG. 3.—Section of breech end of Q.F. 3-in. 20 cwt. Mark I. Gun.

Improvements have been effected by the British, French and American armies in the de Bange obturator with the effect of giving it a longer life. The latest design in the British service consists of an asbestos (with rape oil) pad enclosed in a brass gauze casing. The pad is protected in front by a thin copper disc with a split steel ring about its periphery. A similar ring protects the edge of the pad in the rear and a solid ring forms a bearing for the pad on the vent axial. (E. A. W.)

II. THE CARRIAGE

All artillery carriages must be designed primarily, to provide a support for the gun during firing, and to allow of three separate movements:—

(*a*) Right and left in the horizontal plane . . . . traverse
(*b*) Up and down in the vertical plane . . . . . elevation
(*c*) Axially back and forward . . . . recoil

All carriages, therefore, are built up on the same general lines, and consist of two main portions:—

The basic structure provides the support, and should remain fixed during firing.

The super-structure provides for the three firing movements, and is divided into:—

1. Carriage body, which is pivoted on the basic structure and is capable of movement in the horizontal plane to a greater or less extent according to the type of carriage. It consists of two steel side pieces joined by transoms. On the top of each side piece is a bearing to receive the trunnions, one on each side of the cradle.
2. Cradle, which is pivoted by its trunnions in the carriage body, and can be elevated and depressed in the vertical plane. It is so constructed that the gun can slide backwards and forwards through it, if it be a ring-shaped cradle; or on it, if it be trough-shaped.
3. Recoiling parts, which connect the gun to the cradle and govern its movements.

The superstructure, having in all cases the same functions to perform, does not alter greatly, except in size and weight for different carriages. The type of basic structure depends altogether on the purpose for which the equipment is designed. Guns of the fixed defences, for instance, which are securely anchored to the ground, and may have to traverse in any direction, have their basic structure circular in shape. Semi-mobile equipments, which are moved to a temporary position in separate loads, cannot be anchored as firmly as fixed guns and have the basic structure a rectangle with its long sides in the line of fire, so as to provide support in the line of greatest shock. In this case the carriage body is pivoted near the front of the basic structure, and traverse is reduced to about 25 degrees each way. The mobile gun, or howitzer, must be ready to come into action at short notice, and so its basic structure must form a travelling as well as a firing support. Thus, the basic structure in this case consists of a pair of wheels, an axletree and a trail. The mobile carriage may be supported at three or four points.

Three Point Support.—Only the two wheels and the point of the trail, which is secured by a spade embedded in the earth, are in contact with the ground. To preserve lateral stability the force of the recoil must not be allowed to act far to either side of the centre of the trail; consequently only a small angle of traverse—4 degrees each way—is possible without lifting the spade and moving the whole carriage. A wide space must be left, in the centre of the trail, into which the gun may recoil when firing at high angles of elevation.

Mention must be made here of a special type of three point support carriage, in which traverse is given by moving the front of the trail along the axle. In this case the carriage body becomes unnecessary, and bearings for the cradle trunnions are formed on the sides of the trail. The force of recoil always acts straight down the centre of this trail, which gives great lateral stability. A disadvantage, however, is that the spade forms the centre of the circle in which the front of the trail must move, and it follows that when the gun is traversed to the right, the right wheel must move back and the left wheel forward, and vice versa. This makes traversing very hard work on any but the most favourable ground and necessitates a somewhat complicated traversing gear. Examples of this type are the British Q.F. 18 pr. mark IV and the French 75 mm. guns.

Four Point Support.—The amount of traverse given by ordinary three point support carriages is quite insufficient for dealing with rapidly moving targets such as tanks and armoured cars. The need for more traverse is met by using a split trail, the halves of which can be splayed out for firing, each half having a spade at its rear end. This greatly widens the support in rear, and allows of traverse up to 25 degrees each way, while maintaining stability. At high elevations the gun is free to recoil between the legs of the trail. For travelling the legs are pinned together and hooked to a limber in the usual way.

Anti-aircraft Equipments.—For defence against aircraft, the first requirements are all round traverse and extreme elevation. This necessitates a carriage approximating in design to the fixed mounting. The basic structure consists of a base ring bolted down to the travelling platform. The carriage body, built specially high to allow of great elevation, has a circular race on its underside to fit over a "live roller ring" which revolves on the base ring and so facilitates rapid traverse. The travelling platform can be lowered from its wheels to the ground and anchored for firing.

Possible Developments.—The rapid advance of mechanical transport and the increased use of tracked in place of wheeled vehicles for cross country work give an indication of the lines on which mobile carriages of the future may develop. Tractor drawn artillery is now common, and it is easy to imagine that the mobile gun of the near future will leave its wheels, and fire either from the tractor itself, or from a tracked vehicle towed by the tractor. In either case the basic structure will probably be a circular pedestal clamped to the floor of the vehicle and capable of all-round traverse.

Gears.—To provide the necessary movements of the parts of a carriage in relation to one another certain gears are used. They are traversing gears, elevating gears and sight actuating gears. Traversing provides for the movement of the carriage body on the basic structure in the horizontal plane. In its simplest form this gear consists of a nut and screw, the nut being held on a pivot at the rear of the carriage body, and the screw carried in a pivoted bearing on the trail in such a way that it can revolve but can have no lateral movement. The screw being turned by a handwheel, forces the nut to one side or the other, thus traversing the carriage body about its pivot. For heavy equipments and those requiring wide traverse, a more complicated system is employed; and may include one or more driving shafts with spur, bevel and worm gearing.

Elevating Gear.—This provides for the elevation and depression of the cradle in the bearings of the carriage body. It is effected by a toothed arc or arcs attached to the cradle, and actuated by spur pinions on a cross shaft carried in the bearings in the carriage body. On one end of the cross shaft a worm wheel is keyed. A handwheel on the carriage body, working through spur or bevel gearing, if necessary, turns a worm which rotates the worm wheel and with it the horizontal shaft and its pinions. The pinions, being in mesh with the elevating arcs, impart the necessary movement to the cradle. It should be noted that the elevating arcs can, in many cases, be detached from the cradle, and are provided with hollow bosses which fit loosely over the cradle trunnions, so that arcs and cradle may move independently of one another when required.

Sight actuating gears may include spur, worm or nut and screw gearing, and are employed to give the necessary movements to the axis of the sight, relatively to the axis of the piece. At the same time the angle, or equivalent range, at which the sight has been set with regard to the axis of the piece is recorded.

Sighting.—A gun carriage must provide means of laying the line of sight on the target, and of laying the axis of the piece at such an angle (tangent elevation) relative to the line of sight that the trajectory will intersect it at the target range. The arrangements are complicated by the necessity of allowing for the lateral movement of a projectile due to its spin, known as "drift" and for any difference in level of the wheels due to uneven ground. The reciprocating sights used with modern carriages allow for drift and for difference in level of wheels by tilting the sight at an angle to the vertical. This is done by cross levelling a bubble mounted on the bracket which carries the telescope.

Two main sighting systems are used with mobile carriages:—

1. *Rocking bar system.* In this case, the axis of the sight is first moved relatively to the axis of the piece, through the angle of tangent elevation. This is done by the sight operating gear. Next, the gun and sight are moved together, by the elevating and traversing gears, until the line of sight is on the target. One man performs these two separate operations, a process much too slow for the engagement of rapidly moving targets.
2. *Independent line of sight.* Here the laying is done by two men. One, by means of the elevating and traversing gears, keeps the line of sight continuously on the target. The other, using the range gear, which moves the gun independently of the sight, keeps the axis of the piece continuously set at the angle of tangent elevation. As these movements can be carried out simultaneously and independently, much time is saved.

III. BUFFERS AND RECUPERATORS

The kinetic energy acquired by the gun on firing is absorbed by the buffer, recuperator and friction, and in this way the velocity of recoil is diminished, and the gun finally brought to rest. The recuperator is designed to store up energy so that it may return the gun to the firing position and retain it there at the maximum elevation. The buffer must absorb energy not accounted for by the recuperator and friction.

In mobile carriages, to preserve stability, the heavier portion of the recoil system recoils with the gun, and a long recoil is provided for the same reason: further, as the gun recoils, the stability moment decreases, so the resistance to recoil must be correspondingly decreased. Hence the system of graduated resistance is employed with mobile carriages. While the gas is acting on the gun, recoil should be as free as possible to preserve the aim, and reduce the couple on the recoiling parts. The maximum resistance to recoil comes into action at the end of the period of free recoil, and then diminishes. Fig. 4 (left) is a typical resistance space diagram for graduated recoil.

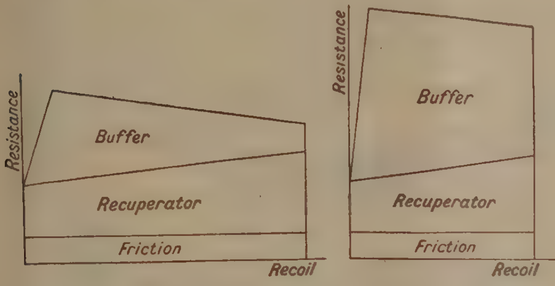


FIG. 4.—Resistance space diagrams. Graduated recoil (left) and controlled recoil (right).

The length of recoil is determined from the condition that the maximum recoil energy with free recoil (calculated from the ballistics of the gun) must equal the work done by the total resistance to recoil, *i.e.*, the area of the diagram. The buffer resistance can be obtained from the diagram, for the recuperative and frictional resistances can be calculated reasonably accurately. British mobile equipments have centre trunnions, so recoil must be shortened as elevation increases in order that the recoiling parts may not foul the ground. Recoil is then said to be controlled. The resistance-space diagram for such a system will be similar to that shown in fig. 4 (right). Since recoil is shorter and the total area must be the same, the resistance due to the buffer is greater than in graduated recoil (fig. 4 left). This increase in resistance does not affect the question of stability, since the stability moment increases with the elevation.

With fixed mountings the question of stability does not arise, so short recoil is generally employed. Further, the total resistance to recoil is a minimum when retained constant, and the system of equalised resistance is therefore adopted.

The Buffer.—This consists of a cylinder filled with liquid in which works a piston and rod: either the cylinder or rod recoils with the gun; between piston and cylinder is a flow space for the liquid which decreases during recoil. The resistance to the flow of liquid through this flow space retards and finally checks the motion, and the resistance can be varied by suitably varying the flow space. The withdrawal of the piston rod at full recoil leaves a partial vacuum in the cylinder which assists the initial stages of recuperation, but before the buffer can act as a control to recuperation, the liquid must be banked up on the face of the piston remote from the rod. At this instant the recoiling parts have their maximum recuperative velocity: further, the flow space is increasing, and the resistance is insufficient to absorb the surplus energy. A further controlling device is therefore fitted to ensure the gun coming quietly to rest in the firing positi

The flow space, calculated and afterwards corrected experimentally, is varied by the following methods:—

(*a*) A circular piston and longitudinal grooves of constant width and varying depth cut in the cylinder walls.

(*b*) Rectangular ports in the piston sliding over valve keys, metal bars contoured to give the required flow space, fixed to the cylinder walls.

(*c*) A hollow piston rod with circular piston sliding over a tapered control rod fixed to the cylinder. Ports in the piston provide a passage for the liquid.

(*d*) A valve with ports cut in it is rotated on the piston rod by feathers upon it engaging spiral feather-ways in the cylinder walls. It rotates against a valve having similar ports which is fixed to the piston rod.

Systems (*a*) and (*b*) are suitable for short recoil. System (*d*) is particularly adaptable to controlled recoil and is used in modern mobile carriages. Controlled recoil necessitates cut off gear to reduce the flow space automatically as the gun elevates. A link or cam gear placed between cradle and carriage body rotates the piston rod through bevel or spur gearing. Cut off therefore occurs earlier in the recoil stroke.

Control to recuperation is necessary to prevent a metal to metal blow, as the flow space in the buffer increases with recuperation. The following devices are in use:—

(*a*) A control plunger with a flat on it displaces liquid from a control chamber, the chamber having filled with liquid on recoil. The most modern equipments combine an additional adjustable exit for the liquid with this system to suit special conditions. Thus recuperation takes place in three stages: (1) unresisted except by friction; (2) resisted by the buffer and friction; (3) resisted by the buffer, plunger and friction.

(*b*) Two separate valves, one to control recoil, the other to control recuperation, the former being idle when the latter is functioning and vice versa. The system is best applied to the rotating valve type of buffer and affords two-stage control to recuperation.

(*c*) A valve on the tapered control rod allows the hollow piston rod to fill with liquid on recoil. On recuperation the valve closes and the rod displaces the liquid through shallowing grooves in the hollow piston rod. Recuperation is thus controlled from the outset.

The Recuperator.—This consists of a set of springs either in a single or a double column, or of a chamber containing compressed air; in either case it must be under sufficient initial compression to retain the gun in the firing position at the maximum elevation. Part of the recoil energy is stored in the recuperator by further compressing either the air or springs, and this energy returns the gun to firing position.

Spring Recuperator.—A single column consists of one or more spiral springs, separated by parting plates, placed end to end on a compressor rod secured to the gun. The system is mounted in a case fixed to a cradle, so that on recoil the springs are compressed by the compressor rod. The telescopic system consists of two banks of springs separated by a hollow tube, but connected to each other by a flange at each end of the tube. The outer bank bears against the casing in rear, the inner bank against the compressor rod in front. On recoil the action is telescopic, so that the compression per column is reduced. For this reason the system is more suitable for long recoil equipments than a single column. In any case the life of a spring is limited and it is liable to fatigue.

Air Recuperator.—Air, initially compressed, is in contact, either directly or through liquid, with a piston, which on recoil further compresses the air. Recuperators are thus classed as pneumatic or hydro-pneumatic, the latter class being subdivided according as the liquid and air are in contact or separated. Liquid is used on account of the difficulty of sealing air at a high pressure. With pneumatic recuperators the air is sealed by a liquid gland, the liquid pressure being intensified in order to effect the seal. With the hydro-pneumatic system, one cylinder contains liquid acting on the face of a packed piston connected by its rod to the cradle cap, and communicates through a retard valve, port and pipe to another cylinder containing liquid and compressed air, the cylinders recoiling with the gun. The retard valve permits a free flow of liquid during recoil, but closes to control the rate of recuperation; the outlet of the pipe is arranged to be always below the liquid level, to prevent the air passing to the liquid cylinder.

This system is liable to aeration, and in a more modern design, liquid and air are separated by a packed floating piston having a tail rod which intensifies the liquid pressure, reducing the tendency for air to escape. The tail rod also acts as an indicator for the quantity of liquid in the system, as it is visible from the front of the cradle cap through which it projects.

The compression ratio should be low to reduce the final pressure and heating effect, and usually lies between 1·5 and 2. To give a low compression ratio the piston area should be small relative to that of the air cylinder, but, at the same time, it should be as large as possible to reduce the initial pressure for convenience in charging and sealing. From a knowledge of the compression ratio, piston area and length of recoil (which is the working length of the recuperator) the volume of the initially compressed air can be estimated. Low initial pressure and low compression ratio entail bulky construction, particularly of the air cylinder; the design of the cradle limits the size of the system, and for this reason the initial pressure in a mobile equipment is generally higher than that in a fixed mounting.

Air recuperators, compared with springs, have the advantages that, firstly, an increase in power can easily be obtained without an increase in weight; secondly, run up can be controlled by the recuperator as well as by the buffer; and, thirdly, troubles due to fractured or fatigued springs are eliminated. On the other hand, air systems require skilled attention for their proper maintenance, and as they absorb a greater proportion of recoil energy than springs, a loss of pressure is much more likely to overload the buffer than a spring breakdown; correct charging is therefore essential.

The air used in recuperators must be dry and free from dust to prevent rust and abrasion and to preserve the mirror surface necessary on the rods and cylinders; the use of air bottles charged with specially dried air instead of pumps minimises the risk of allowing moist air to enter a system, while the French favour the use of nitrogen instead of air. Some experimental recuperators of stainless steel are being tried, but certain manufacturing difficulties remain to be overcome. A special liquid mixture is used in buffers and recuperators; it should be non-freezing in any climate, acid-free, non-inflammable and of slight viscosity which should be little affected by temperature change. Only the specified liquid should be used, as it is for that liquid that the flow space is designed, but glycerine may be used in emergency.

Packings.—These may be distinguished as joint rings, soft packings and high pressure packings. Joint rings, copper, leather or vulcanised fibre are used with plugs, stuffing boxes, etc., for standing joints. Soft packings of asbestos, lead and hemp moulded to shape are used in stuffing boxes to seal under normal pressures, and to centre the rod. High pressure packings in the form of rubber or leather rings of "U" or "L" section are used to seal under high pressures. Generally a combination of soft and high pressure packings is used. Fig. 5 shows the general arrangement of a modern rotating valve type of buffer and hydropneumatic recuperator with floating piston as fitted to a mobile carriage. (E. J. C.)

IV. NAVAL ORDNANCE

War experience has proved that, at sea, victory will always rest with the side that can hit the hardest at the longest range, and recent years have seen a steady increase in the size of the guns carried by warships of all types.

The 12-inch Gun.—In 1911 the 12-in. gun, which for over 10 years had been the standard heavy gun for the navies of the world, had, in the British Navy, reached the limit of its development in the 12-in. mark 11 50 calibre gun. This gun formed the main armament of the six battleships which followed the first "Dreadnoughts" and of the contemporary battle cruisers. In the first three battleships ("Vanguard" class) the guns were placed as in the "Dreadnought," but in the "Colossus" class the midship turrets were placed "en échelon," so that all 10 guns could be fired on either broadside. This disposition of the main armament marks the transition stage to the centre line arrangement, which by 1915 had been adopted in the capital ships of all navies. In the secondary or anti-torpedo boat armaments, the 12-pdr. Q.F. gun was replaced by a 4-in. Q.F. or B.L. gun in all these ships.

In contemporary ships in foreign navies the 12-in. gun still held its place as the main armament, but the desire to increase the heavy gun power was shown by both the United States and Japan, who mounted 12 of these guns as against 10 in the British ships. The secondary armament in foreign navies was usually greater at this period than in the British ships. The Japanese used a mixed armament of 6-in. and 4·7-in. guns and the United States employed the 5-in. gun.

By 1912 the demand for an increase in range combined with greater hitting power became insistent and a new gun—the 13·5 breech loading mark 5 was introduced into the British fleet. This gun, which weighs 68 tons and fires a 1,400 lb. projectile with a velocity of about 2,500 fs., shows a very marked advance in power over the most highly developed gun of 12-in. calibre. Ten of these 13·5 guns formed the main armaments of the "Orion" and "King George V." classes which were completed in 1912–3, and the battle cruisers of the "Lion" class, built at the same time, mounted eight. In these battleships and battle cruisers, and in all subsequent capital ships built for the British fleet, the heavy guns are mounted on the centre line. Thus the whole armament can be brought to bear, through a very large arc of fire, upon either broadside, and the maximum gun power is developed. In all these ships the 4-in. gun was retained as the secondary armament, but a change was made in the next class—the "Iron Duke" completed in 1914. The main armament of these ships remained the same but the 6-in. B.L. gun displaced the 4-in. in the secondary armament.

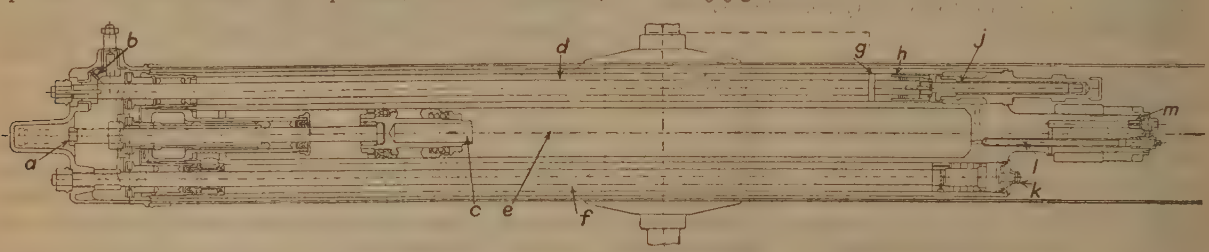
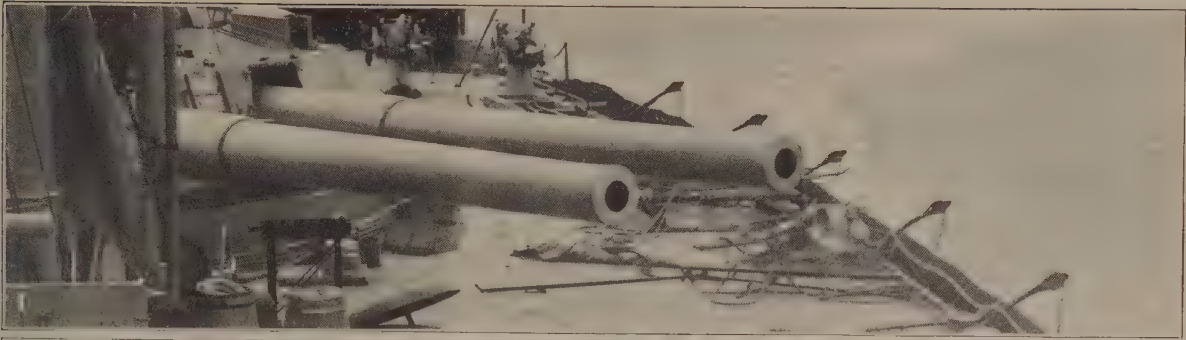
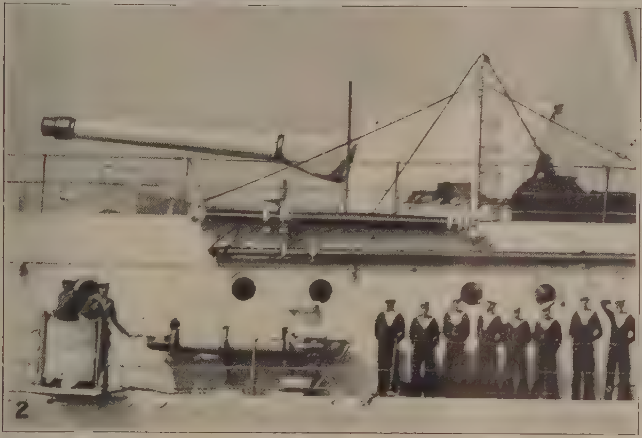


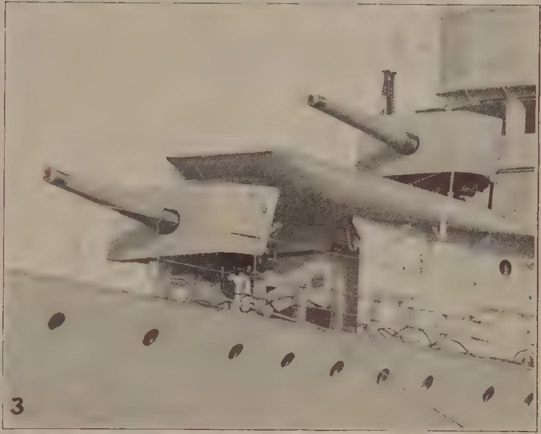
Fig. 5.—General arrangement of buffer and recuperator. *a.* Tail rod (leakage). *b.* Cut-off gear segments. *c.* Floating piston. *d.* Buffer cylinder. *e.* Air reservoir. *f.* Recuperator cylinder. *g.* Recoil valve. *h.* Rotating valve. *j.* Control plunger. *k.* Dust cover. *l.* Air valve. *m.* Air filling plug.

The 15-inch Gun.—The year 1915 marked another great step forward in the gun power of the British fleet by the introduction of the 15-in. gun. This gun weighs 100 tons and fires a 1,920 lb. shell with a muzzle velocity of 2,500 foot seconds. The muzzle energy developed is thus twice that of the most powerful 12-in. gun, and as the rate of fire of the 12-in. and 15-in. guns is the same under battle conditions, upon this count alone the hitting power of a British battleship may be said to have been doubled between 1912 and 1915. In addition, the heavier gun has a greater range—and what is most important of all—considerably greater accuracy at extreme ranges.

The 10 battleships of the "Queen Elizabeth" and "Royal Sovereign" class each mount eight of these 15-in. guns in their main armament, supported by a powerful battery of 6-in. guns. The battle cruisers of the "Renown" class have six 15-in. guns,







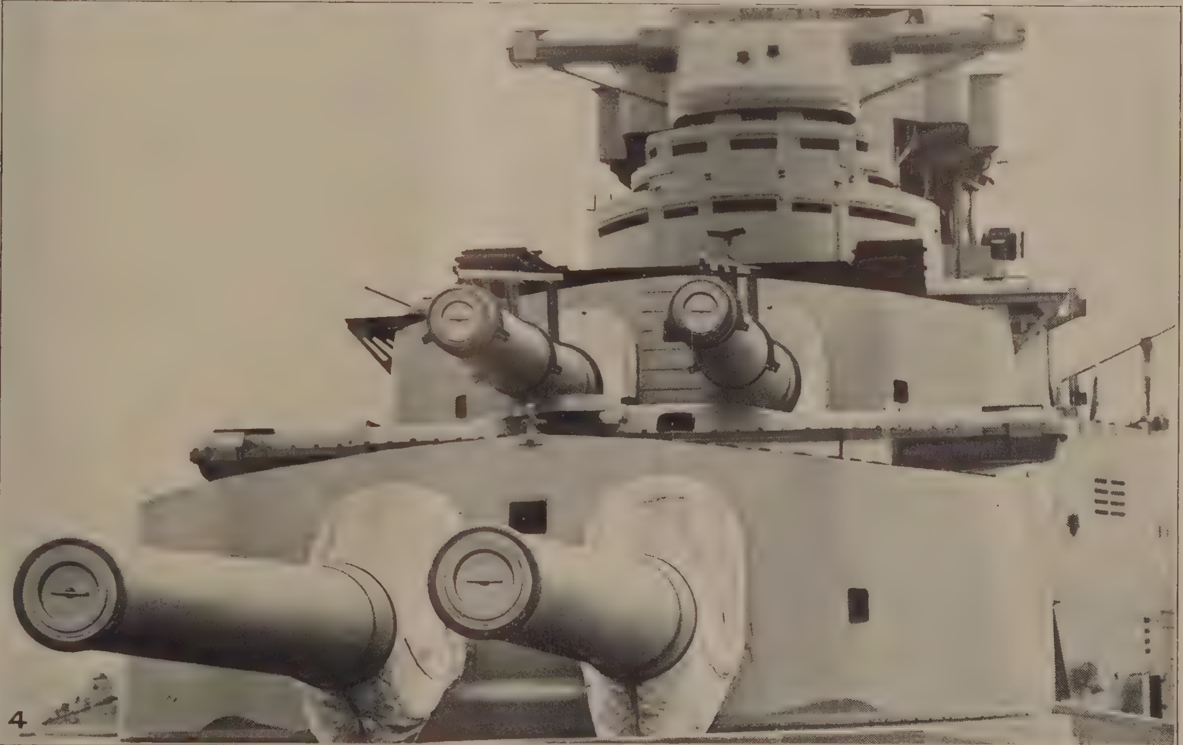


FIG. 1. 12-in. guns on H.M.S. "Dreadnought" (stern turret). FIG. 2. 7·5-in. guns (bow) of H.M.S. "Effingham." FIG. 3. 4·7-in. guns of H.M.S. "Wallace" ("W"- class destroyer). FIG. 4. 15-in. guns of H.M.S. "Hood."

(*Photos. Stephen Cribb, Southsea.*)

with a reversion to the 4-in. gun, mounted in triple mountings, as a secondary armament. The "Hood," which was the first capital ship completed whose design embodied the lessons learnt at the battle of Jutland, carries eight 15-in. guns and a battery of 16 5·5-in. B.L. guns. The armament of this ship is arranged in the same way as that of the "Queen Elizabeth," but the ship is much longer and faster.

The 16-inch Gun.—A further advance has been made in the size of the guns of the capital ships now being completed—the "Nelson" and "Rodney." These ships carry nine 16-in. guns of a new pattern in three triple turrets, all in the centre line forward in the ship, and the secondary armament consists of 12 6-in. guns in double turrets, three on each side in the after part of the ship.

In other navies during the period 1911–25 a similar general increase in the size of the guns, both for the main and secondary armaments, has taken place. In both the United States and Japanese navies, the 12-in. gun was replaced by the 14-in. in all ships built after 1914, and this gun remained the standard weapon in both navies until the ships projected in 1921, wherein a 16-in. gun has been adopted, the general arrangement of the armament being similar to that of the British "Queen Elizabeth." For the secondary armament, the United States retained the 5-in. gun, until 1921, when the 6-in. gun was adopted. Japan, on the other hand, after adhering to the 6-in. gun as the secondary weapon in her later ships, has now reverted to a gun of 5·5-in. calibre.

The German Navy was always one step behind other fleets in the size of the guns mounted in the main armament. The early German "Dreadnoughts" were armed with the 11-in. gun, which had for many years been the heaviest weapon employed in the German fleet.. After 1912, the 12-in. gun became the standard weapon for the capital ships and remained so until the battle of Jutland in 1916. At this date, a few ships mounting 15-in. guns were approaching completion, but they were not finished in time to be actually employed. The guns employed in the secondary armament of the German ships were similar to those in the British Fleet—a 4·1-in. gun in the earlier ships or a 5·9-in. gun in the later ones.

Heavy Guns and Mountings.—Recent years have not brought about any very drastic changes in the main principles by which heavy gun turrets are worked. The most recent designs of twin turrets in the British Navy show no very great difference in general arrangement from those in which the 12-in. guns were mounted in the earlier "Dreadnoughts." The guns have increased from 12 in. to 15 in. in calibre, their weight and that of their ammunition has been more than doubled; consequently there are additional and more powerful machines, and many alterations in detail, but the general design has not been altered. The power used in the British Navy for working the turrets is entirely hydraulic, supplied by hydraulic pumps which are situated outside the structure of the turret. The hydraulic system is heavy, but it is reliable and successfully withstood the severe test imposed upon it during the War, in the very large number of turrets afloat in the British fleet. Any other system will have to be proved to be very reliable before it can be expected to supplant it.

The Japanese follow the British system, but in other navies electrical power has been used almost entirely for working the turret machinery. Electrical machines have made great strides in efficiency and reliability in recent years, and the combination of electric motors and hydraulic transmission (of the type of the Williams-Janney and Hele-Shaw machines) has rendered electric power peculiarly adaptable to turret machinery. This system has been used in all recent United States designs and the increased use of electrical power for the auxiliary and possibly for the main engines of warships, may lead to the electro-hydraulic system being generally adopted in power-worked gun mountings.

Triple Turrets.—Triple turrets have appeared in most navies, but the British Navy has been slow to adopt the innovation. The development is due to the desire to increase the gun power of the ships, without unduly increasing the size of the ships themselves. By the agreement made at Washington the size of capital ships is limited to 35,000 tons and of guns to 16-in. calibre. All nations therefore began to try to place the greatest gun power possible into ships of this size without sacrificing protection and speed and having due regard to the radius of action required of the units of each particular fleet. Six guns mounted in two triple turrets occupy less length of the ship, which is one of the most important factors, than do the same number of guns in three twin turrets. Weight of heavy armour is thus saved which can be used for other purposes. Designs of quadruple turrets have been made, but it is not clear that economy of space results from their adoption, chiefly owing to difficulties in the ammunition storage and supply. There appears to be little doubt that the triple turret will be adopted by all navies in the near future.

Medium Heavy Guns and Mountings.—No modern capital ships now mount medium heavy guns in either their main or secondary armaments. Guns from 11 to 7-in. calibre are not powerful enough to be of any real use at long range against armoured ships, and, since their ammunition is too heavy to be manhandled, they cannot be used for rapid fire, and would consequently be out of place in the secondary armament. The relative weakness of the medium calibre gun was well illustrated at the battle of the Falkland Islands, when the German armoured cruisers, armed with 8-in. guns, speedily fell victims to the greater range and hitting power of the 12-in. guns of the British battle cruisers.

In the mountings of 6-in. and smaller guns a general change has taken place as the result of war experience, from the old pedestal (P.) mounting to the central pivot (C.P.). This was necessitated by the demand for greater ranges and therefore increased elevation. In the P. mountings the elevation was limited to about 20°, as the bottom of the cradle carrying the gun then fouled the pedestal. In the C.P. mountings a circular plate is bolted to the deck, having a low pivot in the centre; on this plate is carried, on rollers, a revolving platform, the pivot being only used to prevent lateral motion. On the platform are built two transoms, on the top of which are the trunnion bearings, in which the gun and cradle swing in elevation between the transoms. The latest C.P. mountings for 6-in. and 4·7-in. guns admit of elevation of 30° or more. The C.P. principle has also been adopted for all anti-aircraft mountings in which elevations up to 85° are necessary.

Anti-aircraft Guns.—The rapid development of aircraft has called for a new type of armament in the form of the high angle gun. The commencement of the War found all nations unprepared to meet the new form of attack. The menace had been realised, but none of the belligerent nations had advanced much beyond the experimental stage in the development of an anti-aircraft armament. Consequently a large number of improvised equipments were produced, none of which were satisfactory. The problem of hitting an airship or aeroplane is a difficult one, since the target is moving in three planes at high speed. A vast amount of experience was obtained on shore during the War and high angle gunfire succeeded in making aircraft fly at a greater height and therefore the attainment of their objective became more difficult. At sea, much less experience was gained and the problem is a much more difficult one, since the platform upon which the gun is mounted is a moving and unstable one, thus adding greatly to the complications.

All warships now carry two or more anti-aircraft guns. In the British fleet a 3-in. Q.F. semi-automatic gun was used at first, but this has now been replaced by the 4 in. Q.F. mark 5 gun on a specially designed high angle mounting. The tendency is to increase the size of anti-aircraft guns. The first essential, however, for an efficient gun for this purpose is extreme rapidity of fire and a limit is imposed upon the size of the gun by the weight of the ammunition. A round of fixed ammunition for a 4.7-in. gun weighs about 80 lb. and this is as much as can be handled by one man with any degree of rapidity. It does not appear therefore that high angle guns will increase above this calibre unless a complicated power worked mounting is introduced, and this does not at present appear probable. (*See* GUNNERY: WASHINGTON CONFERENCE.) (S. H. W.)

OREGON (*see* 20.242), a State of the United States of America. The population in 1920 was 783,389 as against 672,765 in 1910, an increase of 16·4%: at the end of 1925 it was estimated at 1,007,725. The 1925 population of the 33 cities and towns with more than 2,500 inhabitants was 51% of the total population, as against 49·9% and 45·6% in 1920 and 1910 respectively.

Forestry.—In 1922 the virgin forest area was 21,344,000 ac., or about 34% of the total area. The timber stand in 1923 was 395,776,229 mill board feet. The total annual depletion of merchantable stand by fire and cutting during the years 1920–5 was about 1·2%. There were 14 national forests with an area of 24,086 sq. m. within the boundaries of the State. Oregon ranked first in the nation as a timber-bearing State and second in lumber production. In 1923 it produced 12·61% of the nation's soft-wood lumber; its cut was 3,800,000 mill board ft., valued at $110,000,000. The number of sawmills was 685; 45,000 men were employed and the lumber industry pay-roll was 65% of the entire industrial pay-roll of the State: 80% of the outgoing products were lumber and wood.

Agriculture.—Of the total land area 22·1% (13,542,318 ac.) was in 1920 included in the 50,206 farms; in 1925 14,170,043 ac., of which 4,984,375 ac. were improved, were in 55,909 farms. The gain in the total farm acreage during the decade 1910–20 was 15%, and from 1920–5, 4·3%; the gain in the improved acreage during the decade was 14·9%, but from 1920–5 the shrinkage of tillable land in the farms was nearly 2%. The average value of farms and buildings was 12·4% less in 1925 than in 1920. The total value of farm property in 1910 was $528,243,782, and in 1920 was $818,559,751: 81% of the Oregon farms were, in 1920, operated by the owners. The crop values in 1920 were 192·7% higher than in 1910. The conspicuous increases in production in the decade 1910–20 were in forage, ensilage and fruits. The total field crops in 1920 were worth $131,884,639. Live stock in 1925 consisted of 2,002,378 sheep, 483,813 beef cattle, 312,518 dairy cattle, 225,350 horses and 223,287 swine. In 1924, 16,250,000 lb. of wool were produced.

Mining.—The mineral output includes gold, silver, copper, lead, platinum, quicksilver, Portland cement, lime, clay products, monumental and building stone, coal, crushed rock, sand and gravel, diatomaceous earth, gypsum and mineral water. The total annual value is about $5,500,000, and in the years 1920–5 increased at the rate of about $250,000 a year. Its most valuable mineral products are sand and gravel for building and highway construction and the common clay used in the manufacture of brick and drain tile. The expansion of mining activity has centred in the production of copper east of Baker, and that increase adds to the production of the precious metals associated with copper ores.

Industries.—Oregon has distinct advantages for special lines of industry, including an abundance of raw materials, an equable and moist climate favourable to the production of textile fabrics, and readily available hydroelectric power. The relatively high transportation cost has been the main factor handicapping development. In 1914 Oregon's manufactured products were valued at $109,761,951 and the average number of wage-earners employed was 28,829: in 1925 the volume of output had increased to about $363,912,328, and employment was furnished to some 62,655 workers. The chief industries arranged in order of value of products were lumber and timber products, slaughtering and meat-packing, dairy products, woollen goods, printing and publishing and canning and preserving.

Transportation.—In the years 1910–25 there were two distinct periods of transportation improvement. In the decade 1910–20 there were the opening of the main waterways, the extension of the railways (increasing the mileage by more than one-half), and a thorough commitment to the construction of a system of State highways with a consistent development. During the five years 1920–5 there was the maintenance of the channel depths of the waterways, the projecting and partial construction of the extensions needed to complete the Oregon railway network, and the continuation of highway construction. With the completion of the Celilo canal in 1915, the Columbia and its tributary, the Snake, were made navigable to Lewiston, Idaho. Through the construction of this canal above the city of The Dalles a fall of 80 ft. in a stretch of 9 m. was overcome. With the transference to the Federal Govt. in 1915 of the canal and locks around the Willamette Falls at Oregon City, the free use of the Willamette was secured. The co-operation of the Federal Govt. and the port authorities of Portland secured a deep-water channel in the Willamette and Columbia from Portland to the sea.

The railway construction during the decade provided:—

(1) Lines to the Pacific coast, from Portland to Tillamook and from Eugene to Coos Bay; (2) extensions into central Oregon with parallel lines up the Deschutes river to Bend and westward from Vale in the Snake river valley; (3) construction on the gap between Natron and Klamath Falls as part of a double line for Oregon-California traffic; (4) an electric line from Portland to Eugene and a steam line from Corvallis to Eugene.

The railway mileage in the State in 1910 was 2,413·61; in 1920, 3,626·77; in 1925, 3,347 steam and 589 electric.

In the period 1920–5 a 30-m. extension into central Oregon by the Oregon short line was completed, and construction activity on the Natron-Klamath cut-off has brought it almost to completion. Notwithstanding these additions to the railway mileage in Oregon in the 15 years 1910–25, a complete lack of railway lines still existed in the large southeastern section of the State, comprising about one-half its area. Not only is the possible development of this section thus hindered, but the timber-covered area to the west has no direct transportation route to the great lumber market of the prairie states to the east. The development of a state highway system, begun in 1917, has been regularly carried forward: at the close of the year 1925 the total mileage was 4,463, of which 889 m. were paved and 2,188 m. had macadam surfacing. A definite market road system for each county has been approved.

Education.—In 1920 the total enrolment of grade-school and high-school pupils was 148,412; in 1925 it was 187,982. Funds for the maintenance of the schools increased 69% in the years 1920–5.

History.—During 1910–20 recourse was freely had to the "Oregon system" of direct legislation to enact constitutional amendments and statutory laws. Through initiative petition, referendum petition and by vote of the Legislature, 174 proposals were submitted to the people; of these, 73 were approved. The people of Oregon by this procedure established prohibition, woman suffrage and a rural credit system. Citizenship qualification for the franchise, the right to veto single items in appropriation bills, the abolition of the poll tax, classification of property for taxation and State-wide limitation of the rate of increase of taxation and indebtedness were also thus enacted. Legislation also included the establishment of a minimum wage, workmen's compensation and pensions for widows and a "blue-sky law" licensing sales of corporation securities. While three-fourths of the voters usually vote with the Republican party, the representative leaders of the State during 1910–20 were two Democrats, George E. Chamberlain as U.S. Senator and Oswald West as governor. Mr. Chamberlain was promoted from the governorship to the Senate. During the period 1920–5 the majority party was better able to maintain its unity, electing two governors in succession and sending a solid delegation of Republicans to Congress. In 1922, however, the Democratic governor, Walter M. Pierce, was elected by a decided majority on issues of retrenchment and revenue reforms.

In the decade 1910–20 the people of Oregon began to demand more active progress in their State Government. While there had been before 1910 a half-hearted venture in railway regulation, later repudiated, and institutions of higher education had been receiving meagre support for some decades, the spirit of the constitution of 1857 was still dominant. Later, however, the desire for an early realisation of an adequate highway system, and the assured prospect of regular revenues from automobile licences, led to the authorisation in 1917 of a State bond issue for the building of a State highway system. The limit of indebtedness then fixed was 2% of the assessed valuation. This limit was raised in 1920 to 4% for the State. The counties are authorised to borrow up to 6% of assessed valuation to secure funds for highway improvement. The governors during 1911–25 were Oswald West (Dem.), 1911–5; James Withycombe (Rep.), 1915–9; Ben W. Olcott (Rep.), 1919–23; Walter M. Pierce (Dem.), 1923– .

(F. G. Y.)

ORELLI, HANS KONRAD VON (1846–1912), Swiss theologian (*see* 20.251), died at Basle Nov. 8 1912.

ORINOCO (*see* 20.275).—During the 15 or 20 years ending in 1926 economic conditions in the region of the Orinoco and its tributaries have passed through three states: normal, depressed during the World War years and a subsequent revival. The improved conditions are largely caused by Europe's renewed demands for raw materials. Ciudad Bolivar (pop. 20,000), the metropolis of the region, has extended modern sanitation and improved health conditions, paved some streets, installed electricity, initiated motor-car service, extended telegraph and telephones and constructed some modern homes. Beer, ice, candles, macaroni, lumber, fishing and mining are local and regional industries. Cattle business, largely north of the Orinoco and Apure rivers, is expanding, and estimates place the number of head at several million. British interests in the San Fernando region are active in breeding and shipping to Port of Spain for slaughter and re-export. Ciudad Bolivar is increasing the export of hides; tonka-bean shipments range from 70,000 to 600,000 pounds yearly; exports of egret feathers to France and of balata largely to England are increasing. The indications of petroleum in the Orinoco delta are promising. German, British, French and American companies, in the order given, represent foreign investments. There is some gold mining and much prospecting is carried on in the region.

ORLANDO, VITTORIO EMANUELE (1860–), Italian politician and jurist, was born at Palermo March 19 1860. Becoming a barrister and a law professor, he was first elected deputy for Partinico in Sicily in 1898. He was Minister of Education in the Giolitti-Tittoni Cabinet of 1903–5, and of Justice in the Giolitti Cabinet of 1907–9, and again under Salandra in Nov. 1914. Although a Giolittian at heart, he was in favour of Italian intervention in the World War. On the resignation of the Salandra Cabinet in June 1916 he remained in office under Boselli as Minister of the Interior, and when the latter resigned Orlando was entrusted with the formation of a new Cabinet. After the Armistice he went to Paris as president of the Italian peace delegation. When President Wilson launched his appeal on Fiume to the Italian people over the heads of their delegates, he returned to Rome, where he was triumphantly received, but after his return to Paris without the guarantees he was supposed to have secured, and without obtaining any satisfactory solution of the Adriatic problem, the Chamber voted against him and he resigned on June 19 1919.

On Dec. 2 1919 he was elected President of the Chamber. He at first supported Fascism and the Mussolini Govt. and was re-elected deputy in 1924 on the Government list; but after the Matteotti affair he withdrew his support, without, however, abandoning the Chamber. At the municipal elections of Palermo in Aug. 1925 he mobilised all his adherents in favour of the anti-Fascist list but upon the subsequent triumph of the Fascists Sig. Orlando retired from Parliament.

ORLEANS, LOUIS PHILIPPE ROBERT, Duke of (1869–1926) (*see* 20.285), died at Palermo March 28 1926.

ORPEN, SIR WILLIAM NEWENHAM MONTAGUE (1878–), British painter, was born at Stillorgan, County Dublin, Nov. 27 1878 and studied at the Dublin Metropolitan School of Art and at the Slade School, London. He was elected A.R.A. in 1910 and R.A. in 1919. He first exhibited at the New English Art Club, of which he became a member in 1900, his early work being marked by preoccupation with spacing and silhouette and the use of quiet harmonies of grey and brown, with a note of vivid red or blue. He soon turned to the use of bright colour and the study of light, seen in a series of brilliant portrait interiors such as the "Hon. Percy Wyndham" (1907), "Myself and Venus" (1910, now in Pittsburgh Gallery, U.S.A.). About this time he became well known for his vigorously characterised portraits. During the World War Orpen received an appointment as official artist and in 1918 an exhibition of his war pictures was held in London. Many of these are now in the Imperial War Museum. He was created K.B.E. in 1918. He wrote *An Onlooker in France* (1921) and *Stories of Old Ireland and Myself* (1924).

ORTHODOX EASTERN CHURCHES (*see* 20.333).—As regards the ecclesiastical position in the Near East, this article deals only with the "Orthodox" Churches—an adjective used in its technical sense, and having here no bearing on the question of right or wrong belief—and not with the uniats (the Churches which acknowledge the Roman obedience but keep their own rites), or with the separated Churces of the East—the Armenians, Nestorians, Jacobites and Copts. It is necessarily dependent on literature of a fugitive nature, such as magazines and newspapers, and on the observation of recent travellers. One preliminary remark, which throws light on many of the problems to be discussed, must be made. A marked feature of Orthodox Christianity is that political independence has usually led to ecclesiastical independence. This is a fact of great importance.

The Position Before the War

Position at the Outbreak of War.—Russia, with Georgia, is reckoned to have had nearly 100,000,000 Slavonic Orthodox.[1] Georgia, an exarchate once independent, was gradually being Russianised; the exarch was a Russian and an *ex officio* member of the Russian Holy Synod since 1801, while his suffragan bishops were Georgians. The effects of Tsarism on the Russian Church have been described by a learned observer as not good.[2] "Under the guise of protecting the Church, the state in reality had enslaved it." The Church was, he continues, in a state of paralysis, and the Russian educated classes were estranged from it.

The Orthodox Church in Turkey (Greek), under the Ecumenical Patriarch, Archbishop of Constantinople— often erroneously in the West called the Patriarch of Constantinople—is believed to have numbered 2,500,000 in Europe—counting in those transferred to the kingdom of Hellas in 1912—and 2,000,000 in Asia Minor and the islands.[3] In Greece proper, where the autocephalous position of the Church was recognised by the Ecumenical Patriarch in 1850, there were about 2,000,000 orthodox (*ib.*)

In the Austro-Hungarian Empire there were several orthodox Churches, chiefly Slavonic, with some 3,000,000 souls: The Karlowitz Serbian Church; those of Dalmatia and Cattaro, joined to the Ruthenian Bukowina, though far distant from it; of Bosnia and Hercegovina; of Transylvania; and a certain number of orthodox scattered in various districts. The Bulgarian Church was made autocephalous by the Sultan in 1876, when the Bulgarian exarch resided in Constantinople; but the Ecumenical Patriarch did not recognise its independence. It numbered about 4,000,000.

In Rumania the old Church of Okhrida was suppressed in 1767, and the Orthodox then became subject to the Ecumenical Patriarch till recent times. They numbered about 4,500,000. The same state of things obtained in Serbia (1,500,000), where the old Church of Ipek was suppressed in 1766.

The little Church of Montenegro (about 200,000 souls) was made independent in 1766 and governed by a metropolitan who had one suffragan bishop.[4] (Note that in some of the separated Churches of the East the metropolitans have no suffragans.) In addition there were the Orthodox in the patriarchate of Antioch, that of Jerusalem, that of Alexandria, Cyprus, autocephalous since 431, and the monastery of Mount Sinai, autocephalous since 1575, the archbishop of which usually resides in Egypt

The Position After the War

The alterations in the boundaries of the various states have necessarily had a great effect on the Church.[5] But a much greater effect has been produced by the internal convulsions in Russia and Turkey.

Russia has lost Poland and the Baltic provinces; but this has not affected the Orthodox Church to a very great extent, as the bulk of the population was of other faiths. Poland has still 3,000,000 Orthodox; Lithuania has 23,000 Orthodox and 35,000 "Old Believers;" Czechoslovakia has very few orthodox, 90% of the population being Roman Catholics or Uniats.[6]

In Russia proper and in Georgia the effect has been most disastrous. At first the revolution promised well for the Orthodox. A Holy Synod of 12 bishops and a council of bishops, priests and laymen were established in 1917; the office of Chief Procurator—a layman who had represented the Tsar, and who wielded very great powers—was abolished; the patriarchate, discontinued by Peter the Great since 1700, was revived (Nov. 1 1917) in the person of Tikhon, Patriarch of Moscow and all Russia, who was enthroned on Dec. 4 1917. But the Bolshevist régime dashed all the hopes of the Church. The new rulers set themselves to oppose Christianity in all its forms. The patriarch was imprisoned, and only liberated, owing to the general expression of civilised public opinion, after a long incarceration, in May 1923.

All teaching of religion in public schools was forbidden; parents were not allowed to teach their children religion; only candidates for the priesthood, if over 18 years of age, might learn theology. No minister of religion could enjoy full civil rights. No religious association could hold property, and all property of existing religious associations was confiscated to the State, which might at its pleasure lend buildings for religious worship. Monasteries were to be converted to useful purposes.[1]

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[1] Hastings, *Encyclopaedia of Religion and Ethics*, 10. 875.

[2] Prof. Agéiev in *The Christian East*, 1920, 1. 15.

[3] *Encyclopaedia of Religion and Ethics*, 6. 429.

[4] *Encyclopaedia of Religion and Ethics*, 6. 431.

[5] The new frontiers, as far as they are fixed, may be seen in the *Royal Geographical Society's Journal*, 53. 370, 54. 188, 55. 160, 65. 90.

[6] *Goodwill*, pp. 135–139.

A great persecution of the Orthodox has broken out, and according to the official figures, within a period of less than two years, 1,275 bishops (and priests?) and 6,775 other persons have been executed for their religion.[2] Most of the remaining bishops who have not escaped from Russia have been interned in or about Moscow, or in monasteries in the Far North. And the only organisation that has been found possible is a synod of 15 Russian bishops which holds its sessions outside Russia, at Belgrade. The patriarch Tikhon died in 1925, and a makeshift for the patriarchate has been devised in the shape of a locum tenens. The passive resistance of the Russian peasantry has been the great obstacle to the Government's endeavour to suppress Christianity, and the so-called reformed Russian Church, a body encouraged by the Soviet power, has so far been a failure for the same reason. In Georgia, the Church is in as great confusion as in Russia; since the first revolution the tendency has been towards independence in ecclesiastical matters.

The Ecumenical Patriarchate.—Post-War Turkey, with its curtailed frontiers, has as its aim the creation of an entirely Moslem State; and among other things the Turkish Govt. desires the abolition of the Ecumenical Patriarchate. But the European Powers, while restoring Constantinople to Turkey, prevented this, and at Lausanne the Turkish delegates made a formal declaration of their Government that the Patriarchate would be allowed to continue.[3] Yet, as far as Turkey is concerned, the Patriarchate is little more than "the shadow of a shade." By the Treaty of Lausanne all Greek Orthodox residents in Constantinople before Oct. 30 1918 are exempt from expulsion. All other Greeks in Turkey, however, are liable to expulsion, and those in Asia Minor have been settled in the new Greece and elsewhere, in many cases in exchange for Moslems. Only Turkish subjects can be metropolitans in Turkey, and therefore the episcopate has to be recruited from the comparatively few Greek residents in Constantinople. Outside modern Turkey the Ecumenical Patriarch, not the Metropolitan of Athens, has jurisdiction in Macedonia, Western Thrace, Epirus, Crete and the Aegean Islands, and this is an exception to the rule about ecclesiastical independence mentioned above.[4]

Yugoslavia, called in the Treaties the Serb-Croat-Slovene State, is now re-organising its Church, which includes the former Serbian Church, the Karlowitz Serbian Church, that of Dalmatia and Cattaro, that of Bosnia and Hercegovina (these three formerly in Austro-Hungary) and Montenegro. During the Great War many Serbians were in England; over 600 refugees, young ordinands, were there instructed and prepared for the Orthodox priesthood under Serbian priests.[5] Many others were in France, engaged in secular pursuits, and in other countries. This will be a convenient place to remark on the changed ecclesiastical conditions in both Yugoslavia and Rumania. Before the War Rumania and Serbia were inhabited practically by Orthodox alone. But the enlarged boundaries have brought in many Roman Catholics and Lutherans, and this has complicated the problem of national religions. The former idea of one country, one church, has to be given up, and religion and politics cannot have the same close connection that they had before. Moreover, the greatest hindrance to the reorganisation of the Orthodox Church in the Balkans and in Rumania is the exaggerated national feeling and jealousy of each country against the others. This jealousy is much more felt between the different branches of Orthodoxy than between them and the Roman Catholics or Lutherans.[6]

Rumania.—To the former Rumanian Church, with its two metropolitans, is now added the Transylvanian Church (formerly in Hungary), with its Metropolitan at Hermannstadt, and suffragan bishops at Arad and Kazansebes; and also the Churches of Bukowina and Bessarabia. The United Church now numbers some 11,000,000, out of a total population of about 12,500,000.[7]

Greater Greece.—The old metropolitanate of Athens has not been greatly affected. For Macedonia, etc., see above; but it is hard to see how the Ecumenical Patriarch in Constantinople can under the changed conditions exercise an effective supervision over these districts. Salonika has now become once more a Christian city, and the mosques which had originally been Christian churches have now been restored to Orthodox worship.

Bulgaria has lost the Aegean coast to Greece, and part of the Dobruja to Rumania. Otherwise the Church has not been much affected. It has, by the official census of 1920, about 4,000,000 members, almost all of Bulgarian nationality, out of a total population of nearly 5,000,000, of whom about 700,000 are Moslems, chiefly Turks.[8]

We now pass to the smaller communities in Asia and Africa which were once under Turkish rule. The orthodox patriarchate of Jerusalem, now under British mandate, consists of about 30,000 Arab and Greek Christians and a few Russians. The chief obstacles to progress are the jealousies between Arabs and Greeks, and the financial difficulties of the monasteries. There is now no orthodox theological seminary in Palestine.

The orthodox patriarchate of Antioch, now under French mandate, suffers from the same difficulties as that of Jerusalem. It has some 300,000 members. The orthodox ("Melkite") Patriarch of Alexandria has only a small following of about 100,000, as has been the case since the Monophysite schism in the 5th century. Under him is the Archbishop of Nubia. The autocephalous Churches of Cyprus (with about 200,000 orthodox) and Mount Sinai have not been greatly affected by the War.

(A. J. M.)

ORTHOPAEDIC SURGERY.— The influence of the War upon the practice of orthopaedic surgery is related to organisation, and to lessons learnt in technique from the handling of large groups of cases. Efficiency at the front and at the hospitals in England was attained only when segregation of various types of injury became established. The treatment of fractures during the early part of the War was attended not only by unnecessary deformity, but also by a high mortality, and remained unsatisfactory until special hospitals were started, manned by teams of expert surgeons. In compound fractures of the femur an initial mortality of 80% was ultimately reduced to 25%. This dramatic change was accomplished by immediate reduction and fixation of the fracture, by segregation and by continuity of treatment both at the seat of war and at home. Knowledge thus gained has formed the basis of the efforts to place the organisation and teaching of fractures upon a different basis with a view to minimising the disabilities of industrial accidents. Reform lies in the simplification of apparatus, and in an intensive education in their application, in segregation of fractures in special wards and in appointing surgeons with special qualifications to teach the student.

Technique.—The World War supplied us with exceptional opportunities of acquiring an improved technique in certain reconstructive operations which have an important bearing upon civil surgery. Amongst these stand prominently injuries to the peripheral nerves, tendon transplantations, bone grafting and bone infections. The enormous number of complete nerve lacerations enabled a finished operative technique to be built up, which was largely wanting before the War. Many misconceptions were corrected, such as the worthlessness of complete transplants of nervous or other tissue to bridge gaps in peripheral nerves, and the doubtful value of lateral nerve anastomosis. In cases of irreparable destruction to nerves, healthy muscles were transposed to take the place of paralysed ones. These operations proved singularly successful where large tracts of the musculospinal nerve were irreparably damaged.

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[1] The translation of an official summary of Soviet legislation against religion is given in the *Church Times*, Oct. 30 1925.

[2] *Church Times*, Nov. 20 1925.

[3] June 10 1923.

[4] *See* an informative series of four articles on *The Orthodox Churches* by Dr. Greig, Bishop of Gibraltar in *Theology*, 10–11, March, April, July, Aug. 1925.

[5] *The Christian East*, 48. f, 51. f, 54.

[6] Greig in *Theology*, 11. 8, 66.

[7] *Goodwill*, p. 114 ff.

[8] *Goodwill*, p. 127.

Certain flexor muscles of the forearm were attached in such a way that extension of the wrist and fingers became assured. Bone graft surgery received a great impetus during the War and has since been extended. This has led to considerable research on the viability of transplanted tissue, and in the case of the bone it is held that the transplant is a scaffold along which the fresh bonelaying cells creep from the embracing bone and deposit new bone, the scaffolding itself being ultimately removed by absorption. War experiences have permanently affected the treatment of virulent infections. The Carrel-Dakin method has permanently established itself as well as the procedure of laying open infected bone cavities so that the soft tissues fall in easily to obliterate the gap when the infection is at an end.

Care of Cripples.—The most notable advance in orthopaedic surgery following the War is in the organisation for the care and cure of cripples. This consists in the establishment of well-equipped open-air hospitals in various parts of Great Britain, known as hospital schools, fully staffed by surgeons specially trained to deal with deformities of every kind. These schools provide treatment and education for the cripple, and are associated with what are known as after-care clinics situated in small towns covering an area of from 40 to 50 m. distant from the hospital in every direction. These after-care clinics are visited by the hospital staff at stated times, and are attended by out-patients who have been inmates of the hospital school, and by cases from the district, who are often seen at a sufficiently early date to prevent deformities from arising. These hospitals and clinics are run in close association and agreement with the local practitioners, the education authorities and the Ministry of Health. This scheme, in association with preventive measures, promises practically to eliminate the cripple. Its aims are to secure the potential cripple at the earliest moment, to give him expert institutional treatment in fresh air and sunlight and to secure continuity of treatment until recovery is complete.

Artificial Light.—Of the special advances in knowledge that have taken place since the War, the evolution of the artificial light treatment as an auxiliary form of therapeutics for tuberculosis of bones and joints and of rickets may be instanced. The work of Rollier, Leonard Hill and others has given prominence to the therapeutic value of sunlight (*see* HELIOTHERAPY), and in the absence of sun extended observation favours the conclusion that we have in various forms of artificial light a promising substitute. This treatment, as in the case of heliotherapy, must be looked upon merely as an accessory measure in surgical tuberculosis. It is most effective when used in combination with other surgical procedures. It should be pointed out that there is grave danger in spreading a belief that other forms of treatment are unnecessary and subsidiary.

Infantile Paralysis.—The serious epidemic of infantile paralysis has resulted in a more widespread knowledge of the early symptomatology and important work has been done, especially by the late Prof. Lovett of Harvard from 1916 onwards. It has now been proved that complete rest and immobilisation and the elimination of meddlesome therapeutics have resulted in lessening the severity of symptoms by limiting the paralysis. The mass of material rendered available by these epidemics has thrown new light on the actual treatment of deformity. Tendon transplantations for various deformities of the feet have given place to operative stabilisation of the flail foot, and transplantations when practised are now associated with reconstructive operations upon bone. This combination has resulted in more satisfactory function.

Rickets.—Rickets and allied nutritional diseases, largely as a result of starvation diets during the War, have received close investigation by many observers abroad and at home. Considerable work on the aetiology, particularly with reference to diet, exercise and sunlight, has been carried out at Johns Hopkins Hospital, the Lister Institute and by Findlay of Glasgow, Mellanby and Chick. Much has been discovered regarding "vitamines" or "accessory food factors" (*see* VITAMINES). The report of the Research Committee provisionally deals with only two varieties; one known as vitamine A, or fat soluble A, and the other as anti-rachitic vitamine. Both are essential to the diet of growing animals. Defect in the one leads to arrest of growth and loss of weight; in the other a deficiency in the deposit of lime salts. The committee conclude that an anti-rachitic vitamine is a central factor in the prevention of rickets; and that a deficiency of calcium and phosphorous, in conjunction with a deficiency of anti-rachitic vitamine, hastens rickets. The greater the discrepancy in the calcium phosphorus intake the greater need for an appropriate anti-rachitic intake. It has now been proved that sunlight and ultra-violet rays act as an antidote to a deficiency diet, and can ward off the on-coming of rickets. This work has added considerably to the knowledge of orthopaedic surgeons, and has rendered unnecessary a good deal of the operative treatment for rachitic deformities.

Spinal Treatment.—The writings of Hibbs, Calve, Girdlestone and Waldenstrom have enabled us to place in accurate perspective the bony fixation of the vertebral column in tubercular disease of the spine. Forcible correction and fixation of the spine in lateral curvature is being abandoned in favour of less drastic measures, and bony fixation of the flail spine in paralytic cases is being performed with promising results.

Other Operations.—Operative treatment in osteoarthritis, especially in the non-articular type, is being more widely practised. This consists in stabilising the joint by exercising the joint surfaces and in the complete removal of diseased synovial membrane in the knee joints. The so-called operations of arthroplasty, or mobilisation in ankylosis of joints is becoming more common, and the results more encouraging. They mainly consist of the loosening and reconstruction of the bone ends, and the introduction of transplanted or living tissue between the bone ends to secure movement.

The treatment of fractures of the neck of the femur by wide abduction of the limb with internal rotation have been still further perfected by Royal Whitman of New York, and a large percentage of recoveries in this obstinate type of fracture occurring in old age is reported. The pathology of the rarer bone diseases such as "cysts of bone," "myeloid sarcoma," "Paget's disease" have been closely studied by many observers, resulting in valuable information in relation to operative procedure.

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ÖRTZEN, GEORG, BARON VON (1829–1910), German poet and prose writer (*see* 20.342), died in Freiburg May 26 1910. His later works include: *Nebensachen* (1910); *Auf Schwarzwaldwegen* (1910).

ORZESZKO, ELIZA (1842–1910), Polish novelist (*see* 20.343), died at Grodno May 18 1910.

OSAKA, Japan (*see* 20.344), brought several suburban districts within its boundaries in 1925 and had a population of 1,252,972 in 1920. It was a busy industrial centre with over 7,000 factories in 1921; the cotton manufacture, in particular, has developed rapidly. There is an acute shortage of houses and rents are high. Many people migrated from the north to Osaka after the earthquake in 1923, since the southern and south-western districts are believed to be immune from severe shocks. In 1909 one-third of the city was destroyed by fire and though it was rebuilt with wider streets and better buildings, there are still many wooden houses and bridges, dangerous in case of fire, and its factories and warehouses compare less favourably with European and American standards than those of Tokyo. Work on a drainage system was started in 1909, but is still incomplete. Railways in the neighbourhood are in process of electrification, and there were 51 m. of tramways in 1925.

Trade has grown very largely, but most goods are loaded and discharged at Kobe, as the river is only navigable for small vessels. A programme of port improvements was, however, undertaken in 1906 to make the harbour suitable for ocean-going ships, including the erection of jetties and warehouses, and the protection of the shore was practically completed in 1914; and further work on land reclamation has been undertaken. A fourth shipbuilding yard was opened in 1911. A pharmaceutical school was opened in 1917 and in 1919 the university of medicine was made into a general university. The spread of pulmonary tuberculosis has caused alarm and a tuberculosis laboratory has been opened. In 1919 a municipal home for workpeople, including an employment bureau and a children's clinic, was inaugurated.

OSBORN, HENRY FAIRFIELD (1857–), American palaeontologist, was born at Fairfield, Conn., Aug. 8 1857. Graduating from Princeton University in 1877, he was appointed assistant professor of natural science there in 1881, becoming professor of comparative anatomy in 1883. He went to Columbia University as Da Costa professor of biology in 1891 and was professor of zoology there from 1896 to 1910, in the latter year being appointed research professor of zoology. He was also curator of the department of vertebrate palaeontology of the American Museum of Natural History from 1891 to 1910. He was appointed vertebrate palaeontologist to the U.S. Geological Survey, 1904. From 1894 to 1916 he was connected with the Brearley School for Girls as director and president. He served as chairman of the executive committee of the New York Zoological Society 1896–1903, and assisted in founding the fine Zoological Park in the borough of the Bronx, New York City. (*See* EVOLUTION; PALAEONTOLOGY.)

Osborn's works include *From the Greeks to Darwin* (1894); *Evolution of Mammalian Molar Teeth* (1907); *The Age of Mammals* (1910); *Huxley and Education* (1910); *Men of the Old Stone Age* (1915); *Origin and Evolution of Life* (1917); and *The Earth Speaks to Bryan* (1925).

OSLER, SIR WILLIAM (1849–1919), British physician, was born at Bond Head, Canada, July 12 1849. He was educated at Trinity College School, Port Hope, Trinity University, Toronto and at McGill University, Montreal, where he took the M.D. degree in 1872. He studied medicine in London, Leipzig and Vienna and was in 1874 appointed professor of medicine at McGill University. From 1884 to 1889 he was professor of clinical medicine in the University of Pennsylvania, and from 1889 to 1904 professor of medicine at Johns Hopkins University. In 1905 he was appointed regius professor of medicine at Oxford, where he also served as a curator of the Bodleian Library, as a delegate of the University Press and as one of the Radcliffe trustees. In 1911 he was created a baronet. Sir William Osler carried out original and valuable researches on the diseases of the spleen and blood and also made eminent contributions to the study of infections of the heart, of angina pectoris, of malaria and of many minor maladies. He was the author of many medical works, of which the most important is *The Principle and Practice of Medicine* (1892, latest edition 1916), and of a volume of essays entitled *Aequanimitas*. Sir William died at Oxford Dec. 29 1919.

OSLO, formerly CHRISTIANIA (*see* 6.279), the capital of Norway, changed its name as from Jan. 1 1925, Oslo being the original appellation of the city. The population was 258,483 in 1920. Between 1912 and 1921 large sums were spent on building and equipping quays. Vessels up to 10,000 tons can be built in the ship-building yards. Garden suburbs have been erected by the municipality at Ullevaal, where there is the largest municipal hospital in the country, and at Töien. At the latter place are three buildings, the first erected in 1908, which house the mineralogical and palaeontological, zoological and botanical collections. A third Viking ship, that of Oseberg, has been added to the others in the historical museum. The Margaret church, built by the Swedish colony in memory of the late Crown Princess of Sweden, was consecrated in 1925. Three new theatres have been built since the World War. A trade intelligence bureau was founded in 1919, and the central bureau of statistics reorganised in 1918. A beginning has been made with the electrification of the state railways, from Oslo to Drammen. The Dovre railway, connecting Oslo with Trondhjem, was completed in 1921, and the Östbane station has been extended. The joint scheme of the state and the municipality for deriving power from the Glommen river has been delayed, but three units of 13,000 kw. were in use early in 1925.

OSSENDOWSKI, FERDINAND ANTHONY (1876–), Polish traveller and writer, was born May 27 1876 in the government of Witebsk. He studied at the University of St. Petersburg (Leningrad) and at Paris, where he received the degree of docteur des sciences and officier d'Académie for his work entitled *The Allotropy of Silver*. He was appointed lecturer of physics and physical chemistry at the Tomsk Polytechnic and then became successively a lecturer in chemistry, physics, geography; a manufacturer, a commercial manager, a journalist, a novelist, a physician, a draughtsman, a teacher of languages, and a mineralogist. Ossendowski was twice imprisoned for supposed political offences. While at the university he was sentenced to five months' imprisonment for taking part in a manifestation against capital punishment, and, at the time of the Russo-Japanese War, he was brought before a Russian law court for leading a patriotic organisation in the Far East with the object of preventing civil war after the defeat of the Russian Army. He was sentenced to death but the sentence was later commuted to 20 months' imprisonment. During this period Ossendowski's books on prisons appeared, which aroused a great deal of controversy and led to a revision of the Russian prison system.

After the outbreak of the Communist revolution, Ossendowski held office as financial adviser to the Government of General Kolchak in Siberia. After Kolchak's Govt. fell, he made his way through the forests to Mongolia disguised as a peasant. His journey through Central Asia is recounted in *Beasts, Men and Gods* (1923), and his other works on Asia include *Man and Mystery in Asia* (1924), and *The Shadow of the Gloomy East* (1925). His play *The Living Buddha* had a successful run at the National Theatre in Warsaw.

Ossendowski also published a number of scientific books, including *The Theory of Fermentation, Vegetation of the Pacific Ocean and the Extraction of Iodine; The Origin of Petroleum according to Scientific Hypothesis, Contribution to the Hydrography of the Ussuri Territories; Contribution to the Oceanography of the Pacific, The Coal Industry in Russia and Its Possibilities.* See Sven Hedin, *Ossendowski und die Wahrheit* (1925).

OSTEND, Belgium (*see* 20.356), had a population in 1923 of 44,271. Large sums have been recently spent in enlarging and improving the town and suburbs, which is one of the most popular watering places in Europe. It is computed that it is visited by nearly 1,000,000 people yearly. It is also a port for cross-channel services and the chief Belgian fishing port. The new fishing harbour includes a wet dock for steam trawlers, a tidal dock for sailing boats and a slipway. Extensive harbour and dock works were completed before the World War.

The War Period.—Ostend was occupied by the Germans for four years during the War, and was at first, until it was rendered untenable by aerial bombardments, a base for destroyers and submarines. In May 1918 the entrance channel to the harbour and the canal to Ghent and Bruges were blocked to all craft except the smallest submarines by the sinking of the "Vindictive." After the War she was raised and broken up. Parts of the "Vindictive," "Intrepid" and "Thetis" have been made into a memorial on the Digue. During the German occupation over 2,000 bombs were dropped on the town, and an enormous amount of damage was done. The new marine station and the locks were blown up, and the Central station badly damaged. Restoration, however, was so rapid that two years after the Armistice hardly a trace of the havoc was left. A new lighthouse, in place of the large one destroyed in 1916, was finished in 1924. In 1922 a monument to commemorate the work of the people of Ostend among refugees fleeing to England was unveiled in front of the church of St. Peter and St. Paul, and in the English church is a plaque in memory of those who were killed in the raid on Zeebrugge. (*See* ZEEBRUGGE.)

OSTEOPATHY.—According to its advocates, osteopathy is that system of the healing art which regards the structural integrity and adjustment of the mechanism of the body as the most important single factor in maintaining the organism in health, in contrast to the older systems which regard the chemical intake of the body as the most important factor. In other words osteopathy is based on the belief that the hunody is a vital mechanism, a living machine, which, given some physical and mental environment, good food, proper e e, pure air and pure water, will be healthy—that is, will funcproperly, so long as all the cells and parts of that vital meism are in normal adjustment. Osteopathy teaches that ural derangement of the body is the predisposing cause of de. Such structural derangement causes functional perversic the vascular and nervous system, weakening the nutritioncesses and lowering the powers of resistance of the body; ie one hand, producing congestion, either general or local ve or passive; on the other, depriving tissues of an adequblood and lymph supply. This perversion impairs the rebuildf cells after waste due to active functioning and retards the ination of waste products through body drainage, thus makthe body unable to withstand climatic changes or unhygieni insanitary surroundings, and offering a hospitable mediumhe invasion and propagation of pathogenic germs. Inte of mechanical structure determines the normality of functg. That structural perversion is the basic cause of functi disturbance or disease is a distinctive and fundamental prin of osteopathy.

Diagnostic Methods.—Osteopathic diagnosiludes examination of the whole body and its excretions, esply the articulations and alignments of the vertebrae, ribs pelvis. Symptoms are noted, and chemical, microscopic, hy, sanitary and other findings are studied to aid in determini existing conditions of tissue, viscera and function. Of su e importance, however, is the physical examination to disc existing mechanical tissue lesions.

Therapeutic Methods.—Osteopathic theraps may, and usually does, consist in the specific manipulatimoval of the lesion or structural perversion, by effecting tisadjustments, which free the remedial anti-toxic and auto-prcve resources of the organism itself; or it may consist in cong hygienic, dietetic, environmental and psychic conditions;n the application of operative surgery for fractures, lacerat and the removal of abnormal growths or organs so diseased be dangerous to life; or it may be the administration of anti for poisons and other dangerous substances. In osteopatherapeutics the fundamental principle is, " Find the lesion, a it, and let it alone."

Historical Matter.—The founder of osteopath r. Andrew Taylor Still, was born in Virginia Aug. 6 1827, died at his home in Kirksville, Mo., Dec. 12 1917. He wapractising allopathic physician at the beginning of the AmeriCivil War, served as a Union officer, and at the close of the wturned to his home in Kansas and resumed the practice of rofession. Gradually his confidence in the efficacy of drugs means of healing weakened, and his faith in the inherent cve power of the body strengthened, until June 22 1874, whe publicly announced that he would henceforth discard the userugs as a curative measure and would dedicate the remaind his life in aiding nature in the alleviation of disease by thechanical readjustment of the disordered body. The Americchool of Osteopathy was opened at Kirksville, Mo., in 1892. re were in 1925, over 9,000 graduate practitioners of osteoy in all parts of the world.

Legal Recognition.—In addition to the school at ksville, there were in 1921 six others in the United States ted to the teaching of osteopathy. The curricula of the cpathic colleges embrace all the subjects taught in other medicolleges, except *Materia Medica*, in place of which there is inclue Principles and Practice of Osteopathy " and " Osteopatherapeutics." Osteopathy was by 1925 recognised and reged by law in 47 states of the United States. The one remainstate, through court decisions, makes its practice legal.

There is an international organisation, The Americasteopathic Assn., having some 4,000 active members; an ostathic association in each state in the Union; associations in ada; the New England Osteopathic Assn., the Western Ostthic Assn., the Eastern Osteopathic Assn., the South Atlantiates Osteopathic Assn., Osteopathic Women's National ., a British Osteopathic Association, the Academy of Osteopathic Clinical Research, and the American Society of Ophthalmology and Oto-Laryngology. There are 10 or 12 magazines and periodicals published by the profession.

OSTWALD, WILHELM (1853–), German chemist, was born in Riga Sept 2 1853 and educated at the University of Dorpat. In 1882 he became a professor in Riga, and five years later was appointed professor of physical chemistry in the University of Leipzig, where he was later director of the Physico-chemical Institute. In 1906 he resigned his university appointments and subsequently lived in retirement in Saxony. Ostwald will be chiefly remembered for his discovery in 1900 of a method of oxidising ammonia to form oxides of nitrogen; a mixture of air and ammonia being passed over a platinum catalyst with a specially treated surface. By means of this process and by later developments in connection with it, Germany was enabled to continue the manufacture of explosives during the World War after the Allied blockade had been enforced. In 1909 Ostwald was awarded the Nobel Prize for chemistry. His published works include *Lehrbuch der allgemeinen Chemie* (2nd ed. 1884–87) and *Grundlinien der anorganischen Chemie* (5th ed. 1922) which have been translated into English.

OTIS, HARRISON GRAY (1837–1917), American journalist, was born near Marietta, O., Feb. 10 1837. He became a printer's apprentice, working in various offices in Illinois, Iowa, Ohio and Kentucky. He served throughout the Civil War, and rose to be lieutenant-colonel. He was in the Government printing office at Washington, D.C., 1867–70, and in 1870 moved to California, where he managed the Santa Barbara *Press*. In July 1882 he became connected with the Los Angeles *Daily Times*, obtaining control of that paper in 1886. He served in the war with Spain as brigadier-general in the Philippines 1898–9. In 1910 the *Times* building was dynamited, 21 employees being killed. He died at Los Angeles July 30 1917.

OTTAWA (*see* 20.369), the capital of the Dominion of Canada, had a population of 107,843 in 1921; a later estimate gives it as 126,000. The population is about half British and half French. Ottawa is the headquarters of the Air Force and the Royal Canadian Mounted Police, and contains the National Victoria Museum, the National Art Gallery, the Royal Observatory and the Royal Mint; while the Central Canadian Experimental Farm is in the vicinity. Parliament buildings were almost completely destroyed by fire in 1916; the magnificent library and the Senate House fortunately escaped. Reconstruction was started at once. The main front of the new buildings is the same length as that of the former one, but the height is double; in the main tower is a War Memorial chamber. Other buildings erected since 1911 include the Grand Trunk (now Canadian National) Union station, on the east bank of the Rideau canal and the south side of Rideau street, and the Château Laurier hotel facing the Parliament buildings. The Canadian War Memorial, an arch 45 ft. high, was in course of erection in 1926. A colony for the use of civil servants has been built close to Rockliffe Park. The city possesses 2,000 ac. of park lands. Ottawa in 1924 had 452 industrial establishments, largely for wood products, including one of the biggest lumber factories in the British Empire. Electric power is generated at Chaudière Falls.

OTTOMAN EMPIRE, THE (*see* 27.426).—After an existence lasting well-nigh six centuries and a half the empire founded by Osman (1288–1326) expired on Oct. 29 1923 when the Great National Assembly at Angora by an unanimous vote constituted the Turkish Republic. Since the death of Suleiman the Magnificent in 1566 the Ottoman Empire had been gradually decaying, and throughout the 19th century its demise from time to time had been almost hourly expected. Successive wars had shorn it of its outlying provinces, especially in Europe, and from being an empire that extended in the 16th century from Budapest to the Sudan and from Oran to the Caspian Sea it was left by the Treaty of Sèvres (*q.v.*) with an area of no more than 175,000 sq. m. and a population of barely 8,000,000.

Contrary to expectations, it received its *coup de grace* not from one of the great Christian Powers but from a section of its own subjects. It fell before the democratic movement inaugurated at Angora in 1919 by Mustafa Kemal Pasha (*q.v.*), and in the following year the Parliament at Constantinople held its last meeting. Two years later Mehmed VI., last Sultan of the House of Osman, fled from Constantinople on board a British ship of war. In consequence the Great National Assembly at Angora decreed his deposition both as Sultan and Caliph in a *fetva* passed on Nov. 19 1922. As Caliph the Assembly elected Abdul Mejid Effendi, a son of the late Sultan Aziz; but in less than two years even the Caliphate was swept away and the House of Osman finally banished (March 2 1924) from the lands over which it had for so long held sway. (*See* CALIPHATE; TURKEY.)

See Lord Eversley's *The Turkish Empire* (2nd ed., 1923), probably the best general survey of the history of the Empire. See also W. Miller, *The Ottoman Empire, 1801–1913* (1913).

OUSE (*see* 20.380).—The question of the navigation of the English river, the Great Ouse, between Bedford and King's Lynn was raised in 1913 at Bedford and a committee was formed to inquire into the subject, but no further steps were taken until the Land Drainage Act of 1918 made it possible to deal with the problem. The Ouse is a long and difficult river, largely artificial, and in 1913 the locks were decayed and unworkable between Bedford and St. Ives. Parts of the stream had never been adequately cleared and the cutting called the New Bedford river, which carries one arm of the river to the sea, was suffering from a long period of neglect. In 1920 an Act was passed superseding various minor authorities and placing the drainage of the Ouse in the hands of a board. The decision to rate the owners and occupiers of land adjoining the river in the upper reaches above Earith, where it enters the Fen country, as well as the Fen dwellers, for the purpose of making drainage and tidal channels in the Fen area, aroused opposition from the first. The "uplanders" considered that their assistance should be confined to the portion of the river above Earith, and the comparatively small area of land adjoining it. The Ministry of Agriculture, as the result of an inquiry held in 1924, decided that it was impossible to relieve them of their liabilities under the Act, unless the Government undertook comprehensive works on the tidal portion of the river. A suggested grant of about £1,500,000 was refused as insufficient and a long dispute followed between the drainage board and the upland farmers, who refused to pay the rate levied for administrative purposes. Distraints were carried out in Jan. 1925 and the goods sold at Cambridge.

Protests from the Upland Riparian Owners and Occupiers' Association and continued refusals of payment led to further negotiations with the Ministry of Agriculture, which resulted in the passing of a temporary suspension order in April, with the proviso that no fresh rate should be levied or drainage work done in the "upland" area (except by consent of a sub-committee of the board consisting of representatives of that area) until the end of 1926; that the Ouse district should be surveyed; and that a commission should be appointed to investigate the whole problem. The Upland Riparian Owners' Association adopted a fighting policy, stating that they did not require a drainage commission in their area; and that the river could be surveyed for obstacles and these removed, if necessary, by the National Farmers' Union. They also put forward the suggestion that with cooperation between the millers and the county surveyors the flood waters could be passed through more rapidly. Efforts were being made later in the year to induce the "uplanders" to pay their arrears of rates. A new bridge over the old Bedford river was begun in 1925, but difficulties were caused by the floods. It was decided to approach the county authorities with a view to their taking responsibility for the bridges, many of which were inadequate for the traffic.

OXFORD (*see* 20.405).—The population of the city increased from 53,048 in 1911 to 57,052 in 1921. The garden suburbs on the Cowley and the Iffley roads are only small, but others are in progress. In 1925 the city adopted a town-planning scheme, by which arrangements are made for diverting through traffic round the city, and to preserve its amenities.

The War Period.—The two most important facts in the history of the university since 1911 have been the World War and the two commissions. In the War 14,561 Oxford men served in the British Forces, and 2,660 lost their lives. But the greatest service rendered by the university was the supply of officers. Thanks to the O.T.C., nearly 2,000 Oxford men received commissions in the first two months of the War. After this, Oxford became one of the main training grounds for officers; for the last three years of the War, there always were nearly 2,000 cadets in Oxford and the examination schools and those colleges which were not given up to cadets became hospitals. The number of undergraduates fell to 1,087 in Jan. 1915 and 550, 460 and 369 in the same months in 1916, 1917 and 1918 respectively. The tide began to turn in the latter part of 1918; in Jan. 1919 there were 1,357 men in residence; and in the following 18 months the entries were so heavy that by Oct. 1920 there were about 4,500 men and 650 women actually in residence. Since that time, all the men's colleges have striven to reduce their numbers; so that the figures for undergraduates in Oct. 1925 were about 3,400 men and 750 women. These figures indicate clearly one of the indirect results of the War, the admission of women as full members of university. This change was made in 1920.

New Statutes.—The royal commission, set up in 1919, reported in 1922; most of its recommendations had been embodied in Statutes by the end of 1925, by the statutory commission appointed in 1923, although the actual changes made by the commission will only begin to come fully into effect in Oct. 1926. It was satisfactory to Oxford men to find that a commission appointed by a reforming government, and composed of men of all political parties, reported so favourably on the work of the universities as a whole; so far from being pronounced to be homes of idleness, the main complaint made against most of the teachers was that they worked too hard (see *Report*, pp. 26, 39, 48). To remedy this, and to allow for the extension of university activities, the royal commission recommended a grant to Oxford and to Cambridge of £110,000 a year each; only £60,000 was given at first, but in the spring of 1925 this was increased to £85,000.

It is hard to say what the effect of the new statutes will be. They seem likely rather to carry on the developments which the old universities were already making, than to introduce revolutionary changes. At Oxford, for example, there has been a growing tendency since about 1900 to lay ever-increasing stress on the necessity of research work. To encourage this, the degrees of Bachelor of Letters and Bachelor of Science were set up in 1895, the Doctorate of Philosophy in 1917; the regulations for the B.Litt. are now being remodelled in the light of experience. In the examination, too, for the honours degree in natural science, students of chemistry can only obtain a class if they spend a year on a piece of research.

Another important line of change is that in future the full emoluments of college entrance scholarships will be given only to those who show actual need for help. It remains to be seen how this change will work; but in this, as in other matters, the commissioners have done as little as possible to interfere with the independence of colleges, and great care has been taken to prevent the lowering of standard for scholarships and to see that scholarships do not become merely eleemosynary.

The machinery of government of the university has also been developed since 1900, mainly by voluntary action, but in part by the commissioners. The hebdomadal council has been made more representative of the whole university; university finance management has been remodelled, first in 1912 in one of the reforms carried out by Lord Curzon, and then by a statute of 1920. The studies of the university too are now put under a general board of the faculties, which was set up in 1913 and is elected by the resident teachers. A further instance of development is the change in the theological degrees, which in 1920 were thrown open to students of all denominations, and made to depend, so far as the D.D. is concerned, on the production of a "serious contribution to learning."

Benefactions.—The material resources of Oxford have also been steadily increased by the generosity of benefactors, especially old members. Natural science has been the chief gainer, with new laboratories for engineering (1912), for chemistry (thanks mainly to Mr. Dyson Perrins) in 1912, for pathology from the Dunn trustees and for biochemistry from Mr. Whitley and the Rockefeller Foundation. The Welch bequest (1915) has added another £50,000 to the resources of biological science, and the Govt. by placing at Oxford the Institutes of Agricultural Engineering (1923) and of Imperial Forestry (1924), has shown its confidence in the oldest university as the fittest place to provide for the newest needs of the empire.

Next to the development of natural science, the most marked feature of the decade 1915–25 has been the growth of modern language teaching. Professorships of French and Italian have been founded by Sir Basil Zaharoff and Mr. Arthur Serena respectively; Sir Heath Harrison has provided scholarships for undergraduate travel (1919), and Mr. Laming has founded travelling fellowships in connection with his old college, Queen's (1924). Closely allied with this development is the increasing number of fellowships for study in the universities of the United States, which are being founded by Americans as a counterpart to the work of Cecil Rhodes.

The Bodleian continues to receive gifts, not only of books and pictures as in Lord Curzon's Napoleonic Collection (1925), but also in cash, as Walter Morrison's £50,000 in 1920. Mention should also be made of Barnett House, founded in 1914 in memory of Rev. S. A. Barnett.

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(J. We.*)

OXFORD AND ASQUITH, HERBERT HENRY ASQUITH, 1st Earl of (*see* 2.769).—The opening of the session of 1911 may be taken as the crowning moment in Mr. Asquith's public career. The issue of the constitutional struggle with the Lords was not yet decided, but it was no longer in doubt. It had been practically settled by the events of the previous autumn. The round table conference, which had been called in the hope of reaching an agreed settlement, had broken down, and Mr. Asquith had decided to appeal once more to the country. The election took place in December and the Govt. returned with a commanding majority of 126.

The decisive mandate which the country had given in December dictated the issue that immediately occupied the new Parliament. A bill abolishing the veto of the House of Lords was introduced into the House of Commons and, despite energetic opposition, passed all its stages by the beginning of the summer. But the real crisis had yet to come. The battle had still to be won in the Lords and there the opposition were entrenched in overwhelming power. There was only one way to victory. Ever since the emergence of the struggle it had been evident that the attainment of Mr. Asquith's goal depended on whether he could in the last resort invoke the authority of the Crown to dilute the House of Lords with new peers sufficient to change its complexion. It had been assumed that he had armed himself with this authority after the first election in 1910; but the assumption was unfounded. What was the position now? The question was answered on July 20. The Parliament bill, now in the House of Lords undergoing its second reading, was so amended as to deprive it of any utility for the purpose for which it was framed. Mr. Asquith therefore addressed to Mr. Balfour, the leader of the opposition, a letter stating that the Govt. had decided, if the bill in its essential form could be passed in no other way, the Crown would be advised to create a sufficient number of peers to ensure its passage, and that the Crown had signified its willingness to accept such advice.

The publication of this letter aroused an unprecedented storm, and on July 24, on rising in the House of Commons to make a statement, Mr. Asquith was greeted with a demonstration without parallel in living memory. For the best part of an hour he stood speechless before the roar of anger that issued from the Opposition benches, and at last resumed his seat without having uttered a continuous sentence. What became known as "the pothouse brawl" inaugurated the last stage of the struggle. The Govt. was accused of "dragging in the King," and the Opposition organised an uncompromising resistance in the belief that the Govt. would not dare to carry its threat into execution. The issue, however, was determined on Aug. 10, when the final debate was taking place in the House of Lords, by a statement of Lord Morley confirming the Government's previous intimation of His Majesty's intention. Up to this point the "Die-Hards" seemed to be assured of a majority, but in the division they were defeated. The bill was passed. On Aug. 18 the Parliament Act received the Royal Assent, and the House of Lords stood shorn of its historic privileges.

From this victory Mr. Asquith proceeded to his next great task, with the ground sensibly cleared for action. Gladstone's successive Home Rule adventures had broken on the rock of the Lords' veto. Mr. Asquith now approached the subject with the advantage that that rock no longer obstructed the channel. But before the Irish issue was fully launched another controversy absorbed the Prime Minister's activities. From that controversy the country has not yet emerged. Discontent had long been growing prevalent in the mining industry, and at the end of Feb. 1912, having failed to secure the concessions and advances they demanded, the miners' union declared a strike. Vast dislocation followed and unemployment became widespread. From the outset the Govt. endeavoured to bring the conflicting parties to agreement and Mr. Asquith took on himself the personal charge of the negotiations. A month's fruitless efforts left the country on the brink of paralysis, and the Govt. thereupon introduced the Miners' Minimum Wage bill, which, by providing a half-way solution, forced the hands of both sides and brought the immediate struggle to an end, although the issue incidentally raised—that of the reorganisation and control of the coal industry—was to perplex Parliament and the country for many years to come.

Meanwhile, the Home Rule bill had been introduced and with the Government majority behind it there was little difficulty in securing its passage through the House of Commons, while the Parliament Act provided adequately against the resistance of the House of Lords. That House fought the delaying action, which was all the opposition now in its power. On Jan. 30 1913 it rejected the Home Rule bill at the second reading. Under the Parliament Act the Lords' power of rejection is limited to two successive sessions. The bill was introduced again and in July 1913 it was again rejected by the Lords. After its next passage through the Commons it would have overridden opposition and automatically become law. By this time, however, the political atmosphere was heavy with forebodings from other quarters. The opposition to the measure took an extra-parliamentary shape. The notorious Ulster Covenant had been promulgated in the previous Sept. and talk of open rebellion, should Home Rule be passed, was already current. In June arms had been discovered both at Belfast and Dublin. As the year wore on the outlook became still more serious and a speech by Mr. Bonar Law, the leader of the Conservative party, at Blenheim, seemed to give encouragement to the idea of resistance by force. On Sept. 25 the Ulster Unionist Council appointed a provisional Govt. and prominent Conservatives openly preached armed resistance. Sir Edward Carson, the leader of the Ulster Unionists, left no doubt that in the last resort Ulster would fight.

With the close of the session of 1913 there came a brief lull, and during the recess conversations with the Opposition leaders were opened by Mr. Asquith, who throughout preserved an attitude of patience and forbearance. It will always be matter for controversy whether, when the policy of violent resistance had been adopted, he was justified in ignoring so direct a challenge to constitutional government. His natural disposition was to allow the utmost scope for the play of discussion and the influence of the time element; but it is an open secret that he would have taken up the challenge but for the persuasions of Mr. John Redmond, the leader of the Irish Nationalists, who believed that the prosecution of the Ulster leaders would prejudice the prospects of friendly relations with Ulster when Home Rule was actually on the statute book. In any case, the conversations of the autumn were futile, and on March 9 1914 the Govt. announced the provisions of their amending bill, their last word of compromise. The chief provision of this bill was that any county in the north of Ireland was to be allowed to vote itself out of the operation of Home Rule for a period of five years.

The offer was rejected by the Opposition and now events rushed forward to an apparently unavoidable catastrophe. Sir Edward Carson was hastening to and fro, reviewing the rebel army of Ulster which had now assumed alarming proportions. On the night of April 24–5, 55,000 rifles were landed at Larne from a German port for the use of the Ulster army. On the other side of the border the Nationalists were beginning to enrol a volunteer army and to make counter-preparations. Meanwhile a more sinister menace appeared. In the debate on the vote of censure on the Govt. on March 19 Mr. Bonar Law, speaking on the Home Rule issue, had used the ominous phrase "soldiers are citizens like the rest of us." There had been much talk of disaffection in the army in regard to the coercion of Ulster, and on March 20 it took shape in the Curragh incident (*see* IRELAND) which led to the resignation of Col. Seely, the Secretary for War. For a moment it seemed that the loyalty of the army was imperilled and the situation that confronted the Govt. looked desperate. But the announcement by Mr. Asquith next day that he would assume the Secretaryship for War created a profound impression in Parliament and stopped for the time being at all events what had seemed like a riot in the army. Following the mutilation of the amending bill by the House of Lords and Sir Edward Carson's challenge to the Govt. to "give us a clean cut or come and fight us," the King, on Mr. Asquith's advice, summoned a conference at Buckingham Palace on July 20 to see if some agreement was still not possible. It broke down four days later and the last hope of avoiding a violent issue seemed gone.

What Mr. Asquith would have done to avert a civil war while maintaining the authority of the constitution was not to be revealed, for on the day that the Buckingham Conference broke up Austria sent her ultimatum to Serbia, and within 10 days the British Army was embarking not for Ulster but for Flanders. In the feverish struggle within the Cabinet that preceded the entry of Great Britain into the World War Mr. Asquith's position was never in doubt. He had throughout been a party to the ambiguous military understandings and conversations which had been in progress with France since before the fall of the Balfour Govt. in 1905, and when the War came he did not waver in his conviction that both the duty and the interest of this country lay in throwing the country's whole weight into the scales against what he considered to be the calculated design of the Central Powers to establish a military despotism over Europe.

The invasion of Belgium by Germany saved his Govt. from disruption, and he addressed himself, free from domestic disquietudes, to the heaviest task ever imposed on a British Prime Minister. For the moment even the Irish trouble subsided, all political differences were shelved and Mr. Asquith became the voice of a united nation in a measure unequalled in modern Parliamentary history. The speeches he delivered in the early days of the War have taken their place beside the classic orations of Pitt during the Napoleonic wars, and his constancy of mind and freedom from all personal ambition played a dominating part during the next two years in laying the foundations of the ultimate victory. It was not to be expected that in the presence of so vast a convulsion discontents would not develop. They became clamant as the true character of the struggle emerged and as the popular idea of a swift decision gave place to the certainty of a long war of attrition. Mr. Asquith had made no change in the political constitution of his Cabinet at the outbreak of war, although he had taken the leaders of the Opposition into his confidence and private counsels, but by the spring of 1915 it became clear that this informal relation would have to yield to a formal coalition.

In Feb. Mr. Bonar Law and Lord Lansdowne intimated that they could accept no responsibility for the way in which the War was being conducted, and in the popular Press—which Mr. Asquith had no talent for flattering—a powerful and ceaseless agitation arose, directed mainly against Mr. Asquith, Sir Edward Grey and Lord Haldane and inspired by the inevitable shortage of munitions which the progress of the War had revealed. Coincidentally, a violent disagreement as to the employment of the navy in the Gallipoli adventure had arisen between Mr. Churchill, the First Lord of the Admiralty, and Lord Fisher, the First Sea Lord, and on May 26 Mr. Asquith reformed his Cabinet on a Coalition basis, bringing in the leaders of the Opposition and excluding Lord Haldane. To meet the growing need for munitions, a special Ministry of Munitions was set up with Mr. Lloyd George at its head.

The reconstruction of the Ministry did not allay dissatisfaction. Within the Cabinet friction developed, and, outside, the Press agitation grew in violence. There was a persistent leakage of Cabinet secrets, certain newspapers betraying a knowledge of most confidential government business with such regularity as to suggest inspiration. A phrase, "Wait and See," which Mr. Asquith had used in reply to a question in the House of Commons years before, became the daily gibe of the malcontent Press, and Sir Edward Grey, then in the midst of the most delicate situation with the United States, was accused of "feeding Germany" because of his attitude on the subject of contraband from America. The war-weariness that had overtaken the country provided an atmosphere in which this propaganda of discontent flourished, and the head of the Govt. was the easier target for attack because he neither "squared" the Press nor hit back at his critics. The inevitable rupture came in the autumn of 1916, when the German raid into Rumania—now seen in its true proportions—served to drive home the attack, and at a time when Mr. Asquith was severely stricken by the loss of his eldest son in the War.

It arose over a question of Cabinet reorganisation. For some time the formation of an inner Cabinet had been under discussion. At the beginning of Dec. 1916 Mr. Lloyd George, who upon the death of Lord Kitchener had become Secretary for War and whose prestige with the Press had long been in the ascendant, submitted a definite scheme for the formation of such a body. From this body the Prime Minister was to be excluded. His right to control policy was not challenged, but he would not direct the deliberations of the inner Cabinet. The *coup* burst upon the country with the announcement of the popular newspapers that Mr. Lloyd George was "packing up" in sheer despair at the inefficient conduct of the War. His highly confidential challenge to the position of Mr. Asquith was under consideration when an article appeared in *The Times* (then owned by Lord Northcliffe) giving full details of the supposed arrangements and suggesting that Mr. Asquith had already agreed. Mr. Lloyd George denied any knowledge of this article; but Mr. Asquith, after consulting with his friends, decided to reject the proposal. Upon this Mr. Lloyd George resigned, and his resignation being followed by that of other influential members of the Cabinet—including some who hoped that their action would give the Prime Minister the opportunity of reforming his Cabinet on a new basis—Mr. Asquith informed the King that he could no longer be responsible for carrying on the business of the Govt.; and within a few days the second Coalition Govt. was formed with Mr. Lloyd George as Prime Minister.

Thus ended Mr. Asquith's long and memorable tenure of the Premiership. This is not the place to pass judgment upon his career or upon his conduct of the War, but it may be pointed out that the hopes of an early victory as the result of a change of Govt. were not realised, and the subsequent disclosures have thrown an entirely different light on the military position at the end of 1916 from that which prevailed at the time. For the remainder of the War he occupied a seat in the front Opposition bench, speaking rarely and only on occasions when the interest of the nation seemed to demand his intervention. At the election of 1918, when Mr. Lloyd George swept the country with an appeal for the maintenance of the Coalition, he did not escape the general wreck of the Liberal party, losing the seat of East Fife which he had held throughout his parliamentary career. In 1920 he returned to the House of Commons as member for Paisley and resumed his position as head of the remnant of the Liberal party in that House. This position he occupied during two succeeding Parliaments. In 1924, after an election fought on the issue of Protection, he, as the head of a pivotal majority, was responsible for the accession to power of the first Labour Govt., and later in the year for the Government's overthrow on a question of alleged governmental interference with the prosecution of a Communist. At the election which followed he was defeated at Paisley, and he retired to the House of Lords as the Earl of Oxford and Asquith.[1] (A. G. G.*)

OXFORD AND ASQUITH, MARGOT, COUNTESS OF, the sixth daughter of Sir Charles Tennant, 1st Bart., married, in 1894, as his second wife, Herbert Henry Asquith, later the Earl of Oxford and Asquith. Previous to her marriage she was well known as a member of the coterie known as the "Souls," and afterwards continued to be one of the wittiest and most brilliant women in London society. In 1922 she published *The Autobiography of Margot Asquith* (2 vol.), which attracted considerable attention and a certain amount of criticism owing to the writer's frankness of expression. It is generally acknowledged to be, however, one of the most valuable chronicles of the time. After its publication she undertook a lecture tour in America, and in 1925 published *Places and Persons.*

OYAMA, IWAO, PRINCE (1842–1916), Japanese soldier (*see* 20.424), died on Dec. 12 1916.

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[1] On May 26 1926, consequent on the General Strike, correspondence was published between Lord Oxford and Mr. Lloyd George with reference to the failure of the latter to consult his colleagues. This led to a breach in the party. (See LIBERAL PARTY.) (Ed. *E.B.*)

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